

Changes for the Better

MOULDED CASE CIRCUIT BREAKERS,
EARTH LEAKAGE CIRCUIT BREAKERS,
EARTH LEAKAGE RELAYS &
CIRCUIT PROTECTORS

HANDLING AND MAINTENANCE



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1. Items to be practiced without fail for safety

For correct operation, please go over this paper “Items to be practiced without fail for safety” beforehand.

- Essential items to ensure safety are stated here. Be sure to follow the cautionary instructions given below.
- The manufacturers assembling their products using this breaker are requested to convey the requirements stated in this section “Items to be practiced without fail for safety” to the end users.
- The marks used respectively mean the following.

 DANGER	Wrong handling can cause dangerous situation in which possibility of fatal accidents or serious injuries is assumed.
 CAUTION	Wrong handling can cause dangerous situation in which possibility of significant or minor injuries or only impersonal damages is assumed.

	Warning for possible electrification under certain conditions.
	Warning for possible outbreak of a fire under certain conditions.

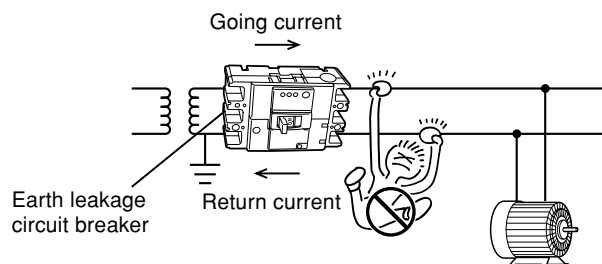
	This means prohibition. Never ignore this indication.
	Be sure to follow these instructions without fail.

1.1 Cautionary instructions for operation

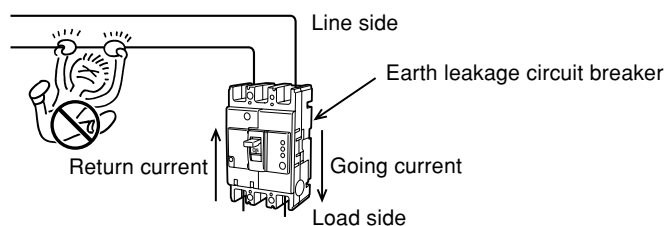
DANGER



- Don't touch the terminal. Electrification can result.
- The earth leakage circuit breaker is so composed to operate when differential current between going and returning reaches certain level, and no leakage is detected in the case as illustrated below. Never touch, therefore, the uncovered charged parts, two places at a time, and the power source side of the earth leakage circuit breaker. The circuit breaker doesn't operate at the electrification.



[When uncovered charged parts are touched at two places]



[When the power source side of the breaker is touched]

⚠ CAUTION



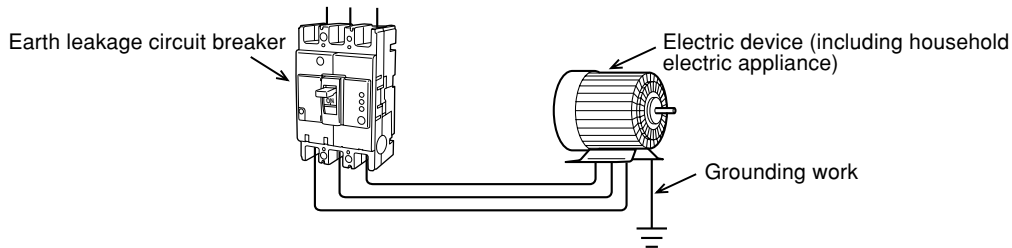
- Layman's work is dangerous. Any electric work must be carried out by a qualified person (electrician).



- When the breaker cuts off automatically, turn it on after eliminating the cause. Otherwise, electrification and fire can result.

If the cause is unknown, please contact us at our service station, branch offices, local offices, or ask an electrician in your country.

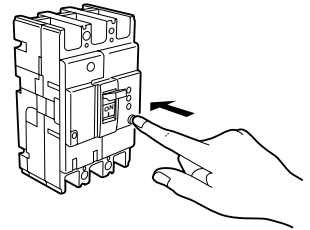
- Be sure to earth all the electrical devices of the circuits in which the earth leakage circuit breaker is used.



- Check operation of the earth leakage circuit breaker once a month or so by pressing the test button.

The breaker is out of order if it isn't turned to "OFF" or "TRIP."

Please get in touch with us at our service stations, branch offices, local offices, or ask an electrician in your country.



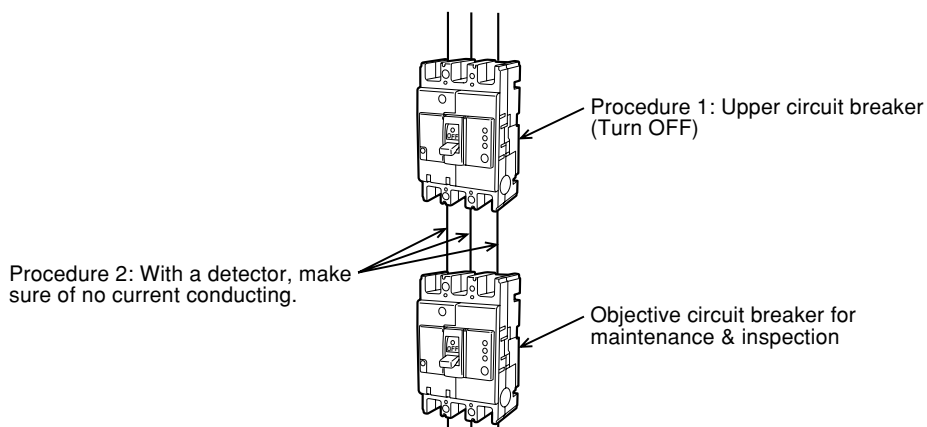
1.2 Cautionary instructions for maintenance & inspection

⚠ CAUTION



- Maintenance and inspection must be practiced by a specialist having electrical knowledge.

- Before maintenance & inspection, turn off the upper circuit breaker and make sure of no current conducting to avoid possible electrification.



- Retighten the terminals regularly according to the inspection manual. Otherwise, fire can take place.

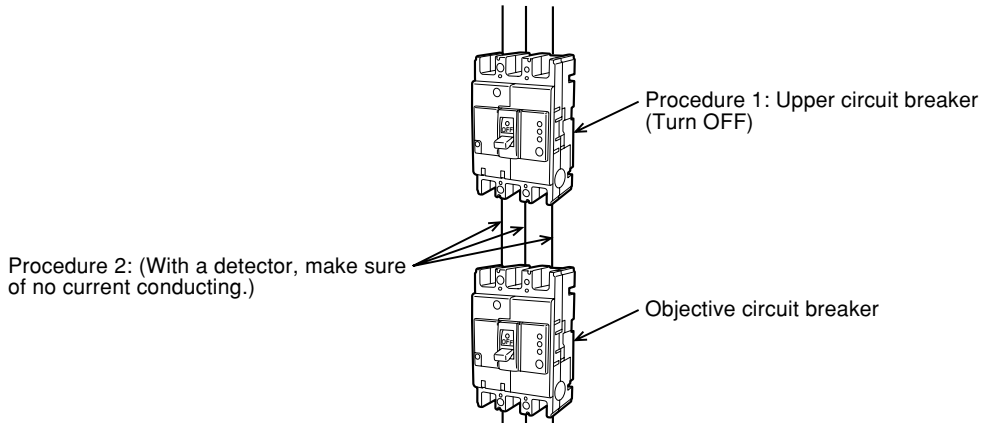
(5.2 Periodical inspection
As for fastening torque, refer to
Appendix 2.)

1.3 Cautionary instructions for work

CAUTION



- Any electric work must be carried out by a qualified person (electrician).
- Before wiring, turn off the upper circuit breaker and make sure of no current conducting. Electrification can result.

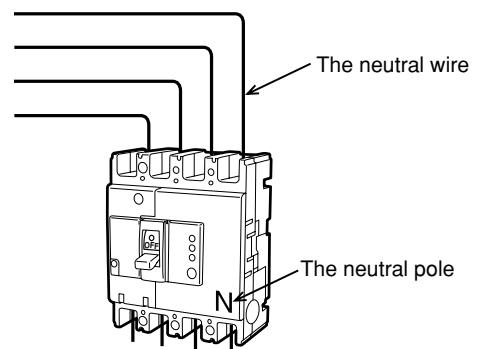
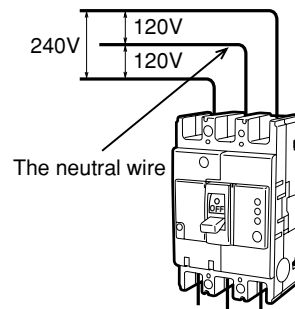


- Earth leakage circuit breaker dedicated to single phase 3-wire and three phase 4-wire types, be sure to connect the neutral wire to the neutral phase. Open phase or overcurrent fails operation and causes fire.

For 1 ϕ , 3-W, connect the neutral wire to neutral pole

When used for single phase, 3-wire type, connect the neutral wire to the neutral pole of the earth leakage circuit breaker.

For 3 ϕ , 4-W, connect the neutral wire to neutral pole



- Connect the earth leakage circuit breaker to the power source suitable for the ratings of the breakers. Connecting to a wrong power can cause malfunction and failure.

⚠ CAUTION



- At wire connection, fasten the terminal screws with the torque stated in the instruction manual. Fastening with incorrect torque can cause fire.

Example of front connection type fastening torque (Others are in Appendix 2.)

Terminal screw	Screw diameter	M5	M6	M8			M12
	Shape						
	Fastening torque N·m	2~3	2.5~4.0	5.0~7.0	8.0~13.0	8.0~13.0	40.0~50.0

Solderless terminal screw	Screw diameter	M6	M10	M16	M18	M20	M24
	Shape						
	Fastening torque N·m	4.0~6.0	3.5~4.5	20.0~30.0	30.0~40.0	30.0~40.0	50.0~60.0

Tightening torque for Solderless terminal

Size of conductor, IEC(mm ²)	Size of conductor, AWG or kcmil(mm ²)	Tightening torque [N·m]	
		NF125-CW NF125-SW NF125-HW	NV125-CW/NV125-SW/NV125-HW NF125-SGW/NF125-HGW/NF250-SGW NF125-RGW/NF250-RGW NF125-RGW/NF250-RGW NF250-RGW/NF250-UGW
2.5	14(2.1)	4	5
4.0	12(3.3)	4	5
6.0	10(5.3)	4	5
10	8(8.4)	4.5	13
16	6(13.3)	5.1	13
25	4(21.2)	5.1	13
35	3(26.7)	6.5	13
–	2(33.6)	6.5	13
50	1(42.4)	6.5	13
–	1/0(53.5)	6.5	13
70	2/0(67.4)	6.5	13
95	3/0(85.0)	–	25.5
–	4/0(107)	–	25.5
120	250(127)	–	25.5
150	300(152)	–	25.5
185	350(177)	–	25.5



- Refrain from installing in abnormal environment such as high temperature, high humidity, high dust content, corrosive gas ambient, or of excessive vibration or impact. Electrification, fire, or operation failure can result.



- Carry out the work avoiding foreign matters such as dust, concrete powder, steel chips, and rain water to enter into the equipment. Otherwise, operation failure can result.

2. Before using

Besides operation, the items in this section are also applicable to work, maintenance and inspection.

2.1 Cautionary instructions in general

DANGER

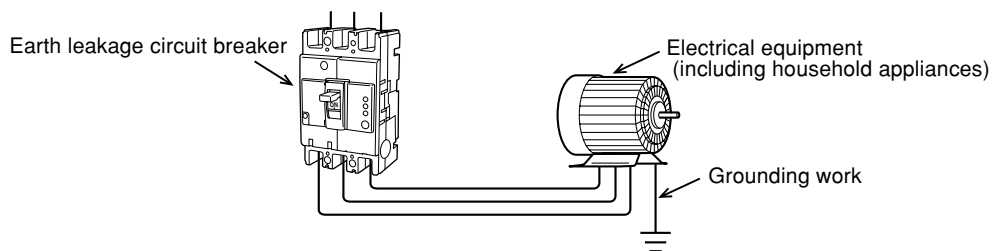


- (1) Refrain from touching the terminal unit as electrification can result.

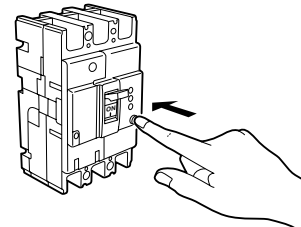
Note: Besides the terminal of the circuit breaker, the terminal unit includes the wires, bus bars, ring-type terminals, and other wiring materials.

CAUTION

- (1) Layman's work is dangerous. Any electrical work must be carried out by a qualified person (electrician).
- (2) Be sure to earth all the electrical devices of the circuits in which the earth leakage circuit breaker is used.



- (3) Check operation of the earth leakage circuit breaker once a month or so by pressing the test button. The breaker is out of order if it isn't turned "OFF" or "TRIP". Please contact us at our service stations, branch offices, local offices, or ask an electrician in your country.



2.2 Operation

2.2.1 Switching operation

Electric power can be turned ON/OFF by moving the handle up/down.

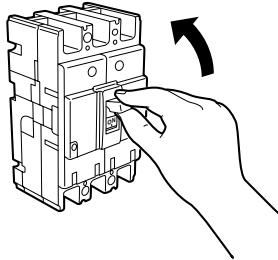
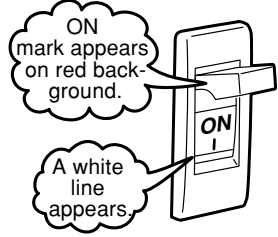
Note 1. Never apply any excessive impact to the handle.

Note 2. When the extension handle is used, fix it firmly with screws. After use, remove the extension handle quickly.

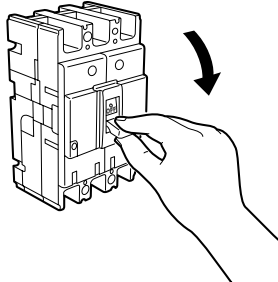
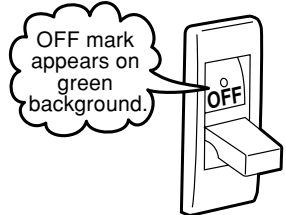
Note 3. ON, OFF operation must operate quickly and correctly. Otherwise it may cause open phase with a few time when operated slowly in case of some types of breakers.

Operating method and condition of the circuit breaker are illustrated below.

① Closing (ON)

	ON operation	ON state indication
Switch on the power (closing)	 <p>Moving the handle upward closes the circuit.</p>	 <p>ON mark appears on red background. A white line appears.</p>

② Opening (OFF)

	OFF operation	OFF state indication
Switch off the power (opening)	 <p>Moving the handle downward opens the circuit.</p>	 <p>OFF mark appears on green background.</p>

2.2.2 Trip and reset operation

(1) For moulded-case circuit breaker

① Tripping

The moulded-case circuit breaker has an overcurrent tripping device which opens the circuit on detecting magnitude of overload current or short-circuit current, and is used for protecting electric wires and other power circuit.

Automatic opening (breaking) of circuits in this way is called “tripping.”

For some products, the circuit breakers can be tripped mechanically from the outside by pressing the trip button provided on the cover.

Press the trip button while the circuit breakers is kept “ON.” When in “OFF” state, tripping is not made in some cases.

There are two kinds of trip indications as shown below.

Type	Trip indication	Re-closing method
Moulded-case circuit breaker in general NF, NFE, MB, BH.		Eliminate the cause of tripping ↓ Reset operation ↓ Re-closing

⚠ CAUTION



At an automatic breaking, eliminate the cause then switch on the breaker. Otherwise fire can be resulted.

If the cause isn't known, contact us at our service stations, branch offices, local offices, or ask an electrician in your country.

② Reset operation

In the case of (1)-(b) of above (1), re-closing is possible by resetting.

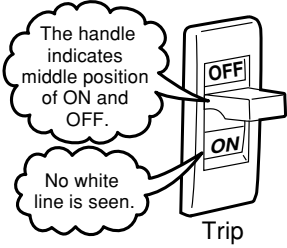
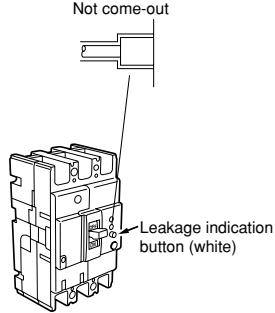
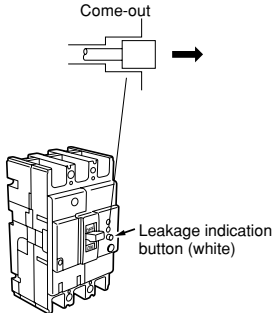
Resetting		Reset check
	Pull down the handle forcefully in OFF direction. 	When hands are released after reset, the handle turns to either mode shown below.
		Turns OFF. (reset completion)
		Returns to trip (not completion) ↓ Repeat resetting once more.

(2) For earth leakage circuit breaker

① Trip

Tripping of earth leakage circuit breaker includes two kinds; leak trip in which magnitude of leakage is detected for automatic tripping (open circuit), and overcurrent trip in which magnitude of overload current or short-circuit current is detected for automatic tripping.

For distinction of two kinds of tripping, the leak indication button comes out at leak trip only. The indication button also comes out when the leak test button is pushed for checking leak current operation.

Type	Handle indication	Leakage indication button	
		Overcurrent trip or tripping by trip button	Leakage trip; tripping by leakage test button
NV, MN			

⚠ CAUTION



When the breaker cuts off automatically, turn ON the handle after eliminating the cause. Otherwise, electrification and fire can take place.

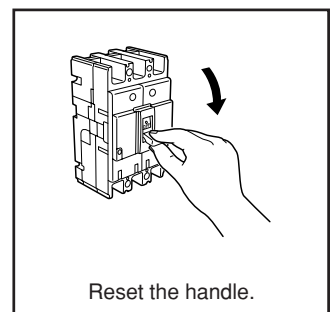


If the cause isn't known, contact us at our service stations, branch offices, local offices, or ask an electrician in your country.

② Reset operation

When the leakage indication button comes out, remove the cause of failure, reset in the following procedure, then close the circuit again.

Type	Handle reset	Leakage indicator reset
NV30-CS~50-CSA	Push down forcefully the handle in OFF direction.	Automatically reset when the handle is turned to ON position.
NV63-CW~600-CW NV32-SW~1200-SB		Automatically reest when the handle is reset.



(3) For earth leakage relay

① Operation

When leakage is detected by the earth leakage relay, contact point output is given, the leakage indicator button comes out, or the leakage indication lamp glows.

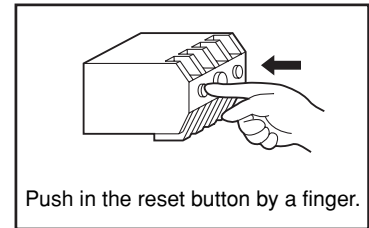
② Reset operation

CAUTION



When the leakage indication button comes out or the leakage indication lamp glows, remove the cause then reset before starting operation again. Otherwise, electrification can result. If the cause isn't known, contact us at our service stations, branch offices, local offices, or ask an electrician in your country.

Type	Handle reset	Leakage indicator reset
NV-ZSA, NV-ZLA	—	Push to the projected reset button for leakage indicator.
NV- ZU, NV-ZBA NV-ZHA	—	Pushing the reset button turns off the leak indication lamp and resets. Turning off the control power also re-sets automatically.



(4) Circuit protector

① Trip

The handle turns off at tripping.

Note: Where an alarm switch is attached, the handle stops between ON and OFF positions.

② Reset

Eliminate the cause of tripping, then close. (Resetting isn't necessary as the circuit protector is reset automatically.)


Note: When an alarm switch is attached, move the handle to OFF side once, then to ON side for reclosing. (The alarm switch of CP30-BA is reset at ON operation.)

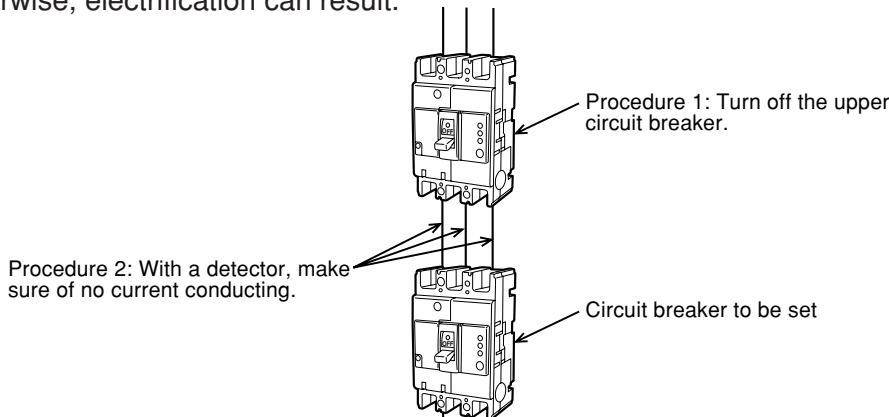
2.3 How to set current rating, trip characteristic, sensitive current and operating time

2.3.1 Cautionary instructions for setting

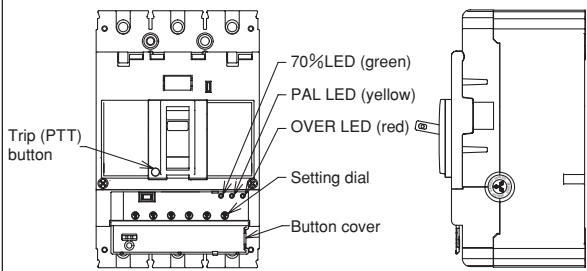
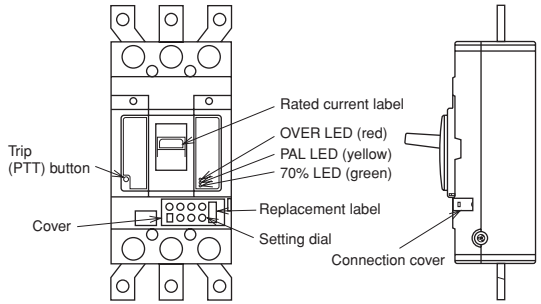
⚠ CAUTION

- Let a person having technical knowledge of electricity set the breaker.
- Before setting, turn off the upper circuit breaker, or turn off the circuit breaker to be set or trip the breaker, then make sure of no current conducting. Otherwise, electrification can result.

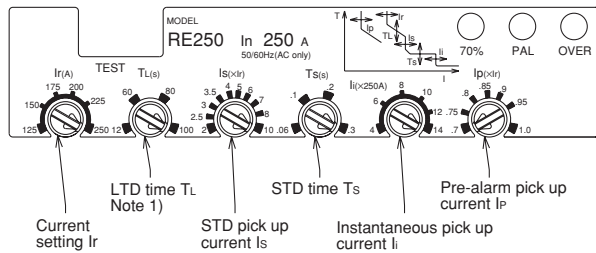




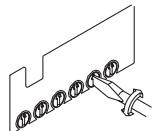
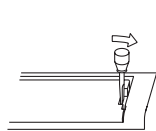
2.3.2 How to set characteristics of molded-case circuit breakers [electronic overcurrent tripping type]

	Group A	Group B
Applicable model	NF125-SGW(RE), NF125-HGW(RE), NF160-SGW(RE) NF160-HGW(RE), NF250-SGW(RE), NF250-HGW(RE)	NF400-SEW, NF400-HEW, NF400-REW, NF400-UEW NF630-SEW, NF630-HEW, NF630-REW, NF800-CEW, NF800-SEW, NF800-HEW, NF800-REW, NF800-UEW NF1000-SEW, NF1250-SEW, NF1600-SEW
Layout of setting dials		

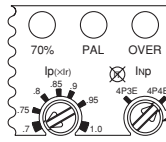
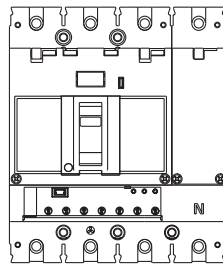
[for Group A]



Step setting type:
 LTD time T_L
 STD pick up current I_s ,
 STD time T_s
 Pre-alarm pick up current I_p
 Continuously adjustable type:
 Current setting I_r
 Instantaneous pick up current I_i



For setting, turn the arrow of each dial to the position desired



Neutral protection I_{NP}

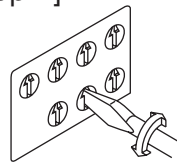
- (1) Open the button cover using a screwdriver as illustrated at left.
- (2) Set operating characteristics by turning the dials.
 For turning the dials for characteristic setting, use a screwdriver as illustrated at left a

- ① A slotted head screwdriver of 3mm width and 0.5mm thickness at the top is suitable for the setting.
- ② At setting, refrain from applying force more than necessary as such can cause broken.
 (Adequate operation torque is 0.02N·m maximum.)
 * As for I_s and I_p setting, a set value may advance to the next one in some cases
- ③ Except for the dials of current setting I_r and instantaneous pick up current I_i keep the arrow of the setting dials within the range of the thick line of setting value.
- ④ On 4P circuit breakers, neutral protection is selected using a 2-position setting:
 4P 3E (neutral unprotected),
 4P 4E (neutral protection at I_r), where I_r is the circuit breaker current setting.

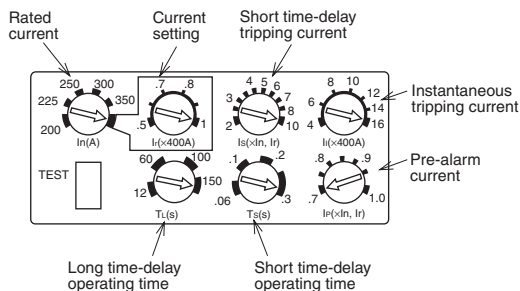
- (3) Close the button cover.

Setting method

[for Group B]

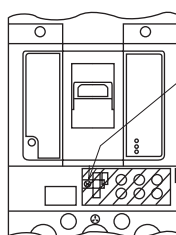


For setting, turn the arrow of each dial to the scale position desired



Step setting type:
 Rated current I_n
 Long time-delay operating time T_L
 Short time-delay tripping current I_s
 Short time-delay operating time T_s
 Pre-alarm current I_p

Continuously adjustable type:
 Current setting I_r (Note 1)
 Instantaneous trip current I_i



Fastening torque
 0.3~0.6N·m

- (1) Open the transparent cover.
- (2) Set tripping characteristics by turning the dials.
 For turning the dials for characteristic setting, use a screwdriver as illustrated at left.

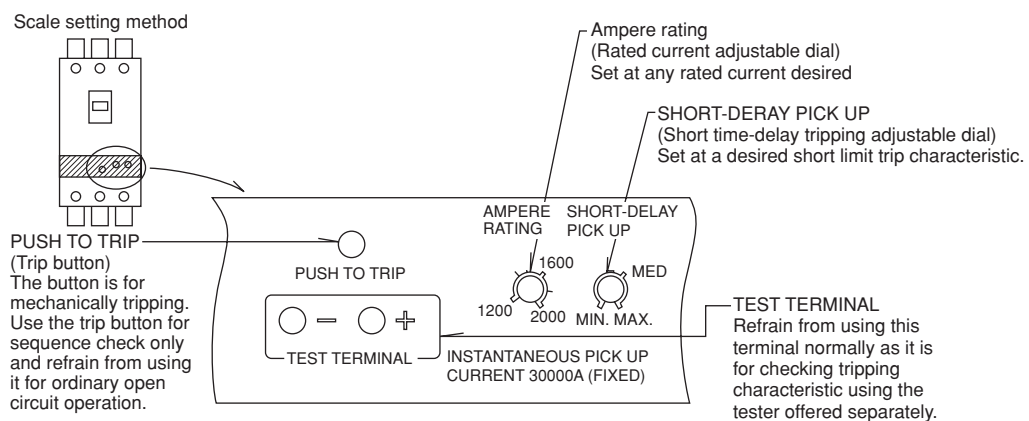
- ① A slotted head screwdriver of 4.5mm width and 0.6 mm thickness at the top is suitable for the setting.
- ② At setting, refrain from applying force more than necessary as such can cause failures.
 (Adequate operation torque is 0.05N·m maximum.)
- ③ Except for the dials of current setting I_r and instantaneous tripping current I_i , keep the arrow of the setting dials within the range of the thick line of setting value.
 Stopping the arrow in the middle may advance the set value to the next one in some cases.
 * As for I_s setting, a set value may advance to the next one in some cases.

- (3) Take the seal of the same value for setting value out of the replacement labels, and stick the label to the top of the handle.
- (4) Close the transparent cover.

2.3.3 How to set characteristics of molded-case circuit breakers [electronic overcurrent tripping type]

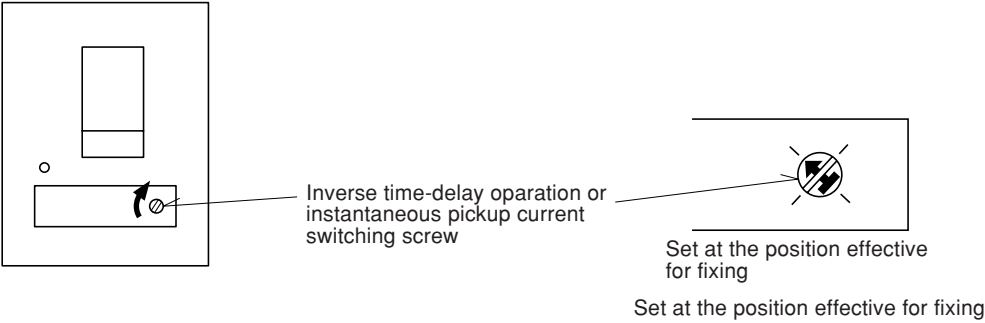
Applicable model	ETR (Electronic trip relay) mounting circuit breaker (NF1250-UR)	
Item	Rated current	Short time-delay tripping characteristic
Layout of setting terminals		
Setting method	<ol style="list-style-type: none"> (1) Take off the seal, loosen the cover set screw and take off the cover. (2) Loosen the rated current switching screw, move it to the position desired for setting by fingers, and tighten it with 0.3 to 0.45 N·m torque. A slotted head screwdriver of 4.5mm width and 0.6mm thickness at the top is suitable for the setting. (3) Take the label and the seal of the same value for setting value out of the replacement labels. (4) Change the rated current label at the top end of the handle. (5) Attach the cover, and stick the seal. 	<ol style="list-style-type: none"> (1) Remove the seal, loosen the cover set screw, and take off the cover. (2) Loosen the short limit pickup current switching screw, move it to the desired setting position by fingers, and tighten it with 0.3 to 0.45 N·m torque. A slotted head screwdriver of 4.5mm width and 0.6mm thickness at the top is suitable for the setting. (3) Take the seal out of the replacement labels. (4) Attach the cover and stick the seal.

2.3.4 How to set characteristics of molded-case circuit breakers [Applicable models: NFE2000-S, NFE3000-S, NFE4000-S]

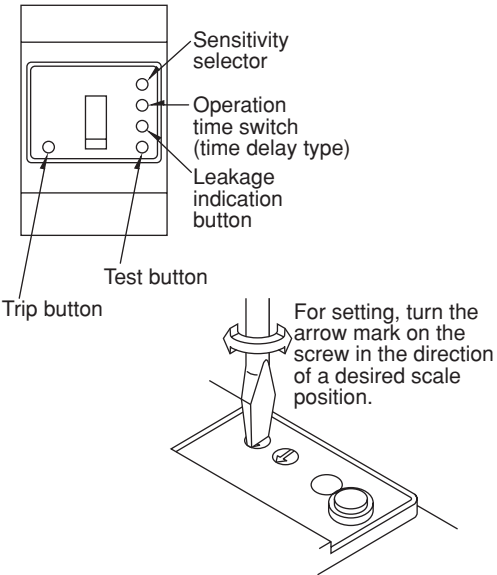
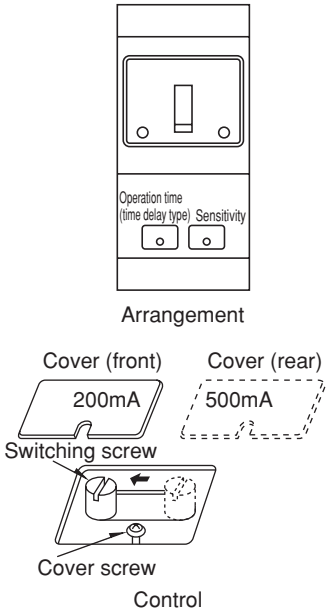


Remarks: For the electronic circuits of circuit breaker, control power is supplied from the built-in current transformer. Accordingly, the breakers can be used with no regard to circuit voltage.

2.3.5 How to set inverse time-delay or instantaneous tripping characteristics of circuit breakers [Adjustable thermal or magnetic type]

Applicable model	Adjustable magnetic type NF125-SGW(RT), NF125-HGW(RT), NF160-SGW(RT), NF160-HGW(RT), NF250-SGW(RT), NF250-HGW(RT), NF630-SW, NF800-SDW, NF1000-SDW, NF1250-SDW, NF1600-SDW, NF2000-S, NF2500-S, NF3200-S, NF4000-S, NV630-SW, NV1000-SB, NV1200-SB, NF-SJW, NF-HJW
Item	Inverse time-delay or instantaneous tripping characteristic
Layout of setting terminals	
Setting method	Inverse time-delay operation or instantaneous pickup current can be adjusted simply by turning the switching screw. For setting current of each notch, please refer to the operation characteristic curve. Note 1. Trip current differs at middle position of the scale. Note 2. Turn the adjust button in arrow direction only. Note 3. A slotted head screwdriver of 1mm thickness at the top is suitable for the setting.

2.3.6 How to switch voltage, sensitivity current and operating time (time delay type) of earth leakage circuit breakers

Applicable model	NV63-CW, NV125-CW, NV250-CW, NV32-SW, NV63-SW, NV125-SW, NV250-SW, NV63-HW, NV125-HW, NV250-HW, NV125-RW, NV250-RW, NV400-CW, NV400-SW, NV630-CW, NV630-SW	NV1000-SB, NV1200-SB
	Multi voltage, sensitivity switching in 3 steps	Dual voltage, sensitivity switching in 2 steps
Setting terminal arrangement		
Voltage selection	Multi voltage types can be used for three circuit voltages as it is.	Dual voltage type can be used for two circuit voltages as it is.
Sensitivity, operating time	<ul style="list-style-type: none"> A slotted head screwdriver of 4.5mm width and 0.6mm thickness at the top is suitable for setting. Stopping between two set values makes sensitivity current or operating time unstable in some cases. Be sure to set at the position of each set value. Refrain from applying unnecessary force at the time of setting. It can cause failure. (Adequate operation torque is 0.05N·m max.) 	<p>The sensitivity selector is attached to the right side of the cover viewed from the front side.</p> <p>To change from 500mA to 200mA, take the procedure state below while referring to the illustration given above.</p> <ol style="list-style-type: none"> Loosen the cover screw and take off the cover. Loosen the switching screw and move it to the left. *Turn 5 to 6 times with a screwdriver suitable for the groove width. Fasten the switching screw. Tighten the screw firmly as the bottom is to be connected electrically. Cover tightening torque: 0.4 to 0.6N·m A slotted head screwdriver of 6mm width and 0.8mm thickness at the top is suitable for setting. Set the cover back in place and fix with the screw. *For the time delay type of the above model, switching procedure of operating time is the same as that of current switching.

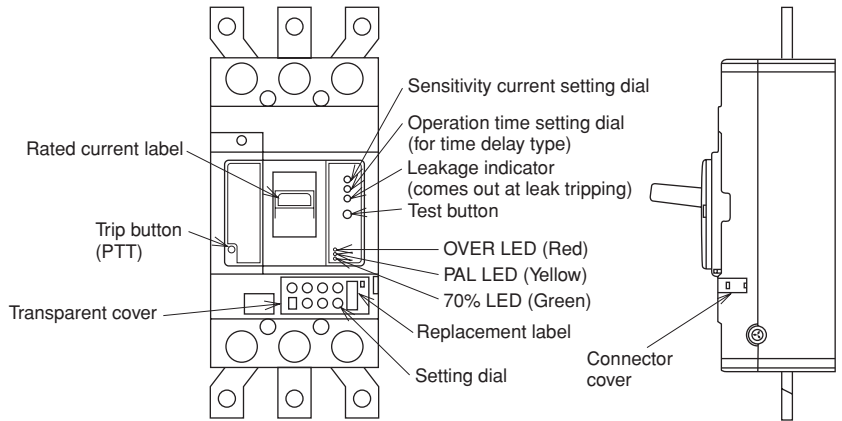
2.3.7 How to change rated current, tripping characteristic and leak tripping characteristic of earth leakage circuit breakers (electronic overcurrent tripping type)

Applicable model	<p>NV100-SEP, NV100-HEP NV250-SEW, NV250-HEW</p>
Setting dial arrangement	
Tripping characteristics setting method	<p>(1) Take off the seal, if stucked. (2) Loosen the cover screw and open the cover. (3) Set tripping characteristics by turning the dials. For turning the dials for characteristic setting, use a screwdriver as illustrated at left.</p> <ol style="list-style-type: none"> A slotted head screwdriver of 3 mm width and 0.5 mm thickness at the top is suitable for the setting At setting, refrain from applying force more than necessary as such can cause failures. (Adequate operation torque is 0.02N·m maximum.) Except for the dials of current setting I_r and instantaneous tripping current I_i, keep the arrow of the setting dials within the range of the thick line of setting value. Stopping the arrow in the middle may advance the set value to the next one in some cases. * As for I_s setting, a set value may advance to the next one in some cases. <p>(4) The blank labels may be used for indication of the current setting I_r. Please fill in the blank label with oily ink, and stick the label to the position under the handle. (5) Close the cover and fasten the screws. (6) Stick the seal, if it is necessary.</p> <p>Step setting type: Long time-delay operating time T_L Short time-delay tripping current I_s Short time-delay operating time T_s Pre-alarm current I_p Continuously adjustable type: Current setting I_r Instantaneous trip current I_i</p> <p>Fastening torque 0.9~1.2N·m</p>
Setting method of leak tripping characteristics (sensitivity current, operation time)	<ul style="list-style-type: none"> For setting sensitivity current and operation time, open the cover in the same procedure as for tripping characteristic setting. A slotted head screwdriver of 4.5mm width and 0.6mm thickness is suitable for the setting. Stopping in the middle of each set values makes sensitivity current or operating time unstable in some cases. Be sure to set exactly at the position of each set value. At setting refrain from applying force more than necessary as such can cause failures. (Adequate operation torque is 0.05N·m maximum.) <p>For setting, turn the arrow of each dial to the scale position desired.</p>

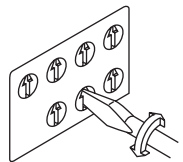
Applicable model

NV400-SEW, NV400-HEW, NV400-REW
 NV630-SEW, NV630-HEW
 NV800-SEW, NV800-HEW

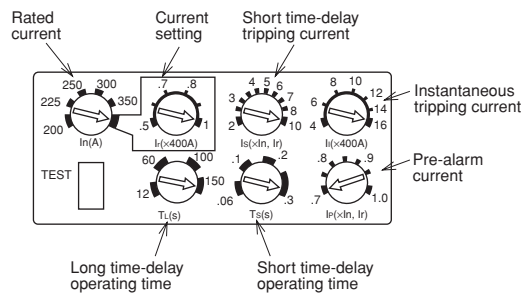
Setting dial arrangement



Tripping characteristics setting method



For setting, turn the arrow of each dial to the scale position desired



Step setting type:

- Rated current I_n
- Long time-delay operating time T_l
- Short time-delay tripping current I_s
- Short time-delay operating time T_s
- Pre-alarm current I_p

Note 1.

Current setting I_r becomes effective when rated current I_n is set as maximum.

