



राष्ट्रीय मोटर वाहन परीक्षण ट्रैक (राष्ट्रीय मोटर वाहन बोर्ड, भारी उद्योग मंत्रालय, भारत सरकार के अंतर्गत)
NATIONAL AUTOMOTIVE TEST TRACKS
 (Under National Automotive Board, Ministry of Heavy Industries, Govt. of India)

N T O B-Li S 0060

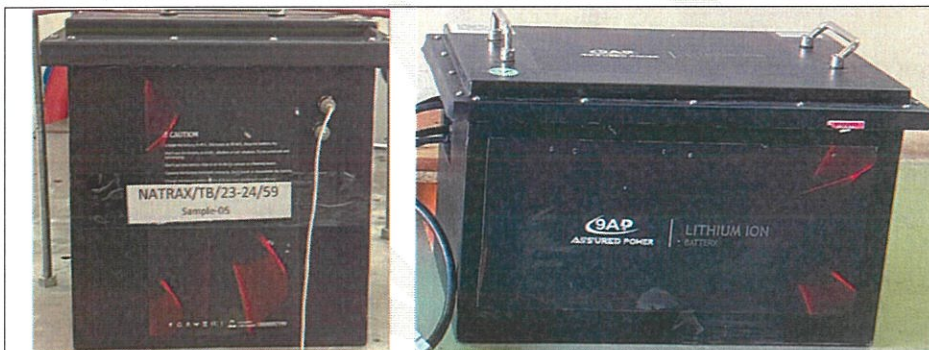
Dated: 28-12-2023

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.	002, dated: 30.10.2023

3.0 DESCRIPTION OF DEVICE UNDER TEST (DUT):

S.No	Particulars	Description
i	DUT NAME	REESS
ii	Trade Mark	9AP
iii	Battery Type	LFP PRISMATIC
iv	Battery Pack Capacity (Ah)	100Ah
v	Operating Voltage	42.4V-58.4V
vi	Rated Voltage	51.2V
vii	Battery Pack Id/Model	9APLP51.2V100Ah
viii	Battery Dimensions (l*b*h)	499.2mm*314.2mm*288.2mm
ix	Battery Weight In (Kg)	52Kg
x	Battery Module Drawing no.	AMBITDDL9APHU082303
xi	Battery Pack Sr. no.	9APZ1I42230900000



TRADE NAME- 9AP
 BATTERY MODEL- 9APLP51.2V100Ah
 CELL CHEMISTRY- LFP
 CELL RATING- 3.2V/100Ah
 BMS MODEL- 9APLP24S150A
 BMS SPECIFICATION- 15S-24S 150A
 MANUFACTURING- OCTOBER 2023

Remarks: Refer page 26 of 26 for Disclaimer

NATRAX CASE ID: NATRAX/TB/23-24/59

Authorized Signatory:

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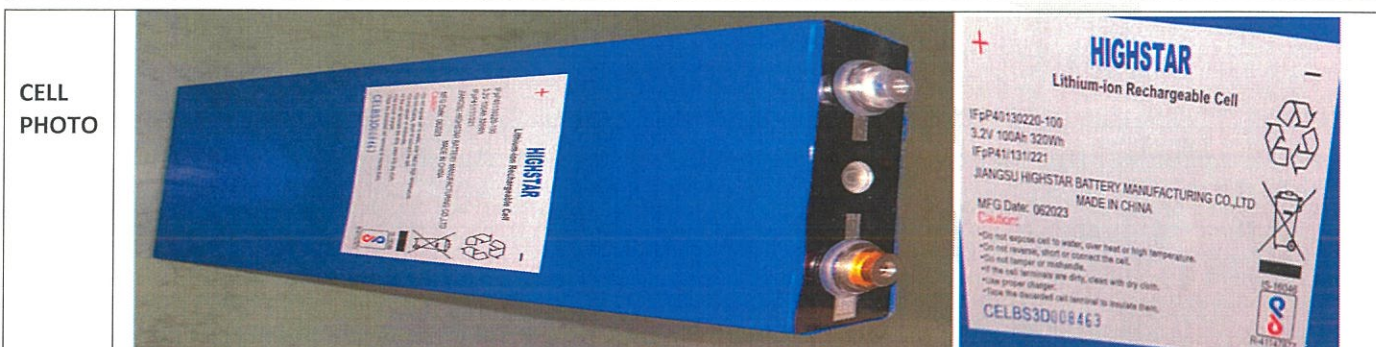
PREPARED BY	CHECKED BY	APPROVED BY
Rishikesh Sharma Engineer	Manish Mandloi Sr. Engineer	Umesh Raghuwanshi Asst. Manager



