

Test Report

IB-13-8-085

about the electrostatic properties
of the BFM[®] material Seeflex 040AS
and its use in potentially explosive areas

(Translation)

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Editor

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(Translation)**1 Order**

- 1.1 Customer: BFM Global Ltd, Beach Haven 0749, Auckland,
New Zealand
- 1.2 Supplier: IBExU Institut für Sicherheitstechnik GmbH, Freiberg,
Germany
- 1.3 Delivery of the test sample: 21 August 2013

2 Test object, origination

In the scope of the Reports IB-10-8-058 [1] and IB-12-8-052 [2] as well as the Addition IB-13-8-029 [3] BFM[®] connectors of 4 different flexible materials (Seeflex 040, Seeflex 400W, LM4 and Seeflex 040E) were examined for the BFM Global Ltd in Auckland (New Zealand) with regard to the electrostatic behaviour.

The following material sample was delivered for the examination which was carried out here:

- BFM[®] material Seeflex 040AS (clear ether based thermoplastic polyurethane alloy with antistatic infusion): material sample of 30 cm x 20 cm, thickness = 1,1 mm

3 Execution of the tests and test results**3.1 Measuring conditions**

The measuring was carried out in a conditioned room with the following parameters:

- Test temperature: 23 °C
- Relative humidity: 30 %

- Before the tests: storage of the material sample for at least 24 hours under the mentioned conditions

3.2 Surface resistance and volume resistivity

Test standards: IEC 93:1993, IEC 167:1993

Measuring instrument: Tera Ohm-Meter F-H12.020 of company Knick Elektronische Messgeräte GmbH & Co. KG (test instrument no.: 0209)

3.2.1 Surface resistance

Test electrode: parallel electrodes according to IEC 167

Electrode length l: 10 cm

Electrode distance a: 1 cm

Measuring results at an instrument voltage of 500 V:

Surface resistance: $1.6 \cdot 10^9 \Omega$

Surface resistivity: $1.6 \cdot 10^{10} \Omega$

3.2.2 Volume resistivity

Test electrode: circular electrode

Electrode surface: 20 cm^2

Volume resistivity at

Instrument voltage = 100 V: $6.6 \cdot 10^8 \Omega \cdot \text{m}$

Instrument voltage = 500 V: $1.7 \cdot 10^8 \Omega \cdot \text{m}$

4 Assessment of the measuring results

Seeflex 040AS is a dissipative material both with regard to the determined surface resistance and the volume resistivity. Dissipative substances and materials have a volume resistivity higher than $10^4 \Omega \cdot \text{m}$ but equal to or lower than $10^9 \Omega \cdot \text{m}$, or a surface resistance between $10^4 \Omega$ and $10^9 \Omega$ (measured at 23 °C and 50 % relative humidity), or a surface resistance between $10^4 \Omega$ and $10^{11} \Omega$ (measured at 23 °C and 30 % relative humidity) [4, 5].

In accordance with the test results and [1] the tested BFM[®] Material Seeflex 040AS can be used without restrictions in all dust explosion hazardous areas (dust explosion hazardous zones are possible both inside and outside the BFM[®] connector), if the mechanical design of the BFM[®] connector is as per [1] (length of the BFM[®] connector: 200 mm). BFM[®] connectors with a standard length up to 200 mm can also be used without restrictions in outer gas explosion hazardous areas of the zone 1 and 2, respectively (outer zone 0 is not considered because it is normally not present there).

The aforementioned conclusions apply both to the free fall of explosive dust through the BFM[®] connectors and to the pneumatic transport.

Larger hose lengths

At the pneumatic transport [6] and also at the free fall of dusts an increasing charging of the hoses at increasing distance from the spigot (flange) has to be anticipated with an increasing hose length of the homogeneous hose materials.

Because the material Seeflex 040AS is dissipative, but the resistances are still relatively high, this material can be used in explosive dust atmospheres up to a hose length of maximum 2 m in the free fall (Up to this length additional tests are not necessary.). Particularly at dusts with very high resistances and at a very dry atmosphere (air) the risk of dangerous charging increases with an increasing hose length.

In the case of the material Seeflex 040AS, BFM[®] connectors with a length up to 2 m can also be used at the free fall at an outer explosive gas atmosphere of the zone 1 and 2.

At the pneumatic dust transport at which considerably higher charging can arise the BFM[®] connectors made of Seeflex 040AS can be used only with a standard length up to 200 mm.

Literature:

- [1] Test Report IB-10-8-058 about the electrostatical properties of the BFM[®] connectors Seeflex 040, Seeflex 400W and LM4 and their use in potentially explosive areas,
IBExU Institut für Sicherheitstechnik GmbH, Freiberg, 08 October 2010
- [2] Test Report IB-12-8-052 about the electrostatic properties of the BFM[®] material Seeflex 040 E and its use in potentially explosive areas,
IBExU Institut für Sicherheitstechnik GmbH, Freiberg, 24 July 2012
- [3] Addition IB-13-8-029 to the Test Reports IB-10-8-058 and IB-12-8-052: BFM[®] connectors of Seeflex 020 and Seeflex 020E as well as larger hose lengths
IBExU Institut für Sicherheitstechnik GmbH, Freiberg, 11 March 2013
- [4] TRBS 2153: Technische Regeln für Betriebssicherheit - Vermeidung von Zündgefahren infolge elektrostatischer Aufladungen, Februar 2009
- [5] Technical Report CLC/TR 50404: Electrostatics – Code of practice for the avoidance of hazards due to static electricity, June 2003
- [6] Blum, C., M. Glor, C.-D. Walther und W. Fath: Elektrostatische Zündgefahren beim pneumatischen Transport brennbarer Stäube durch isolierende oder ableitfähige Rohre und Schlauchleitungen,
VDI-Berichte Nr. 2182, S. 163-170, Düsseldorf: VDI-Verlag 2012