

# HRC

## Residual Current Circuit Breaker

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# Feature

## HRC Residual Current Circuit Breaker

RCCB (also popularly known as ELCB) is a mechanical switching device designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the leakage current attains a given value under specified conditions. Hyundai offers a wide range of RCCBs for protecting human life against fatal electric shocks as well as for providing protection against fire caused by earth faults.





## Product Feature

HD HYUNDAI ELECTRIC introduces the HRC series of RCCBs rating from 16 A to 125 A. The range offers a variety of feature such as conditional short circuit breaking capacity of 10 kA across entire range in accordance with IEC/EN 61008-1, it also incorporates features like inscription window, safety terminal, dual termination, positive contact indication, field fittable auxiliary contacts, test button for regular inspection. We have CB certification for all types of RCCB such as AC/A/A-APR/F/B.

### Deluxe Type

### Standard Type



#### Product Performance

- Test button for regular inspection
- Conditional short-circuit current capacity 10 kA
- Advance neutral

- Type AC/A/A-APR/F/B type
- RCCB test button for regular inspection
- Compact structure and external design
- Conditional short-circuit current capacity 10 kA
- Time delayed Type (S)



#### Product Structure

- Inscription window
- Simple and robust operating mechanism
- Dual termination for bus-bar as well as cable connection
- N phase at the left pole
- Test button

- Dual termination for bus-bar as well as cable connection
- N phase at the left pole
- There are two indication windows on the surface, the upper one is for ON/OFF indication and the lower one is for leakage fault indication
- The special shape is added to the cage lug so that the cable is firmly fastened and does not fall easily
- Test button



#### Accessories

- AUX/ALT



#### Specification

- IEC/EN 61008-1

- IEC/EN 61008-1

## Product Overview





Deluxe Type



Standard Type

# Selection Table

## HRC (Deluxe Type)

Model	HRC63, 63 AF	HRC100, 125 AF
		
Reference Standard	IEC/EN 61008-1	IEC/EN 61008-1
No. of Poles	2P (1P + N), 4P (3P + N)	2P (1P + N), 4P (3P + N)
N Phase Position	Left	Left
Rated Current (In)	16, 25, 32, 40, 50, 63 A	80, 100, 125 A
Rated Voltage (Ue)	AC 240/415 V	AC 240/415 V
Rated Frequency (F)	50/60 Hz	50/60 Hz
Rated Conditional Short Circuit Current (Isc)	10 kA	10 kA
Rated Residual Operating Current (IΔn)	30, 100, 300	30, 100, 300
Rated Making Breaking Capacity (Im)	630 A or 10 In whichever is greater	630 A or 10 In whichever is greater
Operating Characteristics in Presence of Residual Current with d.c Components	AC / A	AC / A
Trip Time	1 IΔn < 300 ms, 5 IΔn < 40 ms	1 IΔn < 300 ms, 5 IΔn < 40 ms
Rated Insulation Voltage (Ui)	500 V	500 V
Rated Impulse Voltage (Uimp)	4 kV	4 kV
Dielectric Strength	2.5 kV	2.5 kV
Electrical/Mechanical Endurance (no. of operations) Minimum	10,000/20,000	10,000/20,000
Operating Temperature	-40 °C to + 55 °C	-40 °C to + 55 °C
Humidity	95 % RH	95 % RH
Terminal Capacity (max)	35 mm <sup>2</sup>	50 mm <sup>2</sup>
Tightening Torque	2 N·m	2.5 N·m
Vibration	3 g	3 g
Shock Resistance	40 mm free fall	40 mm free fall
Protection Class	IP20	IP20
Positive Contact Indication	Red-ON, Green-OFF	Red-ON, Green-OFF
Net Weight in kg	0.215 kg (for 2P) ; 0.335 kg (for 4P)	0.230 kg (for 2P) ; 0.404 kg (for 4P)
Dimensions (H x D x W)/Pole in mm	87.5 x 73.0 x 35.9 mm (for 2P) ; 87.5 x 73.0 x 71.8 mm (for 4P)	87.5 x 73.0 x 35.9 mm (for 2P) ; 87.5 x 73.0 x 71.8 mm (for 4P)
Mounting	Clip on DIN Rail (35 mm x 7.5 mm)	Clip on DIN Rail (35 mm x 7.5 mm)
Installation Position	Vertical/Horizontal	Vertical/Horizontal
Case & Cover	Molded, flame retardant thermoplastic material	Molded, flame retardant thermoplastic material
Busbar Connections	Pin/Fork type	Pin/Fork type
Auxiliary Contacts	Yes	Yes

