

MITSUBISHI Low-Voltage Air Circuit Breakers series
World Super AE

三菱低压空气断路器 World Super AE
三菱低压气中遮断器 World Super AE

MODEL AE-SW

INSTRUCTION MANUAL 使用说明书 取扱説明書

Types covered in this manual 本手册适用于以下型号产品 対象機種

AE630-SW AE1000-SW AE1250-SW AE1600-SW
AE2000-SWA
AE2000-SW AE2500-SW AE3200-SW
AE4000-SWA
AE4000-SW AE5000-SW AE6300-SW

IMPORTANT NOTE: Before using these Series AE breakers, please read these instructions carefully, and make sure that all actual users also read them.

重要注释: 在使用 AE 断路器系列以前, 请务必仔细阅读本说明书, 并确保所有用户也阅读本说明。


ご使用の前に必ずこの取扱説明書をお読みください。
この説明書は、最終ユーザまでお届けください。

MITSUBISHI ELECTRIC CORPORATION



Safety precautions



- Before using this device, make sure to read this instruction manual thoroughly. Important safety information is included in this manual. Be sure to follow the instructions.
- Please make sure that the end user receives this instruction manual.
- This instruction manual is prepared for an electrical expert.

Symbols have the following meaning.

 DANGER	Incorrect handling of the product will result in a hazardous situation, such as death or serious injury.
--	--

 CAUTION	Incorrect handling of the product may result in a hazardous situation according to circumstances.
--	---

	Warning for possible electrical shock under certain conditions.
	Warning for possible outbreak of a fire under certain conditions.

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

DANGER

- Do not use the product under the conditions with over-rated current. Otherwise, ground-fault or short circuit fault could occur due to dielectric breakdown, or explosion could occur due to a short circuit protection failure.
- Do not touch terminal area. There is a risk of electrical shock.

CAUTION

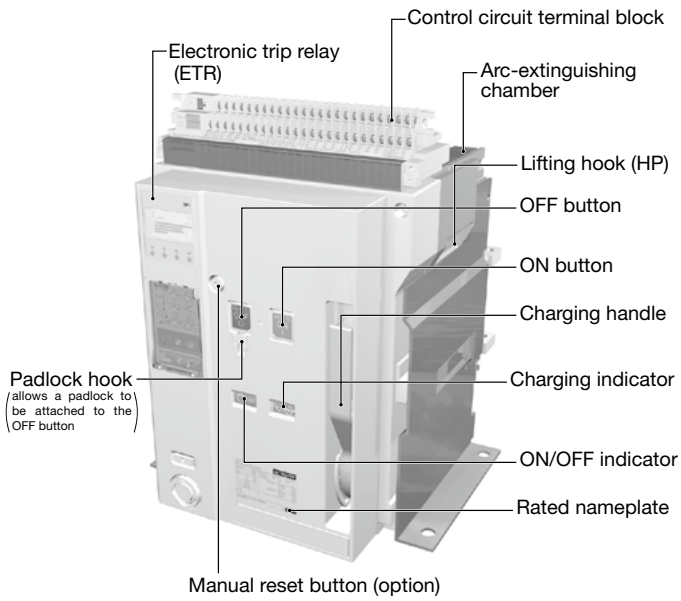
- The electrical work shall be performed by qualified personnel (electrical expert).
- Inspection and maintenance should be performed by qualified personnel (electrical expert). Before performing wiring works, turn off the upstream circuit breaker. Failure to do so may expose you to electrical shock.
- Tighten the terminal screw with the torque specified in the instruction manual. Failure to do so may cause a fire.
- Do not install or store in an abnormal environment with high temperature, high humidity, dust, corrosive gas, vibrations, or shocks, etc. To do so may cause a fire, malfunction of the circuit breaker or make it inoperative.
- Protect the circuit breaker so that foreign particles, such as dust, concrete powder and iron powder, and rain water will not enter the circuit breaker. Failure to do so may cause malfunction or fire.
- When the circuit breaker trips automatically, remove the cause before turning on the handle. Failure to do so may cause an electric shock or a fire.
- Retighten the terminals periodically. Failure to do so may cause a fire.
- Use the product in 50/60 Hz. Failure to do so may cause malfunction, inoperativeness or fire.
- Do not use in strong magnetic field.
When using a transceiver, keep it off at least 1 meter from the ACB.
- Do not disassemble.
Malfunction and operation failures can be caused.
- Dispose of the product as industrial waste.

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External view

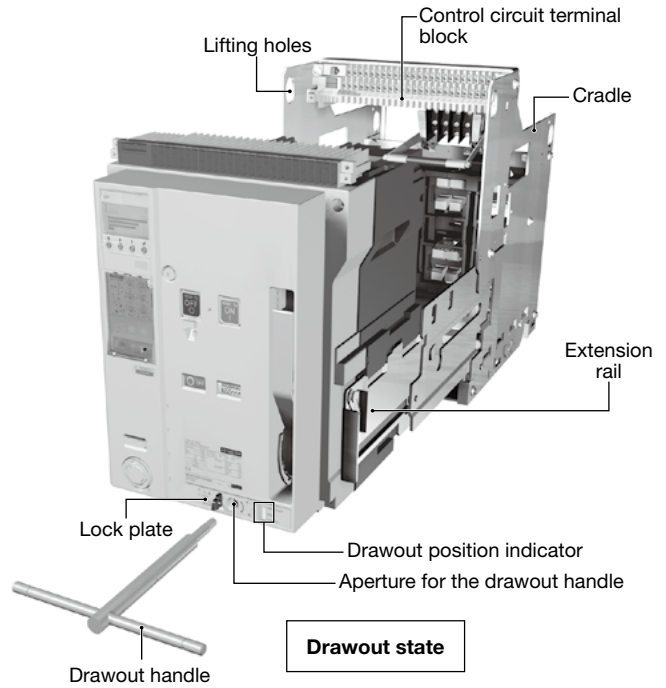
< Fixed type >



Note: The fixed type includes lifting hook (HP).

Fig. 4-1

< Drawout type >



Note: The drawout type includes a drawout handle.

Fig. 4-2

< Drawout type >

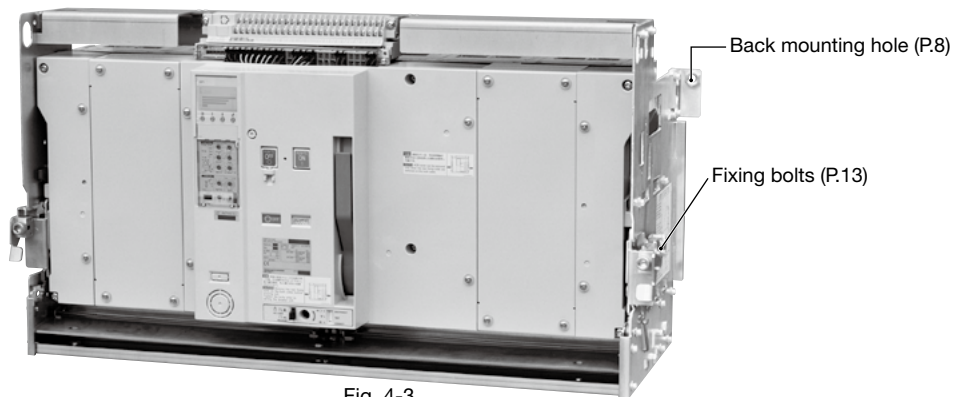


Fig. 4-3

Fig. 4-1 shows AE1600-SW 3-pole fixed type, Fig. 4-2 shows AE1600-SW 3-pole drawout type, and Fig. 4-3 shows AE6300-SW 3-pole drawout type.

Internal structure

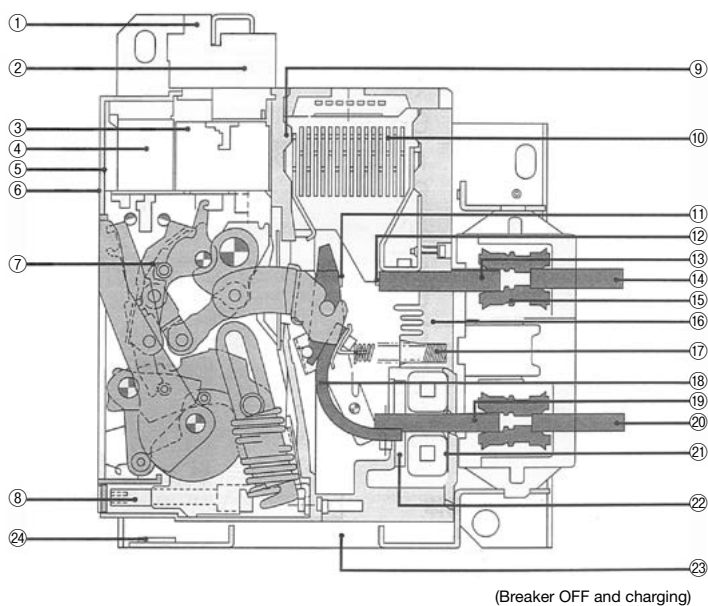


Fig. 5-1

- ① Control circuit terminal block
- ② Control circuit connector
- ③ Auxiliary switch
- ④ Shunt trip device, closing coil, undervoltage trip device
- ⑤ Electronic trip relay (ETR)
- ⑥ Cover
- ⑦ Open/close mechanism
- ⑧ Drawout mechanism
- ⑨ Intermediate base
- ⑩ Arc-extinguishing chamber
- ⑪ Contact on the movable side
- ⑫ Contact on the fixed side
- ⑬ Conductor on the breaker
- ⑭ Conductor on the cradle
- ⑮ Main circuit junction
- ⑯ Base
- ⑰ Contact spring
- ⑱ Flexible conductor
- ⑲ Conductor on the breaker
- ⑳ Conductor on the cradle
- ㉑ Power supply CT
- ㉒ Current sensor coil
- ㉓ Cradle
- ㉔ Cradle nameplate

Outline dimensions and product weight

Table 5-1

Model		AE630-SW	AE1000-SW	AE1250-SW	AE1600-SW	AE2000-SWA
Outline dimensions Note 1) a × b × c × d (mm)	Fixed type	3 poles	340 × 410 × 290 × 40			340 × 410 × 290 × 108
		4 poles	425 × 410 × 290 × 40			425 × 410 × 290 × 108
	Drawout type	3 poles	300 × 430 × 375 × 61			300 × 430 × 375 × 104
		4 poles	385 × 430 × 375 × 61			385 × 430 × 375 × 104
Product weight Note 2) (kg)	Fixed type	3 poles	35	35	35	44
		4 poles	42	42	43	43
	Drawout type	3 poles	56	56	56	62
		4 poles	70	70	70	75
	Cradle only	3 poles		24		27
		4 poles		28		32

Note 1) d dimensions: when the product is connected horizontally. For AE2000-SWA, when it is connected vertically.
Note 2) Weight (reference value) when an electronic trip relay is attached. It does not include any other accessories.

Table 5-2

Model		AE2000-SW	AE2500-SW	AE3200-SW	AE4000-SWA	
Outline dimensions Note 1) a × b × c × d (mm)	Fixed type	3 poles	475 × 410 × 290 × 40			475 × 410 × 290 × 117
		4 poles	605 × 410 × 290 × 40			605 × 410 × 290 × 117
	Drawout type	3 poles	435 × 430 × 375 × 61			439 × 430 × 375 × 109
		4 poles	565 × 430 × 375 × 61			569 × 430 × 375 × 109
Product weight Note 2) (kg)	Fixed type	3 poles	51	52	54	73
		4 poles	64	64	67	92
	Drawout type	3 poles	81	81	85	101
		4 poles	101	101	106	127
	Cradle only	3 poles	33		34	46
		4 poles	40		42	58

Note 1) d dimensions: when the product is connected horizontally. For AE4000-SWA, when it is connected vertically.
Note 2) Weight (reference value) when an electronic trip relay is attached. It does not include any other accessories.

Table 5-3

Model		AE4000-SW	AE5000-SW	AE6300-SW
Outline dimensions Note 1) a × b × c × d (mm)	Fixed type	3 poles	874 × 414 × 290 × 136	
		4 poles	1004(1134) × 414 × 290 × 136	
	Drawout type	3 poles	889 × 480 × 375 × 123	
		4 poles	1019(1149) × 480 × 375 × 123	
Product weight Note 2) (kg)	Fixed type	3 poles	141	148
		4 poles	159(179)	166(188)
	Drawout type	3 poles	194	208
		4 poles	223(247)	238(269)
	Cradle only	3 poles	98	107
		4 poles	113(127)	121(138)

Note 1) d dimensions: it is connected vertically.
Note 2) Weight (reference value) when an electronic trip relay is attached. It does not include any other accessories.

● Fixed type

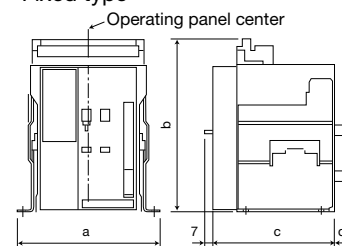


Fig. 5-2

● Drawout type

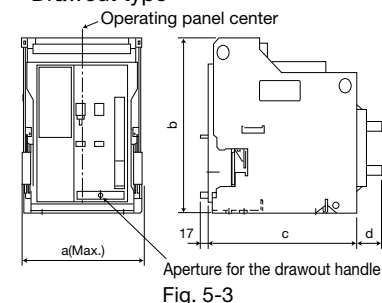


Fig. 5-3

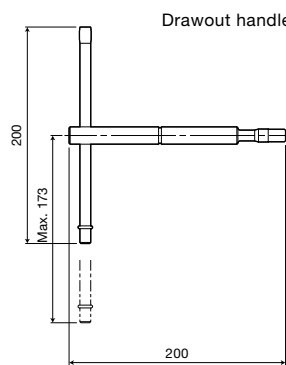


Fig. 5-4

Unpacking

- ① Make sure that the packing case is free from any abnormality such as being broken and/or wet.
- ② Check the indication on the package and the rated nameplate of the breaker, and confirm that it matches your order.
Serial number is indicated on the rated nameplate and on the cradle nameplate (Fig. 5-1②).

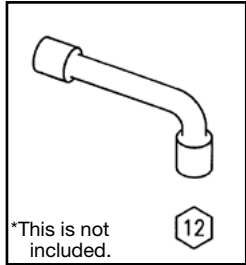


Fig. 6-1

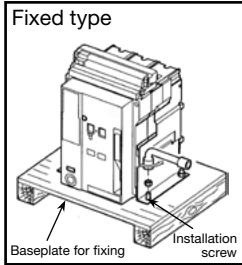


Fig. 6-2

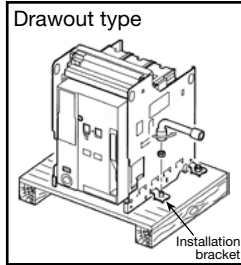


Fig. 6-3

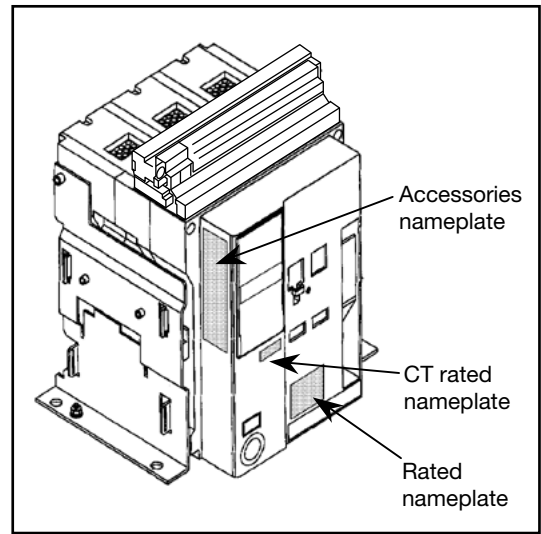


Fig. 6-4

Storage

* If this product is used after being stored for more than 6 years, maintenance is required including lubrication etc. before operation. Please contact our representative office.

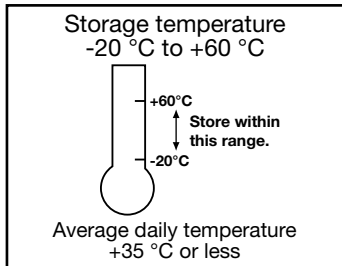


Fig. 6-5

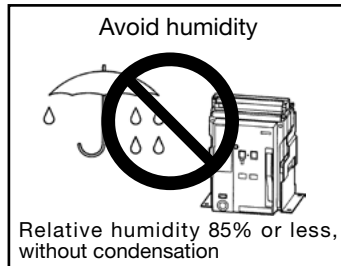


Fig. 6-6

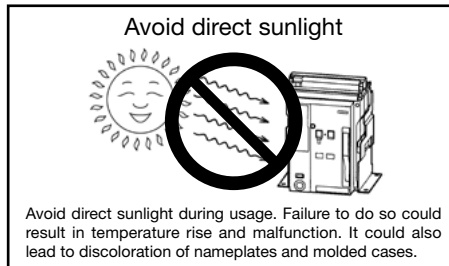


Fig. 6-7

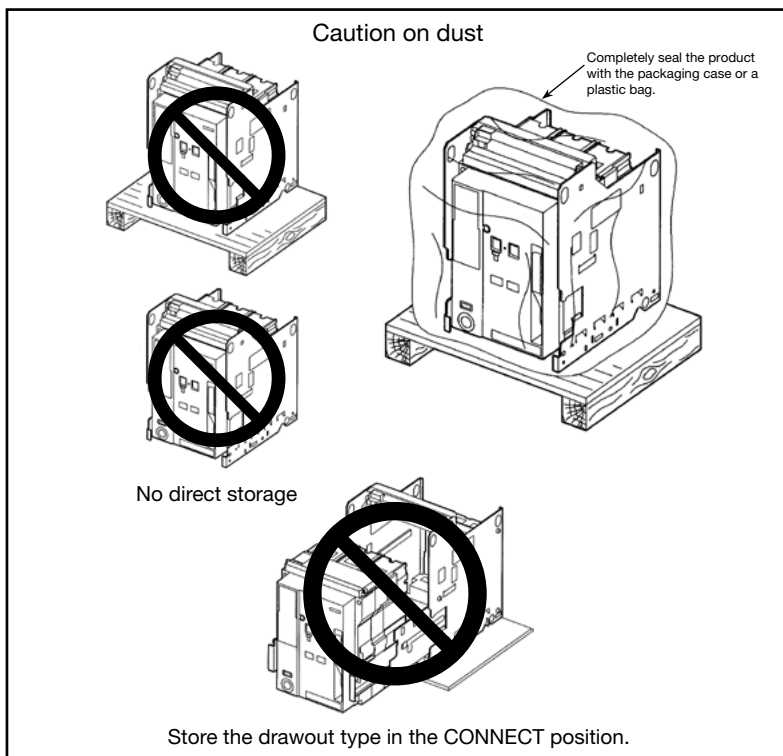


Fig. 6-8

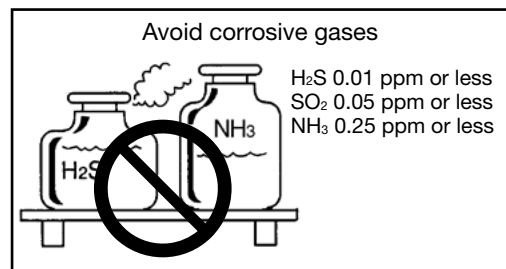


Fig. 6-9

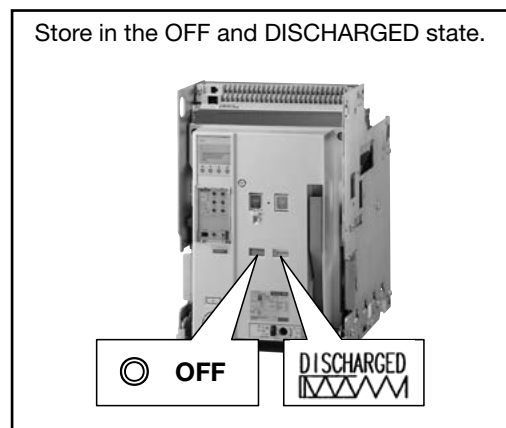


Fig. 6-10

Transportation

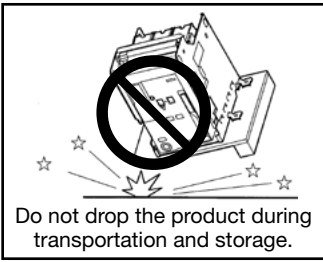


Fig. 7-1

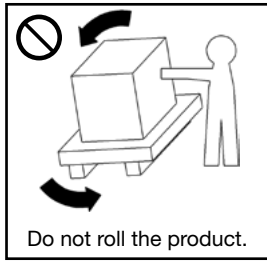
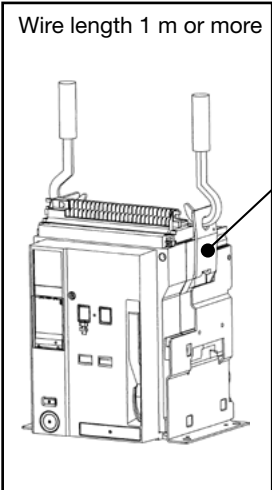


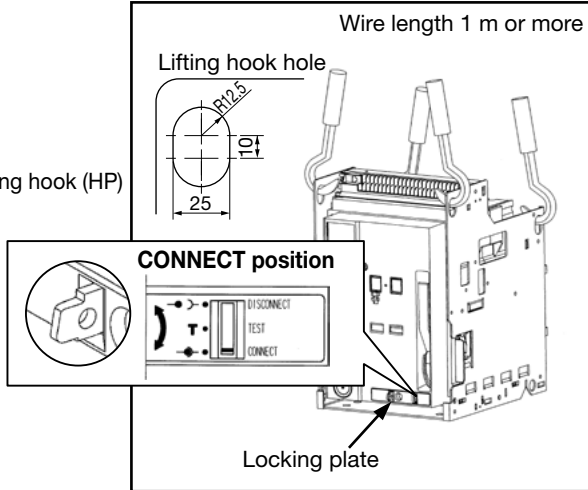
Fig. 7-2



Fixed type

Fig. 7-3

Take caution not to scratch the control circuit terminal block when lifting the product with the lifting hook (HP). Securely attach the lifting hook (HP) so that they will not come off during transportation.



Drawout type

Fig. 7-4

When transporting the product with its cradle attached, check that the lock plate is protruded in the CONNECT position. Do not use anything else but the lifting holes.

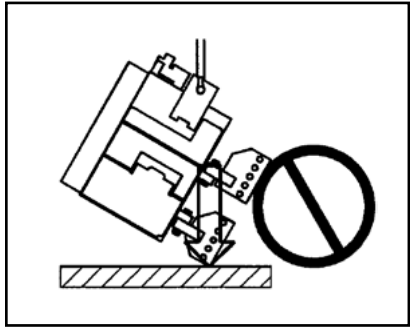


Fig. 7-5

Since the conductors side is heavy, be careful not to give an impact to the product and the conductors when landing the product.

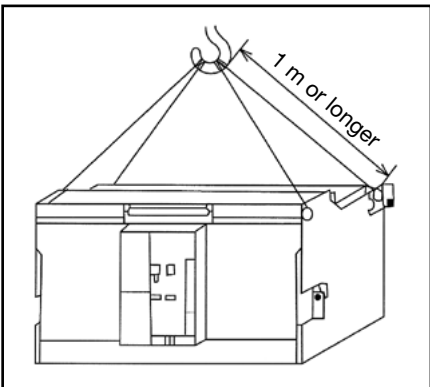


Fig. 7-6

When transporting a drawout type breaker (AE4000-SW ~ AE6300-SW), be sure to use 4 wires with a length of 1 m or longer, or a lifter.

