

# HANDLING INSTRUCTION & INSPECTION AND MAINTENANCE

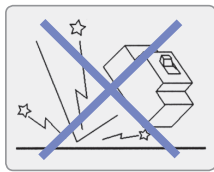
# Handling Instruction

## | Storage |

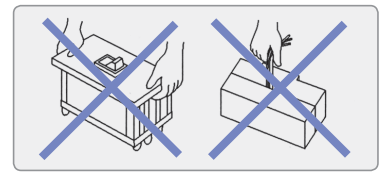
- Do not expose to corrosive gases.
- Do not expose to harmful gases including sulfur, ammonia and so on.
- Do not expose to high humidity for a long period.
- Do not expose to direct sunlight for a long period.
- Store at -20°C to +60°C without dust and humidity.
- Keep the handle in OFF position.

## | Transportation |

- Do not drop or apply shock during transportation. These can cause malfunctions in the breaker.



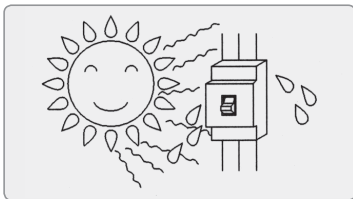
- Hold the breaker body for transportation. Do not hold terminal bus bar or external lead cable of accessories.



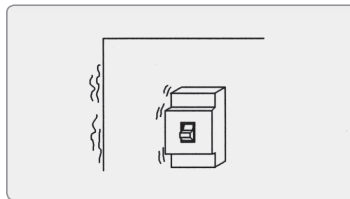
## | Standard operating condition for normal performance |

Ambient temperature	-5°C – +40°C, the average temperature for 24 hours shall not exceed 35°C
Relative humidity	45 - 85%
Vibration & shock	without excessive vibration and shock
Altitude	up to 2,000m
Surrounding	without excessive water vapor, oil vapor, smoke, dust, salts and corrosive materials

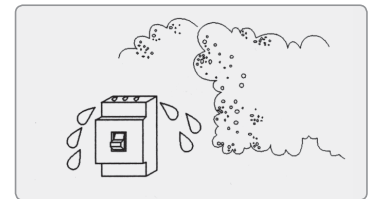
## | Installation and connection |



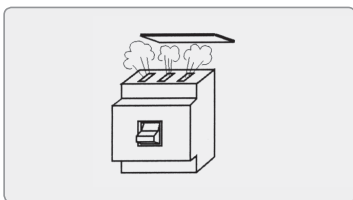
- **Keep away from direct sunlight.**  
High temperatures can cause malfunctions.



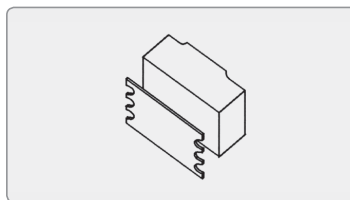
- **Avoid any vibration or shock.**  
If vibration or shock is expected, install breaker with shock absorber.



- **Keep away from dust or metal pieces.**  
When any work that accompanies dust or metal cutting is required, please cover the breaker first.

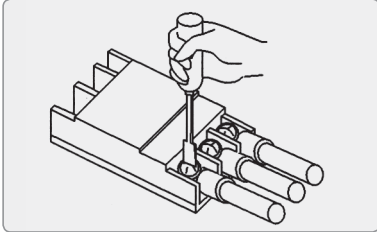


- **Do not cover the terminal part completely for arc exhaust.**  
Otherwise the breaking capacity may be decreased.



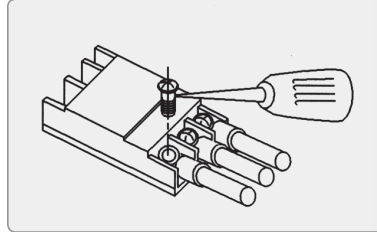
- **Do not take off the black insulation plate in back side of breaker.**  
Otherwise insulation shall be decreased or not secured.

## | Installation and connection |



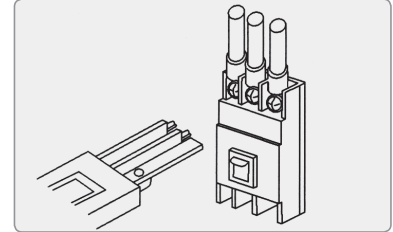
- **Tighten the terminal screws to proper torque specified in manual.**

The loose connection may cause overheating, and excessive torque may damage screws and terminal parts.



