Wilhelm-Jost-Institut

Institute for applied physical-chemical Process- and Safety engineering

Research- and Test Laboratory of the INBUREX Consulting GmbH

Test Report

Determination of the safety characteristics

of different Poly Urethane samples

for Filcoflex B.V.

5171PW Kaatsheuvel,

Netherlands

Project-No. TL/12639/18

Möhnesee, 08 August 2018

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Summary of results page: 1 of 2

Safety characteristics of PU-UF 03 (0.36 mm)

Test No.	Test Methode	Test Result
TL12639OW01	Surface resistance	$5 \times 10^{12}\ \Omega$ The sample can be classified as non conductive.
TL12639DW01	Volume resistance	$4*10^{12}\ \Omega m$ The sample can be classified as non conductive.
TL12639PBD01	possible generation of propagation brush discharges	Propagating brush discharges could be determined with respect to the described test procedure.

Safety characteristics of PKPU (2.0 mm)

Test No.	Test Methode	Test Result
TL12639OW02	Surface resistance	$2 \times 10^{11}\ \Omega$ The sample can be classified as electrostatically dissipative.
TL12639DW02	Volume resistance	$2*10^{10}\ \Omega m$ The sample can be classified as non conductive.
TL12639PBD02	possible generation of propagation brush discharges	No propagating brush discharges could be determined with respect to the described test procedure.

Place, Date Möhnesee, 08 August 2018

Signatures

i.A. Ewa Müller
Laboratory Technician

i.V. Dipl.-Ing. Martin Gosewinkel
Manager Test Laboratory

INBUREX CONSULTING GmbH August-Str. 59067 Hamm

Test results are obtained exclusively with the substance provided for the purpose of investigation by the customer and are based on the sample state at the time of analysis. Further conclusions and evaluations based on these findings are exclusively in the customer's sphere of responsibility. It is only permitted to pass the complete test report without the written consent of the test laboratory, but not in part.

Summary of results page: 2 of 2

Safety characteristics of PU-UF15 (1.49 mm)

Test No.	Test Methode	Test Result
TL12639OW03	Surface resistance	$2 \times 10^{11}\ \Omega$ The sample can be classified as electrostatically dissipative.
TL12639DW03	Volume resistance	$5*10^{10}\ \Omega m$ The sample can be classified as non conductive.
TL12639PBD03	possible generation of propagation brush discharges	No propagating brush discharges could be determined with respect to the described test procedure.

Place, Date Möhnesee, 08 August 2018

Signatures

i.A. Ewa Müller
Laboratory Technician

INBUREX CONSULTING GmbH August-Thyssen-Str. 59067 Hamm

i.V. Dipl.-Ing. Martin Gosewinkel
Manager Test Laboratory

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Determination of the Surface resistance and surface resistivity according to IEC 60093/EN 1149 and TRGS 727

Test Report No.	TL/12639/18_OW01	**Classification**	Highly confidential
Sample	PU-UF 03 (0.36 mm)	**Client**	Filcoflex B.V.
Sample No.	12639/1		5171 PW Kaatsheuvel, Netherlands
Test No.	TL12639OW01	**Contact person**	Mr. Werner van Loon

Test method

As measuring tool a Teraohm-Meter from the company ELTEX has been used. The surface resistance is the electrical resistance between two electrodes contacting the same surface of a material or object. It is depending on the geometry of the electrode arrangement and is commonly expressed in ohms. The surface resistivity is the resistance across opposite sides of a surface of unit length and width and is commonly expressed also in [Ω] or in [Ωm]. With regard to the TRGS 727 respectively IEC 60079-32-1 materials or objects can be classified according to their surface resistance at test conditions of 23 °C and 30 % relative humidity as **conductive** ($\leq 10^4\Omega$), **electrostatically dissipative** ($10^4\Omega$ up to $10^{11}\Omega$) or **non-conductive** ($>10^{11}\Omega$).

Remarks

The room temperature was 29 °C, the relative humidity 35 %rF.

Results

Test	Surface resistance [Ω]
1	$5*10^{12}$
2	$4*10^{12}$
3	$5*10^{12}$
4	$6*10^{12}$
5	$6*10^{12}$

The sample can be classified as **non conductive**.

