N	T	0	B-Li	S	0044

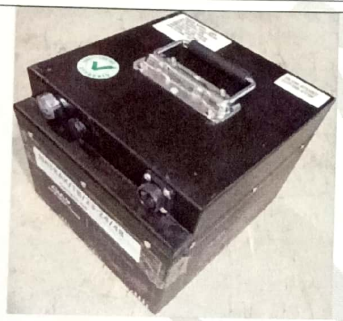
Dated: 06-11-2023

TEST REPORT

1.0	NAME AND ADDRESS OF THE CUSTOMER	M/s AMBIT TRANSMISSION PRODUCTS PVT.LTD. B-5, IIE SIGADDI GROWTH CENTRE, SIDCUL ,KOTDWARA,PAURI GARHWAL,UTTARAKHAND-246149(INDIA)
1.1	NAME AND ADDRESS OF THE MANUFACTURER	M/s AMBIT TRANSMISSION PRODUCTS PVT.LTD. B-5, IIE SIGADDI GROWTH CENTRE, SIDCUL ,KOTDWARA,PAURI GARHWAL,UTTARAKHAND-246149(INDIA)
2.0	TESTING REFERENCE LETTER No.	001, Dated:- 27.09.2023

3.0 DESCRIPTION OF DEVICE UNDER TEST (DUT):

S.No	Particulars	Description
i	DUT NAME	REESS
ii	Trade Mark	9AP
iii	Battery Type	Li-ion (NMC)
iv	Battery Pack Capacity (Ah)	28.6Ah
v	Operating Voltage	47.6V-72.25V
vi	Rated Voltage	61.2V
vii	Battery Pack Id/Model	9APNC61.2V28.6Ah
viii	Battery Dimensions (l*b*h)	210mm*220mm*200mm
ix	Battery Weight In (Kg)	14.8Kg
x	Battery Module Drawing no.	AMBITDDN9APIK072301
xi	Battery Pack Sr. no.	9APZ1F30230900036



SERIAL NUMBER - 9APZ1F30230900036
BLUETOOTH NUMBER - A4C13752BF4F

TRADE NAME - 9AP
BATTERY MODEL - 9APNC61.2V28.6AH
CELL CHEMISTRY- NMC
CELL RATING - 3.6V/2600mAh
BMS SPECIFICATION - 17S 60A
BMS MODEL - 9AP
MANUFACTURING - SEPTEMBER 2023

Remarks: Refer page 27 of 27 for Disclaimer

NATRAX CASE ID: NATRAX/TB/23-24/48

Authorized Signatory:

PREPARED BY	CHECKED BY	APPROVED BY
Rishikesh Sharma	Manish Mandloi	Umesh Raghuwanshi
Engineer	Sr. Engineer	Asst. Manager

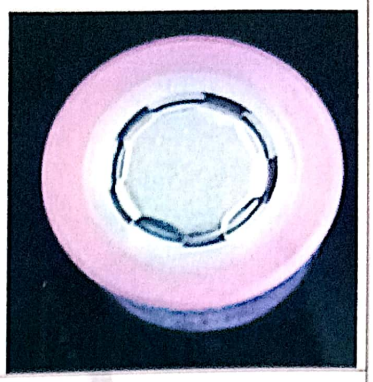
NATIONAL AUTOMOTIVE TEST TRACKS ★ NATRAX

कार्यालय: आगरा – मुम्बई मार्ग (एन.एच. 52), पिथमपुर फ्लाईओवर के आगे,
पोस्ट–खण्डवा (पिथमपुर के पास), जिला–धार –454774 (म.प्र.)
Office: Agra – Mumbai Highway (NH – 52), Next to Pithampur Flyover,
Post- Khandwa (Near Pithampur), Dist. Dhar (M.P.) – 454774, Web: www.natrax.in

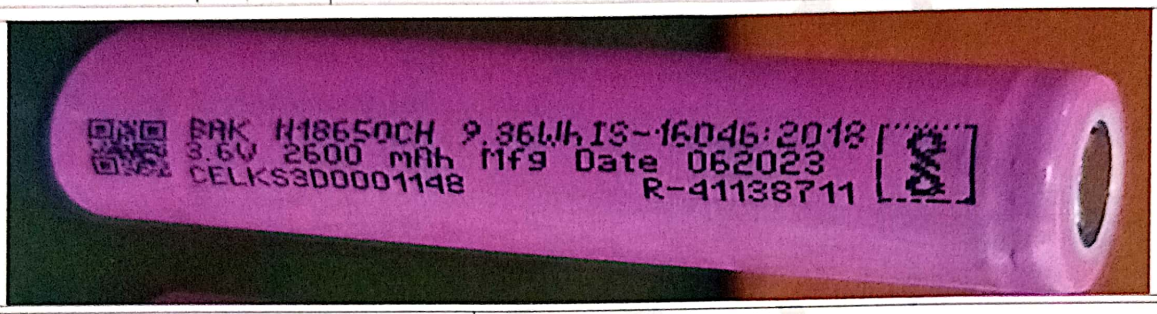
मुख्य कार्यालय: दूसरी मंजिल, प्रशासनिक भवन, आईकेट परिसर – II,
सेक्टर – 11, आई. एम. टी. मानेसर, गुरुग्राम, हरियाणा – 122051
Corporate Office: 2nd Floor, Administrative Building, ICAT Campus-II,
Sector-11, IMT Manesar, Gurugram, Haryana – 122051
Tel: 01246 900 000, Website: www.natrip.in

N	T	0	B-Li	S	0044	Dated: 06-11-2023

4	Cell	Description
i	Cell Manufacture Name	ZHENGZHOU BAK BATTERY CO. LTD
ii	Cell Chemistry, Form Factor & Dimensions	CYLINDRICAL,L-65±0.2MM , Ø-18.3±0.15MM
iii	Cell Voltage & Capacity	3.6V, 2.6Ah
iv	Cell Voltage Range	2.5V – 4.25V
v	Cell Model No.	N18650CH
vi	Cell Batch Code No.	R-41138711
vii	Configuration of cells	1S11P
viii	Cell Type	NMC
ix	Cell certification report/Date	IEC/22100704 / 07/11/2022



