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Specification RK 6755 Revision A

DSPL

SCOPE

This Quality Assurance Specification establishes the quality standard for DSPL.

The objective of this document is to specify tests which will qualify the performance of Automotive wiring in-line splices, protected and insulated by DSPL tubing.

For Qualification purposes standardised splice components are used to eliminate sample variation. It has been established that the wire insulation material will meet the requirements herein prior to commencement of testing.

Approved Signatories*

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*** This document is electronically reviewed and approved - therefore no signatures will appear.**

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1. REVISION HISTORY

Revision Number	Change Request	Date	Incorporated By
1	Initial	9 June 2000	Barry Jenkins
A	Local Doc type updated	23June2023	Basavaraja D A

2. REQUIREMENTS

2.1 Composition, Appearance and Colour

The tubing components shall be essentially free from pinholes, bubbles, cracks, defects and inclusions and shall be constructed as a dual walled heat shrinkable tubing having a hot melt adhesive inner wall with an outer wall of an irradiated, modified polyolefin material. The jacket colour shall be black or clear. Inner adhesive wall shall be light amber.

2.2 Dimensions

Dimensions shall be as specified in the relevant SCD

2.3 Test Requirements

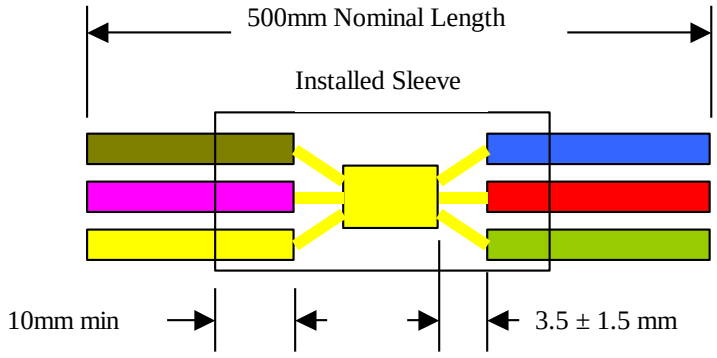
The requirements of Table 5 will be met by either tubing installed onto splices or tubing installed onto mandrels as appropriate when prepared as recommended herein (Section 3)..

3. PREPARATION AND INSTALLATION OF TEST SPECIMENS

3.1 Splice Specimens

The overall length of the splice assembly shall be nominally 500 mm and it shall be established prior to testing that the wire insulation material will meet all the tests herein. Wire meeting this requirement is Raychem Type 67 wire.
The splice assembly is constructed and installed as described in PIP-048

FIGURE 1 - RECOMMENDED SPLICE ASSEMBLY



3. PREPARATION AND INSTALLATION OF TEST SPECIMENS (Continued)

3.1.1 Splice Components

Refer to Table 1 for typical component combinations.

Wire - Raychem 67A 0219-18-X cut to 250 mm

- Strip length of wire 15 mm

3.1.2 Product Application Equipment

Raychem RBK-ILS Processor

UHI-250 Thermal Probe

3.1.3 Splice Installation

The relevant splice tubing shall be centred onto the splice area and shrunk into position using the RBK-ILS Processor as detailed in PIP-048. The splices shall be allowed to cool naturally to ambient temperature for a minimum of 30 minutes prior to testing for Insulation Resistance as described in Clause 4.4 of this specification.

Table 1 Splice Components and Construction

Size	Length (mm)	Splice Configuration
DSPL-NR1	50	2:1
DSPL-NR3	65	7:4
NB: Splices can be manufactured by ultrasonic, resistance welding or crimping as required by the customer.		

4. INDIVIDUAL PHYSICAL PROPERTY TESTS

4.1 Dimensions and Longitudinal Change

The test method shall be as specified in ASTM D2671. The length and inside diameter of five 150mm long specimens of expanded tubing shall be measured. The specimens shall be recovered at 200°C ± 5°C for 3 minutes in a fan assisted air circulating oven, and immediately quenched in water at room temperature and the dimensions remeasured. The longitudinal change shall be expressed as a percentage of the original length. The recovered wall thickness shall be determined from four measurements equi-spaced around the circumference and the mean value shall be recorded. Blocking of the adhesive liner shall not constitute a failure.

