MITSUBISHI ELECTRIC

Changes for the Better

for a greener tomorrow

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

HANDLING AND MAINTENANCE

12A

CONTENTS

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.

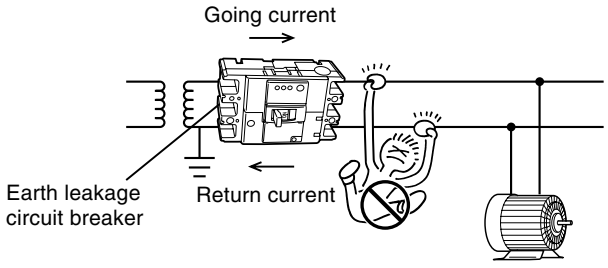
	Warning for possible electrification under certain conditions.
	Warning for possible outbreak of a fire under certain conditions.

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

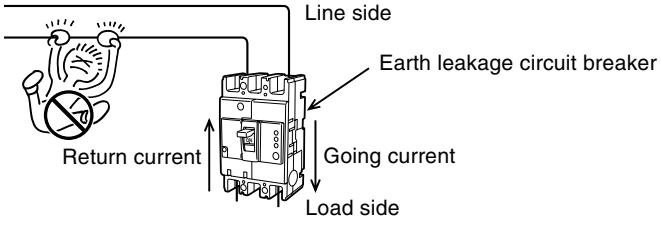
1.1 Cautionary instructions for operation

⚠ 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.



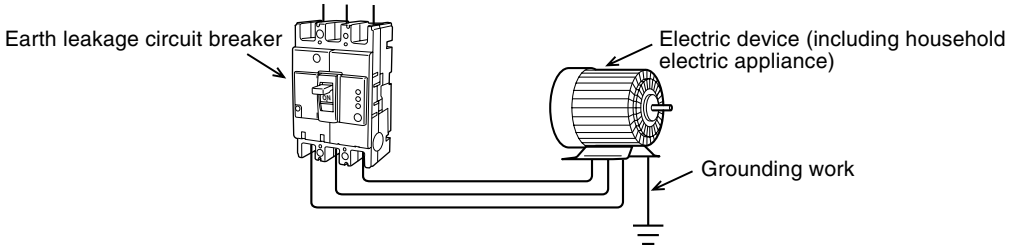
[When uncovered charged parts are touched at two places]



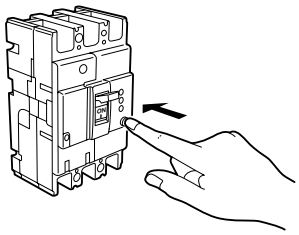
[When the power source side of the breaker is touched]

⚠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.



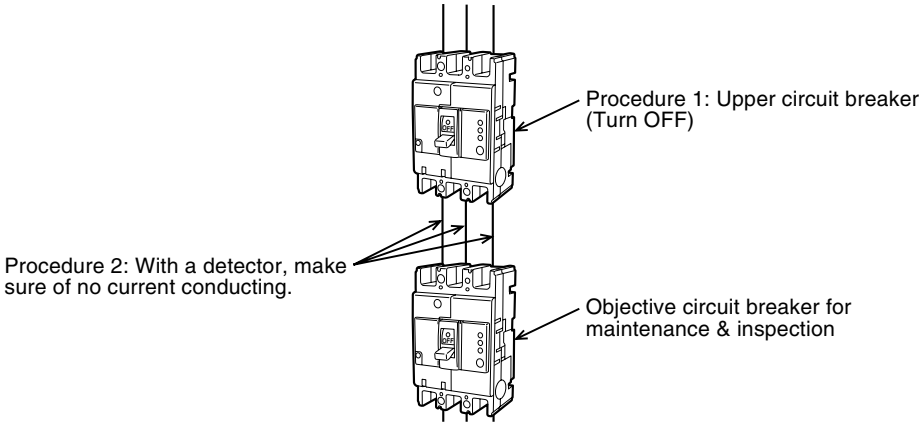
- Check operation of the earth leakage circuit breaker once a month or so by pressing the test button.
  The breaker is out of order if it isn't turned to "OFF" or "TRIP."
  Please get in touch with us at our service stations, branch offices, local offices, or ask an electrician in your country.



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.



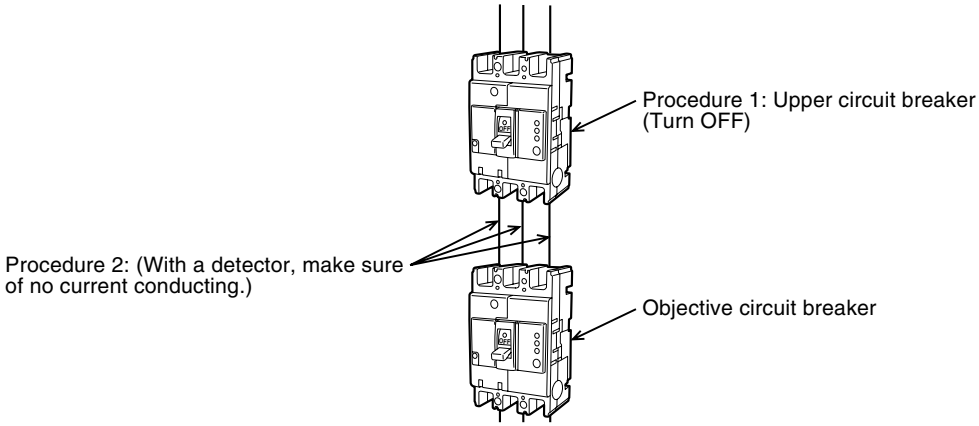
- Retighten the terminals regularly according to the inspection manual. Otherwise, fire can take place.

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

1.3 Cautionary instructions for work

⚠CAUTION

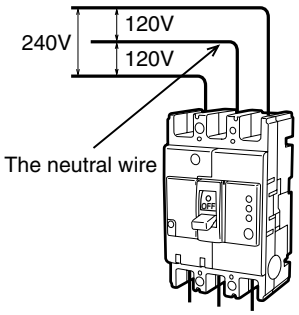
- Any electric work must be carried out by a qualified person (electrician).
- Before wiring, turn off the upper circuit breaker and make sure of no current conducting. Electrification can result.



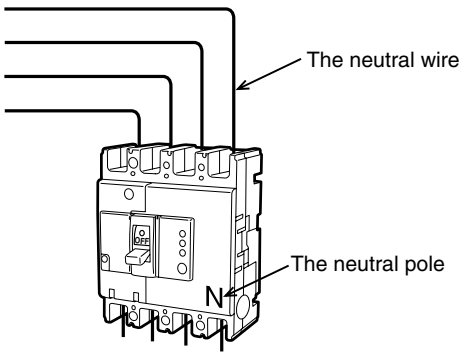
- Earth leakage circuit breaker dedicated to single phase 3-wire and three phase 4-wire types, be sure to connect the neutral wire to the neutral phase. Open phase or overcurrent fails operation and causes fire.

For 1ϕ, 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 3ϕ, 4-W, connect the neutral wire to neutral pole

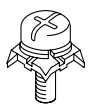
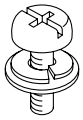
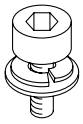
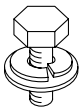
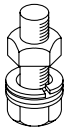


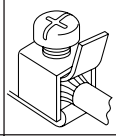
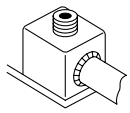
- Connect the earth leakage circuit breaker to the power source suitable for the ratings of the breakers. Connecting to a wrong power can cause malfunction and failure.

⚠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-CV NV125-CV NF125-SV NV125-SV NF125-HV NV125-HV NF125-UV	NF125-SEV NF160-SGV NF250-CV NF250-HGV NF125-HEV NF160-LGV NF250-SV NF250-RGV NF125-SGV NF160-HGV NF250-HV NV250-SEV NF125-LGV NF250-UV NV250-HEV NF125-HGV NF250-SEV NF125-RGV NF250-HEV NV125-SEV NF250-SGV NV125-HEV NF250-LGV
2.5	14(2.1)	4.5	9
4.0	12(3.3)	4.5	9
6.0	10(5.3)	4.5	9
10	8(8.4)	4.5	9
16	6(13.3)	5.5	9
25	4(21.2)	5.5	18
35	3(26.7)	6.5	18
–	2(33.6)	6.5	18
50	1(42.4)	6.5	18
–	1/0(53.5)	6.5	18
70	2/0(67.4)	6.5	24.5
95	3/0(85.0)	–	24.5
–	4/0(107)	–	24.5
120	250(127)	–	24.5

• 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.

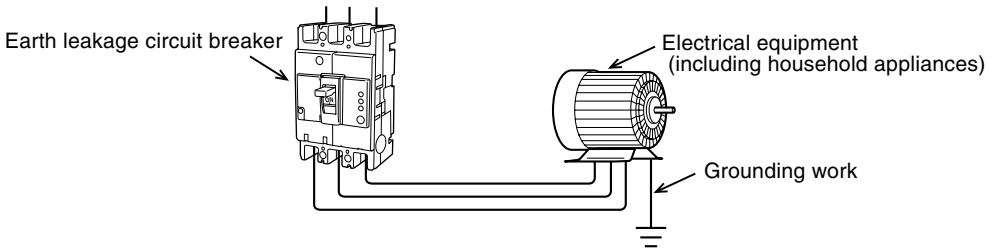
2.1 Cautionary instructions in general

⚠ DANGER

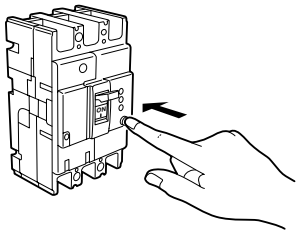
(1) Refrain from touching the terminal unit as electrification can result.
Note: Besides the terminal of the circuit breaker, the terminal unit includes the wires, bus bars, ring-type terminals, and other wiring materials.

⚠ 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.

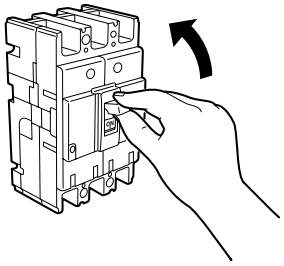
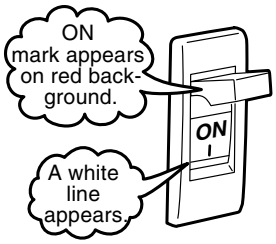
Note 1. Never apply any excessive impact to the handle.

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

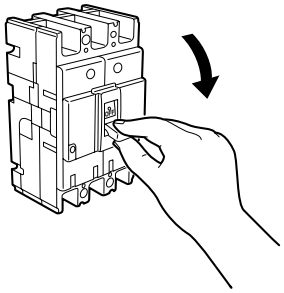
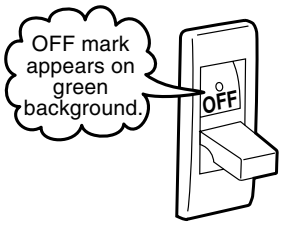
Note 3. ON, OFF operation must operate quickly and correctly. Otherwise it may cause open phase with a few time when operated slowly in case of some types of breakers.

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

① Closing (ON)

	ON operation		ON state indication
Switch on the power (closing)		Moving the handle upward closes the circuit.	

② Opening (OFF)

	OFF operation		OFF state indication
Switch off the power (opening)		Moving the handle downward opens the circuit.	

2.2.2 Trip and reset operation

(1) For moulded-case circuit breaker

① Tripping

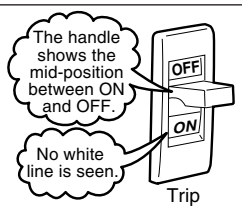
The moulded-case circuit breaker has an overcurrent tripping device which opens the circuit on detecting magnitude of overload current or short-circuit current, and is used for protecting electric wires and other power circuit.

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.

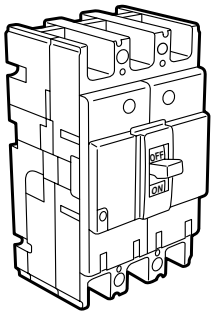
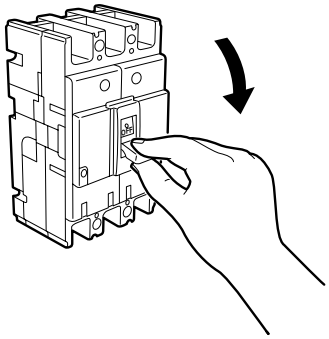
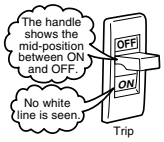
Type	Trip indication	Re-closing method
Moulded-case circuit breaker in general NF, MB, BH.	 Trip	Eliminate the cause of tripping ⇩ Reset operation ⇩ Re-closing

⚠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.

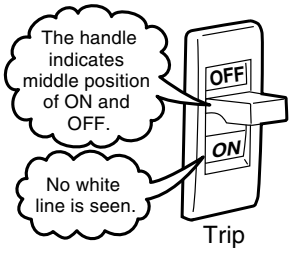
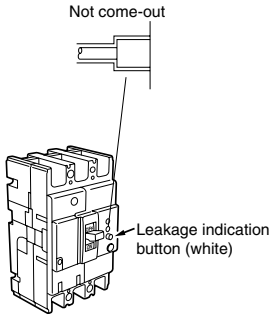
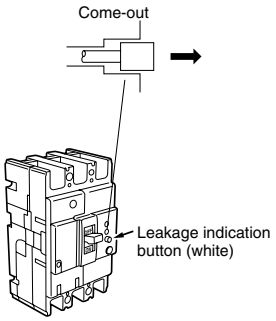
Resetting		Reset check
 Tripped state	Pull down the handle forcefully in OFF direction. 	When hands are released after reset, the handle turns to either mode shown below. Turns OFF. (reset completion)  Returns to trip (not completion) ⇩ Repeat resetting once more.  Trip

(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			

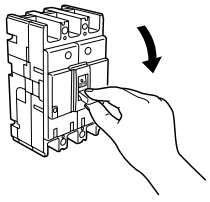
⚠CAUTION

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
NV63-CV~630-CW NV32-SV~800-SEW NV63-HV~800-HEW NV50-SVFU~250-HVU	Push down forcefully the handle in OFF direction.	Automatically reest when the handle is reset.



Reset the handle.

(3) For earth leakage relay

① Operation

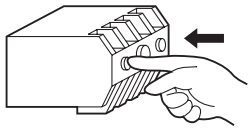
When leakage is detected by the earth leakage relay, contact point output is given, the leakage indicator button comes out, or the leakage indication lamp glows.

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



Push in the reset button by a finger.

(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.)

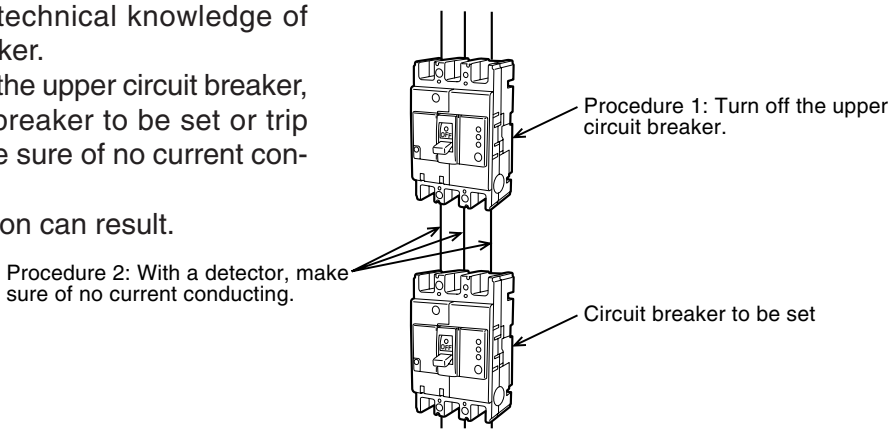
Note: When an alarm switch is attached, move the handle to OFF side once, then to ON side for reclosing. (The alarm switch of CP30-BA is reset at ON operation.)

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.



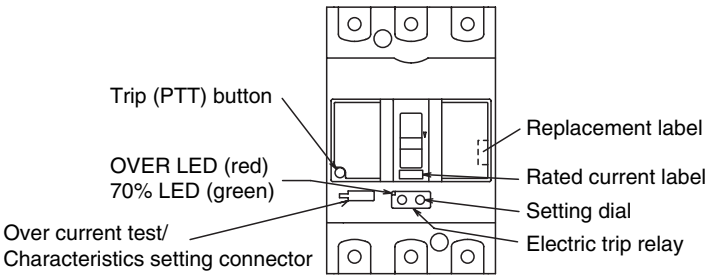
2.3.2 How to set characteristics of molded-case circuit breakers [electronic overcurrent tripping type]

(1) 100~250A frame

Applicable model

NF125-SEV, NF125-HEV, NF250-SEV, NF250-HEV

Setting dial arrangement

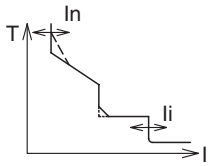


Tripping characteristics setting method

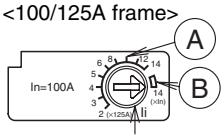
- Setting of rated current and instantaneous trip current

(1) Set tripping characteristics by turning the dials. For turning the dials for characteristic setting, use a screwdriver as illustrated at left.
- 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 0.02 N·m maximum.)

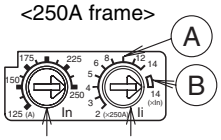
(2) The blank labels may be used for indication of the current setting Ir.
Please fill in the blank label with oily ink, and stick the label to the position under the handle.

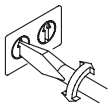


<100/125A frame>



<250A frame>





Frame size (A frame)	100				125	250
Standard current (A)	125					250
Rated current In (A)	50	60	75	100	125	125~250 adjustable (12.5A step adjustable)
Instantaneous trip current Ii (A)	Ⓐ 2-3-4-5-6-8-10-12-14×Standard current Ⓑ 14×rated current In					

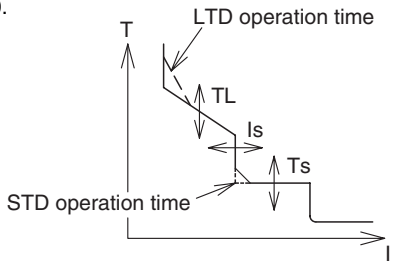
Tripping characteristics setting method

• Setting of other operation characteristics

The following items can be set and tested using the breaker test and setter Y-350.

Long-term operation time : TL	12-60-80-100s (at 200% In)
Short-term tripping current : Is	2-2.5-3-3.5-4-5-6-7-8-10×In
Short-term operation time : Is	0.1-0.2-0.3s
LTD operation time : I^6 t	ON (I^6 t) - OFF (I^2 t)
STD operation time : I^2 t	ON (I^2 t) - OFF (FLAT)

The electronic breaker is adjusted to the under line settings as a default.

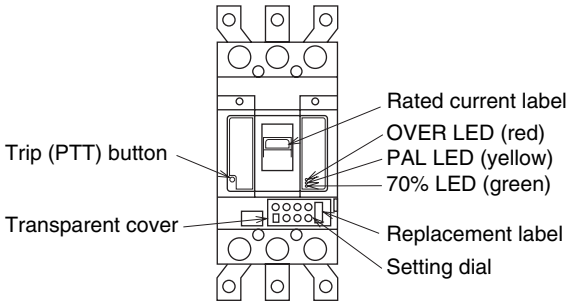


(2) 400~1600A frame

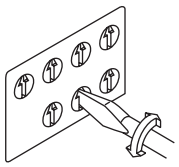
Applicable model

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

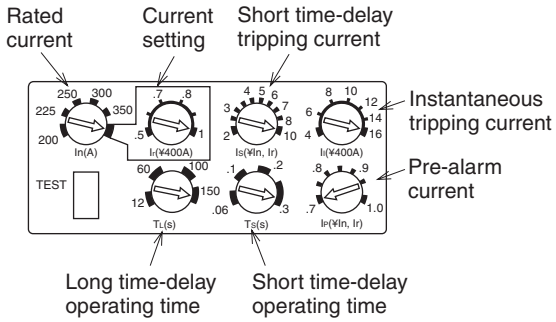
Setting dial arrangement



Setting method



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

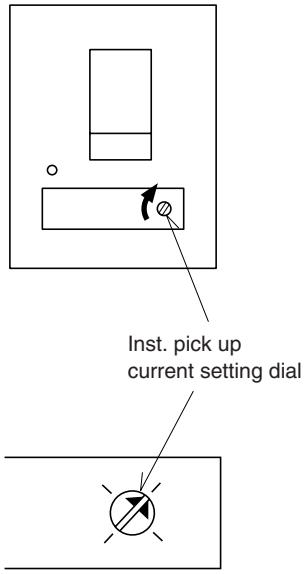


Step setting type:
- Rated current In
- Long time-delay operating time TL
- Short time-delay tripping current Is
- Short time-delay operating time Ts
- Pre-alarm current IP

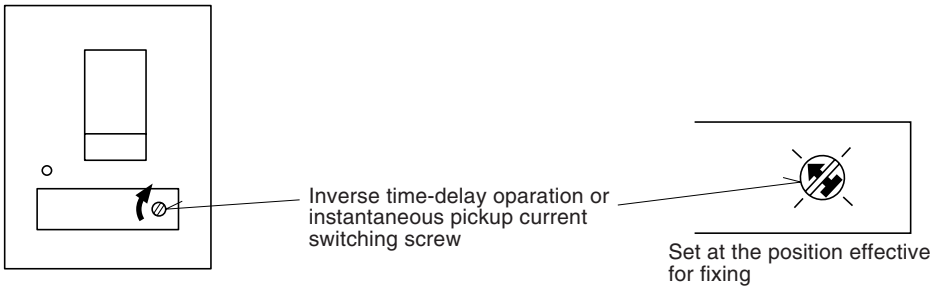
Continuously adjustable type:
- Current setting Ir (Note 1)
- Instantaneous trip current Ii

(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 4.5 mm 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 0.05 N·m maximum.)
③ Except for the dials of current setting Ir and instantaneous tripping current Ii, 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 Is 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.

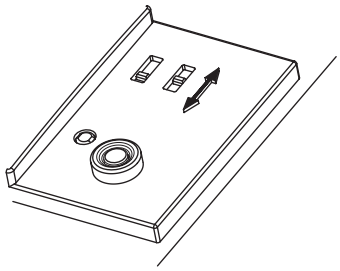
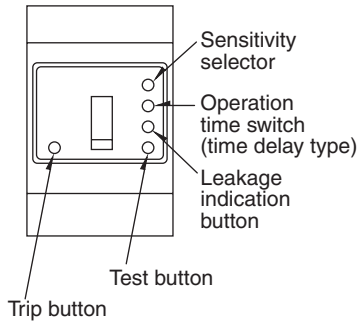
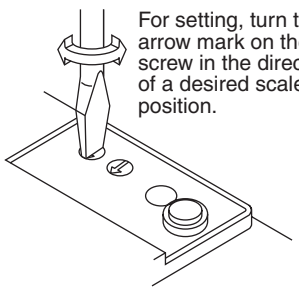
(3) Others

Applicable model	NF800-SDW, NF1250-SDW, NF1600-SDW NF-SLW
Setting dial arrangement	 Set at the position effective for fixing.
Setting method	Inst. pick up current can be adjustable by turning the setting dial. • Please refer to the operating characteristics for the setting current of each notch. Note 1. Stopping in the middle of each set values makes Inst. pick up current unstable. Note 2. Turn the arrow of each dial to the scale position desired. Note 3. A flathead screwdriver of 8 mm width and 1.0 thickness is suitable.

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

Applicable model	Adjustable magnetic type NF800-SDW, NF1250-SDW, NF1600-SDW
Item	Inverse time-delay or instantaneous tripping characteristic
Layout of setting terminals	
Setting method	Inverse time-delay oparation 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.

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

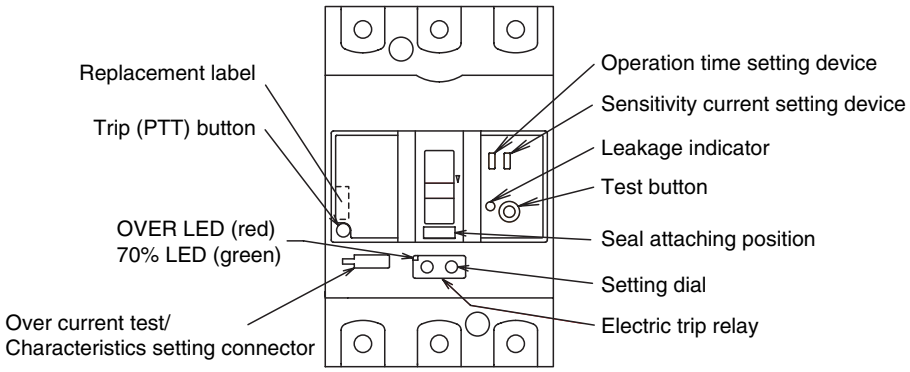
Applicable model	NV32-SV NV63-CV, NV63-SV, NV63-HV NV125-CV, NV125-SV, NV125-HV NV250-CV, NV250-SV, NV250-HV	NV400-CW, NV400-SW NV630-CW, NV630-SW
		Multi voltage, sensitivity switching in 3 steps
Setting terminal arrangement		 
Sensitivity, operating time	• Stopping between two set values makes sensitivity 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.	• A slotted head screwdriver of 4.5 mm width and 0.6 mm 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. (Addequate operation torque is 0.05 N·m max.)