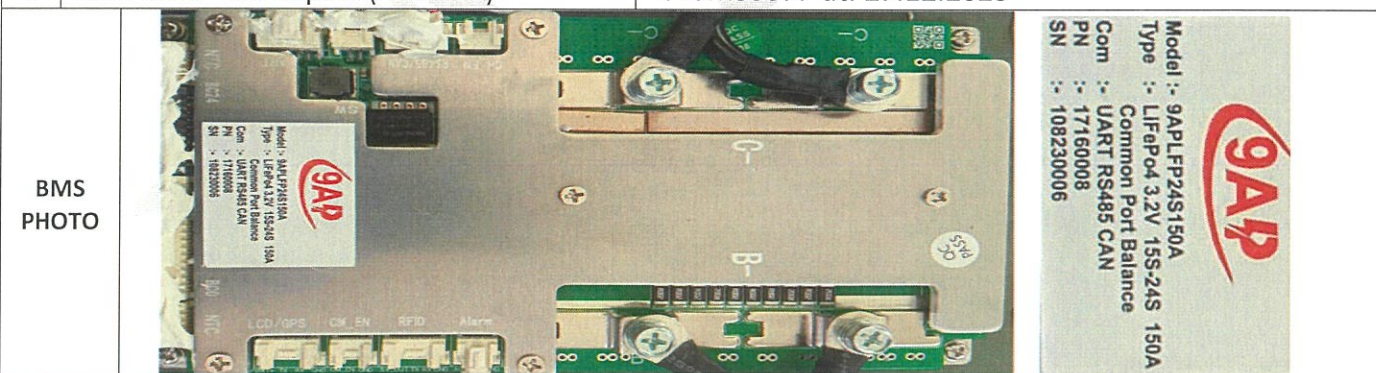
कार्यालय: आगरा - मुम्बई मार्ग (एन.एच. 52), पिथमपुर फ्लाईओवर के आगे,
 पोस्ट-खण्डवा (पिथमपुर के पास), जिला-धार -454774 (म.प्र.)
 Office: Agra - Mumbai Highway (NH - 52), Next to Pithampur Flyover,
 Post- Khandwa (Near Pithampur), Dist. Dhar (M.P.) - 454774, Web: www.natrax.in

मुख्य कार्यालय: दूसरी मंजिल, प्रशासनिक भवन, आईकैट 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




4	Cell	Description
i	Cell Manufacture Name	JIANGSU HIGHSTAR BATTERY MANUFACTURING CO.,LTD
ii	Cell Chemistry, Form Factor & Dimensions	LFP, Prismatic
III	Cell Voltage & Capacity	3.2V&100Ah
iv	Cell Voltage Range	2.7±0.05V – 3.65±0.05V
v	Cell Model No.	IFpP40130220-100
vi	Cell Batch Code No.	R-41138711
vii	Configuration of cells	16S1P
viii	Cell Type	LFP, Prismatic
ix	Cell certification report/Date	IEC/22121203 / 03/01/2023




5	BMS	Description
I	BMS Make	AMBIT TRANSMISSION PRODUCTS PVT.LTD
II	BMS Model/ ID No.	9AP
III	BMS Software version/ Hardware version	51/9APL24S150A
iv	BMS Communication Protocol	UART & CAN
v	BMS EMC Test Report (referred)	CTOMS0877 dt. 27.12.2023







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Rishikesh Sharma Engineer	Manish Mandloi Sr. Engineer	Umesh Raghuwanshi Asst. Manager	



6	Battery Charger	Description
i	Charger Sr. no.	230940001
ii	Charger (External/On Board)	External
iii	Charger Make / Model	RAPIDTRON/ RE3AC4820
iv	Trade Name of Charger	RAPIDTRON
v	Charger Type	CAN based Lithium Ion charger
CHARGER PHOTO		

7	Sample Receipt date	30-10-2023
8	Removable/ Fixed	Fixed battery- Mechanical Drop test not applicable customer given declaration.
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 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 & L5	
18	Any deviation from test method: No	
19	Total No. of Pages	26 (Report with Annexures) + 2 (Drawing)

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Authorized Signatory:		Page 03 of 26	Format no. NATRAX/TB/L/2023/01
PREPARED BY	CHECKED BY		APPROVED BY
			
Rishikesh Sharma Engineer	Manish Mandloi Sr. Engineer		Umesh Raghuwanshi 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/23-24/59-01	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	50 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	04.11.2023			
Test End Date	04.11.2023			
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.		

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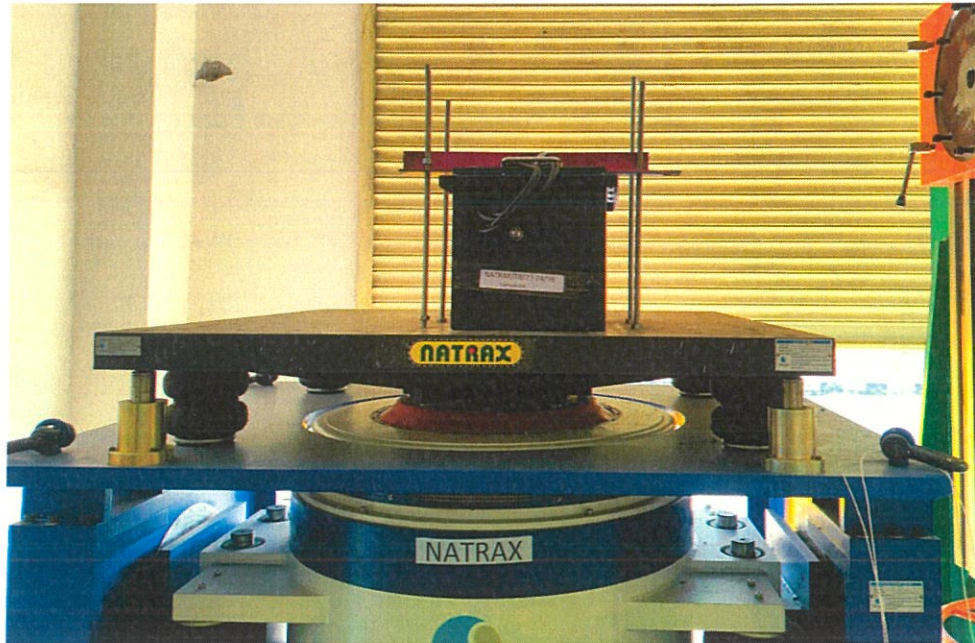
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Rishikesh Sharma			Manish Mandloi
Engineer			Sr. Engineer

