Global Leader

ISO 9001/ISO 14001/OHSAS 18001(N/A)
REGISTERED FIRM
DNV Certification B.V., THE NETHERLANDS

HAT Series
Air Circuit Breaker

ACB

Air
Circuit
Breaker

HYUNDAI
HEAVY INDUSTRIES CO., LTD.

ACB

Air Circuit Breaker

HAT Series

Basic Standards

IEC 60947-2	International Electrotechnical Commission
BS EN60947-2/U.K.	British Standard
VDE 0660/Germany	Verband Deutscher Elektrotechniker
AS 1930/Australia	Australian Standard
NEMA PUB NO. SG3/U.S.A.	National Electrical Manufacturers Association
ANSI C37.13/U.S.A.	American National Standard Institue
KS C8325/Korea	Korean Industrial Standard

Approval & Application

KR/Korea	Korean Register of Shipping
GL/Germany	Germanischer Lloyd
LR/U.K.	Lloyd's Register of Shipping
ABS/U.S.A.	American Bureau of Shipping
NK/Japan	Nippon Kaiji Kyokai
BV/France	Bureau Veritas

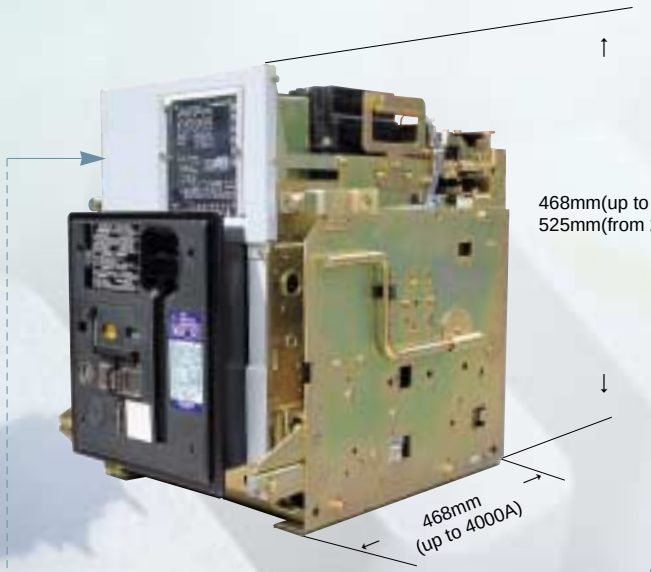
We build a better future!

CONTENTS

1. “HAT ACB” is Available in Ten Types, from 630A to 5000A Frame Sizes

The breaker height and depth are standardized throughout the “HAT ACB” series.

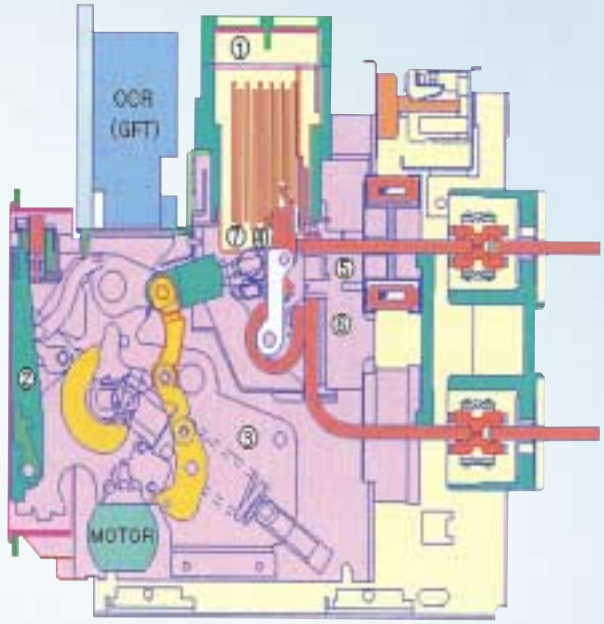
- **Fixed type :** 500mm(height), 343mm(depth) (up to 4000A).
- **Draw-out type :** 468mm(height) (up to 2000A frame),
  525mm(height) (from 2500A to 4000A)
  458mm(depth) (up to 4000A).



All types re available either in 3-pole or 4-pole constructions

Photo shows draw-out type

2. “HAT ACB” a Compact, High-Performance Circuit Breaker



① Double-segregated arc chamber for maximum fault interruption performance.

② Charging handle stored flush in the front panel.

③ Operating mechanism of a simple cam system for lightweight slim construction.
Mechanically reliable parts, such as ball bearings are used at the key points.

④ Two tip contact system.
Arc damage to the main contacts during opening and closing operations is substantially reduced by the arcing contacts which close before the main contacts (during closing operations) and which open after the main contacts (during opening operations).

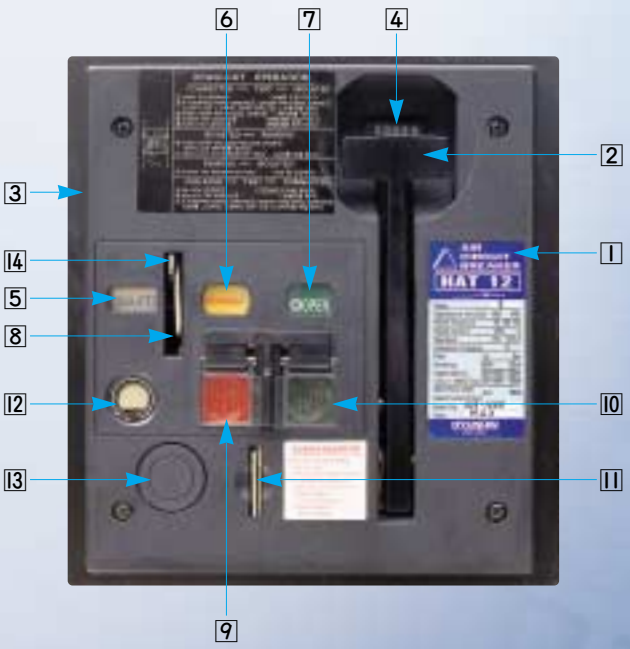
⑤ U-Shaped current path.
This design utilises the electronmagentic repulsive force between the arms of the “U” conductor to provide additional contact pressure in the closed position.
In breaking, the magnetic force drives the arc into the arc chute.

⑥ Combination bolted/soldered connections.
This arrangement reduces heating and ensures high stability of the connection.
There is also no possibility of loosening, thus eliminting the need for retightening.

⑦ Early make, late break, neutral pole contact.
The neutral pole contact closes earlier than, and opens later than the main circuit contacts.
This effectively prevents the occurrence of abnormal voltages between the phase lines and the neutral line thus ensures safety.
Since the operation of the neutral pole contact is mechanically linked with the operation of the main circuit contacts, it is impossible to leave the neutral pole open or to accidentally open or close the neutral pole only.

3. Front Panel Designed for the HAT ACB

The front panel is common for all frame sizes in the “HAT ACB” series.
This will help standardize your switchboard design.



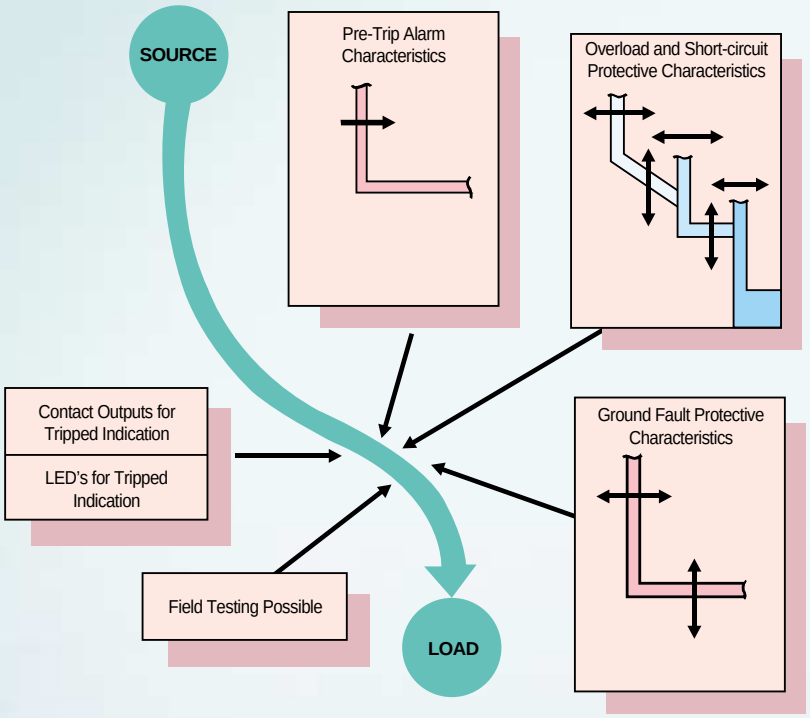
The front panel indicator provides breaker position indication : CONNECTED, TEST or ISOLATED.

1 Name plate
2 Charging handle
3 Dust plate
4 Close-open cycle counter
5 Position indicator
6 Spring charge indicator
7 Close-open indicator
8 Position padlock
9 Push-to-open button
10 Push-to-close button
11 Open padlock
12 Draw-out handle insertion hole
13 Key lock fitting section
14 Position stop release lever

The shutter prevents erroneous insertion of the handle.
This can be opened by downing the position stop release lever only when the breaker is open.
When the breaker is closed, the release lever cannot be downed.
Thus the shutter cannot be opened.

4. AOR-L Multi-Protective Device Incorporating a Microprocessor

Providing High Performance Protection for Your Electrical Distribution System.



◉ Pre-Trip Alarm

- **Prevents Sudden Power Loss by Pre-Trip Application Feature**

Due to the ever increasing use of office automation systems and electronic office equipment in office buildings and factories, electric power demand fluctuates largely depending on the time zone of the day.

These, higher than forecast, power demands often reach the overload level of protective devices installed in the distribution network.

If such a condition continues, a trip signal which prevents unwanted loss of power would be generated by multiprotective device before causing a loss of important or continuous load.

- **Specifications for Pre-Trip Alarm**

1. Selectable set at 75%~110% of base current(Io).
2. The operating time is 60s~200s(selectable).
3. Mounted with output contact (1a) an output signal can be provided by a (1a) contact or display lamp.
4. Downstream circuit breakers can be opened forcible via a shunt trip device when the output contact (1a) of the pre-trip alarm operates.(Refer to Fig. 1)

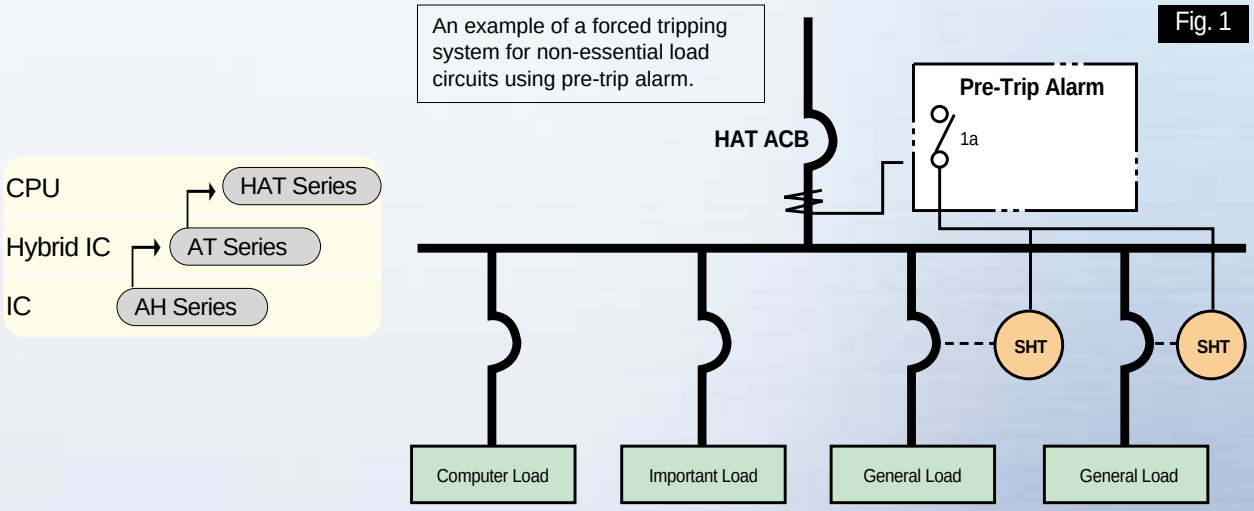
For General Feeder Circuit
7 Combinations

For Generator Protection Circuit
3 Combinations

Chronological survey of air circuit breakers and the core hardware in the protective devices.

Fig. 1

An example of a forced tripping system for non-essential load circuits using pre-trip alarm.



◉ OCR Specification

The AOR multi-function protection device is available in 9 version: 7 types with L-type characteristic(for general feeder circuit), and 3 with S-type characteristic.(for generator protection)

Protection Characteristic	Type	Protection Functions			Trip Indicators		Current Monitoring Function	Field Test Facility	Control Voltage
		LTD STD INST	Pre-Trip	GFT	Single Contact Type	Individual Contact and LED Type			
General Feeder	AOR-1L-AL	●	×	×	●	×	×	×	×
	AOR-1L-AS	●	●	×	×	●	×	●	●
	AOR-1L-AM	●	●	×	●	×	×	●	●
	AOR-1L-GL	●	×	●	●	×	×	×	×
	AOR-1L-GS	●	●	●	×	●	×	●	●
	AOR-1L-GM	●	●	●	●	×	×	●	●
	AOR-1D-GM	●	●	●	●	×	●	●	●
Generator Protection	AOR-1S-AL	●	×	×	●	×	×	×	×
	AOR-1S-AS(15)	●	●	×	×	●	×	●	●
	AOR-1S-AS(18)	●	●	×	●	×	×	●	●

● = "Yes" or available, × = "No" or "Not" available.

Ratings

◉ Ratings for Industrial Plant Applications

TYPE			HAT06	HAT08	HAT10	HAT12	HAT16	HAT20	HAT25	HAT32	HAT40	HAT50
						∗ ●	△ ■ ∗	●	△ ■	●	△ ■	■
Amperes frame (A) ❶	IEC, BS, VDE, AS		630	800	1000	1250	1600	2000	2500	3200	4000	5000
	NEMA, ANSI		630	800	1000	1250	1600	2000	2500	3200	3600	5000
Neutral pole amperes (A)			630	800	1000	1250	1600	1600❸	2000	2000	2000	2000	5000
Number of poles ❷			2,3 | 4	2,3 | 4	2,3 | 4	2,3 | 4	2,3 | 4	2,3 | 4	2,3 | 4	2,3 | 4	2,3 | 4	2,3 | 4	2,3 | 4
Rated primary current of over-current trip devices (A) • for general feeder circuit use			80 160 320 630	80 160 320 630 800	160 320 630 800 1000	160 320 630 800 1000 1250	320 630 800 1000 1250 1600	320 630 1000 1250 1600 2000	250 500 1000 2000 2500	1600 3200	4000	5000
Rated primary current of over-current trip devices [Io] (A) • for generator protection use ([Io] is generator rated current)			40≤Io≤80 80〈Io≤160 160〈Io≤320 320〈Io≤630	40≤Io≤80 80〈Io≤160 160〈Io≤320 320〈Io≤630 630〈Io≤800	160≤Io≤320 320〈Io≤630 400〈Io≤800 500〈Io≤1000 630〈Io≤1000	160≤Io≤320 320〈Io≤630 500〈Io≤1000 630〈Io≤1250	320≤Io≤630 630〈Io≤1250 800〈Io≤1600	160≤Io≤320 320〈Io≤630 630〈Io≤1250 800〈Io≤1600 1000〈Io≤2000	125≤Io≤250 250〈Io≤500 500〈Io≤1000 1000〈Io≤2000 2000〈Io≤2500	800≤Io≤1600 1600〈Io≤3200	2000≤Io≤4000	3200≤Io≤5000
Rated insulation voltage [Ui] (V)			AC1000	AC1000	AC1000	AC1000	AC1000	AC1000	AC1000	AC1000	AC1000	AC1000
Rated operational voltage [Ue] (V)			AC690	AC690	AC690	AC690	AC690	AC690	AC690	AC690	AC690	AC690
Rated breaking Cap. (kA, sym.) / Making Cap. (kA peak)												
IEC BS VDE AS (Ics)	with INST	AC 690V	30/63	35/73.5	35/73.5	35/73.5	35/73.5	35/73.5	45/94.5	45/94.5	45/94.5	85/187
	[Ics] = 100% [Icu]	AC 600V	42/88.2	50/105	50/105	50/105	50/105	50/105	50/105	65/143	65/143	85/187
		Up to AC 500V	50/105	65/143	65/143	65/143	65/143	65/143	65/143	85/187	85/187	100/220
	without INST	AC 690V	30/63	35/73.5	35/73.5	35/73.5	35/73.5	35/73.5	45/94.5	45/94.5	45/94.5	70/154
		Up to AC 500V	42/88.2	50/105	50/105	50/105	50/105	50/105	50/105	50/105	65/143	70/154
NEMA ANSI	with INST	AC 600V	22/50.6	42/96.6	42/96.6	42/96.6	42/96.6	42/96.6	50/115	50/115	65/149.5	85/187
		AC 480V	30/69	50/115	50/115	50/115	50/115	50/115	65/149.5	65/149.5	85/196.5	100/220
		Up to AC 240V	42/96.6	65/149.5	65/149.5	65/149.5	65/149.5	65/149.5	85/196.5	85/196.5	85/196.5	100/220
	without INST	AC 660V	22/50.6	42/96.6	42/96.6	42/96.6	42/96.6	42/96.6	42/96.6	50/115	65/149.5	70/161
		Up to AC 480V	30/69	50/115	50/115	50/115	50/115	50/115	50/115	65/149.5	65/149.5	70/161
Rated impulse withstand voltage (Uimp) (kV)			8	8	8	8	8	8	8	8	8	8
Rated short time withstand current RMS [Icw] (kA)		1S	42	42	50	50	50	50	50	65	65	85
		3S	35	35	45	45	45	45	45	50	50	70
Latching current RMS (kA)			35	35	50	50	50	50	50	65	65	85
Total breaking time(s)			0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Closing opeation time	Spring charging time(s) max.		10	10	10	10	10	10	10	10	10	10
	Close time (s)		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Weight (kG), draw-out type			82 | 98	83 | 100	85 | 106	85 | 106	90 | 113	91 | 115	137 | 165	152 | 188	175 | 211	340	440

Key applicable to both ratings (page 8 and 9).
❶ Values in open air at 40˚C (45˚C for marine applications).
❷ 2-pole type is identical to 3-pole type except the centre pole is omitted.
❸ 1400A for applications based on NEMA and ANSI Standard.

∗ marked type approved by KERI.
● marked type approved by ASTA.
△ Certified by Nuclear Power station.
■ marked type approved by CESI.

Outline Dimensions (mm)		HAT06/08		HAT10/12		HAT16		HAT20		HAT25		HAT32		HAT40		HAT50	
Number of Poles		2,3	4	2,3	4	2,3	4	2,3	4	2,3	4	2,3	4	2,3	4	2, 3	4
Fixed Type	a	380	465	380	465	380	465	380	465	470	585	530	665	530	665	-	-
	b	500	500	500	500	500	500	500	500	500	500	500	500	500	500	-	-
	c	343	343	343	343	343	343	343	343	343	343	343	343	343	343	-	-
	d	79	79	79	79	79	79	79	79	79	79	79	79	79	79	-	-
Drawout Type	a	368	453	368	453	368	453	368	453	458	573	518	653	518	653	747	937
	b	468	468	468	468	468	468	468	468	525	525	525	525	525	525	685	685
	c	458	458	458	458	458	458	458	458	458	458	458	458	458	458	579	579
	d	82	82	82	82	82	82	92	92	82	82	82	82	82	82	135	135

◉ Ratings for Marine Applications

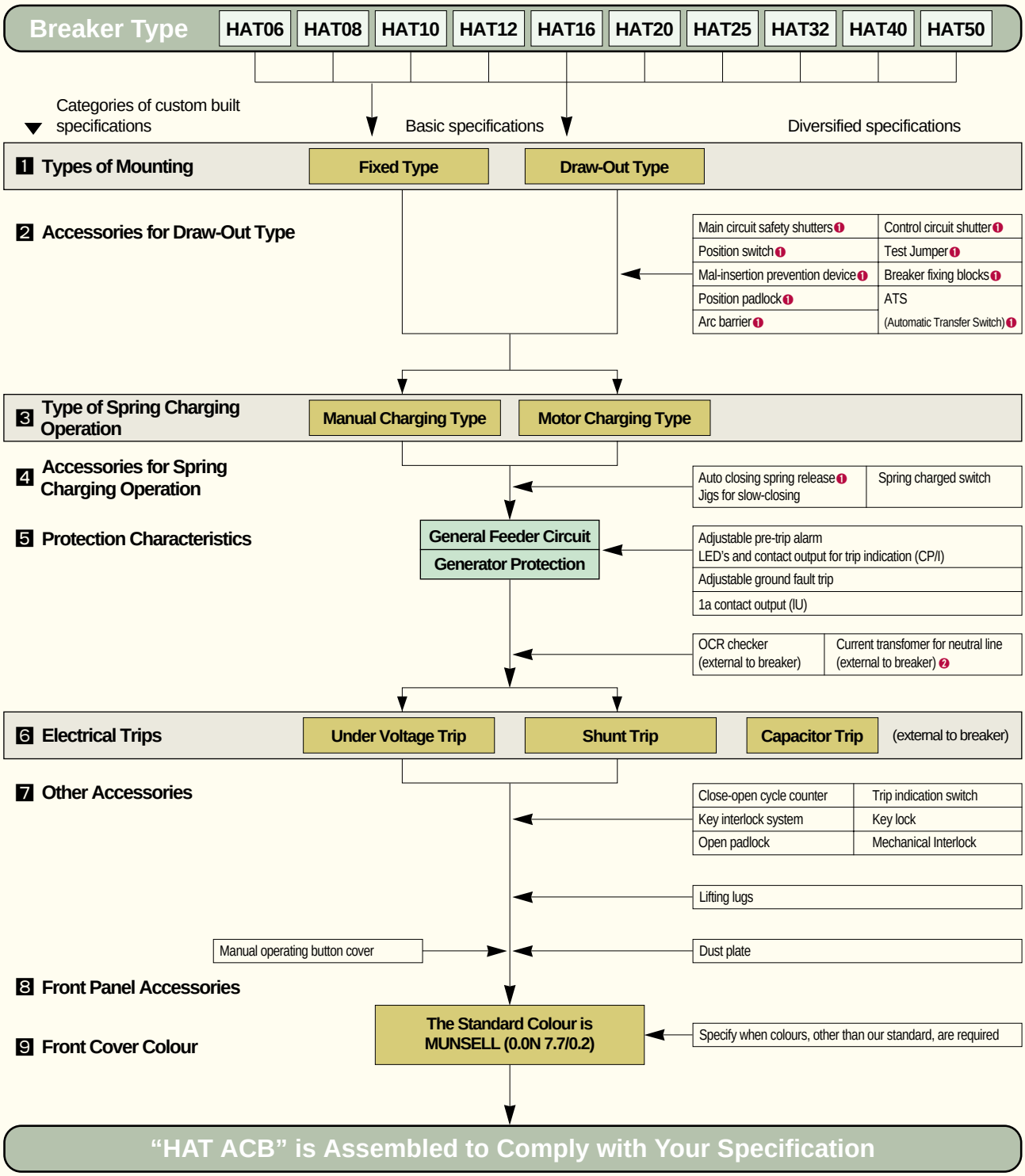
TYPE			HAT06	HAT12	HAT16	HAT20	HAT25	HAT32	HAT40
Amperes frame (A) ❶			630	1250	1600	2000	2500	3200	4000
Number of poles ❷			3	3	3	3	3	3	3
Rated current of over-current trip devices (A) • for generator protection use (Io is generator rated current)			40≦Io≦80 80〈Io≦160 160〈Io≦320 320〈Io≦630	160≦Io≦320 320〈Io≦630 630〈Io≦1250	160≦Io≦1600	160≦Io≦2000	125≦Io≦250 250〈Io≦500 500〈Io≦1000 1000〈Io≦2000 2000〈Io≦2500	800≦Io≦1600 1600〈Io≦3200	2000≦Io≦4000
Rated primary current of over-current trip devices (A) • for general feeder circuit use			80 160 320 630	320 630 1250	320 630 1000 1250 1600	320 630 1000 1250 1600 2000	250 500 1000 2000 2500	1600 3200	4000
Rated insulation voltage [Ui] (V)			AC 1000V	AC 1000V	AC 1000V	AC 1000V	AC 1000V	AC 1000V	AC 1000V
AC rated breaking capacity (kA, sym.) / Making capacity (kA, peak)									
KR	with INST	AC 690V							
		600V							
		480V	35/77.2	65/145	65/145	65/145	65/145	65/145	
	without INST	up to 480V	35/77.2	50/111	50/111	50/111	50/111	65/145	
LR	with INST	AC 690V							
		600V							
		500V			50/122		65/154		65/196
	without INST	up to 500V		50/105		50/105		50/105	
ABS	with INST	AC 690V							
		600V							
		480V	35/77.2	65/145	65/145		65/145	65/145	65/196
	without INST	up to 480V	35/77.2	50/111	50/111	50/105	50/111	65/145	
GL	with INST	AC 690V	22/59.4	35/81	35/81		45/106	45/106	
		600V	30/76	50/126	50/126		50/126	65/168	
		480V	35/90.2	65/190.5	65/190.5		65/190.5	65/190.5	
	without INST	up to 480V				50/105			65/151.6
BV	with INST	AC 690V							
		600V							
		500V	35/85.4	65/148.5	65/148.5		65/148.5	85/220.6	
	without INST	up to 500V	35/85.4	50/122.23	50/119.95	50/105	50/130.95	65/162.37	65/196
NK	with INST	AC 690V							
		600V		50/105	50/105				
	without INST	up to 690V		50/105	50/105				
Other ratings									
Short time current RMS (kA)		1S	35	50	50	50	50	65	
		3S	30	45	45	45	45	50	
Latching current RMS (kA)			35	50	50	50	50	65	
Total breaking time (s)			0.035	0.035	0.035	0.035	0.035	0.035	
Rated closing time	Spring charging time (s) max.		10	10	10	10	10	10	
	Closing time (s) max.		0.05	0.05	0.05	0.05	0.05	0.05	
Weight (kG), 3-pole draw-out type			82	85	90	91	137	152	

Internal Resistance, Power Consumption, Reactance *Per pole value.		HAT06/08	HAT10/12	HAT16	HAT20	HAT25	HAT32	HAT40	HAT50
Internal Resistance (mΩ)	Draw-out type	0.060	0.048	0.041	0.034	0.023	0.018	0.014	0.02
	Fixed type	0.040	0.025	0.022	0.018	0.016	0.010	0.010	-
Power Consumption (W)	Draw-out type	23.81/38.4	48.00/75.00	104.96	136.00	143.75	184.32	224.00	500.00
	Fixed type	15.88/25.60	25.00/39.06	56.32	72.00	100.00	102.40	160.00	-
Reactance (mΩ)	Draw-out type	0.150	0.098	0.085	0.078	0.063	0.055	0.050	0.057
	Fixed type	0.150	0.098	0.085	0.078	0.063	0.055	0.050	-

Selection of Specification

◉ A Wide Choice of Specifications to Suit Your Particular Application

"HAT ACB" classified into ten categories.
We are sure that our custom-built specification of "HAT ACB" will contribute to your system design.



❶ Available on draw-out type
❷ Necessary for 3-phase, 4 wire system with AG.(Built-in on 3-pole type)

◉ "Shut-in Three Positions" Type

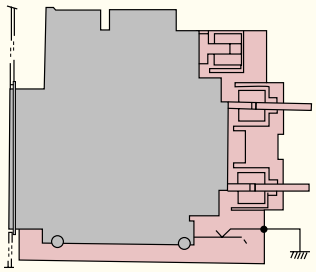
- **Draw-Out Type**
  The Draw-out type consists of a breaker and a draw-out cradle.
  The breaker can be drawn out from the cradle.

  There are four breaker positions:
  CONNECTED, TEST, ISOLATED and REMOVED.

  The switchboard panel door can be shut even when the breaker is in the ISOLATED position.
  (shut-in-three position type)

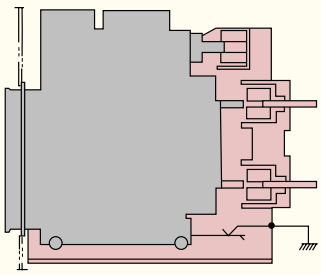
- **Fixed Type**
  The breaker is directly installed in place.

1 Connected Position



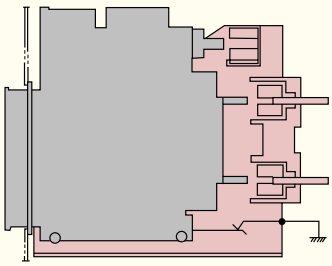
Both main and control circuits are connected for normal service.

2 Test Position



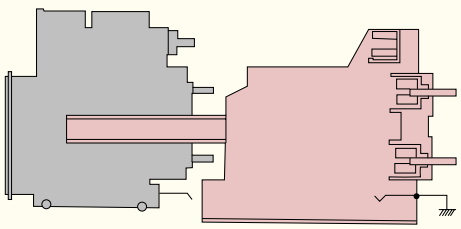
The main circuits are isolated, and the control circuits are connected. This position permits operation tests with the switchboard panel door shut.

3 Isolated Position



Both main and control circuits are isolated. The switchboard panel door can be shut.

4 Removed Position



The breaker is complete out of the cradle for removal.

Spring Charging Operation

◉ Manual Charging Type

The closing springs are manually charged by pumping the charging handle.
When the PUSH TO CLOSE button is pressed, the closing springs are released, quickly closing the breaker.
An electrical latch release can be provided for remote closing applications.
The closing springs must be charged manually prior to remote closing operation.

◉ Motor Charging Type

An electric motor automatically charges the closing springs.
When the PUSH TO CLOSE button is pressed, the closing springs are released, quickly closing the breaker.
With the breaker closed, the motor automatically starts to charge the springs again for the next closing opertion.
Manual charging is also possible.
Separate charging and closing circuits are available on request.

◉ Motor Charging and Closing Operation

- **Charging of closing springs**
  (1) The spring charge indicator shows 'DISCHARGED'.
  (2) The spring charged OFF switch is closed.
  (3) The control voltage is supplied across the terminals [1] and [2].
  (4) The motor operates to charge the closing springs.
  (5) When the closing springs are charged, the spring charged OFF switch becomes open to stop the motor. The indicator shows 'CHARGED'.

- **Closing the breaker**
  (1) Check that the spring charged indicator is showing 'CHARGED'.
  (2) Under the above condition, the spring charged ON switch is closed.
  (3) CLOSED-OPEN indicator shows "OPEN".
  (4) AUX. switch is kept turned on.
  (5) Turn on the CLOSE switch.
  (6) The latch release is energized.
  (7) The closing springs are released.
  (8) The breaker is closed.

- **Anti-pumping function**
  (1) If the closing springs are released, the spring discharged OFF switch is closed.
  If the CLOSE signal is continuously supplied, the hold relay is energized, which self-seals with its a-contact HC closed.
  (2) It's b-contact HC becomes open.
  (3) This prevents the latch release from being energized.
  (4) In the sequence of (1) to (3), the anti-pumping function works to prevent reclosing of the breaker.

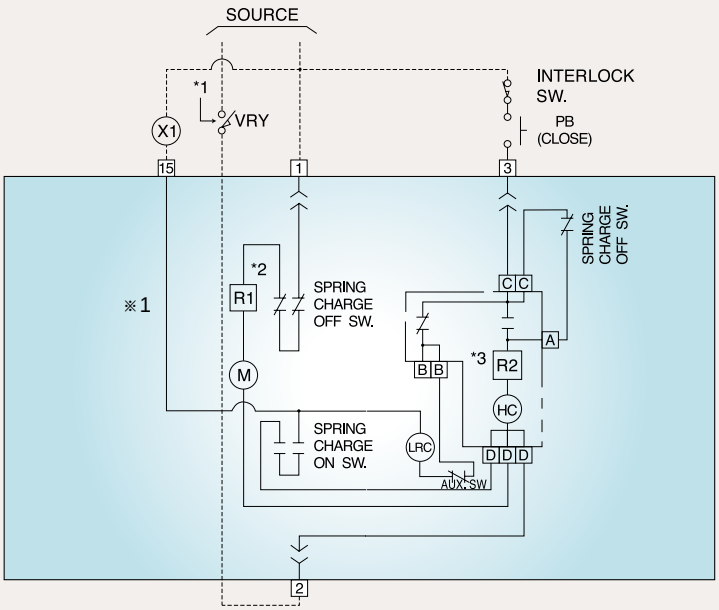
◉ Motor Charging and Closing Control Circuits

M	Charging Motor
HC	Hold Relay (Anti-Pumping)
LRC	Latch Release Coil (Closing)
X1	Auxiliary Relay (Not Supplied)
—	Manufacturer's Wiring
···	User's Wiring
〈〈	Disconnecting Device

※1
For DC voltages, spring charged indication is possible by connection of an external relay across terminals [3] and [5].

Rated voltage of the relay must be the same as the motor rated voltage.

＊1 : Fitted with circuit rated 240, 250V AC.
＊2 : For circuits of rated control voltage 125V DC.
＊3 : For circuit of rated control voltage 200 to 220V.



◉ Rating of Motor Charging Type

Breaker Type	Rated Voltage (V)	Min. & Max. Operation Voltage (V)	Inrush Current IMP (Peak Value) (A)	Steady-State Current IMF (AC. RMS Value) (A)	Charging Time (S)	Closing Command Current(LRC) (Peak Value) (A)
HAT06 HAT08 HAT10 HAT12 HAT16 HAT20	AC240-250	204-275	2.9(240V)	0.5	2.8	1.6(240V)
	AC200-230	170-253	3.4(220V)	0.5	2.4	1.5(220V)
	AC100-120	85-132	6.3(110V)	1.2	2.4	3.1(110V)
	DC200-220	150-242	2.8(220V)	0.5	2.7	1.3(220V)
	DC125	94-138	2.2(125V)	0.8	3.0	3.4(125V)
	DC100-110	75-121	6.5(100V)	0.9	3.8	3.0(100V)
	DC24	18-26	16.9(24V)	3.4	2.7	8.8(24V)
HAT25	AC240-250	204-275	2.8(240V)	0.8	3.4	1.7(240V)
	AC200-230	170-253	3.4(220V)	0.6	2.5	1.6(220V)
	AC100-120	85-132	6.1(110V)	1.1	2.5	3.2(110V)
	DC200-220	150-242	2.8(220V)	0.5	3.1	1.4(220V)
	DC125	94-138	2.4(125V)	1.0	3.0	3.5(125V)
	DC100-110	75-121	6.5(100V)	1.2	3.5	2.8(100V)
	DC24	18-26	16.9(24V)	3.7	3.5	8.8(24V)
HAT32 HAT40	AC240-250	204-275	2.8(240V)	0.8	4.0	1.9(240V)
	AC200-230	170-253	3.2(220V)	0.6	3.0	1.7(220V)
	AC100-120	85-132	6.0(110V)	1.2	3.0	3.2(110V)
	DC200-220	150-242	2.8(220V)	0.5	3.1	1.5(220V)
	DC125	94-138	2.5(125V)	1.0	3.0	3.5(125V)
	DC100-110	75-121	6.0(100V)	0.9	3.5	2.9(100V)
	DC24	18-26	15.5(24V)	3.8	4.2	8.9(24V)
HAT50	AC240-250	204-275	2.8(240V)	1.0	4.0	1.9(240V)
	AC200-230	170-253	3.2(220V)	0.8	3.0	1.7(220V)
	AC100-120	85-132	6.0(110V)	1.6	3.0	3.2(110V)
	DC200-220	150-242	2.8(220V)	0.7	3.1	1.5(220V)
	DC125	94-138	2.5(125V)	1.3	3.0	3.5(125V)
	DC100-110	75-121	6.0(100V)	1.2	3.5	2.9(100V)
	DC24	18-26	15.5(24V)	4.6	4.2	8.9(24V)

Accessories for Spring Charging Operation

◉ Automatic Closing Spring Release

The closing springs are automatically released as the breaker is drawn out from the TEST position to the ISOLATED position. (STANDARD)

◉ JIG for Slow-Closing

Jigs can be supplied with the breaker for inspection and maintenance purposes.
Slow-closing operation can be made by the charging handle when the slow-closing jigs are installed.

◉ Spring Charged Switch

This switch electrically indicated the charged condition of the closing springs.

Rating Load	Resistive	Motor
AC 125V	16A	4A
AC 250V	16A	4A
AC 380V	16A	4A
DC 125V	0.4A	0.05A

Protection Characteristics

◉ Type AOR Multi-Protective Device

This device is a high-reliability, multi-function protection relay, utilizing a 8-bit microprocessor.
In addition to three over-current protective functions, (long time-delay, short time-delay and instantaneous), a pre-trip alarm and or ground fault protective function can also be incorporated with in one device.

Indication for long time-delay trip and pick-up, via the LED and terminals for field checking (OCR checker required), are included in the device.
Furthermore, two additional operation indication functions can be included.
By using these functions, simplified field checking becomes possible.

1. Protective functions

AL	Adjustable long time-delay trip
AS	Adjustable short time-delay trip
AI	Adjustable instantaneous trip
AP	Adjustable pre-trip alarm
AG	Adjustable ground fault trip

2. Operation indication functions

IU — Operation indication contact (integrated display) providing one normally open contact, terminals 22 23, closes to provide tripped indication when either AL, AS, AI or AG function operates.