Installation

< Drawout type >

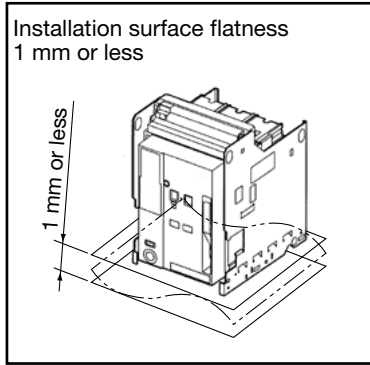


Fig. 8-1

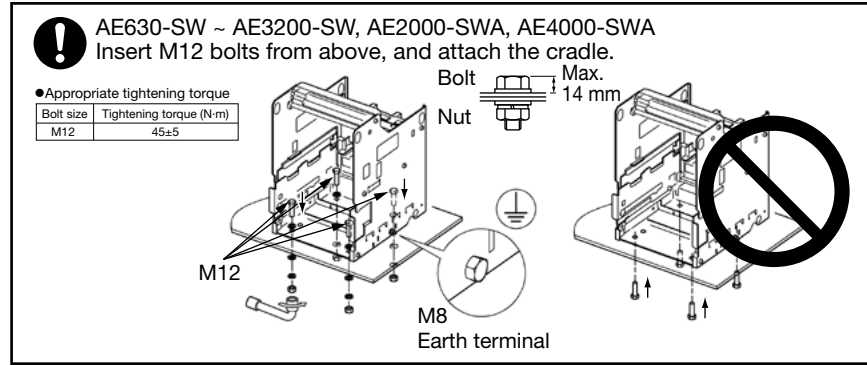


Fig. 8-2

For AE4000-SW ~ AE6300-SW 3-pole and 4-pole (HN) products, insert four M12 bolts from the bottom and two from the back and attach the cradle as shown in Fig. 8-3. For the 4-pole (FN)* products, insert six M12 bolts from the bottom and two from the back and attach the cradle as shown in Fig. 8-4.

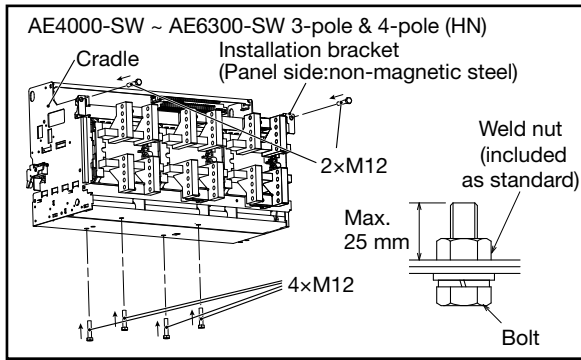


Fig. 8-3

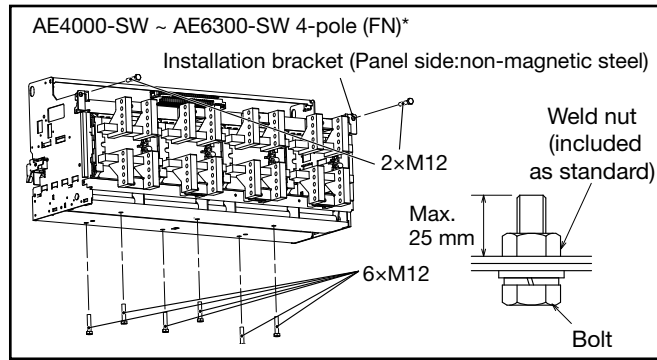


Fig. 8-4

*4-pole product (FN): 4-pole product of which neutral poles have the same current capacity as the other poles.

Perform drawout operation (connect position to drawout position) as instructed. (Refer to P.14 and 15)

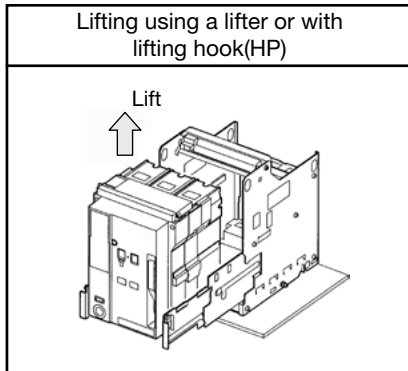


Fig. 8-5

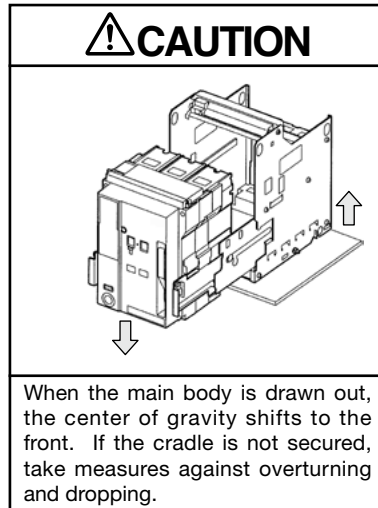


Fig. 8-6

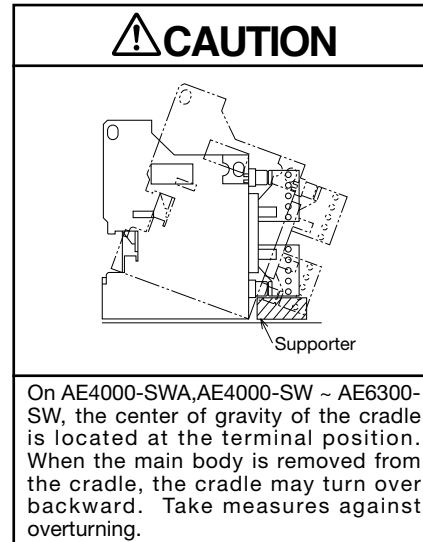


Fig. 8-7

< Fixed type >

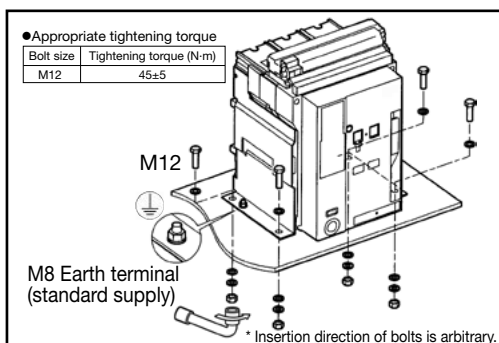


Fig. 8-8

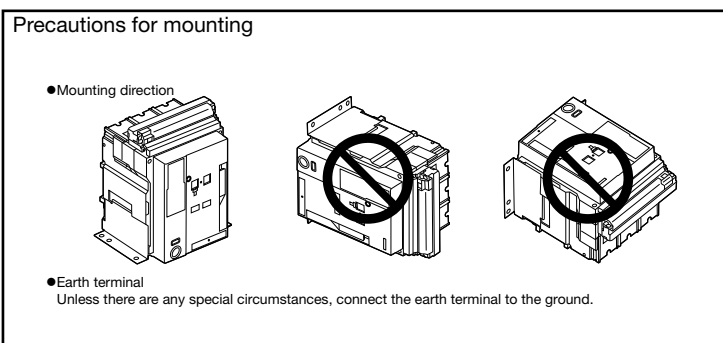


Fig. 8-9

Installation of the drawout handle

The drawout handle can be installed either onto the right or left of the cradle as required. A drawout handle, installation bracket, installation screws, and hexagon nuts are provided with the breaker.

● Installation onto the left side

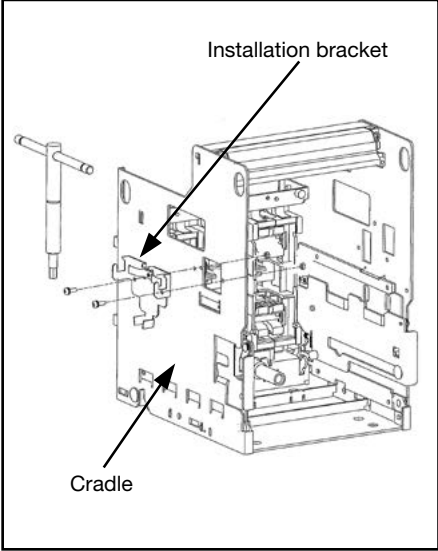


Fig. 9-1

● Installation onto the right side

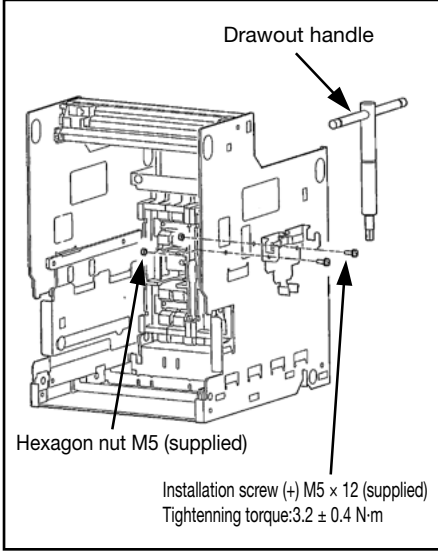
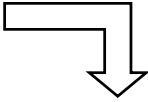


Fig. 9-2



Note) When a mechanical interlock (MI) or door interlock (DI) is attached, the drawout handle cannot be installed onto the right side of the cradle.

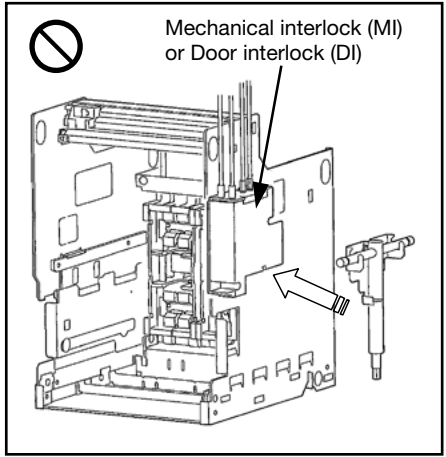


Fig. 9-3

Installation of the inter-phase barrier (BA)

Insert in the slot on the breaker. (Refer to Fig. 9-4 and Fig. 9-5)

< Fixed type >

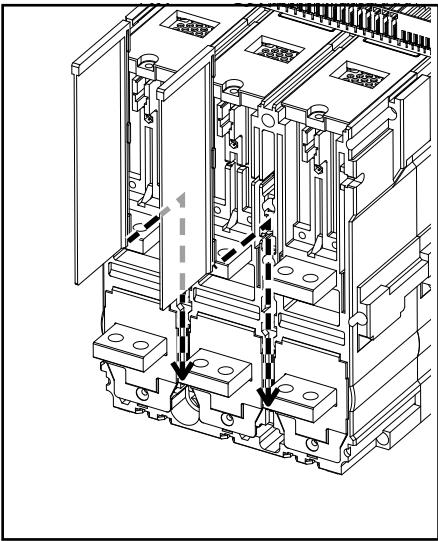


Fig. 9-4

< Drawout type >

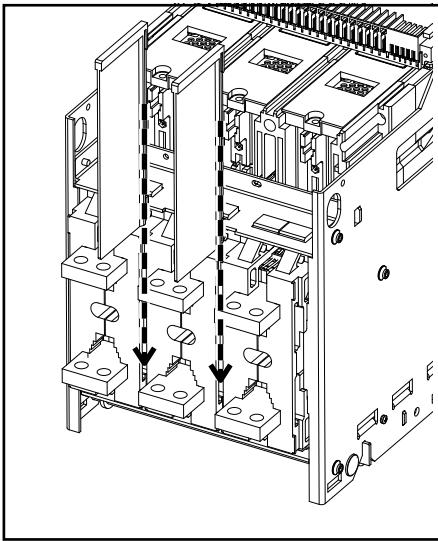


Fig. 9-5

Connection

Use M12 screws (made of copper), spring washers, and small washers to connect to the conductors.
Clean the contact surface and securely tighten the screws with a appropriate torque.

The connecting area on main circuit terminal of the breaker is different depending on the shape of the breaker's terminal.
Refer to the outline dimensions in the catalog.

■ Main circuit

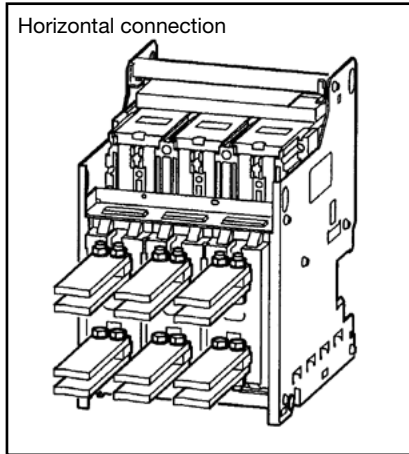


Fig. 10-1

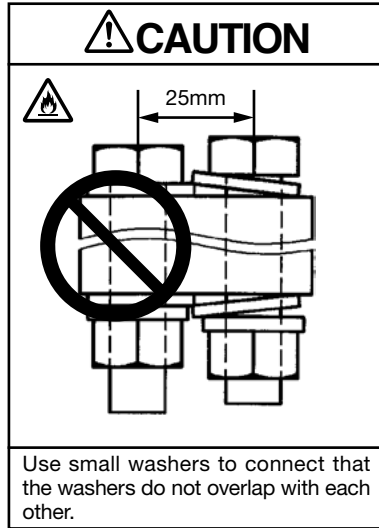


Fig. 10-2

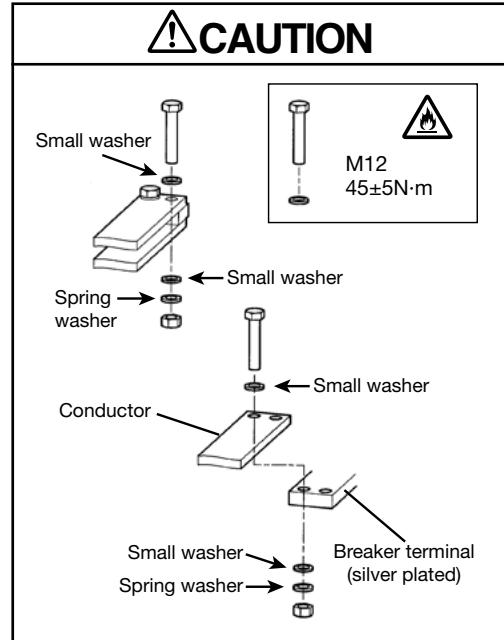


Fig. 10-3

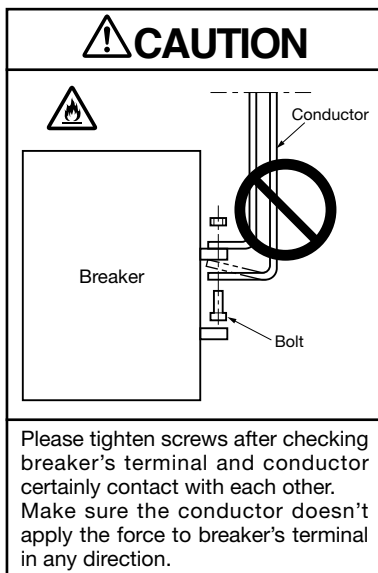


Fig. 10-4

CAUTION Appropriate tightening torque for conductor connection

Bolt size	Tightening torque (N·m)
M12	45±5

Keep an insulation distance between the conductors to be connected according to the standard of the panel.

Since fault current flowing through the conductors causes large electromagnetic forces, the conductors should be secured firmly, using the values in the below table as a reference. Max. distance between fixing support and breaker bus bar should be less than 200mm.

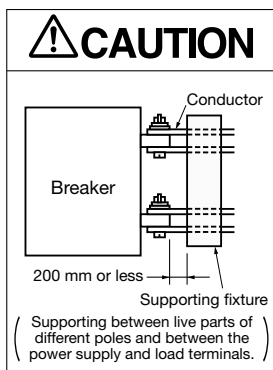


Fig. 11-1

Table 11-1 Electromagnetic force per 1 m of conductor (in the case of three phase short circuit) (N/m)

Type	AE630-SW - AE1600-SW	AE2000-SWA		AE2000-SW - AE3200-SW	AE4000-SWA				AE4000-SW - AE6300-SW
		3 poles	4 poles		Drawout type		Fixed type		
					3 poles	4 poles	3 poles	4 poles	
Conductor distance (mm)	85	115	105	130	190	170	152	145	262
Prospective fault current kA (pf)									
30(0.2)	7700	5700	6300	5100	3500	3900	4300	4500	2500
42(0.2)	15100	11200	12200	9900	6800	7600	8500	8900	5000
50(0.2)	21400	15800	17300	14000	9600	10700	12000	12600	7000
65(0.2)	36100	26700	29300	23600	16200	18100	20200	21200	11800
75(0.2)	-	-	-	31500	21500	24100	26900	28200	15800
85(0.2)	-	-	-	40400	27600	30900	34500	36200	20000
100(0.2)	-	-	-	-	-	-	-	-	27800
130(0.2)	-	-	-	-	-	-	-	-	47000

When selecting conductors to be connected to the breakers, ensure that they have a sufficient current capacity. Refer to the right table.

Table 11-2 Conductor size
(IEC 60947-1, Ambient Temp. 40 °C, Open air)

Rated current MAX (A)	Conductor to be connected (copper)			
	Quantity	Conductor size (mm)	Arrangement	
630	2	40 x 5	Vertical	
1000	2	60 x 5		
1250	2	80 x 5		
1600	2	100 x 5		
2000	3	100 x 5		
2500	4	100 x 5		
3200*1	3	100 x 10		
	2	150 x 10		
4000 (AE4000-SWA drawout type)	4	150 x 10		
4000 (AE4000-SWA fixed type)	3	150 x 10		
4000 (AE4000-SW)	4	100 x 10		
5000	4	150 x 10		
6300	4	200 x 10		

(Note) Table 11-2 shows the conductor size that is indicated in IEC 60947-1 with an ambient temperature of 40 °C and in an open air environment. Fig. 11-2 shows the testing conditions.

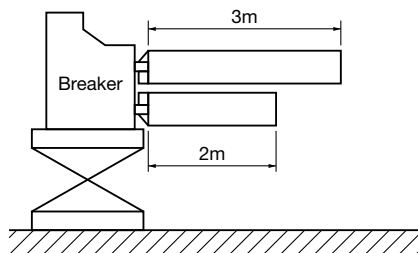


Fig. 11-2

*1 For 3200 A, connect a conductor which is sized for 3150 A.
For 3200 A or higher, there is no specification by IEC (IEC 60947-1). (Specification by the manufacturer)

■ Control circuit terminal block

! Tightening with excessive torque above the specification may cause damages of terminals and screws.
Be sure to tighten with the specified torque.
After removing screws, make sure not to tighten the screws diagonally.
Be careful not to apply excessive tension to the wirings.
Use a cross-head screwdriver with a diameter that matches the cross-shaped groove.
M3.5..... No. 2

Control circuit terminal block
Applicable crimp-type terminals

Applicable crimp-type terminals for M3.5 screws with an outer diameter of 7.2 mm or less. (Wire size 1.25 mm² ~ 2.0 mm²)

A = 7.2 mm or less

Fig. 11-3

Fig. 11-4

Crossover wiring

Fig. 11-5

Insert operation

■ DRAWOUT position→CONNECT position

- ① Pull the lock lever toward you (step 1), unhook the lock lever from the cradle, and then pull out the extension rail (step 2).

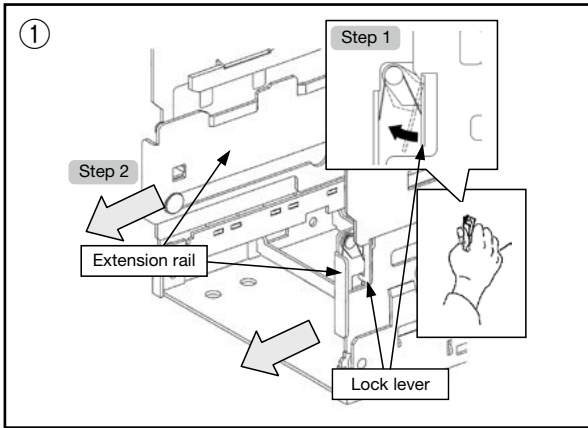


Fig. 12-1

- ③ With the extension rail pulled out to the furthest position, slowly push the breaker in until you hear the clicking sound when it does not move. When inserting the breaker from the DRAWOUT position to the DISCONNECT position, be sure to do so evenly on the right and left sides. (Do not forcefully push the right or left terminal area only.) If it is uneven (if the breaker is inserted diagonally), it does not go in smoothly. For a breaker installed in an elevated location, perform this operation with two people.

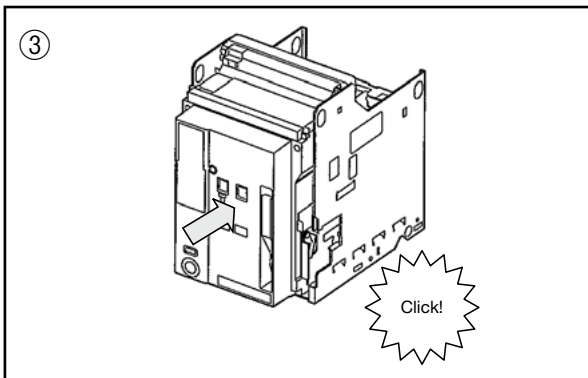


Fig. 12-3

- ④ Insert the drawout handle while pressing the OFF button. Check that the drawout position indicator indicates DISCONNECT (Fig. 12-7).

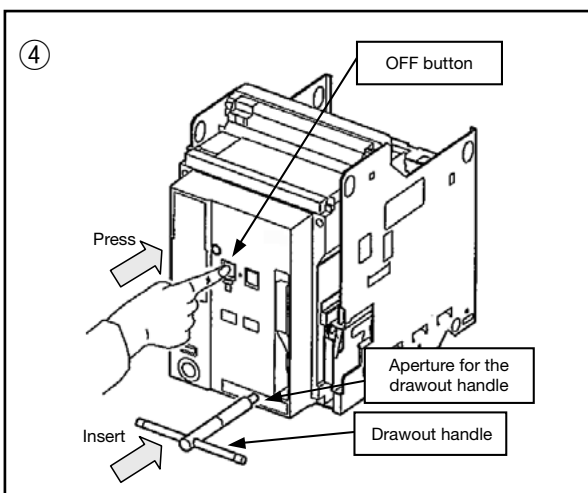


Fig. 12-6

- ② With the extension rail pulled out to the furthest position, lift the breaker once by using a lifter or dedicated lifting hook (HP), and then lower the breaker down onto the drawout rail. Place the dent of the breaker onto the notch of the drawout rail. (Fig. 12-5)

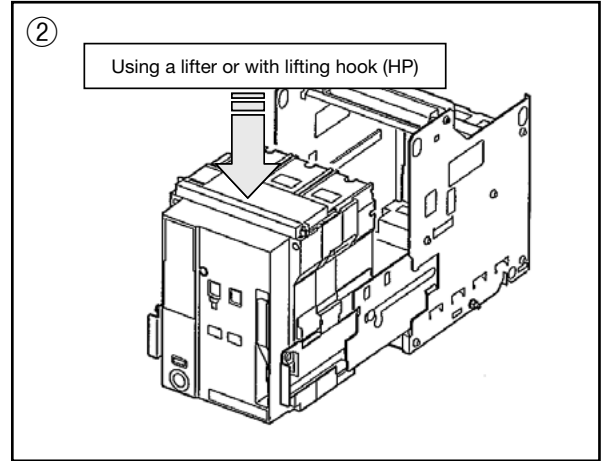


Fig. 12-2

⚠ CAUTION

Drop

If the breaker is placed on the rail while the cradle is not secured, the center of gravity shifts forward. Be sure to take preventative measures against the unit tipping over.

Fig. 12-4

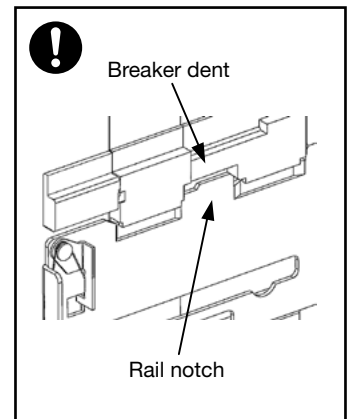


Fig. 12-5

⚠ CAUTION

Pinched finger

When placing the breaker in the panel, take care not to hurt your fingers or hands with the in-panel structure.

