



Inspection/Test Report: Electric Power Trained Vehicles

Legislation

UNECE Regulation 100.01 to Supplement 4

Inspection/Test Details

Location of Inspection/Test:	VCA Headquarters, 1 The Eastgate Office Centre Eastgate Road, Bristol, BS5 6XX
Date of Inspection/Test:	17 th January 2022
VCA Representative(s):	David Mills & Nicholas Bridge
Inspectors office location:	VCA HQ
Manufacturer's Representative(s):	Alexander Howard
Reason for Test Report:	Test report only

Manufacturer Details

Name and Address:	Clipper Automotive @ Richmond Road Cab Centre. 195 Richmond Road, Hackney, London, E8 3NJ
Type:	TX4 Auto
Commercial Description:	Hackney Carriage
Category:	M1

Conclusion

The above mentioned vehicle was tested in accordance with the above mentioned legislation and was found to comply in all respects. This report relates only to the items tested.

Witness Engineer/Test Engineer
Signature:

Name: David Mills
Position: Type Approval Engineer
Date: 18th January 2022

List of Annexes

Annex	No of Pages	Subject
I		
II		



Issue Record

Issue 0 is original report
Issue 1, update Vehicle Type and Worst Case Rationale.

Worst Case Rationale

Full Test Report required for Clipper Cab TX Conversion. Test Report to be used as evidence for IVA inspection.

Clipper Automotive are a Stage 2 manufacturer fitting a drivetrain from a Nissan Leaf/NV200 into the TX4 Auto Taxi, the motor/ inverter stack includes the gearbox, junction box and inverter. Clipper Cabs manufacture the Vehicle Control Unit, with the remainder of components carrying over from Nissan and Tesla. These remain unchanged during the conversion utilising OEM looms and connectors. The on-board charger and DC/DC converter are from a Tesla and meet the applicable requirements below.

Note: This Test Report is only valid for the vehicle VIN which the inspection was conducted against.

Note: Include information on variants and versions this report covers, as applicable. Supporting documents may be annexed to this report

Significant Interpretations, Alternative Test Methods, New Technologies

Not Applicable

Inspection/Tests Required

	Yes, NA, See Report ... / Approval ... / Annex ...
Protection against Electrical Shock:	Yes
Rechargeable Energy Storage System (REESS):	Yes
Functional Safety:	Yes
Isolation Resistance Measurement	Yes
Determination of Hydrogen Emissions:	Not applicable

Vehicle Specification

Vehicle Identification Number:	SCRT4HAMKCC212560
Motor:	Nissan AC synchronous electric motor, engine code EM57
REESS:	Clipper Automotive battery box containing battery modules / cells from Envision / AESC.
Inverter/Controller:	Nissan PDM and Inverter
List of Other Components Connected to HV Bus:	See Information Document,
Working Voltage (DC Bus):	360 V
Working Voltage (AC Bus):	- V





Manufacturer's Documentation

Manufacturer's documentation is complete and reflects the agreed specification for the vehicle tested and covers all variants and versions agreed in the worst case rationale. Information document uploaded to job folder and identified by job number.

Yes

Facility and Equipment Checks

Calibration certificates checked and valid, recorded in the following table:

Yes

Equipment	Serial / Certificate No.	Calibration due*
Multi-Meter	34340717WS	Sep 2021
Multi-Meter	25450302	Sep 2021

*Specify calibrated date + (interval) or calibration due date.

Inspection/Test Requirements

Complies
Yes / NA

Protection against Electric Shock

Protection against Direct Contact

5.1.1. Protections against direct contact with live parts (solid insulator, barrier, enclosure, etc.) are not able to be opened, disassembled or removed without the use of tools.

Yes

5.1.1.1 Live parts inside the passenger compartment or luggage compartment are protected to IPXXD (wire probe).

Yes

Item	Force Applied (N)	Comment
REESS	-	IPXXD protected from luggage compartment access. IPXXB protected from other directions.

Note: Applied force only needs to be measured if deemed necessary.

Limit: 0.9 - 1.1 N

5.1.1.2 Live parts in areas other than the passenger compartment or luggage compartment are protected to IPXXB (jointed finger probe).

Yes

Item	Force Applied (N)	Comment
Junction Box	-	IPXXB Protected
REESS	-	IPXXB Protected

Note: Applied force only needs to be measured if deemed necessary.

Limit: 9 - 11 N

5.1.1 Connectors (including vehicle inlet) comply with at least one of the following options:

Yes



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- a Connectors comply with IPXXB or IPXXD, as appropriate to their location, when separated without the use of tools;
- b Connectors are located underneath the floor and are provided with a locking mechanism;
- c Connectors are provided with a locking mechanism and other components, not being part of the connector, can only be removed with the use of tools in order to separate the connector;
- d Voltage of the live parts becomes equal or below DC 60 V or equal or below AC 30 V (RMS) within one second after the connector is separated.

