



TEST REPORT

on testing a nonmetallic material for reactivity with oxygen

BAM reference	23021273-I-E
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Customer	Weicon GmbH & Co. KG Königsberger Straße 255 48157 Münster Germany
Order date	July 10, 2023
Reference	-
Receipt of order	July 10, 2023
Test samples	Lubricant Weicon Silikonfett, batch 321990094
Receipt of samples	July 19, 2023
Test date	July 19, 2023, to August 16, 2023
Test location	Division 2.1 "Safety of Energy Carriers"; building no. 41 Unter den Eichen 87, 12205 Berlin, Germany
Test procedure according to	DIN EN 1797 und ISO 21010 "Cryogenic Vessels - Gas/Material Compatibility"
(in the current version)	Annex of code of practice M 034-1 (BGI 617-1) "List of nonmetallic materials compatible with oxygen", by German Social Accident Insurance Institution for the raw materials and chemical industry TRGS 407 Technical Rules for Hazardous Substances "Tätigkeiten mit Gasen - Gefährdungsbeurteilung" Chapter 3 "Informationsermittlung und Gefährdungsbeurteilung" and Chapter 4 "Schutzmaßnahmen bei Tätigkeiten mit Gasen"

This test report consists of page 1 to 5 and enclosure 1.

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The German version is legally binding, except an English version is issued exclusively.

1 Documents and Test Samples

The following documents and samples were submitted to BAM:

- 1 Test application
Safety-related investigation on lubricant Weicon Silikonfett, batch 321990094, for use in gaseous oxygen service at temperatures up to 60 °C
 - 1 Sicherheitsdatenblatt Silikonfett
(12 pages, Fa. Weicon GmbH & Co. KG, Version 1.03, date of issue: 4/13/2023)
 - 1 Technisches Datenblatt Silikonfett
(1 page, Fa. Weicon GmbH & Co. KG, date of issue: 19.08.2022)
 - 1 Customer Master Data Sheet (CMDS) (June 14, 2023)
- 450 g of the lubricant Weicon Silikonfett, batch 321990094
Color: Colorless, transparent



2 Applied Test Methods

The lubricant Weicon Silikonfett, batch 321990094, shall be used for gaseous oxygen service at temperatures up to 60 °C.

The following test method was applied:

2.1 Testing for Ignition Sensitivity to Gaseous Oxygen Impacts

Generally, this test method is required if rapid oxygen pressure changes, so-called gaseous oxygen impacts, on the material cannot be safely excluded in usage.

3 Sampling

The material sample used for the investigation was provided by the customer.

3.1 Preparation of Samples

Prior to testing, the lubricant was stirred with a spatula for homogenization.

4 Tests

4.1 Testing for Ignition Sensitivity to Gaseous Oxygen Impacts

The test method is described in enclosure 1. Based on the specified use conditions by the customer, the test was performed at 60 °C.

4.1.1 Assessment Criterion

According to DIN EN 1797 "Cryogenic Vessels - Gas/Material Compatibility" and to ISO 21010 "Cryogenic Vessels - Gas/Material Compatibility" the criterion for a reaction of the sample to gaseous oxygen impacts is a temperature rise of at least 20 °C.

If the sample exhibits a change in color, or in consistency after testing, this is also considered as a positive reaction by BAM for safety reasons, even if there is no temperature rise detectable of at least 20 °C.

4.1.2 Results

In each of the test series, the initial oxygen pressure p_i was at ambient pressure.

Sample Temperature t_i [°C]	Final Oxygen Pressure p_F [bar]	Reaction
60	30	no*
60	40	on 1 st impact
60	30	on 4 th impact
60	25	on 1 st impact
60	20	no*
60	20	no*

* Within a series of five consecutive impacts

In two separate test series, each consisting of a series of five consecutive impacts, no reaction of the lubricant Weicon Silikonfett, batch 321990094, with oxygen could be observed at following conditions:

Sample Temperature t_i [°C]	Final Oxygen Pressure p_F [bar]
60	20

5 Summary of the Test Results

In two separate tests, each consisting of a series of five consecutive impacts, no reaction of the sample with oxygen could be observed at final pressures of 20 bars at a temperature of 60 °C.

