



An Engineering Report

for

D & B INJECTION MOULDERS LTD

ENVIRONMENTAL TESTING
OF
METRIC CABLE GLANDS

REPORT NO. 2715/04

May 2004

ENVIRONMENTAL TESTING OF METRIC CABLE GLANDS

Author

Approval



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No representation or warranty is given that Tests performed under the terms of the Contract constitute, in themselves, a sufficient programme for the Customer's purpose, nor that the Customer's Equipment tested is suitable for any particular purpose. Certified that the specimens detailed herein have been subjected to the tests as required by the order unless otherwise stated herein.

The quality control arrangements are in accordance with the conditions of our UKAS accreditation.

ENVIRONMENTAL TESTING OF METRIC CABLE GLANDS

SUMMARY

The Metric Cable Glands were tested to determine if they met the requirements of BS EN 50262:1999, Metric Cable Glands for Electrical Installations.

The specimens met the requirements of the tests, where levels are specified.

The results obtained from all the tests are given in the section5 of this report.

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Date of Specimen Receipt 31st October 2003

Date of Test(s): 14th November 2003 to 3rd March 2004

Date of Report: May 2004

The work that forms the subject of this report was carried out on behalf of D & B Injection Moulders Ltd in accordance with their Order No. 1155 under the terms of conditions of Cape Engineering UK Limited Works Order No. 31268.

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APPENDIX A

Test Report Nos. 138350, 138351, 138352, 138353 from Warrington Fire Research for the Resistance to Abnormal Heat Tests.

1 INTRODUCTION

The object of these tests was to demonstrate that the test specimens met the requirements of BS EN 50262:1999, Metric Cable Glands for Electrical Installations.

2 SPECIMEN

| | | | | | | | |
|-----------------|---------------------|--------|-------|--------|---------|--------|---------|
| Part Name: | Metric Cable Glands | | | | | | |
| Size: | M16 | M16 | M20 | M20 | M20 | M25 | M25 |
| Cable Range: | 3-7mm | 5-10mm | 4-9mm | 6-12mm | 10-14mm | 9-14mm | 13-18mm |
| Cape Stores No: | 17403 | 17404 | 17405 | 17406 | 17407 | 17408 | 17409 |

Three samples of the M16, 3-7mm range and M25, 13-18mm range Glands and one sample of each of the other Glands were subjected to each test.

3 SPECIFICATION

All testing was carried out in accordance with BS EN 50262:1999 Sections 5, 7, 8, 9.1, 9.4, 9.5, 10.3, and 12.1

For the purposes of this testing the Cable Glands were classified as:

Non-metallic cable glands without cable anchorage with insulating characteristics.

3.1 Cable Retention Test

Tested in accordance with BS EN 50262:1999 Sections 5 and 9.1.

3.2 Resistance to Impact Test

Tested in accordance with BS EN 50262:1999 Sections 5 and 9.4.

3.3 Excess Tightening Test

Tested in accordance with BS EN 50262:1999 Sections 5 and 9.5.

3.4 Insulation Resistance Test

Tested in accordance with BS EN 50262:1999 Sections 5 and 10.3.

3.5 Ingress Protection Test

Tested in accordance with BS EN 50262:1999 Section 12, to an IP characteristic 68.

3.6 Resistance to abnormal heat

This test was carried out by Warrington Fire Research and their report is included in appendix A.

4 PROCEDURE

4.1 Preconditioning

The specimens were placed in a temperature chamber and conditioned for 168 hours at 85°C. They were then removed from the chamber and allowed to remain at laboratory ambient temperature for at least 24 hours before being placed in a humidity chamber and conditioned to 20°C and 50%rh for a period of 24 hours.

4.2 Visual Inspection

The specimens were inspected and assessed in accordance with Sections 7 and 8 of BS EN 50262:1999 for Marking and Construction.

4.3 Cable Retention

A test mandrel with an outside diameter equal to the smallest specified cable diameter was inserted into each specimen, and the gland tightened to the specified tightening torque. The test mandrels consisted of a circular steel rod with a rubber sleeve over the outside, except for the two smallest sizes which were round wooden rods. The test mandrel was marked to identify its axial position in the specimen, and then loaded axially with the specified force for a period of 5 minutes. After the test period the mandrel was checked and any axial movement recorded.

4.4 Resistance to Impact Test

Each specimen was fitted with a test mandrel, as for the previous test, they were then cooled to -20°C and allowed to stabilise overnight. Each specimen in turn was then removed from the chamber, secured into a support plate, so the test mandrel was horizontal, and an impact mass with a hemispherical end of 25mm diameter allowed to strike the closing nut close as close as possible to the centre of the topmost flat. The specimen was removed from the support plate, inspected for damage, and then returned to the test chamber to recondition at -20°C.

Once all the specimens had been tested at the lowest impact energy they were all tested with the next impact energy level. This was repeated until they had been tested with the maximum energy impact, or the specimen showed signs of damage or failure.