(Median value: $5*10^{12}\,\Omega$, at a measuring voltage of 100 V)

Determination of the volume resistance and volume resistivity according to IEC 60093/EN 1149-1 and TRGS 727

Test Report No.	TL/12639/18_DW01	**Classification**	Highly confidential
Sample	PU-UF 03 (0.36 mm)	**Client**	Filcoflex B.V.
Sample No.	12639/1		5171 PW Kaatsheuvel, Netherlands
Test No.	TL12639DW01	**Contact person**	Mr. Werner van Loon

Test method

As measuring tool a Teraohm-Meter from the company ELTEX has been used. The volume resistivity is the electrical resistance between two electrodes contacting the top and bottom side of a material or object. It is depending on the geometry of the electrode arrangement and is commonly expressed in ohms.
Materials or objects can be classified according to their volume resistivity at test conditions of 23 °C and 50 % relative humidity as **conductive** ($\leq 10^4 \Omega$m), **electrostatically dissipative** ($10^4 \Omega$m up to $10^9 \Omega$m) or **non conductive** ($>10^9 \Omega$m).

Remarks

The room temperature was 29 °C, the relative humidity 35 %rF.

Results

Test	Volume resistance [Ω]	Factor [m]	Volume resistivity [Ωm]
1	$5*10^{11}$	7.9	$4*10^{12}$
2	$1.2*10^{12}$	7.9	$9.5*10^{12}$
3	$5*10^{11}$	7.9	$4*10^{12}$
4	$1.4*10^{12}$	7.9	$1.1*10^{13}$
5	$5*10^{11}$	7.9	$4*10^{12}$

The sample can be classified as **non conductive**.

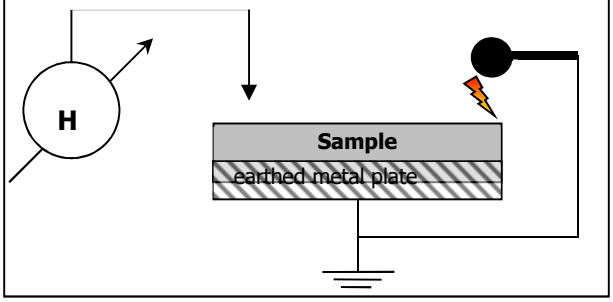
(Median value: $4*10^{12}$ Ωm)

Determination of the possible generation of propagation brush discharges

Test Report No.	TL/12639/18_PBD01	**Classification**	Highly confidential
Sample	PU-UF03 (0.36 mm)	**Client**	Filcoflex B.V.
Sample No.	12639/1		5171 PW Kaatsheuvel, Netherlands
Test No.	TL12639PBD01	**Contact person**	Mr. Werner van Loon

Test method

Principle of the test method



The sample is located on an earthed metal plate.

It was charged by means of a high voltage source (electrostatic gun, U = 70 kV) for about 120 sec.

Then it was tried to initiate a propagating brush discharge by decreasing the distance between an earthed metal sphere and the charged sample.

Remarks The room temperature was 30 °C, the relative humidity 35 %rF.

Results

Test	Determination of a propagating brush discharges
1 (220 mm x 360 mm)	Propagating brush discharges could be determined with respect to the described test procedure.
2 (440 mm x 360 mm)	Propagating brush discharges could be determined with respect to the described test procedure.

Determination of the Surface resistance and surface resistivity according to IEC 60093/EN 1149 and TRGS 727

Test Report No.	TL/12639/18_OW02	**Classification**	Highly confidential
Sample	PKPU (2.0 mm)	**Client**	Filcoflex B.V.
Sample No.	12639/2		5171 PW Kaatsheuvel, Netherlands
Test No.	TL12639OW02	**Contact person**	Mr. Werner van Loon

Test method

As measuring tool a Teraohm-Meter from the company ELTEX has been used. The surface resistance is the electrical resistance between two electrodes contacting the same surface of a material or object. It is depending on the geometry of the electrode arrangement and is commonly expressed in ohms. The surface resistivity is the resistance across opposite sides of a surface of unit length and width and is commonly expressed also in [Ω] or in [Ωm]. With regard to the TRGS 727 respectively IEC 60079-32-1 materials or objects can be classified according to their surface resistance at test conditions of 23 °C and 30 % relative humidity as **conductive** ($\leq 10^4\Omega$), **electrostatically dissipative** ($10^4\Omega$ up to $10^{11}\Omega$) or **non-conductive** ($>10^{11}\Omega$).

