

TRANSLATION

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Report
on the testing of
the electrostatic properties
of powder-coated pipe sections
with conducting coating powder type PI1003NRA732

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Bochum, 22/04/09

DEKRA EXAM GmbH

(signed: Dr. Hesener)

(signed: Dr. Blum)

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Only the German original is binding both technically and legally.

- 1 Subject:** Powder-coated pipe sections of the Jacob modular pipework system
- 2 Type** Conducting coating powder type PI1003NRA732
- 2 Report prepared for:** Fr. Jacob Söhne GmbH & Co, Porta Westfalica
- 3 Report based on:** 1.) Test application of 18/03/2009
2.) Test samples

4 Description:

In addition to uncoated metal pipe sections, completely powder-coated pipe sections of the Jacob modular pipework system are also delivered. The purpose of the coating is to prevent corrosion. Because coating can cancel the electrostatic earthing between pipe sections, resistance measurements were carried out at an individual pipe section and at assembled pipe sections. The pipe sections were assembled with conducting U-shaped seals/gaskets and different pull-rings for the U-shaped seals/gaskets (2-part and Quick Connect[®] pull-rings). The electrostatic properties of U-shaped seals/gaskets of conducting EPDM and conducting PTFE had been examined earlier (see „Report on the electrostatic properties of plastic material“, reference No. 1100/178/06 BVS-BI, EXAM Fachstelle für Explosionsschutz - Bergbau Versuchsstrecke, dated 28/08/06). To simulate a worst-case scenario, the thickness of the coat on the pipe sections was approximately 120 µm to 400 µm, which was substantially more than the thickness of approximately 30 µm to 60 µm expected in industrial production.

5 Test:

For the test, the surface resistance of an individual pipe section and the resistance between assembled pipe sections were measured. For this purpose, two and three pipe sections, respectively, were connected by U-shaped seals/gaskets and pull rings. A conducting U-shaped seal/gasket, which served as electrode, was installed at both pipe ends (see Figure 1 and Figure 2).



Figure 1 Test setup - one pipe section

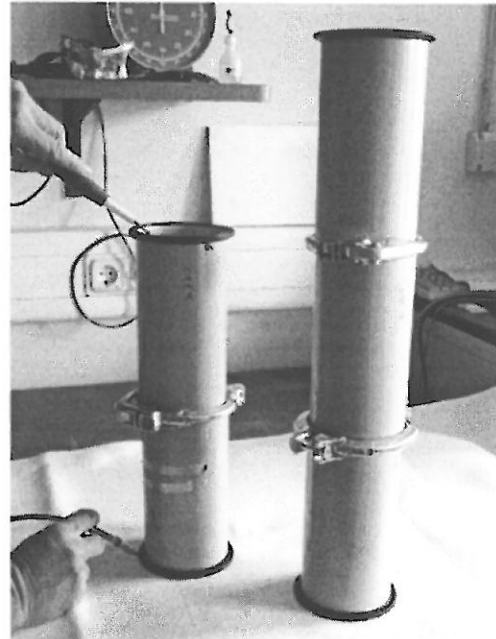


Figure 2 Test setup - several pipe sections

The surface resistance measured at the individual pipe section was:¹

$$R_o \approx 1.0 \cdot 10^3 \Omega$$

The resistance measured at a pipe segment of three pipe sections was maximum

$$R_o \approx 3.7 \cdot 10^3 \Omega.$$

Thus, a conducting connection exists between the pipe sections.

The measuring value is not affected by the type of pull-ring used.

¹ During the test, it was found that the surface resistance value depended strongly on the type of electrodes and the contact pressure of the electrodes at the powder-coated pipe section. Electrodes applied loosely or pasted on fail to establish sufficient electric contact with the pipe section. Tightly fixed hose clamps or conducting cooper gaskets ensure sufficient contact.

6 Evaluation:

The resistance to earth of metal parts in potentially explosive atmospheres must be less than $10^6 \Omega$. Assuming that the piping system is connected to the internal equipotential bonding system, the resistance to earth of the powder-coated pipe sections type PI1003NRA732 is less than $10^6 \Omega$ everywhere. Thus, the coating in combination with the conducting U-shaped seals/gaskets and the pull-rings has sufficient discharge capacity. Additional earthing methods (Jacob earthing bridge or earthing lugs/grounding lugs with earthing-cable/grounding wire) are therefore not required from an electrostatic point of view. Consequently, there are no objections to using such a coated piping system in potentially explosive atmospheres provided it is linked to the internal equipotential bonding system.

Bochum, 22/04/09

Prepared by

(signed: Dr. Blum)