4.2 Inner Wall Flow Test

This test is carried out on standard length cut pieces of DSPL tubing material and is intended as a guide to adhesive flow.

Five specimens shall be selected at random and conditioned at 200 ± 5°C for 3 minutes in a fan assisted air circulating oven after which time approximately 5mm of one end is crimped together using flat faced pliers for approximately 30 seconds.

The specimens are then allowed to cool for a minimum of 15 minutes then reconditioned at 200 ± 5°C for a further 3 minutes. Upon removal from the oven the specimens shall be allowed to cool for 15 minutes minimum and examined for adhesive blocking. The tests shall be considered satisfactory if all specimens are totally blocked in at least one area of the specimen length.

4.3 Split Resistance

Five standard length cut pieces of DSPL tubing material shall be selected at random and slid onto the appropriate solid steel mandrels as stated in Table 2.

The specimens shall then be conditioned in a fan assisted air circulating oven at 200 ± 5°C for 10 minutes ± 30 seconds. Upon removal from the oven the specimens shall be examined visually for evidence of splitting. There shall be no splitting.

Table 2 Substrate Selection Guide

Product	Nominal Mandrel Diameter	
	(mm)	(ins)
DSPL-NR1	4.8	3/16
DSPL-NR3	9.5	3/8

INDIVIDUAL PHYSICAL PROPERTY TESTS (Continued)

4.4 Insulation Resistance Test

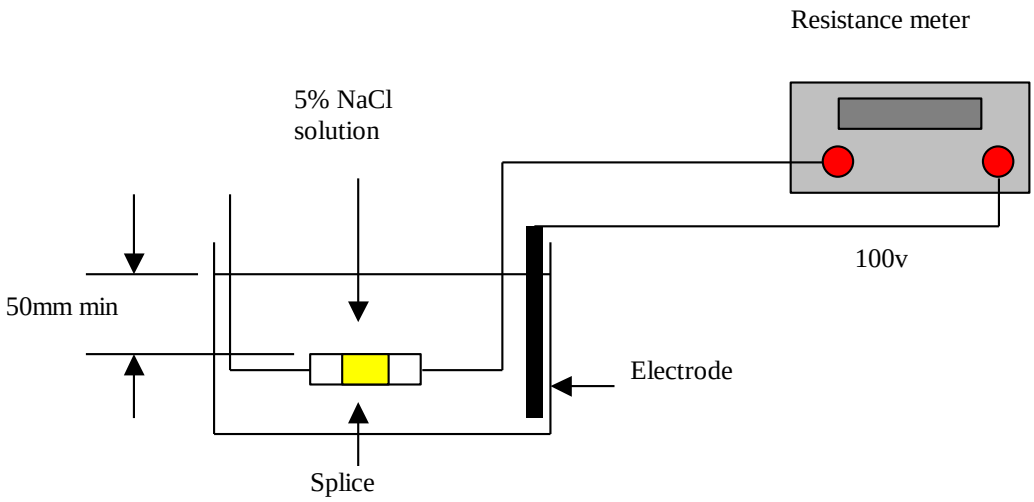
The apparatus shall be essentially as shown in Figure 2.

All installed splice specimens shall be immersed initially in salt solution (5% by weight) at 23 ± 3°C for 24 ± 2 hours.

After this conditioning period the resistance between each specimen and an immersed electrode (of surface area 100mm square) shall be measured by means of a suitable Megohmmeter. The reading shall be taken 30 seconds after application of 100v dc. Resistance of less than 2×10^8 Ohms shall constitute a failure.

Subsequent Insulation Resistant tests after individual test sections shall be carried out after 1 hour immersion only.

