

SIGRAFLEX® MF

Approvals

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Zertifikat

Die Dichtung vom Typ **SIGRAFLEX MF V20011Z2MF mit Edelstahlbördel**

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

wurde von uns nach den Vorgaben der VDI-Richtlinie 2440 (Ausgabe November 2000) geprüft. Bei 10 MPa Ausgangspressung und nach 48-stündiger Auslagerung bei 300°C an Luft und anschließender Leckagemessung bei Raumtemperatur und 1 bar Druckdifferenz mittels Helium-Massenspektrometrie erfüllt sie mit

$1.5 \cdot 10^{-7}$ mbar l / (s·m)

das Leckageratenkriterium

10^{-4} mbar l / (s·m)

und gilt damit hinsichtlich des oben genannten Leckagekriteriums als

hochwertig im Sinne der TA Luft.

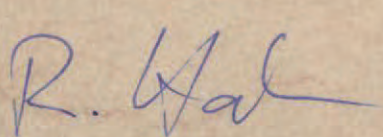
Dieses Zertifikat gilt nur in Verbindung mit unserem

Prüfungsbericht 950 666 001 Dr.Koc/Hh/Gd vom 22. Januar 2003

und den dort niedergelegten Prüf- und Randbedingungen.



Stuttgart, den 22.01.2003


Dipl.-Ing. R. Hahn
Fachgruppenleiter Dichtungstechnik



Industrie Service

Bescheinigung



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 ($Q_A = 30 \text{ MPa}$)
- 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

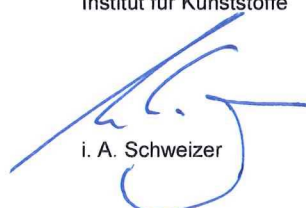
Klasse B, mit 100 bar Innendruck, bei einer Mindestflächenpressung $Q_{\min}$, von ca. 13 N/mm^2

Klasse C, mit 100 bar Innendruck, $Q_{\min}$ um weitere 25 % reduziert, d. h. ca. 10 N/mm^2

Diese Bescheinigung ist gültig bis September 2017.

München, den 17.09.2014

TÜV SÜD Industrie Service GmbH
 Institut für Kunststoffe


 i. A. Schweizer

API 607 Rev. 4 Fire Test with Exxon Modifications Test Report

Performed for

SGL Technic Inc.
Polycarbon Division

Sigraflex MF
6 inch Class 300 Gaskets
Project Number: 20292
January 2003

Performed by

YARMOUTH RESEARCH AND TECHNOLOGY

92 East Elm Street
Yarmouth, ME 04096 USA
(207) 829-5359
yrtlab@maine.rr.com
www.yarmouthresearch.com

TÜV NEDERLAND B.V.

De Waal 21C
Postbus 120 NL 5680 AC BEST

FIRE TYPE-TESTING TEST CERTIFICATE

REGISTRATION / CERTIFICATE N°.: 03.001.39B

TÜV Nederland B.V.

hereby grants

: **SGL TECHNOLOGIES GmbH**
Werner von Siemens Strasse 18
D-86405 Meitingen

the right to publish this certificate verbatim and unabridged,
considering the successful testing by Franz Schuck GmbH at Steinheim, Germany, in compliance
with the **British Standard 6755; Part 2; 1987**; "fire type - testing requirements"
including amendments up till N°. 6712; 1991.

The flange-leak rates applied are the external-leak rates of the forementioned standard.

TESTGASKETS

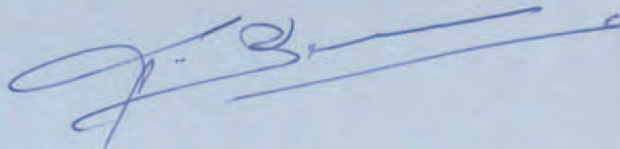
Gasket Type	: SIGRAFLEX MF with inner eyelet Grade V20011Z2MF with perforated stainless steel insert
Nominal Diameter	: DN 15, DN 32, DN 80, DN 200 und DN 400
Pressure rating	: ANSI CLASS 150
Gasket material	: Graphite with 1.4401 perforated stainless steel sheet reinforcement and PTFE / 1.4401 stainless steel lining
Inner Eyelet	: 1.4571, 0.15mm
Purity	: According DIN 51903
Testflange Material	: 1.4571
Testflange Bolts / Nuts	: A4 70 / A4 80
Date of Testing	: 05-02-2003 and 06-02-2003
Report N°.	: B03.001.02.00.00

QUALIFICATION RANGE

This certificate represents the validity for gaskets qualified as:

