SIEMENS

Low Voltage Insulated Case Circuit Breaker

UL489 Circuit Breaker

WL Circuit Breaker

Operating Instructions Catalog No.: CBIM-01001-0119

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

NOTE

These instructions do not purport to cover all details or variations in equipment, or to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise, which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office. The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

TRADEMARKS

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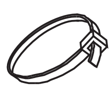
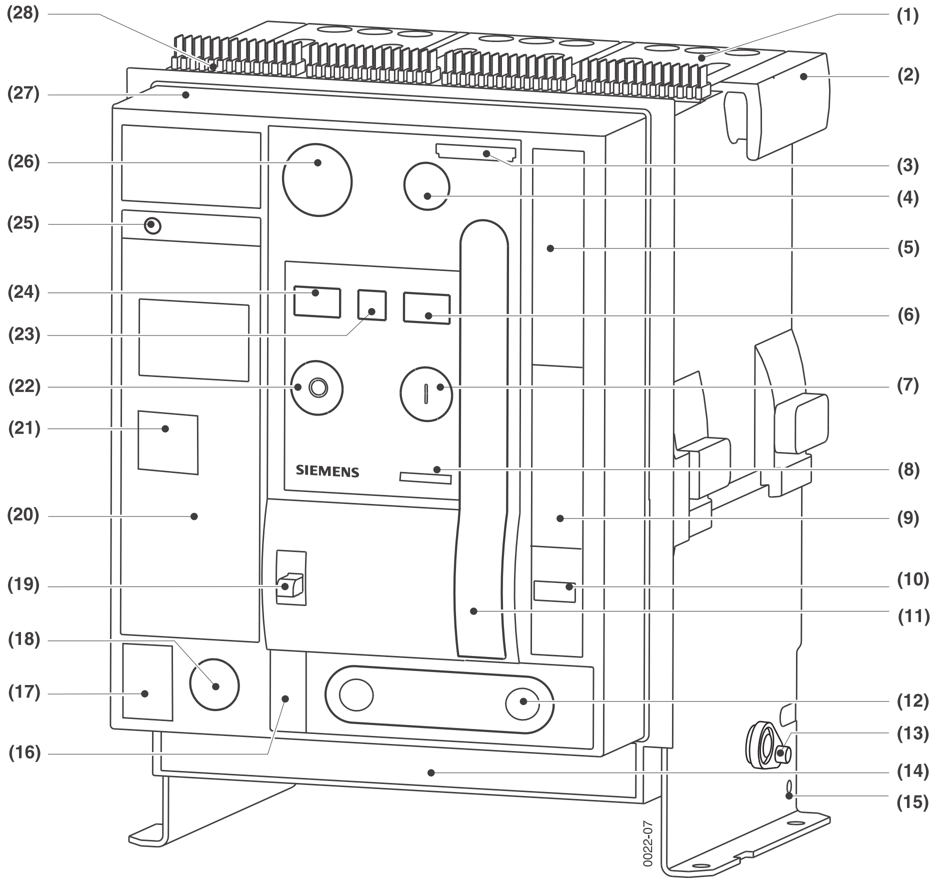
Symbols

	Visual examination
	Hook
	Slotted-type screwdriver
	Cruciform screwdriver Philips (PH), PoziDriv (PZ)
	Torx screwdriver (T)
	Hex socket screwdriver
	Open end wrench
 **10 Nm** **89 lb-in**	Tightening torque
	Cable tie
	Add in writing
$\boxed{1}$	First step of action sequence

Contents

1 Overview

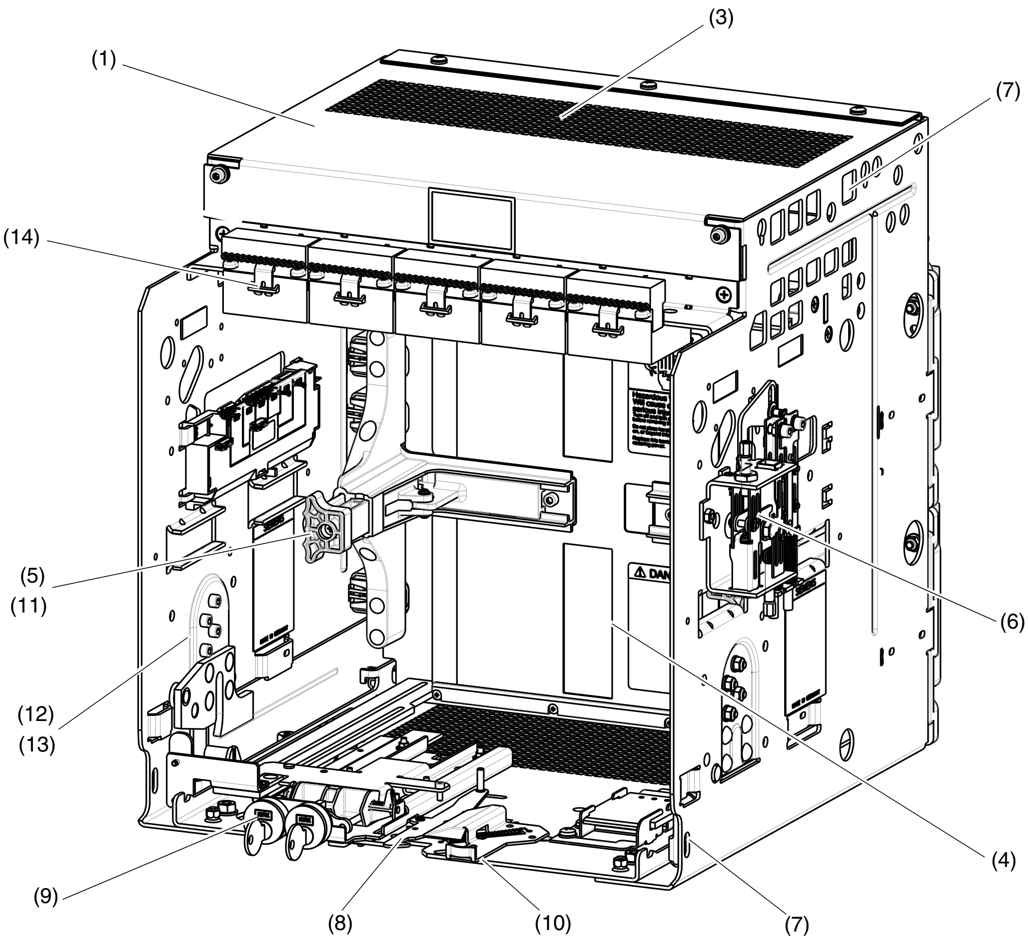
1.1 Circuit Breaker



(1) Arc chute → (page 24-5)
(2) Carrying handle
(3) Identification tags
(4) Motor disconnect switch (option) → (page 13-3)
(5) Circuit breaker type label → (page 2-1)
(6) Spring charge indicator → (page 6-7)
(7) Mechanical "CLOSE" button
(8) Rated current value
(9) Racking pictogram
(10) Make-break operations counter (option)
(11) Spring charging lever → (page 6-4)
(12) Racking handle
(13) Racking shaft
(14) Options label → (page 2-1)
(15) Grounding terminal
(16) Position indicator → (page 6-2)
(17) Table for ground-fault protection → (page 9-12)
(18) Key lock for racking handle
(19) Mechanical release of racking handle (option)
(20) Trip unit → (page 9-1)
(21) Rating Plug
(22) "OPEN" button **or**
"EMERGENCY OPEN" mushroom pushbutton (option)
(23) "Ready-to-close" indicator → (page 6-7)
(24) Circuit breaker OPEN / CLOSED indicator → (page 6-7)
(25) Tripped indicator (reset button) → (page 6-9)
(26) Locking device "lock OPEN" (option)
(27) Front panel
(28) Secondary Disconnects

1.1 Cradle

(with optional accessories)

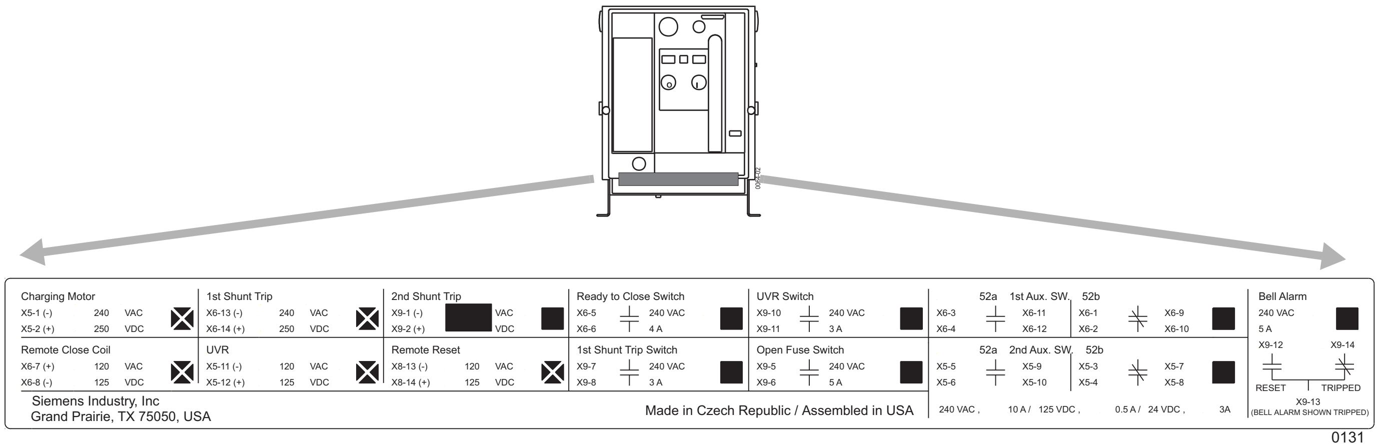


(1) Arc chute cover (option)
(2) Hole for crane hook
(3) Arc vent openings
(4) Shutter (option)
(5) Locking device shutter (standard for shutters)
(6) Mutual mechanical circuit breaker interlocking (option)
(7) Locking provision for guide rail
(8) Door interlock (option)
(9) Locking device in OPEN position (option)
(10) Cradle mounted locking device against closing the circuit breaker in disconnect position (option)
(11) Shutter operating device
(12) Rejection feature
(13) Option-related coding
(14) Secondary disconnects

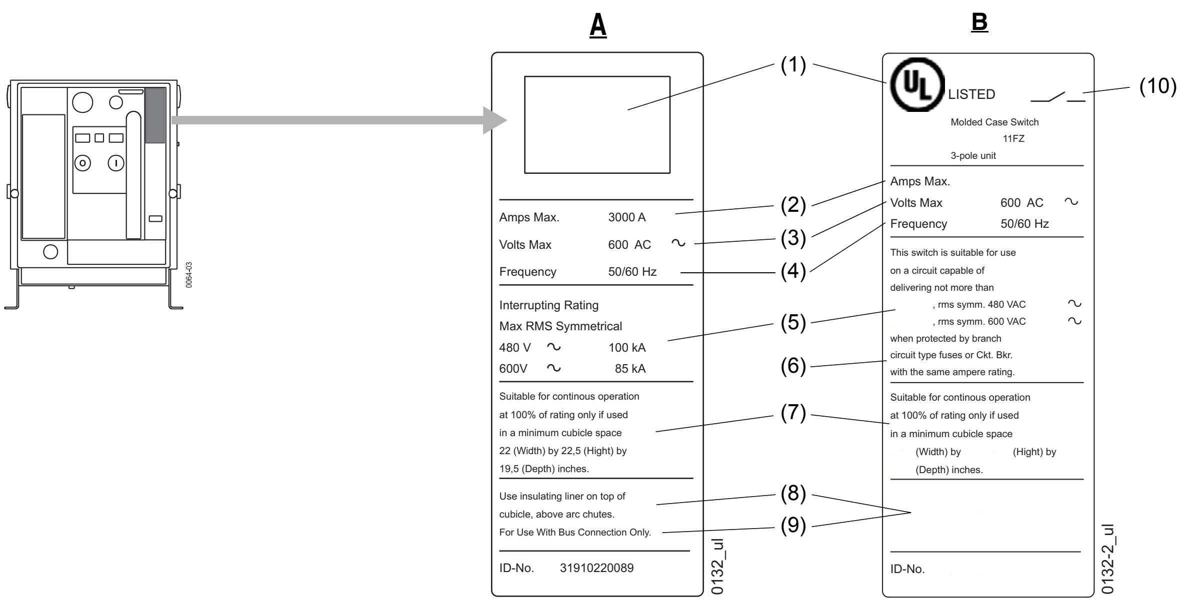
2 Labels

2.1 Circuit breaker frame accessory label

(with terminal designations)



2.2 Circuit breaker frame type label

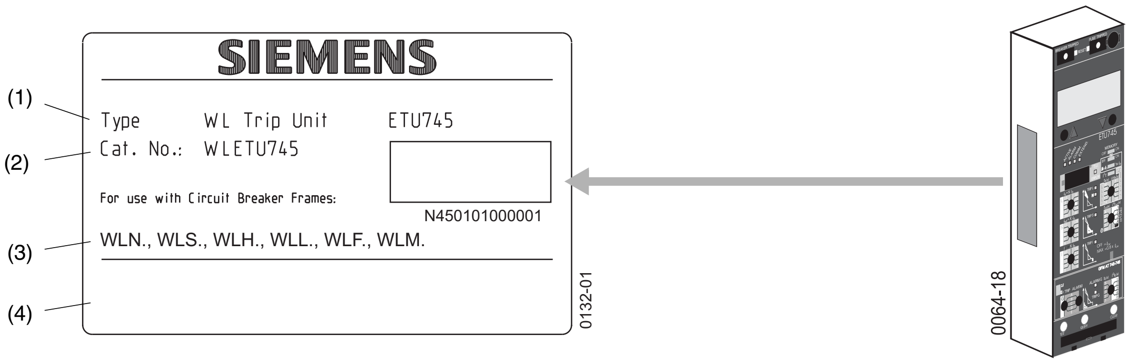


A **Circuit breaker**
B **Non-automatic switch**
(1) UL-Mark (for circuit switch applied by a white sticker, within the shown frame)
(2) Maximum rated current
(3) Rated operating voltages
(4) Rated frequency
(5) Rated short-circuit breaking capacity
(6) Necessary overcurrent protection
(7) Enclosure size
(8) Installation space
(9) Main connections
(10) Switch mark

2.3 Frame designation

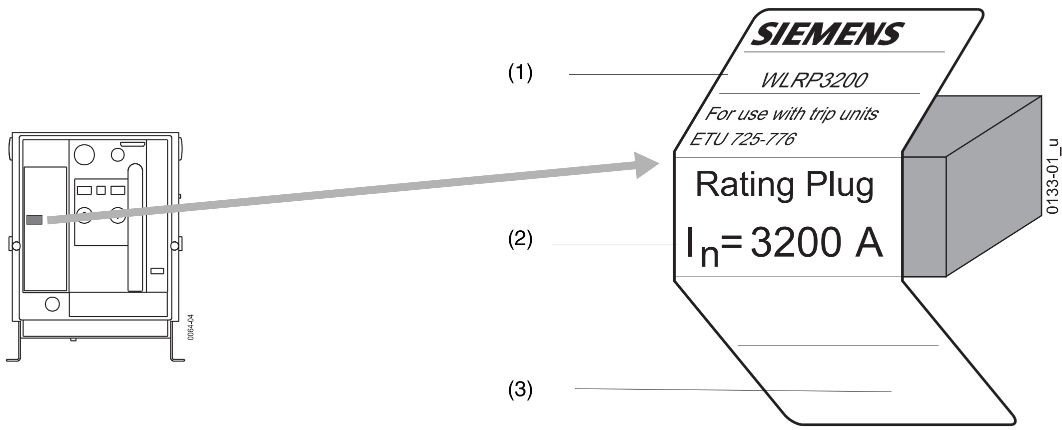
(1) Type of circuit breaker (WL)
(2) Siemens interrupting class
(3) Frame size
(4) Draw-out or fixed mounted circuit breaker
(5) No. of poles
(6) Maximum rated continuous current

2.4 Trip unit designation



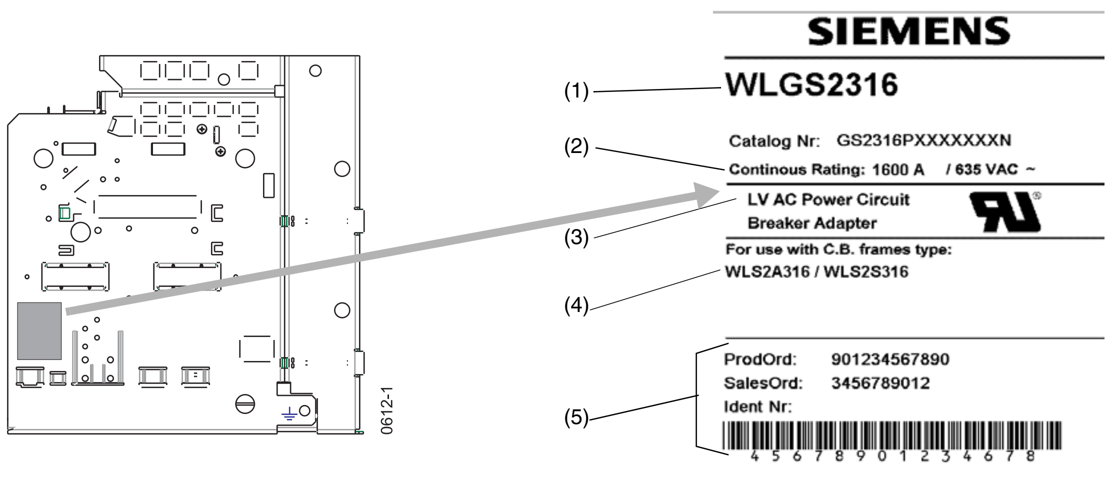
(1) Type
(2) Catalog number
(3) Can be used in the following types of circuit breakers
(4) Regulatory approvals on a separate label

2.5 Rating Plug label



(1) Catalog number
(2) Rated current of the circuit breaker
(3) Regulatory approvals on a separate label

2.6 Cradle type label



(1) Catalog number
(2) Rated current and voltage of the cradle
(3) UL listing mark
(4) Circuit breakers that can be used with this cradle
(5) Sales order, production order, cradle identification number

A second type label is attached to the baseplate inside the cradle or on one of its side walls.

3 Standard specifications

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment/property damage.

Turn off and lock out all power supplying this equipment before working on this device.

Only qualified personnel should work on this equipment, after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained herein and on the devices.

The successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

Qualified Personnel

For the purpose of this instruction manual and these product labels, a "qualified person" is one who is familiar with the installation, construction and operation of the equipment and the hazards involved and who, in addition, has the following qualifications:

a) Is trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.

b) Is trained in the proper care and use of protective equipment in accordance with established safety practices.

c) Is trained in rendering first aid.

The circuit breakers are suited for operation in enclosed spaces not subject to operating conditions aggravated by dust, corrosive vapors or gases. Circuit breakers to be installed in dusty or damp locations must be appropriately enclosed.

The circuit breaker frame and the trip units are in conformity with the standards:

- UL 489
- NAVAL use according UL 489 Suppl. SB
- CSA C22.2 No. 5-02

The cradles are in conformity with the standards:

- UL 489
- CSA C22.2 No. 5-02

The accessories are in conformity with the standards:

- UL 489
- CSA C22.2 No. 5-02

The molded case switches are in conformity with the standards:

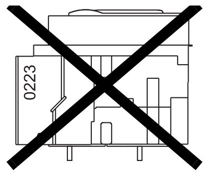
- UL 489
- CSA C22.2 No. 5-02
-

4 Packing and Lifting

4.1 Unpacking

Unpack the circuit breaker and inspect it for damage.

If the circuit breaker or cradle is to be installed at a later date:
they may only be stored and redispatched in the original packing.



NOTICE

Equipment Damage.

Placing the circuit breaker on its rear side may cause damage to the finger cluster assemblies.

When handling circuit breakers, do not place them on their rear side.

4.2 Weights

Frame Size		Weight		
	Fixed-mounted circuit breaker	Draw-out circuit breaker	Cradle	Circuit breaker + Cradle
I 800 A / 1200 A	86 lb	137 lb	108 lb	Only lift separately
II 800 A / 1200 A	124 lb	159 lb	112 lb	Only lift separately
II 1600 A	124 lb	159 lb	112 lb	Only lift separately
II 2000 A	130 lb	177 lb	128 lb	Only lift separately
II 2500 A / 3000 A	141 lb	209 lb	152 lb	Only lift separately
II C-class	148 lb	220 lb	163 lb	Only lift separately
III	181 lb	260 lb	306 lb	Only lift separately
III C-class	200 lb	278 lb	306 lb	Only lift separately

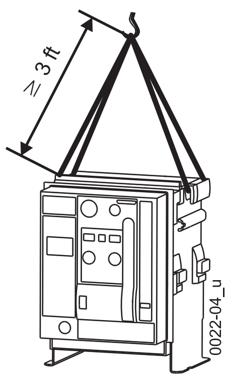
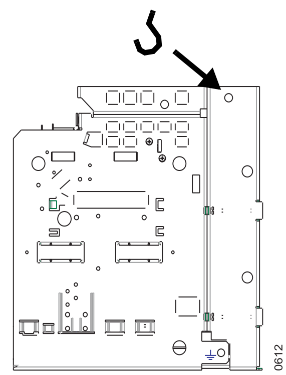
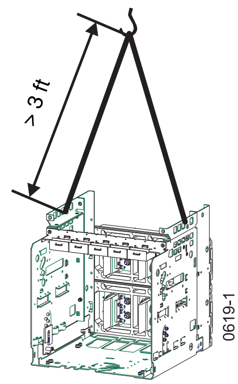
4.3 Lifting with a crane

DANGER

Heavy Equipment.

Improper lifting will cause death, serious personal injury, or equipment/property damage.

Never lift a circuit breaker or cradle above personnel. Follow instructions for use of lifting bar assembly. Use OSHA/NIOSH approved crane equipment and personal protection equipment for lifting/moving the circuit breakers and cradles.

Circuit Breaker	Cradle
 max. ∅ ½“ rope	
	

NOTICE

Lifting a frame size III cradle with a breaker inside may result in distortion of the cradle.

Remove the frame size III breaker from the cradle before lifting.

4.4 Lifting with a Lifting Bar Assembly

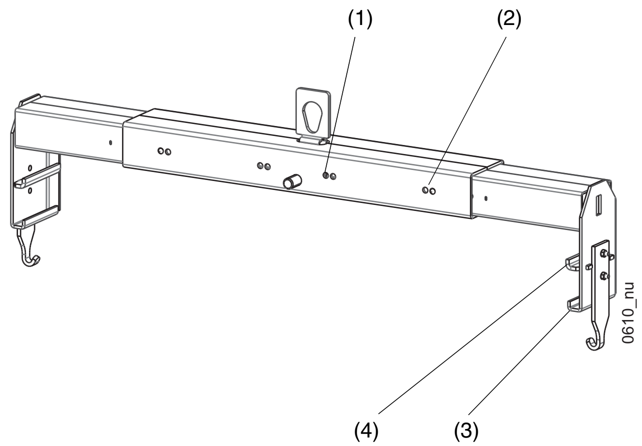
DANGER

Heavy Equipment.

Improper lifting will cause death, serious personal injury, or equipment/property damage.

Never lift a circuit breaker or cradle above personnel. Follow instructions for use of lifting bar assembly. Use OSHA/NIOSH approved crane equipment and personal protection equipment for lifting/moving the circuit breakers and cradles.

4.4.1 Lifting bar assembly (3-pole)

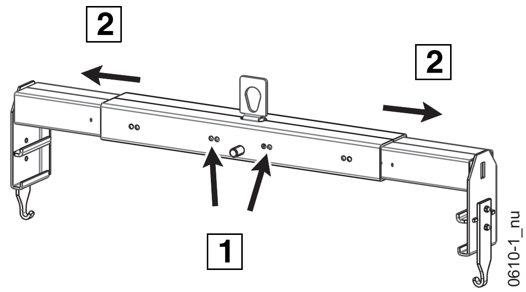


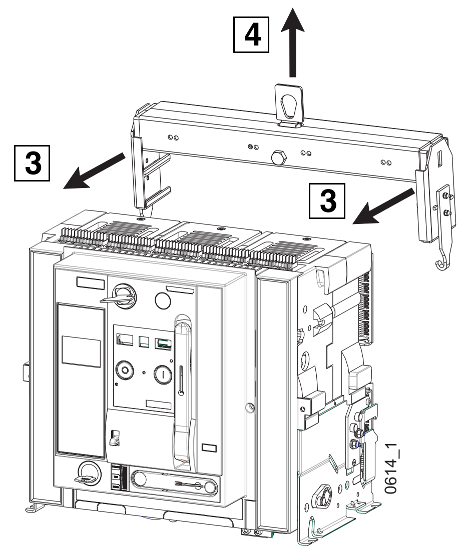
(1) Locking position for circuit breaker in frame size II
(2) Locking position for circuit breaker in frame size III
(3) Receptacle for circuit breaker carrying handle FS II / III
(4) Receptacle for circuit breaker carrying handle

NOTE

Always lock the lifting bar assembly symmetrically on both sides.

4.4.2 Lifting the circuit breaker





	Catalog No
Lifting beam for circuit breaker and cradle	WLLFT
Portable hoist for use with the lifting beam	WLHOIST

5 Installation

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

DANGER

Heavy Equipment.

Improper lifting will cause death, serious personal injury, or equipment/property damage.

Never lift a circuit breaker, fuse carriage, or cradle above personnel. Follow instructions for use of lifting bar assembly. Use OSHA/NIOSH approved crane equipment and personal protection equipment for lifting/moving the circuit breakers and cradles.

WARNING

High speed moving parts.

Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

5.1 Mounting

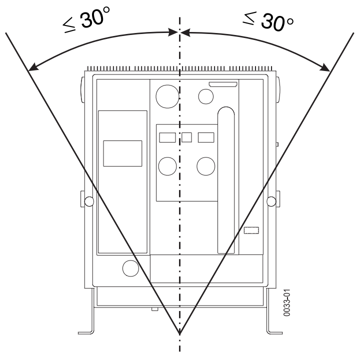
5.1.1 Mounting position

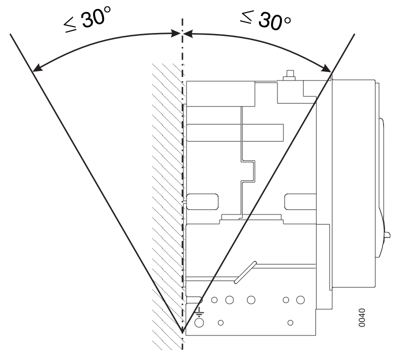
WARNING

Heavy Equipment

Can cause serious personal injury.

Use care when racking the breaker into the disconnect position. When a draw-out circuit breaker is mounted tilting toward the front side, it is possible that the circuit breaker may slide out on the rails.

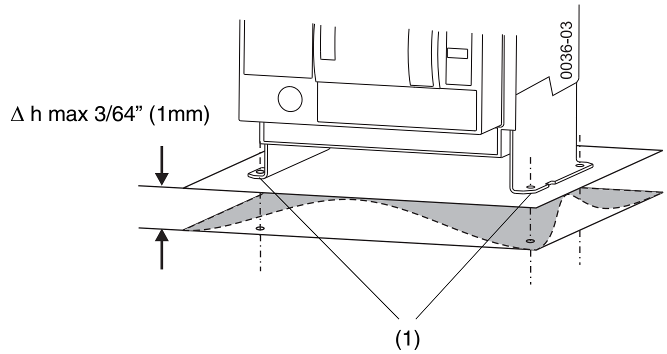




5.1.2 Mounting on horizontal surface - Mounting tolerances

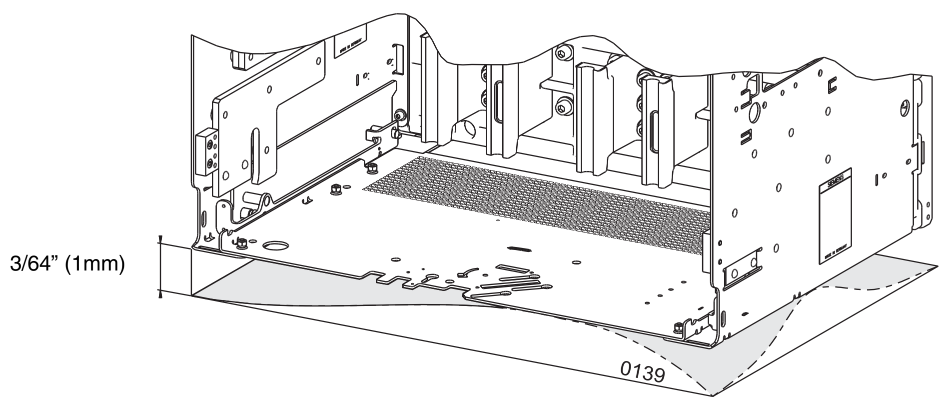
The circuit breaker must be mounted on a rigid, level surface, capable of supporting the weight of the breaker, cradle, and associated busbar components. The maximum amount of offset in the mounting plane is 3/64“ (1mm).

Fixed-mounted breaker

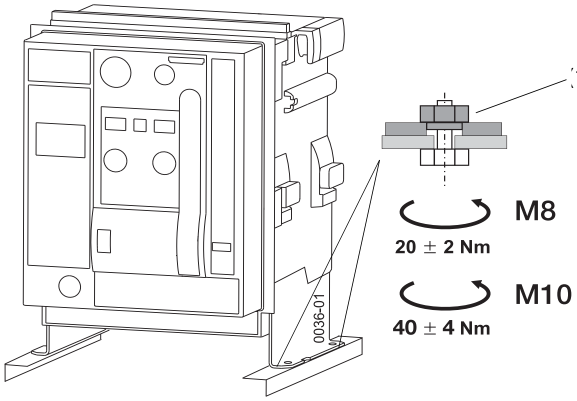


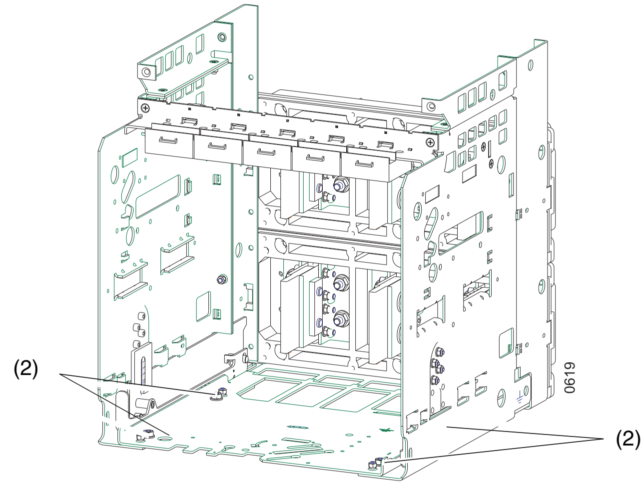
(1) Mounting points

Cradles for draw-out breaker



NOTICE
Damage to finger clusters.
Improperly aligned bussing at the terminal connections may affect the position of the bus stabs. Misaligned bus stabs may result in damage to the finger clusters during circuit breaker rack-in.
Do not distort the cradle terminal connections when connecting to the main bus.



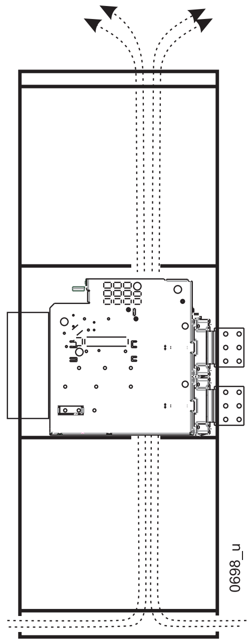


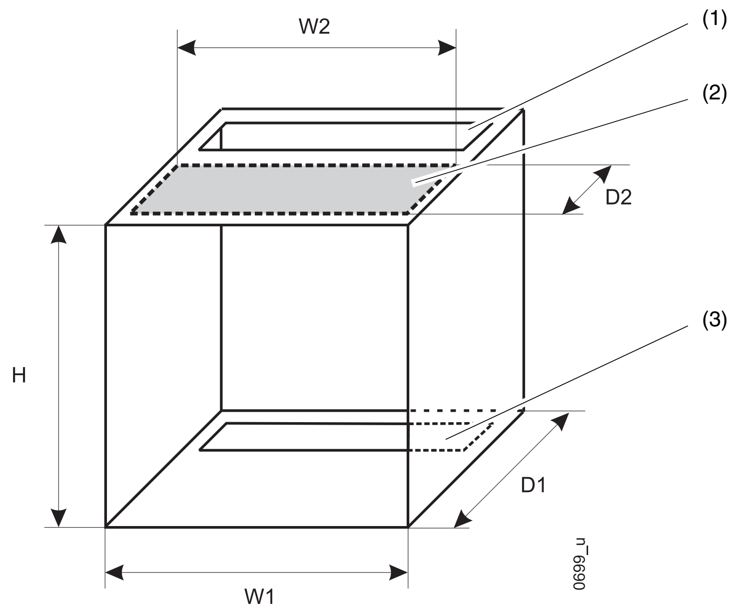
(1) Fixed-mounted circuit breaker with 4 captive nuts for:
FS I / II: bolts M8 + washers kit catalog no. WLMETRC
FS III: bolts M10 + washers kit catalog no. WLMETRC3
Alternatively with bolts, washers and nuts:
FS I / II: $^{5}/_{16}$“ / M8
FS III: $^{3}/_{8}$“ / M10

(2) Cradle with 4 holes for:
FS I: countersunk head screws M6 or 1/4“ + belleville washer + nuts

FS II / III: screws M8 or 5/16“ + belleville washer + nuts

5.1.3 Cubicle and ventilation





(1) Upper ventilation opening
(2) Insulating liner use NEMA GPO-3, min. 0.094“ thick or comparable material
(3) Lower ventilation opening

Frame size	Frame rating (A)	Interrupting Class	Minimal cubicle dimensions			Insulating liner dimensions		Cubicle ventilation	
			Width W1 (inch)	Height H (inch)	Depth D1 (inch)	Width W2 (inch)	Depth D2 (inch)	Top (square inch)	Bottom (square inch)
I	800	S,H,L	22	15[1]	19.5	18.5	10.5	not required	
	1200								
II	800	S, L, C	22	22.5[1]	19.5	18.5	10.5		
	1200								
	1600								
	2000								
	2500								
	3000							55	55[1]
III	4000	L	32	22.5[2]	19.5	28.5	10.5	48 (2“ by 24“)	88[3]
	5000								
	4000	C	32	30	19.5	28.5	10.5	48 (2“ by 24“)	88[3]
	5000								

1) Cubicle height given for use with insulating liner on cubicle top or cradle equipped with standard cover
2) Cubicle height given for use with insulating liner on cubicle top or cradle equipped with optional cover
3) Provided by cradle holes

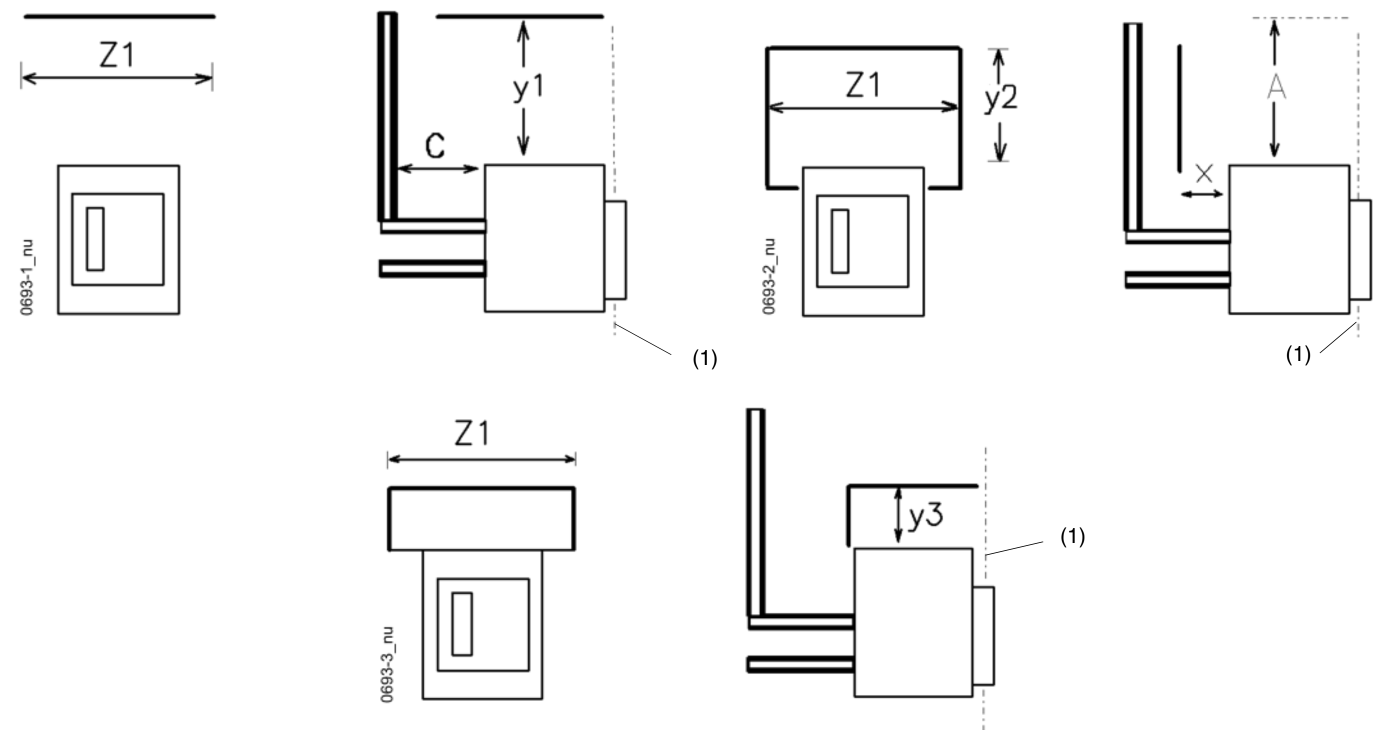
5.1.3.1 Clearances / arcing space

Generally:

The installation space dimensions given on the type label ensure the necessary clearances to grounded metal surfaces up to 600 V AC according to UL 489.

Additional guidelines for applications without compartmentalization as cubicles or for positioning of parts within the cubicle are given below. Clearances to live parts, grounded metallic parts and non-conductive parts must be maintained. The required minimum clearances are specified for rated voltages of 480 V AC and 600 V AC. In consideration for a ventilated switchboard: the minimum installation volume is calculated based on the specified height, width and depth, taking into consideration the power losses of ventilated switchgear.

5.1.3.2 Fixed-mounted circuit breaker



1) Cubicle door
A Minimum clearance see → (page 5-8)
C Minimum distance to the bus
X Installation clearance of the barrier
y1 Distance of the barriers
y2 Height of the barriers
y3 Height for pressure dissipation
Z1 Width of the barriers

<table>
<tr><th rowspan="2">FS
BG</th><th rowspan="2">Class</th><th colspan="12">Dimensions for phase barriers made of insulating material[1)]
(mm)</th></tr>
<tr><th colspan="2">y1[2)]</th><th colspan="2">Z1</th><th colspan="2">C</th><th colspan="2">y2[2)]</th><th colspan="2">X</th><th colspan="2">y3[2)]</th></tr>
<tr><th colspan="2">Operating voltage
(V)</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th></tr>
<tr><td rowspan="3">I</td><td>S</td><td rowspan="3">60</td><td rowspan="3">60</td><td rowspan="3">470</td><td rowspan="3">470</td><td rowspan="3">25</td><td rowspan="2">125</td><td rowspan="3">100</td><td>100</td><td rowspan="3">0</td><td rowspan="3">0</td><td>60</td><td rowspan="2">80</td></tr>
<tr><td>H</td><td>125</td><td rowspan="2">80</td></tr>
<tr><td>L</td><td>140</td><td>150</td><td>120</td></tr>
<tr><td rowspan="3">II</td><td>S</td><td>60</td><td>60</td><td rowspan="2">470</td><td rowspan="2">470</td><td rowspan="2">25</td><td>125</td><td rowspan="2">100</td><td>100</td><td rowspan="3">0</td><td rowspan="3">0</td><td>60</td><td>80</td></tr>
<tr><td>L</td><td>100</td><td>100</td><td>140</td><td>150</td><td>150</td><td>150</td></tr>
<tr><td>C</td><td>60</td><td>60</td><td>470</td><td>470</td><td colspan="2">not possible</td><td>60</td><td>150</td><td>300</td><td>300</td></tr>
<tr><td rowspan="2">III</td><td>L</td><td>60</td><td>60</td><td rowspan="2">710</td><td rowspan="2">710</td><td>25</td><td>125</td><td>100</td><td>150</td><td rowspan="2">0</td><td rowspan="2">0</td><td>150</td><td>150</td></tr>
<tr><td>C</td><td>300</td><td>300</td><td colspan="2">not possible</td><td>300</td><td>300</td><td>400</td><td>400</td></tr>
</table>

1) Valid with nominal cubicle width only
FS I, II: 22“
FS III: 32“

2) Measured from top surface of arc chutes

<table>
<tr><th rowspan="2">FS
BG</th><th rowspan="2">Class [4)]</th><th colspan="10">Dimensions for dead metal barriers[1)]
(mm)</th></tr>
<tr><th colspan="2">y1[2)]</th><th colspan="2">Z1</th><th colspan="2">C</th><th colspan="2">y2[2)]</th><th colspan="2">X[3)]</th></tr>
<tr><th colspan="2">Operating voltage
(V)</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th></tr>
<tr><td rowspan="3">I</td><td>S</td><td>70</td><td>70</td><td rowspan="3">470</td><td rowspan="3">470</td><td rowspan="3">25</td><td rowspan="2">125</td><td rowspan="3">100</td><td>100</td><td rowspan="3">16</td><td rowspan="3">16</td></tr>
<tr><td>H</td><td rowspan="2">100</td><td rowspan="2">125</td><td>125</td></tr>
<tr><td>L</td><td>140</td><td>150</td></tr>
<tr><td rowspan="2">II</td><td>S</td><td>100</td><td>100</td><td rowspan="2">470</td><td rowspan="2">470</td><td rowspan="2">25
25</td><td>125</td><td rowspan="2">100</td><td>100</td><td rowspan="2">16</td><td rowspan="2">16</td></tr>
<tr><td>L</td><td>125</td><td>125</td><td>140</td><td>150</td></tr>
<tr><td>III</td><td>L</td><td>125</td><td>125</td><td>710</td><td>710</td><td>25</td><td>125</td><td>100</td><td>150</td><td>16</td><td>16</td></tr>
</table>

1) Valid with nominal cubicle width only
FS I, II: 22“
FS III: 32“

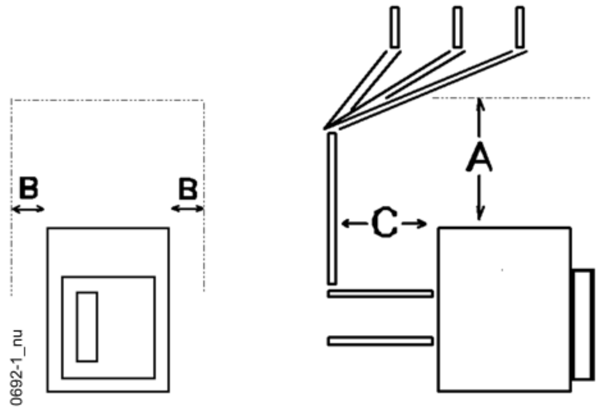
2) Measured from top surface of arc chutes

3) "16" is a measurement taken from the rounded protrusions on the rear of the housing

4) Class C with phase barriers made of insulating material only → (page 5-5)

5.1.3.3 Draw-out circuit breaker

Without arc chute cover



A Minimum vertical clearance
B Minimum clearance on either side
C Minimum horizontal rear-side clearance

FS	Class [3]	Dimensions (mm)											
		A[1]				B				C			
		u		v, c		u[2]		v, c		u[2]		v, c	
Operating voltage (V)		480	600	480	600	480	600	480	600	480	600	480	600
I	S, H, L	Consult Technical Support											
II	S	150	300	100	100	20	50	10	10	14	14	10	10
II	L	250	600	100	100	50	100	10	10	14	30	10	10
III	L	250	500	100	100	50	100	10	10	14	14	10	10

1) Measured from top surface of arc chutes

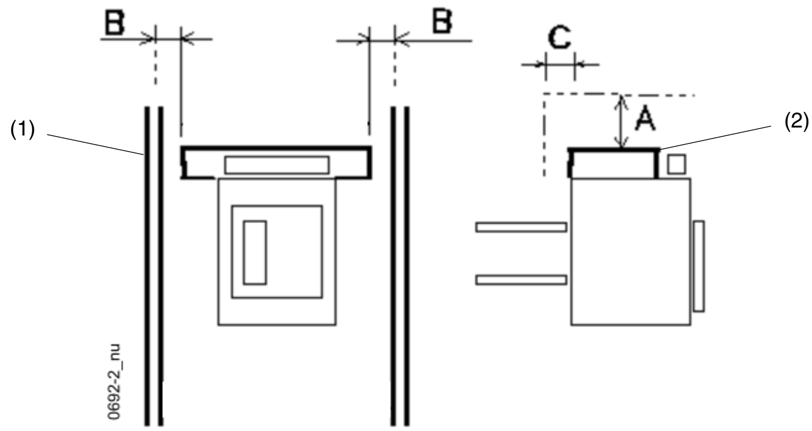
2) Valid with unblocked arcing space on top only

3) Class C with phase barriers made of insulating material only → (page 5-5)

u Minimum clearance to live parts
v Minimum clearance to grounded metal parts
c Minimum clearance to non-conductive parts

With arc chute cover

Arc chute covers for draw-out cradles are options for every frame size. The gases are directed to the side outlets of the cradle. Openings to the outside provided on the sides of the cradle shall not be blocked. Ventilation openings on the upper rear ensure that no gas can escape upwards.



1) Switchgear
2) Arc chute cover
A Minimum vertical clearance
B Minimum clearance on either side
C Minimum rear-side clearance

<table>
<tr><th rowspan="3">FS
BG</th><th rowspan="3">Class [3]</th><th colspan="12">Dimensions
(mm)</th></tr>
<tr><th colspan="4">A[1]</th><th colspan="4">B</th><th colspan="4">C</th></tr>
<tr><th colspan="2">u</th><th colspan="2">v, c</th><th colspan="2">u[2]</th><th colspan="2">v, c</th><th colspan="2">u[2]</th><th colspan="2">v, c</th></tr>
<tr><th colspan="2">Operating voltage
(V)</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th><th>480</th><th>600</th></tr>
<tr><td rowspan="3">I</td><td>S</td><td rowspan="3">14</td><td rowspan="3">14</td><td rowspan="3">0</td><td rowspan="3">0</td><td rowspan="3">100</td><td rowspan="2">100</td><td rowspan="3">10</td><td rowspan="3">10</td><td rowspan="3">14</td><td rowspan="3">14</td><td rowspan="3">0</td><td rowspan="3">0</td></tr>
<tr><td>H</td></tr>
<tr><td>L</td><td>225</td></tr>
<tr><td rowspan="2">II</td><td>S</td><td rowspan="2">14</td><td rowspan="2">14</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">50</td><td>100</td><td rowspan="2">10</td><td rowspan="2">10</td><td rowspan="2">14</td><td rowspan="2">14</td><td rowspan="2">0</td><td rowspan="2">0</td></tr>
<tr><td>L</td><td>225</td></tr>
<tr><td>III</td><td>L</td><td>14</td><td>14</td><td>0</td><td>0</td><td>50</td><td>200</td><td>10</td><td>10</td><td>14</td><td>14</td><td>0</td><td>0</td></tr>
</table>

1) Measured from top surface of arc chutes
2) Openings in top of cradle side wall shall not be blocked, side clearance of 30 mm required.
3) Class C with phase barriers made of insulating material only → (page 5-5)

u Minimum clearance to live parts
v Minimum clearance to grounded metal parts
c Minimum clearance to non-conductive parts

5.2 Main terminal connections

For main terminal dimensions of individual frame sizes, refer to: → Frame sizes / dimension drawings (page 7-1)

The main terminals and connectors are intended for busbar connection with NEMA hole patterns. The number and size of the busbars connected to the circuit breaker must be selected per UL 891 in order to meet the design and test requirements according to UL 891 depending on the rated current, defined by the rating plug. Different bussing in a given frame size may be applicable.

5.2.1 Cradle connections

Drawout circuit breaker		Connections to Line/Load side cradle connectors		
Frame Size	**I_{nmax}**	**Number of available busbars mounting positions**	**Busbar cross-section**	**Number of holes**
I	800 A / 1200 A	1 - 3	4“ x ¼“[1)]	4
II	800 A / 1200 A / 1600 A	1 - 3	4“ x ¼“[1)]	4
	2000 A	2 - 4		
	2500 A / 3000 A	3 - 5		
III	4000 A / 5000 A	5 - 7	5“ x ¼“[2)]	6

1) The terminal permits the use of 2“ x ¼“ busbars.
2) The terminal permits the use of 4“ x ¼“ busbars.

5.2.2 Horizontal connections for fixed mount breakers

NOTICE

Equipment Damage.

Cables which are connected directly to the horizontal bus terminals using cable terminals can damage the circuit breaker when short-circuit currents occur.

Always connect mechanical cable lugs to front connected bus terminals (→ Wire connectors (page 5-24)) or other type of properly braced bus.

Fixed Mount circuit breaker		Connections to Line/Load side horizontal terminals		
Frame Size	**I_{nmax}**	**Number of available busbars mounting positions**	**Busbar cross-section**	**Number of holes**
I	800 A / 1200 A	1 - 4	3“ x ¼“[1)]	2
II	800 A / 1200 A / 1600 A	1 - 4	4“ x ¼“[1)]	3
	2000 A			
	2500 A / 3000 A			
III	4000 A / 5000 A	2 - 6	5“ x ¼“[2)]	4

1) The terminal permits the use of 2“ x ¼“ busbars.
2) The terminal permits the use of 4“ x ¼“ busbars.

5.2.3 Vertical connections for fixed mount circuit breakers

Fixed mount circuit breaker		Connection to Line/Load Side terminal with vertical connectors		
Frame Size	**I_{nmax}**	**Number of busbars**	**Busbar cross-section**	**Number of holes**
I	800 A / 1200 A	1 - 3	3“ x ¼“[1]	2
II	800 A / 1600 A	1 - 3	4“ x ¼“[1]	3
	2000 A	2 - 4		
	2500 A / 3000 A	3 - 5		
III	4000 A / 5000 A	5 - 7	5“ x ¼“[2]	4

1) The terminal permits the use of 2“ x ¼“ busbars.

2) The terminal permits the use of 4“ x ¼“ busbars.

5.2.3.1 Fitting fixed-mounted circuit breaker with vertical adapter

DANGER

Hazardous voltage.

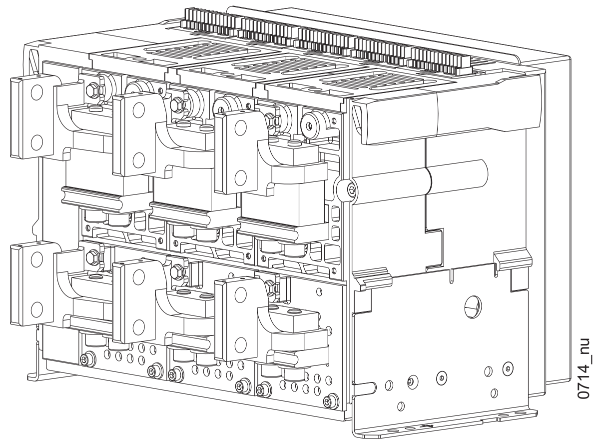
Will cause death, serious personal injury, or equipment damage.

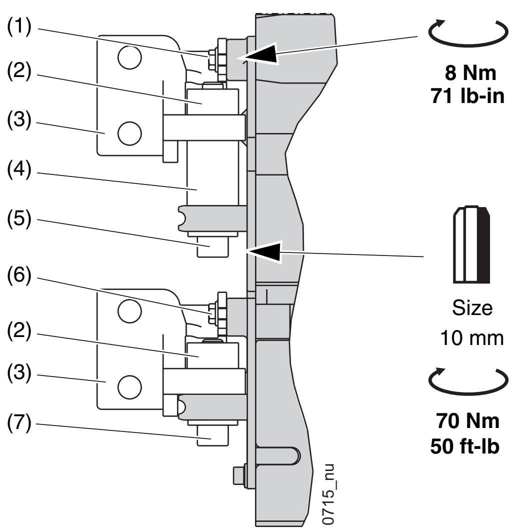
Turn off and lock out all power supplying this equipment before working on this device.

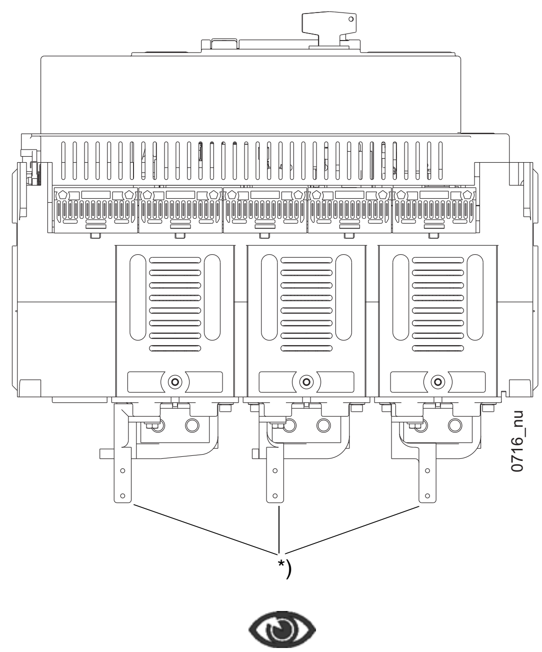
- OPEN the circuit breaker and discharge the closing spring→ (page 24-2)
- Remove fixed-mounted circuit breaker

Frame size I

NOTE
The bus connectors are different for the three poles. Installation as shown below.





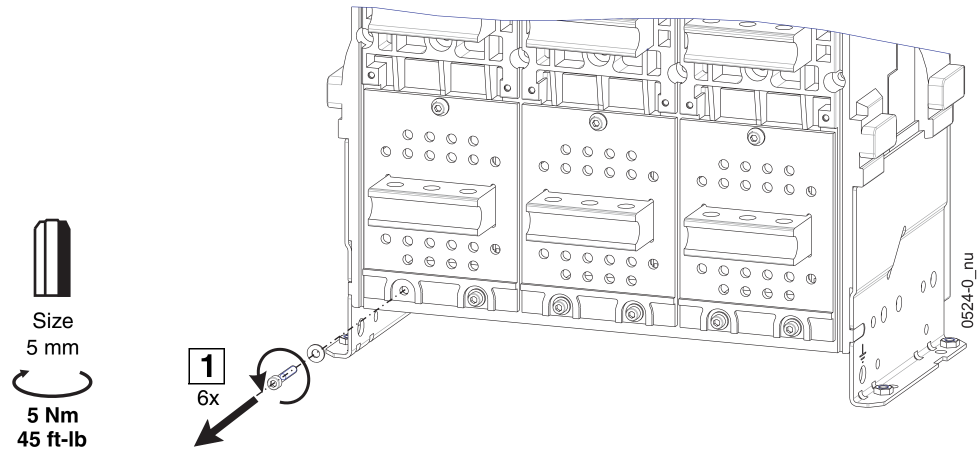


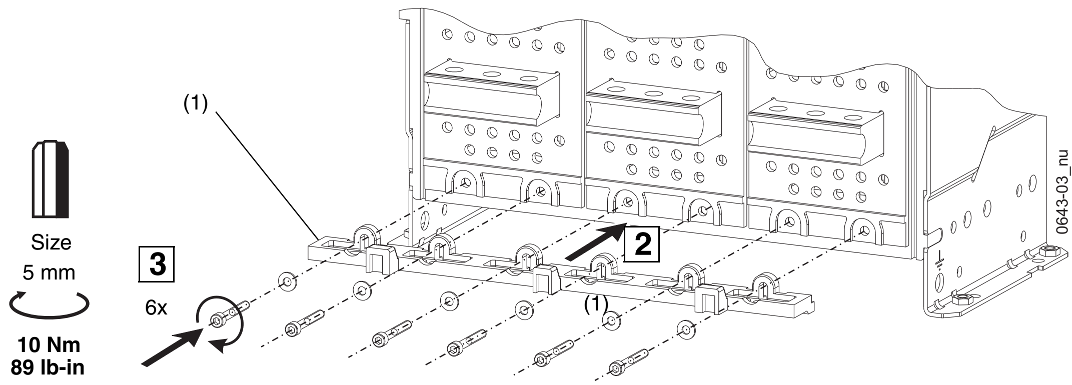
(1) Hex head screw M6x20
(2) Threaded plate 2xM12
(3) Vertical adapter
(4) Riser
(5) Socket head cap screw M12x90
(6) Hex head screw M6x35
(7) Socket head cap screw M12x50

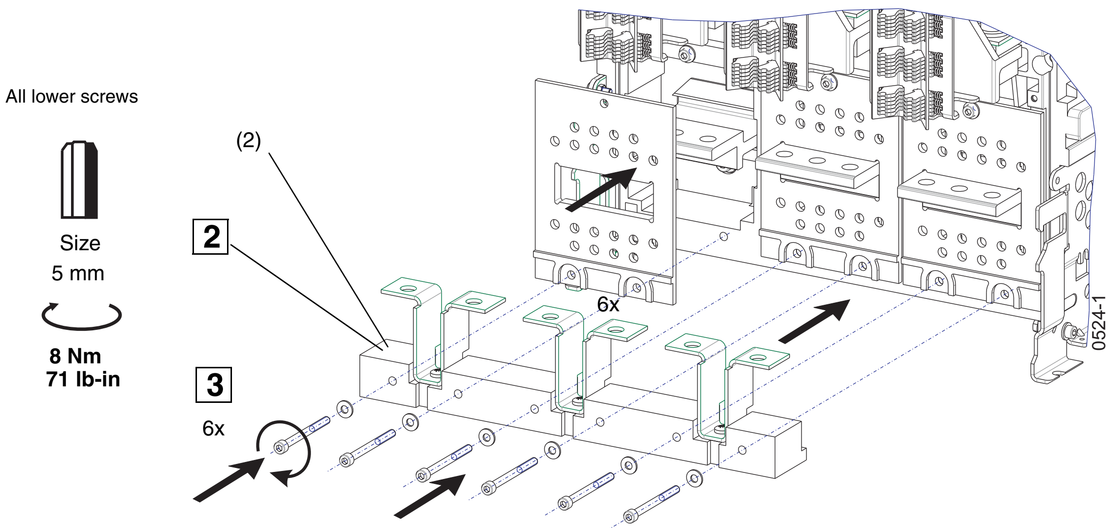
*) Different offset

Frame size II

Installing support for the lower contacts



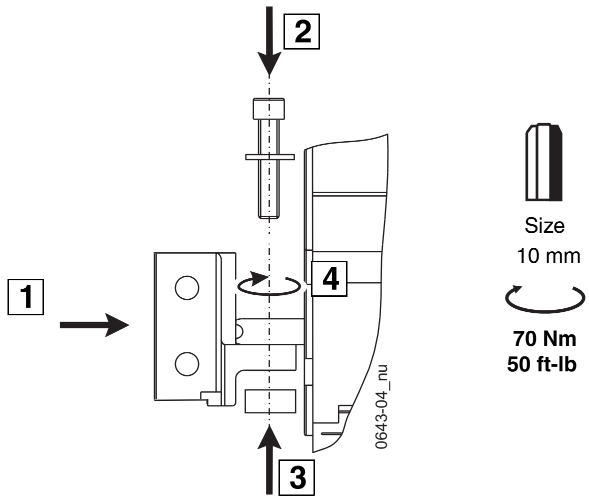




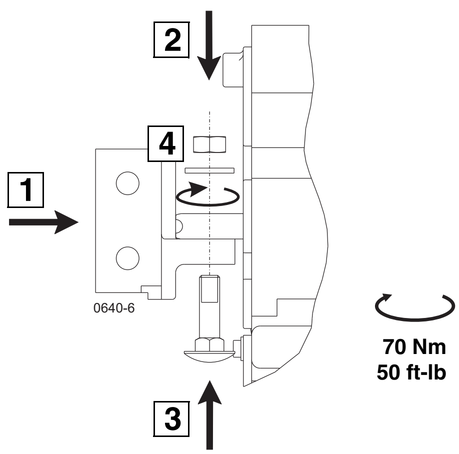
(1) Frame size II, 3200 A
(2) Frame size II, 800-2000 A

Attaching vertical adapter

Construction Style A

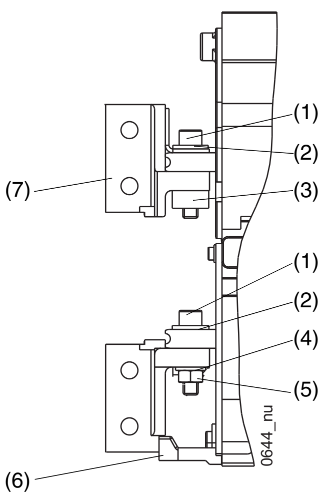


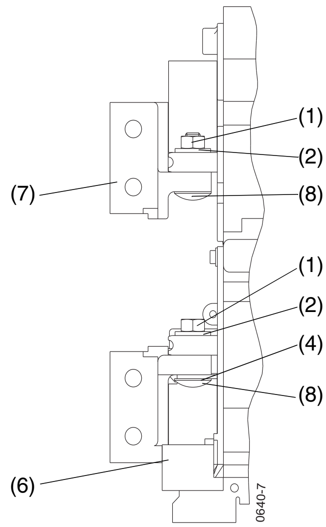
Construction Style B

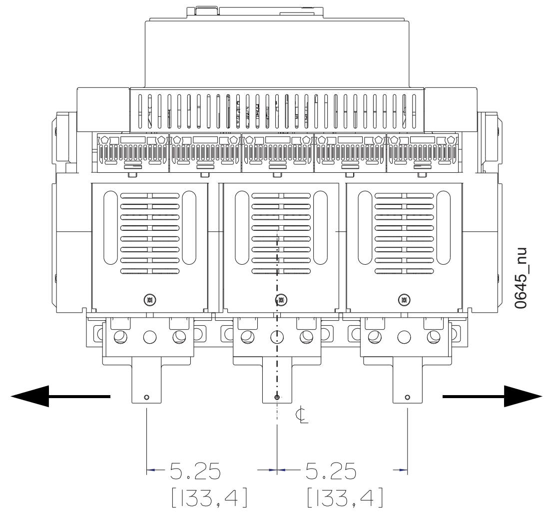


Alignment of vertical adapters

NOTE
Center the vertical adaptor of the center pole (phase B) on the copper connector of adapter and tighten it. Shift the vertical adaptors (7) of the outer poles (phase A & B) outwards until the specified distance of 5 1/4" is reached and tighten them.



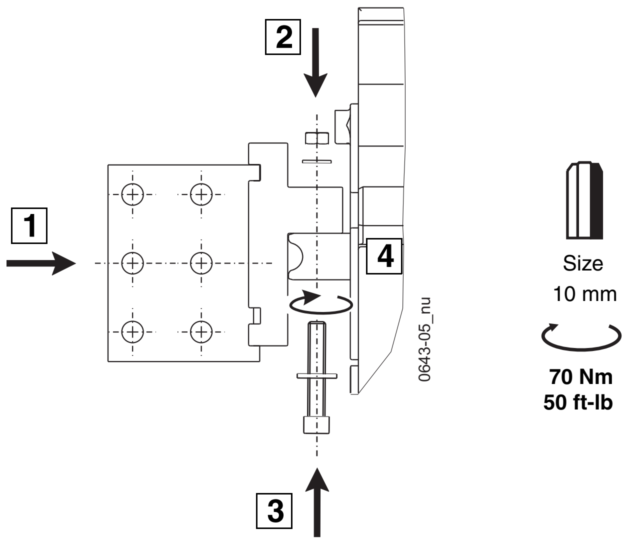




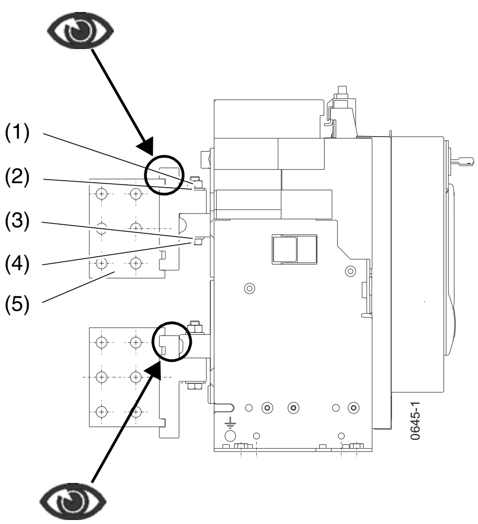
(1) Hex-head screw
800 A, 1200 A, 1600 A: M12 x 45,
2000 A: M12 x 55,
3000 A: M12 x 80,
(2) Belleville washer
(3) Threaded plate
(4) Washer
(5) 800 A, 1200 A, 1600 A, 2000 A: M12 nut
3000 A: threaded plate
(6) Support
(7) Vertical adapter
(8) Carriage bolt M12 with belleville washer and nut

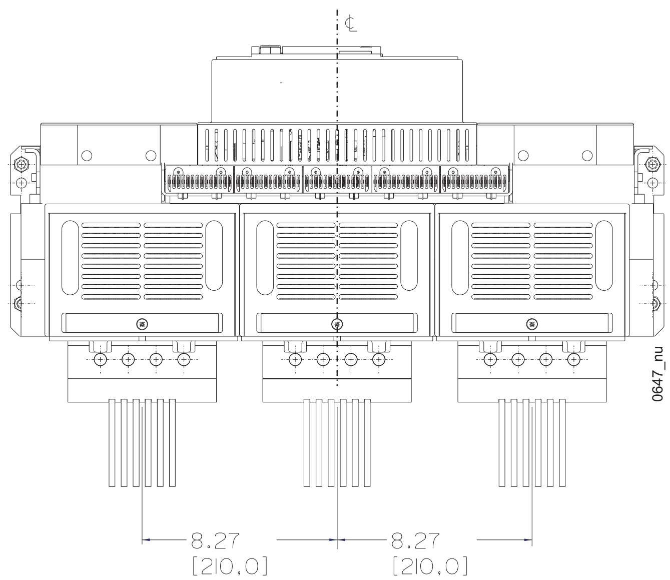
Frame size III

Attaching vertical adapter



Alignment of vertical adapters





(1) Hex-head screw M12 x 80
(2) Belleville washer
(3) Washer
(4) M12 nut
(5) Vertical adapter

5.2.3.2 Catalog numbers

Fixed-mounted circuit breaker vertical connectors	Frame size	Max. circuit breaker rated current $I_{n\,max}$ (A)	Catalog No.
Set for 3 phases, load and line	I	800 /1200	WLH1R12CONUL
Set for 3 phases, load and line	II	800 / 1200 / 1600	WLL2R16CONUL
		2000	WLL2R20CONUL
		2500 / 3000	WLL2R30CONUL
	II (Class C)	800 / 1200 / 1600 / 2000 / 2500 / 3000	WLC2R30CONUL
	III	4000 / 5000	WLC3R50CONUL

5.2.4 Front connections

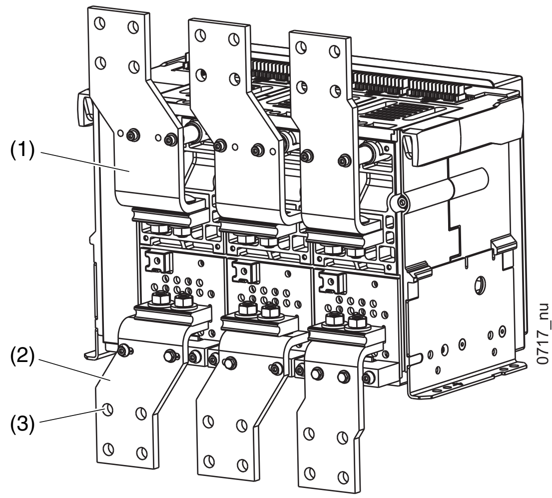
5.2.4.1 Bussing

Fixed-mounted circuit breaker		Line/Load Side Terminal Busbars with front connectors		
Frame Size	I_{nmax}	Number of busbars	Busbar cross-section	Number of holes
I	800 A / 1200 A	1 - 3	3“ x ¼“	4
II	800 A / 1200 A / 1600 A	1 - 3	4“ x ¼“	4
	2000 A	2 - 4		
	2500 A / 3000 A	2 - 5		
III	4000 A / 5000 A	5 - 7	5“ x ¼“ [1)]	6

1) Use of 4“ x ¼“ busbars is possible.

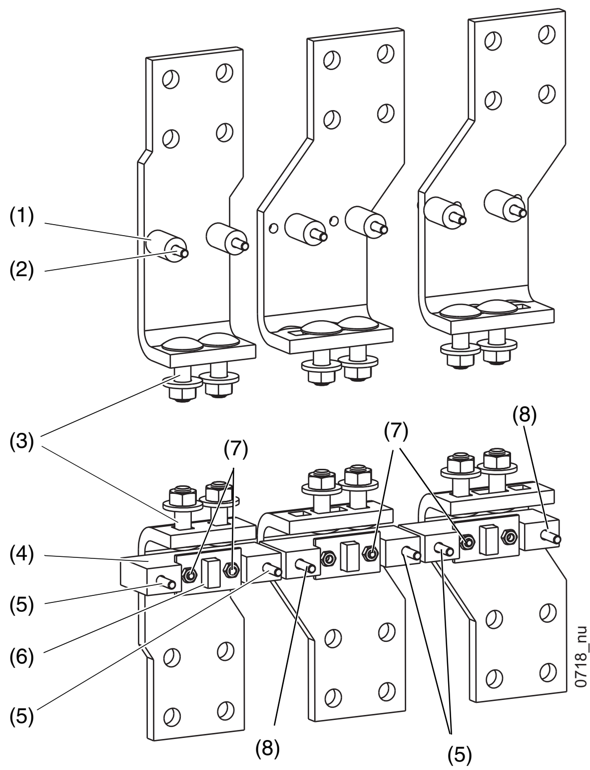
5.2.4.2 Fitting fixed mounted circuit breaker with front connectors

Frame size I



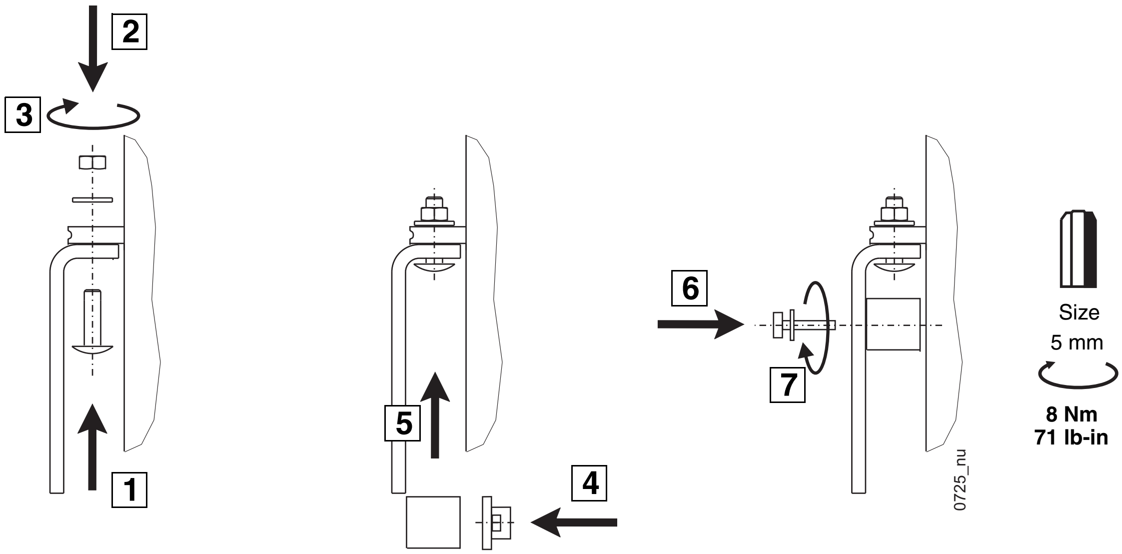
(1) Long connectors: line
(2) Short connectors: load
(3) Holes ∅ 13.5 mm

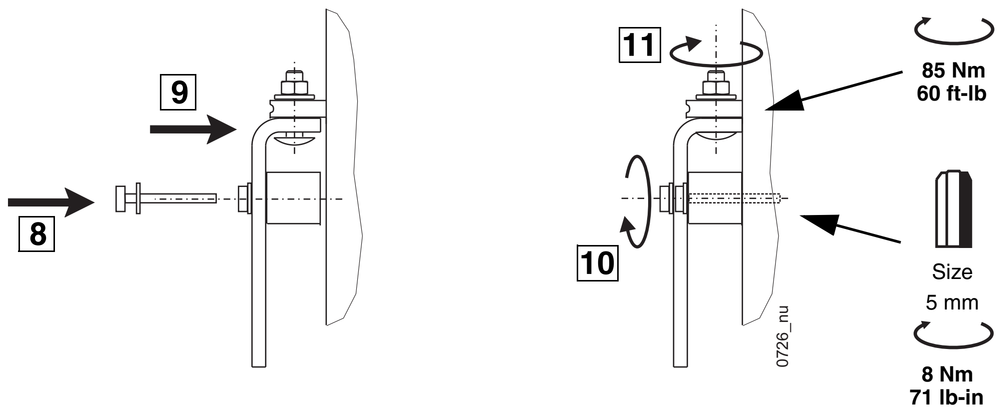
Removing of 6 screws on lower ends of sensor covers → (page 5-13).



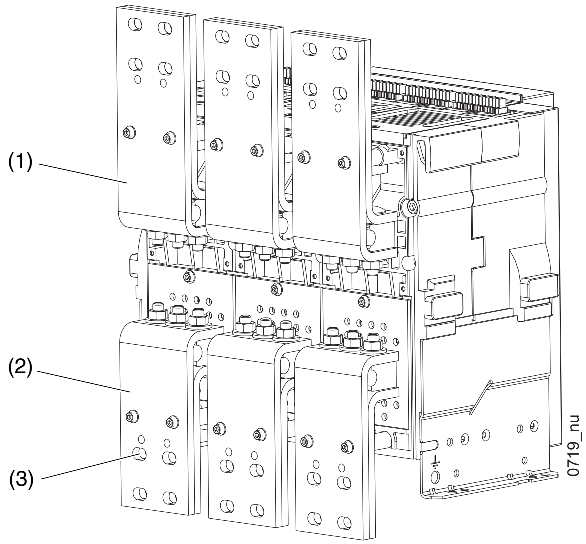
(1) Spacer
(2) Socket head cap screw ISO 4762 M6x55
(3) Carriage bolt M12x40 with belleville washer and nut
(4) Support
(5) Socket head cap screw ISO 4762 M6x60 with belleville washer
(6) Bracket with 2 captive nuts M6
(7) Hex-head screws ISO 4017 M6x50 with belleville washers
(8) Socket head cap screw ISO 4762 M6x70 with belleville washer

Mounting (load side)



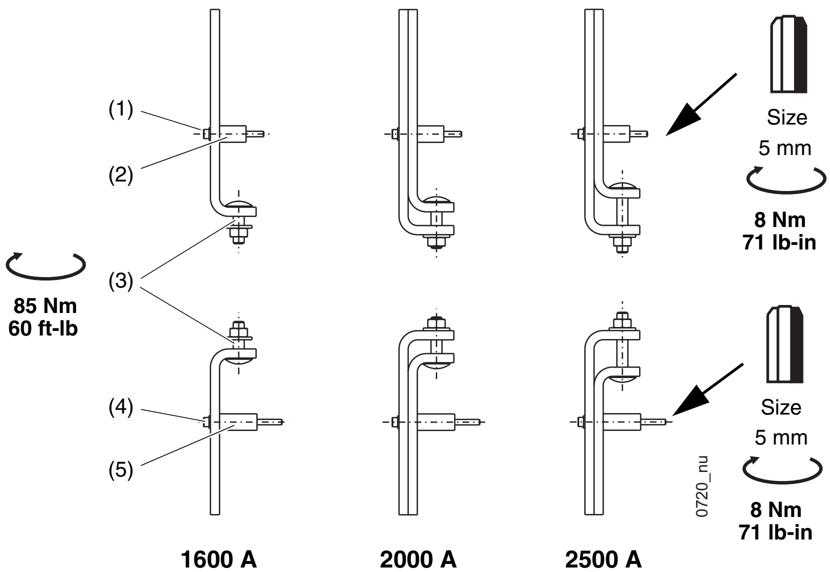


Frame size II



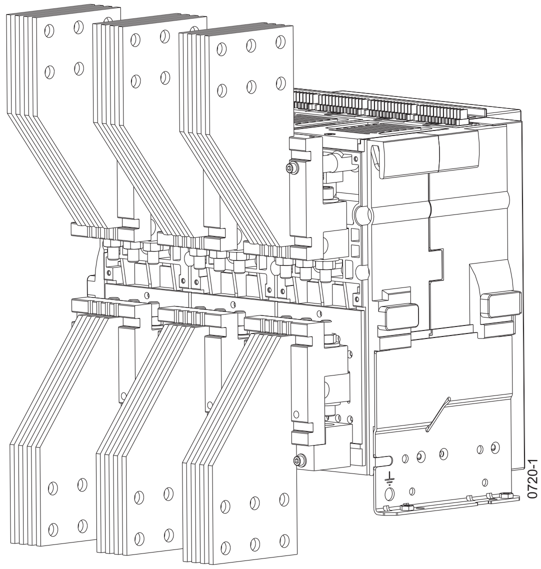
(1) Long connectors: line
(2) Short connectors: load
(3) Holes ∅ 13.5 mm

Removing of 6 screws on lower ends of sensor covers → (page 5-13).

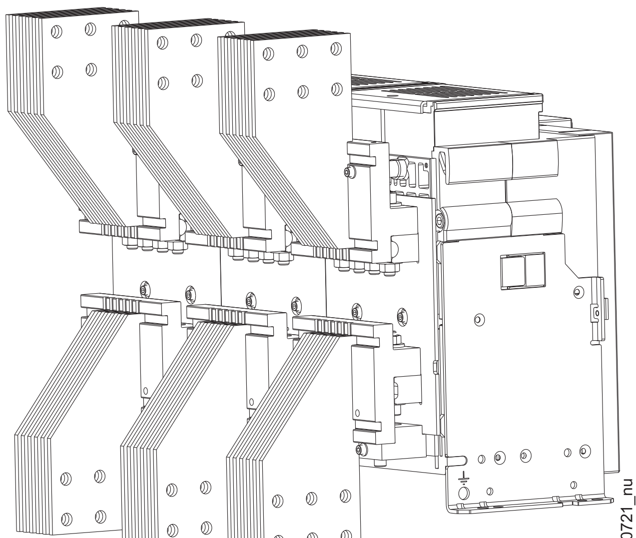


(1) Short socket head cap screw ISO 4762 M6 with belleville washer
(2) Short spacer
(3) Carriage bolt M12 with belleville washer and nut
(4) Long socket head cap screw ISO 4762 M6 with belleville washer
(5) Long spacer

Frame size II
3000 A

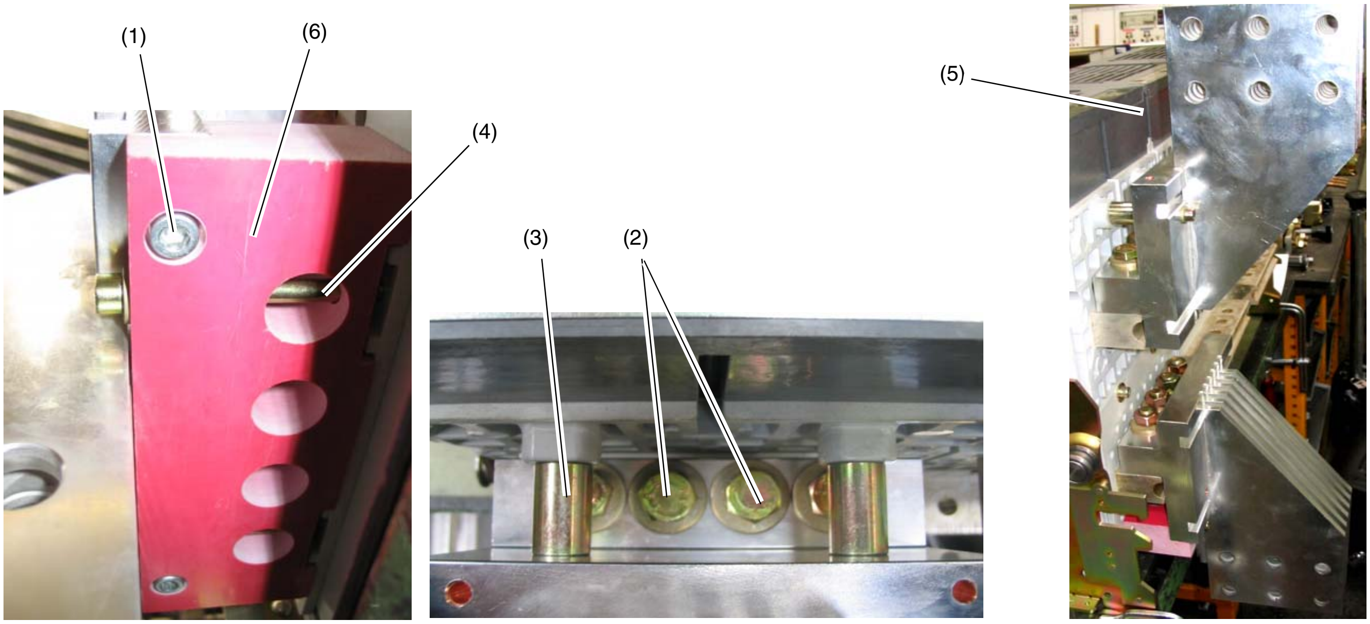


Frame size III



(1) Holes ∅ 14 mm

Mounting Frame size II 3000 A and Frame size III



1. Remove 6 screws from the lower side of the sensor covers → (page 5-13).
2. Locate the connectors on the breaker terminals and secure them with screws M12, nuts and belleville washers. Screw orientation: Nuts between terminals (facing each other).
   Do not tighten yet.

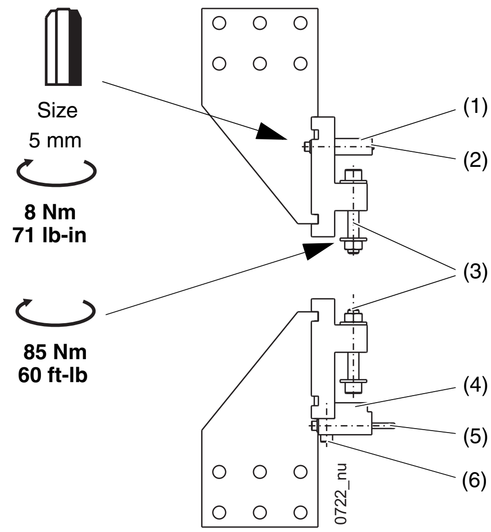
Upper terminals

3. Assemble the steel bushings (3) with screws M6x75 (5) and belleville washers.
   Do not tighten yet.
4. Push the connector against the steel bushings (3).
5. Tighten the center screws M12 (2) to the specified torque (85 Nm / 60 ft-lb)
6. Remove the steel bushings (3) and screws.
7. Tighten the outer screws M12 (5) to the specified torque (85 Nm / 60 ft-lb)
8. Assemble the steel bushings (3) and scews (5) again and tighten to the specified torque (8 Nm / 70 lb-in)

Lower terminals

9. Assemble the support (6) to the connector using self-tapping screws M6x25 (1) and tighten to the specified torque (8 Nm / 70 lb-in).
10. Assemble screws M6 (4) with belleville washers.
    Do not tighten yet.
11. Push the connector and support against the circuit breaker housing.
12. Tighten the center screws M12 to the specified torque (85 Nm / 60 ft-lb). Tool access via the holes in the support.
13. Remove the M6 screws (4).
14. Tighten the outer screws M12 to the specified torque (85 Nm / 60 ft-lb). Tool access via the holes in the support.
15. Mount the M6 screws (4) again and tighten to the specified torque (8 Nm / 70 lb-in).

NOTE
Store or pack the frame on a pedestal of about 2“ height, to protect the extending lower ends of the load connectors from being damaged.



(1) Spacer
(2) Socket head cap screw ISO 4762 M6x75 with belleville washer
(3) Socket head cap screw ISO 4762 M12x90 with belleville washer and nut
(4) Support
(5) Socket head cap screw ISO 4762 M6x85 with belleville washer
(6) Taptite screw DIN 7500 - EE - M6x25

5.2.4.3 Catalog numbers

Front connectors	Frame size	Max. circuit breaker rated current $I_{n\ max}$ (A)	Catalog No.
Set for 3 phases, load and line	I S, H, L	800 /1200	WLH1F12CONUL
Set for 3 phases, load and line	II S,L	800 / 1200 / 1600	WLL2F16CONUL
		2000	WLL2F20CONUL
		2500	WLL2F25CONUL
		3000	WLL2F30CONUL
	III L	4000 / 5000	WLL3F50CONUL

5.2.5 Wire connectors

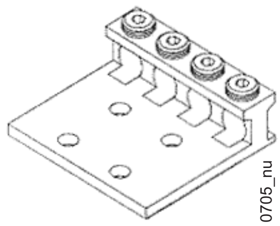
Wire connectors allow cables to be connected directly to the front connections of the circuit breaker.

NOTICE

Equipment Damage.

Short-circuit currents greater than 65 kA may cause damage to wire connectors or connected cables.

The use of wire connectors in switchgear with short-circuit currents greater than 65 kA is not permitted.



Wire connectors are tested according to UL 486A-486B with flexible standard cables.

5.2.5.1 Cabling

Frame size	Rated current	No. of cables per connector	Connector wire range	Torque
I	800 A / 1200 A	1 - 4	6 - 350 kcmil Cu / Al	325 lb-in 36 Nm
II	1200 A	1 - 4	6 - 350 kcmil Cu / Al	325 lb-in 36 Nm
	1600 A	1 - 6	300 - 600 kcmil Cu / Al	375 lb-in 42 Nm
	2000 A	1 - 6	250 - 600 kcmil Cu	375 lb-in 42 Nm

5.2.5.2 Mounting

DANGER

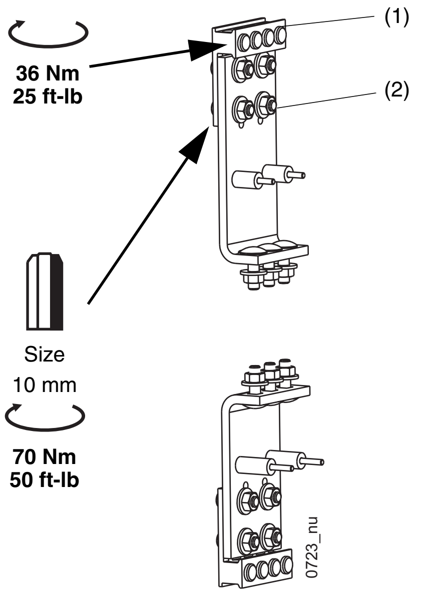
Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

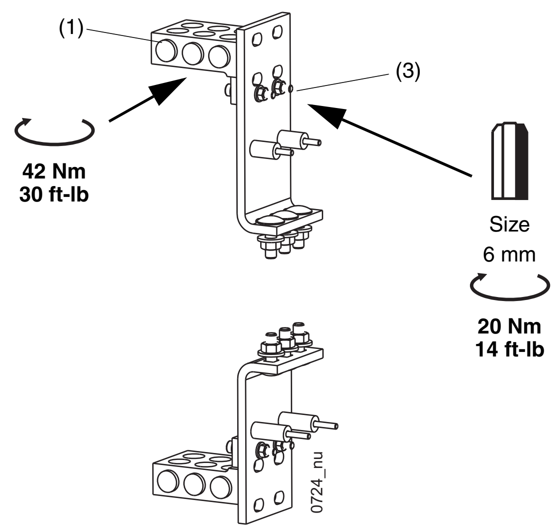
Turn off and lock out all power supplying this equipment before working on this device.

1. Attach the front connectors.
2. Attach power cables to wire connectors and tighten cable set screws to a torque given below.
3. Mount pressure wire connectors to the front connectors with mounting bolts, belleville washers and nuts and tighten to a torque given below.

A



B



A FS I and FS II, 1200 A
B FS II, 1600 A and 2000 A

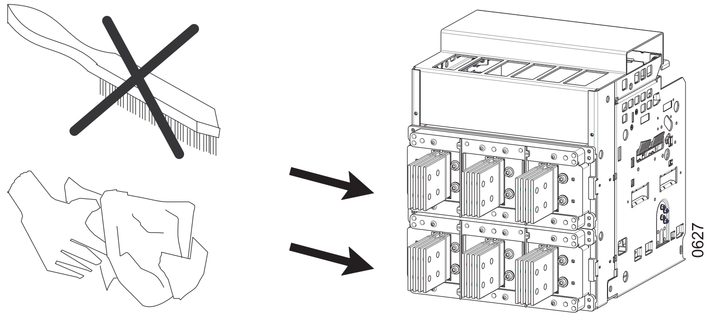
(1) Wire main connector
(2) 4x Socket head cap screws ISO 4762-M12x35 or 1/2” x 1 1/4” with belleville washer and nut
(3) 2x Socket head cap screws ISO 4762-M8x50 or 3/8” x 2” with belleville washer and nut

5.2.5.3 Catalog numbers

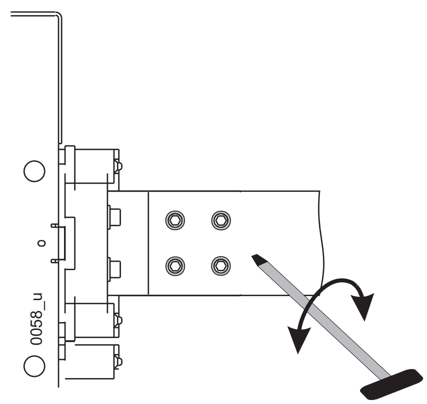
Frame size	Max. circuit breaker rated current $I_{n\ max}$ (A)	Catalog No.
I / II	800 / 1200 / 1600	WLS2P12CONUL
II	1600 / 2000	WLS2P20CONUL

5.3 Bus connections to the cradle

Clean the main conductor connection (plated busbars)



Securing line and load-side busbars



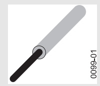
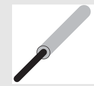
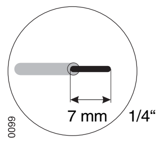
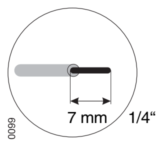
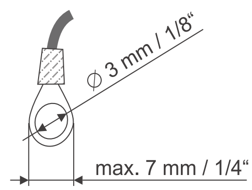
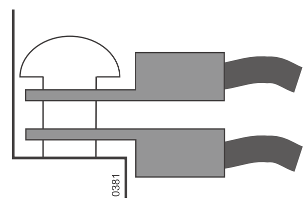
Use grade 5 bolts $^{1}/_{2}$“ and Belleville washers. Tighten to a torque of 70 Nm / 50 lb-ft.

5.4 Secondary wiring

Terminal assignment

→ (page 8-1)

Cross-sections

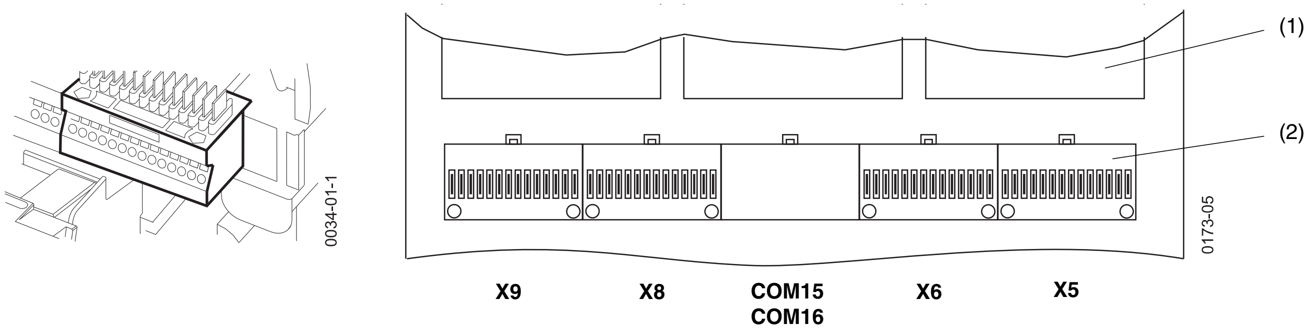
Connection type	Strip conductors	1 x 	2 x  
Screw clamp terminal (SIGUT system)		**20 -14 AWG** 1) **0.5 - 2.5 mm**^{2} 1)	**20 -14 AWG** 1) **0.5 - 1.5 mm**^{2} 1)
Spring clamp terminal		**20 -14 AWG** 1) **0.5 - 2.5 mm**^{2} 1)	**20 -14 AWG** 2) **0.5 - 2.5 mm**^{2} 2)
Ring terminal system		**14 - 16 AWG** Recommendation: AMP, PIDG series Catalog No. 50881  **10 AWG** Recommendation: Siemens part Catalog No. WL10RL	

1) Use of wire end ferrules (crimp style) is possible
1 x up to14 AWG tube-type **without** insulating sleeve
1 x up to 16 AWG tube-type **with** insulating sleeve
2 x up to 16 AWG tube-type **with** insulating sleeve, twin wire end ferrule

2) 2 x up to 14 AWG tube-type **without** insulating sleeve
2 x up to 16 AWG tube-type **with** insulating sleeve

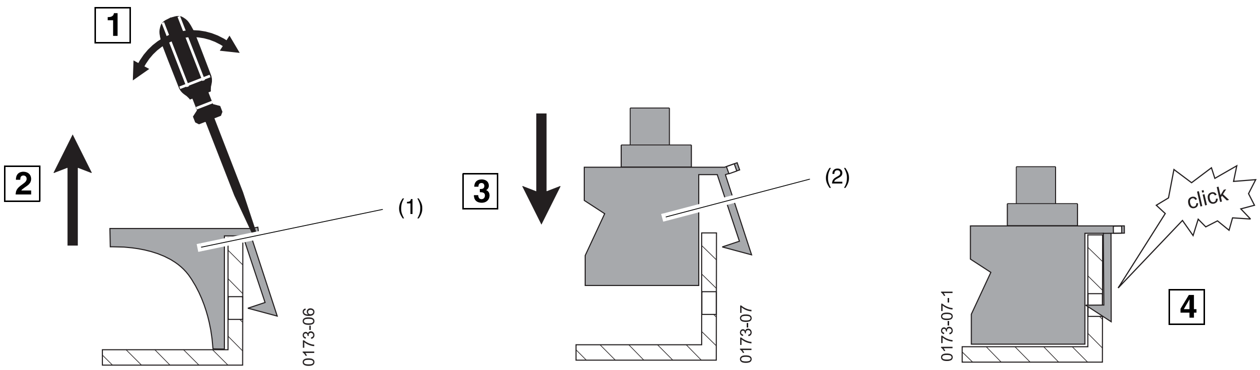
5.4.1 Breaker Secondary Disconnects

Arrangement

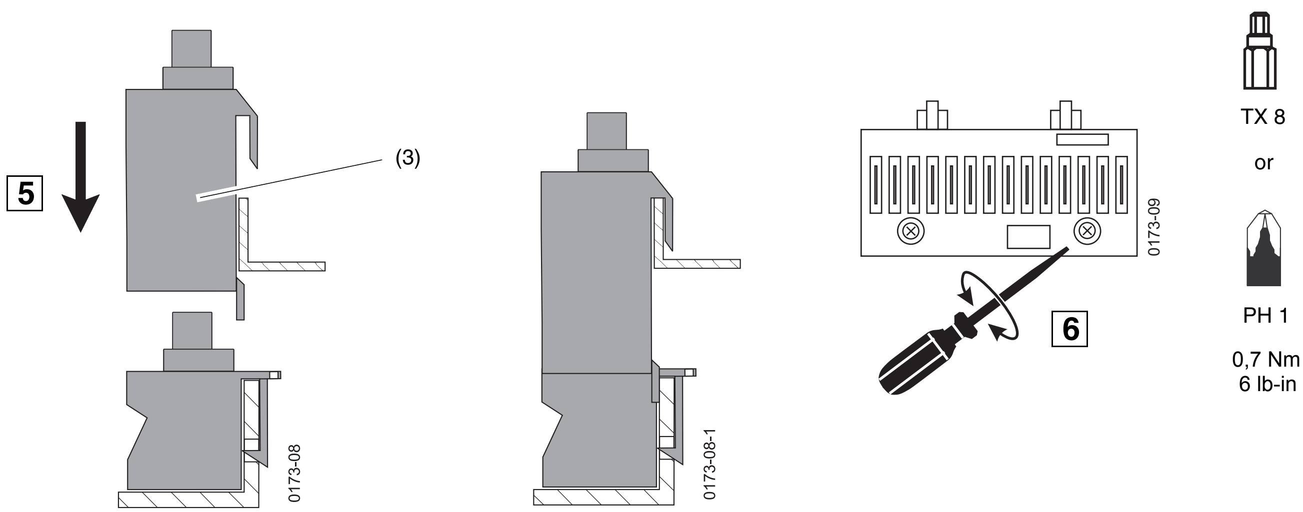


(1) Arc chute
(2) Secondary disconnect block

Field installation



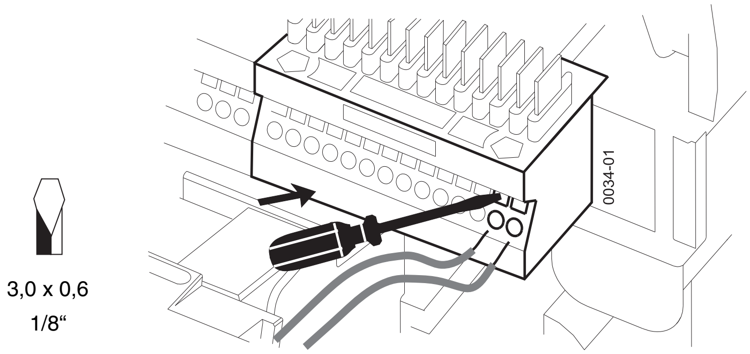
(1) Dummy block
(2) Secondary disconnect block



(3) Secondary disconnect adapter block for high arc chutes.

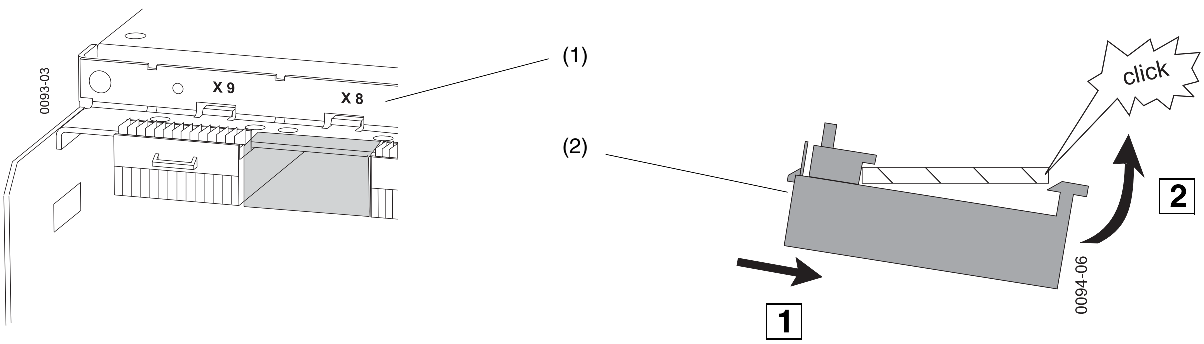
Connecting secondary wiring

Spring clamp terminal



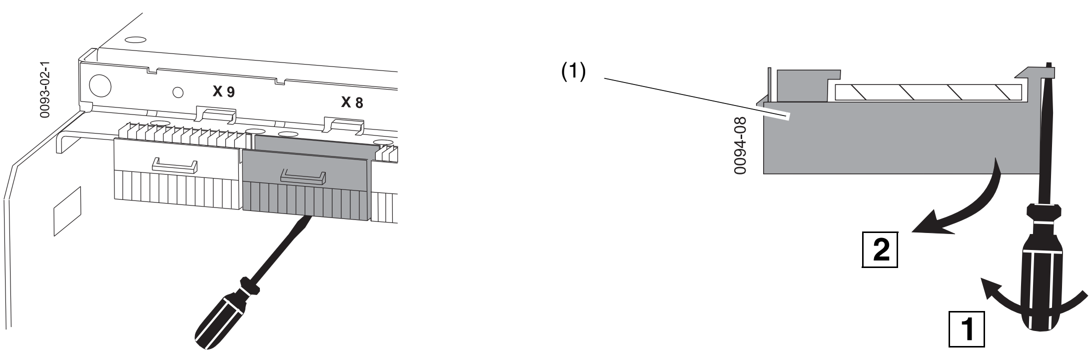
5.4.2 Cradle Secondary Disconnect Blocks

Field installation



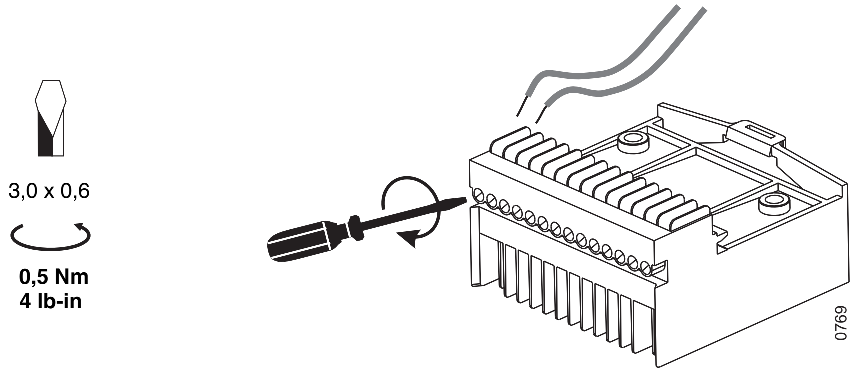
(1) Cradle with sliding contact modules
(2) Secondary disconnect blocks

Disassembly



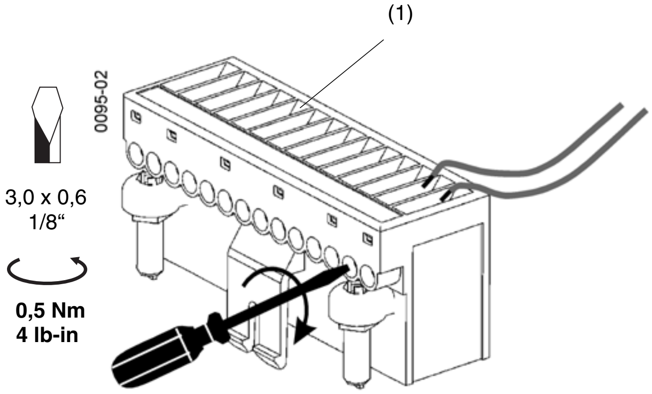
(1) Secondary disconnect block

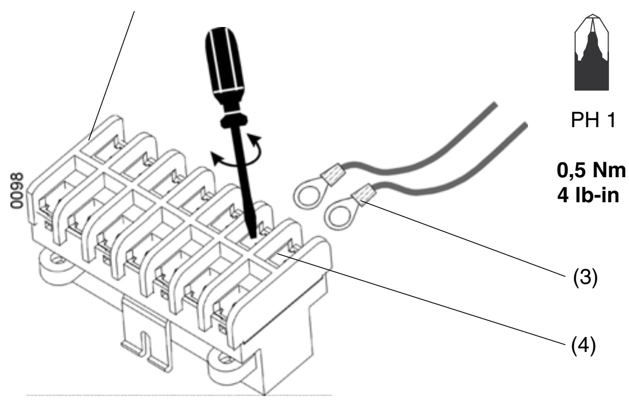
For the screw clamp terminal, a low profile, one-piece, sliding disconnect module is also available.



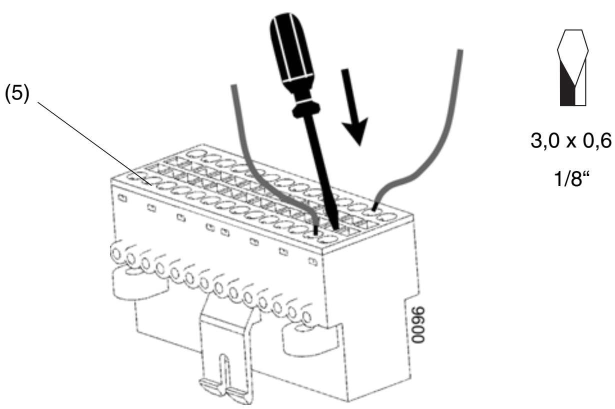
5.4.3 Secondary disconnect terminal blocks

Versions



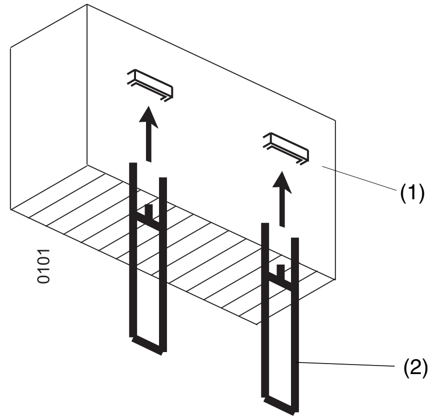


(1) Screw clamp terminal system
(2) Ring terminal system
(3) Insulated ring terminal
(4) Screws ANSI B 18.6.3 #4



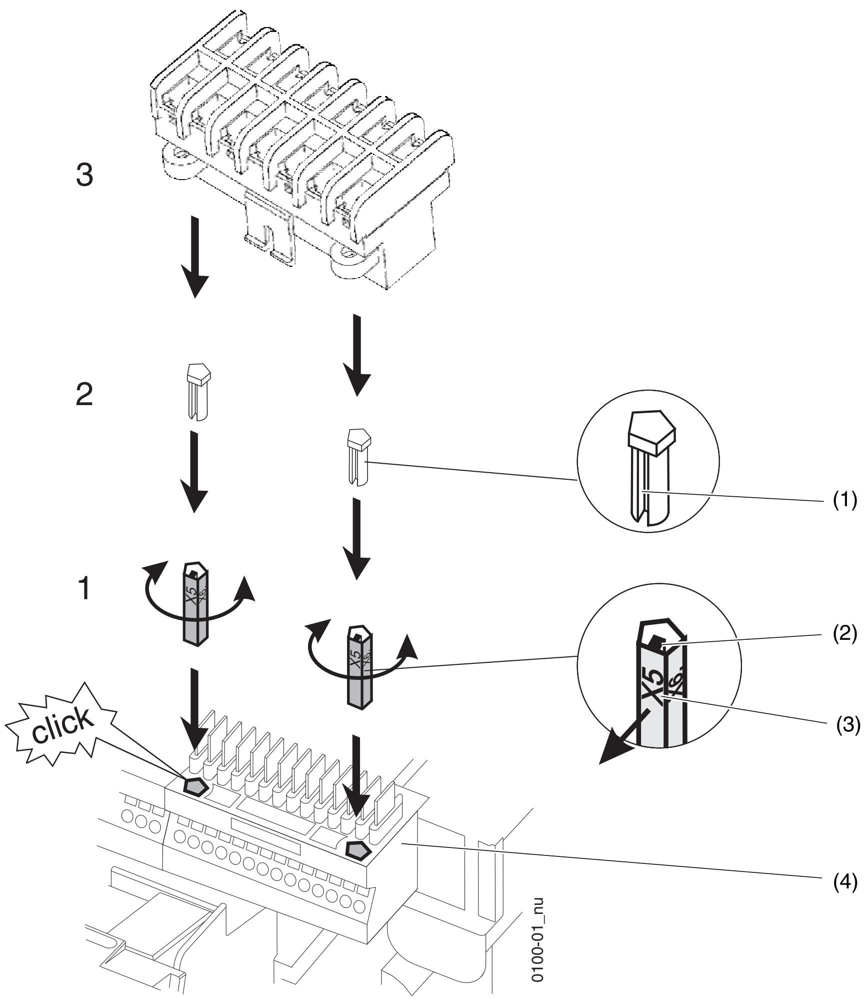
(5) Spring clamp terminal system
2 terminals per contact

Mounting of guide tongues (fixed-mounted circuit breakers only)



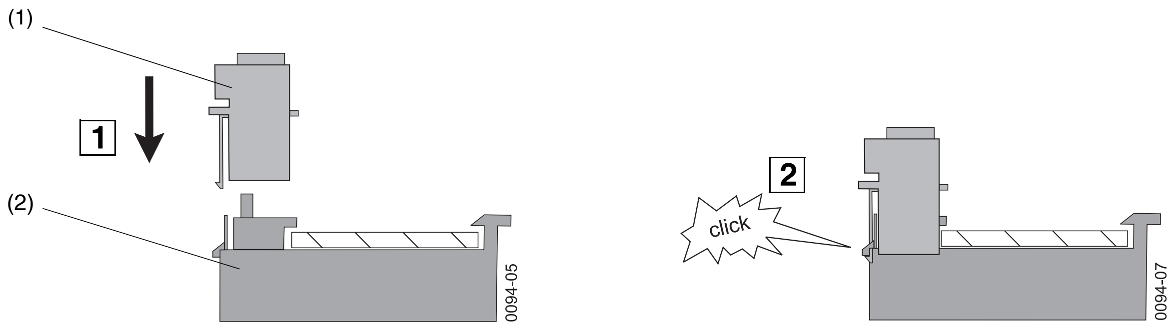
(1) Back side of secondary disconnect block
(2) Guide tongues

Coding secondary disconnect blocks (fixed-mounted circuit breakers only)



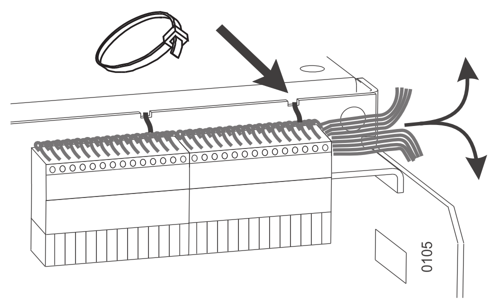
(1) Male pin: groove
(2) Female socket: guide
(3) Module designation (here X5, must be visible from the front)
(4) Module X5

Attaching the secondary disconnect blocks

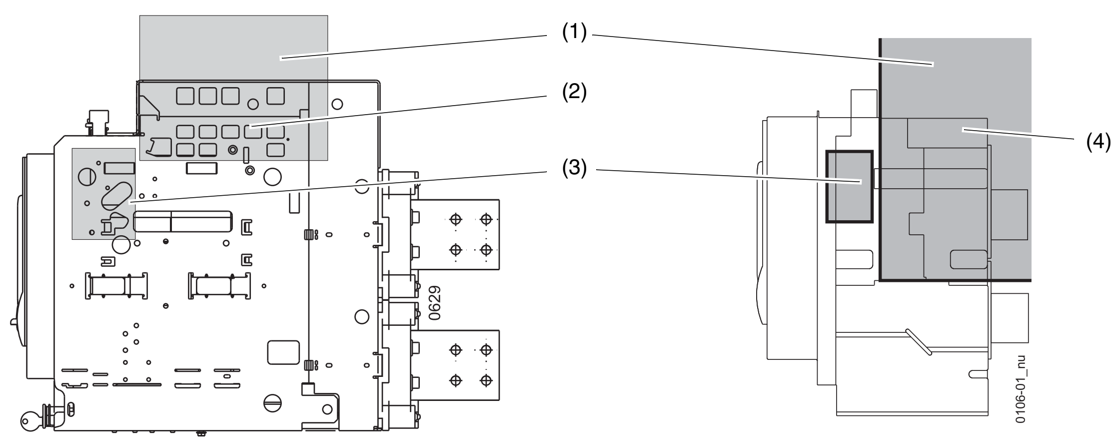


(1) Secondary disconnect blocks
(2) **Fixed-mounted circuit breaker:** Breaker secondary disconnect block
Draw-out circuit breaker: Cradle secondary disconnect block

5.4.4 Wiring in cradle



NOTICE
Impermissable area for wires: **Damage to wires in this area.**



(1) Arcing space*)
(2) Arcing openings
(3) Mounting location for mechanical interlock
(4) Carrying handle

***)** If arc chute covers are installed, the wires of the secondary disconnect blocks must not be laid on these covers.

5.4.5 Catalog numbers

	Catalog No.
Circuit breakers secondary disconnect block	WLCNMD
Secondary disconnect extension (FS III & FS II class C only)	WLCNMDA
Screw clamp terminal (SIGUT) system	WLGAUXPLUGP
Spring clamp terminal	WLGAUXPLUGT
Ring terminal system	WLGAUXPLUGR
Coding set	WLCODEKITUL
Blanking cover	WLGDAUXPLUG
Ring terminal crimp lug for AWG 10 wire	WL10RL
Cradle secondary disconnect block with integrated low profile screw clamp terminal block	WLGAUXPLUGL

6 Commissioning

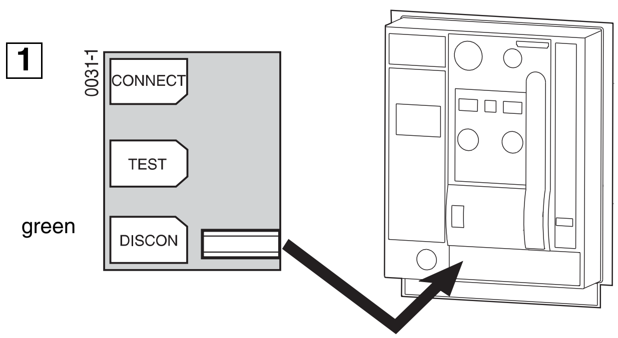
6.1 Preparation of draw-out circuit breaker

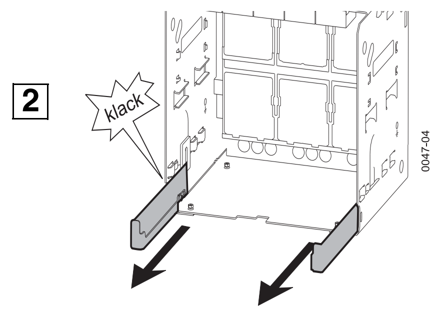
NOTE
On FS I circuit breakers, the racking handle is located in an upright position on the right side, but is operated in the same manner.

