

From MS/ENB3	Our reference Prijo Ulahannan	Phone +91 80 6783 6100	E-Mail Prijo.ulahannan@in.bosch.com	Date: 18-Aug-2022 Report No.: Ather_04_TR
-----------------	----------------------------------	---------------------------	--	---

Report:	Test report
Title:	Mechanical strength test
Customer:	Ather India

Document approval		
	Name	Signature
Prepared by	Prijo Ulahannan	
Reviewed by	Mahantesh Ramannavar	

## 1. Issues (situation, motivation and tasks)

The Ather Company has designed and developed a charging connector for electric vehicles, which is patented. Ather has approached Bosch (BGSW) to validate the charging connector between the vehicle and the charging station according to IS 17017 selective tests as prescribed by Ather requirements.

Samples of vehicle connector and vehicle inlet used for test were used for test. The task was to check strength to maintain the integrity of the samples after being subjected to mechanical strength test occurring in normal use. Test and acceptance criteria are as per **IS 17017** chapter no.26.2, 26.3 and 26.4 to check the functionality of the samples.

## 2. Results, short version

	o.k.	not o.k.
<b>2.1 Visual inspection of plastic parts for cracks and breakage (New condition)</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>2.2 Ball Impact Test (Vehicle inlet)</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>2.3 Drop test to check detachment or loosening (Vehicle connectors)</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>2.4 Mechanical Load Flexing Test (Vehicle connectors)</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

The overall result of the examined samples is:

- ☒ **Positive**  
☐ **Negative: No further analysis required**

**Recommendation for further work:** NA.

From MS/ENB3	Our reference Prijo Ulahannan	Phone +91 80 6783 6100	E-Mail Prijo.ulahannan@in.bosch.com	Date: 18-Aug-2022 Report No.: Ather_04_TR
-----------------	----------------------------------	---------------------------	--	---

### 3. Conclusions and consequences

**All connector samples have passed the test.** All the test parameters are within the specified limit of assessment criteria.

### 4. Results, long version

- Plastic parts and terminals inspected before test for abnormalities like cracks, burrs, rust and breakage. All the samples subjected to test were in good/acceptable condition → **OK**

#### 4.1 Ball Impact Test (Vehicle inlet) – OK (See Chapter 5.4 for criteria)

Sample - 1	OK
Sample - 2	OK
Sample - 3	OK

#### Humidity test after the test – OK (See Chapter 5.4 for criteria)

Insulation resistance values After Humidity test		
Sample No.	Insulation resistance between terminals and housing at 500V in GΩ	Insulation resistance between terminals at 500V in GΩ
1	5.8	3.33
2	7.3	3.8
3	8.9	2.2

**Note: 1 GΩ = 1000 MΩ**

Dielectric Strength Test after Humidity test		
Sample no.	Withstand voltage between terminals 2000V and 50 Hz	Withstand voltage between terminals and housing 2000V and 50 Hz
1 - 3	No electric breakdown and No damage on housings or terminals by deformations or melting	No electric breakdown and No damage on housings or terminals by deformations or melting

From MS/ENB3	Our reference Prijo Ulahannan	Phone +91 80 6783 6100	E-Mail Prijo.ulahannan@in.bosch.com	Date: 18-Aug-2022 Report No.: Ather_04_TR
-----------------	----------------------------------	---------------------------	--	---

#### 4.2 Drop test to check detachment/loosening (Vehicle connectors) – OK (See chapter 5.4 for Criteria)

Sample - 1	OK
Sample - 2	OK
Sample - 3	OK

#### Humidity test after the test – OK (See Chapter 5.4 for criteria)

Insulation resistance values After Humidity test (Criteria : not less than 5 MΩ.)		
Sample No.	Insulation resistance between terminals and housing at 500V in GΩ	Insulation resistance between terminals at 500V in GΩ
1	5.1	2.56
2	6.3	2.52
3	4.9	3.1

**Note: 1 GΩ = 1000 MΩ**

Dielectric Strength Test after Humidity test		
Sample no.	Withstand voltage between terminals 2000V and 50 Hz	Withstand voltage between terminals and housing 2000V and 50 Hz
1 - 3	No electric breakdown and No damage on housings or terminals by deformations or melting	No electric breakdown and No damage on housings or terminals by deformations or melting