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

Applicable model

NV125-SEV, NV125-HEV
NV250-SEV, NV250-HEV

Setting dial arrangement

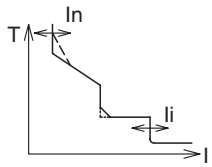


Tripping characteristics setting method

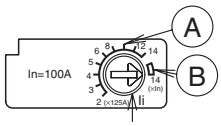
• Setting of rated current and instantaneous trip current

(1) Set tripping characteristics by turning the dials. For turning the dials for characteristic setting, use a screwdriver as illustrated at left.
- 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 0.02 N·m maximum.)

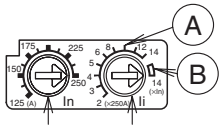
(2) The blank labels may be used for indication of the current setting Ir. Please fill in the blank label with oily ink, and stick the label to the position under the handle.

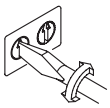


<100/125A frame>



<250A frame>





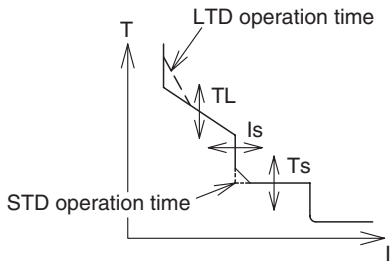
Frame size (A frame)	100				125	250
Standard current (A)	125					250
Rated current In (A)	50	60	75	100	125	125~250 adjustable (12.5A step adjustable)
Instantaneous trip current Ii (A)	Ⓐ 2-3-4-5-6-8-10-12-14×Standard current Ⓑ 14×rated current In					

• Setting of other operation characteristics

The following items can be set and tested using the breaker test and setter Y-350.

Long-term operation time : TL	12-60-80-100s (at 200% In)
Short-term tripping current : Is	2-2.5-3-3.5-4-5-6-7-8-10×In
Short-term operation time : Is	0.1-0.2-0.3s
LTD operation time : I^6 t	ON (I^6 t) - OFF (I^2 t)
STD operation time : I^2 t	ON (I^2 t) - OFF (FLAT)

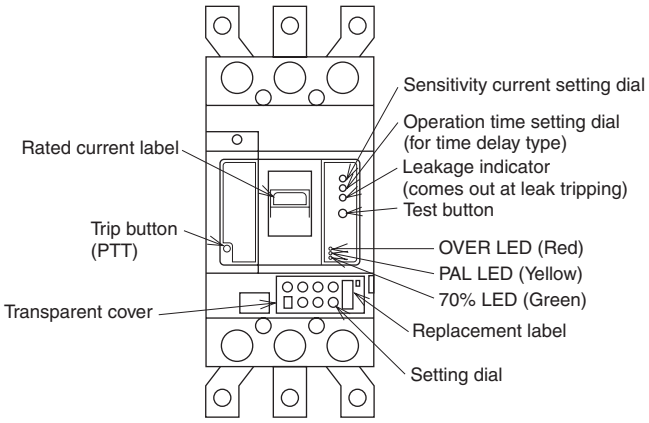
The electronic breaker is adjusted to the under line settings as a default.



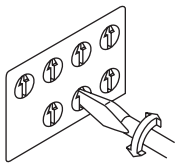
Applicable model

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

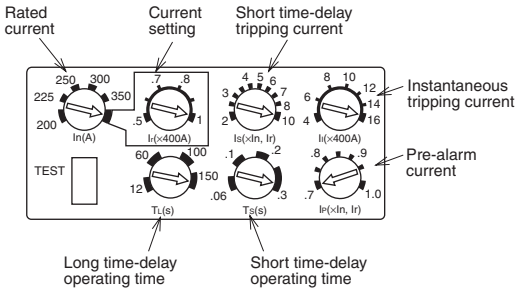
Setting dial arrangement



Tripping characteristics setting method



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



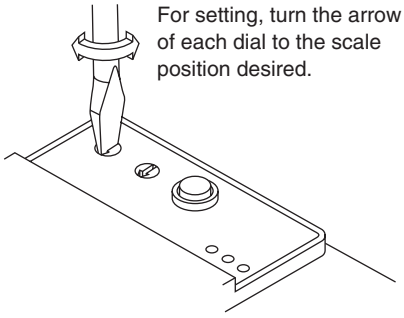
Step setting type:
- Rated current In
- Long time-delay operating time T_L
- Short time-delay tripping current I_S
- Short time-delay operating time T_S
- Pre-alarm current I_P

Continuously adjustable type:
- Current setting Ir
- 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 4.5 mm 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 0.05 N·m maximum.)
③ Except for the dials of current setting Ir 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 Is 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.

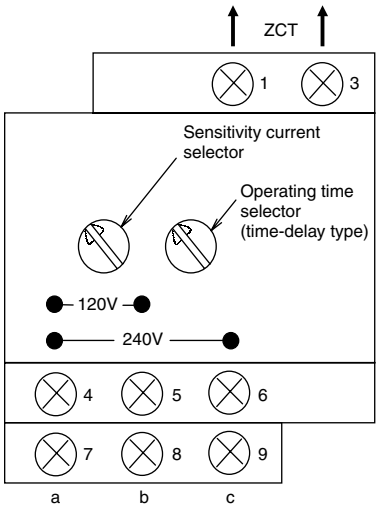
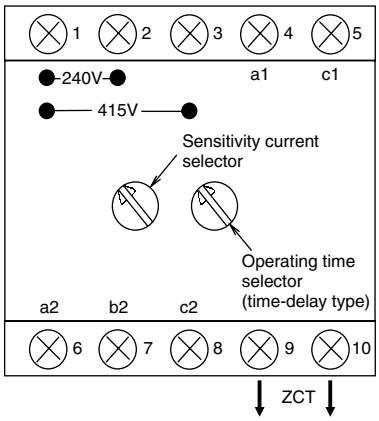
Setting method of leak tripping characteristics (sensitivity current, operation time)

- For setting sensitivity current and operation time, open the cover in the same procedure as for tripping characteristic setting.
- A slotted head screwdriver of 4.5 mm width and 0.6 mm 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 0.05 N·m maximum.)



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

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

Applicable model	Earth leakage relay	
	ZBA	ZSA, ZHA, ZLA
Switching terminal arrangment		
Voltage selection	• 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.	• 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.
Sensitivity, operation time	• 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.)	• 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.)

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°C……0.9 times

  60°C……0.7 times

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

⚠CAUTION

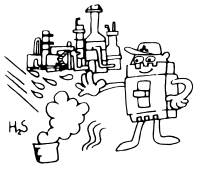
- Refrain from installing in any unusual environment of high temperature, high humidity, dust, corrosive gas, vibration and impact. Electrification, fire, and malfunction can result.

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	 Freezing warehouse, low temperature room	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 temperatur. (For storing, consider the use is possible up to -50°C at the lowest.)	• 1600 A frame of S-series and lower • All models of C-series	–
High temperature, high humidity	 Chemical plant	Circuit breaker for moisture-fungus treatment 一種熱帯処理 MOISTURE-FUNGUS TREATMENT 二種熱帯処理 MOISTURE-FUNGUS TREATMENT	• 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 special materials are used. In humid environment, insulation strength and other electrical performances tend to be lowered. The special surface treatment and the special materials are used to avoid such deterioration.	• 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	 Chemical plant, Oil refining plant	Added corrosion resistive circuit breaker 耐食増し CORROSION RESIST	• 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. * Concentration of corrosive gas allowed by the Safety and Health Standard: (Ex.) H_2S (10 ppm), HCl (5 ppm), Cl_2 (1 ppm), SO_2 (5 ppm), NH_3 (25 ppm) - (Japan Industrial Health Association, since 1973) Where concentration of corrosive gas is about 1/100 of the noted level and H_2S (0.01 ppm), the standard MCCB can be used. Expected service life (MTTF) will be less than 15 years.	(Note 2) • Front connection, rear connction, 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	 Cement plant, spinning mill, gravel pit	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.)

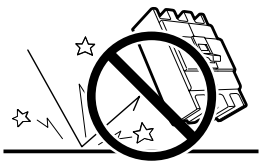
④ Terminal covers (The cover is contained in the same package for some models, but not for others.)

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

3.5 Conditions during transport and storage

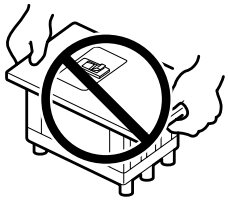
3.5.1 Transport

Packing and transportation shall be carried out with care



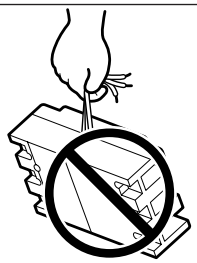
Never drop the packing.

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



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

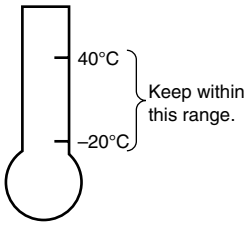
Don't bring the breaker up with holding the wires for carrying.



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

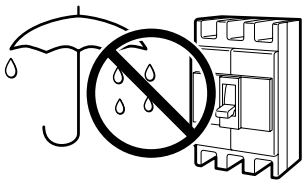
3.5.2 Storage

Storage temperature



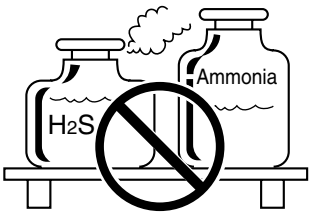
Average temperature for 24 hours, however, shall not be higher than 35°C.

Avoid humid air.
Relative humidity: 85% max.



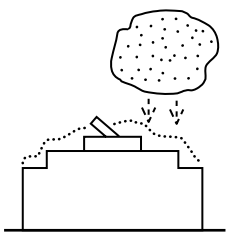
- Don't leave the breaker in a humid place for a long time.
- Keep the breaker so as not be dewed.

Avoid corrosive gas.

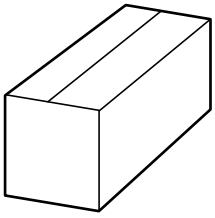


Storage the breaker in the environment of no corrosive gas.
H_2S 0.01 ppm max. SO_2 0.05 ppm max.
NH_3 0.25 ppm max.

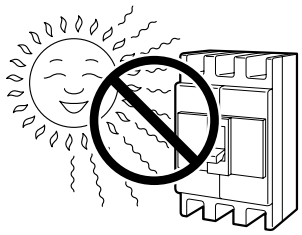
Place of low dust content



Housed in a packing case for storage



Avoid direct sunlight.



Avoid direct insolation during storage.

3.6 Installation and connection

3.6.1 General

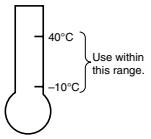
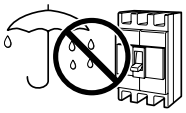
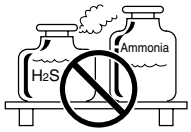
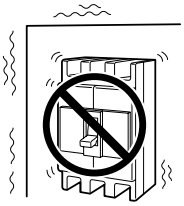
⚠CAUTION

- 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

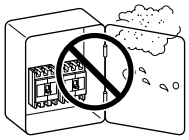
⚠CAUTION

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.

Operating ambient temperature: –10°C to 40°C	Avoid humid air. Relative humidity 85% max.	Avoid corrosive gas.	Avoid vibration and impact.
 Average temperature for 24 hours, however, shall not be higher than 35°C.	 • Install the breakers in a place of low humidity • Keep the breakers so as not be dewed.	 Install the breakers in the environment of no corrosive gas. H_2S 0.01ppm max. SO_2 0.05ppm max. NH_3 0.25ppm max.	

⚠CAUTION

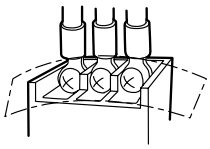
Use care to avoid rain, drill chips and other chips. Malfunction and operation failure can result.



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.

Don't put dust and chips inside through the exhaust port.

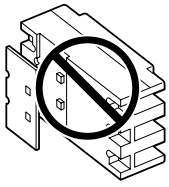
Cover the exhaust port with the sheet when under construction.



It is danger of poor electrification and abnormal temperature rise.

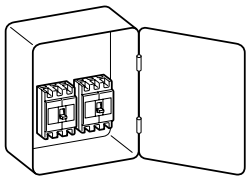
Don't disassemble!

Malfunction and operation failures can result.



Do not remove the compound filled in the threads at the rear surface and the rear cover.

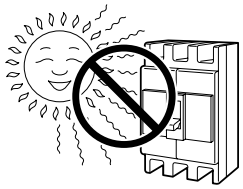
Use in a enclosure.



Be sure to use the breakers in a casing and never use them being exposed because arc is generated.

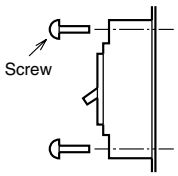
Avoid direct sunlight.

Temperature rise can lead to malfunction.



Use specified screws only.

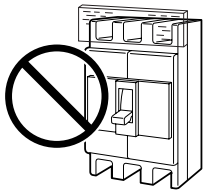
Install the breakers to the correct position using the specified screws (length and number of pieces) or the specified fittings.



Don't block up the exhaust port.

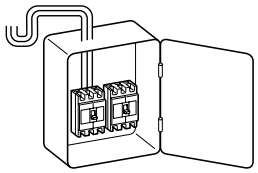
Breaking performance may possibly be lowered.

Don't put a flammable parts near the breaker.



It is in danger of fire when breaking the circuit.

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.

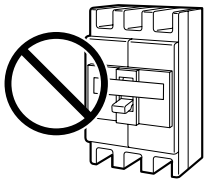
Never use thinner, detergent, and other chemicals for cleaning.

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

Clean the breaker using air cleaner or by brushing.

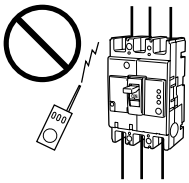
Do not adhere gum tape on the name plate.

The name plate may come off.



Avoid strong electro magnetic field.

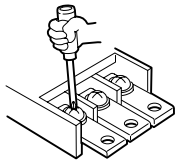
When a transceiver is used, keep it off at least 1 meter from installed places of the earth leakage circuit breakers and circuit breakers with electronic over-current release.



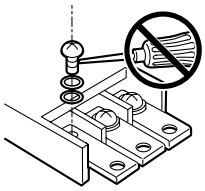
3.6.3 Connection

⚠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.

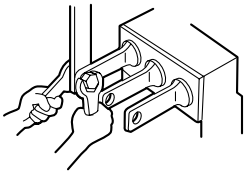


Oil is prohibitive to threads



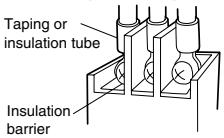
Oiling lowers frictions leading to loose screw. Over tightening causes breakage of the screw.

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.

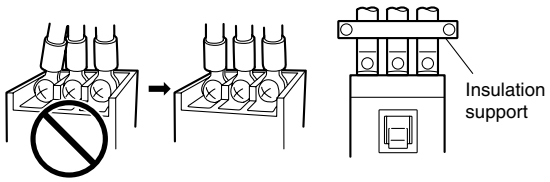
Use the terminal screws packed together.

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.

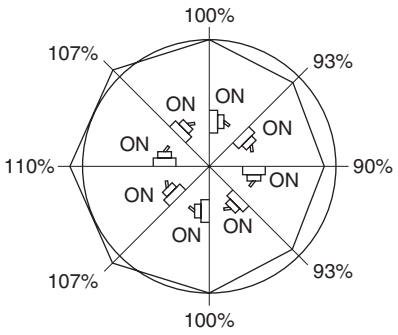
Magnetic force per 1 meter of conductor (In the case of 3-phase short circuit) N

Conductor distance cm / Let-through current r.m.s.kA (pf)	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

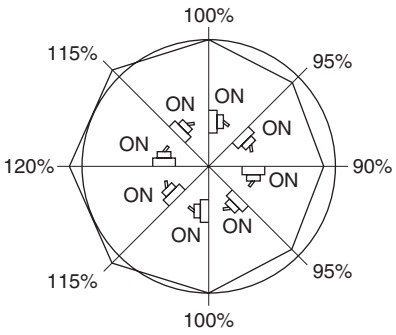
3.6.4 Mounting direction

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

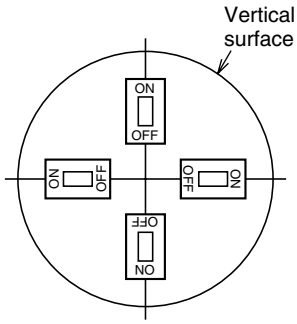
	Type
Moulded-case circuit breaker	NF30-CS
Circuit protector	CP30-BA, CP-S



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



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

• Basic concept

Insulation distance (distance indicated in standards)

Be sure to at least secure the insulation distances (spatial distance and creeping distance) specified by the codes and standards of the relevant equipment and facilities where the circuit breakers are installed.

It is recommended that insulation barriers and insulation tape be used to enhance the electrical insulation between bare-live parts and between bare-live parts and ground to avoid accidents otherwise caused by a loose metal piece, conductive dust, abnormal surge voltage in the circuit or a similar event so as to improve the reliability of panels.

Arc space (insulation space)

At the exhaust outlet side of breaker, arc space is necessary. When the actual load circuit is opened, especially when a large current such as overload or short-circuit is interrupted, ionized gas is emitted from the exhaust outlet. This gas can cause a short circuit between bare, live parts such as busbars, and also can cause grounding faults between conductive installation metal panels.

Therefore, it is important to secure enough arc space at the exhaust outlet side of the breaker and to strengthen insulation of parts exposed to the gas. In addition, securing enough space at the front of the exhaust outlet is necessary, because when the gas emission is blocked, failures such as deterioration of breaking performance can be caused.

• Insulation required part

With regard to insulation of bear, live parts of the line side of the breaker, please make sure to insulate at least C part C indicated in the diagram above with insulation tape, a tube or a terminal cover.

① A : Distance from the circuit breaker to the ceiling plate
② B1 : Distance from the circuit breaker to the uncovered conducting part of the upper circuit breaker terminal (front connection)
③ B2 : Distance from the lower circuit breaker to the end face of the upper circuit breaker (rear connection)
④ D1 : Distance from the side of the breaker to the side plate
⑤ C : Insulated length of the power source terminal of the circuit breaker (front connection)

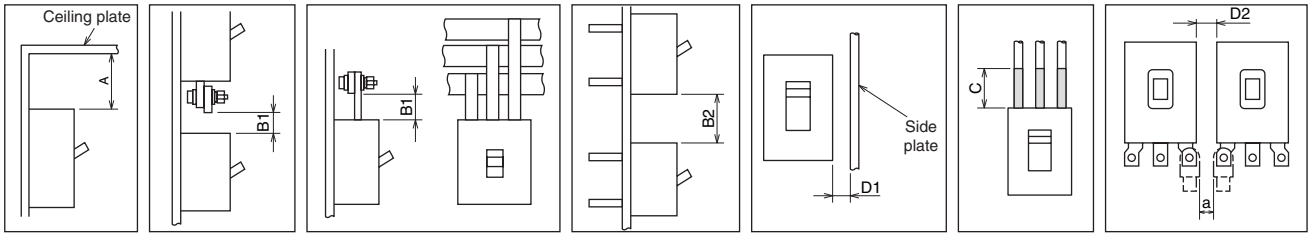
Please secure insulation using insulating tape, insulating tubing, insulation barrier, or a terminal cover, between bare charge parts within this size range. Please refer to a table a necessary size must.

◇ When using insulation tape and insulation tubing together with insulation barriers and terminal covers, make them overlap with the other by at least 10 mm.
◇ For the models with insulation barriers supplied as standard, please make sure to use the barriers.
a : clearance specified in standard

⑥ D2 : Side-to-side spacing of breakers

While the circuit breakers can basically be installed together without a clearance in between, be sure to observe the following instructions.

◇ It is desirable to install an insulation barrier between the adjacent circuit breakers or insulate the bare-live parts considering the effect of cutoff gas.
◇ Be sure to secure the insulation distance (dimension a) as the minimum, indispensable requirement.
◇ With a leakage circuit breaker and a leakage alarm circuit breaker installed in close contact with the other, a current of 2,500A or higher flowing through one of the circuit breakers could cause the other to operate falsely.
Be sure to secure a distance of at least 50 mm in between.
◇ A circuit breaker of 400-ampere frame or larger with an SHT or a UVT could operate falsely if a current of 50 kA or higher flows through the adjacent circuit breaker. Be sure to secure a distance of at least 50 mm in between.



Insulation distance (mm) (440VAC or below) *Figures in parentheses are for 230VAC or below.

Class • Series	Model		Ceiling plate			Vertical spacing		C	Horizontal spacing
			A			B1, B2			
	MCCB	ELCB	Uncovered metal Plate		Insulated plate, coated plate	Without terminal cover	With terminal cover		D1
			Without terminal cover	With terminal cover					
C • S • H • R • MB	NF30-CS	—	10	10	10	20	20	(*1)	20
	NF32-SV, NF63-CV	NV63-CV	5	5	5	20	20	(*1)	20
	NF63-SV, NF63-HV	NV32-SV, NV63-SV, NV63-HV	10	10	10	30	30	30	25
	NF125-CV	NV125-CV	50(30)	40(30)	10	50	50	(*1)	25
	NF125-SV	NV125-SV	50(10)	30(10)	10	50	50	50	25
	NF125-HV	NV125-HV	50	40	40	80	80	80	40
	NF250-CV	NV250-CV	40	40	40	50	50	50	50
	NF125-SEV, NF250-SV, NF250-SEV NF125-SGV, NF160-SGV, NF250-SGV	NV125-SEV, NV250-SV, NV250-SEV	70(40)	40	40	70(50)	50	70(50)	50
	NF125-HEV, NF250-HV, NF250-HEV NF125-LGV, NF160-LGV, NF250-LGV NF125-HGV, NF160-HGV, NF250-HGV	NV125-HEV, NV250-HV, NV250-HEV	80	60	60	80	80	80	60
	NF400-CW	NV400-CW	60	60	60	60	60	60	40
	NF400-SW, NF400-SEW	NV400-SW, NV400-SEW	70	70	70	70	70	70	70
	NF400-HEW, NF400-REW	NV400-HEW, NV400-REW	200	200	200	200	200	200	150
	NF630-SW, NF630-SEW, NF630-CW	NV630-CW, NV630-SW, NV630-SEW	70	70	70	70	70	70	70
	NF630-HEW, NF630-REW	NV630-HEW	200	200	200	200	200	200	150
	NF800-SEW, NF800-CEW	NV800-SEW	80	80	80	80	80	80	80
	NF800-HEW, NF800-REW	NV800-HEW	200	200	200	200	200	200	150
	NF1000-SEW, NF1250-SEW NF1600-SEW	—	100	100	100	100	100	100	100
R • U	NF125-RGV, NF250-RGV	—	30 (*6)	30 (*6)	30 (*6)	50 (*9)	50 (*9)	50	5
	NF125-UV, NF250-UV	—	(*1)	(*1)	(*1)	(*1)	(*1)	(*1)	25
	NF400-UEW	—	70	70	70	70	70	70	70
	NF800-UEW	—	80	80	80	80	80	80	80
UL	NF225-CWU	—	(40)	—	(40)	(50)	—	(50)	(50)
	NF50-SVFU	—	10 (*6)	10 (*6)	10 (*6)	20 (*7)	20 (*7)	30	10
	NF100-CVFU	—	50(25)	40(25)	10	50	50	50	25(15)
	NF125-SVU(*4)	—	40(10)	30(10)	10	50	50	50	25(20)
	NF125-HVU(*5)	—	40	40	40	80	80	80	25(20)
	NF250-SVU(*4)	—	40	40	40	70(50)	50	70(50)	50(20)
	NF250-HVU(*5)	—	40	40	40	80	80	80	50(20)
	NF-SKW(*5)	—	70	70	70	70	70	70	70
	NF-SLW(*5)	—	70	70	70	70	70	70	70

Remark: 1. The table shows the dimensions in the case of the use of a large terminal cover (TC-L).

Notes *1 It is not necessary to provide an insulation distance (an arc space) on the power supply side. However, if a grounding metal piece or the like comes in close contact with the terminal, be sure to completely insulate the terminals or the bare-live parts of the cable conductors.

*2 At more than 440 V AC, the distance shall be 10 mm.

*3 For 480Y/277V AC.

*4 For 480V AC.

*5 For 600Y/347V AC.

*6 An exhaust port is provided also on the circuit breaker load side. Secure the dimension A both on the power supply side and on the load side.

*7 When any of the circuit breakers NF125-RGV to NF250-RGV is used on the upstream side, an exhaust port is provided also on the circuit breaker load side. Secure the larger distance of the dimension B1 of NF125-RGV, NF250-RGV or NF50-SVFU and the dimension B1 of the downstream circuit breaker.

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

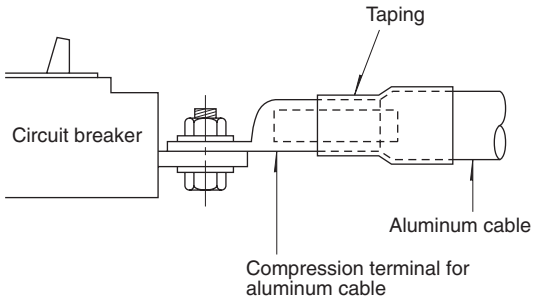
If size of connection wire is thinner than the test wire size, temperature of the breaker terminals increases and overcurrent tripping operation characteristic may change in some cases. (Operating time becomes shorter usually.) At motor load, for example, influence of change in operation characteristic 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 maifunction failures can result by heat of breaker, use the operating current not to exceed the below value.