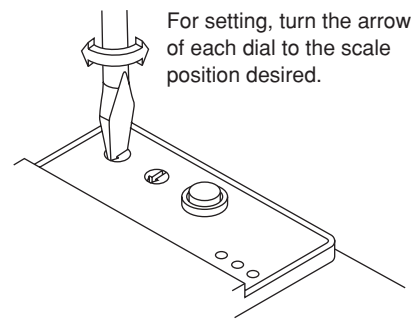
Continuously adjustable type:

- Current setting I_r (Note 1)
- Instantaneous trip current I_i

- (1) Open the transparent cover.
- (2) Set tripping characteristics by turning the dials.
 For turning the dials for characteristic setting, use a screwdriver as illustrated at left.
 - ① A slotted head screwdriver of 4.5mm width and 0.6 mm thickness at the top is suitable for the setting.
 - ② At setting, refrain from applying force more than necessary as such can cause failures. (Adequate operation torque is 0.05N·m maximum.)
 - ③ Except for the dials of current setting I_r and instantaneous tripping current I_i , keep the arrow of the setting dials within the range of the thick line of setting value. Stopping the arrow in the middle may advance the set value to the next one in some cases.
 * As for I_s setting, a set value may advance to the next one in some cases.
- (3) Take the seal of the same value for setting value out of the replacement labels, and stick the label to the top of the handle.
- (4) Close the transparent cover.

Setting method of leak tripping characteristics (sensitivity current, operation time)

- For setting sensitivity current and operation time, open the cover in the same procedure as for tripping characteristic setting.
- A slotted head screwdriver of 4.5mm width and 0.6mm thickness is suitable for the setting.
- Stopping in the middle of each set values makes sensitivity current or operating time unstable in some cases. Be sure to set exactly at the position of each set value.
- At setting refrain from applying force more than necessary as such can cause failures. (Adequate operation torque is 0.05N·m maximum.)



For setting, turn the arrow of each dial to the scale position desired.

2.3.8 How to switch voltage, sensitivity current and operating time of earth-leakage relay

Applicable model	Earth leakage relay		
Switching terminal arrangement	ZBA	ZSA, ZHA, ZLA	ZU
Voltage selection	<ul style="list-style-type: none"> When source voltage is 120V in the above drawing, connect to 4 and 5 terminals. When source voltage is 240V in the above drawing, connect to 4 and 6 terminals. 	<ul style="list-style-type: none"> When source voltage is 240V in the above drawing, connect to 1 and 2 terminals. When source voltage is 415V in the above drawing, connect to 1 and 3 terminals. 	<ul style="list-style-type: none"> When source voltage is 240V in the above drawing, connect to 6 and 7 terminals. When source voltage is 415V in the above drawing, connect to 6 and 8 terminals.
Sensitivity, operation time	<ul style="list-style-type: none"> As lotted head screwdriver of 4.5mm width at the top and 0.6mm thickness is suitable for setting. Stopping between two set values makes sensitivity current or operating time unstable in some cases. Be sure to set at the position of each set value. Refrain from applying unnecessary force at the time of setting. It can cause failure. (Adequate operation torque is 0.05N·m max.) 	<ul style="list-style-type: none"> As lotted head screwdriver of 4.5mm width at the top and 0.6mm thickness is suitable for setting. Stopping between two set values makes sensitivity current or operating time unstable in some cases. Be sure to set at the position of each set value. Refrain from applying unnecessary force at the time of setting. It can cause failure. (Adequate operation torque is 0.05N·m max.) 	<ul style="list-style-type: none"> Turn the change-over switch with a screwdriver to set the arrow at a desired scale position.

3. Installation

3.1 Notice for selection

For selection, refer to the catalog, technical data, specifications and other technical materials.

For any question concerning the selection method, please enquire us.

We are not responsible for any failure and damage caused by wrong selection.

3.2 Normal service conditions

Our circuit breakers of the standard specifications are to be used in the following standard conditions.

- Operating ambient temperature: -10 to 40°C (Average temperature for 24 hours, however, shall not be higher than 35°C .)
- Relative humidity: 85% max. with no dewing
- Altitude: 2,000 m maximum
- Ambient of no excessive water or oil vapour, smoke, dust, salt content, corrosive substance, vibration, and impact

Expected service life (MTTF) under the above conditions is 15 years.

- Lowering ratio of operational current in special ambient temperature over 40°C .
 50°C0.9 times
 60°C0.7 times

Expected service life (MTTF) will be reduced compare with normal service conditions.

CAUTION







- Refrain from installing in any unusual environment of high temperature, high humidity, dust, corrosive gas, vibration and impact. Electrification, fire, and malfunction can result.

Note. The environment shall be free from any dewing or freezing.

3.3 Non-standard conditions

When operated under different conditions from the normal service conditions, it is necessary to take the following measures against the operating conditions.

Even with such measures taken, however, service life may become shorter in some cases.

Special environment		Circuit breaker for special environment	Specifications	Applicable model	
				MCCB	ELCB
Low temperature	 <p>Freezing warehouse, low temperature room</p>	Circuit breaker for low temperature 低温用 LOW TEMP. USE	This breaker is so designed to enable power supply, switching, and short circuit breaking at -40°C. The operating characteristics change at low temperature as they are adjusted for the reference ambient temperature. (For storing, consider the use is possible up to -50°C at the lowest.)	<ul style="list-style-type: none"> 1600 A frame of S-series and lower All models of C-series 	-
High temperature, high humidity	 <p>Chemical plant</p>	Circuit breaker for moisture-fungus treatment 一種熱帯処理 MOISTURE-FUNGUS TREATMENT 二種熱帯処理 MOISTURE-FUNGUS TREATMENT	<ul style="list-style-type: none"> Moisture-fungus treatment of the 1st kind In addition to special surface treatment and special materials, corrosionproof treatment is applied. Moisture-fungus treatment of the 2nd kind Special surface treatment is applied and other electrical performances tend to be lowered. The special surface treatment and the special materials are used to avoid such deterioration. 	<ul style="list-style-type: none"> Moisture-fungus treatment of the 1st kind (Note 2) Front connection, rear connection, and flush plate type of S-series and C-series of 2000A frame and lower. Moisture-fungus treatment of the 2nd kind All models of S- and C- series 	(Note 2) All models of S- and C- series All models of leakage relay (Moisture-fungus treatment of the 2nd kind only)
Corrosive gas, salt content	 <p>Chemical plant, Oil refining plant</p>	Added corrosion resistive circuit breaker 耐食増し CORROSION RESIST	<ul style="list-style-type: none"> In the environment containing much corrosive gas (gas concentration level up to the note *given below), it is advisable to use MCCB of added corrosion resistive specifications. For the breakers of added corrosionproof type, corrosionproof plating is applied to the metal parts. Where concentration of corrosive gas exceeds the level stated below, it is necessary to use MCCB of added corrosion resistive type being enclosed in a waterproof type enclosure or in any enclosure of protective structure. <p>* Concentration of corrosive gas allowed by the Safety and Health Standard: (Ex.) H₂S (10 ppm), HCl (5 ppm), Cl₂ (1 ppm), SO₂ (5 ppm), NH₃ (25 ppm) - (Japan Industrial Health Association, since 1973)</p> <p>Where concentration of corrosive gas is about 1/100 of the noted level and H₂S (0.01 ppm), the standard MCCB can be used. Expected service life (MTTF) will be less than 15 years.</p>	(Note 2) <ul style="list-style-type: none"> Front connection, rear connection, and flush plate type of series S and C of 2000A frame and smaller 	(Note 2) All models of S- and C- series
Dust, vapour	 <p>Cement plant, spinning mill, gravel pit</p>	Enclosed circuit breaker	Enclosed circuit breaker of dustproof (type I) or waterproof (type W) is advisable for places where much dust or vapour is contained. For installing circuit breakers in explosionproof enclosure, use non-ammonia mould product.		

Note 1. SHT and UVT of internal accessories are excluded.

2. Electronic types are excluded.

3.4 Inspection at arrival

- (1) Make sure that the packing case is free from any abnormality such as breaking and wetting.
- (2) Referring to the name plate, make sure that the delivered breaker is in conformity with your order.
- (3) Check for the parts contained in the same package.

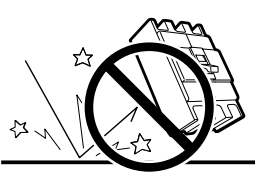
- ① Mounting screws
- ② Terminal screws
- ③ Insulation barriers (The barrier is contained in the same package for some models, but not for other models.)
- ④ Terminal covers (The cover is contained in the same package for some models, but not for others.)

Note: At unpacking, be careful so that the sealing pages may not be scattered around.

3.5 Conditions during transport and storage


3.5.1 Transport

Packing and transportation shall be carried out with care




Never drop the packing.

Don't bring the breaker by holding the flash plate for carrying.



Carrying in this manner is dangerous as the breaker may drop.

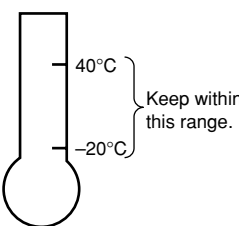
Don't bring the breaker up with holding the wires for carrying.



Holding on the attached lead wires of internal accessories for carrying as unreasonable force is applied to the attached wires.

3.5.2 Storage

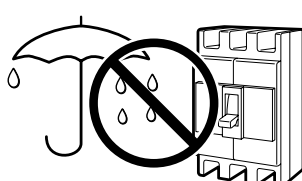
Storage temperature



Keep within this range.

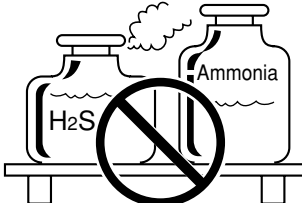
Average temperature for 24 hours, however, shall not be higher than 35°C.

Avoid humid air.
Relative humidity: 85% max.



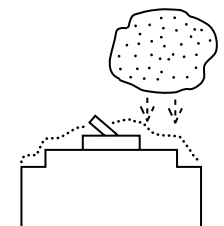
- Don't leave the breaker in a humid place for a long time.
- Keep the breaker so as not be dewed.

Avoid corrosive gas.

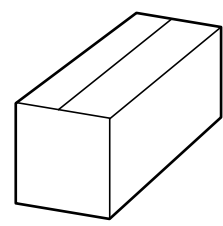


Storage the breaker in the environment of no corrosive gas.
H₂S 0.01 ppm max. SO₂ 0.05 ppm max.
NH₃ 0.25 ppm max.

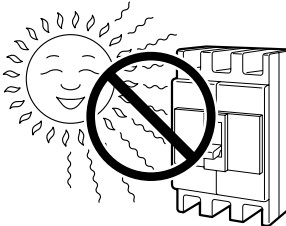
Place of low dust content



Housed in a packing case for storage




Avoid direct sunlight.




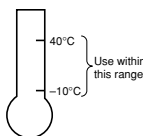
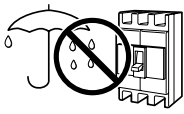
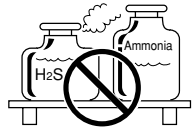
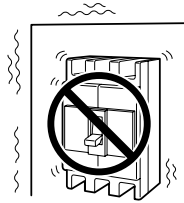
Avoid direct insolation during storage.

3.6 Installation and connection

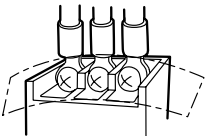
3.6.1 General

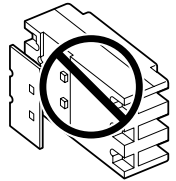
⚠ CAUTION	
	<ul style="list-style-type: none"> • Let a qualified person (electrician) carry out the electrical work. • Before wiring, turn the upper circuit breaker to OFF. Make sure that no power is supplied to prevent that the electrification can occur.

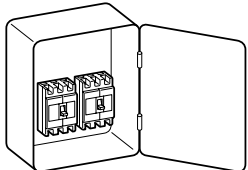
3.6.2 Installation

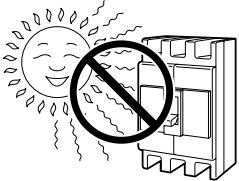
⚠ CAUTION			
<p> Install the breaker in normal environment. In case of any unusual environments such as high temperature, high humidity, dust, corrosive gas, vibration and impact, the fire, the malfunction, and any operation failures can result.</p>			
<p>Operating ambient temperature: -10°C to 40°C</p>  <p>Average temperature for 24 hours, however, shall not be higher than 35°C.</p>	<p>Avoid humid air. Relative humidity 85% max.</p>  <ul style="list-style-type: none"> • Install the breakers in a place of low humidity • Keep the breakers so as not to be dewed. 	<p>Avoid corrosive gas.</p>  <p>Install the breakers in the environment of no corrosive gas. H₂S 0.01 ppm max. SO₂ 0.05 ppm max. NH₃ 0.25 ppm max.</p>	<p>Avoid vibration and impact.</p> 

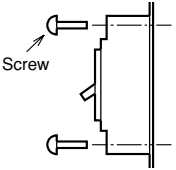
⚠ CAUTION
<p>Use care to avoid rain, drill chips and other chips. Malfunction and operation failure can result.</p>  <p>Avoid direct exposure to rain, oil, dust and powder etc. Pay close attention, in particular, to drill chips made from steel plates and other conductive wastes.</p>


<p>Don't put dust and chips inside through the exhaust port.</p>
<p>Cover the exhaust port with the sheet when under construction.</p>  <p>It is danger of poor electrification and abnormal temperature rise.</p>

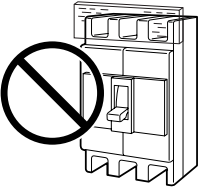
<p>Don't disassemble!</p>
<p>Malfunction and operation failures can result.</p>  <p>Do not remove the compound filled in the threads at the rear surface and the rear cover.</p>

<p>Use in a enclosure.</p>
 <p>Be sure to use the breakers in a casing and never use them being exposed because arc is generated.</p>

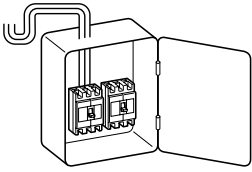
<p>Avoid direct sunlight.</p>
<p>Temperature rise can lead to malfunction.</p> 

<p>Use specified screws only.</p>
<p>Install the breakers to the correct position using the specified screws (length and number of pieces) or the specified fittings.</p> 

<p>Don't block up the exhaust port.</p>
<p>Breaking performance may possibly be lowered.</p> 

<p>Don't put a flammable parts near the breaker.</p>
 <p>It is in danger of fire when breaking the circuit.</p>

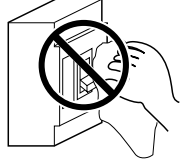
Prevent the ingress of water into the enclosure.



See to it so that rain water isn't allowed to enter into the board along the wires, for example.

Never use thinner, detergent, and other chemicals for cleaning.

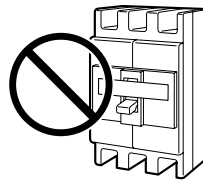
It is likely to make letters on the plate illegible or to lower insulation performance.



Clean the breaker using air cleaner or by brushing.

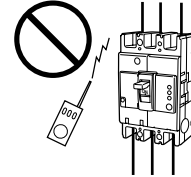
Do not adhere gum tape on the name plate.

The name plate may come off.



Avoid strong electro magnetic field.

When a transceiver is used, keep it off at least 1 meter from installed places of the earth leakage circuit breakers and circuit breakers with electronic over-current release.

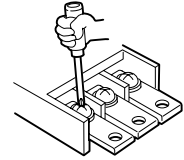


3.6.3 Connection

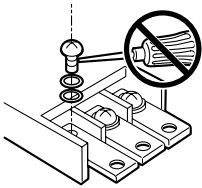
⚠ CAUTION



- At the time of wire connection, tighten the terminals screws with the tightening torque shown in Appendix 4. Otherwise, fire can result.
- Loose fastening leads to overheat and can cause malfunction.
- Excessive fastening injures the screws and breaks the moulded case.
- Use a screwdriver suitable for screw shape.

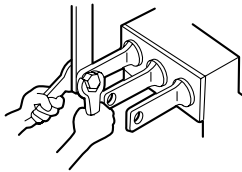


Oil is prohibitive to threads



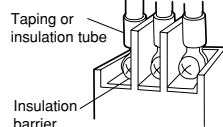
Oiling lowers frictions leading to loose screw. Over tightening causes breakage of the screw.

Don't deform the studs



Fasten the conductors of rear connection type without deforming the stud

Insulate the live and exposed part



When insulation distance isn't enough, or for the live and exposed part of the terminal to prevent short-circuit or ground fault due to metal piece dropping, applying insulation by taping, insulation tube, and insulation barrier. Of 400V and higher systems, in particular, uncovered conducting part is dangerous. Note. The model that a standard packs insulation barrier together is to install insulation barrier.

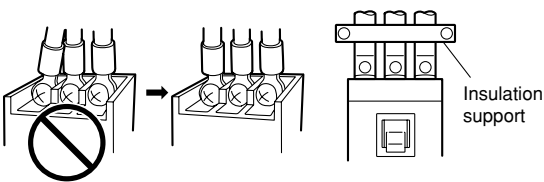
Use the terminal screws packed together.

Long terminal screw makes insulation distance insufficient, while short terminal screw causes insufficient tightening force, which leads to overheat.

Use ring-type terminals of suitable size.

Where a large number of solderless terminals are used for connection, connect them referring to Appendix 4.

Fix the conductors firmly keeping the poles parallel with each other



Attach the connecting conductors so that the poles are kept parallel with each other.

Fix (bundle) the connecting conductors firmly as significant magnetic force is generated according to magnitude of fault current.

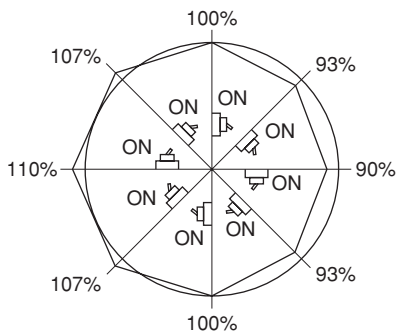
Magnetic force per 1 meter of conductor (In the case of 3-phase short circuit) N

Let-through current r.m.s.kA (pf)	Conductor distance cm	
	10	20
10 (0.4)	500	250
18 (0.3)	1900	950
25 (0.2)	4500	2250
35 (0.2)	8900	4450
42 (0.2)	12800	6400
50 (0.2)	18200	9100
65 (0.2)	30800	15400
85 (0.2)	52600	26300
100 (0.2)	73000	36500
125 (0.2)	114000	57000

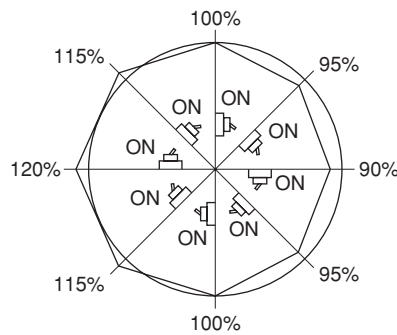
3.6.4 Mounting direction

(1) For the following models, pay attention to attaching position as overcurrent tripping is of fHydraulic-magnetic type and the tripping characteristic varies depending on mounting position. It is recommendable to use them attached vertically.

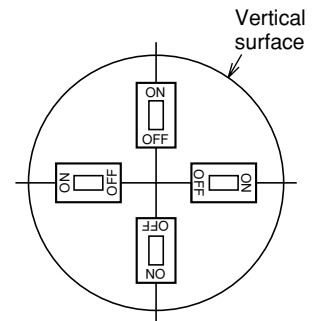
	Type
Moulded-case circuit breaker	NF30-CS, NF50-SS (1P), NF63-CW NF32-SW, NF63-SW, NF63-HW, NF50-SWU
Earth leakage circuit breaker	NV30-CS, NV50-CSA NV63-CW NV32-SW, NV63-SW, NV63-HW
Moulded-case circuit breaker for motor protection	MB30-CS, MB32-SW, MB50-CW, MB50-SW
Circuit protector	CP30-BA, CP-B, CP-S



Rate of change of rated current by mounting angle (For NF, NV, MB)



Rate of change of rated current by mounting angle (For CP)

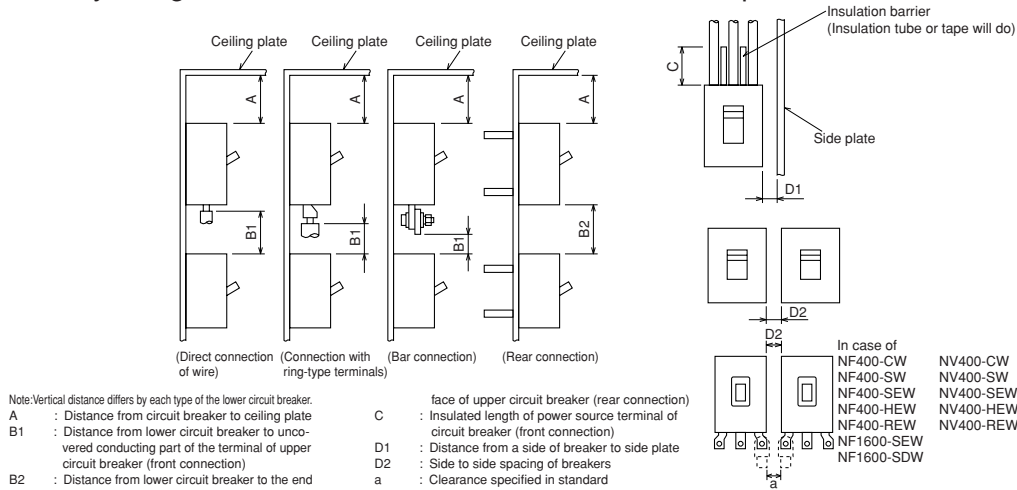


Mounting position which can assure operation characteristic for hydraulic-magnetic type

(2) Thermal-magnetic type and electronic type are not affected by mounting direction.

3.6.5 Distances between circuit breaker and earthed metal parts

When short circuit current is cut off, ionized gas goes out of the exhaust port at the power source side of the circuit breaker. At the power source side of the circuit breaker, provide the insulation distance shown in the table so that the outgoing gas may not be bothered. Short circuit and ground fault can also be resulted by dropped metal pieces, abnormal surge voltage generated in the lines, or by dust, iron chip, and salt content. Insulate uncovered conductors at the power source side of the circuit breaker exactly using insulation barriers, insulation tubes, and tapes.



Insulation distance mm (AC 440V and less)

Distances are obtained tests defined in the IEC 60947-2 standard.

Series	NFB Type name	NV Type name	Ceiling plate		Vertical spacing		C	Horizontal spacing	
			A		B1, B2			D1	D2
			Without terminal cover	With terminal cover	Without terminal cover	With terminal cover			
C · S · MB	NF30-CS, MB30-CS	NV30-CS, NV50-CSA	10	10	10	20	20	Larger than the dimension of exposed conducting part (Note 5) May be put in tight contact (Note 2) (Note 3)	
	NF32-SW, NF63-CW, MB30-SW, MB50-CW	NV63-CW	5	5	5	20	20		
	NF63-SW, NF63-HW, MB50-SW	NV32-SW, NV63-SW, NV63-HW	10	10	10	30	30		
	NF125-CW	NV125-CW	50 (30)	40 (30)	10	50	50		
	NF125-SW, MB100-SW	NV125-SW	50 (10)	30 (10)	10	50	50		
	NF125-HW	NV100-HEP, NV125-HW	50	40	40	80	80		
	NF250-CW	NV250-CW	40	40	40	50	50		
	NF160-SW, NF250-SW, MB225-SW	NV250-SW, NV250-SEW	70 (40)	40	40	70 (50)	50		
	NF160-HW, NF250-HW	NF250-HW, NV250-HEW	80	60	60	80	80		
	NF125-SGW, NF125-HGW, NF160-SGW	—	30	30	30	50	50		
	NF160-HGW, NF250-SGW, NF250-HGW	—	30	30	30	50	50		
	NF400-CW	NV400-CW	60	60	60	60	60		
	NF400-SW, NF400-SEW	NV400-SW, NV400-SEW	70	70	70	70	70		
	NF400-HEW, REW	NV400-HEW, REW	200	200	200	200	200		
	NF630-SW, NF630-SEW, NF630-CW	NV630-CW, NV630-SW, NV630-SEW	70	70	70	70	70		
	NF630-HEW, REW	NV630-HEW	200	200	200	200	200		
	NF800-SEW, NF800-CEW	NV800-SEW	80	80	80	80	80		
	NF800-HEP, REP	NV800-HEW	200	200	200	200	200		
NF1000-SEW, NF1250-SEW, NF1250-SDW, NF1600-SEW, NF1600-SDW, NF2000-S, NF2500-S, NF3200-S, NF4000-S	NV1000-SB, NV1200-SB	100	100	100	100	100			
U	NF125-RGW, NF125-UGW	—	0 (Note 4)	0 (Note 4)	0 (Note 4)	5	25		
	NF250-RGW, NF250-UGW	—							
	—	NV125-RW							
	—	NV250-RW							
	NF400-UEW	—							
BH	NF800-UEW	—	80	80	80	80	80		
	NF1250-UR	—	200	200	200	200	200		
	BH, BH-P, BH-S, BH-PS	—	10	10	10	20	20		
UL	NF50-SWU (AC240V and less)	NV50-SWU (AC240V and less)	10	—	10	30	30		
	NF100-CWU (AC240V and less)	—	50 (30)	—	10	50	50		
	NF100-SWU (AC480Y/277V and less)	NV100-SWU (AC240V and less)	50 (10)	—	10	50	50		
	NF225-CWU (AC240V and less)	NV225-CWU (AC240V and less)	40	—	40	50	50		
	NF-SFW, NF-SJW (AC600Y/480V and less)	—	30	—	30	50	50		
	NF-HJW (AC600Y/480V and less)	—	30	—	30	50	50		

Note 1. The figures in parentheses in the table are the dimensions applied to AC 230 V and lower.

Note 2. Settle D2 dimension so that insulation distance (a according to each standard) can be secured.

Note 3. When NVs at both sides are put in contact and 2500A or higher current flows through NV at one side, the other NV may operate needless motion being affected by the magnetic field. In such a case, set D2 at 50mm or more.

Note 4. The terminal unit at the power side has no exhaust port and is so composed to discharge no arc requiring no insulation distance (space) to the power side. When an earth metal is put in contact with the terminal unit, however, uncovered part of the terminal or the wire must be insulated exactly using terminal covers, insulation barriers, tubes, and tapes to secure insulation distance (space) to the earth metal (the distance specified in board specifications etc.).

Note 5. Where surface type uncovered bars are used for connection, insulate by taping to the point where the bars overlap with the insulation barrier or to the root of the circuit breaker.

Note 6. In case of over AC440V, the distance is 10mm.

3.6.6 Current-carrying capacity and operating temperature

(1) Operating current vs. ambient temperature

Rated current of circuit breakers is adjusted for the rated ambient temperature. This is because circuit breakers are often installed in a casing as a switchboard or a control board, and temperature of the installed place of the breaker becomes higher than ambient temperature of the wires. If temperature of the installation site of circuit breakers greatly differ from the rated ambient temperature, it is necessary to correct rated current according to the temperature correction curve (shown in the Paragraph of characteristics and outside shape in the catalog). Load current can be increased up to the rated current corrected according to ambient temperature.

However, set current rating with enough allowance while taking fluctuation of power voltage and load current into consideration so that maximum operating current may not exceed the rated current.

① Cautionary instructions for using heat resistive wire

For using insulated wires of higher heat resistance than that of 600 V PVC insulated wire (allowable temperature 60°C), it is necessary to take the following points into consideration.

For circuit breakers, size of test wire is stipulated by each test current in IEC60947-1

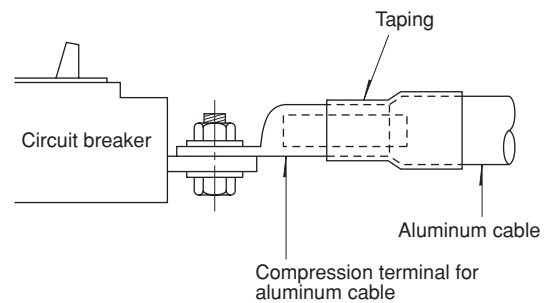
If size of connection wire is thinner than the test wire size, temperature of the breaker terminals increases and overcurrent tripping operation characteristic may change in some cases. (Operating time becomes shorter usually.) At motor load, for example, influence of change in operation characteristic by difference in size of connection wire is insignificant and can be disregarded because the load current is far lower than the rated current of the circuit breaker.

Size of test wire

Range of test current (A)	Conductor size (mm ²)
0 < ≤ 8	1.0
8 < ≤ 12	1.5
12 < ≤ 15	2.5
15 < ≤ 20	2.5
20 < ≤ 25	4.0
25 < ≤ 32	6.0
32 < ≤ 50	10
50 < ≤ 65	16
65 < ≤ 85	25
85 < ≤ 100	35
100 < ≤ 115	35
115 < ≤ 130	50
130 < ≤ 115	50
150 < ≤ 175	70
175 < ≤ 200	95
200 < ≤ 225	95
225 < ≤ 250	120
250 < ≤ 275	150
275 < ≤ 300	185
300 < ≤ 350	185
350 < ≤ 400	240

② Connection of aluminum conductors

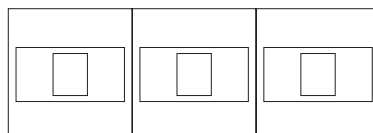
- When aluminum conductors are connected, be careful to prevent the contact resistance (due to the oxidized film of aluminum) from being increased.
- The surface of the connection point of the aluminum conductors shall be properly treated by plating (zinc displacement-Copper-Silver) or by joint compound. If the treatment is done only by joint compound, reliability is low, this should be limited to when plating is impossible (eg. at site).
- For aluminum cables, use compression terminals that are exclusively for aluminum cables.
- The compression portion of the terminal shall be provided with taping, and the aluminum wire shall not be exposed to the atmosphere.



(2) Maximum operating current of installation without clearance between breakers

In case of installation without clearance between breakers, because malfunction failures can result by heat of breaker, use the operating current not to exceed the below value.

Type name of breaker	Maximum operating current
BH BH-P BH-S BH-PS CP30-BA CP-B CP-S NF30-CS MB30-CS NV30-CS NV50-CSA MB30-CS NF32-SW NF63-CW MB30-SW NV63-SW NV63-CW MB50-SW NF63-SW NF63-HW NV63-SW NV63-HW MB50-SW NF125-CW NV125-CW NF125-SW NF125-SGW MB100-SW NV125-SW NV100-SEP NF125-HW NF125-HGW NV125-HW NV100-HEP NF160-SGW NF160-HGW NF250-CW NV250-CW NF250-SW NF250-SGW MB225-SW NV250-SW NV250-SEW NF250-HW NF250-HGW NV250-HW NV250-HEW	80% of rated current
NF400-CW NF400-SW NF400-SEW NF400-HEW NV400-CW NV400-SW NV400-SEW NV400-HEW NF400-REW NF400-UEW NV400-REW NF630-CW NF630-SW NF630-SEW NF630-HEW NV630-CW NV630-SW NV630-SEW NV630-HEW NF630-REW NF800-CEW NF800-SDW NF800-SEW NF800-HEW NV800-SEW NV800-HEW NF800-REW NF800-UEW	90% of rated current



3.6.7 Breaker arrangements

(1) Connection of no-fuse breaker

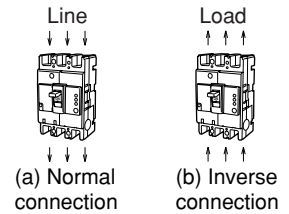
① Inverse connection

The illustration (a) is the standard connecting arrangement of line and load of the breaker terminals.

Except for the models which accept inverse connection, connection of (b) may lower breaking performance and inverse connection isn't advisable.

CAUTION

When connected inversely, indication shall be made for line side and load side.



Models which accept inverse connection	Except for breaker with MDU	BH	BH-P	BH-S	BH-PS	CP30-BA	
		NF32-SW	NF63-CW	NF63-SW	NF63-HW	NF125-CW	NF125-SW
		NF125-SGW	NF125-HW	NF125-HGW	NF125-RGW	NF125-UGW	NF160-SW
		NF160-SGW	NF160-HW	NF160-HGW	NF250-CW	NF250-SW	NF250-SGW
		NF250-HW	NF250-HGW	NF250-RGW	NF250-UGW		
		MB30-SW	MB50-CW	MB50-SW	MB100-SW	MB225-SW	
		NF400-CW	NF400-SW	NF400-SEW	NF400-HEW	NF400-REW	NF400-UEW
		NF630-CW	NF630-SW	NF630-SEW	NF630-HEW	NF630-REW	
		NF800-CEW	NF800-SDW	NF800-SEW	NF800-HEW	NF800-REW	NF800-UEW
		NF1000-SEW	NF1000-SDW	NF1250-SEW	NF1250-SDW	NF1600-SEW	
		NF1600-SDW	NF2000-S	NF2500-S	NF3200-S	NF4000-S	
		NV400-CW	NV400-SW	NV400-SEW	NV400-HEW	NV400-REW	
		NV630-CW	NV630-SW	NV630-SEW	NV630-HEW	NV630-REW	NV800-HEW
		DSN63-CW	DSN125-CW	DSN250-CW	DSN30-SW	DSN50-SW	
DSN63-SW	DSN125-SW	DSN250-SW	DSN400-CW	DSN630-CW	DSN800-CW		
DSN400-SW	DSN630-SW	DSN800-SW	DSN1000-SEW	DSN1250-SW	DSN1600-SW		
DSN2000-S	DSN2500-S	DSN3200-S	DSN4000-S				

② Electronic circuit breaker

CAUTION

When 3-pole circuit breakers are used for single phase 2-wire lines, connect correctly in the manner illustrated below. Otherwise, overcurrent fails operation and causes fire.

Correct method of connection

Connection method of A

Connection method of B

Connection method of C

(a) Connection method of A
This connection may be acceptable only when carrying out the temperature-rise test in the acceptance test. Please never use this connection in any actual applications.

(b) Connection method of B or C
Please never use this connection in any actual use. Since the temperature-rise of the internal electronic circuit and the breaking performance are not guaranteed.

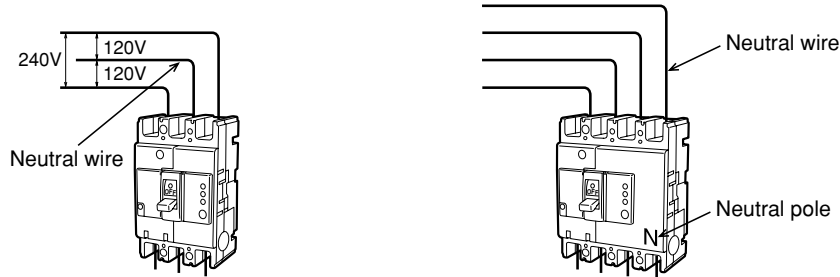
(2) Connection of earth leakage circuit breaker

⚠ CAUTION

- ① Connect to a power source suitable for the rating of the circuit breaker. Otherwise, malfunction and failure can result.
Application of overvoltage outside the applicable voltage range can cause burning as the earth leakage circuit breaker incorporates electronic circuits.
Application of lower voltage than the applicable voltage range also fails operation.

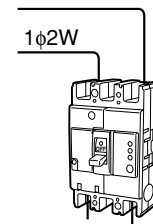


- ② Where a circuit breaker is used for 1 phase 3 wire system and 3 phase 4 wire system, be sure to connect the neutral wire to the neutral pole of the circuit breaker. Otherwise, operation fails at overcurrent.



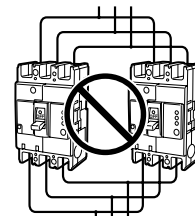
(a) For single phase two wire system, refrain from using neutral pole.

Where a 3-pole earth leakage circuit breaker is used for single phase 2 wire system, connect to the right and left poles of the circuit breaker. Using the neutral pole fails operation as the control power for the operation is supplied through the left and right poles.



(b) Don't connect in parallel.

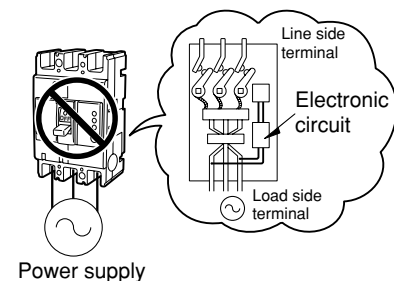
Refrain from parallel connection as unnecessary operation takes place because of loop circuit formed or the leak tripping unit is burnt in some cases. Also refrain from parallel connection of the earth leakage circuit breaker with a moulded use circuit breaker.



(c) Don't connect in reverse.

The electronic circuit of ELCB as standard are short time rating. If used by reverse connection, the electronic circuit have damaged by continuous voltage of after tripping. Therefore must not use reverse connection.

The following types are possible to using by reverse connection.



Types	Applicable voltage
NV32-SW, NV63-CW, NV63-SW NV125-CW, NV125-SW, NV250-CW, NV250-SW	AC230V
NV400-CW, NV400-SW, NV400-SEW, NV400-HEW NV400-REW, NV630-CW, NV630-SW, NV630-SEW NV630-HEW, NV800-SEW, NV800-HEW	AC230-400-440V

Note 1. Measuring display unit (MDU) breakers are not available.

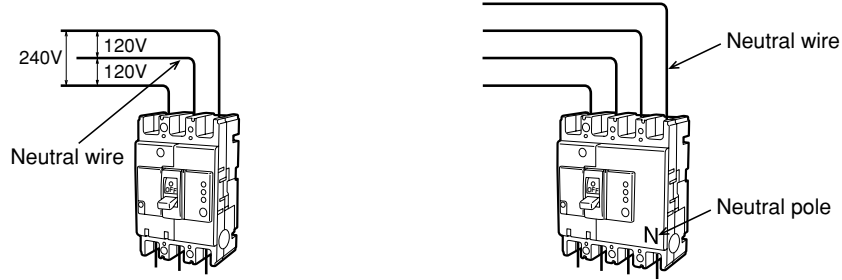
(3) Connection of Molded-case circuit breaker with earth leakage current

! CAUTION

- ① Connect to a power source suitable for the rating of the circuit breaker. Otherwise, malfunction and failure can result.
 Application of overvoltage outside the applicable voltage range can cause burning as the earth leakage circuit breaker incorporates electronic circuits.
 Application of lower voltage than the applicable voltage range also fails operation.

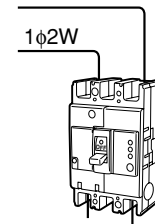


- ② Where a circuit breaker is used for 1 phase 3 wire system and 3 phase 4 wire system, be sure to connect the neutral wire to the neutral pole of the circuit breaker. Otherwise, operation fails at overcurrent.



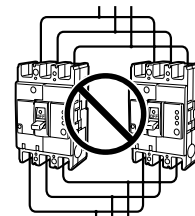
(a) For single phase two wire system, refrain from using neutral pole.

Where a 3-pole earth leakage circuit breaker is used for single phase 2 wire system, connect to the right and left poles of the circuit breaker. Using the neutral pole fails operation as the control power for the operation is supplied through the left and right poles.



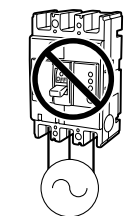
(b) Don't connect in parallel.

Refrain from parallel connection as unnecessary operation takes place because of loop circuit formed or the leak tripping unit is burnt in some cases. Also refrain from parallel connection of the earth leakage circuit breaker with a moulded use circuit breaker.



(c) Don't connect in reverse.

Reverse connection should not be used.