#### 4.3 Mechanical Load Flexing Test (Vehicle connectors) – OK (See chapter 5.4 for Criteria)

Sample - 1	OK
Sample - 2	OK
Sample - 3	OK

From MS/ENB3	Our reference Prijo Ulahannan	Phone +91 80 6783 6100	E-Mail Prijo.ulahannan@in.bosch.com	Date: 18-Aug-2022 Report No.: Ather_04_TR
-----------------	----------------------------------	---------------------------	--	---

## 5. Details

### 5.1 Part details:

Sl. No.	Description	Part number	Manufacture date / Received date	Remarks
1	Vehicle Inlet	340A0013634	July-2022	-
2	Vehicle connector	340A0021042	July-2022	-

### 5.2 Equipment details:

Sl. No.	Test equipment	Equipment no.	Remarks
1	Test set up ball impact test	ATS-019	Location: External lab (NABL - <b>TC-7419</b> )
2	Drop test set up	ATS-026	Location: External lab (NABL - <b>TC-7419</b> )
3	Bending/Flexing test set up	ATS-029	Location: External lab (NABL - <b>TC-7419</b> )
4	Humidity chamber	ATS-008	Location: External lab (NABL - <b>TC-7419</b> )

### 5.3 Sample preparation, test setup and test details:

#### 5.3.1 Ball Impact Test (Vehicle inlet)

1. Visual inspection of plastic parts conducted on all the samples before test.
2. 3 samples of vehicle inlets are used for test.
3. Preconditioning is performed in a chamber at a temperature of 30°C ± 2 K for 16 h.
4. Blows are applied to the samples by swinging or dropping a 50.8 mm diameter steel sphere, weighing 0.535 kg, from a height (H), which will produce an impact as indicated in Table 19 (See chapter 5.4).
5. Five blows are applied to each test sample by means of ball impact test apparatus.
6. The first four blows are applied when the accessory is mounted as in normal use on a vertical board.
7. The impact face of the ball pendulum is arranged such that when the ball pendulum hangs freely, the impact face just touches the side of the accessory. The point of contact shall be substantially at the the appropriate projections of that face.
8. The ball pendulum is then raised, released and the blow applied.
9. The accessory is then revolved 90° about an axis perpendicular to the mounting face and a second blow is then applied.
10. The same procedure is repeated for two successive rotations of 90°, with a total of 4 blows being applied.

From  
MS/ENB3

Our reference  
Prijo Ulahannan

Phone  
+91 80 6783 6100

E-Mail  
Prijo.ulahannan@in.bosch.com

Date: 18-Aug-2022  
Report No.:  
Ather\_04\_TR

11. The fifth blow is applied with the plane of the ball pendulum perpendicular to the plane of the mounting board such that the ball pendulum strikes the sample at its furthestmost projection from the mounting board.
12. Each blow shall provide an impact energy according to Table 19 (See chapter 5.4)
13. Same procedure was followed for the all the other samples.
14. Humidity cycles as per chapter 20.3 **IS 17017** is performed followed with insulation resistance test and dielectric measurement. (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)
15. See pictures in chapter 6 Enclosure.

### 5.3.2 Drop test to check detachment or loosening (Vehicle connectors)

1. Visual inspection of plastic parts conducted on all the samples before test.
2. 3 samples of vehicle connectors are used for test.
3. Preconditioning is performed in a chamber at a temperature of 30°C ± 2 K for 16 h.
4. vehicle connectors are tested with a flexible cable as delivered.
5. The free end of the cable and an additional rope or other flexible means, etc., attached to the flexible cable, both having a total length of 2.25 m, is fixed to a wall at a height of 1 m above the floor, as shown in Fig. 13 (See chapter 5.4)
- 5 The sample is held so that the cable is horizontal and then it is allowed to fall on to a concrete floor. This is done eight times, the cable being rotated through 45 ° at its fixing each time.
- 6 Same procedure was followed for the all the other samples.
- 7 Humidity cycles as per chapter 20.3 **IS 17017** is performed followed with insulation resistance test and dielectric measurement. (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)
- 8 See pictures in chapter 6 Enclosure.

