

Power Relays (Over 2 A)

HE-S RELAYS SC Type

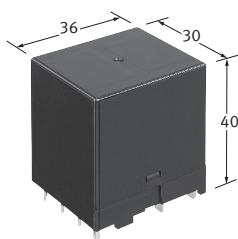
Product Catalog

**IN Your
Future**

HE-S RELAYS SC Type

Compact size 2 Form A and 2 Form A 1 Form B 40 A power relays for Charging Station

[Protective construction] Flux-resistant



(Unit : mm)

FEATURES

- SCCR(Short-Circuit Current Rating)
Compliant with IEC62752/IEC62955
- High-capacity
- Max. switching current : 40 A
- Detection of welded main contacts enables the construction of a safety circuit (2 Form A 1 Form B)
- Compact size
- Low operating power: 2,500 mW
(holding power: 400 mW)
- Contact gap: Min 3.0 mm
(Compliant with IEC62752/IEC62955)
- Mirror contact mechanisms:
Compliant with EN60947-4-1 mirror contact

TYPICAL APPLICATIONS

- Charging Station
(mode2 Charging Cable/mode3 EVSE)
- Photovoltaic power generation system
(Power conditioner system)
- Elevator
- Inverter
- Semiconductor Inspection Equipment

DETAILS FEATURES

■ Contact gap (initial)

Form A contact	Min. 3.0 mm each (Form A contact)
Form B contact	Min. 0.5 mm (When Form A contact welded)

■ Most suitable for IEC compliant charging stations

IEC61851-1, IEC62955, IEC62752

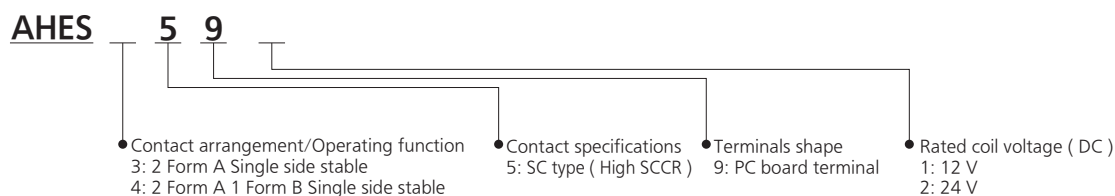
- Contact gap: Min.3.0 mm (initial)
- Expected electrical life:
10 A make / break, 40 A carry 480 V AC 50×10^3
- SCCR (Short-Circuit Current Rating) :
 $I_p = 1.85 \text{ kA} / I^2t = 4.5 \text{ kA}^2\text{s}$, $I_p = 1.5 \text{ kA} / I^2t = 6.0 \text{ kA}^2\text{s}$

■ Insulation distance (initial)

Between Form A contact and coil	Min. 9.6 mm (Clearance/Creepage)
Between Form B contact and coil	Min. 3.2 mm (Clearance/Creepage)
Between Form A contact sets	Min. 8.2 mm (Clearance/Creepage)
Between Form A contact and Form B contact	Min. 9.6 mm (Clearance/Creepage)

Power Relays (Over 2 A) HE-S RELAYS SC Type

ORDERING INFORMATION (PART NO.)



TYPES

■ PC board terminal

Contact arrangement	Rated coil voltage	Part No.	Standard packing	
			Inner carton	Outer carton
2 Form A (2a)	12 V DC	AHES3591	25 pcs.	100 pcs.
	24 V DC	AHES3592		
2 Form A 1 Form B (2a1b)	12 V DC	AHES4591		
	24 V DC	AHES4592		

RATING

■ Coil data

- Operating characteristics such as " Operate voltage " and " Release voltage " are influenced by mounting conditions or ambient temperature, etc.
Therefore, please use the relay within ± 5 % of rated coil voltage.
- " Initial " means the condition of products at the time of delivery.

Rated coil voltage	Operate voltage* ¹ (at 20 °C)	Release voltage* ¹ (at 20 °C)	Rated operating current (± 10 %, at 20 °C)	Coil resistance (± 10 %, at 20 °C)	Rated operating power	Max. allowable voltage (at 20 °C)
12 V DC	Max. 75 % V of rated coil voltage (Initial)	Min. 5 % V of rated coil voltage (Initial)	208 mA	57.6 Ω	2,500 mW Holding* ² : 400 mW* ³	110 % V of rated coil voltage
24 V DC			104 mA	230.4 Ω		

*1: Square, pulse drive

*2: When using with the holding voltage, switch to the holding voltage after 100 ms from the application of the coil rated voltage.