DISCONNECT position

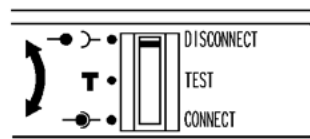


Fig. 12-7

- ⊘ (Prohibition)** Do not insert the drawout handle without pressing the OFF button. When inserting or pulling out the drawout handle or during operation, be sure to place the drawout handle straight into the Aperture for the drawout handle. Failure to do so could result in breakage.

⑤ Press in the lock plate until it clicks onto the latch, and unlock.



(Caution)

- (a) If unlocking the lock plate feels difficult, slightly rotate the drawout handles to the right or left.
- (b) Be sure to push in the lock plate to the unlock position. The position indicator may not operate correctly.

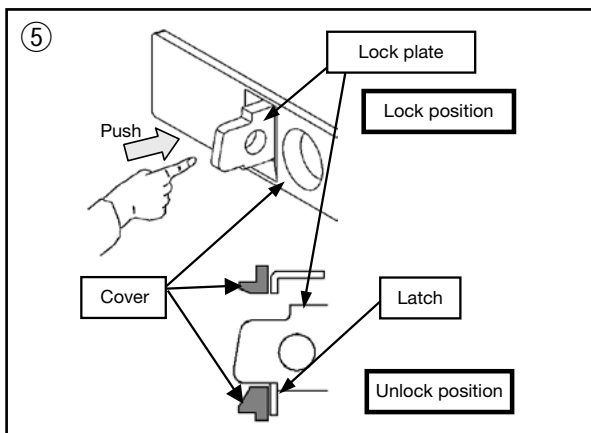


Fig. 13-1

⑥ Unlock, release your hands from the lock plate, and rotate the drawout handle clockwise.



(Caution)

- Do not draw out during the insert operation. The drawout position may not be indicated correctly. If that is the case, pull out the breaker to the DISCONNECT position once, and then retry the insert operation.

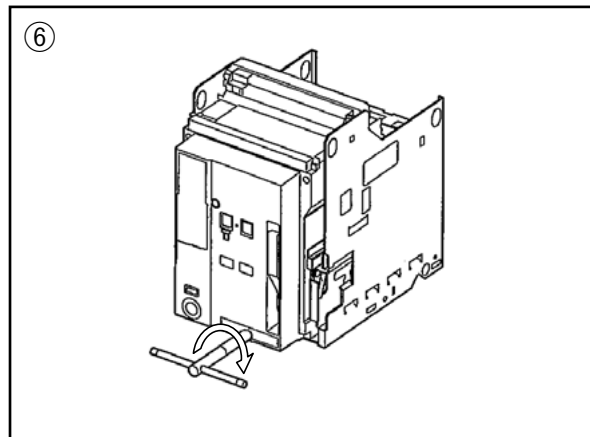


Fig. 13-2

⑦ When the breaker is inserted to the testing position, the drawout position indicator shows TEST position, and the lock plate is protruded automatically, locking the drawout handle rotation.



(Caution)

- Do not rotate the drawout handle while the lock plate is protruded.

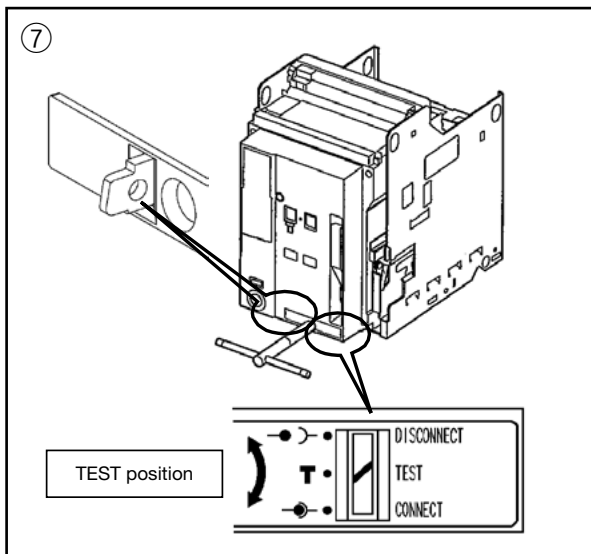


Fig. 13-3

⑧ Insert the lock plate, and rotate the drawout handle clockwise. When the breaker is inserted to the CONNECT position, the lock plate is protruded automatically, completing the insert operation. At this time, the drawout position indicator shows the CONNECT position. For all breaker types, the operation load becomes heavy during operation from the TEST position to the CONNECT position or at the main circuit junction insertion position, but this is not a fault.

⚠ CAUTION

Be sure to insert until the lock plate is protruded. If it is not protruded, the connection may be incomplete.



(Caution)

- (a) After completing the insertion, do not rotate the drawout handle.
- (b) The drawout position indicator shows the position (CONNECT, TEST) when the lock plate is protruded. When the lock plate is unlocked, it shows a reference position.
- (c) The breaker cannot be closed with the drawout handle inserted.

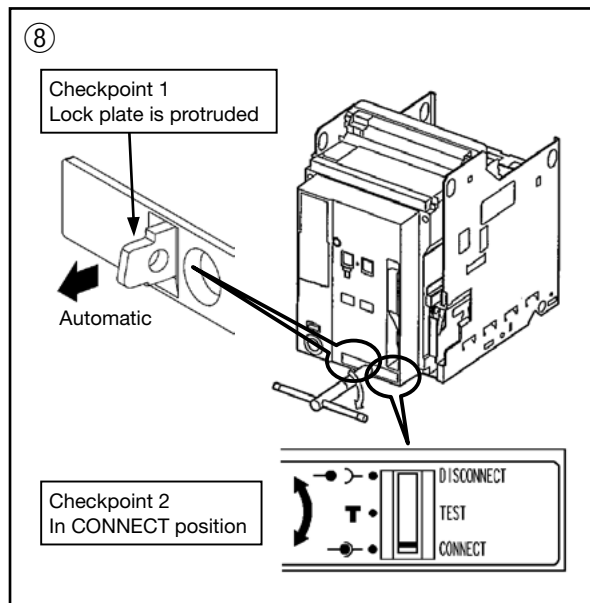


Fig. 13-4

⑨ For AE4000-SW ~ AE6300-SW, always tighten the fixing bolts on both sides of the cradle as shown in Table 13-5, and securely fix the breaker.

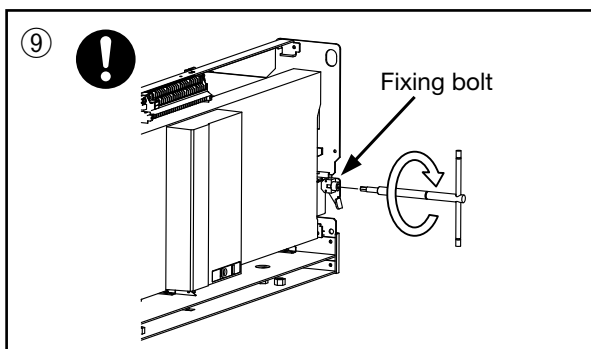


Fig. 13-5

Drawout operation

CONNECT position → DRAWOUT position

- For AE4000-SW ~ AE6300-SW, unfasten the two fixing bolts on both sides of the cradle, and unlock. If drawout is performed without unlocking, the cradle and the drawout mechanism may be damaged. (Fig. 14-1)

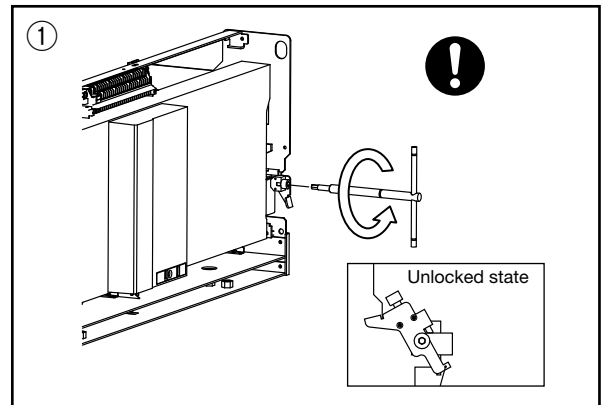


Fig. 14-1

- Insert the drawout handle while pushing the OFF button.

CONNECT position

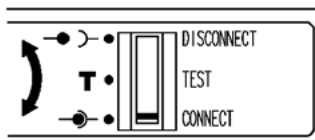


Fig. 14-2

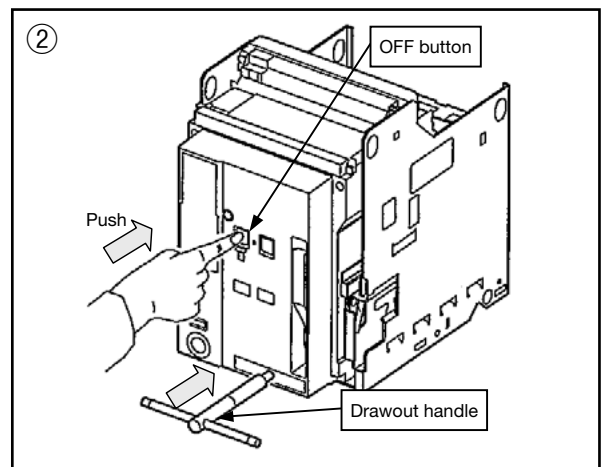


Fig. 14-3



(Prohibition)

Do not insert the drawout handle without pressing the OFF button. Failure to do so could result in breakage.

- Push in the lock plate until it clicks onto the latch, and unlock.



(Caution)

- If unlocking the lock plate feels difficult, slightly rotate the drawout handles to the right or left.
- Be sure to press in the lock plate to the unlock position. The position indicator may not operate correctly.

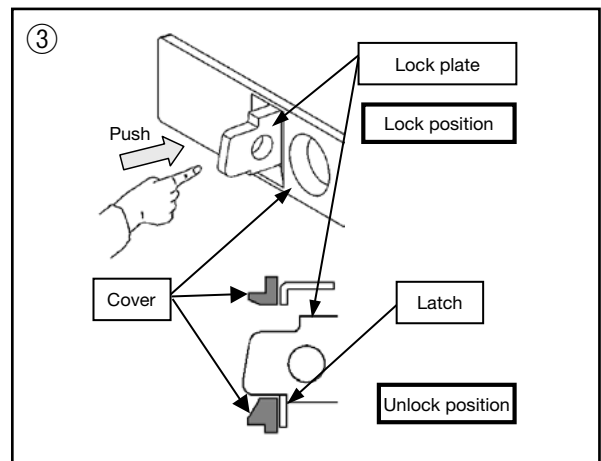


Fig. 14-4

- Unlock, release your hands from the lock plate, and rotate the drawout handle counterclockwise.



(Caution)

Do not insert during the drawout operation. The drawout position may not be indicated correctly. To perform the insert operation, pull out the breaker to the DISCONNECT position once, and then retry the insert operation. When transitioning from the CONNECT position to the TEST position, and when the breaker terminals are detached from the main circuit junction, the operation may feel light, but this is not a fault.

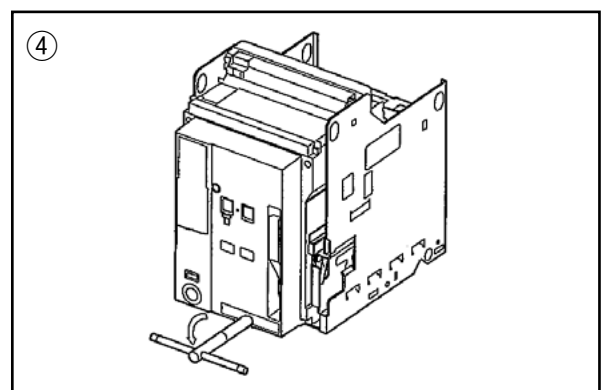


Fig. 14-5

- ⑤ When the breaker is drawn out to the TEST position, the drawout position indicator shows TEST position, and the lock plate is protruded automatically, locking the drawout handle rotation.



(Caution)

Do not rotate the drawout handle while the lock plate is protruded.

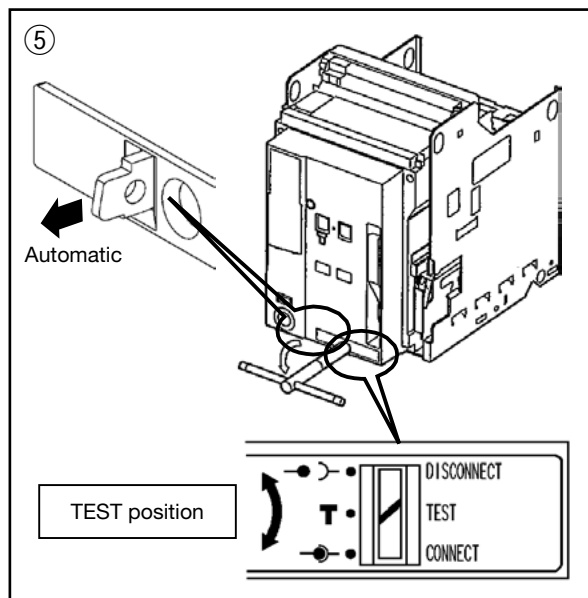


Fig. 15-1

- ⑥ Next, insert the locking plate and rotate the handle counterclockwise until the drawout position indicator shows DISCONNECT and the breaker does not move. Drawout operation is now completed. The breaker can be pulled out using both hands.



(Caution)

- (a) The lock plate sometimes gets protruded before reaching the DISCONNECT position. If that is the case, push in the lock plate to stay in the unlocked state, and continue rotating the handle.
- (b) If unlocking the lock plate feels difficult, slightly rotate the drawout handles to the right and left.
- (c) At the DISCONNECT position the drawout handle may spin around without the lock plate being protruded.

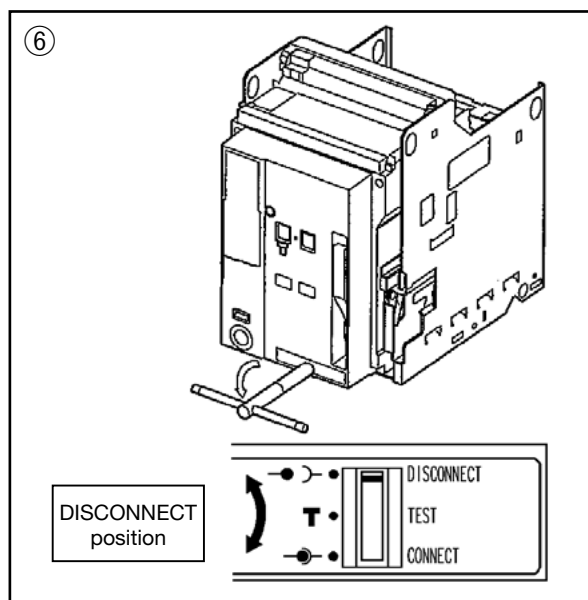


Fig. 15-2

- ⑦ To detach the breaker from the cradle, pull the lock lever toward you, unhook, pull out the extension rail evenly on the right and left side, and then pull out the breaker.

! CAUTION

Drop

By pulling the breaker, the center of gravity shifts forward. Be sure to take preventative measures against a fall or drop when the cradle is not secured.

! CAUTION

Pinched finger

When pulling out the breaker, take care not to hurt your fingers or hands with the in-panel structure.

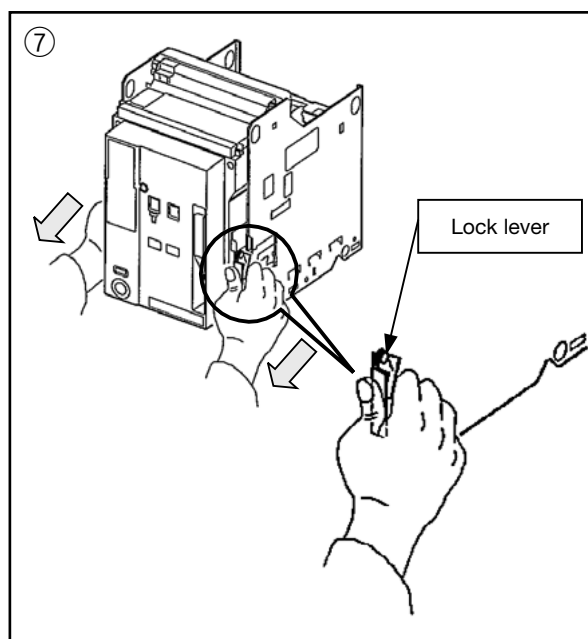


Fig. 15-4

Fig. 15-3

- ⑧ When pulling out the breaker, be sure to do so evenly on the right and left sides.
 (Do not forcefully pull the right or left area only.)
 If it is uneven (if the breaker is coming out diagonally), it does not come out smoothly.
 For a breaker installed in an elevated location, perform this operation with two people.

(Caution)
 AE4000-SWA and AE4000-SW ~ AE6300-SW have their cradle center of gravity on their terminal areas. Be sure to take preventative measures against a fall or drop by installing a support for the cradle (Fig. 16-1).

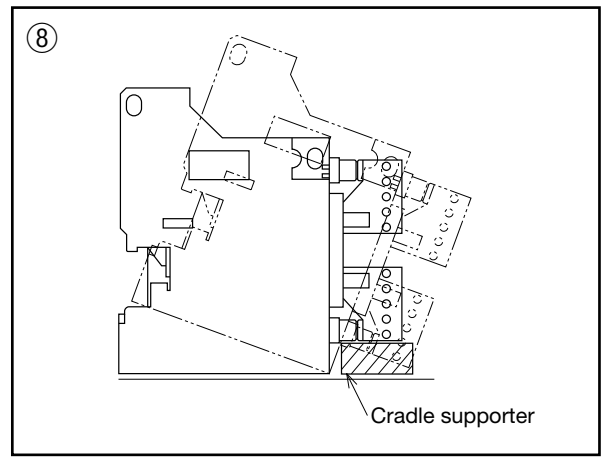


Fig. 16-1

Charging operation

< Manual charging >

Press the charging handle down at full stroke 7 or 8 times until a click sounds. (It is completion when a charging handle becomes light.) Then, the closing spring will be fully charged. The charging indicator will show CHARGED.

(Caution)
 Do not forcefully press down the charging handle. Doing so could result in breakage.

Model	Charging operation power
AE630-SW ~ AE1600-SW, AE2000-SWA 3pole	30N·m
AE2000-SW ~ AE3200-SW, AE2000-SWA 4pole, AE4000-SWA AE4000-SW ~ AE6300-SW	40N·m

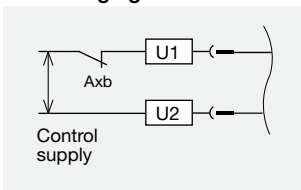
* Values in the tables are reference values.

< Motor charging (MD) > Option

The closing spring is charged by an electric motor. When the breaker is closed, the spring is charged automatically (ON-charge method).

- Manual charging operation is also possible using the charging handle.
- Although the charging motor has a short time rating it can be continuously operated for up to ten times.
- Since the charging complete switch is separate from the motor charging circuit, the sequence can be arranged as required.

OFF charging method



OFF charging method is also available. The closing spring is charged automatically when the breaker is opened. This is available only by externally connecting b contact (Axb) of the auxiliary switch to the motor charging circuit in series. In case of DC power supply, please use high capacity auxiliary switch (HAX).

Polarity of DC circuit use

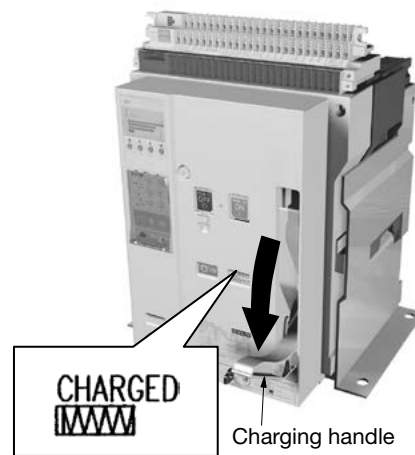
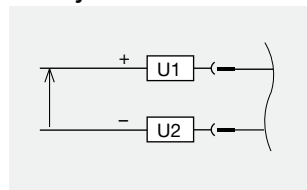


Fig. 16-2

Table 16-1 Motor charging rating

Rated voltage (V)	Applicable voltage range (V)	Applied voltage (V)	Inrush		Steady current (A)	Charging time (s)	Criterion for power requirement (VA, W)
			Current [Peak value] (A)	time (s)			
24DC	18 ~ 26.4	24	22	< 0.4	6	≤ 5	500
48DC	36 ~ 52.8	48	14	< 0.4	3		700
100-125 AC/DC	85 ~ 137.5	100	10(10)	AC: < 0.45	3(4)		1000
		125	12(12)	DC: < 0.25	3(4)		700
200-250 AC/DC	170 ~ 275	200	5(7)	AC: < 0.45	1(2)	1000	
		250	6(8)	DC: < 0.25	1(2)		

Note1) Values in parentheses show values for AE4000-SWA 4 pole and AE4000-SW ~ AE6300-SW.
 Note2) We cannot manufacture AE4000-SWA 4 pole and AE4000-SW ~ AE6300-SW in 24V DC and 48V DC rating.

Note3) When choosing from the power supply capacity required to perform motor charging, make sure that its voltage after a voltage drop at power input is still within the applicable voltage range.

Note4) These values are for reference, not guaranteed values.

Note5) Common use for 50 and 60Hz in AC.

Motor charging circuit diagram

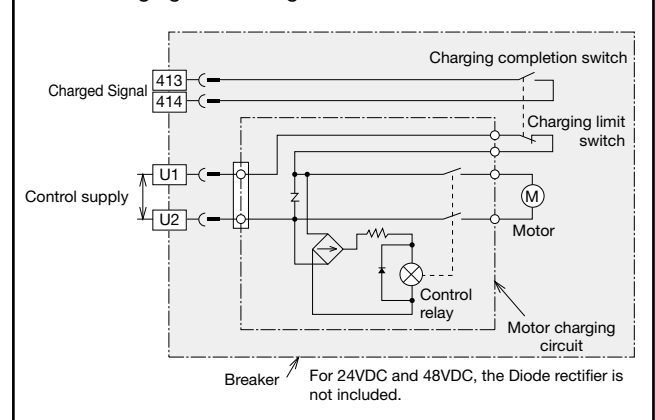


Fig. 16-3

Open/close operation

< Conditions for closing operation >

ON operation becomes available when the following conditions are met.

- The breaker is OFF condition.
- The closing spring is charged.
The charging indicator shows “CHARGED”.
- The state without OFF operations.
 - Without SHT operation
 - Without mechanical lock (Padlock, Cylinder lock, Mechanical interlock etc.)
 - UVT controller power is supplied and no operation with trip terminals.
 - The manual reset button is being reset

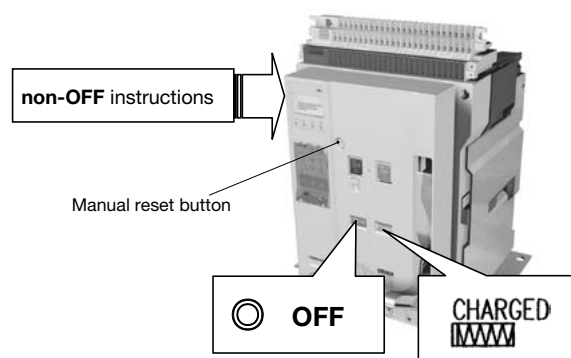


Fig. 17-1

Manual open/close operation

< Closing >

Push the ON button, the breaker will close. The ON/OFF indicator will show “ON”, and the charging indicator will show “DISCHARGED”. Operating force is less than 50N.



(Caution)

When an OFF locking device (padlock, cylinder lock, etc.) is being used, release the lock, and then perform the closing operation.

When closing or opening a drawout type breaker at the CONNECT or TEST position, do so with the locking plate protruded.

