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## Trip Circuit Supervision Relay (7PJ13)

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# 7PJ13



## Description

Trip Circuit Supervision Relay is an electronic-circuit based relay which is used to monitor and supervise the integrity of circuit breaker's trip coil and other wiring circuits of low-voltage and medium-voltage network. Trip Circuit Supervision Relay is connected with a circuit breaker to monitor the trip circuit positions (open or closed).

Trip Circuit Supervision Relay generates a trip circuit failure alarm, either if the trip circuit supply is disconnected or if the trip circuit connection is changed to an open circuit. Trip circuit continuity is measured by supplying the supervision

current of 0.7 mA to 1.5 mA and sensing the flow of current with two opto-couplers. The circuit breaker contact indicates the status of relay whether the circuit breaker is in open position or closed position.

The front panel of Trip Circuit Supervision Relay comprises of single LED with dual colored to indicate the status of process.

In a healthy condition, the Green LED flashes and the output relay reaches the pick-up condition. In the fault condition, the Red LED flashes and the output relay reaches the drop-off condition and operates after a delay of 500 ms.

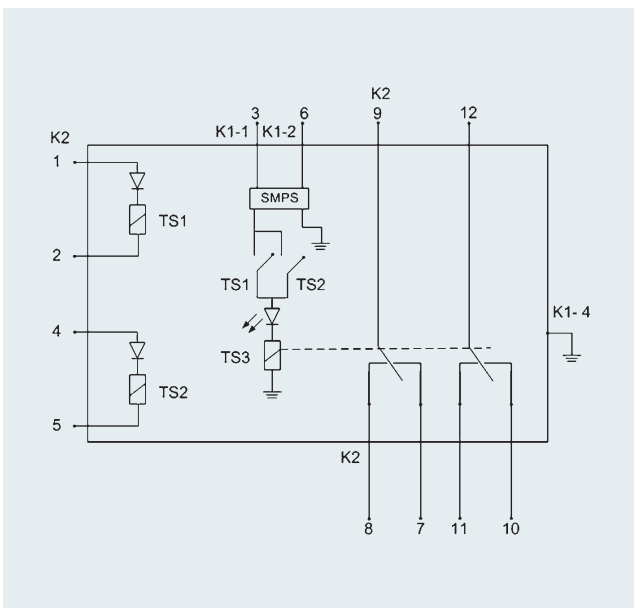


Figure 1.1 - Block diagram of Trip Circuit Supervision Relay

## Features

The salient features of Trip Circuit Supervision Relay are:

- Universal auxiliary voltage range with very low burden (i.e.) 24 V to 230 V AC/DC at less than 4 watts
- Universal supervision voltage range (i.e.) 24 V to 230 V DC
- Compact-in-size 48x96 mm
- Fitted with flush-mounting
- Continuous supervision of trip circuit in Pre-closed, Post-closed condition, and latched trip condition
- Detects faults such as Auxiliary voltage loss and circuit breakage in supervised circuits
- Indicates operational status by single LED with dual color
- Relay has been type tested in accordance with IEC60255 standards

## Applications

Trip Circuit Supervision Relay is used in the following field applications:

- Used for monitoring activities. The trip circuit wiring is supervised from the positive supply to the negative supply when the circuit breaker is in open position or closed position.
- Used for detecting and generating circuit breaker alarm, if the trip circuit supply is failed.
- Used to generate an alarm if the trip signal is received but the circuit breaker fails to operate.

## Mounting Instructions

Trip Circuit Supervision Relay comprises of all the mounting elements required for the mounting. To flush mount the Trip Circuit Supervision Relay, the following requirements should be satisfied:

- Cut a hole in the panel with a measurement of 45mm x 92mm (HxW).
- Carry out all the required internal wiring connections.
- Flush Trip Circuit Supervision Relay into panel and lock with the clamps.

