

# Compact CF molded case circuit breaker table of contents

---

	page
<b>molded case circuit breaker</b>	
<b>introduction , advantages</b>	2
standard compliance	2
ratings	2
interrupting capability	2
<b>description</b>	4
<b>trip unit characteristics</b>	6
<b>time current curves</b>	7
<b>accessories</b>	9
<b>accessories wiring diagram</b>	12
<b>power connections</b>	13
<b>molded case switch</b>	14
<b>dimensions</b>	15
<b>appendix</b>	
routine maintenance guidelines	19
UL 489 test procedures	20
international standards	22

---

# Compact CF molded case circuit breaker introduction, advantages

## standard compliance

CF circuit breakers are built in accordance with Underwriters Laboratories standard UL 489. The circuit breaker and its accessories, except when noted, are listed under UL files E63335, E103955 and E103740.

## additional tests :

in addition to standard tests, CF circuit breakers meet UL standard 489 optional requirements (high available fault current).

## interrupting capability

Compact circuit breakers are listed for 3 levels of interrupting capabilities :

- 22,000 Amps at 480V for the standard circuit breaker
- 35,000 Amps at 480V for the high interrupting circuit breaker
- 150,000 Amps at 480V for the current limiting circuit breaker

CF type 480V AC	no. poles	ampere ratings (A) @ 40°C	UL listed interrupting ratings	
			RMS Sym. Amps 240V	480V
<b>standard breakers</b>				
CF 250N	2-3	90-100-125-150-175-200-225-250	25,000	22,000
<b>high interrupting breakers</b>				
CF 250H	2-3	90-100-125-150-175-200-225-250	65,000	35,000
<b>current limiting breakers</b>				
CF 250L	3	90-100-125-150-175-200-225-250	150,000	150,000

## ratings

9 ratings from 90 to 250 Amperes.  
Trip units are non interchangeable.

ampere ratings (A)	magnetic setting (A)	
	low	high
<b>CF 250N - CF 250H - CF 250L</b>		
90	540	990
100	600	1000
125	750	1250
150	900	1500
175	1050	1750
200	1200	2000
225	1350	2250
250	1500	2500
<b>CF 250NC ①</b>		
150	900	1500
250	1500	2500

① instantaneous trip circuit breaker without overload protection

## easy installation

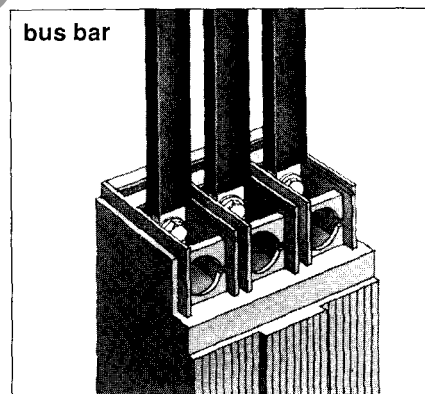
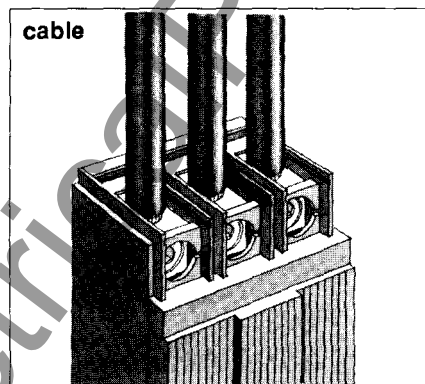
CF circuit breakers have been designed to simplify mounting in panels and to increase safety of operations.

### Common depth

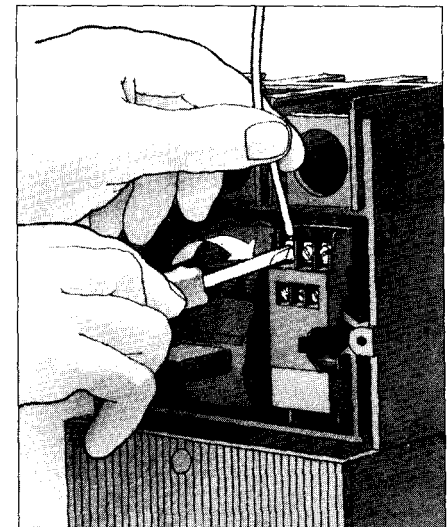
All standard and high interrupting Compact circuit breakers from 250 to 1200A have a common depth of 4 1/2".

### Connection

Cu-Al pressure terminals are listed per UL file E103955 and can be either factory or field installed.



**Built-in control terminal blocks** are provided with the accessories, consequently intermediate terminals are not required for the connection of control wiring. They are located behind a front accessory cover. Removing this cover gives no direct access to live parts. Internal accessories are UL listed and are field installable.



# Compact CF molded case circuit breaker advantages

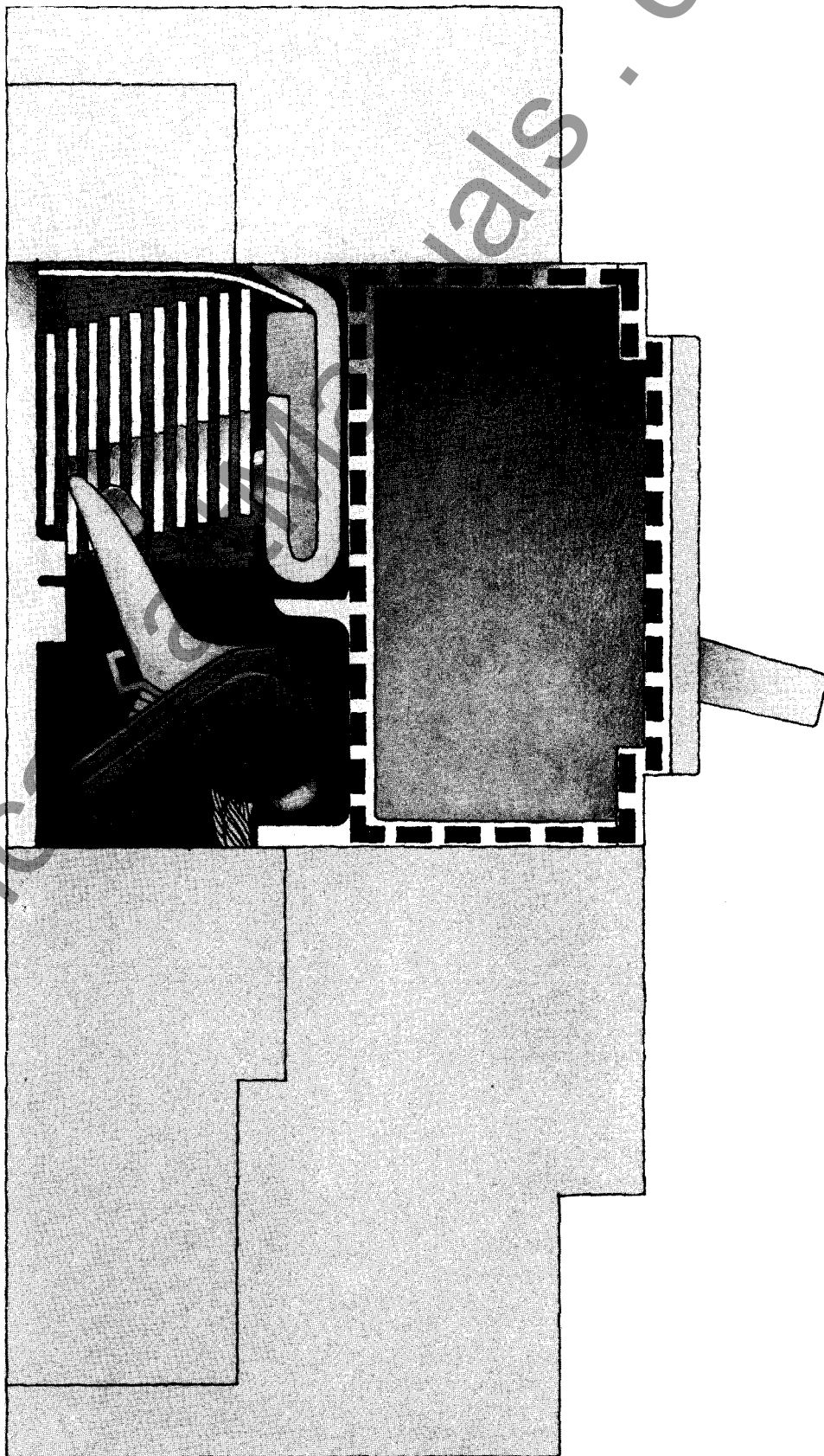
## safety

### Isolation function

The operating handle is representative of the position of the main contacts .  
The OFF position can be reached only when the main contacts are fully opened.

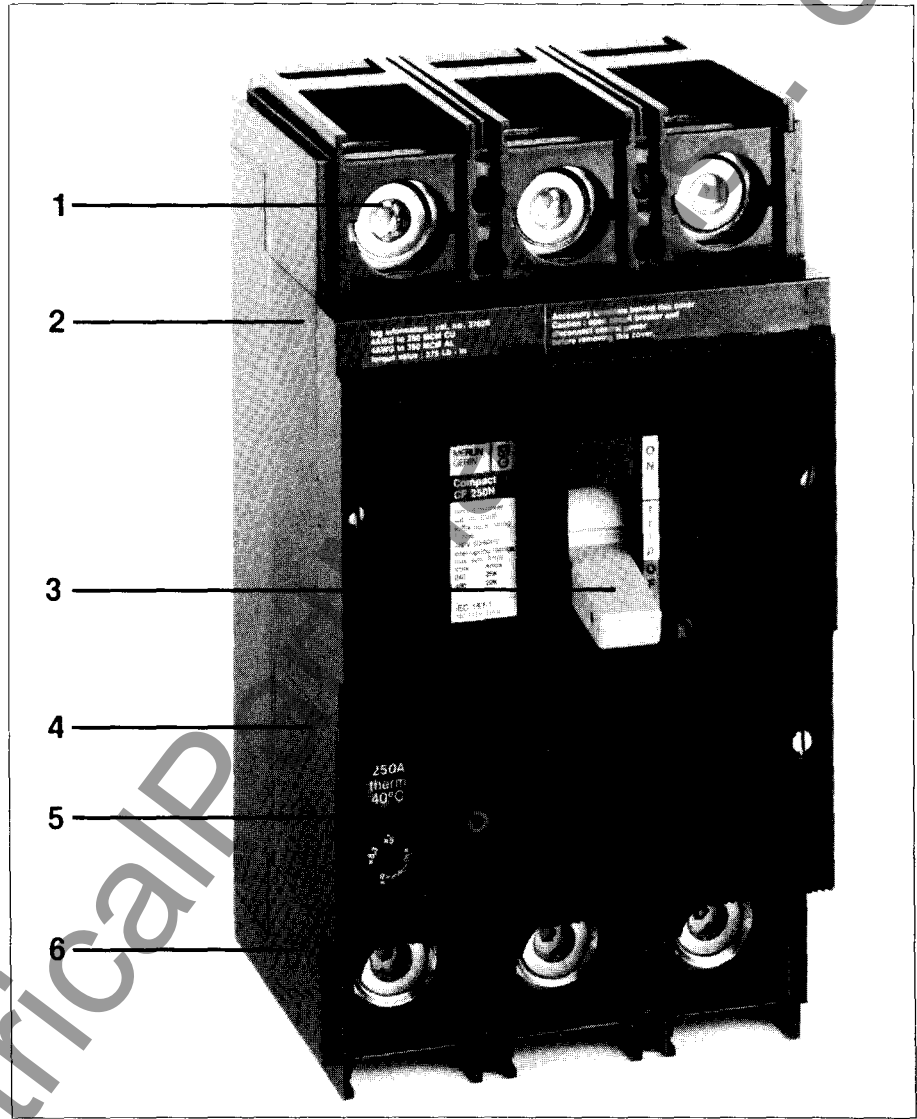
### Double insulation

Two insulation barriers separate the front of the circuit breaker from live parts.  
This reinforced insulation allows safe operation and safe installation of the electrical auxiliaries . The compartment in which they are installed is independant from the casing of the main contacts.



# Compact CF molded case circuit breaker description

- 1 - Terminal connectors
- 2 - Three-pole high strength glass polyester casing
- 3 - Handle with three positions : ON-TRIPPED-OFF
- 4 - Thermal magnetic trip unit with a single instantaneous adjustment of all poles.
- 5 - Push-to-trip button
- 6 - Line and load terminal covers



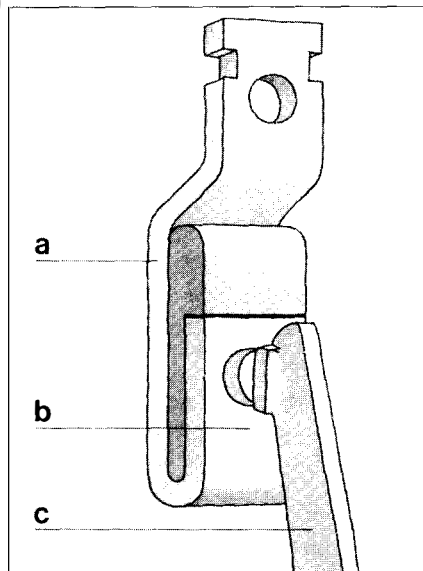
CF circuit breakers exist in two different physical sizes, one for the standard and high interrupting type, and another one for the current limiting type.

## standard and high interrupting rating circuit breakers

Simplicity and efficiency of design is achieved by using the following principles :

### Contact repulsion

Electrodynamic forces are generated by the current flowing in parallel conductors b and c. The moving contact is blown-off by those repulsive forces, which appear on a short circuit current.

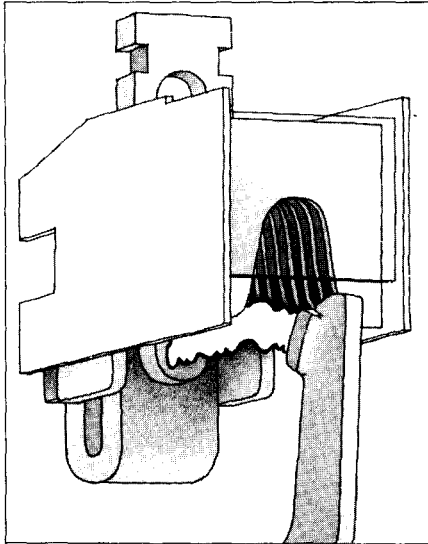


Conductor a has been shielded by a magnetic screen in order to minimize the attractive force it creates on conductor c.

# Compact CF molded case circuit breaker description

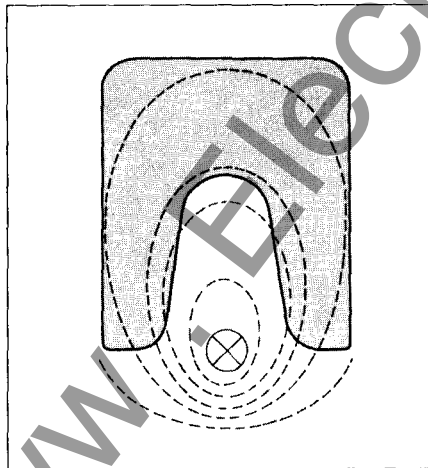
## Magnetic field enhancement

The magnetic force which propels the arc into the arc chute is dependant upon the magnetic field in the arc path. This is the purpose of the U-shaped steel plate around the contacts.



**Generation of local overpressure**, by placing gas generating material near the arc roots. In the event of thermal shock, gas is given off, which, due to the combined effect of blast and pressure, contributes to elongate the arc.

**Arc quenching** due to the design and materials of the arc chute, a magnetic force  $F$  draws the arc into the V-shaped plates. It is then split and cooled until extinction.



## current limiting circuit breakers

A series association of the basic circuit breaker, including the arrangements described above, and a limiting compartment equipped with an original system enables outstanding performances to be obtained.

- very high interrupting capability
- specialization of the devices according to the current to be interrupted :

- the basic circuit breaker interrupts currents of up to 4,000 Amperes,
- over 4,000 Amperes, both devices operate simultaneously. This mutual assistance noticeably reduces contact wear.

These performances are obtained by combination of the following techniques in the current limiting block :

- contact repulsion
- overpressure generation
- enhancement of induced magnetic field.

**Contact repulsion.** The effect of the repulsive electrodynamic forces described above is accentuated by the length of opposite conductors. The moving contacts are repulsed.

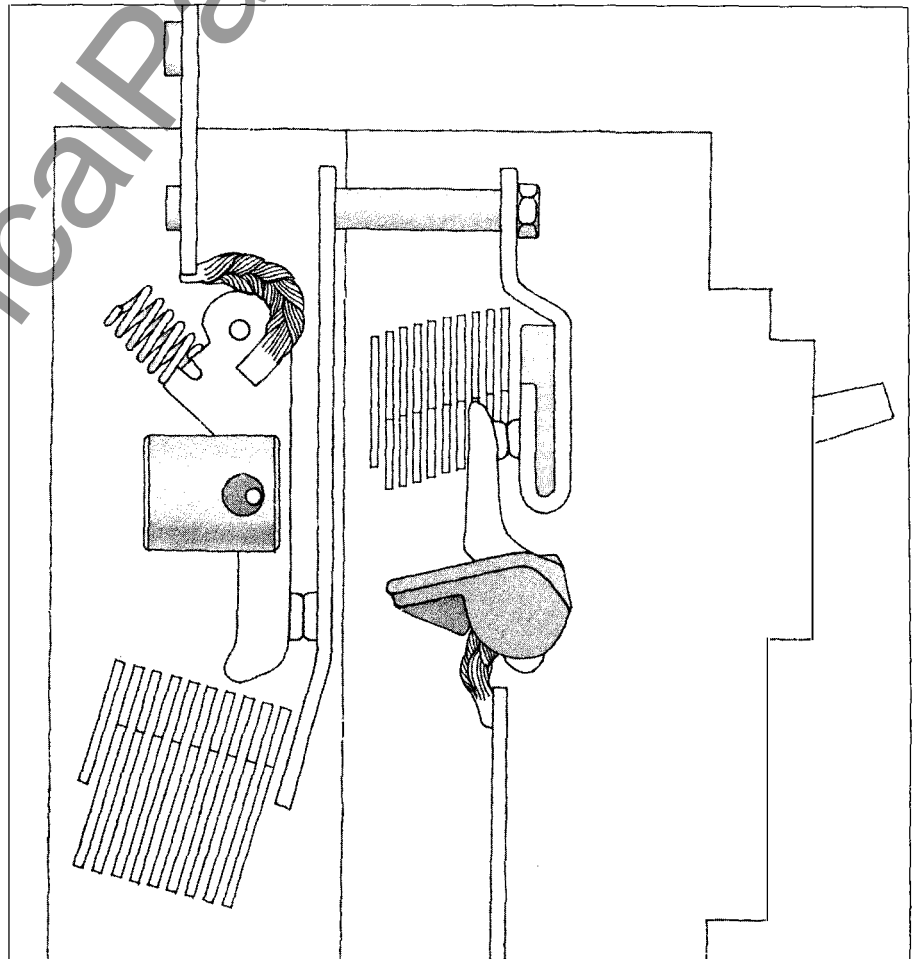
## Overpressure generation

As in the basic breaker, a gas generating material produces both gas pressure and blast and helps arc interruption.

## Contact and tripping coordination

By means of calibrated U-shaped circuit inertia and spring force , full opening of basic circuit breaker is ensured by tripping before reclosing of current limiting unit contacts arms.

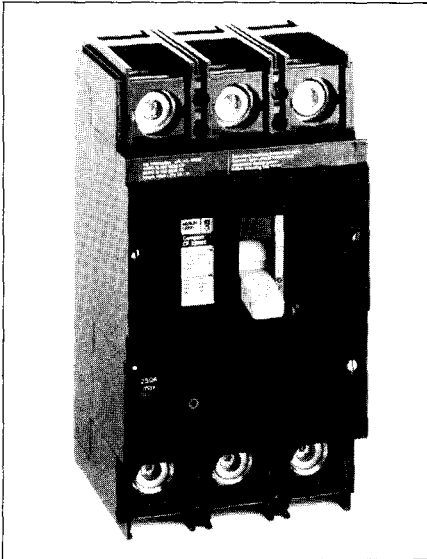
The combined action of the above together with the 2 sets of contacts in series allows very rapid interruption of any fault current and a very high current limitation.



# Compact CF molded case circuit breaker trip unit characteristics

## instantaneous trip circuit breaker

catalog number 35017

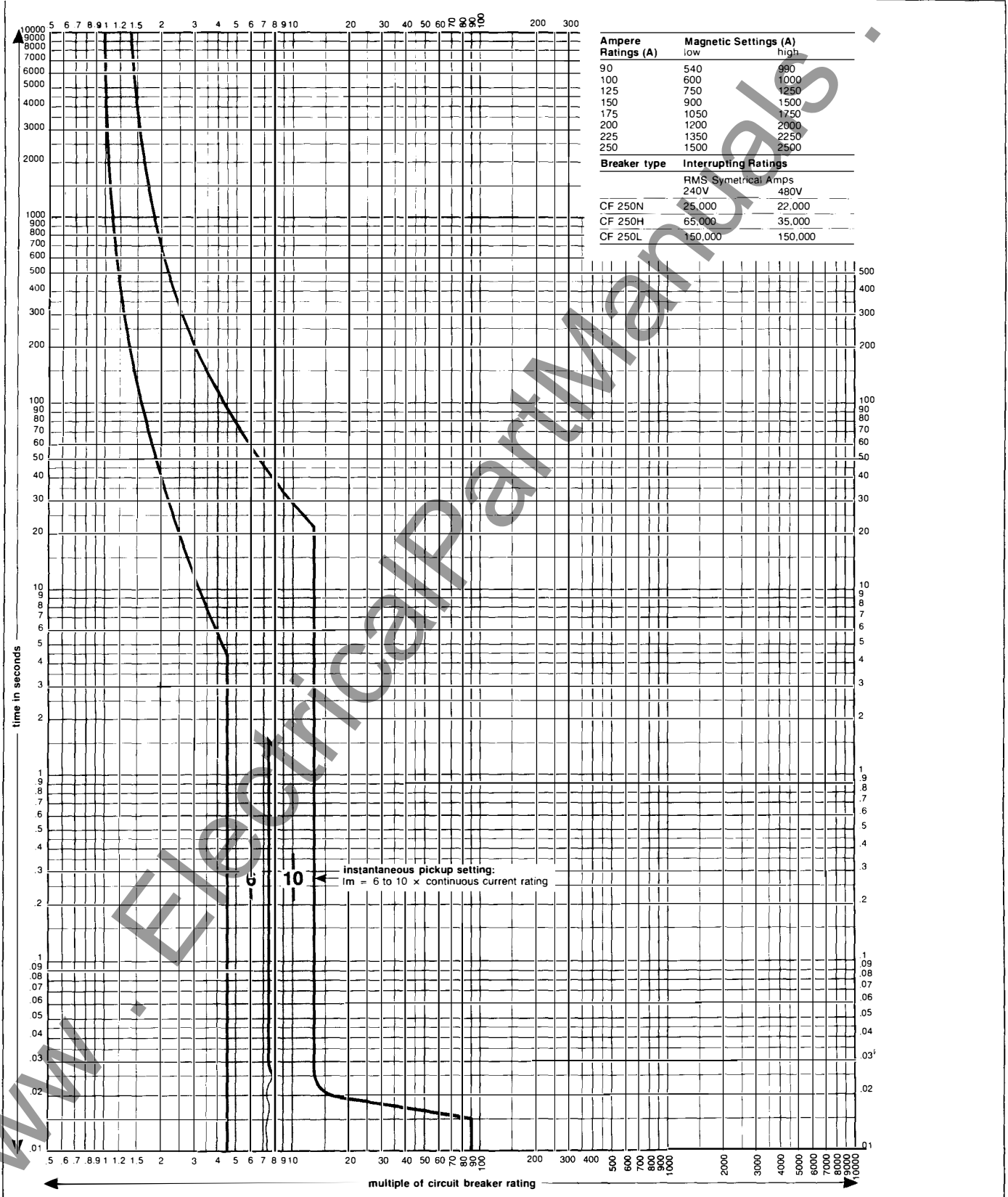


type	ampere rating (A) @ 40°C	magnetic setting (A)		UL listed interrupting rating RMS sym. amps	
		low	high	240V	480V
CF 250NC	150	900	1500	25,000	22,000
	250	1500	250	25,000	22,000

Instantaneous trip circuit breakers are similar to standard circuit breakers except that they do not provide overload protection. The magnetic trip is equipped with a single adjustment knob for all poles.

