



DEVELOPMENT TEST REPORT

CONFIDENTIAL

Report No. ARAI/AED/20222023/3100013430/DT/5075
Dated: 27-JUN-2022

1.0	Name and Address of the Customer	M/s. ATHER ENERGY PRIVATE LIMITED 3RD FLOOR TOWER D, IBC KNOWLEDGE PARK, BANNERGHATTA MAIN ROAD, BANGALORE-560029, KARNATAKA, INDIA
2.0	Customer Letter Reference	Email dated: 21-MAR-2022
3.0	Test Objective	Testing of DC EV vehicle connector (charging gun) and vehicle inlet (for light electric vehicles) according to IS 17017-2-1.
4.0	Condition of the Test Component	The test components were received in good condition.
5.0	Description of the Device Under Test (DUT)	DC EV Charging gun and Vehicle inlet
5.1	Make	Ather Energy Private Limited
	Part numbers	340A0021532, 340A0021531
	DUT Photos	
		
6.0	Result: The DC EV Charging gun and vehicle inlet (for light electric vehicles) serial numbers: "340A0021532, 340A0021531" meets the requirements as per clause 8.0(Test results) of this report	

		
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An ISO 9001, ISO 14001, ISO 45001 and ISO/IEC 27001 Certified Organization

7.0 DUT Details:

General product information:
The DUT submitted for the test is a DC EV charging gun and vehicle inlet for Light electric vehicles, Ratings:120V DC Max, 100Amp DC Max current Number of poles: 9 poles (CP, PP, CAN HIGH, CAN LOW, DC+, DC-, PE) + 2 dummy poles

8.0 Test Results:

Sr. No	Test Title	Annex No.	Complies (Yes/No/ N/A)
1.0	Tests and verifications as per IS17017-2-1 Clause no 10 of this report.	--	Yes
2.0	Electrical tests as per IS17017-2-1.	01	Yes
3.0	Environmental/ Climatic tests as per IS17017-2-1.	02	Yes
4.0	Mechanical tests	03	Yes

	
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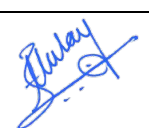
This test report pertains only to the components / parts / assemblies / vehicles etc., actually tested at ARAI in the presented condition based on the documents / information produced / submitted by the customer. The issuance of this test report alone does not indicate any measure of approval, certification, supervision, control of quality surveillance by ARAI of the product. No extract, abridgement or abstraction from this test report shall be published or used to advertise the product without the written consent of the Director, ARAI, 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. ARAI 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 provision of Indian laws or laws of other countries, will be the sole responsibility of the customer and ARAI shall not be liable for any claims or damages, made by the party, whatsoever. The customer shall alone be liable for the same and undertakes to indemnify ARAI in this regard. Further, the ARAI 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 ARAI. The appropriate local courts at Pune shall have the jurisdiction in respect of any dispute, claim or liability arising out of this report.

Place of Issue: ARAI-HTC, Pune


9.0 Connector Photos:	
Charging gun Part no: 340A0021532	Vehicle Inlet Part no: 340A0021531
	
	
Markings:	
	
	
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10.0 Requirements as per IS17017-2-1



Sr. no	Test requirement/specifications	Observation/Remark
1	Ratings	
1.1	Preferred rated operating voltage ranges:	120VDC Max
1.2	Preferred Rated Currents	100A DC Max
1.3	Rated Current for Signal or Control Purposes	Rated current for signal or control purposes is 2 A.
1.4	Accessories suitable or not Suitable for Making and Breaking an Electrical Circuit Under Load	Not suitable for making and breaking an electrical circuit under load
1.5	Accessories Suitable for, or not Suitable for, Making and Breaking an Electrical Circuit Under Load	Complies
1.6	Connection between the power supply and the electric vehicle:	
2	General	
2.1	Types of Vehicle Connectors	DC EV Charging gun and vehicle inlet, as declared by customer
2.2	Basic Interface	DC interface as declared by customer

