Report

on Testing a Gasket Material for Reactivity with Oxygen

BAM
Bundesanstalt für Materialforschung und -prüfung

Reference Number	2-2853/2014 E
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Customer	Rich. Klinger Dichtungstechnik GmbH & Co KG Am Kanal 8 - 10 2352 Gumpoldskirchen Austria
Order Date	November 17, 2014
Reference	Eb
Receipt of Order	November 21, 2014
Test Samples	Gasket material Klingersil® C-4400, batch 23930, for use in flanged connections in piping, valves and fittings or other components for gaseous oxygen service at 130 bar and 60 °C; BAM Order-No.: 2.1/52 393 I
Receipt of Samples	November 20, 2014
Test Date	May 18 to May 22, 2015
Test Location	BAM - Working Group "Safe Handling of Oxygen"; building no. 41, room no. 073
Test procedure according to	DIN EN 1797:2002-02 „Cryogenic Vessels - Gas/Material Compatibility" ISO 21010:2014 „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 2014; TRGS 407 Technical Rules for Hazardous Substances "Tätigkeiten mit Gasen - Gefährdungsbeurteilung" chapter 3 "Informationsermittlung und Gefährdungsbeurteilung" and chapter 4 "Schutzmaßnahmen bei Tätigkeiten mit Gasen" Edition: June 2013

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

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In case a German version of the test report is available, exclusively the German version is binding.

TEST REPORT

1 Documents and Test Samples

The following documents and samples were submitted to BAM:

1 Test Application

15 Disks gasket material Klingersil® C-4400, batch 23930
Outer-Ø: 140 mm; Thickness: 2 mm
Color: Green
one side with imprint KLINGERSIL C-4400

2 Test Methods

To evaluate the compatibility of Klingersil® C-4400, batch 23930, for use as a gasket material in flanged connections in piping, valves and fittings or other components for gaseous oxygen service at 130 bar and 60 °C, a flange test at 130 bar and 60 °C was carried out.

A determination of the autogenous ignition temperature (AIT) and an investigation of the aging resistance in high pressure were not necessary as the gasket material is not for use at temperatures greater than 60 °C.

3 Results

3.1 Flange Test

According to the above-mentioned maximum operating conditions of Klingersil® C-4400, batch 23930, the flange test was performed at 130 bar oxygen pressure and at a temperature of 60 °C. The test method is described in annex 1.

Results:

Test No.	Oxygen Pressure [bar]	Temperature [°C]	Notes
1	130	60	Only those parts of the gasket burn that project into the pipe.
2	130	60	same behavior as in test no. 1
3	130	60	same behavior as in test no. 1
4	130	60	same behavior as in test no. 1
5	130	60	same behavior as in test no. 1

In five tests at 130 bar oxygen pressure and 60 °C, only those parts of the gasket 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

In five tests of the flange test at 130 bar oxygen pressure and 60 °C, only those parts of the gasket 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.

On basis of these results, there are no objections with regard to technical safety to use the gasket material Klingersil® C-4400, batch 23930, with a maximum thickness of 2 mm in flange connections made of copper, copper alloys or steel at following conditions:

Maximum Oxygen Pressure [bar]	Maximum Temperature [°C]
130	60

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 Klingersil® C-4400, batch 23930, for liquid oxygen service. For this case, a particular test for reactivity with liquid oxygen needs to be carried out.

5 Comments

The test results only refer to batch 23930 of Klingersil® C-4400.

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.

BAM Federal Institute for Materials Research and Testing
12200 Berlin, July 9, 2015

Division 2.1
"Gases, Gas Plants"

On behalf of

Dr. Thomas Kasch

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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.