Remarks

The room temperature was 29 °C, the relative humidity 35 %rF.

Results

Test	Surface resistance [Ω]
1	$3*10^{11}$
2	$2*10^{11}$
3	$2*10^{11}$
4	$1*10^{11}$
5	$1*10^{11}$

The sample can be classified as **electrostatically dissipative**.

(Median value: $2*10^{11}\,\Omega$, at a measuring voltage of 100 V)

Determination of the volume resistance and volume resistivity according to IEC 60093/EN 1149-1 and TRGS 727

Test Report No.	TL/12639/18_DW02	**Classification**	Highly confidential
Sample	PKPU (2.0 mm)	**Client**	Filcoflex B.V.
Sample No.	12639/2		5171 PW Kaatsheuvel, Netherlands
Test No.	TL12639DW02	**Contact person**	Mr. Werner van Loon

Test method

As measuring tool a Teraohm-Meter from the company ELTEX has been used. The volume resistivity is the electrical resistance between two electrodes contacting the top and bottom side of a material or object. It is depending on the geometry of the electrode arrangement and is commonly expressed in ohms.
Materials or objects can be classified according to their volume resistivity at test conditions of 23 °C and 50 % relative humidity as **conductive** ($\leq 10^4 \Omega$m), **electrostatically dissipative** ($10^4 \Omega$m up to $10^9 \Omega$m) or **non conductive** ($>10^9 \Omega$m).

Remarks

The room temperature was 29 °C, the relative humidity 35 %rF.

Results

Test	Volume resistance [Ω]	Factor [m]	Volume resistivity [Ωm]
1	$1.3*10^{10}$	1.4	$1.8*10^{10}$
2	$1.4*10^{10}$	1.4	$2.0*10^{10}$
3	$1.5*10^{10}$	1.4	$2.1*10^{10}$
4	$1.5*10^{10}$	1.4	$2.1*10^{10}$
5	$1.4*10^{10}$	1.4	$2.0*10^{10}$

The sample can be classified as **non conductive**.

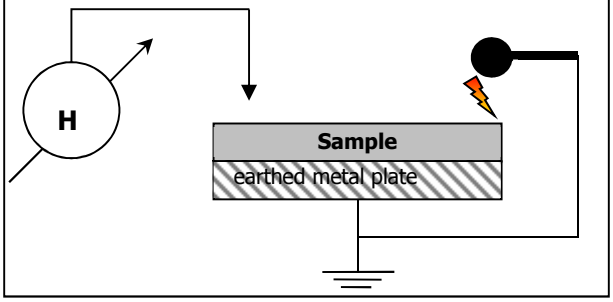
(Median value: $2*10^{10}$ Ωm)

Determination of the possible generation of propagation brush discharges

Test Report No.	TL/12639/18_PBD02	**Classification**	Highly confidential
Sample	PKPU (2.0 mm)	**Client**	Filcoflex B.V.
Sample No.	12639/2		5171 PW Kaatsheuvel, Netherlands
Test No.	TL12639PBD02	**Contact person**	Mr. Werner van Loon

Test method

Principle of the test method



The sample is located on an earthed metal plate.

It was charged by means of a high voltage source (electrostatic gun, U = 70 kV) for about 120 sec.

Then it was tried to initiate a propagating brush discharge by decreasing the distance between an earthed metal sphere and the charged sample.

Remarks The room temperature was 30 °C, the relative humidity 35 %rF.

Results

Test	Determination of a propagating brush discharges
1 (220 mm x 360 mm)	No propagating brush discharges could be determined with respect to the described test procedure.
2 (440 mm x 360 mm)	No propagating brush discharges could be determined with respect to the described test procedure.