CELL PHOTO



5	BMS	Description
I	BMS Make	AMBIT TRANSMISSION PRODUCTS PVT.LTD
Ii	BMS Model/ ID No.	9AP
Iii	BMS Software version/ Hardware version	52/9APN17S60A
iv	BMS Communication Protocol	UART & 485 & CAN
v	BMS EMC Test Report (referred)	CT0MS0738, 19.10.2023

BMS PHOTO

Remarks: Refer page 27 of 27 for Disclaimer

NATRAX CASE ID: NATRAX/TB/23-24/48

Authorized Signatory:

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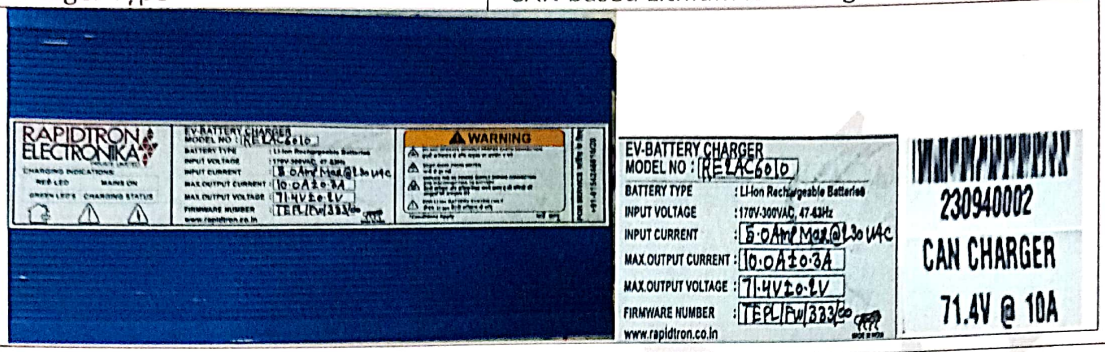
PREPARED BY	CHECKED BY	APPROVED BY
Rishikesh Sharma	Manish Mandloi	Umesh Raghuwanshi
Engineer	Sr. Engineer	Asst. Manager

NATIONAL AUTOMOTIVE TEST TRACKS NATRAX

N	T	0	B-Li	S	0044	Dated: 06-11-2023

6	Battery Charger	Description
i	Charger Sr. no.	230940002
ii	Charger (External/On Board)	External
iii	Charger Make / Model	RAPIDTRON/ RE2AC6010
iv	Trade Name of Charger	RAPIDTRON
v	Charger Type	CAN based Lithium ion charger
CHARGER PHOTO		

7	**Sample Receipt date**	05-10-2023
8	**Removable/ Fixed**	Removable Battery
9	**Condition of Sample**	Good (No physical damage observed)
10	**Test Objective**	To validate the safety requirements with respect to the Rechargeable Electrical Energy Storage System (REESS) of L category vehicle as per the requirements of AIS-156(Part II) 2022 amendment 3 Phase 2.
11	**Functional Verification**	Functional verification done and REESS was found satisfactory
12	**Test Method**	Test method referred from AIS-156(Part II) 2022 amendment 3 Phase 2.
13	**Test Description and date of Performance**	Please refer the ANNEXURE-1 of this report
14	**Conclusion**	The REESS specified in Sr. No. 3.0 of this test report met all the test requirements when tested as per AIS-156(Part II) 2022 amendment 3 Phase 2 as mentioned in Annexure-1 of this report.
15	**Test Results**	Please refer the test requirements and results in ANNEXURE-I of this report
16	**Test Location**	EV Test Lab, NATRAX
17	**Test Sample applicability on vehicle models: L1, L2 (2-Wheelers)**	
18	**Total No. of Pages**	27 (Report with Annexures) + 1 (Drawings)

PREPARED BY	CHECKED BY		APPROVED BY
Rishikesh Sharma	Manish Mandloi		Umesh Raghuwanshi
Engineer	Sr. Engineer		Asst. Manager

NATIONAL AUTOMOTIVE TEST TRACKS ★ NATRAX

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ANNEXURE-1

1.0 TEST REQUIREMENTS AND RESULTS:

1.1	**Vibration Test** **Reference Standard: AIS 156(Part II)-2022 (A3P2)**		
1.1.1	**Procedure**		
Sample ID: NATRAX/TB/23-24/48-01	**Particulars**	**Parameter During Test**	
	Test Component	REESS Subsystem (Battery Pack)	
	Ambient temperature (20 ± 10°C)	27 °C	
	Test Component SOC (>50%)	90 %	
	Protection Devices of DUT	Fuse	
	Test Axis	Z-Axis (Vertical Axis)	
	Test Component Weight	14.8 Kg	
	Frequency Type	Sinusoidal	
	Frequency Sweep	7 Hz to 200 Hz to 7 Hz Frequency [Hz] 7-18	
	For Weight 12Kg or More	**Frequency [Hz]**	**Acceleration [m/s2]**
		7-18	10
		18 - approximately 25	Gradually increased from 10 to 20
		25 - 200	20
	Frequency Sweep Time	15 Minutes	
	Total Frequency Sweep	12	
	Test Duration	3 Hours	
	Observation duration after Standard Cycle	1 Hour	
	Test Start Date	18.10.2023	
	Test End Date	18.10.2023	
1.1.2	**Test Result**		
	Requirement	**Observations**	
	During the test, there shall be no evidence of: (a) Electrolyte leakage (b) Rupture c) Fire (d) Explosion	No Electrolyte leakage, no rupture, no fire and no explosion.	
	Standard cycle	Standard cycle was feasible after test.	
	The isolation resistance measured after the test	Isolation resistance was found greater than 100Ω/Volt.	