# Compact CF molded case circuit breaker time current curves

standard, high and current limiting circuit breaker



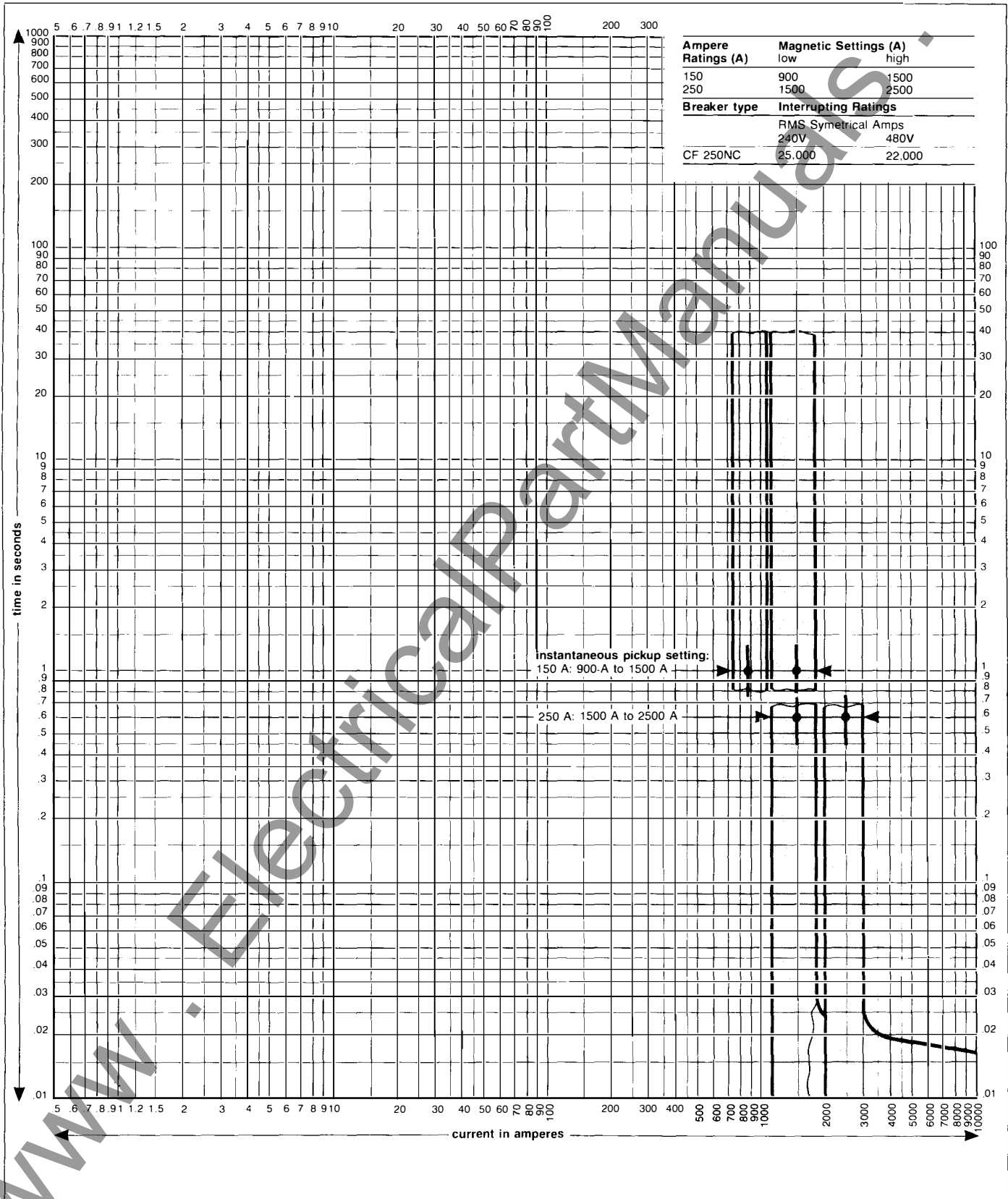
Ampere Ratings (A)	Magnetic Settings (A)	
	low	high
90	540	980
100	600	1000
125	750	1250
150	900	1500
175	1050	1750
200	1200	2000
225	1350	2250
250	1500	2500

Breaker type	Interrupting Ratings	
	RMS Symmetrical Amps	
	240V	480V
CF 250N	25,000	22,000
CF 250H	65,000	35,000
CF 250L	150,000	150,000

# Compact CF molded case circuit breaker time current curves

## instantaneous trip circuit breaker





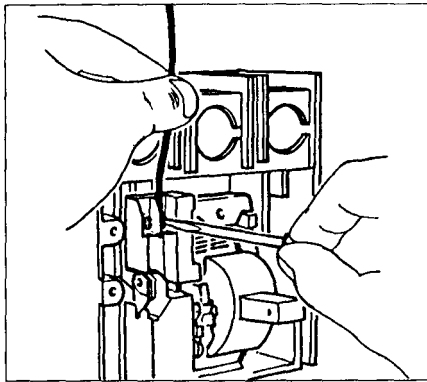
# Compact CF molded case circuit breaker accessories

## available accessories

Internal accessories are field installable and comply with requirements of Underwriters Laboratories Standard UL 489. They are listed for field installation per UL E63335.

## internal accessories terminals

Accessories terminals are standard and located within the breaker, behind the accessories cover.



**Caution :**  
open circuit breaker and disconnect control power before removing this accessory cover

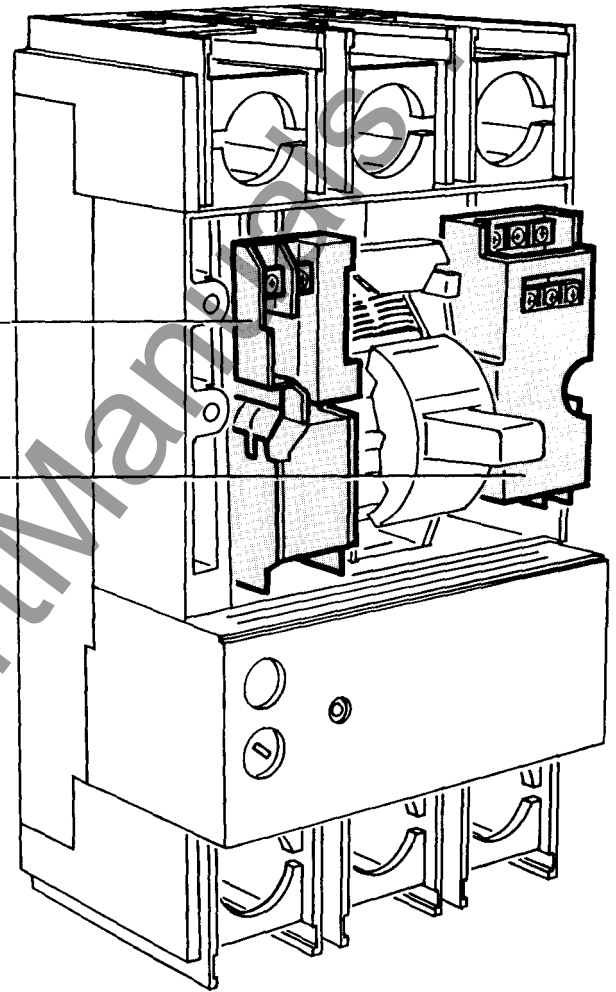
Each terminal may be connected by one or two stranded copper wires 18 to 14 AWG .

Tightening torque : 12 Lb-in.  
Cable strip length : 3/8 " approximate.

## location

shunt trip or undervoltage trip

1 aux. + 1 alarm switch or 2 auxiliary switches



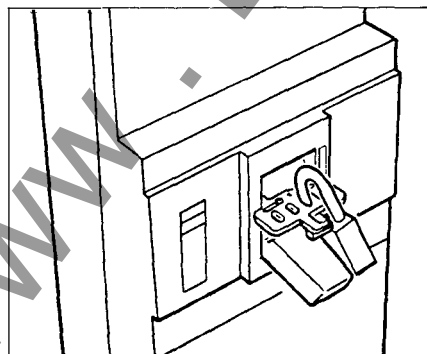
## padlock adaptator

A padlock adaptator is available to padlock the CF circuit breaker in the OFF position. It is similar to the one used on CE, CJ and CK type.

The adaptator accomodates up to 3 padlocks

Shackle diameter : 1/4 to 5/16

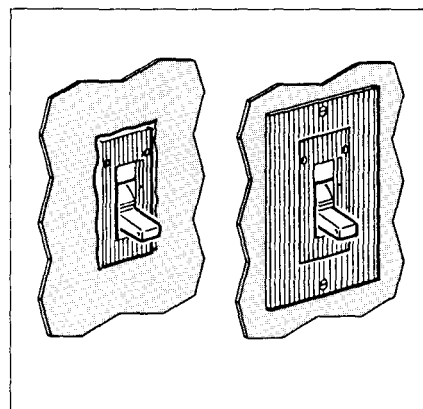
catalog number 44936



## door escutcheon

A door escutcheon provides better appearance of the door cutout . It is fixed to the door with two screws.

catalog number 42977



## sealing bellows

Degree of protection around the toggle can be improved by using a sealing bellows.

catalog number 42896

## label holder

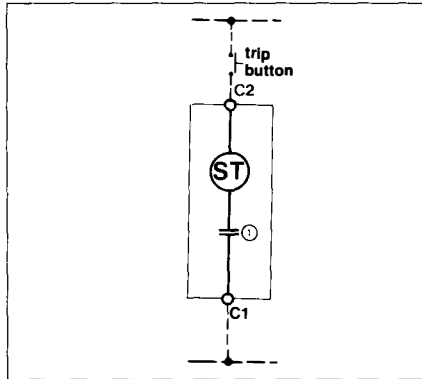
A label holder can be clipped-on the front cover . It permits an easy circuit breaker identification.

catalog number 42976

# Compact CF molded case circuit breaker

## shunt trip

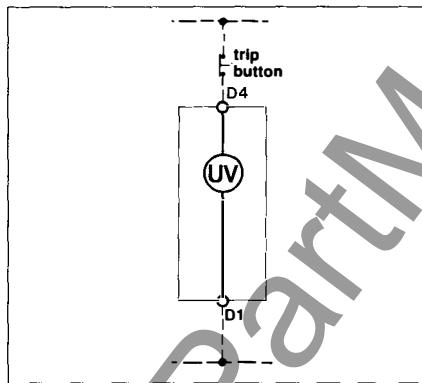
The shunt trip is intermittently rated with a series normally open contact. AC shunt trips can be operated at 55 percent of their rated voltage, making them suitable for use with ground fault protection devices.



rated voltage (V)	inrush current (A)	cat.no
60 Hz		
120	2.2	37437
240	1.6	37446
480	1.0	37447
DC		
24	11	37435
48	4.5	37436
125	2.0	37437

## undervoltage trip device

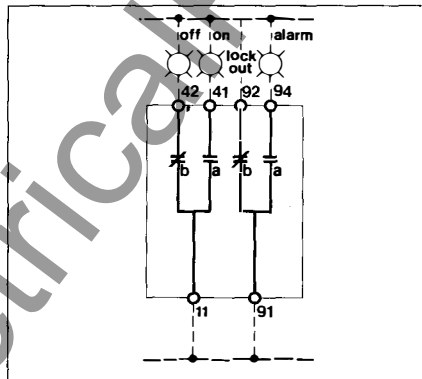
Undervoltage trip devices may be used as circuit interlocks. If an undervoltage condition exists, operation of the closing mechanism of the circuit breaker will not permit the main contacts to touch, even momentarily.



rated voltage (V)	sealed-in current (A)	cat.no
60 Hz		
120	0.030	7418
240	0.020	37419
480	0.011	37420
DC		
24	0.035	37410
48	0.020	37411
125	0.010	37412

## one auxiliary switch and one alarm switch

In addition to one auxiliary switch, one SPDT switch provides alarm/lockout information. When the breaker is reset, the "a" contact (alarm) is open, and the "b" contact (lockout) is closed. This SPDT switch is operated when the breaker is tripped by the trip unit, shunt trip or undervoltage trip device or "push-to-trip" button.

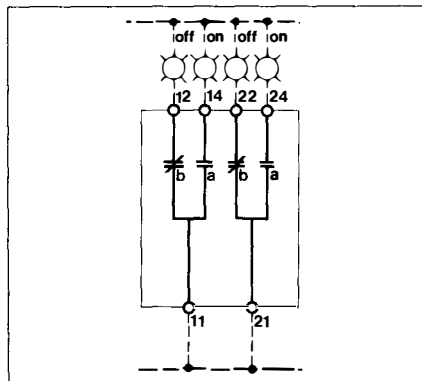


max voltage (V)	freq	max current (A)
1 auxiliary switch		
240	50/60 Hz	6
125	DC	0.3
1 alarm switch		
240	50/60 Hz	5
125	DC	0.3

catalog number 374001

## two auxiliary switches

This block is similar to the above described device, except that two auxiliary switches are provided.



max voltage (V)	freq	max current (A)
240	50/60 Hz	6
125	DC	0.3

catalog number 374002

# Compact CF molded case circuit breaker

## rotary operating handle

Two versions are available :

### Directly mounted

This handle is directly fitted on the circuit breaker .

It accomodates as standard up to three padlocks to lock the handle in the OFF position. However, a knockout can be removed to allow the locking of the handle in the ON position. Due to the trip free mechanism padlocking in such a position will not prevent the circuit breaker from tripping under overcurrent conditions.

Shackle diameter : 1/4 to 5/16.

Not UL listed

catalog number 43820

### Door-mounted type

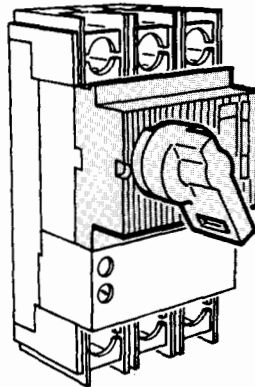
The rotary of the first handle is removable and can be fitted on a door-mounted mechanism. An extension of 16" long is supplied.

The mechanism has the same function as the directly mounted type and provides door interlocking.

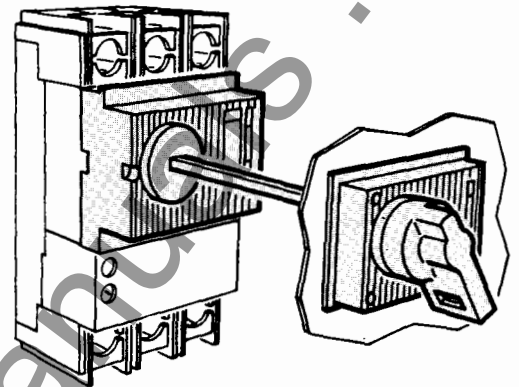
Not UL listed

catalog number 43821

directly mounted type



door-mounted type



## motor operator

The motor operator operates remotely or locally the circuit breaker. It is easily installed without any adjustments.

ON, TRIPPED and OFF positions are clearly indicated .

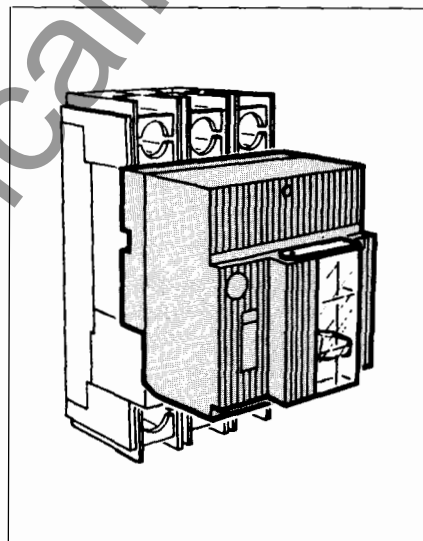
Provision for padlocking is provided as standard to lock the toggle in the OFF position. Manual or remote closing is thus prohibited.

Two interlocks electrically disconnect the motor operator when the front transparent cover is open for local operation or padlocking and when the complete mechanism is rocked.

Two models are available according to the desired closing time :

- standard : 0.2 seconds
- synchronizing : 0.06 seconds

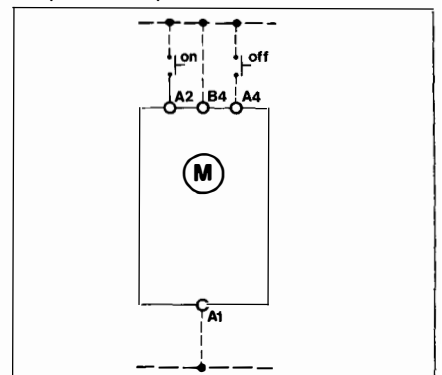
Not UL listed



voltage (V)	catalog number	
	standard	synchronizing
AC 120	43775	43754
	43776	43755
DC	24	43770
	48	43771
	125	43772
		43752

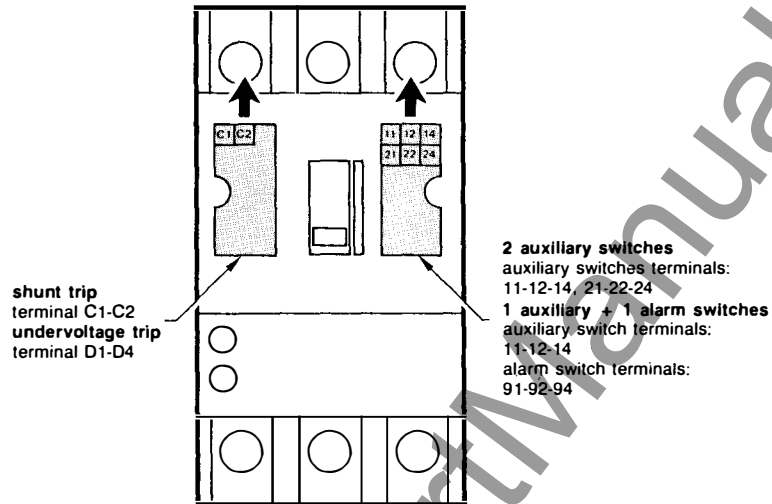
rated voltage (V)	inrush current (A)	fuse amps (A)
50/60 Hz		
120	6	10
240	4	10
DC		
24	15	15
48	11	10
125	6	10

Maximum operating frequency :  
2 operations per minute



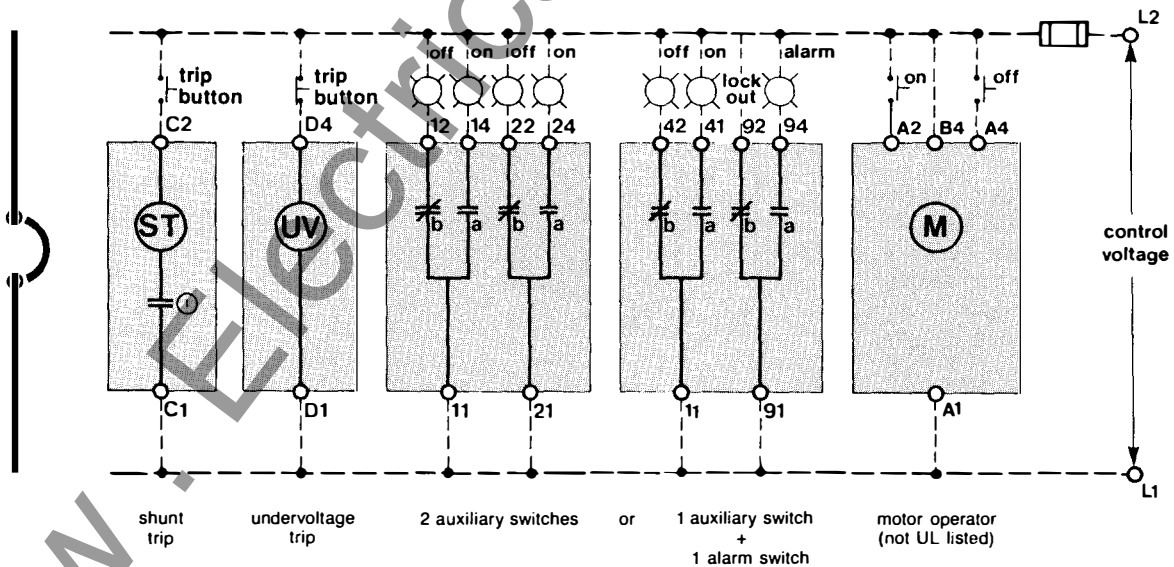
# Compact CF molded case circuit breaker accessories wiring diagram

## Location



## wiring diagram

note: contacts are shown with the breaker in the open and reset position



1 coil clearing switch

# Compact CF molded case circuit breaker power connections

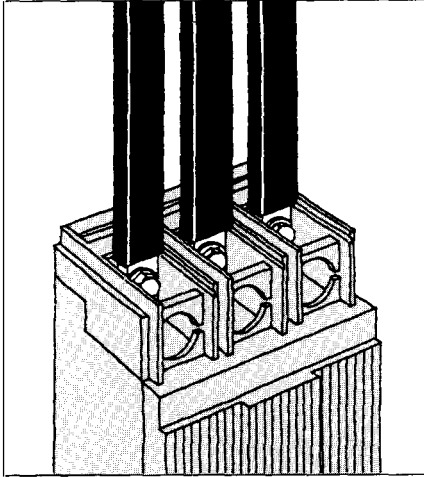
CF circuit breakers may be connected with bus bars or cables on both line and load side.

The type of connections shall be specified when ordering.

A field modification is possible to either mount or remove the cable lugs.

Complete instructions are given with the set of 3 lugs and in the installation instructions supplied with the breaker.

## connection with bus bars



CF circuit breaker can be connected with copper or aluminium bus bars.

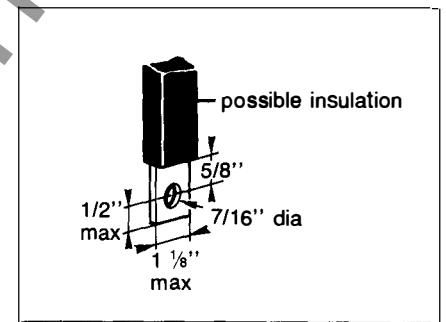
### Tightening

The bus bars shall be secured with the screws and Belleville washers provided.

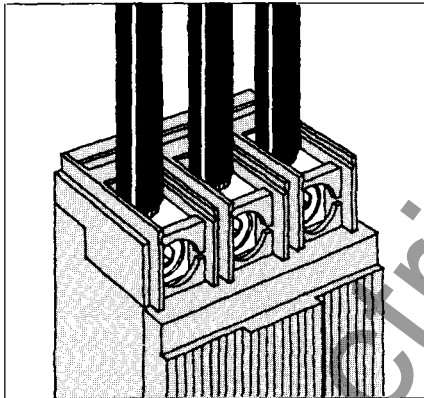
Tightening torque is 275 lb-in.

### Note :

for voltages above 240V, insulation of bus bars may be required to meet spacings between phases required by the NEC.



## connection with cables



Cables can be connected by pressure type terminals with a range of :

4 AWG to 250 MCM Cu

4 AWG to 350 MCM Al.

The cable strip length is : 1".

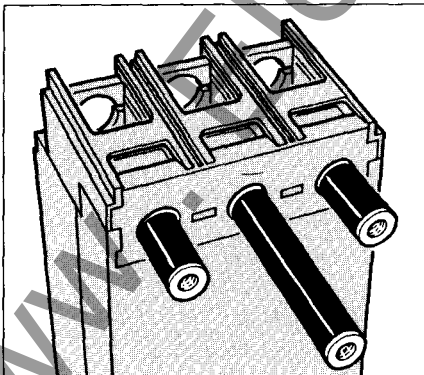
Screws shall be torqued at 375 lb-in (3/8" allen wrench).

### Caution :

for reliable electrical contact, connectors are plated, do not abrase them.

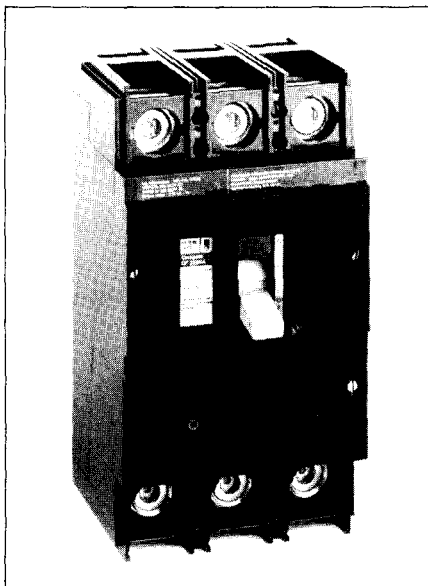
The connectors are secured on breaker by screws tightened at 275 lb-in (5/16" allen wrench).