The details of the impact energy levels are given in Table 3.

4.5 Excess Tightening Test

A test mandrel with an outside diameter equal to the largest specified cable diameter was inserted into each specimen. The gland was then tightened to the 1.5 times the manufacturers specified torque. The specimen was then dismantled and examined for signs of damage.

The torque values specified were M16 – 8Nm, M20 – 10Nm, M25 – 12Nm

4.6 Insulation Resistance Test

The specimens were placed in a humidity cabinet and conditioned at 25°C. Once stabilised, the relative humidity was increased to 93%. The specimens remained at these conditions for a minimum of 120 hours. The specimens were then removed from the chamber in turn, a short insulated plug fitted into the sealing part of the specimen and a conductive plate secured to the threaded end. The specimen was then filled with copper powder and buried in a container of copper powder up to the conductive plate. Two probes from an insulation tester were then inserted, one in the centre of the specimen and the other into the copper powder surrounding the specimen. The insulation resistance between the two probes was then measured at a potential of 500 volts.

This was repeated for all specimens.

4.7 Ingress Protection Test

The samples previously subjected to the Excessive Tightening test were subjected to the Ingress Protection test in accordance with BS EN 60529 IP68.

The specimens were screwed into the walls of a steel pressure vessel, from the outside, using the sealing washers provided. The specimens were fitted with blanking plugs machined to the diameter of the maximum size cable specified for the gland, and tightened to the manufacturers maximum torque value.

The vessel with specimens attached was then placed within the dust chamber and the pressure vessel evacuated to 2 kPa and subjected to the dust environment for a period of 8 hours.

After the dust test was completed the end faces of the pressure vessel were removed and replaced the other way around, so that the specimens were within the vessel. The vessel was filled with water and pressurised to 4 bar (equivalent to an immersion depth of approximately 40.8m). This was maintained for a period of 7 days, during which time the specimens were observed for signs of leakage.

5 RESULTS

5.1 Visual Inspection

The specimens met the requirements of Sections 7 and 8 of BS EN 50262:1999 for Marking and Construction when inspected. The identification markings remained visible and legible after rubbing with cloth soaked in water, and then again when soaked with commercial grade unleaded petroleum spirit.

5.2 Cable Retention

The results of this test are given in Table 3. No mandrel movement was observed after the test period on any specimen.

5.3 Resistance to Impact Test

The results of the testing are given in Table 4. One of the M16, 3-7mm Cable Range specimens survived an impact of 20J (Category 8) all other samples failed at levels between 4J (Category 5) and 20J (Category 8).

5.4 Excess Tightening Test

All specimens passed the excess tightening test without thread failure or any other signs of damage or degradation.

The torque applied to the specimens was:

M16 specimens 12Nm, M20 specimens 15Nm, M25 specimens 18Nm.

5.5 Insulation Resistance Test

All specimens exceeded the required minimum insulation value of 5 MΩ, and the results are given in Table 5

5.6 Ingress Protection Test

The specimens were tested to the requirements of IP 6X, and then visually inspected, no signs of dust was evident within the vacuum vessel they were secured in, therefore they met the requirements of IP 6X.

The specimens were then tested to the requirements of IP X8, at a pressure of 4 bar for a period of 7 days, and when visually inspected, no visible signs of water was evident around the specimens throughout this period, therefore they met the requirements of IP X8.

The specimens can therefore be given the rating IP68

**5.7 Resistance to Abnormal Heat
'Not UKAS Accredited'**

This test was carried out by Warrington Fire Research and their report Nos. 138350 to 138353 are included in appendix A of this report.

6 QUALITY ASSURANCE

6.1 Quality Management System

The quality management system for the Test Laboratory is accredited by the United Kingdom Accreditation Service and is known as UKAS Testing Laboratory No 0026.

The quality management system has been approved against the international quality standard ISO 9001 by ASTA Certification Services. ASTA Certificate No 12689 refers.

The Civil Aviation Authority has approved the quality management system in accordance with British Civil Airworthiness Requirements (BCAR), Chapter A8-6 and Chapter A8-8, CAA Approval Categories B4 and E2.

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS accreditation schedule for our Laboratory. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

7 EQUIPMENT AND INSTRUMENTATION

7.1 Traceability

All equipment has been calibrated as required using standards traceable to National or International standards, in accordance with the requirements of BS EN 30012-1/ISO 10012-1/BS 5781. Traceability is established through UKAS accredited calibration laboratories.

The test equipment and instrumentation used for each test are detailed in the tables below.

Each item of calibrated equipment and instrumentation was used within its valid calibration period.