*3: With 40 % V coil holding voltage

Power Relays (Over 2 A) HE-S RELAYS SC Type

Specifications

Item			Specifications	
Contact data	Contact arrangement		2 Form A (2a), 2 Form A 1 Form B (2a1b)	
	Form A contact	Contact resistance (initial)	Max. 100 mΩ (by voltage drop 1 A 6 V DC) , Max. 10 mΩ (by voltage drop 20 A 6 V DC, reference value)	
		Contact material	AgSnO ₂ type	
	Form B contact*5	Contact resistance (initial)	Max. 100 mΩ (by voltage drop 1 A 6 V DC)	
		Contact material	Au flashed AgNi type	
	Form A contact	Contact rating (resistive)	40 A 480 V AC	
		Max. switching power (resistive)	19,200 VA	
		Max. switching voltage	480 V AC	
		Max. switching current	40 A (at −40 to +70 °C) 35 A (at +70 to +85 °C)	
		Min. switching load *1	100 mA 5 V DC	
		Form B contact*5	Contact rating (resistive)	0.5 A 30 V DC
			Max. switching power (resistive)	15 W
	Max. switching voltage		30 V DC	
	Max. switching current		0.5 A	
	Max. Carrying current		1 A	
	Min. switching load *1		10 mA 5 V DC	
	Insulation resistance (initial)			Min. 1,000 MΩ (at 500 V DC, Measured portion is the same as the case of dielectric strength)
	Dielectric strength (initial)	Between open Form A contacts		2,000 V rms for 1 min (detection current: 10 mA)
		Between Form A contact and coil		5,000 V rms for 1 min (detection current: 10 mA, coil de-energized)
		Between Form A contact sets		5,000 V rms for 1 min (detection current: 10 mA, coil de-energized)
Between open Form B contacts*5		1,000 V rms for 1 min (detection current: 10 mA)		
Between Form B contact and coil*5		2,000 V rms for 1 min (detection current: 10 mA, coil de-energized)		
Between Form A contact and Form B contact		5,000 V rms for 1 min (detection current: 10 mA, coil de-energized)		
Surge withstand voltage (initial) *2	Between contact and coil		10,000 V (Between Form A contact and coil, coil de-energized) , 2,500 V (Between Form B contact and coil, coil de-energized)	
Coil holding voltage*3			40 to 100 % V (at −40 to +40 °C Contact current Form A contact: 40 A) 40 to 50 % V (at +40 to +85 °C Contact current Form A contact: 35 to 40 A)	
Time characteristics (initial)	Operate time		Max. 30 ms (at rated coil voltage, at 20 °C, without bounce)	
	Release time*4		Max. 10 ms (at rated coil voltage, at 20 °C, without bounce, without coil diode)	
Shock resistance	Functional		98 m/s ² (half-sine shock pulse: 11 ms, detection time: 10 μs)	
	Destructive		980 m/s ² (half-sine shock pulse: 6 ms)	
Vibration resistance	Functional		10 to 55 Hz (at double amplitude of 1 mm, detection time: 10 μs)	
	Destructive		10 to 55 Hz (at double amplitude of 1.5 mm)	
Expected life	Mechanical life (without coil diode)		Min. 2 × 10 ⁵ ope. (at 180 times/min)	
Conditions	Conditions for usage, transport and storage		Ambient temperature: −40 to 70 °C (Max. carrying current 40 A) −40 to 85 °C (Max. carrying current 35 A, transport and storage) Humidity: 5 to 85 % RH (Avoid icing and condensation)	
Unit weight			Approx. 75 g	

*1: This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

*2: Wave is standard shock voltage of $\pm 1.2 \times 50 \mu s$.

*3: Coil holding voltage is the coil voltage after 100 ms from the applied rated coil voltage.

*4: Release time will lengthen if a diode, etc., is connected in parallel to the coil. Be sure to verify operation under actual conditions.

*5: Regarding Form B contact, only the 2 Form A 1 Form B (2a1b) type applies.