6.1.1 Inserting the circuit breaker into the cradle

NOTE
Remove padlocks from the shutter and place the locking device in the stowed position → (page 15-18).

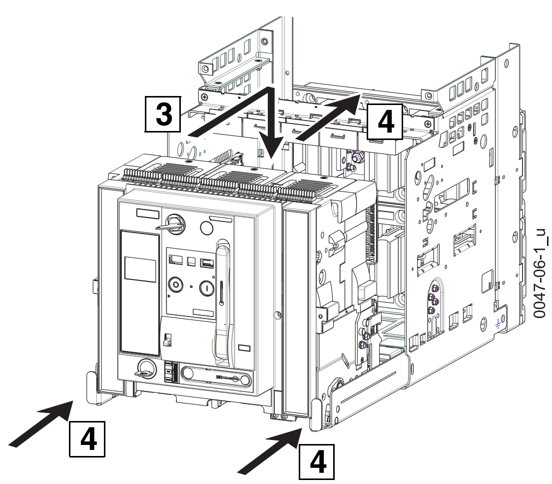
Check circuit breaker position indicator/
Draw out guide rails

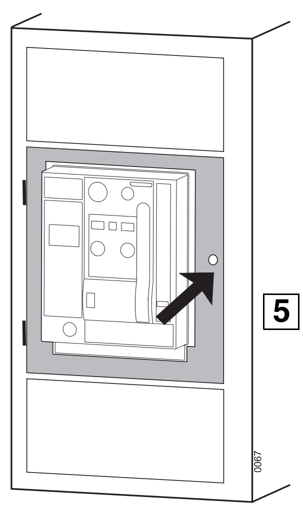




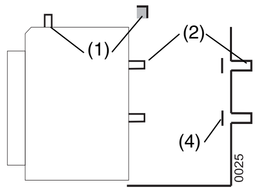
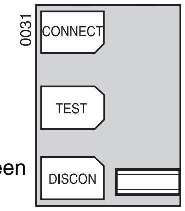
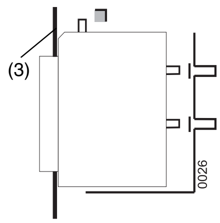
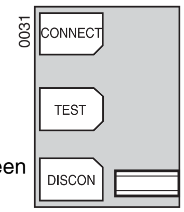
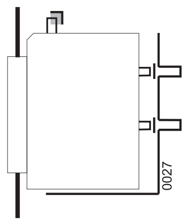
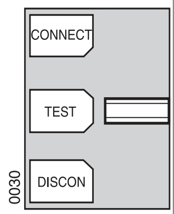
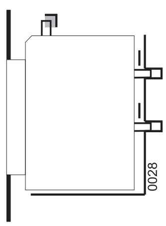
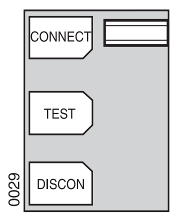
1) The circuit breaker can only be pushed in when the indicator displays "DISCON".
2) Pull out guide rails to the end-stop.

Place the circuit breaker into the guide rails and push it into the cradle up to the disconnected position. Close cubicle door.



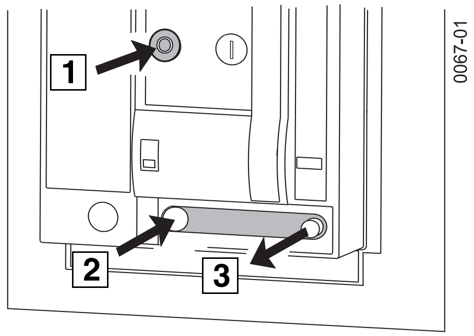


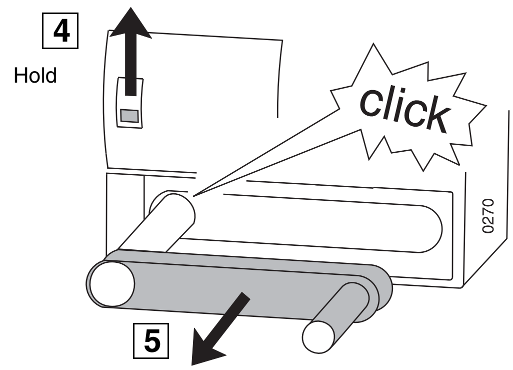
6.1.2 Positions of the circuit breaker in the cradle

	Diagram	Positon indicator	Primary Circuit	Secondary Circuit	Cubicle Door	Shutter
Withdrawn position		green 	disconnected	disconnected	open	closed
Disconnected position		green 	disconnected	disconnected	closed	closed
Test position		blue 	disconnected	connected	closed	closed
Connected position		red 	connected	connected	closed	open

(1) Secondary circuit
(2) Primary circuit
(3) Cubicle door
(4) Shutter

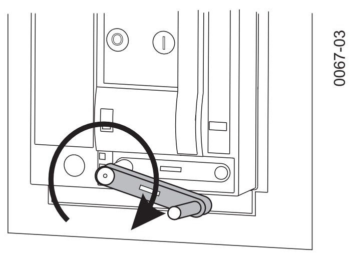
6.1.3 Unlocking the racking handle / withdrawing the racking handle

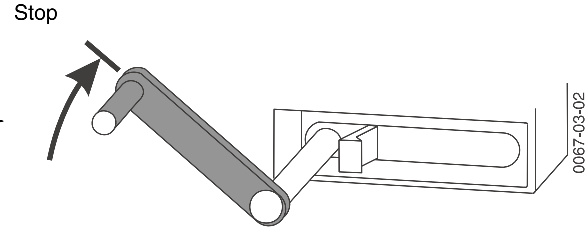




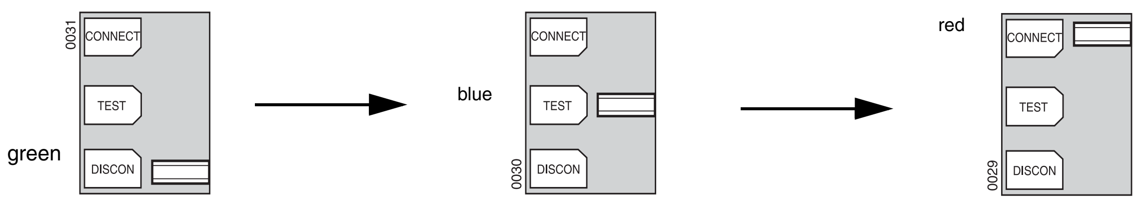
1. OPEN circuit breaker
2. Push the crank inwards
3. Pull out the handle
4. Lift and hold the control lever
5. Pull out the crank

6.1.4 Racking circuit breaker into connected position

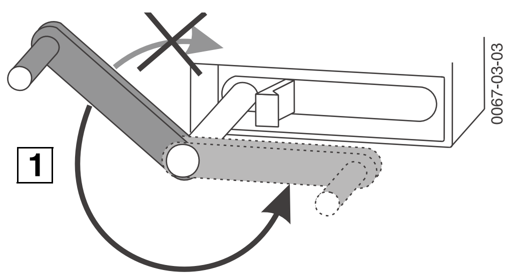


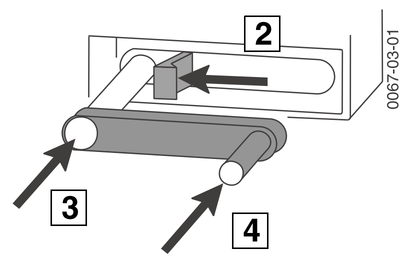


Position indicator



6.1.5 Inserting racking handle





NOTICE

Racking Handle Damage.

Turning the racking handle beyond the stop will cause damage to the racking mechanism.

When the stop is reached, rotate the racking handle counter-clockwise until it can be pushed inwards.

6.2 Charge the closing spring

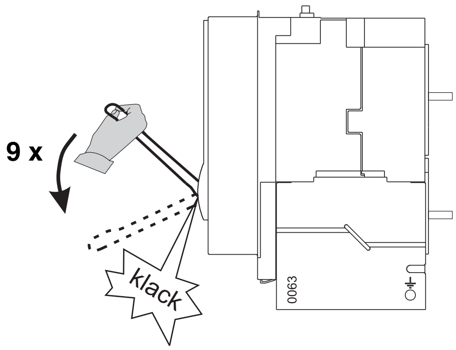
Charging manually

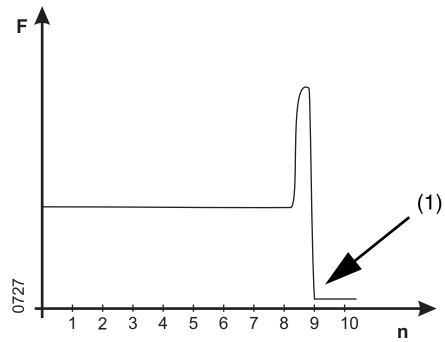
WARNING

Heavy equipment

May result in serious injury and/or property damage.

Secure the circuit breaker before charging it manually (e.g. during service on the work bench).



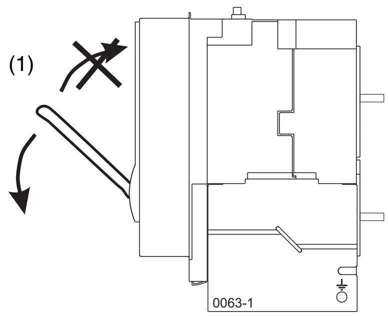


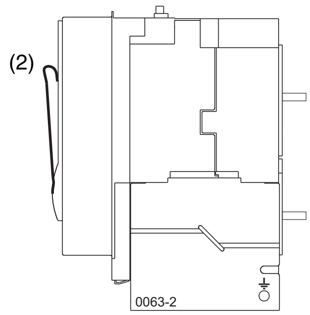
F Handle force
n Number of strokes
(1) Spring charged

NOTE

To charge the spring mechanism, grip the handle firmly and carry out each stroke evenly, moving the lever down as far as it will go. Despite a significant increase in the required actuating force, the lever must be moved as far in the ninth stroke as in the first eight. When the closing spring is fully charged, the lever can be moved without resistance.

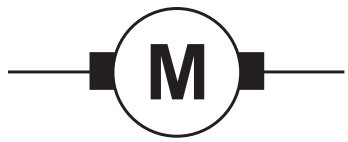
Condition after 9 strokes:





(1) incomplete stroke, repeat stroke completely
(2) completely charged

Charging with a motor-operated mechanism



The motor-operated mechanism starts automatically when the control voltage is applied. The motor switches off automatically when the charging process is completed.

The motor will re-engage immediately following spring discharge (closing operation).
→ Installing the motor operator (page 13-1)

6.3 Check list for commissioning

DANGER

Hazardous voltage.

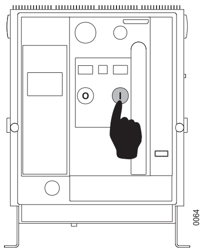
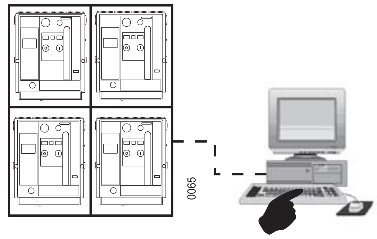
Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

Action required		✓
Verify the circuit breaker is OPEN		
Verify the Rating Plug is installed → Rating Plug (page 9-43)		
Verify the TRIP indicator is reset		
Set the trip unit to appropriate values → Trip units (page 9-1)		
Apply secondary and control voltages		
Close the cubicle door		
Rack circuit breaker into connected position		
Push in the racking handle		
Charge closing spring		
Ensure the following conditions exist		
Undervoltage release	energized	
Shunt trip(s)	not energized	
Electrical closing lockout → (page 8-4)	not energized	
Electrical interlocking of closing coil in the switch board control wiring	disabled	
Locking devices	not activated	
Indicators		
		

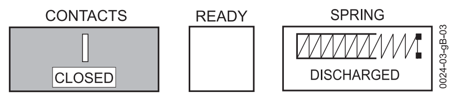
6.4 Closing the circuit breaker

Indicators

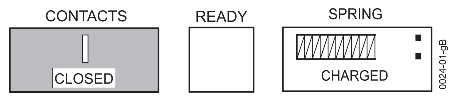
CLOSE button	Remote activation
 or	

Indicators

Without motor-operated mechanism

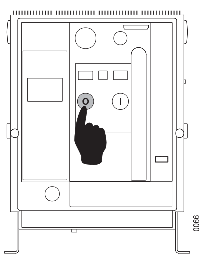
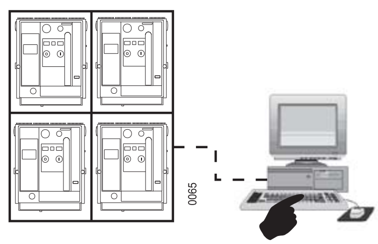


With motor-operated mechanism
after 10 seconds



(The closing spring will be recharged by the motor-operated mechanism immediately after the circuit breaker has closed)

6.5 Opening the circuit breaker

OPEN button	Remote activation
 or	

Indicators

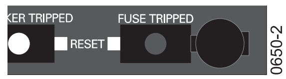
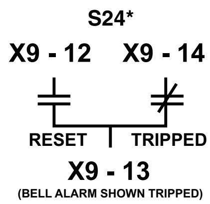
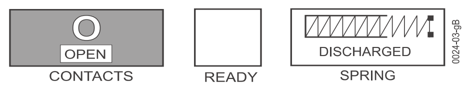
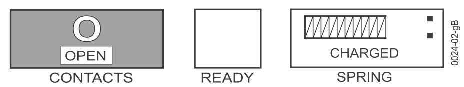
Without motor-operated mechanism

With motor-operated mechanism

NOTE

The minimum time interval between ON- and OFF-signal of the Low-Voltage Power Circuit Breakers 3WL shall not be shorter than 100 ms.

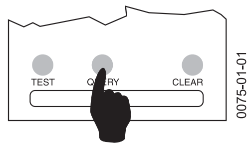
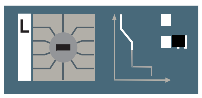
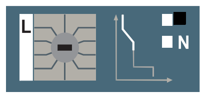
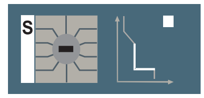
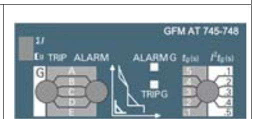
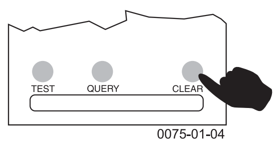
6.6 Tripping

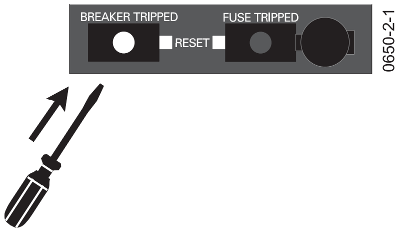
Tripped by	Trip unit
Bell Alarm (tripped) indicator	
Bell Alarm	
Breaker indicators	**Indicators** Without motor-operated mechanism  With motor-operated mechanism 

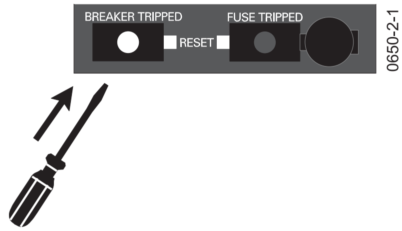
* The breaker is untripped, and the Bell Alarm is shown reset

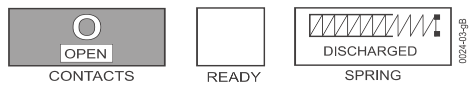
6.7 Reclosing a circuit breaker tripped by the trip unit

NOTE
The reason for tripping can be displayed using the "QUERY" button on the trip unit. This is stored for at least two days, provided that the trip unit was activated for at least 10 minutes before tripping.

1 **Find reason for tripping**					
2 **Indicator**	 Overload in main conductor	 Overload in neutral conductor	 Short circuit: short-time-delay trip	 Short circuit: instantaneous trip	 Ground fault trip
3 **Find and rem-edy cause**	- Check downstream load - Check trip unit settings		- Inspect switchgear - Check downstream load		
4 **Inspect circuit breaker**			Inspect contact system for possible damage → Maintenance (page 24-1)		
5 **Clear trip cause**					

<table>
<tr>
<td>6
Reset Bell Alarm</td>
<td>

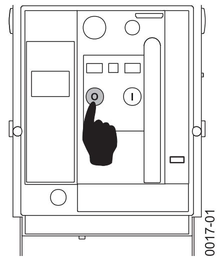
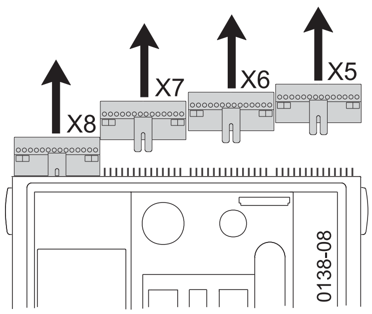
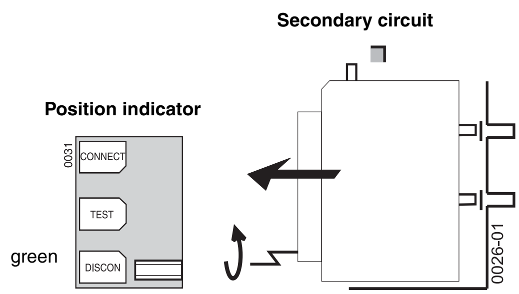
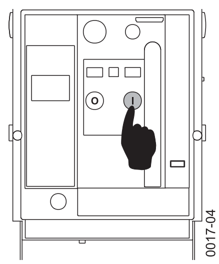
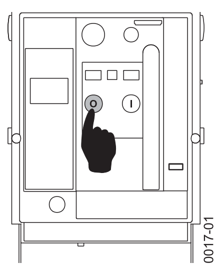
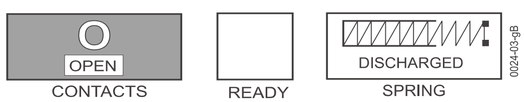
Electric remote reset of Bell Alarm → (page 10-5)
(optional)</td>
<td>With mechanical reclosing lockout
(optional)


Manual reset of reclosing lockout, Bell Alarm and tripped indicator → (page 10-2)</td>
</tr>
<tr>
<td rowspan="2">7
Indicators</td>
<td colspan="2">Without motor-operated mechanism

</td>
</tr>
<tr>
<td colspan="2">With motor-operated mechanism

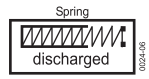
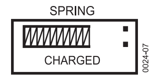
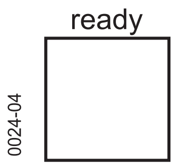
</td>
</tr>
<tr>
<td></td>
<td colspan="2">→Charge the closing spring (page 6-4)

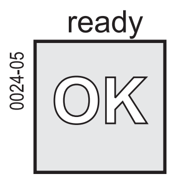
→Closing the circuit breaker (page 6-7)</td>
</tr>
</table>

6.8 Removing from service

	Fixed-mounted circuit breaker	Draw-out circuit breaker
1 **OPEN the circuit breaker**		
2 **Disconnect secondary circuits**		
3 **Depress the CLOSE button**		
4 **Depress the OPEN button**		
5 **Indicators**		

6.9 Troubleshooting

Fixed-‘mounted breaker	Draw-out circuit breaker	Disturbance	Possible cause(s)	Remedy
X	X	Circuit breaker cannot be closed. Circuit breaker **not** ready to close.	1. Closing spring not charged 	Charge closing spring 
X	X	"Ready-to-close" indicator shows: 	2. Undervoltage release not energized.	Energize undervoltage release
X	X		3. Electrical closing interlock effective	Switch off control voltage for interlocking
X	X		4. Key lock engaged (optional accessory)	Unlock
X	X		5. Padlocks installed	Remove padlocks
X	X		6. "EMERGENCY OPEN" button engaged in operating position (accessories)	Release "EMERGENCY OPEN" button by rotating it
X	X		7. Lockout effective against closing when cubicle door is open (accessories)	Close cubicle door
X	X		8. Electronic trip unit missing or incorrectly installed	Install electronic trip unit properly
X	X		9. Shunt trip energized	De-energize shunt trip
	X		10. Racking handle withdrawn	Rack circuit breaker into disconnected, test or connected position, unlatch crank and push it fully in
X	X		11. Closing coil energized	Closing coil has to be deenergized shortly for reclosing
X	X		12. Mutual mechanical circuit breaker interlocks effective (accessories)	Open second circuit breaker or rack into disconnected position

Fixed-mounted breaker	Draw-out circuit breaker	Disturbance	Possible cause(s)	Remedy
X	X	Circuit breaker cannot be closed. Circuit breaker ready to close. "Ready-to-close" indicator: 	1. Closing coil not energized or incorrectly energized	Check or apply correct voltage
X			2. The secondary disconnects have been removed	Plug in the secondary disconnects

	X	Circuit breaker cannot be moved from the withdrawn position into the disconnected position	1. Racking mechanism of circuit breaker not in disconnected (DISCON) position (Check circuit breaker position indicator)	Rack the mechanism into disconnected position (green position indicator)

	X	Circuit breaker cannot be fitted in the guide rails	1. Factory mounted coding of circuit breaker and cradle does not match.	The circuit breaker is not rated for use in this cradle. Replace with the proper circuit breaker (permissible circuit breakers are listed on the cradle type label).

	X	When racking from the disconnected into the test position, the circuit breaker does not move during the first 6 rotations (approximately)	2. Not a fault (functional property)	Continue racking

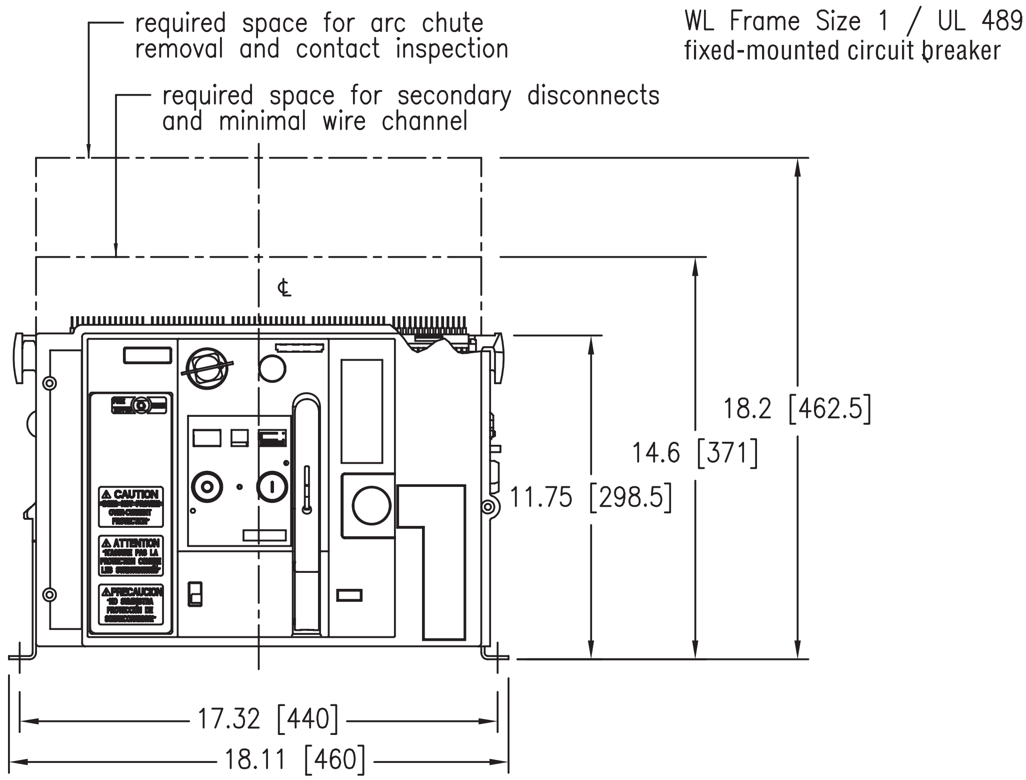
	X	Racking handle cannot be drawn out	1. Circuit breaker is closed	Press "OPEN" button and pull racking handle block out
	X		2. Cubicle door not completely closed (Locking device as accessory)	Close cubicle door

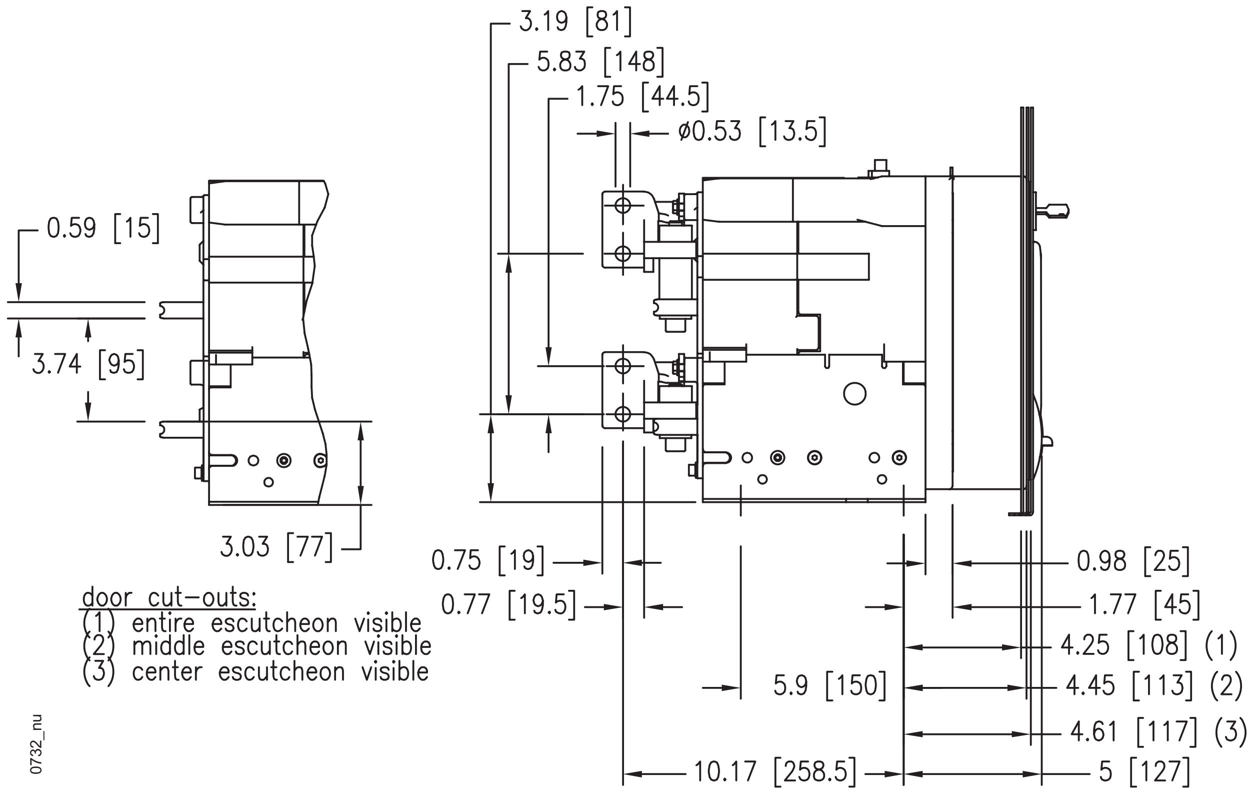
	X	Racking handle cannot be pushed in	1. Racking handle is interlocked	Rack circuit breaker into disconnected, test or connected position, unlatch crank and push it fully in

X		Cubicle door cannot be opened (door interlock as accessory)	1. Closed circuit breaker is preventing opening of cubicle door	Open the circuit breaker
	X		2. Circuit breaker in connected position	Rack circuit breaker into test or disconnected position

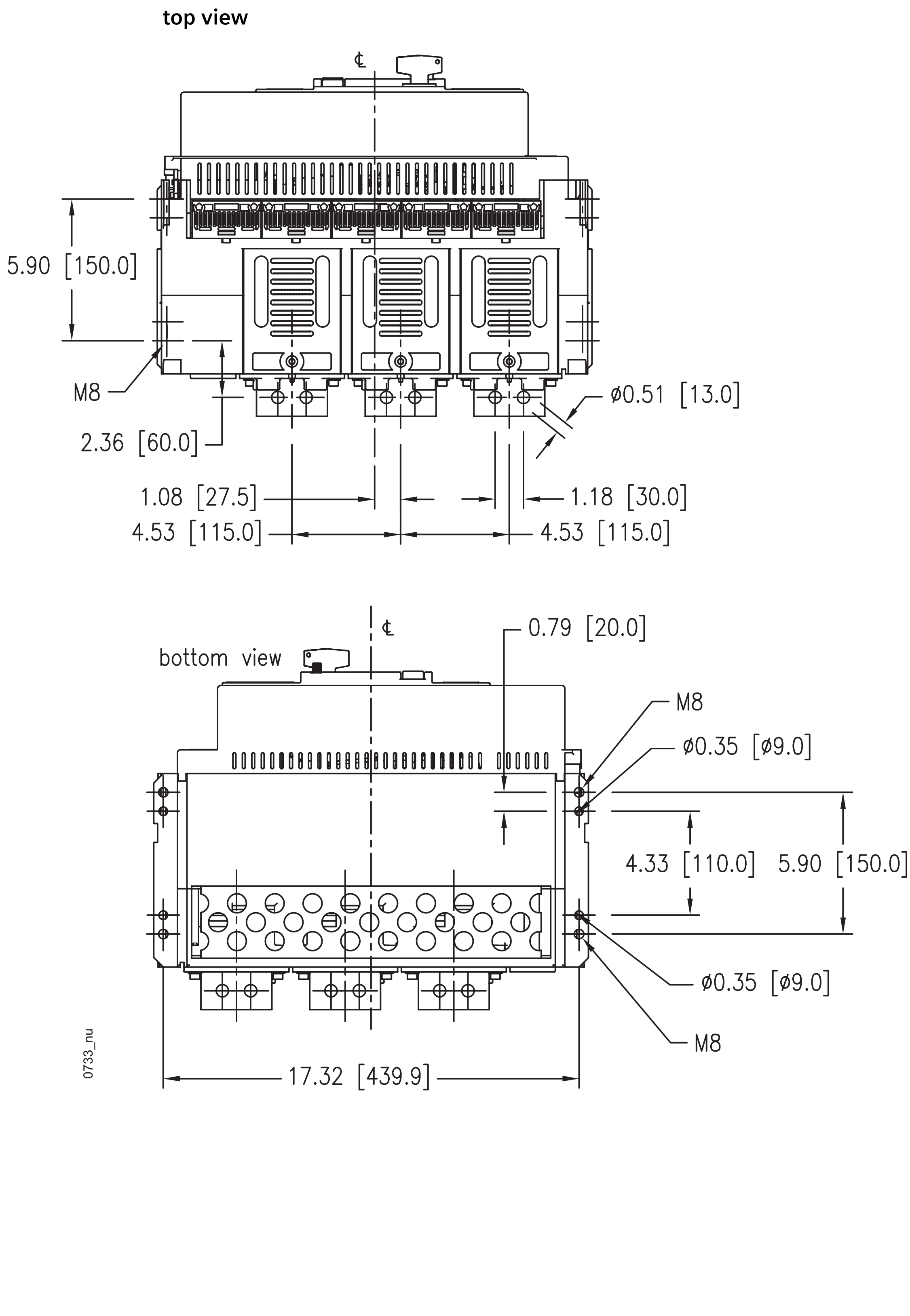
7 Frame sizes / dimension drawings

7.1 Frame size I, fixed-mounted version



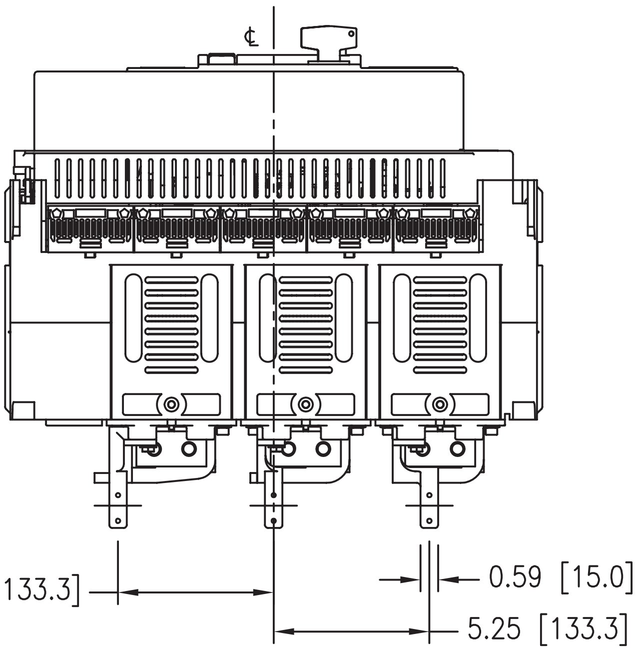


Horizontal connectors

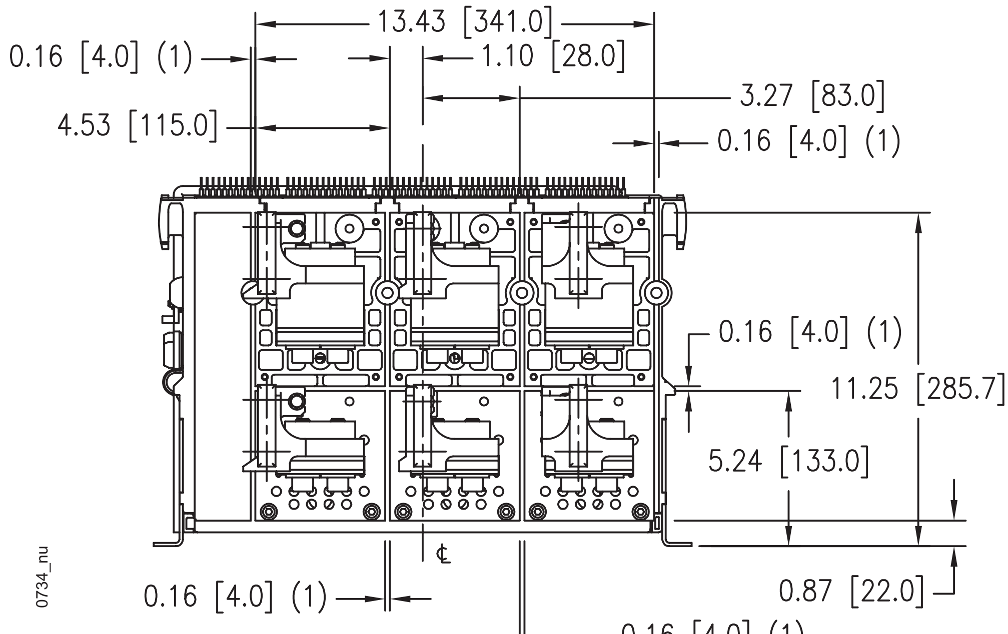


Rear vertical connectors

top view



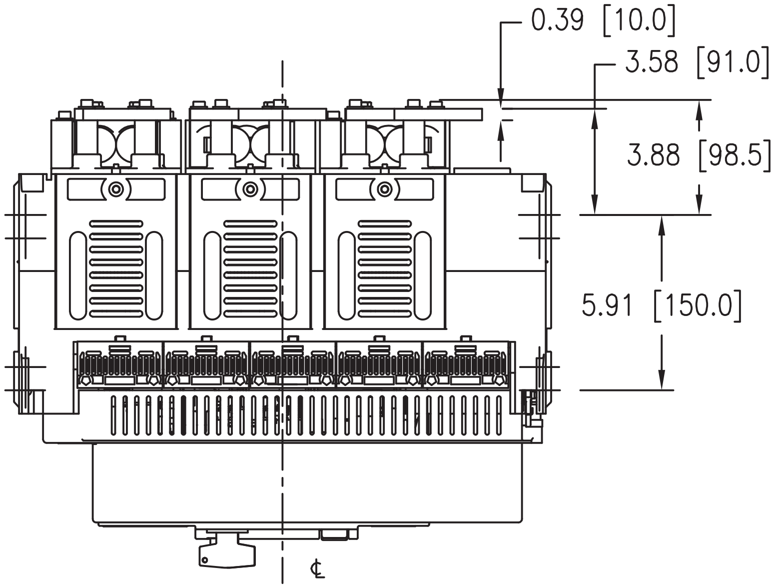
rear view



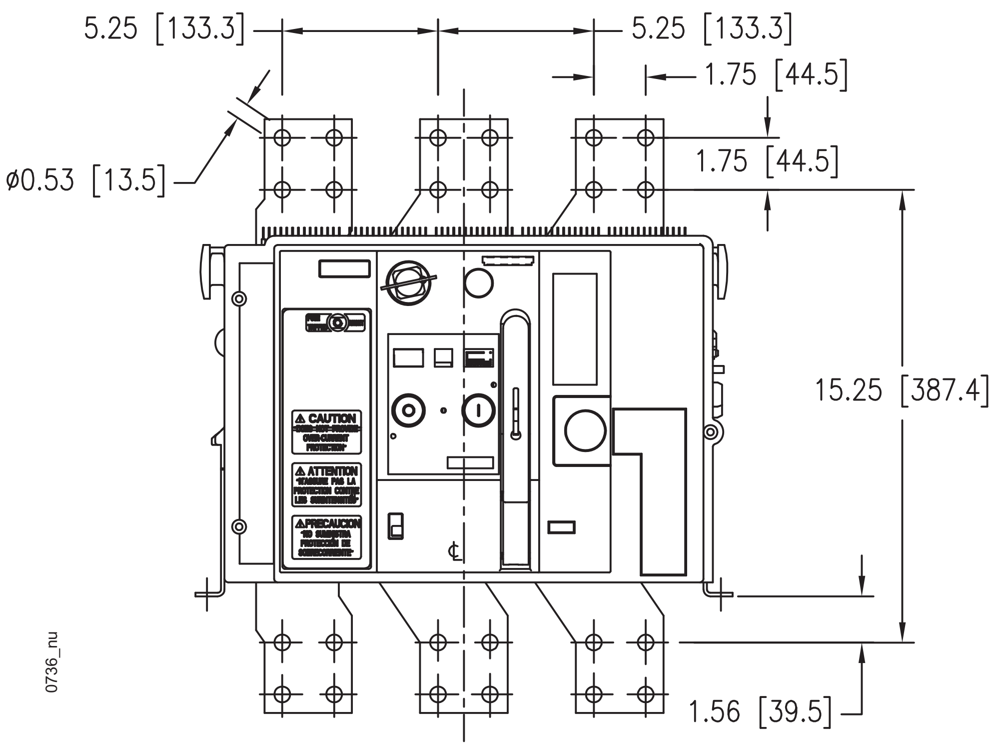
(1) = slots for insulation barriers

Front connectors

top view

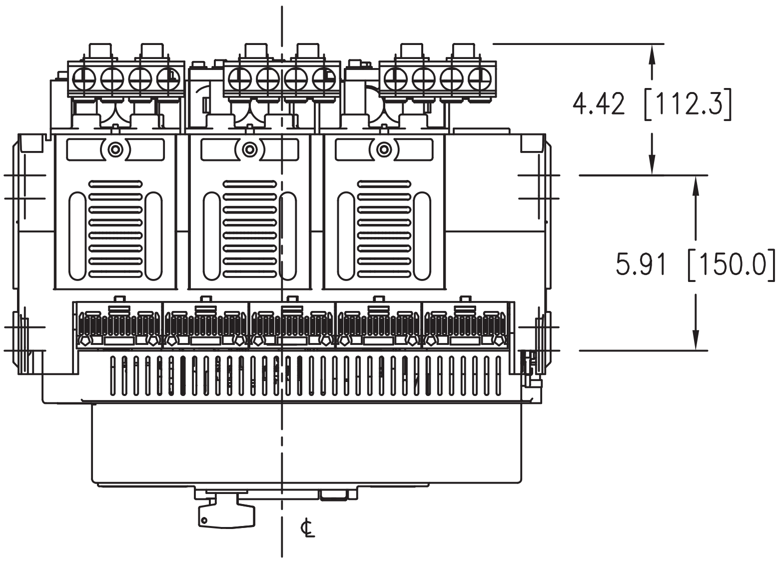


front view

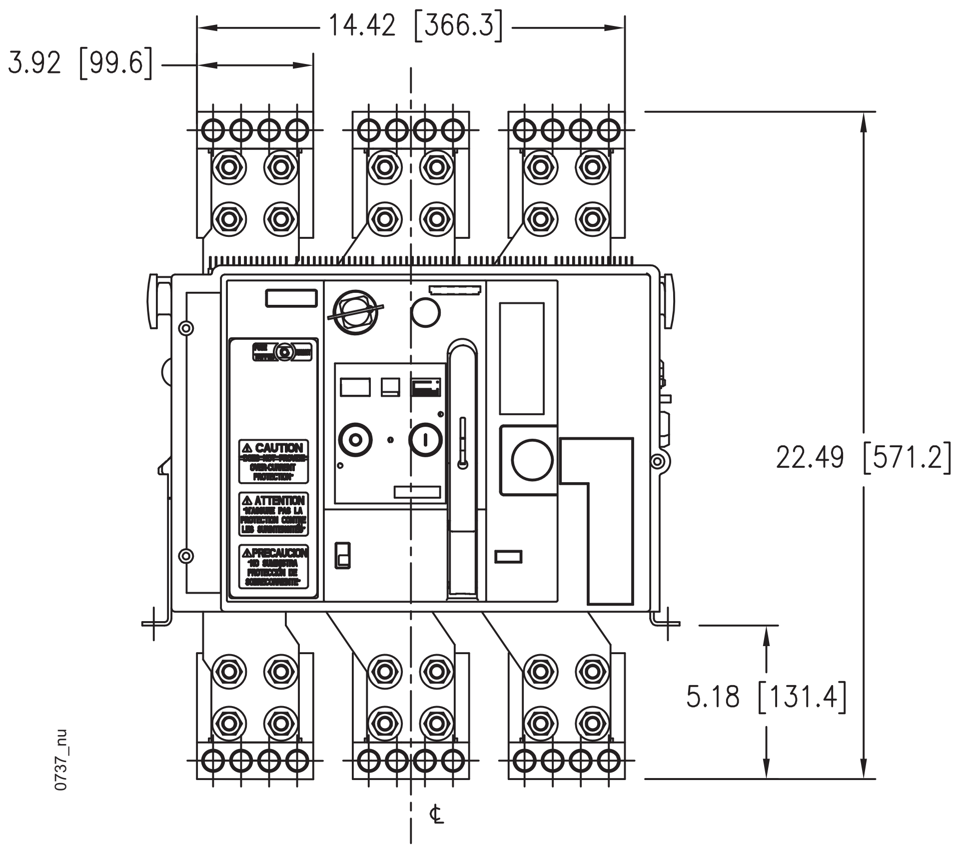


Front connectors and pressure wire terminals

top view

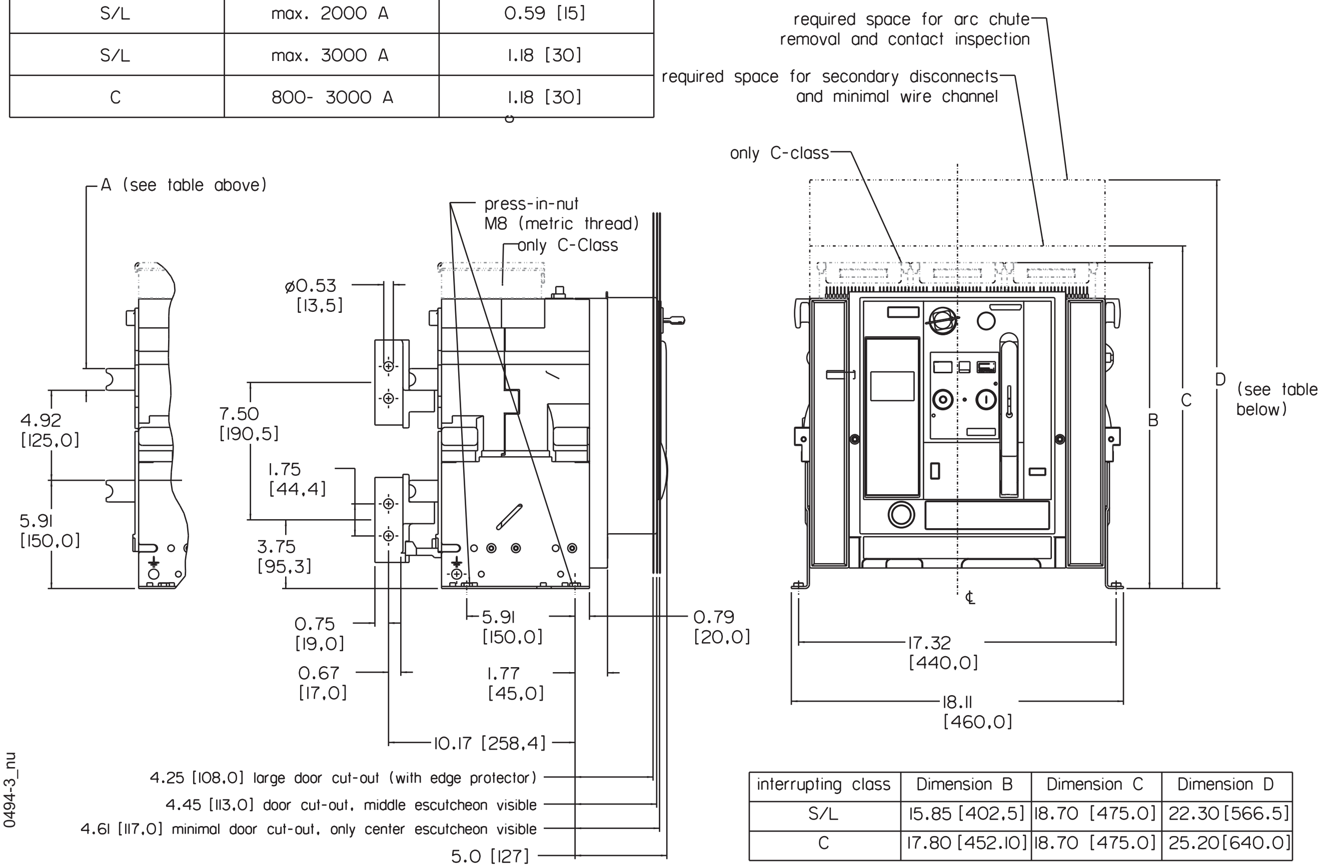


front view



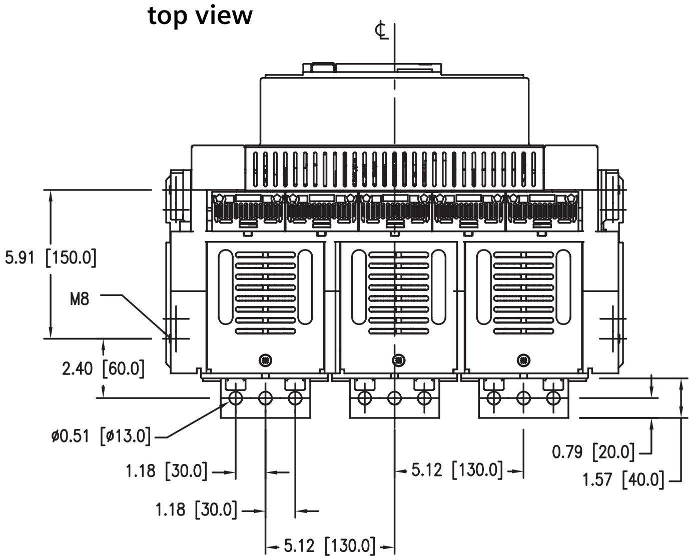
7.2 Frame size II, fixed-mounted version

interrupting class	rated current	dimension A
S/L	max. 1600 A	0.39 [10]
S/L	max. 2000 A	0.59 [15]
S/L	max. 3000 A	1.18 [30]
C	800- 3000 A	1.18 [30]

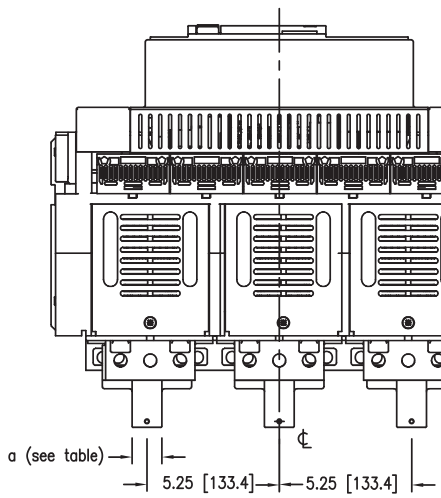


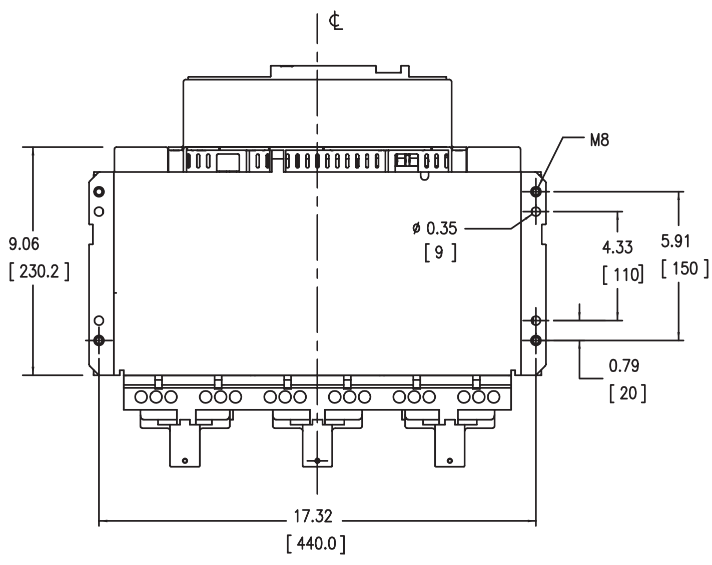
interrupting class	Dimension B	Dimension C	Dimension D
S/L	15.85 [402,5]	18.70 [475.0]	22.30 [566.5]
C	17.80 [452.10]	18.70 [475.0]	25.20 [640.0]

top view

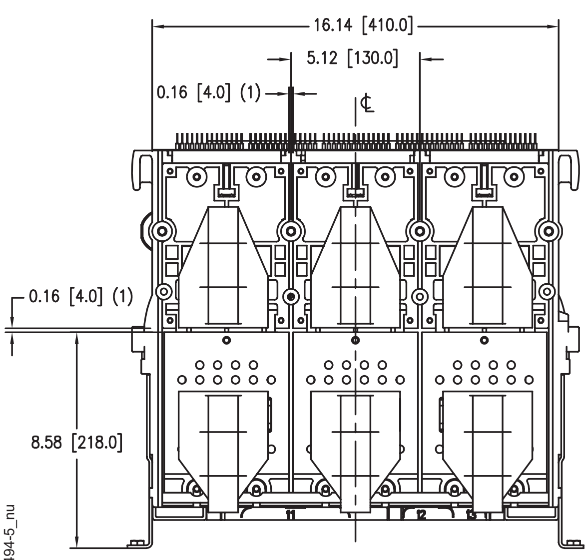


rated current	dimension a
max. 1600 A	0.39 [10]
max. 2000 A	0.59 [15]
max. 3000 A	1.18 [30]
Class C always	1.18 [30]





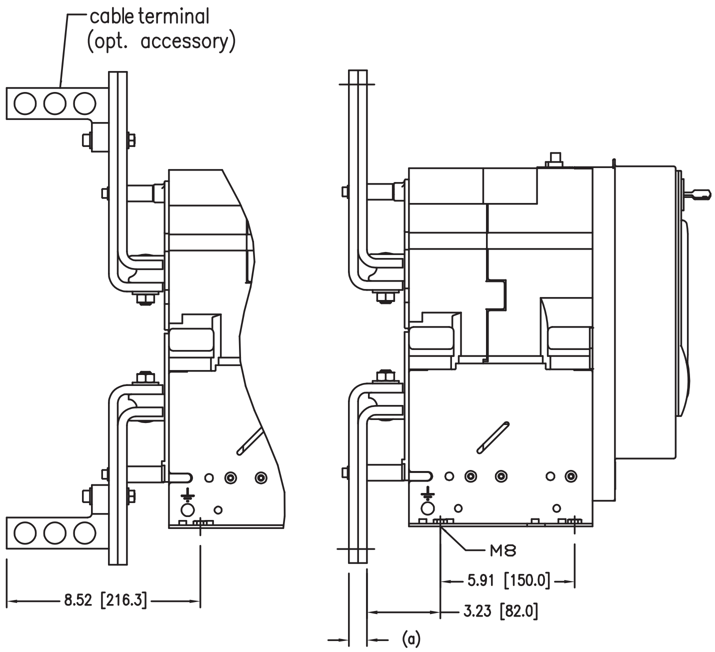
rear view



0494-5_nu

(1) = Slots 0.2 [5] for insulation barriers

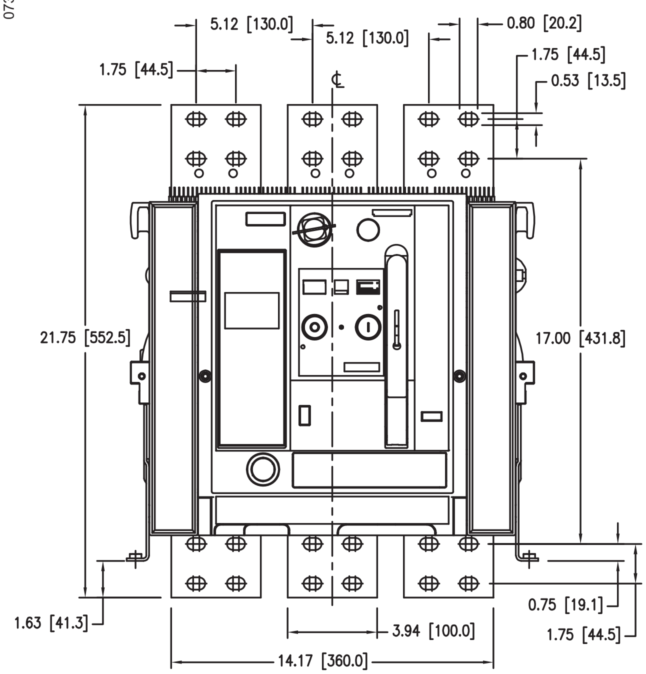
LH side view



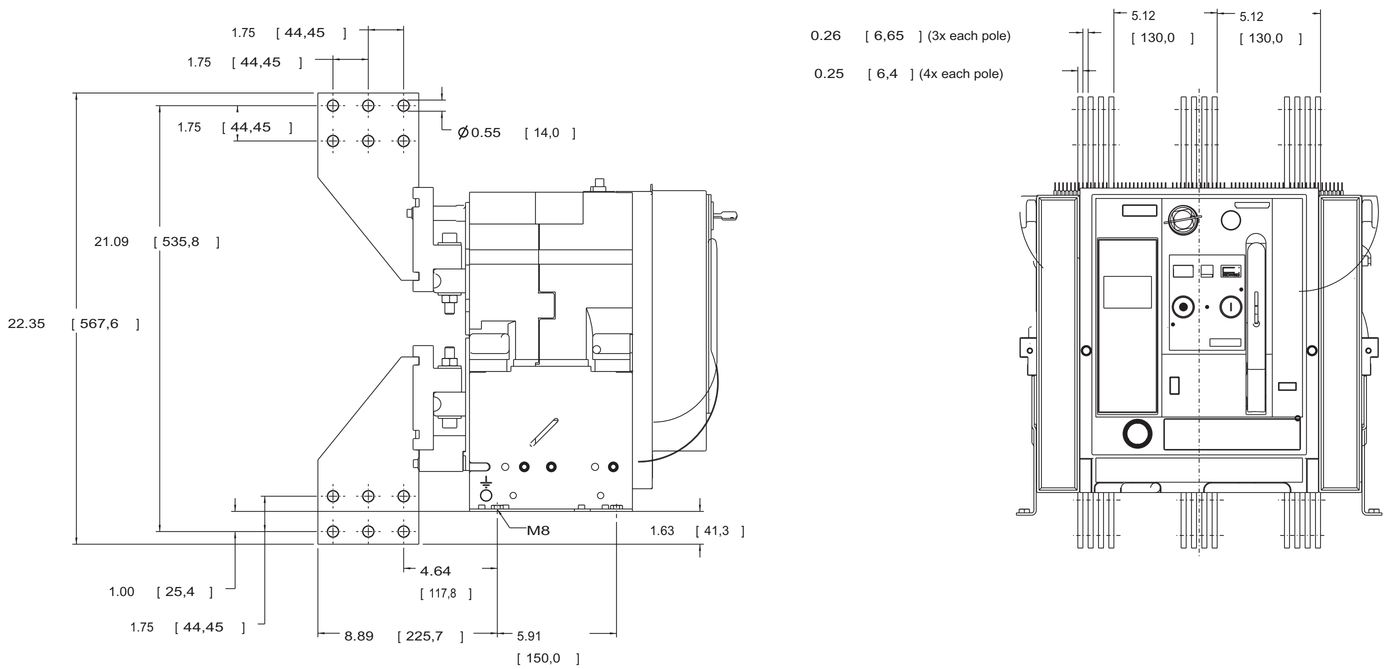
rated current	dimension a
max. 1600 A	0.39 [10]
max. 2000 A	0.79 [20]
max. 2500 A	0.79 [20]

0738_nu

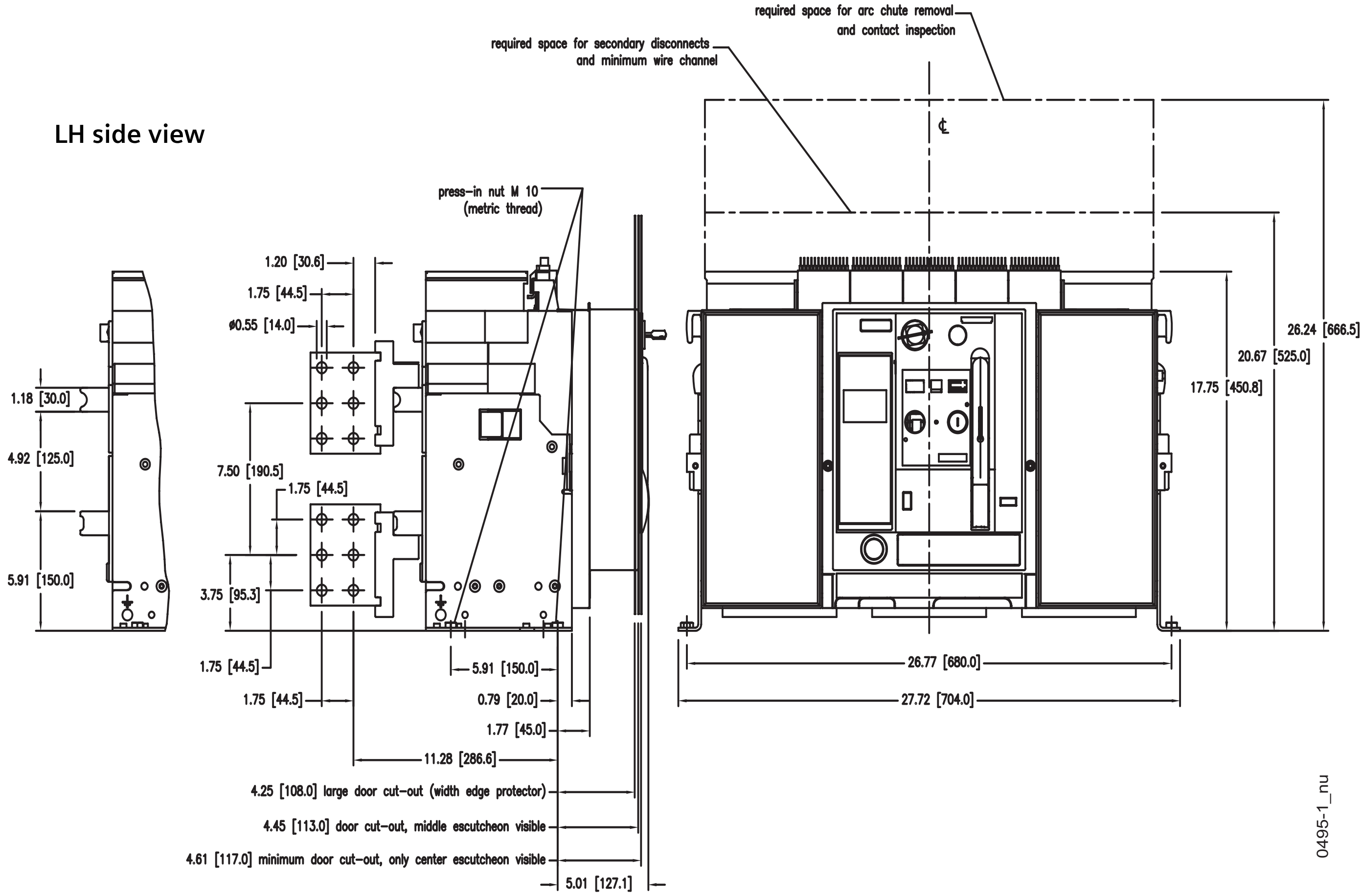
front view



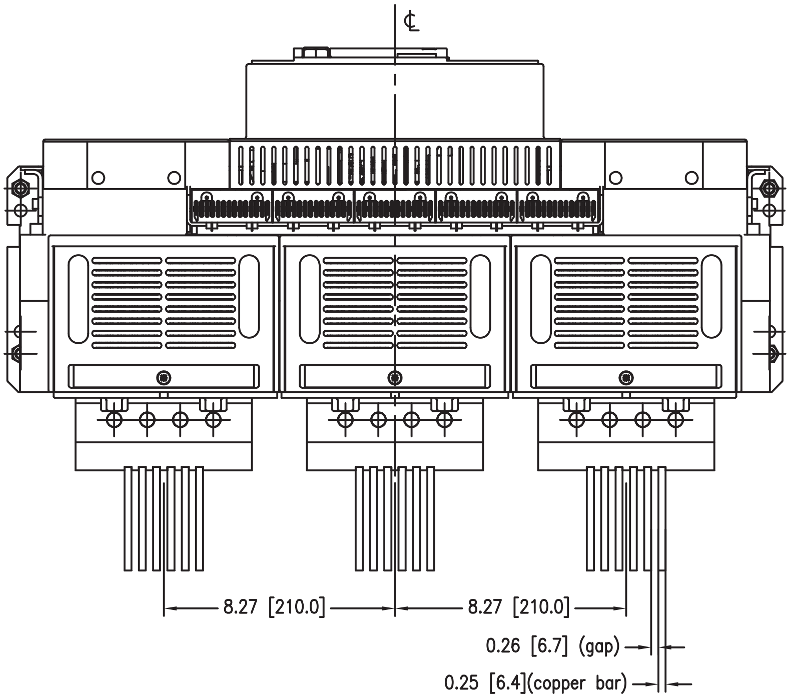
7.3 Frame size II, 3000 A



7.4 Frame size III, fixed-mounted version

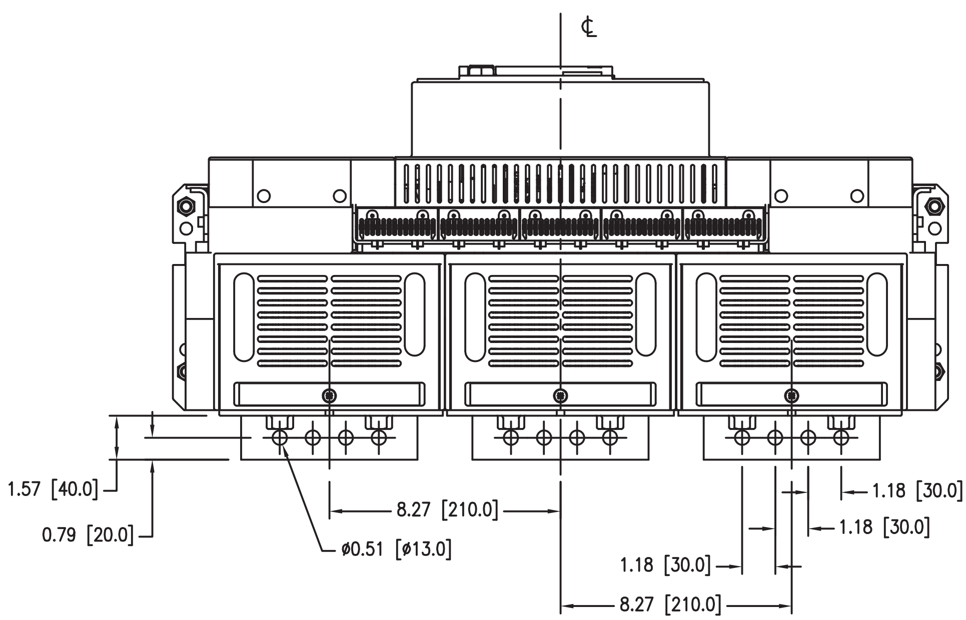


top view

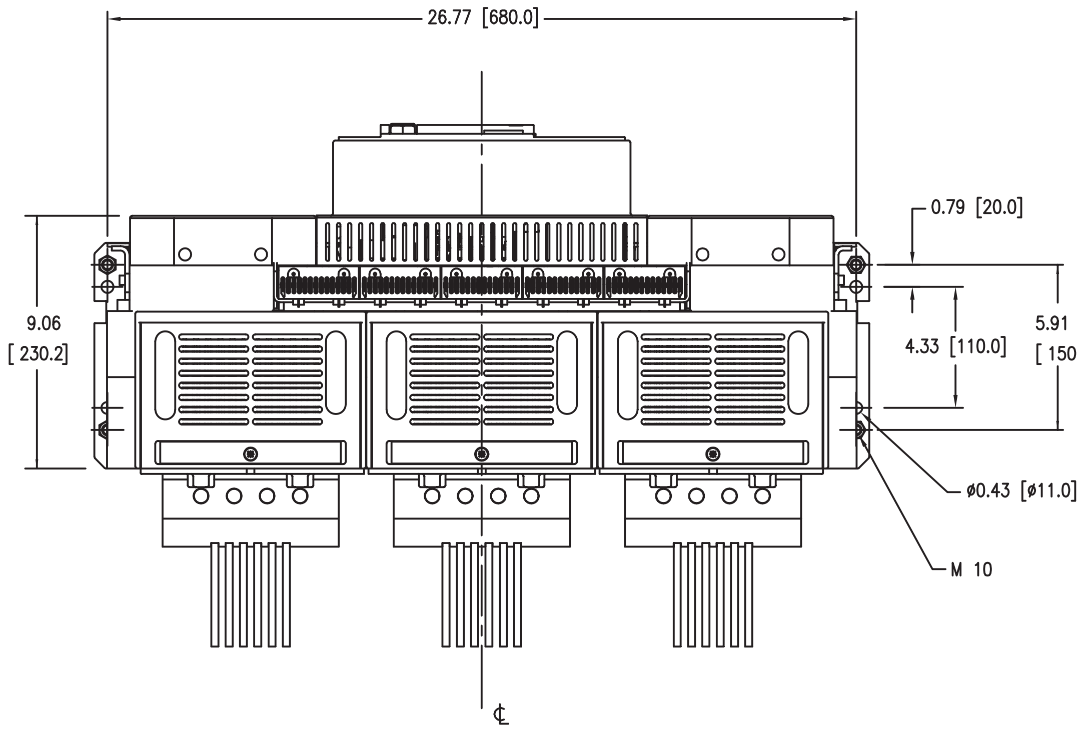


0495-2_nu

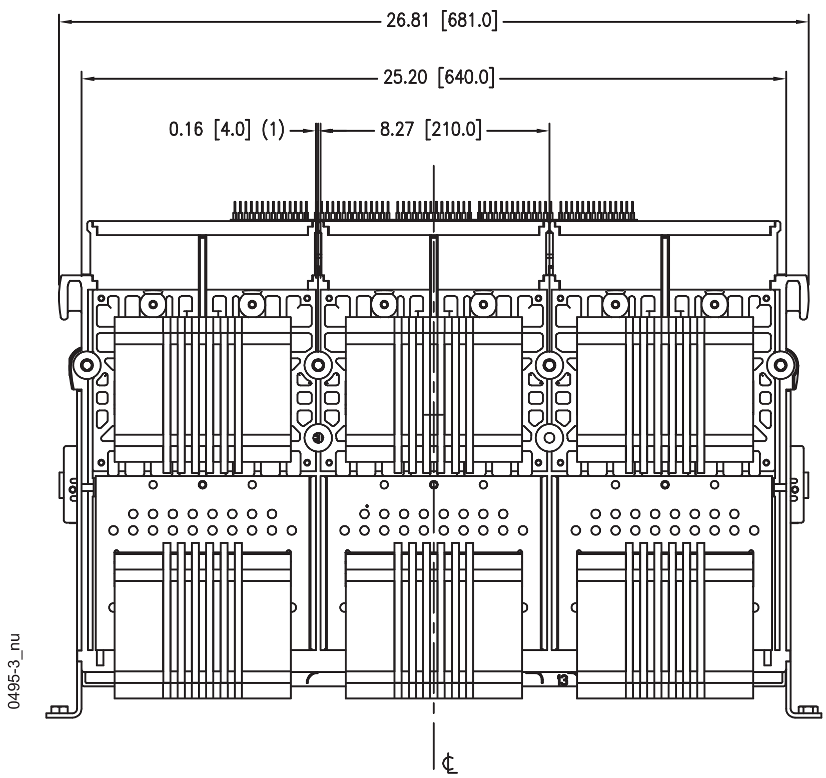
top view



top view

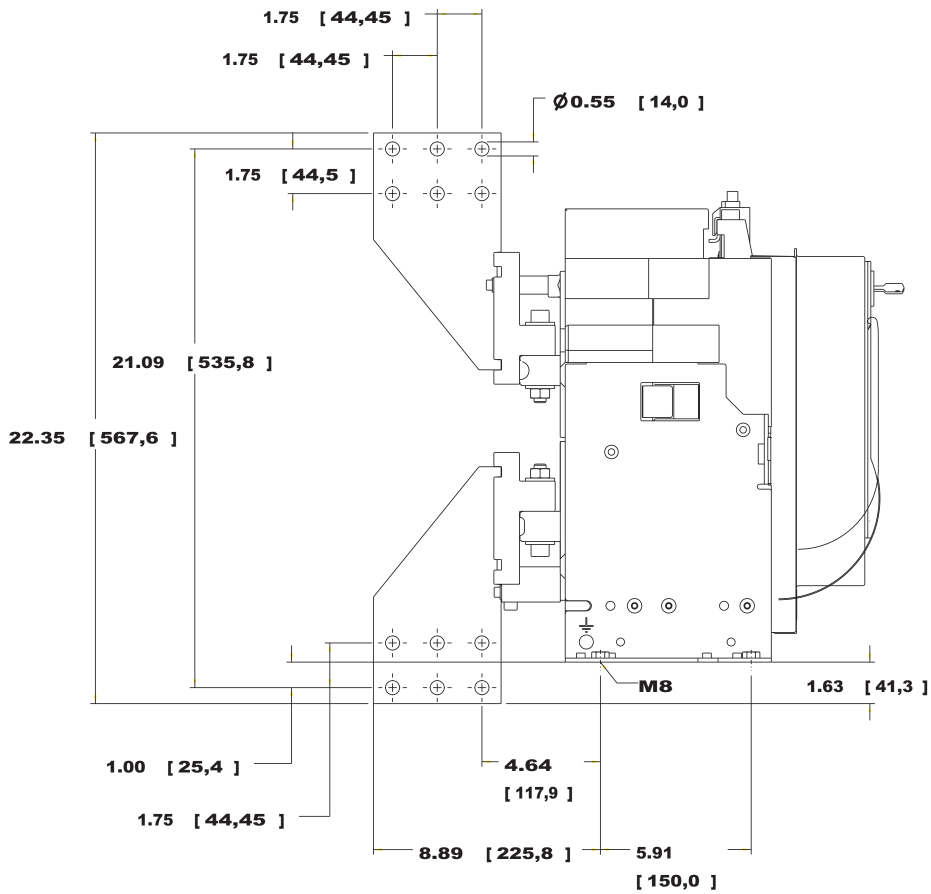


rear view

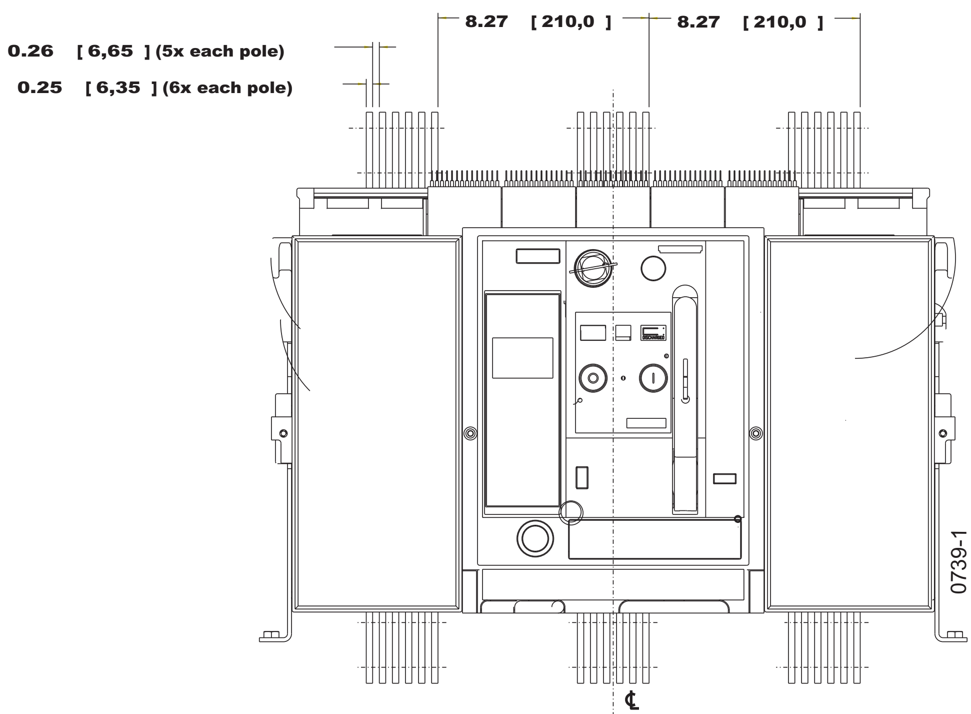


(1) = Slots 0.2 [5] for insulation barriers

LH side view

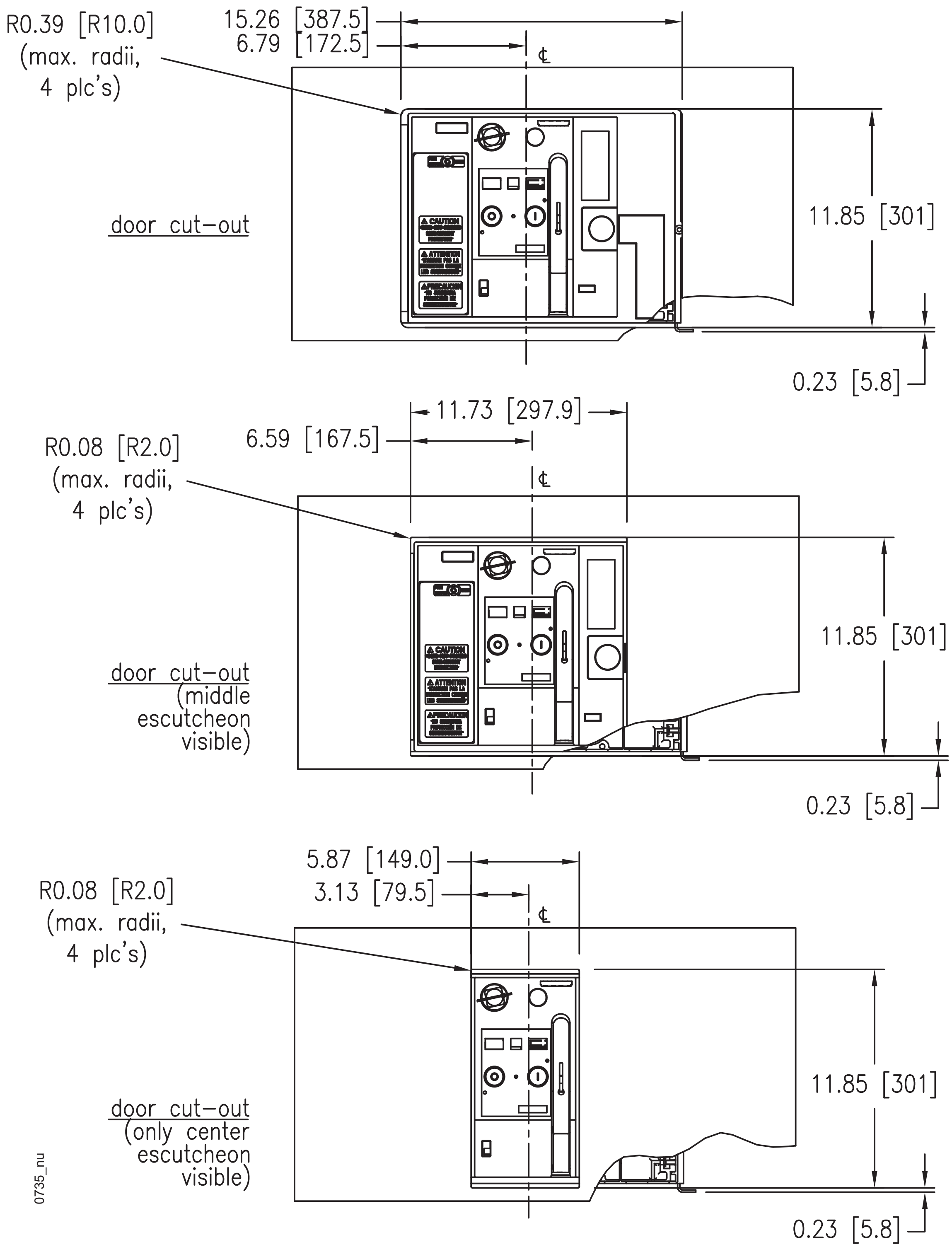


front view

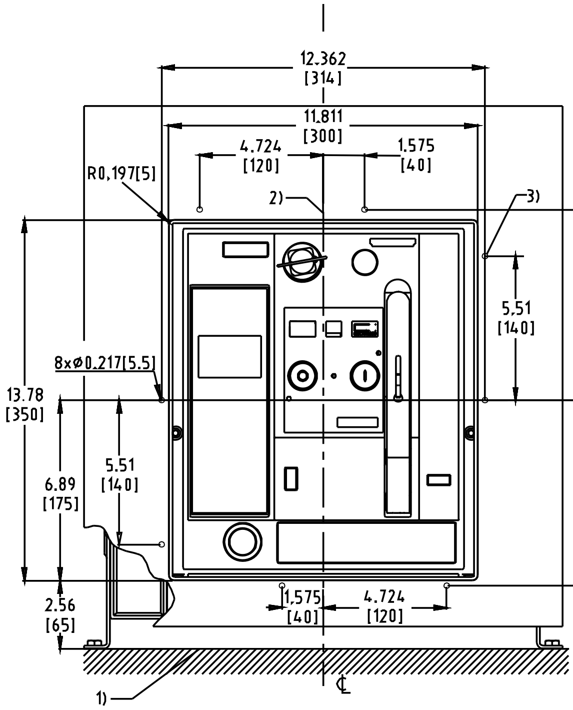


7.5 Door cut-outs, fixed-mounted circuit breaker

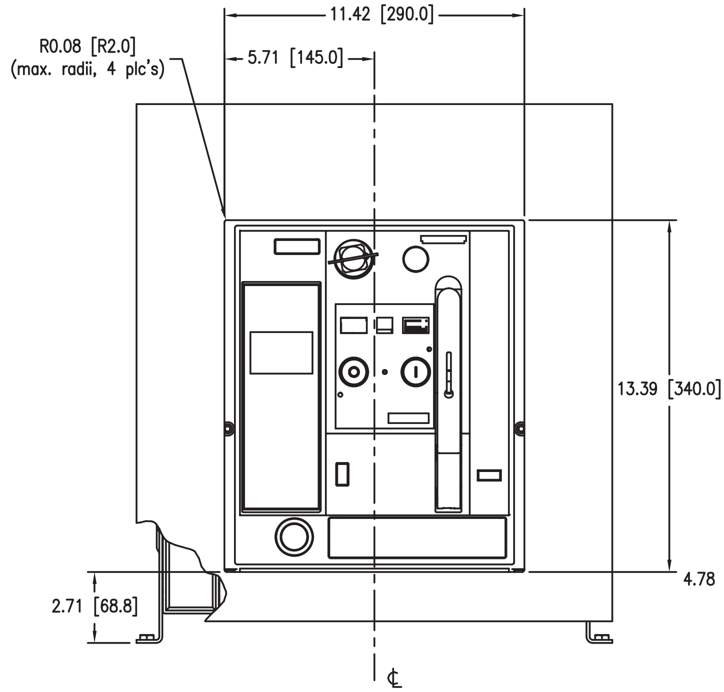
Frame size I



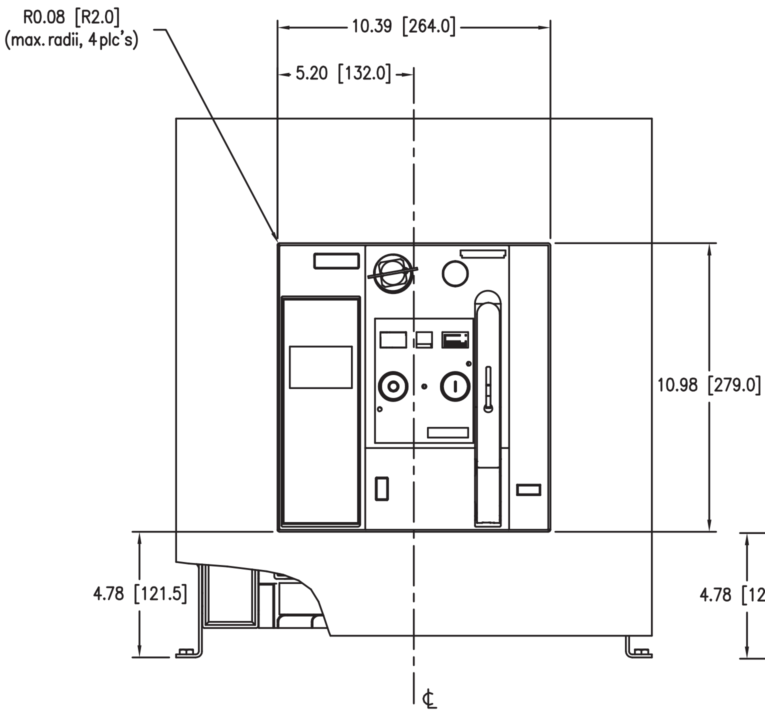
Frame size II / III

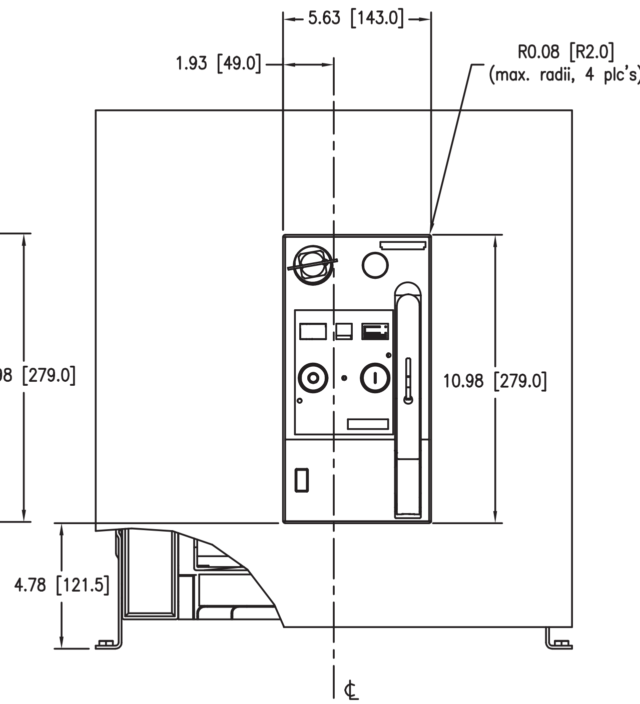


Door cut-out and mounting holes for edge protector
(door sealing frame)



Door cut–out (with edge protector)
(Cut–out after mounting edge protector)



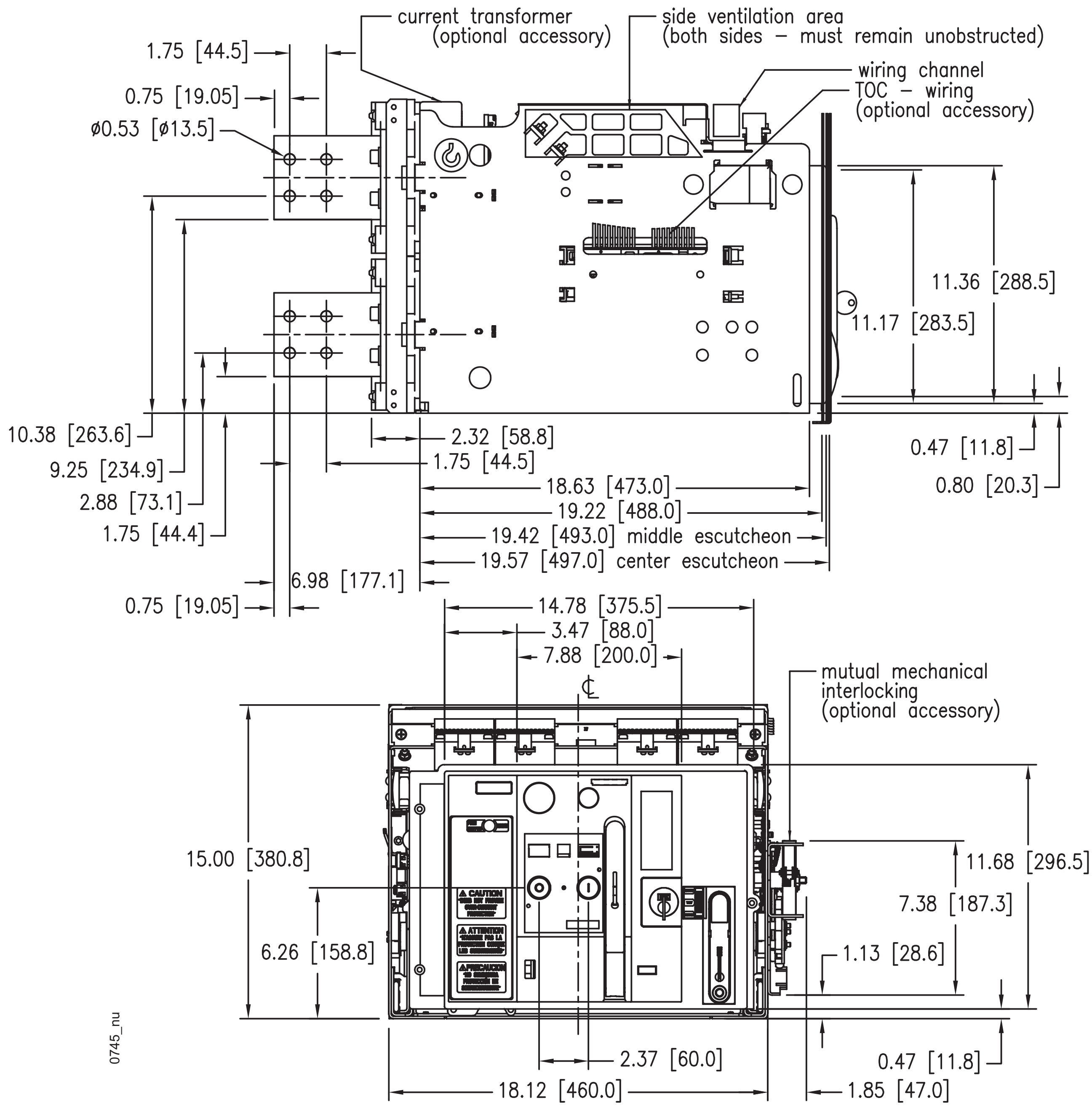


0496_nu

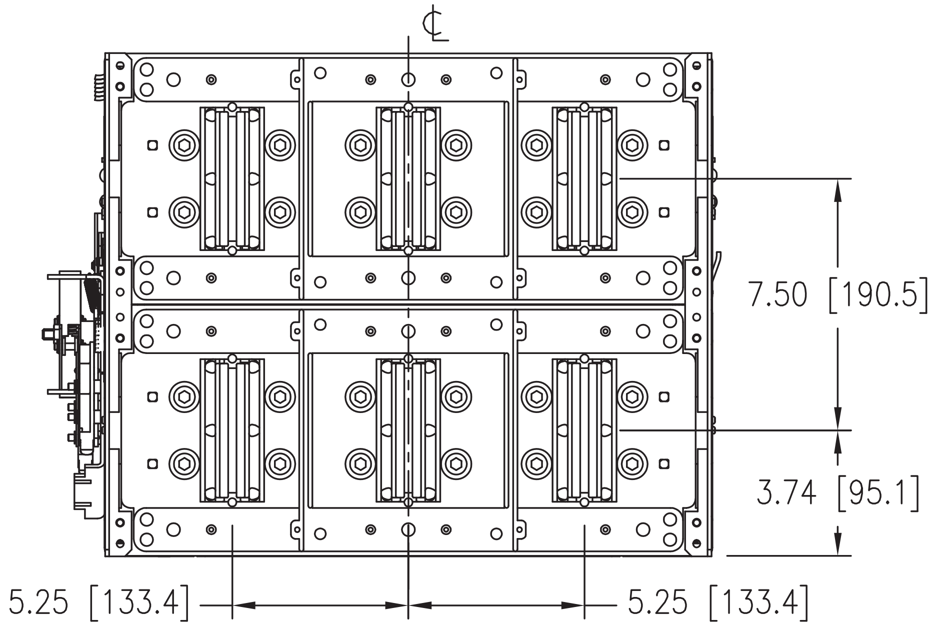
Door cut–out
(Middle escutcheon visible)

Minimal door cut–out
(Only center escutcheon visible)

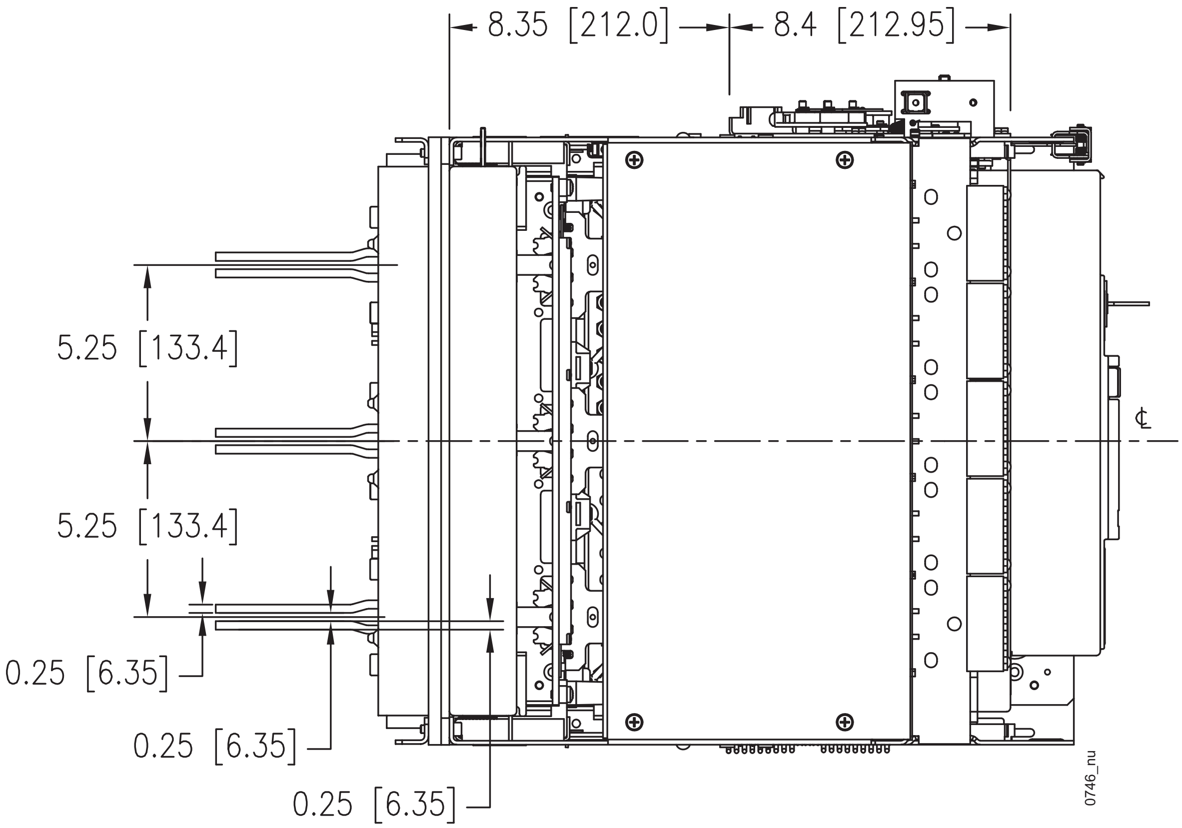
7.6 Frame size I, draw-out version



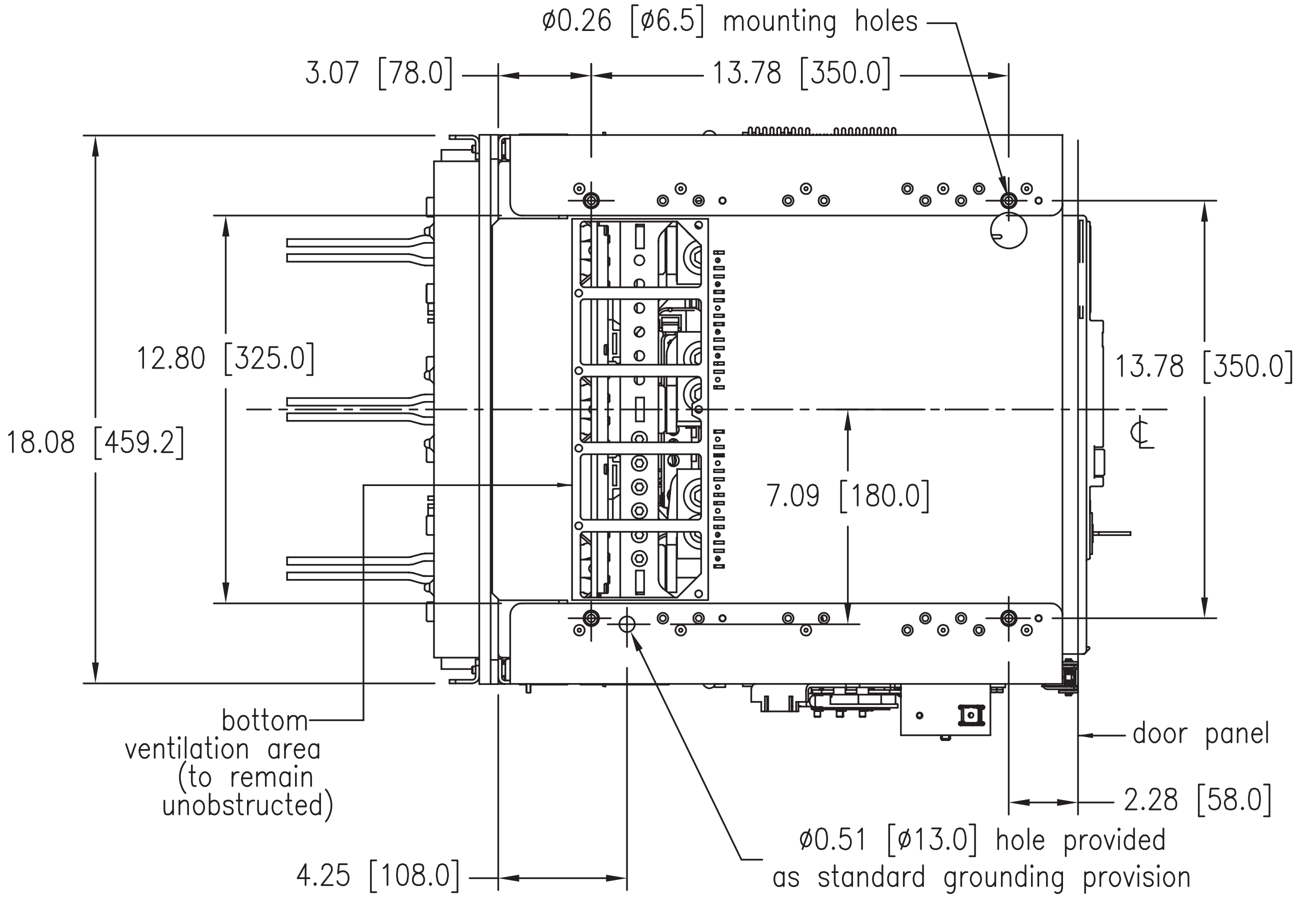
rear view



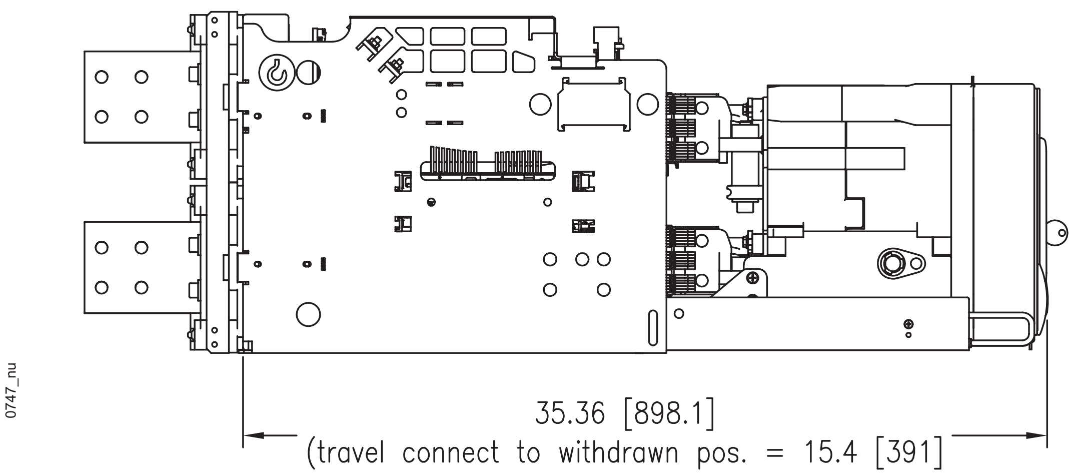
top view



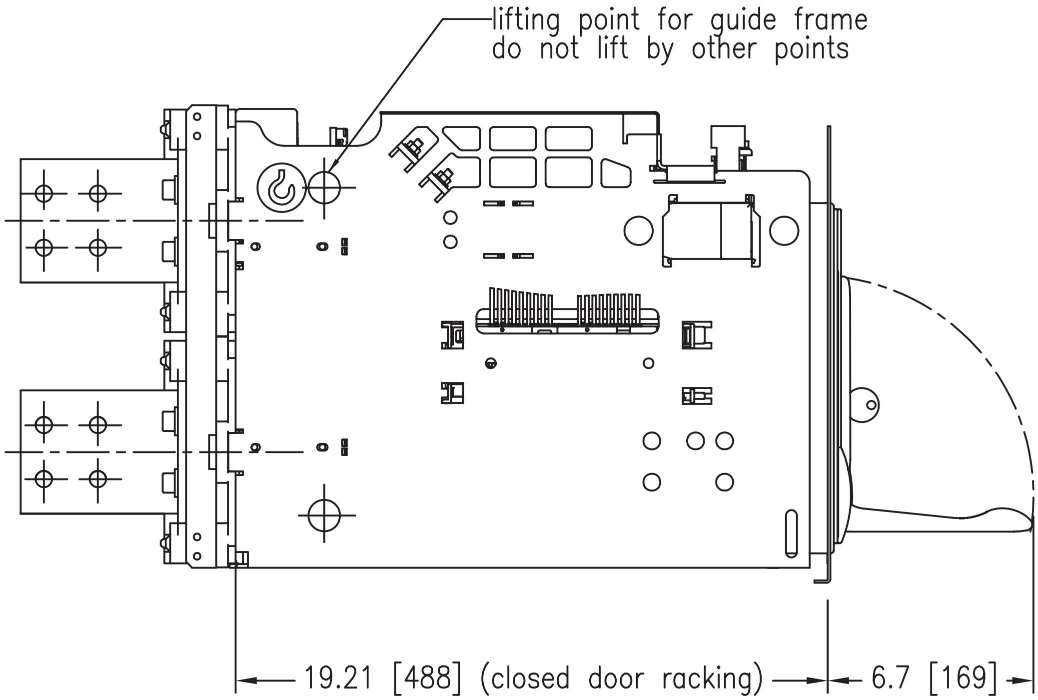
bottom view

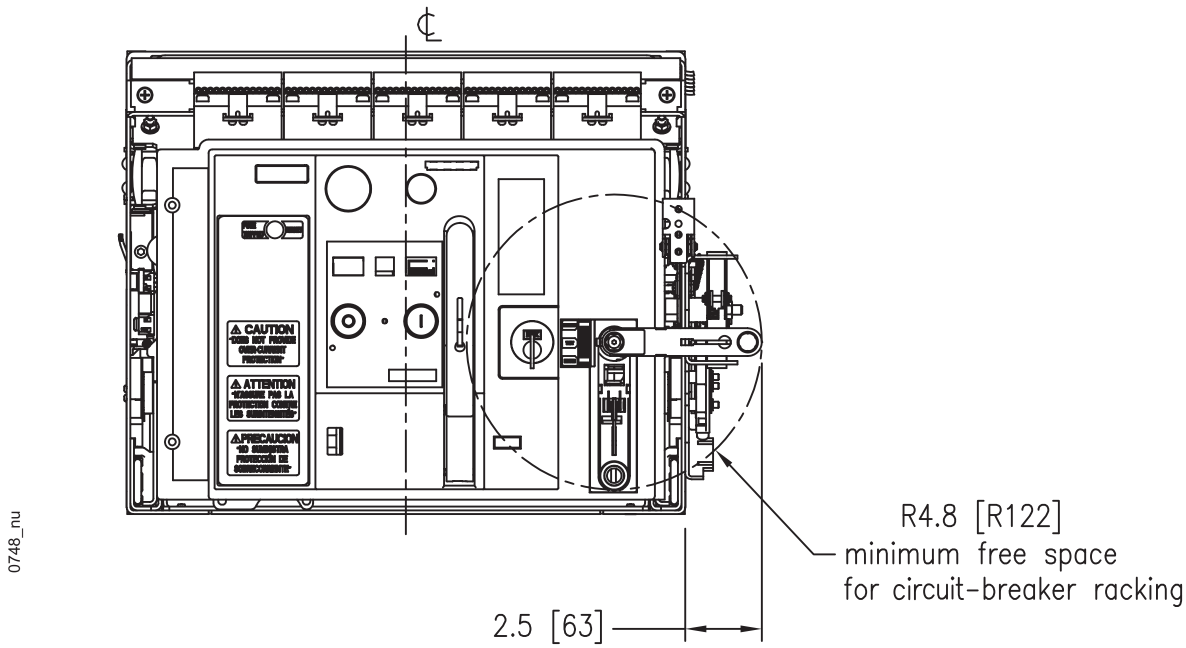


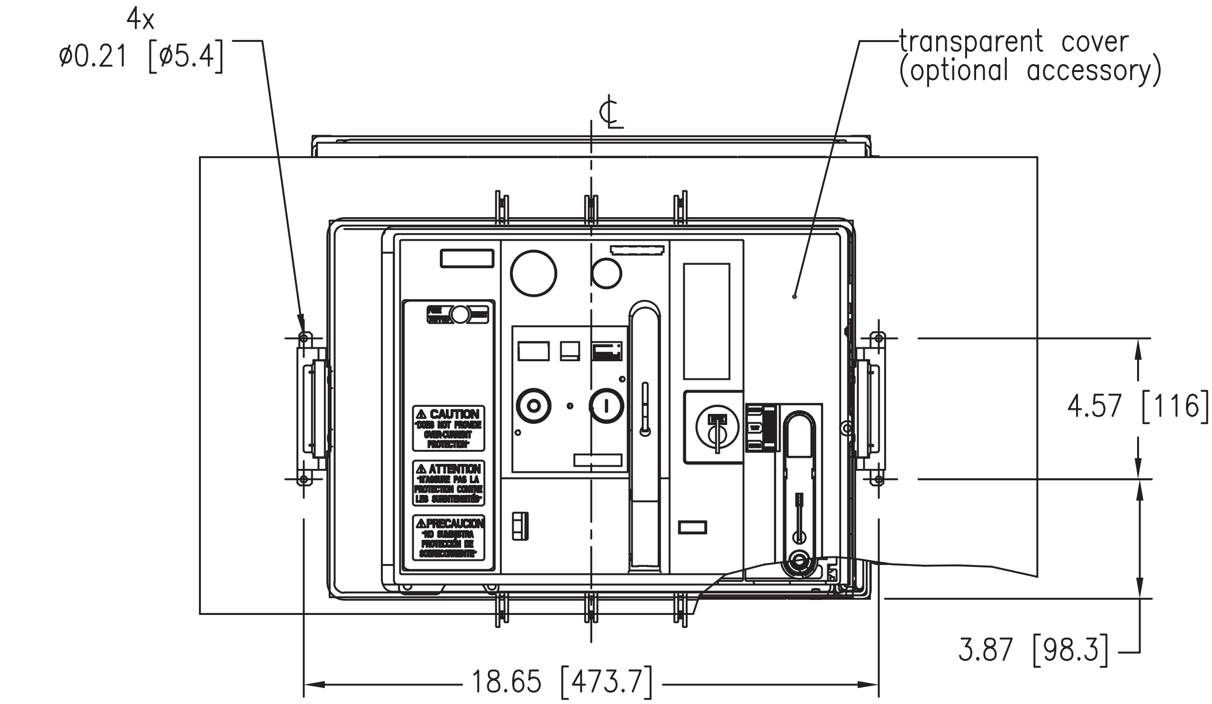
ø0.26 [ø6.5] mounting holes
3.07 [78.0]
13.78 [350.0]
12.80 [325.0]
18.08 [459.2]
13.78 [350.0]
7.09 [180.0]
bottom
ventilation area
(to remain
unobstructed)
door panel
2.28 [58.0]
ø0.51 [ø13.0] hole provided
as standard grounding provision
4.25 [108.0]