Model								Maximum operating current
BH CP30-BA NF30-CS	BH-P CP-B	BH-S CP-S	BH-PS					80% of rated current
NF32-SV NF63-SV NF125-CV NF125-SV NF125-HV NF125-RGV	NF63-CV NF63-HV NF125-SGV NF125-LGV NF125-HGV	NF125-SEV NF125-HEV		NV32-SV NV63-SV NV125-CV NV125-SV NV125-HV	NV63-CV NV63-HV			
NF160-SGV NF250-CV NF250-SV NF250-HV	NF160-LGV NF250-LGV NF250-SGV NF250-HGV	NF160-HGV NF250-RGV		NV250-CV NV250-SV NV250-HV	NV250-SEV NV250-HEV			
NF400-CW NF400-REW	NF400-SW NF400-UEW	NF400-SEW	NF400-HEW	NV400-CW NV400-REW	NV400-SW	NV400-SEW	NV400-HEW	90% of rated current
NF630-CW NF630-REW	NF630-SW	NF630-SEW	NF630-HEW	NV630-CW	NV630-SW	NV630-SEW	NV630-HEW	
NF800-CEW NF800-REW	NF800-SDW NF800-UEW	NF800-SEW	NF800-HEW	NV800-SEW	NV800-HEW			

3.6.7 Breaker arrangements

(1) Connection of molded case circuit breaker

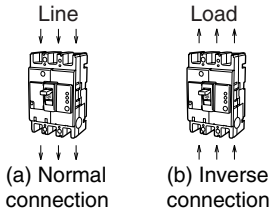
① Inverse connection

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.

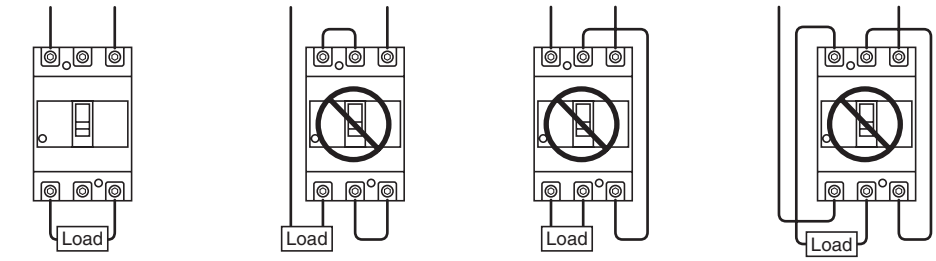


NF-C, NF-S, NF-H, NF-R and NF-U class BH-P, CP30-BA, NV-C, S, H and R class of 400 to 800AF, NF100-CVFU, NF125-SVU, NF125-HVU, NF250-SVU, NF250-HVU	Reverse connection is allowed for the standard models.

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.

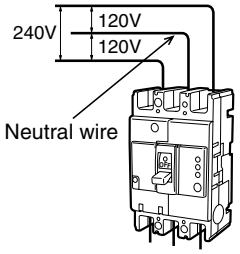
(b) Connection method of B or C
Please never use this connection in any actual use. Since the temperature-rise of the internal electronic circuit and the breaking performance are not guaranteed.

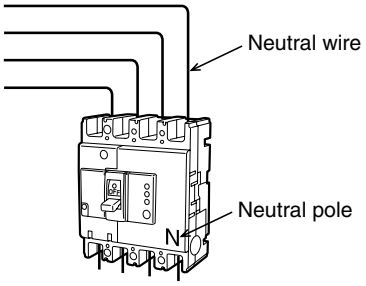
(2) Connection of earth leakage circuit breaker

⚠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.

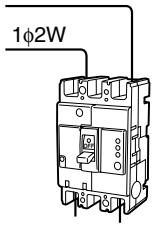
② Where a circuit breaker is used for 1 phase 3 wire system and 3 phase 4 wire system, be sure to connect the neutral wire to the neutral pole of the circuit breaker. Otherwise, operation fails at overcurrent.





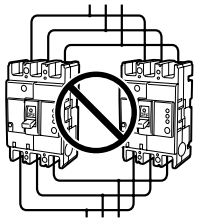
(a) For single phase two wire system, refrain from using neutral pole.

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.



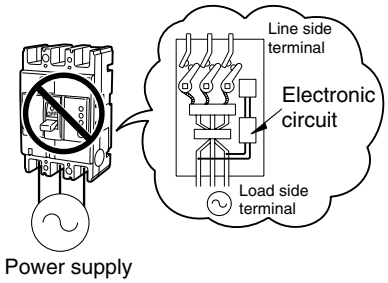
(b) Don't connect in parallel.

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.



Model	Applicable voltage
NV32-SV, NV63-CV, NV63-SV, NV125-CV, NV125-SV NV250-CV, NV250-SV, NV225-CWU NV100-CVFU, NV125-SVU, NV125-HVU, NV250-SVU NV250-HVU	230V AC
NV400-CW, NV400-SW, NV400-SEW, NV400-HEW NV400-REW, NV630-CW, NV630-SW, NV630-SEW NV630-HEW, NV800-SEW, NV800-HEW	230-400-440V AC

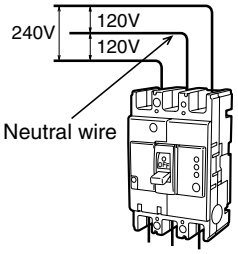
Note 1. Measuring display unit (MDU) breakers are not available.

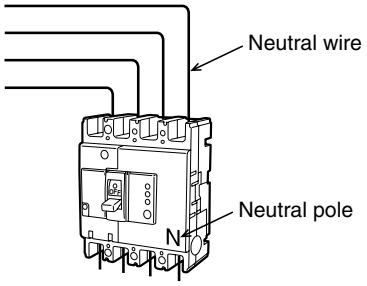
(3) Connection of Molded-case circuit breaker with earth leakage current

⚠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.

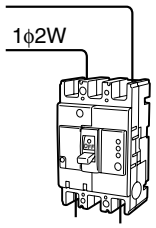
② Where a circuit breaker is used for 1 phase 3 wire system and 3 phase 4 wire system, be sure to connect the neutral wire to the neutral pole of the circuit breaker. Otherwise, operation fails at overcurrent.





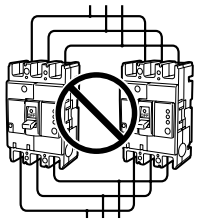
(a) For single phase two wire system, refrain from using neutral pole.

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.



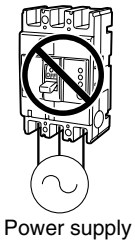
(b) Don't connect in parallel.

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.



(4) MDU Breaker (Circuit Breaker with Measuring Display Unit)

<WS-V Series MDU Breakers>

Applicable model
NF250-SEV with MDU, NF250-HEV with MDU

<W & WS Series MDU Breakers>

Applicable model
NF250-SW with MDU NF400-SEP/HEP, NF630-SEP/HEP, NF800-SEP/HEP with MDU

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 curcuit.
  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, V1-2 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.

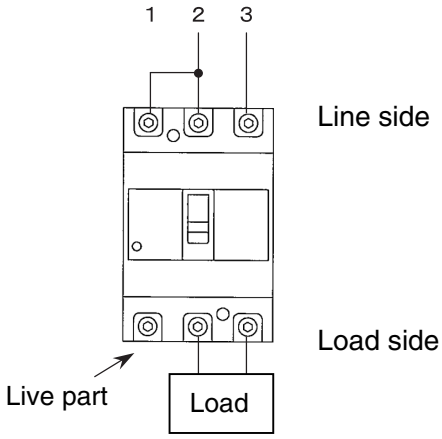


Fig1. Connection of using in 1 phase 2 wire.

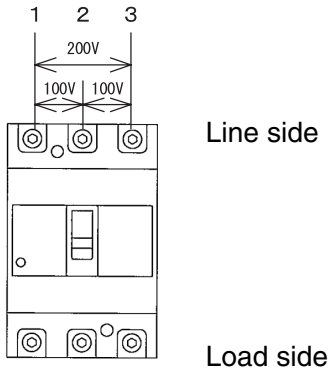


Fig2. Connection of using in 1 phase 3 wire.

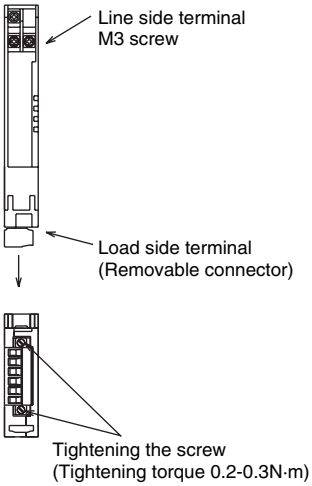
- Please note that three pole breaker with MDU cannot be used in three phase four line system.
  When three pole breaker with MDU is used for three phase four line system, it becomes as shown in the table below.

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.

WS-V Series Wiring connection for breaker mounting type MDU unit

⚠CAUTION

- The screw size of line side terminal for breaker mounting type MDU unit is M3. Tighten the terminal screw according to the specified tightening torque (0.6-0.8N·m).
- In the load side terminal for breaker mounting type MDU unit, connect the wire shown as below after removing the terminal cover and removable connector.



Wire size

	Single connection	Double connection
Single wire	0.2-2.5mm^2	0.2-1.0mm^2
Stranded wire	0.2-2.5mm^2	0.2-1.5mm^2
Stranded wire with rod terminal (without insulation sleave)	0.25-2.5mm^2	0.25-1mm^2
Stranded wire with rod terminal (with insulation sleave)	0.25-2.5mm^2	0.5-1.5mm^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.
- Tighten the screw after connecting the wire and attaching the removable connector. Standard tightening torque is 0.2-0.3N·m.

WS-V Series Wiring connection panel mounting type MDU unit

⚠CAUTION

- The wire size of panel mounting type MDU unit is shown as below.

Wire size

	Single connection	Double connection
Single wire	0.14-1.5mm^2	0.14-1mm^2
Stranded wire	0.14-1.5mm^2	0.14-0.75mm^2
Stranded wire with rod terminal (without insulation sleave)	0.25-1mm^2	0.25-0.5mm^2
Stranded wire with rod terminal (with insulation sleave)	0.25-1mm^2	0.5-0.5mm^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
  Recommended driver : Model name “SZS 0.6 × 3.5” manufactured by Phenix contact
  Wire strip length 6.5mm
- 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.

W & WS Series Wiring connection for MDU unit

⚠CAUTION

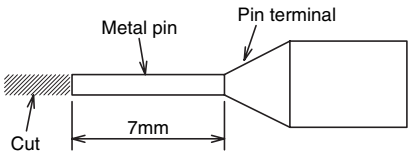
- The size of wiring MDU is shown as below.

	Single connection	Double connection
Single wire	ø0.45-ø1.2mm	ø0.45-ø0.8mm
Twisted wire	0.14-1.5mm	0.14-0.75mm

- 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 0.25mm^2:AI 0.25-6 YE
Cross section of wiring 0.5mm^2:AI 0.5-6 WH
Terminal for 2 wires 0.5mm^2 × 2:AI-TWIN 2 × 0.5-8 WH

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.

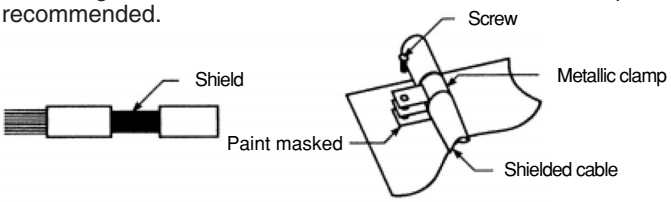
Condition 1: (Power distribution board, control panel board)

(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.

Measurement of insulation resistance and withstand voltage test

⚠CAUTION

• Voltage transformers are conncted 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 △ 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 5V DC 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		
State of handle			ON	OFF	ON	OFF	Test condition
Between live part and earth (except MDU terminal)			○	○	○	○	2500V AC 1min (In the case of these tests, Do not connect MDU terminal to live part or erath)
Between different poles	Line side	Between left and middle poles	△	○	×	○	
		Between middle and right poles	△	○	×	○	
		Between left and right poles	△	○	×	○	
		Between middle and neutral poles	△	○	×	○	
	Load side	Between left and middle poles	△	△	×	×	
		Between middle and right poles	△	△	×	×	
		Between left and right poles	△	△	×	×	
		Between middle and neutral poles	△	△	×	×	
Between line and load terminal			—	○	—	○	
Between main circuit and MDU terminal (L1, L2)			○	○	○	○	2500V AC 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)			○	○	○	○	1500V AC 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.)			○	○	○	○	

Note 1. Connect MDU terminal (L1, L2, 113, 114, DA, DB, DG, SLD and FG) to the earth side.
Note 2. Connect MDU terminal (113, 114, DA, DB, DG, SLD and FG) to the earth side.
Note 3. Do not test between MDU terminal (DA, DB, DG and SLD) and MDU terminal (FG).
Note 4. Connect each MDU terminals (DA, DB, DG, SLD, FG) before you start the test.

Error codes for W & WS Series MDU Breaker

When an error occurs on MDU

(1) “Er” is displayed in left 2 digits of numerical LED and error code is displayed in right 3 digits of numerical LED.
(“L ERR” LED is turn on with CC-Link option)

(2) When MDU with CC-Link option, then reply error code.

Error details and corrective action for each trouble occurrence are shown below,

[LED display status]

Description	Left 2 digits of numerical LED	Right 3 digits of numerical LED	Error details	Corrective action
Common	Er	006	Hardware error Real time clock IC error	Reset the power supply of the MDU. Electric energy data is not cleared by this operation. In the case of MDU with CC-Link option, the other method is to push RESET switch. But a part of electric energy data may be cleared by this method. Therefore record the electric energy data before pushing RESET switch.
	Er	007	Hardware error ADC error	
	Er	050	Hardware error EEPROM error	
	Er	051	Hardware error EEPROM error	
CC-Link option	L ERR. LED turn on		Communication data error	Wire the communication cable correctly.
			Station number setting or transmission baud rate setting is changed.	Returned to the previous state. Push RESET switch when the setting was changed.
			Station number or transmission baud rate set outside the range.	Modify it to the correct setting.

[Error codes] For CC-Link

Error code (hex)	Error details	Corrective action
01H	Undefined command	Modify it to the correct command.
C0H	Hardware error	Reset the power supply of the MDU. Electric energy data is not cleared by this operation. In the case of MDU with CC-Link option, the other method is to push RESET switch. But a part of electric energy data may be cleared by this method. Therefore record the electric energy data before pushing RESET switch.
C1H	Out of channel range	Modify it to the correct channel.
C2H	Out of setting range	Modify it to the correct setting.

Note 1. Please read each module instruction manual when other errors, except for above mentioned table, occur.

2. Once error status flag (RX(n+1)A) is “1” (ON), the flag can not be reset by PLC reset.
   Error reset request flag shall be “1” (ON) to reset error status flag (RY(n+1)A).
   Refer to the error code, the error cause shall be removed before resetting.

3. Alarm and input bit (RXn2, RXn6 and RXn7) can not be change while error status flag (RX(n+1)A) is “1” (ON).
   Immediate removing from the failure cause is recommended.

3.6.8 Instruction for connections

⚠CAUTION

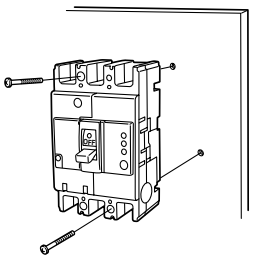
Use the applicable connection parts for breaker.
Otherwise it may result in fire.

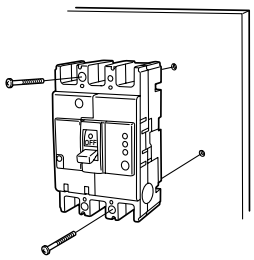
(1) Front connection

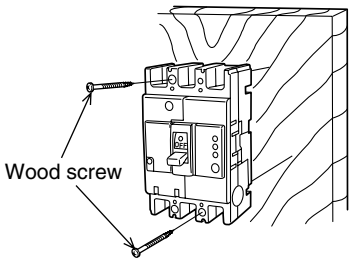
① Mounting

Mount directly using the mount hole.

Mount plate

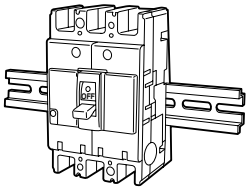






• Mount screws for steel plate and for wood plate (a part of NV models) are attached. For dimension, refer to Appendix 1.
Note) In some cities, mounting onto wood board is limited by fire defense code and others.

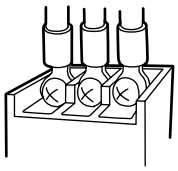
Mounting on IEC rail



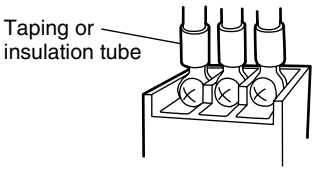
• Fix by attaching a slip stopper.

② Connection

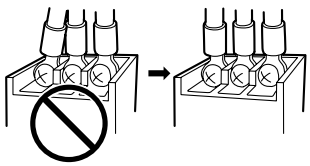
Wire connection with ring-type terminal



• For connection using ring-type terminals, refer to Appendix 4 for selection.



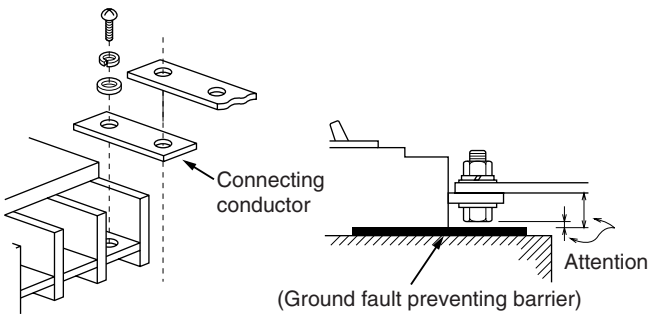
• Cover up exposed and conducting part of ring-type terminals with tube or insulation tape.



• Fasten the ring-type terminals so that the wires of different poles are kept parallel with each other.

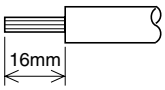
Bar connection

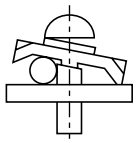
- When conductors are connected directly, process the conductors to the outline dimensions stated in the conductor machining drawing.
- To connect a conductor to a bar terminal, pay attention to insulation to the ground. Ground fault preventing barrier can be made to your designation.
- After making 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.

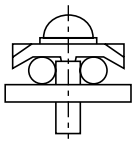


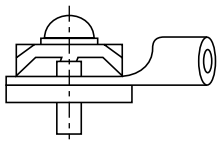
Clamp connection

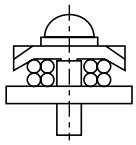
- When connected directly to a terminal, insert the solid or stranded wire straight, then fasten the terminal screws.
  Ring-type terminals and bars can also be connected.
- For stranded wires, divided the strands for insertion, then fasten. Retightening is necessary for stranded wires at initial connection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




(One solid wire)


(Two solid wires)

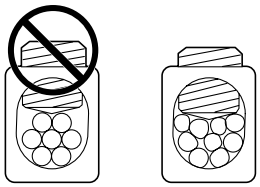

(Connection with ring-type terminal)


(Thick stranded wire)

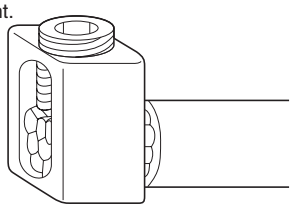
Connection with solderless terminal

- 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.



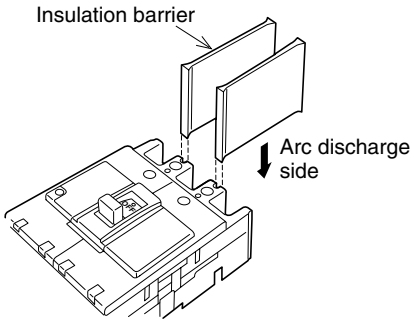
③Insulation

(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 arch 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-SV, NF63-CV NF125-CV, NF125-UV, NF100-CVFU BH(2P, 3P, 40A, 50A) BH-P, BH-S, BH-PS	NV32-SV, NV63-CV NV125-CV, NV100-CVFU	○	—	—	—
NF63-SV, NF63-HV NF125-SV, NF125-HV	NV63-SV, NV63-HV NV125-SV, NV125-HV	Packed together as the standard practice	—	—	—
NF125-SEV, NF125-HEV, NF250-CV, NF250-SV, NF250-HV NF250-SEV, NF250-HEV NF125-SGV, NF125-LGV, NF125-HGV, NF125-RGV NF160-SGV, NF160-LGV, NF160-HGV NF250-SGV, NF250-LGV, NF250-HGV, NF250-RGV	NV125-SEV, NV125-HEV NV250-CV, NV250-SV, NV250-HV NV250-SEV, NV250-HEV	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) NF630-CW, NF630-SW, NF630-SEW, NF630-HEW NF630-REW	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
NF800-CEW, NF800-SEW, NF800-HEW, NF800-REW NF800-SDW, NF800-UEW	NV800-SEW, NV800-HEW	Packed together as the standard practice	○	○	○
NF1000-SEW, NF1250-SEW, NF1250-SDW	—	Packed together as the standard practice	—	—	Packed together as the standard practice
NF1600-SEW, NF1600-SDW		Packed together as the standard practice	—	—	—

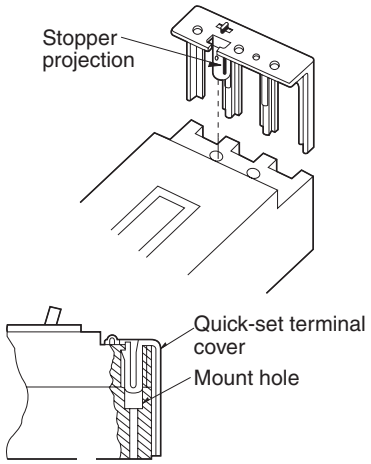
④Terminal cover

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).

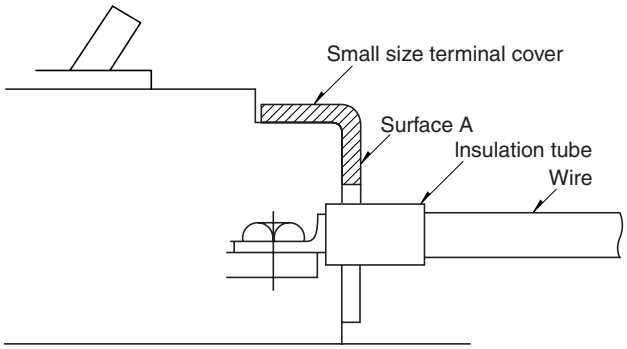
- Quick set terminal cover

  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.)



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.

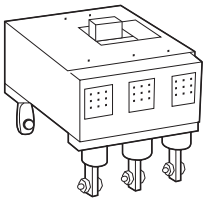


Note. No insulation barriers are needed with terminal covers are attached.

(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.

①Bar stud

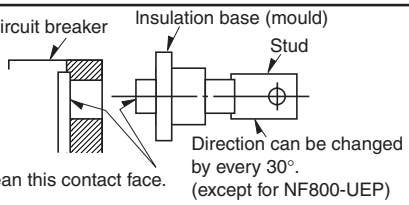


Assembling procedure (A)

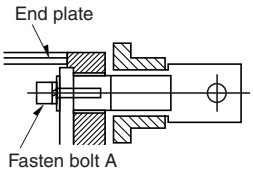
Model of breaker to be assembled	NF400-CW, NF400-SW NF400-SEW, NF400-HEW NF400-REW NF400-UEW(3P)	NF630-CW, NF630-SW NF630-SEW, NF630-HEW NF630-REW	NF400-UEW(4P) NF800-CEW, NF800-SDW NF800-SEW, NF800-HEW NF800-REW, NF800-UEW
	NV400-CW, NV400-SW NV400-SEW, NV400-HEW NV400-REW	NV630-CW, NV630-SW NV630-SEW,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

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

1. Clean the stud

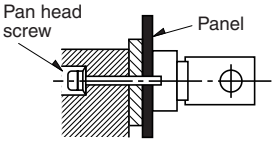


2. Attach the stud to the circuit breaker.



3. Attach onto the panel.

With the attached set screws, mount onto the panel using the mount hole on the circuit breaker. If the mount hole on the panel isn't threaded, use nuts.

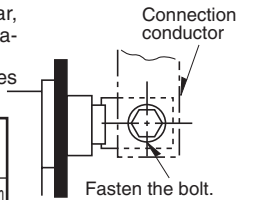


Assemble the circuit breaker and the insulation base and attach them together onto the panel.

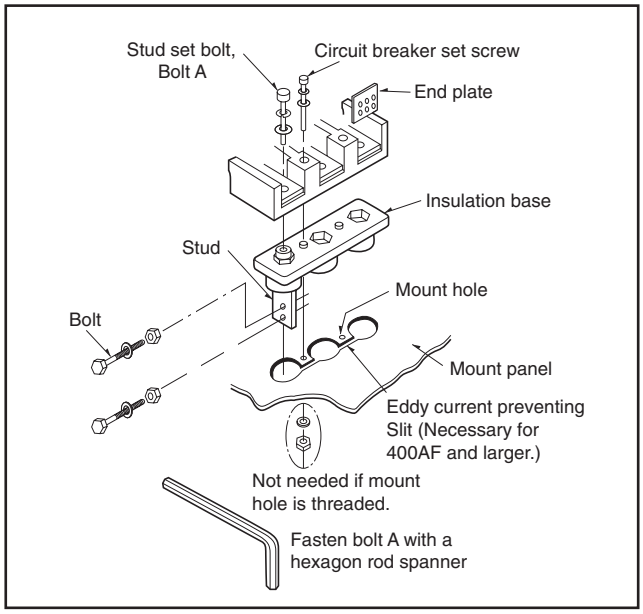
4. Connect the connecting conductor.