Determination of the Surface resistance and surface resistivity according to IEC 60093/EN 1149 and TRGS 727

Test Report No.	TL/12639/18_OW03	**Classification**	Highly confidential
Sample	PU-UF 15 (1.49 mm)	**Client**	Filcoflex B.V.
Sample No.	12639/3		5171 PW Kaatsheuvel, Netherlands
Test No.	TL12639OW03	**Contact person**	Mr. Werner van Loon

Test method

As measuring tool a Teraohm-Meter from the company ELTEX has been used. The surface resistance is the electrical resistance between two electrodes contacting the same surface of a material or object. It is depending on the geometry of the electrode arrangement and is commonly expressed in ohms. The surface resistivity is the resistance across opposite sides of a surface of unit length and width and is commonly expressed also in [Ω] or in [Ωm]. With regard to the TRGS 727 respectively IEC 60079-32-1 materials or objects can be classified according to their surface resistance at test conditions of 23 °C and 30 % relative humidity as **conductive** ($\leq 10^4\Omega$), **electrostatically dissipative** ($10^4\Omega$ up to $10^{11}\Omega$) or **non-conductive** ($>10^{11}\Omega$).

Remarks

The room temperature was 29 °C, the relative humidity 35 %rF.

Results

Test	Surface resistance [Ω]
1	$2*10^{11}$
2	$2*10^{11}$
3	$2*10^{11}$
4	$6*10^{11}$
5	$7*10^{11}$

The sample can be classified as **electrostatically dissipative**.

(Median value: $2*10^{11}\,\Omega$, at a measuring voltage of 100 V)

Determination of the volume resistance and volume resistivity according to IEC 60093/EN 1149-1 and TRGS 727

Test Report No.	TL/12639/18_DW03	**Classification**	Highly confidential
Sample	PU-UF 15 (1.49 mm)	**Client**	Filcoflex B.V.
Sample No.	12639/3		5171 PW Kaatsheuvel, Netherlands
Test No.	TL12639DW03	**Contact person**	Mr. Werner van Loon

Test method

As measuring tool a Teraohm-Meter from the company ELTEX has been used. The volume resistivity is the electrical resistance between two electrodes contacting the top and bottom side of a material or object. It is depending on the geometry of the electrode arrangement and is commonly expressed in ohms.
Materials or objects can be classified according to their volume resistivity at test conditions of 23 °C and 50 % relative humidity as **conductive** ($\leq 10^4 \Omega$m), **electrostatically dissipative** ($10^4 \Omega$m up to $10^9 \Omega$m) or **non conductive** ($>10^9 \Omega$m).

Remarks

The room temperature was 29 °C, the relative humidity 35 %rF.

Results

Test	Volume resistance [Ω]	Factor [m]	Volume resistivity [Ωm]
1	$2.5*10^{10}$	1.9	$4.8*10^{10}$
2	$2.0*10^{10}$	1.9	$4.0*10^{10}$
3	$2.5*10^{10}$	1.9	$4.8*10^{10}$
4	$2.2*10^{10}$	1.9	$4.2*10^{10}$
5	$3.0*10^{10}$	1.9	$5.7*10^{10}$

The sample can be classified as **non conductive**.

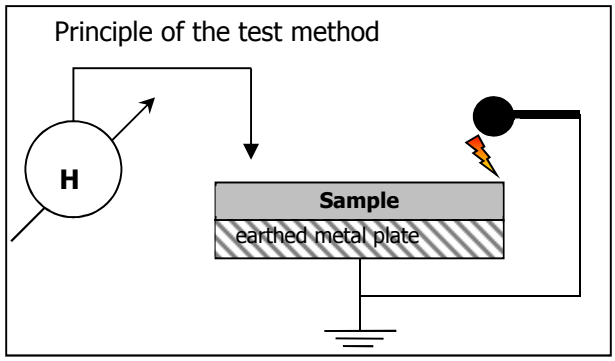
(Median value: $5*10^{10}$ Ωm)

Determination of the possible generation of propagation brush discharges

Test Report No.	TL/12639/18_PBD03	**Classification**	Highly confidential
Sample	PU-UF15 (1.49 mm)	**Client**	Filcoflex B.V.
Sample No.	12639/3		5171 PW Kaatsheuvel, Netherlands
Test No.	TL12639PBD03	**Contact person**	Mr. Werner van Loon

Test method

Principle of the test method



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Remarks The room temperature was 30 °C, the relative humidity 35 %rF.

Results

Test	Determination of a propagating brush discharges
1 (220 mm x 360 mm)	No propagating brush discharges could be determined with respect to the described test procedure.
2 (440 mm x 360 mm)	No propagating brush discharges could be determined with respect to the described test procedure.