Power supply

(4) Connection of MDU breaker

① Connections and installation

⚠ CAUTION

- Do not connect in reverse about line side and load side.
- Do not pull the cable which connects MDU and the circuit breaker over 15N. The cable may come off.
- When the trouble occurred, repair is performed pairing MDU and the circuit breaker.
- The cable which connects MDU and the circuit breaker, shall be kept the distance longer than 10cm from the heavy current circuit. Fix the cable tightly near the connector to avoid the stress to the connector.
- The connector from the circuit breaker is insulated from inside of the circuit breaker.
The breaker usually works even if the cable is not connected with MDU.
But connect the cable early and correctly, because it may become cause of missing measuring.
- Supply the control power to L1 and L2 of MDU terminal. Fuses or MCCB shall be installed in control power circuit.
Do not supply the control power of MDU from the main circuit.
- For function of alarm LED (PAL, OVER) on MDU and contact output (PAL, OAL), MDU and the circuit breaker must be connected with the mutuality and the control power must be supplied to MDU and alarm contact output module.
- When MDU is used in 1 phase 2 wire, the connection is shown in figure 1.
The load side of phase No.1 is live part. It needs insulation processing.
Use the measurement data of I2, I3 and V2-3 Ignore the measurement data of I1, V1-3 and V3-1.
- When MDU is used in 1 phase 3 wire, the connection is shown in figure 2.
The neutral wire connects to phase No.2 of MDU.
If connect the neutral wire to phase No.1 or phase No.3 of MDU, then the measurement is not guaranteed.

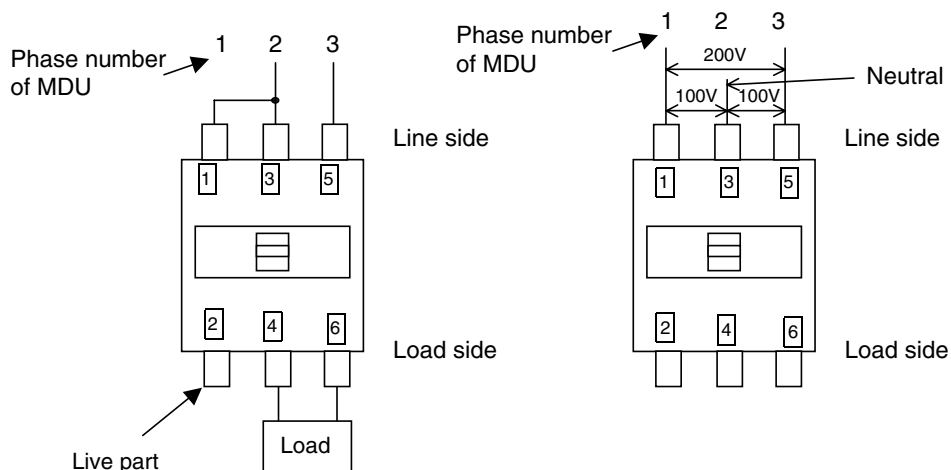


Fig1. Connection of using in 1 phase 2wire. Fig2. Connection of using in 1 phase 3wire.

- Please note that three pole breaker with MDU cannot be used in three phase four line system.
When three pole breaker with MDU is used for three phase four line system, it becomes as shown in the table below.

Measuring items	Status	Reason
Load current	○ Voltage phases × N phase	It is not possible to measure it because current transformer is not in N phase.
Line voltage	○ Voltage phases one another × Voltage phases to N phase	It is not possible to measure it because voltage transformer is not in N phase.
Harmonics current	○ Voltage phases × N phase	It is not possible to measure it because current transformer is not in N phase.
Electric power	×	It is not added in N phase to measure, because current transformer and voltage transformer are not in N phase.
Electric energy	×	It is not added in N phase to measure, because current transformer and voltage transformer are not in N phase.
Power factor	×	It is not added in N phase to measure, because current transformer and voltage transformer are not in N phase.

⚠ CAUTION

- The size of wiring MDU is shown as below.

	Single core	Twisted core
In case of single connection	0.45-1.2mm ²	0.14-1.5mm ²
In case of double connection	0.45-0.8mm ²	0.14-75mm ²

- Tighten the terminal screws with following tightening torque.

Tightening torque	0.5 - 0.6 N·m
Tool minus head screw driver	Bit size Thickness 0.6mm Width 3.5mm
Wire strip length	7mm

- The finish of the wire

In case of single core wire, it can be connected directly to the terminals.

In case of twisted core wire, strip the insulation and twist copper wires. Then it can be connected directly to the terminals. Takes care the short circuit by wiring. The solder plating is not allowed.

Following compression pin terminal is recommended.

Manufacturer : Phenix contact

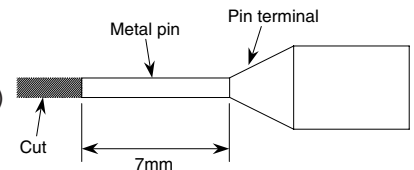
Cross section of wiring 0.25mm²:AI 0.25-6 YE (Catalog NO. 3200179)

Cross section of wiring 0.5mm²:AI 0.5-6 WH(Catalog NO.3200687)

Terminal for 2 wires 0.5mm² × 2:AI-TWIN 2 × 0.5-8 WH(Catalog NO.3200933)

Please contact to the manufacturer as for further details.

However the length of pin terminal (compression) is longer than 7mm, cut the metal pin as follows.



[Note of MDU with electric energy accumulated pulse output option]

⚠ CAUTION

- Output line shall be kept the distance longer than 10cm from the heavy current circuit. And maximum wiring distance is less than and including 100m.
- In the case of pulse output connects to the AC, please pay attention to malfunction of receiver by leakage current by earth capacitance or mutual capacitance between wires.

[Note of MDU with CC-Link option]

⚠ CAUTION

- Make sure to connect DA, DB, DG and SLD terminals on MDU to CC-Link line with shielded twisted pair cable. When the lived wires are connected to CC-Link terminals, by mistake, it may occur electric shock or fire. Because CC-Link terminals use only low voltage signals.
- The shielded twisted pair cable of CC-Link line shall be kept the distance longer than 10cm from the heavy current circuit. However, it shall be kept the distance longer than 30cm from the heavy current circuit when parallel installation with the heavy current circuit is required.
- The hole cutout of the panel board cannot be done with CC-Link for the breaker-mounting of MDU installation. If the hole cutout is done to the panel board, the space in the CC-Link cable wiring makes an useless hole space.

Installation in the panel board (EMC directive)

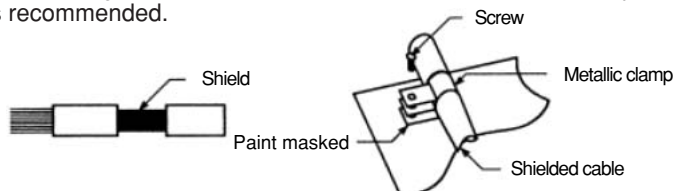
- Following EMC tests are required with IEC60947-2,
 - (i) Radiated radio frequency emission.
 - (ii) Radiated radio frequency electromagnetic field immunity.
- MDU shall be installed in the panel board. It effects not only for safe against electric shock but also to interrupt noise emission from MDU is confirmed in accordance with following conditions.

Condition 1: (Power distribution board, control panel board)

- (i) Power distribution board or control panel board shall be made of conductive materials.
- (ii) Electrical contact impedance of screwed area between top/bottom plates and enclosure shall be as low as possible with paint removing.
- (iii) Internal plate of power distribution board or control panel board shall be also paint removed to reduce the electrical contact impedance around screwed area.
- (iv) Power distribution board or control panel board shall be grounded to the earth with a large cable.

Condition 2: (Power line and grounded line)

- (i) Connect FG terminal of MDU to PE terminal of MDU (panel) holder plate.
Make the earthing point (to be grounded to the earth) near MDU.
PE terminal shall be grounded to this point with as short wire as possible.
PE terminal effects to reduce the noise of MDU and to shut down the external noise.
The grounded wire impedance shall be low.
- (ii) Shielded cable earthing
 - (a) When CC-Link cable or power supply cable of MDU are wired from the panel board, use the shielded cable and ground to the earth near the way out.
Secure earthing reduces electromagnetic induction and high frequency noise.
 - (b) Remove the paint around grounded area to reduce the electrical contact impedance.
Metallic clamp is recommended.



• For further details, please read “MELSEC CPU user’s manual” regarding to the wire and cable connection method to PLC.

② Measurement of insulation resistance and withstand voltage test

CAUTION

- Voltage transformers are connected between the poles on the load side of the circuit breaker.
 - (i) Measurement of insulation resistance
A 1000 volt insulation resistance tester cannot be used with Δ marks in the table as below.
A 500 volt insulation resistance tester shall be used, but measured resistance shows low resistance.
 - (ii) Withstand voltage test
Voltage shall not be applied at the portions with X marks in the table as below.
- The voltage between each terminal must not become DC5V or more when you do the cable check etc. of DA, DB, DG, SLD, and the terminal FG for the CC-Link. It is likely to break down.

Measuring point/test		Measurement of Insulation resistance		Withstand voltage test		Test condition	
		ON	OFF	ON	OFF		
State of handle		ON	OFF	ON	OFF		
Between live part and earth (except MDU terminal)		○	○	○	○	AC2500V 1min (In the case of these tests, Do not connect MDU terminal to live part or earth)	
Between different poles	Line side	Between left and middle poles	Δ	○	×		○
		Between middle and right poles	Δ	○	×		○
	Load side	Between left and right poles	Δ	○	×		○
		Between middle and neutral poles	Δ	○	×		○
Between line and load terminal		—	○	—	○		
Between main circuit and MDU terminal (L1, L2)		○	○	○	○		AC2500V 1min (Note1.)
Between main circuit and MDU terminal (113, 114, FG) (With electric energy accumulated pulse output option)		○	○	○	○		
Between main circuit and MDU terminal (DA, DB, DG, SLD, FG) (With CC-Link option)		○	○	○	○		
Between MDU terminal (L1, L2) and MDU terminal (FG)		○	○	○	○	AC1500V 1min (Note2.)	
Between MDU terminal (L1, L2) and MDU terminal (113, 114, FG) (With electric energy accumulated pulse output option)		○	○	○	○		
Between MDU terminal (L1, L2) and MDU terminal (DA, DB, DG, SLD, FG) (With CC-Link option)(Note3.)(Note4.)		○	○	○	○		

Note1. Connect MDU terminal (L1, L2, 113, 114, DA, DB, DG, SLD and FG) to the earth side.

Note2. Connect MDU terminal (113, 114, DA, DB, DG, SLD and FG) to the earth side.

Note3. Do not test between MDU terminal (DA, DB, DG and SLD) and MDU terminal (FG).

Note4. Connect each MDU terminals (DA, DB, DG, SLD, FG) before you start the test.

3.6.8 Instruction for connections

⚠ CAUTION

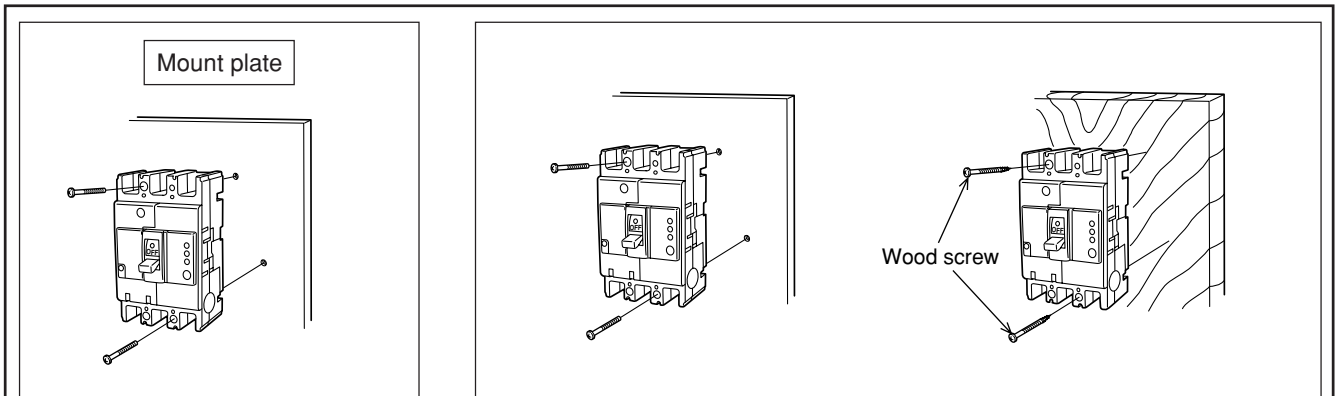
Use the applicable connection parts for breaker.

Otherwise it may result in fire.

(1) Front connection

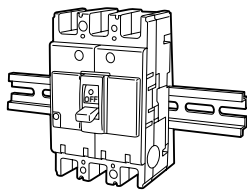
① Mounting

Mount directly using the mount hole.



- Mount screws for steel plate and for wood plate (a part of NV models) are attached. For dimension, refer to Appendix 1.
- Note) In some cities, mounting onto wood board is limited by fire defense code and others.

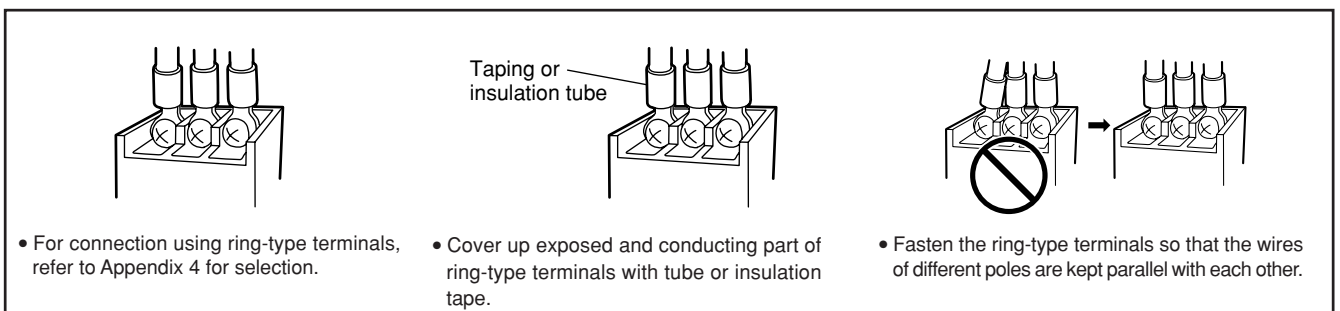
Mounting on IEC rail



- Fix by attaching a slip stopper.

② Connection

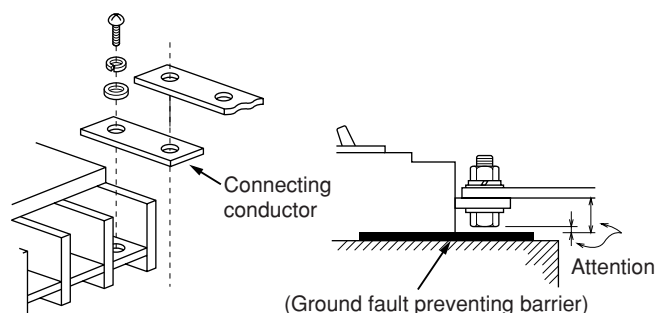
Wire connection with ring-type terminal



- For connection using ring-type terminals, refer to Appendix 4 for selection.
- Cover up exposed and conducting part of ring-type terminals with tube or insulation tape.
- Fasten the ring-type terminals so that the wires of different poles are kept parallel with each other.

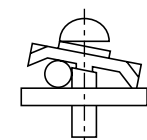
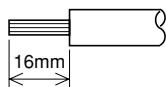
Bar connection

- When conductors are connected directly, process the conductors to the outline dimensions stated in the conductor machining drawing.
- To connect a conductor to a bar terminal, pay attention to insulation to the ground. Ground fault preventing barrier can be made to your designation.
- After making sure that the connecting conductors are free from any contamination and deposition of foreign matter, tighten them firmly.
- Where a connecting conductor is used, insulate the uncovered conductors of the power supply side using insulation barriers.

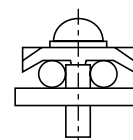


Clamp connection

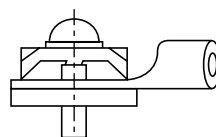
- When connected directly to a terminal, insert the solid or stranded wire straight, then fasten the terminal screws.
Ring-type terminals and bars can also be connected.
- For stranded wires, divided the strands for insertion, then fasten. Re-tightening is necessary for stranded wires at initial connection in particular, as stress slackening takes place after fastening.
- Remove wire insulation to the dimension illustrated below.



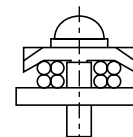
(One solid wire)



(Two solid wires)



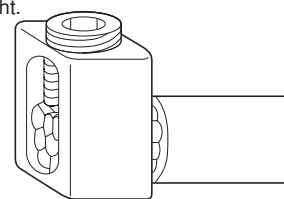
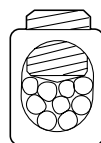
(Connection with ring-type terminal)



(Thick stranded wire)

Connection with solderless terminal

- Crimp after loosening strand of the connection wire and putting the core wires together. Regular inspection and retightening are necessary as the wires come loose as time goes.
- Where stranded wires of fine core such as the wires for appliances are used, use bar type or plate type solderless terminals.
- Refrain from soldering or binding stranded wires on the top end.
- Fasten carefully so that insulating materials of the wire is not caught.



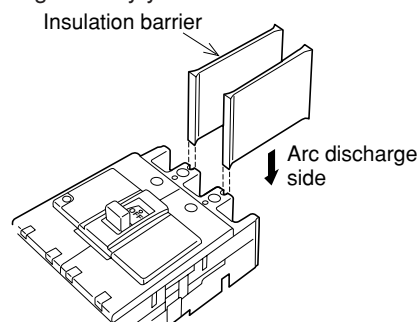
③ Insulation

(a) Insulation barrier

The insulation barriers are used to reinforce insulation between phases of circuit breaker terminals, and to prevent failure caused by conductive foreign matter and dust. Be sure to use insulation barriers for the models of standard type. To prevent problems, we are ready to mount the insulation barriers on the unit designated by you.

⚠ CAUTION

1. For the standard models, be sure to use insulation barriers unless some other effective means are taken such as terminal cover.
2. To the models for which insulation barriers are packed together in both power source side and load side, attach them to both sides.
3. To the models for which insulation barriers are packed together in one side only, attach the barriers to arc discharge side (ON side) in either case of regular connection and inverse connection.



(Those with circle are optional.)

Applicable model		Connecting method			
MCCB	ELCB	Front	Rear	Flush	Plug-in
NF32-SW, NF63-CW MB30-SW, MB50-CW NF125-RGW, NF125-UGW, NF125-CW NF63-ZCW, NF125-ZCW BH(2P, 3P, 40A, 50A) BH-P, BH-S, BH-PS	NV63-CW, NV125-CW, NV125-RW	○	—	—	—
NF63-SW, NF63-HW, NF125-SW, NF125-HW MB50-SW, MB100-SW NF63-ZSW, NF63-ZHW, NF125-ZSW, NF125-ZHW	NV32-SW, NV63-SW, NV63-HW NV125-SW, NV125-HW	Packed together as the standard practice	—	—	—
NF160-SW, NF160-HW, NF250-CW, NF250-SW NF250-HW NF125-SGW, NF125-HGW, NF125-RGW, NF125-UGW NF160-SGW, NF160-HGW NF250-SGW, NF250-HGW, NF250-RGW, NF250-UGW MB225-SW, NF250-ZCW, NF250-ZSW, NF250-ZHW, NF250-ZEW	NV250-CW, NV250-SW, NV250-HW NV250-SEW, NV250-HEW, NV250-RW	Packed together as the standard practice	—	—	Packed together as the standard practice
NF400-CW, NF400-SW, NF400-SEW, NF400-HEW NF400-REW, NF400-UEW(3P), NF400-ZCW, NF400-ZSW NF400-ZEW NF630-CW, NF630-SW, NF630-SEW, NF630-HEW, NF630-REW, NF630-ZCW, NF630-ZSW NF630-ZEW	NV400-CW, NV400-SW, NV400-SEW NV400-HEW, NV400-REW NV630-CW, NV630-SW, NV630-SEW NV630-HEW	Packed together as the standard practice	○	○	Packed together as the standard practice
NF400-UEP(4P), NF800-CEW, NF800-SEW, NF800-HEW, NF800-REW, NF800-SDW, NF800-UEW, NF800-ZEW	NV800-SEW, NV800-HEW	Packed together as the standard practice	○	○	○
NF1000-SEW, NF1250-SEW, NF1250-SDW, NF1250-UR	—	Packed together as the standard practice	—	—	Packed together as the standard practice
NF1600-SEW, NF1600-SDW	—	Packed together as the standard practice	—	—	—

④ Terminal cover

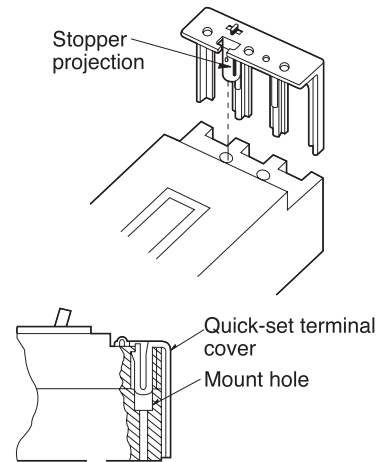
This is used to avoid exposure of charged parts. Different kinds are prepared for each application such as large size terminal cover (TC-L), small size terminal cover (TC-S), transparent terminal cover (TTC), Rear terminal cover (BTC), and plug-in terminal cover (PTC).

• Quick set terminal cover

This cover can be attached simply by inserting into the mount hole on the circuit breaker proper.

To disengage, slip off the cover stop projection by a finger or a screwdriver, then pull out. (PTC is of screw fix type.)

* The models of NF125-SGW/HGW/RGW/UGW, NF160-SGW/HGW, NF250-SGW/HGW/RGW/UGW are excluded.



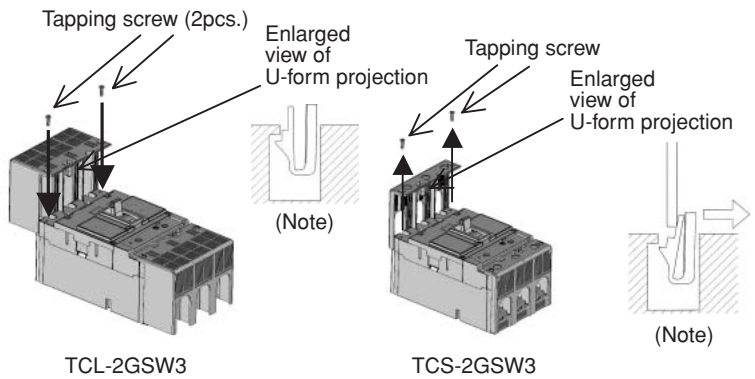
NF125-SGW/HGW/RGW/UGW, NF160-SGW/HGW, NF250-SGW/HGW/RGW/UGW
DSN125-SGW, DSN160-SGW, DSN250-SGW

Mounting

- 1) Put the U-form projection in the hole of the breaker and push the terminal cover strongly to fasten it. (Push the indicated place by the "↓" mark.) (Note)
- 2) Fix the terminal cover with tapping screws (in 4 positions with tightening torque 0.6 – 0.8 N·m).

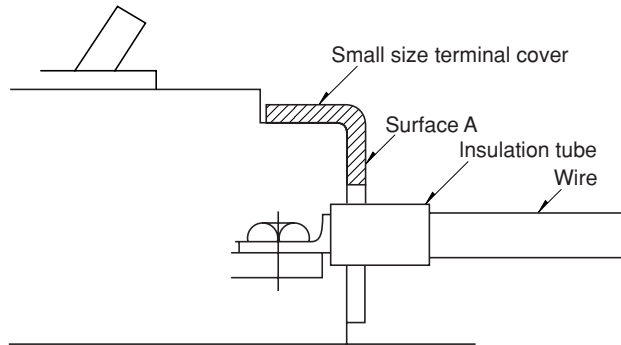
Removing

- 1) Remove the tapping screws.
- 2) Push the tip of the U-form projection fully toward the "→" mark by the screw driver or a finger tip and pull out the terminal cover toward the "↑" mark. (Note)

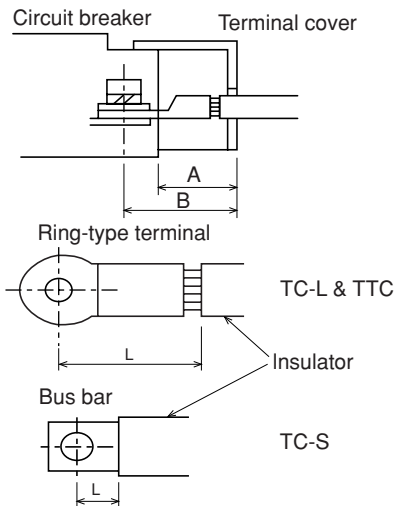


Note. except BTC or PTC

When a small size terminal cover (TC-S) is used, cover up the conducting part of the ring-type terminal with insulation tube or by taping but not exceeding surface A.



Note. No insulation barriers are needed with terminal covers are attached.



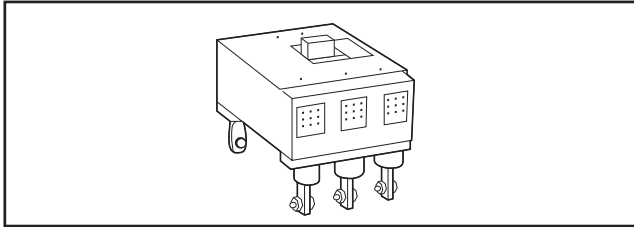
Exposed live parts

Limited condition (mm)	TC-L & TTC			TC-S		
	A	B	L	A	B	L
NF30-CS, MB30-CS, NV30-CS	25	34.5	29.5	5	14.5	12.0
NF32-SW, 50A frame, 63A frame	25	34.5	29.5	4.1	13.5	11.0
NF125-SGW/HGW, NF160-SGW/HGW, NF250-SGW/HGW, NF125-UGW/RGW, NF250-UGW/RGW	40	50.5	45.5	3.5	14.0	11.0
other 125A frame	40	50.5	45.5	4.5	15.0	12.5
other 160A frame, 250A frame	40	50.5	45.5	3.2	13.5	11.0

(2) Rear connection

Rear connection type is for wiring from back side of the panel and terminal connection and bar connection are applicable. Rear studs (with insulation pipe or insulation base) are offered separately. Assembling is possible, therefore, by each user. For tightening torque, refer to Appendix 2.

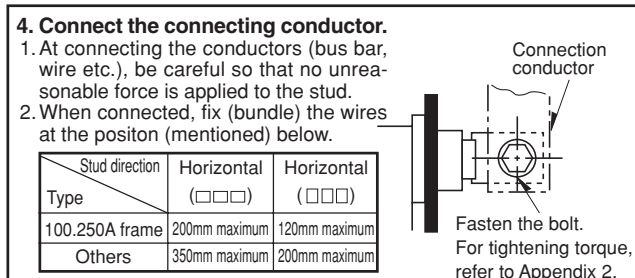
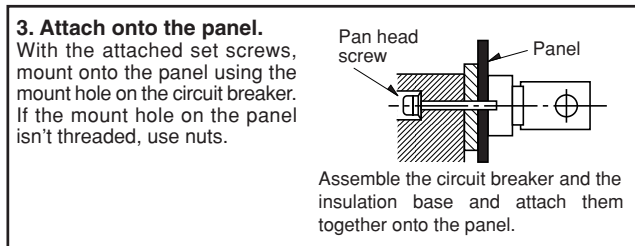
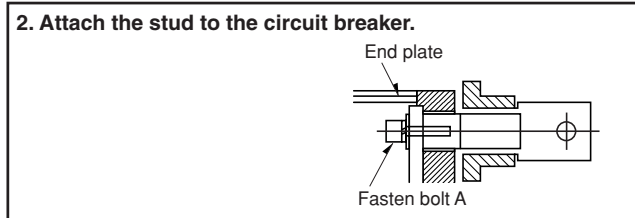
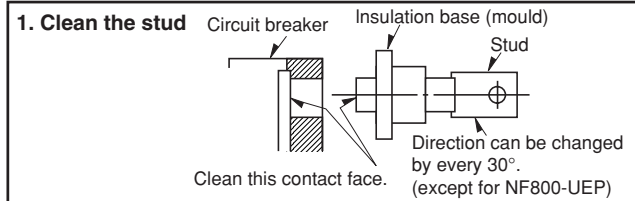
① Bar stud



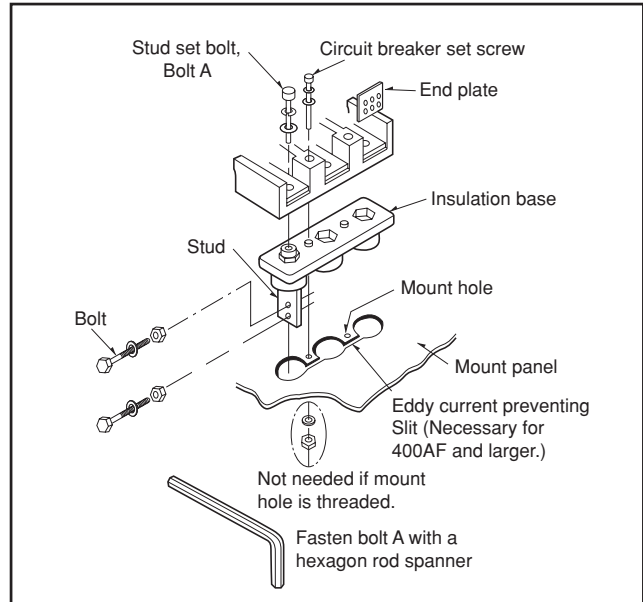
Assembling procedure (A)

Model of breaker to be assembled	NF400-CW, NF400-SW, NF400-SEW, NF400-HEW, NF400-REW, NF400-UEW(3P) NF400-ZCW, NF400-ZSW, NF400-ZEW NF630-CW, NF630-SW, NF630-SEW NF630-HEW, NF630-REW NF630-ZCW, NF630-ZSW, NF630-ZEW	NF400-UEW(4P) NF800-CEW, NF800-SDW NF800-SEW, NF800-HEW NF800-REW, NF800-UEW NF800-ZEW
	NV400-CW, NV400-SW, NV400-SEW, NV400-HEW, NV400-REW NV630-CW, NV630-SW NV630-SEW, NV630-HEW	NV800-SEW, NV800-HEW
Size of bolt A	M8	M10
Tightening torque N·m	20	30

Take $\pm 20\%$ of the figures in the above table (tightening torque) as the rough guide of adequate range of tightening torque.



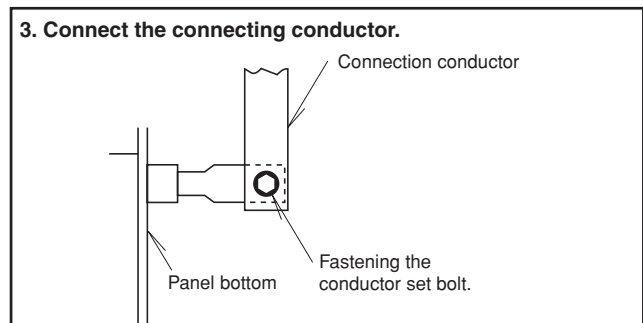
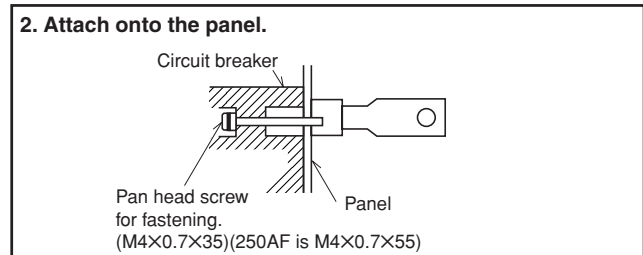
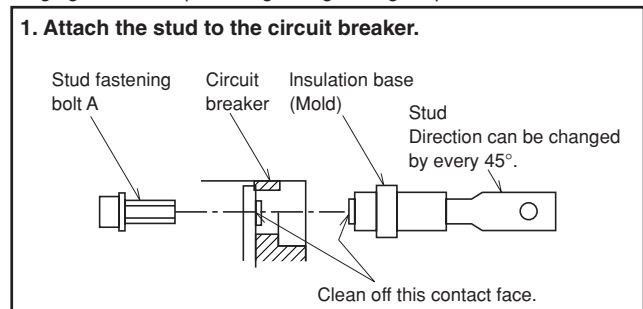
The figures in the above table indicate distance from the top face of the panel. In the case of bus bar connection, the distance can be somewhat longer.



Assembling procedure (B)

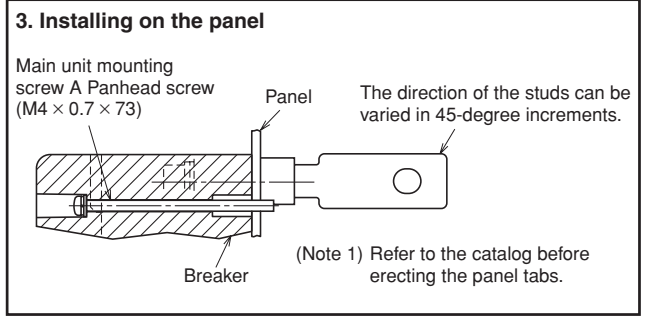
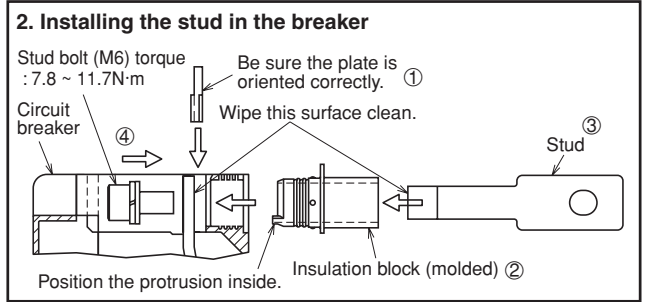
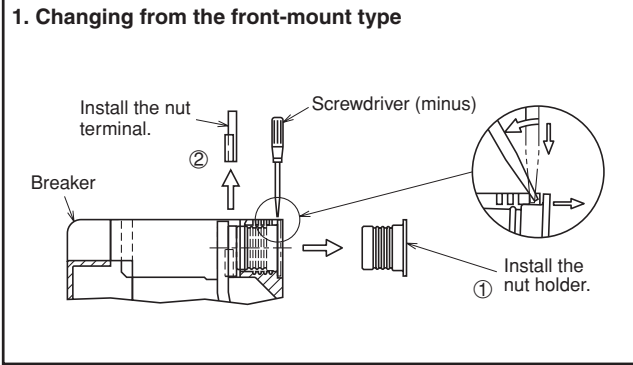
Model to be assembled	NF125-CW, NF125-SW NF125-HW, MB100-SW NV125-CW, NV125-SW NV125-HW, NV125-RW	NF160-SW, NF160-HW NF250-CW, NF250-SW NF250-HW, MB225-SW NF250-ZCW, NF250-ZSW NF250-ZHW, NF50-ZEW NV250-CW, NV250-SW NV250-HW, NV250-SEW NV250-HEW, NV250-RW
Size of bolt A	M6	M6
Tightening torque N·m	4	10

Take $\pm 20\%$ of the figures in the above table (tightening torque) as the rough guide of adequate range of tightening torque.



Assembling procedure (C)

Model to be assembled	NF125-SGW, NF125-HGW NF160-SGW, NF160-HGW NF250-SGW, NF250-HGW NF125-RGW, NF125-UGW NF250-RGW, NF250-UGW
Size of bolt A	M6
Tightening torque N·m	7.8~11.7



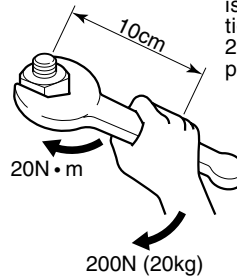
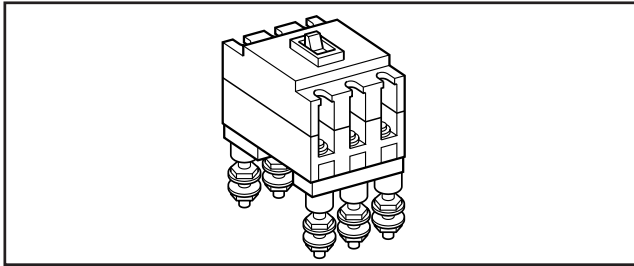
Cautionary instructions by each model

Model	Assembling procedure	Detail
NF400-CW, NF400-SW, NF400-SEW NF400-HEW, NF400-REW, NV400-CW NV400-SW, NV400-SEW, NV400-HEW NV400-REW, NF400-ZCW, NF400-ZSW NF400-ZEW NF630-CW, NF630-SW, NF630-SEW NF630-HEW, NF630-REW, NF630-ZCW NF630-ZSW, NF630-ZEW, NV630-CW NV630-SW, NV630-SEW, NV630-HEW NF800-CEW, NF800-SEW, NF800-SDW NF800-HEW, NF800-REW, NF800-UEW NF800-ZEW, NV800-SEW, NV800-HEW	A-2	<p>Fasten L-fitting together as illustrated.</p>
NF400-CW, NF400-SW, NF400-SEW NF400-HEW, NF400-REW NF400-UEW(3P), NV400-CW NV400-SW, NV400-SEW, NV400-HEW NV400-REW, NF400-ZCW, NF400-ZSW NF400-ZEW NF630-CW, NF630-SW, NF630-SEW NF630-HEW, NF630-REW, NF630-ZCW NF630-ZSW, NF630-ZEW, NV630-CW NV630-SW, NV630-SEW, NV630-HEW	A-4	<p>Insert the insulation tube into the center pole. For 4-pole breakers, insert the tube into the neutral pole, too.</p>

Kind of end plate

Type	NF400-CW, NF400-SW NF400-SEW, NF400-HEW, NF400-REW, NF400-UEW(3P) NF400-ZCW, NF400-ZSW, NF400-ZEW NF630-CW, NF630-SW NF630-SEW, NF630-HEW, NF630-REW NF630-ZCW, NF630-ZSW, NF630-ZEW	NF400-UEW(4P) NF800-CEW, NF800-SDW NF800-SEW, NF800-HEW NF800-REW, NF800-UEW NF800-ZEW
	NV400-CW, NV400-SW NV400-SEW, NV400-HEW, NV400-REW NV630-CW, NV630-SW NV630-SEW, NV630-HEW	NV800-SEW NV800-HEW
Kind of end plate	Insulation plate (size: 52 X 32.7)	Insulation plate (size: 60 X 51.9)

① Screw stud connection

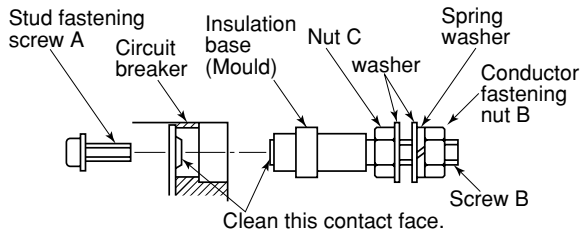


Generally, about 20kg power is generated by arm. So, tightening torque comes to 20N·m by grip-ping illustrated position.

Assembling procedure (A)

Model to be assembled	NF30-CS, MB30-CS, NV30-CS NF32-SW, NF63-CW, NF63-SW, NF63-HW MB30-SW, MB50-CW, MB50-SW NV32-SW, NV63-CW, NV63-SW, NV63-HW NF63-ZCW, NF-ZSW, NF63-ZHW
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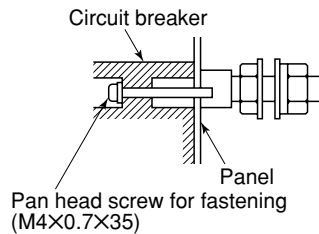
1. Attach the stud onto the circuit breaker.