- OFF after 40ms except AM and GM types
- Withstand voltage(terminals-earth) 1500V
- AM/GM type have integrated continuous contact and seperate LED's

CP/I — LEDs and contacts for tripped indication.
Should the device operate, an LED is lit to indicate which trip function, AL, AS/AI or AG, tripped the breaker.

The associated contact, AL, AS/AI, AP or AG closes to provide tripped indication.
Furthermore, the device provides a CPU abnormally monitoring LED and contact output for complete system security.

Separate control power required.

AP function automatically resets when the current level drops below pick-up current [Ip], but other indications remain ON until the PUSH TO RESET button is operated.

Withstand voltage (terminals-earth) 1,500V

3. Combintation of protective functions and operation indication functions
(Please see table below)

4. Field check function by OCR checker
For details, refer to page 29.
By check switches AL, AS and AI functions can be checked.

5. Check switches are only available on types
AOR-1L-AS, AOR-1L-GS, AOR-1L-GM, AOR-1L-AM and AOR-1S-AS.

6. MCR function (Option)
The MCR(Making Current Release) is an instantaneous tripping element that is in operation only during the closing cycle of the ACB.

This function trips the ACB when the short circuit current exceeds the pickup current setting during closing operation.

After the ACB has competely closed, the MCR function is disabled.

The MCR function is set by INST/MCR switch.

7. Precise protection co-ordination
● Non position for pick-up current:
The pick-up current setting dials for the long time-delay, short timedelay and instantaneous trip functions have a NON position to make the associated function inoperative, there by permitting a quick change or selection of the required functions.

◉ Combination Table of Protective Functions

Protective Function	Indication Function	Type of Multi-Protective Function	
		For General Feeder Circuit	For Generator Protection
AL AS AI	IU	AOR-1L-AL	AOR-1S-AL
AL AS AI AP MCR	CP/I	AOR-1L-AS	AOR-1S-AS
AL AS AI AG	IU	AOR-1L-GL	–
AL AS AI AP MCR AG	CP/I	AOR-1L-GS	–
AL AS AI AP MCR	IU CP/I	AOR-1L-AM	–
AL AS AI AP MCR AG	IU CP/I	AOR-1L-GM	–
AL AS AI AP AG	IU CP/I	AOR-1D-GM(Digital display type)	

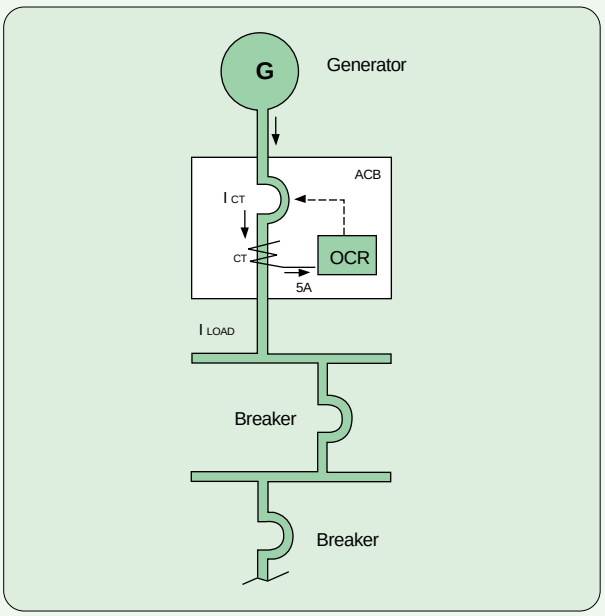
● Fail-safe function for system security:
In the event of a fault current exceeding ten times the setting of the base current (Io) (five times for generator protection) while the AL, AS and AI functions are set to the NON position, the circuit breaker "Fail-Safe" function will interrupt the fault current in a time equal to the short-time delay setting (T_2).

8. Determine the protective characteristics appropriate for your application

Type AOR multi-protective device, the base current (Io) serves as the base to determine the long time-delay trip, short time-delay trip, instantaneous trip, pre-trip alarm and ground fault characteristics.

The following steps show how to determine the optimum base current(Io) that will provide the most appropriate characteristic to suit your application.

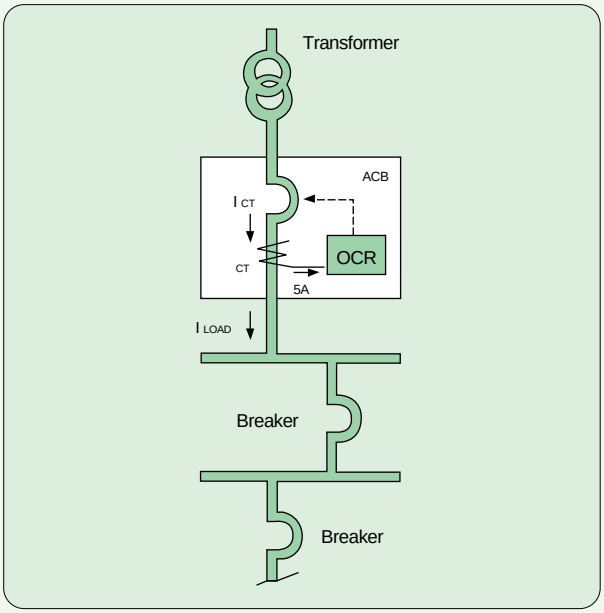
◉ For Generator Protection Circuits



Step 1
Determine the rated generator current.(I_{GEN})
Step 2
Determine the base current(Io) which is the reference current for the AL, AS, AI, AP pick-up current settings of the multi-protective device.
Step 3
Determine the long time-delay trip(AL), short time-delay trip(AS), instantaneous trip(AI), and pre-trip alarm(AP) characteristics.
(See Pages 22 to 24)

Breaker	Rated Current(Io) in (A)
HAT06	40≦〔Io〕≦630
HAT08	40≦〔Io〕≦800
HAT10	40≦〔Io〕≦1000
HAT12	40≦〔Io〕≦1250
HAT16	40≦〔Io〕≦1600
HAT20	40≦〔Io〕≦2000
HAT25	125≦〔Io〕≦2500
HAT32	800≦〔Io〕≦3200
HAT40	2000≦〔Io〕≦4000
HAT50	2500≦〔Io〕≦5000

◉ For General Feeder Circuits



Step 1
Determine the largest normal load current (I_{LOAD}) that will pass through the Air Circuit Breaker.
Step 2
Select the rated primary current (I_{CT}) of the multi-protective device.
The table below lists the values of (I_{CT}) available for the respective breaker types.
Select (I_{CT}) according to the following criteria.
(I_{CT}) ≧ (I_{LOAD})
Step 3
Determine the base current (Io) which is the reference current for the AL, AS, AI and AG pick-up current settings.Select one of the four base current values (Io)=(I_{CT}) x 0.5 or 0.63 or 0.8 or 1.0
Step 4
Determine the long time-delay trip(AL), short time-delay trip (AS), instantaneous trip(AI), Pre-trip alarm(AP) and ground fault frip(AG) characteristics **(See Pages 16 to 21, 25, 26, 27)**

NOTE:
The ground fault trip function is not available when the rated primary current (I_{CT}) of OCR is 80, 160 or 250A.

Breaker	Rated Primary Current(I_{CT}) in (A) of OCR
HAT06	80, 160, 320, 630
HAT08	80, 160, 320, 630, 800
HAT10	80, 160, 320, 630, 800, 1000
HAT12	80, 160, 320, 630, 800, 1000, 1250
HAT16	80, 160, 320, 630, 800, 1000, 1250, 1600
HAT20	80, 160, 320, 630, 800, 1000, 1250, 1600, 2000
HAT25	250, 500, 1000, 2000, 2500
HAT32	1600, 3200
HAT40	4000
HAT50	5000

NOTE: The rated secondary current of all current transformers (CT) is 5A.

Protection Characteristics

◉ Multi-Protective Device AOR-1L-GS

Settings and Operation Indication LEDs

TYPE	AOR-1L-GS						
Characteristics							
AL							
Pick-up current [I_1] (A)	[Io] × (0.8 - 0.85 - 0.9 - 0.95 - **1.0** - 1.05 - 1.1 - NON), 8 graduations Non-tripping at [I_1] setting × 105% and below. Tripping at 120% and above						
Time-delay [T_1] (S)	(0.5 - 1.25 - 2.5 - 5 - 10 - **15** - 20 - 25 - 30) at [I_1] × 600% current, 9 graduations						
Setting tolerance (%)	±15% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
Characteristics							
AS							
Pick-up current [I_2] (A)	[Io] × (2 - 2.5 - 3 - 4 - **6** - 8 - 10 - NON), 8 graduations						
Setting tolerance (%)	±15%						
Time-delay [T_2] (ms) 7 graduations	80	160	**240**	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	55	120	190	260	330	400	460
Max. total clearing time (ms)	150	240	335	425	520	610	700
Characteristics							
AI or MCR							
Pick-up current [I_3] (A)	[Io] × (4 - 6 - 8 - 10 - **12** - 14 - 16 - NON), 8 graduations						
Setting tolerance (%)	±20%						
Characteristics							
AP							
Pick-up curren [I_P] (A)	[Io] × (0.75 - 0.8 - 0.85 - **0.9** - 0.95 - 1.0 - 1.05 - 1.1), 8 graduations						
Setting tolerance (%)	±7.5% (±10% when [I_{CT}] of type HAT06 is 160A or 80A)						
Time-delay [T_P] (S)	(60 - 80 - 100 - 120 - **140** - 160 - 180 - 200) at over [Ip] setting, 8 graduations						
Setting tolerance (%)	±20%						
Characteristics							
AG ❷							
Pick-up current [I_G] (A)	[I_{CT}] × (0.1 - 0.15 - **0.2** - 0.25 - 0.3 - 0.35 - 0.4), 7 graduations						
Setting tolerance (%)	±20%						
Time-delay [T_G] (ms) 7 graduations ❶	80	160	**240**	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	40	110	170	240	310	380	450
Max. total clearing time (ms)	180	270	365	455	545	640	730
LEDs and Contacts for operation indication							
CP/I	Applied						
Control power for LEDs	AC 100-125V or AC 200-250V/5VA, DC 100-125V, DC 200-250V or DC 24V/5W						
Ratings of operation indication contacts — Rated voltage	AC 250V	DC 220V					
Ratings of operation indication contacts — Rated current (resistive load)	125 VA (2A Max)	60W (2A Max)					
Ratings of operation indication contacts — Rated current (conductive load)	20 VA (2A Max)	10W (2A Max)					

❶ AG delay setting dial is common to the AS delay setting dial.
❷ Not applicable when (I_{CT}) is 80A, 160A or 250A.
※ Bold Character is Standard Setting.

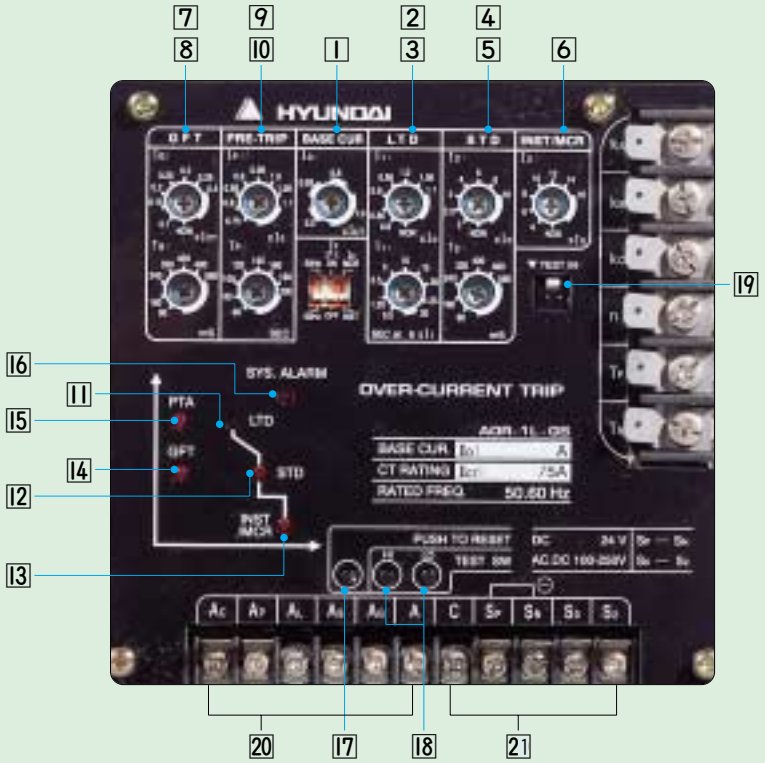
Base Current [Io] Values

Breaker Type	Applicable (I_{CT}) (A)	(Io) Value(A) (I_{CT}) ×0.5	(I_{CT}) ×0.63	(I_{CT}) ×0.8	(I_{CT}) ×1.0
HAT06	80	40	50	63	80
	160	80	100	125	160
	320	160	200	250	320
	630	320	400	500	630
HAT08	320	160	200	250	320
	630	320	400	500	630
	800	400	500	640	800
HAT10	320	160	200	250	320
	630	320	400	500	630
	1000	500	630	800	1000
HAT12	320	160	200	250	320
	630	320	400	500	630
	1250	630	800	1000	1250

Breaker Type	Applicable (I_{CT}) (A)	(Io) Value(A) (I_{CT}) ×0.5	(I_{CT}) ×0.63	(I_{CT}) ×0.8	(I_{CT}) ×1.0
HAT16	1600	800	1000	1250	1600
HAT20	2000	1000	1250	1600	2000
HAT25	250	125	160	200	250
	500	250	320	400	500
	1000	500	630	800	1000
	2000	1000	1250	1600	2000
	2500	1250	1600	2000	2500
HAT32	1600	800	1000	1250	1600
	3200	1600	2000	2500	3200
HAT40	4000	2000	2500	3200	4000
HAT50	5000	2500	3200	4000	5000

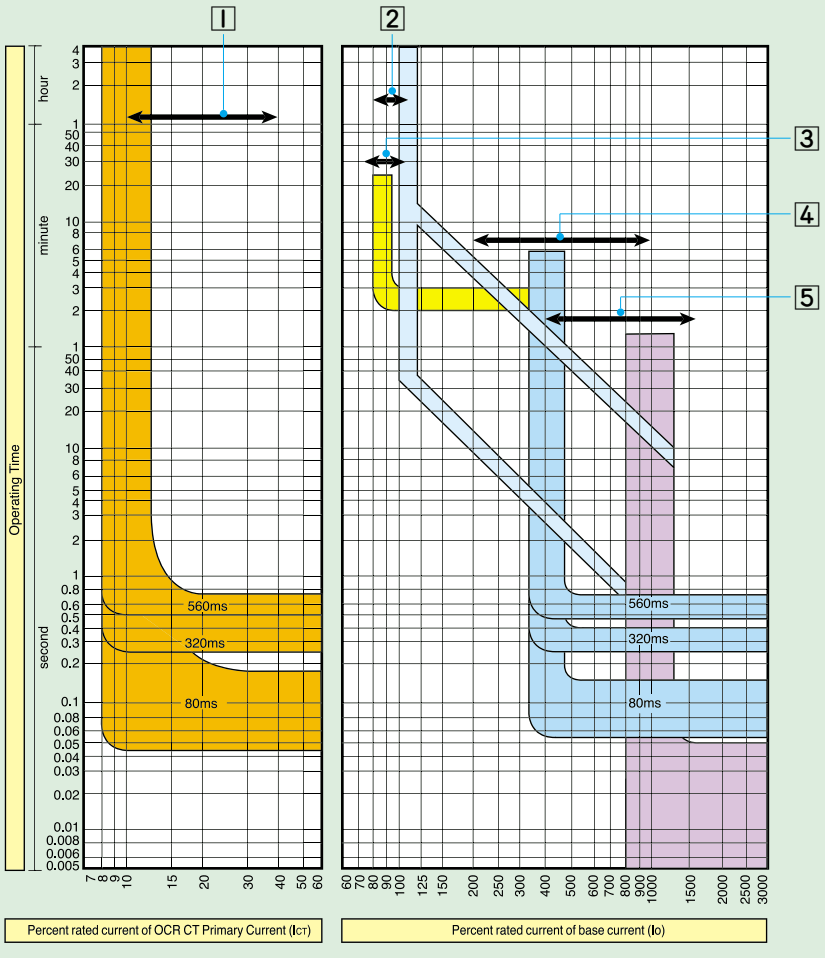
Front Face of Multi-Protective Device

Type : AOR - 1L - GS



1	Base current setting dial
2	AL pick-up current setting dial
3	AL time setting dial
4	AS pick-up current setting dial
5	AS time setting dial
6	AI pick-up current setting dial
7	AP pick-up current setting dial
8	AP time setting dial
9	AG pick-up current setting dial
10	AG time setting dial
11	LED for AL tripped indication
12	LED for AS tripped indication
13	LED for AI/MCR tripped indication
14	LED for AG tripped indication
15	LED for AP tripped indication
16	LED for CPU tripped indication
17	Reset button
18	Field test button
19	Test terminal
20	Contacts for operation indication
21	Control power input terminals

Multi-Protective Characteristics



1	AG pick-up current setting range
2	AL pick-up current setting range
3	AP pick-up current setting range
4	AS pick-up current setting range
5	AI pick-up current setting range

Protection Characteristics

◉ Multi-Protective Device AOR-1L-GL

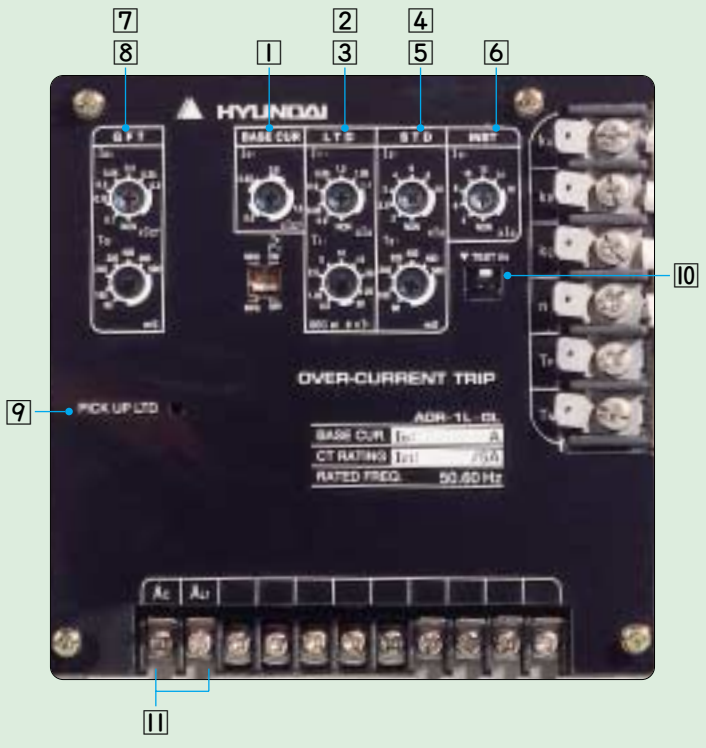
Settings and Contacts for Operation Indication

TYPE	AOR-1L-GL						
Characteristics							
AL							
Pick-up current [I_1] (A)	[Io] × (0.8 - 0.85 - 0.9 - 0.95 - **1.0** - 1.05 - 1.1 - NON), 8 graduations						
	Non-tripping at [I_1] setting × 105% and below. Tripping at 120% and above.						
Time-delay [T_1] (S)	(0.5 -1.25 - 2.5 - 5 - 10 - **15** - 20 - 25 - 30) at [I_1] × 600% current 9 graduations						
Setting tolerance (%)	±15% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
Characteristics							
AS							
Pick-up current [I_2] (A)	[Io] × (2 - 2.5 - 3 - 4 - **6** - 8 - 10 - NON), 8 graduations						
Setting tolerance (%)	±15%						
Time-delay [T_2] (ms) 7 graduations	80	160	**240**	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	55	120	190	260	330	400	460
Max. total clearing time (ms)	150	240	335	425	520	610	700
Characteristics							
AI							
Pick-up current [I_3] (A)	[Io] × (4 - 6 - 8 - 10 - **12** - 14 - 16 - NON), 8 graduations						
Setting tolerance (%)	±20%						
Characteristics							
AG ❷							
Pick-up current [I_G] (A)	[I_{CT}] × (0.1 - 0.15 - **0.2** - 0.25 - 0.3 - 0.35 - 0.4), 7 graduations						
Setting tolerance (%)	±20%						
Time-delay [T_G] (ms) 7 graduations ❶	80	160	240	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	40	110	170	240	310	380	450
Max. total clearing time (ms)	180	270	365	455	545	640	730
Contacts for operation indication							
IU							
Ratings of operation indication contacts	Rated voltage	AC 250V	DC 220V				
	Rated current (resistive load)	125VA (2A Max)	60W (2A Max)				
	Rated current (conductive load)	20VA (2A Max)	10W (2A Max)				

❶ AG delay setting dial is common to the AS delay setting dial. ❷ Not applicable when (I_{CT}) is 80A, 160A or 250A.

Front Face of Multi-Protective Device

Type : AOR - 1L - GL



1	Base current setting dial
2	AL pick-up current setting dial
3	AL time setting dial
4	AS pick-up current setting dial
5	AS time setting dial
6	AI pick-up current setting dial
7	AG pick-up current setting dial
8	AG time setting dial
9	LED for AL pick-up indication
10	Test terminal
11	Contacts for operation indication

◉ Multi-Protective Device AOR-1L-AS

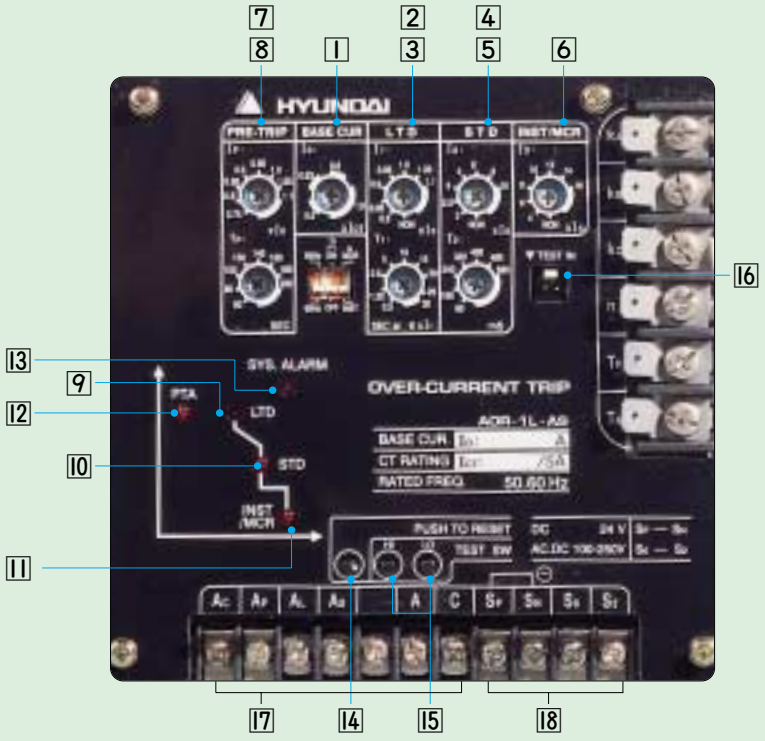
Settings and Operation Indication LEDs

TYPE	AOR-1L-AS						
Characteristics							
AL							
Pick-up current [I_1] (A)	[Io] × (0.8 - 0.85 - 0.9 - 0.95 - **1.0** - 1.05 - 1.1 - NON), 8 graduations Non-tripping at [I_1] setting × 105% and below. Tripping at 120% and above						
Time-delay [T_1] (S)	(0.5 -1.25 - 2.5 - 5 - 10 - **15** - 20 - 25 - 30) at [I_1] × 600% current 9 graduations						
Setting tolerance (%)	±15% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
Characteristics							
AS							
Pick-up current [I_2] (A)	[Io] × (2 - 2.5 - 3 - 4 - **6** - 8 - 10 - NON), 8 graduations						
Setting tolerance (%)	±15%						
Time-delay [T_2] (ms) 7 graduations	80	160	**240**	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	55	120	190	260	330	400	460
Max. total clearing time (ms)	150	240	335	425	520	610	700
Characteristics							
AI or MCR							
Pick-up current [I_3] (A)	[Io] × (4 - 6 - 8 - 10 - **12** - 14 - 16 - NON), 8 graduations						
Setting tolerance (%)	±20%						
Characteristics							
AP							
Pick-up current [I_P] (A)	[Io] × (0.75 - 0.8 - 0.85 - **0.9** - 0.95 - 1.0 - 1.05 - 1.1), 8 graduations						
Setting tolerance (%)	±7.5% (±10% when [I_{CT}] of type HAT06 is 160A or 80A)						
Time-delay [T_P] (S)	(60 - 80 - 100 - 120 - **140** - 160 - 180 - 200) at over [Ip] setting, 8 graduations						
Setting tolerance (%)	±20%						
LEDs and Contacts for operation indication							
CP/I	Applied						
Control power for LEDs	AC 100-125V or AC 200-250V/5VA, DC 100-125V, DC 200-250V or DC 24V/5W						
Ratings of operation indication contacts — Rated voltage	AC 250V	DC 220V					
Ratings of operation indication contacts — Rated current (resistive load)	125VA (2A Max)	60W (2A Max)					
Ratings of operation indication contacts — Rated current (conductive load)	20VA (2A Max)	10W (2A Max)					

Front Face of Multi-Protective Device

Type : AOR - 1L - AS

- [1] Base current setting dial
- [2] AL pick-up current setting dial
- [3] AL time setting dial
- [4] AS pick-up current setting dial
- [5] AS time setting dial
- [6] AI pick-up current setting dial
- [7] AP pick-up current setting dial
- [8] AP time setting dial
- [9] LED for AL tripped indication
- [10] LED for AS tripped indication
- [11] LED for AI/MCR tripped indication
- [12] LED for AP tripped indication
- [13] LED for CPU tripped indication
- [14] Reset button
- [15] Field test button
- [16] Test terminal
- [17] Contacts for operation indication
- [18] Control power input terminal



Protection Characteristics

◉ Multi-Protective Device AOR-1L-AL

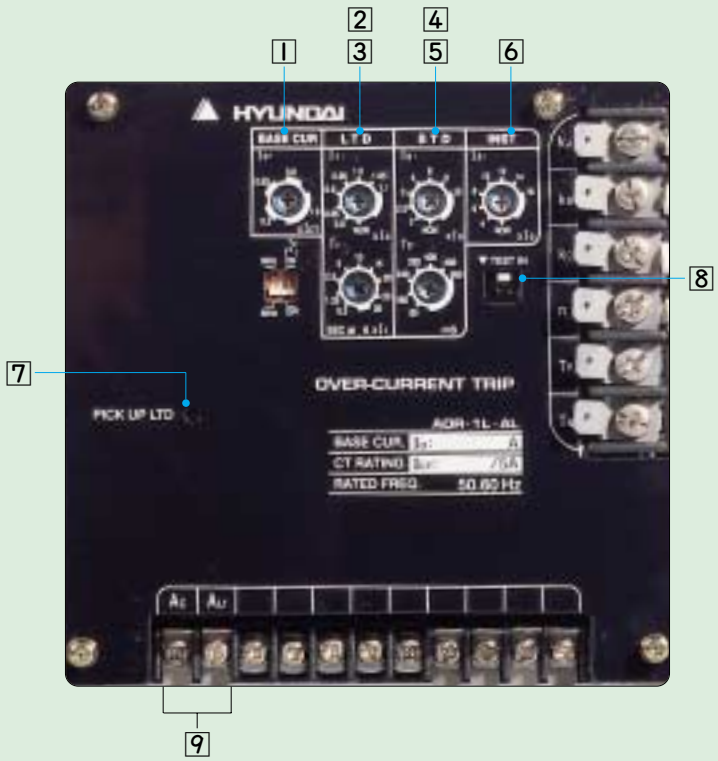
Settings and Contacts for Operation Indication

TYPE		AOR-1L-AL						
Characteristics AL								
Pick-up current [I_1] (A)		[Io] × (0.8 - 0.85 - 0.9 - 0.95 - **1.0** - 1.05 - 1.1 - NON), 8 graduations Non-tripping at [I_1] setting × 105% and below. Tripping at 120% and above						
Time-delay [T_1] (S)		(0.5 - 1.25 - 2.5 - 5 - 10 - **15** - 20 - 25 - 30) at [I_1] × 600% current, 9 graduations						
Setting tolerance (%)		±15% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
Characteristics AS								
Pick-up current [I_2] (A)		[Io] × (2 - 2.5 - 3 - 4 - **6** - 8 - 10 - NON), 8 graduations						
Setting tolerance (%)		±15%						
	Time-delay [T_2] (ms) 7 graduations	80	160	**240**	320	400	480	560
	Opening time (ms)	100	180	260	340	420	500	580
	Resettable time (ms)	55	120	190	260	330	400	460
	Max. total clearing time (ms)	150	240	335	425	520	610	700
Characteristics AI								
Pick-up current [I_3] (A)		[Io] × (4 - 6 - 8 - 10 - **12** - 14 - 16 - NON), 8 graduations						
Setting tolerance (%)		±20%						
Characteristics IU								
Ratings of operation indication contacts	Rated voltage	AC 250V	DC 220V					
	Rated current (resistive load)	125VA (2A Max)	60W (2A Max)					
	Rated current (conductive load)	20VA (2A Max)	10W (2A Max)					

Front Face of Multi-Protective Device

Type : AOR - 1L - AL

- 1 Base current setting dial
- 2 AL pick-up current setting dial
- 3 AL time setting dial
- 4 AS pick-up current setting dial
- 5 AS time setting dial
- 6 AI pick-up current setting dial
- 7 LED for AL pick-up indication
- 8 Test terminal
- 9 Contacts for operation indication



◉ Multi-Protective Device AOR-1L-GM

Settings and Contacts for Operation Indication

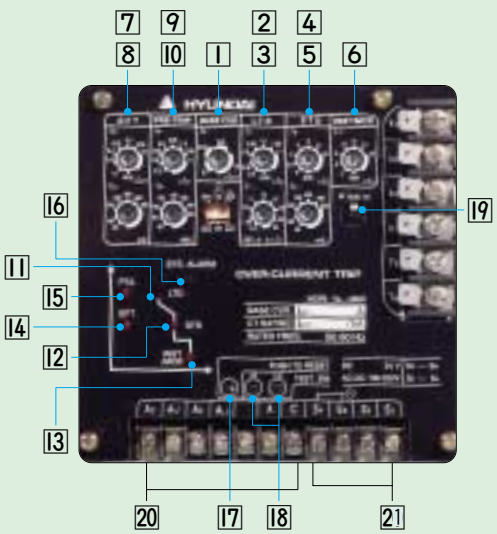
TYPE	AOR-1L-GM, AOR-4L-GM						
Characteristics							
AL							
Pick-up current [I_1] (A) ❶	[Io] × (0.8 - 0.85 - 0.9 - 0.95 - **1.0** - 1.05 - 1.1 - NON), 8 graduations						
Setting tolerance (%)	Non-tripping at [I_1] setting × 105% and below. Tripping at 120% and above.						
Time-delay [T_1] (S)	(0.5 - 1.25 - 2.5 - 5 - 10 - **15** - 20 - 25 -30) at [I_1] × 600% current, 9 graduations						
Setting tolerance (%)	±15% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
Characteristics							
AS							
Pick-up current [I_2] (A)	[Io] × (2 - 2.5 - 3 - 4 - **6** - 8 - 10 - NON), 8 graduations						
Setting tolerance (%)	±15%						
Time-delay [T_2] (ms) 7 graduations	80	160	**240**	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	55	120	190	260	330	400	460
Max. total clearing time (ms)	150	240	335	425	520	610	700
Characteristics							
AI or MCR							
Pick-up current [I_3] (A)	[Io] × (4 - 6 - 8 - 10 - **12** - 14 - 16 - NON), 8 gradutions						
Setting tolerance (%)	±20%						
Characteristics							
AP							
Pick-up curren [I_P] (A)	[Io] × (0.75 - 0.8 - 0.85 - **0.9** - 0.95 - 1.0 - 1.05 - 1.1), 8 graduations						
Setting tolerance (%)	±7.5% (±10% when [I_{CT}] of type HAT06 is 160A or 80A)						
Time-delay [T_P] (S)	(60 - 80 - 100 - 120 - **140** - 160 - 180 - 200) at over [Ip] setting, 8 graduations						
Setting tolerance (%)	±20%						
Characteristics							
AG ❷							
Pick-up current [I_G] (A)	[I_{CT}] × (0.1 - 0.15 - **0.2** - 0.25 - 0.3 - 0.35 - 0.4), 7 graduations						
Setting tolerance (%)	±20%						
Time-delay [T_G] (ms) 7 graduations ❶	80	160	240	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	40	110	170	240	310	380	450
Max. total clearing time (ms)	180	270	365	455	545	640	730
Contacts for operation							
CP/I IU	Applied						
Control power for LEDs	AC 100-125V or AC 200-250V/5VA, DC 100-125V, DC 200V-250V or DC 24V/5W						
Ratings of operation indication contacts — Rated voltage	AC 250V	DC220V					
Rated current (resistive load)	125 VA (2A Max)	60W (2A Max)					
Rated current (conductive load)	20 VA (2A Max)	10W (2A Max)					

❶ AG delay setting dial is common to the AS delay setting dial. ❷ Not applicable when (I_{CT}) is 80A, 160A or 250A

Front Face of Multi-Protective Device

Type : AOR - 1L - GM

[1] Base current setting dial	[14] LED for AG tripped indication
[2] AL pick-up current setting dial	[15] LED for AP tripped indication
[3] AL time setting dial	[16] LED for CPU tripped indication
[4] AS pick-up current setting dial	[17] Reset button
[5] AS time setting dial	[18] Field test button
[6] AI pick-up current setting dial	[19] Test terminal
[7] AP pick-up current setting dial	[20] Contacts for operation indication
[8] AP time setting dial	[21] Control power input terminals
[9] AG pick-up current setting dial	
[10] AG time setting dial	
[11] LED for AL tripped indication	
[12] LED for AS tripped indication	
[13] LED for AI/MCR tripped indication	



Protection Characteristics

◉ Multi-Protective Device AOR-1S-AS

Settings and Operation Indication LEDs

TYPE	AOR-1S-AS						
Characteristics							
AL							
Pick-up current [I_1] (A) ❶	[Io] × (0.8 - 1.0 - 1.05 - **1.1** - 1.15 - 1.2 - 1.25 - NON), 8 graduations						
Setting tolerance (%)	±5% (±10% when [I_{CT}] of type HAT06 is 160A or 80A)						
Time-delay [T_1] (S)	(15 - 20 - 25 - **30** - 40 - 50 - 60) at [I_1] × 120% current						
Setting tolerance (%)	±15% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
Characteristics							
AS							
Pick-up current [I_2] (A)	[Io] × (2 - 2.5 - 2.7 - **3** - 3.5 - 4 - 4.5 -5 - NON), 9 graduations						
Setting tolerance (%)	±10% (±15% when [I_{CT}] of type HAT06 is 160A or 80A)						
Time-delay [T_2] (ms) 7 graduations	80	160	240	320	**400**	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	55	120	190	260	330	400	460
Max. total clearing time (ms)	150	240	335	425	520	610	700
Characteristics							
AI or MCR							
Pick-up current [I_3] (A)	[Io] × (4 - 6 - 8 - **10** - 12 - 14 - 16 - NON), 8 graduations						
Setting tolerance (%)	±20%						
Characteristics							
AP							
Pick-up current [I_P] (A)	[Io] × (0.75 - 0.8 - 0.85 - **0.9** - 0.95 - 1.0 - 1.05 - 1.1), 8 graduations						
Setting tolerance (%)	±5% (±10% when [I_{CT}] of type HAT06 is 160A or 80A)						
Time-delay [T_P] (S) ❶	(5 - **10** - 15 - 20 - 25 - 30 - 35 - 40 - 45) at over [Ip] setting, 8 graduations						
Setting tolerance (%)	±15% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
LEDs and Contacts for operation indication							
CP/I	Applied						
Control power for LEDs	AC 100-125V or AC 200-250V/5VA, DC 100-125V, DC 200-250V or DC 24V/5W						
Ratings of operation indication contacts — Rated voltage	AC 250V	DC 220V					
Ratings of operation indication contacts — Rated current (resistive load)	125VA (2A Max)	60W (2A Max)					
Ratings of operation indication contacts — Rated current (conductive load)	20VA (2A Max)	10W (2A Max)					

❶ Fixed setting of 10 seconds at 120% rated base current [Io] when [I_1] is set at Non. ※ Bold Character is Standard Setting.

