



ศูนย์ทดสอบแบตเตอรี่ยานยนต์ไฟฟ้า
Electric Vehicle Battery Testing Center

Standards and Calibrations Required in Batteries

TAI'S ELECTRIC VEHICLE
BATTERY TESTING CENTER

Challenges and Issues Facing Electric Vehicles in Thailand

1. EV Fire and Explosion Incidents : Between 2022 and 2023, there were about 7-10 reported incidents of EV fires and explosions. These were mainly caused by charging issues and battery damage.

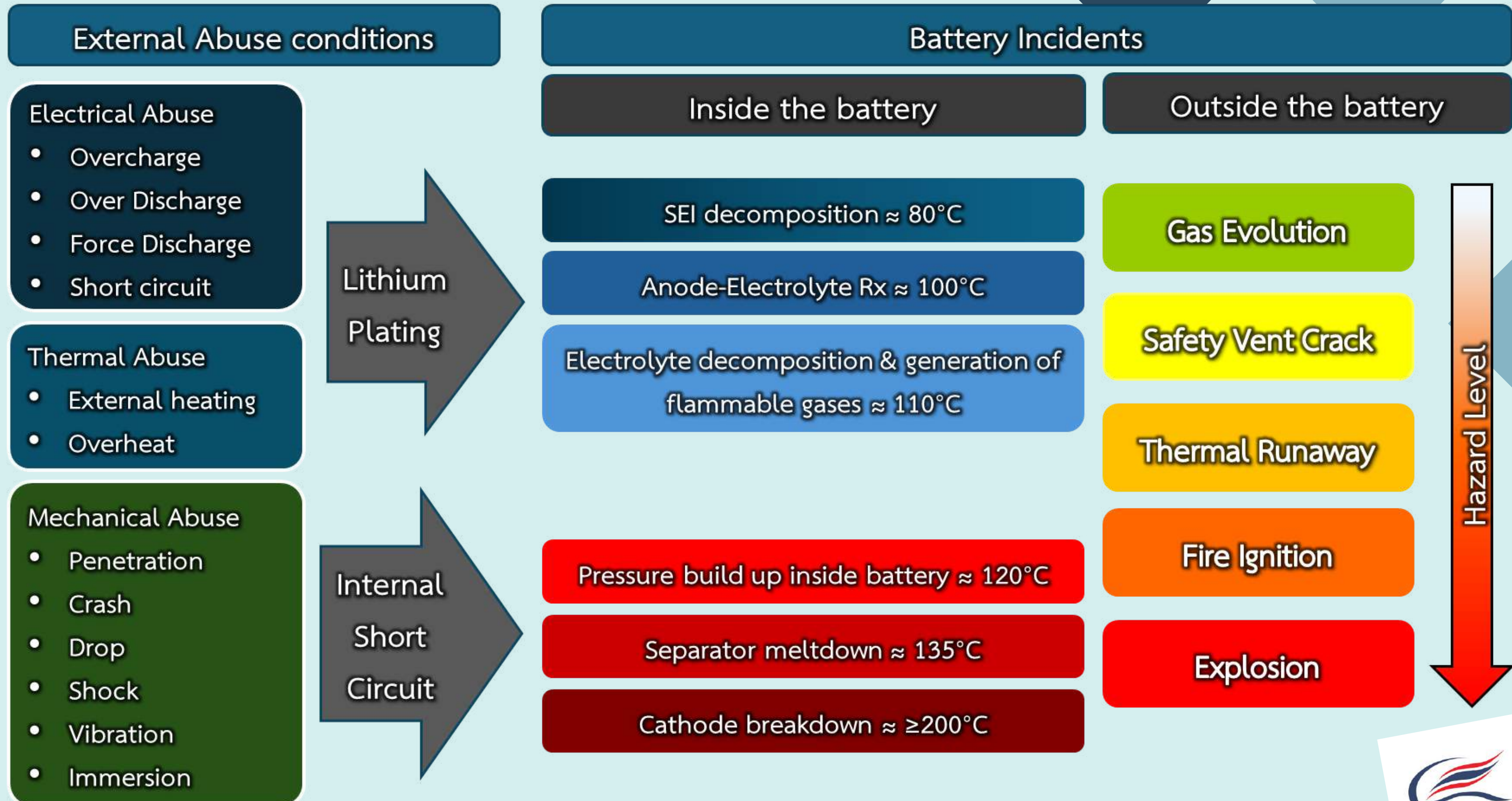
2. Charging Problems : A 2023 inspection revealed that approximately 10-15% of electric charging stations did not meet safety standards, posing risks to users.

3. Accidents Involving EVs : In 2023, there were around 60 reported accidents involving EVs. Most of these occurred during urban driving and were related to vehicle control issues.

4. Battery Degradation : EV batteries can degrade by 20-30% after about 5-7 years of use, which may pose safety risks.

5. Flood Impact on Battery: In 2023, a survey during the flooding in Southern Thailand found that approximately 50 to 70 electric vehicles (EVs) were damaged by the flood.

Classification of Battery Damages



Standard for Electric Vehicle

Electric power train

UNR 100 (มอก. 3026) Part 1
 UNR 85 (มอก. 2331) Net power
 UNR 101 (มอก. 2335) Energy consumption
 IEC 60349 (มอก. 3032) Motor
 ISO 21782 (มอก. 3382) Inverter, DC/DC converter

REESS

UNR 100 (มอก. 3026) Part 2
 ISO 6469-1 (มอก. 3102-1) Safety
 ISO 12405-4 (มอก. 3378-4) Performance
 IEC 61982 (มอก. 61982) Non-Lithium
 ISO 18300 (มอก. 3379) Lithium+Lead acid

Electric cable

ISO 6722 (มอก. 3248) Single core
 ISO 14572 (มอก. 3249) Single/Multi

On-board charge

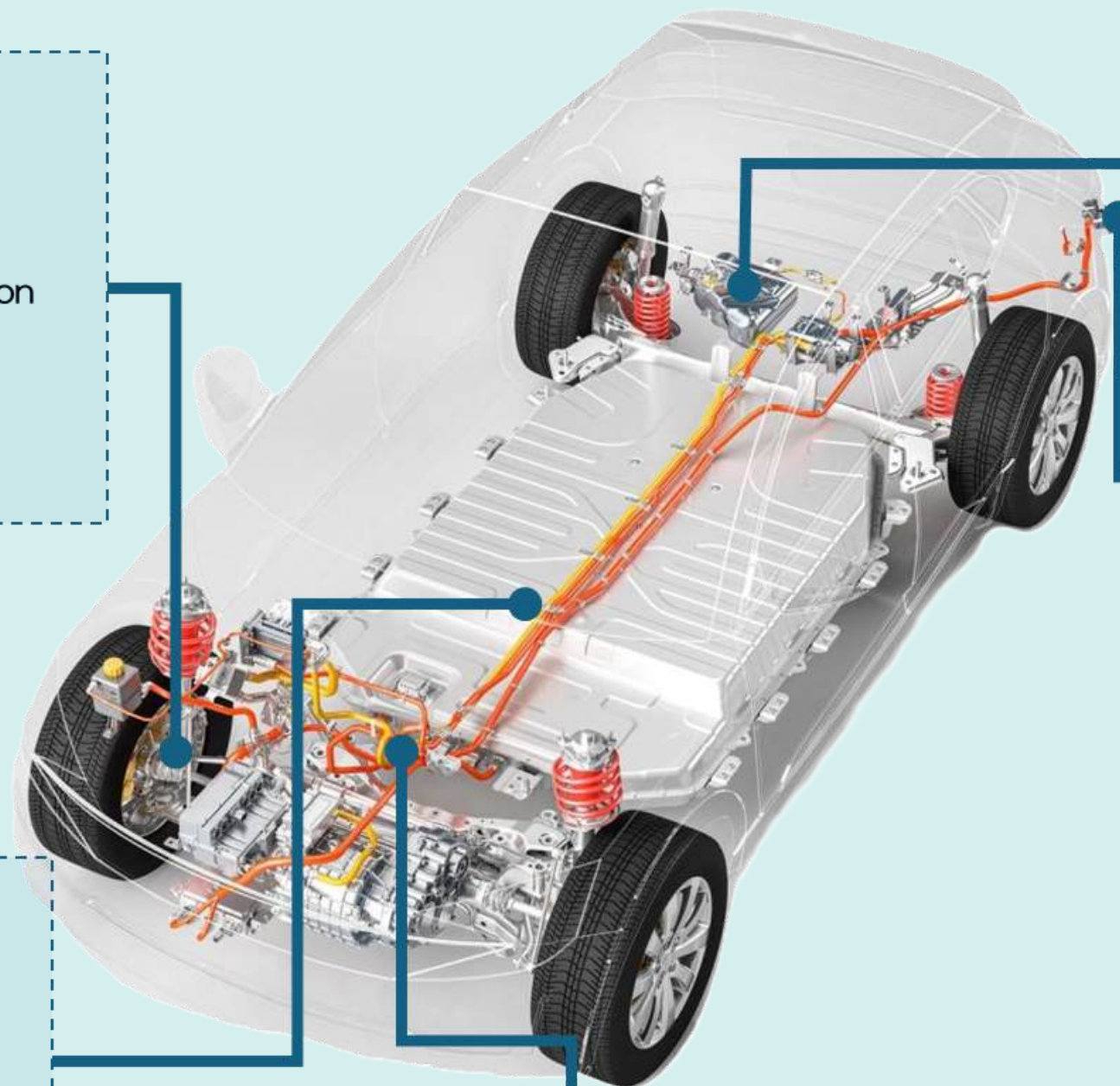
ISO 17409 (มอก. 2776) Wire charge
 ISO 19363 (มอก. 3380) Wireless charge
 CISPR 25 (มอก. 2929) EMC
 IEC 62335 (มอก. 2909) Circuit breaker