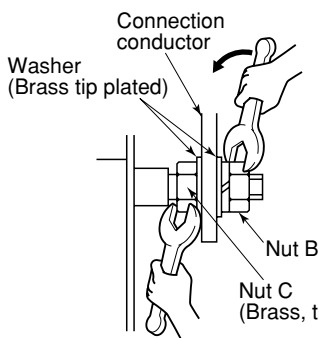
2. Mount onto the panel.

(Note)

Tap the panel referring to the catalog.



3. Connect the connection conductor.

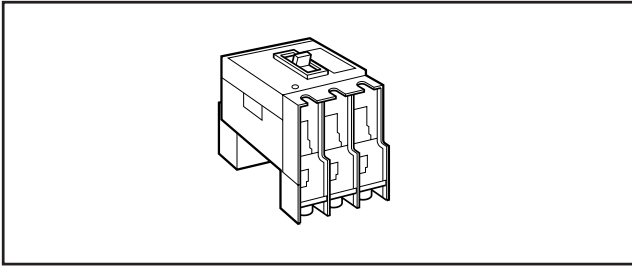


Fasten nut B
(Note)
Hold nut C with a wrench.
Be careful so as not to apply unreasonable force to the stud.

Tightening torque for screw stud

Type (Ampere frame)	Tightening torque N·m	
	Stud fastening screw A <Nominal diameter of screw>	Conductor fastening nut B <Nominal diameter of screw>
30A frame } 63A frame	1 <M4>	2 <M6>

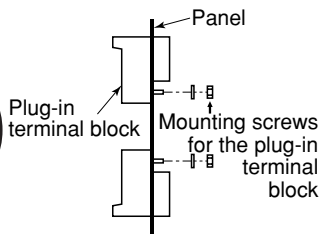
(3) Plug-in type



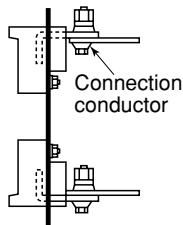
• Assembling procedure

1. Attach the plug-in terminal block having the stud onto the panel or the angle.

(If the plug-in terminal block is separate type, place the circuit breaker temporarily for positioning the push-in terminal block.)

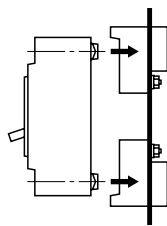


2. Attach the connection conductor to the plug-in stud.

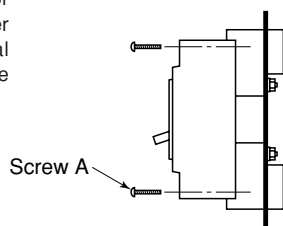


3. Turn OFF the circuit breaker and insert into the plug-in terminal block.

(Take off the cushion (foamed polystyrene of white) inserted into the tulip part)

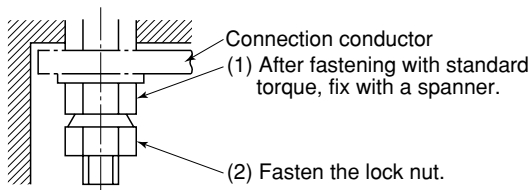


4. With the attached screw or to nut, fix the circuit breaker onto the plug-in terminal block using the mount hole on the breaker.

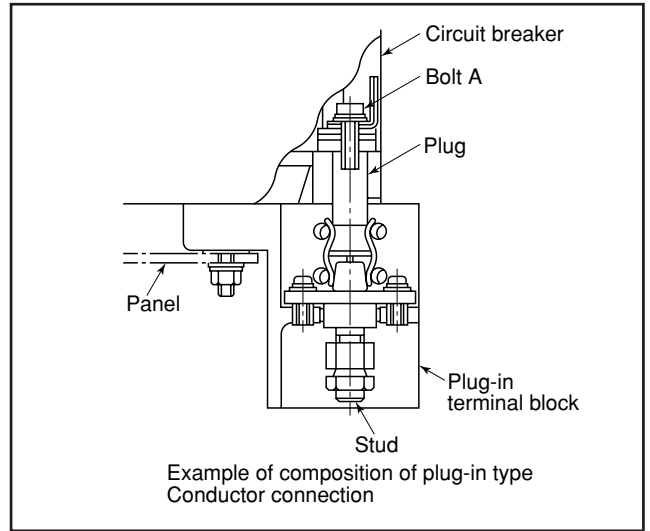


(Note)

- * At wiring, refrain from applying excessive tensile load onto the stud.
- * Fasten the double-nut type in the following manner.

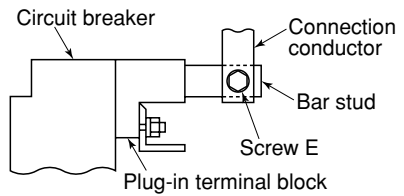


- * At fastening the connection conductor, refrain from applying excessive load onto the side wall of the plug-in terminal block.

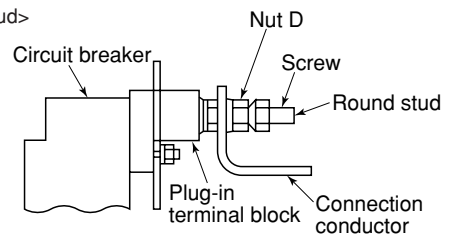


• Conductor connection

<Bar stud>

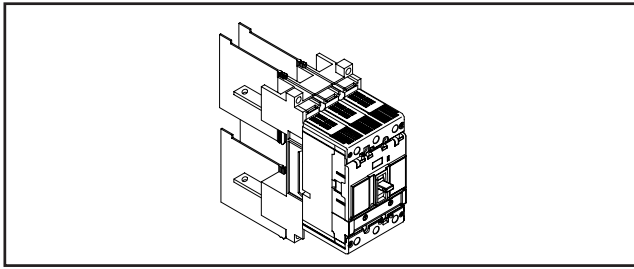


<Screw stud>

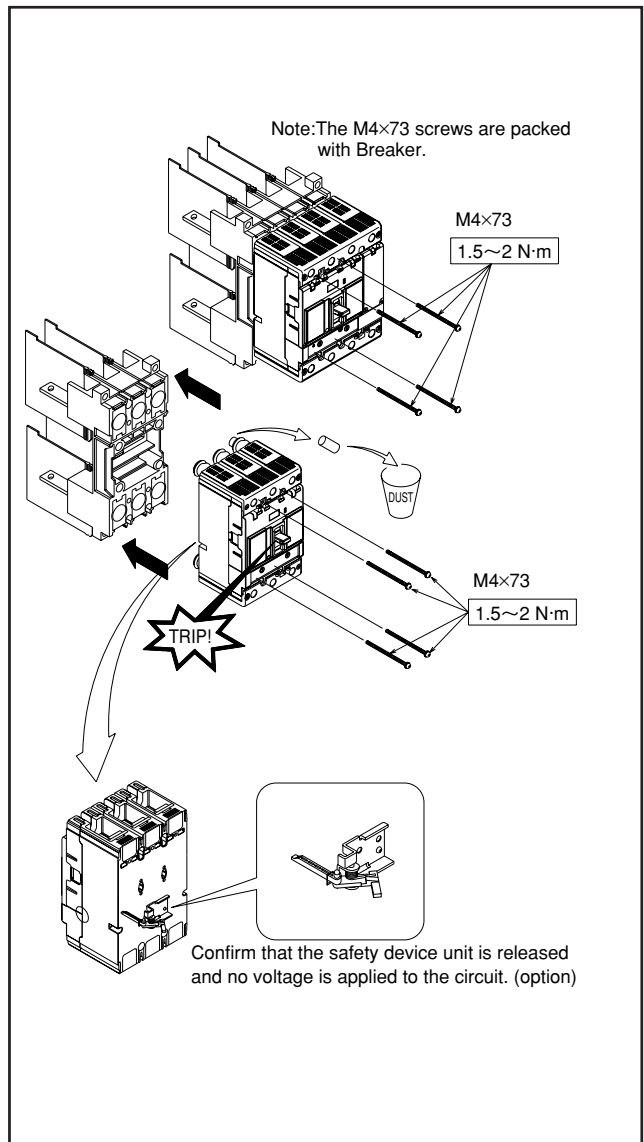
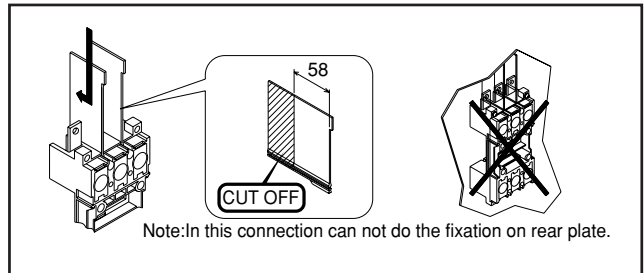
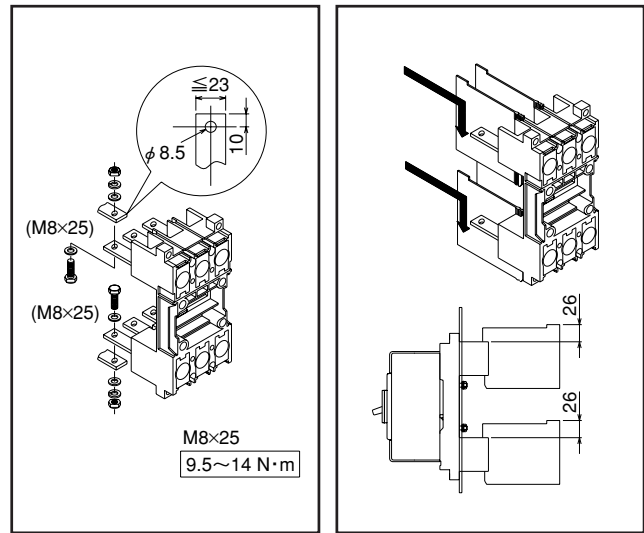
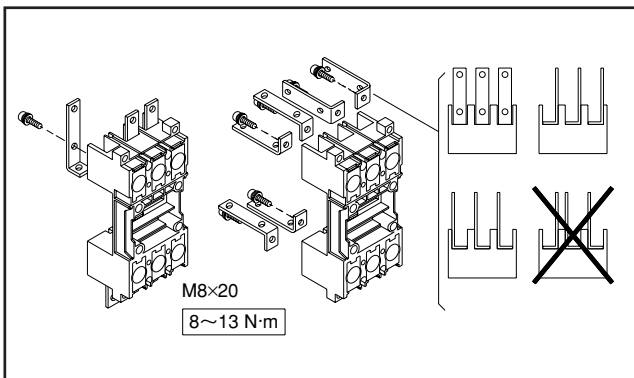
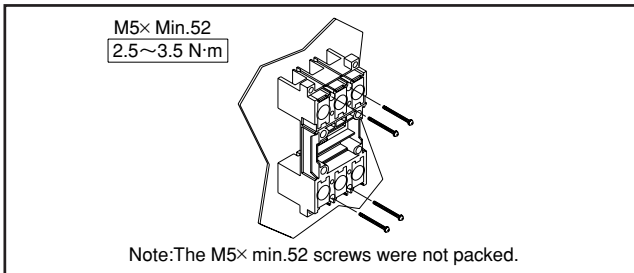
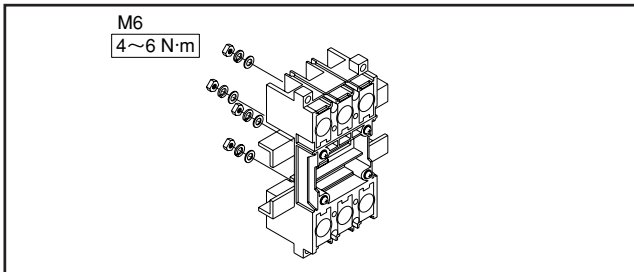
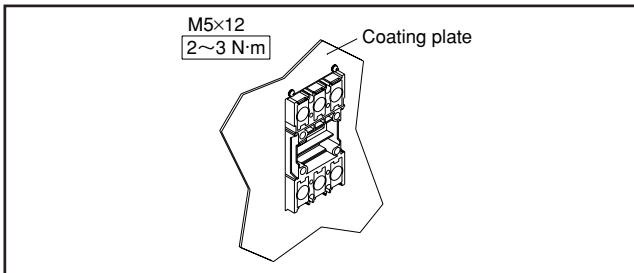
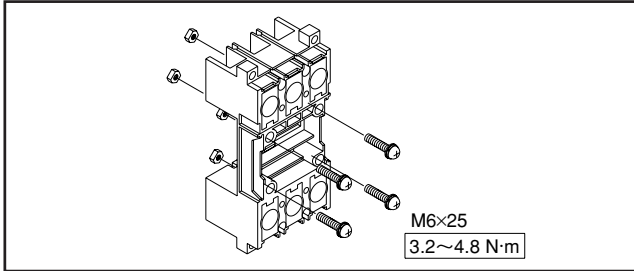


- For fastening torque, refer to Appendix 2.

types for
 NF125-SGW, NF125-HGW,
 NF160-SGW, NF160-HGW,
 NF250-SGW, NF250-HGW



• Assembling



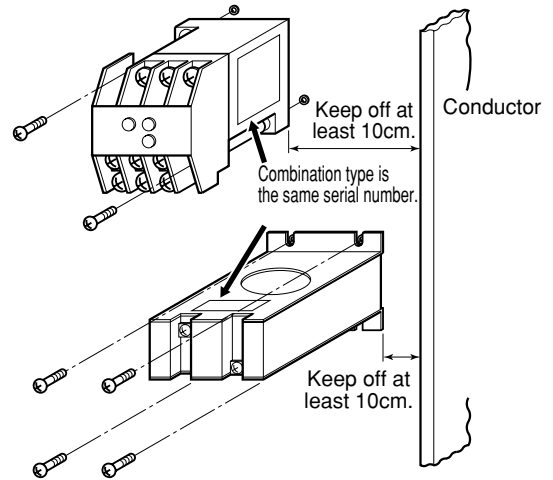
(5) Earth leakage relay

① Mounting

1. Mount the earth leakage relay and the ZCT unit separately. Refer to the catalog for mounting dimension.
2. With the relay of interchangeable type, the relay unit and the ZCT unit can be combined freely.
For the relay of combination type, be sure to combine the relay unit and the ACT unit of the same manufacturing number.

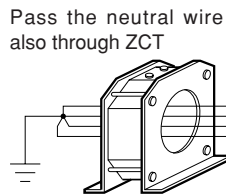
Series	Hole diameter of ZCT (mm)						With primary conductor (A)	
	15	30	40	60	80	100	600~2000A	3200A
NV-ZBA NV-ZSA NV-ZHA NV-ZLA	Interchangeable type						Combination type	
NV-ZU	Combination type						—	

3. To avoid influence of outside magnetic field, mount the relay and the ZCT at least 10cm off the conductors which a large current of over several thousands ampere flows.

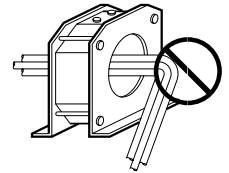


② Connection

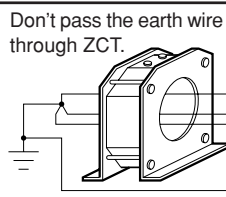
1. For single phase three-wire system and 3 phase 4-wire system, be sure to pass the three or four wires including the neutral wire through ZCT. (Pass the wire intended to conduct load current through ZCT.)



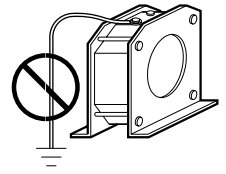
4. Don't bend sharply the wires passed through ZCT near the ZCT. When a primary conductor of over 300A is passed through, keep 30cm or more straight at one side.



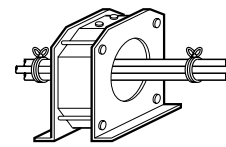
2. Where the line include a wire dedicated to grounding, refrain from passing the earth wire through ZCT. (Don't pass the wire not intended for conducting load current through ZCT.)



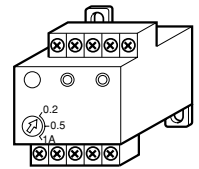
5. Refrain from grounding the lead wire of the ZCT.



3. Bundle the wires passed through ZCT with clamp bands, for example, as they may apply mechanical stress to the ZCT when large current over the rated overcurrent strength flows at a short-circuit failure and others.



6. Make sure that the setting is free from any error as sensitivity current is switchable with some models.



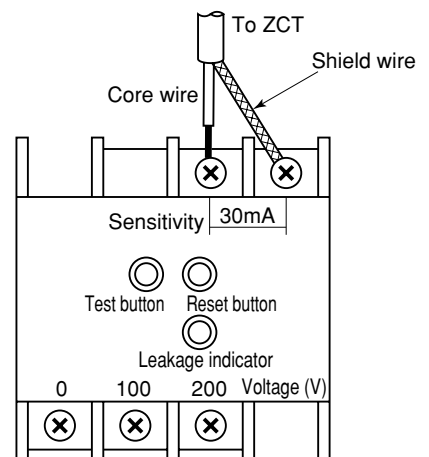
7. Where the relay unit is connected to the ZCT unit, take the following procedure.

Kind of lead wire used vs. sensitivity

Sensitivity	Length of lead wire		
	1m	1m~3m	3m~7m
30mA	Single core shield wire		
100 · 200mA	Stranded vinyl coated wire		of 0.5 to 2mm ²
500mA and more	of 0.5 to 2mm ²		

- Notes
1. Number of turns of wire stranding is about 40turns/m.
 2. Where single core shield wire is used, connect the core wire and the shield wire in the right way according to the instruction manual. Example of NV-ZBA type is shown at the right.

Example of single core shield connection (NV-ZBA type)



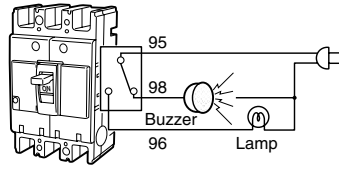
3.6.9 Instruction for accessories

(1) Internal accessories

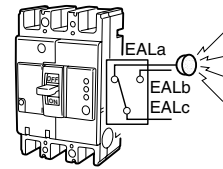
The following devices are installed into the circuit breakers.

For the accessories with lead wires, allow at least 8 mm spacing when circuit breakers are installed side by side.

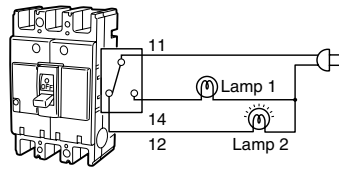
AL Alarm switch
This switch is for electrically indicate tripping of the circuit breakers.



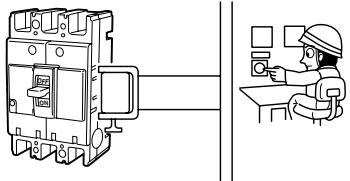
EAL Earth leakage alarm switch
The switch for electrically indicating trip state of the earth leakage circuit breaker by ground fault. Smaller frame than 225A are provided with SLT as the standard arrangement. (It is attached to the back of the circuit breaker of built-in type.)



AX Auxiliary switch
This is for indicating ON/OFF state of the circuit breakers electrically.

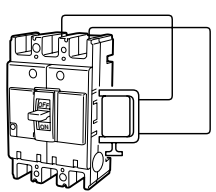


SHT Shunt trip
The device to electrically trip the circuit breakers from a remote position. The allowable operation voltage range is 70 to 110% of rated voltage.



TBM Test button module
This device is for remotely testing by applying voltage. The same control sequence as SHT of NF can be assembled, and parallel connection of TBMs is possible. (SLT is attached as the standard.)

UVT Under voltage trip
The device for tripping the circuit breakers automatically when supply voltage comes down. The operating voltage is 70 to 35% of the UVT rated voltage. At 85% and above of the rated voltage the circuit breaker can be closed.



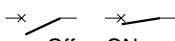

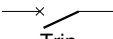

MG Insulation switch
Attaching insulation switch enables measurement of interpole meg at the load side simply by turning off the earth leakage circuit breaker.

LT, SLT Lead wire terminal block
This is connection with internal auxiliary devices, and can be prepared according to your designation. (Dimensions of LT or SLT differs somewhat according to number of pieces attached and model of auxiliary devices.)

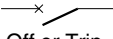

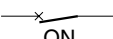

(2) AL (Alarm switch), AX (Auxiliary switch)

- AL (Alarm switch) is for indicating trip state of the circuit breakers electrically.
- AX (Auxiliary switch) is for indicating ON/OFF state of the circuit breakers electrically.

Operation of AL switch

State of circuit breaker	Contact condition of AL switch
 Off or ON	 . 98 (Open) . 96 (Close)(Note.1) . 95 (DC +)
 Trip	 . 98 (Close) . 96 (Open)(Note.1) . 95 (DC +)

Operation of AX switch

State of circuit breaker	Contact condition of AX switch
 Off or Trip	 . 14 (Open) . 12 (Close)(Note.1) . 11 (DC +)
 ON	 . 14 (Close) . 12 (Open)(Note.1) . 11 (DC +)

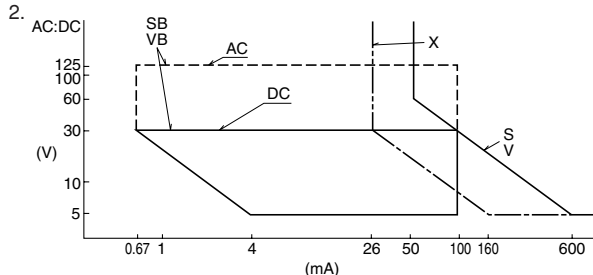
- Note 1. When used for DC circuit, pay attention to polarity.
 2. The dots of terminal marking shown in above examples means the sequence number of accessories.

AL • AX

Rating of switch

Micro switch used	AC			DC		
	Voltage (V)	Amps (A)		Voltage (V)	Amps (A)	
		Resistance load	Induction load		Resistance load	Induction load
S	460	-	-	250	0.2	0.2
	250	3	2	125	0.4	0.4
	125	5	3	30	4	3
V	460	5	2	250	0.3	0.3
	250	10	10	125	0.6	0.6
	125	10	10	30	10	6
X (Note,1)	460	5	2.5	250	5	3
	250	10	10	125	10	6
	125	10	10	30	10	10

Note 1. When used for DC circuit of Type X, pay attention to polarity.



For lower area than above bottom limit of applicable load, use the switch for minute load.

AL and AX for minute load

Micro switch used	AC			DC		
	Voltage (V)	Amps (A)		Voltage (V)	Amps (A)	
		Resistance load	Induction load		Resistance load	Induction load
SB	125	0.1	-	30	0.1	-
VB	125	0.1	-	30	0.1	-

For use in small current area, enquire us separately.

- Note 1. For model of breakers to be assembled each type of micro switch, refer to the catalogue.
 2. Practice insulated termination to the lead wires not used.
 3. Unusual resistance is indicated in some cases when measured at minute current of a digital switch, for example.

(3) SHT (Shunt trip)

- The device to trip circuit breakers electrically from a remote position.
- Allowable operating voltage range is 70 to 110% of the rated voltage.

■ Coil rating (Standard)

Type designation of circuit breakers		Cut off switch	Voltage (Note 3) (V)	Input VA (Note 1)		Operating time (Note 2)		
				AC	DC			
NF-C-S-H-U MB	32(30)-63A Frame 125A Frame (NF125-SGW/HGW/RGW/UGW are excluded)	Equipped	AC100-240 380-550 (Compatible to 50 and 60Hz.) DC100-125	120	50	15 or less		
	160-250A Frame NF125-SGW/HGW/RGW/UGW				60			
NF400-CW, NF400-SW, NF400-SEW, NF400-HEW, NF400-REW NF400-UEW, NF400-ZCW, NF400-ZSW, NF400-ZEW NF630-CW, NF630-SW, NF630-SEW, NF630-HEW NF630-REW, NF630-ZCW, NF630-ZSW, NF630-ZEW NF800-CEW, NF800-SDW, NF800-SEW, NF800-ZEW NF800-HEW, NF800-REW, NF800-UEW NV400-CW, NV400-SW, NV400-SEW, NV400-HEW, NV400-REW NV630-CW, NV630-SW, NV630-SEW, NV630-HEW NV800-SEW, NV800-HEW		Equipped	AC100-450/DC100-200	100V	20	5~15		
				200V	50		100V	10
				380V	120		200V	35
				450V	170			
NF1000-SEW, NF1250-SEW, NF1250-SDW NF1600-SEW, NF1600-SDW NF1250-UR		Equipped	AC100-120 200-240 380-450 DC100	200	70	7~15		

Cautionary instructions for use

Note 1. Use the applicable power supply capacity so that voltage drop by SHT operating current may not go down below the allowable operating voltage range.

2. Operating time means the time from application of rated voltage to the SHT to the point when the main contact of the circuit breaker opens.
3. 50 Hz and 60 Hz can be used commonly.

Remark 1. Design the control circuit so that the power supply of SHT is turned off after operation of SHT and before making the circuit breaker again.

2. All the SHTs at present are with coil seizure preventing switch, but some old SHTs are of short time rating (30 sec) without any switch for coil seizure prevention. To those of short time rating, refrain from applying voltage in continuity.
3. Keep number of times of tripping lower than those shown below as SHT operation trips the circuit breaker.
4. Keep at the control voltage of SHT within the range of the rated voltage. Applying higher control circuit voltage can cause breakage of the seizure preventing switch or of the circuit breaker itself. Applying lower control circuit voltage can result failure of tripping, and breakage of the coil can cause when continuous low voltage is applied to the SHT coil.
5. Provide the operation circuit of SHT with short-circuit protecting devices such as fuses.
6. Refrain from closing the circuit breaker while applying voltage to the SHT as it can make switching life of the breaker shorter.



Rated current (A)	Number of operating cycle (IEC60947-2)			Number of operation by SHT, UVT, or trip button
	With current	Without current	Total	
$I_n \leq 100$	1500	8500	10000	10% of the total number of operations
$100 < I_n \leq 315$	1000	7000	8000	
$315 < I_n \leq 630$	1000	4000	5000	
$630 < I_n \leq 2500$	500	2500	3000	
$2500 < I_n$	500	1500	2000	

Remarks: Number of operation by the test button of earth leakage circuit breakers is 1,000 times.

(4) UVT (Under voltage trip)

- (a) This device make it possible to turn ON the circuit breaker after resetting manually when supply voltage is recovered at least to 85% after dropping to 70 to 35% or lower and tripping the breaker.
- (b) Be sure to practice reset closing operation by applying the specified voltage to the coil of UVT.
- (c) Refrain from reset closing operation of the circuit breaker without energizing the UVT as it accelerates wear of the tripping latch and an cause failure.
- (d) Be sure to set a small size NFB or fuses in the UVT circuit.

① Coil rating of UVT

○: Standard type
△: Produce upon request

Type name of breaker	Specifications		Coil rating			
	Resettable type	Reset prevention type	Voltage V		Input VA	Operation time (ms) (Note 2)
			Standard voltage	Special Voltage (Note 1)		
NF50-SRU, NF100-SRU/HRU NV50-SRU, NV100-SRU/HRU	—	○	AC100-110 (Note 3) 110-127 200-220 220-240 380-415 400-440 DC24 100-110	—	10	30 or less
NF32-SW, NF63-CW/SW/HW, NF50-HCW NF50-HRW NF125-CW/SW/HW/RW/UW NF250-CW/SW/HW/SEW/HEW/RW/UW MB30-SW, MB50-CW/SW, MB100-SW MB225-SW NV32-SW, NV63-CW/SW/HW NV125-CW/SW/HW/RW NV250-CW/SW/HW/RW MN50-CW/SW, MN100-SW, MN225-SW	—	○	(Note 3) AC100-110/120-130 selectable 200-220/230-250 selectable 380-415/440-480 selectable DC100/110 selectable	(Note 3) AC24/48 selectable 500-550/600 selectable DC24/48 selectable 110/125 selectable	5	30 or less
NF-SFW/SJW/HJW	○	—				
NF-SKW/SLW, NV-SKW	○ (Note 4)	—				
NF50-SWU, NF100-SWU, NF100-CWU, NF225-CWU NV50-SWU, NV100-SWU, NV225-CWU	—	○	AC100-110/120-130 selectable 200-220/230-250 selectable 380-415/440-480 selectable DC100/110 selectable (Note 3)	AC24/48 selectable (Note 3) DC24/48 selectable 110/125 selectable	5	30 or less
NF100-SEP/HEP	○ (Note 4)	△				
NF400-CW/SW/SEW/HEW/REW/UEW NF630-CW/SW/SEW/HEW/REW NF800-CEW/SDW/SEW/HEW/REW/UEW NV400-CW/SW/SEW/HEW/REW NV630-CW/SW/SEW/HEW NV800-SEW/HEW	○ (Note 4)	△ (Note 5)	AC100-110 (Note 3) 200-220 400-440 DC100	AC110-120 (Note 3) 220-240 380-415 440-480 500-550 DC24 48 110	5	5-30
NF1000-SEW, NF1250-SEW/SDW, NF1200-UR NF1600-SEW/SDW	△	○	AC100-120 (Note 3) 200-240 380-450 DC100-110	AC24 (Note 3) DC24 48 48 440-480 120-125 500-550	5	5-35
NF2000-S, NF2500-S, NF3200-S, NF4000-S	△	○	60Hz AC110 50Hz AC100 220 200 440 400	AC120 (Note 3) DC100 240 380	20	5-30

Note 1. Manufacturing range of special voltage type differ by each model. Please enquire.

Note 2. The operating time is from non-voltage of the UVT to the start of main contact opening.

Note 3. Commonly used for both 50 Hz, and 60 Hz.

Note 4. ON operation without energizing closes the circuit breaker instantly and trips.

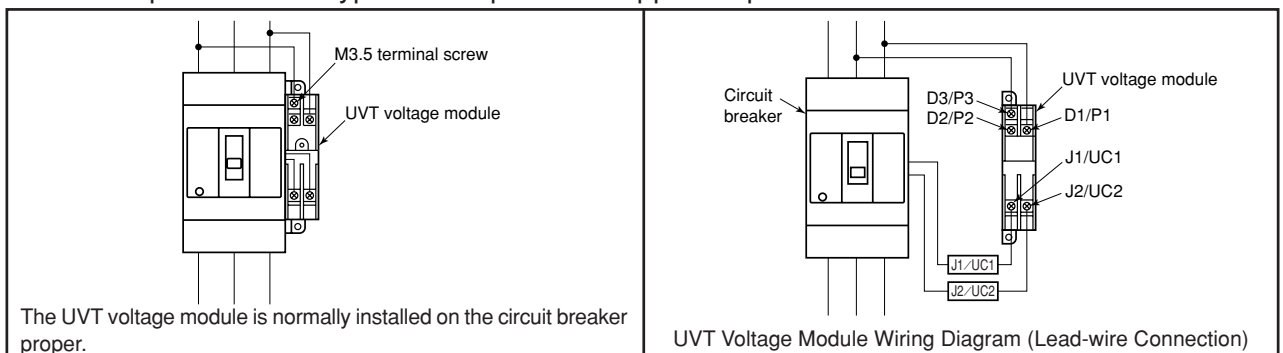
Note 5. Left-pole mounting

② Composition of UVT

(a) NF32-SW to NF250-HEW

A UVT mechanical unit is incorporated in the circuit breaker, and a UVT voltage-control module is attached outside. Lowered voltage is detected by the UVT voltage-control module, and the UVT mechanical unit functions to trip.

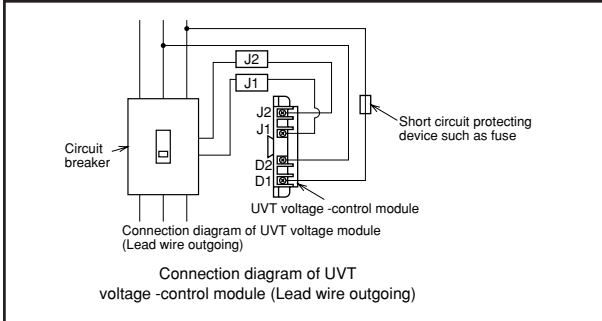
The UVT voltage module is normally installed on the circuit breaker proper with lead wire terminal block. A separate mount type can be produced upon request.



(b) NF400-CW to NF1600-SEW, NF100-SEP-HEP

A UVT mechanical unit is incorporated in the circuit breaker, and a UVT voltage-control module is attached outside. Lowered voltage is detected by the UVT voltage-control module, and the UVT mechanical unit functions to trip. Some are so composed to trip even when the handle of the circuit breaker is at OFF state but the coil of the UVT mechanical unit isn't energized, while others are composed for no tripping under this state.

Separate type is the standard for UVT voltage -control module, but a lead wire terminal block can be attached to the circuit breaker proper.



⚠ CAUTION

Keep the control voltage within the range of the rated voltage of UVT. Applying higher control circuit voltage can cause burning of the UVT coil and fire. Applying lower control circuit voltage can result in malfunction and noise generation in the case of AC.

③ Resettable type and reset prevention type UVT

■ Resettable type

The circuit breaker is not made the trip condition even if the UVT coil is not excited when the circuit breaker handle is set in the OFF or RESET positions. Therefore, when it resets by electric operation, the UVT coil hold reset status also for no exciting. Moreover, if the breaker is operated to ON in the state of no exciting the UVT coil, the circuit breaker normally trip. But since the main contact of the circuit breaker may contact momentarily depending on the breaker model or the auxiliary switch may change momentarily in with auxiliary switch, please use reset prevention type for the electrical interlock.

■ Reset prevention type

When the UVT coil is in no excited condition, the circuit breaker can not be operated into OFF position even if it reset from trip status. If the excitation voltage of the UVT coil returns more than standard, the circuit breaker can reset in the OFF position.

④ Time delay type UVT

(Except for NF2000-S to NF4000-S)

- Operating time of this type has a time lag.
- Operation at instantaneous break down can be avoided.

Type name of UVT module	Time delay	Voltage (V)	
		Standard	Special
UVT-MC	100ms	AC100-120 200-240 380-450 (Commonly used for 50/60Hz) DC100-110	AC24 48 440-480 500-550 (Commonly used for 50/60Hz) DC24 48
U-05S	500ms	AC100-120 200-240 400-450 (Commonly used for 50/60Hz)	—
U-10S	1s		
U-05W	0.1-0.3-0.5s (selectable)	AC24/48 AC100-120/200-240/380-450 AC200-250/380-450/460-550 (Commonly used for 50/60Hz) DC100-110	AC380-450/460-550/600-690 (Commonly used for 50/60Hz) DC24/48
U-30W	0.5-1-3s (selectable)	AC100-120/200-240/380-450 AC200-250/380-450/460-550 (Commonly used for 50/60Hz)	—

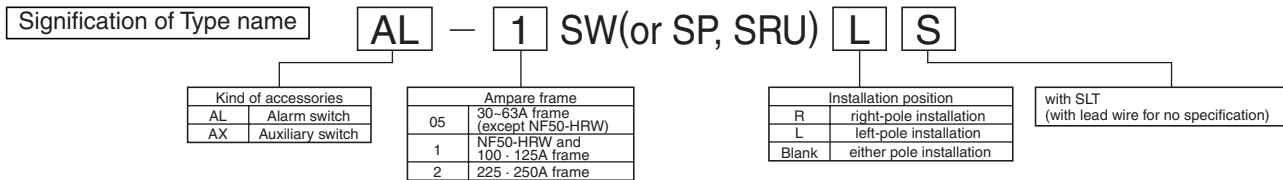
(5) Cassette accessories

① 30~250 A frames

The cassette accessories, AL, AX, AL+AX, SHT, and UVT can be installed to the following models by each user.

Type name of accessories (indicated by the attached name plate)

Applicable models		Mounting pole	AL	AX	AL+AX	SHT	UVTN or UVTs
NFB	NV						
NF50-SRU NF100-SRU NF100-HRU		for right pole	AL-05SRUR AL-05SRURS	AX-05SRUR AX-05SRURS	ALAX-05SRUR ALAX-05SRURS	SHTA240-05SRUR SHTA480-05SRUR SHTD125-05SRUR SHTA240-05SRURS SHTA480-05SRURS SHTD125-05SRURS	—
		for left pole					
NF32-SW, NF63-CW, NF63-SW, NF63-HW MB30-SW, MB50-CW, MB50-SW NF50-HCW	NV50-SRU NV100-SRU NV100-HRU	for left pole	AL-05SRUL AL-05SRULS	AL-05SRUL AL-05SRULS	ALAX-05SRUL ALAX-05SRULS	SHTA110-05SRULS SHTA127-05SRULS SHTA220-05SRULS SHTA240-05SRULS SHTA415-05SRULS SHTA440-05SRULS SHTD024-05SRULS SHTD110-05SRULS	UVTNA110-05SRULS UVTNA127-05SRULS UVTNA220-05SRULS UVTNA240-05SRULS UVTNA415-05SRULS UVTNA440-05SRULS UVTND024-05SRULS UVTND110-05SRULS
		for right pole	AL-05SWR AL-05SWRS	AX-05SWR AX-05SWRS	ALAX-05SWR ALAX-05SWRS	SHTA240-05SWR SHTA550-05SWR SHTD125-05SWR SHTA240-05SWRS SHTA550-05SWRS SHTD125-06SWRS	UVTNA130-05SWR UVTNA250-05SWR UVTNA480-05SWR UVTND110-05SWR UVTNA130-05SWRS UVTNA250-05SWRS UVTNA480-05SWRS UVTND110-05SWRS
NF32-SW, NF63-CW, NF63-SW, NF63-HW MB30-SW, MB50-CW, MB50-SW NF50-HCW	NV32-SW, NV63-CW NV63-SW, NV63-HW MN50-CW, MN50-SW	for left pole	AL-05SWL AL-05SWLS	AX-05SWL AX-05SWLS	ALAX-05SWL ALAX-05SWLS	—	UVTNA130-05SWL UVTNA250-05SWL UVTNA480-05SWL UVTND110-05SWL UVTNA130-05SWLS UVTNA250-05SWLS UVTNA480-05SWLS UVTND110-05SWLS
		for right pole	AL-1SW AL-1SWRS	AX-1SW AX-1SWRS	ALAX-1SW ALAX-1SWRS	SHTA240-1SWR SHTA550-1SWR SHTD125-1SWR SHTA240-1SWRS SHTA550-1SWRS SHTD125-1SWRS	UVTNA130-1SWR UVTNA250-1SWR UVTNA480-1SWR UVTND110-1SWR UVTNA130-1SWRS UVTNA250-1SWRS UVTNA480-1SWRS UVTND110-1SWRS
NF50-HRW, NF125-CW, NF125-SW NF125-HW, NF125-RW, NF125-UW MB100-SW	NV125-CW, NV125-SW NV125-HW, NV125-RW MN100-SW	for left pole	AL-1SW AL-1SWLS	AX-1SW AX-1SWLS	ALAX-1SW ALAX-1SWLS	—	UVTNA130-1SWL UVTNA250-1SWL UVTNA480-1SWL UVTND110-1SWL UVTNA130-1SWLS UVTNA250-1SWLS UVTNA480-1SWLS UVTND110-1SWLS
		for right pole	AL-2SWR AL-2SWRS	AX-2SWR AX-2SWRS	ALAX-2SWR ALAX-2SWRS	SHTA240-2SWR SHTA550-2SWR SHTD125-2SWR SHTA240-2SWRS SHTA550-2SWRS SHTD125-2SWRS	—
NF250-CW, NF250-SW, NF250-HW NF250-RW, NF250-UW NF250-SEW, NF250-HEW MB225-SW	NV250-CW, NV250-SW NV250-HW, NV250-RW NV250-SEW, NV250-HEW MN225-SW	for left pole	AL-2SWL AL-2SWLS	AX-2SWL AX-2SWLS	ALAX-2SWL ALAX-2SWLS	—	—
		for right pole	AL-1SPR AL-1SPRS	AX-1SPR AX-1SPRS	ALAX-1SPR ALAX-1SPRS	SHTA1-1SPR SHTA2-1SPR SHTA4-1SPR SHTD1-1SPR SHTA1-1SPRS SHTA2-1SPRS SHTA4-1SPRS SHTD1-2SPRS	—
NF100-SEP, NF100-HEP	NV100-SEP, NV100-HEP	for left pole	AL-1SPL AL-1SPLS	AX-1SPL AX-1SPLS	ALAX-1SPL ALAX-1SPLS	—	—
		for right pole					

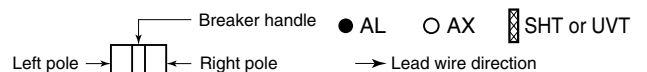


Mount position

Series	NF, MB			NV, MN	
Type name	NF32-SW NF63-CW/SW/HW NF125-CW/SW	NF32-SW(3P) NF63-CW(3P) NF63-SW/HW(3P,4P) NF50-HRW NF125-CW(3P) NF125-SW(3P,4P) NF125-HW NF125-RW/UW MB30-SW MB50-CW/SW MB100-SW	NF100-SEP/HEP NF250-CW/SW/HW NF250-SEW/HEW NF250-RW/UW MB225-SW	NV32-SW NV63-CW/SW/HW NV125-CW/SW/HW NV125-RW MN50-CW/SW MN100-SW	NV100-SEP/HEP NV250-CW/SW/HW NV250-SEW/HEW NV250-RW MN225-SW
Number of poles	2-pole	2-pole, 3-pole, 4-pole	2-pole, 3-pole, 4-pole	2-pole, 3-pole, 4-pole	3-pole, 4-pole
Accessories		(Note 1)	(Note 1)	(Note 2)	(Note 2)
AL					
AX					
AL+AX					
SHT				—	—
UVT			—		—

Note 1. The type with SLT for right pole can't be attached to 4-pole circuit breaker.