FIGURE 2 - INSULATION RESISTANCE TEST



INDIVIDUAL PHYSICAL PROPERTY TESTS (Continued)

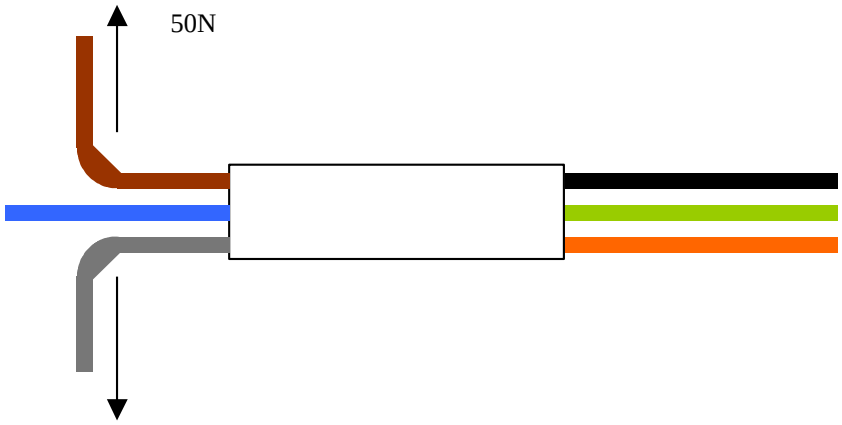
4.5 Strain Relief

This test is carried out on splice assemblies constructed as described in Clause 3.1.3 Table 1. Five specimens of each size shall be tested.

Secure one wire from any end in the upper jaw of a suitable tensile testing machine and any other wire from the same end in the lower jaw. The initial jaw separation shall be 100mm and rate of separation shall be 100mm per minute. The test shall be carried out at an ambient temperature of 23 ± 3°C (Refer to Figure 2).

Each test specimen shall be loaded to 50N and the load immediately released. All specimens shall then be checked for Insulation Resistance according to Clause 4.4 of this Specification.

FIGURE 3 – STRAIN RELIEF



4.6 Heat Ageing (Long Term)

Twenty five specimens shall be prepared as described in Clause 3.1.3 (Table 1).

The specimens shall be suspended vertically in a fan assisted air circulating oven and conditioned at 125 ± 3°C for 3000 hours. After conditioning, the specimens shall be allowed to cool naturally to room temperature and visually examined for signs of outer jacket cracking. Visual discolouration of the adhesive does not constitute failure.

All specimens shall be subjected to the Insulation Resistance test per Clause 4.4.

INDIVIDUAL PHYSICAL PROPERTY TESTS (Continued)

4.7 Cold Impact

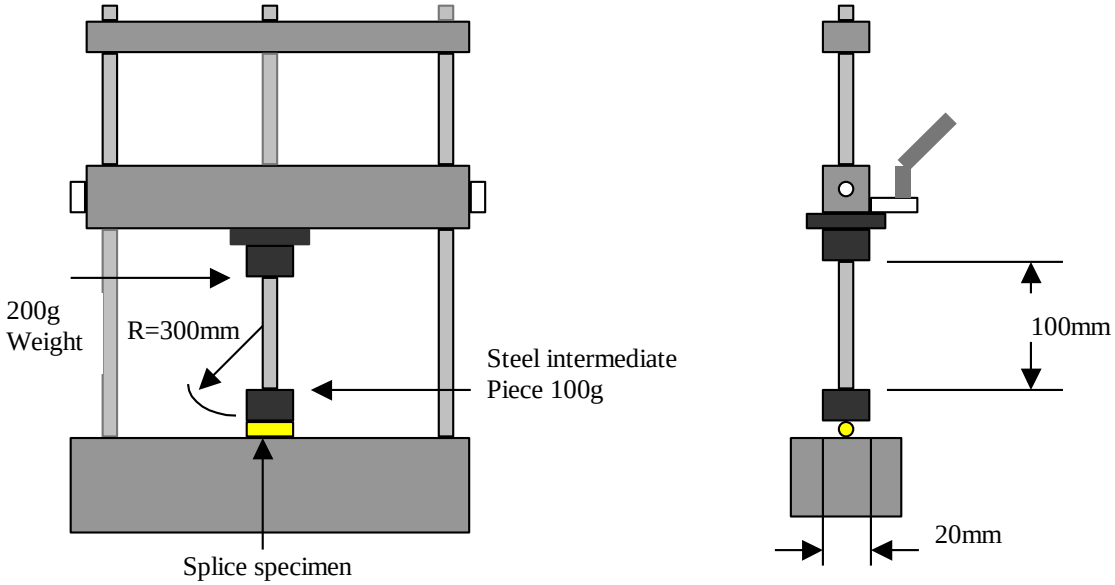
The test apparatus shall be essentially as shown in Figure 4 and the test method based on ISO 6722/1.