## rear connections ①



① not UL listed

# Compact CF molded case switch



## ratings

CF 250NA	max rating	when protected by :		
		CF 250N	CF 250H	CF 250L
suitable for use on a circuit (max. RMS sym. amps)	at 240V	25,000	65,000	150,000
	at 480V	25,000	35,000	150,000

## accessories-dimensions- installation-connections

Molded case switch accessories, dimensions, installation and connection are identical to those of the corresponding circuit breaker.

	page
accessories	9
dimensions	15
connection	13

## construction

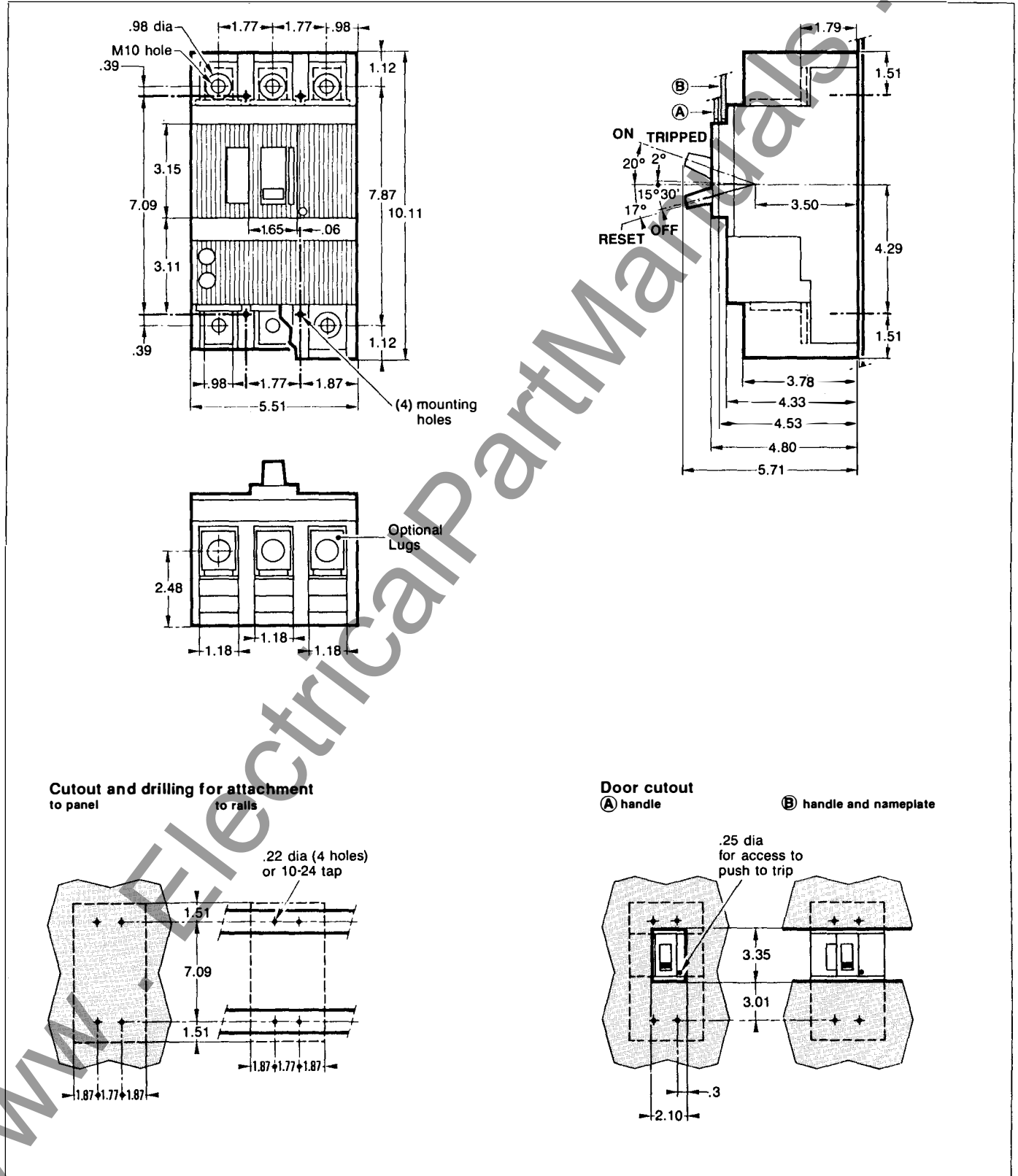
CF molded case switch is designed identically to CF molded case circuit breaker, except that it is not equipped with trip unit.

**Caution :**  
molded case switches does not provide overcurrent protection.

Molded case switch can be protected by a CF circuit breaker.

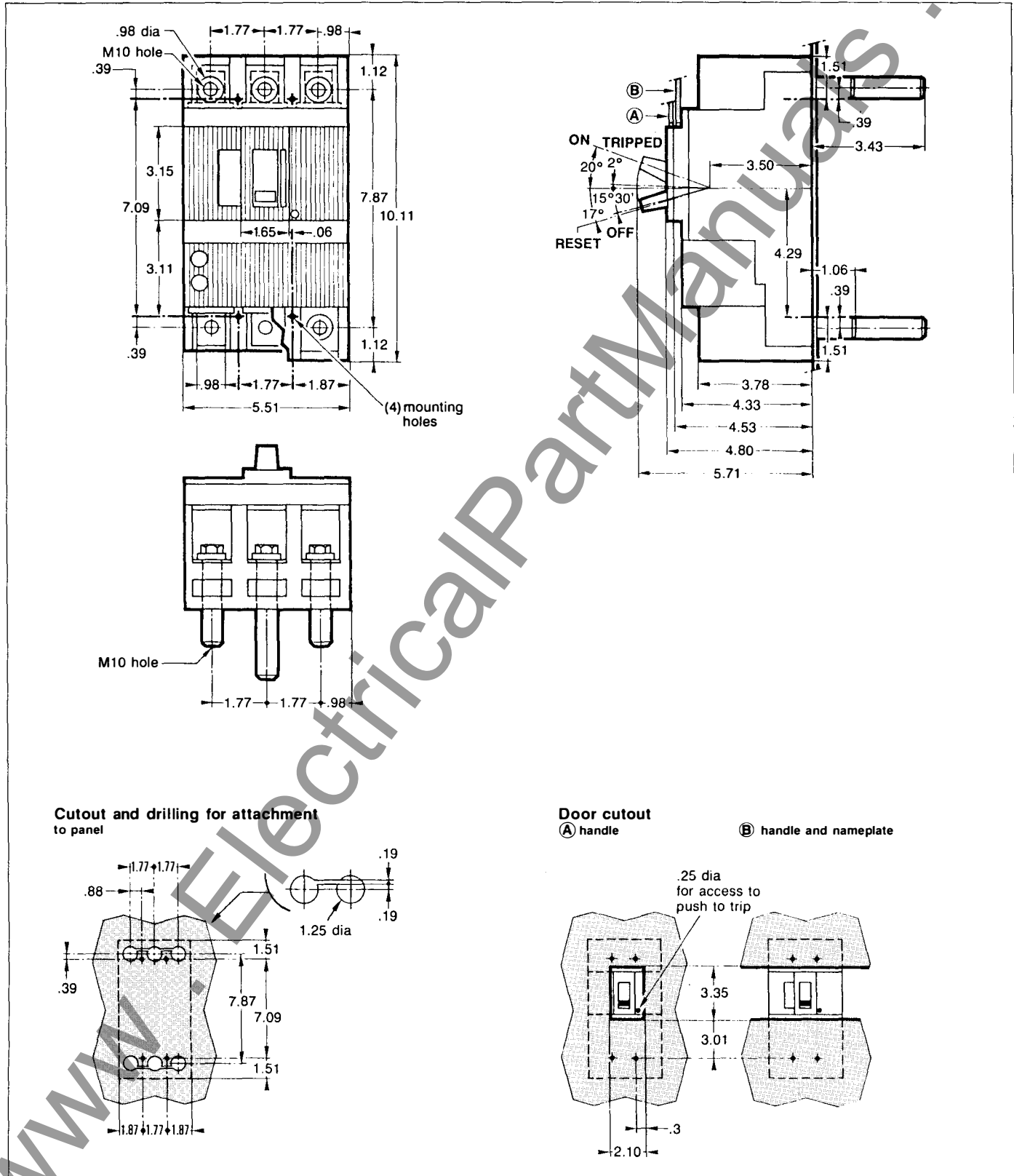
# Compact CF molded case circuit breakers dimensions

CF 250N - CF 250H - CF 250NC - CF 250NA  
front connection - 2 and 3-pole



# Compact CF molded case circuit breakers dimensions

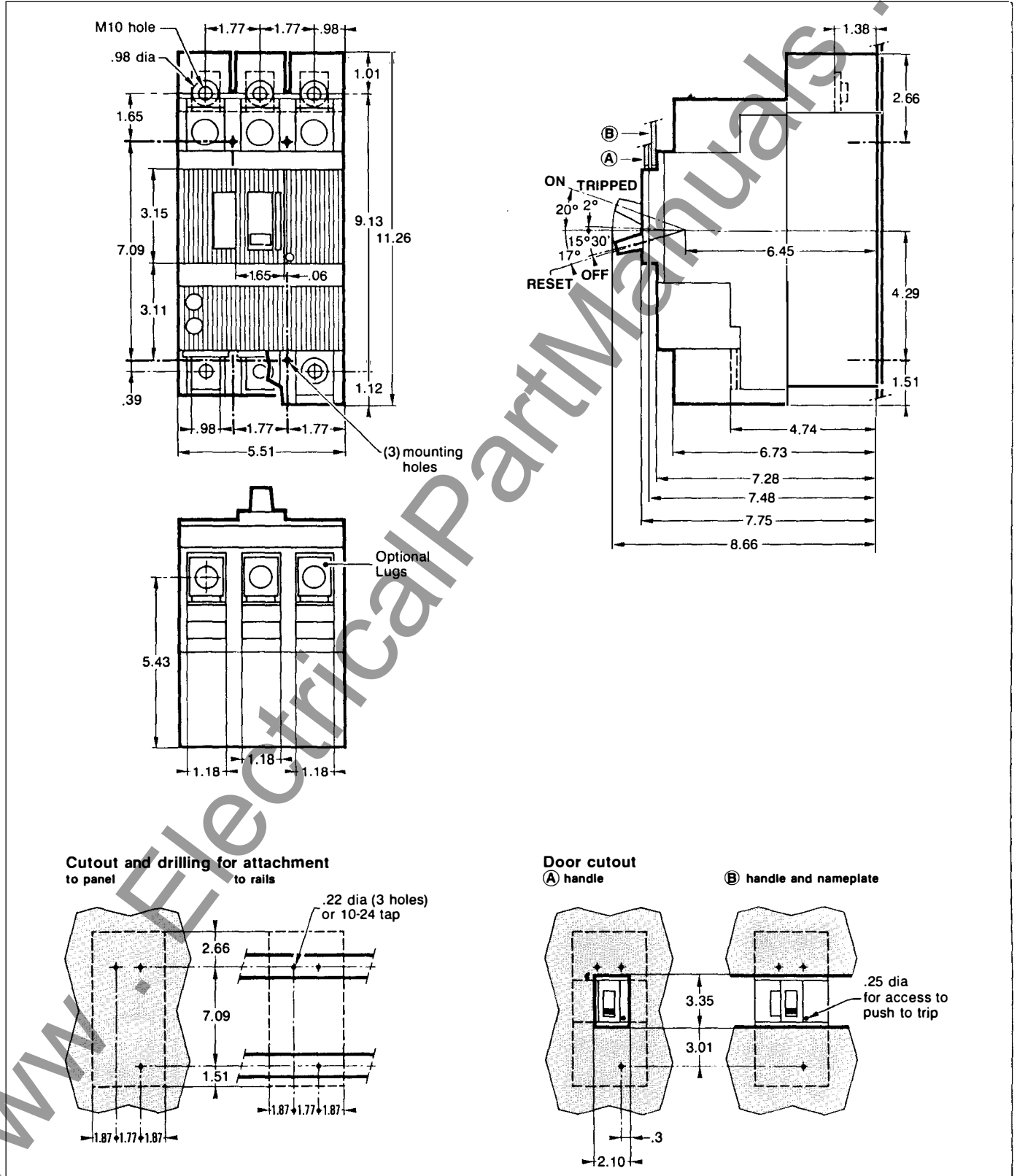
CF 250N - CF 250H - CF 250NC - CF 250NA  
 rear connection - 2 and 3-pole





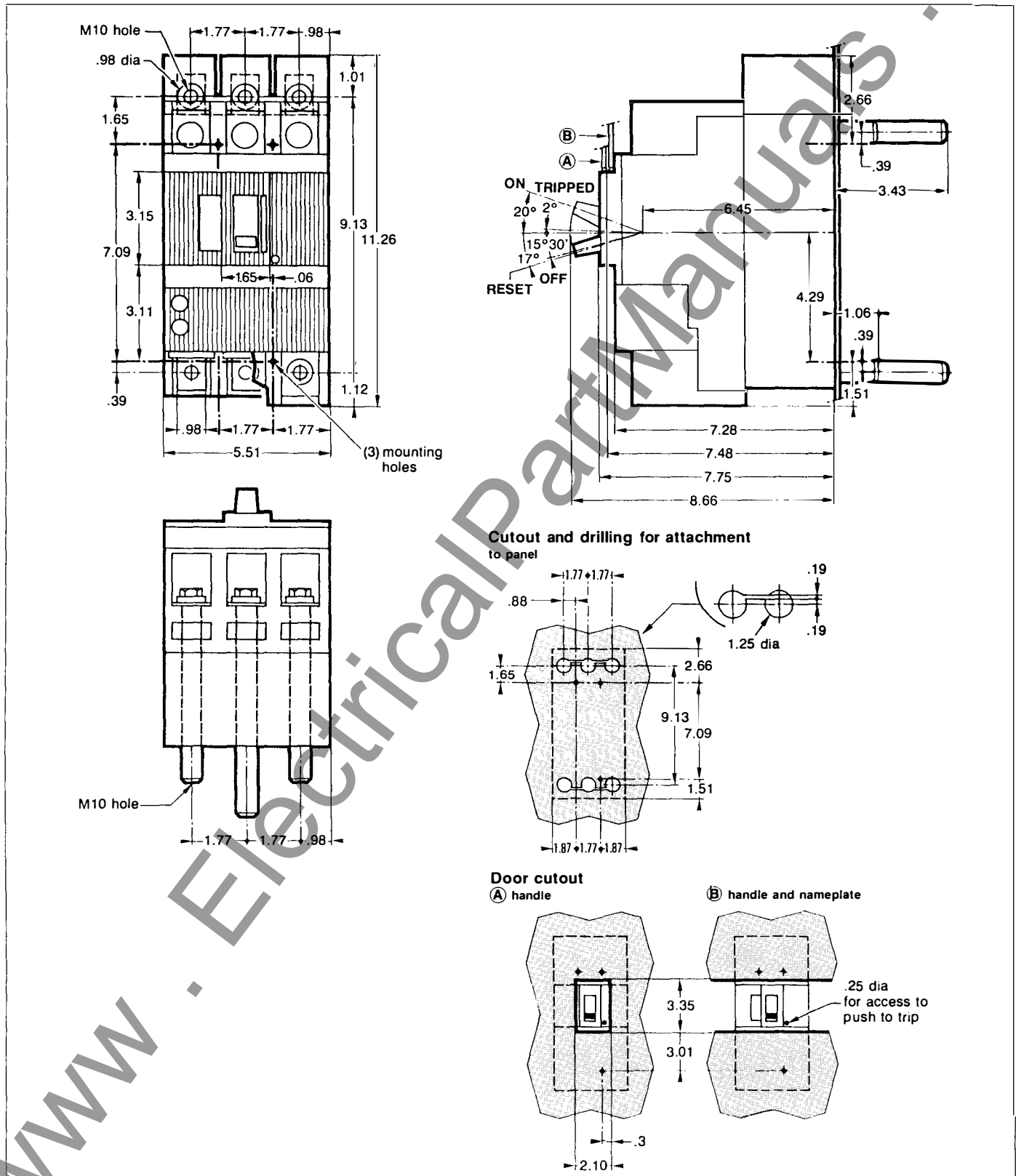
# Compact CF molded case circuit breakers dimensions

## CF 250L front connection



# Compact CF molded case circuit breakers dimensions

## CF 250L rear connection



# Compact CF molded case circuit breakers routine maintenance guidelines

## recommended inspection intervals

Merlin Gerin circuit breakers are designed to be maintenance-free. However, all equipment with moving parts requires periodic inspection to ensure optimum performance and reliability. We recommend that the circuit breakers be routinely inspected six months after installation, followed by annual inspection. Intervals can vary depending on your particular experience.

## inspection of terminals

- Connections to circuit breaker terminals could be inspected. If there is discoloration due to overheating, the joint should be disassembled and the surface cleaned before reinstallation. It is essential that electrical connections be made carefully in order to prevent overheating.
- Check for terminal tightness.

## cleaning

Remove the dust and dirt that have accumulated on the circuit breaker surface and terminals.

## mechanical checks

Even over long periods circuit breakers are not often required to operate on overload or short-circuit conditions. Therefore it is essential to operate the breaker periodically. To trip the breaker, push the push-to-trip button.

## insulation resistance tests

When breakers are subjected to severe operating conditions, insulation resistance test should be performed as indicated in NEMA standard publication no AB2-1980.

An insulation resistance test is used to determine the quality of the insulation between phases and phase to ground. The resistance test is made with a DC voltage higher than the rated voltage, to determine the actual resistance of the insulation. The most common method employs a "megger" type instrument. A 1000-volt instrument will provide a more reliable test because it is capable of detecting tracking on insulated surfaces. Resistance values below 1 megohm are unsafe and should be investigated.

An insulation test should be made :

- between line and load terminals of individual poles with the circuit breaker contacts open.
- between adjacent poles and from poles to the metallic supporting structure with the circuit breaker contacts closed. The latter test may be done with the circuit breaker in place after the line and load conductors have been removed, or with the circuit breaker bolted to a metallic base which simulates the in-service mounting.

## electrical tests

These tests require equipment for conducting pole resistance, overcurrent and instantaneous tripping, in accordance with NEMA standard publication no AB 2. They are not within the scope of normal field operation.

## Important

**All tests must be made on circuit breakers which have been de-energized, and disconnected so as to prevent accidental contact with live parts.**

## Caution

**Since molded case circuit breakers contain factory-sealed and calibrated elements, it is essential that the seal is not broken and the circuit breaker is not tampered with. Molded-case circuit breakers should not be field adjusted or repaired. In the case of malfunction, the circuit breaker should be replaced or repaired at the Merlin Gerin factory, or by an authorized representative.**

# Compact CF molded case circuit breakers UL 489 test procedures

(extrat from UL 489 with revisions through January 2nd, 1986)

## standard tests

For solid state trip breaker, and uncompensated thermal breaker rated 40°C, the test sequences are :

test	sequence		
	X	Y	Z
200% calibration at 25°C (77°F)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
135% calibration at 25°C (77°F)	<input type="checkbox"/>	<input type="checkbox"/>	
calibration of adjust instant trip overload	<input type="checkbox"/>	<input type="checkbox"/>	
tungsten lamp load	①		
100% calibration at 40°C (104°F)	②		
temperature and 100% calibration at 25°C (77°F)	<input type="checkbox"/>		
endurance		<input type="checkbox"/>	
200% calibration at 25°C (77°F) repeated		<input type="checkbox"/>	
135% calibration at 25°C (77°F) repeated		<input type="checkbox"/>	
interrupting ability (Y sequence)		<input type="checkbox"/>	
interrupting ability (Z sequence)			<input type="checkbox"/>
200% trip out at 25°C (77°F)		<input type="checkbox"/>	<input type="checkbox"/>
dielectric voltage withstand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- ① Applies only for breakers rated 55 A or less, 125 or 125/250V or less  
② Applies only for thermal breakers rated 40°C.

## standard specifications

### 200% calibration at 25°C :

The breaker must trip within time limits which depend on the rating from 2 minutes for a 30A rated breaker, up to 30 minutes over 2000A.

### 135% calibration at 25°C

The breaker must trip within two hours (for breakers rated more than 50 A).

### Calibration of adjustable instantaneous trip

The breaker must trip within the range of 80-120% of the maximum marked tripping current and 75-125% of the minimum marked tripping current.

### Overload

Up to 1600A, fifty operations at 600% of rated current ; 2000 and 2500A, twenty-five operations at 600 % of rated current;  
3000 to 6000A, three operations at 600% followed by twenty-five operations at 200 % of rated current.  
The power factor shall be from 0.45 to 0.50 lagging.

### Temperature

When connected with specified cables or bus bars (see below) and with its rated current, the temperature rises on the breaker and at its terminals does not exceed specified limits.

Examples of specified wires and bus

■ bars "75°C" copper wire

rating	number	size
100A	1	1 AWG (60°C)
	or 1	3 AWG
250A	1	250 MCM
400A	2	3/0 AWG
600A	2	350 MCM
800A	3	300 MCM
1000A	3	400 MCM
1200A	4	350 MCM

■ Copper Bus Bar

rating	number	size
1600A	2	1/4 x 3
2000A	2	1/4 x 4
2500A	2	1/4 x 5
	or 4	1/4 x 2
3000A	4	1/4 x 4

(1200A or less : 1000A / in<sup>2</sup>)

### Endurance

The breaker must complete an endurance test :

■ operations at rated current and rated voltage

■ followed by no load operation .

The power factor shall be 0.75 to 0.80 lagging.

Examples:

frame size	number of cycles of operations		
	with current	without current	total
100A	6,000	4,000	10,000
225A	4,000	4,000	8,000
400A	1,000	5,000	6,000
600A	1,000	5,000	6,000
800A	500	3,000	3,500
1200A	500	2,000	2,500
1600A	500	2,000	2,500
2000A	500	2,000	2,500
2500A	500	2,000	2,500
3000A	400	1,100	1,500

# Compact CF molded case circuit breakers

## Interrupting ability (Y sequence)

After endurance tests and calibrations repeated, the breaker completes an opening followed by a close-open operation (O-t-CO), with specified current.

Examples for three pole breakers:

frame rating	RMS Sym.Amps (3 poles O-t-CO)
100A ①	3000
225A	3000
400A	5000
600A	6000
800A	10000
1200A	14000
1600A	10000
2000A	25000
3000A	35000

① Above 250V.

## Interrupting ability (Z sequence)

A 3-pole breaker rated 240, 480 or 600V have to complete an opening operation and a close-open operation (O-t-CO) on each pole, at rated voltage, followed by an opening operation (O) using all the three poles for the frame sizes up to 1200A, an additional close-open operation on the three poles is required). Examples for 3-pole breaker :

frame rating	RMS Sym. Amps	
	each pole O-t-CO	common O O-t-CO
100 to 800A	8660	10000
1000 to 1200A	12120	14000
1600	1400	20000
2000	14000	25000
3000	25000	35000

## Dielectric

After tests, the breaker must withstand for one minute a voltage of 1000V plus twice the rated voltage between :

- line and load terminals
- terminals of opposite polarity
- live parts and the overall enclosure

## Optional test : high available fault current

Breakers having passed all the standard tests may have the UL label applied at higher values than the standard. Test sequence is as follow :

- 200% calibration
- interrupting capacity : an opening operation followed by a close open operation (O-t-CO) on all poles are performed on the circuit breaker. The power factor over 20000A shall be 0.15 to 0.2 lagging
- trip out at 250%
- dielectric at twice the rated test voltage.

## Optional test : 100% rated

Breakers having passed all the standard tests may have the UL label applied to use the circuit breaker in an enclosure, when caring 100% of its maximum rating. The circuit breaker is submitted to additional temperature tests performed as in Standard tests, except that the breaker is installed in an enclosure. The dimensions and possible ventilations shall be recorded and shall be marked on the breaker.

## tests on accessories

### Shunt trip and undervoltage trip

These devices are submitted to temperature, overvoltage, operation, endurance and dielectric tests.