ANNEXURE-1

1.1.3

Vibration Test Setup (Photo)



Test Report

Report time: Nov-03-2023 21:57:45
 Test name: LITHIUM Battery Vibration test -
 Test status: Test Stopped (Schedule Finished)

Data measured at: Nov-04-2023 14:28:13
 Test type: VCS (Swept Sine)
 Run folder: VIBRATION TEST-028 Nov 03, 2023 17:47-03

Testing time

Remaining Time: 00:00:00
 Run Start Time: Nov-03-2023 17:47:04
 Test parameters
 Current Frequency: 7.000 Hz
 Signal Plot Points: 2048

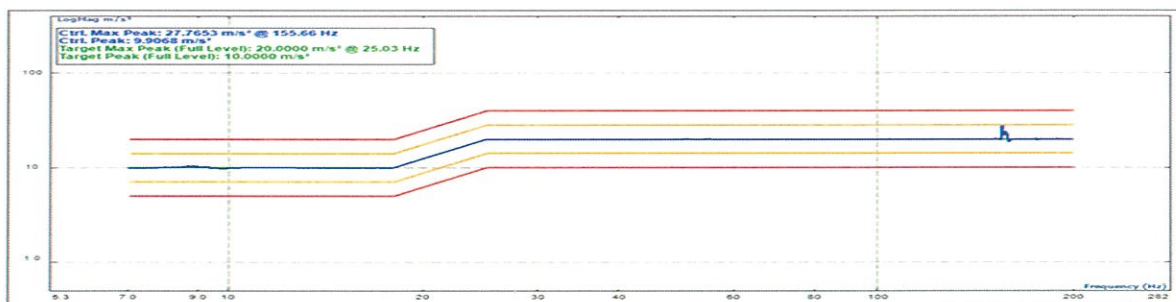
Total elapsed time: 03:00:12

Full level elapsed time: 03:00:00

Sweeping Rate: 0.64487 Oct/Min
 Sweep Type: Logarithmic

Sweep Number: 24

Control Composite



Testing time

Remaining Time: 00:00:00

Total elapsed time: 03:00:12

Full level elapsed time: 03:00:00

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Prepared By



Rishikesh Sharma
 Engineer

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Checked By



Manish Mandloi
 Sr. Engineer

ANNEXURE-1

1.3	Mechanical Shock Reference Standard: AIS 156(Part II)-2022 (A3P2)	
1.3.1	Procedure	
Sample ID: NATRAX/TB/23-24/59-02	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	50 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	30.11.2023
	Test End Date	30.11.2023

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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Prepared By	 Rishikesh Sharma Engineer		Checked By
			 Manish Mandloi Sr. Engineer

ANNEXURE-1

1.3.3

Mechanical Shock Test Setup (Photo)



Test Report

Report time: Nov-30-2023 15:35:08
 Test name: Battery Shock Test -
 Test status: Test Stopped (Schedule Finished)

Data measured at: Nov-30-2023 13:44:01
 Test type: VCS (Shock)
 Run folder: X DIRECTION49 Nov 30, 2023 15-24-38