7.2 Uncertainty of Measurement

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

| | | |
|-------------|---|------------|
| Pressure | : | +/- 0.5% |
| Time | : | +/- 0.6% |
| Temperature | : | +/- 0.75°C |
| Mass | : | +/- 2.0% |
| Insulation | : | +/- 10% |
| Humidity | : | +/- 4.8% |
| | : | |

Uncertainty of Measurement

Table 1

| Description | Manufacturer | QA Number | Calibration Due Date |
|---------------------------------|-------------------------|-----------|----------------------|
| Climatic Chamber | Thermotron | 1714 | 13.01.04 |
| Chart Recorder | Yokogawa | 118 | 22.05.04 |
| Platinum Resistance Thermometer | Sensing Devices Limited | 5018 | 07.01.04 |
| Platinum Resistance Thermometer | Sensing Devices Limited | 3009 | 25.11.04 |
| Weigh Scales | Snowrex | 2179 | 20.10.04 |
| Force Meter | Salter | 25A | 24.10.04 |
| Insulation Meter | Level | 320 | 10.10.04 |
| IP Dust Chamber | Cape | 717 | N/A |
| 10 bar Pressure Transducer | Druck | 2275 | 18.09.04 |
| Digital Pressure Display | Cape | 2273 | 18.09.04 |
| Humidity Chamber | Thermotron | 37 | 28.02.04 |
| Chart Recorder | Yokogawa | 1919 | 21.11.04 |
| Aspirated Wick | Cape | 2664 | 21.05.04 |

Test Equipment and Instrumentation

Table 2

| Specimen | Mandrel Size | Load applied to mandrel | Movement of Mandrel after 5 minutes |
|-------------------|--------------|-------------------------|-------------------------------------|
| M16 3-7mm Cable | 3mm | 5N | No Movement |
| M16 3-7mm Cable | 3mm | 5N | No Movement |
| M16 3-7mm Cable | 3mm | 5N | No Movement |
| M16 5-10mm Cable | 5mm | 10N | No Movement |
| M20 4-9mm Cable | 4mm | 5N | No Movement |
| M20 6-12mm Cable | 6mm | 10N | No Movement |
| M20 10-14mm Cable | 10mm | 15N | No Movement |
| M25 9-14mm Cable | 9mm | 15N | No Movement |
| M25 13-18mm Cable | 13mm | 20N | No Movement |
| M25 13-18mm Cable | 13mm | 20N | No Movement |
| M25 13-18mm Cable | 13mm | 20N | No Movement |

Results of Cable Retention Test

Table 3

| Specimen | Impact energy without failure J (Category) | Impact energy causing failure J (Category) | Mode of failure |
|-------------------|--|--|--|
| M16 3-7mm Cable | 4J (Category 5) | 7J (Category 6) | Broke through body on gland nut side of flange |
| M16 3-7mm Cable | 4J (Category 5) | 7J (Category 6) | Broke through M16 thread |
| M16 3-7mm Cable | 20J (Category 8) | | No failure |
| M16 5-10mm Cable | 4J (Category 5) | 7J (Category 6) | Broke through body on gland nut side of flange |
| M20 4-9mm Cable | 2J (Category 4) | 4J (Category 5) | Broke through M20 thread |
| M20 6-12mm Cable | 7J (Category 6) | 10J (Category 7) | M20 thread pulled through nut |
| M20 10-14mm Cable | 4J (Category 5) | 7J (Category 6) | Broke through M20 thread |
| M25 9-14mm Cable | 4J (Category 5) | 7J (Category 6) | Broke through M25 thread |
| M25 13-18mm Cable | 7J (Category 6) | 10J (Category 7) | Axial split along body thread at gland nut |
| M25 13-18mm Cable | 7J (Category 6) | 10J (Category 7) | M25 thread pulled through nut |
| M25 13-18mm Cable | 10J (Category 7) | 20J (Category 8) | Gland body shattered |

Results of Impact Test

Table 4

| Specimen | Insulation Resistance at 500 volts |
|-------------------|---|
| M16 3-7mm Cable | 1.1 GΩ |
| M16 3-7mm Cable | 1.3 GΩ |
| M16 3-7mm Cable | 2.1 GΩ |
| M16 5-10mm Cable | 1.0 GΩ |
| M20 4-9mm Cable | 1.4 GΩ |
| M20 6-12mm Cable | 1.8 GΩ |
| M20 10-14mm Cable | 2.2 GΩ |
| M25 9-14mm Cable | 4.0 GΩ |
| M25 13-18mm Cable | 1.5 GΩ |
| M25 13-18mm Cable | 2.3 GΩ |
| M25 13-18mm Cable | 2.4 GΩ |

Results of Insulation Resistance Test Table 5

DISTRIBUTION

| Copy No | Format | Company | Recipient |
|----------------|---------------|------------------------------|------------------|
| 1 | Paper | D & B Injection Moulders Ltd | Mr J. Dyson |
| 2 | Paper | Cape Engineering UK Ltd | Archives |

APPENDIX A

WARRINGTON FIRE RESEARCH TEST REPORT Nos. 138350, 138351, 138352, 138353

Test Report

WARRES No.138350

BS EN 60695-2-11: 2001
Fire Hazard Testing
Part 2. Test Methods
Section 1/Sheet 1:

Glow -Wire end –product test and guidance

Sponsored By

D & B Injection Moulders Limited
Unit 3 Kiln Hill Industrial Estate
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*W*arrington
FIRE
research

Test Report

WARRES No.138350

BS EN 60695-2-11: 2001
Fire Hazard Testing
Part 2. Test Methods
Section 1/Sheet 1:

Glow -Wire end –product test and guidance

Sponsored By

D & B Injection Moulders Limited
Unit 3 Kiln Hill Industrial Estate
Slaithwaite
Huddersfield
West Yorkshire
HD7 5JS

1 Purpose Of Test

To evaluate the performance of a material utilising the guidance and evaluation criteria specified in BS EN 60695-2-11: 2001 "Fire hazard testing, Part 2. Test Methods. Section 11: Glow-wire end-product test and guidance" when it is subjected to the conditions of the test specified in BS EN 60695-2-10: 2001 "Fire hazard testing, Part 2. Test Methods. Section 10. Glow-wire test methods-General".

2 Scope of Test

BS EN 60695-2-11: 2001 specifies the details of a glow wire test when applied to end products for fire hazard testing.

For the purpose of this standard, end product means electrotechnical equipment its sub-assemblies and components.

If possible, the specimen should be a complete equipment, sub-assembly or component.

If the test cannot be made on the complete equipment, sub-assembly or component, it is acceptable to:

- A) Cut a piece containing the part under examination from it, or
- B) Cut an aperture in the complete specimen, sub-assembly or component to allow access of the glow- wire, or
- C) Remove the part under examination in its entirety and test it separately.

The test results make it possible to provide a relative comparison of various electrotechnical equipment, their sub assemblies and components, according to their ability not to produce burning or glowing falling particles that will ignite materials or components normally surrounding or situated underneath the specimen, and to limit the propagation of flame.

The test method may not be appropriate for small components with a linear surface dimension less than 20mm, for which reference may need to be made to other test methods (for example, the needle flame test).

3 Material Sent For Test

The description of the material given below has been prepared from the information provided by the sponsor of the test. All values quoted are nominal, unless tolerances are given.

The specimen was a cable gland connector (product reference "Nylon Cable Gland IP68 Range", colour reference "Red Ral 3020") having a wall thickness of 2.5mm, a density of 1.13g/cm³ and was stated by the sponsor to be manufactured from "Nylon 6".

The sponsor further stated that the cable gland connector complied with the requirements of a V2 rating as defined in UL94.

The specimens were supplied by the sponsor of the test. Warrington Fire Research Centre was not involved in any selection or sampling procedure.

4 Conditioning Of Specimens

The specimens were received on the 9th March 2004.

Prior to the test the specimens were conditioned for a period of 24 hours at a temperature of from between 15°C and 35°C and a relative humidity of from between 45% and 75%

5 Date Of Test

The test was performed on the 18th March 2004.

6 Test Procedure

The test was performed in accordance with the requirements of BS EN 60695-2-11: 2001 utilising the test procedures specified in BS EN 60695-2-10: 2001 and this report should be read in conjunction with those Standards.

In accordance with the standard, wrapping tissue was placed 200mm below the point of glow-wire application.

7 Test Results

A total of three specimens were tested and the following observations were recorded:

Where:

- | | | |
|-------|---|---|
| t_1 | = | The duration from the beginning of tip application up to the time at which the specimen or the layer placed below it ignites. |
| t_2 | - | The duration from the beginning of tip application up to the time when flames extinguish during or after the period of application. |
| t_3 | - | The duration of tip application |

Glow Wire Temperature

Observations

550°C Specimen No 1

On application of the glow wire the following observations were recorded :

1. The specimen melted in the area of glow wire application. No flaming of the specimen was observed during the application of the glow wire.
2. No flaming was observed after removal of the glow wire.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_i = Not applicable (no ignition)
 t_e = Not applicable (no ignition)
 t_a = 30sec

650°C Specimen No 2

On application of the glow wire the following observations were recorded :

1. The specimen melted in the area of glow wire application. No flaming of the specimen was observed during the application of the glow wire.
2. No flaming was observed after removal of the glow wire.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_i = Not applicable (no ignition)
 t_e = Not applicable (no ignition)
 t_a = 30sec

750°C Specimen No 3

On application of the glow wire the following observations were recorded:

1. The specimen melted in the area of glow wire application. Flaming of the specimen was observed during the application of the glow wire.
2. Flaming was observed after removal of the glow wire for a maximum period of 50 seconds.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_i = 1 second
 t_e = 120 seconds
 t_a = 30 seconds

The test results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential smoke hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and will therefore invalidate the test results. It is the responsibility of the supplier of the product to ensure that the product which is supplied is identical with the specimens which were tested.