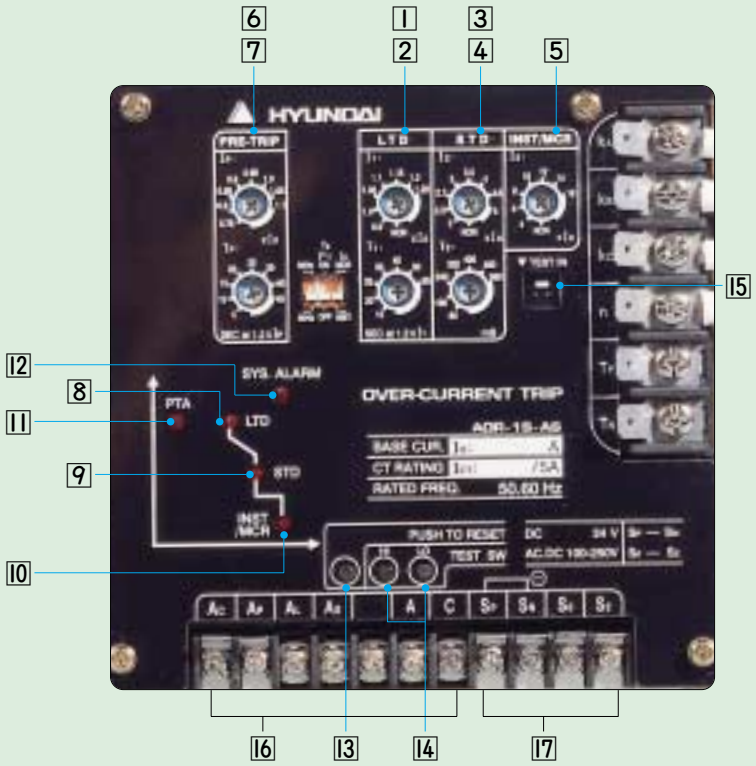
Acceptable Range of Base Current [Io] for the Rated Generator Current [I_{GEN}]

Baeaker Type	Rated Primary Current [I_{CT}] (A)	[I_{GEN}] = (Io) Range (A)
HAT06	80	40≦[Io]≦80
	160	80〈[Io]≦160
	320	160〈[Io]≦320
	630	320〈[Io]≦630
HAT12	320	160≦[Io]≦320
	630	320〈[Io]≦630
	1250	630〈[Io]≦1250
HAT16	1600	800≦[Io]≦1600
HAT20	2000	1000≦[Io]≦2000
HAT25	250	125≦[Io]≦250
	500	250〈[Io]≦500
	1000	500〈[Io]≦1000
	2000	1000〈[Io]≦2000
	2500	2000〈[Io]≦2500
HAT32	1600	800≦[Io]≦1600
	3200	1600〈[Io]≦3200
HAT40	4000	2000≦[Io]≦4000
HAT50	5000	2500≦[Io]≦5000

Front Face of Multi-Protective Device

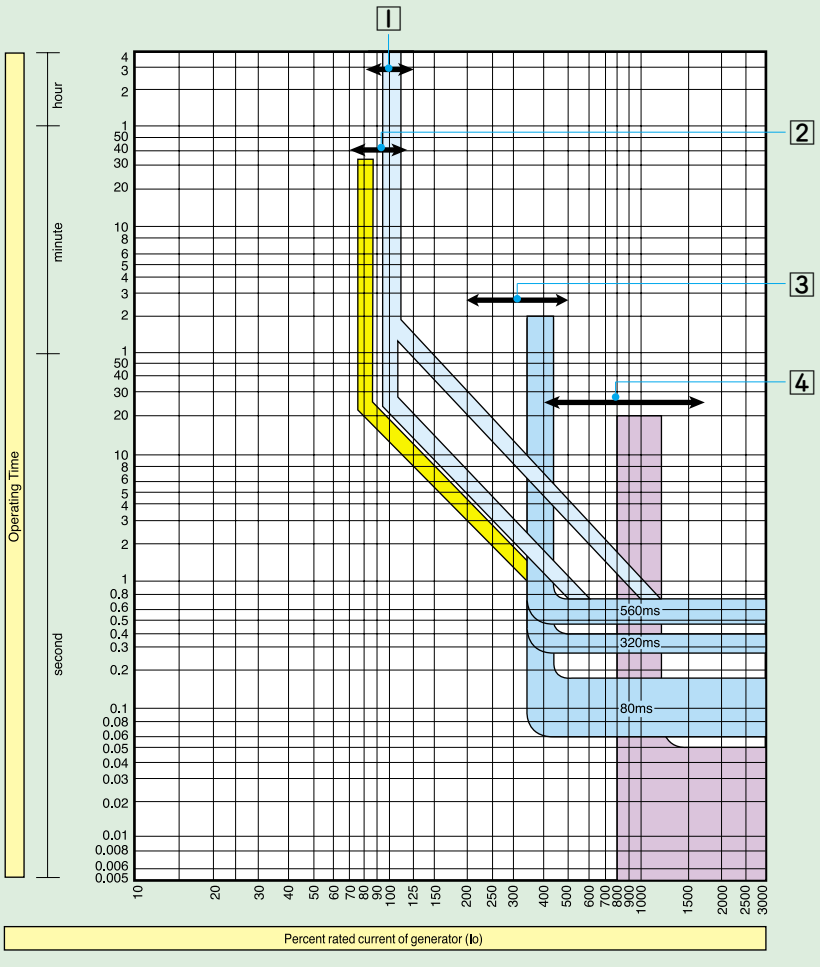
Type : AOR - 1S - AS

1	AI pick-up current setting dial
2	AL time setting dial
3	AS pick-up current setting dial
4	AS time setting dial
5	AI pick-up current setting dial
6	AP pick-up current setting dial
7	AP time setting dial
8	LED for AL tripped indication
9	LED for AS tripped indication
10	LED for AI/MCR tripped indication
11	LED for AP tripped indication
12	LED for CPU tripped indication
13	Reset button
14	Field test button
15	Test terminal
16	Contacts for operation indication
17	Control power input terminal



Multi-Protective Characteristics

1	AL pick-up current setting range
2	AP pick-up current setting range
3	AS pick-up current setting range
4	AI pick-up current setting range



Protection Characteristics

◉ Multi-Protective Device AOR-1S-AL

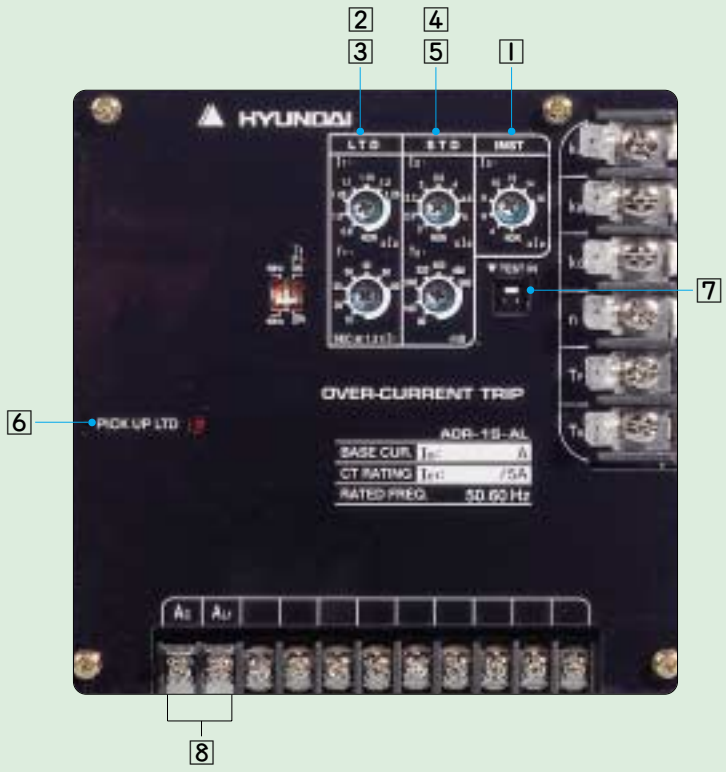
Settings and Contacts for Operation Indication

TYPE	AOR-1S-AL						
Characteristics							
AL							
Pick-up current [I_1] (A)	[Io] × (0.8 - 1.0 - 1.05 - **1.1** - 1.15 - 1.2 - 1.25 - NON), 8 graduations ±5% (±10% when [I_{CT}] of type HAT06 is 160A or 80A)						
Time-delay [T_1] (S)	(15 - 20 - 25 - **30** - 40 - 50 - 60) at [I_1] × 120% current, 7 graduations						
Setting tolerance (%)	±15% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
Characteristics							
AS							
Pick-up current [I_2] (A)	[Io] × (2 - 2.5 - 2.7 - **3** - 3.5 - 4 - 4.5 -5 - NON), 9 graduations						
Setting tolerance (%)	±10% (±15% when [I_{CT}] of type HAT06 is 160A or 80A)						
Time-delay [T_2] (ms) 7 graduations	80	160	240	320	**400**	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	55	120	190	260	330	400	460
Max. total clearing time (ms)	150	240	335	425	520	610	700
Characteristics							
AI							
Pick-up current [I_3] (A)	[Io] × (4 - 6 - 8 - **10** - 12 - 14 - 16 - NON), 8 graduations						
Setting tolerance (%)	±20%						
Contacts for operation indication							
IU							
Ratings of operation indication contacts	Rated voltage	AC 250V	DC 220V				
	Rated current (resistive load)	125VA (2A Max)	60W (2A Max)				
	Rated current (conductive load)	20VA (2A Max)	10W (2A Max)				

Front Face of Multi-Protective Device

Type : AOR - 1S - AL

I	AI pick-up current setting dial
2	AL pick-up current setting dial
3	AL time setting dial
4	AS pick-up current setting dial
5	AS time setting dial
6	LED for AL pick-up indication
7	Test terminal
8	Contacts for operation indication



◉ Multi-Protective Device AOR-1L-AM

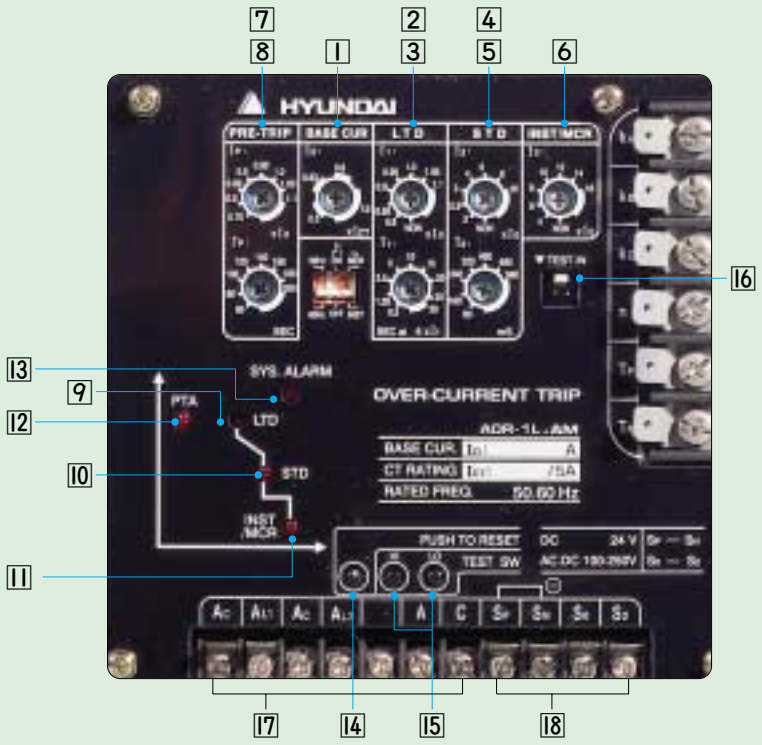
Settings and Operation Indication LEDs

TYPE	AOR-1L-AM						
Characteristics							
AL							
Pick-up current [I_1] (A)	[Io] × (0.8 - 0.85 - 0.9 - 0.95 - **1.0** - 1.05 - 1.1 - NON), 8 graduations						
	Non-tripping at [I_1] setting × 105% and below. Tripping at 120% and above.						
Time-delay [T_1] (S)	(0.5 - 1.25 - 2.5 - 5 - 10 - **15** - 20 - 25 - 30) at [I_1] × 600% current, 9 graduations						
Setting tolerance (%)	±15% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
Characteristics							
AS							
Pick-up current [I_2] (A)	[Io] × (2 - 2.5 - 3 - 4 - **6** - 8 - 10 - NON), 8 gradutions						
Setting tolerance (%)	±15%						
Time-delay [T_2] (ms) 7 graduations	80	160	**240**	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	55	120	190	260	330	400	460
Max. total clearing time (ms)	150	240	335	425	520	610	700
Characteristics							
AI or MCR							
Pick-up current [I_3] (A)	[Io] × (4 - 6 - 8 - 10 - **12** - 14 - 16 - NON), 8 gradutions						
Setting tolerance (%)	±20%						
LEDs and Contacts for operation indication							
AP							
Pick-up curren [I_P] (A)	[Io] × (0.75 - 0.8 - 0.85 - **0.9** - 0.95 - 1.0 - 1.05 - 1.1), 8 graduations						
Setting tolerance (%)	±7.5% (±10% when [I_{CT}] of type HAT06 is 160A or 80A)						
Time-delay [T_P] (S)	(60 - 80 - 100 - 120 - **140** - 160 - 180 - 200) at over [Ip] setting, 8 graduations						
Setting tolerance (%)	±20%						
Characteristics							
CP/I IU	Applied						
Control power for LEDs	AC 100-125V or AC 200-250V/5VA, DC 100-125V, DC 200-250V or DC 24V/5W						
Ratings of operation indication contacts — Rated voltage	AC 250V	DC 220V					
Ratings of operation indication contacts — Rated current (resistive load)	125VA (2A Max)	60W (2A Max)					
Ratings of operation indication contacts — Rated current (conductive load)	20VA (2A Max)	10W (2A Max)					

Front Face of Multi-Protective Device

Type : AOR - 1L - AM

- [1] Base current setting dial
- [2] AL pick-up current setting dial
- [3] AL time setting dial
- [4] AS pick-up current setting dial
- [5] AS time setting dial
- [6] AI pick-up current setting dial
- [7] AP pick-up current setting dial
- [8] AP time setting dial
- [9] LED for AL tripped indication
- [10] LED for AS tripped indication
- [11] LED for AI/MCR tripped indication
- [12] LED for AP tripped indication
- [13] LED for CPU tripped indication
- [14] Reset button
- [15] Field test button
- [16] Test terminal
- [17] Contacts for operation indication
- [18] Control power input terminal



Protection Characteristics

◉ Multi-Protective Device AOR-1D-GM (Digital Display)

Settings and Operation Indication LEDs

TYPE	AOR-1D-GM						
Characteristics							
AL							
Pick-up current [I_1] (A)	[Io] × (0.4 - 1.2 - NON), 2% graduations						
	Non-tripping at [I_1] setting × 105% and below. Tripping at 120% and above.						
Time-delay [T_1] (S)	(15 - 20 - 25 - 30 - 40 - 50 - 60) at [I_1] × 120% current						
	(1 - 2 - 3 - 4 - 5) at [I_1] × 300% current						
	(0.5 - 1.25 - 2.5 - 5.0 - 10 - 15 - 20 - 30) at [I_1] × 600% current						
Setting tolerance (%)	±10% (±20% when [I_{CT}] of type HAT06 is 160A or 80A)						
Characteristics							
AS							
Pick-up current [I_2] (A)	[Io] × (1 - 10 NON), 20% graduations						
Setting tolerance (%)	±10%						
Time-delay [T_2] (ms) 7 graduations	80	160	240	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	55	120	190	260	330	400	460
Max. total clearing time (ms)	150	240	335	425	520	610	700
Characteristics							
AI							
Pick-up current [I_3] (A)	[Io] × (2 - 16 NON), 20% graduations						
Setting tolerance (%)	±10%						
Characteristics							
AP							
Pick-up current [I_P] (A)	[Io] × (0.32 - 1.0), 2% graduations						
Setting tolerance (%)	±5% (±10% when [I_{CT}] of HAT06 is 160A or 80A)						
Time-delay [T_P] (s)	(5 - 120) at [Ip] × 100% current						
Setting tolerance (%)	±10% (±15% when [I_{CT}] of HAT06 is 160A or 80A)						
Characteristics							
AG							
Pick-up current [I_G] (A)	[Io] × (0.1 - 0.4 NON), 2% graduations						
Setting tolerance (%)	±10% ❶						
Time-delay [T_2] (ms) 7 graduations	80	160	240	320	400	480	560
Opening time (ms)	100	180	260	340	420	500	580
Resettable time (ms)	55	120	190	260	330	400	460
Max. total clearing time (ms)	150	240	335	425	520	610	700
CP/I IU							
Control power for LEDs	AC, DC 100-250V						
AMMETER							
Current display tolerance (%)	±3%						
	R, S, T, N Phase ❷						

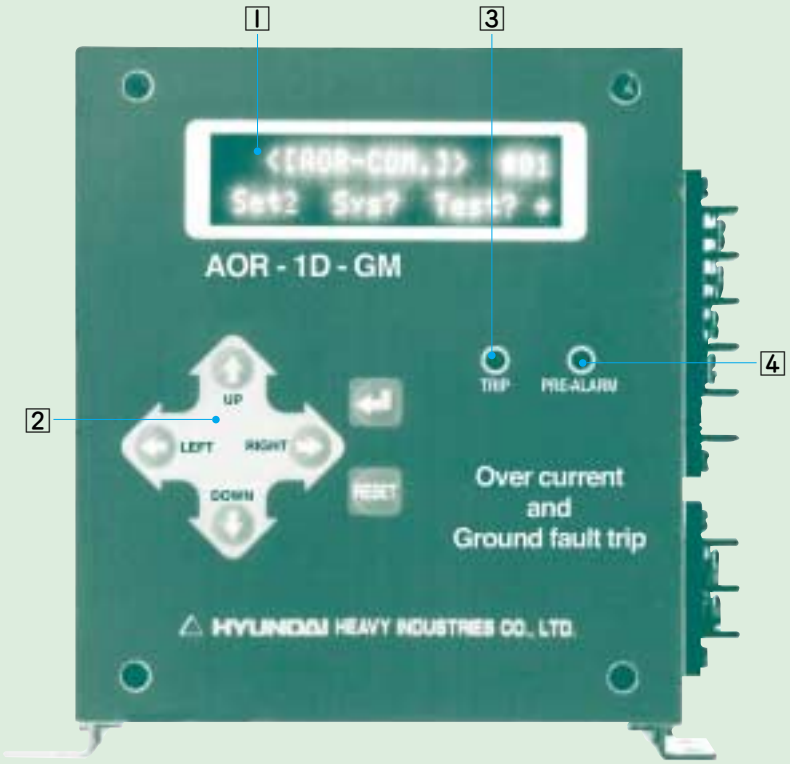
❶ Not applied in 80A, 160A, 250A CT.
❷ Display the current volues which have more than 20% of rated current.

◆ Base Current [Io] = [I_{CT}]

Front Face of Multi-Protective Device

Type : AOR - 1D - GM

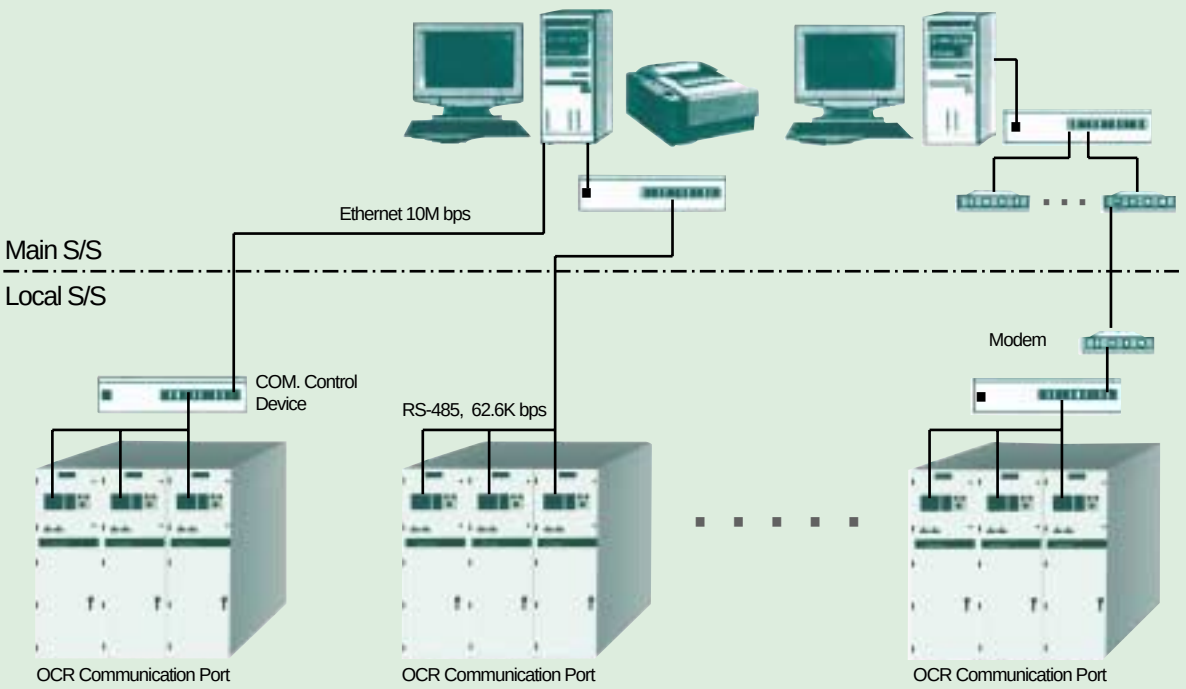
1 Monitoring mode
2 Setting & function mode
↑ Key (Up)
↓ Key (Down)
← Key (Left)
→ Key (Right)
↵ Enter key
RESET Reset key
3 Pick-up & fault trip LEDs
4 Pre-trip alarm indicate LEDs



Communication Function

AOR has two RS-485 communication port.

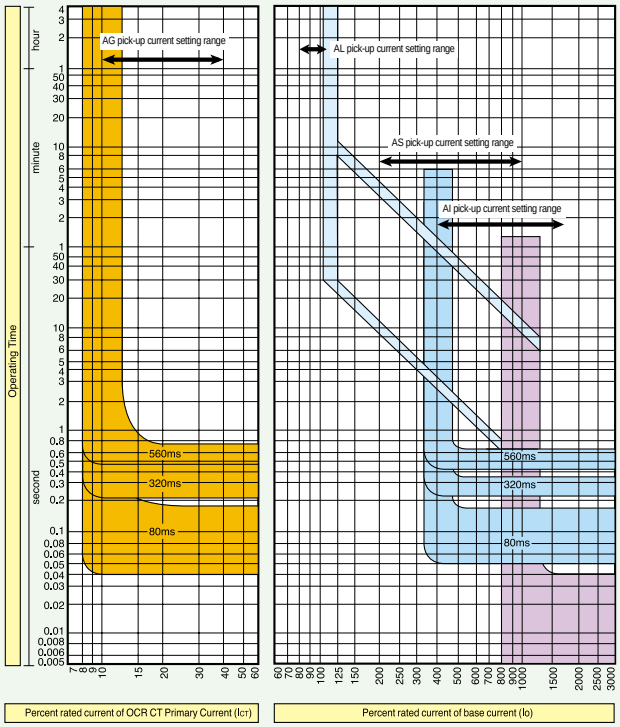
HHI SCADA system [HIMAP(Hyundai Intelligent Measuring And Protection)] allows the breaker to directly be operated, supervise the power system and monitor the load condition through the interface unit.



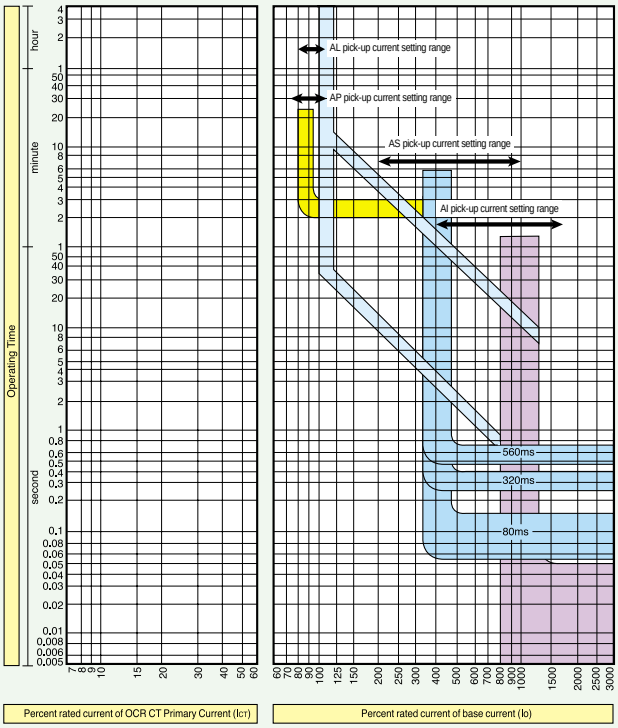
Protection Characteristics

◉ Multi-Protective Characteristics

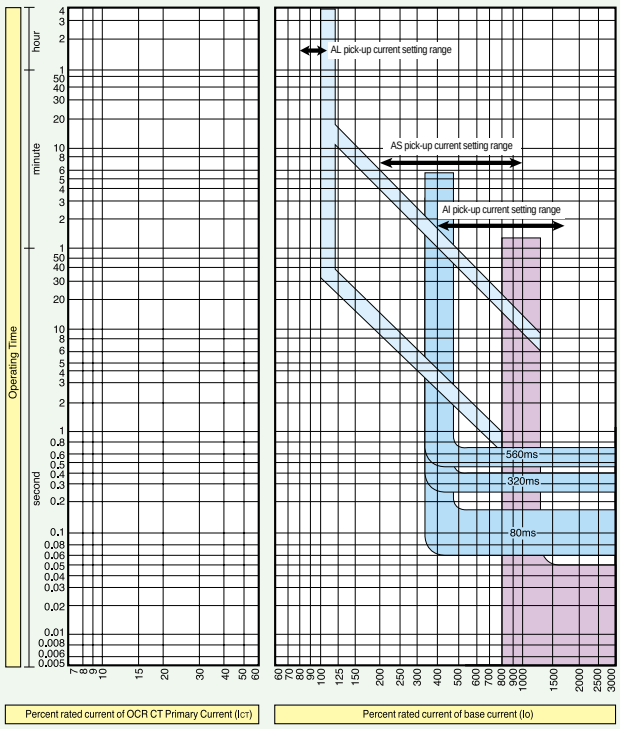
AOR-1L-GL



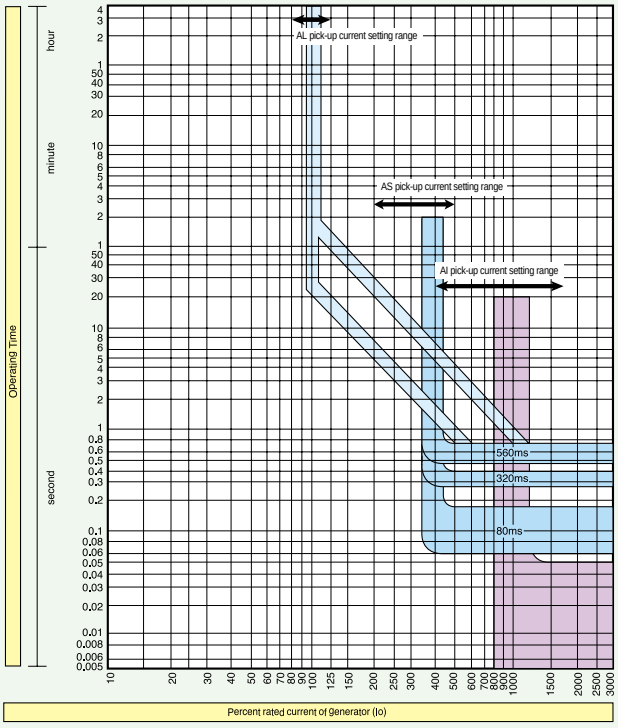
AOR-1L-AS



AOR-1L-AL



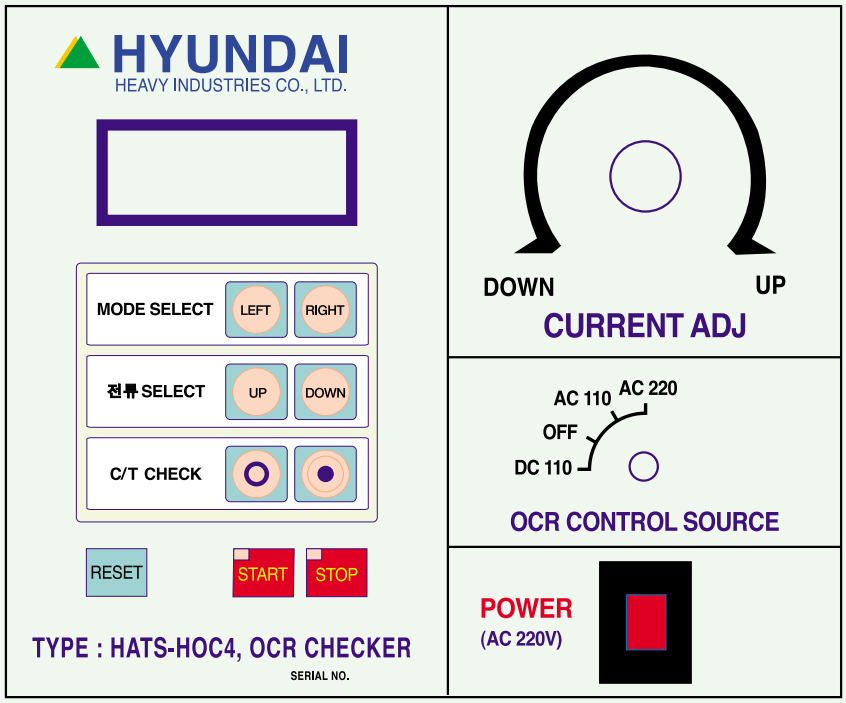
AOR-1S-AL



◉ OCR Checker (External)

Type HOC4 OCR checker operates on 220V AC and permits over-current release tests without requiring any special skill ideal for inspection, testing and maintenance purposes.

TYPE	HATS-HOC4
Rated Voltage	AC220V 50/60Hz
Power Consumption	500VA
Test Functions	Over-current trip device calibration test • Long time-delay trip • Instantaneous trip • Short time-delay trip • Continuity check current transformers • Pre-trip Alarm • Ground fault trip
Outline Dimension	W400 × H250 × D300 (mm)
Weight	15kgf



◉ Current Transformer for Neutral Line

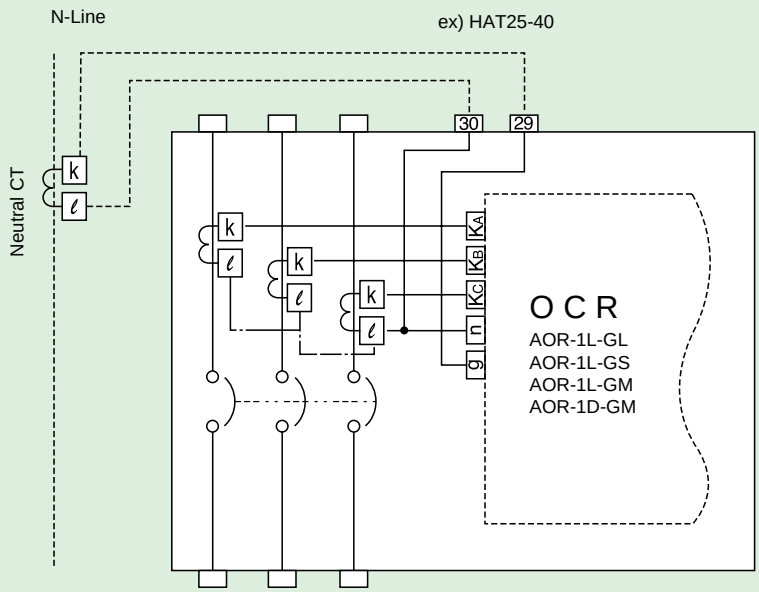
Ground fault protection in 3-phase, 4-wire system is possible with a 3-pole breaker using the ground fault trip function.

In this application a neutral line current transformer that matches the breaker's ground fault protection characteristic should be used and the specification of the neutral line CT is as below.

A neutral line CT is built into the 4-pole type when the breaker ground fault protection is used.

Power Consumption	5VA
Rated Primary Current	Equal to the value of ACB CT
Rated Secondary Current	5A

◉ Connection Diagram for Neutral CT



Electrical Tripping Devices

Shunt Trip (SHT)

The shunt trip is uesd to electrically open the breaker from a remote place(s).

The shunt trip may be used to open the breaker by means of external protective devices, shch as over-current relays or reverse power relays.

Both shunt trip and undervoltage trip may be fitted in a single breaker.

Shunt Trip Ratings

Breaker Type	Rated Voltage (V)	Operational Voltage (V)	Peak Excitation Current(A)	Current Passage Time(ms)
	AC421-480	252-528	1.2(450V)	25
HAT06	AC380-420	228-462	1.3(380V)	25
HAT08	AC180-250	108-275	1.5(220V)	25
HAT10	AC100-150	60-165	3.1(110V)	25
HAT12	DC150-230	90-276	1.3(220V)	30
HAT16	DC90-125	54-150	2.7(100V)	30
HAT20	DC48	29-57	4.8(48V)	30
	DC24	14-28	8.8(24V)	29
	AC421-480	252-528	1.3(450V)	25
	AC380-420	252-462	1.4(380V)	23
	AC180-250	108-275	1.6(220V)	24
HAT25	AC100-150	60-165	3.2(110V)	24
	DC150-230	90-276	1.4(220V)	28
	DC90-125	54-150	2.8(100V)	30
	DC48	29-57	4.9(48V)	29
	DC24	14-28	8.8(24V)	28
	AC421-480	252-528	1.3(450V)	24
	AC380-420	252-462	1.4(380V)	23
	AC180-250	108-275	1.7(220V)	23
HAT32	AC100-150	60-165	3.2(110V)	23
HAT40	DC150-230	90-276	1.5(220V)	28
HAT50	DC90-125	54-150	2.9(100V)	27
	DC48	29-57	4.9(48V)	27
	DC24	14-28	8.9(24V)	27

Capacitor Trip

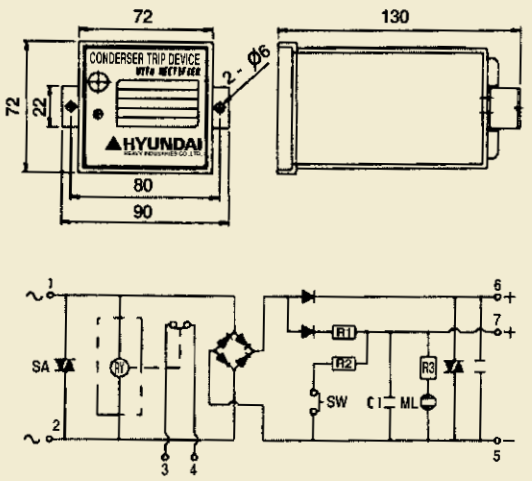
The capacitor trip is used in conjunction with a shunt trip, to ensure normal operation of the latter within 30 seconds after the control power (AC) is out or in a low voltage condition.

A combination of capacitor trip and shunt trip work as a normal AC-rated shunt trip, and may be used to open the breaker by an external protective devices.

Condenser Trip

Order no	HVFS-T7	HVFS-T9
Rated Input Voltage	AC 110V	AC 220V
Stored Voltage	DC 145V	DC 290V
Rated Current	DC 2A	
Rated Freguency	50 / 60Hz	
Delay Time	1.5 SEC	
Applied Rules	IEC 694 / KSC 4611	

Control Circuit & Outside Dimensions



AC input power	NO. 1, 2
Condensor trip power	NO. 7(+), 5(+)
DC power	NO. 6(+), 5(+)
Delay Contact	NO. 3, 4

◉ Under-Voltage Trip

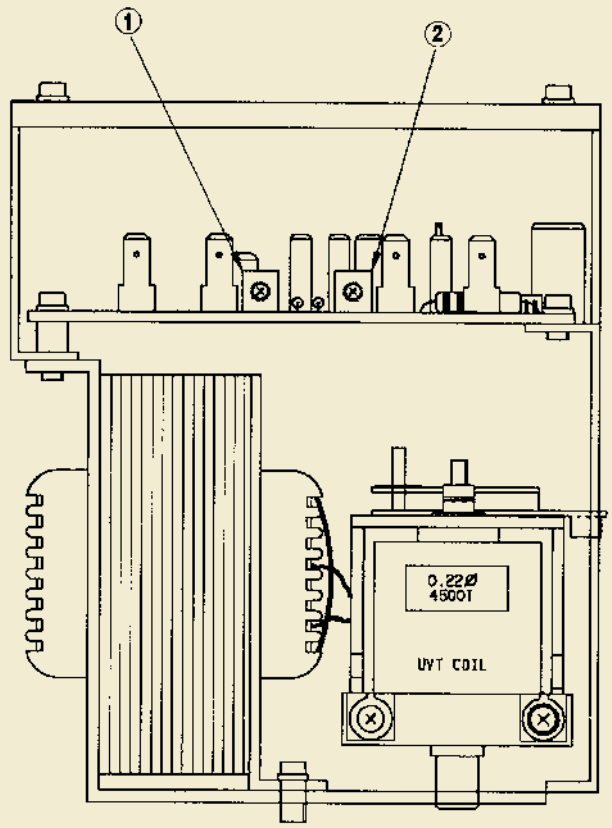
The undervoltage trip (UVT) automatically opens the Air Circuit Breaker when control power voltage drops below a predetermined value.

When the voltage is restored to a value higher then the pick-up voltage, the Air Circuit Breaker can be closed, the under-voltage trip consists of a tripping mechanism and a trip control device.