ANNEXURE-1

1.1.3	Vibration Test Setup (Photo)

Test Report

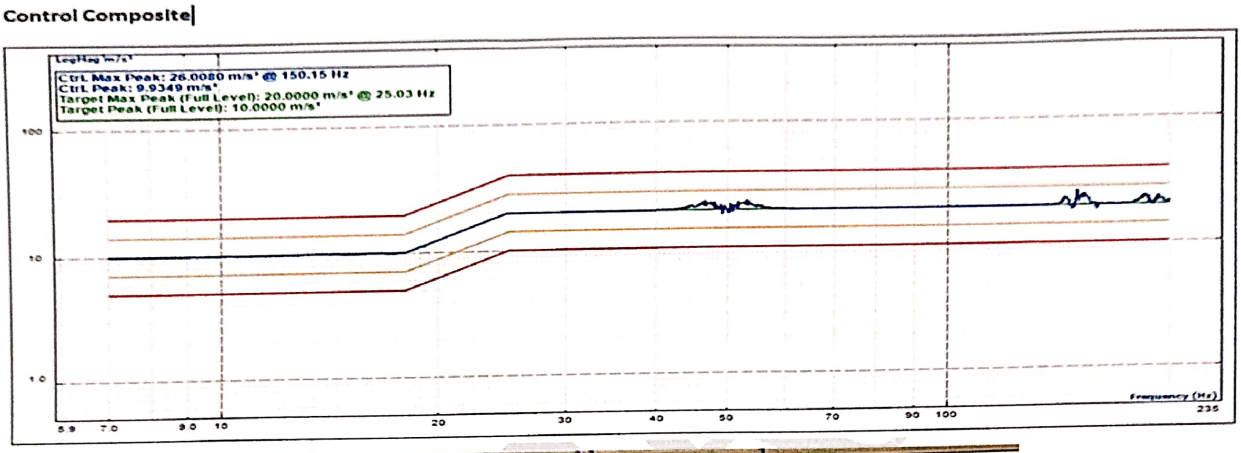
Report time: Oct-19-2023 14:05:48
Test name: lITHIUM Battery Vibration test -
Test status: Test Stopped (Schedule Finished)

Data measured at: Oct-18-2023 14:50:12
Test type: VCS (Swept Sine)
Run folder: VIBRATION TEST-0114 Oct 18, 2023 11-53-08

Testing time
Remaining Time: 00:00:00
Run Start Time: Oct-18-2023 11:53:22
Total elapsed time: 03:00:12
Full level elapsed time: 03:00:00

Test parameters
Current Frequency: 7.000 Hz
Signal Plot Points: 2048
Sweeping Rate: 0.64487 Oct/Min
Sweep Type: Logarithmic
Sweep Number: 24

Control Composite



Remarks: Refer page 27 of 27 for Disclaimer			*Format no. NATRAX/TB/L/2023/01*
Prepared By	*Page 05 of 27*	NATIONAL AUTOMOTIVE TEST TRACKS NATRAX	**Checked By**
Rishikesh Sharma			**Manish Mandloi**
Engineer			**Sr. Engineer**

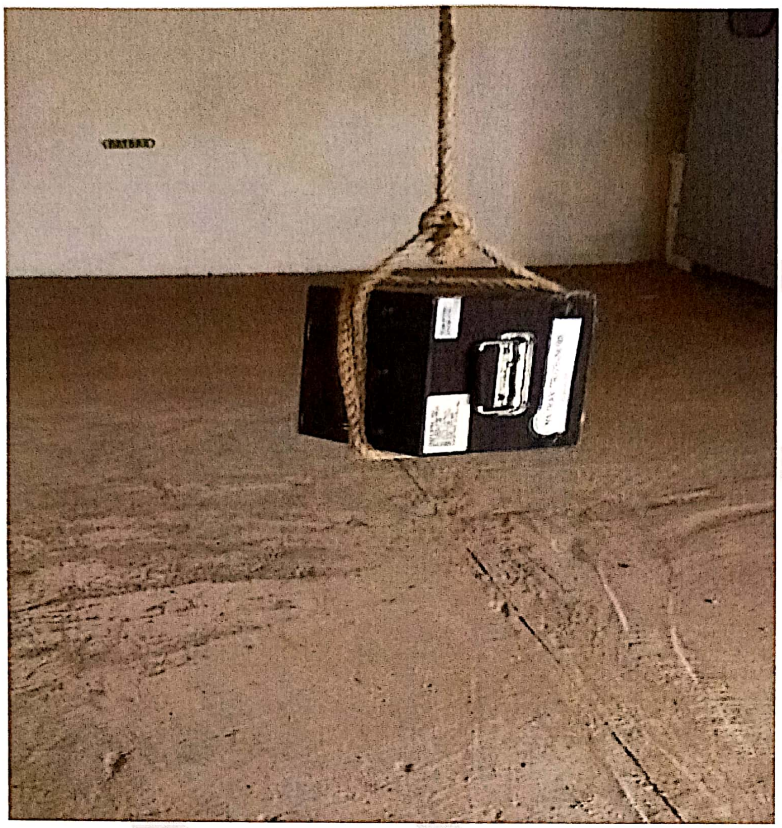
ANNEXURE-1

1.2	**Mechanical Drop Test** **Reference Standard: AIS 156(Part II)-2022 (A3P2)**	
1.2.1	**Procedure**	
Sample ID: NATRAX/TB/23-24/48-03	**Particulars**	**Parameter During Test**
	Test Component	REESS Subsystem (Battery Pack)
	Ambient temperature (20 ± 10°C)	26 °C
	Test Component SOC (≥90%)	90 %
	Protection Devices of DUT	Fuse
	Test Component Weight	14.8 Kg
	Height of the free fall for REESS	1 m
	Total no. of Drop (Free fall)	6 (Battery has 6 Faces)
	DUT Free fall orientation	Each surface facing floor
	Type of surface	Horizontal concrete pad
	Test Duration	3 Hours
	Observation duration after Standard Cycle	1 Hour
	Test Start Date	17.10.2023
	Test End Date	17.10.2023

1.2.2	**Test Result**	
	Requirement	**Observations**
	During the test, there shall be no evidence of: (a) Electrolyte leakage (b) Rupture c) Fire (d) Explosion	No Electrolyte leakage, no rupture, no fire and no explosion.
	Standard cycle	Standard cycle was feasible after test.
	The isolation resistance measured after the test.	Isolation resistance was found greater than 100Ω/Volt.

