SGL GROUP
THE CARBON COMPANY

SIGRAFLEX® SELECT

Approvals

Table of Contents

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MPA **MPA STUTTGART**
Otto-Graf-Institut
Materialprüfungsanstalt Universität Stuttgart

Zertifikat

Die Dichtung vom Typ **SIGRAFLEX SELECT V16010C3I mit Edelstahlinnenbördel**

der **SGL TECHNOLOGIES GmbH**
Werner-von-Siemens-Str. 18
D-86405 Meitingen

wurde von uns nach den Vorgaben der VDI-Richtlinie 2440 (Ausgabe November 2000) geprüft. Bei 30 MPa Ausgangspressung und nach 48-stündiger Warmlagerung bei 300°C an Luft und anschließender Leckagemessung bei Raumtemperatur und 1 bar Druckdifferenz mittels Helium-Massenspektrometrie (24 h Messzeit) erfüllt sie mit

$3{,}8 \cdot 10^{-5}$ mbar l / (s·m)

das Leckageratenkriterium

$1{,}0 \cdot 10^{-4}$ mbar l / (s·m)

und gilt damit hinsichtlich des oben genannten Leckagekriteriums als

hochwertig im Sinne der TA Luft.

Dieses Zertifikat gilt nur in Verbindung mit unserem
Prüfungsbericht 9 000 873 001 Dr.Koc/Hh/Gd vom 15. April 2004
und den dort niedergelegten Prüf- und Randbedingungen.

UNIVERSITÄT STUTTGART
MATERIALPRÜFUNGSANSTALT (26)

Stuttgart, den 15.04.2004

Dipl.-Ing. R. Hahn
Fachgruppenleiter Dichtungstechnik

API Standard 607 Fourth Edition
Fire Test Report

Performed for

SGL Technic Inc.
SGL Carbon Group

Sigraflex Select
6 inch Class 300 Gaskets

Project Number: 20370
September 2003

Performed by

YARMOUTH RESEARCH AND TECHNOLOGY

92 East Elm Street
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ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD
Industrie Service

Bescheinigung

SGL GROUP
THE CARBON COMPANY

SGL Carbon GmbH
Werner-von-Siemens-Str. 18
86405 Meitingen

Hiermit wird bescheinigt, dass die u. g. Dichtungen der oben genannten Firma in Anlehnung an die Ausblassicherheit (VDI 2200) überprüft und anerkannt wurden. Einzelheiten sind dem entsprechenden Untersuchungsbericht, A.-Nr. 450696 zu entnehmen.

Das Produkt erfüllt die Anforderungen:

- Ausgangsflächenpressung (Q_A = 30 MPa)
- Ausblassicherheit Klasse C
- TRwS Ausblassicherheit nach TÜV-Prüfanweisung > 2,5* p_{max}

Grundlage des Zertifikats ist die Prüfanweisung zur Ausblassicherheit hinsichtlich des Eignungsnachweises von Flanschdichtungen des Instituts für Kunststoffe.

Voraussetzung hierfür ist die Verwendung von Flanschsystemen aus Stahl, welche die Mindestflächenpressung im Einbau erreichen oder überschreiten sowie unterhalb der maximal zulässigen Temperatur und des maximal zulässigen Innendrucks betrieben werden.

Produktbeschreibung:

- Sigraflex® Universal
- Sigraflex® Universal Pro
- Sigraflex® Hochdruck
- Sigraflex® Hochdruck Pro
- Sigraflex® Select
- Sigraflex® MF
- Sigraflex® HEXAGON
- Sigraflex® APX2 Hochdruck

Ausblassicherheit:

Klasse A, mit 100 bar Innendruck, bei Restflächenpressung nach Auslagerung

Klasse B, mit 100 bar Innendruck, bei einer Mindestflächenpressung Q_{smin}, von ca. 13 N/mm²

Klasse C, mit 100 bar Innendruck, Q_{smin} um weitere 25 % reduziert, d. h. ca. 10 N/mm²

Diese Bescheinigung ist gültig bis September 2017.