## Supervision Operation

Trip Circuit Supervision Relay contact operates in the following 3 supervision conditions:

### Supervision in pre-close condition

After the tripping circuit is completed, a small amount of sensing current flows through TS1, TS2, circuit breaker auxiliary contacts (52b), and tripping coil. Trip Circuit Supervision Relay indicates a healthy condition by flashing the Green LED.

If the tripping circuit becomes an open circuit or loss of supply voltage, an unhealthy condition of Trip Circuit Supervision Relay is indicated by flashing Red LED and issue a control command by drop-off contacts.

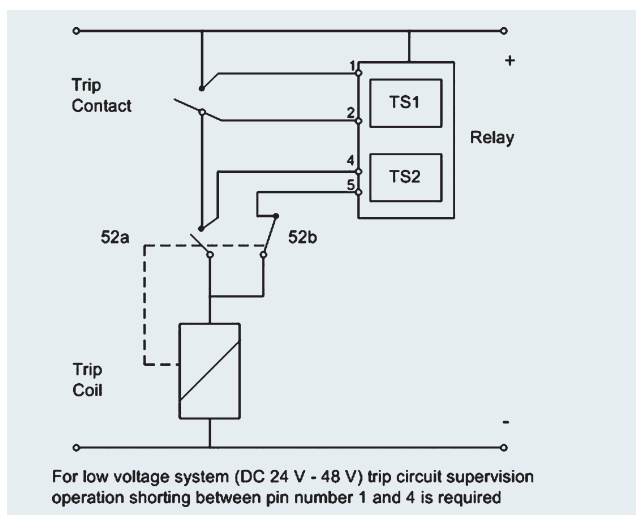


Figure 1.2 - Supervision in pre-close condition

### Supervision in post-close condition

After the tripping circuit is completed, a small amount of sensing current flows through TS1, circuit breaker auxiliary contacts (52a) and tripping coil. Trip Circuit Supervision Relay indicates a healthy condition by flashing the Green LED.

If the tripping circuit becomes an open circuit or loss of supply voltage, the unhealthy condition of Trip Circuit Supervision Relay is indicated by flashing Red LED and issue a control command by drop-off contacts.

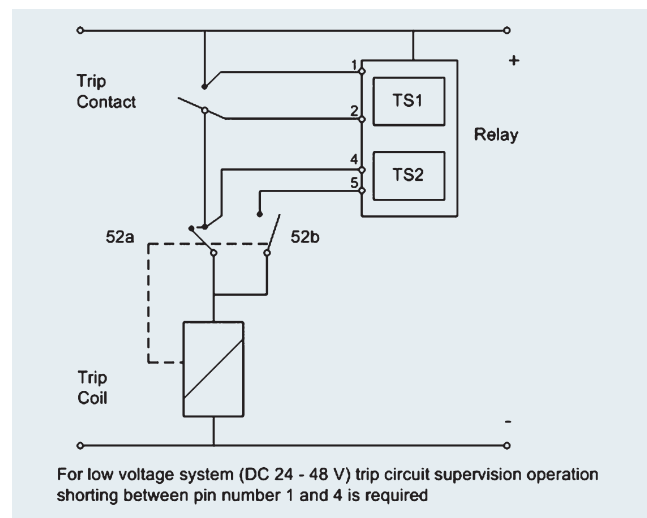


Figure 1.3 - Supervision in post-close condition

### Supervision in latched trip condition

After the tripping circuit is completed, a small amount of sensing current flows through TS2, circuit breaker auxiliary contacts (52b) and tripping coil. Trip Circuit Supervision Relay indicates a healthy condition by flashing the Green LED.

If the tripping circuit becomes an open circuit or loss of supply voltage, the unhealthy condition of Trip Circuit Supervision Relay is indicated by flashing Red LED and issue a control command by drop-off contacts.