◉ Rating

Type of UVT		Rated Voltage(V) 50/60Hz	Operating Voltage (V)		Exciting Coil Current (A)
			Pick-Up Voltage	Drop-Out Voltage	
HATS-T	AC	480 - 500	324 - 338	250 - 260	0.15 (480V)
		430 - 470	282 - 334	188 - 245	0.15 (450V)
		410 - 430	280 - 290	215 - 224	0.15 (415V)
		360 - 400	240 - 268	160 -207	0.15 (380V)
		200 - 240	135 - 165	96 - 120	0.15 (220V)
		100 - 120	67.5	48 - 60	0.15 (110V)
HATS-U	AC	480 - 500	324 - 338	250 - 260	0.15 (480V)
		430 - 470	282 - 334	188 - 245	0.15 (450V)
		410 - 430	280 - 290	215 - 224	0.15 (415V)
		360 - 400	240 - 268	150 - 207	0.15 (380V)
		200 - 240	135 - 165	96 - 120	0.15 (220V)
		100 - 120	67.5	48 - 60	0.15 (110V)
	DC	200 - 220	130 - 160	88 - 105	0.1 (200V)
		100 - 125	65 - 80	44 - 53	0.1 (100V)

◉ Adjustment for Pick-up & Drop-out Voltage



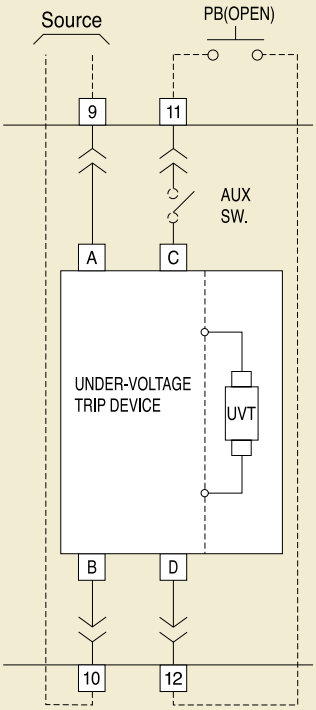
● Two types of UVT are available :

① An instantaneous trip, which trip the Air Circuit Breaker immediately, its circuit voltage drops below a predetermined value.

② A time-delay trip, which operates with a time-delay of 500ms, thus providing coordination with the short time-delay characteristic.

The UVT device is also available for DC applications in conjunction with a current limiting resistor.(installed externally to the breaker)

◉ Control Circuit



Pick-up Voltage :
When operating voltage of pick-up is higher than the value of standard setting(85% of rated voltage), Knob① turn right within the operating voltage of UVT rating table.

When pick-up voltage is lower than the value of standard setting(85%), Knob ① turn left within the operating voltage of UVT rating table.

Drop-out Voltage :
When operating voltage of drop-out is higher than the value of standard setting(50% of rated voltage), Knob② turn right within the operating voltage of UVT rating table.

When operating voltage of drop-out is lower than the value of standard setting, Knob② turn left within the operating voltage of UVT rating table.

Other Accessories

◉ Auxiliary Switch Assembly

Auxiliary switches electrically indicate the open-closed status of the breaker.
For Draw-out type, the auxiliary switches operate in the CONNECTED and TEST positions only.
However, where the marine classification society's rules apply, they operate in the CONNECTED position only.

Rating of Auxiliary Swith	
AC550V	7A
DC250V	2.5A

[Auxiliary switch assembly]

◉ Trip Indication Switch

Operation of the trip indication switch varies depending on what device trips the breaker and whether or not the closing springs are charged.(see table opposite)

Breaker Tripped by	Operation of trip indication switch	
	Closing springs charged	Closing springs discharged
Over-Current Trip Shunt Trip Undervoltage Remote Opening Trip	Switch is ON for 40ms. then to OFF	Switch remains ON until closing springs are charged
Undervoltage Condition	Switch remains ON until undervoltage condition is restored to normal	Switch remains ON until closing springs are charged after undervoltage condition has restored to normal
Manual Opening by PUSH-OPEN Button	Switch remains ON until PUSH-TO-OPEN button is released	Switch remains ON until closing springs are charged after PUSH-TO-OPEN button has been released

◉ Close-Open Cycle Counter

This device counts and indicates the number of close-open cycles.

◉ Key Lock

The key lock is available in two types :
Lock-in-open type to loke the breaker in the OPEN position,
or lock-in-closed type to lock the breaker in the CLOSED position.

◉ Rating

Load	Resistive	Lamp	Inductive	Motor
AC125V	5A	0.7A	4A	1.3A
DC250V	5A	0.5A	4A	0.8A

◉ Lifting Lugs

◉ Open Padlock

The breaker is padlocked in the OPEN position.
(padlocks not supplied)


[Use padlocks(not supplied) having a shackle of ø 8 or 6mm]

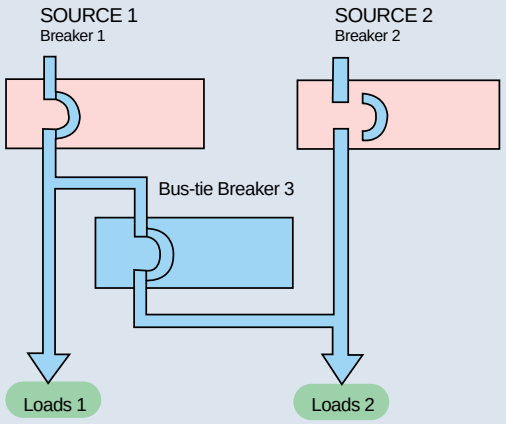
◉ Key Interlock

The key interlock is a system of interlocking between breakers, each fitted with a lock-in-open type key lock.

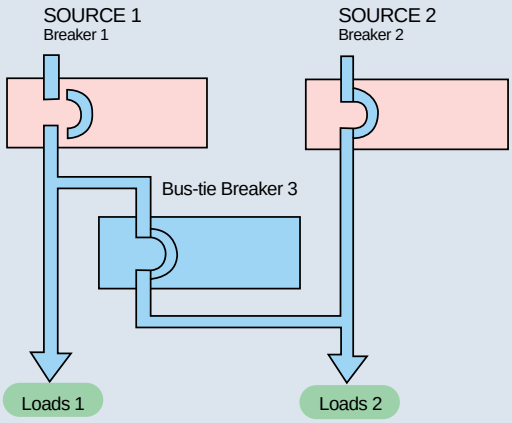
- The key must be inserted to release the lock before the breaker can be closed.
- The breaker must be opened and locked in the open position before the key can be removed.
- Utilizing the lock-in-open type lock feature and using keys less than the number of the key-lock breakers, an effective and reliable interlock system is formed.
- Breakers are available with a cylinder lock fitted.

Example : Prevention of parallel connection of two sources with a bus-tie breaker.

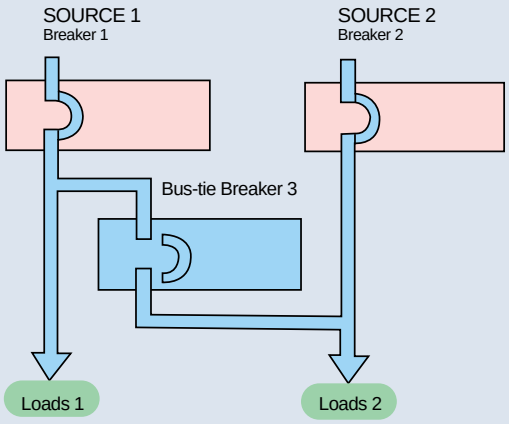
Breaker 2 cannot be closed



Breaker 1 cannot be closed



Breaker 3 cannot be closed



◉ Front Panel Dust Plate

The front panel dust plate effectively provides a dust proof seal, between the front panel of the breaker and the cut-out of the switchboard, when the breaker is located between the CONNECTED and ISOLATED position.

◉ Manual Operation Button Covers

The manual operation button covers prevent erroneous operation of the PUSH-TO-CLOSE button and the PUSH-TO-OPEN button.

The covers can be padlocked. (Diameter of hasp ; 8 or 6mm dia.) Padlocks are not supplied.

◉ Front Cover Colour

The standard colour is MUNSELL.(0.0N 7.7/0.2)

[Standard colour]

Accessories for Draw-out Type

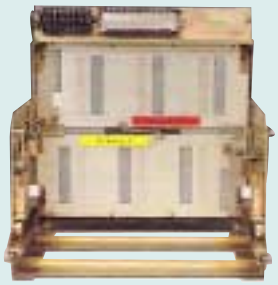
Main Circuit Safety Shutters

When the breaker is drawn out, the shutters automatically conceal and insulate the main circuit disconnect contacts on the cradle.

The top shutter and bottom shutter are independent.
Each shutter can be padlocked in the closed position.

For safety during inspection and maintenance, up to three padlocks may be applied to each of the top and bottom shutters.
(padlocks not supplied)
The top shutter and bottom shutter can be opened or closed independently by manual operation.

Maintenance can be done in the open position.
(The mechanism is released automatically by insertingthe breaker)
The top shutter and bottom shutter are individually movable and removable.



Control Circuit Safety Shutter

The control circuit's disconnected contacts have independent shutters for increased safety.

Breaker Fixing Blocks

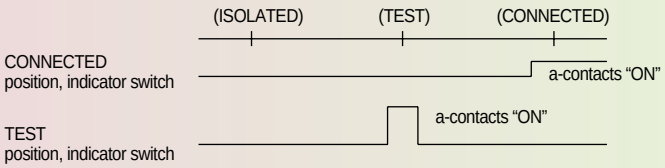
These provide reinforcement for the breaker mounting where vibration occurs.
They are always fitted when the breaker is subject to marine classification society rules.

Position Switches

The position switches operate when the breaker is in the CONNECTED position, TEST position, to electrically indicate the breaker position.
The position switches are available in three switch combinations.

(1) CONNECTED position, indicator switches (3 max)
(2) TEST position, indicator switches (3 max)
(3) CONNECTED and TEST position, indicator switches (3 max)

Position Switch, Operating Sequence



Position Switch, Rating

Load	Resistive	Lamp	Inductive	Motor
AC 250V	10A	1.5A	6A	2A
DC 30V	6A	3A	6A	3A
DC 125V	0.6A	0.1A	0.6A	0.1A
DC 250V	0.3A	0.05A	0.3A	0.05A

Test Jumper

The test jumper allows open-close tests on the removed breaker.

Mal-Insertion Prevention Device

A good interchangeability exists in "HAT ACB" series Air Circuit Breakers.
Because of this feature there is a possibility for a breaker of a different rating being placed into the cradle.
This is effectively prevented by the use of the mal-insertion.

ARC Barrier

When a short circuit current is interrupted, arc gas comes out of the arc chutes.
For this reason, when mounting other electrical equipment, devices or earthed metals on the upper portion of the arc chute of the breaker, a sufficient distance is necessary. (refer to the outside dimensional drawing)
By use of the arc barrier this distance becomes smaller.
The barrier can be installed with the cradle, with the draw out type breaker.
The arc barrier is a heat proof, flame-resistant insulating plate.

◉ Position Padlock

The breaker can be padlocked in three positions CONNECTED, TEST and ISOLATED. (Padlocks are not supplied) (Shackle diameter 8 or 6 mm dia)

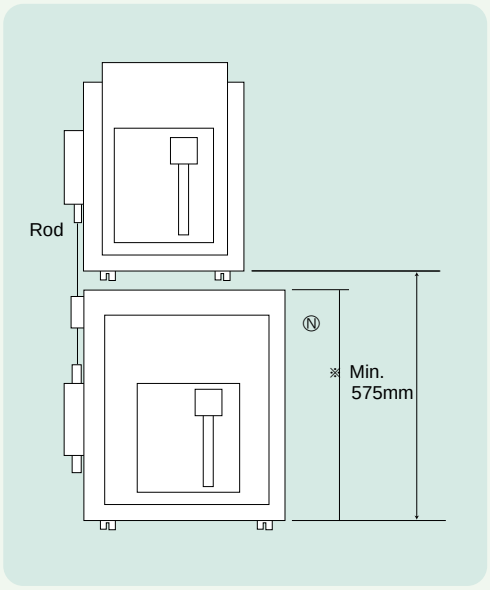
◉ Mechanical Interlock

Mechanical interlocks for interlocking 2 or 3 ACBs in vertical (except HAT50) arrangements are available.

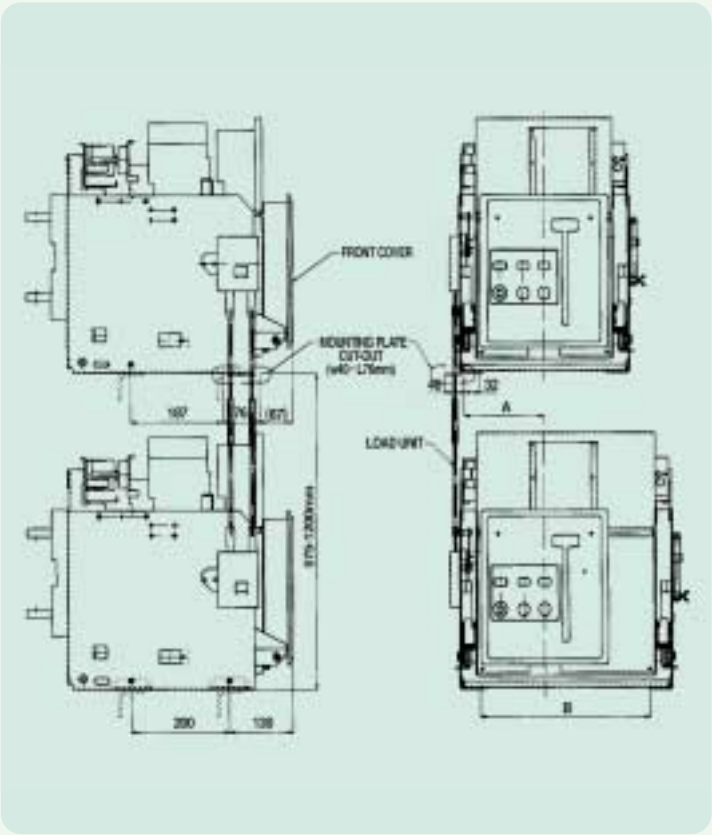
Interlocking is possible between any frame size with in the HAT-ACB range.

◉ Vertical Type

Contact HHI for the details of vertical type with 3 ACBs.



※ Minimum pitch (575mm) is possible if the proper insulating distance is obtained.
For larger pitch, consult HHI(maximum 1200mm)



Type / Size	HAT06~20		HAT25		HAT32~40	
	3P	4P	3P	4P	3P	4P
A (mm)	162	204.5	207	264.5	237	304.5
B (mm)	260	345	350	465	410	545

◉ Posiltion SW

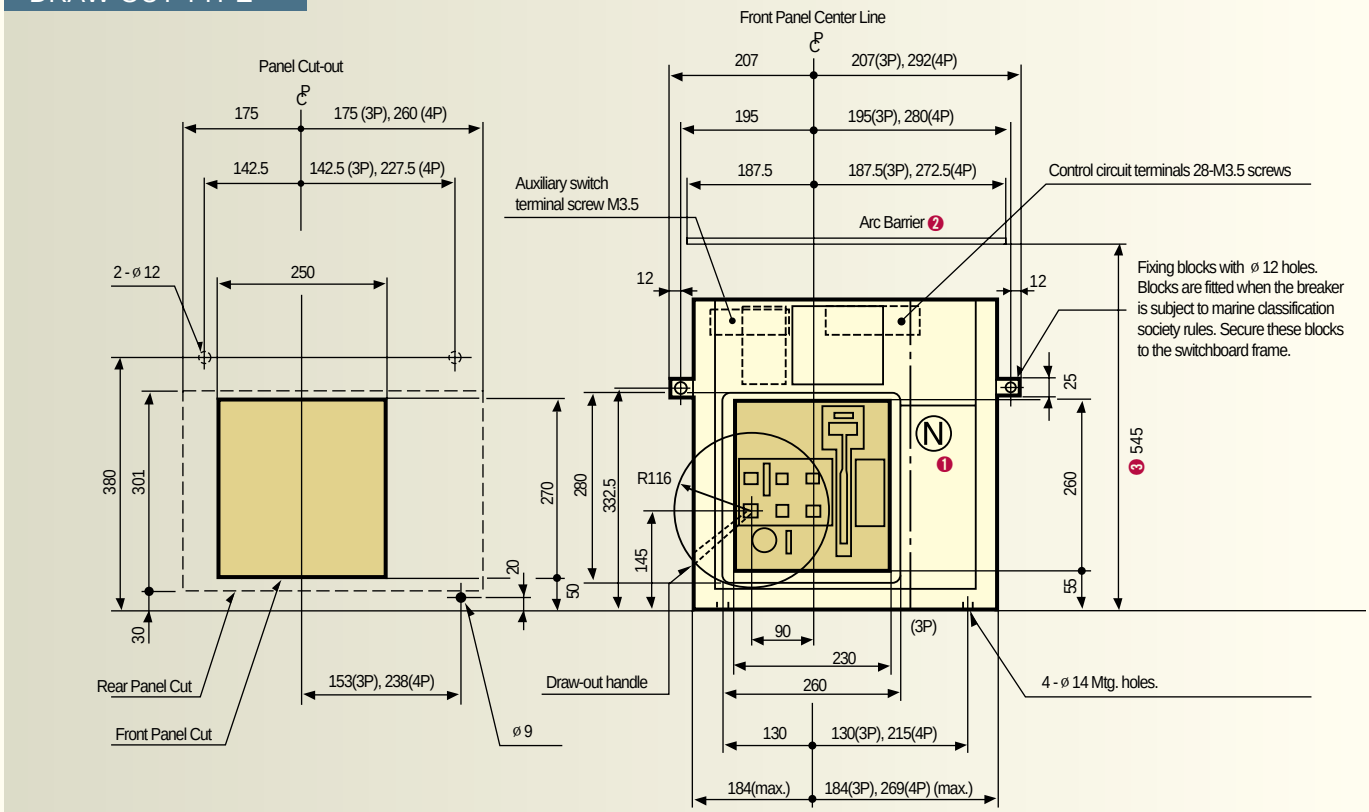
Position SW Spec.	Contact Condition	Terminal No.		Order Suffix
		Test Position	Connection Position	
TEST 1C / CONN 1C	ON	61 - 62	71 - 72	Q
	OFF	61 - 63	71 - 73	
TEST 2C	ON	61 - 62	-	S
	OFF	61 - 63	-	
	ON	64 - 65	-	
	OFF	64 - 66	-	
CONN 2C	ON	-	71 - 72	R
	OFF		71 - 73	
	ON		74 - 75	
	OFF		74 - 76	
TEST 3C / CONN 3C	ON	61 - 62	71 - 72	Q, R, S
	OFF	61 - 63	71 - 73	
	ON	64 - 65	74 - 75	
	OFF	64 - 66	74 - 76	
	ON	67 - 68	77 - 78	
	OFF	67 - 69	77 - 79	

Outline Dimensions

◉ Type HAT06, 08, 10, 12 and HAT16

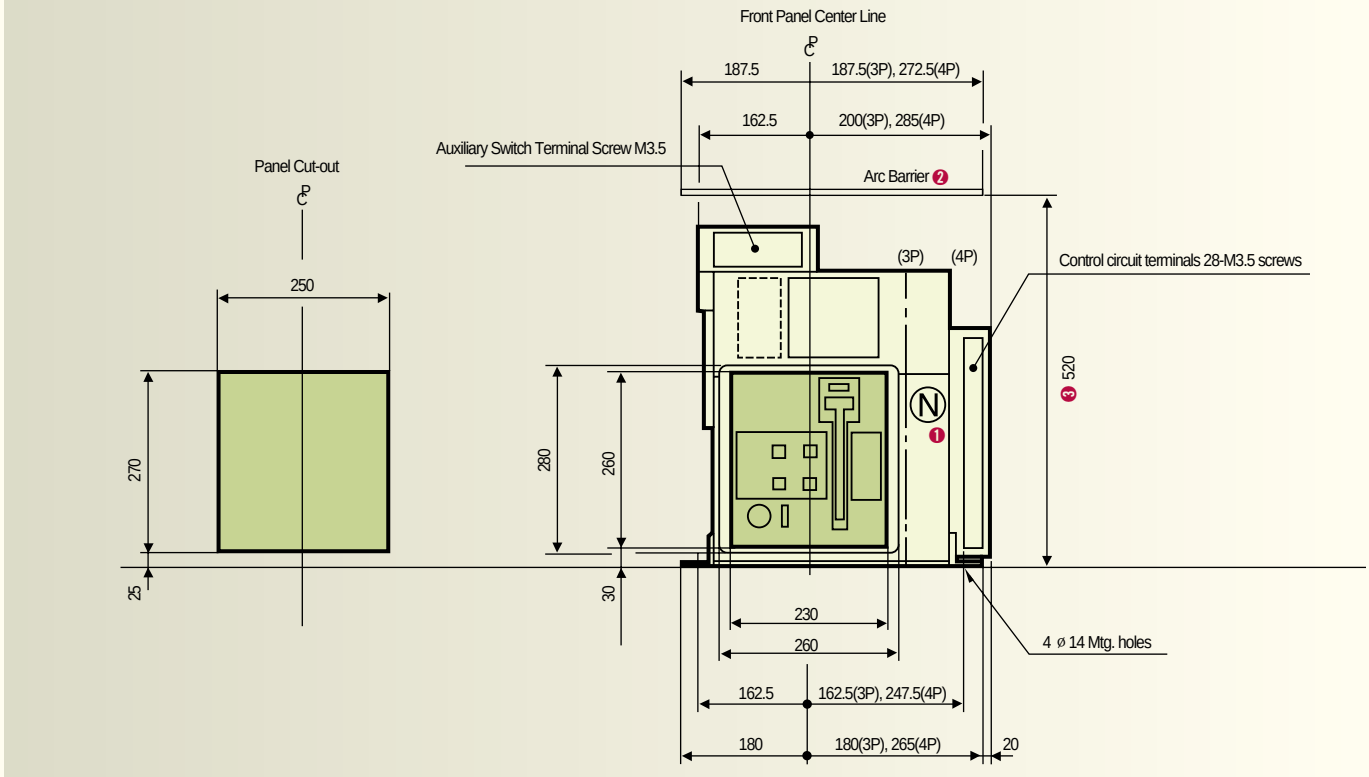
Scale 1/10

DRAW-OUT TYPE

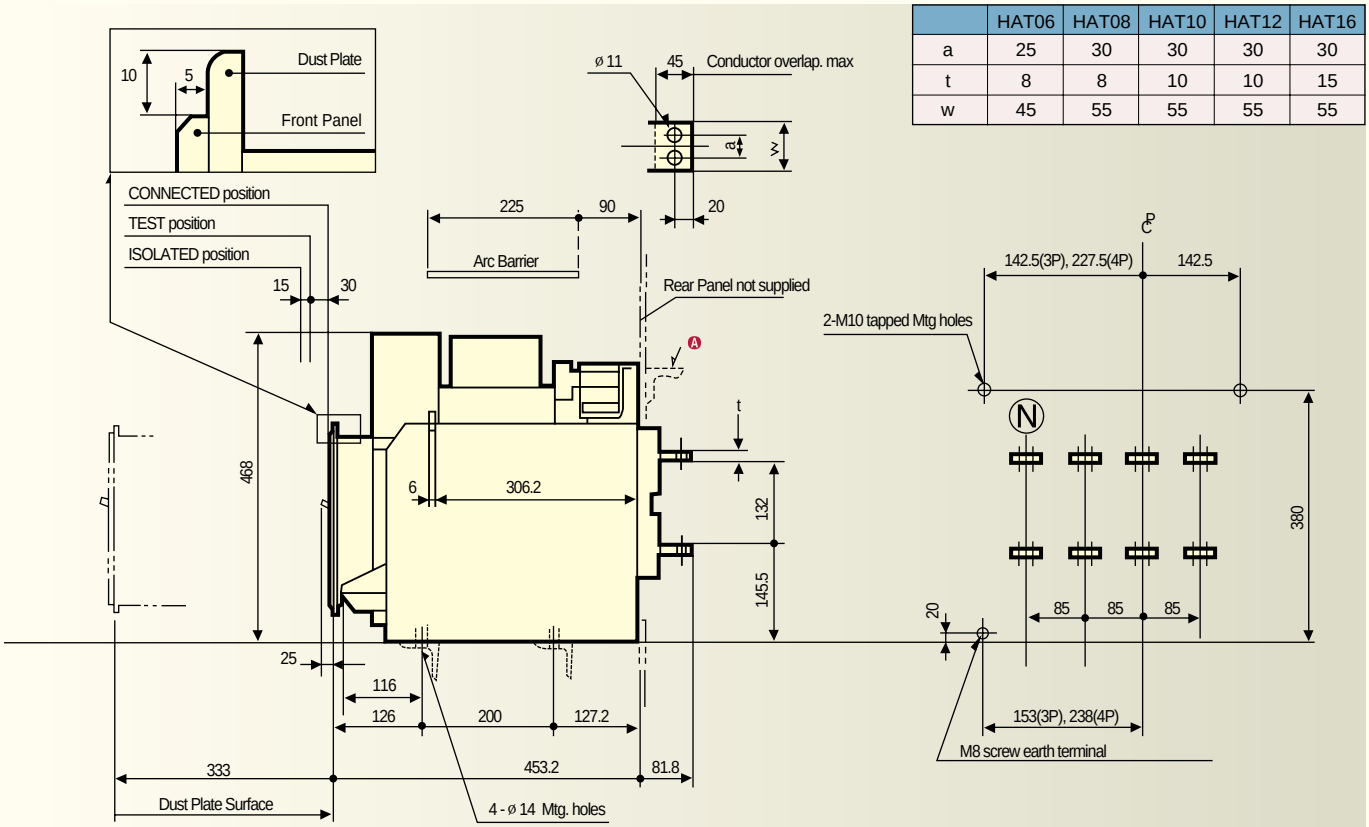


Note : ❶ Ⓝ is neutral pole of 4-pole breaker.
❷ A heat and flame resistance insulating material should be installed as an arc barrier.
In the case of draw-out type, the cradle with arc barrier is available.
❸ When an arc barrier is not applied, the recommended distances to protect electrical devices and grounded metal parts are 650mm for draw-out type and 625mm for fixed type.

FIXED TYPE

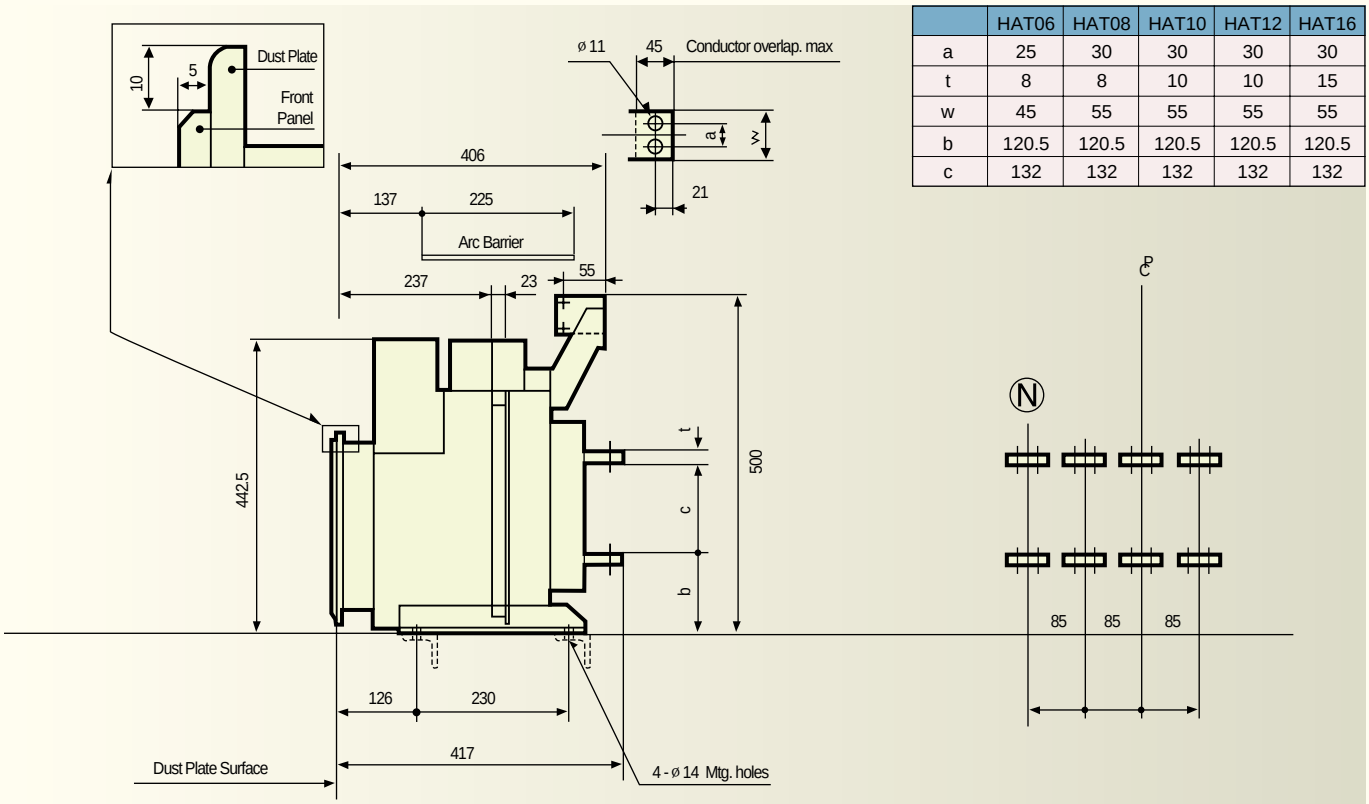


	HAT06	HAT08	HAT10	HAT12	HAT16
a	25	30	30	30	30
t	8	8	10	10	15
w	45	55	55	55	55



Note : A To be used where the breaker is exposed to severe vibration necessary when the breaker is subject to marine classification society rules.
• Mounting angle steel not supplied.

	HAT06	HAT08	HAT10	HAT12	HAT16
a	25	30	30	30	30
t	8	8	10	10	15
w	45	55	55	55	55
b	120.5	120.5	120.5	120.5	120.5
c	132	132	132	132	132



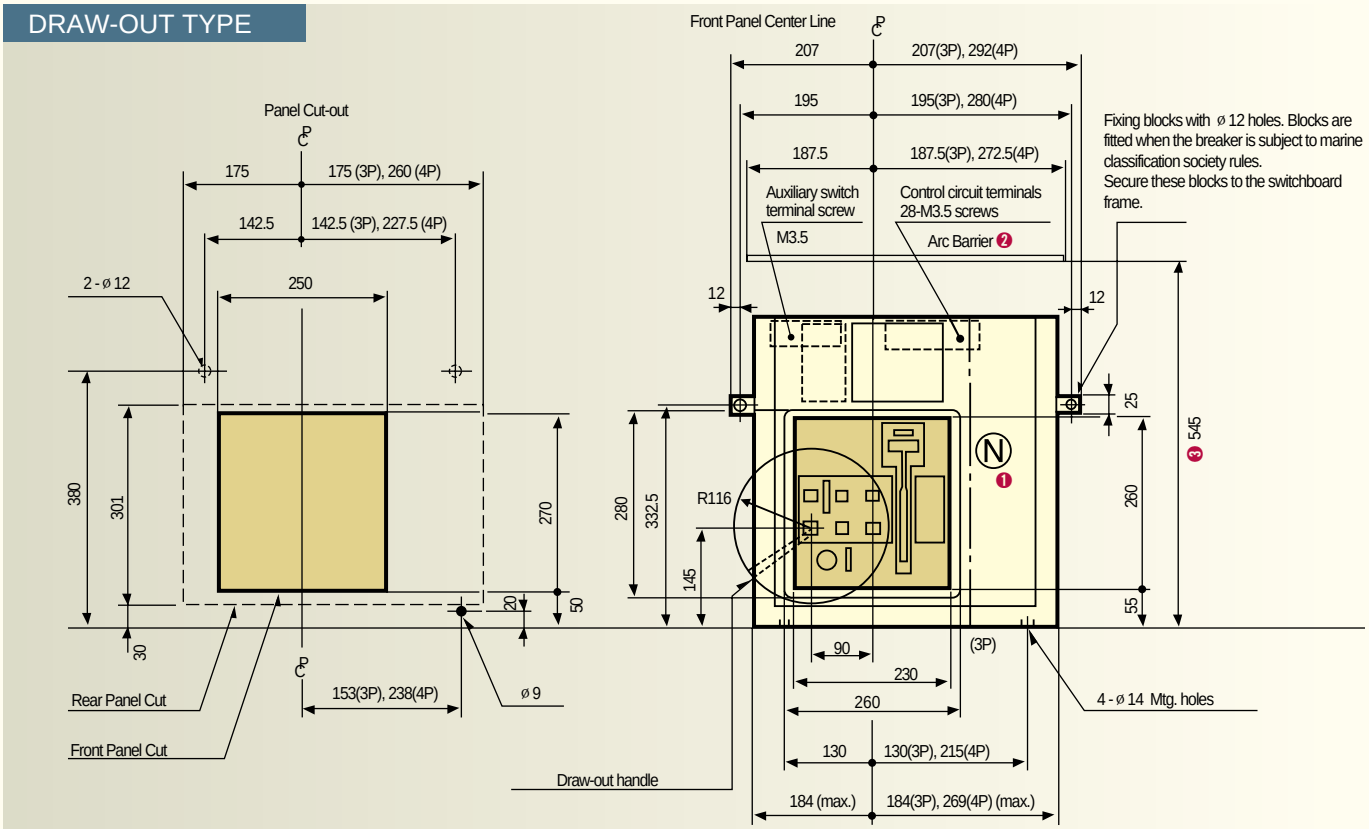
• Mounting angle steel not supplied.

Outline Dimensions

Type HAT20

Scale 1/10

DRAW-OUT TYPE

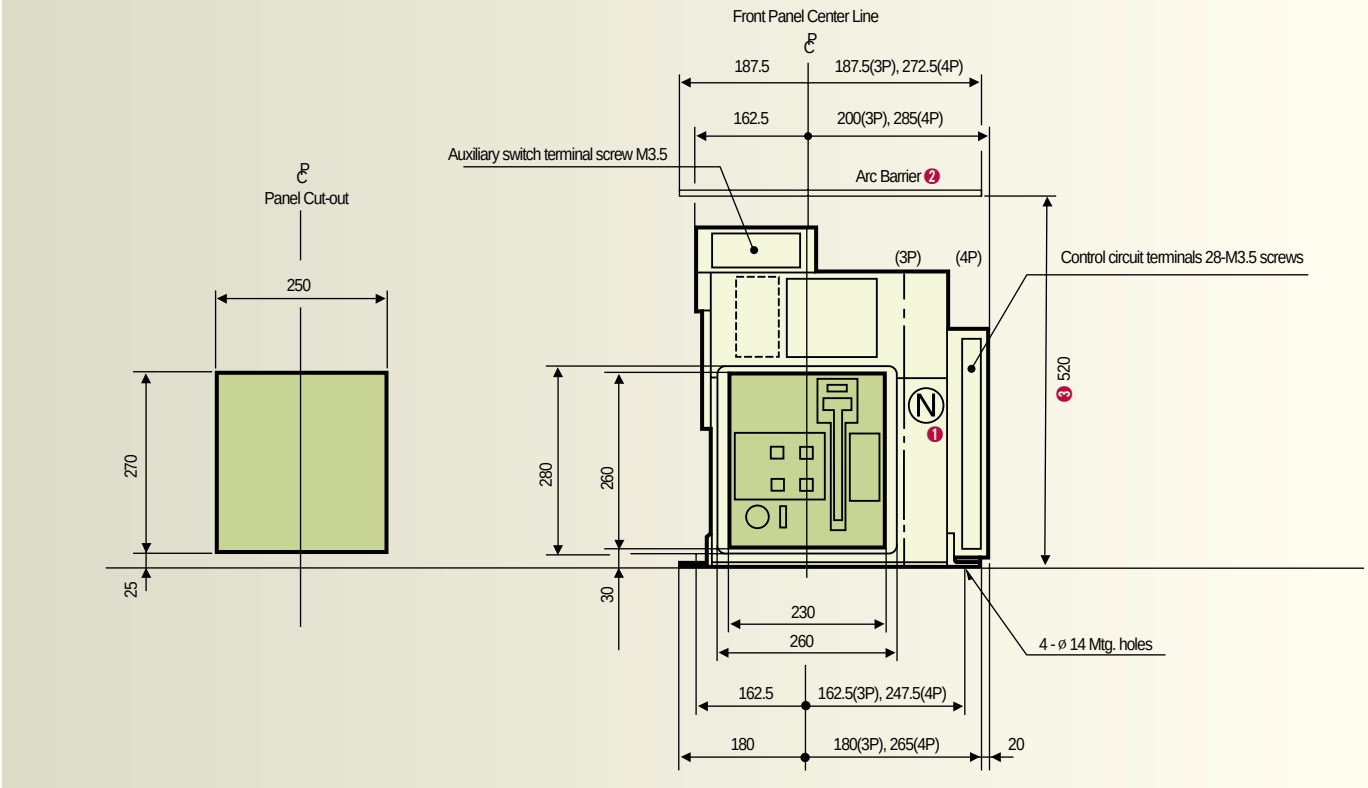


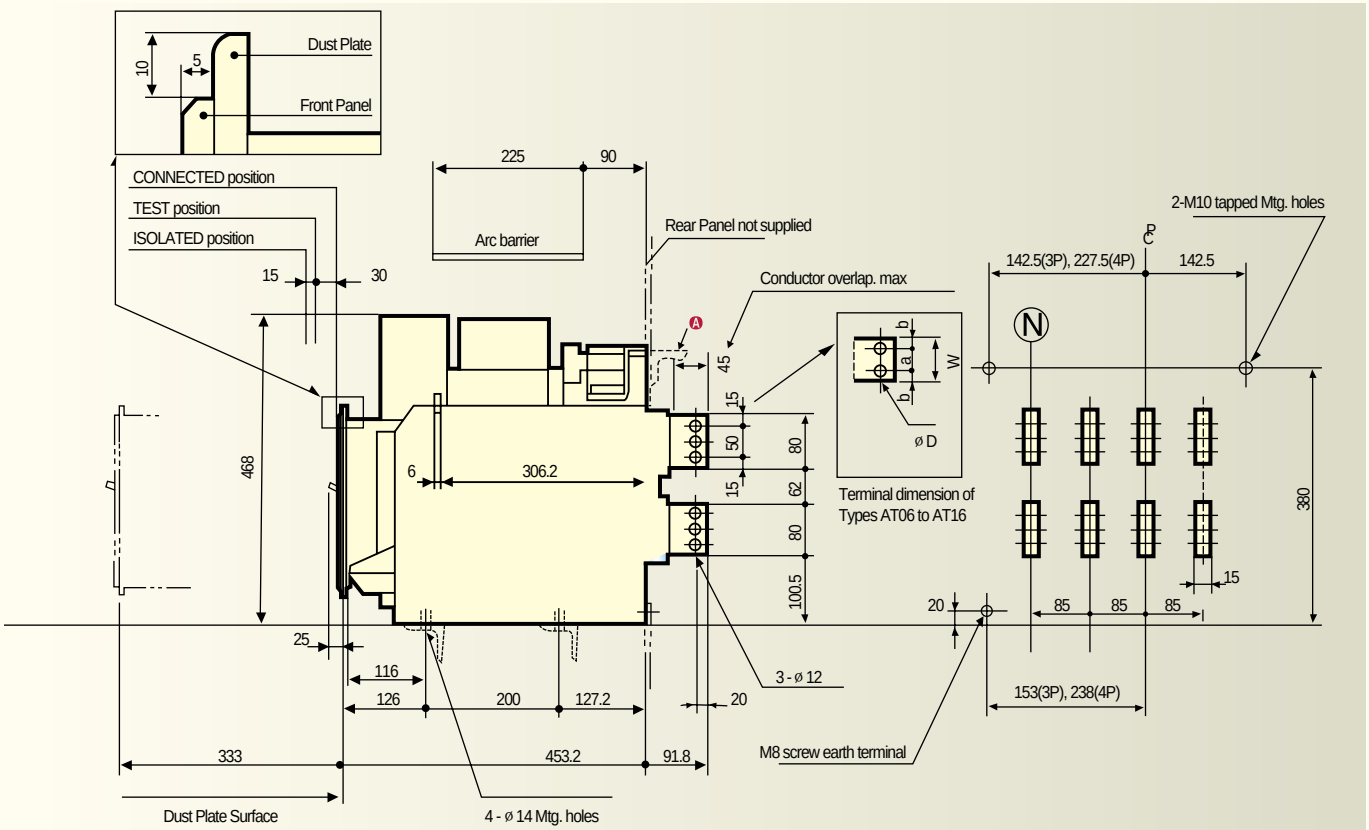
Note : ❶ Ⓝ is neutral pole of 4-pole breaker

❷ A heat and flame resistance insulating material should be installed as an arc barrier.
In the case of draw-out type, the cradle with arc barrier is available.