8 Evaluation of Test Results

BS EN 60695-2-11: 2001 specifies that, unless otherwise specified in any relevant technical specification, the specimen is considered to have satisfactorily withstood the glow-wire test if one of the following two situations applies:

- a) If there is no flame or glowing;
- b) If flames or glowing of the specimen, of the surroundings and of the layer below extinguish within 30 seconds after removal of the glow-wire, i.e. $t_a \leq t_a + 30$ seconds (where t_a is the duration of tip application), and the surrounding parts and the layer below have not burned away completely.

Note: When a layer of wrapping tissue is used, there shall be no ignition of the wrapping tissue.

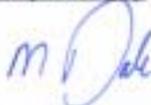
Therefore, the results obtained demonstrate that the product, as tested, satisfactorily withstood the glow-wire test at temperatures of 550°C and 650°C with an application period of 30 seconds as specified in BS EN 60695-2-11: 2001.

9 Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

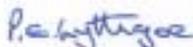
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Reported By



M DALE
Technical Officer
Reaction to Fire Testing

Approved By



P E LYTHGOE
Testing Manager
Reaction to Fire Testing
For and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date of Issue: 21st April 2004

Test Report

WARRES No.138351

BS EN 60695-2-11: 2001

Fire Hazard Testing

Part 2. Test Methods

Section 1/Sheet 1:

Glow -Wire end -product test and guidance

Sponsored By

D & B Injection Moulders Limited

Unit 3 Kiln Hill Industrial Estate

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Huddersfield

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Warrington
FIRE
research

Test Report

WARRES No.138351

BS EN 60695-2-11: 2001
Fire Hazard Testing
Part 2. Test Methods
Section 1/Sheet 1:
Glow -Wire end –product test and guidance

Sponsored By

D & B Injection Moulders Limited
Unit 3 Kiln Hill Industrial Estate
Slaithwaite
Huddersfield
West Yorkshire
HD7 5JS

1 Purpose Of Test

To evaluate the performance of a material utilising the guidance and evaluation criteria specified in BS EN 60695-2-11: 2001 "Fire hazard testing, Part 2. Test Methods. Section 11: Glow-wire end-product test and guidance" when it is subjected to the conditions of the test specified in BS EN 60695-2-10: 2001 "Fire hazard testing, Part 2. Test Methods. Section 10. Glow-wire test methods-General".

2 Scope of Test

BS EN 60695-2-11: 2001 specifies the details of a glow wire test when applied to end products for fire hazard testing.

For the purpose of this standard, end product means electrotechnical equipment its sub-assemblies and components.

If possible, the specimen should be a complete equipment, sub-assembly or component.

If the test cannot be made on the complete equipment, sub-assembly or component, it is acceptable to:

- A) Cut a piece containing the part under examination from it, or
- B) Cut an aperture in the complete specimen, sub-assembly or component to allow access of the glow- wire, or
- C) Remove the part under examination in its entirety and test it separately.

The test results make it possible to provide a relative comparison of various electrotechnical equipment, their sub assemblies and components, according to their ability not to produce burning or glowing falling particles that will ignite materials or components normally surrounding or situated underneath the specimen, and to limit the propagation of flame.

The test method may not be appropriate for small components with a linear surface dimension less than 20mm, for which reference may need to be made to other test methods (for example, the needle flame test).

3 Material Sent For Test

The description of the material given below has been prepared from the information provided by the sponsor of the test. All values quoted are nominal, unless tolerances are given.

The specimen was a cable gland connector (product reference "Nylon Cable Gland IP68 Range", colour reference "Black Ral 9004") having a wall thickness of 2.5mm, a density of 1.13g/cm³ and was stated by the sponsor to be manufactured from "Nylon 6".

The sponsor further stated that the cable gland connector complied with the requirements of a V2 rating as defined in UL94.

The specimens were supplied by the sponsor of the test. Warrington Fire Research Centre was not involved in any selection or sampling procedure.

4 Conditioning Of Specimens

The specimens were received on the 9th March 2004.

Prior to the test the specimens were conditioned for a period of 24 hours at a temperature of from between 15°C and 35°C and a relative humidity of from between 45% and 75%.

5 Date Of Test

The test was performed on the 18th March 2004.

6 Test Procedure

The test was performed in accordance with the requirements of BS EN 60695-2-11: 2001 utilising the test procedures specified in BS EN 60695-2-10: 2001 and this report should be read in conjunction with those Standards.

In accordance with the standard, wrapping tissue was placed 200mm below the point of glow-wire application.

