N	T	0	B-Li	S	0059

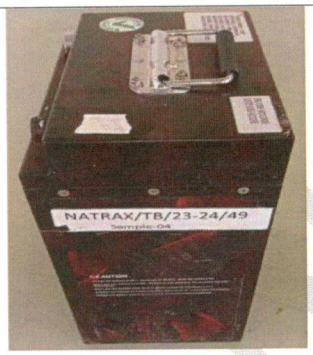
Dated: 28-12-2023

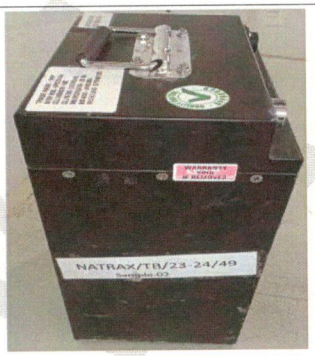
TEST REPORT

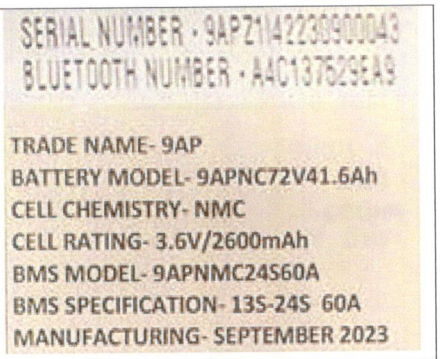
1.0	NAME AND ADDRESS OF THE CUSTOMER	M/s AMBIT TRANSMISSION PRODUCTS PVT.LTD. B-5, IIE SIGADDI GROWTH CENTRE, SIDCUL ,KOTDWARA,PAURI GARHWAL,UTTARAKHAND-246149(INDIA)
1.1	NAME AND ADDRESS OF THE MANUFACTURER	M/s AMBIT TRANSMISSION PRODUCTS PVT.LTD. B-5, IIE SIGADDI GROWTH CENTRE, SIDCUL ,KOTDWARA,PAURI 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)	41.6Ah
v	Operating Voltage	56V-85V
vi	Rated Voltage	72V
vii	Battery Pack Id/Model	9APNC72V41.6AH
viii	Battery Dimensions (l*b*h)	235mm*165mm*385mm
ix	Battery Weight In (Kg)	24.4Kg
x	Battery Module Drawing no.	AMBITDDN9APKO072302
xi	Battery Pack Sr. no.	9APZ1I42230900043







Remarks: Refer page 28 of 28 for Disclaimer

NATRAX CASE ID: NATRAX/TB/23-24/49

Authorized Signatory:

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

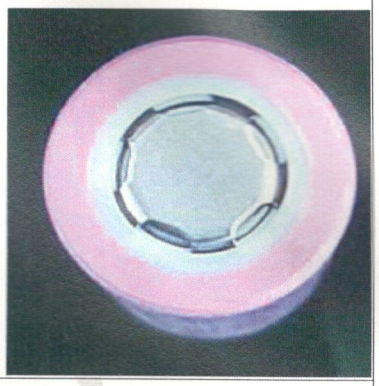
राष्ट्रीय मोटर वाहन परीक्षण ट्रैक नेटवर्क

कार्यालयः 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

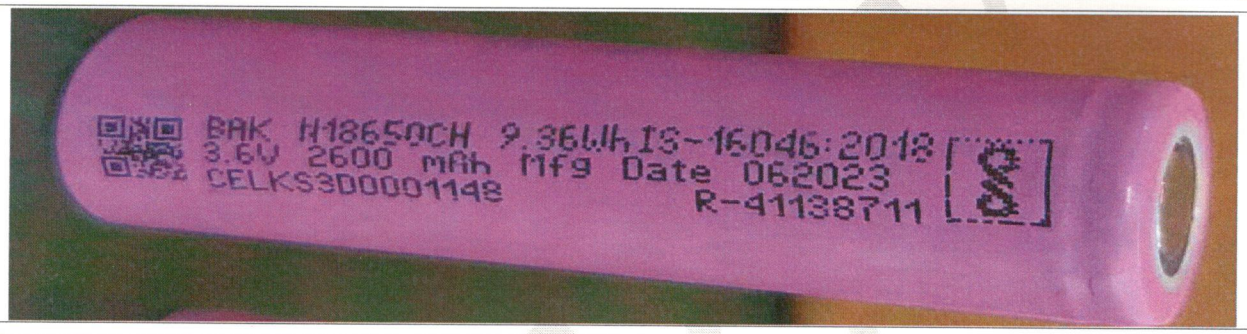
मुख्य कार्यालयः दूसरी मंजिल, प्रशासनिक भवन, आईकेट परिसर – II, सेक्टर – 11, आई. एम. टी. मानेसर, गुरुग्राम, हरियाणा – 122051
Corporate Office: 2nd Floor, Administrative Building, ICAT Campus-II, Sector-11, IMT Manesar, Gurugram, Haryana – 122051
Tel: 01246 900 000, Website: www.natrip.in

N	T	0	B-Li	S	0059	Dated: 28-12-2023

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	20S16P
viii	Cell Type	NMC
ix	Cell certification report/Date	IEC/22100704 / 07/11/2022

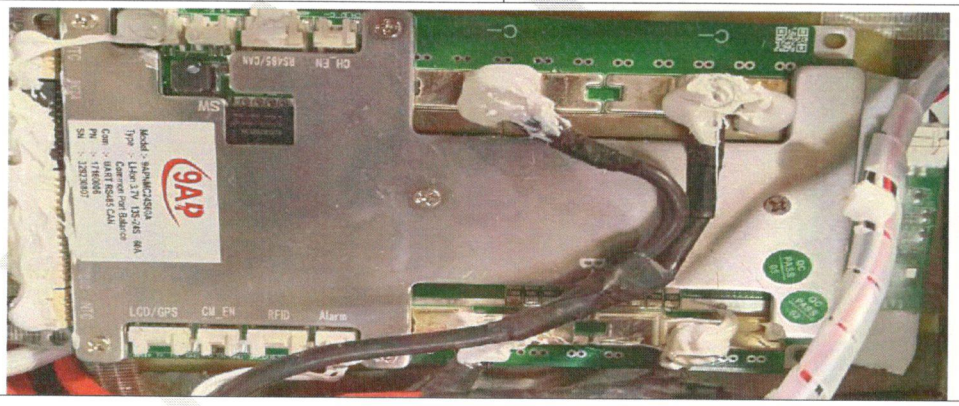


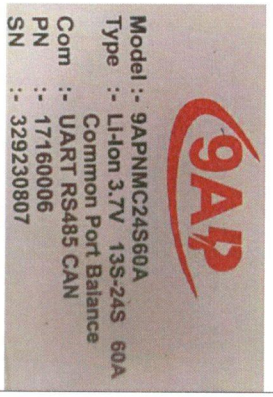
CELL PHOTO



5	BMS	Description
I	BMS Make	AMBIT TRANSMISSION PRODUCTS PVT.LTD
Ii	BMS Model/ ID No.	9APNMC24S60A
Iii	BMS Software version/ Hardware version	51/9APN24S60A
iv	BMS Communication Protocol	UART RS485 CAN
v	BMS EMC Test Report (referred)	CT0MS0878, 27.12.2023

