



TECHNICAL REPORT

Test of Surface Resistance and Insulation Resistance of Extraction Arms.

DTI project no.: 781542-3

Scope:

This report covers the technical requirements related to the use of the extraction arms in areas where there are special requirements to ESD and/or ATEX.

ESD: Electrostatic discharge

ATEX: Equipment for Explosive Atmospheres



Title:

**Test of Surface Resistance and Insulation Resistance of
Extraction Arms**

Carried out for:

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Technical report no. 781542-3

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1. The task

An Electrostatic brush discharge from none metallic parts can act as a source of ignition when an explosive gas/air mixture is present. Charging of none metallic parts can typically occur when the parts are rubbed by dry clothes (e.g. during cleaning) or during operation when e.g. a rapid air flow pass the none metallic surface. To avoid such discharges, it is essential that the none metallic parts are designed with a limited surface resistance and furthermore the individual none metallic parts must not be isolated from each other. The end to end resistance through the full assembly must be limited.

Danish Technological Institute are requested to perform test on the submitted Extraction Arms in accordance with the requirements of the ATEX directive 2014/34/EU with test methods as specified by the electrical standards EN 60079-0:2012 §7.4.2 a) ref. testing to clause 26.13. or IEC 60079-0:2011 clause 7.4.2 a) ref. testing in clause 26.13. ESD requirements according to IEC 61340-5-1: 2016 are fulfilled at the same time.

Identical requirements on how to avoid electrostatically charging can be found in several other standards such as the none-electrical standards EN/ISO 80079-36: 2016 clause 6.7.5 and IEC TS 60079-32-1:2013 clause 13.3.4 ("*Explosive Atmospheres - Electrostatic Hazards- guidance*")

2. Products / samples covered by this assessment

This test and assessment covers the below listed four Alsident "main extraction systems":

1. System 50 Flex AS
2. System 50 AS
3. System 75 AS
4. System 100 AS

*) AS = Antistatic / ESD

The systems can be build up and combined in several variants including different lengths of flex hoses, different number of joints, joints with damper, different types of table-, wall and ceiling -mounts. Different types of hoods (dome / flat) and several types of suction nozzles/suction pens.

Alsident Systems designed in the antistatic version for use in Ex-areas are marked accordingly: **Ex II 1 GD**

Alsident System A/S have delivered all relevant test samples and a complete product catalogue (revision DK.09.2017) covering the different accessories available for the four main systems listed above.

3. Test Principle

The purpose of this test is to determine whether the extraction arms can be charged and thereby become an ignition source for explosive atmospheres.

Two types of tests are relevant:

3.1. Test of Surface Resistance of involved plastic materials

The requirement can be accomplished by adding a conductive filler to the plastic material to ensure that the electrical insulation resistance on the surface does not exceed $1\text{G}\Omega$ at 23°C ($\pm 2^\circ\text{C}$) at 50 % relative humidity ($\pm 5\%$) measured in accordance with EN 60079-0:2012, § 26.13.

Several types of conductive plastic materials and coatings are used for the different part in the extraction arms.

Datasheets for the used materials/coatings are delivered to Danish Technological Institute. Specifications of the used plastics and coatings are listed in **Appendix A** to this report.

3.2. Test of Insulation Resistance of Extraction Arms

The conductivity through the complete extraction arm are in addition relevant to secure that the electrical connection through separate parts, such as the flexible joints, are sufficient.

In accordance with IEC TS 60079-32-1 clause 13.3.4 a maximum value of $1\text{M}\Omega$ is preferable and values above $100\text{M}\Omega$ are only acceptable under special circumstances e.g. if strong charging mechanism are identified. Typical values will most often be between $10\text{k}\Omega$ and $100\text{M}\Omega$.

4. Treatment

Preparation of test samples: The samples have been cleaned and treated in a climate chamber. According to standard EN/IEC 60079-0:2012, clause 26.13, the specimens shall be treated/ conditioned for at least 24 hours at a temperature of $23^\circ\text{C} \pm 2^\circ\text{C}$ and at a relative humidity, that does not exceed $50\% \pm 5\%$.

The testing is done under the same conditions. The samples were placed in a climate chamber on 2nd. January 2018 at 10:30 The test was carried out the 3rd of January 2018 at 14:00 a.m.

5. Test Procedure

The test is carried out on the same conditions that the samples were treated under, $23\text{ }^{\circ}\text{C} \pm 2^{\circ}\text{C}$, and a relative humidity that does not exceed $50\% \pm 5\%$.