## HRC (Standard Type)

Model	HRC63S, 63 AF	HRC100S, 125 AF
		
Reference Standard	IEC/EN 61008-1	IEC/EN 61008-1
No. of Poles	2P (N + 1P), 4P (N + 3P)	2P (N + 1P), 4P (N + 3P)
N Phase Position	Left	Left
Rated Current (In)	6, 10, 13, 15, 16, 20, 25, 32, 40, 50, 63 A	80, 100, 125 A
Rated Voltage (Ue)	AC 240/415 V	AC 240/415 V
Rated Frequency (F)	50/60 Hz	50/60 Hz
Rated Conditional Short Circuit Current (Isc)	10 kA	10 kA
Rated Residual Operating Current (IΔn)	10, 30, 100, 300, 500 mA (10 mA: up to 40 A)	30, 100, 300, 500 mA
Rated Making Breaking Capacity (Im)	500 A or 10 In whichever is greater	500 A or 10 In whichever is greater
Operating Characteristics in Presence of Residual Current with d.c Components	AC / A / A-APR / F / B type	AC / A / A-APR / F / B type
Trip Time	1 IΔn < 300 ms, 5 IΔn < 40 ms	1 IΔn < 300 ms, 5 IΔn < 40 ms
Rated Insulation Voltage (Ui)	690 V	690 V
Rated Impulse Voltage (Uimp)	4 kV	4 kV
Dielectric Strength	2.5 kV	2.5 kV
Electrical/Mechanical Endurance (no. of operations) Minimum	10,000/20,000	10,000/20,000
Operating Temperature	-40 °C to + 55 °C	-40 °C to + 55 °C
Humidity	95 % RH	95 % RH
Terminal Capacity (max)	25 mm <sup>2</sup>	50 mm <sup>2</sup>
Tightening Torque	2.5 N·m	2.5 N·m
Vibration	3 g	3 g
Shock Resistance	40 mm free fall	40 mm free fall
Protection Class	IP20	IP20
Positive Contact Indication	Red-ON, Green-OFF	Red-ON, Green-OFF
Net Weight in kg	0.200 kg (for 2P) ; 0.310 kg (for 4P)	0.230 kg (for 2P) ; 0.370 kg (for 4P)
Dimensions (H x D x W)/Pole in mm	81.0 x 74.0 x 35.8 mm (for 2P) 81.0 x 74.0 x 71.6 mm (for 4P)	90.9 x 74.0 x 35.8 mm (for 2P) 90.9 x 74.0 x 71.6 mm (for 4P)
Mounting	Clip on DIN Rail (35 mm x 7.5 mm)	Clip on DIN Rail (35 mm x 7.5 mm)
Installation Position	Vertical/Horizontal	Vertical/Horizontal
Case & Cover	Molded, flame retardant thermoplastic material	Molded, flame retardant thermoplastic material
Busbar Connections	Pin/Fork type	Pin/Fork type
Auxiliary Contacts	No	No

# Accessory (Deluxe Type)

## Auxiliary Contact + Alarm Trip (AXT)

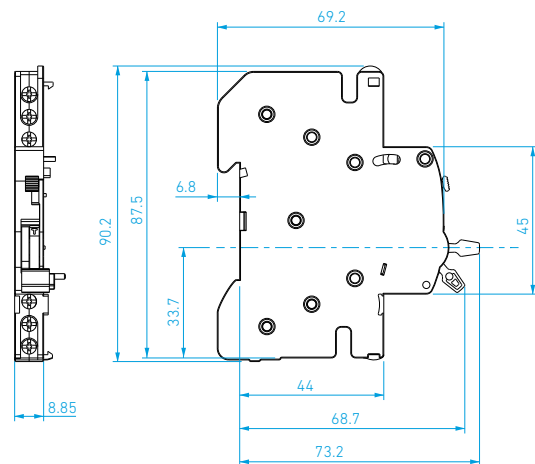
### Technical Specification

Standard Conformity	IEC/EN 60947-5-4
Current Carrying Capacity (max)	6 A
Rated Voltage (Ue)	AC 240 V
Contact Configuration	1NO + 1NC
Rated Insulation Voltage	AC 500 V
Rated Frequency (F)	50/60 Hz
Utilization Category	AC 12
Electrical Endurance (no. of operations)	10,000
Terminal Capacity (max)	2.5 mm <sup>2</sup>
Protection Class	IP20
Power Loss	3 Watts
Dimensions (H x D x W)	90.2 x 73.2 x 8.85 mm
Net Weight	36 g
Mounting	Left side of RCCB (HRC63/100), Common use of AXT HGD125

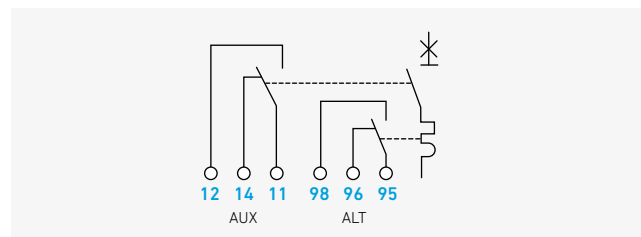
## Ordering Information

AXT HGD125	AUX/ALT
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## Dimension

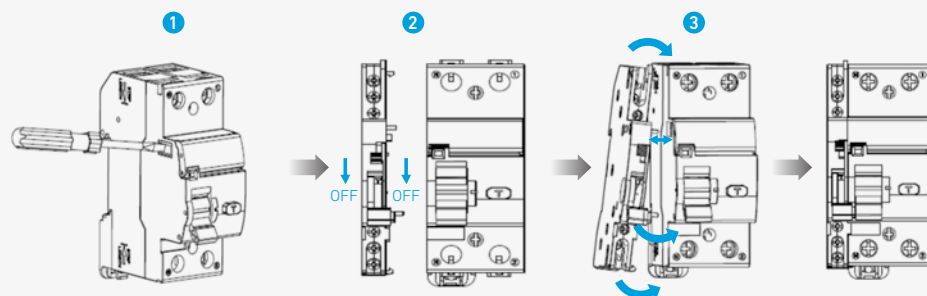


## Circuit Diagram

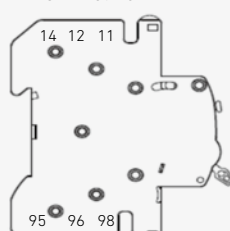


## Assembling with RCCB (HRC Accessories)

- 1 Remove the window sticker of the protection device with screw driver or by hand
- 2 Make sure the knob is in OFF position  
Caution: Don't mount in ON position
- 3 Rotate the AXT so as to bring it nearer to the protection device for locking. Adjust the locks present at the upper end of AXT in such a way that they get fitted in slots present in protection device



Terminal No.