BMS PHOTO





Remarks: Refer page 28 of 28 for Disclaimer

NATRAX CASE ID: NATRAX/TB/23-24/49

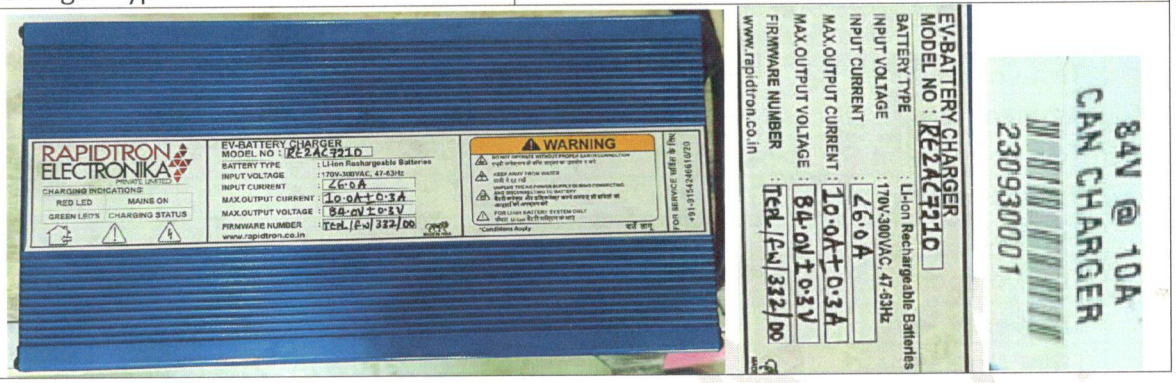
Authorized Signatory:

Page 02 of 28

Format no. NATRAX/TB/L/2023/01

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

T	0	B-Li	S	0059	Dated: 28-12-2023

6	Battery Charger	Description
i	Charger Sr. no.	230930001
ii	Charger (External/On Board)	External
iii	Charger Make / Model	RAPIDTRON/ RE2AC7210
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-1 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**	28 (Report with Annexures) + 1 (Drawings)

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

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/23-24/49-01	**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	24.4Kg	
	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	12.10.2023	
	Test End Date	12.10.2023	
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-13-2023 14:05:48
Test name: lITHIUM Battery Vibration test -
Test status: Test Stopped (Schedule Finished)

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

Testing time
Remaining Time: 00:00:00
Run Start Time: Oct-12-2023 11:53:22

Total elapsed time: 03:00:12

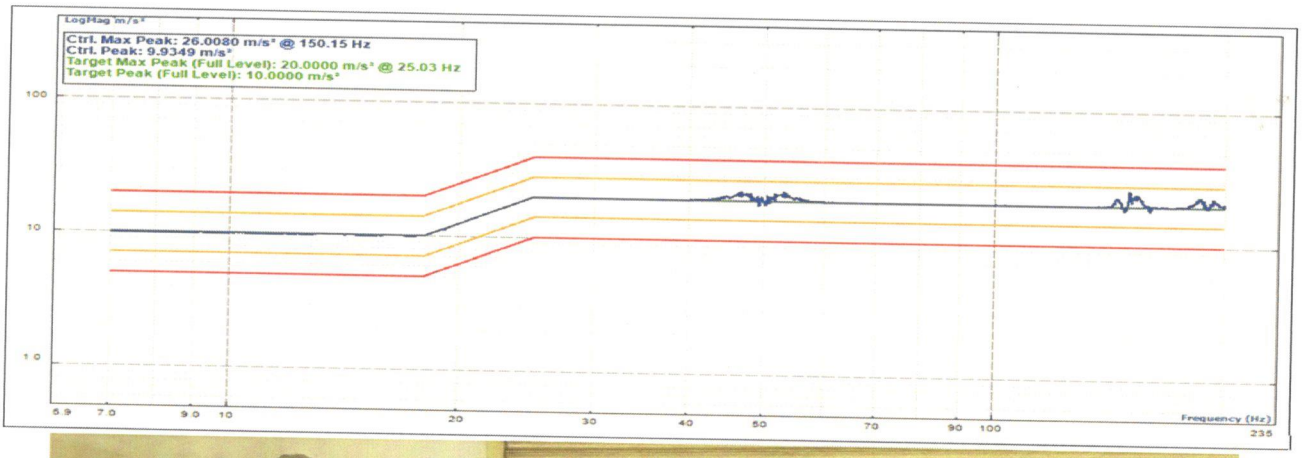
Full level elapsed time: 03:00:00

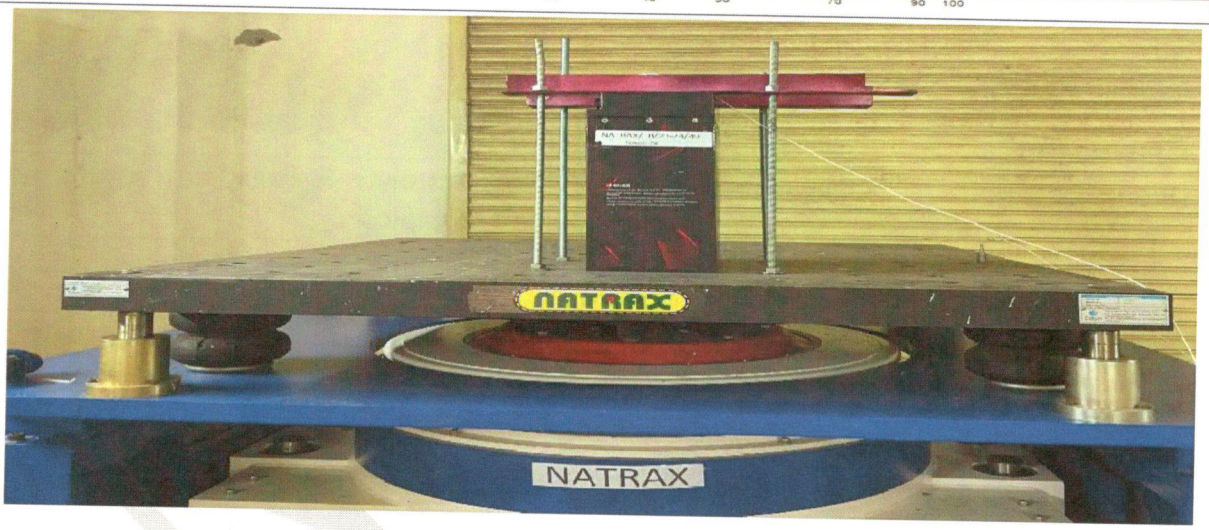
Test parameters
Current Frequency: 7.000 Hz
Signal Plot Points: 2048

