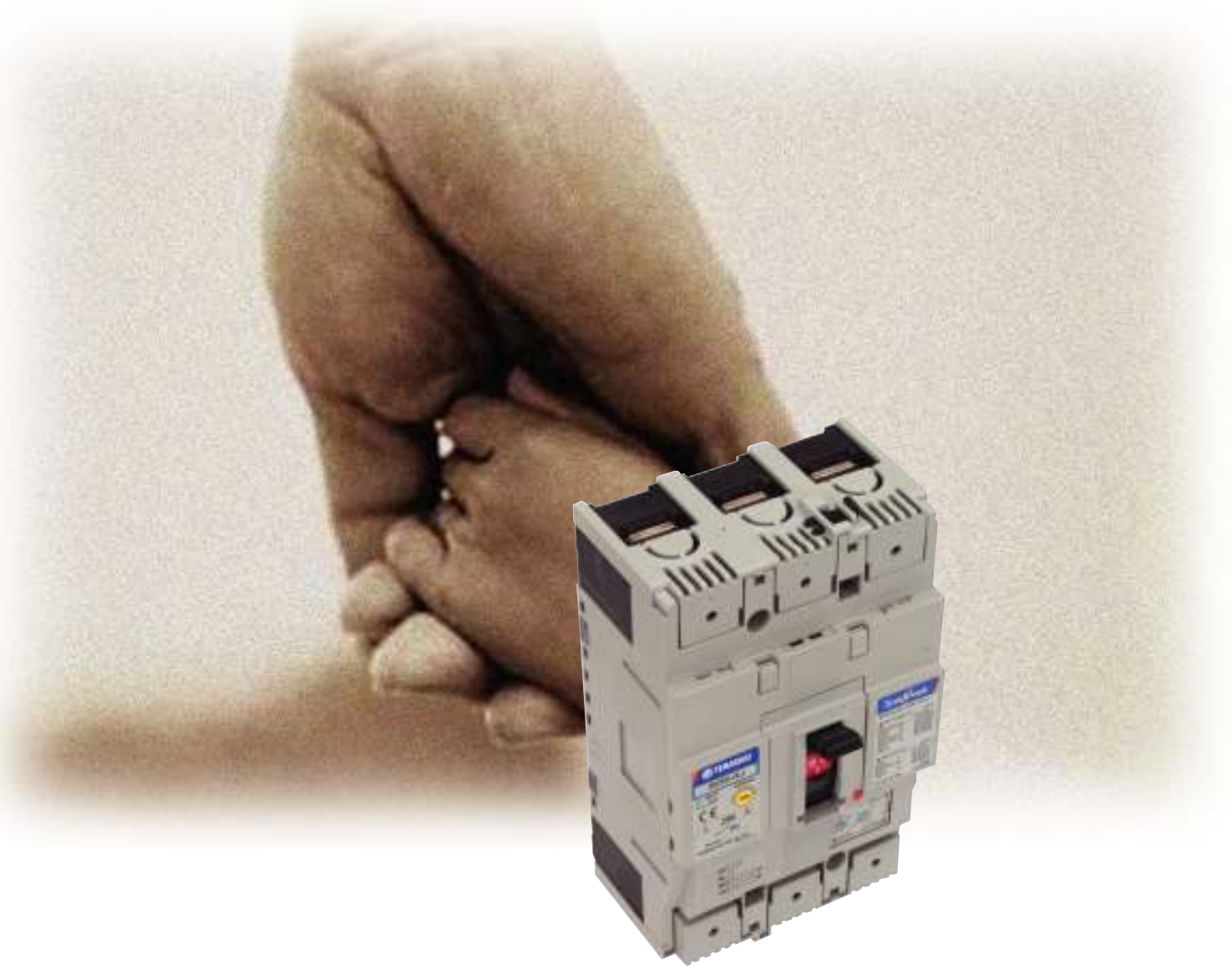
TERASAKI
Innovators in Protection Technology

TemBreak2

Moulded Case Circuit Breaker
Instruction Manual



11-M61E

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1. HANDLING AND MAINTENANCE

Storage

- Avoid corrosive gas

Do not leave it in an atmosphere of sulphur gas, ammonia gas, etc.

- Avoid moisture
- Avoid humidity over a long period of time
- Avoid direct sunshine

Do not expose to direct sunshine for a long period of time

- Avoid dust

Please keep wrapped
Please keep the breaker in the ON position when being stored
Storage temperature -20 degrees C to 60 degrees C.

