WSD 2234 Issue 1

Automotive 200°C Rated HTPC Cable Specification

August 2013

TE connectivity AUTOMOTIVE

Table of Contents

1 Scope

This specification covers the requirements for 200°C rated HTPC power cable.

The detailed requirements of the individual products within the range are defined on the Specification Control Drawing (SCD). Where a difference occurs between this document and the SCD, the SCD shall take precedence. This specification has been based on the documents as listed in section 2.

2 Related Documents

Reference is made in this document to the following specifications:

FORD ES-AU5T-1A348-AA REV. LET. E, 3-29-2011 Refer to ISO 6722-1:2011(E)	Ford Global Wire Specification
PSA 9646147599 Issue D, 20/12/2010 Refer to ISO 6722:2006(E)	Technical Specification Electrical Power Conductor
RENAULT 36-05-009 Issue N, October 2010 Refer to ISO 6722:2006(E)	Electric Wires Very Low Tension and Low Tension
Fiat Auto Normazione 9.91107 5th August 2003	LT Single Pole Cables (Test Requirements)
Fiat Auto Normazione 7.Z8220 21st June 2004	LOW TENSION SINGLE/MULTIPLE PERFORMANCE CONDUCTOR CABLES Material properties and performance under test for temperature, environmental and mechanical (Test Methods)
ISO 6722:2006(E) Second Edition, 2006-08-01	Road Vehicles - 60 V and 600 V Single-Core Cables - Dimensions, Test Methods and Requirements

3 Quality Assurance Provisions

The tests detailed in section 5 are to be carried out at the frequencies described below. Where appropriate, individual test frequencies may be modified through the use of statistically derived data.

3.1 Quality Assurance

The supplier shall provide reasonable access to facilities for quality audit and control purposes on customer request.

3.2 Test Frequency

Tests are divided into four frequency categories. These are routine, lot/batch, production quality and qualification tests.

3.2.1 Routine Tests (100%)

Performed on 100% of the production length.

3.2.2 Lot/Batch Tests (Lot)

Performed on each production batch. A batch is any quantity of material manufactured on a substantially continuous basis, under conditions that are presumed uniform.

3.2.3 Qualification Tests (Q)

These are performed:
i) Prior to first shipment of a new product.
ii) Whenever any significant change is made to the materials or manufacturing process.

4 Cable Constructions and Materials

4.1 Conductors

4.1.1 Copper Conductors

Strands shall be clean, bright and free from surface irregularities. Constructions shall show no kinks, joints or other irregularities in the completed conductor. They shall comply with section 5 and the SCD.

4.2 Cable Insulation

The insulation system shall meet the requirements of section 5 of this specification. It shall be extruded to cover the conductor uniformly and be homogeneous, smooth and free from flaws. The insulation shall not be loose, but be capable of stripping cleanly without damage to the conductor.

4.2.1 Colour

The colours shall be as defined in the Specification Control Drawing (SCD).

5 Tests and Test Methods

5.1 Tests (test all sizes unless otherwise specified)

Clause	Frequency	Method	Definition	Test Requirements (For applicable specification see section 2)
5.1.1	Lot	-	Wall thickness	See SCD.
5.1.2	Lot	-	Wire diameter	See SCD.
5.1.3	Lot	-	Conductor diameter	See SCD.
5.1.4	Lot	ISO 6722 Clause 6.1	Conductor resistance	See SCD.
5.1.5	100%	FORD ES-AU5T-1A348-AA Clause 3.10.4	Insulation faults (tested at spooling 8kV)	No breakdown.
5.1.6	Q	Fiat Std. 7.Z8210 Clause 2.4	Insulation resistance	$>10^9$ Ωmm.
5.1.8	Q	FORD ES-AU5T-1A348-AA Clause 3.11.1	Pressure test at high temperatures	No breakdown.
5.1.9	Q	PSA 9646147599 Clause 5.6.3.3	High temperature pressure	No breakdown.
5.1.10	Q	FORD ES-AU5T-1A348-AA Clause 3.11.2	Low temperature winding	No conductor visible. No breakdown. ($10mm^2$ ONLY)
5.1.11	Q	Fiat Std. 7.Z8220 Clause 3.4	Cold bend test	No cracking, failure or damage. At 1kV/1min, leakage current ≤100mA. Breakdown voltage >3kV. ($10, 16\ mm^2$ ONLY)
5.1.12	Q	Fiat Std. 7.Z8220 Clause 4.3 (For $10mm^2$ use same test conditions as $16mm^2$)	Cold impact test	No cracking, failure or damage. At 1kV/1min, leakage current ≤100mA. Breakdown voltage >3kV.
5.1.13	Q	PSA 9646147599 Clause 5.6.3.1.	Tensile strength and yield strength of the insulator	Minimum tensile strength 10 MPa. Minimum elongation at break 150%. (before and after ageing 240hrs/225°C)

