MITSUBISHI

World Super AE

ENGLISH

JAPANESE

MITSUBISHI Low-Voltage Air Circuit Breakers series
World Super AE
三菱低圧気中遮断器 World Super AE

Type AE-SW

INSTRUCTION MANUAL
取扱説明書

Types covered in this manual
対象機種

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

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

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。

05C

Safety precautions

- Before using this device, make sure to read this Instruction manual thoroughly. The cautionary items noted herein are of the utmost importance for the safe use of this device, and should always be strictly followed.
- Please make sure that the final user receives this Instruction manual.
- This Instruction manual is prepared for an electrical expert.

The following symbols have been used:

⚠DANGER	Failure to follow these instructions may result in dangerous conditions, which in turn could lead to severe personal injury or even death.

⚠CAUTION	Failure to follow these instructions may result in dangerous conditions, which could result in moderate to slight personal injury or damage to equipments and facilities.

	Warning for possible electrification 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 this device on the conditions over ratings. 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 the terminals. There is a risk of electrical shock.

⚠CAUTION

- A qualified electrician should install this equipment.
- Inspection and maintenance should be performed by a qualified electrician and only after shutting off the electric power and verifying that there is no voltage present. Failure to do so could result in an electrical shock.
- Make sure to tighten the terminal screws to the torque specified in the instruction manual. Failure to do so could result in fire.
- Do not install in areas subject to high temperatures, high humidity, dust, corrosive gas, vibrations, or shocks, etc. To do so could result in malfunction or fire.
- Install so that trash, concrete dust, iron filings or rainwater cannot get into the circuit breaker unit interior. Failure to do so could result in malfunction or fire.
- When the circuit breaker trips automatically, always clear the source of the malfunction before closing the circuit breaker. Failure to do so could result in fire.
- Terminal screws should be tightened periodically. Failure to do so could result in fire.
- Use the breaker in 50/60 Hz. Failure to do so could result in malfunction or fire.
- Dispose of this product as industrial waste.

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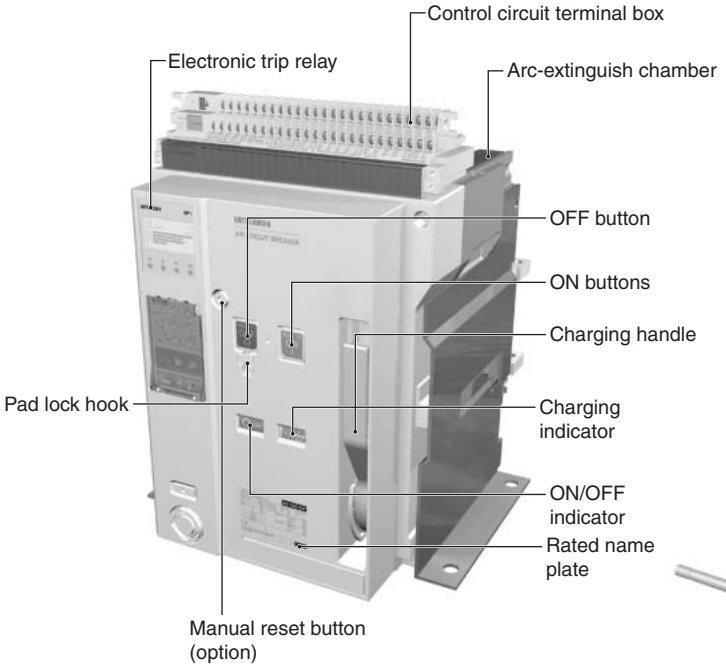
External view

< Fixed type >



Note: The fixed type is provided with lifting hooks (HP).

Fig. 3-1

< Drawout type >

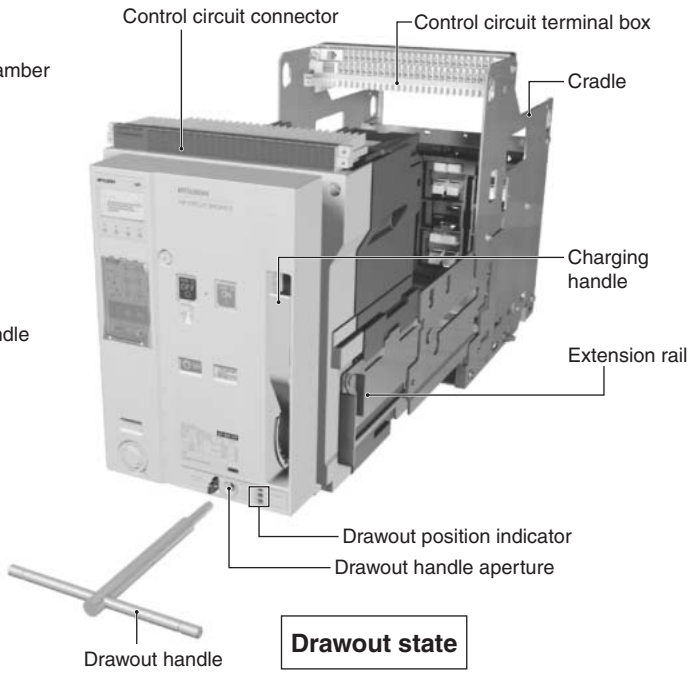


Fig. 3-2

Internal construction

AE-SW

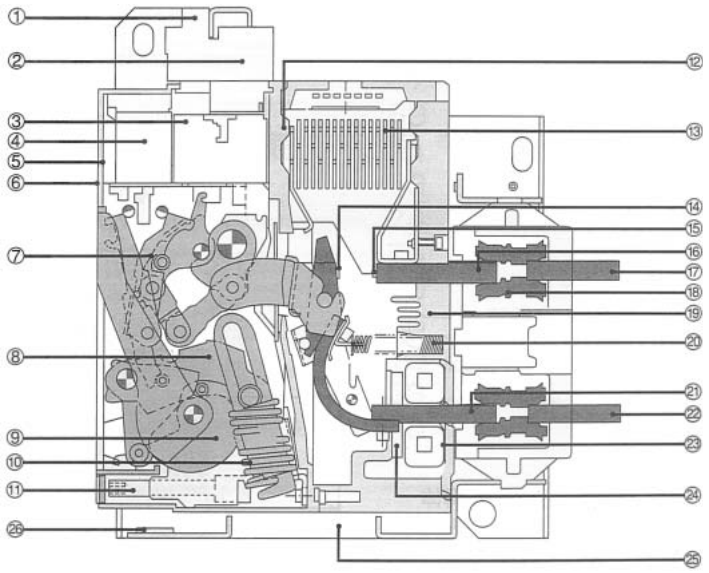


Fig. 4-1

①Control circuit terminal block
②Control circuit connector
③Auxiliary switch
④Shunt trip device, closing coil
⑤Electronic trip relay
⑥Front cover
⑦Tripping mechanism
⑧Closing mechanism
⑨Charging mechanism
⑩Closing spring
⑪Drawout mechanism
⑫Intermediate base
⑬Arc-extinguishing chamber
⑭Movable contact
⑮Fixed contact
⑯Conductor on the breaker
⑰Conductor on the cradle
⑱Main circuit junction
⑲Base
⑳Contact spring
㉑Conductor on the breaker
㉒Conductor on the cradle
㉓Power supply CT
㉔Current sensor coil
㉕Cradle
㉖Cradle name plate

Outline dimensions and Weight

Table 4-1

Type			AE630-SW	AE1000-SW	AE1250-SW	AE1600-SW	AE2000-SWA
Dimension a × b × c × d (mm)	Fixed type	3P	340 × 410 × 290 × 40				340 × 410 × 290 × 108
		4P	425 × 410 × 290 × 40				425 × 410 × 290 × 108
	Drawout type	3P	300 × 430 × 368 × 61				300 × 430 × 368 × 104
		4P	385 × 430 × 368 × 61				385 × 430 × 368 × 104
Weight (kg)	Fixed type	3P	40	41		42	47
		4P	50	51		52	57
	Drawout type	3P	63	64		65	70
		4P	77	78		79	84
	Cradle only	3P	26				31
		4P	30				35

● Fixed type

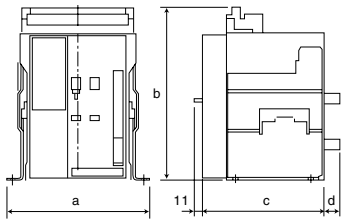


Fig. 4-2

Table 4-2

Type			AE2000-SW	AE2500-SW	AE3200-SW	AE4000-SWA
Dimension a × b × c × d (mm)	Fixed type	3P	475 × 410 × 290 × 40			475 × 410 × 290 × 117
		4P	605 × 410 × 290 × 40			605 × 410 × 290 × 117
	Drawout type	3P	435 × 430 × 368 × 61			439 × 430 × 368 × 109
		4P	565 × 430 × 368 × 61			569 × 430 × 368 × 109
Weight (kg)	Fixed type	3P	60	61	63	81
		4P	72	73	75	99
	Drawout type	3P	92	93	95	108
		4P	113	114	116	136
	Cradle only	3P	35		36	49
		4P	43		44	61

● Drawout type

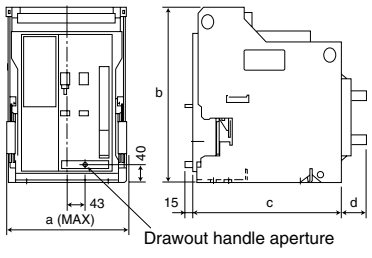


Fig. 4-3

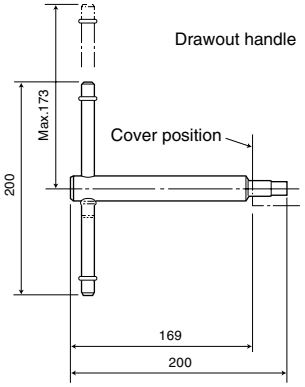


Fig. 4-4

Unpacking

① Make sure that the packing case is free from any abnormality such as breaking and/or wetting.
② Referring to the rating nameplate, make sure that the delivered breaker is in conformity with your order. Serial No. is indicated on the rated name plate and the cradle name plate (Fig. 4-1㉖).

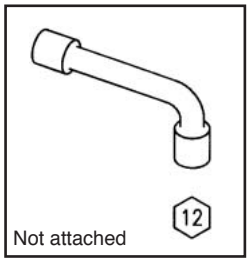


Fig. 5-1

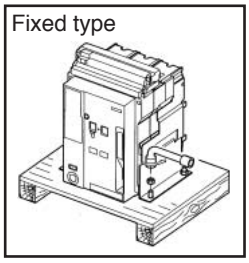


Fig. 5-2

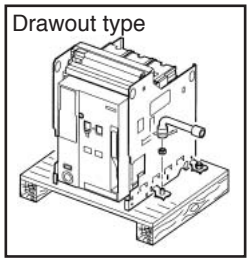


Fig. 5-3

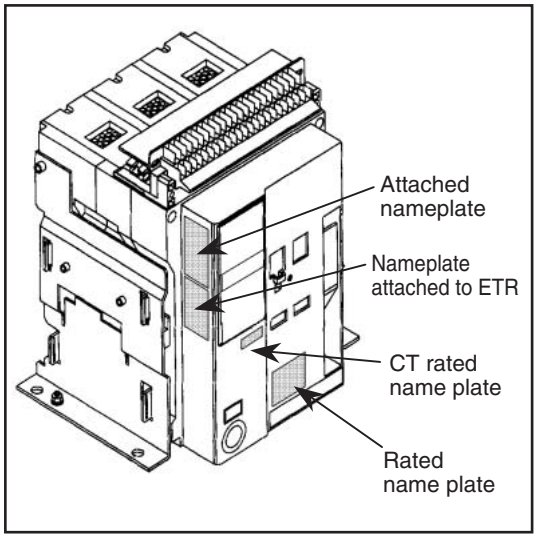


Fig. 5-4

Storage

✻ When you start using the breaker after storage and if its storage period is over 6 years, use it after lubrication as stated in "Grease lubricating procedure" for the maintenance manual.

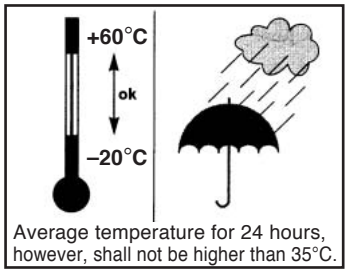


Fig. 5-5

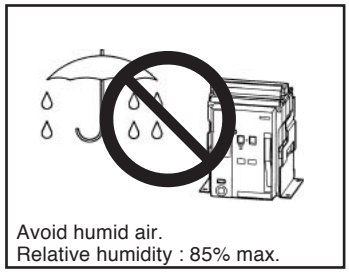


Fig. 5-6

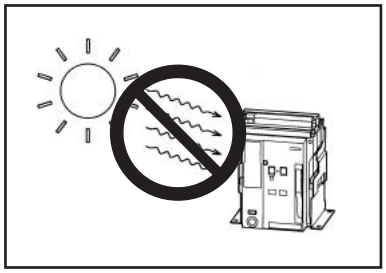


Fig. 5-7

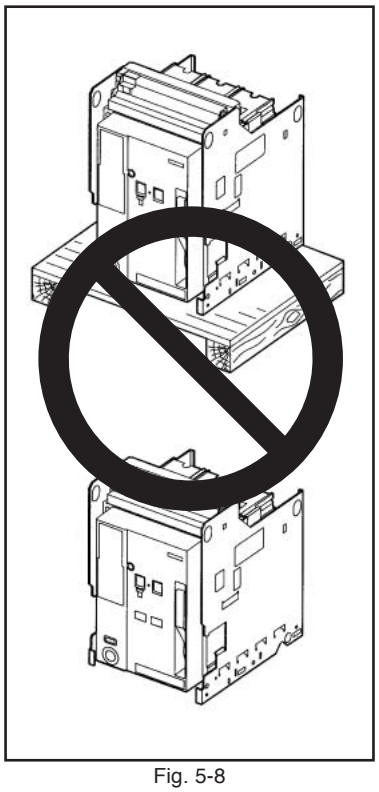


Fig. 5-8

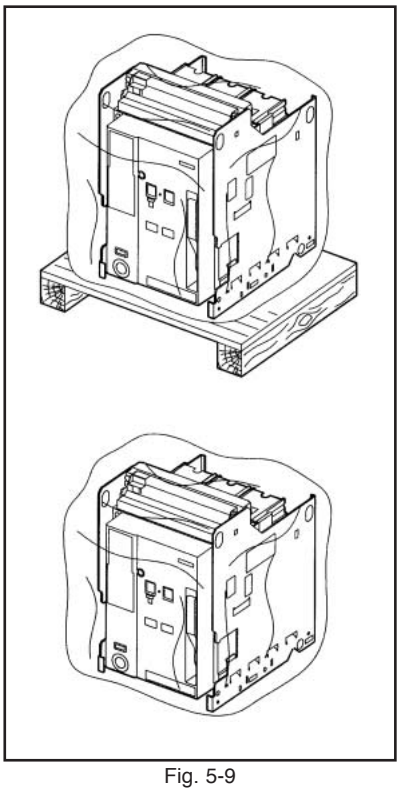


Fig. 5-9

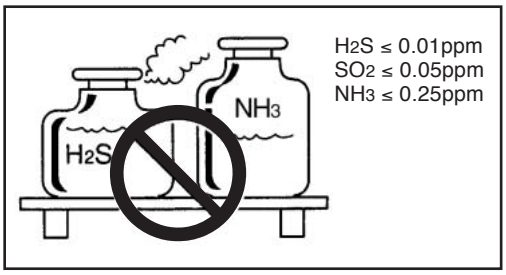


Fig. 5-10

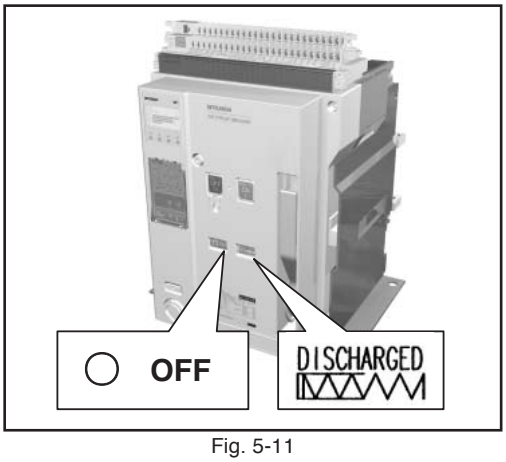


Fig. 5-11

Handling

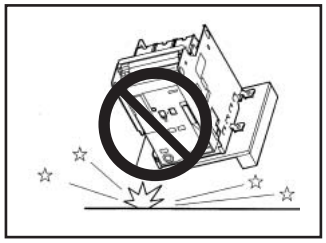


Fig. 6-1

Never drop the breaker when handling.

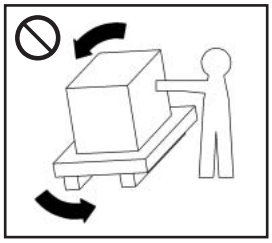
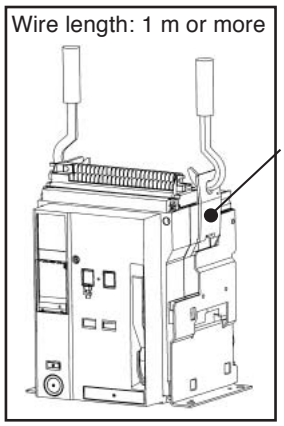


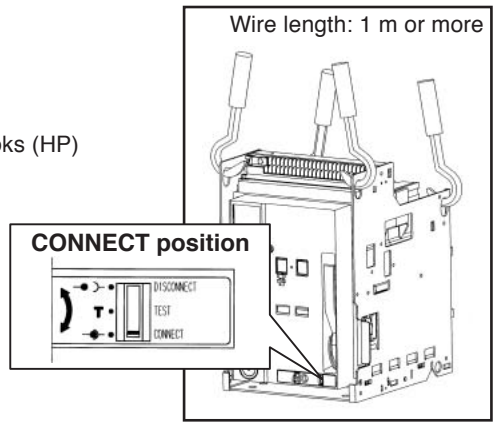
Fig. 6-2

Never roll the breaker when handling.



