

**BAM**Bundesanstalt für
Materialforschung
und -prüfung

Report

on Testing a Sealing Material for Reactivity with Oxygen

Reference Number 2-2048/2013 E

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Customer Gambit Lubawka Sp.zo.o.
Wojska Polskiego 16
58-420 Lubawka
Polen

Order Date July 12, 2013

Receipt of Order July 16, 2013

Test Samples Flat gasket material Gambit AF-OIL for use in flanged connections in piping, valves and fittings or other components for gaseous oxygen service up to 100 bar and temperatures up to 60 °C;
BAM Order-No. 2.1/51 637

Receipt of Samples July 15, 2013

Test Date October 30, 2013 to November 7, 2013

Test Location BAM - Working Group "Safe Handling of Oxygen";
building no. 41, room no. 073

Test Procedure or Requirement According to DIN EN 1797: 2002-02
„Cryogenic Vessels - Gas/Material Compatibility“
ISO 21010: 2004-07
„Cryogenic Vessels - Gas/Material Compatibility“
Annex of technical bulletin 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;
Technical 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 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 flat gasket material Gambit AF-OIL
Diameter: 140 mm; Thickness 1 mm
- 15 Disks flat gasket material Gambit AF-OIL
Diameter: 140 mm; Thickness 1 mm
- 3 Color: Green

2 Test Methods

A flange test was carried out at 100 bar and 60 °C to evaluate the compatibility of the flat gasket material Gambit AF-OIL for use in flanged connections in piping, valves and fittings or other components for gaseous oxygen service.

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

3 Results

3.1 Flange Test

The test method is described in annex 1.

Results:

Test No.	Oxygen Pressure [bar]	Temperature [°C]	Comments
1	100	60	Only those parts of the gasket burn that project into the pipe. The connection remains gas-tight.
2	100	60	Same behavior as in test no. 1
3	100	60	Same behavior as in test no. 1
4	100	60	Same behavior as in test no. 1
5	100	60	Same behavior as in test no. 1

In five tests at 100 bar oxygen pressure and 60 °C, only those parts of the flat gasket material Gambit AF-OIL 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 results of the flange testing, there are no objections with regard to technical safety to use the flat gasket material Gambit AF-OIL in flange connections made of copper, copper alloys or steel at following conditions:

Maximum Temperature	Maximum Oxygen Pressure
60 °C	100 bar

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

According to the BAM-Standard "Testing for Reactivity with Liquid Oxygen on Mechanical Impact", described in annex 2, the flat gasket material Gambit AF-OIL is not suitable for liquid oxygen service.

5 Comments

The test results refer exclusively to the tested batch of the flat gasket material Gambit AF-OIL.

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, December 5, 2013**

Division 2.1 "Gases, Gas Plants"

On behalf of



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

- Copies:
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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.