



**EXPERIENCE OF NON-ASBESTOS GASKETS  
ON LIQUID AND DRY CHLORINE GAS SERVICE**

**GEST 94/216**

**Second Edition**

**June 2004**

**EURO CHLOR PUBLICATION**

---

*This document can be obtained from:  
EURO CHLOR - Avenue E. Van Nieuwenhuyse 4, Box 2 - B-1160 BRUSSELS  
Telephone: 32-(0)2-676 72 65 - Telefax : 32-(0)2-676 72 41*

## **Euro Chlor**

Euro Chlor is the European federation which represents the producers of chlorine and its primary derivatives.

Euro Chlor is working to:

- improve awareness and understanding of the contribution that chlorine chemistry has made to the thousands of products, which have improved our health, nutrition, standard of living and quality of life;
- maintain open and timely dialogue with regulators, politicians, scientists, the media and other interested stakeholders in the debate on chlorine;
- ensure our industry contributes actively to any public, regulatory or scientific debate and provides balanced and objective science-based information to help answer questions about chlorine and its derivatives;
- promote the best safety, health and environmental practices in the manufacture, handling and use of chlor-alkali products in order to assist our members in achieving continuous improvements (*Responsible Care*).

\*\*\*\*\*

This document has been produced by the members of Euro Chlor and should not be reproduced in whole or in part without the authorisation of Euro Chlor.

Euro Chlor and its members make no guarantee and assume no liability whatsoever for the use or the interpretation of any of the information in this document.

Prior to 1990, Euro Chlor's technical activities took place under the name BITC (Bureau International Technique du Chlore). References to BITC documents may be assumed to be to Euro Chlor documents.

## RESPONSIBLE CARE IN ACTION

Chlorine is essential in the chemical industry and consequently there is a need for chlorine to be produced, stored, transported and used. The chlorine industry has co-operated over many years to ensure the well-being of its employees, local communities and the wider environment. This document is one in a series which the European producers, acting through Euro Chlor, have drawn up to promote continuous improvement in the general standards of health, safety and the environment associated with chlorine manufacture in the spirit of *Responsible Care*.

The recommendations, techniques and standards presented in these documents are based on the experiences and best practices adopted by member companies of Euro Chlor at their date of issue. They should be taken into account in the operation of existing processes and in the design of new installations. They are in no way intended as a substitute for the relevant national or international regulations which should be fully complied with.

It has been assumed in the preparation of these publications that the users will ensure that the contents are relevant to the application selected and are correctly applied by appropriately qualified and experienced people for whose guidance they have been prepared. The contents are based on the most authoritative information available at the time of writing and on good engineering, medical or technical practice but it is essential to take account of appropriate subsequent developments or legislation. As a result, the text may be modified in the future to incorporate evolution of these and other factors.

This edition of the document has been drawn up by the Safety Working Group to whom all suggestions concerning possible revision should be addressed through the offices of Euro Chlor.

## Summary of the Main Modifications in this version

Section	Nature
2	Alineas 3 and 4 are added
2.1	Only the reference of the gasket is maintained; remarks on composition are deleted
All tables	The number of years of experience is changed into the year where the experience began.
3.1	The reference Siem Supranite PGAC F was added
3.3	The reference Sigraflex WS 3862 was added

## TABLE OF CONTENTS

<b>1. INTRODUCTION</b>	<b>5</b>
<b>2. GENERAL REMARKS</b>	<b>6</b>
2.1. PTFE	6
2.2. ARAMIDE FIBRE	6
2.3. CARBON FIBRE	6
<b>3. NON-ASBESTOS GASKETS ON LIQUID CHLORINE AND DRY CHLORINE GAS SERVICE</b>	<b>7</b>
3.1. PTFE	7
3.2. ARAMIDE FIBRE	8
3.3. CARBON FIBRE	9

## 1. INTRODUCTION

This publication summarises the experience to date where non-asbestos gaskets have been found to give reliable service on liquid chlorine and dry chlorine gas applications.