#### ■ Overvoltage test

It checks that the device is capable of withstanding 110% of its rated voltage continuously without injury (this test does not apply to a shunt trip with an "a" contact connected in series).

#### ■ Operation

The shunt trip must operate at 75% of its rated voltage (except that shunt trip devices for use with ground fault protection shall operate at 55%).

The undervoltage trip must trip the breaker when the voltage is between 35 and 70% of its rated voltage and shall seal (i.e.: the breaker cannot be turned on ON position) when the voltage is at 85% or more of its rated voltage.

#### ■ Endurance

The device must be capable of performing successfully for 10% of the number of "with current" operations of the breaker.

### Auxiliary and alarm switches

Auxiliary and alarm switches must be submitted to temperature, overload, endurance and dielectric tests.

#### ■ Overload test

The test consists of fifty operations making and breaking 150% of rated current at rated voltage, with a 75-80% power factor in AC and non inductive load in DC.

#### ■ Endurance

The switch must make and break its rated current at rated voltage, with a 75-80% power factor in AC, and non inductive load in AC for :

100% of the number of operations "with current" for auxiliary switches, and 10% of this number for alarm switches.

# international standard

## molded case circuit breaker

In addition to UL 489 standard CF breakers comply with IEC 157-1 standard as per table below

CF type	ampere rating (A)	UL listed		IEC 157-1
		Interrupting Rating		
		RMS Sym. Amps		
		240V	480V	380/415V
2-3 pole	40°C			
<b>standard breakers</b>				
CF 250N	250	25,000	22,000	25,000
<b>high interrupting breakers</b>				
CF 250H	250	65,000	35,000	35,000
<b>current limiting breakers</b>				
CF 250L	250	150,000	150,000	150,000

## molded case switch

CF type	ampere rating	short circuit withstand	when protected by fuse
		RMS Sym. Amps	of max. ratings (A)
3 pole			
CF 250NA	250A	100,000	250

## shunt trip

rated voltage (V)			
UL 489 listed		IEC 157-1	
60Hz	120	50/60Hz	110-127
	240		220-240
	480		380-415
DC	24	DC	24
	48		48
	125		125

## undervoltage trip

rated voltage (V)			
UL 489 listed		IEC 157-1	
DC	24V	DC	24V
	48V		48V
	125V		125V

## auxiliary switches, alarm switch, overcurrent trip switch.

IEC 157-1 characteristics are the same as those indicated in page 10.

## circuit breakers for compliance with other world standards.

Where compliance with IEC standards is required, Merlin Gerin offers a versatile range (x) of CF circuit breakers to meet your specific need. Units include two, three or four poles, voltages up to 660V ratings from 160 to 250 A, three levels of interrupting capabilities up to 660V.

An extensive range of accessories complements the product line.

For further information, please contact your Merlin Gerin representative.

(x) not UL listed

[www.ElectricalPartManuals.com](http://www.ElectricalPartManuals.com)

www.ElectricalPartManuals.com



[www.ElectricalPartManuals.com](http://www.ElectricalPartManuals.com)

---

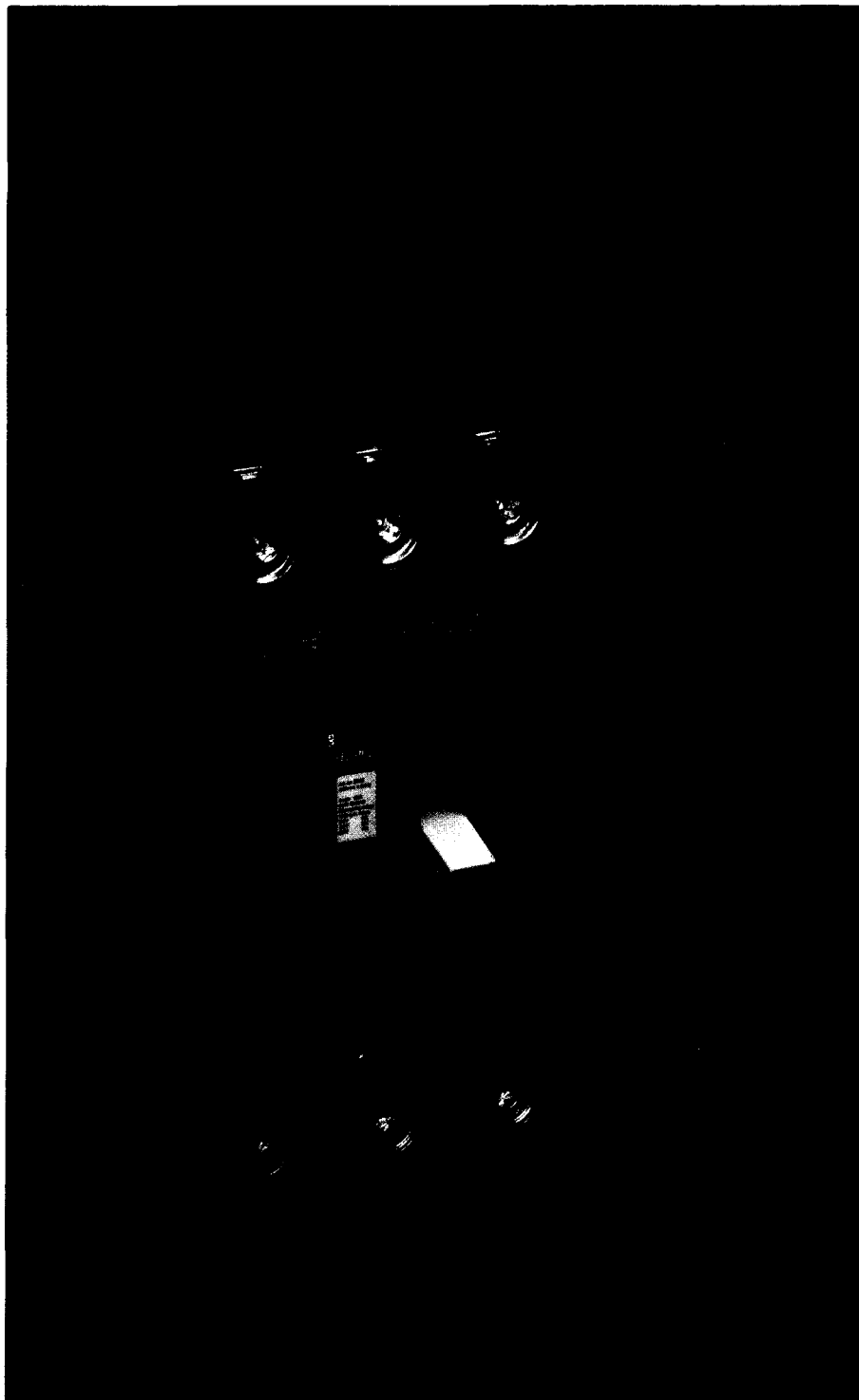
MERLIN GERIN INC.  
5000 Highlands Pkwy.  
Suite 150  
SMYRNA, GA 30080  
(404) 432.2744

As standard specifications and designs change  
from time to time, please ask for confirmation of  
the information given in this publication.

photos : Merlin Gerin, B. Maurice  
illustrations : Y. Marchand.  
IPV - 02/87 - 1000 - Imp. Colorpress

# MERLIN GERIN

**molded case  
circuit breakers  
250A**



*mastering electrical power*



[www.ElectricalPartManuals.com](http://www.ElectricalPartManuals.com)

# Compact CF circuit breaker table of contents

---

	page
<b>molded case circuit breaker</b>	
<b>introduction</b>	
standard compliance	2
ratings	2
interrupting ratings	2
<b>advantages</b>	3
<b>description</b>	2, 4
current limiting circuit breakers	5
I <sub>p</sub> and I <sub>t</sub> <sup>2</sup> curves	6
<b>time current curves</b>	7
<b>accessories</b>	
terminals	11
location	11
padlock adaptator	11
door escutcheon	11
label holder	11
boot	11
shunt trip	12
undervoltage trip device	12
auxiliary and alarm switches	12
overcurrent trip switch	12
motor operator	13
rotary operating handle	15
<b>wiring diagrams</b>	16
<b>main connections</b>	
front connection	17
rear connection	17
plug-in mounting	17
<b>molded case switch</b>	18
<b>dimensions</b>	19
<b>appendix</b>	
UL 489 test procedures	24
routine maintenance guidelines	26
international standards	27

# Compact CF circuit breaker introduction, description

## standard compliance

CF circuit breakers are built in accordance with Underwriters Laboratories standard UL 489 and CSA C22-2 no.5. The circuit breaker and its accessories, except when noted, are listed under UL files E107820, E107821, E107822, E116305 and E103740.

## additional tests

In addition to standard tests, CF circuit breakers meet UL standard 489 optional requirements (high available fault current).

## compliance with international standards

In addition to UL489 and CSA C22-2 no.5 the Compact CF has been designed to comply also with the international standard IEC 157-1 as well as with the major standards :

- british BS 4752,
- german VDE 660,
- french NF C63-120,
- australian AS 2184.

Compact circuit breakers have been approved for marine application by American Bureau of Shipping, Bureau Veritas, Lloyd's Register of Shipping, Registro Italiano Navale, Germanische Lloyd's and Det Norske Veritas.

## interrupting ratings

Compact circuit breakers are listed for 3 levels of interrupting capabilities :

- 35,000 Amps at 480V for the standard breaker
- 42,000 Amps at 480V for the high interrupting breaker
- 150,000 Amps at 480V for the current limiting breaker.

## ratings

7 ratings from 70 to 250 Amperes. Non interchangeable trip units.

ampere ratings(A)	magnetic setting (A)	
	low	high
<b>CF 250N - CF 250H - CF 250L</b>		
70	fixed at 700	
90	fixed at 900	
100	fixed at 1000	
125	750	1250
150	900	1500
175	1050	1750
200	1200	2000
225	1350	2250
250	1500	2500
<b>CF 250HC - CF 250LC</b>		
150	900	1500
250	1500	2500

CF type 2, 3-pole 600Y/347V AC	UL listed - CSA approved interrupting ratings		
	RMS Sym. Amps		
	240V	480V	600V
<b>standard breakers</b>			
CF 250N	65,000	35,000	10,000
<b>high interrupting breakers</b>			
CF 250H	100,000	42,000	10,000
<b>current limiting breakers</b>			
CF 250L	150,000	150,000	65,000
<b>motor circuit protectors</b>			
CF 250HC	100,000	42,000	10,000
CF 250LC	150,000	150,000	65,000

Motor circuit protectors are similar to standard circuit breakers except that they do not provide overload protection. The magnetic trip has a single adjustment for all three poles.

They are equipped with a push to trip.

**Time current curves** : pages 7-8-9-10

# Compact CF circuit breaker advantages

## reinforced insulation

Two insulation barriers separate the front face of the circuit breaker from the main contacts.

This reinforced insulation allows safe operation and installation of the electrical auxiliaries. The compartment in which they are installed is independent from the compartment of the main contacts.

## integral partitioning

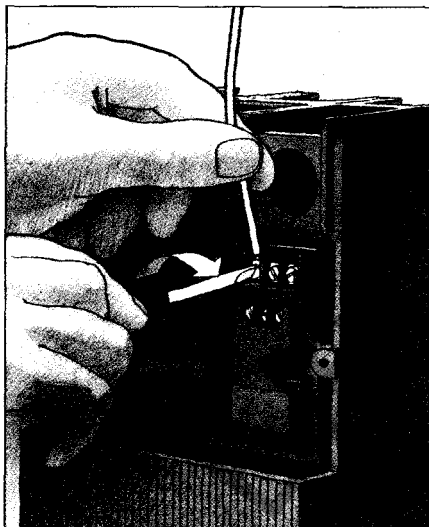
Once the front cover has been removed, to give access to the auxiliary compartments, the main circuits remain fully insulated. Furthermore, interphase partitioning allows full insulation between each pole even if the front cover has been removed.

## isolation function

The operating handle is representative of the position of the main contacts. The OFF position can be reached only when the main contacts are fully opened.

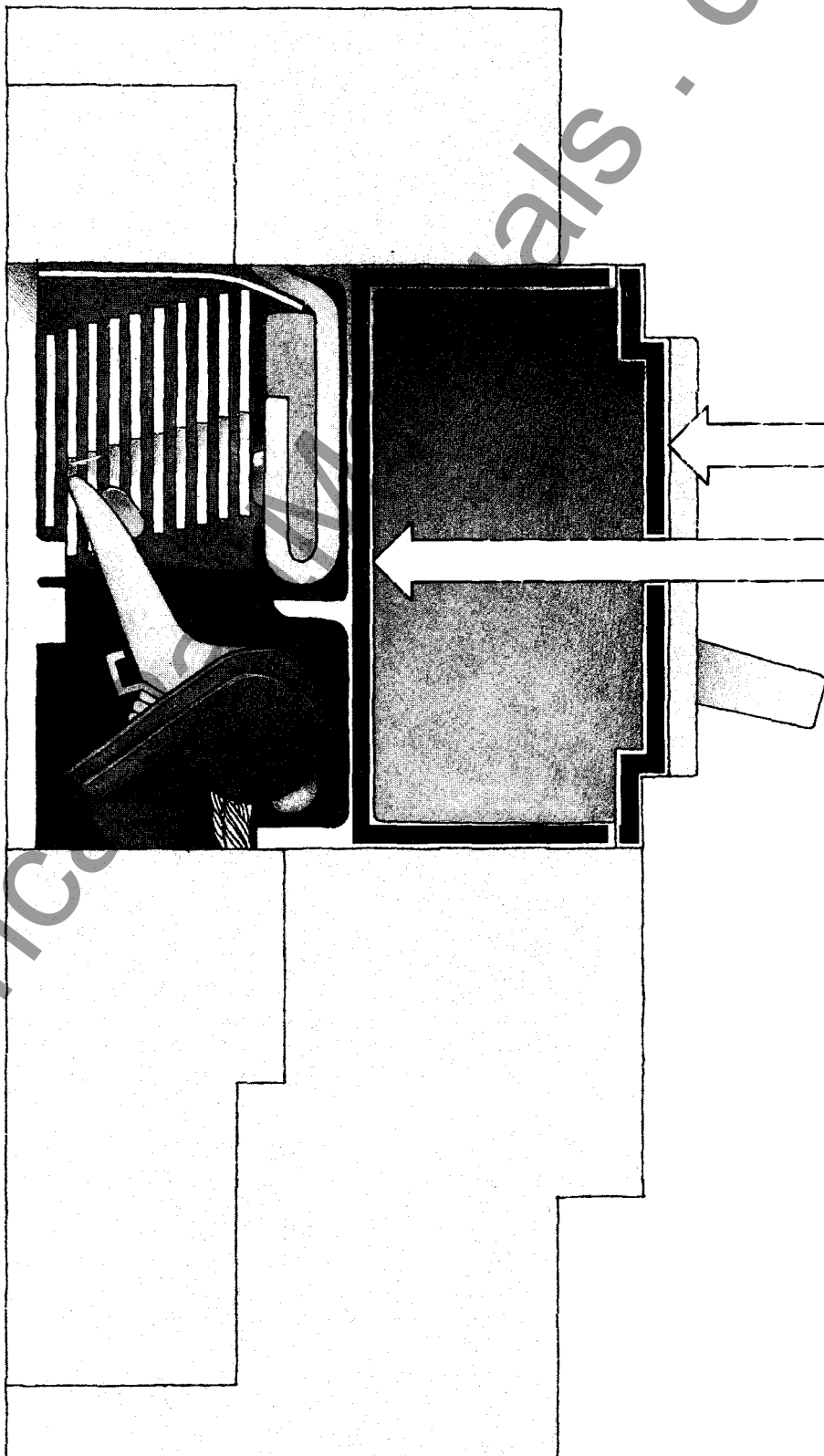
## built-in terminal blocks

Are provided with the accessories. Consequently, intermediate terminals are not required for the connection of control wiring. They are located behind a front accessory cover. Removing this cover gives no access to direct access to live parts. Internal accessories are UL listed and are field installable.



## plug-in disconnecting interlock

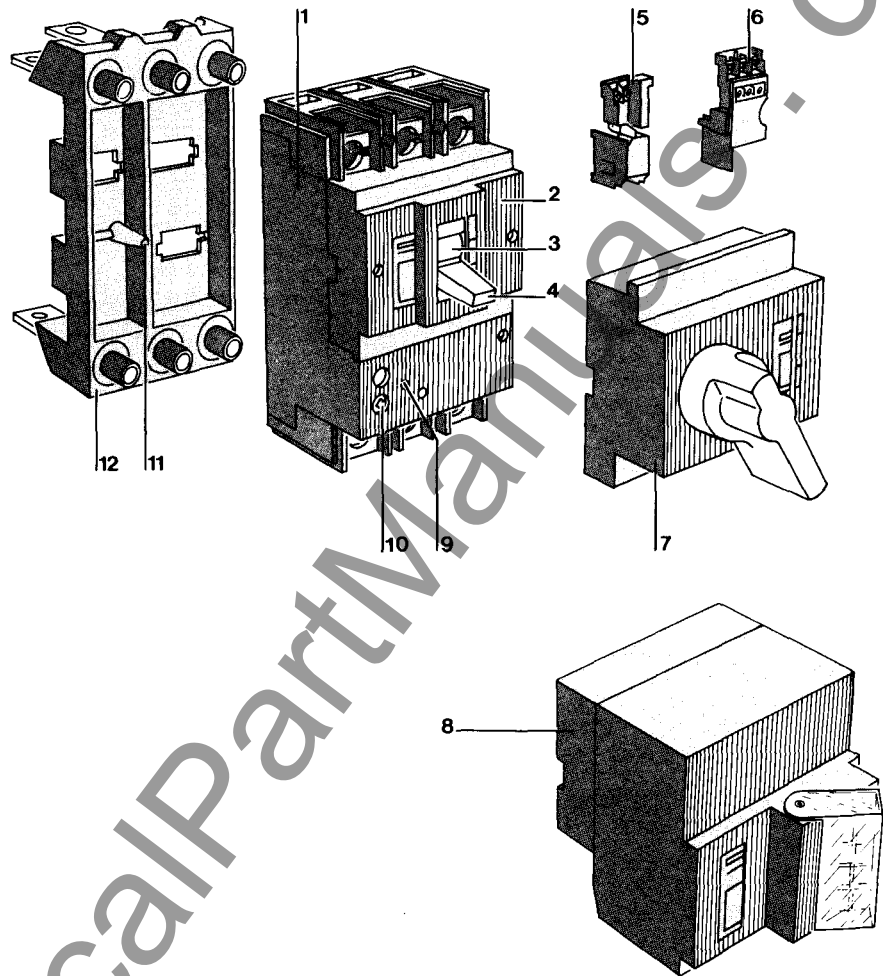
As a safety feature, in the event of disconnecting a closed breaker, a mechanical interlock will trip the breaker before the separation of the main disconnects.



# Compact CF circuit breaker description

## description

- 1 three-pole high strength glass polyester casing
- 2 front accessory cover (accessory terminals located on left and right hand side behind this cover)
- 3 quick-make/quick break mechanism
- 4 handle with three positions :  
ON-TRIPPED-OFF
- 5 shunt trip or undervoltage trip devices
- 6 auxiliary and alarm switches
- 7 rotary operating handle
- 8 motor operator
- 9 push-to-trip button
- 10 thermal magnetic trip unit with a single instantaneous adjustment of all poles
- 11 plug-in disconnecting interlock
- 12 plug-in assembly



CF circuit breakers exist in two different physical sizes, one for the standard and high interrupting type, and another one for the current limiting type.

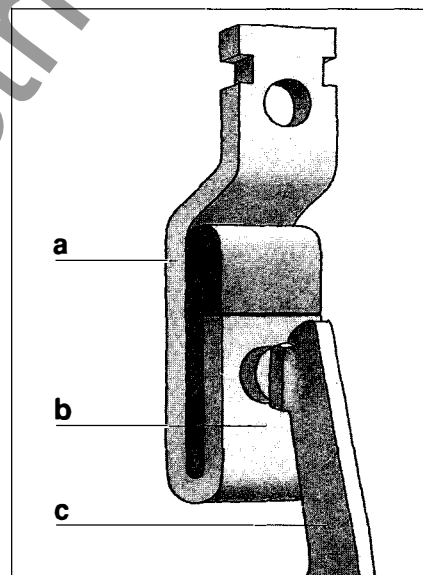
## standard and high interrupting rating circuit breakers

Simplicity and efficiency of design is achieved by using the following principles :

### Contact repulsion

Electrodynamic forces are generated by the current flowing in parallel conductors **b** and **c**. The moving contact is blown-off by those repulsive forces, which appear on a short circuit current.

Conductor **a** has been shielded by a magnetic screen in order to minimize the attractive force it creates on conductor **c**.

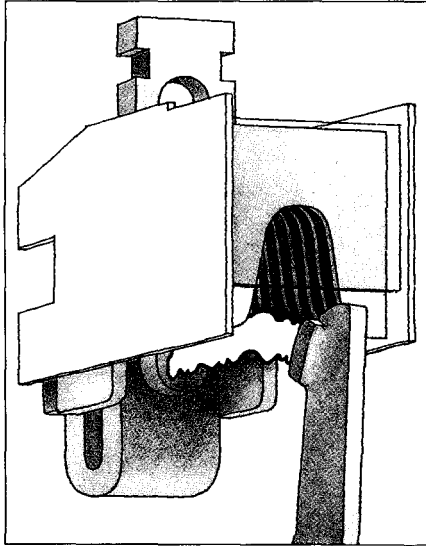




# Compact CF circuit breaker description

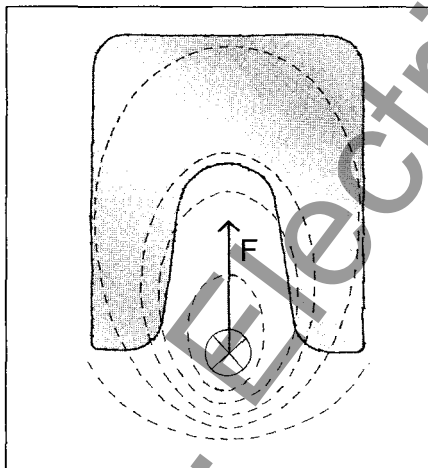
## Magnetic field enhancement

The magnetic force which propels the arc into the arc chute is dependant upon the magnetic field in the arc path. This is the purpose of the U-shaped steel plate around the contacts.



**Generation of local overpressure, by placing gas generating material near the arc roots.** In the event of thermal shock, gas is given off, which, due to the combined effect of blast and pressure, contributes to elongate the arc.

**Arc quenching due to the design and materials of the arc chute, a magnetic force  $F$  draws the arc into the V-shaped plates. It is then split and cooled until extinction.**



## current limiting circuit breakers

A series association of the basic circuit breaker, including the arrangements described above, and a limiting compartment equipped with an original system enables outstanding performances to be obtained.

- very high interrupting capability
  - specialization of the devices according to the current to be interrupted :
    - the basic circuit breaker interrupts currents of up to 4,000 Amperes,
    - over 4,000 Amperes, both devices operate simultaneously. This mutual assistance noticeably reduces contact wear.
- These performances are obtained by combination of the following techniques in the current limiting block :
- contact repulsion
  - overpressure generation
  - enhancement of induced magnetic field.

**Contact repulsion.** The effect of the repulsive electrodynamic forces described above is accentuated by the length of opposite conductors. The moving contacts are repulsed.