11-12 - ON } AUX  
11-14 - OFF } AUX

95-96 - ON/OFF } ALT  
95-98 - TRIP } ALT

# Accessory Ordering Information

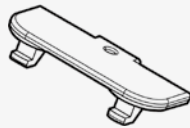
## Deluxe Type

Type		Code	Description
HRC63	AXT	AXT HGD125	AUX/ALT

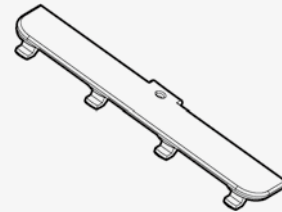
## Standard Type

Type		Code	Description
HRC63S	TCF	TCF HRC63S 2P TCF HRC63S 4P	RCCB terminal cover with sealing structure

2P



4P



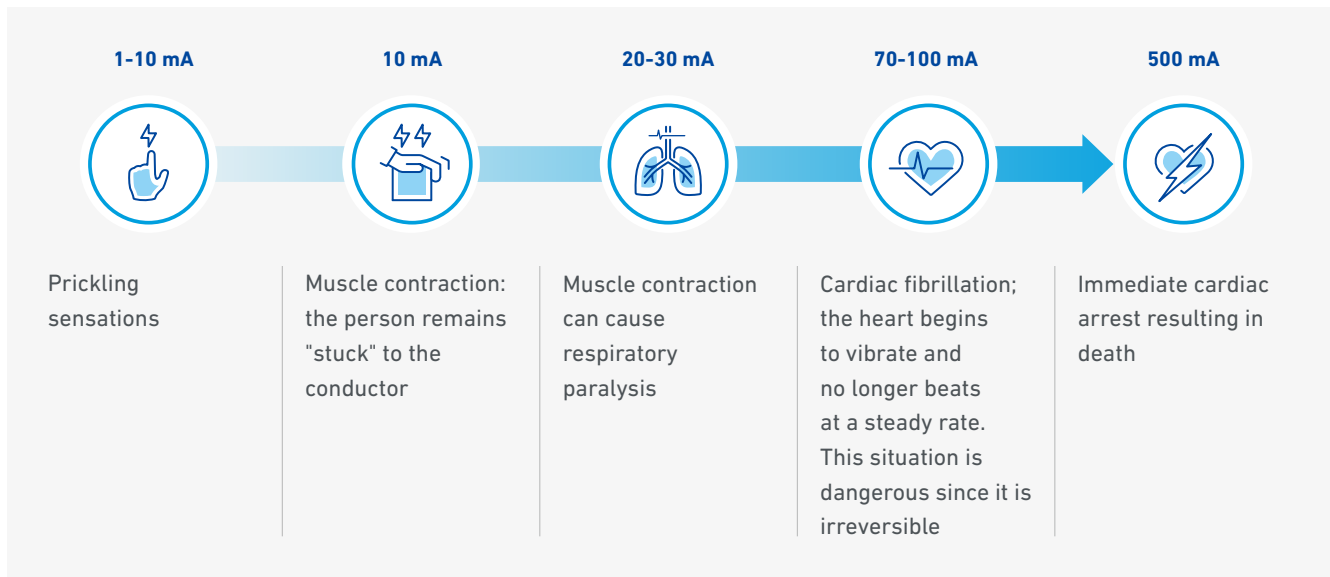
# Technical Data

## Standard Use Environment

The use of exposed, substandard, badly wired, wrongly connected or damaged equipment as well as frayed or badly repaired cables reduces the safety of an installation and increases the risk of person receiving an electric shock. RCCBs are electrical devices which afford a very high degree of protection against the risks of electrocution and fire caused by earth faults.

### Protection Against Electrocution

Electrocution is a passage of current through human body, which is dangerous. The flow of current through human body affects vital functions of breathing & heartbeat. Effect of electric current through human body has been well researched and following chart summarizes the results:



However, electrocution should not be viewed in terms of "current" alone, but in terms of "contact voltage". A person gets electrocuted by coming in contact with an object that has a different potential from his/her own. The difference in potential causes the current to flow through the body.

The human body has known limits:

- Under normal dry conditions, voltage limit = 50 V
- In damp surroundings, voltage limit = 25 V

A correctly chosen RCCB can detect small currents flowing to earth and reduces the risk of electrocution.

### Protection Against Indirect Contact

Over current protection devices like MCB are unable to act promptly on small earth leakage currents. To comply with wiring regulations, the earth fault loop impedance in Ohms, multiplied by the rated tripping current of the RCCB in amperes must not exceed 50.

### Example

For an RCCB with a rated tripping current of 30 mA, the maximum permissible earth fault loop impedance is calculated as follows:

$$Z_s (\text{max}) = 50 / I_n = 50 / 0.03 = 1,666$$

### Protection Against Fire

The majority of fires which occur as a result of faulty wiring are started by current flowing to earth. Fire can be started by fault current of less than 1 amp. The normal domestic overload protective device such as a fuse or MCB will not detect such a small current. A correctly chosen RCCB will detect this fault current and interrupt the supply, hence, reducing the risk of a fire starting.

