

NUMBER GS-12-1782	TYPE GENERAL PRODUCT SPECIFICATION	Amphenol FCI	
TITLE DURAEV™		PAGE 1 of 9	REVISION B
		AUTHORIZED BY NEBU P MATHEW	DATE 06/08/2023
		CLASSIFICATION UNRESTRICTED	

1.0 Objective

This specification defines the performance, test, quality and reliability requirements of the DURAEV Connector used for electric vehicle application.

2.0 Scope

This specification is applicable to the generic characteristics and test methods applicable to the DURAEV family of products that provides a separable interconnect for charging and discharging applications in an electric vehicle.

3.0 Ratings

3.1 Operating Voltage Rating = 120 V_{DC}

3.2 Operating Current Rating = Refer below table

Operating Current Rating (A)	Power Cable Size (SQMM)
70	16
50	10
20	2.5

3.3 Operating Temperature Range = -20 to 90 (°C)¹

Note 1: includes the terminal temperature rise when powered

4.0 Applicable Documents

4.1 AFCI Specifications

4.1.1 Engineering drawings:

- 10169536
- 10169537

4.1.3 Application specification(s):

- GS-20-0764

4.1.4 Material specification(s):

(1) Non-flammability UL94-V0

4.2 National or International Standards

- IEC TS 63066:2017: Low-voltage docking connectors for removable energy storage units

4.4 AFCI Laboratory Reports - Supporting Data

- ELX 05 22 020

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5.0 Requirements

5.1 Qualification

Connectors furnished under this specification shall be capable of meeting the qualification test requirements specified herein.

5.2 Material

5.2.1 Plug Terminals

- Power and Signal: High Performance Cu Alloy

5.2.2 Socket Terminals

- Power and Signal: High Performance Cu Alloy

5.2.3 Plug Housing

- PA 66 GF30, UL94-V0

5.2.4 Socket Housing

- PBT GF30, UL94-V0

5.2.5 Gasket

- Silicone Rubber, UL94-V0

5.2.6 O-ring

- Silicone Rubber, UL94 rated

5.2.7 IP cap

- PA 66 GF30, UL94-V0

5.2.8 Lanyard

- TPE, UL94-V0

5.3 Finish

The finish for applicable components shall be as specified herein or equivalent.

5.3.1 Socket Signal Contact

- Au

5.3.2 Plug Signal Contact

- Au

5.3.3 Socket & Plug Power Contacts

- Ag

5.4 Design and Construction

Connectors shall be of the design, construction, and physical dimensions specified on the applicable product drawing. There shall be no cracks, burrs or other physical defects that may impair performance.

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- Socket terminals are assembled with the housing and potted for IP
- Plug terminals are assembled with the housing, potted for IP and over molded

Connector Type: Removable connector

Connector Size:

- Socket: Width 50mm x Length 32 mm x Height 37.4 mm
- Plug: Width 50 mm x Length 31 mm x Height 37 mm
- Mated condition: Width 50 mm x Length 32 mm x Height 45 mm

Terminal Termination Type: Crimped

5.5 Usage guidelines

- Product is not recommended for hot plugging applications

6.0 Electrical Characteristics

6.1 Contact Resistance, Low Level (LLCR)

The following details shall apply:

- Method of Connection - Attach current and voltage leads according to proper schematics
- Test Voltage - 20 milli-volts DC max open circuit.
- Test Current - Not to exceed 100 milli-amperes.

6.2 Insulation Resistance

The insulation resistance shall not be less than 5 mega-ohms.

Measurements shall be in accordance with IEC 63066.

The following details shall apply:

- Test Voltage - 500 volts DC.
- Electrification Time - 1 min
- Points of Measurement - Between adjacent contacts of the mated specimen.

6.3 Dielectric Withstanding Voltage

There shall be no flashover or arcing to be observed when mated connectors are tested in accordance with IEC 63066.