Gaskets made from compressed asbestos fibres (CAF) have been used very successfully for many years for liquid chlorine and dry chlorine gas applications and the material had become the automatic choice within the chlorine industry. However in recent years concerns have been expressed over possible health risks from asbestos. Directive 99 77 EC imposes a ban on all new uses and installations of asbestos (excluding electrolytic diaphragms) no later than 1<sup>st</sup> January 2005. However, Member States have the freedom to introduce a ban at an earlier date, if they choose. (Asbestos components already in service prior to any implementation date may remain in service until the end of their service life). As a result, a number of alternative materials have been tried on liquid- and dry chlorine gas applications. Whilst CAF is still the material which can be recommended with total technical confidence, the experience of other materials is growing.

The document contains information which has come principally from Euro Chlor member companies, although account has also been taken of information collected by the Chlorine Institute in USA. The range of pressure and temperature conditions under which the various materials have been used is not so great as with CAF and, since it is based primarily on practical experience in working plants rather than on controlled experiments in laboratory conditions or on theoretical engineering considerations, the limits quoted should be taken as a guide rather than being treated as accurately defined. The guideline deliberately covers only materials which have been used successfully by several companies for at least 2 years. It is recognized that individual companies may have good experience with materials not covered in this guideline, or with a wider range of operating conditions. It is not suggested that their experience is not valid or that they need to change to materials which are covered. It simply illustrates the fact that this is an area where experience is still being gained, as companies continue to experiment with alternative materials.

The publication will be up-dated periodically to take account of new information as it becomes available.

## 2. GENERAL REMARKS

The data on the experience with non-asbestos gaskets are summarized in the following table.

The given ranges for temperatures and pressures (absolute) are reported operating values. The gasket materials themselves can stand higher temperatures in accordance with to the manufacturer's information.

Specific attention has to be paid for mounting the gaskets in accordance with manufacturer's instructions.

The gasket thickness is dependant on temperature, pressure, size.

Some general remarks are accompanying this table.

### 2.1. *PTFE*

- The gasket thickness varies between 1.6 and 2.0 mm.

### 2.2. *ARAMIDE FIBRE*

- The gasket thickness is standard 2.0 mm.
- The gasket thickness is at least 3.0 mm for gaskets with a steel jacket.

### 2.3. *CARBON FIBRE*

- The gasket thickness is standard 2.0 mm.
- The gasket thickness is at least 3.0 mm for gaskets with a steel foil bordered to the smaller diameter.

A list of the main non asbestos gasket manufacturers appears in the *GEST 94/216 A - Experience of Non-Asbestos Gaskets on Liquid and Dry Chlorine Gas Service – Supplier's references.*

### 3. NON-ASBESTOS GASKETS ON LIQUID CHLORINE AND DRY CHLORINE GAS SERVICE

#### 3.1. PTFE

Type	Make	Medium	Bolting Assembly	Temperature Range (°C)	Pressure Range (bars abs.)	Diameter (mm)	Experience since	Remarks
PTFE	PTFE pure	Liquid Cl <sub>2</sub>	Tongue & groove	- 20 to 50	0.9 to 13	25 to 250	1980	
	PTFE pure	Dry Cl <sub>2</sub> gas	Tongue & groove	- 20 to 50	0.9 to 13	to 500	1980	
	Gylon 3500 –fawn*	Liquid Cl <sub>2</sub>	Tongue & groove Male and female	-35 to 30	1 to 16	25 to 500	1996	
	Gylon 3500 –fawn*	Dry Cl <sub>2</sub> gas	Raised face Tongue & groove	- 35 to 100	1 to 5	25 to 500	1990	
	Gylon 3504 –blue*	Dry Cl <sub>2</sub> gas	Flat	70 to 95	1 to 5	20 to 350	1997	
		Liquid Cl <sub>2</sub>	Flat	- 35 to 10	up to 15	25 to 250	1990	
	Gylon 3510 –white*	Liquid Cl <sub>2</sub> and Dry Cl <sub>2</sub> gas	Raised face	- 35 to 120	1 to 14	25 to 600	1998	
	Gylon 3545*	Liquid Cl <sub>2</sub>	Flat	0 to 40	up to 13	to 500	1995	
	Siem Supranite PGAC	Liquid Cl <sub>2</sub> and Dry Cl <sub>2</sub> gas	Flat Tongue & groove	- 35 to 100	1 to 16	25 to 500	1995	
Siem Supranite PGAC F	Liquid Cl <sub>2</sub> and Dry Cl <sub>2</sub> gas	Tongue & groove	-15 to 90	1 to 19	25 to 250	2000		

\* Gylon is trademark of Garlock.