Testing time

Remaining pulse: 0.0
 Run Start Time: Nov-30-2023 15:24:40

Total elapsed: 22.0

Full level elapsed: 2.0

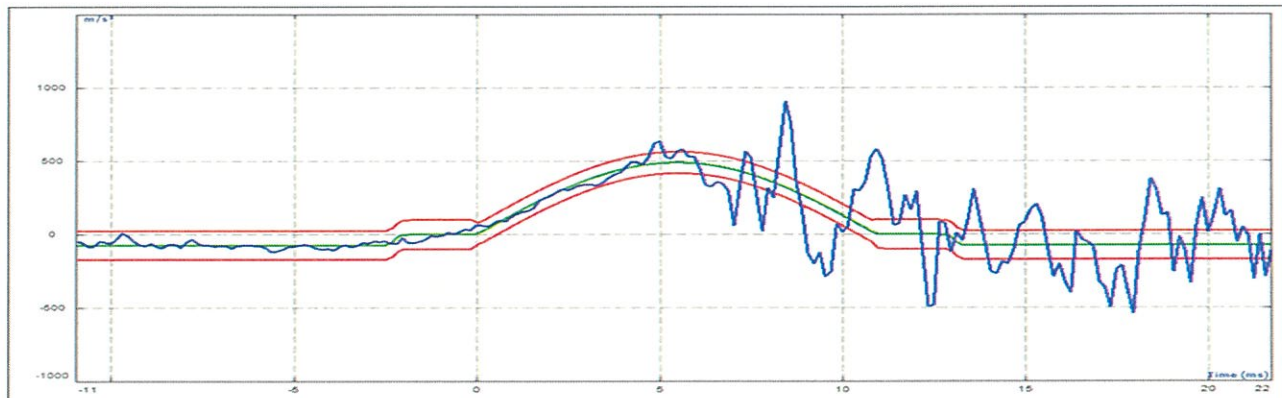
Test parameters

Sampling Rate (fs): 6400.00 Hz
 Block Time: 0.32 s

Frequency range (fa): 2500.00 Hz

Block Size: 2048

Control Composite



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Rishikesh Sharma
 Engineer

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 Sr. Engineer

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ANNEXURE-1

2.1	Thermal Shock & Cycling Test Reference Standard: AIS 156(Part II)-2022 (A3P2)	
2.1.1	Procedure	
Sample ID: NATRAX/TB/23-24/59-04	Particulars	Parameter During Test
	Test Component	REESS Subsystem (Battery Pack)
	Ambient temperature ($20 \pm 10^{\circ}\text{C}$)	27 $^{\circ}\text{C}$
	Test Component SOC (>50%)	80 %
	Protection Devices of DUT	Fuse
	Positive Set Temperature	60 $^{\circ}\text{C}$
	Positive Temperature Duration	6 Hours
	Time taken to reach Negative Set Temperature	20 Minutes
	Negative Set Temperature	-40 $^{\circ}\text{C}$
	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	03.11.2023
	Test End Date	09.11.2023

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 100 Ω /Volt.

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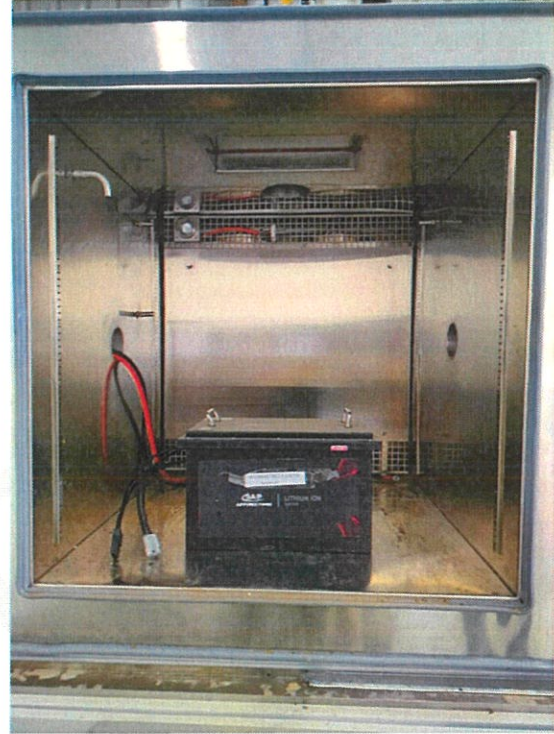
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Prepared By		Checked By
		
Rishikesh Sharma		Manish Mandloi
Engineer		Sr. Engineer

ANNEXURE-1

2.1.3

Thermal Shock & Cycling Test Setup (Photo)



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Prepared By

Checked By





Rishikesh Sharma
Engineer




Manish Mandloi
Sr. Engineer

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ANNEXURE-1

3.1	Fire Resistance Test	
	Reference Standard: AIS 156(Part II)-2022 (A3P2)	
3.1.1	Procedure	
Sample ID: NATRAX/TB/23-24/59-05	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	03.11.2023
	Test End Date	03.11.2023

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Rishikesh Sharma Engineer			Manish Mandloi Sr. Engineer




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

3.1.3	Test Setup
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<div></div>			<div></div>	
Rishikesh Sharma			Manish Mandloi	
Engineer			Sr. Engineer	

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/23-24/59-05	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	50 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	02.11.2023
	Test End Date	02.11.2023




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Rishikesh Sharma		Manish Mandloi
Engineer		Sr. Engineer

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	
		

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			 Manish Mandloi Sr. Engineer

ANNEXURE-1

4.2 Over-Charge Protection		
Reference Standard: AIS 156(Part II)-2022 (A3P2)		
4.2.1	Procedure	
Sample ID: NATRAX/TB/23-24/59-02	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	40 A
	Test Stopped when	The charging continued until the tested-device (automatically) interrupts or limits the charging.
	Observation Period	1 Hour
	Test Start Date	02.11.2023
	Test End Date	02.11.2023

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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 Rishikesh Sharma Engineer		  Manish Mandloi Sr. Engineer	