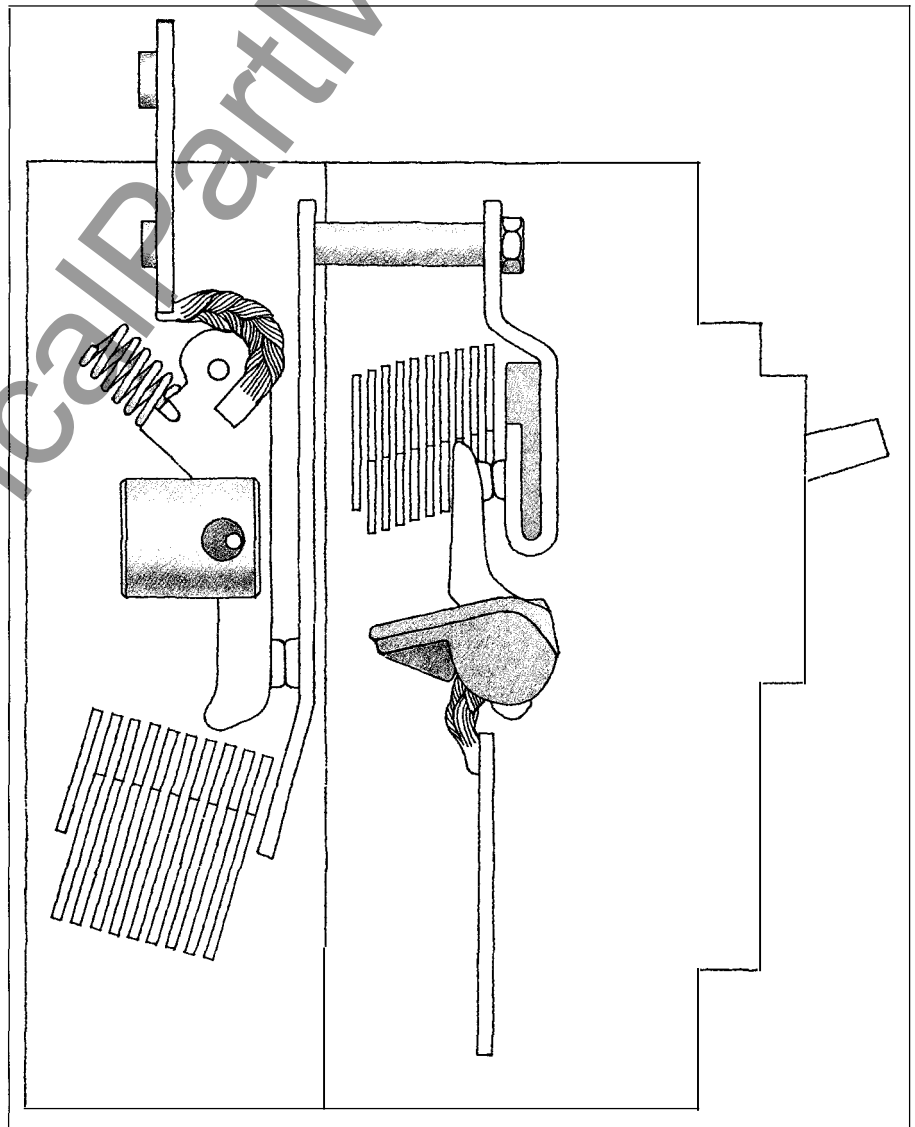
## Overpressure generation

As in the basic breaker, a gas generating material produces both gas pressure and blast and helps arc interruption.

## Contact and tripping coordination

By means of calibrated U-shaped circuit inertia and spring force, full opening of basic circuit breaker is ensured by tripping before reclosing of current limiting unit contacts arms.

The combined action of the above together with the 2 sets of contacts in series allows very rapid interruption of any fault current and a very high current limitation.



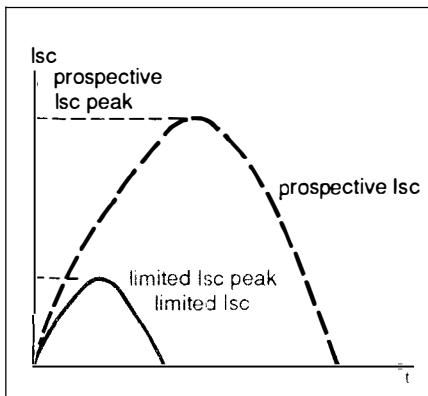
# Compact CF circuit breaker description

## $I_p$ and $I^2t$ curves

The limitation capability of a circuit breaker is that characteristic whereby only a current less than the prospective fault current is allowed to flow under short-circuit conditions.

This is illustrated by limitation curves which give :

- **the limited peak let-through current** in relation to the RMS sym. value of the prospective short-circuit current (the short-circuit current that would flow continuously in the absence of protective equipment) ;
- **the limited let-through energy** (thermal stress) in relation to the RMS sym. value of the prospective short-circuit current.



Installation of current limiting circuit breakers offers several advantages :

### Better protection

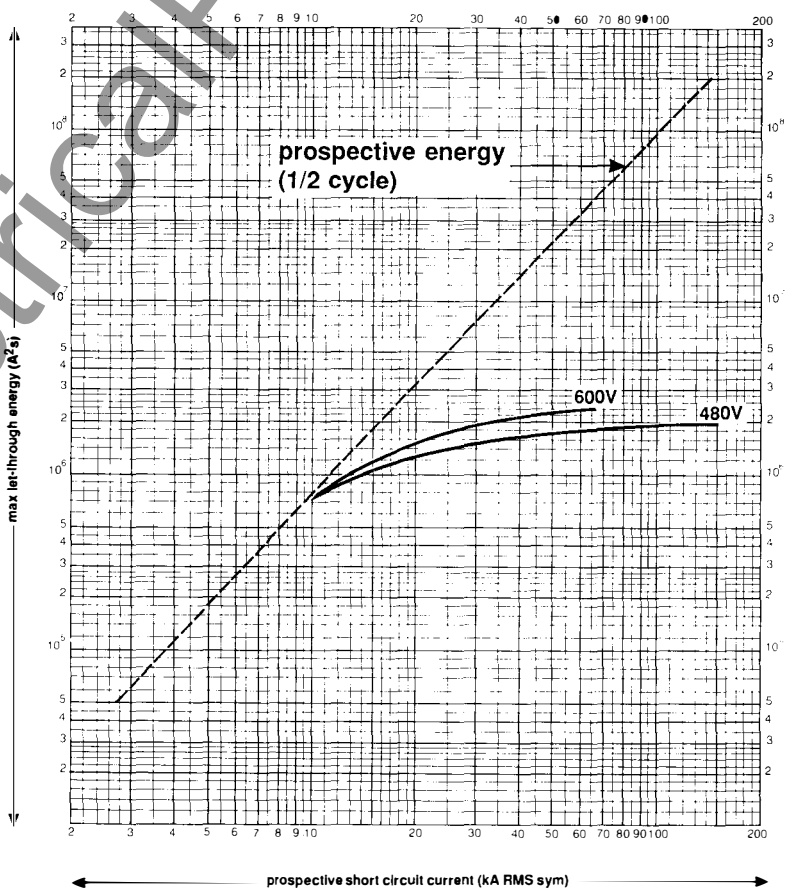
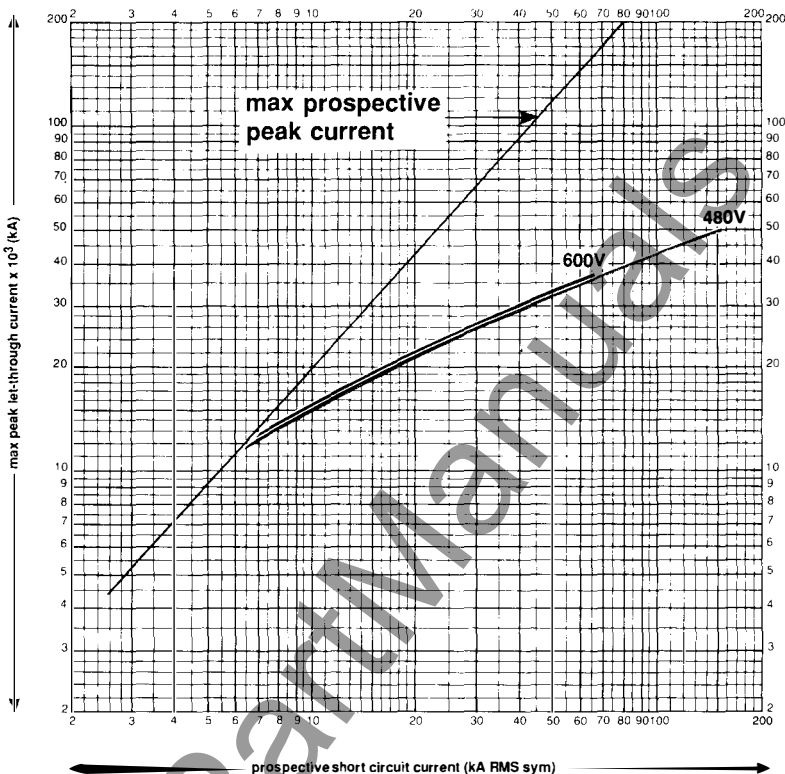
Current limiting circuit breakers considerably reduce the undesirable effects of short-circuit currents in an installation.

### Reduced mechanical effects

Electrodynamic forces are reduced, thus electrical contacts are less likely to be deformed or broken.

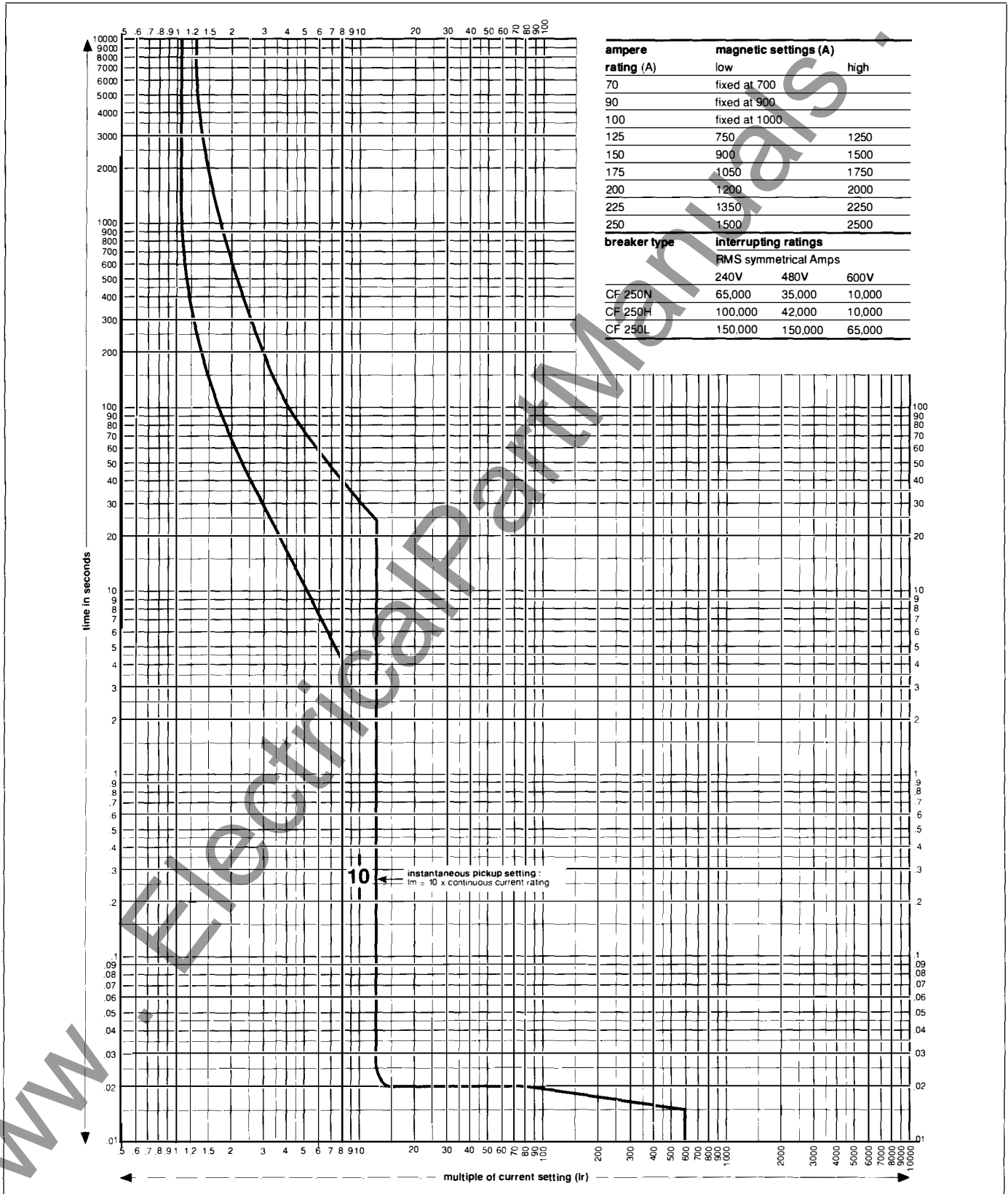
### Reduced electromagnetic effects

Measuring equipment situated near an electrical circuit is less affected.



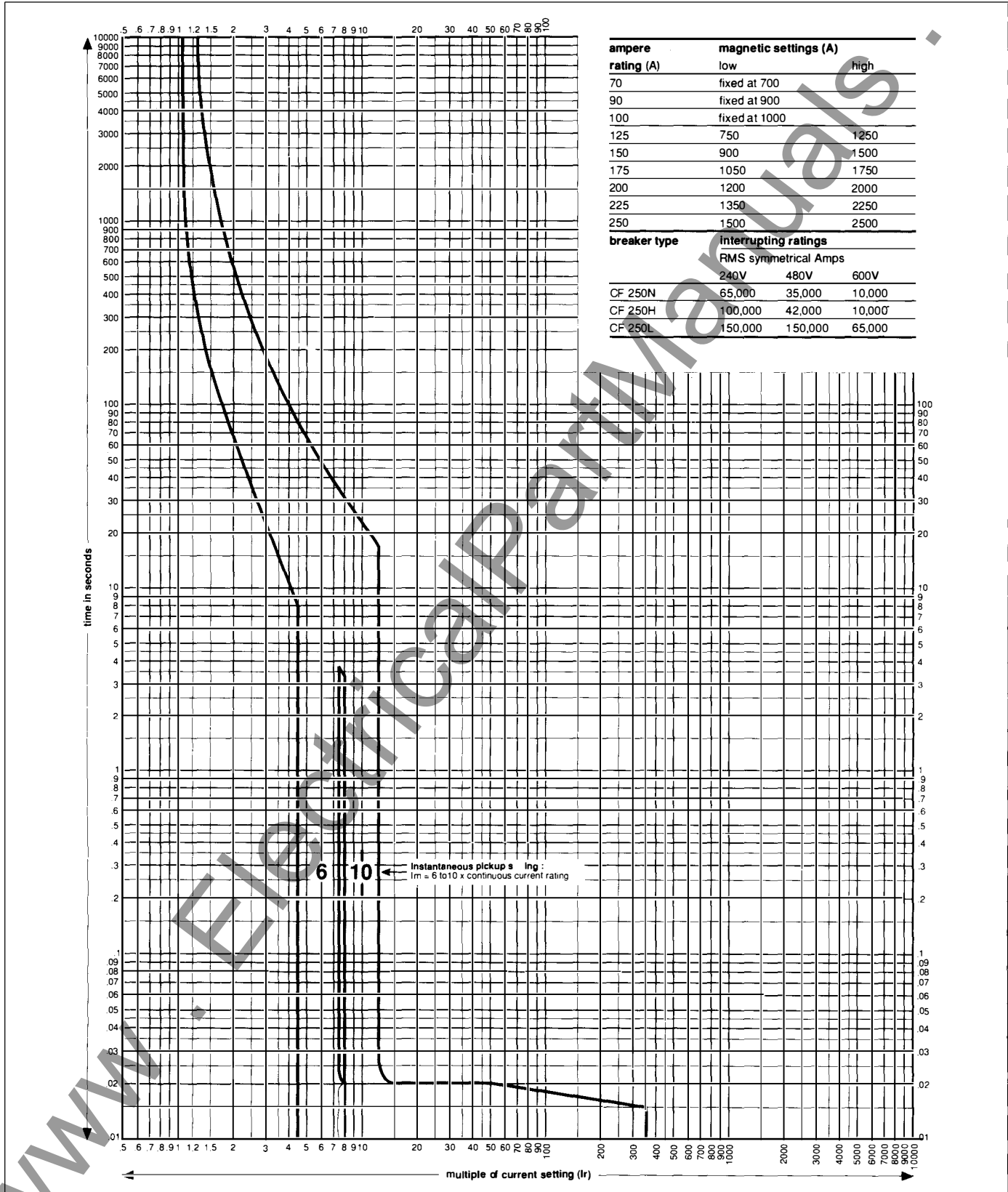
# Compact CF circuit breaker time current curves

70, 90 and 100 Amp.



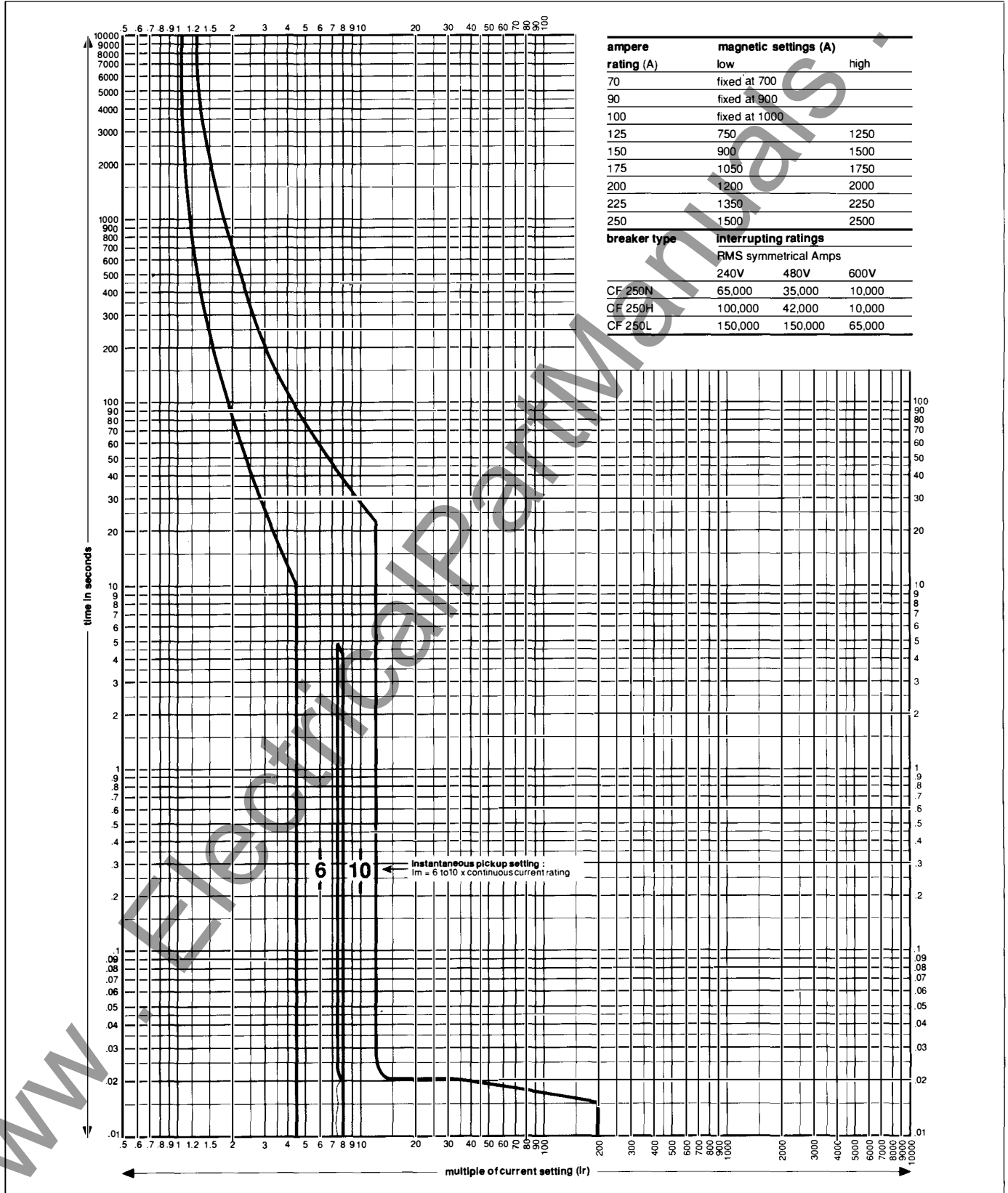
# Compact CF circuit breaker time current curves

125, 150 and 175 Amp.



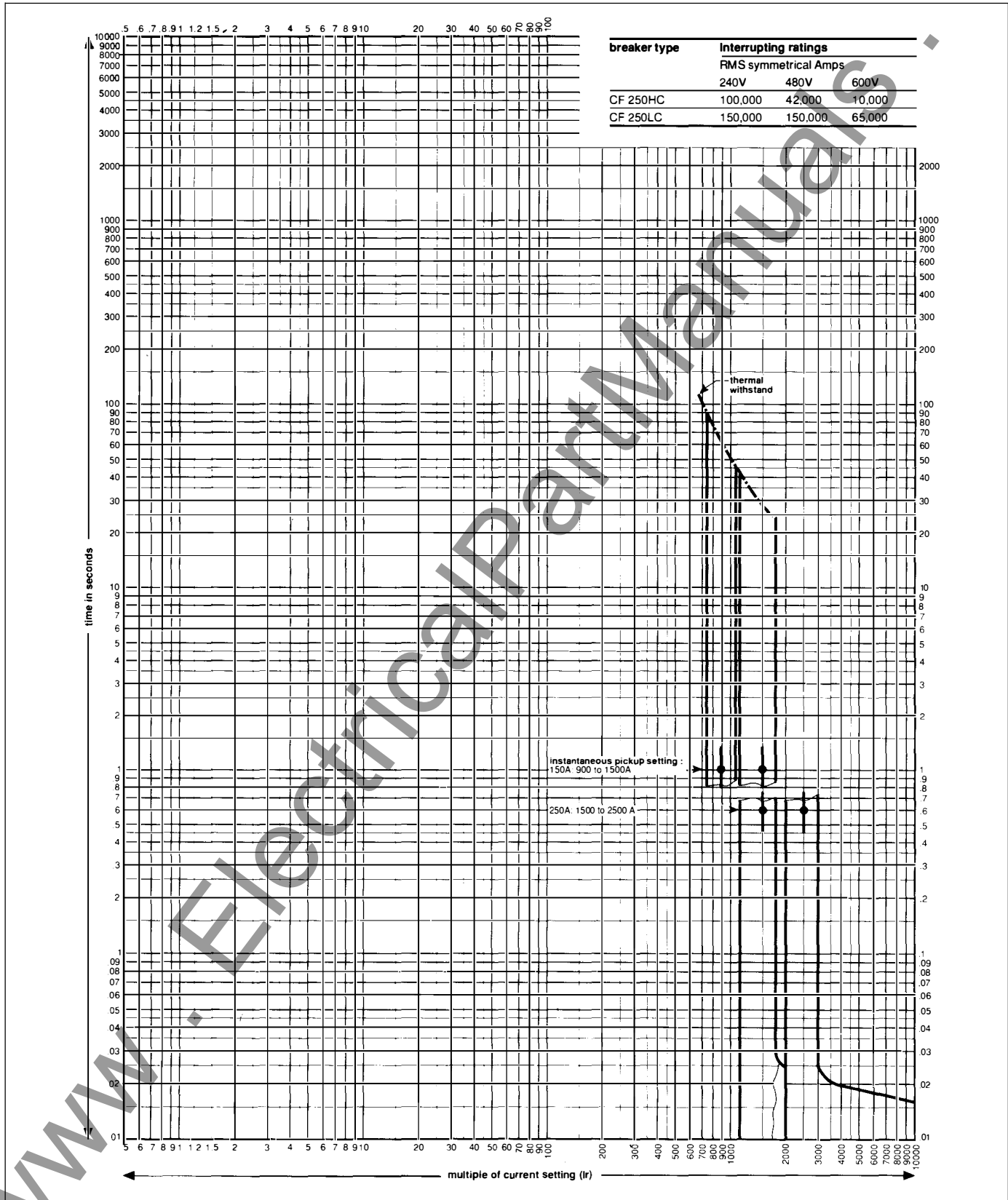
# Compact CF circuit breaker time current curves

200, 225 and 250 Amp.



# Compact CF circuit breaker time current curves

instantaneous trip for motor circuit protectors 150 and 250Amp.