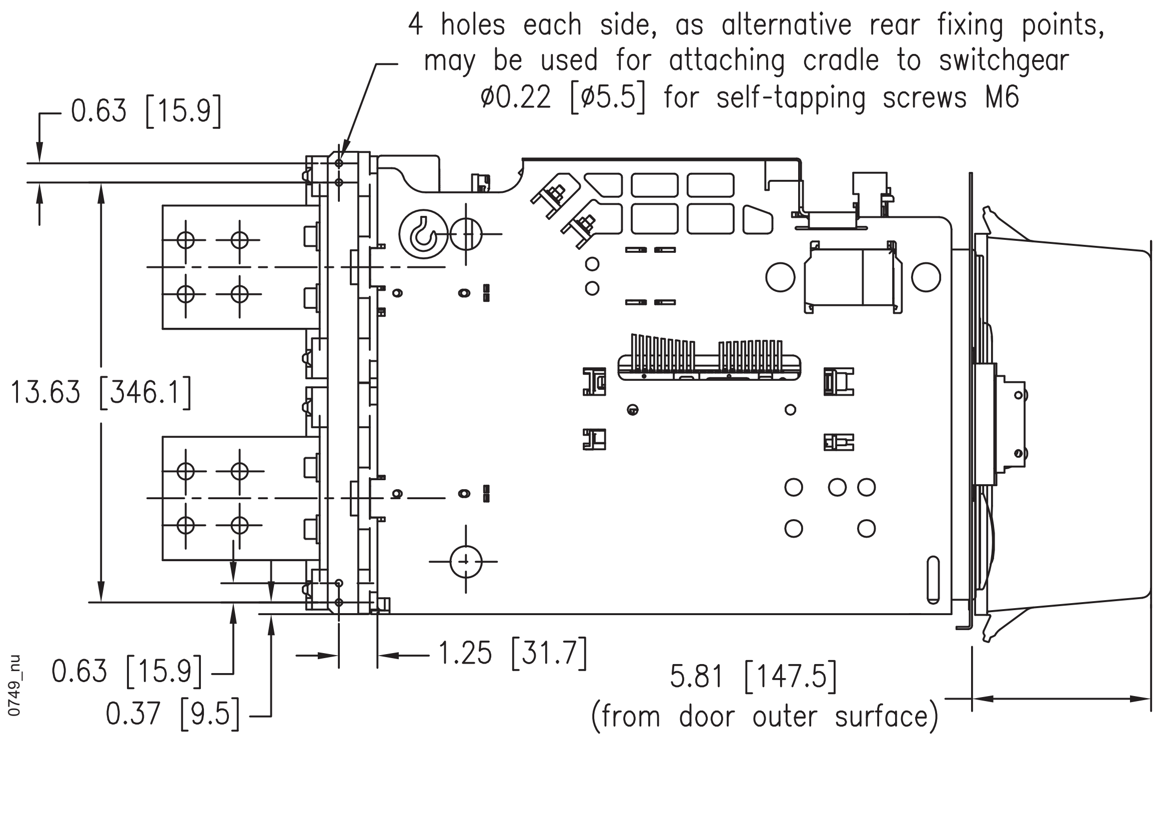


0747_nu
35.36 [898.1]
(travel connect to withdrawn pos. = 15.4 [391]

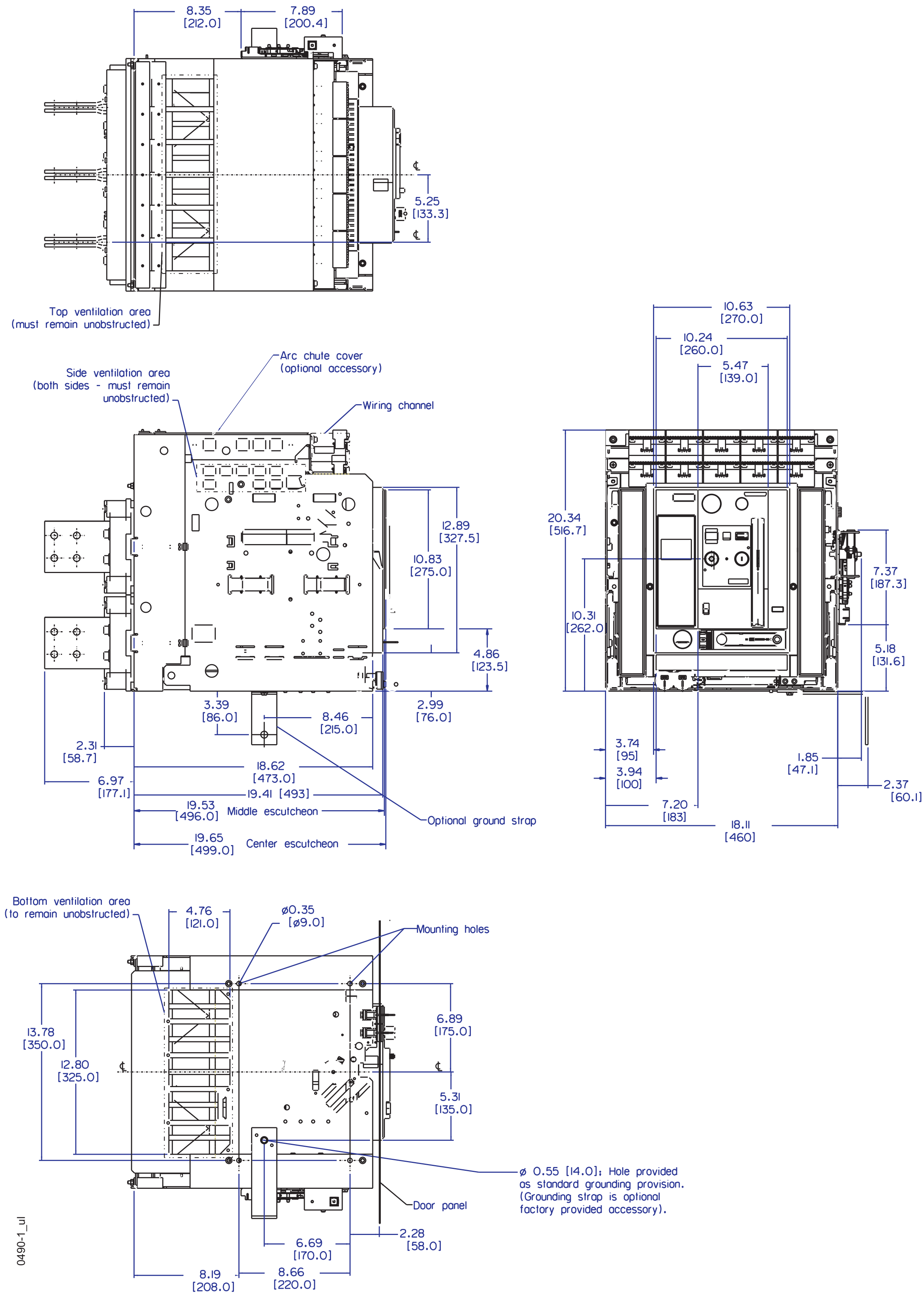

lifting point for guide frame
do not lift by other points
19.21 [488] (closed door racking)
6.7 [169]


℄
R4.8 [R122]
minimum free space
for circuit-breaker racking
2.5 [63]
0748_nu

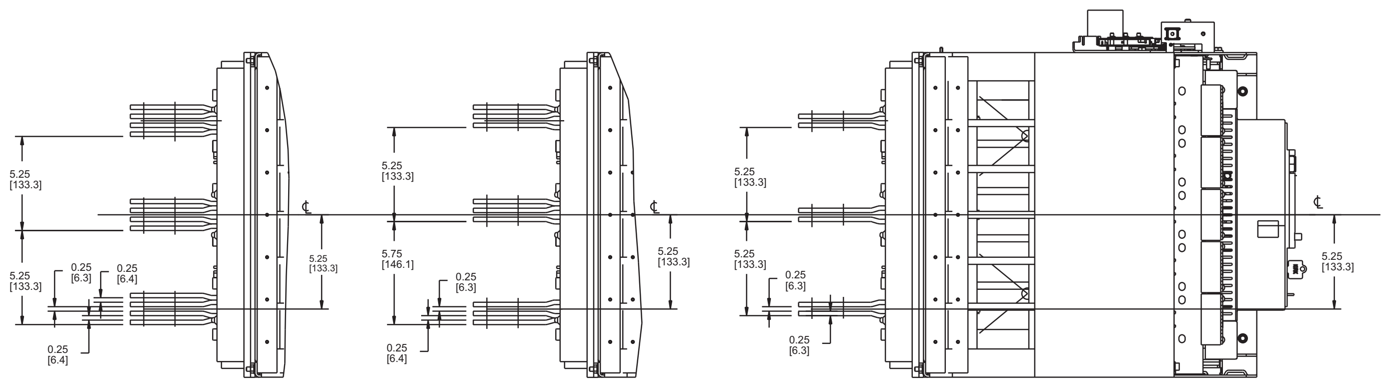

4x
ø0.21 [ø5.4]
transparent cover
(optional accessory)
℄
CAUTION
ATTENTION
PRECAUCION
4.57 [116]
3.87 [98.3]
18.65 [473.7]

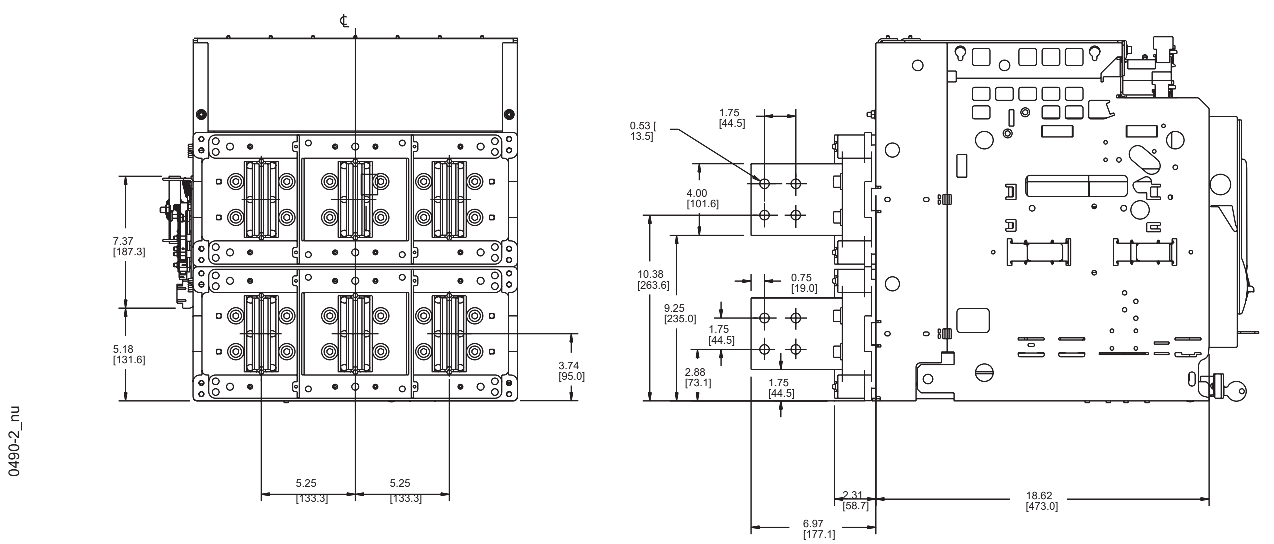

4 holes each side, as alternative rear fixing points,
may be used for attaching cradle to switchgear
ø0.22 [ø5.5] for self-tapping screws M6
0.63 [15.9]
13.63 [346.1]
0.63 [15.9]
0.37 [9.5]
1.25 [31.7]
5.81 [147.5]
(from door outer surface)
0749_nu

7.7 Frame size II, draw-out version

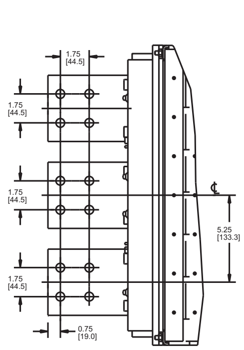


2500/3000A 2000A 800/1200/1600A

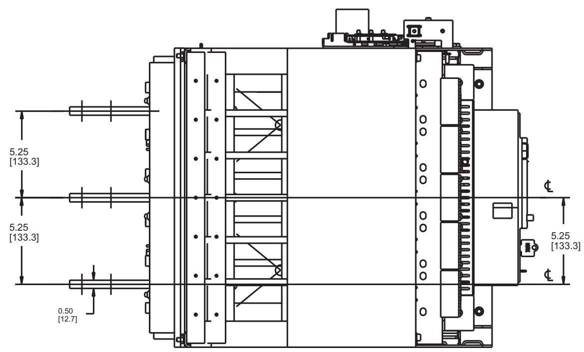


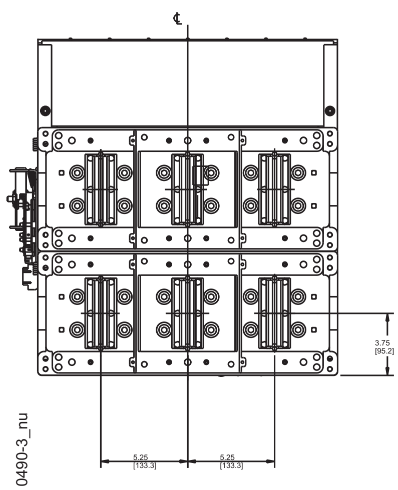


HORIZONTAL MAIN
BUS CONNECTORS



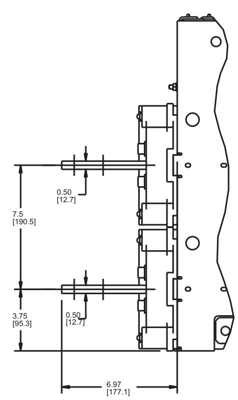
VERTICAL MAIN
BUS CONNECTORS



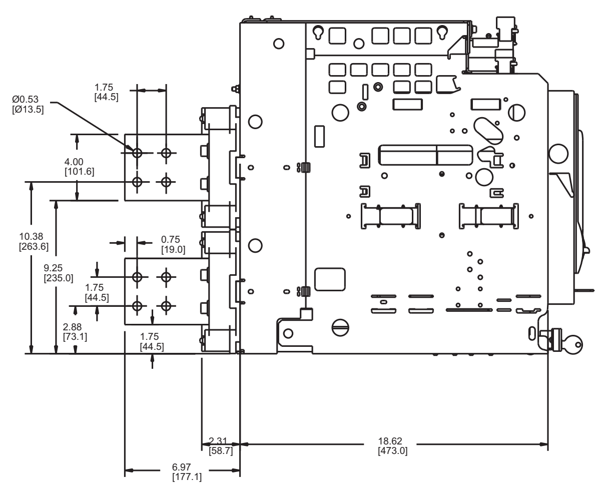


0490-3_nu

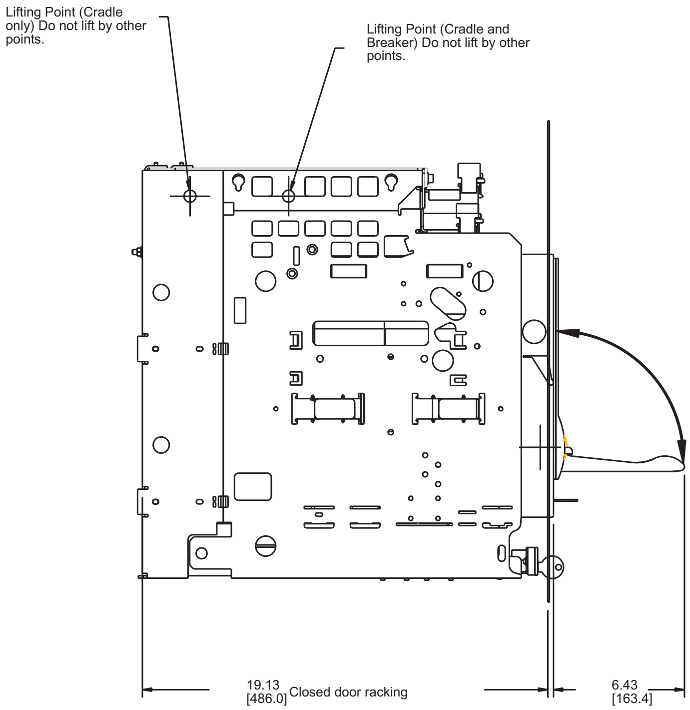
HORIZONTAL MAIN
BUS CONNECTORS



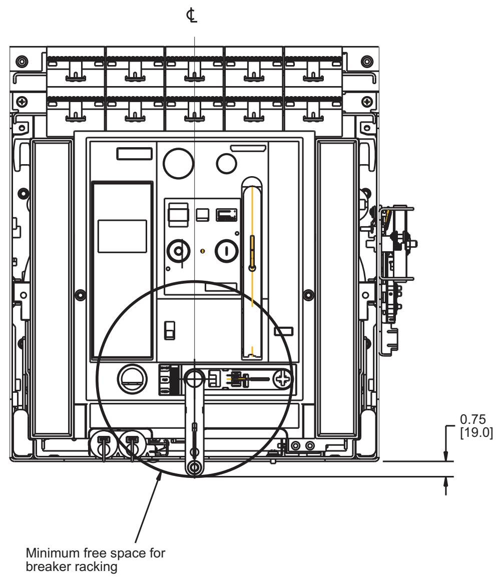
VERTICAL MAIN
BUS CONNECTORS



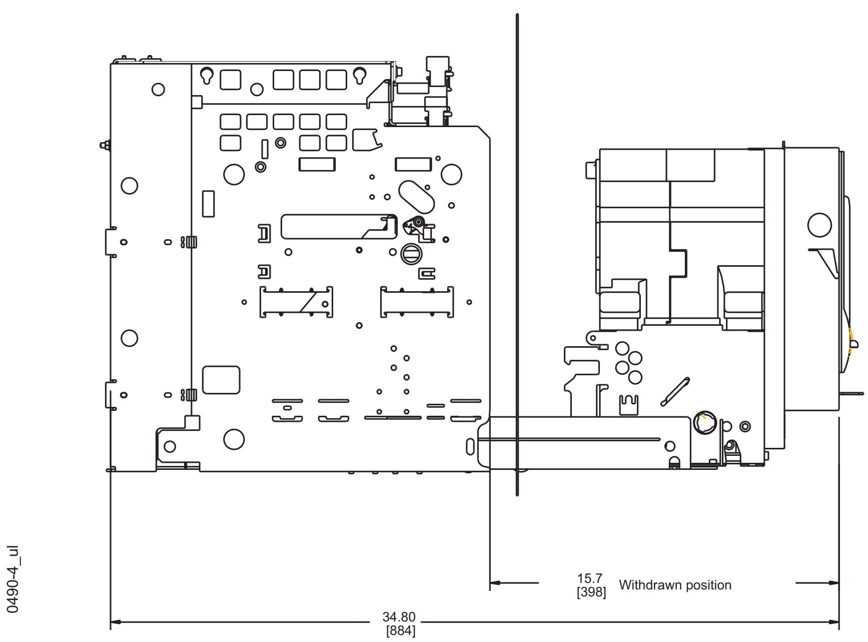
NOTE:
ROTATABLE MAIN BUS CONNECTORS ARE ONLY AVAILABLE UNDER THE FOLLOWING CONDITIONS:
(1) ONLY ACCETABLE FOR FS II 800A-2000A FRAME SIZES
(2) ONLY ACCETABLE FOR SHORT CIRCUIT RATINGS OF 85KAIC OR LESS



Lifting Point (Cradle only) Do not lift by other points.
Lifting Point (Cradle and Breaker) Do not lift by other points.
19.13 [486.0] Closed door racking
6.43 [163.4]

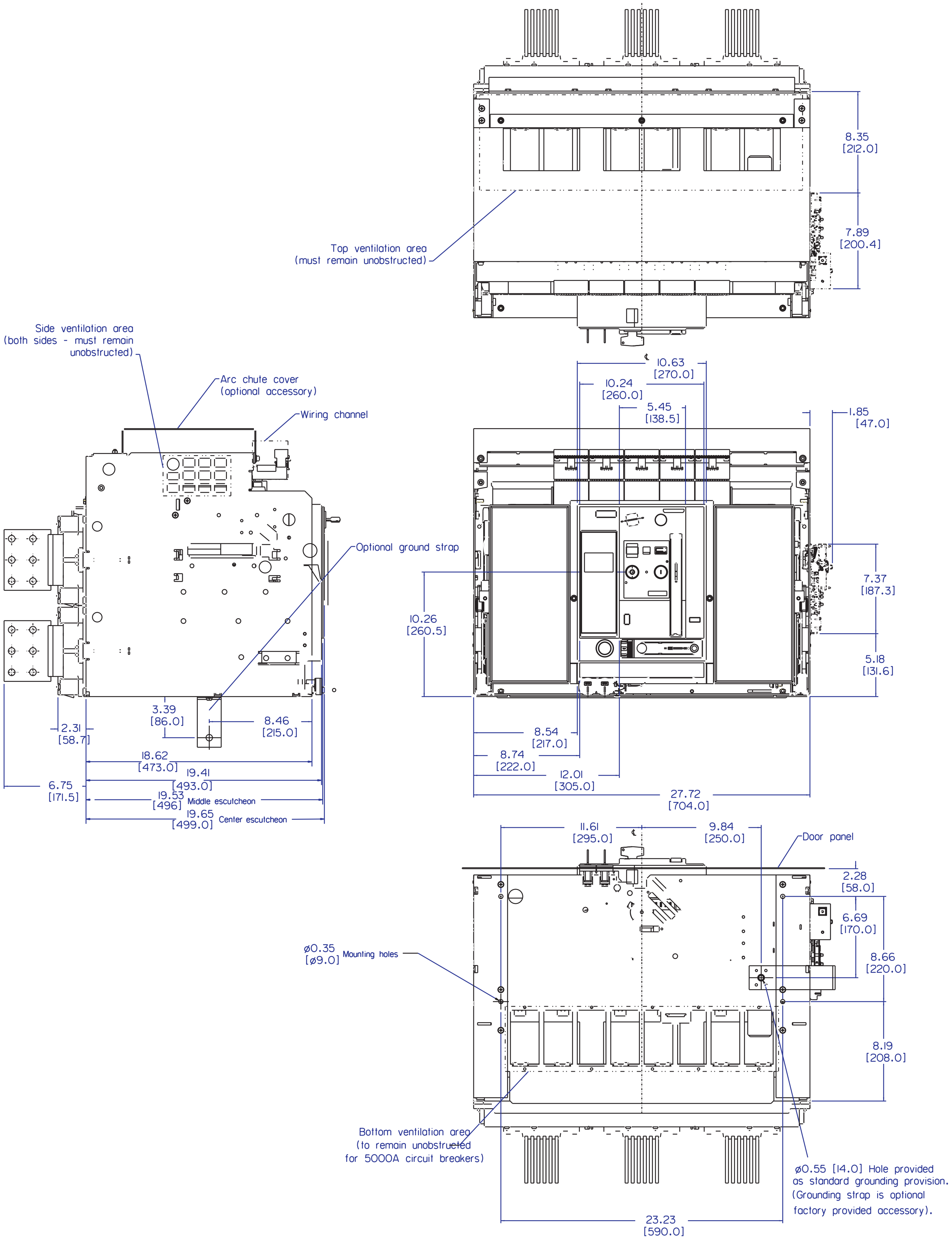


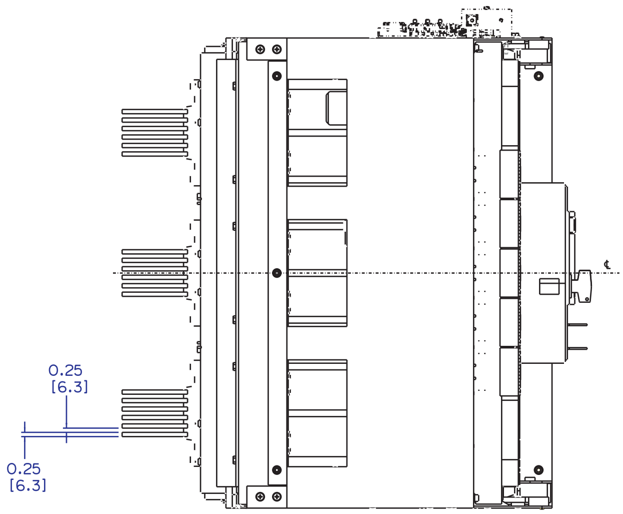
℄
0.75 [19.0]
Minimum free space for breaker racking



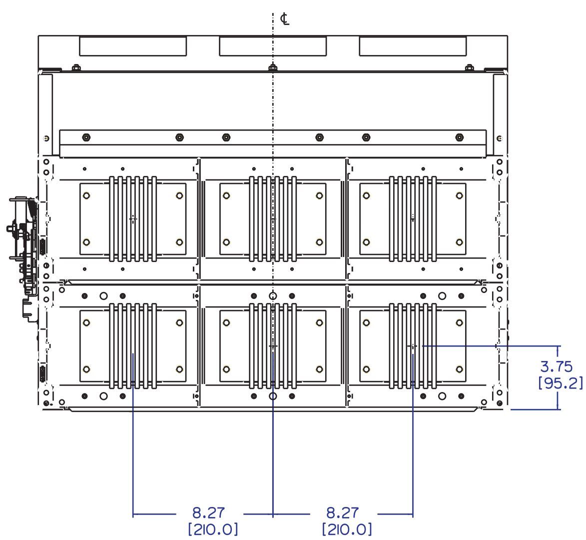
0490-4_ul
15.7 [398] Withdrawn position
34.80 [884]

7.8 Frame size III, draw-out version

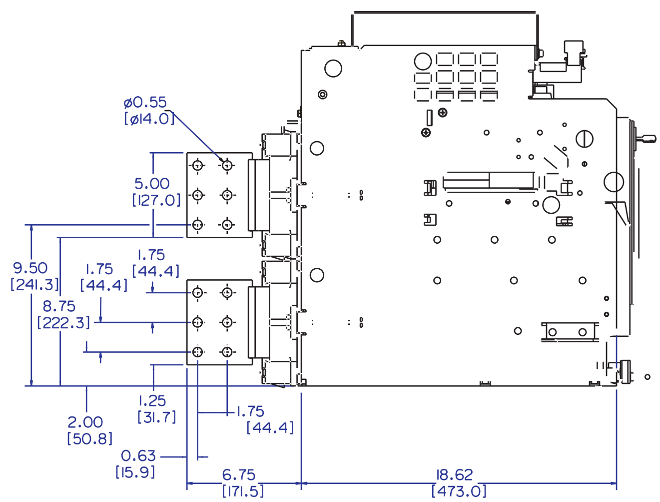




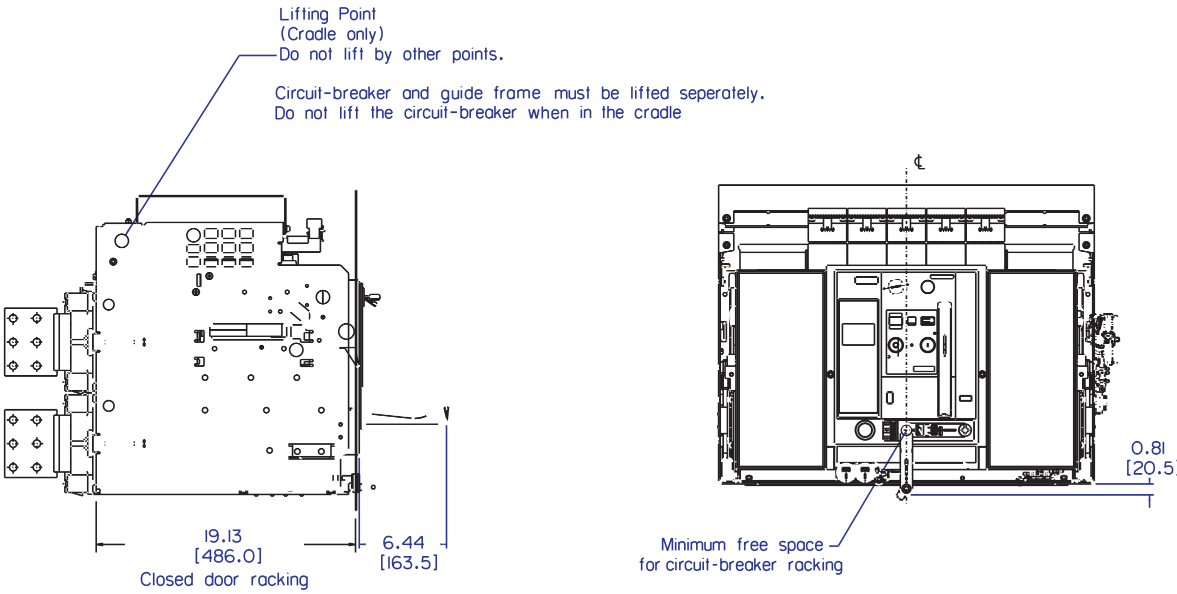
℄
0.25
[6.3]
0.25
[6.3]

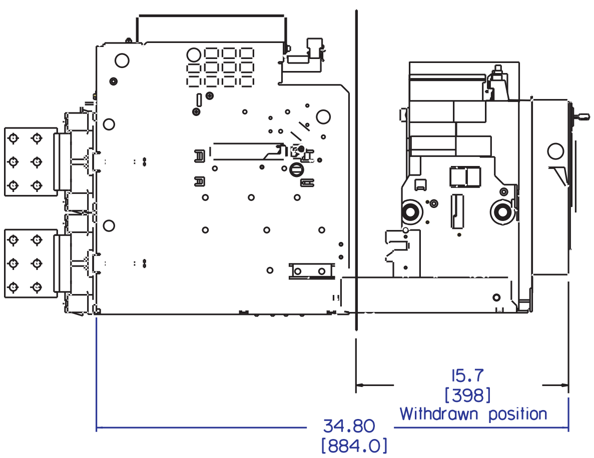


℄
3.75
[95.2]
8.27
[210.0]
8.27
[210.0]



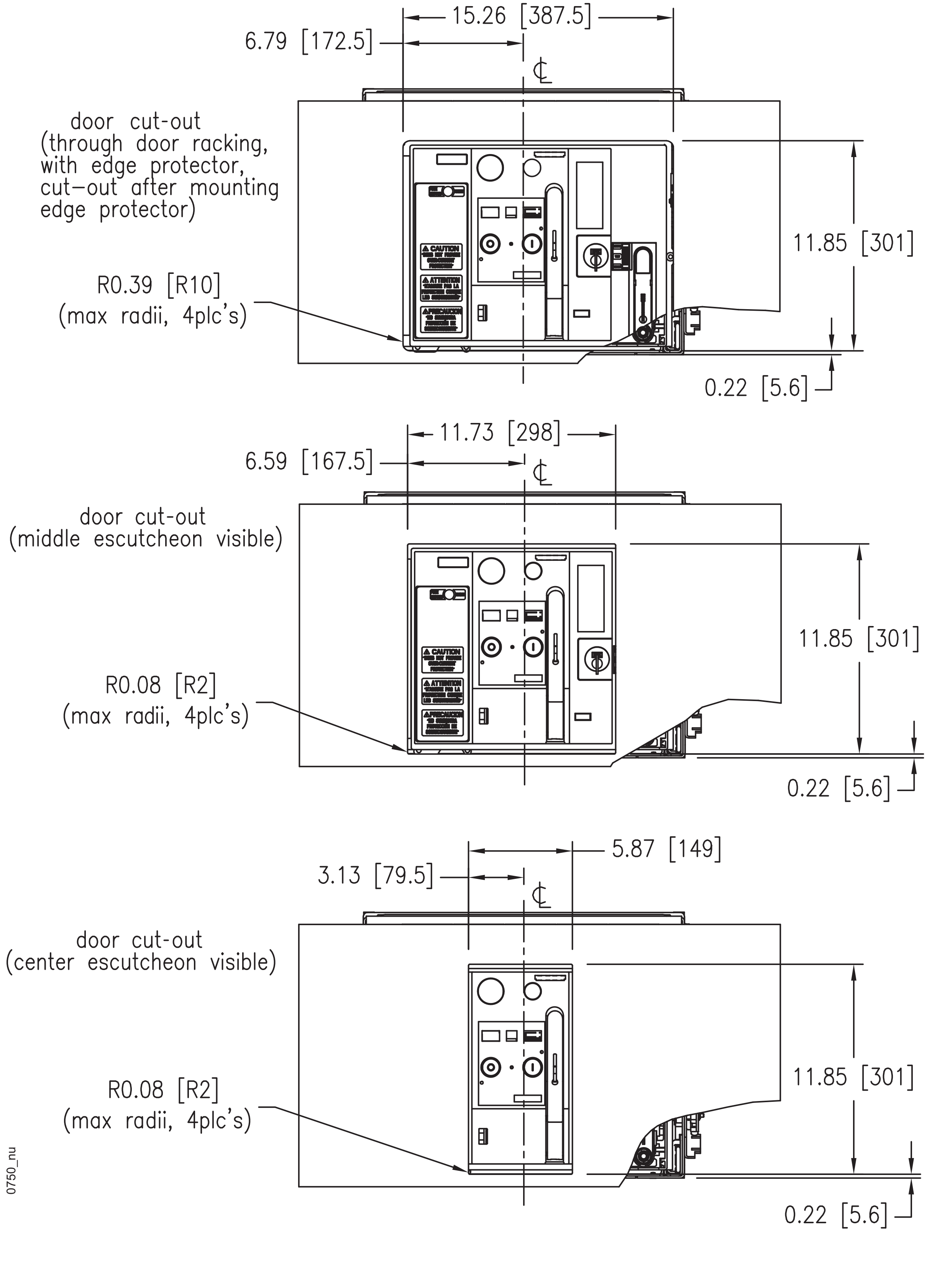
ø0.55
[ø14.0]
5.00
[127.0]
9.50
[241.3]
1.75
[44.4]
1.75
[44.4]
8.75
[222.3]
1.25
[31.7]
1.75
[44.4]
2.00
[50.8]
0.63
[15.9]
6.75
[171.5]
18.62
[473.0]


Lifting Point
(Cradle only)
Do not lift by other points.
Circuit-breaker and guide frame must be lifted seperately.
Do not lift the circuit-breaker when in the cradle
19.13
[486.0]
Closed door racking
6.44
[163.5]
0.81
[20.5]
Minimum free space
for circuit-breaker racking


15.7
[398]
Withdrawn position
34.80
[884.0]

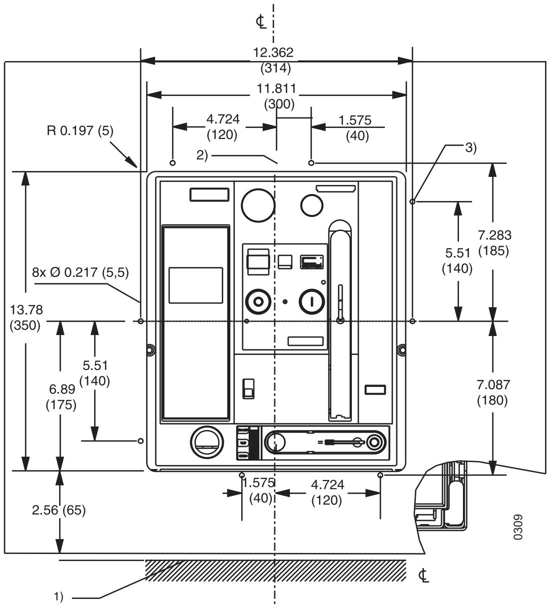
7.9 Door cut-outs for draw-out circuit breakers

Frame size I

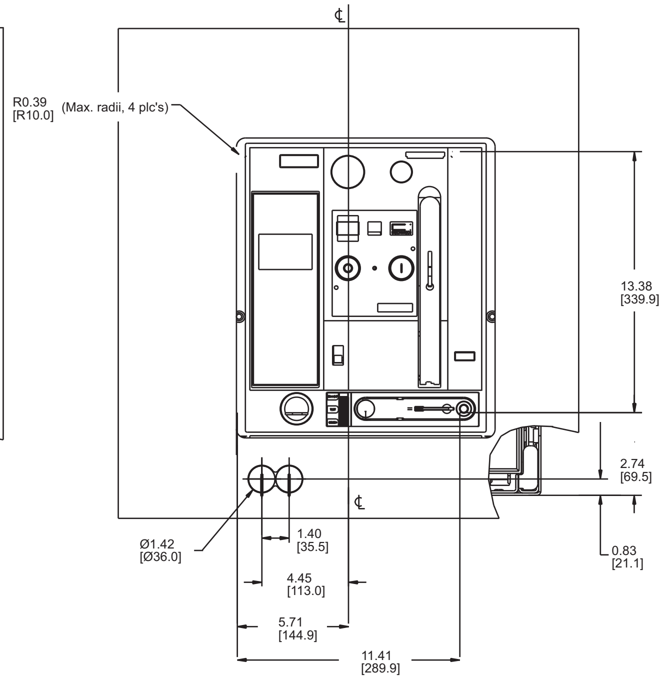


7.10 Frame size II / III

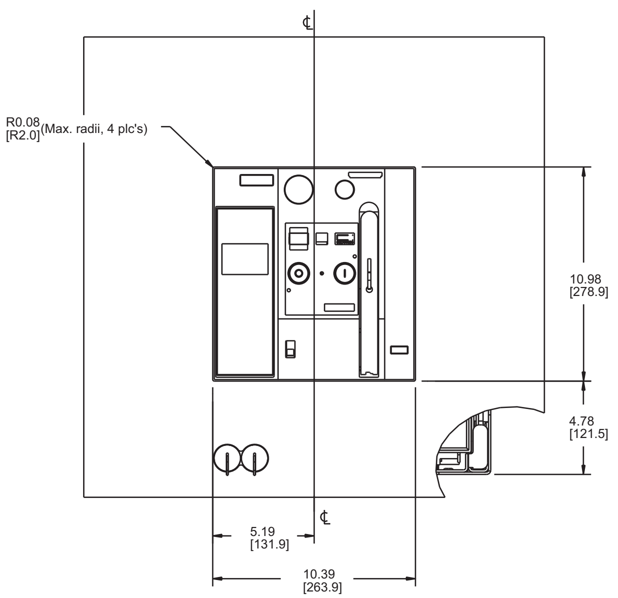
Door cut-out and mounting holes for edge protector
(door sealing frame)



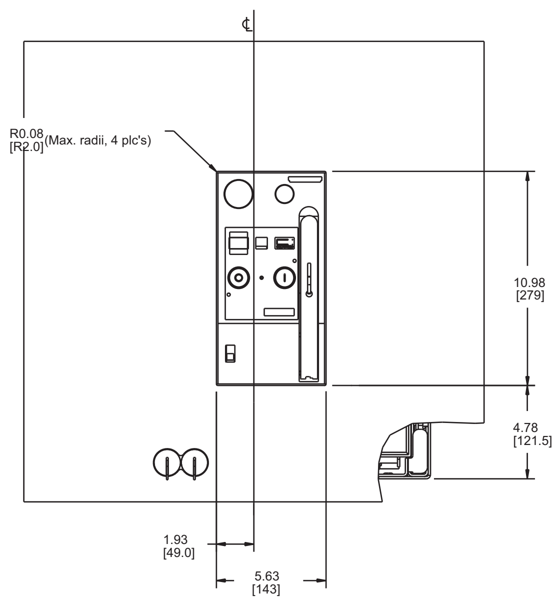
Door cut-out (with edge protector)



Door cut-out
(Middle escutcheon visible)

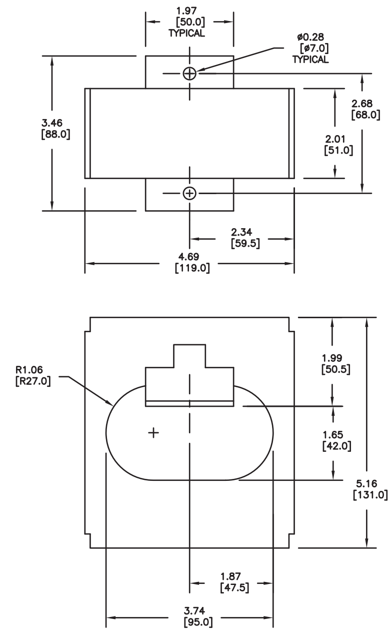


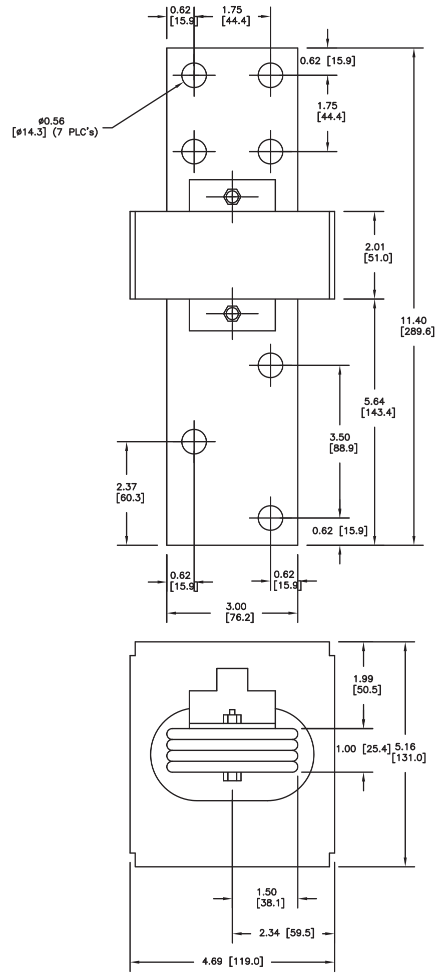
Minimal door cut-out
(Only center escutcheon visible)



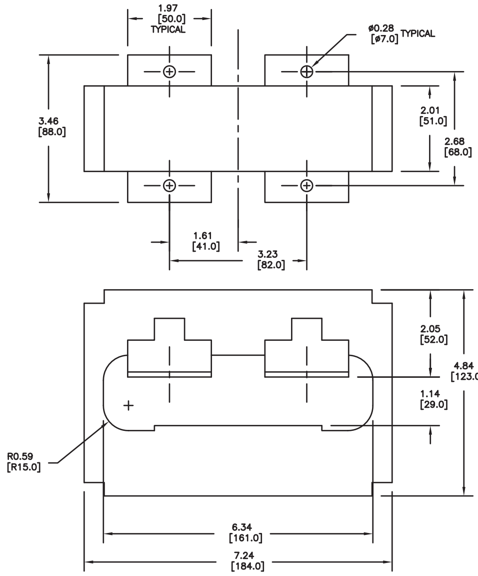
7.11 External sensor for neutral conductor

WLNCT2

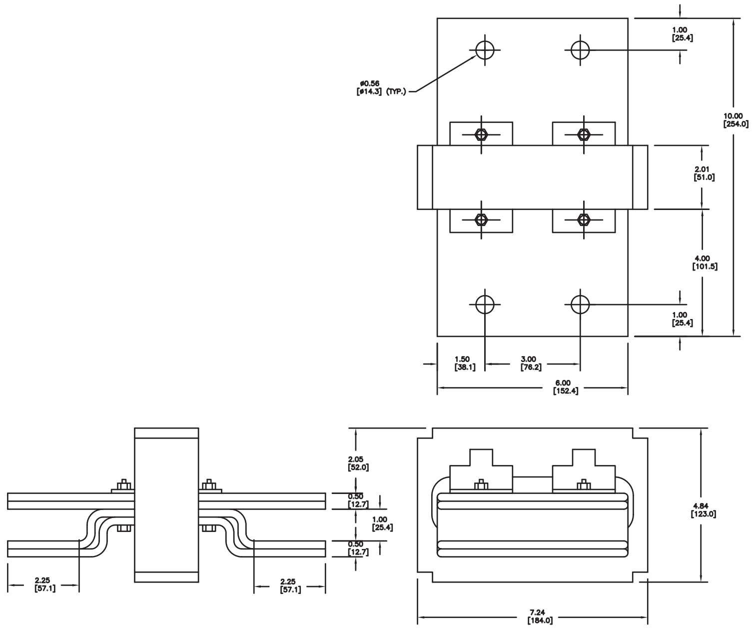




WLNCT3

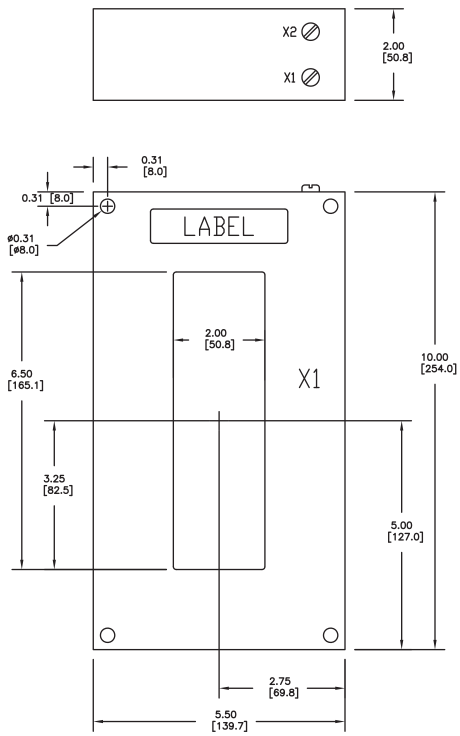


1.97
[50.0]
TYPICAL
ø0.28
[ø7.0] TYPICAL
3.46
[88.0]
2.01
[51.0]
2.68
[68.0]
1.61
[41.0]
3.23
[82.0]
2.05
[52.0]
4.84
[123.0]
1.14
[29.0]
R0.59
[R15.0]
6.34
[161.0]
7.24
[184.0]



1.00
[25.4]
ø0.56
[ø14.3] (TYP.)
10.00
[254.0]
2.01
[51.0]
4.00
[101.5]
1.00
[25.4]
1.50
[38.1]
3.00
[76.2]
6.00
[152.4]
2.05
[52.0]
0.50
[12.7]
1.00
[25.4]
0.50
[12.7]
2.25
[57.1]
2.25
[57.1]
4.84
[123.0]
7.24
[184.0]

Iron Core: WLG800NMCT23, WLG1200NMCT23, WLG1600NMCT23, WLG2000NMCT23, WLG2500NMCT23, WLG3000NMCT23, WLG3200NMCT23, WLG4000NMCT23, WLG5000NMCT23, WLG6000NMCT23, WLGNMDGCT23



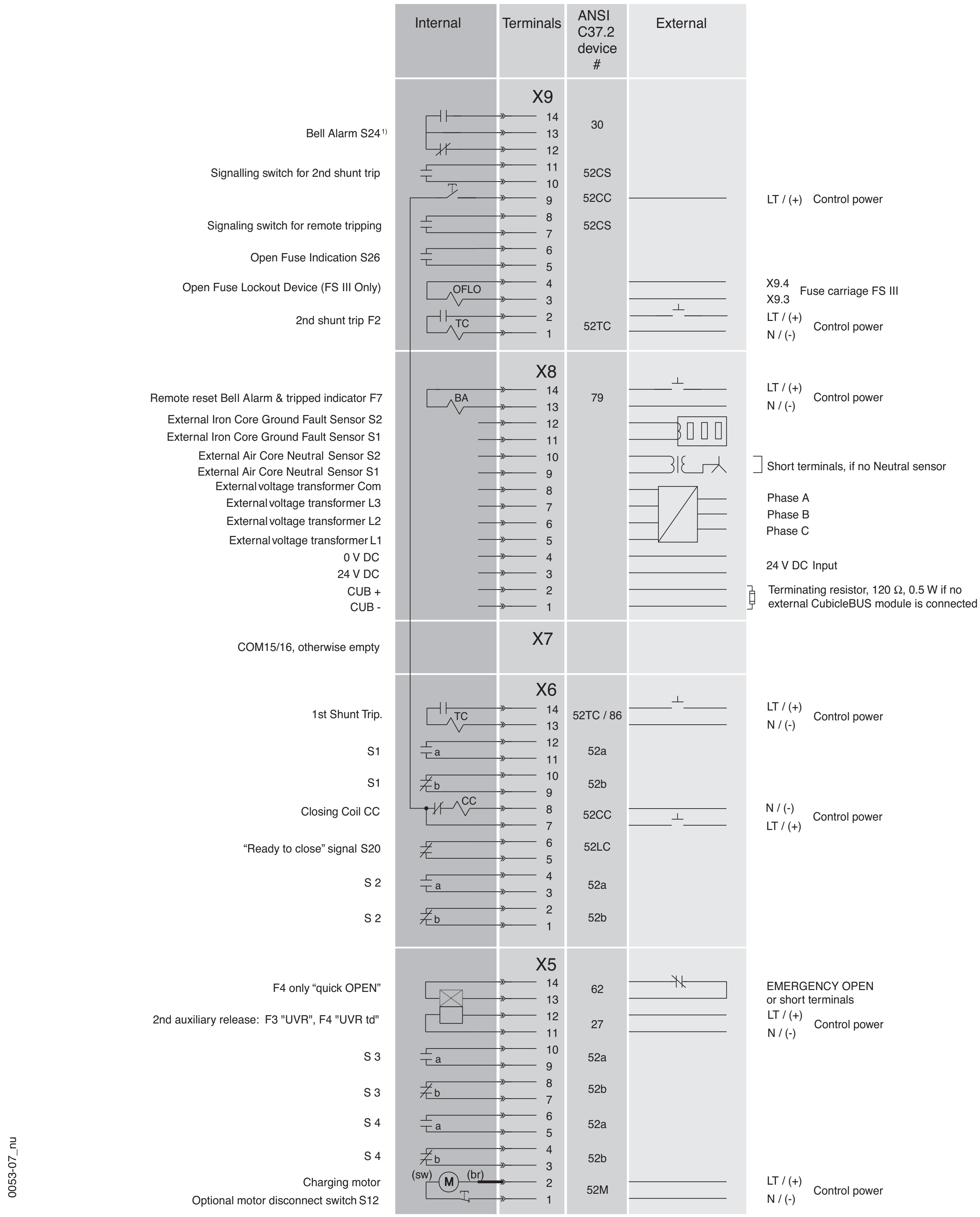
7.12 Further dimension drawings

- Door sealing frame → (page 22-1)
- Shrouding cover → (page 23-2)

Additional information on: Cut-outs for "through-door racking" with Door sealing frame (page 22-1) is given in Chapter 22.
Cut-outs for attaching the Plexiglas cover are shown in Chapter 23.

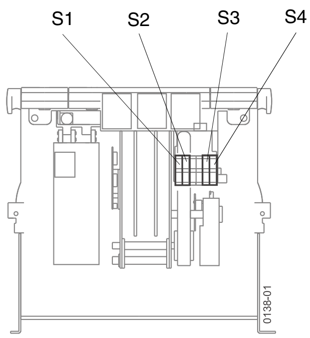
8 Circuit diagrams

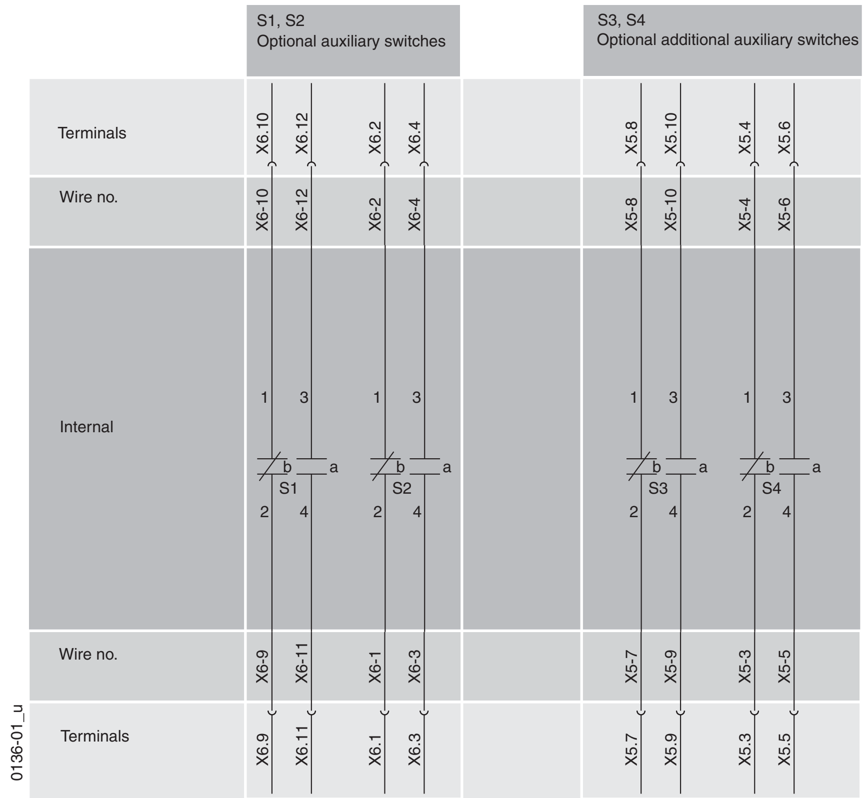
8.1 Terminal assignment



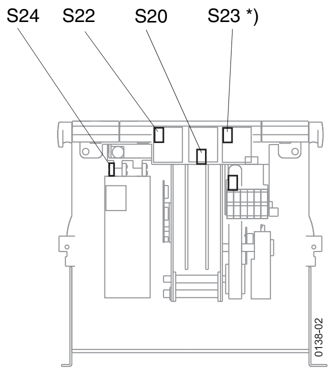
1) The breaker is untripped, and the bell alarm is shown reset

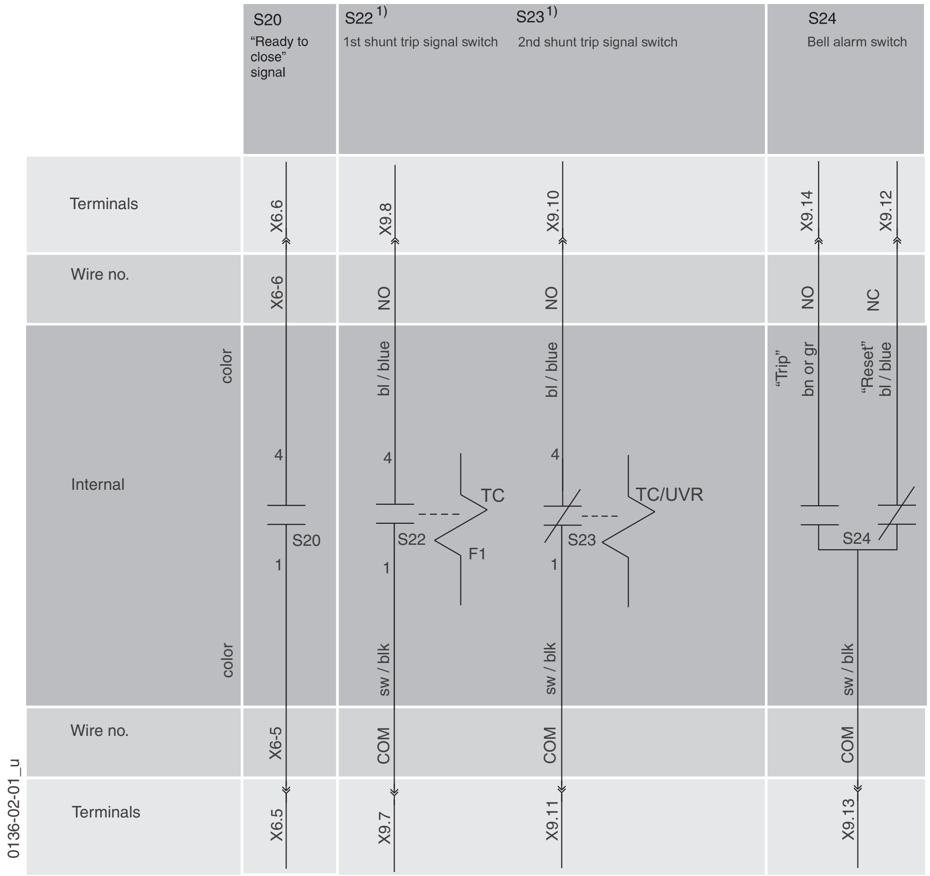
8.2 Auxiliary switches





Signaling switches

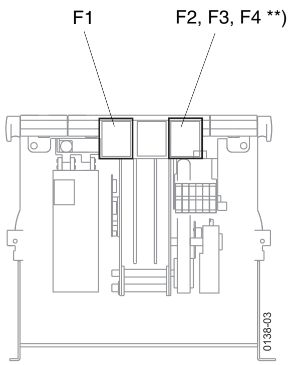


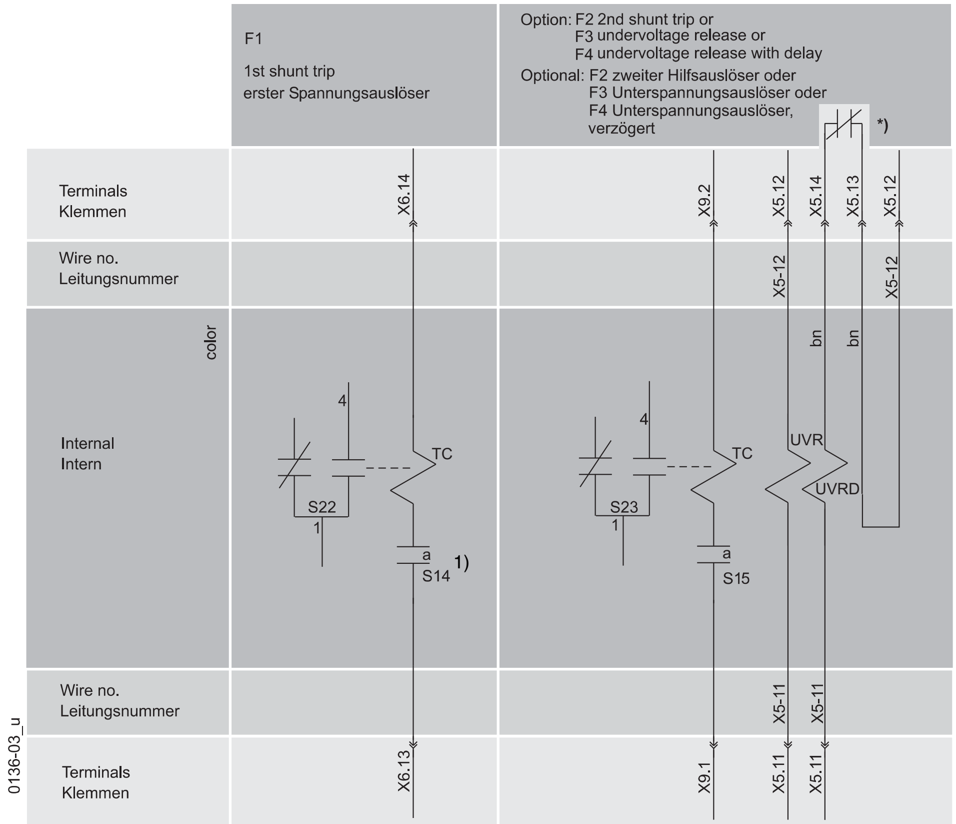


*) Same installation location as S43

1) Contact closed means that the undervoltage release is energized or shunt trip is not energized - circuit breaker is possibly "Ready-to-close".
Contact open means that the undervoltage release is not energized or shunt trip is energized - circuit breaker is not "Ready-to-close".

8.3 Shunt Trip, Undervoltage Trip / Electrical closing lockout



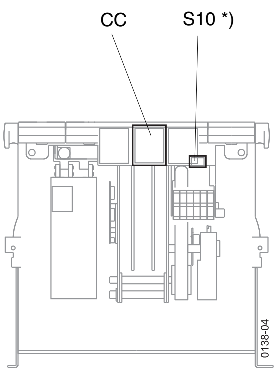


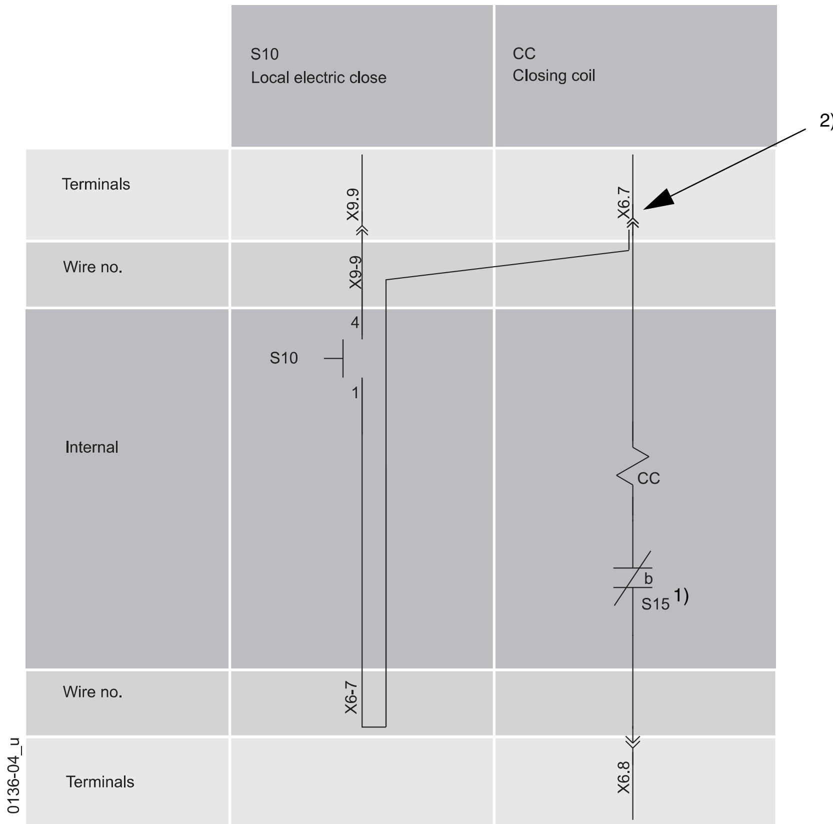
*) EMERGENCY OPEN or short terminals

**) Same installation location

1) For circuit breaker equipped with shunt trip and closing coil, the combined cutoff- switch S14 / S15 will be used. (One switch NO + NC is serving both coils.)

8.4 Closing Coil / Electrical CLOSE



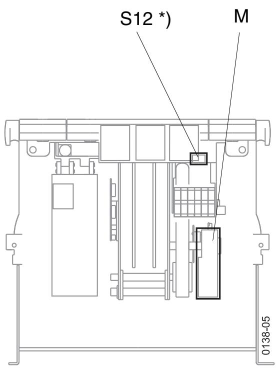


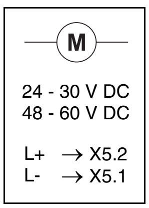
*) Same installation location as S12

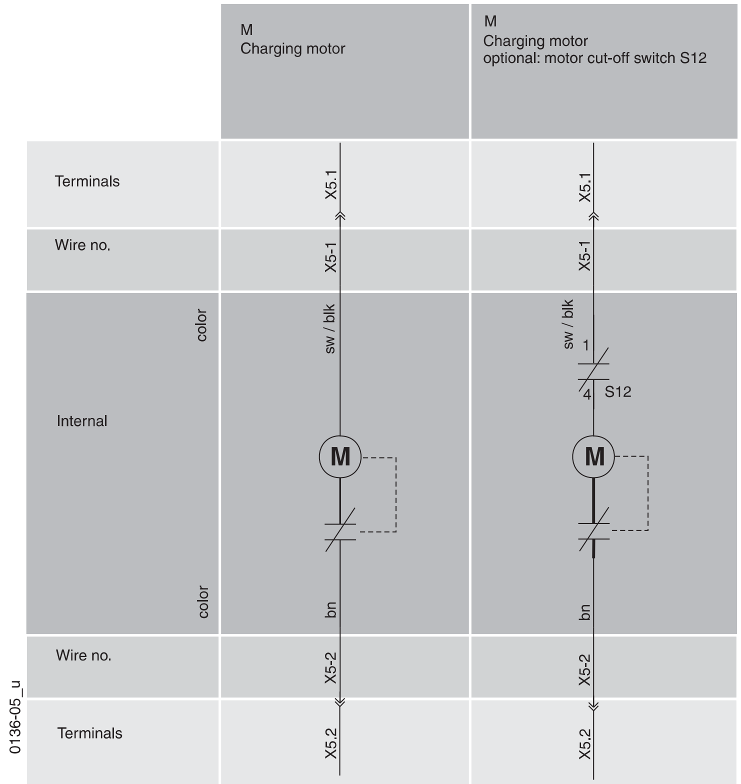
1) For circuit breaker equipped with shunt trip and closing coil, the combined cutoff- switch S14 / S15 will be used. (One switch NO + NC is serving both coils.)

2) Use twin wire end ferrule
Crimping tool e.g.: Weidmüller PZ3 to PZ6, WAGO Variocrimp 4

8.5 Motor-operated mechanism

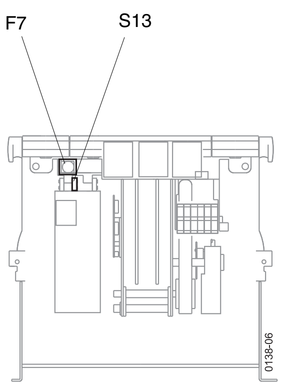


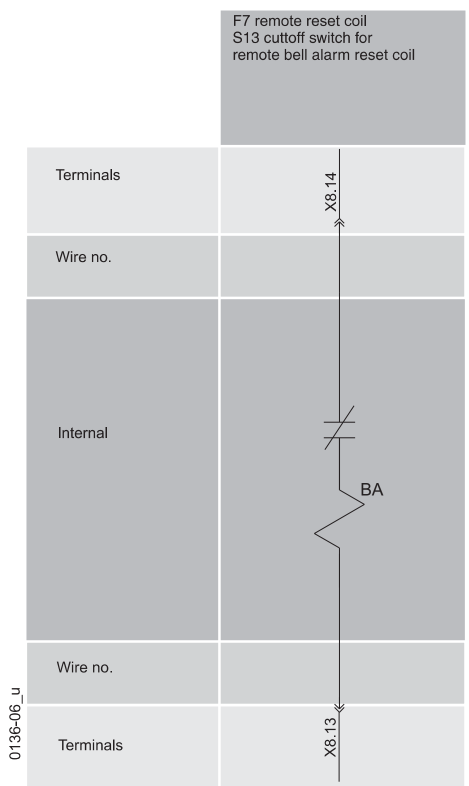




*) Same installation location as S10

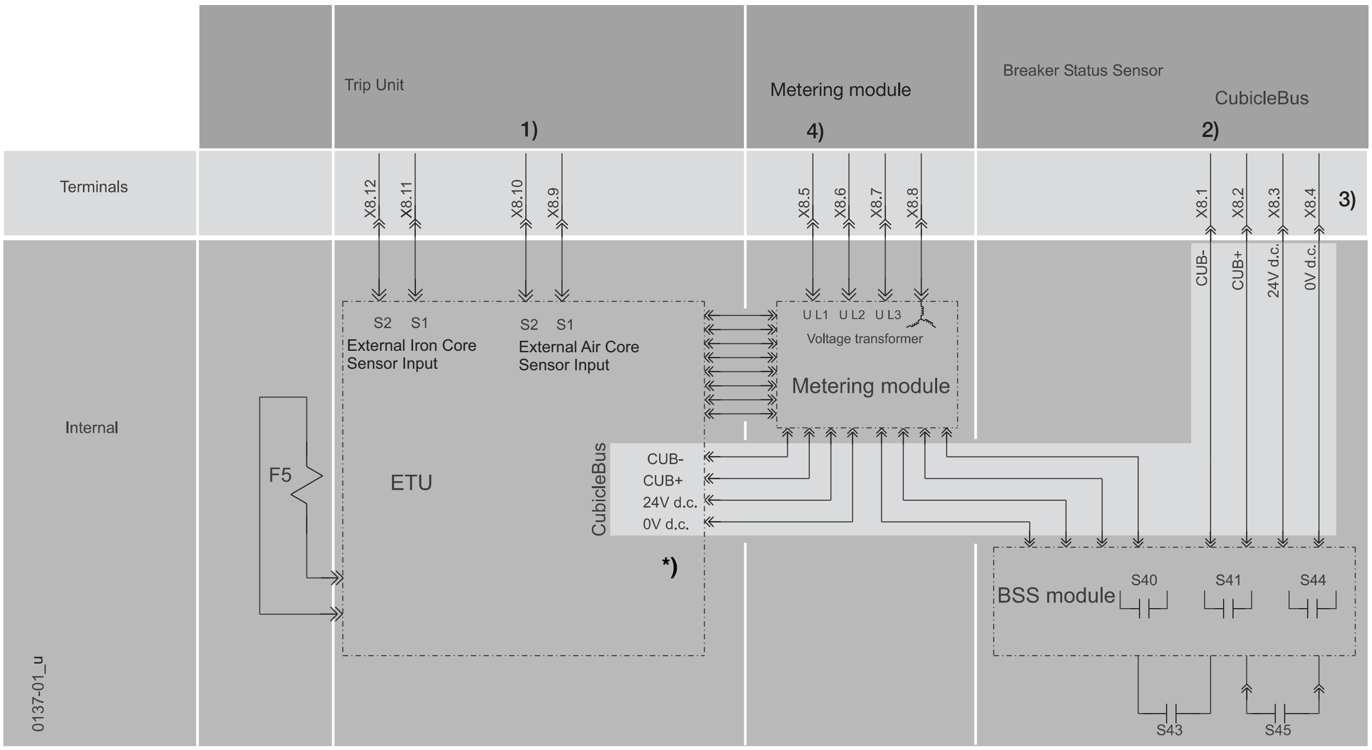
8.6 Remote Bell Alarm Reset





8.7 Trip unit circuitry for ETU745-776

8.7.1 With Breaker Status Sensor (BSS) and metering module



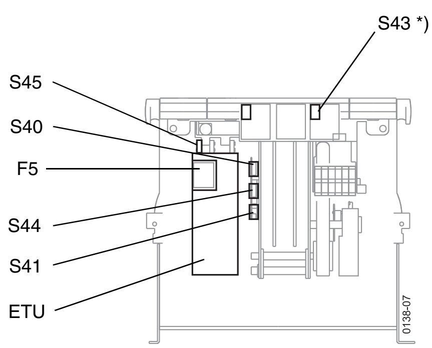
1) Jumper X8.9-X8.10 if there is no external N sensor

2) Terminating resistor 120 Ω, 0.5 W on X8-1 / X8-2, if no external **Cubicle**BUS - module is connected

3) If no metering module and no BSS module is used: Direct connection X8 to ETU

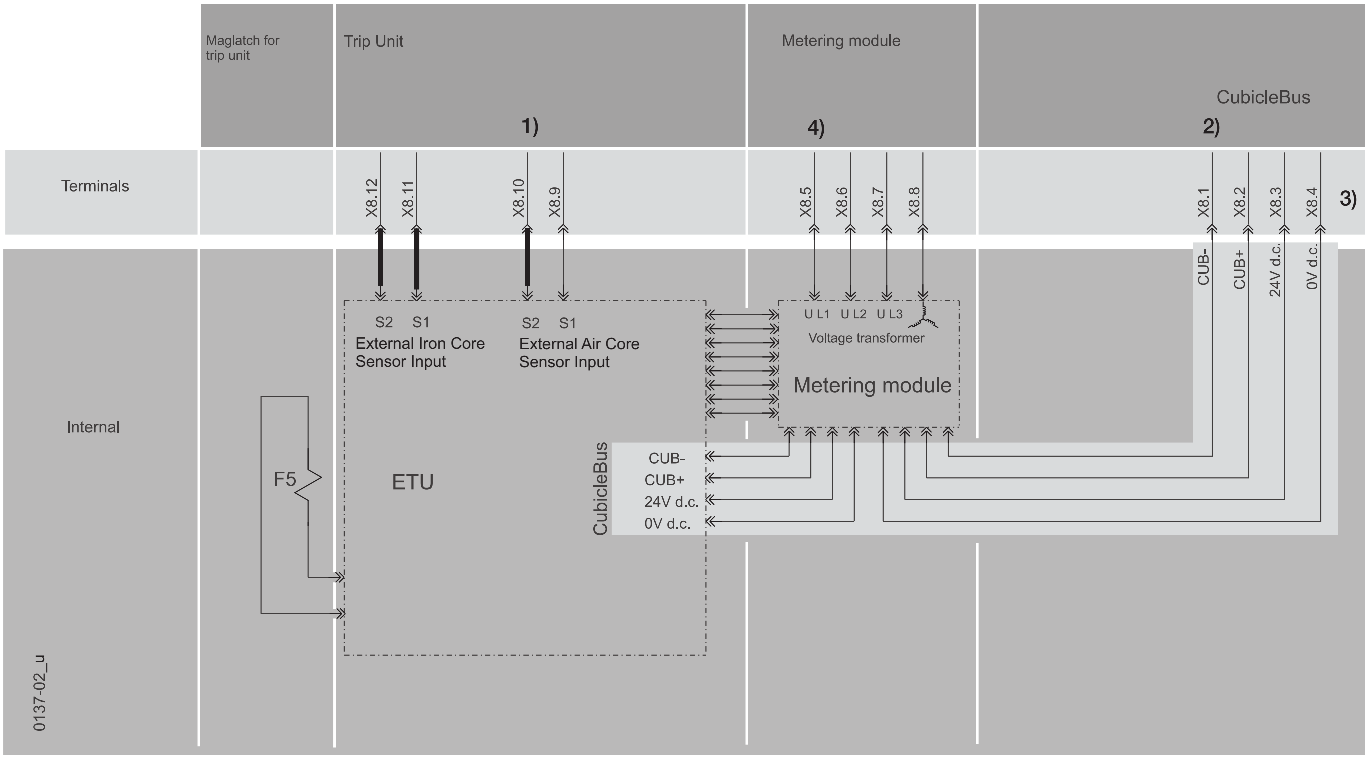
4) Connection to external voltage transformers

- BSS module: Breaker Status Sensor
- **Cubicle**BUS : Bus system for interconnection of circuit breaker components and COM modules
- ETU: Electronic Trip Unit
- S40 signaling switch "Ready-to-close"
- S41 signaling switch for spring charge level
- S43 signaling switch 2nd shunt trip F3 or F4
- S44 signaling switch for main contacts OPEN / CLOSE position
- S45 Bell Alarm signaling switch



*) same installation location as S23

8.7.2 Metering module only



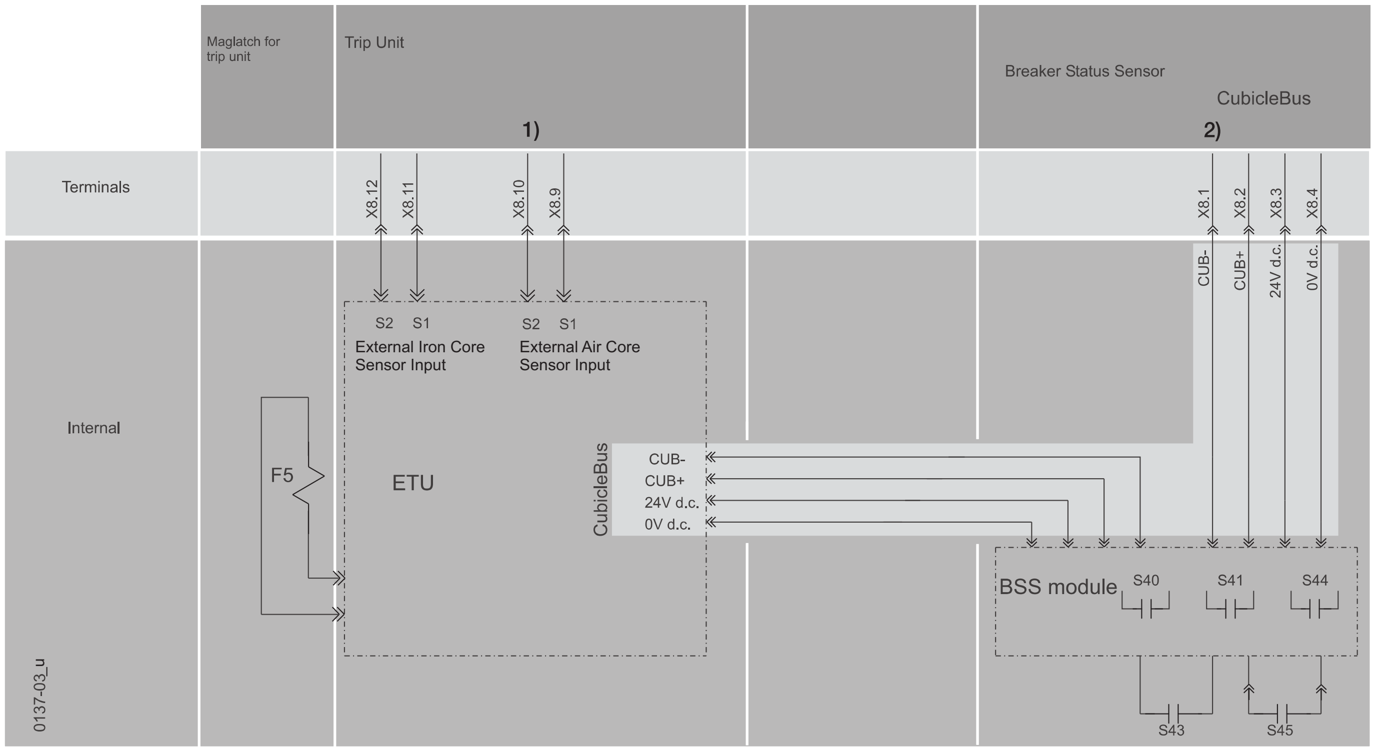
1) Jumper X8.9-X8.10 if there is no external N sensor

2) Terminating resistor 120 Ω, 0.5 W on X8-1 / X8-2, if no external **Cubicle**BUS - module is connected

3) If no metering module and no BSS module is used: Direct connection X8 to ETU

4) Connection to external voltage transformers

8.7.3 Breaker Status Sensor (BSS) only



1) Jumper X8.9-X8.10 if there is no external N sensor

2) Terminating resistor 120 Ω, 0.5 W on X8-1 / X8-2, if no external **Cubicle**BUS - module is connected

9 Electronic components

9.1 Trip units

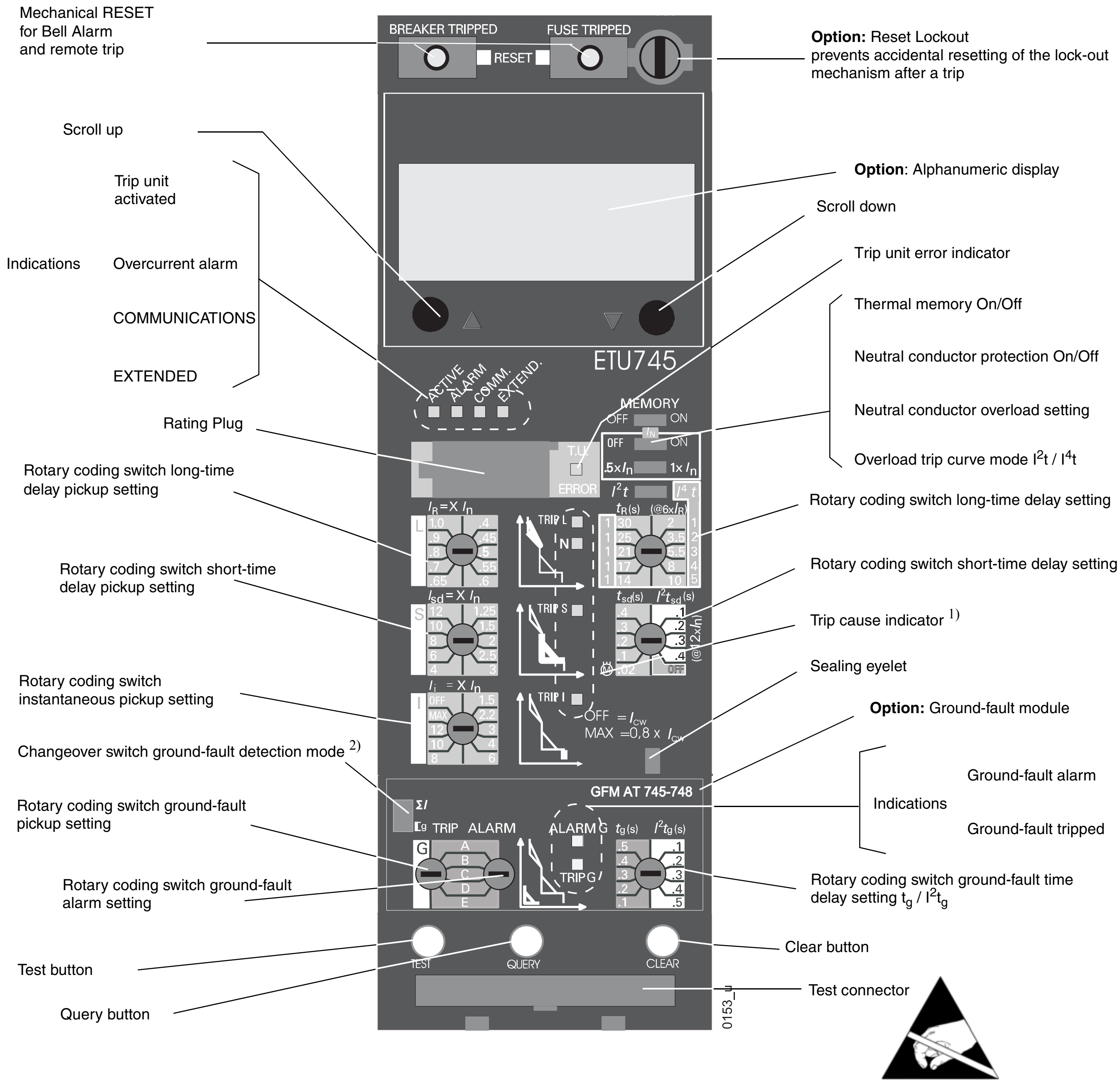
9.1.1 Overview of function

Functions	Trip Units ETU745 → (9-2)	 ETU776 → (9-7)
Basic protective functions → (page 9-11)		
Overload protection (L-tripping)	✓	✓
Short-time-delayed short-circuit protection (S-tripping)	✓	✓
Instantaneous short-circuit protection (I-tripping)	✓	✓
Neutral conductor protection (N-tripping)	✓	✓
ground-fault tripping	o	o
Additional functions → (page 9-13)		
Load monitoring	✓	✓
Pre-trip signal for long-time trip	✓	✓
Thermal memory can be switched on/off	✓	✓
Zone selective interlocking	o	o
Neutral conductor protection can be switched on/off	✓	✓
Short-time delayed short-circuit protection can be switched on/off	✓	✓
Instantaneous short-circuit protection can be switched on/off	✓	✓
Short-time delayed short-circuit protection switchable to I^2t	✓	✓
Overload protection switchable to I^4t	✓	✓
Changeable parameter sets	-	✓
Ground-fault protection to I^2t	o	o
Ground-fault alarm	o	o
Display → (page 9-17)		
Alphanumeric display	o	-
Graphical display (fixed-mounted)	-	✓
Communication		
Communication via **Cubicle**BUS	✓	✓
Communication via PROFIBUS DP	o	o
Communication via Modbus RTU	o	o
Communication via Modbus TCP	o	o
Communication via PROFINET IO	o	o
Metering function → (page 9-77)		
Metering function *PLUS*	o	o
Parameterization		
Parameterization via rotary coding switches	✓	-
Parameterization via communication (absolute values)	-	✓
Parameterization via menu (absolute values)	-	✓
Remote parameterization of basic protective functions	-	✓
Remote parameterization of additional functions	✓	✓
Other		
Option for connecting to an external 24 V DC power supply	✓	✓

✓ standard
o optional
- not available
1 fixed

9.1.2 Trip unit ETU745

Overview



1) The trip cause is stored internally for at least two days if the trip unit has been activated for at least 10 min before tripping (for unlimited time with auxiliary power).

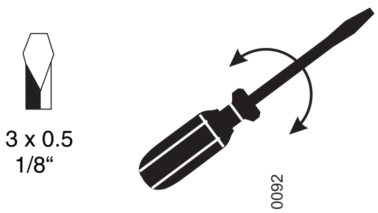
2) Changeover switch only accessible with removed module.

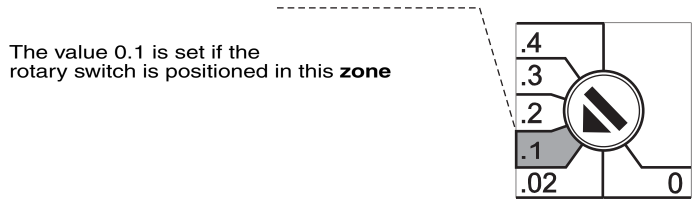
NOTICE
Electrostatic Discharge
Trip unit may become inoperative.
Before the protective cover is removed, ensure that the equipment to be connected, and also the operating personnel, are at the same potential.

Overcurrent protection settings

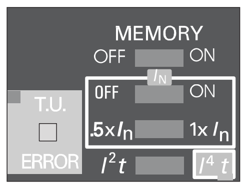
NOTICE
Circuit breaker may trip.
If the trip settings are changed while the breaker is closed (and under load) the breaker may trip.
Adjust parameters only when the circuit breaker is in the open position.

The parameters for the basic functions are adjusted with rotary coding switches.





Various additional functions are adjusted with slide switches.



The settings for the additional function "load monitoring" can be adjusted via:

- the alphanumeric display → (page 9-17)
- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2)

These settings can only be adjusted if the trip unit is activated, i.e. it must be connected to an external 24 V DC voltage supply (UL Listed Class 2).

Protective functions

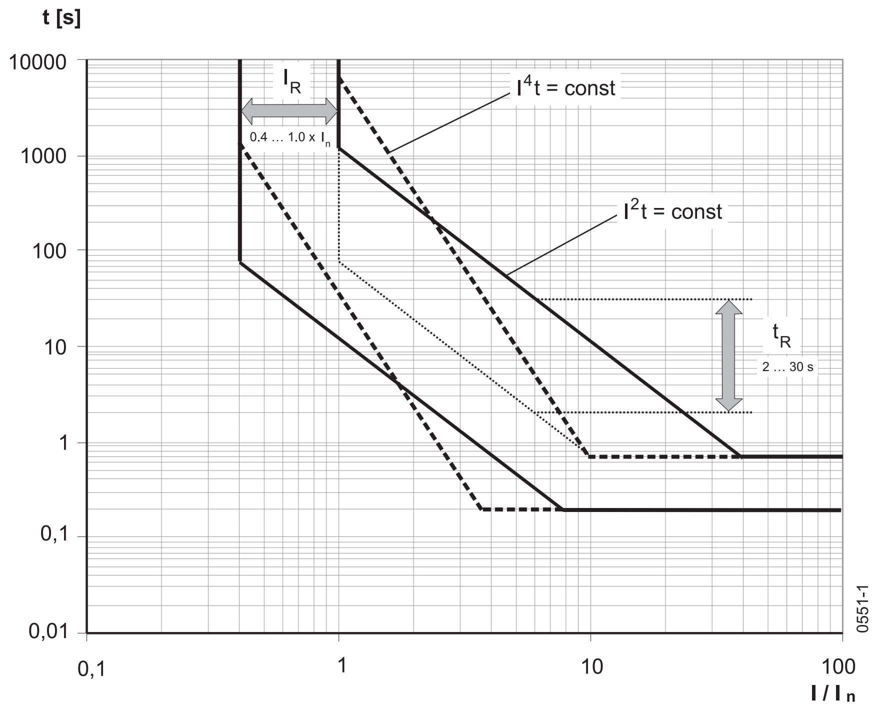
→ Overload protection – L-tripping (page 9-11)
→ Short-time delayed short-circuit tripping – S-tripping (page 9-11)
→ Instantaneous short-circuit tripping – I-tripping (page 9-12)
→ Ground-fault tripping – G-tripping (page 9-12)
→ Neutral conductor protection – N-tripping (page 9-13)
→ Load monitoring (load restore / load shedding) (page 9-13)
→ Leading signal for L-tripping (page 9-13)
→ Thermal memory can be switched On/Off (page 9-14)
→ Ground-fault protection modules (page 9-44)

Characteristics

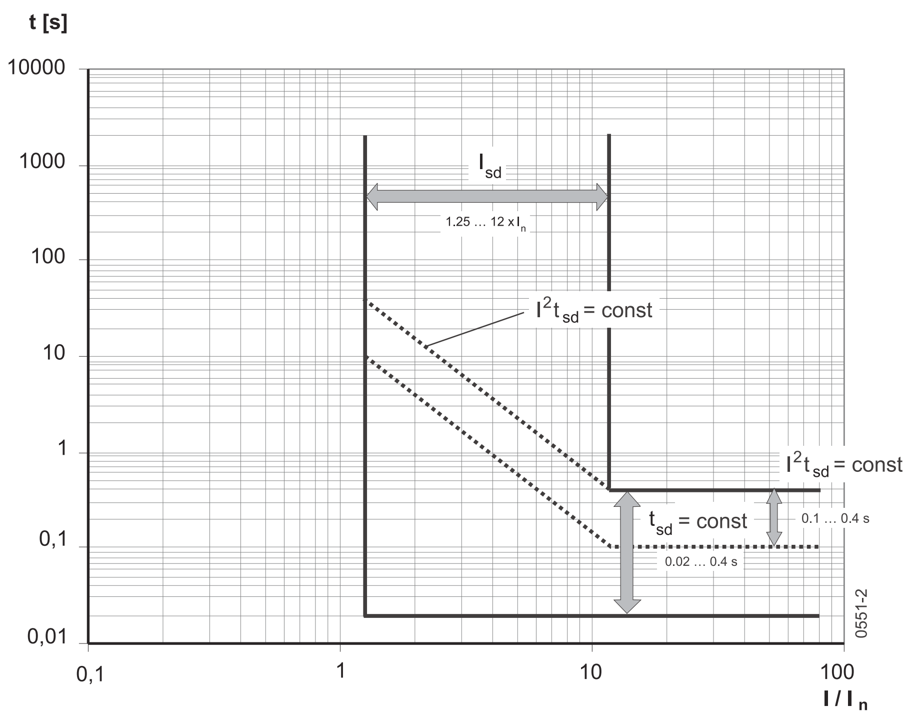
The ranges shown in the following are only setting ranges of the respective parameters. Possible tolerance ranges are not included here. Tolerance ranges are shown in the Easy TCC Time Current Curve Software.

The characteristics apply to the circuit breaker version H-class, 480 V, frame size II, with ground-fault protection module.

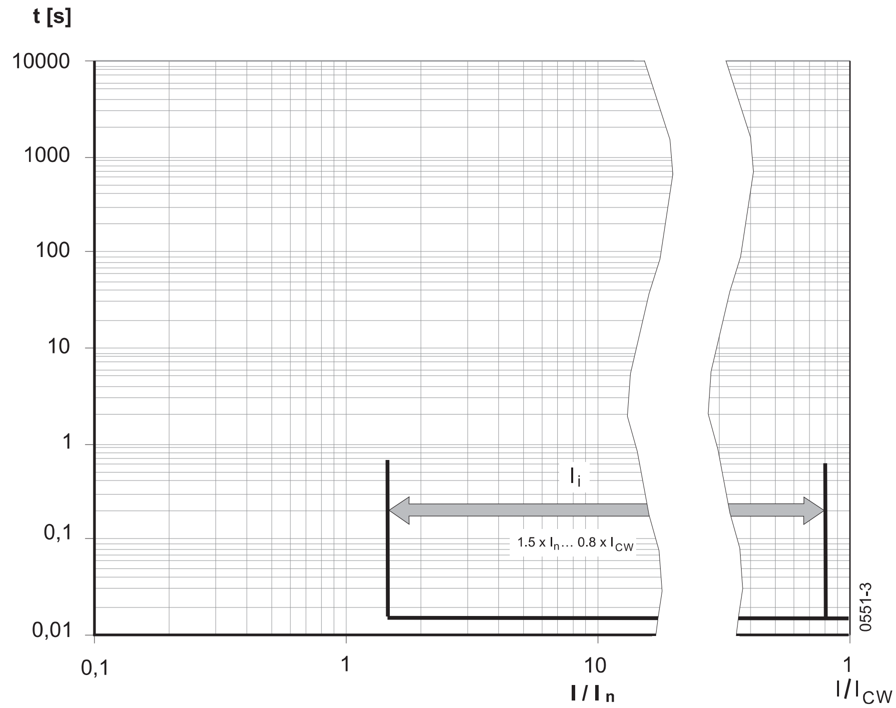
L-tripping



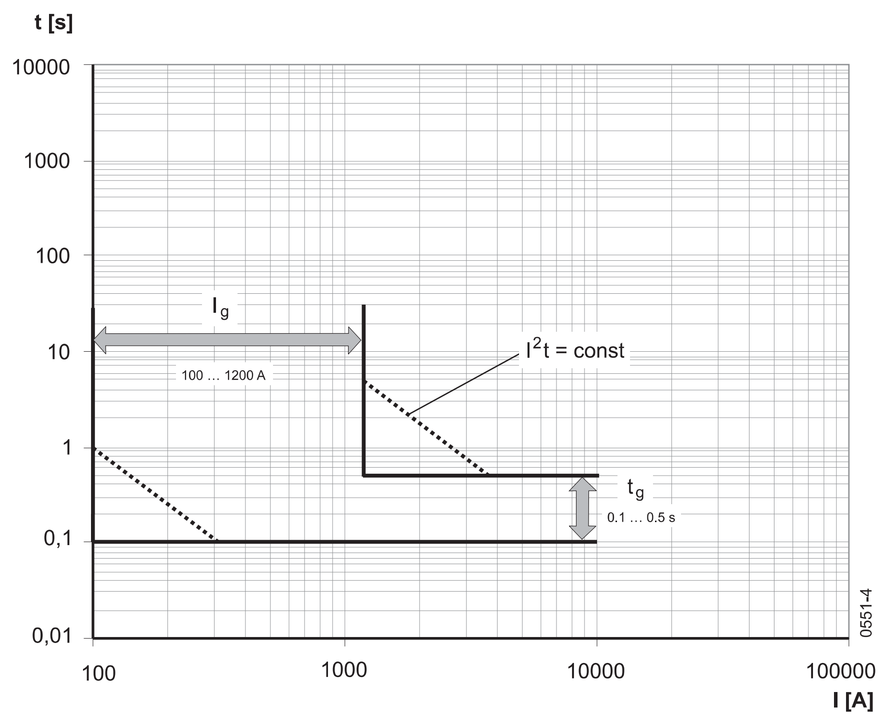
S-tripping



I-tripping



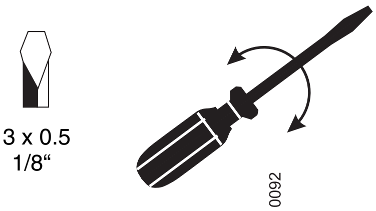
Ground-fault tripping

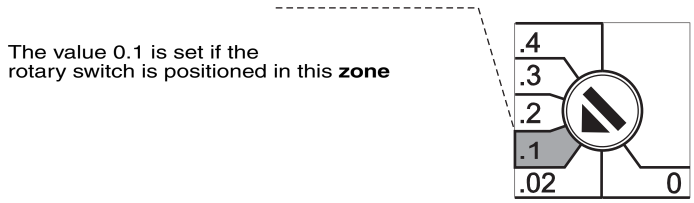


Overcurrent protection settings

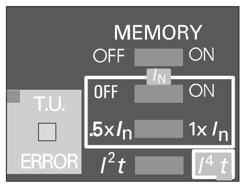
NOTICE
Circuit breaker may trip. If the trip settings are changed while the breaker is closed (and under load) the breaker may trip. Adjust parameters only when the circuit breaker is in the open position.

The parameters for the basic functions are adjusted with rotary coding switches.





Various additional functions are adjusted with slide switches.



The settings for the additional function "load monitoring" can be adjusted via:

- the alphanumeric display → (page 9-17)
- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2)

These settings can only be adjusted if the trip unit is activated, i.e. it must be connected to an external 24 V DC voltage supply (UL Listed Class 2).

Protective functions

→ Overload protection – L-tripping (page 9-11)
→ Short-time delayed short-circuit tripping – S-tripping (page 9-11)
→ Instantaneous short-circuit tripping – I-tripping (page 9-12)
→ Ground-fault tripping – G-tripping (page 9-12)
→ Neutral conductor protection – N-tripping (page 9-13)
→ Load monitoring (load restore / load shedding) (page 9-13)
→ Leading signal for L-tripping (page 9-13)
→ Thermal memory can be switched On/Off (page 9-14)
→ Ground-fault protection modules (page 9-44)

Characteristics

The ranges shown in the following are only setting ranges of the respective parameters. Possible tolerance ranges are not included here. Tolerance ranges are shown in the Easy TCC Time Current Curve Software. The characteristics apply to the circuit breaker version H-class, 480 V, frame size II, with ground-fault protection module.

L-tripping

→ (page 9-4)

S-tripping

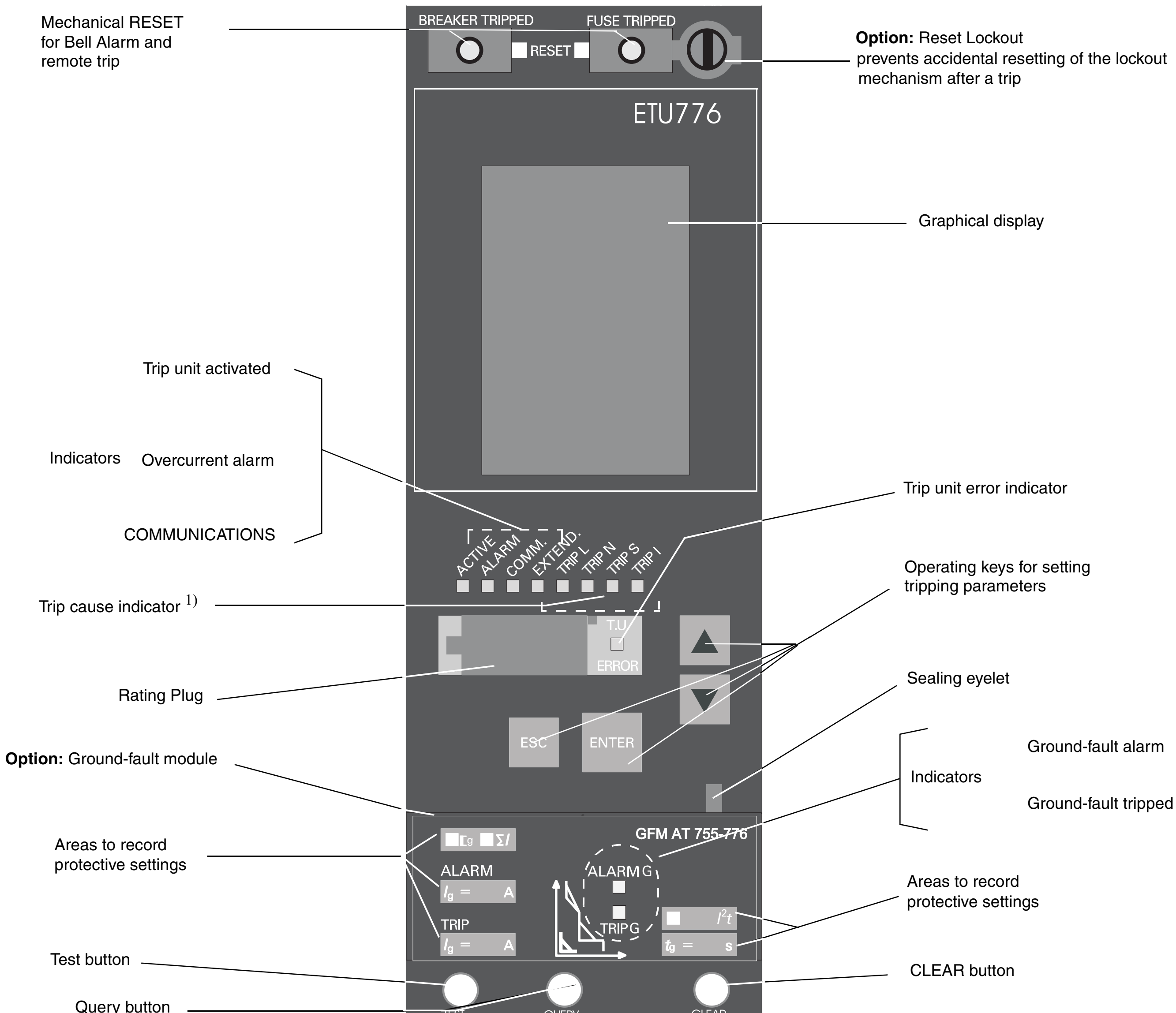
→ (page 9-4)

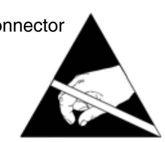
Ground-fault tripping

→ (page 9-5)

9.1.3 Trip unit ETU776

Overview





1) The trip cause is stored internally for at least two days if the trip unit has been activated for at least 10 min before tripping (for unlimited time with auxiliary power).

NOTICE
Electrostatic Discharge
Trip unit may become inoperative.
Before the protective cover is removed, ensure that the equipment to be connected, and also the operating personnel, are at the same potential.

Overcurrent protection settings

NOTICE
Circuit breaker may trip. If the trip settings are changed while the breaker is closed (and under load) the breaker may trip. Adjust parameters only when the circuit breaker is in the open position.

All parameters for the basic and the additional functions can be adjusted via:

- the graphical display → (page 9-28)
- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2)

To do this, the trip unit must be activated, i.e. it must be connected to an external 24 V DC voltage supply (UL Listed Class 2).

Protective functions

→ Overload protection – L-tripping (page 9-11)
→ Short-time delayed short-circuit tripping – S-tripping (page 9-11)
→ Instantaneous short-circuit tripping – I-tripping (page 9-12)
→ Ground-fault tripping – G-tripping (page 9-12)
→ Neutral conductor protection – N-tripping (page 9-13)
→ Load monitoring (load restore / load shedding) (page 9-13)
→ Leading signal for L-tripping (page 9-13)
→ Thermal memory can be switched On/Off (page 9-14)
→ Ground-fault protection modules (page 9-44)

Characteristics

The ranges shown in the following are only setting ranges of the respective parameters. Possible tolerance ranges are not included here. Tolerance ranges are shown in the Easy TCC Time Current Curve Software.

The characteristics apply to the circuit breaker version H-class, 480 V, frame size II, with ground-fault protection module.

L-tripping

→ (page 9-4)

I-tripping

→ (page 9-5)

Ground-fault tripping

→ (page 9-5)

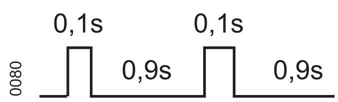
9.1.4 Indicators

Scope of indications depends on the type of trip unit.

<table>
<tr>
<td>Trip unit is activated

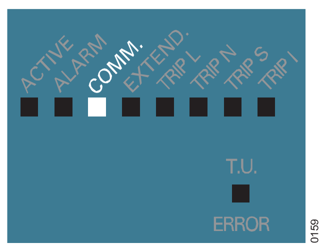
$I > I_{min}$
- or when 24 V auxiliary power is applied.

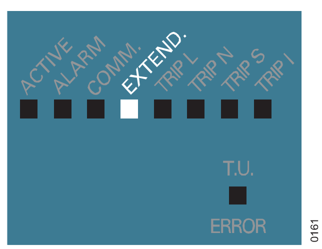
I_{min}:
- 80 A for frame size II
- 150 A for frame size III</td>
<td>

Flashing LED

</td>
</tr>
<tr>
<td>Overcurrent alarm

- Steady LED, if

$I \geq I_R$</td>
<td>
</td>
</tr>
<tr>
<td>Communication active

- Another CublicleBUS module has been recognized and communication started.</td>
<td>
</td>
</tr>
<tr>
<td>Extended protective function has tripped

- due to metering function
- trip cause saved in event memory
- trip cause readable via:
* TD400 and the software "powerconfig"
* the COM modules with a PC with the software “powerconfig” installed
→ (page 29-2)
* graphical display (ETU776)
* external digital output modules</td>
<td>
</td>
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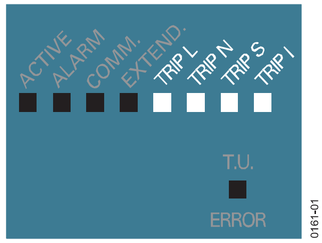
</table>

<table>
<tr>
<td>

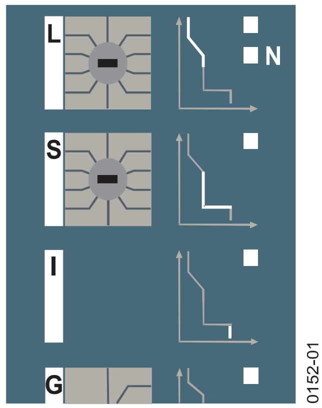
Protective function has tripped (overcurrent)

- Indicator lights up when the Query button is pressed
- Only one trip cause is displayed
- Only the last trip cause is displayed

</td>
<td>



or



</td>
</tr>
<tr>
<td>

LED T.U. ERROR

1. T.U. Error flashes:

Limited protective function, the protective parameters are reset to minimum values.

Causes:

- Rated current of the Rating Plug is higher than that of the circuit breaker
- Rotary coding switch in undefined intermediate position
- Trip unit defective

2. T.U. Error lights up continuously:

Protective function not available.

Causes:

- Rating Plug not compatible with circuit breaker type
- Trip unit defective

</td>
<td>

</td>
</tr>
</table>

9.1.5 Protective functions

9.1.5.1 Basic protective functions

The basic protective functions of the trip unit are ensured without additional auxiliary voltage. The required energy is supplied by the circuit breaker's internal energy transformers.

To evaluate the currents, the electronic system of the trip unit calculates the r.m.s value.

The individual functions are parameterized according to the types via:

- rotary coding switch (ETU745)
- electronic data transfer (ETU776) via:
  - TD400 and the software "powerconfig"
  - the COM modules with a PC with the software “powerconfig” installed → (page 29-2)
- the control board (ETU776)

Overload protection – L-tripping

The current setting I_R defines the maximum continuous current the circuit breaker can carry without tripping. The long-time delay t_R determines the maximum duration of an overload without tripping.

Setting values for I_R	
ETU745	I_R = (0.4 / 0.45 / 0.5 / 0.55 / 0.6 / 0.65 / 0.7 / 0.8 / 0.9 / 1.0) x I_n
ETU776	I_R = (0.4 - 1.0) x I_n (given in Amps)

Setting values for t_R	
ETU745	t_R = 2 / 3.5 / 5.5 / 8 / 10 / 14 / 17 / 21 / 25 / 30 sec. (at 6 x I_R)
ETU776	t_R = 2 - 30 sec. (at 6 x I_R)

The tripping characteristic is an I^2t characteristic. Some trip units can be switched over to an I^4t characteristic.
→ (page 9-14)

Short-time delayed short-circuit tripping – S-tripping

On trip units ETU745 - 776, tripping due to the short-circuit current I_{sd} can be delayed by the time t_{sd}.

This provides selectivity for short-circuit protection in switchgear with several grading levels.

Setting values for I_{sd}	
ETU745	I_{sd} = (1.25 / 1.5 / 2 / 2.5 / 3 / 4 / 6 / 8 / 10 / 12) x I_n
ETU776	I_{sd} = 1.25 x I_n - 0.8 x I_{CW} (given in Amps)

Setting values for t_{sd}	
ETU745	t_{sd} = 0.02(M)[1)] / 0.1 / 0.2 / 0.3 / 0.4 sec.; OFF
ETU776	t_{sd} = 0.02(M)[1)] / 0.08 - 4 sec.[2)]; OFF

1) The delay time 0.02 sec. is not an I^2t function.
The motor protection function is activated in this position.

2) For settings t_{sd} >0.4 sec., the maximum possible setting I_{sd} is reduced automatically according to the frame size:
Frame size I : 15 kA
Frame size II : 20 kA
Frame size III : 30 kA

The setting "OFF" for trip units ETU745 and ETU776 is provided to deactivate the short-time delayed short-circuit protection.

If the zone selective interlocking (ZSI) → (page 9-14) is used and the ZSI module is set to "S" or "S+G" the adjusted delay time t_{sd} is automatically set to 50 ms provided that in the event of short-circuit the circuit breaker does not receive a blocking signal from a downstream circuit breaker. In this case regardless of the adjusted t_{sd} value the circuit breaker will trip after 50 ms.

If a blocking signal exists the adjusted delay time tsd is valid. For safety reasons after 3 s the blocking signal is terminated.

Some trip units can be switched over to an I^2t-characteristic. → (page 9-15)

Motor protection function

When the short-time delay is set to 20ms (t_{sd} = Ⓜ 0.02 sec.), a special motor protective function is enabled which prevents short-time tripping during the turn-on inrush for motors. At the same time, a phase loss sensing function is enabled → (page 9-13) and the thermal time constant used for long-time protection is changed from one suitable for bus protection to one suitable for motor protection.

Instantaneous short-circuit tripping – I-tripping

If the current setting I_i is exceeded, the circuit breaker is tripped instantaneously.

Setting values for I_i	
ETU745	OFF: $I_i = I_{CW}$ $I_i = (1.5 / 2.2 / 3 / 4 / 6 / 8 / 10 / 12 \times I_n$ MAX = 0.8 x I_{CW}
ETU776	$I_i = 1.5 \times I_n - 0.8 \times I_{cs}$; OFF : $I_i = I_{CW}$

Ground-fault tripping – G-tripping

If the trip unit is equipped with a ground-fault protection module, loads can be protected against impermissibly high ground-fault currents.

Trip units ETU745 - 776 can be equipped with it optionally. → Ground-fault protection modules (page 9-44)

The response value I_g, together with the setting for the delay time t_g, determines the shutdown of ground-fault currents.

Setting values for I_g		
	Frame size	
	I & II	III
A	100 A	400 A
B	300 A	600 A
C	600 A	800 A
D	900 A	1000 A
E	1200 A	1200 A

Setting values for t_g	
ETU745	t_g = 0.1 / 0.2 / 0.3 / 0.4 / 0.5 sec.
ETU776	t_g = 0.1 - 2.0 sec.

If the zone selective interlocking (ZSI) → (page 9-14) is used and the ZSI module is set to "S" or "S+G" the adjusted delay time t_g is automatically set to 100 ms provided that in the event of ground-fault the circuit breaker does not receive a blocking signal from a downstream circuit breaker. In this case regardless of the adjusted t_g value the circuit breaker will trip after 100 ms.

If a blocking signal exists the adjusted delay time t_g is valid. For safety reasons after 3 s the blocking signal is terminated. Some trip units can be switched over to an I^2t-characteristic.

Neutral conductor protection – N-tripping

Trip units ETU745 - 776 also make it possible to protect the neutral conductor against overload. This requires a current transformer for the neutral conductor, which can be retrofitted if necessary. → (page 9-97)

For tripping, the same long-time delay t_R applies as for overload tripping.

Setting values for I_N	
ETU745	$I_N = (0.5 / 1.0) \times I_n$; OFF
ETU776	$I_N = (0.2 - 2.0) \times I_n$; OFF

NOTICE

Neutral Conductor Overheating.

Neutral conductor or insulation may be damaged.

Settings $I_N > 1 \times I_n$ should only be used if the neutral conductor has been properly sized.

9.1.5.2 Additional functions

Load monitoring (load restore / load shedding)

Trip units ETU745 - ETU776 offer the possibility of additional load monitoring. Two current values, "load shedding" and "load restore", as well as a delay time t_x, can be set.

If the setting value "load restore" is undershot, and the lower limit value for current transmission is exceeded at the same time, a signal is output by the **Cubicle**BUS after the set delay time t_x has elapsed. If the setting value "load shedding" is exceeded, a signal is output by the **Cubicle**BUS after the set delay time t_x has elapsed. These signals can be used to connect or disconnect loads, thereby preventing an overload tripping of incoming circuit breakers.

Setting values for load monitoring	
"Load shedding" and "load restore"	40 A - 1.5 x I_n
Delay time	t_x = 1 - 15 sec.

Load monitoring can be adjusted via:

- the alphanumeric display (ETU745)
- the graphical display (ETU776)
- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2)

Leading signal for L-tripping

Trip units ETU745 - 776 provide a leading signal for "L-tripping", which is transmitted via the **Cubicle**BUS 100 milliseconds before overload tripping. In this way it is possible e.g. to disconnect thyristor controllers.

Phase loss sensing

When phase loss sensing is active and the load current on the least-loaded phase is at least 50% below that of the highest loaded phase, the long-time pickup value I_R is automatically reduced to 80% of its set value. This is designed to prevent overheating conditions in motor loads when a single phase of voltage is lost and the motor is operating on 2 phases. If the highest and lowest load phase currents return to differing by less than 50%, I_R returns to its set value.

