Test report | Surface resistance

1. Introduction

Filcoflex B.V. manufactures flexible connections for the food industry. In many applications, the flexible connection must comply to certain propeties regarding electrostatic energy in relation to ATEX.

IMQ S.p.A was commissioned to develop and conduct a suitable test procedure for the evaluation of various flexible materials named in chapter 2, hereinafter collectively referred to as the "materials", to test the surface resistance. These materials were tested by Fabio Elli and approved by Manuela Grassi of IMQ S.p.A and were released at the 18th of November in 2019.

Whenever this test report mentions "supplier", this refers to Filcoflex B.V.'s (raw) material supplier.

2. Tested materials

For these tests the following materials were used and tested:
- PU-MAG08

The tested specimens are thin sheets of non-metallic material selected, sent and provided by supplier.

The dimensions of the sample sheets are 210×300mm.

3. General data

3.1 Sample details

Samples received on:	15 November 2019 Items sampled and sent by supplier
IMQ samples reference:	BEM 97794
Samples tested amount:	1 sample
Samples accepted on:	15 November 2019
Object under analysis recognition:	Not carried out Unless otherwise stated, the characteristics of the materials were taken from supplier description and were not verified by the laboratory.

3.2 Testing location

Testing dates:	15 to 18 November 2019
Testing laboratory:	IMQ S.p.A. - Via Quintiliano, 43 - I-20138 Milano
Testing site:	Via Quintiliano, 43 - I-20138 Milano

3.3 Environmental conditions

Ambient temperature:	23,5°C
Relative humidity:	32,0% RH
Atmospheric pressure:	1010 mBar

4. Test setup

4.1 Possible case verdicts

Along with the volume resistance, the surface resistance of a material determines its electrostatic properties. In the table below, the value ranges and their meaning regarding the material for both these resistances are stated.

These tests should be performed at a relative humidity of 30% RF (±5%) and a temperature of 25°C (±5°C).

	Surface resistance	Volume resistance
Insulating	> 10^{11} Ω	> 10^{9} Ωm
Electrostatically dissipative	10^{4} Ω up to 10^{11} Ω	10^{4} Ωm up to 10^{9} Ωm
Non-conductive	< 10^{4} Ω	< 10^{4} Ωm

4.2 Test performed

Test performed	Clause	Sample amount
Surface resistance test of parts of non-metallic materials	26.13	1

4.3 General remarks

Throughout this report, a comma is used as the decimal separator.

Unless otherwise stated, the uncertainties for the tests and measurements are evaluated in accordance with the IMQ Operational Instruction IO-LAB-001, IO-LAB-004 and IO-LAB-U12.

The uncertainties evaluation has been carried out in accordance with IECEx OD 012 (only when the IECEx scheme is applicable) or IEC guide 115 "Application of uncertainty of measurement's to conformity assessment activity in the electrotechnical sector" and IECEE OD 5014.

IMQ's internal procedure PG-037 ensures that the requirements for traceability of calibrations, of all test equipment requiring calibration, and the calibration intervals are met.

The ability or reliability of the materials to perform their intended function in a particular application has not been investigated.

Unless otherwise specified, warnings, installation instructions and/or user manuals provided with the samples have been checked in Italian or English.

Filcoflex B.V. declines any responsibility derived from missing or incorrect information provided by the supplier.

5. Test results

5.1 Dimensions

Sample dimensions:	210×300 mm
Electrode 1 Length:	100 mm
Electrode 2 Length:	100 mm
Electrode 1 Width:	1 mm
Electrode 2 Width:	1 mm
Electrode internal distance:	10 mm

5.2 Desired conditions

The table below shows the desired conditions for the room during the surface resistance tests. The IMQ test specialists have started regulating these factors of the room 24 hours prior to testing.

Room temperature:	23 °C
Relative humidity:	30% RH
Duration:	24 hours

5.3 Conditions during test

After regulating the conditions in the room for 24 hours, the measured conditions during the tests can be found below.

Room temperature:	23,5 °C
Atmosphere pressure:	1010 mBar
Relative humidity:	32,0% RH
Direct Voltage applied:	500 V
Test duration:	65 seconds

5.4 Surface resistance test result

Shown below are the measurements of the tests. All tests were performed under the conditions mentioned in chapter 5.3.

Sample	Surface resistance
1	$6{,}41\times10^{10}\ \Omega$ [1]
1	$9{,}06\times10^{10}\ \Omega$ [2]

For each electrode, prior to conditioning, the resistance is checked, in order to verify that the electrode is actually conductive (<10 Ω)

See appendix in chapter 9 for the photographic documentation.

