

<b>Prüfbericht-Nr.:</b> <i>Test Report No.:</i>	<b>50102046 003</b>	<b>Auftrags-Nr.:</b> <i>Order No.:</i>	<b>214091390</b> 214092846	Seite 1 von 7 Page 1 of 7	
<b>Kunden-Referenz-Nr.:</b> <i>Client Reference No.:</i>	N/A	<b>Auftragsdatum:</b> <i>Order date:</i>	<b>27.09.2017</b> 10.11.2017		
<b>Auftraggeber:</b> <i>Client:</i>	PDM Co., Ltd. 2-5-19 Anryu, Suminoe-ku, Osaka-shi, Osaka 559-0003 Japan				
<b>Prüfgegenstand:</b> <i>Test item:</i>	Heat Insulation material				
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type No.:</i>	Heat buster CEMP				
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	Safety test				
<b>Prüfgrundlage:</b> <i>Test specification:</i>	Penetration test according to customer request				
<b>Wareneingangsdatum:</b> <i>Date of receipt:</i>	27.11.2017				
<b>Prüfmuster-Nr.:</b> <i>Test sample No.:</i>	Sample No.1				
<b>Prüfzeitraum:</b> <i>Testing period:</i>	27.11.2017 – 27.11.2017				
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	See Other				
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	See Other				
<b>Prüfergebnis*:</b> <i>Test result*:</i>	Siehe Sonstiges / See Other				
<b>geprüft von / tested by:</b>	 12.12.2017 Y. Tsukamoto / Project Engineer		<b>kontrolliert von / reviewed by:</b>	 12.12.2017 Y. Yamanaka / Project Engineer	
<b>Datum</b> <i>Date</i>	<b>Name / Stellung</b> <i>Name / Position</i>	<b>Unterschrift</b> <i>Signature</i>	<b>Datum</b> <i>Date</i>	<b>Name / Stellung</b> <i>Name / Position</i>	<b>Unterschrift</b> <i>Signature</i>
<b>Sonstiges / Other:</b> No pass/fail criteria since this test is R&D purpose. 50102046 002 amends to 003 to correct the sample specification and focus on test No.1 per customer request. Place of testing: 1-3-14 Fukaeminami, Higashinari-ku Osaka 537-0002 Japan, TÜV Rheinland Japan Ltd., Kansai Technology Assessment Center (KTAC) Testing laboratory: TÜV Rheinland Japan Ltd., Kansai Technology Assessment Center (KTAC), Osaka laboratory					
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of the test item at delivery:</i>			Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(fail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(fail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested					
<b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b> <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>					

**Tests performed (name of test and test clause):**

Penetration test 27.11.2017

Penetration test is conducted to see the effectiveness of heat insulation material. Heat insulation material is used for the counter measure for the fire and explosion of the battery.