The following details shall apply:

- Connector status: Mated
- Test Voltage: 500 V AC (Signal contact) and 2000 V AC (Power contact); 50 Hz (sine-wave)
- Duration: 1 min between each pole

6.4 Temperature Rise to determine Rated Current

Test as per IEC 60512-5-1

The following details shall apply:

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- (a) Test duration: 1 h
- (b) Temperature rise not to exceed 30°C
- (c) Standalone test to determine rated current
- (d) Thermocouples to determine temperature rise placed on the cable insulation and the housing

7.0 Mechanical Characteristics

7.1 Mating/Unmating Force

The force to mate and unmate a socket and compatible plug shall not exceed 75 N.

The following details shall apply:

- a. Cross Head Speed – 25.4 mm/min.
- b. Lubrication – Yes
- c. Utilize free-floating fixtures.

7.2 Durability

The connector pairs shall be capable of withstanding 10000 mating/unmating cycles.

- a. Test configuration: Mate and unmate accessories for 10000 cycles at 7.5 strokes/min.
- b. Wipe terminals after 500 strokes.

8.0 Environmental Conditions

8.1 Temperature Cycling

- (a) Connector status: Mated; Use minimum 2 m Cable length on terminals
- (b) Temperature Range: -20 Deg C to 60 Deg C
- (c) Current to be applied: Rated Current
- (d) Number of cycles: 135 (required)
- (e) Requirements: No visual defects, The deviation of each individual recorded value of the temperature rise by the test is maintained within $T_{avg} \pm 15\%$

8.2 Damp Heat for accessories - IEC 60068-2-30

- (a) Connector status: Mated
- (b) Temperature Range: -20 Deg C to 60 Deg C
- (c) Relative Humidity: 91% - 95%
- (d) Number of cycles: 6
- (e) Duration: 6 days (1 cycle/24 hours)

8.3 Temperature Rise – IEC 63066

- (a) Connector Status: Mated
- (b) Current: 70 A AC
- (c) Connection: Series

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(d) Requirement: T rise of terminals shall not exceed 50 K

8.5 Salt Spray – IEC 60068-2-52

(a) Severity Level: 4

(b) Test Condition-

◆ Sub Cycle: Salt Spray Humidity Cycling

- Temperature: Salt mists at 35 deg C +/- 2 deg C
- Humidity Condition: 40 deg C +/- 2 deg C
- Relative Humidity: 93% +/- 3%
- Duration: 4 Days (24 hours; first 2 hours: Salt spray Projection; remaining 22 hours: Humidity storage)
- Number of Cycles: 4

◆ Continuous Humidity Storage

- Temperature: 23 deg C +/- 2 deg C
- Relative Humidity: 55% +/- 5%
- Duration: 3 Days

(c) Duration- 14 days (one cycle: 7 days)

(d) Requirement: No corrosion to be observed in the active area.

8.6 Dry heat for Bodies – IEC 60068-2-14

(a) Connector Status: Mated and Unmated

(b) Temperature: 80 deg C (For Thermoplastic) and 70 deg C (For Rubber)

(c) Duration: 7 days (For Thermoplastic) and 10 Days (For Rubber)

(d) Requirements: No visible cracks to be observed, material must not turn sticky

8.7 Cold Resistance for Bodies – IEC 60068-2-1

(a) Connector Status: Mated and Unmated

(b) Temperature: -20 deg C

(c) Requirements: No visible cracks to be observed, material must not turn sticky

8.8 Vibration (Random)

(a) RMS acceleration: 27.8 m/s²

(b) Duration: 8 hours/axis (X, Y & Z)

(c) Requirement: No discontinuity > 1µs to be observed; Breakage shall not occur

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(d) Refer the table below for test values:

Frequency (Hz)	PSD (m/s ²) 2/Hz
10	20
55	6.5
180	0.25
300	0.25
360	0.14
1000	0.14

8.9 Mechanical Shock

- (a) Acceleration: 500 m/s²
- (b) Number of shocks: 10 shocks/axis/direction
- (c) Pulse duration: 6 ms
- (d) Pulse shape: Half sinusoidal
- (e) Requirement: No discontinuity > 1µs to be observed; Breakage shall not occur

8.10 IPX7

- (a) Test Condition: Immersed under water at 1 meter height for 30 minutes.
- (b) Requirement: No water to be observed inside the sample after test.