When an undervoltage trip device (UVT) is equipped, wait 1.5 sec. after applying the rated voltage before closing the breaker.

To perform the ON operation, check that the drawout position indicator shows “CHARGED” before pressing the ON button. (Fig. 17-2)

* If undervoltage tripping device (UVT) is UVT with a-contact, wait for 1.8 sec. Instead of 1.5 sec.

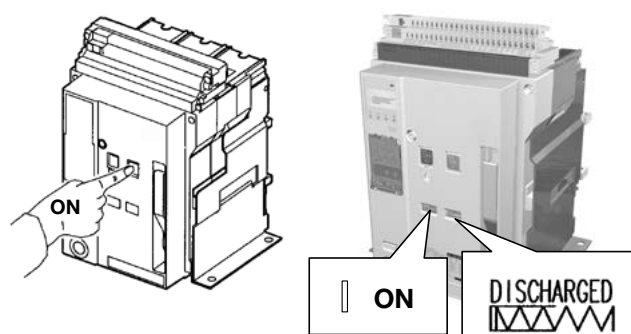


Fig. 17-2

< Opening >

Push the OFF button, the breaker will be opened and the ON/OFF indicator will show “OFF”. Operating force is less than 50N.

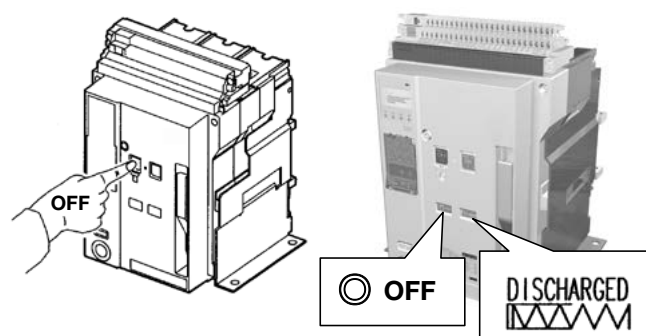


Fig. 17-3

Electric open/close operation

< Closing >

Opening operation can be performed electrically by using a closing coil (CC). By applying the rated voltage to **A1** and **A2** on the control circuit terminal block, the breaker can be closed.

The pumping preventing relay that performs only one operation with one input command is built in.

To close again, turn OFF the closing coil control supply (between **A1** and **A2**) once, and apply the rated voltage again. For a closing command to CC, wait at least a 0.5 sec. interval after completing charging and turning OFF the breaker.



(Caution)

For a closing command to CC after completing charging, wait at least a 0.5 sec. interval. If a closing command is given within 0.5 sec. after charging completion, the design life of the opening/closing operation may be shortened.

In some cases, the breaker does not close by a closing command given within 0.5 sec. after a manual OFF operation or an OFF operation by SHT.

When an undervoltage trip device (UVT) is equipped, the breaker does not close unless the power supply is applied. (After applying the control supply to UVT, wait 1.5 sec. for the closing operation to become available.)

If undervoltage tripping device (UVT) is UVT with a-contact, wait for 1.8 sec. Instead of 1.5 sec.

< Opening >

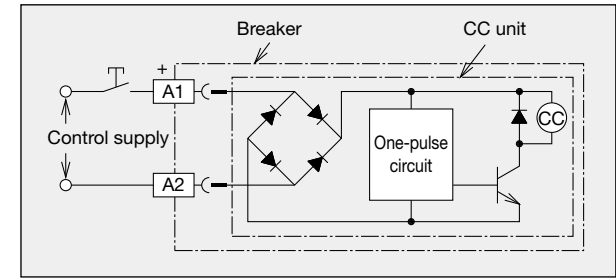
Opening operation can be performed electrically by using a shunt trip device (SHT) or undervoltage trip device (UVT).

For SHT, apply a rated voltage to **C1** and **C2** of the control circuit terminal block.

For UVT, open between the trip terminals **DT1** and **DT2** of the control circuit terminal block. (A short-circuit bar is equipped when shipped from the factory. Remove this before using.)

Alternatively, turn OFF the voltage applied to **D1** and **D2**.

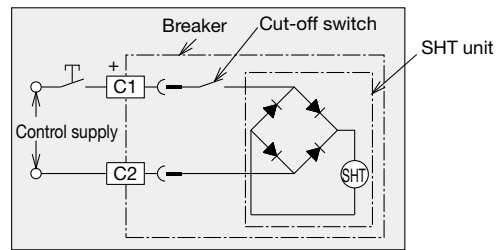
CC circuit diagram



Note) The 24 V DC to 48 V DC models are not equipped with rectifier circuits.

Fig. 18-1

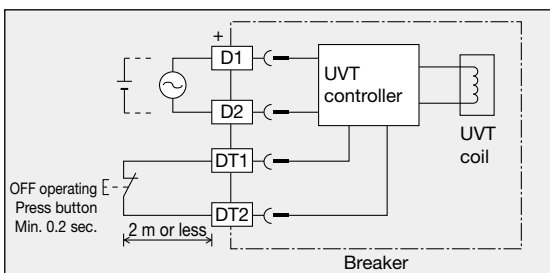
SHT circuit diagram



Note) The 24 V DC to 48 V DC models are not equipped with rectifier circuits.

Fig. 18-2

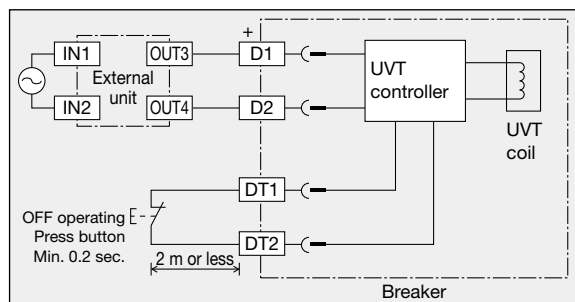
UVT circuit diagram (with the 100 to 120 V AC, 200 to 240 V AC, or DC spec. models)



Note) For the rating of the OFF operation press button switch, use one for 150 V DC and 0.5 A or higher.

Fig. 18-3

UVT circuit diagram (with the 380 to 460 V AC models)



Note) For the rating of the OFF operation press button switch, use one for 150 V DC and 0.5 A or higher. The external unit is dedicated to AE-SW. Only one UVT controller can be connected to one external unit.

Fig. 18-4

Door interlock (DI)

< Procedures for releasing the door interlock >

Interlocks can be manually released even if the breaker is in the ON state.
 For this, make a hole of $\phi 7$ or larger in the panel door. (Refer to Fig. 19-1)
 For the details such as installation and adjustment methods, check the instruction manual provided with the door interlock.

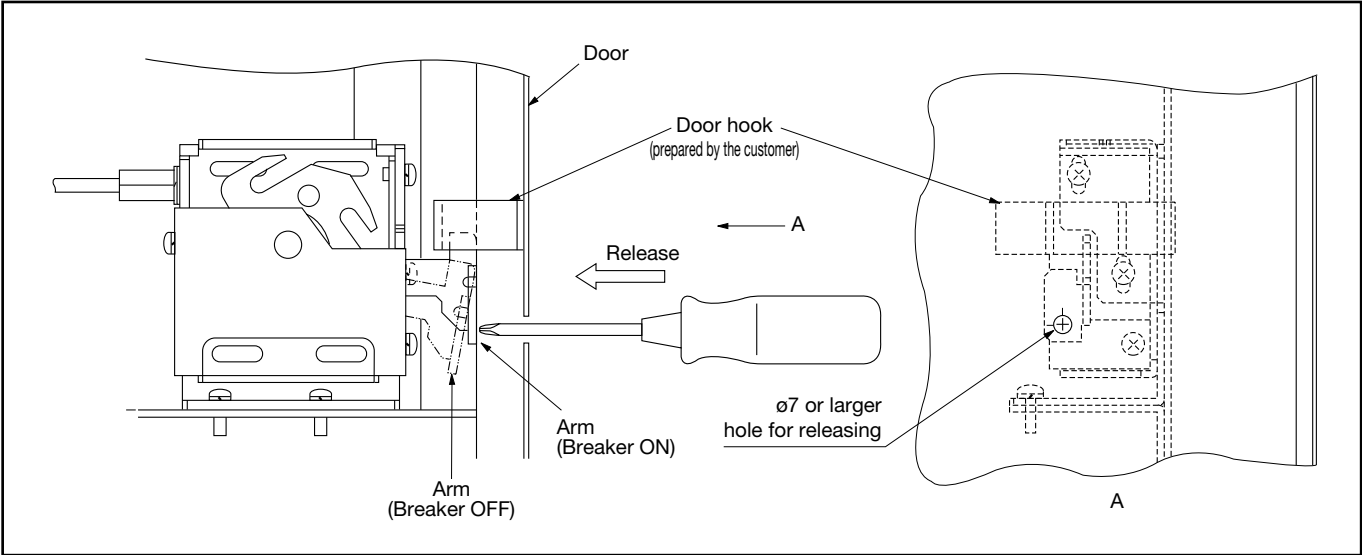


Fig. 19-1

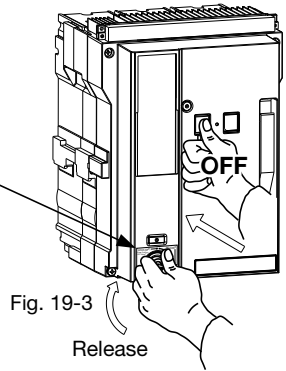
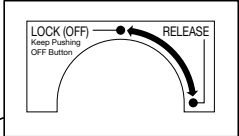
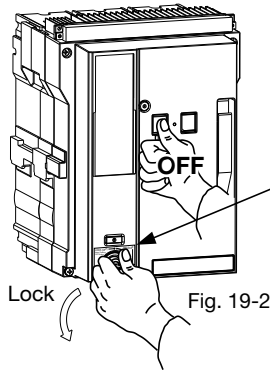
Cylinder lock (CYL) and Castell lock (CAL)

< OFF lock procedures >

Press the OFF button to turn off the breaker.
 Turn the key counterclockwise while pressing the OFF button to lock the OFF state. Then, you can remove the key. (Fig. 19-2)

< Releasing procedure >

Insert the key and rotate it clockwise.
 If the key is stiff to rotate, push down the OFF button and rotate the key clockwise. (Fig. 19-3)
 The key cannot be removed in the released state.



OCR alarm (AL) [MRE: manual reset type]

When the breaker is tripped, the OCR alarm (AL) is continuously output.
 After the breaker is tripped, press the manual reset button, which is located in front of the breaker, to reset.
 Without a reset, the breaker cannot be turned ON.

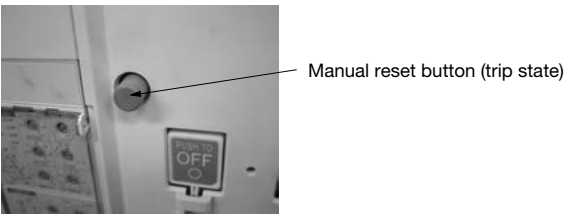


Fig. 19-4

Shutter lock (SST-LOCK)

When pulling out a breaker equipped with a safety shutter (SST) from the cradle, its safety shutter can be locked in the closing position so that the live parts cannot be touched. A padlock (shackle diameter $\varnothing 5$ or less) is provided by the customer.

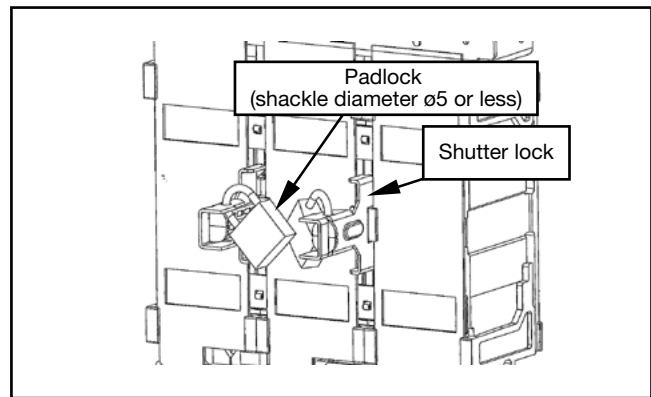


Fig. 20-1

Safety shutter nameplate

Please refer to the example below when using the safety shutter nameplates "BUSBARS" and "CABLES," which are enclosed with the safety shutter (SST).

(Fig. 20-2)

Remove debris and dust from the safety shutter before adhering the nameplate.

(BUSBARS: Line side, CABLES: Load side)

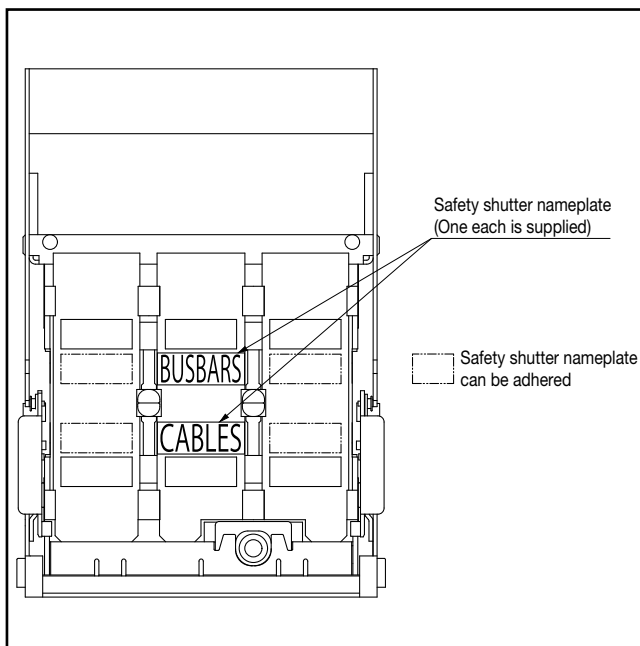


Fig. 20-2

Functions of electronic trip relay (ETR) parts

< Function description of each part >

- ① ERR. LED, contact output
 When any abnormality or setting failure is found in the ETR, this provides a notification of the abnormal status. When the power supply type is P3 ~ P5, contact output is given between [513] and [574] on the control circuit terminal block.
 - Functional abnormality in ETR (microprocessor, H/W)
 - Incorrect setting (mis-setting of Int/MCR)
 - Abnormality in in-breaker wiring related to ETR
- ② RUN LED (ETR)
 ETR indicates the operable state. If the control power supply is applied, or when approx. 10% of the rated current flows to the main circuit, the internal circuit is activated, turning on this LED.
- ③ RUN LED (option setting module) [Option]
 This indicates that the option setting module is in an operable state. If the control power supply is applied, or when approx. 10% of the rated current flows to the main circuit, the internal circuit is activated, turning on this LED.
- ④ Trip cause indicator (LED, contact output) [Option]
 The cause of a trip is indicated by LED. When the power supply type is P3 ~ P5, a contact output is given between [513] (common) and [524], [534], [544], or [554] on the control circuit terminal block. PAL LED will blink when the current exceeds the pre-alarm current setting (I_p), and will be lit after 1/2 of the LTD time is passed. At this time, the contact output will also be made.

- ⑤ TAL LED, contact output [Option]
 The ETR temperature detector becomes operable when a TAL sensor is installed. When the power supply type is P3 ~ P5, a contact output is given between [513] and [564] on the control circuit terminal block. When the temperature drops, the output will be reset. To retain the output, use an external sequence.
- ⑥ MCR (Making-current release) [Option]
 The setting can be switched between the instantaneous current (INST) and MCR functional current (MCR). In the MCR setting, INST characteristic is enabled from the time of breaker closing (OFF to ON), and after closing, the INST characteristic becomes disabled. If specified at the time of ordering, an MCR switch is built in to the breaker. When shipped from the factory, this is set to the INST side.(Fig. 21-2)
- ⑦ RESET button
 To reset the trip cause indicator (LED, contact output), use the "RESET" button in front of ETR, or short-circuit [RS1] and [RS2] on the control circuit terminal block for 0.5 seconds or longer. (The power supply type P1 and P2 are not provided with the function to reset from the control circuit terminal block.) There is also a function to temporarily lock LTD and STD to test the INST characteristic by using a dedicated field testing device. (For operating instructions, refer to the instruction manual of the tester.)

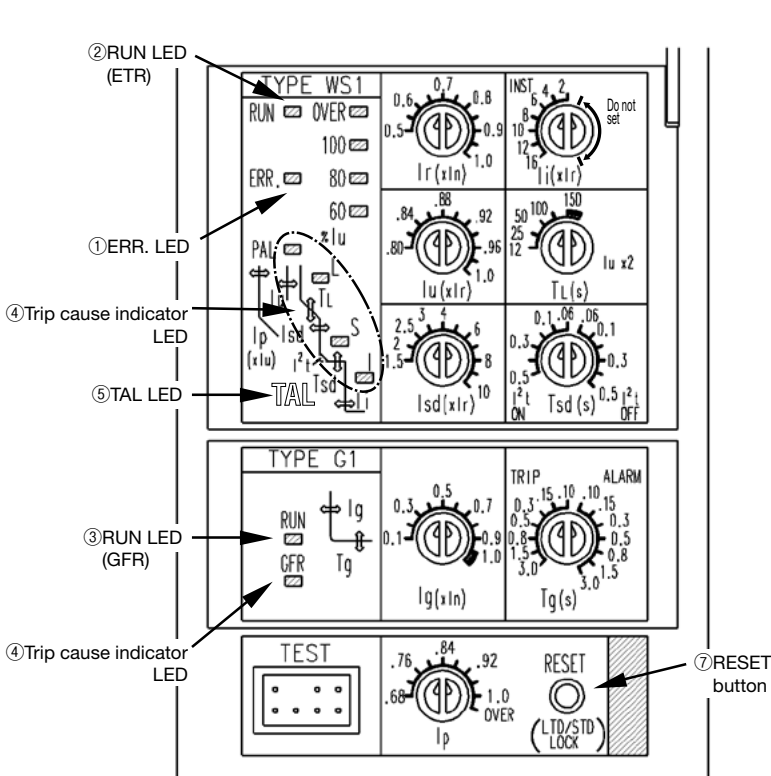


Fig. 21-1 Example) WS1G1

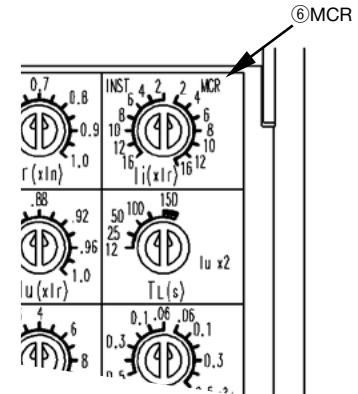


Fig. 21-2

For the display (including measuring functions) and interface unit, see the separate instruction manual.

< Load current indicator LED >

The current value, which is used as a reference by the load current indicator LED, varies depending on the applications and relay types.

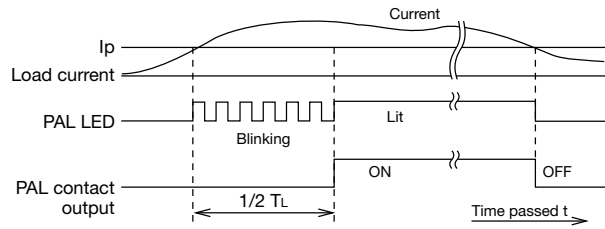
Table 22-1

Application classification	Relay type	Reference current for LED display	LED display
General use	WS (WS1) (WS2) (WS3)	I _u Uninterrupted current	OVER ■
			100 ■ 80 ■ 60 ■ %I _u
Generator protection	WM (WM1) (WM2) (WM3)	I _L LTD pick-up current	100 ■ 80 ■ 60 ■ 40 ■ %I _L
Special purpose	WB (WB1) (WB2) (WB3)	I _r Rated current setting	OVER ■ 100 ■ 80 ■ 60 ■ %I _r
Protection coordination	WF (WF1) (WF2) (WF3)	I _r Rated current setting	OVER ■ 100 ■ 80 ■ 60 ■ %I _r

Note) When the "OVER" LED of WS, WB, or WF type or the "100%" LED of WM type is lit, the current value is over the uninterrupted current. The breaker will trip after the ETR set time is passed.

< Pre-alarm operation >

PAL LED will blink when the current exceeds the pre-alarm current setting (I_p), and will be lit after 1/2 of the long time lag (T_L) is passed. The power supply type P3 to P5 will also perform a contact output. For the operation time period, refer to the characteristic curve.



< Control power supply >

This is required for the trip cause indicator (LED, contact output), the measurement extension module, displays, etc. Over-current and short-circuit protection is performed by the power supply CT energy, even if the control power supply is not available.

Power supply type	Rated voltage (V)	Applicable voltage range (V)	Criterion for power requirement (VA)	Alarm output contacts
P1	100-240 AC/DC	85-264 AC/DC	15	-
P2	24-60 DC	18-72 DC	10	-
P3	100-240 AC 100-125 DC	85-264 AC 85-138 DC	15	6 contacts
P4	24-60 DC	18-72 DC	10	6 contacts
P5	100-240 DC	85-264 DC	15	6 non-contacts (SSR)

- (1) Overcurrent protection is powered by the CT, which is built into the breaker. It is operable regardless of the external power supply. Ground fault protection (GFR) is also operable at 0.2 to 1.0 rated current (I_n) settings, regardless of the control power supply.
- (2) 6 contact outputs are set as below.

①LTD	②STD/INST	③G1/E1/AP	④PAL	⑤TAL	⑥ERR.
Self-hold type	Self-hold type	See the table below.	Auto-reset type	Auto-reset type	Auto-reset type

Dial setting	G1	E1	AP
TRIP side	Self-hold type	Self-hold type	-
ALARM side	Auto-reset type	Auto-reset type	Auto-reset type

Self-hold type...The output state is held until it is reset.
Auto-reset type...Output is reset upon returning to the normal condition.

→ Contact capacity (power supply type P3, P4)

Voltage (V)		Current (A)	
		Resistance load	Induction load
		cosφ=1.0	cosφ=0.4 L/R=0.7
AC (50/60 Hz)	240	1	0.5
	120	1	1
DC	125	0.1	0.05
	30	1	1

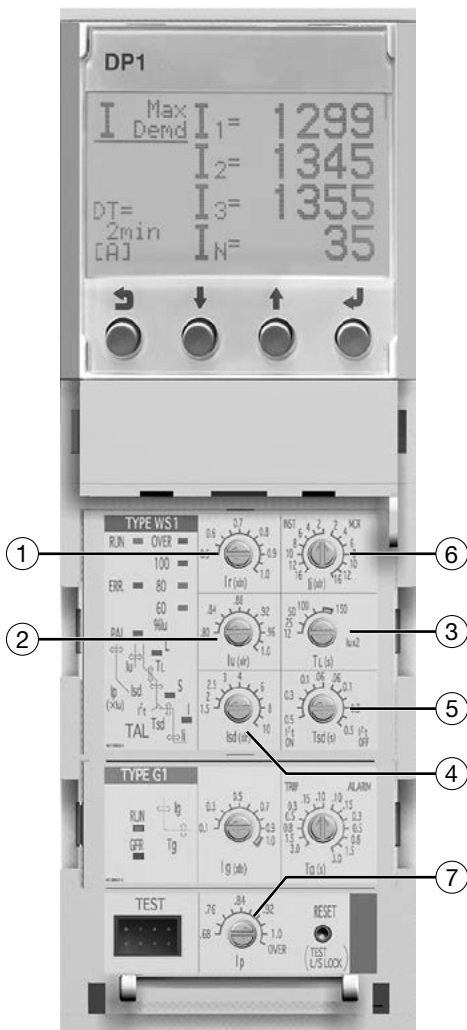
→ Current capacity (power supply type P5)

Voltage (V)		Steady current (A)	Permissible peak current at open/close (A)	ON resistance (Ω)
				(Max.)
AC (50/60 Hz)	240	0.1	0.3	5
	120	0.1	0.3	5
DC	240	0.1	0.3	5
	30	0.1	0.3	5

CAUTION

With the power supply types P3 and P4, high-sensitivity relays are used for contact outputs. Because of that, contact outputs may trigger chattering noise (approx. 1 ms of mis-outputs) at breaker opening/closing in some panel installation conditions. When using the product in a fast-response sequence, install a filtering circuit of a few milliseconds or perform double reading of samples.