Sweeping Rate: 0.64487 Oct/Min
Sweep Type: Logarithmic

Sweep Number: 24

Control Composite





Remarks: Refer page 28 of 28 for Disclaimer

Format no. NATRAX/TB/L/2023/01

Prepared By		Checked By
Rishikesh Sharma	*Page 05 of 28*	Manish Mandloi
Engineer		Sr. Engineer

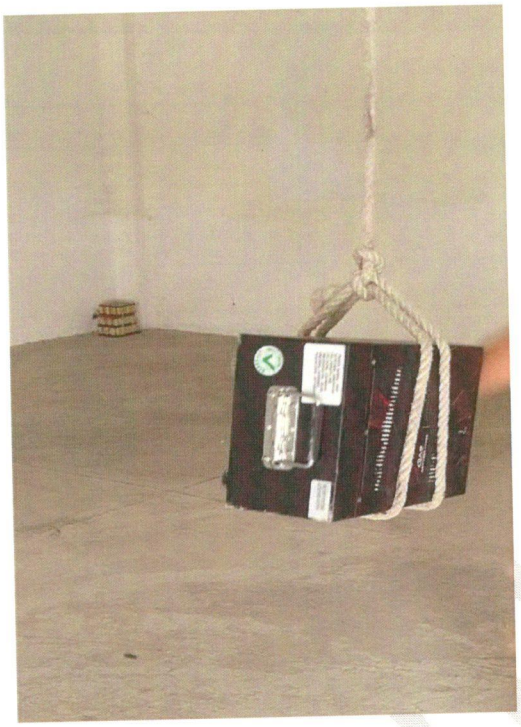
ANNEXURE-1

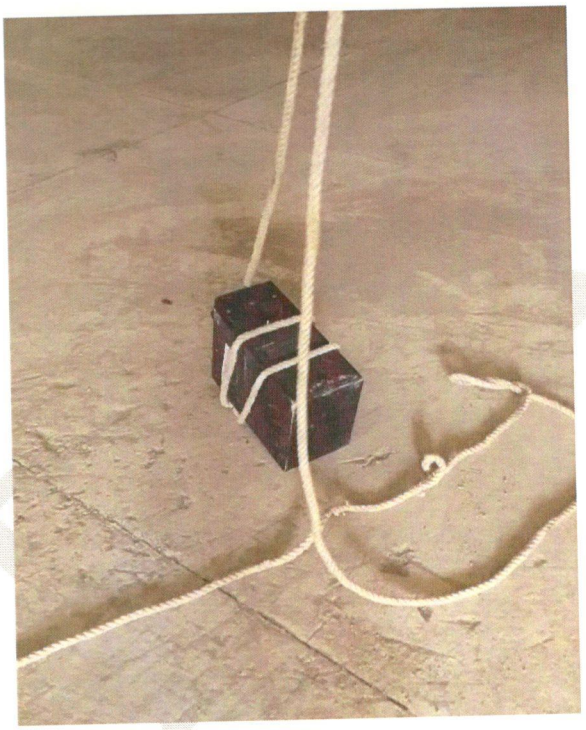
1.2	Mechanical Drop Test Reference Standard: AIS 156(Part II)-2022 (A3P2)	
1.2.1	Procedure	
Sample ID: NATRAX/TB/23-24/49-03	**Particulars**	**Parameter During Test**
	Test Component	REESS Subsystem (Battery Pack)
	Ambient temperature (20 ± 10°C)	26 °C
	Test Component SOC (≥90%)	90 %
	Protection Devices of DUT	Fuse
	Test Component Weight	24.4 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)





ANNEXURE-1

1.3	**Mechanical Shock** **Reference Standard: AIS 156(Part II)-2022 (A3P2)**	
1.3.1	**Procedure**	
Sample ID: NATRAX/TB/23-24/49-02	**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	24.4 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	17.10.2023
	Test End Date	17.10.2023

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.

ANNEXURE-1

1.3.3	Mechanical Shock Test Setup (Photo)

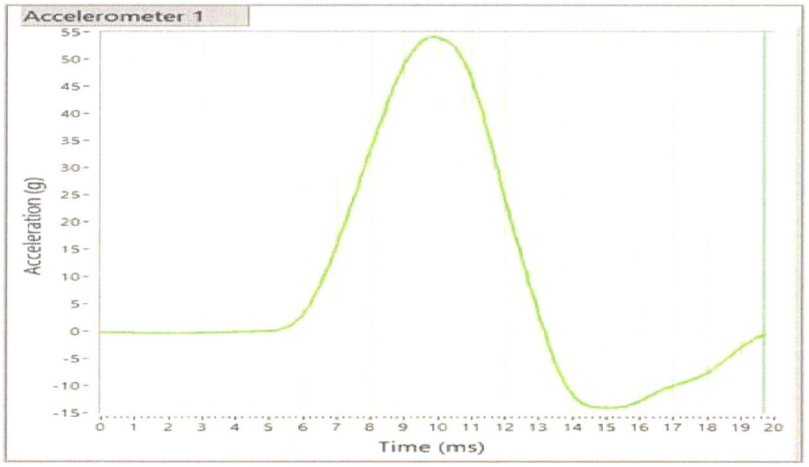
(Tarang Pneumatic Shock Test Machine)

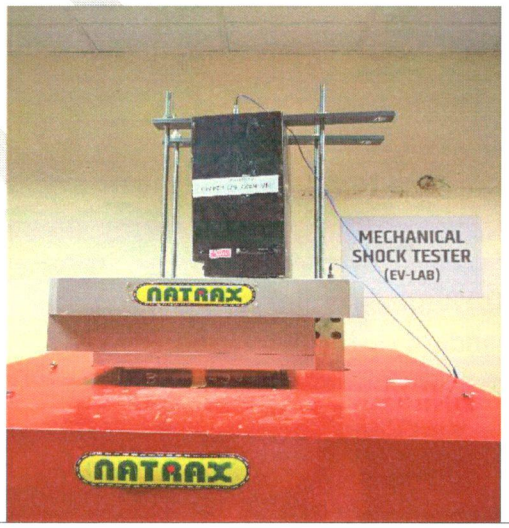
WAVE FORM REPORT

'TARANG' TSC-1001 Test Report File
Shock Test Number: 1
Time: 3:51:54 PM
Date: 10/17/2023
Test operator: AMBIT
Channel Number: 2
Accelerometer Sensitivity (mV/g): 9.790
Accelerometer S No: LW225606

