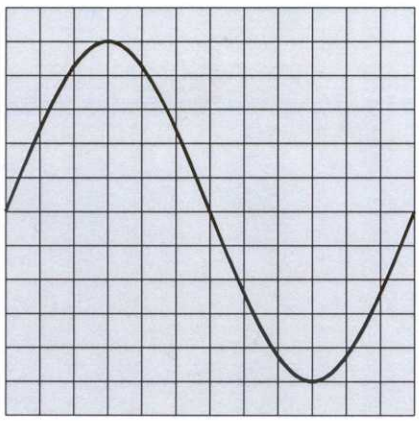


Test Report
PPR 1741

Qualification
RayGel 22-M-5
RayGel 24-M-5
PowerGel filled joint

CENELEC HD 623 S1: 1996
IEC 61238-1: 1993

Pages: 9
Appendix:1

Test done by: Claude Koeppe Technician	Signature:	Date: 26.01.04.
Test done or directed, Report prepared by: Norbert Schulz Application Engineer	Signature:	Date: 26.01.04
Released by: Stefan Rasser Product Manager	Signature:	Date: 26.1.04

tyco Electronics
Energy Division

Tyco Electronics Raychem GmbH
Finsinger Feld 1
D-85521 Ottobrunn
Munich, Germany
Tel. + 49 89 6089-0
Fax + 49 89 6096345

Contents

Appendix:

Load cycling print out

1. Test object

RayGel 22/24-M-5, PowerGel filled snap closure straight joints of two half shells to seal and insulate small electrical power cable connections. Each product includes a mechanical, insulated 5 core connector block, a cable tie, allen key, and installation instruction.

2. Test requirements

The complete product was tested in accordance with CENELEC HD 623 S1: 1996 „Specification for joints, stop ends and outdoor terminations for cables rated voltage 0.6/1.0kV“.

3. Conclusion

The low voltage joint RayGel 22/24-M-5 meets the requirements of CENELEC HD 623 S1: 1996, including the thermal stability requirement and an impact test at ambient temperature.

The tested joints are typical for common PVC, EPR or XLPE insulated cables with cross sections from 5 x 1.5mm² to 5 x 16mm² for round, solid or stranded, aluminium and copper conductors.

4. Description and test samples

4.1 Product description

The RayGel 22/24-M-5 joints are basically snap closures made of Polypropylene including a five core mechanical connector block. The closures are filled with a high performance silicone gel (Raychem PowerGel). If the two half shells are closed around the cable joint, the gel performs as a seal against moisture and performs also as an electrical insulation.

The included connector block is made of a Polypropylene housing incorporating five tinned brass alloy mechanical connectors.

4.2 Cables

The following cable types confirming to the German industrial standard VDE 0271.

NYY-J cable type discription:

Cu conductor, PVC insulation, PVC sheath, 3 phase, 1 neutral,1 earth.

type: - 5 x 1.5mm² NYY-J
manufacturer : - Wasskönig-Walter

type: - 5 x 6mm² NYY-J
manufacturer : - Wasskönig-Walter

type: - 5 x 16mm² NYY-J
manufacturer : - Kordes-Kabel

5. Installations

Product testing:

1 sample RayGel 22-M-5 was installed on a 5x1.5mm² cable
1 sample RayGel 22-M-5 was installed on a 5x 6mm² cable
1 sample RayGel 24-M-5 was installed on a 5x 6mm² cable
1 sample RayGel 24-M-5 was installed on a 5x16mm² cable

6. Test procedure product testing

Test sequence in accordance with CENELEC HD 623 S1:1996:

Test	HD 623 subclause
1. A.C.-voltage withstand in air	6.6.4
2. Insulation resistance in air	6.6.7
3. A.C.-voltage withstand in water	6.6.4
4. Insulation resistance in water	6.6.7
5. Load cycling in air 70°C conductor temp.	6.6.8
6. Load cycling in water 70°C conductor temp.	6.6.8
7. A.C.-voltage withstand in water	6.6.4
8. Insulation resistance in water	6.6.7

6.1 A.C.-voltage withstand in air

An A.C.-voltage of 4kV / 50Hz was applied for a time of one minute on the bundled conductors. The same voltage was applied again between each phase core in turn and all other phase cores.