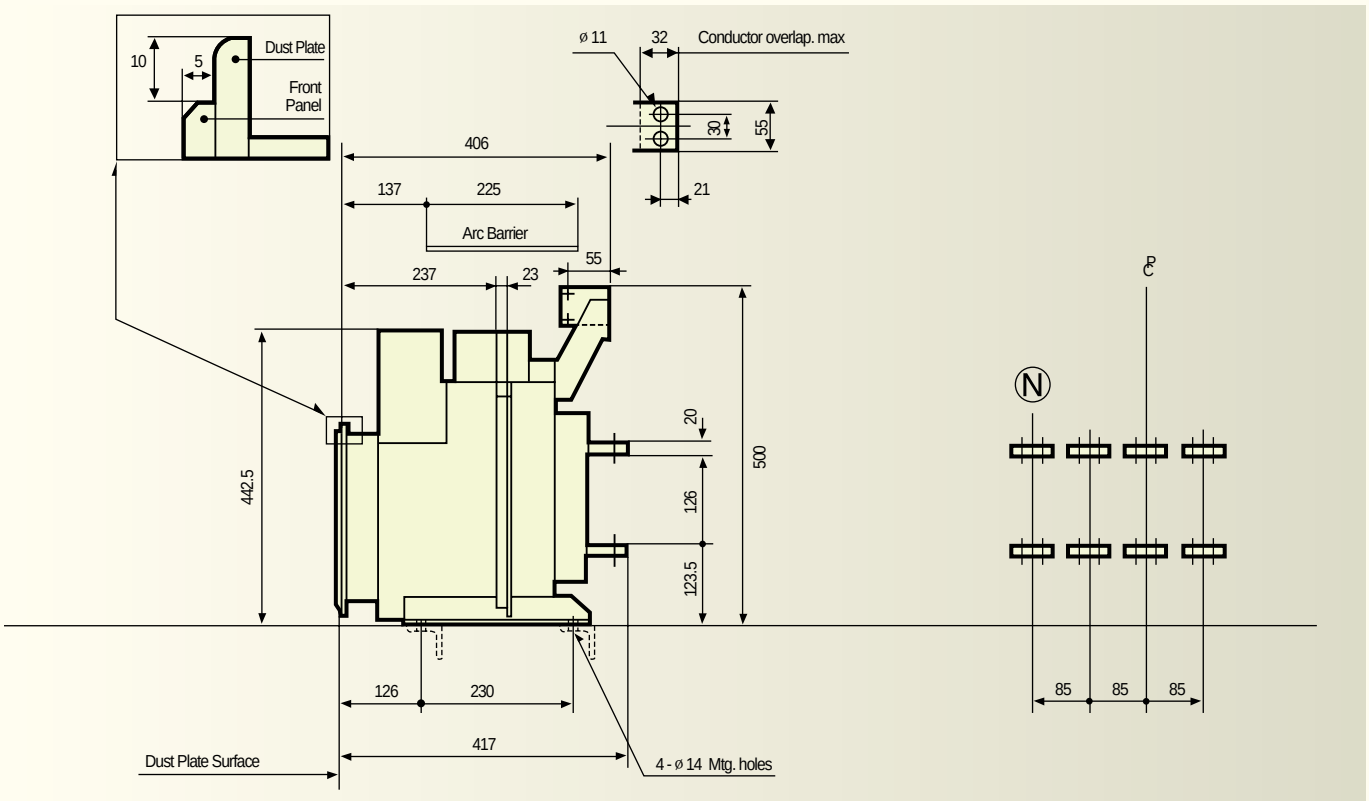
❸ When an arc barrier is not applied, the recommended distances to protect electrical devices and grounded metal parts are 650mm for draw-out type and 625mm for fixed type.

FIXED TYPE





Note : A To be used where the breaker is exposed to severe vibration necessary when the breaker is subject to marine classification society rules.
• Mounting angle steel not supplied.



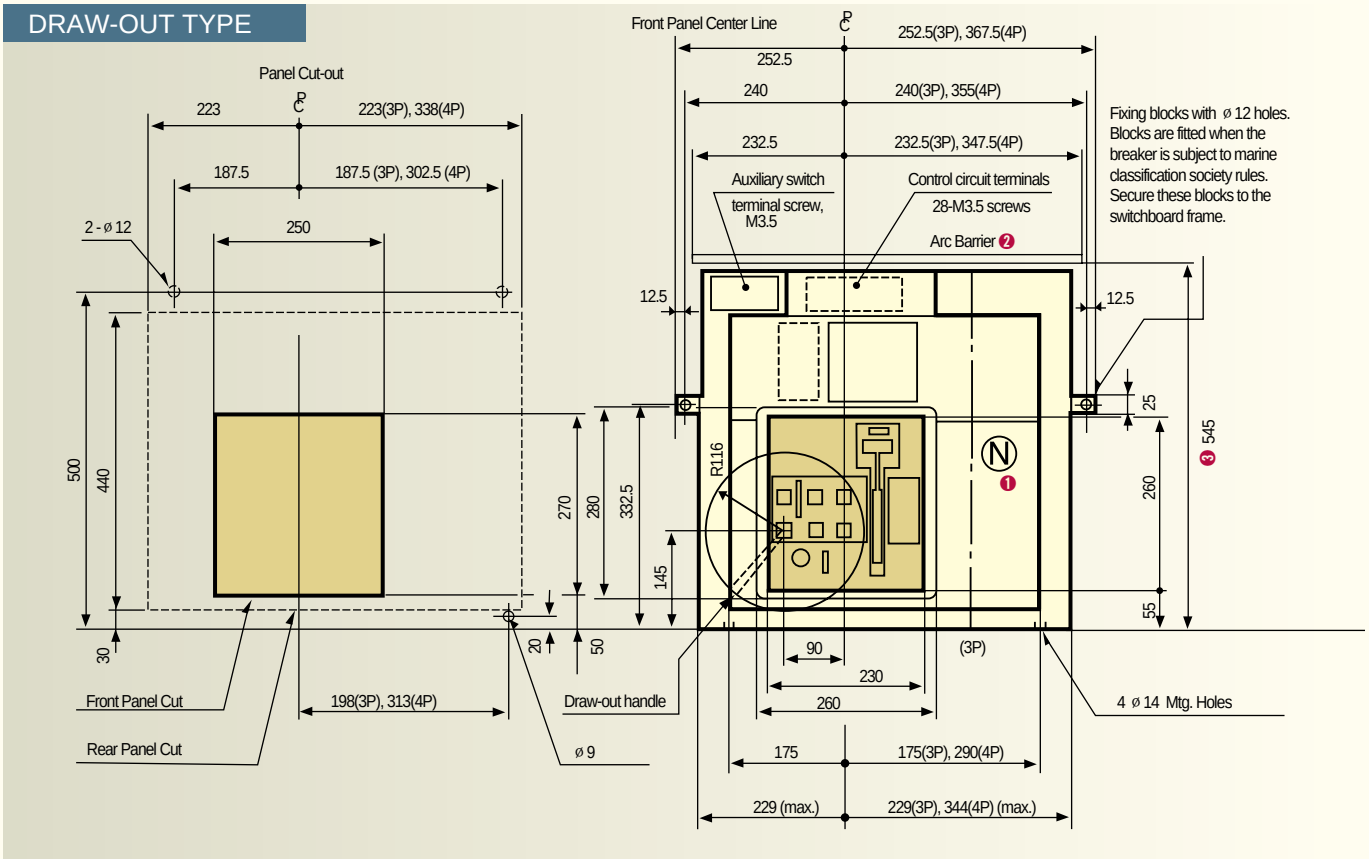
• Mounting angle steel not supplied.

Outline Dimensions

Type HAT25

Scale 1/10

DRAW-OUT TYPE

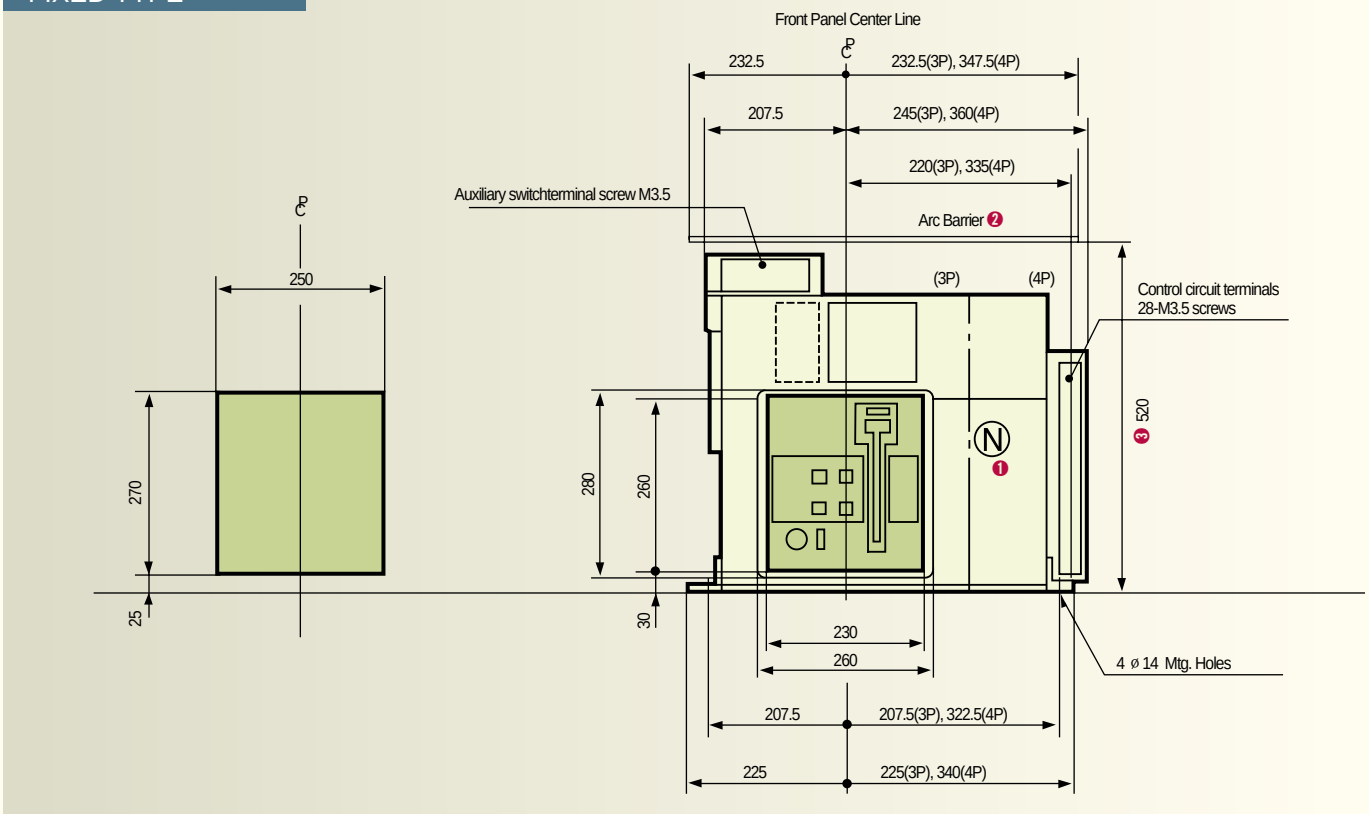


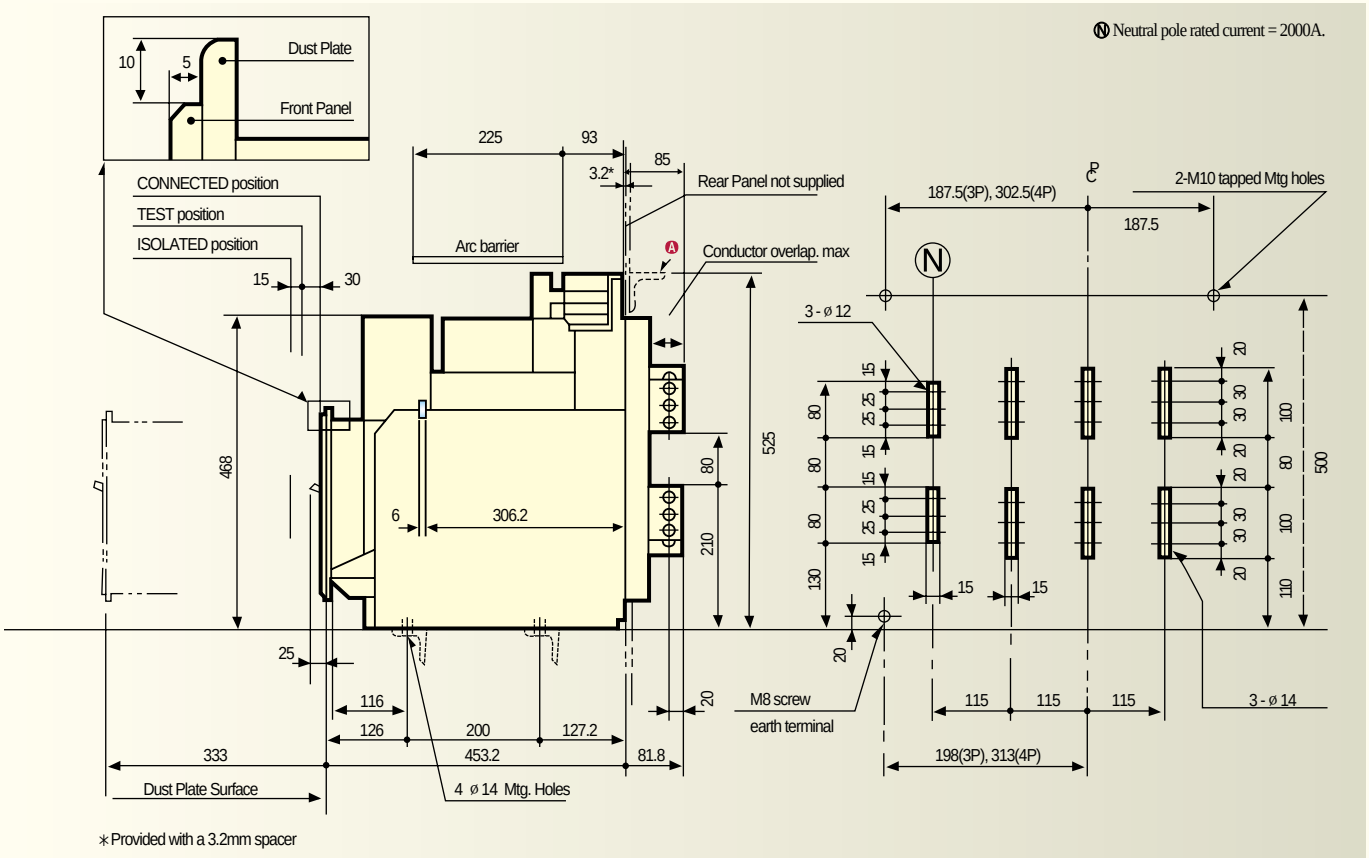
Note : ❶ Ⓝ is neutral pole of 4-pole breaker

❷ A heat and flame resistance insulating material should be installed as an arc barrier.
In the case of draw-out type, the cradle with arc barrier is available.

❸ When an arc barrier is not applied, the recommended distances to protect electrical devices and grounded metal parts are 650mm for draw-out type and 625mm for fixed type.

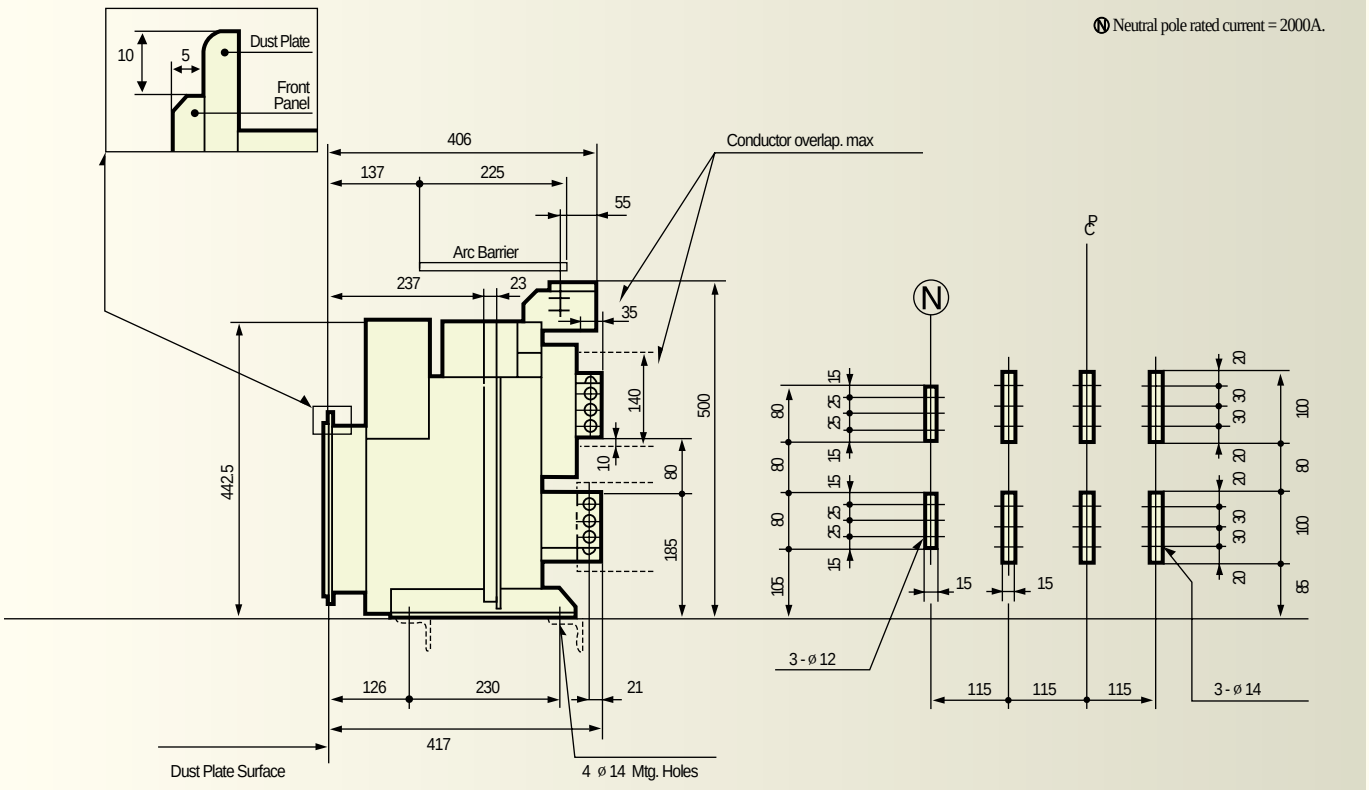
FIXED TYPE





∗Provided with a 3.2mm spacer

Note : Ⓐ To be used where the breaker is exposed to severe vibration necessary when the breaker is subject to marine classification society rules.
• Mounting angle steel not supplied.



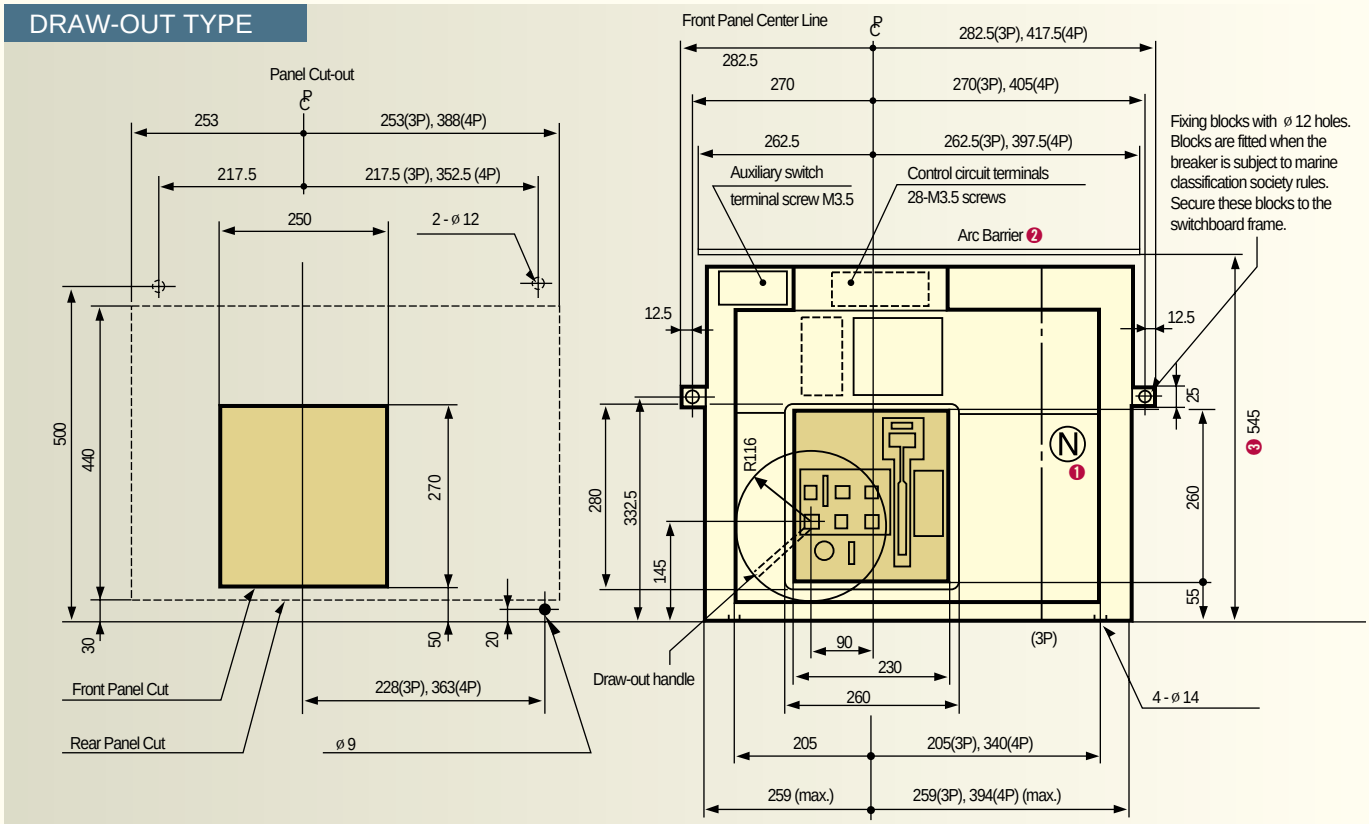
• Mounting angle steel not supplied.

Outline Dimensions

Type HAT32

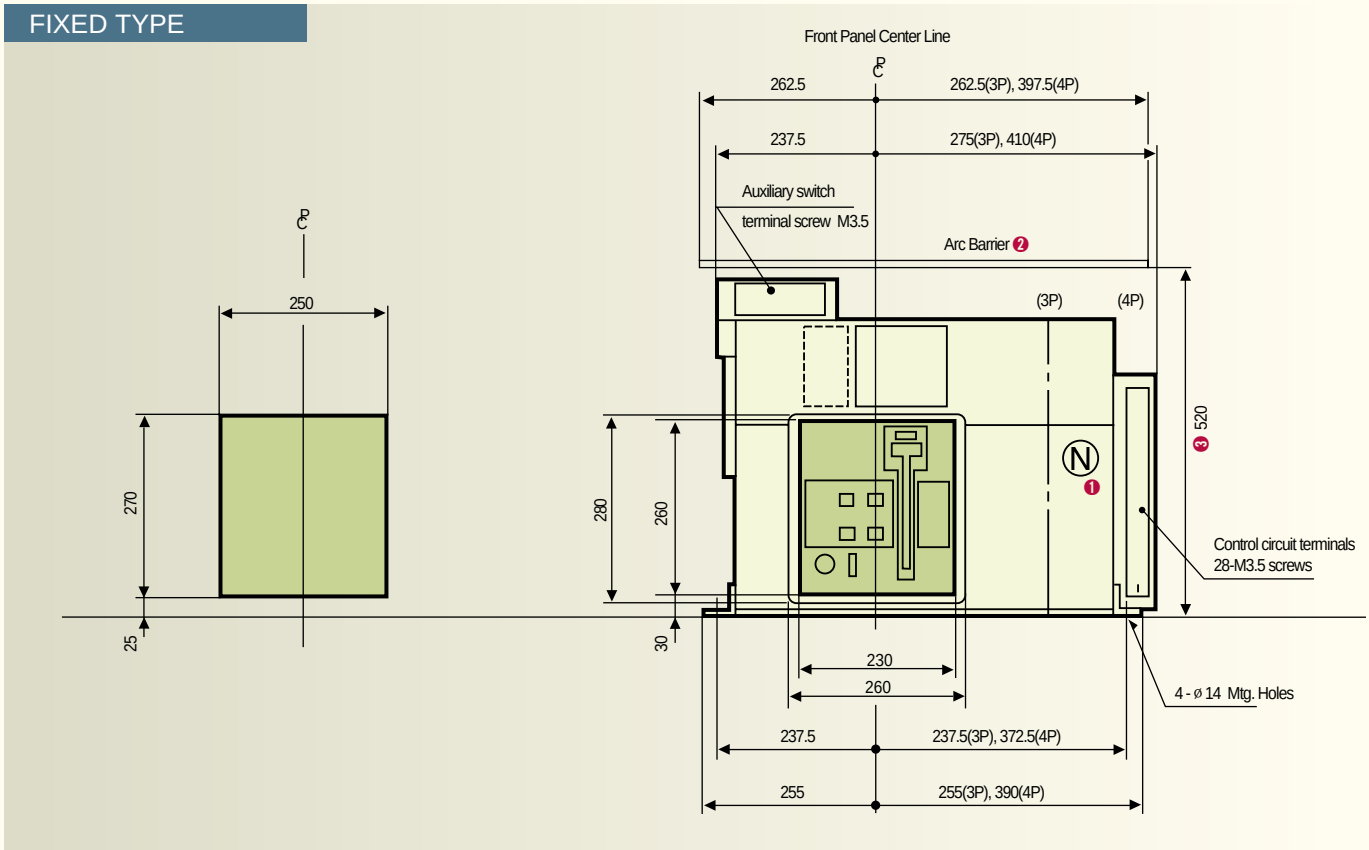
Scale 1/10

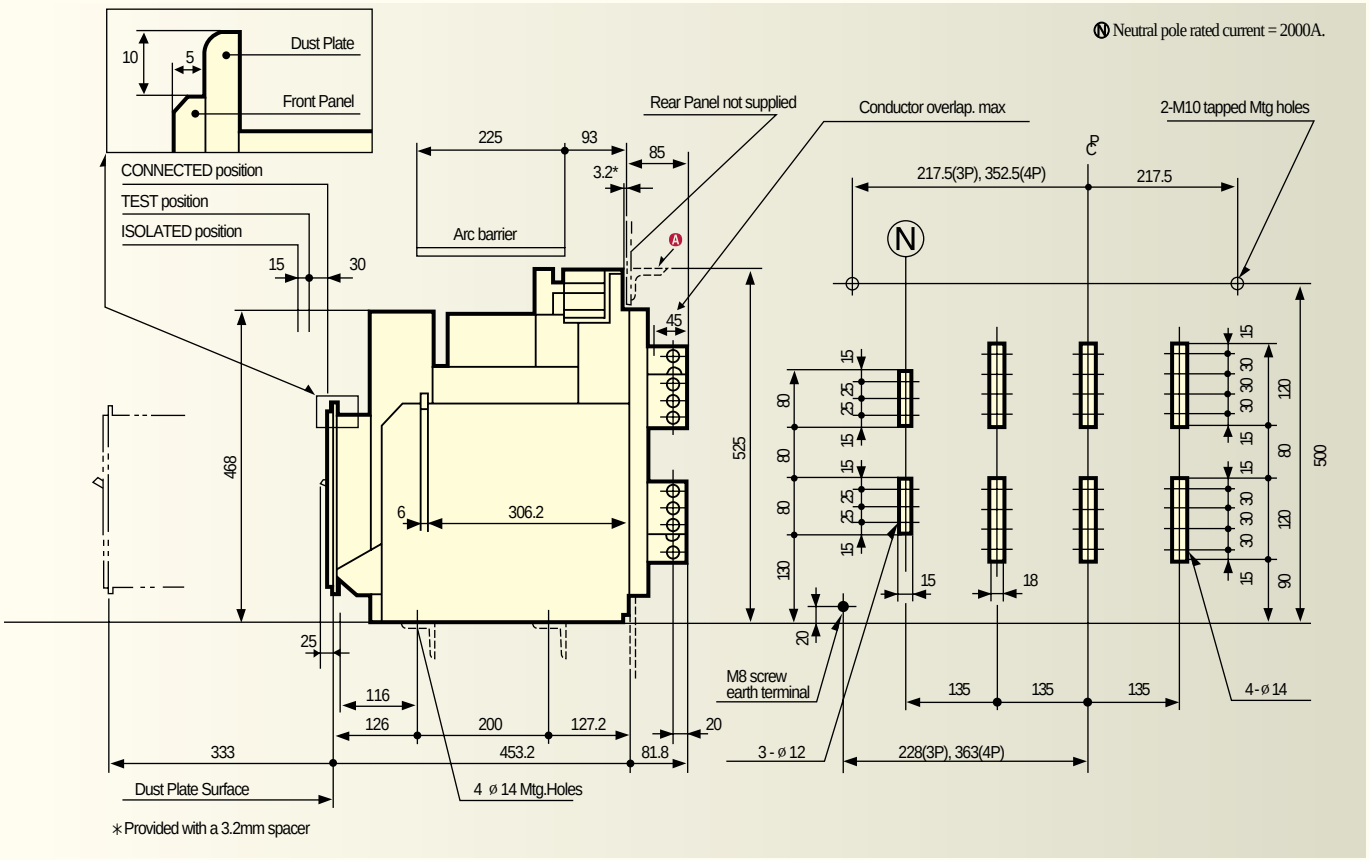
DRAW-OUT TYPE



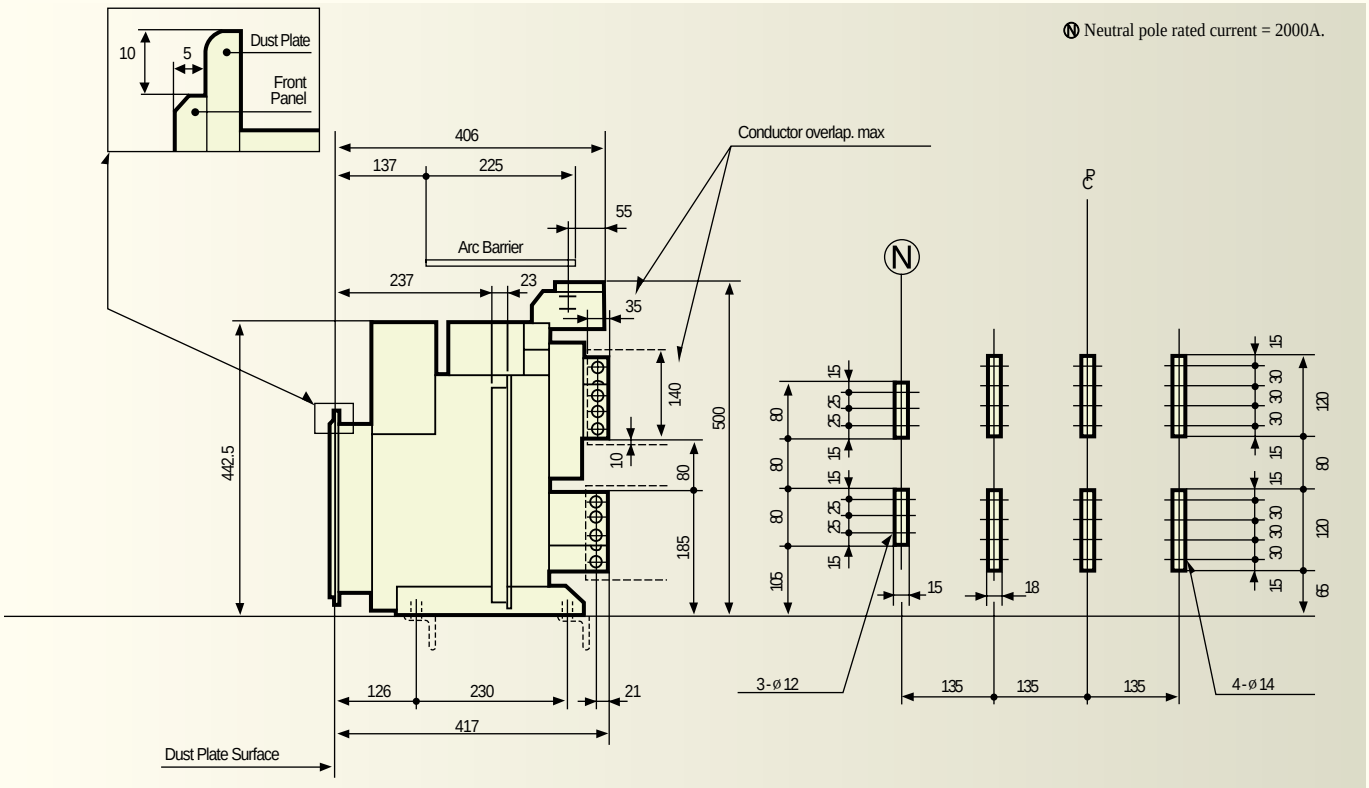
Note : ❶ Ⓝ is neutral pole of 4-pole breaker
❷ A heat and flame resistance insulating material should be installed as an arc barrier.
In the case of draw-out type, the cradle with arc barrier is available.
❸ When an arc barrier is not applied, the recommended distances to protect electrical devices and grounded metal parts are 650mm for draw-out type and 625mm for fixed type.

FIXED TYPE





Note : Ⓐ To be used where the breaker is exposed to severe vibration necessary when the breaker is subject to marine classification society rules.
• Mounting angle steel not supplied.



