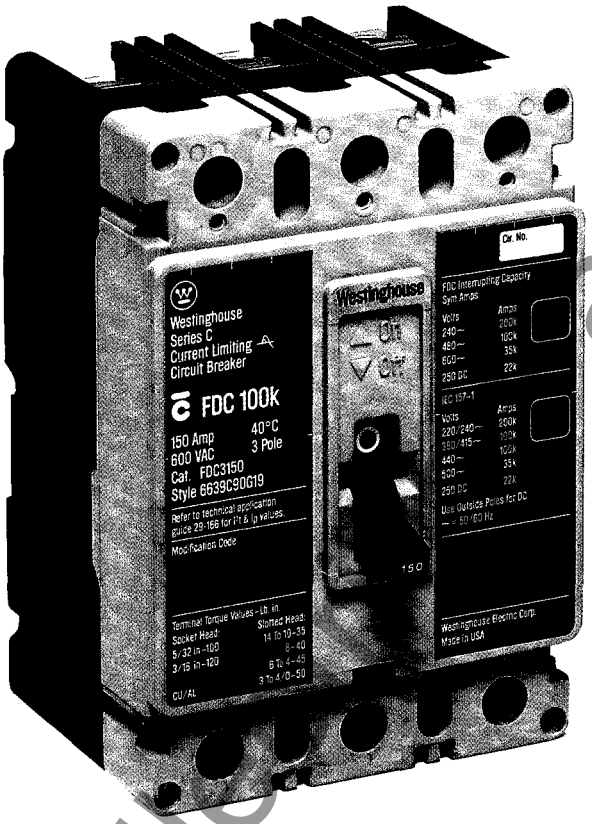
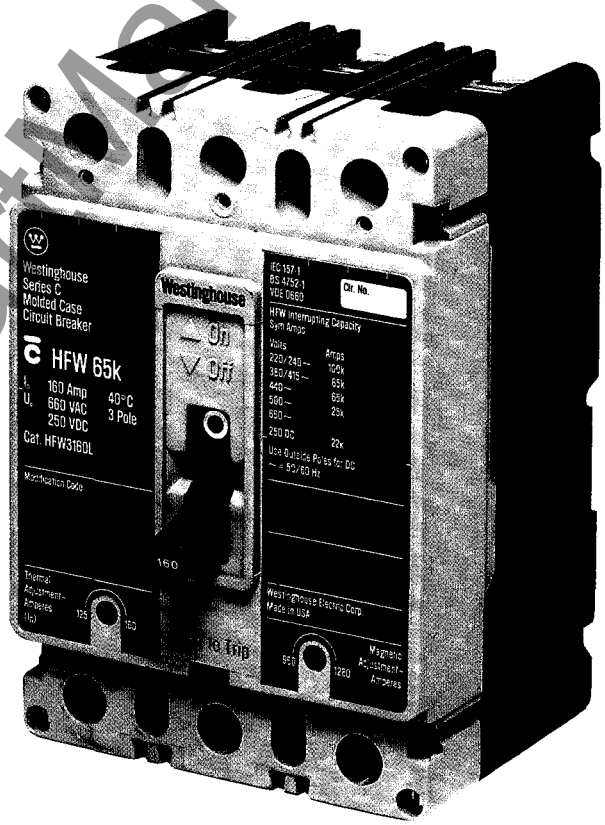
SERIES C®

F-Frame Molded Case Circuit Breakers



D Model, 15 to 150 Amperes



W Model, 10 to 160 Amperes

Series C Molded Case Circuit Breakers, F-Frame
Section 1 – Introduction

Series C Circuit Breakers

The new Series C line of molded case circuit breakers represents a significant step forward in circuit protection technology. It incorporates, in frame ratings 150A to 1600A, interrupting capacities as high as 100 kA at 480 Vac (200 kA at 240 Vac) in physical sizes normally associated with standard interrupting capacity breakers. Series C circuit breakers are physically and electrically interchangeable with the industrial line of molded case circuit breakers they replace.

There are two branches to the Series C line. One complies with applicable UL, NEMA, and CSA standards as well as being assigned P1 interrupting ratings under IEC 157-1. The second complies with IEC 157-1 and is assigned both P1 and P2 interrupting ratings.

The branch which complies with applicable UL/NEMA/CSA standards is composed of six frame ratings: 150A, 250A, 400A, 600A, 1200A, and 1600A. The six frame ratings of the IEC branch of the Series C line are 160A, 250A, 400A, 630A, 1250A, and 1600A and are physically interchangeable with the corresponding UL/NEMA/CSA frames.

Series C circuit breakers in the 150A through 630A frame sizes are available with thermal-magnetic trip units. Electronic trip units can be supplied in the 400A through 1600A frame sizes. The electronic trip units for the 400A, 600A, and 630A frames are field interchangeable with the thermal magnetic trip unit in the same frame size.

The 150A and 160A frame sizes of the Series C are available in 1-,2-,3-, and 4-pole models, while the remainder of the line is available in 2-,3-, and 4-pole models.

Series C UL listed 500 volt Dc breakers for ungrounded systems only are available in frame ratings from 150 Amp through 1600 Amp.

A complete line of external as well as plug-in internal accessories is available for use with Series C circuit breakers.

Because of its unique stationary conductor configuration, the 100 kA (at 480 Vac) interrupting capacity model of each Series C frame size is inherently current limiting. These models can, therefore, be used in series tested applications at the 100 kA level to protect specified, lower interrupting capacity downstream circuit breakers. This current limiting action is achieved without the use of fuse-type current limiters or extra sets of contacts. The 65 kA (at 480 Vac) interrupting capacity model of each Series C frame rating provides for simple, fully rated application on the 480 Vac secondary of unit substations up to 2500 kVA.

Series C Literature

A new format has been designed for the Series C circuit breaker literature. The literature is designed to provide each user with the needed information, presented in the most usable form. The literature includes:

- Frame Books – which provide basic descriptions, technical data, dimensional data, and ordering information for each Series C circuit breaker and associated accessories
- Instruction Leaflets – which provide installation, inspection, operation, and adjustment information for Series C circuit breakers and accessories
- Technical Application Guide – which provides basic definitions and standards, code requirements, and technical application information for Series C circuit breakers
- Time/Current Curve Packets – which provide full-size time/current characteristics curves for each Series C circuit breaker
- Maintenance and Troubleshooting Guide – which provides maintenance procedures and troubleshooting information for Series C circuit breakers and accessories.

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Series C Molded Case Circuit Breakers, F-Frame
Section 1 – Introduction

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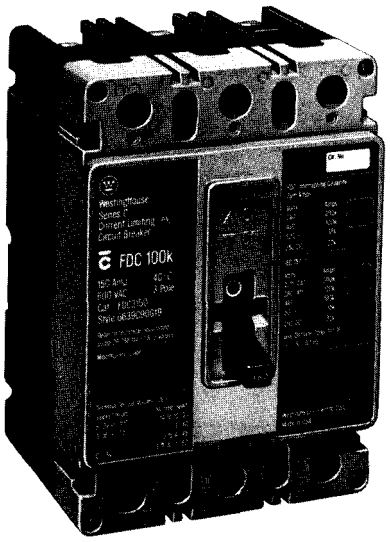


Figure 1-1. F-Frame Series C Circuit Breaker

1-1. General Information

F-Frame Circuit Breaker
The F-frame Series C thermal-magnetic circuit breaker (Figure 1-1) is available in two basic models: the D model and the W model. The D model (rated from 15A to 150A) is designed to comply with Underwriters Laboratories, Inc. Standard UL489, Canadian Standards Association Standard C22.2 No. 5, and International Electrotechnical Commission Recommendation IEC 157-1 (P1). The W model (rated from 10A to 160A) complies with International Electrotechnical Commission Recommendation IEC 157-1 (P1 and P2). Instantaneous (magnetic) only circuit interrupters (motor circuit protectors), molded case switches (circuit interrupters), and mining duty circuit breakers are also available.

The F-frame circuit breaker is designed to physically and electrically replace the EB, EHB, FB, and HFB circuit breakers (FB circuit breaker family). An innovative design of internal components allows applications to be extended to higher interrupting rating levels. In addition, the higher interrupting and current limiting performance capabilities of the F-frame circuit breaker allow it to be applied in situations that previously required physically larger circuit breakers. Each circuit breaker nameplate is color coded to provide easy identification of type and interrupting capacity rating.

The F-frame circuit breaker is available in 1-, 2-, 3-, and 4-pole configurations to satisfy application requirements in all types of electrical systems. A modular accessory concept permits wide flexibility in accessory installation.

This frame book provides basic information about the thermal-magnetic circuit breaker and molded case switch models of the F-frame circuit breaker. Separate publications cover instantaneous-only circuit interrupters (motor circuit protectors) and mining duty circuit breakers.

1-2. F-Frame Circuit Breaker Types

Thermal-Magnetic Circuit Breaker
The thermal-magnetic circuit breaker provides thermal (inverse time) and magnetic (instantaneous) tripping and is equipped with a manual Push-to-Trip mechanism. The thermal-magnetic circuit breaker is available in several types based on maximum voltage and continuous current ratings, interrupting capacity ratings, and standards compliance. Types EHD, FDB, FD, HFD, FDC and HFDDC⑥ are listed in accordance with Underwriters Laboratories, Inc. Standard UL489 and Canadian Standards Association Standard C22.2 No. 5. All types except EHD comply with International Electrotechnical Commission Recommendation IEC 157-1 (P1). Types FW, HFW, and FWC comply with International Electrotechnical Commission Recommendation IEC 157-1 (P1 and P2).

Table 1-1 gives the interrupting capacity ratings for the different circuit breaker types. Each rating is achieved by specific design features incorporated into the circuit breaker.

Instantaneous-Only Circuit Interrupter (Motor Circuit Protector)
The instantaneous-only circuit interrupter (motor circuit protector) provides tripping for short circuit protection only. Additional information about this device is in a separate frame book. (29-111)

Molded Case Switch (Circuit Interrupter)
Molded case switches are used as compact switches in applications requiring high current switching capabilities. The molded case switches are constructed of circuit breaker components and are available as high instantaneous-automatic devices. The molded case switches are listed in accordance with Underwriters Laboratories, Inc. Standard UL1087 under UL File E59918.

The high instantaneous-automatic molded case switch is equipped with a non-adjust-

Table 1-1. F-Frame Circuit Breaker Interrupting Capacity Ratings

UL489 Interrupting Capacity Ratings

Circuit Breaker Frame	Number of Poles	Interrupting Capacity (Symmetrical Amperes)					
		Volts Ac (50/60 Hz)				Volts Dc	
		240	277	480	600	125	250①
EHD	1	.....	14,000	.....	.....	10,000	.....
	2, 3	18,000	.....	14,000	.....	.....	10,000
FDB	2,3,4	18,000	.....	14,000	14,000	.....	10,000
FD	1	.....	25,000	.....	.....	10,000	.....
	2,3,4	65,000	.....	25,000	18,000	.....	10,000
HFD	1	.....	65,000	.....	.....	10,000	.....
	2,3,4	100,000	.....	65,000	25,000	.....	22,000
FDC	2,3,4	200,000	.....	100,000	35,000	.....	22,000
HFDDC	3	.....	.....	.....	.....	.....	⑤

IEC 157-1 Interrupting Capacity Ratings (P1)②

Circuit Breaker Frame	Number of Poles	Interrupting Capacity (Symmetrical Amperes)						
		Volts Ac (50/60 Hz)					Volts Dc④	
		220/240	380/415	440	500	660	125	250①
FDB	2, 3, 4	18,000	14,000	14,000	14,000	.....	.....	10,000
FD	1	25,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	65,000	25,000	25,000	18,000	.....	.....	10,000
HFD	1	65,000	.....	.....	.....	.....	10,000	.....
	2, 3	100,000	65,000	65,000	25,000	.....	.....	22,000
FDC	2, 3, 4	200,000	100,000	100,000	35,000	.....	.....	22,000
FW	1	25,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	65,000	25,000	25,000	18,000	③	.....	10,000
HFW	1	65,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	100,000	65,000	65,000	25,000	③	.....	22,000
FWC	2, 3, 4	200,000	100,000	100,000	35,000	③	.....	22,000

① Two-pole circuit breaker, or two poles of three-pole circuit breaker.
② Interrupting ratings are subject to final test verification. Refer to Westinghouse for P2 ratings.
③ Refer to Westinghouse.
④ DC ratings apply to substantially non-inductive circuits.
⑤ Interrupting rating is 15,000 amps at 500 volt Dc with 3 poles in series, for ungrounded systems only.
⑥ HFDDC is UL only and is not tested to other standards.

able, instantaneous trip mechanism that protects the switch if it is subjected to a fault current above its withstand rating. The switch does not provide low level fault or inverse time overload protection and must be used with a properly rated overcurrent protective device.

1-3. Advantages

The Series C circuit breaker line represents an entirely new approach to circuit breaker design. The F-frame circuit breaker uses new design features that improve performance and extend application capabilities while maintaining physical interchangeability with the existing FB circuit breaker family.

The following list highlights the advantages of the F-frame circuit breaker over previously available circuit breakers. (Figure 1-2).

a. Performance
The F-frame circuit breaker provides higher interrupting capacities and improved current limiting capabilities compared to previous standard line circuit breakers. The enhanced performance characteristics extend F-frame circuit breaker use to applications that previously required physically larger circuit breakers.

b. Designs
Thermal-magnetic designs include fixed or adjustable thermal and magnetic trip settings. The D model circuit breakers have fixed thermal and magnetic settings to provide application consistency. The W model circuit breakers have adjustable thermal settings and either fixed or adjustable magnetic settings to provide application flexibility where local codes and standards permit the use of adjustable circuit breakers.

The molded case switch (circuit interrupter) is equipped with a non-adjustable high instantaneous trip unit.

c. Construction Details
1-, 2-, 3-, and 4-pole configurations satisfy application requirements for all types of electrical systems. The 4-pole configuration provides 3-phase, 4-wire neutral line circuit breaking where required by local codes and applications.

Physical frame size allows interchangeability with the existing FB circuit breaker family without modifying the enclosure or mounting details.

External hardware is in English (D models) or metric (W models) thread sizes to accommodate user needs.

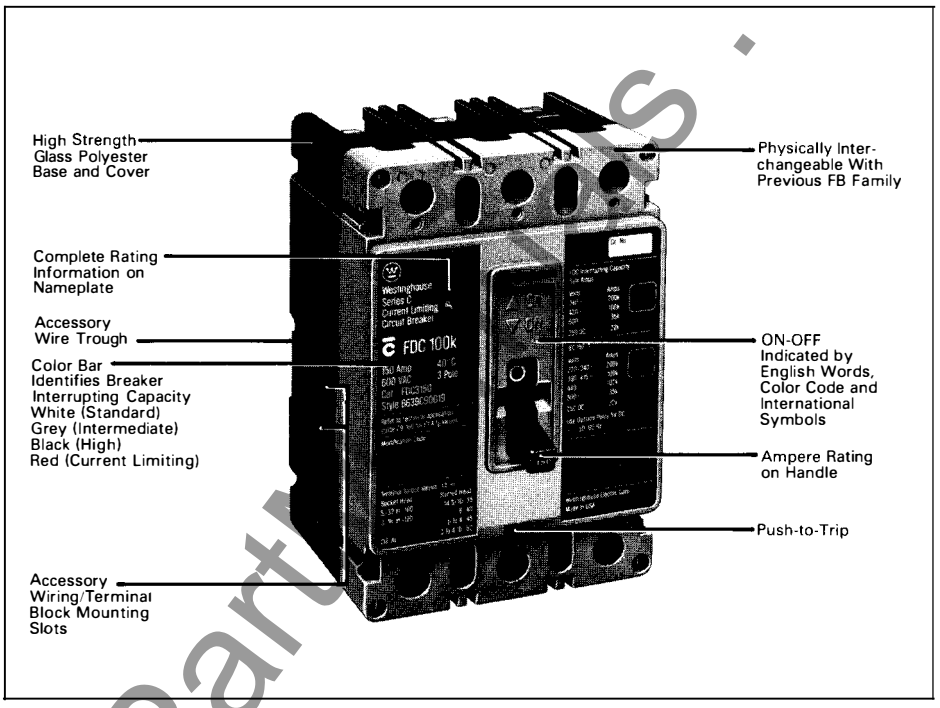


Figure 1-2. F-Frame Circuit Breaker Features

A Push-to-Trip button provides a local means of manually exercising the trip mechanism.

High strength glass-polyester base and cover have excellent dielectric qualities and reduce the need for fungus proofing. Cover design reduces the possibility of accidental contact with live terminations.

Operating mechanism design provides increased air gap between stationary and moving contacts when circuit breaker is in tripped position. The increased air gap provides greater arc impedance during contact opening, which allows higher interrupting capacity ratings to be obtained in compact frame sizes.

Variations in contact assembly designs allow different interrupting capacities in one physical frame size.

The one piece molded crossbar assembly has high dielectric qualities and ensures simultaneous operation of all moving contacts.

Positive operating mechanism ensures that the operating handle stays in the ON position when the contacts are closed.

Handle operating force and throw are compatible with circuit breakers in the FB family, allowing changeover to the F-frame circuit breaker with little or no handle mechanism modification.

Back plate insulates internal component hardware from the circuit breaker mounting surface.

d. Internal Accessories
Modular plug-in accessory design simplifies factory installation for improved customer service and facilitates field installation where local codes and standards permit. Molded accessory frames provide improved electrical clearance and dielectric quality.

The internally mounted accessories include auxiliary switch, alarm (signal)/lockout switch, shunt trip, undervoltage release mechanism and low energy shunt trip. These accessories are designed to meet most ac and dc rating requirements.

Internal accessory wiring options provide wire routing versatility. The standard wiring method is pigtail leads exiting from the rear of the circuit breaker base. Options include pigtail leads extending through a slot in the side of the base where the accessory is mounted, or through a molded trough to the opposite side of the base. Additional options include side mounted terminal blocks.

e. External Accessories
Cover design permits field installation of key interlocks, padlockable handle lock

Series C Molded Case Circuit Breakers, F-Frame
Section 1 – Introduction

hasp, and electrical or manual handle operators without modifying the cover.

A factory installed cylinder lock can be mounted in the cover providing a simplified system for locking the trip bar in the tripped position.

Plug-in adapters provide convenience for front-removable switchboard construction.

The F-frame models can be operated by existing handle mechanism types, including Vari-depth, slide plate, SM, MC, and AMT.

f. Markings
The Series C circuit breaker line features a new format of nameplate which provides easy identification of circuit breaker type, rating, and operating status.

Nameplates are color coded for immediate rating identification. A color-coded bar identifies the type and the interrupting rating (kA) at the most common application voltage (480 or 380 Vac). The color codes are as follows:

White: EHD/FDB

Grey: FD/FW

Black: HFD/HFW

Red: FDC/FWC.

Consolidated nameplate design provides complete identification and rating information in an easily readable, understandable format.

Circuit breaker status is clearly indicated by circuit breaker handle position and color-coded flags (red for ON, green for OFF, and white for TRIP). The on and off positions are identified in English words (ON and OFF) and international symbols (I and O).

g. Equipment Literature
A complete line of technical literature produced in several languages provides specification, ordering, application, and instructional information. This makes the circuit breaker easy to specify, purchase, and apply, saving time and minimizing application errors.

Dimensional data is in English and metric units to satisfy user requirements.

h. Standards Compliance
The Series C circuit breaker is designed to comply with the following standards:

- Australian Standard AS 2184, Moulded Case Circuit Breakers
- British Standards Institution Specification BS 4752: Switchgear and Control Gear, Part 1: Circuit Breakers
- Canadian Standards Association Standard C22.2 No. 5, Service Entrance and Branch Circuit Breakers
- International Electrotechnical Commission Recommendation IEC 157-1 (P1 and P2), Low-Voltage Distribution Switchgear, Part 1: Circuit Breakers
- National Electrical Manufacturers Association Standards Publication No. AB1-1986, for Molded Case Circuit Breakers
- South African Bureau of Standards Standard SABS 156, Standard Specification for Moulded Case Circuit Breakers
- Swiss Electro-Technical Association Standard SEV 157-1, Safety Regulations for Circuit Breakers
- Underwriters Laboratories, Inc. Standard UL489, Molded Case Circuit Breakers and Circuit Breaker Enclosures, Including Marine Circuit Breakers
- Union Technique de l'Electricite Requirements NF C 63-120, Low Voltage Switchgear and Control Gear Circuit Breaker Requirements
- Verband Deutscher Elektrotechniker (Association of German Electrical Engineers) Specification VDE 0660, Low Voltage Switch Gear and Control Gear, Circuit Breakers.

Compliance with these standards satisfies most local and international codes, assuring user acceptability and simplifying application.

i. Federal Specification Classifications
Federal specification W-C-375b is complied with as follows:

EHD: 1-pole Class 13a;
2-, 3-pole Class 13b

FDB①: 2-, 3-pole Class 18a

FD①: 1-pole Class 13a;
2-, 3-pole Class 22a

HFD①: 1-pole Class 13a;
2-, 3-pole Class 23a

FDC①: 2-, 3-pole Class 24a.

① Except range of current trip is 15-150A.

Series C Molded Case Circuit Breakers, F-Frame
Section 2 – Applications

2-1. Introduction

Application flexibility of the F-frame circuit breaker is enhanced by the higher interrupting ratings and current limiting characteristics designed into the Series C line (Figure 2-1).

2-2. Switchboard Application

The EHD, FDB, FD/FW, HFD/HFW, and FDC/FWC circuit breakers are used in distribution systems to provide feeder and branch protection.

2-3. Panelboard Application

The F-frame circuit breaker is used in panelboard applications as both a main and a branch protection device.

2-4. Busway Plug-In Application

The F-frame circuit breaker can be applied in busway plug-in units to provide branch protection. Size compatibility between the FB family and the F-frame circuit breaker facilitates replacement without changing busway plug-in units.

2-5. Individual Enclosure Application

The F-frame circuit breaker can be applied in individual enclosures to meet specific installation requirements.

2-6. Machine Tool Control Panel Application

In machine tool applications, F-frame circuit breakers and molded case switches can be applied to meet individual equipment requirements.

2-7. Special Applications

In mining, motor circuit protection, uninterruptible power systems (DC battery breakers), and other applications, special versions of the F-frame circuit breaker provide safe equipment control and protection. For additional information, see separate frame books or refer to Westinghouse.

For all 3-phase Delta, grounded B phase applications, refer to Westinghouse.

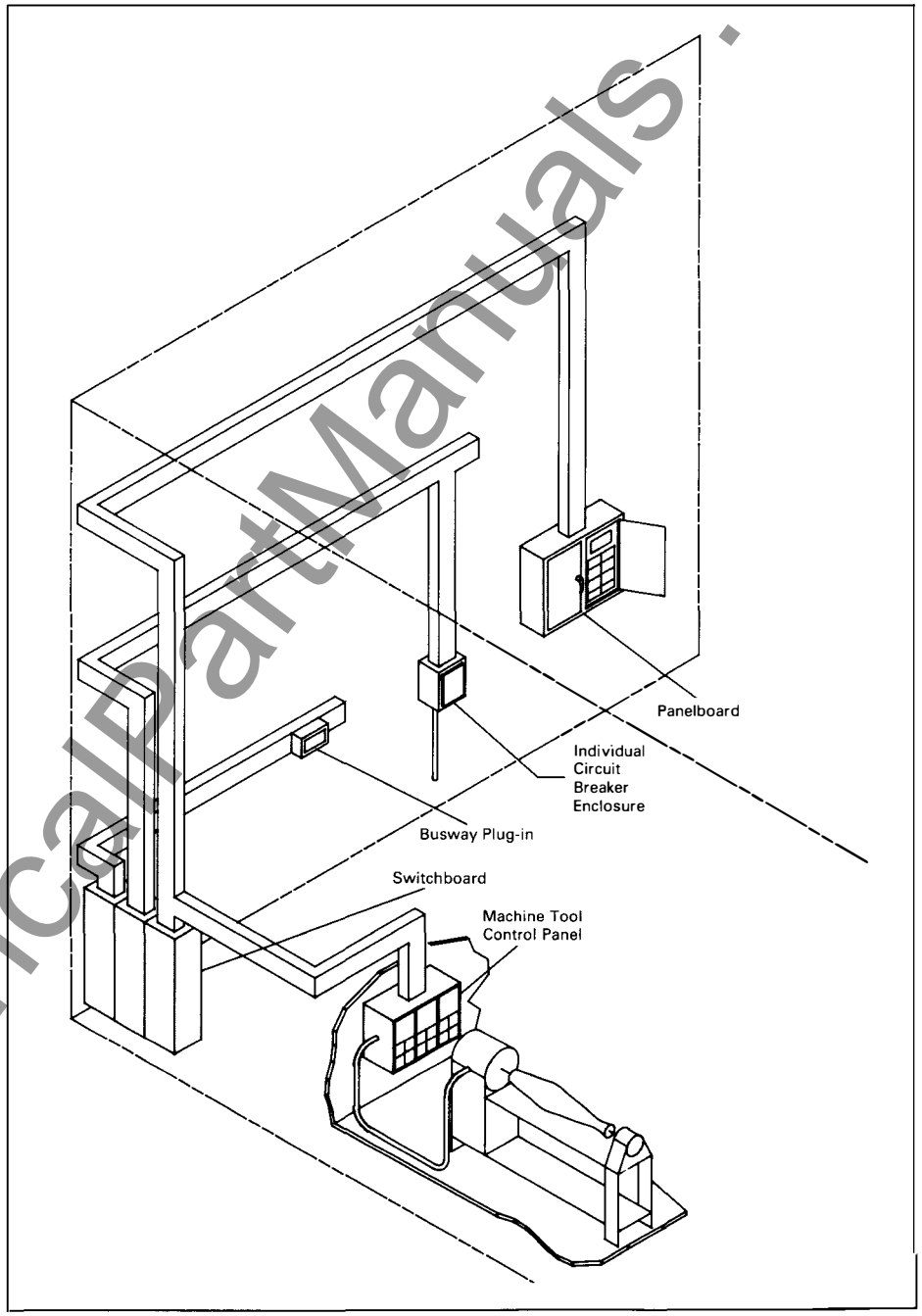


Figure 2-1. F-Frame Circuit Breaker Typical Applications

Series C Molded Case Circuit Breakers, F-Frame
Section 3 – Description

3-1. Physical Description

The F-frame circuit breaker consists of the following components mounted inside a molded glass-polyester case (Figure 3-1):

a. Operating mechanism
b. Arc extinguishers
c. Stationary contact assemblies
d. Moving contact assemblies
e. Trip mechanisms.

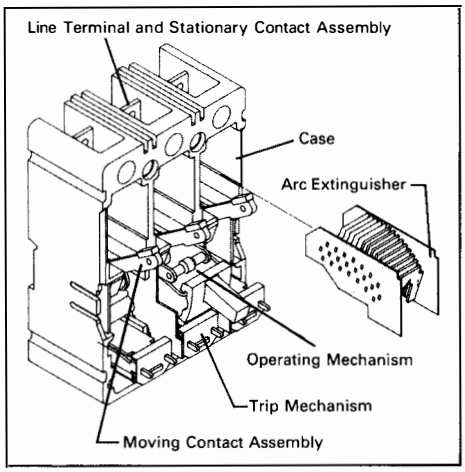


Figure 3-1. F-Frame Circuit Breaker Components

3-2. Functional Description

The F-frame circuit breaker disconnects a load from an electrical supply when the handle is operated, when an overcurrent or short circuit condition develops, or when a manual trip is initiated. Circuit breaker operation is provided by a spring-loaded toggle operating mechanism that provides quick-make and quick-break, trip free operation.

The current path in the circuit breaker is shown in Figure 3-2. When the circuit breaker contacts are closed, the current flows from the line terminal, through the stationary and moving contact assemblies, through a copper shunt to the thermal-trip bimetal, through the bimetal and magnetic-trip element, to the load terminal.

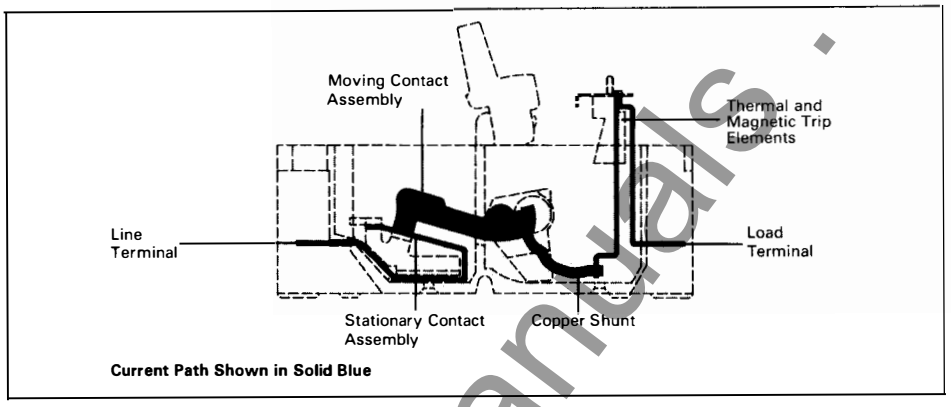


Figure 3-2. F-Frame Circuit Breaker Current Path (HFD/HFW Stationary Contact Shown)

3-3. Component Description

The following paragraphs give the physical and functional descriptions of the circuit breaker components. Differences between the FD/FW, HFD/HFW, and FDC/FWC circuit breakers are described.

Molded Case

The molded case (Figure 3-3) is a housing for electrically insulating the circuit breaker components and internal accessories. The case consists of a glass-polyester base and cover. The internal case molding forms cavities that isolate terminal areas, individual arc chambers, the operating mechanism, and internal accessories. Barriers isolate the operating mechanism from the accessory mounting cavities. Slots in the cover provide ventilation for the arc chambers. The external case molding forms terminal enclosures to help prevent accidental contact with the terminals. The outside of the case accomodates externally mounted accessories. Mounting slots in the base accommodate external terminal blocks for connections to internal accessories. Alternatively, these slots act as side exit holes for internal accessory pigtail leads. Other slots allow pigtail leads to exit from the back of the base. A trough molded into the back of the base provides internal accessory lead routing across the back of the circuit breaker. A back plate insulates live mounting components.

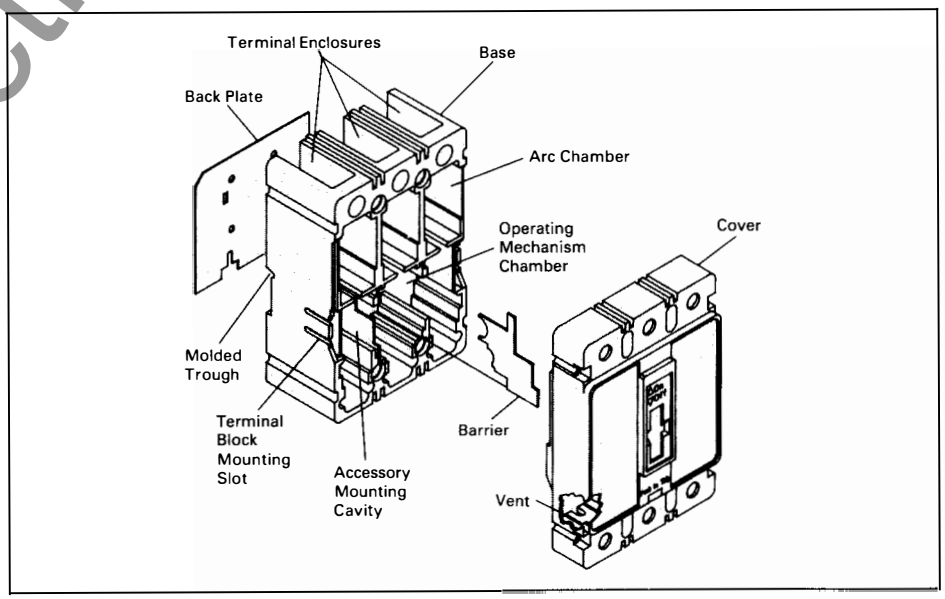


Figure 3-3. Molded Case

Series C Molded Case Circuit Breakers, F-Frame
Section 3 – Description

Operating Mechanism
The operating mechanism provides a means of manually switching the moving contact position from open to closed and from closed to open, and it provides the mechanical means to open the contacts when trip conditions occur. The handle position indicates the contact status: closed, tripped, or open.

Manual Operation
Manual operation of the circuit breaker handle closes and opens the moving contact assembly. When the cradle is hooked in the latch (Figure 3-4), the handle arm controls crossbar rotation. When the handle arm is moved from one position to the other, the crossbar rotates and the moving contacts open or close. The link arrangement between the handle arm and the crossbar provides spring-loaded toggle operation.

Trip Operation
The trip operation provides contact opening when the trip mechanism is actuated. The trip mechanism can be actuated thermally; magnetically; or manually by the Push-to-Trip button, the cylinder lock, the shunt trip, or the undervoltage release mechanism accessories. Trip operation can occur only when the cradle is hooked into the latch. When a trip element operates (Figure 3-5), the trip bar rotates and releases the latch. When the latch is released, the handle arm springs pull the cradle against the handle arm and, at the same time, rotate the crossbar to open the contacts.

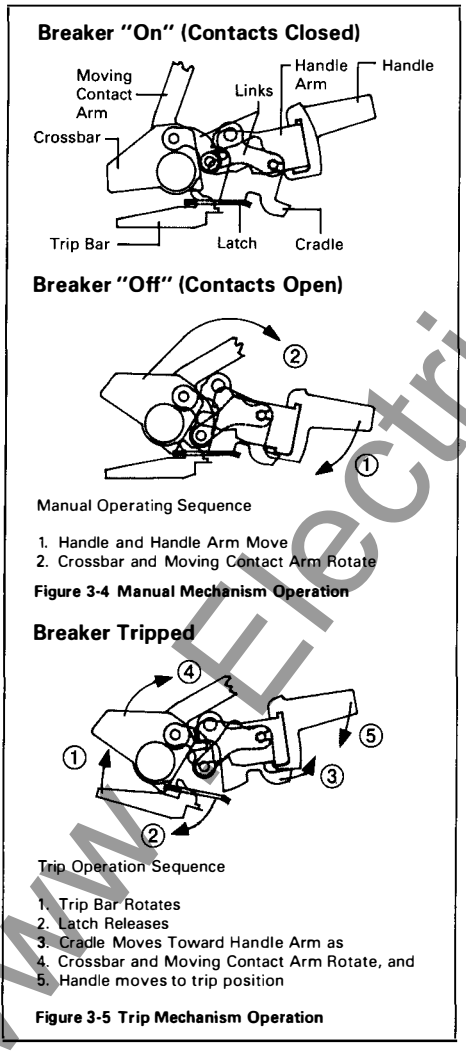


Figure 3-4 Manual Mechanism Operation

Figure 3-5 Trip Mechanism Operation

Arc Extinguishers
The arc extinguishers dissipate arcs that result when the circuit breaker interrupts current flow. Each arc extinguisher consists of a stack of uniformly spaced, U-shaped steel plates held together by two insulating side plates (Figure 3-6).

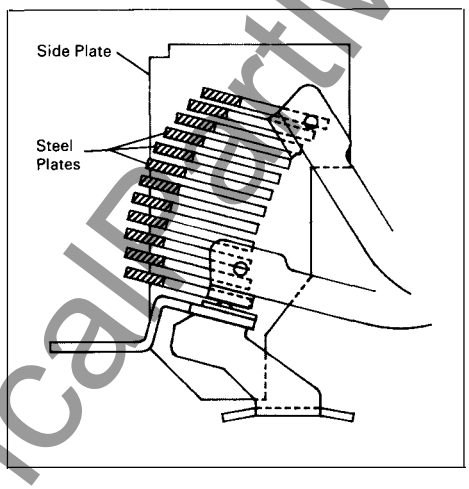


Figure 3-6. Arc Extinguisher

When an interruption occurs and the contacts separate, the current flow through the ionized region between the contacts induces a magnetic field around the arc and arc extinguisher (Figure 3-7). As the lines of magnetic flux show, the force drives the arc into the steel plates, deionizing the gas while dividing and cooling the arc.

Stationary Contact Assemblies
The stationary contact assemblies provide the conducting paths between the line terminals and the moving contacts. Three basic stationary contact assembly configurations are used: EHD, FDB, FD/FW; HFD/HFW; and FDC/FWC.

EHD, FDB, FD/FW Stationary Contact Assemblies
The EHD, FDB, FD/FW circuit breakers use a conventional stationary contact assembly (Figure 3-8). It consists of a line terminal copper conductor and a silver tungsten (EHD, FDB, FD) or silver graphite (FW) contact.

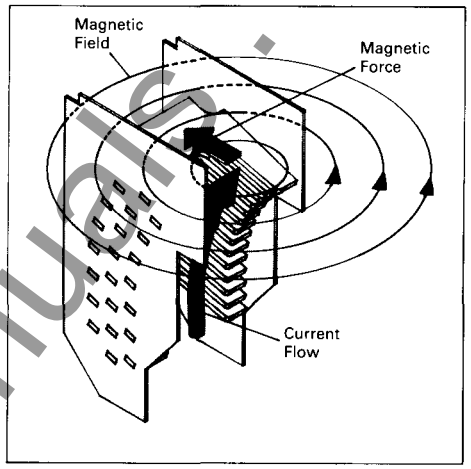


Figure 3-7. Arc Extinguisher Operation

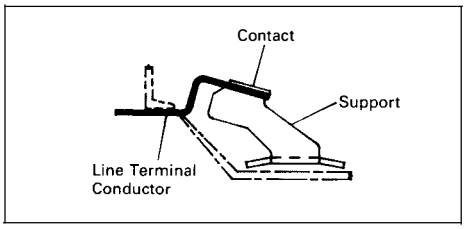


Figure 3-8. FD/FW Stationary Contact Assembly

HFD/HFW Stationary Contact Assembly
The HFD/HFW circuit breaker uses a reverse-loop stationary contact assembly (Figure 3-9). It consists of a line terminal copper conductor that is formed into a loop, and a silver tungsten (HFD) or silver graphite (HFW) contact.

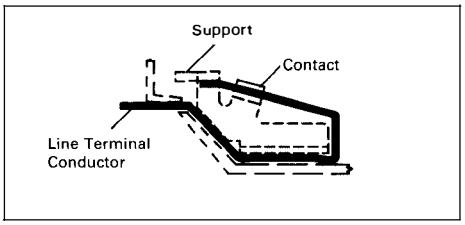


Figure 3-9. HFD/HFW Stationary Contact Assembly

FDC/FWC Stationary Contact Assembly
Each FDC/FWC circuit breaker stationary contact assembly (Figure 3-10) consists of a line terminal copper conductor connected through a pivoted joint to a copper contact conductor and a silver tungsten (FDC) or silver graphite (FWC) contact. The line terminal conductor and contact conductor form a reverse loop. A compression spring behind the contact conductor limits movement and returns the contact conductor to the normal position after a high fault trip.

Series C Molded Case Circuit Breakers, F-Frame
Section 3 – Description

The FDC/FWC stationary contact assembly operates on the same principle as the HFD/HFW stationary contact assembly, but it provides greater arc extension and faster contact opening.

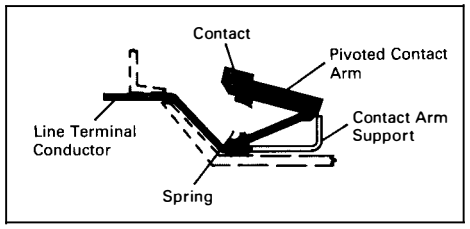


Figure 3-10. FDC/FWC Stationary Contact Assembly

Contact Blow-Apart
When current is flowing through the contacts of the HFD/HFW circuit breakers, the positions of the reverse loop and the moving contact arm induce opposing magnetic fields. The resulting opposing forces along the magnetic flux lines cause rapid contact blow-apart under high current interrupt conditions.

When the FDC/FWC circuit breaker trips under high current conditions, the pivoted joint (Figure 3-11) allows the lower contact to move downward as the moving contact moves upward. The compression spring limits the downward movement and returns the contact conductor to the normal position.

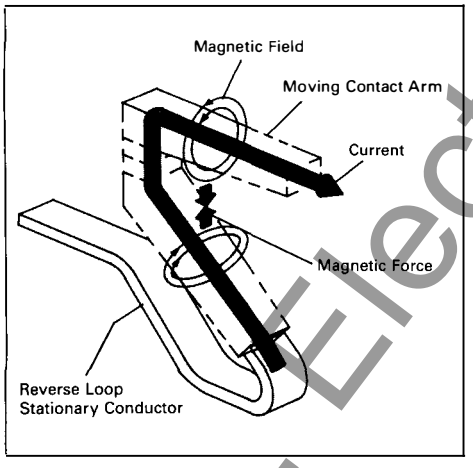


Figure 3-11. Contact Blow-Apart

Moving Contact Assembly
The moving contact assembly provides continuity between the line and load terminals when the circuit breaker is on. When the circuit breaker trips or is switched off, the moving contact assembly moves through the arc extinguisher away from the stationary contact.

The moving contact arm is connected to the operating mechanism crossbar (Figure 3-12). The crossbar and moving contact arm assembly rotates to close the contacts. After the contacts touch, the crossbar overtravels to create firm contact closure, and an arm latch holds the moving contact arm in place.

During overload conditions, when the operating mechanism is tripped, the crossbar and moving contact arm rotate together. Under high level fault conditions when the contact blow-apart forces are strong enough, the moving contact arms independently pivot away from the stationary contact during the tripping operation.

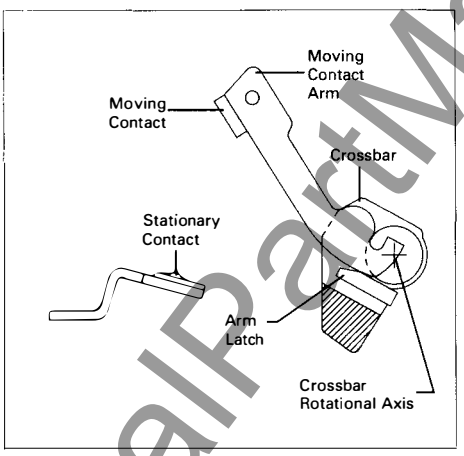


Figure 3-12. Moving Contact Assembly

Trip Mechanisms
The trip mechanisms provide automatic (thermal and magnetic) and manual (Push-to-Trip button) means to trip the circuit breaker. Each trip mechanism rotates and unlatches the trip bar thereby releasing the operating mechanism latch and causing the circuit breaker to trip (Figure 3-13).

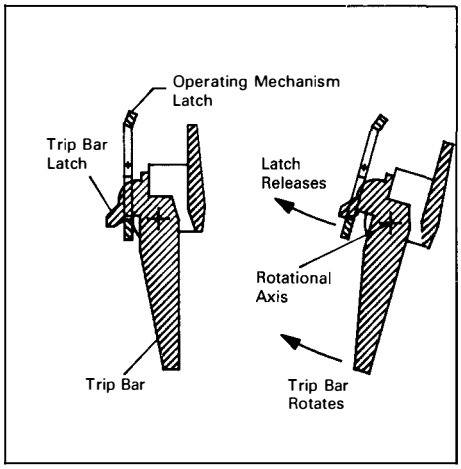


Figure 3-13. Trip Bar Operation

Thermal (Inverse Time) Trip Mechanism
The thermal trip mechanism operates in response to overload conditions. The mechanism includes a bimetal element located behind the trip bar (Figure 3-14). The bimetal element is part of the current carrying path. When there is an overload, the increased current flow heats the bimetal and causes it to bend. As the bimetal bends, it touches and rotates the trip bar causing the circuit breaker to trip. The time needed for the bimetal to bend and trip the circuit breaker varies inversely with the current.

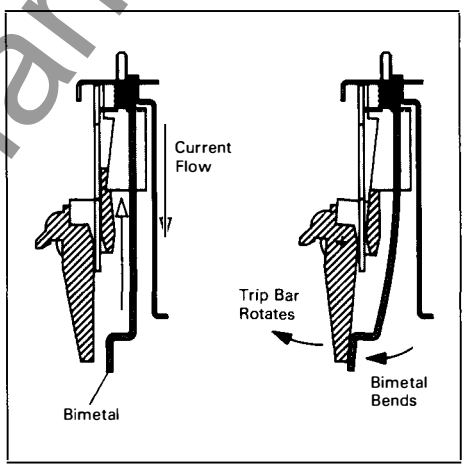


Figure 3-14. Thermal Trip Operation

Magnetic (Instantaneous) Trip Mechanism
The magnetic trip mechanism operates when there is a high current (short circuit) in the current path. The mechanism includes an electromagnet and an armature. When high level current passes through the conductor, the magnetic field strength of the electromagnet rapidly increases and attracts the armature (Figure 3-15). As the

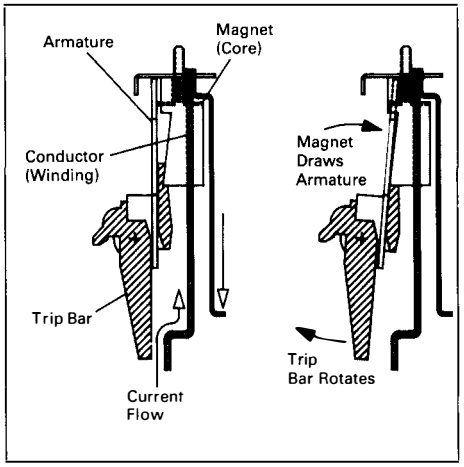


Figure 3-15. Magnetic Trip Operation

top of the armature is drawn to the electromagnet, the armature rotates the trip bar causing the circuit breaker to trip.

Push-to-Trip Mechanism
The Push-to-Trip mechanism provides a manual means of tripping the circuit breaker by depressing a button located in the circuit breaker cover. When the Push-to-Trip button (Figure 3-16) is pressed, a plunger rotates the trip bar causing the circuit breaker to trip.

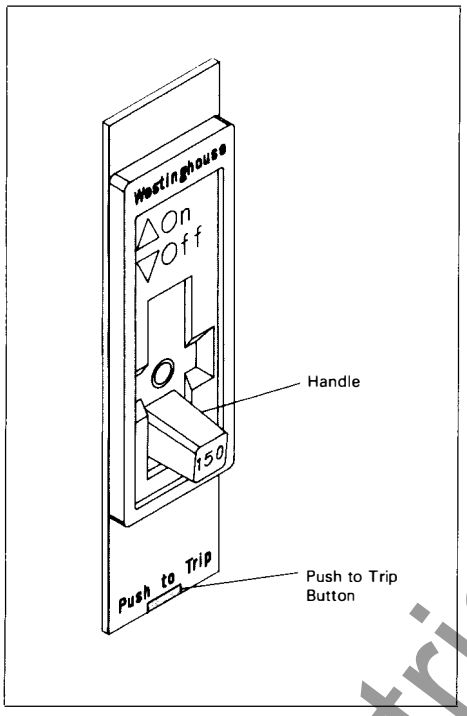


Figure 3-16. Push-to-Trip Button

FW, HFW, and FWC Adjustable Thermal and Adjustable Magnetic Mechanism
The thermal and magnetic elements of FW, HFW, FWC circuit breakers can be adjusted by rotating the adjustment buttons (Figure 3-17) in the cover of the circuit breaker to the desired setting marked on the label. The adjustable thermal mechanism has movable elements (one per pole) connected by a common adjustment linkage. Each pole element is in the form of an inclined plane (wedge) and is located between the bimetal strip and the trip bar. Movement of the wedge adjusts the bimetal trip bar gap varying the necessary bimetal travel required to trip the circuit breaker. The magnetic pickup setting is adjusted by a linkage that varies the spring tension on the magnet armature.

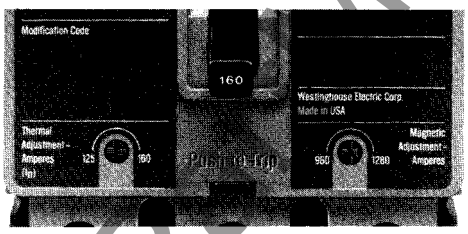


Figure 3-17. Adjustment Buttons

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

4-1. General Information
A complete line of accessories is available for use with the Series C circuit breakers and molded case switches. Commonly required internally mounted accessories are plug-in types for use only with the Series C line. The following paragraphs describe each accessory and provide operation, rating, and specification information. In this section, "circuit breaker" shall also include molded case switch unless otherwise stated.

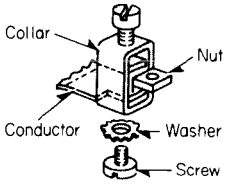
4-2. Termination Accessories
Termination accessories of two basic types are available: terminal connection devices, which accomodate typical circuit breaker connection variations; and termination protection devices which provide terminal isolation.

Termination Connection Devices
- Line and Load Terminals
- Keeper Nut
- Rear Connecting Studs
- Plug-In Adapters
- Panelboard Connecting Straps

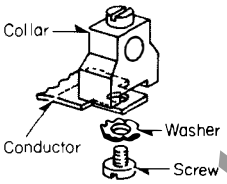
Termination Protection Devices
- Terminal Shields
- Terminal End Covers
- Interphase Barriers

Line and Load Terminals

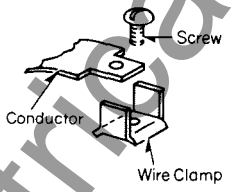
Line and load terminals provide wire connecting capabilities for specific ranges of continuous current ratings and wire types. Except as noted, terminals comply with Underwriters Laboratories, Inc. Standards UL486A or UL486B. Unless otherwise specified, F-frame circuit breakers are factory equipped with load terminals only.



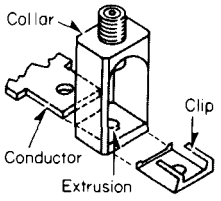
Style 624B100G02
Style 624B100G18
Collar encloses conductor and is held in position by a screw, lockwasher and nut.



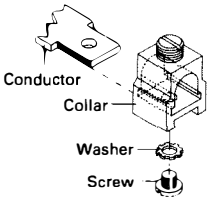
Style 624B100G10
Collar is assembled on top of conductor and is secured with a screw and lockwasher.



Style 624B100G14
Wire clamp is secured to the conductor with a screw.

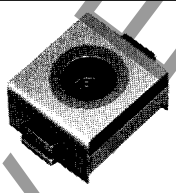


Style 624B100G17
Collar encloses conductor and is secured with a clip. The clip legs slide over the conductor and clip end snaps around bottom of collar.



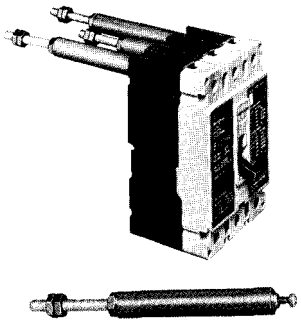
Style 624B100G19
Collar slides onto conductor and is held in position by a screw and lockwasher.

Keeper Nut



The keeper nut slides onto the line or load conductor of the circuit breaker and acts as a threaded adapter for the conductor to accept a ring terminal or other bolt-on connector. The keeper nut is available with English and metric thread sizes. (Field installation only). Listed per UL File E7819.

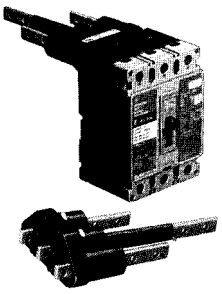
Rear Connecting Studs



Rear connecting studs are available in several sizes to accommodate specific fixed-mounted circuit breaker applications. The rear connecting studs are rated 100A or 150/160A. See Section 5 for dimensional data. (Field installation only)

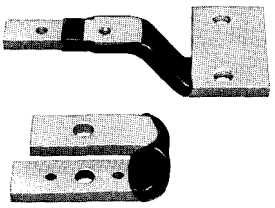
Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

Plug-In Adapters



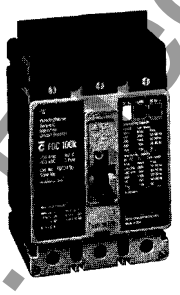
Plug-in adapters simplify installation and front removal of circuit breakers. Individual line and load plug-in adapters are available for rear connection applications on 2-, 3-, and 4-pole circuit breakers. Common mounting plates for line and load end adapters are available. The plug-in adapters are rated 100A or 150/160A. Plug-in adapters are component recognized through 150A per UL File E56845.① See Section 6 for plug-in adapter dimensional data. (Field installation only)

Panelboard Connecting Straps



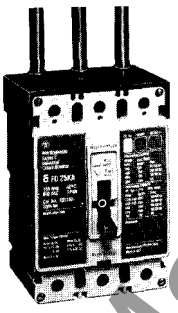
Panelboard connecting straps are used to connect the circuit breaker terminals to the panelboard bus. The panelboard connecting straps are available in two types with 50A, 100A, and 150/160A ratings: outside pole and center pole.

Terminal Shields



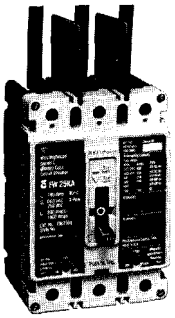
The terminal shield provides protection against accidental contact with live line terminations. Terminal shields are formed from high dielectric insulating material and fasten over the front terminal access openings. Small holes in the shields provide limited access to the terminals for tightening connectors. Terminal shields are listed per UL File E7819. (Field installation only)

Terminal End Covers



The terminal end covers are designed for use in motor control center applications where, because of confined spaces, line side conductors are normally custom fitted. The molded end covers are made of high dielectric glass-polyester and slide over the line ends of the circuit breaker. Close fitting conductor openings are molded into the end covers. The end cover and circuit breaker case fit together to form terminal compartments that isolate discharged ionizing gasses during circuit breaker tripping. Terminal end covers are available with two conductor opening diameters, 0.25 and 0.41 inch, and are listed per UL File E7819. (Field installation only)

Interphase Barriers



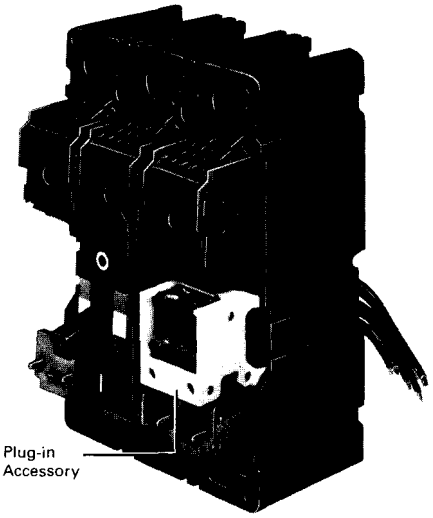
The interphase barriers provide additional electrical clearance between circuit breaker poles for special termination applications. The barriers are high dielectric insulating plates that are installed in the molded slots between the terminals. Interphase barriers are listed per UL File E7819. (Field installation only)

① Recognition of some components pending, refer to Westinghouse.

4-3. Internal Accessories

Internal accessories for the EHD, FDB, FD, HFD, and FDC models are listed for factory installation per UL File E7819, and comply with requirements in Underwriters Laboratories Standard, Inc. UL489 for sealed circuit breakers. Plug-in internal accessories (Figure 4-9) can be field installed in FW, HFW, and FWC models. Internal accessories can also be field installed in D model circuit breakers where UL standards do not apply and where local codes and standards permit. The plug-in internal accessories include:

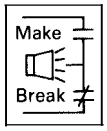
- Alarm (Signal)/Lockout Switch
- Auxiliary Switch
- Shunt Trip
- Undervoltage Release.
- Low Energy Shunt Trip



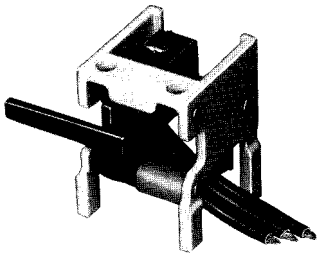
Typical Internal Plug-in Accessory Installed in F-frame Circuit Breaker

Different accessory wiring options are available to satisfy most circuit breaker mounting applications. The standard wiring method is 18-inch pigtail leads extending through a slot at the rear of the base. Options allow the pigtail leads to be routed through a slot in the side of the base where the accessory is mounted, or through a molded trough to the opposite side of the base. Additional options include side-mounted terminal blocks. If accessory leads longer than 18 inches are required, side mounted terminal blocks should be used. To identify allowable accessory installation combinations, see paragraph 4-8. Internally mounted accessories identified in paragraph 4-8 are shown in this section by a graphic symbol in a shaded blue box.