Electrical socket

IEC 62196 (มอก. 2749)

Station charge

IEC 61851 (มอก. 61851) Wire charge
 IEC 61980 (มอก. 61980) Wireless charge
 IEC 62840 (มอก. 62840) Battery swap
 IEC 60364-7-722 (มอก. 3068) installation
 IEC 61439-7 (มอก. 1436-7) Switch gear
 CISPR 12 (มอก. 2930) EMC
 IEC 62463 (มอก. 2955) Type F,B,CB
 IEC 62955 (มอก. 3462) RDC-DD
 IEC 62893 (มอก. 3060) Cable



Automotive and Tire Testing, Research and Innovation Center (ATTRIC)



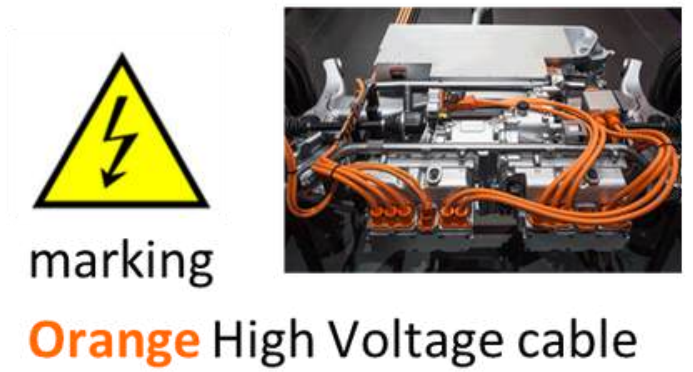
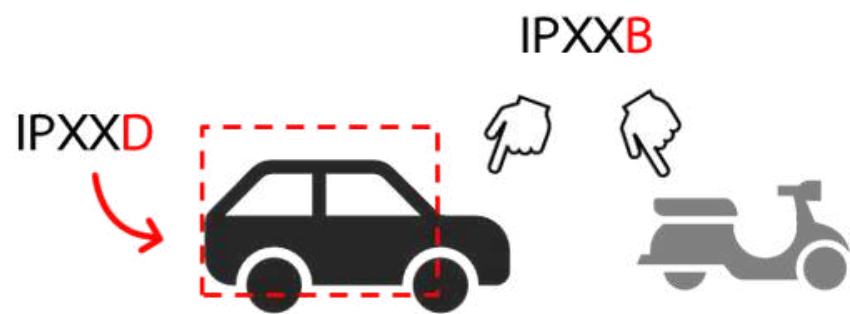
TAI's EV Battery Testing Center



Scope of Services UN-R100,136

Part 1 Electrical safety

- Protection against electrical shock
- Functional safety
- Water resistance (UN-R136)



Part 2 UN-R100 (Rev.02,03)



Vibration



Mechanical shock



Fire resistance



Over charge protection



Over discharge protection



Over temperature protection



Thermal shock



External short circuit protection



Mechanical integrity

Part 2 UN-R100 (Rev.03)



Over current protection



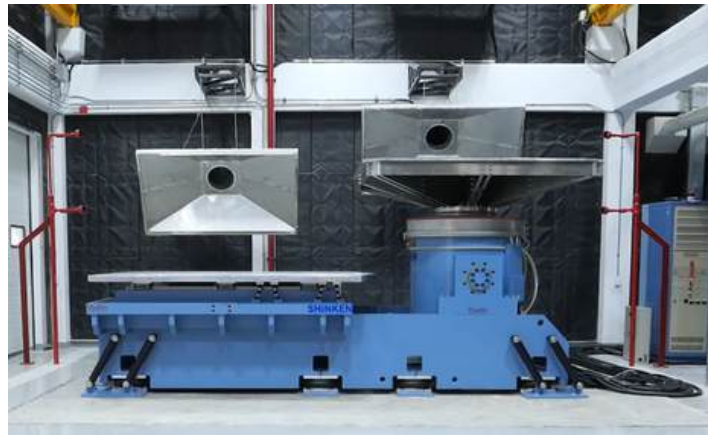
Thermal runaway (in 2028)

Part 2 UN-R136



Drop

EV's equipment



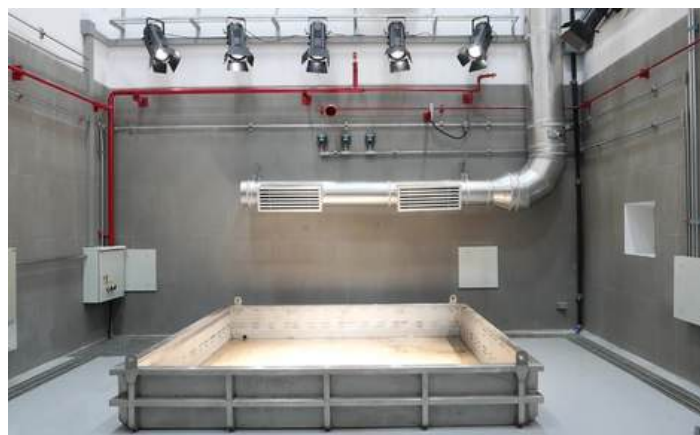
Vibration



Mechanical integrity



Over temperature



External short circuit



Mechanical shock



Fire resistance



Thermal shock



Over charge&discharge



Drop

Electrical Abuse : Over temperature protection test



Rev.02

- Battery will charge or discharge to increase its temperature until it stops functioning