**Test item particulars** .....: Heat insulation material**Battery cell used for the test**

Identification / Type No.....: 18650

Nominal Capacity (mAh) .....: Typ 2600 mAh

Rated voltage (V).....: 3.7 V

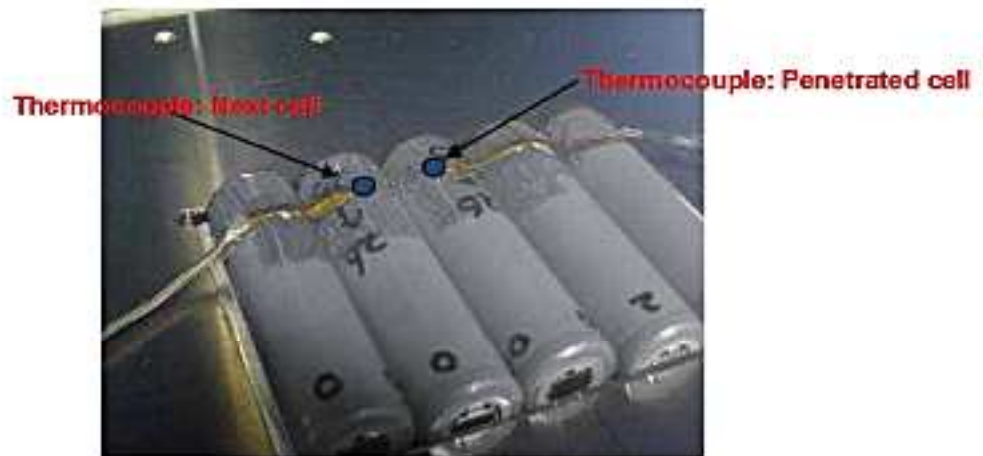
Nominal mass (g) .....: 48.0 g

External dimensions (mm) .....: 18.6 x 65.0 mm

**Possible test case verdicts:**

- test case does not apply to the test object.....: N/A
- test object does meet the requirement .....: P (Pass)
- test object does not meet the requirement.....: F (Fail)

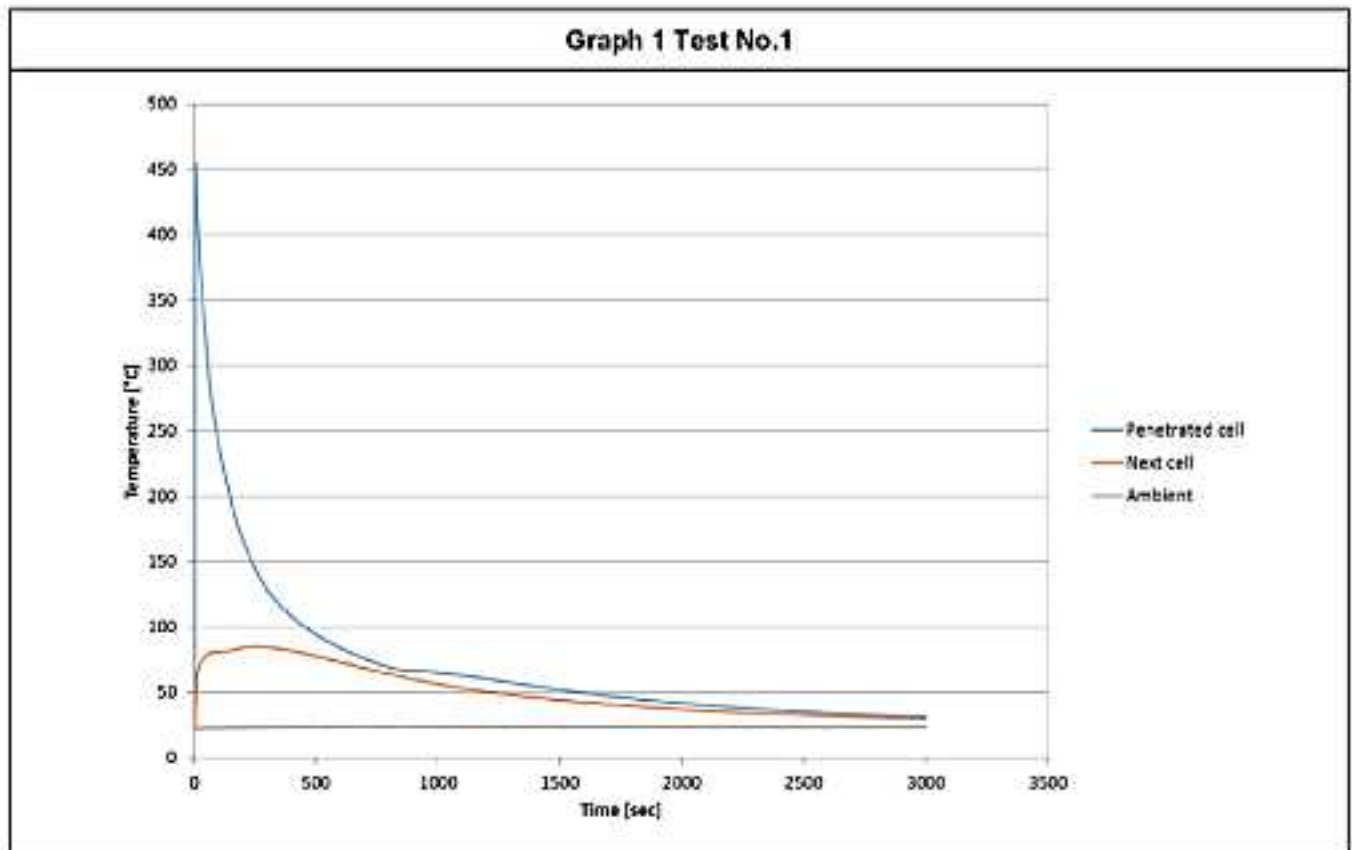
Nail penetration test according to customer request			
	Test	Result-Remark	Verdict
1.	Test name		N/A
	Precondition: Not required.		
	Test set up: 5 Li-ion battery cells packed by heat insulation material.	Packed by heat insulation material.	
	Test condition:  Ambient: Room temperature Nail diameter: 3 mm Penetration speed: 10 mm/sec Penetration point: Center cell out of 5 cells Penetration depth: Through the cell	Done according to requirement.	
	Termination criteria: Not specified.		
	Requirement: No pass/fail criteria.		