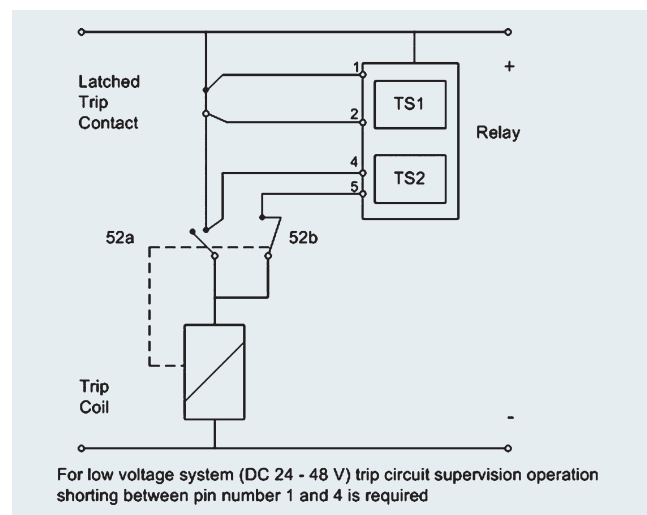


Figure 1.4 - Supervision in latched trip condition

# MLFB (Ordering Code)

Use the following ordering information to order Trip Circuit Supervision Relay.

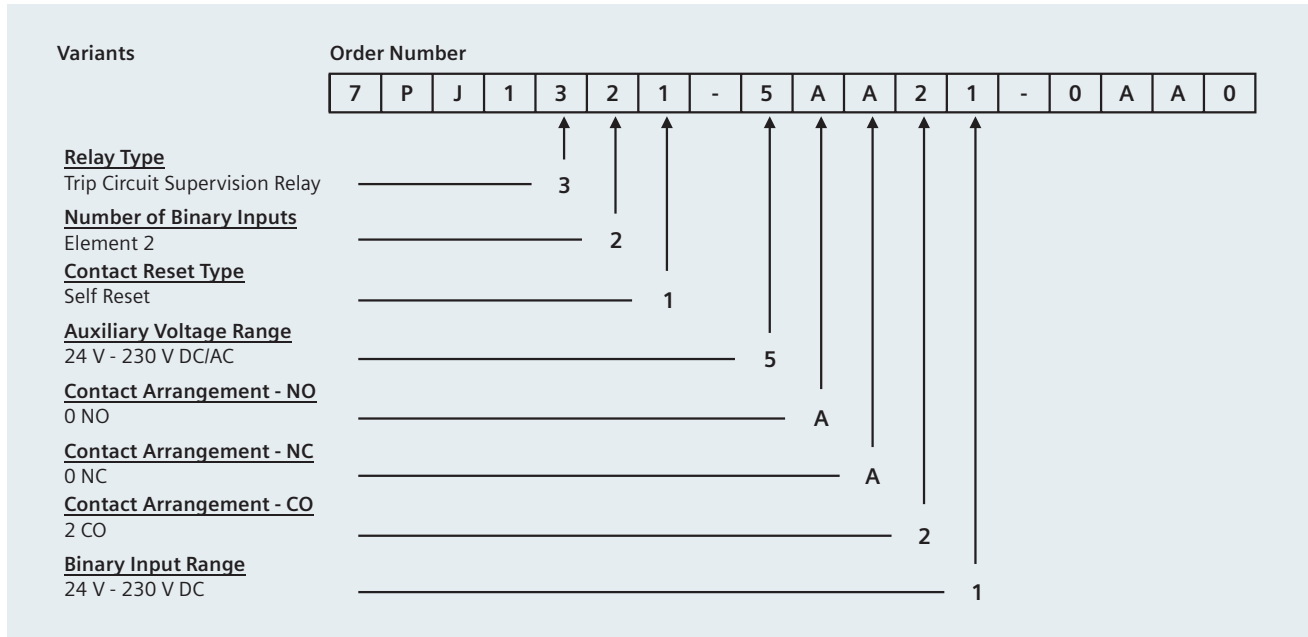


Figure 1.5 - MLFB of Trip Circuit Supervision Relay

# Terminal Diagram

The terminal diagram is located on the top of Trip Circuit Supervision Relay housing and displays the terminal numbers and terminals.