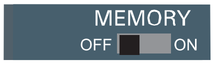
In the trip unit ETU776, phase loss sensing can be activated independently from the motor protection t_{sd} setting of 20ms.

Thermal memory can be switched On/Off

Trip units ETU745 - 776 make it possible to continue with the internally calculated reproduction of the thermal processes in downstream switchgear and consumers even if the circuit breaker is open and the electronic system has no external supply. In this way, an effective protection against thermal overload can also be guaranteed for frequent closing and opening processes.

The thermal memory can be activated via:

- a slide switch (ETU745)



- the graphical display (ETU776)
- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2).

Zone selective interlocking

If the circuit breaker is combined with a ZSI module → (page 9-87), a short-circuit occurring in systems with several grading levels can be precisely localized.

For this purpose, all circuit breakers are interconnected through their ZSI-modules.

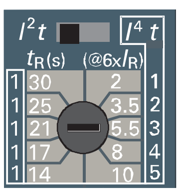
When a short-circuit occurs, each circuit breaker affected by the short-circuit current queries its downstream circuit breaker to determine whether the short-circuit is also present in the next downstream grading level. In the direction of the energy flow, only the circuit breaker nearest to the short-circuit is tripped. A delay time which may have been set for the short-circuit tripping is deactivated. However, tripping takes place after 50 milliseconds at the earliest.

Overload protection switchable to I^4t

The trip units ETU776 and ETU745 can be set to perform long-time protection using either I^2t or I^4t. I^4t will yield faster tripping times and will improve coordination with many types of fuses. The ETU745 can be switched between the two modes via a slide switch and the ETU776 via a menu setting.

In this case, the setting options for the long delay time t_R change as follows:

Setting values for t_R	
ETU745	t_R = 1 / 2 / 3 / 4 / 5 sec. (at 6 x I_R)
ETU776	t_R = 1- 5 sec. (at 6 x I_R)



Short-time delayed short-circuit protection switchable to I^2t

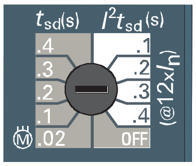
Trip units ETU745 - 776 make it possible to switch over from a constant delay time to an I^2t-characteristic. In this way, the delay time depends on the short-circuit current, but with a constant I^2t_{sd}-value, providing better coordination with downstream fuses.

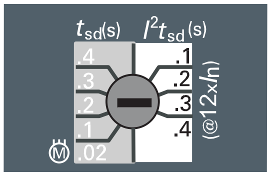
In this case, the setting options for the short-time delay t_R are as follows:

Settings for t_{sd}	
ETU745	t_{sd} = 0.1 / 0.2 / 0.3 / 0.4 sec. (at 12 x I_n)
ETU776	t_{sd} = 0.1 - 0.4 sec. (at 12 x I_n)

Switchover to the I^2t_{sd} characteristic can be made via:

- the t_{sd} rotary coding switch (ETU745); this must be set to a value in the white area.





- the graphical display (ETU776)
- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2).

Changeable parameter sets

The trip unit ETU776 contains two complete sets of protective parameters and can be switched between them locally or remotely. This enables lowering instantaneous and short-time settings for arc flash mitigation as well as changing parameters when the source of supply changes between utility and generator.

Switching between parameter sets can be made manually via:

- the graphical display (ETU776)

or remotely via:

- the **Cublicle**BUS with an input signal at the digital input module.
- the PROFIBUS DP
- the PROFINET IO, Modbus TCP and Modbus RTU.

Ground-fault protection switchable to I^2t characteristic

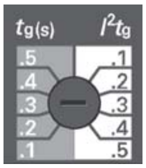
The ground-fault protection modules for trip units ETU745 - 776 make it possible to switch over from a constant delay time to an I^2t characteristic.

This provides an inverse-time tripping characteristic with a constant I^2t_g value, providing better selectivity of the ground-fault protection in systems with several grading levels.

The setting options for the delay time remain unchanged.

Switchover to the I^2t_g characteristic can be made via:

- the t_g rotary coding switch (ETU745);
  this must be set to a value in the white area.



- the graphical display (ETU776)
- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2).

Ground-fault alarm

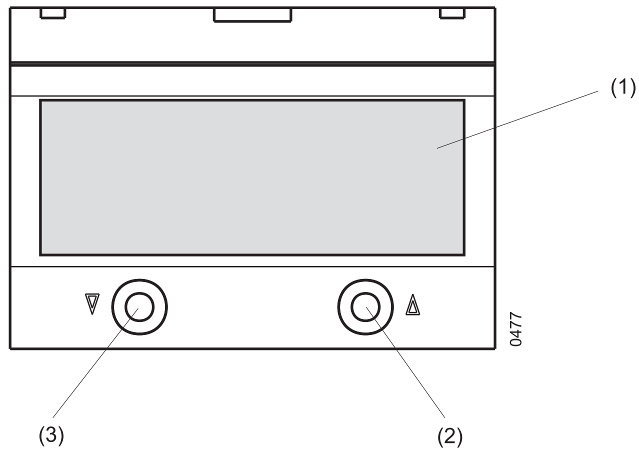
→ Ground-fault protection modules (page 9-44)

9.1.6 ETU displays

9.1.6.1 Alphanumeric display

Trip units ETU745 can be fitted with an alphanumeric display.

Overview



(1) Screen (4 lines with 20 characters each)
(2) Up key
(3) Down key

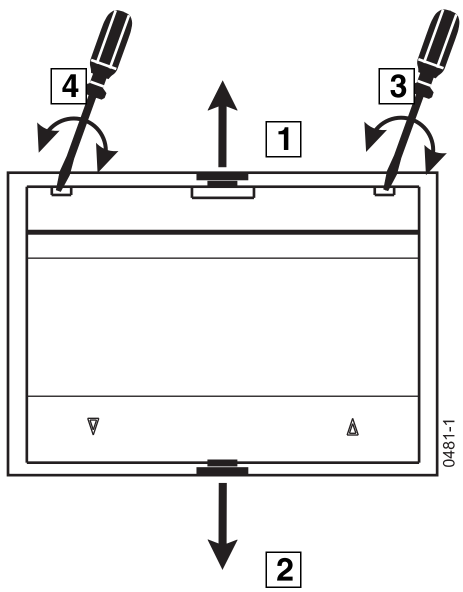
Field installation

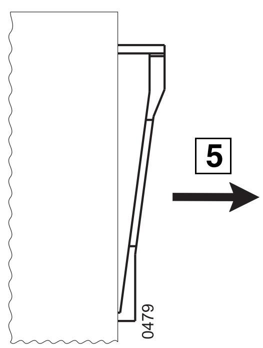
The trip units ETU745 can be field installed with an alphanumeric display.

	**DANGER**
	**Hazardous voltage.** **Will cause death, serious personal injury, or equipment damage.** Turn off and lock out all power supplying this equipment before working on this device.

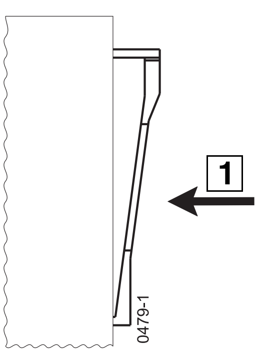
- OPEN circuit breaker and discharge the closing spring → (page 24-2)
- Disconnect external 24 V DC voltage supply, if applicable
- Remove sealing cap of trip unit, if applicable → (page 9-53)

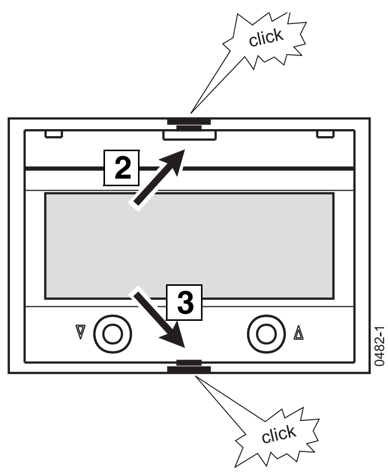
Removing dummy flange





Installing display and latching it tight





- Fit and seal trip unit sealing cap, if applicable → (page 9-53)
- Reconnect external 24 V DC voltage supply, if applicable

Modifying the angle of the display

At the factory, the alphanumeric display is installed with a downward inclination. However, it can be turned in a vertical direction by 180°, the display is then inclined upwards.

DANGER

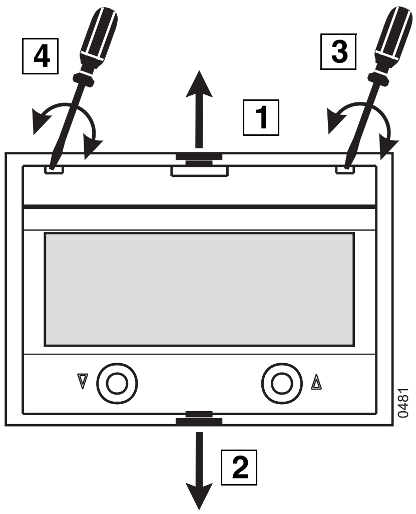
Hazardous voltage.

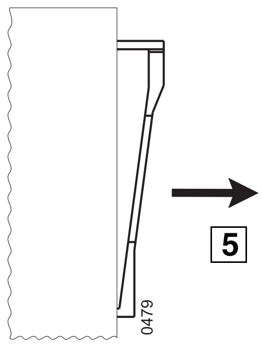
Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

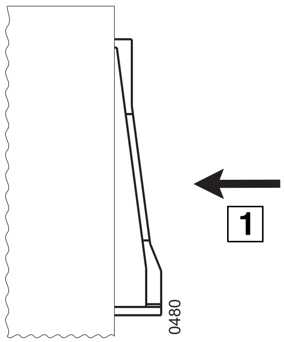
- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Disconnect external 24 V DC voltage supply, if applicable
- Remove trip unit sealing cap, if applicable → (page 9-53)

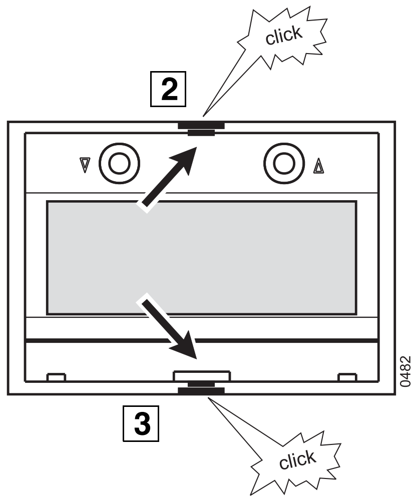
Removing the display





Turn the display through 180°, insert and lock it into place





- Fit and seal the trip unit sealing cap, if applicable → (page 9-53)
- Reconnect external 24 V DC voltage supply, if applicable

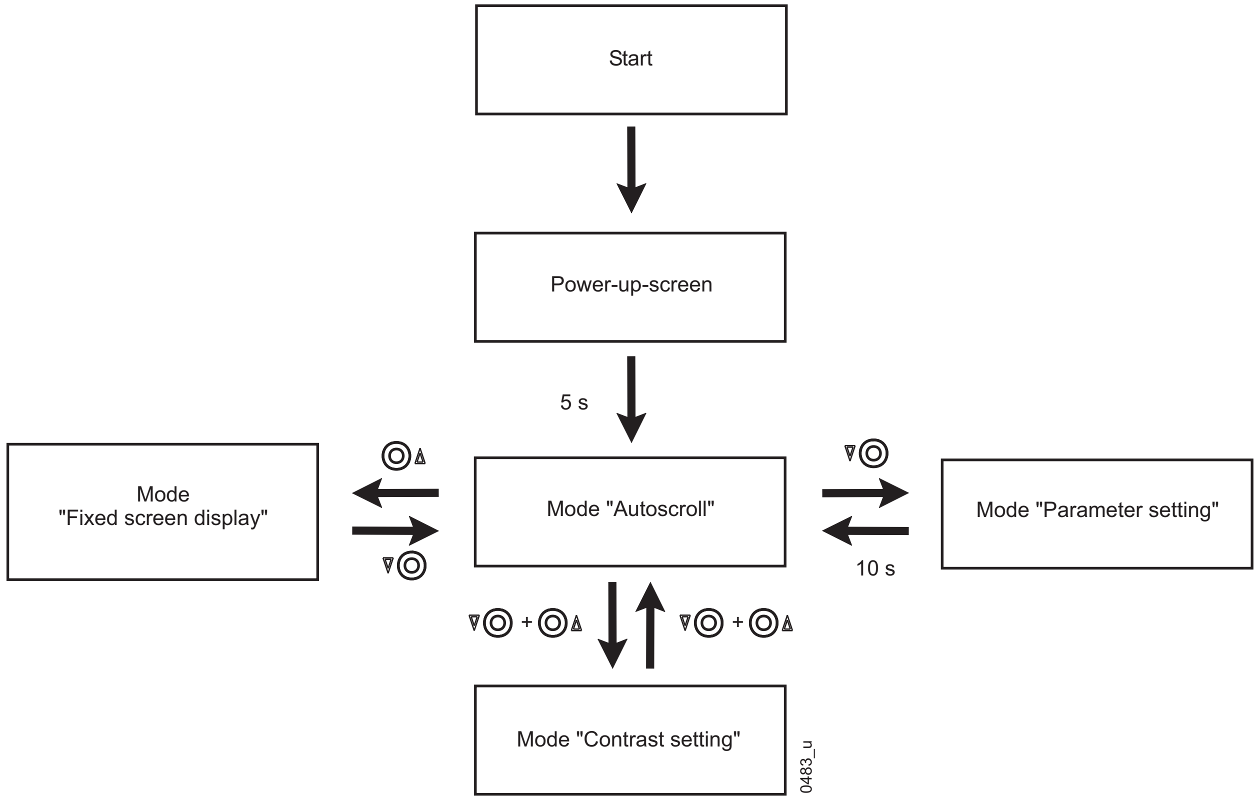
Catalog number

	Catalog No.
Alphanumeric display for ETU745	WLLCD48

Menu structure ETU745

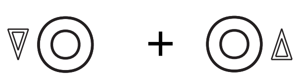
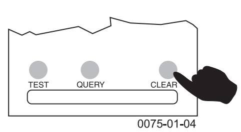
After the supply voltage has been applied, the display changes from "Power-up screen" to "Autoscroll" mode after about 5 sec. Thereafter, further modes can be accessed by means of the two buttons.

Overview



"Autoscroll" mode

During normal operation, the display is in "Autoscroll" mode

To access "Autoscroll" mode, press the following button(s)	
In "Fixed screen display" mode	
In "Tripping counter reset" mode	 or 
In "Contrast setting" mode	
In "Parameter setting" mode	Do not press any button for 10 seconds
In "Tripping info" mode	

In this mode, the display automatically changes to the next screen every 5 seconds.

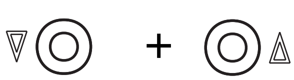
If there is no metering module installed, the display changes continuously back and forth between screens 1 and 2.

If there is a metering module installed, a total of five screens are displayed in "Autoscroll" mode.

Screens displayed in "Autoscroll" mode	
without metering module	
Screen 1 I1....=......00000.A I2....=......00000.A I3....=......00000.A IN....=......00000.A	Current I_1 Current I_2 Current I_3 Current I_N
Screen 2 Ig....=......00000.A	Ground-fault current I_g (A value is only displayed if a ground-fault protection module is fitted.)
with metering module installed, additionally	
Screen 3 KW...=.±..00000.kW KVA..=....00000.kVA KVAR.=.±..00000.kVAR PF...=.±..0,000.xxxx	Active power P Apparent power S Reactive power Q Power factor
Screen 4 V12.=.........0000.V V23.=.........0000.V V31.=.........0000.V	Voltage V_{12} Voltage V_{23} Voltage V_{31}
Screen 5 W.↑.=...00000,00.MWh W.↓.=...00000,00.MWh PowerFlowDir.......↑ f...=.......00,0 Hz	Energy (positive direction) Energy (negative direction) Present direction of energy flow Frequency

NOTE

The data to be displayed are updated every time the screen page is set up again. No updates take place when a screen page is being displayed.

Button functions in "Autoscroll" mode	
	Display is frozen; Switchover to "Fixed screen display" mode
	Change to "Parameter setting" mode
	Change to "Contrast setting" mode

Mode "Fixed screen display"

To access "Fixed screen display" mode, press the following button:	
In "Autoscroll" mode	

In this mode, maintenance information is provided with the number of circuit breaker trips and electrical open/close operations as well as with maintenance instructions. The information displayed depends on the number of circuit breaker trips operations.

Num.of.Trips...00000 Num.of.Ops.....00000	Number of trips Number of open/close operations
Num.of.Trips...00000 Num.of.Ops.....00000 Prepare for contact maintenance	Number of trips Number of open/close operations Maintenance instructions

Button functions in "Fixed screen display" mode	
	Change to next higher screen level
	Change to "Autoscroll" mode
+	Change to "Tripping counter reset" mode

"Tripping counter reset" submode

This mode makes it possible to reset the counter for the trips and the open/close operations to zero.

NOTE

The counter should only be reset after contact maintenance.
If the counter is reset without contact maintenance having been performed, the maintenance information displayed will not correspond to the actual condition of the contacts.

To access "Tripping counter reset mode", press the following button(s)	
In the "Fixed screen display" mode	+

Screens displayed in "Tripping counter reset" mode	
Screen 1 Reset.Trips.and.Ops Counter? yes:.↑+↓ no:.↑.or.↓	This screen is used for safety queries. Reset the counter after contact maintenance only.

Screens displayed in "Tripping counter reset" mode	

Screen 2
`Trips.and.Ops`
`Counter.reset`
`continue:.↑.or.`
	Counter reset for trips and open/close operations confirmed.

Button functions in "Tripping counter reset" mode	
If screen 1 is displayed	
 or 	Canceling, no counter reset to zero Change to "Autoscroll" mode
 + 	Counter reset to zero Change to screen 2
If screen 2 is displayed	
 or 	Change to "Autoscroll" mode

"Parameter setting" mode

NOTICE
Circuit breaker may trip. If the trip settings are changed while the breaker is closed (and under load) the breaker may trip. Adjust parameters only when the circuit breaker is in the open position.

In this mode, the following parameters can be adjusted:

- load shedding
- load restore
- delay time for load shedding/load restore
- language setting for display

To access "Parameter setting" mode, press the following button(s):	
In "Autoscroll" mode	

Screens displayed in "Parameter setting" mode	

Screen 1
`Change Parameters`
`Load.Shed..=.0000.A`
`↑=+ ↓=-`
`↑.und.↓=Confirm`
	Setting
	Load shedding

Screen 2
`Change Parameters`
`Load.Restore=.0000.A`
`↑=+ ↓=-`
`↑.und.↓=Confirm`
	Setting
	Load restore

Screen 3
`Change Parameters`
`tx.........=...00.s`
`↑=+ ↓=-`
`↑.und.↓=Confirm`
	Setting
	Delay time
	Load shedding/load restore

Screen 4
`Change Parameters`
`Sprache/Lang=...XXXX`
`↑=+ ↓=-`
`↑.und.↓=Confirm`
	Setting
	Display language
	XXXX may be ENGL or GERM

Screen 5
`Changed.Parameter`
`being.saved,`
`wait.10s`
	Parameter settings are being changed, switches to "Auto-scroll" mode after 10 seconds

NOTE
When screen 1, 2, 3 or 4 is displayed and no key is pressed within 10 seconds, "Parameter setting" mode is canceled. Any parameter changes performed are not accepted. Display switches back to "Autoscroll" mode

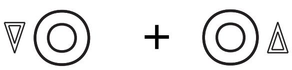
"Contrast setting" mode

In this mode, the contrast of the display can be adjusted.

To access "Contrast setting" mode, press the following button(s):	
In "Autoscroll" mode	

Screens displayed in "Contrast setting" mode	

Screen 1
`Contrast Adjust`
`███████`
`0     50      100 %`
`↑ +  ↓ -     ↑↓ Enter`
	Contrast setting
	The longer the bar, the higher the contrast

Button functions in "Contrast setting" mode	
	Increases the contrast
	Reduces the contrast
	Accept the contrast, switch to the "Autoscroll" mode

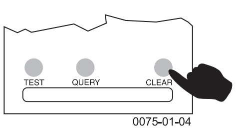
"Tripping info" screen

This mode will automatically be activated as soon as a trip occurs, provided an external 24 V DC voltage supply has been connected.

Screens displayed in "Tripping info" mode	

`Trip.Cause........XX`
`Tripped.Phase.....YY`
`TripCurrnt.000000.A`
	Tripping type
	Phase affected
	XX may be:
	L, S, I, G, N, M[1)]
	YY may be:
	L1, L2, L3,

1) Metering function

Button functions in "Tripping info" mode	
 or 	Display of maintenance instructions If pressed again: Switches back to "Tripping info" mode
	Press CLEAR button Switches to "Autoscroll" mode

"Display parameter changes" screen

The display automatically switches to this mode when a parameter has been changed via the rotary coding switches, provided an external 24 V DC voltage supply has been connected.

Screens displayed in "Display parameter changes" mode	
Parameter changed: XXXXXX.=...000000.YY	Display of the changed value

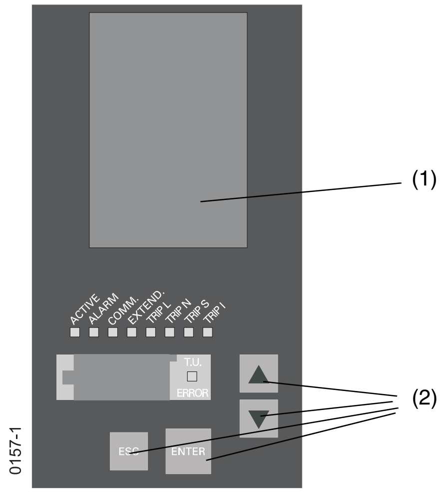
Displayed technical data and units	
Changed data	**Unit**
IR.....=....00000.YY	A
ISD....=....00000.YY	A
Ii.....=....00000.YY	A
IN.....=....00000.YY	A
Ig.....=.....0000.YY	A
Ig.alarm.=...0000.YY	A
tg.....=......000.YY	ms
I^2tg..=......000.YY	ms
I^2tR..=......000.YY	s
I^4tR..=........0.YY	s
tSD....=......000.YY	ms
I^2tSD.=......000.YY	ms
th.mem.=.........YYY	..
IR	Current for overload tripping
ISD	Current for short-time delayed short-circuit tripping
Ii	Current for instantaneous short-circuit tripping
IN	Current for overload protection of the N conductor
Ig	Current for ground-fault protection tripping (this is only displayed if ground-fault protection module is available)
Ig.alarm	Response current for ground-fault protection alarm indicator (this is only displayed if a ground-fault protection module is installed)
tg	Delay time for ground-fault protection (this is only displayed if a ground-fault protection module is installed)
I^2tg	Inverse-time delay (I^2t-dependent) of ground-fault protection (this is only displayed if a ground-fault protection module is installed)
I^2tR	Inverse-time delay (I^2t-dependent) for overload tripping
I^4tR	Inverse-time delay (I^4t-dependent) for overload tripping
tSD	Delay time for short-circuit tripping
I^2tSD	Inverse-time delay (I^2t-dependent) for short-circuit tripping
th.mem	Indicates whether thermal memory is On/Off

Button functions in "Display parameter changes" mode
The changed value is displayed for 4 seconds. The display then switches back to the previous mode.

9.1.6.2 Graphical display

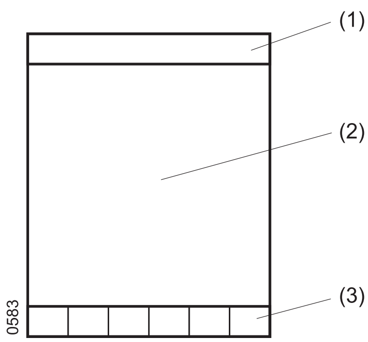
The ETU776 trip unit equipped with a fixed-mounted graphical display as standard. This display enables a text output with a maximum of 8 lines or the graphical representation of characteristics.

It is used both to display data as well as to parameterize the trip unit and the metering function. The display is operated via the operating keys provided on the trip unit.



(1) Graphical display
(2) Operating keys

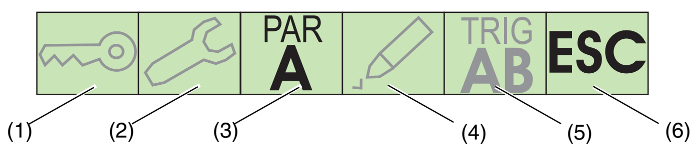
Display overview



(1) Menu title
(2) 8-line alphanumeric display or graphical representation of characteristics
(3) Status line

Status line

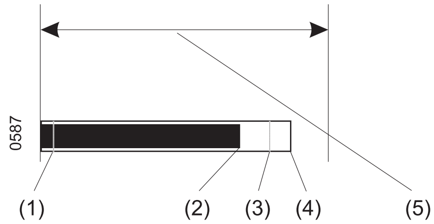
The status line shows, by means of bold symbols, which actions the operator can carry out and which settings are currently active at this moment.



(1) Access with password only
(2) Maintenance required
(3) Set parameter set for protective functions
(4) Editing option
(5) Set trigger
(6) Possible actions by the operator

Representation of bar diagrams

The measured values for some parameters are displayed both as numerical values and graphically in the form of a bar diagram.

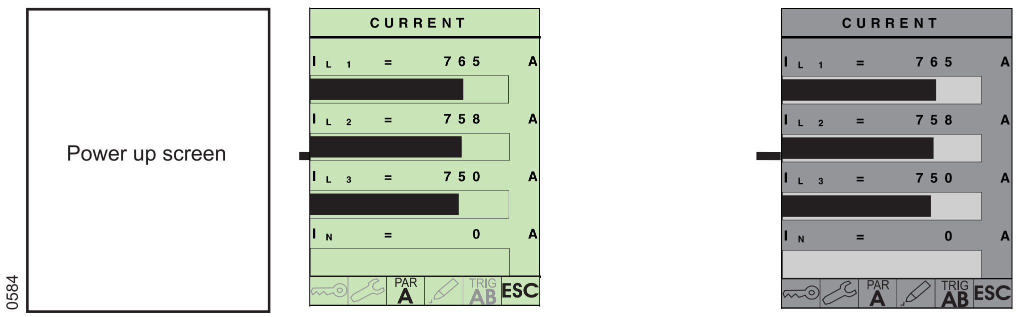


(1) Lowest measured value
(2) Present measured value
(3) Current measured valuee
(4) 100% of the measured parameter
(5) Width of display

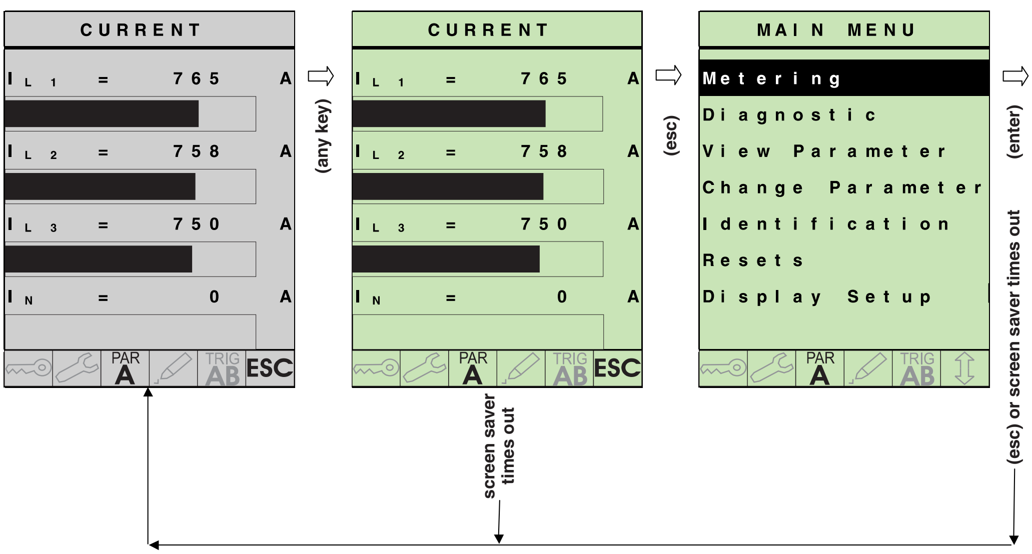
The markings for the lowest and highest measured value are automatically updated during the measurement.

Display during operation

After the supply voltage is applied, the display switches from the "power up screen" to the operational screen after approximately 5 seconds. It shows the currents in the three phases and in the neutral conductor as numerical values and in the form of a bar diagram. The background illumination of the display is automatically switched off after approximately 1 minute. It can be switched on again by pressing any button.



Polling the main menu

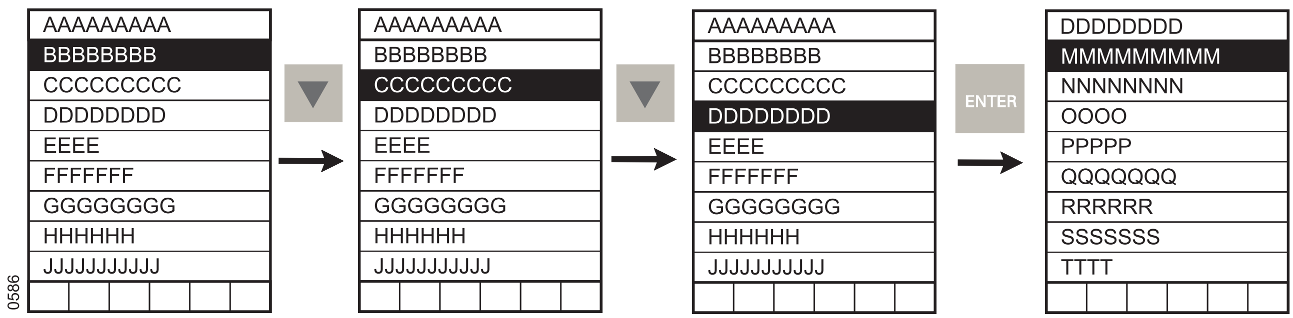


Navigating in the menu structure

Use the operating keys to navigate in the menu structure.

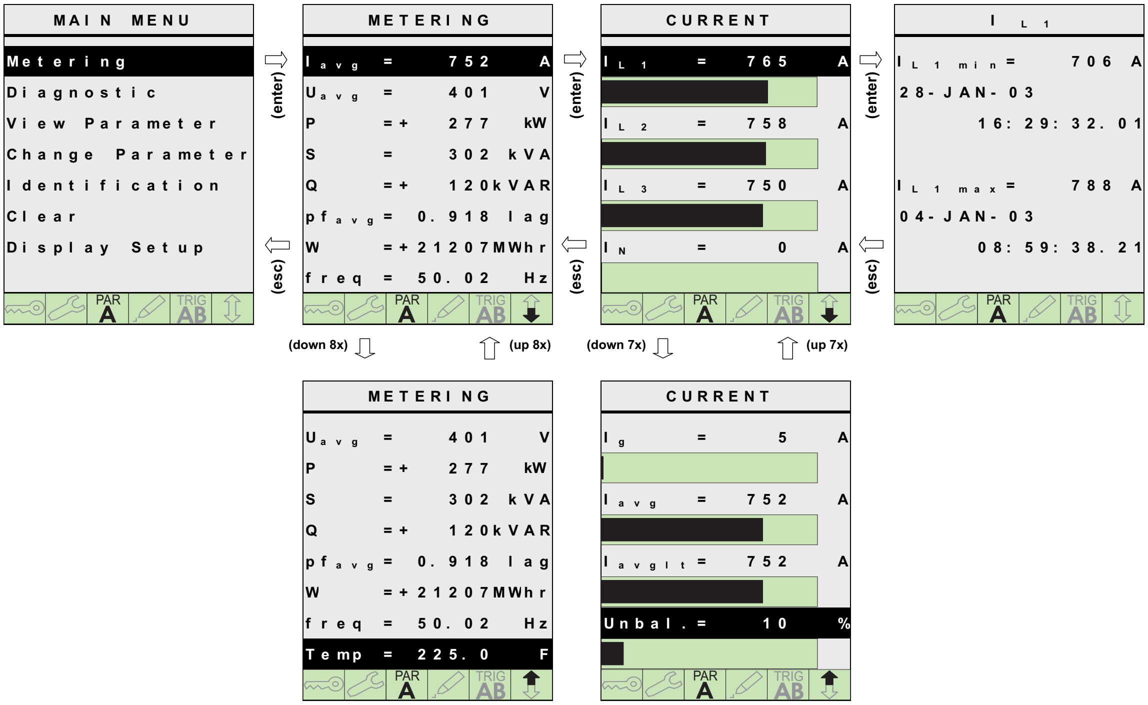
Button functions	
▲ ▼	Shift the marking
ENTER	Select the marked menu item
ESC	Switch back to the previous menu

Selection of a menu item

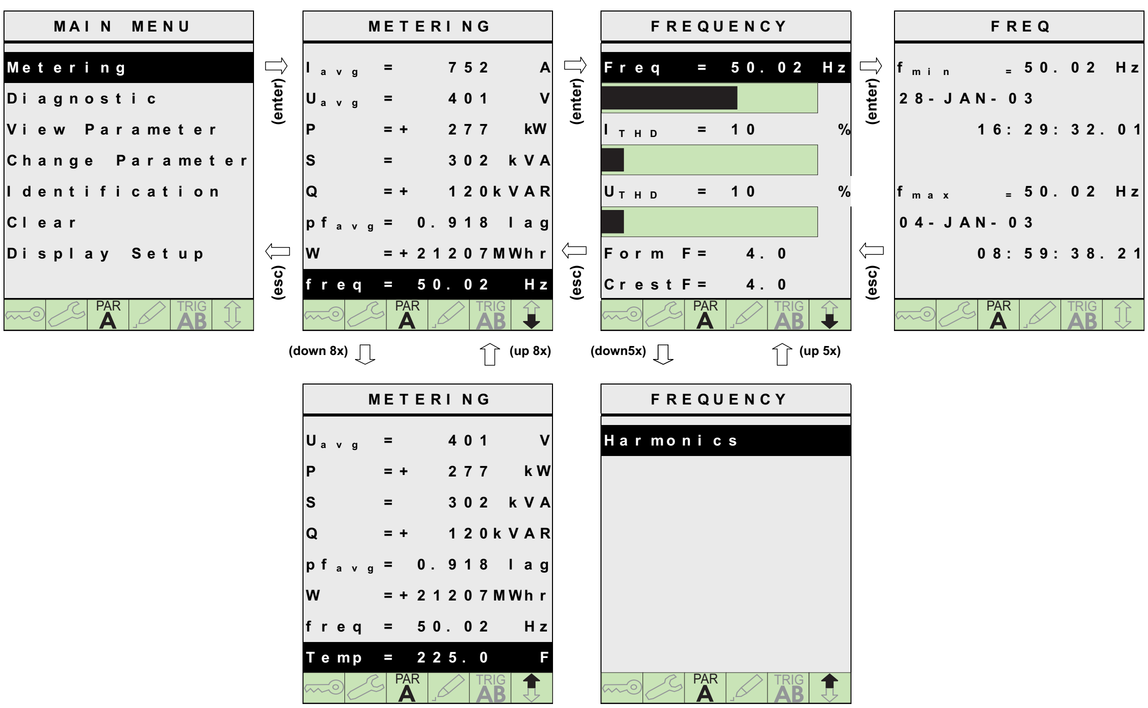


Displaying measured values

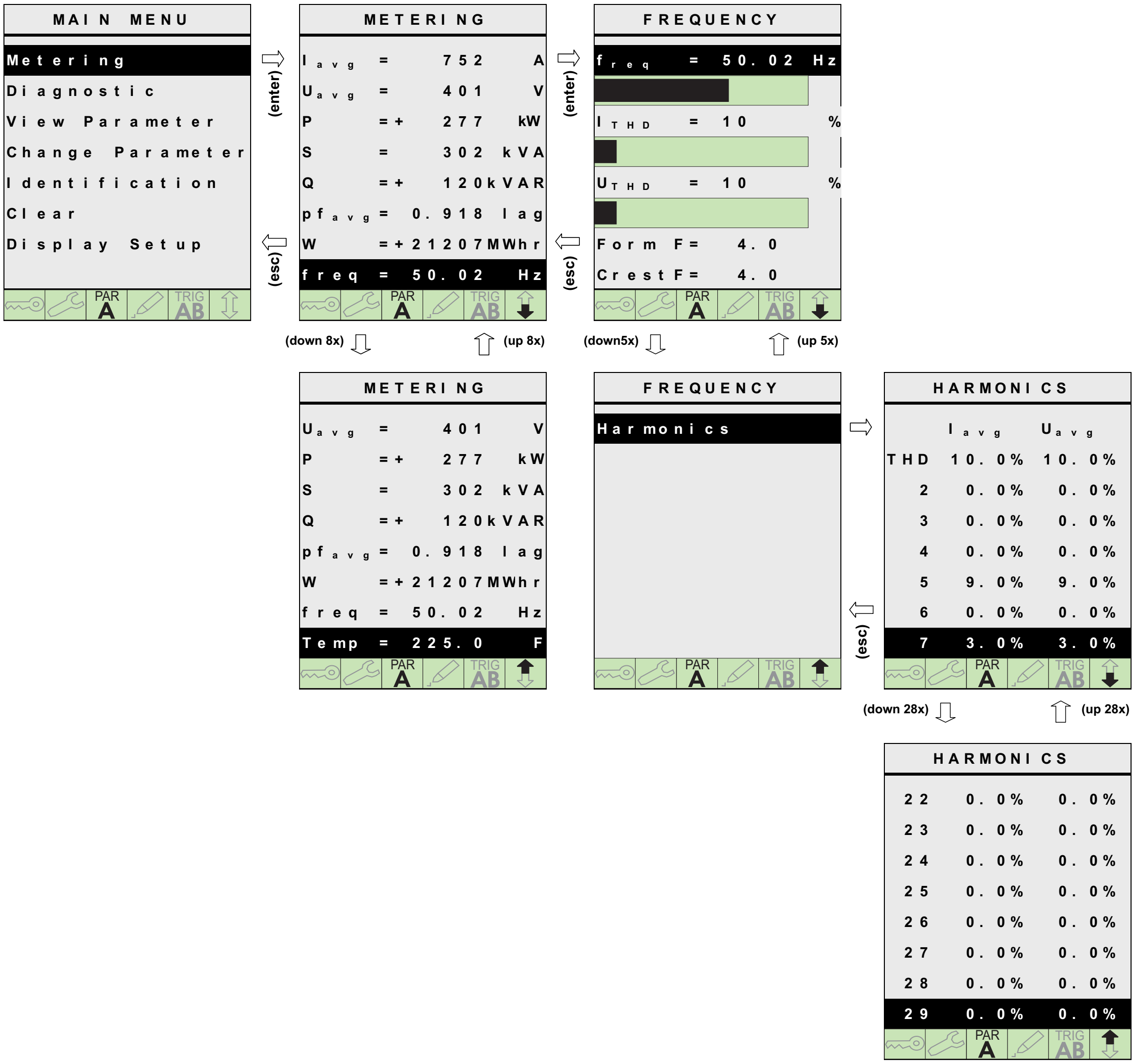
Example 1: Displaying the currents



Example 2: Displaying the frequency

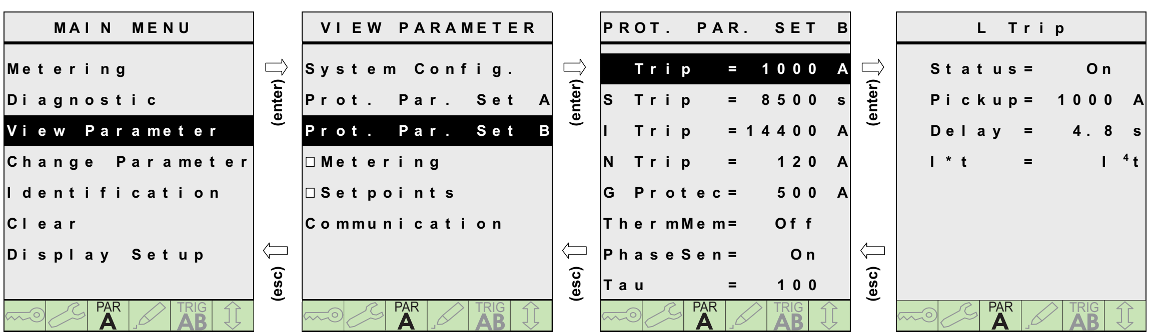


Example 3: Displaying harmonics

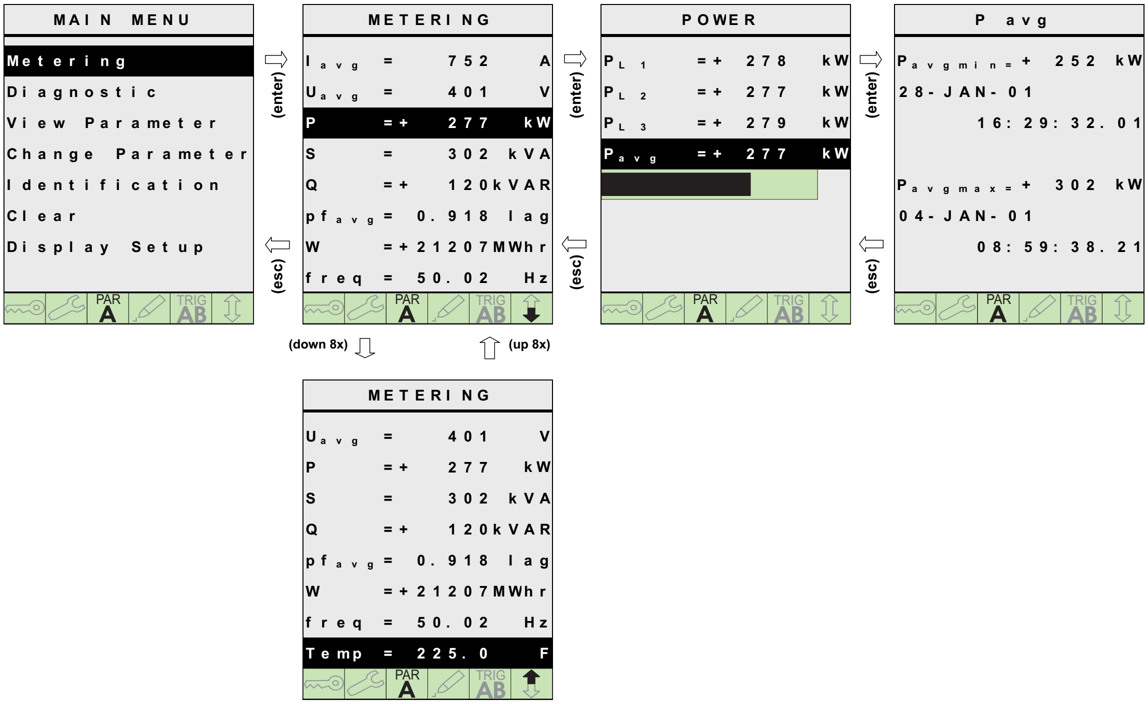


Displaying parameters

Example 4: Displaying parameters parameter settings

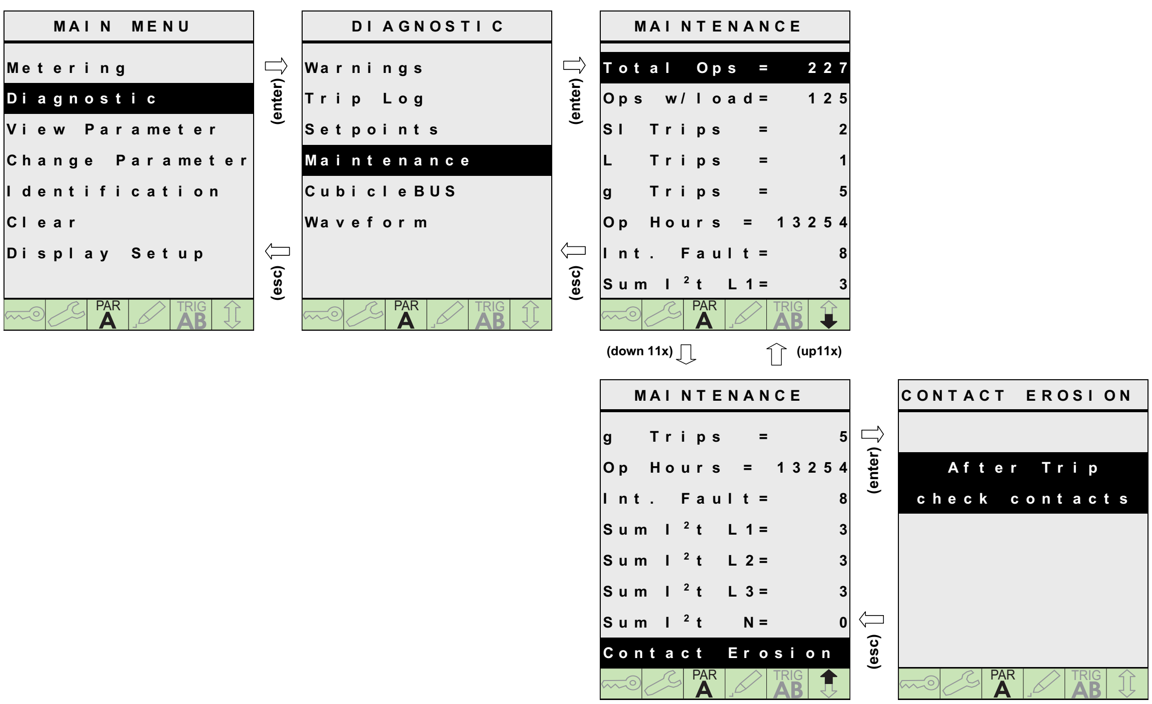


Example 5: Displaying active power

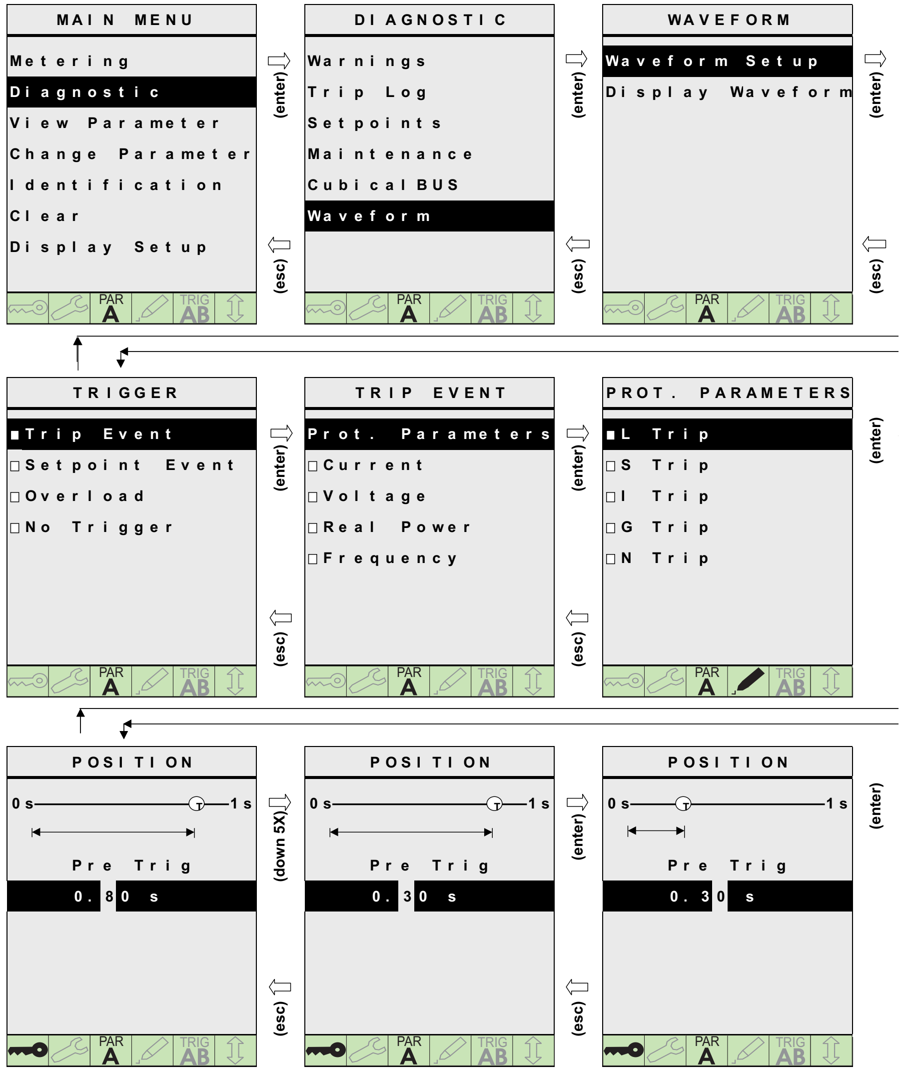


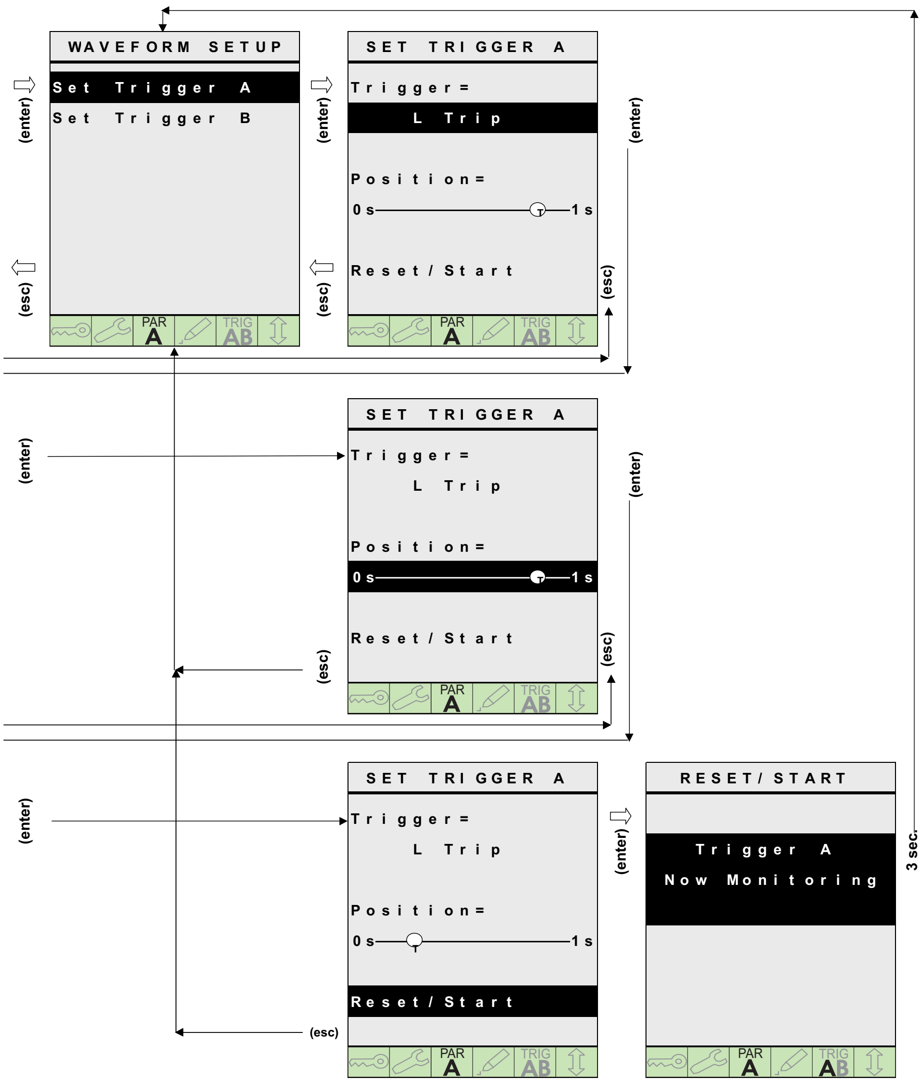
Calling up diagnostic information

Example 6: Querying maintenance information

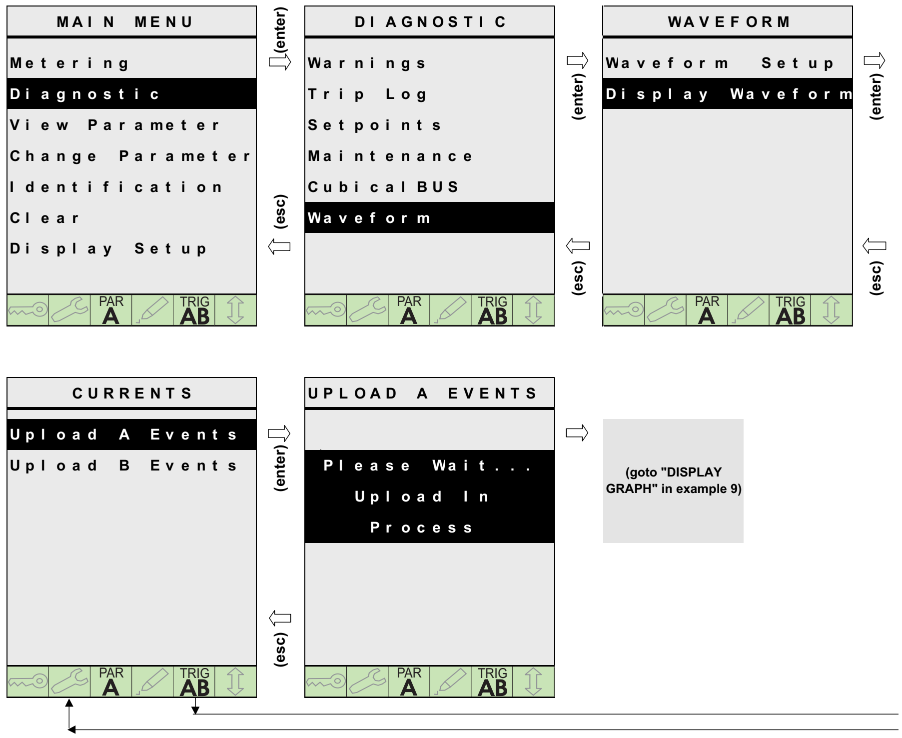


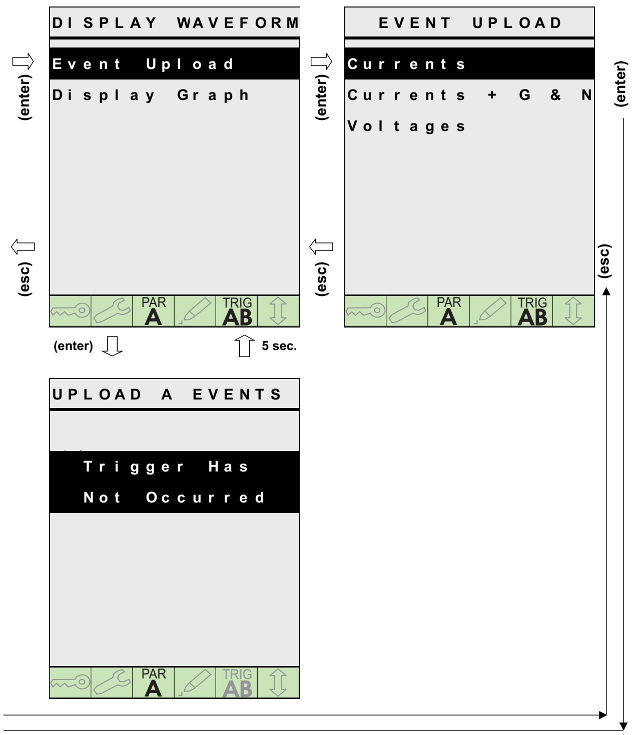
Example 7: Adjusting representation of characteristics




WAVEFORM SETUP
Set Trigger A
Set Trigger B
SET TRIGGER A
Trigger=
L Trip
Position=
0 s
1 s
Reset/Start
RESET/START
Trigger A
Now Monitoring
(enter)
(esc)
3 sec.
PAR
A
TRIG
AB

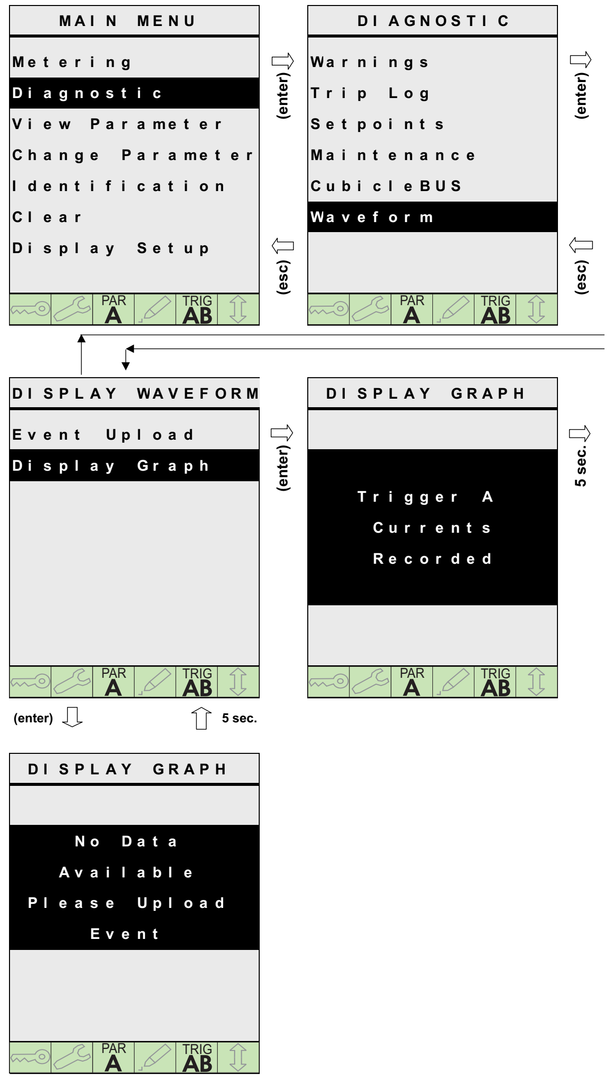
Example 8: Selecting event for displaying characteristics

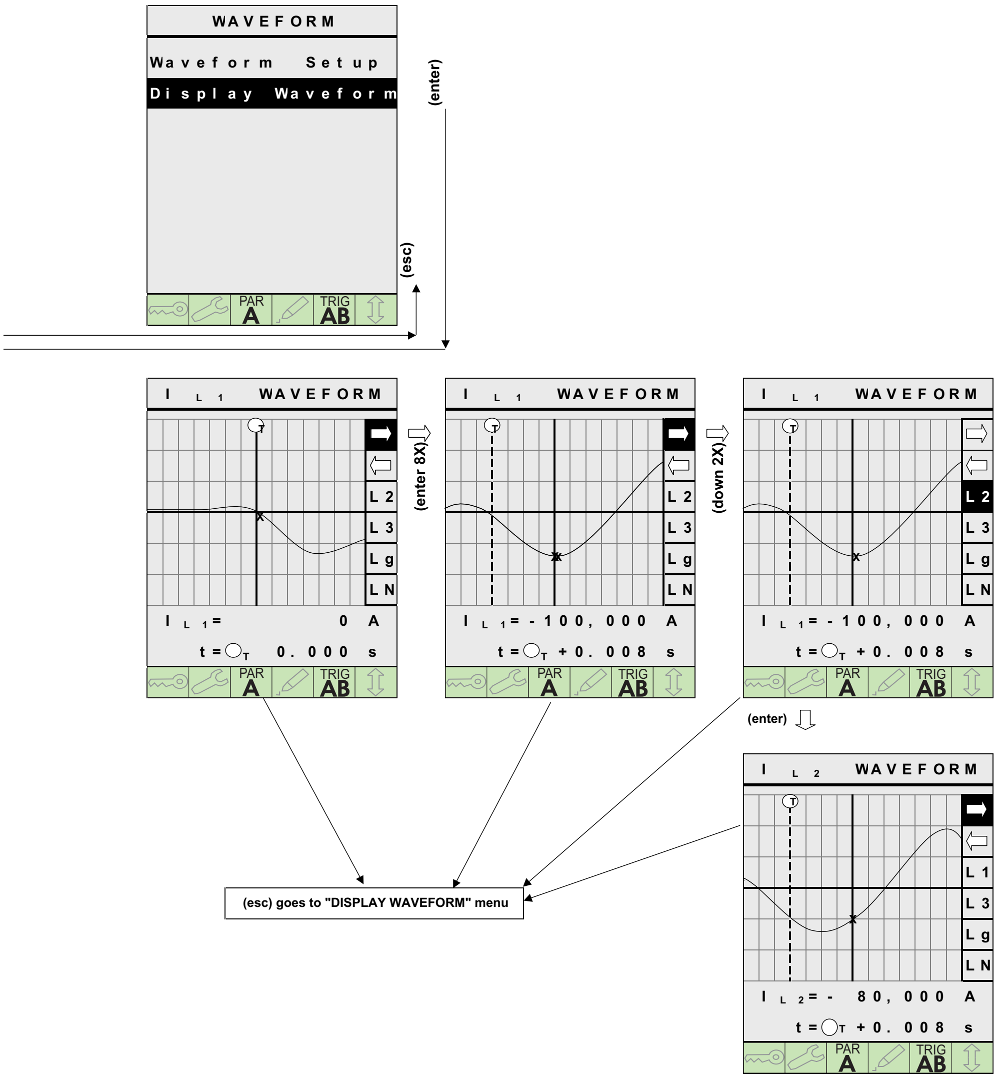




DISPLAY WAVEFORM
Event Upload
Display Graph
EVENT UPLOAD
Currents
Currents + G & N
Voltages
UPLOAD A EVENTS
Trigger Has
Not Occurred
PAR A
TRIG AB
(enter)
(esc)
5 sec.

Example 9: Displaying characteristics



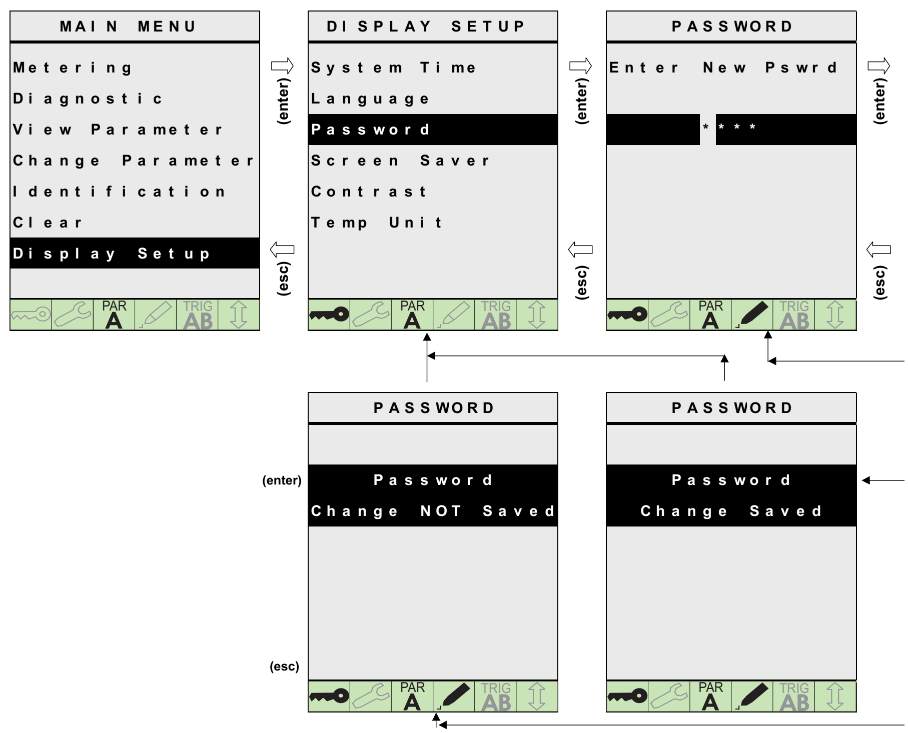

WAVEFORM
Waveform Setup
Display Waveform
(enter)
(esc)
PAR A
TRIG AB
I L1 WAVEFORM
L2
L3
Lg
LN
I L1 = 0 A
t = T 0.000 s
(enter 8X)
I L1 = -100,000 A
t = T +0.008 s
(down 2X)
(enter)
I L2 WAVEFORM
L1
I L2 = - 80,000 A
(esc) goes to "DISPLAY WAVEFORM" menu

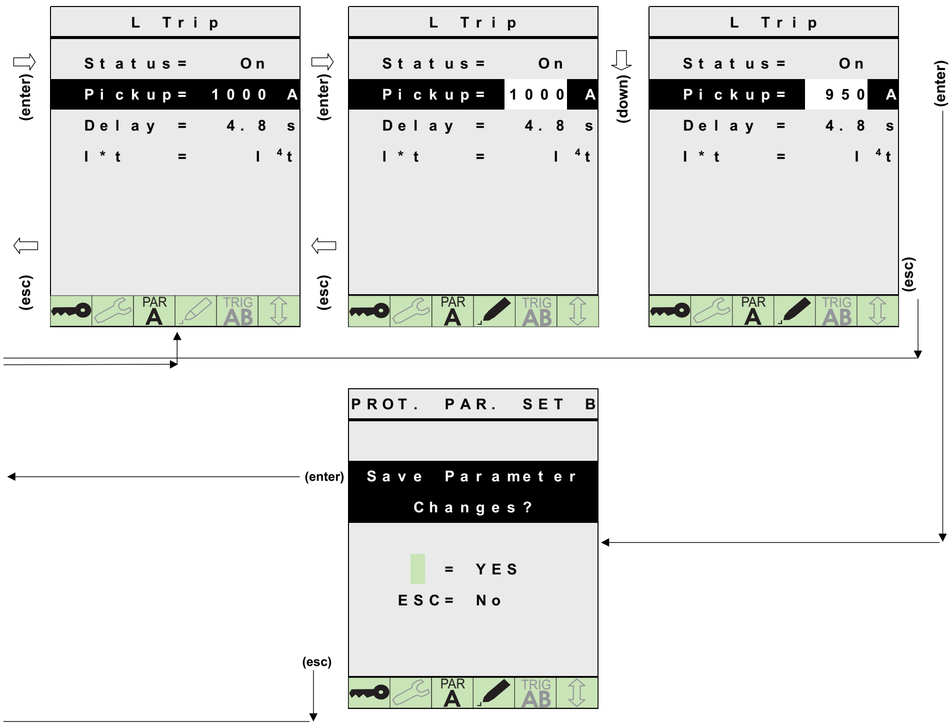
Changing parameters

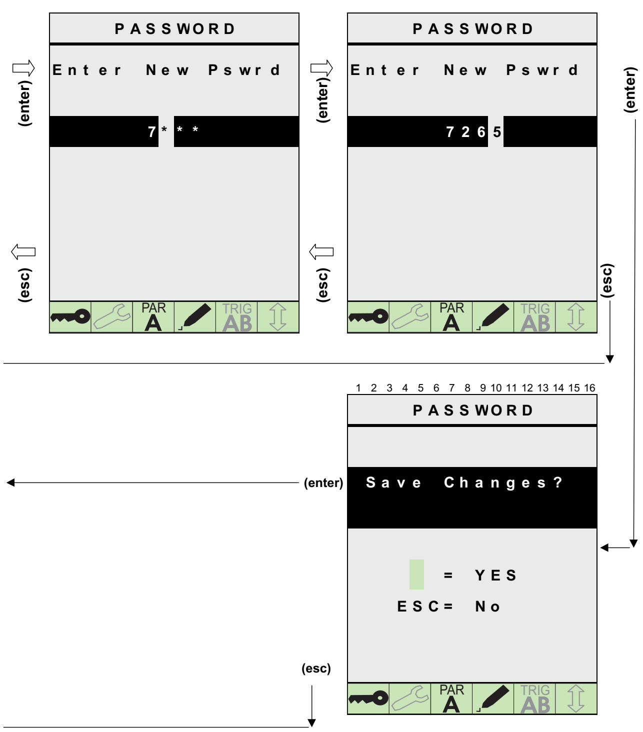
Example 10: Setting protection parameters

Settings the display

Example 11: Entering password

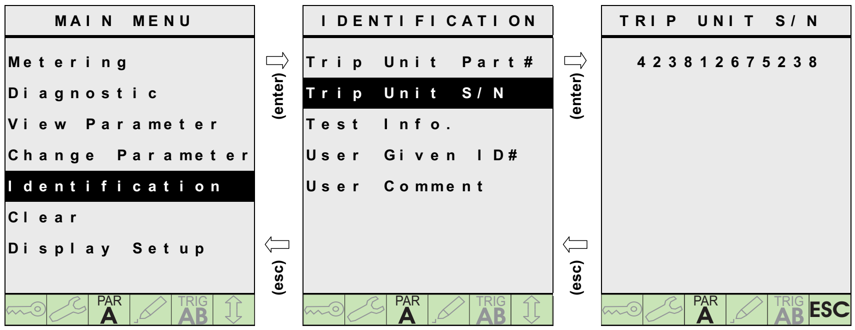



L Trip
Status= On
Pickup= 1000 A
Delay = 4.8 s
I*t = I 4t
(enter)
(esc)
(down)
L Trip
Status= On
Pickup= 950 A
Delay = 4.8 s
I*t = I 4t
PROT. PAR. SET B
Save Parameter Changes?
= YES
ESC= No
PAR
A
TRIG
AB


PASSWORD
Enter New Pswrd
7***
(enter)
(esc)
PASSWORD
Enter New Pswrd
7265
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
PASSWORD
Save Changes?
= YES
ESC= No
PAR
A
TRIG
AB

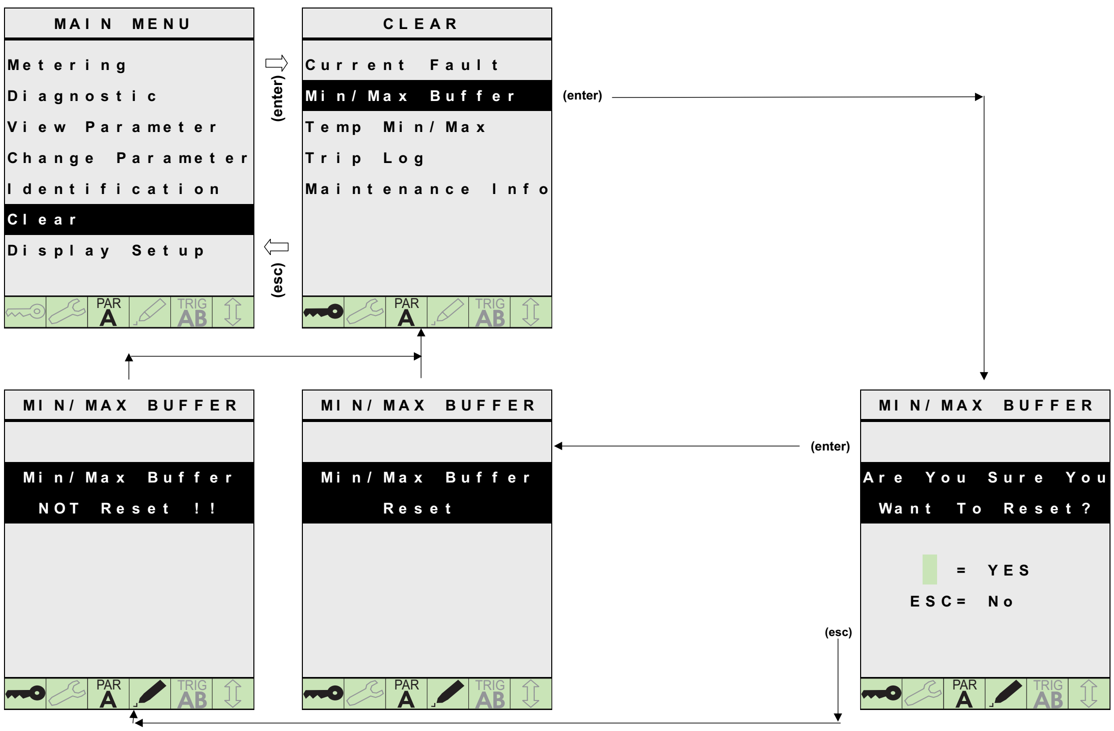
Identifications

Example 12: Identifications

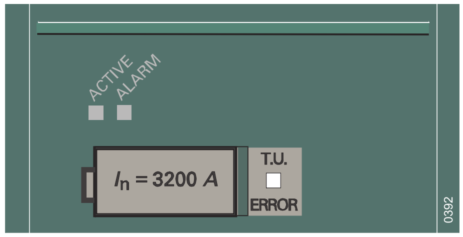


Resetting

Example 13: Resetting the measured minimum and maximum values



9.1.7 Rating Plug



The Rating Plug defines the rated current I_n within a certain range for a given circuit breaker frame size.

If a rating plug with a higher current than the maximum permissible circuit breaker rated continuous current is plugged in, the electronic system of the trip unit recognizes this error and signals it with a flashing T.U. ERROR indicator.

The trip unit ignores the rated current value specified by the incorrect Rating Plug and sets it to the value of the smallest Rating Plug for the frame size of the relevant circuit breaker.

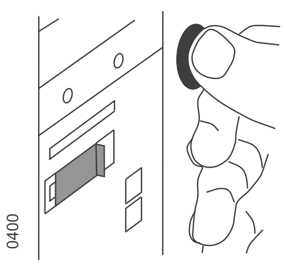
The same happens if a circuit breaker with frame size III is equipped with a Rating Plug smaller than 800 A.
All set protection parameters are adjusted accordingly.

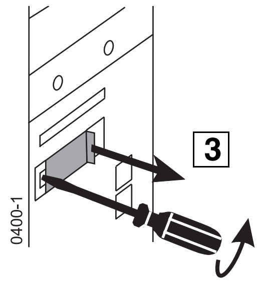
It is not permitted to operate the trip unit without a Rating Plug. If a circuit breaker is nevertheless started up without a Rating Plug, the T.U. ERROR indicator will light up and the trip unit settings will default to the lowest possible settings for that frame rating.

Frame size			**Rating Plug**	**Catalog No.**
I	**II**	**III**		
✓	✓		200 A	WLRP200
✓	✓		225 A	WLRP225
✓	✓		250 A	WLRP250
✓	✓		300 A	WLRP300
✓	✓		315 A	WLRP315
✓	✓		350 A	WLRP350
✓	✓		400 A	WLRP400
✓	✓		450 A	WLRP450
✓	✓		500 A	WLRP500
✓	✓		600 A	WLRP600
✓	✓		630 A	WLRP630
✓	✓		700 A	WLRP700
✓	✓	✓	800 A	WLRP800
✓	✓	✓	1000 A	WLRP1000
✓	✓	✓	1200 A	WLRP1200
✓	✓	✓	1250 A	WLRP1250
✓	✓	✓	1600 A	WLRP1600
✓	✓	✓	2000 A	WLRP2000
	✓	✓	2500 A	WLRP2500
	✓	✓	3000 A	WLRP3000
		✓	3200 A	WLRP3200
		✓	4000 A	WLRP4000
		✓	5000 A	WLRP5000

Replacing Rating Plug

NOTICE
Circuit breaker may trip. If the trip settings are changed while the breaker is closed (and under load) the breaker may trip. Adjust parameters only when the circuit breaker is in the open position.





9.1.8 Ground-fault protection modules

WL trip units can be optionally equipped with modules that add ground fault protection. The modules provide either an alarm-only function or alarm-and-trip functionality.

The modules can be added or removed as necessary in the field.

Settings are found on → (page 9-12)

The following combinations are possible:

Trip unit	Ground-fault protection module
ETU745	GFM A 745 (alarm only) GFM AT 745 (alarm and trip)
ETU776	GFM A 776 (alarm only) GFM AT 776 (alarm and trip)

The following options exist for ground-fault detection:

- Vector sum of the three phase currents plus neutral, if a neutral sensor is connected (residual sensing).
- Direct measurement of the ground-fault current using a separate 1200 A : 1 A iron-core ground fault sensor.

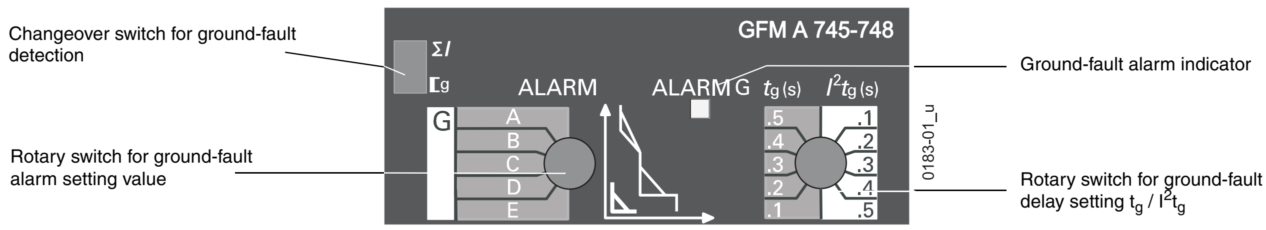
The direct-sense input to the trip unit has the following current-carrying capability:

- max. 1 A continuous
- max. 5 A for 0.5 sec.

Note
If the circuit breaker is applied in a 4-wire system, and residual ground fault protection is desired, it is strongly recommended that a WL neutral sensor (WLNCT2, WLNCT3) be used on the neutral to facilitate the correct vector-summation of the phase currents with the neutral. Failure to apply a neutral sensor may result in erroneous GF alarm and trips.

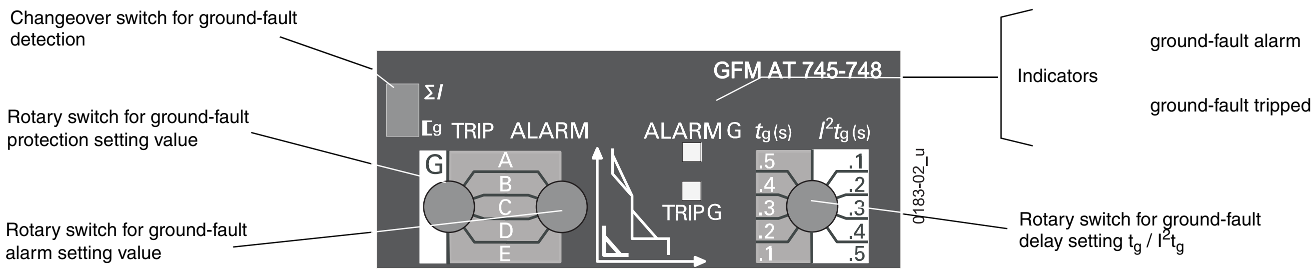
Note
Output of alarms and messages is possible via COM and **Cubicle**BUS modules.

Module GFM A 745



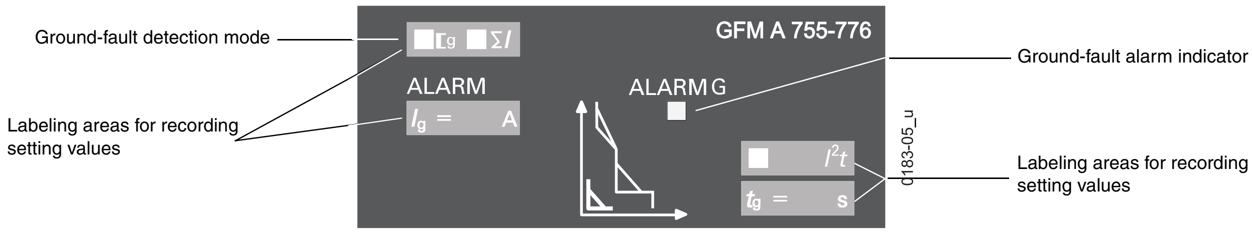
- Alarm only, circuit breaker does not trip
- The changeover switch for ground-fault detection is only accessible when the control panel or the trip unit itself is removed.

Module GFM AT 745



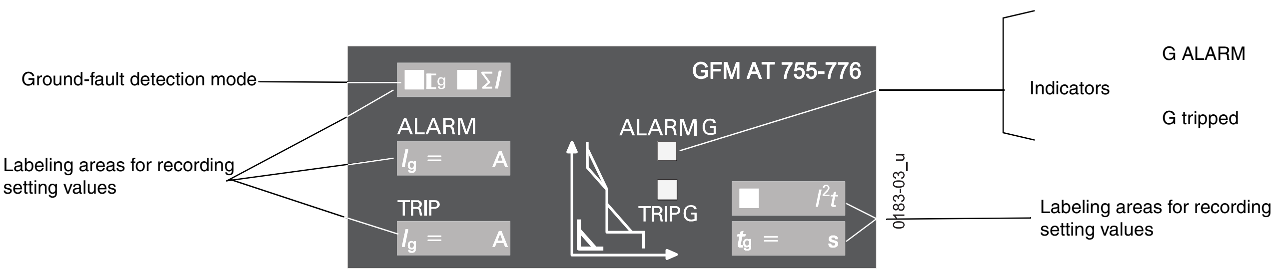
- Ground-fault protection by circuit breaker tripping and alarm signal
- Changeover switch for ground-fault protection accessible only when the control panel or the trip unit itself is removed

Module GFM A 776



- Alarm only, circuit breaker does not trip
- Module programmable via:
  - the graphical display (ETU776)
  - TD400 and the software "powerconfig"
  - the COM modules with a PC with the software “powerconfig” installed → (page 29-2).

Module GFM AT 776



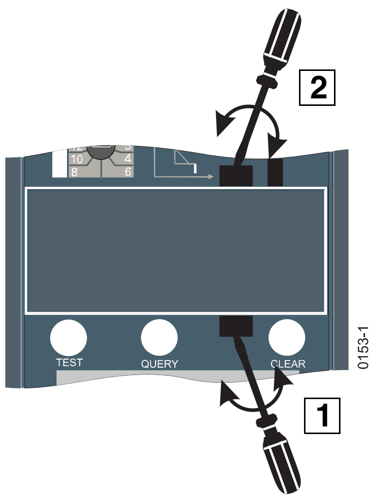
- Ground-fault protection by circuit breaker tripping and alarm signal
- Module programmable via:
  - the graphical display (ETU776)
  - TD400 and the software "powerconfig"
  - the COM modules with a PC with the software “powerconfig” installed → (page 29-2).
- Ground-fault detection selectable:
  - vector sum Σ I = L1+L2+L3+N
  - external iron core ground-fault current sensor 1200 A : 1 A

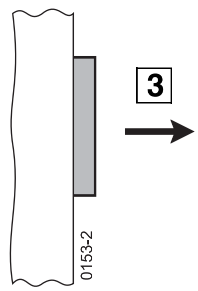
Field installation

 	**DANGER** **Hazardous voltage.** **Will cause death, serious personal injury, or equipment damage.** Turn off and lock out all power supplying this equipment before working on this device.

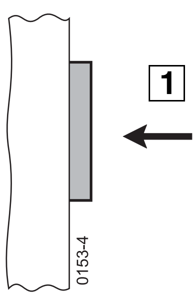
	**WARNING** **High speed moving parts.** **Can cause serious personal injury.** Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

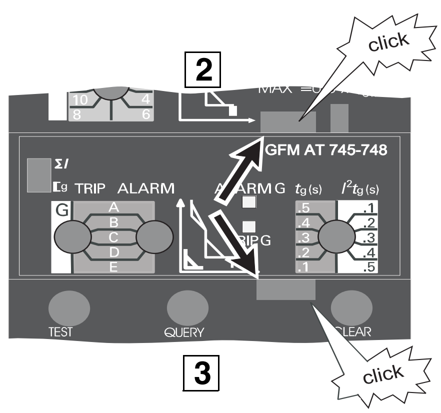
Removing dummy module





Installing and snapping the ground-fault protection module into place





- Switch on external 24 V DC voltage supply, if planned
- Adjust settings for ground-fault protection
- Test the tripping function with the handheld test device → (page 9-99)
- Install and seal sealing cap of trip unit, if applicable → (page 9-53)8

-

Catalog numbers

Ground-fault protection module	Catalog No.
GFM A 745	WLGFA48
GFM AT 745	WLGFM48
GFM A 776	WLGFA76
GFM AT 776	WLGFM76

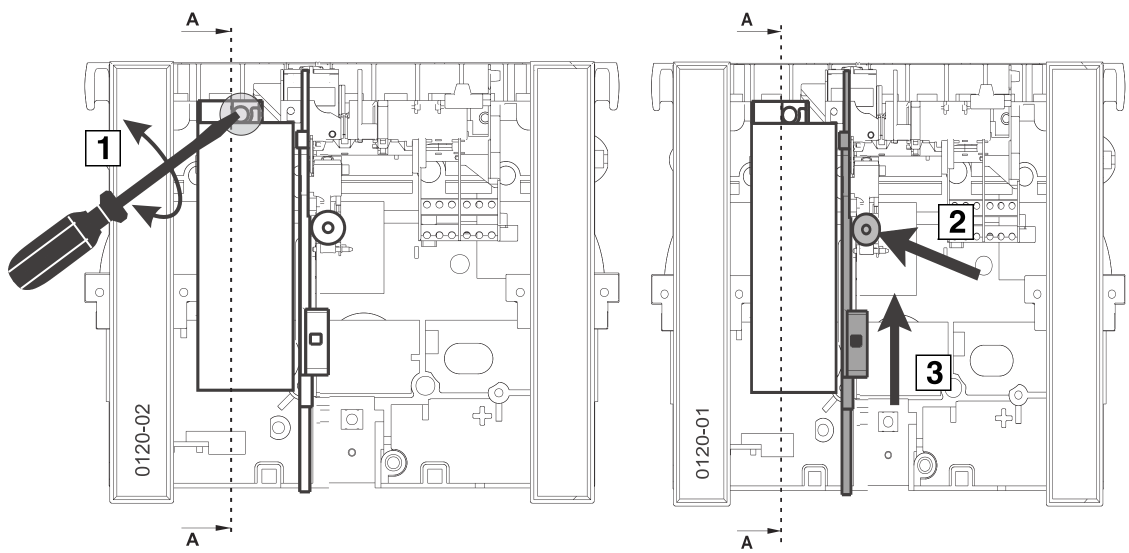
9.1.9 Replace the trip unit

	DANGER
	Hazardous voltage.
	Will cause death, serious personal injury, or equipment damage.
	Turn off and lock out all power supplying this equipment before working on this device.

	WARNING
	High speed moving parts.
	Can cause serious personal injury.
	Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

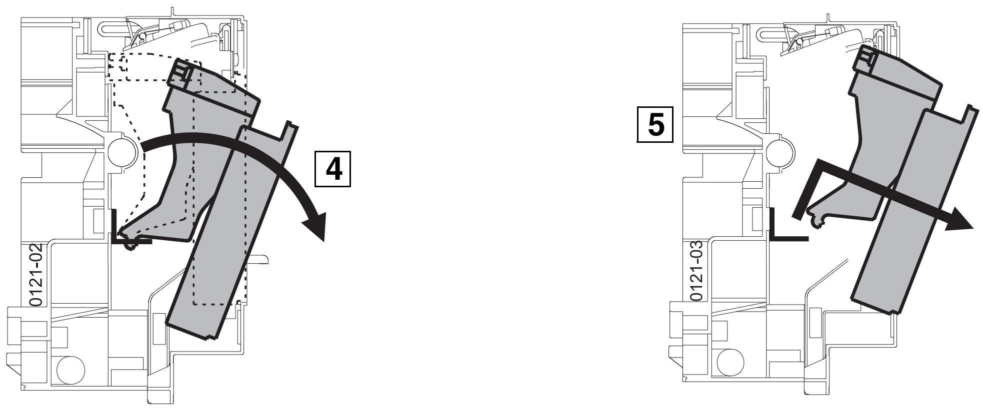
Removing

- OPEN circuit breaker and discharge the closing spring → (page 24-2)
- Remove front panel → (page 24-4)



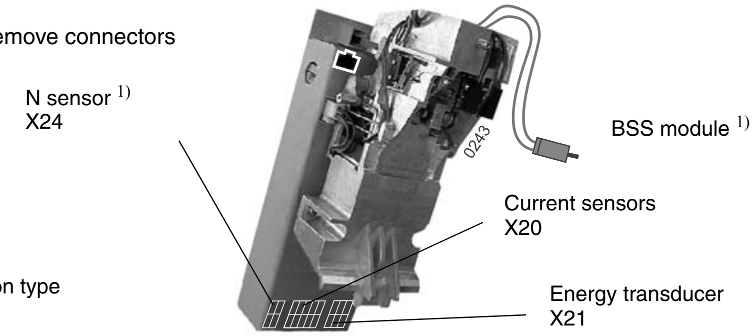
PH 2 5 Nm 44 lb-in

During installation

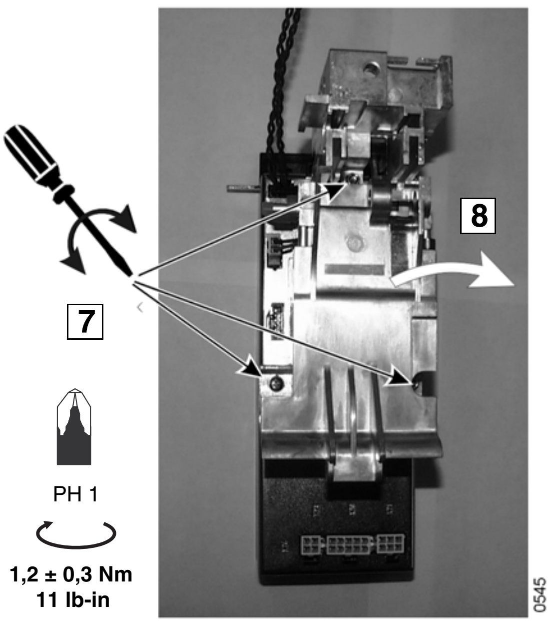


A-A A-A

6 Remove connectors



1) Equipment dependent on type



Installation is carried out in the reverse order.

After replacing the trip unit, always test with the handheld test device → (page 9-99)

For ordering trip units, please refer to the latest version of the "Selection and Application Guide" WL Low Voltage Power Circuit Breaker catalog.

If a trip unit with another configuration than the existing one is installed, the Catalog No. on the options label of the circuit breaker must be changed according to the catalog data.

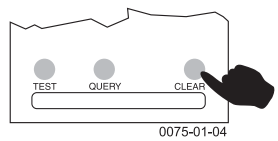
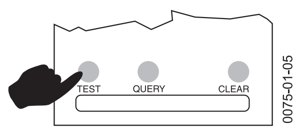
Please contact the technical assistance hotline if you have any queries.

9.1.10 Internal trip unit self-test on the overcurrent tripping function

For commissioning and function testing.

Conditions

- Trip unit is activated by:
  operating current
  external 24 V DC voltage supply
- Current not in overload range
  → Indicators (page 9-9)

<table>
<tr><th></th><th colspan="3">Internal circuit breaker self-test without tripping</th></tr>
<tr><td></td><td colspan="3">Normal operation of the circuit breaker is not impaired</td></tr>
<tr><td></td><td colspan="3">The test can be canceled
at any time by pressing CLEAR
</td></tr>
<tr><td>1</td><td colspan="3"></td></tr>
<tr><td>2</td><td colspan="3">Running light
All indicators will light up one after other (from left to right or from top to bottom)</td></tr>
<tr><td>3</td><td colspan="2">The flashing time corresponds to the long-time delay t_R</td><td>The flashing time deviates more than 10% from the set long-time delay t_R</td></tr>
<tr><td>4</td><td>The L-tripping indicator lights up

Test OK</td><td rowspan="2">T.U. ERROR indicator lights up

Test not OK</td><td rowspan="2">Test not OK

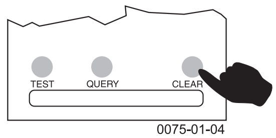
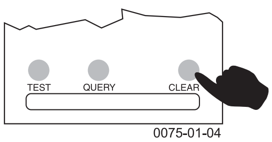
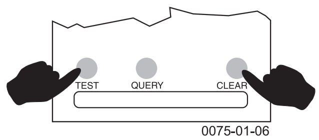
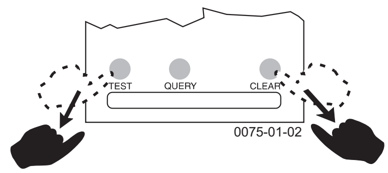
Trip unit is defective, even if the L-tripping indicator lights up</td></tr>
<tr><td>5</td><td>- LED goes out after 30 sec.
- End of internal self-test
- Premature ending of test by pressing CLEAR</td></tr>
<tr><td>6</td><td>Trip unit OK</td><td colspan="2">Testing with handheld test device → Handheld test device (page 9-99)</td></tr>
</table>

NOTICE

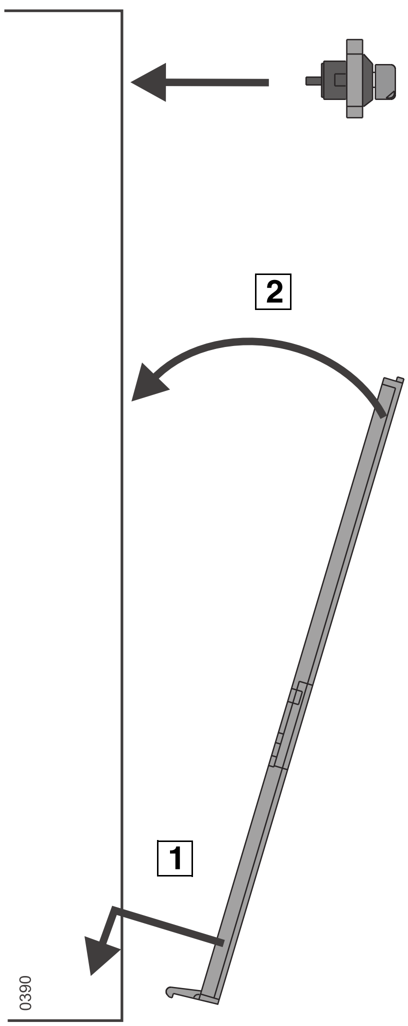
Circuit breaker may trip.

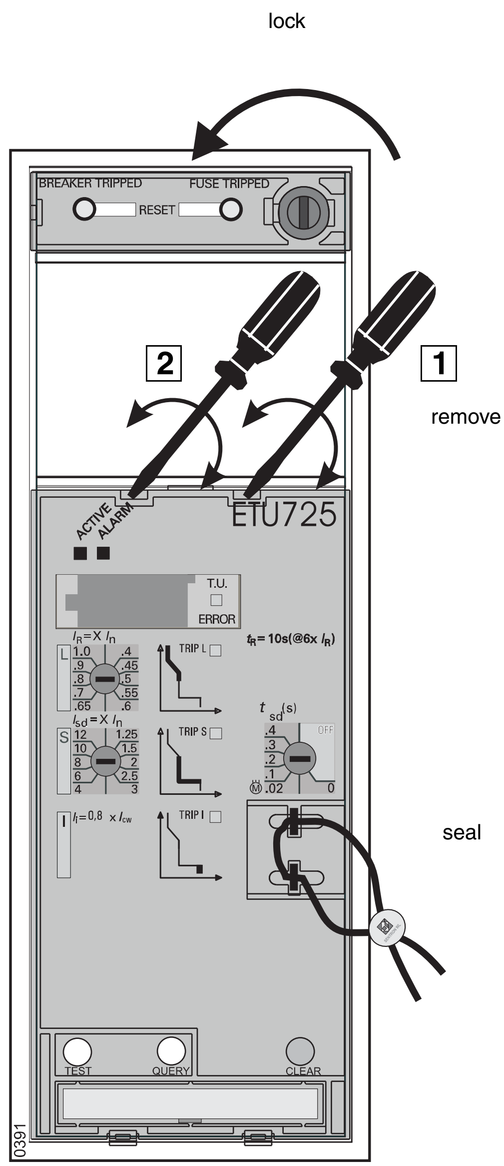
If the trip settings are changed while the breaker is closed (and under load) the breaker may trip.

Adjust parameters only when the circuit breaker is in the open position.

<table>
<tr><th></th><th colspan="3">Internal circuit breaker self-test with tripping</th></tr>
<tr><td></td><td colspan="3">The test can be canceled
at any time by pressing CLEAR
</td></tr>
<tr><td>1</td><td colspan="3">1

Press and hold CLEAR
2

Press and hold TEST
3

Release both buttons at the same time</td></tr>
<tr><td>2</td><td colspan="3">Running light
All indicators will light up one after other (from left to right or from top to bottom)</td></tr>
<tr><td>3</td><td colspan="2">The flashing time corresponds to the long-time delay t_R</td><td>The flashing time deviates more than 10% from the set long-time delay t_R</td></tr>
<tr><td>4</td><td>Circuit breaker trips
Test OK</td><td>Circuit breaker does not trip
Test not OK</td><td>Test not OK
Trip unit is defective, even if the circuit breaker trips</td></tr>
<tr><td>5</td><td>→ Reclosing a circuit breaker tripped by the trip unit (page 6-9)</td><td colspan="2">Test with handheld test device
- Check wiring between trip unit and tripping coil
- Test tripping coil</td></tr>
</table>

9.1.11 Sealing and locking device



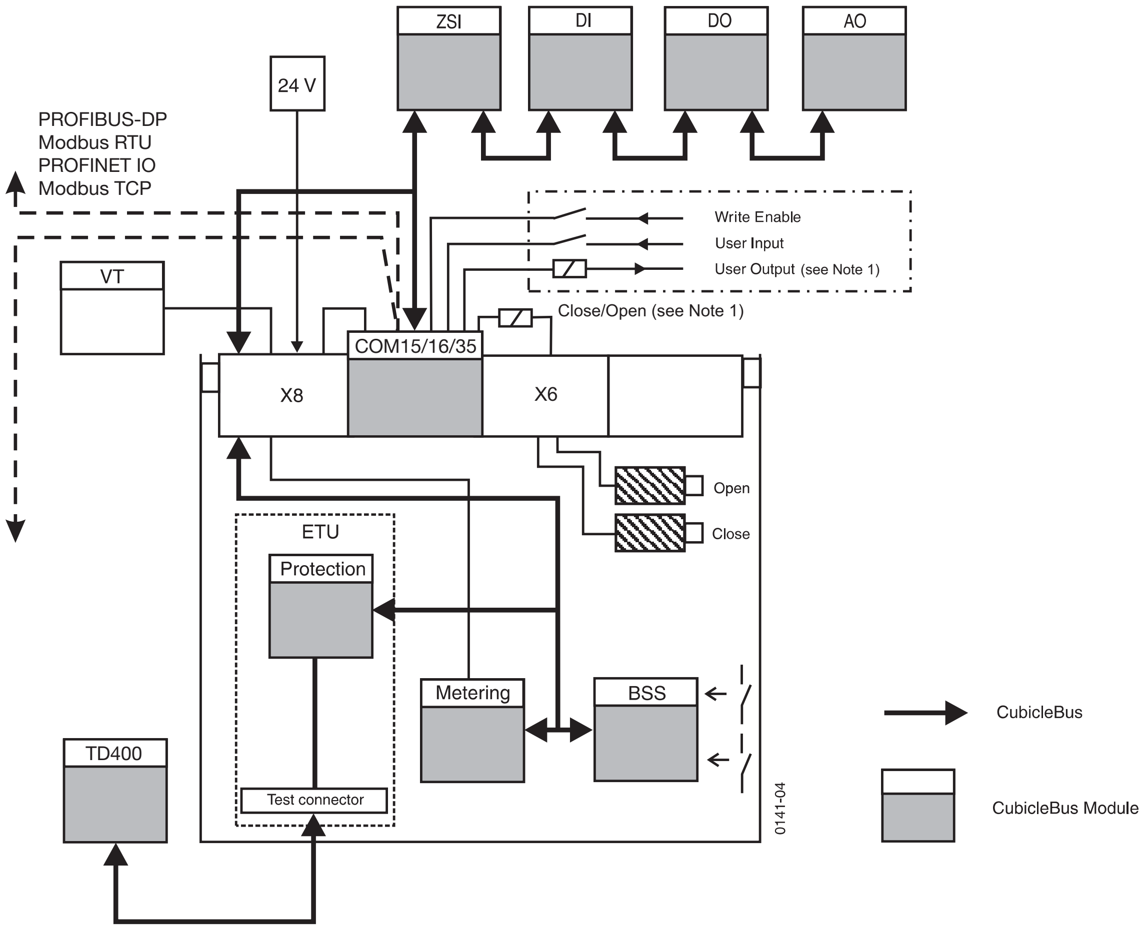


NOTE
Keep sealing wire as short as possible.

	Catalog No.
ETU745	WLTUSC55
ETU776	WLTUSC76

9.2 CubicleBUS Modules

9.2.1 System architecture



1) See communication manual for relay details.

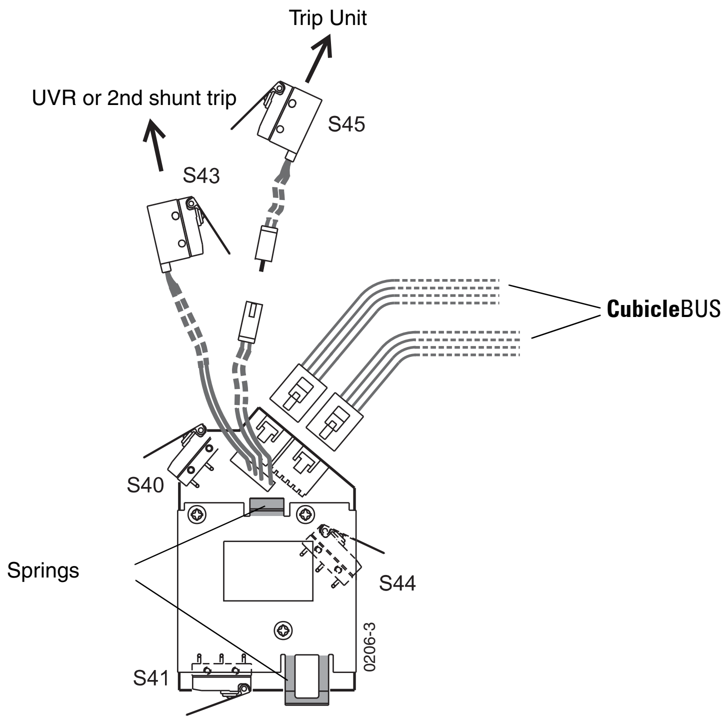
- **AO**: Analog output module
- **BSS**: Breaker Status Sensor for acquisition of signals about the circuit breaker status (always combined with COM module)
- **CubicleBUS**: Internal bus system for interconnection of circuit breaker components and for connection of external **Cubicle**BUS modules
- **COM15/16/35**: Communications modules to connect breaker-internal CubicleBUS to external supervisory systems via PROFIBUS-DP, Modbus RTU, PROFINET IO or Modbus TCP. Always combined with the BSS (Breaker Status Sensor).
- **DI**: Digital input module for capturing the status of ungrounded (potential-free) status signals for the purpose of communicating them or switching active parameter set (ETU776). A maximum of 2 modules in different configurations can be connected.
- **DO**: Digital output modules with 6 outputs each; a maximum of three modules with different configurations or versions can be connected
- **ETU**: Electronic trip unit
- **Metering**: Metering function or metering function *PLUS*
- **Modbus TCP**: Fieldbus for connection of energy management systems and automation systems
- **Open / Close**: Opening coil and closing coil for opening and closing the circuit breaker via communication
- **PROFIBUS DP/PROFINET IO**: Field bus for connection of automation components
- **Protection**: Protection module
- **TD400**: Test Device; adapter for parameterizing, operating and monitoring the circuit breaker via powerconfig
- **VT**: Voltage transformer
- **ZSI**: Module for zone selective interlocking, must always be connected as the first module

NOTE
The basic functions of the electronic trip units do not require an auxiliary power supply. To use extended functions of the trip units requiring data exchange via the **Cubicle**BUS, an external 24 V DC voltage supply must be connected. → (page 9-98)

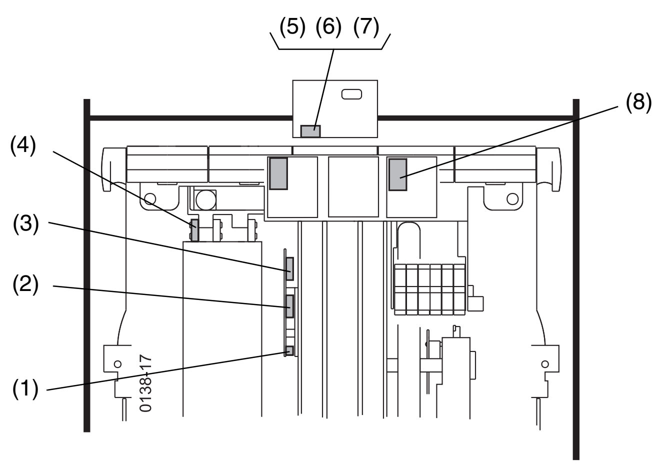
9.2.2 Internal modules

9.2.2.1 Breaker Status Sensor (BSS)

For collecting circuit breaker status information via signaling switches and transmitting these data to the **Cubicle**BUS .



Signaling switches for BSS



(1) Spring charge signaling switch
(2) Signaling switch OPEN / CLOSE position S44
(3) "Ready-to-close" signaling switch
(4) S45 Bell Alarm signaling switch
(5) Signaling switch for connected position S46
(6) Signaling switch for test position S47
(7) Signaling switch for disconnected position S48
(8) Signaling switch S43 UVR or 2nd shunt trip

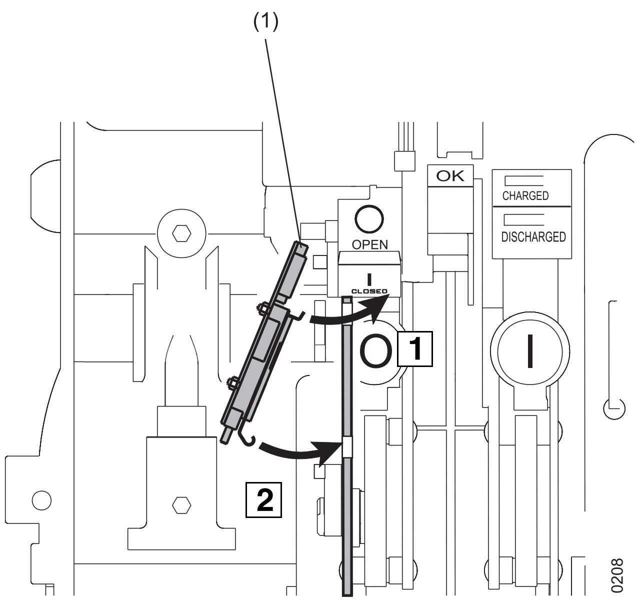
Installing the BSS module

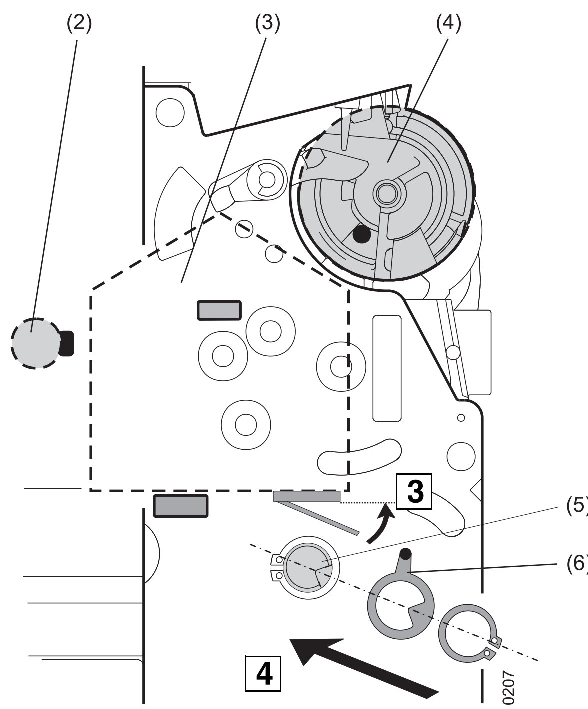
	DANGER
	Hazardous voltage. **Will cause death, serious personal injury, or equipment damage.** Turn off and lock out all power supplying this equipment before working on this device.

	WARNING
	High speed moving parts. **Can cause serious personal injury.** Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

Always discharge the closing spring before removing any covers or the front panel of the circuit breaker (page 24-2).
Move the circuit breaker into the withdrawn position in the cradle (page 24-3) and Removing front panel (page 24-4).

Replace the trip unit (page 9-49).

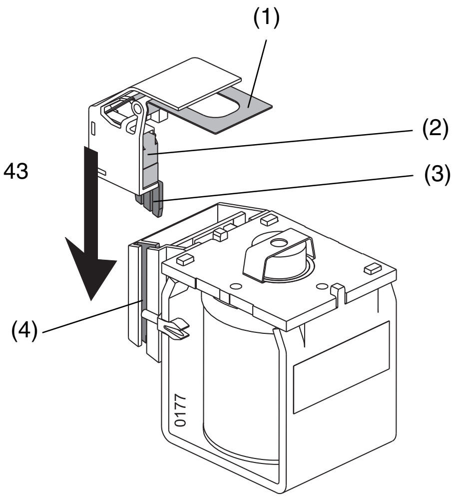




(1) BSS
(2) Actuating shaft
(3) BSS
(4) "Ready-to-close" indicator
(5) Drive shaft
(6) Carrier

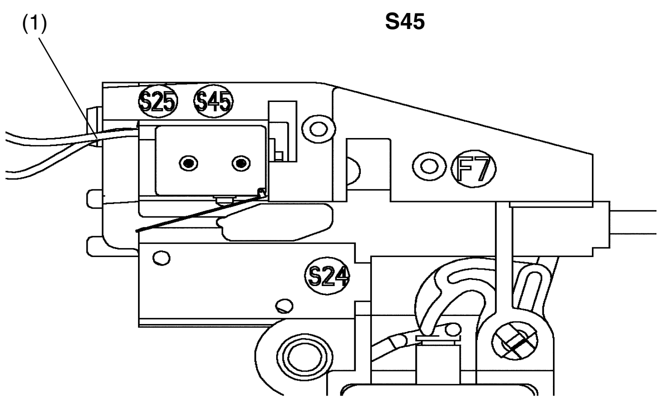
Attaching signaling switch S43 to the 2nd shunt trip / UVR

UVR / 2nd shunt trip: signaling switch S 43



(1) Rocker
(2) Signaling switch
(3) Guide
(4) Groove

Attaching signaling switch S45 to the ETU carriage

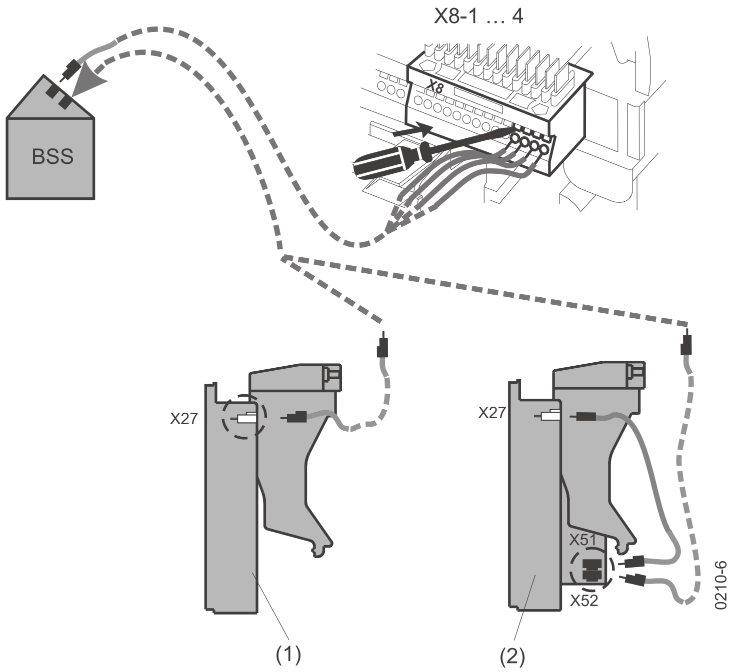


(1) black wiring

Connecting BSS module

The first **Cubicle**BUS connection leads to the secondary disconnect block X8. The second **Cubicle**BUS connection is made according to the circuit breaker equipment.