ANNEXURE-1

1.2.3	Mechanical Drop Test Setup (Photo)



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ANNEXURE-1

1.3	Mechanical Shock Reference Standard: AIS 156(Part II)-2022 (A3P2)	
1.3.1	Procedure	
Sample ID: NATRAX/TB/23-24/48-02	**Particulars**	**Parameter During Test**
	Test Component	REESS Subsystem (Battery Pack)
	Ambient temperature (20 ± 10°C)	26 °C
	Test Component SOC (>50%)	90 %
	Protection Devices of DUT	Fuse
	Test Axis	X-Axis (Linear Axis), Y-Axis (Lateral Axis) and Z-Axis (Vertical Axis)
	Test Component Weight	14.8 Kg
	Frequency Type	Half-Sine
	Peak Acceleration	500 m/s^2
	Pulse Duration	11 milliseconds
	Total Shock	18 (3 shocks in the positive direction followed by 3 shocks in the negative direction in all 3 axis)
	Observation duration after Standard Cycle	1 Hour
	Test Start Date	13.10.2023
	Test End Date	13.10.2023

1.3.2	Test Result	
	Requirement	**Observations**
	During the test, there shall be no evidence of: (a) Electrolyte leakage, (b) Rupture, c) Fire, (d) Explosion	No Electrolyte leakage, no rupture, no fire and no explosion.
	Standard cycle	Standard cycle was feasible after test.
	The isolation resistance measured after the test.	Isolation resistance was found greater than 100Ω/Volt.

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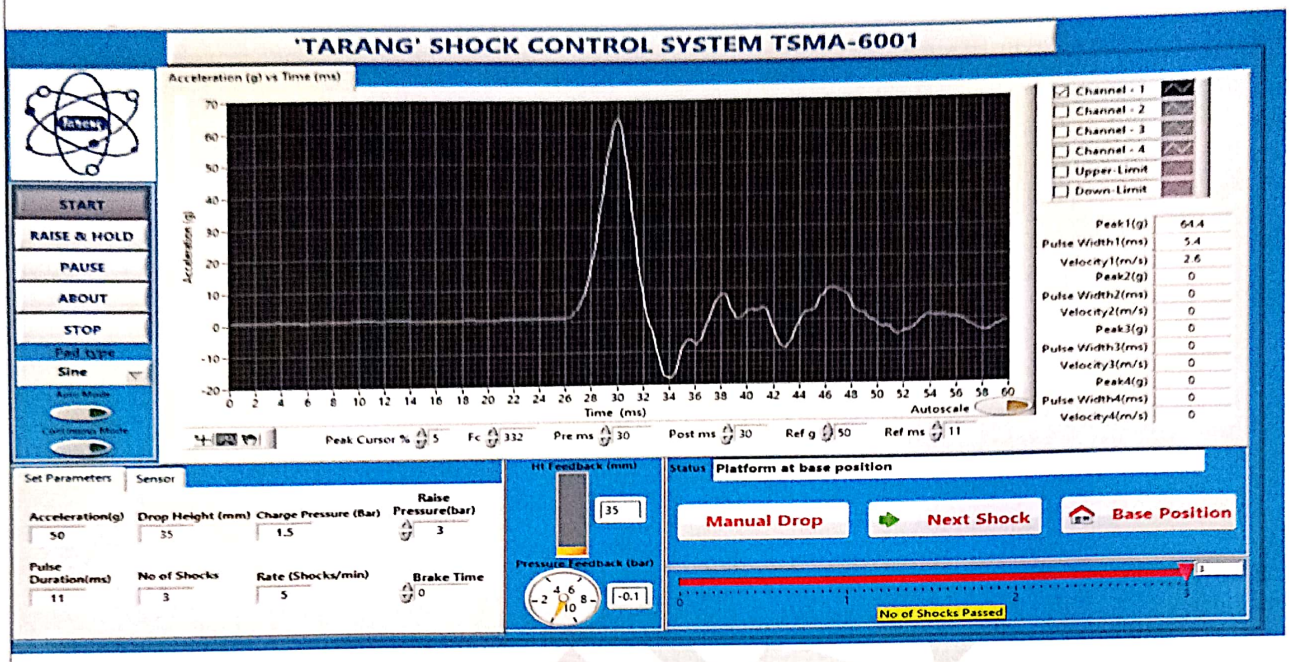
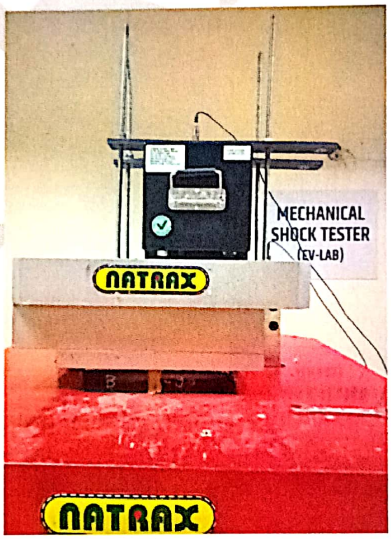
ANNEXURE-1

1.3.3	Mechanical Shock Test Setup (Photo)





Remarks: Refer page 27 of 27 for Disclaimer			*Format no. NATRAX/TB/L/2023/01*
Prepared By	*Page 09 of 27*		**Checked By**
Rishikesh Sharma			Manish Mandloi
Engineer			Sr. Engineer

NATRAX

ANNEXURE-1

2.1	Thermal Shock & Cycling Test Reference Standard: AIS 156(Part II)-2022 (A3P2)	
2.1.1	**Procedure**	
Sample ID: NATRAX/TB/23-24/48-04	**Particulars**	**Parameter During Test**
	Test Component	REESS Subsystem (Battery Pack)
	Ambient temperature (20 ± 10°C)	27 °C
	Test Component SOC (>50%)	80 %
	Protection Devices of DUT	Fuse
	Positive Set Temperature	60 °C
	Positive Temperature Duration	6 Hours
	Time taken to reach Negative Set Temperature	20 Minutes
	Negative Set Temperature	-40°C
	Negative Temperature Duration	6 Hours
	Time taken to reach Positive Set Temperature	20 Minutes
	No of Cycles	5
	Storage Time	24 Hours after test
	Test Start Date	10.10.2023
	Test End Date	16.10.2023

2.1.2	**Test Result**	
	Requirement	**Observations**
	During the test, there shall be no evidence of: (a) Electrolyte leakage (b) Rupture c) Fire (d) Explosion	No Electrolyte leakage, no rupture, no fire and no explosion.
	Standard cycle	Standard cycle was feasible after test.
	The isolation resistance measured after the test.	Isolation resistance was found greater than 100Ω/Volt.