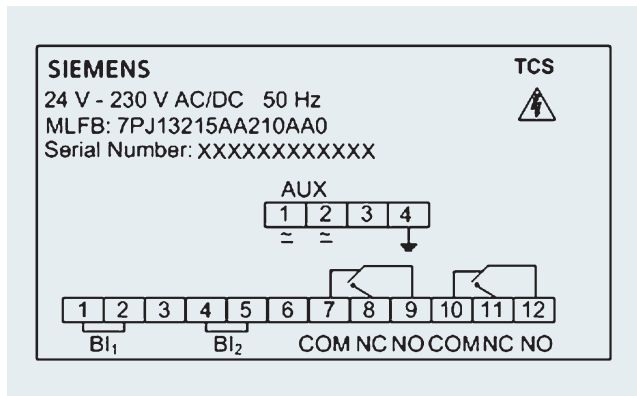


Figure 1.6 - Terminal Diagram of Trip Circuit Supervision Relay

Table 1-2 Binary terminals specification

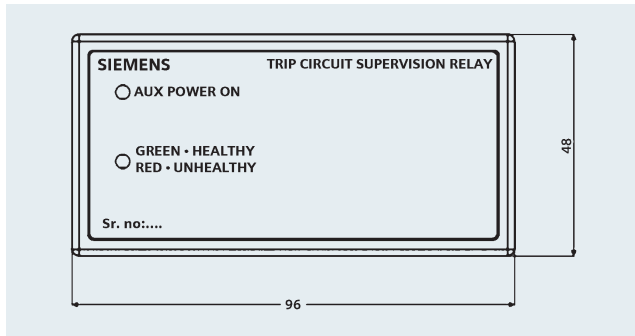
Terminal number	Terminal name	Description
K2-(1)	BI <sub>1</sub>	Binary Input 1-1
(2)	BI <sub>1</sub>	Binary Input 1-2
(3)	-	-
(4)	BI <sub>2</sub>	Binary Input 2-1
(5)	BI <sub>2</sub>	Binary Input 2-2
(6)	-	-
(7)	COM-1	Common
(8)	NC-1	Normal Closed
(9)	NO-1	Normal Open
(10)	COM-2	Common
(11)	NC-2	Normal Closed
(12)	NO-2	Normal Open

Table 1-1 Auxiliary terminals specification

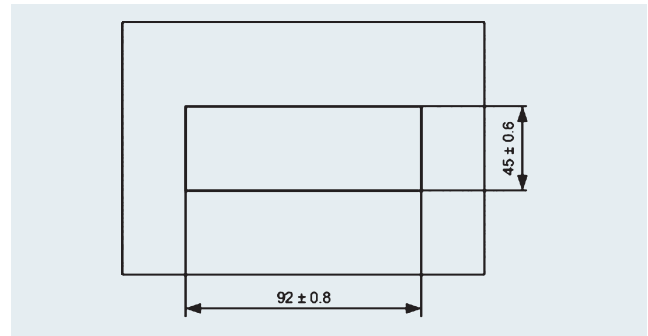
Terminal number	Terminal name	Description
K1-(1)	+~	Auxiliary Voltage Positive
(2)	- ~	Auxiliary Voltage Negative
(3)	-	
(4)	E	Earth