Rev.03

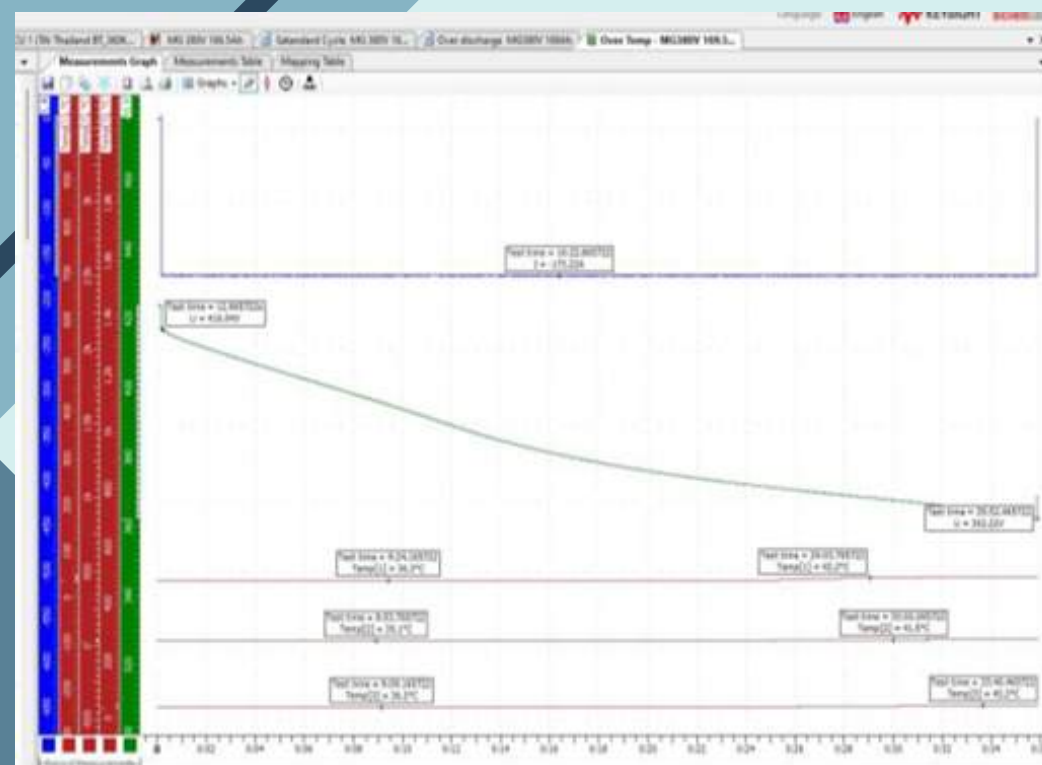
- Battery will charge or discharge to increase its temperature until it stops functioning as rapidly as possible.

- The chamber shall be gradually increased, from 20 ± 10 °C at higher battery temperature

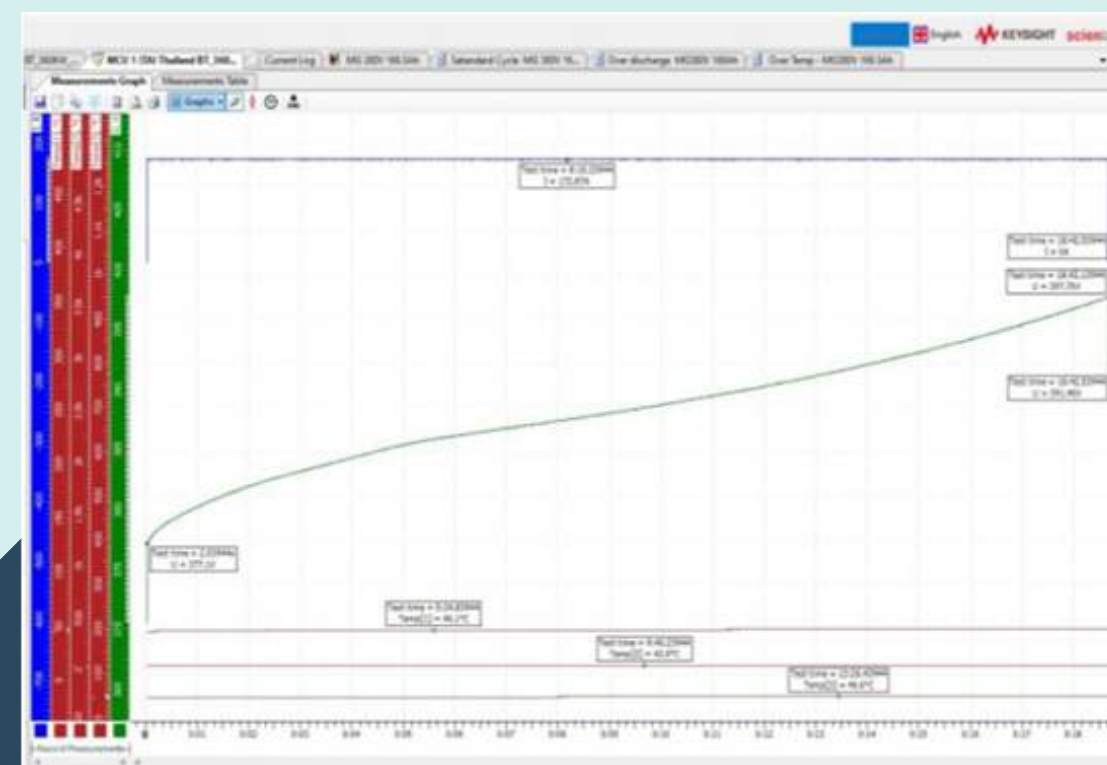
- If battery not stop charging shall be continued until battery is stabilized such that the temperature varies by a gradient of less than 4 °C through 2 hours.

Acceptance criteria

- No Electrolyte leakage
- No Rupture
- No Fire
- No Explosion
- Isolation resistance > 100Ω/V



Discharge



Charge

Electrical Abuse : Over temperature protection calibration

1. Temperature Accuracy Test

Controller (Value)		Measured Value (°C) @ Sensor No.										Judgment Result	Measurement Uncertainty (±) °C
Setting	Indicated	(Sensor No. 1 is reference)											
(°C)		1	2	3	4	5	6	7	8	9			
-40.0	-40.0	-39.4	-39.4	-39.2	-39.4	-39.3	-39.4	-39.1	-39.2	-39.1	-	0.92	
25.0	25.0	24.5	24.6	24.6	24.8	24.5	24.4	24.5	24.5	24.4	-	0.92	
100.0	100.0	99.3	99.2	99.1	99.3	99.3	99.4	99.2	99.4	99.4	-	0.92	

2. Temperature Characterization Test

Indicated Value (°C)	Measured Value (°C) (Sensor No. 1)	Correction (°C)	Uniformity (°C)	Stability (°C)	Overall Variation (°C)
-40.0	-39.4	0.6	0.3	0.1	0.5
25.0	24.5	-0.5	0.3	0.1	0.4
100.0	99.3	-0.7	0.2	0.1	0.5

※ Correction = Measured Value (Sensor No.1) - Indicated Value

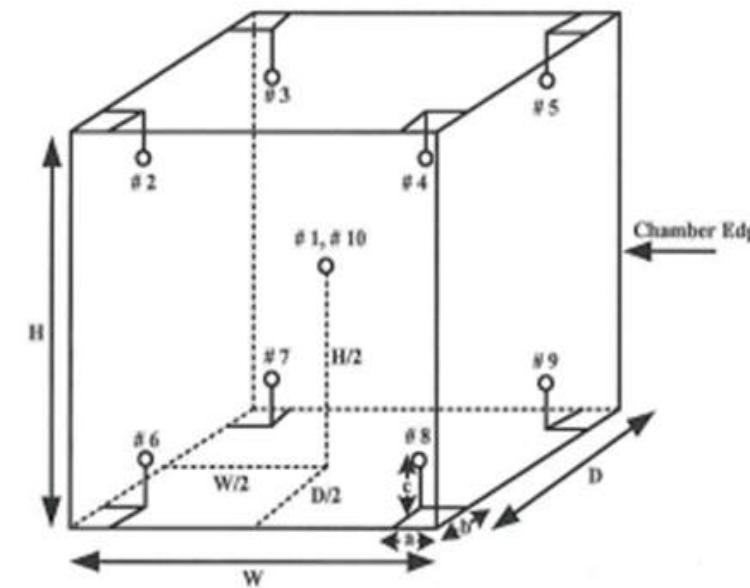
3. Humidity Accuracy Test (Sensor No.10)