Two parallel electrodes made of "Silver paint" are painted on the delivered test samples with dimensions as shown in figure 1.

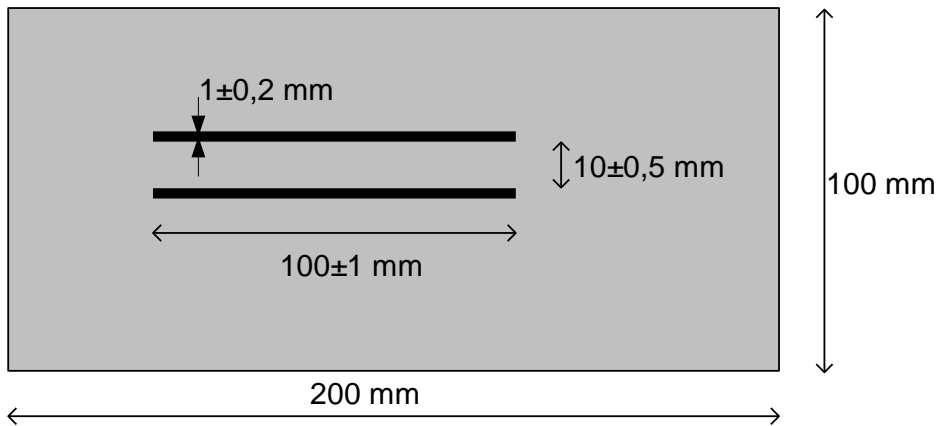


Figure 1: Dimensions for conductive electrodes painted on the samples

A direct voltage of $500\text{ V} \pm 10\text{ V}$ is applied between the electrodes for 65 seconds ± 5 seconds. Thereafter the surface resistance is measured.

For resistance below $0,5\text{ K } \Omega$ an ordinary ohm-meter can be used.

5.1. Measured surface resistances:

Sample	Test Voltage [volt]	Surface resistance measured [Ohm]	Demand: $\leq 10^9$ (1 G Ω) Pass /failed
1: Plastic material for flexible hoses	500	78 Ω	Pass
2: Plastic material for all joints (all sizes)	500	120 Ω	Pass
3: Plastic material for hoods (flat or dome)	500	83 Ω	Pass
4: Plastic material for all tubes	500	150 Ω	Pass
5: Coating for aluminium tubes *)	500	1,3 Ω	Pass

*) Measurement has been done on a coated aluminium tube

Demand: Surface does not exceed 1GΩ at 23° C (± 2 °C) at 50 % relative humidity (± 5 %, Test time 65 seconds).

5.2. Measured Insulation Resistance of Extraction Arms

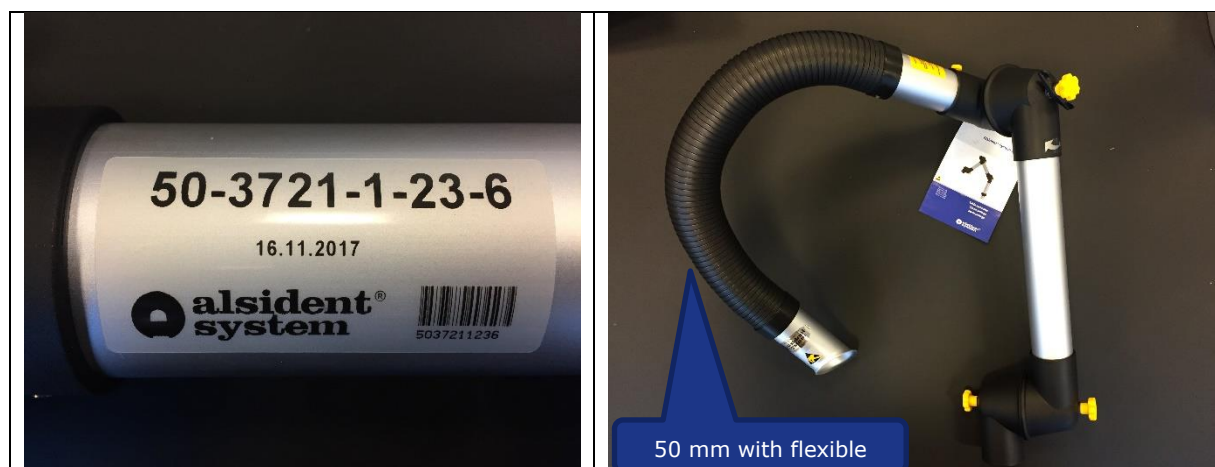
The extraction arms are factory mounted with pre-attached earthing wire. If the extraction arm is mounted into an ESD working area the pre-attached earthing wire is replaced with a new earthing wire with a built in 1MΩ resistance. This special ESD earthing wire is delivered with the arm in a separate plastic back.

