BAM
Bundesanstalt für Materialforschung und -prüfung

Translation

of BAM-Report Ref.-No. 2-2829/2013 of March 14, 2014

Report

on Testing a Non-metallic Material for Reactivity with Oxygen

Reference Number	2-926/2014 E
Copy	1. Copy of 2 Copies
Customer	Rich. Klinger Dichtungstechnik GmbH & Co. KG Am Kanal 8 - 10 2352 Gumpoldskirchen Austria
Order Date	October 14, 2013
Reference	Eb
Receipt of Order	October 21, 2013
Test Samples	KLINGER®top-sil ML1, Batch 19603, gasket material for use in flanged connections in gaseous oxygen piping, in valves and fittings or other components for gaseous oxygen service up to 60 °C. BAM-Order No. 2.1/51 780
Receipt of Samples	October 18, 2013
Test Date	January 16 to February 27, 2014
Test Location	BAM - Working Group "Safe Handling of Oxygen"; building no. 41, room no. 073 and no. 120
Test Procedure according to	DIN EN 1797: 2002-02 „Cryogenic Vessels - Gas/Material Compatibility" ISO 21010: 2004-07 „Cryogenic Vessels - Gas/Material Compatibility" Annex of pamphlet M 034-1 (BGI 617-1) "List of nonmetallic materials compatible with oxygen by BAM Federal Institute for Material Research and Testing.", by German Social Accident Insurance Institution for the raw materials and chemical industry, Edition: March 2013; Rule BGR 500 "Betreiben von Arbeitsmitteln" part 2, chapter 2.32 "Betreiben von Sauerstoffanlagen", paragraph 3.17 "Lubricants and sealing materials", Edition: April 2008.

All pressures of the report are excess pressures.
This test report consists of page 1 to 3 and annex 1.

TEST REPORT

1 Documents and Test Samples

The following documents and samples were submitted to BAM:

1 Test Application
1 Safety Data Sheet (6 Pages, Revision 01, Edition: January 20, 2011)
15 Disks KLINGER®top-sil ML1, Batch 19603
Diameter: 140 mm; Thickness: 2 mm
Colour: Yellow

2 Test Methods

To test and evaluate the compatibility of the gasket material KLINGER®top-sil ML1, Batch 19603, with gaseous oxygen up to 60 °C a flange test was carried out.

The flange test was carried out at 80 °C, because the sealing material should be originally used, at temperatures greater than 60 °C. However, this was not pursued in the course of further testing.

A determination of the autogenous ignition temperature (AIT) and an investigation of the aging resistance in high pressure oxygen were not necessary as the gasket material KLINGER®top-sil ML1, Batch 19603, is not, for use at temperatures greater than 60 °C.

3 Test Results

3.1 Flange Test

The test method is described in annex 1.

Results:

Number of Tests	Temperature [°C]	Oxygen Pressure [bar]	Notes
1	80	160	Only those parts of the gasket burn that project into the pipe.
2	80	160	Same behavior as in test no. 1
3	80	160	Same behavior as in test no. 1
4	80	160	Same behavior as in test no. 1
5	80	160	Same behavior as in test no. 1

In five tests at 160 bar oxygen pressure and 80 °C, only those parts of the gasket material KLINGER®top-sil ML1, Batch 19603, burn that project into the pipe; the fire is neither transmitted to the steel nor does the gasket burn between the flanges. The flange remains gas-tight.

4 Summary and Evaluation

On basis of the flange test results, there are no objections with regard to technical safety to use the gasket material KLINGER®top-sil ML1, Batch 19603, in flange connections made of copper, copper alloys or steel at following conditions:

Maximum Temperature	Maximum Oxygen Pressure
60 °C	160 bar

This applies to flat face flanges, male/female flanges, and flanges with tongue and groove.

This evaluation does not cover the use of the gasket material KLINGER®top-sil ML1, Batch 19603, for liquid oxygen service. For this application, a particular test for reactivity with liquid oxygen needs to be carried out.

5 Comments

This evaluation is based exclusively on the test results of the gasket material KLINGER®top-sil ML1, Batch 19603.

Products on the market that contain a reference to BAM testing shall be marked accordingly. It shall be evident that only a sample of a batch has been tested and evaluated for oxygen compatibility. The reference shall not produce a presumption of conformity that monitoring of the production on a regular basis is being performed by BAM.

It shall be clear that the product may only be used for gaseous oxygen service. The maximum safe oxygen pressure of the product and its maximum use temperature as well as other restrictions in use shall be given.

Federal Institute for Materials Research and Testing (BAM)
12200 Berlin, April 25, 2014

Division 2.1
"Gases, Gas Plants"

On behalf of

Dipl.-Ing. P. Hartwig
Study Director "Safe Handling of Oxygen"

Copies: 1. Copy: Rich. Klinger Dichtungstechnik GmbH & Co. KG
2. Copy: Division 2.1 "Gases, Gas Plants"

Annex 1

Testing of Gaskets for Flanges in Oxygen Steel Pipings

The test apparatus mainly consists of two DN 65 PN 160 steel pipes, each approximately 2 m in length, with corresponding standard flanges welded to each pipe.

Both pipes are sealed using the gasket to be tested. In case of a gasket disk its inner diameter is chosen in such a way that it projects into the pipe. If a gasket tape is under test, both ends of the tape are allowed to project into the pipe. The test apparatus is then pressurized with oxygen up to the desired test pressure. The flange is heated by heating sleeves to the test temperature, at least 50 K lower than the ignition temperature of the gasket. An electrical filament ignites that part of the gasket projecting into the pipe. If the gasket is electrically conductive, such as spiral seals or graphite foils, a nonconductive primer capsule of organic material (PTFE, rubber) is used which acts on the seal.

The gasket's behavior after ignition is important for its evaluation. If the seal burns with such a hot flame that the fire is transmitted to the steel of the flange (in most case the test apparatus is destroyed), the seal is considered unsuitable from the beginning. If only those parts of the seal burn that project into the pipe and the fire is not transmitted to the flanges and if the seal does not burn between the flanges there are no objections with regard to technical safety to use the seal under the conditions tested. Such a positive result is to confirm in four additional tests. If, however, the flanged connection becomes un-tight during a test, e. g., because of softening or burning of the seal, the test has to be continued at a lower temperature and oxygen pressure until a positive test result is reached in five tests, as mentioned above.