Characteristics setting for the WS type



Note) The figure shows a model with an optional G1 setting module, a display, and an MCR switch.

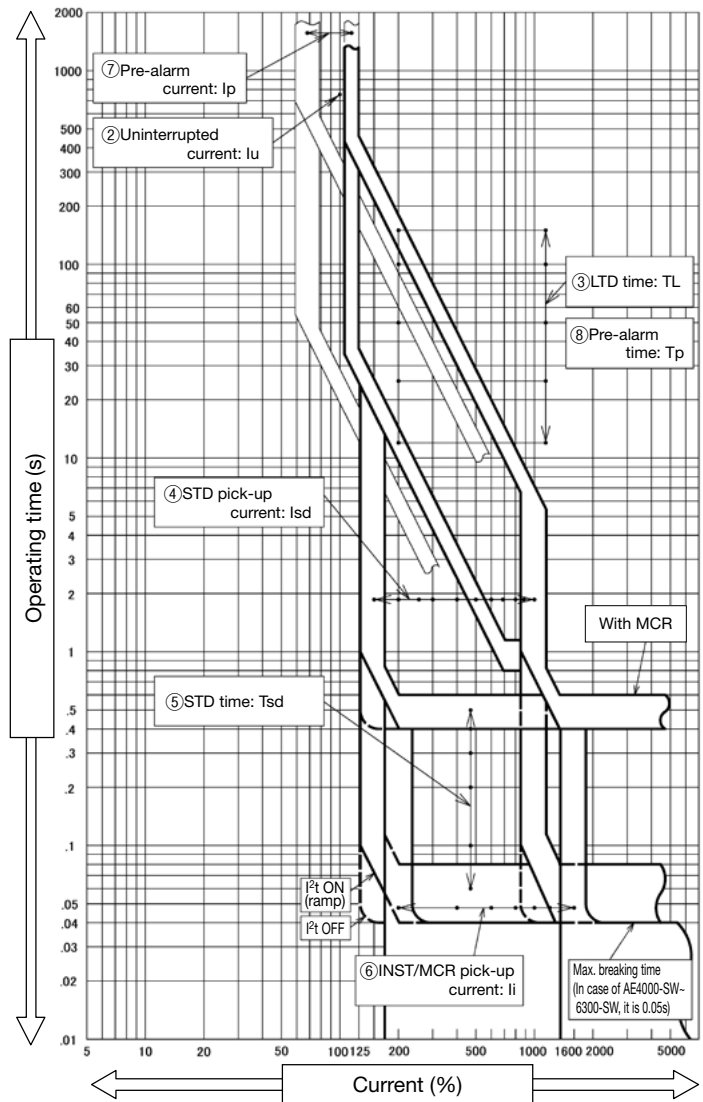


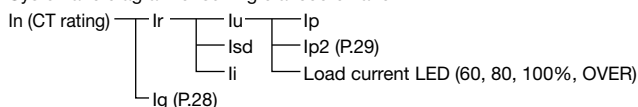
Table 23

No.	Setting item	Symbol	Characteristic setting range	Accuracy	Factory default value
①	Rated current	Ir	0.5 to 1.0 (0.05 step) x In (CT rating)	—	1.0
②	Uninterrupted current	Iu	0.8 to 1.0 x Ir (0.02 step), pick-up current: 1.15 x Iu	1.05 x Iu Pick up not performed 1.25 x Iu Pick up performed	1.0
③	LTD time	Tl	12-25-50-100-150s at Iu x 2	±20%	150
④	STD pick-up current	Istd	1.5-2-2.5-3-4-5-6-7-8-9-10 x Ir	±15%	10
⑤	STD time	Tsd	0.5-0.4-0.3-0.2-0.1-0.06-0.06-0.1-0.2-0.3-0.4-0.5s (I²t ON) (I²t OFF) at Istd x 1.5	±20% It operates in the range between 0.04 and 0.08s when the time set at 0.06s.	0.5 (I²t ON)
⑥	INST/MCR pick-up current	Ii	AE630-SW ~ AE1600-SW: 16-12-10-8-6-4-2-2-4-6-8-10-12-16 x Ir (INST) (MCR) [WS1] AE2000-SWA, AE4000-SWA: 12-10-8-6-4-2-2-4-6-8-10-12 x Ir (INST) (MCR) [WS2] AE5000-SW: 10-8-6-4-2-2-4-6-8-10 x Ir (INST) (MCR) [WS3] AE6300-SW	±15%	WS1...16 (INST) WS2...12 (INST) WS3...10 (INST)
⑦	Pre-alarm current	Ip	Iu x 0.68 to 1.0 (0.04 step)-OVER	±10%	OVER
⑧	Pre-alarm time	Tp	1/2 Tl at Iu x 2 (PAL contact output after passing 1/2 of Tl)	±20%	—

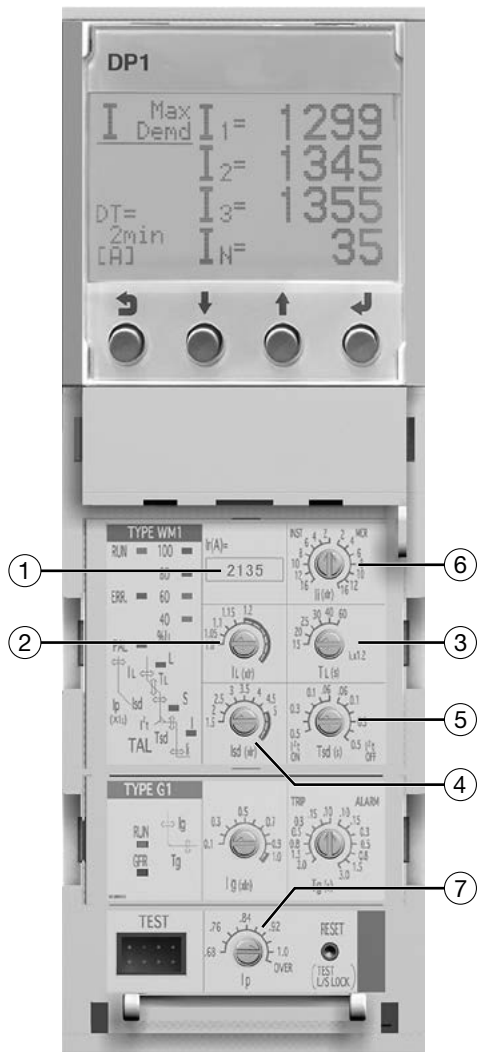
Remark (1) For WS relay, Pre-alarm current "OVER" setting is Iu x 1.15.

Remark (2) The table shows data obtained on the breakers provided with MCR (optional).

Systematic diagram of setting dial coordination



Characteristics setting for the WM type



Note) The figure shows a model with an optional G1 setting module, a display, and an MCR switch.

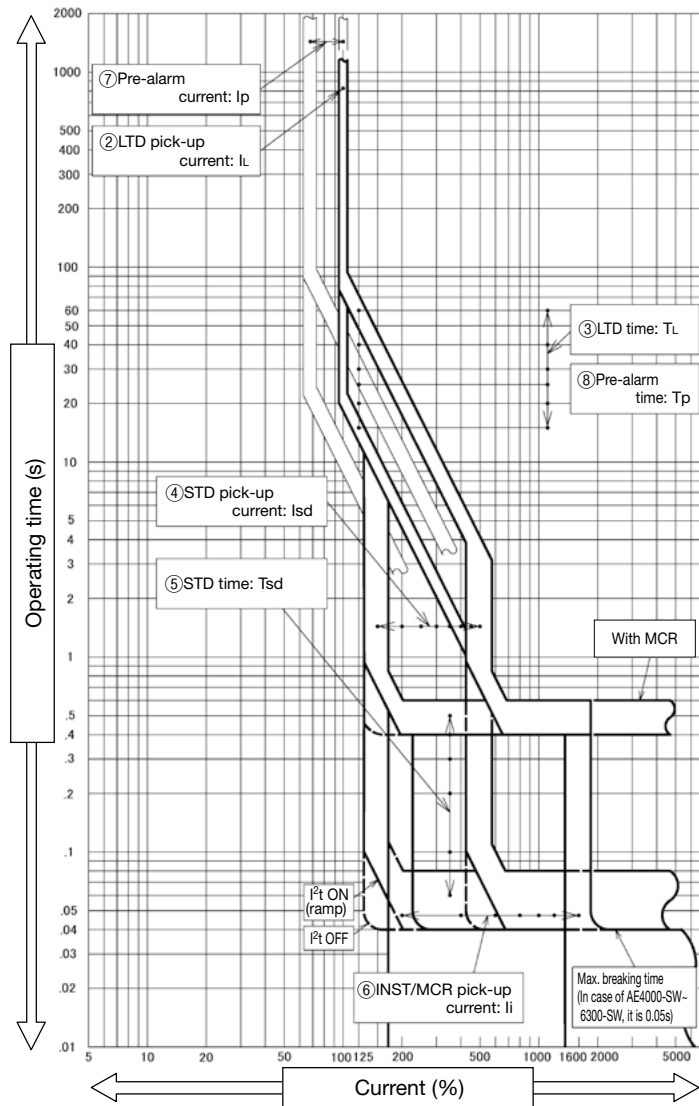


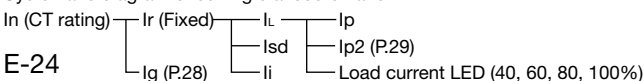
Table 24

No.	Setting item	Symbol	Characteristic setting range	Accuracy	Factory default value	
①	Rated current	I_r	Set to the specified value at the factory ^{Note 1)}	—	To be complied with ordering indication	
②	LTD pick-up current	I_L	1.0-1.05-1.1-1.15-1.2 x I_r	±5%	1.15	
③	LTD time	T_L	15-20-25-30-40-60s at $I_L \times 1.2$	±20%	20	
④	STD pick-up current	I_{sd}	1.5-2-2.5-3-3.5-4-4.5-5 x I_r	±15%	5	
⑤	STD time	T_{sd}	0.5-0.4-0.3-0.2-0.1-0.06-0.06-0.1-0.2-0.3-0.4-0.5s (I^2t ON) (I^2t OFF) at $I_{sd} \times 1.5$	±20% ^{Note 2)} It operates in the range between 0.04 and 0.08s when the time set at 0.06s.	0.5 (I^2t ON)	
⑥	INST/MCR pick-up current	I_i	AE630-SW ~ AE1600-SW AE2000-SW ~ AE3200-SW AE4000-SW	16-12-10-8-6-4-2-2-4-6-8-10-12-16 x I_r (INST) (MCR)	±15% ^{Note 2)}	WM1...16 (INST)
			AE2000-SWA, AE4000-SWA AE5000-SW	12-10-8-6-4-2-2-4-6-8-10-12 x I_r (INST) (MCR)		WM2...12 (INST)
			AE6300-SW	10-8-6-4-2-2-4-6-8-10 x I_r (INST) (MCR)		WM3...10 (INST)
⑦	Pre-alarm current	I_p	$I_L \times 0.68$ to 1.0 (0.04 step) -OVER	±5%	OVER	
⑧	Pre-alarm time	T_p	1/2 T_L at $I_L \times 1.2$ (PAL contact output after passing 1/2 of T_L)	±20%	—	

Remark (1) For WM relay only, when Pre-alarm current I_p is set a "OVER" the I_p value becomes equal to " $I_L \times 1.0$ ".

Remark (2) The table shows data obtained on the breakers provided with MCR (optional).

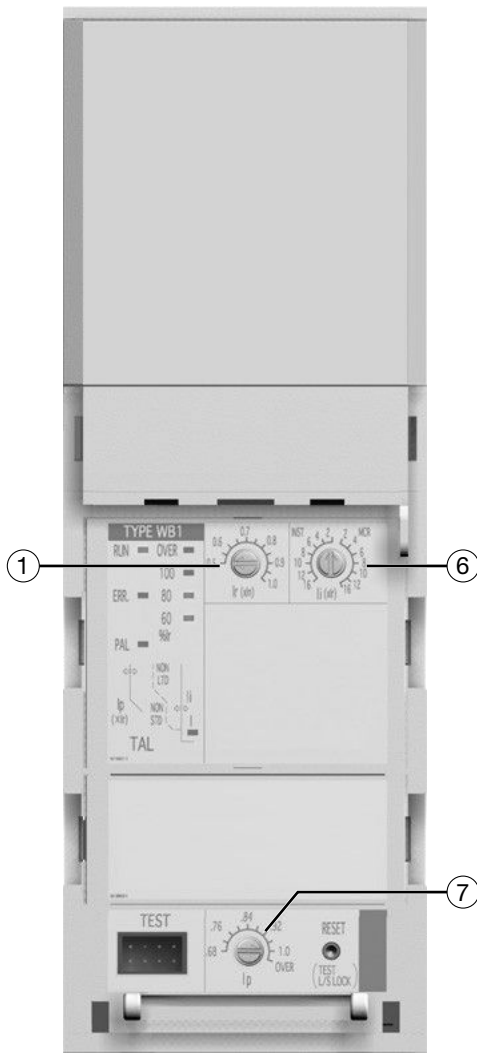
Systematic diagram of setting dial coordination



Note 1) CT rating 250 A and 315 A can be set in 0.1 A steps, and 500 A or higher can be set in 1 A steps.

Note 2) When used without voltage applied to the control power supply (ETR power supply module) T_{sd} , I_i operation time may increase max. 20ms.

Characteristics setting for the WB type



Note) The figure shows a model with an optional MCR switch.

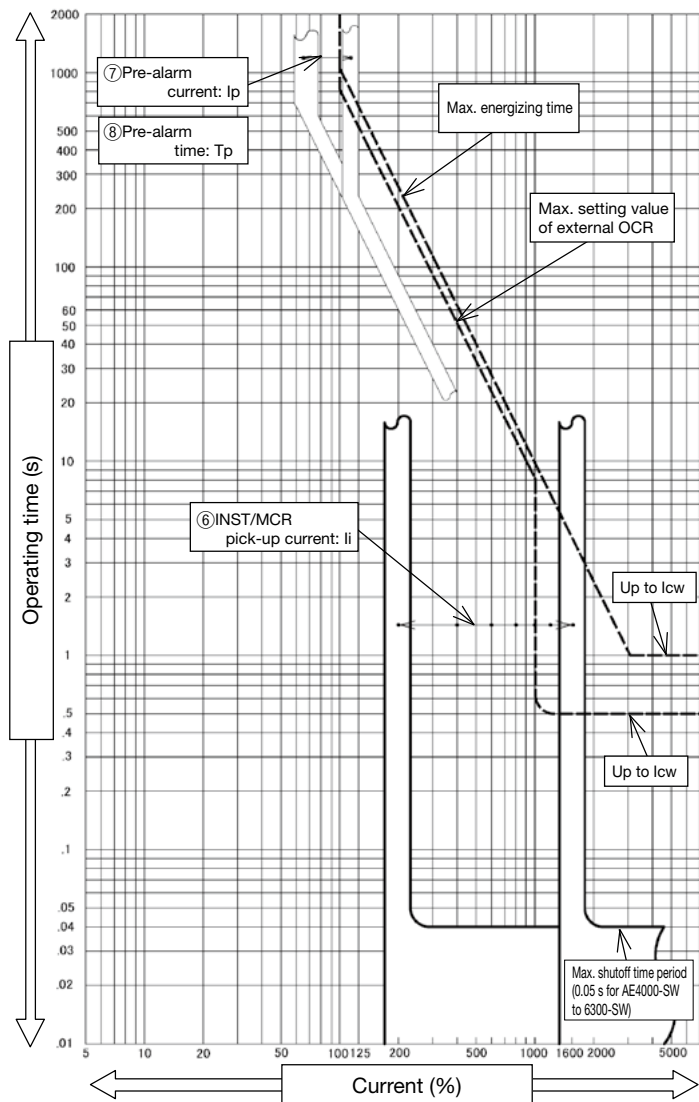


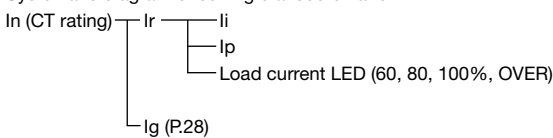
Table 25

No.	Setting item	Symbol	Characteristic setting range	Accuracy	Factory default value
①	Rated current	I _r	0.5 to 1.0 (0.05 step) x I _n (CT rating)	—	1.0
⑥	INST/MCR pick-up current	I _i	AE630-SW ~ AE1600-SW 16-12-10-8-6-4-2-2-4-6-8-10-12-16 x I _r	±15%	WB1...16 (INST)
			AE2000-SW ~ AE3200-SW, AE4000-SW 12-10-8-6-4-2-2-4-6-8-10-12 x I _r		WB2...12 (INST)
			AE5000-SW 10-8-6-4-2-2-4-6-8-10 x I _r		WB3...10 (INST)
⑦	Pre-alarm current	I _p	I _r x 0.68 to 1.0 (0.04 step)-OVER	±10%	OVER
⑧	Pre-alarm time	T _p	75 s at I _r x 2 (PAL contact output after passing 75 s)	±20%	—

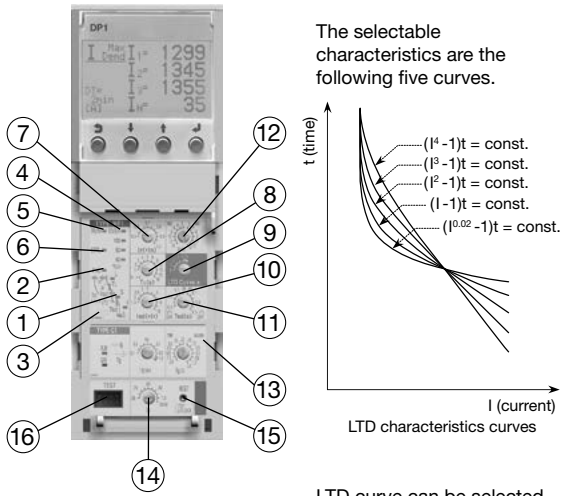
Remark (1) For WB relay, when Pre-alarm current I_p is set at "OVER", the I_p value is "I_r x 1.15".

Remark (2) The table shows data obtained on the breakers provided with MCR (optional).

Systematic diagram of setting dial coordination

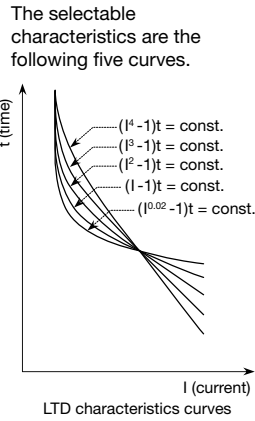


Characteristics setting for the WF type



- ① Trip indicator LED
- ② Pre-alarm LED
- ③ Temperature alarm LED
- ④ Load current LED
- ⑤ RUN LED
- ⑥ ERR. LED
- ⑦ Current setting dial
- ⑧ LTD time setting dial
- ⑨ LTD curve setting dial
- ⑩ STD pick-up setting dial
- ⑪ STD time setting dial
- ⑫ INST/MCR pick-up current setting dial
- ⑬ Optional setting module
- ⑭ Pre-alarm current setting dial
- ⑮ RESET button (TEST L/S LOCK button)
- ⑯ TEST terminal

Note) The figure shows WF1 type with G1 module, Display (DP1) and MCR switch. G1, DP1 and MCR are optional equipments.



LTD curve can be selected by the LTD curve setting dial.

[LTD curve setting "a=2"]

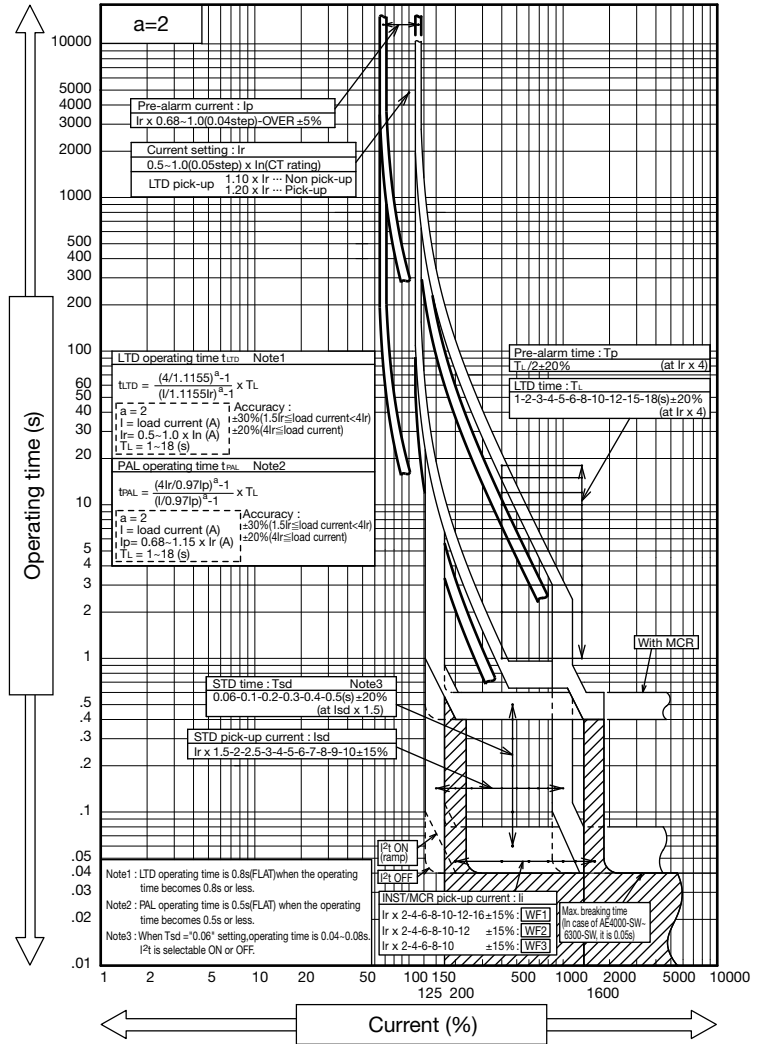


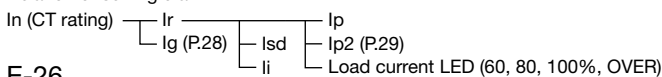
Table 26

No.	Setting item	Symbol	Characteristic setting range	Accuracy	Factory default value	
⑦	Current setting	I_r	$0.5 \sim 1.0 (0.05\text{step}) \times \ln (\text{CT rating})$ LTD pick-up current : $1.15 \times I_r$	$1.10 \times I_r \dots \text{Non Pick-up}$ $1.20 \times I_r \dots \text{Pick-up}$	1.0	
⑧	LTD time	T_L	$1-2-3-4-5-6-8-10-12-15-18\text{s}$	$\pm 30\% (1.5I_r \leq \text{load current} < 4I_r)$ $\pm 20\% (4I_r \leq \text{load current})$	18 at $I_r \times 4$	
⑨	LTD curve setting	a	$0.02-1-2-3-4$	—	2	
⑩	STD pick-up current	I_{sd}	$1.5-2-2.5-3-4-5-6-7-8-9-10 \times I_r$	$\pm 15\%$	10	
⑪	STD time	T_{sd}	$0.5-0.4-0.3-0.2-0.1-0.06-0.06-0.1-0.2-0.3-0.4-0.5\text{s}$ (I _t ON) (I _t OFF)	$\pm 20\%$ It operates in the range between 0.04 and 0.08 when the time set at 0.06s.	0.5 (I _t ON)	
⑫	INST/MCR pick-up current	I_i	AE630-SW ~ AE1600-SW AE2000-SW ~ AE3200-SW AE4000-SW	$16-12-10-8-6-4-2-2-4-6-8-10-12-16 \times I_r$ (INST) (MCR)	$\pm 15\%$	WF1...16 (INST)
			AE2000-SWA, AE4000-SWA AE5000-SW	$12-10-8-6-4-2-2-4-6-8-10-12 \times I_r$ (INST) (MCR)		WF2...12 (INST)
			AE6300-SW	$10-8-6-4-2-2-4-6-8-10 \times I_r$ (INST) (MCR)		WF3...10 (INST)
⑭	Pre-alarm current	I_p	$I_r \times 0.68 \sim 1.0 (0.04\text{step}) - \text{OVER}$	$\pm 5\%$	OVER	
—	Pre-alarm time	T_p	$1/2 T_L \text{ at } I_r \times 4 \text{ (after } 1/2 T_L, \text{ PAL contact output turns on.)}$	$\pm 30\% (1.5I_r \leq \text{load current} < 4I_r)$ $\pm 20\% (4I_r \leq \text{load current})$	—	

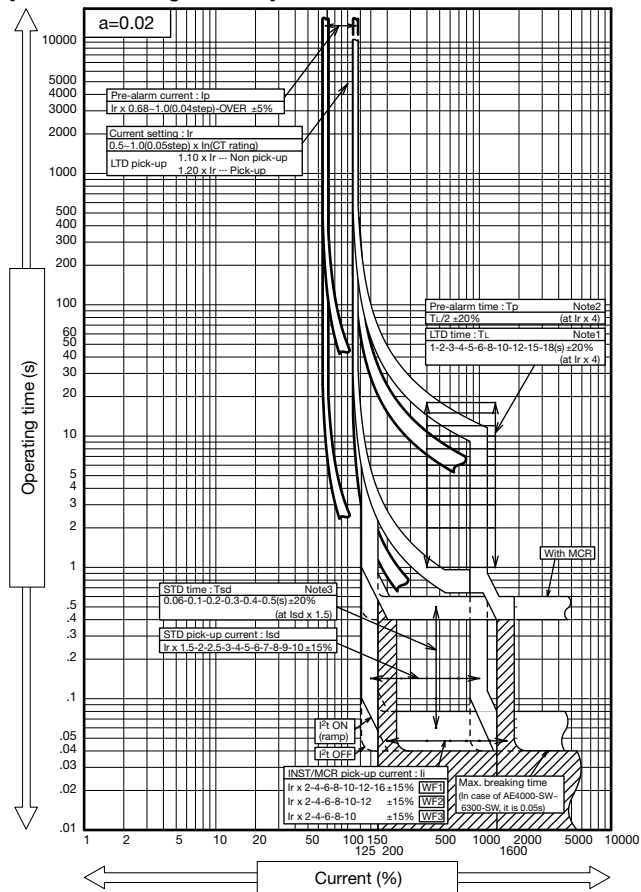
Remark (1) The table and the figure include both optional display and MCR.