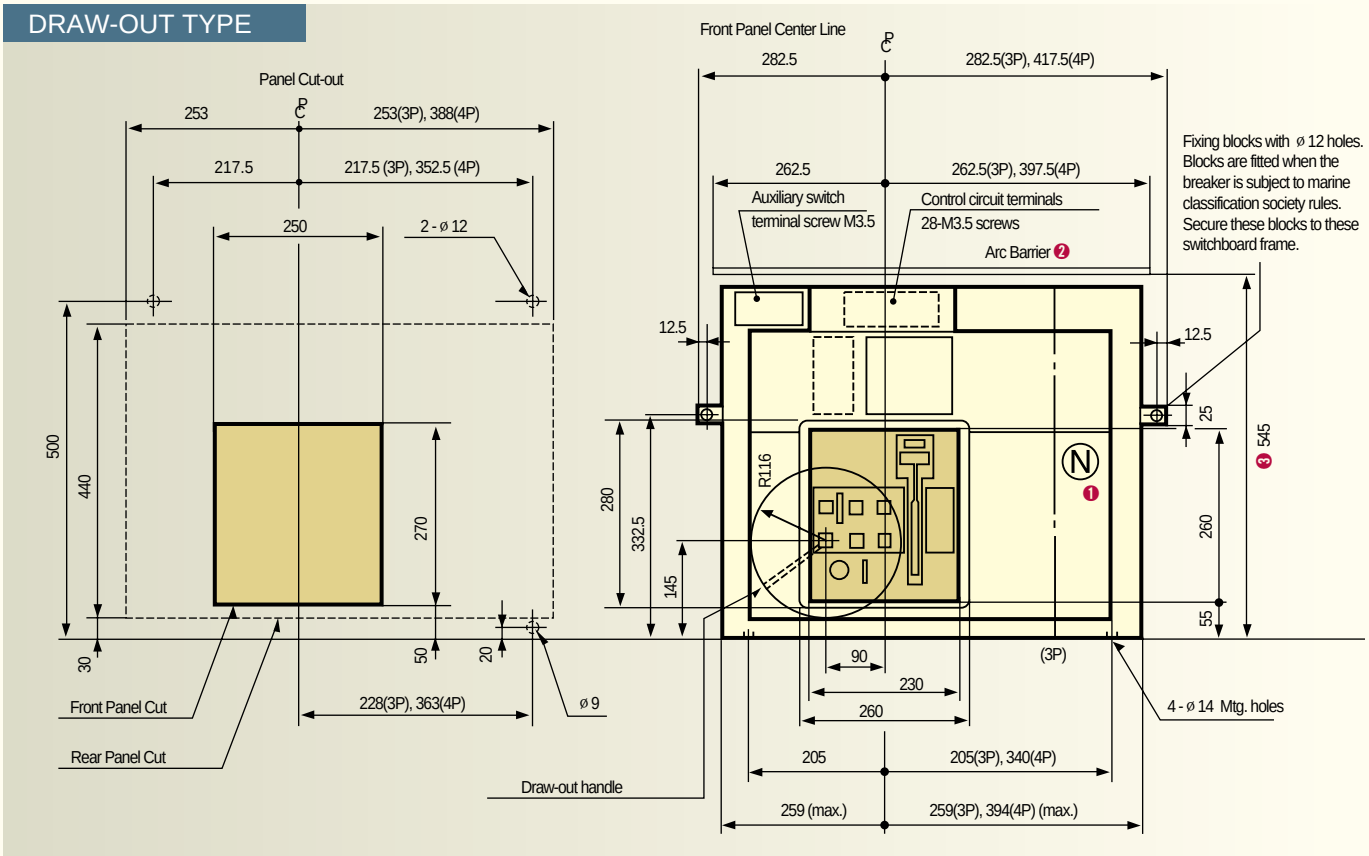
• Mounting angle steel not supplied.

Outline Dimensions

◉ Type HAT40

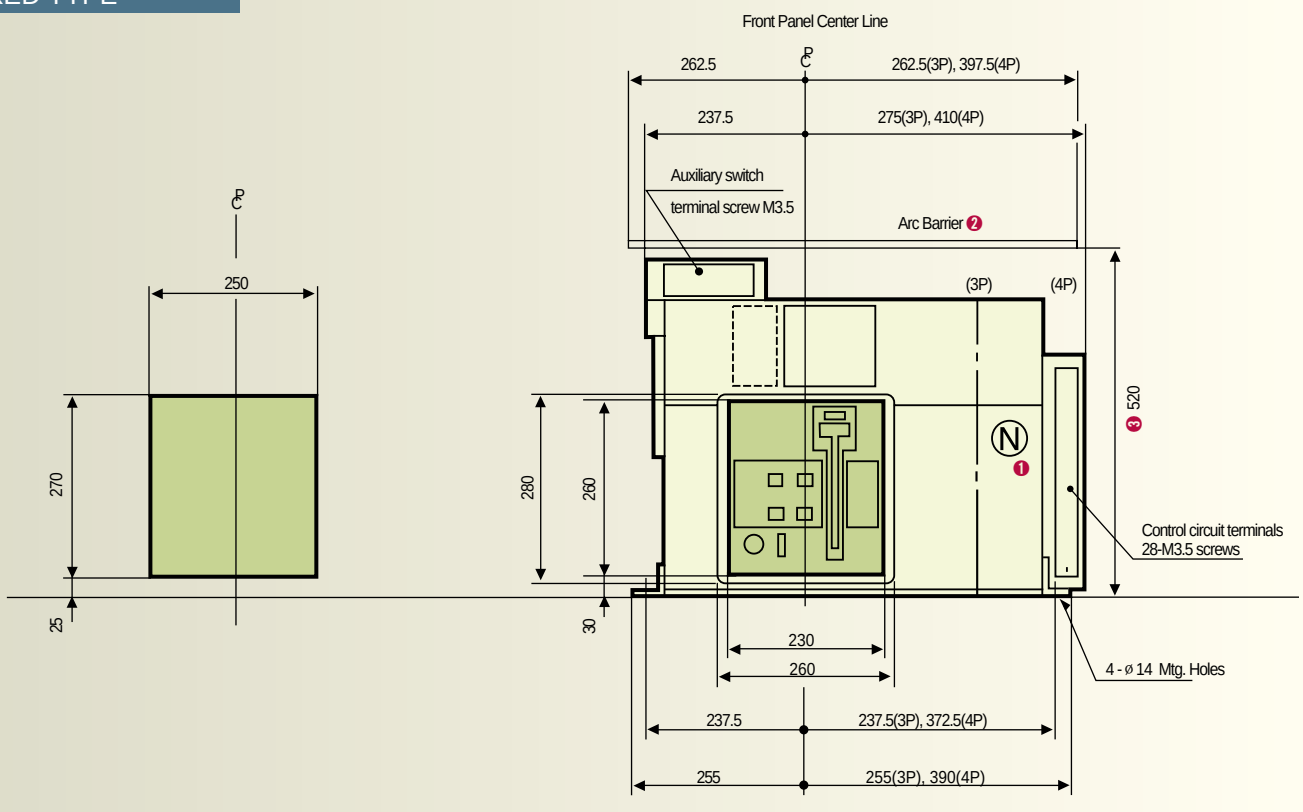
Scale 1/10

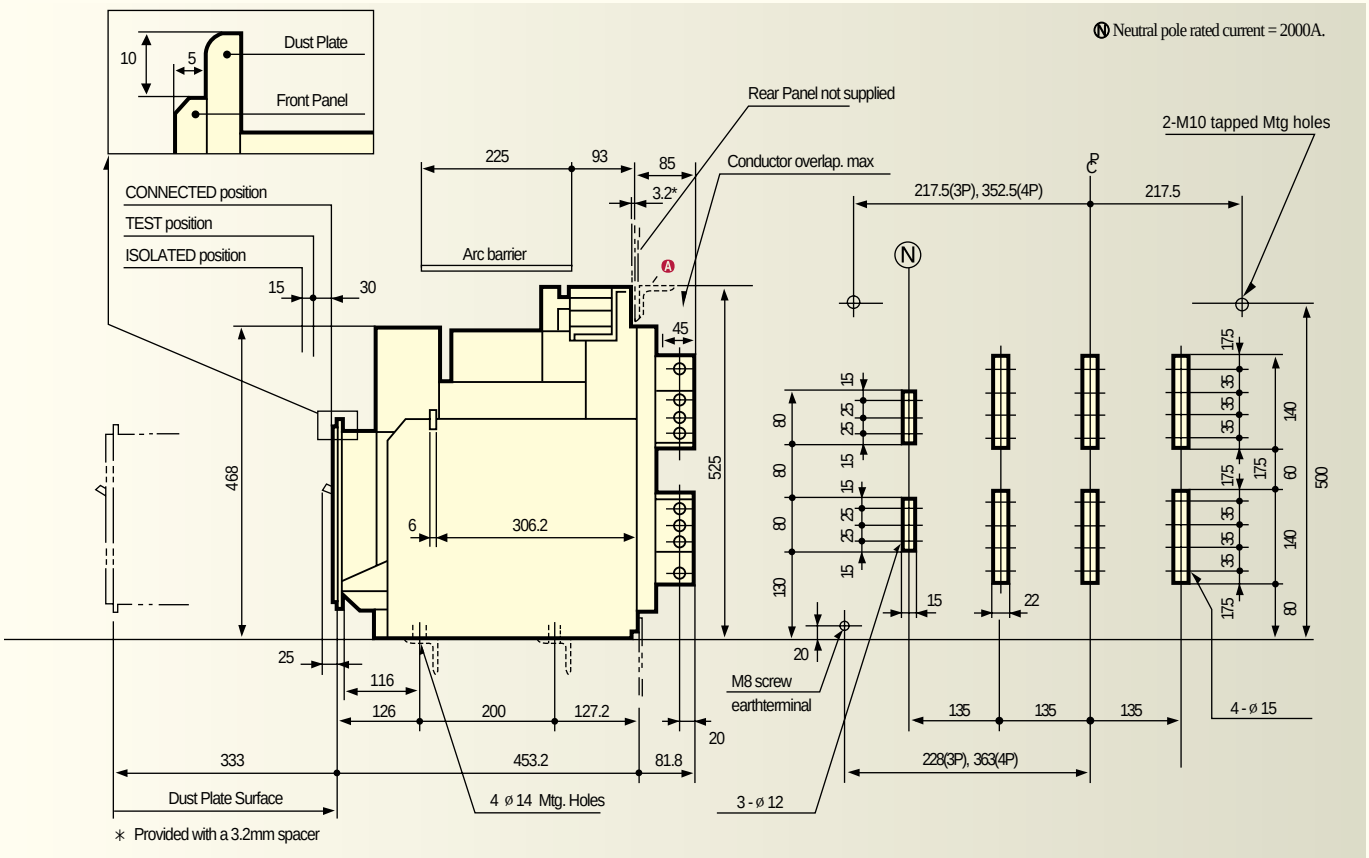
DRAW-OUT TYPE



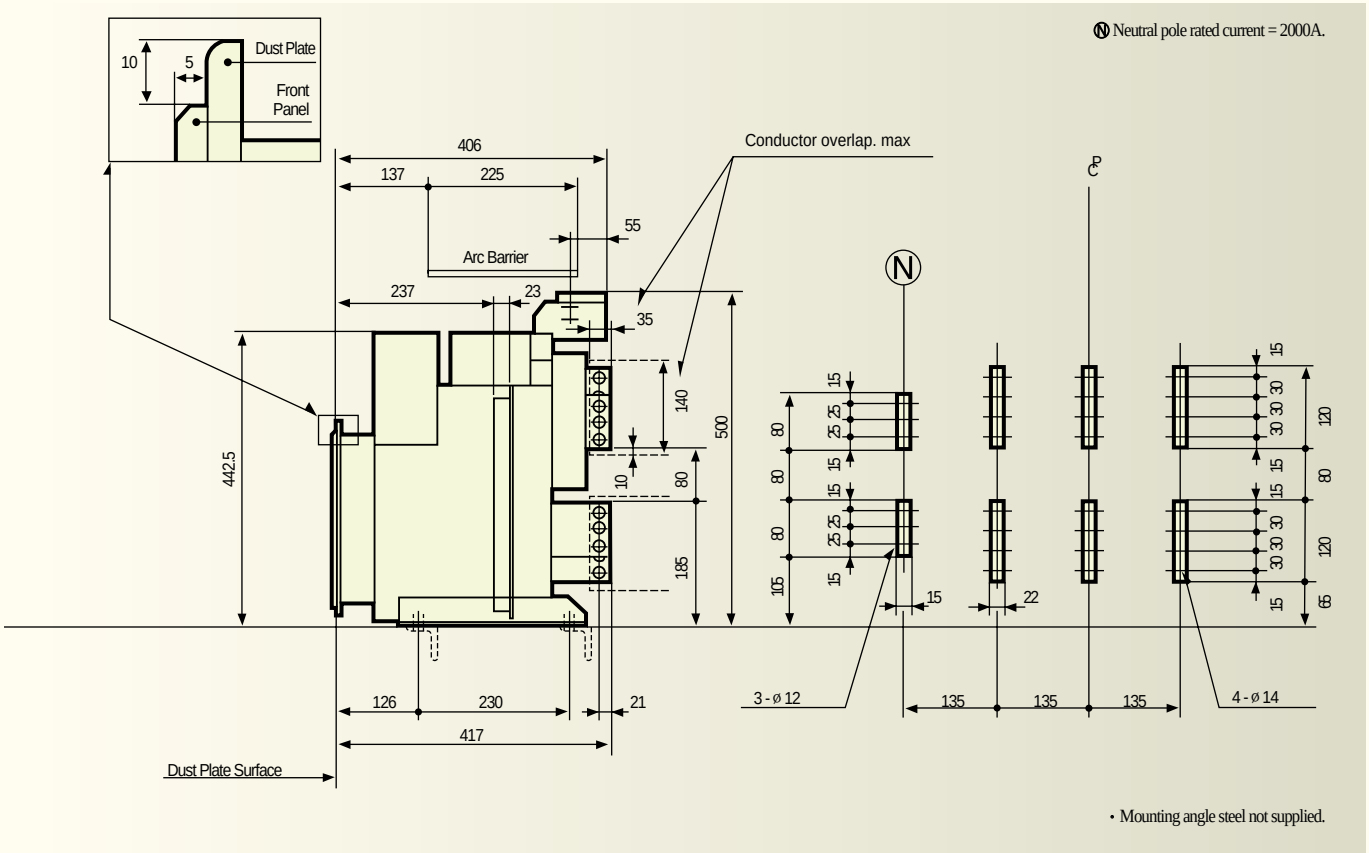
Note : ❶ Ⓝ is neutral pole of 4-pole breaker
❷ A heat and flame resistance insulating material should be installed as an arc barrier.
In the case of draw-out type, the cradle with arc barrier is available.
❸ When an arc barrier is not applied, the recommended distances to protect electrical devices and grounded metal parts are 650mm for draw-out type and 625mm for fixed type.

FIXED TYPE





Note : Ⓐ To be used where the breaker is exposed to severe vibration necessary when the breaker is subject to marine classification society rules.
• Mounting angle steel not supplied.

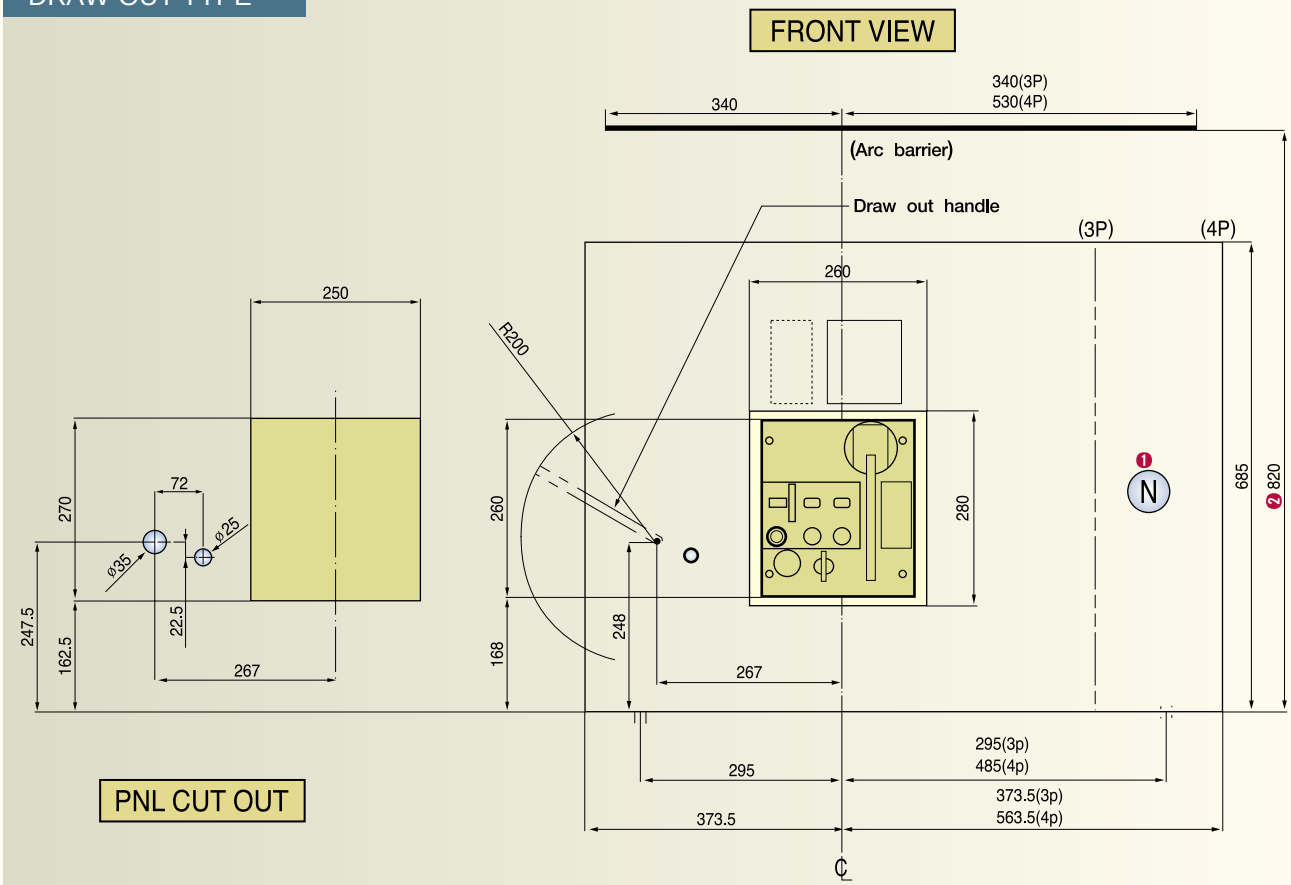


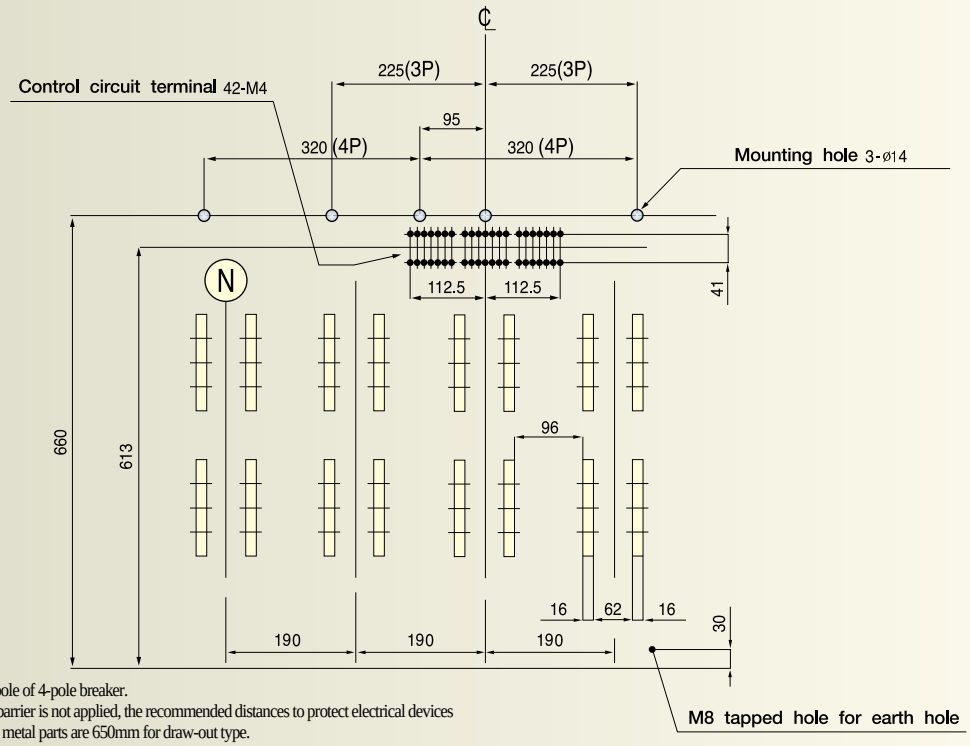
Outline Dimensions

◉ Type HAT50

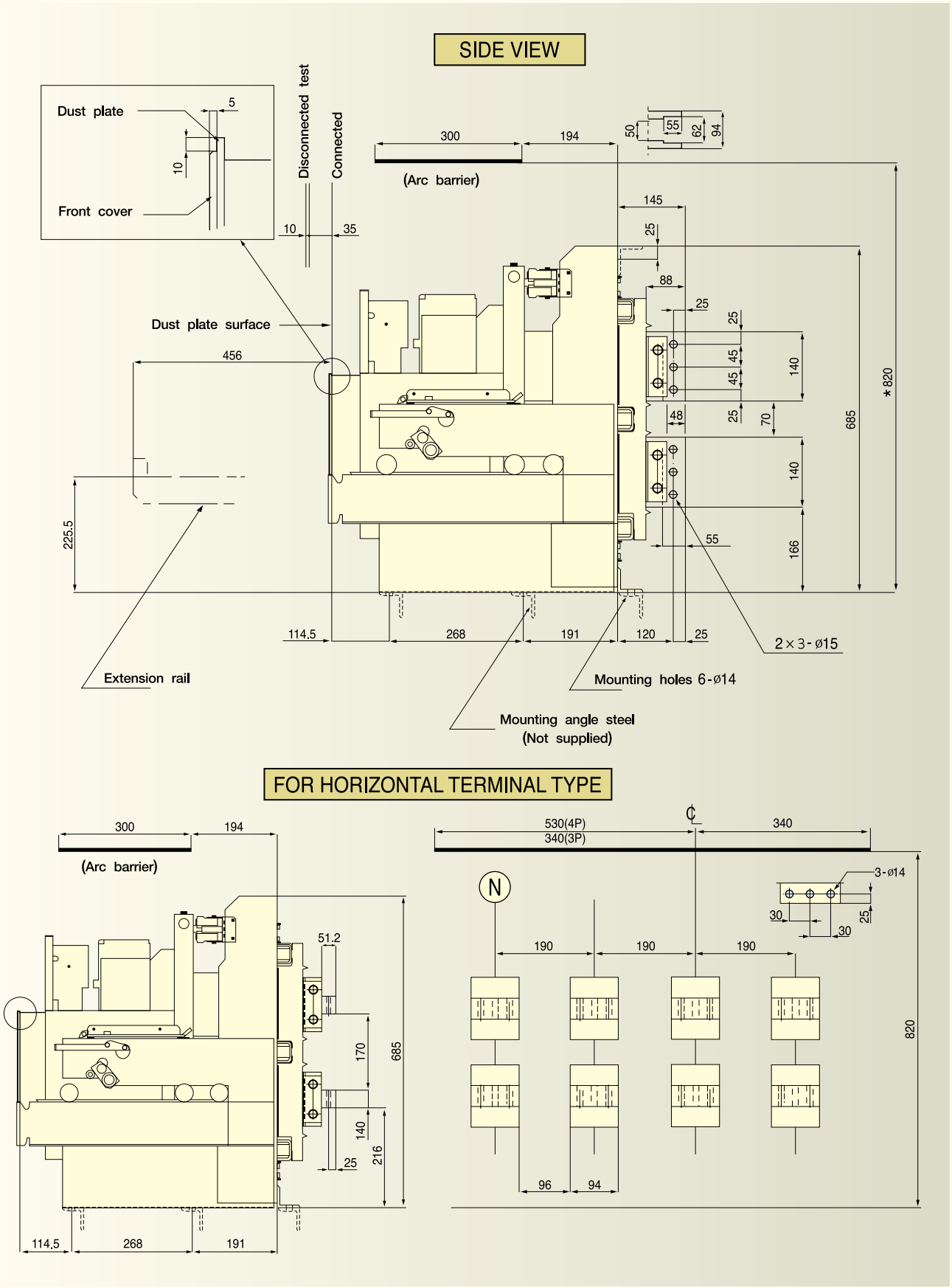
Scale 1/10

DRAW-OUT TYPE



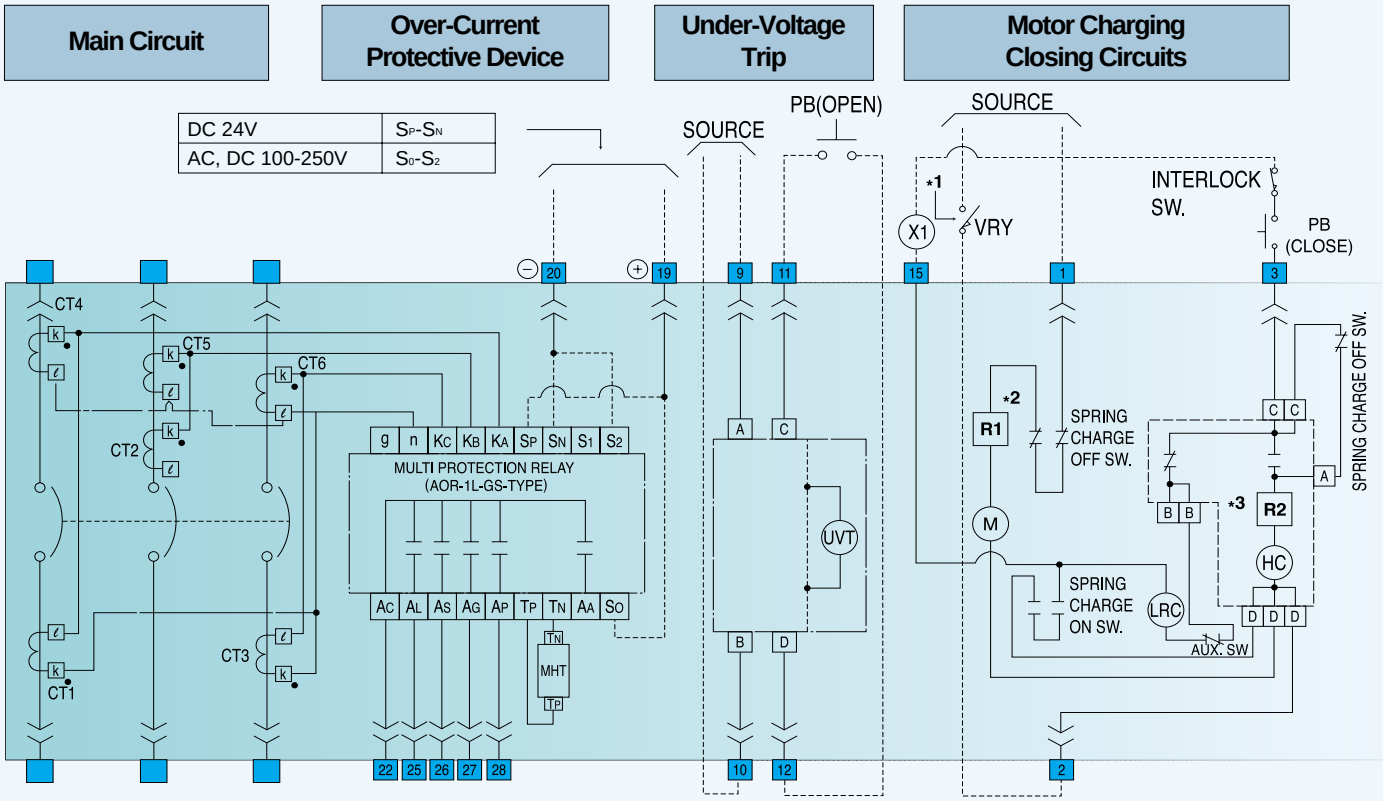


Note : ❶ Ⓝ is neutral pole of 4-pole breaker.
❷ When an arc barrier is not applied, the recommended distances to protect electrical devices and grounded metal parts are 650mm for draw-out type.


SIDE VIEW
Dust plate
Front cover
5
10
Disconnected test
Connected
10
35
300
194
(Arc barrier)
50
55
62
94
145
25
88
25
25
45
45
140
48
25
70
140
166
55
685
*820
Dust plate surface
456
225.5
114.5
268
191
120
25
2×3-ø15
Extension rail
Mounting holes 6-ø14
Mounting angle steel
(Not supplied)
FOR HORIZONTAL TERMINAL TYPE
300
194
(Arc barrier)
51.2
170
685
140
25
216
114.5
268
191
℄
530(4P)
340(3P)
340
N
3-ø14
30
30
25
190
190
190
820
96
94

Connection Diagrams

◉ Type HAT06~40



CT1-3 : CT for over-current trip for types HAT06 to HAT20
CT4-6 : CT for over-current trip for types HAT25 to HAT40
Do not use these output contacts in circuit exceeding 250V AC or 220V DC

* 1 : Fitted with circuit rated 240, 250V AC
* 2 : For circuits of rated control voltage 125V DC
* 3 : For circuit of rated control voltage 200 to 220V

Main Circuit

CT : Current transformer for OCR

Spring Charge Switch Contact

3	15	Spring charge switch contact

Condenser Trip

U	V	Condenser trip source
P	N	Condenser trip

Over-Current Relay (OCR)

19	20		Control power for terminals(CP/I)
22	23		Common line for ind. contact(IU)
22	25	AL	ind. contact(CP/I)
22	26	AS AI	ind. contact(CP/I)
22	27	AG	ind. contact(CP/I)
22	28	AP	Pre-trip alarm(CP/I)
MHT			Magnetic hold trigger

Motor Charging/Closing Circuits

1	2	Source
3		Closing circuit
M		Charging motor
HC		Hold relay
LRC		Latch release coil

Trip Indication Switch

13	14	Trip indication sw.
X1		Auxiliary relay (not supplied)

Note : [23] For IU only, contact No. 25, 26, 27 & 28 are to be alternated to contact No. 23; where the power No. 19 & 20 are not necessary.

Under-Voltage Trip (UVT)

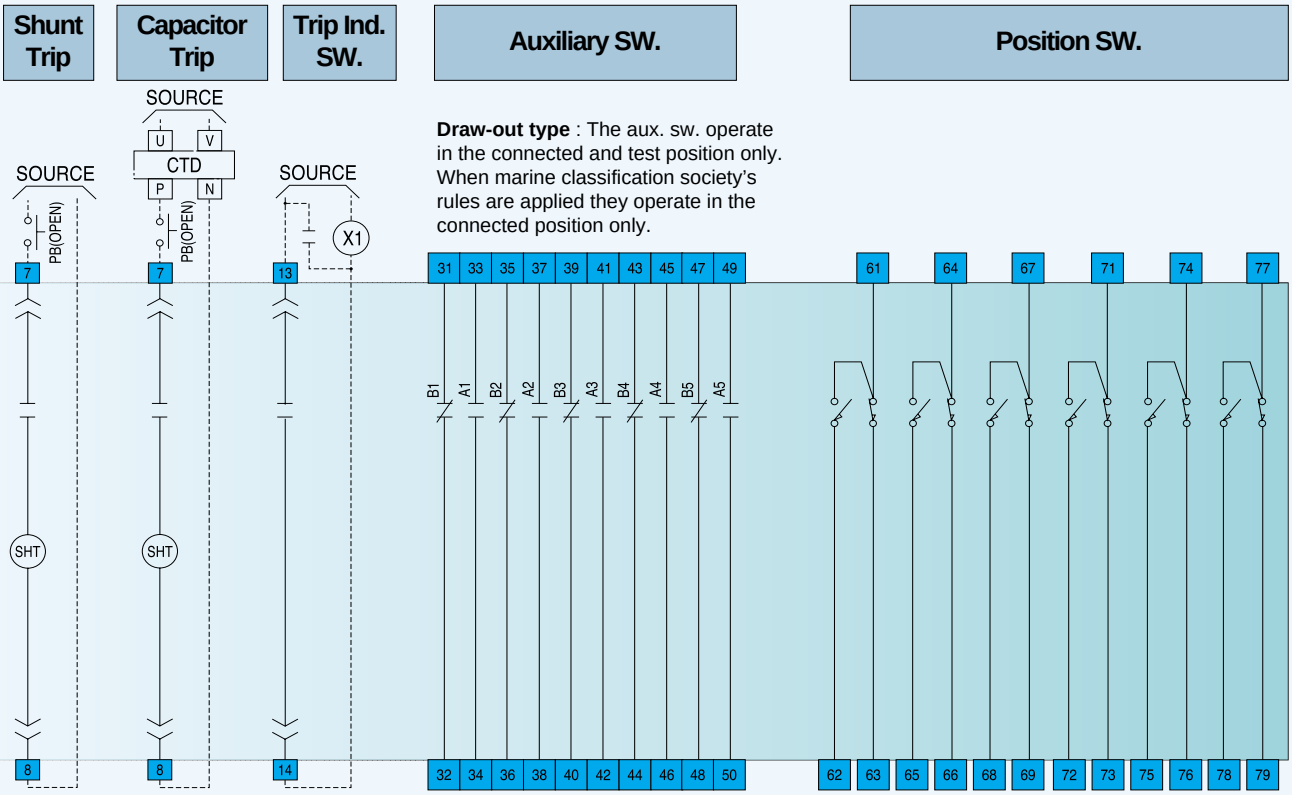
9	10	Source
11	12	Remote electrical tripping
UVT		Under-voltage trip coil
AUX.SW.		Auxiliary switch

Shunt Trip (SHT)

SHT		Shunt trip coil
7	8	Source
AUX.SW.		Auxiliary switch
PB		Push button switch

Auxiliary Switch

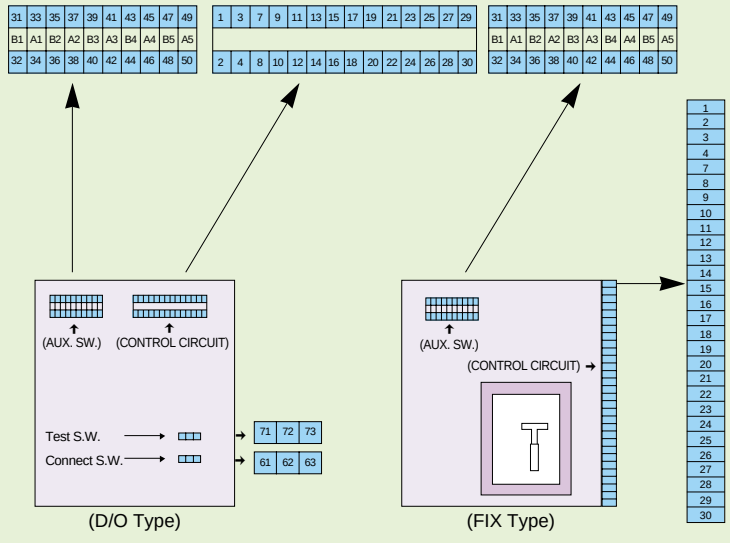
31	50	Auxiliary switch



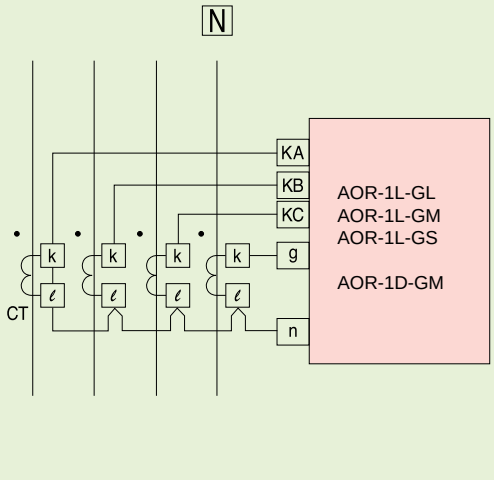
M	Charging Motor
HC	Hold Relay (Anti-Pumping)
LRC	Latch Release (Closing)
—	Manufacturer's Wiring
···	User's Wiring
	Disconnecting Device

Test position	61-62 ON	**Connected position**	71-72 ON
	61-63 OFF		71-73 OFF
	64-65 ON		74-75 ON
	64-66 OFF		74-76 OFF
	67-68 ON		77-78 ON
	67-69 OFF		77-79 OFF

Terminal Arrangement of Control Circuit

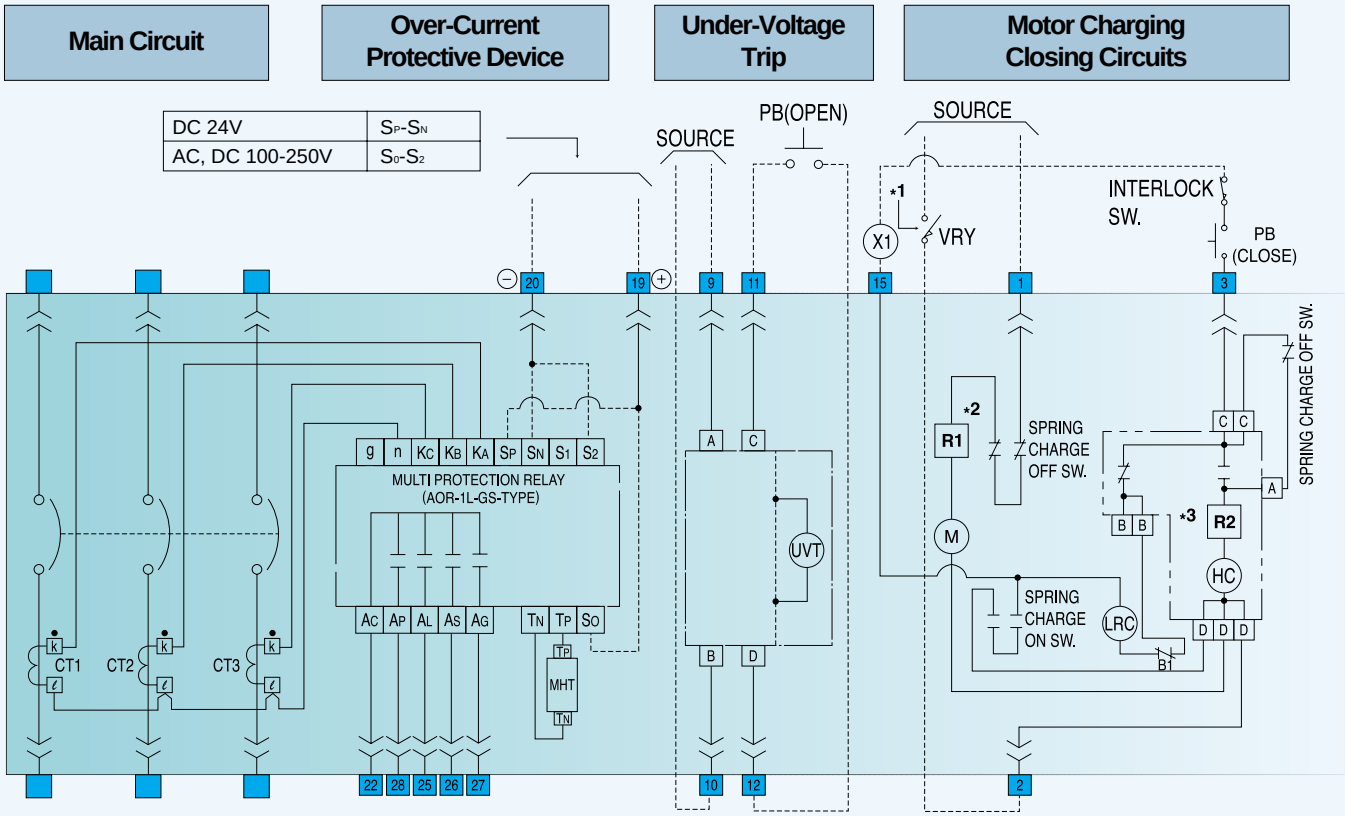


OCR Circuit Diagram for 4-Pole



Connection Diagrams

◉ Type HAT50



Do not use these output contacts in circuit exceeding 250V AC or 220V DC.