# Dimensional Drawings

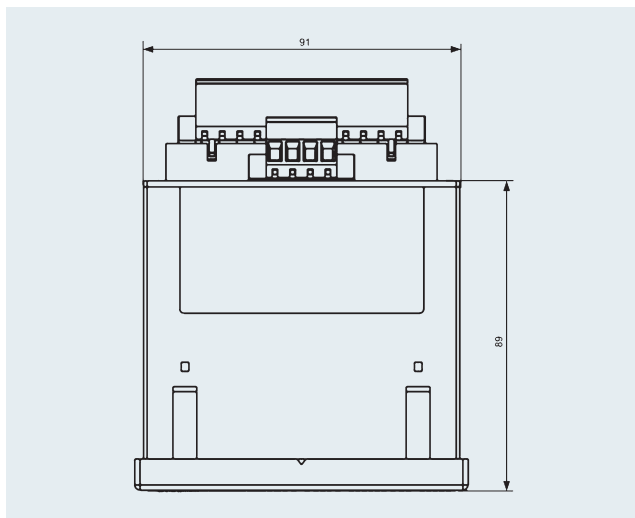
This section displays the different dimensional views of Trip Circuit Supervision Relay.



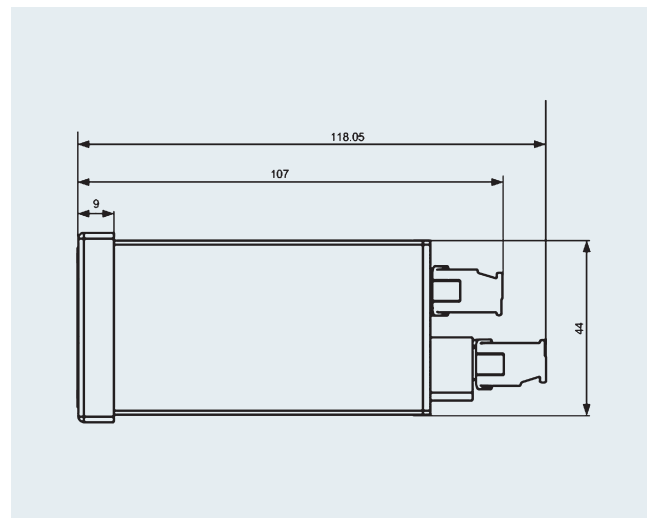
Front view



Panel-cut out view



Top view



Right-side view

Note: All dimensions are in mm.

## Technical Specifications

### Power Supply

Parameter	Value	
Auxiliary voltage range UN	DC 24 V to DC 230 V AC 24 V to AC 230 V	
Auxiliary voltage operating range	75% - 115%	
Input power consumption	< 4 W	
Operate time	> 500 ms and < 800 ms	
Reset Time	< 100 ms	
Rate of Operations	350 operations per hour	
Mechanical life (Loaded)	10,000 Operations (At rated current of resistive load)	
Number of contacts	2 C/O contacts	
Contact details	Rated voltage	AC 250 V DC 250 V
	Rated current	AC 5 A
	Make and carry for 0.5 s	AC 10 A
	Make and carry for 3 s	AC 8 A
	Break	Breaking capacity for DC with circuit time-constant L/R < 40 ms, at DC 48 V/110 V/220 V 1 A/0.25 A/0.15 A

## Binary Inputs

Parameter	Value
Input voltage range DC	DC 24 V to DC 230 V
Input voltage range DC tolerance	75% - 115%
Input power consumption	<1 W
Isolation	AC 2 kV

## External Interfaces

Parameter	Value
Power supply (1 No)	Header: 4 Pin Cabling-type: standard wire, unshielded, max. 2.5 mm <sup>2</sup>
Binary inputs (2 Nos) and Contact outputs (2 Nos)	Header: 12 Pin Cabling-type: standard wire, unshielded, max. 2.5 mm <sup>2</sup>

# Type Testing

This section describes about the type testing performed with Trip Circuit Supervision Relay under different environmental conditions.