	
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Sr. no	Test requirement/specifications	Observation/Remark
3	Classification of Accessories	
3.1	According to the Method of Connecting the Conductors	Non-rewireable
3.2	According to Serviceability	Non-serviceable accessories
3.3	According to Electrical Operation	Accessories not suitable for making and breaking an electrical circuit under load
3.4	According to Interface	DC interface, as declared by customer
3.5	According to the Locking and Interlock Functions	
3.6	According to Locking Facilities	Lockable means provided.
3.7	According to Interlock Facilities	Means of latching provided, Interlock on vehicle side
3.8	According to the Presence of Shutter(s)	Without shutters
4	Marking	
4.1	Accessories shall be marked with: a) Rated current(s) in amperes for power, b) Rated maximum operating voltage(s) in volts, c) The relevant symbol for degree of protection, d) Either the name or trade mark of the manufacturer	Markings provided

	
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Sr. no	Test requirement/specifications	Observation/Remark
4.2	For vehicle connectors, the marking for either the name or trade mark of the manufacturer or the responsible vendor and the type reference, catalogue number or designation shall also be on the outside of the accessory, visible to the user.	Markings provided
4.3	For all accessories, the marking for the maximum rated operating voltage range and rated current shall be in a place which is visible before installation of the accessory.	Markings provided
4.4	Markings shall be indelible and easily legible.	Compiles
5	Dimensions	
5.1	Accessories shall comply with the appropriate standard sheets	Customer specific design for light electric vehicles DC charging. Drawings sheet provided by the customer
5.2	It shall not be possible to engage vehicle connectors with vehicle inlets having different ratings, or having different contact combinations unless safe operation is ensured or other means are provided to ensure safe operation.	Complies

	
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Sr. no	Test requirement/specifications	Observation/Remark
6	Protection against electric shock	
6.1	Accessories shall be so designed that live parts of vehicle connectors, when they are wired as in normal use, and live parts of plugs and vehicle inlets, when they are in partial or complete engagement with the complementary accessories, are not accessible.	Complies Live parts not accessible.
6.2	Accessories shall be so designed that, it should follow contact sequencing for connection and disconnection of vehicle connector	Complies
6.3	It shall not be possible to inadvertently assemble either the part carrying plug or inlet contacts into the enclosure of a socket-outlet or vehicle connector or the part carrying the vehicle connector contacts into the enclosure of a plug or inlet.	Assemblies are Non-rewireable
7	Size and colour of protective earthing conductors	
7.1	The conductor connected to the protective earthing terminal shall be identified by the colour combination green-and-yellow.	2.5 sqmm protective conductor provided.
7.2	The nominal cross-sectional area of the protective earthing conductor and of the neutral conductor,	

	
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Sr. no	Test requirement/specifications	Observation/Remark
8	Provision for Earthing	
8.1	Accessories are provided with a protective earthing contact and a protective earthing terminal.	Provided
8.2	Protective earthing contacts are directly and reliably connected to the protective earthing terminals.	Complies
8.3	Earthing contacts are shrouded or guarded against mechanical damage	Complies
9	Accessories with interlock	
9.1	Accessories classified in "not suitable for making and breaking an electrical circuit under load" shall be provided with an interlock.	Interlock provided
9.2	Vehicle couplers with interlocks shall be so constructed that:	
9.2.1	a vehicle connector cannot be completely withdrawn from the vehicle inlet while the contacts of that vehicle connector are live	Complies
9.2.2	the contacts of the vehicle connector cannot be made live until the vehicle connector is in proper engagement	
9.2.3	The power contacts shall not make or break under load	

	
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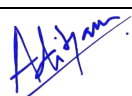

Sr. no	Test requirement/specifications	Observation/Remark
9.3	Pilot Contacts and Auxiliary Circuits	
9.3.1	Pilot contacts and auxiliary circuits used for interlocks shall make after the neutral and phase(s) are made.	Complies
9.3.2	Pilot contacts and auxiliary circuits used for interlock shall break before the phase(s) and neutral are broken.	Complies
10	General Construction	
10.1	Accessible surfaces of accessories shall be free from burrs, flashes and similar sharp edges.	No sharp edges, burrs
10.2	Vehicle connectors when mounted as in normal use and without a plug and vehicle inlet respectively in position shall ensure the degree of protection specified on its marking.	Complies
10.3	Contacts shall be so designed as to ensure adequate contact pressure when completely engaged with the corresponding accessory	Complies
10.4	Enclosures and parts of accessories providing protection against electric shock shall have adequate mechanical strength	Complies
10.5	It shall not be possible to remove these parts without the aid of a tool.	Complies
10.6	Cable entries shall allow the introduction of the conduit or the protective covering of the cable to afford complete mechanical protection.	Complies