* 1 : Fitted with circuit rated 240, 250V AC.
* 2 : For circuits of rated control voltage 125V DC.
* 3 : For circuit of rated control voltage 200 to 220V.

Main Circuit

CT : Current transformer for OCR

Spring Charge Switch Contact

3	15	Spring charge switch contact

Condenser Trip

U	V	Condenser trip source
P	N	Condenser trip

Over-Current Relay (OCR)

19	20		Control power for terminals(CP/I)
22	23		Common line for ind. contact(IU)
22	25	AL	ind. contact(CP/I)
22	26	AS	AI ind. contact(CP/I)
22	27	AG	ind. contact(CP/I)
22	28	AP	Pre-trip alarm(CP/I)
MHT			Magnetic hold trigger

Motor Charging/Closing Circuits

1	2	Source
3		Closing circuit
M		Charging motor
HC		Hold relay
LRC		Latch release coil
3	15	Spring charge switch

Trip Indication Switch

13	14	Trip indication sw.
X1		Auxiliary relay (not supplied)

Note : [23] For IU only, contact No. 25, 26, 27 & 28 are to be alternated to contact No. 23; where the power No. 19 & 20 are not necessary.

Under-Voltage Trip (UVT)

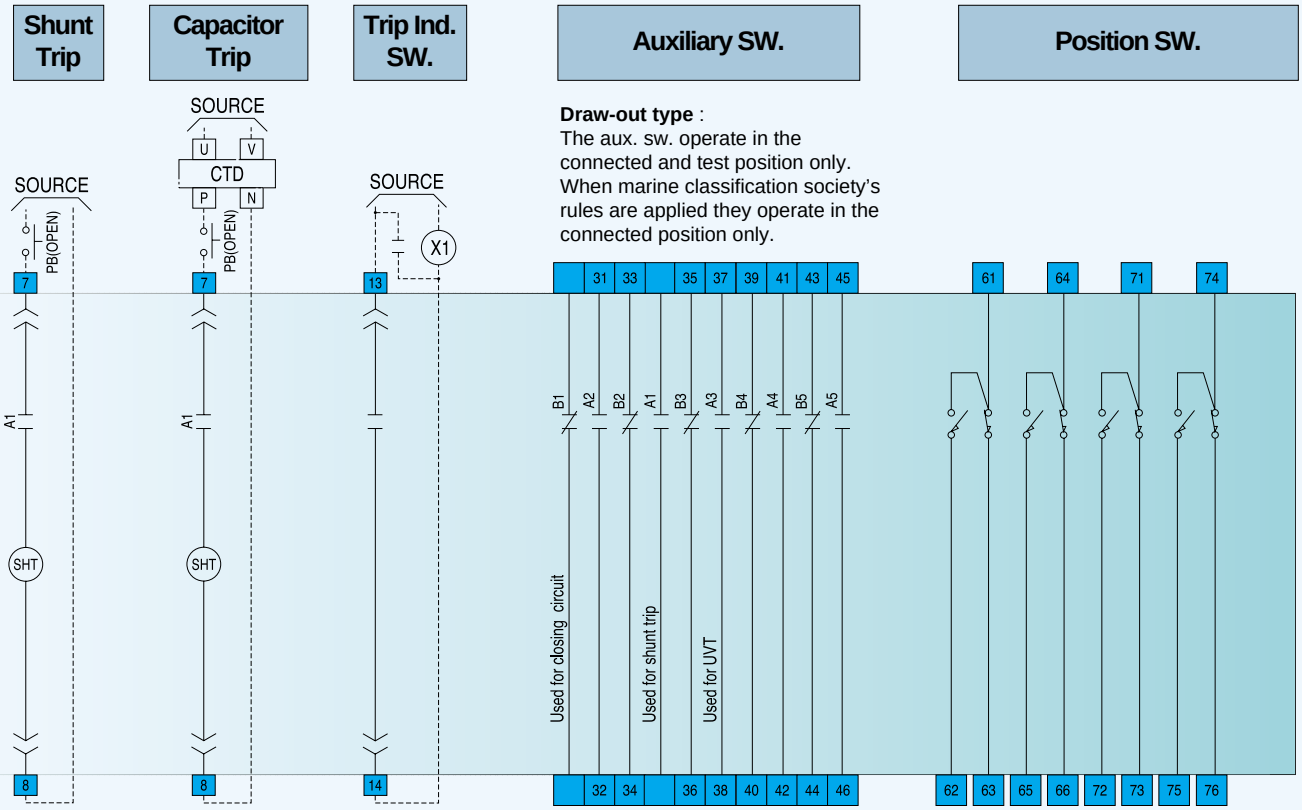
9	10	Source
11	12	Remote electrical tripping
UVT		Under-voltage trip coil

Shunt Trip (SHT)

SHT		Shunt trip coil
7	8	Source
AUX.SW.		Auxiliary switch
PB		Push button switch

Auxiliary Switch

31	46	Auxiliary switch

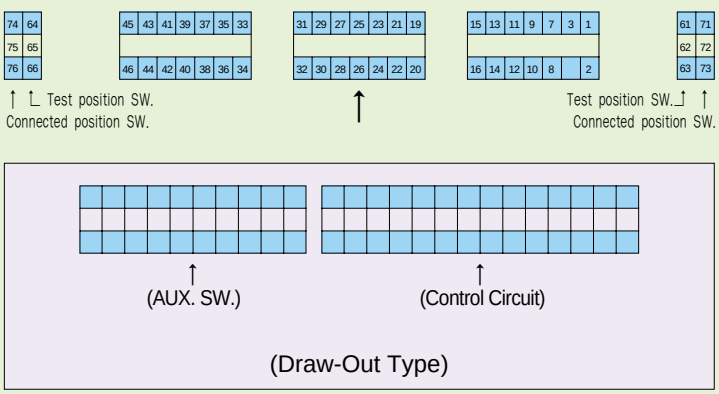


Draw-out type :
The aux. sw. operate in the connected and test position only. When marine classification society's rules are applied they operate in the connected position only.

(M)	Charging Motor
(HC)	Hold Relay (Anti-Pumping)
(LRC)	Latch Release (Closing)
—	Manufacturer's Wiring
···	User's Wiring
	Disconnecting Device

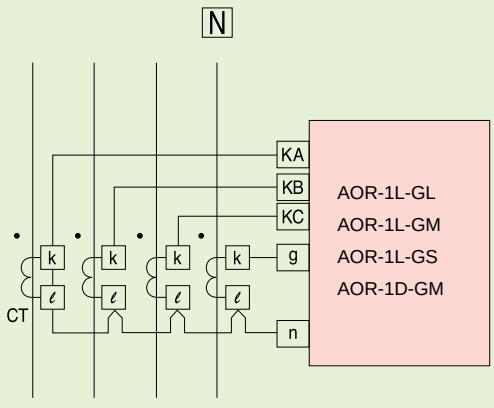
Test position	61-62 ON 61-63 OFF 64-65 ON 64-66 OFF
Connected position	71-72 ON 71-73 OFF 74-75 ON 74-76 OFF

Terminal Arrangement of Control Circuit



HAT50

OCR Circuit Diagram for 4-Pole

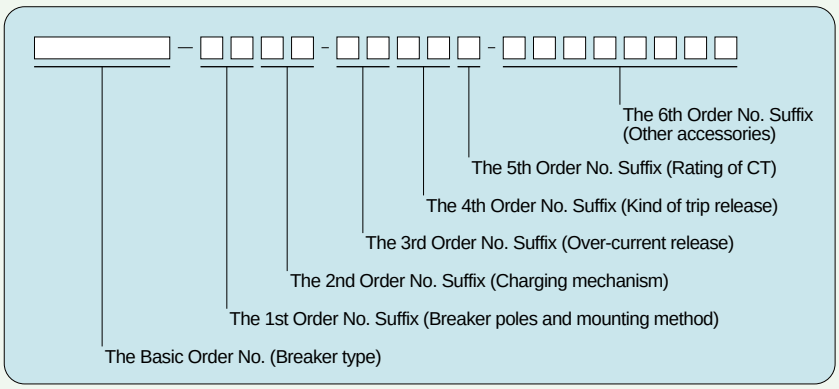


Ordering Information

HAT ACBs have an extensive range of accessories available, enabling the circuit breaker to be custom-built to suit every application.

When ordering HAT ACBs please make a complete type nomenclature as shown in following tables.

◉ Order No. Nomenclature



1. The Basic order no.(Breaker type)

No.	HAT06	HAT08	HAT10	HAT12	HAT16	HAT20	HAT25	HAT32	HAT40	HAT50
Description	630A	800A	1000A	1250A	1600A	2000A	2500A	3200A	4000A	5000A

2. The 1st order no. suffix(Breaker poles and mounting method)

Poles \ Mounting Method	Fixed Type (HAT06~HAT40)	Draw-Out Type
2 Pole	2F	2D
3 Pole	3F	3D
4 Pole	4F	4D

3. The 2nd order no. suffix(Charging mechanism)

No.	Description	No.	Description
H0	Manual Charging	M5	Motor Charging / DC100-110V
M1	Motor Charging / AC100-120V	M6	Motor Charging / DC200V
M2	Motor Charging / AC200-230V	M7	Motor Charging / DC24V
		M9	Motor Charging / DC125V

4. The 3rd order no. suffix(Over-current release)

for General Feeder Circuit			for Generator Protcetion		
No.	Function	Type	No.	Function	Type
00	None	—	00	None	—
02	AL-AS-AI-IU	AOR-1L-AL	14	AL-AS-AI-IU	AOR-1S-AL
03	AL-AS-AI-AP-CP / I / AC, DC	AOR-1L-AS	15	AL-AS-AI-AP-CP / I / AC, DC	AOR-1S-AS
05	AL-AS-AI-AP-IU / AC, DC	AOR-1L-AM	18	AL-AS-AI-AP-IU / AC, DC	AOR-1S-AS
06	AL-AS-AI-AG-IU	AOR-1L-GL			
07	AL-AS-AI-AP-AG-CP / I / AC, DC	AOR-1L-GS			
09	AL-AS-AI-AP-AG-IU / AC, DC	AOR-1L-GM			
17	AL-AS-AI-AP-IU / AC, DC	AOR-1D-GM			

* When ordering, please write down detail setting values of over-current release separately, otherwise It may be setted with our standard values.

for General Feeder Circuit	for Generator Protcetion
Base current (Io)_____A AL pick-up current [I_1]_____A Time -delay [T_1]_____s AS pick-up current [I_2]_____A Time -delay [T_2]_____ms AI pick-up current [I_3]_____A AP pick-up current [I_P]_____[T_1] Time -delay [T_P]_____s AG pick-up current [I_G]_____A Time -delay [T_G] (fixed to T_2)	Rated generator current [I_{GEN}]_____A AL pick-up current [I_1]_____A Time-delay [T_1]_____s at 120% [I_1] AS pick-up current [I_2]_____A Time-delay [T_2]_____ms AI pick-up current [I_3]_____A AP pick-up current [I_P]_____A Time-delay [T_P]_____s

5. The 4th order no. suffix(Kind of trip release)

HAT12 – □□□□ – □□■■□ – □□□□□□□□

No.	Description	No.	Description	No.	Description
00	None	C1	Condenser Trip / AC 110V	T1	UVT (Time DLY) / AC100-120V
S1	Shunt Trip / AC100-150V	C2	Condenser Trip / AC 220V	T2	UVT (Time DLY) / AC200-240V
S2	Shunt Trip / AC180-250V	U1	UVT (INST) / AC 100V-220V	T3	UVT (Time DLY) / AC360-400V
S3	Shunt Trip / AC380-420V	U2	UVT (INST) / AC 200V-240V	T4	UVT (Time DLY) / AC430-470V
S4	Shunt Trip / AC421-480V	U3	UVT (INST) / AC 360V-400V	T5	UVT (Time DLY) / AC480-500V
S5	Shunt Trip / DC90-125V	U4	UVT (INST) / AC 430V-470V		
S6	Shunt Trip / DC150-230V	U5	UVT (INST) / DC 100V		
S7	Shunt Trip / DC24V	U6	UVT (INST) / DC 200V		
S8	Shunt Trip / DC48V				

No.	Description	No.	Description	No.	Description	No.	Description
D1	Shunt Trip (S1)+UVT (T1)	X1	Shunt Trip (S5)+UVT (T3)	W1	Shunt Trip (S1)+UVT (T2)	I 1	Shunt Trip (S1)+UVT (U1)
D2	Shunt Trip (S2)+UVT (T2)	X2	Shunt Trip (S1)+UVT (T3))	W2	Shunt Trip (S1)+UVT (T4)	I 2	Shunt Trip (S2)+UVT (U2)
D3	Shunt Trip (S3)+UVT (T3)	X3	Shunt Trip (S7)+UVT (T4)	W3	Shunt Trip (S2)+UVT (T4)	I 3	Shunt Trip (S3)+UVT (U3)
D4	Shunt Trip (S4)+UVT (T4)	X4	Shunt Trip (S7)+UVT (T2)	W4	Shunt Trip (S5)+UVT (T1)	I 4	Shunt Trip (S4)+UVT (U4)
D5	Shunt Trip (S5)+UVT (U5)	X5	Shunt Trip (S6)+UVT (T2)	W5	Shunt Trip (S5)+UVT (T2)	I 5	Shunt Trip (S5)+UVT (U5)
D6	Shunt Trip (S6)+UVT (U6)	X6	Shunt Trip (S6)+UVT (T3)	W6	Shunt Trip (S5)+UVT (T4)	I 6	Shunt Trip (S6)+UVT (U6)

6. The 5th order no. suffix(Rated primary current of CT)

HAT12 – □□□□ – □□□□■ – □□□□□□□□

No.	Description	No.	Description	No.	Description
I	80A	J	1000A	P	3200A
B	160A	K	1250A	Q	4000A
V	320A	L	1600A	ϕ	None
F	500A(for 2500AF)	M	2000A	H	800A
T	630A	N	2500A	S	5000A

7. The 6th order no. suffix(Other accessories)

HAT12 – □□□□ – □□□□□ – ■■■■■■■■

No.	Description	No.	Description
A	Trip Indication SW	P	Position Padlock
B	Key Lock (in Open Position)	Q	Position Switch (Conn. Position:1C, Test Position:1C)
C	Key Lock (in Close Position)	R	Position Switch (Conn. Position:2C)
E	Safety Shutter	S	Position Switch (Test Position:2C)
F	Fixing Block	W	MAL-Insertion Prevention Device
G	Dust Plate	X	ARC Barrier
J	Test Jumper	Z	OCR Checker
L	Lifting Lug	3	Mechanical Interlock (Double-Vertical)
M	Slow Closing Jig	4	Mechanical Interlock (Triple-Vertical)
N	Neutral CT	5	Cradle Attachment
O	Open Padlock	6	Spring Charged SW
D	Cycle Counter	7	ATS(Automatic Transfer Switch)
		8	MCR(Making Current Release)

* When ordering more than one kind of accessory, please list order No. according to the order of alphabet, Arabia numerals.

Specification	Ordering Number Combination
Amperes Frame : 1250A Rated Breaking Capacity : AC500V / 65kA	HAT12
3 pole, Draw-Out Type	HAT12 – 3 D
Motor Charging / DC 100V	HAT12 – 3 D M 5
Over-Current Release : for General Feeder Circuit, AL-AS-AI-IU	HAT12 – 3 D M 5 – 0 2
Kind of Trip : Shunt Trip / DC 100V	HAT12 – 3 D M 5 – 0 2 S 5
Rated Primary Current of CT : 1250A / 5A	HAT12 – 3 D M 5 – 0 2 S 5 K
Other Accessories : Trip Indication SW. Key Lock in Open Position, Safety Shutter	HAT12 – 3 D M 5 – 0 2 S 5 K – A B E
Setting Values of Over-Current Release	Base current (I_0) 1250 A AL pick-up current [I_1] 1250 A Time-delay [I_1] 15 s AS pick-up current [I_2] 7500 A Time-delay [T_2] 240 s AI pick-up current [I_3] 12500 A

Ordering Information

◉ Spare Parts Ordering Information

No.	Order No.	Specifications
1	HATS-□□	OCR, 0 2 :OCR Order No. (ex: 02←AOR-1L-AL)
2	HATS-AB163	ARC Barrier (HAT06-20, 3P)
3	HATS-AB164	ARC Barrier (HAT06-20, 4P)
4	HATS-AB253	ARC Barrier (HAT25, 3P)
5	HATS-AB254	ARC Barrier (HAT25, 4P)
6	HATS-AB323	ARC Barrier (HAT32-40, 3P)
7	HATS-AB324	ARC Barrier (HAT32-40, 4P)
8	HATS-AC□□P	MOV'G Arcing Contact 0 6 : Ampere Frame (ex: 06←for HAT06)
9	HATS-AS	AUX. Switch Unit (5NO+5NC)
10	HATS-AS2	AUX. Switch for Shunt (2NO+2NC)
11	HATS-CA163S	Shutter (HAT06-20, 3P)
12	HATS-CA164S	Shutter (HAT06-20, 4P)
13	HATS-CA253S	Shutter (HAT25, 3P)
14	HATS-CA254S	Shutter (HAT25, 4P)
15	HATS-CA323S	Shutter (HAT32-40, 3P)
16	HATS-CA324S	Shutter (HAT32-40, 4P)
17	HATS-CC	Cycle Counter
18	HATS-CJ	Control Jack (Male + Female)
19	HATS-CS	Charging up Switch
20	HATS-CT008E	Current Transformer (80/5A, HAT06-20)
21	HATS-CT016E	Current Transformer (160/5A, HAT06-20)
22	HATS-CT032E	Current Transformer (320/5A, HAT06-20)
23	HATS-CT063E	Current Transformer (630/5A, HAT06-20)
24	HATS-CT080E	Current Transformer (800/5A, HAT08-20)
25	HATS-CT110E	Current Transformer (1000/5A, HAT10-20)
26	HATS-CT113E	Current Transformer (1250/5A, HAT12-20)
27	HATS-CT116E	Current Transformer (1600/5A, HAT16-20)
28	HATS-CT120E	Current Transformer (2000/5A, HAT20)
29	HATS-CT203E	Current Transformer (250/5A, HAT25)
30	HATS-CT205E	Current Transformer (500/5A, HAT25)
31	HATS-CT210E	Current Transformer (1000/5A, HAT25)
32	HATS-CT220E	Current Transformer (2000/5A, HAT25)
33	HATS-CT225E	Current Transformer (2500/5A, HAT25)
34	HATS-CT316E	Current Transformer (1600/5A, HAT32)
35	HATS-CT332E	Current Transformer (3200/5A, HAT32)
36	HATS-CT440E	Current Transformer (4000/5A, HAT40)
37	HATS-CT550E	Current Transformer (5000/5A, HAT50)
38	HATS-DF□□□	D/O Frame 0 6 3 : 1st & 2nd Suffix (ex: 063←630A, 3P)
39	HATS-DF064CA	D/O Frame with Shutter
40	HATS-DI16P	ARC Chamber (HAT06~HAT20)
41	HATS-DI25P	ARC Chamber (HAT25)
42	HATS-DI32P	ARC Chamber (HAT32~40)
43	HATS-DP	Dust Plate

44	HATS-FB	Fixing Block
45	HATS-FC□□P	Fix Arcing Contact, [0][6]: Ampere Frame. (ex: 06←for HAT06)
46	HATS-Handle	Draw-Out Handle (for HAT06~HAT40)
47	HATS-IC□□E	Isolating Contact, [0][6]: Ampere Frame. (ex: 06←630A)
48	HATS-IC25NE	Isolating Contact 25N (Neutral)
49	HATS-KL/A	Key Lock (Lock in Open)
50	HATS-KL/B	Key Lock (Lock in Close)
51	HATS-L□	Closing Coil, [5]: Refer 3rd Order Suffix (ex: 5←DC110V)
52	HATS-M□	Motor, [5]: Refer 3rd Order Suffix (ex: 5←DC110V)
53	HATS-MT□□□S	Main Terminal/ HAT063-204 (ex: HATS-MT063S←630A, 3P)
54	HATS-MT□□□P	Main Terminal/ HAT253-504 (ex: HATS-MT253P←2500A, 1Pole)
55	HATS-NCT032E	Neutral CT (320/5A, HAT06-20)
56	HATS-NCT063E	Neutral CT (630/5A, HAT06-20)
57	HATS-NCT113E	Neutral CT (1250/5A, HAT12-20)
58	HATS-NCT116E	Neutral CT (1600/5A, HAT16-20)
59	HATS-NCT205E	Neutral CT (500/5A, HAT25)
60	HATS-NCT210E	Neutral CT (1000/5A, HAT25)
61	HATS-NCT220E	Neutral CT (2000/5A, HAT25)
62	HATS-NCT225E	Neutral CT (2500/5A, HAT25)
63	HATS-NCT316E	Neutral CT (1600/5A, HAT32)
64	HATS-NCT332E	Neutral CT (3200/5A, HAT32)
65	HATS-NCT440E	Neutral CT (4000/5A, HAT40)
66	HATS-OP	Open Padlock
67	HATS-PP	Position Padlock
68	HATS-PST1C1	Position Switch/1P (Test: 1C Conn.: 1C)
69	HATS-S□	Shunt, [1]: Refer 4th Order Suffix (ex: 1←AC110V)
70	HATS-T□	UVT, [1]: Refer 4th Order Suffix (ex: 1←AC110V)
71	HATS-T1U	UVT Unit (Time Delay, AC110V)
72	HATS-T2U	UVT Unit (Time Delay, AC220V)
73	HATS-TJ	Test Jumper
74	HVFS-T7	Capacitor Tripping Device (AC 110V)
75	HVFS-T9	Capacitor Tripping Device (AC 220V)
76	HATS-HOC4	OCR Checker
77	HATS-U□	UVT (Inst Trip) (ex: U5←DC 100V)
78	HATS-Handle5	D/O Handle (HAT50)
79	HASS-Handle	D/O Handle (HAS Type)
80	HATS-MHT	Magnetic Hold Trigger
81	HATS-NCT550E	Neutral CT (5000/5A, HAT50)
82	HATS-AB503	ARC Barrier (HAT50, 3P)
83	HATS-AB504	ARC Barrier (HAT50, 4P)
84	HATS-CT550E	Current Transformer (5000/5A, HAT50)
85	HATS-DI50P	ARC Chamber (HAT50)
86	HATS-PST2	Position Switch/IP (Test:2C)
87	HATS-PSC2	Position Switch/IP (Conn.:2C)

◉ Spare Parts for Marine Applications

No.	Order No.	Specifications	06	12	16	20	25	32	40
1	HATS-SP01	with Motor, OCR, UVT Trip	●						
2	HATS-SP02	with Motor, OCR, UVT Trip		●					
3	HATS-SP03	with Motor, OCR, UVT Trip			●				
4	HATS-SP04	with Motor, OCR, UVT Trip				●			
5	HATS-SP05	with Motor, OCR, UVT Trip					●		
6	HATS-SP06	with Motor, OCR, UVT Trip						●	
7	HATS-SP07	with Motor, OCR, UVT Trip							●
8	HATS-SP08	with Motor, OCR, UVT Trip	●	●					
9	HATS-SP09	with Motor, OCR, UVT Trip	●		●				
10	HATS-SP10	with Motor, OCR, UVT Trip		●	●				
11	HATS-SP11	with Motor, OCR, UVT Trip	●	●	●				
12	HATS-SP12	with Motor, OCR, UVT Trip			●	●			
13	HATS-SP13	with Motor, OCR, UVT Trip		●	●	●			
14	HATS-SP14	with Motor, OCR, UVT Trip			●	●	●		
15	HATS-SP15	with Motor, OCR, UVT Trip				●	●		
16	HATS-SP16	with Motor, OCR, UVT Trip				●	●	●	
17	HATS-SP17	with Motor, OCR, UVT Trip					●	●	
18	HATS-SP18	with Motor, OCR, UVT Trip		●			●		
19	HATS-SP19	with Motor, OCR, UVT Trip		●				●	
20	HATS-SP20	with Motor, OCR, UVT Trip		●			●		●
21	HATS-SP21	with Motor, OCR, UVT Trip						●	●
22	HATS-SP22	with Motor, OCR, Shunt Trip	●						
23	HATS-SP23	with Motor, OCR, Shunt Trip		●					
24	HATS-SP24	with Motor, OCR, Shunt Trip			●				
25	HATS-SP25	with Motor, OCR, Shunt Trip				●			
26	HATS-SP26	with Motor, OCR, Shunt Trip					●		
27	HATS-SP27	with Motor, OCR, Shunt Trip						●	
28	HATS-SP28	with Motor, OCR, Shunt Trip							●
29	HATS-SP29	with Motor, OCR, Shunt Trip	●	●					
30	HATS-SP30	with Motor, OCR, Shunt Trip	●		●				
31	HATS-SP31	with Motor, OCR, Shunt Trip		●	●				
32	HATS-SP32	with Motor, OCR, Shunt Trip	●	●	●				
33	HATS-SP33	with Motor, OCR, Shunt Trip			●	●			
34	HATS-SP34	with Motor, OCR, Shunt Trip		●	●	●			
35	HATS-SP35	with Motor, OCR, Shunt Trip			●	●	●		
36	HATS-SP36	with Motor, OCR, Shunt Trip				●	●		
37	HATS-SP37	with Motor, OCR, Shunt Trip				●	●	●	
38	HATS-SP38	with Motor, OCR, Shunt Trip					●	●	
39	HATS-SP39	with Motor, OCR, Shunt Trip		●			●		
40	HATS-SP40	with Motor, OCR, Shunt Trip		●				●	
41	HATS-SP41	with Motor, OCR, Shunt Trip		●			●		●
42	HATS-SP42	with Motor, OCR, Shunt Trip						●	●

◉ Economical Alterations for HAT-Series ACB

In spite of HAT-Series ACB's excellant characteristics, general users want to have simple optioned, but maintaining main funtioned ACB.

These caused from the fact that HAT Series ACB is designed and manufactured to cover all kinds of optional and special requirements.

For the fulfillment of these kinds of customer's requirements, we prepared economical conversion with the following alterations.

1. Levered draw-out mechanism.
2. Auxiliary switches with 3a3b. (STANDARD)
3. Position guide tag.

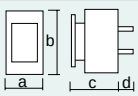
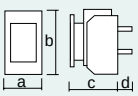
The applications of these conversions are limited as following points.

– Only applied for below 2000 ampere frame.

[Please notice that this ACB is limited to add special accessories]

◉ Ratings for Industrial Plant Applications

TYPE			HAS 06		HAS 08		HAS 10		HAS 12		HAS 16		HAS 20	
Amperes frame (A) ❶	IEC. BS. VDE. AS		630		800		1000		1250		1600	1600	2000	
	NEMA. ANSI		630		800		1000		1250		1600	1600	2000	
Neutral pole amperes (A)			630		800		1000		1250		1600	1600 ❷	2000	
Number of poles			2, 3	4	2, 3	4	2, 3	4	2, 3	4	2, 3	4	2, 3	4
Rated primary current of over-current trip devices · for generator feeder circuit use			80 160 320 630		80 160 320 630 800		160 320 630 800 1000		160 320 630 800 1000 1250		320 630 800 1000 1250 1600		320 630 1000 1250 1600 2000	
Rated primary current of over-current trip devices • for generator protection use160 < Io ≤ 320 (Io is the rated current of generator)			40 ≤ Io ≤ 80 80 < Io ≤ 160 160 < Io ≤ 320 320 < Io ≤ 630		40 ≤ Io ≤ 80 80 < Io ≤ 160 400 < Io ≤ 800 320 < Io ≤ 630 400 < Io ≤ 800		160 ≤ Io ≤ 320 320 < Io ≤ 630 500 < Io ≤ 1000 500 < Io ≤ 1000		160 ≤ Io ≤ 320 320 < Io ≤ 630 800 < Io ≤ 1600 630 < Io ≤ 1250		800 ≤ Io ≤ 1600 630 < Io ≤ 1250		160 ≤ Io ≤ 320 320 < Io ≤ 630 800 < Io ≤ 1600 1000 < Io ≤ 2000	
Rated insulation voltage [Ui](V)			AC1000		AC1000		AC1000		AC1000		AC1000		AC1000	
Rated operational voltage [Ue](V)			AC690		AC690		AC690		AC690		AC690		AC690	
Rated breaking cap.(kA.sym)/Making cap.(kA.peak)														
IEC VDE BS AS [Ics]	with INST [Ics]=100%[Icu]	AC 690V	22/46.2		22/46.2		35/73.5		35/73.5		35/73.5		35/73.5	
		AC 600V	30/63		30/63		50/105		50/105		50/105		50/105	
		Up to AC 500V	35/73.5		35/73.5		65/143		65/143		65/143		65/143	
	without INST	AC 690V	22/46.2		22/46.2		35/73.5		35/73.5		35/73.5		35/73.5	
		Up to AC 500V	35/73.5		35/73.5		50/105		50/105		50/105		50/105	
NEMA ANSI	with INST	AC 600V	22/50.6		22/50.6		42/96.6		42/96.6		42/96.6		42/96.6	
		AC 480V	30/69		30/69		50/115		50/115		50/115		50/115	
		Up to AC 240V	42/96.6		42/96.6		65/149.5		65/149.5		65/149.5		65/149.5	
	without INST	AC 660V	22/50.6		22/50.6		42/96.6		42/96.6		42/96.6		42/96.6	
		Up to AC 480V	30/69		30/69		50/115		50/115		50/115		50/115	
Rated impulse withstand voltage [Uimp] (kV)			8		8		8		8		8		8	
Rated short time withstand current		1S	35		35		50		50		50		50	
RMS [Icw] (kA)		3S	30		50		45		45		45		45	
Latching current RMS (kA)			35		35		50		50		50		50	
Total breaking time (s)		0.04	0.04		0.04		0.04		0.04		0.04			
Closing operation time	Spring charging time (s) max.		10		10		10		10		10		10	
	Closing time (s) max.		0.06		0.06		0.06		0.06		0.06		0.06	
Weight (kg), draw-out type			79	95	79	95	82	103	82	103	87	110	88	112

Outline Dimensions (mm)		HAS 06		HAS 08		HAS 10		HAS 12		HAS 16		HAS 20	
Number of poles		2.3	4	2.3	4	2.3	4	2.3	4	2.3	4	2.3	4
Fixed type 	a	380	465	380	465	380	465	380	465	380	465	380	465
	b	500	500	500	500	500	500	500	500	500	500	500	500
	c	343	343	343	343	343	343	343	343	343	343	343	343
	d	79	79	79	79	79	79	79	79	79	79	79	79
Draw-out type 	a	368	453	368	453	368	453	368	453	368	453	368	453
	b	468	468	468	468	468	468	468	468	468	468	468	468
	c	458	458	458	458	458	458	458	458	458	458	458	458
	d	82	82	82	82	82	82	82	82	82	82	92	92

Internal Resistance Power Consumption, Reactance Per Pole

Description / Type		HAS 06	HAS 08	HAS 10	HAS 12	HAS 16	HAS 20
Internal resistance (m-ohms)	Draw-out type	0.060	0.060	0.048	0.048	0.041	0.034
	Fixed type	0.040	0.040	0.025	0.025	0.022	0.018
Power consumption (W)	Draw-out type	23.81	38.40	48.00	75.00	104.96	136.0
	Fixed type	15.88	25.60	25.00	39.06	56.32	72.00
Reactance (m-ohms)	Draw-out type	0.150	0.150	0.098	0.098	0.085	0.078
	Fixed type	0.150	0.150	0.098	0.098	0.085	0.078

❶ Values in open air at 40˚C .(45˚C for marine applications) ❷ 1400A for applications based on NEMA and ANSI standard.

◉ Ordering Information for Economical Alteration

The following informations are used only for economical conversion type and same method as page 52.

HAS -□□□□-□□□□□-□□□□□□□

1. The Basic Order no Same as Page 52 ■■■■ -□□□□-□□□□□-□□□□□□□□

2. The 1st Order No. Suffix (Poles & Mounting Method) Same as Page 52 [ ] -■■□□-□□□□□-□□□□□□□□

3. The 2nd Order No. Suffix (Charging mechanism) Same as Page 52 [ ] -□□■■-□□□□□-□□□□□□□□

4. The 3rd Order No. Suffix (Over-current release) [ ] -□□□□-■■□□□-□□□□□□□□

No.	Function	Type	No.	Function	Type
00	None	–	06	AL-AS-AI-AG-IU	AOR-1L-GL
02	AL-AS-AI-IU	AOR-1L-AL	09	AL-AS-AI-AP-AG-IU/AC, DC	AOR-1L-GM
05	AL-AS-AI-AP-IU/AC, DC	AOR-1L-AM	14	AL-AS-AI-IU	AOR-1S-AL(＊)

(＊) NO. 14 for generator protection.

5. The 4th Order No. Suffix (Kind of trip release) Same as Page 53 [ ] -□□□□-□□■■□-□□□□□□□

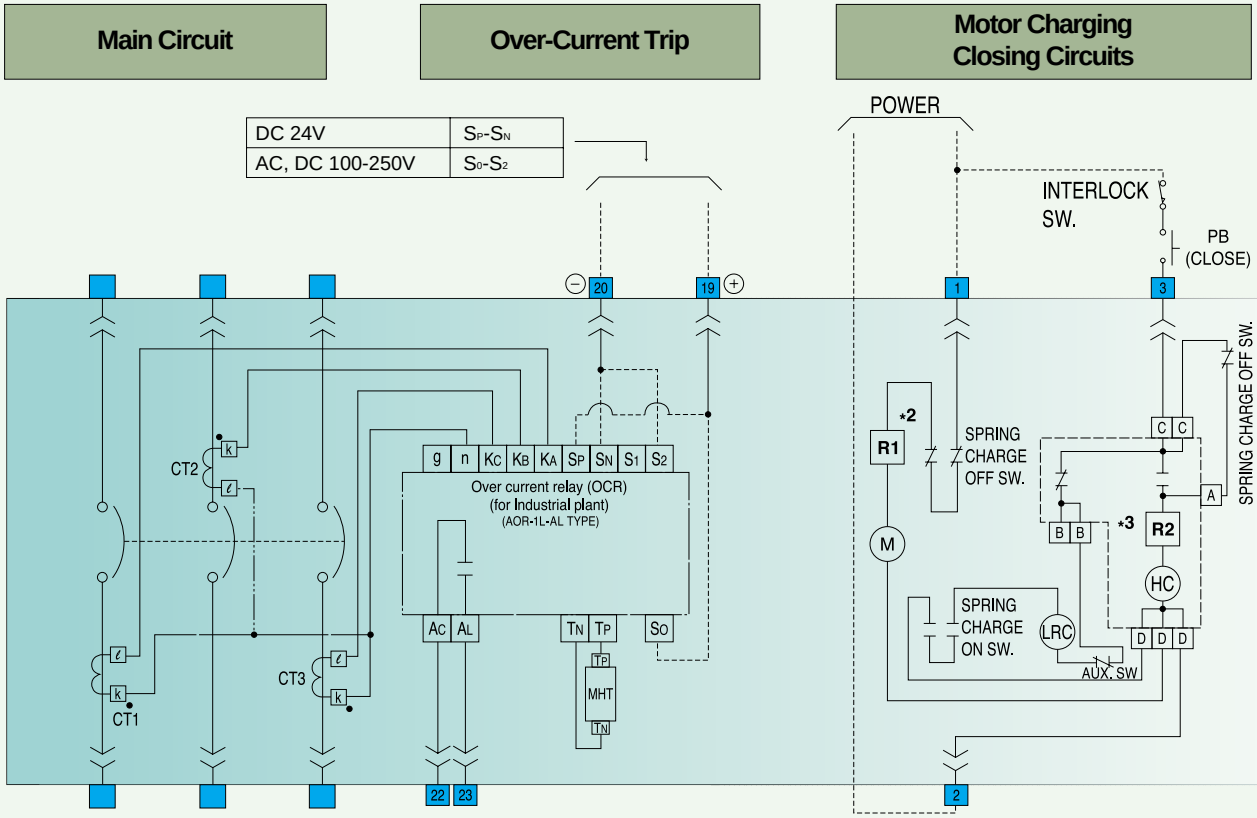
6. The 5th Order No. Suffix (Rated primary current of CT) Same as Page 53 [ ] -□□□□-□□□□■-□□□□□□□

7. The 6th Order No. Suffix (Other Accessories) [ ] -□□□□-□□□□□-■■■■■■■■

No.	Description
B	Key Lock (in Open Position)
C	Key Lock (in Close Position)
E	Safety Shutter
G	Dust Plate
D	Cycle Counter
L	Lifting Lugs
O	Open Padlock
R	Position SW(C2)
X	Arc Barrier

Please contact our branches for further informations or special applications.