München, den 17.09.2014

TÜV SÜD Industrie Service GmbH
Institut für Kunststoffe

i. A. Schweizer

TÜV®

Bundesanstalt für
Materialforschung
und -prüfung

Report

on Testing a Gasket Material for Reactivity with Oxygen

Reference Number	2-813/2013 III E
Copy	1. Copy of 2 Copies
Customer	SGL CARBON GmbH Postfach 11 93 86400 Meitingen Germany
Order Date	March 1, 2013
Receipt of Order	March 8, 2013
Test Samples	SIGRAFLEX SELECT, Batch 12060395, for use as a gasket material in flanged connections in piping, valves and fittings or other components for gaseous oxygen service up to 130 bar and temperatures up to 250 °C; BAM Order-No. 2.1/51 485
Receipt of Samples	March 8, 2013
Test Date	May 27, 2013 to October 29, 2013
Test Location	BAM - Working Group "Safe Handling of Oxygen"; building no. 41, room no. 073 and no. 120
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 pamphlet 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; 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 5 and annex 1 to 3.

1 Documents and Test Samples

The following documents and samples were submitted to BAM:

1 Test Application

1 Safety Data Sheet
(5 pages, revision no. 1.01, revised June 26, 2012)

15 Disks SIGRAFLEX SELECT, Batch 12060395
Outer-Ø: 140 mm
Color: Grey

3 Metal plates,
coated with SIGRAFLEX SELECT, Batch 12060395
Size: 145 mm x 145 mm; Thickness: 1.5 mm
Color: Grey

2 Test Methods

To test and evaluate the compatibility of the sealing material SIGRAFLEX SELECT, Batch 12060395, for use as a gasket material in flanged connections in piping, valves and fittings or other components for gaseous oxygen service up to 130 bar and temperatures up to 250 °C, a flange test, the determination of the autogenous ignition temperature and an investigation of the aging resistance were carried out.

3 Test Results

3.1 Autogenous Ignition Temperature (AIT)

The test method is described in annex 1.

Results:

Test No.	Initial Oxygen Pressure p_I [bar]	Final Oxygen Pressure p_F [bar]	AIT [°C]
1	50	133	> 500
2	50	134	> 500
3	50	134	> 500
4	50	131	> 500
5	50	133	> 500

Up to temperatures of 500 °C, no ignition of the sealing material SIGRAFLEX SELECT, Batch 12060395, could be detected in five tests with initial oxygen pressures of p_I = 50 bar. The final oxygen pressure p_F was approximately 133 bar.

3.2 Artificial Aging

The test method is described in annex 2.

Results:

Time [h]	Temperature [°C]	Oxygen Pressure [bar]	Mass Change [%]
100	275	130	± 0

After aging of the sealing material SIGRAFLEX SELECT, Batch 12060395, at 130 bar oxygen pressure and 275 °C, the test sample was apparently unchanged. The sample mass did not change.

3.2.1 AIT after Artificial Aging

The test method is described in annex 1.

Results:

Test No.	Initial Oxygen Pressure p_I [bar]	Final Oxygen Pressure p_F [bar]	AIT [°C]
1	50	132	> 500
2	50	131	> 500
3	50	134	> 500
4	50	134	> 500
5	50	131	> 500

Up to temperatures of 500 °C, no ignition of the sealing material SIGRAFLEX SELECT, Batch 12060395, could be detected in five tests with initial oxygen pressures of p_I = 50 bar. The final oxygen pressure p_F was approximately 132 bar.

This shows, that, as the non-aged sample, also the aged sample did not ignite at temperatures up to 500 °C.

3.3 Flange Test

The test method is described in annex 3.

Results:

Test No.	Oxygen Pressure [bar]	Temperature [°C]	Comments
1	130	250	Only those parts of the gasket burn that project into the pipe.
2	130	250	Same behavior as in test no. 1
3	130	250	Same behavior as in test no. 1
4	130	250	Same behavior as in test no. 1
5	130	250	Same behavior as in test no. 1

In five tests at 130 bar oxygen pressure and 250 °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 Summary and Evaluation

Up to temperatures of 500 °C, no ignition of the sealing material SIGRAFLEX SELECT, Batch 12060395, could be detected with a final oxygen pressure p_F of approximately 133 bar.

At a temperature of 275 °C and an oxygen pressure of 130 bar, the sealing material SIGRAFLEX SELECT, Batch 12060395, proved to be sufficient aging resistant. The sample mass did not change. Up to temperatures of 500 °C, no ignition of the aged sealing material SIGRAFLEX SELECT, Batch 12060395, could be detected with a final oxygen pressure p_F of approximately 132 bar. This shows, that, as the non-aged sample, also the aged sample did not ignite at temperatures up to 500 °C.