Fixed type

Fig. 6-3



Drawout type

Fig. 6-4

When the drawout breaker is lifted with the cradle, lift it when it is the “CONNECT” position.

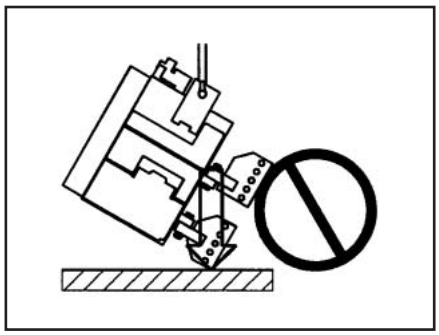


Fig. 6-5

When lifting and placing, be careful neither to drop nor to impact the breaker and the terminals for the center of gravity is by the terminal.

Installation

< Drawout type >

Tolerance on support flatness ≤ 1 mm

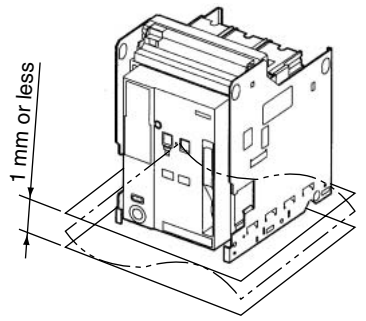


Fig. 7-1

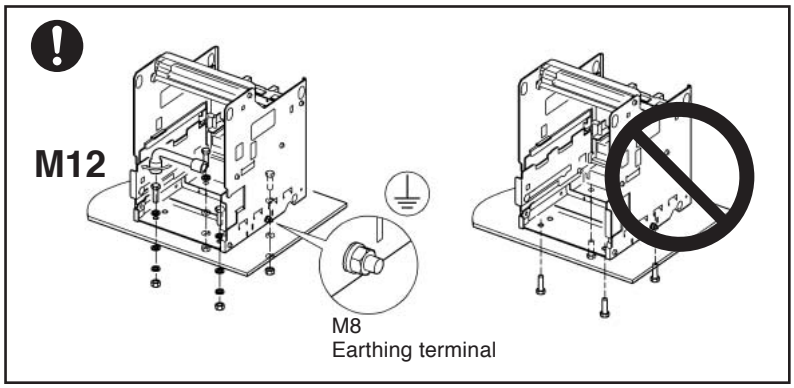


Fig. 7-2

Operate the drawout operation (CONNECT position to DRAWOUT position) according to instructions of drawout operation. (Refer to P.13 and 14.)

Lifting by lifting truck or lifting hooks

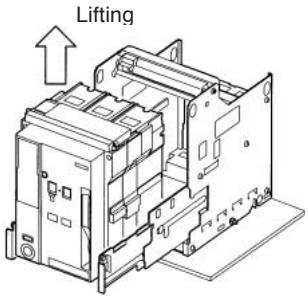
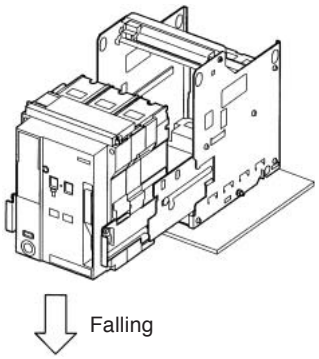


Fig. 7-3

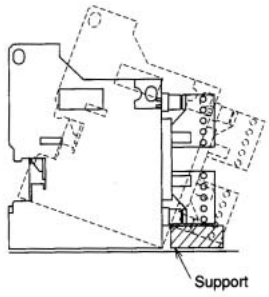
⚠CAUTION



When the main body is drawn out, the center of gravity shifts to the front. If the cradle is not secured, take measures against overturning and dropping.

Fig. 7-4

⚠CAUTION



On AE4000-SWA, the center of gravity of the cradle is located at the terminal position. When the main body is removed from the cradle, the cradle may turn over backward. Take measures against overturning.

Fig. 7-5

< Fixed type >

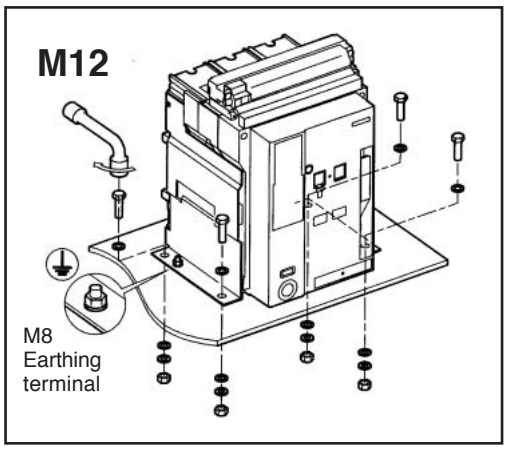


Fig. 7-6

Mount of drawout handle

The drawout handle can be mounted on any of the left and right sides of the cradle.

● Mounting on the left side

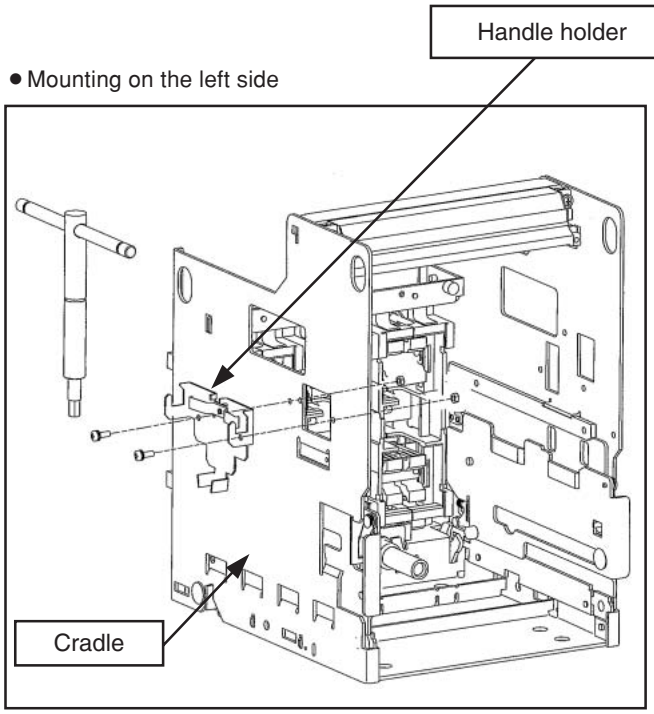


Fig. 8-1

● Mounting on the right side

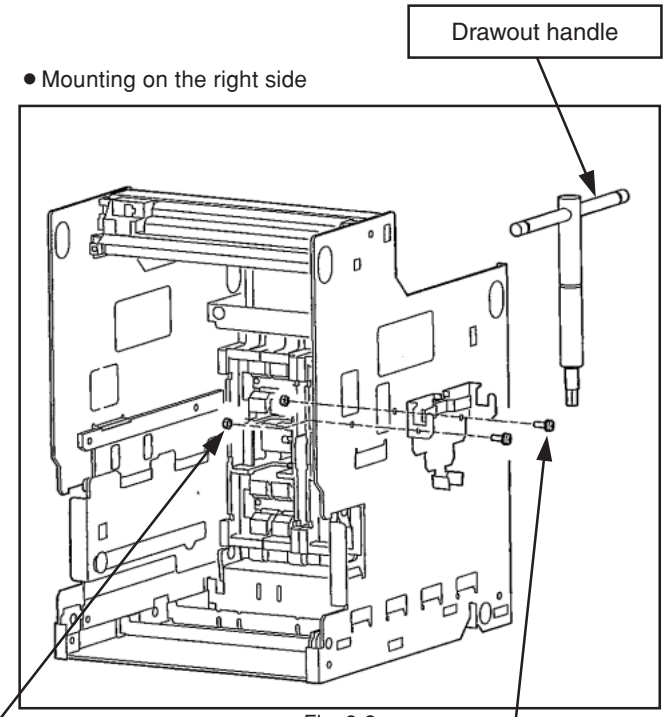


Fig. 8-2

Note: The drawout handle cannot be mounted on the left side of the cradle when the cradle is provided with a mechanical inter lock (MI) or a door inter lock (DI). Mount the handle at an appropriate position in the panel.

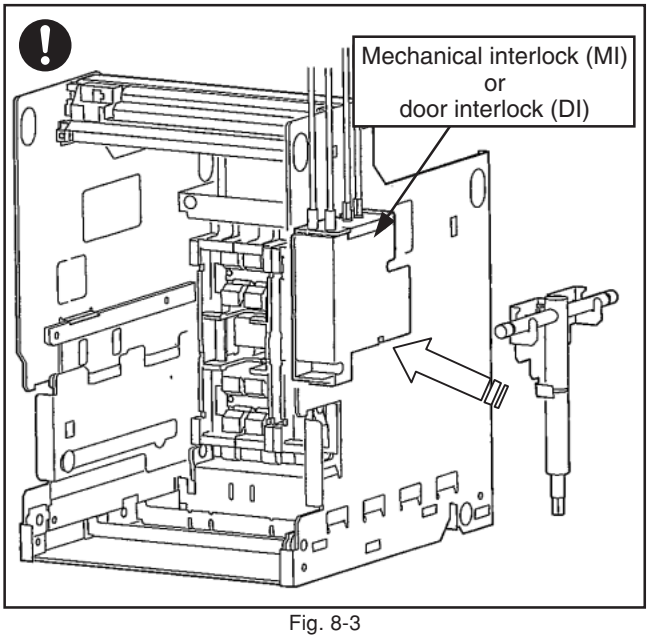


Fig. 8-3

Connection

■Main circuit

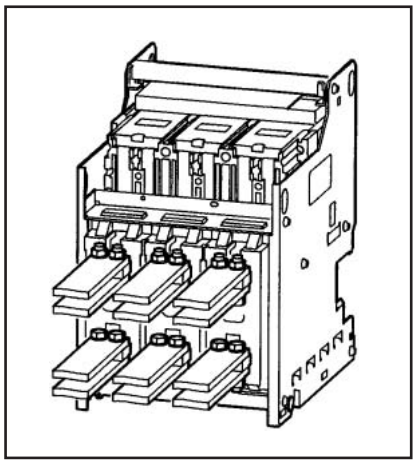
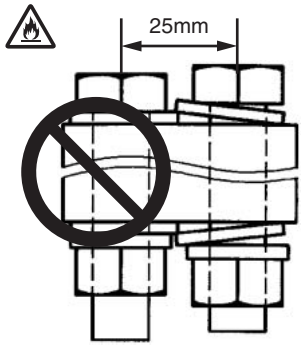


Fig. 9-1

⚠CAUTION



Use small washers to connect that the washers do not overlap with each other.

Fig. 9-2

⚠CAUTION

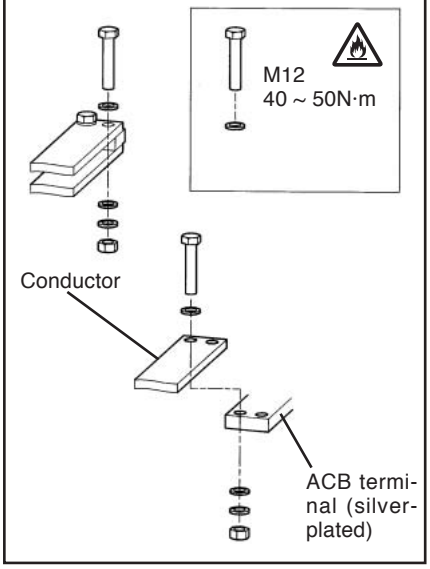


Fig. 9-3

⚠CAUTION

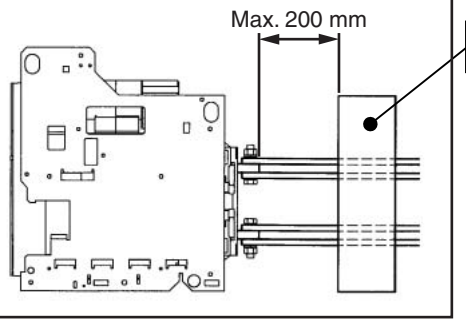


Fig. 9-4

■Control circuit

● Crimp-type terminal size

1.25 mm^2 ~ 2.0 mm^2 wires
Recommended crimp-type terminals
N2-M3(RAP2-3.5) (JST)
FN2-M3(RBP2-3.5) (JST)
N2-YS3A(JST)

If the screw is tightened with excessive torque, the terminal and the screw may be damaged. Tighten the screw to the specified torque.

Screwdrivers should be used whose diameters are of size suited to the diameters of the cruciform grooves. Size of diameter : (Phillips, H shape type)
For M3.5 : No.2

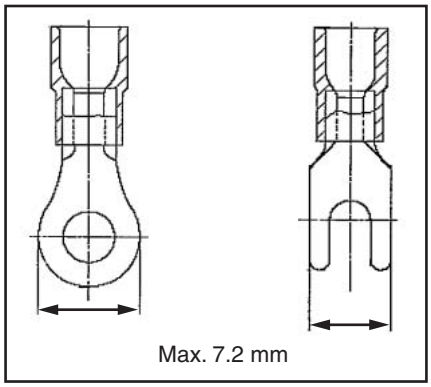


Fig. 9-5

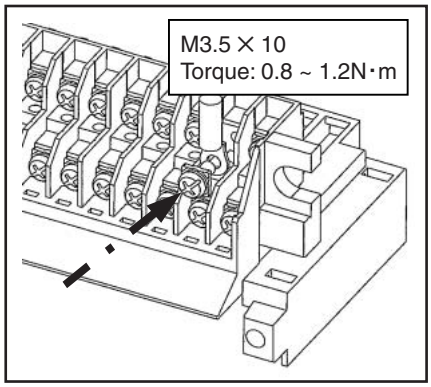


Fig. 9-6

Passage wiring

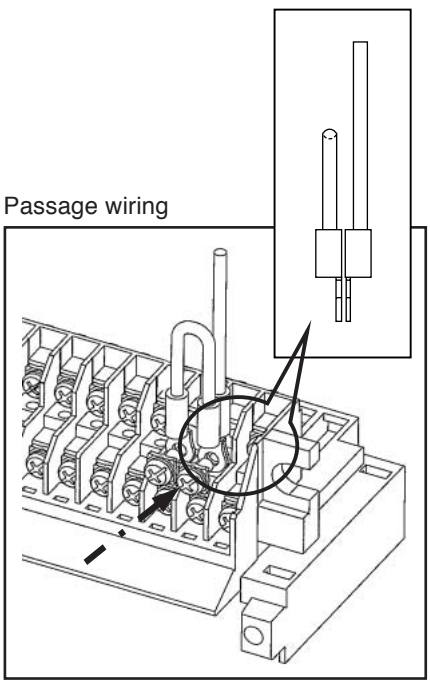


Fig. 9-7

Table 10-1 Electromagnetic force in N per 1 m conductor (3-phase short circulation)

(N)

Type / Conductor distance (mm) / Prospective fault current	AE630-SW ~ AE1600-SW	AE2000-SWA		AE2000-SW ~ AE3200-SW	AE4000-SWA			
					Drawout type		Fixed type	
KA (pf)	85	3P 115	4P 105	130	3P 190	4P 170	3P 152	4P 145
30 (0.2)	7,700	5,700	6,300	5,100	3,500	3,900	4,300	4,500
42 (0.2)	15,100	11,200	12,200	9,900	6,800	7,600	8,500	8,900
50 (0.2)	21,400	15,800	17,300	14,000	9,600	10,700	12,000	12,600
65 (0.2)	36,100	26,700	29,300	23,600	16,200	18,100	20,200	21,200
75 (0.2)	—	—	—	31,500	21,500	24,100	26,900	28,200
85 (0.2)	—	—	—	40,400	27,600	30,900	34,500	36,200

Table 10-2

Conductor size (IEC60947-1)
(40°C ambient temperature, open air)

Rated current max. (A)	Arrangement	Connecting conductors (Copper bus bar)	
		Quantity	Conductor size (mm)
630	Vertical	2	40 × 5
1000	Vertical	2	60 × 5
1250	Vertical	2	80 × 5
1600	Vertical	2	100 × 5
2000	Vertical	3	
2500	Vertical	4	
3200	Vertical	3	100 × 10
4000 (AE4000-SWA Fixed type)	Vertical	3	150 × 10
4000 (AE4000-SWA Drawout type)	Vertical	4	150 × 10

Note: Table 10-2 shows conductor size based on IEC 60947-1 in ambient temperature 40°C and open air. And the examination circuit is as Fig. 10-1

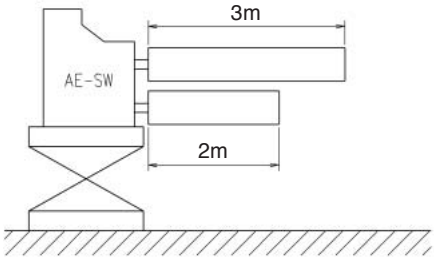


Fig. 10-1

Insert operation

■DISCONNECT → CONNECT position

① Release the lock levers, and pull the extension rails forward.