## Type Testing

Test	Reference	Test Levels
Insulation Resistance	IEC 60255-5, IEC 60255-27	Insulation resistance >100 M ohm at 500 V DC
Hi Voltage (Dielectric) Voltage	IEC 60255-5, IEC 60255-27	2 kV, 50 Hz, 1 min Between all terminals and with respect to earth terminal Between Auxiliary terminal and contacts terminals Between Auxiliary terminal and Supervision circuit terminals Between Supervision terminals and contacts terminals 1.0 kV r.m.s AC, 1 min across changeover relay contacts
Impulse Voltage Withstand Test	IEC 60255-5, IEC 60255-27	5.0 kV, 1.2/50 $\mu$ s, 0.5 J Between all terminals and with respect to earth terminal Between Auxiliary terminal and contacts terminals Between Auxiliary terminal and Supervision circuit terminals Between Supervision terminals and contacts terminals
1 MHz Burst High Frequency Disturbance Test	IEC 60255-22-1	Common-mode test voltage: 2.5 kV Differential test voltage: 1.0 kV Ports are Auxiliary Input, Supervision Inputs, Output Contacts Earth Test duration: 2 s Source impedance: 200 Ohm
Immunity to Electrostatic Discharge	IEC 60255-22-2	Class III, 8 kV discharge in air to all LEDs Front insulated surface 6 kV point contact discharge to any metallic part of the front of the product
Electrical Fast Transient or Burst Requirements	IEC 60255-22-4	Test severity Amplitude: Power port: 4 kV, burst frequency 5 kHz Other ports: 4 kV, burst frequency 5 kHz
Surge Immunity Test	IEC 60255-22-5	Time to half-value: 1.2/50 $\mu$ s Amplitude: 2 kV between all groups and case earth (CM) Auxiliary port R=10 $\Omega$ , C=9 $\mu$ F, For Input/Output port R=40, C=0.5 $\mu$ F Amplitude: 1 kV between terminals of each group (DM) Auxiliary port R=0, C=18 $\mu$ F, For Input/Output Port R=40, C=0.5 $\mu$ F
Immunity to Radiated Electromagnetic Energy	IEC 60255-22-3	Class III: Test field strength, frequency band 80 MHz to 1000 MHz: 1400 MHz to 2700 MHz 10 V/m Test using AM: 1 kHz/80%
Radiated Immunity from Digital Radio Telephones	IEC 60255-22-3	10 V/m, 900 MHz
Immunity to Conducted Disturbances Induced by Radio Frequency Fields	IEC 60255-22-6	Disturbing test voltage: 10 V unmodulated r.m.s 0.15 MHz to 80 MHz, Source Impedance: 150, 80% AM (1 kHz)
Power Frequency Magnetic Field Immunity	IEC 61000-4-8	Level 4, 30 A/m applied continuously 300 A/m applied for 3 s
Conducted Emissions	IEC 60255-25	0.15 MHz - 0.5 MHz, 79 dB $\mu$ V (quasi peak), 66 dB $\mu$ V (average) 0.5 MHz - 30 MHz, 73 dB $\mu$ V (quasi peak), 60 dB $\mu$ V (average)
Radiated Emissions	IEC 60255-25	30 MHz - 230 MHz, 40 dB $\mu$ V/m at 10 m measurement distance 230 MHz - 1 GHz, 47 dB $\mu$ V/m at 10 m measurement distance