Gasket Type	: SIGRAFLEX MF with inner eyelet, Grade V20011Z2MF with perforated stainless steel insert and PTFE / stainless steel lining
Qualification sizes	: DN 15 and larger (NPS ½" and larger)
Qualified Pressure Ratings	: ANSI Class 150 and ANSI Class 300 (PN 16, PN 25 and PN 40)

Steinheim, 06.02.2003
TÜV Nederland B.V.
Ing. F. Bauer, Senior Test Engineer





**Bundesanstalt für
Materialforschung
und -prüfung**

Report

on Testing a Gasket Material for Reactivity with Oxygen

Reference Number 2-813/2013 I 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 MF (V...11Z2MF), Batch 12050023, 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 23, 2013 to September 20, 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.

This test report may only be published in full and without any additions. A revocable permission in writing has to be obtained from BAM for any amended reproduction of this certificate or the publication of any excerpts. The test results refer exclusively to the tested materials.

In case a German version of the test report is available, exclusively the German version is binding.



1 Documents and Test Samples

The following documents and samples were submitted to BAM:

- 1 Test Application
- 1 Material Data Sheet
(2 pages, revision no. 02 2009/0)
- 1 Safety Data Sheet
(5 pages, revision no. 1.00, revised March 11, 2011)
- 15 Disks SIGRAFLEX MF (V... 11Z2MF), Batch 12050023
Outer-Ø: 140 mm
Color: Grey
- 3 Metal plates,
coated with SIGRAFLEX MF (V... 11Z2MF), Batch 12050023
Size: 145 mm x 145 mm; Thickness: 2 mm
Color: Grey

2 Test Methods

To test and evaluate the compatibility of the sealing material SIGRAFLEX MF (V... 11Z2MF), Batch 12050023, 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	132	> 500
2	50	133	> 500
3	50	132	> 500
4	50	131	> 500
5	50	134	> 500

Up to temperatures of 500 °C, no ignition of the sealing material SIGRAFLEX MF (V... 11Z2MF), Batch 12050023, 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	- 0,6

After aging of the sealing material SIGRAFLEX MF (V...11Z2MF), Batch 12050023, at 130 bar oxygen pressure and 275 °C, the test sample was apparently unchanged. The sample lost 0.6 % in mass.

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	134	> 500
3	50	131	> 500
4	50	131	> 500
5	50	134	> 500

Up to temperatures of 500 °C, no ignition of the sealing material SIGRAFLEX MF (V...11Z2MF), Batch 12050023, 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 MF (V...11Z2MF), Batch 12050023, 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 MF (V...11Z2MF), Batch 12050023, proved to be sufficient aging resistant. The sample lost 0.6 % in mass. Up to temperatures of 500 °C, no ignition of the aged sealing material SIGRAFLEX MF (V...11Z2MF), Batch 12050023, 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 MF (V...11Z2MF), Batch 12050023, 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 MF (V...11Z2MF), Batch 12050023, 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 MF (V...11Z2MF), Batch 12050023, 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 12050023 of the sealing material SIGRAFLEX MF (V...11Z2MF).

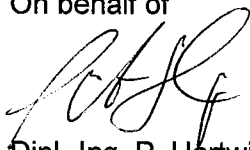
Products on the market that contain a reference to BAM testing shall be marked accordingly. It shall be evident that only a sample of a batch has been tested and evaluated for oxygen compatibility. The reference shall not produce a presumption of conformity that monitoring of the production on a regular 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"



CERT

DIN-DVGW-Baumusterprüfzertifikat

DIN-DVGW type examination certificate

NG-5124CN0281

Registriernummer
registration number

Anwendungsbereich <i>field of application</i>	Produkte der Gasversorgung <i>products of gas supply</i>
Zertifikatinhaber <i>owner of certificate</i>	SGL CARBON GmbH Werner-von-Siemens-Str. 18, D-86405 Meitingen
Vertreiber <i>distributor</i>	SGL CARBON GmbH Werner-von-Siemens-Str. 18, D-86405 Meitingen
Produktart <i>product category</i>	Schmier-/Dicht-/Betriebsmittel: Flachdichtungswerkstoff auf Basis Graphit (5124)
Produktbezeichnung <i>product description</i>	Verbundwerkstoff auf Basis Graphit mit edelstahllarmiertem Graphitkern und außenliegenden Edelstahlfolien mit Hostafloauflage
Modell <i>model</i>	SIGRAFLEX MF (V...11Z2MF)
Prüfberichte <i>test reports</i>	Baumusterprüfung: 12/150/5124/8 vom 27.09.2012 (EBI)
Prüfgrundlagen <i>test basis</i>	DIN 3535-6 (01.01.2011)

Ablaufdatum / AZ
date of expiry / file no.