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications



Alarm (Signal)/ Lockout Switch

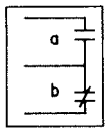


The alarm (signal)/lockout switch monitors circuit breaker trip status and provides remote signaling and interlocking capabilities when the circuit breaker trips. For 2-, 3-, and 4-pole circuit breakers, the alarm (signal)/lockout switch consists of one or two SPDT switches housed in a plug-in module. The SPDT switch contacts are identified as make and break contacts. When the circuit breaker trips, the make contact closes and the break contact opens. For 1-pole circuit breakers, the switch (factory installed only) is mounted on the inside of the cover and the two make leads are routed through an opening in the load end of the circuit breaker. Table 4-1 provides electrical rating data for the alarm (signal)/lockout switch.

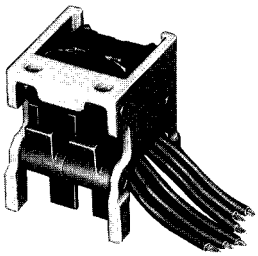
Table 4-1. Alarm (Signal)/Lockout Switch Electrical Rating Data① ②

Maximum Voltage	Freq.	Maximum Current, Amps	Dielectric Withstand Voltage
Multi-Pole Circuit Breakers			
600	50/60 Hz	6	2500
125	dc	0.5③	2200
250	dc	0.25③	2200
Single-Pole Circuit Breakers			
125/250	50/60Hz	6③	2000
28	dc	3③	2000
28	dc	5④	2000

① Endurance: 4000 electrical operations plus 4000 mechanical operations.
② Pigtail wire size: No. 18 AWG (0.82 mm²).
③ Non-inductive load.
④ Inductive (L/R = 0.026).



Auxiliary Switch

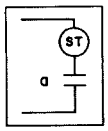


The auxiliary switch provides circuit breaker contact status information by monitoring the position of the moving contact arm. The auxiliary switch is used for remote indication and interlock system verification, and consists of one or two SPDT switches housed in a plug-in module. Each SPDT switch has one "a" and one "b" contact. When the circuit breaker contacts are open, the "a" contact is open and the "b" contact is closed. Table 4-2 provides electrical rating data for the auxiliary switch.

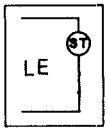
Table 4-2. Auxiliary Switch Electrical Rating Data⑤⑥

Maximum Voltage	Freq.	Maximum Current, Amps	Dielectric Withstand Voltage
125⑧	50/60 Hz	1	2500
600	50/60 Hz	6	2500
125	dc	0.5⑦	2200
250	dc	0.25⑦	2200

⑤ Endurance: 4000 electrical operations plus 4000 mechanical operations.
⑥ Pigtail wire size: No.18 AWG (0.82 mm²).
● Non-inductive load
⑧ For use in electronic circuit of 100 micro-amps and 15 VDC minimum.

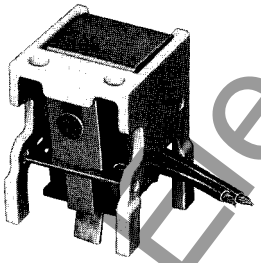


Standard



Low Energy

Shunt Trip



The shunt trip provides remote controlled tripping of the circuit breaker. The shunt trip consists of an intermittent rated solenoid with a tripping plunger and a cutoff switch mounted in a plug-in module. The 120V, AC shunt trip is marked, "suitable for use with ground fault protection devices." Table 4-3 provides electrical rating data for the shunt trip.

A low energy shunt trip device, rated 24V, DC, is available for special applications. A cut-off switch must be included in the external circuit.

Notes:
1. Average unlatching time: 6 milliseconds.
2. Average circuit breaker contact total opening time: 18 milliseconds
3. Endurance: 4000 electrical operations plus 4000 mechanical operations
4. Pigtail wire size: No. 18 AWG (0.82 mm²).

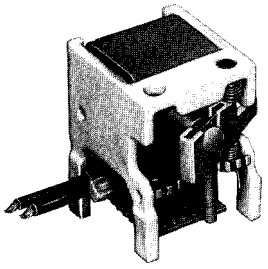
Table 4-3. Standard Shunt Trip Electrical Rating Data

Electrical Operating Ratings

50/60 Hz			dc		
Supply Voltage	Minimum Operating Voltage	VA	Supply Voltage	Minimum Operating Voltage	VA
9		40	12		100
12	6.3	75	24	8.4	400
24		300			
48		90	48		100
60		130	60		160
110	33.6	440	110	33.6	530
120		520	120		630
127		580	125		680
208		170	220		50
220	146	180	250	154	65
240		220	...		...
380		530	...		...
400		130	...	...	...
415		140	...	...	...
440		150	...	...	...
480	280	180	...	...	...
525		220	...	...	...
550		240	...	...	...
600		280	...	...	...

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

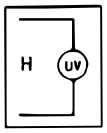
Undervoltage Release Mechanism



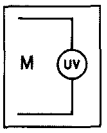
The undervoltage release mechanism monitors a voltage (typically a line voltage) and trips the circuit breaker when the voltage falls to between 70 and 35 percent of the solenoid coil rating. Table 4-4 provides electrical rating data for each operating voltage of the handle reset undervoltage release mechanism.

NOTE: Undervoltage release mechanism accessories are not designed for, and should not be used as, circuit interlocks

There are two different types of undervoltage release mechanisms available: handle reset and manual reset.



Handle Reset (Standard)
The undervoltage release mechanism consists of a continuous rated solenoid with a plunger and tripping lever mounted in a plug-in module. The tab on the tripping lever resets the undervoltage release mechanism when normal voltage has been restored and the circuit breaker handle is moved to the reset (OFF) position. With less than pickup voltage applied to the undervoltage release mechanism, the circuit breaker contacts will not touch when a closing operation is attempted.



Manual Reset (Optional)
The accessory consists of two metal cores held together by the flux of a surrounding coil. As voltage drops in the coil, the lower core drops pivoting a lever which presses against the trip bar, and at the same time extends a plunger through the circuit breaker cover as an indication of an undervoltage trip. When voltage is restored, the plunger projecting through the circuit breaker cover must be depressed to reset the undervoltage release mechanism. This accessory can be factory installed only. Consult Westinghouse for availability.

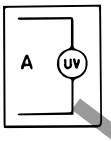


Table 4-4. Undervoltage Release Mechanism (Handle Reset) Electrical Rating Data

Electrical Operating Ratings									
50/60 Hz					dc				
Supply Voltage	Dropout Voltage Min.	Dropout Voltage Max.	Pickup Voltage Max.	VA	Supply Voltage	Dropout Voltage Min.	Dropout Voltage Max.	Pickup Voltage Max.	VA
9 12	4.2	6.3	7.6	1.3 2.5	12	4.2	8.4	10.2	2.8
24	8.4	16.8	20.4	1.4	24	8.4	16.8	20.4	1.6
48 60	21	33.6	40.8	1.2 1.9	48 60	21	33.6	40.8	1.3 2.0
110 120 127	44.5	77	93.5	1.3 1.5 1.7	110 120 125	44.5	77	93.5	1.5 1.7 1.9
208 220 240	84	145.6	176.8	2.2 2.4 2.9	220 250 ...	87.5 ...	154 ...	187 ...	2.6 3.4 ...
380 415 440 480	168	266	323	2.9 3.5 3.9 4.6	... ...	... ...	... ...	... ...	... ...
525 550 600	210	367	446	4.3 4.8 5.8	... ...	... ...	... ...	... ...	... ...

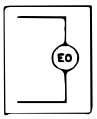
Notes:
1. Endurance: 4000 electrical operations plus 4000 mechanical operations

4-4. Handle Operating Accessories

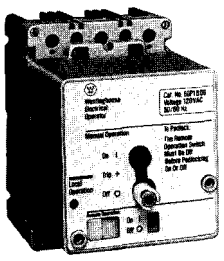
The handle operating accessories provide indirect electrical or manual circuit breaker handle operation. These accessories are field installed only and include:

- Electrical (Solenoid) Operator
- Rotary Handle
- Vari-Depth Handle Mechanism
- Slide Plate Handle Mechanism
- Type SM Safety Handle Mechanism
- Type MC Motor Control Handle Mechanism
- Type AMT Vari-Depth/Vari-Width Flange Mounted Handle Mechanism

To identify allowable accessory installation combinations, see paragraph 4-8. Handle operating accessories identified in paragraph 4-8 are shown in this section by a graphic symbol in a shaded blue box.



Electrical (Solenoid) Operator①



The electrical (solenoid) operator is a single solenoid mechanism that enables local and remote circuit breaker ON, OFF, and reset switching. The electrical operator is mounted on the circuit breaker cover within the trimline of the circuit breaker. The electrical operator uses a unique bistable latch that allows the device to operate using one time of 5 cycles (80 ms) making it suitable for generator synchronizing applications.

Means are provided for local and remote electrical operation and for local manual operation.② A special handle design includes provisions for padlocking the manual operating handle in the ON or OFF position. (Handle padlocking does not affect the trip free operation of the circuit breaker.) The handle will accept one padlock shackle with a maximum diameter of 1/4 inch (6mm). An interlock electrically disconnects the solenoid when the electrical operator cover is removed. Table 4-5 provides electrical rating data for the electrical (solenoid) operator. The electrical (solenoid) operator is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.

(continued)

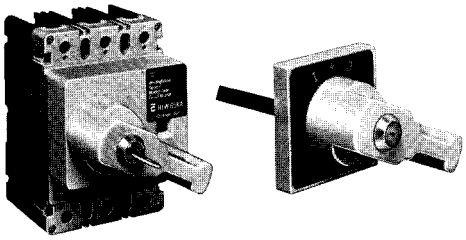
● Electrical operator is also suitable for use with Types EB, EHB, FB, and HFB circuit breakers.
② 24 VDC electrical operator has remote electrical and local manual operations only.

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

Table 4-5. Electrical (Solenoid) Operator Electrical Rating Data②

Voltage●	Freq.	Inrush Current Amps	Maximum Operating Time	Fuse④ Amps
24	50/60 Hz or dc	40	5 cycles (80ms)	15
120		10		3
240		5		2

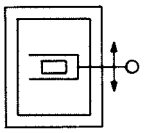
Rotary Handle



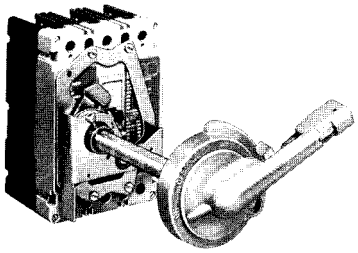
The rotary handle mechanism mechanically transfers the rotating operation of the rotary handle to the in-line toggle operation of the circuit breaker handle. A window in the handle mechanism case indicates circuit breaker status: ON, "1" on a red background; TRIP, "+" on a white background; OFF, "0" on a green background. The handle mechanism is mounted on the circuit breaker cover within the trimline and will take up to three padlock shackles, each with a maximum diameter of 1/4 inch (6mm). A cylinder lock can be installed in the handle. The handle is designed to be locked in the OFF position, however, one knockout tab is provided in the handle mounting boss which must be removed to lock the handle in the ON position. Trip-free operation permits the circuit breaker to trip if the handle is locked in the ON position. For this condition, the handle will continue to indicate ON.

The handle is removable, and a 10-inch (250mm) shaft extension is available to use with the handle mechanism when the circuit breaker is mounted behind the fixed or hinged front cover of a NEMA 1 enclosure. Provision is made for mounting an early-make/early-break auxiliary switch on the handle mechanism for use with undervoltage release mechanisms. Styles with red handles and yellow background labels are available for use on main disconnect devices where required by local codes. Consult Westinghouse for availability.

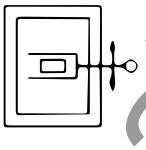
● UL listing pending, refer to Westinghouse.
② The electrical operator design is endurance tested for 10,000 electrical operations.
③ Tolerance: +10%, −15% of nominal voltage
④ Use current-limiting type fuse where required



Vari-Depth Handle Mechanism

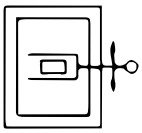


The vari-depth handle mechanism provides a means of externally operating the circuit breaker and can be applied to enclosures of varying depths. The handle mechanism can be used in NEMA 1, 3R, 4, 7, 9, and 12 enclosure applications, depending on the accessory components selected. The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 5/16 inch (7.94mm). The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.

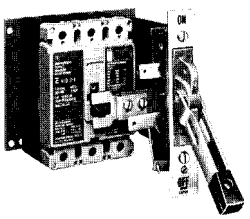


Slide Plate Handle Mechanism

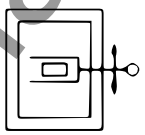
The slide plate handle mechanism provides a means of externally operating a circuit breaker installed in a shallow depth enclosure. When applied to enclosures that are hinged on the right-hand side, the handle mechanism also functions as an enclosure locking device. The handle mechanism can be used in NEMA 1, and 12 enclosure applications; a special version can be used in NEMA 3, 4, and 5 enclosure applications. The handle mechanism will accept up to three padlock shackles each with a maximum diameter of 5/16 inch (7.94mm). The handle mechanism is an Underwriters Laboratories, Inc. recognized component for panelboard accessories under UL File E56845.①



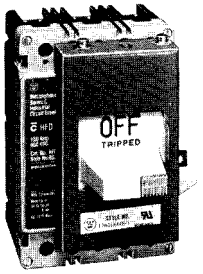
Type SM Safety Handle Mechanism



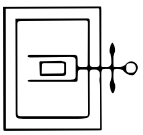
The SM safety handle mechanism provides a means of externally operating a circuit breaker mounted in an enclosure and is designed to reduce the possibility of circuit breaker tampering. The handle mechanism is especially suited for use in automotive and machine tool industries through its conformance to NEMA 12 and J. I. C. requirements. A specially modified handle mechanism for NEMA 4 enclosure applications is also available. The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 3/8 inch (9.52mm). The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.



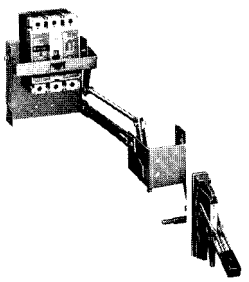
Type MC Motor Control Handle Mechanism



The MC motor control handle mechanism is a linear-operating, fixed depth mechanism designed for through door mounting in standardized and shallow depth enclosures. The handle mechanism provides positive operation and direct disconnect status indication and is interlocked with the enclosure door so that the door can be opened only when the handle is OFF. (A defeater supplied with the handle mechanism can be used to bypass the interlock for maintenance and inspection.) The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 3/8 inch (7.92mm). The handle mechanism is an Underwriters Laboratories, Inc. recognized component for panelboard accessories under UL File E56845.①



Type AMT Vari-Depth/ Vari-Width Handle Mechanism



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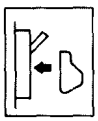
The AMT vari-depth/vari-width flange mounted handle mechanism is an extra heavy-duty mechanism designed for mounting in flange-type enclosures. The handle mechanism is available for mounting above or below the centerline of the circuit breaker handle, is suitable for various enclosure depths, and can also be used in various horizontal position applications. A door interlock prevents the enclosure from being opened with the handle mechanism in the ON position and prevents the handle mechanism from being switched ON unless the enclosure door is closed. The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 3/8 inch (7.92mm). The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.

4-5. Lock and Interlock Accessories

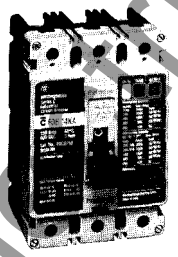
Lock and interlock accessories are used to deter undesired circuit breaker operation and establish interlocked control systems. Lock and interlock accessories include:

- Nonlockable Handle Block
- Padlockable Handle Lock Hasp
- Cylinder Lock
- Key Interlock
- Sliding Bar Interlock
- Walking Beam Interlock.

To identify allowable accessory installation combinations, see paragraph 4-8. Lock and interlock accessories identified in paragraph 4-8 are shown in this section by a graphic symbol in a shaded blue box.

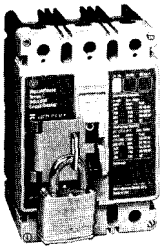


Non-Padlockable Handle Block

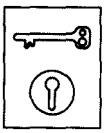


The nonlockable handle block secures the circuit breaker handle in either the ON or OFF position. (Trip-free operation allows the circuit breaker to trip when the handle block holds the circuit breaker handle in the ON position.) The device is positioned over the circuit breaker handle and secured by a setscrew to deter accidental operation of the circuit breaker handle. Listed per UL File E7819. (Field installation only)

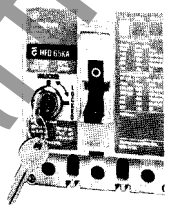
Padlockable Handle Lock Hasp



The padlockable handle lock hasp allows the handle to be locked in the ON or OFF position. (Trip-free operation allows the circuit breaker to trip when the handle lock holds the circuit breaker handle in the ON position.) The hasp mounts on the circuit breaker cover within the trimline. The cover is predrilled on both sides of the operating handle so that the hasp can be mounted on either side of the handle. The hasp will accommodate up to three padlocks with 1/4 inch (6-mm) shackles. Listed per UL File E7819. (Field installation only)①

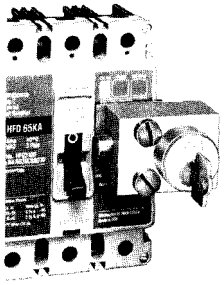


Cylinder Lock②



The cylinder lock internally blocks the trip bar in the tripped position to prevent the circuit breaker from being switched ON. The cylinder lock is factory installed in the circuit breaker cover. Other internally mounted accessories cannot be installed in the same pole as the cylinder lock. Not UL listed.

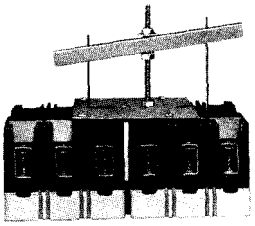
Key Interlock



The key interlock is used to externally lock the circuit breaker handle in the OFF position. When the key interlock is locked, an extended deadbolt blocks movement of the circuit breaker handle. Uniquely coded keys are removable only with the deadbolt extended. Each coded key controls a group of circuit breakers for a given specific customer installation.

The key interlock assembly is Underwriters Laboratories, Inc. listed for field installation under UL file E7819 and consists of a mounting kit and a purchaser supplied deadbolt lock. The mounting kit comprises a mounting plate, which is secured to the circuit breaker cover in either the left- or right-pole position, key interlock mounting screws, and a wire seal. Specific mounting kits are required for individual key interlock types.

Walking Beam Interlock



The walking beam interlock provides mechanical interlocking between two adjacent circuit breakers of the same pole configuration. The walking beam interlock mounts on a bracket behind and between the circuit breakers. A plunger on each end of the beam is inserted through an access hole in the back plate and base of each circuit breaker. The walking beam interlock prevents both circuit breakers from being switched ON at the same time. If a walking beam interlock is installed, the wiring troughs in the back of the circuit breaker case are blocked by the plungers and cannot be used for cross wiring. Factory modified circuit breakers are required for this application.

① The single pole latch is a snap-on design, not a hasp.
② Use of cylinder lock may reduce interrupting rating of circuit breaker. Refer to Westinghouse.

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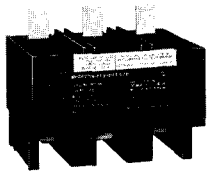
Section 4 – Accessories and Modifications

4-6. Miscellaneous Accessories
- Base Mounting Hardware
- LFB Current Limiter Attachment
- Earth Leakage Protection Module.

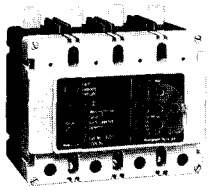
Base Mounting Hardware
Hardware for surface mounting of circuit breakers is supplied only on request. Hardware consists of mountig screws and lockwashers. Order hardware for circuit breaker pole configurations as required.

LFB Current Limiter



The LFB current limiter is an accessory that bolts to the load end of a standard FDB or FD thermal-magnetic circuit breaker, providing 200,000A interrupting capacity at up to 600 Vac. LFB current limiters for thermal-magnetic circuit breakers are listed with Underwriters Laboratories, Inc. under File E47239.

Earth Leakage Protection Module



The earth leakage protection module is an add-on accessory designed to protect personnel and equipment from low level earth leakage (ground fault) conditions. It consists of a current sensing element and an amplifier circuit that trips the associated circuit breaker by signaling a shunt trip or undervoltage release mechanism. (No external power to the shunt trip is needed.) Refer to Westinghouse for availability.

4-7. Modifications
Limited modifications to the basic circuit breaker and molded case switch are available to satisfy specific customer requirements All modifications are completed at the factory. The following modifications are available:
- Special Calibration
- Moisture-Fungus Treatment
- Marine Applications

If additional modifications are required, refer to Westinghouse. The following paragraphs describe available modifications.

Special Calibration
Special non-UL listed calibrations are available for certain ambient temperatures other than 40°C and for frequencies other than 50/60 Hz or dc. Reduced interrupting ratings will apply for 400 Hz applications. Maximum thermal calibration limited to 135A at 400 Hz.

Moisture-Fungus Treatment
All series C circuit breaker cases are molded from glass-polyester which does not support the growth of fungus. Any parts which are susceptible to the growth of fungus will require special treatment.

Marine Applications
UL489 listed 40°C circuit breakers for marine application on vessels over 65 feet are available. Non-aluminum terminals are required.

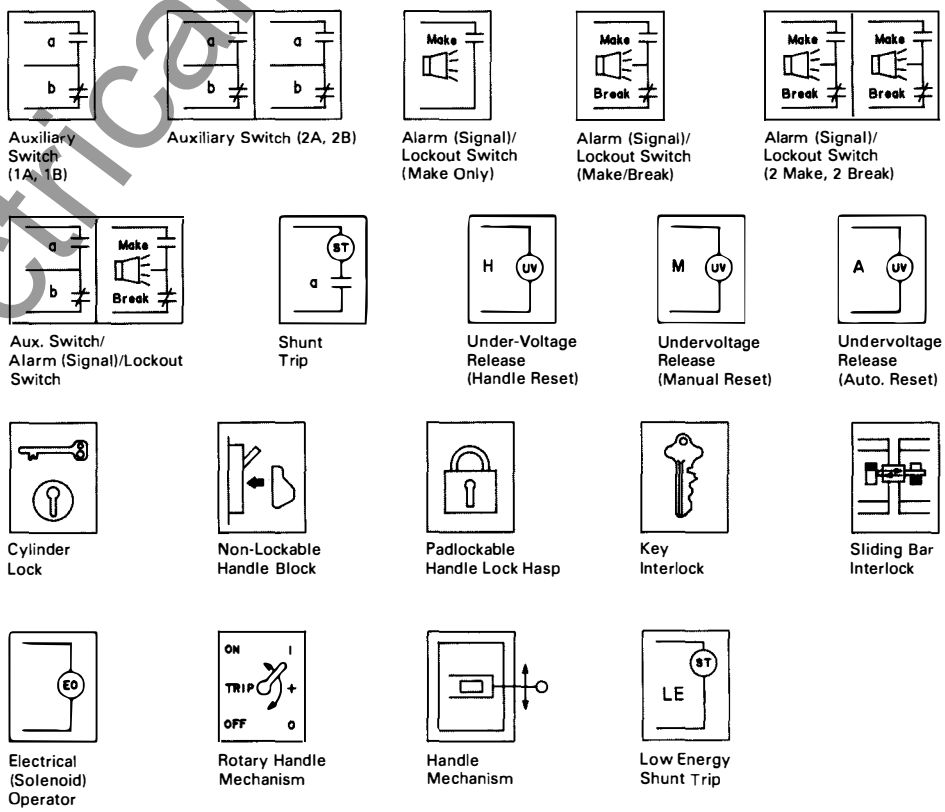
4-8. Accessory Combinations
Different combinations of accessories can be supplied, depending on the types of accessories and the number of poles in the circuit breaker. Tables on pages 19, 20 show the different accessories or combinations that can be used internally and externally with each pole of 1-, 2-, 3-, and 4-pole circuit breakers. Each pole in a particular circuit breaker configuration is identified by a column head; each accessory or combination that can be used with that pole is identified by symbols in a box below the column head. Unless otherwise noted, one internal and one external accessory can be selected for each pole.

The manual reset undervoltage release mechanism or the cylinder lock will occupy the accessory mounting cavity in the circuit breaker base and also project through the cover. Therefore, if either of these devices is selected, no other internal or external accessory can can be applied to that particular pole. In the tables, these accessories are identified by repeating the symbol in the internal and cover boxes. If a manual reset undervoltage release mechanism or cylinder lock is selected, the electrical (solenoid) operator or any external handle mechanism cannot be used.

Some external accessories will cover more than one pole. In the tables, when a box containing accessory symbols spans more than one column, any accessory within that box occupies the area of the cover indicated.

Accessory Legend
The accessory legend shows each symbol used in the accessory combination tables.

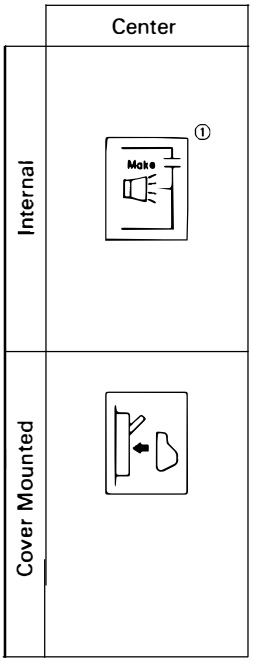
Accessory Symbols Used in Accessory Combination Examples (See pages 19, 20)



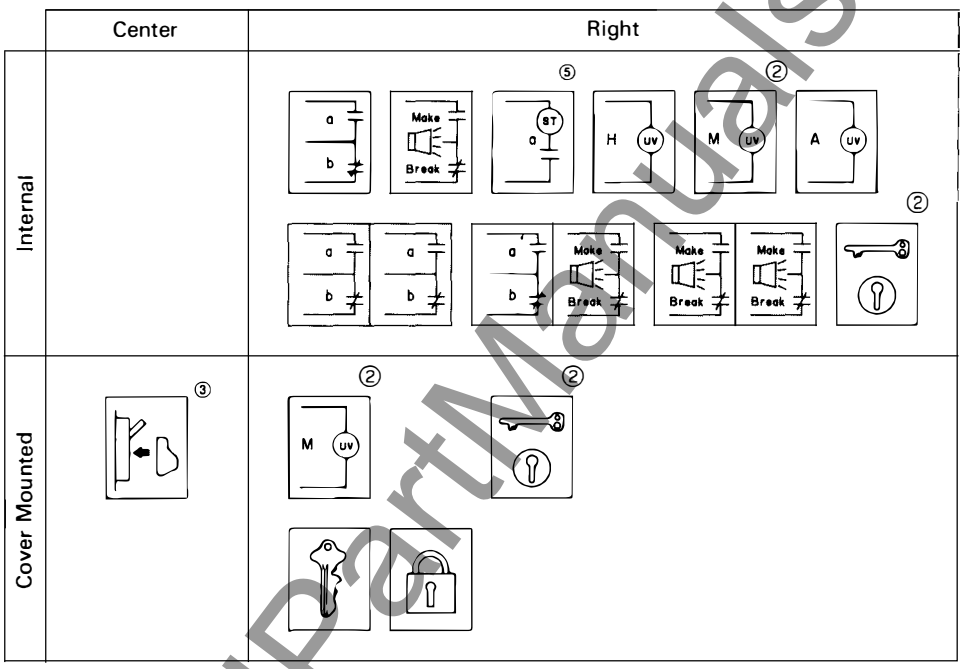
Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

Allowable Accessory Combinations

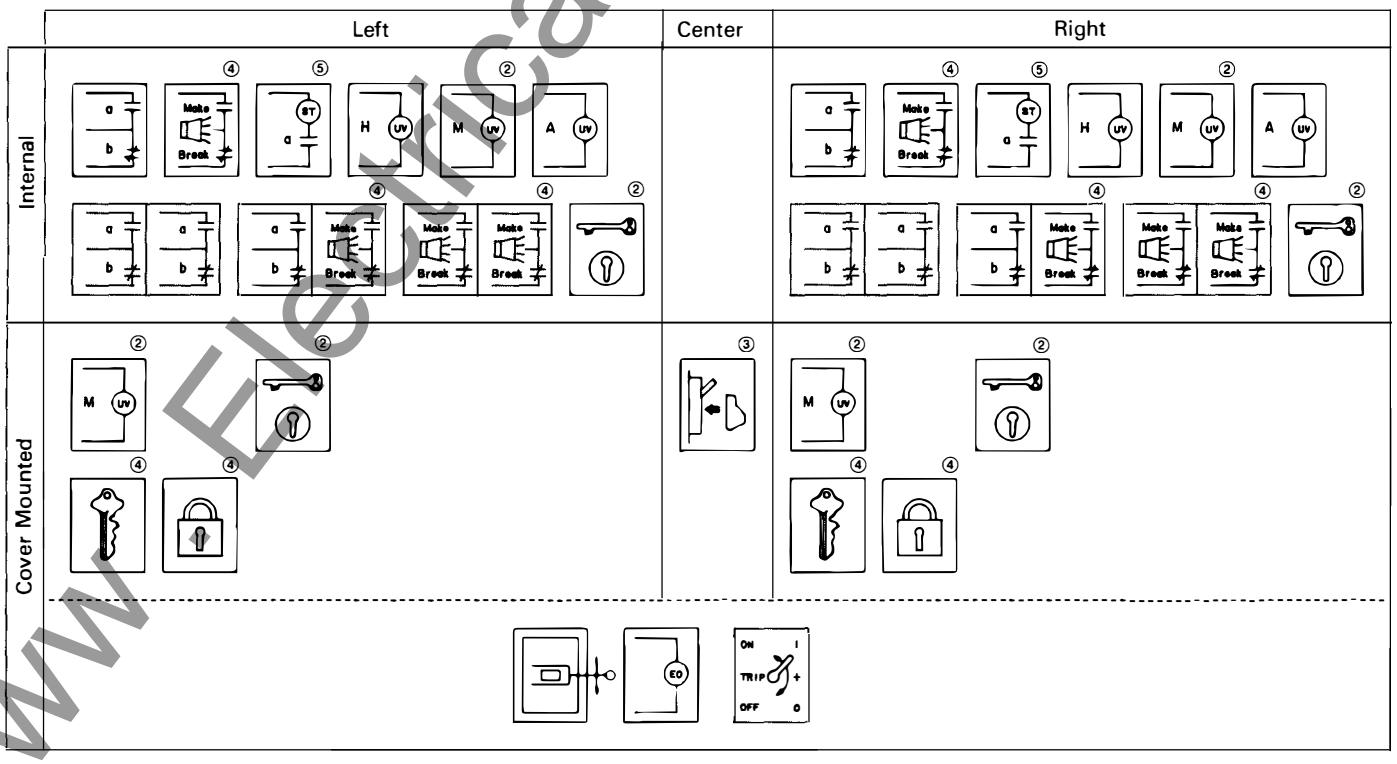
Single Pole Breaker



Two Pole Breaker



Three Pole Breaker



① Factory installed. Pigtail leads exit load end only.
② Occupies internal and cover spaces.
③ Non-padlockable handle block cannot be mounted simultaneously with either key interlock, padlockable handle hasp or sliding bar interlock.
④ May be mounted in or on left or right pole – not both.
⑤ Also includes low energy shunt trip.

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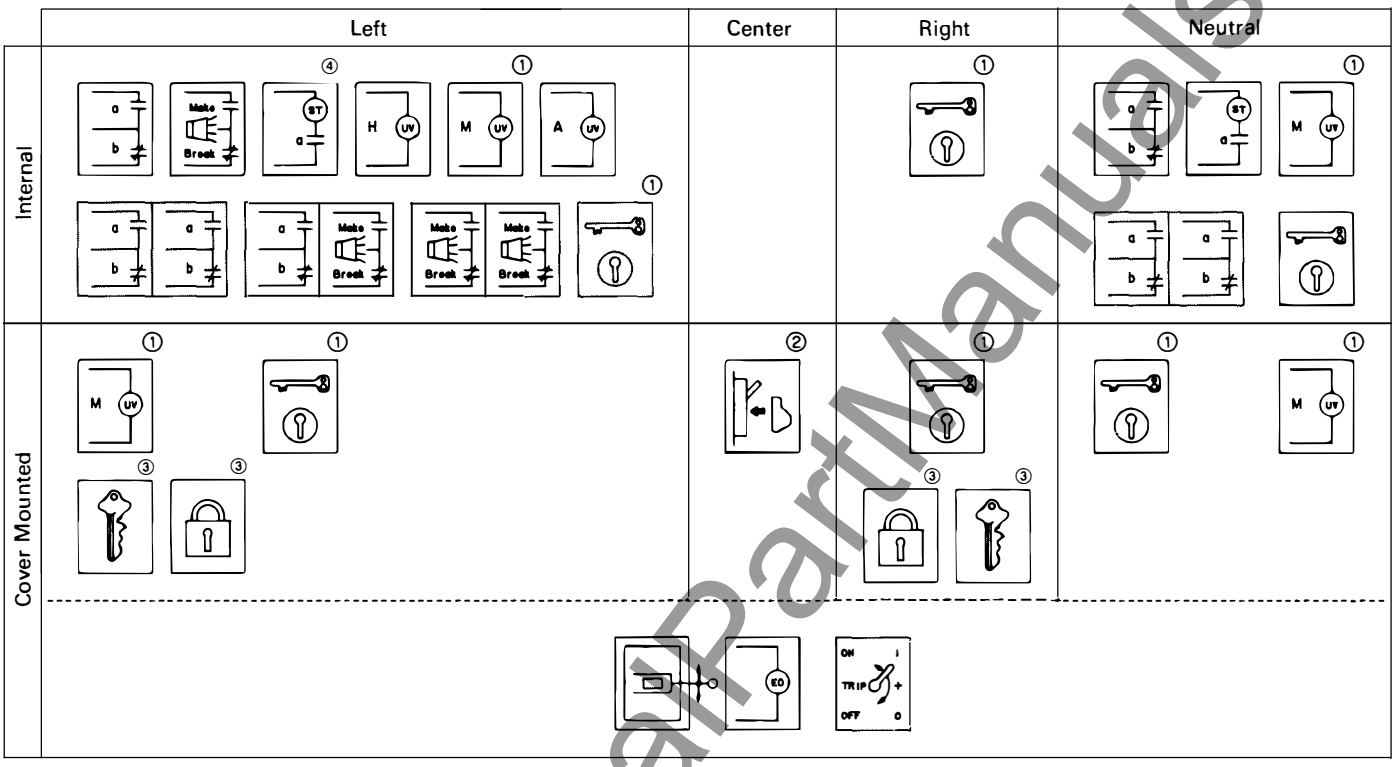
Section 4 – Accessories and Modifications

Allowable Accessory Combinations, Continued

Four Pole Breaker



① Occupies internal and cover spaces.
② Non-padlockable handle block cannot be mounted simultaneously with either key interlock, padlockable handle hasp or sliding bar interlock.
③ May be mounted on left or right pole – not both.
④ Also includes low energy shunt trip.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Selection and Ordering Information
When ordering an F-frame circuit breaker or molded case switch, use the catalog numbers given in Tables 5-1 through 5-8. Interrupting ratings can be found in Table 1-1. List any accessories or modifications required together with the applicable catalog number. Handle mechanisms are suitable for use with all Series C F-frame circuit breakers. REFER TO WESTINGHOUSE FOR AVAILABILITY OF ALL CIRCUIT BREAKERS, MOLDED CASE SWITCHES, ACCESSORIES, AND MODIFICATIONS.

Circuit Breaker Selection
Circuit breaker catalog numbers are identified in Tables 5-1, 5-2, 5-3, 5-4, and 5-5. Circuit breakers ordered using these catalog numbers include standard load terminals only.

Add suffix V to catalog number to order circuit breakers calibrated to 50°C ambient (not UL listed). Same price as standard 40°C breakers.

4-pole circuit breakers have neutral poles unprotected as standard. For 100% protected neutral poles, add suffix E to catalog number. For 50% protected neutral poles, add suffix EH to catalog number.

Add suffix L to catalog number to order circuit breakers with standard line and load terminals.

List Prices: See Price List 29-020. Discount Symbol CB-2.

Ordering Information Examples

Customer requirement 1:

One molded case circuit breaker per UL489; 3-pole, 600 Vac, 100A with 65 kA interrupting rating at 480 Vac with load end terminals only. A factory installed 1A/1B auxiliary switch is required in the left pole, with pigtail leads exiting the right side of the circuit breaker, and a 120 Vac shunt trip with a terminal block in the right pole.

Order as follows:

Qty 1 Circuit Breaker HFD3100, with factory installed auxiliary switch A1X1LC and shunt trip SNT1RT08.

When ordering an accessory that is for installation by the customer, use the field installation kit catalog number.

Customer requirement 2:

240 Vac handle reset undervoltage release mechanism with 18-inch pigtail leads for field installation in the left mounting cavity of an FW 3-pole circuit breaker.

Order as follows:

Qty 1 Undervoltage release mechanism (handle reset) UVH1LP11K.

Catalog Number and Suffix Priority
When adding suffixes to established catalog numbers shown in Tables 5-1 through 5-5, the following order should be maintained:
First priority: V – 50°C Calibration
Second priority: E – Protected Neutral Pole (4-pole circuit breaker only)
Third Priority: L – Standard line and load terminals
Examples

1. FD3100VL: Catalog number for 50°C FD3100 calibrated circuit breaker with standard line and load terminals supplied
2. HFW4160JE: Catalog number for HFW4160J (adjustable thermal, adjustable magnetic) circuit breaker with protected neutral pole

Table 5-1. Type EHD and FDB Thermal-Magnetic Circuit Breaker Catalog Numbers

Continuous Ampere Rating at 40°C	Type EHD			Type FDB		
	1-Pole 277 Vac 125 Vdc	2-Pole 480 Vac 250 Vdc	3-Pole 480 Vac	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac
10①●	EHD1010	EHD2010	EHD3010	FDB2010	FDB3010	FDB4010
15	EHD1015②	EHD2015	EHD3015	FDB2015	FDB3015	FDB4015
20	EHD1020②	EHD2020	EHD3020	FDB2020	FDB3020	FDB4020
25	EHD1025	EHD2025	EHD3025	FDB2025	FDB3025	FDB4025
30	EHD1030	EHD2030	EHD3030	FDB2030	FDB3030	FDB4030
35	EHD1035	EHD2035	EHD3035	FDB2035	FDB3035	FDB4035
40	EHD1040	EHD2040	EHD3040	FDB2040	FDB3040	FDB4040
45	EHD1045	EHD2045	EHD3045	FDB2045	FDB3045	FDB4045
50	EHD1050	EHD2050	EHD3050	FDB2050	FDB3050	FDB4050
60	EHD1060	EHD2060	EHD3060	FDB2060	FDB3060	FDB4060
70	EHD1070	EHD2070	EHD3070	FDB2070	FDB3070	FDB4070
80	EHD1080	EHD2080	EHD3080	FDB2080	FDB3080	FDB4080
90	EHD1090	EHD2090	EHD3090	FDB2090	FDB3090	FDB4090
100	EHD1100	EHD2100	EHD3100	FDB2100	FDB3100	FDB4100
110				FDB2110	FDB3110	FDB4110
125				FDB2125	FDB3125	FDB4125
150				FDB2150	FDB3150	FDB4150

① Not UL listed.
② UL listed for SWD applications, see NEC Article 240-83(d).
③ 5 KA max.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Table 5-2. Type FD, HFD, FDC Thermal-Magnetic Circuit Breaker Catalog Numbers

Continuous Ampere Rating at 40°C	Type FD				Type HFD				Type FDC			
	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac
10●③	FD1010③	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	FD1015⑤	FD2015	FD3015	FD4015	HFD1015⑤	HFD2015	HFD3015	HFD4015	.....	FDC2015	FDC3015	FDC4015
20	FD1020⑤	FD2020	FD3020	FD4020	HFD1020⑤	HFD2020	HFD3020	HFD4020	.....	FDC2020	FDC3020	FDC4020
25	FD1025	FD2025	FD3025	FD4025	HFD1025	HFD2025	HFD3025	HFD4025	.....	FDC2025	FDC3025	FDC4025
30	FD1030	FD2030	FD3030	FD4030	HFD1030	HFD2030	HFD3030	HFD4030	.....	FDC2030	FDC3030	FDC4030
35	FD1035	FD2035	FD3035	FD4035	HFD1035	HFD2035	HFD3035	HFD4035	.....	FDC2035	FDC3035	FDC4035
40	FD1040	FD2040	FD3040	FD4040	HFD1040	HFD2040	HFD3040	HFD4040	.....	FDC2040	FDC3040	FDC4040
45	FD1045	FD2045	FD3045	FD4045	HFD1045	HFD2045	HFD3045	HFD4045	.....	FDC2045	FDC3045	FDC4045
50	FD1050	FD2050	FD3050	FD4050	HFD1050	HFD2050	HFD3050	HFD4050	.....	FDC2050	FDC3050	FDC4050
60	FD1060	FD2060	FD3060	FD4060	HFD1060	HFD2060	HFD3060	HFD4060	.....	FDC2060	FDC3060	FDC4060
70	FD1070	FD2070	FD3070	FD4070	HFD1070	HFD2070	HFD3070	HFD4070	.....	FDC2070	FDC3070	FDC4070
80	FD1080	FD2080	FD3080	FD4080	HFD1080	HFD2080	HFD3080	HFD4080	.....	FDC2080	FDC3080	FDC4080
90	FD1090	FD2090	FD3090	FD4090	HFD1090	HFD2090	HFD3090	HFD4090	.....	FDC2090	FDC3090	FDC4090
100	FD1100	FD2100	FD3100	FD4100	HFD1100	HFD2100	HFD3100	HFD4100	.....	FDC2100	FDC3100	FDC4100
110	FD1110	FD2110	FD3110	FD4110	HFD1110	HFD2110	HFD3110	HFD4110	.....	FDC2110	FDC3110	FDC4110
125	FD1125	FD2125	FD3125	FD4125	HFD1125	HFD2125	HFD3125	HFD4125	.....	FDC2125	FDC3125	FDC4125
150	FD1150	FD2150	FD3150	FD4150	HFD1150	HFD2150	HFD3150	HFD4150	.....	FDC2150	FDC3150	FDC4150

Table 5-3. Type FW, HFW Fixed Thermal, Non-Adjustable Magnetic Single Pole Circuit Breaker Catalog Numbers④

Continuous Ampere Rating at 40°C	Type FW 240 Vac 125 Vdc	Type HFW 240 Vac 125 Vdc
10①③	FW1010	.....
16	FW1016	HFW1016
20	FW1020	HFW1020
25	FW1025	HFW1025
32	FW1032	HFW1032
40	FW1040	HFW1040
50	FW1050	HFW1050
63	FW1063	HFW1063
80	FW1080	HFW1080
100	FW1100	HFW1100
110	FW1110	HFW1110
125	FW1125	HFW1125
160	FW1160	HFW1160

Table 5-4. Type FW, HFW, FWC Adjustable Thermal, Non-Adjustable Magnetic Circuit Breaker Catalog Numbers④

Maximum Continuous Ampere Rating at 40°C	Thermal Adjustment Range	Type FW			Type HFW			Type FWC		
		2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac
50	50-40	FW2050	FW3050	FW4050	HFW2050	HFW3050	HFW4050	FWC2050	FWC3050	FWC4050
63	63-50	FW2063	FW3063	FW4063	HFW2063	HFW3063	HFW4063	FWC2063	FWC3063	FWC4063
80	80-63	FW2080	FW3080	FW4080	HFW2080	HFW3080	HFW4080	FWC2080	FWC3080	FWC4080
100	100-80	FW2100	FW3100	FW4100	HFW2100	HFW3100	HFW4100	FWC2100	FWC3100	FWC4100
125	125-100	FW2125	FW3125	FW4125	HFW2125	HFW3125	HFW4125	FWC2125	FWC3125	FWC4125
160	160-125	FW2160	FW3160	FW4160	HFW2160	HFW3160	HFW4160	FWC2160	FWC3160	FWC4160

Table 5-5. Type FW, HFW, FWC Adjustable Thermal, Adjustable Magnetic Circuit Breaker Catalog Numbers④

Maximum Continuous Ampere Rating at 40°C	Thermal Adjustment Range	Type FW			Type HFW			Type FWC		
		2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac
50	50-40	FW2050J	FW3050J	FW4050J	HFW2050J	HFW3050J	HFW4050J	FWC2050J	FWC3050J	FWC4050J
63	63-50	FW2063J	FW3063J	FW4063J	HFW2063J	HFW3063J	HFW4063J	FWC2063J	FWC3063J	FWC4063J
80	80-63	FW2080J	FW3080J	FW4080J	HFW2080J	HFW3080J	HFW4080J	FWC2080J	FWC3080J	FWC4080J
100	100-80	FW2100J	FW3100J	FW4100J	HFW2100J	HFW3100J	HFW4100J	FWC2100J	FWC3100J	FWC4100J
125	125-100	FW2125J	FW3125J	FW4125J	HFW2125J	HFW3125J	HFW4125J	FWC2125J	FWC3125J	FWC4125J
160	160-125	FW2160J	FW3160J	FW4160J	HFW2160J	HFW3160J	HFW4160J	FWC2160J	FWC3160J	FWC4160J

① Not UL listed.
② 2-pole circuit breakers supplied in 3-pole frame.
③ 5 KA max. interrupting rating only.
④ W model circuit breakers not UL listed.
⑤ UL listed for SWD applications. See NEC Article 240-83(d).

ORDERING INFORMATION

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Molded Case Switch Selection
Molded case switch catalog numbers are identified in Tables 5-6, 5-7, and 5-8. For UL listed, series tested circuit breaker-molded case switch and fuse-molded case switch application data, refer to Westinghouse. Molded case switches ordered using these catalog numbers include standard load terminals only.

Table 5-6. Type EHD High Magnetic (K) Molded Case Switch Catalog Numbers①

Continuous Ampere Rating at 40°C	1-Pole	2-Pole	3-Pole
	277 Vac 125 Vdc	480 Vac 250 Vdc	480 Vac
	Type EHD (K)		
100	EHD1100K	EHD2100K	EHD3100K

Table 5-7. Type FD High Magnetic (K) Molded Case Switch Catalog Numbers①

Continuous Ampere Rating at 40°C	1-Pole	2-Pole	3-Pole	4-Pole
	277 Vac 125 Vdc	600 Vac 250 Vdc	600 Vac	600 Vac
	Type FD (K)			
100	FD1100K	FD2100K	FD3100K	FD4100K
150	FD1150K	FD2150K	FD3150K	FD4150K

Table 5-8. Molded Case Switch High Magnetic Trip Setting

Frame	Rating	Trip Setting (Amps)	Tolerance (Percent)
EHD/FD	100	700	±20
FD	150	800	±20

Table 5-9. Type HFDDC 500 Volt Dc Breaker Catalog Numbers④

Continuous Ampere Rating at 40°C	3 Pole
15	HFDDC3015L
20	HFDDC3020L
25	HFDDC3025L
30	HFDDC3030L
35	HFDDC3035L
40	HFDDC3040L
45	HFDDC3045L
50	HFDDC3050L
60	HFDDC3060L
70	HFDDC3070L
80	HFDDC3080L
90	HFDDC3090L
100	HFDDC3100L
110	HFDDC3110L
125	HFDDC3125L
150	HFDDC3150L

Accessories
Accessory catalog or style numbers are identified on pages 23 through 29. All mounting hardware is supplied unless otherwise noted.

Termination Accessories
Line and Load Terminals
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 nonstandard or optional line and/or load terminals are required, order by style number (no charge when ordered with circuit breaker). Specify if factory installation required.

Max. Breaker Amps	Terminal Body Material	Wire Type	AWG Wire Range	Metric Wire Range mm²	Style Numbers Package of 3 Terminals
Standard Pressure Type Terminals					
20(EHD)	Steel	Cu/Al	#14-#10	2.5-4	624B100G14
100	Steel	Cu/Al	#14-1/0	2.5-50	624B100G02
160②	Aluminum	Cu/Al	#4-4/0	25-95	624B100G17
Optional Cu/Al Pressure Terminals					
50	Aluminum	Cu/Al	14-#4	2.5-16	624B100G10
100	Aluminum	Cu/Al	#4-4/0	25-95	624B100G17
100	Aluminum	Cu/Al	#14-1/0	2.5-50	624B100G19
160②③	Stainless Steel	Cu	#4-4/0	25-95	624B100G18

Keeper Nut
Keeper nuts are available in English and metric thread sizes in packages of 12.

Thread Type	Thread Size	Catalog Number Package of 12
English	10-32	KPR1A
Metric	M-5	KPR1AM

Interphase Barrier
Catalog Number (Package of 2 barriers): IPB1

The interphase barrier is available for extended insulation between circuit breaker poles. Specify quantity when ordering.

Shorting Straps
Catalog Number: SS150
(Package of 2 straps)
These shorting straps are used to series connect poles of type HFDDC 500 volt Dc breakers.

Terminal Shield
The terminal shield is available for line terminal areas in 1-, 2-, 3- and 4-pole circuit breakers. Special terminal shields are also available for use when an electrical (solenoid) operator is mounted on the circuit breaker. The standard style number by pole for each terminal shield (shown in table below) is for a package of 10 and is priced per each package. Special terminal shields are packaged individually.

Number of Poles	Style Numbers Standard (Package of 10)	Special
1	625B229G06	.....
2	625B229G07	.....
3	625B229G08	4210B95G01
4	625B229G09	4210B95G02

Terminal End Cover
The terminal end cover is available for 3-pole circuit breakers only. Two conductor opening sizes are available. Specify quantity (one per circuit breaker) when ordering.

Conductor Opening Diameter (Inches)	Catalog Number
0.25 (6.35 mm)	TEC1
0.41 (10.41 mm)	TEC2

① For non-domestic molded case switch applications, use EHD(K) or FD(K) versions. No FW(K) versions available.
② UL listed through 150A only.
③ UL listed for copper wire only.
④ Includes line and load Cu/Al terminals

Series C Molded Case Circuit Breakers, F-Frame
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Panelboard Connecting Straps
The panelboard connecting straps are available in two sizes to meet the needs of most standard panelboard applications. The panelboard connecting straps are listed by panelboard bus spacing. Style numbers for special mounting brackets for CDP panelboard installations are also included.

Bus Spacing (Inches)	Continuous Current Rating (Amperes)	Pole Connector Type	
		Center	Outside
		Style Number	Style Number
5-3/4 Inch Deep Box, 600 Vac Max			
2¾	50	673B142G02	673B142G09
2¾	100	673B142G02	673B142G10
2¾	150	673B142G04	673B142G03
3½	50	1253C72G01	1253C72G02
3½	100	1253C73G03	1253C73G04
3½	150	1253C73G01	1253C73G02

Mounting Bracket

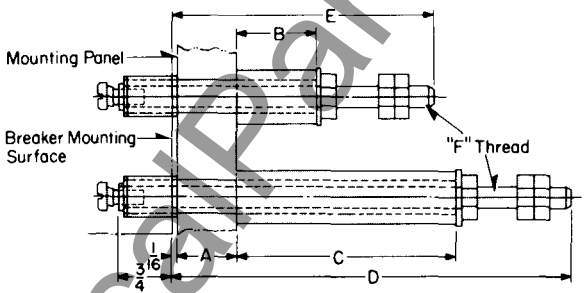
Style Numbers	
2-Pole	3-Pole
624B600H02	624B600H01

Rear Connecting Studs
Each rear connecting stud assembly consists of one stud and one tube. Select alternate long and short stud assemblies for circuit breakers with more than one pole to maintain proper clearances between poles. One assembly is required for line-end and one for load-end of each pole. Tubes must be ordered separately. Connecting studs are available only with English thread sizes.

Plug-In Adapter
Plug-in adapters are available for 2-, 3-, and 4-pole circuit breaker configurations. One plug-in adapter is used for each terminal end (line or load); specify quantity when ordering. A one-piece steel mounting plate is available at no charge when ordered with line and load plug-in adapters (field installation only).

Continuous Current Rating (Amperes)	Style Numbers		
	2-Pole	3-Pole	4-Pole
100	507C036G13	507C036G15	179C968G03
150/160	507C036G14	507C036G16	179C968G04
Mounting Plate	176C511H01	507C047H01	①

① Refer to Westinghouse for availability.



Stud Ampere Rating	Stud Style Number	Panel Thickness (Inches)	Tube Length (Inches)		Tube Style Number	Dimensions (Inches)		
		A	B	C		D	E	F
For 15A to 100A Circuit Breakers								
100A Short	451D874G01	1	1 1/16	....	32B9446H20	....	3 5/8	5/16 - 18
100A Short	451D874G01	1 1/16 to 1 5/16	1 3/8	....	32B9446H21	....		
100A Short	451D874G01	3/8 to 5/8	1 11/16	....	32B9446H22	....		
100A Short	451D874G01	1/4 to 5/16	2	....	32B9446H23	....		
100A Long	451D874G02	1	....	3 7/16	32B9446H24	6 1/8	....	
100A Long	451D874G02	1 1/16 to 1 5/16	....	3 3/4	32B9446H25		....	
100A Long	451D874G02	3/8 to 5/8	....	4 1/16	32B9446H26		....	
100A Long	451D874G02	1/4 to 5/16	....	4 3/8	32B9446H27		....	
For 110A to 160A Circuit Breakers								
160A Short	374D883G01	1	1 1/16	....	374D883H06	....	4 1/4	7/16 - 14
160A Short	374D883G01	1 1/16 to 1 5/16	1 3/8	....	374D883H07	....		
160A Short	374D883G01	3/8 to 5/8	1 11/16	....	374D883H08	....		
160A Short	374D883G01	1/4 to 5/16	2	....	374D883H09	....		
160A Long	374D883G02	1	....	3 7/16	374D883H10	7 1/2	....	
160A Long	374D883G02	1 1/16 to 1 5/16	....	3 3/4	374D883H11		....	
160A Long	374D883G02	3/8 to 5/8	....	4 1/16	374D883H12		....	
160A Long	374D883G02	1/4 to 5/16	....	4 3/8	374D883H13		....	

ORDERING INFORMATION

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Internal Accessories

Alarm (Signal)/Lockout Switch

Number of Contacts (Make and Break)	Mounting Location (Pole)	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Opposite Side	Terminal Block: Same Side	Field Installation Kits①: Pigtail Leads	Terminal Block
		Catalog Numbers				Catalog Numbers	
1	Left②	A1L1LA	A1L1LB	A1L1LC	A1L1LT	A1L1LPK	A1L1LTK
	Right	A1L1RA	A1L1RB	A1L1RC	A1L1RT	A1L1RPK	A1L1RTK
2	Left②	A2L1LA	A2L1LB	.....	A2L1LT	A2L1LPK	A2L1LTK
	Right	A2L1RA	A2L1RB	.....	A2L1RT	A2L1RPK	A2L1RTK
1 (Make Only)	Single Pole	A1L1CA③					

Auxiliary Switch

Number of Contacts a and b	Mounting Location (Pole)	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Opposite Side	Terminal Block: Same Side	Field Installation Kits①: Pigtail Leads	Terminal Block
		Catalog Numbers				Catalog Numbers	
1	Left②	A1X1LA	A1X1LB	A1X1LC	A1X1LT	A1X1PK	A1X1LTK
		E1X1LA⑦	E1X1LB⑦	E1X1LC⑦	.....	.....	.....
	Right or Neutral	A1X1RA	A1X1RB	A1X1RC	A1X1RT	A1X1PK	A1X1RTK
		E1X1RA⑦	E1X1RB⑦	E1X1RC⑦	.....	.....	.....
2	Left②	A2X1LA	A2X1LB	.....	A2X1LT	A2X1PK	A2X1LTK
		E2X1LA⑦	E2X1LB⑦	.....	.....	.....	.....
	Right or Neutral	A2X1RA	A2X1RB	.....	A2X1RT	A2X1PK	A2X1RTK
		E2X1RA●	E2X1RB⑦	.....	.....	.....	.....