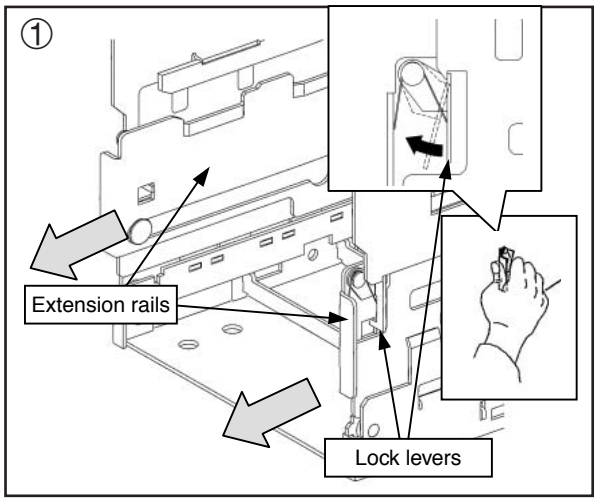


Fig. 11-1

② Place the breaker on the extension rails, using a lifter or ropes. Mount the concave of the breaker in the rail protruding portion. (Fig. 11-5)

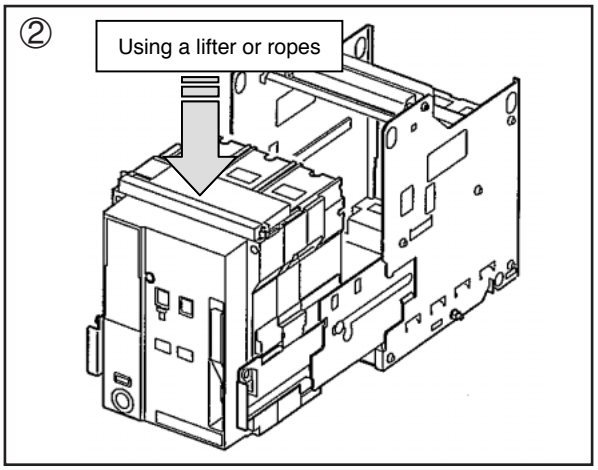


Fig. 11-2

③ Slowly push the breaker in unit it does not move.

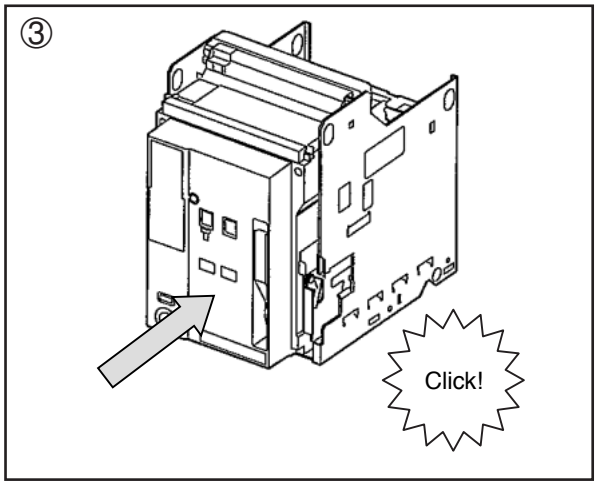
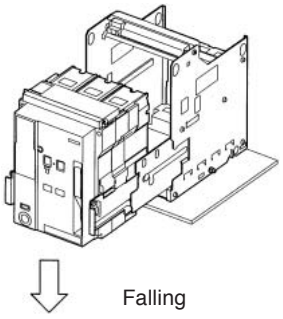


Fig. 11-3

⚠CAUTION



If the breaker main body is put on the rails with the cradle unsecured, the center of gravity shifts to the front. Take measures against overturning.

Fig. 11-4

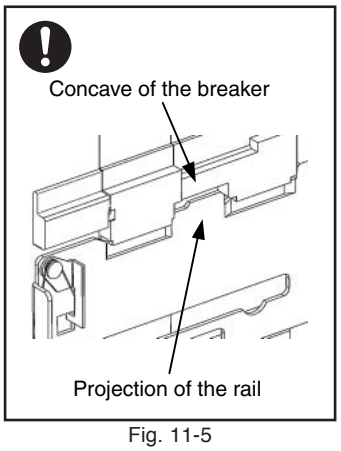


Fig. 11-5

④ Keeping the OFF button pushed, insert the drawout handle. Make sure that the drawout position indicator shows “DISCONNECT” (Fig. 11-7).

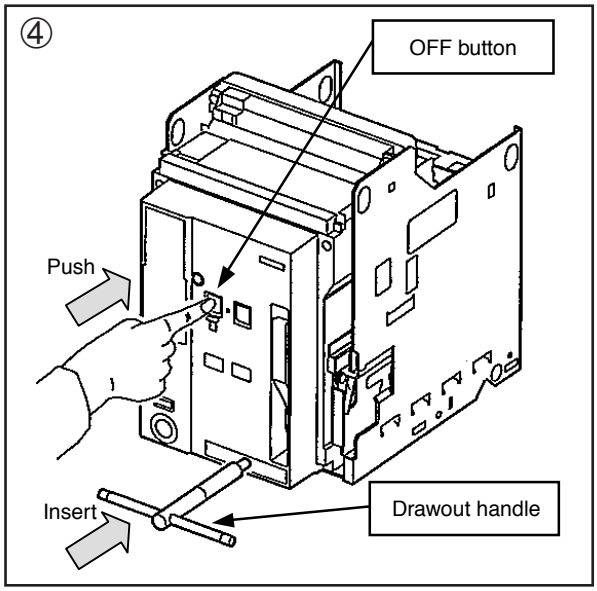


Fig. 11-6

⚠CAUTION

Shut finger

Take care not to shut finger between extension rails and switch board when the breaker is insert.

DISCONNECT position

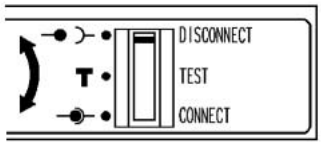


Fig. 11-7

(Prohibition)

Do not insert the drawout handle unless the OFF button is pushed.
There is a possibility of damaging.

⑤ Push the lock plate in fully until it is latched to release the lock.

(Note:)

(a) If the lock plate is not fully released, turn the drawout handle to right and left a little.

(b) Be sure to push the lock plate in fully to release position, otherwise the drawout position indicator may not function collectoly.

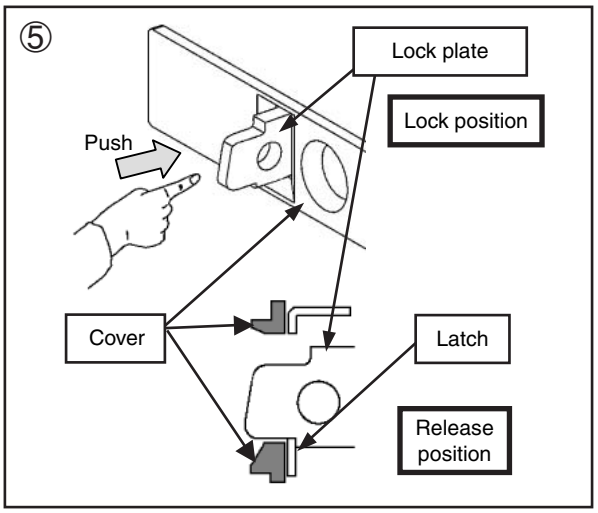


Fig. 12-1

⑦ When the breaker is inserted to the test position, the drawout position indicator shows TEST position, and the lock plate automatically protrudes to lock the drawout handle.

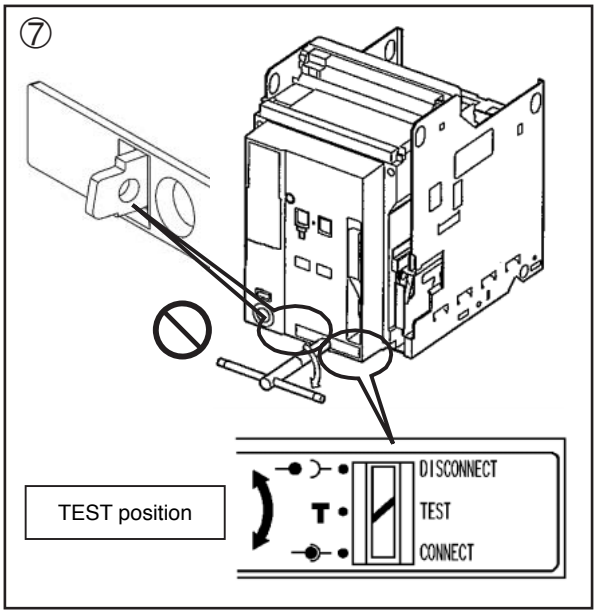


Fig. 12-3

⑥ After releasing the lock plate, turn the drawout handle clockwise. Operating torque is less than 30 N·m.

(Note:)

(a) In the middle of insert operation, do not turn the drawout handle drawout operation. The drawout position indicator may not function correctly.

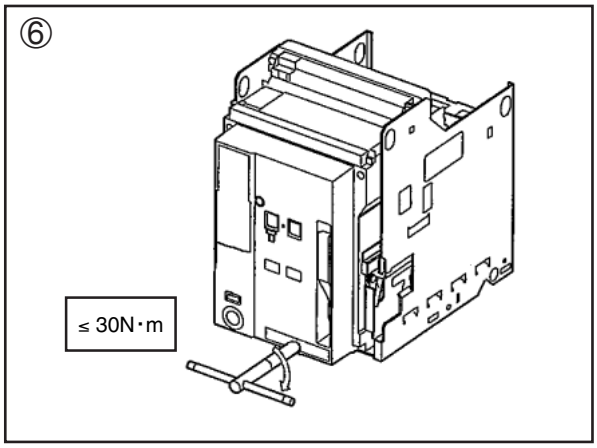


Fig. 12-2

⑧ Then, push the lock plate to turn the handle clockwise. When the breaker is inserted to the connect position, the lock plate automatically protrudes to indicate that the breaker has been inserted completely. The drawout position indicator shows CONNECT position.

⚠CAUTION

Insert the breaker until the lock plate protrudes. If it does not protruding, the breaker may not be connected completely.

(Note:)

(a) After insertion is completed, do not turn the drawout handle further.

(b) The drawout position indicator shows the position (CONNECT or TEST) of the breaker at the time when the lock plate protrudes. When the lock plate is in the released state, the indicator shows the reference position.

(c) It is impossible to close the breaker when inserting the drawout handle.

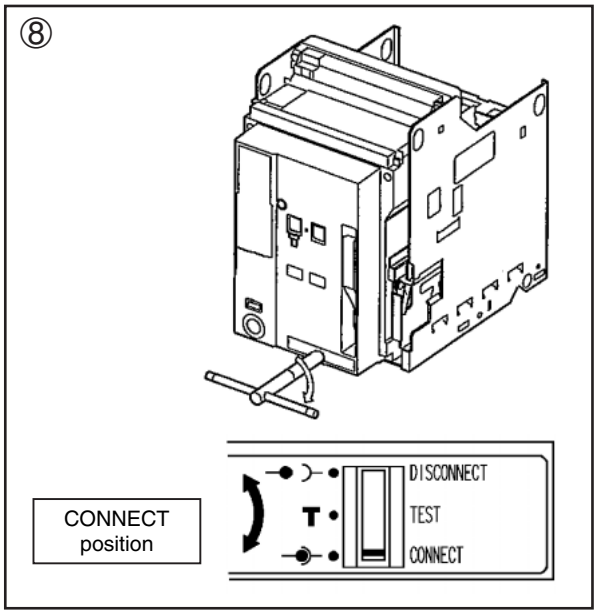


Fig. 12-4

Drawout operation

■CONNECT → DISCONNECT position

① Keeping the OFF button pushed, insert the drawout handle.

CONNECT position

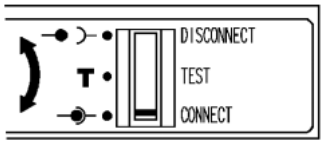


Fig. 13-1

(Prohibition)

Do not insert the drawout handle unless the OFF button is pushed.

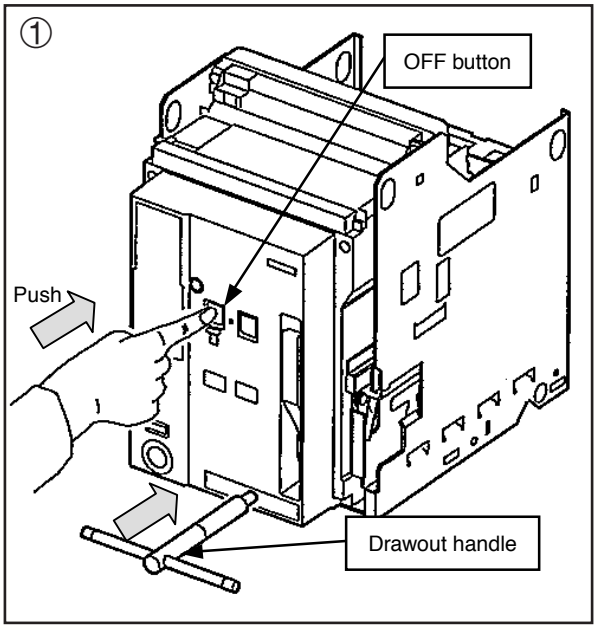


Fig. 13-2

② Push the lock plate in fully until it is latched to release the lock.

(Note:)

(a) If the lock plate is not fully released, turn the drawout handle to right and left a little.

(b) Be sure to push the lock plate in fully to the release position, otherwise the drawout position indicator may not function correctly.

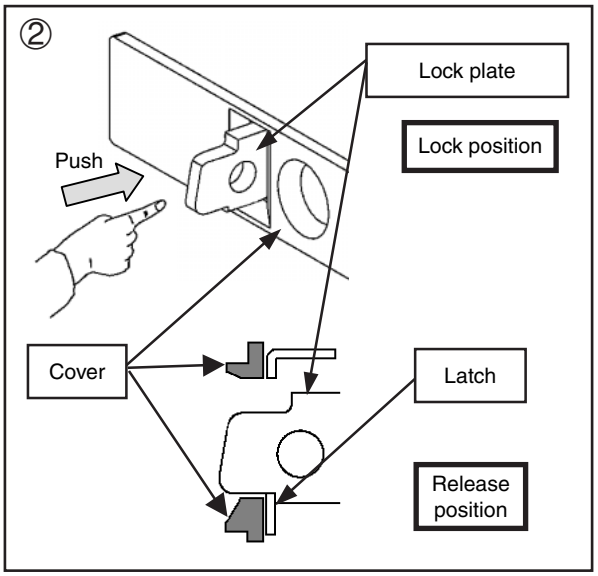


Fig. 13-3

③ After releasing the lock plate, turn the drawout handle counterclockwise. Operating torque is less than 30 N·m.

(Note:)

(a) In the middle of drawout operation, do not turn the drawout handle insert operation. The drawout position indicator may not function correctly.

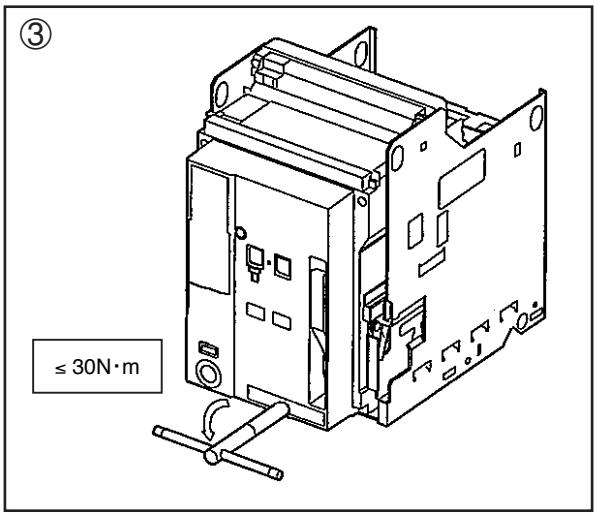


Fig. 13-4

④ When the breaker is drawn out to the test position, the drawout position indicator shows TEST position, and the lock plate automatically protrudes to lock the drawout handle.

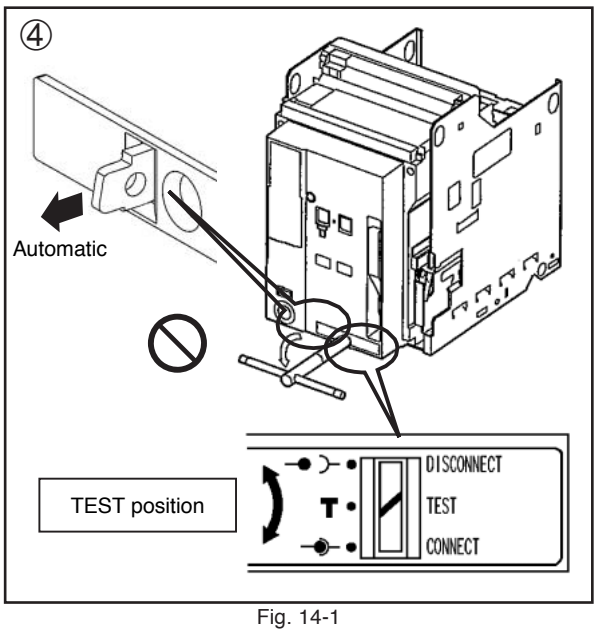


Fig. 14-1

⑤ Then, push in the lock plate, turn the drawout handle counterclockwise to change the displayed extraction position to the DISCONNECT position until the drawout position indicator shows disconnect position. The handle operation is completed. The breaker can be drawn out by hand.