2. The cassette type can't be attached to the earth leakage circuit breaker with MG.



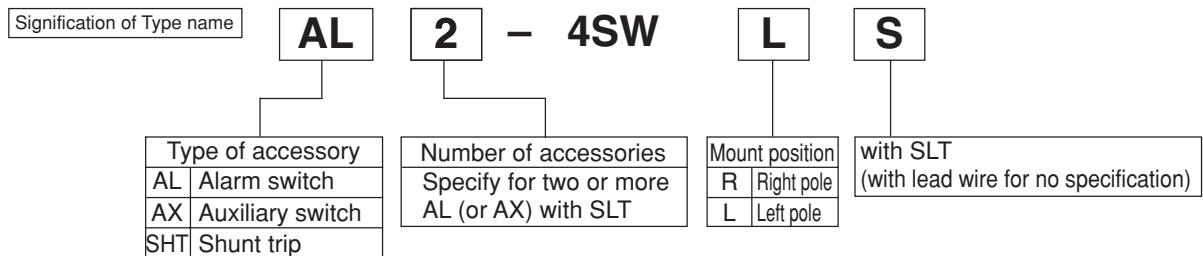
②400~800A frames

● The cassette accessories, AL, AX, AL+AX, and SHT can be installed to the following models by each user.

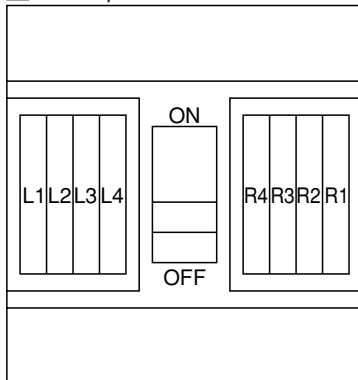
□ Type name of accessories (Indicated by the attached label)

Applicable models	Number of pole	Mounting pole	AL	AX	AL+AX	SHT
NF400-CW/SW/SEW/HEW/REW/UEW NF630-CW/SW/SEW/HEW/REW NF800-CEW/SDW/SEW/HEW/REW/UEW	2, 3	for right pole	—	⊙AX-4SW ⊙AX-4SWRS ⊙AX2-4SWRS	—	⊙SHT-4SW ⊙SHT-4SWRS
NV400-CW/SW/SEW/HEW/REW NV630-CW/SW/SEW/HEW NV800-SEW/HEW	2, 3, 4	for left pole	⊙AL-4SWL ⊙AL-4SWLS ⊙AL2-4SWLS	⊙AX-4SW ⊙AX-4SWLS ⊙AX2-4SWLS	⊙ALAX-4SWL ⊙ALAX-4SWLS	⊙SHT-4SW ⊙SHT-4SWLS
	3, 4	for left pole				

- Note 1. AX or SHT with leads is common use for right and left poles, so can be mounted in either right and left poles.
 2. For mounting plural AL, AX, or AL+AX with leads, install necessary number of the single type accessories.
 3. For mounting three or more AL and AX with SLT, order separately.
 4. For the type with SLT mounting to right pole of 4-pole circuit breaker, order separately.



□ Mount position



FrameA	400					600-630-800							
Mount position	L1	L2	L3	R2	R1	L1	L2	L3	L4	R4	R3	R2	R1
Accessory													
AL	○	○	—	—	—	○	○	○	—	—	—	—	—
AX	○	○	—	○	○	○	○	○	○	—	—	○ ^{Note1.}	○
AL+AX	○	○	—	—	—	○	○	—	—	—	—	—	—
SHT	—	○	—	○	—	—	—	○	—	Note 1.○	—	—	—

- Note 1. AX in R2 and SHT in R3 · R4 can't be mounted together.
 2. Accessories can't be mounted into R1, R2, R3, or R4 for earth leakage circuit breakers.

Cautionary instructions for using cassette accessories

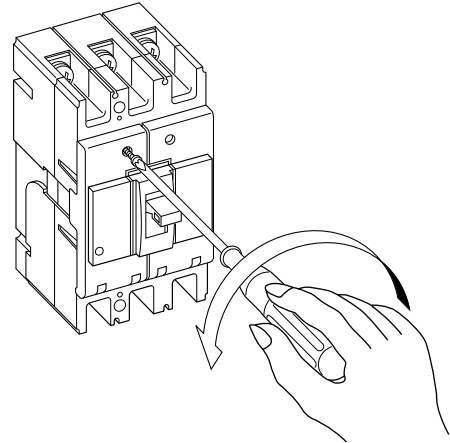
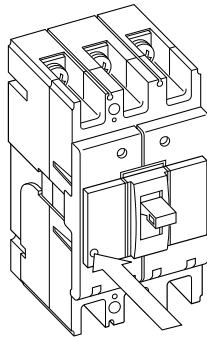
- Note 1. For mounting and dismantling the cassette accessories, be sure to drop the control voltage of the circuit breaker and the accessories to zero, and trip the circuit breaker.
 2. For the applicable accessories and mounting pole concerning each type of breaker, refer to the table in the catalogue.
 3. Mount AL or AX in order of number attached to L or R.
 4. The type with SLT for right pole can't be attached to 4-pole circuit breaker.
 5. The cassette type of AL, AX, or SHT can't be attached to the earth leakage circuit breaker with MG.
 6. The type with SLT can't be attached to the flush-mounting type circuit breaker.
 7. For AL or AX with lead wire, the length of the lead wire outside of the breaker depend on the attached position.
 8. The accessory with SLT and the one with lead wire or the one with SLT can't be mounted together into the same pole.
 9. The cassette accessory can't be attached into the pole mounted UVT (under voltage trip).

⚠ CAUTION

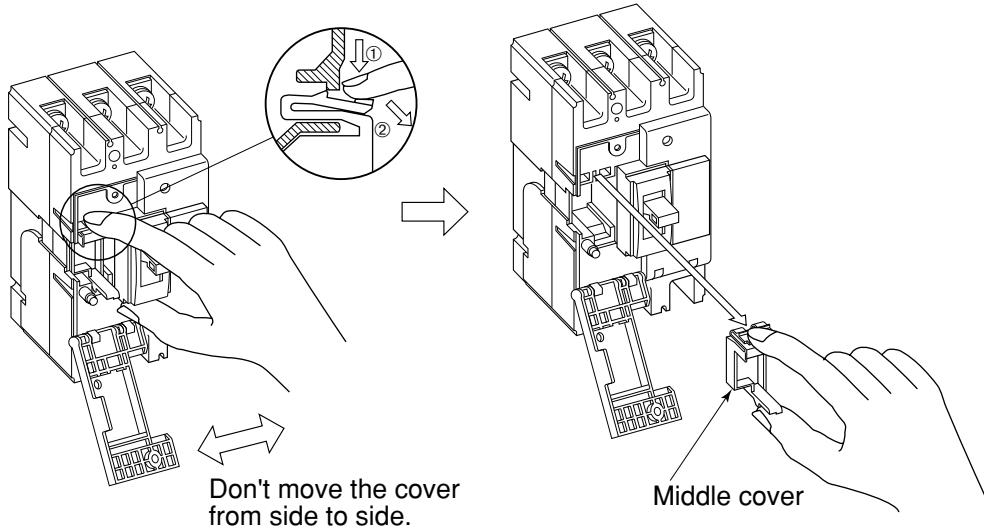


- For mounting and dismantling the cassette accessories, be sure to drop voltage of the circuit breaker and the accessories to zero as electrification can result.
Burning can take place should the circuit breaker operation for breaking.
- Never attach while the handle is at ON, OFF position. The parts are broken and can cause failure.

- ① Before opening the cover, press the trip button, and loosen the screw of the breaker cover. ② Then open the cover.



- ③ If any middle cover or other accessories are attached, remove them before mounting the cassette accessory. (To the circuit breaker having a middle cover, be sure to attach the middle cover while no cassette accessories are mounted.)

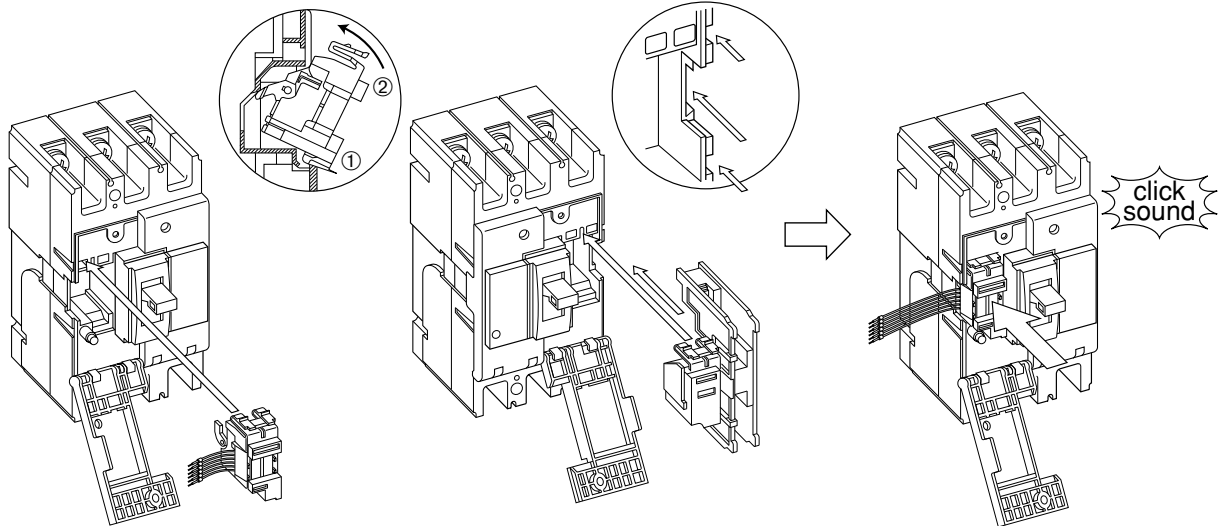


- [Models having the middle cover] NF50-HRW(40, 50A)
 NF125-SW, NF125-HW, NF125-RW, NF125-UW
 NV125-SW, NV125-HW,
 NF100-HEP, NV100-HEP
 NF250-HEW, NF250-UW
 NV250-HEW
 NF800-HEW, NF800-REW, NF800-UEW
 NV800-HEW

④ Push the accessory into the circuit breaker to the point where click sound is heard.



• Don't mount at ON, OFF position. The accessory may fail normal operation or may be broken.

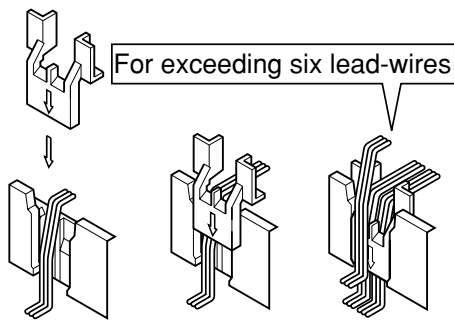


• With lead wires

• With the lead wire terminal block SLT

• The state that attached accessory

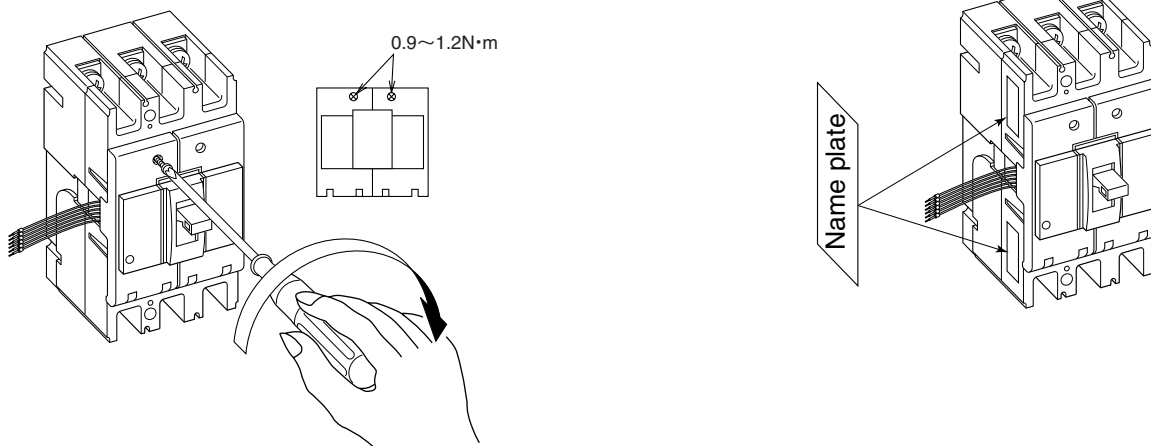
For 600~800A frames with lead wires, fix the lead wires on the side of the breaker by the attachment.



⑤ Close the cover and tighten the screws.

⑥ Close the cover and tighten the screws. Attach the name plate packed together onto a side of the circuit breaker. (except with SLT type)

Fastening torque



⑦ Attach assembling the accessory, be sure to check for smooth operation before use.

Note 1. Please do not re-use what once removed cassette accessories after use. (Since the environment, the number of times of use, and the storage situation are unknown, quality cannot be guaranteed.

2. The lead wire which is not used should perform insulated processing of the end of the lead wire.

(6) EAL (Earth leakage alarm switch)

This switch is for electrically indicating tripped state of an earth leakage circuit breaker at a ground fault.

Operation of EAL switch

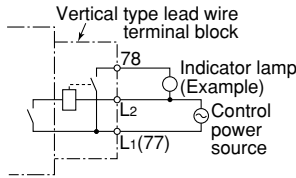
Condition of circuit breaker	Contact condition of EAL switch	
Tripped by overload or short-circuit fault ON-OFF	250A fram and below	78 (open) 77
	400A fram and above	98 (open) 96 (closed) 95
Tripped by ground fault	250A fram and below	78 (closed) 77
	400A fram and above	98 (closed) 96 (open) 95

Rating of EAL switch (250A frame and below)

Voltage V	Current A	
	Resistance load	Induction load
200	3	2
100	3	2

Specify voltage as the switch for 100V differs from that for 200V.

Control power is necessary at each voltage. For wire connection, see the drawing at right.



Rating of micro load EAL switch (400A frame and above)

Microswitch used	AC			DC		
	Voltage V	Resistance load	Induction load	Voltage V	Resistance load	Induction load
SB	125	0.1	—	30	0.1	—
VB	125	0.1	—	30	0.1	—

For use in micro current area, please enquire us separately.

(Note) For model of breakers to be assembled each type of micro switch, refer to the catalogue.

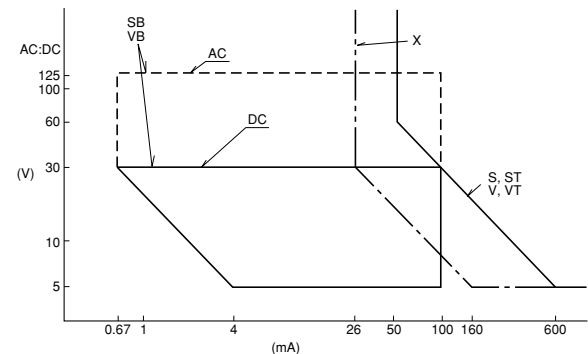
Rating of EAL (400A frame and above)

Microswitch used	AC			DC		
	Voltage V	Resistance load	Induction load	Voltage V	Resistance load	Induction load
S	460	—	—	250	0.2	0.2
	250	3	2	125	0.4	0.4
	125	5	3	30	4	3
V	460	5	2	250	0.3	0.3
	250	10	10	125	0.6	0.6
	125	10	10	30	10	6

Rating of corrosion-proof EAL switch (400A frame and above)

Micro switch of corrosion-proof type used	AC			DC		
	Voltage V	Resistance load	Induction load	Voltage V	Resistance load	Induction load
ST	460	—	—	250	0.2	0.2
	250	3	2	125	0.4	0.4
	125	5	3	30	4	3
VT	460	1	0.5	250	0.3	0.3
	250	5	4	125	0.4	0.4
	125	5	4	30	5	3

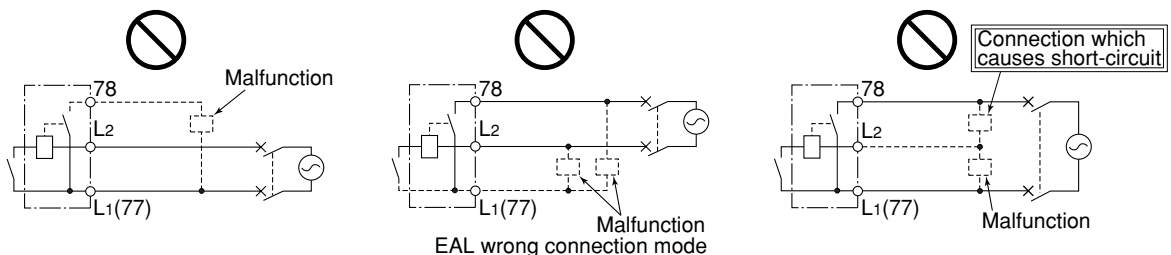
If the breaker is treated by the 1st kind moisture-fungus treatment or by added corrosion-proof treatment, the micro switch of corrosion-proof type is to be used.



For lower area than above limit of applicable load, use the switch for minute load.

⚠ CAUTION

① Connect the wires in the right way. Wrong connection can cause malfunction or short circuit.



② Avoid electrification, ground fault and contact with the main circuit as EAL output is internally connected with the control power.

Before starting operation, be sure to press the test button of the earth leakage circuit breaker to make sure of operation. The test button doesn't operate unless voltage is applied between the right and left pole of the breaker.

(7) TBM (Test button module)

- ① This module is used for testing earth leakage circuit breaker remotely while applying voltage. For time lag type, keep applying voltage for more than two seconds.
- ② The voltage application system is insulated from the main circuit and SHT of MCCB can be used commonly with the control sequence.

Type name	NV63-CW~NV250-CW, NV400-CW, NV630-CW, NV32-SW~NV250-SW, NV400-SW, NV630-SW, NV63-HW~NV250-HW NV100-SEP, NV250-SEW, NV400-SEW~NV800-SEW, NV100-HEP, NV250-HEW, NV400-HEW, NV400-REW, NV630-HEW, NV800-HEW MN50-CW, MN30-SW~MN225-SW	
Control input rated voltage	AC100-240/DC100-240	(DC24V) (Note 1)
Applicable voltage range	AC/DC80-264V 50/60Hz	DC18-30V
Control input	1 VA max.	

Note 1. This module is manufactured for AC100-240/DC100-240V unless otherwise specified in particular.
For DC24V, specify to that effect.

Cautionary instructions for use

Note 1. For operation, apply voltage also to the right and the left poles of the circuit breaker. Testing of the circuit breaker fails unless voltage is applied.

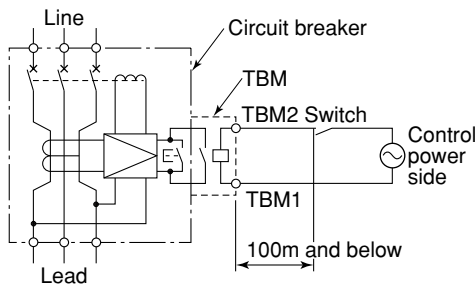
2. For sequence control of TBM, keep applying voltage until operation starts.

Earth leakage circuit breaker: (High-spped type 0.1sec. or longer
Time lag type 2 seconds min.

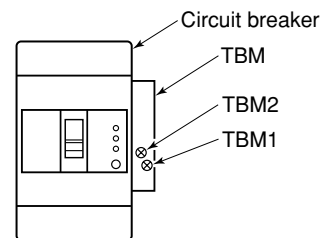
3. Resetting the circuit breaker while applying voltage to the TBM and closing again trips the breaker.
Reduce voltage to zero, therefore, when the circuit breaker is closed again.

4. Number of times of testing is 1,000 times. Refrain from testing over 1,000 times.

5. The distance of wiring to the switch is 100m and below.



TBM connection diagram



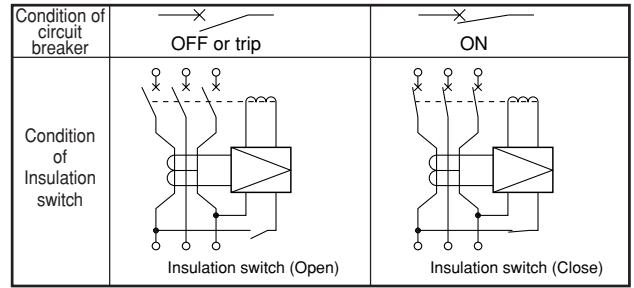
Port name

(8) MG (Insulation switch)

This switch is attached for insulation resistance measurement between right and left poles of the models to which control power is supplied through the right and the left poles, such as earth leakage circuit breaker.

Operation of insulation switch

Connecting a switch interlocked with the handle to one control circuit and turning off the circuit breaker opens the control circuit making it possible to carry out insulation resistance measurement. Even with the standard breakers, insulation resistance measurement is possible between a charged part and ground, the left pole and the middle pole, and between the middle pole and the right pole. Insulation resistance measurement between the left pole and the right pole only reduce the indication to zero but never breaks the ELCB.



(9) PAL (Pre-alarm module)

This module functions to give alarm output when load current exceeds a preset current level and serves for securing continuous power supply and also for preventive maintenance. The electronic breakers with mount digital ETR of 100 to 800A frames are provided with this module as an option. (Some models are with this module as the standard equipment.)

(1000 to 2000A frames are prepared for exclusive use.)

Type	Pre-alarm LED (Auto reset)	Solid state relay (SSR) output-Contactless output (Auto Reset)		Pre-alarm module-Contact output (1a)			
		Option	Switching capacity	Auto reset	Self-holding	Switching capacity	Reset system
NF100-SEP NF100-HEP	Standard equipment	Option	DC24V-AC100-200V 20mA	Option (Note 1)	Option	AC100V or AC200V 2A	Press the reset switch or turn off control power.
NF250-SEW NF250-HEW							
NV100-SEP NV100-HEP							
NV250-SEW NV250-HEW							
NF400-SEW NF400-HEW							
NF630-SEW NF630-HEW NF630-REW							
NF800-CEW NF800-SEW NF800-HEW NF800-REW NF800-UEW							
NV400-SEW NV400-HEW NV400-REW							
NV630-SEW NV630-HEW							
NV800-SEW NV800-HEW							
			DC24V- AC100-200V 20mA			AC125V 2A AC250V 2A DC30V 2A DC100V 0.3A	

Note 1. Pre-alarm module is normally self-holding. Auto reset can be produced upon request.

① Pre-alarm LED

The LED starts blinking on the circuit breaker when load current exceeds the preset current, then changes to continuous glowing when pre-alarm output is given.

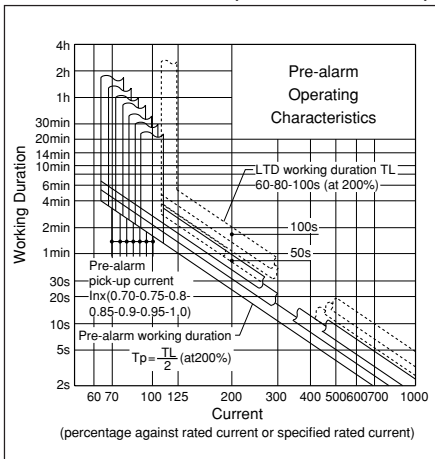
② Solid state relay output

Open the upper cover of the circuit breaker, connect the connector of the lead wire packed together, and use it as the lead wire outlet. In this case, only the lead wire output of the internal accessories can be attached to the right pole. (For flush plate type, the outlet is manufactured in advance as PAL mount.)

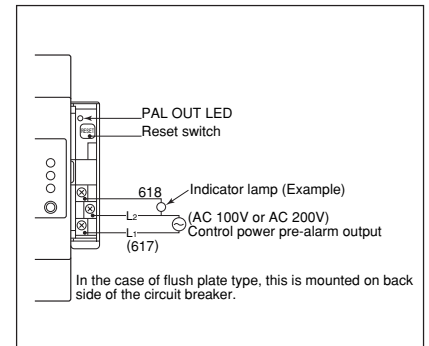
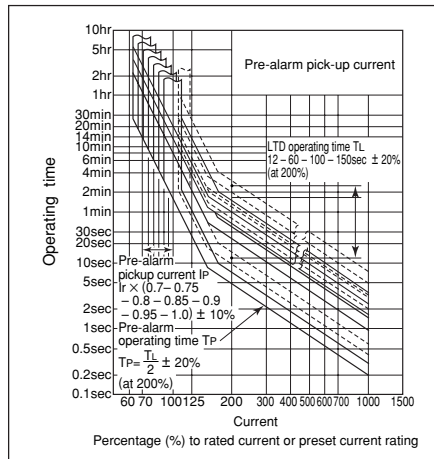
③ Pre-alarm module

SLT is attached as a standard equipment and is used as the control power source of AC100V or AC200V. In this case, no other internal accessories can be attached to the right pole. (Auto resetting is also applicable.)

Pre-alarm characteristics (100 and 250A frames)



Pre-alarm characteristics (400 to 800A frames)



⚠ CAUTION

Be careful to electrification, ground fault, and contact with the main circuit as PAL output is internally connected with the control power source.

3.6.10 External accessories

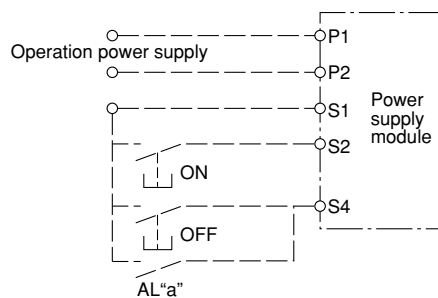
(1) Electric operation device

① Spring-charged type (1)

- Electric operation : When ON switch is turned off, a relay drives the motor to reset the latch mechanism, instantaneously turning the breaker ON with the accumulated force of the input spring. When OFF switch is turned off, the relay drives the motor to turn the breaker OFF (reset) and charge the input spring at the same time.
- Manual operation : Shift MANU/AUTO selector switch on the cover top to MANU then press ON button. The latch mechanism is reset and the accumulated force of the input spring instantaneously turns on the breaker ON.
Turning OFF (resetting)
Draw out the manual handle and reciprocate it a few dozen times to turn the breaker OFF (reset) and charge the input spring at the same time.

Caution on remote operation (electric operation)

- Press ON switch for 0.1 sec. or more, and OFF switch for 20 msec. or more. Otherwise the switches may not work.
- The electric operation circuit is set up so OFF switch takes priority. Even if ON switch and OFF switch are pressed at the same time, therefore, the breaker is turned OFF without fail.
- For the automatically reset type, use a breaker alarm switch (micro-loading) and connect terminals S1, S2 and S4 as shown in following Fig. Since the operation circuit has an ON signal one-shot output circuit in addition to the function to give priority to the OFF switch, an automatic resetting system with an UVT is set up and such a cycle as ON (invalid) → trip → OFF (reset) does not repeat even if the breaker has been tripped without UVT excitation when the ON signal is continually transmitted.
In addition, when the circuit breaker trip from OFF status by the UVT, the circuit breaker can not reset automatically. Invalid operation of ON is required. After invalid operation of ON, it resets automatically.



- If a reset preventive UVT is installed and the UVT has been unexcited when the breaker is OFF, the breaker mechanism trips but the electric operation unit breaker OFF status is kept indicated. Even if the UVT is excited afterward, the breaker mechanism is kept tripped and turning the switch ON trips the mechanism. In such a case, the electric operation unit indicates tripped (ON is indicated for the 225·250AF). After resetting, turn on the breaker OFF again.
- Any articles using same voltage incorporate switching power supply, so they may interfere with any communications equipment (AM radio, for instance) used in their vicinity. In such a case, provide a noise filter on the input side. An electrolytic capacitor is used as switching power supply. Draw your due attention to the use and custody at high temperature.

Caution on manual operation

[Turning ON]

- (i) Shift MANU/AUTO selector switch to MANU. When MANU has been selected, the electric operation circuit will be automatically open.
- (ii) Press ON button. The latch mechanism is disengaged and the accumulated force of the input spring turns the breaker ON. The ON button operating load is approx. 50 N.

[Turning OFF]

- (i) Shift MANU/AUTO switch to MANU. When MANU has been selected, the electric operation circuit will be automatically open.
- (ii) Draw out the manual handle and reciprocate it a few tens of times to turn the breaker OFF and charge the input spring.

<<For 50·100·125AF>>

Reciprocate the manual handle a few times. The breaker status will be indicated as "TRIP", and the spring status, "Discharge". In such a case, the input spring is not fully charged. So reciprocate the manual handle until "Charge" is indicated.

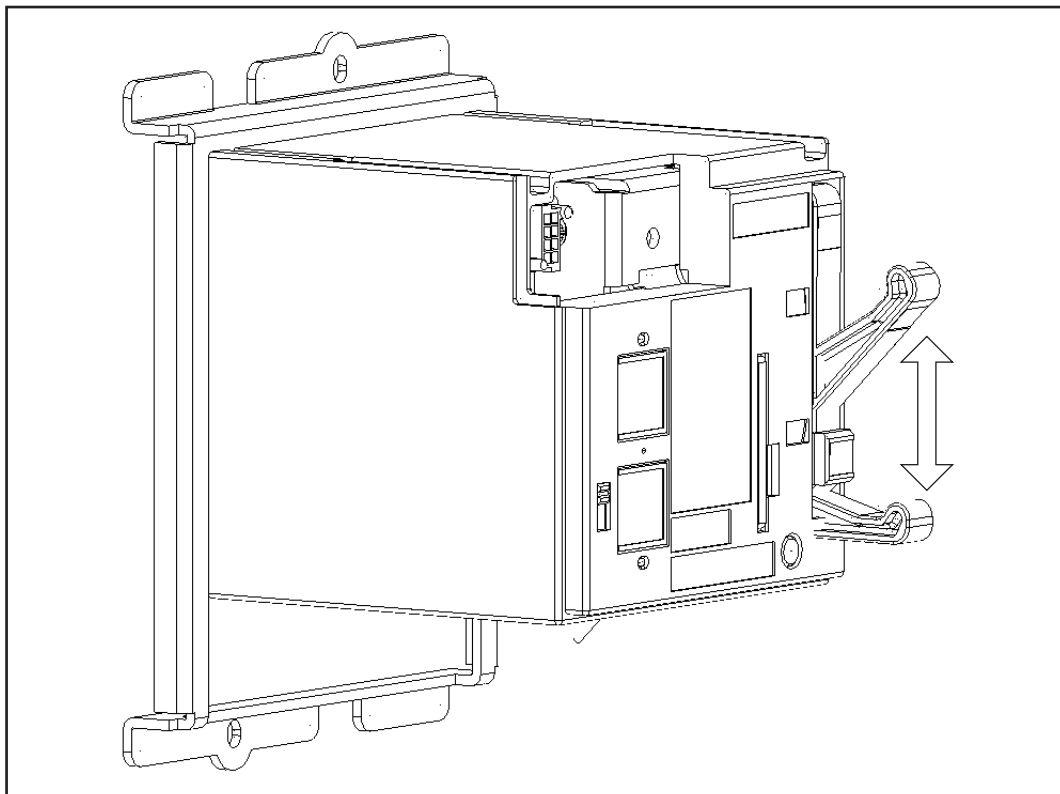
<<For 225·250AF>>

Reciprocate the manual handle until the breaker status is indicated as "OFF".

The breaker can be turned OFF without shifting the selector switch to MANU. However, the breaker is also controlled by remote operation, so operate the handle after shifting the selector switch to MANU.

- (iii) After reciprocating the handle, be sure to return the MANU/AUTO selector switch to AUTO. When the switch has returned to AUTO, the electric operation circuit is automatically closed.

Note: When MANU is selected with the MANU/AUTO selector switch, the breaker cannot be electrically (remotely) operated. So be sure to return the selector switch to AUTO after ending manual operation.



Caution on OPEN (trip) button operation

- (i) Shift MANU/AUTO selector switch to MANU. When MANU has been selected, the electric operation circuit will be automatically open.
- (ii) Press OPEN (trip) button and the breaker trips. The OPEN (trip) button operating load is approx. 5 N.
- (iii) After pressing OPEN button, be sure to return the MANU/AUTO selector switch to AUTO. When AUTO has been selected, the electric operation circuit is automatically closed.

Note 1: The breaker is structured so OPEN (trip) button cannot be pressed when the breaker is OFF.

Note 2: Be sure not to turn the breaker OFF with the OPEN (trip) button pressed. Otherwise the electric operation unit may be damaged.

Caution on test button operation

- (i) To check the test button operation, check the breaker leakage indicator button through the inspection hole at the right side of the electric operation unit. Also check that the breaker operation status is indicated as "trip (yellow)" (for the 50·100·125AF).

Earth leakage breaker delay time and sensitivity selection

- Take the following procedure:
 - (i) Remove the operation circuit terminal wire and a power supply module setscrew to remove the power supply module from the electric operation base.
 - (ii) Remove 2 setscrews from the electric operation unit, and remove the electric operation base from the breaker.
 - (iii) Set the breaker sensitivity current selector switch and the earth leakage tripping time selector switch.
 - (iv) After setting them, install the electric operation base and the power supply module.
 - (v) Replace the sensitivity current nameplate and the earth leakage tripping time nameplate with those for the newly set ones.
 - (vi) Connect the operation circuit terminal again.
 - (vii) Check each operation again.

(a) How to install

The users who purchased a single electric operation unit for 50·100·125AF are requested to take the following procedure before installing the electric operation unit on the breaker:

<<50·100·125AF>>

- (1) For the no-fuse breaker, untighten the breaker cover screw and remove the part shown in Fig.1 with nippers then tighten the breaker cover screw again. For the other breakers, cut out the indicating plate in the position shown in Fig.1 with a cutter.
- (2) Insert the attached indicating plate into the indicating plate hole on the breaker as shown in Fig.2.