Auxiliary Switch and Alarm (Signal)/Lockout Switch Combination

Mounting Location (Pole)	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Terminal Block: Same Side	Field Installation Kits①: Pigtail Leads	Terminal Block
	Catalog Numbers			Catalog Numbers	
Left	AAL1LA	AAL1LB	AAL1LT	AAL1LPK	AAL1LTK
Right	AAL1RA	AAL1RB	AAL1RT	AAL1RPK	AAL1RTK

Shunt Trip

Select shunt trip catalog number for the voltage within the indicated voltage range. Shunt trip coils are designed to be applied at specific ac or dc voltages within the voltage range shown. Specific application voltages and electrical ratings are shown in Table 4-3. Electrical ratings are also shown on applicable circuit breaker accessory nameplates.

Voltage Rating (Ac Freq = 50/60 Hz)	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Opposite Side	Terminal Block: Same Side	Field Installation Kits①: Pigtail Leads	Terminal Block
	Catalog Numbers				Catalog Numbers	
Left Pole Mounting						
9- 24 Vac or Vdc	SNT1LA03	SNT1LB03	SNT1LC03	SNT1LT03	SNT1LP03K	SNT1LT03K
48-127 Vac or Vdc⑤	SNT1LA08	SNT1LB08	SNT1LC08	SNT1LT08	SNT1LP08K	SNT1LT08K
208-380 Vac	SNT1LA12	SNT1LB12	SNT1LC12	SNT1LT12	SNT1LP12K	SNT1LT12K
415-600 Vac or 220-250 Vdc	SNT1LA18	SNT1LB18	SNT1LC18	SNT1LT18	SNT1LP18K	SNT1LT18K
Right② or Neutral Pole Mounting						
9- 24 Vac or Vdc	SNT1RA03	SNT1RB03	SNT1RC03	SNT1RT03	SNT1RP03K	SNT1RT03K
48-127 Vac or Vdc⑤	SNT1RA08	SNT1RB08	SNT1RC08	SNT1RT08	SNT1RP08K	SNT1RT08K
208-380 Vac	SNT1RA12	SNT1RB12	SNT1RC12	SNT1RT12	SNT1RP12K	SNT1RT12K
415-600 Vac or 220-250 Vac	SNT1RA18	SNT1RB18	SNT1RC18	SNT1RT18	SNT1RP18K	SNT1RT18K

Low Energy Shunt Trip⑥

Mounting Positions 24 Vdc	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Opposite Side	Terminal Block: Same Side	Field Installation Kits①: Pigtail Leads	Terminal Block
	Catalog Numbers				Catalog Numbers	
Left Pole②	LST1LA	LST1LB	LST1LC	LST1LT	LST1LPK	LST1LTK
Right Pole	LST1RA	LST1RB	LST1RC	LST1RT	LST1RPK	LST1RTK

① Not listed with Underwriters Laboratories, Inc. for field installation.
② Standard mounting location.
③ Leads exit load end of circuit breaker. Factory installation only.
④ Standard pigtail lead exit location.
⑤ 120 Vac marked suitable for ground fault protection devices.
⑤ Cutoff provisions required in control circuit.
● 125 volt (Max.), 50/60 HZ switch for use in electronic circuit of 100 micro-amp and 15 VDC minimum.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Undervoltage Release Mechanism (Handle Reset)

Select handle reset undervoltage release mechanism catalog number for the voltage within the indicated voltage range. Undervoltage release mechanism coils are designed to be applied at specific ac or dc voltages within the voltage range shown. Specific application voltages and electrical ratings are shown in Table 4-4. Electrical ratings are shown on applicable circuit breaker accessory nameplates.

Voltage Rating (ac Freq = 50/60 Hz)	Connection Type and Location					
	18-inch Pigtail Leads			Terminal Block	Field Installation Kits①	
	Same Side	Rear⑥	Opposite Side	Same Side	Pigtail Leads	Terminal Block
	Catalog Numbers				Catalog Numbers	
Left Pole Mounting						
9- 12 Vac	UVH1LA02	UVH1LB02	UVH1LC02	UVH1LT02	UVH1LP02K	UVH1LT02K
24 Vac	UVH1LA03	UVH1LB03	UVH1LC03	UVH1LT03	UVH1LP03K	UVH1LT03K
48- 60 Vac	UVH1LA05	UVH1LB05	UVH1LC05	UVH1LT05	UVH1LP05K	UVH1LT05K
110-127 Vac	UVH1LA08	UVH1LB08	UVH1LC08	UVH1LT08	UVH1LP08K	UVH1LT08K
208-240 Vac	UVH1LA11	UVH1LB11	UVH1LC11	UVH1LT11	UVH1LP11K	UVH1LT11K
380-480 Vac	UVH1LA15	UVH1LB15	UVH1LC15	UVH1LT15	UVH1LP15K	UVH1LT15K
525-600 Vac	UVH1LA18	UVH1LB18	UVH1LC18	UVH1LT18	UVH1LP18K	UVH1LT18K
12 Vdc	UVH1LA20	UVH1LB20	UVH1LC20	UVH1LT20	UVH1LP20K	UVH1LT20K
24 Vdc	UVH1LA21	UVH1LB21	UVH1LC21	UVH1LT21	UVH1LP21K	UVH1LT21K
48- 60 Vdc	UVH1LA23	UVH1LB23	UVH1LC23	UVH1LT23	UVH1LP23K	UVH1LT23K
125 Vdc	UVH1LA26	UVH1LB26	UVH1LC26	UVH1LT26	UVH1LP26K	UVH1LT26K
220-250 Vdc	UVH1LA28	UVH1LB28	UVH1LC28	UVH1LT28	UVH1LP28K	UVH1LT28K
Right Pole Mounting②						
9- 12 Vac	UVH1RA02	UVH1RB02	UVH1RC02	UVH1RT02	UVH1RP02K	UVH1RT02K
24 Vac	UVH1RA03	UVH1RB03	UVH1RC03	UVH1RT03	UVH1RP03K	UVH1RT03K
48- 60 Vac	UVH1RA05	UVH1RB05	UVH1RC05	UVH1RT05	UVH1RP05K	UVH1RT05K
110-127 Vac	UVH1RA08	UVH1RB08	UVH1RC08	UVH1RT08	UVH1RP08K	UVH1RT08K
208-240 Vac	UVH1RA11	UVH1RB11	UVH1RC11	UVH1RT11	UVH1RP11K	UVH1RT11K
380-480 Vac	UVH1RA15	UVH1RB15	UVH1RC15	UVH1RT15	UVH1RP15K	UVH1RT15K
525-600 Vac	UVH1RA18	UVH1RB18	UVH1RC18	UVH1RT18	UVH1RP18K	UVH1RT18K
12 Vdc	UVH1RA20	UVH1RB20	UVH1RC20	UVH1RT20	UVH1RP20K	UVH1RT20K
24 Vdc	UVH1RA21	UVH1RB21	UVH1RC21	UVH1RT21	UVH1RP21K	UVH1RT21K
48- 60 Vdc	UVH1RA23	UVH1RB23	UVH1RC23	UVH1RT23	UVH1RP23K	UVH1RT23K
125 Vdc	UVH1RA26	UVH1RB26	UVH1RC26	UVH1RT26	UVH1RP26K	UVH1RT26K
220-250 Vdc	UVH1RA28	UVH1RB28	UVH1RC28	UVH1RT28	UVH1RP28K	UVH1RT28K

Handle Operating Accessories

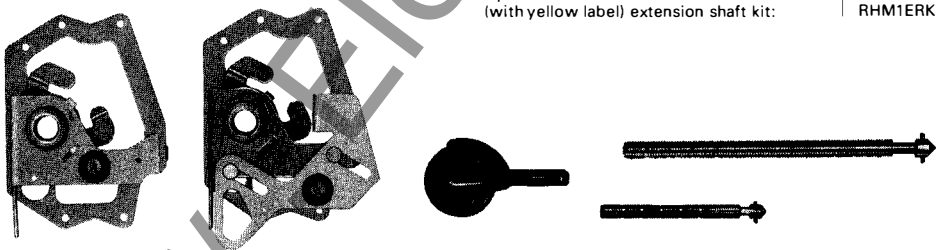
Electrical (Solenoid) Operator

Operating Voltage	Frequency	Catalog Numbers	
		Terminal Block	18-Inch Pigtail Lead
24	50/60 Hz	.....	EOP1P03
120	or	EOP1T07	EOP1P07
240	DC	EOP1T11	EOP1P11

Rotary Handle Mechanism

Description	Catalog Number
Rotary handle mechanism standard grey handle:	RHM1G
Rotary handle mechanism optional red handle with yellow label:	RHM1R
Early-make electrical interlock kit (2a-2b):	RHM1EK
Cylinder lock kit:	RHM1CLK
Standard grey remote mounted handle extension shaft kit:	RHM1EGK
Optional red remote mounted handle (with yellow label) extension shaft kit:	RHM1ERK

Vari-Depth Handle Mechanism



W/O Lock off — With lock off

Mechanisms③④⑤⑦		Handle⑦	Shaft⑦			
Standard – (No Internal Lockoff)	Special – (With Internal Lockoff)	NEMA 1, 3R, 12 (With Hardware)	Standard		Long	
Style Number	Style Number	Style Number	Style Number	Panel Depth	Style Number	Panel Depth
373D958G22	373D958G23	504C323G03	47A4446G36	5-10¼	47A4446G37	10½-14

① Not listed with Underwriters Laboratories, Inc. for field installation.
② Standard mounting location.
③ When circuit breaker is used with plug-in kits or rear connected studs, special mounting hardware is required. Refer to Westinghouse.
④ Includes hardware.
⑤ Outline and drilling plan reference – drawing 653D270.
⑥ Standard pigtail lead exit location.
⑦ UL listed for field installation under E64983.

Accessories for Vari-Depth Handle Mechanism

Special Handles: Meet NEMA 4 requirements. These handles are similar to standard handles, except they include an internal neoprene gasket. Due to gasketing effect between handle and housing, handle will not indicate a tripped position when used with circuit breakers. Not UL listed.

Standard Finish:
Style Number: 504C323G04

Handle Kits: These kits are for use with NEMA 4, 7 and 9 cast enclosures. The kits include a special operating handle, mounting bolts and an adapter bushing (bushing may be purchased separately). Kits may be used with standard mechanisms and shafts as required. Not UL listed.

For NEMA 4, 9 Enclosure
Kit Style Number: 314C794G10

For NEMA 7 Enclosure
Kit Style Number: 314C794G09

Adapter Bushing Only:
Style Number: 314C794G04

Type MC Motor Control Handle Mechanism

For use with NEMA 1 Enclosure
Catalog Number SMCU150FD

For use with NEMA 12 Enclosure
Catalog Number CMCU150FD

Type SM Safety Handle Mechanism

Right Hand Mounting, Enclosure Cover Hinged on Left: Cat. No. SM150R

Left Hand Mounting, Enclosure Cover Hinged on Right: Cat. No. SM150L
For Door Hardware, see page 29

Slide Plate Handle Mechanism

Enclosure Cover Hinged on Right (Drilling Plan Reference: 657D074)
Vertical Mounting,
Padlocks in OFF Position
Style No. 314C386G03

Padlocks in ON or OFF Position
Style Number 314C386G10

Horizontal Mounting,
Padlocks in "OFF" Position
Style Number 314C386G06

NEMA 3, 4, 5 Outdoor or Hazardous Location Handle Mechanisms

(Drilling Plan Reference 48A3656)

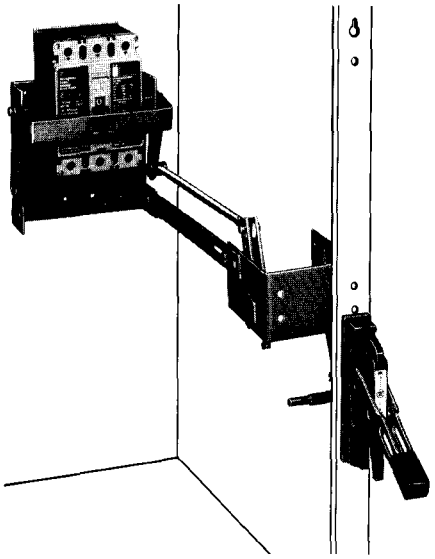
Padlocks in OFF Position
Style Number 48A3656G03

Padlocks in ON or OFF Position
Style Number 48A3656G04

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Type AMT Vari-Depth, Vari-Width Flange Mounted Handle Mechanism

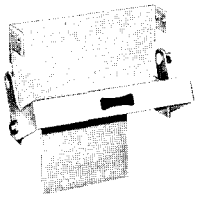
For Type EHD, FDB, FD, HFD, FDC, FW, HFW and FWC Molded Case Breakers



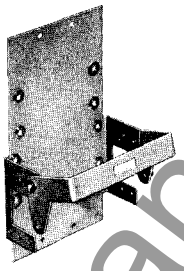
Assembled Type AMT for Above Handle Mounting (Breaker Not Included)

Type AMT Component Parts

Backplate and Yoke Assembly

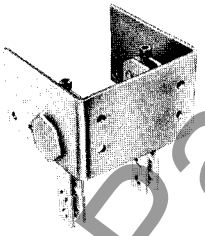


Below Handle Mtg.

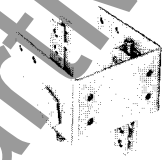


Above Handle Mtg.

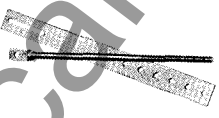
Flange Mounted Pivot Mechanism



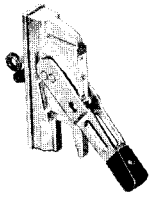
Above Handle Mtg.



Below Handle Mtg.



Rod Brace Assembly



Operating Handle

Catalog Numbers②

Complete Assembly	Consists of and Shipped as Component Parts Listed Below			
	Backplate and Yoke Assembly	Operating Rod and Brace Assembly①	Flange Mounted Pivot Mechanism Assembly①	External Operating Handle
Above Handle Mounting With Short Rod and Brace				
AMTFBASV	AMTFB	AMTRB1	AMTPM	AMTOP
Above Handle Mounting With Long Rod and Brace				
AMTFBALV	AMTFB	AMTRB2	AMTPM	AMTOP
Below Handle Mounting With Short Rod and Brace				
AMTFBBSV	AMTFB-B	AMTRB1	AMTPM-B	AMTOP
Below Handle Mounting With Long Rod and Brace				
AMTFBBLV	AMTFB-B	AMTRB2	AMTPM-B	AMTOP
Below Handle Fixed-Width With Short Rod				
AMTFBBSF	AMTFB-B	AMTR	AMTPM-F	AMTOP

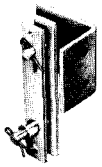
Ordering Information

1. Order a complete mechanism using Complete Assembly catalog number. Mechanism will be shipped as individual components shown above and listed below.
2. Order spacer kits or door hardware adapter as required.
3. Individual component parts may be ordered by Catalog Number.

Accessories for Type AMT Mechanisms

Spacer Kit to Vary Width (Not for use with fixed mechanisms)
Cat. Number: AMTSK1
This spacer kit is for up to 1-inch variation and consists of multiples of thin spacers to be used as required. A maximum of two kits per installation may be used. Hardware is not supplied because of dimensional variations. Use standard ¼-inch x 20 bolts.

Fixed Width Pivot Mechanism
Cat. No. AMTPM-F②



Enclosure Depth Dimensions in Inches for Operating Rod and Brace Assembly

Short Rod		Long Rod	
Cat. No.	**AMTRB1②**	Cat. No.	**AMTRB2②**
Min.③	**Max.**	Min.	**Max.**
6½	**14**	12½	**18**

① Width spacer kit not included.
② UL listed per E64983.
③ Width spacer kits cannot be used with short rod at minimum enclosure depth.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Lock and Interlock Accessories

Nonlockable Handle Block
Catalog Number: LKD1

One per circuit breaker.

Padlockable Handle Lock Hasp
Catalog Numbers
2, 3, 4 pole breakers: PLK1
1 pole breakers①: PHL1

The padlockable handle lock can be mounted on either side of the operating handle①. One per circuit breaker: field installation only.

Cylinder Lock
The cylinder lock is factory installed in the circuit breaker cover. Internal accessories cannot be installed in the same pole as the cylinder lock.

Number of Poles	Mounting Location		
	Left	Right	Neutral
	Catalog Numbers		
2	.....	CLK1R	.....
3	CLK1L	CLK1R	.....
4	CLK1L	CLK1R	CLK1N

Key Interlock Mounting Kit
Key interlock mounting kits are for field installation only. Select mounting kit catalog numbers to match type of lock used. Key interlocks are supplied by customer.

Lock Manufacturer	Lock Type	Bolt Projection in Withdrawn Position	Kit Cat. No.
Superior	B-4003-1	3/8 inch	KYK1
Kirk	F	3/8 inch	
Square D	SF	None	
Federal Pioneer	VF	3/8 inch	
Castell	K or QK	3/8 inch	CTK1

Walking Beam Interlock

Catalog Number: WBL1

The walking beam interlock is available for mounting between two adjacent circuit breakers spaced 1/4 inch apart and having the same pole configuration. The two circuit breakers must be factory modified to accept the walking beam interlock assembly (suitable for use with either 2-, 3-, or 4-pole circuit breakers). With properly modified circuit breakers, the walking beam interlock is suitable for field installation. Order circuit breakers of the type and rating required modified for field installation of the walking beam interlock.

Miscellaneous Accessories

Base Mounting Hardware
Base mounting hardware is supplied at no charge when ordered with a circuit breaker or molded case switch. When ordering separately, refer to price list.

English Thread

No. of Poles	Description	Type of Mounting	Style Numbers
1	.164-32 x 3.188 inch Pan-Head Steel Screws, Lockwashers, and Clamps	Individual	624B375G01
		Group (one set of hardware for two circuit breakers)	624B375G02
2	.164-32 x 1.5 inch Pan-Head Steel Screws and Lockwashers	Individual	4218B80G01
3, 4		Individual	4218B80G02

Metric Thread

No. of Poles	Description	Type of Mounting	Style Numbers
1	M4 - 0.7 x 80mm Pan-Head Steel Screws, Lockwashers, and Clamps	Individual	4218B80G09
		Group (one set of hardware for two circuit breakers)	4218B80G10
2	M4 - 0.7 x 38mm Pan-Head Steel Screws and Lockwashers	Individual	4218B80G11
3, 4		Individual	4218B80G12

LFB Current Limiter Attachment

Circuit Breaker Rating① Amps.	Catalog Numbers
15-70	LFB3070R
80-160	LFB3150R

① Ratings through 70A can be supplied with terminals for Cu cable only (#14 – #2.) Order by description.

Earth Leakage Protection Module
Refer to Westinghouse for ratings and availability.

Modifications

Special Calibration

Type of Calibration	1 – 24 Identical Units	24 or More Identical Units
Thermal	Add 10% to list price of complete circuit breaker	No price addition
Magnetic		No price addition
Frequency		No price addition

Moisture-Fungus Treatment
Order by description, refer to price list.

Marine Applications
When listing Mark for marine applications under UL489 is required, specify requirement when ordering. Nonaluminum terminals must be used. Available on D model circuit breakers only. No price addition applies.

● The one pole lock is a snap-on type.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Door Hardware
Door hardware listed in this section may be used with Types SM and AMT handle mechanisms.

Three choices of door hardware and an auxiliary handle are offered to provide the best latching scheme for individual needs. The door hardware is designed with a provision for padlocking, and a coin-proof slot that requires the use of a tool to open the door, for maximum security.

Select desired hardware below. Additional latches can be ordered from accessories section if desired.

Hardware Item	Description and Catalog Numbers
	With sliding latches for smaller panels up to approx. 30" high. Catalog Numbers Right Hand: DH1R Left Hand: DH1L
	With 2 roller latches for intermediate panels up to approx. 40" high. Catalog Numbers Right Hand: DH2R Left Hand: DH2L
	With 3 roller latches for larger panels approx. 40" and higher. Catalog Numbers Right Hand: DH3R Left Hand: DH3L
	Auxiliary handle for larger panels Catalog Numbers Right Hand: DH4R Left Hand: DH4L

Note:
Right hand enclosure cover hinged on left,
Left hand enclosure cover hinged on right.

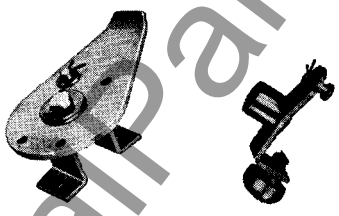
Accessories
Dress Nameplates: Required to meet automotive specifications. Mounts from inside enclosure and covers operating mechanism mounting bolts, making mechanism non-removable when enclosure door is closed.

Style Number: 373D260G05

Electrical Interlock Kit: Provides 1 N. C. and 1 N. O. contacts (SPDT switch) for use with auxiliary circuits. Mounts to end of mechanism housing as shown.

Style Number: 622B747G01

Auxiliary Latch Kits: Provide an additional latch for use with applications where two point latching may not be adequate.



Sliding Latch **Rolling Latch**

For Door Hardware Using Sliding Latches
Right or Left Hand Mtg.: Style No. 656D669G01

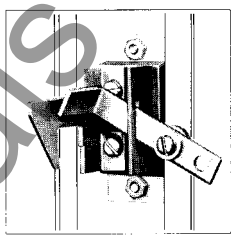
For Door Hardware Using Roller Latches
Right Hand Mtg.: Style No. 370D801G04

Left Hand Mtg.: Style No. 370D802G04

Door Operated Interlock Defeater Kit for Type SM Mechanisms: Required when door hardware is not used, operates as door closes. Additional door securing means such as screw latch, also required (to be supplied by box manufacturer).

Style Number: 623B214G02

Door Hardware Kit
Cat. No. AMTDHA



This adapter kit is for use with door hardware kits DH1R, DH2R, or DH3R for type SM handle mechanisms to permit the use and interlocking of right hand installation of the type AMT handle mechanism (Below-the-Handle or Above-the-Handle type).

Door Interlock Kit for Side Plate Handle Mechanism
Three point interlock for use with mechanisms where regular interlock is not adequate.

Style Number 28A2656G08
(Drilling Plan Reference 208B624)

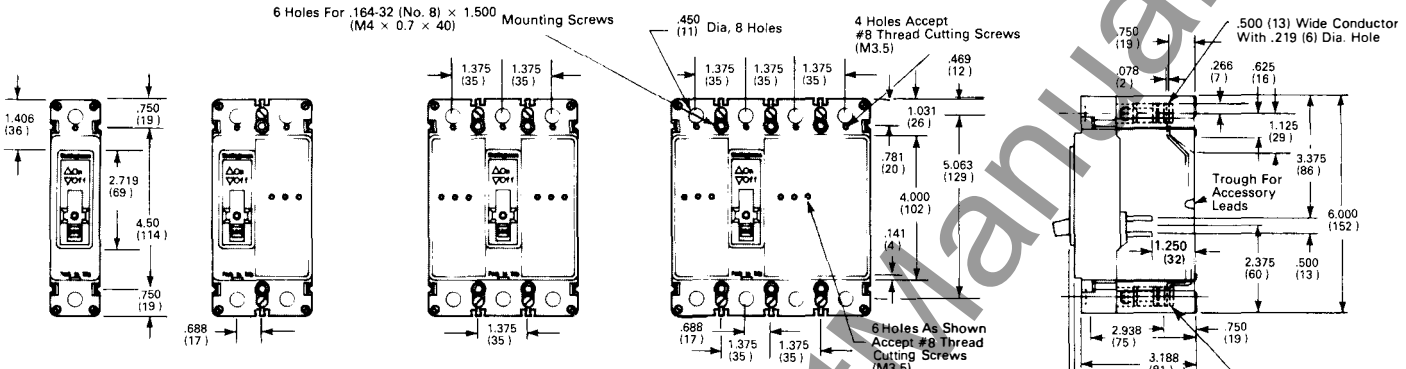
Series C Molded Case Circuit Breakers, F-Frame

Section 6 – Dimensional Data

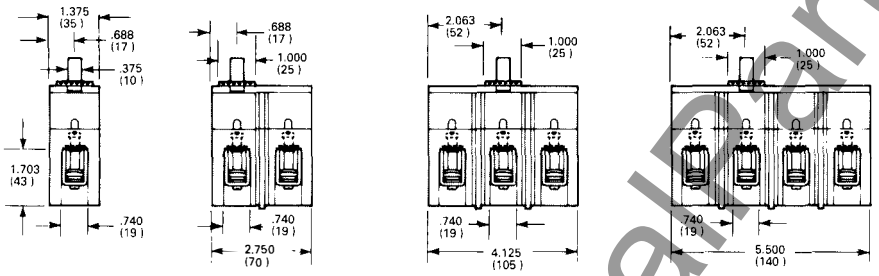
Dimensions in Inches and (Millimeters)

Not to be used for construction purposes unless approved.

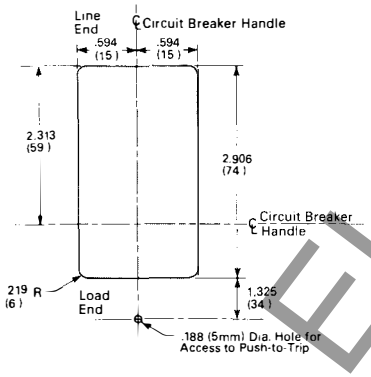
Line End **Line End** **Line End** **Line End**



Line/Load End **Line/Load End** **Line/Load End** **Line/Load End**

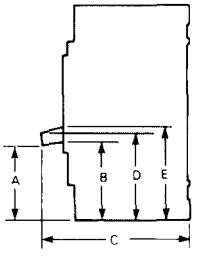


Front Cover Cutout



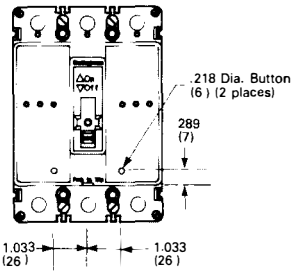
Circuit Breaker Handle Travel Distances

Circuit Breaker Status	Dimension A	B	C	D	E
On	3.07 (78)	2.92 (74)	3.96 (101)	3.40 (86)	3.33 (85)
Tripped	2.65 (67)	2.57 (65)	4.06 (103)	2.99 (76)	2.98 (76)
Off	2.08 (53)	2.14 (54)	4.12 (105)	2.42 (61)	2.56 (65)
Reset	1.98 (50)	2.05 (52)	4.11 (104)	2.30 (58)	2.48 (63)



Adjustable Thermal/Magnetic Buttons

Line End

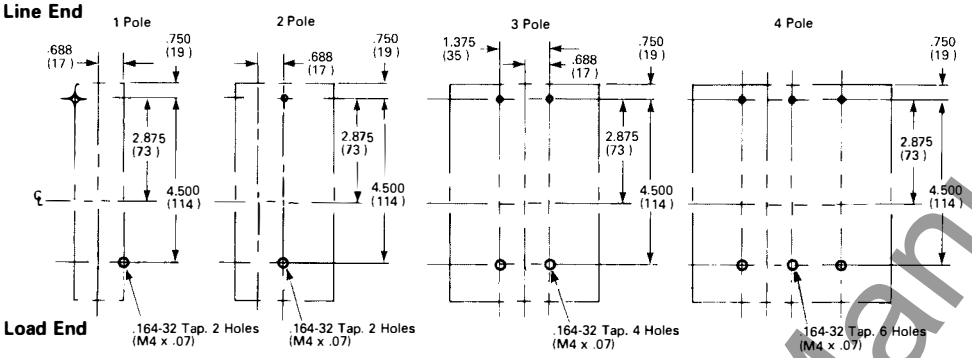


Series C Molded Case Circuit Breakers, F-Frame
Section 6 – Dimensional Data

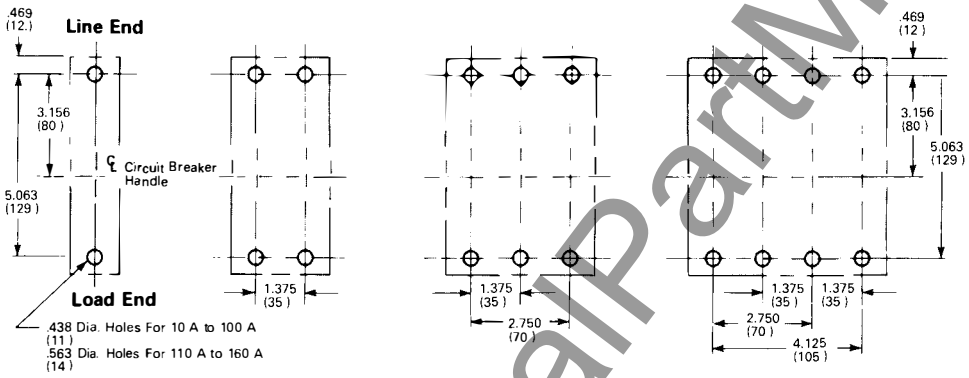
Dimensions in Inches and (Millimeters)
Not to be used for construction purposes unless approved.

Front Connected Drilling Plan

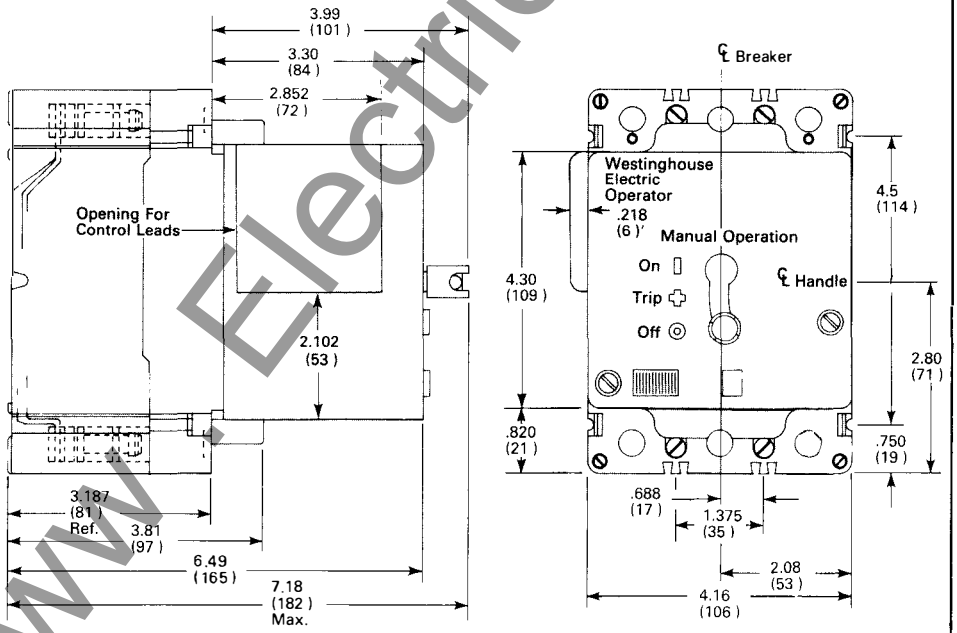
Line End



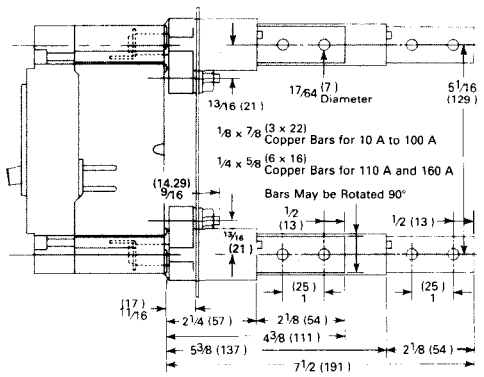
Rear Connected Drilling Plan



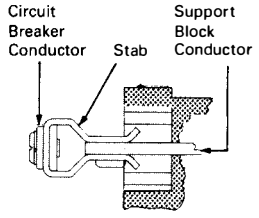
Electrical (Solenoid) Operator



Plug-in Adapter



Plug-in and Bolt-on Detail



Plug-in
Bolt stab to circuit breaker conductor, then plug into support block.

Bolt-on
Bolt stab to support block, then bolt support block to circuit breaker conductors.

Series C Molded Case Circuit Breakers, F-Frame
Section 7 – Guide Specifications

Typical Specifications For Series C Molded Case Circuit Breakers

Electrical circuits shall be protected by Series C Molded Case Circuit Breakers as manufactured by Westinghouse Electric Corporation.

Each pole of the circuit breakers shall provide complete circuit overcurrent protection by having inverse time and instantaneous tripping characteristics and, where applicable, be current limiting.

The circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against short circuit currents. Tripping due to overload or short circuits shall be clearly indicated by the position of the handle. The ON and OFF positions shall be clearly marked on the cover of the circuit breaker along with the international symbols I for ON and 0 for OFF on the handle providing positive indication of the circuit breaker contact position. Additionally, a color-coded indication of the circuit breaker contact position shall be provided: red for ON, green for OFF, and white for tripped. An easily accessible Push-to-Trip button for mechanically exercising the trip unit shall be provided on the cover of each circuit breaker. All poles of a multi-pole circuit breaker shall be so constructed as to ensure simultaneous open, close, and trip operations.

Circuit breakers shall be completely enclosed in a high strength glass-polyester case. Non-interchangeable trip circuit breakers shall be factory sealed; interchangeable trip circuit breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible from the front of the circuit breaker. Contacts shall be non-welding silver alloy. Arc extinction must be accomplished by means of DE-ION® arc chutes, consisting of metal grids mounted in an insulating support.

The minimum interrupting ratings of the circuit breakers shall be at least equal to the available short circuit current at the line terminals. Where applicable, circuit breakers shall be UL listed for series tested application.

Circuit breakers in frame sizes 100A through 600A shall be equipped with thermal-magnetic trip units. Circuit breakers in 1200A and through 1600A frame sizes shall be equipped with solid state trip units that are insensitve to changes in ambient temperature within the normal operating temperature range of the circuit breaker. 400A, 600A, and 630A frame sizes shall be designed to accept either thermal-magnetic or solid state interchangeable trip units.

Circuit breakers shall be listed with Underwriters Laboratories, Inc. under standard UL489, conform to the applicable requirements of NEMA Standards Publication AB1-1986, meet the appropriate classifications of Federal Specifications W-C-375b, and/or comply with the requirements of International Electrotechnical Commission Recommendation, IEC 157-1.

Circuit breaker ratings and modifications shall be indicated on the drawings.

Molded case circuit breakers shall be of the inverse time and instantaneous trip type as provided by thermal-magnetic or solid state trip elements with either standard interrupting, high interrupting, or current limiting characteristics as shown in Section 1 of this frame book. These circuit breakers shall be listed per UL489.

Motor circuit protectors shall be of the instantaneous (magnetic) only type, providing instantaneous short circuit protection by means of a front adjustable trip unit. Instantaneous-only circuit interrupters shall be component recognized per UL489.

Molded case switches shall be of the same construction as the related listed circuit breaker and equipped with a factory sealed, nonadjustable, high instantaneous-only tripping feature.

Molded case switches shall have no overload or low level fault protection provided and shall be marked with a maximum withstand rating denoting the type and level of upstream protection required. Molded case switches shall be listed per UL1087.

Internally mounted accessories including alarm (signal)/lockout switches, auxiliary switches, shunt trips, undervoltage release mechanisms and low energy shunt trips shall be of the plug-in type and shall be listed for field installation in circuit breakers which are not factory sealed.

Electrical operators for circuit breakers of the 400A frame size and below shall be of the single solenoid type with maximum 5-cycle (80 ms) closing characteristics. All electrical operators shall be cover mounted. All electrical operators shall be listed for field installation per UL489.

Electrical characteristics of accessories shall be as indicated on the drawings.

Circuit breakers in the 150A frame size shall be supplied in 1-, 2-, 3-, and 4-pole models as specified on the drawings. Circuit breakers in frame sizes 250A through 1600A shall be supplied in 2-, 3-, or 4-pole models as specified on the drawings.

Accessory wiring shall be brought out through the side or rear of the circuit breaker or be connected to a terminal block mounted on the side of the circuit breaker as specified. The ability to route accessory wiring to the opposite side of the circuit breaker through a trough in the base shall be provided.

Circuit breakers shall be provided with uniformly designed nameplates to clearly indicate the type, rating, listing/recognition/certification marks, accessory details, and other information defined in UL489.

All terminals shall comply with UL486A and B and CSA 1165A Standards. Torque markings shall be provided per UL489.

Westinghouse Electric Corporation
Distribution and Control Business Unit
Electrical Components Division
Pittsburgh, Pennsylvania, U.S.A. 15220

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SERIES C®

F-Frame Molded Case Circuit Breakers

D Model, 15 to 150 Amperes

W Model, 10 to 160 Amperes

Series C Molded Case Circuit Breakers,
Section 1 – Introduction

Series C Circuit Breakers

The new Series C line of molded case circuit breakers represents a significant step forward in circuit protection technology. It incorporates, in frame ratings 150A to 2000A, interrupting capacities as high as 100 kA at 480 Vac (200 kA at 240 Vac) in physical sizes normally associated with standard interrupting rating breakers. Series C circuit breakers, in most frame sizes, are physically and electrically interchangeable with the industrial line of molded case circuit breakers they replace.

There are two branches to the Series C line. The branch covering domestic applications complies with applicable UL, NEMA, and CSA standards, as well as being assigned interrupting ratings under IEC 157-1 or IEC 947-2. The world class branch complies with IEC 947-2. The domestic product line which complies with applicable UL/NEMA/CSA standards is composed of six frame ratings: 150A, 250A, 400A, 600A, 1200A, and 1600A/2000A. The six frame ratings of the IEC branch of the Series C line are 160A, 250A, 400A, 630A, 1250A, and 1600A/2000A and are physically interchangeable with the corresponding UL/NEMA/CSA frames.

Series C circuit breakers in the 150A through 630A frame sizes are available with thermal-magnetic trip units. Electronic trip units can be supplied in the 400A through 2000A frame sizes. The electronic trip units for the 400A, 600A, and 630A frames are field-interchangeable with the thermal-magnetic trip unit in the same frame size.

The 150A and 160A frame sizes of Series C circuit breakers are available in 1-, 2-, 3-, and 4-pole models. The 250A through 1250A frame sizes are available in 2-, 3-, and 4-pole models, and the 1600A and 2000A frame sizes are available in 3- and 4-pole models only.

A complete line of external as well as plug-in internal accessories is available for use with Series C circuit breakers.

Because of unique conductor configuration, the 100 kA (at 480 Vac) interrupting rating model of each Series C frame size is inherently current limiting. These models can, therefore, be used in series tested applications at the 100 kA level to protect specified, lower interrupting rating downstream circuit breakers. This current limiting action is achieved without the use of fuse-type current limiters or extra sets of contacts. The 65 kA (at 480 Vac) interrupting rating model of each Series C circuit breaker provides for simple, fully rated application on the 480 Vac secondary of unit substations up to 2500 kVA.

Series C Literature

A new format has been designed for the Series C circuit breaker literature. The literature is designed to provide each user with the needed information presented in the most usable form. The literature includes:

- Frame Books – provide basic descriptions, application data, technical data, dimensional data, and ordering information for each Series C circuit breaker and associated accessories
- Instruction Leaflets – provide installation, inspection, operation, and adjustment information for Series C circuit breakers and accessories
- Time/Current Curve Packets – provide full-size time/current characteristic curves for each Series C circuit breaker

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Series C Molded Case Circuit Breakers, F-Frame
Section 1 – Introduction

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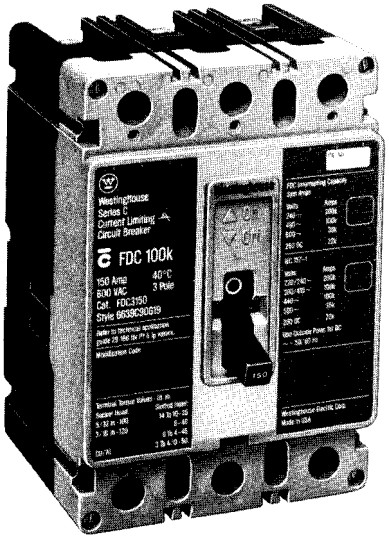


Figure 1-1. F-Frame Series C Circuit Breaker

1-1. General Information

F-Frame Circuit Breaker
The F-frame Series C thermal-magnetic circuit breaker (Figure 1-1) is available in two basic models: the D model and the W model. The D model (rated from 15A to 150A) is designed to comply with Underwriters Laboratories, Inc. Standard UL489, Canadian Standards Association Standard C22.2 No. 5, and International Electrotechnical Commission Recommendation IEC 157-1 (P1). The W model (rated from 10A to 160A) complies with International Electrotechnical Commission Recommendation IEC 947-2. Instantaneous (magnetic) only circuit interrupters (motor circuit protectors), molded case switches (circuit interrupters), and mining duty circuit breakers are also available.

The F-frame circuit breaker is designed to physically and electrically replace the EB, EHB, FB, and HFB circuit breakers (FB circuit breaker family). An innovative design of internal components allows applications to be extended to higher interrupting rating levels. In addition, the higher interrupting and current limiting performance capabilities of the F-frame circuit breaker allow it to be applied in situations that previously required physically larger circuit breakers. Each circuit breaker nameplate is color coded to provide easy identification of type and interrupting capacity rating.

The F-frame circuit breaker is available in 1-, 2-, 3-, and 4-pole configurations to satisfy application requirements in all types of electrical systems. A modular accessory concept permits wide flexibility in accessory installation.

This frame book provides basic information about the thermal-magnetic circuit breaker and molded case switch models of the F-frame circuit breaker. Separate publications cover instantaneous-only circuit interrupters (motor circuit protectors) and mining duty circuit breakers.

1-2. F-Frame Circuit Breaker Types

Thermal-Magnetic Circuit Breaker
The thermal-magnetic circuit breaker provides thermal (inverse time) and magnetic (instantaneous) tripping and is equipped with a manual Push-to-Trip mechanism. The thermal-magnetic circuit breaker is available in several types based on maximum voltage and continuous current ratings, interrupting capacity ratings, and standards compliance. Types EHD, FDB, FD, HFD, current limiting FDC and HFDDC⑥ are listed in accordance with Underwriters Laboratories, Inc. Standard UL489 and Canadian Standards Association Standard C22.2 No. 5. All types except EHD comply with International Electrotechnical Commission Recommendation IEC 157-1 (P1). Types FW, HFW, and FWC comply with International Electrotechnical Commission Recommendation IEC 947-2. Table 1-1 gives the interrupting capacity ratings for the different circuit breaker types. Each rating is achieved by specific design features incorporated into the circuit breaker.

Instantaneous-Only Circuit Interrupter (Motor Circuit Protector)
The instantaneous-only circuit interrupter (motor circuit protector) provides tripping for short circuit protection only. Additional information about this device is in a separate frame book. (29-111)

Molded Case Switch (Circuit Interrupter)
Molded case switches are used as compact switches in applications requiring high current switching capabilities. The molded case switches are constructed of circuit breaker components and are available as high instantaneous-automatic devices. The molded case switches are listed in accordance with Underwriters Laboratories, Inc. Standard UL1087 under UL File E59918.

The high instantaneous-automatic molded case switch is equipped with a non-adjust-

Table 1-1. F-Frame Circuit Breaker Interrupting Capacity Ratings

UL489 Interrupting Capacity Ratings

Circuit Breaker Frame	Number of Poles	Interrupting Capacity (Symmetrical Amperes)					
		Volts Ac (50/60 Hz)				Volts Dc	
		240	277	480	600	125	250①②
EHD	1	.....	14,000	.....	.....	10,000	.....
	2, 3	18,000	.....	14,000	.....	.....	10,000
FDB	2,3,4	18,000	.....	14,000	14,000	.....	10,000
FD	1	.....	25,000	.....	.....	10,000	.....
	2,3,4	65,000	.....	25,000	18,000	.....	10,000
HFD	1	.....	65,000	.....	.....	10,000	.....
	2,3,4	100,000	.....	65,000	25,000	.....	22,000
FDC	2,3,4	200,000	.....	100,000	35,000	.....	22,000
HFDDC⑥	3	.....	.....	.....	.....	.....	⑤

IEC 157-1 Interrupting Capacity Ratings (P1)

Circuit Breaker Frame	Number of Poles	Interrupting Capacity (Symmetrical Amperes)						
		Volts Ac (50/60 Hz)					Volts Dc④	
		220/240	380/415	440	500	660	125	250①
FDB	2, 3, 4	18,000	14,000	14,000	14,000	.....	.....	10,000
FD	1	25,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	65,000	25,000	25,000	18,000	.....	.....	10,000
HFD	1	65,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	100,000	65,000	65,000	25,000	.....	.....	22,000
FDC	2, 3, 4	200,000	100,000	100,000	35,000	.....	.....	22,000
FW	1	25,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	65,000	25,000	25,000	18,000	③	.....	10,000
HFW	1	65,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	100,000	65,000	65,000	25,000	③	.....	22,000
FWC	2, 3, 4	200,000	100,000	100,000	35,000	③	.....	22,000

IEC 947-2 Interrupting Capacity Ratings

Circuit Breaker Type	Number of Poles	Interrupting Capacity (Symmetrical Amperes)							
		Volts Ac (50/60 Hz)						Volts②⑦	
		380		415		690		250	
		I_{cu}	I_{cs}	I_{cu}	I_{cs}	I_{cu}	I_{cs}	I_{cs}	I_{cs}
FW	1, 2, 3, 4	35,000	(18,000)	35,000	(18,000)	12,000	(6,000)	10,000	(5,000)
HFW	1, 2, 3, 4	65,000	(33,000)	65,000	(33,000)	14,000	(7,000)	20,000	(10,000)
FWC	1, 2, 3, 4	100,000	(50,000)	100,000	(50,000)	18,000	(9,000)	20,000	(10,000)

① Two-pole circuit breaker, or two poles of three-pole circuit breaker.
② Time constant is 3 milliseconds minimum at 10 kA and 8 milliseconds minimum at 22 kA.
③ Refer to Westinghouse.
④ DC ratings apply to substantially non-inductive circuits.
⑤ Interrupting rating is 15,000 amps at 500 volt Dc with 3 poles in series, for ungrounded systems only.
⑥ HFDDC is UL only and is not tested to other standards.
⑦ Time constant is 5 milliseconds minimum at 10 kA and 15 milliseconds minimum at 22 kA.

able, instantaneous trip mechanism that protects the switch if it is subjected to a fault current above its withstand rating. The switch does not provide low level fault or inverse time overload protection and must be used with a properly rated overcurrent protective device.

1-3. Advantages

The Series C circuit breaker line represents an entirely new approach to circuit breaker design. The F-frame circuit breaker uses new design features that improve performance and extend application capabilities while maintaining physical interchangeability with the existing FB circuit breaker family.

The following list highlights the advantages of the F-frame circuit breaker over previously available circuit breakers. (Figure 1-2).

a. Performance
The F-frame circuit breaker provides higher interrupting capacities and improved current limiting capabilities compared to previous standard line circuit breakers. The enhanced performance characteristics extend F-frame circuit breaker use to applications that previously required physically larger circuit breakers.

b. Designs
Thermal-magnetic designs include fixed or adjustable thermal and magnetic trip settings. The D model circuit breakers have fixed thermal and magnetic settings to provide application consistency. The W model circuit breakers have adjustable thermal settings and either fixed or adjustable magnetic settings to provide application flexibility where local codes and standards permit the use of adjustable circuit breakers.

The molded case switch (circuit interrupter) is equipped with a non-adjustable high instantaneous trip unit.

c. Construction Details
1-, 2-, 3-, and 4-pole configurations satisfy application requirements for all types of electrical systems. The 4-pole configuration provides 3-phase, 4-wire neutral line circuit breaking where required by local codes and applications.

Physical frame size allows interchangeability with the existing FB circuit breaker family without modifying the enclosure or mounting details.

External hardware is in English (D models) or metric (W models) thread sizes to accommodate user needs.

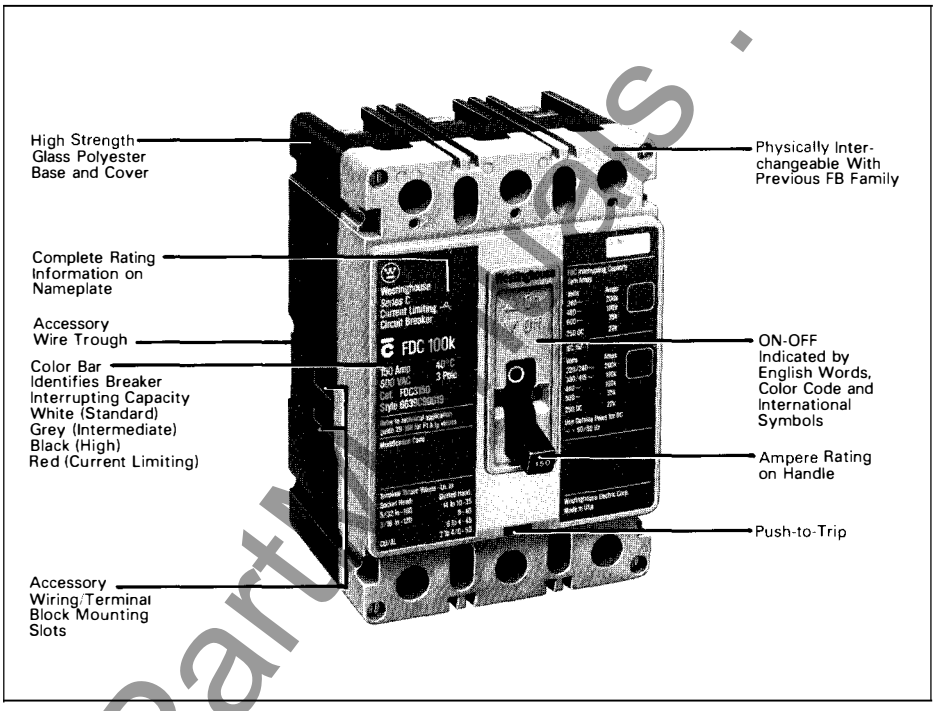


Figure 1-2. F-Frame Circuit Breaker Features

A Push-to-Trip button provides a local means of manually exercising the trip mechanism.

High strength glass-polyester base and cover have excellent dielectric qualities and reduce the need for fungus proofing. Cover design reduces the possibility of accidental contact with live terminations.

Operating mechanism design provides increased air gap between stationary and moving contacts when circuit breaker is in tripped position. The increased air gap provides greater arc impedance during contact opening, which allows higher interrupting capacity ratings to be obtained in compact frame sizes.

Variations in contact assembly designs allow different interrupting capacities in one physical frame size.

The one piece molded crossbar assembly has high dielectric qualities and ensures simultaneous operation of all moving contacts.

Positive operating mechanism ensures that the operating handle stays in the ON position when the contacts are closed.

Handle operating force and throw are compatible with circuit breakers in the FB family, allowing changeover to the F-frame circuit breaker with little or no handle mechanism modification.

Back plate insulates internal component hardware from the circuit breaker mounting surface.

d. Internal Accessories
Modular plug-in accessory design simplifies factory installation for improved customer service and facilitates field installation where local codes and standards permit. Molded accessory frames provide improved electrical clearance and dielectric quality.

The internally mounted accessories include auxiliary switch, alarm (signal)/lockout switch, shunt trip, undervoltage release mechanism and low energy shunt trip. These accessories are designed to meet most ac and dc rating requirements.

Internal accessory wiring options provide wire routing versatility. The standard wiring method is pigtail leads exiting from the rear of the circuit breaker base. Options include pigtail leads extending through a slot in the side of the base where the accessory is mounted, or through a molded trough to the opposite side of the base. Additional options include side mounted terminal blocks.

e. External Accessories
Cover design permits field installation of key interlocks, padlockable handle lock

Series C Molded Case Circuit Breakers, F-Frame
Section 1 – Introduction

hasp, and electrical or manual handle operators without modifying the cover.

A factory installed cylinder lock can be mounted in the cover providing a simplified system for locking the trip bar in the tripped position.

Plug-in adapters provide convenience for front-removable switchboard construction.

The F-frame models can be operated by existing handle mechanism types, including Vari-depth, slide plate, SM, MC, and AMT.

f. Markings
The Series C circuit breaker line features a new format of nameplate which provides easy identification of circuit breaker type, rating, and operating status.

Nameplates are color coded for immediate rating identification. A color-coded bar identifies the type and the interrupting rating (kA) at the most common application voltage (480 or 380 Vac). The color codes are as follows:

White: EHD/FDB

Grey: FD/FW

Black: HFD/HFW

Red: FDC/FWC.

Consolidated nameplate design provides complete identification and rating information in an easily readable, understandable format.

Circuit breaker status is clearly indicated by circuit breaker handle position and color-coded flags (red for ON, green for OFF, and white for TRIP). The on and off positions are identified in English words (ON and OFF) and international symbols (I and O).

g. Equipment Literature
A complete line of technical literature produced in several languages provides specification, ordering, application, and instructional information. This makes the circuit breaker easy to specify, purchase, and apply, saving time and minimizing application errors.

Dimensional data is in English and metric units to satisfy user requirements.

h. Standards Compliance
The Series C circuit breaker is designed to comply with the following standards:

- Australian Standard AS 2184, Moulded Case Circuit Breakers
- British Standards Institution Specification BS 4752: Switchgear and Control Gear, Part 1: Circuit Breakers
- Canadian Standards Association Standard C22.2 No. 5, Service Entrance and Branch Circuit Breakers
- International Electrotechnical Commission Recommendation IEC 157-1, IEC 947-2, Low-Voltage Distribution Switchgear, Part 1: Circuit Breakers
- National Electrical Manufacturers Association Standards Publication No. AB1-1986, for Molded Case Circuit Breakers
- South African Bureau of Standards Standard SABS 156, Standard Specification for Moulded Case Circuit Breakers
- Swiss Electro-Technical Association Standard SEV 157-1, Safety Regulations for Circuit Breakers
- Underwriters Laboratories, Inc. Standard UL489, Molded Case Circuit Breakers and Circuit Breaker Enclosures, Including Marine Circuit Breakers
- Union Technique de l'Electricite Requirements NF C 63-120, Low Voltage Switchgear and Control Gear Circuit Breaker Requirements
- Verband Deutscher Elektrotechniker (Association of German Electrical Engineers) Specification VDE 0660, Low Voltage Switch Gear and Control Gear, Circuit Breakers.

Compliance with these standards satisfies most local and international codes, assuring user acceptability and simplifying application.

i. Federal Specification Classifications
Federal specification W-C-375b is complied with as follows:

EHD: 1-pole Class 13a;
2-, 3-pole Class 13b

FDB①: 2-, 3-pole Class 18a

FD①: 1-pole Class 13a;
2-, 3-pole Class 22a

HFD①: 1-pole Class 13a;
2-, 3-pole Class 23a

FDC①: 2-, 3-pole Class 24a.

● Except range of current trip is 15-150A.

Series C Molded Case Circuit Breakers, F-Frame
Section 2 – Applications

2-1. Introduction

Application flexibility of the F-frame circuit breaker is enhanced by the higher interrupting ratings and current limiting characteristics designed into the Series C line (Figure 2-1).

2-2. Switchboard Application

The EHD, FDB, FD/FW, HFD/HFW, and FDC/FWC circuit breakers are used in distribution systems to provide feeder and branch protection.

2-3. Panelboard Application

The F-frame circuit breaker is used in panelboard applications as both a main and a branch protection device.

2-4. Busway Plug-In Application

The F-frame circuit breaker can be applied in busway plug-in units to provide branch protection. Size compatibility between the FB family and the F-frame circuit breaker facilitates replacement without changing busway plug-in units.