Clause	Frequency	Method	Definition	Test Requirements (For applicable specification see section 2)
5.1.14	Q	RENAULT 36-05-009 Clause 6.5.1	Heat ageing series 1 (Group 1 3000hrs/200°C) (Group 2 240hrs/225°C)	No cracks. No breakdown.
5.1.15	Q	RENAULT 36-05-009 Clause 6.5.2	Heat ageing series 2 (Shrinkage, 240hrs/225°C)	Maximum shrinkage ≤1 mm each end.
5.1.16	Q	FORD ES-AU5T-1A348-AA Clause 3.11.5	Short term heat ageing, 240 h	No conductor visible. No breakdown.
5.1.17	Q	FORD ES-AU5T-1A348-AA Clause 3.11.6	Long term heat ageing, 3000 h	No conductor visible. No breakdown.
5.1.18	Q	Fiat Std. 7.Z8220 Clause 3.6	Cold flexibility after accelerated ageing	No cracking, failure or damage. At 1kV/1min, leakage current ≤100mA Breakdown voltage >3kV.
5.1.19	Q	PSA 9646147599 Clause 5.6.5.2	Thermal overload	No cracks. No breakdown.
5.1.20	Q	FORD ES-AU5T-1A348-AA Clause 3.11.7		No conductor visible. No breakdown.
5.1.21	Q	Fiat Std. 7.Z8220 Clause 3.2		No cracking or failure. At 1kV/1min, leakage current ≤100mA. Breakdown voltage >3kV.
5.1.22	Q	Fiat Std. 7.Z8220 Clause 3.3	Shrinkage under heat	Reduction in length ≤ 2%.
5.1.23	Q	PSA 9646147599 Clause 5.6.3.8.	Flexibility	Record values.
5.1.24	Q	PSA 9646147599 Clause 5.6.3.6	Stripping force	Record values.
5.1.25	Q	PSA 9646147599 Clause 5.6.3.7	Adherence of insulator to core	Record values.
5.1.26	Q	RENAULT 36-05-009 Clause 7	Combustability	Test piece must be self-extinguishing. Burning must not have reached reference mark. No ignited droplets must cause the tissue paper to catch fire.

Clause	Frequency	Method	Definition	Test Requirements (For applicable specification see section 2)
5.1.27	Q	FORD ES-AU5T-1A348-AA Clause 3.11.9	Resistance to flame propagation	Self extinguish within 70s. >50mm unburnt at top.
5.1.28	Q	Fiat Std. 7.Z8220 Clause 3.7	Flame test	Extinguishing time <30 secs.
5.1.29	Q	PSA 9646147599 Clause 5.6.5.7	Resistance to flame propagation	Extinguishing time <30 secs.
5.1.30	Q	PSA 9646147599 Clause 5.6.5.6	Behaviour under hydrolysis/electrolysis	$>10^9$ Ωmm. No cracks. No breakdown.
5.1.31	Q	RENAULT 36-05-009 Clause 6.9.	Resistance to fluids (Test 10mm^2 as this is considered representative of product range)	No cracks. No breakdown.
5.1.32	Q	PSA 9646147599 Clause 5.6.5.8 (*fluids common to Renault 36-05-009 can be omitted see below) * Zinc chloride sol^n, power steering fluid, battery acid	Behaviour under chemical agents (Test 10mm^2 as this is considered representative of product range)	Visually acceptable. No breakdown.
5.1.33	Q	FORD ES-AU5T-1A348-AA Clause 3.12	Fluid compatibility (Test 10mm^2 as this is considered representative of product range)	No conductor visible. No breakdown.
5.1.34	Q	Fiat Std. 7.Z8220 Clause 3.8	Resistance to chemicals	No cracking, failure or damage. Max increase in outside diameter 15%. Significant colour change admissible. At 1kV/1min, leakage current ≤100mA. Breakdown voltage >3kV
5.1.35	Q	ISO 6722 Clause 11.2.3	Insulated electric wires occasionally exposed to battery acid	No visible conductor. No breakdown.
5.1.36	Q	PSA 9646147599 Clause 5.6.5.10	Chemical compatibility of the cabling components. (Scapa 580)	No cracks. No breakdown.
5.1.37	Q	FORD ES-AU5T-1A348-AA Clause 3.13	Temperature and humidity cycling	No conductor visible. No breakdown.
5.1.38	Q	FORD ES-AU5T-1A348-AA Clause 3.14	Resistance to ozone	No cracks.

5.2 Additional Tests

Clause	Frequency	Definition	Test Requirements
5.2.1	Lot	Tensile strength & elongation	Dumbbells or tubes of cable insulation shall be cut and tested on a tensometer. Using a starting jaw gap of 50 mm, a gauge length of 20 mm and a jaw separation speed of 250 mm/minute. Minimum requirement: Tensile strength = 12.4 MPa. **Elongation at break = 200**
5.2.2	Lot	Heat shock	A length of finished cable shall be wound around a mandrel having a diameter equal to the diameter of the cable or back upon itself for a minimum of 6 turns and secured to prevent unwinding. The sample shall be placed in an air-circulating oven at 300°C for one hour. After this period the sample shall be removed from the oven and allowed to return to ambient temperature. The sample shall be visually inspected and shall show no signs of cracking or melting.
5.2.3	Q	Withstand, breakdown voltage and leakage current.**	A 10 metre sample of cable shall be prepared and 25mm of insulation stripped from each end. The sample is coiled and the ends twisted together. See Fiat 7.Z8210, clause 2.3.3. for apparatus. The cable sample is soaked (with ends protruding) in a 3% (by mass) NaCl solution for 4 hours. An a.c. test voltage (50 Hz or 60 Hz) of 1kV is applied between the sample conductor and test solution for 30mins. The leakage current is measured in accordance with Fiat Std. 7.Z8210 Clause 2.3.5. The measured leakage current will be ≤100mA. The test voltage is then raised at a rate of 500 V/s to 5kV and held for 5 minutes. The sample shall exhibit no breakdown / no disruptive charge

** “Composite" test method meets requirements of PSA, Renault, Ford and Fiat.

6 Revision History

Issue No.	Amendment No.	CR No.	Date	Incorporated By
-	-	-	-	-

Prepared by	Approved by	Approved by
Richard Cording Electronic Sign-off. No signature will appear	Mark Hacker Electronic Sign-off. No signature will appear	Paul Scott Electronic Sign-off. No signature will appear
Application Support Engineer	Product Manager	Engineering Manager

Tyco Electronics UK Ltd.
Faraday Road, Dorcan
SWINDON, SN3 5HH
Tel: (01793) 528171
Fax: (01792) 572516
www.te.com