Power Relays (Over 2 A) HE-S RELAYS SC Type

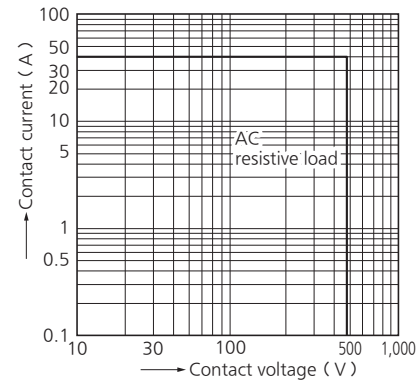
Expected electrical life (without coil diode)

Regarding Form B contact , only the 2 Form A 1 Form B (2a1b) type applies.

Type	Load	Switching capacity	Number of operations
Form A contact	Resistive	10 A make / break, 40 A carry 480 V AC	50×10^3 (ON : OFF = 1 s : 9 s)
	Resistive	40 A 480 V AC	6×10^3 (ON : OFF = 1 s : 9 s)
Form B contact	Resistive	0.5 A 30 V DC	100×10^3 (ON : OFF = 1 s : 9 s)

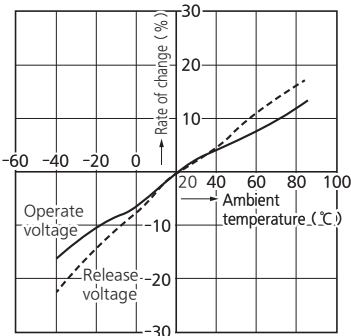
REFERENCE DATA

1. Max. switching capacity



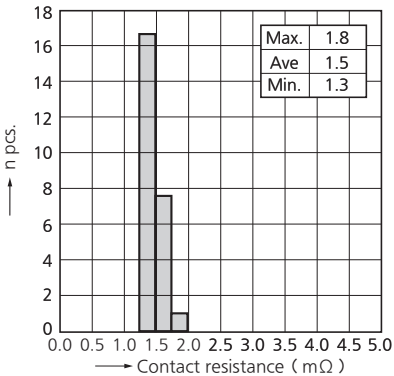
2. Ambient temperature characteristics (Average)

Tested sample: AHES4591, 6 pcs.



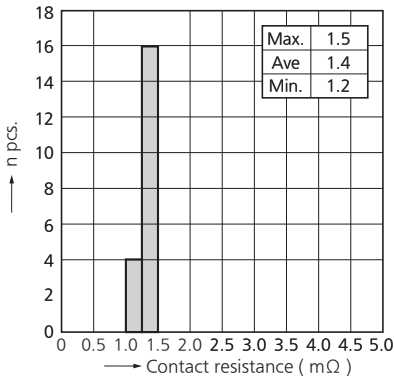
5-1. Contact resistance (6 V DC, 20 A)

Tested sample: AHES4591, 20 pcs.
Conditions: 6 V DC, 20 A



5-2. Contact resistance (6 V DC, 40 A)

Tested sample: AHES4591, 20 pcs.
Conditions: 6 V DC, 40 A



Power Relays (Over 2 A) HE-S RELAYS SC Type

DIMENSIONS (Unit: mm)

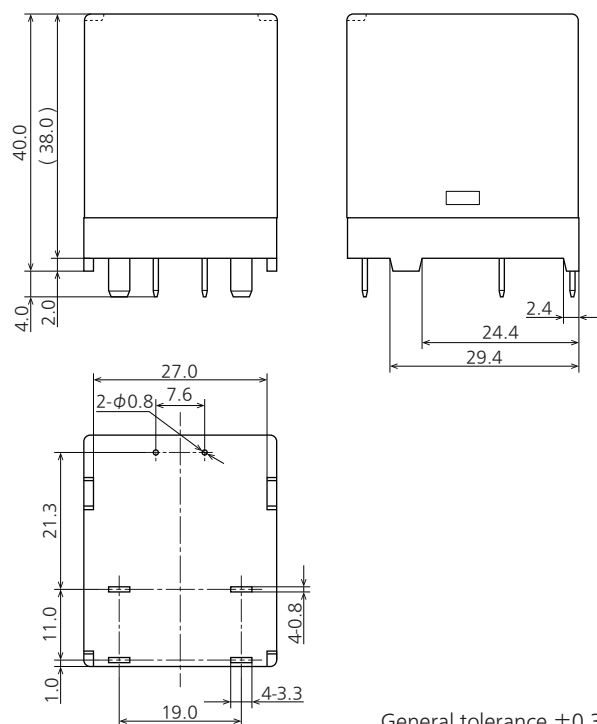
CAD The CAD data of the products with a " CAD " mark can be downloaded from our Website.

