

**BAM**Bundesanstalt für
Materialforschung
und -prüfung

Report

on the Evaluation of a Gasket Material for Gaseous Oxygen Service

Reference Number II-1411/2007 E
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1 Application

Customer Novus Sealing Limited
Hunsworth Lane
Cleckheaton, West Yorkshire,
BD19 3UJ
UNITED KINGDOM

Order Date June 15, 2007

Receipt of Order June 20, 2007

Test Samples Novus 34 for use in flange connections in gaseous oxygen piping, valves and fittings, and components at temperatures greater than 60 °C.
BAM-Order No. II.1/ 48 937

Receipt of Samples June 19, 2007 and July 31, 2007

Test Date July 23, 2007 to September 17, 2007

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

Test procedure according to BAM Test Report 2393/96, II-1411 and test results according to
DIN EN 1797: 2002-02
„Cryogenic Vessels - Gas/Material Compatibility“
and
Annex of pamphlet M034-I
„Liste der nichtmetallischen Materialien die von der Bundesanstalt für Materialforschung und -prüfung (BAM) zum Einsatz in Anlageteilen für Sauerstoff als geeignet befunden worden sind“ (Edition: October 2006) according to rule BGR 500 „Betreiben von Arbeitsmitteln“ part 2, chapter 2.32 „Betreiben von Sauerstoffanlagen“, Edition: March 2007.

All pressures of this report are excess pressures.

This test report consists of page 1 to 4 and annex 1 to 3.

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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

- 1 Application of June 15, 2007
- 1 Material data sheet
- 1 Safety data sheet
- 11 Disks, diameter 140 mm; thickness 2 mm
with imprint: novus SEALING LIMITED
colour: gray-white

3 Test Methods and Results

The material has already been tested and evaluated in 1996 under Ref.-No. 2393/96, II-1411. In that case the Artificial Aging, a check test of the Autogenous Ignition Temperature (AIT), and a check test of the Flange Test has been carried out.

3.1 Autogenous Ignition Temperature (AIT) – Check Test

The test method is described in annex 1.

Results:

Test No.	Oxygen pressure p_a [bar]	Oxygen pressure p_e [bar]	AIT [°C]
1	114	171	165
2	114	169	162
3	114	169	163
4	114	172	168
5	114	171	169

In five tests with an oxygen pressure of $p_a = 114$ bar, an AIT of 165 °C was determined with a standard deviation of ± 3 °C. The oxygen pressure p_e at ignition is approximately 170 bar.

3.2 Artificial Aging

The test method is described in annex 2.

Results:

Time [h]	Temperature [°C]	Oxygen Pressure [bar]	Mass Change [%]
100	115	160	1,5

After aging of Novus 34 at a temperature of 115 °C and 160 bar oxygen pressure, the material was very brittle. The mass of the test sample gained at 1,5 %.

3.2.1 AIT after Artificial Aging

The test method is described in annex 1.

Results:

Number of tests	Oxygen pressure p_a [bar]	Oxygen pressure p_e [bar]	AIT [°C]
1	114	171	165
2	114	170	162
3	114	170	163
4	114	170	166
5	114	171	165

In five tests with an oxygen pressure of $p_a = 114$ bar, an AIT of 164 °C was determined with a standard deviation of ± 2 °C. The oxygen pressure p_e at ignition is approximately 170 bar. This shows, that the AIT of the aged sample is unchanged compared to the AIT of the non-aged sample within the precision of measurement.

3.3 Flange Test – Check Test

The test method is described in annex 3.

Results:

Number of tests	Oxygen pressure [bar]	Temperature [°C]	Notes
1	160	90	Only those parts of the gasket burn that project into the pipe. The connection remained gas-tight.
2	160	90	Only those parts of the gasket burn that project into the pipe. The connection remained gas-tight.

At 160 bar oxygen pressure and 90 °C only those parts of the sealing material Novus 34 burn that project into the pipe; the fire is neither transmitted to the steel nor does the gasket burn between the flanges. The flange connection remained gas-tight.

4 Evaluation

The product Novus 34 has already been tested and evaluated as a sealing material for use in flanged connections in gaseous oxygen piping, valves and fittings, and components for gaseous oxygen service under reference number 2393/96, II-1411, in 1996.

At a temperature of 115 °C and an oxygen pressure of 160 bar, the material proved not to be sufficient aging resistant. As a result of the aging test, the material was brittle. Therefore, the gasket Novus 34 is suitable only for use in flanges that are not dynamically stressed. Furthermore, the unfavourable aging behaviour may reduce the gasket's usability.

On basis of those test results and the results of the flange test, by check test, there are no objections with regard to technical safety to use the sealing material Novus 34 in flange connections made of copper, copper alloys or steel at following conditions:

Maximum Temperature	Maximum Oxygen Pressure
90 °C	160 bar

This report does not cover the use of the sealing material Novus 34 for liquid oxygen service. A particular test for reactivity with liquid oxygen needs to be carried out to evaluate the compatibility of the sealing material Novus 34 with liquid oxygen.

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 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, October 19, 2007

Division II.1
"Gases, Gas Plants"



Dr. Chr. Binder
Head of Working Group

Working Group
"Safe Handling of Oxygen"



Dipl.-Ing. K. Arlt
Engineer in Charge

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