◉ Connection Diagrams for Economical Alteration



CT 1-3 : CT for over-current trip for types HAS06 to HAS20.
Do not use these output contacts in circuit exceeding 250V AC or 220V DC.

* 2 : For circuit of rated control voltage 125V DC.
* 3 : For circuit of rated control voltage 200 to 220V.

Main Circuit

CT : Current transformer for OCR

Auxiliary Switch

31	42	Auxiliary switch

Capacitor Trip (CTD)

U	V	Source
P	N	Remote electrical tripping

Over-Current Relay (OCR)

19	20	Control power for terminals(CP/I)
22	23	Common line for ind. contact(IU)
MHT		Magnetic hold trigger

Under-Voltage Trip (UVT)

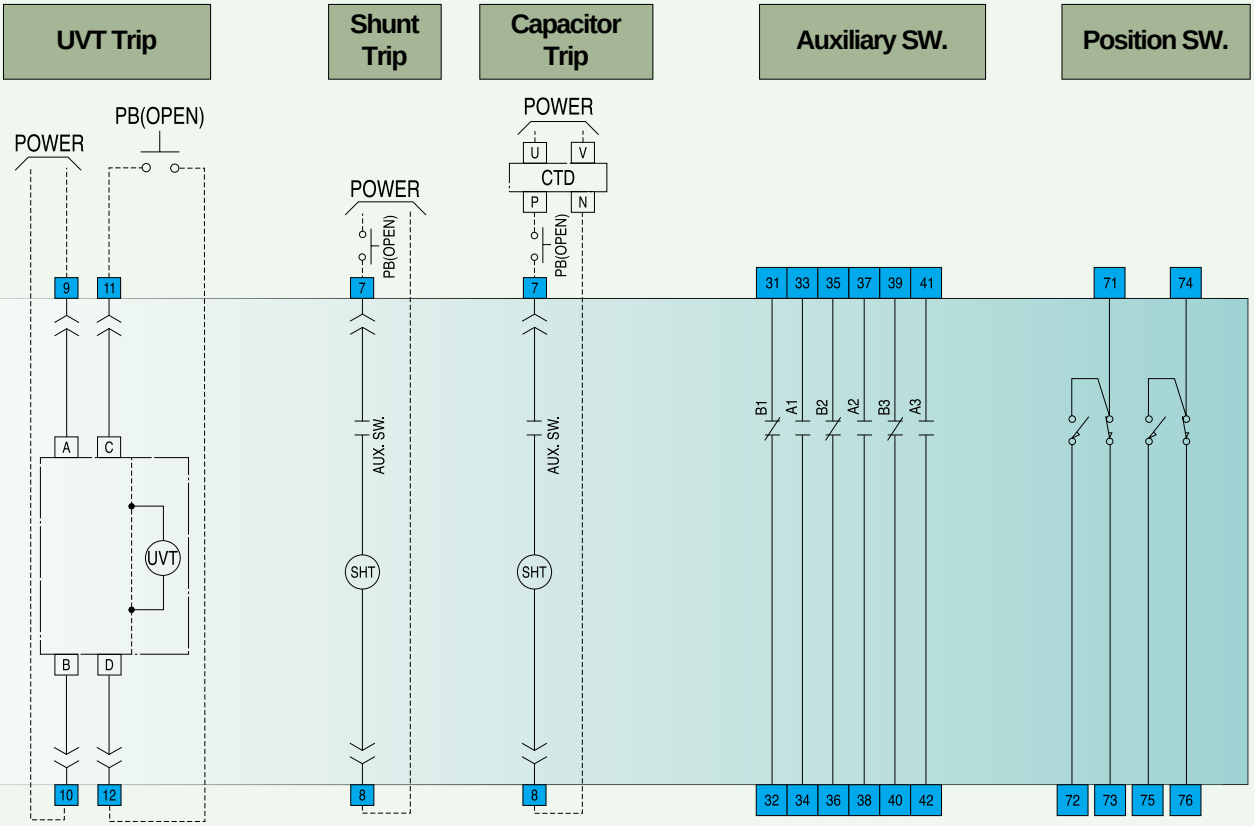
9	10	Power source
11	12	Remote electrical tripping
UVT		Under-voltage trip device

Shunt Trip (SHT)

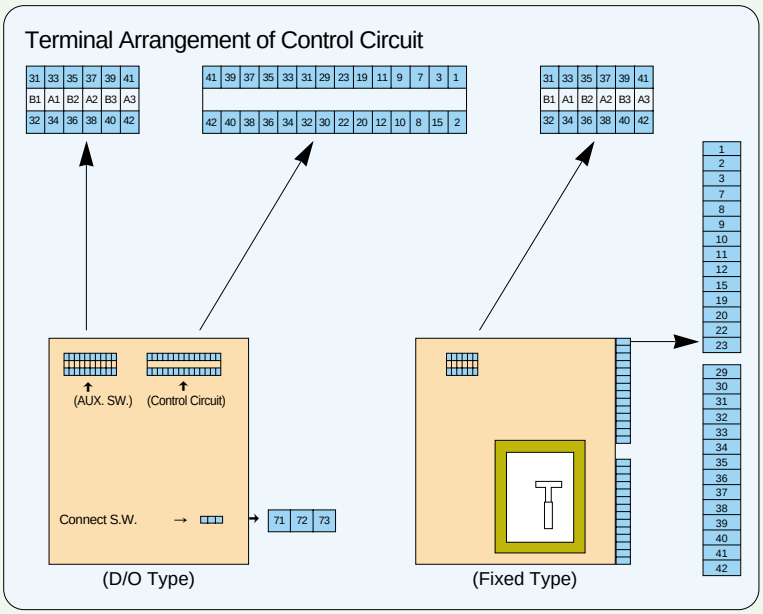
SHT		Shunt trip coil
7	8	SHT circuit
AUX.SW.		Auxiliary switch
PB		Push button switch

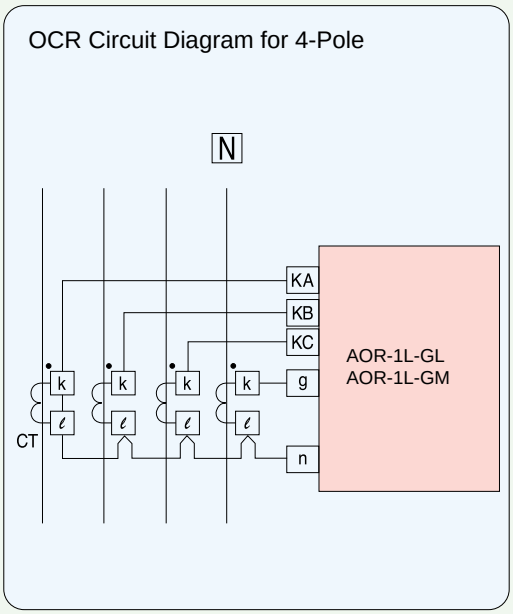
Motor Charging/Closing Circuits

1	2	Source
3		Closing circuit
M		Charging motor
HC		Hold relay
LRC		Latch release coil(closing)
PB		Push button switch



Connected position
71-72 ON
71-73 OFF
74-75 ON
74-76 OFF



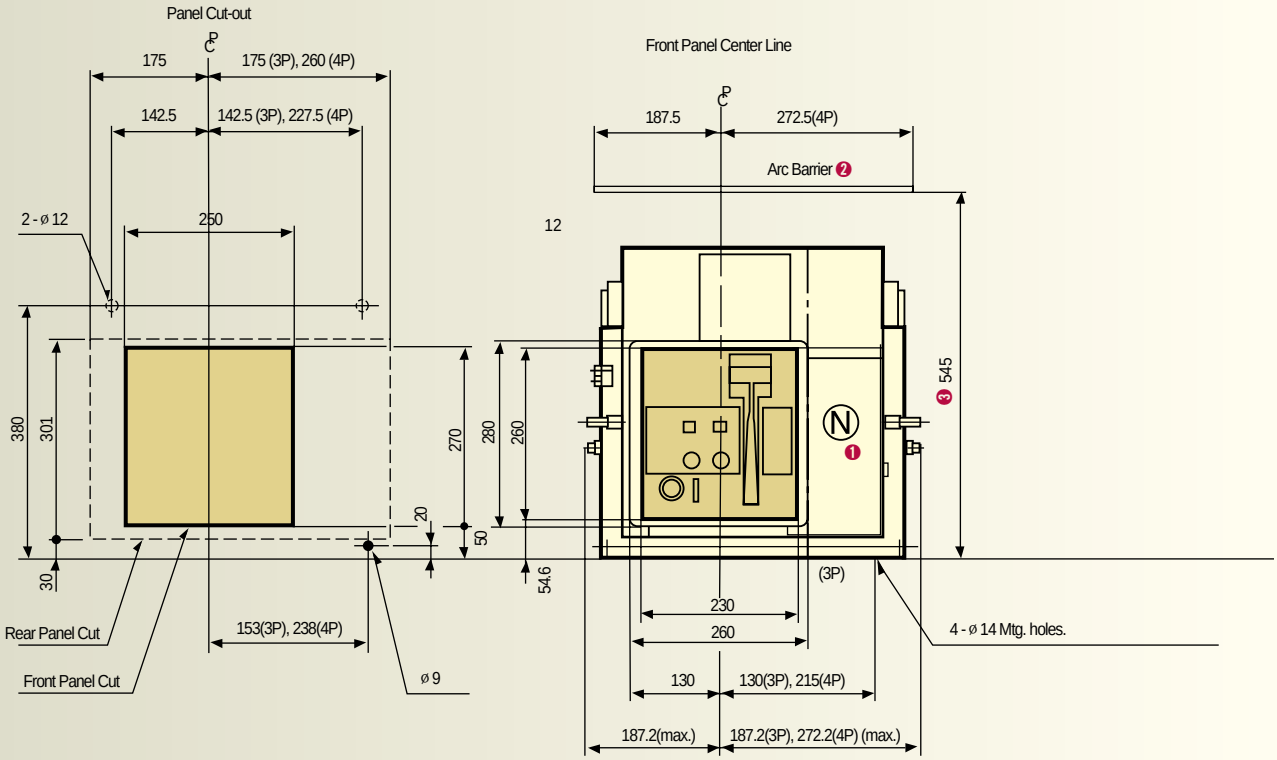


Outline Dimensions

◉ Type HAS06, 08, 10, 12 and HAS16

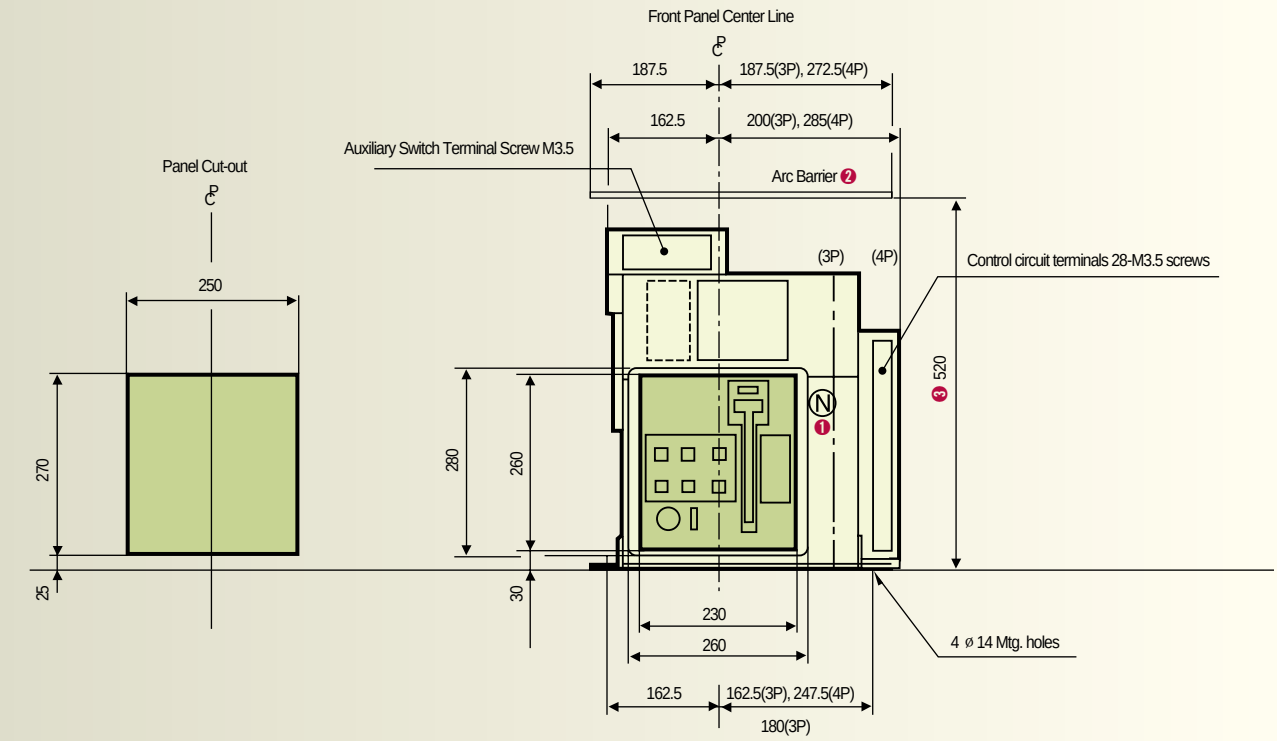
Scale 1/10

DRAW-OUT TYPE

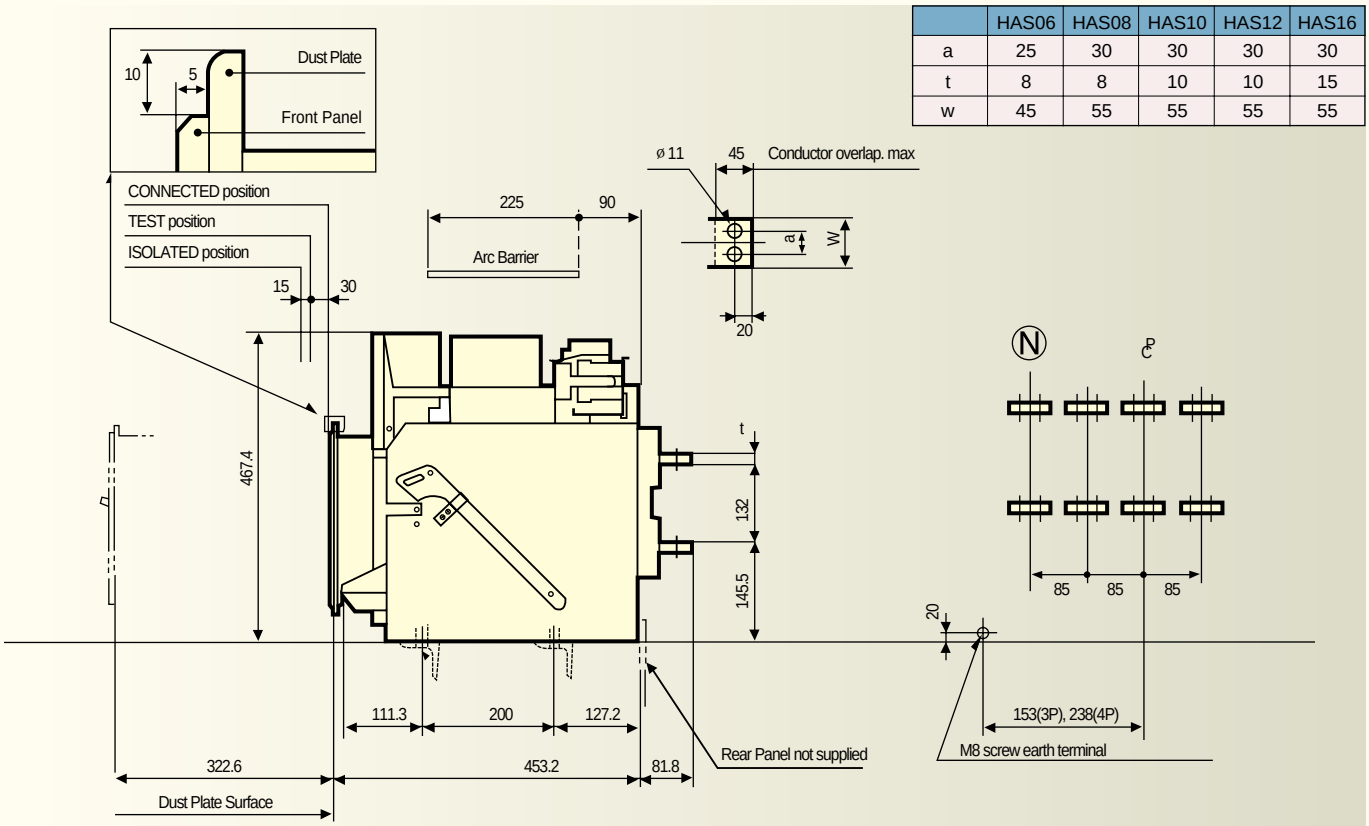


Note : ❶ Ⓝ is neutral pole of 4-pole breaker
❷ Use arc barrier of a heat and flame resistant insulating material.
❸ When no arc barrier is used, the minimum requierd distance is 650mm with respect to electrical devices, grounded metal parts etc, located above.

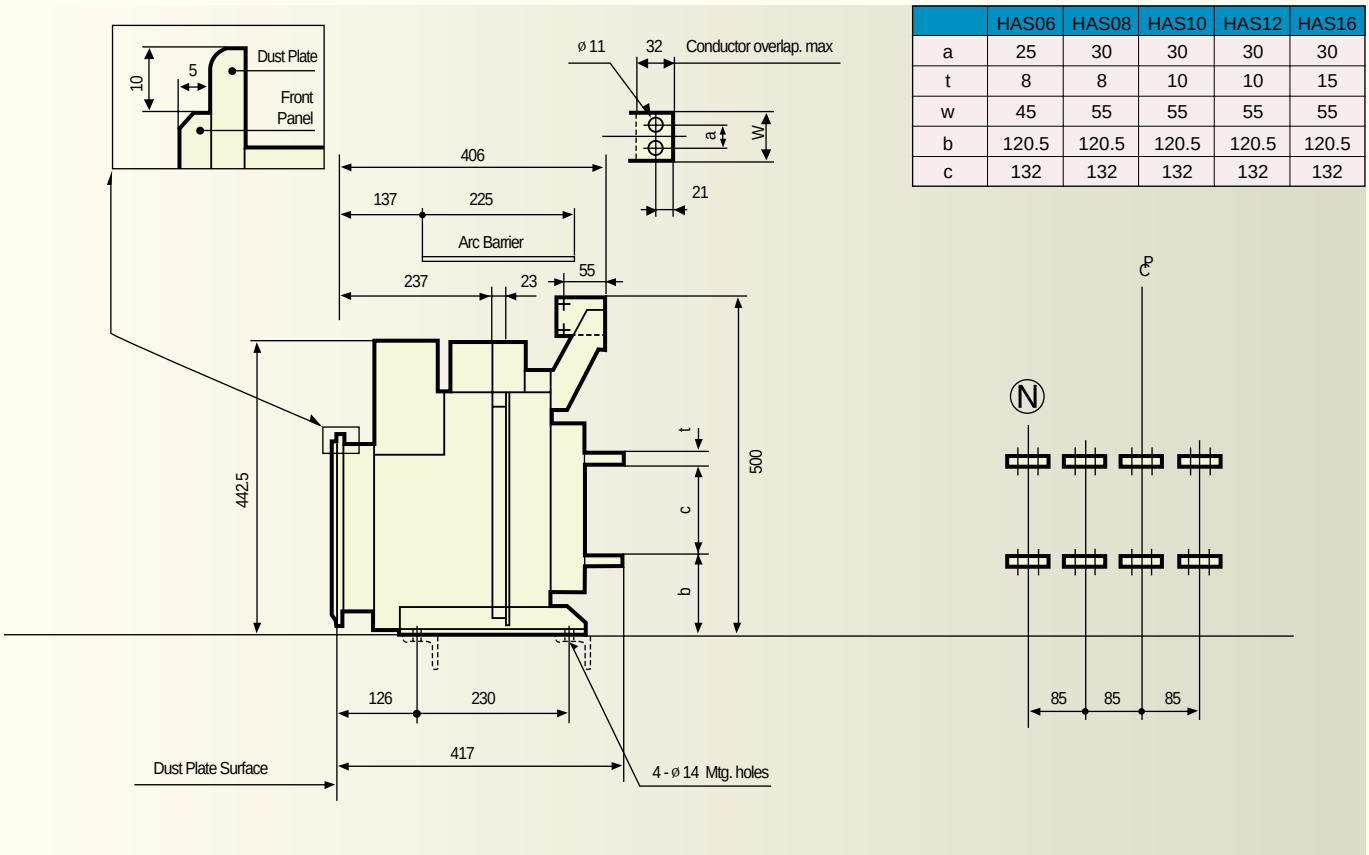
FIXED TYPE



	HAS06	HAS08	HAS10	HAS12	HAS16
a	25	30	30	30	30
t	8	8	10	10	15
w	45	55	55	55	55



	HAS06	HAS08	HAS10	HAS12	HAS16
a	25	30	30	30	30
t	8	8	10	10	15
w	45	55	55	55	55
b	120.5	120.5	120.5	120.5	120.5
c	132	132	132	132	132

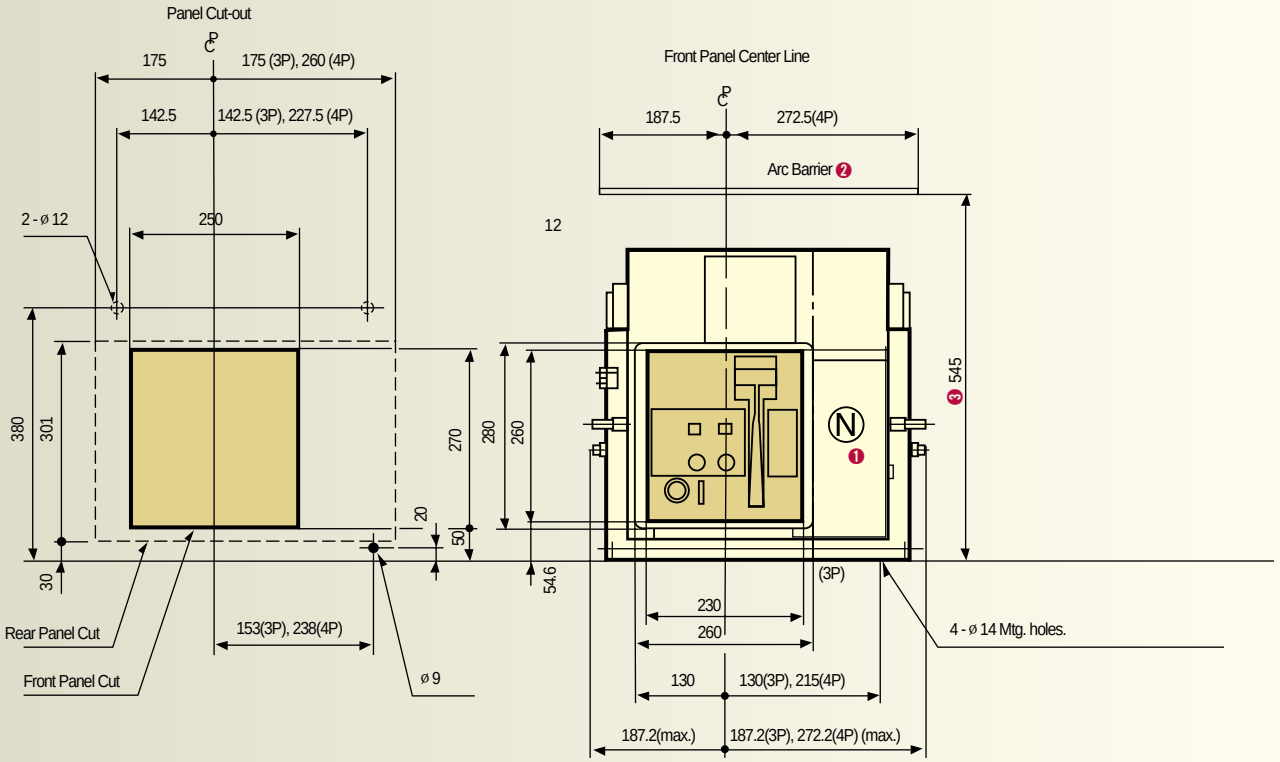


Outline Dimensions

◉ Type HAS20

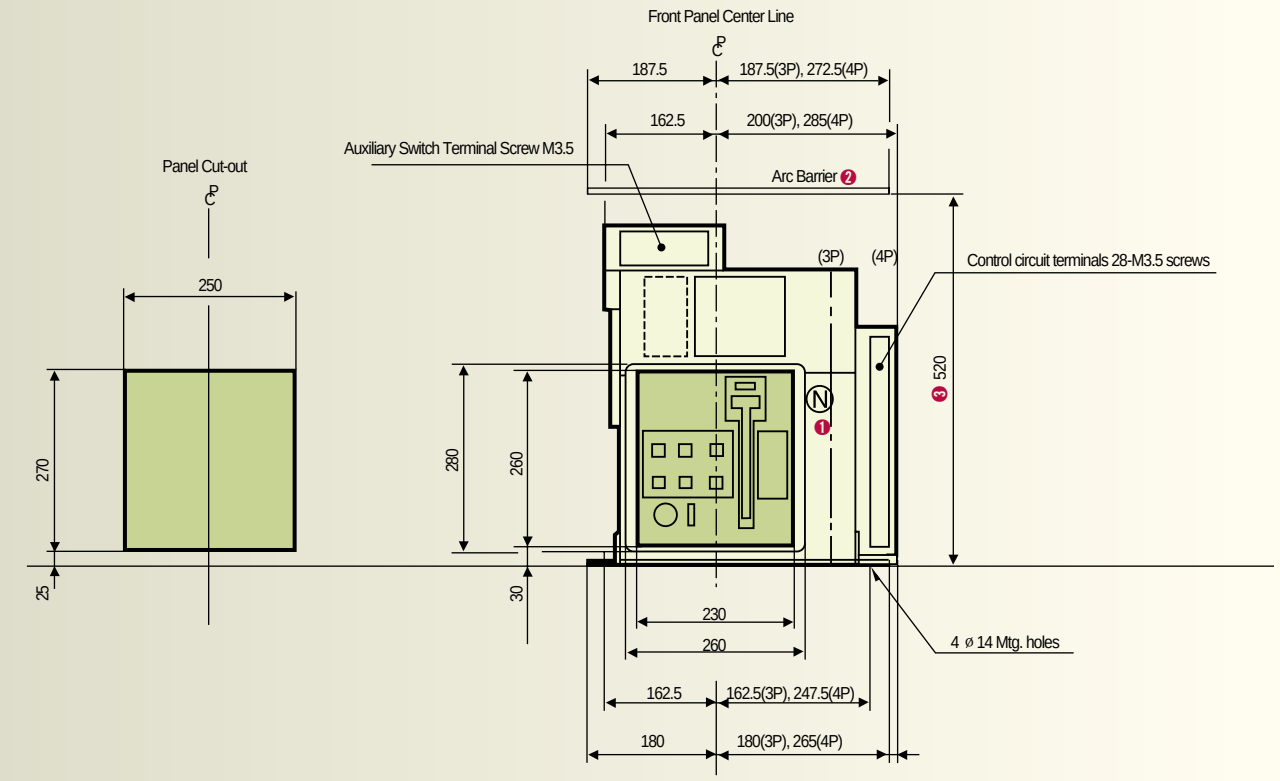
Scale 1/10

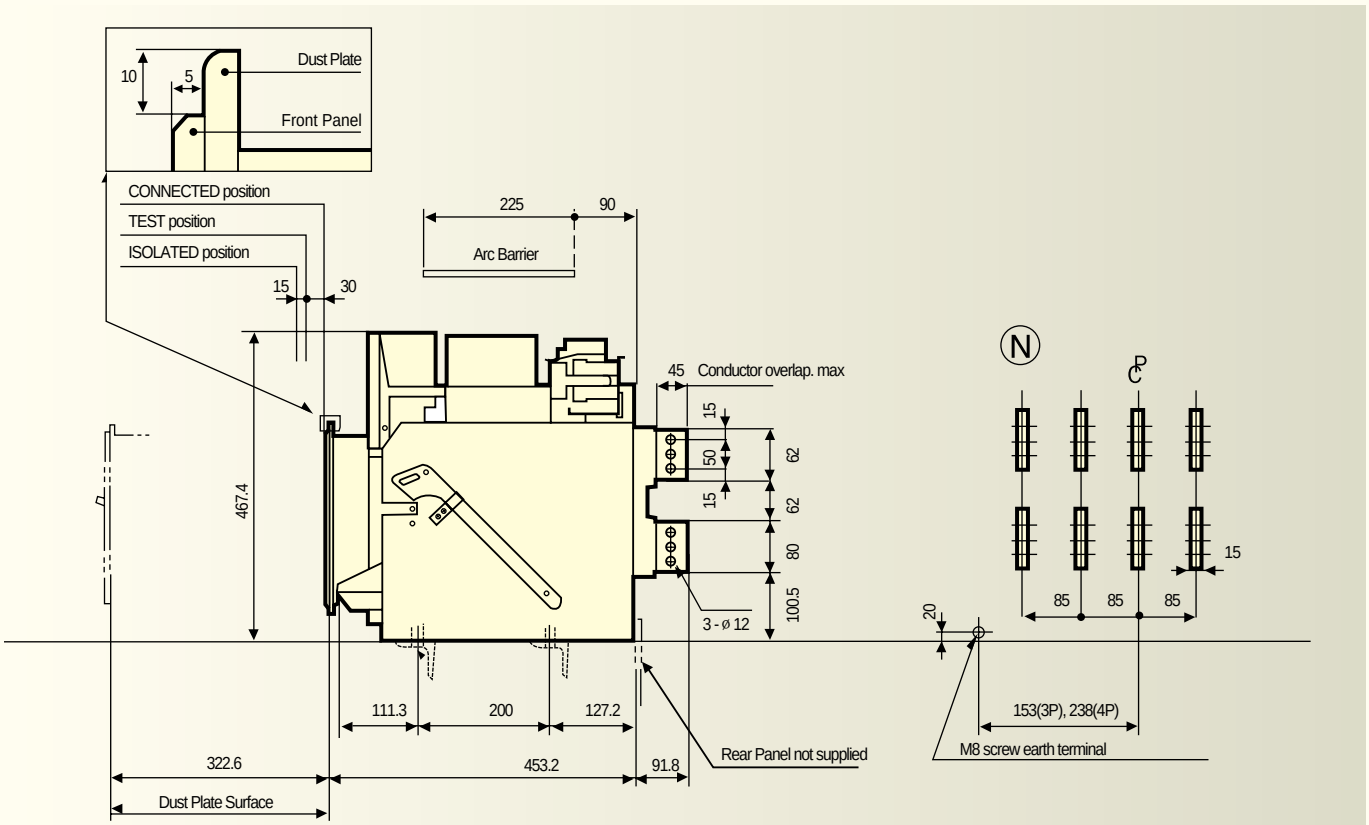
DRAW-OUT TYPE

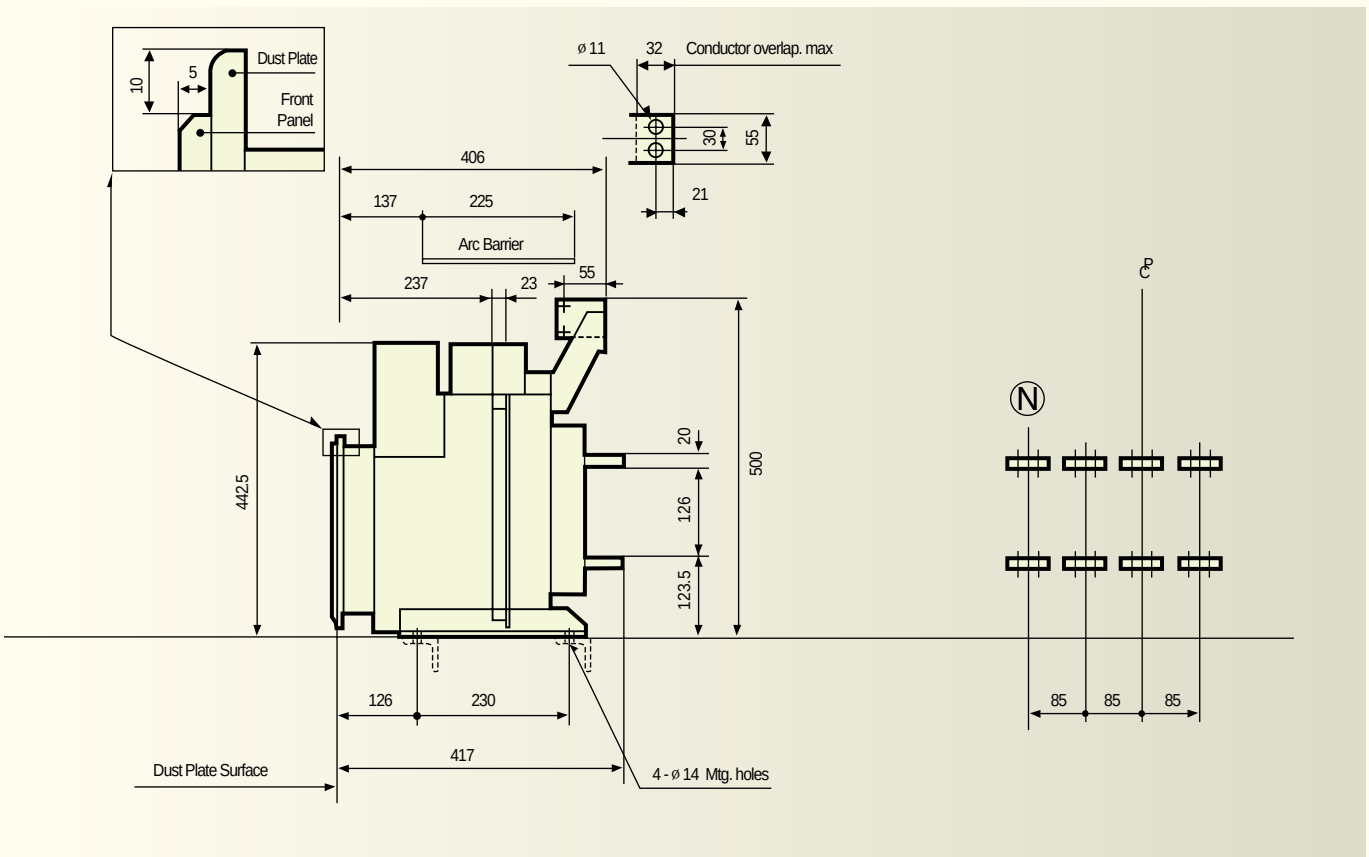


Note : ❶ Ⓝ is neutral pole of 4-pole breaker
❷ Use arc barrier of a heat and flame resistant insulating material.
❸ When no arc barrier is used, the minimum requierd distance is 650mm with respect to electrical devices, grounded metal parts etc, located above.

FIXED TYPE




Dust Plate
Front Panel
10
5
CONNECTED position
TEST position
ISOLATED position
15
30
225
90
Arc Barrier
45
Conductor overlap. max
15
50
15
62
62
80
100.5
3 - ø 12
467.4
111.3
200
127.2
322.6
453.2
91.8
Dust Plate Surface
Rear Panel not supplied
N
P
C
15
85
85
85
20
153(3P), 238(4P)
M8 screw earth terminal


Dust Plate
Front Panel
10
5
ø 11
32
Conductor overlap. max
30
55
21
406
137
225
Arc Barrier
237
23
55
442.5
20
126
123.5
500
126
230
417
Dust Plate Surface
4 - ø 14 Mtg. holes
N
P
C
85
85
85

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