Transport

- Pack and transport securely

Avoid moisture and corrosive gas during extended transportation

- Ensure all accessories and breakers are well packaged and protected during transportation.

2. STANDARD ENVIRONMENT

The standard environment for MCCBs is as follows:

Ambient temperature	-5^{o}C to +50^{o}C The average temperature for 24 hours must not exceed 35^{o}C
Relative humidity	45% to 85%
Vibration Impact	Ensure any abnormal vibration or impacts are avoided
Altitude	Below 2000m
Atmosphere	Avoid excessive water vapour, oil vapour, smoke, dust, or freezing conditions. Sudden changes in temperature, condensation or freezing must not occur.

Please use a special environment (treated) breaker when used in an environment other than that above.

3. INSTALLATION AND CONNECTION

Installation precaution

- Avoid direct sunshine

Do not install in direct sunlight, the device may malfunction due to over temperature

- Avoid vibration and impact

Reduce the influence of vibration and impact by installing some cushioning/protective material

- Avoid dust and cutting powder

Rain water, oil, dust must not be in direct contact with the device especially metal cuttings used on steel plate etc.

- Do not block the arc gas vents of the device

The breaking capacity performance might be decreased. Please ensure the insulation distance of the conductive parts and any earthed parts are adequate. Please refer to catalogue for the insulation distances.

- Ensure the base of the device is secure

Do not remove any fastening that secures the back of the moulded base.

- Ensure the correct mounting position

3. Cont'd INSTALLATION AND CONNECTION

Connection precaution

● Ensure correct torque is applied
Loose conductors cause overheating and malfunction
Over tightening conductors may cause damage of the screw and the mould
Please refer to the catalogue for the tightening torque
● Do not lubricate screws
Please do not apply the lubricating oil to the screw. Applying lubricating oil may make the screw loose and cause overheating
● All bare conductors to be insulated.
For front-connected breakers insulate all bare conductors up to the breaker.
If interpole barriers are supplied ensure they are fitted; insulate all bar conductors until they overlap the interpole barriers.
● Ensure all fixings have not been damaged
Rear connected devices do not apply excessive force to the studs
● Ensure a good connection to the supply and the load
Please refer to the catalogue when you reverse connect the supply and the load.
● Ensure the conductors are firmly fixed at each pole in parallel.
Install conductors so that on each pole they are parallel. (Large electromagnetic forces affect the connections during a fault).
Ensure the conductors are securely supported with an insulated support, refer to the condition table below:

Electromagnetic force that works around conductors 1m

Short-circuit current kA ( ) : power factor	Electromagnetic force(In case of 3 phase short-circuit) N	
	Conductor distance(10cm)	Conductor distance(20cm)
10(0.4)	490	245
18(0.3)	1880	940
25(0.2)	4430	2215
35(0.2)	8690	4345
42(0.2)	12520	6260
50(0.2)	17740	8870
65(0.2)	29980	14990
85(0.2)	51270	25635
100(0.2)	70960	35480
125(0.2)	110870	55435

4. Maintenance and Inspection

4.1 Initial Inspection

Before placing the installed breaker in service, make sure of the following:

No	Inspection item**	Judgment
1	Ensure product packing, iron chippings, wire pieces, or other conductive foreign objects are not near or on breaker	There must no foreign objects.
2	Ensure the cover and base are not cracked nor damaged	There must be no cracking or damage.
3	Ensure terminal screws and wire clamp screws are securely tightened.	Is a regulated torque used? Refer to the catalogue for the tightening torque.
4	The insulation resistance is measured by using a 500V megger.	The insulation resistance is 5MΩ or more.
5	Check of the rated voltage and breaking capacity of the breaker	The rated voltage and breaking capacity of the breaker are suited to the application.

**Attention: Please check the following item after confirming the voltage is not applied.

Caution should be taken when conducting dielectric withstand voltage tests

Test voltage during dielectric withstand tests must not exceed the values shown in the following table:

Main circuit		**Auxiliary/control circuit(*1)**	
Rated insulation voltage	Test voltage (AC, r.m.s. value)	Rated insulation voltage	Test voltage (AC, r.m.s. value)
Ui≦300V	2000V for 1 min.	Uis≦60V	1000V for 1 min.(*2)
300V<Ui≦690V	2500V for 1 min	60V<Uis≦600V	2 x Uis＋1000V(but not less than 1500V) for 1 min.