7 Test Results

A total of three specimens were tested and the following observations were recorded:

Where:

- | | | |
|-------|---|---|
| t_1 | = | The duration from the beginning of tip application up to the time at which the specimen or the layer placed below it ignites. |
| t_2 | = | The duration from the beginning of tip application up to the time when flames extinguish during or after the period of application. |
| t_3 | = | The duration of tip application |

Glow Wire Temperature

Observations

550°C Specimen No 1

On application of the glow wire the following observations were recorded :

1. The specimen melted in the area of glow wire application. No flaming of the specimen was observed during the application of the glow wire.
2. No flaming was observed after removal of the glow wire.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_1 = Not applicable (no ignition)
 t_2 = Not applicable (no ignition)
 t_3 = 30sec

650°C Specimen No 2

On application of the glow wire the following observations were recorded :

1. The specimen melted in the area of glow wire application. No flaming of the specimen was observed during the application of the glow wire.
2. No flaming was observed after removal of the glow wire.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_1 = Not applicable (no ignition)
 t_2 = Not applicable (no ignition)
 t_3 = 30sec

750°C Specimen No 3

On application of the glow wire the following observations were recorded:

1. The specimen melted in the area of glow wire application. Flaming of the specimen was observed during the application of the glow wire.
2. Flaming was observed after removal of the glow wire for a maximum period of 90 seconds.
3. One of the three specimens tested produced flaming droplets and caused ignition of the wrapping tissue placed below the specimen.

As a result t_1 = 1 second
 t_2 = 120 seconds
 t_3 = 30 seconds

The test results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential smoke hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and will therefore invalidate the test results. It is the responsibility of the supplier of the product to ensure that the product which is supplied is identical with the specimens which were tested.

8 Evaluation of Test Results

BS EN 60695-2-11: 2001 specifies that, unless otherwise specified in any relevant technical specification, the specimen is considered to have satisfactorily withstood the glow-wire test if one of the following two situations applies:

- a) If there is no flame or glowing;
- b) If flames or glowing of the specimen, of the surroundings and of the layer below extinguish within 30 seconds after removal of the glow-wire, i.e. $t_e \leq t_a + 30$ seconds (where t_a is the duration of tip application), and the surrounding parts and the layer below have not burned away completely.

Note: When a layer of wrapping tissue is used, there shall be no ignition of the wrapping tissue.

Therefore, the results obtained demonstrate that the product, as tested, satisfactorily withstood the glow-wire test at temperatures of 550°C and 650°C with an application period of 30 seconds as specified in BS EN 60695-2-11: 2001.

9 Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

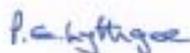
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Reported By



M DALE
Technical Officer
Reaction to Fire Testing

Approved By



P E LYTHGOE
Testing Manager
Reaction to Fire Testing
For and on behalf of
WARRINGTON FIRE RESEARCH CENTRE

Date of Issue: 21st April 2004

Test Report

WARRES No.138352

BS EN 60696-2-11: 2001
Fire Hazard Testing
Part 2. Test Methods
Section 1/Sheet 1:
Glow -Wire end –product test and guidance

Sponsored By

D & B Injection Moulders Limited
Unit 3 Kiln Hill Industrial Estate
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FIRE
research

Test Report

WARRES No.138352

BS EN 60695-2-11: 2001
Fire Hazard Testing
Part 2. Test Methods
Section 1/Sheet 1:
Glow -Wire end –product test and guidance

Sponsored By

D & B Injection Moulders Limited
Unit 3 Kiln Hill Industrial Estate
Slaithwaite
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HD7 5JS

1 Purpose Of Test

To evaluate the performance of a material utilising the guidance and evaluation criteria specified in BS EN 60695-2-11: 2001 "Fire hazard testing, Part 2. Test Methods. Section 11: Glow-wire end-product test and guidance" when it is subjected to the conditions of the test specified in BS EN 60695-2-10: 2001 "Fire hazard testing, Part 2. Test Methods. Section 10. Glow-wire test methods-General".

2 Scope of Test

BS EN 60695-2-11: 2001 specifies the details of a glow wire test when applied to end products for fire hazard testing.

For the purpose of this standard, end product means electrotechnical equipment its sub-assemblies and components.

If possible, the specimen should be a complete equipment, sub-assembly or component.

If the test cannot be made on the complete equipment, sub-assembly or component, it is acceptable to:

- A) Cut a piece containing the part under examination from it, or
- B) Cut an aperture in the complete specimen, sub-assembly or component to allow access of the glow- wire, or
- C) Remove the part under examination in its entirety and test it separately.

The test results make it possible to provide a relative comparison of various electrotechnical equipment, their sub assemblies and components, according to their ability not to produce burning or glowing falling particles that will ignite materials or components normally surrounding or situated underneath the specimen, and to limit the propagation of flame.

The test method may not be appropriate for small components with a linear surface dimension less than 20mm, for which reference may need to be made to other test methods (for example, the needle flame test).

3 Material Sent For Test

The description of the material given below has been prepared from the information provided by the sponsor of the test. All values quoted are nominal, unless tolerances are given.

The specimen was a cable gland connector (product reference "Nylon Cable Gland IP68 Range", colour reference "GREY Ral 7001") having a wall thickness of 2.5mm, a density of 1.13g/cm³ and was stated by the sponsor to be manufactured from "Nylon 6".

The sponsor further stated that the cable gland connector complied with the requirements of a V2 rating as defined in UL94.

The specimens were supplied by the sponsor of the test. Warrington Fire Research Centre was not involved in any selection or sampling procedure.

4 Conditioning Of Specimens

The specimens were received on the 9th March 2004.