Connector on	Wiring Harness connects to	Complies with a, b, c or d*
REESS	PDM	a & c
PDM	REESS	a & c
PDM Components (See Worst Case Notes)	-	a & c

Where option 'a' is used, the applied force should be noted in column 3 if it has been deemed necessary to measure.

Limits: IPXXD – 0.9 - 1.1 N; IPXXB – 9 - 11 N

5.1.1.3

Service disconnect, if fitted, complies with one of the following options:

Yes

- Has protection degree IPXXB when separated*

~~- Cannot be opened, disassembled or removed without tools*~~

*Strikethrough, as appropriate.

Ann 3, Table 1

Force applied to test probe, if applicable:

-

N

NA

Limit: 9 - 11 N

5.1.1.4.1.

Figure 1 symbol appears on or near the REESS.

Yes

Figure 1



5.1.1.4.2.

Figure 1 symbol is also visible on enclosures and barriers, which, when removed, expose live parts of high voltage circuits, except:

Yes

- Where barriers or enclosures cannot be accessed, opened or removed, unless other vehicle components are removed with the use of tools;
- Where barriers or enclosures are located underneath the vehicle floor.

Note: This provision is optional to any connector for high voltage buses.

Locations on vehicle where symbol is displayed:

On battery & PDM stack



On boot battery set x2

5.1.1.4.3.

Cables for high voltage buses that are not located within enclosures are identified by having an outer covering with the colour orange.

Yes

Protection against Indirect Contact

5.1.2.1.

Exposed conductive parts, such as a conductive barrier or enclosure, are galvanically connected to the electrical chassis using electrical wire or ground cable, by welding, or by connection using bolts, etc. so that no dangerous potentials are produced.

Yes

5.1.2.2.

Resistance between all exposed conductive parts and the electrical chassis is lower than 0.1 ohms when there is current flow of at least 0.2 A. This requirement is satisfied if the galvanic connection has been established by welding.

Yes

Component	Grounding Method	Resistance (Ω)
Front REES	Earth strap	0.1
Motor inverter	Earth strap	<0.1
Rear REES	Earth strap	0.1

5.1.2.3.

Where the vehicle is intended to be connected to the grounded external electric power supply through a conductive connection, a device to enable the galvanical connection of the electrical chassis to the earth ground is provided.

Yes

5.1.2.3.

Device enables connection to the earth ground before exterior voltage is applied to the vehicle and retains the connection until after the exterior voltage is removed from the vehicle.

Yes

Isolation Resistance – Separate AC and DC Buses

5.1.3.1.

Isolation resistance between the high voltage bus and the electrical chassis has a minimum value of 100 ohms/volt of the working voltage for DC buses and a minimum value of 500 ohms/volt of the working voltage for AC buses.

NA

AC bus isolation resistance:

-

Ω/v

DC bus isolation resistance:

-

Ω/v

Note: The isolation resistance between the high voltage bus and the electrical chassis may be demonstrated by calculation, measurement or a combination of both. The measurement is conducted according to Annex 4 'Isolation Resistance Measurement Method' or a method equivalent to it.

Isolation Resistance – Combined AC and DC Buses

5.1.3.2.

If AC/DC high voltage buses are galvanically connected, isolation resistance between the high voltage bus and the electrical chassis has a minimum value of 500 ohms/volt of the working voltage.

NA



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5.1.3.2.	<p>If all AC high voltage buses are protected by one of the two following measures, isolation resistance between the high voltage bus and the electrical chassis has a minimum value of 100 ohms/volt of the working voltage:</p>	Yes
	<ul style="list-style-type: none"> - Double or more layers of solid insulators, barriers or enclosures that meet the requirement in paragraph 5.1.1 independently; for example, the wiring harness* - Mechanically robust protections that have sufficient durability over vehicle service life, such as motor housings, electronic converter cases or connectors* 	
	<p>*Strikethrough, as appropriate.</p> <p>Combined AC/DC bus isolation resistance: 24883 Ω/v</p> <p>Note: The isolation resistance between the high voltage bus and the electrical chassis may be demonstrated by calculation, measurement or a combination of both. The measurement is conducted according to Annex 4 'Isolation Resistance Measurement Method' or a method equivalent to it.</p>	