Controller (Value)		Measured Value (Single point measurement)	Correction (%R.H.)	Judgment Result	Uncertainty (±) %R.H.
Setting Value	Indicated Value				
25 %R.H. (at 60 °C)	25 %R.H.	26.0 %R.H.	1.0	-	3.8
95 %R.H. (at 60 °C)	95 %R.H.	94.8 %R.H.	-0.2	-	4.3

※ Correction = Measured Value (Sensor No.10) - Indicated Value



4. Location Install of Sensor



Section 1 - Voltage Measurement Accuracy Test (option 305 or 306)

Range	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
Channel 0~1000V	50.000 V	49.675 V	50.1875 V	50.1875 V	50.325 V	PASS	0.00058 V
	250.00 V	249.570 V	249.9896 V	249.9896 V	250.430 V	PASS	0.0059 V
	500.00 V	499.450 V	499.9598 V	499.9598 V	500.550 V	PASS	0.0059 V
	750.00 V	749.325 V	750.0123 V	750.0123 V	750.675 V	PASS	0.0059 V
	1000.00 V	999.200 V	999.9943 V	999.9943 V	1000.800 V	PASS	0.0059 V

Section 2 - Current Measurement Accuracy Test (option 202)

Range	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
Channel 0~600A	0.000 A	-0.068 A	0.000 A	0.000 A	0.068 A	PASS	0.00058 A
	100.000 A	99.739 A	99.813 A	99.813 A	100.261 A	PASS	0.036 A
	200.000 A	199.870 A	199.981 A	199.981 A	200.130 A	PASS	0.072 A
	300.000 A	299.805 A	299.937 A	299.937 A	300.195 A	PASS	0.11 A

Specification of: Battery test system

- PACK cyclers (1000V 600A 360kW & 180kW)
- MODULE cycler (60V 300A 18 kW)
- Cell cyclers (6V 100A 0.6kW)

Specification of : Chamber

- Walk-in Chamber No. 1 (1.8 x 1.9 x 1.9 m3)
- Walk-in Chamber No. 2 (2.4 x 2.4 x 2.1 m3)
- Temperature range -40 °C to +100 °C
- Explosion proof
- Fire extinguishing system

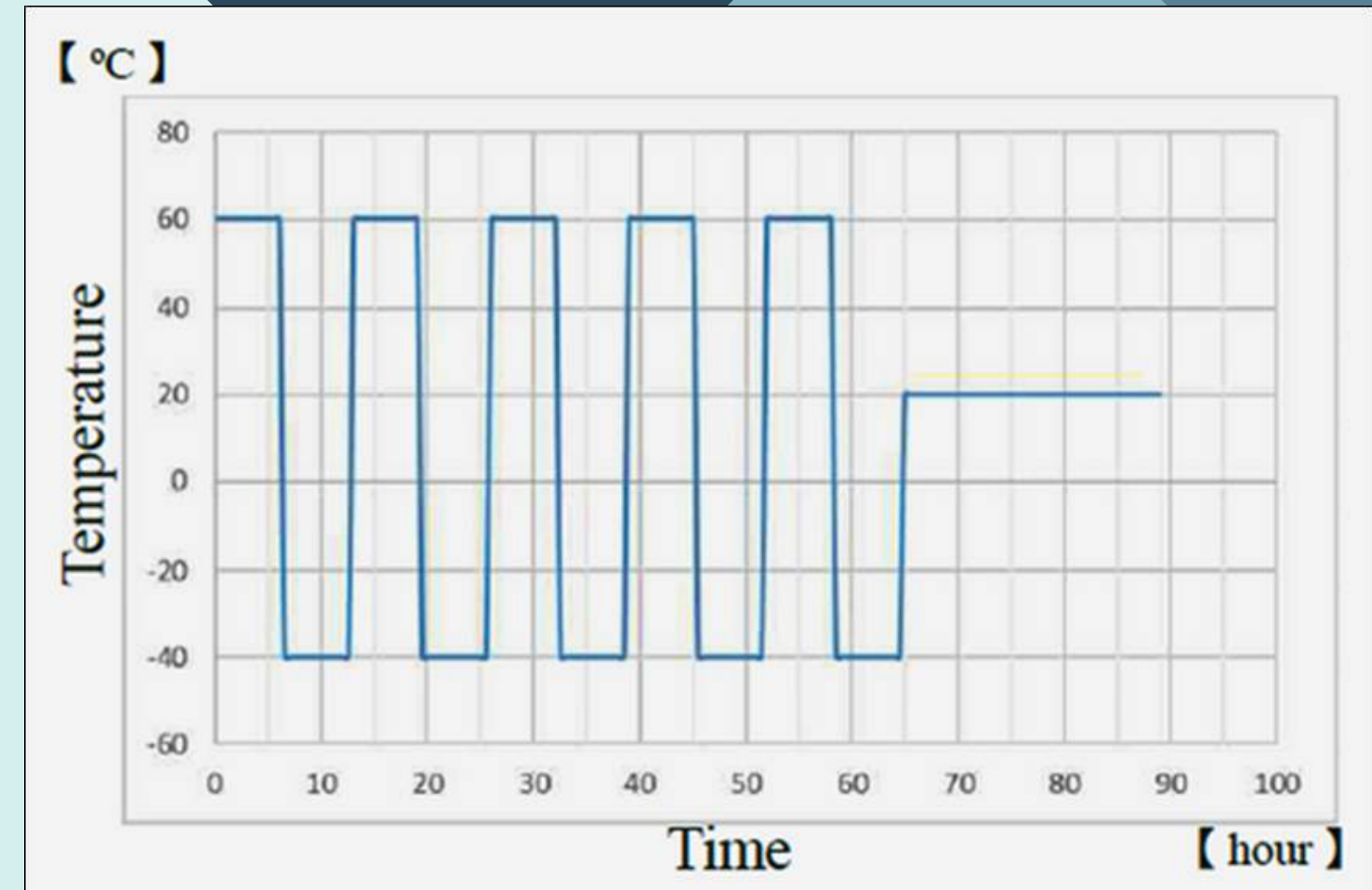


Thermal Abuse : Thermal shock and cycling test

- Heating 60 °C 6 hours, Cooling -40 °C 6 hours
- The time interval between test temperature extremes shall be 30 minutes.
- Stored 24 hours at 20 ± 10 °C. (Rev.03 22 ± 5 °C.)
- Testing period : 5 cycle, 12 hours/cycle, after test 24 hours, 84 hours

Acceptance criteria

- No Electrolyte leakage
- No Rupture
- No Fire
- No Explosion
- Isolation resistance > 100Ω/V



Specification of : Thermal shock chamber

- Thermal shock chamber (2.5 x 2.5 x 2.0 m.)
- Temperature range -40 °C to +85 °C
- Heating/Cooling rate 5°C/min (-40 to 60 °C within 30 minutes)
- Explosion proof
- Fire extinguishing system



Thermal Abuse : Thermal shock and cycling calibration

Table 1: Mean Temperature of various test point after chamber temperature has stabilized

Temperature Setting	Test Point (°C)									
	PT 1	PT 2	PT 3	PT 4	PT 5	PT 6	PT 7	PT 8	PT 9	PT 10
-20	-20.00	-20.00	-20.10	-20.10	-20.10	-20.00	-20.40	-19.90	-20.20	-20.30
-40	-40.00	-40.10	-40.10	-39.90	-39.90	-39.90	-40.00	-39.60	-40.00	-40.40
25	24.90	24.90	24.90	25.00	24.80	24.90	24.80	25.30	24.70	24.60
60	60.80	60.60	60.70	60.50	60.50	60.40	60.20	60.70	60.60	60.40
80	80.20	80.80	80.50	80.50	80.70	80.60	80.70	80.80	79.80	80.80

Table 2: Maximum and Minimum Temperature of various test point when the chamber temperature had stabilized