6. Measurement equipment

Cause	Testing	Equipment ID	Range used	Lastest calibration	Next calibration
26.13	Surface resistance test	Baro-Thermohygrometer GSG-GFTB 100 S-05773	T: (-25 - +70) °C U: (10-70)% RH	18 Aug. 2019	31 Aug. 2020
26.13	Surface resistance test	Caliper Mitutoyo - CD-15CPX S-06538	(0-150) mm	22 Feb. 2019	19 Feb. 2020
26.13	Surface resistance test	Megaohmmeter SEFELEC - M1500P S-01659	100kΩ - 1TΩ	28 Mar. 2019	31 Mar. 2020
26.13	Surface resistance test	Chronometer Hanhart - Profil 2 S-05009	-	19 Mar. 2019	31 Mar. 2020
26.13	Surface resistance	Surface test apparatus - P-03503	-	-	-
26.13	Surface resistance test	Metallic ruler ABC - H48740500 P-02866	(0-0,5) m	08 Jan. 2019	31 Jan. 2020

[1] Test is performed with the "Silver stripes" method
[2] Test is performed with surface resistance apparatus P-03503

7. Measurement uncerainties

The measurement uncertainties stated in this document have been determined according to the ISO/IEC guide 98 and to EA-4/16. Usually, they have been estimated as expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of approximately 95%. Normally, this factor k is 2

Operational instruction	Test	Uncertainty	Range
IO-LAB-U01	Temperature (for regulating)	2 °C	-
IO-LAB-U02	Relative humidity (for regulating)	7% RH	-
IO-LAB-U04	Dimensions	0,05 mm 0,10 mm 0,5% 1,2%	≤1 mm 1 - 25 mm > 25 mm > 150 mm
IO-LAB-U07	Test duration	1%	-
IO-LAB-U08	Test Voltage	2,5%	DC - 1 kHz
IO-LAB-U12	Electric resistance in DC	8% 15%	1MΩ - 1 TΩ > 1 TΩ

8. Summary

As the test results in chapter 5.4 state, the measured surface resistance is less than or equal to (≤) 9,06 $\times 10^{10}\Omega$ for the tested materials.

Meaning that, according to the electrostatic properties data as shown in chapter 4.1, the surface resistance of the materials can be classified as electrostatically dissipative.

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Function: Managing Director
Date: 29/10/2026



Disclaimer
The information contained herein is believed to be accurate as of the date of this document. If any of the above mentioned regulations change after the date of declaration, this information is no longer valid.

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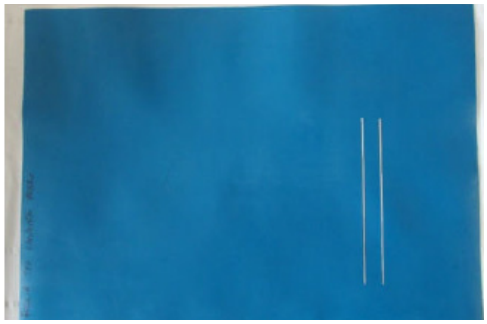
9. Appendix

9.1 Reference documents

Document	Date	Title
EN 60079-0	2018	Explosive atmospheres Part 0: Equipment - General requirements
EN 60079-32-2	2015	Explosive atmospheres Part 32-2: Electrostatic hazards - Tests

These attachments may include schematics, components information, component test reports, particular standards test reports, standard test reports, information from accompanying docuements and similar.

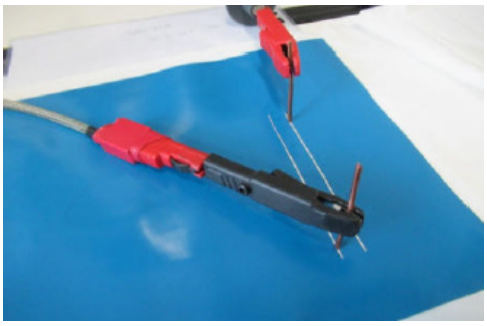
9.2 Photographic documentation



Sample 1 | Prepared for test



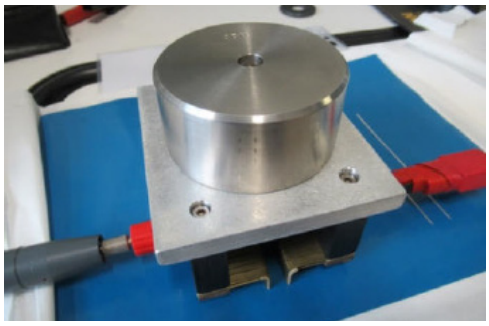
Sample 1 | Test setup



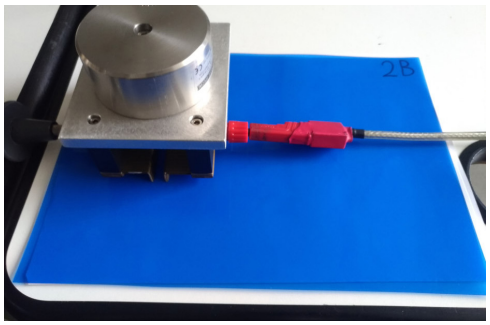
Sample 1 | Under test (Silver stripes)



Sample 1 | Test result (Silver stripes)



Sample 1 | under test (Test apparatus)



Sample 2B | Test setup



Sample 2B | Results