Observation 2

Selected Test
Peak (g): 54.03
Pulse Duration (ms): 7.20
Filter Cut Off (Hz): 100





ANNEXURE-1

2.1	Thermal Shock & Cycling Test Reference Standard: AIS 156(Part II)-2022 (A3P2)	
2.1.1	**Procedure**	
Sample ID: NATRAX/TB/23-24/49-04	**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	16.10.2023
	Test End Date	22.10.2023

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

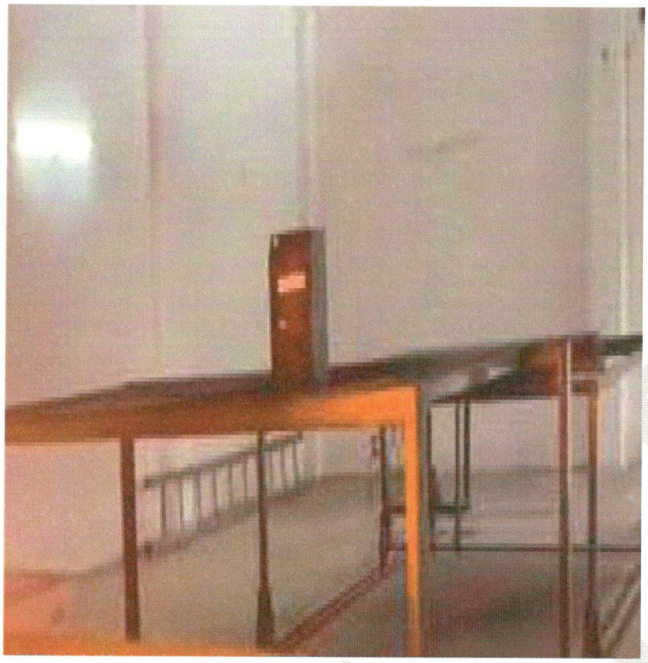
2.1.3	Thermal Shock & Cycling Test Setup (Photo)

ANNEXURE-1

3.1	Fire Resistance Test Reference Standard: AIS 156(Part II)-2022 (A3P2)	
3.1.1	**Procedure**	
Sample ID: NATRAX/TB/23-24/49-01	**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



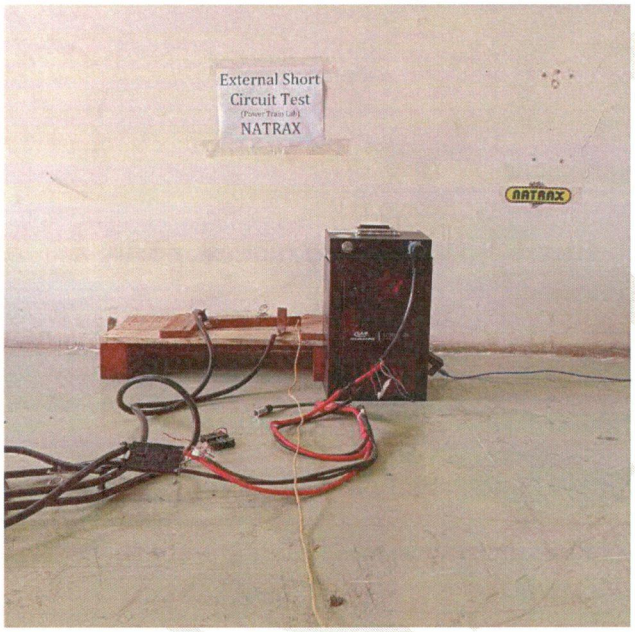
ANNEXURE-1

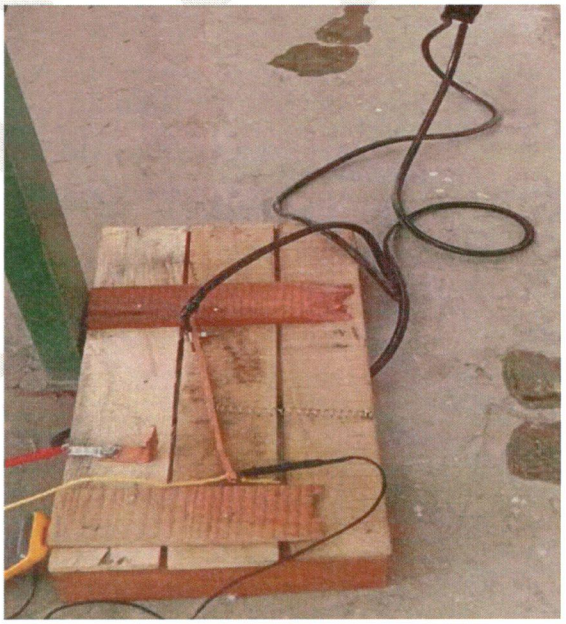
PROTECTION VARIFICATION

4.1	External Short Circuit Protection Reference Standard: AIS 156(Part II)-2022 (A3P2)	
4.1.1	Procedure	
Sample ID: NATRAX/TB/23-24/49-05	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	24.4 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





ANNEXURE-1

4.2	**Over-Charge Protection** **Reference Standard: AIS 156(Part II)-2022 (A3P2)**	
4.2.1	**Procedure**	
Sample ID: NATRAX/TB/23-24/49-02	**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.

4.2.3	Test Setup

	A	B	G	I	J	K	L	M	N
1	Test Name:	OVER CHARGE AMBIT -49							
2	Test Date:	13-10-2023 13:08							
3	Operator ID:	Admin							
4	Program Name:	CHARGE							
5	Program Description:								
6	Program Databa	C:\VisuaLCN\Programs\NATRAX.mdb							
7	Module Type:	yd							
8	Module Descript	LCV 100-80							
9	Address:	Port: 1, Sys Controller: 3 Circuit: 7							
10	Name:	Port 1, Ctrl 3, Addr 7							
11									
12	Exclude	Total Time, (h:m:s	Step	Current, A	Voltage, V	Power, W	Constant F	Internal R	Amp-Hour
13	No	00:01.0	1	10	69.73	1045	0	0	0
14	No	00:02.0	1	10	69.81	1046	0	0	0
15	No	00:03.0	1	10	69.86	1047	0	0	0.01
16	No	00:04.0	1	10	69.9	1048	0	0	0.01
17	No	00:05.0	1	9.99	69.93	1048	0	0	0.02
18	No	00:06.0	1	10	69.96	1049	0	0	0.02
19	No	00:07.0	1	10	69.99	1049	0	0	0.02
20	No	00:08.0	1	10	70.01	1050	0	0	0.03
21	No	00:09.0	1	10	70.04	1050	0	0	0.03
7120	No	58:28.0	1	10	83.05	1596	0	0	29.22
7121	No	58:29.0	1	10	83.06	1597	0	0	29.22
7122	No	58:30.0	1	10	83.07	1598	0	0	29.23
7123	No	58:31.0	1	10	83.08	1599	0	0	29.23
7124	No	58:32.0	1	10	83.09	1600	0	0	29.23
7125	No	58:33.0	1	10	83.1	1601	0	0	29.23
7126	No	58:34.0	1	0.1	0	0	0	0	29.24
7127	No	58:35.0	1	0.1	0	0	0	0	29.24

ANNEXURE-1

4.3	**Over-Discharge Protection** **Reference Standard: AIS 156(Part II)-2022 (A3P2)**	
4.3.1	**Procedure**	
Sample ID: NATRAX/TB/23-24/49-02	**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	20 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.