4.2.3

Test Setup

1 Test Name: OVER CHARGE AMBIT 51V 100Ah
 2 Test Date: 02-11-2023 11:08
 3 Operator ID: Admin
 4 Program Name CHARGE
 5 Program Description:
 6 Program Data: C:\VisuaLCN\Programs\NATRAX.mdb
 7 Module Type: yd
 8 Module Description: LCV 100-80
 9 Address: Port: 1, Sys Controller: 3 Circuit: 1
 10 Name: Port 1, Ctrl Device ID:

11								
12	Exclude	Total Time, Cycle	Current, A	Voltage, V	Power, W	Internal Resi	Amp-Hours, Watt-Hours L	
13	No	00:01.0	1	40	54.56	2182	0	0.5
14	No	00:02.0	1	40	54.63	2185	0	0.02
15	No	00:03.0	1	40	54.68	2187	0	0.03
16	No	00:04.0	1	40	54.73	2189	0	0.04
17	No	00:05.0	1	40	54.76	2190	0	0.05
18	No	00:06.0	1	40	54.8	2192	0	0.06
19	No	00:07.0	1	40	54.82	2192	0	0.07
20	No	00:08.0	1	40	54.85	2194	0	0.08
21	No	00:09.0	1	40	54.87	2194	0	0.09
26	No	39:34.0	1	40	58.31	2332	0	66.37
27	No	39:35.0	1	40	58.33	2333	0	66.38
28	No	39:36.0	1	40	58.36	2334	0	66.39
29	No	39:37.0	1	40	58.38	2335	0	66.4
30	No	39:38.0	1	40	58.4	2336	0	66.42
31	No	39:39.0	1	40	58.43	2337	0	66.43
32	No	39:40.0	1	0.01	80.41	0	0	66.44
33	No	39:41.0	1	0.01	78.83	0	0	66.44
34	No	39:42.0	1	0.01	75.95	0	0	66.44

OVER CHARGE AMBIT51V100AH

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Prepared By

Checked By

Rishikesh Sharma

Manish Mandloi

Rishikesh Sharma

Manish Mandloi

Engineer




Sr. Engineer



ANNEXURE-1

4.3	Over-Discharge Protection Reference Standard: AIS 156(Part II)-2022 (A3P2)	
4.3.1	Procedure	
Sample ID: NATRAX/TB/23-24/59-03	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	50 A
	Test Stopped when	The discharging continued until the tested-device (automatically) interrupts or limits the discharging.
	Observation Period	1 Hour
	Test Start Date	02.11.2023
	Test End Date	02.11.2023

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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Rishikesh Sharma Engineer			Manish Mandloi Sr. Engineer

4.3.3 Test Setup

1 Test Name: OVER DISCHARGE AMBIT51V100AH
 2 Test Date: 02-11-2023 11:01
 3 Operator ID: Admin
 4 Program Nam Dis-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: 3
 10 Name: Port 1, Ctr Device ID:

	Exclude	Total Time Cycle	Current, A	Voltage, V	Power, W	Constant R _e	Internal R _e	Amp-Hour	Watt-Hour	
3	No	00:01.0	1	-50	51.31	-2565	1.03	0	-0.01	-0.5
4	No	00:02.0	1	-50	51.23	-2561	1.02	0	-0.02	-1.2
5	No	00:03.0	1	-50	51.18	-2559	1.02	0	-0.03	-1.9
6	No	00:04.0	1	-50	51.15	-2557	1.02	0	-0.05	-2.6
7	No	00:05.0	1	-50	51.11	-2555	1.02	0	-0.06	-3.3
8	No	00:06.0	1	-50	51.08	-2554	1.02	0	-0.08	-4.1
9	No	00:07.0	1	-49.99	51.06	-2552	1.02	0	-0.09	-4.8
0	No	00:08.0	1	-50	51.03	-2551	1.02	0	-0.1	-5.5
59	No	42:27.0	1	-50	42.86	-2143	0.86	0	-35.37	-1738
60	No	42:28.0	1	-50	42.84	-2142	0.86	0	-35.38	-1738.6
61	No	42:29.0	1	-50	42.81	-2140	0.86	0	-35.39	-1739.2
62	No	42:30.0	1	-50	42.77	-2138	0.86	0	-35.41	-1739.8
63	No	42:31.0	1	-50	42.75	-2137	0.85	0	-35.42	-1740.4
64	No	42:32.0	1	-0.02	-11.46	0	172.97	0	-35.43	-1740.8
65	No	42:33.0	1	-0.02	-13.89	0	20.54	0	-35.43	-1740.8
66	No	42:34.0	1	-0.02	-11.50	0	120.02	0	-35.43	-1740.8

OVER DISCHARGE AMBIT51V100AH

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Manish Mandloi

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Engineer

Sr. Engineer




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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/23-24/59-04	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	40 A
	Discharging Current	50 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	03.11.2023
	Test End Date	03.11.2023

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.