ANNEXURE-1

2.1.3	Thermal Shock & Cycling Test Setup (Photo)

NATRAX

ANNEXURE-1

3.1	**Fire Resistance Test** **Reference Standard: AIS 156(Part II)-2022 (A3P2)**
3.1.1	**Procedure**

Sample ID: NATRAX/TB/23-24/48-01

General Parameter

Particulars	Parameter During Test
Test Component	REESS Subsystem (Battery Pack)
Ambient temperature (> 0°C)	26 °C
Test Component SOC (>50%)	80 %
Protection Devices of DUT	Fuse
Fuel Temperature	Less than 20°C

Test Fixture Parameter

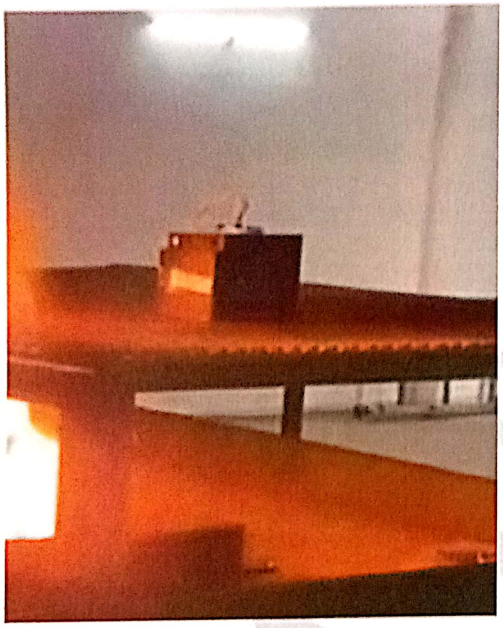
Particulars	Parameters During Test
Grating Table steel rods diameter (Eqvl.)	6-10 mm
Distance between Grating Table steel rods	4-6 Cm
Fuel	Petrol
Fuel Pan Dimension	L- 450mm, B- 350mm, H- 80mm
Fuel Level from Pan Top	< 8 cm
Distance between Fuel Level and DUT	50 cm
Fixed Component	Fuel Pan
Movable Component	DUT Fixture
Screen Height from Fuel Level	3 cm
Length and Width of the screen	2 to 4 cm smaller than Pan
Screen Material (Brick)	SK 30
Test Lab Ventilation	Yes (Indoor with Ventilation)

Test Parameter

Particulars	Parameter During Test
Fuel Pan distance from DUT	3 m
Pre-Heating Duration (Phase-A)	60 s
Duration of DUT direct Exposure to Flame (Phase-B)	70 s
Duration of DUT direct Exposure to Flame (Phase-C)	60 s
Observation Time	3 Hours
Test End Date	17.10.2023
Test End Date	17.10.2023

3.1.2	Test Result	
	Requirement	Observation
	No explosion at end of test.	No explosion observed.

3.1.3	Test Setup



ANNEXURE-1

PROTECTION VARIFICATION

4.1	External Short Circuit Protection Reference Standard: AIS 156(Part II)-2022 (A3P2)	
4.1.1	Procedure	
Sample ID: NATRAX/TB/23-24/48-05	Particulars	Parameters During Test
	Test Component	REESS Subsystem (Battery Pack)
	Battery Management System	Available
	Ambient temperature (20 ± 10°C)	27 °C
	Test Component SOC (>50%)	80 %
	Protection Devices of DUT	Fuse
	DUT Condition	Active Mode
	Test Component Weight	14.8 Kg
	Connector resistance	< 5 mΩ
	Test Stopped when	REESS's operated and interrupted the short circuit.
	Observation duration after Standard Cycle	1 Hour
	Test Start Date	16.10.2023
	Test End Date	16.10.2023

4.1.2	Test Result	
	Requirement	**Observations**
	During the test, there shall be no evidence of: (a) Electrolyte leakage (b) Rupture c) Fire (d) Explosion	No Electrolyte leakage, no rupture, no fire and no explosion.
	External Short Circuit Protection	REESS's operated and interrupted the short circuit as soon as the current crossed the upper limit set in the Battery Management System
	Standard cycle	Standard cycle was feasible after test.
	The tested battery was kept in observation for 1 hour	Normal Functionality was observed.
	The isolation resistance measured after the test.	Isolation resistance was found greater than 100Ω/Volt.

4.1.3	Test Setup	
		

NATRAX

ANNEXURE-1

4.2	Over-Charge Protection Reference Standard: AIS 156(Part II)-2022 (A3P2)	
4.2.1	Procedure	
Sample ID: NATRAX/TB/23-24/48-02	**Particulars**	**Parameter During Test**
	Test Component	REESS Subsystem (Battery Pack)
	Battery Management System	Available
	Ambient temperature (20 ± 10°C)	26 °C
	Protection Devices of DUT	Fuse
	DUT Condition	Active Mode
	Charging Current	10 A
	Test Stopped when	The charging continued until the tested-device (automatically) interrupts or limits the charging.
	Observation Period	1 Hour
	Test Start Date	13.10.2023
	Test End Date	13.10.2023

4.2.2	Test Result	
	Requirement	**Observations**
	During the test, there shall be no evidence of: (a) Electrolyte leakage (b) Rupture c) Fire (d) Explosion	No Electrolyte leakage, no rupture, no fire and no explosion.
	Over-charge Protection	Automatic Interruption
	Standard cycle	Standard cycle was feasible after test.
	The tested battery was kept in observation for 1 hour	Normal Functionality was observed.
	The isolation resistance measured after the test.	Isolation resistance was found greater than 100Ω/Volt.

