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TECHNICAL REPORT

concerning

Insulation Resistance Test of Extraction Arms

Carried out for:

Alsident System A/S
Finlandsvej 10
DK-8450 Hammel
Att.: Berit Sand

Date: 2004-09-28
This report was prepared by: Ricky Lausen
Our Reference No.: 1211854
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Test Principle

The purpose of this test is to determine whether a non-metallic material is capable of being charged to produce brush discharges and thus being able to act as a source of ignition to an explosive gas/air or steam/air mixture.

The equipment should be designed in a manner so as to avoid any danger of ignition due to electrostatic charges during use, maintenance and cleaning.

This requirement is satisfied by suitable selection of material so that the insulation resistance does not exceed 1GΩ at 23°C (±2°C) and 50% relative humidity (±5%).

The test has been carried out in accordance with EN 13463-1:2001 part 13.3.4.7. Non-electrical equipment for potentially explosive atmospheres – Part 1 Basic method and requirements. Part 13.3.5. which refers to test procedure in EN 50014:1997 part 23.4.7.7. Electrical apparatus for potentially explosive atmospheres. General requirements.

In order to avoid that the accumulated charge turns into a source of ignition, the parts must be earthed. In accordance with DX/CLC/TR 50404:2003 part 11.3.4 Electrostatics code of practice for the avoidance of hazards due to static electricity, the recommendation is an earth resistance of less than $10^6\Omega$.

The end-to-end resistance is measured in accordance with relevant parts of IEC 61340-4-1: 2003 Standard test methods for specific applications – Electrical resistance of floor coverings and installed floors.

Test Parts

The extraction arms from Alsident Systems are used to extract potentially explosive atmospheres from work stations in hazardous areas. Two different systems have been tested, SYSTEM®75, which works with air volumes between 140 and 180 m^3, and SYSTEM®100, which works with air volumes between 140 and 400 m^3.

The arms with fitted hoods are made from a non-metallic material, and we have been asked to test them for ignition sources in the form of static electricity in accordance with the requirements in the ATEX Directive 94/9/EC.

This can be done by checking that the insulation resistance does not exceed 1GΩ at 23°C (±2°C) and 50% relative humidity (±5%) in relation to EN 13463-1:2001 part 7.4.4.

Figure 1 shows SYSTEM®75 with a hood that was fitted during the test.

Figure 1: Test Piece 1

Figure 2 shows SYSTEM®100 with a hood that was fitted during the test.