1. At connecting the conductors (bus bar, wire etc.), be careful so that no unreasonable force is applied to the stud.
2. When connected, fix (bundle) the wires at the positon (mentioned) below.

Type \ Stud direction	Horizontal (□□□)	Horizontal (□□□)
100.250A frame	200mm maximum	120mm maximum
Others	350mm maximum	200mm maximum



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.

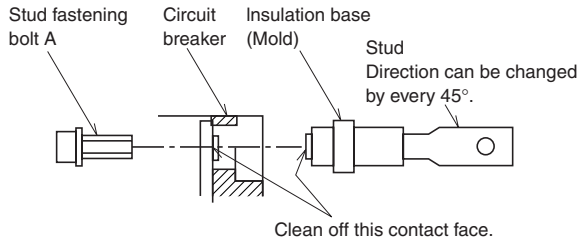


Assembling procedure (B)

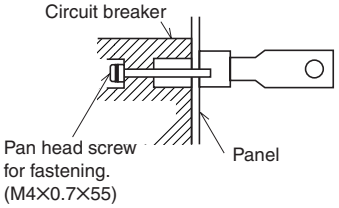
Model to be assembled	NF125-CV NF125-SV NF125-HV NF125-UV	NF125-SEV, NF125-HEV NF250-CV, NF250-SV, NF250-HV NF250-SEV, NF250-HEV, NF250-RV, NF250-UV NF125-SGV, NF125-LGV, NF125-HGV, NF125-RGV NF160-SGV, NF160-LGV, NF160-HGV NF250-SGV, NF250-LGV, NF250-HGV, NF250-RGV
	NV125-CV NV125-SV NV125-HV	NV125-SEV, NV125-HEV NV250-CV, NV250-SV, NV250-HV NV250-SEV, NV250-HEV
Size of bolt A	M6	M6
Tightening torque N·m	4	10

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

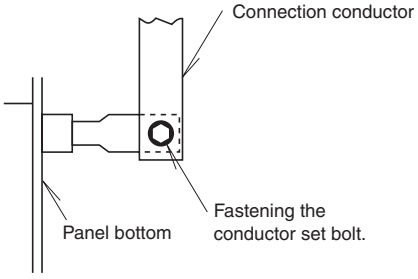
1. Attach the stud to the circuit breaker.



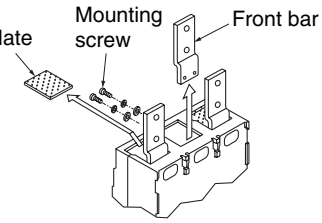
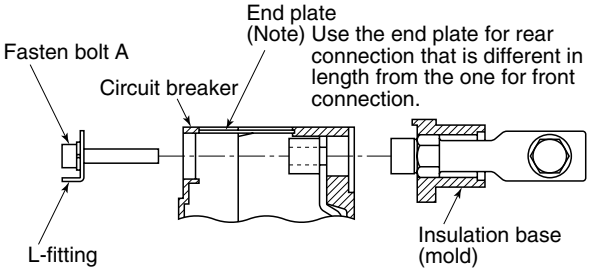
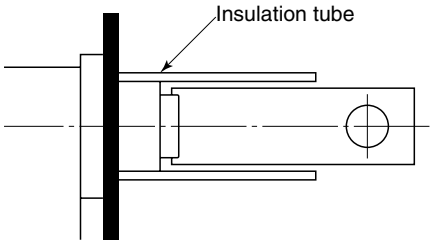
2. Attach onto the panel.



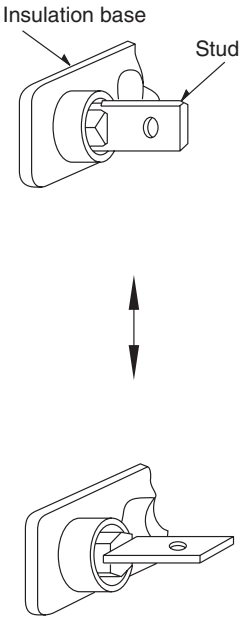
3. Connect the connecting conductor.



Cautionary instruction

Model name	Assembling procedure	Detail
NF400-UEW(4P) NF800-CEW, NF800-SDW NF800-SEW, NF800-HEW NF800-REW, NF800-UEW	A-1	When changing from front type to rear type, please conduct a following procedure. ①Remove the end plate. ②Remove the front bar.  (e.g. 800AF)
NF400-CW, NF400-SW NF400-SEW, NF400-HEW NF400-REW NF400-UEW(3P) NV400-CW, NV400-SW NV400-SEW, NV400-HEW NV400-REW NF630-CW, NF630-SW NF630-SEW, NF630-HEW NF630-REW NV630-CW, NV630-SW NV630-SEW, NV630-HEW NF800-CEW, NF800-SEW NF800-SDW, NF800-HEW NF800-REW, NF800-UEW NV800-SEW, NV800-HEW	A-2	 Fasten L-fitting together as illustrated.
NF400-CW, NF400-SW NF400-SEW, NF400-HEW NF400-REW NF400-UEW(3P) NV400-CW, NV400-SW NV400-SEW, NV400-HEW NV400-REW NF630-CW, NF630-SW NF630-SEW, NF630-HEW NF630-REW NV630-CW, NV630-SW NV630-SEW, NV630-HEW	A-4	 Insert the insulation tube into the center pole. For 4-pole breakers, insert the tube into the neutral pole, too.

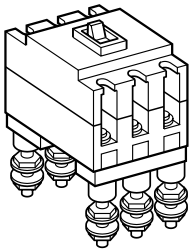
The direction of stud can be changed easily.
(except for NF800-UEW)



Kind of end plate

Model name	NF400-CW, NF400-SW NF400-SEW, NF400-HEW NF400-REW, NF400-UEW(3P)	NF630-CW, NF630-SW NF630-SEW, NF630-HEW NF630-REW	NF400-UEW(4P) NF800-CEW, NF800-SDW NF800-SEW, 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
Kind of end plate	Insulation plate (52 × 32.5)		Insulation plate (60 × 52)

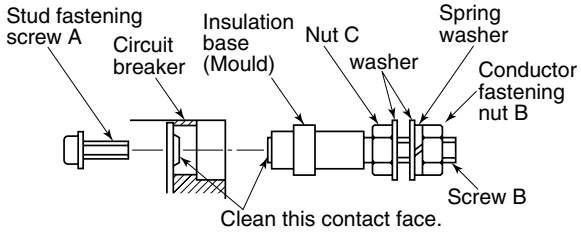
②Screw stud connection



Assembling procedure (A)

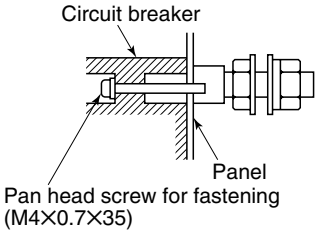
Model to be assembled	NF32-SV, NF63-CV, NF63-SV, NF63-HV NV32-SV, NV63-CV, NV63-SV, NV63-HV

1. Attach the stud onto the circuit breaker.

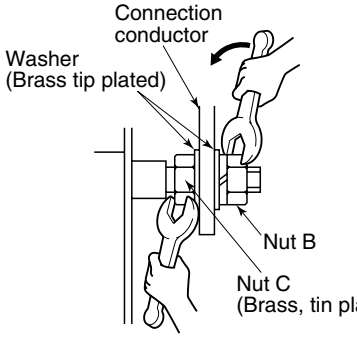


2. Mount onto the panel.

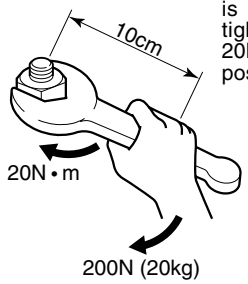
(Note)
Tap the panel referring to the catalog.



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.

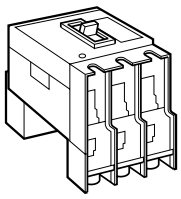


Generally, about 20kg power is generated by arm. So, tightening torque comes to 20N • m by grip-ping illustrated position.

Tightening torque for screw stud

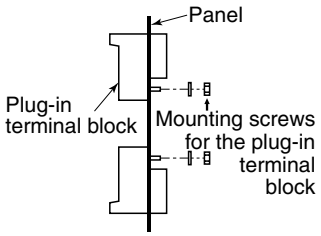
Type (Ampere frame)	Tightening torque N·m	
	Stud fastening screw A <Nominal diameter of screw>	Conductor fastening nut B <Nominal diameter of screw>
30A frame 〜 63A frame	1 <M4>	2 <M6>

(3) Plug-in type

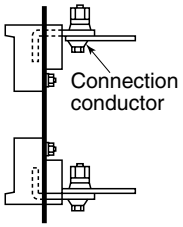


• Assembling procedure

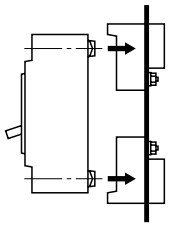
1. Attach the plug-in terminal block having the stud onto the panel or the angle.
   (If the plug-in terminal block is separate type, place the circuit breaker temporarily for positioning the push-in terminal block.)



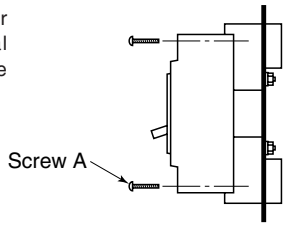
2. Attach the connection conductor to the plug-in stud.



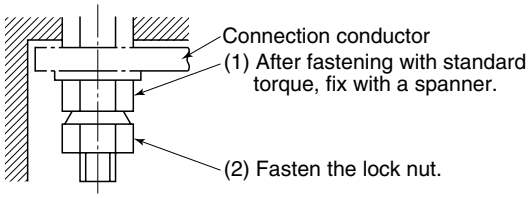
3. Turn OFF the circuit breaker and insert into the plug-in terminal block.
   (Take off the cushion (foamed polystyrene of white) inserted into the tulip paart)



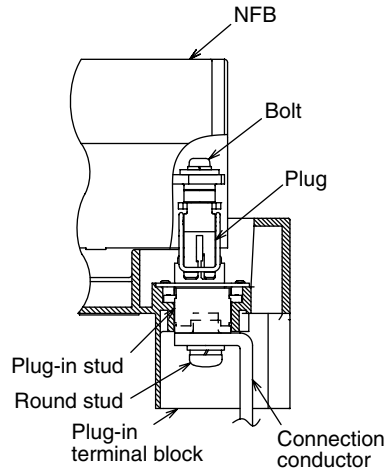
4. With the attached screw or to nut, fix the circuit breaker onto the plug-in terminal block using the mount hole on the breaker.



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



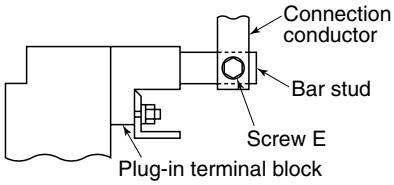
✻ At fasten ing the connection conductor, refrain from applying excessive load onto the side wall of the plug-in terminal block.



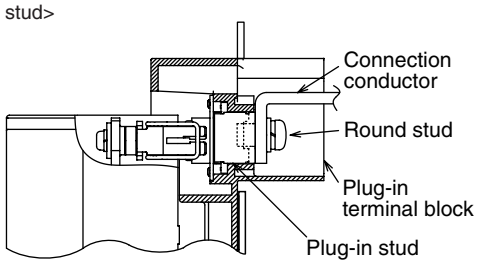
Example of composition of plug-in type

• Conductor connection

<Bar stud>



<Screw stud>



• For fastening torque, refer to Appendix 2.

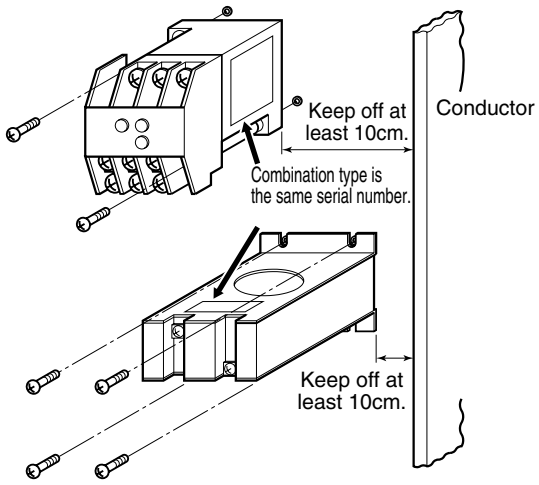
(4) Earth leakage relay

①Mounting

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
								—

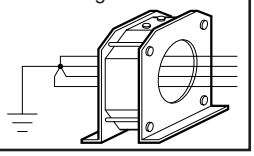
3. To avoid influence of outside magnetic field, mount the relay and the ZCT at least 10cm off the conductors which a large current of over several thousands ampere flows.



②Connection

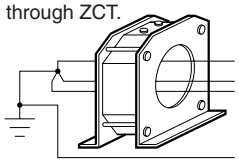
1. For single phase three-wise system and 3 phase 4-wire system, be sure to pass the three or four wires including the neutral wire through ZCT. (Pass the wire intended to conduct load current throught ZCT.)

Pass the neutral wire also through ZCT

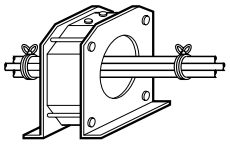


2. Where the line include a wire dedicated to grounding, refrain from passing the earth wire through ZCT. (Don't pass the wire not intended for conducting load current through ZCT.)

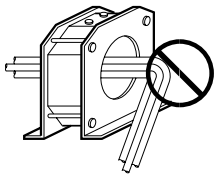
Don't pass the earth wire through ZCT.



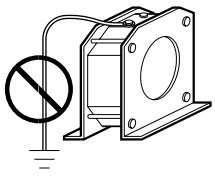
3. Bundle the wires passed through ZCT with clamp bands, for example, as they may apply mechanical stress to the ZCT when large current over the rated overcurrent strength flows at a short-circuit failure and others.



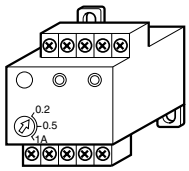
4. Don't bend sharply the wires passed through ZCT near the ZCT. When a primary conductor of over 300A is passed through, keep 30cm or more straight at one side.



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



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



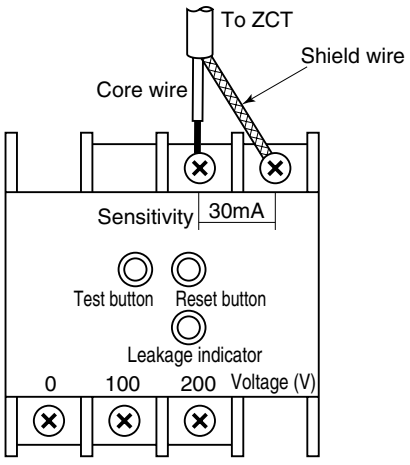
7. Where the relay unit is connected to the ZCT unit, take the following procedure.

Kind of lead wire used vs. sensitivity

Sensitivity	Length of lead wire		
	1m	1m~3m	3m~7m
30mA	Stranded vinyl coated wire of 0.5 to 2mm²	Single core shield wire of 0.5 to 2mm²	
100 · 200mA			
500mA and more			

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 acdording to the instruction manual. Example of NV-ZBA type is shown at the right.

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



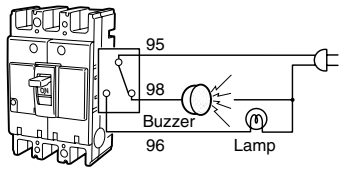
3.6.9 Instruction for accessories

(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.

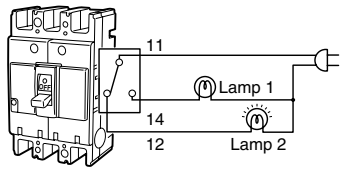
AL Alarm switch

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



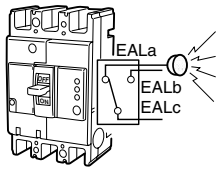
AX Auxiliary switch

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



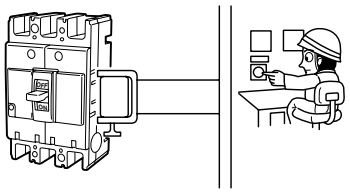
EAL Earth leakage alarm switch

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.)



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.

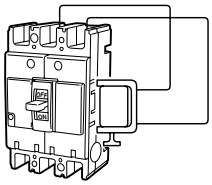


TBM Test button module

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 cosed.



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 +)

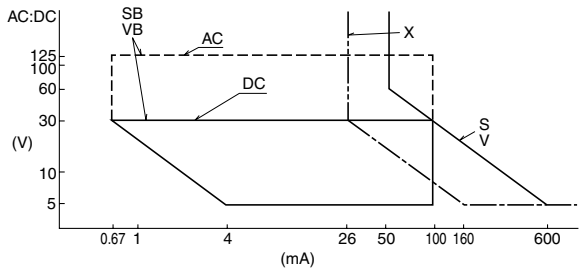
Note 1. When used for DC circuit, pay attention to polarity.
2. The dots of terminal marking shown in above examples means the sequence number of accessories.

AL • AX Rating of switch

Micro switch used	AC Voltage (V)	AC Amps (A) Resistance load	AC Amps (A) Induction load	DC Voltage (V)	DC Amps (A) Resistance load	DC Amps (A) 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.

2.



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 Voltage (V)	AC Amps (A) Resistance load	AC Amps (A) Induction load	DC Voltage (V)	DC Amps (A) Resistance load	DC Amps (A) 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)

Model	Provision of coil burnout preventing switch	Voltage (V)	Input (VA) (Note 1) AC	Input (VA) (Note 1) DC	Operating time (Note 2) (ms)
NF50-SVFU NV50-SVFU	Provided	100-240 AC 380-440 100 DC	120	60	15 or less
NF32-SV, NF63-CV/SV/HV, NF125-SGV/LGV/HGV NF160-SGV/LGV/HGV, NF125-CV/SV/HV/SEV/HEV/RGV/UV NF250-CV/SV/HV/SEV/HEV/RGV/UV NF250-SGV/LGV/HGV NV32-SV, NV63-CV/SV/HV NV125-CV/SV/HV/SEV/HEV, NV250-CV/SV/HV/SEV/HEV NF100-CVFU, NF125-SVU/HVU, NF250-SVU/HVU NV100-CVFU, NV125-SVU/HVU, NV250-SVU/HVU		100-240 AC 380-550 100-125 DC		50	
NF225-CWU		100-240 AC 380-480 100-125 DC		60	
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, NF-SKW, NF-SLW		Compatible with 100 to 450 AC and 100 to 200 DC	100V 20 200V 50 380V 120 450V 170	100V 10 200V 35	5-15
NF1000-SEW, NF1250-SEW/SDW NF1600-SEW/SDW		100-120 AC 200-240 380-450 100 DC	200 300	70 100	7-15 15-25

Note 1. Ensure that the voltage of the operating power supply for SHT is not dropped below the allowable operating voltage (70% of the rated minimum voltage value) by the input power.

2. The operating time is the time from when the rated voltage is applied to the shunt tripping device until the main contact of the circuit breaker starts opening.

Remark: 1. The accessory is usable at 50 Hz and 60 Hz.

Cautionary instructions for use

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 fro zapplying 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) With current	Without current	Total	Number of operation by SHT, UVT, or trip button
In≤100	1500	8500	10000	10% of the total number of operations
100<In≤315	1000	7000	8000	
315<In≤630	1000	4000	5000	
630<In≤2500	500	2500	3000	
2500<In	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 possilble 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 MCCB or fuses in the UVT circuit.

① Coil rating of UVT

Model	Specification		Coil ratings			
	Reset type	Non-reset type	Voltage (V)		Input (VA)	Operating time (Note 2) (ms)
			Standard voltage	Special voltage (Note 1)		
NF50-SVFU NV50-SVFU	–	○	100-130 AC/DC 200-250 AC 380-480 AC	24 AC/DC 48 AC/DC	5	30 or less
NF32-SV, NF63-CV/SV/HV/HRV NF125-CV/SV/HV/RGV/SEV/HEV/UV NF125-SGV/LGV/HGV, NF160-SGV/LGV/HGV NF250-CV/SV/HV/RGV/SEV/HEV/UV NF250-SGV/LGV/HGV NV32-SV, NV63-CV/SV/HV NV125-CV/SV/HV/SEV/HEV NV250-CV/SV/HV/SEV/HEV NF100-CVFU, NF125-SVU/HVU, NF250-SVU/HVU NV100-CVFU, NV125-SVU/HVU, NV250-SVU/HVU	○	○		24 AC/DC 48 AC/DC 500-600 AC		
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)	(Note 3) Switching between 100 to 110 and 120 to 130 AC Switching between 200 to 220 and 230 to 250 AC Switching between 380 to 415 and 440 to 480 AC Switching between 100 and 110 DC	(Note 3) Switching between 24/48 AC Switching between 500 to 550/600 AC Switching between 24/48 DC Switching between 110/125 DC	5	5-30
NF1000-SEW, NF1250-SEW NF1600-SEW	○	○				5-35
NF-SKW/SLW	○ (Note 4)	–				5-30
NF225-CWU	–	○		Switching between (Note 3) 24/48 AC Switching between 24/48 DC Switching between 110/125 DC		30 or less

Note 1. Some special voltage models vary in voltage range.
2. The operating time is the time from when the undervoltage tripping device is set to the no-voltage state until the main contact starts opening.
3. The accessory is usable at 50 Hz and 60 Hz.
4. If UVT is turned on without excitation, the circuit breaker instantaneously opens and immediately trips.
5. Only for installation on the left pole

② Reset type and non-reset type UVT

■ Reset type

The reset type UVT has a structure which does not trip a circuit breaker even if the UVT coil is not excited when the circuit breaker handle is in the OFF or reset position. Therefore, it keeps the circuit breaker in the reset state even if the coil is not excited when the breaker is reset electrically. When the coil in the unexcited state is turned on, the circuit breaker is normally tripped. However, the major contacts of some models of circuit breakers may instantaneously close, or, on circuit breakers with AX, the AX switches may instantaneously change over. For electrical interlock, use a non-reset type UVT.

■ Non-reset type

When the UVT coil is not excited, the circuit breaker cannot be set to the off state even if the circuit breaker is tried to be reset from the tripped state. When the coil exciting voltage restores to the reference voltage or more, the circuit breaker can be reset to the off state.

③ Time delay UVT

- This type of UVT has a time delay in operation.
- It can prevent operation upon occurrence of instantaneous power failure.

UVT module type name	Time delay	Voltage (V)	
		Standard voltage	Special voltage
U-05W	Switching among 0.1, 0.3 and 0.5 s	24/48 AC 100–120/200–240/380–450 AC 220–250/380–450/460–550 AC (Compatible with 50 Hz and 60 Hz) 100–110 DC	380–450/460–550/600–690 AC (Compatible with 50 Hz and 60 Hz) 24/48 DC
U-30W	Switching among 0.5, 1 and 3 s	100–120/200–240/380–450 AC 220–250/380–450/460–550 AC (Compatible with 50 Hz and 60 Hz)	–

④ Structure of UVT

The UVT mechanical unit is installed in a circuit breaker, and the UVT voltage module is installed on the outside of the circuit breaker. When the voltage drops, the UVT voltage module detects the voltage drop, and the UVT mechanical unit trips the circuit breaker.
The UVT voltage module has a vertical lead wire terminal block and is normally installed on the body. The external module will be manufactured to order.