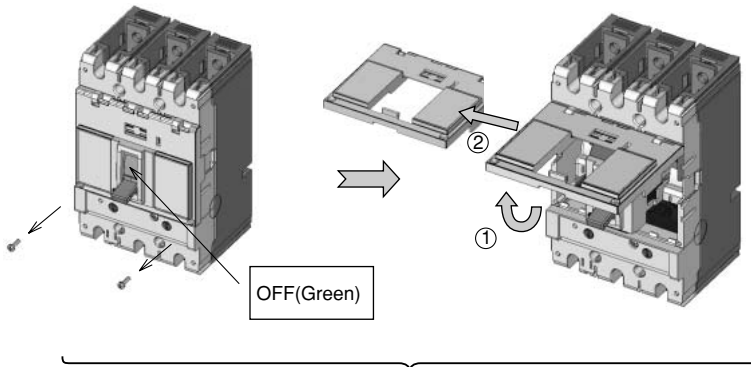
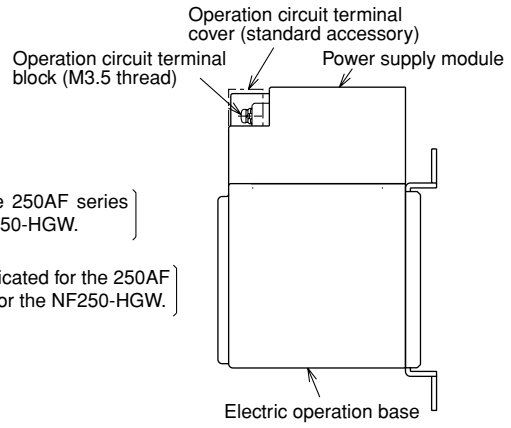
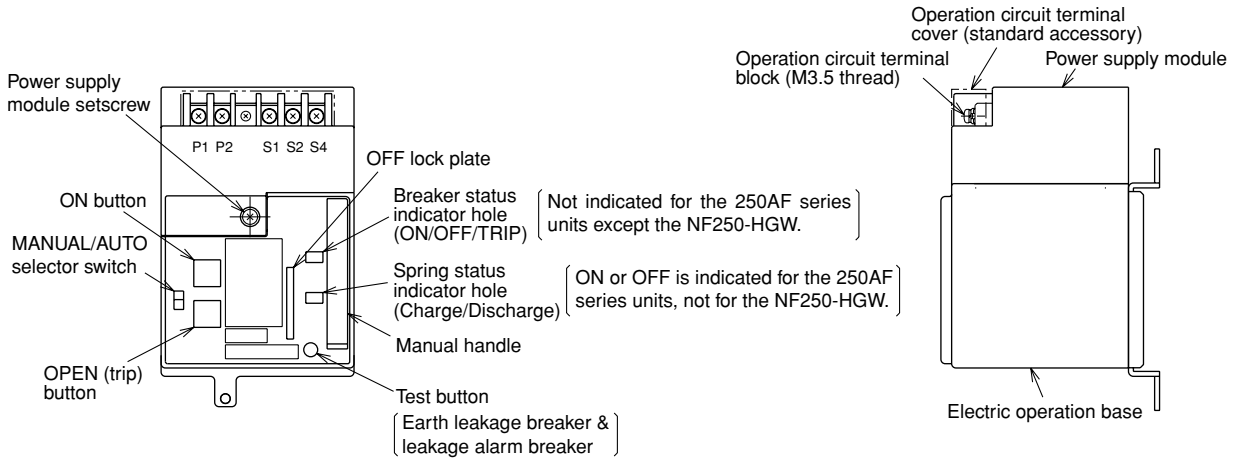


Fig. 3

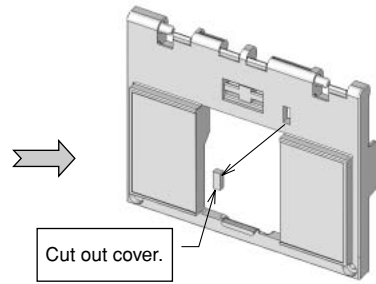


Fig. 4

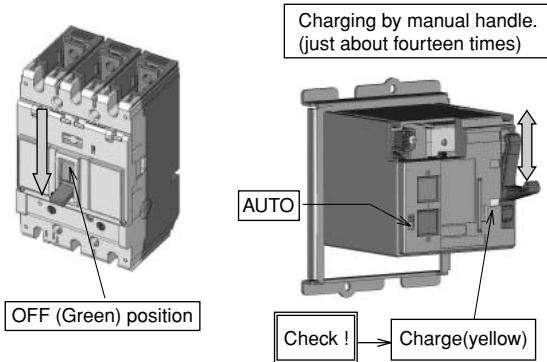


Fig. 6

Fig. 7

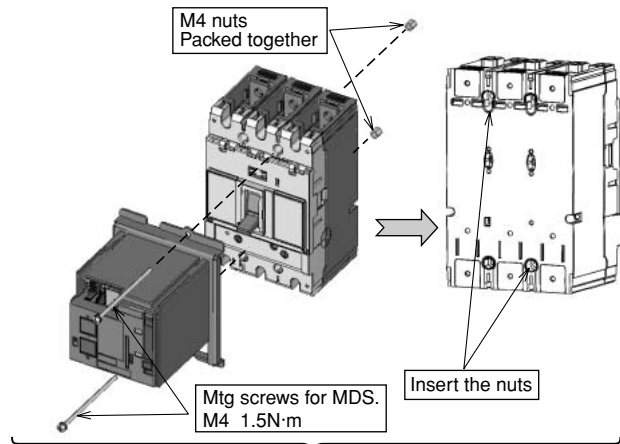


Fig. 8

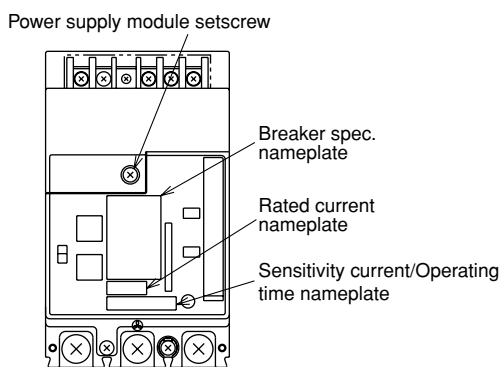


Fig. 11

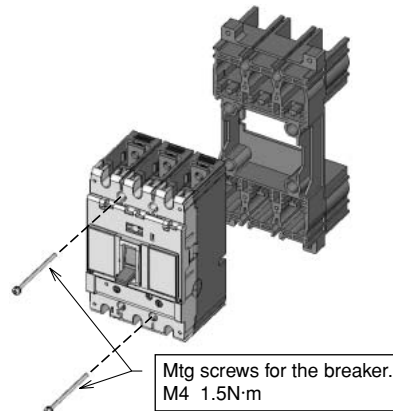


Fig. 12

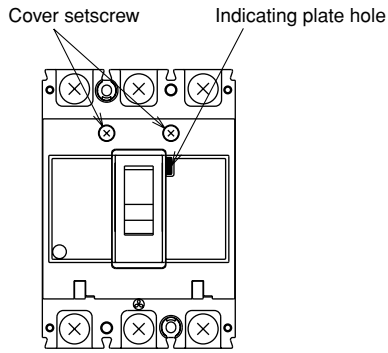


Fig. 1

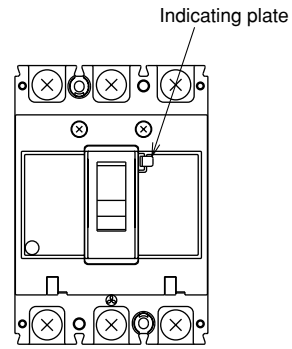


Fig. 2

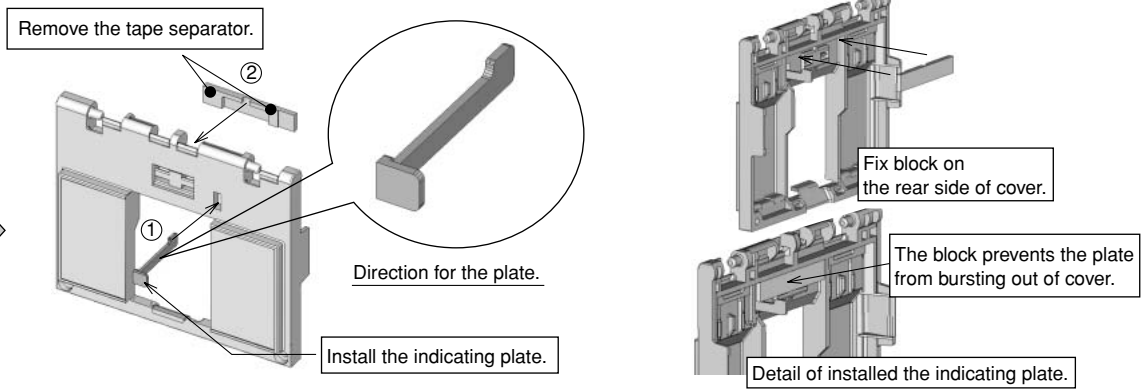


Fig. 5

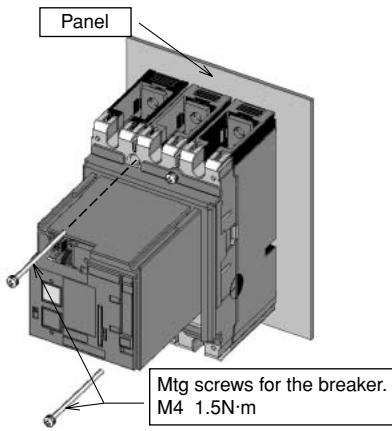


Fig. 9

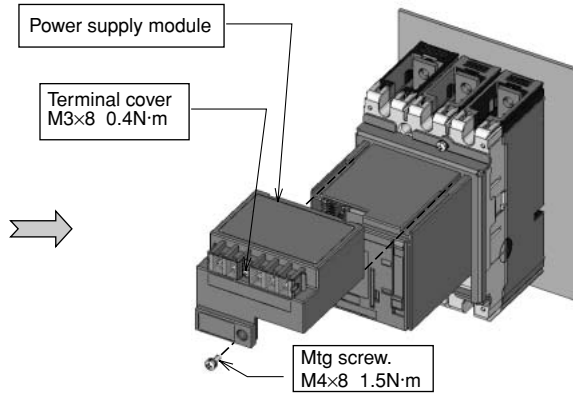


Fig. 10

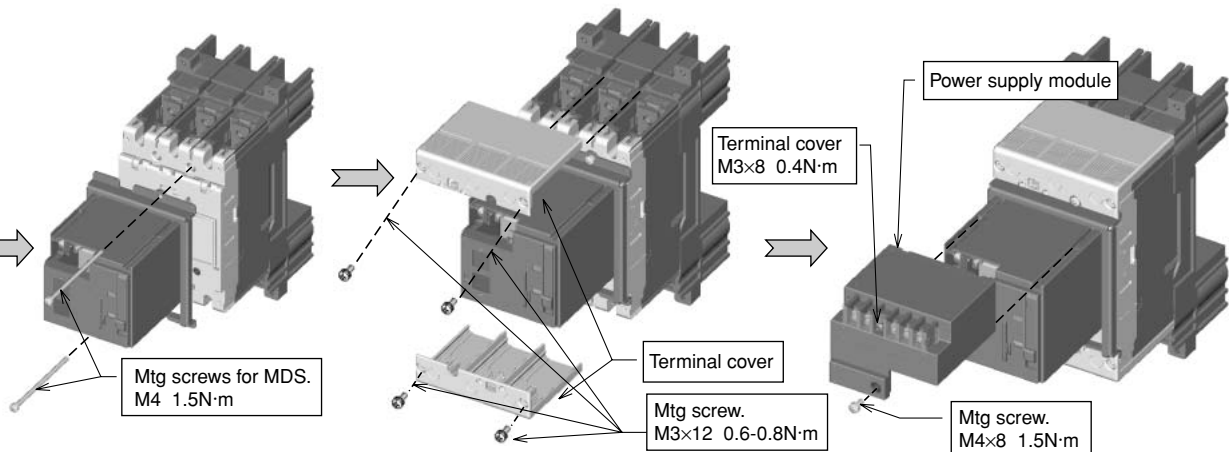


Fig. 13

Fig. 14

(i) For the Front and Rear connection type

- (1) Untighten the power supply module setscrew to remove the power supply module from the electric operation unit.
- (2) Turn the breaker OFF (Fig. 6).
- (3) Set the electric operation unit to "Charge" (Fig. 7)
(or "OFF" for 250AF except NF250-HGW).
- (4) Install the electric operation base on the breaker with attached 2 pcs. each of electric operation unit setscrews and nuts (Fig. 8)
(The users who purchased the breaker equipped with an electric operation unit need not take steps (2) - (4) above).
- (5) Install the breaker equipped with an electric operation base on the panel with 2 breaker setscrews (Fig. 9).
- (6) Inserting to fix the power supply module into the electric operation base groove with a power supply module setscrew (Fig. 10).

Note: Before installing the power supply module, complete wiring the breaker and installing the terminal cover. After installing the power supply module, the breaker cannot be wired and the terminal cover cannot be installed.

- (7) Paste the attached nameplates on the electric operation unit cover as shown in Fig. 11.

(ii) Plug-in type

- (1) Untighten the power supply module setscrew to remove the power supply module from the electric operation unit.
- (2) Turn the breaker "OFF."
- (3) Set the electric operation unit to "Charge" (or "OFF" for 250AF except NF250-HGW).
- (4) Install the breaker on the plug-in terminal block with 2 breaker setscrews (Fig. 12).
- (5) Tighten the electric operation base and the breaker to the plug-in terminal block with attached 2 electric operation unit setscrews (Fig. 13).
- (6) Insert to fix the power supply module into the electric operation base groove with a power supply module setscrew (Fig. 14).

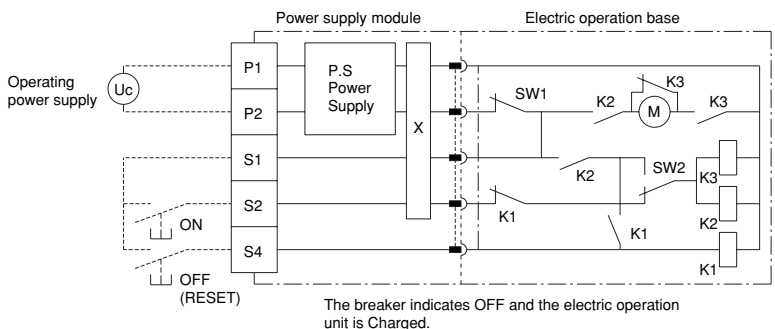
Note: Before installing the power supply module, complete wiring the breaker and installing the terminal cover. After installing the power supply module, the breaker cannot be wired and the terminal cover cannot be installed.

- (7) Paste the attached nameplates on the electric operation unit cover as shown in Fig. 11.

(b) Operation circuit connection

- (i) Connect the operation power supply to the operation power supply terminals (P1 and P2). There is no polarity.
- (ii) Connect ON switch and OFF switch to the operation switch terminals (S1, S2 and S4). For the operation switches, use the micro-loading switches (with approx. DC 24 V, 30 mA of switching capacities) prepared at your side.

Note: For the voltage sharing items, the rush current (capacitor charging current 60A 1msec) mentioned later flows to the breaker and the fuse in the power supply circuit. So select the items with care to prevent fusion and operation errors.



P.S	Switching power supply (AC 100-240 V/DC 100-250 V types only)
SW1	MANU/AUTO selector switch
SW2	Charge/Discharge detecting switch
(M)	Motor
K1	Relay (for OFF switch)
K2	Relay (for the motor)
K3	Relay (for the motor)
X	Pumping preventive circuit

(c) Caution on withstand voltage tests

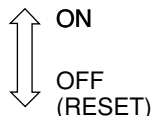
The withstand voltage between the operation circuit terminals (P1, P2, S1, S2 and S4) and the ground is AC 1500 V.

③ Motor-operated type (2)

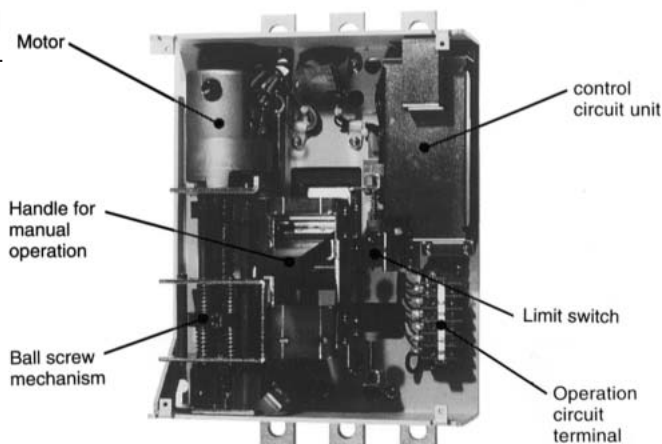
- **Electrical Operation** : The circuit-breaker is turned ON/OFF (reset) converting the forward and reverse rotation of motor into rectilinear motion by ball screw.
- **Manual Operation** : Manual operation handle is manipulated directly toward On or Off side of the circuit-breaker.



Fig. 2 Manual Operation



※ Make sure to operate up to the position indicated by the name plate. (Should the operation be suspended midway, the limit switch for electrical operation may possibly not function, which will cause an error.



※ In case when the unit is provided with the internal accessory for NFB, the terminal block of its lead-wire is mounted on the NFB.

Structure (with the cover for motor-operated type electrical operation unit removed)

(a) Precaution to be taken for handling

⚠ CAUTION



Every time the electrical operation unit is dismantled or remounted, turn off the master circuit-breaker, switch off the operational circuit to make sure that the main and operational circuits are not alive (charged). Beware of electric shock. Notice that the manual operation handle operates at high speed during electric operation. Never try to perform the electric operation with cover opened. Turn off the power supply for operational circuit at the time of manual operation.

- When the circuit-breaker trips, the resetting (reclosing) procedure depends on the status of the electric operation unit before the trip:
 Trip with unit ON: Resetting (OFF) operation → ON operation
 Trip with unit OFF: ON operation → Resetting (OFF) operation → ON operation.
- Never try to apply ON and OFF operation signals continuously. There must be a time interval of 0.5 sec or longer between the ON and OFF signals.
- Since the electric operation unit is of intermittent rating, never try to operate 10 times or more continuously (ON and OFF consecutive operation is counted as one operation).
- The operational voltage shall be within 85 to 110% of the rated operation voltage.
- In case of automatic reset mode, resetting operation shall be made with 0.5 sec of time interval after the NFB tripped.
- Note that the electrical operation unit will not display the trip when the circuit-breaker trips due to some trouble (overload, short-circuit, leakage), internal accessories (UVT, SHT) or to the trip button, test button.
- The electrical operation unit incorporating pumping prevention device, it can be turned off while the ON switch is maintained thrown, but it cannot be turned ON continuously after that. If it is to be turned on, once change the ON switch over to OFF, and then apply again the ON switch.
- In the manual operation mode, make sure to manipulate the manual operation handle up to the position indicated by the name plate.
- The withstand voltage of the electrical operation circuit is 1500V. If the withstand voltage test is performed under a voltage exceeding 1500V together with other equipment, cut off the terminals (P1, P2, S2 and S4) of the operational circuit.
- Note that the leak sensitivity current and action time changeover device for Earth leakage circuit breakers have been set 500 mA 2.0 sec (at delivery). If the user wants to change this setting, proceed to the change only after removing the frame.

(b) Mounting

- (i) Front-connection/Rear-connection (Other than the U-series).
 - (i)-1 Sequential order for mounting the electrical operation type MCCB
 - a) Detach the four cover mount screws (A) to remove the cover.
 - b) Fix the electric operation type MCCB on the panel using four MCCB mount screws (B).
 - c) Connect the electric operation unit to the terminal of operational circuit.
 - d) Fasten the cover with four cover mount screws (A).
 - (i)-2 Maintenance and inspection of electrical operation unit (Removal of this unit only)
 - a) Detach the four cover mount screws (A) to remove the cover.
 - b) Remove the four frame mount screws (C).
 - c) Slide the electric operation unit slightly toward the power supply side to remove the frame from hook pin.
 - * When mounting the unit on the MCCB, thread the handle between the rollers of the bracket beforehand. The electric operation unit has been so designed that it may be supported temporarily by the hook pin in case of setting with screws.
 - * Mount the electric operation unit so that the end of the trip lever matches with the position of the trip button of MCCB.
 - * The end of the trip lever projects from the plane F of the frame. Take care not to allow the trip lever to be deformed.
- (ii) Flush plate type (Other than the U-series)
 - a) Mounting the electric operation type MCCB
 - Fix the MCCB on the panel or the like using the attaching (mount) screws (E) for flash plate.
 - * NF1600-SEW/SDW shall be mounted with the mount angle of MCCB.
 - b) Maintenance and inspection of electrical operation unit (Removal of this unit only) Same as for front connection/rear connection types.
 - Note. When mounting 800 AF and subsequents, the smaller slider out of the two sorts of sliders (insulating plates) between the bracket and cover shall be incorporated into the upper plane, and the notched portion of the larger one into the lower left corner.
- (iii) Mounting the front-connection and rear-connection (U-series)
 - (iii)-1 NF400-SEW (3P)
 - a) Detach the electrical operation unit from the circuit-breaker.
 - Step 1 Detach the four cover mount screws (A) to remove the cover.
 - Step 2 Remove the four frame mount screws (C).
 - Step 3 Slide the electric operation unit slightly toward the power supply side to remove the frame from hook pin to remove the electric operation unit from the circuit-breaker.
 - Precaution to be taken:
 - The end of the trip lever projects from the plane F of the frame.
 - Take care not to allow the trip lever to be deformed.
 - b) Mount the circuit-breaker on the board using four circuit-breaker mount screws (B). The mounting onto the board is the same as that of the circuit-breaker both for front connection and rear connection types.
 - c) Mount the electric operation unit in the sequential order reverse to a).
 - Note 1. When mounting on the circuit-breaker, thread the handle between the rollers of the bracket beforehand.
 - Note 2. The electric operation unit has been so designed that it may be supported temporarily by the hook pin in case of setting with screws.
 - Note 3. Before mounting the cover, connect electric operation unit to the terminal of the operational circuit.

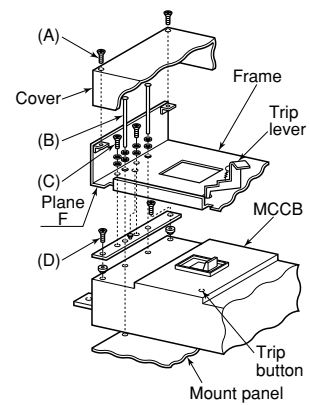


Fig. 3

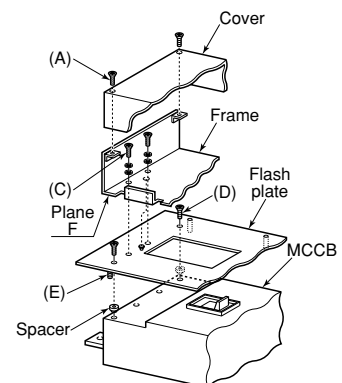


Fig. 4

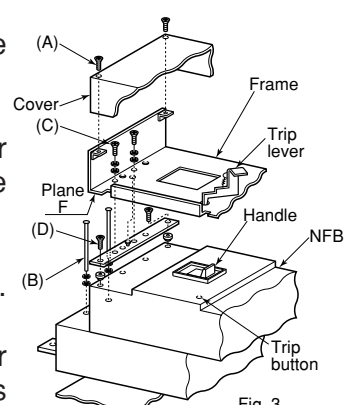
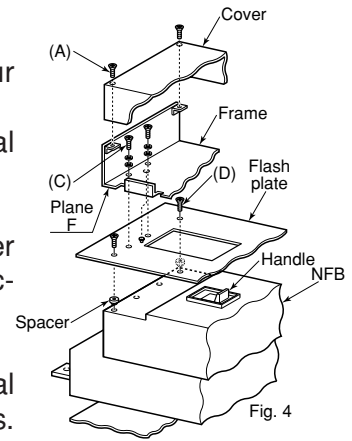


Fig. 3

(iii)-2 NF400-UEW(4P), NF800-UEW

- Detach the four cover mount screws (A) to remove the cover.
 - Fasten the electric operation type circuit-breaker using the four breaker mount screws (B).
 - Connect electric operation unit to the terminal of the operational circuit.
 - Fix the cover with the four cover mount screws (A).
- ※ If the electric operation unit is to be removed from the circuit-breaker for maintenance and inspection, the removal shall be made according to the procedure for NF400-UEW(3P).

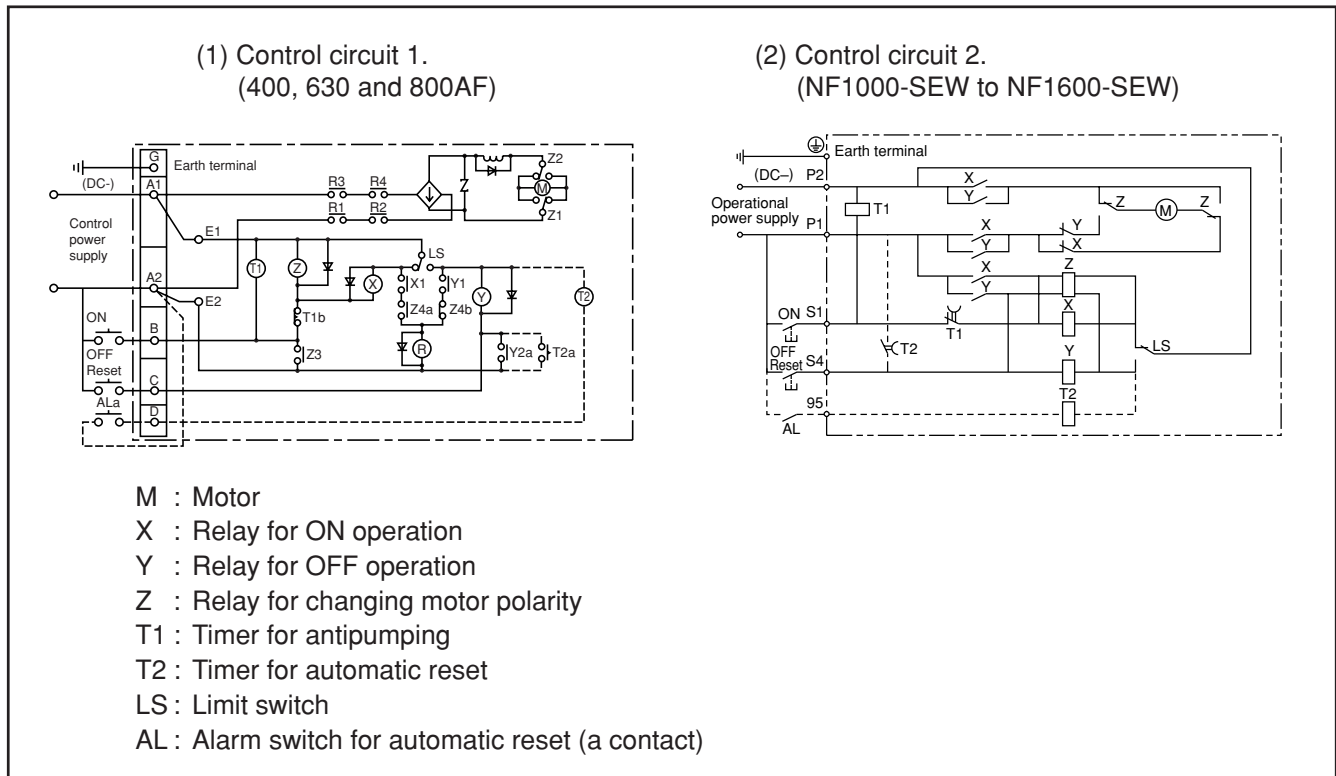


(iv) Flush plate type (refer to Fig. 4) (U-series)

- Maintenance and inspection of electrical operation unit (Removal of this unit only) Same as for front connection/rear connection types.
- Note. When mounting it, the smaller slider out of the two sorts of sliders (insulating plates) between the bracket and cover shall be incorporated into the upper plane, and the notched portion of the larger one into the lower left corner.

(c) Motor-operated type electric operation circuitry

Note. The portion indicated by broken lines in the circuitry, is added in the case of automatic resetting.



Note 1. The above diagram indicates the MCCB when it is OFF.

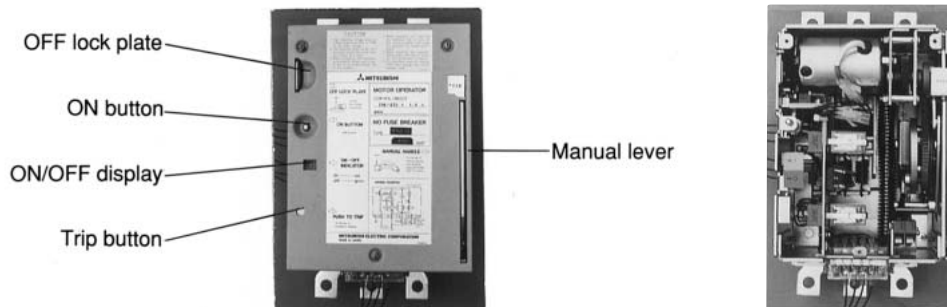
Note 2. Since the electric operation is of self-sustaining type, instantaneous closing of operational switch only ensures the required operation.

Note 3. The portion surrounded by the alternate long and short line represents the interior of the electrical operation unit which has already been wired. Note that the (T2) ondelay timer for the alarm switch for automatic resetting is not standardized. The user is requested to specify it.

Note 4. The relay has polarity in case of DC operation. Decide the polarity you desire as shown in the above diagram.

④ Spring-charged type (2)

- **Electrical Operation** : When the ON operation switch is closed, the closing coil is excited, latch mechanism is released and the closing spring will turn on the circuit-breaker instantaneously. If the OFF operation switch is closed, the relay will come into function to start the motor. If, under these conditions, the circuit-breaker is turned OFF (reset), the closing spring will be charged instantaneously.
- **Manual Operation:** Depressing the ON button will release the latch mechanism, and the closing spring will turn on the circuit-breaker instantaneously.
OFF (reset) Operation. When the manual lever is taken out depressing the leaf spring, and the lever is thrown a dozen times reciprocatedly, the circuit-breaker turns OFF (resetting) and the closing spring is charged at the same time.



(a) Precaution to be taken when handling

⚠ CAUTION

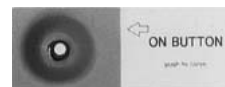
Every time the electrical operation unit is dismantled or remounted, turn off the master circuit-breaker, switch off the operational circuit to make sure that the main and operational circuits are not live (charged). Beware of electric shock.

Case of remote operation (electric operation)

- (i) The operational voltage shall be within the range from 85 to 110% of the rated operational voltage.
- (ii) Since the electric operation unit is of intermittent rating, avoid operating it 10 times or more continuously (ON and OFF consecutive operation is counted as one operation).
- (iii) The turning off by the electric operation requires about 2 sec (from application of OFF signal on the electric operation unit to turning off of the circuit-breaker). If one wants to open urgently the main circuit by remote operation, it is recommended to use the circuit-breaker with SHT or UVT.
- (iv) When the circuit-breaker trips, the resetting (reclosing) procedure depends on the status of the electric operation unit before the trips:
 Trip with unit ON : Resetting (OFF) operation → ON operation
 Trip with unit OFF : On operation → Resetting (OFF) operation → ON operation

Case of local (manual) operation

- (i) **Turning ON**
 Pressing the ON button will release the latch mechanism and turn on the circuit-breaker instantaneously by the energy of the closing spring.
- (ii) **Turning OFF (reset)**
 The manual turning OFF (resetting) should be repeated more than 10 times after taking out the manual lever. Repeat the operation of manual lever without fail up until the manual lever idles. After completion of the manual operation, house the lever into its original position.
Note. Sometimes the operational load reduces more or less midway with the circuit-breaker turning off emitting a sound. Never fail to continue to operate the manual lever until it does idling.
- (iii) **Trip operation**
 The circuit-breaker with the electric operation unit has been so designed that it should not trip even if the trip button is depressed under OFF condition. When the circuit-breaker is to be tripped on occasion, for instance, of witnessed test, it shall either be made to trip after once it shall be turned ON or shall trip by turning it on with trip button depressed.



- (iv) In case when the main circuit is to be opened in emergency:
If the main circuit is to be opened in emergency by manual operation, the circuit-breaker shall be made to trip depressing the trip button.

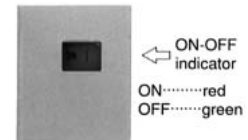
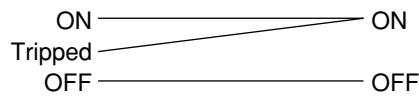


- (v) OFF lock plate
If the electric operation unit is locked with a padlock with the OFF lock plate drawn out, it cannot be operated anymore electrically nor mechanically. This locking shall therefore be applied when ON operation is to be prohibited or erroneous closing is to be avoided.
Note. The OFF lock plate has been so designed that it cannot be drawn out before the completion of charging.
Up to three padlocks can be attached.



Indicator

- (i) Pay your full attention to it that the electric operation unit does not indicate trip even when the circuit-breaker trips. It will indicate as below. Trip indicator may be manufactured upon your request.
(Condition of the circuit-breaker) (Indicate by the electric operation unit)



- (ii) Electric operation unit with trip indicator (special order)
Notice that the electric operation unit indicate trip when the circuit-breaker trips, but that the trip indicator will evolve as below when the resetting operation is resumed. (Tripped → Indicate evolution of the electric operation unit when resetting) Tripped → ON → OFF

Case of circuit-breaker with UVT

- (i) In case when the UVT comes into function with the circuit-breaker ON:
Making just after excitation of UVT becomes possible by automatic reset type circuitry.
- (ii) In case when the UVT becomes non-excited with the circuit-breaker OFF:
Making is possible immediately after the excitation of UVT.

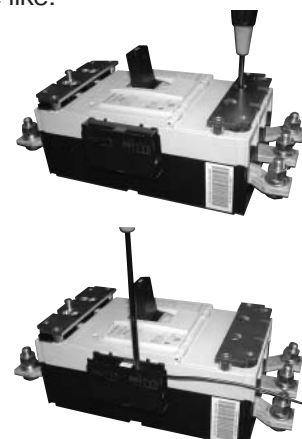
(b) Mounting method

Precaution to be taken when handling

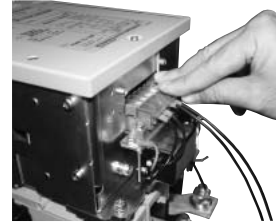
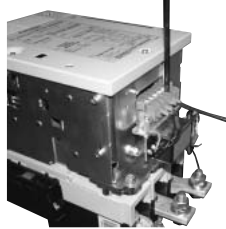
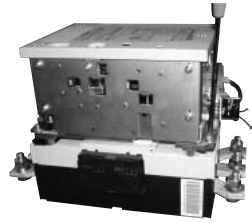
- (i) Dismantling and remounting of the electric operation unit from and onto the circuit-breaker shall be done with the circuit-breaker tripped or ON and with the electric operation unit discharged (indicator of the electric operation unit: ON).
- (ii) Note that the electric operation unit can be dismantled and remounted with cover provided (except the Flush plate type).
- (iii) If the electric operation unit is to be handled individually, confirm beforehand that it is discharged (indicator : ON (red)).
If it is charged, depress the ON button to discharge it. Since the discharge is accompanied by a severe shock, discharging operation should be performed on a firm stand or the like.

Mounting the front connection, rear connection and plung-in type

- (i) Remove the electric operation unit.
- (ii) Mount the circuit-breaker on the board. The mounting on the board is the same as that for the independent circuit-board both for front-connection, rear-connection and plug-in types.
- (iii) Wire the circuit-breaker with the internal accessory unit. If the circuit-breaker has already been provided with the accessory, proceed to the wiring work under the condition.

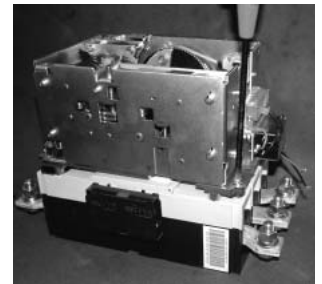
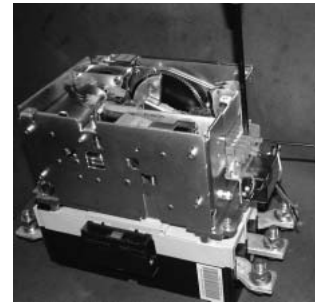


- (iv) Mount the electric operation unit on the circuit-breaker. Attaching screws are four M6 screws, The electric operation unit has been so designed that it can be provisionally supported by hook pin when it is to be fastened with screws.
- (v) Wire the electric operation unit to the control circuit. Mount the terminal cover after the wiring.



Mounting the flush plate type

- (i) Detach the cover mounting screws of the electric operation unit.
- (ii) Detach the electric operation unit from the circuit-breaker.
- (iii) Mount the circuit-breaker on the board. The mounting method on the board is the same as that for the rear-connection type circuit-breaker.
- (iv) Wire the circuit-breaker with its internal accessory. Refer to the above-mentioned mounting method for the rear-connection type.
- (v) Mount the electric operation unit on the circuit-breaker after removing the cover of the electric operation unit.
- (vi) Connect the electric operation unit to the control circuit. Mount the terminal cover after wiring.

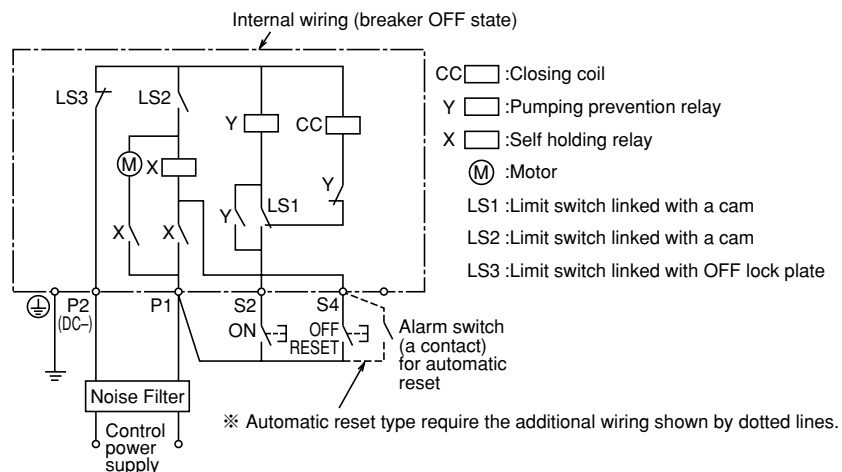


- (vii) Mount the cover of the electric operation unit after fitting the panel to be supplied by user.



• Operational Circuit

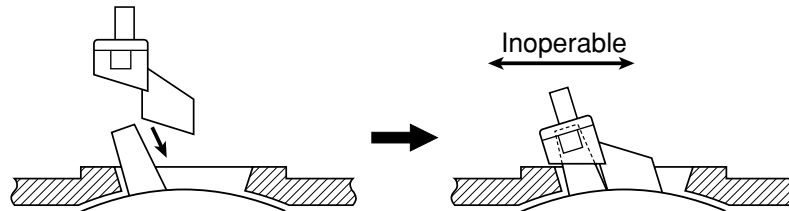
Such wiring as shown by the broken line will be added for the automatic resetting type.



(2) Lock cover (LC)

The lock cover is a plug-in type handle mechanism that can prohibit operation readily without applying any lock. A "Warning Tag" can be attached to it.

One can safely use this mechanism since it may trip with its handle locked at ON position if any overcurrent flows.



CAUTION

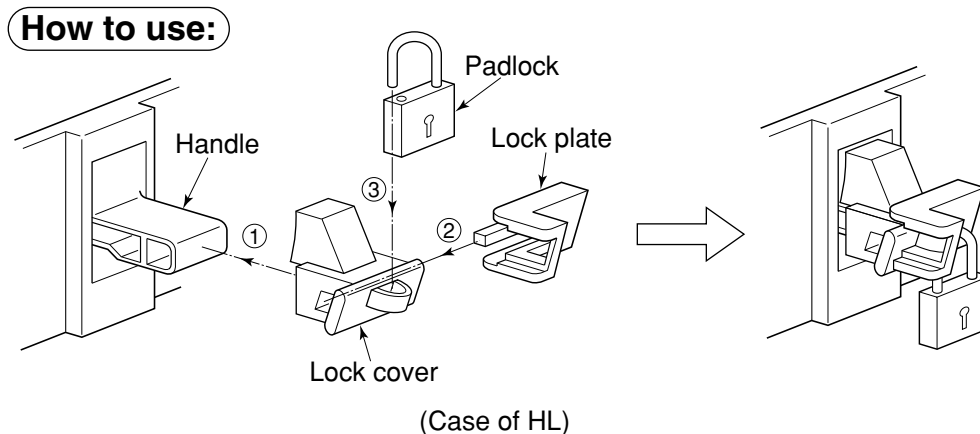


The wiring work shall be performed with the master circuit-breaker OFF even if the unit is locked into OFF position. Since an electric shock is to be apprehended, always confirm that there is no current flowing before proceeding to the wiring.

- ① Use the circuit-breaker always with the lock cover fully inserted. (Insert once again if the circuit-breaker trips.)
- ② Never try to trip by the trip button with the circuit-breaker locked into OFF position. Otherwise, the internal mechanism may be destructed.

(3) Handle lock (HLN, HLF or HL-S)

The handle lock is a device that locks ON or OFF the handle of the circuit-breaker. Users can safely use their lock because the circuit-breaker trips when an overcurrent flows therethrough even if the handle is locked into ON position. There are two types of locks: HLN and HLF which are used as mounted on the handle and HL-S which is used as fixed on the cover of the circuit-breaker.



⚠ CAUTION



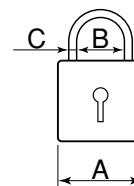
The wiring work shall be performed with the master circuit-breaker OFF even if the unit is locked into OFF position. Since an electric shock is to be apprehended, always confirm that there is no current flowing before proceeding to the wiring.

- ① Never try to trip the circuit-breaker by trip button with the circuit-breaker locked into OFF position. Otherwise, the internal mechanism may be broken.
- ② The padlock to be used shall be that which is commercially available with the nominal dimensions as shown in the table on the right hand.

Dimensions of padlock (mm)

Applicable type	A (Nominal dimensions)	B	C
NF250-A frame and below, NV250-A frame and below	25 *	14 *	4 *
NF400-A frame and above, NV400-A frame and above	40 *	22 *	5.5 *
NF2000-S and above	70	Standard ones in the same package	

* A:35, B:19, and C:5 for HL-S

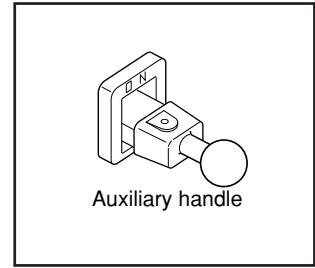


(4) Extension handle

This handle makes easy the opening/closing operation of the circuit-breaker.

Note 1. The extension handle, if used, shall be firmly fixed into the main handle.

Note 2. The extension handle should be detached from the main handle promptly after use, because if attached to the main handle the auxiliary may give the internal mechanism a severe shock to reduce its service life or will get into the air when the circuit-breaker trips.