# Compact CF circuit breaker accessories

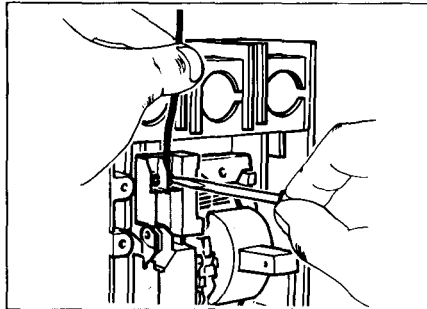
terminals  
padlock adaptor  
door escutcheon  
boot  
label holder

Internal accessories comply with requirements of Underwriters Laboratories Standard UL 489 and CSA C22-2 no.5. Most of them as noted are listed for field installation per UL file E107821.

accessories	installation
shunt trip	field installable
undervoltage trip	field installable
2 auxiliary switches	field installable
1 aux. + 1 alarm switches	field installable
motor operator	field installable
overcurrent trip switch	factory mounted

## terminals

Internal accessory terminals are standard and located within the breaker, behind the accessory cover. Each terminal may be connected by one or two stranded copper wires 18 to 14 AWG. Tightening torque : 12 lb. in. Cable strip length : 3/8" approximate.

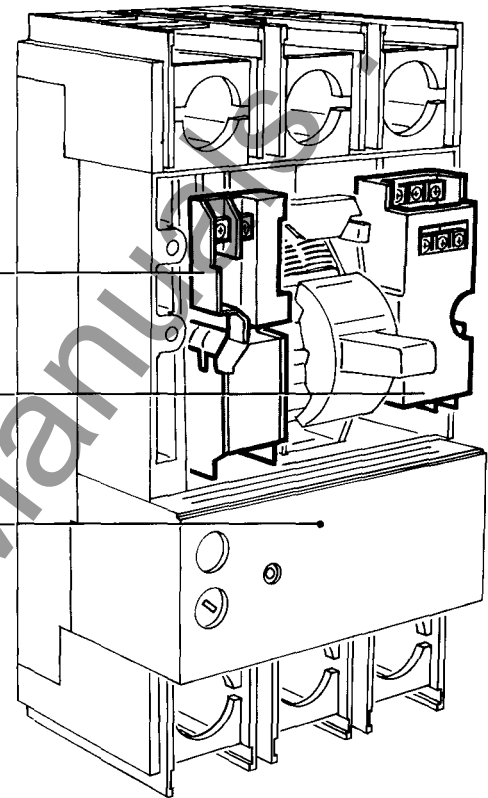


## location

shunt trip or undervoltage trip

2 auxiliary switches or 1 aux. + 1 alarm switches

overcurrent trip switch



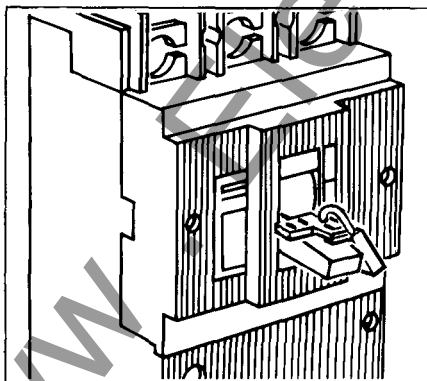
Caution : open circuit breaker and disconnect control power before removing the front accessory cover.

## padlock adaptor

A padlock adaptor is available to padlock the circuit breaker in the OFF position. It is similar to the one used on CE, CF and CJ type.

The adaptor accomodates up to 3 padlocks.  
Padlock shackle diameter : 1/4 to 5/16.

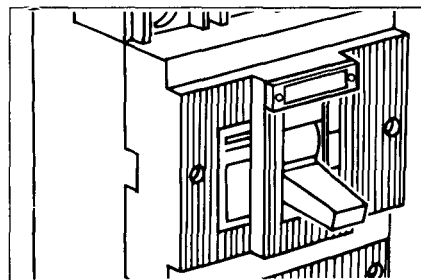
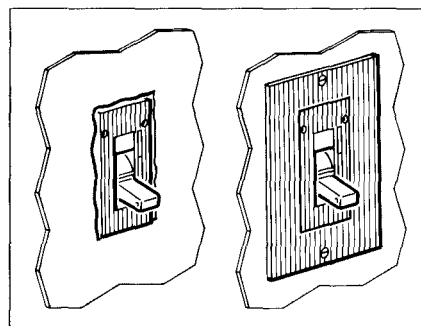
catalog number 44936



## door escutcheon

A door escutcheon provides better appearance of the door cutout. It is fixed to the door with two screws.

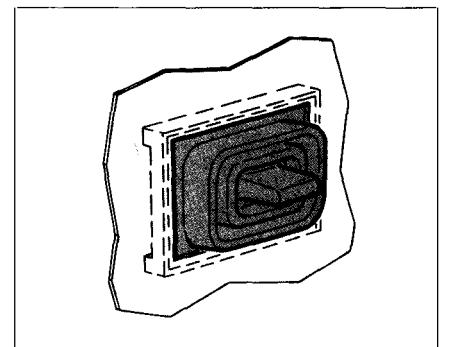
catalog number 42977



## boot

The boot provides a light seal when a breaker is used behind a panel or door with cutout. The square part fits over the breaker cover and the middle provides a rubber cover for the toggle, improving protection to NEMA 3R.

catalog number 42896



## label holder

A label holder can be clipped onto the front cover. It permits an easy circuit breaker identification. It comes in pack of ten.

catalog number 42976

# Compact CF circuit breaker accessories

shunt trip  
undervoltage trip device  
auxiliary and alarm  
switches  
overcurrent trip switch

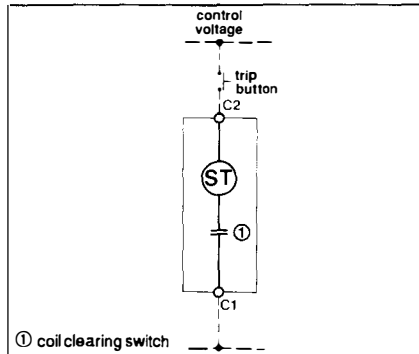
## shunt trip

The shunt trip is intermittently rated with a series normally open contact.  
AC shunt trips can be operated at 55 percent of their rated voltage, making them suitable for use with fault protection devices.

### Minimum operating voltage :

AC : 55 % of rated voltage  
DC : 75 % of rated voltage

\* during 20 ms max.



rated voltage (V)	Inrush * current (A)	cat. no.
60 Hz		
120	1.6	37437
240	0.9	37446
480	0.6	37446
600	0.5	37447
DC		
12	11.0	37434
24	11.2	37435
48	3.6	37436
125	1.8	37437

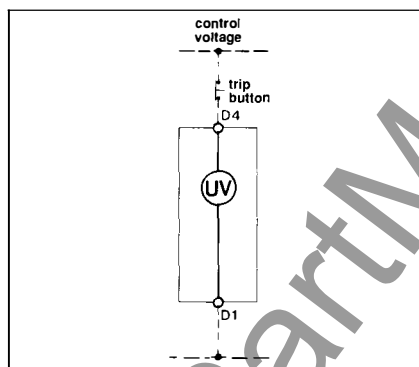
## undervoltage trip device

Undervoltage trip devices may be used as circuit interlocks.

If an undervoltage condition exists, operation of the closing mechanism of the circuit breaker will not permit the main contacts to touch, even momentarily.

**Dropout** : 35-70 % of rated voltage

**Pickup** : 85 % of rated voltage



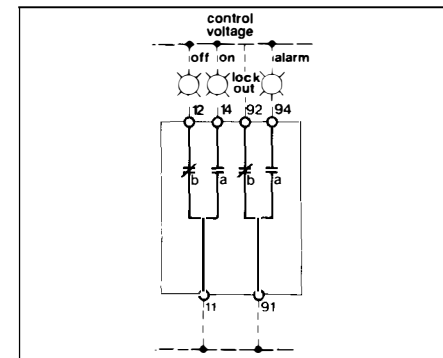
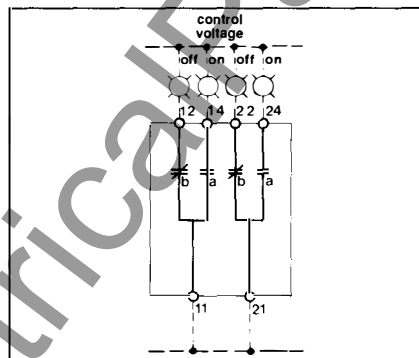
rated voltage (V)	sealed-in current (A)	cat. no.
60 Hz		
120	0.030	37418
240	0.020	37419
480	0.011	37420
600	0.008	37421
DC		
24	0.035	37410
48	0.020	37411
125	0.010	37412

## auxiliary and alarm switches

Auxiliary switches consist of SPDT switches and provide remote information of the breaker status.

Alarm switch provides alarm/lockout information. When the breaker is reset, the "a" contact (alarm) is open, and the "b" contact (lockout) is closed.

This SPDT switch is operated when the breaker is tripped by the trip unit, shunt trip, undervoltage trip device or "push-to-trip" button.



2 auxiliary switches **cat. no. 37402**

1 aux. + 1 alarm switch **cat. no. 37401**

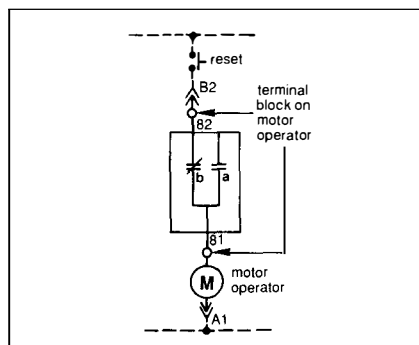
voltage (V)	2 auxiliary auxiliary		1 auxiliary + 1 alarm alarm	
50/60 Hz	240	6	6	5
	480	6	6	5
	600	3	3	3
DC	125	0.5	0.5	0.5
	250	0.25	0.25	0.25

## overcurrent trip switch

The auxiliary switch consists of a SPDT contact.

The "b" contact open when the breaker operates through the trip unit (overcurrent or ground fault). It does not operate if tripping is by shunt trip, undervoltage trip device or push-to-trip button.

This contact is used as interlock when resetting of the breaker is done remotely or automatically by means of a motor operator.



voltage	current (A)	
50/60 Hz	240V	6
DC	125V	0.3

note : not available on m.c.s

catalog number **37403**

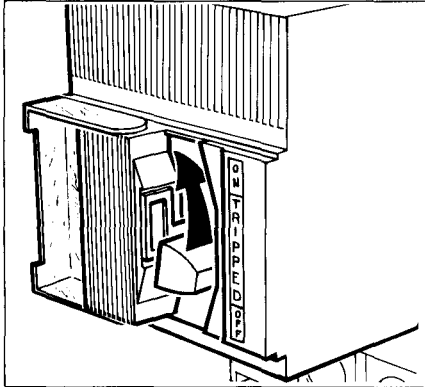


# Compact CF circuit breaker accessories

## motor operator

### motor operator

The motor operator remotely operates the circuit breaker and provides a handle to manually operate it as well. ON, TRIPPED and OFF positions are clearly indicated by the operating handle. Provision for padlocking is provided as standard to lock the toggle in the OFF position.



When locked manual or remote closing is impossible. Interlock switches electrically disconnect the motor operator when the front transparent cover is open for local operation or padlocking and when the complete mechanism is opened for connecting internal accessories (shunt trip, undervoltage trip device, auxiliary switches or the motor operator)

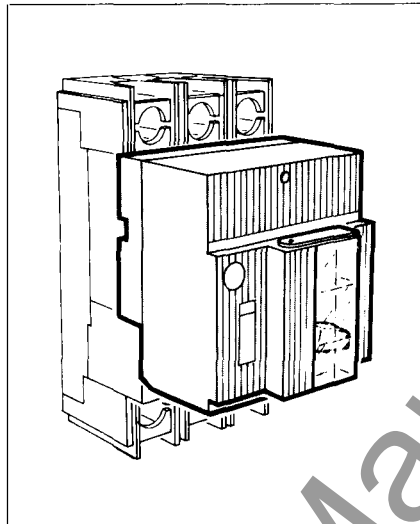
Under fault conditions the operating handle will indicate the tripped position of the breaker. Depending on the wiring, resetting can be done locally, remotely or automatically (see wiring diagrams).

#### Note :

When using an overcurrent trip switch (cat. no. 37403), automatic resetting is not possible after an overcurrent, i.e. short circuit or overload, but possible after a voluntary tripping, local or remote. (Field installable)

voltage (V)	catalog number	
	standard	synchronizing
AC	120	37464 43754
	240	37465 43755
DC	24	37460
	48	37461
	125	37462 43752

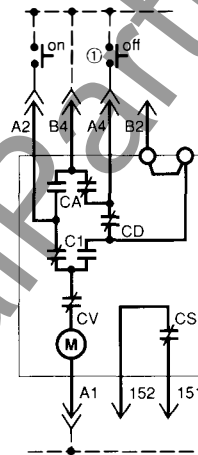
- ① **caution** : control diagram shall be designed to interlock remote on and off orders
- ② overcurrent trip switch is recommended to lock remote resetting after an electrical fault
- C1 limit switch
- CV locking switch, opens when :
  - the breaker is manually operated
  - the breaker is padlocked
  - the motor operator is rocked
- CD built-in alarm switch, operates when breaker trips by an electrical fault or opening coils
- CA selffeeding switch
- CS electrical interlock switch delivered with automatic source changeover, operates when operator handle indicates the off position
- M motor



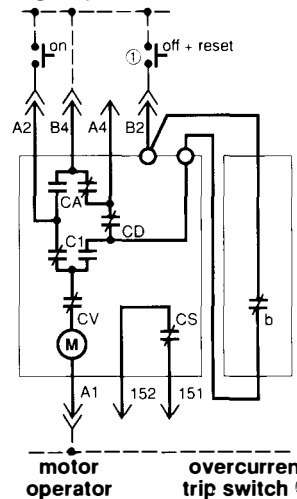
rated voltage (V)	inrush current (A)	fuse amps (A)
50/60 Hz		
120	6	10
240	4	10
DC		
24	15	15
48	11	10
125	6	10

Operating voltage : 85-110 % of rated voltage  
 Max. operation frequency : 2 per minute  
 Closing time :  
 ■ standard : 200 ms  
 ■ synchronizing : 60 ms (not UL listed)  
 Opening time : 500 ms  
 Minimum operating order : 100 ms  
 Endurances : 10,000 mechanical O.C. cycles.

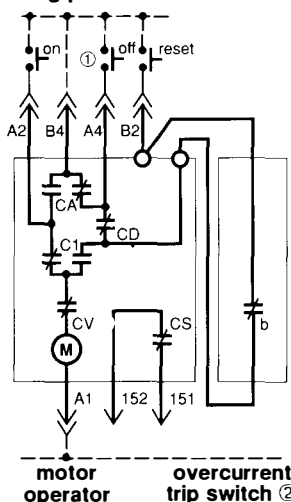
### standard scheme (manual resetting)



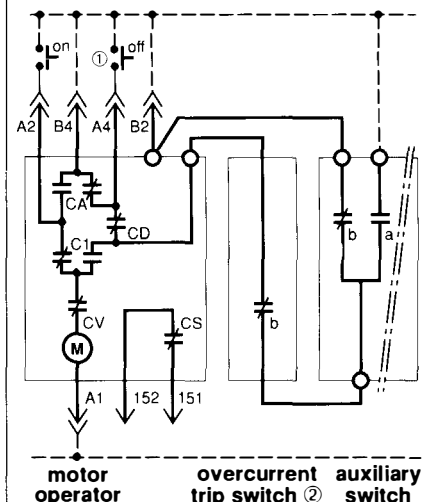
### remote resetting during opening sequence



### remote resetting using a resetting push button



### automatic resetting after tripping



# Compact CF circuit breaker accessories

motor operator

## mechanical interlock

Mounted on the two operators, the interlock prevents the two breakers from being simultaneously closed. Breakers can be both or individually opened.

In addition to the mechanical interlock, an electrical interlock is mandatory between the two operators.

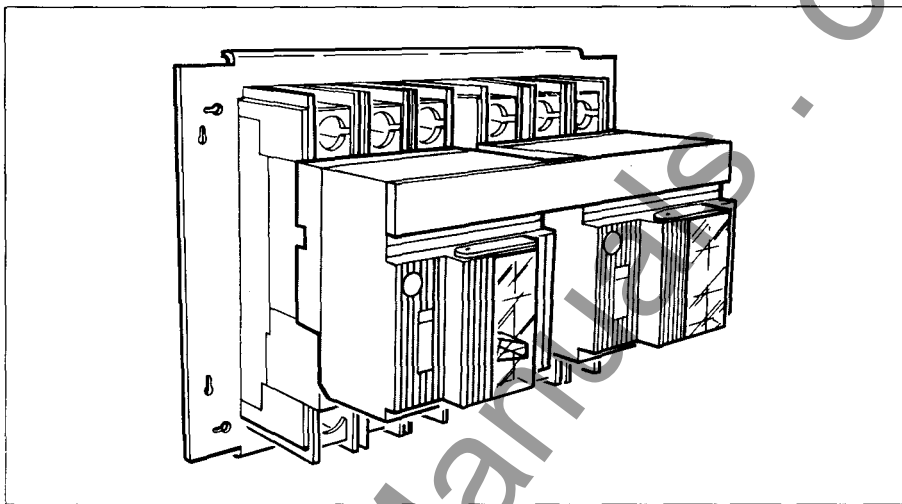
Factory mounted

switching time : 0.9 sec.

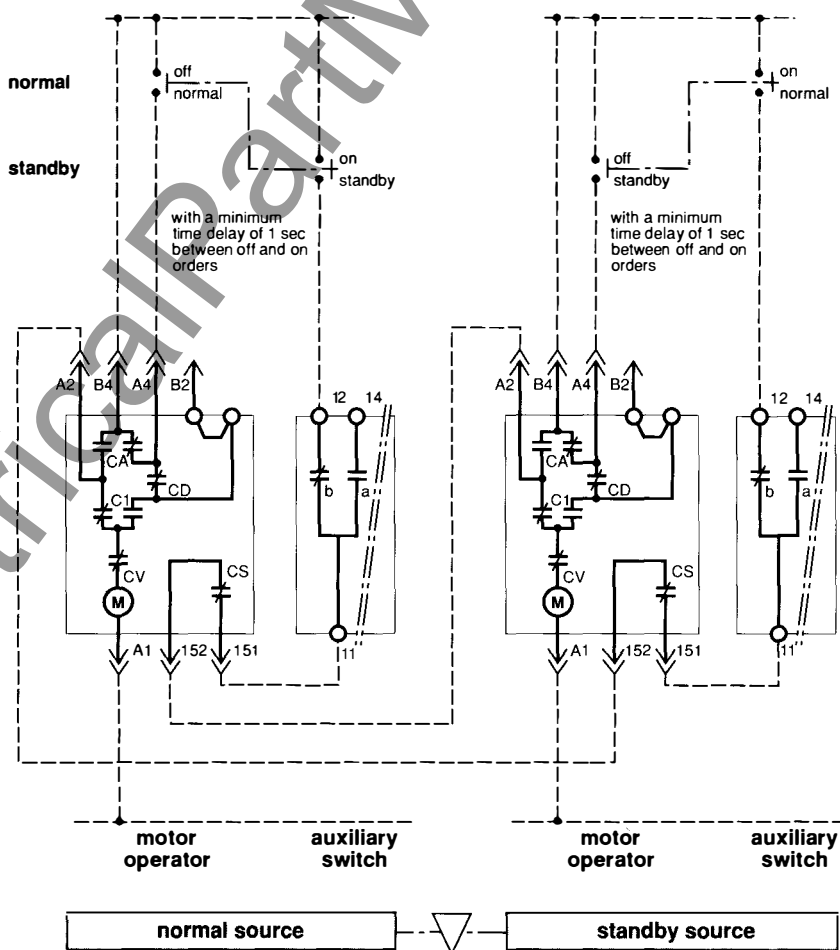
number of switching operations : 10,000

catalog number

37470



## electrical interlock



### rotary operating handle

Three versions are available :

#### Directly mounted

This handle is directly mounted on the circuit breaker. It accommodates as standard up to three padlocks to lock the handle in the OFF position. However, a knockout tab can be removed to allow the locking of the handle in the ON position. Due to the trip free mechanism padlocking in such a position will not prevent the circuit breaker from tripping under overcurrent conditions. The handle will continue to indicate ON.

Padlock shackle diameter : 1/4 to 5/16.

#### Note :

A mechanical interlock (cat. no. 44826) links two rotary handles and constitutes a manual source changeover. This device is only available for direct rotary handles. Simultaneous closing of the two breakers is prevented but simultaneous opening is possible. The breakers are normally fixed on a panel or on rails.

#### Door-mounted type

The handle is removable and can be fitted on a door-mounted mechanism. A 16" long shaft extension is supplied and can be cut to a suitable length. A cutting and drilling jig is provided.

The mechanism has the same functions as the directly mounted type and provides door interlocking preventing the door from being opened when the breaker is closed.

The handle mechanism can be used in NEMA 3R and 12 enclosure applications.

#### Note :

Door interlock can be disabled or defeated by turning the defeating screw located on the front face.

It accommodates as standard up to three padlocks to lock the handle in the OFF or ON (by removing a knockout) position. Padlocking is possible only if the coupling of the extension shaft and the door mounted mechanism is correct.

#### MCC type

The MCC type is designed for Compact CE and CF used in Motor Control Centers. It comes as a single part and allows to operate the breaker through door preventing:

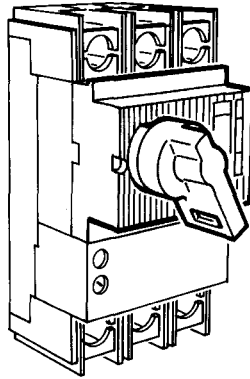
- the door from being opened when the breaker is closed
- the breaker from being closed when the door is opened

The handle can be locked in OFF position by one to three padlocks.

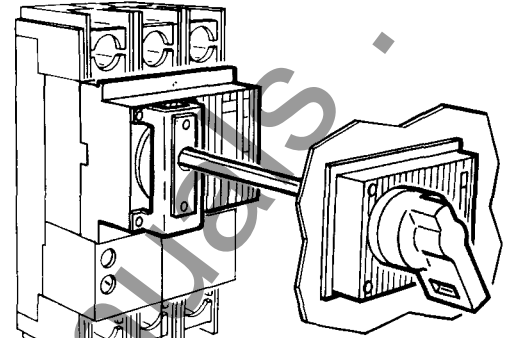
Padlock shackle diameter : 1/4 to 5/16.

Level of protection : NEMA type 1

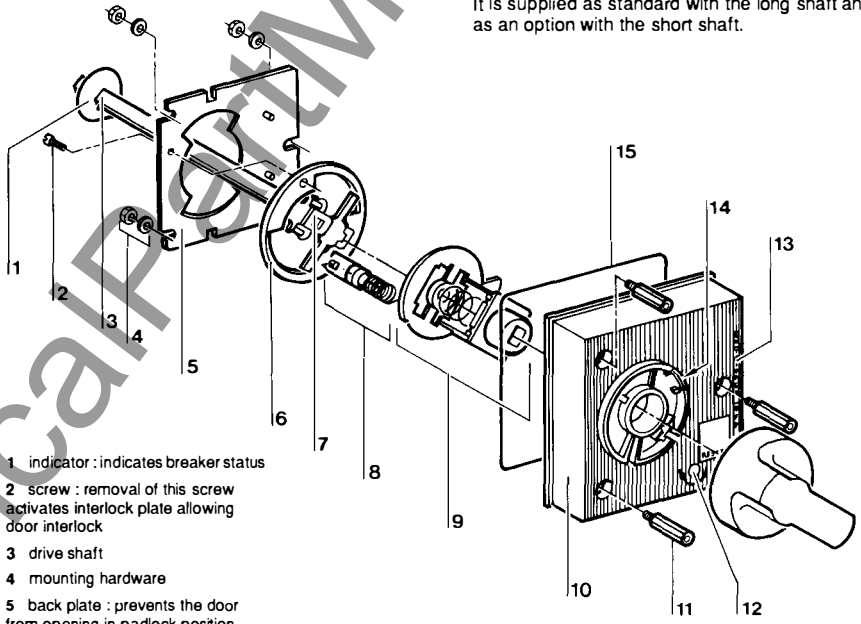
#### directly mounted type



#### door-mounted type

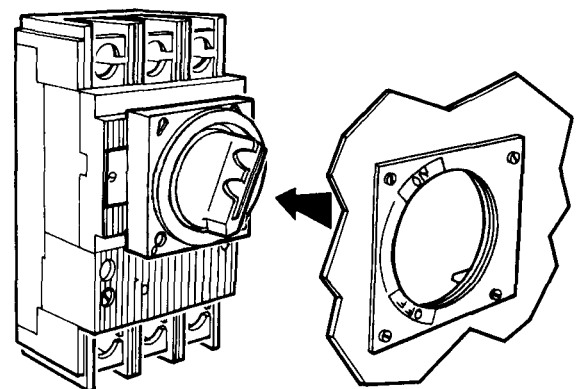


Designed for use with the extended rotary handle, this bracket eliminates play of the shaft. It is supplied as standard with the long shaft and as an option with the short shaft.