(Note:)

(a) The lock plate may project before the breaker moves to the DISCONNECT position. Push the lock plate in and continue to operate the handle.

(b) If the lock plate is not fully released, turn the drawout handle to right and left a little.

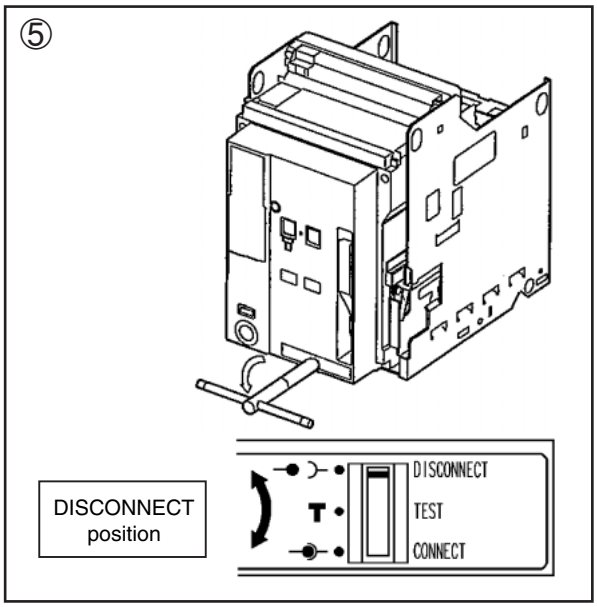
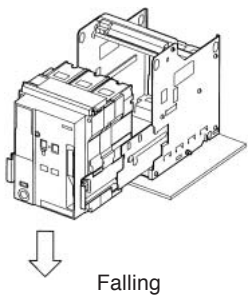


Fig. 14-2

⑥ To remove the breaker main body from the cradle, pull the lock levers toward you to unlock the main body, pull the rails toward you, and draw out the breaker.

⚠CAUTION



When the main body is drawn out, the center of gravity shifts to the front. If the cradle is not secured, take measures against overturning and falling.

⚠CAUTION

Take care not to shut finger between extension rails and switch board when the breaker is drawn out.

Fig. 14-3

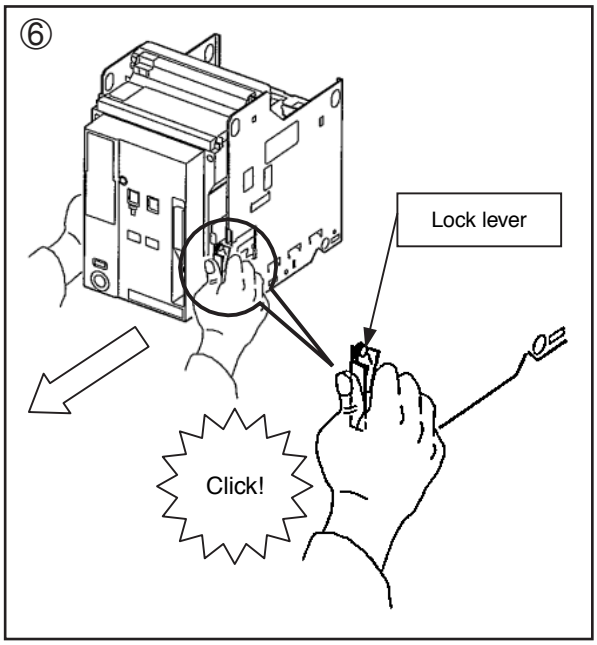
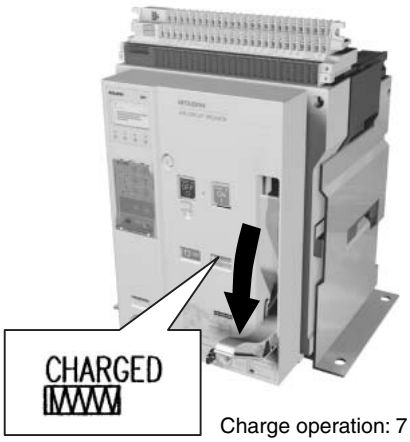


Fig. 14-4

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.
The operating load is 30 N·m or less.



Charge operation: 7 to 8 times

Fig. 15-1

< Motor charging >

The closing spring is electrically charged.
This is an “ON charge method”, in which the spring is automatically charged when the breaker is closed.

- Manual charging operation is also possible using the charging handle.
- Pumping prevention is assured both electrically and mechanically.
- 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.

Table 15-1 Motor charging rating

Rated voltage (V)	Applicable voltage range (V)	Applied voltage (V)	Inrush current (peak) (A)	Steady current (A)	Charging time	Criterion for power requirement (VA)
24 DC	18-26.4	24	22	6	5 sec or less	500
48 DC	36-52.8	48	14	3		
100-125 AC/DC	85-137.5	100	10 (10)	3 (4)		700
		125	12 (12)	3 (4)		1000
200-250 AC/DC	170-275	200	5 (7)	1 (2)		700
		250	6 (8)	1 (2)		1000

Note: Contents in parentheses show the case of AE4000-SWA 4-pole.
24 V DC and 48 V DC products of AE4000-SWA 4-pole cannot be manufactured.

MD circuit diagram

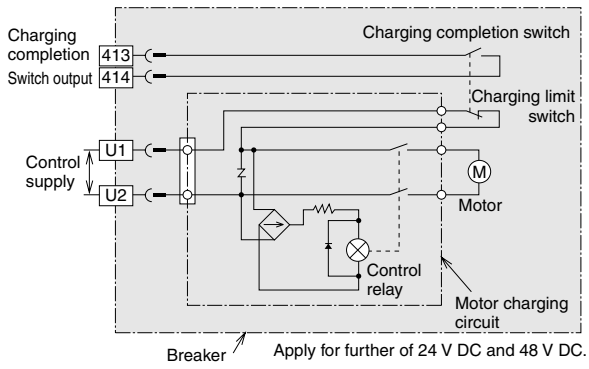


Fig. 15-2

Opening/Closing operation

< Conditions of ON operation >

ON operation will be possible, when all the following conditions have fulfilled.

- 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.

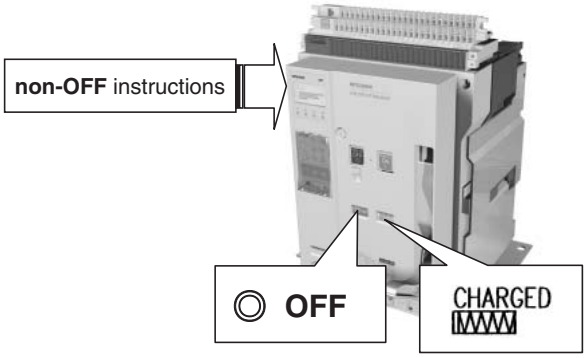


Fig. 16-1

Manual 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.

(Note:)
When the OFF lock device (Padlock, cylinder lock, castell lock etc.) is used, the closing operation should be made after the lock is released.
Opening and closing of the drawout type breaker must be carried out in either the CONNECT or the TEST position.
If an under voltage trip device (UVT) is provided, its rated voltage should be applied before attempting to close and open the breaker.

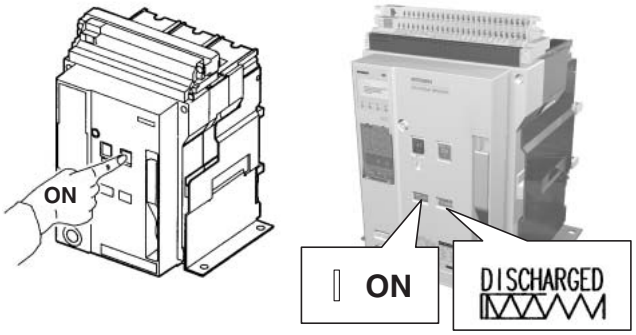


Fig. 16-2

< Opening >

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

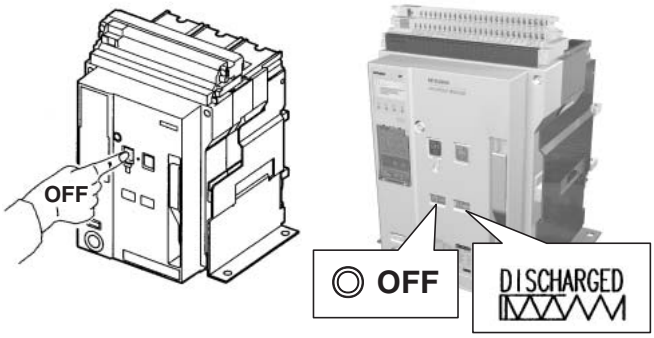


Fig. 16-3

Opening/Closing operation

Electrical operation

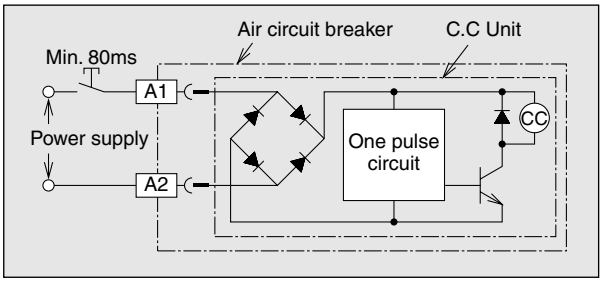
< Closing >

Remote closing can be made by emerging the closing coil (CC). Apply the rated voltage to the control terminals A1, A2, and the breaker closes.
The unit comprises an unti-pumping circuit which allows only one action without first de-energizing then re-energizing.
To re-close the breaker, once turn off power (between A1 and A2) to the closing coil, and re-apply the rated voltage to them.
When the breaker has an under-voltage trip device (UVT), the breaker cannot be closed if power is not applied. (After power is applied to the UVT, it takes a waiting time of 1.5 sec until the breaker can be closed.)

< Opening >

The use of a shunt trip device (SHT) or an under-voltage trip device (UVT) enables to electrically trip the breaker.
When an SHT is used, apply the rated voltage to C1 and C2 on the control circuit terminal block.
When a UVT is used, open the trip terminals DT1 and DT2 on the control circuit terminal block. (A short-circuiting bar has been fitted before shipment. Remove the bar before using the terminals.)
Or turn off an applied voltage to D1 and D2.

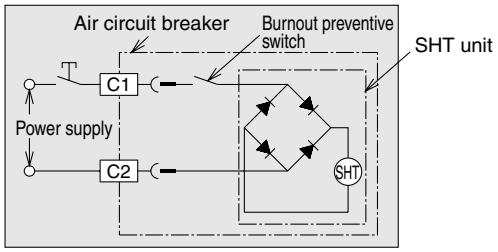
Control supply



Note: 24 to 48 V DC does not have rectifier circuit.

Fig. 17-1

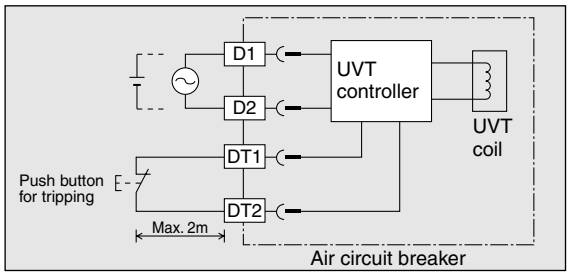
SHT circuit diagram



Note: 24 to 48 V DC does not have rectifier circuit.

Fig. 17-2

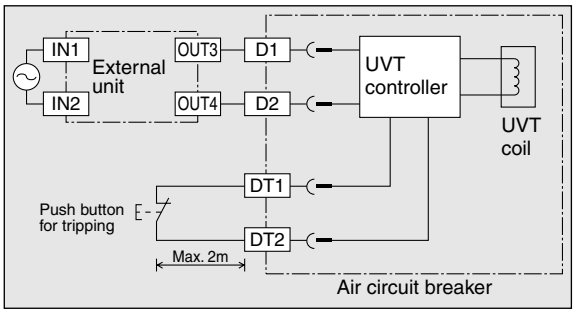
UVT circuit diagram (for 100 ~ 120 V AC, 200 ~ 240 V AC or DC voltage)



Note: Use a pushbutton for tripping having power ratings of 150 V DC and 0.5 A or more.

Fig. 17-3

UVT circuit diagram (for 380 ~ 460 V AC)



Note: Use a pushbutton for tripping having power ratings of 150 V DC and 0.5 A or more.
The external transformer dedicated for AE-SW is used.
Only one UVT controller can be connected to one external unit.

Fig. 17-4

Door interlock (DI)

< Procedures for releasing door interlock >

① Even when the breaker is on, the interlock can be manually released.
For this purpose, make a hole 7 or more in diameter in the panel door. (See the following figure.)

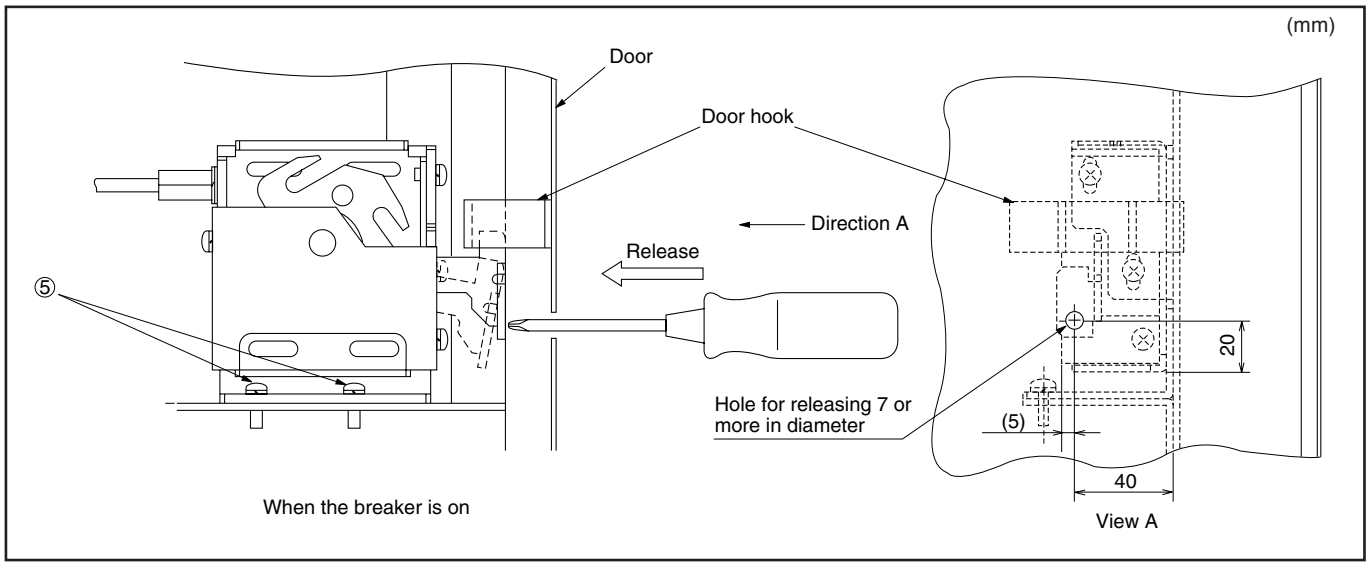


Fig. 18-1

Cylinder lock (CYL) and Castel Lock (CAL)

< Procedures for locking in off state >

① Press the OFF button to turn off the ACB.

② Hold down the OFF button and turn the key to the locking side. Then, the key can be removed, and the breaker will be locked in the off state.

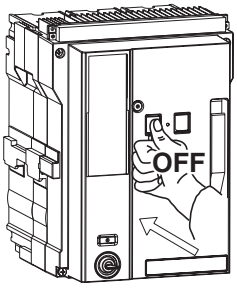


Fig. 18-2

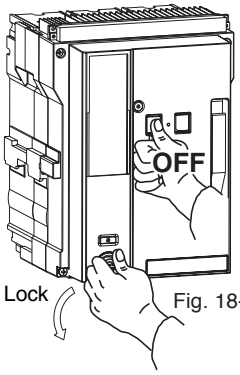


Fig. 18-3

< Releasing procedures >

① Insert the key, and turn the key to the releasing side.
If the key cannot be turned smoothly, hold down the OFF button and turn the key to the releasing side.

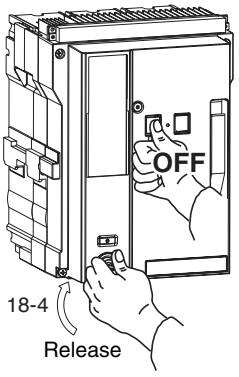


Fig. 18-4

Shutter lock (SST-LOCK)

The safety shutter can be locked at the closing position so that the live parts are not touched.
Prepare a pad lock (5 in diameter) by yourself.

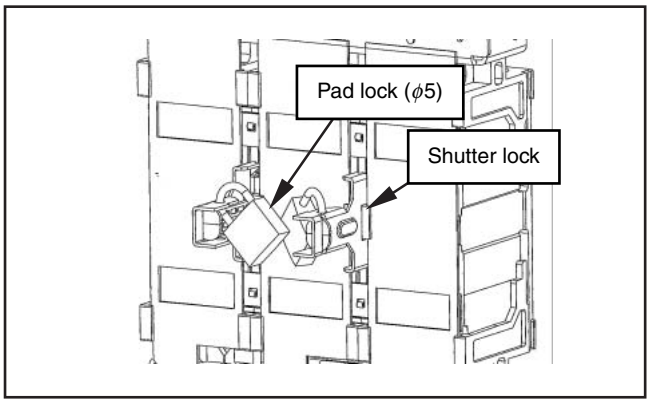


Fig. 18-5

Functions of electronic trip relay (ETR) parts

< Functions >

① ERR. LED, Contact alarm output
When any abnormality or setting failure is found in ETR, the LED alerts the operators to the abnormal status. When the power type is P3 to P5, contact output is given between 513 and 574 on the control circuit terminal block.