■ 2 Form A (2a)

CAD



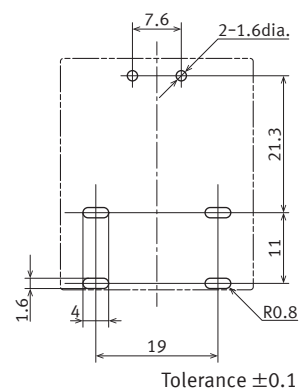
External dimensions



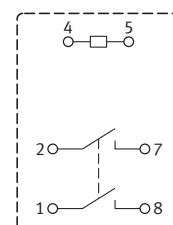
General tolerance ± 0.3

Note: Terminal dimensions are values without pre-soldering thickness.

Recommended PC board pattern
(BOTTOM VIEW)



Schematic
(BOTTOM VIEW)

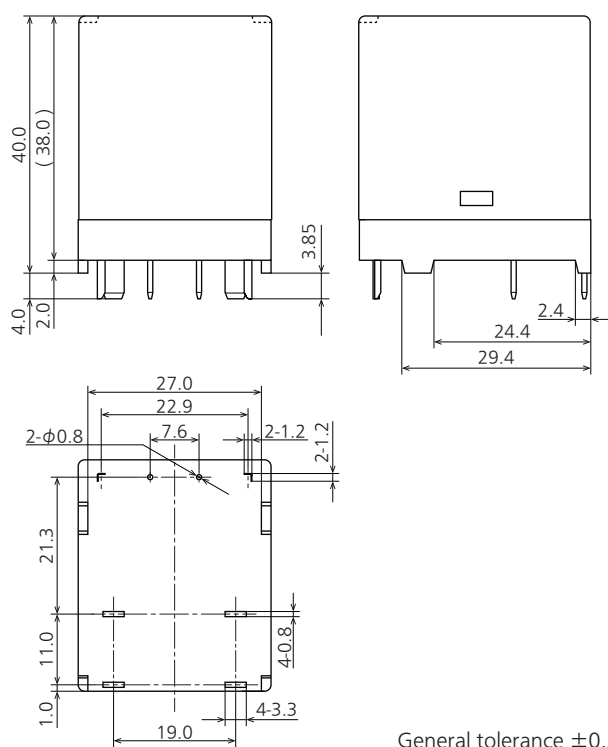


■ 2 Form A 1 Form B (2a1b)

CAD



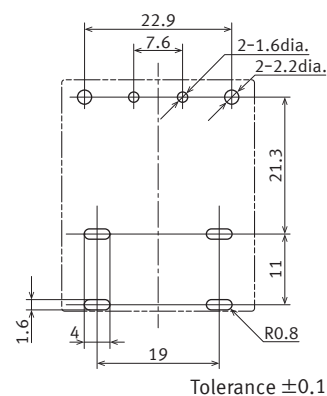
External dimensions



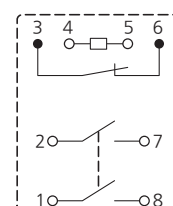
General tolerance ± 0.3

Note: Terminal dimensions are values without pre-soldering thickness.

Recommended PC board pattern
(BOTTOM VIEW)



Schematic
(BOTTOM VIEW)



Power Relays (Over 2 A) HE-S RELAYS SC Type

SAFETY STANDARDS

Each standard may be updated at any time, so please check our Website for the latest information.

■ UL/C-UL (Approved)

Form A contact

File No.	Contact rating	Operations	Ambient temperature
E43149	Make / Break 10 A, Rated 40 A 480 V AC Resistive	50×10^3	70 °C
	40 A 480 V AC Resistive	6×10^3	70 °C
	35 A 277 V AC Resistive	6×10^3	85 °C

Form B contact (2a 1b type only)

File No.	Contact rating	Operations	Ambient temperature
E43149	1 A 30 V DC Resistive	100×10^3	85 °C

■ CSA (Approved)

CSA standard certified by C-UL

■ VDE (Approved)