8.11 Thermal Change for Contacts – IEC 60068-2-14, Test Nb

- (a) Connector Status: Mated and Unmated
- (b) Temperature range: -40 deg C to 130 deg C
- (c) Duration: 20 Cycles (1 Cycle 3 Hours)

8.12 Dry Heat for Contacts – IEC 60068-2-2

- (a) Connector Status: Mated and Unmated
- (b) Temperature : 130 Deg C
- (c) Duration: 120 Hours

8.13 Damp Heat for Contacts – IEC 60068-2-30

- (a) Connector Status: Mated and Unmated
- (b) Temperature range: 25 deg C to 55 deg C (Mated) & -10 deg C to 55 deg C (Unmated)
- (c) Duration: 5 Cycles for both temperature ranges

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9.0 QUALITY ASSURANCE PROVISIONS

9.1 Equipment Calibration

All test equipment and inspection facilities used in the performance of any test shall be maintained in a calibration system in accordance with ANSI Z-540 and ISO 9000.

9.2 Inspection Conditions

Unless otherwise specified herein, all inspections shall be performed under the following ambient conditions:

- a. Temperature: 25 +/- 5 deg C
- b. Relative Humidity: 30% to 60%
- c. Barometric Pressure: Local ambient

9.3 Sample Quantity and Description

The sample size and description are listed for each test in the appropriate section of this document.

9.4 Acceptance

9.4.1 Electrical and mechanical requirements placed on test samples as indicated in paragraphs 6.0 and 7.0 shall be established from test data using appropriate statistical techniques or shall otherwise be customer specified, and all samples tested in accordance with this product specification shall meet the stated requirements.

9.4.2 Failures attributed to equipment, test setup, or operator error shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for qualification.

9.5 Qualification Testing

Qualification testing shall be performed on sample units produced with equipment and procedures normally used in production. The test sequences shall be as shown in the qualification test table. Data shall be provided with the samples noting production history: production lot codes for components and assemblies, components and assemblies produced to print revision A, verification of plating composition and thickness, etc.

9.6 Re-Qualification Testing

If any of the following conditions occur, the responsible product engineer shall initiate requalification testing consisting of all applicable parts of the qualification test matrix.

- a. A significant design change is made to the existing product which impacts the product form, fit or function. Examples of significant changes shall include, but not be limited to, changes in the plating material composition or thickness, contact force, contact surface geometry, insulator design, contact base material, or contact lubrication requirements.
- b. A significant change is made to the manufacturing process which impacts the product form, fit or function.
- c. A significant event occurs during production or end use requiring corrective action to be taken relative to the product design or manufacturing process

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9.7 Qualification Test Table

Table-1

Test	Electrical Endurance - Temperature Burden	Salt Stress Endurance	Climatic Endurance for Bodies	Random Vibration & Mechanical Shock
Visual	1,10	1,7	1,9	1,4
Insulation Resistance	2,8	2,5	2, 7	
Dielectric Strength	3,9	3,6	3, 8	
Temperature Rise	7			
IPX7				
Random Vibration				2
Mechanical Shock				3
Salt Spray		4		
Damp Heat for Accessories	5			
Dry Heat for Bodies			4	
Aging for Bodies			5	
Cold Resistance for Bodies			6	
Thermal Change for Contacts				
Dry Heat for Contacts				
Damp Heat for Contacts				
Temperature cycling	4,6			

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Table-2

Test	Seal Aging	Climatic Endurance for Contacts
Visual	1,5	1,16
Insulation Resistance		2,5,8,11,14
Dielectric Strength		3,6,9,12,15
Temperature Rise		
IPX7	2,4	
Random Vibration		
Mechanical Shock		13
Salt Spray		
Damp Heat for Accessories		
Dry Heat for Bodies		
Aging for Bodies		
Cold Resistance for Bodies		
Thermal Change for Contacts		4
Dry Heat for Contacts		7
Damp Heat for Contacts		10
Temperature cycling	3	

REVISION RECORD

Rev	Page	Description	EC#	Date
A	All	Initial Release	N/A	10/08/22
B	All	Added usage guidelines	ECR-ELX-I-48448	06/08/23