ESPEC Quality is more than a word

Today, the automotive industry accelerates electronic multi-functions. According to this trend, safety standards such as ISO26262 and IEC61508 require high environmental stress that is generated by thermal shock chambers for higher reliability of vehicle equipments.

Accelerated temp. recovery time -perfect for quick evaluation of solder crack

As product reliability demands and testing time for stress tests are increasing, product development time is decreasing.
This model combines the newly developed highly accelerated air to air thermal shock chamber, which has reduced thermal shock testing time by one-third, with a conductor resistance evaluation system, which evaluates the reliability of connectors on print substrates and electronic parts. As a result, development time can be reduced and power consumption can be economized.

Features

<Highly Accelerated Air to Air Thermal Shock Chamber>

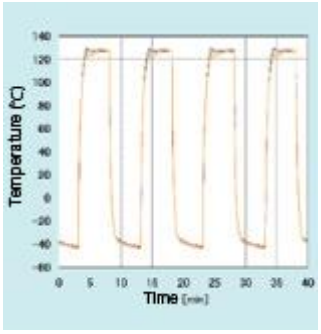
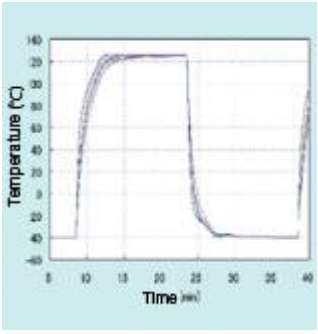
- Obtain test results that correlate with a conventional thermal shock test.
  *1 Coffin-Manson evaquation is used for this thermal shock testing. The relationship between the life cycle and the temperature change is expressed in the following formula.
  $L=A(\Delta T)^{-n}$
  L=Life cycle
  A=Constant
  ΔT=Temperature change
  n=Temperature cycle acceleration factor
  This explains that the exposure time has no effect on the evaluation results. The same results have been observed in sample tests which ESPEC conducted independently.

- High velocity and unique air flow control enable a temperature recovery time of 3 minutes between +125°C and -40°C. It reduces thermal shock testing time by one-third for significantly faster testing.
- Frost-free circuit prevents the formation of frost, thereby eliminating the need to stop a test and perform defrosting.
  It reduces the time and power consumption used for defrosting.
- With wind velocity controller allows control of wind velocity, a chamber enables conventional thermal shock testing.

<Conductor Resistance Evaluation System>

- Constantly measure micro current and micro resistance during thermal shock tests to accurately obtain the absolute value and rate of change to determine failures.
- Available from a direct current measurement system and an alternating current measurement system.

Test cases of confirming validity of velocity (one-third the exposure time of conventional test)

<table>
<tr><th></th><th colspan="3">Highly accelerated thermal cycle test
(air chamber)</th><th colspan="3">Conventional thermal cycle test
(air chamber)</th></tr>
<tr><td>Temperature range</td><td colspan="6">-40°C ⇔ +125°C（⊿t＝165°C）</td></tr>
<tr><td>Exposure time</td><td colspan="3">5 minutes</td><td colspan="3">15 minutes</td></tr>
<tr><td rowspan="3">Temperature profile</td><td colspan="3"> 
</td><td colspan="3"> 
</td></tr>
<tr><td></td><td>Hot
(+123°C or more)</td><td>Cold
(-38°C or less)</td><td></td><td>Hot
(+123°C or more)</td><td>Cold
(-38°C or less)</td></tr>
<tr><td>Substrate temperature recovery time</td><td>1.1 to 1.3 minutes</td><td>1.5 to 2.5 minutes</td><td>Substrate temperature recovery time</td><td>3.4 to 7.9 minutes</td><td>3.7 to 6.2 minutes</td></tr>
</table>

	Substrate temperature hold time	3.7 to 3.9 minutes	3.5 to 2.5 minutes	Substrate temperature hold time	7.1 to 11.6 minutes	8.8 to 11.3 minutes

