

# Report

on Testing a Gasket Material for Reactivity with Oxygen

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| <b>Reference Number</b>            | II-962/2009 E  |
| <b>Copy</b>                        | 1. Copy of 2 Copies  |
| <b>Customer</b>                    | TEMAC a.s.<br>Nymburská 53<br>28913 ZVĚŘÍNEK<br>TSCHECHISCHE REPUBLIK  |
| <b>Order Date</b>                  | April 14, 2009   |
| <b>Test Samples</b>                | Gasket material Temasil HT for use in flanged connections in gaseous oxygen piping, in valves and fittings or other components for gaseous oxygen service up to 60 °C.<br>BAM-Order No. II.1/49 627  |
| <b>Receipt of Samples</b>          | April 16, 2009   |
| <b>Test Date</b>                   | July 22, 2009 to October 28, 2009  |
| <b>Test Location</b>               | BAM Working Group "Safe Handling of Oxygen", building no. 41, room no. 073 and no. 120   |
| <b>Test Procedure According to</b> | DIN EN 1797: 2002-02<br>„Cryogenic Vessels - Gas/Material Compatibility“<br>ISO 21010: 2004-04<br>„Cryogenic Vessels - Gas/Material Compatibility“<br>Annex of pamphlet M 034-1 (BGI 617-1)<br>„Liste der nichtmetallischen Materialien die von der Bundesanstalt für Materialforschung und -prüfung (BAM) zum Einsatz in Anlageteilen für Sauerstoff als geeignet befunden worden sind.“,<br>to pamphlet M 034 „Sauerstoff“ (BGI 617)<br>Berufsgenossenschaft der chemischen Industrie<br>Edition: October 2008;<br>according chapter 3.17 „Gleitmittel und Dichtwerkstoffe“<br>to rule BGR 500 „Betreiben von Arbeitsmitteln“ part 2,<br>chapter 2.32 „Betreiben von Sauerstoffanlagen“,<br>Edition: September 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.

2009-01

✘ Safety in technology and chemistry



TEST REPORT

## 1 Documents and Test Samples

The following documents and samples were submitted to BAM:

- 1 Test Application
- 1 Safety Data Sheet
- 1 Material Data Sheet
- 15 Disks Temasil HT
  - Diameter 140 mm; Thickness 1,95 mm
  - Colour: One side light blue and the other one marbled dark blue

## 2 Test Methods

A determination of the autogenous ignition temperature (AIT) and an investigation of the aging resistance in high pressure were not necessary as gasket Temasil HT 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:

| Number of Tests | Oxygen Pressure [bar] | Temperature [°C] | Notes   |
|-----------------|-----------------------|------------------|---|
| 1               | 90                    | 60               | Only those parts of the gasket burn that project into the pipe. |
| 2               | 90                    | 60               | same behavior as in test no. 1                                  |
| 3               | 90                    | 60               | same behavior as in test no. 1                                  |
| 4               | 90                    | 60               | same behavior as in test no. 1                                  |
| 5               | 90                    | 60               | same behavior as in test no. 1                                  |

In five tests at 90 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 Evaluation

On basis of the test results, there are no objections with regard to technical safety to use the gasket Temasil HT in flange connections made of copper, copper alloys or steel at following conditions:

|                     |                         |
|---------------------|-------------------------|
| Maximum Temperature | Maximum Oxygen Pressure |
| up to 60 °C         | up to 90 bar            |

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

This evaluation does not cover the use of the material for liquid oxygen service. For this application, a particular test for reactivity with liquid oxygen needs to be carried out.

#### 5 Comments

The test results refer exclusively to the tested material.

Products that have been tested by us, and which are on the market, shall be marked according to our evaluation in the BAM test report. A label on a product saying that a BAM test has been performed and (or) citing our reference number, only, is not tolerable. The use of the product and its safe operating conditions must also be given.

It shall be clear that the product 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.

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12200 Berlin, Februar 10, 2010

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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.

## Adresa

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