■Outline drawing

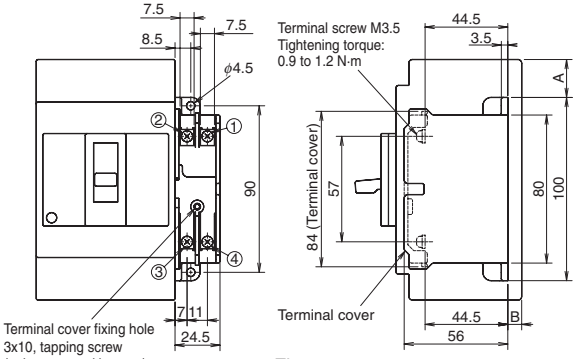


Fig. 1

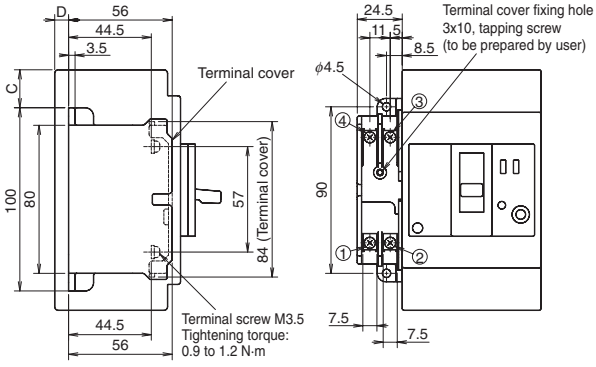


Fig. 2

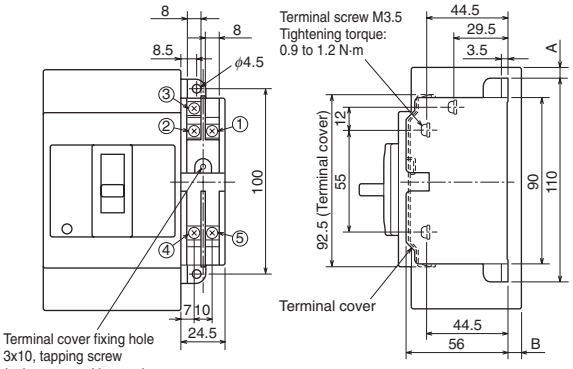


Fig. 3

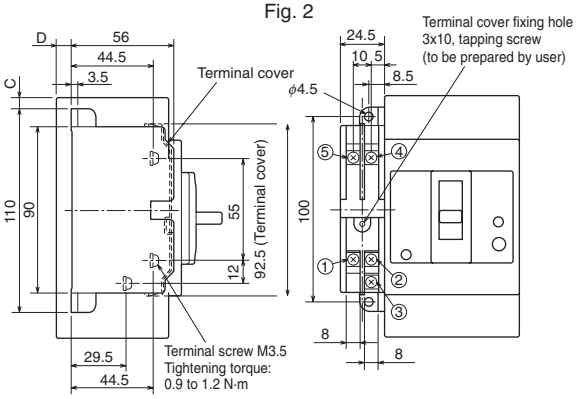
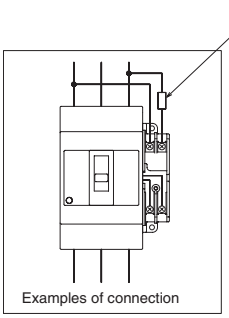


Fig. 4

■Examples of connection

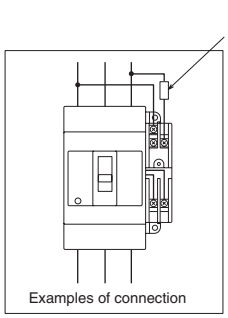


Terminal symbols

①	D1/P1	Control power supply terminal (COM)
②	D2/P2	Control power supply terminal (rated voltage)
③	J1/UC1	UVT coil connecting terminal
④	J2/UC2	UVT coil connecting terminal

Remarks: 1 When the UVT voltage module is installed on the body (standard), the UVT is supplied with J1/UC1 and J2/UC2 terminals connected with the UVT coil.
2 When the UVT is installed on the left pole side, the UVT module terminal positions are reversed (on the power supply and load sides). Carefully connect the terminals.

Fig. 5



Terminal symbols

①	D1/P1	Control power supply terminal (COM)
②	D2/P2	Control power supply terminal (rated voltage Lo)
③	D3/P3	Control power supply terminal (rated voltage Hi)
④	J1/UC1	UVT coil connecting terminal
⑤	J2/UC2	UVT coil connecting terminal

Remarks: 1 When the UVT is used at the rated voltage Lo, connect the control voltage to D1/P1 and D2/P2 terminals.
When the UVT is used at the rated voltage Hi, connect the control voltage to D1/P1 and D3/P3 terminals.
(Ex.) 100 to 110/120 to 130 V AC
(Rated voltage Lo/rated voltage Hi)
2 When the UVT voltage module is installed on the body (standard), the UVT is supplied with J1/UC1 and J2/UC2 terminals connected with the UVT coil.
3 When the UVT is installed on the left pole side, the UVT module terminal positions are reversed (on the power supply and load sides). Carefully connect the terminals.

Fig. 6

Table 1 Installation on right pole side

Model	Reference drawing	Variable dimensions	
		A	B
NF50-SVFU	Fig. 1 Fig. 5	11	7.5
NF32-SV, NF63-CV/SV/HV		20.5	7.5
NF100-CVFU		20.5	7.5
NF125-CV/SV/HV		20.5	7.5
NF125-SVU/HVU		41.5	7.5
NF125-UV		81.5	7.5
NF125-SEV/HEV/RGV, NF250-CV/SV/HV/RGV/SEV/HEV NF125-SGV/LGV/HGV, NF160-SGV/LGV/HGV NF250-SGV/LGV/HGV		38	7.5
NF250-SVU/HVU		48	7.5
NF250-UV		113	7.5
NF225-CWU	Fig. 3 Fig. 6	25.5	7.5
NF400-CW/SW/SEW/HEW/REW NF630-CW/SW/SEW/HEW/REW, NF-SKW		67.5	41.5
NF400-UEW(3P)		107.5	138.5
NF800-CEW/SDW/SEW/HEW/REW, NF-SLW		76.5	41.5
NF400-UEW(4P), NF800-UEW		123.5	138.5
NF1000-SEW, NF1250-SEW, NF-1600-SEW		161	63

Table 2 Installation on left pole side

Model	Reference drawing	Variable dimensions	
		C	D
NV125-CV/SV/HV	Fig. 2	20.5	7.5
NV125-SEV/HEV, NV250-CV/SV/HV/SEV/HEV	Fig. 5	38	7.5
NF400-CW/SW/SEW/HEW/REW NF630-CW/SW/SEW/HEW/REW NV400-CW/SW/SEW/HEW/REW NV630-CW/SW/SEW/HEW NF-SKW	Fig. 4 Fig. 6	67.5	41.5
NF400-UEW(3P)		107.5	138.5
NF800-CEW/SDW/SEW/HEW/REW NV800-SEW/HEW, NF-SLW		76.5	41.5
NF400-UEW(4P), NF800-UEW		123.5	138.5

(5) Cassette accessories

①30~250 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)

Model		Installation pole	AL	AX	AL+AX	SHT	UVTN or UVTS
MCCB	ELCB						
NF50-SVFU		For right pole	AL-03SVU AL-03SVURS	AX-03SVU AX-03SVURS	ALAX-03SVU ALAX-03SVURS	SHTA240-03SVUR SHTA440-03SVUR SHTD100-03SVUR SHTA240-03SVURS SHTA440-03SVURS SHTD100-03SVURS	–
		For left pole					
	NV50-SVFU	For left pole	AL-03SVU AL-03SVULS	AX-03SVU AX-03SVULS	ALAX-03SVU ALAX-03SVULS	SHTA240-03SVUL SHTA440-03SVUL SHTD100-03SVUL SHTA240-03SVULS SHTA440-03SVULS SHTD100-03SVULS	–
NF32-SV, NF63-CV, NF63-SV, NF63-HV NF125-CV, NF125-SV, NF125-HV NF125-SGV, NF125-LGV, NF125-HGV NF160-SGV, NF160-LGV, NF160-HGV NF125-SEV, NF125-HEV NF125-RGV, NF125-UV NF250-CV, NF250-SV, NF250-HV NF250-SGV, NF250-LGV, NF250-HGV NF250-SEV, NF250-HEV NF250-RGV, NF250-UV		For right pole	AL-05SV AL-05SVRS	AX-05SV AX-05SVRS	ALAX-05SV ALAX-05SVRS	SHTA240-05SVR SHTA550-05SVR SHTD125-05SVR SHTA240-05SVRS SHTA550-05SVRS SHTD125-05SVRS	UVTNAD130-05SVR UVTSAD130-05SVR UVTNA250-05SVR UVTSA250-05SVR UVTNA480-05SVR UVTSA480-05SVR UVTNAD130-05SVRS UVTSAD130-05SVRS UVTNA250-05SVRS UVTSA250-05SVRS UVTNA480-05SVRS UVTSA480-05SVRS
		For left pole					
	NV32-SV, NV63-CV NV63-SV, NV63-HV NV125-CV, NV125-SV NV125-HV NV125-SEV, NV125-HEV NV250-CV, NV250-SV NV250-HV NV250-SEV, NV250-HEV	For left pole	AL-05SV AL-05SVLS	AX-05SV AX-05SVLS	ALAX-05SV ALAX-05SVLS	SHTA240-05SVL SHTA550-05SVL SHTD125-05SVL SHTA240-05SVLS SHTA550-05SVLS SHTD125-05SVLS	UVTNAD130-05SVL UVTSAD130-05SVL UVTNA250-05SVL UVTSA250-05SVL UVTNA480-05SVL UVTSA480-05SVL UVTNAD130-05SVLS UVTSAD130-05SVLS UVTNA250-05SVLS UVTSA250-05SVLS UVTNA480-05SVLS UVTSA480-05SVLS
NF100-CVFU NF125-SVU/HVU NF250-SVU/HVU		For right pole	AL-05SVU AL-05SVURS	AX-05SVU AX-05SVURS	ALAX-05SVU ALAX-05SVURS	SHTA240-05SVUR SHTA550-05SVUR SHTD125-05SVUR SHTA240-05SVURS SHTA550-05SVURS SHTD125-05SVURS	UVTNAD130-05SVUR UVTSAD130-05SVUR UVTNA250-05SVUR UVTSA250-05SVUR UVTNA480-05SVUR UVTSA480-05SVUR UVTNAD130-05SVURS UVTSAD130-05SVURS UVTNA250-05SVURS UVTSA250-05SVURS UVTNA480-05SVURS UVTSA480-05SVURS
		For left pole					
	NV100-CVFU NV125-SVU/HVU NV250-SVU/HVU	For left pole	AL-05SVU AL-05SVULS	AX-05SVU AX-05SVULS	ALAX-05SVU ALAX-05SVULS	SHTA240-05SVUL SHTA550-05SVUL SHTD125-05SVUL SHTA240-05SVULS SHTA550-05SVULS SHTD125-05SVULS	UVTNAD130-05SVUL UVTSAD130-05SVUL UVTNA250-05SVUL UVTSA250-05SVUL UVTNA480-05SVUL UVTSA480-05SVUL UVTNAD130-05SVULS UVTSAD130-05SVULS UVTNA250-05SVULS UVTSA250-05SVULS UVTNA480-05SVULS UVTSA480-05SVULS

Interpretation of type name

(1) Alarm switch • Auxiliary switch

AL 2 – 4 SV (or SW) L S B

Kind of accessory	
AL	Alarm switch
AX	Auxiliary switch

Number of accessories to be installed
When installing more than one AL or AX with SLT, specify the number.

Ampere frame	
05	For 30 to 250A frames
4	For 400 to 800A frames

Installation position	
R	Right pole, 2 or 3 poles
RF	Right pole, 4 poles
L	Left pole
Blank	Right and left

Kind of switch	
Blank	Standard
B	Minute load

With SLT (vertical lead wire terminal block) (with lead wires drawn out unless otherwise specified)

(2) Shunt tripping device • Undervoltage tripping device

SHT A1 – 1 SV (or SW) R S

Kind of accessory	
SHT	Shunt tripping device
UVTN (Note 1) UVTS (Note 2)	Undervoltage tripping device

Voltage (SHT)	
A240	100-240V AC
A440	380-440V AC
A480	380-480V AC
A550	380-550V AC
D100	100V DC
D125	100-125V DC
Blank	100-450V AC/100-200V DC

Ampere frame	
05	For 30 to 250A frames
4	For 400•600•630A frames For 800A frames (3P)
8	For 800A frames (4P)

Installation position	
R	Right pole, 2 or 3 poles
RF	Right pole, 4 poles
L	Left pole
Blank	Right and left

With SLT (vertical lead wire terminal block) (with lead wires drawn out unless otherwise specified)

Voltage (UVTN or UVTS)	
AD130	Switching between 100 to 130 V AC and 100 to 130 V DC
A250	200-250V AC
A480	380-480V AC

Note 1. The circuit breaker cannot be reset if voltage is not applied to UVTN. (Non-reset type UVT)
2. The circuit breaker can be reset even if voltage is not applied to UVTS. (Reset type UVT)

②400~800A frames

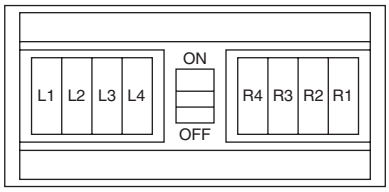
● The cassette accessories, AL, AX, AL+AX, and SHT can be installed to the following models by each user.

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

Model		Installation pole	AL	AX	AL+AX	SHT	UVTN or UVTS
MCCB	ELCB						
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		For right pole (2, or 3 poles)	–	AX-4SW AX-4SWRS AX2-4SWRS	–	SHT-4SW SHT-4SWRS	–
		For right pole (4 poles)	–	–	–	SHT-4SWRFS SHT-8SWRFS	–
		For left pole (2, 3 or 4 poles)	AL-4SWL AL-4SWLS AL2-4SWLS	AX-4SW AX-4SWLS AX2-4SWLS	ALAX-4SWL ALAX-4SWLS	SHT-4SW SHT-4SWLS	–
	NV400-CW, NV400-SW NV400-SEW, NV400-HEW NV400-REW NV630-CW, NV630-SW NV630-SEW, NV630-HEW NV800-SEW, NV800-HEW	For left pole (2, 3 or 4 poles)					

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 separatelly.
4. For the type with SLT mounting to right pole of 4-pole circuit breaker, order separatelly.

☐Installation positions



Frame (A)	400 • 600 • 630					800							
Accessory \ Installation positions	L1	L2	L3	R2	R1	L1	L2	L3	L4	R4	R3	R2	R1
AL	○	○	–	–	–	○	○	○	–	–	–	–	–
AX	○	○	–	○	○	○	○	○	○	–	–	○ (Note 1)	○
AL + AX	○	○	–	–	–	○	○	–	–	–	–	–	–
SHT	–	○		○		–	–	○		○ (Note 1)		–	–

* Accessories only for Earth Leakage Circuit Breakers (NV-C, S and H), Earth Leakage Alarm Breakers (NF-Z) and single-phase 3-wire circuits (NF-N and NV-N) cannot be installed to R1, R2, R3 or R4.
Note 1. It is impossible to simultaneously install AX on R2 and SHT on R3 or R4.

Cautionary instructions for using cassette accessories

Note 1. For mounting and dismounting 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).

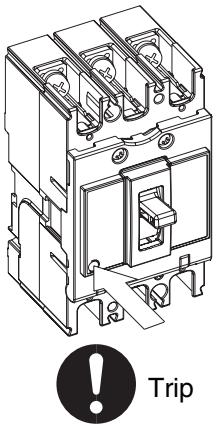
How to attach cassette accessories

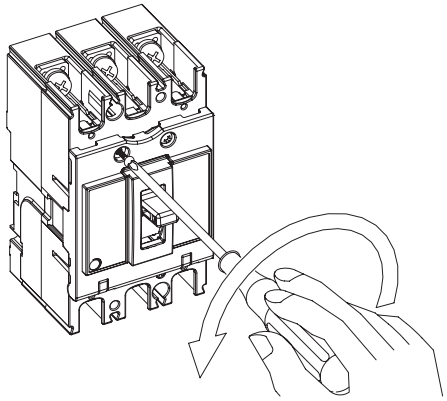
⚠CAUTION

- For mounting and dismounting 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.

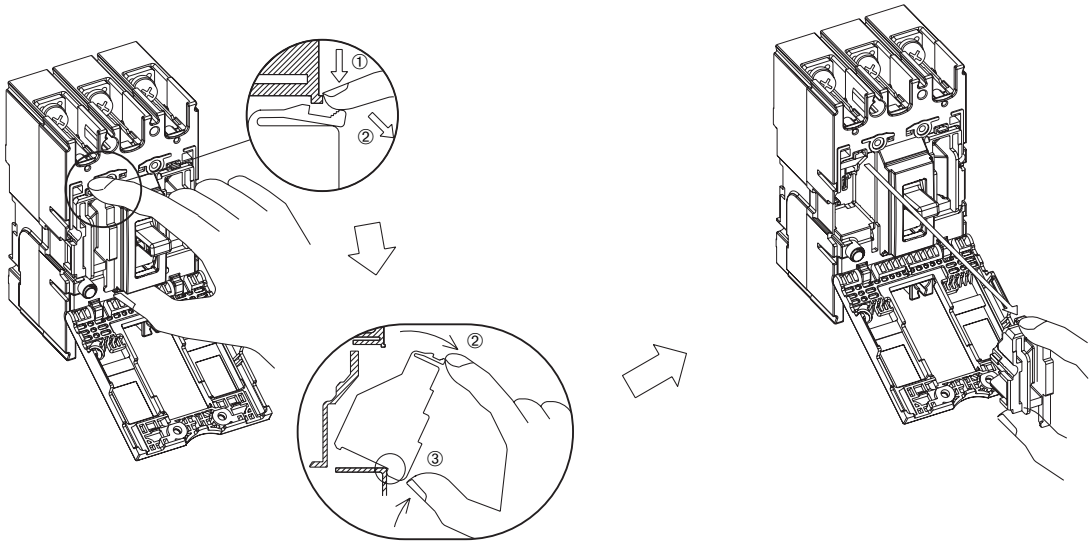
①Before opening the cover, press the trip button, and loosen the screw of the breaker cover.

②Then open the cover.





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

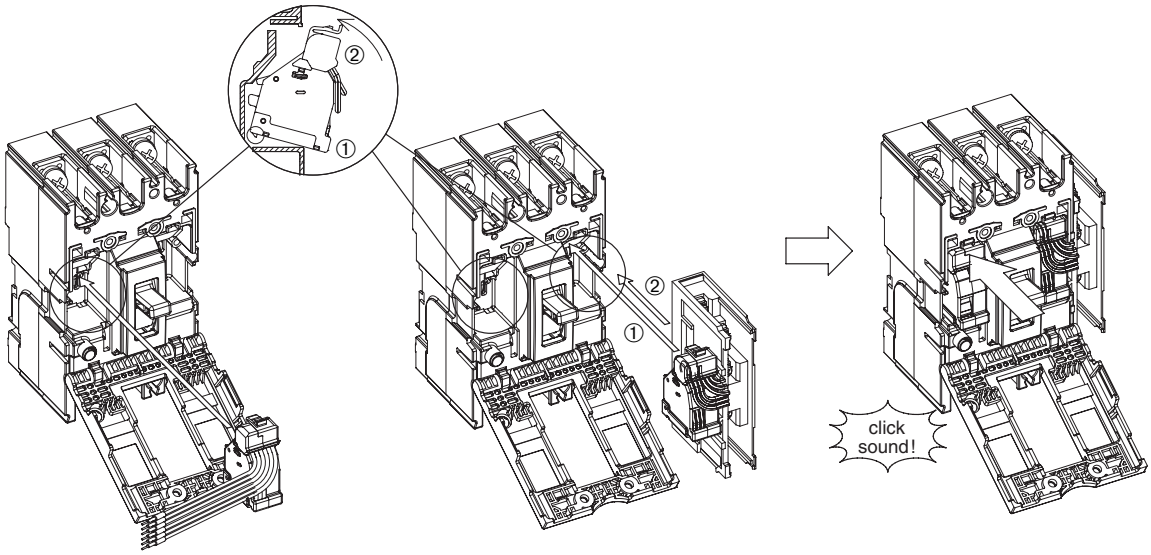


[Models having the middle cover]

NF125-SV, NF125-HV, NF125-RV, NF125-UV
NV125-SV, NV125-HV
NF250-SV, NF250-HV
NV250-SV, NV250-HV
NF125-SVU, NF125-HVU, NV125-SVU, NV125-HVU
NF250-SVU, NF250-HVU, NV250-SVU, NV250-HVU
NF250-HEV, NF250-UV
NV250-HEV
NF125-SEV, NF125-HEV
NV125-SEV, NV125-HEV
NF400-REW, NF400-UEW
NF630-REW
NV400-REW
NF800-HEW, NF800-REW, NF800-UEW
NV800-HEW

④Push 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.

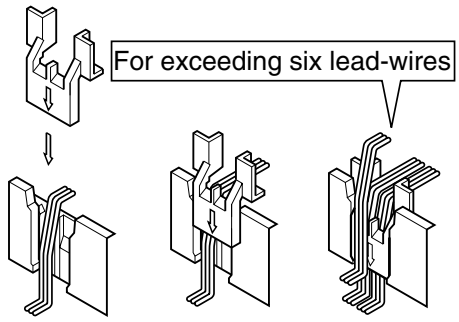


• With lead wires

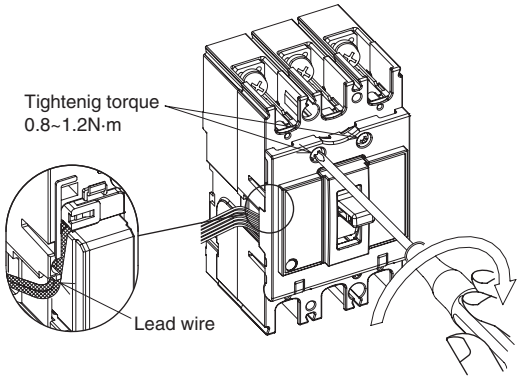
• With the lead wire terminal block SLT

• The state that attached accessory

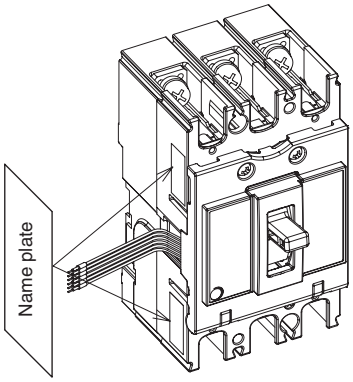
For 600~800A frames with lead wires, fix the lead wires on the side of the breaker by the attachment.



⑤Close the cover and tighten the screws.



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



⑦Attach 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)

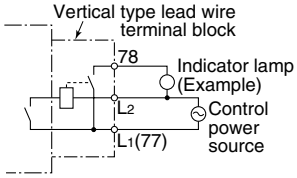
This switch is for electrically indicating tripped state of an earth leakage circuit breaker at a ground fault.

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)

AC		
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	Current A		Voltage V	Current 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 micro current area, please enquire us separately.
(Note) For model of breakers to be assembled each type of micro switch, refer to the catalogue.

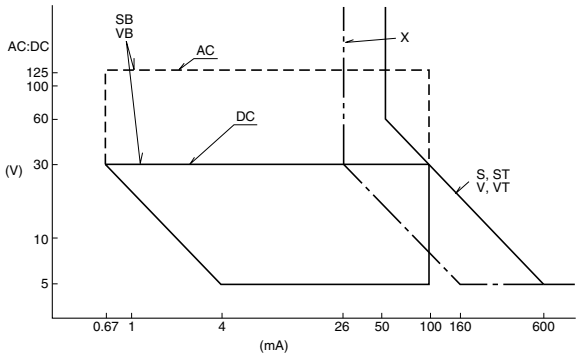
Rating of EAL (400A frame and above)

Microswitch used	AC			DC		
	Voltage V	Current A		Voltage V	Current 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

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

	Micro switch of corrosion-proof type used	AC			DC		
		Voltage V	Current A		Voltage V	Current A	
			Resistance load	Induction load		Resistance load	Induction load
For corrosion-proof type	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

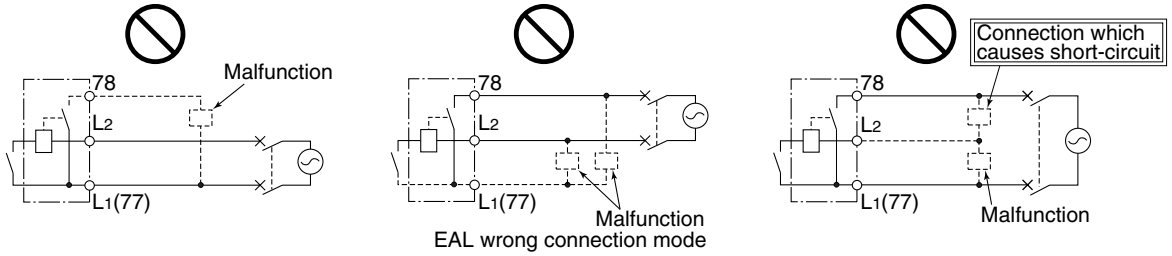
If the breaker is treated by the 1st kind moisture-fungus treatment or by added corrosion-proof treatment, the micro switch of corrosion-proof type is to be used.



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.

Model	NV32-SV NV63-CV/SV/HV NV125-CV/SV/HV NV125-SEV/HEV NV250-CV/SV/HV/SEV/HEV NV50-SVFU NV100-CVFU NV125-SVU/HVU NV250-SVU/HVU	NV400-CW/SW NV630-CW/SW NV400-SEW~NV800-SEW NV400-HEW~NV800-HEW NV400-REW
Control input Rated voltage (V)	Compatible with 100 to 240 AC and 100 to 240 DC (24 DC) (Note 1)	
Control input (VA)	1.5 VA or less	1 VA or less

Note 1. This module is manufactured for 100-240VAC/100-240VDC unless otherwise specified in particular. For 24VDC, specify to that effect.

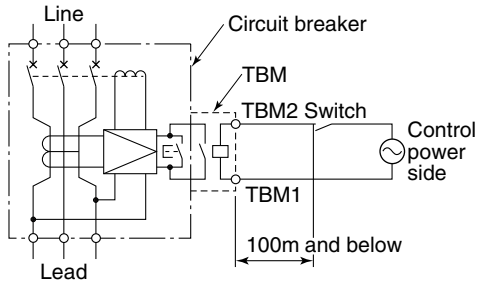
Cautionary instructions for use

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.

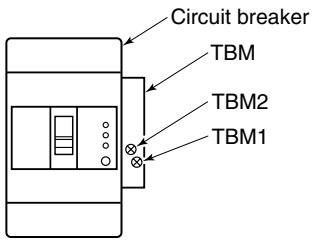
2. For sequence control of TBM, keep applying voltage until operation starts.