2-5. Individual Enclosure Application

The F-frame circuit breaker can be applied in individual enclosures to meet specific installation requirements.

2-6. Machine Tool Control Panel Application

In machine tool applications, F-frame circuit breakers and molded case switches can be applied to meet individual equipment requirements.

2-7. Special Applications

In mining, motor circuit protection, uninterruptible power systems (DC battery breakers), and other applications, special versions of the F-frame circuit breaker provide safe equipment control and protection. For additional information, see separate frame books or refer to Westinghouse.

For all 3-phase Delta, grounded B phase applications, refer to Westinghouse.

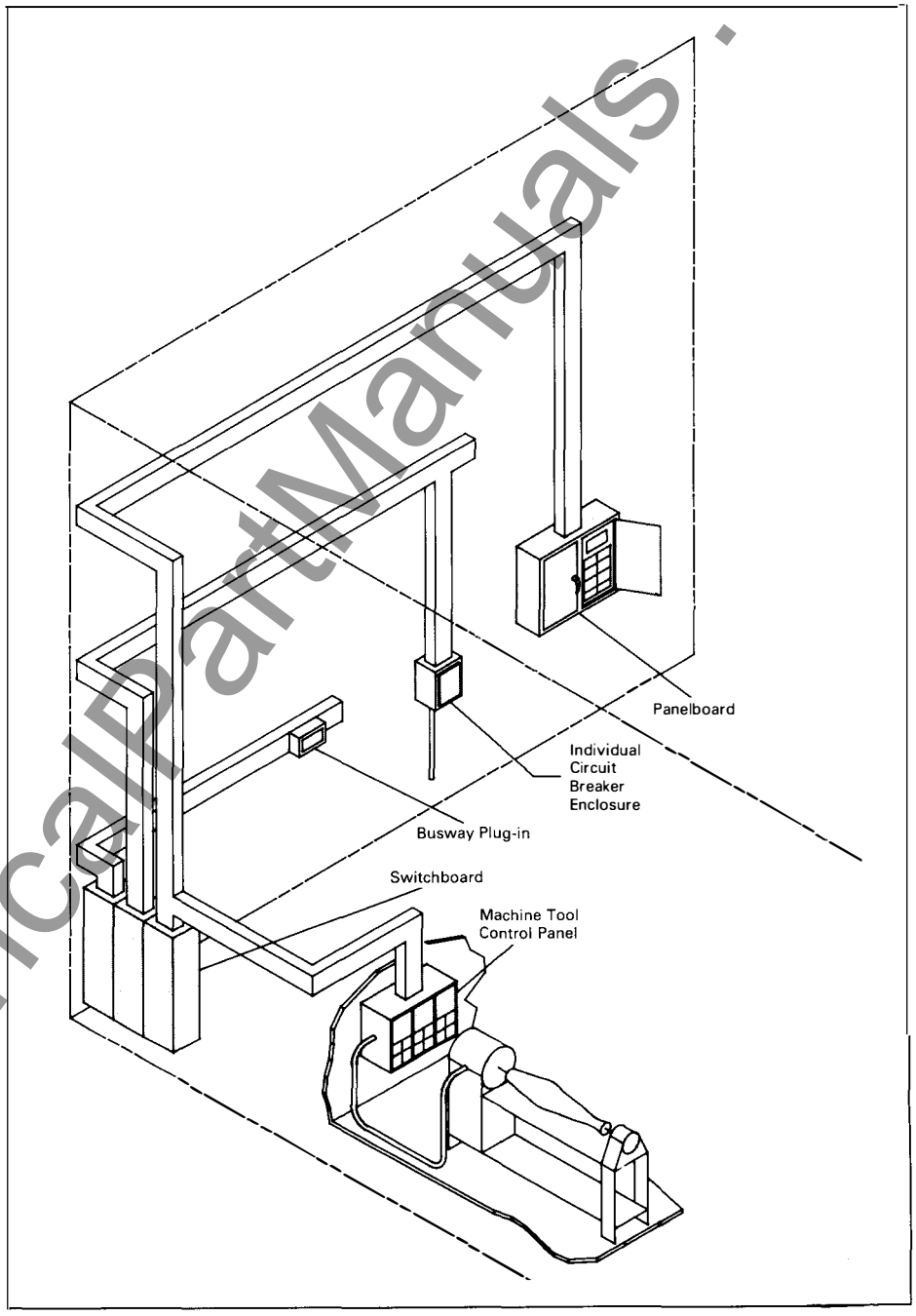


Figure 2-1. F-Frame Circuit Breaker Typical Applications

Series C Molded Case Circuit Breakers, F-Frame
Section 3 – Description

3-1. Physical Description

The F-frame circuit breaker consists of the following components mounted inside a molded glass-polyester case (Figure 3-1):

a. Operating mechanism
b. Arc extinguishers
c. Stationary contact assemblies
d. Moving contact assemblies
e. Trip mechanisms.

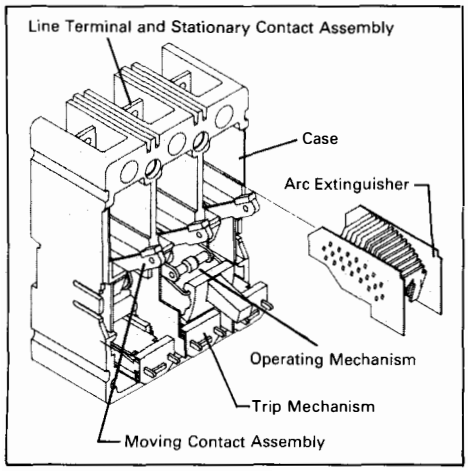


Figure 3-1. F-Frame Circuit Breaker Components

3-2. Functional Description

The F-frame circuit breaker disconnects a load from an electrical supply when the handle is operated, when an overcurrent or short circuit condition develops, or when a manual trip is initiated. Circuit breaker operation is provided by a spring-loaded toggle operating mechanism that provides quick-make and quick-break, trip free operation.

The current path in the circuit breaker is shown in Figure 3-2. When the circuit breaker contacts are closed, the current flows from the line terminal, through the stationary and moving contact assemblies, through a copper shunt to the thermal-trip bimetal, through the bimetal and magnetic-trip element, to the load terminal.

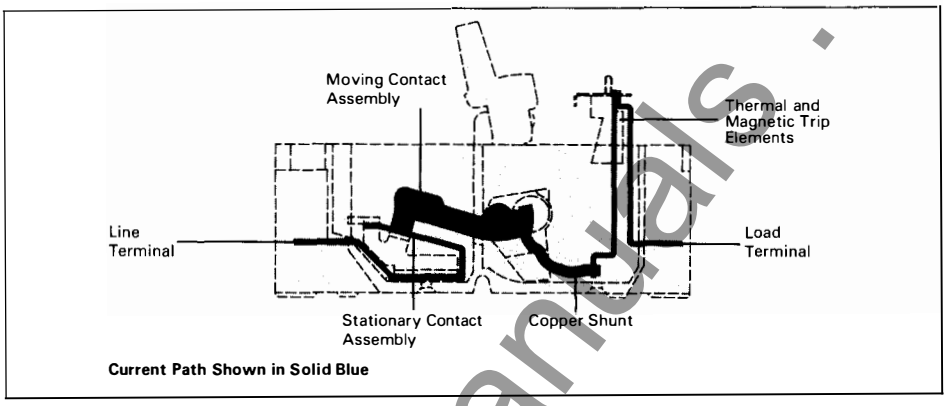


Figure 3-2. F-Frame Circuit Breaker Current Path (HFD/HFW Stationary Contact Shown)

3-3. Component Description

The following paragraphs give the physical and functional descriptions of the circuit breaker components. Differences between the FD/FW, HFD/HFW, and FDC/FWC circuit breakers are described.

Molded Case

The molded case (Figure 3-3) is a housing for electrically insulating the circuit breaker components and internal accessories. The case consists of a glass-polyester base and cover. The internal case molding forms cavities that isolate terminal areas, individual arc chambers, the operating mechanism, and internal accessories. Barriers isolate the operating mechanism from the accessory mounting cavities. Slots in the cover provide ventilation for the arc chambers. The external case molding forms terminal enclosures to help prevent accidental contact with the terminals. The outside of the case accomodates externally mounted accessories. Mounting slots in the base accommodate external terminal blocks for connections to internal accessories. Alternatively, these slots act as side exit holes for internal accessory pigtail leads. Other slots allow pigtail leads to exit from the back of the base. A trough molded into the back of the base provides internal accessory lead routing across the back of the circuit breaker. A back plate insulates live mounting components.

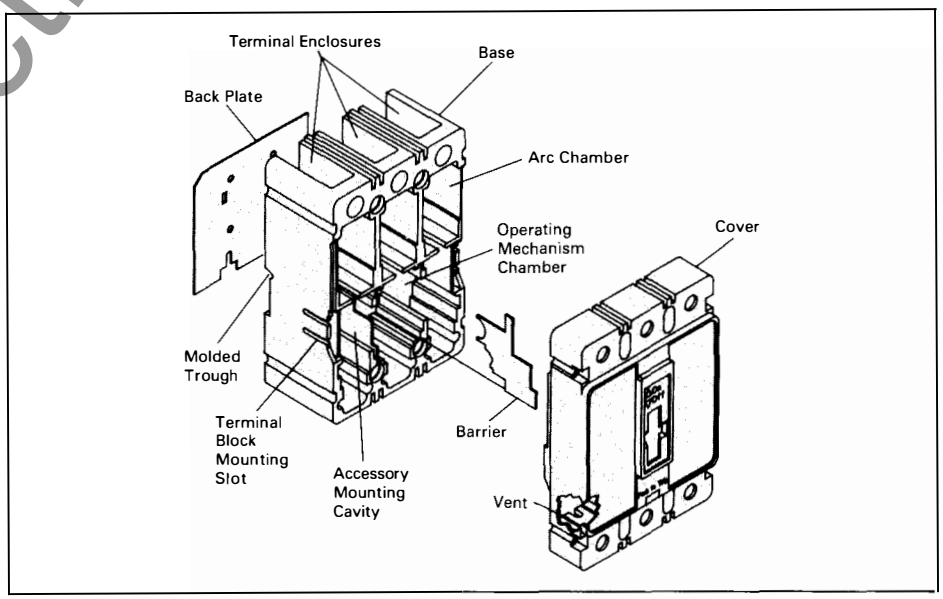


Figure 3-3. Molded Case

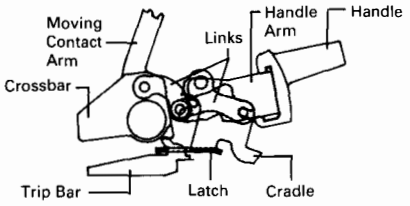
Series C Molded Case Circuit Breakers, F-Frame
Section 3 – Description

Operating Mechanism
The operating mechanism provides a means of manually switching the moving contact position from open to closed and from closed to open, and it provides the mechanical means to open the contacts when trip conditions occur. The handle position indicates the contact status: closed, tripped, or open.

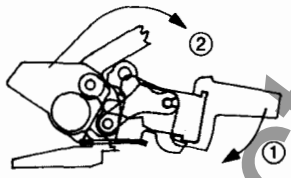
Manual Operation
Manual operation of the circuit breaker handle closes and opens the moving contact assembly. When the cradle is hooked in the latch (Figure 3-4), the handle arm controls crossbar rotation. When the handle arm is moved from one position to the other, the crossbar rotates and the moving contacts open or close. The link arrangement between the handle arm and the crossbar provides spring-loaded toggle operation.

Trip Operation
The trip operation provides contact opening when the trip mechanism is actuated. The trip mechanism can be actuated thermally; magnetically; or manually by the Push-to-Trip button, the cylinder lock, the shunt trip, or the undervoltage release mechanism accessories. Trip operation can occur only when the cradle is hooked into the latch. When a trip element operates (Figure 3-5), the trip bar rotates and releases the latch. When the latch is released, the handle arm springs pull the cradle against the handle arm and, at the same time, rotate the crossbar to open the contacts.

Breaker "On" (Contacts Closed)



Breaker "Off" (Contacts Open)

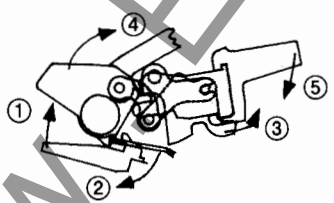


Manual Operating Sequence

1. Handle and Handle Arm Move
2. Crossbar and Moving Contact Arm Rotate

Figure 3-4 Manual Mechanism Operation

Breaker Tripped



Trip Operation Sequence

1. Trip Bar Rotates
2. Latch Releases
3. Cradle Moves Toward Handle Arm as
4. Crossbar and Moving Contact Arm Rotate, and
5. Handle moves to trip position

Figure 3-5 Trip Mechanism Operation

Arc Extinguishers
The arc extinguishers dissipate arcs that result when the circuit breaker interrupts current flow. Each arc extinguisher consists of a stack of uniformly spaced, U-shaped steel plates held together by two insulating side plates (Figure 3-6).

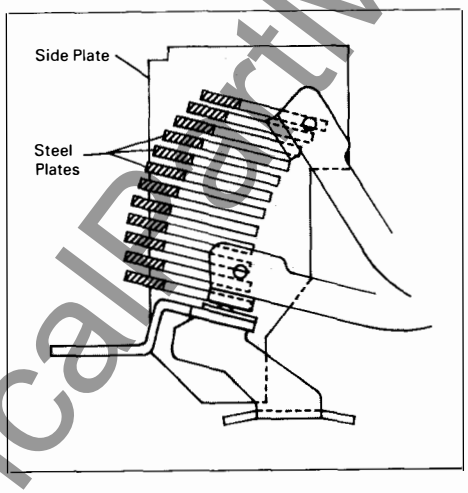


Figure 3-6. Arc Extinguisher

When an interruption occurs and the contacts separate, the current flow through the ionized region between the contacts induces a magnetic field around the arc and arc extinguisher (Figure 3-7). As the lines of magnetic flux show, the force drives the arc into the steel plates, deionizing the gas while dividing and cooling the arc.

Stationary Contact Assemblies
The stationary contact assemblies provide the conducting paths between the line terminals and the moving contacts. Three basic stationary contact assembly configurations are used: EHD, FDB, FD/FW; HFD/HFW; and FDC/FWC.

EHD, FDB, FD/FW Stationary Contact Assemblies
The EHD, FDB, FD/FW circuit breakers use a conventional stationary contact assembly (Figure 3-8). It consists of a line terminal copper conductor and a silver tungsten (EHD, FDB, FD) or silver graphite (FW) contact.

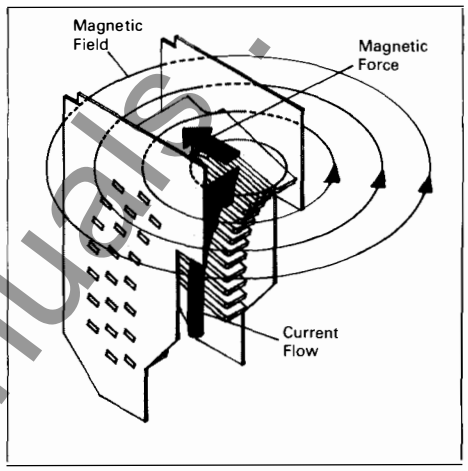


Figure 3-7. Arc Extinguisher Operation

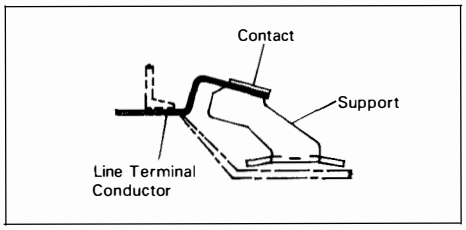


Figure 3-8. FD/FW Stationary Contact Assembly

HFD/HFW Stationary Contact Assembly
The HFD/HFW circuit breaker uses a reverse-loop stationary contact assembly (Figure 3-9). It consists of a line terminal copper conductor that is formed into a loop, and a silver tungsten (HFD) or silver graphite (HFW) contact.

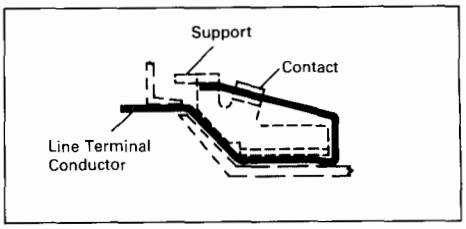


Figure 3-9. HFD/HFW Stationary Contact Assembly

FDC/FWC Stationary Contact Assembly
Each FDC/FWC circuit breaker stationary contact assembly (Figure 3-10) consists of a line terminal copper conductor connected through a pivoted joint to a copper contact conductor and a silver tungsten (FDC) or silver graphite (FWC) contact. The line terminal conductor and contact conductor form a reverse loop. A compression spring behind the contact conductor limits movement and returns the contact conductor to the normal position after a high fault trip.

Series C Molded Case Circuit Breakers, F-Frame
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The FDC/FWC stationary contact assembly operates on the same principle as the HFD/HFW stationary contact assembly, but it provides greater arc extension and faster contact opening.

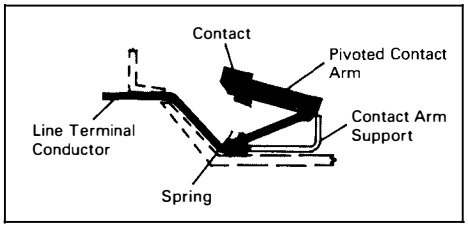


Figure 3-10. FDC/FWC Stationary Contact Assembly

Contact Blow-Apart
When current is flowing through the contacts of the HFD/HFW circuit breakers, the positions of the reverse loop and the moving contact arm induce opposing magnetic fields. The resulting opposing forces along the magnetic flux lines cause rapid contact blow-apart under high current interrupt conditions.

When the FDC/FWC circuit breaker trips under high current conditions, the pivoted joint (Figure 3-11) allows the lower contact to move downward as the moving contact moves upward. The compression spring limits the downward movement and returns the contact conductor to the normal position.

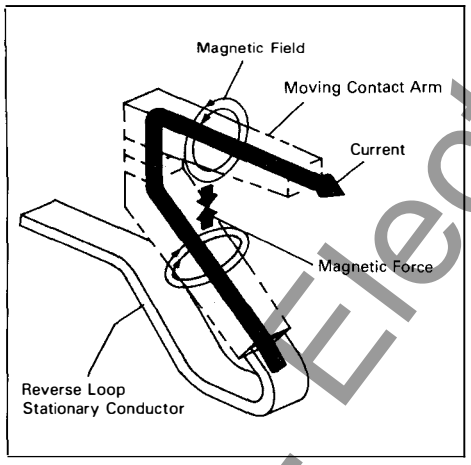


Figure 3-11. Contact Blow-Apart

Moving Contact Assembly
The moving contact assembly provides continuity between the line and load terminals when the circuit breaker is on. When the circuit breaker trips or is switched off, the moving contact assembly moves through the arc extinguisher away from the stationary contact.

The moving contact arm is connected to the operating mechanism crossbar (Figure 3-12). The crossbar and moving contact arm assembly rotates to close the contacts. After the contacts touch, the crossbar overtravels to create firm contact closure, and an arm latch holds the moving contact arm in place.

During overload conditions, when the operating mechanism is tripped, the crossbar and moving contact arm rotate together. Under high level fault conditions when the contact blow-apart forces are strong enough, the moving contact arms independently pivot away from the stationary contact during the tripping operation.

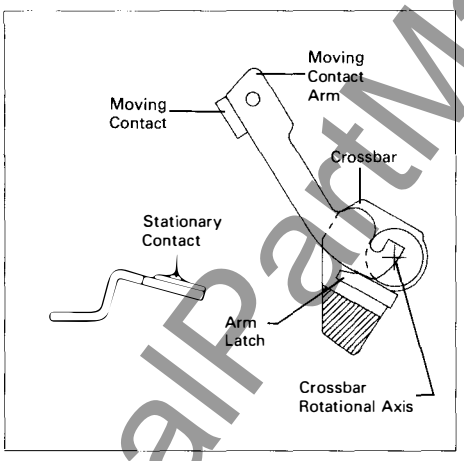


Figure 3-12. Moving Contact Assembly

Trip Mechanisms
The trip mechanisms provide automatic (thermal and magnetic) and manual (Push-to-Trip button) means to trip the circuit breaker. Each trip mechanism rotates and unlatches the trip bar thereby releasing the operating mechanism latch and causing the circuit breaker to trip (Figure 3-13).

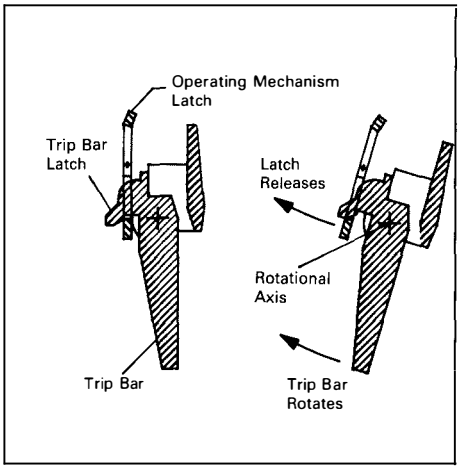


Figure 3-13. Trip Bar Operation

Thermal (Inverse Time) Trip Mechanism
The thermal trip mechanism operates in response to overload conditions. The mechanism includes a bimetal element located behind the trip bar (Figure 3-14). The bimetal element is part of the current carrying path. When there is an overload, the increased current flow heats the bimetal and causes it to bend. As the bimetal bends, it touches and rotates the trip bar causing the circuit breaker to trip. The time needed for the bimetal to bend and trip the circuit breaker varies inversely with the current.

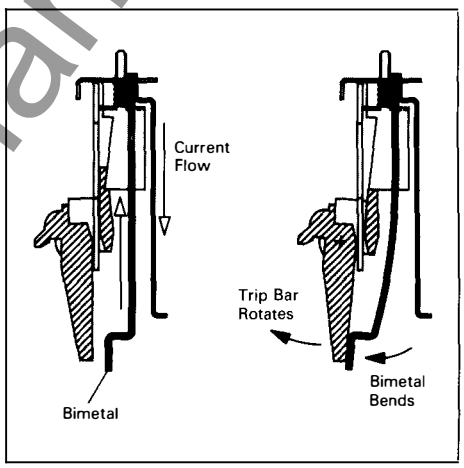


Figure 3-14. Thermal Trip Operation

Magnetic (Instantaneous) Trip Mechanism
The magnetic trip mechanism operates when there is a high current (short circuit) in the current path. The mechanism includes an electromagnet and an armature. When high level current passes through the conductor, the magnetic field strength of the electromagnet rapidly increases and attracts the armature (Figure 3-15). As the

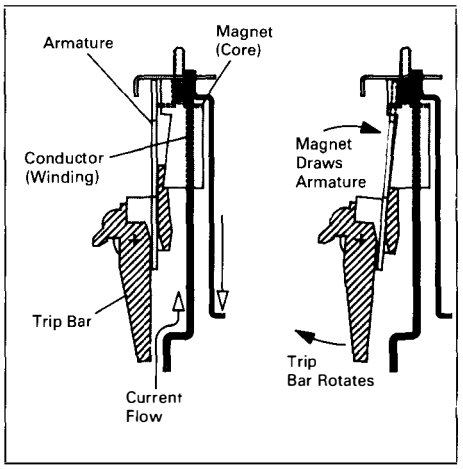


Figure 3-15. Magnetic Trip Operation

top of the armature is drawn to the electromagnet, the armature rotates the trip bar causing the circuit breaker to trip.

Push-to-Trip Mechanism
The Push-to-Trip mechanism provides a manual means of tripping the circuit breaker by depressing a button located in the circuit breaker cover. When the Push-to-Trip button (Figure 3-16) is pressed, a plunger rotates the trip bar causing the circuit breaker to trip.

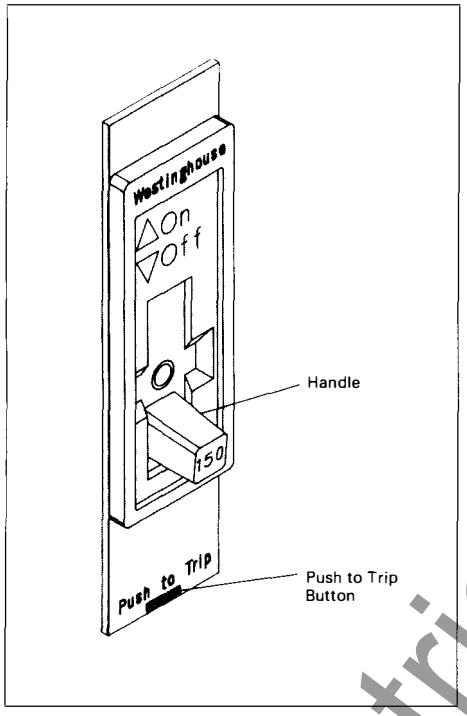


Figure 3-16. Push-to-Trip Button

FW, HFW, and FWC Adjustable Thermal and Adjustable Magnetic Mechanism
The thermal and magnetic elements of FW, HFW, FWC circuit breakers can be adjusted by rotating the adjustment buttons (Figure 3-17) in the cover of the circuit breaker to the desired setting marked on the label. The adjustable thermal mechanism has movable elements (one per pole) connected by a common adjustment linkage. Each pole element is in the form of an inclined plane (wedge) and is located between the bimetal strip and the trip bar. Movement of the wedge adjusts the bimetal trip bar gap varying the necessary bimetal travel required to trip the circuit breaker. The magnetic pick-up setting is adjusted by a linkage that varies the spring tension on the magnet armature.

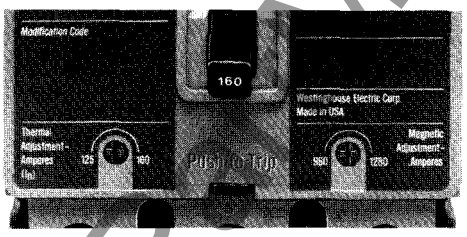


Figure 3-17. Adjustment Buttons

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

4-1. General Information
A complete line of accessories is available for use with the Series C circuit breakers and molded case switches. Commonly required internally mounted accessories are plug-in types for use only with the Series C line. The following paragraphs describe each accessory and provide operation, rating, and specification information. In this section, "circuit breaker" shall also include molded case switch unless otherwise stated.

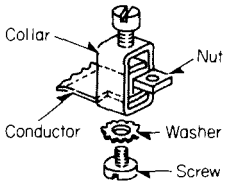
4-2. Termination Accessories
Termination accessories of two basic types are available: terminal connection devices, which accomodate typical circuit breaker connection variations; and termination protection devices which provide terminal isolation.

Termination Connection Devices
- Line and Load Terminals
- Keeper Nut
- Rear Connecting Studs
- Plug-In Adapters
- Panelboard Connecting Straps

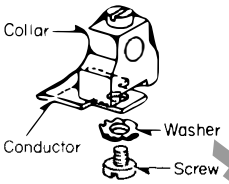
Termination Protection Devices
- Terminal Shields
- Terminal End Covers
- Interphase Barriers

Line and Load Terminals

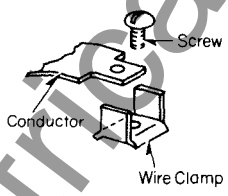
Line and load terminals provide wire connecting capabilities for specific ranges of continuous current ratings and wire types. Except as noted, terminals comply with Underwriters Laboratories, Inc. Standards UL486A or UL486B. Unless otherwise specified, F-frame circuit breakers are factory equipped with load terminals only.



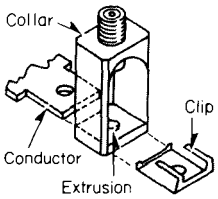
Style 624B100G02
Style 624B100G18
Collar encloses conductor and is held in position by a screw, lockwasher and nut.



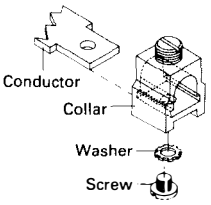
Style 624B100G10
Collar is assembled on top of conductor and is secured with a screw and lockwasher.



Style 624B100G14
Wire clamp is secured to the conductor with a screw.

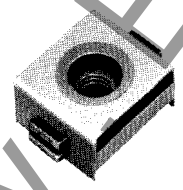


Style 624B100G17
Collar encloses conductor and is secured with a clip. The clip legs slide over the conductor and clip end snaps around bottom of collar.



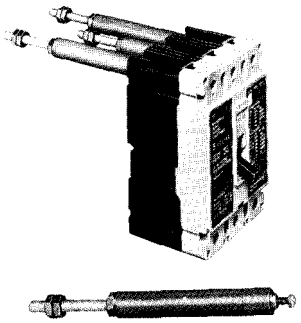
Style 624B100G19
Collar slides onto conductor and is held in position by a screw and lockwasher.

Keeper Nut



The keeper nut slides onto the line or load conductor of the circuit breaker and acts as a threaded adapter for the conductor to accept a ring terminal or other bolt-on connector. The keeper nut is available with English and metric thread sizes. (Field installation only). Listed per UL File E7819.

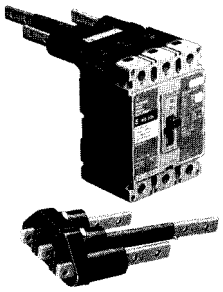
Rear Connecting Studs



Rear connecting studs are available in several sizes to accommodate specific fixed-mounted circuit breaker applications. The rear connecting studs are rated 100A or 150/160A. See Section 5 for dimensional data. (Field installation only)

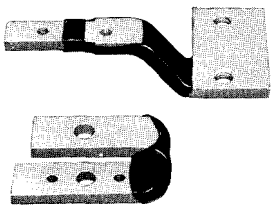
Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

Plug-In Adapters



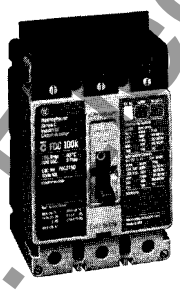
Plug-in adapters simplify installation and front removal of circuit breakers. Individual line and load plug-in adapters are available for rear connection applications on 2-, 3-, and 4-pole circuit breakers. Common mounting plates for line and load end adapters are available. The plug-in adapters are rated 100A or 150/160A. Plug-in adapters are component recognized through 150A per UL File E56845.① See Section 6 for plug-in adapter dimensional data. (Field installation only)

Panelboard Connecting Straps



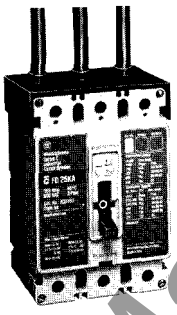
Panelboard connecting straps are used to connect the circuit breaker terminals to the panelboard bus. The panelboard connecting straps are available in two types with 50A, 100A, and 150/160A ratings: outside pole and center pole.

Terminal Shields



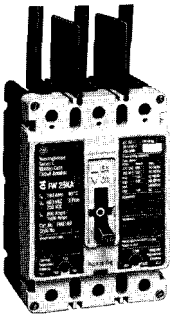
The terminal shield provides protection against accidental contact with live line terminations. Terminal shields are formed from high dielectric insulating material and fasten over the front terminal access openings. Small holes in the shields provide limited access to the terminals for tightening connectors. Terminal shields are listed per UL File E7819. (Field installation only)

Terminal End Covers



The terminal end covers are designed for use in motor control center applications where, because of confined spaces, line side conductors are normally custom fitted. The molded end covers are made of high dielectric glass-polyester and slide over the line ends of the circuit breaker. Close fitting conductor openings are molded into the end covers. The end cover and circuit breaker case fit together to form terminal compartments that isolate discharged ionizing gasses during circuit breaker tripping. Terminal end covers are available with two conductor opening diameters, 0.25 and 0.41 inch, and are listed per UL File E7819. (Field installation only)

Interphase Barriers



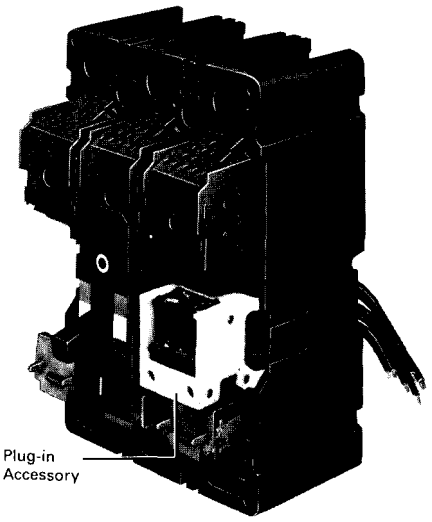
The interphase barriers provide additional electrical clearance between circuit breaker poles for special termination applications. The barriers are high dielectric insulating plates that are installed in the molded slots between the terminals. Interphase barriers are listed per UL File E7819. (Field installation only)

① Recognition of some components pending, refer to Westinghouse.

4-3. Internal Accessories

Internal accessories for the EHD, FDB, FD, HFD, and FDC models are listed for factory installation per UL File E7819, and comply with requirements in Underwriters Laboratories Standard, Inc. UL489 for sealed circuit breakers. Plug-in internal accessories (Figure 4-9) can be field installed in FW, HFW, and FWC models. Internal accessories can also be field installed in D model circuit breakers where UL standards do not apply and where local codes and standards permit. The plug-in internal accessories include:

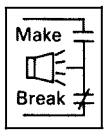
- Alarm (Signal)/Lockout Switch
- Auxiliary Switch
- Shunt Trip
- Undervoltage Release.
- Low Energy Shunt Trip



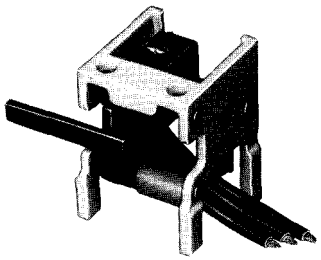
Typical Internal Plug-in Accessory Installed in F-frame Circuit Breaker

Different accessory wiring options are available to satisfy most circuit breaker mounting applications. The standard wiring method is 18-inch pigtail leads extending through a slot at the rear of the base. Options allow the pigtail leads to be routed through a slot in the side of the base where the accessory is mounted, or through a molded trough to the opposite side of the base. Additional options include side-mounted terminal blocks. If accessory leads longer than 18 inches are required, side mounted terminal blocks should be used. To identify allowable accessory installation combinations, see paragraph 4-8. Internally mounted accessories identified in paragraph 4-8 are shown in this section by a graphic symbol in a shaded blue box.

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications



Alarm (Signal)/ Lockout Switch

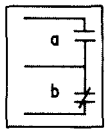


The alarm (signal)/lockout switch monitors circuit breaker trip status and provides remote signaling and interlocking capabilities when the circuit breaker trips. For 2-, 3-, and 4-pole circuit breakers, the alarm (signal)/lockout switch consists of one or two SPDT switches housed in a plug-in module. The SPDT switch contacts are identified as make and break contacts. When the circuit breaker trips, the make contact closes and the break contact opens. For 1-pole circuit breakers, the switch (factory installed only) is mounted on the inside of the cover and the two make leads are routed through an opening in the load end of the circuit breaker. Table 4-1 provides electrical rating data for the alarm (signal)/lockout switch.

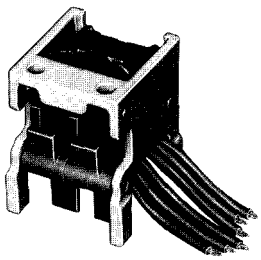
Table 4-1. Alarm (Signal)/Lockout Switch Electrical Rating Data①②

Maximum Voltage	Freq.	Maximum Current, Amps	Dielectric Withstand Voltage
Multi-Pole Circuit Breakers			
600	50/60 Hz	6	2500
125	dc	0.5●	2200
250	dc	0.25●	2200
Single-Pole Circuit Breakers			
125/250	50/60Hz	6●	2000
28	dc	3③	2000
28	dc	5④	2000

● Endurance: 4000 electrical operations plus 4000 mechanical operations.
② Pigtail wire size: No. 18 AWG (0.82 mm²).
● Non-inductive load.
④ Inductive (L/R = 0.026).



Auxiliary Switch

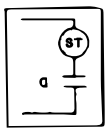


The auxiliary switch provides circuit breaker contact status information by monitoring the position of the moving contact arm. The auxiliary switch is used for remote indication and interlock system verification, and consists of one or two SPDT switches housed in a plug-in module. Each SPDT switch has one "a" and one "b" contact. When the circuit breaker contacts are open, the "a" contact is open and the "b" contact is closed. Table 4-2 provides electrical rating data for the auxiliary switch.

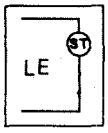
Table 4-2. Auxiliary Switch Electrical Rating Data⑤⑥

Maximum Voltage	Freq.	Maximum Current, Amps	Dielectric Withstand Voltage
125⑧	50/60 Hz	1	2500
600	50/60 Hz	6	2500
125	dc	0.5●	2200
250	dc	0.25⑦	2200

⑤ Endurance: 4000 electrical operations plus 4000 mechanical operations.
⑥ Pigtail wire size: No.18 AWG (0.82 mm²).
⑦ Non-inductive load
⑧ For use in electronic circuit of 100 micro-amps and 15 VDC minimum.

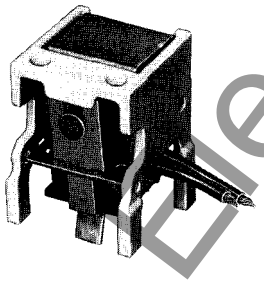


Standard



Low Energy

Shunt Trip



The shunt trip provides remote controlled tripping of the circuit breaker. The shunt trip consists of an intermittent rated solenoid with a tripping plunger and a cutoff switch mounted in a plug-in module. The 120V, AC shunt trip is marked, "suitable for use with ground fault protection devices." Table 4-3 provides electrical rating data for the shunt trip.

A low energy shunt trip device, rated 24V, DC, is available for special applications. A cut-off switch must be included in the external circuit.

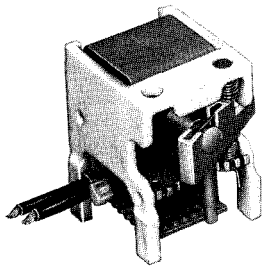
Notes:
1. Average unlatching time: 6 milliseconds.
2. Average circuit breaker contact total opening time: 18 milliseconds
3. Endurance: 4000 electrical operations plus 4000 mechanical operations
4. Pigtail wire size: No. 18 AWG (0.82 mm²).

Table 4-3. Standard Shunt Trip Electrical Rating Data

Electrical Operating Ratings					
50/60 Hz			dc		
Supply Voltage	Minimum Operating Voltage	VA	Supply Voltage	Minimum Operating Voltage	VA
9		40	12		100
12	6.75	75	24	9	400
24		300			
48		90	48		100
60		130	60		160
110	36	440	110	36	530
120		520	120		630
127		580	125		680
208		170	220		50
220	156	180	250	165	65
240		220	...		...
380		530	...		...
400		130	...	...	...
415		140	...	...	...
440		150	...	...	...
480	300	180	...	...	...
525		220	...	...	...
550		240	...	...	...
600		280	...	...	...

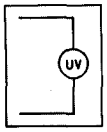
Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

Undervoltage Release Mechanism



The undervoltage release mechanism monitors a voltage (typically a line voltage) and trips the circuit breaker when the voltage falls to between 70 and 35 percent of the solenoid coil rating. Table 4-4 provides electrical rating data for each operating voltage of the handle reset undervoltage release mechanism.

NOTE: Undervoltage release mechanism accessories are not designed for, and should not be used as, circuit interlocks



Handle Reset

The undervoltage release mechanism consists of a continuous rated solenoid with a plunger and tripping lever mounted in a plug-in module. The tab on the tripping lever resets the undervoltage release mechanism when normal voltage has been restored and the circuit breaker handle is moved to the reset (OFF) position. With less than pickup voltage applied to the undervoltage release mechanism, the circuit breaker contacts will not touch when a closing operation is attempted.

Table 4-4. Undervoltage Release Mechanism (Handle Reset) Electrical Rating Data

Electrical Operating Ratings

50/60 Hz					dc				
Supply Voltage	Dropout Voltage Min.	Dropout Voltage Max.	Pickup Voltage Max.	VA	Supply Voltage	Dropout Voltage Min.	Dropout Voltage Max.	Pickup Voltage Max.	VA
9	4.2	6.3	7.6	1.3	12	4.2	8.4	10.2	2.8
12				2.5					
24	8.4	16.8	20.4	1.4	24	8.4	16.8	20.4	1.6
48	21	33.6	40.8	1.2	48	21	33.6	40.8	1.3
60				1.9	60				2.0
110				1.3	110				1.5
120	44.5	77	93.5	1.5	120	44.5	77	93.5	1.7
127				1.7	125				1.9
208				2.2	220	87.5	154	187	2.6
220	84	145.6	176.8	2.4	250				3.4
240				2.9	...	...	...	...	...
380				2.9	...	...	...	...	...
415	168	266	323	3.5	...	...	...	...	...
440				3.9	...	...	...	...	...
480				4.6					
525				4.3	...	...	...	...	...
550	210	367	446	4.8	...	...	...	...	...
600				5.8	...	...	...	...	...

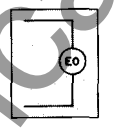
Notes:
1. Endurance: 4000 electrical operations plus 4000 mechanical operations

4-4. Handle Operating Accessories

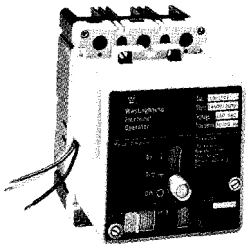
The handle operating accessories provide indirect electrical or manual circuit breaker handle operation. These accessories are field installed only and include:

- Electrical (Solenoid) Operator
- Vari-Depth Handle Mechanism
- Slide Plate Handle Mechanism
- Type SM Safety Handle Mechanism
- Type MC Motor Control Handle Mechanism
- Type AMT Vari-Depth/Vari-Width Flange Mounted Handle Mechanism
- Type AMT Vari-Depth/Fixed Width Flange Mounted Handle Mechanism

To identify allowable accessory installation combinations, see paragraph 4-8. Handle operating accessories identified in paragraph 4-8 are shown in this section by a graphic symbol in a shaded blue box.



Electrical (Solenoid) Operator①



The electrical (solenoid) operator is a single solenoid mechanism that enables local and remote circuit breaker ON, OFF, and reset switching. The electrical operator is mounted on the circuit breaker cover within the trimline of the circuit breaker. The electrical operator uses a unique bistable latch that allows the device to operate using one time of 5 cycles (80 ms) making it suitable for generator synchronizing applications.

Means are provided for local and remote electrical operation and for local manual operation. A special handle design includes provisions for padlocking the manual operating handle in the ON or OFF position. (Handle padlocking does not affect the trip free operation of the circuit breaker.) The handle will accept one padlock shackle with a maximum diameter of 1/4 inch (6mm). An interlock electrically disconnects the solenoid when the electrical operator cover is removed. Table 4-5 provides electrical rating data for the electrical (solenoid) operator. The electrical (solenoid) operator is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.

Table 4-5. Electrical (Solenoid) Operator Electrical Rating Data②

Voltage	Freq.	Inrush Current Amps	Maximum Operating Time	Fuse④ Amps
120●	50/60 Hz AC	10	5 cycles (80ms)	3
240●		5		2
24⑤	DC	50		15-25
120●	DC	14	5 cycles (80ms)	3-5
240⑤	DC	8		2-3

● Electrical operator is also suitable for use with Types EB, EHB, FB, and HFB circuit breakers.
② The electrical operator design is endurance tested for 10,000 electrical operations.
● Tolerance: +10%, −15% of nominal voltage.
● Use current-limiting type fuse where required.
⑤ Tolerance: ±10% of nominal voltage.

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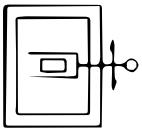
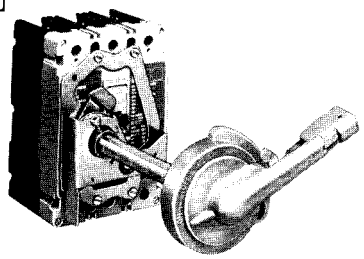
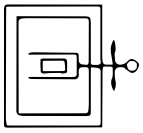


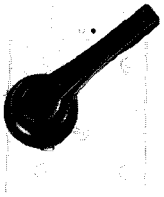
Vari-Depth Handle Mechanism



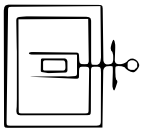
The vari-depth handle mechanism provides a means of externally operating the circuit breaker and can be applied to enclosures of varying depths. The handle mechanism can be used in NEMA 1, 3R, 4, 7, 9, and 12 enclosure applications, depending on the accessory components selected. The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 5/16 inch (7.94mm). The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.



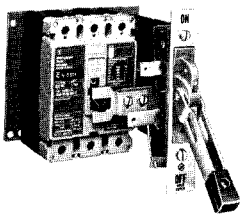
Slide Plate Handle Mechanism



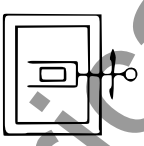
The slide plate handle mechanism provides a means of externally operating a circuit breaker installed in a shallow depth enclosure. When applied to enclosures that are hinged on the right-hand side, the handle mechanism also functions as an enclosure locking device. The handle mechanism can be used in NEMA 1, and 12 enclosure applications; a special version can be used in NEMA 3, 4, and 5 enclosure applications. The handle mechanism will accept up to three padlock shackles each with a maximum diameter of 5/16 inch (7.94mm). The handle mechanism is an Underwriters Laboratories, Inc. recognized component for panelboard accessories under UL File E56845.①



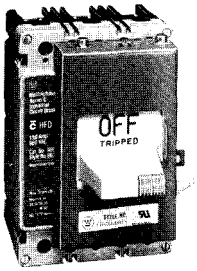
Type SM Safety Handle Mechanism



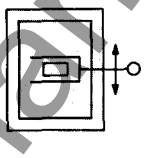
The SM safety handle mechanism provides a means of externally operating a circuit breaker mounted in an enclosure and is designed to reduce the possibility of circuit breaker tampering. The handle mechanism is especially suited for use in automotive and machine tool industries through its conformance to NEMA 12 and J. I. C. requirements. A specially modified handle mechanism for NEMA 4 enclosure applications is also available. The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 3/8 inch (9.52mm). The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.



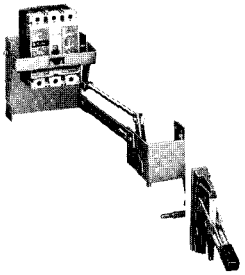
Type MC Motor Control Handle Mechanism



The MC motor control handle mechanism is a linear-operating, fixed depth mechanism designed for through door mounting in standardized and shallow depth enclosures. The handle mechanism provides positive operation and direct disconnect status indication and is interlocked with the enclosure door so that the door can be opened only when the handle is OFF. (A defeater supplied with the handle mechanism can be used to bypass the interlock for maintenance and inspection.) The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 3/8 inch (7.92mm). The handle mechanism is an Underwriters Laboratories, Inc. recognized component for panelboard accessories under UL File E56845.①



Type AMT Vari-Depth/ Vari-Width Handle Mechanism



The AMT vari-depth/vari-width flange mounted handle mechanism is an extra heavy-duty mechanism designed for mounting in flange-type enclosures. The handle mechanism is available for mounting above or below the centerline of the circuit breaker handle, is suitable for various enclosure depths, and can also be used in various horizontal position applications. A door interlock prevents the enclosure from being opened with the handle mechanism in the ON position and prevents the handle mechanism from being switched ON unless the enclosure door is closed. The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 3/8 inch (7.92mm). The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.

① UL listing pending, refer to Westinghouse.

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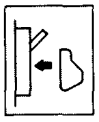
4-5. Lock and Interlock Accessories

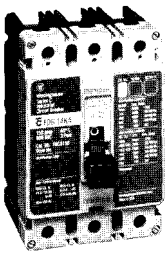
Lock and interlock accessories are used to deter undesired circuit breaker operation and establish interlocked control systems. Lock and interlock accessories include:

- Nonlockable Handle Block
- Padlockable Handle Lock Hasp
- Cylinder Lock
- Key Interlock
- Sliding Bar Interlock
- Walking Beam Interlock.

To identify allowable accessory installation combinations, see paragraph 4-8. Lock and interlock accessories identified in paragraph 4-8 are shown in this section by a graphic symbol in a shaded blue box.

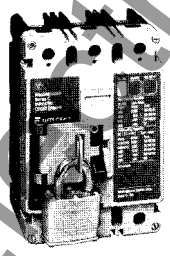


Non-Padlockable Handle Block

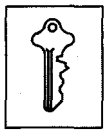


The nonlockable handle block secures the circuit breaker handle in either the ON or OFF position. (Trip-free operation allows the circuit breaker to trip when the handle block holds the circuit breaker handle in the ON position.) The device is positioned over the circuit breaker handle and secured by a setscrew to deer accidental operation of the circuit breaker handle. Listed per UL File E7819. (Field installation only)

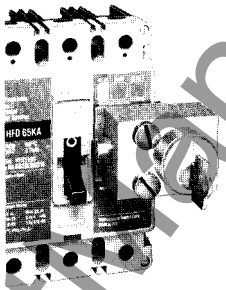
Padlockable Handle Lock Hasp



The padlockable handle lock hasp allows the handle to be locked in the ON or OFF position. (Trip-free operation allows the circuit breaker to trip when the handle lock holds the circuit breaker handle in the ON position.) The hasp mounts on the circuit breaker cover within the trimline. The cover is predrilled on both sides of the operating handle so that the hasp can be mounted on either side of the handle. The hasp will accommodate up to three padlocks with 1/4 inch (6-mm) shackles. Listed per UL File E7819. (Field installation only)①



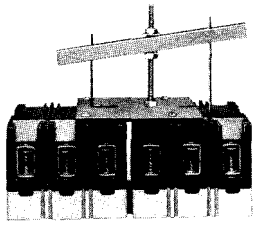
Key Interlock



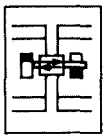
The key interlock is used to externally lock the circuit breaker handle in the OFF position. When the key interlock is locked, an extended deadbolt blocks movement of the circuit breaker handle. Uniquely coded keys are removable only with the deadbolt extended. Each coded key controls a group of circuit breakers for a given specific customer installation.

The key interlock assembly is Underwriters Laboratories, Inc. listed for field installation under UL file E7819 and consists of a mounting kit and a purchaser supplied deadbolt lock. The mounting kit comprises a mounting plate, which is secured to the circuit breaker cover in either the left- or right-pole position, key interlock mounting screws, and a wire seal. Specific mounting kits are required for individual key interlock types.

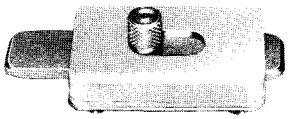
Walking Beam Interlock



The walking beam interlock provides mechanical interlocking between two adjacent circuit breakers of the same pole configuration. The walking beam interlock mounts on a bracket behind and between the circuit breakers. A plunger on each end of the beam is inserted through an access hole in the back plate and base of each circuit breaker. The walking beam interlock prevents both circuit breakers from being switched ON at the same time. If a walking beam interlock is installed, the wiring troughs in the back of the circuit breaker case are blocked by the plungers and cannot be used for cross wiring. Factory modified circuit breakers are required for this application.



Sliding Bar Interlock



The sliding bar interlock provides mechanical interlocking between two adjacent 3-pole circuit breakers. It is installed on the enclosure cover between the circuit breakers. When the sliding bar interlock handle is moved from one side to the other, a bar extends to alternately block movement of the circuit breaker handles and prevents both circuit breakers from being switched to ON at the same time. Sliding bar interlocks are not UL listed. (Field installation only.)

① The single pole latch is a snap-on design, not a hasp.
② Use of cylinder lock may reduce interrupting rating of circuit breaker. Refer to Westinghouse.

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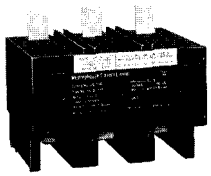
4-6. Miscellaneous Accessories
- Base Mounting Hardware
- LFD Current Limiter Attachment
- Earth Leakage Protection Module.

Base Mounting Hardware
Hardware for surface mounting of circuit breakers is supplied only on request. Hardware consists of mountig screws and lockwashers. Order hardware for circuit breaker pole configurations as required.

LFD Current Limiter



The LFD current limiter is an accessory that bolts to the load end of a standard FDB or FD thermal-magnetic circuit breaker, providing 200,000A interrupting capacity at up to 600 Vac. LFD current limiters for thermal-magnetic circuit breakers are listed with Underwriters Laboratories, Inc. under File E47239.

4-7. Modifications
Limited modifications to the basic circuit breaker and molded case switch are available to satisfy specific customer requirements All modifications are completed at the factory. The following modifications are available:
- Special Calibration
- Moisture-Fungus Treatment
- Marine Applications

If additional modifications are required, refer to Westinghouse. The following paragraphs describe available modifications.

Special Calibration
Special non-UL listed calibrations are available for certain ambient temperatures other than 40°C and for frequencies other than 50/60 Hz or dc. Reduced interrupting ratings will apply for 400 Hz applications. Maximum thermal calibration limited to 135A at 400 Hz.

Moisture-Fungus Treatment
All series C circuit breaker cases are molded from glass-polyester which does not support the growth of fungus. Any parts which are susceptible to the growth of fungus will require special treatment.

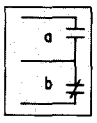
Marine Applications
UL489 listed 40°C circuit breakers for marine application on vessels over 65 feet are available. Non-aluminum terminals are required. In addition, other marine specifications may require 50°C ambient calibration.

4-8. Accessory Combinations
Different combinations of accessories can be supplied, depending on the types of accessories and the number of poles in the circuit breaker. Tables on pages 19, 20 show the different accessories or combinations that can be used internally and externally with each pole of 1-, 2-, 3-, and 4-pole circuit breakers. Each pole in a particular circuit breaker configuration is identified by a column head; each accessory or combination that can be used with that pole is identified by symbols in a box below the column head. Unless otherwise noted, one internal and one external accessory can be selected for each pole.

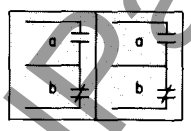
Some external accessories will cover more than one pole. In the tables, when a box containing accessory symbols spans more than one column, any accessory within that box occupies the area of the cover indicated.

Accessory Legend
The accessory legend shows each symbol used in the accessory combination tables.