Remark (2) For WF relay, when Pre-alarm current I_p is set at "OVER", the I_p value is " $I_r \times 1.15$ ".

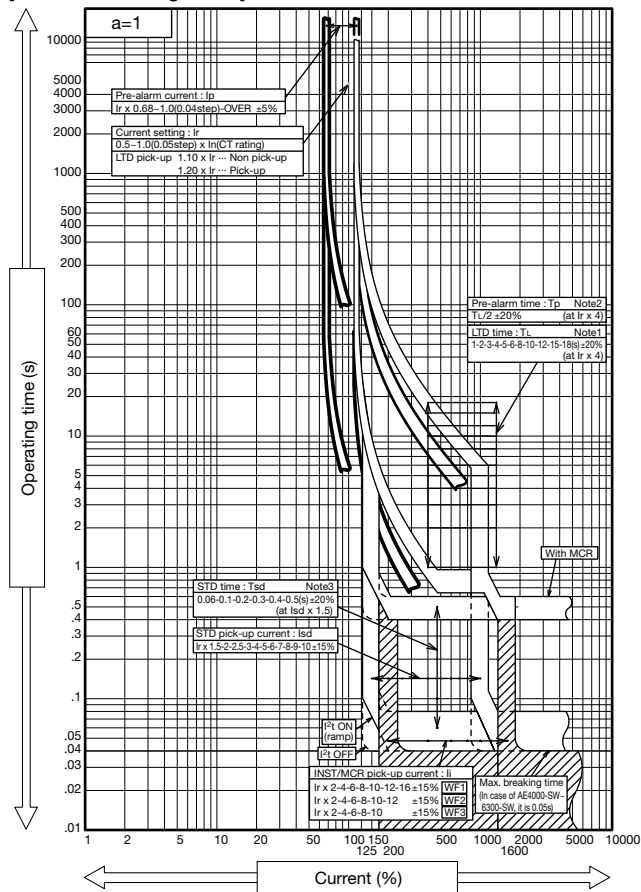
Relation of setting dial



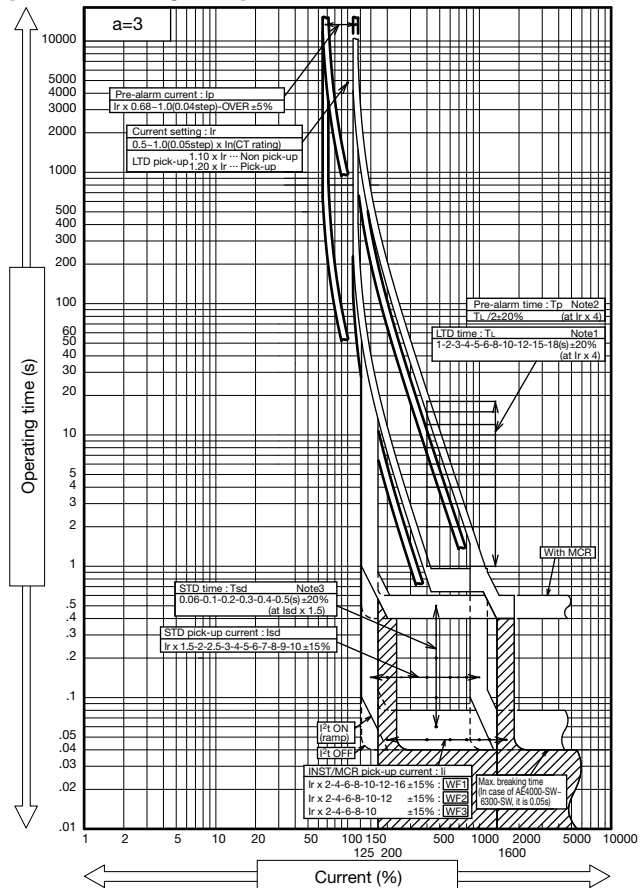
[LTD curve setting "a=0.02"]



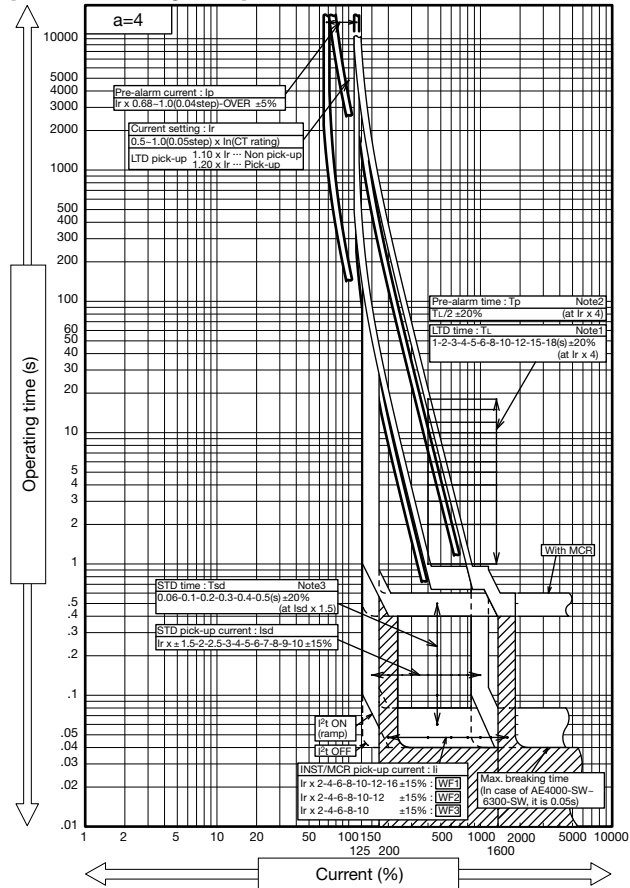
[LTD curve setting "a=1"]



[LTD curve setting "a=3"]



[LTD curve setting "a=4"]



Note 1: LTD operating time t_{LTD} is calculated by the following equations.

$$t_{LTD} = \frac{(4/1.1155)^a - 1}{(1/1.1155)^a - 1} \times T_L \begin{matrix} a = \text{LTD curve setting} \\ I = \text{load current (A)} \\ I_r = 0.5 - 1.0 \times \ln(A) \\ T_L = 1 - 18 (s) \end{matrix}$$

The accuracy of operating time is $\pm 30\%$ ($1.5I_r \leq \text{load current} < 4I_r$) or $\pm 20\%$ ($4I_r \leq \text{load current}$). LTD operating time is 0.8s (FLAT) when the operating time becomes 0.8s or less.

Note 3: When $T_{std} = "0.06"$ setting, operating time is 0.04-0.08s. I_{st} is selectable: ON or OFF.

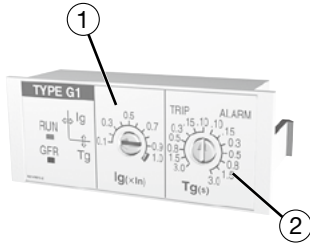
Note 2: PAL operating time t_{PAL} is calculated by the following equations.

$$t_{PAL} = \frac{(4I_r/0.97I_p)^a - 1}{(I_r/0.97I_p)^a - 1} \times \frac{T_L}{2} \begin{matrix} a = \text{LTD curve setting} \\ I = \text{load current (A)} \\ I_r = 0.5 - 1.0 \times \ln(A) \\ I_p = 0.68 - 1.15 \times I_r (A) \\ T_L = 1 - 18 (s) \end{matrix}$$

The accuracy of operating time is $\pm 30\%$ ($1.5I_r \leq \text{load current} < 4I_r$) or $\pm 20\%$ ($4I_r \leq \text{load current}$). PAL operating time is 0.5s (FLAT) when the operating time becomes 0.5s or less.

Characteristics setting for the optional setting modules

< Characteristics setting for the G1 module >



- To provide ground fault protection for a 3-pole breaker used in the 3-phase 4-wire system, a neutral pole CT (NCT) is required. For the specification, refer to the catalog. For the installation of the NCT, refer to the instruction manual provided with the NCT.
- The G1 module cannot be attached to the AE630-SW low rating models (CT rating: 500 A, 315 A, 250 A). To set the ground fault pick-up current I_g to 0.1, the control power supply must be applied. (If the control power supply is not applied, ground fault protection cannot be provided correctly.)

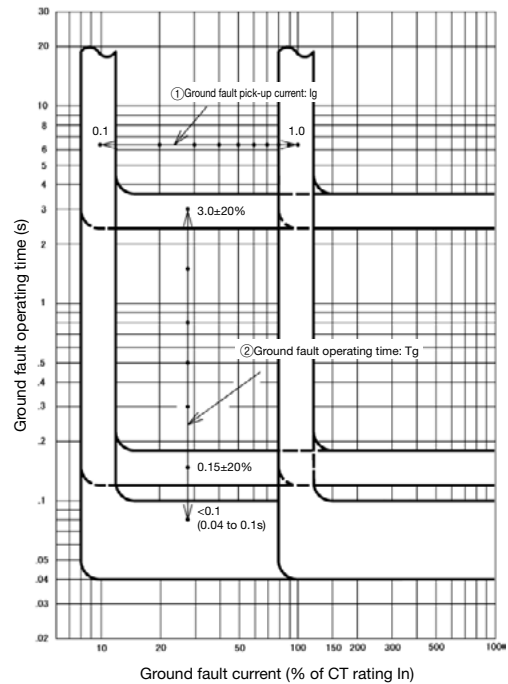


Table 28-1

No.	Setting item	Symbol	Characteristic setting range	Accuracy	Factory default value
①	Ground fault pick-up current	I_g	0.1 to $1.0 \times I_n$ (0.1 step)	$\pm 20\%$	1.0
②	Ground fault operating time	T_g	$3.0-1.5-0.8-0.5-0.3-0.15- <0.1>$ (TRIP) $<0.1-0.15-0.3-0.5-0.8-1.5-3.0</math> s (ALARM)(at 1.5 \times I_g)$	$\pm 20\%$	3s(TRIP)
-	Alarm output	-	TRIP: self-hold type / ALARM: automatic reset type	-	Self-hold type(TRIP)

< Characteristics setting for the E1 module >

E1 module, in combination with an external ZCT, provides electric leakage protection.

To provide the electric leakage protection, a control power supply is required.

ZCT for load circuit

ZCT type	Breaker type, number of poles
ZCT163	AE630-SW ~ AE1600-SW 3-pole
ZCT323	AE630-SW ~ AE1600-SW 4-pole AE2000-SW ~ AE3200-SW 3-pole
ZCT324	AE2000-SW ~ AE3200-SW 4-pole

- Type combinations shown in this table are for reference.
- Choose the one that matches the size of the conductor to be connected.

ZCT with primary conductor

ZCT type	Breaker type, number of poles
ZTA1200A	AE630-SW ~ AE1000-SW 3-pole model
ZTA2000A	AE1250-SW ~ AE2000-SW 3-pole model AE2000-SWA 3-pole model

The types not listed above can also be used if their rated current setting (I_r) is ZCT permissible current value or lower.

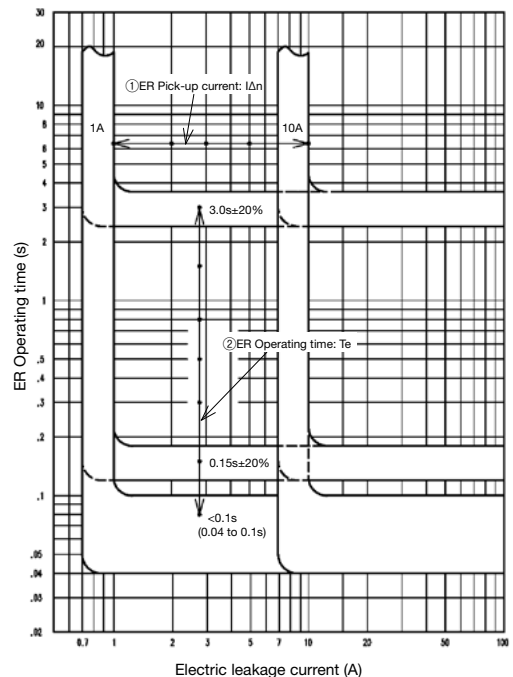
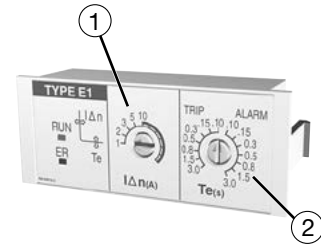
ZCT for transformer earth wire

ZCT type					
ZT15B	ZT30B	ZT40B	ZT60B	ZT80B	ZT100B

- Be sure to use with the ZCT specified by Mitsubishi Electric.
- For the ZCT installation, refer to the instruction manual provided with the ZCT.

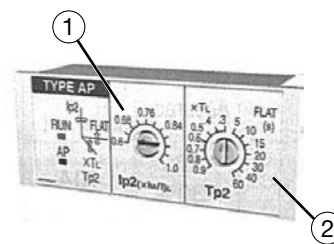
Table 28-2

No.	Setting item	Symbol	Characteristic setting range	Accuracy	Factory default value
①	ER Pick-up current	$I_{\Delta n}$	1-2-3-5-10A	0% -30%	10A
②	ER Operating time	T_e	$3-1.5-0.8-0.5-0.3-0.15- <0.1s>$ (TRIP) $<0.1-0.15-0.3-0.5-0.8-1.5-3</math> s (ALARM)(at 1.5 \times I_{\Delta n})$	$\pm 20\%$	3s(TRIP)
-	Alarm output	-	TRIP: self-hold type / ALARM: automatic reset type	-	Self-hold type(TRIP)

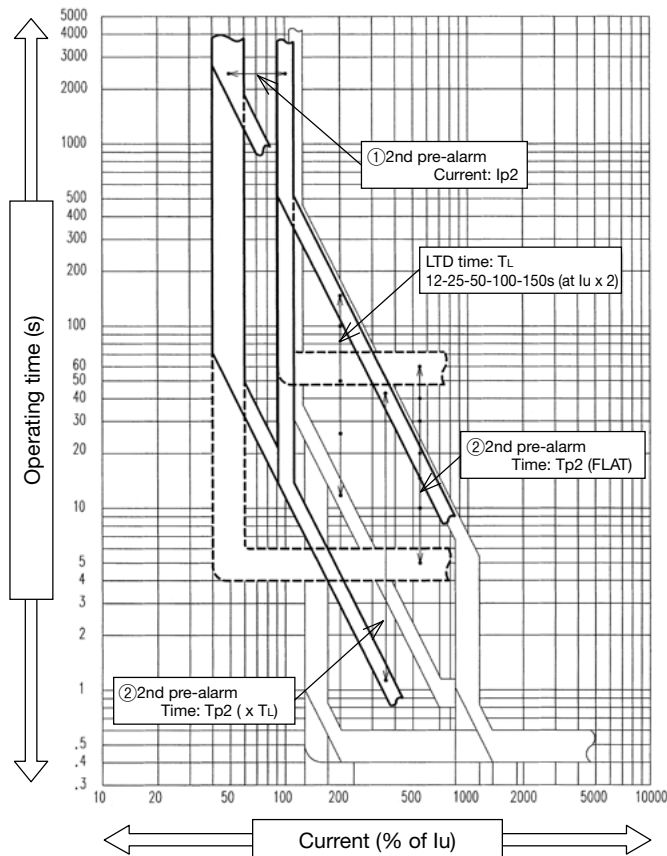


< Characteristics setting for the AP module >

By combining this with the pre-alarm function installed as standard, the two-step pre-alarms can be constructed. For the AE630-SW low rating types, be sure to apply the control power supply. This cannot be combined with the WB type.



●With the WS type



●With the WM type

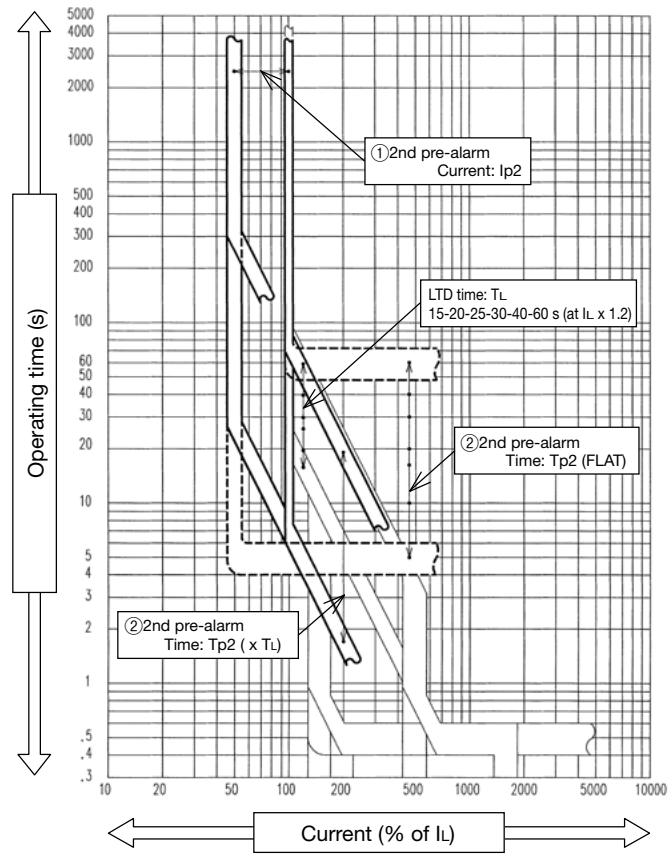


Table 29

No.	Setting item	Symbol	Characteristic setting range	Accuracy	Factory default value
①	2nd pre-alarm current	Ip2	0.5-0.6-0.7-0.8-0.84-0.88-0.92-0.96-1.0 x Iu	±10% WS	1.0
			0.5-0.6-0.7-0.8-0.84-0.88-0.92-0.96-1.0 x Il	±5% WM	
②	2nd pre-alarm time	Tp2	0.9-0.8-0.7-0.6-0.5-0.4-0.3 x Tl - 5-10-15-20-30-40-60s (x Tl) (FLAT)	±20%	0.9(x Tl)

< N5 module >

LTD and pre-alarm characteristics of the neutral pole are 50% of the voltage pole. However, STD and INST characteristics are the same as for the voltage pole (100%). For the AE630-SW low rating types, be sure to apply the control power supply. This cannot be combined with the WB type.



Setting procedure for the electronic trip characteristics

< Setting procedure >

Note) Move the screwdriver in the direction of the arrow.

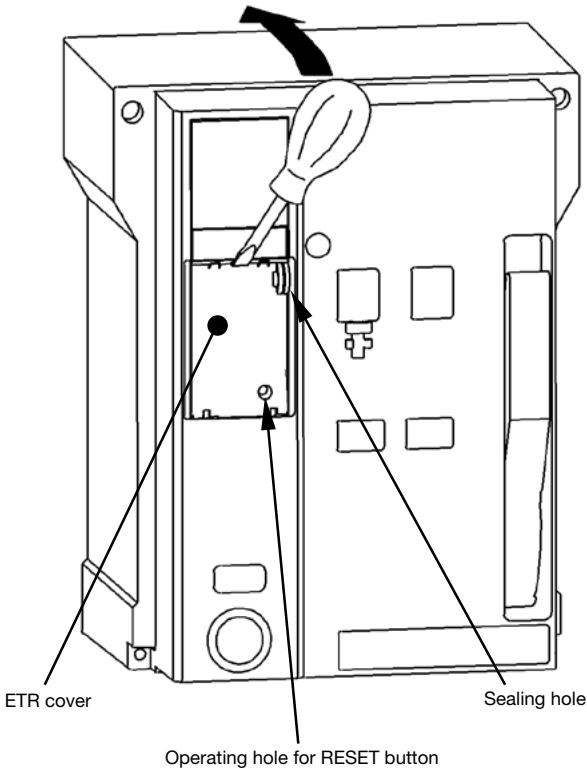


Fig. 30-1

CAUTION

Before changing the setting, turn off the breaker's main power supply and, the ETR's control power supply, and confirm that no current is flowing.

① Prepare a small flat tipped screwdriver.

0.8 mm or less Side view of the tip

6 mm or less 6 mm or less

② Insert a flat tipped screwdriver into the upper opening of the ETR cover. Then, lightly push the handle as shown in Fig. 28-1 to open the ETR cover.

③ There are 2 types of switches. Operate them accordingly.

(a) Stepping type

- This is a rotary stepping switch. Do not stop in between steps.
- If the dial is in the middle, the settings on either side are enabled.
- Operate in the range of 0.02N.m torque or less.
- When MCR (option) is not attached, I_i is set as shown in Fig. 30-3.

Do not set to the "Do not set" area. Always set to the INST side.

(For the function descriptions of MCR, refer to P.21.)