## NON-ASBESTOS GASKETS ON LIQUID CHLORINE AND DRY CHLORINE GAS SERVICE (continued)

### 3.2. ARAMIDE FIBRE

Type	Make	Medium	Bolting Assembly	Temperature Range (°C)	Pressure Range (bars abs.)	Diameter (mm)	Experience since	Remarks
ARAMIDE FIBRE*	Permanite AF2200	Liquid Cl <sub>2</sub> and Dry Cl <sub>2</sub> gas	Raised face	0 to 60	1 to 10		1996	
	Klinger Sil C 4400	Liquid Cl <sub>2</sub> Dry Cl <sub>2</sub> gas	Tongue & groove	- 34 to 30	0.9 to 15	25 to 100	1993	
	Klinger Sil C 4400 With stainless steel Jacket	Dry Cl <sub>2</sub> gas	Flat	0 to 60	1 to 4	25 to 500	1995	Thickness at least 3 mm
	Reinz AFM 34	Liquid Cl <sub>2</sub>	Tongue & groove	- 34 to 100	0.8 to 10	25 to 150	1995	Attention has to be paid to the condition of the flanges (smooth and parallel surfaces)
		Dry Cl <sub>2</sub> gas	Raised face	- 34 to 100	0.8 to 12	up to 700	1995	
	Permanite 2200 black Supranite 2200	Liquid Cl <sub>2</sub> and Dry Cl <sub>2</sub> gas	Flat	0 to 40	up to 13	25 to 250	1995	
	Chesterton 196	Liquid Cl <sub>2</sub> and Dry Cl <sub>2</sub> gas	Flat	0 to 40	up to 13	25 to 250	1995	

\* Aramide fibre: only pH above 3 is allowed.

## NON-ASBESTOS GASKETS ON LIQUID CHLORINE AND DRY CHLORINE GAS SERVICE (continued)

### 3.3. CARBON FIBRE

Type	Make	Medium	Bolting Assembly	Temperature Range (°C)	Pressure Range (bars abs.)	Diameter (mm)	Experience since	Remarks
CARBON FIBRE	Klinger Sil C 4500	Dry Cl <sub>2</sub> gas	Tongue & groove	- 34 to 60	0.9 to 15	25 to 500	1995	e.g. railtanker manhole flange
	Klinger Sil C 4500 With stainless steel foil bordered to the smaller diameter	Liquid Cl <sub>2</sub> Dry Cl <sub>2</sub> gas Rail tankers	Flat Raised face	Liq = - 20 to 20 Gas = - 20 to 80 R.T.= - 20 to 40	1 to 13.5	50	1994	Applied for railtankers
	Klinger Sil C 4500 (graphite)	Liquid Cl <sub>2</sub> Dry Cl <sub>2</sub> gas Sulphuric acid 96-98%	Tongue & groove Flat	Liq = - 30 to 30 Gas = - 30 to 20 Acid = - 30 to 30	1 to 20	25 to 500	1995	Applied for railtankers
	Klinger Sil C 4500	Dry Cl <sub>2</sub> gas Sulphuric acid 96-98%	Flat	- 20 to 30	1 to 2	up to 150	1994	Good results on the sulphuric acid system of the chlorine gas drying tower.
Graphite with perforated stainless steel sheet	Sigraflex WS 3862	Liquid Cl <sub>2</sub> Dry Cl <sub>2</sub> gas	Tongue & groove Flat	-34 to 90	0 to 20	15 to 600	1990 1997 for rail tanks	Pay attention the assembly

\* trademark SGL group

Industrial consumers of chlorine, engineering and equipment supply companies worldwide and chlorine producers outside Europe may establish a permanent relationship with Euro Chlor by becoming Associate Members or Technical Correspondents.

Details of membership categories and fees are available from:

Euro Chlor  
Avenue E Van Nieuwenhuyse 4  
Box 2  
B-1160 Brussels  
Belgium

Tel: +32 2 676 7211  
Fax: +32 2 676 7241  
e-mail: [eurochlor@cefic.be](mailto:eurochlor@cefic.be)  
Internet: <http://www.eurochlor.org>