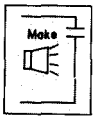
Accessory Symbols Used in Accessory Combination Examples (See pages 19, 20)



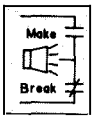
Auxiliary Switch (1A, 1B)



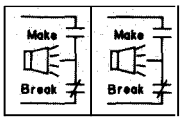
Auxiliary Switch (2A, 2B)



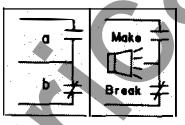
Alarm (Signal)/ Lockout Switch (Make Only)



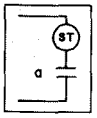
Alarm (Signal)/ Lockout Switch (Make/Break)



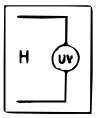
Alarm (Signal)/ Lockout Switch (2 Make, 2 Break)



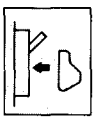
Aux. Switch/ Alarm (Signal)/Lockout Switch

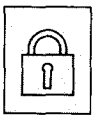


Shunt Trip

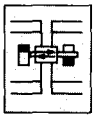


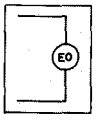
Under-Voltage Release


Non-Lockable Handle Block

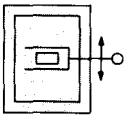

Padlockable Handle Lock Hasp

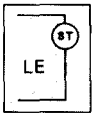

Key Interlock


Sliding Bar Interlock



Electrical (Solenoid) Operator


Handle Mechanism

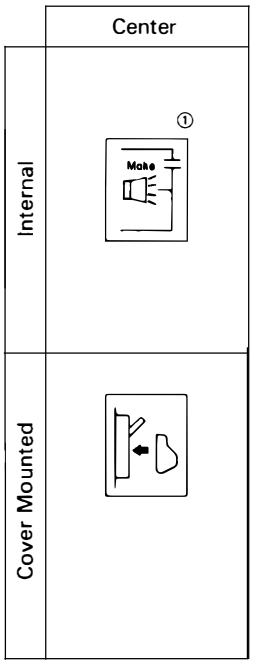


Low Energy Shunt Trip

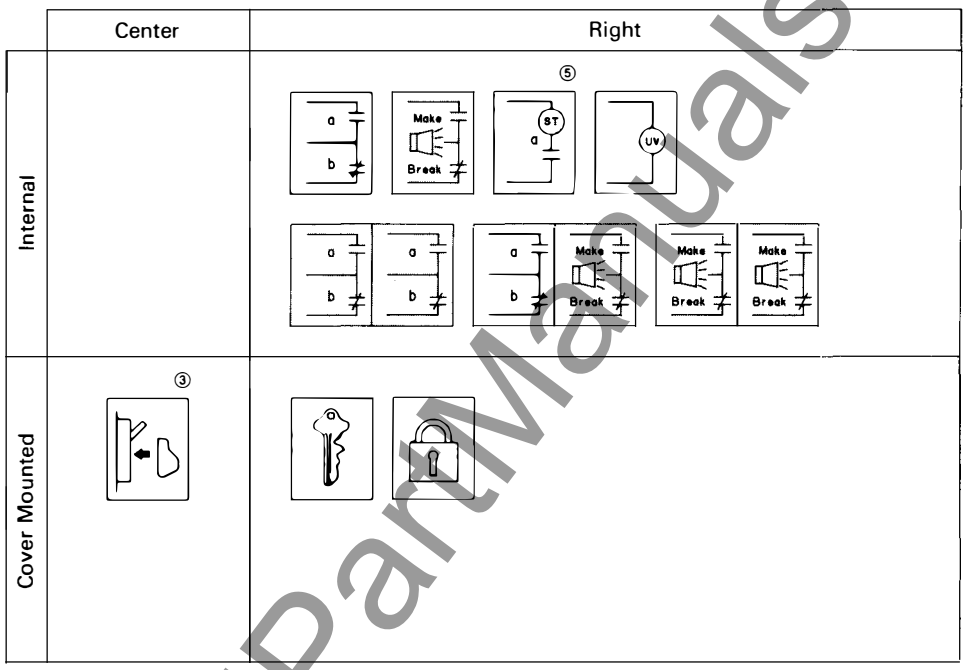
Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

Allowable Accessory Combinations

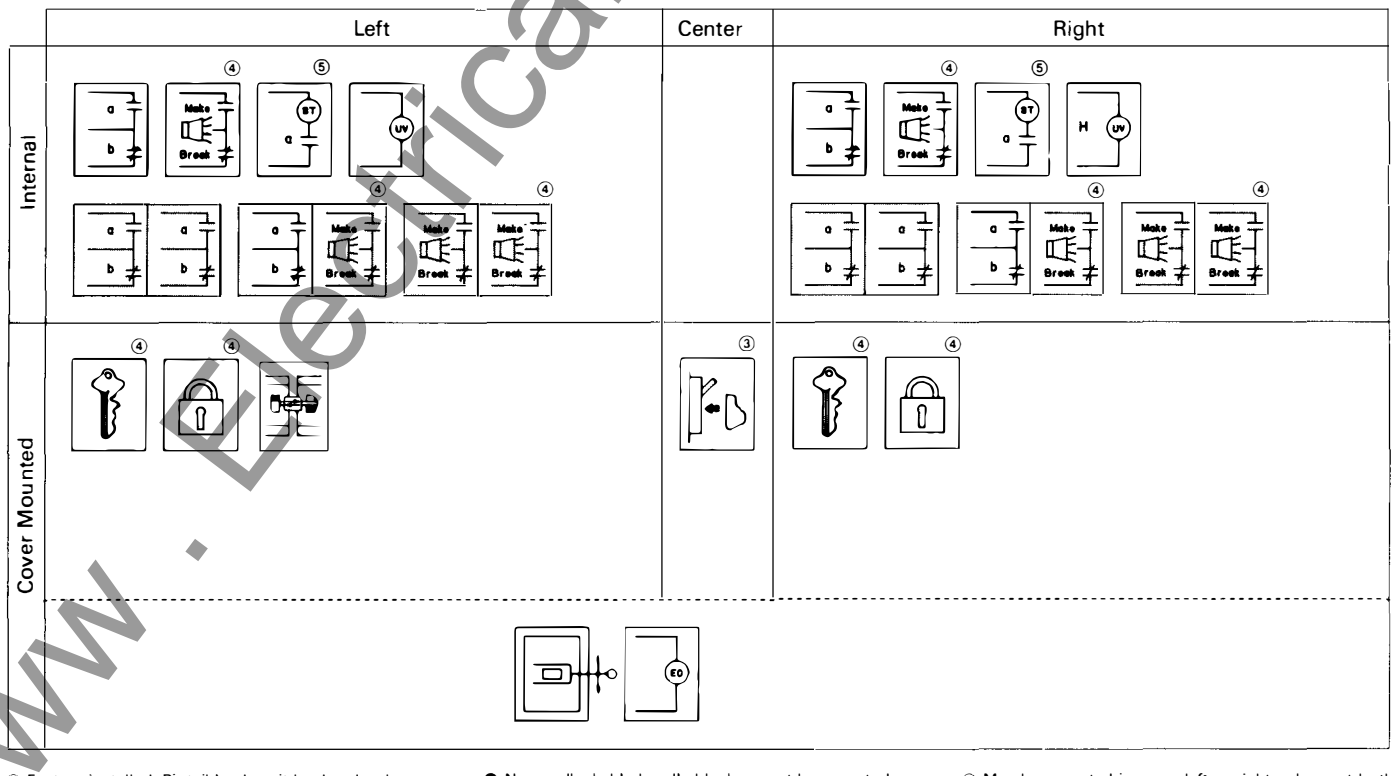
Single Pole Breaker



Two Pole Breaker



Three Pole Breaker



① Factory installed. Pigtail leads exit load end only.
● Occupies internal and cover spaces.

● Non-padlockable handle block cannot be mounted simultaneously with either key interlock, padlockable handle hasp or sliding bar interlock.

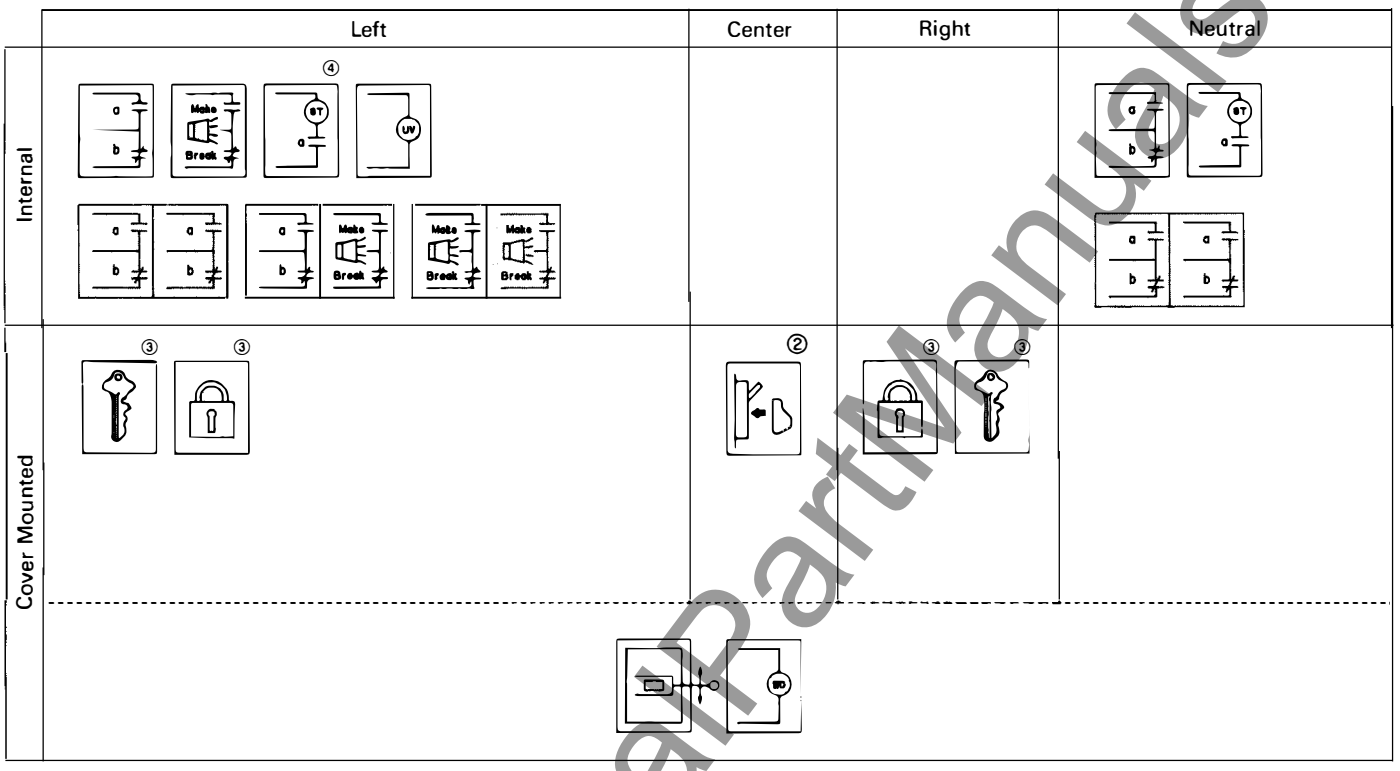
④ May be mounted in or on left or right pole – not both.
⑤ Also includes low energy shunt trip.

Series C Molded Case Circuit Breakers, F-Frame

Section 4 – Accessories and Modifications

Allowable Accessory Combinations, Continued

Four Pole Breaker



① Occupies internal and cover spaces.
② Non-padlockable handle block cannot be mounted simultaneously with either key interlock, padlockable handle hasp or sliding bar interlock.
③ May be mounted on left or right pole – not both.
④ Also includes low energy shunt trip.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Selection and Ordering Information
When ordering an F-frame circuit breaker or molded case switch, use the catalog numbers given in Tables 5-1 through 5-8. Interrupting ratings can be found in Table 1-1. List any accessories or modifications required together with the applicable catalog number. Handle mechanisms are suitable for use with all Series C F-frame circuit breakers. REFER TO WESTINGHOUSE FOR AVAILABILITY OF ALL CIRCUIT BREAKERS, MOLDED CASE SWITCHES, ACCESSORIES, AND MODIFICATIONS.

Circuit Breaker Selection
Circuit breaker catalog numbers are identified in Tables 5-1, 5-2, 5-3, 5-4, and 5-5. Circuit breakers ordered using these catalog numbers include standard load terminals only.

Add suffix V to catalog number to order circuit breakers calibrated to 50°C ambient (not UL listed). Same price as standard 40°C breakers.

4-pole circuit breakers have neutral poles unprotected as standard. For 100% protected neutral poles, add suffix E to catalog number. For 50% protected neutral poles, add suffix EH to catalog number.

Add suffix L to catalog number to order circuit breakers with standard line and load terminals.

List Prices: See Price List 29-020. Discount Symbol CB-2.

Ordering Information Examples

Customer requirement 1:

One molded case circuit breaker per UL489; 3-pole, 600 Vac, 100A with 65 kA interrupting rating at 480 Vac with load end terminals only. A factory installed 1A/1B auxiliary switch is required in the left pole, with pigtail leads exiting the right side of the circuit breaker, and a 120 Vac shunt trip with a terminal block in the right pole.

Order as follows:

Qty 1 Circuit Breaker HFD3100, with factory installed auxiliary switch A1X1LC and shunt trip SNT1RT08.

When ordering an accessory that is for installation by the customer, use the field installation kit catalog number.

Customer requirement 2:

240 Vac undervoltage release mechanism with 18-inch pigtail leads for field installation in the left mounting cavity of an FW 3-pole circuit breaker.

Order as follows:

Qty 1 Undervoltage release mechanism (handle reset) UVH1LP11K.

Catalog Number and Suffix Priority
When adding suffixes to established catalog numbers shown in Tables 5-1 through 5-5, the following order should be maintained:
First priority: V – 50°C Calibration
Second priority: E – Protected Neutral Pole (4-pole circuit breaker only)
Third Priority: L – Standard line and load terminals

Examples
1. FD3100VL: Catalog number for 50°C FD3100 calibrated circuit breaker with standard line and load terminals supplied
2. HFW4160JE: Catalog number for HFW4160J (adjustable thermal, adjustable magnetic) circuit breaker with protected neutral pole

Table 5-1. Type EHD and FDB Thermal-Magnetic Circuit Breaker Catalog Numbers

Continuous Ampere Rating at 40°C	Type EHD			Type FDB		
	1-Pole 277 Vac 125 Vdc	2-Pole 480 Vac 250 Vdc	3-Pole 480 Vac	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac
10①③	EHD1010	EHD2010	EHD3010	FDB2010	FDB3010	FDB4010
15	EHD1015②	EHD2015	EHD3015	FDB2015	FDB3015	FDB4015
20	EHD1020②	EHD2020	EHD3020	FDB2020	FDB3020	FDB4020
25	EHD1025	EHD2025	EHD3025	FDB2025	FDB3025	FDB4025
30	EHD1030	EHD2030	EHD3030	FDB2030	FDB3030	FDB4030
35	EHD1035	EHD2035	EHD3035	FDB2035	FDB3035	FDB4035
40	EHD1040	EHD2040	EHD3040	FDB2040	FDB3040	FDB4040
45	EHD1045	EHD2045	EHD3045	FDB2045	FDB3045	FDB4045
50	EHD1050	EHD2050	EHD3050	FDB2050	FDB3050	FDB4050
60	EHD1060	EHD2060	EHD3060	FDB2060	FDB3060	FDB4060
70	EHD1070	EHD2070	EHD3070	FDB2070	FDB3070	FDB4070
80	EHD1080	EHD2080	EHD3080	FDB2080	FDB3080	FDB4080
90	EHD1090	EHD2090	EHD3090	FDB2090	FDB3090	FDB4090
100	EHD1100	EHD2100	EHD3100	FDB2100	FDB3100	FDB4100
110				FDB2110	FDB3110	FDB4110
125				FDB2125	FDB3125	FDB4125
150				FDB2150	FDB3150	FDB4150

① Not UL listed.
② UL listed for SWD applications, see NEC Article 240-83(d).
③ 5 KA max.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Table 5-2. Type FD, HFD, Current Limiting FDC Thermal-Magnetic Circuit Breaker Catalog Numbers

Continuous Ampere Rating at 40°C	Type FD				Type HFD				Type FDC			
	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole⑥ 600 Vac	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole⑥ 600 Vac	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole⑥ 600 Vac
10①③	FD1010③	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	FD1015⑤	FD2015	FD3015	FD4015	HFD1015⑤	HFD2015	HFD3015	HFD4015	.....	FDC2015	FDC3015	FDC4015
20	FD1020⑤	FD2020	FD3020	FD4020	HFD1020⑤	HFD2020	HFD3020	HFD4020	.....	FDC2020	FDC3020	FDC4020
25	FD1025	FD2025	FD3025	FD4025	HFD1025	HFD2025	HFD3025	HFD4025	.....	FDC2025	FDC3025	FDC4025
30	FD1030	FD2030	FD3030	FD4030	HFD1030	HFD2030	HFD3030	HFD4030	.....	FDC2030	FDC3030	FDC4030
35	FD1035	FD2035	FD3035	FD4035	HFD1035	HFD2035	HFD3035	HFD4035	.....	FDC2035	FDC3035	FDC4035
40	FD1040	FD2040	FD3040	FD4040	HFD1040	HFD2040	HFD3040	HFD4040	.....	FDC2040	FDC3040	FDC4040
45	FD1045	FD2045	FD3045	FD4045	HFD1045	HFD2045	HFD3045	HFD4045	.....	FDC2045	FDC3045	FDC4045
50	FD1050	FD2050	FD3050	FD4050	HFD1050	HFD2050	HFD3050	HFD4050	.....	FDC2050	FDC3050	FDC4050
60	FD1060	FD2060	FD3060	FD4060	HFD1060	HFD2060	HFD3060	HFD4060	.....	FDC2060	FDC3060	FDC4060
70	FD1070	FD2070	FD3070	FD4070	HFD1070	HFD2070	HFD3070	HFD4070	.....	FDC2070	FDC3070	FDC4070
80	FD1080	FD2080	FD3080	FD4080	HFD1080	HFD2080	HFD3080	HFD4080	.....	FDC2080	FDC3080	FDC4080
90	FD1090	FD2090	FD3090	FD4090	HFD1090	HFD2090	HFD3090	HFD4090	.....	FDC2090	FDC3090	FDC4090
100	FD1100	FD2100	FD3100	FD4100	HFD1100	HFD2100	HFD3100	HFD4100	.....	FDC2100	FDC3100	FDC4100
110	FD1110	FD2110	FD3110	FD4110	HFD1110	HFD2110	HFD3110	HFD4110	.....	FDC2110	FDC3110	FDC4110
125	FD1125	FD2125	FD3125	FD4125	HFD1125	HFD2125	HFD3125	HFD4125	.....	FDC2125	FDC3125	FDC4125
150	FD1150	FD2150	FD3150	FD4150	HFD1150	HFD2150	HFD3150	HFD4150	.....	FDC2150	FDC3150	FDC4150

Table 5-3. Type FW, HFW Fixed Thermal, Non-Adjustable Magnetic Single Pole Circuit Breaker Catalog Numbers①④

Continuous Ampere Rating at 40°C	Type FW 240 Vac 125 Vdc	Type HFW 240 Vac 125 Vdc
10③	FW1010	.....
16	FW1016	HFW1016
20	FW1020	HFW1020
25	FW1025	HFW1025
32	FW1032	HFW1032
40	FW1040	HFW1040
50	FW1050	HFW1050
63	FW1063	HFW1063
80	FW1080	HFW1080
100	FW1100	HFW1100
110	FW1110	HFW1110
125	FW1125	HFW1125
160	FW1160	HFW1160

Table 5-4. Type FW, HFW, FWC Adjustable Thermal, Non-Adjustable Magnetic Circuit Breaker Catalog Numbers①④

Maximum Continuous Ampere Rating at 40°C	Thermal Adjustment Range	Type FW			Type HFW			Type FWC		
		2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole⑦ 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole⑦ 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole⑦ 660 Vac
50	50-40	FW2050	FW3050	FW4050	HFW2050	HFW3050	HFW4050	FWC2050	FWC3050	FWC4050
63	63-50	FW2063	FW3063	FW4063	HFW2063	HFW3063	HFW4063	FWC2063	FWC3063	FWC4063
80	80-63	FW2080	FW3080	FW4080	HFW2080	HFW3080	HFW4080	FWC2080	FWC3080	FWC4080
100	100-80	FW2100	FW3100	FW4100	HFW2100	HFW3100	HFW4100	FWC2100	FWC3100	FWC4100
125	125-100	FW2125	FW3125	FW4125	HFW2125	HFW3125	HFW4125	FWC2125	FWC3125	FWC4125
160	160-125	FW2160	FW3160	FW4160	HFW2160	HFW3160	HFW4160	FWC2160	FWC3160	FWC4160

Table 5-5. Type FW, HFW, FWC Adjustable Thermal, Adjustable Magnetic Circuit Breaker Catalog Numbers①④

Maximum Continuous Ampere Rating at 40°C	Thermal Adjustment Range	Magnetic Adjustment Range	Type FW			Type HFW			Type FWC		
			2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole⑦ 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole⑦ 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole⑦ 660 Vac
50	50-40	300-500	FW2050J	FW3050J	FW4050J	HFW2050J	HFW3050J	HFW4050J	FWC2050J	FWC3050J	FWC4050J
63	63-50	315-630	FW2063J	FW3063J	FW4063J	HFW2063J	HFW3063J	HFW4063J	FWC2063J	FWC3063J	FWC4063J
80	80-63	400-800	FW2080J	FW3080J	FW4080J	HFW2080J	HFW3080J	HFW4080J	FWC2080J	FWC3080J	FWC4080J
100	100-80	500-1000	FW2100J	FW3100J	FW4100J	HFW2100J	HFW3100J	HFW4100J	FWC2100J	FWC3100J	FWC4100J
125	125-100	625-1250	FW2125J	FW3125J	FW4125J	HFW2125J	HFW3125J	HFW4125J	FWC2125J	FWC3125J	FWC4125J
160	160-125	800-1600	FW2160J	FW3160J	FW4160J	HFW2160J	HFW3160J	HFW4160J	FWC2160J	FWC3160J	FWC4160J

① Not UL listed.
② 2-pole circuit breakers supplied in 3-pole frame.
③ 5 KA max. interrupting rating only.
④ W model circuit breakers not UL listed.
⑤ UL listed for SWD applications. See NEC Article 240-83(d).
⑥ Right pole neutral.
⑦ Left pole neutral.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Molded Case Switch Selection
Molded case switch catalog numbers are identified in Tables 5-6, 5-7, and 5-8. For UL listed, series tested circuit breaker-molded case switch and fuse-molded case switch application data, refer to Westinghouse. Molded case switches ordered using these catalog numbers include standard load terminals only.

Table 5-6. Type EHD High Magnetic (K) Molded Case Switch Catalog Numbers①

Continuous Ampere Rating at 40°C	2-Pole 480 Vac 250 Vdc	3-Pole 480 Vac
	Type EHD (K)	
100	EHD2100K	EHD3100K

Table 5-7. Type FD High Magnetic (K) Molded Case Switch Catalog Numbers①

Continuous Ampere Rating at 40°C	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac
	Type FD (K)		
100	FD2100K	FD3100K	FD4100K
150	FD2150K	FD3150K	FD4150K

Table 5-8. Molded Case Switch High Magnetic Trip Setting

Frame	Rating	Trip Setting (Amps)	Tolerance (Percent)
EHD/FD	100	1050	±20
FD	150	1200	±20

Table 5-9. Type HFDDC 500 Volt Dc Breaker Catalog Numbers④

Continuous Ampere Rating at 40°C	3 Pole
15	HFDDC3015L
20	HFDDC3020L
25	HFDDC3025L
30	HFDDC3030L
35	HFDDC3035L
40	HFDDC3040L
45	HFDDC3045L
50	HFDDC3050L
60	HFDDC3060L
70	HFDDC3070L
80	HFDDC3080L
90	HFDDC3090L
100	HFDDC3100L
110	HFDDC3110L
125	HFDDC3125L
150	HFDDC3150L

Accessories
Accessory catalog or style numbers are identified on pages 23 through 29. All mounting hardware is supplied unless otherwise noted.

Termination Accessories
Line and Load Terminals
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 nonstandard or optional line and/or load terminals are required, order by style number (no charge when ordered with circuit breaker). Specify if factory installation required.

Max. Breaker Amps	Terminal Body Material	Wire Type	AWG Wire Range	Metric Wire Range mm²	Style Numbers Package of 3 Terminals
Standard Pressure Type Terminals					
20(EHD)	Steel	Cu/Al	#14-#10	2.5-4	624B100G14
100	Steel	Cu/Al	#14-1/0	2.5-50	624B100G02
160②	Aluminum	Cu/Al	#4-4/0	25-95	624B100G17
Optional Cu/Al Pressure Terminals					
50	Aluminum	Cu/Al	14-#4	2.5-16	624B100G10
100	Aluminum	Cu/Al	#4-4/0	25-95	624B100G17
100	Aluminum	Cu/Al	#14-1/0	2.5-50	624B100G19
160②③	Stainless Steel	Cu	#4-4/0	25-95	624B100G18

Keeper Nut
Keeper nuts are available in English and metric thread sizes in packages of 12.

Thread Type	Thread Size	Catalog Number Package of 12
English	10-32	KPR1A
Metric	M-5	KPR1AM

Interphase Barrier
Catalog Number (Package of 2 barriers): IPB1

The interphase barrier is available for extended insulation between circuit breaker poles. Specify quantity when ordering.

Terminal Shield
The terminal shield is available for line terminal areas in 1-, 2-, 3- and 4-pole circuit breakers. Special terminal shields are also available for use when an electrical (solenoid) operator is mounted on the circuit breaker. The standard style number by pole for each terminal shield (shown in table below) is for a package of 10 and is priced per each package. Special terminal shields are packaged individually.

Number of Poles	Style Numbers Standard (Package of 10)	Special
1	625B229G06	.....
2	625B229G07	.....
3	625B229G08	4210B95G01
4	625B229G09	4210B95G02

Terminal End Cover
The terminal end cover is available for 3-pole circuit breakers only. Two conductor opening sizes are available. Specify quantity (one per circuit breaker) when ordering.

Conductor Opening Diameter (Inches)	Catalog Number
0.25 (6.35 mm)	TEC1
0.41 (10.41 mm)	TEC2

① For non-domestic molded case switch applications, use EHD(K) or FD(K) versions. No FW(K) versions available.
② UL listed through 150A only.
③ UL listed for copper wire only.
④ Includes line and load Cu/Al terminals

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

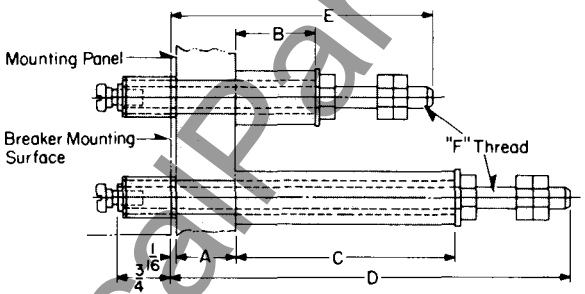
Panelboard Connecting Straps
The panelboard connecting straps are available in two sizes to meet the needs of most standard panelboard applications. The panelboard connecting straps are listed by panelboard bus spacing. Style numbers for special mounting brackets for CDP panelboard installations are also included.

Bus Spacing (Inches)	Continuous Current Rating (Amperes)	Pole Connector Type	
		Center	Outside
		Style Number	Style Number
5-3/4 Inch Deep Box, 600 Vac Max			
2¾	50	673B142G02	673B142G09
2¾	100	673B142G02	673B142G10
2¾	150	673B142G04	673B142G03
3½	50	1253C72G01	1253C72G03
3½	100	1253C73G03	1253C73G06
3½	150	1253C73G01	1253C73G05

Mounting Bracket

Style Numbers	
2-Pole	3-Pole
624B600H02	624B600H01

Rear Connecting Studs
Each rear connecting stud assembly consists of one stud and one tube. Select alternate long and short stud assemblies for circuit breakers with more than one pole to maintain proper clearances between poles. One assembly is required for line-end and one for load-end of each pole. Tubes must be ordered separately. Connecting studs are available only with English thread sizes.



Stud Ampere Rating	Stud Style Number	Panel Thickness (Inches) A	Tube Length (Inches) B	C	Tube Style Number	Dimensions (Inches) D	E	F
For 15A to 100A Circuit Breakers								
100A Short	451D874G01	1	1 1/16	....	32B9446H20	....		
100A Short	451D874G01	1 1/16 to 1 5/16	1 3/8	....	32B9446H21	....	3 5/8	
100A Short	451D874G01	3/8 to 5/8	1 11/16	....	32B9446H22	....		
100A Short	451D874G01	1/4 to 5/16	2	....	32B9446H23	....		
100A Long	451D874G02	1	....	3 7/16	32B9446H24		....	5/16 - 18
100A Long	451D874G02	1 1/16 to 1 5/16	....	3 3/4	32B9446H25	6 1/8	....	
100A Long	451D874G02	3/8 to 5/8	....	4 1/16	32B9446H26		....	
100A Long	451D874G02	1/4 to 5/16	....	4 3/8	32B9446H27		....	
For 110A to 160A Circuit Breakers								
160A Short	374D883G01	1	1 1/16	....	374D883H06	....		
160A Short	374D883G01	1 1/16 to 1 5/16	1 3/8	....	374D883H07	....	4 1/4	
160A Short	374D883G01	3/8 to 5/8	1 11/16	....	374D883H08	....		
160A Short	374D883G01	1/4 to 5/16	2	....	374D883H09	....		
160A Long	374D883G02	1	....	3 7/16	374D883H10		....	7/16 - 14
160A Long	374D883G02	1 1/16 to 1 5/16	....	3 3/4	374D883H11	7 1/2	....	
160A Long	374D883G02	3/8 to 5/8	....	4 1/16	374D883H12		....	
160A Long	374D883G02	1/4 to 5/16	....	4 3/8	374D883H13		....	

Plug-In Adapter
Plug-in adapters are available for 2-, 3-, and 4-pole circuit breaker configurations. One plug-in adapter is used for each terminal end (line or load); specify quantity when ordering. A one-piece steel mounting plate is available at no charge when ordered with line and load plug-in adapters (field installation only).

Continuous Current Rating (Amperes)	Style Numbers		
	2-Pole	3-Pole	4-Pole
100	507C036G13	507C036G15	179C968G03
150/160	507C036G14	507C036G16	179C968G04
Mounting Plate	176C511H01	507C047H01	●

● Refer to Westinghouse for availability.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Internal Accessories
Alarm (Signal)/Lockout Switch

Number of Contacts (Make and Break)	Mounting Location (Pole)	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Opposite Side	Terminal Block: Same Side	Field Installation Kits①: Pigtail Leads	Terminal Block
		Catalog Numbers				Catalog Numbers	
1	Left②	A1L1LA	A1L1LB	A1L1LC	A1L1LT	A1L1LPK	A1L1LTK
	Right	A1L1RA	A1L1RB	A1L1RC	A1L1RT	A1L1RPK	A1L1RTK
2	Left②	A2L1LA	A2L1LB	.....	A2L1LT	A2L1LPK	A2L1LTK
	Right	A2L1RA	A2L1RB	.....	A2L1RT	A2L1RPK	A2L1RTK
1 (Make Only)	Single Pole	A1L1CA③					

Auxiliary Switch

Number of Contacts a and b	Mounting Location (Pole)	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Opposite Side	Terminal Block: Same Side	Field Installation Kits①: Pigtail Leads	Terminal Block
		Catalog Numbers				Catalog Numbers	
1	Left②	A1X1LA	A1X1LB	A1X1LC	A1X1LT	A1X1PK	A1X1LTK
		E1X1LA⑦	E1X1LB⑦	E1X1LC⑦	.....	.....	.....
	Right or Neutral	A1X1RA	A1X1RB	A1X1RC	A1X1RT	A1X1PK	A1X1RTK
		E1X1RA⑦	E1X1RB⑦	E1X1RC⑦	.....	.....	.....
2	Left②	A2X1LA	A2X1LB	.....	A2X1LT	A2X1PK	A2X1LTK
		E2X1LA⑦	E2X1LB⑦	.....	.....	.....	.....
	Right or Neutral	A2X1RA	A2X1RB	.....	A2X1RT	A2X1PK	A2X1RTK
		E2X1RA⑦	E2X1RB⑦	.....	.....	.....	.....

Auxiliary Switch and Alarm (Signal)/Lockout Switch Combination

Mounting Location (Pole)	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Terminal Block: Same Side	Field Installation Kits①: Pigtail Leads	Terminal Block
	Catalog Numbers			Catalog Numbers	
Left	AAL1LA	AAL1LB	AAL1LT	AAL1LPK	AAL1LTK
Right	AAL1RA	AAL1RB	AAL1RT	AAL1RPK	AAL1RTK

Shunt Trip

Select shunt trip catalog number for the voltage within the indicated voltage range. Shunt trip coils are designed to be applied at specific ac or dc voltages within the voltage range shown. Specific application voltages and electrical ratings are shown in Table 4-3. Electrical ratings are also shown on applicable circuit breaker accessory nameplates.

Voltage Rating (Ac Freq = 50/60 Hz)	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Opposite Side	Terminal Block: Same Side	Field Installation Kits●: Pigtail Leads	Terminal Block
	Catalog Numbers				Catalog Numbers	
Left Pole Mounting						
9- 24 Vac or Vdc	SNT1LA03	SNT1LB03	SNT1LC03	SNT1LT03	SNT1LP03K	SNT1LT03K
48-127 Vac or 48-60 Vdc⑤	SNT1LA08	SNT1LB08	SNT1LC08	SNT1LT08	SNT1LP08K	SNT1LT08K
208-380 Vac or 110-127 Vdc	SNT1LA12	SNT1LB12	SNT1LC12	SNT1LT12	SNT1LP12K	SNT1LT12K
415-600 Vac or 220-250 Vdc	SNT1LA18	SNT1LB18	SNT1LC18	SNT1LT18	SNT1LP18K	SNT1LT18K
Right② or Neutral Pole Mounting						
9- 24 Vac or Vdc	SNT1RA03	SNT1RB03	SNT1RC03	SNT1RT03	SNT1RP03K	SNT1RT03K
48-127 Vac or 48-60 Vdc⑤	SNT1RA08	SNT1RB08	SNT1RC08	SNT1RT08	SNT1RP08K	SNT1RT08K
208-380 Vac or 110-127 Vdc	SNT1RA12	SNT1RB12	SNT1RC12	SNT1RT12	SNT1RP12K	SNT1RT12K
415-600 Vac or 220-250 Vac	SNT1RA18	SNT1RB18	SNT1RC18	SNT1RT18	SNT1RP18K	SNT1RT18K

Low Energy Shunt Trip⑥

Mounting Positions 24 Vdc	Connection Type and Location: 18-inch Pigtail Leads: Same Side	Rear④	Opposite Side	Terminal Block: Same Side	Field Installation Kits①: Pigtail Leads	Terminal Block
	Catalog Numbers				Catalog Numbers	
Left Pole②	LST1LA	LST1LB	LST1LC	LST1LT	LST1LPK	LST1LTK
Right Pole	LST1RA	LST1RB	LST1RC	LST1RT	LST1RPK	LST1RTK

① Not listed with Underwriters Laboratories, Inc. for field installation.
② Standard mounting location.
③ Leads exit load end of circuit breaker. Factory installation only.
④ Standard pigtail lead exit location.
⑤ 120 Vac marked suitable for ground fault protection devices.
⑥ Cutoff provisions required in control circuit.
⑦ 125 volt (Max.), 50/60 HZ switch for use in electronic circuit of 100 micro-amp and 15 VDC minimum.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Undervoltage Release Mechanism (Handle Reset)
Select handle reset undervoltage release mechanism catalog number for the voltage within the indicated voltage range. Undervoltage release mechanism coils are designed to be applied at specific ac or dc voltages within the voltage range shown. Specific application voltages and electrical ratings are shown in Table 4-4. Electrical ratings are shown on applicable circuit breaker accessory nameplates.

Voltage Rating (ac Freq = 50/60 Hz)	Connection Type and Location					
	18-inch Pigtail Leads			Terminal Block	Field Installation Kits①	
	Same Side	Rear⑥	Opposite Side	Same Side	Pigtail Leads	Terminal Block
	Catalog Numbers				Catalog Numbers	
Left Pole Mounting						
24 Vac	UVH1LA03	UVH1LB03	UVH1LC03	UVH1LT03	UVH1LP03K	UVH1LT03K
48- 60 Vac	UVH1LA05	UVH1LB05	UVH1LC05	UVH1LT05	UVH1LP05K	UVH1LT05K
110-127 Vac	UVH1LA08	UVH1LB08	UVH1LC08	UVH1LT08	UVH1LP08K	UVH1LT08K
208-240 Vac	UVH1LA11	UVH1LB11	UVH1LC11	UVH1LT11	UVH1LP11K	UVH1LT11K
380-480 Vac	UVH1LA15	UVH1LB15	UVH1LC15	UVH1LT15	UVH1LP15K	UVH1LT15K
525-600 Vac	UVH1LA18	UVH1LB18	UVH1LC18	UVH1LT18	UVH1LP18K	UVH1LT18K
12 Vdc	UVH1LA20	UVH1LB20	UVH1LC20	UVH1LT20	UVH1LP20K	UVH1LT20K
24 Vdc	UVH1LA21	UVH1LB21	UVH1LC21	UVH1LT21	UVH1LP21K	UVH1LT21K
48- 60 Vdc	UVH1LA23	UVH1LB23	UVH1LC23	UVH1LT23	UVH1LP23K	UVH1LT23K
125 Vdc	UVH1LA26	UVH1LB26	UVH1LC26	UVH1LT26	UVH1LP26K	UVH1LT26K
220-250 Vdc	UVH1LA28	UVH1LB28	UVH1LC28	UVH1LT28	UVH1LP28K	UVH1LT28K
Right Pole Mounting②						
24 Vac	UVH1RA03	UVH1RB03	UVH1RC03	UVH1RT03	UVH1RP03K	UVH1RT03K
48- 60 Vac	UVH1RA05	UVH1RB05	UVH1RC05	UVH1RT05	UVH1RP05K	UVH1RT05K
110-127 Vac	UVH1RA08	UVH1RB08	UVH1RC08	UVH1RT08	UVH1RP08K	UVH1RT08K
208-240 Vac	UVH1RA11	UVH1RB11	UVH1RC11	UVH1RT11	UVH1RP11K	UVH1RT11K
380-480 Vac	UVH1RA15	UVH1RB15	UVH1RC15	UVH1RT15	UVH1RP15K	UVH1RT15K
525-600 Vac	UVH1RA18	UVH1RB18	UVH1RC18	UVH1RT18	UVH1RP18K	UVH1RT18K
12 Vdc	UVH1RA20	UVH1RB20	UVH1RC20	UVH1RT20	UVH1RP20K	UVH1RT20K
24 Vdc	UVH1RA21	UVH1RB21	UVH1RC21	UVH1RT21	UVH1RP21K	UVH1RT21K
48- 60 Vdc	UVH1RA23	UVH1RB23	UVH1RC23	UVH1RT23	UVH1RP23K	UVH1RT23K
125 Vdc	UVH1RA26	UVH1RB26	UVH1RC26	UVH1RT26	UVH1RP26K	UVH1RT26K
220-250 Vdc	UVH1RA28	UVH1RB28	UVH1RC28	UVH1RT28	UVH1RP28K	UVH1RT28K

ORDERING INFORMATION

Handle Operating Accessories
Electrical (Solenoid) Operator

Operating Voltage	Frequency 50/60 Hz	Catalog Numbers	
		Terminal Block	18-Inch Pigtail Lead
120	AC	EOP1T07	EOP1P07
240		EOP1T11	EOP1P11
24	DC	EOP1T03DC	EOP1P03DC
120		EOP1T07DC	EOP1P07DC
240		EOP1T11DC	EOP1P11DC

Vari-Depth Handle Mechanism

W/O Lock off **With lock off**

Mechanisms③●●⑦		Handle⑦	Shaft⑦			
Standard – (No Internal Lockoff)	Special – (With Internal Lockoff)	NEMA 1, 3R, 12 (With Hardware)	Standard		Long	
Style Number	Style Number	Style Number	Style Number	Panel Depth	Style Number	Panel Depth
373D958G22	373D958G23	504C323G03	47A4446G36	5-10¼	47A4446G37	10½-14

① Not listed with Underwriters Laboratories, Inc. for field installation.
② Standard mounting location.
③ When circuit breaker is used with plug-in kits or rear connected studs, special mounting hardware is required. Refer to Westinghouse.
④ Includes hardware.
⑤ Outline and drilling plan reference – drawing 653D270.
⑥ Standard pigtail lead exit location.
● UL listed for field installation under E64983.

Accessories for Vari-Depth Handle Mechanism
Special Handles: Meet NEMA 4 requirements. These handles are similar to standard handles, except they include an internal neoprene gasket. Due to gasketing effect between handle and housing, handle will not indicate a tripped position when used with circuit breakers. Not UL listed.

Standard Finish:
Style Number: 504C323G04

Handle Kits: These kits are for use with NEMA 4, 7 and 9 cast enclosures. The kits include a special operating handle, mounting bolts and an adapter bushing (bushing may be purchased separately). Kits may be used with standard mechanisms and shafts as required. Not UL listed.

For NEMA 4, 9 Enclosure
Kit Style Number: 314C794G10

For NEMA 7 Enclosure
Kit Style Number: 314C794G09

Adapter Bushing Only:
Style Number: 314C794G04

Type MC Motor Control Handle Mechanism
For use with NEMA 1 Enclosure
Catalog Number SMCU150FD

For use with NEMA 12 Enclosure
Catalog Number CMCU150FD

Type SM Safety Handle Mechanism
Right Hand Mounting, Enclosure Cover Hinged on Left: Cat. No. SM150R

Left Hand Mounting, Enclosure Cover Hinged on Right: Cat. No. SM150L
For Door Hardware, see page 29

Slide Plate Handle Mechanism

Enclosure Cover Hinged on Right (Drilling Plan Reference: 657D074)
Vertical Mounting,
Padlocks in OFF Position
Style No. 314C386G03

Padlocks in ON or OFF Position
Style Number 314C386G10

Horizontal Mounting,
Padlocks in "OFF" Position
Style Number 314C386G06

NEMA 3, 4, 5 Outdoor or Hazardous Location Handle Mechanisms
(Drilling Plan Reference 48A3656)

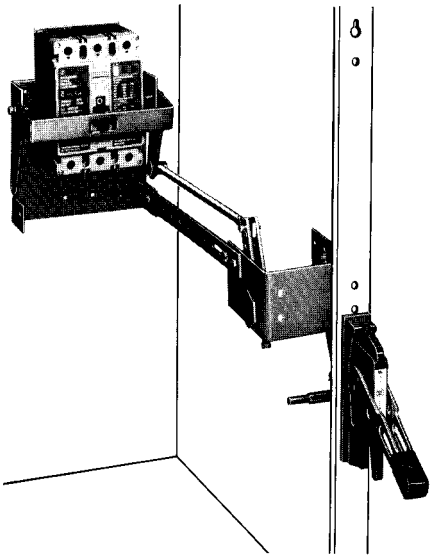
Padlocks in OFF Position
Style Number 48A3656G03

Padlocks in ON or OFF Position
Style Number 48A3656G04

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

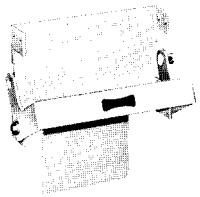
Type AMT Vari-Depth, Vari-Width Flange Mounted Handle Mechanism

For Type EHD, FDB, FD, HFD, FDC, FW, HFW and FWC Molded Case Breakers

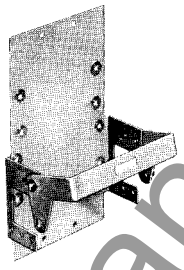


Assembled Type AMT for Above Handle Mounting (Breaker Not Included)

Type AMT Component Parts
Backplate and Yoke Assembly

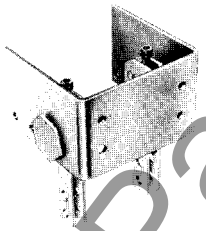


Below Handle Mtg.



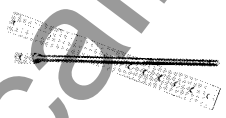
Above Handle Mtg.

Flange Mounted Pivot Mechanism

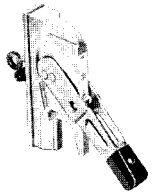


Above Handle Mtg.

Below Handle Mtg.



Rod Brace Assembly



Operating Handle

Catalog Numbers②

Complete Assembly	Consists of and Shipped as Component Parts Listed Below			
	Backplate and Yoke Assembly	Operating Rod and Brace Assembly①	Flange Mounted Pivot Mechanism Assembly①	External Operating Handle
Above Handle Mounting With Short Rod and Brace				
AMTFBASV	AMTFB	AMTRB1	AMTPM	AMTOP
Above Handle Mounting With Long Rod and Brace				
AMTFBALV	AMTFB	AMTRB2	AMTPM	AMTOP
Below Handle Mounting With Short Rod and Brace				
AMTFBBSV	AMTFB-B	AMTRB1	AMTPM-B	AMTOP
Below Handle Mounting With Long Rod and Brace				
AMTFBBLV	AMTFB-B	AMTRB2	AMTPM-B	AMTOP
Below Handle Fixed-Width With Short Rod				
AMTFBBSF	AMTFB-B	AMTR	AMTPM-F	AMTOP

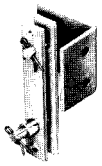
Ordering Information

1. Order a complete mechanism using Complete Assembly catalog number. Mechanism will be shipped as individual components shown above and listed below.
2. Order spacer kits or door hardware adapter as required.
3. Individual component parts may be ordered by Catalog Number.

Accessories for Type AMT Mechanisms

Spacer Kit to Vary Width (Not for use with fixed mechanisms)
Cat. Number: AMTSK1
This spacer kit is for up to 1-inch variation and consists of multiples of thin spacers to be used as required. A maximum of two kits per installation may be used. Hardware is not supplied because of dimensional variations. Use standard ¼-inch x 20 bolts.

Fixed Width Pivot Mechanism
Cat. No. AMTPM-F②



Enclosure Depth Dimensions in Inches for Operating Rod and Brace Assembly

Short Rod		Long Rod	
Cat. No.	**AMTRB1②**	Cat. No.	**AMTRB2②**
Min.③	**Max.**	Min.	**Max.**
6½	**14**	12½	**18**

① Width spacer kit not included.
② UL listed per E64983.
③ Width spacer kits cannot be used with short rod at minimum enclosure depth.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Lock and Interlock Accessories

Nonlockable Handle Block
Catalog Number: LKD1

One per circuit breaker.

Padlockable Handle Lock Hasp
Catalog Numbers
2, 3, 4 pole breakers: PLK1
1 pole breakers①: PHL1

The padlockable handle lock can be mounted on either side of the operating handle①. One per circuit breaker: field installation only.

Key Interlock Mounting Kit
Key interlock mounting kits are for field installation only. Select mounting kit catalog numbers to match type of lock used. Key interlocks are supplied by customer.

Lock Manufacturer	Lock Type	Bolt Projection in Withdrawn Position	Kit Cat. No.
Superior	B-4003-1	3/8 inch	KYK1
Kirk	F	3/8 inch	
Square D	SF	None	
Federal Pioneer	VF	3/8 inch	
Castell	K or QK	3/8 inch	CTK1

Walking Beam Interlock

Catalog Number: WBL1

The walking beam interlock is available for mounting between two adjacent circuit breakers spaced 1/4 inch apart and having the same pole configuration. The two circuit breakers must be factory modified to accept the walking beam interlock assembly (suitable for use with either 2-, 3-, or 4-pole circuit breakers). With properly modified circuit breakers, the walking beam interlock is suitable for field installation. Order circuit breakers of the type and rating required modified for field installation of the walking beam interlock.

Slide Bar Interlock

Catalog Number: SBK1

The sliding bar interlock is available for mounting between two adjacent 3-pole circuit breakers with circuit breakers centerline spacing at 4 3/8 inches and enclosure front panel thickness of 1/8 or 3/16 inches. (For field installation only.)

Miscellaneous Accessories

Base Mounting Hardware
Base mounting hardware is supplied at no charge when ordered with a circuit breaker or molded case switch. When ordering separately, refer to price list.

English Thread

No. of Poles	Description	Type of Mounting	Style Numbers
1	.164-32 x 3.188 inch Pan-Head Steel Screws, Lockwashers, and Clamps	Individual	624B375G01
		Group (one set of hardware for two circuit breakers)	624B375G02
2	.164-32 x 1.5 inch Pan-Head Steel Screws and Lockwashers	Individual	4218B80G01
3, 4		Individual	4218B80G02

Metric Thread

No. of Poles	Description	Type of Mounting	Style Numbers
1	M4 - 0.7 x 80mm Pan-Head Steel Screws, Lockwashers, and Clamps	Individual	4218B80G09
		Group (one set of hardware for two circuit breakers)	4218B80G10
2	M4 - 0.7 x 38mm Pan-Head Steel Screws and Lockwashers	Individual	4218B80G11
3, 4		Individual	4218B80G12

LFD Current Limiter Attachment

Circuit Breaker Rating● Amps.	Catalog Numbers
15-70	LFD3070R
80-160	LFD3150R

● Ratings through 70A can be supplied with terminals for Cu cable only (#14 – #2.)*Order by description.

Modifications

Special Calibration
For special thermal, magnetic, or frequency calibration, order by description; refer to price list.

Moisture-Fungus Treatment
Order by description, refer to price list.

Marine Applications
When listing Mark for marine applications under UL489 is required, specify requirement when ordering. Nonaluminum terminals must be used. Available on D model circuit breakers only. No price addition applies.

① The one pole lock is a snap-on type.

ORDERING INFORMATION

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Door Hardware
Door hardware listed in this section may be used with Types SM and AMT handle mechanisms.

Three choices of door hardware and an auxiliary handle are offered to provide the best latching scheme for individual needs. The door hardware is designed with a provision for padlocking, and a coin-proof slot that requires the use of a tool to open the door, for maximum security.

Select desired hardware below. Additional latches can be ordered from accessories section if desired.

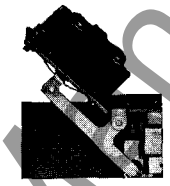
Hardware Item	Description and Catalog Numbers
	With sliding latches for smaller panels up to approx. 30" high. Catalog Numbers Right Hand: DH1R Left Hand: DH1L
	With 2 roller latches for intermediate panels up to approx. 40" high. Catalog Numbers Right Hand: DH2R Left Hand: DH2L
	With 3 roller latches for larger panels approx. 40" and higher. Catalog Numbers Right Hand: DH3R Left Hand: DH3L
	Auxiliary handle for larger panels Catalog Numbers Right Hand: DH4R Left Hand: DH4L

Note:
Right hand enclosure cover hinged on left,
Left hand enclosure cover hinged on right.

Accessories
Dress Nameplates: Required to meet automotive specifications. Mounts from inside enclosure and covers operating mechanism mounting bolts, making mechanism nonremovable when enclosure door is closed.

Style Number: 373D260G05

Electrical Interlock Kit: Provides 1 N. C. and 1 N. O. contacts (SPDT switch) for use with auxiliary circuits. Mounts to end of mechanism housing as shown.



Style Number: 622B747G01

Auxiliary Latch Kits: Provide an additional latch for use with applications where two point latching may not be adequate.

Sliding Latch

Rolling Latch

For Door Hardware Using Sliding Latches
Right or Left Hand Mtg.: Style No. 656D669G01

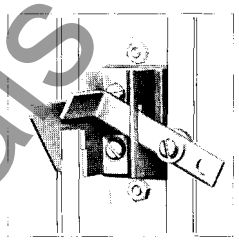
For Door Hardware Using Roller Latches
Right Hand Mtg.: Style No. 370D801G04

Left Hand Mtg.: Style No. 370D802G04

Door Operated Interlock Defeater Kit for Type SM Mechanisms: Required when door hardware is not used, operates as door closes. Additional door securing means such as screw latch, also required (to be supplied by box manufacturer).

Style Number: 623B214G02

Door Hardware Kit
Cat. No. AMTDHA



This adapter kit is for use with door hardware kits DH1R, DH2R, or DH3R for type SM handle mechanisms to permit the use and interlocking of right hand installation of the type AMT handle mechanism (Below-the-Handle or Above-the-Handle type).

Door Interlock Kit for Side Plate Handle Mechanism
Three point interlock for use with mechanisms where regular interlock is not adequate.

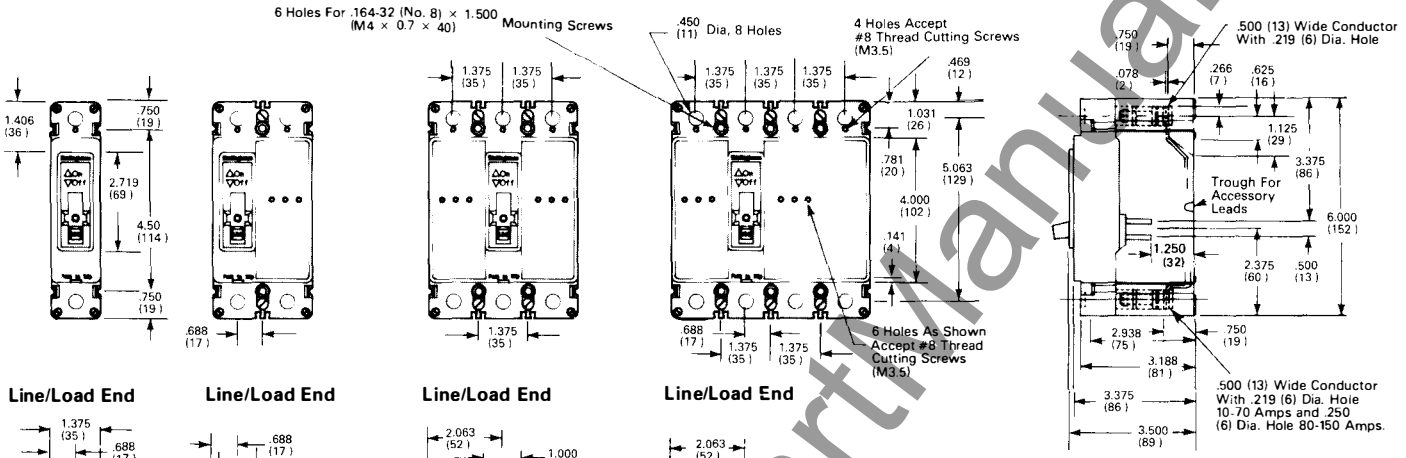
Style Number 28A2656G08
(Drilling Plan Reference 208B624)

ORDERING INFORMATION

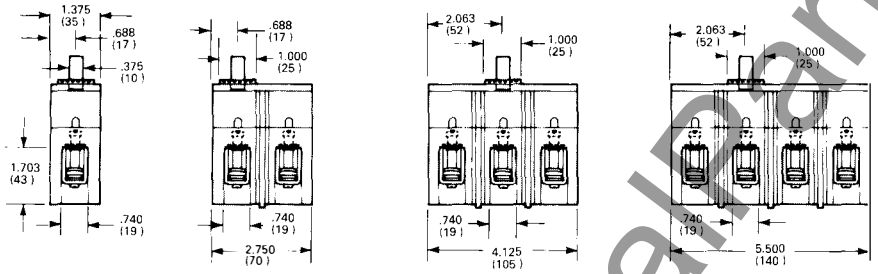
Series C Molded Case Circuit Breakers, F-Frame
Section 6 – Dimensional Data

Dimensions in Inches and (Millimeters)
Not to be used for construction purposes unless approved.

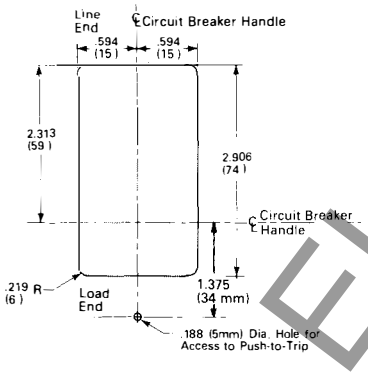
Line End **Line End** **Line End** **Line End**



Line/Load End **Line/Load End** **Line/Load End** **Line/Load End**

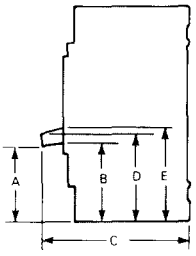


Front Cover Cutout



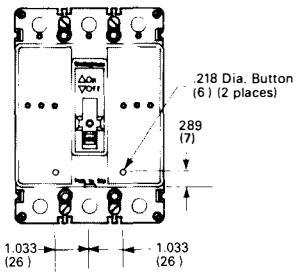
Approximate Shipping Weight (Lbs.)