- ETR function (Microprocessor, H/W)
- Mis-setting of INST. /MCR dial (P.19)
- Internal wiring of breaker related to ETR

② RUN LED (ETR)
This LED indicates that ETR is functional. When control power is applied or approx. 10% of current flows into the main circuit, the internal circuit will start, and the LED will light.

③ RUN LED (Optional setting module)
This LED indicates that the optional setting module is functional.
When the control power is applied or approx. 10% of the main circuit current flows, the LED will light.

④ Trip indicator (LED and contact alarm output)
The LED indicates the tripping or pre-alarm status. When the power supply type is P3 to P5, contact output is given between 513 (common) and 524, 534, 544 and 554 on the control circuit terminal block.
When the current exceeds pre-alarm current setting (Ip), the PAL LED will blink. When the LTD time (1/2 of TL) is passed, the PAL LED will light and output the contact.

⑤ TAL LED and contact output Option
The ETR temperature detector is made functional by fitting a TAL sensor.
When the power type is P3 to P5, 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, take measures with an external sequence.

⑥ MCR (Making current release) Option
Only when the breaker is turned on (from the off state), it has the INST function. After it is turned on, the INST function will be disabled. If you specify the use of MCR when placing an order, the MCR switch will be incorporated in the main body. MCR will be functional by setting the INST setting dial of ETR to the MCR side.

⑦ Reset button
The trip indicator (LED and contact alarm output) can be reset by pressing the “RESET” button on the front panel of ETR or short-circuiting RS1 and RS2 on the control circuit terminal block.
(P1 and P2 types are not provided with the function to reset the indication from the control circuit terminal block.)
A function is provided to temporarily lock LTD and STD when the INST function is tested with the field test device. (See the breaker tester instruction manual.)

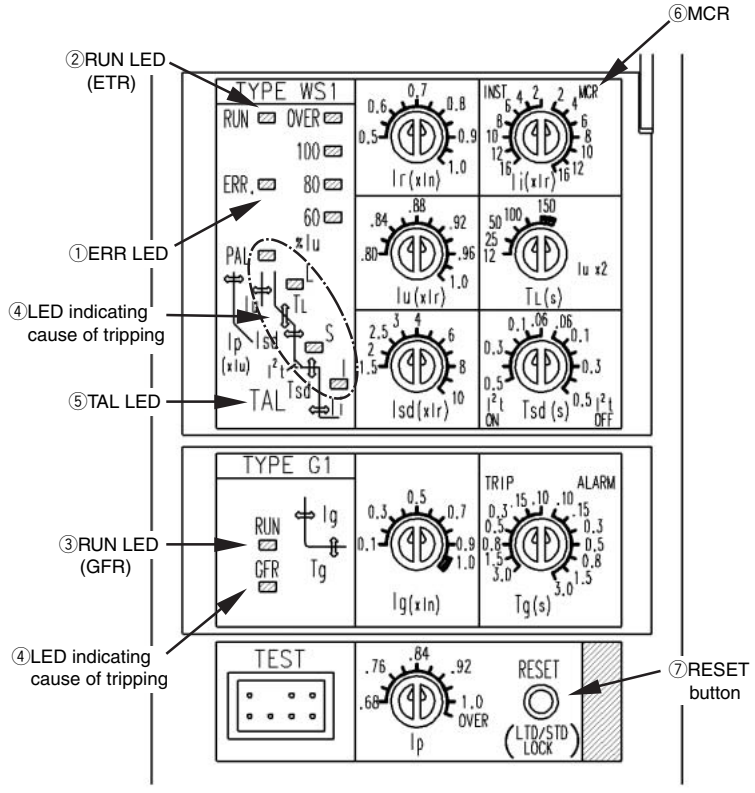


Fig. 20-1

As for the extended measuring functions, display and interface unit, see the separate instruction manual.

< Load current LED >

The current value which is used as the reference of the load current indication LED, varies depending on the ETR types and characteristics setting.

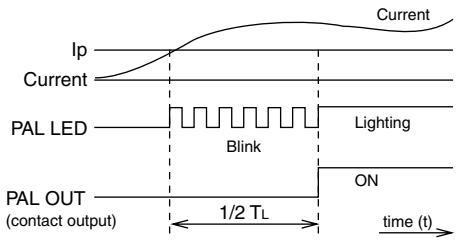
Table 21-1

Usage	ETR type	Base current of LED indication	Load current LED indication
General use	WS (WS1 WS2)	Iu Uninterrupted current	OVER ■ 100 ■ 80 ■ 60 ■ %Iu
Generator protection use	WM (WM1 WM2)	I_L LTD pick-up current	100 ■ 80 ■ 60 ■ 40 ■ %I_L
Special purpose use	WB (WB1 WB2)	Ir Rated current	OVER ■ 100 ■ 80 ■ 60 ■ %Ir

Note: When the "OVER" of WS type and the "100%" of LED are lighting, the current value is over LTD pick-up current.
The breaker carries out trip operation after specified time.

< Pre-alarm function >

When the current exceeds pre-alarm current setting (Ip), the PAL LED will blink. When the LTD time (1/2 of T_L) is passed, the PAL LED will light and output the contact.



< Power supply >

Power supply is required for the trip indicator (LED, alarm contact output), the measurement extension module, the display (LCD), etc. Over-current tripping, function when there is no control power supply, it operates with the energy of internal CT.

Table 21-2 Ratings of the power supply and output contacts

Power type	Rated voltage	Alarm output contacts
P1	100-240V AC·DC	-
P2	24-60V DC	-
P3	100-240V AC 100-125V DC	6-contacts
P4	24-60V DC	6-contacts
P5	100-240V DC	6-contacts (SSR)

Table 21-3 Alarm contact capacity (Power type P3 and P4)

Voltage (V)		Resistive load cos ϕ=1.0	Inductive load cos ϕ=0.4 L/R=0.7
AC	240	1A	0.5A
	120	1A	1A
DC	125	0.1A	0.05A
	30	1A	1A

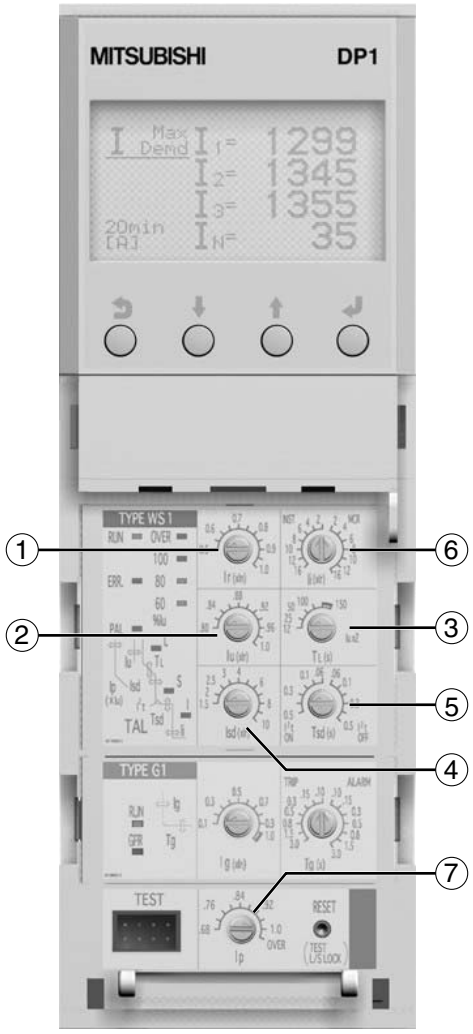
Table 21-4 Contact capacity (Power type P5)

Voltage (V)		Current	Peak current	max. ON resistance
AC	240	0.1A	0.3A	5Ω
	120	0.1A	0.3A	5Ω
DC	240	0.1A	0.3A	5Ω
	30	0.1A	0.3A	5Ω

⚠CAUTION

In case of power type P3 or P4, the alarm contact output relay is high sensitive relay. Therefore may occur a chattering noise (approximately 1 ms) by ON/OFF operation of the breaker. Please adopt a time constant filter of several ms, or sampling double reading, or the like.

Characteristics setting of type WS relay



Note: The figure includes the optional G1 setting module, display and MCR.

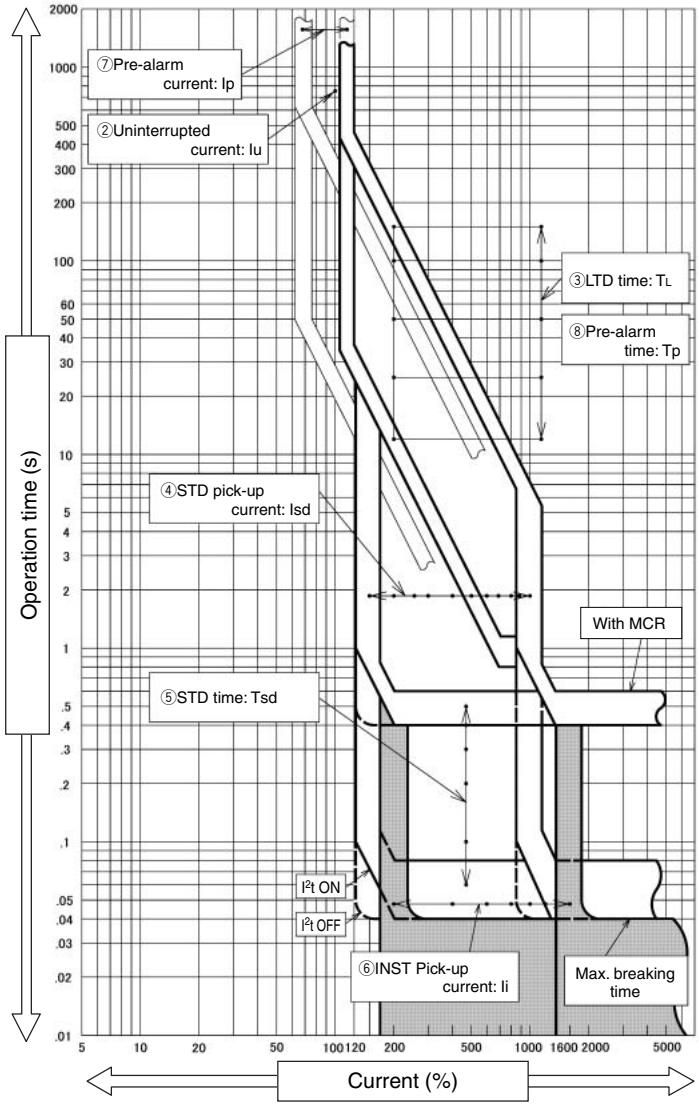


Table 22

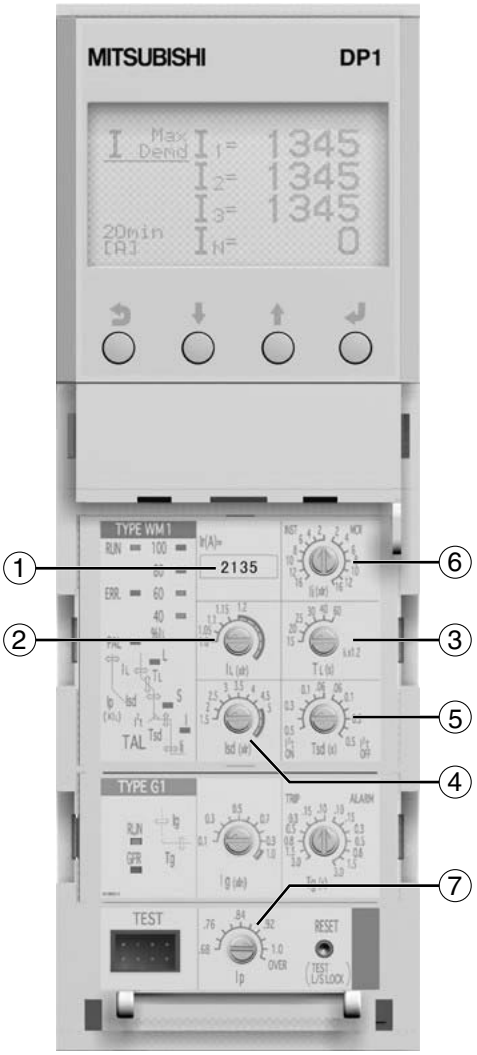
No.	Setting items	Mark	Adjustable setting range		Accuracy	Setting for shipment
			AE630-SW to AE1600-SW AE2000-SW to AE3200-SW	AE2000-SWA AE4000-SWA		
①	Rated current	Ir	0.5 to 1.0 (in 0.05 steps) ×In (CT rating)		—	1.0
②	Uninterrupted current	Iu	0.8 to 1.0 ×Ir (0.02 steps), Pick-up current: 1.15xIu		1.05×Iu···Non pick-up 1.25×Iu···Pick-up	1.0
③	LTD time	TL	12-25-50-100-150s at Iu×2		±20%	150
④	STD pick-up current	Isd	1.5-2-2.5-3-4-5-6-7-8-9-10 ×Ir		±15%	10
⑤	STD time	Tsd	0.5-0.4-0.3-0.2-0.1-0.06- (I²t ON)	0.06-0.1-0.2-0.3-0.4-0.5s (I²t OFF)	±20% 0.06···0.04-0.08s	0.5 (I²t ON)
⑥	INST Pick-up current	Ii	16-12-10-8-6-4-2-2-4-6-8-10-12-16 ×Ir (INST) (MCR) WS1	12-10-8-6-4-2-2-4-6-8-10-12 ×Ir (INST) (MCR) WS2	±15%	WS1···16 (INST) WS2···12 (INST)
⑦	Pre-alarm current	Ip	Iu×0.68 to 1.0 (0.04 steps)-OVER		±10%	OVER
⑧	Alarm time	Tp	1/2 TL (after 1/2TL, PAL output contact turns on)		±20%	—

The table shows data obtained on the breakers provided with MCR (optional). For breakers without MCR, the setting position for MCR is not provided.

Relation of setting dial

In (CT rating) — Ir — Iu — Ip
Ir — Isd — Load current LED (60, 80, 100, OVER)
Ir — Ii
Ir — Ig (Page 25)

Characteristics setting of type WM relay



Note: The figure includes the optional G1 setting module, display and MCR.

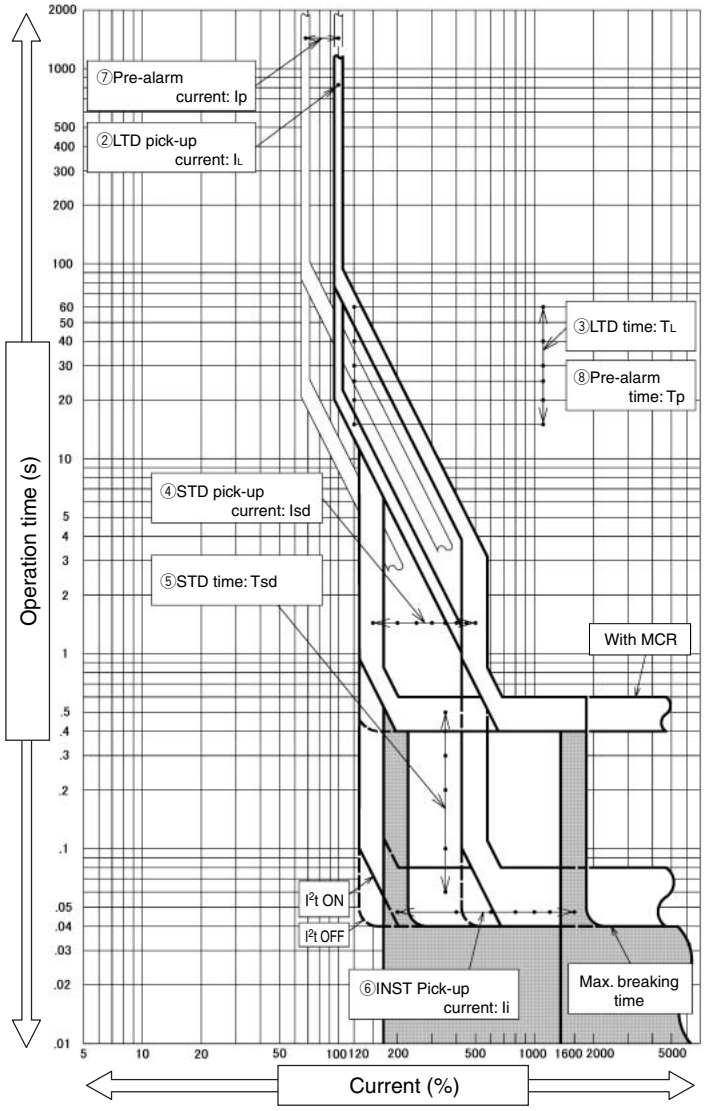


Table 23

No.	Setting items	Mark	Adjustable setting range		Accuracy	Setting for shipment
			AE630-SW to AE1600-SW AE2000-SW to AE3200-SW	AE2000-SWA, AE4000-SWA		
①	Rated current	Ir	0.63 to 1.0×In Set to specified current value before shipment (Fixed)		—	Set to specified value before shipment
②	LTD pick-up current	I_L	1.0-1.05-1.1-1.15-1.2		±5%	1.15
③	LTD time	T_L	15-20-25-30-40-60s at I_L×1.2		±20%	15
④	STD pick-up current	Isd	1.5-2-2.5-3-3.5-4-4.5-5 ×Ir		±15%	5
⑤	STD time	Tsd	0.5-0.4-0.3-0.2-0.1-0.06- (I²t ON) 0.06-0.1-0.2-0.3-0.4-0.5s (I²t OFF)		±20% 0.06···0.04-0.08s	0.5 (I²t ON)
⑥	INST Pick-up current	Ii	16-12-10-8-6-4-2-2-4-6-8-10-12-16 ×Ir (INST) (MCR) WM1	12-10-8-6-4-2-2-4-6-8-10-12 ×Ir (INST) (MCR) WM2	±15%	WM1···16 (INST) WM2···12 (INST)
⑦	Pre-alarm current	Ip	I_L×0.68 to 1.0 (0.04 steps)-OVER		±5%	OVER
⑧	Alarm time	Tp	1/2 T_L (after 1/2T_L, PAL output contact turns on)		±20%	—

The table shows data obtained on the breakers provided with MCR (optional). For breakers without MCR, the setting position for MCR is not provided.
When the WM relay is used, the pre-alarm current at the setting, OVER, is the same as that at 1.0.