→ Circuit diagrams (page 8-1)



(1) ETU745 - 776 without metering function
(2) ETU745 - 776 with metering function
(3) X51-X52 External conducted cubicle bus link does only exist in release 1. release 2 uses an internal link

9.2.2.2 COM module

General

The communication modules permit access to the circuit breaker via their respective fieldbus interface:

- Reading and writing parameters
- Reading circuit breaker states
- Reading measured values
- Transmitting messages and alarms
- Transmitting maintenance information
- Sensing the position of the circuit breaker in the guide frame
- Additional functions via internal inputs and outputs
- Closing and opening the circuit breaker via fieldbus
- Implementing circuit breaker-internal CubicleBUS information

Further information can be found in the system manuals of the respective communication modules:

3WL circuit breakers with communication capability via the COM35 communication module - PROFINET IO, Modbus TCP
https://support.industry.siemens.com/cs/ww/en/view/109757987

System manual for 3WL/3VL circuit breakers with communication capability - Modbus
https://support.industry.siemens.com/cs/ww/en/view/39850157

System manual for 3WL/3VL circuit breakers with communication capability - PROFIBUS
https://support.industry.siemens.com/cs/ww/en/view/12560390

IT Security

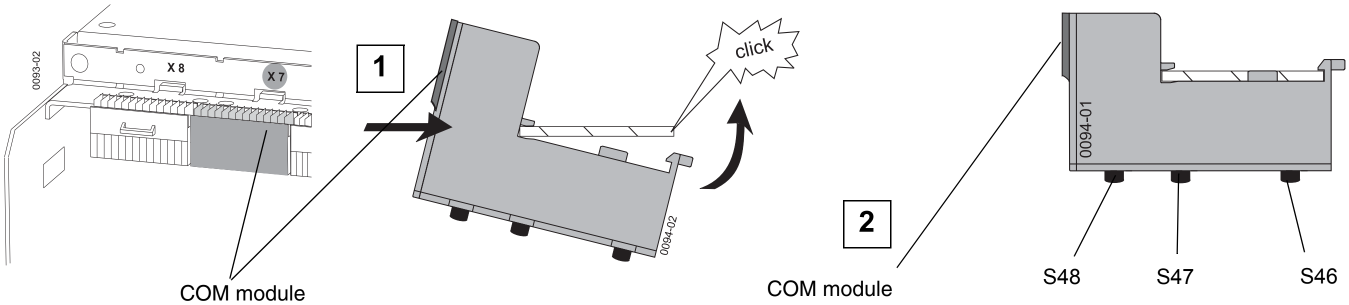
In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept. For more information about industrial security, please visit https://www.siemens.com/industrialsecurity

Note

This product is intended for industrial environments (Environment A, in accordance with IEC 60947-1/-2).In residential environments, this device can cause unwanted radio interferences.In this case, it is the user's responsibility to address accordingly.

Fitting COM module on the guide frame

- Switch off and discharge the storage spring
  → (page 24-2)
- Pull the breaker into maintenance position → (page 24-3)

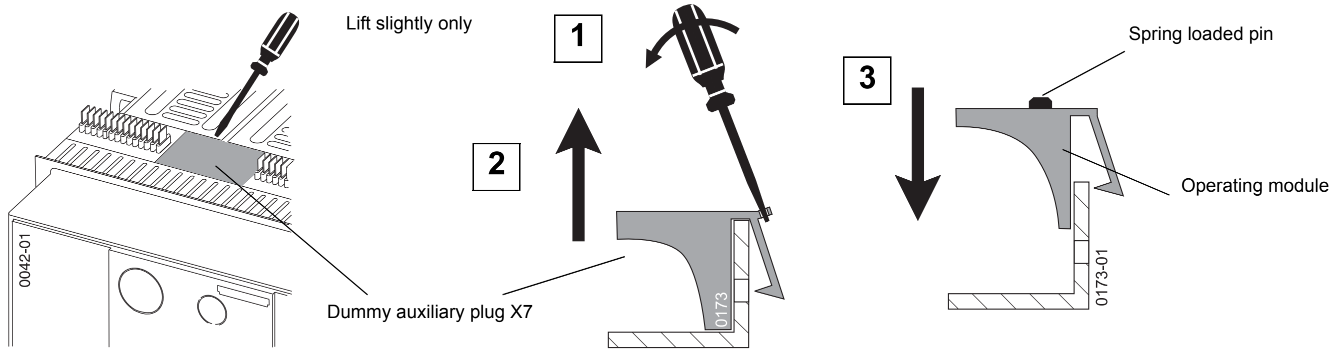


S46, S47 und S48:

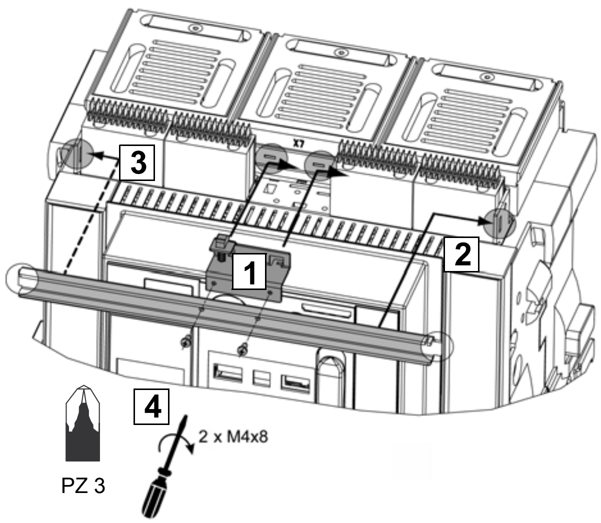
Signaling switch for sensing the position of the circuitbreaker in the guide frame for forwarding to the respective fieldbus and the **Cubicle**BUS

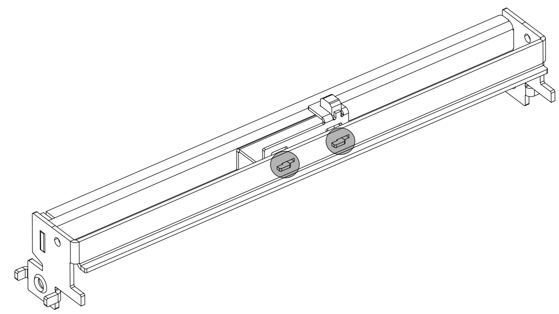
Attaching the position indicating module to the withdrawable circuit breaker

For actuating signaling switches S46, S47 and S48.

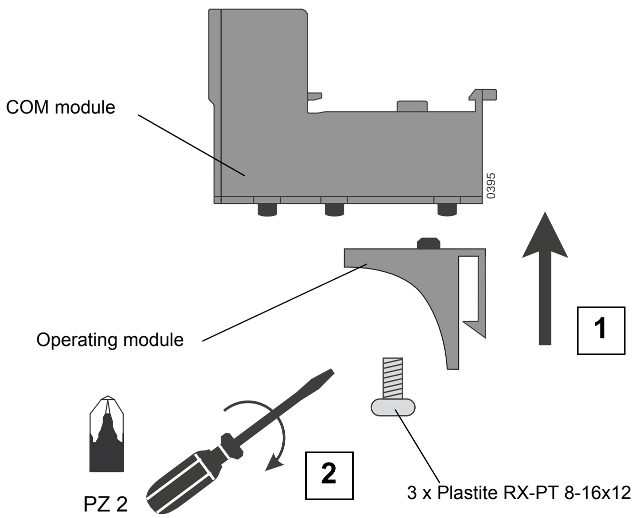


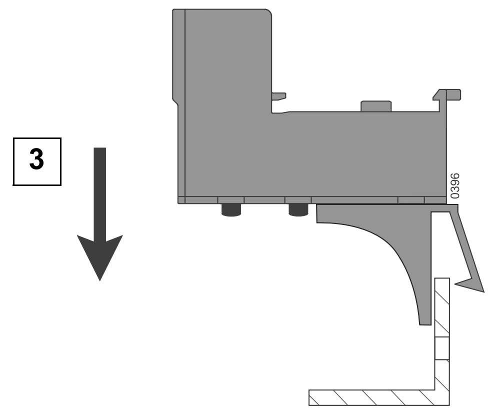
For frame size II and frame size III, L & C-class:





Fitting COM module on the fixed-mounted breaker

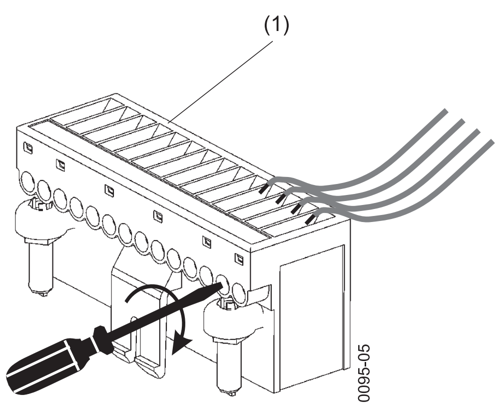


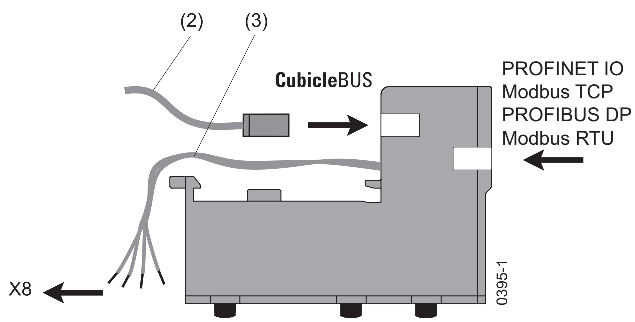


Connecting wires

→ Circuit diagrams (page 8-1)

Note
If necessary, missing auxiliary terminals may be added (receptacle, auxiliary connectors and sliding contact module for guide frames). → (page 5-27)



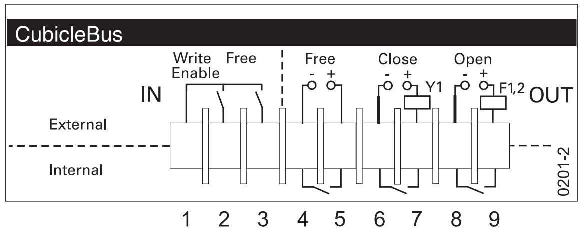


(1) Secondary connector X8
(2) Connecting cable to first external **Cubicle**BUS -module or terminating resistor
(3) Connecting cable to secondary connector X8

Designation	Assignment	Terminal
X8-1	**Cubicle**BUS -	X8.1
X8-2	**Cubicle**BUS +	X8.2
X8-3	24 V DC +	X8.3
X8-4	24 V DC GND	X8.4

NOTICE
If no external **Cubicle**BUS -modules are connected to the COM module, the terminating resistor must be plugged into the **Cubicle**BUS terminal. Absence of the terminating resistor can cause errors and potentially loss of communications.

Connections for additional inputs and outputs



IEC 61558 SELV/PELV – UL 1310 Class 2 Power Supply Only			
	Voltage	Max. Current	
		COM15/16	**COM35**
Power Supply:	24 V DC	125 mA	125 mA
Write Enable:		10 mA	10 mA
Free IN:		10 mA	10 mA
Free OUT:		400 mA	400 mA (1A@T_{amb} < 40°C)
Close:		400 mA	400 mA
Open		400 mA	400 mA

Ratings at $T_{ambient}$ < 70°C

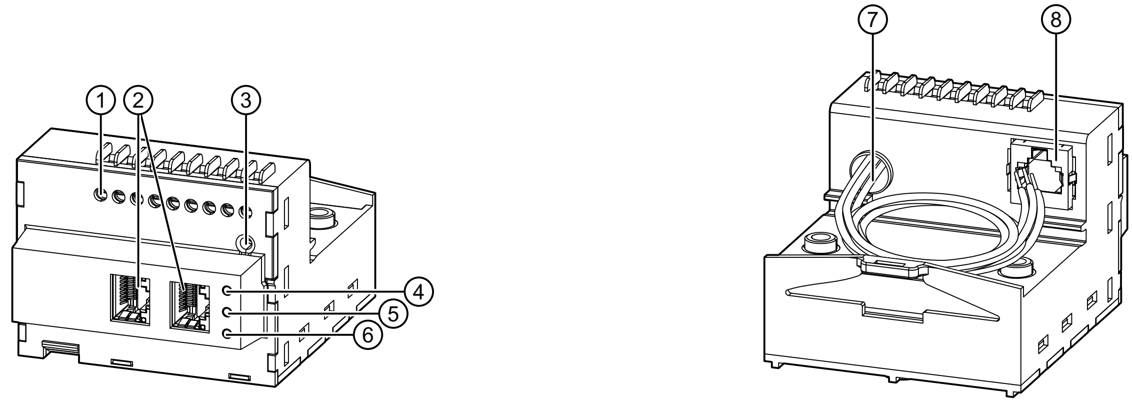
More detailed information about the use of these inputs and outputs can be found in the relevant system manuals

9.2.2.3 COM35 module

The COM35 communications module permits access to the circuit breaker via the fieldbus protocols PROFINET IO and Modbus TCP.

The COM35 also features:

- Ethernet switch functionality
- Both protocols may be used simultaneously on both ports
- Dynamic Arc Sentry (DAS) via the COM35 inputs and outputs
- Signed firmware update
- Tripped signal (bell alarm) via the COM35 output



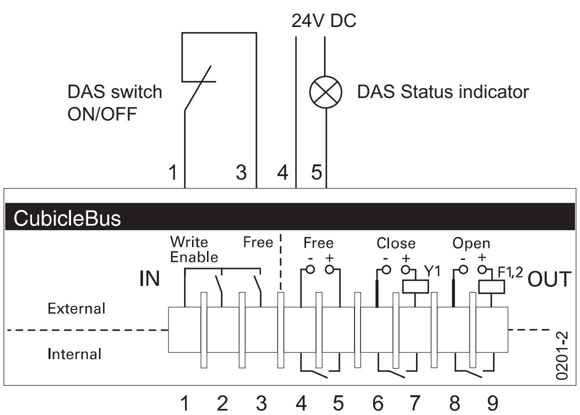
(1) Input/output terminals for user connection to additional functions
(2) RJ45 sockets for PROFINET IO and Modbus TCP connection
(3) Function-select button
(4) Activity LED PROFINET IO
(5) Activity LED Modbus TCP
(6) Activity LED **Cubicle**BUS
(7) Connections to the secondary disconnect contact system X8
(8) **Cubicle**BUS connection for connecting external **Cubicle**BUS modules or a **Cubicle**BUS terminating resistor

Note
The COM35 module can be specified as part of the circuit breaker catalog number or ordered separately: WLCOM35: Includes COM35 module and mounting hardware. WLCOM35RET: Retrofit kit including COM35, BSS and all required components to retrofit communications into a breaker.

Indicators

LED	Indication	Meaning
PROFINET IO	green	Normal PROFINET IO communcation
	green flashing	Communication with PROFINET IO Controller, no communication with PROFINET IO Supervisor
	red	No communication with PROFINET IO Controller, no communication with PROFINET IO Supervisor
Modbus TCP	green	At least one opened Modbus TCP connection
	green flashing	Ethernet link available but no Modbus TCP connection
	off	No Ethernet link
CubicleBUS	off	No **Cubicle**BUS participant active
	green	**Cubicle**BUS communication operating
	green flashing	No ETU installed (e.g: non-automatic/ disconnect switch application)
	red	**Cubicle**BUS error

Utilizing the programmable DAS function of the COM35:



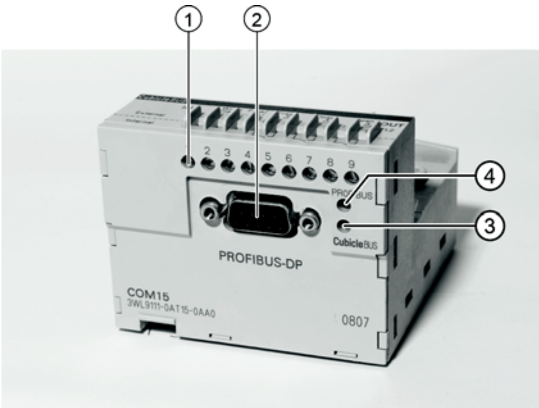
The COM35, exclusively, provides the ability to activate the DAS function of the WLETU776 directly via the COM35's programmable I/O. When the COM35 is programmed to enable this function, opening the connection between terminals 1 and 3 will cause the trip unit to switch to Parameter Set B. When contact is made between these two terminals, the trip unit will utilize Parameter Set A. The programmable output can then be used to activate a local status indicator (as illustrated). This COM35 I/O functionality must be programmed by the user via Siemens powerconfig software.

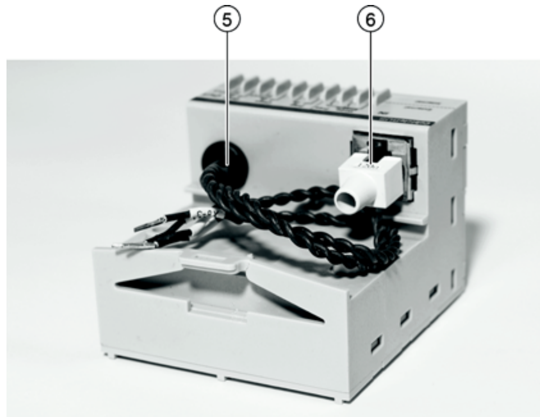
The programable output can carry a load of 1A, up to an ambient temperature of 45C (113F). Above that, the current–carrying capability of the output should be de-rated to 400mA at 70C (158F). The length of the wires connecting the activation switch to the input of the COM35 should be less than 50m (165ft) and be AWG18. Twisted/shielded-pair wiring is recommended for cable runs approaching this length.

9.2.2.4 COM15 module

The COM15 communication module allows access to the circuit breaker via the PROFIBUS DP fieldbus interface.

Overview





(1) Connection terminals for additional inputs and outputs to provide special functions
(2) SUB-D plug, 9-pole, for PROFIBUS DP connection
(3) **Cubicle**BUS LED
(4) PROFIBUS DP-LED
(5) Connecting cables to secondary connector X8
(6) **Cubicle**BUS connection for connecting external **Cubicle**BUS -modules or for the terminating resistor

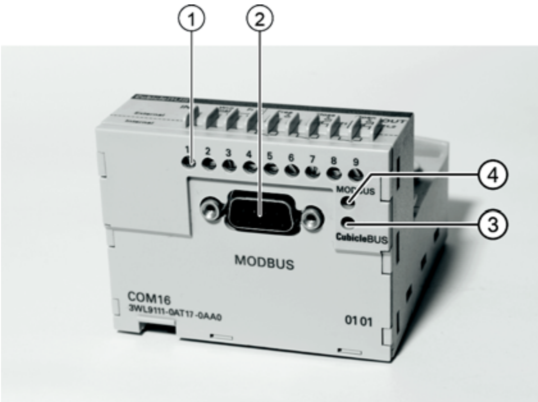
Indicators

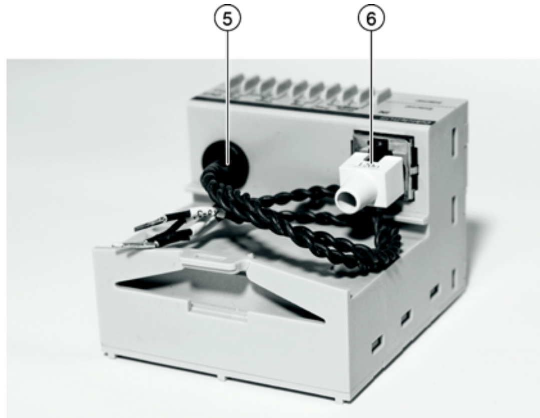
LED	Indication	Significance
PROFIBUS DP	off	No 24v dc power connected
	green	PROFIBUS DP communication active
	red	Bus fault or bus not responding
CubicleBUS	off	No **Cubicle**BUS -modules found or no 24v dc power connected
	green	**Cubicle**BUS communication active
	green flashing	**Cubicle**BUS device found, but no connection to ETU or metering function
	red	**Cubicle**BUS error

9.2.2.5 COM16 module

The COM16 communication module permits access to the circuit breaker via the Modbus RTU fieldbus interface.

Overview





(1) Connection terminals for additional inputs and outputs to provide special functions
(2) SUB-D plug, 9-pole, for Modbus RTU connection
(3) **Cubicle**BUS LED
(4) Modbus RTU LED
(5) Connecting cables to secondary connector X8
(6) **Cubicle**BUS connection for connecting external **Cubicle**BUS modules or for the terminating resistor

Installation and operation

Assembly is done as for the COM35 module:
for the guide frame → (page 9-60)
for fixed-mounted breakers → (page 9-62)

Installation and operating is described in the system handbook with document order number 3ZX1012-0WL10-1AC1.
It can be downloaded free of charge from:
http://support.automation.siemens.com/WW/view/en/39850157

Indicators

LED	Indication	Significance
PROFIBUS DP	off	No 24v dc power connected
	green	Modbus communication functioning
	red	No Modbus communication or timeout
CubicleBUS	off	No **Cubicle**BUS -modules found or no 24v dc power connected
	green	**Cubicle**BUS communication active
	green flashing	**Cubicle**BUS device found, but no connection to ETU or metering function
	red	**Cubicle**BUS error

Modbus RTU interface

The COM16 module is equipped with a 3-wire RS485 interface. The Modbus RTU connector is a 9-pin female Sub-D connector with the following pinout:

Pin	
1	RS485 Reference
5	Transceiver Terminal 1, V1 voltage
9	Transceiver Terminal 0, V0 voltage
2-4, 6-8	Not connected

Cables connecting COM16 modules via RS485 must contain three insulated conductors and a shield. The three isolated conductors connect to Pins 1, 5 & 9. The RS485 Reference must only be grounded at one end, preferably at the master. Grounding the RS485 Reference in multiple locations can allow common mode voltages to be imposed on the RS485 Transceiver terminals which can prevent communication and potentially damage the device.

The cable shield must only be grounded at one end, preferably at the master. Grounding the shield in multiple locations can allow circulating ground currents in the shield which can prevent successful communication.

Write Enable input

The COM16 Module is equipped with an input that must be activated to allow the module to accept remote control commands as well as remote parameterization. When this input is not active, the module will reject all incoming packets that would normally change the state of an output (open/close circuit breaker) or change protective parameters. Normal polling and communication of data are not affected.

The following commands are blocked if the Write Enable input is inactive:

- opening/closing circuit breaker
- resetting after a trip
- Changing any protective function parameters and extended protective function parameters
- changing any communications parameter (e.g. address)
- changing any parameter of the metering function (e.g. demand period length)
- resetting any diagnostic or service-related counter or indicator
- setting/resetting outputs of the digital output modules

The following commands are always allowed, independent of the state of the Write Enable input:

- changing and setting the trigger settings of the waveform capture function
- reading the contents of the waveform buffer
- changing alarm and setpoint function settings
- changing any of the customer-changeable text strings
- resetting the min/max log
- setting/resetting the "Free Output" of the COM16 module
- setting system time

Modbus RTU Functionality

Transmission Protocol

The COM16 module operates in the RTU transmission mode. ASCII transmission mode is not supported.

Overview of supported Functions

The COM16 module provides the following Modbus RTU function codes for accessing the data contained in the WL circuit breaker.

FC	Name	Description
02:	Read Discrete Inputs	Reads the state of the Bits in the Status Register
01:	Read Coils	Reads the state of multiple Control Bits and Extra Flags
05:	Write Single Coil	Sets the state of a single Control Bit or Extra Flag
15:	Write Multiple Coils	Sets the state of multiple Control Bits and Extra Flags
04:	Read Input Registers	Reads the Basic Data Registers. Three Basic Types (1, 2 and 3) are supported.
03:	Read Holding Registers	Reads a complete data set.
16:	Write Multiple Registers	Writes a complete data set.
07:	Read Exception Status	Reads the state of eight Exception Status bits
08:	Diagnostics	Function provides a method for checking the communication between the master and the slave
11:	Get Comm Event Counter	Returns a status word and an event count from the communications event counter
12:	Get Comm Event Log	Returns a status word, event count, message count, and a field of event bytes

Modbus RTU Communication settings

For Modbus RTU communication, the following settings must be made in the COM16 module: baud rate, serial transmission configuration, Modbus RTU address.

Modbus RTU Slave Address

The Modbus RTU communication address range of the COM16 module is 1 through 126.

Modbus RTU address 0 is used as a broadcast address in Modbus RTU systems.

Modbus RTU address 0xF1(hex) is defined as a broadcast address for COM16 modules.

The Modbus RTU slave address is assigned to data point 5 and may be changed by writing a new address value to high-byte of register 40962 (0xA002). If the COM16 module receives an invalid slave address value, the invalid value will be ignored.

Baud Rate

Baud rate settings of 1200, 2400, 4800, 9600 and 19200 are supported. 19200 baud is the default setting. The baud rate is assigned to data point 427 and may be changed by writing a new baud rate value to high-byte of register 40984 (0xA022). The following numbers are used to identify the selected baud rate. If the COM16 module receives an invalid baud rate, the invalid baud rate will be ignored.

Number	Baud rate
0	1200
1	2400
2	4800
3	9600
4	19200

Parity

Parity settings of "No Parity", "Odd Parity" and "Even Parity" are supported. "Even Parity" is the default setting. The parity is assigned to data point 428 and may be changed by writing a new parity value to the low-byte of register 40994 (0xA022). The following numbers are used to identify the selected parity. If the COM16 module receives an invalid parity, the invalid parity will be ignored.

Number	Parity
0	No Parity
1	Odd Parity
2	Even Parity

Auto configuration of baud rate and parity

The factory settings for baud rate and parity are 19200 baud and "Even Parity". These settings may be changed either by writing from the master to data points 427 and 428 in register 40994 (0xA022) or via the auto configuration process. The auto configuration process only occurs when the supply voltage is switched on.

When the supply voltage is switched on, the COM16 module monitors the bus activity. If the COM16 module detects bus activity but cannot receive any valid data, the auto configuration process is started. The module cycles through all combinations of baud rate and parity until it finds the combination which allows it to receive valid data. This combination is then saved and the auto configuration process ended.

If the COM16 module does not find a combination that allows it to receive valid data after cycling through all combinations, it will adopt the original settings for baud rate and parity, and the auto configuration process will be ended.

The time required to complete the auto configuration process can be several seconds depending on:

- Baud rate
- How often the master transmits a telegram
- The length of the messages transmitted by the master
- The number of tests required to detect a valid baud rate/parity combination

Changing the communication parameters

The communication parameters of the COM16 module can be changed by writing the required parameters (baud rate, serial configuration and Modbus RTU communication address) in data set 160.

		Dataset	160	Communication Parameters						
		Address:	A000	hex, Registers: 36, Access: Read / Write						
Register	Byte	HIGH/ LOW Byte	Description	Data point	Source WL	Source VL[1]	Source VL[2]	Format	Length	Scaling
40960	0		Header; value 0x00 00 00 00	—	COM16	COM11	COM21	—	32	—
40962	4	HIGH	Reserved	—	—	—	—	—	8	—
	5	LOW	Modbus RTU address	5	COM16	COM11	COM21	Unsigned char	8	0
40963	6	HIGH	Basic data type (1, 2 or 3)	6	COM16	COM11	COM21	Unsigned char	8	—
	7	LOW	Reserved	—	—	—	—	—	8	—
40964	8		Changeable data points in the basic data	7	COM16	COM11	COM21	Unsigned char	224	—
40984	48	HIGH	Modbus baud rate	427	COM16	COM11	COM21	Unsigned char	8	—
	49	LOW	Modbus parity	428	COM16	COM11	COM21	Unsigned char	8	—
40994	68	HIGH	Property for Byte 49	—	COM16	COM11	COM21	Property byte	8	—
	69	LOW	Property for Byte 48	—	COM16	COM11	COM21	Property byte	8	—
40995	70	HIGH	Reserved	—	—	—	—	Property byte	8	—
	71	LOW	Property for Byte 5	—	COM16	COM11	COM21	Property byte	8	—
40996	72	HIGH	Property for Byte 6	—	COM16	COM11	COM21	Property byte	8	—
	73	LOW	Reserved	—	—	—	—	Property byte	8	—
40997	74	HIGH	Property for Byte 8	—	COM16	COM11	COM21	Property byte	8	—
	75	LOW	Reserved	—	—	—	—	Property byte	8	—
78			**Total Bytes**							

Note: Registers not listed are reserved.

For details on data formats and properties, see "SENTRON WL VL circuit breakers with communication capability MODBUS" manual.

Modbus RTU function codes

In addition to the Modbus RTU function codes of the COM16 module, described on page 9-68, the following definitions of the Status Register, Control Bits, Extra Flags, Basic Types and Exception Status Bits apply to the COM16 module.

Status Register

The Status Register provides WL status information to the Modbus RTU master. The Status Register is accessed using the following functions:

- 02 Read Input Status Discretes
- 04 Read Input Registers

Bit number	WL
0, 1	Circuit breaker position 00 = disconnected position 01 = connected position 10 = test position 11 = circuit breaker not present
2, 3	Circuit breaker status 00 = not ready 01 = circuit breaker open 10 = circuit breaker closed 11 = circuit breaker tripped
4	Circuit Breaker is "Ready-to-close"
5	Undervoltage release
6	Closing spring charged
7	Overload warning
8	Setpoints active
9	Warning(s) active
10	Modbus RTU "Write enable" input active
11	User input
12, 13, 14	Trip 000 = no trip 001 = overload trip 010 = instantaneous short-circuit trip 011 = short time delayed short-circuit trip 100 = ground-fault trip 101 = trip caused by extended protective function 110 = N conductor trip
15	Load shedding

Control Bits and Extra Flags

Control Bits and Extra Flags make it possible for the Modbus RTU master to control various WL functions.
The Control Bits and Extra Flags are accessed using the following functions:

- 01 Read Coils
- 05 Write Single Coil
- 15 Write Multiple Coils

Bit number		WL
Control Bits	0, 1	Breaker open / close 00 = no action 01 = open circuit breaker 10 = close circuit breaker 11 = no action
	2	clear reason for trip
	3	Not used
	4	User output 0 = User output Off 1 = User output On
	5	Not used
	6	Not used
	7	Not used
Extra Flags	8, 9	not used
	10	Clear log book
	11	Clear all min/max values
	12	Clear temperature min/max values
	13	Not used
	14	Clear maintainance counters
	15	Synchronize system clock at a rising edge Sets the time to xx:30:00:00

Byte Order

Data points larger than two bytes transmitted in the Motorola Format (Big-Endian).

Byte Order			Type of Data
Byte 0	Byte 0		char, unsigned char
Byte 1	Byte 1		
Byte 0	High Byte		signed int, unsigned int
Byte 1	Low Byte		
Byte 0	High Byte	High Word	signed long, unsigned long
Byte 1	Low Byte		
Byte 2	High Byte	Low Word	
Byte 3	Low Byte		

Basic Data Types

Basic data types 1, 2 and 3 are supported. Basic data type 1 is the default setting. Basic data type 1 consists of 7 registers, basic data type 2 consists of 13 registers and Basic data type 3 consists of 22 registers.

Basic data is accessed using the function:

04 Read Input Registers - Reads the Basic Data including the Status Register

Basic Data Type 1 Registers and Default Data Points

Register	Byte	Name	Default Data Point – WL
1	0, 1	Status Register	WL status bits
2	2, 3	Data Block 1	Phase L1 current
3	4, 5	Data Block 2	Phase L2 current
4	6, 7	Data Block 3	Phase L3 current
5	8, 9	Data Block 4	Current in phase under highest load
6	10	Block 1 property byte	Property byte of phase L1 current
	11	Block 2 property byte	Property byte of phase L2 current
7	12	Block 3 property byte	Property byte of phase L3 current
	13	Block 4 property byte	Property byte of max current in phase under highest load

Basic Data Type 2 Registers and Default Data Points

Register	Byte	Name	Default Data Point – WL
1	0, 1	Status Register	WL status bits
2	2, 3	Data Block 1	Phase L1 current
3	4, 5	Data Block 2	Phase L2 current
4	6, 7	Data Block 3	Phase L3 current
5	8, 9	Data Block 4	Current in phase under highest load
6	10, 11	Data Block 5	Current in neutral conductor
7	12, 13	Data Block 6	Average phase-to-phase voltage
8	14, 15	Data Block 7	Average power factors of 3 phases
9	16, 17	Data Block 8	Total active energy of 3 phases[a)]
10	18	Block 1 property byte	Property byte of phase L1 current
	19	Block 2 property byte	Property byte of phase L2 current
11	20	Block 3 property byte	Property byte of phase L3 current
	21	Block 4 property byte	Property byte of current in phase under highest load
12	22	Block 5 property byte	Property byte of current in neutral conductor
	23	Block 6 property byte	Property byte of average phase-to-phase voltage
13	24	Block 7 property byte	Property byte of average power factors of 3 phases
	25	Block 8 property byte	Property byte of total active energy of 3 phases

a) Only 2 bytes of the 4 byte data point will be communicated (range: 0 - 65535 MWh)

Basic Data Type 3 Registers and Default Data Points

Register	Byte	Name	Default Data Point – WL
1	0, 1	Status Register	WL status bits
2	2, 3	Data Block 1	Phase L1 current
3	4, 5	Data Block 2	Phase L2 current
4	6, 7	Data Block 3	Phase L3 current
5	8, 9	Data Block 4	Current in phase under highest load
6	10, 11	Data Block 5	Current in neutral conductor
7	12, 13	Data Block 6	Phase-to-phase voltage L1 to L2
8	14, 15	Data Block 7	Phase-to-phase voltage L2 to L3
9	16, 17	Data Block 8	Phase-to-phase voltage L3 to L1
10	18, 19	Data Block 9	Phase-to-neutral voltage L1
11	20, 21	Data Block 10	Phase-to-neutral voltage L2
12	22, 23	Data Block 11	Phase-to-neutral voltage L3
13	24, 25	Data Block 12	Average power factor of 3 phases
14	26, 27	Data Block 13	Total active energy of 3 phases*
15	28, 29	Data Block 14	Total apparent power of 3 phases
16	30	Block 1 property byte	Property byte of phase L1 current
	31	Block 2 property byte	Property byte of phase L2 current
17	32	Block 3 property byte	Property byte of phase L3 current
	33	Block 4 property byte	Property byte of current in phase under highest load
18	34	Block 5 property byte	Property byte of current in neutral conductor
	35	Block 6 property byte	Property byte of phase-to-phase voltage L1 to L2
19	36	Block 7 property byte	Property byte of phase-to-phase voltage L2 to L3
	37	Block 8 property byte	Property byte of phase-to-phase voltage L3 to L1
20	38	Block 9 property byte	Property byte of phase-to-neutral voltage L1
	39	Block 10 property byte	Property byte of phase-to-neutral voltage L2
21	40	Block 11 property byte	Property byte of phase-to-neutral voltage L3
	41	Block 12 property byte	Property byte of average power factors of 3 phases
22	42	Block 13 property byte	Property byte of total active energy of 3 phases[a)]
	43	Block 14 property byte	Property byte of total apparent power of 3 phases

* Only 2 bytes of the 4 byte data point will be communicated (range: 0 - 65535 MWh)

Exception Status Bits

The Exception Status Bits are accessed using the following functions:

07 Read Exception Status - Reads the state of the Exception Status Bits

Bit	Description
0	Excessive breaker contact wear
1	Communication with trip unit OK
2	COM16 is OK
3 - 7	Reserved

Further information about the application of these inputs and outputs is given in the "WL Modbus RTU Communication Manual" WL Low Voltage Power Circuit Breaker catalog.

Catalog number

	Catalog No.
WL Breaker Configuration Software	POWERCONFIG

9.2.2.6 Metering function *PLUS*

Trip units ETU745 - ETU776 can be equipped with a metering function *PLUS*. This, however, requires external voltage transformers providing a three-phase metering voltage (such as the Siemens WL3VT).

This data can be shown on the display of the trip units, transmitted by the COM module via PROFIBUS DP, PROFINET IO, Modbus RTU, or Modbus TCP, and passed on to the outputs of external **Cubicle**BUS modules. Based on this data, conclusions can be drawn about the condition of the power system. To use the metering function without communication, an external 24 V auxiliary voltage supply is required.

NOTICE

High voltages may damage the MeteringPLUS module.

The secondary voltage of the external voltage transformers must not exceed 150 V AC RMS or 300 V AC peak value.

In addition to the values for the currents, the metering function *PLUS* provides data on voltages, powers, energy values, power factors and frequency via the **Cubicle**BUS for further processing.

These data can be shown on the display of the trip units, transmitted to the PROFIBUS DP via the COM15 module or to the Modbus RTU via the COM16 module and transferred to the outputs of external **Cubicle**BUS modules. Based on these data, conclusions can be drawn about the condition of the power system.

Measured parameter	**Range**	**Accuracy**[1]
Currents I_{L1}, I_{L2}, I_{L3}, I_N	30 - 8000 A	± 1 % of measurement range
Ground current measured per GF mode setting (residual or direct sense).	100 - 1200	± 5 % of measurement range
Line-to-line voltages U_{L12}, U_{L23}, U_{L31}	15 - 130 V 130 - 1150 V	± 5 % of read value ± 1 % of measurement range
Line-to-neutral-line voltages U_{L1N}, U_{L2N}, U_{L3N}	10 - 75 V 75 - 700 V	± 5 % of read value ± 1 % of measurement range
Average line-to-line voltages U_{avgD}	15 - 130 V 130 - 1150 V	± 5 % of read value ± 1 % of measurement range
Average line-to-neutral-line voltages U_{avgY}	10 - 75 V 75 - 700 V	± 5 % of read value ± 1 % of measurement range
Apparent power S_{L1}, S_{L2}, S_{L3}	13 - 8000 kVA	± 2 % of measurement range ± 2 % vom Messbereich
Total apparent power	13 - 24000 kVA	± 2 % of measurement range
Active power P_{L1}, P_{L2}, P_{L3}	-8000 - +8000 kW	± 2 % of apparent power (P.F. > 0.6)
Total active power	-24000 - +24000 kW	± 2 % of apparent power (P.F. > 0,6)
Reactive power Q_{L1}, Q_{L2}, Q_{L3}	-6400 - +6400 kVar	± 4 % of apparent power
Total reactive power	-20000 - +20000 kVar	± 4 % of apparent power
Power factors $\cos\varphi_{L1}$, $\cos\varphi_{L2}$, $\cos\varphi_{L3}$,	-0,6 - 1 - +0.6 -0.6 - 1 - +0,6	± 0.04 ± 0,04
Power factor total	-0.6 - 1 - +0.6 -0,6 - 1 - +0,6	± 0.04 ± 0,04
Ampere demand per phase of currents I_{L1}, I_{L2}, I_{L3}	30 - 8000 A	± 1 % of measurement range
3-phase ampere demand	30 - 8000 A	± 1 % of measurement range
Active power demand per phase in L_1, L_2, L_3	13 - 8000 kW	± 2 % of apparent power (P.F. > 0.6)
3-phase active power demand	13 - 8000 kW	± 2 % of measurement range
Apparent power demand per phase in L_1, L_2, L_3	13 - 8000 kVA	± 2 % of measurement range
3-phase apparent power demand	13 - 8000 kVA	± 2 % of measurement range
3-phase reactive power demand	-8000 - +8000 kVar	± 4 % of apparent power
Active energy in the normal direction	1 - 10000 MWh	± 2 %
Active energy in the reverse direction	1 - 10000 MWh	± 2 %
Reactive energy in the normal direction	1 - 10000 MVarh	± 2 %
Reactive energy in the reverse direction	1 - 10000 MVarh	± 2 %
Frequency	15 - 40 Hz 40 - 70 Hz 70 - 440 Hz	± 0.1 Hz ± 0,1 Hz
Total harmonic distortion of current and voltage	2 - 100 %	± 2 % of measurement range up to 29^{th} harmonic
Phase unbalance of current and voltage[2]	2 - 150 %	± 1 % of displayed value

1) The given measured value tolerances are valid for one year based on an average operating temperature of 25 °C. After this period, deviations may occur. The given tolerances for measured values for which the measured voltage is consumed when being determined are only valid if the voltage measurement is carried out with an accuracy of 0.5 %.

2) **ANSI definition:** Ratio of the largest difference between the phases and the average of all 3 phases.

Extended metering functions

The metering function *PLUS* is used to implement extended protective functions beyond the functionality of the trip units.

Parameter	Range	Delay
Undervoltage	100 - 1100 V	0 - 15 sec.
Overvoltage	200 - 1200 V	0 - 15 sec.
Active power in normal direction	1 - 12000 kW	0 - 15 sec.
Active power in reverse direction	1 - 12000 kW	0 - 15 sec.
Overfrequency	40 - 70 Hz	0 - 15 sec.
Underfrequency	40 - 70 Hz	0 - 15 sec.
Phase current unbalance 1)	5 - 50%	0 - 15 sec.
Phase voltage unbalance 1)	5 - 50%	0 - 15 sec.
Phase rotation		
Pickup THD current	3 - 50%	5 - 15 sec.
Pickup THD voltage	3 - 50%	5 - 15 sec.

1) **ANSI definition:**
Ratio of the largest difference between the phases and the average of all 3 phases.

If one of these parameters exceeds or falls below its default settings, the trip unit is tripped after the adjusted delay via the **Cubicle**BUS .

The parameters can be adjusted via:

- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2)
- the graphical display (ETU776)

Setpoints

The setpoint function can be used to signal or record special events in the power system.

Parameter	Range	Delay
Phase overcurrent	30 - 10000 A	0 - 255 sec.
Ground overcurrent	30 - 12000 A	0 - 255 sec.
Neutral overcurrent	30 - 10000 A	0 - 255 sec.
phase current unbalance*	5 - 50%	0 - 255 sec.
current demand	30 - 10000 A	0 - 255 sec.
undervoltage	100 - 1100 V	0 - 255 sec.
phase voltage unbalance*	5 - 50%	0 - 255 sec.
overvoltage	100 - 1100 V	0 - 255 sec.
overpower in normal direction	1 - 12000 kW	0 - 255 sec.
KW reverse	1 - 12000 kW	0 - 255 sec.
KW demand	1 - 12000 kW	0 - 255 sec.
KVA demand	1 - 12000 kVA	0 - 255 sec.
KVAR demand	1 - 12000 kVar	0 - 255 sec.
KVAR consumed	1 - 12000 kVar	0 - 255 sec.
KVAR delivered	1 - 12000 kVar	0 - 255 sec.
KVA	1 - 12000 kVA	0 - 255 sec.
overfrequency	40 - 70 Hz	0 - 255 sec.
underfrequency	40 - 70 Hz	0 - 255 sec.
Under-PF (power factor)	-0.001 - 0.001	0 - 255 sec.
Over-PF (power factor)	-0.001 - 0.001	0 - 255 sec.
current THD	3 - 50%	0 - 255 sec.
voltage THD	3 - 50%	0 - 255 sec.
crest factor	1 - 2.55	0 - 255 sec.
form factor	1 - 2.55	0 - 255 sec.

1) **ANSI definition:**
Ratio of the largest difference between the phases and the average of all 3 phases.

If one of these parameters exceeds or falls below its default settings, the trip unit is tripped after the adjusted delay via the **Cubicle**BUS .

The parameters can be adjusted via:

- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2)
- the graphical display (ETU776).

Additional functions

The metering function *Plus* offers two additional functions:

- two independent waveform buffers
- harmonic analysis

The two independent waveform buffers can be used to analyze the current and voltage values at the time of the event.

If the waveform buffers are programmed to "recording" (standard setting), continuous recording takes place until a previously defined event occurs. Then, the recording is stopped, and the current or voltage waveforms at the time of the event can be observed on a visual display (graphical LCD, laptop or PC). The time window is one second; the resolution is 1649 values/second.

Settings for waveform buffers	
Currents	I_{L1}, I_{L2}, I_{L3}, I_{LN}, I_g
Voltages	U_{L1}, U_{L2}, U_{L3}

The waveform buffers can also be started or stopped individually via the communication channels (PROFIBUS DP, PROFINET IO, Modbus TCP, Modbus RTU, **Cubicle**BUS).

The waveform buffers can be parameterized via:

- TD400 and the software "powerconfig"
- the COM modules with a PC with the software “powerconfig” installed → (page 29-2)
- the graphical display (ETU776)

9.2.2.7 Connecting voltage transformers

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

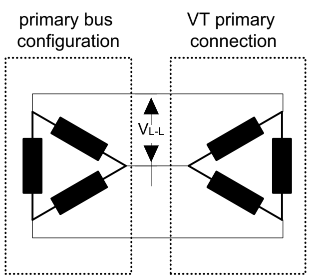
The metering module ("Meter*PLUS* Function") can be set to expect 3W or 4W (LL/LG) connections and will correct the amplitude and phase of the signal as necessary.

The parameters on the trip unit must be set as follows:

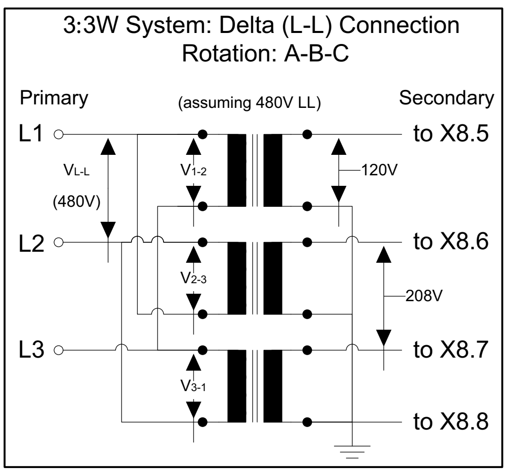
(1) VT Primary voltage (100 V ac ... 1200 V ac)
(2) VT Secondary voltage
(100 V/110 V/120 V)
(3) VT Connection
(Wye / LG, Delta / LL)

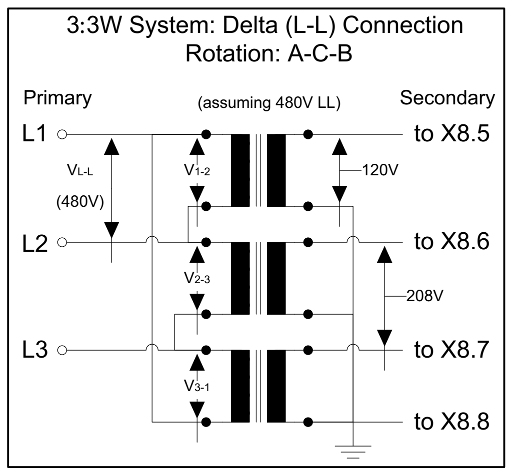
Three VTs must be used at all times.

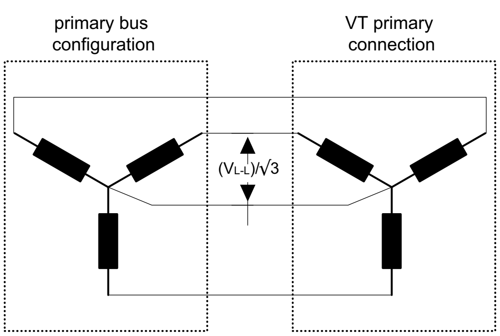
All three VTs must be rated for the rated LL voltage (e.g. 480 V) and can have either 100 V / 110 V or 120 V secondary rated voltage.



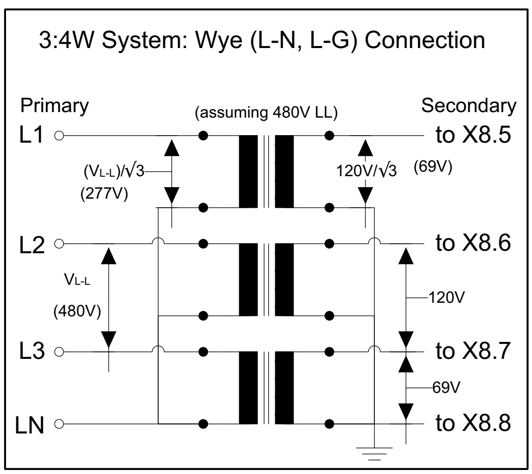
Metering VT Settings:
Delta/Wye : Delta
VT Primary: 480 (for instance)
VT Secondary: 120 (for instance)







Metering VT Settings:
Delta/Wye : Wye
VT Primary: 480 (for instance)
VT Secondary: 120 (for instance)



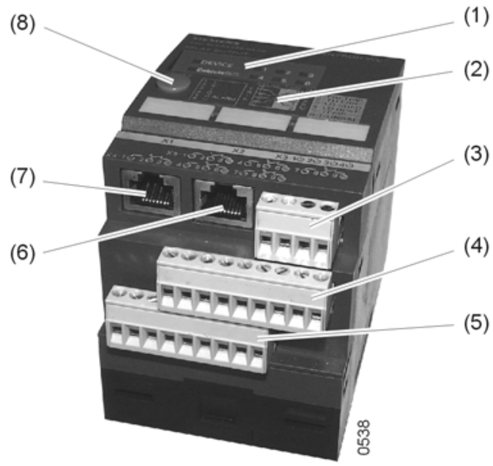
Note: Required primary and secondary overcurrent protection (fusing) not shown for clarity.

9.2.3 External CublicleBUS modules

9.2.3.1 General

Application

External **Cubicle**BUS modules are used for communication between the WL circuit breaker and the secondary equipment in the circuit breaker panel. They are provided to control analog indications, transmit the circuit breaker tripping status and the reason for tripping and to read additional control signals. Furthermore, with one of these modules it is possible to implement a zone selective interlocking for short-circuit protection.



CubicleBUS connections at module:
X3-1 = Ground 24V DC
X3-2 = CubicleBUS -
X3-3 = CubicleBUS +
X3-4 = +24V DC

CubicleBUS connections at breaker:
X8-1 = CubicleBUS -
X8-2 = CubicleBUS +
X8-3 = +24V DC
X8-4 = Ground 24V DC

(1) Indicator LED
(2) Rotary coding switch
(3) Connection X3: **Cubicle**BUS
(4) Connection X5: inputs or outputs
(5) Connection X4: inputs or outputs
(6) Connection X2: **Cubicle**BUS
(7) Connection X1: **Cubicle**BUS
(8) "TEST" button

Installation

The external **Cubicle**BUS modules are snapped onto a standard 35-mm DIN rail inside the switchgear panel. It must be ensured that the length of the connecting cable of the first module to the circuit breaker does not exceed 6.5 ft.

Connection setup

The **Cubicle**BUS modules must only be connected to each other and to the circuit breaker using the pre-assembled cables supplied. These cables are also used for the 24 V DC voltage supply of the **Cubicle**BUS modules.
If more than two **Cubicle**BUS modules are connected, the 24 V DC voltage supply must be fed via a separate cable from module to module.

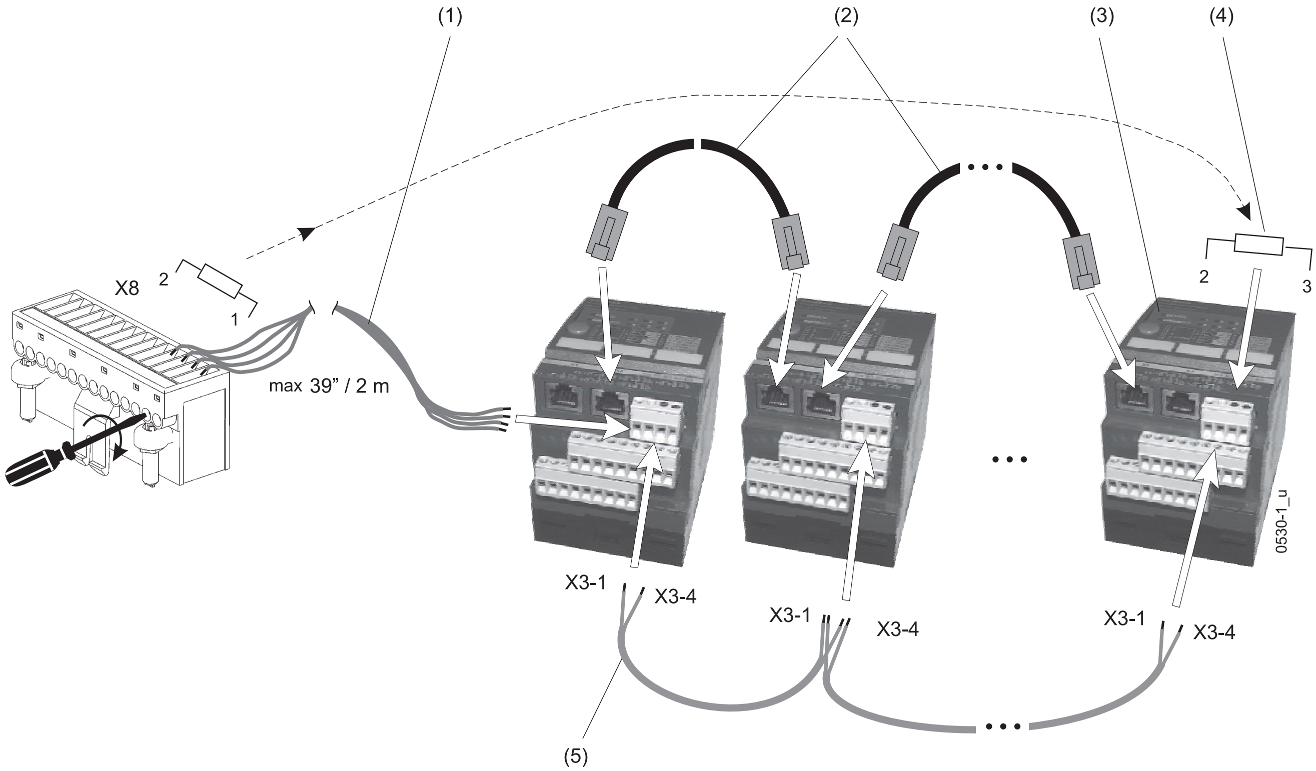
Only one **Cubicle**BUS module can be connected directly to a circuit breaker. Further modules must be connected from module to module. Radial cables are not permissible.

If provided, the ZSI module is always the first module, and must be connected directly to the circuit breaker.

The **Cubicle**BUS cable must be connected to the X3 connection of the last module with a 120 Ω 0.5 W resistor.

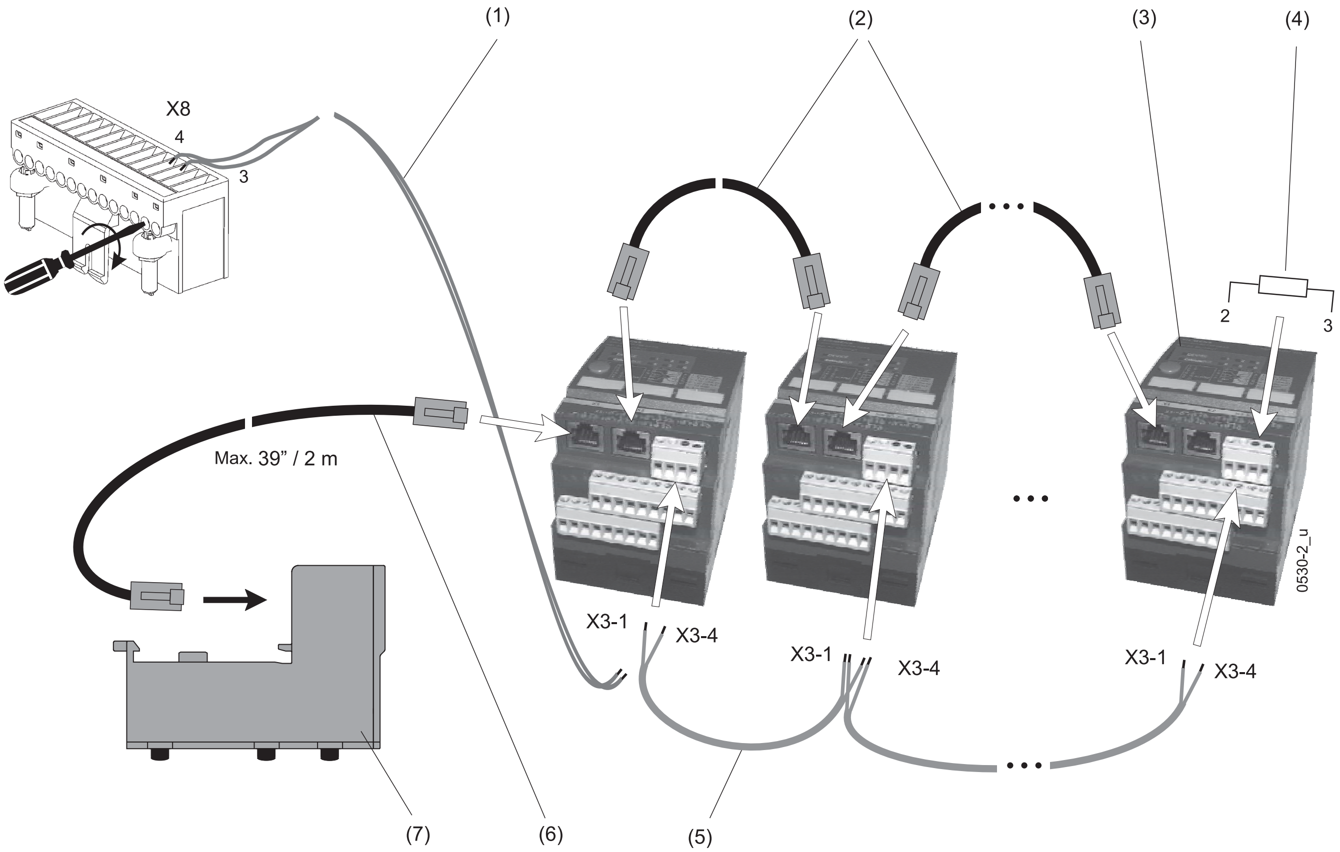
The total length of the **Cubicle**BUS cables must not exceed 30 ft from auxiliary current plug X8 of the circuit breaker to the last **Cubicle**BUS module.

Circuit breaker without COM module



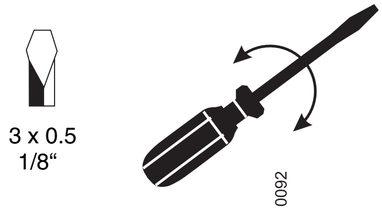
(1) Connecting cable to 1st module (4-conductor, conductors X8-4/X3-1 twisted with X8-3/X3-4 and X8-1/X3-2 twisted with X8-2/X3-3)
(2) Connecting cables between modules
(3) **Cubicle**BUS modules
(4) Terminating resistor 120 Ω 0.5 W
(5) Cable connection for 24 V DC voltage supply

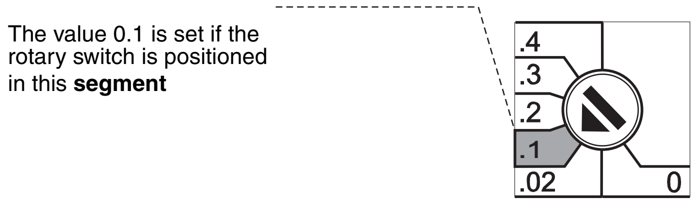
Circuit breaker with COM module



(1) **Only if there are more than 2 CubicleBUS modules:**
Connecting cables between the X8 and the first CubicleBUS module for 24 V DC voltage supply
(2) Connecting cables between CubicleBUS modules
(3) CubicleBUS modules
(4) Terminating resistor 120 Ω 0.5 W
(5) Connecting cables between the modules for 24 V DC voltage supply
(6) Connecting cable between the COM module and the first CubicleBUS module (with two RJ45 plugs)
(7) COM module

Changing settings





Indicators

LED	Indication	Significance
DEVICE	green	Module in operation
	yellow	Module in test mode
	red	Module faulty
CubicleBUS	green	Connection to **Cubicle**BUS available
	off	No connection to **Cubicle**BUS
All other LEDs	yellow	Option set or signal available
	off	Option not set or no signal available

Module test

NOTICE

Unintended operation of the circuit breaker and other devices.

The test circuits of this unit emit real output signals that may cause operation of the circuit breaker and other devices that may be connected to the associated CubicleBUS module.

During the test, the circuit breaker and downstream devices shoud be isolated to prevent unintended device operations.

The correct operation of the **Cubicle**BUS modules can be verified in the test mode. The test mode is started by pushing the "TEST" button once. All outputs and the associated LEDs are switched off. The color of the DEVICE LED changes from green to yellow.

Testing inputs and outputs

Pressing the "TEST" Button	Reaction
Twice quickly	- LED 1 on - Input/output 1 on
After a pause, twice quickly	- LED 1 and input/output 1 off, LED 2 on - Input/output 2 on
After a pause, twice quickly	- LED 2 and input/output 2 off, LED 3 on - Input/output 3 on
...	...
After a pause, twice quickly	- LED 5 and input/output 5 off, LED 6 on - Input/output 6 on
After a pause, once	Input/output 6 off, all LEDs on
Once	Test mode starts again, all inputs/outputs and the associated LEDs are off

Pushing the "TEST" button several times in quick succession when an LED is on switches the respective input/output on and off alternately.

Testing LEDs only

Pushing the "Test" button several times with pauses in between switches the LEDs on successively. After the last LED, all LEDs are switched on.

Repeated pushing the "TEST" button starts the test mode again, and all LEDs, inputs and outputs are switched off.

Leaving the test mode

Do not press the "TEST" button for approximately 30 sec.

If all LEDs are on, the test mode will already be quitted after about 4 sec.

9.2.3.2 ZSI module

Function

When circuit breakers are combined with ZSI modules, a short-circuit occurring in systems with several grading levels can be precisely localized.

For this purpose, all circuit breakers are interconnected via their ZSI modules.

When a short-circuit or ground-fault occurs, each circuit breaker affected by the short-circuit current queries its downstream circuit breaker to determine whether the short-circuit is present in the next downstream device. Only the circuit breaker nearest the short-circuit, in the upstream direction, is tripped. If "S" or "S+G" is selected on the ZSI module and the circuit breaker does not receive a blocking signal - ZSI-IN - from its downstream circuit breaker, in the event of short-circuit, the delay time setting for the short-circuit trip is set to 50 ms. If a short-circuit is detected, a blocking signal - ZSI-OUT - will be sent to the upstream circuit breakers. The trip takes place after 50 ms. It typically delays between 80 and 90 ms.

If "S" or "S+G" is selected on the ZSI module and the circuit breaker does not receive a blocking signal - ZSI-IN - from its downstream circuit breaker, in the event of ground-fault, the delay time setting for the ground-fault trip is set to 100 ms.

If a ground-fault is detected, a blocking signal - ZSI-OUT - will be sent to the upstream circuit breakers. The trip takes place after 100 ms. It typically delays between 130 and 140 ms.

After a maximum delay time of 3 s, a given blocking signal ZSI-OUT is terminated.

Installation

→ (page 9-83)

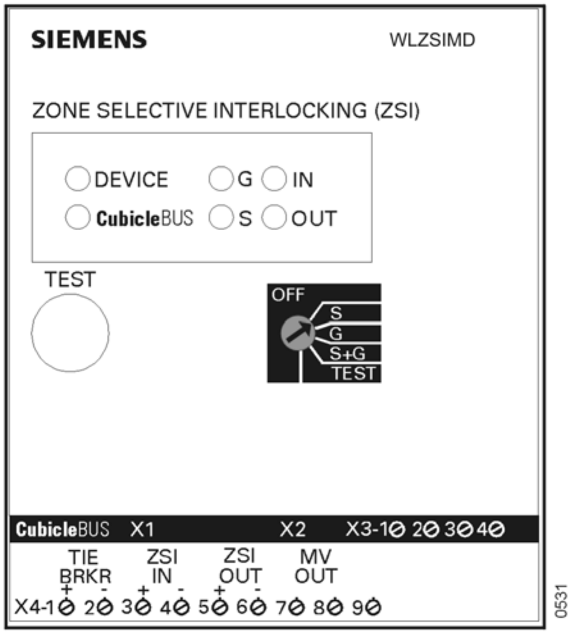
Connection

→ Connection setup (page 9-83)

Only one ZSI module can be connected per circuit breaker.

If the ZSI module is used together with other **Cubicle**BUS modules, the ZSI module must be connected directly to the COM module or secondary terminal block X8.

Terminal assignment



Terminal	Connection
TIE BRKR	Only for Tie Breakers; Allows complete ZSI functionality in systems with tie breakers
ZSI IN	ZSI modules of downstream circuit breakers
ZSI OUT	ZSI modules of upstream circuit breakers
MV OUT	Signal to the medium-voltage level

Observe the specified polarity when connecting: plus to plus and minus to minus.

The maximum wire length of the ZSI wiring is 400 m for a wire diameter of AWG 18 (2-wire conductor).
For ZSI connections between only WL circuit breakers, wire lengths of up to 1000 m are permissible if the conductor diameter is increased to AWG 13.

The ZSI connections must consist of twisted pair cables or shielded cables.

The ZSI module allows connection of up to:

- 8 circuit breakers at the ZSI IN input and
- 20 circuit breakers at the ZSI OUT output

Note: Prior to testing the circuit breaker via primary injection and while 24v dc is applied to the trip unit and ZSI module, turn the rotary switch to OFF. If this is not done, the trip unit will "remember" being part of the ZSI system and will always trip according to its ZSI time (80ms) during a short-time overcurrent test instead of in its set delay.

Be sure to turn ZSI back on prior to re-energizing the system.

Settings

→ Changing settings (page 9-86)

Settings ZSI module	
OFF	ZSI function deactivated
S	ZSI module effective for short-time delayed short-circuits only
G	ZSI-module effective for ground-fault protection only
S+G	ZSI-module effective for short-time delayed short-circuits and ground-fault protection
TEST	Test position for checking the ZSI functionality

Indicators

→ (page 9-86)

Testing

→ (page 9-86)

In addition, a special test feature of the ZSI module (rotary coding switch in TEST position) makes it possible to check the ZSI wiring and the operativeness of the ZSI electronics.

9.2.3.3 Digital input module

Function

With the digital input module, up to 6 additional binary signals (DC 24 V) can be connected to the system.

These input signals are transferred to the PROFIBUS DP, PROFINET IO, Modbus RTU and Modbus TCP via the **Cubicle**BUS, and can be evaluated accordingly.

For trip units ETU776, it is possible as an alternative to use an input signal of this type at input 1 to switch between two different sets of protection parameters (if provided).

Installation

→ (page 9-83)

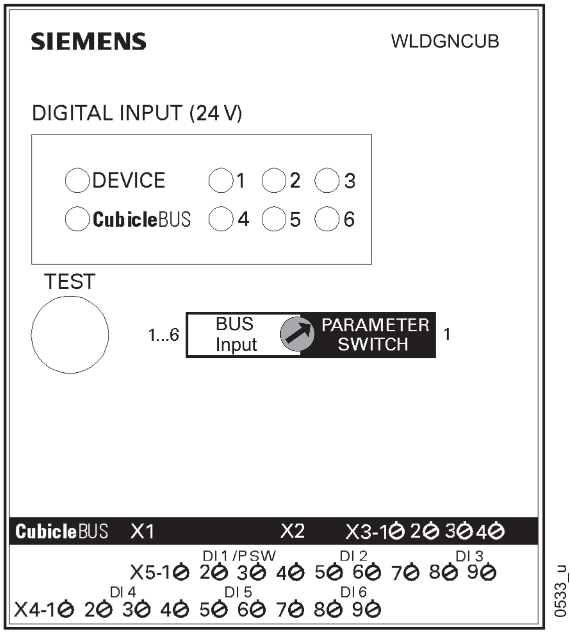
Connection

→ Connection setup (page 9-83)

A maximum of two digital input modules can be operated on the **Cubicle**BUS at the same time

- 1 module with the "BUS INPUT" setting
- 1 module with the "PARAMETER SWITCH" setting

Terminal assignment



Terminal assignment of digital input module	
X4	Inputs 4-6
X5	Inputs 1-3

Settings

→ Changing settings (page 9-86)

Settings of digital input module	
PROFIBUS DP INPUT	Inputs 1-6 are active. If an input signal is present, a corresponding message is output via the COM module to the respective fieldbus.
PARAMETER SWITCH	Input 1 is used for parameter switchover. All other inputs have no function. No input signal (LED 1 not lights up): Parameter set A activated Input signal available (LED 1 lights up): Parameter set B activated

NOTE
The parameter switchover query can be overruled by a query via the PROFIBUS DP, Modbus RTU and Modbus TCP / PROFINET IO-communication, the TD400 or the graphical display. For further details please refer to "SENTRON 3WL / 3VL Circuit Breakers with communication capability - PROFIBUS DP”.

Indicators

→ (page 9-86)

Testing

→ (page 9-86)

9.2.3.4 Digital output modules

Function

With digital output modules, up to 6 signals can be transmitted.

If the trip unit signals an event, the corresponding LED lights up after the adjusted delay time has elapsed, and the module sets a signal at the corresponding output.

Digital output modules are available in the following versions:

- with rotary coding switch and relay outputs
- configurable and with relay outputs

Installation

→ (page 9-83)

Connection

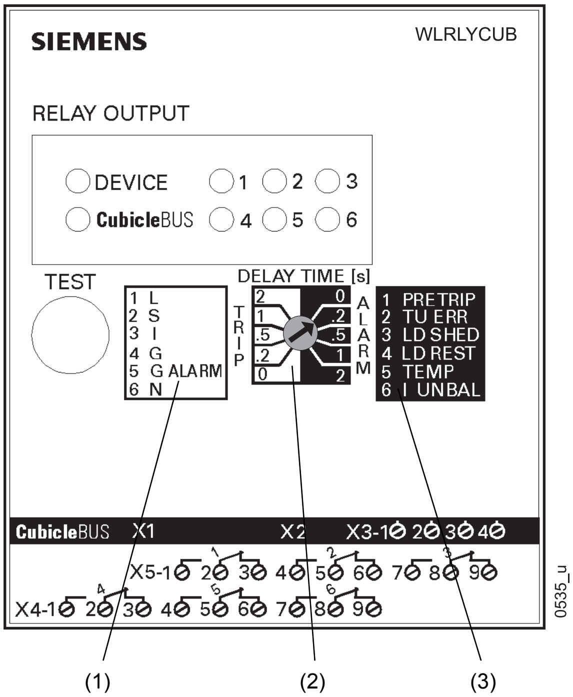
→ Connection setup (page 9-83)

If a combination of digital output modules with rotary switch and configurable digital outputs is to be connected to a circuit breaker, the following can be connected per circuit breaker:

- 1 digital output module with rotary coding switch and output assignment 1
- 1 digital output module with rotary coding switch and output assignment 2
- 1 configurable digital output module

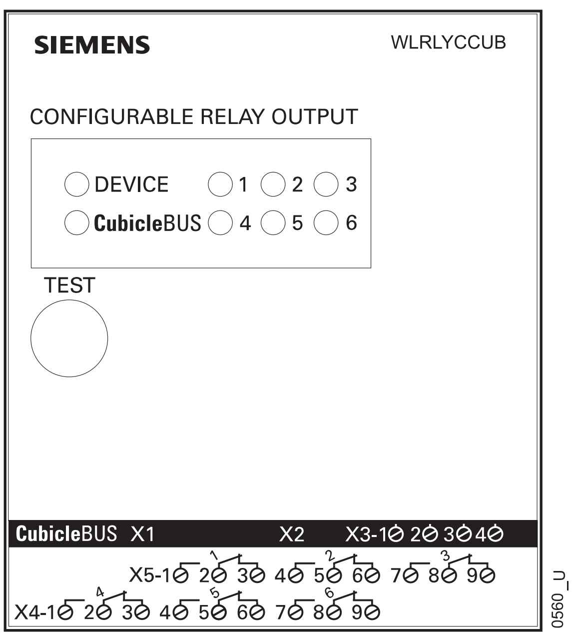
Terminal assignment

Digital output modules with rotary switch



(1) Output assignment 1
(2) Delay time setting
(3) Output assignment 2

Configurable digital output modules



Terminal assignment of digital output module	
X4	Outputs 4-6
X5	Outputs 1-3

Digital output modules with relay output provide changeover contacts at their outputs.

Current carrying capacity of the outputs	
Relay output	250 V AC, 12 A 25 V DC, 12 A

Settings

Digital output modules with rotary coding switch

→ Changing settings (page 9-86)

Terminal assignment 1 (TRIP)	
L	Signaling contact overload tripping
S	Signaling contact short-time delayed short-circuit tripping
I	Signaling contact instantaneous short-circuit tripping
G	Signaling contact ground-fault tripping
G ALARM	Signaling contact ground-fault alarm
N	Signaling contact neutral conductor tripping

Delay time setting	
TRIP	0 - 2 sec.
ALARM	0 - 2 sec.

The delay time setting determines how long a signal of the trip unit must be present until the corresponding LED lights up and the signal is set at the corresponding output.

Output assignment 2 (ALARM)	
PRE TRIP	Signaling contact leading signal overload tripping (delay time 0 sec.)
TU ERR	Signaling contact ETU error
LD SHED	Signaling contact load shedding (delay time 0 sec.)
LD REST	Signaling contact load restore (delay time 0 sec.)
TEMP	Signaling contact temperature alarm
I UNBAL	Signaling contact phase unbalance current

Configurable digital output modules

The configurable output module is pre-programmed with the most frequently-used events assigned to the outputs. The configuration can be changed using:

- the with the TD400 through the test connector of the trip unit
- through a COM module using the PC software "powerconfig" → (page 29-2).

Default Event Settings	
1:	Parameter Set B Active
2:	Load Shed Alarm Active
3:	Circuit Breaker Open
4:	Circuit Breaker Tripped
5:	Parameter Set B Active
6:	Circuit Breaker Closed

Indicators

→ (page 9-86)

Testing

→ (page 9-86)

9.2.3.5 Analog output module

Function

With the analog output module, analog measured values can be transmitted, which can be shown on the cubicle door by means of moving-coil instruments. A total of 4 outputs is available.

For the output signal, two different formats can be selected:

- 4 - 20 mA, output via terminal strip X5
- 0 - 10 V, output via terminal strip X4

Installation

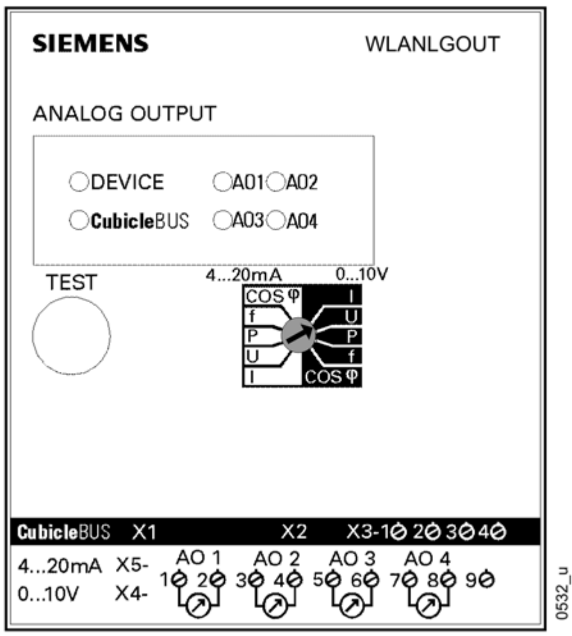
→ (page 9-83)

Connection

→ Connection setup (page 9-83)

A maximum of 2 analog output modules can be connected; the rotary coding switches of these modules must, however, have different settings.

Terminal assignment



Settings

→ Changing settings (page 9-86)

The measured values to be signaled are adjusted using the rotary switch. They are always present on the two terminal strips in the corresponding format.

The following values are available at the outputs:

Output assignment				
Position	**AO 1**	**AO 2**	**AO 3**	**AO 4**
I	I_{L1}	I_{L2}	I_{L3}	I_N
U	U_{L12}	U_{L23}	U_{L31}	U_{L1N}
P	P_{L1}	P_{L2}	P_{L3}	S_{total}
f	f	U_{LLavg}	P_{total}	$P.F._{avg}$
P.F.	$P.F._{L1}$	$P.F._{L2}$	$P.F._{L3}$	Phase unbalance current in%

Indicators

→ (page 9-86)

Testing

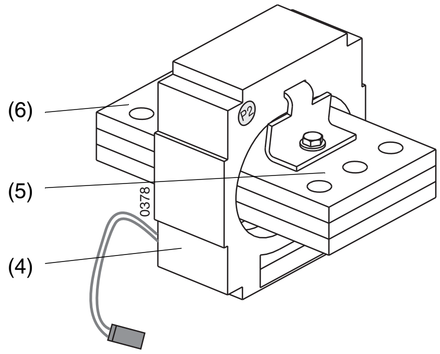
→ (page 9-86)

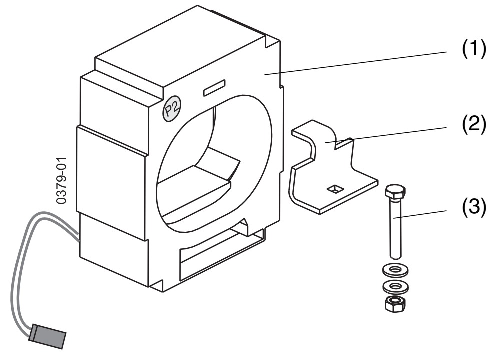
9.2.3.6 Catalog numbers

Each **Cubicle**BUS module is supplied with a 0.2 m (7.8") connecting cable for the **Cubicle**BUS connection.

CubicleBUS module	Catalog No.
ZSI module	WLZSIMD
Analog output module	WLANLGCUB
Digital output module with relay output	WLRLYCUB
Digital output module with relay output, parameterizable	WLRLYCCUB
Digital input module	WLDGNCUB
CubicleBUS cable (1 m)	WLCBUSCABLE1
CubicleBUS cable (2 m)	WLCBUSCABLE2
CubicleBUS cable (0.2 m)	WLCBUSCABLE02
CubicleBUS cable (4 m)	WLCBUSCABLE4
CubicleBUS cable (9 m)	WLCBUSCABLE9

9.2.4 External sensor for neutral conductor



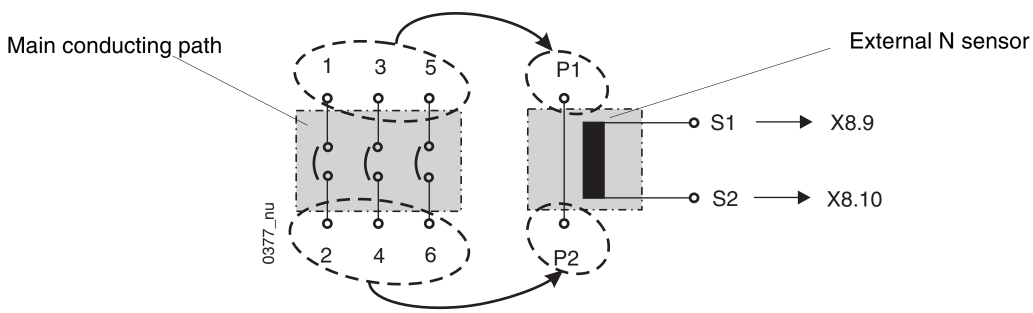


(1) Version for copper bar on switchgear side
(2) Mounting bracket
(3) Screw M6 with washers and nut
(4) Version with copper connectors
(5) Connector P2
(6) Connector P1

→ Dimension drawings (page 7-30)

Terminal assignment

Remove bridge X8.9 - X8.10



This arrangement ensures the same direction of the current flow for the circuit breaker and the external neutral sensor.

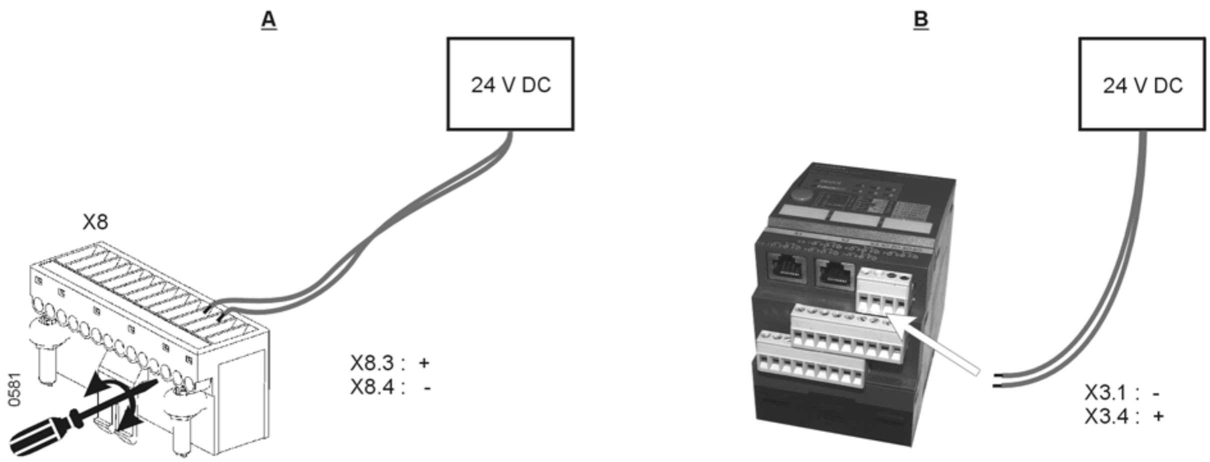
9.3 External voltage supply

The basic protective functions (L, S, I, & G) of the electronic trip units do not require an auxiliary power supply.

To use the extended functions of trip units ETU745 - 776 requiring data exchange via the **Cubicle**BUS , an external 24 V DC (class 2) voltage supply must be connected.

Connection

Version A: Connection to secondary terminal block X8 (preferred version)
Version B: Connection to any **Cubicle**BUS module



Requirements

The external voltage supply with 24 V DC must fulfill at least the requirements of UL class 2.

The Siemens power supply listed below may be used to supply power to a single circuit breaker. A second circuit breaker requires its own power supply.

The external power supply used for electronic components must not be used to supply the motor-operated mechanism.

When using voltage supply units from other manufacturers, the following conditions must be fulfilled:

- Primary-switched-mode power supply unit
- 24 V DC, ± 3 %
- Current rating: minimum 3.7A per circuit breaker
- EMC according to: IEC 61000-4-4, 4kV on main side; IEC 61000-4-5, 4kV line-to-earth, 2kV line-to-line.

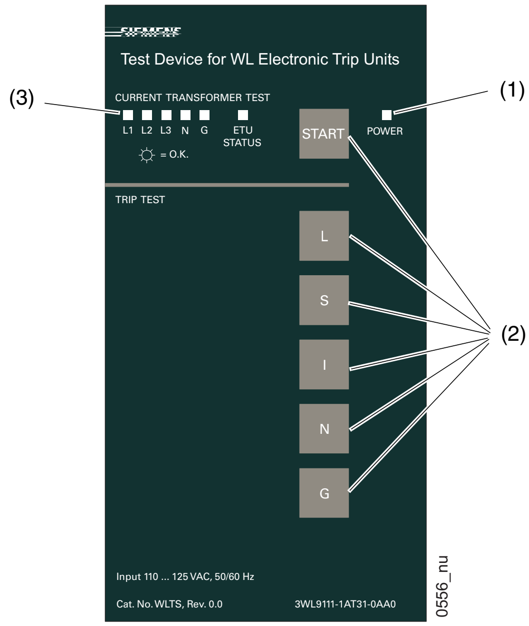
Catalog number

Power supply	Catalog No.	MLFB
120/230 VAC / 24 VDC, 3.8A SITOP PSU100C NEC CLASS 2	WLSITOP1	6EP1332-5BA20

9.4 Handheld test device

The handheld test device is used to check that the trip unit, the energy and current transformers, the F5 tripping coil and the measured value display are functioning properly.

9.4.1 View



(1) LED for operating voltage indication
(2) Control buttons
(3) 6 LEDs to show test results

9.4.2 Preparations

- Open and isolate the circuit breaker
- Document the trip unit setting values of the overload release
- Setting value $I_R = 1.0\ I_n$
- Interrupt external voltage supply for the electronic system, if present
- Remove the cap from test connector X25 of the trip unit

NOTICE

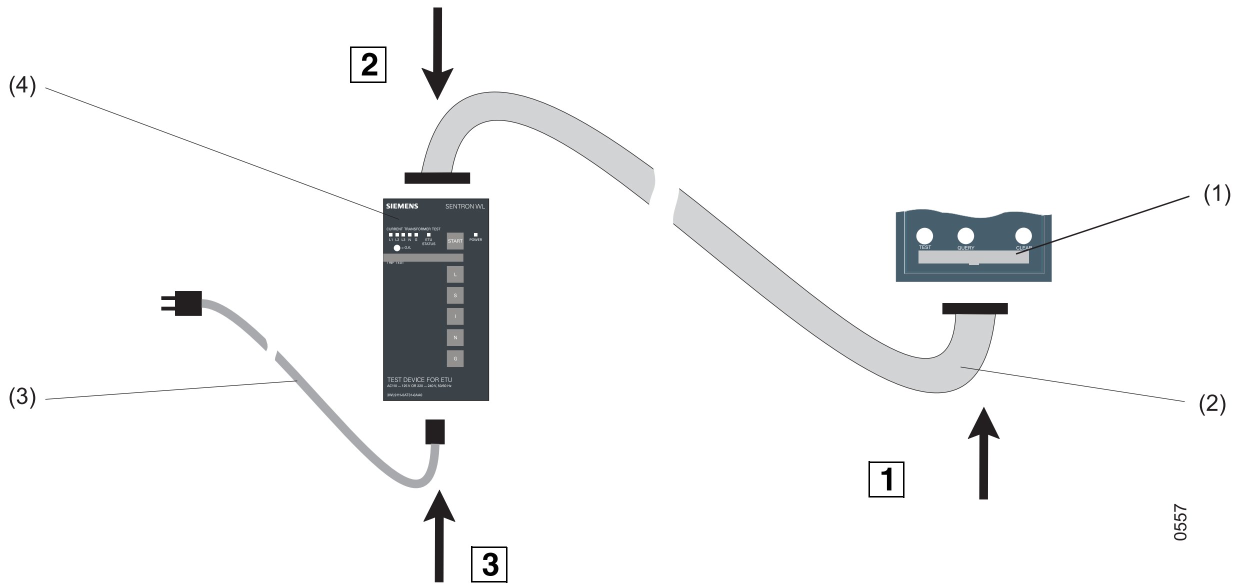
Circuit breaker may trip.

If the trip settings are changed while the breaker is closed (and under load) the breaker may trip.

Adjust parameters only when the circuit breaker is in the open position.

9.4.3 Connecting

NOTE
Observe the connecting sequence. Malfunctions and incorrect test results may result if the sequence is not observed.



(1) Test connector of the trip unit
(2) 40-pole ribbon cable with plugs
(3) Voltage supply
(4) Handheld test device

9.4.4 Voltage supply

The handheld test device is supplied by a 110 - 125 V AC network.

9.4.5 Operation

The status test begins after the voltage supply has been connected. The various components and parameters of the trip unit are queried. If the status test has been completed successfully, the "ETU STATUS" LED will light up continuously.

If it has not been completed successfully, the "ETU STATUS" LED will flash. The type of flashing indicates what type of fault is present.

Indicator	Significance
1 x briefly, pause	Handheld test device defective
2 x briefly, pause	Trip unit defective
4 x briefly, pause	- Parameters not set correctly - Current sensor not properly connected - Wrong Rating Plug - Missing Rating Plug
5 x briefly, pause	- Tripping coil F5 not properly connected - Coil defective

The status test can be repeated any time by pressing the "START" button for at least three seconds.

It is also possible to test a trip unit that is already activated, i.e. one that is supplied by an external voltage source. However, it must be taken into account that the "ETU STATUS" LED may briefly flash twice when the status test result is displayed, even if there have not been any faults. As a precaution, the status test should be repeated without external voltage supply.

Testing the current and energy sensors

To test the current sensors and energy transducers, press the "START" button.

START

A lit-up LED confirms the proper operation of the corresponding sensor/converter. If an LED flashes, the corresponding sensor/converter is not present, not properly connected, nonconforming, or a transformer without power supply is connected.

Testing the tripping function

To test the tripping function, press one of the buttons "L", "S", "I", "N" or "G".

L S I N G

Long-time delayed tripping Test

If the test is successful, the "ETU STATUS" LED will light up a solid green. If errors are detected (the trip unit malfunctions), the "ETU STATUS" LED will flash. Count the number of flashes to determine the fault (all fault codes are listed on page 9-104).

L

1 Charge the circuit breaker
2 Close the circuit breaker
3 Press the [L] button

The circuit breaker will trip after the set long-time delay time, plus approx. 2 seconds processing time, has elapsed. If the test device has completed a test without faults, the "ETU STATUS" LED will light up continuously green. If a fault is detected, the LED will flash. The type of flashing indicates what type of fault is present (fault codes are listed on page 9-104).

Short-time delayed tripping Test

The short-time delayed short-circuit tripping function and the trip unit circuitry can be tested using the test device.

S

1 Charge the circuit breaker
2 Close the circuit breaker
3 Press the [S] button

The circuit breaker will trip after the set short-time delay time, plus approx. 2 seconds processing time, has elapsed. If the test device has completed a test without faults, the "ETU STATUS" LED will light up continuously green. If a fault is detected, the LED will flash. The type of flashing indicates what type of fault is present (fault codes are listed on page 9-104).

Instantaneous tripping test

The instantaneous tripping function and the trip unit circuitry can be tested using the test device.

I

1 Charge the circuit breaker
2 Close the circuit breaker
3 Press the [I] button

The circuit breaker will trip after approx. 2 seconds processing time. If the test device has completed a test without faults, the "ETU STATUS" LED will light up continuously green. If a fault is detected, the LED will flash. The type of flashing indicates what type of fault is present (fault codes are listed on page 9-104).

Neutral conductor tripping test

The long-time delayed short-circuit tripping function for the neutral conductor and the trip unit circuitry for ETU type 776 can be tested using the test device.The current sensor for the neutral conductor must be attached (page 9-97) and the "Neutral conductor protection" function must be switched on (page 9-13).

[N]

1 Charge the circuit breaker
2 Close the circuit breaker
3 Press the [N] button

The circuit breaker will trip after the set long-time delay time, plus approx. 2 seconds processing time, has elapsed. If the test device has completed a test without faults, the "ETU STATUS" LED will light up continuously green. If a fault is detected, the LED will flash. The type of flashing indicates what type of fault is present (fault codes are listed on page 9-104).

Ground-fault tripping test

The ground-fault tripping function and the trip unit circuitry of ETU types 745-746 with an installed ground-fault protection module (with tripping function WLGFM48 or WLGFM76) can be tested using the test device. The current sensor for the neutral conductor (page 9-97) and/or the iron-core ground-fault sensor (page 9-44) must be attached.

[G]

1 Charge the circuit breaker
2 Close the circuit breaker
3 Press the [G] button

The circuit breaker will trip after the set ground-fault tripping delay time, plus approx. 2 seconds processing time, has elapsed. If the test device has completed a test without faults, the "ETU STATUS" LED will light up continuously green. If a fault is detected, the LED will flash. The type of flashing indicates what type of fault is present (fault codes are listed on page 9-104).

Testing the measured value display

This function works by inputting a signal into the trip unit. The signal is displayed as a single-phase current on the trip unit's display, and the current's measured value is also transmitted via the communication interface to the connected **Cublicle**BUS modules and the connected Modbus RTU / PROFIBUS DP networks.

This feature only works with an integrated display (WLETU745 with WLLCD48, WLETU776), and communicates test signals when a communication interface and/or a **Cublicle**BUS module is installed on the trip unit.This feature does not work when a MeteringPLUS (WLMETERP) module is installed.

[I] + [N]

1 Connect 24 V DC to power the trip unit.
2 Press the [I] and [N] buttons simultaneously

A single-phase test signal is fed into the trip unit, which simulates a single-phase load current for the ETU. The local display, the connected communications and connected **Cublicle**BUS modules output this current value. The test signal will specify the simulated value to the first phase for 30 seconds, before changing to the next phase. The cycle runs in the order L1, L2, L3, N, G. The test cycle is completed when all phases have been tested.

Activation the trip unit

To activate the trip unit, press the "N" and "G" buttons simultaneously.

[N] + [G]

The trip unit will remain activated until another button on the handheld test device (WLTS) is depressed.

With this function, the "T.U.-Error"-LED can be checked if the status test had finished with the error "Trip unit defective".

9.4.6 Finishing

- Restore the documented settings
- Mount the cover on X25

9.4.7 Catalog numbers

	Catalog No.
Handheld test device	WLTS
Replacement cables	WLTSC

10 Reset the reclosing lockout and the Bell Alarm

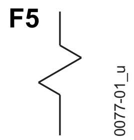
10.1 Resetting the Bell Alarm

1

Circuit breaker is **tripped** by trip unit

Automatic reset

Tripping coil



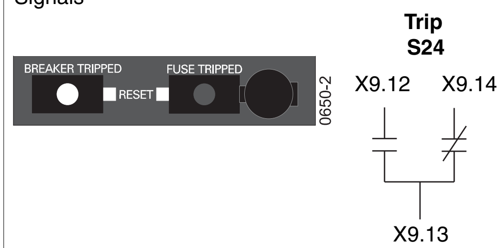
Automatic
reset of the maglatch

2

Indicators

Circuit breaker is **immediately** "Ready-to-close" again,
if closing spring is charged.

Signals



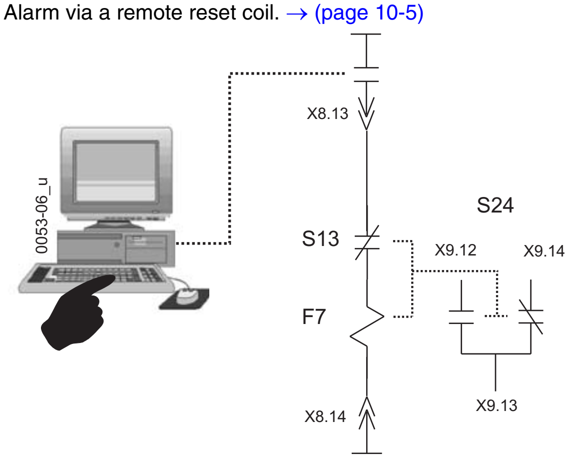
Bell Alarm

3

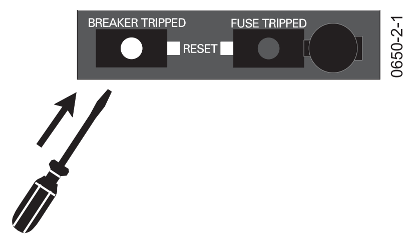
Reset Bell Alarm

Electrical remote reset

Option: Electrical remote reset of reclosing lockout and the
Bell Alarm via a remote reset coil. → (page 10-5)

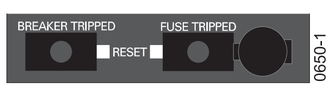


Manual reset

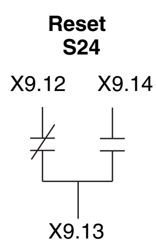


Press Bell Alarm (red pin), until it latches

4



Bell Alarm Reset



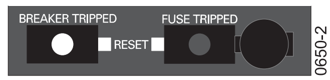
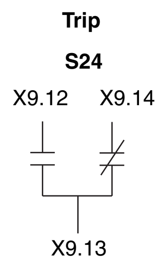
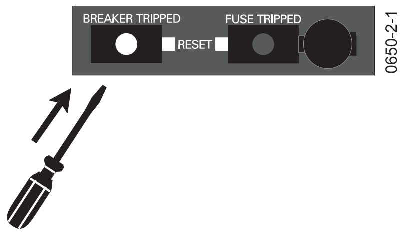
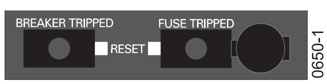
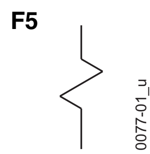
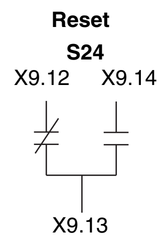
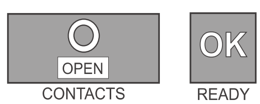
Bell Alarm

Tripped signal reset

10.2 Resetting the Bell Alarm with reclosing lockout (optional)

WL circuit breakers are normally configured to be immediately "Ready-to-close" again following a trip. With the automatic reset of the Bell Alarm, the tripping coil is automatic resetting after the trip unit has tripped. The circuit breaker is immediately "Ready-to-close" again. For confirmation, the tripped indicator must be reset, either manually on the trip unit or via the remote reset coil.

When the WL breaker is configured with option WLNOAUTRSET, the tripping coil must be manually reset before the circuit breaker is capable of closing. The following instruction details the resetting of the Bell Alarm, and the tripping coil.

<table>
<tr><td>1</td><td colspan="2">Circuit breaker is tripped by the trip unit</td></tr>
<tr><td>2</td><td>Indicators
</td><td>Signals


Bell Alarm</td></tr>
<tr><td>3</td><td colspan="2">Manual reset

Press Bell Alarm (red pin), until it latches</td></tr>
<tr><td>4</td><td>
Bell Alarm reset</td><td>

Tripping coil
Bell Alarm
Tripping coil and Bell Alarm are reset.</td></tr>
<tr><td>5</td><td colspan="2">Indicators

Circuit breaker is "Ready-to-close" again if the closing spring is charged and no interlock is active.</td></tr>
</table>

10.3 Field Installation of a reclosing lockout

To activate the Bell Alarm lockout, the automatic reset must be removed. The tripping coil, the tripped indicator and the tripped signal must be reset manually at the breaker. Reclosing of the circuit breaker is blocked until the trip indicator has been reset.

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

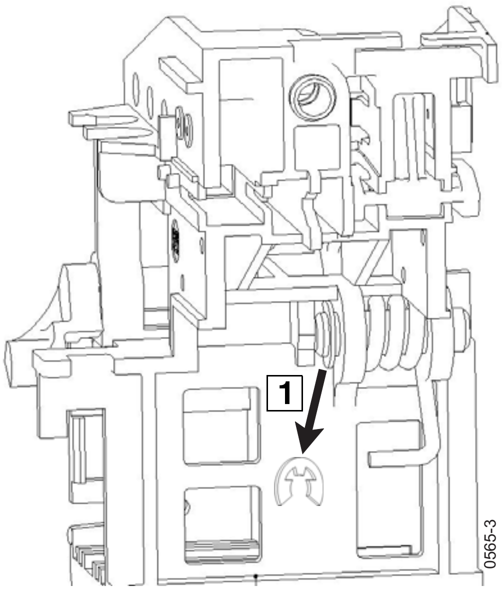
High speed moving parts.

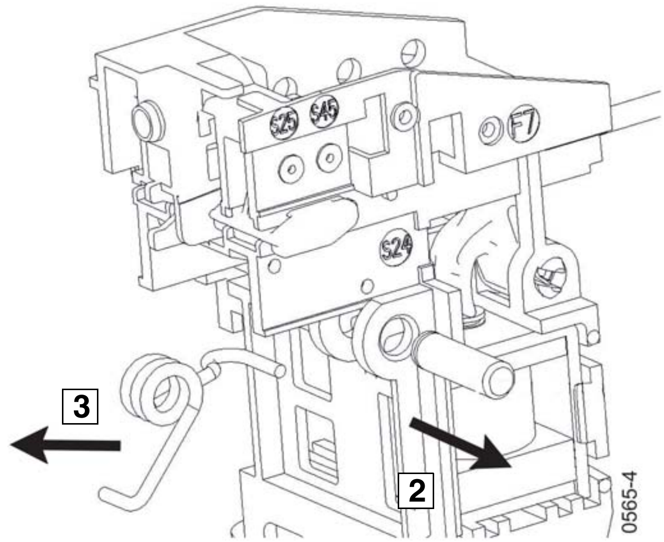
Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

- OPEN the circuit breaker and discharge the closing spring → (page 24-2).
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3).
- Remove front panel → (page 24-4).
- Remove the trip unit → (page 9-49).

10.3.1 Removing the automatic reset mechanism





1 Remove lock washer
2 Remove bolt
3 Remove reset spring

Then

- Install trip unit → (page 9-49)
- Install front panel → (page 24-4)

10.4 Installing the remote Bell Alarm reset

NOTICE
Can only be used with automatic reclosing lockout reset. The remote reset coil will otherwise be overloaded and damaged.

10.4.1 Mounting remote reset coil and cut-off switch

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

High speed moving parts.

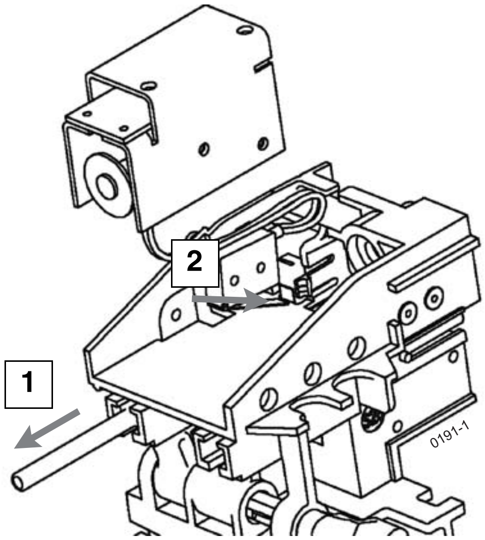
Can cause serious personal injury.

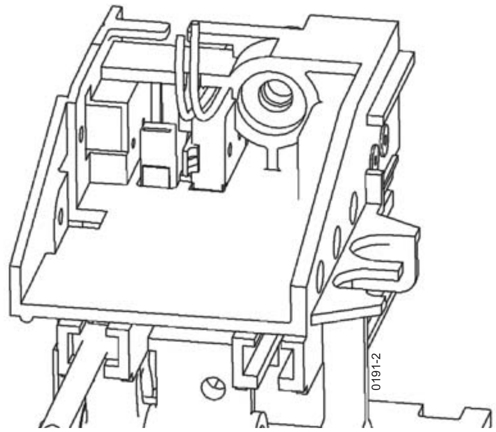
Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

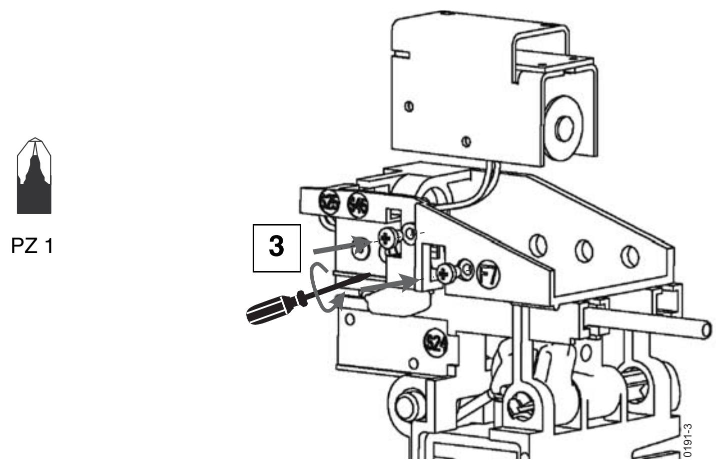
- OPEN the circuit breaker and discharge the closing spring → (page 24-2).
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3).
- Remove front panel → (page 24-4).
- Remove the trip unit → (page 9-49).

Mounting electrical remote reset coil F7

NOTICE
When routing the wires, care must be taken to ensure that wires are not damaged when reinstalling the ETU carriage.

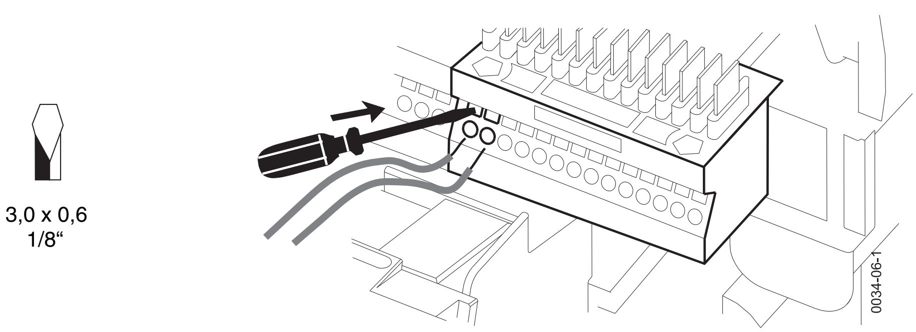






10.4.2 Connecting wires

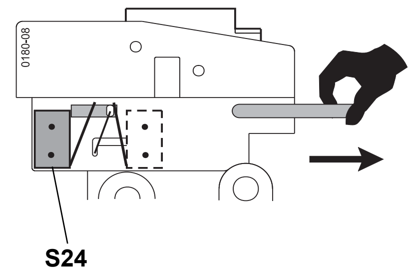
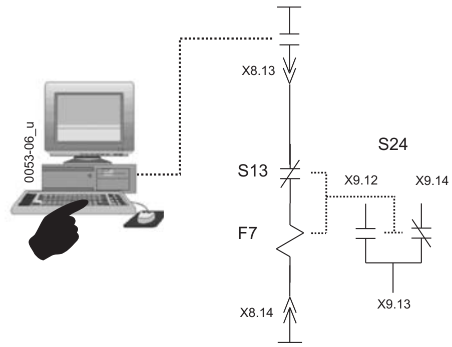
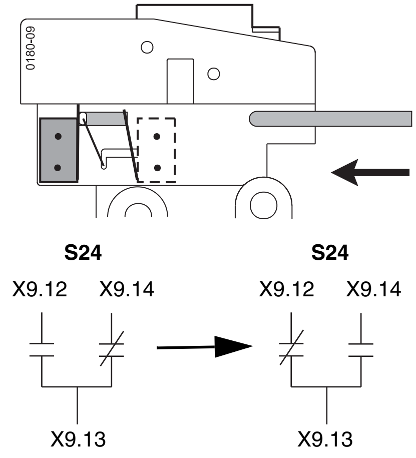
→ (page 8-1)



Terminals

X8.13
X8.14

10.4.3 Function test

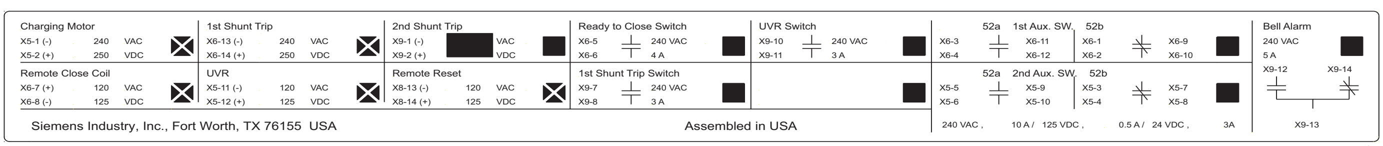
1	2	3
 	 	

Then

- Install trip unit → (page 9-49)
- Install front panel → (page 24-4)

10.4.4 Updating the options label

NOTE
After installing additional electrical components, add the following data and mark with a "x", using an indelible ink pen.



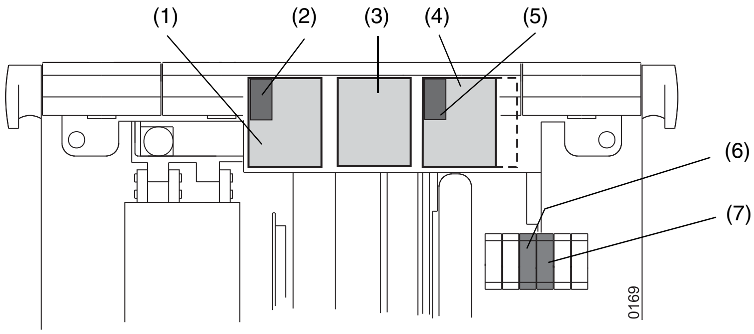
0131_nu_fw

	Voltage	Catalog No.
Electric Bell Alarm reset coil	24 V DC	WLRSET24
	48 V DC	WLRSET48
	110 - 125 V AC / DC	WLRSET120
	208 - 250 V AC / DC	WLRSET240

11 Shunt Trip / Closing Coil / Undervoltage release

11.1 Overview

Mounting locations



(1) 1st shunt trip F1
(2) Signaling switch S22
(3) Closing coil CC
(4) 2nd shunt trip F2
or undervoltage release (instantaneous) F3
or undervoltage release (time-delayed) F4
(5) Signaling switch S23 **or** S43
(6) Cut-off switch S14 for shunt trip 5% duty cycle
(7) Cut-off switch S15 for closing coil CC 5% duty cycle

Shunt trips with 100% ED may be used as an electrical closing lockout.

11.2 Installing shunt trips, closing coils, and undervoltage devices

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

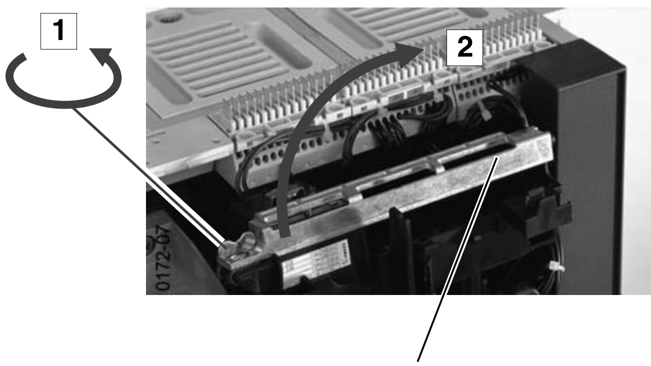
WARNING

High speed moving parts.

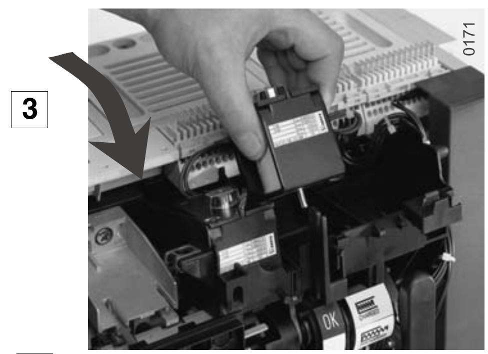
Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)



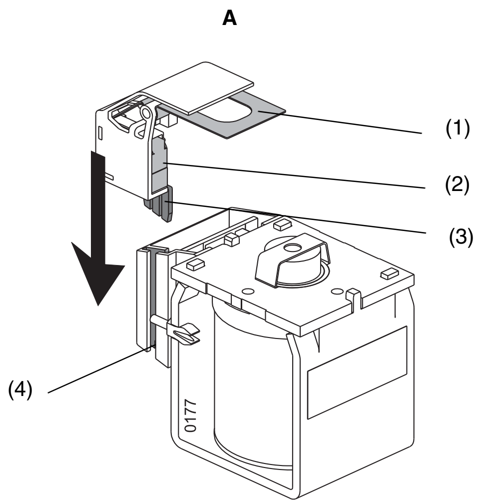
Retaining bracket

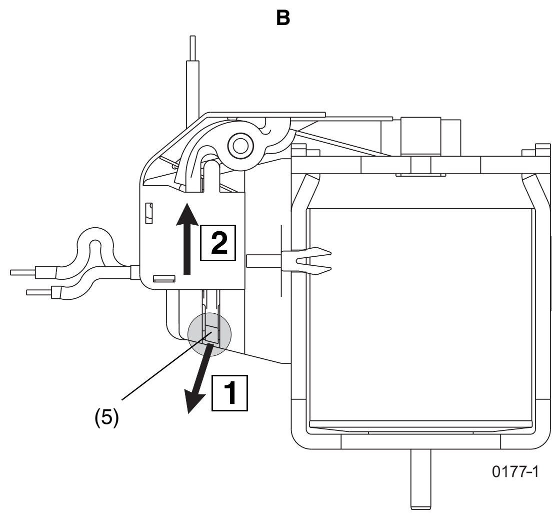


4 Replace retaining bracket and screw down.

11.3 Installing optional signaling switches on shunt trips, closing coils, and undervoltage devices

Signals the the operating status of the shunt trip, closing coil, or undervoltage device to the BSS.