Figure 2: Test Piece 2

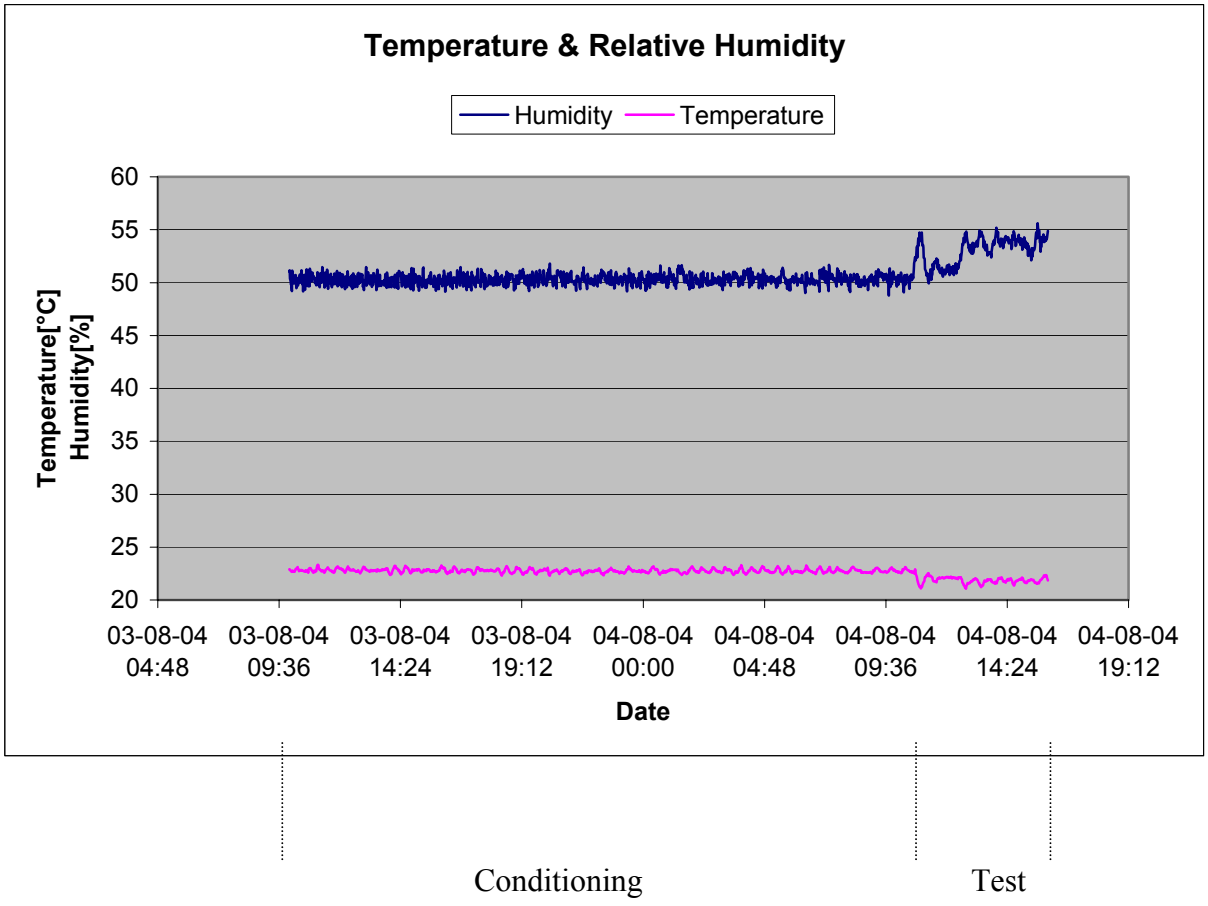
The test may be carried out with the actual piece or with a flat sample of the material from which the equipment is constructed. The test is carried out with the actual piece in accordance with EN 50014:1997 part 23.4.7.8.

Treatment

The two arms have been cleaned and treated in a climate chamber. In accordance with standard EN 13463-1:2001, part 13.3.4.7, the test parts should be treated/conditioned for 24 hours at a temperature of 23°C ±2°C and at a relative humidity no higher than 50% ±5%. Therefore, the test should be carried out under the same conditions.

The test parts were placed in the climate chamber on 3 August 2004 at 09.30.

The graphs in the chart below show the variations in the relative humidity and temperature during the period 3 August 2004 at 09.30 until 4 August 2004 at 16.00, before and after treatment and during the test.



Test Procedure

The test is carried out under the same conditions as those under which the parts were treated, 23°C ±2°C and a relative humidity no higher than 50% ±5%. Reference to EN 13463-1:2001 part 13.3.4.7.

Two parallel electrodes are glued onto each arm with conductive glue (SYSTEM®75 and SYSTEM®100) with dimensions as shown in Figure 3.