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



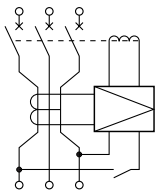
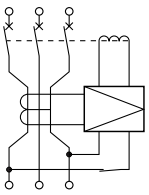
Port name

(8) MG (Insulation switch)

This switch is attached for insulation resistance measurement between rihght 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.

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.

Operation of insulation switch

Condition of circuit breaker	OFF or trip	ON
Condition of Insulation switch	 Insulation switch (Open)	 Insulation switch (Close)

(9) PAL (Pre-alarm module)

The pre-alarm is a function to output an alarm when the load current exceeds the preset current value. It is helpful in securing continuous power supply and preventive maintenance.
It can be fitted to electronic circuit breakers with a frame size from 125 to 1600 A.

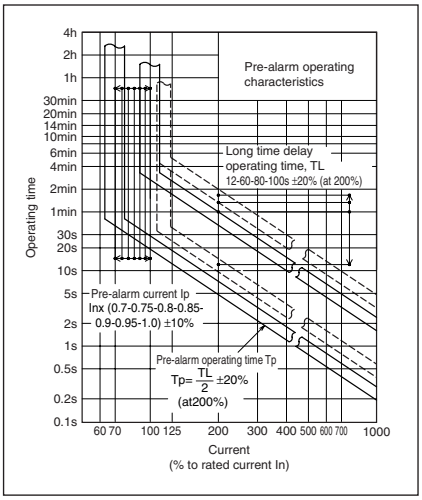
■125 and 250A frames

• Pre-alarm module (PAL module)

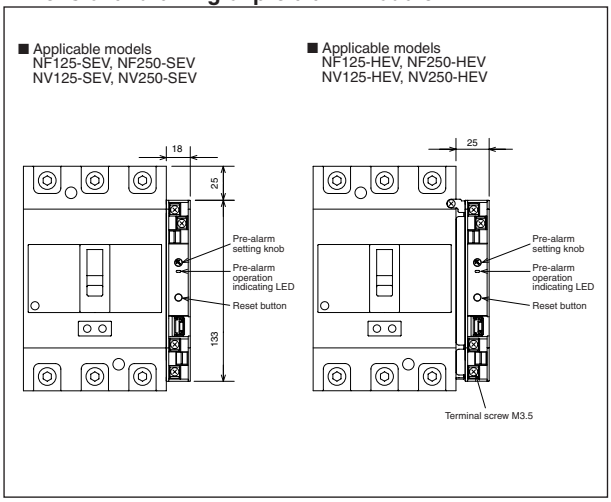
The standard modules have SLT. Other internal accessories cannot be installed on the right pole side.
A control power supply (compatible with 100 to 240 V AC and DC) is necessary. The control power supply voltage range is 85 to 246 V AC/DC, and the required volt-ampere is 5 VA.

Model	Switching capacity Contact output (1a)	Resetting method
NF125-SEV NF125-HEV NF250-SEV NF250-HEV NV125-SEV NV125-HEV NV250-SEV NV250-HEV	125V AC 2A 30V DC 2A 250V AC 2A 100V DC 0.3A	Press the reset button, or turn off the control power supply.

Pre-alarm characteristics

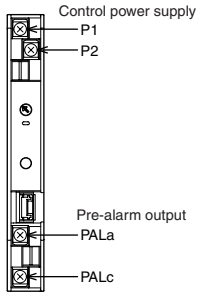


Dimensional drawing of pre-alarm module



Terminal arrangement

NF125-SEV NF125-HEV
NF250-SEV NF250-HEV
NV125-SEV NV125-HEV
NV250-SEV NV250-HEV



• Pre-alarm LED indication

When the load current exceeds the preset current value, the LED lamp on the pre-alarm module front panel starts blinking. When the pre-alarm output is given, the lamp stops blinking and turns on.

• Pre-alarm current setting (IP setting)

The pre-alarm current can be set to the rated current In × 0.7, 0.75, 0.8, 0.85, 0.9, 0.95 or 1.0 with the knob on the pre-alarm module front panel.

■400 A frame or above

• Solid state relay (SSR) output (PAL lead)

The lead wires are drawn out. On the right pole side, only internal accessories with lead wires drawn out can be installed. A control power supply is unnecessary.

Model	Switching capacity Solid state relay (SSR) — Non-contact output	Resetting method
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 NV400-SEW NV400-HEW NV400-REW NV630-SEW NV630-HEW NV800-SEW NV800-HEW	24 to 240V AC/DC 20mA	When the load current becomes lower than the preset current value, the alarm is reset.

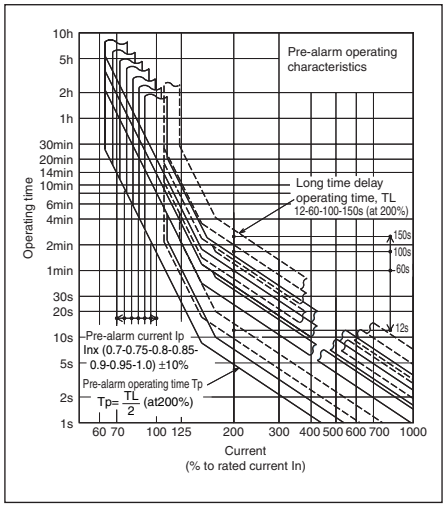
• **Pre-alarm module (PAL module)**

The standard modules have SLT. Other internal accessories cannot be installed on the right pole side.

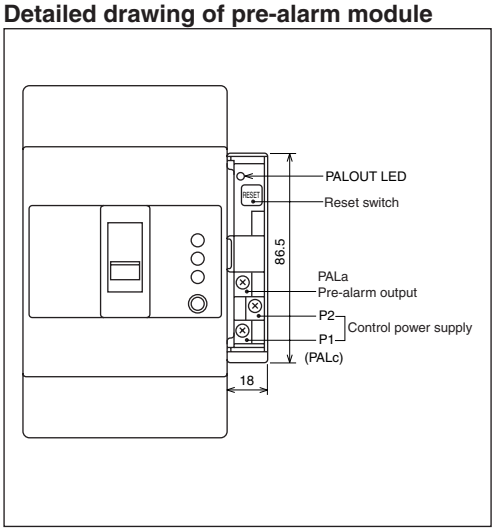
A control power supply (compatible with 100 to 200 V AC) is necessary. The control power supply voltage range is 80 to 242 V AC, and the required volt-ampere is 10 VA.

Model	Switching capacity Contact output (1a)	Resetting method
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 NV400-SEW NV400-HEW NV400-REW NV630-SEW NV630-HEW NV800-SEW NV800-HEW	100 V AC or 200 V AC, 2 A	Press the reset button, or turn off the control power supply.

Pre-alarm characteristics



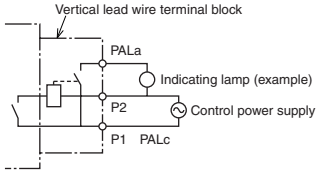
Detailed drawing of pre-alarm module



Pre-alarm module output rating

AC		
Voltage V	Current (A)	
	Resistive load	Inductive load
200	3	2
100	3	2

A control power supply (compatible with 100 to 200 V AC) is necessary. For the wiring method, see the following figure. (The control power supply voltage range is 80 to 242 V AC.) The required volt-ampere is 10 VA.



• **Pre-alarm LED display (standard device)**

When the load current exceeds the preset current value, the LED lamp on the circuit breaker front panel starts blinking. When the pre-alarm output is given, the lamp stops blinking and turns on.

• **Pre-alarm current setting (IP setting)**

The pre-alarm current can be set to the rated current In × 0.7, 0.75, 0.8, 0.85, 0.9, 0.95 or 1.0 with the knob on the circuit breaker front panel.

⚠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)

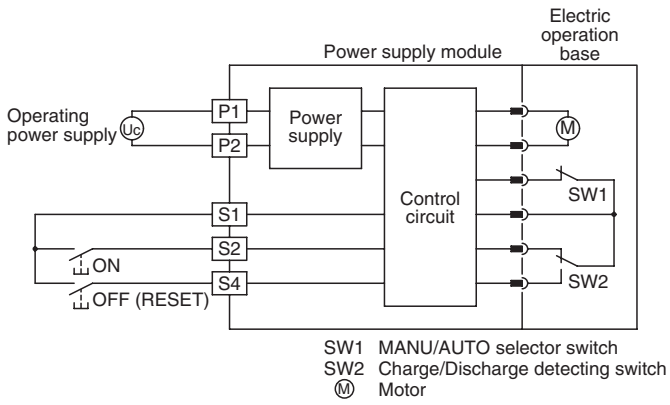
- Electric operation : When ON switch is turned off, a relay drives the motor to reset the latch mechanism, instantaneously turning the breaker ON with the accumulated force of the input spring. When OFF switch is turned off, the relay drives the motor to turn the breaker OFF (reset) and charge the input 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)

(i) Press ON switch for 0.1 sec. or more, and OFF switch for 20 msec. or more. Otherwise the switches may not work.

(ii) 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.

(iii) 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 addtion, 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.



(iv) 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]

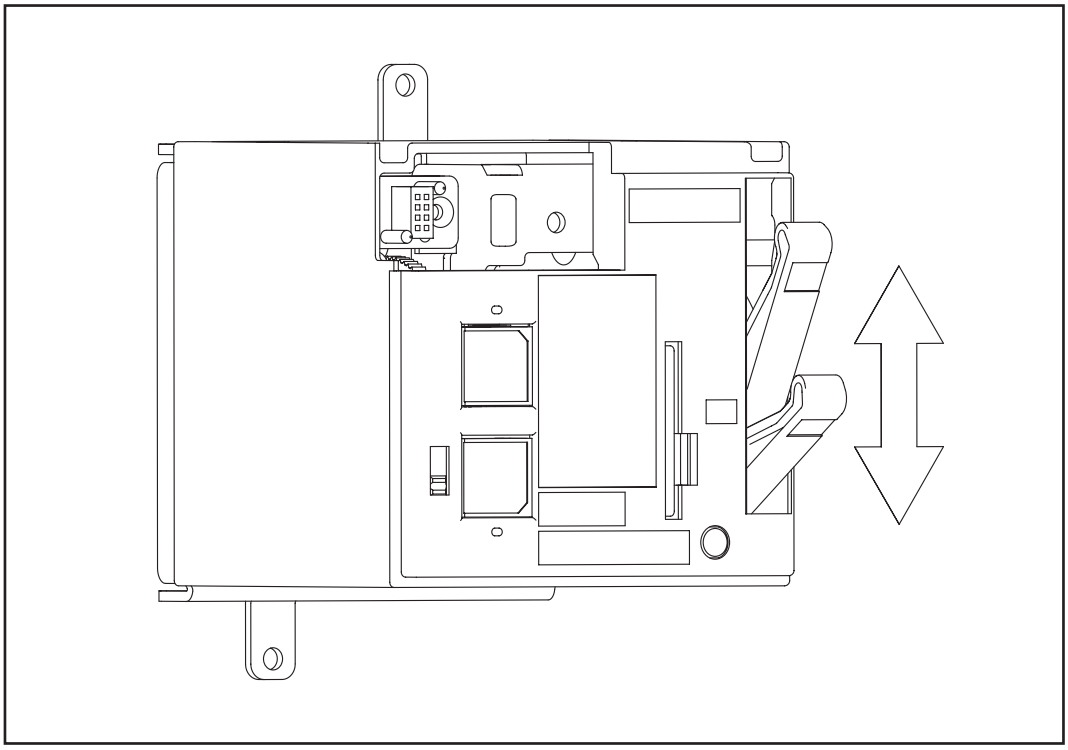
(i) Shift MANU/AUTO switch to MANU. When MANU has been selected, the electric operation circuit will be automatically open.

(ii) Draw out the manual handle and reciprocate it a few tens of times to turn the breaker OFF and charge the input spring.

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)”.

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

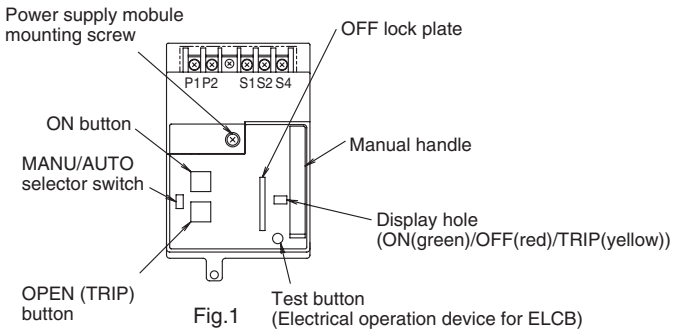


Fig.1

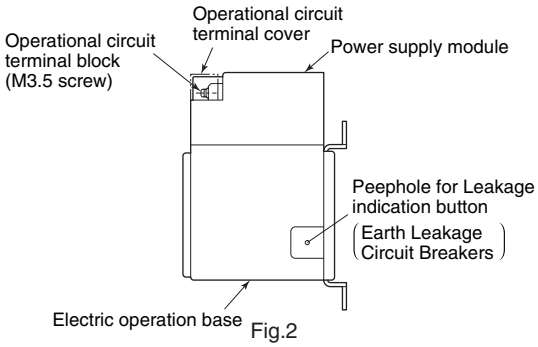


Fig.2

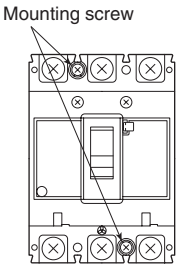


Fig.3

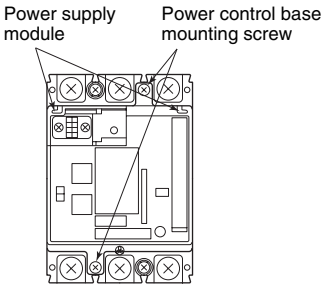


Fig.4

(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.
(3) Set the electric operation unit to “Charge”.
(4) Install the electric operation base on the breaker with attached 2 pcs. each of electric operation unit setscrews and nuts.
(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.
(6) Inserting to fix the power supply module into the electric operation base groove with a power supply module setscrew.

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.

(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”.
(4) Install the breaker on the plug-in terminal block with 2 breaker setscrews.
(5) Tighten the electric operation base and the breaker to the plug-in terminal block with attached 2 electric operation unit setscrews.
(6) Insert to fix the power supply module into the electric operation base groove with a power supply module setscrew.

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.

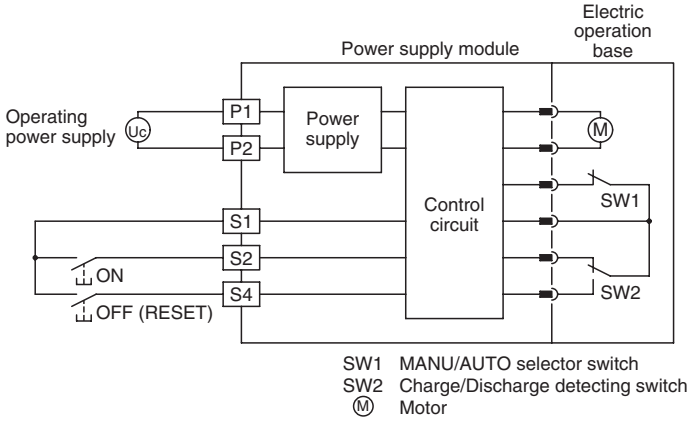
(7) Paste the attached nameplates on the electric operation unit cover.

(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. 24 VDC, 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.



SW1	MANU/AUTO selector switch
SW2	Charge/Discharge detecting switch
Ⓜ	Motor

(c) Caution on withstand voltage tests

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

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.

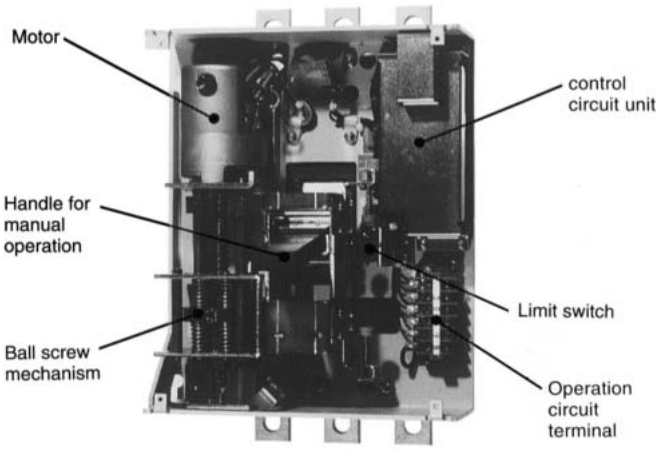
• Manual Operation : Manual operation handle is manipulated directly toward On or Off side of the circuit-breaker.

Fig. 2 Manual Operation

ON

OFF
(RESET)

❊ 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 MCCB, the terminal block of its lead-wire is mounted on the MCCB.

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.

(i) 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: Resettting (OFF) operation → ON operation
Trip with unit OFF: ON operation → Resetting (OFF) operation → ON operation.

(ii) 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.

(iii) 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).

(iv) The operational voltage shall be within 85 to 110% of the rated operation voltage.

(v) In case of automatic reset mode, resetting operation shall be made with 0.5 sec of time interval after the MCCB tripped.

(vi) 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.

(vii) 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.

(viii) In the manual operation mode, make sure to manipulate the manual operation handle up to the position indicated by the name plate.

(ix) 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.

(x) 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.

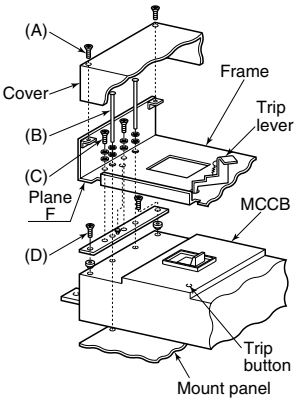


Fig. 3

(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.

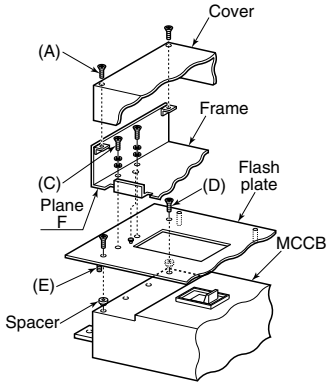


Fig. 4

(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.

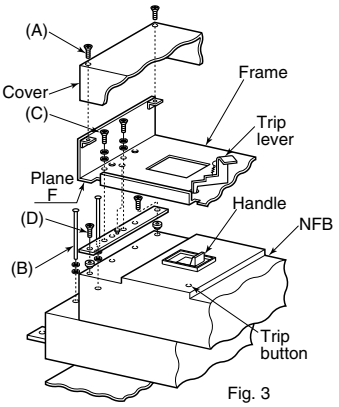


Fig. 3

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

a) Detach the four cover mount screws (A) to remove the cover.

b) Fasten the electric operation type circuit-breaker using the four breaker mount screws (B).

c) Connect electric operation unit to the terminal of the operational circuit.

d) 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).

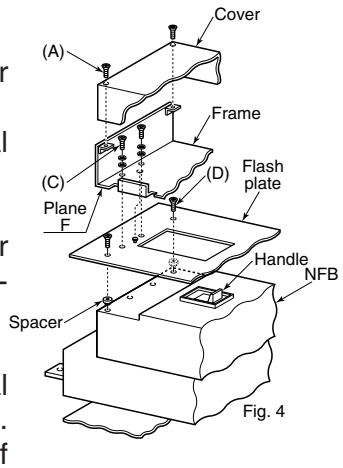


Fig. 4

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

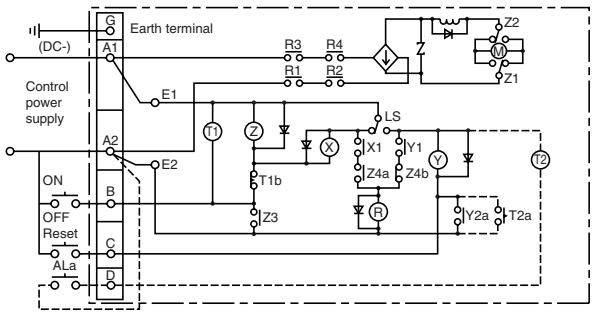
a) Maintenance and inspection of electrical operation unit (Removal of this unit only) Same as for front connection/rear connection types.

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.

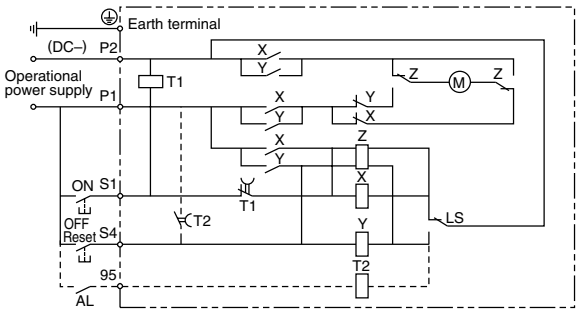
(c) Motor-operated type electric operation circuitry

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

(1) Control circuit 1.
(400, 630 and 800AF)



(2) Control circuit 2.
(NF1000-SEW to NF1600-SEW)



M : Motor
X : Relay for ON operation
Y : Relay for OFF operation
Z : Relay for changing motor polarity
T1 : Timer for antipumping
T2 : Timer for automatic reset
LS : Limit switch
AL : Alarm switch for automatic reset (a contact)

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.

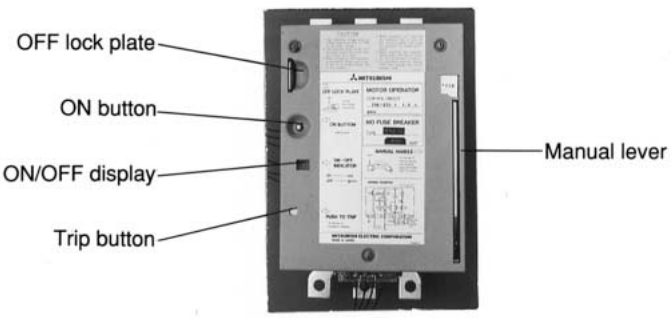
Note 3. The portion surrounded by the alternate long and short line represents the interior of the electrical operation unit which has already been wired. Note that the (T2) ondelay timer for the alarm switch for automatic resetting is not standardized. The user is requested to spacify it.

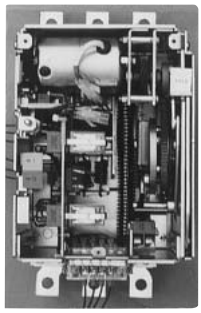
Note 4. The relay has polarity in case of DC operation. Decide tha polarity you desires as shown in the above diagram.

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)

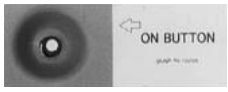
(i) The operational voltage shall be within the range from 85 to 110% of the rated operational voltage.

(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.

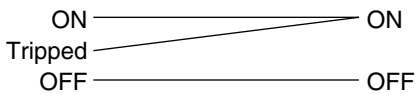
(iii) Trip operation
The circuit-breaker with the electric operation unit has been so designed that it should not trip even if the trip button is depressed under OFF condition. When the circuit-breaker is to be tripped on occasion, for instance, of witnessed test, it shall either be made to trip after once it shall be turned ON or shall trip by turning it on with trip button depressed.

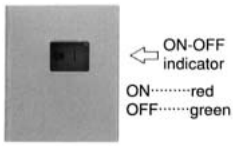
(iv) In case when the main circuit is to be opened in emergency:
If the main circuit is to be opened in emergency by manual operation, the circuit-breaker shall be made to trip depressing the trip button.

(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.

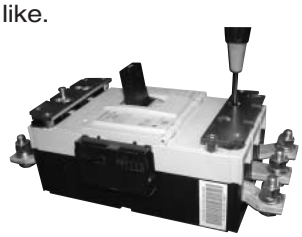
(b) Mounting method

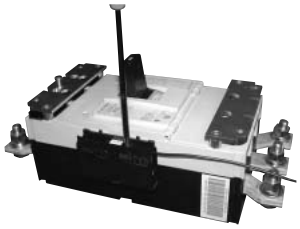
Precaution to be taken when handling

(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 plug-in type

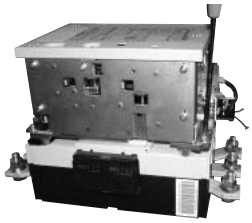
(i) Remove the electric operation unit.
(ii) Mount the circuit-breaker on the board. The mounting on the board is the same as that for the independent circuit-board both for front-connection, rear-connection and plug-in types.
(iii) Wire the circuit-breaker with the internal accessory unit. If the circuit-breaker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

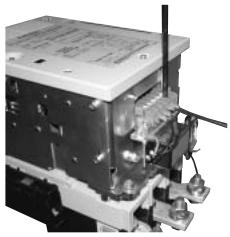


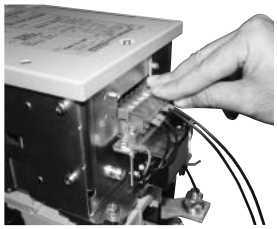


(iv) Mount the electric operation unit on the circuit-breaker. Attaching screws are four M6 screws, The electric operation unit has been so designed that it can be provisionally supported by hook pin when it is to be fastened with screws.

(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.

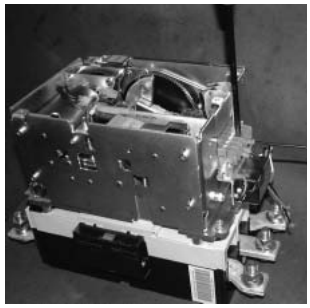
(ii) Detach the electric operation unit from the circuit-breaker.