Note: *1 Between the terminal group and ground only

*2 Not applicable to motor-operated breaker for DC24V. Performance of dielectric withstand voltage Is AC 500V.

4.2 Periodic inspection

Periodic inspection is necessary to prevent unexpected failures and to maintain the breakers performance.
In addition to the initial inspection a further inspection should be conducted approx one month after the breaker is Placed in service. Periodic inspection of the breaker is needed at intervals depending on the service conditions.

Service environments		**Examples**	**Suggested intervals**
Standard	・Ambient air is always clean and dry.	Dust proofed, air-conditioned control room	・Within 10 years after installation: Every two or three years ・More than 10 years after installation: Every year ・More than 15 years after installation: Every six months
	・Ambient air is less dusty and free of corrosive gases.	Switchboard or distribution board is in a place or room which is not dust proofed and air-conditioned	・Within 10 years after installation: Every year ・More than 10 years after installation: Every six months ・More than 15 years after installation: Every month
Adverse	・Ambient air is dusty or contains some sulfurous acid, hydrogen sulfide or salt, or is high in humidity.	Geothermal power plant, sewage treatment facility, steel mill, paper mill and pulp plant	・Within five years after installation: Every six months ・More than five years after installation: Every month
	・Ambient air contains excessive dust or corrosive gases	Chemical plants, quarry, and mine	・Every month

Caution : Please check the following item after confirming the voltage is not applied.

Inspection item	Judgment	Remedy
Check the terminal screws	Are there any loose screws/studs?	If there is a loose screw/stud retighten to the regulated torque. Refer to the catalogue for the torque.
Check for dust and other contaminates such as oil	Terminal must be dust and contaminate free	Clean the terminals Wipe off any dust and or contaminate with a dry cloth.
Check the cover and base of the device	Check the cover and base for cracks or damage	Replace.
Check the handle operation	The handle operation must be smooth	Replace.
Check for discolouration caused by abnormal temperature rise at the terminals	The terminal must not be discoloured by overheating.	Replace. (A little discoloration of silver-plated terminal is permissible.)
Check the insulation resistance using a 500V megger.	The insulation resistance is 5MΩ or more.	Replace.（for 5MΩ or less）

4.3 Inspection and Care after Short-circuit Current Interruption

When a breaker trips open to interrupt a short-circuit current, a decision whether the breaker can be reused or needs to be replaced should be based on the magnitude of the short-circuit current. The following shows the guidelines for this decision.

1) If there is no contamination of arc gas vents and no other abnormal symptom are found, the breaker can be reused.

2) If contamination with black soot is found at arc gas vents, measure the insulation resistance. And if the insulation resistance exceeds 5 MΩ, the breaker will be reusable.
However, the breaker should still be monitored for overheating at the terminals.
If the insulation resistance measured is less than 5 MΩ conduct a dielectric withstand test on the breaker; if this testing shows that the breaker has the specified dielectric strength, minimize the load on breaker. Doing this will permit the breaker to be used with the provision that it should be replaced as soon as practicable.
While the breaker is reused always monitor for overheating at the terminals.

3) If the operating handle and/or arc gas vents is contaminated heavily with soot and molten metal particles, replace the breaker immediately.

4.4 Switching durability (number of switching cycles) of breaker

The switching durability performance of breaker is different depending on the ampere frame (frame size). The standard IEC 60947-2-1 provides the table shown below.

It is necessary to note that it is not suitable for frequent operations unlike an electromagnetic contactor because the circuit breaker is a protection device.

The opening and switching durability (number of switching cycles) of the TemBreak2 MCCB from 125A frame to 400A frame is shown in brackets.

1	2	3	4	5
Rated current(A)*1	Cycles/hour*2	Switching cycles		
		Without current	With current*3	Total
In≦100	120	8500 (30,000)	1500	10000 (30,000)
100＜In≦315	120	7000 (30,000)	1000	8000 (30,000)
315＜In≦630	60	4000 (15,000)	1000	5000 (15,000)
630＜In≦2500	20	2500	500	3000
2500＜In	10	1500	500	2000

*1: This means the maximum rated current for a given frame size.

*2: Column 2 gives the minimum operation rate.