Test Point	Temperature Conditions (°C)			
	-20		-40	
	Maximum	Minimum	Maximum	Minimum
PT 1	-19.55	-20.55	-39.80	-40.15
PT 2	-19.55	-20.50	-39.95	-40.45
PT 3	-19.50	-20.55	-39.35	-40.55
PT 4	-19.55	-20.50	-39.60	-40.50
PT 5	-19.70	-20.65	-39.70	-40.60
PT 6	-19.60	-20.55	-39.65	-40.10
PT 7	-19.80	-20.75	-39.80	-40.20
PT 8	-19.45	-20.15	-39.45	-40.00
PT 9	-19.75	-20.75	-39.70	-40.60
PT 10	-19.90	-20.85	-40.30	-40.65

Table 3: Maximum and Minimum Temperature of various test point when the chamber temperature had stabilized

Test Point	Temperature Conditions (°C)			
	25		60	
	Maximum	Minimum	Maximum	Minimum
PT 1	25.25	24.60	60.90	60.60
PT 2	25.20	24.60	60.70	60.45
PT 3	25.25	24.65	60.80	59.95
PT 4	25.25	24.65	60.90	60.15
PT 5	25.15	24.35	60.55	60.40
PT 6	25.25	24.45	60.45	60.25
PT 7	25.15	24.35	60.35	60.20
PT 8	25.60	25.05	60.80	60.60
PT 9	25.05	24.45	60.70	60.40
PT 10	25.05	24.10	60.45	60.35

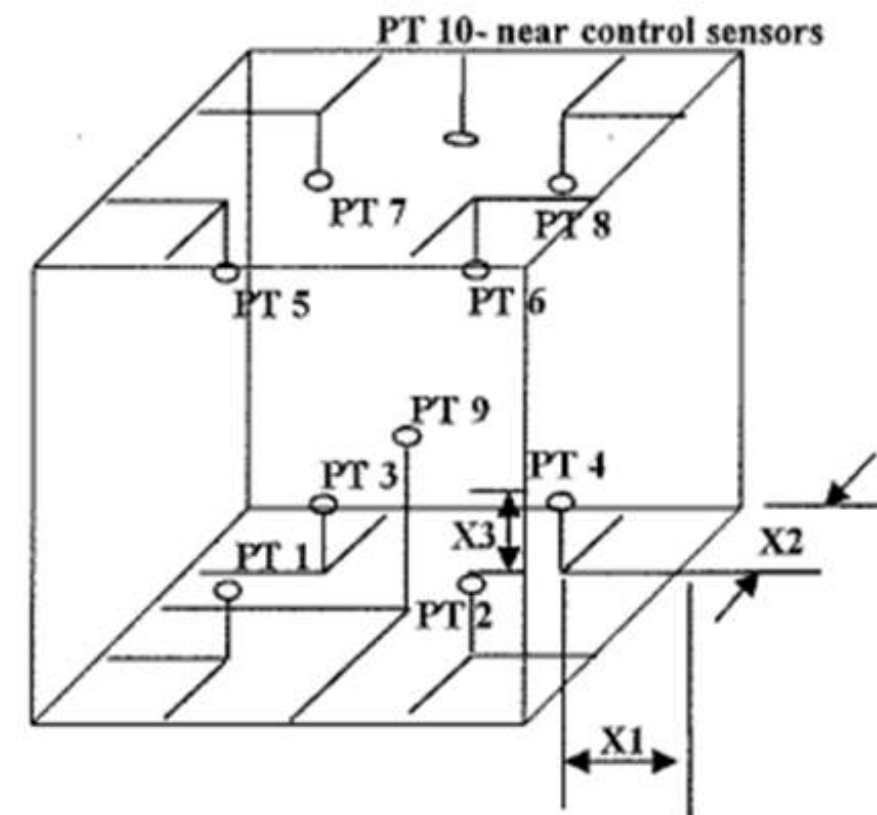
Table 4: Maximum and Minimum Temperature of various test point when the chamber temperature had stabilized

Test Point	Temperature Conditions (°C)	
	80	
	Maximum	Minimum
PT 1	80.30	80.10
PT 2	80.85	80.55
PT 3	80.60	80.35
PT 4	80.65	80.50
PT 5	80.80	80.45
PT 6	80.75	80.55
PT 7	80.85	80.65
PT 8	80.90	80.65
PT 9	79.95	79.55
PT 10	80.85	80.65

Table 5 : Results of chamber calibration based on test point 1 to 9

Temperature Setting (°C)	Mean Display Reading (°C)	Mean Measure Readings Of 9 Points (°C)	Measurement Uncertainty Of Mean Value (°C)	Spatial Variation (°C)	Coverage Factor (k)	Overall Temperature Variation (°C)	
						Maximum	Minimum
-20	-20.0	-20.1	1.2	0.5	2.0	-19.45	-20.75
-40	-40.0	-39.9	1.3	0.5	2.0	-39.35	-40.60
25	25.0	24.9	1.0	0.6	2.0	25.60	24.35
60	60.0	60.6	1.1	0.6	2.0	60.90	59.95
80	80.0	80.5	1.1	1.0	2.1	80.90	79.55

Note : Spatial Variation is the difference between the mean maximum and minimum of sensors Pt 1 to Pt 9 (table 1)
Temperature sensors correction values have been added into the reported measurement data.



Mechanical Abuse : Vibration test

UN R100

Frequency (Hz)	Acceleration (m/s ²)
7 - 18	10
18 - 30	gradually reduced from 10 to 2
30 - 50	2