Breaker Type	No. of Poles		
	1	2	3
EHD	2	3	4½
FDB	..	3	4½
FD	2	3	4½
HFD	2	3	4½
FDC	..	3¼	4¾



Adjustable Thermal/Magnetic Buttons

Line End



Circuit Breaker Handle Travel Distances

Circuit Breaker Status	Dimension A	B	C	D	E	Handle Force, Lbs.① 15A	100A	150A
On	3.07 (77.98)	2.92 (74.17)	3.96 (100.58)	3.40 (86.36)	3.33 (84.58)	9	12	14
Tripped	2.65 (67.31)	2.57 (65.28)	4.06 (103.12)	2.99 (75.95)	2.98 (75.69)	3●	4●	4●
Off	2.08 (52.83)	2.14 (54.36)	4.12 (104.65)	2.42 (61.47)	2.56 (65.02)	11	15	15
Reset	1.98 (50.29)	2.05 (52.07)	4.11 (104.39)	2.30 (58.42)	2.48 (62.99)	11	20	21

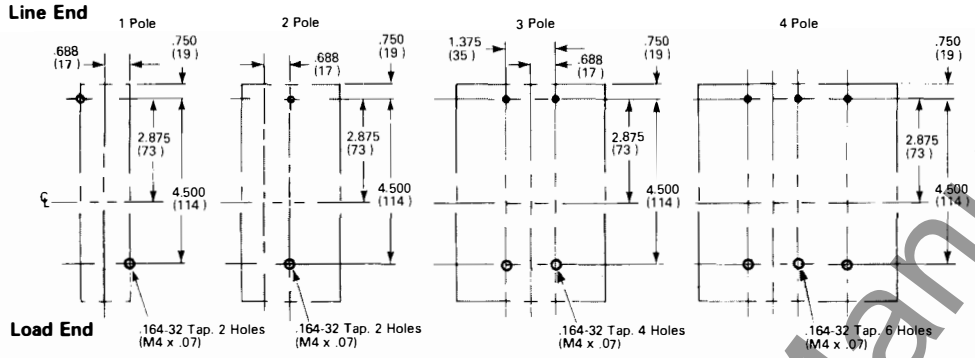
① Measured .125 (3.175) above escutcheon.
② Applied by circuit breaker handle to external handle mechanism.

Series C Molded Case Circuit Breakers, F-Frame
Section 6 – Dimensional Data

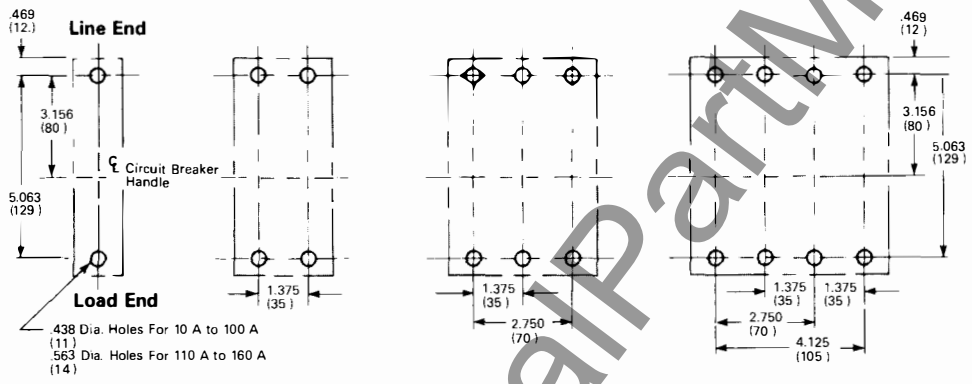
Dimensions in Inches and (Millimeters)
Not to be used for construction purposes unless approved.

Front Connected Drilling Plan

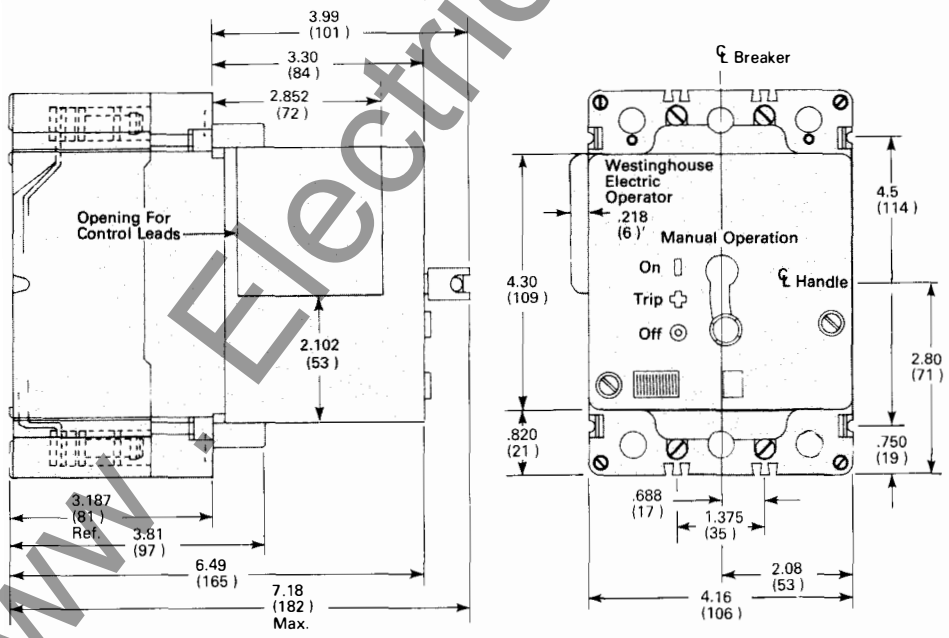
Line End



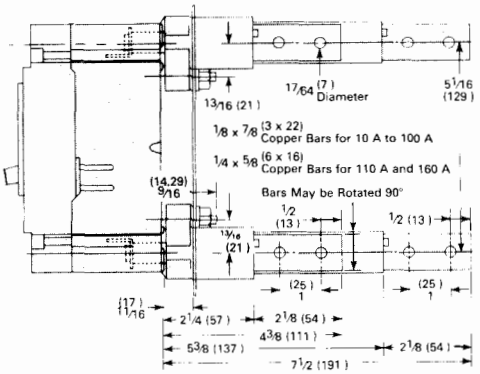
Rear Connected Drilling Plan



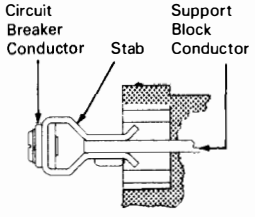
Electrical (Solenoid) Operator



Plug-in Adapter



Plug-in and Bolt-on Detail



Plug-in
Bolt stab to circuit breaker conductor, then plug into support block.

Bolt-on
Bolt stab to support block, then bolt support block to circuit breaker conductors.

Series C Molded Case Circuit Breakers, F-Frame
Appendix A – Guide Specifications

Typical Specifications For Series C Molded Case Circuit Breakers

Electrical circuits shall be protected by Series C Molded Case Circuit Breakers as manufactured by Westinghouse Electric Corporation.

Each pole of the 2- and 3-pole circuit breakers shall provide complete circuit overcurrent protection by having inverse time and instantaneous tripping characteristics and, where applicable, be current limiting.

The circuit breakers shall be operated by a toggle type handle and shall have an independent quick-make, quick-break, over-center switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against short circuit currents. Tripping due to overload or short circuits shall be clearly indicated by the position of the handle. The ON and OFF positions shall be clearly marked on the cover of the circuit breaker along with the international symbols I for ON and 0 for OFF on the handle providing positive indication of the circuit breaker contact position. Additionally, a color-coded indication of the circuit breaker contact position shall be provided: red for ON, green for OFF, and white for tripped. An easily accessible Push-to-Trip button for mechanically exercising the trip unit shall be provided on the cover of each circuit breaker. All poles of a multi-pole circuit breaker shall be so constructed as to ensure simultaneous open, close, and trip operations.

Circuit breakers must be completely enclosed in a high strength glass-polyester case.

Non-interchangeable trip circuit breakers shall be factory sealed; interchangeable trip circuit breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible from the front of the circuit breaker. Contacts shall be non-welding silver alloy. Arc extinction must be accomplished by means of DE-ION® arc chutes, consisting of metal grids mounted in an insulating support.

The minimum interrupting ratings of the circuit breakers shall be at least equal to the available short circuit current at the line terminals. Where applicable, circuit breakers shall be UL listed for series tested application.

Circuit breakers in 150A and 250A frame sizes shall be equipped with thermal-magnetic trip units. Circuit breakers in 400A, 600A, and 630A frame sizes shall be designed to accept either thermal-magnetic or electronic interchangeable trip units. Circuit breakers in 800A, 1200A, 1250A, and 1600A frames sizes shall be equipped with electronic trip units. The electronic trip units shall be insensitive to changes in ambient temperature within the normal operating temperature range of the circuit breaker.

Circuit breakers shall be listed with Underwriters Laboratories, Inc. under standard UL489, conform to the applicable requirements of NEMA Standards Publication AB1-1986, meet the appropriate classifications of Federal Specifications W-C-375b, and/or comply with the requirements of International Electrotechnical Commission Standard IEC 947-2.

Circuit breaker ratings and modifications shall be indicated on the drawings.

Molded case circuit breakers shall be of the inverse time and instantaneous trip type as provided by thermal-magnetic or electronic trip elements with either standard interrupting, high interrupting, or current limiting characteristics as shown in Section 1 of this frame book. These circuit breakers shall be listed per UL489.

Molded case circuit interrupters (motor circuit protectors) shall be of the instantaneous (magnetic) only type, providing instantaneous short circuit protection by means of a front-adjustable trip unit. Instantaneous-only circuit interrupters shall be component recognized per UL489.

Molded case switches shall be of the same construction as the related listed circuit breaker and equipped with a factory sealed, nonadjustable, high instantaneous-only short circuit protection.

Molded case switches shall have no overload or low-level fault protection provided and shall be marked with a maximum withstand rating denoting the type and level of upstream overcurrent protection required. Molded case switches shall be listed per UL1087.

Internally mounted accessories including alarm (signal)/lockout switches, auxiliary switches, shunt trips, and undervoltage release mechanisms shall be of the plug-in type and shall be listed for field installation in circuit breakers which are not factory sealed.

Electrical operators for circuit breakers of the 400A frame size and below shall be of the solenoid type with maximum 5-cycle closing characteristics. Electrical operators for circuit breaker frame sizes 600A through 1600A shall be of the motor driven type. All electrical operators shall be cover mounted. All electrical operators shall be listed for field installation per UL489.

Electrical characteristics of accessories shall be as indicated on the drawings.

Circuit breakers in the 150A frame size shall be supplied in 1-, 2-, 3-, and 4-pole models, as specified on the drawings. Circuit breakers in frame sizes 250A through 1200A shall be supplied in 2-, 3-, or 4-pole models, 3- and 4-pole models, as specified on the drawings.

Accessory wiring shall be brought out through the side or rear of the circuit breaker, or be connected to a terminal block mounted on the side of the circuit breaker, as specified. The ability to route accessory wiring to the opposite side of the circuit breaker through a trough in the base shall be provided.

Note: For 1600 ampere frames, accessory wiring is available on right side only. No wiring trough is provided.

Circuit breakers shall be provided with uniformly designed nameplates to clearly indicate the type, rating, listing/recognition/certification marks, accessory details, and other information defined in UL489.

All terminals shall comply with UL486A and B and CSA C22.2 No. 65M. Torque markings shall be provided per UL489.

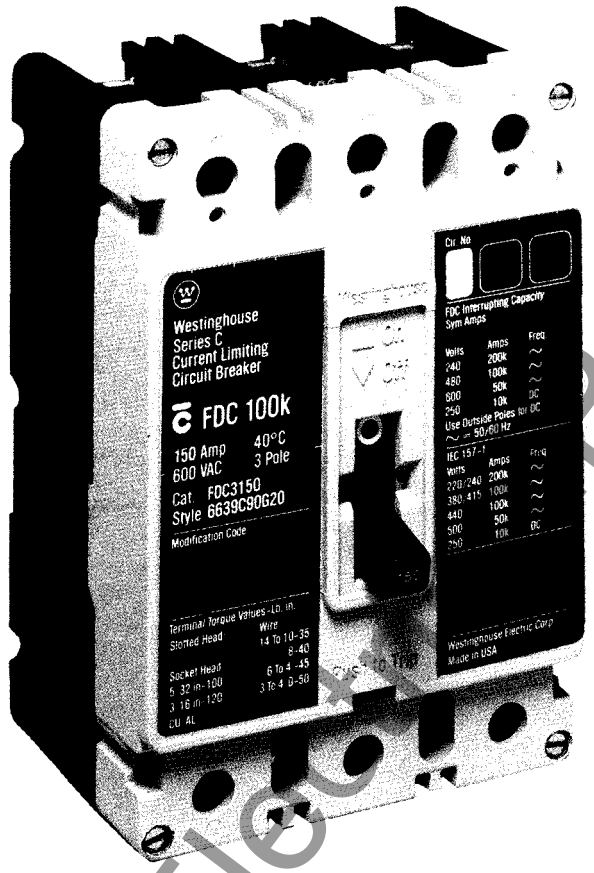
Westinghouse Electric Corporation
Distribution and Control Business Unit
Electrical Components Division
Pittsburgh, Pennsylvania, U.S.A. 15220

Printed in U.S.A.

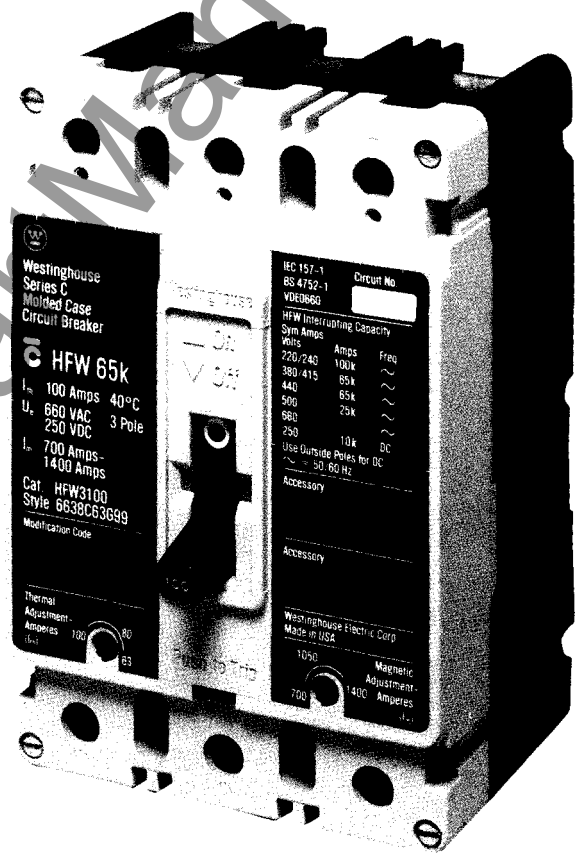
January 1992

SERIES C™

F-Frame Molded Case Circuit Breakers



D Model, 15 to 150 Amperes



W Model, 10 to 160 Amperes

Series C Molded Case Circuit Breakers, F-Frame
Section 1 – Introduction

Series C Circuit Breakers

The new Series C line of molded case circuit breakers represents a significant step forward in circuit protection technology. It incorporates, in frame ratings 150A to 1600A, interrupting capacities as high as 100 kA at 480 Vac (200 kA at 240 Vac) in physical sizes normally associated with standard interrupting capacity breakers. Series C circuit breakers are physically and electrically interchangeable with the industrial line of molded case circuit breakers they replace.

There are two branches to the Series C line. One complies with applicable UL, NEMA, and CSA standards as well as being assigned P1 interrupting ratings under IEC 157-1. The second complies with IEC 157-1 and is assigned both P1 and P2 interrupting ratings.

The branch which complies with applicable UL/NEMA/CSA standards is composed of six frame ratings: 150A, 250A, 400A, 600A, 1200A, and 1600A. The six frame ratings of the IEC branch of the Series C line are 160A, 250A, 400A, 630A, 1250A, and 1600A and are physically interchangeable with the corresponding UL/NEMA/CSA frames.

Series C circuit breakers in the 150A through 630A frame sizes are available with thermal-magnetic trip units. Electronic trip units can be supplied in the 250A through 1600A frame sizes. The electronic trip units for the 250A, 400A, 600A, and 630A frames are field interchangeable with the thermal magnetic trip unit in the same frame size.

The 150A and 160A frame sizes of the Series C are available in 1-,2-,3-, and 4-pole models, while the remainder of the line is available in 2-,3-, and 4-pole models.

A complete line of external as well as plug-in internal accessories is available for use with Series C circuit breakers.

Because of its unique stationary conductor configuration, the 100 kA (at 480 Vac) interrupting capacity model of each Series C frame size is inherently current limiting. These models can, therefore, be used in series tested applications at the 100 kA level to protect specified, lower interrupting capacity downstream circuit breakers. This current limiting action is achieved without the use of fuse-type current limiters or extra sets of contacts. The 65 kA (at 480 Vac) interrupting capacity model of each Series C frame rating provides for simple, fully rated application on the 480 Vac secondary of unit substations up to 2500 kVA.

Series C Literature

A new format has been designed for the Series C circuit breaker literature. The literature is designed to provide each user with the needed information, presented in the most usable form. The literature includes:

- Frame Books – which provide basic descriptions, technical data, dimensional data, and ordering information for each Series C circuit breaker and associated accessories
- Instruction Leaflets – which provide installation, inspection, operation, and adjustment information for Series C circuit breakers and accessories
- Technical Application Guide – which provides basic definitions and standards, code requirements, and technical application information for Series C circuit breakers
- Time/Current Curve Packets – which provide full-size time/current characteristics curves for each Series C circuit breaker
- Maintenance and Troubleshooting Guide – which provides maintenance procedures and troubleshooting information for Series C circuit breakers and accessories.

Note
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Series C Molded Case Circuit Breakers, F-Frame
Section 1 – Introduction

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Section 1 – Introduction

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Series C Molded Case Circuit Breakers, F-Frame
Section 1 – Introduction

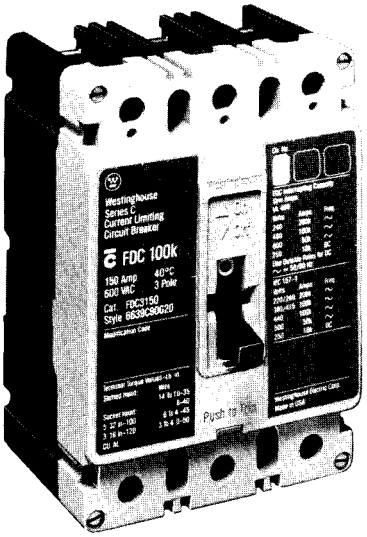


Figure 1-1. F-Frame Series C Circuit Breaker

1-1. General Information

F-Frame Circuit Breaker
The F-frame Series C thermal-magnetic circuit breaker (Figure 1-1) is available in two basic models: the D model and the W model. The D model (rated from 15A to 150A) is designed to comply with Underwriters Laboratories, Inc. Standard UL489, Canadian Standards Association Standard C22.2 No. 5, and International Electrotechnical Commission Recommendation IEC 157-1 (P1). The W model (rated from 10A to 160A) complies with International Electrotechnical Commission Recommendation IEC 157-1 (P1 and P2). Instantaneous (magnetic) only circuit interrupters, molded case switches (circuit interrupters), and mining duty circuit breakers are also available.

The F-frame circuit breaker is designed to physically and electrically replace the EB, EHB, FB, and HFB circuit breakers (FB circuit breaker family). An innovative design of internal components allows applications to be extended to higher interrupting rating levels. In addition, the higher interrupting and current limiting performance capabilities of the F-frame circuit breaker allow it to be applied in situations that previously required physically larger circuit breakers. Each circuit breaker nameplate is color coded to provide easy identification of type and interrupting capacity rating.

The F-frame circuit breaker is available in 1-, 2-, 3-, and 4-pole configurations to satisfy application requirements in all types of electrical systems. A modular accessory concept permits wide flexibility in accessory installation.

This frame book provides basic information about the thermal-magnetic circuit breaker and molded case switch models of the F-frame circuit breaker. Separate publications cover instantaneous-only circuit interrupters (motor circuit protectors) and mining duty circuit breakers.

1-2. F-Frame Circuit Breaker Types

Thermal-Magnetic Circuit Breaker
The thermal-magnetic circuit breaker provides thermal (inverse time) and magnetic (instantaneous) tripping and is equipped with a manual Push-to-Trip mechanism. The thermal-magnetic circuit breaker is available in several types based on maximum voltage and continuous current ratings, interrupting capacity ratings, and standards compliance. Types EHD, FDB, FD, HFD, and FDC are listed in accordance with Underwriters Laboratories, Inc. Standard UL489 and Canadian Standards Association Standard C22.2 No. 5.⑤ All types except EHD comply with International Electrotechnical Commission Recommendation IEC 157-1 (P1). Types FW, HFW, and FWC comply with International Electrotechnical Commission Recommendation IEC 157-1 (P1 and P2). Table 1-1 gives the interrupting capacity ratings for the different circuit breaker types. Each rating is achieved by specific design features incorporated into the circuit breaker.

Instantaneous-Only Circuit Interrupter (Motor Circuit Protector)
The instantaneous-only circuit interrupter (motor circuit protector) provides tripping for short circuit protection only. Additional information about this device is in a separate frame book. Refer to Westinghouse.

Molded Case Switch (Circuit Interrupter)
Molded case switches are used as compact switches in applications requiring high current switching capabilities. The molded case switches are constructed of circuit breaker components and are available in two types: nonautomatic and high instantaneous-automatic. The molded case switches are listed in accordance with Underwriters Laboratories, Inc. Standard UL1087.⑤
CANCELLED 4/87
The nonautomatic molded case switch is designed to open and close a circuit by manual (nonautomatic) means. The nonautomatic switch has a limited withstand rating with no overload, short circuit, or ground fault protection capability. The switch must be protected by a properly rated overcurrent protective device.

The high instantaneous-automatic molded case switch is equipped with a non-adjust-

Table 1-1. F-Frame Circuit Breaker Interrupting Capacity Ratings

UL489 Interrupting Capacity Ratings②

Circuit Breaker Frame	Number of Poles	Interrupting Capacity (Symmetrical Amperes)					
		Volts Ac (50/60 Hz)				Volts Dc	
		240	277	480	600	125	250①
EHD	1	.....	14,000	.....	.....	10,000	.....
	2, 3	18,000	.....	14,000	.....	.....	10,000
FDB	2,3,4	18,000	.....	14,000	14,000	.....	10,000
FD	1	.....	25,000	.....	.....	10,000	.....
	2,3,4	65,000	.....	25,000	18,000	.....	10,000
HFD	1	.....	65,000	.....	.....	10,000	.....
	2,3,4	100,000	.....	65,000	25,000	.....	~~20,000~~ 22,000
FDC	2,3,4	200,000	.....	100,000	~~50,000~~ 35,000	.....	~~20,000~~ 22,000

IEC 157-1 Interrupting Capacity Ratings (P1)②

Circuit Breaker Frame	Number of Poles	Interrupting Capacity (Symmetrical Amperes)						
		Volts Ac (50/60 Hz)					Volts Dc④	
		220/240	380/415	440	500	660	125	250①
FDB	2, 3, 4	18,000	14,000	14,000	14,000	.....	.....	10,000
FD	1	25,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	65,000	25,000	25,000	18,000	.....	.....	10,000
HFD	1	65,000	.....	.....	.....	.....	10,000	.....
	2, 3	100,000	65,000	65,000	25,000	.....	.....	20,000
FDC	2, 3, 4	200,000	100,000	100,000	~~50,000~~ 33,000	.....	.....	20,000
FW	1	25,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	65,000	25,000	25,000	18,000	③	.....	10,000
HFW	1	65,000	.....	.....	.....	.....	10,000	.....
	2, 3, 4	100,000	65,000	65,000	25,000	③	.....	~~20,000~~ 22,000
FWC	2, 3, 4	200,000	100,000	100,000	~~50,000~~ 35,000	③	.....	~~20,000~~ 22,000

① Two-pole circuit breaker, or two poles of three-pole circuit breaker.
② Interrupting ratings are subject to final test verification. Refer to Westinghouse for P2 ratings.
③ Refer to Westinghouse.
④ DC ratings apply to substantially non-inductive circuits.
⑤ Some listings pending. Refer to Westinghouse.

able, instantaneous trip mechanism that protects the switch if it is subjected to a fault current above its withstand rating. The switch does not provide low level fault or inverse time overload protection and must be used with a properly rated overcurrent protective device.

1-3. Advantages

The Series C circuit breaker line represents an entirely new approach to circuit breaker design. The F-frame circuit breaker uses new design features that improve performance and extend application capabilities while maintaining physical interchangeability with the existing FB circuit breaker family.

The following list highlights the advantages of the F-frame circuit breaker over previously available circuit breakers. (Figure 1-2).

a. Performance
The F-frame circuit breaker provides higher interrupting capacities and improved current limiting capabilities compared to previous standard line circuit breakers. The enhanced performance characteristics extend F-frame circuit breaker use to applications that previously required physically larger circuit breakers.

b. Designs
Thermal-magnetic designs include fixed or adjustable thermal and magnetic trip settings. The D model circuit breakers have fixed thermal and magnetic settings to provide application consistency. The W model circuit breakers have adjustable thermal settings and either fixed or adjustable magnetic settings to provide application flexibility where local codes and standards permit the use of adjustable circuit breakers.

Two molded case switch (circuit interrupter) designs are available: a nonadjustable high-instantaneous type and a nonautomatic switching device.

c. Construction Details
1-, 2-, 3-, and 4-pole configurations satisfy application requirements for all types of electrical systems. The 4-pole configuration provides 3-phase, 4-wire neutral line circuit breaking where required by local codes and applications.

Physical frame size allows interchangeability with the existing FB circuit breaker family without modifying the enclosure or mounting details.

External hardware is in English (D models) or metric (W models) thread sizes to accommodate user needs.

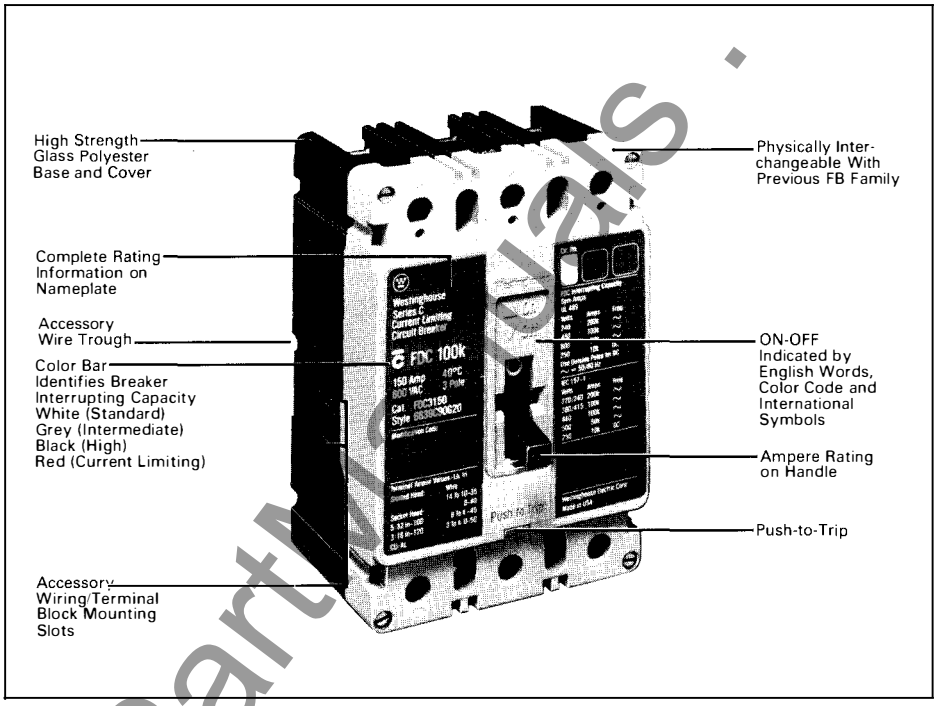


Figure 1-2. F-Frame Circuit Breaker Features

A Push-to-Trip button provides a local means of manually exercising the trip mechanism.

High strength glass-polyester base and cover have excellent dielectric qualities and reduce the need for fungus proofing. Cover design reduces the possibility of accidental contact with live terminations.

Operating mechanism design provides increased air gap between stationary and moving contacts when circuit breaker is in tripped position. The increased air gap provides greater arc impedance during contact opening, which allows higher interrupting capacity ratings to be obtained in compact frame sizes.

Variations in contact assembly designs allow different interrupting capacities in one physical frame size.

The one piece molded crossbar assembly has high dielectric qualities and ensures simultaneous operation of all moving contacts.

Positive operating mechanism ensures that the operating handle stays in the ON position when the contacts are closed.

Handle operating force and throw are compatible with circuit breakers in the FB family, allowing changeover to the F-frame circuit breaker with little or no handle mechanism modification.

Back plate insulates internal component hardware from the circuit breaker mounting surface.

d. Internal Accessories
Modular plug-in accessory design simplifies factory installation for improved customer service and facilitates field installation where local codes and standards permit. Molded accessory frames provide improved electrical clearance and dielectric quality.

The internally mounted accessories include auxiliary switch, alarm (signal)/lockout switch, shunt trip, and undervoltage release mechanism. These accessories are designed to meet most ac and dc rating requirements.

Internal accessory wiring options provide wire routing versatility. The standard wiring method is pigtail leads exiting from the rear of the circuit breaker base. Options include pigtail leads extending through a slot in the side of the base where the accessory is mounted, or through a molded trough to the opposite side of the base. Additional options include side mounted terminal blocks.

e. External Accessories
Cover design permits field installation of key interlocks, padlockable handle lock

Series C Molded Case Circuit Breakers, F-Frame
Section 1 – Introduction

hasp, and electrical or manual handle operators without modifying the cover.

A factory installed cylinder lock can be mounted in the cover providing a simplified system for locking the trip bar in the tripped position.

Plug-in adapters provide convenience for front-removable switchboard construction.

The F-frame models can be operated by existing handle mechanism types, including Vari-depth, slide plate, SM, MC, and AMT. A new rotary handle mechanism is also available.

f. Markings
The Series C circuit breaker line features a new format of nameplate which provides easy identification of circuit breaker type, rating, and operating status.

Nameplates are color coded for immediate rating identification. A color-coded bar identifies the type and the interrupting rating (kA) at the most common application voltage (480 or 380 Vac). The color codes are as follows:

White: EHD/FDB

Grey: FD/FW

Black: HFD/HFW

Red: FDC/FWC.

Consolidated nameplate design provides complete identification and rating information in an easily readable, understandable format.

Circuit breaker status is clearly indicated by circuit breaker handle position and color-coded flags (red for ON, green for OFF, and white for TRIP). The on and off positions are identified in English words (ON and OFF) and international symbols (I and O).

g. Equipment Literature
A complete line of technical literature produced in several languages provides specification, ordering, application, and instructional information. This makes the circuit breaker easy to specify, purchase, and apply, saving time and minimizing application errors.

Dimensional data is in English and metric units to satisfy user requirements.

h. Standards Compliance
The Series C circuit breaker is designed to comply with the following standards:

- Australian Standard AS 2184, Moulded Case Circuit Breakers
- British Standards Institution Specification BS 4752: Switchgear and Control Gear, Part 1: Circuit Breakers
- Canadian Standards Association Standard C22.2 No. 5, Service Entrance and Branch Circuit Breakers
- International Electrotechnical Commission Recommendation IEC 157-1 (P1 and P2), Low-Voltage Distribution Switchgear, Part 1: Circuit Breakers
- South African Bureau of Standards Standard SABS 156, Standard Specification for Moulded Case Circuit Breakers
- Swiss Electro-Technical Association Standard SEV 157-1, Safety Regulations for Circuit Breakers
- Underwriters Laboratories, Inc. Standard UL489, Molded Case Circuit Breakers and Circuit Breaker Enclosures, Including Marine Circuit Breakers
- Union Technique de l'Electricite Requirements NF C 63-120, Low Voltage Switchgear and Control Gear Circuit Breaker Requirements
- Verband Deutscher Elektrotechniker (Association of German Electrical Engineers) Specification VDE 0660, Low Voltage Switch Gear and Control Gear, Circuit Breakers.

Compliance with these standards satisfies most local and international codes, assuring user acceptability and simplifying application.

i. Federal Specification Classifications
Federal specification W-C-375b is complied with as follows:

EHD: 1-pole Class 13a;
2-, 3-pole Class 13b

FDB①: 2-, 3-pole Class 18a

FD①: 1-pole Class 13a;
2-, 3-pole Class 22a

HFD①: 1-pole Class 13a;
2-, 3-pole Class 23a

FDC①: 2-, 3-pole Class 24a.

① Except range of current trip is 15-150A.

Series C Molded Case Circuit Breakers, F-Frame
Section 2 – Applications

2-1. Introduction

Application flexibility of the F-frame circuit breaker is enhanced by the higher interrupting ratings and current limiting characteristics designed into the Series C line (Figure 2-1).

2-2. Switchboard Application

The EHD, FDB, FD/FW, HFD/HFW, and FDC/FWC circuit breakers are used in distribution systems to provide feeder and branch protection.

2-3. Panelboard Application

The F-frame circuit breaker is used in panelboard applications as both a main and a branch protection device.

2-4. Busway Plug-In Application

The F-frame circuit breaker can be applied in busway plug-in units to provide branch protection. Size compatibility between the FB family and the F-frame circuit breaker facilitates replacement without changing busway plug-in units.

2-5. Individual Enclosure Application

The F-frame circuit breaker can be applied in individual enclosures to meet specific installation requirements.

2-6. Machine Tool Control Panel Application

In machine tool applications, F-frame circuit breakers and molded case switches can be applied to meet individual equipment requirements.

2-7. Special Applications

In mining, motor circuit protection, and other applications, special versions of the F-frame circuit breaker provide safe equipment control and protection. For additional information, see separate frame books or refer to Westinghouse.

For all 3-phase Delta, grounded B phase applications, refer to Westinghouse.

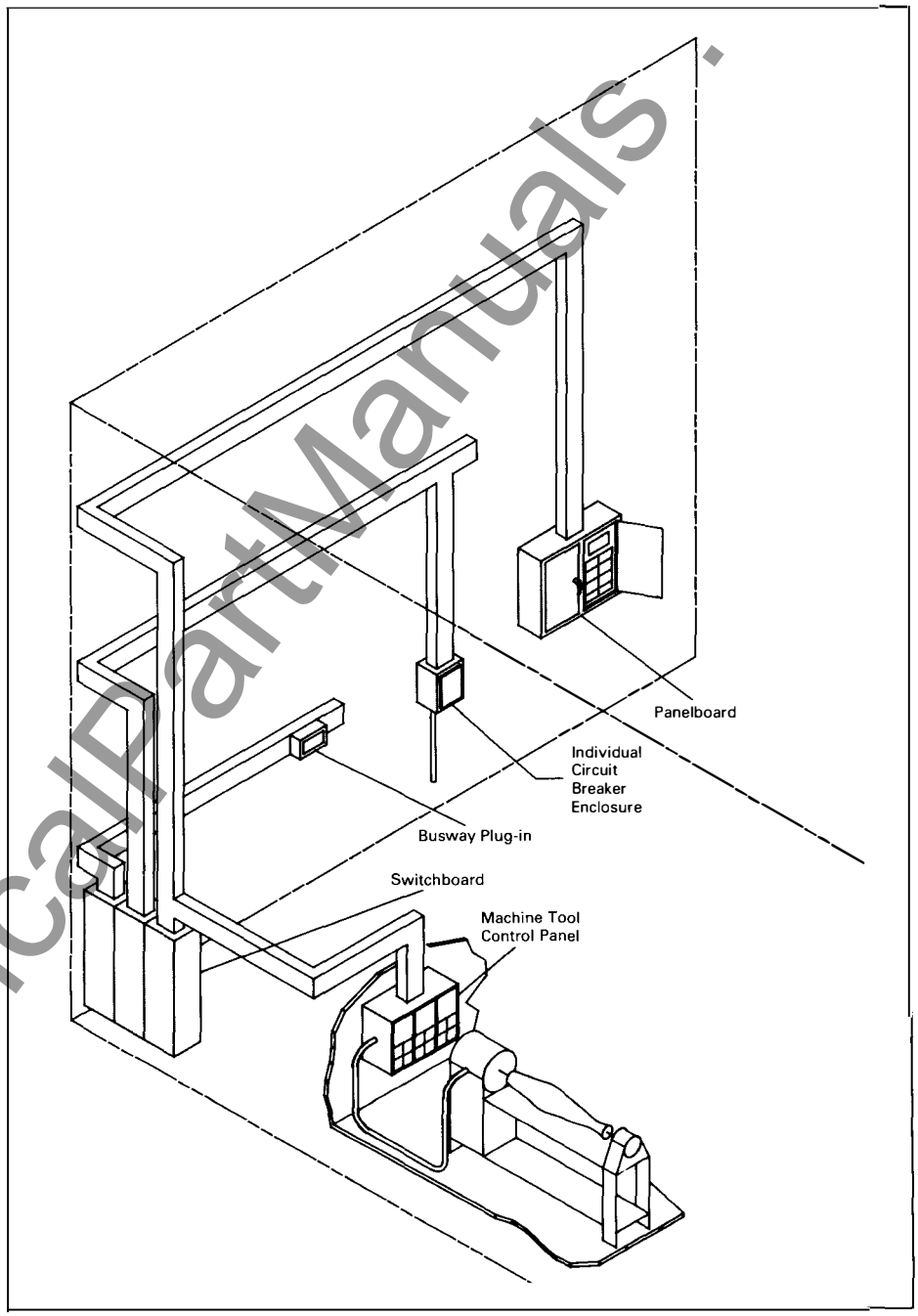


Figure 2-1. F-Frame Circuit Breaker Typical Applications

Series C Molded Case Circuit Breakers, F-Frame
Section 3 – Description

3-1. Physical Description

The F-frame circuit breaker consists of the following components mounted inside a molded glass-polyester case (Figure 3-1):

a. Operating mechanism
b. Arc extinguishers
c. Stationary contact assemblies
d. Moving contact assemblies
e. Trip mechanisms.

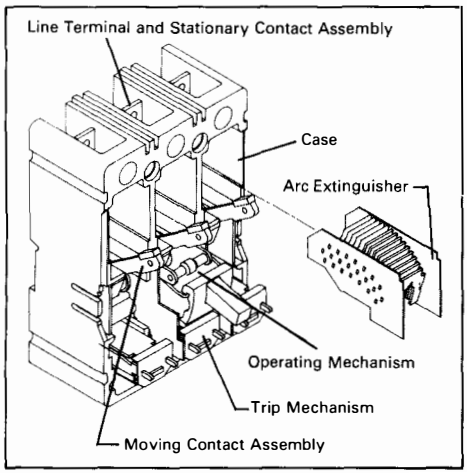


Figure 3-1. F-Frame Circuit Breaker Components

3-2. Functional Description

The F-frame circuit breaker disconnects a load from an electrical supply when the handle is operated, when an overcurrent or short circuit condition develops, or when a manual trip is initiated. Circuit breaker operation is provided by a spring-loaded toggle operating mechanism that provides quick-make and quick-break, trip free operation.

The current path in the circuit breaker is shown in Figure 3-2. When the circuit breaker contacts are closed, the current flows from the line terminal, through the stationary and moving contact assemblies, through a copper shunt to the thermal-trip bimetal, through the bimetal and magnetic-trip element, to the load terminal.

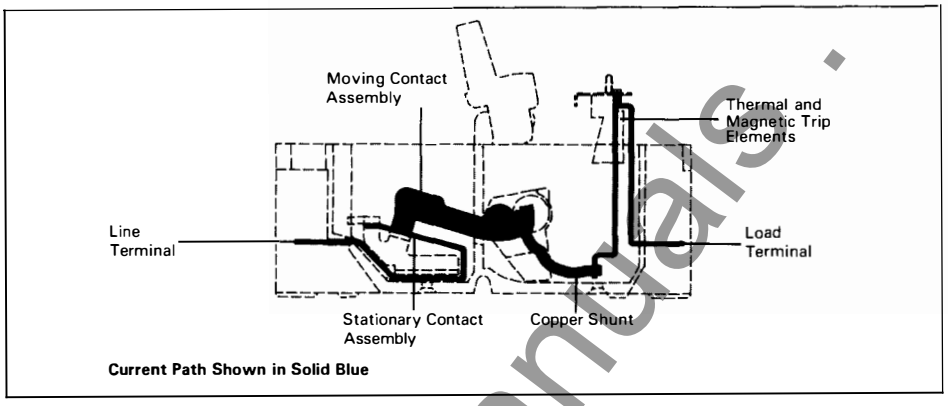


Figure 3-2. F-Frame Circuit Breaker Current Path (HFD/HFW Stationary Contact Shown)

3-3. Component Description

The following paragraphs give the physical and functional descriptions of the circuit breaker components. Differences between the FD/FW, HFD/HFW, and FDC/FWC circuit breakers are described.

Molded Case

The molded case (Figure 3-3) is a housing for electrically insulating the circuit breaker components and internal accessories. The case consists of a glass-polyester base and cover. The internal case molding forms cavities that isolate terminal areas, individual arc chambers, the operating mechanism, and internal accessories. Barriers isolate the operating mechanism from the accessory mounting cavities. Slots in the cover provide ventilation for the arc chambers. The external case molding forms terminal enclosures to help prevent accidental contact with the terminals. The outside of the case accomodates externally mounted accessories. Mounting slots in the base accommodate external terminal blocks for connections to internal accessories. Alternatively, these slots act as side exit holes for internal accessory pigtail leads. Other slots allow pigtail leads to exit from the back of the base. A trough molded into the back of the base provides internal accessory lead routing across the back of the circuit breaker. A back plate insulates live mounting components.

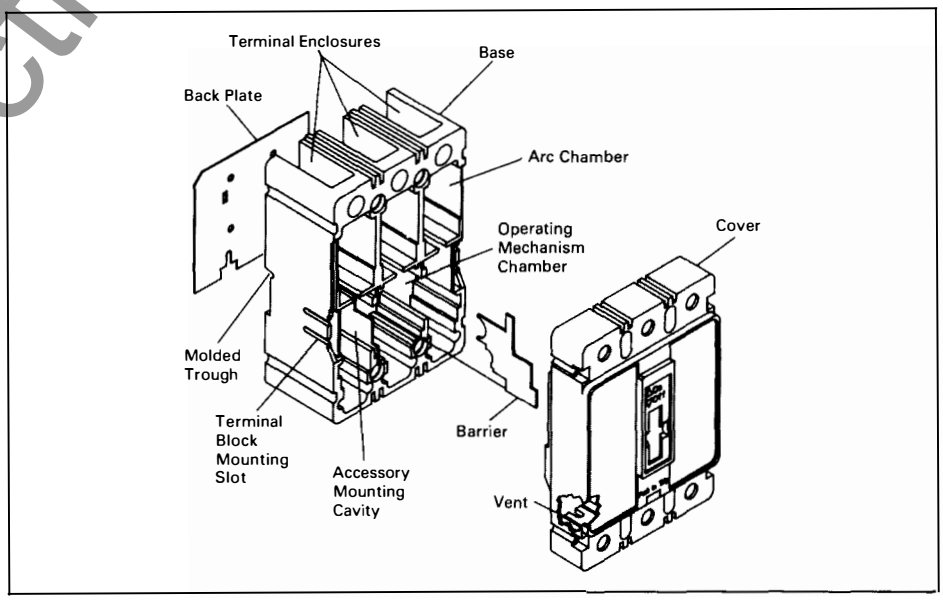


Figure 3-3. Molded Case

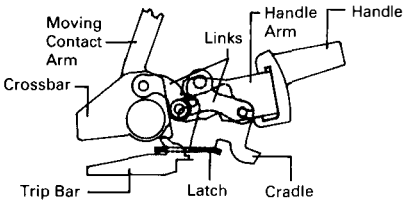
Series C Molded Case Circuit Breakers, F-Frame
Section 3 – Description

Operating Mechanism
The operating mechanism provides a means of manually switching the moving contact position from open to closed and from closed to open, and it provides the mechanical means to open the contacts when trip conditions occur. The handle position indicates the contact status: closed, tripped, or open.

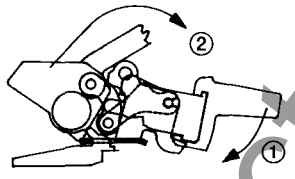
Manual Operation
Manual operation of the circuit breaker handle closes and opens the moving contact assembly. When the cradle is hooked in the latch (Figure 3-4), the handle arm controls crossbar rotation. When the handle arm is moved from one position to the other, the crossbar rotates and the moving contacts open or close. The link arrangement between the handle arm and the crossbar provides spring-loaded toggle operation.

Trip Operation
The trip operation provides contact opening when the trip mechanism is actuated. The trip mechanism can be actuated thermally; magnetically; or manually by the Push-to-Trip button, the cylinder lock, the shunt trip, or the undervoltage release mechanism accessories. Trip operation can occur only when the cradle is hooked into the latch. When a trip element operates (Figure 3-5), the trip bar rotates and releases the latch. When the latch is released, the handle arm springs pull the cradle against the handle arm and, at the same time, rotate the crossbar to open the contacts.

Breaker "On" (Contacts Closed)



Breaker "Off" (Contacts Open)

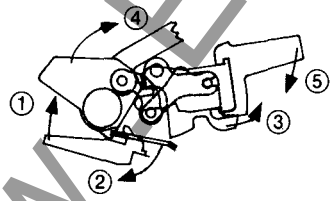


Manual Operating Sequence

1. Handle and Handle Arm Move
2. Crossbar and Moving Contact Arm Rotate

Figure 3-4 Manual Mechanism Operation

Breaker Tripped



Trip Operation Sequence

1. Trip Bar Rotates
2. Latch Releases
3. Cradle Moves Toward Handle Arm as
4. Crossbar and Moving Contact Arm Rotate, and
5. Handle moves to trip position

Figure 3-5 Trip Mechanism Operation

Arc Extinguishers
The arc extinguishers dissipate arcs that result when the circuit breaker interrupts current flow. Each arc extinguisher consists of a stack of uniformly spaced, U-shaped steel plates held together by two insulating side plates (Figure 3-6).

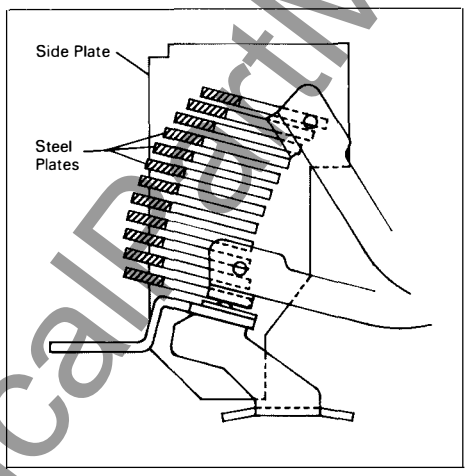


Figure 3-6. Arc Extinguisher

When an interruption occurs and the contacts separate, the current flow through the ionized region between the contacts induces a magnetic field around the arc and arc extinguisher (Figure 3-7). As the lines of magnetic flux show, the force drives the arc into the steel plates, deionizing the gas while dividing and cooling the arc.

Stationary Contact Assemblies
The stationary contact assemblies provide the conducting paths between the line terminals and the moving contacts. Three basic stationary contact assembly configurations are used: EHD, FDB, FD/FW; HFD/HFW; and FDC/FWC.

EHD, FDB, FD/FW Stationary Contact Assemblies
The EHD, FDB, FD/FW circuit breakers use a conventional stationary contact assembly (Figure 3-8). It consists of a line terminal copper conductor and a silver tungsten (EHD, FDB, FD) or silver graphite (FW) contact.

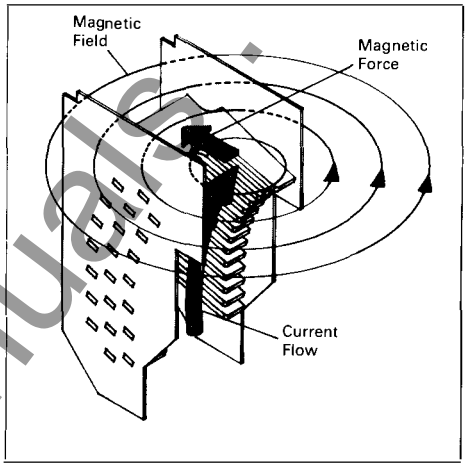


Figure 3-7. Arc Extinguisher Operation

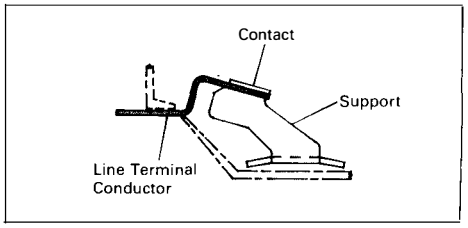


Figure 3-8. FD/FW Stationary Contact Assembly

HFD/HFW Stationary Contact Assembly
The HFD/HFW circuit breaker uses a reverse-loop stationary contact assembly (Figure 3-9). It consists of a line terminal copper conductor that is formed into a loop, and a silver tungsten (HFD) or silver graphite (HFW) contact.

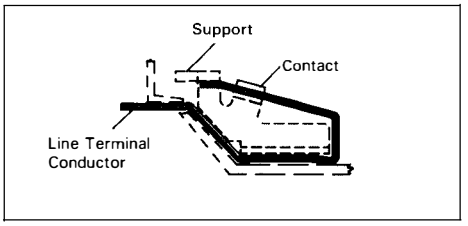


Figure 3-9. HFD/HFW Stationary Contact Assembly

FDC/FWC Stationary Contact Assembly
Each FDC/FWC circuit breaker stationary contact assembly (Figure 3-10) consists of a line terminal copper conductor connected through a pivoted joint to a copper contact conductor and a silver tungsten (FDC) or silver graphite (FWC) contact. The line terminal conductor and contact conductor form a reverse loop. A compression spring behind the contact conductor limits movement and returns the contact conductor to the normal position after a high fault trip.

Series C Molded Case Circuit Breakers, F-Frame
Section 3 – Description

The FDC/FWC stationary contact assembly operates on the same principle as the HFD/HFW stationary contact assembly, but it provides greater arc extension and faster contact opening.

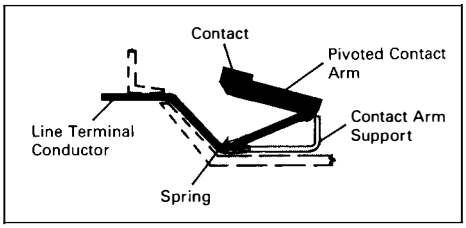


Figure 3-10. FDC/FWC Stationary Contact Assembly

Contact Blow-Apart
When current is flowing through the contacts of the HFD/HFW circuit breakers, the positions of the reverse loop and the moving contact arm induce opposing magnetic fields. The resulting opposing forces along the magnetic flux lines cause rapid contact blow-apart under high current interrupt conditions.

When the FDC/FWC circuit breaker trips under high current conditions, the pivoted joint (Figure 3-11) allows the lower contact to move downward as the moving contact moves upward. The compression spring limits the downward movement and returns the contact conductor to the normal position.

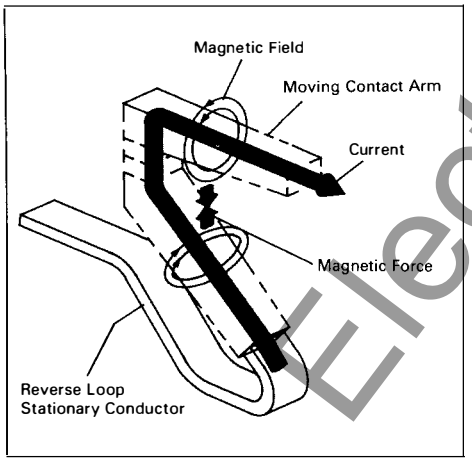


Figure 3-11. Contact Blow-Apart

Moving Contact Assembly
The moving contact assembly provides continuity between the line and load terminals when the circuit breaker is on. When the circuit breaker trips or is switched off, the moving contact assembly moves through the arc extinguisher away from the stationary contact.

The moving contact arm is connected to the operating mechanism crossbar (Figure 3-12). The crossbar and moving contact arm assembly rotates to close the contacts. After the contacts touch, the crossbar overtravels to create firm contact closure, and an arm latch holds the moving contact arm in place.

During overload conditions, when the operating mechanism is tripped, the crossbar and moving contact arm rotate together. Under high level fault conditions when the contact blow-apart forces are strong enough, the moving contact arms independently pivot away from the stationary contact during the tripping operation.

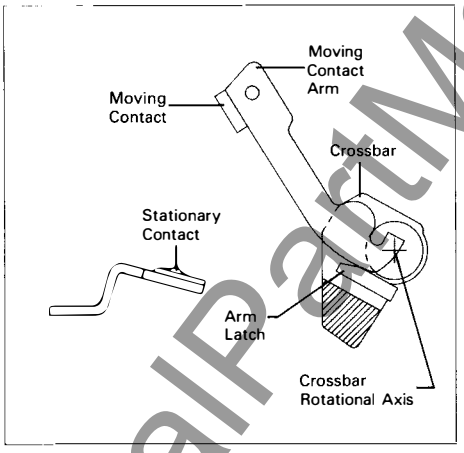


Figure 3-12. Moving Contact Assembly

Trip Mechanisms
The trip mechanisms provide automatic (thermal and magnetic) and manual (Push-to-Trip button) means to trip the circuit breaker. Each trip mechanism rotates and unlatches the trip bar thereby releasing the operating mechanism latch and causing the circuit breaker to trip (Figure 3-13).

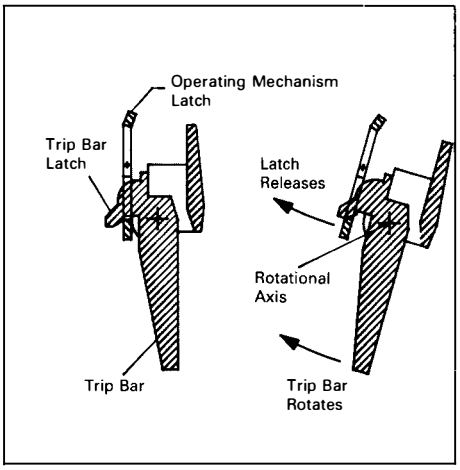


Figure 3-13. Trip Bar Operation

Thermal (Inverse Time) Trip Mechanism
The thermal trip mechanism operates in response to overload conditions. The mechanism includes a bimetal element located behind the trip bar (Figure 3-14). The bimetal element is part of the current carrying path. When there is an overload, the increased current flow heats the bimetal and causes it to bend. As the bimetal bends, it touches and rotates the trip bar causing the circuit breaker to trip. The time needed for the bimetal to bend and trip the circuit breaker varies inversely with the current.

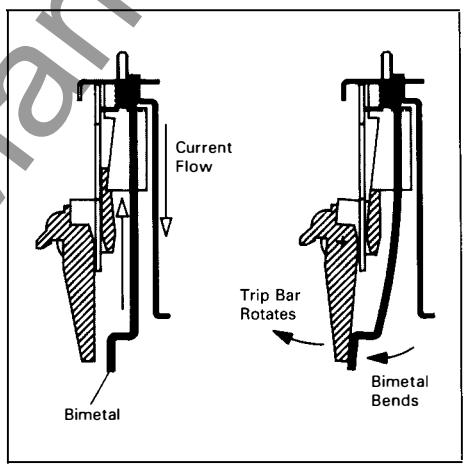


Figure 3-14. Thermal Trip Operation

Magnetic (Instantaneous) Trip Mechanism
The magnetic trip mechanism operates when there is a high current (short circuit) in the current path. The mechanism includes an electromagnet and an armature. When high level current passes through the conductor, the magnetic field strength of the electromagnet rapidly increases and attracts the armature (Figure 3-15). As the

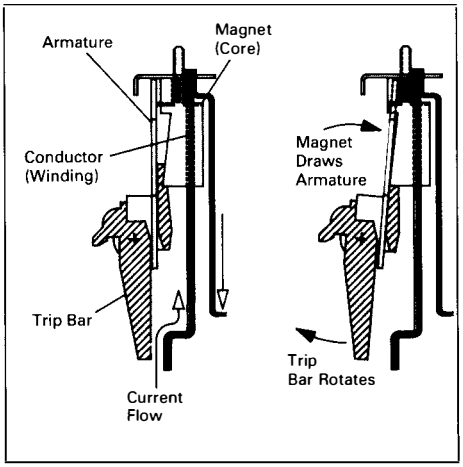


Figure 3-15. Magnetic Trip Operation

top of the armature is drawn to the electromagnet, the armature rotates the trip bar causing the circuit breaker to trip.