Proposal of a new test method

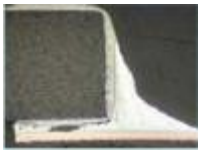
Cross-section observation
There is no notable difference in cracking or advancing

Highly accelerated method

500cycle

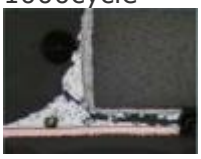
1000cycle

2000cycle
Conventional method

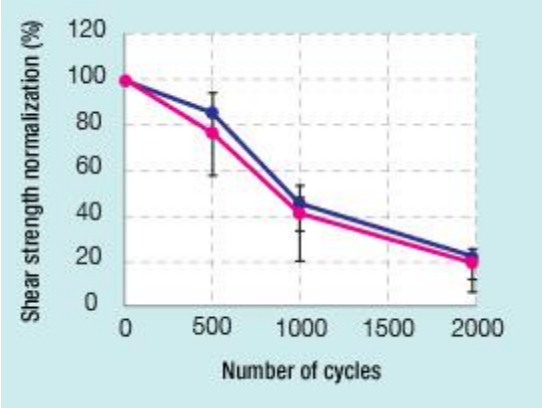


500cycle

1000cycle



2000cycle
Strength test
There is no difference in the joining strength deterioration



Specifications

<Highly Accelerated Air to Air Thermal Shock Chamber>

Model		TSH-13-W
Method		Temperature recovery (highly accelerated operation)
Performance	High-temperature exposure	+60°C to +200°C
	Low-temperature exposure	-70°C to 0°C
	Temperature recovery (highly accelerated operation)	High-temperature exposure: +125°C 5 minutes Low-temperature exposure: -40°C 5 minutes Specimen: 1.36 kg (using a glass epoxy substrate) Temperature recovery rate: within 3 minutes
System		Mechanical two-way refrigeration system (water cooled)
Construction	Inside capacity	12L
	Test area	W300×H200×D200mm
	Outside dimensions	W1430×H1900×D1370mm
	Weight	Approx. 1,070 kg

<Conductor Resistance Evaluation System (direct current measurement system)>

Model	AMR-040-UD
Measurement system	Electric current measurement system
Channel construction	40 standard channels (max. 280 channels per rack)）
Channel control	10 channel unit

Resistance measurement range	$1.0\times10^{(-3)}$ ～$1.0\times10^{(6)}$ Ω
Measurement range	1Ω, 10Ω, 100Ω, 1kΩ, 10kΩ, 100kΩ, 1MΩ, AUTO
Measuring instrument	Model：34420A (Agilent Technologies)
Outside dimensions	W530×H1750×D940mm

<Conductor Resistance Evaluation System (alternating current measurement system)>

Model	AMR-040-UA
Measurement system	Electric current measurement system
Channel construction	40 standard channels (max. 280 channels per rack)
Channel control	10 channel unit
Resistance measurement range	1.0×10（-3）～1.0×10（6）Ω
Measurement range	10mΩ, 100mΩ, 1Ω, 10Ω, 100Ω, 1kΩ, 10kΩ, AUTO
Measuring instrument	Model：4338B (Agilent Technologies)
Outside dimensions	W530×H1750×D940mm

Examples

· -40°C ⇔ +125°C	Test area recovery time 5 min, exposure time 5 min	Specimen: In-vehicle DC-DC convertor
· -40°C ⇔ +65°C	Test area recovery time 5 min	Specimen: In-vehicle battery cell

Recommended products for customers viewing this product

Conductor Resistance Evaluation System (AMR)

Air to Air Thermal Shock Chamber

Large Capacity Liquid to Liquid Thermal Shock Chamber

Thermal Shock Chamber 300°C Specification

Large Capacity Thermal Shock Chamber 603EL (600L)

Air to Air Thermal Shock Chamber with Humidity

High-rate Thermal Cycle Chamber