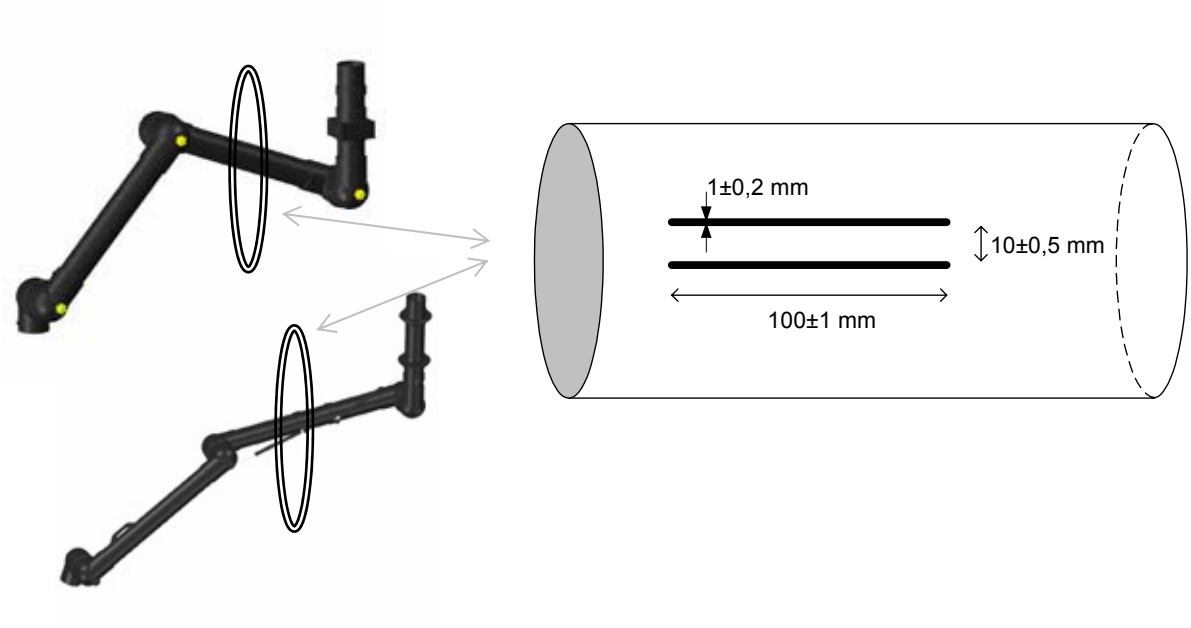


Figure 3: Dimensions for electrodes glued to test pieces 1 and 2.

A direct voltage of 500V ±10V is applied between the electrodes for one minute. The insulation resistance of the material is then measured, and the result is entered in Test Table 1. The measuring instrument used is an insulation tester Unilap ISO X.

Test Table 1

Determination of Insulation Resistance				
Test:	SYSTEM® 75:	Test:	SYSTEM® 100:	Remarks
1	14.06 kΩ	1	24.62 kΩ	
2	13.20 kΩ	2	20.51 kΩ	
3	14.91 kΩ	3	24.27 kΩ	
4	14.68 kΩ	4	20.09 kΩ	
5	14.85 kΩ	5	24.73 kΩ	
Mean	14.34 kΩ		22.84 kΩ	

An electrode is glued to the fitted hood with conductive glue. The earth connection of the arms is used as the other electrode.

A direct voltage of 500V ±5V is applied to the electrodes for one minute. The end-to-end resistance is measured, and the results are entered in Test Table 2. The measuring instrument used is an insulation tester Unilap ISO X.

Test Table 2

Determination of end-to-end resistance				
Test:	SYSTEM® 75:	Test:	SYSTEM® 100:	Remarks
1	11.16 kΩ	1	38.0 kΩ	
2	10.59 kΩ	2	39.0 kΩ	
3	10.85 kΩ	3	39.3 kΩ	
4	11.03 kΩ	4	38.5 kΩ	
5	10.97 kΩ	5	39.2 kΩ	
Mean	10.92 kΩ		38.8 kΩ	

Conclusion

The test of the insulation resistance of both SYSTEM®75 and SYSTEM®100 fulfils the requirements in EN 13463-1:2001 part 7.4.4 for a maximum insulation resistance of 1 GΩ.

The test shows that the insulation resistance of SYSTEM®75 is different from the insulation resistance of SYSTEM®100. If SYSTEM®75 has an average insulation resistance of 14 kΩ, then the average insulation resistance of SYSTEM®100 is 22 kΩ.

Random samples at the joints show that the insulation resistance is less than the insulation resistance of the tested part of the arm (1-2 kΩ).

This may be due to the fact that the tested parts of the arms are extruded, whereas the joints are injection moulded. An extrusion process binds the black carbon fibres differently to the injection moulding process, even if the recipe is the same.

The test of the end-to-end resistance for both SYSTEM®75 and SYSTEM®100 with fitted hoods fulfils the recommendations in DX/CLR/TR 50404:2003 part 11.3.4 for a resistance to earth of less than 1MΩ.

SYSTEM®75 and SYSTEM®100 with fitted hoods meets the requirements made of non-metallic equipment parts in EN13463-1:2001 and thereby for category 1, 2 and 3 for explosion group I and II in the ATEX Directive. The systems can be marked in accordance with EN13463-1:2001:

Material marked with category 1 GD may be used in all zones 0, 1 and 2 and 20, 21 and 22. In his risk assessment, the user can refer to the fact that the suction arms meet the standard EN13463-1:2001 and thereby reduce his risk assessment to the function in which they are used.

Aarhus, 28 September 2004

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