4.3.3	Test Setup

	A	B	C	I	J	K	L	M	N	O
1	Test Name: OVER DISCHARGE AMBIT-49									
2	Test Date:	16-10-2023 10:36								
3	Operator ID	Admin								
4	Program Na	Dis-charge								
5	Program Description:									
6	Program Da	C:\VisualCN\Programs\NATRAX.mdb								
7	Module Typ	yd								
8	Module Des	LCV 100-80								
9	Address:	Port: 1, Sys Controller: 3 Circuit: 3								
10	Name:	Port 1, Ctr	Device ID:							
11										
12	Exclude	Total Tim	Cycle	Current, A	Voltage, V	Power, W	Constant	Internal R	Amp-Hou	Watt-Hou
13	No	0:00:01.0	1	-20	67.86	-1425	3.23	0	0	-0.3
14	No	0:00:02.0	1	-20	67.81	-1424	3.23	0	-0.01	-0.7
15	No	0:00:03.0	1	-20	67.77	-1423	3.23	0	-0.01	-1.1
16	No	0:00:04.0	1	-20	67.74	-1422	3.23	0	-0.02	-1.5
17	No	0:00:05.0	1	-20	67.7	-1421	3.22	0	-0.02	-1.9
18	No	0:00:06.0	1	-20	67.68	-1421	3.22	0	-0.03	-2.3
19	No	0:00:07.0	1	-20	67.65	-1420	3.22	0	-0.04	-2.7
20	No	0:00:08.0	1	-20	67.63	-1420	3.22	0	-0.04	-3.1
21	No	0:00:09.0	1	-20	67.6	-1419	3.22	0	-0.05	-3.5
137	No	0:07:05.0	1	-20	59.69	-1253	2.84	0	-2.47	-159.7
138	No	0:07:06.0	1	-20	59.43	-1247	2.83	0	-2.47	-160
139	No	0:07:07.0	1	-20	59.23	-1243	2.82	0	-2.48	-160.4
140	No	0:07:08.0	1	-20	59.08	-1240	2.81	0	-2.48	-160.7
141	No	0:07:09.0	1	-20	58.95	-1237	2.81	0	-2.49	-161.1
142	No	0:07:10.0	1	-0.01	-12.91	0	325.67	0	-2.49	-161.3

ANNEXURE-1

4.4	**Over-Temperature Protection** **Reference Standard: AIS 156(Part II)-2022 (A3P2)**	
4.4.1	**Procedure**	
Sample ID: NATRAX/TB/23-24/49-04	**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	20 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

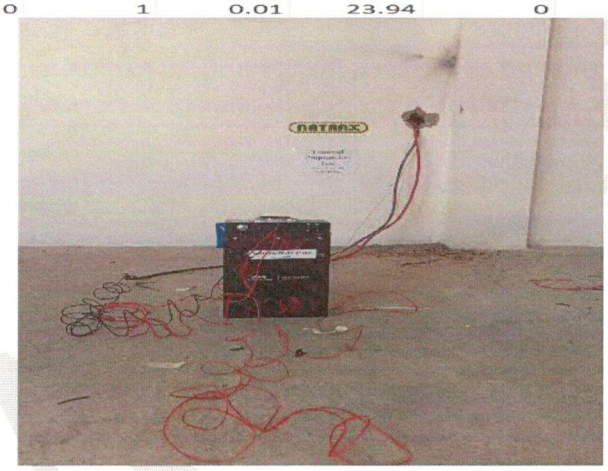
4.5	Thermal Propagation Reference Standard: AIS 156(Part II)-2022 (A3P2)	
4.5.1	**Procedure**	
Sample ID: NATRAX/TB/23-24/49-03	**Particulars**	**Parameter During Test**
	Test Component	REESS Subsystem (Battery Pack)
	Battery Management System	Operational
	Potation devices SOC	Not Applicable
	Test Component SOC	95 %
	Trigger Method	Single cell over charge method
	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) were met. Max. Temp. of Charging: 62.5°C. Max. surface Temp. of initiation cell recorded- 62.5 °C The initiation cell surface temp. was increased up to 62.5 °C and then stared falling down automatically. The audio-visual alarm activated above 55°C.
	Test Stopped when	The test was stopped when the initiation cell temperature started falling down automatically from 62.5°C and No fire and explosion was observed.
	Test Start Date	16.10.2023
	Test End Date	16.10.2023

4.5.2	Test Results:	
	Requirement	**Observations**
	During the test, there shall be no evidence of: (a) Fire. (b) Explosion.	1. No fire, No explosion observed during test. 2. The Audio-visual alarm activated above 55°C, 3. As declared by the customer (letter no.-**005**, dt. **06.11.2023**), battery pack was specially designed to restrict the thermal runaway, the customer has used potting material to restrict the thermal runaway. 4. All clauses of 6.11 as per AIS:156 Part 2 were verified. 5. As thermal runaway did not occur and no fire or explosion occurred and the test was stopped when the initiation cell temperature started falling down automatically from 62.5°C and No fire and explosion was observed., therefore the tested device meets thermal propagation requirement.