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ANNEXURE-1

4.5	Thermal Propagation Reference Standard: AIS 156(Part II)-2022 (A3P2)	
4.5.1	Procedure	
Sample ID: NATRAX/TB/23-24/59-01	Particulars	Parameter During Test
	Test Component	REESS Subsystem (Battery Pack)
	Battery Management System	Operational
	Potential devices SOC	Not Applicable
	Test Component SOC	95 %
	Trigger Method	Single Cell 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) $dT/dt \geq [1^\circ\text{C/s}]$ of the measured temperature.	Thermal runaway detected. Only condition (ii) and (iii) were met as per the following: a) The measured temperature was 162.7°C. b) The declared operating temperature by manufacturer was 60°C c) $dT/dt = (144-141)/8-5 = 3/3 = 1$ Therefore $dT/dt \geq [1^\circ\text{C/s}]$.
	Thermal runaway can be judged when: (a) Both (i) and (iii) are detected: or (b) Both (ii) and (iii) are detected	2. The Audio-visual alarm activated above 60°C. 3. At 127.8°C the pressure release vent was opened.
	Test Stopped when	The test was stopped after detection of thermal runaway and No fire and Explosion happened
	Test Start Date	02.11.2023
	Test End Date	02.11.2023

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4.5.2	Test Result	
	Requirement	Observations
	During the test, there shall be no evidence of: (a) Fire. (b) Explosion.	1. No fire and No explosion observed during test. 2 The Audio-visual alarm activated above 60°C. 3. Max test temp. Reached 162.7°C. 4. All clauses of 6.11 as per AIS:156 Part 2 were verified, 5. As thermal runaway occurred and no fire or explosion occurred, therefore the tested device meets thermal propagation requirement

4.5.3	Documentation	
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 No.- AMBIT/DD/DFMEA/05, Letter no.- 004 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.- 004 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.- .- 004 Dated:- 06.11.2023

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4.6.3 Test Setup

Test Name: Thermal propagation Ambit 51v 100ah
 Test Date: 02-11-2023 14:52
 Operator ID: Admin
 Program Name: 3.7V 16Ah
 Program Description:
 Program Data: C:\VisualCN\Programs\NATRAX.mdb
 Module Type: yd
 Module Description: LCV 100-80
 Address: Port: 1, Sys Controller: 3 Circuit: 4
 Name: Port 1, Ctr Device ID:

Exclude	Total Time	Cycle	Current, A	Voltage, V	Power, W	Amp-Hours	Watt-Hours	User Vari	Temperat
No	00:01.0	1	70	5.34	373	0.01	0	0	27.4
No	00:02.0	1	70	5.33	373	0.03	0.1	0	27.4
No	00:03.0	1	69.99	5.35	374	0.05	0.2	0	27.4
No	00:04.0	1	69.99	5.34	373	0.07	0.3	0	27.4
No	00:05.0	1	70	5.29	369	0.09	0.4	0	27.4
No	00:06.0	1	70	5.33	373	0.11	0.5	0	27.4
No	00:07.0	1	69.99	5.32	372	0.13	0.7	0	27.4
No	00:08.0	1	69.99	5.32	372	0.15	0.8	0	27.4
No	25:04.0	1	69.99	2.01	140	98.8	567.2	0	140.1
No	25:05.0	1	69.99	2.01	140	98.82	567.2	0	141
No	25:06.0	1	70	2.01	140	98.84	567.2	0	142
No	25:07.0	1	70	2.02	141	98.86	567.3	0	143
No	25:08.0	1	70	2.01	140	98.87	567.3	0	144
No	25:09.0	1	69.99	2.01	140	98.89	567.3	0	145.1



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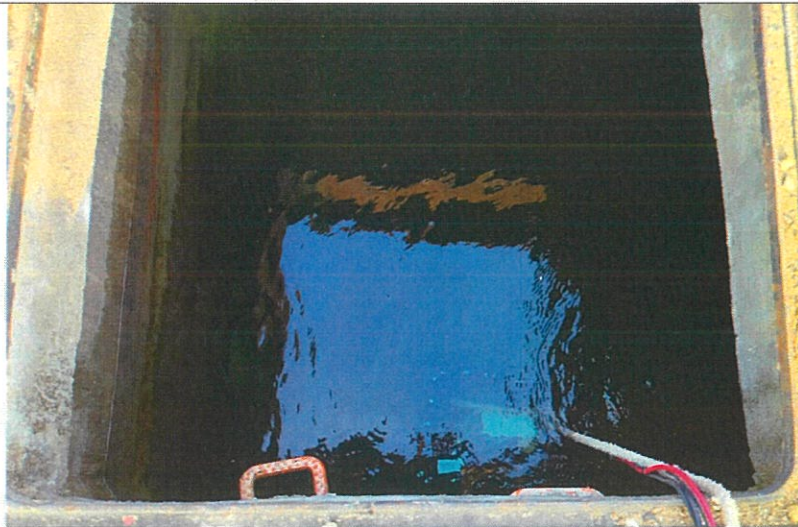
ANNEXURE-1