From MS/ENB3	Our reference Prijo Ulahannan	Phone +91 80 6783 6100	E-Mail Prijo.ulahannan@in.bosch.com	Date: 18-Aug-2022 Report No.: Ather_04_TR
-----------------	----------------------------------	---------------------------	--	---

### 5.3.3 Mechanical Load Flexing Test (Vehicle connectors)

1. Visual inspection of plastic parts conducted on all the samples before test.
2. 3 samples of vehicle connectors are used for test.
3. The sample is fixed to the oscillating member of the apparatus so that, when this is at the middle of its travel, the axis of the flexible cable, where it enters the sample, is vertical and passes through the axis of oscillation
4. The oscillating member is so positioned that the flexible cable makes the minimum lateral movement when the oscillating member of the test apparatus is moved over its full travel.
5. The cable is loaded with a weight such that the force applied is as shown in Table 20 (See chapter 5.4).
6. The oscillating member is moved backwards and forwards through an angle of 90° (45° on either side).
7. The number of flexing being 20000 and the rate of flexing 60 per minute.
8. Same procedure was followed for the all the other samples.
9. See pictures in chapter 6 Enclosure.

### 5.4 Test conditions and assessment criteria:

#### 5.4.1 Ball Impact Test (Vehicle inlet)

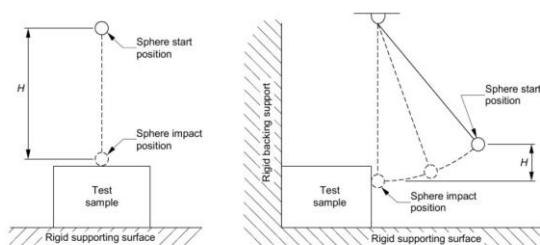


FIG. 12 BALL IMPACT TEST

Table 19 Impact Energy for Ball Impact Test  
( Clause 26.2 )

Rating A	Energy J	
	Vehicle Inlets	Socket-outlets
Up to and including 32	1	1
Above 32 and up to and including 100	2	2
Above 100 and up to and including 150	3	3
Above 150 and up to and including 400	4	4

**SS**

**Note :** PE = mgh used for H calculation

#### Asessemnt Criteria:

After the test, the samples shall show that'

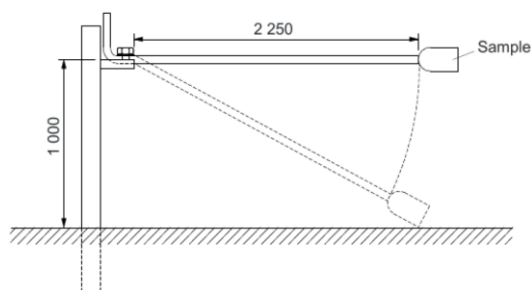
- a) no part has become detached; and
- b) no part has moved, loosened or deformed to the extent that the part no longer functions or operates as intended.

Accessories with enclosures of thermoplastic material shall withstand the test of clause 21.4.

Note: IP tests are not performed since it was not on the scope.

From MS/ENB3	Our reference Prijo Ulahannan	Phone +91 80 6783 6100	E-Mail Prijo.ulahannan@in.bosch.com	Date: 18-Aug-2022 Report No.: Ather_04_TR
-----------------	----------------------------------	---------------------------	--	---

#### 5.4.2 Drop test to check detachment or loosening (Vehicle connectors)



All dimensions in millimetres.

FIG. 13 ARRANGEMENT FOR MECHANICAL STRENGTH TEST FOR PLUGS AND VEHICLE CONNECTORS

#### Assesment Criteria:

After the test, the samples shall show no damage within the meaning of this standard; in particular, no part shall have become detached or loosened. The samples shall not expose parts likely to become live. The samples shall maintain their IP rating.

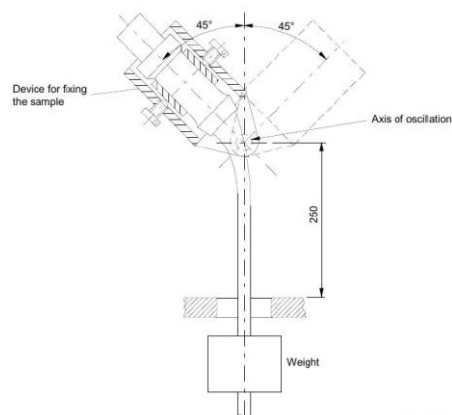
Accessories with enclosures of thermoplastic material shall withstand the test of clause 21.4.

Note: IP tests are not performed since it was not on the scope.