Five splice specimens per Clause 3.1.3 (Table 1) shall be conditioned together with the test apparatus in a suitable cold chamber for a minimum of 4 hours at -40 ± 2°C. The apparatus shall be pre-conditioned for a minimum of 4 hours prior to commencement of testing.

Each specimen shall be subjected to a single drop of a 200g weight from a height of 100mm whilst still in the cold chamber ensuring that the weight centrally impacts the splice area.

After test the specimens shall be removed from the cold chamber, allowed to stabilise to room temperature and examined visually for signs of cracking of the outer jacket. Each specimen shall then be subjected to the Insulation Resistance test per Clause 4.4.

FIGURE 4 – COLD IMPACT TEST RIG



INDIVIDUAL PHYSICAL PROPERTY TESTS (Continued)

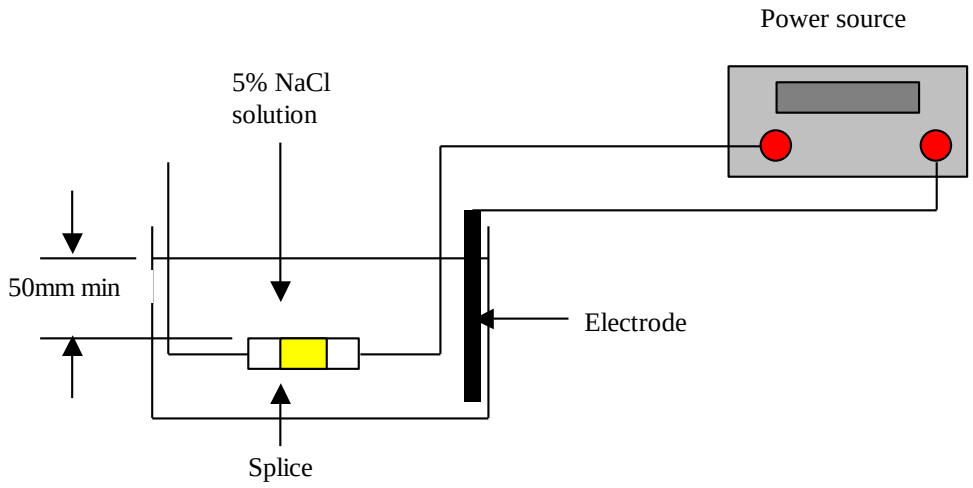
4.8 Accelerated Ageing Test

Fifty splice specimens per Clause 3.1.3 (Table 1) shall be suspended vertically in a fan assisted air circulating oven and conditioned for 168 ± 2 hours at 130 ± 5°C. After the conditioning period the specimens shall be removed from the oven and allowed to cool naturally to room temperature and visually examined for signs of cracking of the outer jacket. Discolouration of the adhesive liner does not constitute a failure. Each specimen shall then be subjected to the Insulation Resistance test per Clause 4.4.

4.9 Dielectric Test

The test method and apparatus shall be essentially as described in IEC 243 (Refer to Figure 5). Five splice specimens per Clause 3.1.3 (Table 1) shall be subjected to the following test. Each specimen shall be immersed in a 5% (by weight) saline solution at 23 ± 3°C for 4 hours ± 5 minutes with the wire ends overhanging the solution bath. The test voltage shall be applied between each conductor and the salt solution at a rate of 500 volts per second until a voltage of 3kV AC is reached. This voltage shall be maintained for 30 minutes. There shall be no flashover of the splice sleeve.

FIGURE 5 - DIELECTRIC TEST RIG



INDIVIDUAL PHYSICAL PROPERTY TESTS (Continued)

4.10 Fluid Compatibility

4.10.1 Fluid Soak

Five splice specimens per Clause 3.1.3 (Table 1) shall be immersed in each of the fluids listed in Table 3 at a temperature of 100 ± 3°C for 30 ± 2 minutes.