Relation of setting dial

In (CT rating) — Ir (Fixed) — I_L — Ip
Isd — Load current LED (40, 60, 80, OVER)
Ig(Page 25) — Ii

Characteristics setting of type WB relay

Note: The figure include MCR function.

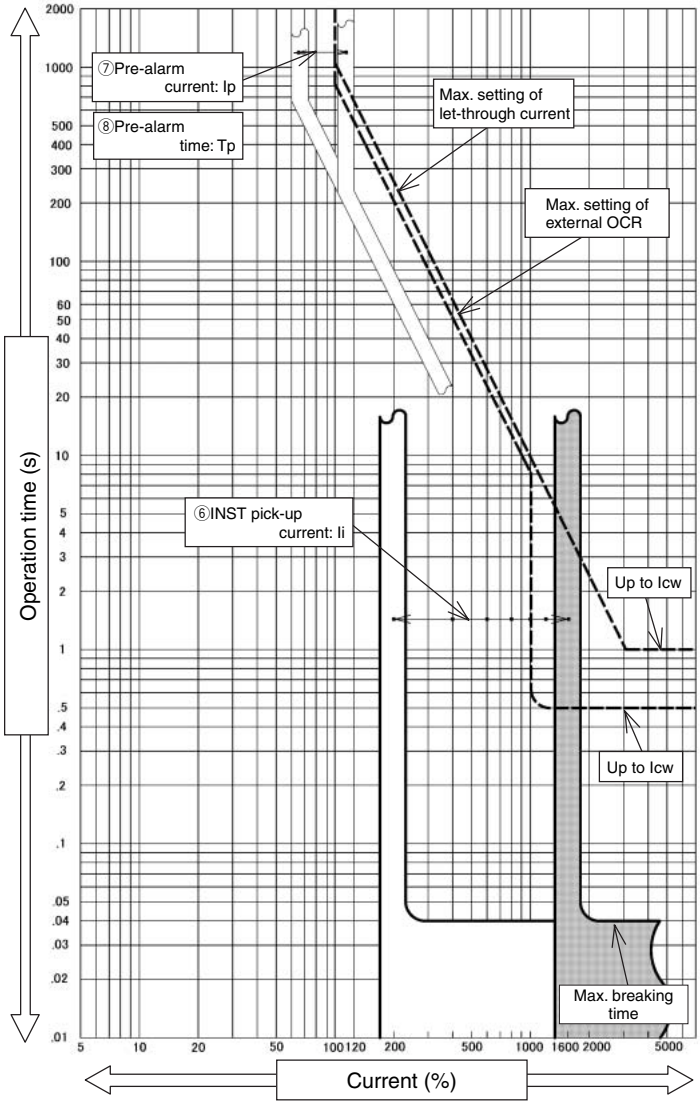


Table 24

No.	Setting items	Mark	Adjustable setting range		Accuracy	Setting for shipment
			AE630-SW to AE1600-SW AE2000-SW to AE3200-SW	AE2000-SWA, AE4000-SWA		
①	Rated current	Ir	0.5 to 1.0 (in 0.05 steps) ×In (CT rating)		—	1.0
⑥	INST pick-up current	Ii	16-12-10-8-6-4-2-2-4-6-8-10-12-16 ×Ir (INST) (MCR) WB1	12-10-8-6-4-2-2-4-6-8-10-12 ×Ir (INST) (MCR) WB2	±15%	WB1···16 (INST) WB2···12 (INST)
⑦	Pre-alarm current	Ip	Ir×0.68 to 1.0 (0.04 steps)-OVER		±5%	OVER
⑧	Alarm time	Tp	After 75s at Ir×2, PAL output contact turns on.		±20%	—

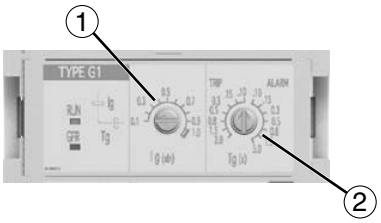
The table shows data obtained on the breakers provided with MCR (optional). For breakers without MCR, the setting position for MCR is not provided.

Relation of setting dial

In (CT rating) — Ir — Ii
Ir — Ip
Ir — Load current LED (60, 80, 100, OVER)
In (CT rating) — Ig (Page 25)

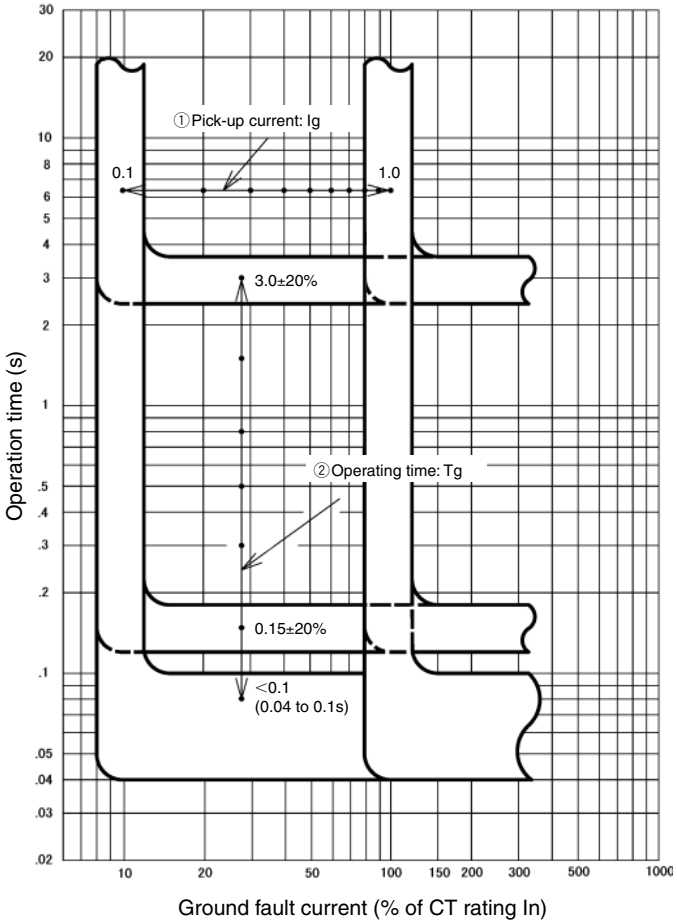
Characteristic setting of optional setting module

< Characteristics setting of G1 module >



⚠CAUTION

Ground fault protection is not applicable for low-rating of AE630-SW (CT rating: 500A or less).



Note: If the ground fault current setting, Ig, is 0.2 or more, the module operates even when control power is not applied.

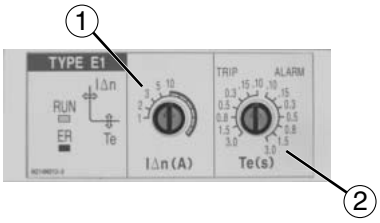
Table 25

No.	Setting items	Mark	Adjustable setting range	Accuracy	Setting for shipment
①	Ground fault pick-up current	Ig	0.1 to 1.0×In (0.1 steps)	±20%	1.0
②	Ground fault time	Tg	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 s (ALARM)	±20%	3 (TRIP)

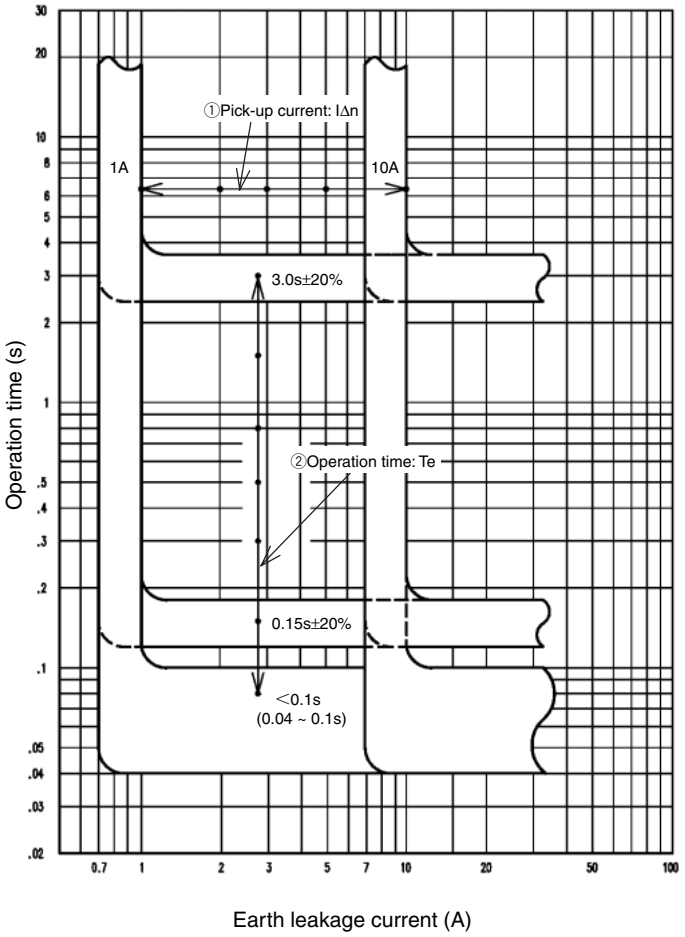
As for AP Module, N5 Module, refer to a separate instruction manual.

Characteristic setting of optional setting module

< Characteristic setting of E1 module >



By combining the ETR with Earth leakage protection(ER) and External ZCT, earth leakage protection is possible. Control supply is necessary for this function.



ZCT for load circuit

ZCT types	ACB types, poles
ZCT163	AE630-SW ~ AE1600-SW 3P
ZCT323	AE630-SW ~ AE1600-SW 4P AE2000-SW ~ AE3200-SW 3P
ZCT324	AE2000-SW ~ AE3200-SW 4P

As for outline dimensions, refer to AE-SW catalogue, and make your choice in reference to the BUSBAR size.

ZCT with primary conductors

ZCT types	ACB types, poles
ZTA1200A	AE630-SW ~ AE1600-SW 3P
ZTA2000A	AE1250-SW ~ AE1600-SW, AE2000-SWA 3P

ZCT for ground wire of transformer types

ZCT types					
ZT15B	ZT30B	ZT40B	ZT60B	ZT80B	ZT100B

Note: Be sure to combine with ZCT of our products.

Table 26

No.	Setting items	Mark	Adjustable setting range	Accuracy	Setting for shipment
①	ER pick-up current	IΔn	1A-2A-3A-5A-10A	0% –30%	10A
②	ER time	Te	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 s (ALARM) (at 1.5 × IΔn)	±20%	3s(TRIP)

Setting the operation characteristics

< Setting procedure >

Note: Press the screwdriver in the direction of the arrow to open the cover.

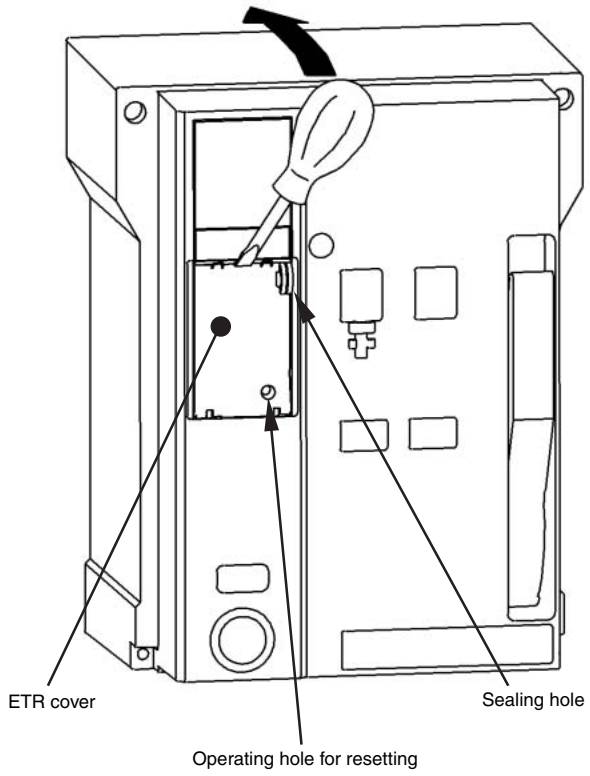


Fig. 27-1

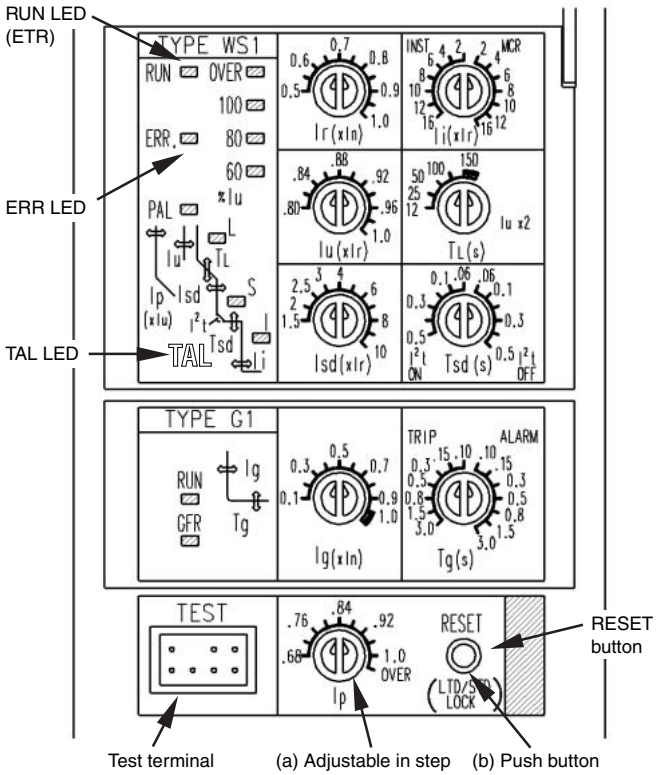
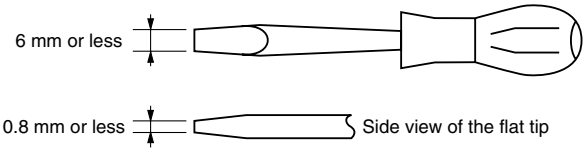


Fig. 27-2

⚠CAUTION	Before setting, turn off the breaker then make sure of no current conducting.

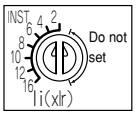
① Prepare a small flat tipped screwdriver.



② Insert the flat tipped screwdriver into the opening of the ETR (Electronic trip relay) cover. Then, lightly turn the screwdriver to the upside as shown in Fig. 19-1, and the ETR cover will open.

③ The following two types of switches are used. Operate the switches in accordance with the following procedures.

(a) Adjustable in step
A rotary step switch. Do not stop turning the switch at a point between steps. As for set in the between steps, it is work at one of two adjacent. The setting is the same in the zone between two continuous readings on the heavy line. (Operating torque: 0.02 N·m or less)



When MCR (optional) is not provided, Ii is set as shown below. Do not set the switch in the “Do not set” range indicated by the arrows. Set the switch on the INST side. As for the functions of MCR, see page 20.

(b) Pushbutton switch
A restorable pushbutton switch. Press the switch with a force of 3N or less.

④ When any characteristic setting has been changed, check the tripping characteristics using a field test device. A dedicated field test device is available to check the characteristics through the test terminal of ETR. As for the checking procedures, see the instruction manual of the field test device.

Specifications for field test device Y-2000

Test item	LTD, STD, INST, GFR, PAL
Testable range	1% to 2500%
Outside dimension (mm)	230(W) × 120(H) × 290(D)
Counter	0.000 to 999.999s
Control voltage	100 – 240V AC 50 / 60Hz
Weight	5kg

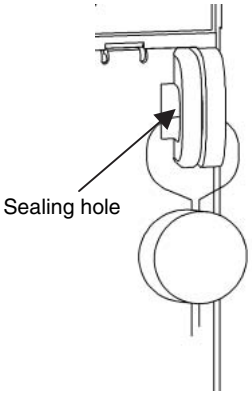


Fig. 27-3

< Relay sealing >

Seal the ETR cover by using the sealing hole at the top of the ETR cover, if it is necessary.

< Example for ETR characteristics setting >

For setting calculation, take AE1600-SW 1600A WS1G1 relay for example.
Current settings and operating times are calculated.