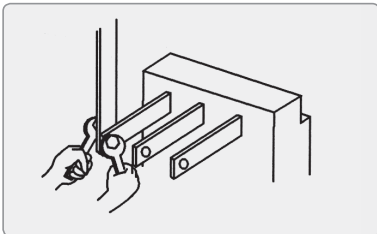
- **Do not apply lubricant on terminal parts.**

The lubricant lets screws loose and overheating occurs.



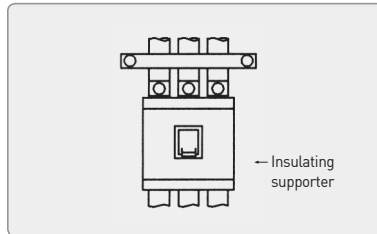
- **Insulate exposed conductors.**

To prevent short-circuit, be sure to insulate exposed conductors by interpole barrier, terminal cover, insulating tube, insulating tape and so on.



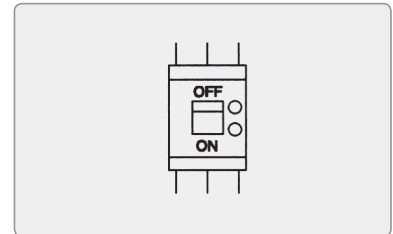
- **Do not modify the shape of studs or terminal accessories.**

Excessive force to stud and terminal accessories should also be avoided.



- **Fix each conductor in parallel.**

Short-circuit current can occur electromagnetic force between conductors, so each conductor is required to fixed firmly in parallel.



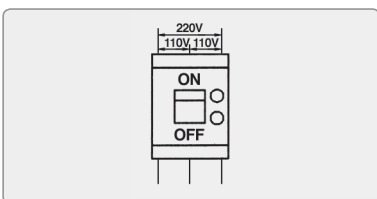
- **Reverse feeding of earth leakage circuit breaker is not allowed.**

In case of reverse feeding, power is supplied to circuit even the breaker trips, and it shall damage trip coil.

[Electromagnetic force per 1m conductor at 3 phase short-circuit] (Unit : N [kgf])

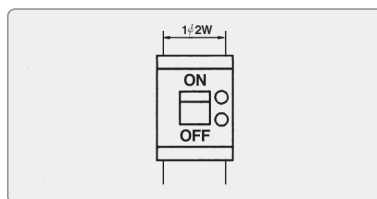
Short-circuit current / Internal power factor (kA)	Distance between conductors	
	10cm	20cm
10/0.4	490/50	245/25
18/0.3	1863/190	932/95
25/0.2	4412/450	2206/225
35/0.23	8630/880	4315/440
42/0.2	12455/1270	6277/635
50/0.2	17652/1800	8826/900
65/0.2	29910/3050	14955/1525
85/0.2	51190/5220	25595/2510
100/0.2	70804/7220	35402/3610
125/0.2	110815/11300	55408/5650

## | Connection of earth leakage circuit breaker |



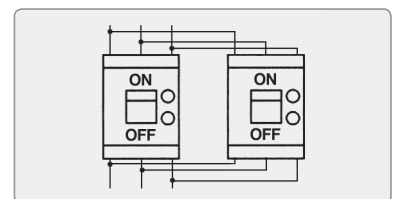
- **Single phase three line circuit**

Power line shall be connected to both side poles of breaker, and neutral line to middle pole.



- **Single phase two line circuit**

Circuit shall be connected to both side poles of breaker, and middle pole shall not be connected.



- **Parallel connection is not allowed.**

Parallel connection causes current unbalance, malfunction and trip coil damage.

# Inspection and Maintenance

## | Initial inspection |

- Please check the following prior to breaker operation.

Check point
Terminal part shall be clean from dust, metal pieces and so on.
Breaker shall not have any crack or damages.
There should be non condensation on terminal parts.
Insulation resistance should be more than 5MΩ.
Terminal screws shall be tightened with specified torque.

## | Dielectric test |

- The test shall be done in these conditions.