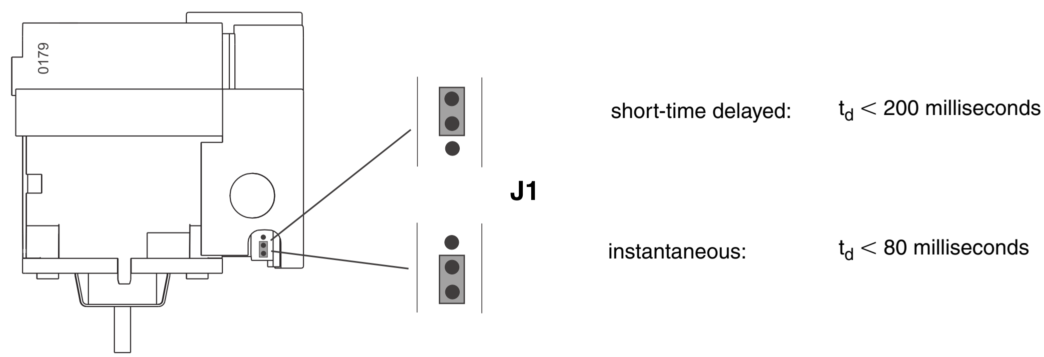
A Snap in place
B Disassembly

(1) Rocker
(2) Signaling switch
(3) Guide
(4) Groove
(5) Snap-fit

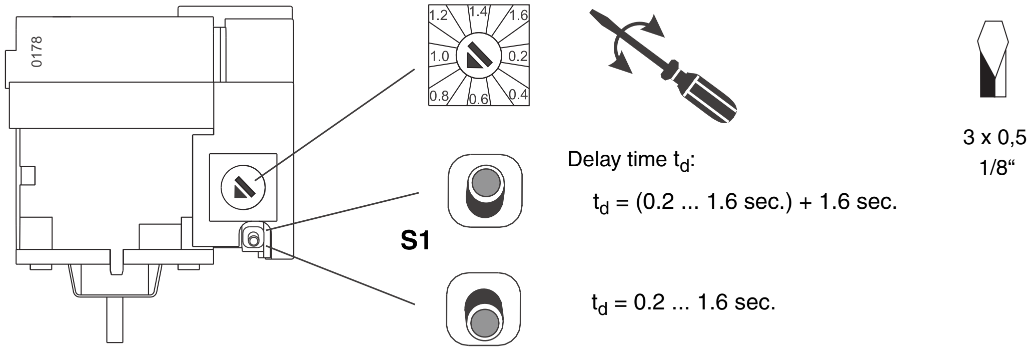
1 Disengage the snap-fit
2 Pull out the signaling switch

11.4 Setting delay times on undervoltage release

Instantaneous release

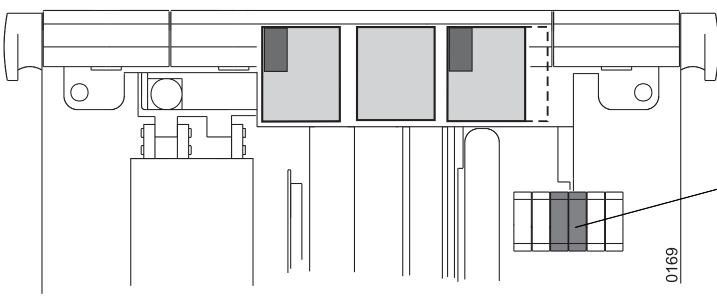


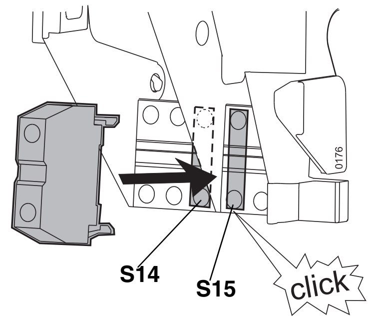
Time-delayed release

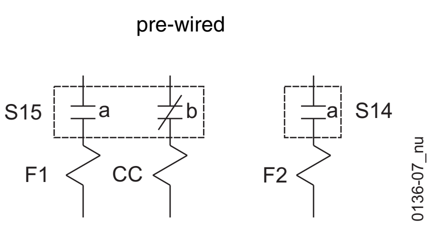


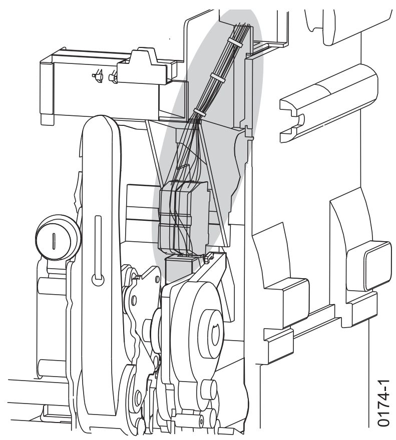
11.5 Field Installation of a cut-off switch for shunt trips and closing coils

Does not apply to continuous duty devices.

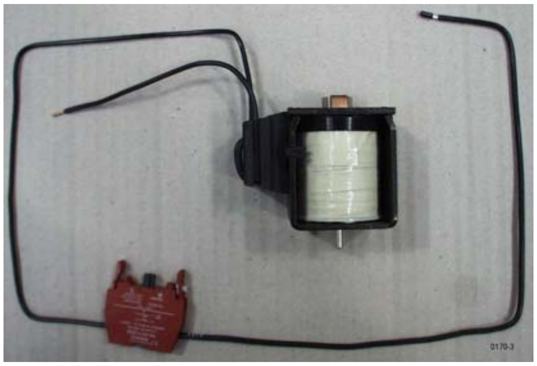






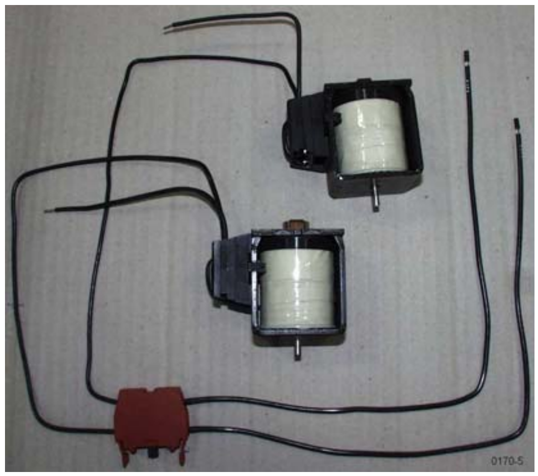


A



B

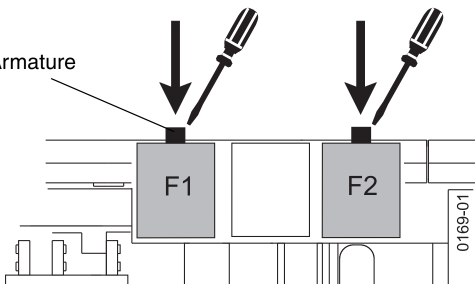
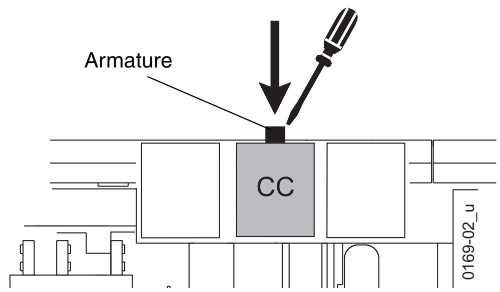
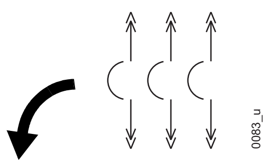
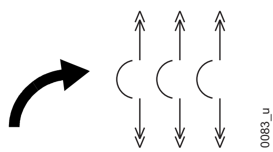
C



A Shunt trip with cut-off switch S14
B Closing coil with cut-off switch S15
C Combination of shunt trip and closing coil with combined cut-off switch S14/S15

11.6 Mechanical function test

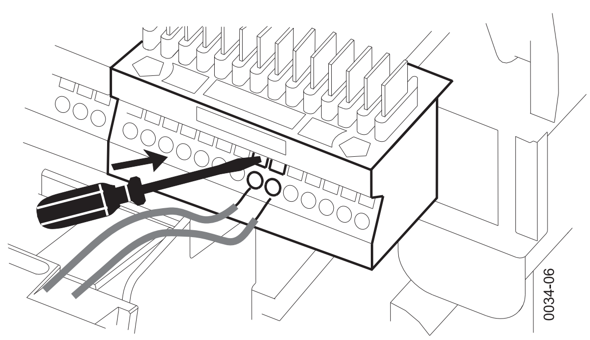
	⚠ **WARNING**
	High speed moving parts. **Can cause serious personal injury.** Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

	Shunt trip	**Closing coil**
1	→ Charge the closing spring manually (page 6-4)	
2	→ Close circuit breaker (page 6-7)	
3		
4	 Circuit breaker **opens**	 Circuit breaker **closes**
5		→ Opening the circuit breaker (page 6-7)

11.7 Connecting wires

→ Circuit diagrams (page 8-4)

3,0 x 0,6
1/8“



Terminals

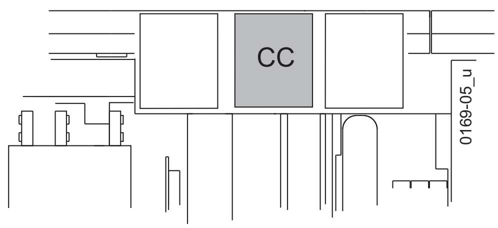
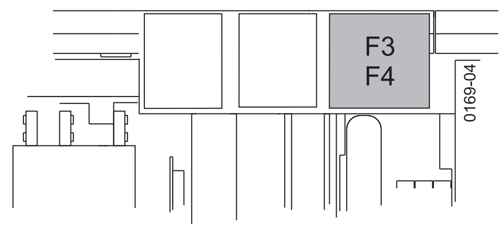
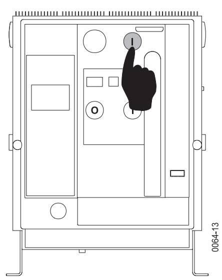
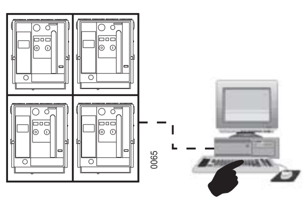
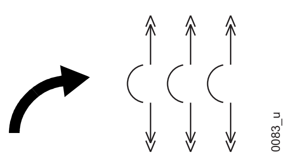
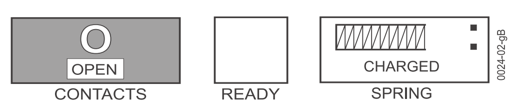
CC	: X6.7 / X6.8
F1	: X6.13 / X6.14
F2, F3	: X5.11 / X5.12
F4	: X5.11 ... X5.14
S10	: X9.9 / X6.7

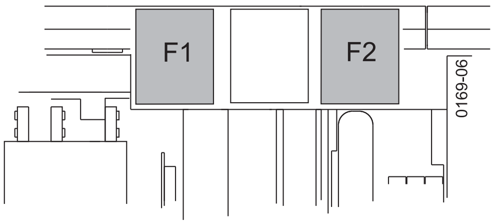
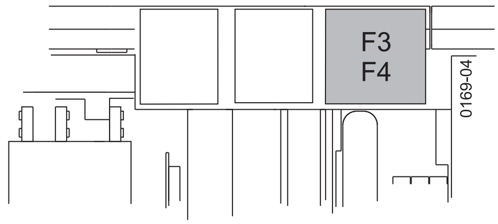
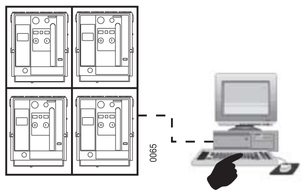
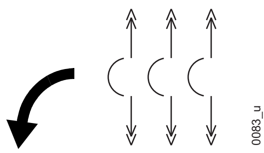
11.8 Final tasks

- Install front panel → (page 24-4)
- Attach secondary disconnect blocks → (page 5-32)
- Connect wires to secondary disconnect block→ (page 5-30)
- Move the draw-out circuit breaker into the test position → (page 6-2)
- Ensure control voltage is connected

11.9 Electrical function test

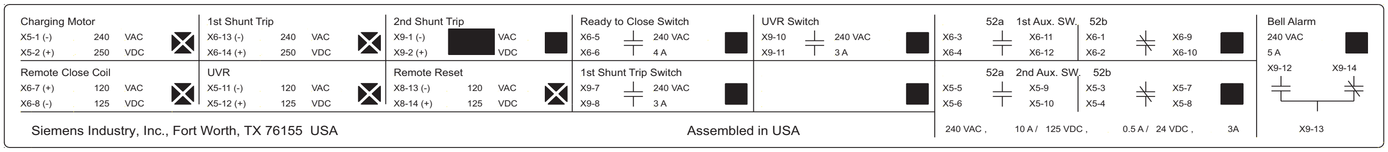
NOTE
Make sure that the closing coil with 5% operating time is only activated when the circuit breaker is ready for closing. Otherwise the closing coil will be damaged.

	Closing coil	**Undervoltage release**
1	→ Charge the closing spring (page 6-4)	
2		
3	**Actuate the closing coil** Electrical Closed Remote activation 	 **Remove control power to test undervoltage release.**
4	 Circuit breaker **closes**	

	Shunt trip	**Undervoltage release**
1	→ Charge the closing spring (page 6-4) → Closing the circuit breaker (page 6-7)	
2		
3	**Actuate shunt trip** Remote activation 	**Remove control power to test undervoltage release.**
4	Circuit breaker **opens** 	

11.10 Updating the options label

NOTE
After installing additional electrical components, mark with a "x", using an indelible ink pen. The voltage must also be noted in the box.



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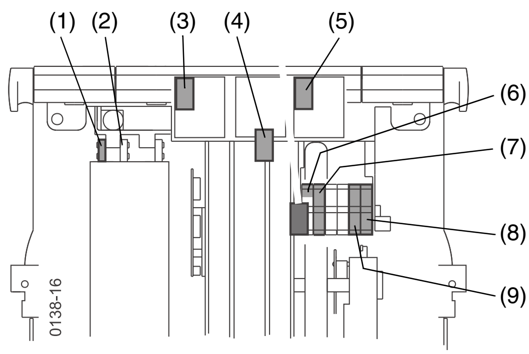
Closing coil	VAC 50/60 Hz	VDC	Catalog No.
Closing coil	—	24	WLRCS24
	—	48	WLRCS48
	110-127	110-125	WLRCS120
	208-240	220-250	WLRCS240

Signaling switches	Catalog No.
Signaling switch for 1st shunt trip	WLSTC
Signaling switch for 2nd shunt trip or undervoltage release	WLUVRC

1st Shunt Trip	VAC 50/60 Hz	VDC	Catalog No.
Shunt trip F1 with cut-off switch, opening time 40 ms	—	24	WLST24
	—	48	WLST48
	110-127	110-125	WLST120
	208-240	220-250	WLST240
Shunt trip F1 for continous energizing, opening time 80 ms	-	24	WLSTCD24
	-	48	WLSTCD48
	120	125	WLSTCD120
	240	250	WLSTCD240

2nd Shunt Trip or UVR	VAC 50/60 Hz	VDC	Catalog No.
Shunt trip F2	—	24	WLST24
	—	48	WLST48
	110-127	110-125	WLST120
	208-240	220-250	WLST240
Undervoltage release F3 (instantaneous)	—	24	WLUV24
	—	48	WLUV48
	110-127	110-125	WLUV120
	208-240	220-250	WLUV240
Undervoltage release F4 (time-delayed)	—	48	WLUVD48
	110-127	110-125	WLUVD120
	208-240	220-250	WLUVD240

12 Auxiliary and control switches



(1) Bell Alarm S24
(2) Cut off switch for remote reset coil S13 → (page 10-5)
(3) Signaling switch S22 for 1st shunt trip → (page 11-3)
(4) Signaling switch for "Ready-to-close" S20
(5) Signaling switch S23 for 2nd shunt trip or under-voltage release → (page 11-3)
(6) Contact position-driven auxiliary switch S1
(7) Contact position-driven auxiliary switch S2
(8) Contact position-driven auxiliary switch S4
(9) Contact position-driven auxiliary switch S3

12.1 Installing internal auxiliary switches S1 - S4

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

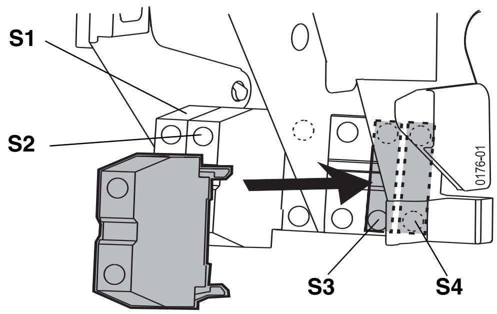
WARNING

High speed moving parts.

Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)



The connecting wires from the auxiliary switches must be connected to terminals X5 and X6 according to the wiring plan (page 8-2).

Contact position-driven auxiliary switches	Catalog No.
S1 + S2 (2 "a" + 2 "b" contacts)	WLAS2
S1 + S2 + S3 + S4 (4 "a" + 4 "b" contacts)	WLAS4

12.2 Installing the "Ready-to-close" switch S20


DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

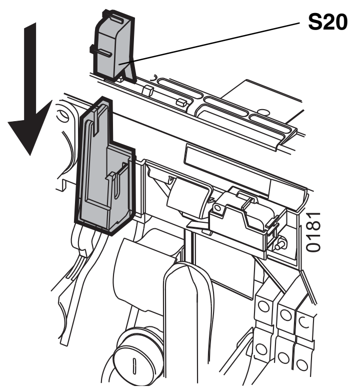
WARNING

High speed moving parts.

Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

Snap-in mounting



The connecting wires from the "Ready-to-close" signaling switch must be connected to terminal X6 according to the wiring plan (page 8-2).

Signaling switches	Catalog No.
"Ready-to-close" signaling switch S20	WLRTCS

12.3 Trip Signaling Switches

 	**DANGER** **Hazardous voltage.** **Will cause death, serious personal injury, or equipment damage.** Turn off and lock out all power supplying this equipment before working on this device.

	**WARNING** **High speed moving parts.** **Can cause serious personal injury.** Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

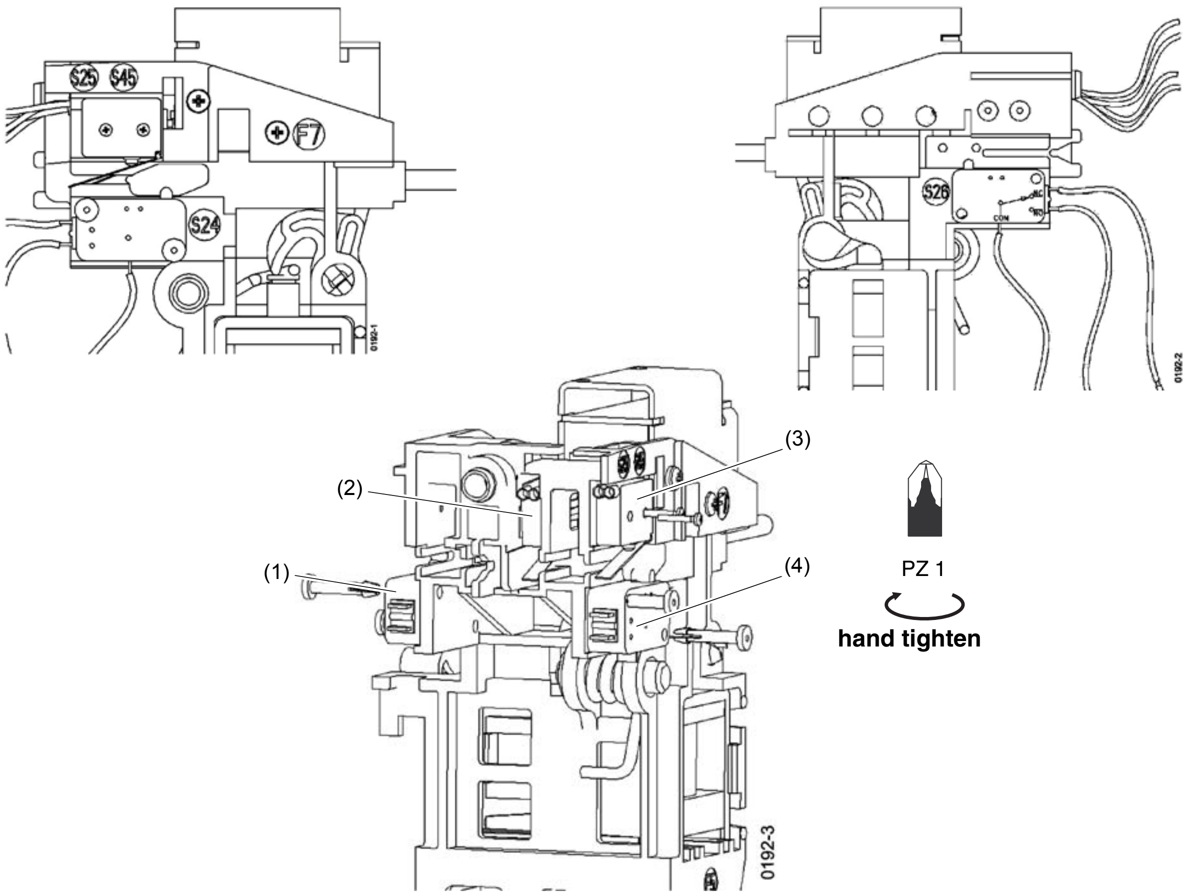
- Remove trip unit → (page 9-49)

12.3.1 Trip Signaling Switches S13, S24, and S26

NOTICE

Over-tightening the mounting screws may deform the signaling switch and could lead to an incorrect indication of breaker status.

Hardware shall be tightened carefully until the underside of the screw head is flush with the mounting surface.

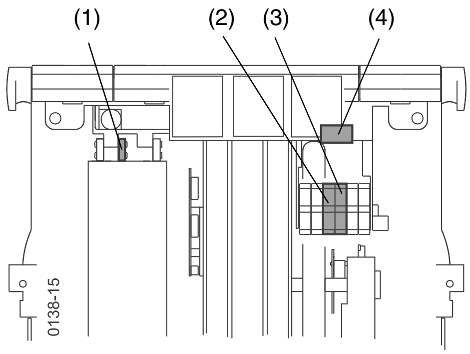


(1) S26 assembled with snap-in pins
(2) S13 snap in assembly
(3) S25 / S45 assembled with self-tapping screws
(4) S24 assembled with snap-in pins

The connecting wires from the signaling switches must be connected to secondary disconnects X8 and X9 according to the wiring plan (page 8-2) and (page 8-6).

Signaling switches	Catalog No.
Bell Alarm S24 (1 form C contact)	WLBA

12.4 Control switches - Connecting wires



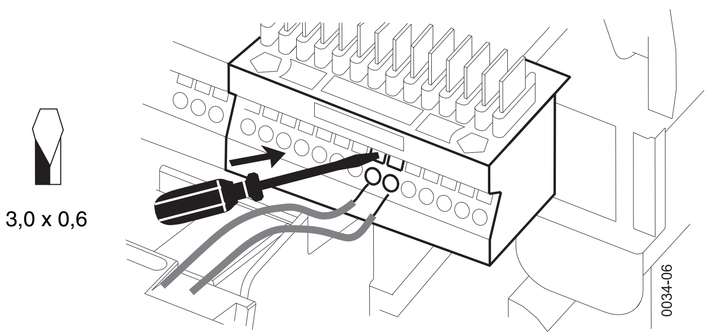
(1) Cut-off switch S13 for remote reset
(2) Cut-off switch S14 for shunt trip F1 → (page 11-4)
(3) Cut-off switch S15 for closing coil CC → (page 11-4)
(4) Motor disconnecting switch S12 → (page 13-3)

12.5 Communication switches

→ Signaling switches for BSS (page 9-55)

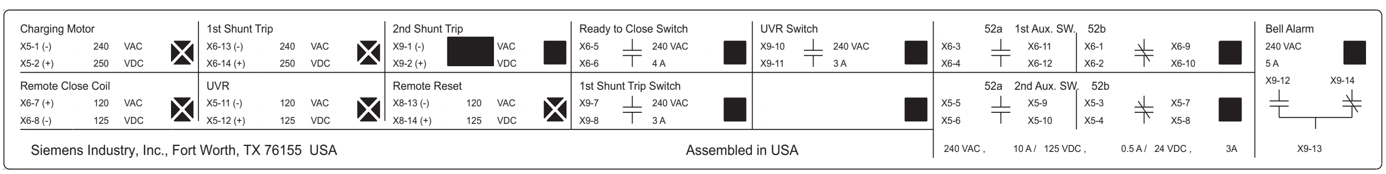
12.6 Connecting secondary wiring

→ Circuit diagrams (page 8-4)



12.7 Updating the options label

NOTE
After installing additional components, mark the following data with a "x", using an indelible ink pen.



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12.8 Mechanism Operated Contacts (MOC)

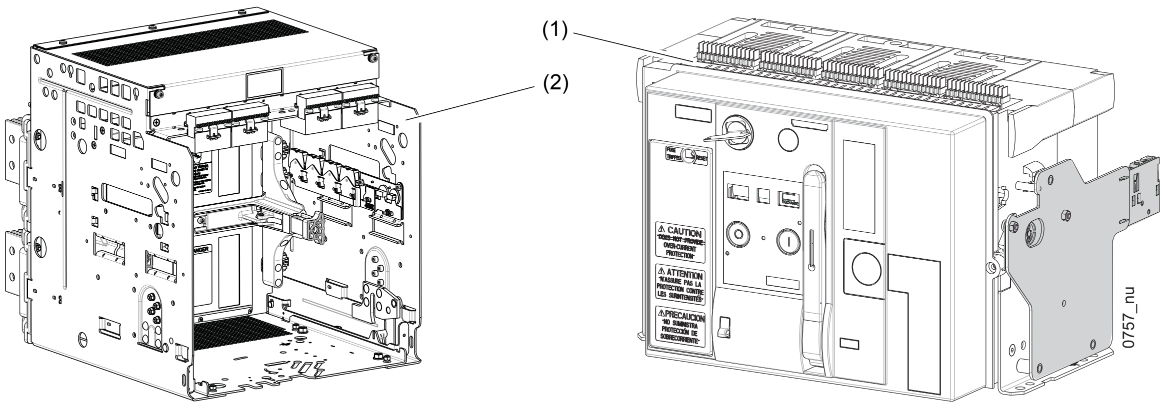
The circuit breaker may be equipped with an external auxiliary switch assembly. These external auxiliary switches are known as Mechanism Operated Contacts. In short, the assembly is also referred to as the MOC.

The MOC assembly is mounted within the circuit breaker compartment (cradle) and is connected to the main breaker-driveshaft via a coupler, which is added to the circuit breaker during the MOC installation.

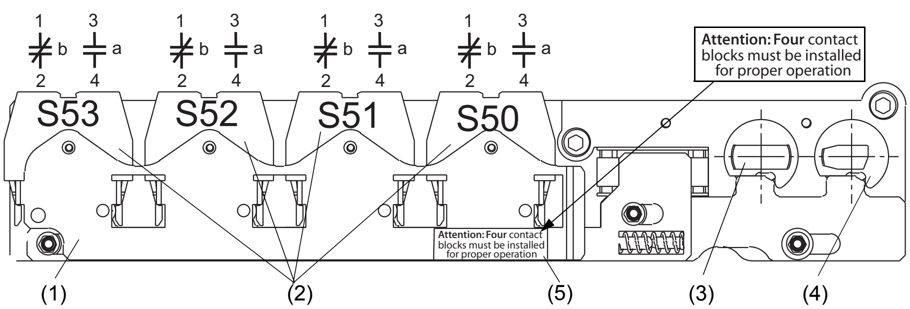
The circuit breaker, itself, may be optionally ordered with either no internal auxiliary switches, a set of four internal auxiliary switches (2 *a* + 2 *b* contacts), or eight internal auxiliary switches (4 *a* + 4 *b* contacts).

With the addition of a MOC device, an additional eight auxiliary switches (4 *a* + 4 *b* contacts) may be added to a circuit breaker.

Note referencing ANSI C37.100:
“a” contact: A secondary contact that is open when the circuit breaker is open, and closed when the circuit breaker is closed
“b” contact: A secondary contact that is closed when the circuit breaker is open, and open when the circuit breaker is closed



(1) Fixed-mounted circuit breaker
(2) Cradle



(1) MOC
(2) 4 signaling switches
(3) Driver for connected position
(4) Driver for test position
(5) Warning label

12.8.1 MOC Versions

The MOC device may be ordered in two versions for drawout circuit breakers:

The auxiliary contacts, in the “Connect Only” version of the MOC, only change state when the circuit breaker is opened/closed while it is in the “CONNECTED” position within the circuit breaker compartment. There are two distinct models of the “Connect Only” MOC, one for circuit breaker frame size 2 (WLMOCC) and a second for circuit breaker frame size 3 (WLMOCC3).

The second version is known as the “Test and Connect” version. In the “Test and Connect” version, the auxiliary contacts change state when the circuit breaker is opened/closed while it is in the “TEST” or “CONNECTED” positions within the circuit breaker compartment. Like the “Connect Only” version, there are two distinct models of the “connect only” MOC, one for circuit breaker frame size 2 (WLMOC) and a second for circuit breaker frame size 3 (WLMOC3).

12.8.2 MOC Installation Instructions

There are two MOC versions available: with and without a driver for the test position. The version with only one drive is generally used for fixed-mounted circuit breakers.

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Remove circuit breaker from cradle → (page 24-3)

12.8.2.1 Installing the coupler

In order to interface the MOC assembly (mounted in the circuit breaker compartment), the circuit breaker must be outfitted with a coupler (see Figure 1).

Figure 1

In order to install the coupler, the clear plastic plug in the sidewall of the circuit breaker (see Figure 2) must first be removed. Facing the breaker, the plug is on right sidewall. This is easily accomplished by levering with a small screwdriver.

Figure 2

The coupler snaps onto the end of the steel mainshaft. The steel band should not be removed when installing the coupler. Also ensure that the coupler is oriented properly when installed. Figure 3 illustrates the proper installed orientation of a shaft extension (circuit breaker shown in the OPEN position), with the tampered flange facing the rear of the circuit breaker..

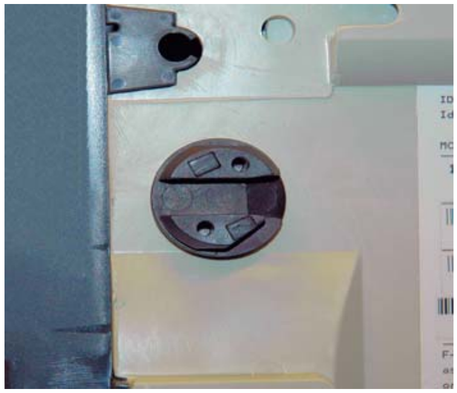
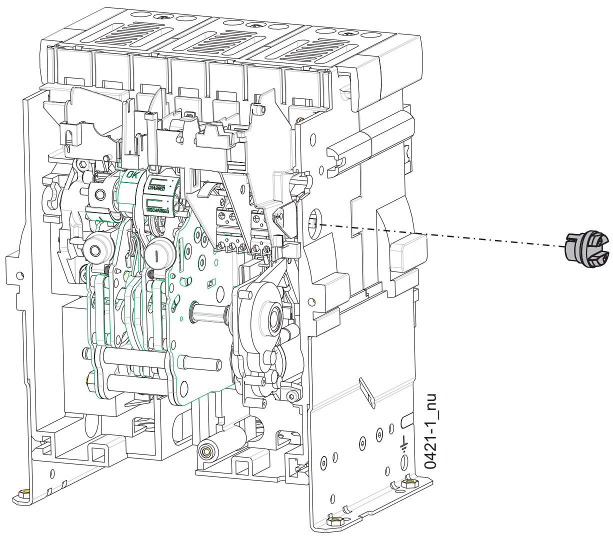
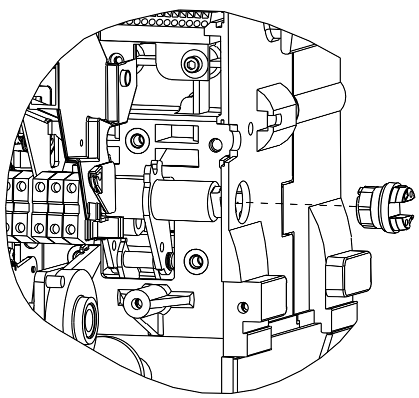
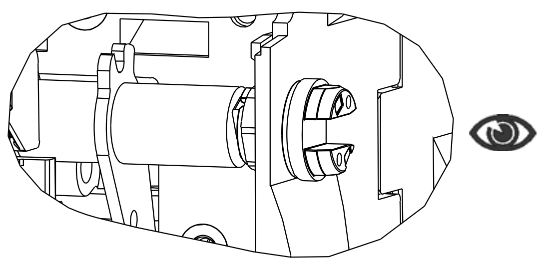


Figure 3



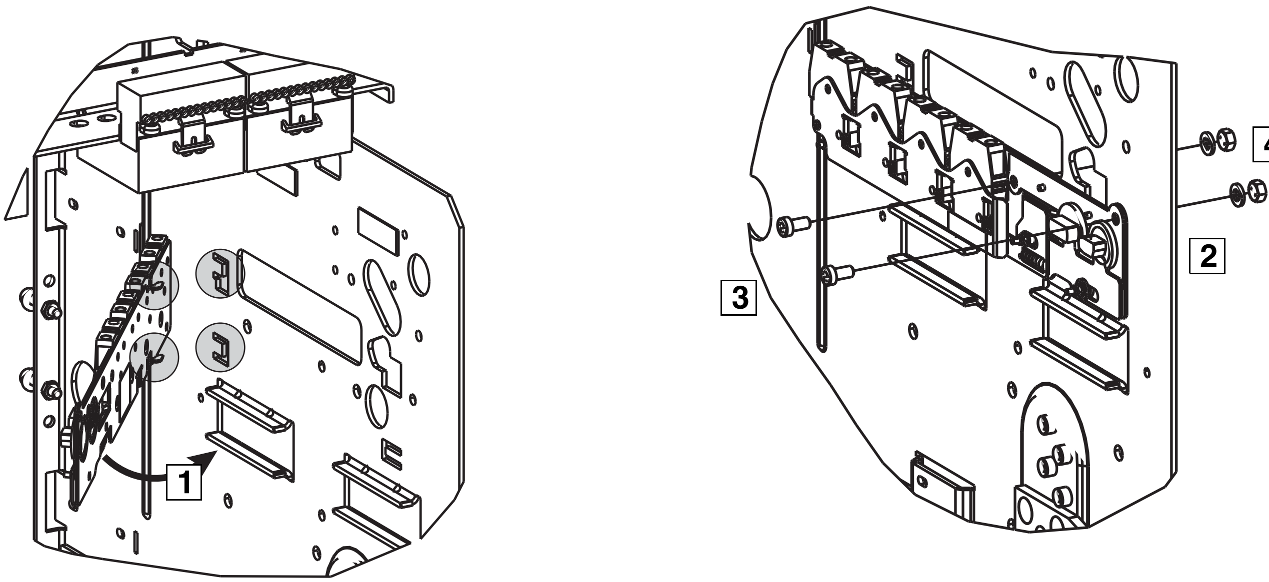




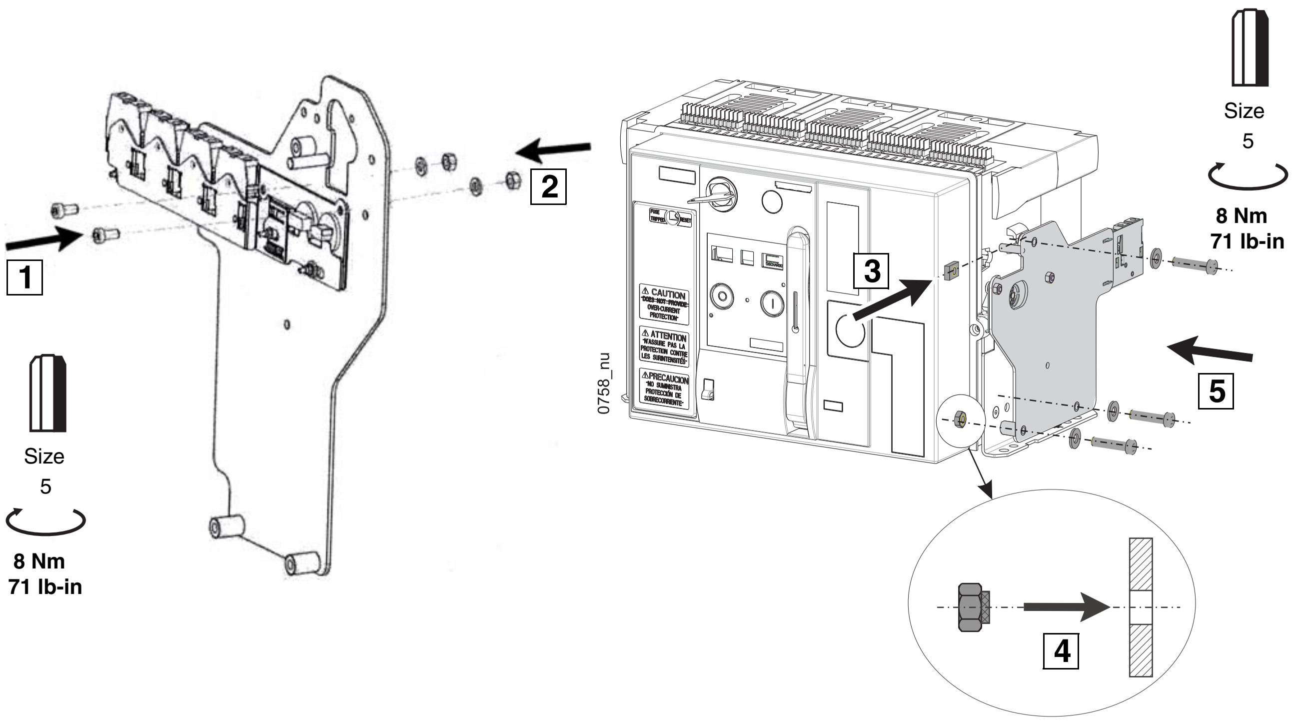
NOTE
The tapered flange of the coupler must point towards the rear side of the circuit breaker.

12.8.2.2 Installing the MOC Baseplate Assembly

The MOC baseplate assembly is secured to the circuit breaker compartment (cradle) by two tabs in the rear and two screws in the front. With the screws inserted from the inside of the cubicle, and the nuts and lockwashers on the outside, the nuts must be torqued to 71 lbin (8 Nm).



12.8.2.3 Mounting on fixed-mounted circuit breakers



12.8.2.4 Removing the Contact Blocks

NOTICE
MOC Reliability
May cause intermittent signaling.
All four contact blocks, whether wired or not, must be installed into the MOC assembly to ensure reliable operation.

The contact blocks must be removed in order to access the terminals for wiring. The contact blocks should be removed by applying a small amount of outward pressure with a thin blade screwdriver, in the area shown in Figure 6.

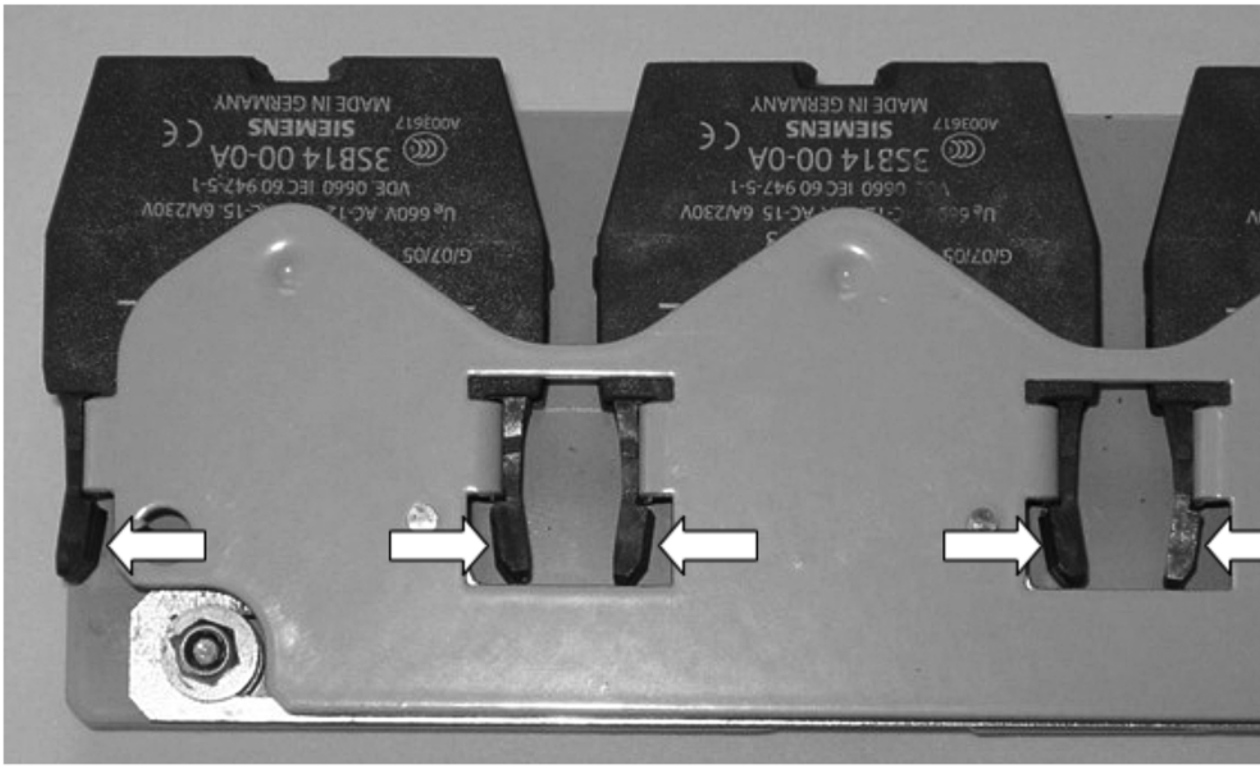
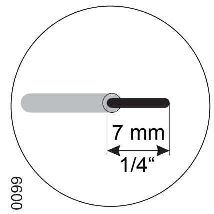


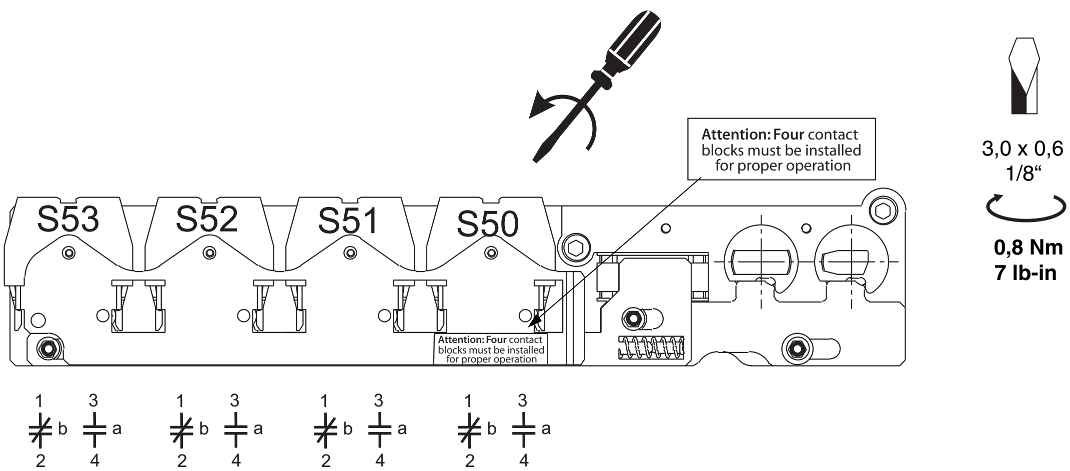
Figure 6

NOTICE
Contact block damage.
May cause loss of signaling.
Do not over-extend the feet of the contact block when reinstalling into the MOC assembly.

12.8.2.5 Wiring the Contact Blocks

The contact blocks are designated (front of cradle to rear of cradle) S50, S51, S52, and S53. Each contact block contains one “a” and one “b” contact, with the terminal designations as shown below. Each terminal accepts a maximum of one wire, 14 AWG (or smaller), and shall be tightened to 7 lbin (0.8 Nm).





12.8.2.6 Installing the Contact Blocks

NOTICE

MOC Reliability

May cause intermittent signaling.

All four contact blocks, whether wired or not, must be installed into the MOC assembly to ensure reliable operation.

The contact blocks must be firmly seated, with the feet of the contact block latched into the MOC assembly housing. If there is damage to the contact block assembly, a replacement contact block must be used. Replacement contact blocks may be purchased per catalog number WLMOCSWK (includes four replacement contact block assemblies).

NOTICE

Contact block damage.

May cause loss of signaling.

Do not over-extend the feet of the contact block when reinstalling into the MOC assembly.

12.8.2.7 Contact Ratings

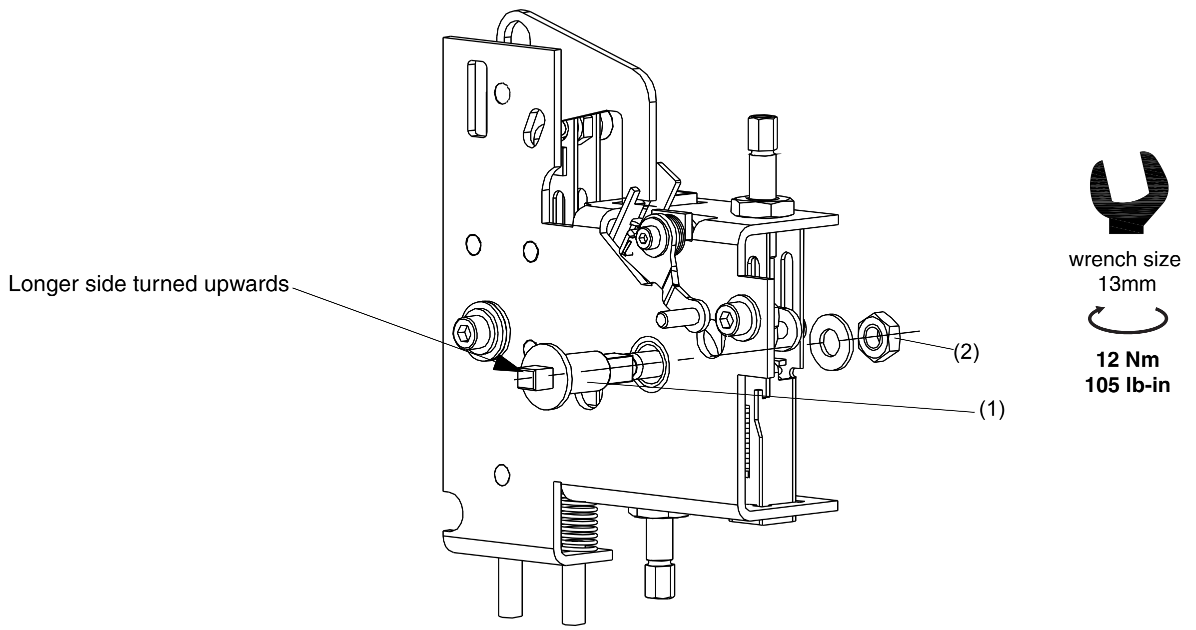
Voltage	Maximum Current		
	Continuous	Making	Breaking
120 VAC	10 A	30 A	3 A
240 VAC	10 A	30 A	3 A
24 VDC	5 A	1.1 A	1.1 A
48 VDC	5 A	1.1 A	1.1 A
125 VDC	5 A	1.1 A	1.1 A
250 VDC	5 A	0.55 A	0.55 A

12.8.3 Order numbers

MOC	Catalog No.
Mechanism Operated Auxiliary Contacts, cradle-mounted, 4 NO + 4 NC, Test and connected position, for draw-out circuit breaker only, FS I and FS II	WLMOC
Mechanism Operated Auxiliary Contacts, cradle-mounted, 4 NO + 4 NC, Connected position only, for draw-out circuit breaker only, FS I and FS II	WLMOCC
Mechanism Operated Auxiliary Contacts, cradle-mounted, 4 NO + 4 NC, Test and connected position, for draw-out circuit breaker only, FS III	WLMOC3
Mechanism Operated Auxiliary Contacts, cradle-mounted, 4 NO + 4 NC, Connected position only, for draw-out circuit breaker only, FS III	WLMOCC3
Mechanism Operated Auxiliary Contacts, 4 NO + 4NC, for UL489 fixed-mounted circuit breaker only, FS I	WLMOCUL1
Mechanism Operated Auxiliary Contacts, 4 NO + 4NC, for UL489 fixed-mounted circuit breaker only, FS II and FS III	WLMOCUL

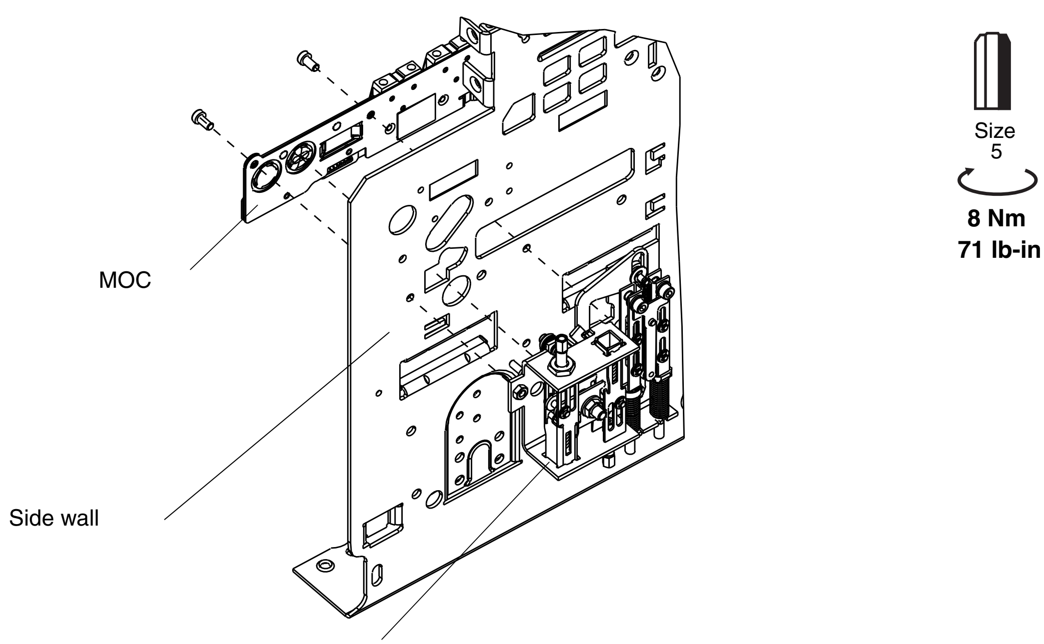
12.8.4 Combination of MOC and mutual mechanical interlocking module

For the MOC to be combined and operated with the mutual mechanical interlocking module, a special clutch shaft must be used in place of the normal one.



(1) Clutch shaft
(2) Lock-nut

12.8.5 Mounting of MOC and mutual mechanical interlocking module on the cradle



Mount on fixed-mounted circuit breakers accordingly

13 Motor-operated mechanism

For charging the closing spring automatically.
It is switched on if the closing spring is discharged and control voltage is applied.
The motor-operated mechanism is automatically switched off after the closing spring has been fully charged.

13.1 Installing the motor operator

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

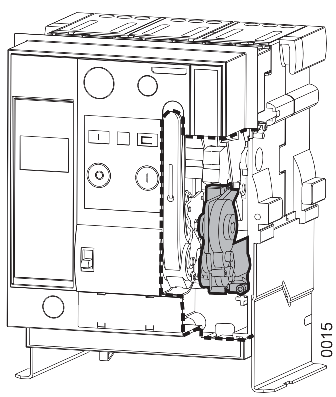
WARNING

High speed moving parts.

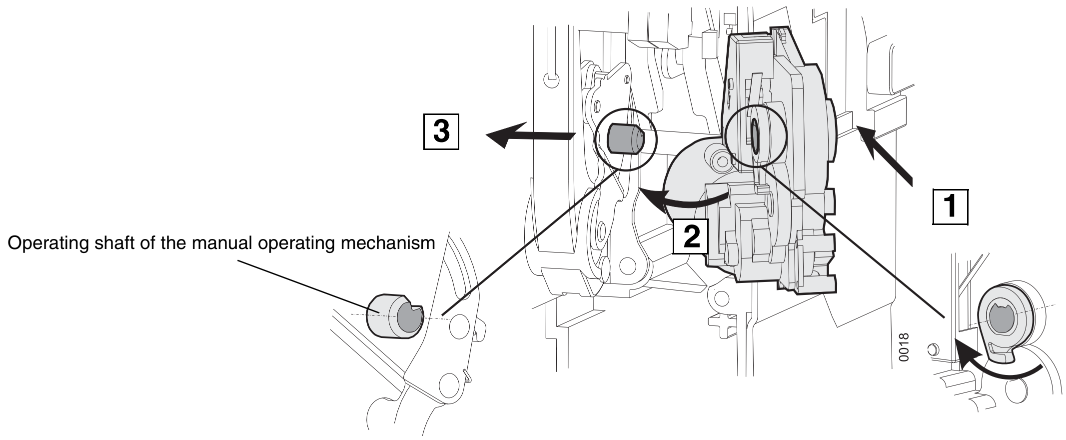
Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

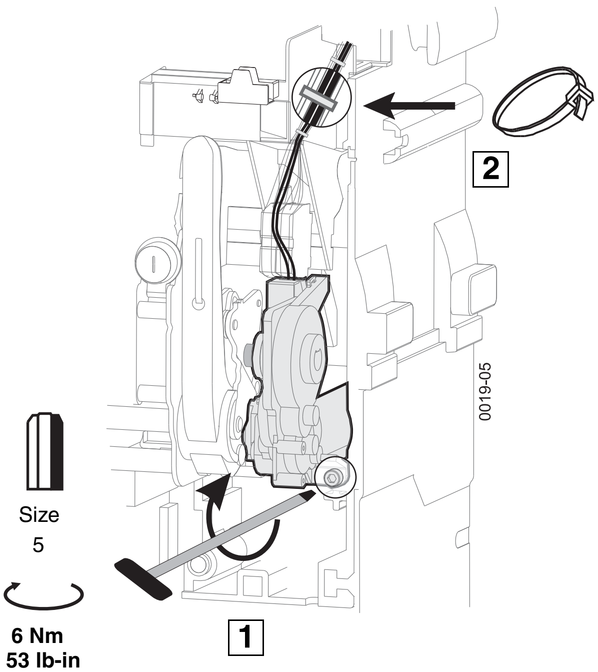
- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)

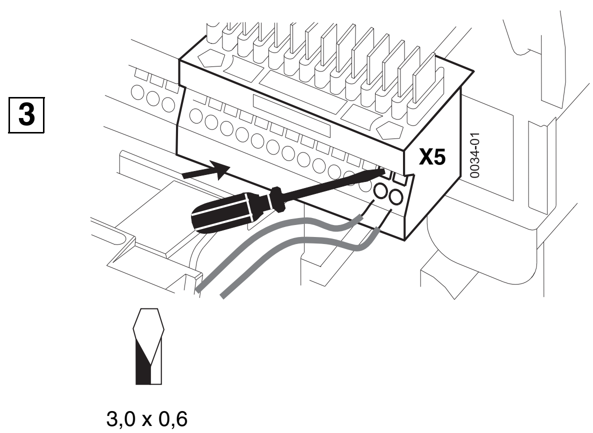


Mounting the motor on the operating shaft



Fixing the motor-operated mechanism & connecting wires

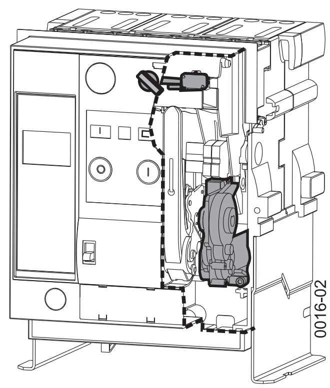




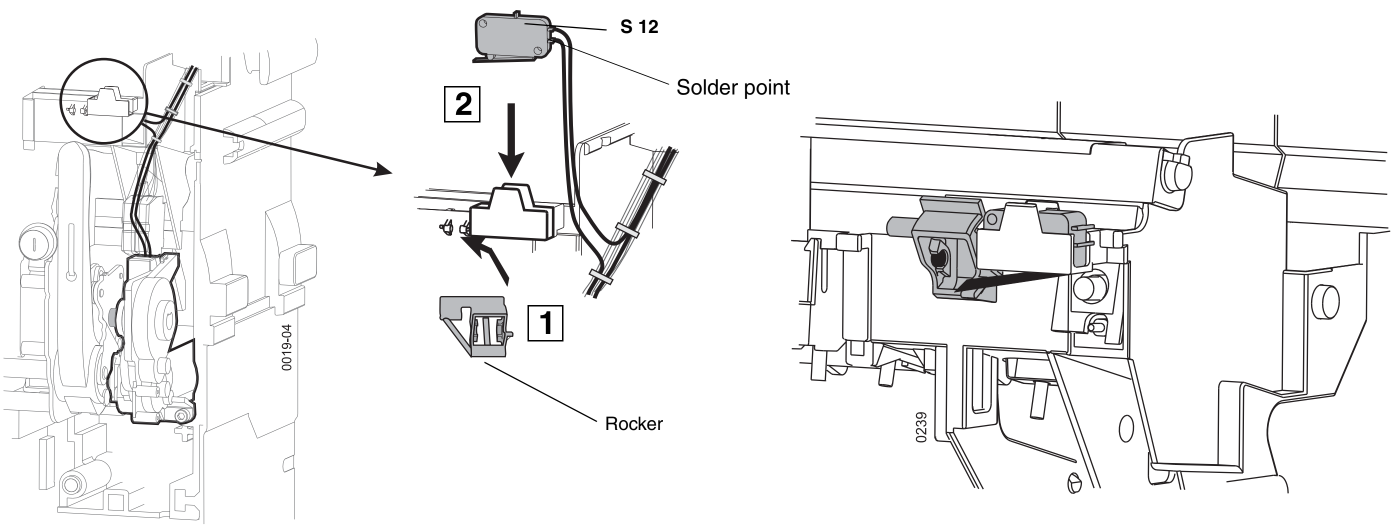
Terminals
X5.1 (-)
X5.2 (+)

13.2 Optional motor disconnect switch on the front panel

Option.
For switching off the motor-operated mechanism control voltage. Supplied pre-assembled with one wire to be soldered .



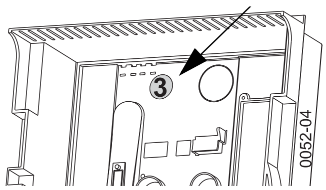
Installing motor disconnect switch

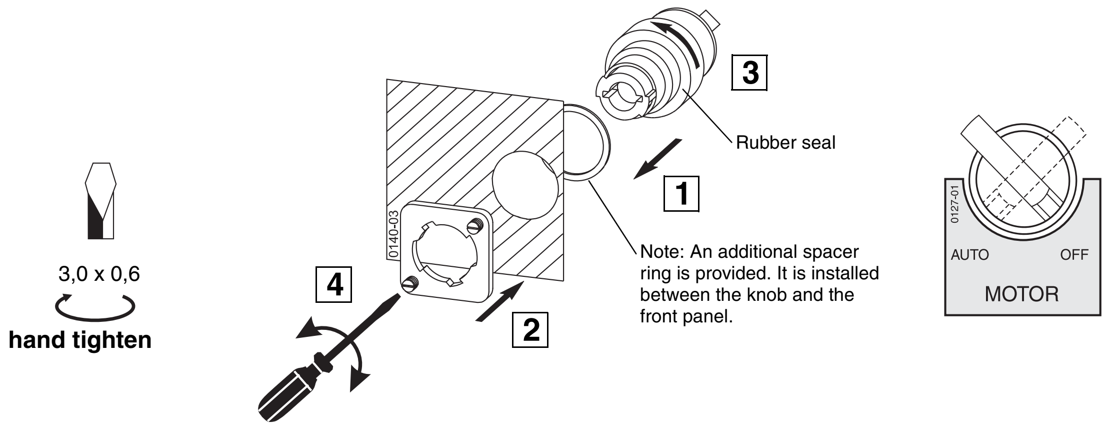


Connecting motor disconnect switch

- Disconnect the brown wire from the motor-operated mechanism from terminal X5.2.
- Connect wire X5-2 of the disconnect switch S12 to terminal X5.2.
- Solder the brown wire from the motor-operated mechanism to terminal 4 of the disconnect switch S12.

Installing the selector knob

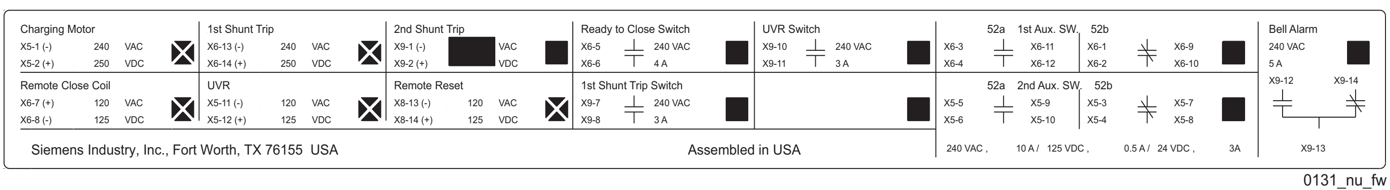




→ Circuit diagrams (page 8-6)

13.3 Updating the options label

NOTE
After installing additional components, mark the following data with a "x", using an indelible ink pen.



	Voltage	Power consumption	Catalog No.
Motor-operated mechanism	24 V DC / 30 V DC	110 W	WLELCMTR24
	48 V DC / 60 V DC	120 W	WLELCMTR48
	110-127 V AC / 110-125 V DC	150 W	WLELCMTR120
	208-240 V AC / 220-250 V DC	130 W	WLELCMTR240
Motor-operated mechanism with motor disconnect switch	24 V DC / 30 V DC	110 W	WLELCMTR24S
	48 V DC / 60 V DC	120 W	WLELCMTR48S
	110-127 V AC / 110-125 V DC	150 W	WLELCMTR120S
	208-240 V AC / 220-250 V DC	130 W	WLELCMTR240S

14 Indicators and operating elements

There are additional indicators and operating elements available for field installation.

14.1 Limiting Access to OPEN/CLOSE Buttons

This accessory kit allows the access to the OPEN and CLOSE buttons of the circuit breaker to be limited in any combination of the supplied components.

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

High speed moving parts.

Can cause serious personal injury.

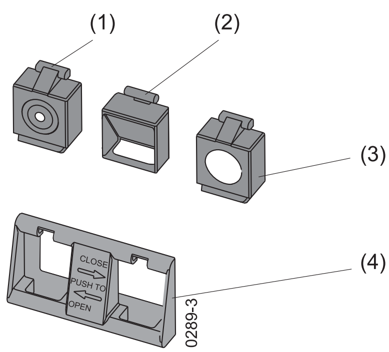
Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

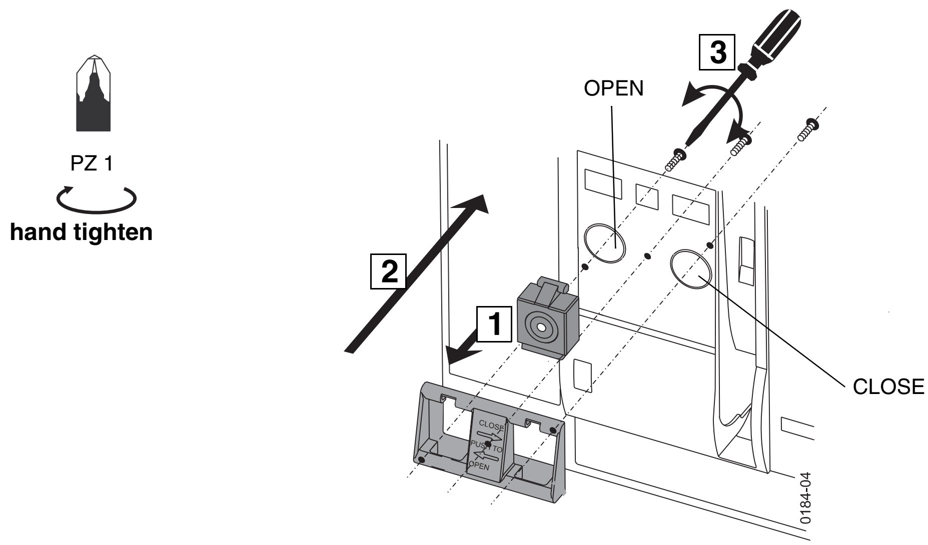
- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)

Supplied Components:

(1) 2x access blocks. Button is only accessible with a 1/8" pin (or smaller) → (page 17-2)
(2) 2x sealing caps for sealing or attaching a padlock to block the button → (page 15-21)
(3) Shield to prevent inadvertent operation
(4) Mounting plate

NOTICE
Damage to accessory.
Over-tightening the mounting screws may strip the plastic frame, or damage components, rendering the accessory unusable.
Hardware shall be tightened carefully until the underside of the screw head is flush with the mounting surface.





Catalog No.

	Catalog No.
Locking set	WLLKKT

14.2 EMERGENCY OPEN button

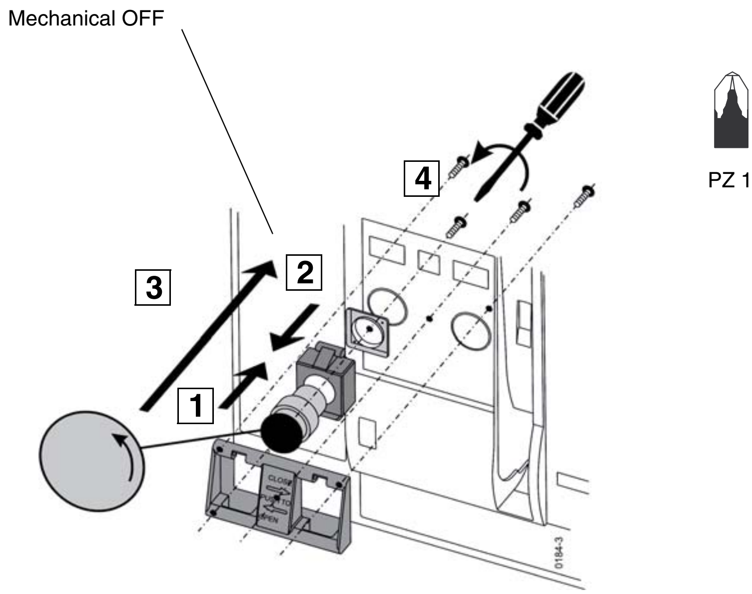
This accessory kit allows the installation of an EMERGENCY STOP mushroom pushbutton above the OPEN button. When depressed, the breaker is opened, and the breaker is held in a trip-free condition until the EMERGENCY STOP mushroom pushbutton is released.

NOTICE

Damage to accessory.

Over-tightening the mounting screws may strip the plastic frame, or damage components, rendering the accessory unusable.

Hardware shall be tightened carefully until the underside of the screw head is flush with the mounting surface.



NOTE

Install the EMERGENCY OFF mushroom pushbutton as shown (arrow on the right side).

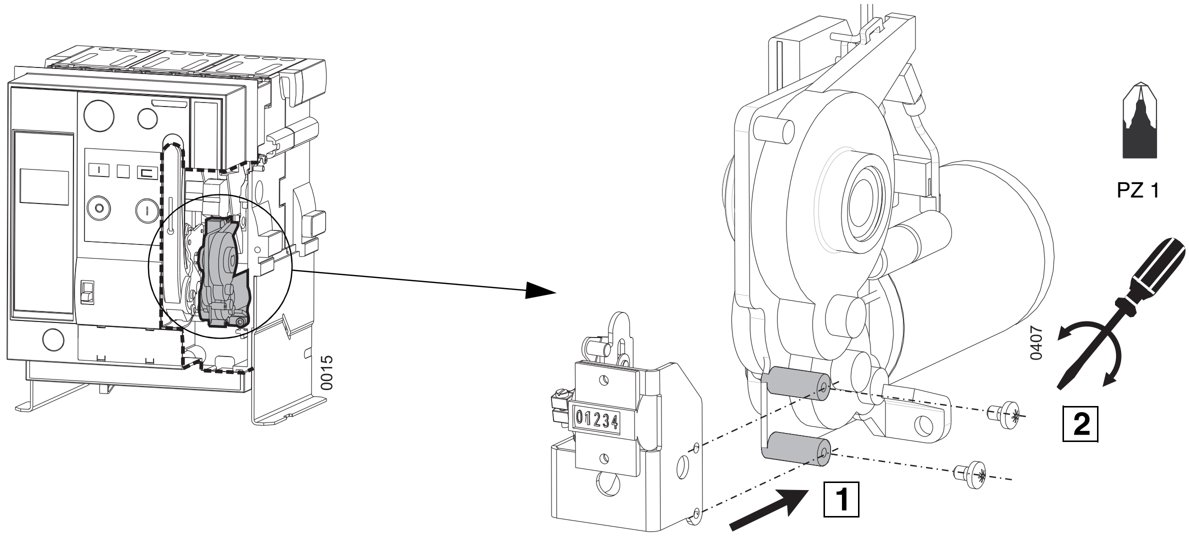
Catalog No.

	Catalog No.
EMERGENCY OFF mushroom pushbutton	WLEPEN

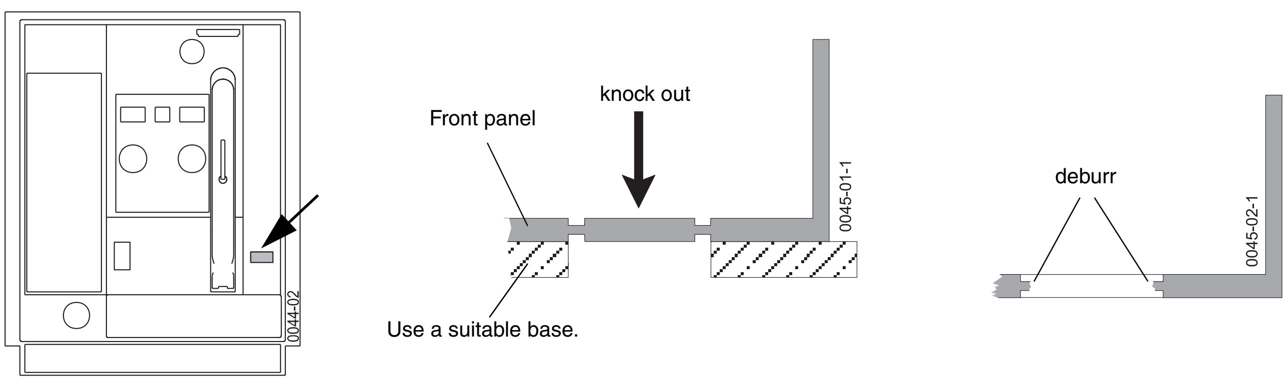
14.3 Operations counter

The operations counter is incremented when the circuit breaker completes the charging cycle (manual or electrically operated).

The mechanical operations counter can be installed only if the circuit breaker is equipped with a motor-operated mechanism.



Knocking out the fields on the front panel



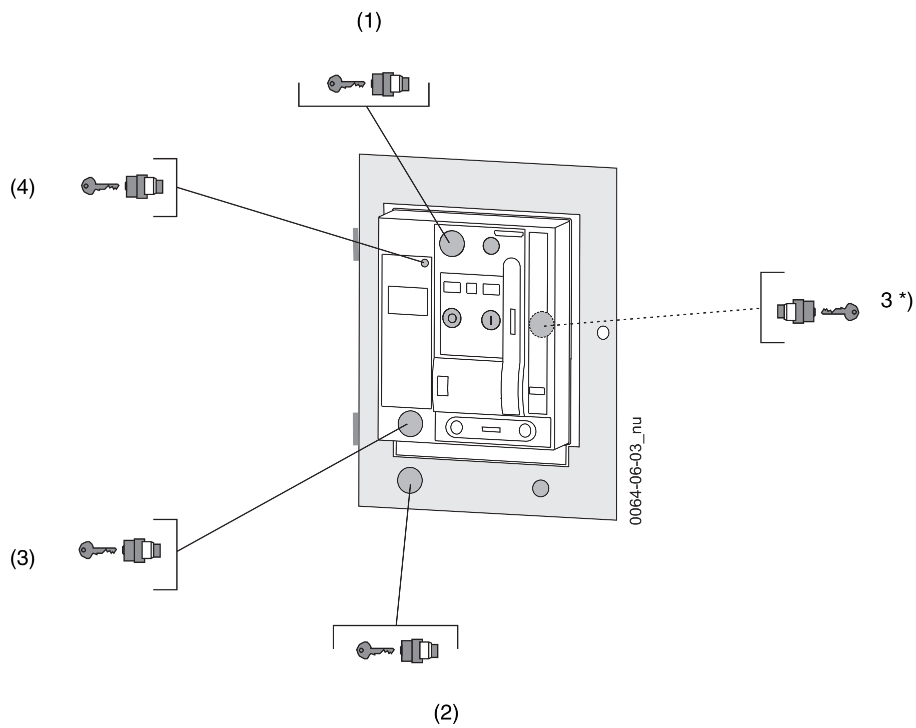
Catalog No.

	Catalog No.
Mechanical operations counter	WLNUMCNT

15 Locking devices

15.1 Key Locks

→ Padlocking provisions (page 15-15)



*) Location on FS I

	Key lock	Manufacturer	Application
1	Breaker-mounted key lock	KIRK SUPERIOR	To activate the locking device, the circuit breaker must be opened. If the circuit breaker is closed, the locking device is blocked. The block is only effective when the key is removed. The key can only be removed in "OPEN" position. → (page 15-2)
2	Cradle-mounted key lock	KIRK SUPERIOR	This cradle-mounted key lock prevents the closing of any circuit breaker installed in the cell which this lock is installed. Up to two independent Kirk or Superior key locks may be installed. To activate the lock, the circuit breaker must be open. If the circuit breaker is closed, the locking device is blocked. The block is only effective if the key is withdrawn. The key can only be removed in the "OPEN" position. → (page 15-4)
3	Racking handle key lock	KIRK SUPERIOR	Prevents drawing out of the racking handle. The circuit breaker is protected from being moved. The block is only effective when the key is removed. → (page 15-9)
4	Bell Alarm and open fuse lockout key lock		A lockable cover prevents resetting the Bell Alarm or open fuse lockout after the breaker trips. → (page 15-14)

15.1.1 Breaker mounted key lock

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

High speed moving parts.

Can cause serious personal injury.

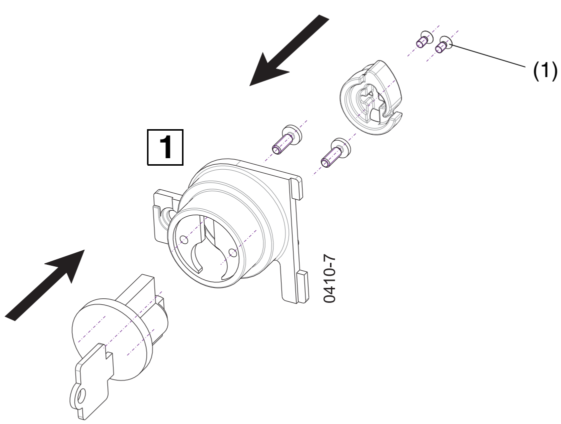
Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

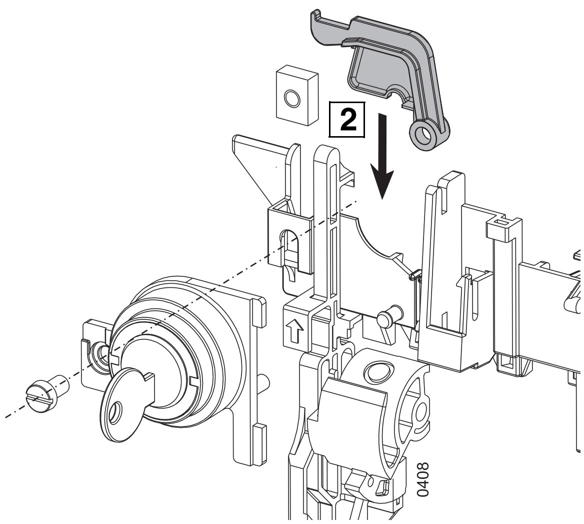
When the key is removed, the circuit breaker is locked in the open position.

- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)
- Remove trip unit → (page 9-49)

Installing the locking mechanism

For key lock types: KIRK, Superior

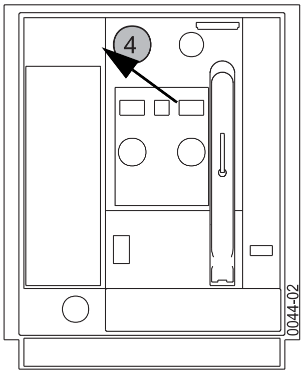


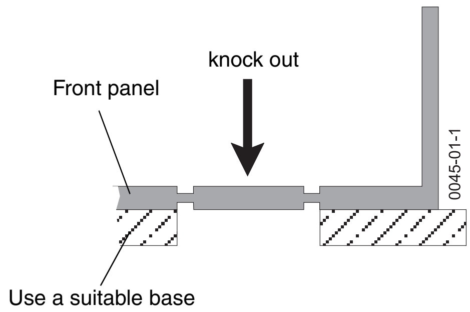


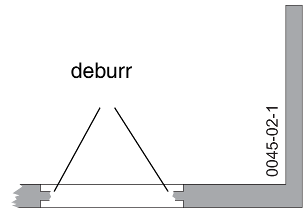
NOTE

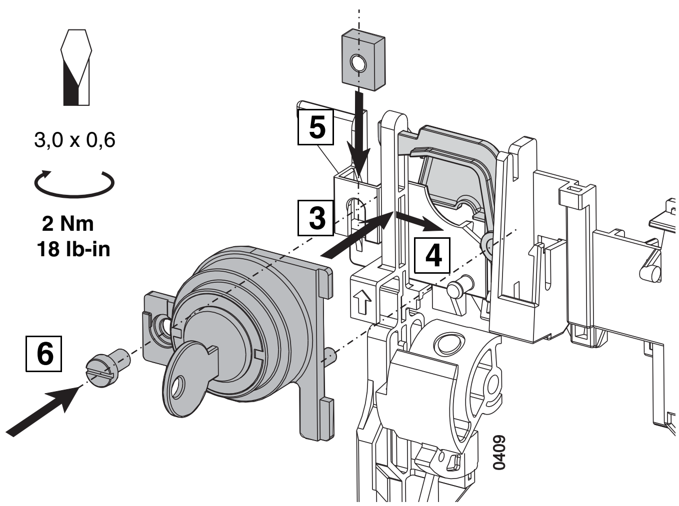
When removing the screws (1), ensure that the cylinder does not slip out of the lock. If this happens, the lock cannot be re-assembled.

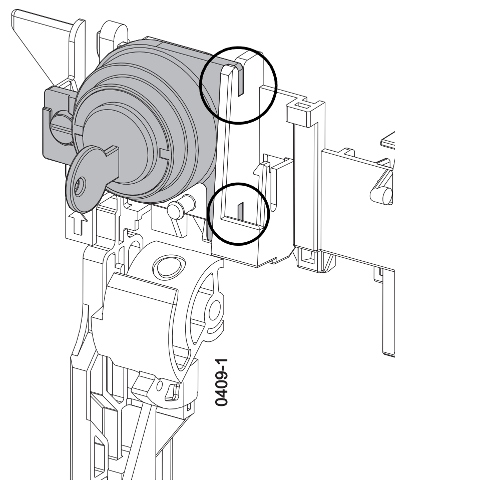
Knocking out the fields on the front panel











Then

- Install trip unit → (page 9-49)
- Install front panel → (page 24-4)

Key lock	Manufacturer	Frame size	Catalog No.
Breaker mounted key lock	KIRK	I / II / III	WLLKOFFKRK
	SUPERIOR		WLLKOFFSUP

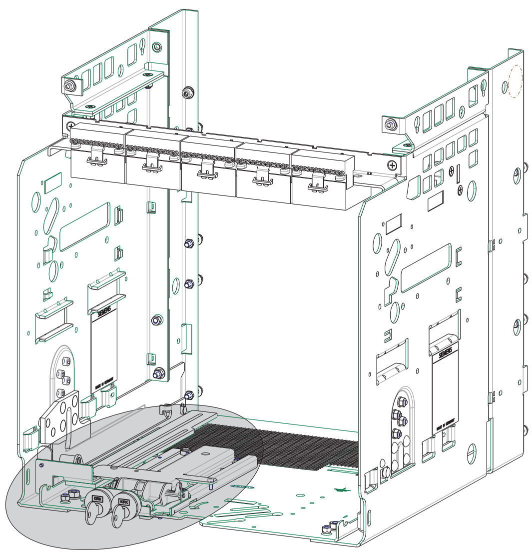
15.1.2 Cradle mounted key lock

Not available for frame size I

	DANGER
	Hazardous voltage. **Will cause death, serious personal injury, or equipment damage.** Turn off and lock out all power supplying this equipment before working on this device.

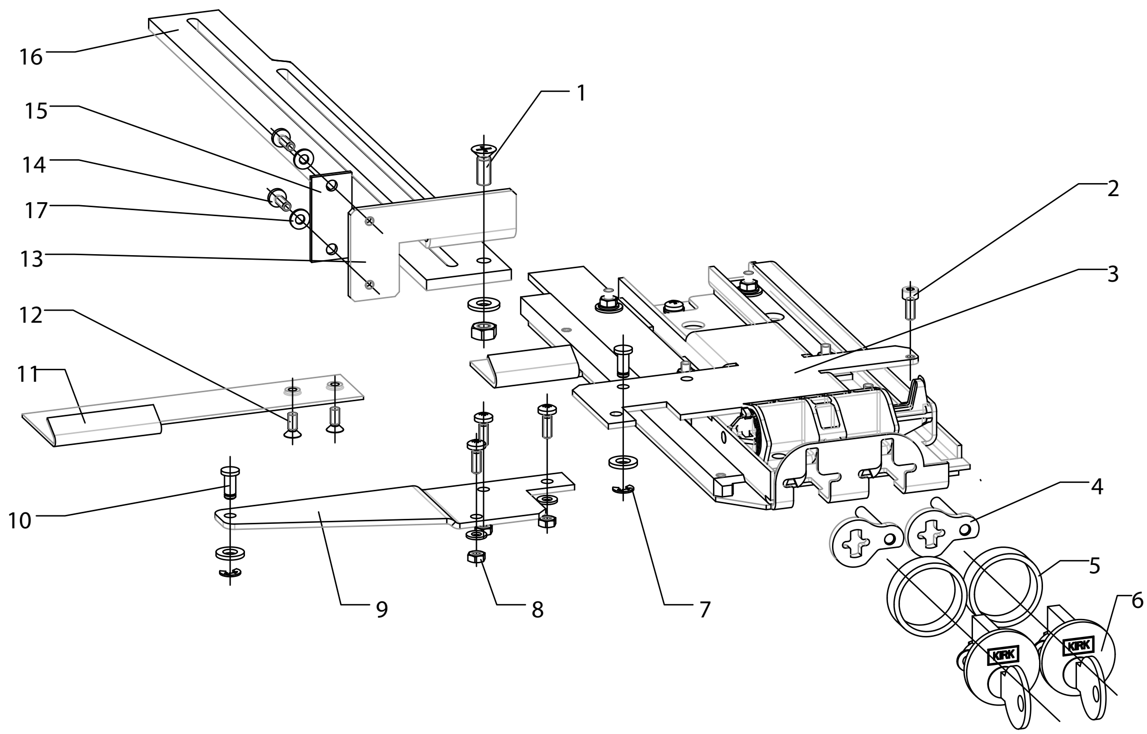
When a key is removed, all circuit breakers racked into this cradle will be locked in the open position.

- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)



0636_nu

Components of the key locking device

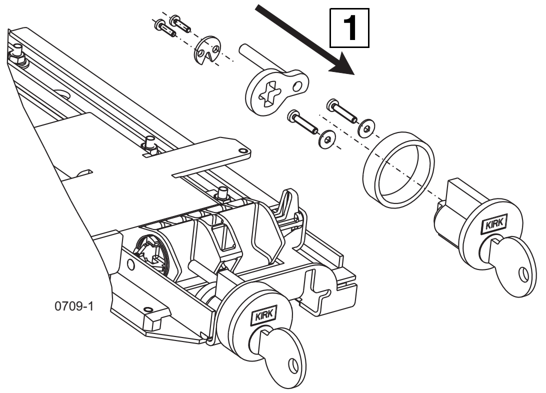


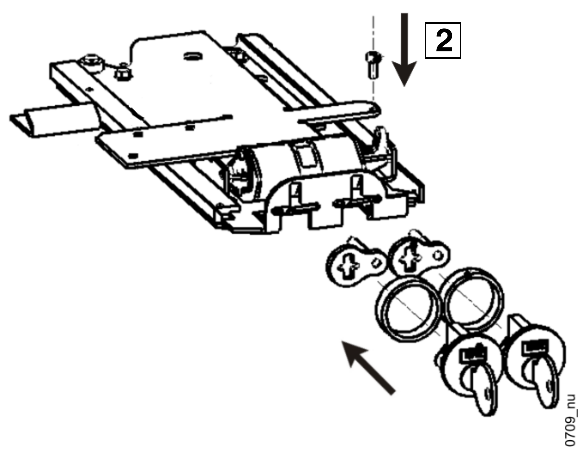
(1)	Countersunk head screw M6 with belleville washer and nut	(13)	Small attachment angle
(2)	M4 socket head cap screw	(14)	2x M4 socket-head cap screws
(3)	Pre-assembled skid with guide	(15)	Spacer (for FS II only)
(4)	Lever	(16)	Plastic slider (slotted) FS II / III: short slot FS II fused: long slot
(5)	Spacer	(17)	2x spring lock washers
(6)	Kirk key, supplied separately including fixing screws		
(7)	Bolt with washer size 5 mm and clip (for 4 mm inner diameter groove; (for 4 mm groove; for FS II only)		
(8)	3x M4 socket-head cap screws with lock waschers and nuts (for FS III only)		
(9)	Extension (for FS III only)		
(10)	Bolt with washer size 5 mm and clip (for 4 mm inner diameter groove; (for 4 mm groove; for FS II only)		
(11)	Ramp extension (for FS III only)		
(12)	2x M4 flat-head screw (for FS III only)		

Installing the locks

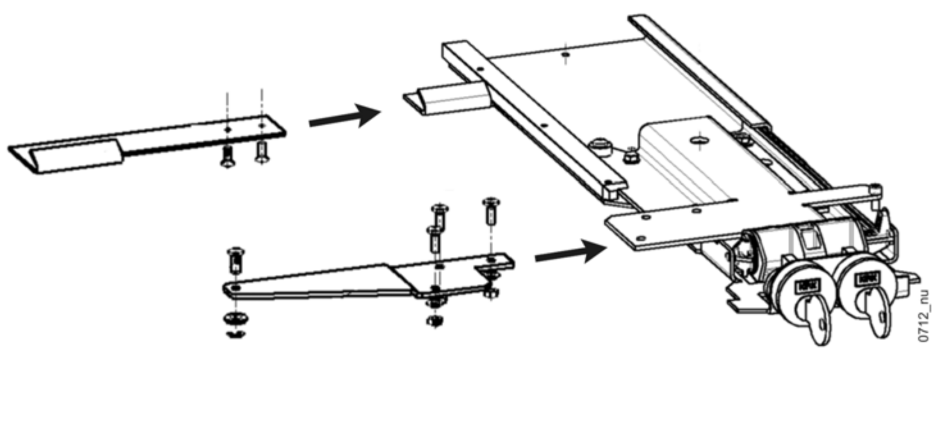
The way in which the locking module unit is installed is the same whether the unit consists of one lock or two locks. Do not use the spacer which may be provided with the key lock. The spacer (5) supplied with the mounting must be used in place of the spacers supplied with the lock.

NOTE
Attach the lever (4) to the KIRK / Superior locks (6) with the screws supplied with the lock. Attach the KIRK / Superior locks (6) together with the spacer (5) to the lock mechanism using the supplied screws.

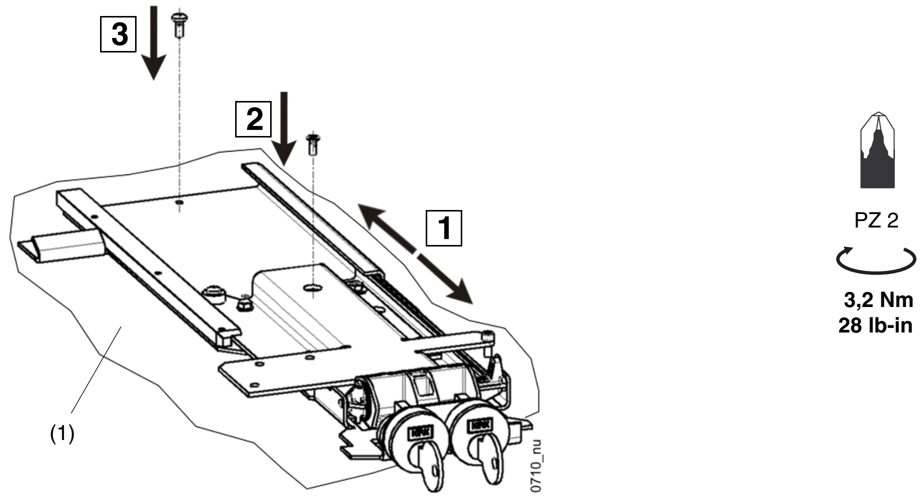




For FS III only:

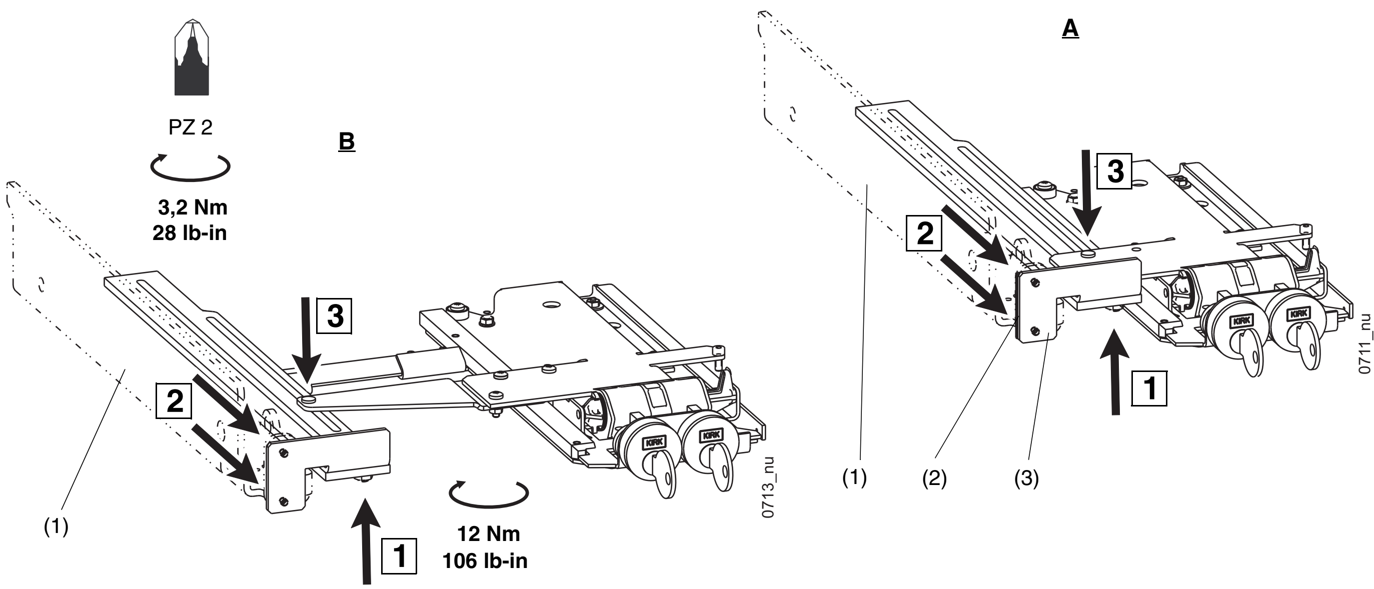


Mounting the skid with guide to the base plate of the cradle



(1) Base plate of the cradle

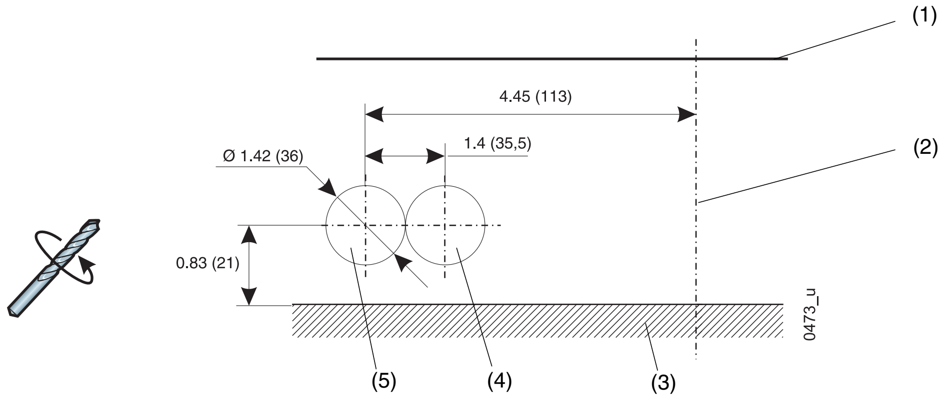
Mounting the guide on the guide rail



A Frame size II
B Frame size III

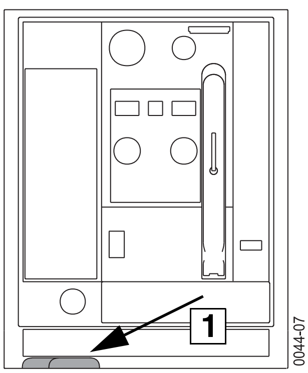
(1) Guide rail on left side
(2) Spacer for FS II must be mounted between angle and guide rail
(3) Attachment angle

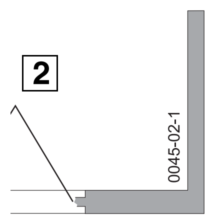
Drilling the hole in the cubicle door



(1) Lower edge of door cutout
(2) Center of front panel
(3) Mounting surface of cradle
(4) Hole for first key cylinder
(5) Hole for second key cylinder (only if planned)

Knocking out the fields on the front panel





1 Knock out the fields on the front panel using a suitable base
2 Deburr the edges

Then:

- Install front panel → (page 24-4)

Function test

- Check that the locking mechanism on the locks can rotate freely when the keys are turned.
- Check that the spring turns the locking mechanism back to the starting position when it is unlocked.
- By repeatedly drawing out and re-inserting the left guide rail, check that the carriage is also actuated and can move freely.

Lock & Key for Cradle Mounting	Manufacturer	Catalog No.
Single lock	Kirk	WLDLKRK
	Superior	WLDSUP
Double lock	Kirk	WLDLDKRK
	Superior	WLDLDSUP

Provision-only for Cradle Lock	Catalog No.
Single Lock Provision	WLDLPR
Double Lock Provision	WLDLDPR

15.1.3 Installing racking handle key lock

When the key is removed, the circuit breaker's racking handle cannot be drawn out, meaning that the circuit breaker cannot be moved into another position.

The key lock for the WL Fuse Carriage racking handle cannot be replaced. If damaged, please consult Technical Support.

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

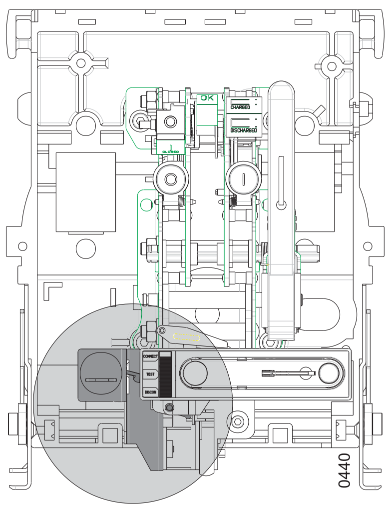
Turn off and lock out all power supplying this equipment before working on this device.

WARNING

High speed moving parts.

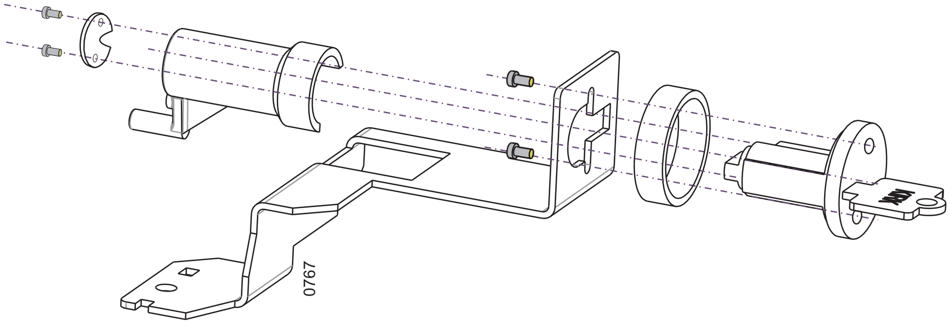
Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.



- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)

Pre-assembling the locking module

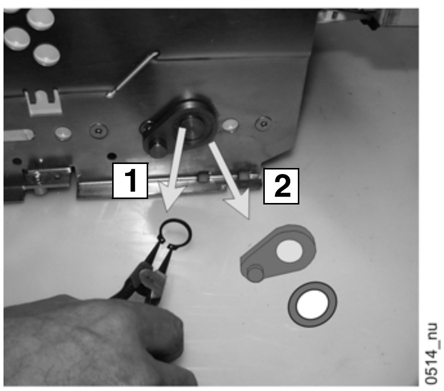


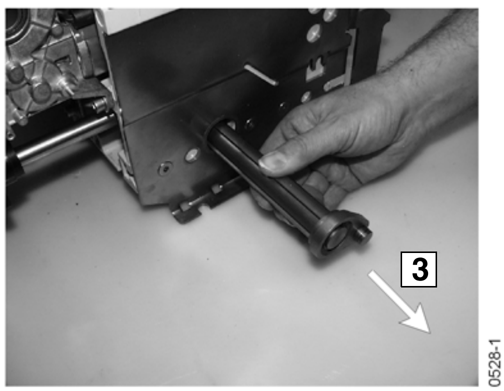
Note
The kit for FS I contains two adapter rings: a wide ring for KIRK locks, and a narrow ring for Superior locks.

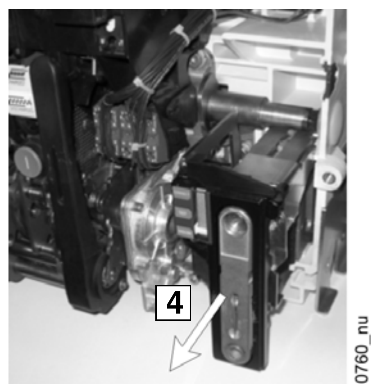
Installing FS I

- Remove the circuit breaker from the cradle → (page 24-3)

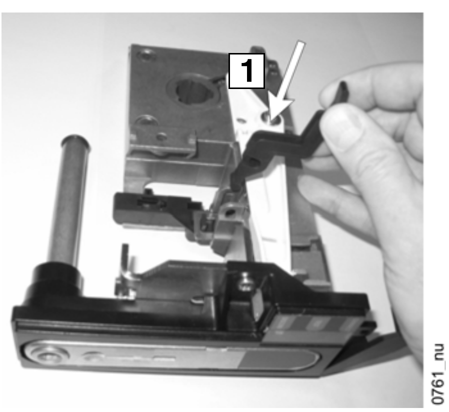
Remove racking mechanism

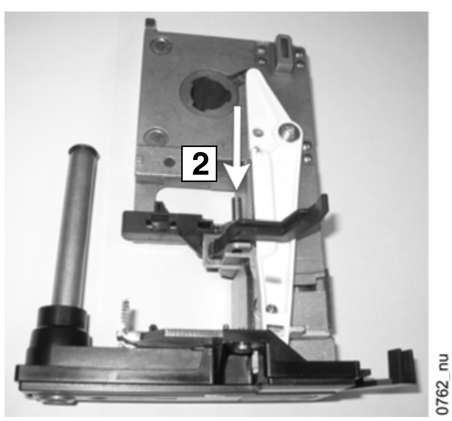


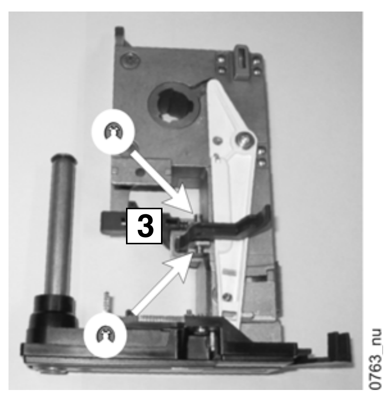




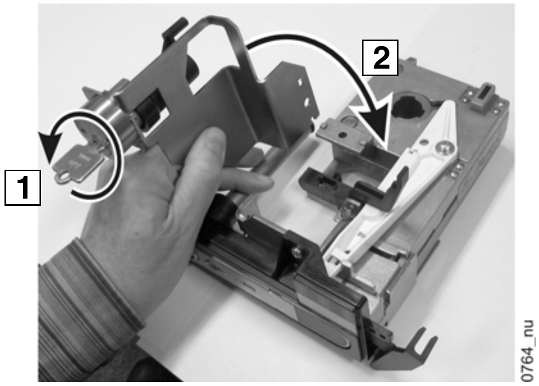
Installing the lever

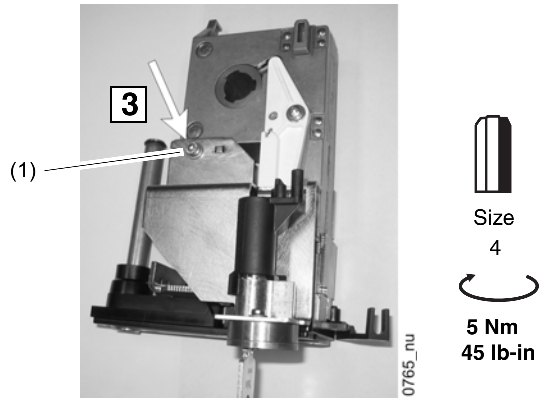






Mounting the locking module



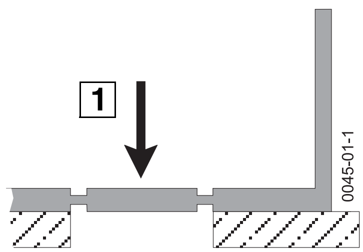


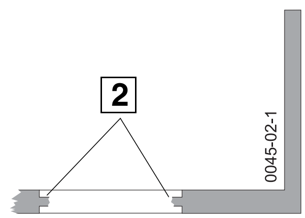
(1) Socket head cap screw M5 with washer and nut

Installing the racking mechanism

Install the racking mechanism in the opposite order to that in which it was removed.

Knocking out the field on the front panel



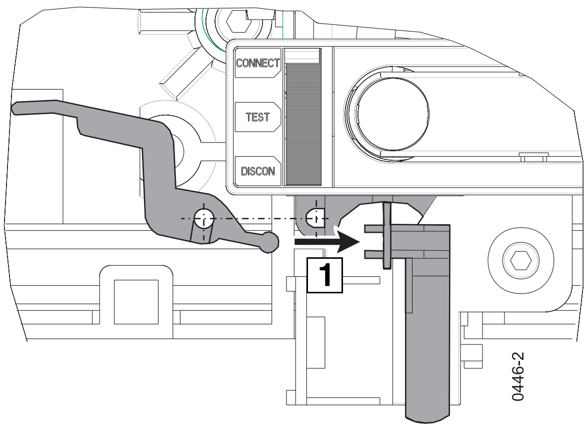


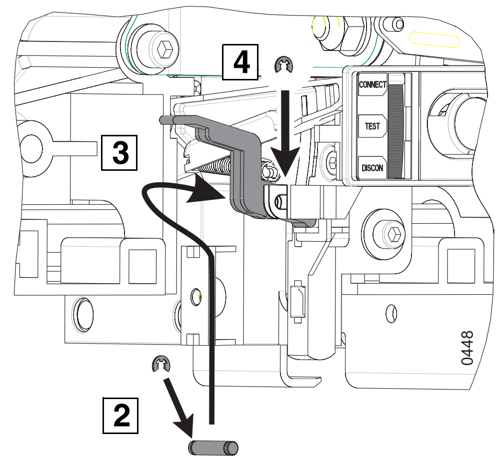
1 Knock out the fields on the front panel using a suitable base
2 Deburr the edges

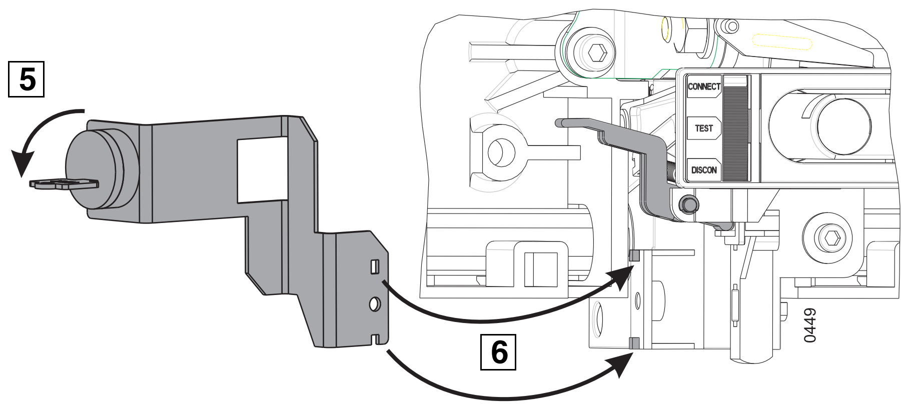
Then:

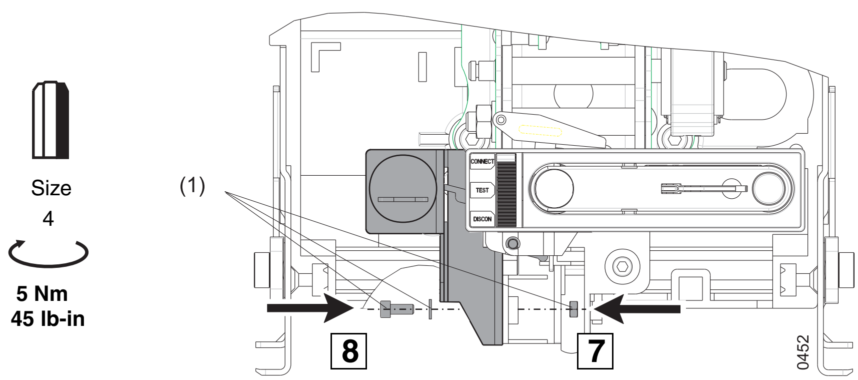
- Install front panel → (page 24-4)

Installing FS II and FS III



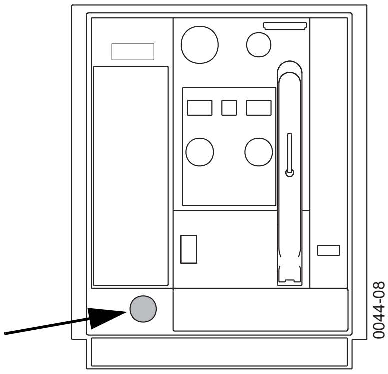


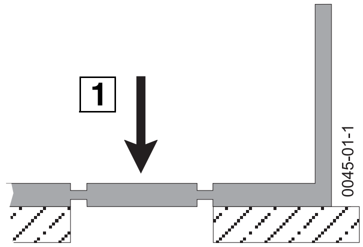


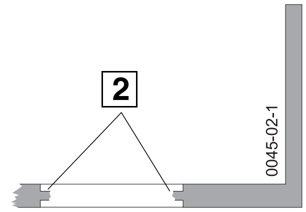


(1) Socket head cap screw M5 with washer and nut

Knocking out the field on the front panel







1. Knock out the fields on the front panel using a suitable base
2. Deburr the edges

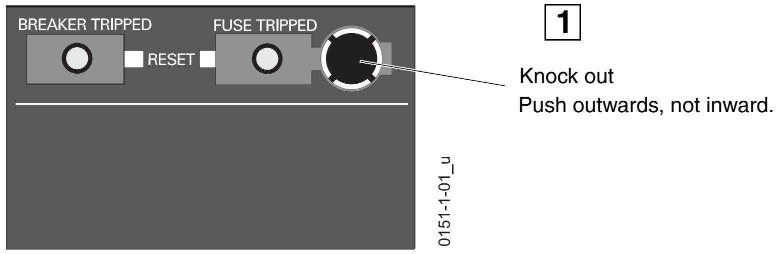
Then:

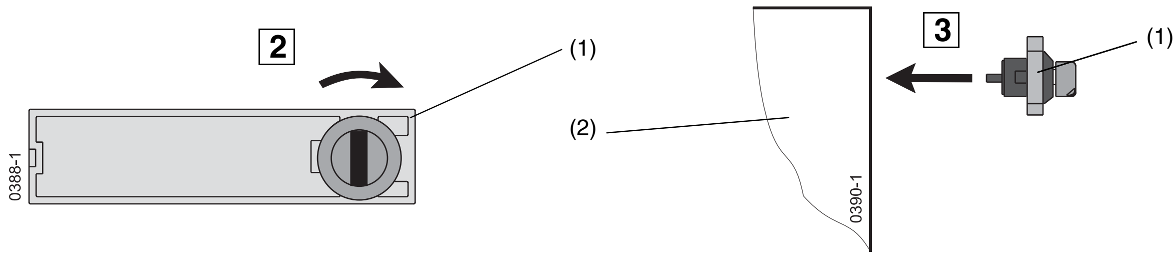
- Install front panel → (page 24-4)

Key lock	Manufacturer	Frame size	Catalog No.
Racking handle key lock	KIRK	I	WLLKCLKRK1
		II / III	WLLKCLKRK
	SUPERIOR	I	WLLKCLSUP1
		II / III	WLLKCLSUP1

15.1.4 Installing a Bell Alarm cover key lock

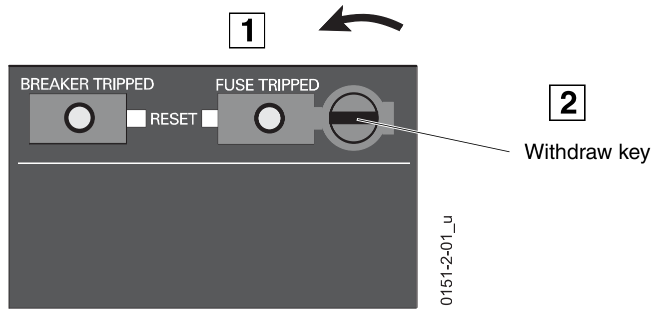
When the key is removed, the cover cannot be removed and the Bell Alarm cannot be reset.