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4.2.3	Test Setup

1	Test Name:	Over Charge Propagation -9AP--48								
2	Test Date:	13-10-2023 14:26								
3	Operator ID:	Admin								
4	Program Nam	CHARGE								
5	Program Description:									
6	Program Data	C:\VisualCN\Programs\NATRAX.mdb								
7	Module Type:	yd								
8	Module Descr	LCV 100-80								
9	Address:	Port: 1, Sys Controller: 3 Circuit: 7								
10	Name:	Port 1, Ctr Device ID:								
11										
12	Exclude	Total Time	Cycle	Current, A	Voltage, V	Power, W	Amp-Hour	Watt-Hou	User Varia	User Varia
13	No	00:01.0	1	10	70.39	703	0	0.1	0	0
14	No	00:02.0	1	10	70.41	704	0	0.3	0	0
15	No	00:03.0	1	10	70.43	704	0	0.5	0	0
16	No	00:04.0	1	10	70.44	704	0.01	0.7	0	0
17	No	00:05.0	1	10	70.45	704	0.01	0.9	0	0
18	No	00:06.0	1	10	70.46	704	0.01	1.1	0	0
19	No	00:07.0	1	10	70.48	704	0.01	1.3	0	0
20	No	00:08.0	1	10	70.49	704	0.02	1.5	0	0
21	No	00:09.0	1	10	70.5	704	0.02	1.7	0	0
22	No	00:10.0	1	10	70.51	705	0.02	1.9	0	0
23	No	00:11.0	1	10	70.51	705	0.03	2.1	0	0
06	No	06:34.0	1	10	71.88	718	1.09	77.8	0	0
07	No	06:35.0	1	10	71.88	718	1.09	78	0	0
08	No	06:36.0	1	9.99	71.89	718	1.09	78.2	0	0
09	No	06:37.0	1	10	71.89	718	1.1	78.4	0	0
10	No	06:38.0	1	10	71.89	718	1.1	78.6	0	0
11	No	06:39.0	1	10	71.9	719	1.1	78.8	0	0
12	No	06:40.0	1	-0.01	79.98	0	1.1	78.8	0	0
13	No	06:41.0	1	-0.01	80.4	0	1.1	78.8	0	0

Over Charge Propagation -9AP--4

NATRAX

ANNEXURE-1

4.3	Over-Discharge Protection Reference Standard: AIS 156(Part II)-2022 (A3P2)	
4.3.1	Procedure	
Sample ID: NATRAX/TB/23-24/48-02	Particulars	Parameter During Test
	Test Component	REESS Subsystem (Battery Pack)
	Battery Management System	Available
	Ambient temperature (20 ± 10°C)	27 °C
	Protection Devices of DUT	Fuse
	DUT Condition	Active Mode
	Discharging Current	18 A
	Test Stopped when	The discharging continued until the tested-device (automatically) interrupts or limits the discharging.
	Observation Period	1 Hour
	Test Start Date	16.10.2023
	Test End Date	16.10.2023

4.3.2	Test Result	
	Requirement	Observations
	During the test, there shall be no evidence of: (a) Electrolyte leakage (b) Rupture c) Fire (d) Explosion	No Electrolyte leakage, no rupture, no fire and no explosion.
	Over-discharge Protection	Interrupted the discharging current.
	Standard cycle	Standard cycle was feasible after test.
	The tested battery was kept in observation for 1 hour	Normal Functionality was observed.
	The isolation resistance measured after the test.	Isolation resistance was found greater than 100Ω/Volt.

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NATRAX

4.3.3 Test Setup

1	Test Name:	Over Discharge Propagation Ambi--48								
2	Test Date:	16-10-2023 12:56								
3	Operator ID:	Admin								
4	Program Name	Dis-charge								
5	Program Description:									
6	Program Datab	C:\VisualCN\Programs\NATRAX.mdb								
7	Module Type:	yd								
8	Module Descrip	LCV 100-80								
9	Address:	Port: 1, Sys Controller: 3 Circuit: 3								
10	Name:	Port 1, Ctr Device ID:								
11										
12	Exclude	Total Time	Cycle	Current, A	Voltage, V	Power, W	Constant I	Internal R	Amp-Hour	Watt-Hou
13	No	00:01.0	1	-18	60.22	-1083	3.35	0	0	-0.2
14	No	00:02.0	1	-18	60.2	-1083	3.34	0	0	-0.5
15	No	00:03.0	1	-18	60.17	-1083	3.34	0	-0.01	-0.8
16	No	00:04.0	1	-18	60.16	-1082	3.34	0	-0.01	-1.1
17	No	00:05.0	1	-18	60.14	-1082	3.34	0	-0.02	-1.4
18	No	00:06.0	1	-18	60.12	-1082	3.34	0	-0.02	-1.7
19	No	00:07.0	1	-18	60.11	-1081	3.34	0	-0.03	-2
20	No	00:08.0	1	-18	60.1	-1081	3.34	0	-0.03	-2.3
21	No	00:09.0	1	-18	60.08	-1081	3.34	0	-0.04	-2.6
22	No	00:10.0	1	-18	60.07	-1081	3.34	0	-0.04	-2.9
23	No	00:11.0	1	-18	60.06	-1081	3.34	0	-0.05	-3.2
1523	No	25:11.0	1	-18	49.28	-887	2.74	0	-7.55	-433.7
1524	No	25:12.0	1	-18	49.2	-885	2.73	0	-7.55	-433.9
1525	No	25:13.0	1	-18	49.13	-884	2.73	0	-7.56	-434.2
1526	No	25:14.0	1	-18	49.05	-882	2.73	0	-7.56	-434.4
1527	No	25:15.0	1	-18	48.97	-881	2.72	0	-7.57	-434.7
1528	No	25:16.0	1	-0.01	-13.35	0	440.44	0	-7.57	-434.8
1529	No	25:17.0	1	-0.01	-11.07	0	203.29	0	-7.57	-434.8
1530	No	25:18.0	1	-0.01	-9.03	0	653.18	0	-7.57	-434.8