Test	Reference	Test Levels
Power Supply Test	IEC 60255-11	Voltage Variations: 18 V - 265 V Voltage interruptions 18 V, 10 ms Voltage interruptions 110 V, 50 ms Ripple in DC voltage: Max 15% of DC value Gradual shutdown/start-up in auxiliary power supply voltage Reversal of DC power supply polarity
Vibration Test	IEC 60255-21-1	Response Class I, 10 Hz - 150 Hz, 0.5 g, 3 axis, Endurance Class I, 10 Hz - 150 Hz, 1.0 g, 3 axis
Shock and Bump	IEC 60255-21-2	Shock response, Class I, 5 g, 11 ms Shock withstand, Class I, 15 g, 11 ms Bump Class I, 10 g, 16 ms
Seismic Test	IEC 60255-21-3	In single axis sine sweep in X-axis sweep (@a sweep rate of 1 octave/min) vibration in the frequency range (5 Hz - 40 Hz) at amplitude of 3.5 mm or 1.0 gn (whichever is less) In single axis sine sweep in Y-axis sweep (@a sweep rate of 1 octave/min) vibration in the frequency range (5 Hz - 40 Hz) at amplitude of 1.5 mm or 0.5 gn (whichever is less)
Degree of Protection	IEC 60529, IEC 60255-27	IP54 Front side IP20 Rear Terminal side
Cold Test	IEC 60068-2-1	-10°C, 96 hours
Dry Heat Test	IEC 60068-2-2	+55°C, 96 hours
Storage Test	IEC 60068-2-1, IEC 60068-2-2	-25°C to +70°C, 16 hours
Damp Heat Test, Cyclic	IEC 60068-2-30	6 days at 95% RH and +40 °C
Rated Burden of Auxiliary and Supervision Circuit	IEC60255-6	Auxiliary port burden at 24 V, 110 V, 220 V DC/AC Supervision port burden at 24 V, 110 V, 220 V DC/AC
Contact Performance at defined rate of operation	IEC60255-6	10,000 mechanical operations at the rate of 350 operations per hour
Contact Test	IEC60255-23	Making capacity, Make and carry capacity, Breaking capacity

### Product Safety Test as per IEC60255-27

Test	Reference	Test Levels
Clearances and Creepage Distances Test	Clearances and creepage distances between external circuits mutual and to the enclosure	≥ 4 mm
IP Rating	For Unit Front side For Unit Rear Terminal side	IP54 IP20
Impulse Voltage	<ul style="list-style-type: none"> <li>• Test voltage: 5 kV</li> <li>• Rise time/time to half-value: 1.2/50 μs</li> <li>• Output energy: 0.5 J</li> </ul>	After test the relay should operate
AC or DC Dielectric Voltage	<ul style="list-style-type: none"> <li>• Test voltage between all live contacts and earth: 500 V DC</li> <li>• Test duration: &gt; 5 s</li> <li>• Test voltage (AC): 2 kV</li> <li>• Test frequency: 50 Hz</li> <li>• Test duration: 1 min</li> </ul>	After test the relay should operate
Insulation Resistance	<ul style="list-style-type: none"> <li>• Test voltage: 500 V DC</li> <li>• Test duration: &gt; 5 s</li> </ul>	> 100 Mohm
Protective Bonding Resistance	<ul style="list-style-type: none"> <li>• Test voltage: &lt;12 V AC/DC</li> <li>• Test duration: 1 min</li> <li>• Bonding resistance</li> </ul>	< 0.1 Ohm
Protective Bonding Continuity	Accessible conductive parts should be bonded with the protective conductor terminal	Low current continuity test
Flammability of insulating materials, components and fire enclosures	<ul style="list-style-type: none"> <li>• Terminals</li> <li>• Terminal Mounting</li> <li>• Wiring</li> <li>• Components Mounting</li> <li>• Enclosure</li> </ul>	<ul style="list-style-type: none"> <li>• IEC 60695-11-10, Class V-2, or Better</li> <li>• IEC 60695-11-10, Class V-1, or Better</li> <li>• IEC 60695-11-10, Class V-1, or Better</li> <li>• IEC 60695-11-10, Class V-2, or Better</li> <li>• IEC 60695-11-10, Class V-1, or Better</li> </ul>
Single-fault Condition	<ul style="list-style-type: none"> <li>• Assessment of</li> <li>• Insulation between circuits and parts</li> <li>• Compliance with requirements for protection against the spread of fire</li> <li>• Overloads</li> <li>• Intermittently rated resistors</li> <li>• Compliance with requirements for mechanical protection</li> </ul>	The equipment shall not present a risk of electric shock or fire after a single-fault test

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