- 1 indicator : indicates breaker status
- 2 screw : removal of this screw activates interlock plate allowing door interlock
- 3 drive shaft
- 4 mounting hardware
- 5 back plate : prevents the door from opening in padlock position
- 6 interlock plate : after removal of screw (2), plate rotates to activate door interlocking function
- 7 male coupler
- 8 interlock defeat : allows the operator to defeat the door interlock and open the door when the breaker is in the ON position (to be used in emergency only)
- 9 female coupler assembly :  
- connects with main coupler  
- insures that the door is closed before breaker operation and padlocking  
- ensures proper operating handle position
- 10 cover
- 11 mounting hardware
- 12 interlock defeat access
- 13 position indications
- 14 breakable tab : provides optional padlocking for ON position
- 15 robber gasket

#### MCC type

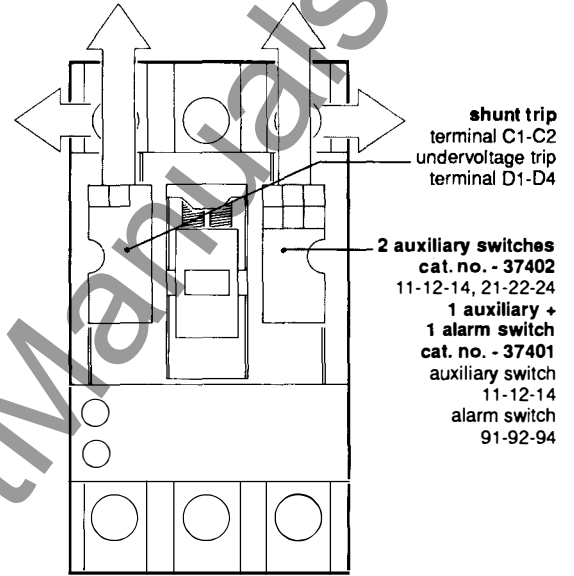
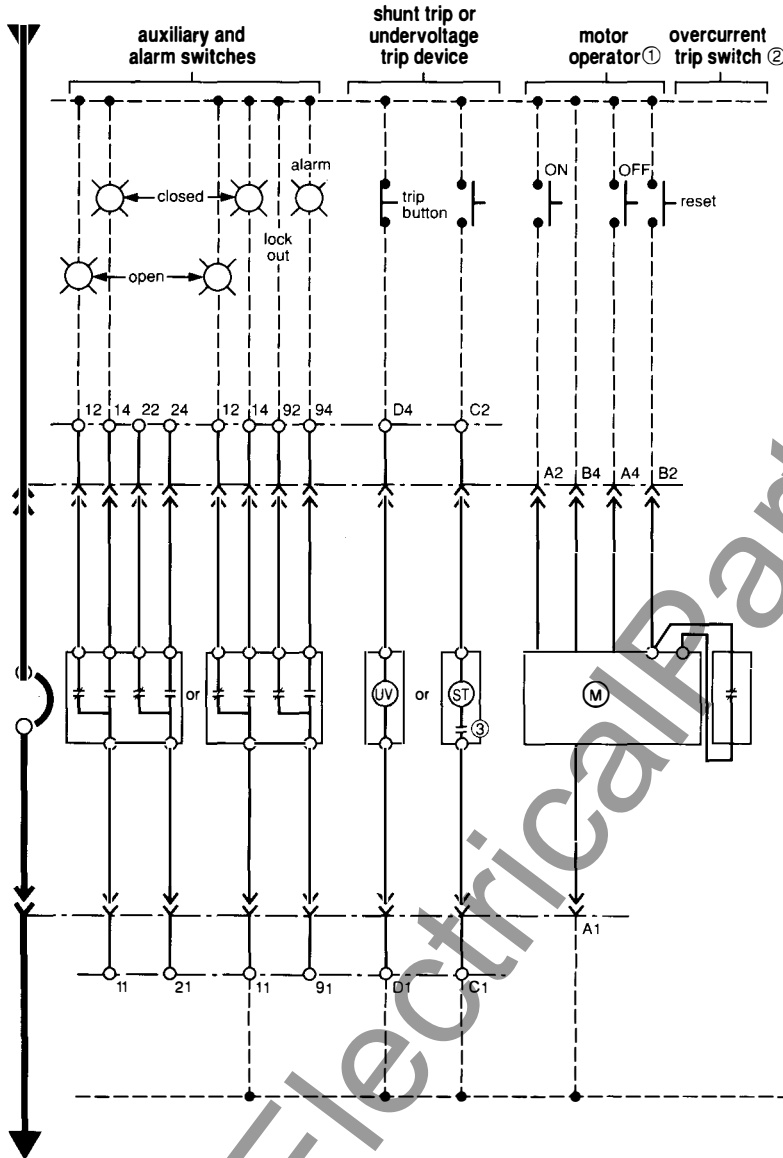


# Compact CF circuit breaker wiring diagrams

## auxiliary switches

## remote operation

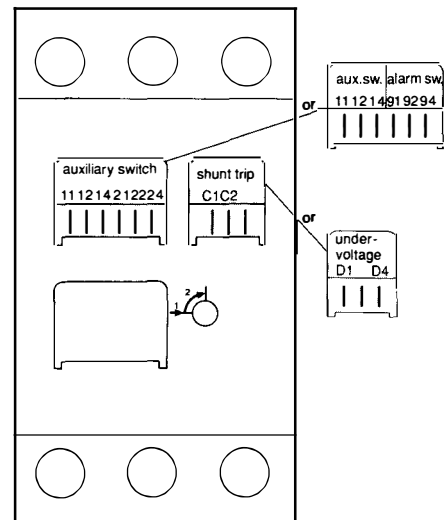
## fixed mounting



➔ possible wire exits  
 I knock-outs. Break only these required depending of the desired direction of wiring.

## plug-in mounting

rear view of breaker



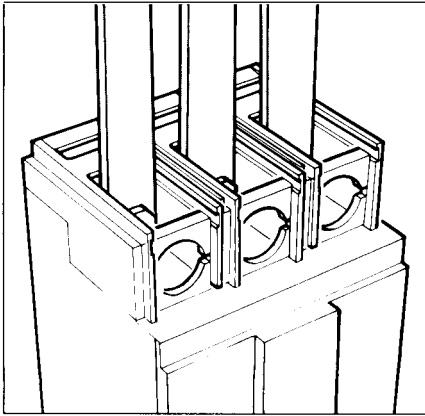
- ① see page 13 for other wiring diagrams
- ② not available on m.c.s.
- ③ coil clearing switch

**Note :** contacts are shown with the breaker in the open and reset position.

# Compact CF circuit breaker main connections

CF circuit breakers may be connected with bus bars or cables on both line and load sides. The type of connections should be specified when ordering. A field modification is possible to either mount or remove the pressure type terminals. Complete instructions are given with the set of pressure type terminals and in the installation instructions provided with the breaker.

## front connection

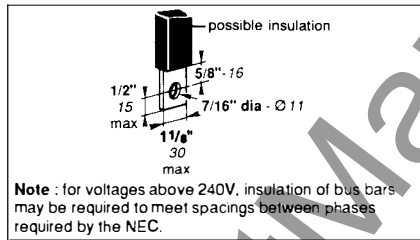


## with bus bars

CF circuit breaker may be connected with copper or aluminium bus bars.

### Tightening

The bus bars shall be secured with the screws and Belleville washers provided. Tightening torque is 275 lb-in.



## with cables

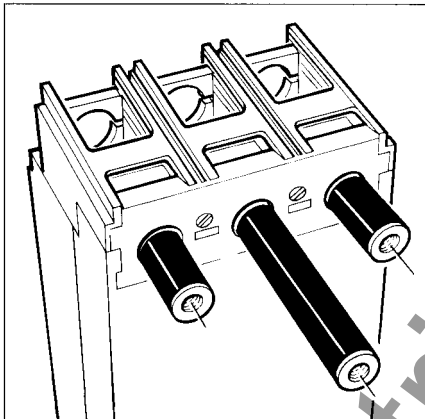
Cables can be connected by pressure type terminals with a range of :  
4 AWG to 250 MCM Cu or  
4 AWG to 350 MCM Al

The cable strip length is : 1"  
Screws shall be torqued at 375 lb. in.  
(3/8" allen wrench).

**Caution : for reliable electrical contact, connectors are plated, do not abrase them.**

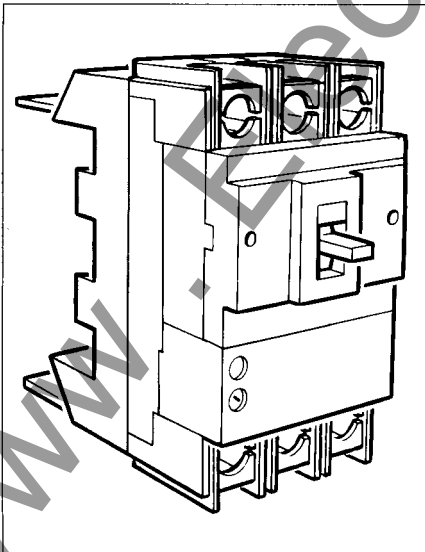
The connectors are secured on breaker by screws tightened at 275 lb. in.  
(5/16" allen wrench).

## rear connection



Rear bus bar connections are used for switchboard mounting.

## plug-in mounting



When the breaker is in the connected position, the primary voltage is fed through the breaker by means of multiple finger disconnects.

As a safety feature, in the event of disconnecting a closed breaker, a mechanical interlock will trip the breaker before the separation of the main disconnects.

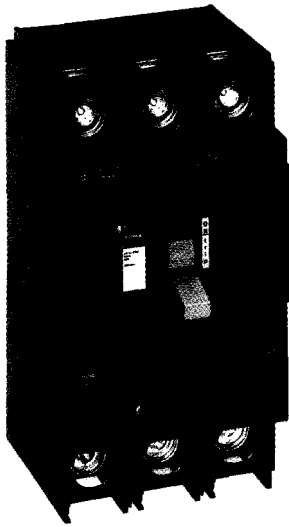
UL listed under file E116305.

### Secondary disconnects

Control voltage of internal accessories is provided through secondary disconnects in the connected position only. See page 16 for the number of secondary disconnects required.

		cat. no.
moving block	3 wires	36393
	6 wires	36696
fixed block	3 wires	42940
	6 wires	42941

# Compact CF switch



## construction

CF molded case switches are designed identically to CF molded case circuit breakers, except that they are not equipped with trip unit. They are listed under UL file E107822.

### Caution :

**Molded case switches do not provide overcurrent protection.**

Molded case switches can be protected by a CF circuit breaker.

## ratings

CF 250NA	max. rating	when protected by Merlin Gerin CB's :		
		CF 250N	CF 250H	CF 250L
suitable for use on a circuit (max. RMS sym. amps)	at 240V	65,000	100,000	150,000
	at 480V	35,000	42,000	150,000
	at 600V	10,000	10,000	65,000

## accessories

The following accessories of the CF circuit breaker may be used with the CF molded case switch :

	page
padlock adaptor	11
door escutcheon	11
boot	11
label holder	11
shunt trip	12
undervoltage trip device	12
2 auxiliary switches	12
1 auxiliary + 1 alarm switches	12
motor operator	13
rotary operating handle	15

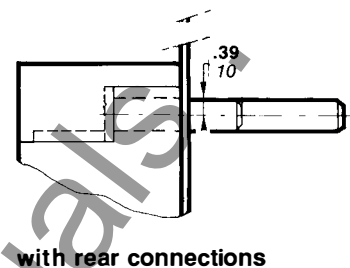
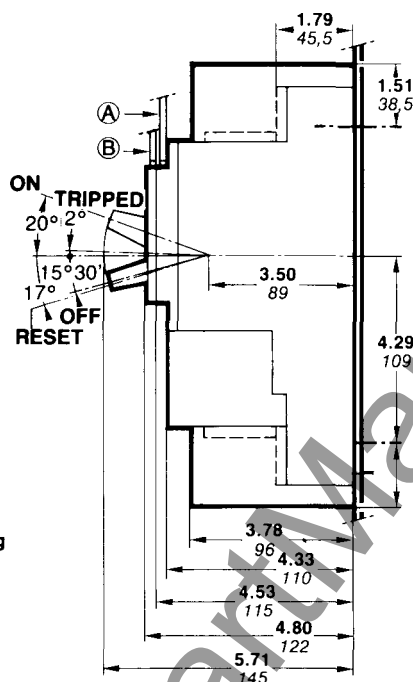
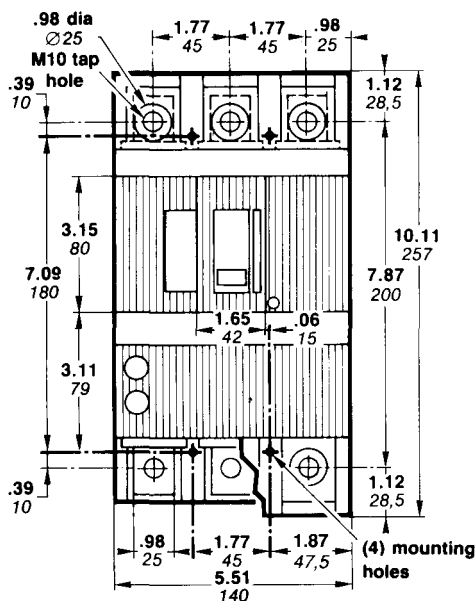
## dimensions-installation-connections

Molded case switch dimensions, installation and connection are identical to those of the corresponding circuit breaker. See page 19 to 23.

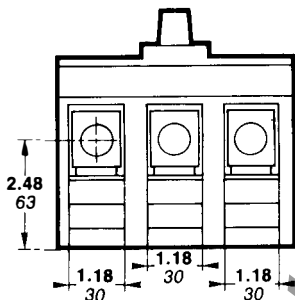
# Compact CF circuit breaker dimensions

Inch / mm

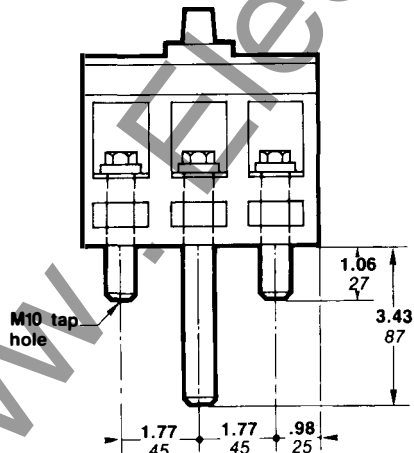
CF 250N - CF 250H  
fixed mounting,  
front or rear connection



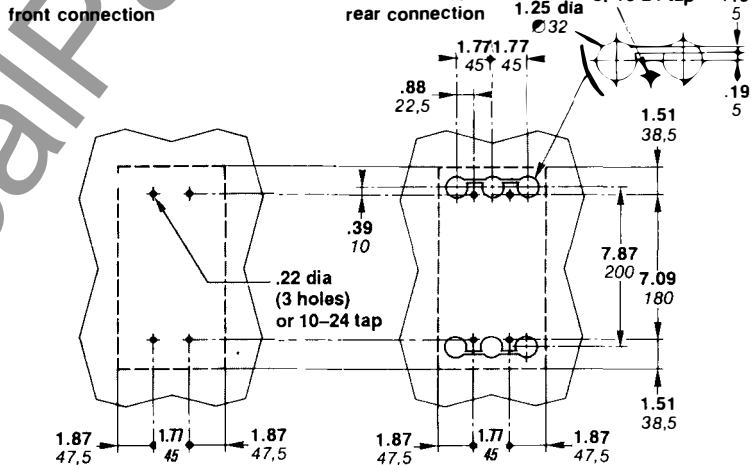
with pressure terminals



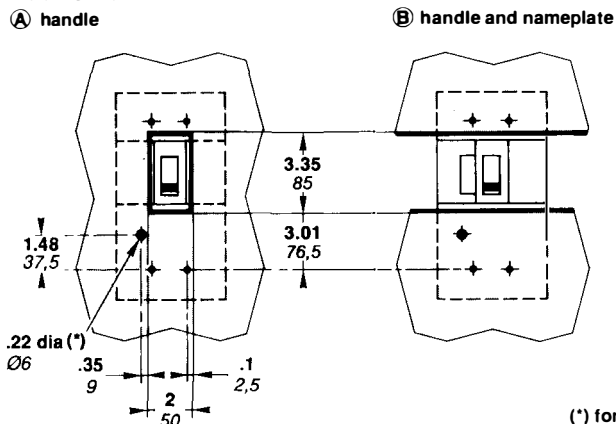
with rear connections



Cutting and drilling for attachment to panel



Door cutout

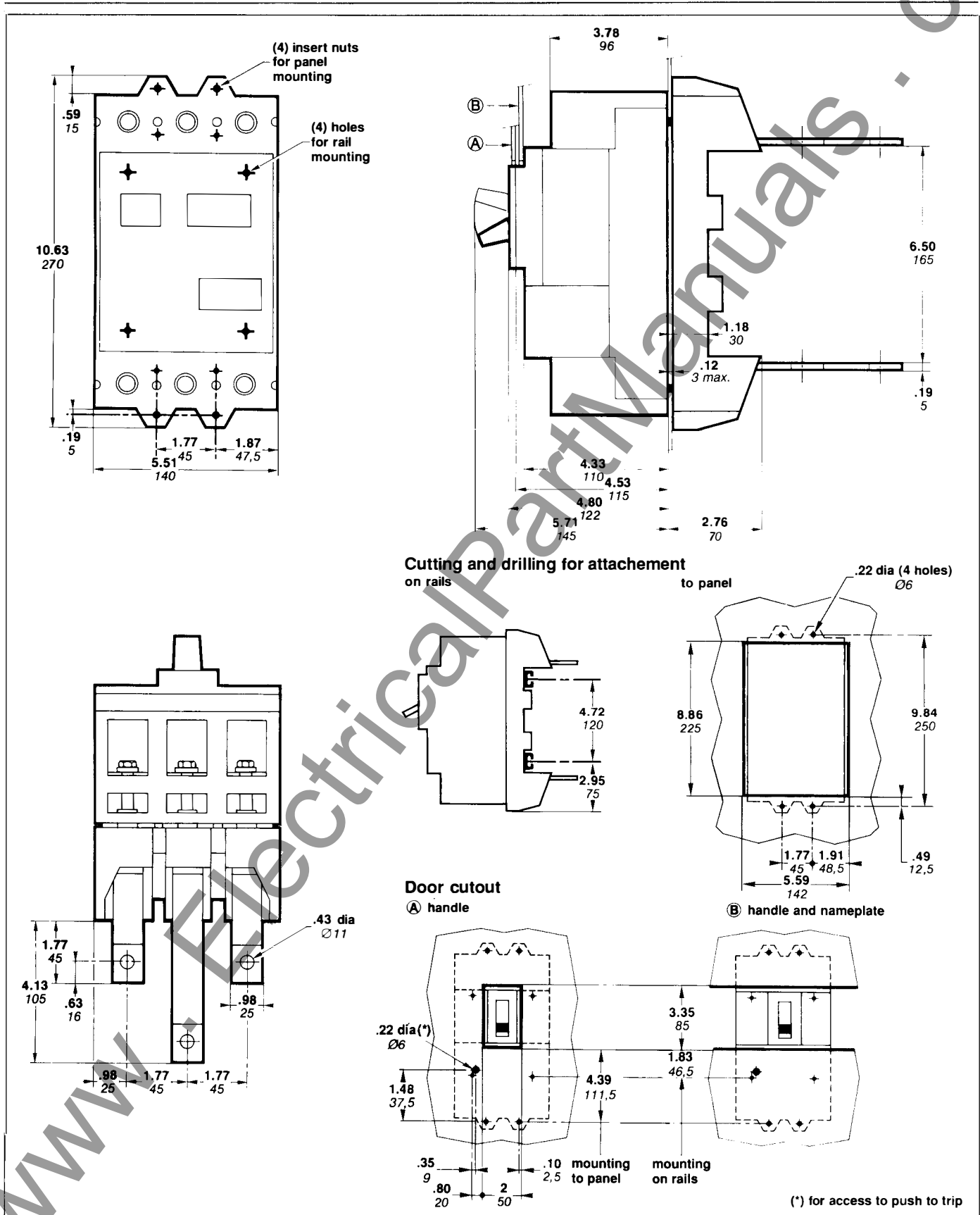


(\*) for access to push to trip

# Compact CF circuit breaker dimensions

Inch / mm

CF 250N - CF 250H  
plug-in mounting

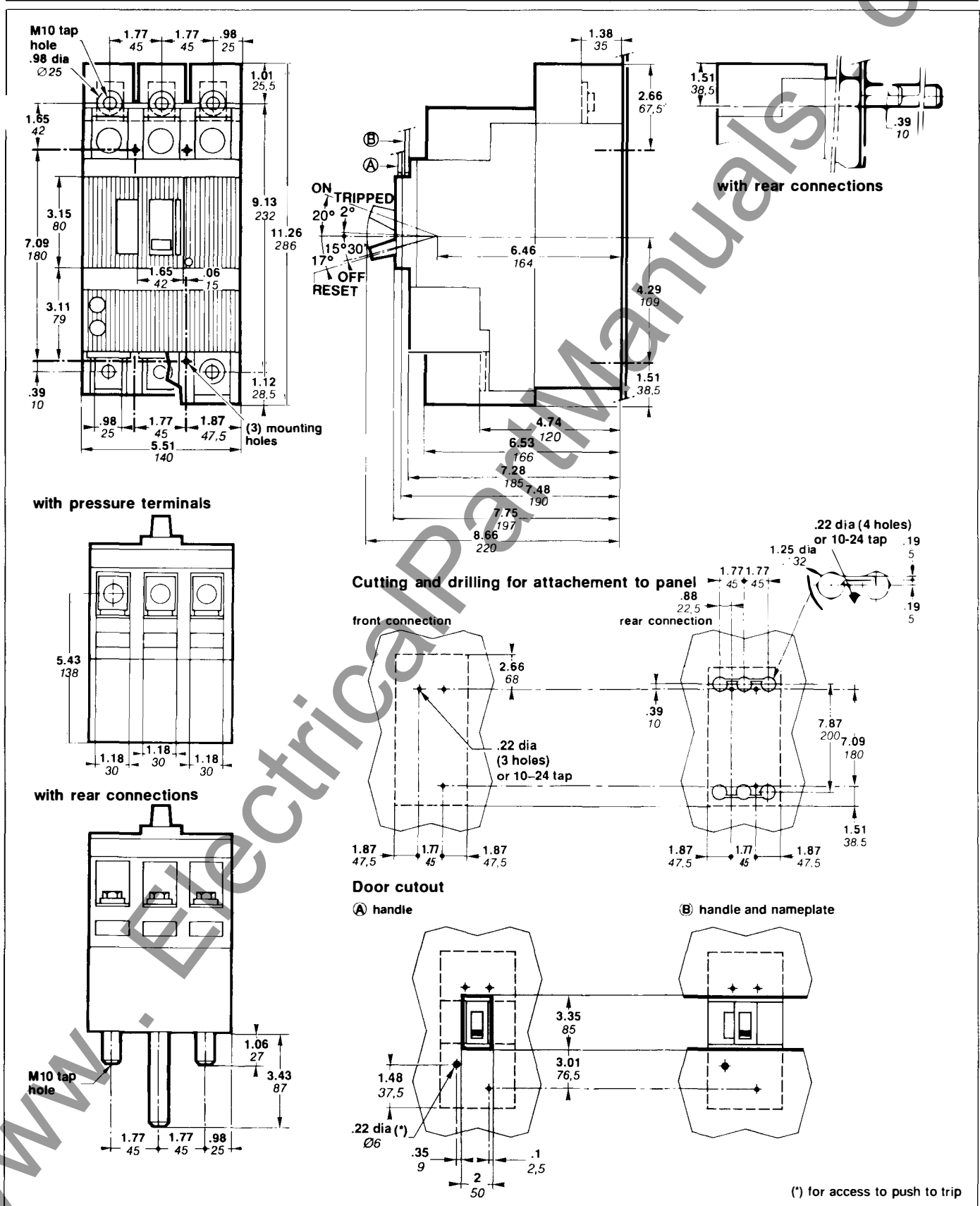




# Compact CF circuit breaker dimensions

Inch / mm

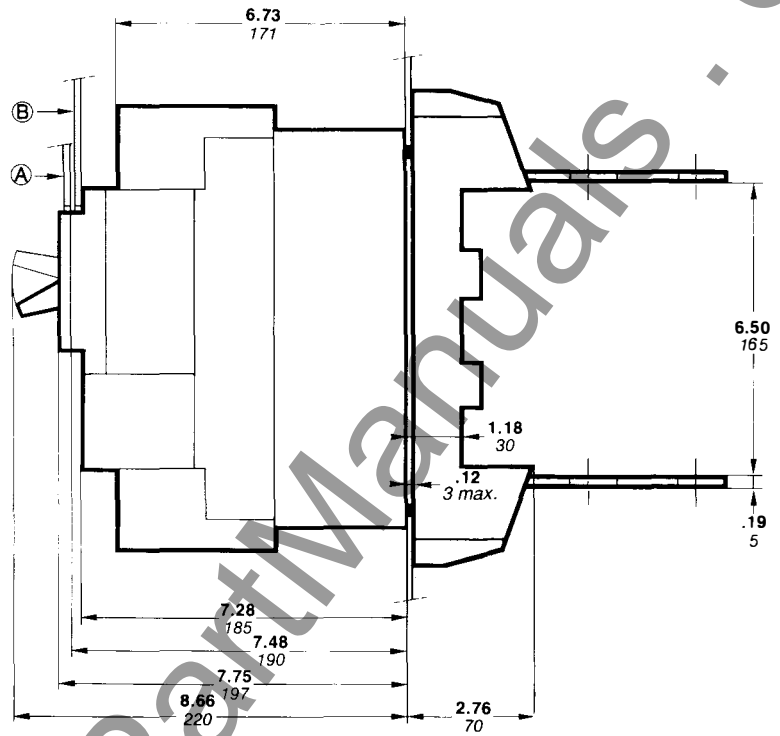
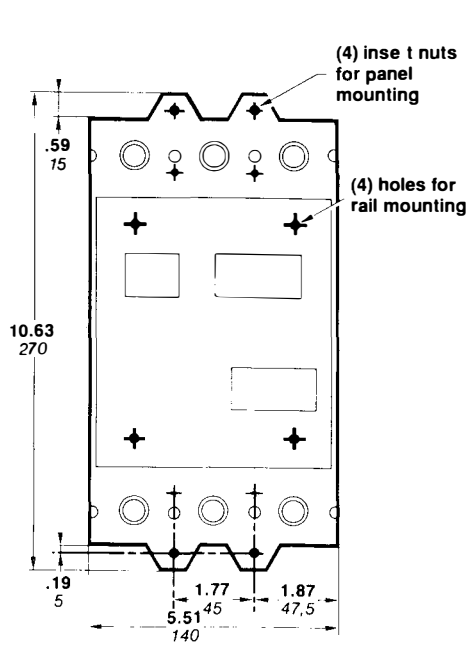
CF 250L  
fixed mounting,  
front or rear connection