UN R136 ≥12 kg

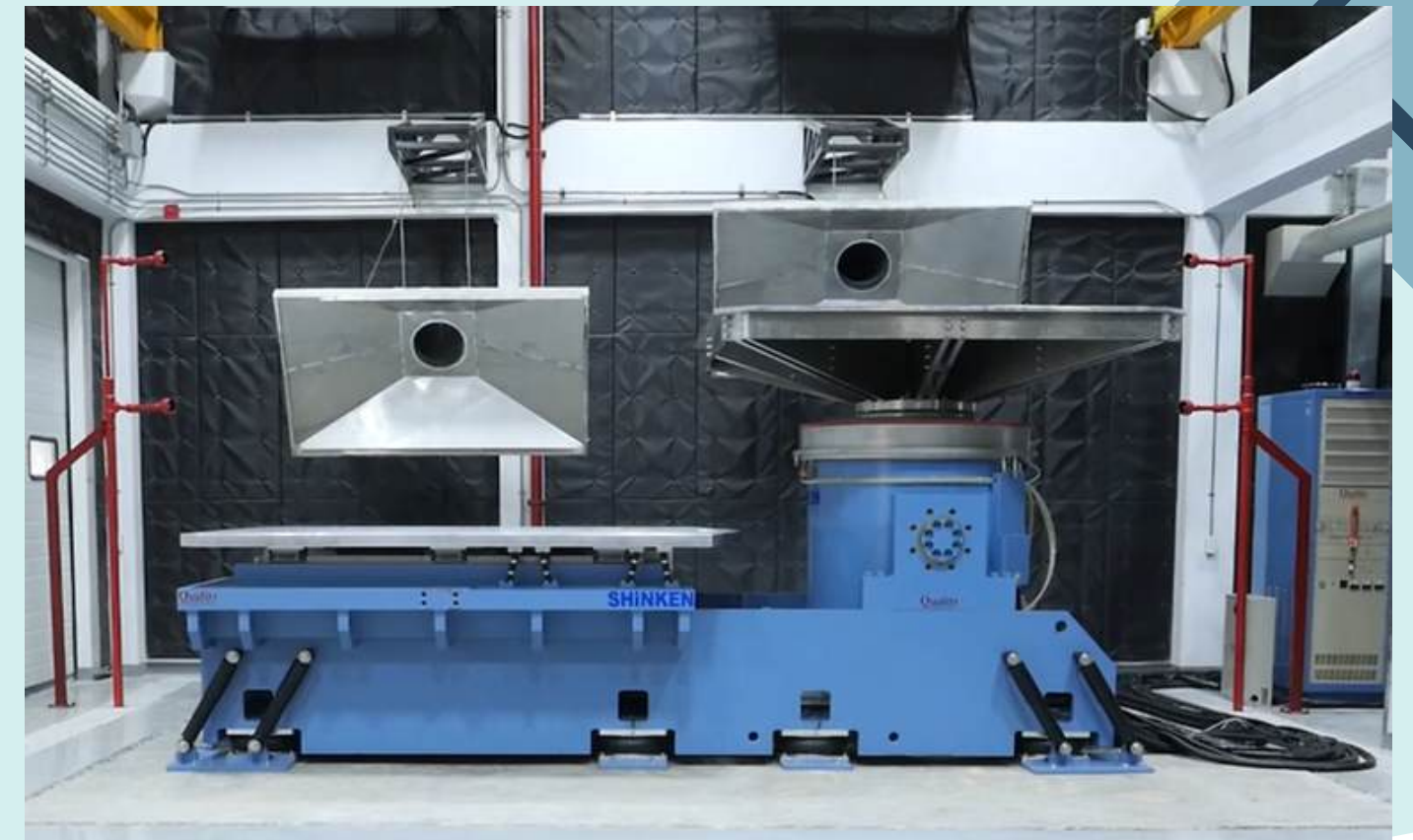
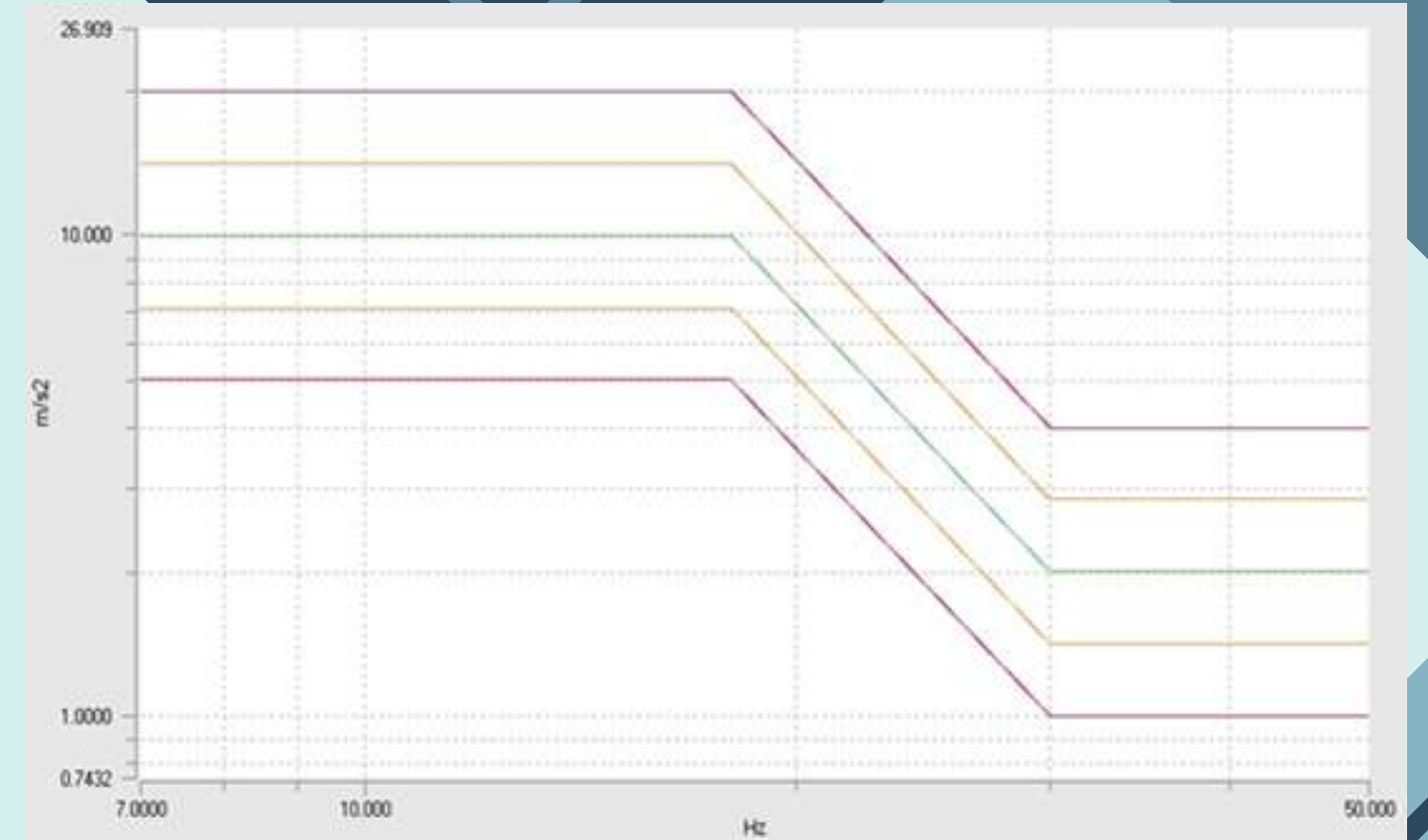
Frequency (Hz)	Acceleration (m/s ²)
7 - 18	10
18 - 50	gradually increased from 10 to 80
50 - 200	2

UN R136 ≤12 kg

Frequency (Hz)	Acceleration (m/s ²)
7 - 18	10
18 - 50	gradually increased from 10 to 20
50 - 200	2

Acceptance criteria

- No Electrolyte leakage
- No Rupture
- No Fire
- No Explosion
- Isolation resistance > 100Ω/V



Specification of: Vibration tester

- Vibration test up to 1000 kg.
- Frequency up to 3 – 2000 Hz
- Able to test in both Vertical and Horizontal

Mechanical Abuse : Vibration calibration

Measurement Results

Section - Acceleration Linearity (peak) Vertical axis

Nominal Acceleration (m/s ²)	Frequency (Hz)	Lower Limit (m/s ²)	Instrumental Value (m/s ²)		Upper Limit (m/s ²)	Result	Uncertainty (m/s ²)
			As Found	As Left			
10.000	7	9.000	10.104	10.104	11.000	PASS	± 0.074
10.000	12	9.000	10.019	10.019	11.000	PASS	± 0.074
10.000	18	9.000	10.021	10.021	11.000	PASS	± 0.074
2.000	30	1.800	1.984	1.984	2.200	PASS	± 0.019
2.000	40	1.800	1.990	1.990	2.200	PASS	± 0.019
2.000	50	1.800	1.985	1.985	2.200	PASS	± 0.019
20.000	25	18.000	19.958	19.958	22.000	PASS	± 0.14
20.000	50	18.000	19.961	19.961	22.000	PASS	± 0.14
20.000	100	18.000	19.850	19.850	22.000	PASS	± 0.14
20.000	150	18.000	19.855	19.855	22.000	PASS	± 0.14
20.000	200	18.000	19.823	19.823	22.000	PASS	± 0.14
80.000	50	72.000	79.512	79.512	88.000	PASS	± 0.56
80.000	100	72.000	78.917	78.917	88.000	PASS	± 0.56
80.000	150	72.000	79.054	79.054	88.000	PASS	± 0.56
80.000	200	72.000	78.876	78.876	88.000	PASS	± 0.56

Note : Accuracy by manufacturer : ±10 % of reading

Calibration with vibration pick up : Shinken, Model. V11-107, S/N.0675

Measurement Results

Section 2 - Acceleration Linearity (peak) Horizontal axis

Nominal Acceleration (m/s ²)	Frequency (Hz)	Lower Limit (m/s ²)	Instrumental Value (m/s ²)		Upper Limit (m/s ²)	Result	Uncertainty (m/s ²)
			As Found	As Left			
10.000	7	9.500	10.101	10.101	10.500	PASS	± 0.074
10.000	12	9.500	10.112	10.112	10.500	PASS	± 0.074
10.000	18	9.500	10.108	10.108	10.500	PASS	± 0.074
2.000	30	1.900	2.002	2.002	2.100	PASS	± 0.019
2.000	40	1.900	1.987	1.987	2.100	PASS	± 0.019
2.000	50	1.900	1.990	1.990	2.100	PASS	± 0.019
20.000	25	19.000	20.081	20.081	21.000	PASS	± 0.14
20.000	50	19.000	20.065	20.065	21.000	PASS	± 0.14
20.000	100	19.000	20.056	20.056	21.000	PASS	± 0.14
20.000	150	19.000	20.055	20.055	21.000	PASS	± 0.14
20.000	200	19.000	20.059	20.059	21.000	PASS	± 0.14
80.000	50	76.000	80.069	80.069	84.000	PASS	± 0.56
80.000	100	76.000	80.078	80.078	84.000	PASS	± 0.56
80.000	150	76.000	80.849	80.849	84.000	PASS	± 0.56
80.000	200	76.000	81.050	81.050	84.000	PASS	± 0.56