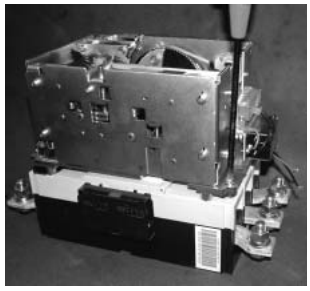
(iii) Mount the circuit-breaker on the board. The mounting method on the board is the same as that for the rear-connection type circuit-breaker.

(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.

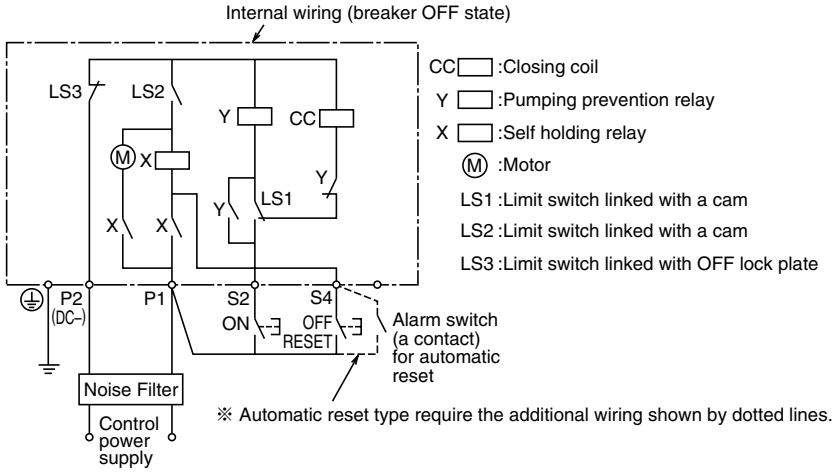




(vii) Mount the cover of the electric operation unit after fitting the panel to be supplied by user.

• Operational Circuit

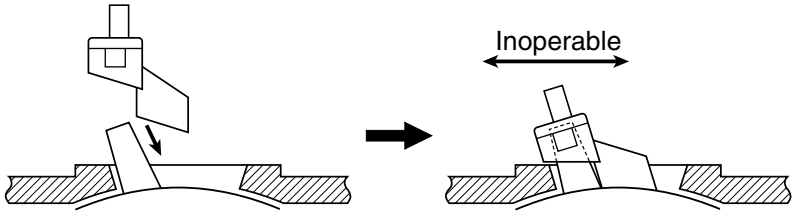
Such wiring as shown by the broken line will be added for the automatic resetting type.



(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

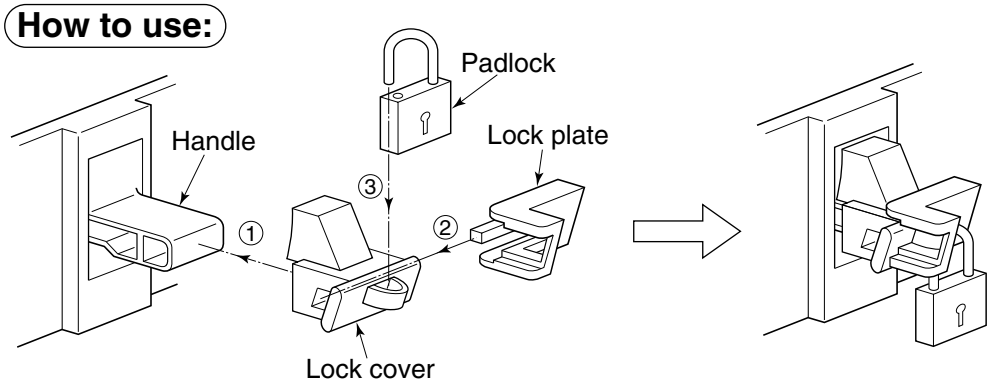
The wiring work shall be performed with the master circuit-breaker OFF even if the unit is locked into OFF position. Since an electric shock is to be apprehended, always confirm that there is no current flowing before proceeding to the wiring.

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 locks is a device that lock 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.



(Case of HL)

⚠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.

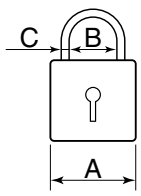
① Never try to trip the circuit-breaker by trip button with the circuit-breaker locked into OFF position. Otherwise, the internal mechanism may be broken.

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 ✻	11 ✻	4 ✻
NF400-A frame and above, NV400-A frame and above	40 ✻	22 or 23 ✻	5.5 ✻

✻ A:35, B:19, and C:5 for HL-S

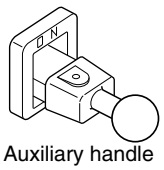


(4) Extension handle

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 promptly afteruse, because if attached to the main 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.



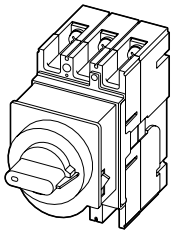
Auxiliary handle

(5) External handles

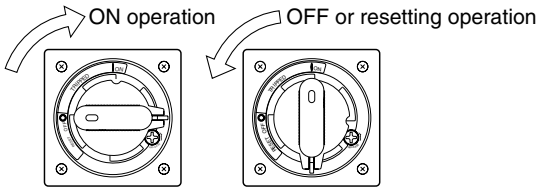
① F type handle

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

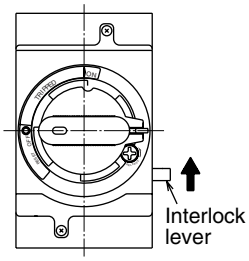


- The handle can turn ON when it is rotated clockwise.
- The handle can turn OFF when it is rotated counterclockwise.
- When the circuit-breaker trips, the handle can be reset if it is rotated counterclockwise further from OFF position.
- The handle is provided with the door lock mechanism that can open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

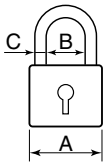


(b) How to release the safety device

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

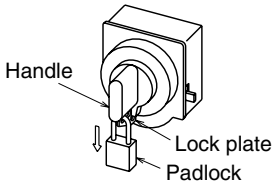
The padlock to be used shall be commercially available one.

Applicable type	A (Nominal dimensions)	B	C
All models	35	19	5
	40	20 or 23	5.5, 6

(c) When locking up

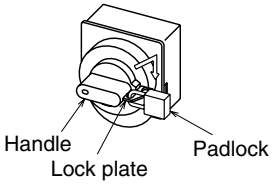
- ON lock

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



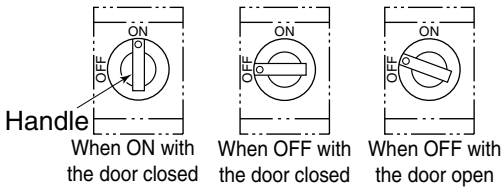
- OFF lock

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.

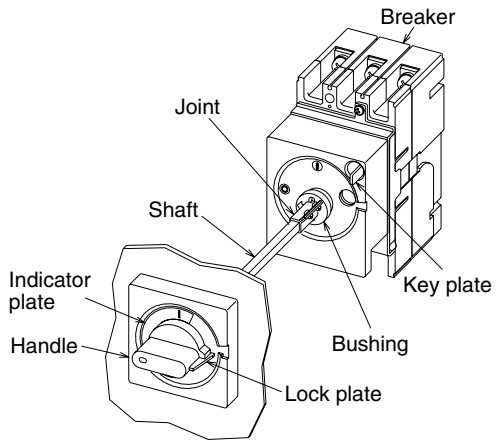
(iv) When the door is to be opened with the circuit-breaker ON, open it with the release pin left turned in the arrowed direction.

(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.

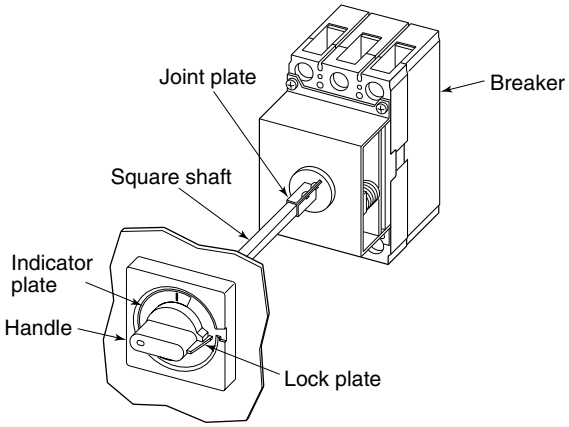
② V type handle

(a) Assembly

● 125 and 250 A frames

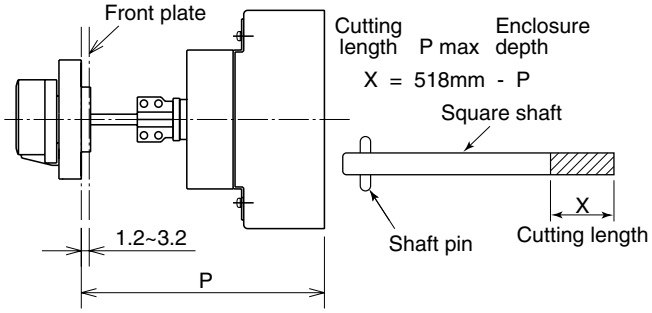


● 400, 630 and 800 A frames

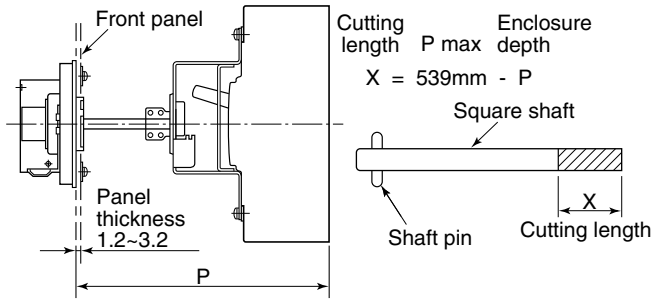


(b) Shaft cutting

● 125 and 250 A frames

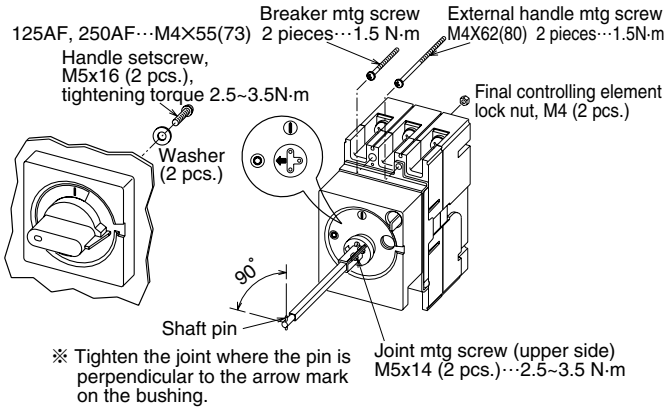


● 400, 630 and 800 A frames

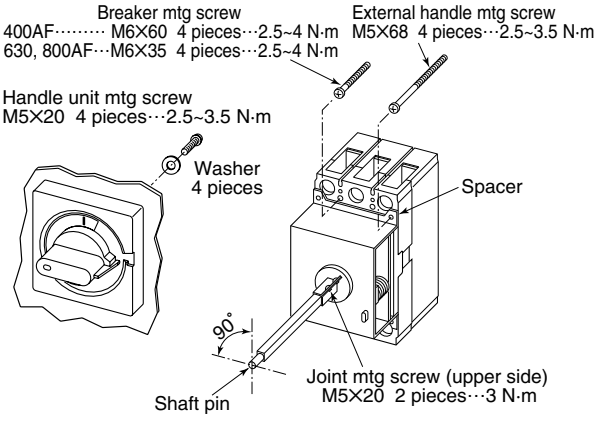


(c) Installation

●125 and 250 A frames



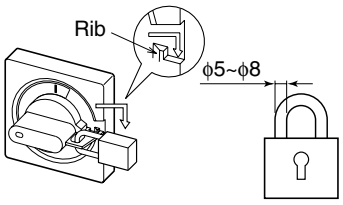
● 400, 630 and 800 A frames



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

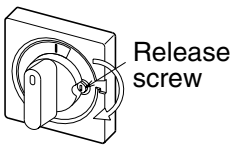
(d) Control handle

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 (ϕ5 - ϕ8). 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.

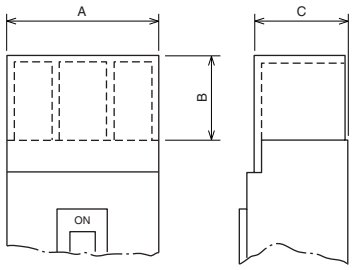
Be careful that the shaft pin rotate when the breaker is tripped under opening the door.

The door cannot be closed in trip position.

Reset operation under opening the door, rotate the square shaft unticlockwise by spanner or monkey wrench.

(6) Terminal cover

The terminal covers are used to avoid exposure of live parts. Many kinds of terminal covers, including large terminal covers (TC-L), small terminal covers (TC-S), transparent terminal covers (TTC), rear terminal covers (BTC) and plug-in terminal covers (PTC), for various models and applications are available, and they are helpful. (The terminal covers cannot be fitted to electrically operated circuit breakers of spring charged type (2) and motor-drive type (2). The standard terminal covers can be used for the spring charged type (1). For the motor-drive type, special terminal covers can be manufactured. Consult us for details.)



TC-L TC-S TTC

• Quick terminal covers

These covers are very convenient because they can be fitted only by inserting them into the mounting holes in the circuit breaker body. To remove the terminal cover, shift the projections of the terminal cover with the tip of a slotted screwdriver or finger, and draw it out.

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)
Ui ≤ 300	2000	Uis ≤ 60	1000
300 < Ui ≤ 690	2500	60 < Uis ≤ 690	2 Uis + 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 △ 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 × marks in the table. (Should the portions with × 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)	
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	△	○	×	○
		Between left - neutral and right - neutral poles	○	○	○	○
	Load side	Between left - middle, middle - right, and middle - neutral poles	○	○	○	○
		Between left - right poles	△	△	×	×
		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)

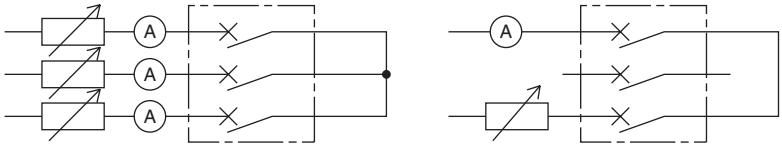
NF400-SEW, NF400-HEW, NF400-REW
NF400-UEW
NF630-SEW, NF630-HEW, NF630-REW
NF800-CEW, NF800-SEW, NF800-HEW
NF800-REW, NF800-UEW
NV250-SEW, NV250-HEW
NV400-SEW, NV400-HEW, NV400-REW
NV630-SEW, NV630-HEW
NV800-SEW, NV800-HEW

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.



Current regulation resistance

Current regulation resistance

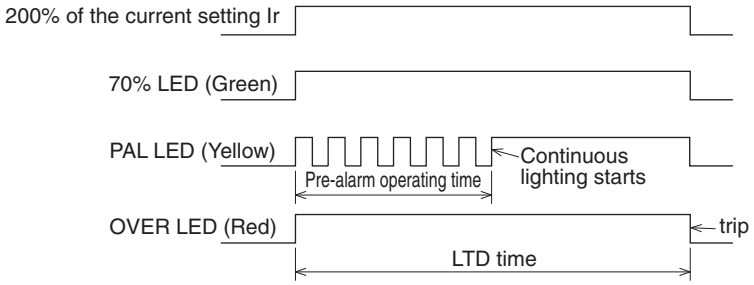
② The respective LEDs on the front face of the circuit-breaker, if on, allow to confirm the respective operational currents.

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

PAL LED (Yellow): If Ip is set 0.7 x Ir, good if flashing every 0.5 sec starts within the range 60 to 80% of the current setting Ir.

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

③ LTD and pre-alarm operating time can be checked by applying a current equivalent to 200% of the current setting Ir. If however any current exceeding the current setting Ir 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 400~800)

Setting of LTD time T_L	T_L=12s	T_L=60s	T_L=100s	T_L=150s
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

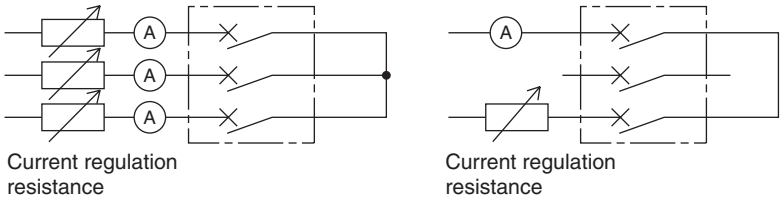
(4) Overcurrent trip test (2) Applicable model: NF250-SEV, NF250-HEV
NV250-SEV, NV250-HEV

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

Use the optional breaker tester "Y-350" or else carry out the test with load current.

If the breaker tester "Y-350" 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.

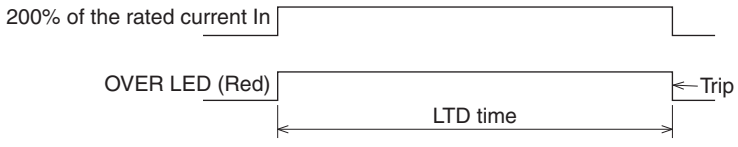


② The respective LEDs on the front face of the circuit-breaker, if on, allow to confirm the respective operational currents.

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

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

③ LTD time can be checked by applying a current equivalent to 200% of the rated current In. If however any current exceeding the rated current In 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.

Setting of LTD time T_L	T_L=12s	T_L=60s	T_L=80s	T_L=100s
LTD operating time	9.6~14.4s	48~72s	64~96s	80~120s

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. ⇕ Large short-circuit current near to the rated breaking capacity	Black soot seen near the vent. ⇕ 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.	Reusable ⇕ 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 emvironment	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	
In ≤ 100	1500	8500	10000	10% of the total opening/ closing frequency
100 < In ≤ 315	1000	7000	8000	
315 < In ≤ 630	1000	4000	5000	
630 < In ≤ 2500	500	2500	3000	
2500 < In	500	1500	2000	

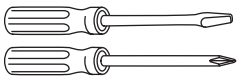
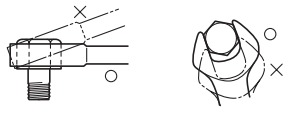
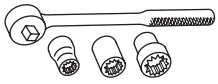
Remark: Number of operation by the test button of ELCB is 1000 times.

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 contacter 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
Tightening of bolts and nuts	 Double-ended wrench	 Screwdriver shall be inserted into the bottom of the groove and then turned.
	 Socket wrench	The socket wrench allows to tighten rather firm. Pay your attention to it that it may break too small bolts and/or buts or else any other bolts if the tightening totque is too great.
	 Hexagonbar 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 interrupting current	To be replaced by new one with larger breaking capacity
			Large consumption of contact	Short-circuit current cut off. End of service life	To be replaced with new one
				Application of overcurrent	
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
			Failure of rated current changeover portion		To be returned for repairing
	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
			Abnormal current running simultaneously with closing (short-circuit closing)		Circuit to be checked to remove the cause
	Operating while in use		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 sonner 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 resister/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		Power supply to be improved
		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;

- Operation
  - Normal operation
    - (1) Operation by leak current, electrification, ground fault etc.
  - Unnecessary operation
    - Those attributable to ELCB
      - (2) Fault of earth leakage circuit breaker
      - (3) Inadequate sensitivity current (too sensitive)
    - Those attributable to circuit and others
      - (4) Operation by surge
      - (5) Operation by circulation current
      - (6) Operation by induction
      - (7) Operation by wrong wire connection
      - (8) Operation by inadequate earth
      - (9) Operation by influence of at ground fault of shunt circuit
      - (10) Operation by overload or short-circuit
      - (11) Operation by environment (vibration, impact etc.)
      - (12) Operation by carrier phone unit
      - (13) Operation by electromagnetic wave
      - (14) Operation by inverters
      - (15) Others (Operation of surge absorber etc.)

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.

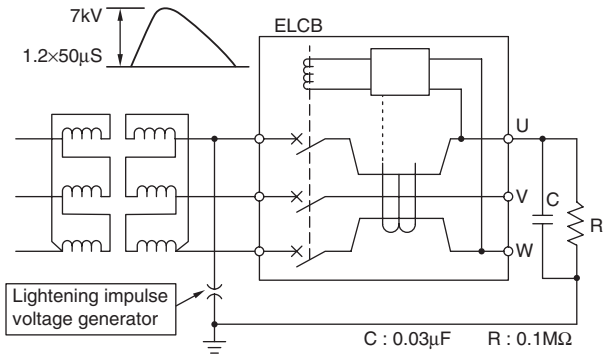
In most cases, leak current from circuits is attributable to static capacity to ground of the wire. Of some electric furnaces and sheath heaters, the insulation resistance comes down when cooled even if the insulation resistance is enough at high temperature, and it takes time to find out the cause of 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 lightening of wires, non-operation test by lightening impulse is set forth in JIS C-8371, and surge resistivity is ensured. Circuit of the lightening 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.

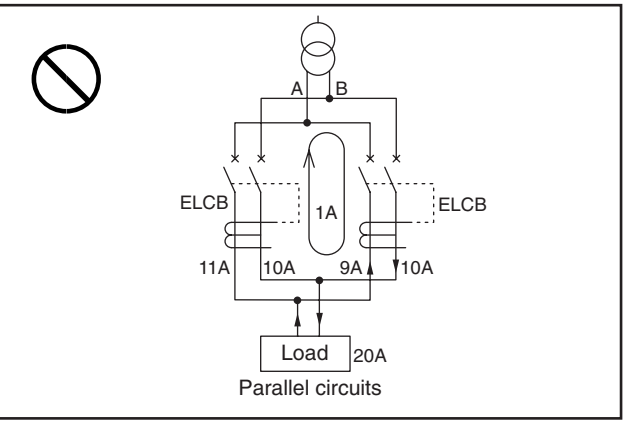


Test circuit of lightening impulse non-operation

(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.



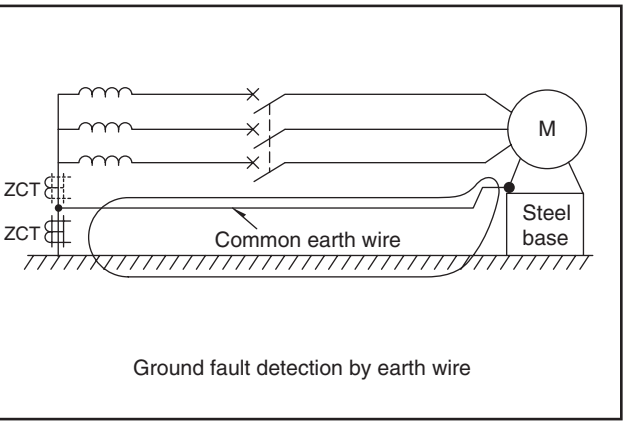
Parallel circuits

(6) 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.

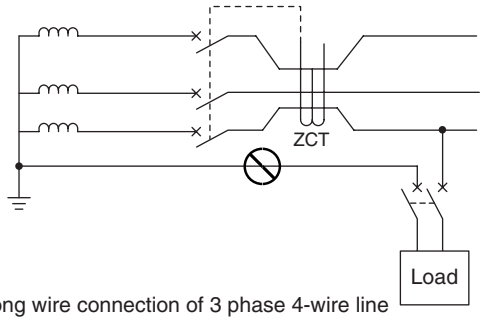
Induction can also be generated in the input circuit of the earth leakage relay, and it is necessary to braid the lead wires between the earth leakage relay, and the ZCT.



Ground fault detection by earth wire

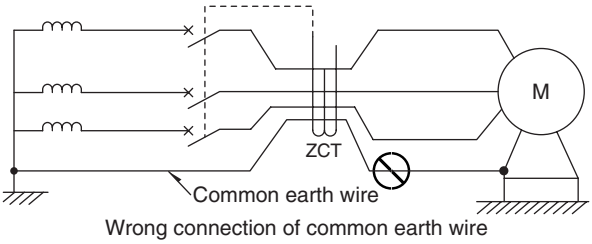
(7) Operation by wrong wire connection

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.



Wrong wire connection of 3 phase 4-wire line

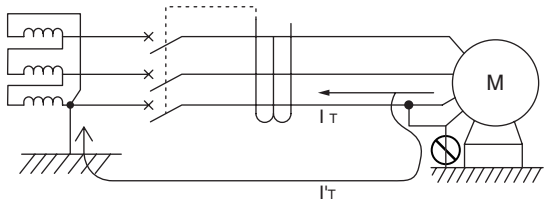
On the other hand, the common earth wire shall not go through the ZCT as it can be cause malfunction at leakage.



Wrong connection of common earth wire

(8) Operation by inadequate earth

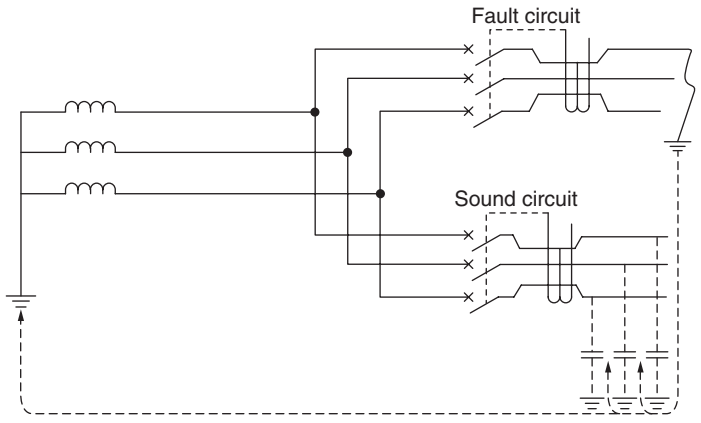
Though the wire is grounded at the earth side, the wire shall not be earthed at the load side. By the voltage of voltage drop in the line at the earth side, a part of the load current is diverted as shown by I'T, and the ELCB is operated.