Form A contact

File No.	Contact rating	Operations	Ambient temperature
40042442	10 A make / break, 40 A carry ($\cos\phi = 1$) 480 V AC	50×10^3	85 °C
	40 A ($\cos\phi = 1$) 480 V AC	10×10^3	85 °C
	35 A ($\cos\phi = 1$) 277 V AC	30×10^3	85 °C

Short circuit withstand capability

File No.	Contact rating
40042442	I_m and $I_{\Delta m} = 320$ A, $U = 250$ V AC, $I_p = 1.5$ kA / $I^2t = 6.0$ kA ² s (IEC62752)
	$I_m = 500$ A, $U = 250$ V AC, $I_p = 1.85$ kA / $I^2t = 4.5$ kA ² s (IEC62955)

Form B contact (2a 1b type only)

File No.	Contact rating	Operations	Ambient temperature
40042442	DC-13 24 V DC 1 A, L/R = 48 ms	80×10^3	85 °C
	1 A (0 ms) 30 V DC	100×10^3	85 °C

■ CQC

Form A contact

File No.	Contact rating	Operations	Ambient temperature
CQC20002 2600136	Making / Breaking 10 A, carrying 40 A 480 V AC	50×10^3	-40 to +70 °C
	40 A 480 V AC	6×10^3	-40 to +70 °C

Form B contact (2a 1b type only)

File No.	Contact rating	Operations	Ambient temperature
CQC20002 2600136	1 A 30 V DC	100×10^3	-40 to +70 °C

INSULATION CHARACTERISTICS (IEC61810-1)

Item	Characteristics
Clearance/Creepage distance (IEC61810-1)	Min. 5.5/8.0 mm (Form A contact)
Category of protection (IEC61810-1)	RT II
Tracking resistance (IEC60112)	PTI 175
Insulation material group	III a
Over voltage category	III
Rated voltage	250 V
Pollution degree	3
Type of insulation (Between contact and coil)	Reinforced insulation
Type of insulation (Between open contact)	Full disconnection

Note(s): Actual value.

GUIDELINES FOR USAGE

■ For cautions for use, please read " GUIDELINES FOR RELAY USAGE ".
https://industry.panasonic.com/global/en/products/control/relay/cautions_use

■ Guidelines for HE-S relays SC type usage

● DC load guidelines

In case the relay is used as a DC high voltage switch, the final failure mode may be uninterruptible. In the event that the power supply cannot be cut off, in the worst case, the fire may spread to the surrounding area. Therefore, configure the power supply so that it can be turned off within one second. Also, consider a fail-safe circuit for your equipment.

When using an inductive load (L load) with $L/R > 1$ ms, take surge absorption measures in parallel with the inductive load.

● About parallel relay connections

When multiple relays are connected in parallel, design the equipment so that the load applied to each relay is within the specified range.

(Concentration of load on one relay leads to early failure.)

● About connecting multiple relays

When connecting multiple relays or when there is heat received from other equipment, heat dissipation may be insufficient and the ambient temperature of the relay may be exceeded. After checking the temperature in the actual device, please design the circuit with sufficient thermal margin.

● About conductor cross-sectional area during mounting

When designing a printed circuit board, ensure that there is sufficient margin in the conductor width and conductor spacing. To reduce the temperature rise, refer to the cross-sectional area of the conductor of UL 508.

<UL508: Table 43.2>

Max. Current (A)	Wire size (copper)	
	Conductor area (mm ²)	Wire size (AWG)
20	3.3	12
30	5.3	10
40	8.4	8

● Ambient Atmosphere

If the relay is used or stored in an atmosphere of corrosive gas (Sulfurous acid gas: SO₂, hydrogen sulfide gas: H₂S), corrosive gas components may adhere to the contacts, resulting in contact failure. Do not use or store the relay in such an atmosphere.

● Method for reducing coil holding voltage

When the coil holding voltage is used by PWM control, the release voltage varies depending on the operating temperature and operating conditions. Therefore, please evaluate the coil holding voltage under the worst operating conditions.