4.5.3	**Documentation (Thermal Propagation Test):**	
4.5.3.1	REESS manufacturer shall submit a risk reduction analysis using appropriate industry standard methodology (for example, IEC 61508, MIL-STD 882E, ISO 26262, AIAG DFMEA, fault analysis as in SAE J2929, or similar), which documents the risk to vehicle user and bystanders caused by thermal propagation which is triggered by an internal short circuit leading to a single cell thermal runaway and documents the reduction of risk resulting from implementation of the identified risk mitigation functions or characteristics.	Verified based on declaration submitted by the manufacturer vide document **Annexure-A_DFMEA PDF** Document Id:- **AMBIT/DD/DFMEA/04,** Declaration letter no.- **005,** Dated:- **06.11.2023**
4.5.3.2	REESS manufacturer shall submit a system diagram of all relevant physical systems and components. Relevant systems and components are those which contribute to the protection of vehicle user and bystanders from hazardous effects caused by thermal propagation triggered by a single cell thermal runaway	Verified based on declaration submitted by the manufacturer vide document of declaration letter no.- **005,** Dated:- **06.11.2023**
4.5.3.3	REESS manufacturer shall submit a diagram showing the functional operation of the relevant systems and components, identifying all risk mitigation functions or characteristics.	Verified based on declaration submitted by the manufacturer vide document of declaration letter no.- **005,** Dated:- **06.11.2023**

4.6.3	Test Setup

	A	B	C	I	J	K	N	Y	Z
1	Test Name:	Tharmal Propagation Ambi							
2	Test Date:	16-10-2023 12:35							
3	Operator ID:	Admin							
4	Program Nan	3.7V 16Ah							
5	Program Description:								
6	Program Data	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 Time	Cycle	Current, A	Voltage, V	Power, W	Amp-Hour	Temperat	Unassigne
13	No	00:01.0	1	6	4.52	27	0	24.8	0
14	No	00:02.0	1	6	4.53	27	0	24.8	0
15	No	00:03.0	1	6	4.54	27	0	24.8	0
16	No	00:04.0	1	5.99	4.54	27	0	24.8	0
17	No	00:05.0	1	6	4.54	27	0	24.8	0
18	No	00:06.0	1	6	4.55	27	0	24.8	0
19	No	00:07.0	1	6	4.55	27	0.01	24.8	0
4402	No	13:10.0	1	6	5.5	33	7.31	61.4	0
4403	No	13:11.0	1	6	5.5	33	7.31	61.5	0
4404	No	13:12.0	1	6	5.5	33	7.31	61.6	0
4405	No	13:13.0	1	6	5.5	33	7.32	61.7	0
4406	No	13:14.0	1	6	5.5	33	7.32	61.8	0
4407	No	13:15.0	1	6	5.5	33	7.32	61.9	0
4408	No	13:16.0	1	6	5.5	32	7.32	62	0
4409	No	13:17.0	1	6	5.5	32	7.32	62.1	0
4410	No	13:18.0	1	6	5.5	33	7.32	62.2	0
4411	No	13:19.0	1	0.01	29.59	0	7.32	62.3	0
4412	No	13:20.0	1	0.01	26.67	0	7.32	62.4	0
4413	No	13:21.0	1	0.01	23.94	0	7.32	62.5	0

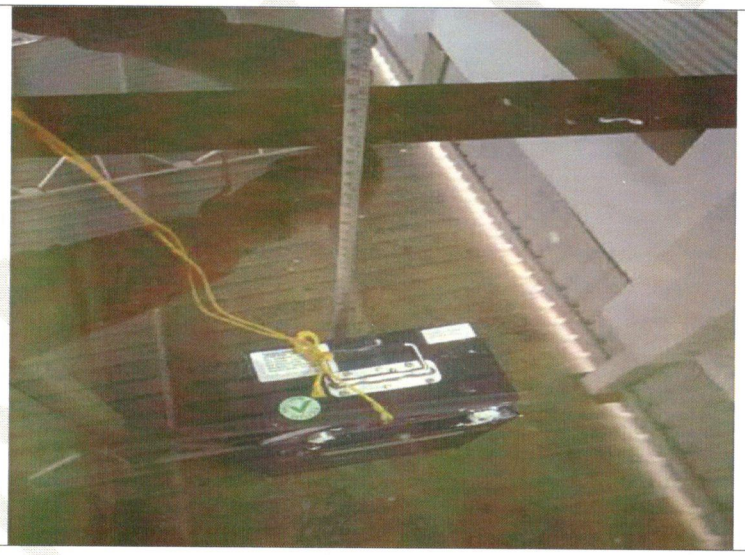


ANNEXURE-1
Water Ingress Protection Test

4.6 TEST REQIRMENTS AND RESULTS:

	IPX7 Reference Standard: IEC 60529 AIS-156 A3 P2
	Procedure
Sample ID: NATRAX/TB/23-24/49-06	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: -** 12-10-2023 **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**



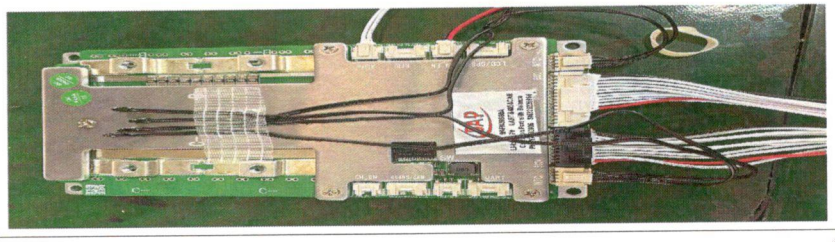
ANNEXURE-1

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	83.1V	Complied
5.3	6.1.2.3 (b)	BMS over discharge protection	16.10.2023	58.95V	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 =30A Discharge Current = 45A	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	84V	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

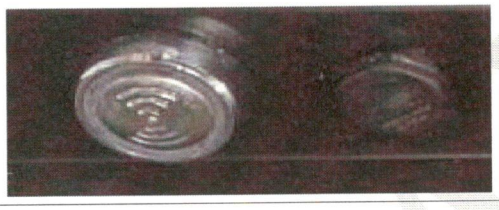
ANNEXURE-1

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 is capable to restrict the regenerative current, as declared by customer	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)	27.12.2023	Report no: CT0MS0878, 27.12.2023	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	16.10.2023	Verified	Complied

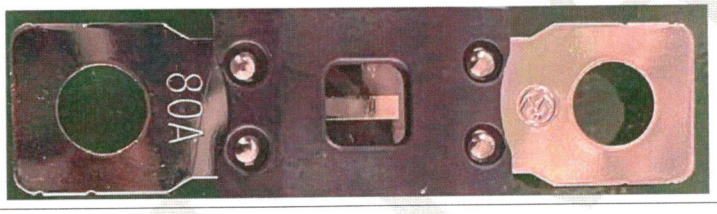
Verification of Temperature Sensor



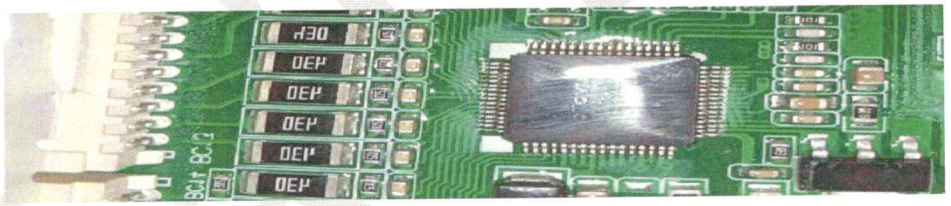
Verification of Pressure Release vent & Visual Alarm



Verification of Safety Fuse- 80A



Verification of Microcontroller-based circuit



Disclaimer:

This test report pertains only to the components/parts/ assemblies etc., actually tested at NATRAX in the presented condition based on the documents / information produced / submitted by the customer. The issuance of this test report alone does not indicate any measure of approval, certification, supervision, control of quality surveillance by NATRAX of the product. No extract, abridgment or abstraction from this test report shall be published or used to advertise the product without the written consent of the Centre Head/ Director, NATRAX, who reserves the absolute right to agree or reject all or any of the details of any items of publicity for which consent may be sought. NATRAX is in no way responsible for any misuse of copying of any design / type system in connection with entire vehicle / components / parts and assemblies. Breach of any statutory provisions of Indian laws of or laws of other countries, will be sole responsibility of the customer and NATRAX shall not be liable for any claims for damages, made by the party, whatsoever. The customer shall alone be liable for the same and undertakes to indemnify NATRAX in this regard. Further, NATRAX has the right to initiate cancellation / withdrawal of the certificate / report issued, in case of any fraud, misrepresentation, when it surfaces and comes in the knowledge of NATRAX. The appropriate local courts at Indore shall have the jurisdiction in respect of any dispute, claim or liability arising out of this report.

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2. NATRAX issues Test Reports/ Extension Reports/ Developmental Test Reports in compliance to Motor Vehicle Act/ Central Motor Vehicle Rules and their provisions as amended from time to time or any other statutory orders under which NATRAX is authorized. Other Rules/ Acts are outside the purview/ Scope of the Test Reports/ Extension Reports/ Developmental Test Reports.
3. Test (s) on prototype/ Vehicle (s) or Sample(s) is/are carries out on the basis of standard test procedures as notified under specific rules/ requested by the applicant. Results of such tests are property of bearer Test Reports/ Extension Reports/ Developmental Test Reports. These results cannot be disclosed unless specifically ordered so by Government/ court etc.
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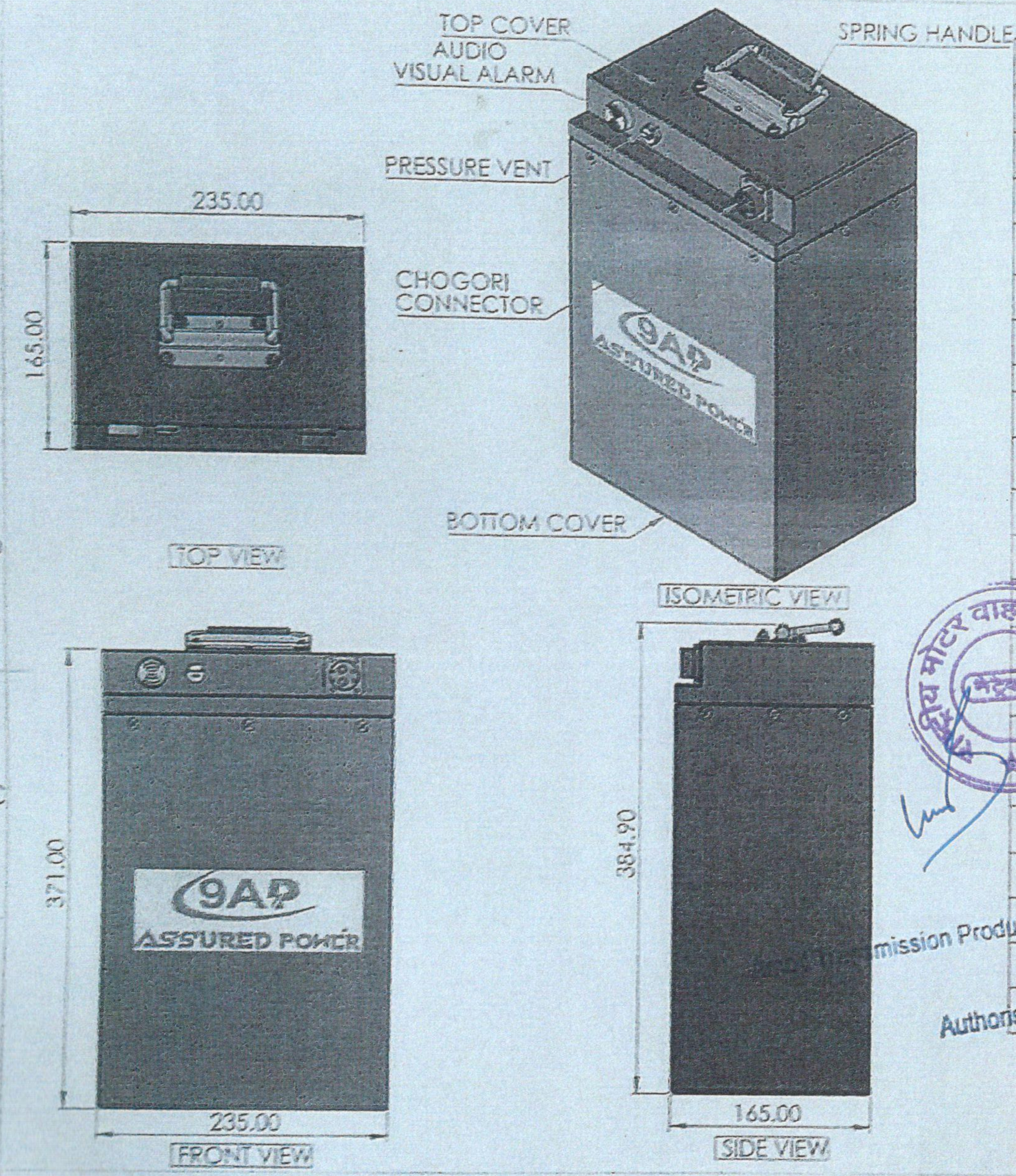
8. Further, NATRAX has the right, but not under obligation to initiate cancellation/ Withdrawal of the Test Reports/ Extension Reports/ Developmental Test Reports is/ are issued in case of any fraud, misrepresentation, when it surfaces and comes in the knowledge of.