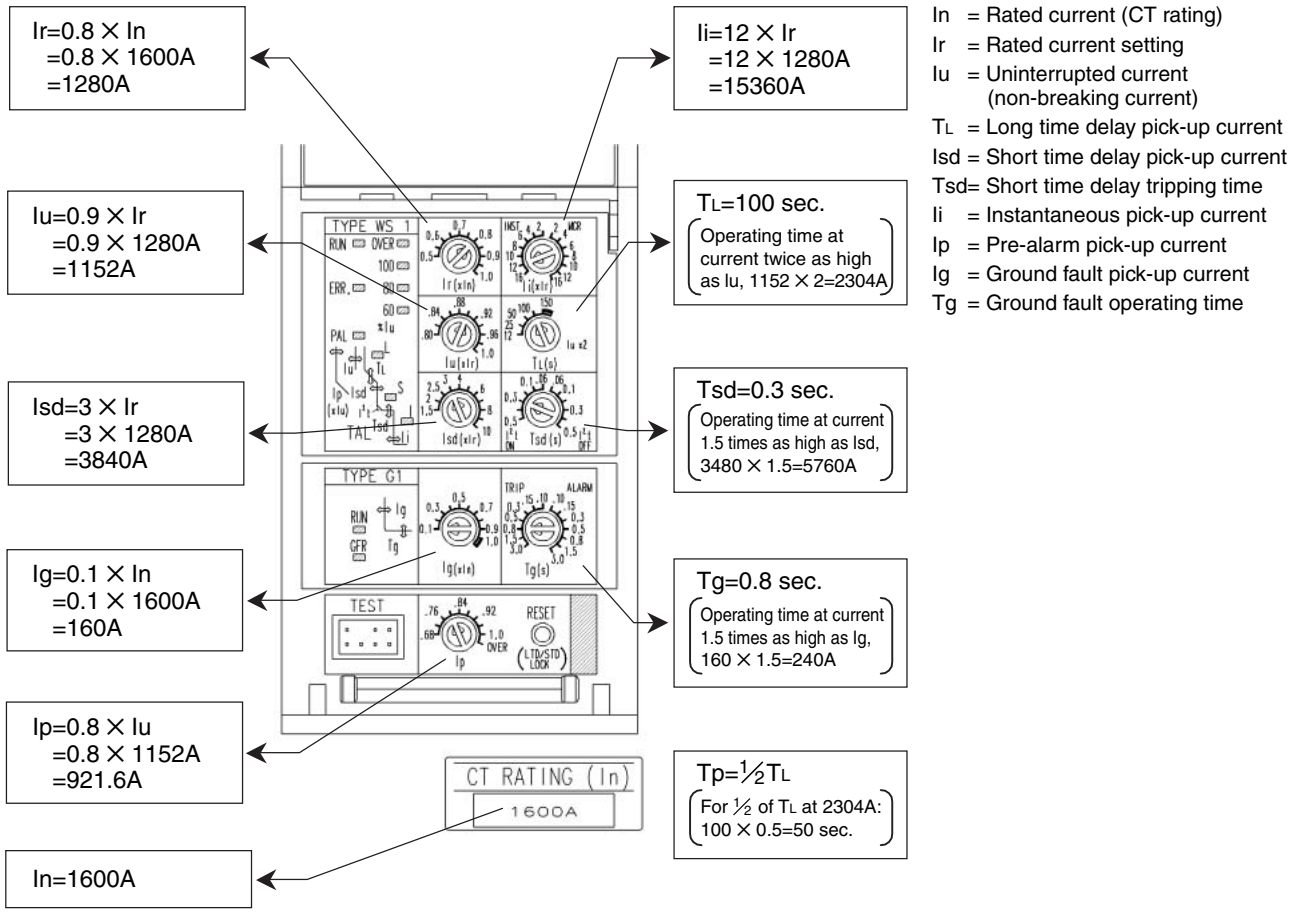


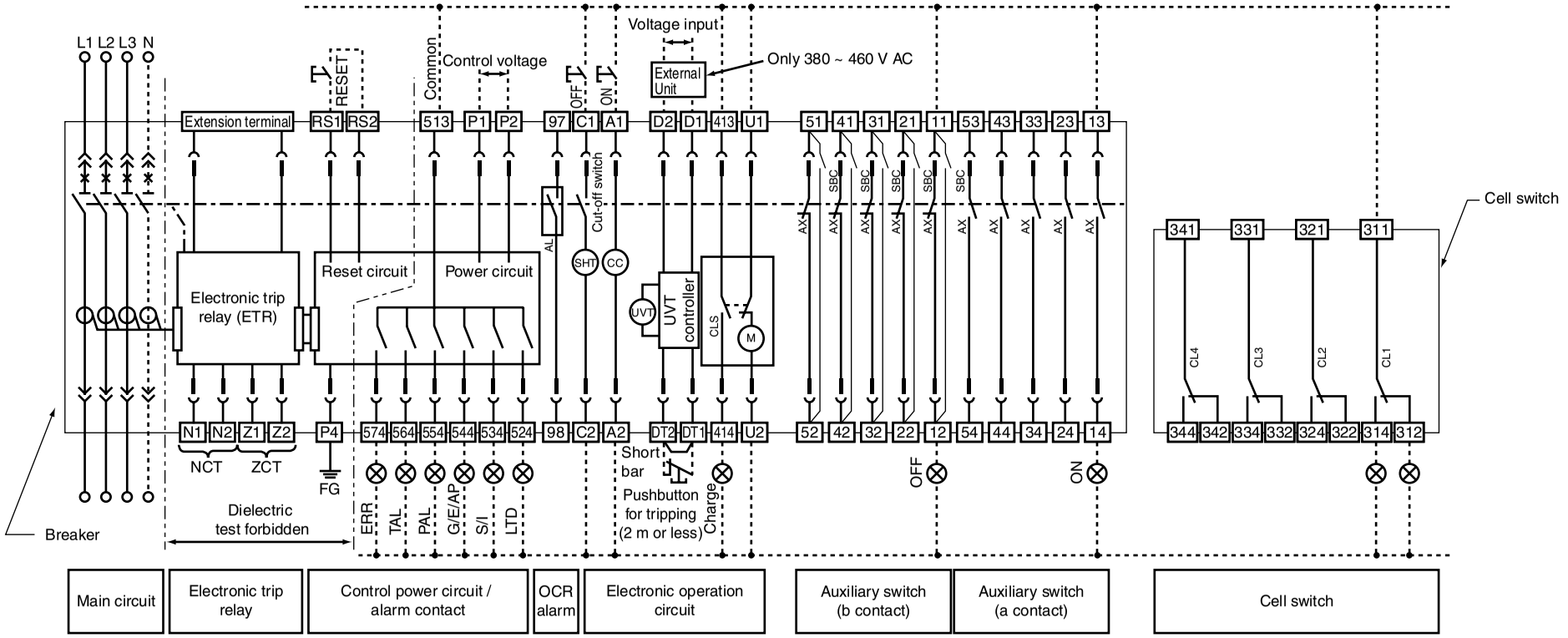
Fig. 28-1

Table 28-1 Calculated current and operating time

In (CT rating)	=1600A	Ii	=15360A±15%
Ir	=1280A	Ip	=921.6A±10%
Iu	=1152A	Tp	=50sec.±20% (at 2304A)
TL	=100sec.±20% (at 2304A)	Ig	=160A±20%
Isd	=3840A±15%	Tg	=0.8sec. (at 240A) ±20%
Tsd	=0.3sec.±20% (at 5760A)		—

Wiring diagram

* The following wiring diagram is for a fully equipped breaker.



Terminal description

13 14 to 53 54	Auxiliary switch a contact
11 12 to 51 52	Auxiliary switch b contact
U1 U2	For motor charging power
413 414	Charging completion switch a contact
D1 D2	For under-voltage tripping power
DT1 DT2	Under-voltage trip terminal
A1 A2	For control of closing coil
C1 C2	For control of shunt tripping
97 98	OCR alarm
P1 P2	For control power
P4	FG: Frame ground
RS1 RS2	Alarm reset (indication of cause of operation, alarm contact)
513 , 524 to 574	Trip cause, alarm contact output
Z1 Z2	ZCT connecting terminal
N1 N2	NCT connecting terminal
Extension terminals	Display unit connecting terminal Interface unit connecting terminal VT unit connecting terminal

Accessory Symbols

SHT	Voltage tripping power device
CC	Closing coil
M	Motor for charging
UVT	Under-voltage trip coil
AX	Auxiliary switch
AL	OCR alarm switch
CLS	Charging completion switch
SBC	Shorting B contact
CL	Cell switch

Internal wiring

External wiring

Control circuit connector (drawout type)

- On 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 5 mm.
- When a coil load is connection in the same control circuit as the ETR, surge absorbers are required to absorb the surge voltage (electromotive force).
- OCR alarm (AL)
  The contact output of the OCR alarm (Standard type AL) is the one-pulse output and the output time is 30 ~ 50 ms. For this reason, this output needs self-holding circuit.
- In case of type P3 or P4, the alarm contact output relay is high sensitive relay. Therefore may occur a chattering noise (approximately 1ms) by ON/OFF operation of the breaker. Please adopt a time constant filter of several ms, or double-reading (sampling), or the like.
- CC (Closing coil)
  Do not use AXb contact for a cut-off switch, because pumping prevention is not performed.
- UVT (Under voltage trip device)
  As the pushbutton switch for tripping, use a switch having a contact capacity of 150 V DC, 0.5 A or more.
  A short-circuiting bar has been fitted to the trip terminals before shipment. Before using the trip terminals, remove the bar.
  Disconnect the voltage input wires during dielectric testing of main circuit.

Fig. 29-1

Installation requirements

■ Arc space

When the short circuit is interrupted, hot gas blows out discharged from the exhaust port of the arc-extinguishing chamber, so provide a clearance as shown in the following table.
In case of drawout type, secure appropriate space to prevent the fingers from getting trapped at the time of drawing.

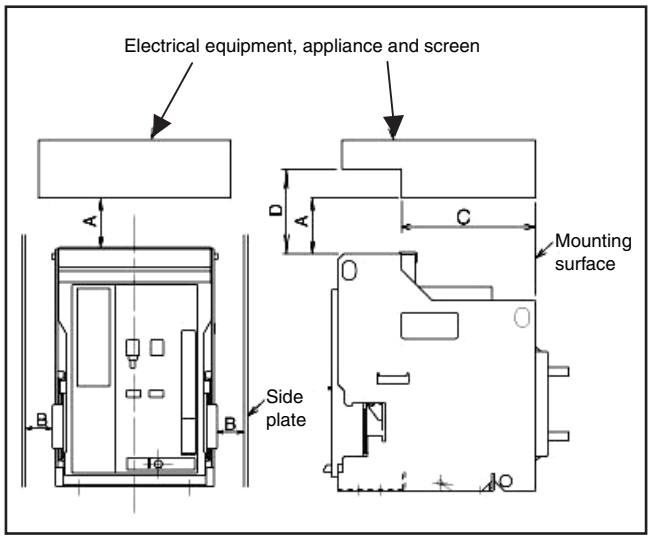


Fig. 30-1

Table 30 Dimensions (mm)

Type		AE-SW Series	
Applicable voltage		600 V AC or less	660 V AC 690 V AC
Fixed type	A	(Note 1) 0	(Note 1)100
	B	(Note 3) 50	(Note 3) 50
	C	162	162
	D	(Note 2) 50	(Note 2) 50
Drawout type	A	0	100
	B	(Note 3) 50	(Note 3) 50
	C	240	240
	D	(Note 2) 50	(Note 2) 50

Note 1: 300 mm or more clearance is necessary to inspect the arc-extinguishing chamber and contacts.

Note 2: The wiring space required for the control terminal block.

Note 3: In case of dimension B becomes larger when the mechanical interlock (MI), door interlock (DI), etc. are installed.

■ Reverse connection available

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

Installation requirements

■ Service Conditions

1. Normal service conditions
   If under ordinary conditions the following normal working conditions are all satisfied, the AE Series air circuit breaker may be used unless otherwise specified.
   ①Ambient air temperature:
   A range of max. +40°C to min. –5°C is recommended. However, the average over 24 hours must not exceed +35°C.
   ②Altitude: 2,000 m (6600 feet) or less
   ③Environmental conditions:
   The air must be clean, and the relative humidify 85% or less at a max. of +40°C.
   Do not use and store in atmospheres with sulfide gas, ammonia gas, etc.
   ($H_2S \leq 0.01$ ppm, $SO_2 \leq 0.05$ ppm, $NH_3 \leq 0.25$ ppm)
   ④Installation condition:
   When installing the AE Series air circuit breaker, refer to the installation instructions in the catalogue and instruction manual.
   ⑤Replacement yardstick :
   Approx. 15 years. It is dependent on the environment. Please refer to “Inspection and Maintenance” section of this manual.

2. Special service conditions
   In case of special service condition, modified air circuit breakers are available. Please specify when ordering.
   Even with such measures taken, however, service life may become shorter in some cases.
   ①Special environmental conditions
   “Circuit breaker for moisture-fungus treatment”
   If it is used at high temperature and/or high humidity, the insulation durability and other electrical/mechanical features may deteriorate. Therefore, the breaker should be specially treated. Circuit breaker for moisture-fungus treatment is recommended.
   “Added corrosion resistive circuit breaker”
   Since some parts may pose problems due to corrosion in the environments where corrosive gas results from the corrosion, added corrosion resistive circuit breaker is recommended.
   ②Special ambient temperature
   If the ambient temperature exceeds +40°C, the uninterrupted current rating will be reduced.
   ③Special altitude
   If it is used at 2,000 m or higher the heat radiation rate is reduced decreasing the operating voltage rating, continuous current capacity and breaking capacity. Moreover the durability of the insulation is also decreased owing to the atmospheric pressure. Apply for further detail.

Guarantee

Guarantee

1. Free guarantee period
   The free guarantee period of the product is one year from the day of purchase.
2. Scope of guarantee
   (1) We will repair the product free of charge within the guarantee period on condition that it has been used under the standard working conditions in conformity with the operating conditions, operating procedures, environmental conditions and instructions specified in the catalogs, manuals and caution labels on the product body.
   (2) In the following cases, the product will be repaired at your expense even within the free guarantee period.
   - Failure caused by your improper storage or handling, carelessness or negligence
   - Failure caused by inadequacies of installation
   - Failure caused by mis-operation or improper modification
   - Failure caused by external factors due to acts of God, such as fire and abnormal voltage, and natural disasters, such as earthquake, windstorm and flood
   - Failure caused by reasons that could not be foreseen on the level of science and technology at the time of delivery

The term “guarantee” used in this section refers to the guarantee only of the delivered product. We are not liable to compensate for any damage induced by the failure of the delivered product.

Inspection and Maintenance

The maintenance and inspection frequency and content are different depending on the working conditions. Read through the following for details of sufficient maintenance and inspection requirements.

⚠CAUTION

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

If maintenance and/or inspection should be carried out without cutting of the power supply in an unavoidable cases, wear rubber gloves and insulated boots laying rubber mat on the floor. Use insulated tools and instruments only. An access to the live parts is necessary in this maintenance and inspection work, when workers' full attention should be paid to the insulation of human body from the live parts.
Any normal opening/closing may be done safely because the live parts are covered with insulated molded case or the like.

1. Guidelines for Inspection and Maintenance

Inspection : ACBs are inspected to detect part that may be deteriorating at an early stage, to maintain the performance of the ACB through timely renewal of consumable and deteriorating parts and to prevent accidents that could otherwise arise as the breaker approaches the end of lifetime.
Maintenance : Maintenance is necessary in order to maintain the performance of the ACB at every two times of inspection, ex. grease lubrication. Please contact to our service network.

1.1 Guidelines for Inspection and Replacement according to the period of use and the environment of usage

It is recommended that periodic inspections are performed about once a month commencing use thereafter according to the guidelines for inspection, maintenance and renewal to ensure a stable, long-term use of the ACB.

Environments			Specific examples	Guidances for inspection	Guidances for maintenance	Guidances for replacement
Reference atmosphere	1	Places with ever clear and dry air.	Dustproof and air-conditioned electrical rooms, etc.	Once every 2 to 3 years	1st : 4 to 6 years 2nd or later : Once every 3 years	Within approx. 15 years
	2	Indoor Where there is no corrosive gas and little dust.	Distribution panels in individual electrical rooms that are not dustproof and air-conditioned.			Within approx. 7 to 15 years
Adverse environment	1	Places with little dust but with such gases as salty, sulfurous acid, hydrogen sulfide, high matures.	Geothermal power plants, waste water treatment, steel miles, paper factories, pulp factories, etc.	Once a year	Once every 2 years	Within approx. 3 to 7 years
	2	Locations with especially service corrosive gas and dust conditions and where humans cannot stay for a long period of time.	Chemical factories, quarries, mining areas, etc.	Once every half year	Once a year	Within approx. 1 to 3 years

1.2 Guidelines for Inspection and Replacement according to the number of operating cycles

Model	Guidelines for inspection		Product performance				
	Number of operating cycles with rated current *	Number of operating cycles without rated current	Limit of number of operating cycles with rated current			Limit of number of operating cycles with overload	
			With rated current	Without current	Total	Current	Number of operating cycles
AE630-SW	every 500 cycles	every 2,000 cycles	5,000	20,000	25,000	6 times the rated current	12 cycles
AE1000-SW							
AE1250-SW							
AE1600-SW							
AE2000-SWA			1,500	23,500			
AE2000-SW	every 150 cycles		1,500	18,500	20,000		
AE2500-SW							
AE3200-SW	every 100 cycles		1,000	19,000			
AE4000-SWA	every 50 cycles	every 1,000 cycles	500	19,500			3 cycles

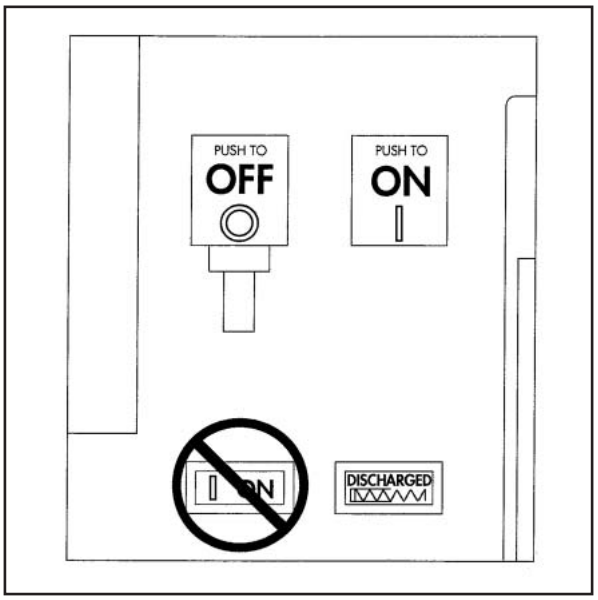
*Operating cycles shall be regarded as being with rated current, even if the current is much less than the maximum rated current of the breaker.