#### 5.4.3 Mechanical Load Flexing Test (Vehicle connectors) – OK

**Table 20 Mechanical Load Flexing Test**  
( Clause 26.4 )

Rated Current A	Force N
Up to and including 20	20
from 21 up to and including 32	25
from 33 up to and including 70	50
from 71 up to and including 250	75
from 251 up to and including 400	100



Linear dimension in millimetres.

FIG. 14 APPARATUS FOR FLEXING TEST

#### Assesment Criteria:

After the test, the samples shall show no physical damage within the meaning of standard.

From  
MS/ENB3

Our reference  
Prijo Ulahannan

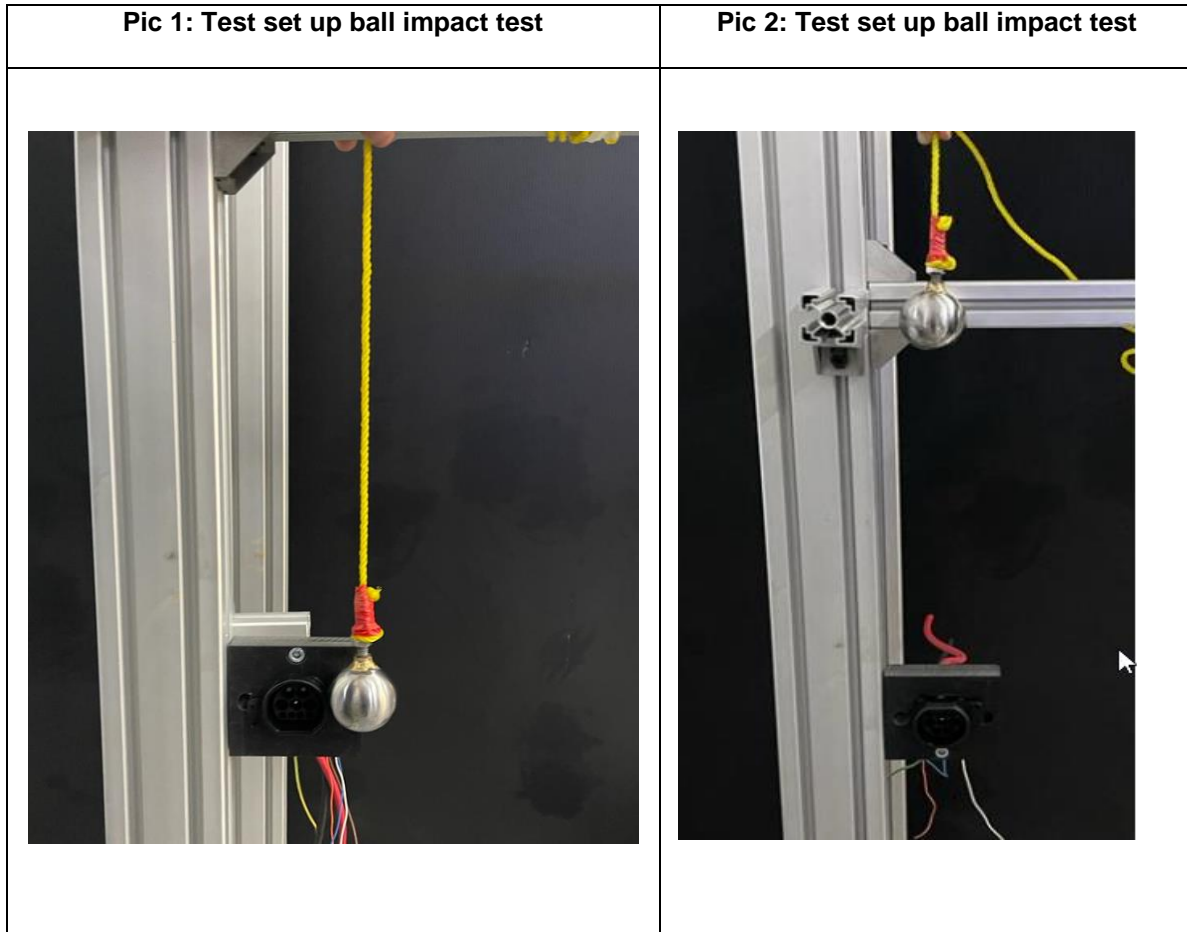
Phone  
+91 80 6783 6100

E-Mail  
Prijo.ulahannan@in.bosch.com

Date: 18-Aug-2022  
Report No.:  
Ather\_04\_TR

## 6. Enclosure

### 6.1 Pictures





From  
MS/ENB3

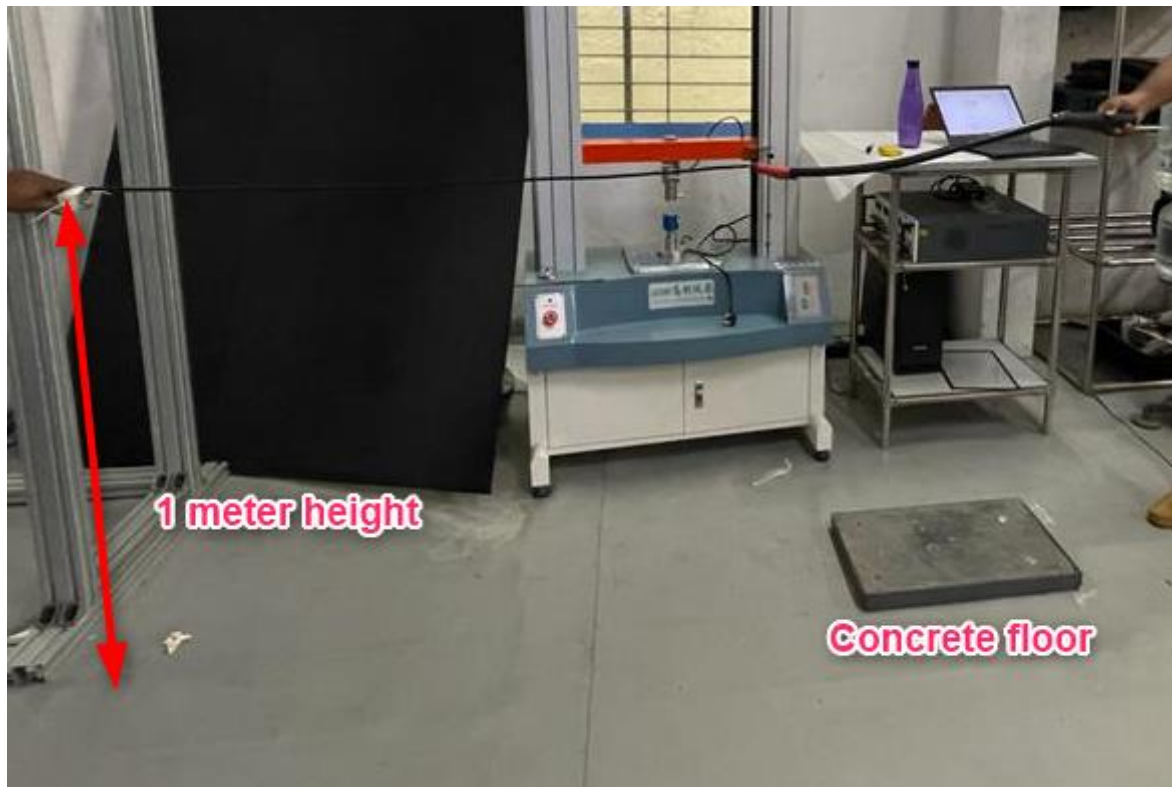
Our reference  
Prijo Ulahannan

Phone  
+91 80 6783 6100

E-Mail  
Prijo.ulahannan@in.bosch.com

Date: 18-Aug-2022  
Report No.:  
Ather\_04\_TR

**Pic 3: Test set up drop test**



From  
MS/ENB3

Our reference  
Prijo Ulahannan

Phone  
+91 80 6783 6100

E-Mail  
Prijo.ulahannan@in.bosch.com

Date: 18-Aug-2022  
Report No.:  
Ather\_04\_TR

**Pic 4: Test set up Flexing Test**



From  
MS/ENB3

Our reference  
Prijo Ulahannan

Phone  
+91 80 6783 6100

E-Mail  
Prijo.ulahannan@in.bosch.com

Date: 18-Aug-2022  
Report No.:  
Ather\_04\_TR

**Pic 5: Test set up for insulation resistance and dielectric measurement**



From  
MS/ENB3

Our reference  
Prijo Ulahannan

Phone  
+91 80 6783 6100

E-Mail  
Prijo.ulahannan@in.bosch.com

Date: 18-Aug-2022  
Report No.:  
Ather\_04\_TR

**Pic 6: Test set up for humidity test**