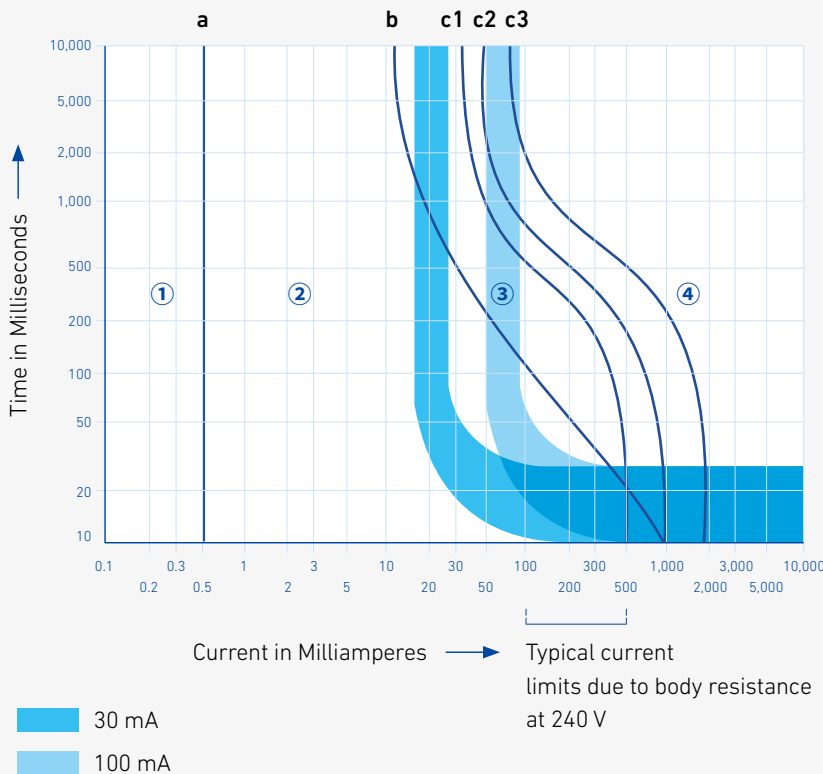
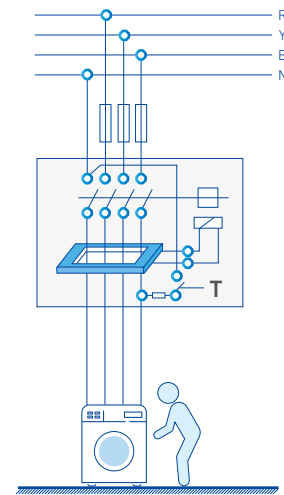
Rated Tripping Current of the RCCB	Maximum Permissible Earth Fault Loop Impedance in
10 mA	5,000
30 mA	1,666
100 mA	500
300 mA	166



### Working Principle

The RCCB works on the current balance principle. The supply conductors, i.e. the phases and the neutral, are passed through a toroid and form the primary windings of a current transformer. Its secondary winding is connected to a highly sensitive electromagnetic trip relay, which operates the trip mechanism.

In a normal circuit, sum of the currents in phases, is equal to the current in the neutral and the vector sum of all currents is equal to zero. If there is any insulation fault in the current and leakage current flows to earth, the currents do not balance and their vector sum is not equal to zero. This imbalance is detected by the core balanced current transformer, and the RCCB is tripped and supply to load is interrupted. The trip mechanism is operated at a residual current between 50-100 % of its rated tripping current.



**Zone** Physiological effects

**Zone 1** Usually no reactions

**Zone 2** Usually no harmful physiological effects

**Zone 3** Usually no organic damage to be expected. Likelihood of muscular contraction and difficulty in breathing, reversible disturbances of formation and conduction of impulse in the heart and transient cardiac arrest without ventricular fibrillation increases with current magnitude and time.

**Zone 4** In addition to the effects of Zone 3, probability of ventricular fibrillation increased upto 5 % (curve C<sub>2</sub>) upto 50 % (curve C<sub>3</sub>) and above 50 % beyond curve C<sub>3</sub>. It increases with magnitude and time, and pathophysiological effects such as cardiac arrest, breathing arrest and heavy burns may occur.

# Technical Data

## Residual Current Circuit Breaker 16 A-100 A

### Sensitivity Selection

#### • 30 mA

A 30 mA RCCB will provide a high degree of protection against electrocution in an accidental shock hazard situation.

The current flowing through human body could be between 80 mA and 240 mA depending on the resistance of the human body and the voltage across it.

To be within zone of the IEC curve, it is necessary for the RCCB to operate within 50 ms at 240 mA and 150 ms at 80 mA.

Both these conditions are satisfied by 30 mA RCCB.

For households, individual outlets, wet areas and temporary installations, RCCB with sensitivity not exceeding 30 mA is advisable.

#### • 100 mA

A 100 mA RCCB will normally give high degree of protection against electrocution but there is a possibility that the shock current could fall below the tripping level of RCCB. This could occur if additional resistances to that of human body are included in the earth path.

The 100 mA RCCB protects against leakage currents and indirect contact with earth loop impedance up to 500 ohms.

#### • 300/500 mA

A 300/500 mA RCCB may be used where only fire protection is required. e.g., on lighting circuits, where the risk of electric shock is small. 300/500 mA RCCB will not give any protection against electrocution.

### Selection of RCCB Type

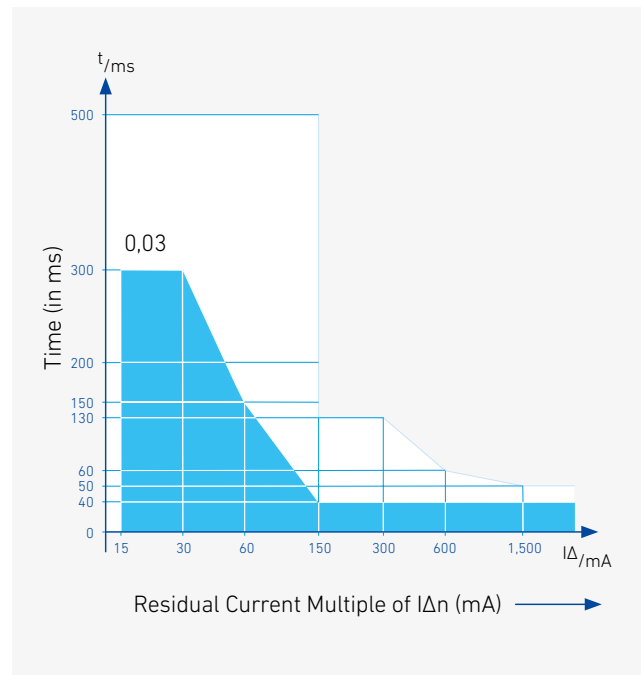
#### RCCB Type AC

AC type RCCB are used for residual sinusoidal alternating current.