- In the bold line area, where there is a range, the setting is the same for the entire area. (Fig. 30-4)

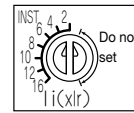


Fig. 30-3

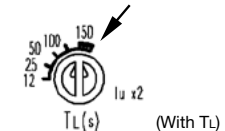


Fig. 30-4

(a) Stepping type

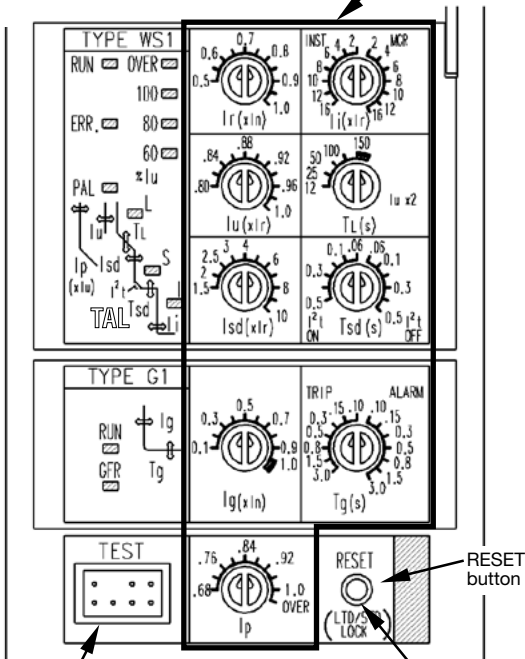


Fig. 30-2

(b) Push button type

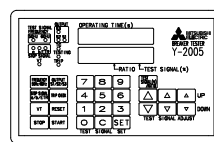
This is a self-recovering push button switch. Push with 3N force or less.

④ After changing a characteristic setting, check the tripping characteristic with a field testing device.

Characteristics can be checked through the ETR test terminal by using a dedicated field testing device. For the check procedure, refer to the instruction manual of the testing device.

Specifications of the field testing device Y-2005

Test item	LTD, STD, INST, GFR, PAL
Testable range	1% to 2500% × I_n
External dimensions mm	220 (width) × 150 (height) × 340 (depth)
Counter	0.000 to 999.999 s
Control voltage	100-240 V AC (50/60 Hz)
Mass	4.8 kg



< Electronic trip relay setting example >

Calculation method for the setting value is explained using the example of the AE1600-SW 1600A WS1G1 relay.

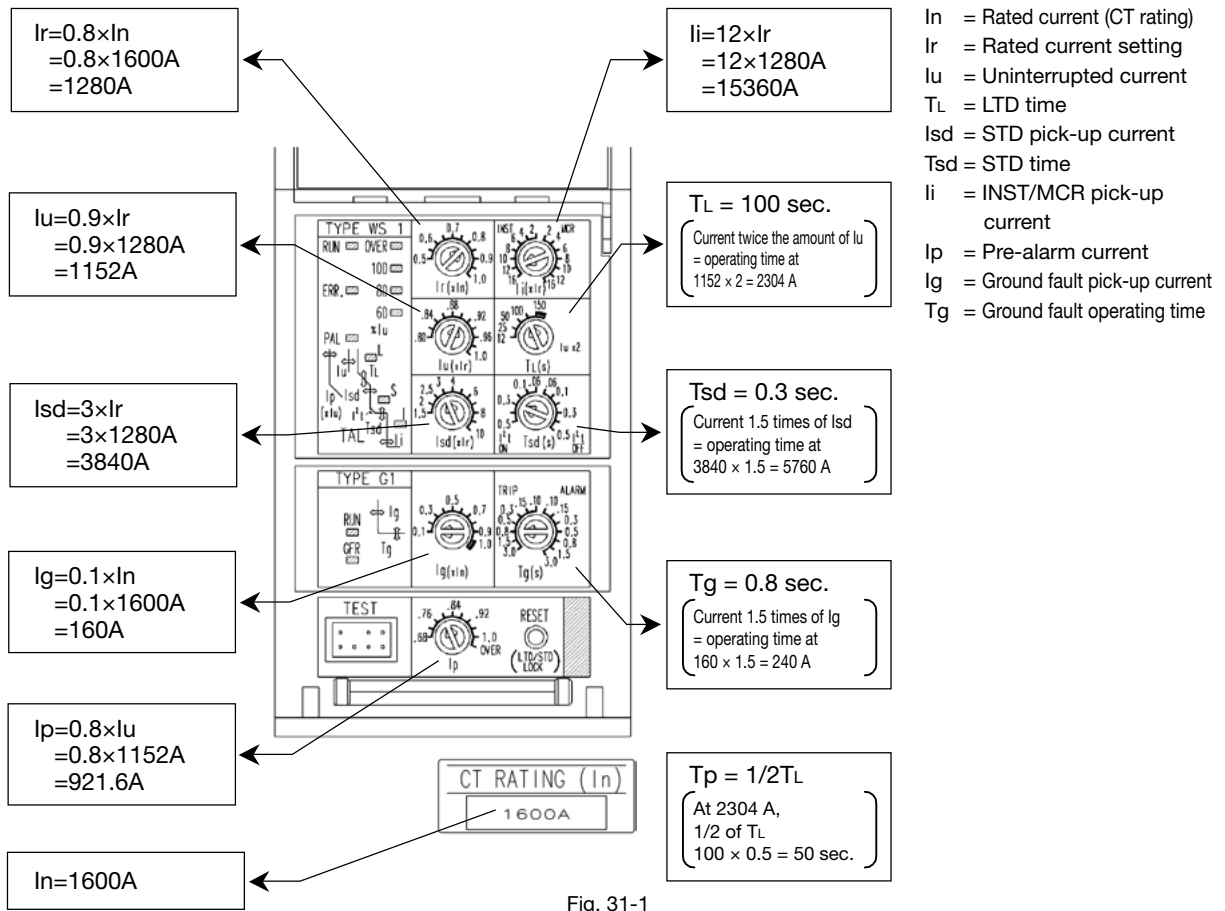


Fig. 31-1

Table 31 Current value and operating time by setting value

I_n (CT rating) = 1600 A	I_i = 15360 A ± 15%
I_r = 1280 A	I_p = 921.6 A ± 10%
l_u = 1152 A	T_p = 50 sec. ± 20% (at 2304 A)
T_L = 100 sec. ± 20% (at 2304 A)	I_g = 160 A ± 20%
l_{sd} = 3840 A ± 15%	T_g = 0.8 sec. (at 240 A) ± 20%
T_{sd} = 0.3 sec. ± 20% (at 5760 A)	-

< Relay sealing >

When sealing is required, use the sealing hole located on top of the ETR cover. (Fig. 31-2)

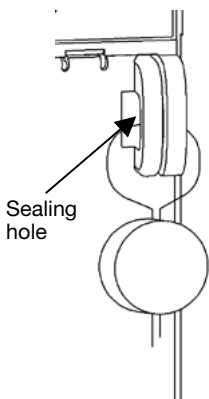
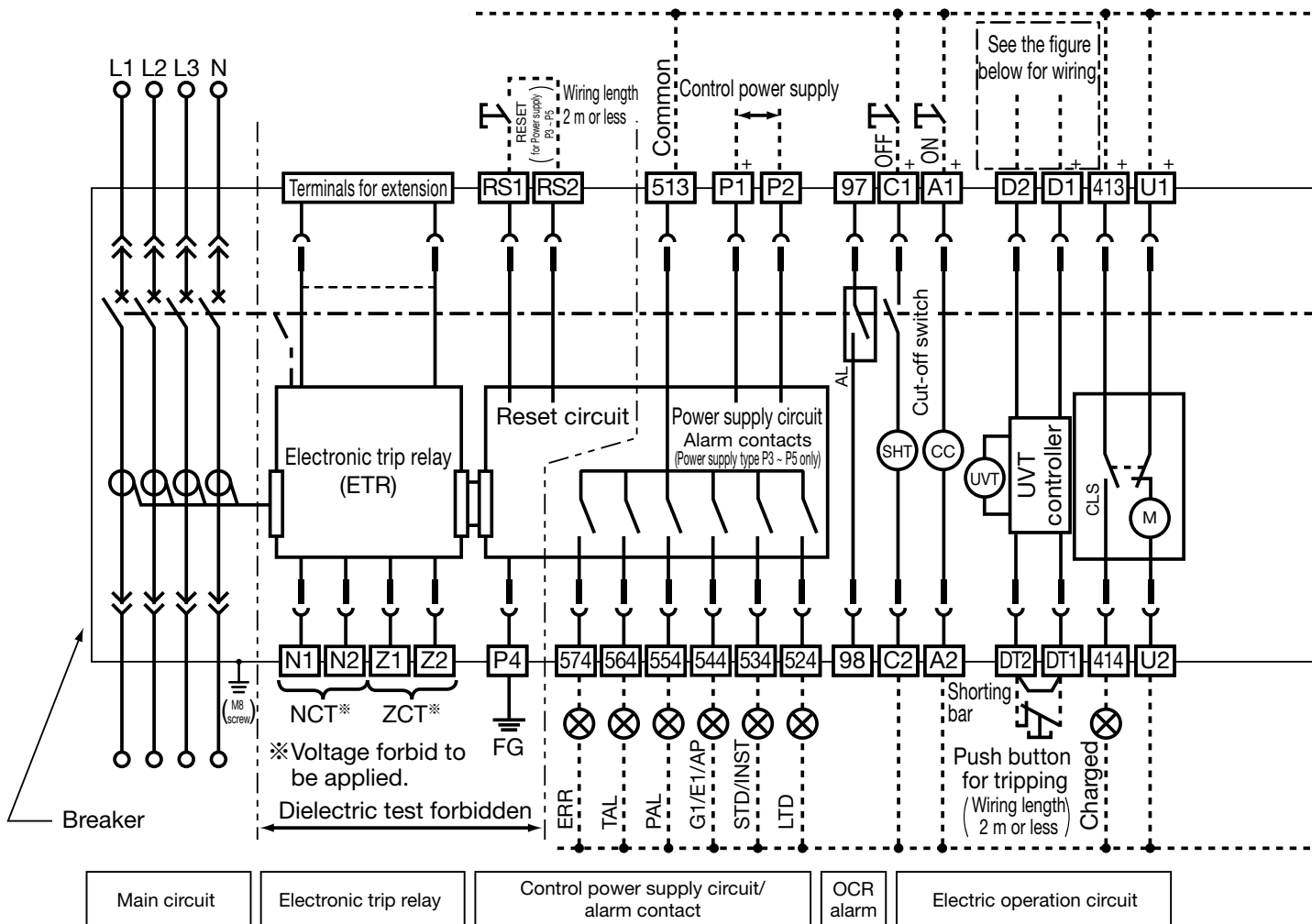


Fig. 31-2

Wiring diagram

* The wiring diagram below shows a fully equipped model.



Terminal description

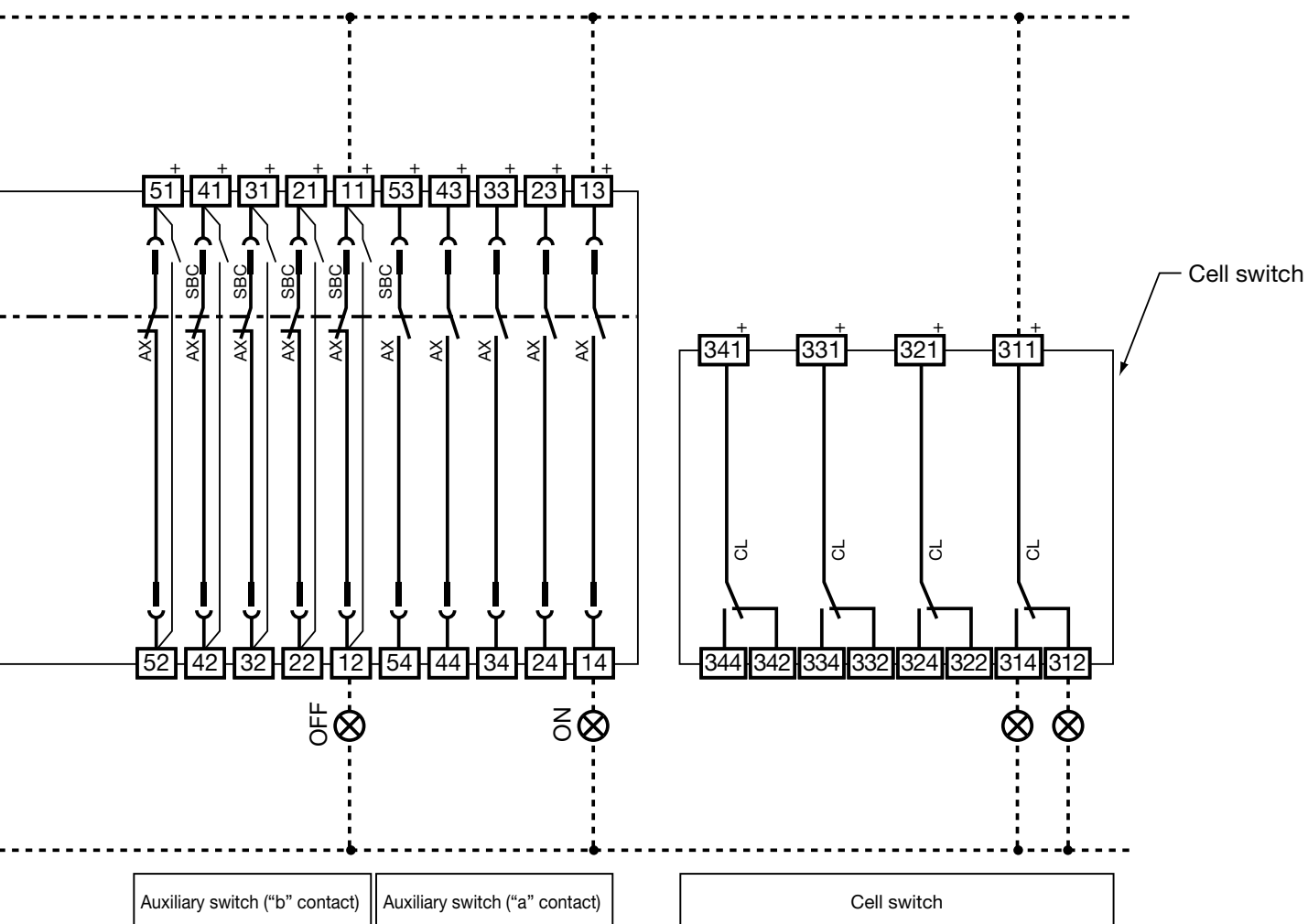
13	14	~	53	54	Auxiliary switch "a"
11	12	~	51	52	Auxiliary switch "b"
U1	U2				Motor charging
413	414				Charged signal (Normal open)
D1	D2				Voltage Input terminal of UVT
DT1	DT2				Trip terminal of UVT (Remote trip)
A1	A2				Closing coil
C1	C2				Shunt trip
97	98				OCR alarm
P1	P2				Power supply for ETR
P4					FG of power supply (FG:Frame Ground)
RS1	RS2				Alarm reset (Trip cause LED, alarm contact)
513	524				Alarm contact for LTD Trip
513	534				Alarm contact for STD or INST Trips
513	544				Alarm contact for Ground fault, Earth leakage trips or 2nd Pre-alarm contact
513	554				Pre-alarm contact
513	564				Temperature alarm contact
513	574				Error alarm contact
Z1	Z2				For external ZCT
N1	N2				For Neutral CT
Extension terminals					For external display DP2
					For Interface unit
					For VT unit

Accessory Symbols

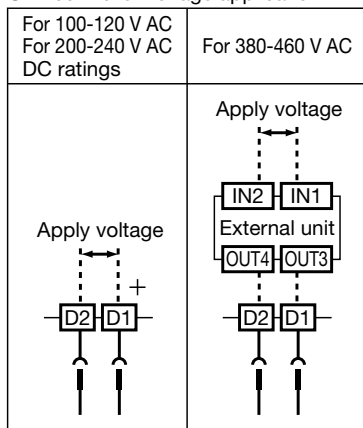
(SHT)	Shunt tripping device
(CC)	Closing coil
(M)	Motor(Motor charging device)
(UVT)	UVT coil
AX	Auxiliary switch
AL	OCR alarm switch
CLS	Charge limit switch
SBC	Shorting b-contact
CL	Cell switch

- Internal wiring
- External wiring (user's wiring)
- ◀ Control circuit connector (drawout type)

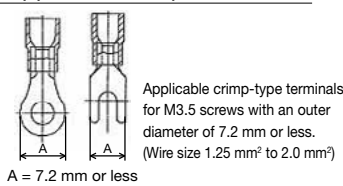
Fig. 32



UVT controller voltage application



Control circuit terminal block
Applicable crimp terminal



- For the drawout type, the cables should have the length which allow the control circuit terminal block to be moved to the left or right by 5mm.
- When a coil load is connected in the same control circuit as the ETR, surge absorbers are required to absorb the surge voltage.
- OCR alarm (AL)
The contact output of the OCR alarm (Standard type AL) is the one-pulse output and the output time is 30~50ms.
For this reason, this output needs self-holding circuit.
- For Power supply type P3 and P4, the high sensitive relay used in contact output may cause the chattering noise (wrong output of 1ms level) during ON and OFF operation, depending on the Panel placing condition. When it is used in the quick responsive sequence, the filter circuit of a few milli-second (ms) should be provided or the double reading sampling should be implemented.
- Closing coil (CC)
As CC is one-pulse driven, it is not necessary to insert AXb for burning prevention purposes. Inserting AXb will cause anti-pumping function to be ineffective.
- Under voltage trip device (UVT)
Use the switch that can open and close 150V DC, 0.5A for remote trip.
Remote trip terminal has short bar at shipment, so remove it before using this function.
Disconnect the voltage input wires during dielectric testing of main circuit.
- Since some terminals are polarized, the wiring should be done correctly as the polarity shown in the wiring diagram when the control voltage is DC. Auxiliary switch (AX) Standard type has no polarity.
- Alarm reset (Terminal: **RS1** and **RS2**) is available only for Power supply type P3, P4 and P5.
For Power supply type P1 and P2, it can not be reset from the Control circuit terminal block (**RS1** and **RS2**).
- Alarm contacts (Terminal : **513**~**574**) are available only for power supply type **P3**, **P4** and **P5**.
- FG (Terminal: **P4**) is the protective earth for power supply (Terminal: **P1**, **P2**).
It is recommended to use this terminal to reduce surge (M8 screw required).
- Shorting b-contact (SBC)
SBC can be provided for all AX b contacts. At the time of shipment from factory, SBC is already connected to control circuit terminal block. Only one more crimp terminal can be added on contact, overlapping with SBC's contact on Terminal: **11**~**51**.

Technical notes

■ Arc space



When a short circuit current is interrupted, hot gas blows out from the exhaust port of the arc-extinguishing chamber. Provide a clearance as shown in Fig. 34.

For the drawout type, ensure appropriate clearance (dimension B) to avoid pinching a finger during the drawout operation.

※ For the fixed type, maintenance can be performed with the clearance shown in Fig. 34.

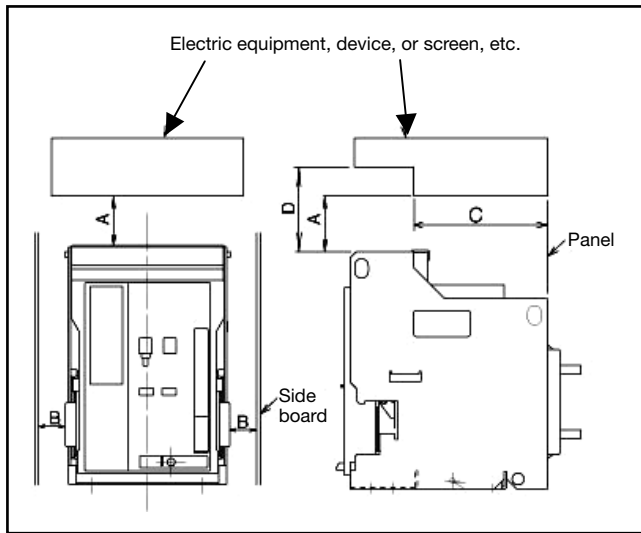


Fig. 34

Table 34 Clearance dimensions

(mm)

Model	AE630-SW ~ AE3200-SW AE2000-SWA, AE4000-SWA		AE4000-SW ~ AE6300-SW
Applied circuit voltage	600 V AC or less	660 V, 690 V AC	690 V AC or less
Fixed type	A	(Note1) 0	(Note1) 100
	B	(Note3) 50	(Note3) 50
	C	162	162
	D	(Note2) 50	(Note2) 50
Drawout type	A	0	100
	B	(Note3) 50	(Note3) 50
	C	240	240
	D	(Note2) 50	(Note2) 50

Note 1: To inspect the arc-extinguishing chamber and main contacts, 300 mm or more is required.

Note 2: Dimension D is the wiring space from the control circuit terminal block.

Note 3: When a mechanical interlock (MI) or door interlock (DI) is being used, dimension B needs to be long enough to install such devices.

■ Reverse connection

Line and Load are not defined on the Main circuit terminals. Therefore, reverse connection is available without any limitation.

■ Performance of withstand voltage

Test points		Withstand voltage (AC)	Rated impulse withstand voltage U _{imp}
Main circuit (Note 1)	Between the main circuit live parts and the ground	3500 V AC 1 minute	12 kV
	Between live parts of different polarity poles		
	Between the power supply and load terminals		
	Between the main circuit live parts and all the control circuit terminal block		
Control circuit	Between all the accessories on the control circuit terminal block ^(Note 2) and the ground	2000 V AC 1 minute	6 kV ^(Note 4)
	Between all the electronic trip relays on the control circuit terminal block ^(Note 3) and the ground		4 kV

Note 1: When testing the dielectric strength with a UVT attached, remove the wiring on the voltage input terminals (D1 and D2).
(When the UVT rating is 380-460 V AC, remove the wiring on the external unit input terminals (IN1, IN2).)

Note 2: Terminals of accessories AX/HAX, MD, UVT, CC, SHT, and AL

Note 3: Electronic trip relay terminals (P1, P2, 513, 524, 534, 544, 554, 564, 574)

Note 4: This is 4 kV for the AE4000-SW ~ AE6300-SW drawout type.

Note 5: Terminals N1, N2, Z1, Z2, RS1, RS2, and P4 of the control circuit terminal block are forbidden for dielectric testing.

■ Operation environment

1. Standard operation environment

The standard operation environment is an environment where all of the following conditions are met. Unless otherwise specified, use the AE Series air circuit breaker in the following environment.

- ① Standard ambient temperature
Use in the range of +40 °C max. and -5 °C min. However, the average temperature over 24 hours must not exceed +35 °C.
- ② Altitude: 2000 m (6600 feet) or less.
- ③ Environmental conditions
The air must be clean with the max. temperature of +40 °C and the relative humidity of 85% or less, and without condensation.
Do not use and store in an atmosphere with corrosive gas, such as sulfide gas and ammonia gas.
(H₂S 0.01 ppm or less, SO₂ 0.05 ppm or less, NH₃ 0.25 ppm or less)
- ④ Installation condition
Install the AE Series air circuit breaker in accordance with the instructions on the catalog and the instruction manual.
- ⑤ Guideline for replacement
Expected product life is 15 years in the standard operation environment.
Time of replacement is highly influenced by the operation environment. Refer to the inspection and maintenance section of this instruction manual.

2. Special operation environment

When the product is used in a condition other than the standard operation environment, its service life may be shorter.

- ① Special operation environment
Operation with high temperature and high humidity.
Operation in an environment where corrosive gas is present.
- ② Special ambient temperature
When the ambient temperature exceeds +40 °C, “uninterrupted current” is reduced.
- ③ Special altitude
When using the product at an altitude over 2000 m, heat dissipation becomes less. This leads to a reduction of the operation voltage, current capacity, and breaking capacity. The dielectric strength is also lowered by the air pressure. Please contact us for details.

Warranty

If any faults or defects (hereinafter “Failure”) found to be the responsibility of Mitsubishi Electric occurs during use of the product within the warranty period, the product shall be repaired at no cost via the sales representative or Mitsubishi Electric Sales office. However, if repairs are required on-site at domestic or overseas locations, expenses to send an engineer will be charged.

1. Warranty period

The warranty period of the product shall be for twelve (12) months after the date of purchase or delivery to the designated place. Note that after manufacture and shipment from Mitsubishi Electric, the maximum distribution period shall be six (6) months, and the longest warranty period after manufacturing shall be eighteen (18) months. The warranty period of the repaired parts shall not exceed the warranty period of the original product before repairs.