Main circuit		Secondary and control circuit	
Rated insulation voltage (Ui)	Test voltage	Rated insulation voltage (Uis)	Test voltage
$U_i \leq AC300V$	AC2000V	$U_{is} \leq AC60V$	AC1000V
$AC300V < U_i \leq AC600V$	AC2500V	$AC60V < U_{is} \leq AC60V$	$2U_{is} + AC1000V$ (Max. AC1500V)

- Test for earth leakage circuit breaker

Test Measuring parts		Insulation resistance test		Dielectric test	
		Handle position		Handle position	
		ON	OFF	ON	OFF
Charging parts and earth		○	○	○	○
R and S phase, S and T phase		○	○	○	○
R and T phase	Line side	×	○	×	○
	Load side	×	×	×	×
Power and line side terminal		-	○	-	○

- Insulation resistance test
  - Please use AC500V insulation resistance tester.
  - Do not measure between R and T phase. Measuring does not cause damage unless AC1000V is applied.
  - The measured resistance value shall be almost 0Ω.
- Dielectric test
  - Do not apply test voltage, if test voltage is applied by mistake, the breaker can not be used.

## | Periodic inspection |

- In order to maintain the performance of breaker and prevent the unpredicted accident, the inspection shall be accompanied after installation and operation.
- Once after one month of operation, thereafter as below.

Circumstance		Inspection cycle after installation
Normal	Clean air, no humidity	within 10 years : once 2-3 year more than 10 years : once a year more than 15 years : once 6 month
	Dust but no corrosive gas	within 10 years : once a year more than 10 years : once 6 month more than 15 years : once a month
Bad	Sulfurous gas, salinity, vapor	within 5 years : once 6 year more than 5 years : once a month
	Excessive corrosive gas	once a month

## | Inspection and processing after breaking of fault current |

- If there is no pollution in arc exhaust parts and no other abnormality, the breaker can be re-used.
- When carbonizing symptom is found around arc exhaust parts, please measure insulation resistance. If the resistance value is more than  $5M\Omega$ , no dielectric breakdown at withstand test voltage and no excessive temperature rise of terminal parts, then the breaker can be re-used.
- If the handle part is carbonized or there is metallic melting in internal of breaker, please replace it with a new one.

# Inspection and Maintenance

## | Troubleshooting |

- In case of any abnormality during breaker operation, please handle it as below.
- For cases not mentioned in below, please contact us.

### • Molded case circuit breaker

Symptom and possible cause		Troubleshooting
Overheating	<ul style="list-style-type: none"> <li>• High temperature of terminal part</li> <li>• Damage in insulation part of terminal</li> </ul>	<ul style="list-style-type: none"> <li>• Loose connection between terminal and conductor</li> <li>• Heating by resistance increase of conductor</li> <li>• Heating from connection part between terminal bus bar and breaker</li> </ul>
	<ul style="list-style-type: none"> <li>• High temperature of breaker body</li> </ul>	<ul style="list-style-type: none"> <li>• Tighten screws with specified torque</li> <li>• Replace with a new breaker</li> <li>• Tighten screws with specified torque</li> <li>• Heating by resistance increase of conductor</li> <li>• Loose internal assembly screws</li> <li>• Increase of current density from cable disconnection</li> <li>• Replace with a new breaker</li> </ul>
Inferior dielectric	<ul style="list-style-type: none"> <li>• Abnormal voltage of load side</li> </ul>	<ul style="list-style-type: none"> <li>• Excessive contact abrasion</li> <li>• Foreign substances on contact</li> <li>• Corrosion of conductor by excessive ON-OFF or corrosive gas</li> <li>• Replace with a new breaker</li> </ul>
Inability of operation	<ul style="list-style-type: none"> <li>• Inability of ON and RESET</li> </ul>	<ul style="list-style-type: none"> <li>• Inability of reset after trip</li> <li>• Non-energized UVT</li> <li>• Insufficient cooling of trip unit</li> </ul>
		<ul style="list-style-type: none"> <li>• Corrosion, damage or deformation of bimetal</li> <li>• Abnormality or damage in mechanism</li> <li>• Exhaustion of durability</li> <li>• Contact melting by excessive high breaking current</li> </ul>
Frequent trip	<ul style="list-style-type: none"> <li>• Trip at under rated current</li> </ul>	<ul style="list-style-type: none"> <li>• High ambient temperature</li> </ul>
		<ul style="list-style-type: none"> <li>• Heating by loose terminal screw connection</li> </ul>
		<ul style="list-style-type: none"> <li>• Heating from inside of breaker</li> </ul>
	<ul style="list-style-type: none"> <li>• Smaller connection conductor than specified size</li> </ul>	
<ul style="list-style-type: none"> <li>• Trip at operational current</li> </ul>	<ul style="list-style-type: none"> <li>• Trip at start-up inrush current</li> <li>• Trip at change-over in star-delta operation</li> <li>• Instantaneous trip at reverse feeding</li> </ul>	
	<ul style="list-style-type: none"> <li>• Instantaneous trip at high start-up inrush current</li> <li>• Instantaneous trip at long start-up inrush current</li> </ul>	
	<ul style="list-style-type: none"> <li>• Short-circuit between motors</li> <li>• Misconnection of SHT, UVT control circuit</li> </ul>	
Malfunction	<ul style="list-style-type: none"> <li>• Non trip at the current higher than specified</li> </ul>	<ul style="list-style-type: none"> <li>• Current breaking by line side fuse or low coordination with primary breaker</li> </ul>
		<ul style="list-style-type: none"> <li>• Extremely low ambient temperature</li> </ul>
		<ul style="list-style-type: none"> <li>• Out of rated frequency</li> </ul>