	
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Sr. no	Test requirement/specifications	Observation/Remark
10.7	Insulating linings, barriers and the like shall have adequate mechanical strength.	Complies
10.8	A gripping surface shall be provided	Provided
11	Construction of Vehicle connectors	
11.1	The enclosure of vehicle connectors shall completely enclose the terminals and the ends of the flexible cable.	Complies
11.2	Parts of a connector do not work loose during normal use	No loosening observed
11.3	Connectors cannot be dismantled without a tool	Complies
11.4	Vehicle connectors incorporate means to meet the marked degree of protection when engaged with the vehicle inlet	Complies
11.5	Means provided to meet the marked degree of protection are securely fixed to the connector	Complies
12	Degree of Protection	
12.1	IP rating marked on device	IP44
12.2	All accessories shall be proof against humid conditions which may occur in normal use.	Complies
13	Insulation resistance and dielectric strength	
13.1	Insulation resistance	Resistance observed $R > 5M\Omega$
13.2	Dielectric Strength test	Test performed at 2kV, No break down or flashover observed

	
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Sr. no	Test requirement/specifications	Observation/Remark
13.3	Normal Operation	
13.3.1	Normal operation cycles in no load 10,000 cycles	After test observation: 1. No detached part 2. No deterioration of enclosures or barriers; 3. No damage to the entry holes for the plug contacts that might impair proper working 4. No loosening of electrical or mechanical connections 5. No seepage of sealing compound 6. The continuity between mating signal and pilot contacts are maintained.
14	Flexible cable and their connection	
14.1	Vehicle connectors shall be so designed that the conductors are relieved from strain, including twisting, where they are connected to the terminals or terminations, and that their covering is protected from abrasion.	Flexible cables provided
14.2	The construction shall ensure that the cable cannot touch accessible metal parts or internal metal parts	Complies
15	Requirements for vehicle connectors	
15.1	Non-rewireable vehicle connectors	
15.1.1	Non-rewireable vehicle connectors shall be provided with a suitable flexible cable	Provided

	
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Sr. no	Test requirement/specifications	Observation/Remark
16	Mechanical strength	
16.1	Accessories shall have adequate mechanical strength so as to withstand the stresses imposed during installation and use.	Complies
17	Change of temperature test	
17.1	Temperature test of IEC 60068-2-14, test procedure Nb	See Annexure no: 02 No deformation observed
18	Resistance to heat	
18.1	Accessories are resistant to heat	See Annexure no: 02 No impairing was observed. Markings still visible after the test
18.2	Devices are heated in cabinet for 1 hour at a temperature of 110 + 5°C and comply with all criteria at the end of the exposure	
19	Vehicle drive over	
19.1	A plug or vehicle connector shall have adequate resistance to damage from being driven over by a vehicle	See Annexure no: 03. No severe cracking, breaking or deformation observed
19.2	Accessories wired with the min. size cable of a type recommended by the manufacturer shall be placed on a concrete floor in any normal position of rest	
20	Ratings	
20.1	A component shall be used in accordance with its rating established for the intended conditions of use	Complies
20.2	Mechanical Assembly	
20.2.1	Loosening of parts in an accessory as a result of vibration due to storage, handling and operation shall not result in a risk of fire, electric shock, injury to persons	Complies
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ANNEXURE 01	
1.1 TEST SPECIFICATIONS	
TEST DETAILS	ELECTRICAL TESTS AS PER IS 17017-2-1
TEST LOCATION	AED, ARAI-HTC


1.2 LABORATORY ENVIRONMENT TEST CONDITIONS					
Ambient temperature	+ 25.5°C.	----	Relative humidity	48.5%RH.	----

1.3 INSULATION RESISTANCE AND DIELECTRIC WITHSTAND TEST	
Test date: 25-MAR-2022	
Test Requirement: The insulation resistance shall be not less than 5 MΩ. Dielectric withstand test at 2000V, No flashover or breakdown shall occur during the test.	
Insulation resistance (IR) test results/observation:	

Test parameters	Test voltage applied	Observation
Between all poles connected together and the body	500	IR ≥ 5 MΩ
Between each pole in turn and all others, these being connected to the body	500	IR ≥ 5 MΩ

Dielectric withstand test results/observation:		
Test parameters	Test voltage applied	Observation
Between all poles connected together and the body	2000	No flashover or breakdown observed during the test.
Between each pole in turn and all others, these being connected to the body	2000	No flashover or breakdown observed during the test.