Customer Name :	AMBIT TRANSMISSION PRODUCTS PVT LTD.
Manufacturer Name:	AMBIT TRANSMISSION PRODUCTS PVT LTD.
Make:	AMBIT TRANSMISSION PRODUCTS PVT LTD.
Battery Type:	NMC Cylindrical
Battery/Module Capacity (Ah in 5 hrs) :	41.6Ah
Rated Voltage :	72V
Model No :	9APNC72V41.6Ah
Trade Name :	9AP
Drawing No. :	AMBITDDN9APKO072302
Configuration of Cell in Pack/Module :	20S/16P
Cell manufacturer's name :	ZHENGZHOU BAK BATTERY CO. LTD
Cell model no.:	N18650CH
Cell form factor & dimensions:	Cylindrical L-65±0.2, Ø 18.3±0.15
Cell trade name:	BAK
Cell voltage & capacity:	3.6V/2600mAh
Cell to cell spacing	0.5 mm
Fuse Rating:	80A
Regenrative current protection:	28A
BMS software version:	51
BMS hardware version	9APN24S60A
BMS DETAIL	13S-24S 60A
BMS MODAL NO.	9APNMC24S60A

CONTROL COPY

Ambit Transmission Products Pvt. Ltd.
Authorised Signatory

GENERAL TOLERANCE CHART (IN MM)

LENGTH OR DIA.	0-6	6-30	30-120	120-315	315-1000	1000-2000	2000-2300
TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2.5

DO NOT SCALE DRAWING

9AP ASSURED POWER (INDIA)

Ambit Transmission Products Pvt. Ltd.

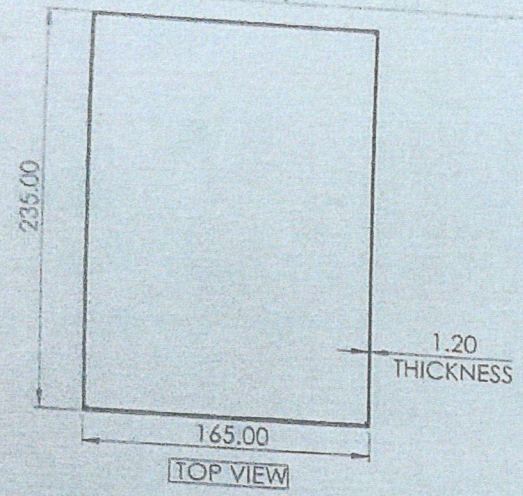
	NAME	SIGNATURE	DATE
DRAWN	PARVEEN KUMAR		20/07/2023
CHK'D	VARDAN SHARMA		21/07/2023
APPV'D	RUPESH KUMAR		22/07/2023
MFG			
Q.A			

THIRD ANGLE

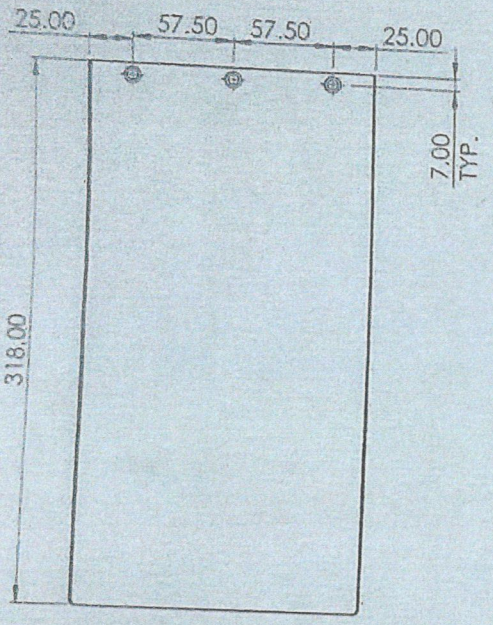
TITLE: GAD OF 72V41.6Ah 20S16P

DWG NO. AMBITDDN9APKO072302

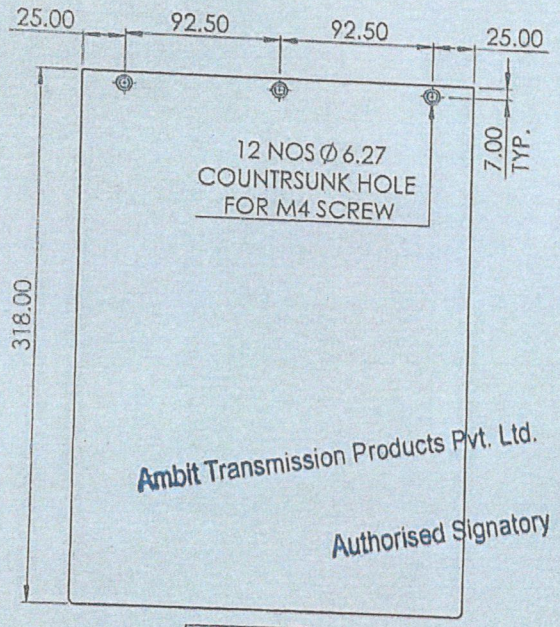
A3



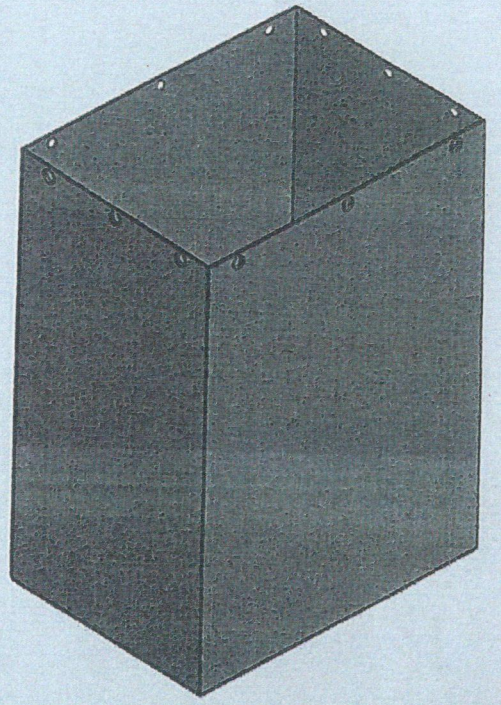
TOP VIEW



FRONT VIEW



SIDE VIEW



ISOMETRIC VIEW

Ambit Transmission Products Pvt. Ltd.

Authorised Signatory

CONTROL COPY

GENERAL TOLERANCE CHART (IN MM)

LENGTH OR DIA.	0-6	6-30	30-120	120-315	315-1000	1000-2000	2000-2300
TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2.5

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
SURFACE FINISH:
TOLERANCES:
LINEAR:
ANGULAR:

FINISH:

DEBURR AND BREAK SHARP EDGES

	NAME	SIGNATURE	DATE
DRAWN	PARVEEN KUMAR		25/07/2023
CHK'D	VARDAN SHARMA		25/07/2023
APPV'D	RUPESH KUMAR		25/07/2023
MFG			
Q.A			

REVISION	DESCRIPTION	DATE

THIRD ANGLE

MATERIAL: CRCA IS:513

WEIGHT: 2.5 KG.

DO NOT SCALE DRAWING

9AP ASSURED POWER (INDIA)

Ambit Transmission Products Pvt.Ltd.
D-5 IIT Sigaldi Growth center sidcul
kotdwar,Pari Garhwal Uttrakhand-246149

TITLE:

BOTTOM COVER 72V41.6Ah

DWG NO. AMBITDDN9APKO072302

A3

SCALE

SHEET 3 OF 6