For safety reasons a safety margin of 100 °C between AIT and maximum operating temperature is being considered in evaluating nonmetallic materials for oxygen service. As the maximum operating temperature is 250 °C, the sealing material SIGRAFLEX SELECT, Batch 12060395, fulfills this criterion.

On basis of those test results and the results of the flange testing, there are no objections with regard to technical safety to use the sealing material SIGRAFLEX SELECT, Batch 12060395, as a gasket material in flanged connections in piping, valves and fittings or other components for gaseous oxygen service at following conditions:

Maximum Temperature	Maximum Oxygen Pressure
250 °C	130 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 sealing material SIGRAFLEX SELECT, Batch 12060395, for liquid oxygen service. For this case, a particular test for reactivity with liquid oxygen needs to be carried out.

5 Comments

The test results refer exclusively to the tested Batch 12060395 of the sealing material SIGRAFLEX SELECT.

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 9, 2013

Division 2.1
"Gases, Gas Plants"

On behalf of

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

Copies:
1. Copy: SGL CARBON GmbH
2. Copy: BAM – Division 2.1 "Gases, Gas Plants"

DIN-DVGW-Baumusterprüfzertifikat

DIN-DVGW type examination certificate

NG-5124BO0148
Registriernummer
registration number

Anwendungsbereich *field of application*	Produkte der Gasversorgung *products of gas supply*
Zertifikatinhaber *owner of certificate*	SGL Technologies GmbH Werner-von-Siemens-Str. 18, D-86405 Meitingen
Vertreiber *distributor*	SGL Technologies GmbH Werner-von-Siemens-Str. 18, D-86405 Meitingen
Produktart *product category*	Schmier-/Dicht-/Betriebsmittel: Flachdichtungswerkstoff auf Basis Graphit (5124)
Produktbezeichnung *product description*	Flachdichtungswerkstoff auf Basis Graphit bestehend aus drei Lagen Graphit und zwei 0,05 mm starken Edelstahleinlagen
Modell *model*	SIGRAFLEX SELECT
Prüfberichte *test reports*	Kontrollprüfung Labor: 07/141/5124/01 vom 27.08.2007 (EBI)
Prüfgrundlagen *basis of type examination*	DIN 3535-6 (01.12.1999)
Ablaufdatum / AZ *date of expiry / file no.*	23.04.2013 / 08-0457-GNV

28.07.2008 Re A-1/2
Datum, Bearbeiter, Blatt, Leiter der Zertifizierungsstelle
date, issued by, sheet, head of certification body

DVGW CERT GmbH - von der Deutschen Akkreditierungsstelle Technik (DATech) in der TGA GmbH akkreditiert für die Konformitätsbewertung von Produkten der Gas- und Wasserversorgung

DVGW CERT GmbH - accredited by Deutsche Akkreditierungsstelle Technik (DATech) in the TGA GmbH for conformity assessment of products of gas and water supply

DAT-ZE-009/96-02

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Herstellerbescheinigung
Manufacturer's Certificate

Die SGL CARBON GmbH als Lieferant des Graphitmaterials

SGL CARBON GmbH as supplier of the graphite material

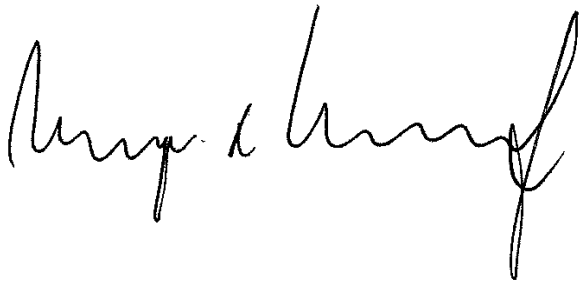
SIGRAFLEX® Select

bestätigt, dass dieses Material der Verordnung (EG) Nr. 1935/2004 über Materialien und Gegenstände, die dazu bestimmt sind, mit Lebensmitteln in Berührung zu kommen, entspricht.

confirms, that this material complies with the Regulation (EC) No. 1935/2004 on materials and articles intended to come into contact with food.

Meitingen, 19. März 2014

SGL CARBON GmbH
Arbeitssicherheit und Umweltschutz
Environment, Health and Safety



Dr. Meyer zu Reckendorf