2. External view and Internal construction

Please refer to page 3 and 4 of this manual.

3. Preparation before Inspection

For routine inspection under normal service conditions, proceed with the following.
Make sure that the circuit breaker is turned OFF.



⚠CAUTION

Do not drawout the circuit breaker when the indicator shows ON. (see page 13)

4. Inspection Details

4.1 Initial Inspection

4.1.1 Inspection prior to applying current
Perform the following inspections after installing the ACB and before applying the current.

Inspection items	Criteria
1. Are the electrical wires and bars fastened securely to the external line connection main terminals?	Must be tightened at the designated tightening torque (M12 screw : 40~50 N · m)
2. Are any conductive foreign objects, such as screw, nails, processing chips from the panel and also connecting lead wires for the withstand voltage tests, left around the terminals?	Must be removed completely.
3. Is the front cover, base, etc. cracked or damaged?	There must be no cracks or damage.
4. Has the breaker been flooded or is there condensation of dew?	There must be no flooding or dew condensation.

(1)Follow the standards in 4.1.2 when carrying out withstand voltage test.
(2)Follow the standards in 4.1.2 when measuring the insulation resistance using a 500 V megohmmeter.

4.1.2 Measurement locations and standards for insulation resistance and withstand voltage tests
(1)Measurement locations for insulation resistance and withstand voltage tests.

Measurement location	Insulation resistance test		Withstand voltage test	
	ON	OFF	ON	OFF
Between the live parts of the main circuit and earth	○	○	○	○
Between live parts of different poles	○	—	○	—
Between main upper terminals and lower terminals	—	○	—	○
Between the live parts of the main circuit and the control circuit terminal block	○	○	○	○
Between the control circuit terminal block and earth	○	○	○	○

(2)Standards for insulation resistance and withstand voltage tests

Insulation Resistance Test : Must be no less than 5 MΩ. (must be no less than 50 MΩ for the ACB alone)

Withstand Voltage Test AC :

Voltage Application Time : 1 min.

Between the live part of the main circuit and the earth	: 3500 V AC
Between live parts of different poles	: 3500 V AC
Between main upper terminals and lower terminals	: 3500 V AC
Between the live part of the main circuit and the control circuit terminal block	: 3500 V AC
Between the control circuit terminal block and earth	: 2000 V AC

(The section of dielectric test forbidden shall depend on the instruction on the control circuit terminal label)

⚠CAUTION

Disconnect the UVT voltage input wires “D1”, “D2” during withstand voltage test of panel board, otherwise UVT controller may be broken. (In the case of 380-460 V spec., remove the voltage input wire “IN1”, “IN2” of UVT external unit)

4.2 Periodic Inspections

It is recommended that periodic inspections are performed once about one month commencing use thereafter according to the guidelines for inspection and renewal to ensure a stable, long-term use of the ACB.

4.2.1 External appearance of the ACB

Inspection item	Inspection method	Criteria	Treatment methods
1.Dust and soiling	Visual inspection	There must be no detrimental deposits of dust and dirt.	Blow with air upon each periodic inspection or clean and remove the dust with a dry cloth. Do not use any solvents, such as a thinner.
2.Loosening of the main circuit terminals	Tighten with a torque wrench.	Must be tightened securely. (M12 screw : 40~50 N · m)	Retighten if necessary.
3.Loosening of control terminals	Tighten with a screwdriver.	Must be tightened securely. (M3.5 screw : 0.8~1.2 N · m)	Retighten if necessary.
4.Cracks, breakage or deformation of the front cover, base and control circuit terminal block	Visual inspection	There must be no cracks, breakage or deformation.	Please contact our company if any abnormalities on the front cover or the control circuit terminal block. Replace the circuit breaker when the base is found to have trouble.
5.Flooding, immersion in water	There must be no flooding or immersion.	There must be no flooding or immersion.	Replace the product if flooding or immersion has occurred.

4.2.2 Conductive parts of the main circuit (External)

Inspection item	Inspection method	Criteria	Treatment methods
1.Measurement of insulation resistance	Measure the insulation resistance with 500 V DC insulation resistance tester (megohmmeter).	Must be no less than 5 MΩ. (must be no less than 50 MΩ for the AE-SW alone.) Testing locations are shown in section 4.1.	Clean and dust off before re-measurement. In case the insulation fails to recuperate, replace the circuit breaker and drawout cradle.
2.Soiling of the main circuit conductor	Visual inspection	There must be no detrimental deposits of dust or soot.	Clean the main conductor.
3.Discoloration and deformation	Visual inspection	There must be no detrimental discoloration of the pressing spring.	Replace the cradle if there are any abnormalities.

4.2.3 Arc extinguishing chamber and movable/fixed contact

Inspection item	Inspection method	Criteria	Treatment methods
1.Soot and stains	Visual inspection	No detrimental deposits of dust and dirt	Remove dust and clean upon each inspection.
2.Breakage of the arc extinguishing chamber	Visual inspection	There must be no breakage.	Please contact our company if there are any abnormalities.
3.Condition of the arc extinguishing plate	Visual inspection	There must be no remarkable arc extinguishing plate melded.	Please contact our company if there are any abnormalities.
4. Movable/Fixed contacts	Visual inspection	There must be no remarkable contact wearing.	Please contact our company if there are any abnormalities.
5.Loosening of the arc extinguishing chamber fastening screw	Tighten with a wrench for M6 screws.	Must be tightened securely. (M6 screw : 2.5~4 N · m)	Retighten if necessary.

4.2.4 Electronic trip relay

Inspection item	Inspection method	Criteria	Treatment methods
1.External appearance of the electronic trip relay	Visual inspection	There must be no breakage or deformation of the external parts and the setting dials.	Please contact our company if there is any breakage or deformation.
2.Dust and soiling	Visual inspection	There must be no detrimental deposits of dust and dirt.	Remove the dust with a dry cloth. Do not use any solvents, such as a thinner.
3.Operating characteristics of the electronic trip relay	Measurement	Use the field test device (Y-2000) to confirm that the characteristics are within the standard values.	Please contact our company if the measured values deviate from the standard values.

4.2.5 Accessory devices (General accessory devices)

Inspection item	Inspection method	Criteria	Treatment methods
1.Closing coil (CC) Shunt trip device (SHT)	Electrical operation	Must operate reliably and without difficulty within the operating voltage range indicated in the “catalog”.	Please contact our company if there are any abnormalities.
2.Auxiliary switch (AX)	Check continuity of AXa and AXb.	Must switch in accordance with the conditions of the ACB.	Please contact our company if there are any abnormalities.
3.Motor charging device (MD)	Electrical operation	Must complete the charging reliably and without difficulty within the designated time and the operating voltage range indicated in the “Instruction Manual”.	Please contact our company if there are any abnormalities.
4.Under voltage trip device (UVT)	Electrical operation	Must be able to close reliably upon application of a voltage that is 85% of the rated voltage and to trip and disable closing by the time the voltage reaches 45% of the rated voltage.	Please contact our company if there are any abnormalities.
5.Safety shutter (SST)	Drawout/Insert operation	(1) There must be no breakage of the parts.	Please contact our company if there are any abnormalities.
		(2) Must be able to perform the drawout /insertion operation without any difficulty.	①Remove any broken parts that impair the drawout/insertion operation.
			②Please contact our company if the drawout/insertion operation cannot be performed.
6.Cell switch (CL)	Drawout/Insert operation	Must switch reliably at the “DISCONNECT”, “TEST” and “CONNECT” positions.	Please contact our company if there are any abnormalities.
7.Mechanical interlock (MI)	Check the gap between the trip pin and the lever.	0.2 to 1.2 mm (Accessory attachment manual)	Please contact our company when cannot be adjusted.

4.3 Inspections After a Breaking Operation

Inspect the items detailed for periodic inspection (section 4.2) when the ACB has performed a breaking operation as a result of an overload current or a short-circuit current.

Reuse is possible if the relevant criteria are satisfied. A circuit must never be reclosed (locally or remotely) before the cause of the fault has been identified and cleared.

However, it is recommended that the ACB be replaced as soon as possible after it has interrupted a large fault current. The ACB should be monitored for unusual temperature rises and other abnormalities until replacement occurs. Refer to the following chart regarding the level of breaking currents and the treatments to be performed:

Level of breaking current	Level of ACB damage	Treatment
1.Breaking current is 6 times or less the rated current (LTD, STD range)	(1) Abnormalities of the external parts cannot be detected visually. (2) Slight wear of contacts, soiling by soot, etc.	Reusable. Refer to section 1.2 regarding the switching operation lifetime at the rated current.
2.Breaking current is 70 percent of the rated breaking capacity or less (STD, INST range)	(1) There is slight overall soiling of the exhaust ports by soot. (2) There is also overall damage of the contacts and the arc extinguishing chamber but only to a slight degree.	Reusable. The breaker can be used if the relevant criteria in section 4.2 are satisfied.
3.Breaking current near to the rated breaking capacity	(1) There is significant overall soiling of the exhaust ports by soot. (2) The contacts and the arc extinguishing chamber also suffer considerable damage.	(1) Immediate replacement is desirable. (2) If immediate replacement is not possible, the breaker can be used carefully by gradually reducing the rated current, etc., provided that the relevant criteria in section 4.2 are satisfied. As an additional test, perform the withstand voltage test to the live parts of the main circuit of the ACB at twice the rated insulation voltage, in other words, at 2000 V. However, replace as soon as possible.

(Note) 1. In the case of the electronic trip relay with the trip indication function, it can be determined whether the cause of the tripping lies in the LTD (long-time-delay), STD (short-time-delay) or INST (instantaneous) level.

2. If the magnitude of the fault current cannot be estimated, treat according to 3 of section 4.3.

5. Fault Diagnosis

Type and condition of abnormality	Defect/Probable cause	Treatment	
		Investigation/Primary treatment	Secondary treatment
1.Cannot close.	1.The closing operation cannot be performed. (1) The OFF-lock device (CYL,CAL,Padlock) is not released.	Release the OFF-lock device. (CYL,CAL,Padlock)	Please contact our company if closing cannot be performed even after completing the primary treatment.
	(2) The drawout position is not appropriate.	Set to either of the “DISCONNECT”, “TEST” or the “CONNECT” positions.	
	(3) The drawout handle is inserted.	Remove the drawout handle.	
	(4) Voltage is not applied to the UVT.	Apply voltage to the UVT.	Refer to the section “Abnormalities of the UVT” if there is an abnormality of the UVT.
	(5) The closing spring is not charged.	Charging operation	1.Please contact our company if charging cannot be performed manually.
			2.Refer to the section “Charging disabled” if electrical charging is not possible.
	(6) The closing coil does not operate. (Manual closing operation can be performed.)	1.If the voltage is not applied, examine the control circuit.	—
		2.In the case of voltage is applied, the breaker has some failure. Please contact our company.	Please contact our company.
	2.The closing operation is performed. (1) Tripping (OFF) is performed simultaneously with the closing operation.	Please contact our company.	—
	(2) Turns OFF when charging after a closing operation.	Please contact our company.	—
	3.The ON button is broken.	Please contact our company.	—
	4.The ON button cannot be pressed.	Please contact our company.	—
2.At the completion of charge, tripping performs at the same time.	External scheme (sequence)	Please examine the external scheme (sequence).	Faulty operating mechanism if the external scheme has no trouble. Please contact our company.
3.OFF disabled.	1.The contact does not open even after pushing the OFF button.	(Note 1) Please contact our company.	—
	2. The SHT does not operate. (Manual OFF operation can be performed.)	1.If the voltage is not applied, examine the control circuit.	—
		2.In the case of voltage applied, the breaker has some failure. Please contact our company.	—
	3.The OFF button cannot be pushed.	Please contact our company.	—
	4. The OFF button is broken.	Please contact our company.	—
4.Charging disabled.	1.Cannot perform manual charging operation.	Please contact our company.	—
	2.Electrical charging cannot be performed.	1.Examine the power supply of control circuit.	—
		2.Examine rated voltage.	In the case of correct voltage is applied, the breaker has some failure. Please contact our company.
	3.The motor turns but closing spring does not charge.	Please contact our company.	—
5.Unusual temperature rise	1.The fastening of the connecting conductor is loose.	Retighten.	Please contact our company if discoloration of the conductor or the terminal molding is noted.
	2.The contact pressure flat spring of the junction is damaged.	Please contact our company.	—
	3.The contact resistance of the contact has increased.	Clean the contact surface (by using wire brush).	Please contact our company if the temperature does not fall even after cleaning the contact surface.
	4.The wear of the contact is severe.	Replace the ACB.	—
	5.Over loaded.	Check the load equipments.	—

(Note 1) When you drawout the breaker forcefully, do it after releasing higher breaker. Drawing out the breaker when it is energized may cause serious accident.

Type and condition of abnormality	Defect/Probable cause	Treatment	
		Investigation/Primary treatment	Secondary treatment
6.Abnormality Electronic Trip Relay (ETR) (1)Trip unnecessarily	1.Tripped at rated current or less	Check the load current and characteristics setting of the ETR.	Please contact our company if there are any abnormalities.
	2.Tripped at starting of load	Check the inrush current and STD/INST setting of the ETR.	Please contact our company if there are any abnormalities.
	3.By Noise/Surge	Please shift the setting of the ETR to upper level (temporary use). Please check connection of the frame ground terminal “P4”.	Reducing the noise/surge, or adding the surge absorber
(2)Abnormal characteristics	1.The breaker does not trip even when an over current flows.	Check the load current and characteristics setting of the ETR. Check the characteristics by the field test device.	Please contact our company if there are any abnormalities.
	2.The characteristics is abnormality. (By field test device)	Check about the field test device setting.	Please contact our company if there are any abnormalities.
(3)Abnormalities of Indication function or contact output	1.The trip indicator LED or alarm contact output does not work.	Check the control power supply, ERR. LED and RUN LED.	Please contact our company.
	2.The display (DP1, DP2) does not function.	Check the cable from the control circuit terminal when using DP2.	
	3.The ERR. LED lit up.	Check the characteristics setting of the ETR.	Please contact our company. (The other factor, refer to page 20)
	4.The RUN LED does not light up.	Check the breaker condition for lighting LED (Refer to page 20).	Please contact our company.
	5.The display key operation is not possible.	Refer to separate instruction manual of Display (DP1, DP2).	Please contact our company.
7.Drawout/insertion operation is not possible.	1.The drawout handle cannot be inserted.	Insert the drawout handle after pushing the OFF button.	Please contact our company if the drawout handle cannot be inserted even when the OFF button is pushed.
	2.The lock plate cannot be pushed in.	Turn the drawout handle slightly to the right and left and push in the lock plate at a position where the lock plate can be pushed in easily.	Please contact our company if the lock plate cannot be pushed in.
	3.The lock plate does not come out at the “TEST” or “CONNECT” position.	Please contact our company.	—
	4.The stopper pin has broken and although the lock plate protrudes out at the “TEST” and “CONNECT” position, the insertion operation does not lock.	Please contact our company.	—
	5.The indication on the drawout indicator does not change.	Please contact our company.	—
	6.The drawout handle does not turn.	Push in the lock plate.	Please contact our company.
	7.The junction is broken and is impairing the drawout/insertion operation.	Please contact our company.	—
	8.The control circuit terminal is broken and is impairing the drawout/insertion operation.	Please contact our company.	—
8.The safety shutter (SST) does not operate.	1.The barrier of the safety shutter (SST) is broken.	Please contact our company.	—
	2.The rod of the safety shutter (SST) unit is broken.	Please contact our company.	—
9.The control circuit terminal does not make contact at the “TEST” and “CONNECT” positions.	1.The molding of the control circuit terminal is broken.	Please contact our company.	—
	2.The blade of the automatic connection terminal is deformed.	Please contact our company.	—
10.The UVT does not draw in (abnormality in the UVT controller).	1.Applied voltage is too low. (Or applied voltage is too high.)	Check the applied voltage, and adjusts applied voltage in accordance to rated voltage of UVT controller.	Please contact our company.
	2.The applied voltage capacity is insufficient.	Check the capacity of the apply voltage.	Please contact our company.
	3.The trip terminals, DT1 and DT2, are opened.	Check whether the trip terminals, DT1 and DT2, are shorted. In case of using the push button for trip, use a b-contact type (normally closed button).	Please contact our company.
11.The auxiliary switch does not operate.	1.Breakage of the operating parts of the auxiliary switch	Please contact our company.	—

memo

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三菱低圧気中遮断器 World Super AE形
MITSUBISHI Low-Voltage Air Circuit Breakers World Super AE

Type AE-SW

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