Recommended operating condition:

Periods: 20 kHz to 100 kHz, Duty Ratio: 50 %

● About welding detection at Form B contact

To detect the main contacts welding by Form B contacts, please design the appropriate detection time considering with the release and bounce time. (2a1b type only)

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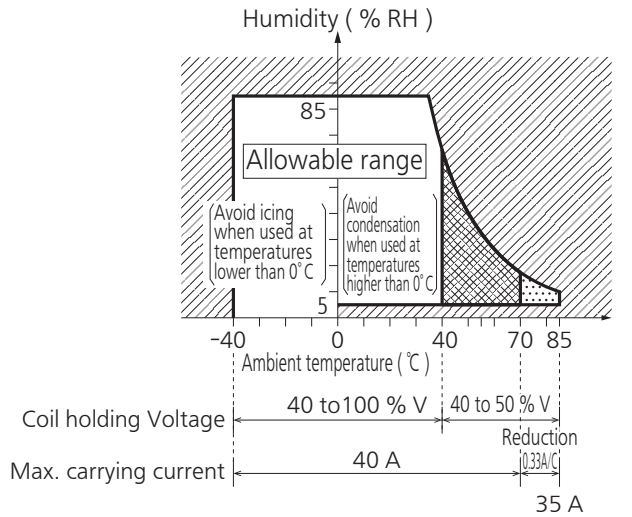
● Conditions for usage, transport and storage

- 1) Ambient temperature
 - −40 to + 70 °C (Max. carrying current 40 A)
 - −40 to + 85 °C (Max. carrying current 35 A)

Note)
When using at 40 °C or higher, the coil holding voltage should be 40 % V to 50 % V.
- 2) Humidity
 - 5 to 85 % RH (Avoid icing and condensation)

Note) In addition the humidity range depends on temperature.
The allowable ranges are as shown in the figure.
- 3) Air pressure
 - 86 to 106 kPa

[Allowable range of temperature and humidity for usage, transport and storage]



● Solder conditions

Please obey the following conditions.

1. Automatic soldering

(1) Preheating

Temperature	Max. 120 °C (solder surface terminal portion)
Time	Within 120 s

(2) Soldering

Solder temperature	260 ±5 °C
Soldering time	Within 10 s

2. Manual soldering

Solder temperature	Max. 270 °C	Max. 350 °C
Soldering time	Within 10 s	Within 5 s

Notes) Effects of soldering heat on the relays vary depending on the PC board. So please confirm actual soldering condition with the PC board used for assembling.

- For cautions for use, please read " GUIDELINES FOR RELAY USAGE ".
https://industry.panasonic.com/global/en/products/control/relay/cautions_use

Precautions for Coil Input

■ Long term current carrying

A circuit that will be carrying a current continuously for long periods without relay switching operation. (circuits for emergency lamps, alarm devices and error inspection that, for example, revert only during malfunction and output warnings with form B contacts) Continuous, long-term current to the coil will facilitate deterioration of coil insulation and characteristics due to heating of the coil itself. For circuits such as these, please use a magnetic-hold type latching relay. If you need to use a single stable relay, use a sealed type relay that is not easily affected by ambient conditions and make a failsafe circuit design that considers the possibility of contact failure or disconnection.

■ DC Coil operating power

Steady state DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5 %. However, please check with the actual circuit since the electrical characteristics may vary. The rated coil voltage should be applied to the coil and the set/reset pulse time of latching type relay differs for each relays, please refer to the relay's individual specifications.

■ Coil connection

When connecting coils of polarized relays, please check coil polarity (+ , -) at the internal connection diagram (Schematic). If any wrong connection is made, it may cause unexpected malfunction, like abnormal heat, fire and so on, and circuit do not work. Avoid impressing voltages to the set coil and reset coil at the same time.

■ Maximum allowable voltage and temperature rise

Proper usage requires that the rated coil voltage be impressed on the coil. Note, however, that if a voltage greater than or equal to the maximum continuous voltage is impressed on the coil, the coil may burn or its layers short due to the temperature rise. Furthermore, do not exceed the usable ambient temperature range listed in the catalog.

● Operate voltage change due to coil temperature rise

In DC relays, after continuous passage of current in the coil, if the current is turned OFF, then immediately turned ON again, due to the temperature rise in the coil, the operate voltage will become somewhat higher. Also, it will be the same as using it in a higher temperature atmosphere. The resistance/temperature relationship for copper wire is about 0.4 % for 1 °C, and with this ratio the coil resistance increases. That is, in order to operate of the relay, it is necessary that the voltage be higher than the operate voltage and the operate voltage rises in accordance with the increase in the resistance value. However, for some polarized relays, this rate of change is considerably smaller.

