

**BAM****Bundesanstalt für  
Materialforschung  
und -prüfung**

## Report

on Testing a Gasket Material for Reactivity with Oxygen

**Reference Number** II-2077/2006 IV E**Copy** 1. Copy of 2 Copies

### 1 Application

**Customer** W.L. Gore & Associates GmbH  
Wernher-von-Braun-Straße 18  
85640 Putzbrunn**Order Date** July 21, 2006**Receipt of Order** July 26, 2006**Test Samples** GORE® gasket DF05 without an adhesive surface for use  
in flanged connections in gaseous oxygen piping at  
temperatures up to 60 °C and for liquid oxygen service.  
BAM-Order No. II.1/ 48 596**Receipt of Samples** July 28, 2006**Test Date** September 21, 2006 to November 2, 2006**Test Location** BAM - Working Group "Safe Handling of Oxygen";  
building no. 41, room no. 073**Test Procedure and  
Evaluation  
According to** BAM-Prüfbericht II-2077/2006 III E, November 2006  
DIN EN 1797: 2002-02  
„Cryogenic Vessels - Gas/Material Compatibility“  
Annex of pamphlet M 034-1 (BGI 617-1)  
„Liste der nichtmetallischen Materialien, die von der  
Bundesanstalt für Materialforschung und -prüfung  
(BAM) zum Einsatz in Anlageteilen für Sauerstoff als  
geeignet befunden worden sind.“  
to pamphlet M 034 „Sauerstoff“ (BGI 617)  
Berufsgenossenschaft der chemischen Industrie  
Edition: October 2005;  
according chapter 3.17 „Gleitmittel und Dichtwerkstoffe“  
to rule BGR 500 „Betreiben von Arbeitsmitteln“ part 2,  
chapter 2.32 „Betreiben von Sauerstoffanlagen“,  
Edition: March 2006

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**

## **2 Documents and Test Samples**

The following documents and samples were submitted to BAM:

- 1 test application
- 1 Safety Data Sheet,
- 1 Material Data Sheet
- 10 m GORE® gasket DF05 without an adhesive surface  
diameter 5 mm  
colour: white

## **3 Test Methods and Results**

A determination of the autogenous ignition temperature (AIT) was not necessary as GORE® gasket DF05 without an adhesive surface is not for use at temperatures greater than 60 °C.

### **3.1 Reactivity with Liquid Oxygen on Mechanical Impact**

The test method is described in annex 1.

Results:

Test No.	Drop heights [m]	Impact energy [Nm]	Reaction
1	0,5	375	no reaction
2	1,0	750	no reaction
3	1,0	750	no reaction
4	1,0	750	no reaction
5	1,0	750	no reaction
6	1,0	750	no reaction
7	1,0	750	no reaction
8	1,0	750	no reaction
9	1,0	750	no reaction
10	1,0	750	no reaction
11	1,0	750	no reaction

No reaction of the material GORE® gasket DF05 without an adhesive surface with liquid oxygen could be detected at drop heights of 1,0 m (impact energy 750 Nm), in ten separate tests.

## **4 Evaluation**

The GORE® gasket DF05 with an adhesive surface has already been tested and evaluated under the reference number II-2077/2006 III E in November 2006.

According to the customer confirmation the gasket material GORE® gasket DF05 without an adhesive surface is an article of identical type and quality apart from the adhesive surface.

On basis of the customer confirmation, those conditions and of the results of the test and evaluation, there are no objections with regard to technical safety to use the GORE® gasket DF05 without an adhesive surface in flange connections made of copper, copper alloys or steel at following conditions:

Maximum Oxygen Pressure	Maximum Temperature
up to 40 bar	up to 60 °C

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

According to the BAM-Standards "Testing for Reactivity with Liquid Oxygen on Mechanical Impact", described in annex 4, there are no objections with regard to technical safety to use the GORE® gasket DF05 without an adhesive surface in components and apparatuses for liquid oxygen. In this case, a limitation to a particular pressure range is not necessary as compression of liquid oxygen causes no significant changes in concentration and therefore has no considerable influence on the reactivity of the gasket material.

## **5 Comments**


This report expires at once, if the composition of the tested material is changed. This report expires on November 30, 2016, at the latest. A prolongation beyond this date is possible, if the manufacturer confirms in writing that the material has not changed since this evaluation.

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 may be used for gaseous oxygen service and liquid 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, November 17, 2006**

**Division II.1**  
**"Gases, Gas Plants"**

  
Dr. Chr. Binder  
Head of Working Group

**Working Group**  
**"Safe Handling of Oxygen"**

  
Dipl.-Ing. P. Hartwig  
Engineer in Charge

Copies:

1. Copy: W.L. Gore & Associates GmbH
2. Copy: BAM – Working Group "Safe Handling of Oxygen"

## **Annex 1**

### Testing for Reactivity with Liquid Oxygen on Mechanical Impact

Approximately 0.5 g of the liquid or divided sample is placed into a sample cup (height = 10 mm; diameter = 30 mm), made of 0.01 mm copper foil. Liquid oxygen is poured into the cup over the sample which is then exposed to the mechanical impact of a plummet (mass = 76.5 kg). The drop height of the plummet can be varied. A steel anvil with a chrome/nickel steel plate supports the sample cup. The anvil, having a mass eight times of the plummet, is supported by four damping elements mounted on the steel frame of the test apparatus that rests on a concrete base.

A reaction of the sample with liquid oxygen is usually indicated by a flame and a more or less strong noise of an explosion. The impact energy, at which no reaction occurs, is determined in varying the drop height of the plummet. This result shall be confirmed in a series of ten consecutive tests under the same conditions. The tests are finished, if reactions can be observed at impact energies of 125 Nm or less (equivalent to a drop height of the plummet of 0.17 m or less). In this case, with regard to technical safety, the material is not suitable for liquid oxygen service.