Water Ingress Protection Test

4.6 TEST REQUIRMENTS AND RESULTS:

Sample ID: NATRAX/TB/23-24/59-06	IPX7
	Reference Standard: IEC 60529 AIS-156 A3 P2
	Procedure
	<p>REESS with 100% SOC shall be tested:-</p> <p><input checked="" type="checkbox"/> The lowest point of enclosures with a height less than 850 mm is located 1000 mm below the surface of water.</p> <p><input type="checkbox"/> The highest point enclosures with a height equal to or greater than 850 mm is located 150 mm below the surface of the water</p> <p>Test Date: - 02-11-2023 Test duration: - 30 min Acceptance Criteria: - There shall be no fire or explosion during testing of REESS.</p> <p>Test Result: - At the end of the test, no fire and no explosion was observed from tested device.</p>

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	02.11.2023	Microcontroller Make: JBD	Complied
5.2	6.1.2.3 (a)	BMS over charge protection	02.11.2023	58.4V	Complied
5.3	6.1.2.3 (b)	BMS over discharge protection	02.11.2023	42.2V	Complied
5.4	6.1.2.3 (c)	BMS over temperature	02.11.2023	T charge= 55°C T discharge= 60°C	Complied
5.5	6.1.2.3 (d)	BMS over current protection	02.11.2023	Charge Current =80A Discharge Current = 150A	Complied
5.6	6.1.2.3 (e)	BMS Short circuit protection	02.11.2023	Verified	Complied
5.7	6.1. 3(a)	Charger voltage cut off	02.11.2023	58.4V	Complied
5.8	6.1.3(b)	Soft start function	02.11.2023	Initial Current = 0.8 A Set Current = 19.86 A	Complied
5.9	6.1.3 (c)	Pre-charge function to detect over discharge	02.11.2023	Verified	Complied
5.10	6.1.3(d)	Input supply variation with battery pack	02.11.2023	Verified	Complied
5.11	6.1.3(f)	Communication verification with battery pack	02.11.2023	Verified	Complied
5.12	Annexure 8k-(3)	Verification of cell charge/discharge cycle data	07.11.2023	Verified	Complied
5.13	Annexure 8k-(7)	Verification of the cell to cell spacing in battery pack	02.11.2023	1 mm	Complied
5.14	Annexure 8k-(8)	Verification of additional safety fuse/ circuit breaker	02.11.2023	Verified	Complied
5.15	Annexure 8k-(9)	Verification of the cells, BMS charger w.r.t serial number	02.11.2023	Verified	Complied

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Sr.N	Cl. No.	Verification/Test Name	Date	Observation	Result
5.0 Verifications:					
5.16	Annexure 8k-(10)	Protection against regenerative	07.11.2023	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)	28.12.2023	Report no: CTOMS0877, 27.12.2023	Complied
5.18	6.1.3(e)	Earth leakage detection	02.11.2023	Verified	Complied
5.19	Annexure 8k-(1)	Verification of manufacturing date on cell	02.11.2023	Verified	Complied
5.20	Annexure 8k-(2)	Cell report Verification as per IS 16893	07.11.2023	Report no: IEC/22121203, Dated:- 03/01/2022	Complied
5.21	Annexure 8k-(4)	Verification of pressure release vent	02.11.2023	Verified	Complied
5.22	Annexure 8k-(5)	Verification of temperature sensor	02.11.2023	Verified	Complied
5.23	Annexure 8k-(6)	Verification of action paralleling circuit in the battery pack	02.11.2023	Verified	Complied
5.24	Annexure 8k-(11)	BMS data logging	07.11.2023	Verified	Complied

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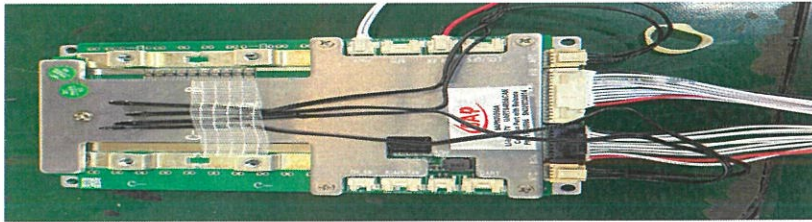

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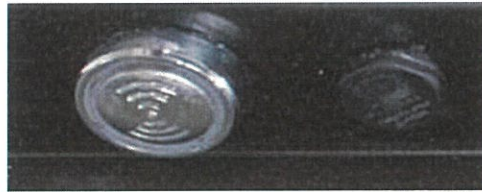
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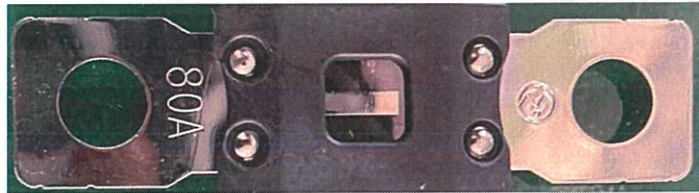
Verification of Temperature Sensor



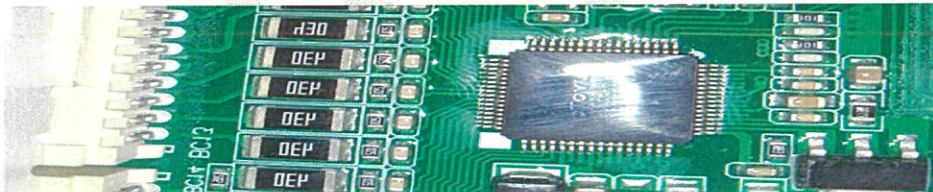
Verification of Pressure Release vent & Visual Alarm