Picture 1 Thermocouple location

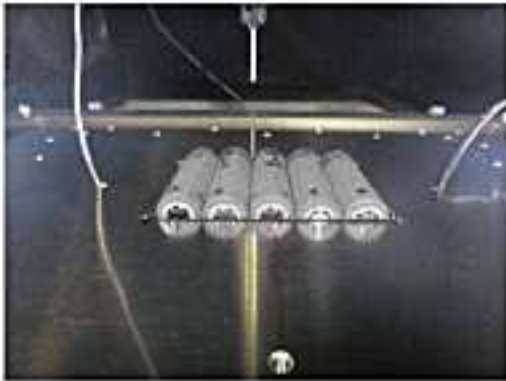
**Table1: Test Result**

Results	Sample No.
	No.1
Heat insulation material amount	Max
Nail Diameter [mm]	3
Penetration speed [mm/sec]	10
Penetration depth	Through the cell (35 mm)
Amb temp [°C]	22.1
Max Temp. Penetrated cell [°C]	455.4
Max Temp. Next cell [°C]	85.4
Appearance of event	Smoke
Propagation in the heat insulation material	No

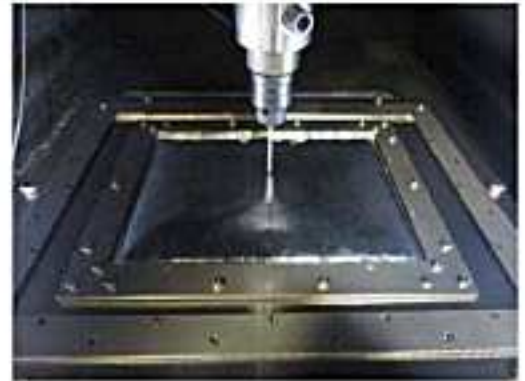




**Test set up**

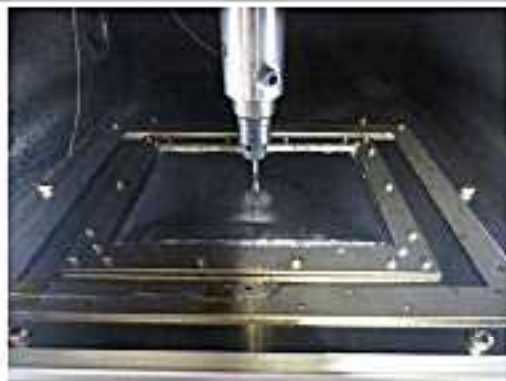


Picture 2 Test No.1 w/o Heat buster



Picture 3 Test No.1 set up

**After test**



Picture 4 Test No.1



Picture 5 Test No.1 w/o Heat buster

**List of test equipment used:**

Clause	ID	Testing / measuring equipment / material used	Type	Manufacturer	Calibration due date
1	ML-0066	Memory HiLogger	LR8400-20	Hioki	18.05.2018
	ML-0089	Crush Tester	TGI-250kN-W1220	Minebea	16.05.2018

- End of Test Report -