Prior to the test the specimens were conditioned for a period of 24 hours at a temperature of from between 15°C and 35°C and a relative humidity of from between 45% and 75%

5 Date Of Test

The test was performed on the 18th March 2004.

6 Test Procedure

The test was performed in accordance with the requirements of BS EN 60695-2-11: 2001 utilising the test procedures specified in BS EN 60695-2-10: 2001 and this report should be read in conjunction with those Standards.

In accordance with the standard, wrapping tissue was placed 200mm below the point of glow-wire application.

7 Test Results

A total of three specimens were tested and the following observations were recorded:

Where:

- | | | |
|-------|---|---|
| t_i | = | The duration from the beginning of tip application up to the time at which the specimen or the layer placed below it ignites. |
| t_e | - | The duration from the beginning of tip application up to the time when flames extinguish during or after the period of application. |
| t_a | - | The duration of tip application |

Glow Wire Temperature

Observations

550°C Specimen No 1

On application of the glow wire the following observations were recorded:

1. The specimen melted in the area of glow wire application. No flaming of the specimen was observed during the application of the glow wire.
2. No flaming was observed after removal of the glow wire.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_i = Not applicable (no ignition)

t_e = Not applicable (no ignition)

t_a = 30sec

650°C Specimen No 2

On application of the glow wire the following observations were recorded:

1. The specimen melted in the area of glow wire application. No flaming of the specimen was observed during the application of the glow wire.
2. No flaming was observed after removal of the glow wire.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_i = Not applicable (no ignition)
 t_e = Not applicable (no ignition)
 t_s = 30sec

750°C Specimen No 3

On application of the glow wire the following observations were recorded:

1. The specimen melted in the area of glow wire application. Flaming of the specimen was observed during the application of the glow wire.
2. Flaming was observed after removal of the glow wire for a maximum period of 29 seconds.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_i = 1 second
 t_e = 59 seconds
 t_s = 30 seconds

850°C Specimen No 4

On application of the glow wire the following observations were recorded:

1. The specimen melted in the area of glow wire application. Flaming of the specimen was observed during the application of the glow wire.
2. Flaming was observed after removal of the glow wire for a maximum period of 36 seconds.
3. One of the three specimens tested produced flaming droplets and caused ignition of the wrapping tissue placed below the specimen.

As a result t_i = 1 second
 t_e = 66 seconds
 t_s = 30 seconds

The test results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential smoke hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and will therefore invalidate the test results. It is the responsibility of the supplier of the product to ensure that the product which is supplied is identical with the specimens which were tested.

8 Evaluation of Test Results

BS EN 60695-2-11: 2001 specifies that, unless otherwise specified in any relevant technical specification, the specimen is considered to have satisfactorily withstood the glow-wire test if one of the following two situations applies:

- a) If there is no flame or glowing;
- b) If flames or glowing of the specimen, of the surroundings and of the layer below extinguish within 30 seconds after removal of the glow-wire, i.e. $t_e \leq t_a + 30$ seconds (where t_e is the duration of tip application), and the surrounding parts and the layer below have not burned away completely.

Note: When a layer of wrapping tissue is used, there shall be no ignition of the wrapping tissue.

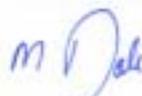
Therefore, the results obtained demonstrate that the product, as tested, satisfactorily withstood the glow-wire test at temperatures of 550°C, 650°C and 750°C with an application period of 30 seconds as specified in BS EN 60695-2-11: 2001.

9 Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

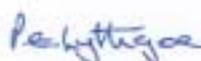
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Reported By



M DALE
Technical Officer
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P E LYTHGOE
Testing Manager
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For and on behalf of
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Date of Issue: 21st April 2004

Test Report

WARRES No.138353

BS EN 60695-2-11: 2001

Fire Hazard Testing

Part 2. Test Methods

Section 1/Sheet 1:

Glow -Wire end –product test and guidance

Sponsored By

D & B Injection Moulders Limited

Unit 3 Kiln Hill Industrial Estate

Slaithwaite

Huddersfield

West Yorkshire

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Warrington
FIRE
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Test Report

WARRES No.138353

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Section 1/Sheet 1:
Glow -Wire end –product test and guidance

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1 Purpose Of Test

To evaluate the performance of a material utilising the guidance and evaluation criteria specified in BS EN 60695-2-11: 2001 "Fire hazard testing, Part 2. Test Methods. Section 11: Glow-wire end-product test and guidance" when it is subjected to the conditions of the test specified in BS EN 60695-2-10: 2001 "Fire hazard testing, Part 2. Test Methods. Section 10. Glow-wire test methods-General".

2 Scope of Test

BS EN 60695-2-11: 2001 specifies the details of a glow wire test when applied to end products for fire hazard testing.

For the purpose of this standard, end product means electrotechnical equipment its sub-assemblies and components.

If possible, the specimen should be a complete equipment, sub-assembly or component.