	
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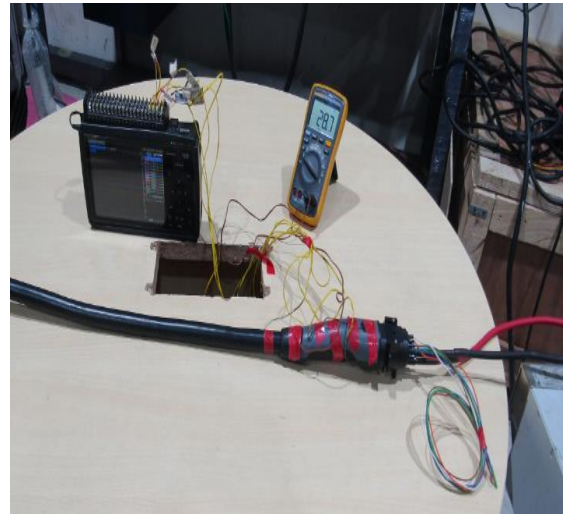
1.4 Temperature Rise test as per IS17017-2-1

Test Date: 25-MAR-2022

1.4.1 Test Requirements/Parameters:

1. Test performed at rated 100VDC, 100Amp current for 1 hour as declared by the manufacturer, to measure the temperature rise.
2. Test setup was done as per the normal use case of the vehicle inlet and the charging gun.
3. The maximum permissible temperature of those parts of the plug and the vehicle connector that can be grasped during normal operation, when tested with the accessory carrying the maximum rated current, shall not exceed
 - 50 °C for metal parts,
 - 60 °C for non-metal parts.
4. For parts which may be touched but not grasped the permissible temperature are
 - 60 °C for metal parts,
 - 85 °C for non-metal parts.

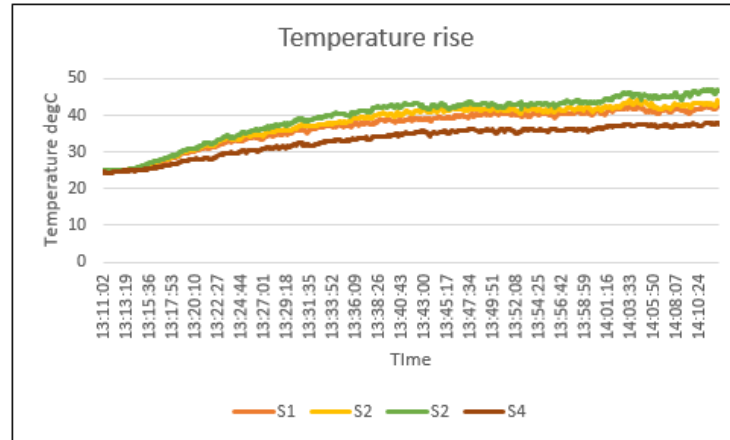
1.4.2 Test setup:



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1.4.3 Test Result:



1.4.4 Test observation:

1. The temperature rise of terminals did not exceed 50 degC
2. Surface temperature in normal use meets the requirements as per clause 1.4.1

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1.5 CONTACT SEQUENCE TEST

Test date: 25-MAR-22

Test Requirement:

To check contact sequence of the control and power pins

Test Result/Observation:

The contact sequence observed while inserting the vehicle connector is:

First contact: Protective earthing (PE)

Second contact: DC Power contacts (DC+ and DC-)

Third contact: Proximity detection (PP)

Fourth contact: Control pilot (CP) and CAN pins (CAN HIGH, CAN LOW)

While withdrawing the vehicle connector:

First release: Control pilot (CP) and CAN pins (CAN HIGH, CAN LOW)

Second release: Proximity detection (PP)

Third release: DC Power contacts (DC+ and DC-)

Fourth release: Protective earthing (PE)

Contact sequencing achieved with different terminal lengths in-order to meet the requirements as per standard.