Push-to-Trip Mechanism
The Push-to-Trip mechanism provides a manual means of tripping the circuit breaker by depressing a button located in the circuit breaker cover. When the Push-to-Trip button (Figure 3-16) is pressed, a plunger rotates the trip bar causing the circuit breaker to trip.

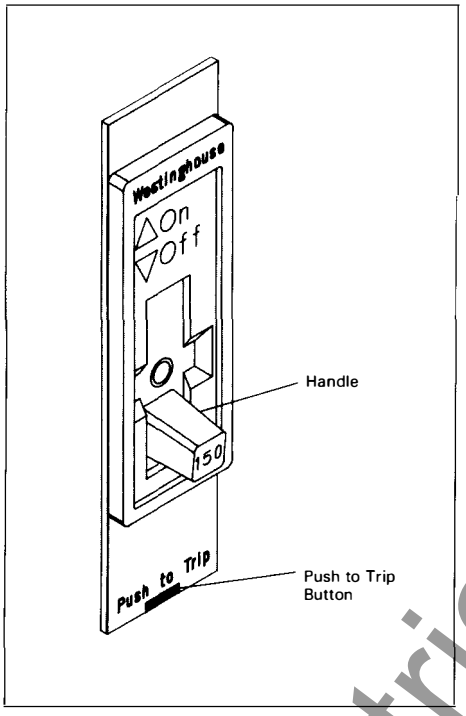


Figure 3-16. Push-to-Trip Button

FW, HFW, and FWC Adjustable Thermal and Adjustable Magnetic Mechanism
The thermal and magnetic elements of FW, HFW, FWC circuit breakers can be adjusted by rotating the adjustment buttons (Figure 3-17) in the cover of the circuit breaker to the desired setting marked on the label. The adjustable thermal mechanism has movable elements (one per pole) connected by a common adjustment linkage. Each pole element is in the form of an inclined plane (wedge) and is located between the bimetal strip and the trip bar. Movement of the wedge adjusts the bimetal trip bar gap varying the necessary bimetal travel required to trip the circuit breaker. The magnetic pick-up setting is adjusted by a linkage that varies the spring tension on the magnet armature.

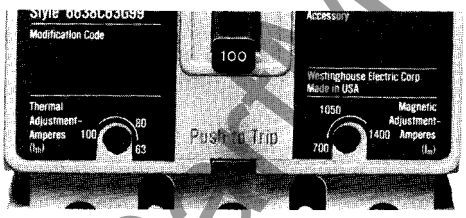


Figure 3-17. Adjustment Buttons

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

4-1. General Information
A complete line of accessories is available for use with the Series C circuit breakers and molded case switches. Commonly required internally mounted accessories are plug-in types for use only with the Series C line. The following paragraphs describe each accessory and provide operation, rating, and specification information. In this section, "circuit breaker" shall also include molded case switch unless otherwise stated.

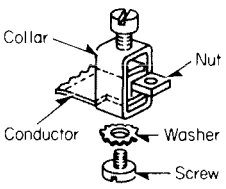
4-2. Termination Accessories
Termination accessories of two basic types are available: terminal connection devices, which accomodate typical circuit breaker connection variations; and termination protection devices which provide terminal isolation.

Termination Connection Devices
- Line and Load Terminals
- Keeper Nut
- Rear Connecting Studs
- Plug-In Adapters
- Panelboard Connecting Straps

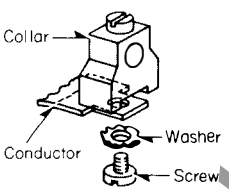
Termination Protection Devices
- Terminal Shields
- Terminal End Covers
- Interphase Barriers

Line and Load Terminals

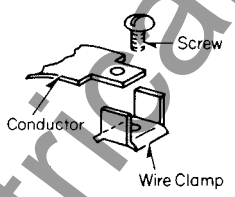
Line and load terminals provide wire connecting capabilities for specific ranges of continuous current ratings and wire types. Except as noted, terminals comply with Underwriters Laboratories, Inc. Standards UL486A or UL486B. Unless otherwise specified, F-frame circuit breakers are factory equipped with load terminals only.



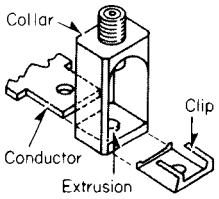
Style 624B100G02
Style 624B100G18
Collar encloses conductor and is held in position by a screw, lockwasher and nut.



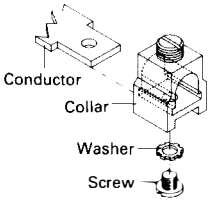
Style 624B100G10
Collar is assembled on top of conductor and is secured with a screw and lockwasher.



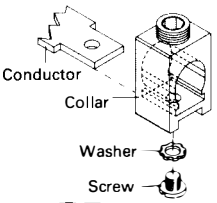
Style 624B100G14
Wire clamp is secured to the conductor with a screw.



Style 624B100G17
Collar encloses conductor and is secured with a clip. The clip legs slide over the conductor and clip end snaps around bottom of collar.

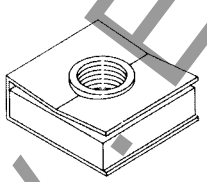


Style 624B100G19
Collar slides onto conductor and is held in position by a screw and lockwasher.



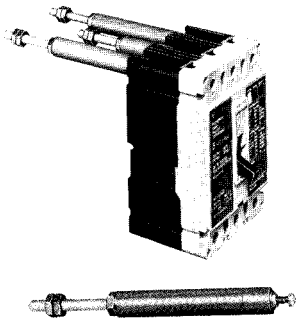
Style 624B100G20
Collar slides onto conductor and is held in position by a screw and lockwasher.

Keeper Nut



The keeper nut slides onto the line or load conductor of the circuit breaker and acts as a threaded adapter for the conductor to accept a ring terminal or other bolt-on connector. The keeper nut is available with English and metric thread sizes. (Field installation only)

Rear Connecting Studs

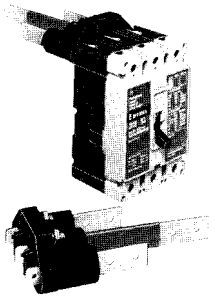


Rear connecting studs are available in several sizes to accommodate specific fixed-mounted circuit breaker applications. The rear connecting studs are rated 100A or 150/160A. Rear connecting studs are component recognized through 150A per UL File E56845.① See Section 5 for dimensional data. (Field installation only)

① Recognition pending, refer to Westinghouse.

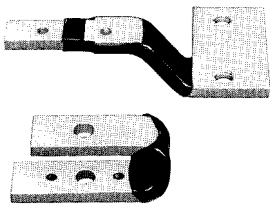
Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

Plug-In Adapters



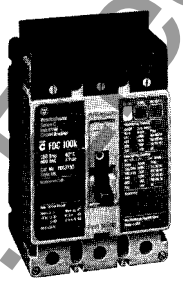
Plug-in adapters simplify installation and front removal of circuit breakers. Individual line and load plug-in adapters are available for rear connection applications on 2-, 3-, and 4-pole circuit breakers. Common mounting plates for line and load end adapters are available. The plug-in adapters are rated 100A or 150/160A. Plug-in adapters are component recognized through 150A per UL File E56845.① See Section 6 for plug-in adapter dimensional data. (Field installation only)

Panelboard Connecting Straps



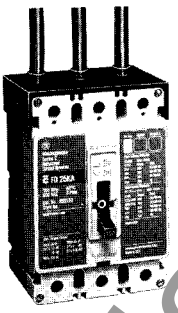
Panelboard connecting straps are used to connect the circuit breaker terminals to the panelboard bus. The panelboard connecting straps are available in two types with 50A, 100A, and 150/160A ratings: outside pole and center pole. Panelboard connecting straps are component recognized through 150A per UL File E56845.②

Terminal Shields



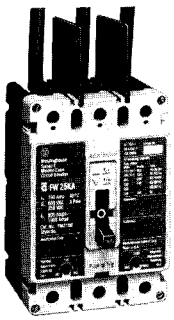
The terminal shield provides protection against accidental contact with live line terminations. Terminal shields are formed from high dielectric insulating material and fasten over the front terminal access openings. Small holes in the shields provide limited access to the terminals for tightening connectors. Terminal shields are component recognized per UL File E56845.② (Field installation only)

Terminal End Covers



The terminal end covers are designed for use in motor control center applications where, because of confined spaces, line side conductors are normally custom fitted. The molded end covers are made of high dielectric glass-polyester and slide over the line ends of the circuit breaker. Close fitting conductor openings are molded into the end covers. The end cover and circuit breaker case fit together to form terminal compartments that isolate discharged ionizing gasses during circuit breaker tripping. Terminal end covers are available with two conductor opening diameters, 0.25 and 0.41 inch, and are component recognized per UL File E56845.② (Field installation only)

Interphase Barriers



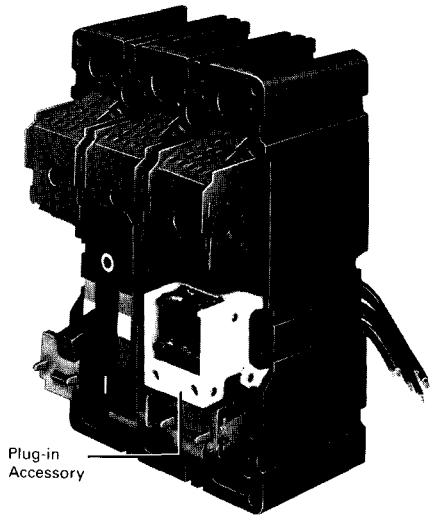
The interphase barriers provide additional electrical clearance between circuit breaker poles for special termination applications. The barriers are high dielectric insulating plates that are installed in the molded slots between the terminals. Interphase barriers are component recognized per UL File E56845.② (Field installation only)

● Recognition of some components pending, refer to Westinghouse.
② Recognition pending, refer to Westinghouse.
② Some UL listings pending, refer to Westinghouse.

4-3. Internal Accessories

Internal accessories for the EHD, FDB, FD, HFD, and FDC models are listed for factory installation per UL File E7819, and comply with requirements in Underwriters Laboratories Standard, Inc. UL489 for sealed circuit breakers.③ Plug-in internal accessories (Figure 4-9) can be field installed in FW, HFW, and FWC models. Internal accessories can also be field installed in D model circuit breakers where UL standards do not apply and where local codes and standards permit. The plug-in internal accessories include:

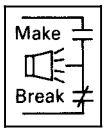
- Alarm (Signal)/Lockout Switch
- Auxiliary Switch
- Shunt Trip
- Undervoltage Release.



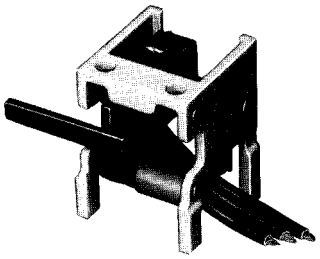
Typical Internal Plug-in Accessory Installed in F-frame Circuit Breaker

Different accessory wiring options are available to satisfy most circuit breaker mounting applications. The standard wiring method is 18-inch pigtail leads extending through a slot at the rear of the base. Options allow the pigtail leads to be routed through a slot in the side of the base where the accessory is mounted, or through a molded trough to the opposite side of the base. Additional options include side-mounted terminal blocks. If accessory leads longer than 18 inches are required, side mounted terminal blocks should be used. To identify allowable accessory installation combinations, see paragraph 4-8. Internally mounted accessories identified in paragraph 4-8 are shown in this section by a graphic symbol in a shaded blue box.

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications



Alarm (Signal)/ Lockout Switch

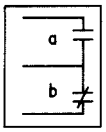


The alarm (signal)/lockout switch monitors circuit breaker trip status and provides remote signaling and interlocking capabilities when the circuit breaker trips. For 2-, 3-, and 4-pole circuit breakers, the alarm (signal)/lockout switch consists of one or two SPDT switches housed in a plug-in module. The SPDT switch contacts are identified as make and break contacts. When the circuit breaker trips, the make contact closes and the break contact opens. For 1-pole circuit breakers, the switch (factory installed only) is mounted on the inside of the cover and the two make leads are routed through an opening in the load end of the circuit breaker. Table 4-1 provides electrical rating data for the alarm (signal)/lockout switch.

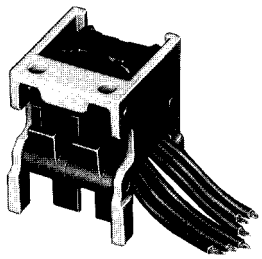
Table 4-1. Alarm (Signal)/Lockout Switch Electrical Rating Data①②

Maximum Voltage	Freq.	Maximum Current, Amps	Dielectric Withstand Voltage
Multi-Pole Circuit Breakers			
600	50/60 Hz	6	2500
125	dc	0.5③	2500
250	dc	0.25③	2500
Single-Pole Circuit Breakers			
125/250	50/60Hz	6③	2000
28	dc	3③	2000
28	dc	5④	2000

① Endurance: 6000 electrical operations plus 4000 mechanical operations.
② Pigtail wire size: No. 18 AWG (0.82 mm²).
③ Non-inductive load.
④ Inductive (L/R = 0.026).



Auxiliary Switch

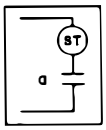


The auxiliary switch provides circuit breaker contact status information by monitoring the position of the moving contact arm. The auxiliary switch is used for remote indication and interlock system verification, and consists of one or two SPDT switches housed in a plug-in module. Each SPDT switch has one "a" and one "b" contact. When the circuit breaker contacts are open, the "a" contact is open and the "b" contact is closed. Table 4-2 provides electrical rating data for the auxiliary switch.

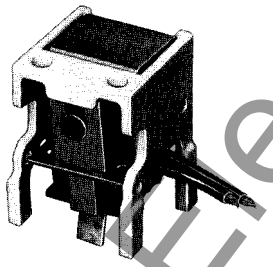
Table 4-2. Auxiliary Switch Electrical Rating Data⑥⑥

Maximum Voltage	Freq.	Maximum Current, Amps	Dielectric Withstand Voltage
600	50/60 Hz	6	2500
125	dc	0.5⑦	2500
250	dc	0.25⑦	2500

⑥ Endurance: 6000 electrical operations plus 4000 mechanical operations.
⑥ Pigtail wire size: No.18 AWG (0.82 mm²).
⑦ Non-inductive load



Shunt Trip



The shunt trip provides remote controlled tripping of the circuit breaker. The shunt trip consists of an intermittent rated solenoid with a tripping plunger and a cutoff switch mounted in a plug-in module. On ac rated shunt trips that are required for use with ground fault protection devices, most solenoids are suitable for operation at 55 percent of rated voltage. Table 4-3 provides electrical rating data for the shunt trip.

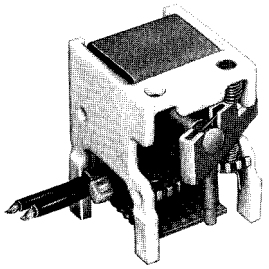
Notes:
1. Average unlatching time: 6 milliseconds.
2. Average circuit breaker contact total opening time: 18 milliseconds
3. Endurance: 6000 electrical operations plus 4000 mechanical operations
4. Pigtail wire size: No. 18 AWG (0.82 mm²).

Table 4-3. Shunt Trip Electrical Rating Data

Electrical Operating Ratings					
50/60 Hz			dc		
Supply Voltage	Minimum Operating Voltage	VA	Supply Voltage	Minimum Operating Voltage	VA
9	6.3	40	12	8.4	100
12		75	24		400
24		300			
48	26	90	48	26	100
60		130	60		160
110		440	110		530
120		520	120		630
127		580	125		680
208	144	170	220	154	50
220		180	250		65
240		220	...		...
380		530	...		...
400	220	130	...	...	...
415		140	...	...	...
440		150	...	...	...
480		180	...	...	...
525		220	...	...	...
550		240	...	...	...
600		280	...	...	...

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

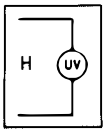
Undervoltage Release Mechanism



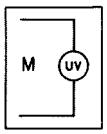
The undervoltage release mechanism monitors a voltage (typically a line voltage) and trips the circuit breaker when the voltage falls to between 70 and 35 percent of the solenoid coil rating. Table 4-4 provides electrical rating data for each operating voltage of the handle reset undervoltage release mechanism.

NOTE: Undervoltage release mechanism accessories are not designed for, and should not be used as, circuit interlocks

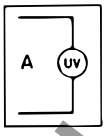
There are three different types of undervoltage release mechanisms available: handle, manual, and automatic reset.



Handle Reset (Standard)
The undervoltage release mechanism consists of a continuous rated solenoid with a plunger and tripping lever mounted in a plug-in module. The tab on the tripping lever resets the undervoltage release mechanism when normal voltage has been restored and the circuit breaker handle is moved to the reset (OFF) position. With less than pickup voltage applied to the undervoltage release mechanism, the circuit breaker contacts will not touch when a closing operation is attempted.



Manual Reset (Optional)
The accessory consists of two metal cores held together by the flux of a surrounding coil. As voltage drops in the coil, the lower core drops, pivoting a lever which presses against the trip bar, and at the same time extends a plunger through the circuit breaker cover as an indication of an undervoltage trip. When voltage is restored, the plunger projecting through the circuit breaker cover must be depressed to reset the undervoltage release mechanism. This accessory can be factory installed only.



Automatic Reset (Optional)
This accessory is similar to the manual reset model, but has no reset plunger. The tripping lever has an extension which rests on the molded crossbar. When the circuit breaker trips and travel of the molded crossbar is almost complete, the tripping lever extension pushes the tripping lever up and resets the undervoltage release mechanism.

Table 4-4. Undervoltage Release Mechanism (Handle Reset) Electrical Rating Data

Electrical Operating Ratings									
50/60 Hz					dc				
Supply Voltage	Dropout Voltage Min.	Dropout Voltage Max.	Pickup Voltage Max.	VA	Supply Voltage	Dropout Voltage Min.	Dropout Voltage Max.	Pickup Voltage Max.	VA
9 12	4.2	6.3	7.6	1.3 2.5	12	4.2	8.4	10.2	2.8
24	8.4	16.8	20.4	1.4	24	8.4	16.8	20.4	1.6
48 60	21	33.6	40.8	1.2 1.9	48 60	21	33.6	40.8	1.3 2.0
110 120 127	44.5	77	93.5	1.3 1.5 1.7	110 120 125	44.5	77	93.5	1.5 1.7 1.9
208 220 240	84	145.6	176.8	2.2 2.4 2.9	220 250 ...	87.5 ...	154 ...	187 ...	2.6 3.4 ...
380 415 440 480	168	266	323	2.9 3.5 3.9 4.6	... ...	... ...	... ...	... ...	... ...
525 550 600	210	367	446	4.3 4.8 5.8	... ...	... ...	... ...	... ...	... ...

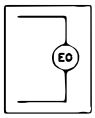
Notes:
1. Endurance: 6000 electrical operations plus 4000 mechanical operations
2. For electrical rating data for manual and automatic reset undervoltage release mechanisms, refer to Westinghouse.

4-4. Handle Operating Accessories

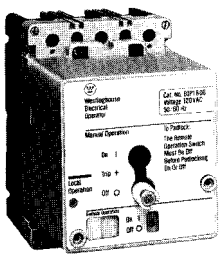
The handle operating accessories provide indirect electrical or manual circuit breaker handle operation. These accessories are field installed only and include:

- Electrical (Solenoid) Operator
- Rotary Handle
- Vari-Depth Handle Mechanism
- Slide Plate Handle Mechanism
- Type SM Safety Handle Mechanism
- Type MC Motor Control Handle Mechanism
- Type AMT Vari-Depth/Vari-Width Flange Mounted Handle Mechanism

To identify allowable accessory installation combinations, see paragraph 4-8. Handle operating accessories identified in paragraph 4-8 are shown in this section by a graphic symbol in a shaded blue box.



Electrical (Solenoid) Operator②



The electrical (solenoid) operator is a single solenoid mechanism that enables local and remote circuit breaker ON, OFF, and reset switching. The electrical operator is mounted on the circuit breaker cover within the trimline of the circuit breaker. The electrical operator uses a unique bistable latch that allows the device to operate using one time of 5 cycles (80 ms) making it suitable for generator synchronizing applications.

Means are provided for local and remote electrical operation and for local manual operation. A special handle design includes provisions for padlocking the manual operating handle in the ON or OFF position. (Handle padlocking does not affect the trip free operation of the circuit breaker.) The handle will accept one padlock shackle with a maximum diameter of 1/4 inch (6mm). An interlock electrically disconnects the solenoid when the electrical operator cover is removed. Table 4-5 provides electrical rating data for the electrical (solenoid) operator. The electrical (solenoid) operator is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.①

(continued)

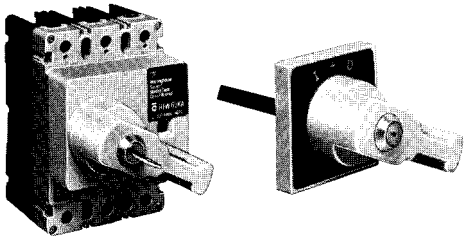
① UL listing pending, refer to Westinghouse.
② Electrical operator is also suitable for use with Types EB, EHB, FB, and HFB circuit breakers.

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

Table 4-5. Electrical (Solenoid) Operator Electrical Rating Data②

Voltage③	Freq.	Inrush Current Amps	Maximum Operating Time	Fuse④ Amps
24	50/60 Hz or dc	40	5 cycles (80ms)	15
120		10		3
240		5		2

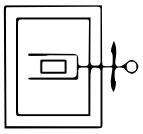
Rotary Handle



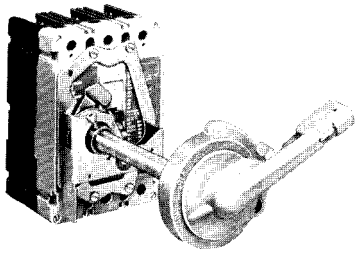
The rotary handle mechanism mechanically transfers the rotating operation of the rotary handle to the in-line toggle operation of the circuit breaker handle. A window in the handle mechanism case indicates circuit breaker status: ON, "1" on a red background; TRIP, "+" on a white background; OFF, "0" on a green background. The handle mechanism is mounted on the circuit breaker cover within the trimline and will take up to three padlock shackles, each with a maximum diameter of 1/4 inch (6mm). A cylinder lock can be installed in the handle. The handle is designed to be locked in the OFF position, however, one knockout tab is provided in the handle mounting boss which must be removed to lock the handle in the ON position. Trip-free operation permits the circuit breaker to trip if the handle is locked in the ON position. For this condition, the handle will continue to indicate ON.

The handle is removable, and a 10-inch (250mm) shaft extension is available to use with the handle mechanism when the circuit breaker is mounted behind the fixed or hinged front cover of a NEMA 1 enclosure. Provision is made for mounting an early-make/early-break auxiliary switch on the handle mechanism for use with undervoltage release mechanisms. Styles with red handles and yellow background labels are available for use on main disconnect devices where required by local codes. The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.①

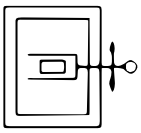
① UL listing pending, refer to Westinghouse.
② The electrical operator design is endurance tested for 10,000 electrical operations.
③ Tolerance: +10%, −15% of nominal voltage
④ Use current-limiting type fuse where required



Vari-Depth Handle Mechanism

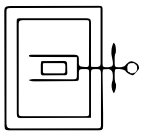


The vari-depth handle mechanism provides a means of externally operating the circuit breaker and can be applied to enclosures of varying depths. The handle mechanism can be used in NEMA 1, 3R, 4, 7, 9, and 12 enclosure applications, depending on the accessory components selected. The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 5/16 inch (7.94mm). The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.

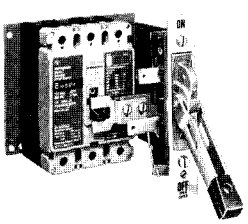


Slide Plate Handle Mechanism

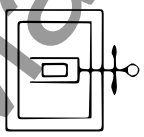
The slide plate handle mechanism provides a means of externally operating a circuit breaker installed in a shallow depth enclosure. When applied to enclosures that are hinged on the right-hand side, the handle mechanism also functions as an enclosure locking device. The handle mechanism can be used in NEMA 1, and 12 enclosure applications; a special version can be used in NEMA 3, 4, and 5 enclosure applications. The handle mechanism will accept up to three padlock shackles each with a maximum diameter of 5/16 inch (7.94mm). The handle mechanism is an Underwriters Laboratories, Inc. recognized component for panelboard accessories under UL File E56845.



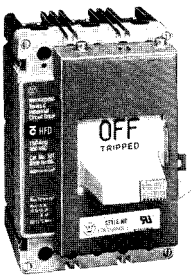
Type SM Safety Handle Mechanism



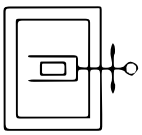
The SM safety handle mechanism provides a means of externally operating a circuit breaker mounted in an enclosure and is designed to reduce the possibility of circuit breaker tampering. The handle mechanism is especially suited for use in automotive and machine tool industries through its conformance to NEMA 12 and J. I. C. requirements. A specially modified handle mechanism for NEMA 4 enclosure applications is also available. The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 3/8 inch (9.52mm). The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.



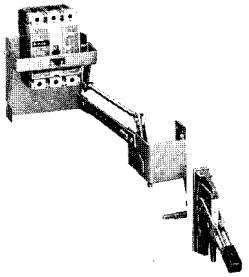
Type MC Motor Control Handle Mechanism



The MC motor control handle mechanism is a linear-operating, fixed depth mechanism designed for through door mounting in standardized and shallow depth enclosures. The handle mechanism provides positive operation and direct disconnect status indication and is interlocked with the enclosure door so that the door can be opened only when the handle is OFF. (A defeater supplied with the handle mechanism can be used to bypass the interlock for maintenance and inspection.) The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 3/8 inch (7.92mm). The handle mechanism is an Underwriters Laboratories, Inc. recognized component for panelboard accessories under UL File E56845.



Type AMT Vari-Depth/ Vari-Width Handle Mechanism



Series C Molded Case Circuit Breakers, F-Frame
Section 7 – Guide Specifications

Typical Specifications For Series C Molded Case Circuit Breakers

Electrical circuits shall be protected by Series C Molded Case Circuit Breakers as manufactured by Westinghouse Electric Corporation.

Each pole of the circuit breakers shall provide complete circuit overcurrent protection by having inverse time and instantaneous tripping characteristics and, where applicable, be current limiting.

The circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against short circuit currents. Tripping due to overload or short circuits shall be clearly indicated by the position of the handle. The ON and OFF positions shall be clearly marked on the cover of the circuit breaker along with the international symbols 1 for ON and 0 for OFF on the handle providing positive indication of the circuit breaker contact position. Additionally, a color-coded indication of the circuit breaker contact position shall be provided: red for ON, green for OFF, and white for tripped. An easily accessible Push-to-Trip button for mechanically exercising the trip unit shall be provided on the cover of each circuit breaker. All poles of a multi-pole circuit breaker shall be so constructed as to ensure simultaneous open, close, and trip operations.

Circuit breakers shall be completely enclosed in a high strength glass-polyester case. Non-interchangeable trip circuit breakers shall be factory sealed; interchangeable trip circuit breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible from the front of the circuit breaker. Contacts shall be non-welding silver alloy. Arc extinction must be accomplished by means of DE-ION® arc chutes, consisting of metal grids mounted in an insulating support.

The minimum interrupting ratings of the circuit breakers shall be at least equal to the available short circuit current at the line terminals. Where applicable, circuit breakers shall be UL listed for series tested application.

Circuit breakers in frame sizes 100A through 600A shall be equipped with thermal-magnetic trip units. Circuit breakers in 1200A and through 1600A frame sizes shall be equipped with solid state trip units that are insensitve to changes in ambient temperature within the normal operating temperature range of the circuit breaker. 250A, 400A, 600A, and 630A frame sizes shall be designed to accept either thermal-magnetic or solid state interchangeable trip units.

Circuit breakers shall be listed with Underwriters Laboratories, Inc. under standard UL489, conform to the applicable requirements of NEMA Standards Publication AB1-1975, meet the appropriate classifications of Federal Specifications W-C-375b, and/or comply with the requirements of International Electrotechnical Commission Recommendation, IEC 157-1.

Circuit breaker ratings and modifications shall be indicated on the drawings.

Molded case circuit breakers shall be of the inverse time and instantaneous trip type as provided by thermal-magnetic or solid state trip elements with either standard interrupting, high interrupting, or current limiting characteristics as shown in Section 1 of this frame book. These circuit breakers shall be listed per UL489.

Molded case circuit interrupters shall be of the instantaneous (magnetic) only type, providing instantaneous short circuit protection by means of a front adjustable trip unit. Instantaneous-only circuit interrupters shall be component recognized per UL489.

Molded case switches shall be of the same construction as the related listed circuit breaker and equipped with a factory sealed, nonadjustable, high instantaneous-only tripping feature. Alternately, molded case switches shall be equipped with non-automatic tripping features.

Molded case switches shall have no overload or low level fault protection provided and shall be marked with a maximum withstand rating denoting the type and level of upstream protection required. Molded case switches shall be listed per UL1087.

Internally mounted accessories including alarm (signal)/lockout switches, auxiliary switches, shunt trips, and undervoltage release mechanisms shall be of the plug-in type and shall be listed for field installation in circuit breakers which are not factory sealed.

Electrical operators for circuit breakers of the 250A frame size and below shall be of the single solenoid type with maximum 5-cycle (80 ms) closing characteristics. Electrical operators for circuit breaker frame sizes 400A through 1600A shall be of the motor driven type with an optional 2-step stored energy mechanism providing maximum 5-cycle (80 ms) closing. All electrical operators shall be cover mounted and fit within the trim line of the circuit breaker. All electrical operators shall be listed for field installation per UL489.

Electrical characteristics of accessories shall be as indicated on the drawings.

Circuit breakers in the 150A frame size shall be supplied in 1-, 2-, 3-, and 4-pole models as specified on the drawings. Circuit breakers in frame sizes 250A through 1600A shall be supplied in 2-, 3-, or 4-pole models as specified on the drawings.

Accessory wiring shall be brought out through the side or rear of the circuit breaker or be connected to a terminal block mounted on the side of the circuit breaker as specified. The ability to route accessory wiring to the opposite side of the circuit breaker through a trough in the base shall be provided.

Circuit breakers shall be provided with uniformly designed nameplates to clearly indicate the type, rating, listing/recognition/certification marks, accessory details, and other information defined in UL489.

All terminals shall comply with UL486A and B and CSA 1165A Standards. Torque markings shall be provided per UL489.

Westinghouse Electric Corporation
Distribution and Protection Business Unit
Commercial Division – Components
Beaver, Pennsylvania U.S.A. 15009

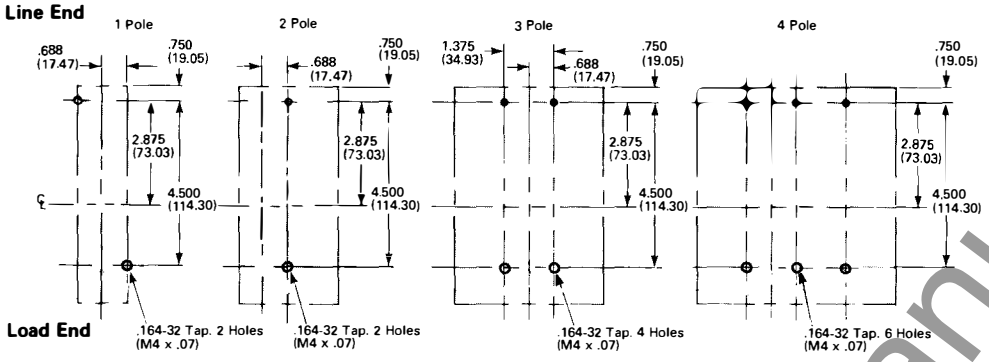
Printed in USA

January, 1985

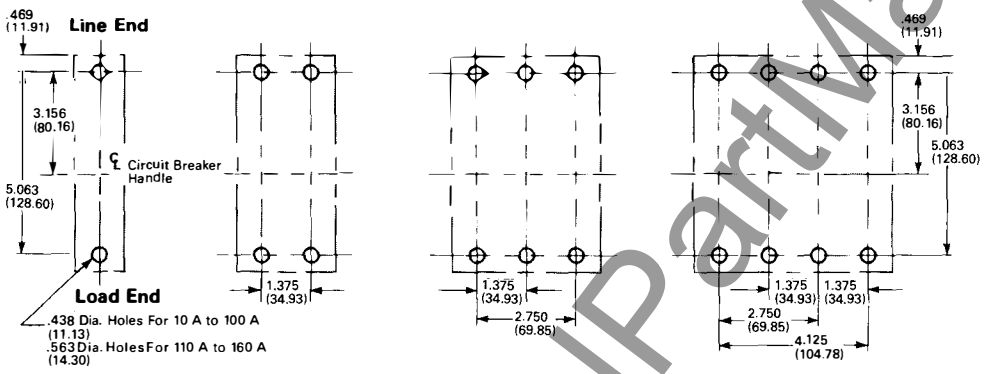
Series C Molded Case Circuit Breakers, F-Frame
Section 6 – Dimensional Data

Dimensions in Inches and (Millimeters)
Not to be used for construction purposes unless approved.

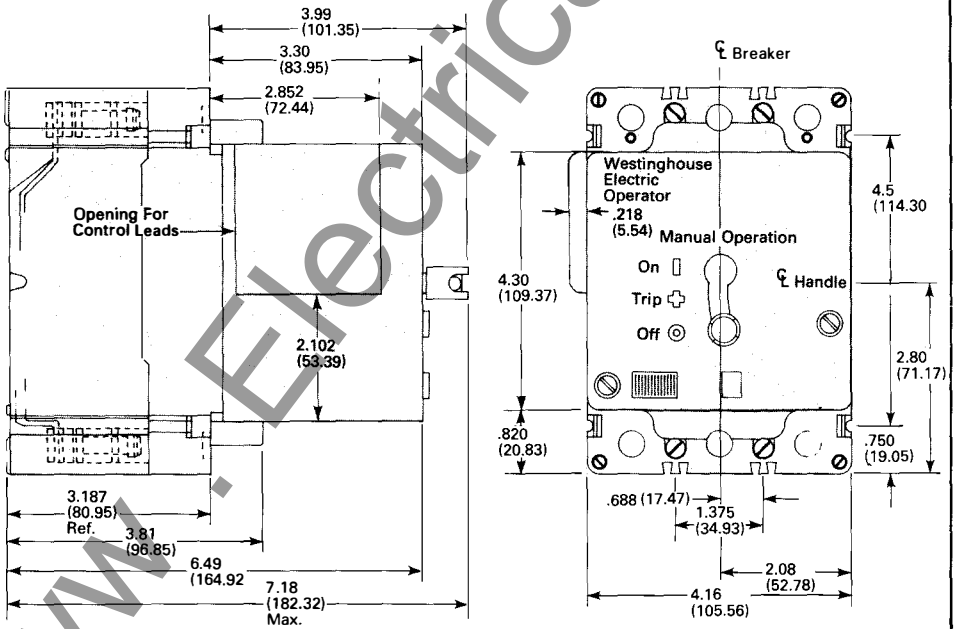
Front Connected Drilling Plan
Line End



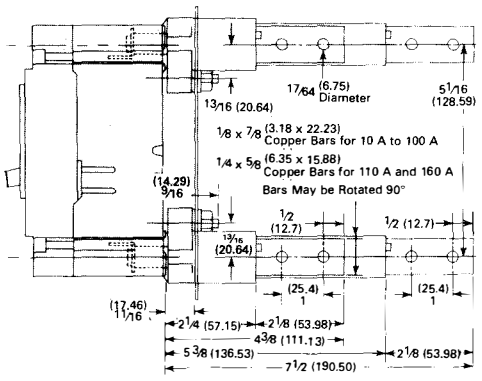
Rear Connected Drilling Plan



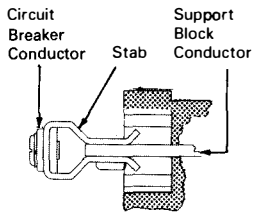
Electrical (Solenoid) Operator



Plug-in Adapter



Plug-in and Bolt-on Detail



Plug-in
Bolt stab to circuit breaker conductor, then plug into support block.

Bolt-on
Bolt stab to support block, then bolt support block to circuit breaker conductors.

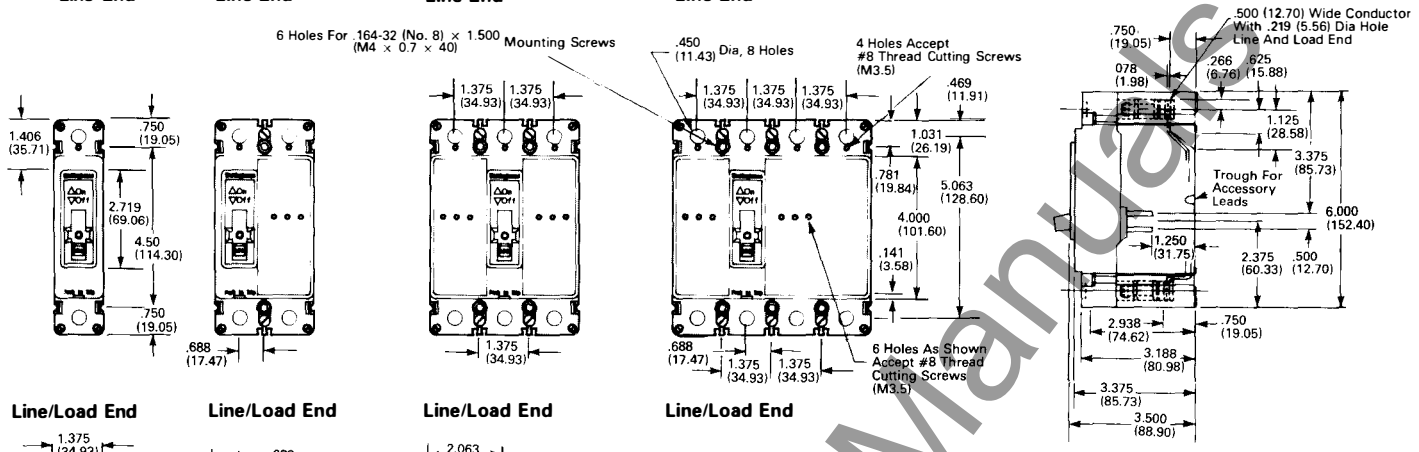
Series C Molded Case Circuit Breakers, F-Frame

Section 6 – Dimensional Data

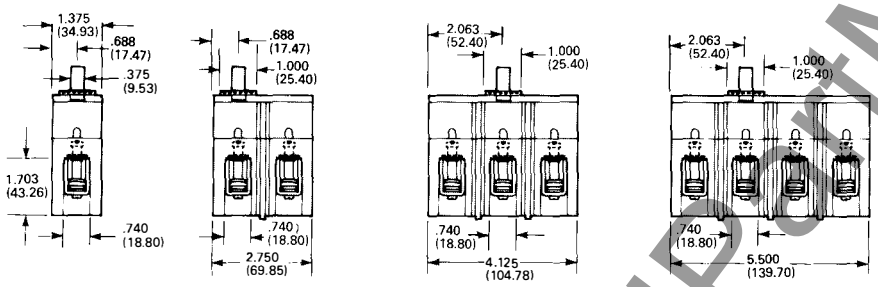
Dimensions in Inches and (Millimeters)

Not to be used for construction purposes unless approved.

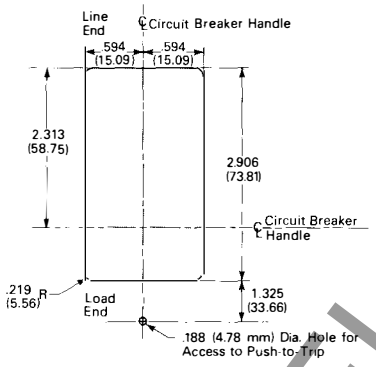
Line End **Line End** **Line End** **Line End**



Line/Load End **Line/Load End** **Line/Load End** **Line/Load End**

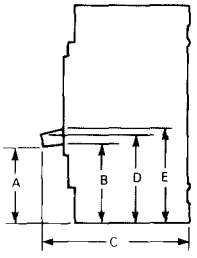


Front Cover Cutout



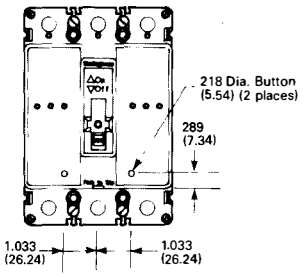
Circuit Breaker Handle Travel Distances

Circuit Breaker Status	Dimension A	B	C	D	E
On	3.07 (77.98)	2.92 (74.17)	3.96 (100.58)	3.40 (86.36)	3.33 (84.58)
Tripped	2.65 (67.30)	2.57 (65.28)	4.06 (103.12)	2.99 (75.95)	2.98 (75.69)
Off	2.08 (52.83)	2.14 (54.36)	4.12 (104.65)	2.42 (61.47)	2.56 (65.02)
Reset	1.98 (50.29)	2.05 (52.07)	4.11 (104.39)	2.30 (58.42)	2.48 (62.99)



Adjustable Thermal/Magnetic Buttons

Line End



Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Door Hardware
Door hardware listed in this section may be used with Types SM and AMT handle mechanisms.

Three choices of door hardware and an auxiliary handle are offered to provide the best latching scheme for individual needs. The door hardware is designed with a provision for padlocking, and a coin-proof slot that requires the use of a tool to open the door, for maximum security.

Select desired hardware below. Additional latches can be ordered from accessories section if desired.

Hardware Item	Description and Catalog Numbers
	With sliding latches for smaller panels up to approx. 30" high. Catalog Numbers Right Hand: DH1R Left Hand: DH1L
	With 2 roller latches for intermediate panels up to approx. 40" high. Catalog Numbers Right Hand: DH2R Left Hand: DH2L
	With 3 roller latches for larger panels approx. 40" and higher. Catalog Numbers Right Hand: DH3R Left Hand: DH3L
	Auxiliary handle for larger panels Catalog Numbers Right Hand: DH4R Left Hand: DH4L

Note:
Right hand enclosure cover hinged on left,
Left hand enclosure cover hinged on right.

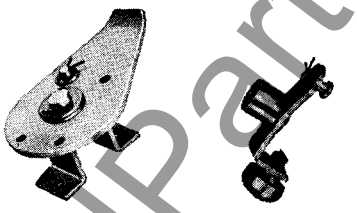
Accessories
Dress Nameplates: Required to meet automotive specifications. Mounts from inside enclosure and covers operating mechanism mounting bolts, making mechanism non-removable when enclosure door is closed.

Style Number: 373D260G05

Electrical Interlock Kit: Provides 1 N. C. and 1 N. O. contacts (SPDT switch) for use with auxiliary circuits. Mounts to end of mechanism housing as shown.

Style Number: 622B747G01

Auxiliary Latch Kits: Provide an additional latch for use with applications where two point latching may not be adequate.



Sliding Latch **Rolling Latch**

For Door Hardware Using Sliding Latches
Right or Left Hand Mtg.: Style No. 656D669G01

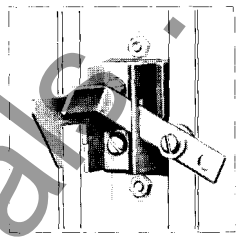
For Door Hardware Using Roller Latches
Right Hand Mtg.: Style No. 370D801G04

Left Hand Mtg.: Style No. 370D802G04

Door Operated Interlock Defeater Kit for Type SM Mechanisms: Required when door hardware is not used, operates as door closes. Additional door securing means such as screw latch, also required (to be supplied by box manufacturer).

Style Number: 623B214G02

Door Hardware Kit
Cat. No. AMTDHA



This adapter kit is for use with door hardware kits DH1R, DH2R, or DH3R for type SM handle mechanisms to permit the use and interlocking of right hand installation of the type AMT handle mechanism (Below-the-Handle or Above-the-Handle type).

Door Interlock Kit for Side Plate Handle Mechanism
Three point interlock for use with mechanisms where regular interlock is not adequate.

Style Number 28A2656G08
(Drilling Plan Reference 208B624)

ORDERING INFORMATION

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Lock and Interlock Accessories

Nonlockable Handle Block

Catalog Number: LKD1

One per circuit breaker.

Padlockable Handle Lock Hasp

Catalog Number: PLK1

The padlockable handle lock can be mounted on either side of the operating handle. One per circuit breaker: field installation only.

Cylinder Lock

The cylinder lock is factory installed in the circuit breaker cover. Internal accessories cannot be installed in the same pole as the cylinder lock.

Number of Poles	Mounting Location		
	Left	Right	Neutral
	Catalog Numbers		
2	.....	CLK1R	.....
3	CLK1L	CLK1R	.....
4	CLK1L	CLK1R	CLK1N

Key Interlock Mounting Kit

Key interlock mounting kits are for field installation only. Select mounting kit catalog numbers to match type of lock used. Key interlocks are supplied by customer.

Lock Manufacturer	Lock Type	Bolt Projection in Withdrawn Position	Kit Cat. No.
Superior	B-4003-1	3/8 inch	KYK1
Kirk	F	3/8 inch	
Square D	SF	None	
Federal Pioneer	VF	3/8 inch	
Castell	K or QK	3/8 inch	CTK1

Sliding Bar Interlock

Catalog Number: SBK1

The sliding bar interlock is available for mounting between two adjacent 3pole circuit breakers with circuit breaker centerline spacing at 4-1/8 inches; for field installation only.

Walking Beam Interlock

Catalog Number: WBL1

The walking beam interlock is available for mounting between two adjacent circuit breakers spaced 1/4 inch apart and having the same pole configuration. The two circuit breakers must be factory modified to accept the walking beam interlock assembly (suitable for use with either 2-, 3-, or 4-pole circuit breakers). With properly modified circuit breakers, the walking beam interlock is suitable for field installation. Order circuit breakers of the type and rating required modified for field installation of the walking beam interlock.

Miscellaneous Accessories

Base Mounting Hardware

Base mounting hardware is supplied at no charge when ordered with a circuit breaker or molded case switch. When ordering separately, refer to price list.

English Thread

No. of Poles	Description	Type of Mounting	Style Numbers
1	.164-32 x 3.188 inch Pan-Head Steel Screws, Lockwashers, and Clamps	Individual	624B375G01
		Group (one set of hardware for two circuit breakers)	624B375G02
2	.164-32 x 1.5 inch Pan-Head Steel Screws and Lockwashers	Individual	4218B80G01
3, 4		Individual	4218B80G02

Metric Thread

No. of Poles	Description	Type of Mounting	Numbers
1	M4 - 0.7 x 80mm Pan-Head Steel Screws, Lockwashers, and Clamps	Individual	4218B80G09
		Group (one set of hardware for two circuit breakers)	4218B80G10
2	M4 - 0.7 x 38mm Pan-Head Steel Screws and Lockwashers	Individual	4218B80G11
3, 4		Individual	4218B80G12

LFB Current Limiter Attachment

Circuit Breaker Rating① Amps.	Catalog Numbers
15-70	LFB3070R
80-160	LFB3150R

① Ratings through 70A can be supplied with terminals for Cu cable only (#14 – #2.) Order by description.

Earth Leakage Protection Module

Refer to Westinghouse for ratings and availability.

Modifications

Special Calibration

Type of Calibration	1 – 24 Identical Units	24 or More Identical Units
Thermal	Add 10% to list price of complete circuit breaker	No price addition
Magnetic		No price addition
Frequency		No price addition

Moisture-Fungus Treatment

Order by description, refer to price list.

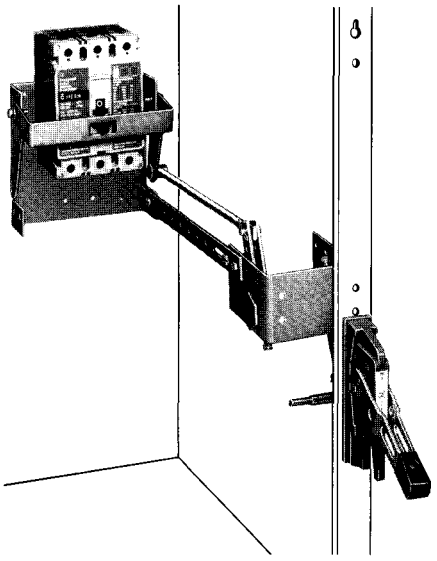
Marine Applications

When listing Mark for marine applications under UL489 is required, specify requirement when ordering. Nonaluminum terminals must be used. Available on D model circuit breakers only. No price addition applies.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Type AMT Vari-Depth, Vari-Width Flange Mounted Handle Mechanism

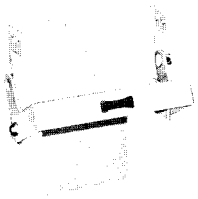
For Type EHD, FDB, FD, HFD, FDC, FW, HFW and FWC Molded Case Breakers



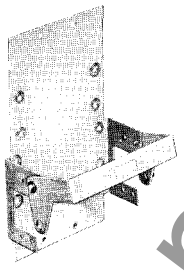
Assembled Type AMT for Above Handle Mounting (Breaker Not Included)

Type AMT Component Parts

Backplate and Yoke Assembly

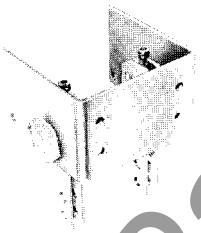


Below Handle Mtg.



Above Handle Mtg.

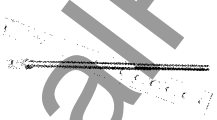
Flange Mounted Pivot Mechanism

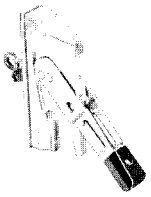


Above Handle Mtg.

Below Handle Mtg.

Rod Brace Assembly





Operating Handle

Catalog Numbers

Complete Assembly	Consists of and Shipped as Component Parts Listed Below			
	Backplate and Yoke Assembly	Operating Rod and Brace Assembly①	Flange Mounted Pivot Mechanism Assembly①	External Operating Handle
Above Handle Mounting With Short Rod and Brace				
AMTFBASV	AMTFB	AMTRB1	AMTPM	AMTOP
Above Handle Mounting With Long Rod and Brace				
AMTFBALV	AMTFB	AMTRB2	AMTPM	AMTOP
Below Handle Mounting With Short Rod and Brace				
AMTFBBSV	AMTFB-B	AMTRB1	AMTPM-B	AMTOP
Below Handle Mounting With Long Rod and Brace				
AMTFBBLV	AMTFB-B	AMTRB2	AMTPM-B	AMTOP
Below Handle Fixed-Width With Short Rod				
AMTFBBSF	AMTFB-B	AMTRB	AMTPM-F	AMTOP

① Width spacer kit not included.
② Fixed-width pivot mechanism shown on page 28.

AMTR 4/87

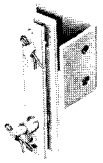
Ordering Information

1. Order a complete mechanism using Complete Assembly catalog number. Mechanism will be shipped as individual components shown above and listed below.
2. Order spacer kits or door hardware adapter as required.
3. Individual component parts may be ordered by Catalog Number.

Accessories for Type AMT Mechanisms

Spacer Kit to Vary Width (Not for use with fixed mechanisms)
Cat. Number: AMTSK1
This spacer kit is for up to 1-inch variation and consists of multiples of thin spacers to be used as required. A maximum of two kits per installation may be used. Hardware is not supplied because of dimensional variations. Use standard ¼-inch x 20 bolts.

Fixed Width Pivot Mechanism
Cat. No. AMTPM-F



Enclosure Depth Dimensions in Inches for Operating Rod and Brace Assembly

Short Rod		Long Rod	
Cat. No.	**AMTRB1**	Cat. No.	**AMTRB2**
Min.①	**Max.**	Min.	**Max.**
6½	**14**	12½	**18**

① Width spacer kits cannot be used with short rod at minimum enclosure depth.

ORDERING INFORMATION

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Undervoltage Release Mechanism (Handle Reset)
Select handle reset undervoltage release mechanism catalog number for the voltage within the indicated voltage range. Undervoltage release mechanism coils are designed to be applied at specific ac or dc voltages within the voltage range shown. Specific application voltages and electrical ratings are shown in Table 4-4. Electrical ratings are shown on applicable circuit breaker accessory nameplates.

Voltage Rating (ac Freq = 50/60 Hz)	Connection Type and Location: 18-inch Pigtail Leads – Same Side	18-inch Pigtail Leads – Rear⑥	18-inch Pigtail Leads – Opposite Side	Terminal Block – Same Side	Field Installation Kits① – Pigtail Leads	Field Installation Kits① – Terminal Block
	Catalog Numbers				Catalog Numbers	
Left Pole Mounting						
9- 12 Vac, 12 Vdc	UVH1LA02	UVH1LB02	UVH1LC02	UVH1LT02	UVH1LP02K	UVH1LT02K
24 Vac or Vdc	UVH1LA03	UVH1LB03	UVH1LC03	UVH1LT03	UVH1LP03K	UVH1LT03K
48- 60 Vac or Vdc	UVH1LA05	UVH1LB05	UVH1LC05	UVH1LT05	UVH1LP05K	UVH1LT05K
110-127 Vac or Vdc	UVH1LA08	UVH1LB08	UVH1LC08	UVH1LT08	UVH1LP08K	UVH1LT08K
208-240 Vac	UVH1LA11	UVH1LB11	UVH1LC11	UVH1LT11	UVH1LP11K	UVH1LT11K
380-480 Vac	UVH1LA15	UVH1LB15	UVH1LC15	UVH1LT15	UVH1LP15K	UVH1LT15K
525-600 Vac	UVH1LA18	UVH1LB18	UVH1LC18	UVH1LT18	UVH1LP18K	UVH1LT18K
220-250 Vdc	UVH1LA28	UVH1LB28	UVH1LC28	UVH1LT28	UVH1LP28K	UVH1LT28K
Right Pole Mounting②						
9- 12 Vac, 12 Vdc	UVH1RA02	UVH1RB02	UVH1RC02	UVH1RT02	UVH1RP02K	UVH1RT02K
24 Vac or Vdc	UVH1RA03	UVH1RB03	UVH1RC03	UVH1RT03	UVH1RP03K	UVH1RT03K
48- 60 Vac or Vdc	UVH1RA05	UVH1RB05	UVH1RC05	UVH1RT05	UVH1RP05K	UVH1RT05K
110-127 Vac or Vdc	UVH1RA08	UVH1RB08	UVH1RC08	UVH1RT08	UVH1RP08K	UVH1RT08K
208-240 Vac	UVH1RA11	UVH1RB11	UVH1RC11	UVH1RT11	UVH1RP11K	UVH1RT11K
380-480 Vac	UVH1RA15	UVH1RB15	UVH1RC15	UVH1RT15	UVH1RP15K	UVH1RT15K
525-600 Vac	UVH1RA18	UVH1RB18	UVH1RC18	UVH1RT18	UVH1RP18K	UVH1RT18K
220-250 Vdc	UVH1RA28	UVH1RB28	UVH1RC28	UVH1RT28	UVH1RP28K	UVH1RT28K

① Not listed with Underwriters Laboratories, Inc. for field installation.
② Standard mounting location.