(1) Cover with safety lock
(2) Trip unit

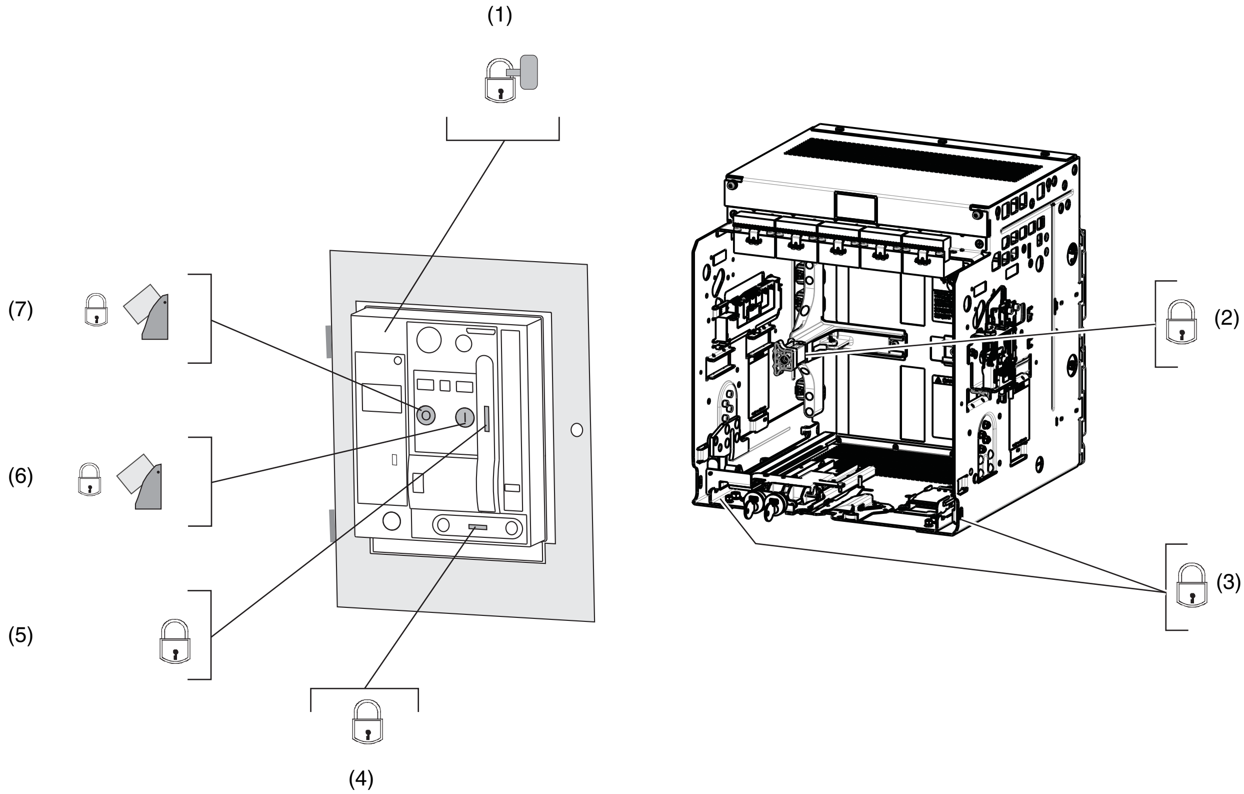
Locking



Key lock	Manufacturer	Catalog No.
Bell Alarm and open fuse lockout key lock	ETU745 ... ETU748	WLTUSC55
	ETU776	WLTUSC76

15.2 Padlocking provisions

→ Key Locks (page 15-1)

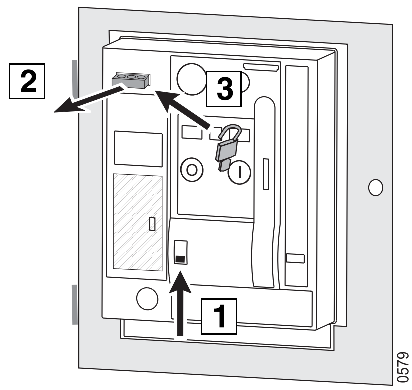


	Padlock locking device	Application
1	Padlock locking bracket for "OPEN"	The locking bracket for "OPEN" can be locked with up to 4 padlocks 1/4" diameter. The circuit breaker cannot be closed.
2	Shutter	If the circuit breaker has been removed, the shutter can be locked with padlocks. → (page 15-18)
3	Guide rails	The guide rails can be locked with 2 padlocks so that they cannot be drawn out. The circuit breaker is either in the connected position or has been removed. It is not possible to insert a circuit breaker into the cradle. → (page 15-19)
4	Racking handle	Up to 3 padlocks can be used to prevent the racking handle being drawn out. The circuit breaker is then locked against being moved. → (page 15-19)
5	Spring charging lever	The spring charging lever can be locked with a padlock. This prevents manual charging of the closing spring. → (page 15-19)
6	CLOSE	Actuation of the CLOSE button can be prevented by locking the sealing cap with up to 3 padlocks. CLOSING via the "electrical CLOSE" button and remote closing remain possible. → (page 15-21)
7	OPEN button	Actuation of the OPEN button can be prevented by locking the sealing cap with up to 3 padlocks. Remote closing remains possible.

15.2.1 Padlock locking the breaker OPEN

When the control gate is raised (step 1), the padlock provision can be extended, and padlocks installed. With padlocks installed, this circuit breaker cannot be closed. This provision will support up to four 1/4" diameter padlocks at one time.

Locking with a padlock



Field installation

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

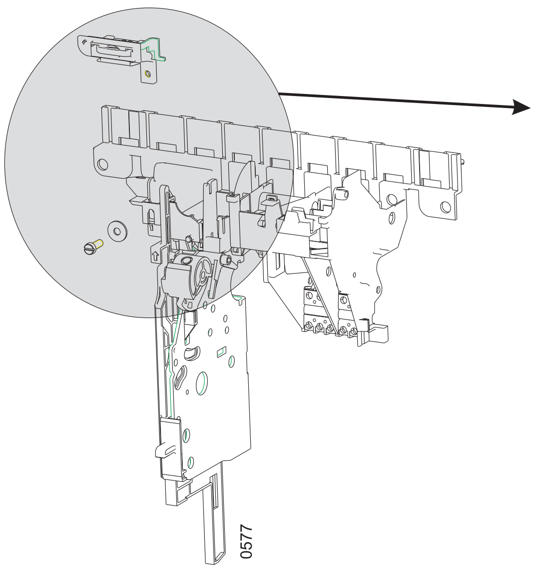
High speed moving parts.

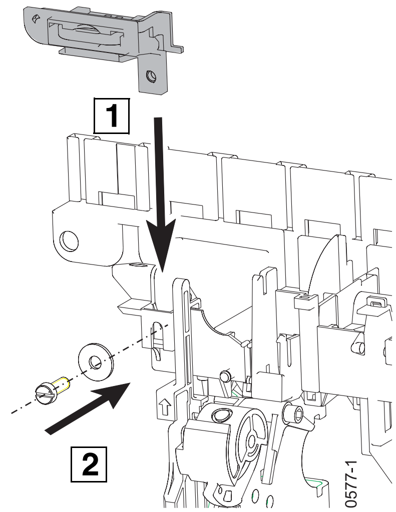
Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

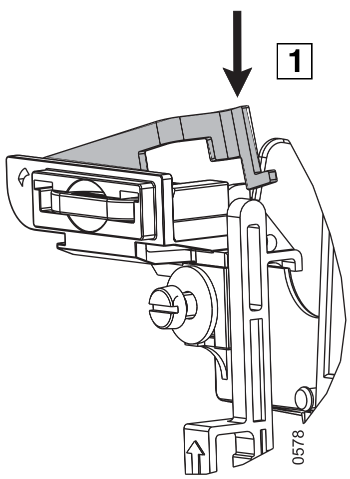
- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)
- Install the control gate if not already present.

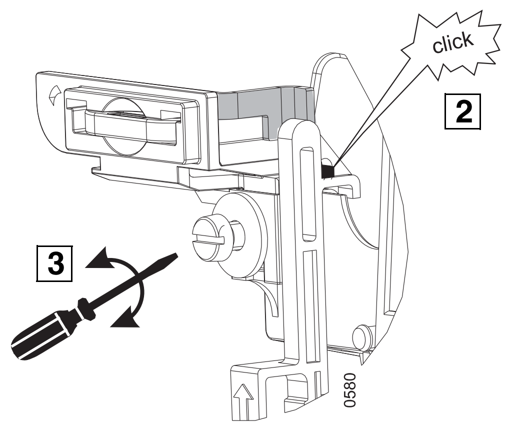
Mounting padlock locking bracket





Latching plate in control gate





Then:

- Install front panel → (page 24-4)

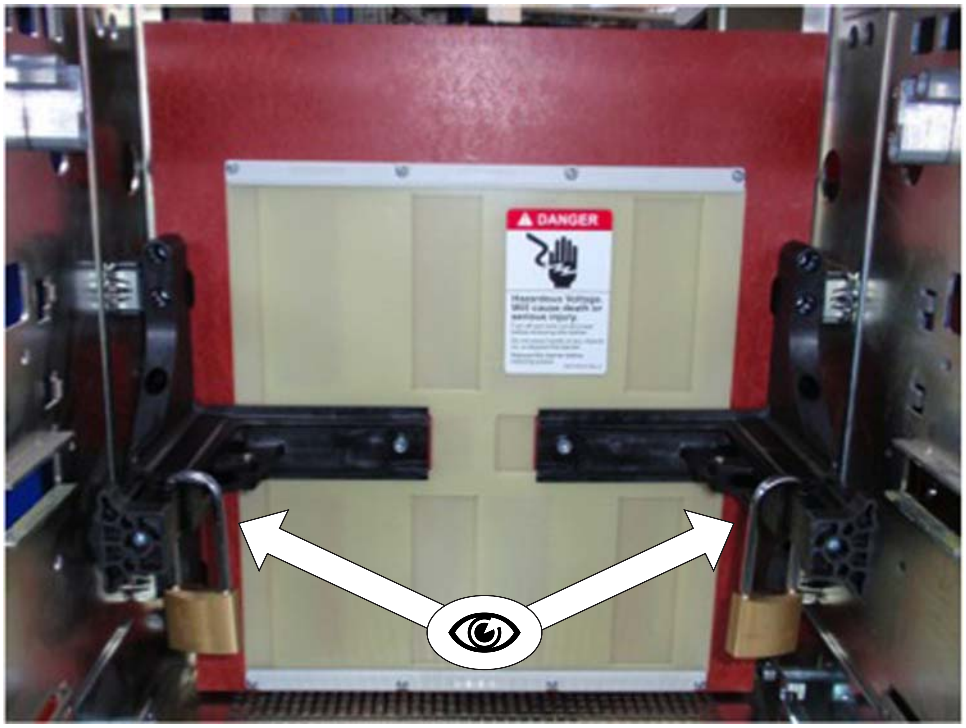
Padlock locking device	**Catalog No.**
Padlock locking breaker/OPEN	WLLKNP

15.2.2 Optional: Intalling padlocks

The WL shutter prevents incidental contact with primary conductors when the circuit breaker is removed from the cradle. At the user's option, padlocks may be installed through the arms of the shutter assembly, as a means of locking out direct access to the primary conductors. One padlock through each arm is required to lock out primary conductor direct access..

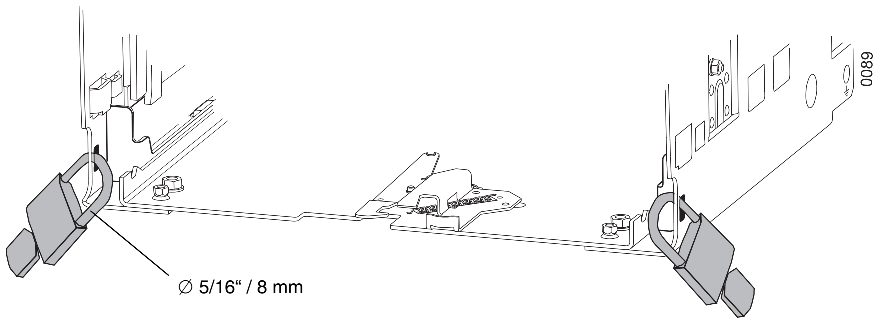
NOTICE
Remove padlocks before inserting breaker into the cradle.

Frame size 2 shown



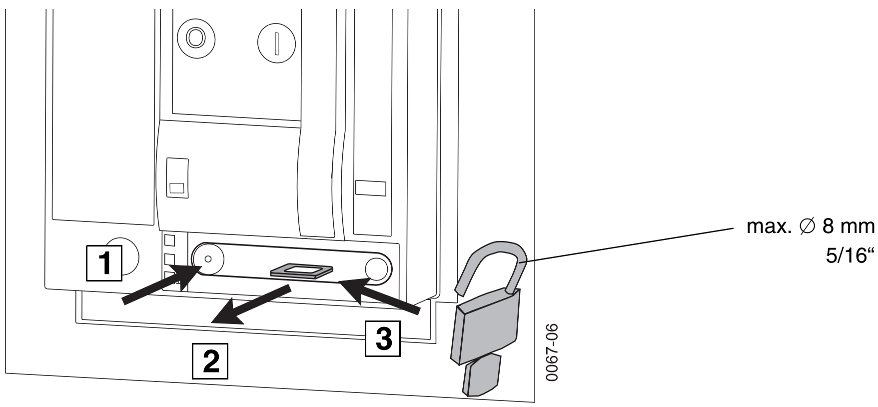
15.2.3 Padlock Locking device for guide rails

The cradle is equipped with this locking device as standard. Up to two padlocks can be applied on each side. This prevents a circuit breaker from being inserted into an empty cradle.

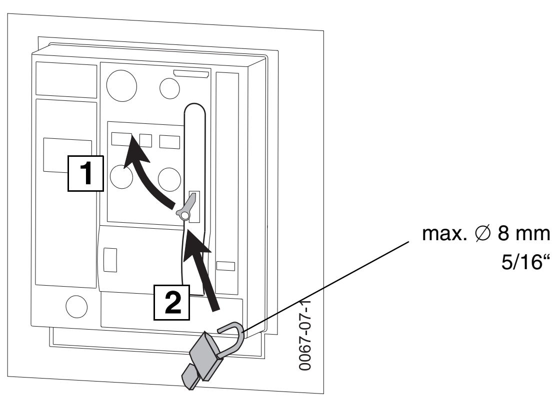


15.2.4 Padlock Locking device for racking handle

Draw-out circuit breakers are equipped with this locking device as standard. Up to three padlocks can be applied to prevent the circuit breaker from being racked into another position.



15.2.5 Padlock Locking device for spring charging lever



This locking device is an optional accessory for preventing manual charging of the circuit breaker closing spring mechanism. It does not prevent charging via the motor-operated mechanism.

Field installation


DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

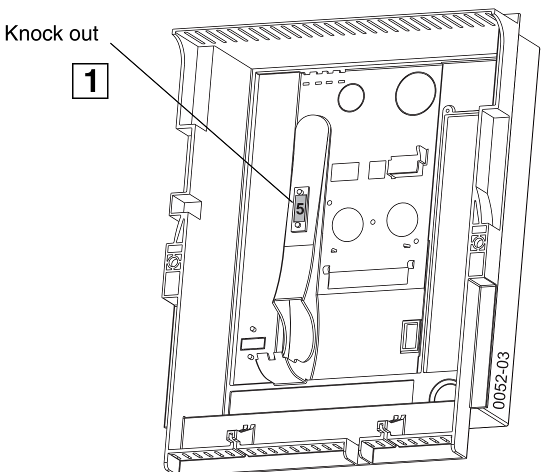
WARNING

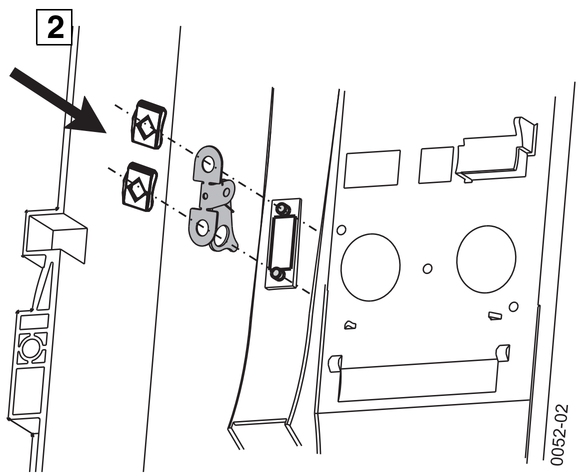
High speed moving parts.

Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

- Open the circuit breaker and discharge the closing spring → (page 24-2)
- Remove front panel → (page 24-4).





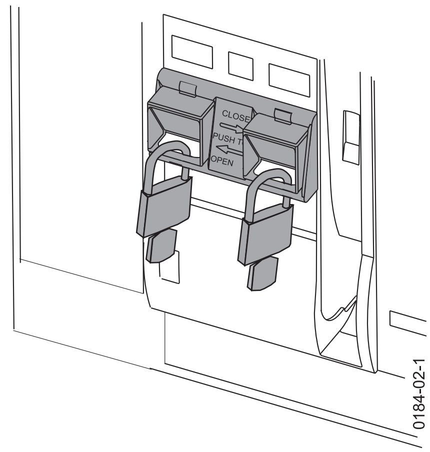
Then:

- Install front panel → (page 24-4)

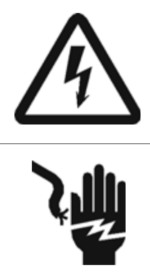
Padlock Locking device	Catalog No.
Locking device for spring charging lever	WLHANDLC

15.2.6 CLOSE/OPEN padlock kit

The manual closing and/or opening of this circuit breaker can be prevented, when this optional accessory is installed. The covers for the CLOSE button and the OPEN button can be fitted with up to three padlocks. With padlocks applied, it is still possible to electrically open and close this circuit breaker.



Field installation of sealing cover



DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

High speed moving parts.

Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)

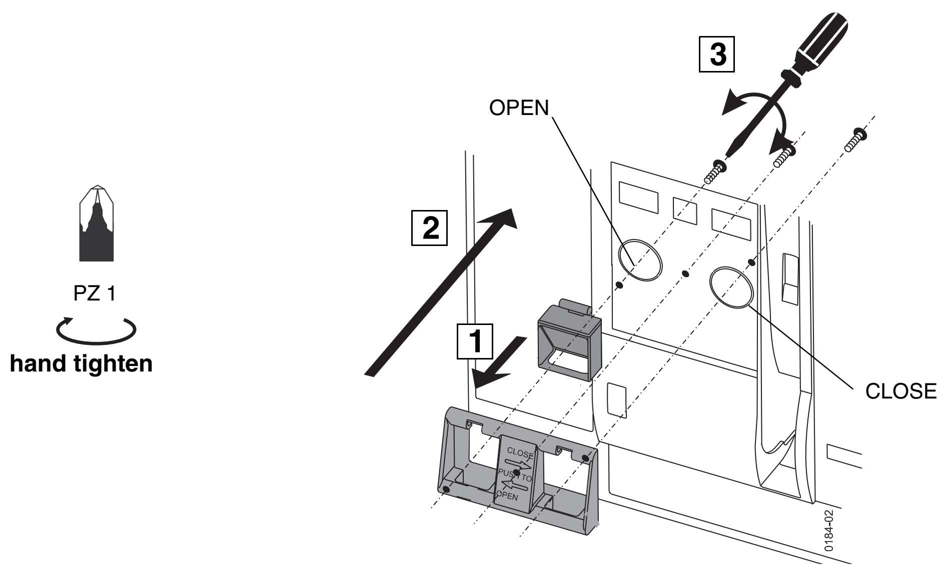
See also → Limiting Access to OPEN/CLOSE Buttons (page 14-1)

NOTICE

Damage to accessory.

Over-tightening the mounting screws may strip the plastic frame, or damage components, rendering the accessory unusable.

Hardware shall be tightened carefully until the underside of the screw head is flush with the mounting surface.

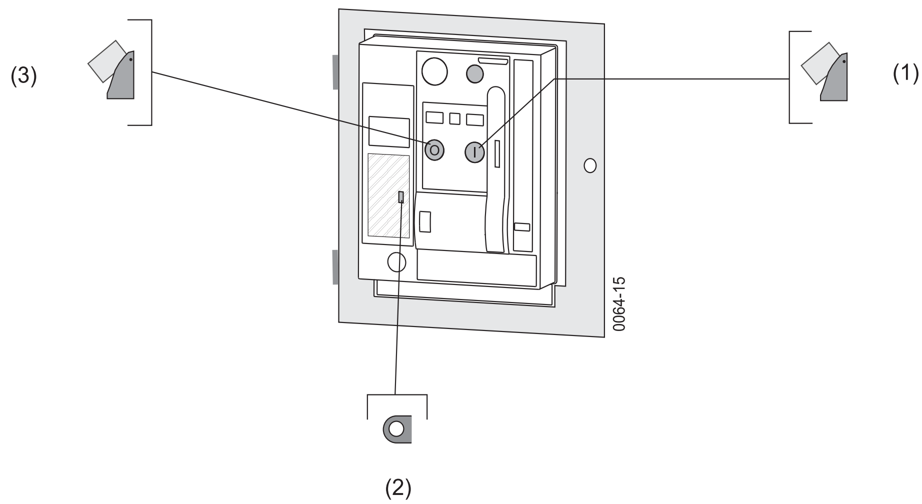


Then:

- Install front panel → (page 24-4)

Padlock Locking device	Catalog No.
CLOSE/OPEN Padlock Kit	WLLKKT

16 Sealing covers



(1) Sealing cover for CLOSE button
(2) Sealing cover for ETU (electronic trip unit)
(3) Sealing cover for OPEN button

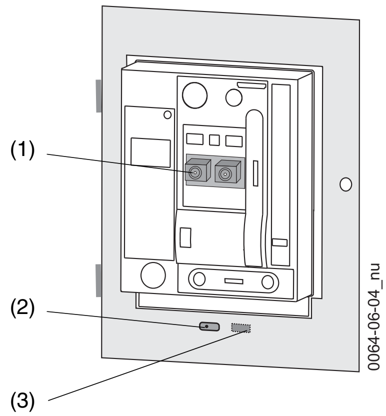
Sealing cover for CLOSE/OPEN buttons

→ Field installation of sealing cover (page 15-22)

Sealing cover for ETU (electronic trip unit)

→ Sealing and locking device (page 9-53)

17 Mechanical interlocks



	Mechanical interlock	Application
1	Access block via CLOSE/OPEN button (locking set)	The CLOSE/OPEN buttons are each covered in such a way that operation is only possible with a tool. → (page 17-2)
2	Cubicle door locking mechanism	The cubicle door cannot be opened - if the fixed-mounted circuit breaker is closed (signal transmission through Bowden cable) or - if the circuit breaker is in the CONNECTED position. → (page 17-3)
3	Interlock against racking when cubicle door is openNot available for FS I	The racking handle cannot be withdrawn if the cubicle door is open.

17.1 Field installation of CLOSE / OPEN buttons blocking device

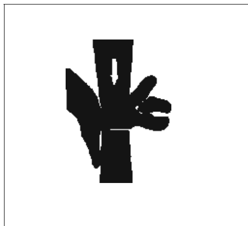
This interlock limits access to the circuit breaker's manual CLOSE and/or OPEN buttons. The blocking device only allows access to the manual CLOSE and/or OPEN buttons via a small tool (1/8" diameter rod).

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.



WARNING

High speed moving parts.

Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

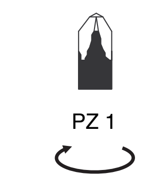
- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Remove front panel → (page 24-4)

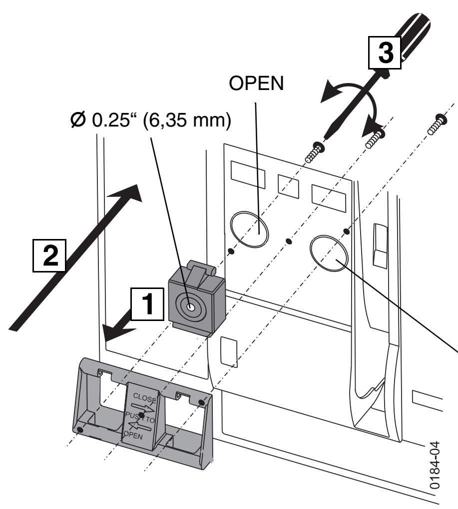
NOTICE

Damage to accessory.

Over-tightening the mounting screws may strip the plastic frame, or damage components, rendering the accessory unusable.

Hardware shall be tightened carefully until the underside of the screw head is flush with the mounting surface.





Then:

- Fit front panel → (page 24-4)

Mechanical interlock	Order No.
Access block via CLOSE button (locking set)	WLLKKT

17.2 Cubicle door interlock

This interlock prevents the cubicle door being opened if the circuit breaker is in the CONNECT position.

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

High speed moving parts.

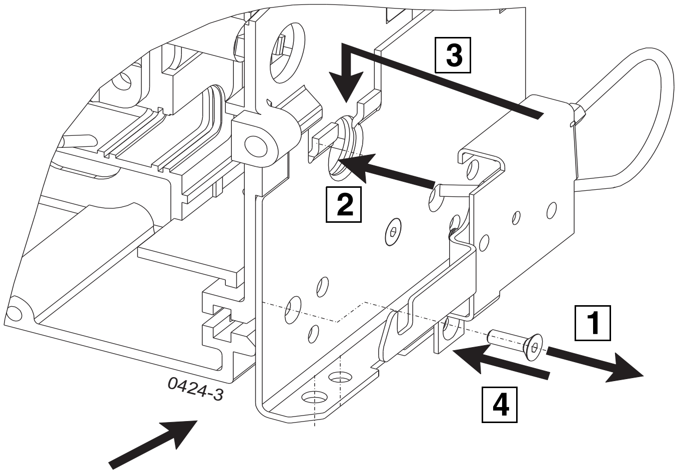
Can cause serious personal injury.

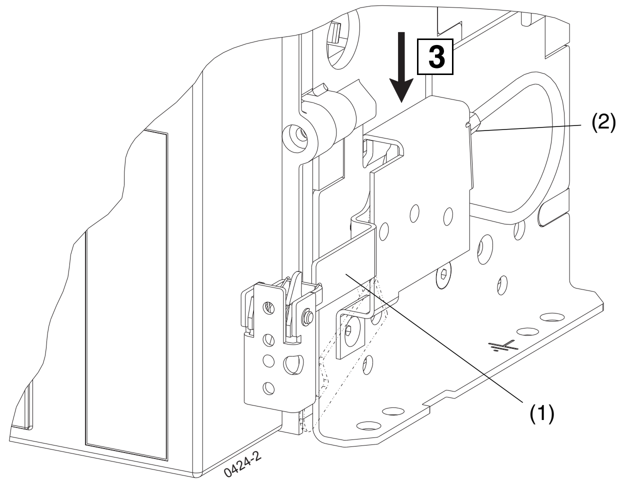
Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

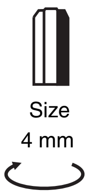
- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the maintenance position in the cradle → (page 24-3)
  remove fixed-mounted circuit breaker
- Remove front panel → (page 24-4)

17.2.1 Installing the interlock mechanism to the cradle

Fixed-mounted circuit breakers, FS I

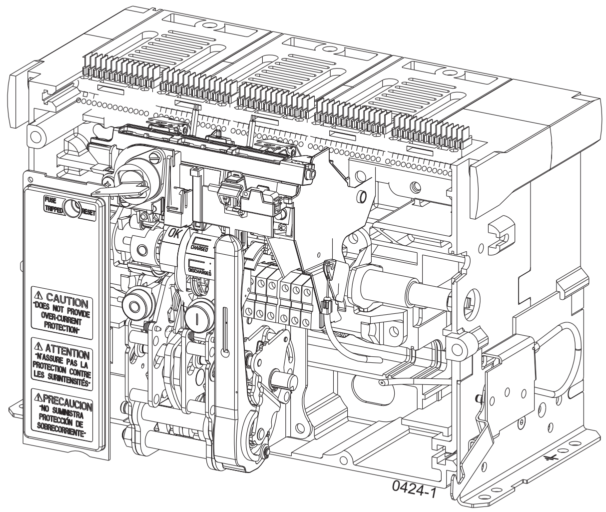






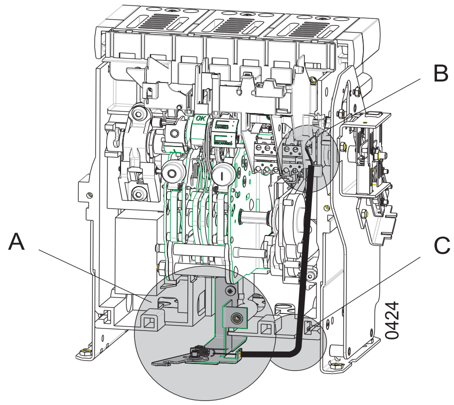
Size
4 mm

10 Nm
89 lb-in

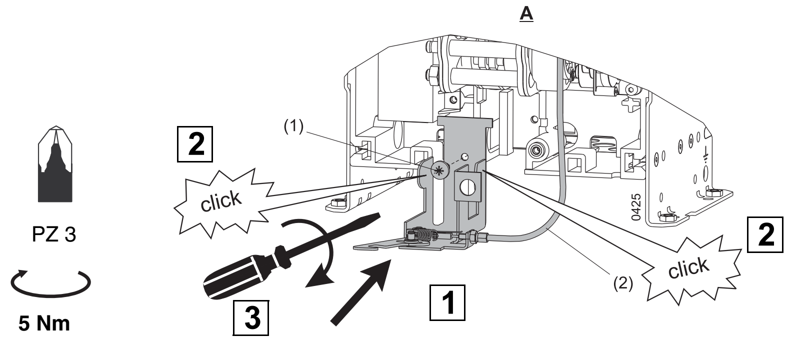


(1) Latching lever
(2) Bowden cable setscrew

Fixed-mounted circuit breakers, FS II / III

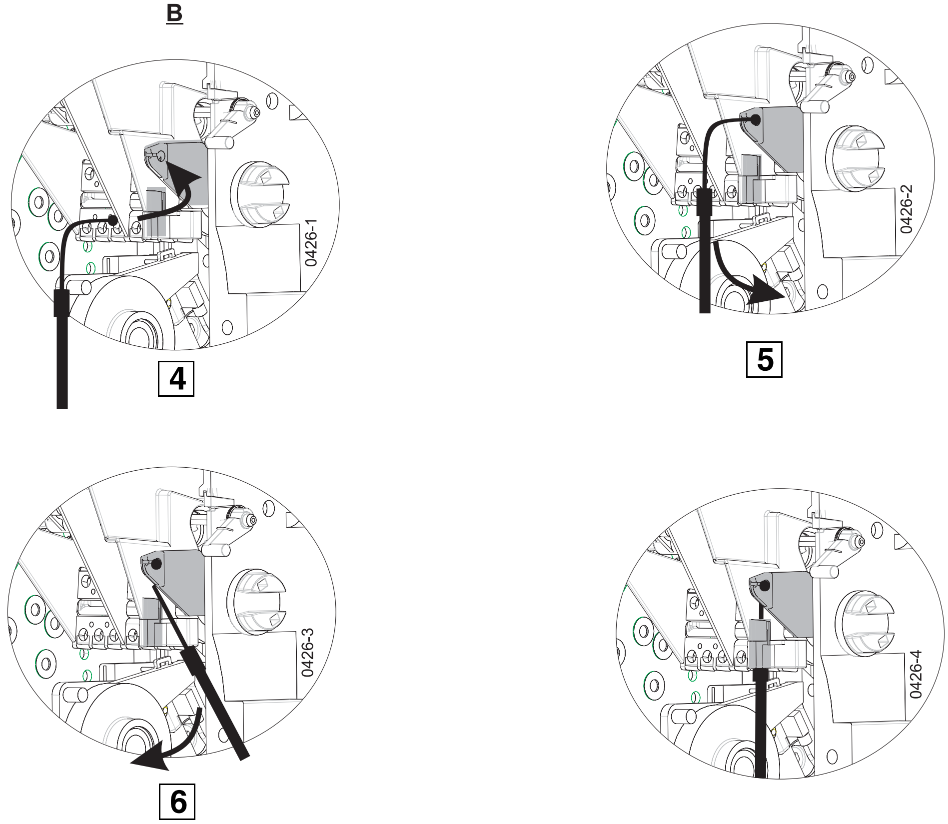


NOTICE
Tighten self-tapping screws carefully.

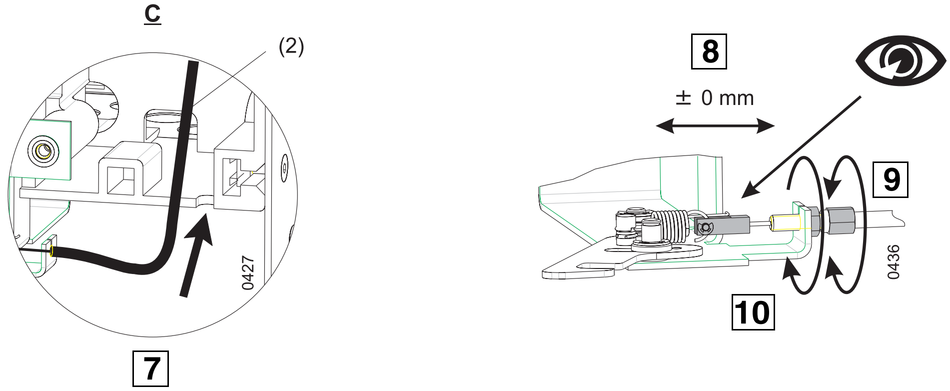


(1) Self-tapping screw
(2) Bowden cable

B



C



Adjusting the bowden cable:

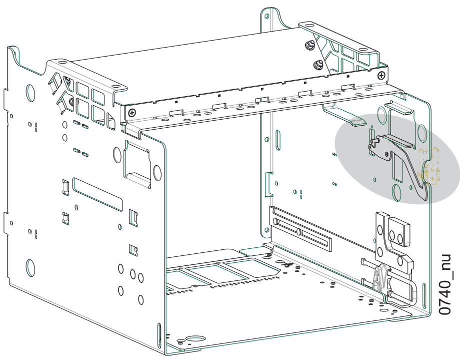
1 Switch the circuit breaker on.
2 **FS I:** Adjust the latching lever into the horizontal position (1) using the Bowden cable setscrew (2) → (page 17-4).
FS II/FS III: Adjust the latching lever into the straight position using the Bowden cable setscrew.
3 Tighten the jam nut on the Bowden cable.

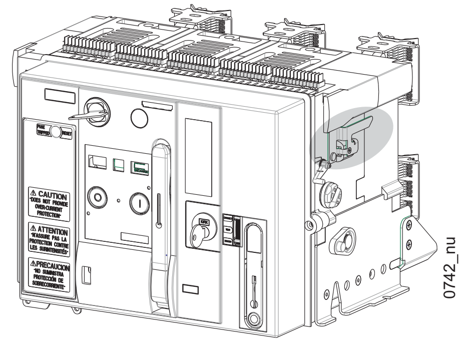
Then:

- Install front panel → (page 24-4)

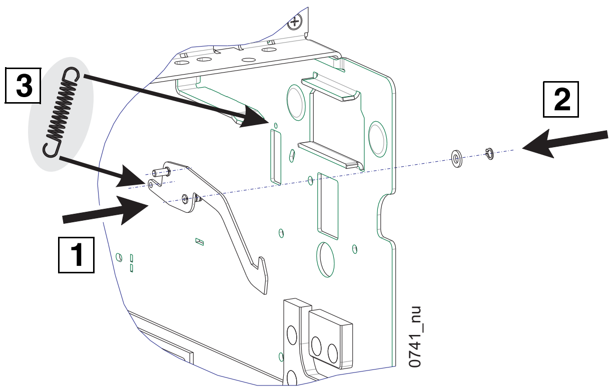
Draw-out circuit breaker

Frame size I

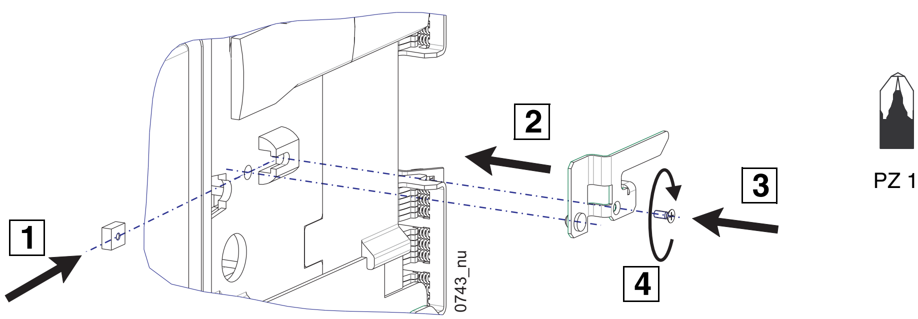




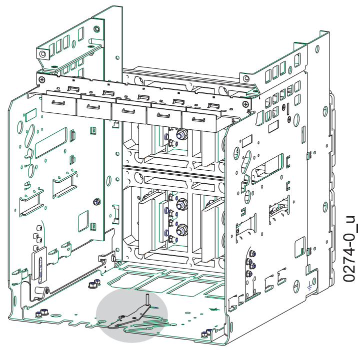
Mounting the latch at the cradle

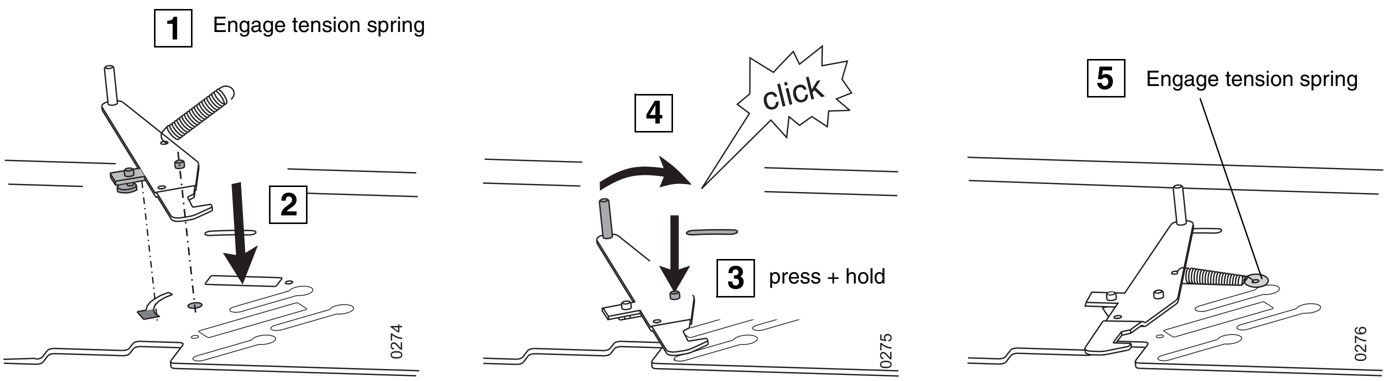


Mounting the operator on the withdrawable circuit breaker



Frame size II / III



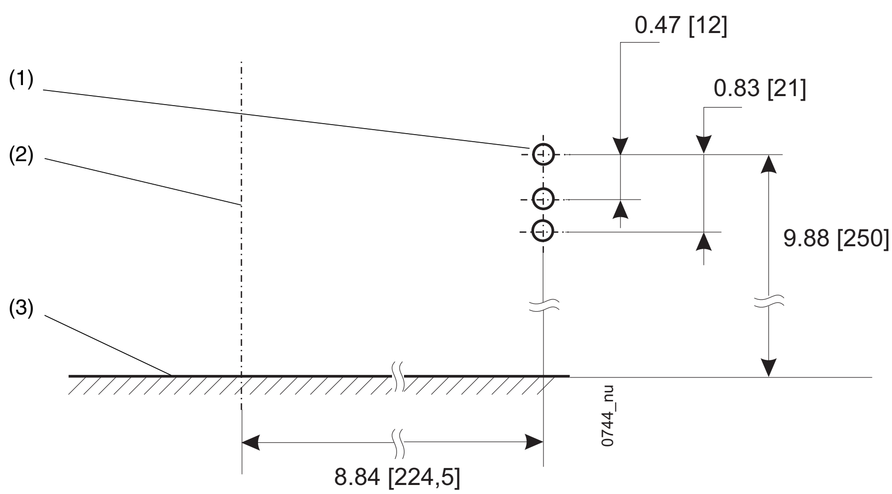


Then:

- Insert the draw-out circuit breaker into the cradle and push it into the disconnected position → (page 6-1)

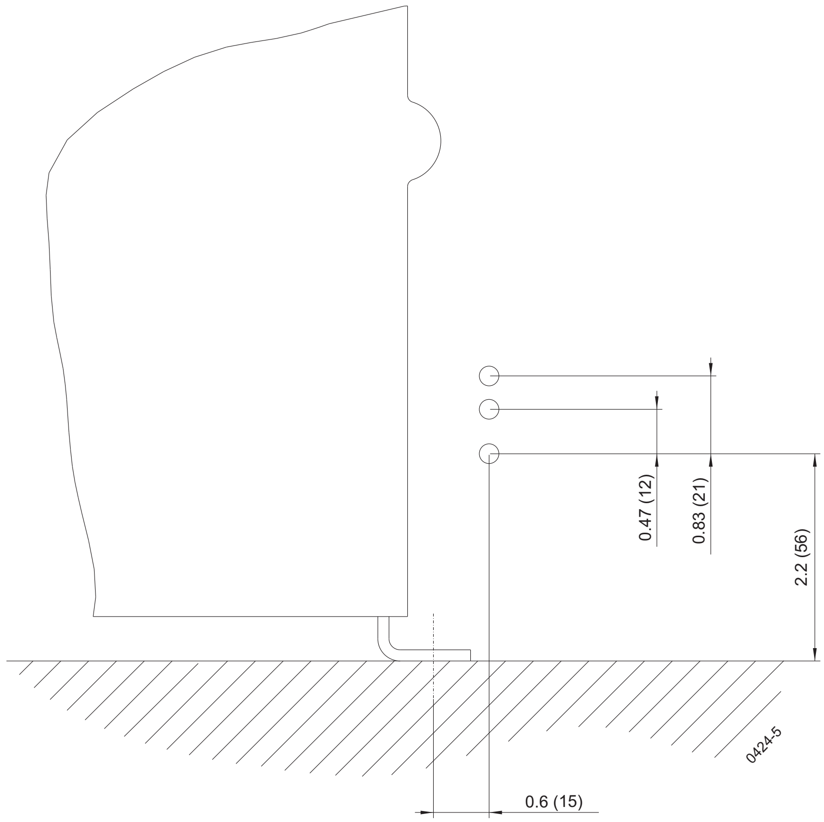
17.2.2 Cubicle door interlock drill pattern

Frame size I / Draw-out circuit breaker

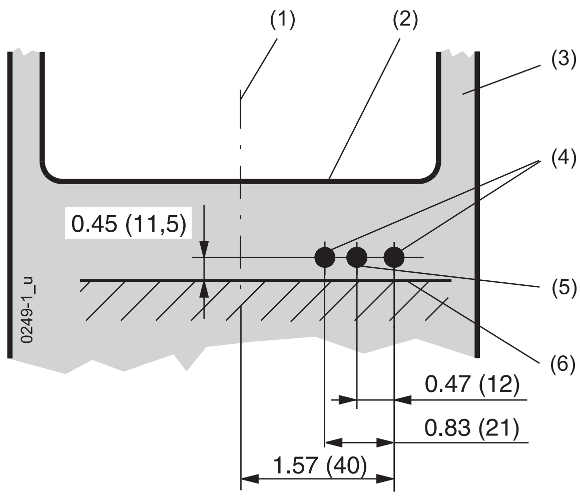


(1) 3 holes Ø $^{7}/_{32}$ inches
(2) Centerline of breaker front panel
(3) Mounting surface

Frame size I / Fixed-mounted circuit breaker

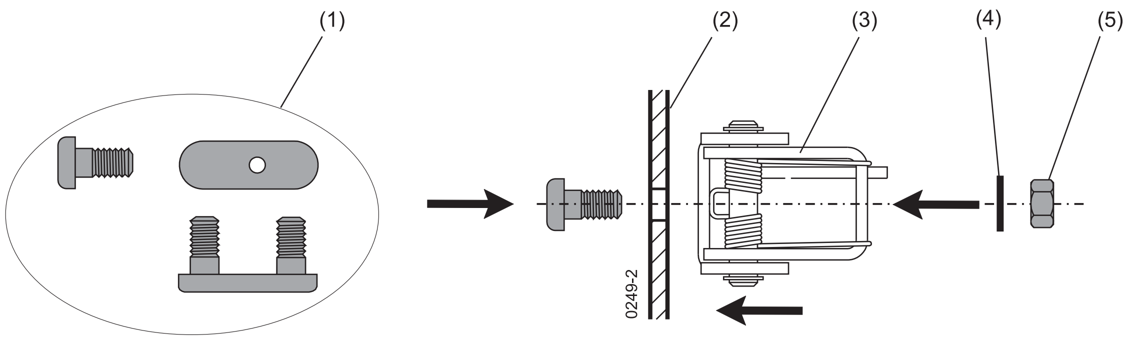


Frame size II / III



(1) Centerline of breaker front panel
(2) Door cutout for breaker front panel
(3) Inner side of cubicle door
(4) Hole for manual defeat Ø $^{7}/_{32}$ inches
(5) Hole for manual defeat Ø $^{7}/_{32}$ inches
Drill this hole only if a manual defeat is required.
(6) Mounting surface

17.2.3 Installing catch on the cubicle door



(1) Clip with hole for manual defeat
(2) Inner side of cubicle door
(3) Catch
(4) 2 washers ISO7089 - 5
(5) 2 hex nuts M5

17.2.4 Function check

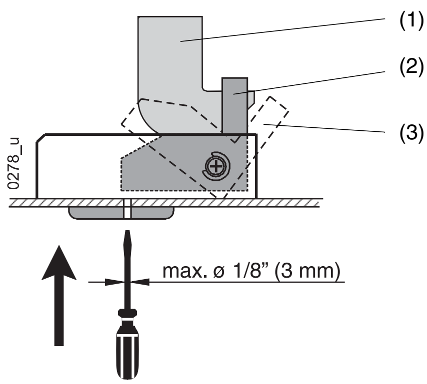
Fixed mounted circuit breaker:

- Close the cubicle door
- Charge the closing spring
- Close

Draw-out circuit breaker:

- Rack the circuit breaker into the connected position
- Close the cubicle door

Checking the manual defeat function:



(1) Lock position with circuit breaker closed
(2) Device in normal position
(3) Device in bypassed position

Then:

- Fixed-mounted circuit breaker: discharge the closing spring

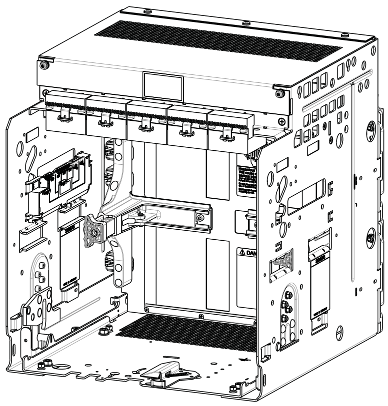
Mechanical interlock	Frame size	Order No.
Door locking mechanism for cradle	I	WLDRLC1
	II / III	WLDRLC
Door locking mechanism for fixed-mounted breaker	I	WLLKOFFDRUL1
	II / III	WLLKOFFDRUL

17.3 Interlock to prevent racking with cubicle door open

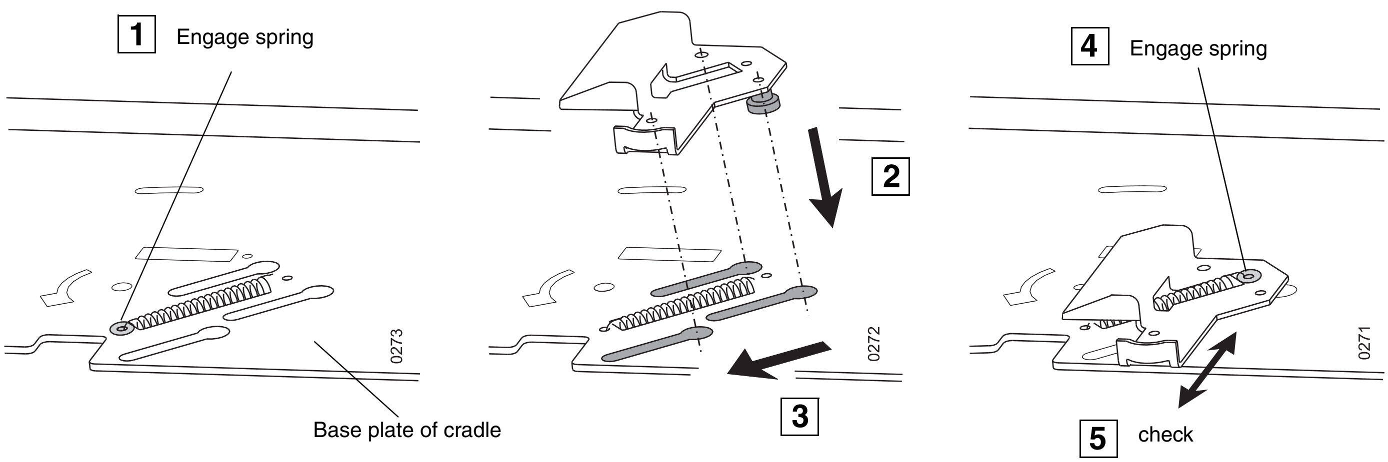
for FS II and FS III only

	DANGER
	Hazardous voltage. **Will cause death, serious personal injury, or equipment damage.** Turn off and lock out all power supplying this equipment before working on this device.

- Open and discharge the closing spring → (page 24-2)
- Remove the circuit breaker from the cradle → (page 24-3)



Installing the mechanical interlock



Function check

- Insert the circuit breaker into the cradle and push it into the disconnected position → (page 6-1)
- It must not be possible to draw out the racking handle

Mechanical interlock	Order No.
Locking device against moving the circuit breaker if the cubicle door is open	WLDRLC5UL

17.4 Coding between circuit breaker and cradle

Draw-out circuit breakers and cradles are equiped with a factory coding.

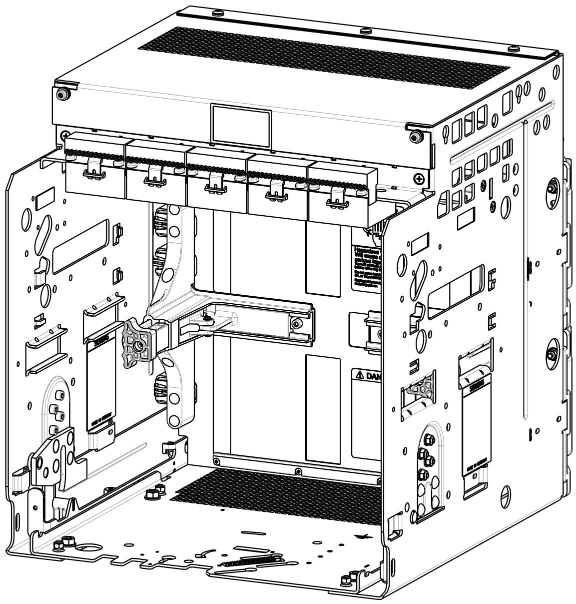
This coding ensures that only circuit breakers can be inserted whose blade contacts match the contacts of the cradle and whose instantaneous interrupting capacity and rated current correspond to those of the cradle.

18 Additional options for the cradle

18.1 Shutter

The shutter is closed when the draw-out circuit breaker is in disconnect position or outside the cradle.

The shutter can be fixed in a closed position and protected against unauthorized opening by means of padlocks. → (page 15-18)



18.1.1 Field installation

⚠ DANGER

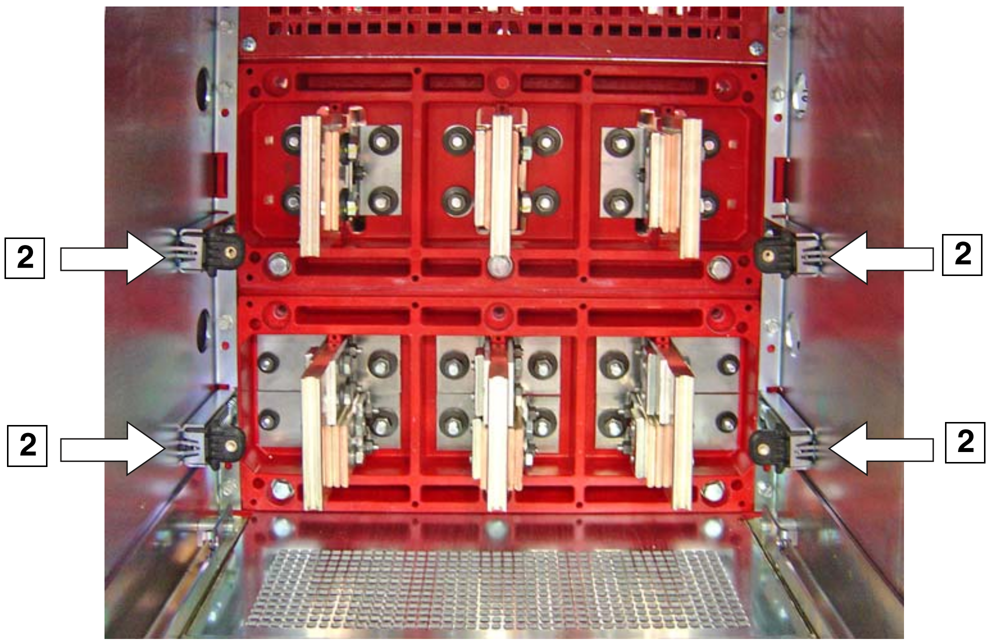
Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

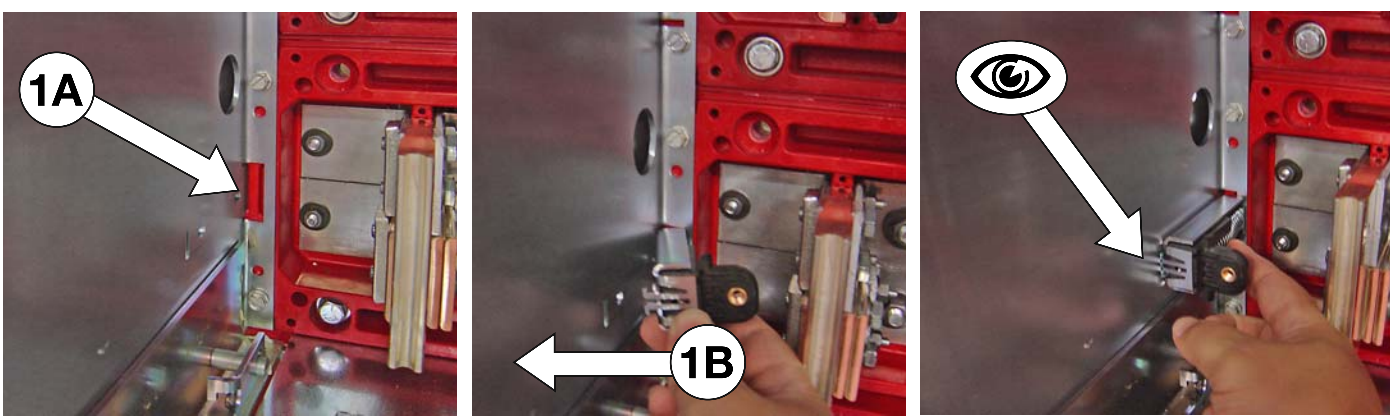
Turn off and lock out all power supplying this equipment before working on this device.

Install Shutter Mounts

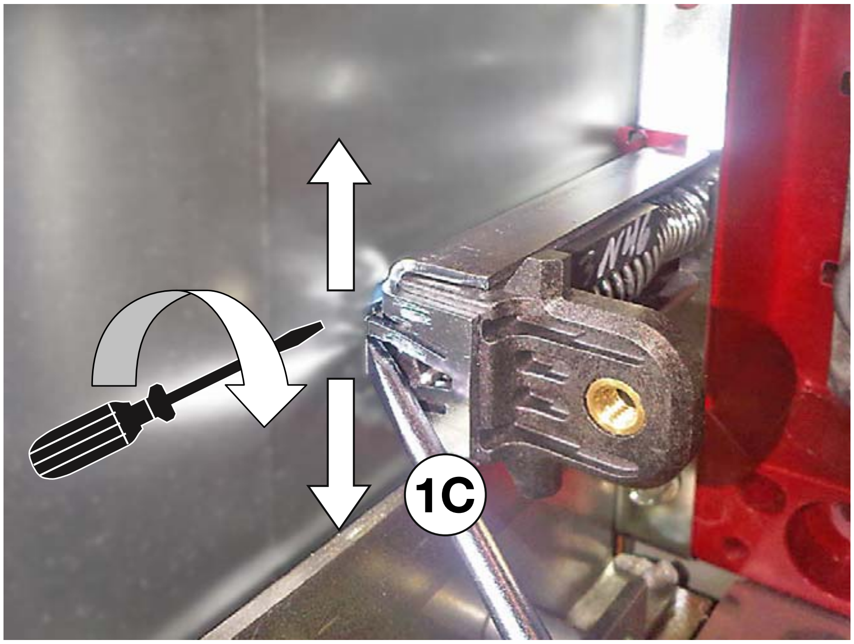
Shutter mounting assemblies are used to support the shutter assembly. There are four shutter mounts per shutter (as noted by the arrows below).

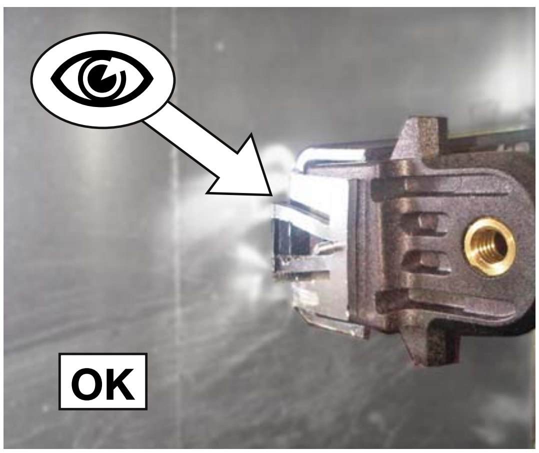


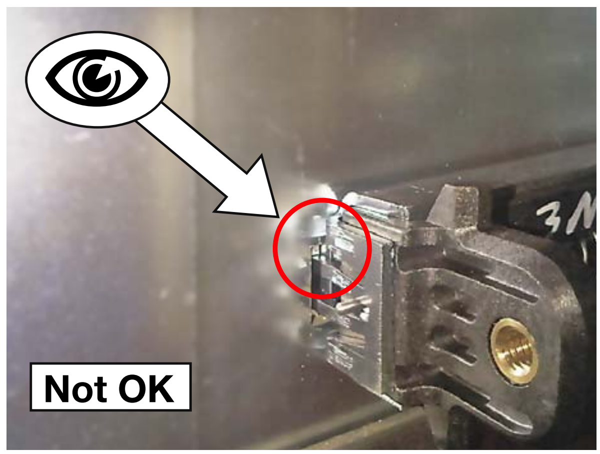
Place each shutter mounting assembly into the cradle locking holes – first by inserting the rear tines (1A) and then rotating the assembly towards the cradle sidewall (1B). Ensure that the locating dowel pins are seated. The front tines will pass through the rectangular opening in the cradle sidewall.



Use the screwdriver blade to spread the front tines by inserting the screwdriver between the tines, and rotating the blade in clockwise and counter-clockwise motions. This will lock the shutter mounts to the cradle.





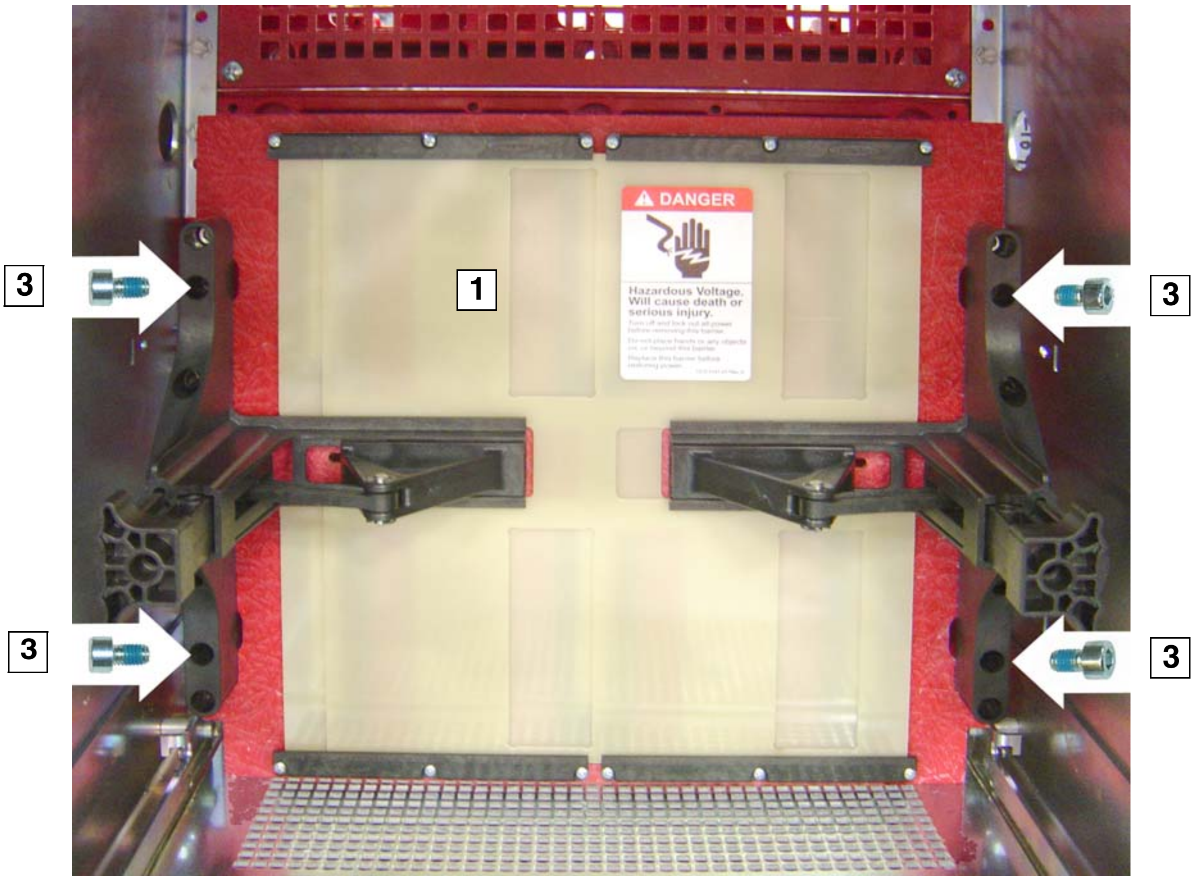


Install Shutter to Mounts

The shutter assembly (Item 1) is secured to the shutter mounting assemblies (Item 2) with four M6 x 10mm patch screws (Item 3) as shown below.

Torque each screw to 30 lb-in (four places).

Frame size 2 shown



18.1.2 Catalog numbers

Frame size	Interrupting class	Catalog No.
I	S, H, L	WLG3SHUT1L
II	S, L	WLG3SHUT2L
	C	WLG3SHUT2M
III	L	WLG3SHUT3L
	C	WLG3SHUT3M

18.2 Truck Operated Contacts - TOC (Cradle Accessory)

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

Truck-operated contacts (TOC) can be installed in the cradle. These enable the signaling of the horizontal position of the breaker in the cradle.

(1)

(1) TOC signaling switch module

Three versions are available (Order numbers → (page 18-7).

WLGSGSW111 (Version 1):

- One form C contact for DISCONNECT position (S30)
- One form C contact for TEST position (S31)
- One form C contact for CONNECT position (S34)

WLGSGSW321 (Version 2):

- One form C contact for DISCONNECT position (S30)
- Two form C contacts for TEST position (S31 and S32)
- Three form C contacts for CONNECT position (S33, S34, and S35)

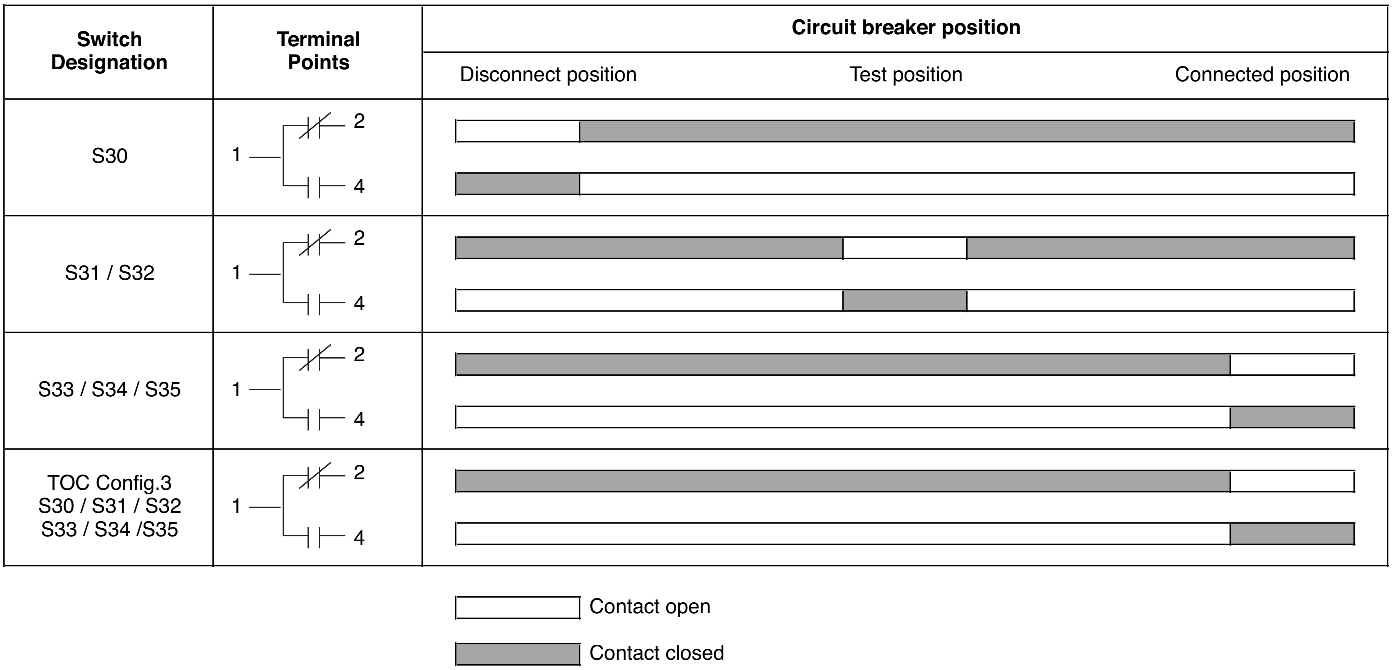
WLGSGSW6 (Version 3):

- Six form C contacts for CONNECT position (S30, S31, S32, S33, S34, and S35)

Terminals

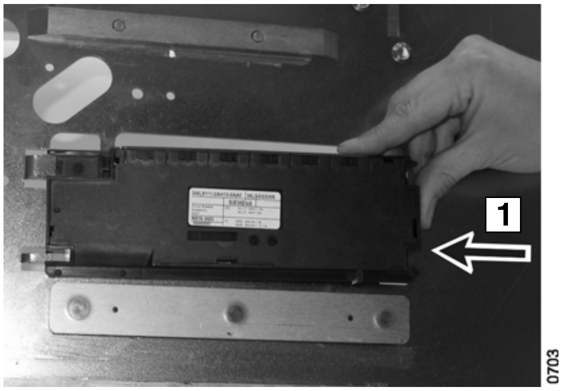
The TOC accessory is equipped with an integrated terminal block. The integrated terminal block is of spring clamp design, and will accept 1xAWG 20 – 1xAWG 14 for each point

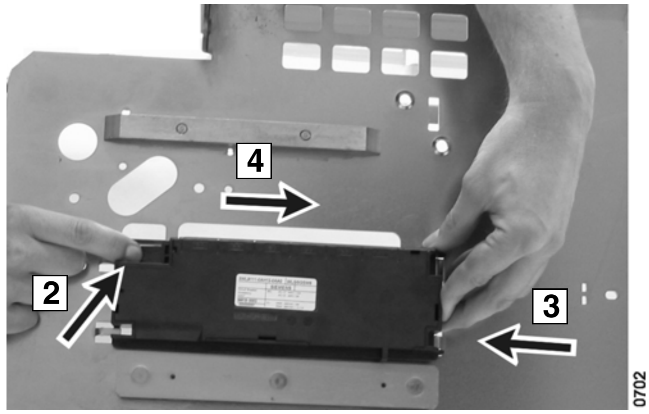
Circuit breaker postion and TOC contact state

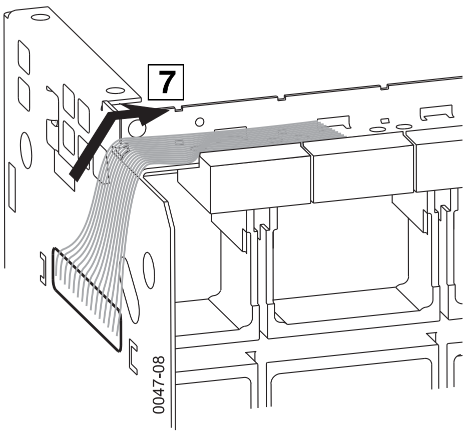


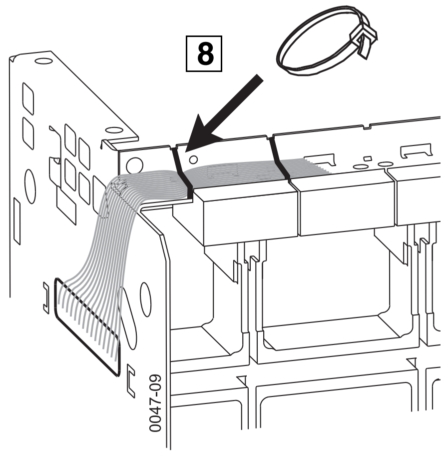
Installation

Depending on the amount of room space around the cradle in the apparatus, it may be necessary to wire the TOC prior to installation.









Then:

- Insert the circuit breaker into the cradle and rack it into the connected position → (page 6-1)

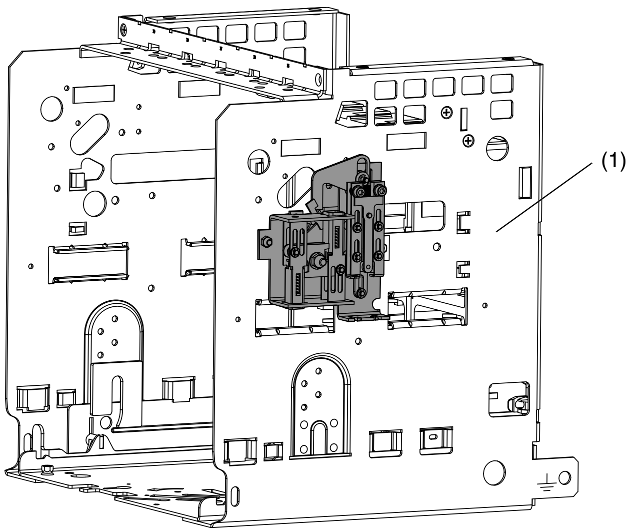
Catalog numbers

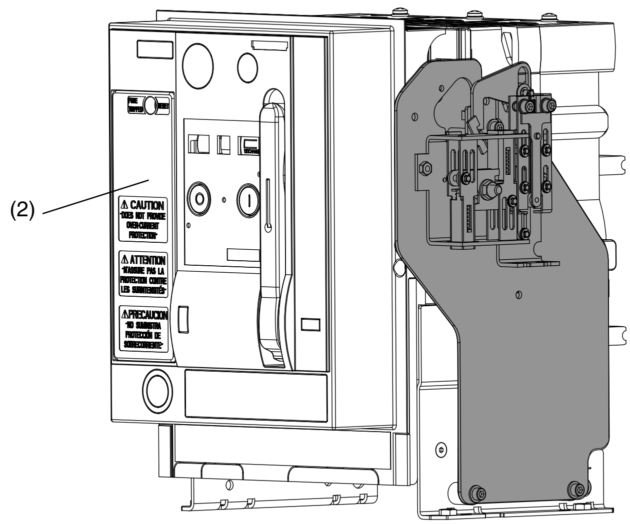
TOC Version	Catalog No.
1 CONNECT, **1** TEST, **1** DISCONNECT	WLGSGSW111
3 CONNECT, **2** TEST, **1** DISCONNECT	WLGSGSW321
6 CONNECT	WLGSGSW6

19 Mechanical circuit breaker interlocking

NOTE
For proper function of the interlocking device, the following minimum prerequisites have to be met: **1** Bowden cables are to be laid out as straight and as unbowed as possible. **2** Bending radii of the Bowden cables must exceed > 20" (500 mm). **3** The total curvature of the Bowden cable must not exceed 540 degrees. **4** When stacking interlocked circuit breakers vertically, the interlocking devices shall be vertically aligned with each other. **5** Circuit breakers intended to be interlocked must be positioned so that Bowden cables of 6 ft or 15 ft (2 m or 4.5 m) length can be laid out per the above requirements 1-4. **6** Before adjusting the interlocking device, the Bowden cables must be secured, e.g. using cable ties. **7** Adequate spacing is required to provide enough room for adjustment of the interlocking device.

Mechanical interlocking module



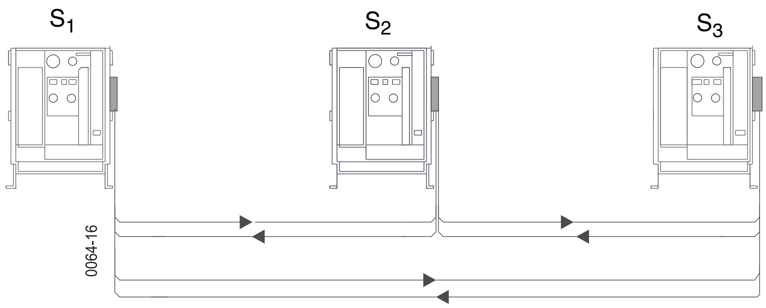


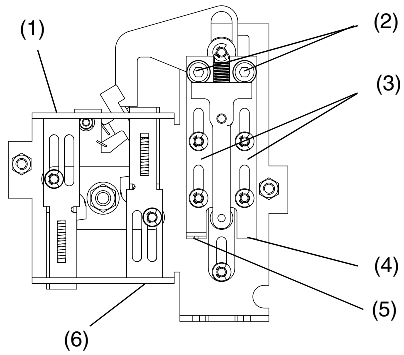
(1) Cradle
(2) Fixed-mounted breaker

19.1 Configurations

A maximum of three circuit breakers may be interlocked.

19.1.1 General notes





(1) Output 1
(2) Holes with press nut for socket head cap screw M6 with washer for the configuration of the mechanical circuit breaker interlocking
(3) Non-interchangeable brackets
(4) Input 1
(5) Input 2
(6) Output 2

In the following configuration instructions, the following designations apply:

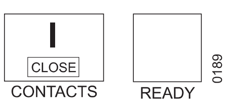
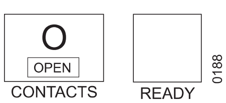
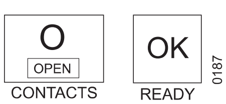
A_1 : Output signal 1

E_1 : Input signal 1

S_1 : Circuit breaker 1

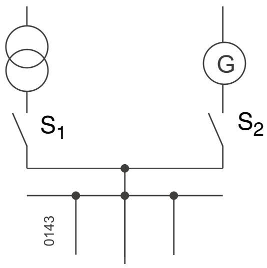
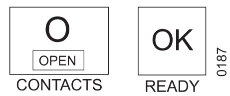
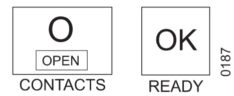
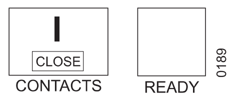
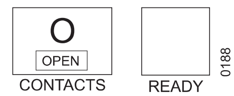
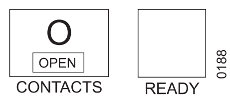
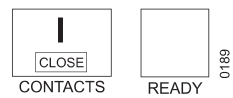
For example, in order to couple the output signal 1 of circuit breaker 1 with the input signal 2 of circuit breaker 2, the abbreviation $S_1\,A_1$ - $S_2\,E_2$ is used.

The states of the circuit breaker are shown at the front panel:

	Circuit breaker closed
	Circuit breaker open and not ready to close (interlocked)
	Circuit breaker open and ready to close (not interlocked)

19.1.2 Mechanical interlocking two sources (open transition)

The two sources are interlocked to prevent paralleling (open transition).

Example	Possible circuit breaker states	
	S_1	**S_2**
		
		
		

Description:

A circuit breaker can be closed only if the other is open.

Materials required:

Each circuit breaker has an interlocking module and a Bowden cable.

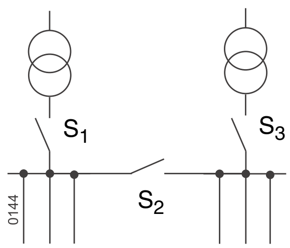
Order no. → (page 19-3)

Connections of Bowden cables:

1st Bowden cable:	$S_1 A_1$	-	$S_2 E_1$
2nd Bowden cable:	$S_2 A_1$	-	$S_1 E_1$

19.1.3 Mechanical interlocking two sources with a tie circuit breaker (open transition)

The two sources are interlocked to prevent paralleling (open transition).

Example	Possible circuit breaker states		
	S 1	**S 2**	**S 3**
	O OPEN CONTACTS OK READY 0187	O OPEN CONTACTS OK READY 0187	O OPEN CONTACTS OK READY 0187
	I CLOSE CONTACTS READY 0189	O OPEN CONTACTS OK READY 0187	O OPEN CONTACTS OK READY 0187
	O OPEN CONTACTS OK READY 0187	I CLOSE CONTACTS READY 0189	O OPEN CONTACTS OK READY 0187
	O OPEN CONTACTS OK READY 0187	O OPEN CONTACTS OK READY 0187	I CLOSE CONTACTS READY 0189
	I CLOSE CONTACTS READY 0189	I CLOSE CONTACTS READY 0189	O OPEN CONTACTS READY 0188
	O OPEN CONTACTS READY 0188	I CLOSE CONTACTS READY 0189	I CLOSE CONTACTS READY 0189
	I CLOSE CONTACTS READY 0189	O OPEN CONTACTS READY 0188	I CLOSE CONTACTS READY 0189

Description:

Any two circuit breakers can be closed, with the third being interlocked.

Materials required:

Each circuit breaker has an interlocking module and a Bowden cables. Three additional Bowden cables must be ordered separately.

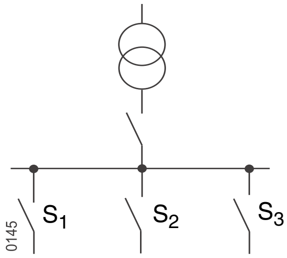
Order no. → (page 19-4)

Connections of Bowden cables:

1st Bowden cable:	S_1 A_1	-	S_2 E_1
2nd Bowden cable:	S_1 A_2	-	S_3 E_1
3rd Bowden cable:	S_2 A_1	-	S_1 E_1
4th Bowden cable:	S_2 A_2	-	S_3 E_2
5th Bowden cable:	S_3 A_1	-	S_1 E_2
6th Bowden cable:	S_3 A_2	-	S_2 E_2

19.1.4 Mechanical interlocking feeder circuit breakers (single load, open transition)

The feeder breakers are interlocked so that only one feeder may be closed at a time.

Example	Possible circuit breaker states		
	S_1	S_2	S_3
 	O OPEN CONTACTS — OK READY 0187	O OPEN CONTACTS — OK READY 0187	O OPEN CONTACTS — OK READY 0187
	I CLOSE CONTACTS — READY 0189	O OPEN CONTACTS — READY 0188	O OPEN CONTACTS — READY 0188
	O OPEN CONTACTS — READY 0188	I CLOSE CONTACTS — READY 0189	O OPEN CONTACTS — READY 0188
	O OPEN CONTACTS — READY 0188	O OPEN CONTACTS — READY 0188	I CLOSE CONTACTS — READY 0189

Description:

When one circuit breaker is closed, the other two cannot be closed.

Materials required:

Each circuit breaker has an interlocking module and a Bowden cable. Three additional Bowden cables must be ordered separately.

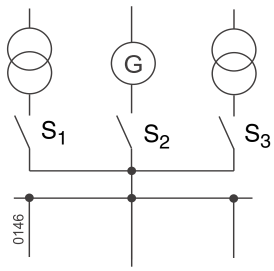
Order no. → (page 19-5)

Connections of Bowden cables:

1st Bowden cable:	S_1 A_1	-	S_2 E_1
2nd Bowden cable:	S_1 A_2	-	S_3 E_1
3rd Bowden cable:	S_2 A_1	-	S_1 E_1
4th Bowden cable:	S_2 A_2	-	S_3 E_2
5th Bowden cable:	S_3 A_1	-	S_1 E_2
6th Bowden cable:	S_3 A_2	-	S_2 E_2

19.1.5 Mechanical interlocking three sources (open transition to standby system)

The standby system is mechanically interlocked with the two source circuit breakers to prevent paralleling the standby system with either or both primary source(s).

Example	Possible circuit breaker states		
	S_1	**S_2**	**S_3**
	O OPEN CONTACTS OK READY 0187	O OPEN CONTACTS OK READY 0187	O OPEN CONTACTS OK READY 0187
	I CLOSE CONTACTS READY 0189	O OPEN CONTACTS READY 0188	O OPEN CONTACTS OK READY 0187
	O OPEN CONTACTS OK READY 0187	O OPEN CONTACTS READY 0188	I CLOSE CONTACTS READY 0189
	I CLOSE CONTACTS READY 0189	O OPEN CONTACTS READY 0188	I CLOSE CONTACTS READY 0189
	O OPEN CONTACTS READY 0188	I CLOSE CONTACTS READY 0189	O OPEN CONTACTS READY 0188

Description:

Two circuit breakers (S_1, S_3) can be independently opened and closed, the third (S_2) being “Ready-to-close” only if the other two are open. If the third is closed, the other two cannot be closed.

Materials required:

Each circuit breaker has an interlocking module and a Bowden cable. A Bowden cable must be ordered separately.

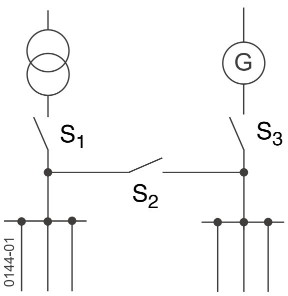
Order no. → (page 19-6)

Connections of Bowden cables:

1st Bowden cable:	S_1 A_1	-	S_2 E_1
2nd Bowden cable:	S_2 A_1	-	S_1 E_1
3rd Bowden cable:	S_2 A_2	-	S_3 E_1
4th Bowden cable:	S_3 A_1	-	S_2 E_2

19.1.6 Mechanical interlocking source and tie circuit breaker (open transition to standby system)

The standby system is mechanically interlocked with the tie circuit breaker to prevent paralleling with primary source.



Example	Possible circuit breaker states		
	S 1	**S 2**	**S 3**
	O OPEN CONTACTS; OK READY; 0187	O OPEN CONTACTS; OK READY; 0187	O OPEN CONTACTS; OK READY; 0187
	O OPEN CONTACTS; OK READY; 0187	I CLOSE CONTACTS; READY; 0189	O OPEN CONTACTS; READY; 0188
	O OPEN CONTACTS; OK READY; 0187	O OPEN CONTACTS; READY; 0188	I CLOSE CONTACTS; READY; 0189
	I CLOSE CONTACTS; READY; 0189	O OPEN CONTACTS; OK READY; 0187	O OPEN CONTACTS; OK READY; 0187
	I CLOSE CONTACTS; READY; 0189	I CLOSE CONTACTS; READY; 0189	O OPEN CONTACTS; READY; 0188
	I CLOSE CONTACTS; READY; 0189	O OPEN CONTACTS; READY; 0188	I CLOSE CONTACTS; READY; 0189

Description:

One circuit breaker (S_1) can be opened and closed independently of the two others. The two others cancel each other out, i.e. one can only be closed if the other is open.

Materials required:

Two of the three circuit breakers (S_2, S_3) each have an interlocking module and a Bowden cable.

Order no. → (page 19-7)

Connections of Bowden cables:

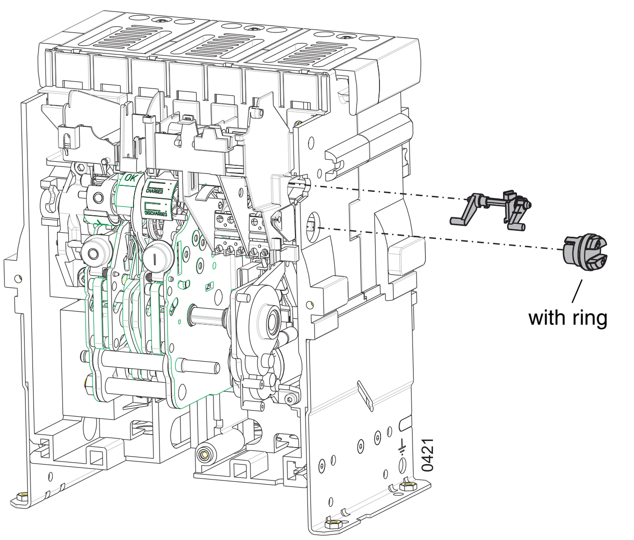
1st Bowden cable:	S_2 A_1	-	S_3 E_1
2nd Bowden cable:	S_3 A_1	-	S_2 E_1

19.2 Installing interlocking module

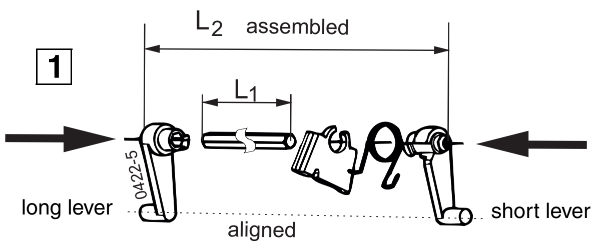
WARNING
High speed moving parts.
Can cause serious personal injury.
Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

- Switch off and discharge the closing spring
  → (page 24-2)
- Remove the breaker from the cradle
  → (page 24-3)
  or remove the fixed-mounted breaker if necessary → (page 5-2)
- Remove front panel and side cover on the right, if required
  → (page 24-4)

19.2.1 Installing intermediate shaft and coupling

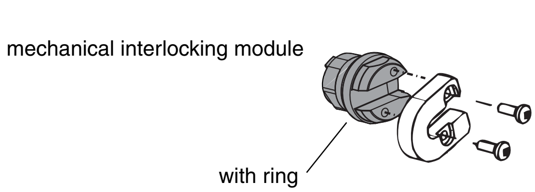


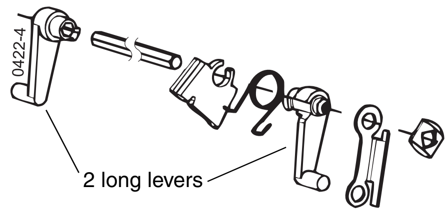
For frame size I & II, and frame size III fixed mount

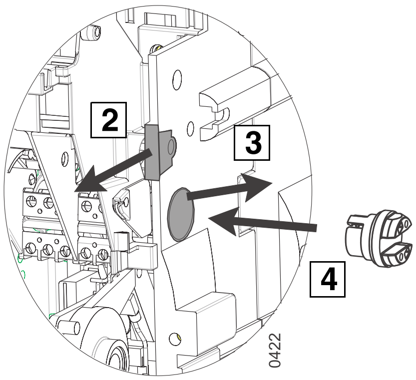


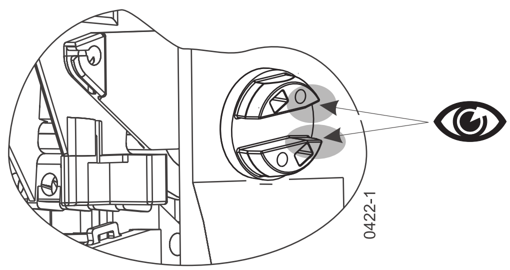
Frame size	Hexagon shaft length L_1 (mm)	Length of assembly L_2 (mm)
I	48	59
II	118	129
III (fixed mount only)	232	243

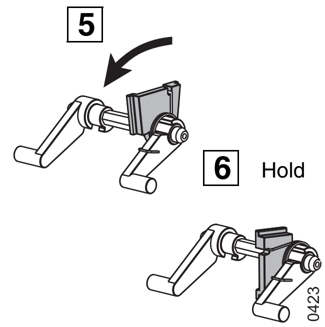
For frame size III, draw out version:

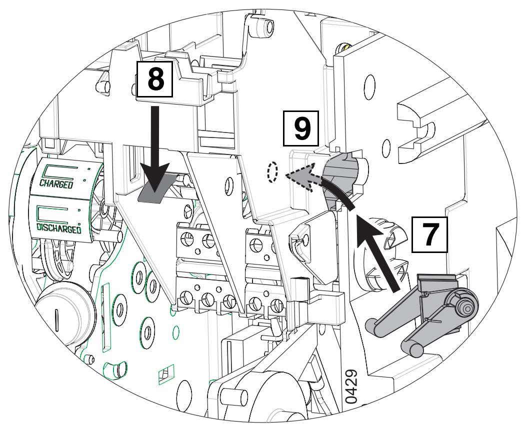




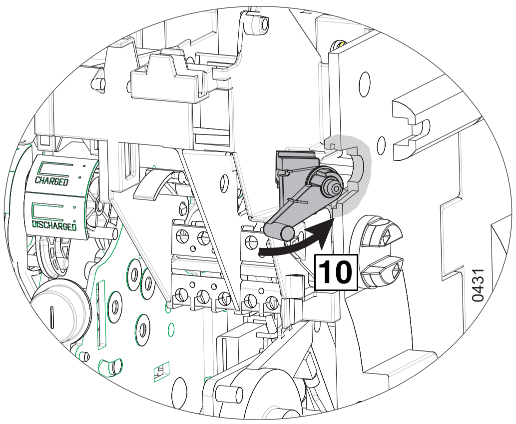


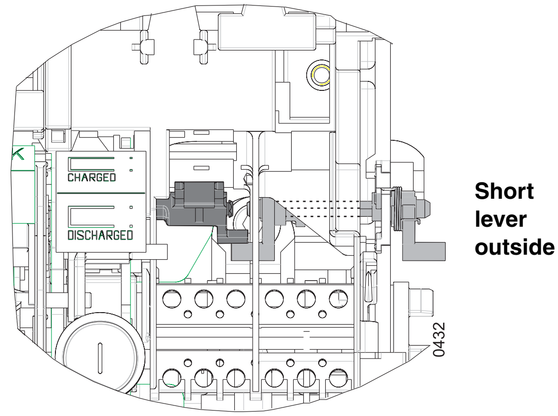




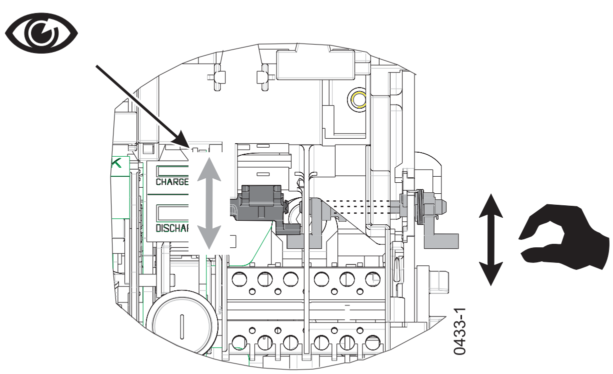


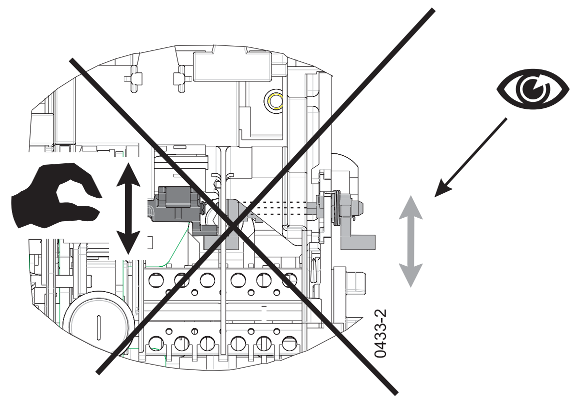
NOTE
Working through step **9**, the intermediate shaft must engage in a hole inside the circuit breaker. Only then it will be possible - working through step **10** - to fit the support for the intermediate shaft in the guide of the side wall.





Function check





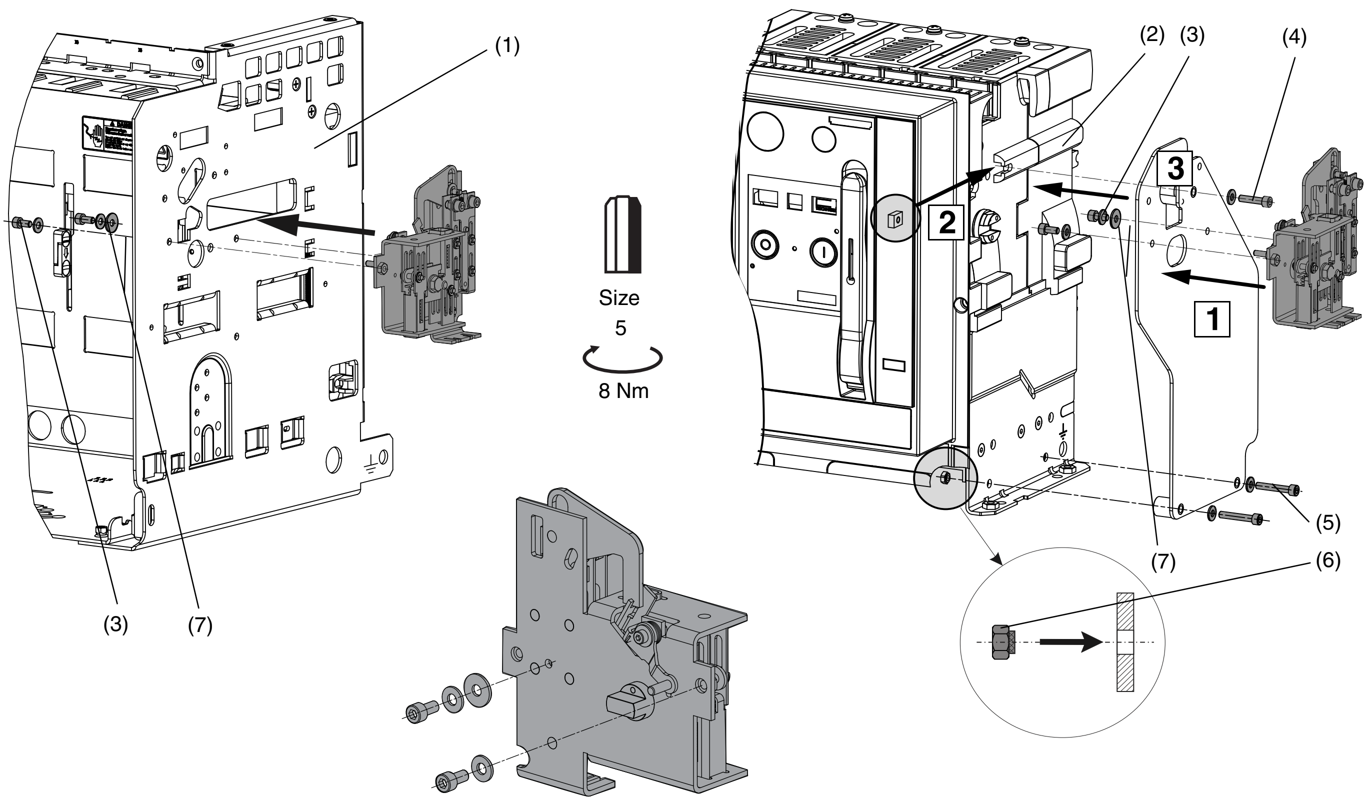
Then:

- Replace front panel and side cover on the right, if it was removed → (page 24-4)

19.2.2 Fitting interlocking module

Note
If there isn't enough free space for installation on the right side of the circuit breaker inside the cubicle, it may be advantageous to pre-assemble the Bowden cables on the output side before fitting the interlocking module. → (page 19-12)

Mechanical interlocking module



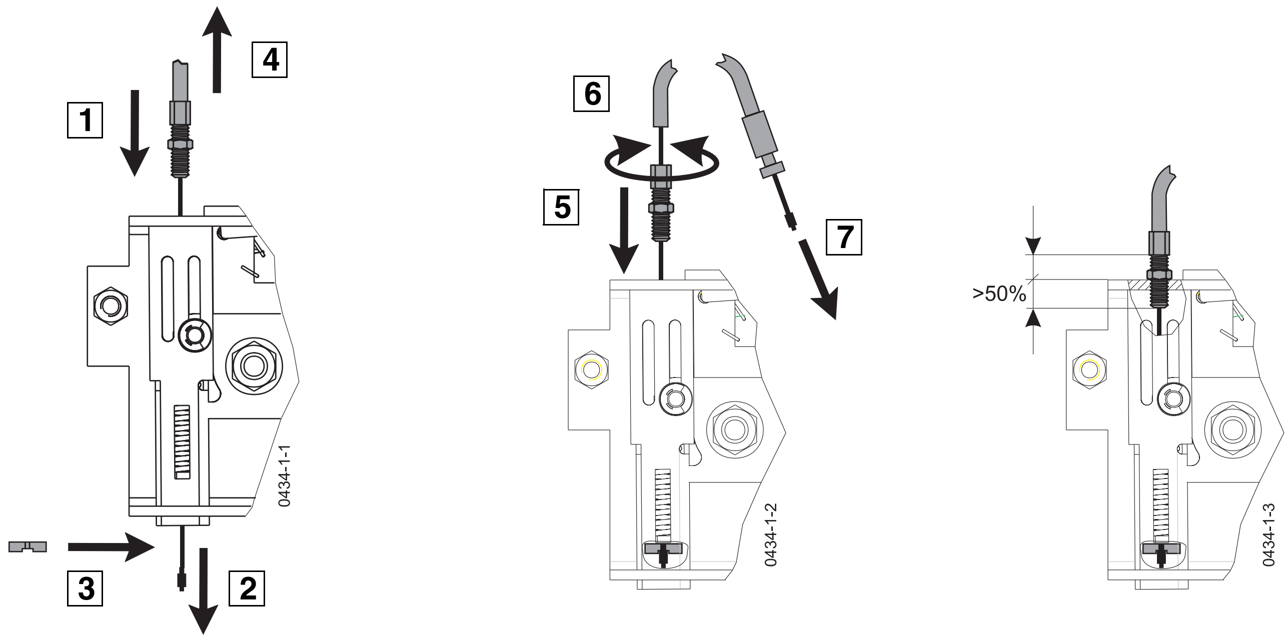
(1) Cradle
(2) Fixed-mounted breaker
(3) 2x socket head cap screw M6x12 with strain washer
(4) 1x socket head cap screw M6x25 with strain washer and square nut
(5) 2x socket head cap screw M6x35 with strain washer
(6) 2x jam nut; penetrates into mounting foot by tightening; if necessary, prevent jam nut from rotating
(7) 1x washer with large outside diameter

Then:

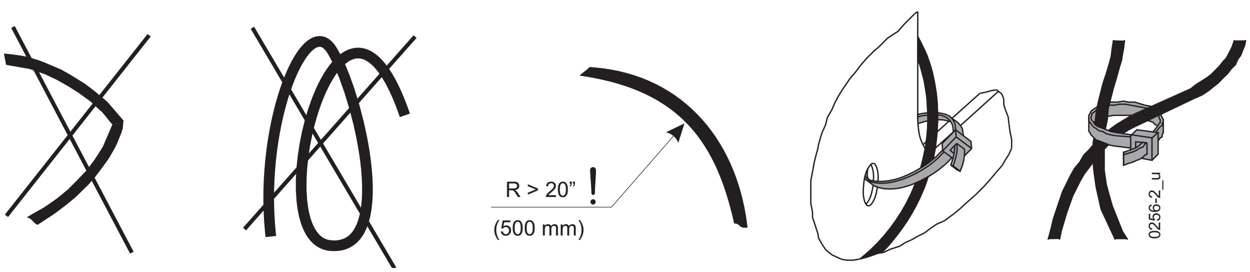
- Install back the breaker → (page 5-2)

19.2.3 Mounting the Bowden cables

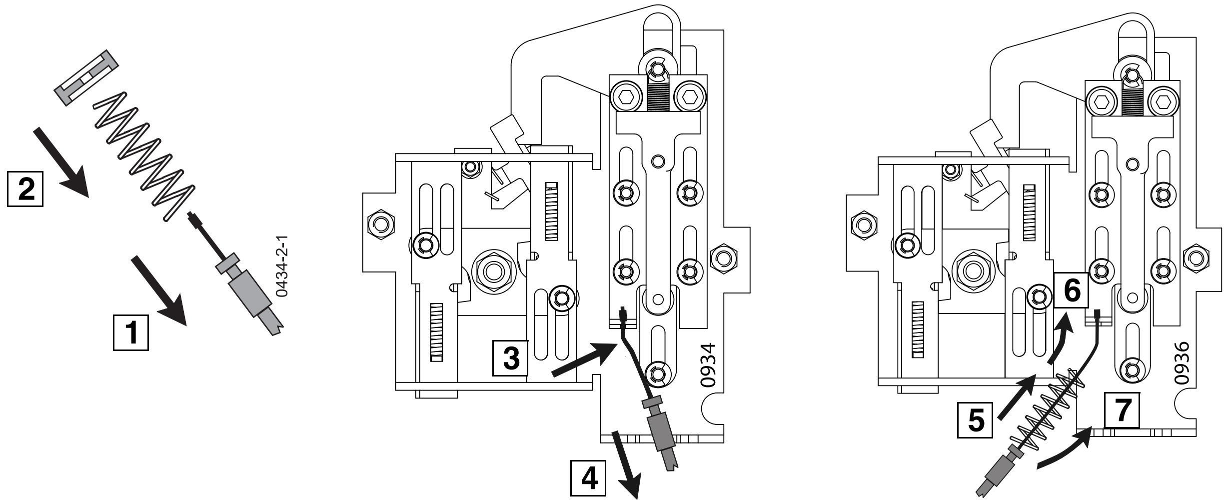
Fitting Bowden cable on output site

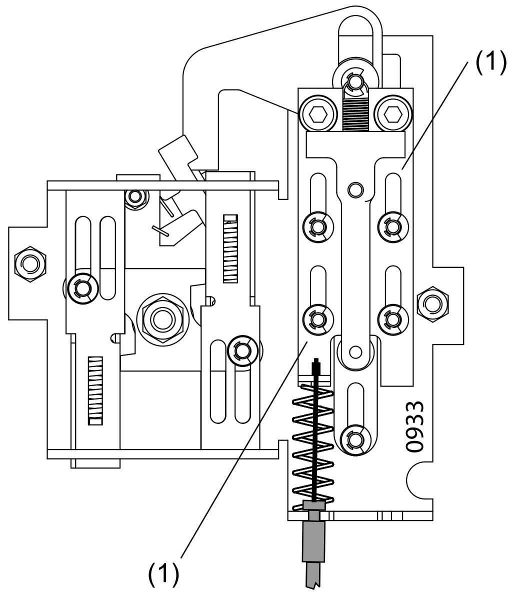


Securing the Bowden cable



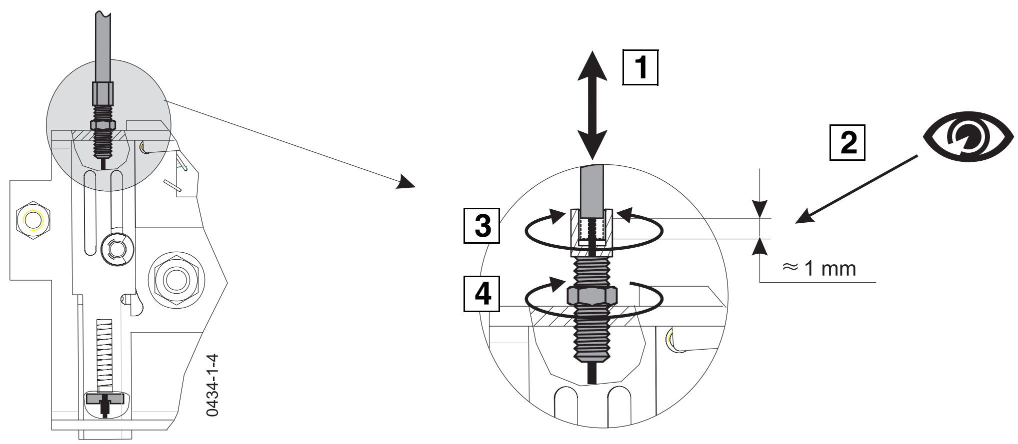
Installing the Bowden cable at the input of the circuit breaker to be interlocked





(1) Steel index clip

Adjusting the Bowden cable



Then:

- According to the planned configuration of the circuit breaker interlocking, screw socket head cap screws with toothed lock washers, respectively plastite-screws with lock washers into the associated index clips if applicable →Configurations (page 19-1)
- Insert the draw-out circuit breaker into the cradle, push into disconnected position, close the cubicle door if required and rack it into connected position → (page 6-1)

19.2.4 Function check

- Close the cubicle doors
- Charge closing spring of circuit breakers to be interlocked → (page 6-4)
- Test the various possibilities of the planned interlocking configuration one after the other
- Re-adjust Bowden cables if necessary

Then:

- Discharge the closing spring of the circuit breakers to be interlocked → (page 24-2)

Note

The following maintenance points must be followed:

1. The adjustment of the Bowden cables needs to be checked after the first 100 breaker operations and must be readjusted if necessary.
2. The adjustment of the interlocking device needs to be checked and, if necessary, readjusted every 1000 operations or at least once every year.
3. During the inspection, the Bowden cables have to be checked against kinks and abrasions, split wires of the exposed steel cable, damage to the cable housing and the adjustment unit (tube setting with thread and nut) and have to be readjusted if necessary. In addition, the movability of movable parts of the interlocking device in their bearings needs to be examined.
4. In extreme environmental conditions (e.g. increased environmental temperature or exposure to chemicals) maintenance checks needs to be performed more frequently.
5. When maintaining the circuit breaker, check the operation of the interlock device and replace as necessary. See table (page -14).

Catalog Numbers

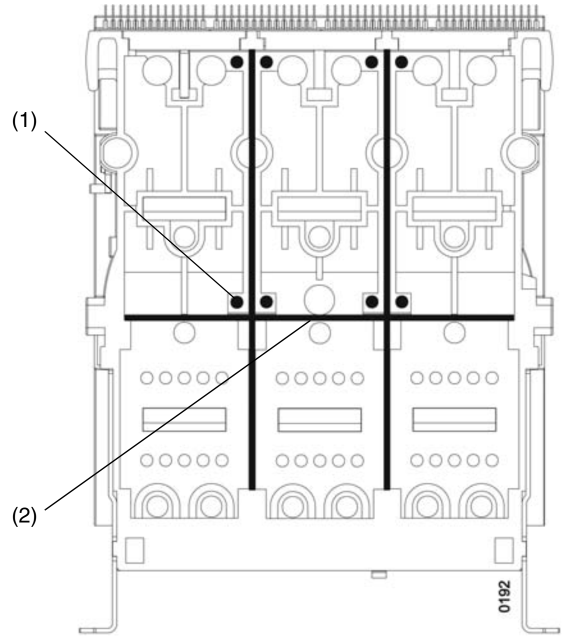
Mechanical Interlocking	Catlog number
Mechanical interlock assembly for drawout circuit breakers (FS I, II, and III)	WLNTLK
Mechanical interlock assembly for fixed-mounted circuit breakers (FS I)	WLNTLKF1
Mechanical interlock assembly for fixed-mounted circuit breakers (FS II and III)	WLNTLKF
Qty.(1) Bowden Cable - 2m	WLNTLWIRE2
Qty.(1) Bowden Cable - 4.5m	WLNTLWIRE4

20 Phase barriers

The rear sides of the fixed-mounted circuit breakers and drawout circuit-breaker cradles feature guide slots and mounting holes for the purpose of incorporating phase barriers. The guide slots are not included on FS II class C breakers.

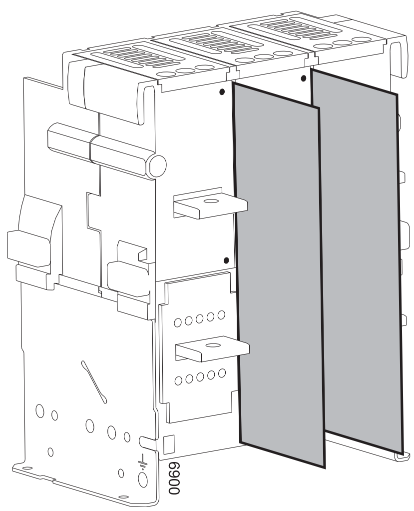
Usable material, e.g.:

NEMA GPO-3, min. thickness 2.3 mm (3/32"), max. thickness 4 mm (5/32") or comparable material

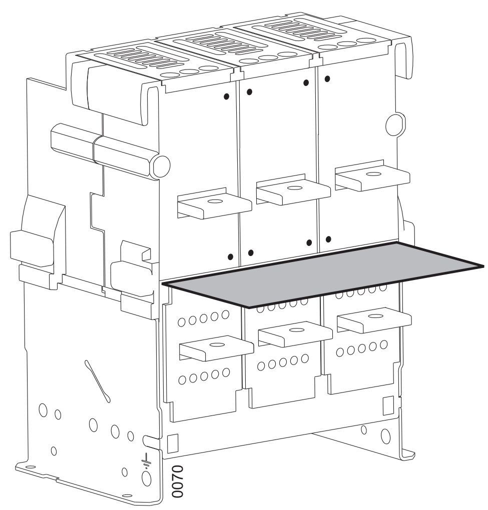


(1) 8 mounting holes for self-tapping screw ∅ 4.2 mm, screw-in depth max. 16 mm
(2) Guide slot 4 mm wide

Vertical



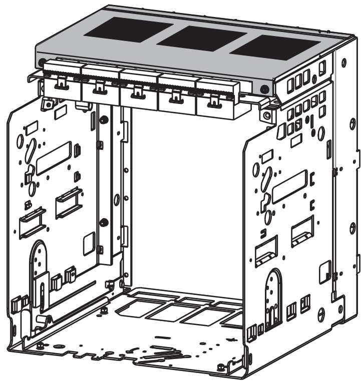
Horizontal



21 Arc chute covers

The arc chute cover is available as an optional accessory for cradles.