Ambient Environment

■ Usage, Transport, and Storage Conditions

During usage, storage, or transportation, avoid locations subjected to direct sunlight and maintain normal temperature, humidity and pressure conditions.

●Temperature/Humidity/Pressure

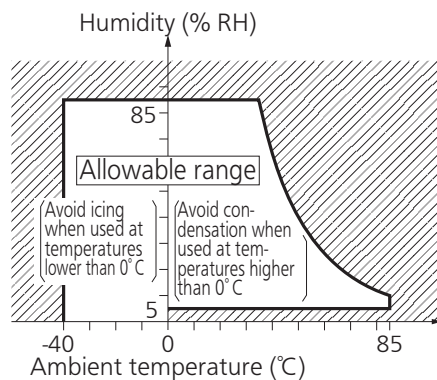
When transporting or storing relays while they are tube packaged, there are cases the temperature may differ from the allowable range. In this case be sure to check the individual specifications.

Also allowable humidity level is influenced by temperature, please check charts shown below and use relays within mentioned conditions. (Allowable temperature values differ for each relays, please refer to the relay's individual specifications.)

1) Temperature:

The tolerance temperature range differs for each relays, please refer to the relay's individual specifications

2) Humidity: 5 to 85 % RH



3) Pressure: 86 to 106 kPa

●Dew condensation

Condensation occurs when the ambient temperature drops suddenly from a high temperature and humidity, or the relay is suddenly transferred from a low ambient temperature to a high temperature and humidity.

Condensation causes the failures like insulation deterioration, wire disconnection and rust etc.

Panasonic Industry Co., Ltd. does not guarantee the failures caused by condensation.

The heat conduction by the equipment may accelerate the cooling of device itself, and the condensation may occur.

Please conduct product evaluations in the worst condition of the actual usage. (Special attention should be paid when high temperature heating parts are close to the device. Also please consider the condensation may occur inside of the device.)

●Icing

Condensation or other moisture may freeze on relays when the temperature become lower than 0 °C. This icing causes the sticking of movable portion, the operation delay and the contact conduction failure etc. Panasonic Industry Co., Ltd. does not guarantee the failures caused by the icing.

The heat conduction by the equipment may accelerate the cooling of relay itself and the icing may occur.

Please conduct product evaluations in the worst condition of the actual usage.

●Low temperature and low humidity

The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

●High temperature and high humidity

Storage for extended periods of time (including transportation periods) at high temperature or high humidity levels or in atmospheres with organic gases or sulfide gases may cause a sulfide film or oxide film to form on the surfaces of the contacts and/or it may interfere with the functions. Check out the atmosphere in which the units are to be stored and transported.

●Package

In terms of the packing format used, make every effort to keep the effects of moisture, organic gases and sulfide gases to the absolute minimum.

●Silicon

When a source of silicone substances (silicone rubber, silicone oil, silicone coating materials and silicone filling materials etc.) is used around the relay, the silicone gas (low molecular siloxane etc.) may be produced.

This silicone gas may penetrate into the inside of the relay. When the relay is kept and used in this condition, silicone compound may adhere to the relay contacts which may cause the contact failure. Do not use any sources of silicone gas around the relay (Including plastic sealed types).

●NOx Generation

When relay is used in an atmosphere high in humidity to switch a load which easily produces an arc, the NOx created by the arc and the water absorbed from outside the relay combine to produce nitric acid.

This corrodes the internal metal parts and adversely affects operation.

Avoid use at an ambient humidity of 85 % RH or higher (at 20 °C). If use at high humidity is unavoidable, please contact our sales representative.

Others

■ Cleaning

- Although the environmentally sealed type relay (plastic sealed type, etc.) can be cleaned, avoid immersing the relay into cold liquid (such as cleaning solvent) immediately after soldering. Doing so may deteriorate the sealing performance.
- Cleaning with the boiling method is recommended (The temperature of cleaning liquid should be 40 °C or lower). Avoid ultrasonic cleaning on relays. Use of ultrasonic cleaning may cause breaks in the coil or slight sticking of the contacts due to ultrasonic energy.

Please refer to " **the latest product specifications** " when designing your product.

- Requests to customers:

<https://industry.panasonic.com/global/en/salespolicies>

■ Global Sales Network Information: industry.panasonic.com/global/en/salesnetwork/globalnetwork

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