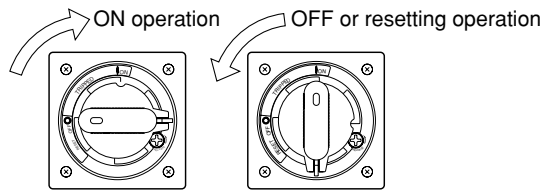
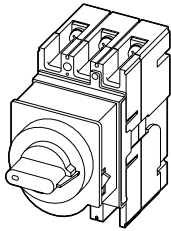
(5) External handles

① F type handle

This handle is intended to manipulate the inboard circuit-breaker from without. It is used when the body of the circuit-breaker is provided with, for instance, the control center.

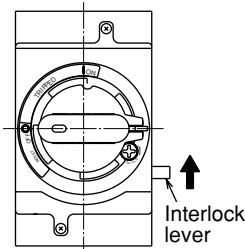
(a) Opening/Closing operation

- The handle can turn ON when it is rotated clockwise.
- The handle can turn OFF when it is rotated counterclockwise.
- When the circuit-breaker trips, the handle can be reset if it is rotated counterclockwise further from OFF position.
- The handle is provided with the door lock mechanism that can open the door only when switching OFF.



(b) How to release the safety device

A safety device that disables the circuit-breaker "ON" with door open has been provided as standard accessory. If the circuit-breaker is to be ON with the door open, turn the handle ON with the interlock lever pushed into the arrowed direction.

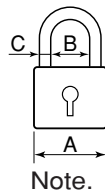


- Padlock: To be supplied by users.

Dimensions of padlock

The padlock to be used shall be commercially available one.

Applicable type	A (Nominal dimensions)	B	C
WSS(Note)	35	19	5
All models	40	22	5.5



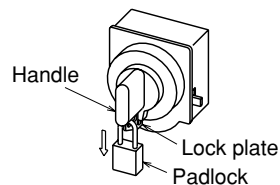
Note.

WSS types (handle models: F05SW2P to F6SWNV) perform trip display when the circuit-breaker trips even when the lock is ON. [Only when one padlock (35mm, 50g or less) is provided.]

(c) When locking up

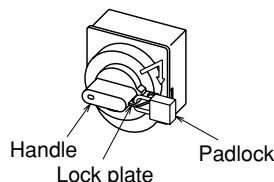
- ON lock

Pull out the lock plate in the arrowed direction with the handle turned to "ON" position then lock the handle with a commercial padlock.



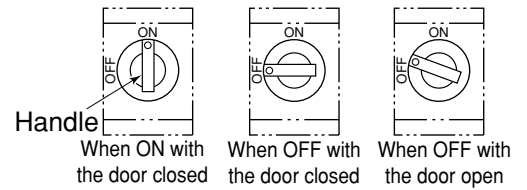
- OFF lock

Turn the handle toward the reset position, while lightly drawing out the lock plate, return the handle in the arrowed direction when the lock plate has been drawn out, then fix the lock plate in the lock position. Use a commercial padlock through the hole on the lock plate to lock the handle.



Attention

- (i) Never fail to remove the extension handle when the opening/closing operation is over or when UVT trip button and/or ELCB test button are operated or tripped. Otherwise it may give the internal mechanism a severe shock or reduce its service life or may get into the air when the circuit-breaker trips.
- (ii) Refrain from using such organic solvent as thinner for cleaning the panel (decorative sheet) or handle.
- (iii) Handle position with the door open:
While the door is open, the handle position at OFF may shift. This results naturally from the structural feature of the external handle. It is not anomaly.
- (iv) When the door is to be opened with the circuit-breaker ON, open it with the release pin left turned in the arrowed direction.
- (v) It is difficult to manipulate the trip button of the circuit-breaker in case of 2 poles. Some metallic wire rod in L-shape shall be prepared.

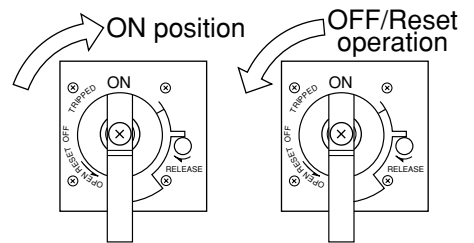


② S type handle

This handle, intended to manipulate the inboard circuit-breaker from without, shall be used when it is to be provided on the door side.

(a) Opening/Closing operation

- Rotating the handle clockwise will turn the circuit-breaker ON.
- Rotating the handle counterclockwise will turn the circuit-breaker OFF.
- When the circuit-breaker trips, it can be reset if the handle is rotated counterclockwise further than OFF position.

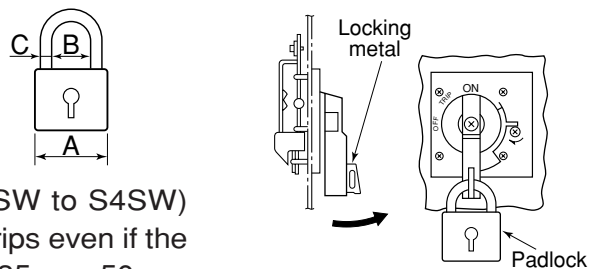


(b) When locking

The external handle can be locked at ON and OFF positions. Raise the locking metal of the external handle and shut a padlock. If the locking metal cannot be raised, move the external handle so that the metal should fit into the groove of the decorative sheet. The padlock shall be supplied by user. Up to 3 padlocks may be attached under normal conditions.

Dimensions of padlock
The padlock to be used shall be commercially available one.

Applicable type	A (Nominal dimensions)	B	C
WSS(Note)	35	19	5
All models	40	22	5.5



Note. S type external handles for WSS (S05SW to S4SW) display the trip when the circuit-breaker trips even if the locking is ON. [Only when one padlock (35mm, 50g or less) is provided.]

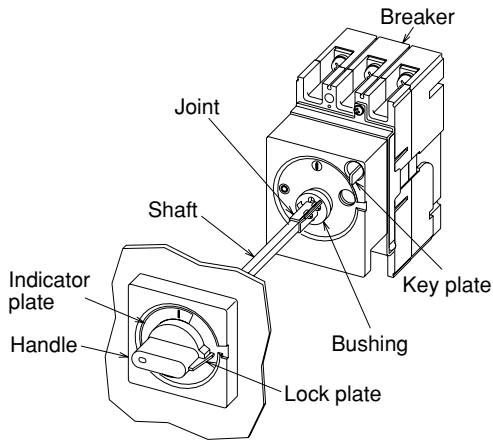
Attention

- (i) Such organic solvent as thinner shall not be used for cleaning the panel (decorative sheet) and external handle.
- (ii) Opening/closing the frontal sheet
 - a) When the front sheet is to be opened, open it gently with the external handle left operated in the OPEN reset direction. When it is to be closed, close it after matching the position of the circuit-breaker handle with that of the external handle.
Never try to close the frontal sheet as left slided forcibly. Otherwise, the parts of the external handle may impinge against the handle of the circuit-breaker to damage it.
 - b) If the frontal sheet is to be opened with the circuit-breaker ON, open it with the release pin left turned in the arrowed direction.

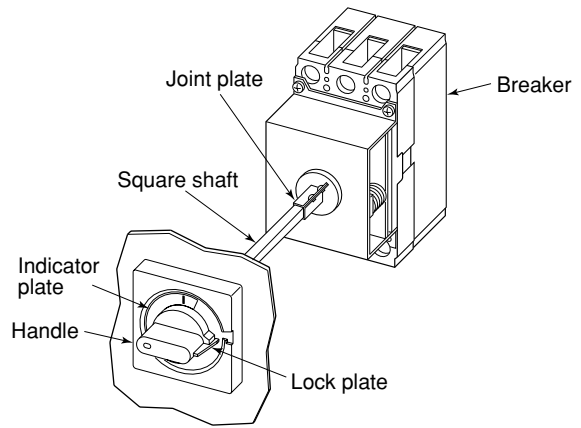
③ V type handle

(a) Assembly

● 125 and 250 A frames

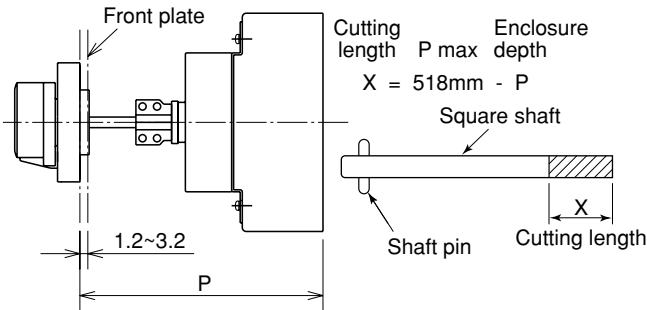


● 400, 630 and 800 A frames

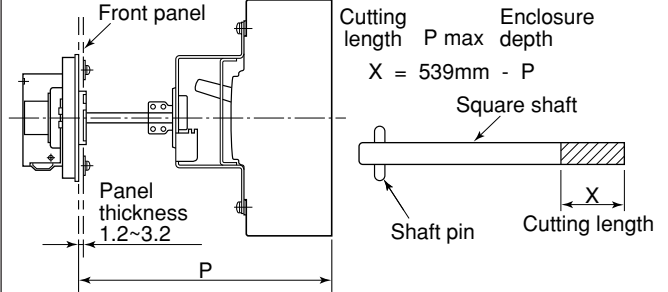


(b) Shaft cutting

● 125 and 250 A frames

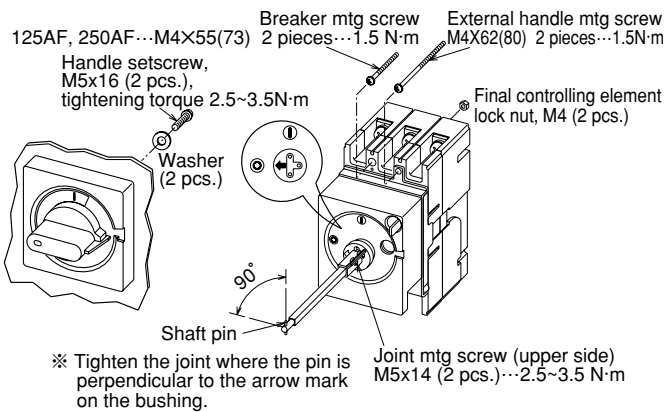


● 400, 630 and 800 A frames

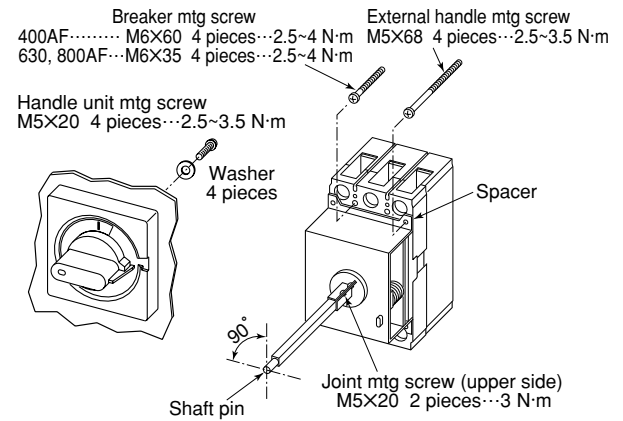


(c) Installation

● 125 and 250 A frames



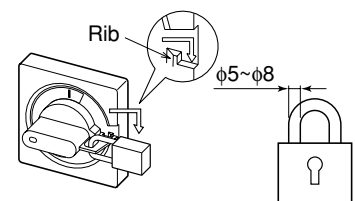
● 400, 630 and 800 A frames



Note. Set the shaft pin at vertical position under OFF state, then mount the joint plate.

(d) Control handle

The handle can be locked in "OFF" position only. Pull out the lock plate in the arrowed direction, while moving the handle toward the resetting side, and hang it on the rib (take care since the handle is heavy). Lock the handle with a commercial padlock ($\phi 5 - \phi 8$). Up to 3 padlocks may be fitted. Padlocks are user-supplied.



(e) Door lock mechanism

The door can be locked in ON position and opened in OFF position. It is position to open the door in ON position to rotate the interlock release screw clockwise.



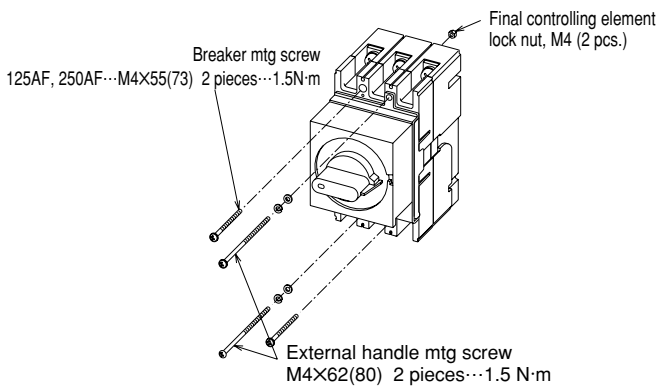
(f) Caution

Mount the external handle under OFF state.
 Be careful that the shaft pin rotate when the breaker is tripped under opening the door.
 The door cannot be closed in trip position.
 Reset operation under opening the door, rotate the square shaft anticlockwise by spanner or monkey wrench.

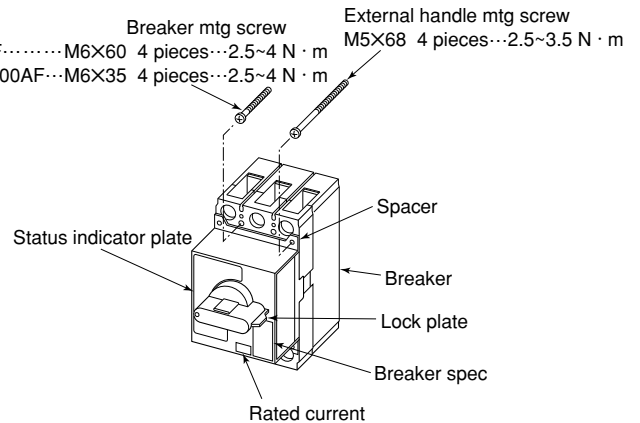
④ R Type handle

(a) Installation

•125 and 250 A frames



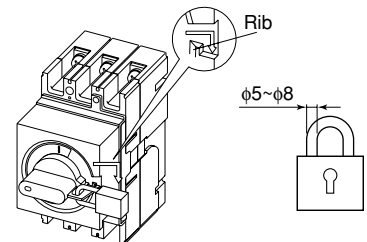
• 400, 630 and 800 A frames



Caution. Mount the external handle under OFF state.

(b) Lock Mechanism

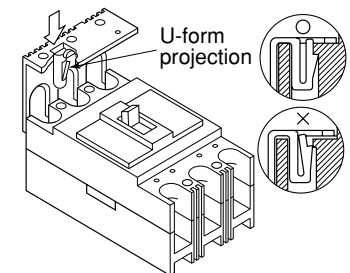
The handle can be locked in "OFF" position only. Pull out the lock plate in the arrowed direction, while moving the handle toward the resetting side, and hang it on the rib (take care since the handle is heavy). Lock the handle with a commercial padlock ($\phi 5 - \phi 8$).



(6) Terminal cover (400 A frame and below)

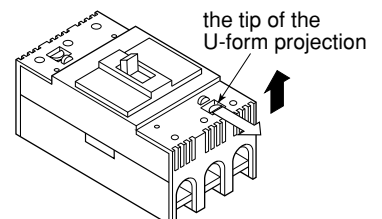
① MOUNTING

Put the U-form projection in the hole of the breaker and push the terminal cover strongly to fasten it. (Push the indicated place by the "↓" mark.)



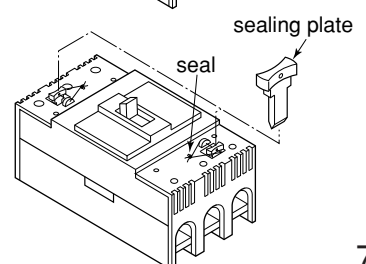
② REMOVING

Push the tip of the U-form projection fully toward the "⇐" mark by the screw driver or a finger tip and pull out the terminal cover toward the "↑" mark.



③ SEALING

Terminal cover can be sealed with the sealing plate and wires.
 Put the sealing plate into the hole of the U-form projection and seal the terminal cover.



Note. Pull the sealing wire so as not to loose.

4. Maintenance and inspection

CAUTION



- Any maintenance/inspection shall be performed by the personnel having expertise concerned. Note that there exists the risk of electrical shock.
- Any maintenance/inspection shall be performed after cutting off the master circuit-breaker and making sure that there is no current flowing. Note that there exists the risk of electrical shock.

- (1) If maintenance and/or inspection should be carried out without cutting off the power supply in an unavoidable cases, wear rubber gloves and insulated boots laying rubber mat on the floor. Use insulated tools and instruments only. An access to the live parts is necessary in this maintenance and inspection work, when workers' full attention should be paid to the insulation of human body from the live parts.
Any normal opening/closing may be done safely because the live parts are covered with insulated moulded case or the like.
- (2) In the event of measurement of sensitivity current and operate time of the ELCB mounted on hot line, de-energize first and then wire before proceeding to the measurement as far as possible. If, from sheer necessity, the measurement should be made under electrified condition, full care should be taken of the safety.

4.1 Initial inspection

The following items shall be checked when electrification is initiated with MCCB and ELCB installed:

Type	Inspection item	Criterion	Remarks
Common	1. Are there any excessive screws, machining chips, cut pieces of electric wire and other conductors around the terminals?	There must never be such foreign matters remaining.	
	2. Is there any crack nor breakage of cover and/or base?	No crack/breakage allowed	
	3. Any dew condensation on the cover, base and/or terminals?	No dewing allowed nor traces of condensation allowed.	
	4. The insulation resistance to be measured by 500V insulation resistance tester.	Measurement should be 5MΩ or higher.	For ELCB, refer to the "Attention."
	5. Are the conductive connections tightened firmly?	The tightening torque should be as prescribed.	
ELCB	6. Is the rated voltage of ELCB the same as that of circuit voltage?	Should be the same.	
	7. Apply voltage and depress the test button to check the operation.	Leak trip state should come out and reclosing possible.	

Attention

(1) Voltage of the withstand voltage test

The withstand voltage test shall be performed in compliance with the table given on the right.

Do not exceed the values given in this table.

Note: Test the operating circuit between the charging part and earthing ground.

Dielectric strength between contacts built in the earth leakage relay and between the earth leakage alarm contacts (ECA and PAL) should be 1000V respectively.

Voltage application time: 1 min.

(V)

Main circuit		Auxiliary or control circuit	
Rated insulation voltage	Test voltage (AC effective value)	Rated insulation voltage of operational circuit	Test voltage (AC effective value)
$U_i \leq 300$	2000	$U_{is} \leq 60$	1000
$300 < U_i \leq 690$	2500	$60 < U_{is} \leq 690$	$2 U_{is} + 1000$ (Min. 1500)

(2) Measurement of insulation resistance and withstand voltage test

Notice that the following applicable types are subject to the restrictions ① and ② below:

Applicable types: Earth leakage circuit breakers.

① Measurement of insulation resistance

A 1000 volt insulation resistance tester cannot be used.

For measuring the insulation resistance a 500 volt insulation resistance tester shall be used.

In portions with Δ in the following table, the circuit breaker with a insulation switch (MG) can be measured its insulation resistance when the circuit breaker is opened (OFF).

② Withstand voltage test

Voltage shall not be applied at the portions with X marks in the table. (Should the portions with X undergo erroneously the withstand voltage test, some trip but some others do not. In any case these portions, if once subjected to the test, shall not be reused.)

Measuring points/test		Tests	Insulation resistance test (Note)		Withstand voltage test (Note)	
			ON	OFF	ON	OFF
State of handle			ON	OFF	ON	OFF
Between the live parts of the main circuit and earth			○	○	○	○
Between different poles	Line side	Between left - middle, middle - right, and middle - neutral poles	○	○	○	○
		Between left - right poles	Δ	○	X	○
		Between left - neutral and right - neutral poles	○	○	○	○
	Load side	Between left - middle, middle - right, and middle - neutral poles	○	○	○	○
		Between left - right poles	Δ	Δ	X	X
		Between left - neutral and right - neutral poles	○	○	○	○
Between line and load terminal			—	○	—	○
Between the live parts of the main circuit - live parts of the control circuit			○	○	○	○
Between the live parts of the control circuit - earth			○	○	○	○

Note) For the MDU breakers, please refer to chapter 4.16

(3) Overcurrent trip test (1)

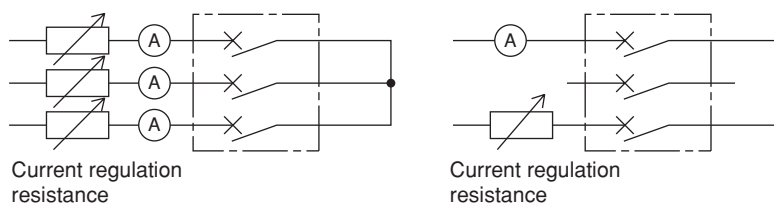
NF125-SGW (RE), NF125-HGW (RE)
NF160-SGW (RE), NF160-HGW (RE)
NF250-SGW (RE), NF250-HGW (RE)
NF400-SEW, NF400-HEW, NF400-REW,
NF400-UEW, NF400-ZEW
NF630-SEW, NF630-HEW, NF630-REW,
NF630-ZEW
NF800-CEW, NF800-SEW, NF800-HEW,
NF800-REW, NF800-UEW, NF800-ZEW
NV250-SEW, NV250-HEW
NV400-SEW, NV400-HEW, NV400-REW
NV630-SEW, NV630-HEW
NV800-SEW, NV800-HEW

The test shall be conducted only in the following test circuits:

Use the optional breaker tester “Y-250” or else carry out the test with load current.

If the breaker tester “Y-250” is used, execute the test according to its manual. Here the testing method is explained assuming with load current.

- ① Apply AC current to the circuit-breaker from three-phase or single-phase power supply. In case of single-phase power supply, apply the current with any two poles in series.



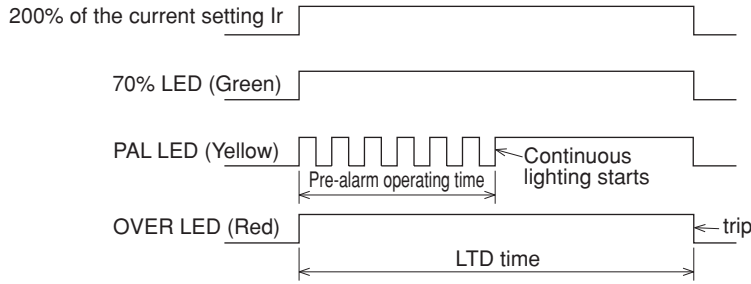
- ② The respective LEDs on the front face of the circuit-breaker, if on, allow to confirm the respective operational currents.

70% LED (Green): Good if continuous lighting commences within a range 60 to 80% of the current setting I_r .

PAL LED (Yellow): If I_p is set $0.7 \times I_r$, good if flashing every 0.5 sec starts within the range 60 to 80% of the current setting I_r .

OVER LED (Red): Good if continuous lighting commences within a range 105 to 125% of the current setting I_r .

- ③ LTD and pre-alarm operating time can be checked by applying a current equivalent to 200% of the current setting I_r . If however any current exceeding the current setting I_r is applied before this test, the operating time reduces. Therefore the first measurement will be invalid in that case. When the circuit-breaker trips, the trip circuit is reset, and the next operating time can be measured under normal conditions.



The result is good if the operating time measured falls within the following range: (Ampere frame 100~250)

Setting of LTD time T_L	$T_L=12\text{sec}$	$T_L=60\text{sec}$	$T_L=80\text{sec}$	$T_L=100\text{sec}$
Pre-alarm operating time	4.8~7.2s	24~36s	32~48s	40~60s
LTD operating time	9.6~14.4s	48~72s	64~96s	80~120s

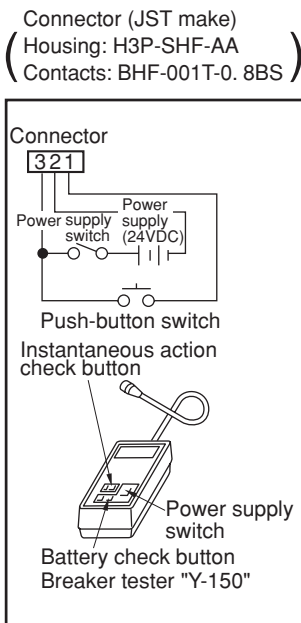
The result is good if the operating time measured falls within the following range: (Ampere frame 400~800)

Setting of LTD time T_L	$T_L=12\text{sec}$	$T_L=60\text{sec}$	$T_L=100\text{sec}$	$T_L=150\text{sec}$
Pre-alarm operating time	4.8~7.2s	24~36s	40~60s	60~90s
LTD operating time	9.6~14.4s	48~72s	80~120s	120~180s

(4) Overcurrent trip test (2)

Applicable type: NF1000-SS NF1250-SS NF1600-SS
NF1250-UR
NF2000-PAL

CAUTION Perform the test under the condition that the circuit-breaker is ON and the load current does not flow.



- ① Prepare the external power supply (24 VDC) and switches or optional breaker tester "Y-150".

- ② Strip off the stamped seal, loosen the transparent cover attaching screws under this seal, and wire the connector to the test terminal.

- ③ Long time delay test.

- (a) When the power supply switch is turned ON, the test signal comes on enabling the long time delay.
(b) The test signal has been so designed that about 200% of the maximum rated current produces. The operating time depends upon the setting of the rated current.

- ④ Instantaneous tripping test

The instantaneous trip happens when the power supply switch and push-button (instantaneous action check button in case of tester) are turned ON.

- ⑤ When the test is over, a stamped seal shall be taken out of the seals for replacement.

- ⑥ Tighten the transparent cover with 0.3 to 0.6 N·m of tightening torque, and stick the stamped seal on the tightening screw.

- ⑦ Though the overcurrent display LED goes off and the trip coil remains tripped if the test is carried out with the circuit-breaker OFF, the circuit-breaker handle remains unchanged (OFF). If application is made under this state, the handle will idle. The test should therefore be performed with the circuit-breaker ON without fail.

Table of LTD test operating time (sec)

Ampere frame	SETTING POSITION					
	1	2	3	4	5	6
1000	500A	600A	700A	800A	900A	1000A
	15-37	22-54	29-73	38-96	49-112	60-150
1250	600A	700A	800A	1000A	1200A	1250A
	14-34	19-46	24-60	38-96	54-136	60-150
1600	800A	1000A	1200A	1400A	1500A	1600A
	15-37	23-59	34-64	46-115	52-130	60-150
2000	1200A	1400A	1500A	1600A	1800A	2000A
	22-54	29-73	34-84	38-96	49-122	60-150

4.2 Periodical inspection

The inspection shall be worked out once one month after the commencement of the use and then periodically in terms of the environmental conditions in order that any trouble may be avoided and that the circuit-breaker can be used for longest possible time.

Yardstick for inspection periodicity

1	Clean and dry environment	Once every 2 to 3 years
2	Environment not exposed to severe dust, corrosive gas vapor, salt, etc.	Once a year
3	Other places than 1 and 2	Once every six months

Type	Inspection item	Criterion	Remarks
Common	1. Is any conductor connection not loosened?	No loosening allowed.	If loosened, the connection should be retightened with such appropriate torque as indicated in the Attached Table.
	2. Are the cover and base not cracked or otherwise damaged? Is the handle not broken?	No crack nor damage on the cover and base. No broken handle.	
	3. Internal submersion by inundation or substantial mud or dust not adhered?	No internal submersion nor substantial mud and/or dust adhered to.	In case of internal submersion, replace the circuit-breaker with a new one, or have it overhauled at our service center.
	4. Is there any abnormal temperature rise?	(1) Visual inspection shall find out no discoloration, by burning, of the stud on the reverse side of the terminal, tightened and the molded portions of the body. (2) No terminal shall manifest any specifically high temperature while the currents of respective phases are well balanced. (Max. allowable value of terminal temperature rise: 60K). (3) No remarkable difference between the right and left sides on the lateral face of the base as long as the load current is well balanced.	(1) Note that there exists some differential temperature between the following terminals: • Between the terminal on line side and that on load side. • Between the terminal of middle pole and those on right and left sides
	5. Is there ON/OFF operation by handle smooth?	Operation should be done smoothly.	Normally open or normally closed circuit-breaker can maintain a smoother operation if it is opened and closed periodically.
	6. Is there TRIP operation by trip button?	The circuit breaker should be able to reset after tripping.	
ELCB	7. Test shall be conducted using the test button.	The circuit-breaker should be able to operate and be closed again for certain.	Test shall be done about once a month.

4.3 Inspection after tripping

When circuit-breaker trip accidental current, it may be either reused or should be replaced by new one depending on the intensity of the accidental current thus trip.

Intensity of the trip current/Degree of damage on MCCB/ELCB and countermeasures to be taken

Intensity of trip current	Degree of damage on MCCB/ELCB	Countermeasures
Case where it is clear that the circuit-breaker operated within the range of time-delay trip	No such anomaly at all as soiled vent	Reusable (The circuit-breaker can function 50 times (100 A or less) at the overload current 6 times higher than the rated current.)
Such relatively low short-circuit current as allows the instantaneous tripping. ↑↓	Black soot seen near the vent. ↑↓	Reusable ↑↓
Large short-circuit current near to the rated breaking capacity	Soot and dust seen also on the handle, and remarkable dirt and grime near the vent. Molten metal adheres to the vent and its vicinity. Severely deformed box of box type circuit-breaker.	To be replaced by new one.

Remark: The leak display button may pop out when the earth leakage breaker trip an accidental current that surpasses the instantaneous trip current.

In case when the intensity of the accidental current cannot be inferred, remove the MCCB/ELCB and measure the insulation resistance. If the result does not attain the prescribed value (5MΩ), proceed to the withstand voltage test.

Though the breaker may be used for the time being if there be prescribed withstand voltage, it shall be replaced with new one as soon as possible.

If both the insulation resistance and withstand voltage are high enough, the breaker may be recognized as reusable. For a certain period, however, it shall be checked for any abnormal temperature rise or any other anomalies.

(1) The measurement of insulation resistance and the withstand voltage test shall be performed according to (1) and (2) of 5.1.

(2) For ELCB, the operation shall be confirmed by test button too.

4.4 Yardstick service life

The maintenance and inspection shall be brought into practice depending on the environment where the circuit-breaker is installed. The longevity of the circuit-breaker cannot be decided only in terms of the year of use. Though the service life requires some diagnosis by some experts, the yardstick of longevity may be as follows:

Yardstick for service life

Degree	Environment	Example	Replacement yardstick (year)
Referential use conditions	1	Places with ever clear and dry air	Dust-proof and air-conditioned electrical room About 10 to 20
	2	Indoor where there is no corrosive gas and little dust	Circuit-breakers in distribution boards and boxes in individual electrical rooms without dust-proof and air-conditioning About 7 to 15
Poor environment	1	Places with little dust but with such gases as salty, sulfurous acid, hydrogen sulfide, high moisture	Geothermal power houses, sewage treatment plants, iron and steel works, paper and pulp plants, etc. About 3 to 7
	2	Places with severe corrosive gases and dust where humans cannot be for a long time	Chemical plants, quarries, mines, etc. About 1 to 3

Size of circuit-breaker frame (A)	Number of operating cycles			Number of operation by voltage tripping, undervoltage tripping devices or trip button
	Electrification	No electrification	Total	
$ln \leq 100$	1500	8500	10000	10% of the total opening/closing frequency
$100 < ln \leq 315$	1000	7000	8000	
$315 < ln \leq 630$	1000	4000	5000	
$630 < ln \leq 2500$	500	2500	3000	
$2500 < ln$	500	1500	2000	

Remark: Number of operation by the test button of ELCB is 1000 times.

The opening/closing life has been prescribed by IEC60947-2 as shown in the table above.

Note that the larger the frame of the circuit-breaker is, the more opening/closing life reduces.

Though the user might think these frequencies to be fewer than expected, this is because the circuit-breaker is basically a protective device that differs from the switch intended for more frequent opening/closing.

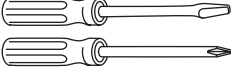

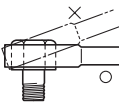

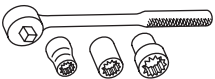

It is recommendable to install an electromagnetic contactor for opening/closing in a case where a capacitor bank is switched in terms of the change in power factor.

Precaution should be taken in use of the circuit-breaker because the tripping by voltage tripping device, in particular, reduces the service life.

4.5 Standard tools and measuring instruments

(1) Standard tools

Our circuit-breakers have been designed so that they may be installed and connected with commercially available tools. Users are requested to mount and connect them using most appropriate tools. Table below gives examples of tools ordinarily used.

Use	Name	Remarks
Screw tightening	 Screwdriver	Screwdrivers should be used whose diameters are of size suited to the diameters of the cruciform grooves. Size of diameter: For M3, M4 and M5: No. 2 For M6 and M8: No. 3
	 Double-ended wrench	  Screwdriver shall be inserted into the bottom of the groove and then turned.
Tightening of bolts and nuts	 Socket wrench	The socket wrench allows to tighten rather firm. Pay your attention to it that it may break too small bolts and/or nuts or else any other bolts if the tightening torque is too great.
	 Hexagon bar spanner	To be used for tightening hexagon socket cap screws. Spanner with suitable diameter should be inserted into the bottom of the groove and then turned.

Note. Also commercially available are such tightening tools (torque wrench as generally called) that allow to control the tightening torque.

(2) Measuring instruments

Name	Use
Multitester	This tester is used generally to measure the voltage in the maintenance and inspection work for circuit-breaker.
Thermistor thermometer	This enables an easy measurement of the temperature of terminals and molds.
Grip tester (clamp meter)	This makes it possible to measure the current of the electric part as electrified.
Insulation resistance tester	Measures the insulation resistance. A 500 VDC insulation resistance tester to be used in the maintenance and inspection of circuit-breaker. (1000 VDC one not to be used)
Earth leakage breaker tester	Measures the sensitivity current and operating time of the earth leakage breaker.

5. Troubleshooting

5.1 Troubleshooting for circuit-breaker proper (MCCB/ELCB)

Trouble		Cause		Countermeasure	
Abnormal operation	Closing impossible	Foreign matter in switching mechanism		Foreign matters to be removed	
		No resetting		To be reset once again	
		Resetting impossible	See below (*)	See below	
	(*) Resetting impossible Tripping impossible OFF impossible	Wear due to trip endurance	Incessant use of voltage trip operation	To be replaced with new one, Voltage trip to be replaced by electric operation	
			End of service life	To be replaced with new one	
		Poor reset mechanism	Poor adjustment	To be returned for repairing	
		Non-excitation of undervoltage coil	Carelessness	To be excited	
		Resetting time has not elapsed		Wait until the bimetal is cooled down	
		Breakage and/or fatigue of the switching spring	Breakage by initial trouble	To be returned for repairing	
			End of service life	To be replaced by new one	
	Fusion of contact due to excessive interruptive current		To be replaced by circuit-breaker with large breaking capacity		
Broken handle	Excessive operation power		Handle to be replaced		
	Poor positional relationship between the external handle and the circuit-breaker		Handle to be replaced Revision of positional relationship		
	Excessive shock from exterior		To be replaced with new one		
Poor electrification	Insulating material mingled between contacts		Foreign matter to be removed (with removable cover) To be returned for repairing (with unremovable cover)		
	Corrosion by infiltrating rain water, etc.		To be replaced with new one		
	Fused conductive portion	Excessive interruptive current	To be replaced by new one with larger breaking capacity		
	Large consumption of contact	Short-circuit current cut off. End of service life Application of overcurrent	To be replaced with new one		
Breakage of rated changeover screw		Excessive tightening torque (tighten with 3 to 4.5 kg-cm of torque)		To be returned for repairing	
Troublesome operation	Troublesome operation under normal load	Too high an ambient temperature	Erroneous selection (temperature correction)	Rating selection to be changed	
			Board hermetically closed	Ventilation	
		Too high a temperature rise	Loosened connection to terminal	Retighten	
		Deviation of applied frequency (thermal-adjustable electromagnetic type 800AF or higher)	Erroneous selection (frequency)	To be replaced with circuit-breaker of suitable frequency	
		Load current strained with much high component		Distortion factor to be decreased by reactor Selection of rating to be changed	
		Rather small measurements by error of measuring instrument due to distorted current		To be measured correctly by a meter with true effective value, and correct selection of rating	
	Electronic type MCCB	Overcurrent display LED is on	Too small a setting of rated current		Correct the setting of rated current
			Tightening forgotten of the changeover screw of rated current		Correct retightening of the rated current changeover screw with tightening torque: 3 to 4.5 kg-cm
	Erroneous action while starting	Exothermic reaction due to repeated starting current		Erroneous selection	To be replaced by a unit with higher rating
		Too long a starting time	Erroneous selection		To be replaced by a unit with higher rating
	Instantaneous action during starting	Too high a starting current		Electromagnetic setting to be change or the unit to be replaced by one with higher rating	
		Too high a starting rush current		Electromagnetic setting to be change or the unit to be replaced by one with higher rating	
		Transient current when changing delta connection to star one. Transient current due to reversible operation		Electromagnetic setting to be change or the unit to be replaced by one with higher rating	
		Rush current at the time of instantaneous restart		Electromagnetic setting to be change or the unit to be replaced by one with higher rating	
		Rare short-circuit of motor		Motor to be repaired	
Bimetal reset incomplete after instantaneous tripping		To be fully restored			
Operating while in use	Abnormal current running simultaneously with closing (short-circuit closing)		Circuit to be checked to remove the cause		
	Transmission was made with antenna of transceiver (5W or higher) closely mounted on the electronic MCCB and earth leakage breaker		Transceiver to be used at a distance at least 1 m from the electronic MCCB		
Short-circuit on line side	Shift from the short-circuit of another conductor		Cause to be removed To be replaced with new one		
	Accumulated dust		Cause to be removed To be replaced with new one		
	Fall of conductor on line side		Cause to be removed To be replaced with new one		
Temperature rise	Too high a temperature on the terminal side	Poor tightening	Poor maintenance	Retighten	
		Contact heavily consumed	End of service life	To be replaced by new one	
		Increased contact resistance	Intrusion of rust and dust	Foreign matters to be removed	
	Too high a temperature on the lateral side of the mould	Complete electromagnetic type used in high frequency (400 Hz, for instance)		Suitable frequency to be selected To be changed into thermal type.	
		Load current distorted containing much high frequency component		Distortion factor to be decreased by reactor Selection of rating to be changed	
		Erroneous measurement dependent on feeling		To be measured with a measuring instrument	
	Exothermic reaction of the tightened portion of stud	Loosened stud		Retighten	
Poor contact between the conductive portion of stud and the body terminal		Reassemble the stud			
Groove machining forgotten for reduction of eddy-current exothermic reaction of rear-connected type iron mount plate (400AF or higher)		Groove to be provided			
No operation	No tripping with over current	Too high a rated current selected		To be replaced by a unit with lower rating	
		Wrong frequency applied		Suitable frequency to be selected	
		Tripping of backup circuit-breaker	Too low a current for instantaneous tripping of backup breaker	Instantaneous electromagnetic switch to be lowered Raise the electromagnetic setting of backup breaker or change the rating	
No operation with tester (electronic MCCB)	Overcurrent display LED does not come on. Or, though it comes on, it goes off sooner than normal.	The battery of breaker tester has come at the end of its service life.		Battery to be replaced.	
	Overcurrent display LED comes on and goes off after prescribed time. But, no tripping.	Poor tripping mechanism		To be returned for repairing.	