The cover is provided to protect the breaker from larger foreign objects (e.g. tools).



0695_nu

21.1 Field installation

DANGER

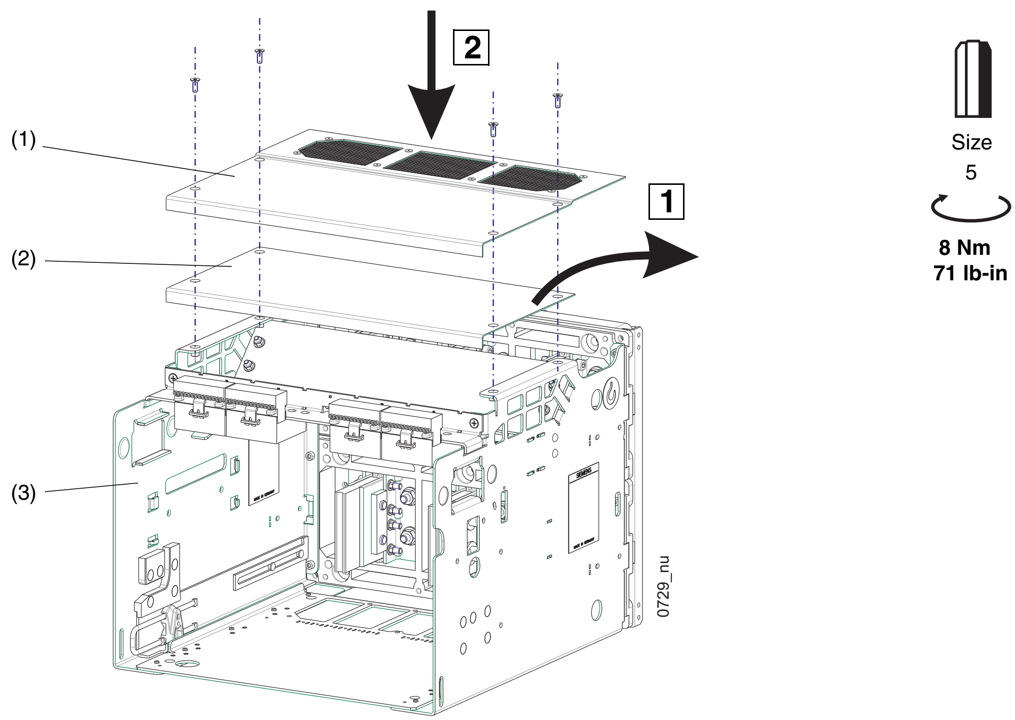
Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Remove the circuit breaker from the cradle → (page 24-3)

Frame size I

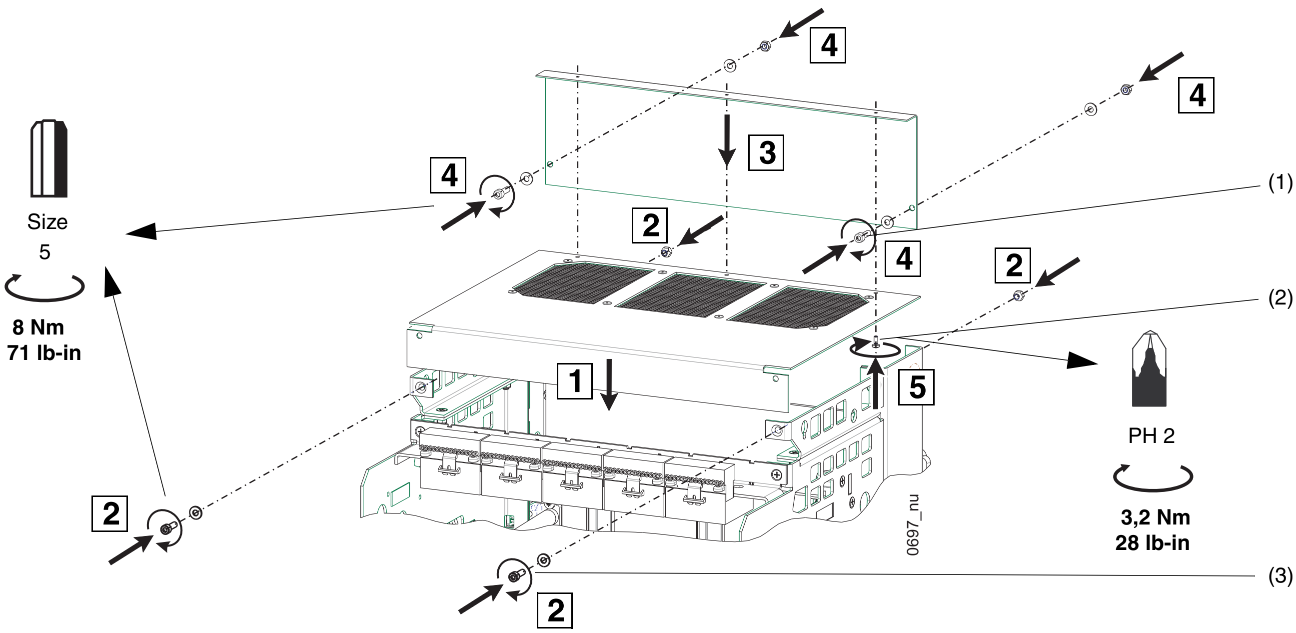


(1) Optional arc chute cover
(2) Standard arc chute cover
(3) Cradle FS I

The optional arc chute cover must replace the shorter, standard cover.

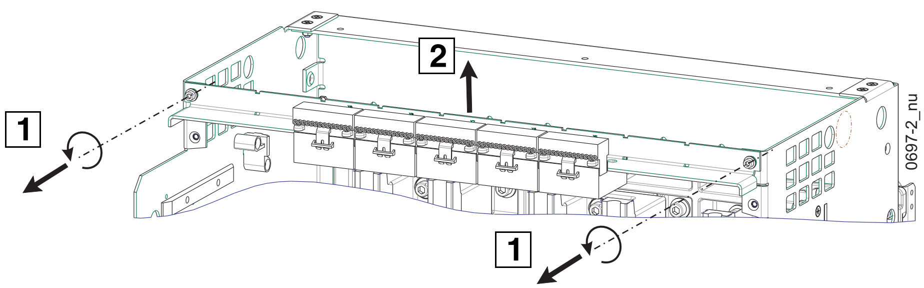
NOTE
Mounting of rear wall attached current transformers on the line side is possible with the standard arc chute cover only.

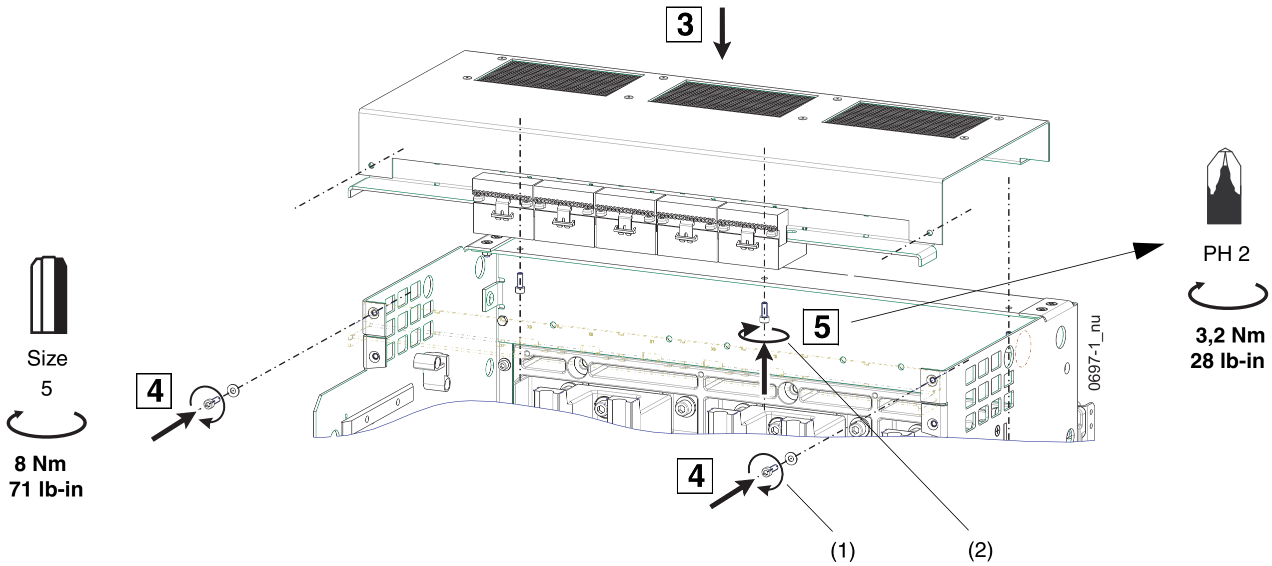
Frame size II



(1) Socket head cap screw M6x20
(2) Self-tapping screw M4 x10
(3) Socket head cap screw M6x20

Frame size III





(1) Socket head cap screw M6x20

Self-tapping screw M4 x10

21.2 Catalog numbers

	Frame size	Catalog No.
Arc chute cover for cradle	I	WLGARC1UL
	II *)	WLGARC2UL

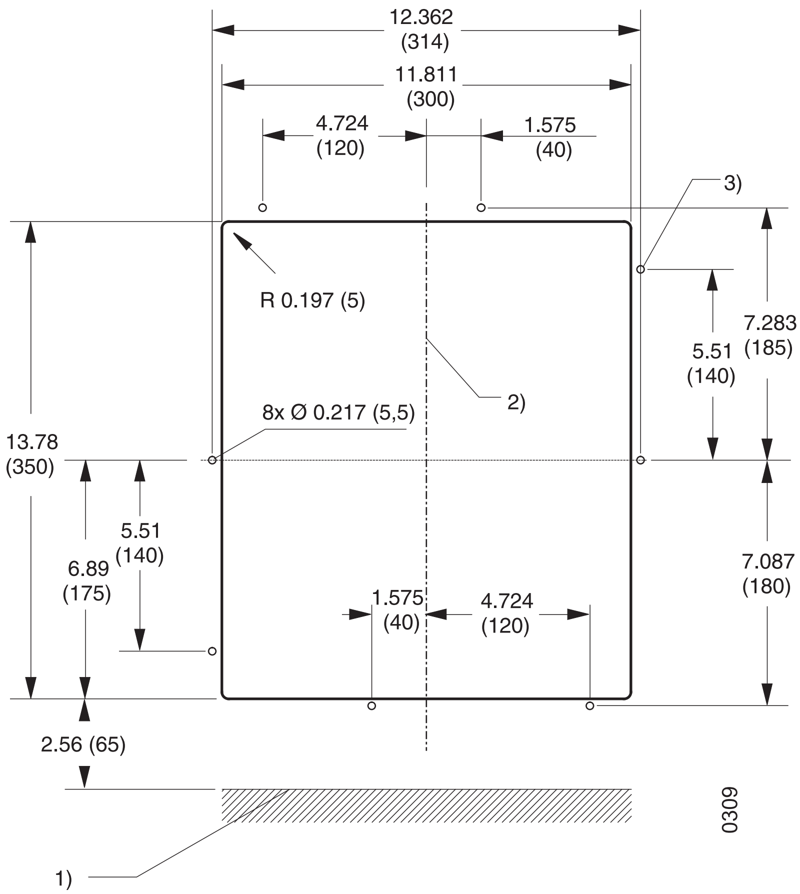
*) Not suitable for class C.

22 Door sealing frame

For frame size II and III only.

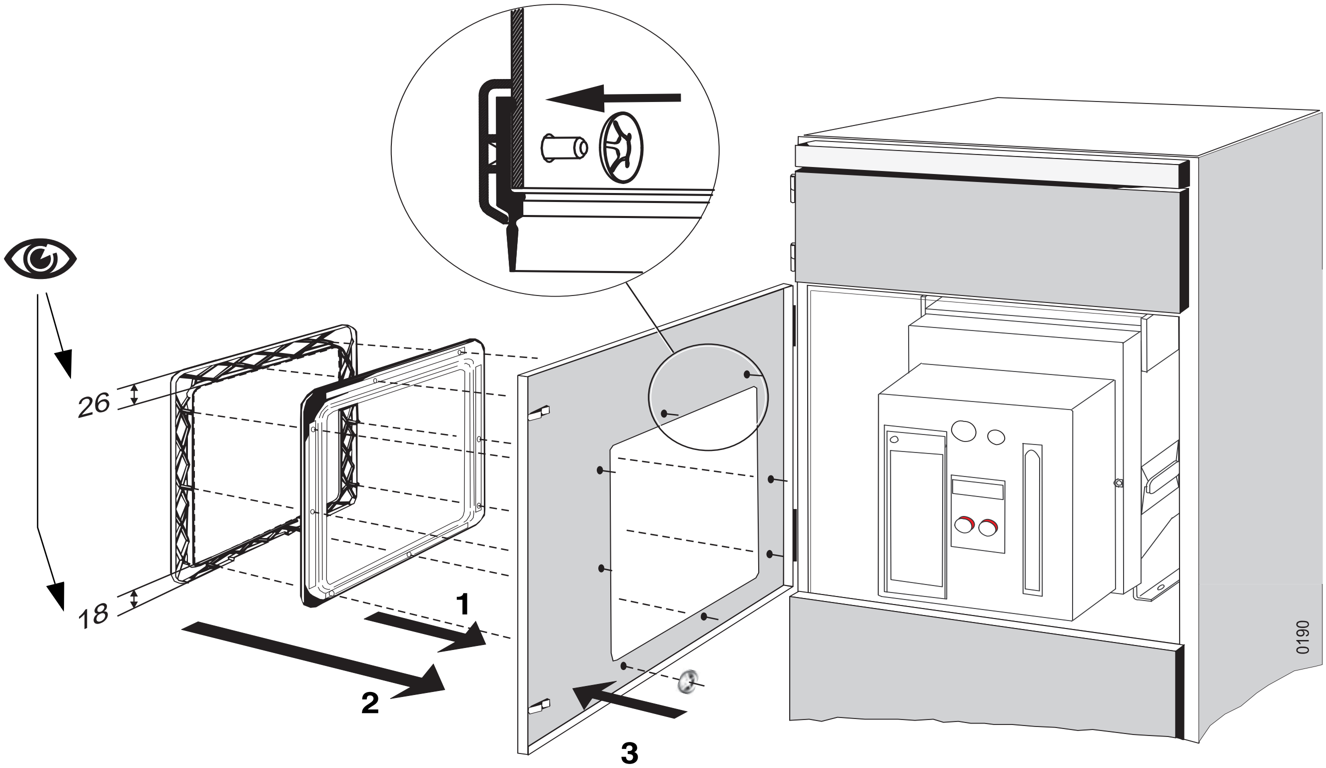
Dimension drawing of door cutout

Front view of the cubicle door



(1) Mounting surface of the circuit breaker or cradle
(2) Center of breaker front panel
(3) Eight mounting holes for the door sealing frame

Installing the door sealing frame



	Catalog No.
Door sealing frame	WLDSF

Not for use with fuse carriages.

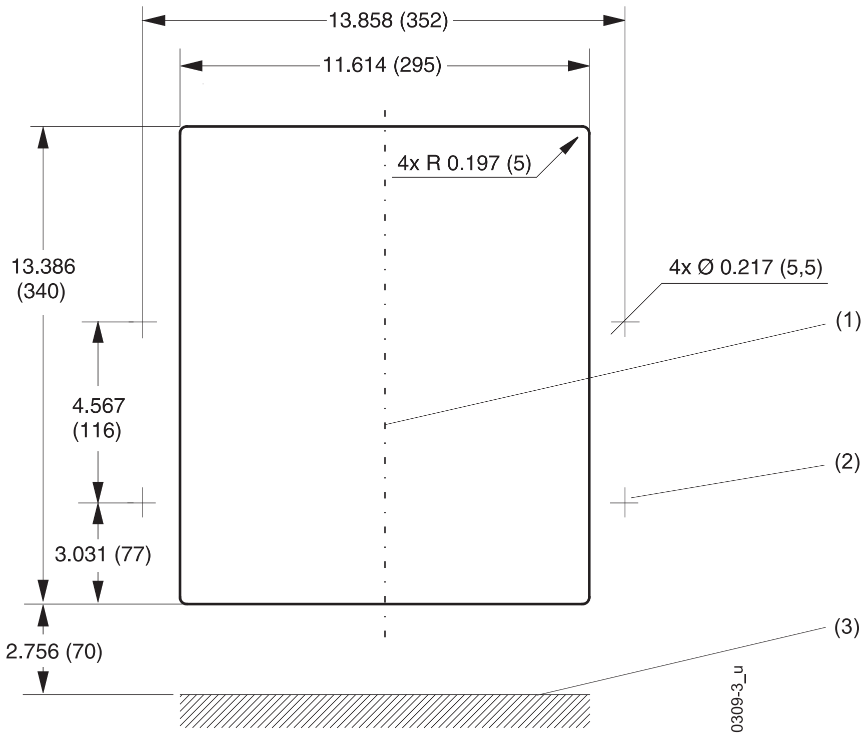
23 Plexiglas breaker cover

NOTE

Following a short circuit interruption, check that the Plexiglas breaker cover is firmly in place and the seal is maintained.

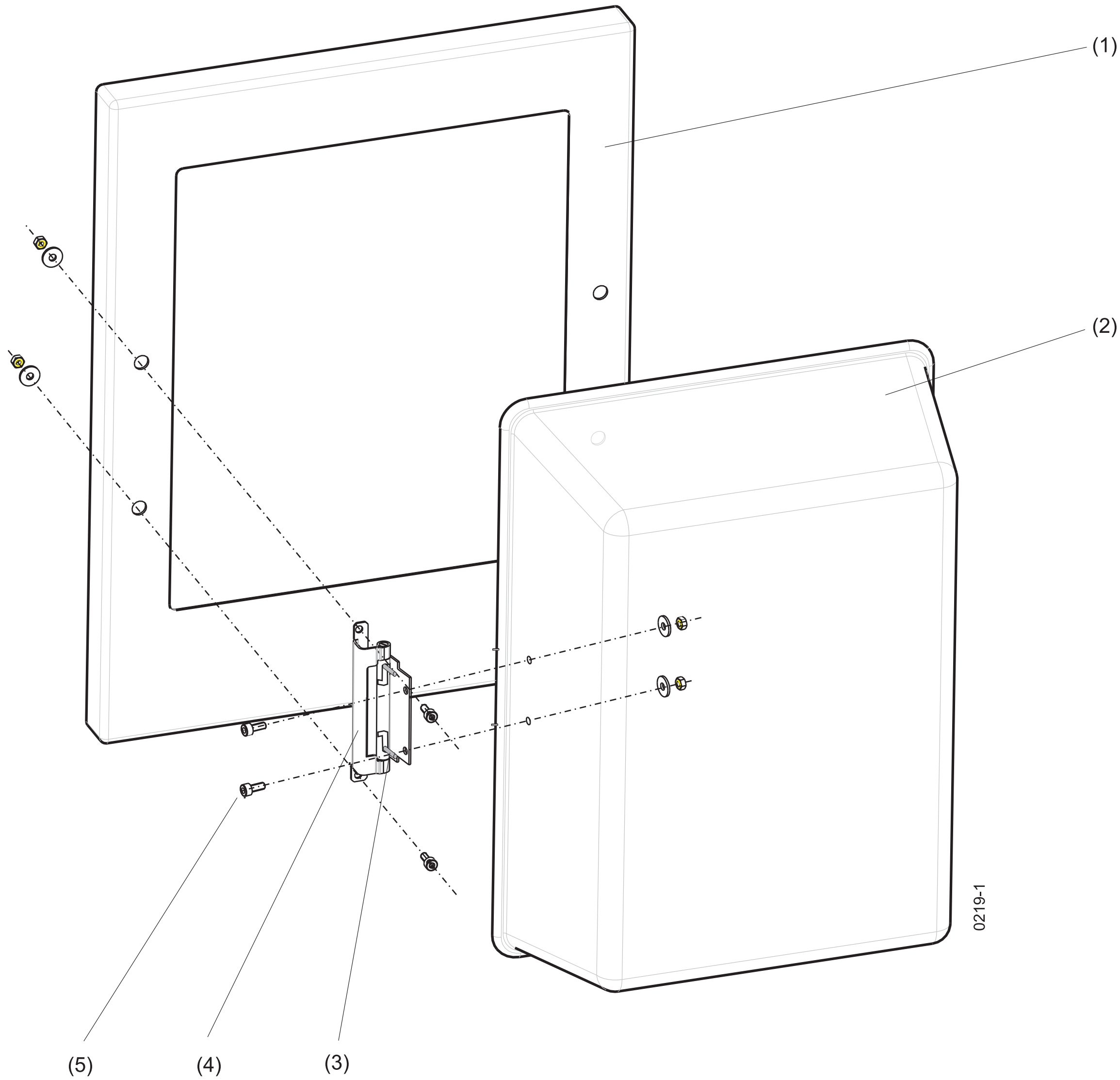
For frame size II / III only.

Dimension drawing for door cutout and mounting holes



(1) Center of breaker front panel
(2) 4 mounting holes for hinges
(3) Mounting surface of circuit breaker or cradle

Attaching the Plexiglas cover



(1) Cubicle door with door cutout
(2) Plexiglas cover
(3) Hinge pin
(4) 2 hinges with opening function (right and left)
(5) 8 x Socket head cap screws M5 with washer and lock nuts

Installation of the right side hinge in the same fashion.

Handling:

To open the Plexiglas cover, push the hinge pins on the left or right hinge together or, to remove the Plexiglas cover, unlock both hinges.

Catalog number

	Catalog No.
Plexiglas cover	WLPGC

24 Maintenance

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment/property damage.

Turn off and lock out all power supplying this equipment before working on this device.

Only qualified personnel should work on this equipment, after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained herein and on the devices.

The successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

WARNING

High speed moving parts.

Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

Qualified Personnel

For the purpose of this instruction manual and these product labels, a "qualified person" is one who is familiar with the installation, construction and operation of the equipment and the hazards involved and who, in addition, has the following qualifications:

d) Is trained and authorized to energize, de-energize, clear, ground and label circuits and equipment in accordance with established safety practices.

e) Is trained in the proper care and use of protective equipment in accordance with established safety practices.

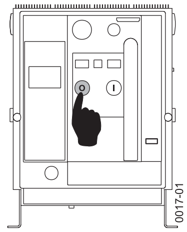
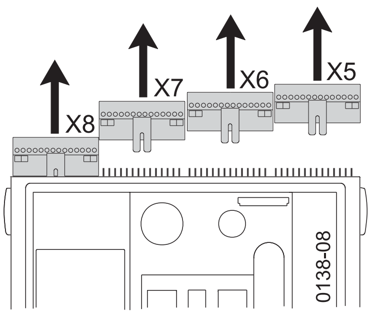
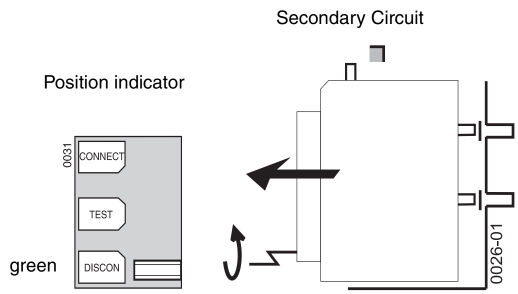
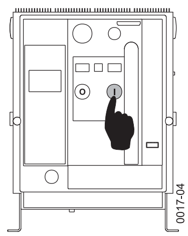
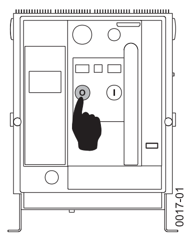
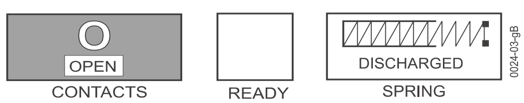
f) Is trained in administering first aid.

The inspection procedure according to NEMA AB4, section 3, must be performed once a year.

The arc chutes and contact system must be inspected according to these operating instructions. If a fault condition opens the circuit breaker, the circuit breaker should be inspected before it is replaced into service.

24.1 Preparation for maintenance

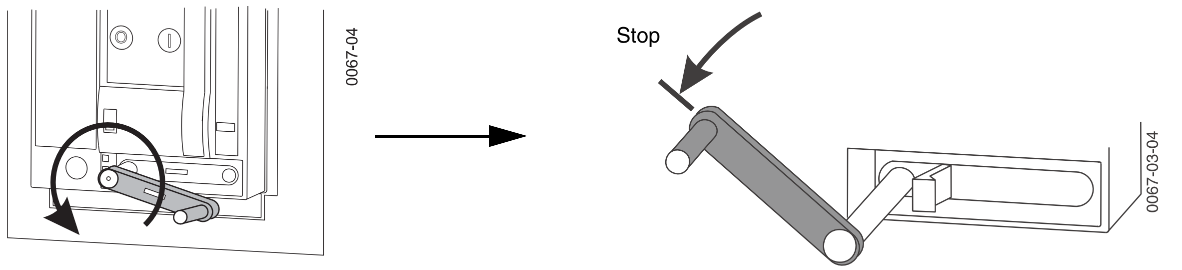
24.1.1 Opening the circuit breaker and discharging the closing spring

	Fixed-mounted circuit breaker	Draw-out circuit breaker
1 OPEN the circuit breaker		
2 Disconnect secondary circuits → (page 24-3)		
3 CLOSE the circuit breaker		
4 Depress the OPEN button again		
5 Indications		

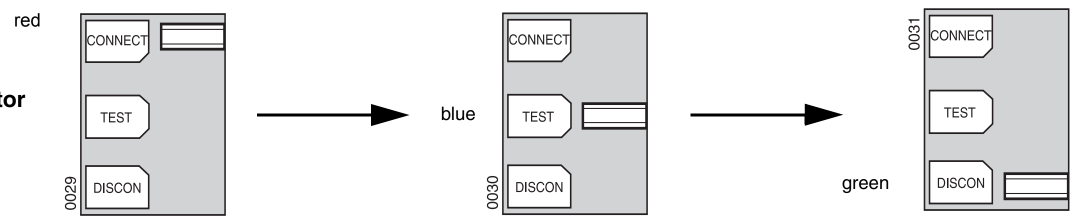
24.1.2 Removing the circuit breaker from the cradle

Crank the circuit breaker into the disconnected position

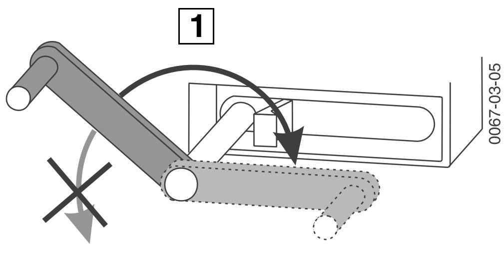
- Unlock racking handle / withdraw racking handle → (page 6-3)

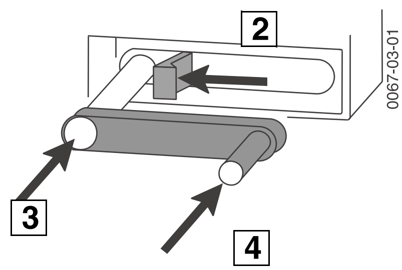


Position indicator



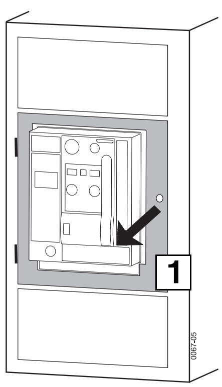
Push in the racking handle

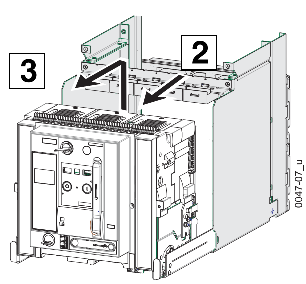




NOTICE
Racking Handle Damage.
Turning the racking handle beyond the stop will cause damage to the racking mechanism.
When the stop is reached, rotate the handle counter-clockwise until it can be stowed.

Pull circuit breaker into withdrawn position and remove





24.2 Changing front panel

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

High speed moving parts.

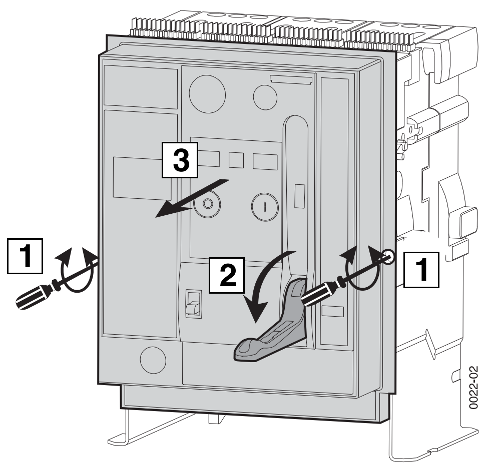
Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

- OPEN the circuit breaker and discharge the closing spring → (page 24-2)

24.2.1 Removing front panel

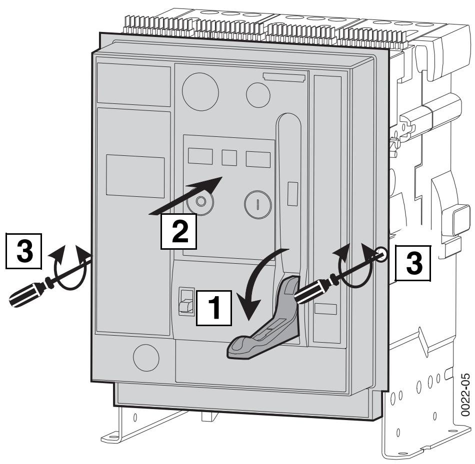
PH 2



24.2.2 Reinstalling the front panel

PH 2

2,5 Nm
22 lb-in



24.3 Checking arc chutes

It is recommended that the arc chutes be inspected on a regular basis.The arc splitter plates erode as the result of load breaking. This constitutes normal wear. The erosion of the arc splitter plates can manifest itself as wear of the plates, a layer of soot, or small spots of collections of molten metal. In case of heavy wear (severe erosion, large deposits of molten metal, etc), the circuit breaker should be replaced.

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

High speed moving parts.

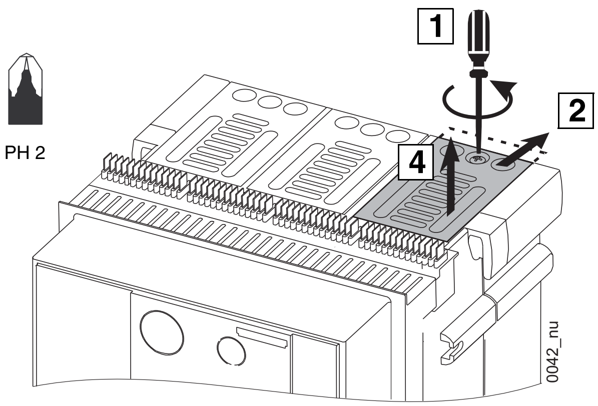
Can cause serious personal injury.

Discharge the closing spring before inspection and before carrying out any work on the circuit breaker.

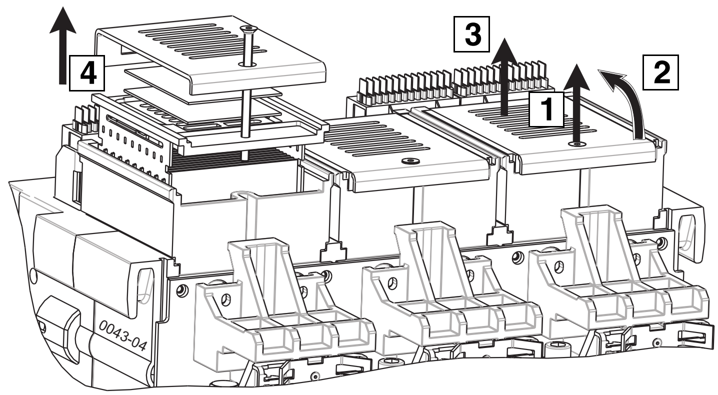
- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)

24.3.1 Removing arc chutes

A



B



FS II, class C shown

A Frame size I and II with flush arc chute
B Frame size II, class C and frame size III

1 Loosen screw by approx. 15 mm; do not remove it;
FS III and FS II, class C:
remove screw completely
2 Push the cover back;
FS III and FS II, class C: lift the cover carefully
3 Remove the cover
4 Take out the arc chute

WARNING

Damage to arc chute components.

Mishandling may lead to broken insulation plates of the arc chute housing, and compromised insulation capacity.

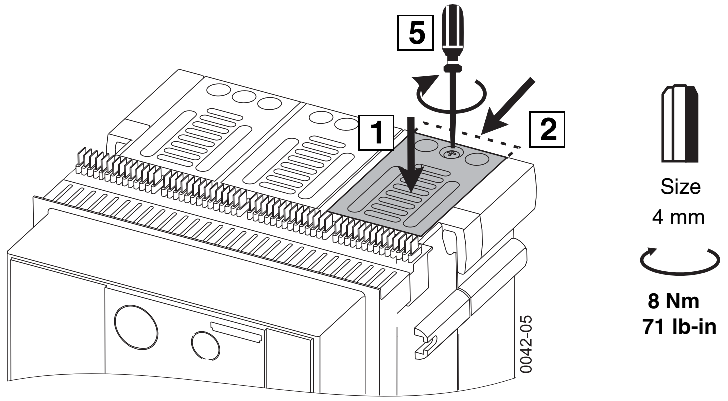
Do not stand arc chutes up, when placing them on a table, or any other surface outside of the circuit breaker. The arc chutes should be placed on their side to prevent breakage of the insulation plates.

24.3.2 Visual inspection

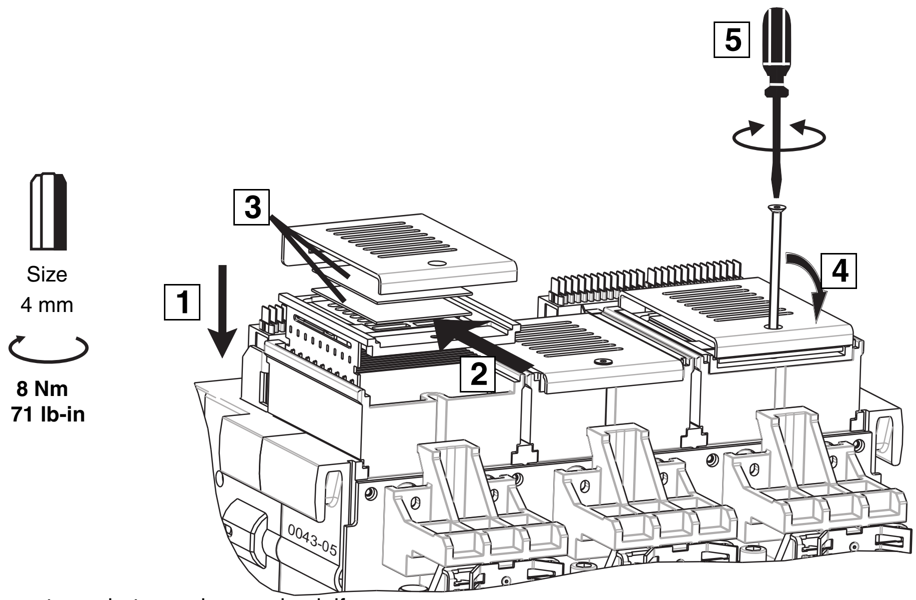
In the case of heavy wear (burnout on arc splitter plates), replace the circuit breaker.

24.3.3 Installing arc chutes

Frame size I and II



Frame size II and class C and frame size III
(Frame size II, class C shown)



1 Insert arc chute, push cover back if necessary
2 Slide the cover into place
3 Check position of the 2 screens, class C only
4 Hook the cover carefully into place and fold it down
5 Insert the screw and tighten to the specified torque

24.4 Inspection of arc chute covers

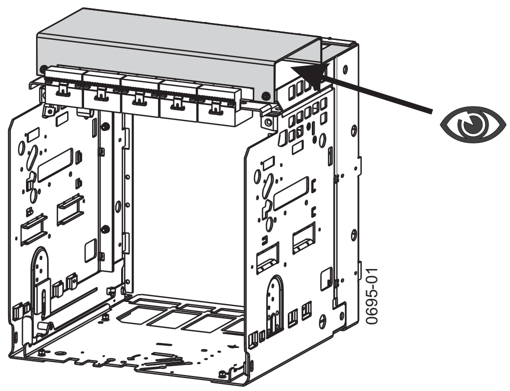
The arc chute cover is available as an optional accessory for cradles.

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.



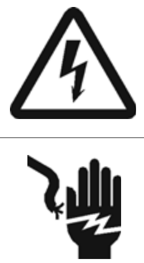
In addition to the arc chute inspection, an inspection of the arc chute covers is also recommended. The powder-coated inner sides of the covers which face the arc chutes must not be burned.

A layer of soot or small spots of collections of molten metal are normal.

If the powder-coating on the inner side of the cover has burned through or damaged, this must be replaced Arc chute covers (page 21-1) in the opposite order

24.5 Checking contact erosion

It is strongly recommended that the breaker's internal contacts be inspected on a regular basis. Load breaking and short-circuit trips cause contact erosion. The WL circuit breaker is equipped with a contact erosion indicator for monitoring wear of the circuit breaker's internal contacts.



DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

WARNING

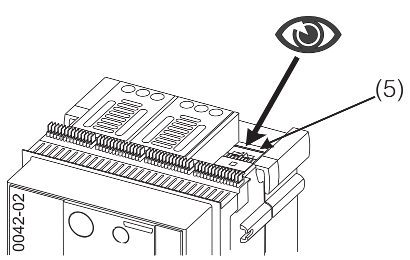
High speed moving parts.

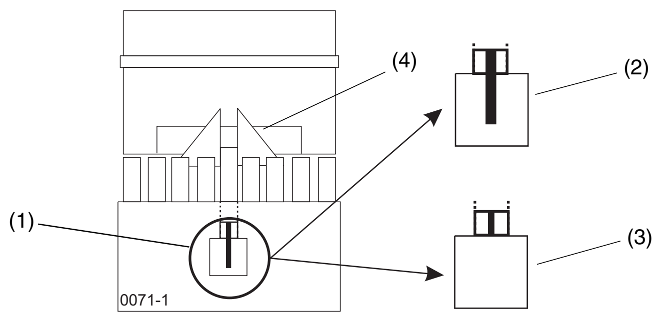
Will cause serious personal injury.

Do not place hands or objects within the arc chamber.

- OPEN circuit breaker the circuit breaker and discharge the closing spring → (page 24-2)
- Move the circuit breaker into the withdrawn position in the cradle → (page 24-3)
- Manually charge the closing spring → (page 6-4)
- Close the circuit breaker → (page 6-7)
- Remove the arc chutes → (page 24-6).

View with the circuit breaker closed





(1) Indicator pin
(2) Indicator pin is visible in the big recess
(3) Indicator pin is no longer visible
(4) Arcing tip
(5) Arc Chamber

If the indicator pin is no longer visible, the circuit breaker must be replaced.

For the visual inspection of fixed-mounted circuit breakers, use a mirror if required.

-

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

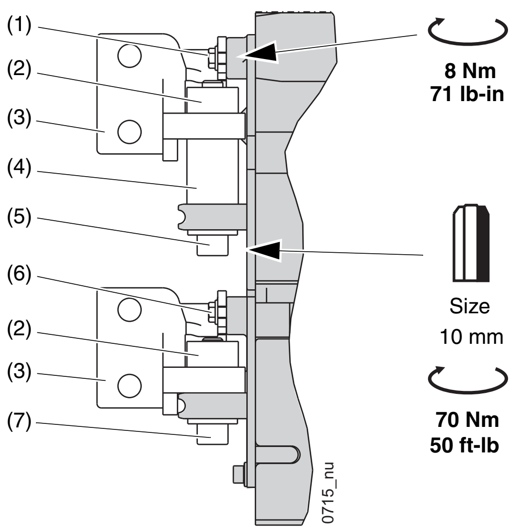
Turn off and lock out all power supplying this equipment before working on this device.

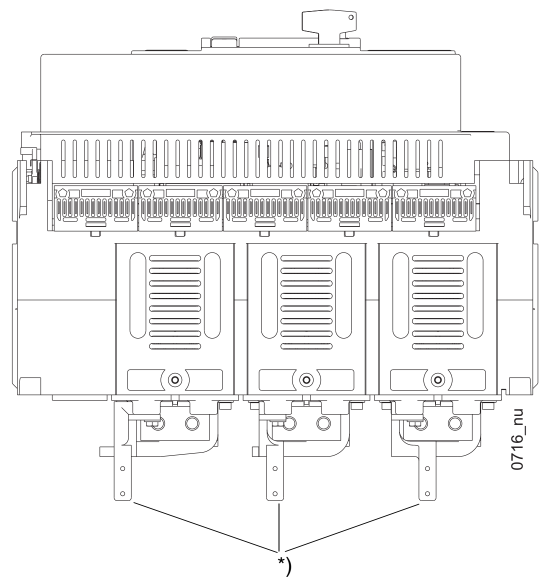
DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.





(1) Hex-head screw M6x20
(2) Threaded plate 2xM12
(3) Vertical adapter
(4) Riser
(5) Socket head cap screw M12x90
(6) Hex-head screw M6x35
(7) Socket head cap screw M12x50

*) Different offset

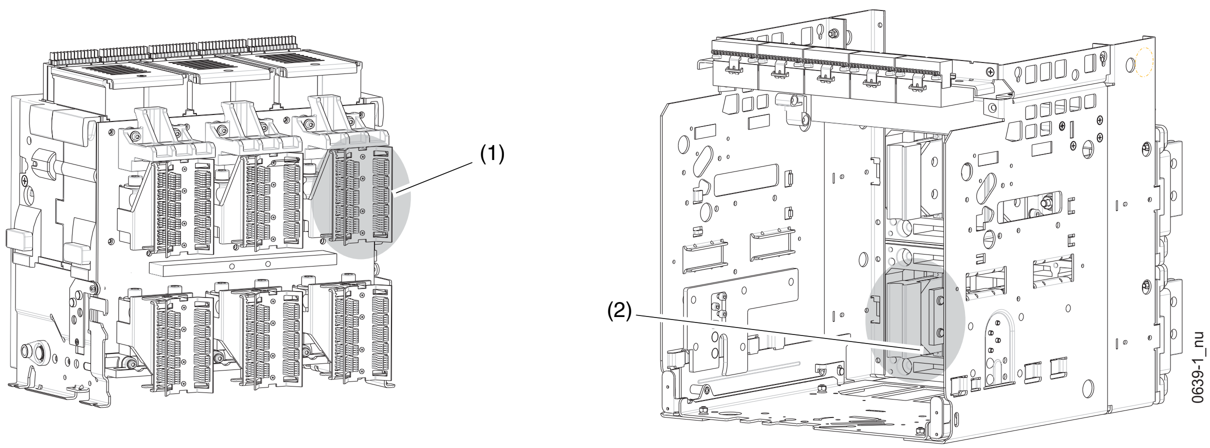
24.6 Exchanging the primary disconnects

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment damage.

Turn off and lock out all power supplying this equipment before working on this device.

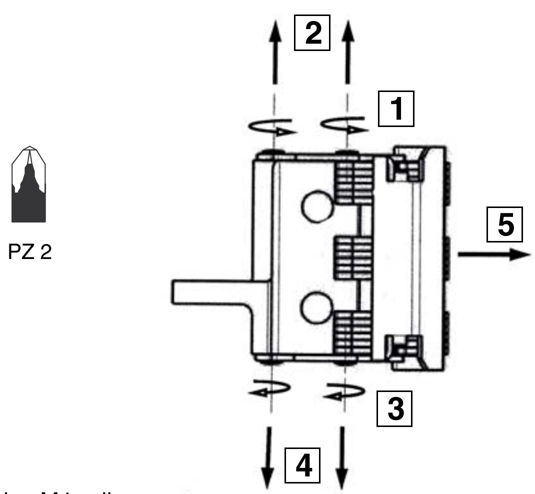


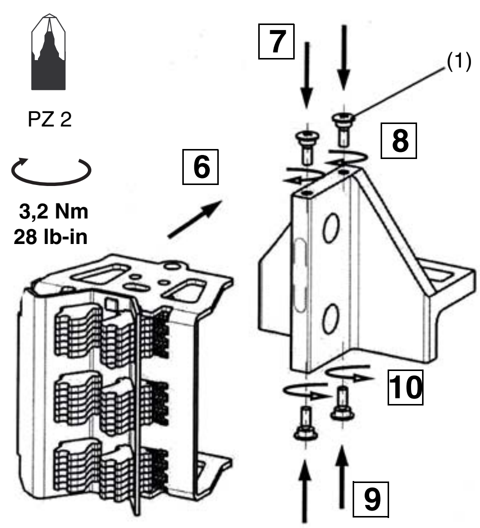
(1) Finger cluster
(2) Stab tip

24.6.1 Exchanging the finger cluster

- OPEN the circuit breaker and discharge the closing spring → (page 24-2)
- Remove the circuit breaker from the cradle → (page 24-3)

All frame sizes

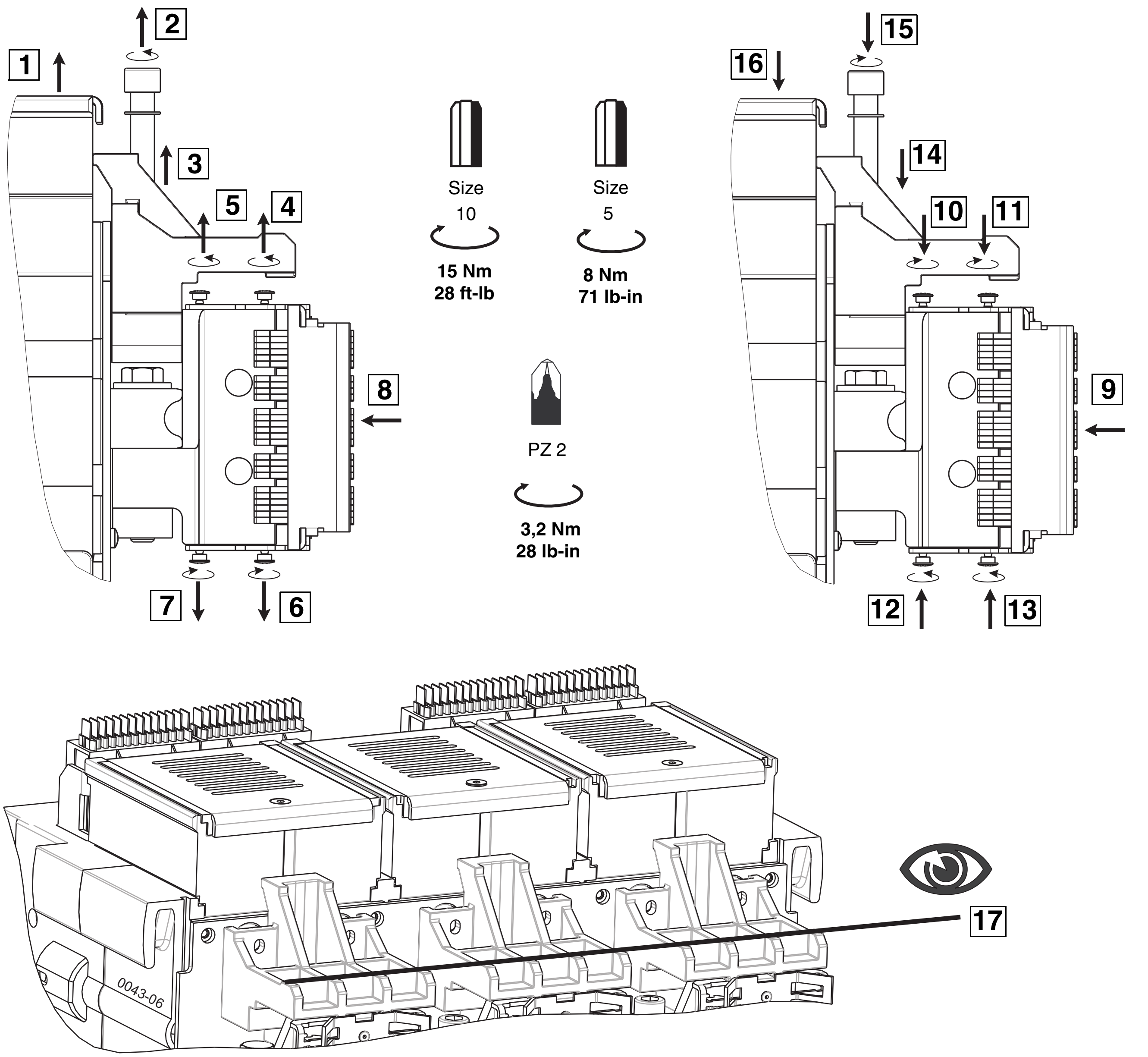




(1) Self-tapping M4 collar screw

1...4 Remove M4 collar screws
5 Remove finger cluster
6 Assemble new finger cluster
7...10 Assemble M4 collar screws

FS II class C only

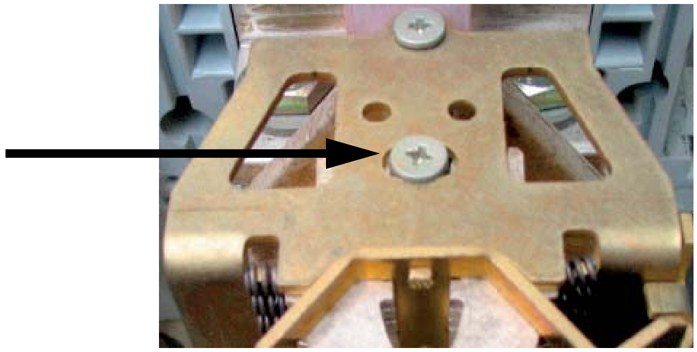


1	Remove the metal arc chute cover
2	Remove M12 screw and washer
3	Remove the plastic part
4...7	Remove M4 collar screws
8	Remove finger cluster
9	Assemble new finger cluster
10...13	Assemble M4 collar screws
14	Assemble the plastic part
15	Assemble M12 screw and washer
16	Assemble metal arc chute cover
17	Ensure that the plastic parts are aligned.

Ensure that the given torque values are observed.

NOTE

Ensure, that the shoulder bolt has free play in the slotted holes of the brass bracket of the finger cluster.



Lubricating the finger clusters

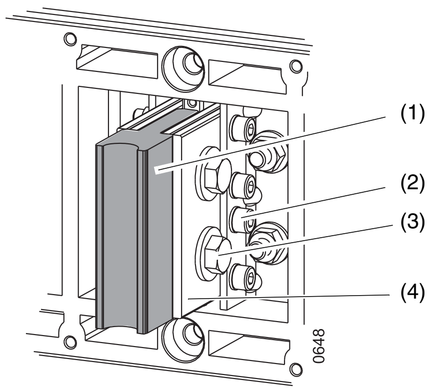
Clean and grease finger contacts on both ends (between stab tip and finger cluster, and between vertical adapter and finger cluster) before assembly. (Grease: Isoflex Topas NB 52 by Klüber Lubrication)

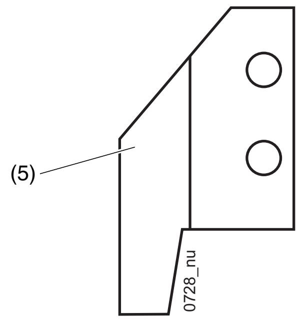
Attaching vertical adapter with finger cluster → (page 24-13)

24.6.2 Catalog numbers

	Frame size	Max. circuit breaker rated current $I_{n\ max}$ (A)	Catalog No.
Replacement Finger Cluster Kit	I	800 /1200	WLFNGR1UL
	II	800 / 1200 / 1600	WLFNGR10UL
		2000	WLFNGR15UL
		800 / 1200 / 2500 / 3000	WLFNGR30UL
	II class C	800/ 1200 / 1600 / 2000 / 2500 / 3000	WLFNGR30ULC
	III	4000 / 5000	WLFCK3
Grease used for assemlby	all	all	WLBGREASE

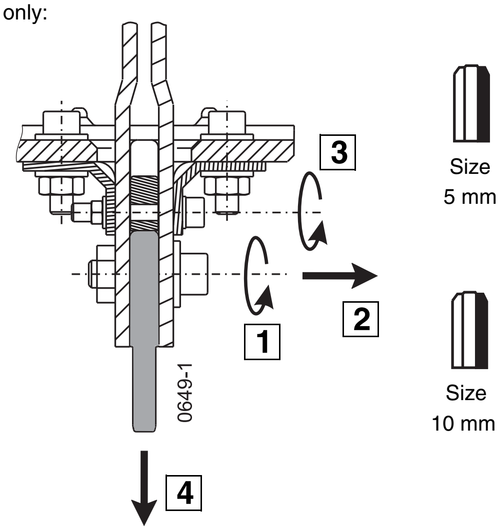
24.6.3 Exchanging the stab tip

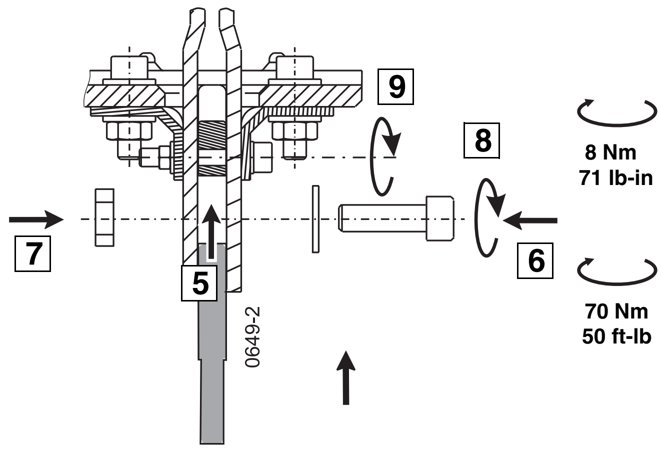




(1) Stab tip
(2) Socket head cap screw M6
(3) Hex-head screw M12
(4) 4“ runback load side
(5) Stab tip for FS I line side

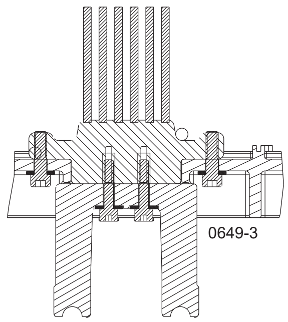
FS I / FS II only:



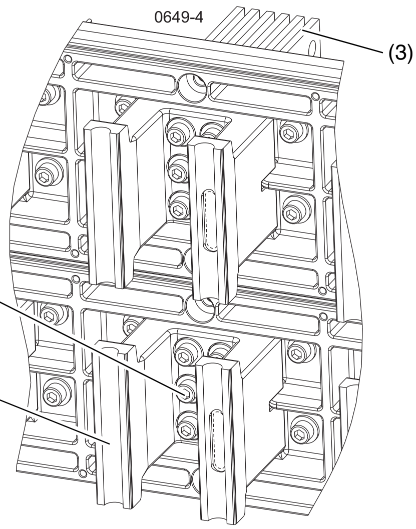


NOTE
Ensure correct orientation of FS I line stab tip when mounting.

FS III only:



Size
8 mm



(1) 6x Socket head cap screw M10x40 (40Nm /28ft-lb) and belleville washer
(2) Stab tip bridge
(3) Vertical bus connector

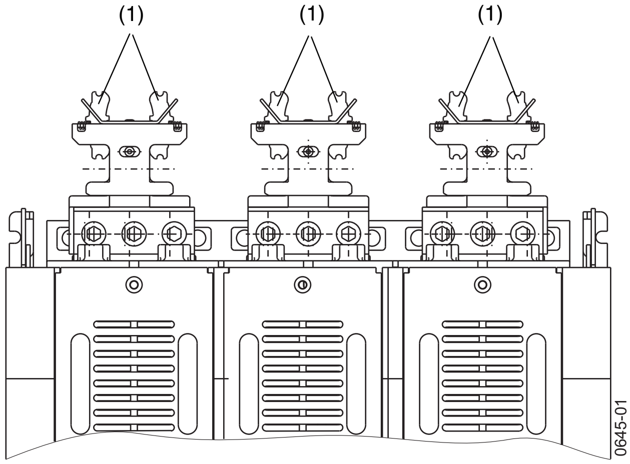
24.6.4 Catalog numbers

	Frame size	Max. circuit breaker rated current $I_{n\ max}$ (A)	Catalog No.
Stab tip line side	I	800 / 1200	WLGST15123LI
	II	800 / 1200 / 1600	WLGST10163LL
		2000	WLGST15203LL
		2500 / 3000	WLGST30323LL
	II class C	800 / 1200 / 1600 / 2000 / 2500 / 3000	WLGST30323LL
Stab tip load side	I	800 / 1200 (2 bolt hole pattern)	WLGST15203LL
		800 / 1200 (4 bolt hole pattern)	WLGST15203LD
	II	800 / 1200 / 1600 (2 bolt hole pattern)	WLGST10163LL
		800 / 1200 / 1600 (4 bolt hole pattern)	WLGST10163LD
		2000 (2 bolt hole pattern)	WLGST15203LL
		2000 (4 bolt hole pattern)	WLGST15203LD
		800 / 1200 / 2500 / 3000	WLGST30323LL
	II class C	800 / 1200 / 1600 / 2000 / 2500 / 3000	WLGST30323LL
Stab tip load and line side	III	4000 / 5000	WLGST30503LL
Grease for contact fingers	all	all	WLBGREASE

24.7 Cleaning and greasing the circuit breaker

for draw-out circuit breaker only

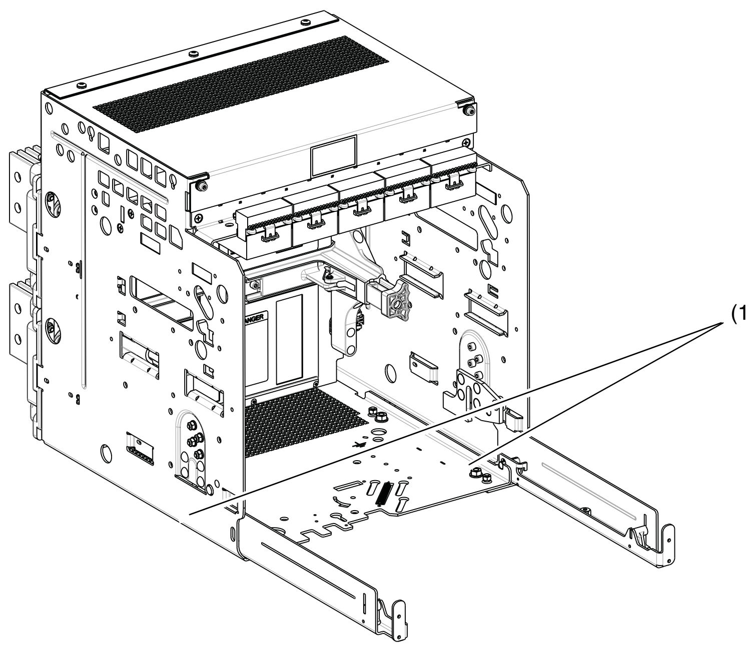
Finger cluster



(1) Greasing points

1 Wipe away old grease and
2 apply new grease

24.8 Cleaning and greasing the cradle



(1) Greasing points

1 Clean the track of the rails and
2 relubricate the designated points

Grease	Catalog No.
Isoflex Topas NB52 manufactured by Klüber Lubrication München KG	WLBGREASE

25 Primary injection testing

DANGER

Hazardous voltage.

Will cause death, serious personal injury, or equipment/property damage.

Turn off and lock out all power supplying this equipment before working on this device.

Only qualified personnel should work on this equipment, after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained herein and on the devices.

The successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

Qualified Personnel

For the purpose of this instruction manual and these product labels, a "qualified person" is one who is familiar with the installation, construction and operation of the equipment and the hazards involved and who,
in addition, has the following qualifications:

a) Is trained and authorized to energize, de-energize, clear, ground and label circuits and equipment in accordance with established safety practices.

b) Is trained in the proper care and use of protective equipment in accordance with established safety practices.

c) Is trained in administering first aid.

Observe Circuit Breaker Settings

The WL circuit breaker ships from the factory with the lowest possible settings. For exisiting circuit breaker installations, it is important to notice and take record of all customer settings of the circuit breaker before performing any testing. These settings should be restored at the conclusion of all inspection and testing.

Proper handling of WL Circuit Breakers

It is important to adhere to all rigging and transportation requirements for Siemens type WL circuit breakers (page 4-1).

CAUTION

Fragile Assembly

Finger Clusters may become damaged or disassembled. Connection may overheat and cause property damage.

Do not rest breaker on finger clusters; avoid impact to finger clusters.

Do not insert busbars wider than 0.40 inch [10 mm] into the finger clusters for the following circuit breaker frames:

WLN2A308, WLN2A316, WLS2A308, WLS2A316, WLS2D308, WLS2D312, WLS2D316, WLH2A308, WLH2A316, WLH2S308, WLH2S316, WLH2Z308, WLH2Z316, WLL2A308, WLL2A316, WLL2D308, WLL2D312, WLL2D316

Do not insert busbars wider than 0.59 inch [15 mm] into the finger clusters for the following circuit breaker frames:

WLS1D308, WLS1D312, WLS1D316, WLS1D320, WLL1D308, WLL1D312, WLL1D316, WLL1D320, WLL1Z308, WLL1Z312, WLL1Z316, WLL1Z320, WLN2A320, WLS2A320, WLS2D320, WLH2A320, WLH2S320, WLH2Z320, WLL2A320, WLL2D320, WLF2A308, WLF2A316, WLF2A320, WLF2S308, WLF2S316, WLF2S320

Do not insert busbars wider than 1.18 inch [30 mm] into the finger clusters for the following circuit breaker frames:

WLN2A332, WLS2A332, WLS2D330, WLH2A332, WLH2S332, WLH2Z325, WLH2Z330, WLL2A332, WLL2D330, WLC2D308, WLC2D312, WLC2D316, WLC2D320, WLC2D325, WLC2D330, WLL3A340, WLL3A350, WLL3S340, WLL3S350, WLL3D340, WLL3D350, WLL3Z340, WLL3Z350, WLF3A332, WLF3A340, WLF3A350, WLF3S332, WLF3S340, WLF3S350, WLM3A340, WLM3A350, WLC3D340, WLC3D350.

Visually inspect all finger clusters prior to installing drawout circuit breakers.

Do not energize a circuit breaker with a damaged finger cluster assembly.

25.1 General Notes

A few facts about WL trip units and breakers will help the tester understand how best to accomplish the required testing quickly and easily.

Air Core Sensor Technology

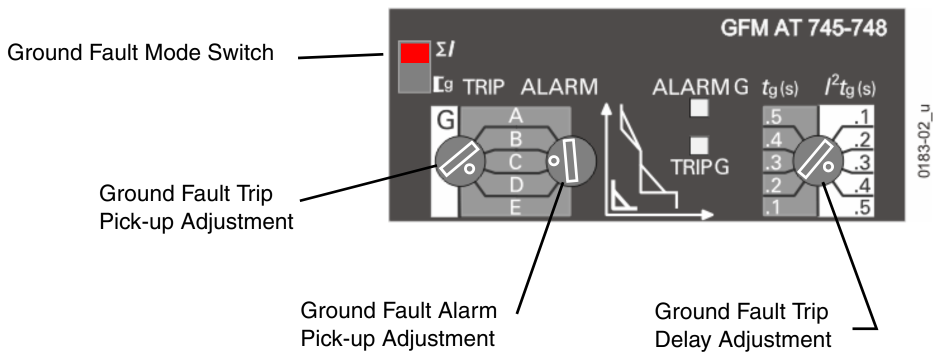
WL Breakers are equipped with air-core current sensors (Rogowsky coils, also known as linear couplers) and, as such, the ETUs cannot be tested by conventional secondary injection techniques.

Ground Fault Protection

WL Breaker trip units can be equipped with ground fault protection according to the table below. Ground fault protection cannot be disabled if it has been installed at the factory. Setting the Ground Fault Mode is either done via switch (see below) or via menu (page 9-44).

ETU Type	Available Ground Fault Modes
ETU 745	Optional: 3 or 4 wire residual, and direct sensing, are both available with additional ground fault protection module. Mode is set by switch.
ETU 755 / 776	Optional: 3 or 4 wire residual, and direct sensing, are both available with additional ground fault protection module. Mode is set by soft setting.

Figure 1



The ground fault pick-up points for the Ground Fault Alarm and Ground Fault Trip settings are independently configurable. The definitions of the A - E dial settings are described below:

Pick-up Setting	Frame Size 1	Frame Size 2	Frame Size 3
A	100 A	100 A	400 A
B	300 A	300 A	600 A
C	600 A	600 A	800 A
D	900 A	900 A	1000 A
E	1200 A	1200 A	1200 A

Ground Fault Mode Selection (Setting)

Before beginning to test, the Ground Fault Mode setting should be verified.

a. If connected to a 3- or 4-wire residual system, the mode switch must be in the summation position. In this mode, the ETU will perform a vector summation of phases A, B, C and if connected, N (Neutral). If this sum is not zero, a ground fault is present and the ETU behaves according to the pickup and delay settings.

b. If connected in system where an external iron-core sensor detects the ground current (such as an MDGF scheme), the switch must be in the Direct Sense position (down). If the switch is in this position, the trip unit will not do a residual calculation and will only respond to a signal from an external iron-core sensor.

c. On an ETU776, these settings are done via the LCD and keypad as there is no physical switch.

Phase Loss Sensing

When single-phase testing, make sure that the short-time delay is not set to the 20ms setting. In this position, a phase-loss sensitivity function is enabled. This function is designed to protect motors from heavy imbalances and loss of one or more phases. When active, and the trip unit detects that the least heavily loaded phase is 50% lower than the most heavily loaded phase, the long-time pickup setting(IR) is reduced to 80% of setting indicated on the display or dial. When this unbalance condition no longer exists, the setting is returned to normal. Single-phase testing will be recognized as a phase unbalance and the long-time pickup will be reduced to 80% of its set value. The resulting trip timing will be faster than indicated in the trip curves. For an ETU776, the phase-loss sensing is controlled by the "PhaseSen" menu item under the protective parameters. When short-time delay is set to 20ms, phase-loss sensing cannot be turned off.

External Ground Fault Sensor Inputs

There are three types of connections for ground fault protection:

a. If applied in a 4-wire system, there will be an external air-core sensor connected to the second ary wiring points X8.9 & 10.

b. If applied in a direct sensed scheme, there will be an external iron-core 1200:1 CT connected to secondary wiring points X8.11 & 12.

c. If applied in a 3-wire system, secondary wiring points X8.9 & 10 must be shorted together.

Activating the WL Trip Unit

The external neutral sensor does not provide power to the trip unit when current is flowing through it. The trip unit must be activated by an auxiliary power source or phase current in order to detect and react to current flowing though the external neutral sensor.

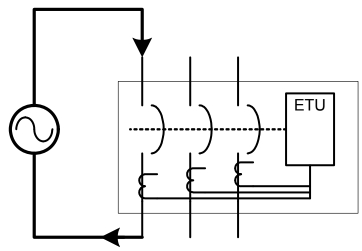
The WL trip units will become active and begin protecting at approximately 80A in a single phase in Frame Size 1 & 2 breakers and approximately 100A in a single phase in a FS3 breaker.

25.2 Primary Injection Phase Current Testing

Circuit Breakers Without Ground Fault Protection

WL Breakers equipped with trip units without ground fault protection can be easily single phase tested by injecting current into either the line or load connection of any phase and out the opposite connection.

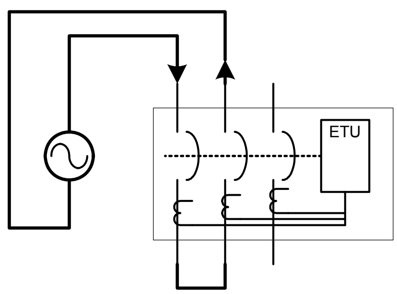
Figure 2



Circuit Breakers With 3- or 4-Wire Residual Ground Fault Protection

WL Breakers equipped with trip units with residual ground fault protection must be phase injected such that the ETU sees two active phases which cancel each other out. This cancellation prevents the ground fault function from tripping. This cancellation is accomplished by injecting current into the line side of one phase, out the load side, back into another load side and back out the line side.

Figure 3



If it is not possible to inject phase current into the breaker as shown in the figure above, the Ground Fault Mode switch can be used to tell the ETU to look for a ground fault signal on a different set of terminals. As stated above, putting the Ground Fault Mode switch in the Direct Sense position will cause the ETU to look for ground fault current on terminals X8.11 and X8.12 and not do the residual calculation. This method can only be used if it is possible to remove the front cover of the breaker to access the switch on the side of the ETU. The switch must be returned to its original position after testing is complete. On an ETU776, these settings are done via the LCD and keypad as there is no physical switch.

25.3 Primary Injection Ground Fault Current Testing

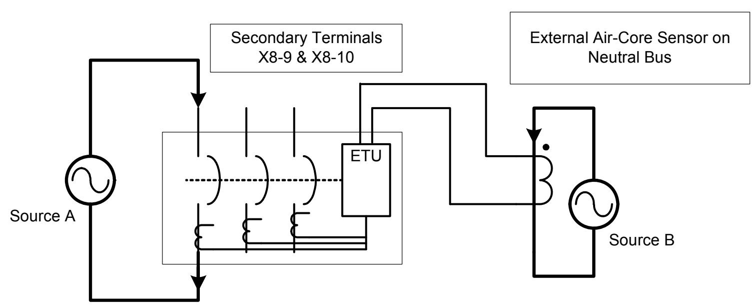
Circuit Breakers With 3-Wire Residual Ground Fault Protection

Testing is accomplished by routing current through one phase of the breaker. The Ground Fault Mode switch must be in the up position (summation symbol) in order for the residual ground fault detection to be tested.

Circuit Breakers using 4-Wire Residual Ground Fault Protection via the External Neutral Sensor (air core)

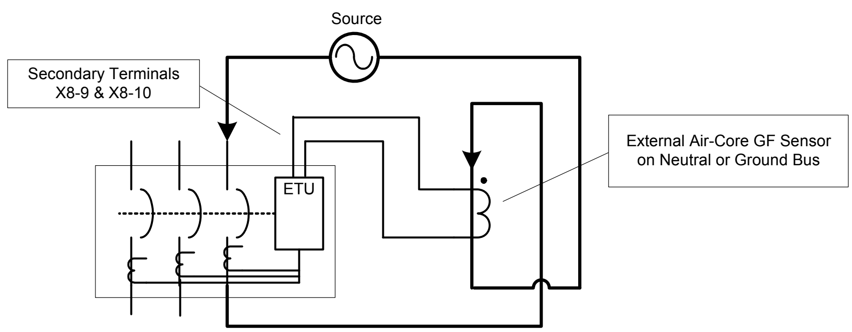
To test a WL breaker equipped with trip 4-wire residual ground fault protection, the ETU must first be activated by injecting 80-100A through the breaker itself (Source A). Once the ETU is active, the test current can be injected through the external neutral sensor to verify its connection and polarity (Source B). The external neutral sensor does not provide energy to the ETU to activate it.

Figure 4



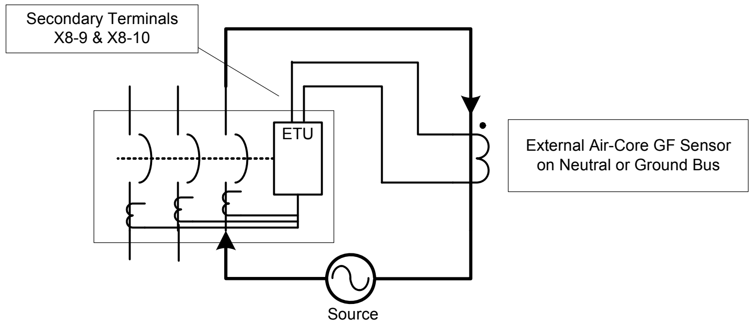
The same test can be conducted using a single power source. The ETU must be activated by injecting a minimum of 100A through the breaker itself. The external neutral sensor does not provide energy to the ETU to activate it. Multiple windings through the external sensor can be added to create greater imbalances.

Figure 5



Also using a single source, the system can be tested to verify that the circuit breaker will not trip.

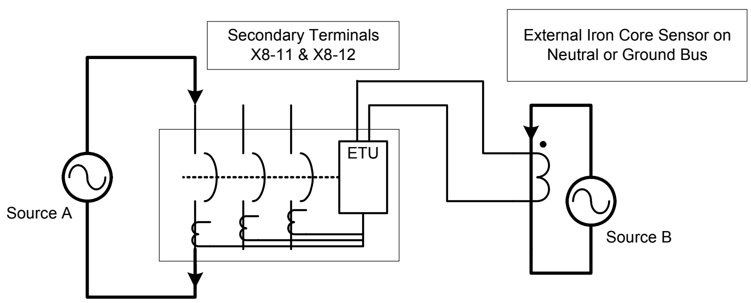
Figure 6



Circuit Breakers using Direct Sensing Ground Fault Protection via the External GF Sensor (iron core)

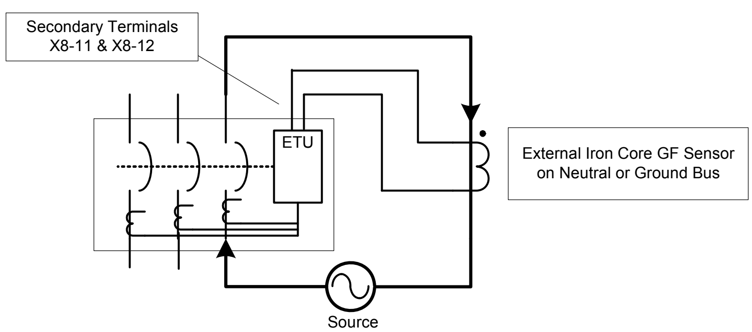
The WL trip units can be connected to an external 1200:1 iron core sensor to provide indication of a ground fault. This configuration requires that the Ground Fault Mode switch be in the down (g) position. The ETU is activated by injecting 80-100A through the breaker itself (Source A). Once the ETU is active, the test current can be injected through the external ground fault sensor to verify its connection and polarity (Source B). The external ground fault sensor does not provide energy to the ETU to activate it.

Figure 7



The same test can be conducted using a single power source. The ETU must be activated by injecting a minimum of 100A through the breaker itself. The external neutral sensor does not provide energy to the ETU to activate it. Multiple windings through the external sensor can be added to simulate greater neutral currents.

Figure 8



25.4 Achieving Correct External Neutral Sensor Polarity

(for air-core sensors WLNCT2 and WLNCT3)

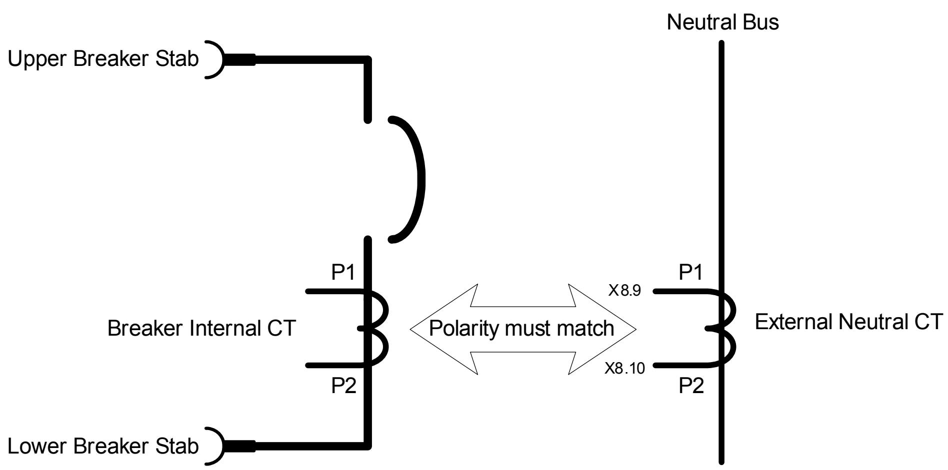
The polarity of the neutral sensor must be observed when installing the neutral sensors in the apparatus. The "dot" side of the sensor, identified as P2 in the drawing below, must face in the same direction as the bottom stabs on the breaker. The schematics and elevation drawing identify the P2 side with a "dot" because that is the label side of the sensor, and most installers and service technicians are accustomed to the label side of the sensor being the 'dot' side. There is also a P2 in a circle on the face of the sensor.

For a top-fed breaker (line on top and load on bottom), the P2 must go towards the load (away from the neutral bus).

For a bottom-fed breaker (line on the bottom and load on the top), the P2 must go towards the neutral bus (away from the load).

As long as the X8-9 and X8-10 leads are connected to the correct terminals on the breaker, the polarity relationship between the internal breaker sensors and the external neutral sensor will be correct for the rules given above.

Figure 9



The correct neutral sensor polarization is achieved when the P1 mark on the neutral sensor is oriented on the neutral bus so that it matches the upper stabs of the breaker (normally the line side). Even if the breaker is bottom fed, the load flow must be such that the lower stabs of the breaker and the P2 mark on the neutral sensor are matched (both line or both load).

The wires from the neutral sensor are color coded as follows:

- BLACK => X8.9 = P1
- BLUE => X8.10 = P2

These wires terminate in a plastic 2-pin connector which is usually connected to a black twisted pair. At the far end of the twisted pair, the two wires are labeled. These wires are usually connected to a shielded, twisted pair which brings the signal to the secondary disconnects (X8.9 & X8.10). If incorrect polarity is detected at the ETU in spite of what appears to be a correctly mounted neutral sensor, then the wires crossing between shipping splits should be inspected carefully.

Sample Circuit Breaker Test Record

The following form is an example of a typical report for recording results of a circuit breaker or ground fault system conformance test. This form may be used in abscence of a preferred document (copies may be required, based on the number of circuit breakers.

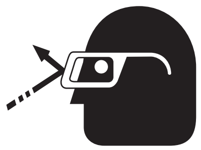
CIRCUIT BREAKER TEST RECORD	
Date Tested:	Circuit Breaker ID:
Tested By:	
Results:	

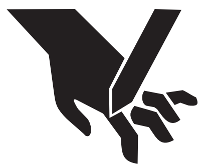
CIRCUIT BREAKER TEST RECORD	
Date Tested:	Circuit Breaker ID:
Tested By:	
Results:	

26 Disposal

26.1 Low-voltage circuit breakers disposal

Siemens circuit breakers are environmentally friendly products, predominantly consisting of recyclable materials. For disposal, some disassembly, separation, and professional-services handling may be required.





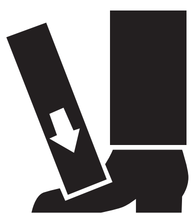
WARNING

Stored energy.

Can cause death or serious injury.

Mechanisms contain stored energy, which may be released during disassembly.

Wear suitable protection and take appropriate precautions when disconnecting and removing parts.



WARNING

Heavy objects.
Can cause death or serious injury.

Disassembly may cause an unbalanced load, and could result in falling objects.

Take appropriate precautions in a properly designated workspace to maximize support and stability.

Materials to be handled include but are not limited to:

- **Metals**:Should be transferred and recycled as mixed scrap metals.
- **Plastics**:Plastic containing a recycle symbol should be recycled. Plastic lacking the recycle symbol should be discarded as industrial waste.
- **Small electronics, insulated cables, and motors**: Should be recycled via electronics scrap disposal companies specialized in separating and sorting as described above.

Disposal regulations vary from locality to locality and may be modified over time. Specific regulations and guidelines should be verified at the time of waste processing to ensure that current requirements are being fulfilled. For specific assistance in understanding and applying regional regulations and policies, or manufacturer's recommendations, refer to the local Siemens service representative for additional information.

WL Insulated Case Circuit Breaker

Ratings for UL489 Listed Breakers

WL frame ratings – frame size 1		800A			1200A			1600A			2000A		
Rating Class		**S**	**H**	**L**	**S**	**H**	**L**	**S**	**H**	**L**	**S**	**H**	**L**
Interrupting current frame Ics (kAIR RMS) 50/60 Hz	240VAC	65	85	100	65	85	100	65	85	100	65	85	100
	480VAC	65	85	100	65	85	100	65	85	100	65	85	100
	600VAC	65	65	65	65	65	65	65	65	65	65	65	65
Short-time current *I*cw (kA RMS)	0.4 sec.	65	65	65	65	65	65	65	65	65	65	65	65
Extended instantaneous protection rating (kA RMS)	480VAC	65	85	100	65	85	100	65	85	100	65	85	100
	600VAC	65	65	65	65	65	65	65	65	65	65	65	65
Close and latch rating (kA RMS)		65	65	65	65	65	65	65	65	65	65	65	65
Applicable rating plug range		200 - 800A			200 - 1200A			200 - 1600A			200 - 2000A		
Minimum enclosure dimension (in.)		22Wx15Hx19.5D			22Wx15Hx19.5D			22Wx15Hx19.5D			22Wx15Hx19.5D		
Mechanical make-time (ms)		35			35			35			35		
Mechanical break-time (ms)		34			34			34			34		
Electric close make-time (ms)		50			50			50			50		
Electric trip/ UV break-time (ms)		40/73			40/73			40/73			40/73		
Electric trip and reclose interval (ms)		80			80			80			80		
Mechanical duty cycles (no maint.)		7500			7500			7500			7500		
Electrical duty cycles (no maint)		7500			7500			7500			7500		
Draw-out breaker efficiency (Watts loss at I_n)		80			180			350			530		
Fixed-mount breaker efficiency (Watts loss at I_n)		60			120			160			270		
Ambient operating temperature (°C)		-25 to 40			-25 to 40			-25 to 40			-25 to 40		
Weights (Fixed Breaker/DO Breaker/Cradle) lbs.		86/137/108			86/137/108			86/137/108			86/137/108		

WL frame ratings – frame size 2		800A			1200A			1600A			2000A			2500A		3000A	
Rating Class		**S**	**L**	**C**	**S**	**L**	**C**	**S**	**L**	**C**	**S**	**L**	**C**	**L**	**C**	**L**	**C**
Interrupting current frame Ics	240VAC	65	100	150	65	100	150	65	100	150	65	100	150	100	150	100	150
(kAIR RMS) 50/60 Hz	480VAC	65	100	150	65	100	150	65	100	150	65	100	150	100	150	100	150
	600VAC	65	85	100	65	85	100	65	85	100	65	85	100	85	100	85	100
Short-time current Icw (kA RMS)	0.4 sec.	65	85	100	65	85	100	65	85	100	65	85	100	85	100	85	100
Extended instantaneous protection	480VAC	65	100	150	65	100	150	65	100	150	65	100	150	100	150	100	150
rating (kA RMS)	600VAC	65	85	100	65	85	100	65	85	100	65	85	100	85	100	85	100
Close and latch rating (kA RMS)		65	85	100	65	85	100	65	85	100	65	85	100	85	100	85	100
Applicable rating plug range		200 - 800A			200 - 1200A			200 - 1600A			200 - 2000A			200 - 2500A		200 - 3000A	
Minimum enclosure dimension (in.)		22Wx22.5Hx19.5D			22Wx22.5Hx19.5D			22Wx22.5Hx19.5D			22Wx22.5Hx19.5D			22Wx22.5Hx19.5D		22Wx15Hx19.5D	
Mechanical make-time (ms)		35			35			35			35			35		35	
Mechanical break-time (ms)		34			34			34			34			34		34	
Electric close make-time (ms)		50			50			50			50			50		50	
Electric trip/ UV break-time (ms)		40/73			40/73			40/73			40/73			40/73		40/73	
Electric trip and reclose interval (ms)		80			80			80			80			80		80	80
Mechanical duty cycles (no maint.)		10,000 (5000 for Class C)			10,000 (5000 for Class C)			10,000 (5000 for Class C)			10,000 (5000 for Class C)			10,000 (5000 for Class C)		10,000 (5000 for Class C)	
Electrical duty cycles (no maint)		7500 (5000 for Class C)			7500 (5000 for Class C)			7500 (5000 for Class C)			4000			4000		4000	
Draw-out breaker efficiency (Watts loss at I_n)		85			150			320			500			680		1000	
Fixed-mount breaker efficiency (Watts loss at I_n)		40			80			120			230			320		480	
Ambient operating temperature (°C)		-25 to 40			-25 to 40			-25 to 40			-25 to 40			-25 to 40		-25 to 40	
Weights (Fixed Breaker/DO Breaker/Cradle) lbs.		124/159/112 148/220/163 (Class C)			124/159/112 148/220/163 (Class C)			124/159/112 148/220/163 (Class C)			130/177/128 148/220/163 (Class C)			130/177/128 148/220/163 (Class C)		130/177/128 148/220/163 (Class C)	

WL Non-Automatic Switch UL 489

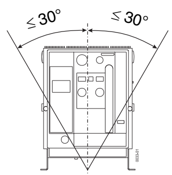
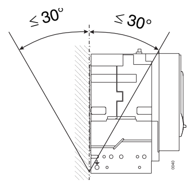
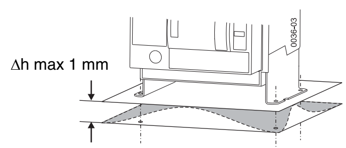
Ratings

WL frame ratings – Frame size 3		4000A		5000A	
Rating Class		**L**	**C**	**L**	**C**
Interrupting current frame Ics (kAIR RMS) 50/60 Hz	240VAC	100	150	100	150
	480VAC	100	150	100	150
	600VAC	85	100	85	100
Short-time current *I*cw (kA RMS)	0.4 sec.	85	100	85	100
Extended instantaneous protection rating	480VAC	100	150	100	150
(kA RMS)	600VAC	85	100	85	100
Close and latch rating (kA RMS)		85	100	85	100
Applicable rating plug range		800 - 4000A		800 - 5000A	
Minimum enclosure dimension (in.)		32Wx22.5Hx19.5D		32Wx22.5Hx19.5D	
Mechanical make-time (ms)		35		35	
Mechanical break-time (ms)		34		34	
Electric close make-time (ms)		50		50	
Electric trip/ UV break-time (ms)		40/73		40/73	
Electric trip and reclose interval (ms)		80		80	
Mechanical duty cycles (no maint.)		5000		5000	
Electrical duty cycles (no maint)		2000		2000	
Draw-out breaker efficiency (Watts loss at I_n)		1100		1100	
Fixed-mount breaker efficiency (Watts loss at I_n)		580		580	
Ambient operating temperature (°C)		-25 to 40		-25 to 40	
Weights (Fixed Breaker/DO Breaker/Cradle) lbs.		181/278/306 200/278/306 (Class C)		181/278/306 200/278/306 (Class C)	

WL frame ratings		Frame size 1 800-1200 A	Frame size 2 800 - 3000A	Frame size 3 4000/5000A
Rating Class		**H**	**L**	**L**
Breaking capacity with external relay (kA RMS)	240VAC	85	100	100
50/60 Hz, instantaneous trip	480VAC	85	100	100
	600VAC	65	85	85
Short-time current Icw (kA RMS)	0.4 sec.	65	85	85

1) Class C

WL circuit breakers

Frame Rating		Frame Size I		Frame Size II						Frame Size III	
		800	1200	800	1200	1600	2000	2500	3000	4000	5000
Endurance											
Mechanical (without maintenance)	operating cycles	7,500	7,500	10,000 7,500[1]	10,000 7,500[1]	10,000 7,500[1]	10,000 7,500[1]	10,000 7,500[1]	10,000 7,500[1]	5,000	5,000
Electrical (without maintenance)	operating cycles	7,500	7,500	7,500	7,500	7,500	4,000	4,000	4,000	2,000	2,000
Switching frequency	operatings/ hour	60	60	60	60	60	60	60	60	60	60
Minimum interval between breaker trip and next closing of circuit breaker (when used with the automatic mechanical reset of the reclosing lock-out)	ms	80	80	80	80	80	80	80	80	80	80
Mounting position											
Weight											
Fixed-mounted circuit breaker	kg/lb	39/86		56/124 67/148[1]			59/130 67/148[1]	64/141 67/148[1]		82/181	
Draw-out circuit breaker	kg/lb	62/137		72/159 100/220[1]			80/177 100/220[1]	95/209 100/220[1]		118/260	
Cradle	kg/lb	49/108		51/112 74/163[1]			58/128 74/163[1]	69/152 74/163[1]		139/306	
Secondary disconnect wire sizes max # of aux. connecting leads x cross section (solid or stranded)	screw-type terminal	1 x AWG 14 or 2 x AWG 16									
	Spring clamp terminal	2 x AWG 14									
	Ring terminal system	2 x AWG 14 1 x AWG 10[2] 2 x AWG 16									
	Pigtail leads (fixed-mounted only)	1 x AWG 14 40“ long									
TOC wire connection size (Cu) max # of aux. connecting leads x cross section (solid or stranded)	Spring clamp terminal	1 x AWG 14									
MOC wire connection size (Cu) max # of aux. connecting leads x cross section (solid or stranded)	Screw clamp terminal	1 x AWG 14									

1) Class C

WL Circuit Breaker Accessory Ratings

Manual-operating mechanism with Mechanical Closing			
Closing/charging the closing spring			
	Maximum actuating force required on hand lever		52 lbs
	Number of hand lever strokes required		9
Motor-operating mechanism with Mechanical and Electrical Closing			
Charging the closing spring			
Closing coil and Shunt Trip	Coil voltage tolerance	24V DC	14 - 28V DC
		48V DC	28 - 56V DC
		120V AC / 125V DC	70 - 140V DC 104 - 127V AC
		240V AC / 250V DC	140 - 280V DC 208 - 254V AC 180Y / 104V AC 220Y / 127V AC
	Power consumption (5% duty cycle)		120 W for 50 ms
	Minimum closing coil actuation signal required (5% duty cycle)		50 ms
Motor-operating mechanism with Mechanical and Electrical Closing			
Motor for charging closing spring			
	Motor voltage tolerance at 120V AC, 240V AC		85 - 110%
	Extended tolerance for battery operation at 24 V DC, 48 V DC, 125 V DC, 250 V DC		70 - 126%
	Power consumption of the motor		110 W
	Time required for charging the closing spring		≤ 10s
For motor and closing coil short-circuit protection			
	Short-circuit protection Standard slow-blow cartridge	24 - 60 V	6A
		110 - 250 V	3A
Auxiliary Release			
Undervoltage release (UVR)	Operating values	≥ 85% (circuit breaker can be closed)	
		35 - 70% (circuit breaker opens)	
	AC Coil voltage tolerance at 120 V AC, 240 V AC		85 - 110%
	DC Extended tolerance for battery operation at 24 V DC, 48 V DC, 125 V DC, 250 V DC		85 - 126%
	Rated control supply voltage	AC 50/60 Hz V	120, 240
		DC V	24, 48, 125, 250
	Power consumption (inrush / contiuous)	AC VA	200 / 5
		DC W	200 / 5
	Opening time of the circuit breaker for AC / DC	ms	200
	UVR (no delay time), 2 settings		
	Setting 1	ms	80
	Setting 2	ms	200
	UVR (with delay time)		
	Adjustable delay	s	0.2 to 3.2
	Reset by additional NC direct opening	ms	≤ 100

WL Circuit Breaker Accessory Ratings

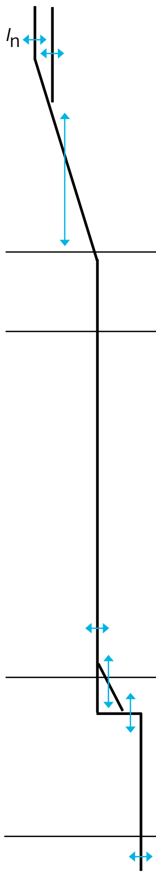
Interlock Shunt Trip (100% continuous duty)					
		Operating range			85 - 110%
		Extended tolerance for battery operation at 24V DC, 48V DC, 125V DC, 250V DC			70 - 126%
		Rated voltage	AC 50/60Hz	V	110, 230
			DC	V	24, 30, 48, 60, 110, 220
		Power consumption	AC / DC	VA / W	15 / 15
		Minimum shunt trip actuation signal at rated voltage		ms	60
		Opening time of the circuit breaker at rated voltage		ms	80
		Short circuit protection Smallest permissible fuse			1A
Auxiliary Contacts and Mechanism Operated Contacts (MOC)					
Contact rating	Alternating current 50/60 Hz	Rated operational voltage	240 V		
		Rated operational current, continuous	10A		
		Rated operational current, making	30A		
		Rated operational current, breaking	3A		
	Direct current	Rated operational voltage	24 V, 125 V, 250 V		
		Rated operational current, continuous	5A		
		Rated operational current, making	1.1A at 24 V, 1.1A at 125 V, 0.55 A at 250 V		
		Rated operational current, breaking	1.1A at 24 V, 1.1 A at 125 V, 0.55 A at 250 V		
Bell Alarm Switch and "Ready-to-close" Signal Contact					
Contact rating	Alternating current 50/60 Hz	Rated operational voltage	240 V		
		Rated operational current, continuous	5A		
		Rated operational current, making	8A		
		Rated operational current, breaking	5A		
	Direct current	Rated operational voltage	24 V, 48 V, 125 V		250 V DC[1)]
		Rated operational current, continuous	0.4 A		0.2 A
		Rated operational current, making	0.4 A		0.2 A
		Rated operational current, breaking	0.4 A		0.2 A
Shunt release, UVR and tripped signaling contacts					
Contact rating	Alternating current 50/60 Hz	Rated operational voltage	127 V, 240 V		
		Rated operational current, continuous	3 A		
		Rated operational current, making	5 A		
		Rated operational current, breaking	3 A		
	Direct current	Rated operational voltage	24 V, 48 V, 125 V, 48 V DC		125 V DC (IEC rating only)
		Rated operational current, making	1.0 A		0.4 A
		Rated operational current, breaking	1.0 A		0.4 A

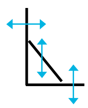
1) 250 V DC rating available since October 2005.

WL Circuit Breaker Accessory Ratings

Truck Operated Contacts (TOC)					
Contact rating	Alternating current 50/60 Hz	Rated operational voltage	120 V		
		Rated operational current, continuous	10 A		
		Rated operational current, making	6 A		
		Rated operational current, breaking	6 A		
	Direct current	Rated operational voltage	24 V	24 V, 48 V, 125 V	250 V
		Rated operational current, continuous	6 A	1 A	1 A
		Rated operational current, making	6 A	0.22 A	0.11 A
		Rated operational current, breaking	6 A	0.22 A	0.11 A

Function overview of the electronic trip units





	Basic Functions	ETU745	ETU776
L	**Long-time overcurrent protection**	✔	✔
	Function can be switched ON/OFF	–	–
	Setting range $I_R = I_n$ x ...	0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.8, 0.9, 1	40-100% of In (Adjustable in Amps①)
	Switch-selectable overload protection (I^2t or I^4t dependent function)	✔	✔
	Setting range of delay time class t_R at I^2t (seconds)	2, 3.5, 5.5, 8, 10, 14, 17, 21, 25, 30	2 ... 30 (step: 0.1s)
	Setting range of delay time t_R at I^4t (seconds)	1, 2, 3, 4, 5	1 ... 5 (step: 0.1s)
	Thermal memor	✔ (via slide switch)	✔ (on/off via key pad or communications)
	Phase loss sensitivity	at t_{sd}=20ms (M)	✔ (on/off via key pad or communications)
N	**N-conductor protection**	✔	✔
	Function can be switched ON/OFF	✔ (via slide switch)	✔ (via key pad or communications)
	N-conductor setting range $I_N = I_n$ x	0.5 ... 1	0.5 ... 2, OFF
S	**Short-time delayed overcurrent protection**	✔	✔
	Function can be switched ON/OFF	✔ (via rotary switch)	✔ (via key pad or communications)
	Setting range $I_{sd} = I_n$ x ...	1.25, 1.5, 2, 2.5, 3, 4, 6, 8, 10, 12	1.25 ... 0.8 x I_{CW} = max (step: 10A)
	Setting range of delay time t_{sd}, fixed (seconds)	0.02 (M), 0.1, 0.2, 0.3, 0.4, OFF	M, 0.08 ... 0.4, OFF (step: 0.001s)
	Switch-selectable short-time delayed short-circuit protection (I^2t dependent function)	✔ (via rotary coding switch)	✔ (via key pad or communications)
	Setting range of delay time t_{sd} at I^2t (seconds)	0.1, 0.2, 0.3, 0.4	0.1 ... 0.4 (step: 0.001s)
	Zone Selective Interlocking (ZSI) function	per CubicleBUS module	per CubicleBUS module
I	**Instantaneous overcurrent protection**	✔	✔
	Function can be switched ON/OFF, Extended Instantaneous Protection is enabled when OFF	✔ (via rotary coding switch)	✔ (via key pad or communications)
	Setting range $I_i = I_n$ x ...	1.5, 2.2, 3, 4, 6, 8, 10, 12 0.8 x I_{CW} = max, OFF = I_{CW} = EIP②	1.5 x I_n ... 0.8 x I_{CS} = max, OFF = I_{CW} = EIP①
G	**Ground fault protection**③	o (field installable module)	o (field installable module)
	Trip and alarm function	✔	✔ (via key pad or communications)
	Detection of the ground fault current by residual summing method	✔	✔
	Detection of the ground fault current by direct summing method	✔	✔
	Setting range of the I_g for trip	A, B, C, D, E (100... 1200A)	A ... E (step: 1A)
	Setting range of the I_g for alarm	A, B, C, D, E (100... 1200A)	A ... E (step: 1A)
	Setting range of the delay time t_g (seconds)	0.1, 0.2, 0.3, 0.4, 0.5	0.1 ... 2.0 (step: 0.001s)
	Switch-selectable ground fault protection (I^2t / fixed)	✔	✔
	Setting range delay time t_g at I^2t	0.1, 0.2, 0.3, 0.4, 0.5	0.1 ... 2.0 (step: 0.001s)
	ZSI ground function	per CubicleBUS module	per CubicleBUS module

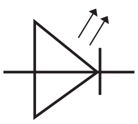
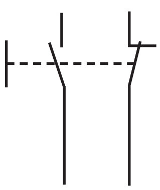
① Note: ETU776 settings via communications: 10A steps for Instantaneous and Short Time pickup, all others 1A steps.
Via ETU Keypad: Below 1000A: 10A steps; 1000A-1600A: 50A steps; 1600A-10000A: 100A steps; Above 10000A, 1000A steps

② Extended Instantaneous Protection (EIP) allows the WL circuit breaker to be applied at the withstand rating of the circuit breaker with minus 0% tolerance; this means there is no instantaneous override at all. EIP further enables the circuit breaker to be applied up to the full instantaneous rating of the circuit breaker in systems where the available fault current exceeds the withstand rating.

✔ available
– not available
o optional

Notes:
M = Motor protection setting indicates phase loss sensitivity is enabled. LT pick-up reduced 80% when phase unbalance > 50%. ST = 20 ms
Communications = Setting the parameters of the trip unit via the Breaker Data Adapter, MODBUS, or PROFIBUS
Key pad = Direct input on the trip unit

Function overview of the electronic trip units

Basic Functions		ETU745	ETU776
Parameter sets			
	Selectable between parameter set A and B	–	✔
LCD			
	LCD, alphanumeric (4-line)	o	–
	LCD, graphic	–	✔
Communication			
	CubicleBUS integrated	✔	✔
	Communication capability via MODBUS or PROFIBUS	✔	✔
Metering function			
	Metering function capability with Metering Function or Metering Function PLUS	✔	✔
Display by LED 			
	Trip unit active	✔	✔
	Alarm	✔	✔
	ETU error	✔	✔
	L trip	✔	✔
	S trip	✔	✔
	I trip	✔	✔
	N trip	✔	✔
	G trip	✔ (only with ground fault module)	✔ (only with ground fault module)
	G alarm	✔ (only with ground fault module)	✔ (only with ground fault module)
	Tripped by extended protection or protective relay function	✔	✔
	Communication	✔	✔
Signal contacts with external CubicleBUS modules (opto or relay) 			
	Overcurrent warning	✔	✔
	Load shedding OFF ON	✔	✔
	Early signal of long- time trip (200ms)	✔	✔
	Temperature alarm	✔	✔
	Phase unbalance	✔	✔
	Instantaneous trip	✔	✔
	Short-time trip	✔	✔
	Long-time trip	✔	✔
	Neutral conductor trip	✔	✔
	Ground fault protection trip	✔ (only with ground fault module)	✔ (only with ground fault module)
	Ground fault alarm	✔ (only with ground fault module)	✔ (only with ground fault module)
	Auxiliary relay	✔	✔
	ETU error	✔	✔

✔ available
– not available
o optional

28 Abbreviations

A	Set current for ground fault protection
A $_{1/2}$	Output information $_{1/2}$ (mutual mechanical interlocking module)
AC	Alternating current
AMP	AMP Incorporated, Harrisburg
ANCE	Association of Standardization and Certification
ANSI	American National Standard Institute
AWG	American Wire Gauge
B	Set current for ground-fault protection
BSS	Breaker Status Sensor
C	Set current for ground-fault protection
CC	Closing coil
COM15	Communication interface
COMM.	Communication
CONNECT	Connected position
CSA	Canadian Standards Association
CUB -	**Cubicle**BUS -
CUB +	**Cubicle**BUS +
D	Set current for ground-fault protection
DC	Direct current
DIN	German Engineering Standard
DISCON	Disconnected position
E	Set current for ground-fault protection
E $_{1/2}$	Input information $_{1/2}$ (mutual mechanical interlocking)
ED	Duty cycle
ESD	Electrostatic-sensitive device
EN	European Standard
ETU	Trip unit (electronic trip unit)
EXTEND.	Extended (additional) protection function
F1	1st shunt trip
F2	2nd shunt trip
F3	Undervoltage release
F4	Undervoltage release with delay time
F5	Tripping coil
F7	Remote reset coil
G-alarm	Ground-fault alarm
G-tripping	Ground-fault tripping
I / O	Input / Output module
I^2t	Delay time-current relationship based on formula I^2t=constant
I^2t_g	Delay time for ground-fault based on formula I^2t_g = constant

I^2t_{sd}	Delay time for S tripping based on formula I^2t_{sd} = constant
I^4t	Delay time-current relationship based on formula I^4t = constant
I-tripping	Instantaneous tripping (short-circuit)
I_{ab}	Operating value for load shedding
I_{an}	Operating value for load restore
I_{cs}	Rated operational short-circuit breaking capacity
I_{cu}	Rated ultimate short-circuit breaking capacity
I_{cw}	Rated short-time withstand current
ID	Identification number
IEC	International Electrotechnical Commission
I_g	Current setting value for G-tripping
I_i	Current setting value for I-tripping
I_{IT}	Single-pole short-circuit test current (IT systems)
I_N	Current setting value for N-tripping
I_n	Rated current (value of Rating Plug)
$I_{n\ max}$	Max. possible rated current
I_R	Current setting value for L-tripping
I_{sd}	Current setting value for S-tripping
L1	Phase 1
L2	Phase 2
L3	Phase 3
L-tripping	Long-time delayed tripping (overload)
LED	Light emitting diode
M	Motor
MOC	Mechanism Operated Auxiliary Conntacts
N	Neutral pole
NC	Normally closed contact
NO	Normally open contact
N-tripping	Neutral (overload) tripping
PIDG	Ring lug style (Trademark of AMP)
PZ 3...6	Crimping tool (Weidmüller GmbH)
$S_{1/2/3}$	Circuit breaker $_{1/2/3}$ (mutual mechanical interlocking module)
S1	Contact position-driven auxiliary switch
S10	Switch Electrical Closed
S11	Motor cut-off switch
S12	Motor disconnect switch
S13	Cut-off switch for remote reset
S14	Cut-off switch for shunt trip F1 (fast operation)
S15	Cut-off switch for closing coil CC (fast operation)
S2	Contact position-driven auxiliary switch
S20	Signaling switch for "ready-to-close"
S22	Signaling switch for 1st shunt trip

S23	Signaling switch for 2nd shunt trip
S24	Bell Alarm signaling switch
S3	Contact position-driven auxiliary switch
S30	Signaling switch for disconnected position (TOC)
S31	Signaling switch for test position (TOC)
S32	Signaling switch for test position (TOC)
S33	Signaling switch for connected position (TOC)
S34	Signaling switch for connected position (TOC)
S35	Signaling switch for connected position (TOC)
S4	Contact position-driven auxiliary switch
S40	**Cubicle**BUS signaling switch for "ready-to-close"
S41	**Cubicle**BUS signaling switch for "closing spring charged"
S43	**Cubicle**BUS signaling switch for 2nd shunt trip
S44	**Cubicle**BUS signaling switch for "main contacts OPEN / CLOSED"
S45	**Cubicle**BUS tripped signaling switch
S46	**Cubicle**BUS signaling switch for connected position
S47	**Cubicle**BUS signaling switch for test position
S48	**Cubicle**BUS signaling switch for disconnected position
S50 ... S53	MOC (external auxiliary switches)
S-tripping	Short-time delayed tripping
SIGUT	Siemens trademark for aux. termination technique
ST	Shunt trip
T.U. ERROR	Trip unit error
TEST	Test position
t_g	Delay time for G-tripping
TOC	Truck operated cell switch (S30 … S35)
t_R	Delay time for L-tripping (defined at 6 x I_R)
TRIP G	Trip cause was ground fault
TRIP I	Trip cause was short-circuit (instantaneous)
TRIP L	Trip cause was overload
TRIP N	Trip cause was neutral pole overload
TRIP S	Trip cause was short-circuit (short-time delayed)
t_{sd}	Delay time for S-tripping
t_x	Delay time for load monitoring
U_c	Rated control voltage
U_e	Rated operational voltage
U_i	Rated insulation voltage
U_{Imp}	Rated impulse withstand voltage
UL	Underwriters Laboratories Inc.
UVR	Undervoltage release (instantaneous)
UVR td	Undervoltage release (delayed)
VT	Voltage transformer

WAGO	WAGO Kontakttechnik, München
X	Terminal designation according to DIN
ZSI	Zone Selective Interlocking
I_{avg}	Present average of current
I_{avglt}	Long term average of current
I_{THD}	Distortion factor of current
U_{THD}	Distortion factor of voltage

29 Glossary

Automatic reset

Circuit breakers feature an automatic reset of the tripping coil. No manual resetting of the Trip Unit is required to
place the circuit breaker in a "Ready-to-close" state. UL 1066 and UL 489 circuit breakers are factory-fitted with this automatic reset feature as standard.
The automatic reset feature can be removed as a customer option.

Auxiliary releases

Both undervoltage releases and shunt trips are available.

BSS module

Breaker Status Sensor - for collecting circuit breaker status information via signaling switches and transmitting these data to the **Cubicle**BUS .

Closing coil

A coil used for electrically closing the circuit breaker.

Closing spring

Module containing a spring as an energy store. The spring is charged by means of a hand-operated lever or a motor, and is latched in its charged state. When the latches are released, the stored energy is transmitted to the pole and the circuit breaker closes.

Coding of auxiliary connectors

The auxiliary connectors are coded to prevent accidental interchanging of the auxiliary wiring connections.

COM modules

Communication modules with access to the circuit breaker:

- Reading and writing parameters
- Reading circuit breaker states/measured values
- Closing and opening the circuit breaker via fieldbus
- Additional functions via floating outputs or inputs
- Implementing breaker-internal **Cubicle**BUS information

Additional functions when a draw-out breaker is used:

- Sensing position of circuit breaker in guide frame

COM15 module

COM15 communication module with access to the circuit breaker via the PROFIBUS DP fieldbus interface.

COM16 module

COM16 communication module with access to the circuit breaker via the Modbus RTU fieldbus interface.

COM35 module

COM35 communication module with access to the circuit breaker via the two fieldbus interfaces PROFINET IO and Modbus TCP.

Additional functions:

- Ethernet switch functionality
- Both protocols are available simultaneously on both ports
- Dynamic Arc Sentry (DAS)
- Firmware update

CubicleBUS

Bus system in the vicinity of the circuit breaker and to the FieldBus (PROFIBUS DP, PROFINET IO, Modbus RTU and Modbus TCP.)

Electrical closing lockout

For electrical interlocking of two or more circuit breakers (closing interlock). The electrical closing lockout can block the circuit breaker from closing via a sustained signal.

Electrical Closed

Electrical activation of the stored energy through the closing coil.

Energy transformer

Power supply for the trip unit.

Guide rail

Used for placing the circuit breaker in the cradle.

Finger clusters

Connect the main terminals of the circuit breaker with the main terminals of the cradle.

Mechanical reclosing lockout and Bell Alarm

After tripping, the circuit breaker cannot be reclosed until the mechanical reclosing lockout has been reset by hand.

Mechanism Operated Auxiliary Contacts (MOC)

A switching module for signaling the circuit breakers switch position, which is mounted in the cradle and activated by the actuating shaft of the circuit breaker.

Motor-operated mechanism

The geared motor charges the closing spring automatically as soon as voltage is applied to the auxiliary connections. After closing, the closing spring is automatically charged for the next closing operation.

Position indicator

To show the circuit breaker position in the cradle.

Powerconfig

Software for commissioning and service, free of charge available at:www.siemens.com/powerconfig-download
powerconfig (from Version 2.2) is used as a shared commissioning and maintenance tool for the circuit breakers with communication capability. It offers a standardized interface and a uniform operator control concept for the activities to be carried out, such as

- Parameterizing
- Operating
- Monitoring, and
- Diagnosing.

powerconfig currently supports German and English. "SENTRON communication handbook" → http://support.automation.siemens.com

Rating Plug

This module defines e.g. the setting range of the overload protection.

Remote reset

The electrical signal of the tripped signaling switch and the red reset button are reset by the optional remote reset coil.

Shunt trip

For remote circuit breaker tripping and locking against closing.

Shutter

Shutters are insulation plates for covering live main circuits in the cradle (shock protection).

Signaling switch for circuit breaker position (TOC)

These auxiliary switches operate according to the circuit breaker position in the cradle (-> Truck-operated contact).

Spring charging lever

The closing spring is charged by several pumping operations.

Tool operation

A cover with a hole (Ø 0,25") means that buttons can only be pressed using a rod.

TOC - Truck operated Cell Switch

For remote signaling of the circuit breaker position in the cradle.

Truck-operated contact (TOC)

A circuit breaker truck-operated auxiliary switch which is mounted in the compartment of a removable circuit breaker and is operated by the circuit breaker frame (-> Signaling switch for breaker position).

Undervoltage release

For remote tripping and interlocking of the circuit breaker. Circuit breaker application in EMERGENCY OPEN circuits together with an EMERGENCY OPEN facility to be arranged separately. The circuit breaker shall not be tripped by short-time voltage drops (e.g. motor start-up).

Undervoltage release (time delayed)

For remote tripping and interlocking of the circuit breaker. The circuit breaker shall not be tripped by voltage drops (e.g. system transfers).

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