Fuel Cell Vehicles

5.1.3.3.	<p>If the minimum isolation resistance requirement cannot be maintained over time, then protection is achieved by any of the following:</p>	NA
	<ul style="list-style-type: none"> - Double or more layers of solid insulators, barriers or enclosures that meet the requirement in paragraph 5.1.1 independently* - On-board isolation resistance monitoring system together with a warning to the driver if the isolation resistance drops below the minimum required value* 	
	<p>*Strikethrough, as appropriate.</p> <p>Note: The isolation resistance between the high voltage bus of the coupling system for charging the REESS, which is not energised besides during charging the REESS, and the electrical chassis, need not be monitored.</p>	

Ann 5	<p>The function of the on-board isolation resistance monitoring system is confirmed by inserting a resistor that does <u>not</u> cause the isolation resistance between the terminal being monitored and the electrical chassis to drop below the minimum required isolation resistance value. The warning is activated.</p>	NA
	<p>Resistance used: - Ω</p>	

Isolation Resistance Requirement for the Coupling System for Charging the REESS

5.1.3.4.	<p>Isolation resistance between the high voltage bus and the electrical chassis is at least 1 MΩ when the charger coupler is disconnected:</p>	NA
	<p>Note: During the measurement, the traction battery may be disconnected.</p>	

Rechargeable Energy Storage System (REESS)

Protection against Excessive Current



5.2.1.	If the REESS is subject to overheating due to excessive current, it is equipped with a protective device, such as fuses, circuit breakers or main contactors.	Yes
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Accumulation of Gas

5.2.2.	Places for containing open type traction battery that may produce hydrogen are provided with a ventilation fan or a ventilation duct to prevent the accumulation of gas.	NA
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Functional Safety

5.3.	Momentary indication is given to the driver when the vehicle is in 'active driving possible mode'. <i>Note: This provision does not apply under conditions where an internal combustion engine provides directly or indirectly the vehicle's propulsion power (providing the engine is running at all times).</i>	Yes
5.3.	When leaving the vehicle, the driver is informed by a signal (additional to the above indication) if the vehicle is still in the active driving possible mode.	Yes
5.3.	If the on-board REESS can be externally charged by the user, vehicle movement by its own propulsion system is impossible as long as the connector of the external electric power supply is physically connected to the vehicle inlet. <i>Note: This requirement is demonstrated by using the connector specified by the car manufacturer.</i>	Yes
5.3.	State of the drive direction control unit is identified to the driver.	Yes

Isolation Resistance Measurement

Measurement Method using DC Voltage from Off-vehicle Sources (For individual components, use this method for items not powered up during section 2.2 test.)

Ann 4, 2.1.1.	Isolation resistance test instrument is capable of applying a DC voltage higher than the working voltage of the high voltage bus.	NA
Ann 4, 2.1.2.	Insulator resistance test instrument connected between the live parts and the electrical chassis.	NA
Ann 4, 2.1.2.	Isolation resistance measured by applying a DC voltage at least half of the working voltage of the high voltage bus.	NA
Ann 4, 2.1.2.	If the system has several voltage ranges, the isolation resistance between those components and the electrical chassis is measured separately by applying at least half of their own working voltage with those components disconnected.	NA





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Component	Test Result (Ω)
-	-

Measurement Method using the Vehicle's Own REESS as DC Voltage Source

(Covers main HV bus and any HV components live during test.)

Ann 4, 2.2.1.	Test conducted using at least the nominal operating voltage, as specified by the vehicle manufacturer.	Yes
Ann 4, 2.2.2.	Voltmeter used measures DC values and has an internal resistance of at least 10 MΩ.	Yes
Ann 4, 2.2.3.1.	V _b :	391.9 V
Ann 4, 2.2.3.2.	V ₁ :	195.8 V
Ann 4, 2.2.3.3.	V ₂ :	196.1 V
	R ₀ :	200 Ω
	If V ₁ is greater than or equal to V ₂ :	
Ann 4, 2.2.3.4.	V ₁ ':	- V
	R _i = R ₀ *(V _b /V ₁ ' - V _b /V ₁):	- Ω
	If V ₁ is less than V ₂ :	
Ann 4, 2.2.3.4.	V ₂ ':	7.6 V
	R _i = R ₀ *(V _b /V ₂ ' - V _b /V ₂):	9913 Ω

Calculation of Overall Isolation Resistance

Overall isolation resistance for the vehicle is calculated by combining the various component resistances as 'resistors in parallel'. This is not required where the entire HV system has been covered by the test in 2.2.

$$R_{total} = \frac{1}{\left[\frac{1}{R_1} + \frac{1}{R_2} + \dots \right]}$$

R_{total}: - Ω

The final result is obtained by dividing the overall resistance by the working bus voltage of the vehicle:

R_{total}/working bus voltage: 24883 Ω/V

Determination of Hydrogen Emissions – Not applicable

(This test is carried out on all vehicles equipped with open type traction batteries)

Remarks

None.

Note: VCA apply measurement uncertainty to calibrated items but not test results.