Requirement: No insulation breakdown

Result: All joints passed the test.

6.2 Insulation resistance in air

The insulation resistance was measured between each phase core in turn and all other phase cores. The insulation resistance was measured at ambient temperature at 500 volts D.C.

Requirement: insulation resistance >50MΩ

Result : All joints passed the test. The values of the insulation resistance were measured with >50MΩ

6.3 A.C.-voltage withstand in water

On all samples the outer sheaths of the cables were removed about 50mm after the end of the joints for a length of 50mm ("window cut"). Thus water can penetrate into the core crutch and simulated a sheath damage during the tests. All further tests were done with this removed cable sheath.

The test samples were immersed in a water bath 1m below the water surface.

An A.C.-voltage of 4kV / 50Hz was applied for a period of one minute between the bunched phase cable cores and the grounded water bath. The voltage was also applied between each phase core in turn and all other phase cores, while the other phase cores were connected together and grounded to the same potential as the water bath.

Requirement: No insulation breakdown

Result: All joints passed the test.

6.4 Insulation resistance in water

The test samples were still immersed in a water bath 1m below the water surface.
The insulation resistance was measured between the phase cable cores and the grounded water bath. The resistance was also measured between each phase core in turn and all other phase cores, while the other phase cores were connected together and grounded to the same potential as the water bath. The insulation resistance between each core phase and the other not grounded core phases was measured as well.
The insulation resistance was measured at ambient temperature at 500 volts D.C. after a voltage stress of one minute.

Requirement: insulation resistance >50MΩ

Result : All joints passed the test. The values of the insulation resistance were measured with >50MΩ

6.5 Load cycling in air

The test loops were subjected to 63 heating cycles under ambient conditions. Each cycle consisted of a 5 hours current heating and a 3 hours cooling period. This is a test temperature of 70°C for cable type NYY-J.(VDE 0271)

A temperature regulator type EUROTHERM regulated the current. It was programmed to perform a three hours linear temperature rising period, followed by a constant temperature of 70°C for a time period of two hours before the cooling period.

Requirement: No insulation breakdown

Result: All joints passed the test.

6.6 Load cycling in water

The test loops were subjected again to 63 heating cycles as described in 6.5. The joints were immersed in a grounded water bath 1m below the water surface. Each cycle consisted of a 5 hours heating and a 3 hours cooling period. The temperature was measured outside the water according to CENELEC HD 623.

Requirement: No insulation breakdown

Result: All joints passed the test.

6.7 A.C.-voltage withstand in water

The test samples were still immersed in a water bath 1m below the water surface.

An A.C.-voltage of 4kV / 50Hz was applied for a period of one minute between the bunched phase cable cores and the grounded water bath. The voltage was also applied between each phase core in turn and all other phase cores, while the other phase cores were connected together and grounded to the same potential as the water bath.

Requirement: No insulation breakdown

Result: All joints passed the test.

6.8 Insulation resistance in water

The test samples were still immersed in a water bath 1m below the water surface.

The insulation resistance was measured between the phase cable cores and the grounded water bath. The resistance was also measured between each

phase core in turn and all other phase cores, while the other phase cores were connected together and grounded to the same potential as the water bath. The insulation resistance between each core phase and the other not grounded core phases was measured as well.

The insulation resistance was measured at ambient temperature at 500 volts D.C. after a voltage stress of one minute.