#### RCCB Type A

A type RCCB is used for residual sinusoidal alternating currents and residual pulsating direct currents, whether suddenly applied or slowly rising. It can therefore handle the residual current waveforms which can occur in the power supply units of single-phase loads with electronic components (e.g. ECG, dimmer switches). This type of residual current protective.

### Actuation Time Characteristics





# Residual Current Device Solution

## Overview

### • Type B

Full type F features.

+ Detection of smooth DC currents.

### • Type F

Full type A-APR features.

+ Detection of high frequency currents up to 1 kHz.

### • Type A-APR

Full type A features.

+ High immunity to unwanted tripping.

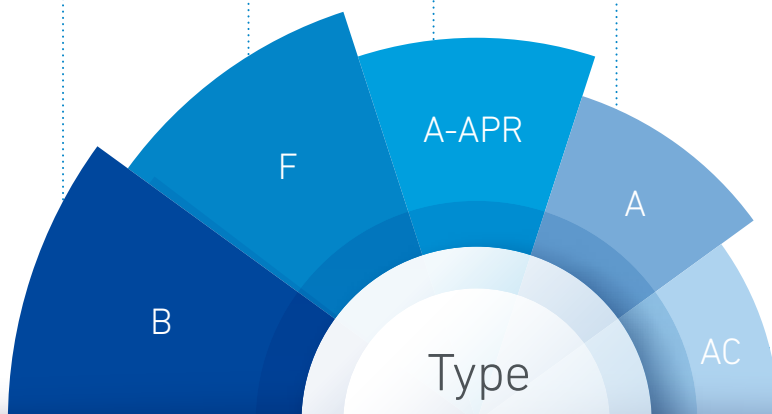
### • Type A

Full type AC features.

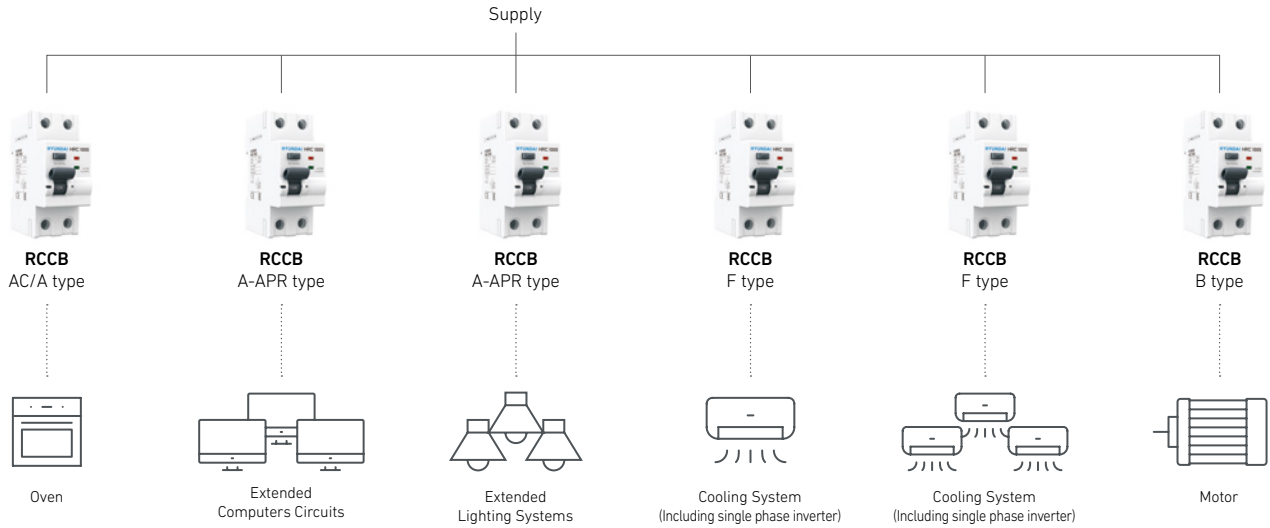
+ Detection of pulsating current with DC components.

### • Type AC

Alternating current only.



## Application



### Generating high frequency interference

#### (Current peaks, harmonics)

- Single-phase variable speed industrial drives (air conditioning, heating, pump)
- Powerful IT equipment, telecommunication equipment
- Heated floor
- Fluorescent lighting powered by extra low voltage transformer, by electronic ballast
- Variable luminosity lighting
- Capacitor banks
- Freezer, cold room



### No special characteristics

- General purpose power sockets
- LED lighting
- Hair dryer, TV, etc.
- Electric heater, water heater



### Including a rectifier (Single-phase)

- Induction cooking appliances
- Washing machines
- Tumble-dryer
- Single-phase UPS
- Single-phase Photovoltaic system
- Machines including diodes, capacitors and rectifiers
- Motors
- Machine tools



### Including an anti-harmonic filter in the power supply or with high availability requirement

- Computer peripheral devices (printers, scanners, etc.)
- Rack of computers and servers
- Hospital
- Supermarket cash registers