This rate may be increased with the consent of the manufacturer. In this case, in this case the rate used shall be stated in the test report

*3: During each operating cycle, the circuit breaker shall remain closed for s sufficient time to ensure that the full current is established, but not exceeding 2 seconds.

4.5 Troubleshooting Guide

If any problems occur during use of the circuit breaker take appropriate action according to the following table.

Problem Category	Symptom	Possible cause	Remedy
Over heat	・Terminal overheat ・Terminal insulation burnout	・Loose terminal screw or conductor connecting screw	・Retighten.
		・Increased resistance of contacts ・Contact failure between stud conductor and breaker terminal (due to loose screw or foreign object)	・Replace.
	・Moulded case over heat (70℃or more)	・Increased resistance of the contacts ・Loose internal connection ・Increased current density in the braided bonding lead due to broken stands	・Replace.
		・High proportion of distorted high frequency components contained in load current.	・Decrease distortion factor of circuit.
Continuity	・Abnormal voltage on the load side	・Excessive wear of the contacts ・Foreign object attached on contacts ・Breakage of contact lead wire (due to excessive switching cycles or corrosion)	・Replace.
Operation failure	・Failure in ON operation	・Reset operation not conducted after tripping operation	・Conduct reset operation.
	・Failure in RESET operation	・Undervoltage trip device not energised ・Bimetal not cooled down after tripping operation ・Bimetal deformed due to corrosion, etc. ・Breaker service life ended due to a large number of switching cycles (conducted using a SHT or UVT) ・Fault of tripping mechanism	・Apply voltage
			・Cool down bimetal and conduct reset operation.
			・Replace.
Nuisance tripping	・Device tripped before rated current was reached	・Excessively high ambient temperature (more than 50℃)	・Lower temperature around breaker by ventilation, etc.
		・Overheat due to loose terminal screw	・Retighten.
		・Overheat inside breaker	・Replace.

Problem Category	Symptom	Possible cause	Remedy
		・Vibration or shock	・Reduce vibration or shock using appropriate damping means.
		・Inadequate rated frequency of breaker	・Use breaker with rated frequency suitable for the application
		・High proportion of distorted high frequency components contained in load current	・Reduce the load current or change the breaker rated current.
		・Conductor cross sectional area smaller than specified	・Use larger-sized connecting conductor or change breaker rated current.
		・Electromagnetic induction noise (electronic breakers)	・Keep breaker away from noise source.
Nuisance tripping	・Device tripped when current was applied	・Excessive surge (electronic breakers)	・Remove surge source.
		・Inrush current ・Inrush current at change over from star to delta connection ・Intermittent inrush current for example inching and plugging ・Additional inrush currents including capacitor charge, incandescent lamp overflow or fluorescent lamp start current	・Change instantaneous tripping characteristics or use breaker with a higher rated current.
No response to overcurrent	・Failure to trip when the specified pickup current is reached.	・Large start current ・Long starting time	・Use breaker with higher rated current.
		・Accidental short-circuit in motor	・Repair or replace motor
		・Incorrect connection of control circuit for SHT or UVT	・Check wiring
		・Failure in coordination with upstream fuse (current limiting) or upstream breaker	・Review coordination scheme.
Accessory failure	・Failure of motor operator	・Low ambient temperature	・Check compensation current.
		・Incorrect rated frequency of breaker	・Select breaker with rated frequency suited to the application

Problem Category	Symptom	Possible cause	Remedy
		・Incorrect wiring in control circuit	・Check and correct wiring
		・Continuously repeated ON/OFF operation	・Check and correct wiring
	・Fault of shunt trip device (SHT)	・Voltage drop due to insufficient current carrying capacity of control wiring	・Use correct wiring.
		・Insufficient capacity of control power source	・Increase capacity.
		・Failure in ON/OFF/RESET operation due to poor adjustment of operation stroke	・Return to Terasaki for repair.
	・Fault on undervoltage trip device (UVT)	・Insufficient capacity of control power source	・Increase capacity.
		・Coil burnout due to continuous excitation, incorrect coil rating, failure of burnout prevention switch, or contact fusion	・Return to Terasaki for repair or replace.
		・Residual magnetism ・Poor stroke adjustment	・Replace or return to Terasaki for repair.
	・Fault on auxiliary switch and alarm switch	・Contact fusion or burnout due to overload to micro switch	・Replace, and reduce load to micro switch using intervening auxiliary relay.
		・Poor adjustment of micro switch	・Return to Terasaki repair.