If the test cannot be made on the complete equipment, sub-assembly or component, it is acceptable to:

- A) Cut a piece containing the part under examination from it, or
- B) Cut an aperture in the complete specimen, sub-assembly or component to allow access of the glow- wire, or
- C) Remove the part under examination in its entirety and test it separately.

The test results make it possible to provide a relative comparison of various electrotechnical equipment, their sub assemblies and components, according to their ability not to produce burning or glowing falling particles that will ignite materials or components normally surrounding or situated underneath the specimen, and to limit the propagation of flame.

The test method may not be appropriate for small components with a linear surface dimension less than 20mm, for which reference may need to be made to other test methods (for example, the needle flame test).

3 Material Sent For Test

The description of the material given below has been prepared from the information provided by the sponsor of the test. All values quoted are nominal, unless tolerances are given.

The specimen was a cable gland connector (product reference "Nylon Cable Gland IP68 Range", colour reference "White Ral 9003") having a wall thickness of 2.5mm, a density of 1.13g/cm³ and was stated by the sponsor to be manufactured from "Nylon 6".

The sponsor further stated that the cable gland connector complied with the requirements of a V2 rating as defined in UL94.

The specimens were supplied by the sponsor of the test. Warrington Fire Research Centre was not involved in any selection or sampling procedure.

4 Conditioning Of Specimens

The specimens were received on the 9th March 2004.

Prior to the test the specimens were conditioned for a period of 24 hours at a temperature of from between 15°C and 35°C and a relative humidity of from between 45% and 75%

5 Date Of Test

The test was performed on the 18th March 2004.

6 Test Procedure

The test was performed in accordance with the requirements of BS EN 60695-2-11: 2001 utilising the test procedures specified in BS EN 60695-2-10: 2001 and this report should be read in conjunction with those Standards.

In accordance with the standard, wrapping tissue was placed 200mm below the point of glow-wire application.

7 Test Results

A total of three specimens were tested and the following observations were recorded:

Where:

- | | | |
|-------|---|---|
| t_1 | = | The duration from the beginning of tip application up to the time at which the specimen or the layer placed below it ignites. |
| t_2 | - | The duration from the beginning of tip application up to the time when flames extinguish during or after the period of application. |
| t_3 | - | The duration of tip application |

Glow Wire Temperature

Observations

550°C Specimen No 1

On application of the glow wire the following observations were recorded :

1. The specimen melted in the area of glow wire application. No flaming of the specimen was observed during the application of the glow wire.
2. No flaming was observed after removal of the glow wire.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_1 = Not applicable (no ignition)
 t_2 = Not applicable (no ignition)
 t_3 = 30sec

650°C Specimen No 2

On application of the glow wire the following observations were recorded :

1. The specimen melted in the area of glow wire application. No flaming of the specimen was observed during the application of the glow wire.
2. No flaming was observed after removal of the glow wire.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result t_1 = Not applicable (no ignition)
 t_2 = Not applicable (no ignition)
 t_3 = 30sec

750°C Specimen No 3

On application of the glow wire the following observations were recorded:

1. The specimen melted in the area of glow wire application. Flaming of the specimen was observed during the application of the glow wire.
2. Flaming was observed after removal of the glow wire for a maximum period of 12 seconds.
3. There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.
- 4.

As a result t_1 = 1 second
 t_2 = 42 seconds
 t_3 = 30 seconds

850°C Specimen No 4

On application of the glow wire the following observations were recorded:

The specimen melted in the area of glow wire application. Flaming of the specimen was observed during the application of the glow wire.

Flaming was observed after removal of the glow wire for a maximum period of 45 seconds.

There was no ignition of the wrapping tissue placed below the specimen at any time during or after the test.

As a result $t_1 = 1$ second
 $t_2 = 75$ seconds
 $t_3 = 30$ seconds

The test results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential smoke hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and will therefore invalidate the test results. It is the responsibility of the supplier of the product to ensure that the product which is supplied is identical with the specimens which were tested.

8 Evaluation of Test Results

BS EN 60695-2-11: 2001 specifies that, unless otherwise specified in any relevant technical specification, the specimen is considered to have satisfactorily withstood the glow-wire test if one of the following two situations applies:

- a) If there is no flame or glowing;
- b) If flames or glowing of the specimen, of the surroundings and of the layer below extinguish within 30 seconds after removal of the glow-wire, i.e. $t_2 \leq t_1 + 30$ seconds (where t_1 is the duration of tip application), and the surrounding parts and the layer below have not burned away completely.

Note: When a layer of wrapping tissue is used, there shall be no ignition of the wrapping tissue.

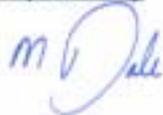
Therefore, the results obtained demonstrate that the product, as tested, satisfactorily withstood the glow-wire test at temperatures of 550°C, 650°C and 750°C with an application period of 30 seconds as specified in BS EN 60695-2-11: 2001.

9 Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

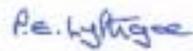
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