27.09.2017 / 12-0675-GNE

09.11.2012 Rie A.1/2

Datum, Bearbeiter, Blatt, Leiter der Zertifizierungsstelle
date, issued by, sheet, head of certification body

DVGW CERT GmbH ist von der DAkkS nach DIN EN 45011:1998
akkreditierte Stelle für die Zertifizierung von Produkten der Energie- und
Wasserversorgung.

DVGW CERT GmbH is an accredited body by DAkkS according to EN
45011:1998 for certification of products for energy and water supply industry.



Deutsche
Akkreditierungsstelle
D-ZE-16028-01-01

DVGW CERT GmbH
Zertifizierungsstelle

Josef-Wirmer-Str. 1-3
53123 Bonn

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Fax +49 228 91 88 - 993

www.dvgw-cert.com
info@dvgw-cert.com

Test report

Food regulatory assessment of SIGRAFLEX MF-seals according the FDA requirements

The results of the test report are property of the client. However use of the results by a third party, publication, or duplication in an excerpted version is subject to a written agreement with the Fraunhofer-Institute for Process Engineering and Packaging.

Customer:	SGL Carbon GmbH 86400 Meitingen
Date of order:	25.5.2011
IVV Order no.:	PA/4367/11
Sample receipt:	9.5.2011 (sample for inspection)
Sample storage:	Remaining test material will be stored for six month in the institute.
Total pages of the report:	3

The results relate only to the investigated samples.

1 Scope

SIGRAFLEX MF seals are used as flat seals in pipes for food processing machines. The seal consist of a high-grade steel reinforces graphite core which at the top and bottom is connected with a high-grade steel film, without the use of adhesive. This in turn is coated with TFM 1700, a modified PTFE. The flat ring seal has a high-grade steel flange on the inside (food contact side). High-grade steel flanges are also sometimes used on the outside. The PTFE-coated high-grade steel film represents the sealing surface. Food contact is largely with the inner steel flange, possibly also with the edges of the PTFE-coated high-grade steel film.

It must be verified that SIGRAFLEX MF seals meet the food legislation requirements according FDA.

The testing is carried out on the basis of the manufacturer's certificates for the individual materials used.

2 Evaluation of the individual layers

According to the manufacturer's information, the high-grade steels which were used (austenitic CrNi-steels) for the high-grade steel films and flanges are suitable for use in contact with foods. In USA there are no statutory regulations for the composition of high-grade steel.

According to the manufacturer's information, the PTFE-copolymer meets the US-American requirements on accordance with 21 CFR 177.1550 "perfluorocarbon resins". The limit value for the total extract ($< 3.1 \text{ mg / dm}^2$ resp. 0.2 mg / in^2) as well as the fluorine content ($< 0.46 \text{ mg / dm}^2$ resp. $0.0.3 \text{ mg / in}^2$) are complied with the based on tests at independent testing institutes.

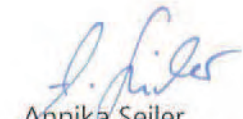
3 Summary

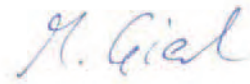
According to the provided certificates of compliance, SIGRAFLEX MF seals is, if used in the proper way, in accordance with the food legislation requirements of USA in contact with all types of food.

4 Signatures

Fraunhofer Institute
Process Engineering
and Packaging

Freising, 9.6.2011


Annika Seiler
(Dep. Head of Migration Laboratory)


Maria Gierl
(Scientist)

Herstellerbescheinigung ***Manufacturer's Certificate***

Die SGL CARBON GmbH als Lieferant des Graphitmaterials

SGL CARBON GmbH as supplier of the graphite material

SIGRAFLEX® MF

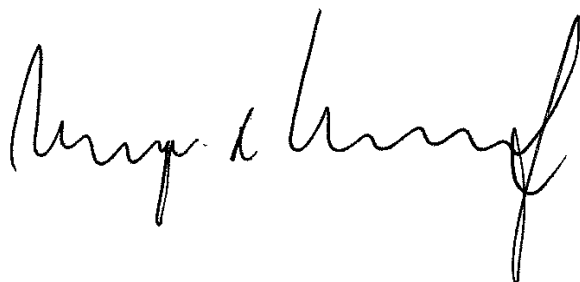
bestätigt, dass dieses Material der Verordnung (EG) Nr. 1935/2004 über Materialien und Gegenstände, die dazu bestimmt sind, mit Lebensmitteln in Berührung zu kommen, entspricht.

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