### • Earth leakage circuit breaker

Symptom and possible cause		Troubleshooting
Malfunction	<ul style="list-style-type: none"> <li>• Earth leakage test button is projected as soon as the breaker is ON</li> </ul>	<ul style="list-style-type: none"> <li>• Earth leakage current higher than trip current since increase of earth interruption capacity depending on wire length</li> </ul>
		<ul style="list-style-type: none"> <li>• Parallel connection</li> <li>• Mis-connection or disconnection of neutral line</li> </ul>
	<ul style="list-style-type: none"> <li>• Trip during normal operation</li> </ul>	<ul style="list-style-type: none"> <li>• Excessive surge</li> <li>• Induction noise by high current generating line</li> <li>• Noise of electromagnetic waves</li> </ul>
		<ul style="list-style-type: none"> <li>• Adjust the residual current</li> <li>• Install the breaker closer to the load</li> </ul>
		<ul style="list-style-type: none"> <li>• Inspect the connection and wiring</li> </ul>
		<ul style="list-style-type: none"> <li>• Remove or keep away from causes</li> </ul>

### • Accessories

Symptom and possible cause		Troubleshooting
Inability of operation or malfunction	<ul style="list-style-type: none"> <li>• Shunt trip (SHT)</li> </ul>	<ul style="list-style-type: none"> <li>• Voltage drop of control circuit</li> </ul>
		<ul style="list-style-type: none"> <li>• Coil damage by different voltage and malfunction of coil protection limit switch</li> </ul>
	<ul style="list-style-type: none"> <li>• Under voltage trip (UVT)</li> </ul>	<ul style="list-style-type: none"> <li>• Inferior mechanism</li> </ul>
		<ul style="list-style-type: none"> <li>• Different rated operational voltage</li> </ul>
	<ul style="list-style-type: none"> <li>• Auxiliary switch (AUX) and trip alarm switch (ALT)</li> </ul>	<ul style="list-style-type: none"> <li>• Damage in contact or contact operation at the current higher than rated current</li> </ul>
		<ul style="list-style-type: none"> <li>• Inferior mechanism</li> </ul>
		<ul style="list-style-type: none"> <li>• Adjust voltage to rated level</li> </ul>
		<ul style="list-style-type: none"> <li>• Replace with a new breaker</li> </ul>
		<ul style="list-style-type: none"> <li>• Replace with a new breaker</li> </ul>
		<ul style="list-style-type: none"> <li>• Apply the rated voltage to UVT</li> </ul>
		<ul style="list-style-type: none"> <li>• Repair or replace with a new breaker</li> </ul>
		<ul style="list-style-type: none"> <li>• Replace with a new breaker</li> </ul>