5.2 Troubleshooting for leakage operation portion

Trouble		Cause	Countermeasure
Trouble-some action	Operates simultaneously with closing (such operation of leakage mechanism as popping-out of the leakage display button)	Too long a wire and too large a ground electrostatic capacity causes the leak current to flow	Rated sensitivity current to be changed, or ELCB to be installed near load
		Normal operation due to leak current	Leak point to be repaired
	Operates during use	Refer to 5.4	
Abnormal operation	Leakage operation and the like by test button, but no display	Poor lamp or its end of service life	To be replaced by new one
		Display button does not come out due to poor adjustment	To be returned for repairing
No operation	Depressing the test button does not lead to operation	Trouble in electronic circuit	To be replaced by new one
		No voltage applied	Apply specified voltage
		Poor continuity of contact	Remove foreign matter on the contact

5.3 Troubleshooting of accessories

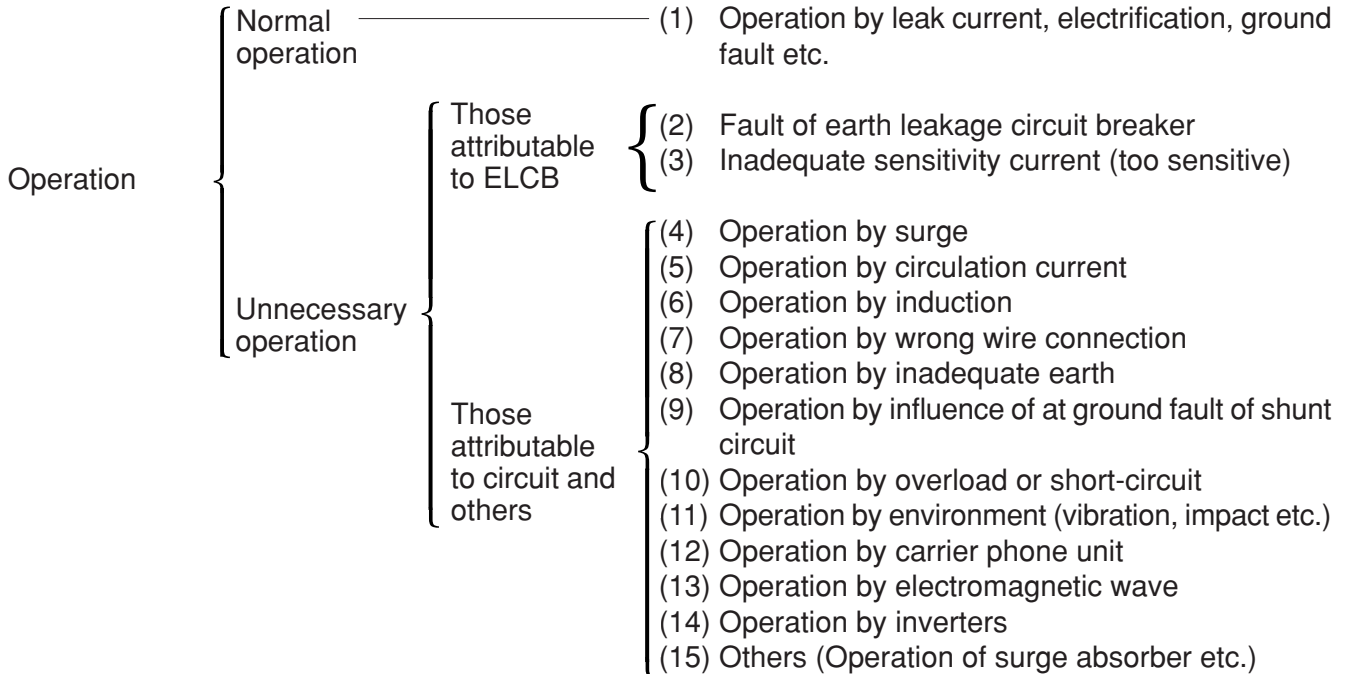
Trouble		Cause		Countermeasure
NFM/NVM (electric operation device)	Operation disabled	Voltage drop of operational power supply	Too low a capacity of the wire of operational circuit	Increase the diameter of the wire
			Too low a capacity of the operational power supply	Improve the operational power supply
		Burnt resistor/motor	Excessive continuous operation	To be returned for repairing (replacement of resistor/motor)
		Erroneous wiring		Regularize the wiring
		Erroneous voltage applied		Regular operational voltage to be applied
	Continuous idling	Operation of ON and OFF circuits at the same time or erroneous manipulation		Push button to be provided with interlock
		Self-sustaining auxiliary switch contact to be used for automatic resetting		The contact for automatic resetting to be used as that for alarm switch
	One turn of idling when closing	Voltage tripping in OFF state or tripping by undervoltage		OFF operation once to reset and ON operation again
		The circuit-breaker proper has automatically cut off and tripped		
	UVT (undervoltage tripping device)	Closing disabled	Erroneous frequency or voltage applied	
No pulling			Too large a voltage drop	Voltage to be improved
No tripping even with no voltage		Trouble in circuit-breaker tripping mechanism		To be returned for repairing
SHT (voltage tripping device)	No tripping action	Insufficient voltage	Operational voltage drop	Power supply to be improved
			Erroneous voltage applied	Power supply to be improved
		Coil burnt out	Continous excitation of coil	To be returned for repairing (replacement of coil, auxiliary contact to be provided for protection from burning)
			Continuous excitation under a voltage inferior to the operating voltage	To be returned for repairing (replacement of coil), power supply to be improved
			Poor auxiliary contact for prevention of burning	To be returned for repairing (replacement of coil, contact to be repaired)
			Abnormal voltage applied	To be returned for repairing (replacement of coil)
AL (alarm switch), AX (auxiliary switch), EAL (earth-leakage alarm, switch), MG (Insulation switch) PAL (pre-alarm)	Malfunction	Poor contact due to overcurrent		To be returned for repairing
		Erroneous wiring	Erroneous wiring when installing	Regular wiring to be made referring to the name plate
		Microload	Erroneous selection	To be returned for repairing (to be replaced with that for microload)
		Loosened attaching screws	Insufficient tightening Vibration during transportation	To be returned for repairing (re-adjustment)

5.4 Analysis of unnecessary operation

Operation of ELCB by the causes on purpose, leak current, electrification, ground fault etc., is normal, while operation by other causes such as surge and induction is unnecessary (called stray operation or nuisance trip). It seems that quite a number of users have the preconception that earth leakage circuit breakers are troublesome as they operate unreasonably. Therefore, unnecessary operation is analyzed and selection of correct ELCB is stated in the following text.

5.4.1 Classification of ELCB operation

ELCB operation is classified as follows;



5.4.2 Detail of operation

(1) Normal operation

Operation of ELCB according to each purpose. Primary examples are shown below.

- ① Deterioration of equipment insulation This is often the case with water handling devices such as washing machine and those subjected to high impact such as press machine.
- ② Deterioration of wire insulation This is often the case with joints and terminals of temporarily installed electric lines.
- ③ Faulty work Ground fault by damage or disconnection of cables during work.
- ④ Careless handling Electrification by wetting and ground fault by surge or dropped foreign matter.

(2) Fault of ELCB

Failure caused by deterioration and corrosion of parts but fault of the leak detecting unit is rare. In some cases, closing becomes unstable because of wear of the magnet or the switching mechanism. Besides such fault, ELCB of low balancing characteristic tends to operation when the motor starts. It is, therefore, necessary, to use ELCB made by reliable manufacturers.

(3) Inadequate sensitivity current

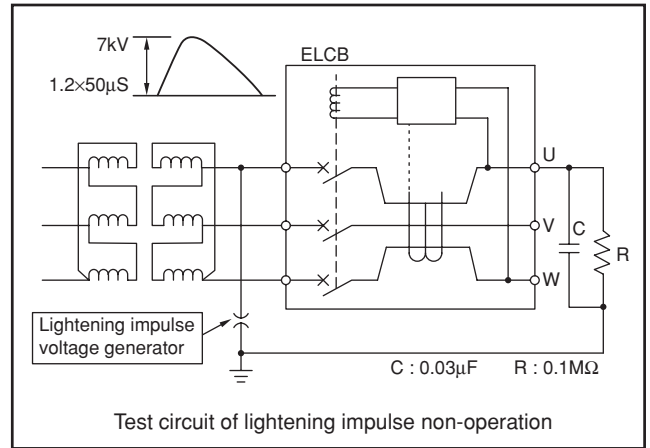
ELCB operates if the sensitivity current is too sensitive compared with normal leak current of the circuit. This is a matter of selection.

In most cases, leak current from circuits is attributable to static capacity to ground of the wire. Of some electric furnaces and sheath heaters, the insulation resistance comes down when cooled even if the insulation resistance is enough at high temperature, and it takes time to find out the cause of ELCB operation.

As to leak current from circuits, it must also be noted that ELCB is operated not only by leak current under normal condition but also by transient leak current to ground at switching or at start-up. Transient leakage at start-up is generated through static capacity to the frame of winding as potential distribution of winding at start-up differs from that during operation.

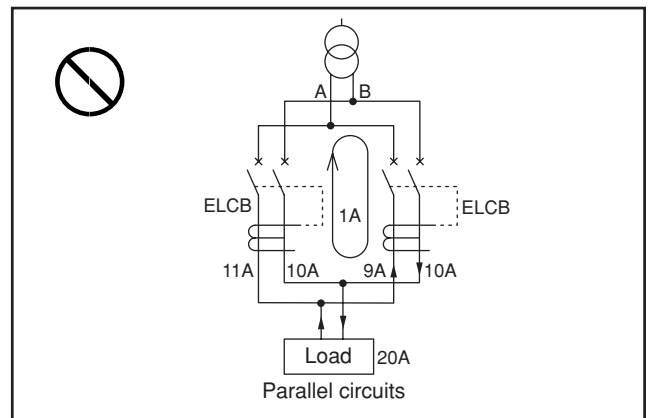
(4) Operation by surge

To surge by secondary transfer of inductive lightning of wires, non-operation test by lightning impulse is set forth in JIS C-8371, and surge resistivity is ensured. Circuit of the lightning impulse non-operation test is shown at right. Almost all NVs of Mitsubishi are provided with a DPDC surge discrimination circuit for judging leak current to ground by ground fault current and surge so as to improve unnecessary operation preventing function.



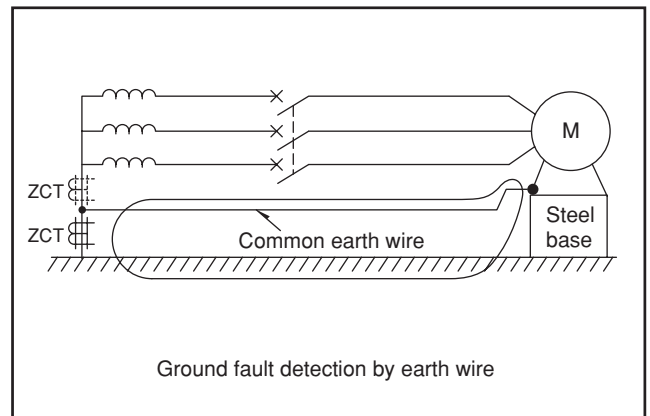
(5) Operation by loop circuit (circulation current)

In the parallel circuits connected at load side, diverted current of each phase isn't necessarily equal between the right and the left branches. If A phase is diverted into 11A and 9A, for example, the difference of 1A is to be circulating in the loop. Parallel use of two ELCBs is therefore prohibitive as the circulation current causes operation of the earth leakage circuit breaker.



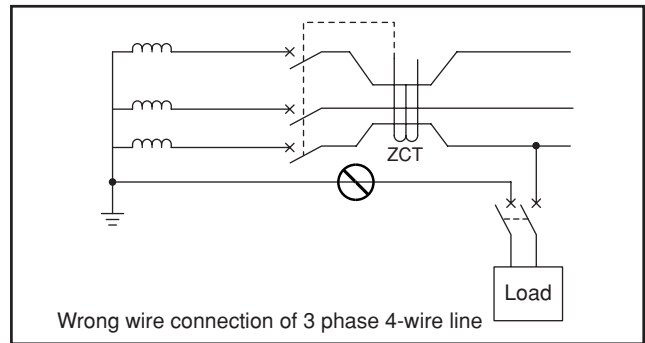
(5) Operation by induction

Those with loop circuits are susceptible to induction. Taking a loop as a loop antenna, the primary winding of ZCT is to be connected with the antenna, and induction is easily generated. When a common earth wire is used, place the ZCT at the position of the continuous line in the drawing, then the primary conductor of the ZCT forms a loop. To avoid this, the ZCT must be placed at the position shown by the dotted line in the drawing. Induction can also be generated in the input circuit of the earth leakage relay, and it is necessary to braid the lead wires between the earth leakage relay, and the ZCT.

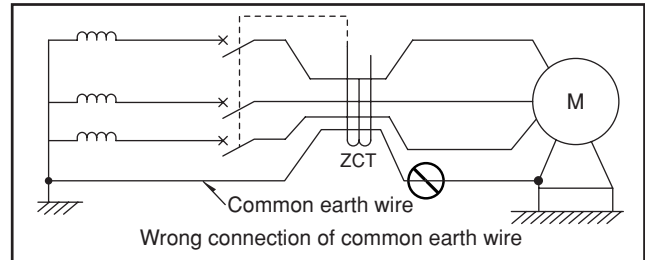


(7) Operation by wrong wire connection

Failure in passing the neutral wire through the ZCT for the lines of single phase 3-wire or 3 phase 4-wire is a simple mistake. In this case, the ELCB is operated by single phase load current.

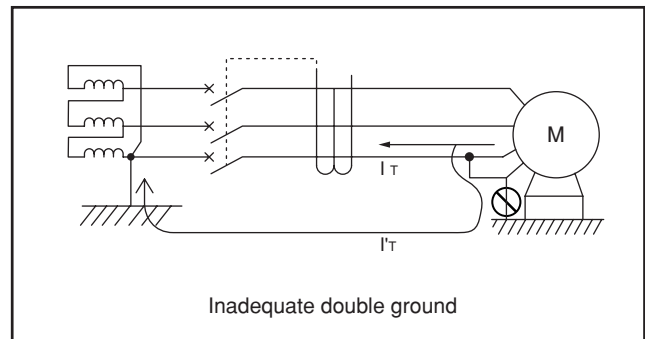


On the other hand, the common earth wire shall not go through the ZCT as it can cause malfunction at leakage.



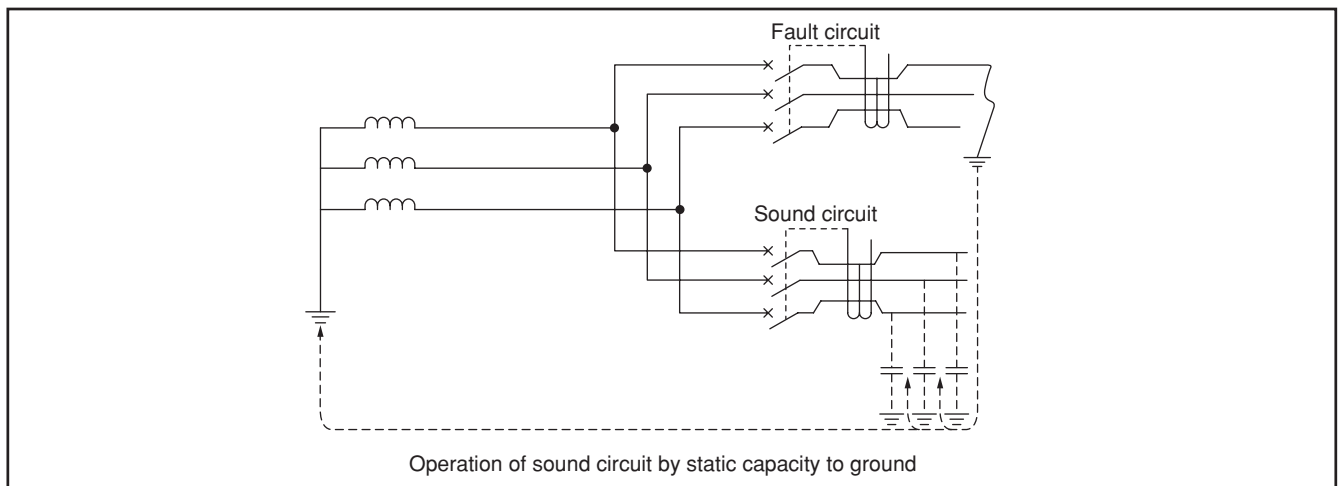
(8) Operation by inadequate earth

Though the wire is grounded at the earth side, the wire shall not be earthed at the load side. By the voltage of voltage drop in the line at the earth side, a part of the load current is diverted as shown by I'_{τ} , and the ELCB is operated.



(9) Operation of sound circuit at ground fault of shunt circuit

Not only the ELCB in the ground fault circuit but also the one in the sound circuit is operated in some cases through the circuit as illustrated below. This can be avoided by keeping sensitive current suitably for the leak current by static capacity to ground.



(10) Operation by overload and short-circuit

It is natural that the devices having overload or short-circuit operation elements operate at short-circuit. However, ELCB is commonly used for many other purposes, and it tends to be overlooked that ELCB operate even at an overload and a short-circuit failure. Moreover, even the one dedicated to ground fault is sometimes operated by an excessive overload and short-circuit because balance performance of ELCB is limited. In these cases, however, overload and short-circuit can be noticed if they are significant.

(11) Environment of vibration, impact, high temperature etc.

These factors may be taken almost equal to those of Mitsubishi's MCCB. Heat resistivity of electronic circuits tends to be fell unreliable. To Mitsubishi's ELCB, enough allowance is given to ratings of the parts, the parts which can withstand high temperature operation are used, and the ICs incorporating temperature compensation circuits are used to ensure stable operation even in varying temperature environment.

(12) Operation by carrier phone unit

Malfunctions of the ELCB can result in some cases when attached to a line provided with a carrier phone, which enables calls through the power line.

Since the carrier phone forcefully gives high frequency signals (normally 50kHz to 400kHz) between the line and the ground, the ELCB detects the high frequency signals as if they are leak current and leads to malfunction. Malfunction or not depends largely on magnitude of the high frequency signals, high frequency characteristic of the ELCB, and degree of rated sensitive current.

(13) Operation by electromagnetic wave

When a portable type transceiver is placed near the ELCB at transmission, particularly intense magnetic field is generated easily resulting in malfunction. Generally speaking, frequency bands of portable type transceivers are 27/28MHz, 50/50MHz, 150MHz, 400MHz, and 900MHz, and the output is about 0.5 to 5W. It is confirmed that the ELCB is free from any malfunction when different kinds of transceivers of 5W output are used for transmission being placed at 1m from the ELCB.

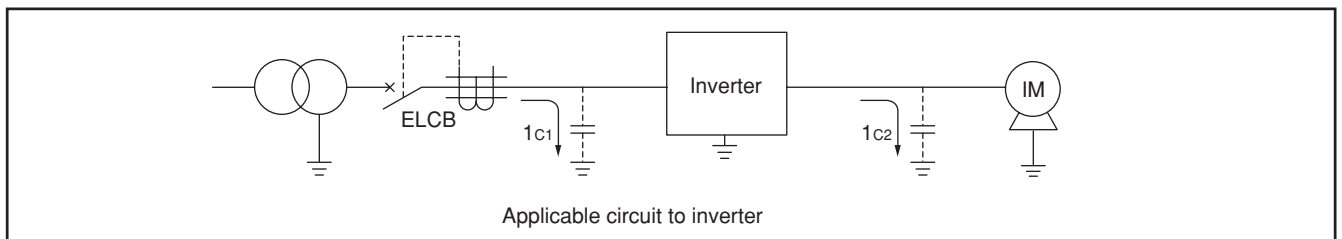
(14) Operation by inverters

Inverters operate many high-frequency components as they turn A.C. power supply to D.C. through rectification, then turn to A.C. again by switching through transistors.

Increased static capacity to ground sometimes causes malfunctions as the high frequency components are kept flowing by the static capacity to ground. To use ELCB in general in an inverter circuit, it is necessary to select those of lower sensitive current than usual in order avoid unnecessary operation.

For ground fault detection of high sensitivity in inverter circuit and yet for stable ground fault detection at both the primary and the secondary sides of the inverters, it is necessary to use an ELCB designed for higher harmonic earth-leakages and surges, which is hardly affected by high frequency components, as the measure against the inverter.

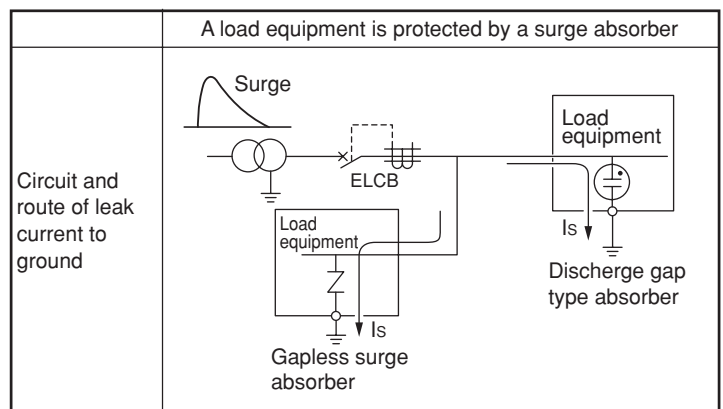
It is also essential to install the ELCB at the primary side of the inverter, and never at the secondary side.



(15) Others

As electronic arrangement of load equipment advances, surge absorbers are installed in the equipment more and more to protect them against surge. As the surge absorbers connected to the ground discharge the surge to the ground, a high leak current is generated to the ground, for a short time though, and unnecessary operation of the ELCB is resulted in some cases.

Most Mitsubishi's ELCB are provided with a DPDC surge discriminating circuit for judging ground fault current by failure such as faulty insulation from leak current to ground by surge, and improvement in the performance of preventing unnecessary operation is realized even when the surge absorber is installed between the line and the ground.



Leak current to ground through surge absorber

6. After-sales service

6.1 Countermeasures to be taken in case of anomaly

Should any anomaly arise while the circuit-breaker is operating, take the following countermeasures:

CAUTION

- Use to be prohibited under abnormal conditions:
Continuing to use the circuit-breaker under abnormal conditions may lead to some accidents.

① With electrical safety supervisor

If any anomaly occurs, the electrical safety supervisor shall be informed of this anomaly, and necessary inspection shall be worked out based on the instructions given by this supervisor. In case when the cause is unknown or repairing required, please contact our Service Center or our branches.

② Without electrical safety supervisor

Immediately contact our Service Center, our branches or the nearest electric work contractor.

6.2 After-sales service system

We have organized a system responding to any requests from users (inspection, repairing, diagnosis of degradation). For any detail, do not hesitate to contact us.

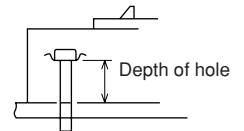
APPENDIX 1 Breaker mounting screws

■ NFB

Series	Type	Depth of hole	Wood screw (round wood screw) for Front-connection	Front-connection	Rear-connection	Plug-in (drawout)	Required quantity per unit			
							1P	2P	3P	4P
S · C · M · E	NF30-CS, MB30-CS	10	4.1 × 25	M4 × 0.7 × 20	M4 × 0.7 × 20	—	—	2	2	—
	NF50-SS(1P)	46	—	M4 × 0.7 × 55	M4 × 0.7 × 55	—	2	—	—	—
	NF32-SW, NF63-CW, NF63-SW, NF63-HW NF125-CW, NF125-SW, NF125-HW NF250-CW, NF250-SW, NF250-HW MB30-SW, MB50-CW, MB50-SW MB100-SW	45	4.1 × 58	M4 × 0.7 × 55	M4 × 0.7 × 55	M4 × 0.7 × 55	—	2	2	4
	NF160-SW, NF160-HW, MB225-SW	45	4.1 × 58	M4 × 0.7 × 55	M4 × 0.7 × 55	M4 × 0.7 × 55 M4 × 0.7 × 73	—	2 (plug-in:4)	2 (plug-in:4)	4
	NF125-SGW, NF125-HGW NF160-SGW, NF160-HGW NF250-SGW, NF250-HGW	63	—	M4 × 0.7 × 73	M4 × 0.7 × 73	M4 × 0.7 × 73	—	4	4	4
	NF400-CW, NF400-SW, NF400-SEW NF400-HEW, NF400-REW NF630-CW, NF630-SW, NF630-SEW NF630-HEW, NF630-REW	47	—	M6 × 60	M6 × 72	M6 × 72	—	4	4	4
	NF800-CEW, NF800-SDW, NF800-SEW NF800-HEW, NF800-REW	15	—	M6 × 35	M6 × 40	M6 × 35	—	4	4	4 (plug-in:6)
	NF1000-SEW, NF1250-SEW, NF1250-SDW NF1600-SEW, NF1600-SDW	18.5 18.5	— —	M8 × 40 M8 × 40	M8 × 40 M8 × 40	M8 × 40 —	— —	4 4	4 4	4 4
	NF125-RGW, NF250-RGW	63	—	M4 × 0.7 × 73	M4 × 0.7 × 73	M4 × 0.7 × 73	—	4	4	—
	NF125-UGW, NF250-UGW	63	—	M4 × 0.7 × 73	M4 × 0.7 × 73	M4 × 0.7 × 73	—	4	4	4
U	NF400-UEW(3P)	47/144	—	M6 × 65/162	M6 × 72/169	M6 × 72/169	—	—	4	—
	NF400-UEW(4P), NF800-UEW	15/112	—	M6 × 35/132	M6 × 40/137	M6 × 35/132	—	—	4	6
	BH, BH-S	—	—	Mounting bracket	—	—	2	4	4	—
BH	BH-P, BH-PS	—	—	—	—	BPA mounting base	—	—	—	—
	UL	NF50-SWU, NF100-CWU, NF100-SWU, NF225-CWU	45	—	M4 × 0.7 × 55	—	—	—	2	2
NF-SFW, NF-SJW, NF-HJW		63	—	M4 × 0.7 × 73	—	—	—	—	4	—

Remark 1) The attaching screws as shaded in the table above shall be delivered in the same packages as MCCB, except the plug-in connection type screws, which shall be put into the package of plug-in type terminal block. Any other attaching screws shall be supplied by users themselves.

- 2) Attaching screws other than hexagonal socket bolts and hexagonal bolts are Round head screws.
- 3) Any models having two types of attaching screws have different screws lengths on line and load sides.
- 4) NF800-UEW have no plug-in type.



■ NV

	Type	Depth of hole	Wood screw (round wood screw) for Front-connection	Screw for iron plate (P round head screw)			Required quantity per unit	
				Front-connection	Rear-connection	Plug-in	2.3P	4P
ELCB	NV-2F, NV-G2N, NV-G3NA	16	4.1 × 25	M4 × 0.7 × 35	—	—	2	—
	NV30-CS, MN30-CS	10	4.1 × 25	M4 × 0.7 × 20	M4 × 0.7 × 20	—	2	—
	NVB50-P	—	—	BPA mounting base	—	—	1	—
	NV32-SW, NV63-CW, NV63-SW, NV63-HW	45	4.1 × 58	M4 × 0.7 × 55	M4 × 0.7 × 55	M4 × 0.7 × 55	2	—
	NV125-CW, NV125-SW, NV125-HW	45	4.1 × 58	M4 × 0.7 × 55	M4 × 0.7 × 55	M4 × 0.7 × 55	2	4
	NV125-RW	45/61	—	M4 × 0.7 × 55/73	M4 × 0.7 × 55/73	M4 × 0.7 × 55/73	4	—
	NV250-SEW, NV250-HEW, NV250-CW, NV250-SW, NV250-HW	45	4.1 × 58	M4 × 0.7 × 55	M4 × 0.7 × 55	M4 × 0.7 × 55	2 (plug in:4)	—
	NV250-RW	45/61	—	M4 × 0.7 × 55/73	M4 × 0.7 × 55/73	M4 × 0.7 × 55/73	4	—
	NV400-CW, NV400-SW, NV400-SEW, NV400-HEW, NV400-REW NV630-CW, NV630-SW, NV630-SEW, NV630-HEW	47	—	M6 × 60	M6 × 72	M6 × 72	4	4
	NV800-SEW, NV800-HEW	15	—	M6 × 35	M6 × 40	M6 × 35	4	4
ELR	Relay	ZBA	10	—	M4 × 0.7 × 20	—	—	2
		ZSA · ZU · ZHA	10.5	—	M4 × 0.7 × 20	Flush (P counter sunk flat head screw) M4 × 0.7 × 12	—	2
	ZCT	ZT15B · ZT30B · ZT40B	—	—	M5 × 0.8 × 20	—	—	4
		ZT60B · ZT80B · ZT100B	—	—	M6 × 20	—	—	4

Remark 1) The attaching screws as shaded in the table above shall be delivered in the same packages as ELCB.

APPENDIX 2 Standard tightening torque for connections

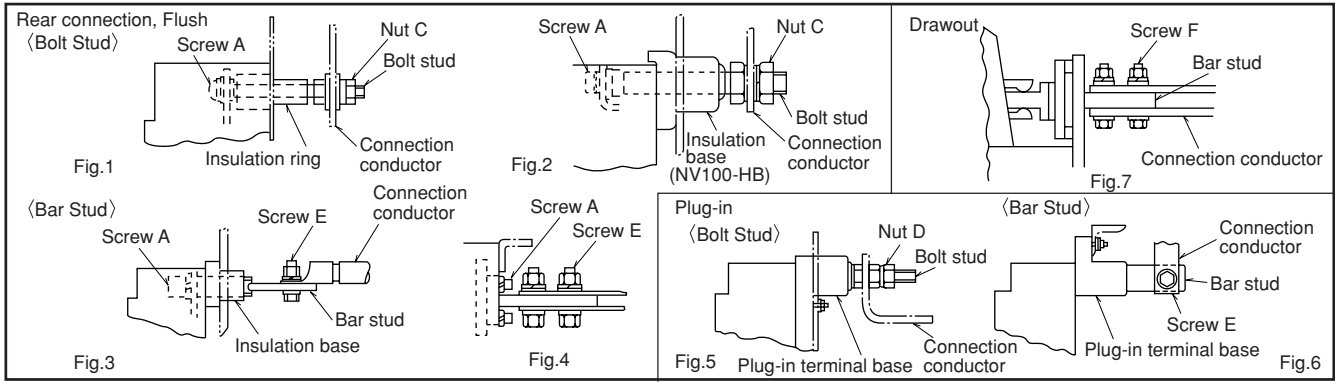


Table List of standard tightening torque for connections (Note 1)

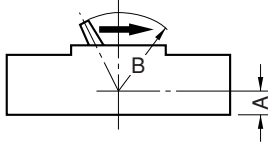
Torque in N·m

Type	Connection	Rear connection								Plug-in type				drawout type		
		Bolt stud				Bar stud				Bolt stud		Bar stud		Bar stud		
		Fig. 1		Fig. 2		Fig. 3		Fig. 4		Fig. 5		Fig. 6		Fig. 7		
		Screw A		Nut C		Screw A		Screw E		Nut D		Screw E		Screw F		
MCCB	ELCB	Size	Torque	Size	Torque	Size	Torque	Size	Torque	Size	Torque	Size	Torque	Size	Torque	
NF30-CS, MB30-CS	NV30-CS, MN30-CS	M4X0.7	—	M6	2	—	—	—	—	—	—	—	—	—	—	—
NF32-SW NF63-CW, NF63-SW, NF63-HW MB30-SW, MB50-CW, MB50-SW	NV32-SW, NV63-CW NV63-SW, NV63-HW	M4X0.7	1	M6	2	—	—	—	—	M6	2	—	—	—	—	—
NF125-CW, NF125-SW, NF125-HW NF125-RW, MB100-SW	NV125-CW, NV125-SW NV125-HW NV100-SEP, NV100-HEP NV125-RW	—	—	—	—	M6	4	M8	12	M8	5	—	—	—	—	—
NF160-SW, NF160-HW, NF250-CW NF250-SW, NF250-HW, MB225-SW	NV250-CW, NV250-SW NV250-HW, NV250-SEW, NV250-HEW, NV250-RW	—	—	—	—	M6	10	M8	12	—	—	M8	12	—	—	—
NF125-SGW, NF125-HGW NF160-SGW, NF160-HGW NF250-SGW, NF250-HGW NF125-RGW, NF125-UGW, NF250-RGW, NF250-UGW	—	—	—	—	—	M6	10	M8	12	—	—	M8	12	—	—	—
NF400-CW, NF400-SW, NF400-SEW NF400-HEW, NF400-REW NF400-UEW(3P)	NV400-CW, NV400-SW NV400-SEW NV400-HEW, NV400-REW	—	—	—	—	M8	20	M12	45	—	—	M12	45	—	—	—
NF400-UEW(4P)	—	—	—	—	—	M10	30	M12	45	—	—	M12	45	—	—	—
NF630-CW, NF630-SW NF630-SEW, NF630-HEW NF630-REW	NV630-CW, NV630-SW NV630-SEW, NV630-HEW	—	—	—	—	M10	30	M12	45	—	—	M12	45	—	—	—
NF800-CEW, NF800-SDW, NF800-SEW NF800-HEW, NF800-REW NF800-UEW (Note 2)	NV800-SEW, NV800-HEW	—	—	—	—	M10	30	2-M12	45	—	—	2-M12	45	—	—	—
NF1000-SEW NF1250-SEW, NF1250-SDW NF1250-UR (Note 2)	NV1000-SB (Note 2) NV1200-SB	—	—	—	—	4-M8	12	2-M12	45	—	—	2-M12	45	—	—	Same as the plug-in type
NF1600-SEW, NF1600-SDW	—	—	—	—	—	4-M8	12	4-M10	25	—	—	—	—	—	—	—

Note 1) The suitable range of tightening torque shall be the corresponding numerical values in the table above $\pm 20\%$. For detail, please refer to the handling procedures to be found in the package.

2) No plug-in type.

APPENDIX 3 Operating force of handle



The numerical values below represent the measurements resulting from the handle as pulled horizontally (arrowed direction). B size gives the dimensions without those of auxiliary handle.

	Type	Poles	Operational force of handle, N · m			Dimensions (mm)	
			ON	OFF	Reset	A	B
M C C B S · C · M	NF30-CS, MB30-CS	2, 3	0.45	0.15	0.03	47	20
	NF32-SW, NF63-SW, NF63-HW, NF63-CW MB30-SW, MB50-SW, MB50-CW	2	1.05	1.25	2.5	32	58
		3	1.35	1.55	3.1		
	NF125-SW, NF125-HW, NF125-CW, MB100-SW	2	0.83	0.99	3.15	33	57
		3	1.31	1.53	4.93		
	NF250-SW, NF250-CW, MB225-SW, NF160-SW	2, 3	2.1	3	5.2	38	54
	NF250-HW, NF250-HEW, NF160-HW	2, 3	2.1	3	5.2	38	54
	NF125-SGW, NF125-HGW, NF-SFW (110A and less)	2, 3	2.9	2.7	2.9	42.5	67.5
		4	3.3	3.1	3.3		
		3	2.9	2.7	2.9		
	NF160-SGW, NF160-HGW	2, 3	3.3	3.1	3.3		
		4	3.6	3.3	3.5		
	NF250-SGW, NF250-HGW	2, 3	4.4	3.9	3.9		
	NF-SFW (125A and more), NF-SJW, NF-HJW	4	4.6	4.0	4.5		
	3	4.4	3.9	3.9			
NF400-SW, NF400-SEW, NF400-HEW, NF400-REW NF630-CW, NF630-SW, NF630-SEW, NF630-HEW NF630-REW	2, 3	10.2	8.4	20	49	106	
NF400-CW	2, 3	7.8	6.15	16.1	49	85	
NF800-CEW, NF800-SDW, NF800-SEW, NF800-HEW NF800-REW	3	13.5	12	30	49	106	
NF1000-SEW, NF1250-SEW, NF1250-SDW, NF1600-SEW, NF1600-SDW	3	15.5	10.1	19.4	84	106	
U	NF125-RGW, NF125-UGW	3	2.9	2.7	2.9	42.5	67.5
	NF250-RGW, NF250-UGW	3	4.4	3.9	3.9	42.5	67.5
	NF400-UEW	3	10.2	8.4	20	146	106
	NF800-UEW	3	13.5	12	30	146	106
E L C B	NV30-CS	3	0.45	0.15	0.03	47	20
	NV63-CW	2, 3	1.35	1.55	3.1	32	58
	NV32-SW, NV63-SW	2, 3					
	NV63-HW	3					
	NV125-SW, NV125-HW, NV125-CW	3	1.31	1.53	4.93	33	57
	NV125-RW	3					
	NV250-SW, NV250-SEW	3	2.1	3	5.2	38	54
	NV250-HW, NV250-HEW	3					
	NV250-CW	3					
	NV250-RW	3	2.1	3	5.2	38	54
	NV400-SW, NV400-SEW, NV400-HEW, NV400-REW NV630-CW, NV630-SW, NV630-SEW, NV630-HEW	3	10.2	8.4	20	49	106
	NV400-CW	3	7.8	6.15	16.1	49	85
	NV800-SEW, NV800-HEW	3	13.5	12	30	49	106

APPENDIX 4 Service network

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China	Mitsubishi Electric Automation (Shanghai) Limited	80 Xin Chang Road, 4th Floor, Shanghai Intelligence Fortune Leisure Plaza, Huang Pu district Shanghai 200003, P.R.China	+86-(0)21-6120-0808
	SHANGHAI SETSUYO TRADING CO.,LTD.	Shanghai Everbright Convention & Exhibition Center Room2306. Block D. 80, Cao bao Rd., Xuhui District Shanghai, P. R. China	+86-(0)21-6432-6698
Colombia	Proelectrico Representaciones S.A.	Cra 53 No 29C-73 U.I.C.- Medellin. COLOMBIA.	+57-4-235-00-28
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Korea	MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD.	2 Fl. Dong Seo Game Channel Bldg., 1F 660-11 Deungchon-Dong, Kanguseo-Ku, Seoul, 157-030 Korea	+82-2-3668-6567
Laos	SOCIETE LAO IMPORT-EXPORT	43-47 Lane Xang Road P.O. BOX 2789 VT Vientiane, Laos	+856-21-215043, 21-215110
Lebanon	COMPTOIR D'ELECTRICITE GENERALE INTERNATIONAL	Cebaco Center-Block A. Autostrade Dora, P.O. BOX: 11-2597 Beirut-Lebanon.	+961-1-240455
Malaysia	mittric Sdn Bhd	12A, Jalan Pemberita U1/49, Temasya Industrial Park, Glenmarie, 40150 Shah Alam, Selangor, Malaysia	+603-5569-3748
Myanmar	PEACE MYANMAR ELECTRIC CO., LTD.	NO. 137/139 Botataung Pagoda Road, Botataung Town Ship 11161, Yangon, Myanmar.	+95-(0)1-202589, 202449, 202590
Nepal	Watt & Volt House Co., Ltd.	KHA 2-65, Volt House Dilli Bazar Post Box: 2108, kathmandu, Nepal	+977-1-411330
New Zealand	Melco Sales (N.Z.) Ltd.	1 Parliament Street Lower Hutt. New Zealand.	+64-4-569-7350
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Pakistan	Prince Electric Co.	16 Brandreth Road Lahore 54000. Pakistan.	+92-(0)42-7654342
Philippines	EDISON ELECTRIC INTEGRATED, INC.	24th Fl. Galleria Corporate Center Edsa Cr, Ortigas Ave. Quezon City, Metro Manila. Philippines.	+63-(0)2-643-8691
Poland	MPL Technology Sp zo.o.	ul. Sliczna 36 31-444 Krakow, Poland.	+48-(0)12-632-28-85
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Thailand	UNITED TRADING & IMPORT CO. LTD.	77/12 Bumrungruang Road, Klong Mahanak, Pomprab Bangkok 10100.	+66-223-4220-3
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Venezuela	ADESCO C.A.	Lie 8, Calpon Elinsu, La Urbina-EDO, Miranda P.O. BOX 78034 Caracas 1074A., Venezuela	+58-2-241-7634
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