Contact terminals photos:

Charging gun terminals:



Vehicle inlet terminals:



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End of Annexure 01

ANNEXURE 02	
2.1 TEST SPECIFICATIONS	
TEST DETAILS	ENVIRONMENTAL/CLIMATIC TESTS AS PER IS 17017-2-1
TEST LOCATION	AED, ARAI-HTC

2.2 LABORATORY ENVIRONMENT TEST CONDITIONS					
Ambient temperature	+ 25.5°C.	----	Relative humidity	48.5%RH.	----

2.3 CHANGE OF TEMPERATURE TEST	
Test date: 24-MAR-2022	
<p>Test Requirement: Accessories with insulated end cap on the contacts shall not be adversely affected by the temperature stress conditions which may occur in normal use.</p>	
<p>Test parameters: Temperature test of IS 9000 (Part 14/Sec 2) with following parameters: a) Test procedure: Nb; b) Lower temperature (TA): -30°C; c) Higher temperature (TB): 100°C; d) Slew rate: 3 K/min; e) Exposure time (t1): 1 h; and f) Number of cycles: 5.</p>	
<p style="text-align: center;">Test Cycle</p>	
<p>Test Result/Observation: No deformation observed after the end of test</p>	


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2.4 RESISTANCE TO HEAT TEST

Test date: 24-MAR-2022

Test Requirement:

Accessories shall be sufficiently resistant to heat.

Test parameters:

The samples are kept for 1 hour in a heating cabinet at a temperature of $110^{\circ}\text{C} \pm 5 \text{ K}$.

Test Result/Observation:

No impairing observed.
No sealing flow observed.
Markings are legible

Test Setup:



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2.5 HUMIDITY STORAGE TEST

Test date: 05-APR-2022

Test Requirement:

All accessories shall be proof against humid conditions which may occur in normal use.

Test parameters:

The humidity treatment is carried out in a humidity cabinet containing air with a relative humidity maintained between 91 percent and 95 percent. The temperature of the air, at all places where samples can be located, is maintained within 1°C of any convenient value T between 20°C and 30°C for 168 hrs

After test:

Markings should be legible

Required IR $\geq 5M\Omega$



Test Setup:



Test result:

Measured IR was found to be $\geq 5M\Omega$

Markings are legible, and no impairing or sealant flow observed

	
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End of Annexure 02

ANNEXURE 03	
3.1 TEST SPECIFICATIONS	
TEST DETAILS	MECHANICAL TESTS
TEST LOCATION	AED, ARAI-HTC

3.2 LABORATORY ENVIRONMENT TEST CONDITIONS					
Ambient temperature	+ 25.5°C.	----	Relative humidity	48.5%RH.	----

3.3 VEHICLE DRIVE OVER TEST
Test date: 18-APR-2022
Test Requirement:
1. A plug or vehicle connector shall have adequate resistance to damage from being driven over by a vehicle, unless it is provided with a cable management system which prevents the accessory from being left on the ground.
2. The wheel is to be rolled over the vehicle connector or plug at a speed of 8 ± 2 km/h. The accessory is to be oriented in a natural resting position before applying the force in a different direction for each sample.
3. There shall be no severe cracking, breakage, or deformation.
Test photo:




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Test Result/Observation:



1. No severe cracking, breakage, or deformation observed.
2. Measured IR after test was found to be $\geq 5M\Omega$.

3.4 DROP TEST

Test date: 25-MAR-2022

Test Requirement:

1. Drop test to be performed from a height of 1m on concrete surface, in all directions
2. There shall be no severe cracking, breakage, or deformation.
3. Test performed as per customer requirements

Test photo:



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Test Result/Observation:



1. No severe cracking, breakage, or deformation observed.
2. Measured IR after test was found to be $\geq 5M\Omega$.

3.5 CONNECTOR RESISTANCE TO DRAG

Test date: 19-APR-2022

Test Requirement:

1. Drag of charging cable for 1km, to check the insulation and mechanical strength
2. There shall be no severe cracking, breakage, or deformation.
3. Test performed as per customer requirements

Test photo:



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Test Result/Observation:



1. No severe cracking, breakage, or deformation observed.
2. Measured IR after test was found to be $\geq 5\text{M}\Omega$.

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3.6 MARKINGS

Test date: 25-MAR-2022

Test Requirement:

1. Markings shall be indelible and easily legible
2. After the humidity treatment, the marking is rubbed vigorously by hand for 15 seconds with a piece of cloth soaked in water and again for 15 seconds with a piece of cloth soaked with petroleum spirit.

Test photo:



Test Result:

After test Markings are indelible and easily legible.
Laser printed markings as declared by manufacturer

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End of Annexure 03

--- END OF TEST REPORT---