Requirement: insulation resistance >50MΩ

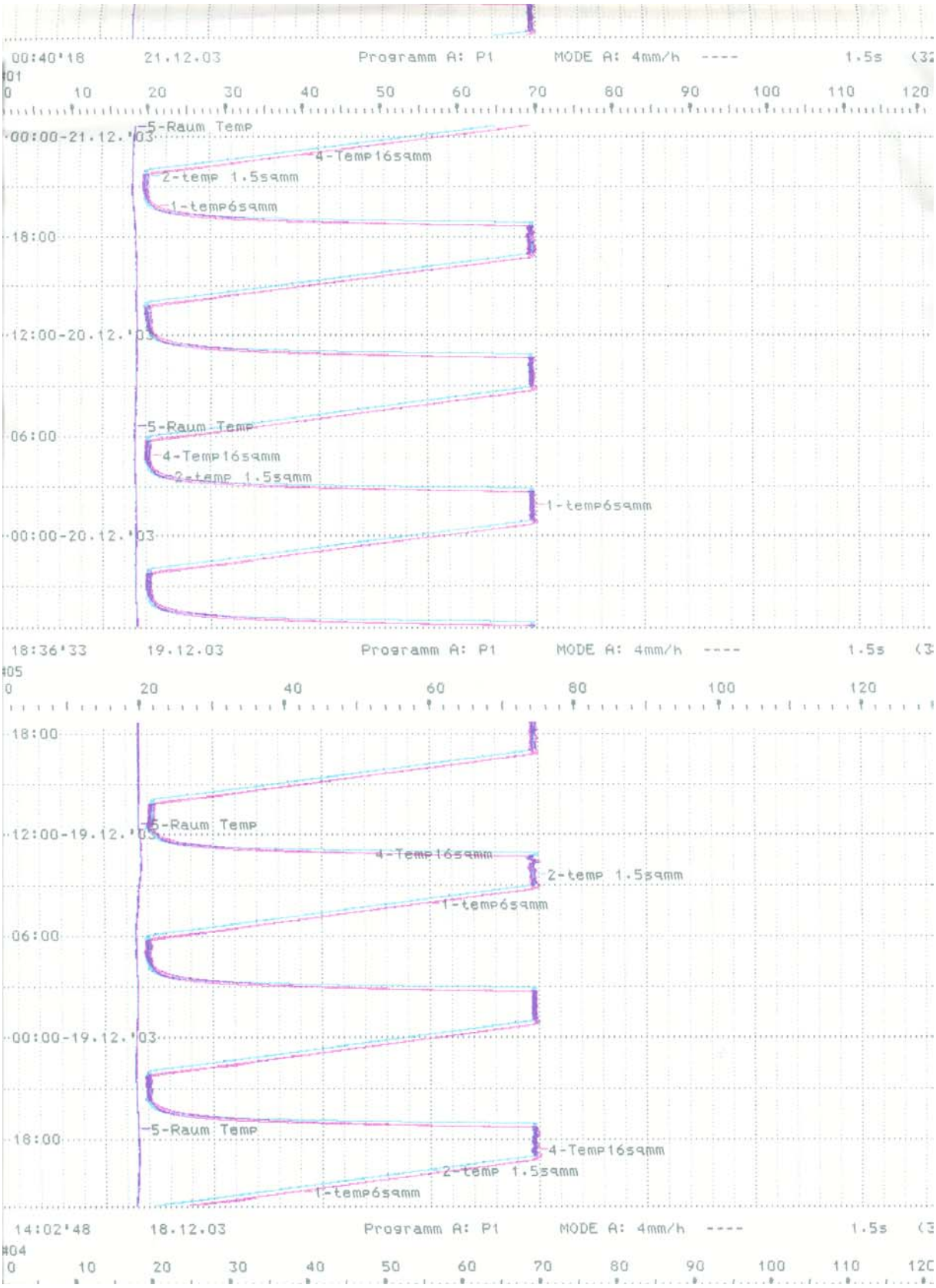
Result : All joints passed the test. The values of the insulation resistance were measured with >50MΩ

7. Equipment and environmental conditions

Equipment used for measurements:

Insulation resistance meter:	BBC Metriso 5000
AC voltage breakdown detector:	Schuntermann & Benninghoven P1000
Temperature regulator:	Eurotherm A70915
AC current meter:	HEME LH2040
Temperature recorder:	Siemens Multireg C1732

Environmental condition during installation and test:
Ambient temperature: 18°C … 20°C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-5-Raum Temp
00:00-21.12.'03
4-Temp16sqmm
2-temp 1.5sqmm
1-temp6sqmm
18:00
12:00-20.12.'03
06:00
-5-Raum Temp
4-Temp16sqmm
2-temp 1.5sqmm
1-temp6sqmm
00:00-20.12.'03
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4-Temp16sqmm
2-temp 1.5sqmm
1-temp6sqmm
06:00
00:00-19.12.'03
18:00
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4-Temp16sqmm
2-temp 1.5sqmm
1-temp6sqmm
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0 10 20 30 40 50 60 70 80 90 100 110