Verification of Safety Fuse- 80A



Verification of Microcontroller-based circuit



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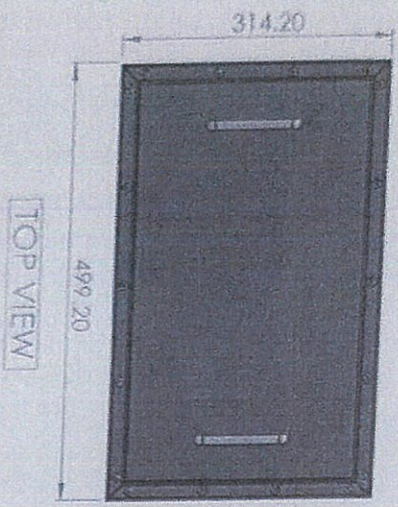
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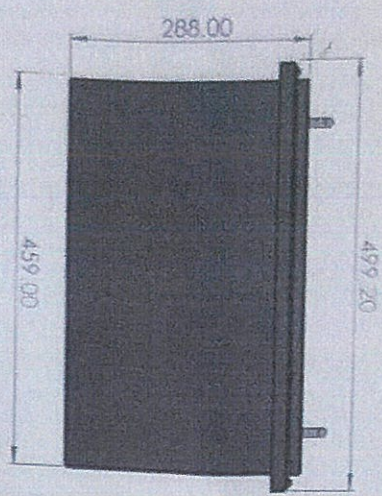
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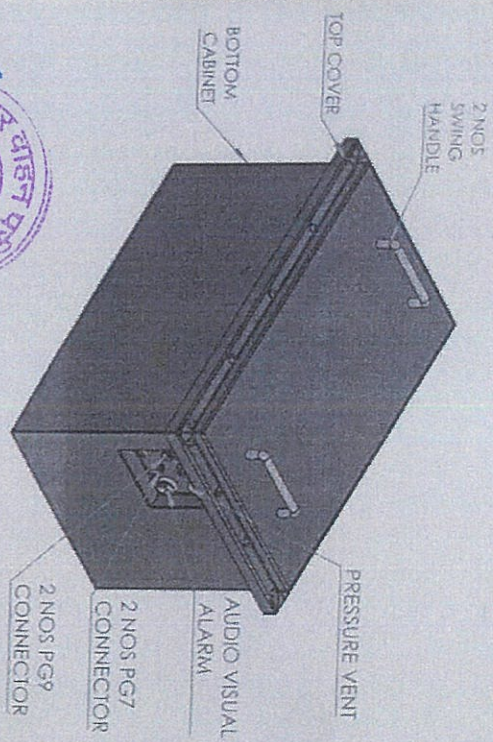




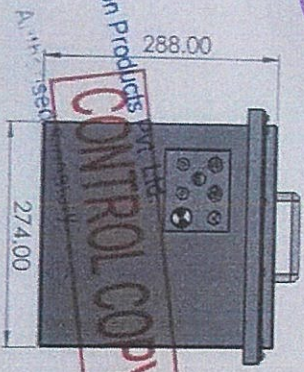
TOP VIEW



FRONT VIEW



ISOMETRIC VIEW



SIDE VIEW



Ambit Transmission Products Pvt. Ltd.

CONTROL COPY

GENERAL TOLERANCE CHART (IN MM)

LENGTH OR DIA	0-6	6-30	30-120	120-315	315-1000	1000-2000	2000-2500
TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2.0

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Customer Name :	AMBIT TRANSMISSION PRODUCTS PVT LTD.
Manufacturer Name:	AMBIT TRANSMISSION PRODUCTS PVT LTD.
Make:	AMBIT TRANSMISSION PRODUCTS PVT LTD.
Battery Type:	LFP PRISMATIC
Battery/Module Capacity :	1000Ah
Rated Voltage :	51.2V
Model No. :	9APLP51.2V1000Ah
Trade Name :	9AP
Drawing No. :	AMBITDD19APHU082303
Configuration of Cell in Pack/Module :	16S/1P
Cell manufacturer's name :	JIANGSU HIGSTAR BATTERY MANUFACTURING CO. LTD
Cell model no.:	IFP40130220-100
Cell form factor & dimension.:	PRISMATIC L-130.2±0.5, W-40.2±0.5, H-220±1.0
Cell trade name:	HIGSTAR
Cell voltage & capacity:	3.2V/100Ah
Cell to cell spacing	1 mm
Fuse Rating:	150A
Regenerative current protection:	80A
BMS software version:	51
BMS hardware version:	9APL24S150A
BMS DETAIL	15S-24S 150A
BMS MODEL	9APLFP24S150A

DESIGN AND DRAWING	REVISION	DATE	DESCRIPTION	DATE
NAME	DATE			
DESIGNER	DATE			
CHECKED	DATE			
APPROVED	DATE			

GAD OF 51.2V1000Ah

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