6 Measurement uncertainty

The tests are carried out in accordance with the standards or guidelines indicated on the cover sheet of this report. Thereafter, the temperature measurement should have a maximum deviation of ± 2 K and the pressure measurement should have a maximum deviation of ± 2 bar.

For the test in Chapter 4.1, the uncertainty is 1.7 K (according to the calibration protocol from January 9, 2023) for the temperature measuring system, and the uncertainty is 0.16 bars (according to the calibration protocol from January 11, 2023) for the pressure gauge.

7 Statements of conformity

The tests are carried out in accordance with the standards or guidelines, stated on the cover sheet of this report. Deviating or supplementary test criteria are described in the respective subchapter "Assessment Criterion" in Chapter 4 "Tests".

8 Opinion and Interpretation

The lubricant Weicon Silikonfett, batch 321990094, shall be used for gaseous oxygen service at temperatures up to 60 °C.

On basis of the test results, the requirements for nonmetallic materials, described in the code of practice M034, annex 2 of code of practice M034-1, Technical Rules for Hazardous Substances TRGS 407 and based on the assessment criteria described in this test report, there are no objections regarding technical safety, to use the lubricant Weicon Silikonfett, batch 321990094, for gaseous oxygen service at following use conditions:

Maximum Temperature [°C]	Maximum Oxygen Pressure [bar]
60	20

9 Comments

This safety-related investigation considers the fact, that rapid oxygen pressure changes - so-called oxygen pressure surges - cannot be safely excluded in usage. In addition, the safety related investigation considers the fact, that the material shall be used in gaseous oxygen service at temperatures up to 60 °C.

The content of the test report refers exclusively to the test sample of the lubricant Weicon Silikonfett, batch 321990094.

Our experience shows that the safety characteristics of a product may vary from batch to batch. Therefore, today, we recommend batch testing of products, that are included for oxygen service. In this context, we would like to mention our paper from September 2009: "The Importance of Quality Assurance and Batch Testing on Nonmetallic Materials Used for Oxygen Service", Journal of ASTM International, Vol. 8th; Paper ID JA102309. This publication can be purchased at www.astm.org.

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.

The product may be used for gaseous oxygen service only. The maximum safe oxygen pressure of the product and its maximum use temperature as well as other restrictions in use shall be given.

**Bundesanstalt für Materialforschung und -prüfung (BAM)
12200 Berlin**

September 4, 2023

Division 2.1 "Safety of Energy Carriers"

by order

Dr. Thomas Kasch
Study Director

Dr. Martin Schmidt
Deputy Head of Division

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Enclosure 1

Testing Nonmetallic Materials for Ignition Sensitivity to Gaseous Oxygen Impacts (V 2023-01)

0.2 g to 0.5 g of the paste-like, of the divided solid, or with ceramic fibres mixed liquid material is placed into a steel tube with a volume of 15 cm³. The heatable steel tube is connected to a high-pressure oxygen accumulator using a 750 mm long pipe (internal diameter 14 mm) and a quick opening valve.

After heating the tube to the test temperature of 60 °C minimum, the quick opening valve is opened. Preheated oxygen of 60 °C at final pressure p_F flows abruptly into the pipe and tube. In this case, the oxygen in the tube and in the pipe is heated and almost adiabatically compressed from initial pressure p_I to final pressure p_F in 17.5 ms \pm 2.5 ms (according to DIN EN 1797 and ISO 21010). If there is a reaction of the sample with oxygen, further tests are performed at a lower final pressure p_F . If there is no reaction of the sample with oxygen, further tests are performed at a higher final pressure p_F . The test is finished, if there is no reaction of the material detected in two test series each consisting of five single tests.

For this test, the maximum test pressure is 450 bars, and the maximum test temperature is 300 °C.