2. Warranty coverage

- (1) The primary failure diagnosis should be performed by users. However, if required by users, Mitsubishi Electric or Mitsubishi Electric Sales office may be able to perform the diagnosis. In that case, for damages caused by any cause found to be the responsibility of Mitsubishi Electric, the diagnosis will be performed at no cost. For details, contact a distributor.
- (2) The coverage shall be limited to ordinary use within the usage state, usage methods, usage environment, and other conditions which follow the instructions and precautions given in the instruction manual, user’s manual, and caution labels on the product.
- (3) Even within the warranty period, repair cost shall be charged for the following cases.
 - [1] Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by selection of hardware or software design on the user side.

- [2] Failure caused by modifications, etc. to the product by the user without any approvals from Mitsubishi Electric.
- [3] In case Mitsubishi Electric product is assembled into a user’s device, failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user’s device is subject to or as necessary by industry standards, had been provided.
- [4] Failure that could have been avoided if the maintenance described in the user’s manual has been performed.
- [5] Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by natural disasters such as earthquakes, lightning, wind and water damages.
- [6] Failure caused by reasons unpredictable based on scientific technology standards at the time of shipment from Mitsubishi Electric.
- [7] Any other failure found not to be the responsibility of Mitsubishi Electric or that admitted not to be so by the user.

In addition, the warranty applies only to the product delivered. It does not apply to the damage that is caused by the failure of the product.

3. The period to supply the spare parts after discontinuation of production
Mitsubishi Electric shall supply spare parts for five years after discontinuation of production.
After five years, Mitsubishi Electric shall supply spare parts until the spare parts run out of stock.

Inspection and maintenance

- | | |
|---|--|
| 1. Guideline for inspection and replacement... 36 | 4. Inspection..... 37 |
| 2. Appearance and structure..... 37 | 5. Handling of abnormal operations..... 40 |
| 3. Preparation before inspection..... 37 | |

The maintenance and inspection items and frequency differ by their operation environment. Carefully read the contents of the manual and perform thorough inspection and maintenance.

CAUTION



- Inspection and maintenance should be performed by an expert with the required knowledge. Failure to do so could result in electrical shock.
- Inspection and maintenance should only be performed after turning off the upper breakers and verifying that there is no current flowing. Failure to do so could result in electrical shock.

If the electricity cannot be shut off, wear rubber gloves and shoes, stand on a rubber mat, and use insulated tools. Pay special attention to the insulation between the human body and live parts as the person must approach close to the live parts. Normal closing/opening operation is safe as the operation parts are insulated with molded material from the live parts.

1. Guideline for inspection and replacement

< Purpose >

Inspection: The purpose of inspecting breakers is to maintain the breaker performance and to prevent accidents caused by aging parts. This can be achieved by finding faulty parts at an early stage and by replacing consumable and wearable parts in a timely manner.

Maintenance: To maintain the breaker's performance, periodic servicing including lubrication is required. Please contact our service department. Do this once every 2 periodic inspections.

1.1 Guideline for periodic inspection, maintenance and replacement based on the operating period and environment

The initial inspection should be performed once after 1 month of operation. After that, periodic inspections should be performed according to the operation environment.

Operation environment		Case example	Guideline for inspection	Guideline for maintenance	Guideline for replacement	
Standard operation environment	1	Environment where air is always clear and dry	Electric chamber with dust prevention and air control	Once every 2 to 3 years	Every 2 periodic inspections	Approx. 15 years
	2	Indoors with little debris and dust and no corrosive gas				In an independent electric chamber, a panel, or a box without dust prevention and air control
Harsh environment	1	Environment with little debris and dust and with sulfurous, hydrosulfuric, saline, or high humidity gas present Environment where average daily ambient temperature exceeds 35 °C	Geothermal plant, wastewater treatment plant, or steel, paper, or pulp factory, etc.	Once every year	Once every 2 years	Approx. 3 ~ 7 years
	2	Environment difficult for a person to remain in for a long time, and environment with excessive debris and dust	Chemical factory, quarry, or mine site, etc.	Once every six months	Once every year	Approx. 1 ~ 3 years

1.2 Guidelines for inspection and replacement based on the number of operating cycles

Model	Guideline for inspection		Product performance				
	Number of operating cycles with rated current*1	Number of operating cycles without rated current*2	Number of operating cycles (cycles)			Overload characteristic	
			With rated current	Without current	Total	Current	Number of operating cycles
AE630-SW	Every 500 cycles	Every 2000 cycles	5,000	20,000	25,000	6 times the rated current	12 cycles
AE1000-SW							
AE1250-SW							
AE1600-SW							
AE2000-SWA							
AE2000-SW	Every 150 cycles	Every 1000 cycles	1,500	18,500	20,000		
AE2500-SW							
AE3200-SW			1,000	19,000			
AE4000-SWA	Every 100 cycles	Every 1000 cycles	1,000	9,000	10,000		
AE4000-SW	Every 50 cycles					500	19,500
AE4000-SW 3 poles	Every 100 cycles	Every 1000 cycles	1,000	4,000	5,000	3 cycles	
AE5000-SW 3 poles							
AE6300-SW 3 poles							
AE4000-SW 4 poles		Every 500 cycles	1,000	4,000	5,000		
AE5000-SW 4 poles							
AE6300-SW 4 poles							

*1 Regardless of the amount of current, when current is turned on and off, it is considered to be an operating cycle with rated current.

*2 Maintenance guideline based on the number of operating cycles is 2000 cycles for all models.

2. Appearance and structure

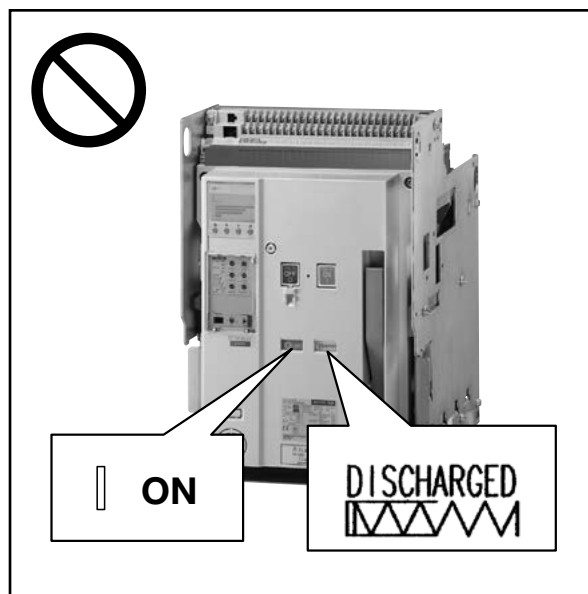
Refer to P.4 and P.5 of this instruction manual.

3. Preparation before inspection

To perform a normal (initial or periodic) inspection, open (turn off) the upper breakers and verify that there is no current flowing. For the control circuit, perform an inspection with the power shut off whenever possible, except when inspecting its operation.

⚠ CAUTION

When inspecting a drawout type breaker with its breaker pulled out, turn off the breaker. (Refer to P.14.)



4. Inspection

4.1 Initial inspection

4.1.1 Inspection items

After installing a breaker, inspect the following points before applying the current.

Inspection items	Criteria
1. Cables and conductors securely connected to the main circuit terminals	Connected at specified tightening torque (M12 screw: 45 ± 5 N·m)
2. Conductive foreign objects, such as screws, processing chips from the panel processing, or lead wires connected in withstand voltage tests, left around terminals	Free of objects and clean
3. Cracks or breakage on the front cover and the base	No cracks or breakage
4. Flood or condensation on the breaker	No flood or condensation

(1) When measuring the insulation resistance with a 500 V insulation tester, follow the standards described in 4.1.2.

(2) When performing a withstand voltage test, follow the standards described in 4.1.2.

4.1.2 Points and standards for the insulation resistance test and withstand voltage test

(1) Points for the insulation resistance test and withstand voltage test

Test point	Insulation resistance test		Withstand voltage test	
	ON	OFF	ON	OFF
Between the main circuit live parts and the ground	○	○	○	○
Between live parts of different polarity poles	○	○	○	○
Between the power supply and load terminals	-	○	-	○
Between the main circuit live parts and the control/operation circuit live parts	○	○	○	○
Between the control/operation circuit live parts and the ground	○	○	○	○

(2) Standards for the insulation resistance test and the AC withstand voltage test

Insulation resistance test : Must be 5 MΩ or more (50 MΩ or more for the air circuit breaker alone)

AC withstand voltage test :

<div style="border-left: 1px solid black; border-right: 1px solid black; border-top: 1px solid black; border-bottom: 1px solid black; padding: 5px; display: inline-block;"> Apply for 1 minute </div>	Between the main circuit live parts and the ground	: 3500 V
	Between live parts of different polarity poles	: 3500 V
	Between the power supply and load terminals	: 3500 V
	Between the main circuit live parts and the control/operation circuit live parts	: 3500 V
	Between the control/operation circuit live parts and the ground	: 2000 V

(for the dielectric test forbidden area, follow the specification on the control circuit terminal block nameplate)

⚠ CAUTION



When performing the withstand voltage test on the main circuit with the breaker built into a panel, remove the wiring "D1" and "D2" to the UVT controller (for 380-460V AC, the external unit input terminals "IN1" and "IN2"). Failure to do so could break the UVT controller.

4.2 Periodic inspection

To prevent accidents and use the breaker stably for a long period of time, we recommend an initial inspection to be performed after 1 month of operation followed by periodic inspections according to the operation environment.

4.2.1 Appearance of the air circuit breaker

Inspection items	Inspection methods	Criteria	Treatment
1. Debris, dust and soiling	Visual check	No debris, dust or dirt attached	Vacuum with a vacuum cleaner during periodic inspections, or clean with a dry cloth. Do not use any solvents, such as thinner, on the front cover and rating nameplates.
2. Loose connection in the main circuit terminal block	Fasten with a torque wrench.	Securely tightened (M12 bolt: $45 \pm 5\text{N}\cdot\text{m}$)	When loose, fasten at the specified torque.
3. Loose connection in the control circuit terminal block	Fasten with a screwdriver.	Securely tightened (M3.5 screw: $1.0 \pm 0.2\text{N}\cdot\text{m}$)	When loose, fasten at the specified torque.
4. Cracks, breakage, or deformation of the front cover, base, or control circuit terminal block	Visual check	No cracks, breakage, or deformation	If any abnormality is found on the front cover or the control circuit terminal block, please contact your local branch office or agency. When there is an abnormality on the base, replace the breaker.
5. Flooding, immersion in water	No flooding or water immersion	No flooding or water immersion	In case of flooding or water immersion, replace the breaker.
6. Extension rail	Visual check	The rail can be drawn out/inserted smoothly.	If any abnormality is found with the rail, contact your local branch office or agency.
7. Lost parts	Visual check	None of the screws, nuts, washers, or retaining rings are lost.	If any parts are missing, contact your local branch office or agency.

4.2.2 Conductive parts of the main circuit (Appearance)

Inspection items	Inspection methods	Criteria	Treatment
1. Insulation resistance measurement	Measure with a 500 V insulation tester	5 M Ω or more (50 M Ω or more for a breaker alone). Refer to section 4.1 for measurement points.	Remove debris and dust with a dry cloth and measure again. If the insulation does not recover, replace the breaker and the cradle.
2. Soiling of the main circuit terminals and connection conductors	Visual check	No debris, dust or soot attached	Clean with a dry cloth.

4.2.3 Arc-extinguishing chamber

Inspection items	Inspection methods	Criteria	Treatment
1. Soot and soiling	Visual check	It is clean.	Take care not to let debris and dirt enter the arc-extinguishing chamber, and vacuum them with a vacuum cleaner or clean with a dry cloth.
2. Breakage	Visual check	No breakage	If any abnormality is found, contact your local branch office or agency.
3. Looseness in fixing screws	Fasten with a screwdriver.	Securely tightened (M6 screw: $3.25 \pm 0.75\text{N}\cdot\text{m}$).	Fasten at the specified torque.

4.2.4 Electronic trip relay

Inspection items	Inspection methods	Criteria	Treatment
1. Appearance of the electronic trip relay	Visual check	No breakage or deformation of the external area or the setting dial	If any breakage or deformation is found, contact your local branch office or agency.
2. Debris, dust and soiling	Visual check	No debris, dust or dirt attached	Clean with a dry cloth. Do not use any solvents, such as thinner.
3. Operation characteristics of the electronic trip relay	Measurement	Values checked with a dedicated field test device (Y-2005) are within reference values.	If the value is outside of the reference values, contact your local branch office or agency.

4.2.5 Accessory (Please contact us for special accessories other than the ones listed below.)

Inspection items	Inspection methods	Criteria	Treatment
1. Closing coil (CC) Shunt trip device (SHT)	Electric operation	Operates fully and smoothly in the rated voltage range.	If any abnormality is seen in the operation, contact your local branch office or agency.
2. Auxiliary switch (AX/HAX)	Conduction check on AXa and AXb	Fully switched over by the opening/closing of the breaker.	If any abnormality is seen in the operation, contact your local branch office or agency.
3. Motor charging device (MD)	Electric operation	Charging is fully completed within the specified time period (5 sec.) and the applicable voltage.	If any abnormality is seen in the operation, contact your local branch office or agency.
4. Undervoltage trip device (UVT)	Electric operation	(1)Closing is not available at 45% or less of the rated voltage, and available at 85% or more. (2)Tripping is available at 45% to 70% of the rated voltage.	If any abnormality is seen in the operation, contact your local branch office or agency.
5. Safety shutter (SST)	Drawout/insert operation	(1)No broken parts	If a broken part is found, contact your local branch office or agency.
		(2)Drawout/insert operation can be performed smoothly.	① If the drawout/insert operation is blocked by a broken piece, remove the piece. ② If the drawout/insert operation cannot be performed, contact your local branch office or agency.
		(3)The shutter closes in the disconnect/drawout position, and the main circuit junction is not visible.	If the shutter does not shut, contact your local branch office or agency.
6. Cell switch (CL)	Drawout/insert operation	Be sure to fully switch over to one of "DISCONNECT," "TEST," or "CONNECT" position.	If any abnormality is seen in the operation, contact your local branch office or agency.
7. Mechanical interlock (MI)	Interlock function check	Gap between the tripping pin and the lever: 0.2 to 1.2 mm For other installation and adjustment procedures, refer to the MI installation manual.	If adjustment is not possible, contact your local branch office or agency.

4.3 Inspection after circuit breaking

If the breaker interrupts off the overload current or short-circuit current, check the periodic inspection items listed in section 4.2.

The breaker can be used again if criteria are met.

Do not close the breaker again until the cause of the accident is confirmed and removed.

When a large fault current is estimated to be interrupted, it is recommended to replace the breaker as soon as possible.

Until replacement, use the breaker but monitor for an abnormal temperature rise or other abnormalities.

Level of breaking current and the treatment methods are listed below for reference.

Level of breaking current	Level of damage to the breaker	Treatment
1. 6 times the rated current or less (LTD, STD range)	(1)No abnormality is seen on the Appearance by a visual check. (2)Wear and soot soiling on main contacts are light.	The breaker can be used again. For the life of the opening/closing operation at the rated current, refer to section 1.2.
2. 70% of the rated breaking current or less (STD, INST range)	(1)Soiling on the entire exhaust port, which is caused by soot, etc., is visible. (2)Main contacts and the arc-extinguishing chamber are lightly damaged.	The breaker can be used again. The breaker can be used again if criteria in section 4.2 are met.
3. Large fault current close to the rated breaking current	(1)Entire exhaust port is heavily soiled by soot, etc. (2)Main contacts and the arc-extinguishing chamber are heavily damaged.	(1)Immediately replacement is recommended. (2)If immediately replacement is not possible, use it carefully at the reduced rated current on the condition that criteria in section 4.2 are met. As an additional test, perform the withstand voltage test on the live parts of the breaker's main circuit at twice the rated insulation voltage, which is 2000 V, and no abnormality should be found. However, replace it soon.

(Note) 1. As for the cause of tripping, the level of breaking current can be determined from the trip cause indicator LEDs of ETR.

2. If the level of the fault current cannot be estimated, handle as in point 3 in section 4.3.

5. Handling of abnormal operations

Types and states of abnormality	Faulty behaviors/estimated causes	Treatment		
		Investigation/primary treatment	Secondary treatment	
1. Unable to close	1. Closing operation cannot be performed. (1)OFF locking device (CYL. CAL, Padlock) is not released.	Release the OFF locking device (CYL. CAL, Padlock).	If closing is still unavailable after the first treatment, contact your local branch office or agency.	
		(2)Drawout position is inappropriate.		Be sure to be at one of "DISCONNECT," "TEST," or "CONNECT" position.
		(3)Drawout handle is inserted.		Take out the drawout handle.
	(4)No voltage is applied to UVT.	Apply voltage to UVT.	When the UVT is faulty, refer to the section of "UVT does not draw in."	
	(5)Closing springs are not charged.	Charge.	1. If manual charging is unavailable, contact your local branch office or agency.	
			2. If motor charging is unavailable, refer to the section of "Motor charging is unavailable."	
	(6)Closing coil does not operate. (It closes by manual operation.)	1. When no voltage is applied, investigate the operation circuit.	-	
		2. When a voltage is applied, check that the connector on the control circuit terminal block is securely inserted.	Contact your local branch office or agency.	
	2. Closing can be performed. (1)It trips (OFF) at the same time as closing.	Contact your local branch office or agency.	-	
			(2)It turns OFF when charging after closing.	-
3. ON button is broken.	Contact your local branch office or agency.	-		
4. Unable to push the ON button.	Contact your local branch office or agency.	-		
2. Closing trip occurs when the charging is completed.	External sequence could be the cause.	Investigate the external sequence.	Contact your local branch office or agency.	
3. Unable to open	1. Unable to open (OFF) even by pressing the OFF button.	Contact your local branch office or agency. <small>Note 1</small>	-	
	2. SHT does not operate. (It opens by manual operation.)	1. When no voltage is applied, investigate the operation circuit.	-	
		2. When voltage is applied, contact your local branch office or agency.	-	
	3. Unable to push the OFF button.	Contact your local branch office or agency.	-	
4. OFF button is broken.	Contact your local branch office or agency.	-		
4. Unable to charge	1. Manual charging is not possible.	Contact your local branch office or agency.	-	
	2. Motor charging is unavailable.	1. Check the power supply from the control circuit.	-	
		2. Check the applicable voltage.	If the motor does not operate even though the correct voltage is applied, contact your local branch office or agency.	
3. Motor operates but it does not charge.	Contact your local branch office or agency.	-		
5. Abnormal temperature rise	1. Connection of the conductors is loose.	Fasten them at the specified torque.	If discoloration of conductors and terminal mold is seen, contact your local branch office or agency.	
	2. Main circuit junction is broken.	Contact your local branch office or agency.	-	
	3. Flowing current is large.	Lower the flowing current.	-	

Note 1: When drawing out the breaker forcefully, do so after opening upper breakers.
If it is drawn out in the energized state, a major accident could occur.

Types and states of abnormality	Faulty behaviors/estimated causes	Treatment	
		Investigation/primary treatment	Secondary treatment
6. Electronic trip relay (ETR) (1)It trips unnecessarily.	1. It trips unnecessarily under normal load.	Check that the load current and ETR are set correctly. Check the trip characteristic with a field test device.	If any abnormality is found in the characteristics, contact your local branch office or agency.
	2. It trips unnecessarily when the load is started.	If the INST and STD settings are overlapping with the start inrush current, raise the settings.	If any abnormality is found, contact your local branch office or agency.
	3. Unnecessary operation due to noise/surge	Temporarily raise the setting values of ETR. Connect the control power supply frame ground.	Suppress noise/surge sources. Add noise/surge absorber.
(2)Abnormality in operation characteristics	1. It does not trip with overcurrent.	Check that the load current and ETR are set correctly. Check the trip characteristic with a field test device.	If no abnormality is found on ETR and the cause is unknown, contact your local branch office or agency.
	2. The characteristic is not observed during testing with a field test device.	Check the setting value of the field test device.	If any abnormality is found in the characteristics, contact your local branch office or agency.
(3)Abnormality in display functions and contact outputs	1. Trip cause LEDs and the pre-alarm contact outputs are not working.	Check that the control power supply is correctly applied and check ERR. LED and RUN LED. For DP2, check the wiring to DP2 from the control circuit terminal block.	If any abnormality is found, contact your local branch office or agency.
	2. Display (DP1, DP2) does not operate.		
	3. ERR. LED is lit.	Setting check: Check if li is set to the "Do not set" position.	Contact your local branch office or agency. (For the causes, refer to P.21.)
	4. RUN LED does not turn on.	Check the light up conditions (lit when the control power supply is applied or when the load current is 10% or more)	Contact your local branch office or agency.
	5. Keypad operation on the display is not available.	Check the instruction manual of the display again.	Contact your local branch office or agency.
7. Drawout/insert operation can be performed.	1. Drawout handle cannot be inserted.	Insert the drawout handle while pressing the OFF button.	If the drawout handle still cannot be inserted while pressing the OFF button, contact your local branch office or agency.
	2. Drawout handle cannot be rotated.	Check if the lock plate is pushed in. For AE4000-SW ~ AE6300-SW, check if the fixing bolts on both sides of the cradle are released.	Contact your local branch office or agency.
	3. The lock plate cannot be pressed in.	Slightly rotate the drawout handles to the right and left, and push the lock plate into a position where it goes in slightly.	If it cannot be pushed in, contact your local branch office or agency.
	4. Lock plate does not get protruded at "TEST" and "CONNECT" positions.	Contact your local branch office or agency.	-
	5. The lock plate is protruded at "TEST" and "CONNECT" positions, but the drawout/insert operation does not get locked.	Contact your local branch office or agency.	-
	6. Drawout position indicator does not change.	Contact your local branch office or agency.	-
	7. The main circuit junction is broken and interrupting the drawout/insert operation.	Contact your local branch office or agency.	-
	8. The control circuit terminal block is broken and interrupting the drawout/insert operation.	Contact your local branch office or agency.	-
	9. The breaker cannot be inserted. The breaker stops in the middle of insertion.	Contact your local branch office or agency.	-
8. Safety shutter (SST) does not operate.	Safety shutter (SST) barrier or unit rod is broken.	Contact your local branch office or agency.	-
9. Control circuit terminal block is not conducted at "TEST" or "CONNECT" position.	1. Mold of the control circuit terminal block is broken.	Contact your local branch office or agency.	-
	2. Terminals of the control circuit terminal block are broken.	Contact your local branch office or agency.	-
10. UVT does not draw in. (Abnormality in the UVT controller)	1. Applied voltage is too low (or too high).	Check the applied voltage, and change the applied voltage in accordance with the UVT controller specifications.	Contact your local branch office or agency.
	2. Power supply capacity is not sufficient.	Check the power supply capacity.	Contact your local branch office or agency.
	3. Trip terminal DT1 and DT2 are open.	Short-circuit between the trip terminal DT1 and DT2. When using a push button switch for tripping, check the push button switch.	Contact your local branch office or agency.
11. Auxiliary switch does not turn over.	1. Abnormality in auxiliary switch parts (inside the breaker)	Contact your local branch office or agency.	-

SERVICE NETWORK

According to Registration of Broadcasting and Communication Equipments belonging in "KC", we inform of the following user guidance.

Applicable models are Electronic type of ACBs, MCCBs and ELCBs.

사용자 안내문

Applicant: MITSUBISHI ELECTRIC AUTOMATION KOREA CO,LTD

Equipment Name : ACB

Country of Origin : JAPAN

Date of Manufacture : Otherwise Noted

Manufacturer : MITSUBISHI ELECTRIC CORPORATION

사용자 안내문

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서

가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

MITSUBISHI Low-Voltage Air Circuit Breakers World Super AE

三菱低压空气断路器 World Super AE

三菱低压气中遮断器 World Super AE

MODEL AE-SW

型号 AE-SW

形名 AE-SW

MITSUBISHI ELECTRIC CORPORATION

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