# Compact CF circuit breaker dimensions

CF 250L  
plug-in mounting

Inch / mm

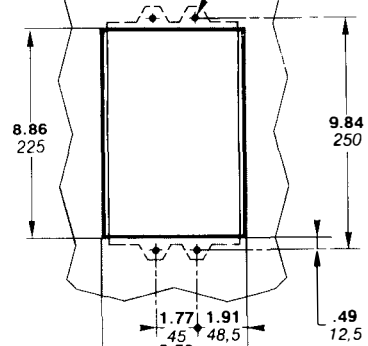
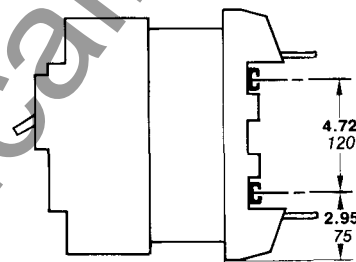


## Cutting and drilling for attachment

on rails

to panel

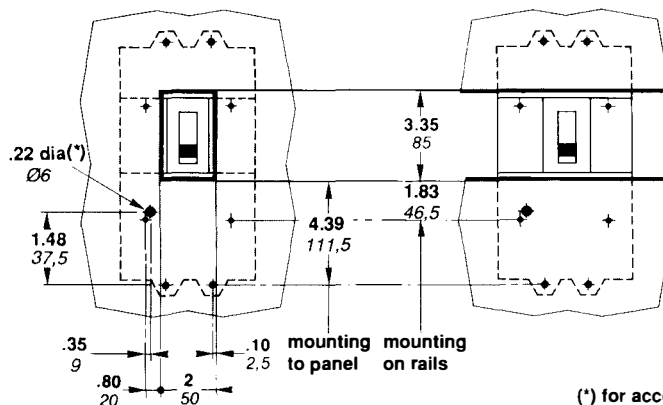
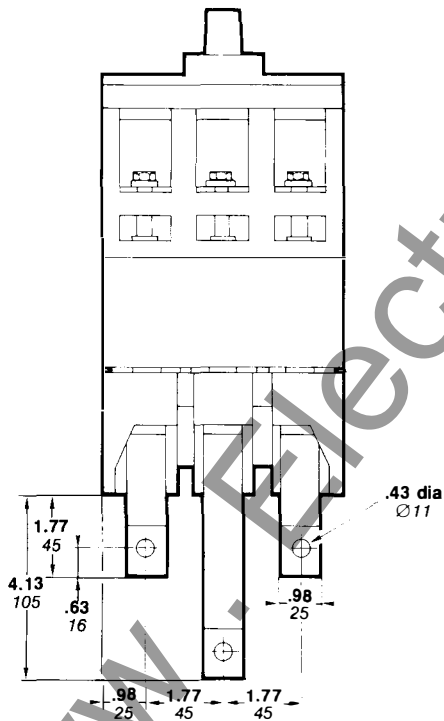
.22 dia (4 holes) Ø6



## Door cutout

(A) handle

(B) handle and nameplate



(\*) for access to push to trip

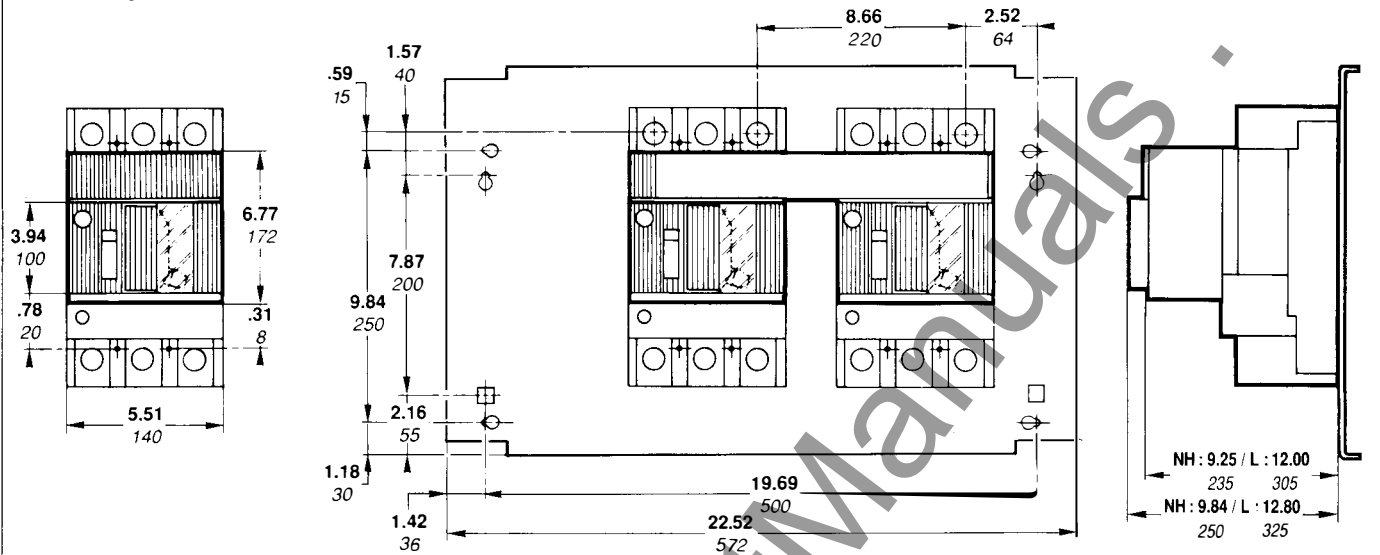
# Compact CF circuit breaker dimensions

inch / mm

motor operator  
rotary operating handle

## motor operator

with mechanical interlock

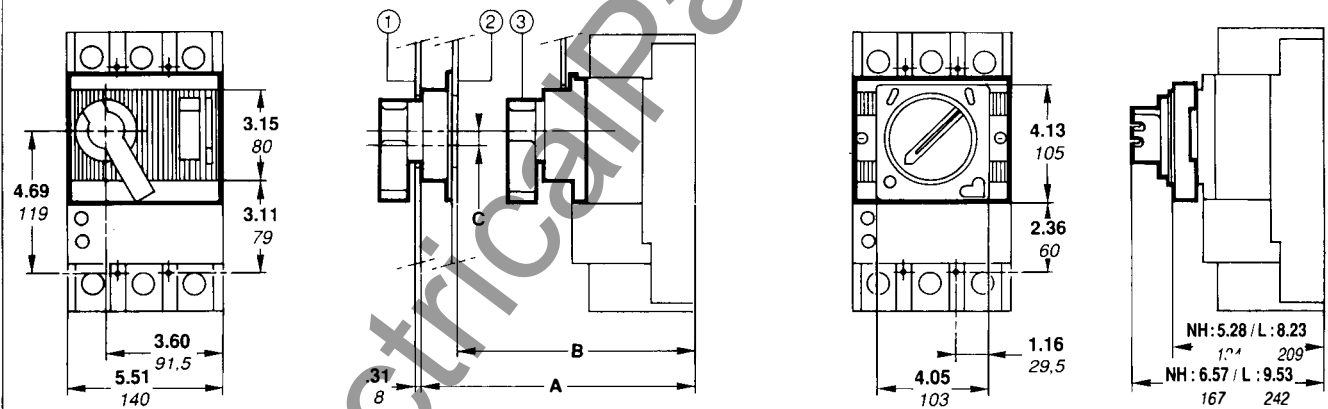


## rotary operating handle

directly mounted

flush / surface / directly mounted

MCC type

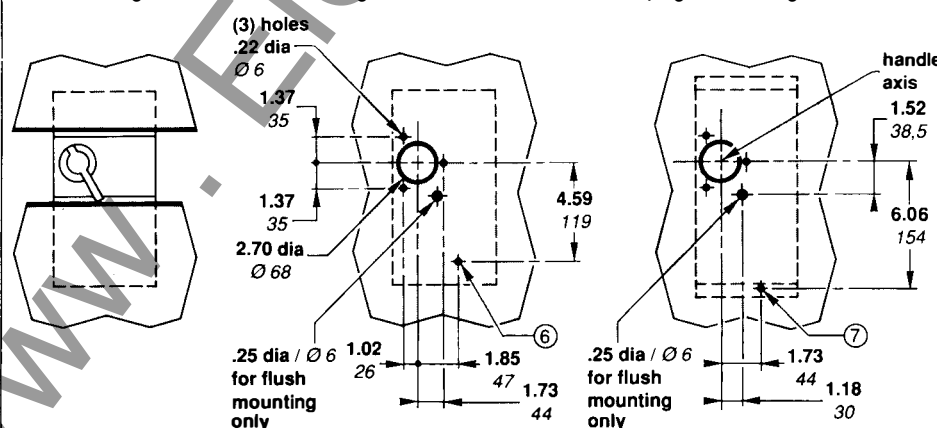


## door cutout

directly mounted  
fixed mounting

door mounted  
fixed mounting

door mounted  
plug-in mounting



## dimensions

	short shaft	long shaft
A min	7.32 / 186	13.86 / 352
A max	12.20 / 310	21.34 / 542
B min	8.98 / 228	12.20 / 310
B max	13.86 / 352	12.69 / 500

## values of allowable sagging C in relation to B

B	from	to	C	
7.32/186	9.06/230	10.63/270	12.20/310	19.69/500
0.04/1	0.08/2	0.12/3	0	

- flush mounted
  - ② surface mounted
  - ③ directly mounted
  - ④ with optional bracket cat.no 42868
  - ⑤ bracket provided with the operating handle must be used
  - ⑥ breaker mounting hole
  - ⑦ plug-in mounting hole
- Note : shaft can be cut to required length

# Compact CF circuit breaker appendix

UL 489 test procedures  
(abstract from UL 489 with revisions through April 6th, 1987)

## standard tests

For solid state trip breaker, and uncompensated thermal breaker rated 40°C, the test sequences are :

test	sequence		
	X	Y	Z
200% calibration at 25°C (77°F)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
135% calibration at 25°C (77°F)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
calibration of adjust instant trip overload	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
tungsten lamp load	①		
100% calibration at 40°C (104°F)	②		
temperature and 100% calibration at 25°C (77°F)	<input type="checkbox"/>		
endurance		<input type="checkbox"/>	
200% calibration at 25°C (77°F) repeated		<input type="checkbox"/>	
135% calibration at 25°C (77°F) repeated		<input type="checkbox"/>	
interrupting ability (Y sequence)		<input type="checkbox"/>	
interrupting ability (Z sequence)			<input type="checkbox"/>
200% trip out at 25°C (77°F)		<input type="checkbox"/>	<input type="checkbox"/>
dielectric voltage withstand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

① Applies only for breakers rated 55 A or less, 125 or 125/250V or less  
② Applies only for thermal breakers rated 40°C.

## standard specifications

### 200% calibration at 25°C

The breaker must trip within time limits which depend on the rating from 3 minutes for a 30A rated breaker, up to 30 minutes over 2000A.

### 135% calibration at 25°C

The breaker must trip within two hours (for breakers rated more than 50 A).

### Calibration of adjustable instantaneous trip

The breaker must trip within the range of 80-120% of the maximum marked tripping current and 75-125% of the minimum marked tripping current.

### Overload

■ up to 1600A : fifty operations at 600% of rated current

■ 2000 and 2500A : twenty-five operations at 600 % of rated current

■ 3000 to 6000A : three operations at 600% followed by twenty-five operations at 200 % of rated current.

The power factor shall be from 0.45 to 0.50 lagging.

### Temperature

When connected with specified cables or bus bars (see below) and with its rated current, the temperature rises on the breaker and at its terminals does not exceed specified limits.

Examples of specified wires and bus :

#### ■ "75°C" copper wire

rating	number	size
100A	1	1 AWG (60°C)
	or 1	3 AWG
250A	1	250 MCM
400A	2	3/0 AWG
600A	2	350 MCM
800A	3	300 MCM
1000A	3	400 MCM
1200A	4	350 MCM

#### ■ copper bus bar

rating	number	size
1600A	2	1/4 x 3
2000A	2	1/4 x 4
	2500A	2
		or 4
3000A	4	1/4 x 4

(1200A or less : 1000A / in<sup>2</sup>)

### Endurance

The breaker must complete an endurance test :

■ operations at rated current and rated voltage

■ followed by no load operation.

The power factor shall be 0.75 to 0.80 lagging.

Examples:

frame size	number of cycles of operations		
	with current	without current	total
100A	6,000	4,000	10,000
225A	4,000	4,000	8,000
400A	1,000	5,000	6,000
600A	1,000	5,000	6,000
800A	500	3,000	3,500
1200A	500	2,000	2,500
1600A	500	2,000	2,500
2000A	500	2,000	2,500
2500A	500	2,000	2,500
3000A	400	1,100	1,500

# Compact CF circuit breaker appendix

UL 489 test procedures  
(abstract from UL 489 with revisions through April 6th, 1987)

## Interrupting ability (Y sequence)

After endurance tests and calibrations repeated, the breaker completes an opening followed by a close-open operation (O-t-CO), with specified current.

Examples for three pole breakers :

frame rating	RMS Sym. Amps (3-pole O-t-CO)
100A <sup>Ⓞ</sup>	3,000
225A	3,000
400A	5,000
600A	6,000
800A	10,000
1200A	14,000
1600A	20,000
2000A	25,000
3000A	35,000

<sup>Ⓞ</sup> Above 250V.

## Interrupting ability (Z sequence)

A 3-pole breaker rated 240, 480 or 600V have to complete an opening operation and a close-open operation (O-t-CO) on each pole, at rated voltage, followed by an opening operation (O) using all the three poles for the frame sizes up to 1200A, an additional close-open operation on the three poles is required).

Examples for three pole breaker :

frame rating	RMS Sym. Amps		
	each pole		common pole
	O-t-CO	O	O-t-CO
100 to 800A	8,660	10,000	
1000 to 1200A	12,120	14,000	
1600A	14,000		20,000
2000A	14,000		25,000
3000A	25,000		35,000

## Dielectric

After tests, the breaker must withstand for one minute a voltage of 1000V plus twice the rated voltage between :

- line and load terminals
- terminals of opposite polarity
- live parts and the overall enclosure.

## Optional tests :

### ■ high available fault current

Breakers having passed all the standard tests may have the UL label applied at higher values than the standard.

Test sequence is as follow :

- 200 % calibration
- interrupting capacity : an opening operation followed by a close open operation (O-t-CO) on all poles are performed on the circuit breaker. The power factor over 20000A shall be 0.15 to 0.2 lagging.
- trip out at 250%
- dielectric at twice the rated test voltage.

### ■ 100% rated

Breakers having passed all the standard tests may have the UL label applied to use the circuit breaker in an enclosure, when carrying 100% of its maximum rating. The circuit breaker is submitted to additional temperature tests performed as in Standard tests, except that the breaker is installed in an enclosure. The dimensions and possible ventilations shall be recorded and shall be marked on the breaker.

## tests on accessories

### Shunt trip and undervoltage trip

These devices are submitted to temperature, overvoltage, operation, endurance and dielectric tests.

#### ■ overvoltage test

It checks that the device is capable of withstanding 110% of its rated voltage continuously without injury (this test does not apply to a shunt trip with an "a" contact connected in series).

#### ■ operation

The shunt trip must operate at 75% of its rated voltage (except that shunt trip devices for use with ground fault protection shall operate at 55%).

The undervoltage trip must trip the breaker when the voltage is between 35 and 70% of its rated voltage and shall seal (i.e.: the breaker cannot be turned on ON position) when the voltage is at 85% or more of its rated voltage.

#### ■ endurance

The device must be capable of performing successfully for 10% of the number of "with current" operations of the breaker.

### Auxiliary and alarm switches

Auxiliary and alarm switches must be submitted to temperature, overload, endurance and dielectric tests.

#### ■ overload test

The test consists of fifty operations making and breaking 150% of rated current at rated voltage, with a 75-80% power factor in AC and non inductive load in DC.

#### ■ endurance

The switch must make and break its rated current at rated voltage, with a 75-80% power factor in AC, and non inductive load in DC for 100% of the number of operations "with current" for auxiliary switches, and 10% of this number for alarm switches.

### Motor operator

The motor operator shall perform the number of "without current" operations indicated for the breaker endurance tests. The first 25 operations shall be conducted at 85% of the motor operator voltage rating. The breaker is to be tripped during these tests.

The next 25 operations shall be conducted at 110% of the motor operator voltage rating. The balance shall be completed at rated voltage without tripping the breaker.

### recommended inspection intervals

Merlin Gerin circuit breakers are designed to be maintenance-free. However, all equipment with moving parts requires periodic inspection to ensure optimum performance and reliability. We recommend that the circuit breakers be routinely inspected six months after installation, followed by annual inspection. Intervals can vary depending on your particular experience.

### inspection of terminals

■ connections to circuit breaker terminals could be inspected. If there is discoloration due to overheating, the joint should be disassembled and the surface cleaned before reinstallation. It is essential that electrical connections be made carefully in order to prevent overheating.

- check for terminal tightness.

### cleaning

Remove the dust and dirt that have accumulated on the circuit breaker surface and terminals.

### mechanical checks

Even over long periods circuit breakers are not often required to operate on overload or short-circuit conditions. Therefore it is essential to operate the breaker periodically. To trip the breaker, push the push-to-trip button.

### insulation resistance tests

When breakers are subjected to severe operating conditions, insulation resistance test should be performed as indicated in NEMA standard publication no AB2-1980. An insulation resistance test is used to determine the quality of the insulation between phases and phase to ground. The resistance test is made with a DC voltage higher than the rated voltage, to determine the actual resistance of the insulation. The most common method employs a "megger" type instrument. A 1000V instrument will provide a more reliable test because it is capable of detecting tracking on insulated surfaces. Resistance values below 1 megohm are unsafe and should be investigated. An insulation test should be made :

- between line and load terminals of individual poles with the circuit breaker contacts open.
- between adjacent poles and from poles to the metallic supporting structure with the circuit breaker contacts closed. The latter test may be done with the circuit breaker in place after the line and load conductors have been removed, or with the circuit breaker bolted to a metallic base which simulates the in-service mounting.

### electrical tests

These tests require equipment for conducting pole resistance, overcurrent and instantaneous tripping, in accordance with NEMA standard publication no AB2. They are not within the scope of normal field operation.

### Important

**All tests must be made on circuit breakers which have been de-energized, and disconnected so as to prevent accidental contact with live parts.**

### Caution

**Since molded case circuit breakers contain factory-sealed and calibrated elements, it is essential that the seal be not broken and the circuit breaker be not tampered with.**

**Molded-case circuit breakers should not be field adjusted or repaired. In the case of malfunction, the circuit breaker should be replaced or repaired at the Merlin Gerin factory, or by an authorized representative.**

# Compact CF circuit breaker international standards

## molded case circuit breaker

In addition to UL 489 and CSA C22- 2 standard CF breakers comply with IEC 157-1 standard as per table below :

CF type 2, 3-pole	ampere rating (A)	interrupting ratings					
		UL 489 - CSA C22-2			IEC 157-1		
		RMS Sym. Amps					
		240V	480V	600V	240V	415V	660V
<b>standard breakers</b>							
CF 250N	250	65,000	35,000	10,000	85,000	35,000	10,000
<b>high interrupting breakers</b>							
CF 250H	250	100,000	42,000	10,000	85,000	50,000	12,000
<b>current limiting breakers</b>							
CF 250L	250	150,000	150,000	65,000	150,000	150,000	60,000

## molded case switch

CJ type 3-pole	ampere rating (A)	short circuit withstand (RMS Sym. Amps)	when protected by fuses of maximum ratings (A)
CF 250NA	250	100,000	250

## shunt trip

rated voltage (V)			
UL 489 listed		IEC 157-1	
60Hz	120	50/60Hz	110-127
	240		220-240
	480		380-415
DC	24	DC	24
	48		48
	125		125

## undervoltage trip device

rated voltage (V)			
UL 489 listed		IEC 157-1	
DC	24	DC	24
	48		48
	125		125

## motor operator

rated voltage (V)			
UL 489 listed		IEC 157-1	
60Hz	120	50/60Hz	110-127
	240		220-240
DC	24	DC	24
	48		48
	125		125

## auxiliary switches, alarm switch, overcurrent trip switch

IEC 157-1 characteristics are the same as those indicated in page 12 .

## circuit breakers for compliance with other world standards

Where compliance with IEC standards is required, Merlin Gerin offers a versatile range (not UL listed) of CF circuit breakers to meet your specific need. Units include two, three or four poles, three levels of interrupting capabilities up to 660V. An extensive range of accessories complements the product line. For further information, please contact your Merlin Gerin representative.

[www.ElectricalPartManuals.com](http://www.ElectricalPartManuals.com)



MERLIN GERIN CANADA <sup>LTD</sup><sub>LTEE</sub>  
855 Matheson Blvd. East, Unit 14, Mississauga,  
Ontario L4W 4L8  
tel: (416) 238-9025  
fax: (416) 238-9028

1375 Graham Boucherville, Québec J4b 6A1  
tel: (514) 641-1340 Telex : 05-268734  
fax: (514) 641-1472

**GRUPE SCHNEIDER** 

AC0061/1E

MERLIN GERIN INC.  
5000 Highlands Pkwy, Suite 150  
SMYRNA, GA 30082, USA  
tel: (404) 432.2744  
fax: (404) 432.9179

As standard specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

photos : B. Maurice  
design by AMEG, Y. Marchand  
IPV - 05/90 - printed by BONNET