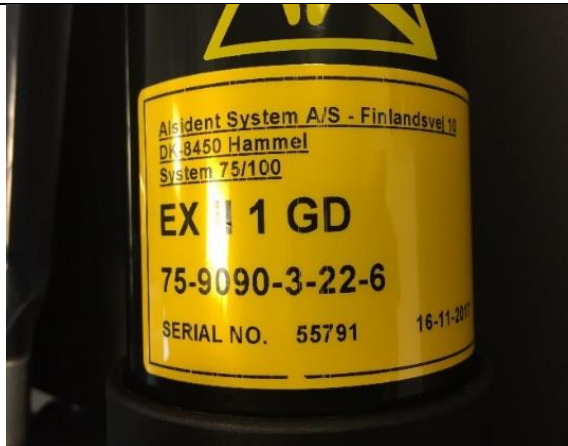
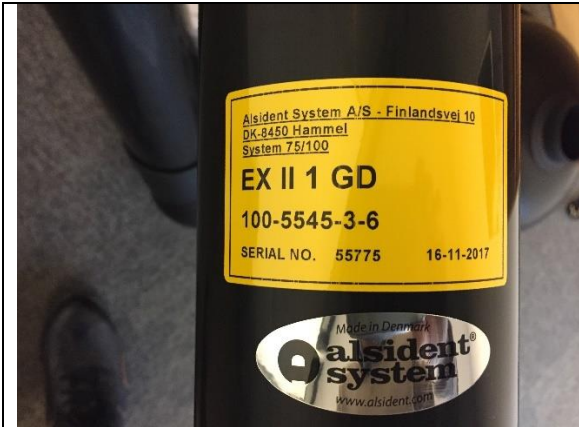
The resistance in the extraction arms has been measured as the "end-to-end" resistance from the factory mounted earthing wire to the opposite end of the suction arm on the accessories mounted e.g. the hood. The resistance through several combinations of suction arms, hoods and flexible arms has been measured with the results as specified below.

End to end resistance				
Test	System 50 Flex AS	System 50 AS	System 75 AS	System 100 AS
1 (multimeter)	10 kΩ	130 kΩ	16 kΩ	8,2 kΩ
2 (at 500 V test voltage)	55 kΩ	4,7 kΩ Measured to mounted aluminum hood	9 kΩ	7,2 kΩ

Demand: Values in the range 10 kΩ to 100 MΩ.

6. Picture report








For ESD working areas the pre-attached earthing wire is replaced with a new earthing wire with a built in 1MΩ resistance.

7. Test equipment used

Used test equipment	Equipment no:	Last Calibration	Next Calibration
Test room (50 ±5) % RH, (23±2) °C	32T 13.60	2017-05-10	2018-05

Conductive Silver Paint: 3863 "Loc-tite"	NA	NA	NA
NORMA UNILAP ISO X	270-A-2442	Calibrated before test with 1GΩ 1% fixed resistor	Calibrated before use
FLUKE Multimeter type 179	130406	31.05.2016	31.05.2018
Measurement of humidity and temperature in test room.			

8. Conclusion

The testing of the surface resistance of the extraction systems: System 50 Flex AS, System 50 AS, System 75 AS and System 100 AS, shows that the measured surface resistance for all plastic materials and coatings - as listed under section 5.1 of this report - are below the required 1 GΩ.

The measurement of the end- to end insulation resistance of extraction arms including various numbers of hoods / suction pen ´s clarifies that there is an appropriate electrical connection between the separate parts to ensure static discharge.

The tested Alsident extraction systems fulfils the antistatic requirements for use in Ex-areas and are marked accordingly: Ex II 1 GD

ESD requirements according to IEC 61340-5-1 are fulfilled at the same time.

Equipment labeled with Category 1 GD can be used in Zone 0, 1 and 2, and in Zone 20, 21 and 22. In its risk assessment, the end user may refer that the suction arms meet the antistatic requirements according to the IEC TS 60079-32-1: "*Explosive Atmospheres - Electro-static Hazard Guidance*"

Taastrup, 18th January 2018


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