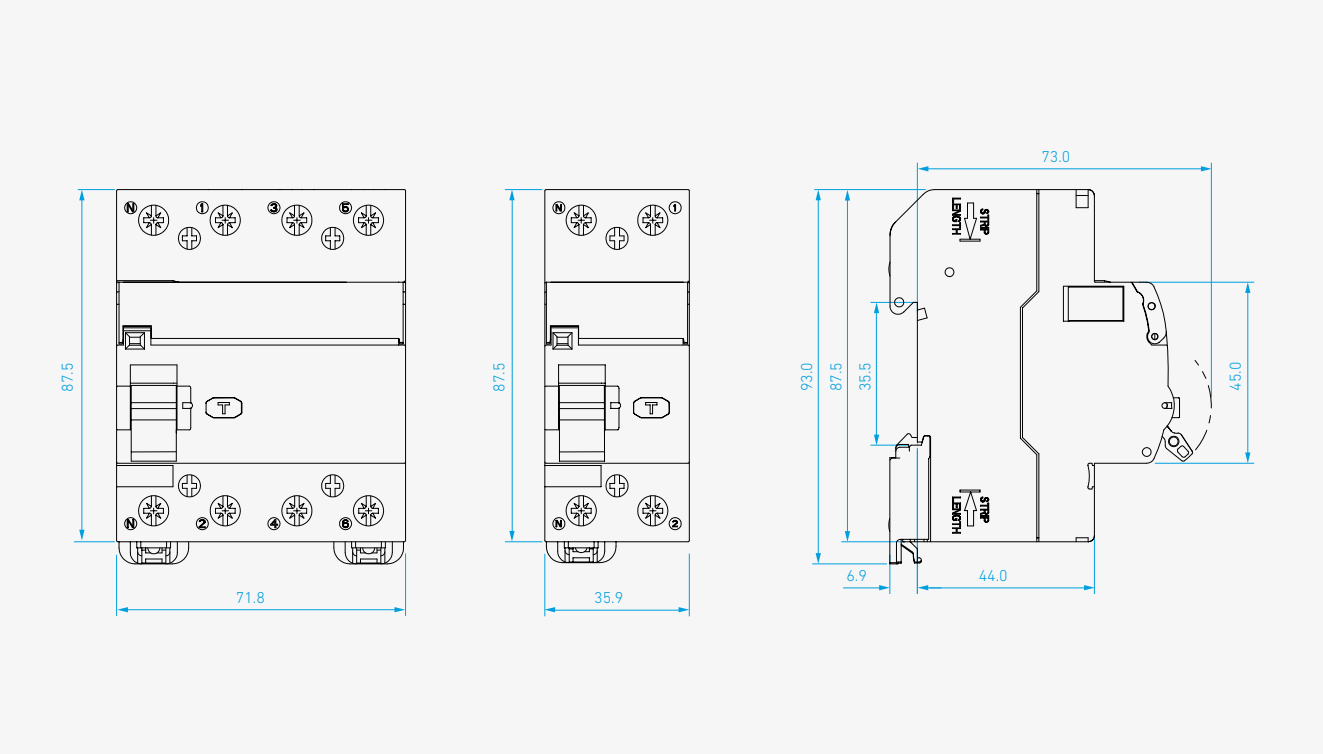
### Including a rectifier (Three-phase)

- Three-phase variable speed industrial drives (motors : cranes, elevators, heating, ventilation, air conditioning, pumps)
- Single/three-phase chargers for EV
- Three-phase UPS (rectifier and inverter)
- Three-phase Photovoltaic system
- Medical equipment with DC current loads

# Dimension

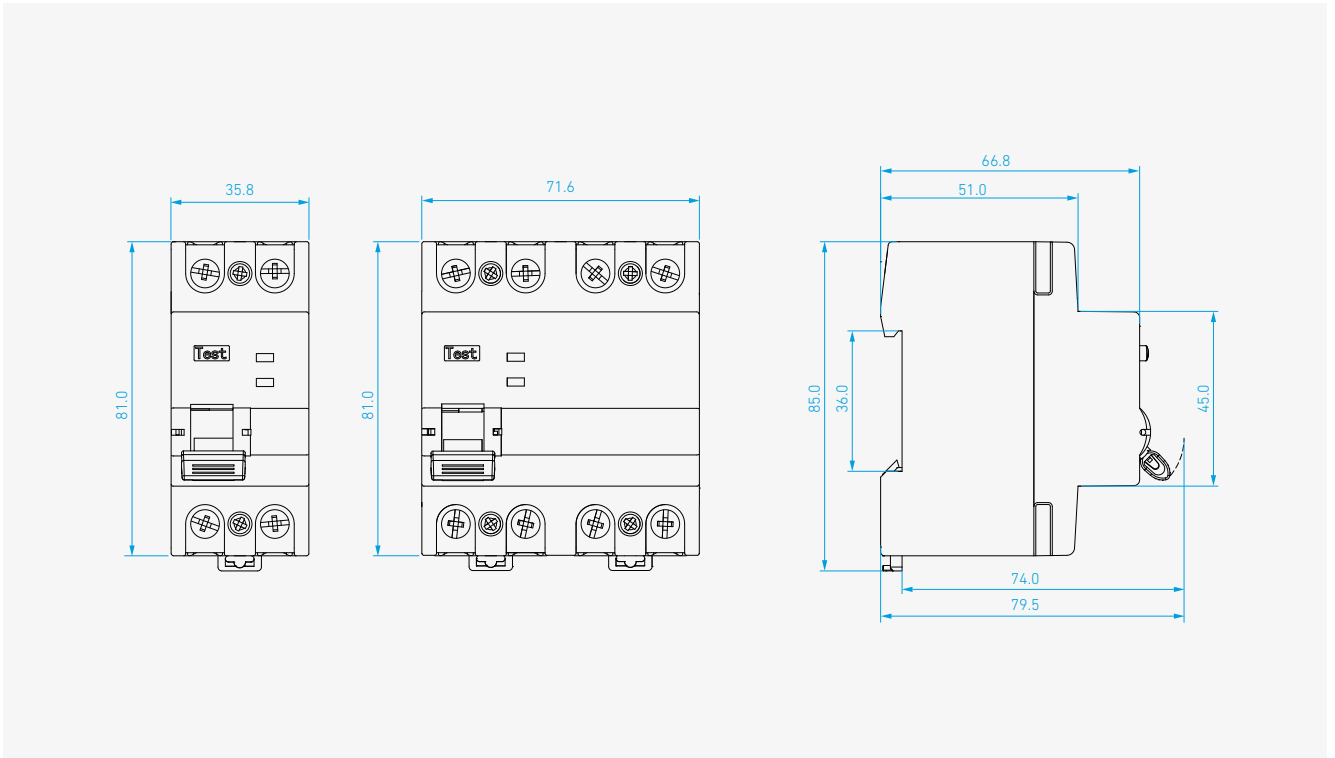
## HRC (Deluxe Type)