Note : Accuracy by manufacturer : ±10 % of reading

Calibration with vibration pick up : Shinken, Model. V11-105S, S/N.0947



Equipment verification

รายงานผลการทวนสอบเครื่องมือทดสอบ

เครื่องมือ: Temperature & Humidity Test Chamber
ผู้ผลิต / รุ่น BESTECH / WW-6-8-WC
Range capacity -40 °C to 100 °C
Working Range -40 °C to 100 °C
Certificate No. 221026DA28

ID No. TIS42156
Serial No. W2008005
Resolution 0.1 °C
งานทดสอบการควบคุมอุณหภูมิ

Reference Sensor (°C)	Controller (Value) Setting (°C) %RH		Controller (Value) Indicating (°C) %RH		Correction (°C)	Controller (Value) Error Setting Indicating (°C) (°C)		Stability ±(°C)	Uniformity (°C)	Uncertainty ±(°C)	Error + Uncertainty Setting Indicating (°C) (°C)		Limit of Error (°C)	Judgement	การเตือนค่า ข้อผิดพลาด
	(°C)	%RH	(°C)	%RH		(°C)	(°C)				(°C)	(°C)			
-39.4	-40.0	-	-40.0	-	0.6	-0.600	-0.600	0.10	0.30	0.92	1.52	1.52	±2	OK	-
-39.4	-40.0	-	-40.0	-	0.6	-0.600	-0.600	0.10	0.30	0.92	1.52	1.52	±2	OK	-
-39.2	-40.0	-	-40.0	-	0.6	-0.800	-0.800	0.10	0.30	0.92	1.72	1.72	±2	NG	-
-39.4	-40.0	-	-40.0	-	0.6	-0.600	-0.600	0.10	0.30	0.92	1.52	1.52	±2	OK	-
-39.3	-40.0	-	-40.0	-	0.6	-0.700	-0.700	0.10	0.30	0.92	1.62	1.62	±2	NG	-
-39.4	-40.0	-	-40.0	-	0.6	-0.600	-0.600	0.10	0.30	0.92	1.52	1.52	±2	OK	-
-39.1	-40.0	-	-40.0	-	0.6	-0.900	-0.900	0.10	0.30	0.92	1.82	1.82	±2	OK	-
-39.2	-40.0	-	-40.0	-	0.6	-0.800	-0.800	0.10	0.30	0.92	1.72	1.72	±2	NG	-
-39.1	-40.0	-	-40.0	-	0.6	-0.900	-0.900	0.10	0.30	0.92	1.82	1.82	±2	OK	-



**NSC-TISI-TIS 17025
TESTING 1729**



รายงานผลการทวนสอบเครื่องมือทดสอบ

เครื่องมือ: Vibration tester
ผู้ผลิต / รุ่น Shinken G-03131
Range capacity (Z) 3-2000 Hz และ (Sine) 0-53 m/s²
Working Range (Z) 7-50 Hz และ 2-10 m/s²
Certificate No. 5523631030281865

ID No. TIS47113
Serial No. SG-5570
Resolution 0.1 m/s²
งานทดสอบการสั่นสะเทือน

Thermal shock

รายงานผลการทวนสอบเครื่องมือทดสอบ

เครื่องมือ: Temperature & Humidity Test Chamber
ผู้ผลิต / รุ่น Espac / BESTECH / WW-12-15-WC
Range capacity -40 °C to 100 °C
Working Range -40 °C to 100 °C
Certificate No. 221026DA27

ID No. TIS42157
Serial No. W2008004
Resolution 0.1 °C
งานทดสอบการควบคุมอุณหภูมิ

Reference Sensor (°C)	Controller (Value) Setting (°C) %RH		Controller (Value) Indicating (°C) %RH		Correction (°C)	Controller (Value) Error Setting Indicating (°C) (°C)		Stability ±(°C)	Uniformity (°C)	Uncertainty ±(°C)	Error + Uncertainty Setting Indicating (°C) (°C)		Limit of Error (°C)	Judgement	การเตือนค่า ข้อผิดพลาด
	(°C)	%RH	(°C)	%RH		(°C)	(°C)				(°C)	(°C)			
99.30	100.0	-	100.0	-	-0.7	0.70	0.70	0.30	0.30	0.98	1.68	1.68	±2	OK	-
99.10	100.0	-	100.0	-	-0.7	0.90	0.90	0.30	0.30	0.98	1.88	1.88	±2	OK	-
99.60	100.0	-	100.0	-	-0.7	0.40	0.40	0.30	0.30	0.98	1.38	1.38	±2	OK	-
99.20	100.0	-	100.0	-	-0.7	0.80	0.80	0.30	0.30	0.98	1.78	1.78	±2	OK	-
99.20	100.0	-	100.0	-	-0.7	0.80	0.80	0.30	0.30	0.98	1.78	1.78	±2	OK	-
99.50	100.0	-	100.0	-	-0.7	0.50	0.50	0.30	0.30	0.98	1.48	1.48	±2	OK	-
99.60	100.0	-	100.0	-	-0.7	0.40	0.40	0.30	0.30	0.98	1.38	1.38	±2	OK	-
99.40	100.0	-	100.0	-	-0.7	0.60	0.60	0.30	0.30	0.98	1.58	1.58	±2	OK	-
99.20	100.0	-	100.0	-	-0.7	0.80	0.80	0.30	0.30	0.98	1.78	1.78	±2	OK	-

Chamber

Section 1-Acceleration Linearity (peak) Vertical axis

Frequency (Hz)	Nominal (Acceleration) (m/s ²)	Instrumental Value (m/s ²)	Error (m/s ²)	Uncertainty ±(m/s ²)	Error+Uncertainty (m/s ²)	Limit of Error (m/s ²)	Judgement
7	10.00	10.104	0.10	0.074	0.18	4.00	OK
12	10.00	10.019	0.02	0.074	0.09	4.00	OK
18	10.00	10.021	0.02	0.074	0.10	4.00	OK
30	2.00	1.984	-0.02	0.019	0.00	4.00	OK
40	2.00	1.990	-0.01	0.019	0.01	4.00	OK
50	2.00	1.985	-0.01	0.019	0.00	4.00	OK
25	20.00	19.958	-0.04	0.14	0.10	4.00	OK
50	20.00	19.961	-0.04	0.14	0.10	4.00	OK
100	20.00	19.850	-0.15	0.14	0.01	4.00	OK
150	20.00	19.855	-0.15	0.14	0.00	4.00	OK
200	20.00	19.823	-0.18	0.14	0.04	4.00	OK
50	80.00	79.512	-0.49	0.56	0.07	4.00	OK
100	80.00	78.917	-1.08	0.56	0.52	4.00	OK
150	80.00	79.053	-0.95	0.56	0.39	4.00	OK
200	80.00	78.876	-1.12	0.56	0.56	4.00	OK