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ANNEXURE-1

4.4	Over-Temperature Protection Reference Standard: AIS 156(Part II)-2022 (A3P2)	
4.4.1	Procedure	
Sample ID: NATRAX/TB/23-24/48-04	**Particulars**	**Parameter During Test**
	Test Component	REESS Subsystem (Battery Pack)
	Temperature Sensor	On Board
	Battery Management System	Available
	Protection Devices of DUT	Fuse
	Chamber Temperature	60°C
	DUT Condition	Active Mode
	Charging Current	10 A
	Discharging Current	18 A
	Test Stopped when	Battery inhibits and/or limits the charge and/or discharge to prevent the temperature increase-(Auto Cut-off)
	Observation Period	1 Hour
	Test Start Date	13.10.2023
	Test End Date	13.10.2023

4.4.2	Test Result	
	Requirement	**Observations**
	During the test, there shall be no evidence of: (a) Electrolyte leakage (b) Rupture c) Fire (d) Explosion	No Electrolyte leakage, no rupture, no fire and no explosion.
	Over-temperature Protection	Inhibited and limits the charge to prevent the temperature increase, when battery temperature reached 54.24°C.
	The isolation resistance measured after the test.	Isolation resistance was found greater than 100Ω/Volt.

ANNEXURE-1

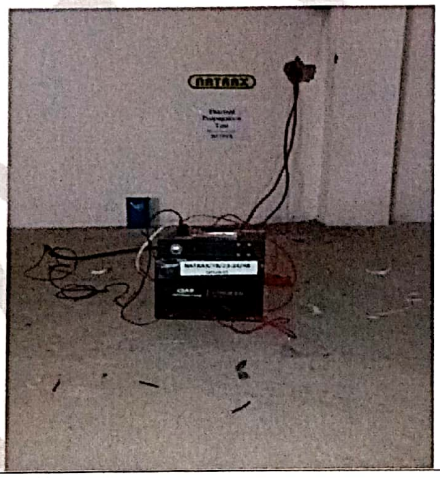
4.5	Thermal Propagation Reference Standard: AIS 156(Part II)-2022 (A3P2)	
4.5.1	Procedure	
Sample ID: NATRAX/TB/23-24/48-03	Particulars	Parameter During Test
	Test Component	REESS Subsystem (Battery Pack)
	Battery Management System	Operational
	Potation devices SOC	Not Applicable
	Test Component SOC	95 %
	Trigger Method	Over Charge
	Initiation cell temperature	22°C
	Maximum temperature (define by the manufacturer)	60°C
	DUT Condition	OK
	Thermal runaway condition (i) The measured voltage of the initiation cell drops: (ii) The measured temperature exceeds [the maximum operating temperature defined by the manufacturer] (iii) dT/dt≥ [1°C/s] of the measured temperature. Thermal runaway can be judged when: (a) Both (i) and (iii) are detected: or (b) Both (ii) and (iii) are detected	Thermal runaway not detected. Only condition (i) and (ii) wear met.
	Test Stopped when	Auto cut-off and Voltage exceeded 200%
	Test Start Date	16.10.2023
	Test End Date	16.10.2023

4.5.2	Test Result	
	Requirement	Observations
	During the test, there shall be no evidence of: (a) Fire. (b) Explosion.	No fire, No explosion observed during test.

4.6.3	Test Setup

	A	B	C	I	J	K	N	X	Y	Z
1	Test Name:	Tharmal Propagation Ambi-48								
2	Test Date:	16-10-2023 12:35								
3	Operator ID:	Admin								
4	Program Nan	3.7V 16Ah								
5	Program Description:									
6	Program Dat	C:\VisualCN\Programs\NATRAX.mdb								
7	Module Type	yd								
8	Module Desc	LCV 100-80								
9	Address:	Port: 1, Sys Controller: 3	Circuit: 4							
10	Name:	Port 1, Ctr	Device ID:							
11										
12	Exclude	Total Tim	Cycle	Current, A	Voltage, V	Power, W	Amp-Hou	Temperat	Temperat	Unassigne
13	No	00:01.0	1	6	4.52	27	0	200	24.8	0
14	No	00:02.0	1	6	4.53	27	0	200	24.8	0
15	No	00:03.0	1	6	4.54	27	0	200	24.8	0
16	No	00:04.0	1	5.99	4.54	27	0	200	24.8	0
17	No	00:05.0	1	6	4.54	27	0	200	24.8	0
18	No	00:06.0	1	6	4.55	27	0	200	24.8	0
19	No	00:07.0	1	6	4.55	27	0.01	200	24.8	0
4407	No	13:15.0	1	6	5.5	33	7.32	29.4	61.9	0
4408	No	13:16.0	1	6	5.5	32	7.32	29.4	62	0
4409	No	13:17.0	1	6	5.5	32	7.32	29.4	62.1	0
4410	No	13:18.0	1	6	5.5	33	7.32	29.4	62.2	0
4411	No	13:19.0	1	0.01	29.59	0	7.32	29.4	62.3	0
4412	No	13:20.0	1	0.01	26.67	0	7.32	29.4	62.4	0
4413	No	13:21.0	1	0.01	23.94	0	7.32	29.4	62.5	0
4414	No	13:22.0	1	0.01	20.94	0	7.32	29.4	62.6	0

Tharmal Propagation Ambi-48



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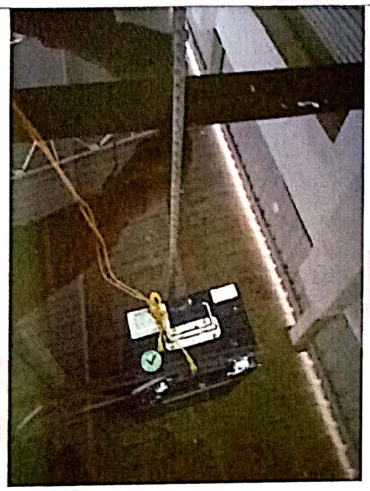
Prepared By	*Page 22 of 27*	NATIONAL AUTOMOTIVE TEST TRACKS	**Checked By**
Rishikesh Sharma			**Manish Mandloi**
Engineer			**Sr. Engineer**