Inadequate double ground

(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.



Operation of sound circuit 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 tempereture 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.

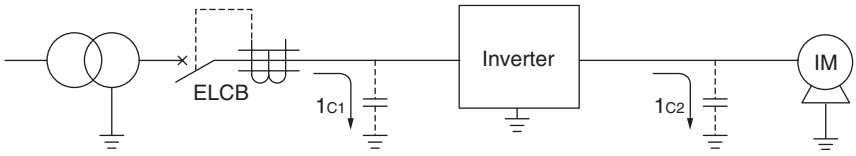
(14) Operation by inverters

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.

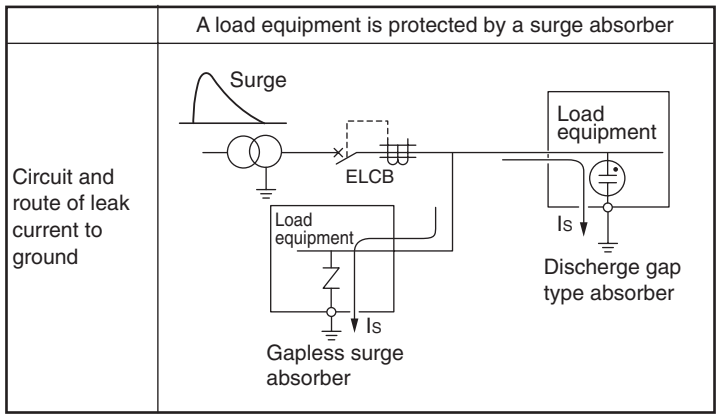
It is also essential to install the ELCB at the primary side of the inverter, and never at the secondary side.



Applicable circuit to inverter

(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.



Leak current to ground through surge absorber

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.

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.

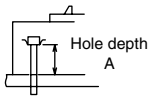
APPENDIX 1 Breaker mounting screws

■ MCCB • MCB

Class	Model	Hole depth A	Wood screw (round wood screw) for front connection	Front connection type	Rear connection type	Plug-in type	Required quantity per unit			
							1P	2P	3P	4P
C • S • H	NF50-SVFU	56	—	M4X0.7X65 (note)	—	—	—	2	2	—
	NF32-SV, NF63-CV, NF63-SV, NF63-HV NF125-CV, NF125-SV, NF125-HV NF100-CVFU, NF125-SVU NF125-HVU	45	4.1×58	M4×0.7×55	M4×0.7×55	M4×0.7×55	—	2	2	4
	NF125-SEV, NF125-HEV NF250-CV, NF250-SV, NF250-HV NF250-SEV, NF250-HEV NF250-SVU, NF250-HVU NF125-SGV, NF125-LGV, NF125-HGV NF160-SGV, NF160-LGV, NF160-HGV NF250-SGV, NF250-LGV, NF250-HGV	45	4.1×58	M4×0.7×55	M4×0.7×55	M4×0.7×55 M4×0.7×73	—	2 (For plug-in type 4)	2	4
	NF30-CS	10	4.1×25	M4×0.7×20	M4×0.7×20	—	—	2	2	—
	NF225-CWU	45	4.1×58	M4×0.7×55	—	—	—	2 (For plug-in type 4)	2	4
	NF400-CW, NF400-SW NF-SKW	47	—	M6×60	M6×72	M6×72	—	4	4	4
	NF400-SEW, NF400-HEW, NF400-REW NF630-CW, NF630-SW, NF630-SEW NF630-HEW, NF630-REW	59	—	M6×72	M6×85	M6×85	—	4	4	4
	NF800-CEW, NF800-SEW NF800-HEW, NF800-REW, NF-SLW	15	—	M6×35	M6×40	M6×35	—	4	4	4
	NF1000-SEW, NF1250-SEW	18.5	—	M8×40	M8×40	M8×40	—	4	4	4
	NF1600-SEW	18.5	—	M8×40	M8×40	—	—	4	4	4
R • U	NF125-RGV NF250-RGV	45	—	M4×0.7×55	M4×0.7×55	M4×0.7×55	—	2	2	—
	NF125-UV, NF250-UV	45/61	—	M4×0.7×55/73	M4×0.7×55/73	M4×0.7×55/73	—	4	4	—
	NF125-UV (4P), NF250-UV (4P)	45	—	M4×0.7×55	M4×0.7×55	M4×0.7×55	—	2	2	4
	NF400-UEW (3P)	47/156	—	M6×65/174	M6×72/181	M6×72/181	—	—	4	—
	NF400-UEW (4P), NF800-UEW	15/112	—	M6×35/132	M6×40/137	M6×35/132	—	—	4	6
BH	BH	—	—	—	—	—	—	—	—	—
	BH-S	—	—	—	—	—	—	—	—	—
	BH-P	—	—	—	—	—	—	—	—	—
	BH-PS	—	—	—	—	—	—	—	—	—
	BH-D6	—	—	—	—	—	—	—	—	—
	BH-DN	—	—	—	—	—	—	—	—	—
	KB-D	—	—	—	—	—	—	—	—	—
	BH-D10	—	—	—	—	—	—	—	—	—

Remarks: 1. The mounting shown in the ▭ sections are enclosed with the MCCB. The mounting screws for the plug-in connection are enclosed with the plug-in terminal block.
All other mounting screws must be prepared by the user.
2. All mounting screws other than the hexagon socket bolts and hexagon bolts are P-type panhead screws.
3. For models with two types of mounting screws, the screw length differs on the supply side and load side.
4. The plug-in type is not available for NF800-UEW.

Note For the P-type panhead screw, use a type with a spring washer and flat washer (small round) combination, or a P-type panhead screw with spring washer and flat washer.



■ ELCB • RCCB • RCBO

Class	Model	Hole depth A	Wood screw (round wood screw) for front connection	Screw for steel plates (P-type panhead screw)			Required quantity per unit	
				Front connection type	Rear connection type	Plug-in type	2, 3P	4P
NV	NV50-SVFU	56	—	M4×0.7×65 (note)	—	—	2	—
	NV32-SV, NV63-CV, NV63-SV, NV63-HV NV125-CV, NV125-SV, NV125-HV NV100-CVFU, NV125-SVU, NV125-HVU	45	4.1×58	M4×0.7×55	M4×0.7×55	M4×0.7×55	2	4
	NV125-SEV, NV125-HEV NV250-CV, NV250-SV, NV250-HV NV250-SEV, NV250-HEV, NV250-SVU, NV250-HVU	45	4.1×58	M4×0.7×55	M4×0.7×55	M4×0.7×55 M4×0.7×73	2 (For plug-in type 4)	4
	NV400-CW, NV400-SW	47	—	M6×60	M6×72	M6×72	4	4
	NV400-SEW, NV400-HEW, NV400-REW NV630-CW, NV630-SW, NV630-SEW NV630-HEW	59	—	M6×72	M6×85	M6×85	4	4
	NV800-SEW, NV800-HEW	15	—	M6×35	M6×40	M6×35	4	4
BV	BV-D	—	—	—	—	—	—	—
	BV-DN	—	—	—	—	—	—	—

Remarks: 1. The mounting shown in the ▭ sections are enclosed with the ELCB.

Note For the P-type panhead screw, use a type with a spring washer and flat washer (small round) combination, or a P-type panhead screw with spring washer and flat washer.

APPENDIX 2 Standard tightening torque for connections

Rear
<Round stud>

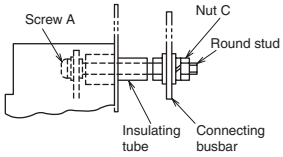


Fig.1

<Bar stud>

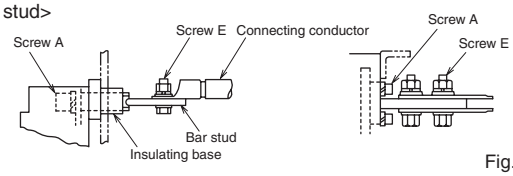


Fig.2

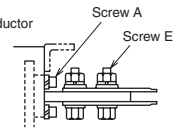


Fig.3

Plug-in
<Screw terminal>

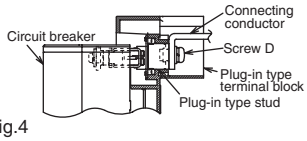


Fig.4

<Bar stud>

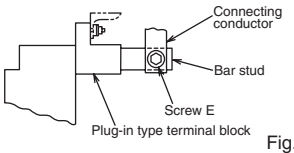


Fig.5

Standard tightening torque (*1)

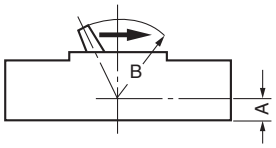
Tightening torque N·m

Model / Connection type		Rear								Plug-in			
		Round stud				Bar stud				Screw terminal		Bar stud	
		Fig.1				Fig. 2, Fig.3				Fig.4		Fig.5	
MCCB	ELCB	Screw A		Nut C		Screw A		Screw E		Screw D		Screw E	
		Size	Tightening torque	Size	Tightening torque	Size	Tightening torque	Size	Tightening torque	Size	Tightening torque	Size	Tightening torque
NF30-CS	—	M4×0.7	1	M6	2	—	—	—	—	—	—	—	—
NF32-SV, NF63-CV NF63-SV, NF63-HV	NV32-SV, NV63-CV NV63-SV, NV63-HV	M4×0.7	1	M6	2	—	—	—	—	M6	3	—	—
NF125-CV, NF125-SV NF125-HV, NF125-UV	NV125-CV, NV125-SV NV125-HV	—	—	—	—	M6	4	M8	12	M8	6	—	—
NF125-SEV, NF125-HEV, NF125-RGV NF250-CV, NF250-SV, NF250-HV, NF250-SEV NF250-HEV, NF250-RGV, NF250-UV NF250-LGV/HGV, NF250-RGV, NF125-SGV/HGV NF125-LGV, NF160-SGV, NF160-LGV/HGV NF125-SGV, NF125-LGV, NF125-HGV NF160-SGV, NF160-LGV, NF160-HGV NF250-SGV, NF250-LGV, NF250-HGV	NV125-SEV, NV125-HEV NV250-CV, NV250-SV NV250-HV, NV250-SEV NV250-HEV	—	—	—	—	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	—	—	—	—	M8	20	M12	45	—	—	M12	45
NF800-CEW, NF800-SDW NF800-SEW, NF800-HEW, NF800-REW	NV800-SEW NV800-HEW	—	—	—	—	M10	30	2-M12	45	—	—	2-M12	45
NF800-UEW (*2)													
NF1000-SEW NF1250-SEW	—	—	—	—	—	4-M8	12	2-M12	45	—	—	2-M12	45
NF1600-SEW	—	—	—	—	—	4-M8	12	4-M10	25	—	—	—	—

Notes *1 The appropriate range of tightening torque is ±20% of each value (standard tightening torque) shown in the above table. Please refer to the supplied assembly manual and instruction manual for more information.

*2 The plug-in type is not available.

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.

	Model	Pole	Rated current	Operational force of handle N·m			Dimensions (mm)	
				ON	OFF	Reset	A	B
MCCB C·S·H·R·M	NF30-CS	2,3	~32A	0.45	0.15	0.03	47	20
	NF50-SVFU	2,3	~63A	0.5	0.7	1.5	55	35
	NF32-SV NF63-CV, NF63-SV, NF63-HV NF100-CVFU	2	~125A	1.2	1.2	1.4	40	50
		3	~32A					
			40~125A	1.6	1.7	2.2		
		4	~32A					
			40~125A	1.9	2.1	2.5		
	NF125-CV, NF125-SV, NF125-HV NF125-SVU, NF125-HVU	2	~125A	1.2	1.2	1.4	40	50
		3		1.6	1.7	2.2		
		4		1.9	2.1	2.5		
	NF125-SEV, NF125-HEV, NF250-CV, NF250-SV NF250-HV, NF250-SEV, NF250-HEV NF250-SVU, NF250-HVU	2,3	~250A	3.5	3.2	3.7		52
		4		4.5	4.2	4.8		
	NF125-SGV, NF125-LGV, NF125-HGV	2,3,4	~125A	2.4	2.2	2.7	40	52
	NF160-SGV, NF160-LGV, NF160-HGV	2,3	~160A					
	NF160-SGV, NF160-LGV, NF160-HGV	4	~160A	3.5	3.2	3.7	40	52
	NF250-SGV, NF250-LGV, NF250-HGV	2,3	~250A					
	NF250-SGV, NF250-LGV, NF250-HGV	4	~250A	4.5	4.2	4.8	40	52
	NF225-CWU	3	~250A	2.1	3	5.2	38	54
	NF400-CW	2,3	~400A	7.8	6.15	16.1	49	85
	NF400-SW, NF400-SEW, NF400-HEW, NF400-REW, NF-SKW NF630-CW, NF630-SW, NF630-SEW, NF630-HEW, NF630-REW	2,3	~630A	10.2	8.4	20	49	106
	NF800-CEW, NF800-SDW, NF800-SEW, NF800-HEW NF800-REW, NF-SLW	3	~800A	13.5	12	30	49	106
	NF1000-SEW, NF1250-SEW, NF1250-SDW NF1600-SEW, NF1600-SDW	3	~1600A	15.5	10.1	19.4	84	106
R·U	NF125-UV	2	~125A	1.2	1.2	1.4	40	50
		3		1.6	1.7	2.2		
		4		1.9	2.1	2.5		
	NF125-RV NF250-RV	2,3	~125A	2.5	2.1	2.3		52
			~250A	3.6	3.1	3.4		
	NF250-UV	2,3	~250A	3.5	3.2	3.7		
		4		4.5	4.2	4.8		
	NF400-UEW	3	~400A	10.2	8.4	20	146	106
	NF800-UEW	3	~800A	13.5	12	30	146	106
	NF1200-UR	2,3	~1200A	15.5	10.1	19.4	88	106
ELCB	NV50-SVFU	2,3	~63A	0.5	0.7	1.5	55	35
	NV32-SV NV63-CV, NV63-SV, NV63-HV NV100-CVFU	2	~125A	1.2	1.2	1.4	40	50
		3	~32A					
			40~125A	1.6	1.7	2.2		
		4	~32A					
			40~125A	1.9	2.1	2.5		
	NV125-SEV, NV125-HEV NV250-CV, NV250-SV, NV250-HV NV250-SVU, NV250-HVU	3	~250A	3.5	3.2	3.7	40	52
		4		4.5	4.2	4.8		
	NV400-CW	3	~400A	7.8	6.15	16.1	49	85
	NV400-SW, NV400-SEW, NV400-HEW, NV400-REW NV630-CW, NV630-SW, NV630-SEW, NV630-HEW	3	~630A	10.2	8.4	20	49	106
	NV800-SEW, NV800-HEW	3	~800A	13.5	12	30	49	106

APPENDIX 4 Service network

Country / Region	Corporation Name	Address	Telephone
Australia	Mitsubishi Electric Australia Pty. Ltd.	348 Victoria Road, Rydalmere, N.S.W. 2116, Australia	+61-2-9684-7777
Belarus	Tehnikon	Oktyabrskaya 19, Off. 705, BY-220030 Minsk, Belarus	+375(0)17/210 46 26
Belgium	Koning & Hartman B.V.	Woluwelaan 31, BE-1800 Vilvoorde, Belgium	+32(0)2/2570240
Chile	Rhona S.A.	Vte. Agua Santa 4211 Casilla 30-D (P.O. Box) Vina del Mar, Chile	+56-32-2-320-600
China	Mitsubishi Electric Automation (China) Ltd.	Mitsubishi Electric Automation Building, No.1386 Hongqiao Road, Shanghai, 200336	+86-21-2322-3030
	Mitsubishi Electric Automation (China) Ltd. BeiJing Branch	9/F, Office Tower1 Henderson Centre 18 Jianguomennei Dajie DongCheng district BeiJing 100005	+86-10-6518-8830
	Mitsubishi Electric Automation (China) Ltd. ShenZhen Branch	Room 2512--2516, Great China International Exchange Square, Jintian Rd.S., Futian District, Shenzhen, 518034	+86-755-2399-8272
	Mitsubishi Electric Automation (China) Ltd. GuangZhou Branch	Room 1609, North Tower, The Hub Center, No.1068, Xing Gang East Road, Haizhu District, Guang Zhou, China 510335	+86-20-8923-6730
	Mitsubishi Electric Automation (China) Ltd. ChengDu Branch	Block B, Room 407-408, Shangri-La Center Offeice Builiding, No.9 BinJiang East Road, Chengdu, China 610021	+86-28-8446-8030
	Mitsubishi Electric Automation (Hongkong) Ltd.	10/F., Manulife Tower, 169 Electric Road, North Point, Hong Kong	+852-2887-8810
Colombia	Proelectrico Representaciones S.A.	Carrera 42 # 75-367 Bod 109 Itagui Colombia	+57-4-4441284
Czech Republic	AUTOCONT CONTROL SYSTEMS S.R.O	Technologická 374/6, CZ-708 00 Ostrava - Pustkovec	+420 595 691 150
Denmark	BEIJER ELECTRONICS A/S	LYKKEGARDSVEJ 17, DK-4000 ROSKILDE	+45(0)46/75 76 66
Egypt	Cairo Electrical Group	9, Rostoum St. Garden City P.O. Box 165-11516 Maglis El-Shaab, Cairo - Egypt	+20-2-27961337
France	Mitsubishi Electric Europe B.V.	25, Boulevard des Bouvets, F-92741 Nanterre Cedex	+33(0)1/55 68 55 68
Germany	Mitsubishi Electric Europe B.V.	Gothaer Str. 8, 40880 Ratingen , Germany	+49(0) 2102 486-0
Greece	KALAMARAKIS - SAPOUNAS S.A.	IONIAS & NEROMILOU STR., CHAMOMILOS ACHARNES, ATHENS, 13678 Greece	+30-2102 406000
	UTECO	5, MAVROGENOUS STR., 18542 PIRAEUS, Greece	+30-211-1206-900
Hungary	Meltrade Ltd.	Fertö utca 14. HU-1107 Budapest, Hungary	+36(0)1-431-9726
India	Mitsubishi Electric India Private Limited	2nd Floor, Tower A&B, Cyber Greens, DLF Cyber City, DLF Phase-III, Gurgaon - 122 022 Haryana, India	+91-124-4630300
	Mitlite Electric Co. Pvt. Ltd.	Plot No.32 G/F, Sector-6 IMT, Manesar, Haryana -122050, India	+91-124-469-5300
Indonesia	P. T. Sahabat Indonesia	P.O.Box 5045 Kawasan Industri Pergudangan, Jakarta, Indonesia	+62-(0)21-6610651-9
Ireland	Mitsubishi Electric Europe B.V.	Westgate Business Park, Ballymount, IRL-Dublin 24, Ireland	+353(0)1-4198800
Israel	Gino Industries Ltd.	26, Ophir Street IL-32235 Haifa, Israel	+972(0)4-867-0656
Italy	Mitsubishi Electric Europe B.V.	Viale Colleoni 7, I-20041 Agrate Brianza (MI), Italy	+39 039-60531
Kazakhstan	Kazpromavtomatika	ul. Zhambyla 28, KAZ - 100017 Karaganda	+7-7212-501000
Korea	Mitsubishi Electric Automation Korea Co., Ltd	1480-6, Gayang-Dong, Gangseo-Gu, Seoul, Korea	+82-2-3660-9572
Lebanon	Comptoir d'Electricite Generale-Liban	Cebaco Center - Block A Autostrade Dora, P.O. Box 11-2597 Beirut - Lebanon	+961-1-240445
Lithuania	Rifas UAB	Tinklu 29A, LT-5300 Panevezys, Lithuania	+370(0)45-582-728
Malaysia	Mittric Sdn Bhd	No. 5 Jalan Pemberita U1/49, Temasya Industrial Park, Glenmarie 40150 Shah Alam, Selangor, Malaysia	+603-5569-3748
Malta	ALFATRADE LTD	99 PAOLA HILL, PAOLA PLA 1702, Malta	+356(0)21-697-816
Maroco	SCHIELE MAROC	KM 7,2 NOUVELLE ROUTE DE RABAT AIN SEBAA, 20600 Casablanca, Maroco	+212 661 45 15 96
Myanmar	Peace Myanmar Electric Co.,Ltd.	NO137/139 Botahtaung Pagoda Road, Botahtaung Town Ship 11161, Yangon, Myanmar	+95-(0)1-202589
Nepal	Watt&Volt House	KHA 2-65, Volt House Dillibazar Post Box: 2108, Kathmandu, Nepal	+977-1-4411330
Netherlands	Imtech Marine & Offshore B.V.	Sluisjesdijk 155, NL-3087 AG Rotterdam, Netherlands	+31(0)10-487-19 11
North America	Mitsubishi Electric Automation, Inc.	500 Corporate Woods Parkway, Vernon Hills, IL 60061 USA	+847-478-2100
Norway	Scanelec AS	Leirvikasen 43B, NO-5179 Godvik, Norway	+47(0)55-506000
Middle East Arab Countries & Cyprus	Comptoir d'Electricite Generale-International-S.A.L.	Cebaco Center - Block A Autostrade Dora P.O. Box 11-1314 Beirut - Lebanon	+961-1-240430
Pakistan	Prince Electric Co.	2-P, GULBERG II, LAHORE - 54660 PAKISTAN	+92-(0)42-35752323 +92-(0)42-35753373
Philippines	Edison Electric Integrated, Inc.	24th Fl. Galleria Corporate Center, Edsa Cr. Ortigas Ave., Quezon City Metro Manila, Philippines	+63-(0)2-634-8691
Poland	Mitsubishi Electric Europe B.V. Polish Branch	Krakowska 50, 32-083 Balice, Poland	+48(0)12 630 47 00
Republic of Moldova	Intehsis SRL	bld. Traian 23/1, MD-2060 Kishinev, Moldova	+373(0)22-66-4242
Romania	Sirius Trading & Services SRL	RO-060841 Bucuresti, Sector 6 Aleea Lacul Morii Nr. 3	+40-(0)21-430-40-06
Russia	Mitsubishi Electric Europe B.V. Moscow Branch	52, bld. 3 Kosmodamianskaya Nab. 115054, Moscow, Russia	+7 495 721-2070
Saudi Arabia	Center of Electrical Goods	Al-Shuwayer St. Side way of Salahuddin Al-Ayoubi St. P.O. Box 15955 Riyadh 11454 - Saudi Arabia	+966-1-4770149
Singapore	Mitsubishi Electric Asia Pte. Ltd.	307 Alexandra Road, Mitsubishi Electric Building, Singapore 159943	+65-6473-2308
Slovakia	PROCONT, Presov	Kupelna 1/, SK - 08001 Presov, Slovakia	+421(0)51-7580 611
	SIMAP	Jana Derku 1671, SK - 91101 Trencin, Slovakia	+ 421(0)32 743 04 72
Slovenia	Inea RBT d.o.o.	Stegne 11, SI-1000 Ljubljana, Slovenia	+386(0)1-513-8116
South Africa	CBI-electric: low voltage	Private Bag 2016, ZA-1600 Isando Gauteng, South Africa	+27-(0)11-9282000
Spain	Mitsubishi Electric Europe B.V. Spanish Branch	Carretera de Rubí 76-80, E-08190 Sant Cugat del Vallés (Barcelona), Spain	+34(0)93-565-3131
Sweden	Euro Energy Components AB	Järnvägsgatan 36, S-434 24 Kungsbacka, Sweden	+46(0)300-690040
Switzerland	TriElec AG	Muehlentalstrasse 136, CH-8201 Schaffhausen	+41-(0)52-6258425
Taiwan	Setsuyo Enterprise Co., Ltd	5th Fl., No.105, Wu Kung 3rd, Wu-Ku Hsiang, Taipei, Taiwan, R.O.C.	+886-(0)2-2298-8889
Thailand	United Trading & Import Co., Ltd.	77/12 Bamrungmuang Road, Klong Mahanak Pomprab Bangkok Thailand	+66-223-4220-3
Tunisia	MOTRA Electric	3, Résidence Imen, Avenue des Martyrs Mourouj III, 2074 - El Mourouj III Ben Arous, Tunisia	+216-71 474 599
Turkey	GTS	Bayraktar Bulvarı Nutuk Sok. No:5, Posta Kutusu34384, TR-34775 Yukan Dudullu-Uemraniye, Istanbul, Turkey	+90(0)216 526 3990
United Kingdom	Mitsubishi Electric Europe B.V.	Travellers Lane, UK-Hatfield, Herts. AL10 8XB, United Kingdom	+44(0)1707-276100
Uruguay	Fierro Vignoli S.A.	Avda. Uruguay 1274 Montevideo Uruguay	+598-2-902-0808
Venezuela	Adesco S.A.	Calle 7 La Urbina Edificio Los Robles Locales C y D Planta Baja, Caracas - Venezuela	+58-212-241-9952
Vietnam	CTY TNHH-TM SA GIANG	10th Floor, Room1006-1007,225 Tran Hung Dao St.,Co Giang Ward, Dist. 1, Ho Chi Minh City, Vietnam	+84-8-838-6727/28/29

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

For Safety : Please read the instruction manual carefully before using the products in this catalog. Wiring and connection must be done by the person have a specialized knowledge of electric construction and wiring.

eco Changes

for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.

MITSUBISHI ELECTRIC CORPORATION
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