After the conditioning period the specimens shall be removed from the fluids, allowed to cool naturally to room temperature, wiped dry and subjected to the Insulation Resistance test per Clause 4.4.

Table 3 Soak Test Fluids

a)	Engine Oil ISO 1817 (Oil No 1)
b)	Automatic Transmission Fluid Dexron 2™

4.10.2 Fluid Splash

Five splice specimens per Clause 3.1.3 (Table 1) shall be immersed in each of the fluids listed in Table 4 at a temperature of 23 ± 3°C for 10 seconds duration at 30 ± 2 minute intervals for a total of 24 hours. After the conditioning period, the specimens shall be removed from the fluids, wiped dry and subjected to the Insulation Resistance test per Clause 4.4.

Table 4 Splash Test Fluids

a)	Diesel Fluid	ISO 1817 Liquid F
b)	Brake Fluid	Dot 4
c)	Gunk™ Degreaser	
d)	Fluid C*[1]	ISO 1817 1999
e)	Fuel 3*[1]	ISO 1817 1999
f)	Wash Fluid	(1% Teepol/Water) by volume
g)	Battery Acid	BS3031 (SG 1.25)
h)	Engine Coolant/Antifreeze	50/50 by volume
*[1] Use fresh fluid for Fuels 3 and C for each batch test. Seal in airtight containers when not in use to avoid evaporation.		

5. RELATED STANDARDS & issue

ASTM D2671: 1999	Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use
BS 3031: 1996	Specification For Sulfuric Acid Used In Lead-Acid Batteries
ISO 1817: 1999	Rubber, vulcanized - Determination of the effect of liquids
ISO 6722/1: 1996	Road Vehicles - Unscreened Low-Tension Cables - Test Methods

Subsequent amendments to, or revisions of, any of the above publications apply to this standard only when incorporated in it by updating or revision.

6. SAMPLING

Tests shall be carried out on a sample taken at random from each batch of finished product. A batch of product is defined as that quantity of tubing extruded at any one time. Testing frequency shall be Production Routine or Qualification. Production Routine tests consisting of Visual Examination, Dimensions, Longitudinal Change, Inner Wall Flow and Split Resistance shall be carried out on every batch. Qualification tests shall be carried out to the requirements of the Design Authority. Qualification of DSPL sizes NR1 and NR3 in black and clear shall qualify the range of product.

7. PACKAGING

Packaging shall be in accordance with good commercial practice. Each package shall bear an identification label showing material quantity, description, size, colour and batch number. Additional information shall be supplied as specified in the contract or order.

TABLE 5 Test Requirements

Test	Test Method	Test Requirements
Dimensions	ASTM D2671	As per Clause 2.2
Longitudinal Change	Clause 4.1	0 - 10%
Inner Wall Flow	Clause 4.2	Total blocking
Split Resistance	Clause 4.3	10min ± 30s at 200 ± 5 °C No splitting
Insulation Resistance Test	Clause 4.4	2 x 10^8 Ohms minimum (24h immersion)
Strain Relief - Insulation Resistance	Clause 4.5 Clause 4.4	50 N 2 x 10^8 Ohms minimum (1h immersion)
Heat Ageing - Visual - Insulation Resistance	Clause 4.6 - Clause 4.4	3000 hours at 125 ±3 °C No cracking of tubing jacket 2 x 10^8 Ohms minimum (1h immersion)
Cold Impact - Visual - Insulation Resistance	Clause 4.7 - Clause 4.4	4h at -40 °C No cracking of tubing 2 x 10^8 Ohms minimum (1h immersion)
Accelerated Heat Ageing - Visual - Insulation Resistance	Clause 4.8 - Clause 4.4	168 ± 2h at 130 ± 5 °C No cracking of tubing 2 x 10^8 Ohms minimum (1h immersion)
Dielectric Test	Clause 4.9	No breakdown at 3kV after 30 minutes
Fluid Soak - Insulation Resistance	Clause 4.10.1 Clause 4.4	30 ± 2min at 100 ±3 °C 2 x 10^8 Ohms minimum (1h immersion)
Fluid Splash (Room Temp) - Insulation Resistance	Clause 4.10.2 Clause 4.4	 2 x 10^8 Ohms minimum (1h immersion)

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