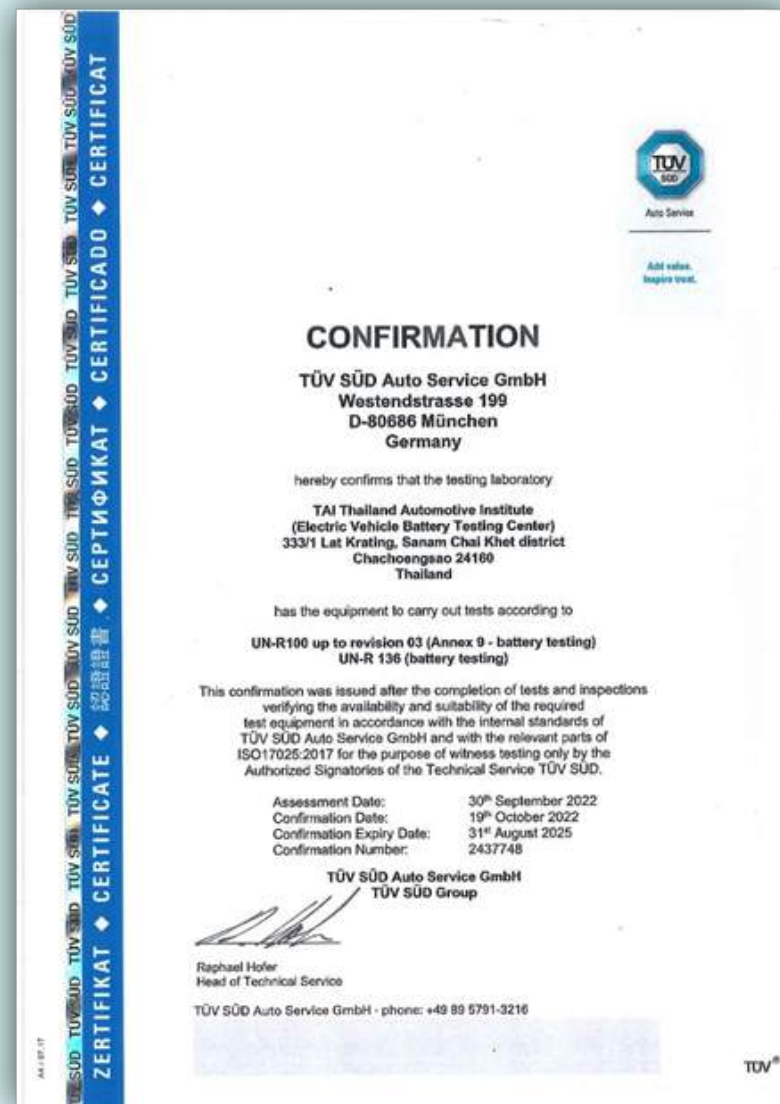
Section 2-Acceleration Linearity (peak) Ho axis

Frequency (Hz)	Nominal (Acceleration) (m/s ²)	Instrumental Value (m/s ²)	Error (m/s ²)	Uncertainty ±(m/s ²)	Error+Uncertainty (m/s ²)	Limit of Error (m/s ²)	Judgement
7	10.00	10.101	0.10	0.074	0.18	4.00	OK
12	10.00	10.112	0.11	0.074	0.19	4.00	OK
18	10.00	10.108	0.11	0.074	0.18	4.00	OK
30	2.00	2.002	0.00	0.019	0.02	4.00	OK
40	2.00	1.987	-0.01	0.019	0.01	4.00	OK
50	2.00	1.990	-0.01	0.019	0.01	4.00	OK
25	20.00	20.081	0.08	0.14	0.22	4.00	OK
50	20.00	20.065	0.07	0.14	0.21	4.00	OK
100	20.00	20.056	0.06	0.14	0.20	4.00	OK
150	20.00	20.055	0.05	0.14	0.20	4.00	OK
200	20.00	20.059	0.06	0.14	0.20	4.00	OK
50	80.00	80.069	0.07	0.56	0.63	4.00	OK
100	80.00	80.078	0.08	0.56	0.64	4.00	OK
150	80.00	80.849	0.85	0.56	1.41	4.00	OK
200	80.00	81.050	1.05	0.56	1.61	4.00	OK

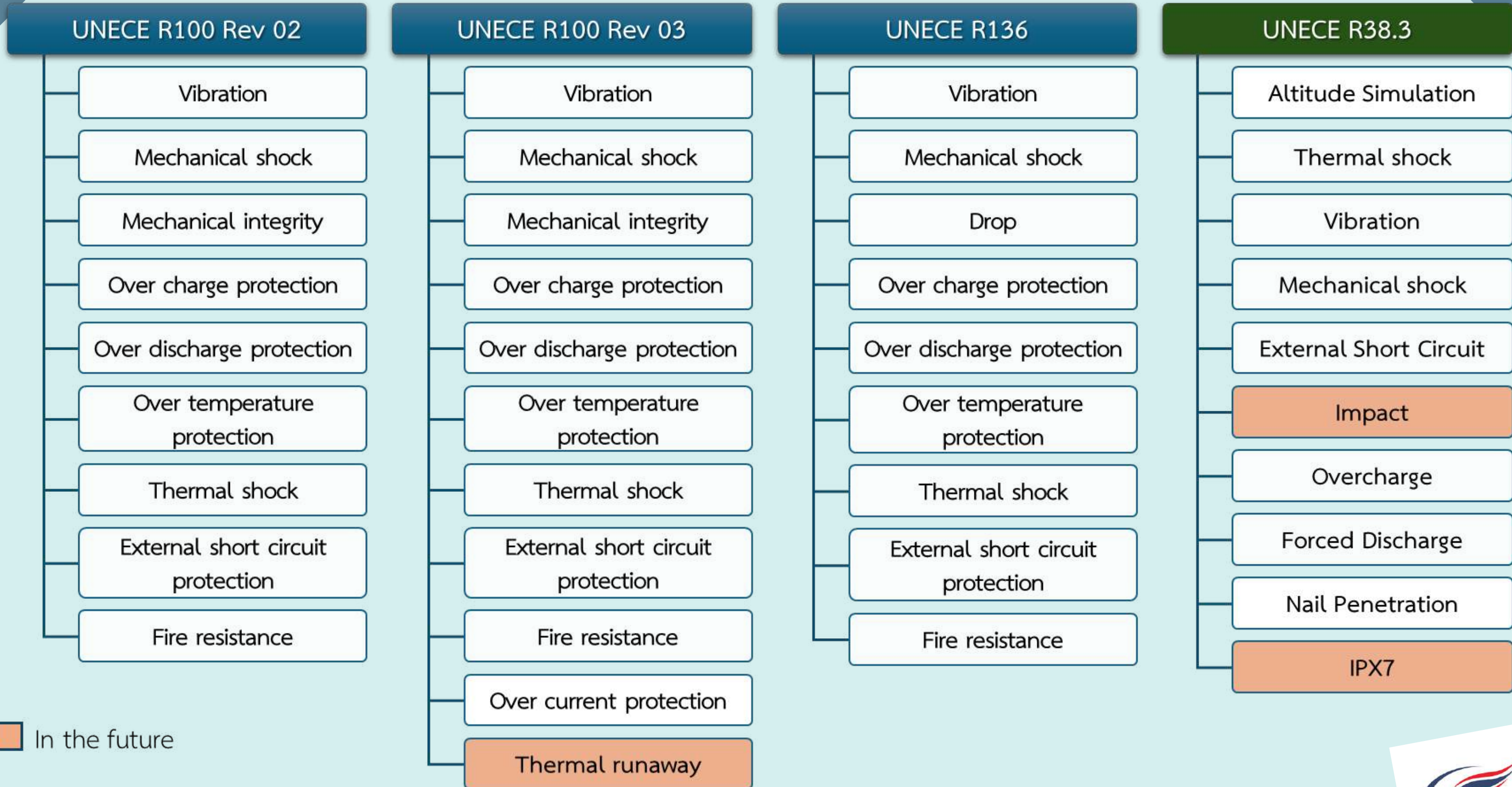
Vibration

EV Battery Testing Center Certification

- Standard No. TIS 17025-2561 (2018) (ISO/IEC 17025: 2017): Thai Industrial Standards Institute (TISI)
- UN-R100 up to revision 03 (Annex 9 – battery testing) UN-R136 (battery testing): TÜV SÜD Auto Service GmbH
- Best Global Partner in providing the powerful solutions for EV/ESS battery testing: Korea Testing Laboratory



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