ANNEXURE-1
Water Ingress Protection Test

4.6 TEST REQIRMENTS AND RESULTS:

	IPX7 Reference Standard: IEC 60529 AIS-156 A3 P2
	Procedure
Sample ID: NATRAX/TB/23-24/48-06	REESS with 100% SOC shall be tested:- ☑ The lowest point of enclosures with a height less than 850 mm is located 1000 mm below the surface of water. ☐ The highest point enclosures with a height equal to or greater than 850 mm is located 150 mm below the surface of the water **Test Date: -** 13-10-2023 **Test duration: -** 30 min **Acceptance Criteria: -** There shall be no fire or explosion during testing of REESS.
	Test Result: - At the end of the test, no fire and no explosion was observed from tested device.

4.6.1	**Test Setup**



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ANNEXURE-1

Sr.N	Cl. No.	Verification/Test Name	Date	Observation	Result
5.0 Verifications:					
5.1	6.1.2.1	BMS Shall be microprocessor/ microcontroller-based circuit	13.10.2023	Microcontroller Make: JBD	Complied
5.2	6.1.2.3 (a)	BMS over charge protection	13.10.2023	71.9V	Complied
5.3	6.1.2.3 (b)	BMS over discharge protection	16.10.2023	48.97V	Complied
5.4	6.1.2.3 (c)	BMS over temperature	13.10.2023	T charge= 55°C T discharge= 60°C	Complied
5.5	6.1.2.3 (d)	BMS over current protection	16.10.2023	Charge Current =21A Discharge Current = 41A	Complied
5.6	6.1.2.3 (e)	BMS Short circuit protection	16.10.2023	Verified	Complied
5.7	6.1. 3(a)	Charger voltage cut off	13.10.2023	71.16V	Complied
5.8	6.1.3(b)	Soft start function	13.10.2023	Initial Current = 1.3 A Set Current = 10.6 A	Complied
5.9	6.1.3 (c)	Pre-charge function to detect over discharge	13.10.2023	Verified	Complied
5.10	6.1.3(d)	Input supply variation with battery pack	13.10.2023	Verified	Complied
5.11	6.1.3(f)	Communication verification with battery pack	13.10.2023	Verified	Complied
5.12	Annexure 8k-(3)	Verification of cell charge/discharge cycle data	16.10.2023	Verified	Complied
5.13	Annexure 8k-(7)	Verification of the cell to cell spacing in battery pack	13.10.2023	0.5mm	Complied
5.14	Annexure 8k-(8)	Verification of additional safety fuse/ circuit breaker	13.10.2023	Verified	Complied
5.15	Annexure 8k-(9)	Verification of the cells, BMS charger w.r.t serial number	13.10.2023	Verified	Complied

ANNEXURE-1

Sr.N	Cl. No.	Verification/Test Name	Date	Observation	Result
5.0 Verifications:					
5.16	Annexure 8k-(10)	Protection against regenerative	16.10.2023	BMS	Complied
5.17	6.1.2.2	BMS shall comply EMC requirements as per AIS 004 Part 3 or AIS 004 Part 33 Rev 1 as applicable at ESA level(test report Verification)	20.10.2023	Report no: CT0MS0738 19.10.2023	Complied
5.18	6.1.3(e)	Earth leakage detection	13.10.2023	Verified	Complied
5.19	Annexure 8k-(1)	Verification of manufacturing date on cell	13.10.2023	Verified	Complied
5.20	Annexure 8k-(2)	Cell report Verification as per IS 16893	20.10.2023	Report no: IEC/22100704, Dated:- 07/11/2022	Complied
5.21	Annexure 8k-(4)	Verification of pressure release vent	13.10.2023	Verified	Complied
5.22	Annexure 8k-(5)	Verification of temperature sensor	13.10.2023	Verified	Complied
5.23	Annexure 8k-(6)	Verification of action paralleling circuit in the battery pack	13.10.2023	Verified	Complied
5.24	Annexure 8k-(11)	BMS data logging	17.10.2023	Verified	Complied

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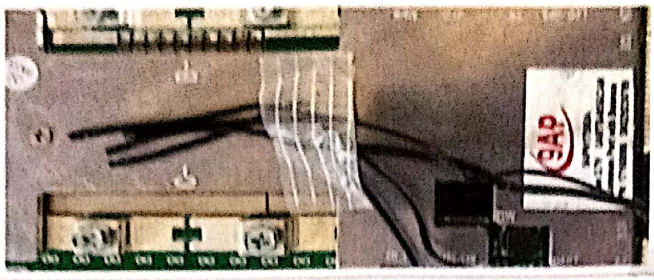
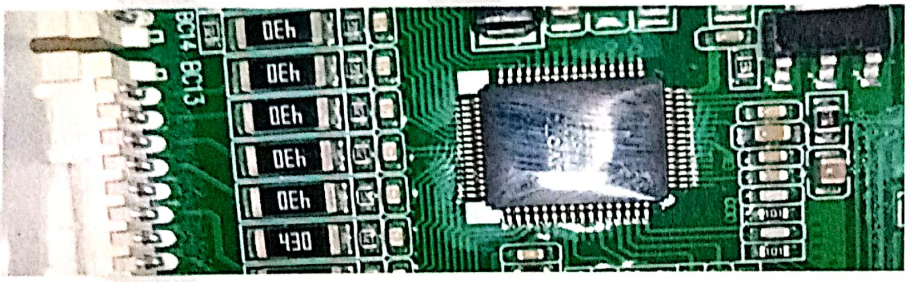
Verification of Temperature Sensor



Verification of Pressure Release vent & Visual Alarm

Verification of Safety Fuse- 60A

Verification of Microcontroller-based circuit



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