HRC63, 63 AF/HRC100,125 AF

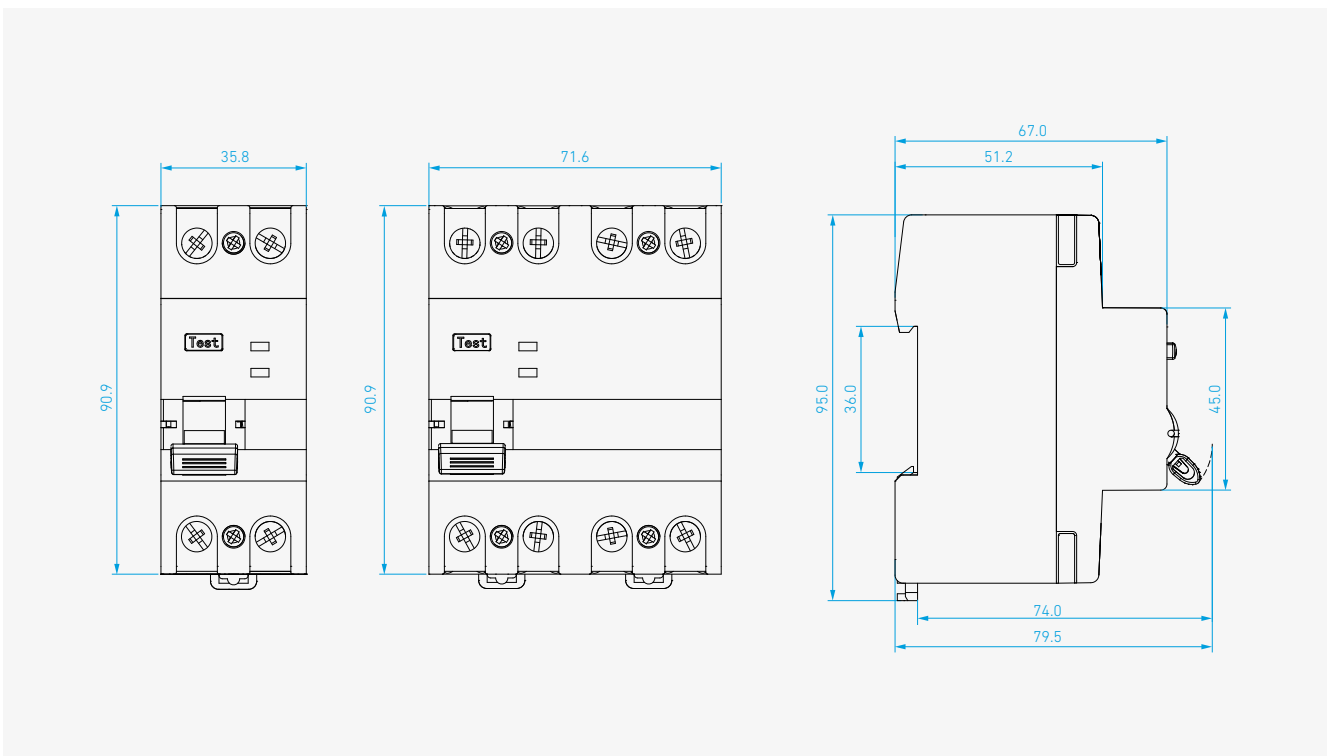


## HRC (Standard Type)

### HRC63S, 63 AF

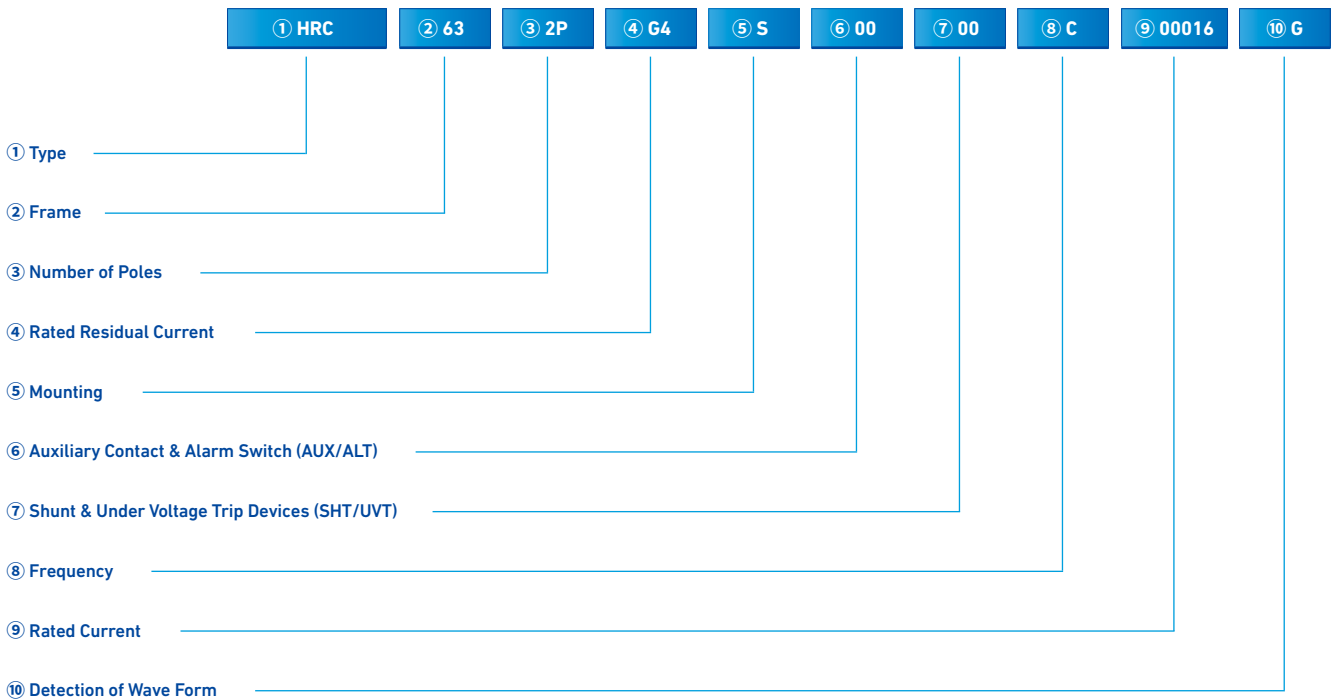


### HRC100S, 125 AF



# RCCB Ordering Information

## Ordering Guidelines (Deluxe Type)



① Type	
HRC	Residual current circuit breaker

② Frame	
63	63 AF (Deluxe type), N-left
100	100 AF (Deluxe type), N-left

③ Number of Poles	
2P	2 Pole (N + 1 Pole)
4P	4 Pole (N + 3 Pole)

④ Rated Residual Current	
G4	30 mA
G5	100 mA
G7	300 mA

⑤ Mounting	
S	Front connection

⑥ Auxiliary Contact & Alarm Switch	
00	Non-attachment

⑦ Shunt & Under Voltage Trip Devices	
00	Non-attachment

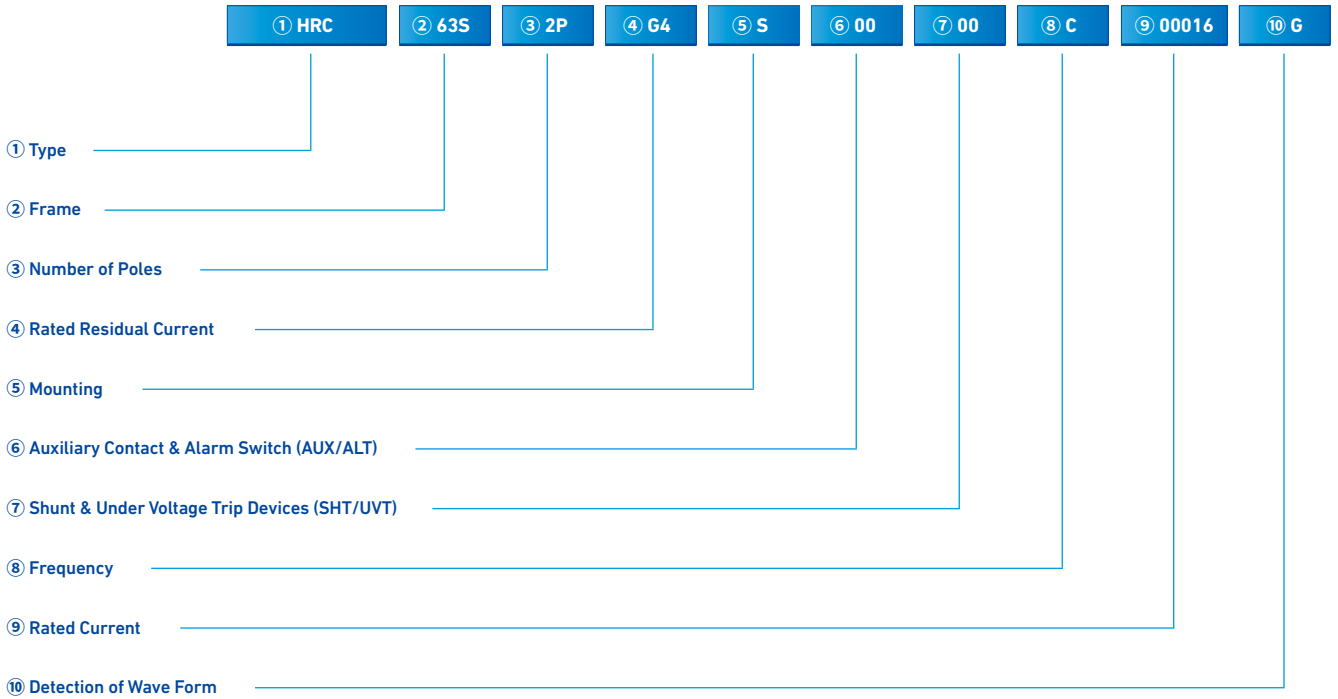
⑧ Frequency	
C	50/60 Hz

⑨ Rated Current	
00016	16 A
00025	25 A
00040	40 A
00050	50 A
00063	63 A
00080	80 A
00100	100 A
00125	125 A

⑩ Detection of Wave Form	
G	AC type
F	A type



## Ordering Guidelines (Standard Type)



① Type	
HRC	Residual current circuit breaker

② Frame	
63S	63 AF (Standard type), N-left
100S	100 AF (Standard type), N-left

③ Number of Poles	
2P	2 Pole (N + 1 Pole)
4P	4 Pole (N + 3 Pole)

④ Rated Residual Current	
G2	10 mA
G4	30 mA
G5	100 mA
G7	300 mA
G8	500 mA






⑤ Mounting	
S	Front connection
T	Time delayed (63 AF & A type only)

⑥ Auxiliary Contact & Alarm Switch	
00	Non-attachment
BB	Individual package

⑦ Shunt & Under Voltage Trip Devices	
00	Non-attachment

⑧ Frequency	
C	50/60 Hz

⑨ Rated Current	
00006	6 A
00010	10 A
00013	13 A
00015	15 A
00016	16 A
00020	20 A
00025	25 A
00032	32 A
00040	40 A
00050	50 A
00063	63 A
00080	80 A
00100	100 A
00125	125 A

⑩ Detection of Wave Form	
G	AC type 
F	A type 
R	A-APR type  APR
H	F type  
B	B type 