Handle Operating Accessories

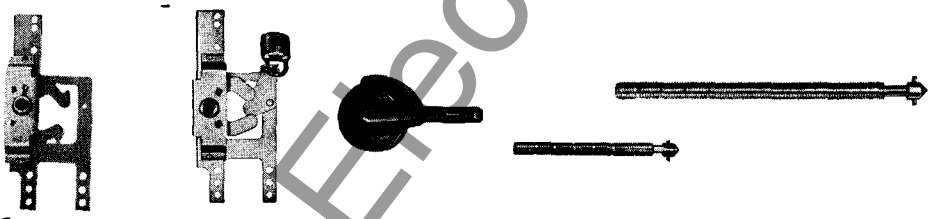
Electrical (Solenoid) Operator

Operating Voltage	Frequency	Catalog Numbers: Terminal Block	18-Inch Pigtail Lead
24	50/60 Hz	EOP1T03	EOP1P03
120	or	EOP1T07	EOP1P07
240	DC	EOP1T11	EOP1P11

Rotary Handle Mechanism

Description	Catalog Number
Rotary handle mechanism standard grey handle:	RHM1G
Rotary handle mechanism optional red handle with yellow label:	RHM1R
Early-make electrical interlock kit (2a-2b):	RHM1EK
Cylinder lock kit:	RHM1CLK
Standard grey remote mounted handle extension shaft kit:	RHM1EGK
Optional red remote mounted handle (with yellow label) extension shaft kit:	RHM1ERK

Vari-Depth Handle Mechanism



Mechanisms③④⑤ – Standard – (No Internal Lockoff) Style Number	Mechanisms③④⑤ – Special – (With Internal Lockoff) Style Number	Handle – NEMA 1, 3R, 12 (With Hardware) Style Number	Shaft – Standard Style Number	Shaft – Standard Panel Depth	Shaft – Long Style Number	Shaft – Long Panel Depth
373D958G05	373D958G06	47A4446G21	47A4446G16	5-10¼	47A4446G15	10½-14

③ When circuit breaker is used with plug-in kits or rear connected studs, special mounting hardware is required. Refer to Westinghouse.
④ Includes hardware.
⑤ Outline and drilling plan reference – drawing 653D270.
⑥ Standard pigtail lead exit location.

Accessories for Vari-Depth Handle Mechanism
Special Handles: Meet NEMA 4 requirements. These handles are similar to standard handles, except they include an internal neoprene gasket. Due to gasketing effect between handle and housing, handle will not indicate a tripped position when used with circuit breakers.

Standard Finish:
Style Number: 504C323G01

Handle Kits: These kits are for use with NEMA 4, 7 and 9 cast enclosures. The kits include a special operating handle, mounting bolts and an adapter bushing (bushing may be purchased separately). Kits may be used with standard mechanisms and shafts as required.

For NEMA 4, 9 Enclosure
Kit Style Number: 314C794G08

For NEMA 7 Enclosure
Kit Style Number: 314C794G03

Adapter Bushing Only:
Style Number: 314C794G04

Type MC Motor Control Handle Mechanism
For use with NEMA 1 Enclosure
Catalog Number SMCU150FB

For use with NEMA 12 Enclosure
Catalog Number CMCU150FB

Type SM Safety Handle Mechanism
Right Hand Mounting, Enclosure Cover Hinged on Left: Cat. No. SM150R

Left Hand Mounting, Enclosure Cover Hinged on Right: Cat. No. SM150L
For Door Hardware, see page 29

Slide Plate Handle Mechanism

Enclosure Cover Hinged on Right (Drilling Plan Reference: 657D074)
Vertical Mounting,
Padlocks in OFF Position
Style No. 314C386G03

Padlocks in ON or OFF Position
Style Number 314C386G10

Horizontal Mounting,
Padlocks in "OFF" Position
Style Number 314C386G06

NEMA 3, 4, 5 Outdoor or Hazardous Location Handle Mechanisms
(Drilling Plan Reference 48A3656)

Padlocks in OFF Position
Style Number 48A3656G03

Padlocks in ON or OFF Position
Style Number 48A3656G04

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Internal Accessories
Alarm (Signal)/Lockout Switch

Number of Contacts (Make and Break)	Mounting Location (Pole)	Connection Type and Location					
		18-inch Pigtail Leads			Terminal Block	Field Installation Kits①	
		Same Side	Rear④	Opposite Side	Same Side	Pigtail Leads	Terminal Block
		Catalog Numbers				Catalog Numbers	
1	Left②	A1L1LA	A1L1LB	A1L1LC	A1L1LT	A1L1LPK	A1L1LTK
	Right	A1L1RA	A1L1RB	A1L1RC	A1L1RT	A1L1RPK	A1L1RTK
2	Left②	A2L1LA	A2L1LB	.....	A2L1LT	A2L1LPK	A2L1LTK
	Right	A2L1RA	A2L1RB	.....	A2L1RT	A2L1RPK	A2L1RTK
1 (Make Only)	Single Pole	A1L1CA③					

Auxiliary Switch

Number of Contacts a and b	Mounting Location (Pole)	Connection Type and Location					
		18-inch Pigtail Leads			Terminal Block	Field Installation Kits●	
		Same Side	Rear④	Opposite Side	Same Side	Pigtail Leads	Terminal Block
		Catalog Numbers				Catalog Numbers	
1	Left② Right or Neutral	A1X1LA A1X1RA	A1X1LB A1X1RB	A1X1LC A1X1RC	A1X1LT A1X1RT	A1X1PK A1X1PK	A1X1LTK A1X1RTK
2	Left② Right or Neutral	A2X1LA A2X1RA	A2X1LB A2X1RB	....	A2X1LT A2X1RT	A2X1PK A2X1PK	A2X1LTK A2X1RTK

Auxiliary Switch and Alarm (Signal)/Lockout Switch Combination

Mounting Location (Pole)	Connection Type and Location				
	18-inch Pigtail Leads		Terminal Block	Field Installation Kits①	
	Same Side	Rear④	Same Side	Pigtail Leads	Terminal Block
	Catalog Numbers			Catalog Numbers	
Left	AAL1LA	AAL1LB	AAL1LT	AAL1LPK	AAL1LTK
Right	AAL1RA	AAL1RB	AAL1RT	AAL1RPK	AAL1RTK

Shunt Trip

Select shunt trip catalog number for the voltage within the indicated voltage range. Shunt trip coils are designed to be applied at specific ac or dc voltages within the voltage range shown. Specific application voltages and electrical ratings are shown in Table 4-3. Electrical ratings are also shown on applicable circuit breaker accessory nameplates.

Voltage Rating (Ac Freq = 50/60 Hz)	Connection Type and Location					
	18-inch Pigtail Leads			Terminal Block	Field Installation Kits①	
	Same Side	Rear④	Opposite Side	Same Side	Pigtail Leads	Terminal Block
	Catalog Numbers				Catalog Numbers	
Left Pole Mounting						
9- 24 Vac or Vdc	SNT1LA03	SNT1LB03	SNT1LC03	SNT1LT03	SNT1LP03K	SNT1LT03K
48-127 Vac or Vdc	SNT1LA08	SNT1LB08	SNT1LC08	SNT1LT08	SNT1LP08K	SNT1LT08K
208-380 Vac	SNT1LA12	SNT1LB12	SNT1LC12	SNT1LT12	SNT1LP12K	SNT1LT12K
415-600 Vac or 220-250 Vdc	SNT1LA18	SNT1LB18	SNT1LC18	SNT1LT18	SNT1LP18K	SNT1LT18K
Right② or Neutral Pole Mounting						
9- 24 Vac or Vdc	SNT1RA03	SNT1RB03	SNT1RC03	SNT1RT03	SNT1RP03K	SNT1RT03K
48-127 Vac or Vdc	SNT1RA08	SNT1RB08	SNT1RC08	SNT1RT08	SNT1RP08K	SNT1RT08K
208-380 Vac	SNT1RA12	SNT1RB12	SNT1RC12	SNT1RT12	SNT1RP12K	SNT1RT12K
415-600 Vac or 220-250 Vac	SNT1RA18	SNT1RB18	SNT1RC18	SNT1RT18	SNT1RP18K	SNT1RT18K

① Not listed with Underwriters Laboratories, Inc. for field installation.
② Standard mounting location.
③ Leads exit load end of circuit breaker. Factory installation only.
④ Standard pigtail lead exit location.

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Panelboard Connecting Straps
The panelboard connecting straps are available in three sizes to meet the needs of most standard panelboard applications. The panelboard connecting straps are listed by panelboard bus spacing. Style numbers for special mounting brackets for CDP panelboard installations are also included.

Bus Spacing (Inches)	Continuous Current Rating (Amperes)	Pole Connector Type	
		Center	Outside
		Style Number	Style Number
5-3/4 Inch Deep Box, 240 Vac Max			
2¼	50	673B142G07	673B142G06
5-3/4 Inch Deep Box, 600 Vac Max			
2¼	50	673B142G02	673B142G09
2½	100	673B142G02	673B142G10
2¼	150	673B142G04	673B142G03
3½	50	1253C72G01	1253C72G02
3½	100	1253C73G03	1253C73G04
3½	150	1253C73G01	1253C73G02

Mounting Bracket

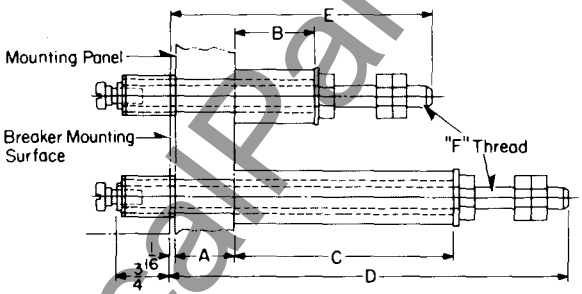
Style Numbers	
2-Pole	3-Pole
624B600H02	624B600H01

Rear Connecting Studs
Each rear connecting stud assembly consists of one stud and one tube. Select alternate long and short stud assemblies for circuit breakers with more than one pole to maintain proper clearances between poles. One assembly is required for line-end and one for load-end of each pole. Tubes must be ordered separately. Connecting studs are available only with English thread sizes.

Plug-In Adapter
Plug-in adapters are available for 2-, 3-, and 4-pole circuit breaker configurations. One plug-in adapter is used for each terminal end (line or load); specify quantity when ordering. A one-piece steel mounting plate is available at no charge when ordered with line and load plug-in adapters (field installation only).

Continuous Current Rating (Amperes)	Style Numbers		
	2-Pole	3-Pole	4-Pole
100	507C036G01	507C036G03	179C968G01
150/160	507C036G02	507C036G04	179C968G02
Mounting Plate	176C511G01	507C047G01	①

① Refer to Westinghouse for availability.



Stud Ampere Rating	Stud Style Number	Panel Thickness (Inches)	Tube Length (Inches)		Tube Style Number	Dimensions (Inches)		
		A	B	C		D	E	F
For 15A to 100A Circuit Breakers								
100A Short	451D874G01	1	1 1/16	....	32B9446H20	....	3 5/8	5/16 - 18
100A Short	451D874G01	1 1/16 to 1 5/16	1 3/8	....	32B9446H21	....		
100A Short	451D874G01	3/8 to 5/8	1 11/16	....	32B9446H22	....		
100A Short	451D874G01	1/4 to 5/16	2	....	32B9446H23	....		
100A Long	451D874G02	1	....	3 7/16	32B9446H24	6 1/8	....	
100A Long	451D874G02	1 1/16 to 1 5/16	....	3 3/4	32B9446H25		....	
100A Long	451D874G02	3/8 to 5/8	....	4 1/16	32B9446H26		....	
100A Long	451D874G02	1/4 to 5/16	....	4 3/8	32B9446H27		....	
For 110A to 160A Circuit Breakers								
160A Short	374D883G01	1	1 1/16	....	374D883H06	....	4 1/4	7/16 - 14
160A Short	374D883G01	1/16 to 5/16	1 3/8	....	374D883H07	....		
160A Short	374D883G01	3/8 to 5/8	1 11/16	....	374D883H08	....		
160A Short	374D883G01	1/4 to 5/16	2	....	374D883H09	....		
160A Long	374D883G02	1	....	3 7/16	374D883H10	7 1/2	....	
160A Long	374D883G02	1 1/16 to 1 5/16	....	3 3/4	374D883H11		....	
160A Long	374D883G02	3/8 to 5/8	....	4 1/16	374D883H12		....	
160A Long	374D883G02	1/4 to 5/16	....	4 3/8	374D883H13		....	

ORDERING INFORMATION

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Molded Case Switch Selection
Molded case switch catalog numbers are identified in Tables 5-6, 5-7, and 5-8. For UL listed, series tested circuit breaker-molded case switch and fuse-molded case switch application data, refer to Westinghouse. Molded case switches ordered using these catalog numbers include standard load terminals only.

Table 5-6. Type EHD High Magnetic (K) and Non-Automatic (N) Molded Case Switch Catalog Numbers

Continuous Ampere Rating at 40°C	1-Pole 277 Vac 125 Vdc	2-Pole 480 Vac 250 Vdc	3-Pole 480 Vac
	Type EHD (K)		
100	EHD1100K	EHD2100K	EHD3100K
	Type EHD (N)		
100	EHD1100N	EHD2100N	EHD3100N

Table 5-7. Type FD, HFD, FDC High Magnetic (K) and Non-Automatic (N) Molded Case Switch Catalog Numbers

Continuous Ampere Rating at 40°C	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac
	Type FD (K)			
100	FD1100K	FD2100K	FD3100K	FD4100K
150	FD1150K	FD2150K	FD3150K	FD4150K
	Type HFD (K)			
100	HFD1100K	HFD2100K	HFD3100K	HFD4100K
150	HFD1150K	HFD2150K	HFD3150K	HFD4150K
	Type FDC (K)			
100	FDC1100K	FDC2100K	FDC3100K	FDC4100K
150	FDC1150K	FDC2150K	FDC3150K	FDC4150K
	Type FD (N)			
100	FD1100N	FD2100N	FD3100N	FD4100N
150	FD1150N	FD2150N	FD3150N	FD4150N

Table 5-8. Type FW, HFW, FWC High Magnetic (K) and Non-Automatic (N) Molded Case Switch Catalog Numbers①

Continuous Ampere Rating at 40°C	1-Pole 277 Vac 125 Vdc	2-Pole 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac
	Type FW (K)			
100	FW1100K	FW2100K	FW3100K	FW4100K
160	FW1160K	FW2160K	FW3160K	FW4160K
	Type HFW (K)			
100	HFW1100K	HFW2100K	HFW3100K	HFW4100K
160	HFW1160K	HFW2160K	HFW3160K	HFW4160K
	Type FWC (K)			
100	FWC1100K	FWC2100K	FWC3100K	FWC4100K
160	FWC1160K	FWC2160K	FWC3160K	FWC4160K
	Type FW (N)			
100	FW1100N	FW2100N	FW3100N	FW4100N
160	FW1160N	FW2160N	FW3160N	FW4160N

① W model molded case switches not UL listed.

Accessories
Accessory catalog or style numbers are identified on pages 23 through 29. All mounting hardware is supplied unless otherwise noted.

Termination Accessories
Line and Load Terminals
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 nonstandard or optional line and/or load terminals are required, order by style number (no charge when ordered with circuit breaker). Specify if factory installation required.

Max. Breaker Amps	Terminal Body Material	Wire Type	AWG Wire Range	Metric Wire Range mm²	Style Numbers Package of 3 Terminals
Standard Pressure Type Terminals					
20(EHD)	Steel	Cu/Al	#14-#10	2.5-4	624B100G14
100	Steel	Cu/Al	#14-1/0	2.5-50	624B100G02
160②	Aluminum	Cu/Al	#4-4/0	25-95	624B100G17
Optional Cu/Al Pressure Terminals					
50	Aluminum	Cu/Al	14-#4	2.5-16	624B100G10
100	Aluminum	Cu/Al	#4-4/0	25-95	624B100G17
100	Aluminum	Cu/Al	#14-1/0	2.5-50	624B100G19
160●	Stainless Steel	Cu/Al	#4-4/0	25-95	624B100G18
160②	Aluminum	Cu/Al	1/0-4/0	70-95	624B100G20

② UL listed through 150A only.
③ UL listing pending. - Cu WIRE ONLY

(Delete 4/87)

Keeper Nut
Keeper nuts are available in English and metric thread sizes in packages of 12.

Thread Type	Thread Size	Catalog Number Package of 12
English	10-32	KPR1
Metric	M-5	KPR1M

Interphase Barrier
Catalog Number (Package of 2 barriers): IPB1

The interphase barrier is available for extended insulation between circuit breaker poles. Specify quantity when ordering.

Style Nos. revised - See Fg. 0.1 dated 4/87

Terminal Shield
The terminal shield is available for line terminal areas in 1-, 2-, 3- and 4-pole circuit breakers. Special terminal shields are also available for use when an electrical (solenoid) operator is mounted on the circuit breaker. Standard terminal shields must be ordered in multiples of 10 (for each style number). Special terminal shields are packaged individually.

Number of Poles	Style Numbers Standard (Package of 10)	Special
1	625B229G03	.....
2	625B229G02	.....
3	625B229G01	4210B95G01
4	625B229G05	4210B95G02

Terminal End Cover
The terminal end cover is available for 3-pole circuit breakers only. Two conductor opening sizes are available. Specify quantity (one per circuit breaker) when ordering.

Conductor Opening Diameter (Inches)	Catalog Number
0.25 (6.35 mm)	TEC1
0.41 (10.41 mm)	TEC2

ORDERING INFORMATION

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Table 5-2. Type FD, HFD, FDC Thermal-Magnetic Circuit Breaker Catalog Numbers

Continuous Ampere Rating at 40°C	Type FD				Type HFD				Type FDC			
	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac	1-Pole 277 Vac 125 Vdc	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac
10●	FD1010	FD2010	FD3010	FD4010	HFD1010	HFD2010	HFD3010	HFD4010	.....	FDC2010	FDC3010	FDC4010
15	FD1015	FD2015	FD3015	FD4015	HFD1015	HFD2015	HFD3015	HFD4015	.....	FDC2015	FDC3015	FDC4015
20	FD1020	FD2020	FD3020	FD4020	HFD1020	HFD2020	HFD3020	HFD4020	.....	FDC2020	FDC3020	FDC4020
25	FD1025	FD2025	FD3025	FD4025	HFD1025	HFD2025	HFD3025	HFD4025	.....	FDC2025	FDC3025	FDC4025
30	FD1030	FD2030	FD3030	FD4030	HFD1030	HFD2030	HFD3030	HFD4030	.....	FDC2030	FDC3030	FDC4030
35	FD1035	FD2035	FD3035	FD4035	HFD1035	HFD2035	HFD3035	HFD4035	.....	FDC2035	FDC3035	FDC4035
40	FD1040	FD2040	FD3040	FD4040	HFD1040	HFD2040	HFD3040	HFD4040	.....	FDC2040	FDC3040	FDC4040
45	FD1045	FD2045	FD3045	FD4045	HFD1045	HFD2045	HFD3045	HFD4045	.....	FDC2045	FDC3045	FDC4045
50	FD1050	FD2050	FD3050	FD4050	HFD1050	HFD2050	HFD3050	HFD4050	.....	FDC2050	FDC3050	FDC4050
60	FD1060	FD2060	FD3060	FD4060	HFD1060	HFD2060	HFD3060	HFD4060	.....	FDC2060	FDC3060	FDC4060
70	FD1070	FD2070	FD3070	FD4070	HFD1070	HFD2070	HFD3070	HFD4070	.....	FDC2070	FDC3070	FDC4070
80	FD1080	FD2080	FD3080	FD4080	HFD1080	HFD2080	HFD3080	HFD4080	.....	FDC2080	FDC3080	FDC4080
90	FD1090	FD2090	FD3090	FD4090	HFD1090	HFD2090	HFD3090	HFD4090	.....	FDC2090	FDC3090	FDC4090
100	FD1100	FD2100	FD3100	FD4100	HFD1100	HFD2100	HFD3100	HFD4100	.....	FDC2100	FDC3100	FDC4100
110	FD1110	FD2110	FD3110	FD4110	HFD1110	HFD2110	HFD3110	HFD4110	.....	FDC2110	FDC3110	FDC4110
125	FD1125	FD2125	FD3125	FD4125	HFD1125	HFD2125	HFD3125	HFD4125	.....	FDC2125	FDC3125	FDC4125
150	FD1150	FD2150	FD3150	FD4150	HFD1150	HFD2150	HFD3150	HFD4150	.....	FDC2150	FDC3150	FDC4150

NOTE: Some deleted – see Pg. 0.1 dated 4/87

Table 5-3. Type FW, HFW Fixed Thermal, Non-Adjustable Magnetic Single Pole Circuit Breaker Catalog Numbers④

Continuous Ampere Rating at 40°C	Type FW 240 Vac 125 Vdc	Type HFW 240 Vac 125 Vdc
10①	FW1010	HFW1010
16	FW1016	HFW1016
20	FW1020	HFW1020
25	FW1025	HFW1025
32	FW1032	HFW1032
40	FW1040	HFW1040
50	FW1050	HFW1050
63	FW1063	HFW1063
80	FW1080	HFW1080
100	FW1100	HFW1100
110	FW1110	HFW1110
125	FW1125	HFW1125
160	FW1160	HFW1160

Table 5-4. Type FW, HFW, FWC Adjustable Thermal, Non-Adjustable Magnetic Circuit Breaker Catalog Numbers④

Maximum Continuous Ampere Rating at 40°C③	Type FW			Type HFW			Type FWC		
	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac
16	FW2016	FW3016	FW4016	HFW2016	HFW3016	HFW4016	FWC2016	FWC3016	FWC4016
25	FW2025	FW3025	FW4025	HFW2025	HFW3025	HFW4025	FWC2025	FWC3025	FWC4025
40	FW2040	FW3040	FW4040	HFW2040	HFW3040	HFW4040	FWC2040	FWC3040	FWC4040
63	FW2063	FW3063	FW4063	HFW2063	HFW3063	HFW4063	FWC2063	FWC3063	FWC4063
100	FW2100	FW3100	FW4100	HFW2100	HFW3100	HFW4100	FWC2100	FWC3100	FWC4100
160	FW2160	FW3160	FW4160	HFW2160	HFW3160	HFW4160	FWC2160	FWC3160	FWC4160

Table 5-5. Type FW, HFW, FWC Adjustable Thermal, Adjustable Magnetic Circuit Breaker Catalog Numbers④

Maximum Continuous Ampere Rating at 40°C③	Type FW			Type HFW			Type FWC		
	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac	2-Pole② 660 Vac 250 Vdc	3-Pole 660 Vac	4-Pole 660 Vac
16	FW2016J	FW3016J	FW4016J	HFW2016J	HFW3016J	HFW4016J	FWC2016J	FWC3016J	FWC4016J
25	FW2025J	FW3025J	FW4025J	HFW2025J	HFW3025J	HFW4025J	FWC2025J	FWC3025J	FWC4025J
40	FW2040J	FW3040J	FW4040J	HFW2040J	HFW3040J	HFW4040J	FWC2040J	FWC3040J	FWC4040J
63	FW2063J	FW3063J	FW4063J	HFW2063J	HFW3063J	HFW4063J	FWC2063J	FWC3063J	FWC4063J
100	FW2100J	FW3100J	FW4100J	HFW2100J	HFW3100J	HFW4100J	FWC2100J	FWC3100J	FWC4100J
160	FW2160J	FW3160J	FW4160J	HFW2160J	HFW3160J	HFW4160J	FWC2160J	FWC3160J	FWC4160J

● Not UL listed, refer to Westinghouse for interrupting ratings.
② 2-pole circuit breakers supplied in 3-pole frame.
③ Refer to Westinghouse for adjustability range for each rating.
④ W model circuit breakers not UL listed.

ORDERING INFORMATION

Series C Molded Case Circuit Breakers, F-Frame
Section 5 – Selection and Ordering Information

Selection and Ordering Information
When ordering an F-frame circuit breaker or molded case switch, use the catalog numbers given in Tables 5-1 through 5-8. Interrupting ratings can be found in Table 1-1. List any accessories or modifications required together with the applicable catalog number. Handle mechanisms are suitable for use with all Series C F-frame circuit breakers. REFER TO WESTINGHOUSE FOR AVAILABILITY OF ALL CIRCUIT BREAKERS, MOLDED CASE SWITCHES, ACCESSORIES, AND MODIFICATIONS.

Cicuit Breaker Selection
Circuit breaker catalog numbers are identified in Tables 5-1, 5-2, 5-3, 5-4, and 5-5. Circuit breakers ordered using these catalog numbers include standard load terminals only.

Add suffix V to catalog number to order circuit breakers calibrated to 50°C ambient (not UL listed).

4-pole circuit breakers have neutral poles unprotected as standard. For protected neutral poles, add suffix E to catalog number.

Add suffix L to catalog number to order circuit breakers with standard line and load terminals.

List Prices: See Price List 29-020. Discount Symbol CB-2.

Ordering Information Examples

Customer requirement 1:

One molded case circuit breaker per UL489; 3-pole, 600 Vac, 100A with 65 kA interrupting rating at 480 Vac with load end terminals only. A factory installed 1A/1B auxiliary switch is required in the left pole, with pigtail leads exiting the right side of the circuit breaker, and a 120 Vac shunt trip with a terminal block in the right pole.

Order as follows:

Qty 1 Circuit Breaker HFD3100, with factory installed auxiliary switch A1X1LC and shunt trip SNT1RT08.

When ordering an accessory that is for installation by the customer, use the field installation kit catalog number.

Customer requirement 2:

240 Vac handle reset undervoltage release mechanism with 18-inch pigtail leads for field installation in the left mounting cavity of an FW 3-pole circuit breaker.

Order as follows:

Qty 1 Undervoltage release mechanism (handle reset) UVH1LP11K.

Catalog Number and Suffix Priority
When adding suffixes to established catalog numbers shown in Tables 5-1 through 5-5, the following order should be maintained:
First priority: V – 50°C Calibration
Second priority: E – Protected Neutral Pole (4-pole circuit breaker only)
Third Priority: L – Standard line and load terminals
Examples
1. FD3100VL: Catalog number for 50°C FD3100 calibrated circuit breaker with standard line and load terminals supplied
2. HFW4160JE: Catalog number for HFW4160J (adjustable thermal, adjustable magnetic) circuit breaker with protected neutral pole

Table 5-1. Type EHD and FDB Thermal-Magnetic Circuit Breaker Catalog Numbers

Continuous Ampere Rating at 40°C	Type EHD			Type FDB		
	1-Pole 277 Vac 125 Vdc	2-Pole 480 Vac 250 Vdc	3-Pole 480 Vac	2-Pole 600 Vac 250 Vdc	3-Pole 600 Vac	4-Pole 600 Vac
10①	EHD1010	EHD2010	EHD3010	FDB2010	FDB3010	FDB4010
15	EHD1015	EHD2015	EHD3015	FDB2015	FDB3015	FDB4015
20	EHD1020	EHD2020	EHD3020	FDB2020	FDB3020	FDB4020
25	EHD1025	EHD2025	EHD3025	FDB2025	FDB3025	FDB4025
30	EHD1030	EHD2030	EHD3030	FDB2030	FDB3030	FDB4030
35	EHD1035	EHD2035	EHD3035	FDB2035	FDB3035	FDB4035
40	EHD1040	EHD2040	EHD3040	FDB2040	FDB3040	FDB4040
45	EHD1045	EHD2045	EHD3045	FDB2045	FDB3045	FDB4045
50	EHD1050	EHD2050	EHD3050	FDB2050	FDB3050	FDB4050
60	EHD1060	EHD2060	EHD3060	FDB2060	FDB3060	FDB4060
70	EHD1070	EHD2070	EHD3070	FDB2070	FDB3070	FDB4070
80	EHD1080	EHD2080	EHD3080	FDB2080	FDB3080	FDB4080
90	EHD1090	EHD2090	EHD3090	FDB2090	FDB3090	FDB4090
100	EHD1100	EHD2100	EHD3100	FDB2100	FDB3100	FDB4100
110				FDB2110	FDB3110	FDB4110
125				FDB2125	FDB3125	FDB4125
150				FDB2150	FDB3150	FDB4150

① Not UL listed, refer to Westinghouse for interrupting ratings.

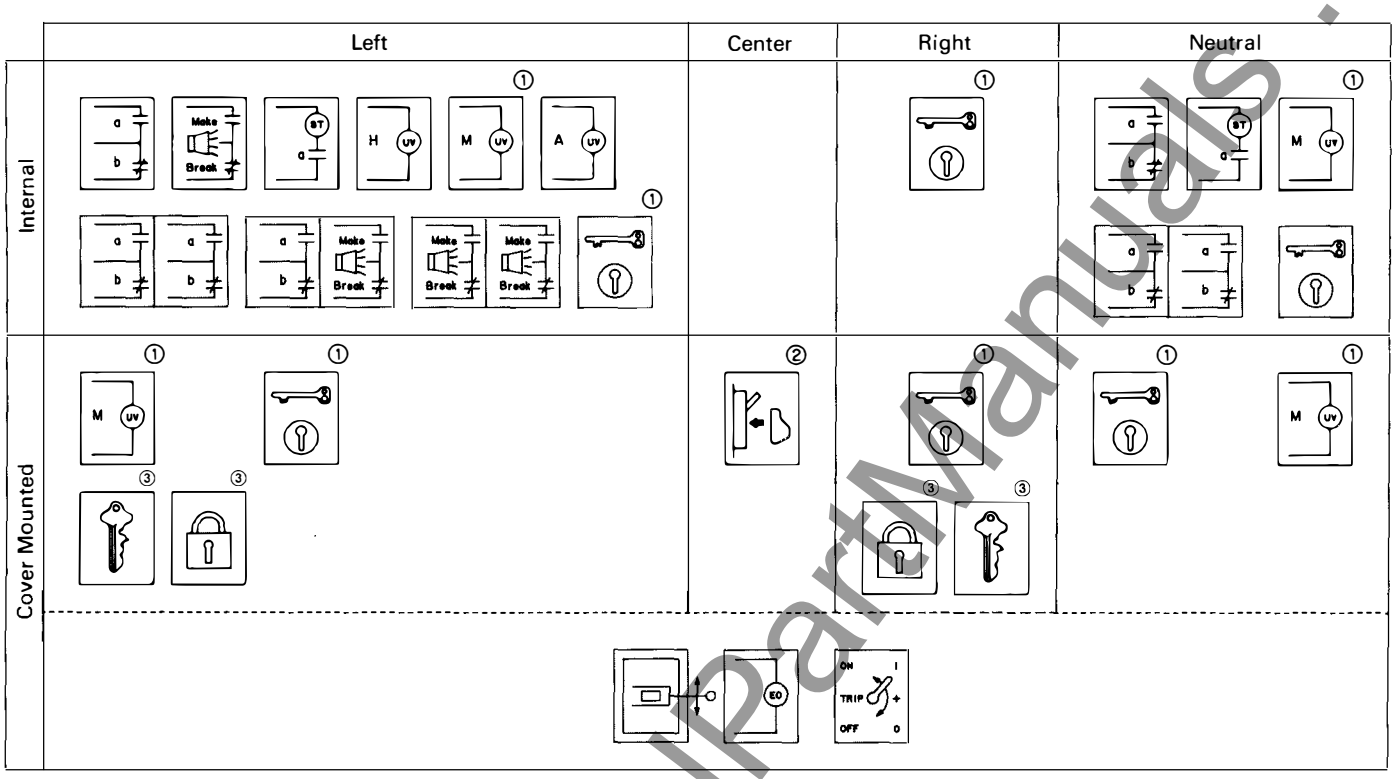
ORDERING INFORMATION

Series C Molded Case Circuit Breakers, F-Frame

Section 4 – Accessories and Modifications

Allowable Accessory Combinations, Continued

Four Pole Breaker

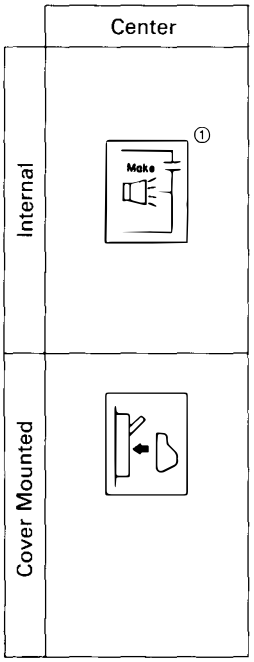


① Occupies internal and cover spaces.
② Non-padlockable handle block cannot be mounted simultaneously with either key interlock, padlockable handle hasp or sliding bar interlock.
③ May be mounted on left or right pole – not both.

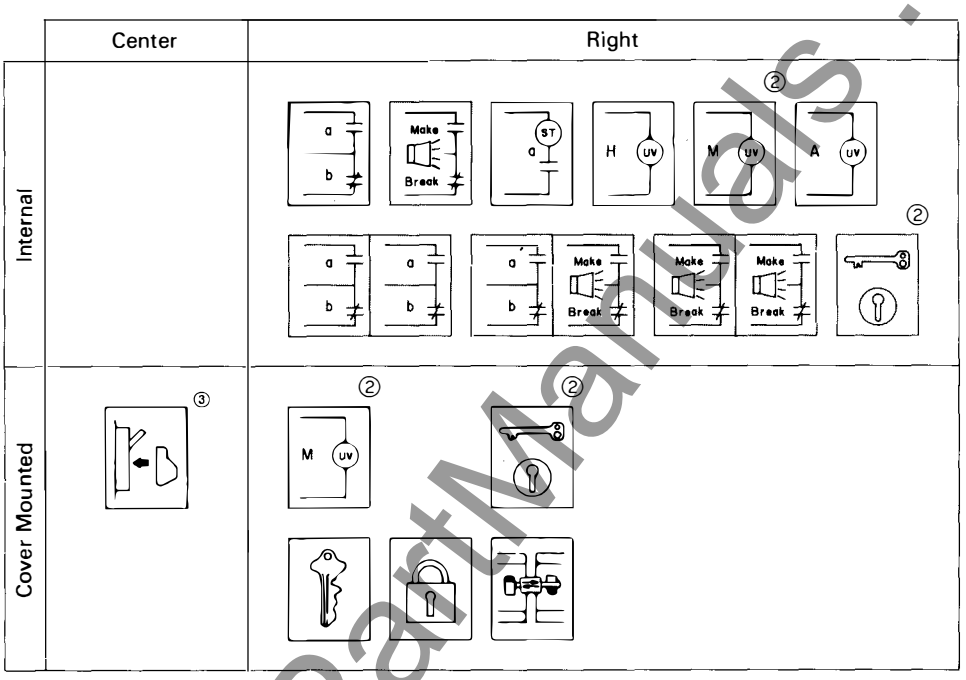
Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

Allowable Accessory Combinations

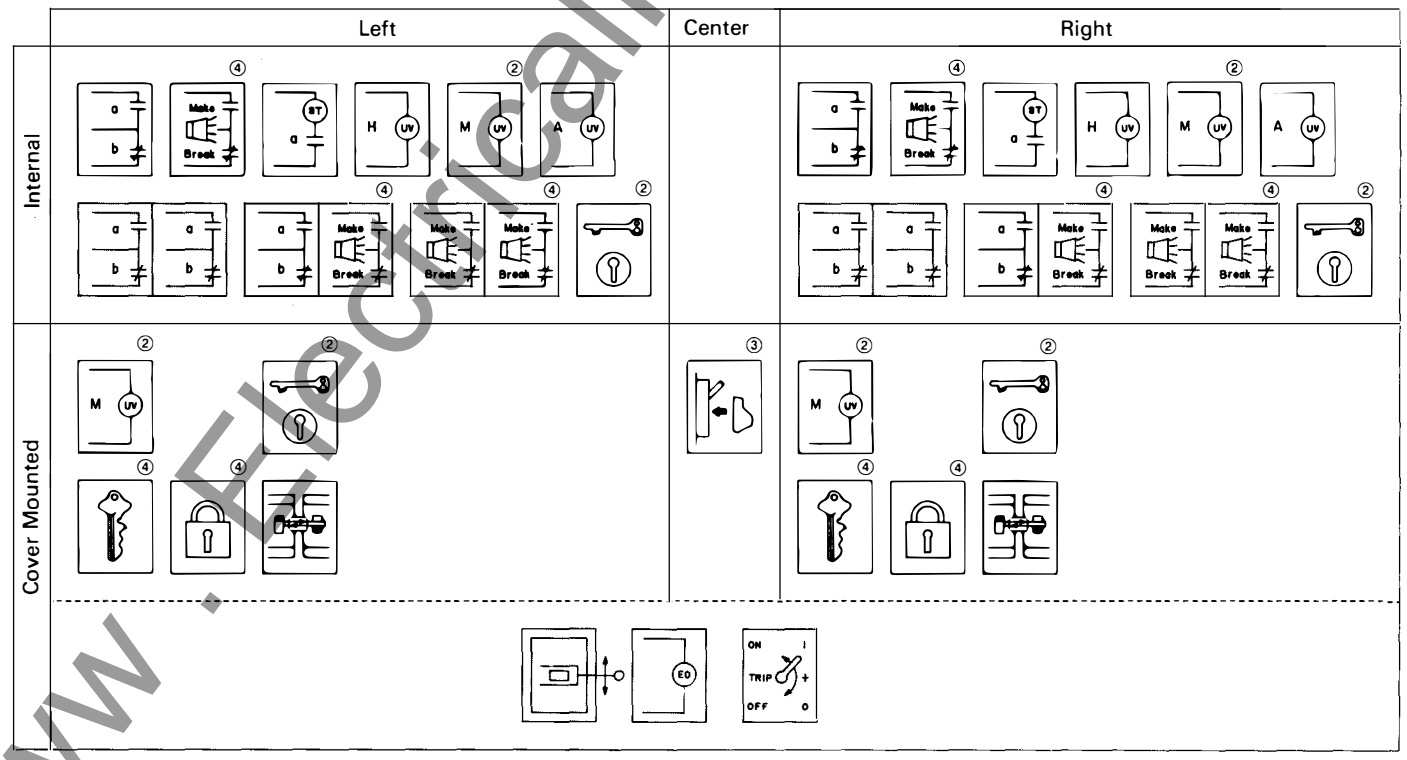
Single Pole Breaker



Two Pole Breaker



Three Pole Breaker



① Factory installed. Pigtail leads exit load end only.
② Occupies internal and cover spaces.
③ Non-padlockable handle block cannot be mounted simultaneously with either key interlock, padlockable handle hasp or sliding bar interlock.
④ May be mounted in or on left or right pole – not both.

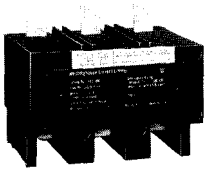
January, 1985

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

4-6. Miscellaneous Accessories
- Base Mounting Hardware
- LFB Current Limiter Attachment
- Earth Leakage Protection Module.

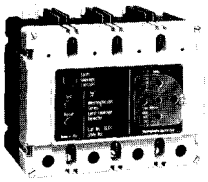
Base Mounting Hardware
Hardware for surface mounting of circuit breakers is supplied only on request. Hardware consists of mountig screws and lockwashers. Order hardware for circuit breaker pole configurations as required.

LFB Current Limiter



The LFB current limiter is an accessory that bolts to the load end of a standard FDB or FD thermal-magnetic circuit breaker, providing 200,000A interrupting capacity at up to 600 Vac. LFB current limiters for thermal-magnetic circuit breakers are listed with Underwriters Laboratories, Inc. under File E47239.

Earth Leakage Protection Module



The earth leakage protection module is an add-on accessory designed to protect personnel and equipment from low level earth leakage (ground fault) conditions. It consists of a current sensing element and an amplifier circuit that trips the associated circuit breaker by signaling a shunt trip or undervoltage release mechanism. (No external power to the shunt trip is needed.) Refer to Westinghouse for further information.

4-7. Modifications
Limited modifications to the basic circuit breaker and molded case switch are available to satisfy specific customer requirements. All modifications are completed at the factory. The following modifications are available:
- Special Calibration
- Moisture-Fungus Treatment
- Marine Applications

If additional modifications are required, refer to Westinghouse. The following paragraphs describe available modifications.

Special Calibration
Special non-UL listed calibrations are available for certain ambient temperatures other than 40°C and for frequencies other than 50/60 Hz or dc. Reduced interrupting ratings will apply for 400 Hz applications. Maximum thermal calibration limited to 135A at 400 Hz.

Moisture-Fungus Treatment
All series C circuit breaker cases are molded from glass-polyester which does not support the growth of fungus. Only a limited number of internal parts and the backplate require special treatment.

Marine Applications①
UL489 listed 40°C circuit breakers for marine application on vessels over 65 feet are available. Non-aluminum terminals are required.

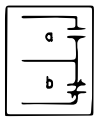
4-8. Accessory Combinations
Different combinations of accessories can be supplied, depending on the types of accessories and the number of poles in the circuit breaker. Tables on pages 19, 20 show the different accessories or combinations that can be used internally and externally with each pole of 1-, 2-, 3-, and 4-pole circuit breakers. Each pole in a particular circuit breaker configuration is identified by a column head; each accessory or combination that can be used with that pole is identified by symbols in a box below the column head. Unless otherwise noted, one internal and one external accessory can be selected for each pole.

The manual reset undervoltage release mechanism or the cylinder lock will occupy the accessory mounting cavity in the circuit breaker base and also poject through the cover. Therefore, if either of these devices is selected, no other internal or external accessory can can be applied to that particular pole. In the tables, these accessories are identified by repeating the symbol in the internal and cover boxes. If a manual reset undervoltage release mechanism or cylinder lock is selected, the electrical (solenoid) operator or any external handle mechanism cannot be used.

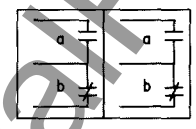
Some external accessories will cover more than one pole. In the tables, when a box containing accessory symbols spans more than one column, any accessory within that box occupies the area of the cover indicated.

Accessory Legend
The accessory legend shows each symbol used in the accessory combination tables.

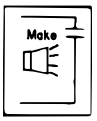
Accessory Symbols Used in Accessory Combination Examples (See pages 19, 20)



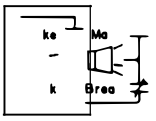
Auxiliary Switch (1A, 1B)



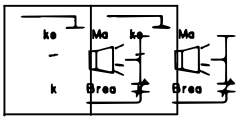
Auxiliary Switch (2A, 2B)



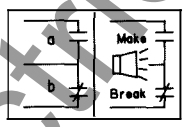
Alarm (Signal)/ Lockout Switch (Make Only)



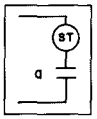
Alarm (Signal)/ Lockout Switch (Make/Break)



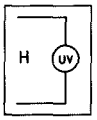
Alarm (Signal)/ Lockout Switch (2 Make, 2 Break)



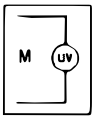
Aux. Switch/ Alarm (Signal)/Lockout Switch



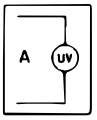
Shunt Trip



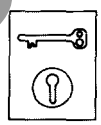
Under-Voltage Release (Handle Reset)

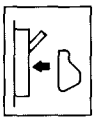


Undervoltage Release (Manual Reset)



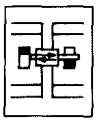
Undervoltage Release (Auto. Reset)

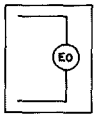

Cylinder Lock


Non-Lockable Handle Block


Padlockable Handle Lock Hasp

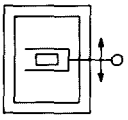

Key Interlock


Sliding Bar Interlock



Electrical (Solenoid) Operator

Rotary Handle Mechanism


Handle Mechanism

① UL listing pending, refer to Westinghouse.

Series C Molded Case Circuit Breakers, F-Frame
Section 4 – Accessories and Modifications

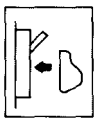
The AMT vari-depth/vari-width flange mounted handle mechanism is an extra heavy-duty mechanism designed for mounting in flange-type enclosures. The handle mechanism is available for mounting above or below the centerline of the circuit breaker handle, is suitable for various enclosure depths, and can also be used in various horizontal position applications. A door interlock prevents the enclosure from being opened with the handle mechanism in the ON position and prevents the handle mechanism from being switched ON unless the enclosure door is closed. The handle mechanism will accept up to three padlock shackles, each with a maximum diameter of 3/8 inch (7.92mm). The handle mechanism is Underwriters Laboratories, Inc. listed as a circuit breaker accessory under UL File E64983.

4-5. Lock and Interlock Accessories

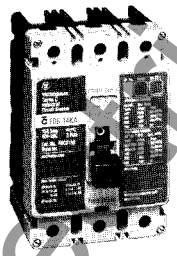
Lock and interlock accessories are used to deter undesired circuit breaker operation and establish interlocked control systems. Lock and interlock accessories include:

- Nonlockable Handle Block
- Padlockable Handle Lock Hasp
- Cylinder Lock
- Key Interlock
- Sliding Bar Interlock
- Walking Beam Interlock.

To identify allowable accessory installation combinations, see paragraph 4-8. Lock and interlock accessories identified in paragraph 4-8 are shown in this section by a graphic symbol in a shaded blue box.



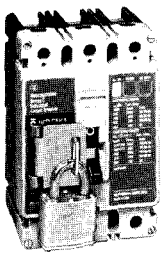
Non-Padlockable Handle Block

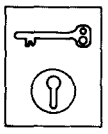


The nonlockable handle block secures the circuit breaker handle in either the ON or OFF position. (Trip-free operation allows the circuit breaker to trip when the handle block holds the circuit breaker handle in the ON position.) The device is positioned over the circuit breaker handle and secured by a setscrew to deer accidental operation of the circuit breaker handle. (Field installation only)

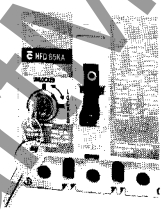
Padlockable Handle Lock Hasp

The padlockable handle lock hasp allows the handle to be locked in the ON or OFF position. (Trip-free operation allows the circuit breaker to trip when the handle lock holds the circuit breaker handle in the ON position.) The hasp mounts on the circuit breaker cover within the trimline. The cover is predrilled on both sides of the operating handle so that the hasp can be mounted on either side of the handle. The hasp will accommodate up to three padlocks with 1/4 inch (6-mm) shackles. UL File E64983 applies① (Field installation only)



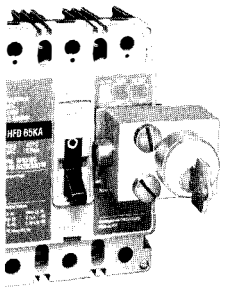


Cylinder Lock②



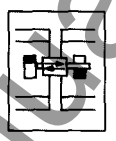
The cylinder lock internally blocks the trip bar in the tripped position to prevent the circuit breaker from being switched ON. The cylinder lock is factory installed in the circuit breaker cover. Other internally mounted accessories cannot be installed in the same pole as the cylinder lock.

Key Interlock

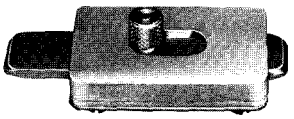


The key interlock is used to externally lock the circuit breaker handle in the OFF position. When the key interlock is locked, an extended deadbolt blocks movement of the circuit breaker handle. Uniquely coded keys are removable only with the deadbolt extended. Each coded key controls a group of circuit breakers for a given specific customer installation.

The key interlock assembly is Underwriters Laboratories, Inc. listed for field installation under UL file E64983 and consists of a mounting kit and a purchaser supplied deadbolt lock.① The mounting kit comprises a mounting plate, which is secured to the circuit breaker cover in either the left- or right-pole position, key interlock mounting screws, and a wire seal. Specific mounting kits are required for individual key interlock types.

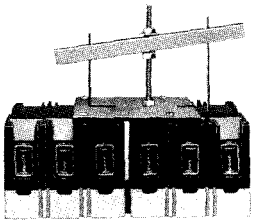


Sliding Bar Interlock



The sliding bar interlock provides mechanical interlocking between two adjacent 3-pole circuit breakers and is installed on the enclosure cover between the circuit breakers. When the sliding bar interlock handle is moved from one side to the other, a bar extends to alternately block movement of the circuit breaker handles and prevents both circuit breakers from being switched ON at the same time. Sliding bar interlocks are not UL listed. (Field installation only)

Walking Beam Interlock



The walking beam interlock provides mechanical interlocking between two adjacent circuit breakers of the same pole configuration. The walking beam interlock mounts on a bracket behind and between the circuit breakers. A plunger on each end of the beam is inserted through an access hole in the back plate and base of each circuit breaker. The walking beam interlock prevents both circuit breakers from being switched ON at the same time. If a walking beam interlock is installed, the wiring troughs in the back of the circuit breaker case are blocked by the plungers and cannot be used for cross wiring. The walking beam interlock is UL listed① for field installation per UL File E64983. Factory modified circuit breakers are required for this application.

● UL listing pending, refer to Westinghouse.
② Use of cylinder lock may reduce interrupting rating of circuit breaker. Refer to Westinghouse.

Westinghouse Electric Corporation
Distribution and Control Business Unit
Components Division
Beaver, Pennsylvania U.S.A. 15009

April, 1987
New Information
Mailed to: E, D, C/29-100A

Type EHD: 15-100 Amperes
Types FDB, FD, HFD, FDC: 15-150 Amperes
Types FW, HFW, FWC: 10-160 Amperes

SERIES C™

F-Frame Molded Case Circuit Breakers

Please refer to Frame Book 29-101, dated January, 1985 and make the following corrections:

Page 4 Table 1-1
- The UL489 interrupting capacity rating of the FDC circuit breaker at 600 Vac is **35,000** amperes rather than 50,000 amperes.
- The IEC 157-1 interrupting capacity of the FDC and FWC circuit breakers at 500 Vac is **35,000** amperes rather than 50,000 amperes.
- The 250 Vdc interrupting ratings of the HFD, FDC, HFW and FWC circuit breakers is **22,000** amperes in all cases.

Page 4 Molded Case Switch
- The nonautomatic type molded case switch has been cancelled and will not be offered as part of the F-Frame Series C product line.
- Footnote ⑤ rather than footnote ① applies to the last sentence of the first paragraph under this heading.

Page 12 Line and Load Terminals
Delete Style 624B100G20. This terminal is no longer available.

Page 22 Table 5-2
Delete the following catalog numbers: FD2010, FD3010, FD4010, HFD2010, HFD3010, HFD4010, FDC2010, FDC3010, FDC4010.

Page 23 Table 5-6
Delete all Type EHD(N) catalog numbers: EHD1100N, EHD2100N, EHD3100N.

Page 23 Table 5-7
- Delete 1-pole Type FDC(K) catalog numbers: FDC1100K, FDC1150K.
- Delete all Type FD(N) catalog numbers: FD1100N, FD2100N, FD3100N, FD4100N, FD1150N, FD2150N, FD3150N, FD4150N.

Page 23 Line and Load Terminals
- Delete Style #624B100G20.
- Footnote ③ should read "UL listed for copper wire only."

Page 23 Terminal Shields
The style numbers of the standard terminal shields are incorrect as shown. Correct as follows:

Number of Poles	Incorrect Style Number	Correct Style Number
1	625B229G03	**625B229G06**
2	625B229G02	**625B229G07**
3	625B229G01	**625B229G08**
4	625B229G05	**625B229G09**

Page 24 Panelboard Connecting Straps
Delete Style Numbers 673B142G06 and 673B142G07.

Page 24 Plug-in Adapter
Mounting plate style numbers are incorrect. Correct as follows:

	Incorrect Style Number	Correct Style Number
2-Pole	176C511G01	**176C511H01**
3-Pole	507C047G01	**507C047H01**

Page 26 Undervoltage Release Mechanism
Catalog numbers for dc UVRs are incorrect. Correct catalog numbers are shown below:

Undervoltage Release Mechanism

Voltage Rating (ac Freq = 50/60 Hz)	Connection Type and Location: 18-inch Pigtail Leads, Same Side	18-inch Pigtail Leads, Rear⑥	18-inch Pigtail Leads, Opposite Side	Terminal Block, Same Side	Field Installation Kits①: Pigtail Leads	Field Installation Kits①: Terminal Block
	Catalog Numbers				Catalog Numbers	
Left Pole Mounting						
9- 12 Vac	UVH1LA02	UVH1LB02	UVH1LC02	UVH1LT02	UVH1LP02K	UVH1LT02K
24 Vac	UVH1LA03	UVH1LB03	UVH1LC03	UVH1LT03	UVH1LP03K	UVH1LT03K
48- 60 Vac	UVH1LA05	UVH1LB05	UVH1LC05	UVH1LT05	UVH1LP05K	UVH1LT05K
110-127 Vac	UVH1LA08	UVH1LB08	UVH1LC08	UVH1LT08	UVH1LP08K	UVH1LT08K
208-240 Vac	UVH1LA11	UVH1LB11	UVH1LC11	UVH1LT11	UVH1LP11K	UVH1LT11K
380-480 Vac	UVH1LA15	UVH1LB15	UVH1LC15	UVH1LT15	UVH1LP15K	UVH1LT15K
525-600 Vac	UVH1LA18	UVH1LB18	UVH1LC18	UVH1LT18	UVH1LP18K	UVH1LT18K
12 Vdc	UVH1LA20	UVH1LB20	UVH1LC20	UVH1LT20	UVH1LP20K	UVH1LT20K
24 Vdc	UVH1LA21	UVH1LB21	UVH1LC21	UVH1LT21	UVH1LP21K	UVH1LT21K
48-60 Vdc	UVH1LA23	UVH1LB23	UVH1LC23	UVH1LT23	UVH1LP23K	UVH1LT23K
125 Vdc	UVH1LA26	UVH1LB26	UVH1LC26	UVH1LT26	UVH1LP26K	UVH1LT26K
220-250 Vdc	UVH1LA28	UVH1LB28	UVH1LC28	UVH1LT28	UVH1LP28K	UVH1LT28K
Right Pole Mounting②						
9- 12 Vac	UVH1RA02	UVH1RB02	UVH1RC02	UVH1RT02	UVH1RP02K	UVH1RT02K
24 Vac	UVH1RA03	UVH1RB03	UVH1RC03	UVH1RT03	UVH1RP03K	UVH1RT03K
48- 60 Vac	UVH1RA05	UVH1RB05	UVH1RC05	UVH1RT05	UVH1RP05K	UVH1RT05K
110-127 Vac	UVH1RA08	UVH1RB08	UVH1RC08	UVH1RT08	UVH1RP08K	UVH1RT08K
208-240 Vac	UVH1RA11	UVH1RB11	UVH1RC11	UVH1RT11	UVH1RP11K	UVH1RT11K
380-480 Vac	UVH1RA15	UVH1RB15	UVH1RC15	UVH1RT15	UVH1RP15K	UVH1RT15K
525-600 Vac	UVH1RA18	UVH1RB18	UVH1RC18	UVH1RT18	UVH1RP18K	UVH1RT18K
12 Vdc	UVH1RA20	UVH1RB20	UVH1RC20	UVH1RT20	UVH1RP20K	UVH1RT20K
24 Vdc	UVH1RA21	UVH1RB21	UVH1RC21	UVH1RT21	UVH1RP21K	UVH1RT21K
48-60 Vdc	UVH1RA23	UVH1RB23	UVH1RC23	UVH1RT23	UVH1RP23K	UVH1RT23K
125 Vdc	UVH1RA26	UVH1RB26	UVH1RC26	UVH1RT26	UVH1RP26K	UVH1RT26K
220-250 Vdc	UVH1RA28	UVH1RB28	UVH1RC28	UVH1RT28	UVH1RP28K	UVH1RT28K

① Not listed with Underwriters Laboratories, Inc. for field installation.
● Standard mounting location.
⑥ Standard pigtail exit location.

Page 26 Vari-Depth Handle Mechanism
Style numbers should be superseded as follows:

Old Style Number	New Style Number
373D958G05	**373D958G22**
373D958G06	**373D958G23**
47A4446G21	**504C323G03**
47A4446G16	**47A4446G36**
47A4446G15	**47A4446G37**

Page 26 Special Handles
Style 504C323G01 shquld be changed to style **504C323G04.**

Page 26 Handle Kits
These style numbers have been superseded as follows:

Old Style Number	New Style Number
314C794G08	**314C794G10**
314C794G03	**314C794G09**

Page 27 Type AMT Handle Mechanism
For the Below Handle Fixed-Width With Short Rod, catalog number AMTRB should be changed to **AMTR.**

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