From: Donald R. Frikken CS7H Corporate Engineering (4-6744)

Date: August 20, 1984

cc Charlie Petit - CS7H
Tom Pryor - CS7H

Re: Use of Asbestos in Piping Systems

PLAINTIFF'S EXHIBIT
MON-1847

To:

Dave Allman	- 1720	Andy Larson	- CS7E
Gene Anthony	- CS7E	Walter Leong	- 1760
Larry Baer	- CS6M	Tom Martin	- CS6G
Dave Barrett	- CS7H	Lynn Meenen	- CS6M
Paul Bernache	- CS7V	Charlie Pannett	- CS6D
Jim Blankenship	- CS6B	Joe Purvis	- CS7V
A. D. Book	- 1560	Wendy Purvis	- F4WB
Jim Borgmeyer	- CS7V	Rich Quinlisk	- CS6B
Len Bornemann	- 1440	Rich Ramsey	- CS6G
Bruce Bradley	- CS6M	Doug Rogel	- 1900
Paul Brewer	- 1740	Glenn Ross	- 1780
George Butler	- 1200	Jack Roubidoux	- CS6M
M. R. Bynum	- 1760	Dennis Sagez	- CS70
Bob Carlton	- CS7D	B. J. Sanders	- 1890
Mike Combs	- 1690	Buddy Satterly	- CS7E
Mac Feld	- CS6G	Mark Schoedel	- CV
Gene Forneris	- 1740	Gene Stecher	- CS70
Barry Hauf	- CS6B	Gus Theodore	- CS6B
Dave George	- CS70	Ralph Tisher	- CS70
Lee James	- CS6M	Al Tung	- CS2B
Joe Jeter	- 1760	Don White	- 1560
Tom Jordan	- 1870	Bill Womack	- 1850

For those of you who haven't seen it, I have attached a copy of Monsanto's policy on the use of asbestos. As you probably know, most of the asbestos we use in new facilities is in piping systems. I developed a proposal for implementation of this policy on CED projects as shown below. The proposal was approved this morning.

PLAN FOR ELIMINATING ASBESTOS IN NEW PIPING SYSTEMS

Line Gaskets

1. Revise piping system masterspecs (PSM's). (I revised the electronic version this morning. Any PSS's developed using the automated system will not have asbestos containing gaskets.)
2. Revise piping system specifications (PSS's) for current projects before January.
3. Stop purchasing gasketing which contains asbestos on January 1, 1985, even if the requisition specifies asbestos.

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Coated and Wrapped Pipe

1. Revise piping system masterspecs (PSM's). (I revised the electronic version this morning. Any PSS's developed using the automated system will not have coated and wrapped pipe.)
2. Revise piping system specifications (PSS's) for current projects before January.
3. Stop purchasing coated and wrapped pipe on January 1, 1985.

Valves

1. Revise valve specifications before December, 1985.
2. Stop purchasing valves which contain asbestos on January 1, 1986, even if the requisition specifies otherwise.

RECOMMENDED ALTERNATES TO ASBESTOS

There is no universal substitute for asbestos. There are generally three materials which have been demonstrated to be suitable:

* Asbestos substitutes
* Reinforced PTFE
* Flexible Graphite

For line gaskets, the primary alternates are compressed non-asbestos sheet, reinforced PTFE and reinforced flexible graphite (vendor information attached). For utilities such as air, water, inert gas and steam, I recommend using Garlock Blue-Gard style 3400. Unless this, or another asbestos substitute has been demonstrated to be suitable in a chemical service, I recommend using the reinforced PTFE for temperatures below 400 F. For temperatures from 400 F to 500 F, flexible graphite should be used in chemical service. Flexible graphite filled spiralwound gaskets should be substituted for asbestos filled spiralwound gaskets. I cannot recommend PTFE filled spiralwound gaskets because of reported leakage at moderate temperatures, presumably caused by creep. I understand the industry is gaining favor for reinforced PTFE filled spiralwound gaskets, but I know of no Monsanto experience with this gasket.

For coated and wrapped pipe, the primary alternates are extruded polyethylene coating and coal tar epoxy coating (K1.3 STD U2).

The primary alternates for valve gaskets are the same as for line gaskets. The primary alternates for valve packing are asbestos substitutes, PTFE and flexible graphite.

For specific applications, I recommend consulting with your friendly Materials Engineer.

Frikken

Don Frikken

MONSANTO'S POLICY ON ASBESTOS

I. Policy Statement

Monsanto's social responsibility policy states that we will provide a safe and healthful workplace for our employes. To support this policy we will ensure that appropriate safety procedures and health considerations are incorporated into the design of all new Monsanto facilities and we will train employes in the safe operating practices and require the use of proper protective devices. To support this policy a program for the identification and elimination of asbestos materials within our workplaces will be developed.

II. Scope

To implement the policy regarding the identification and elimination of asbestos materials we will:

1. Revise the specifications in the CED piping standards to eliminate asbestos gaskets. Situations in which non-asbestos gaskets will not meet the specific requirements will be handled by the operating company and CED on an exception basis.

2. Specify non-asbestos materials for valve packing and other speciality applications. This will require a transition period to inform all of our suppliers well ahead of time that we will no longer accept materials obtaining asbestos, to evaluate the cost and performance of alternatives for asbestos, and to change the Monsanto specifications. Situations in which non-asbestos materials will not meet the specific requirements will be handled by the operating company and CED on an exception basis. The target date for completion is December 31, 1985.

3. Replace asbestos in existing facilities with non-asbestos materials when repair, replacement, modification projects or executed. Situations in which non-asbestos materials will not meet the specific requirements will be handled by the operating company and CED on an exception basis.

4. Manage in a manner to assure proper protection of personnel those situations in which asbestos remains by:

   a) providing workplace guidelines that reflect the state of technology today and that comply with all governmental regulations on handling, working with, and disposal of asbestos.

b) Maintaining a "state-of-the-art" awareness of the evolution of potential asbestos substitutes and of the evolution of technology, industry practices, and governmental regulations on handling, working with, and disposal of asbestos.

c) Periodically reviewing and evaluating those situations in which asbestos is still used.

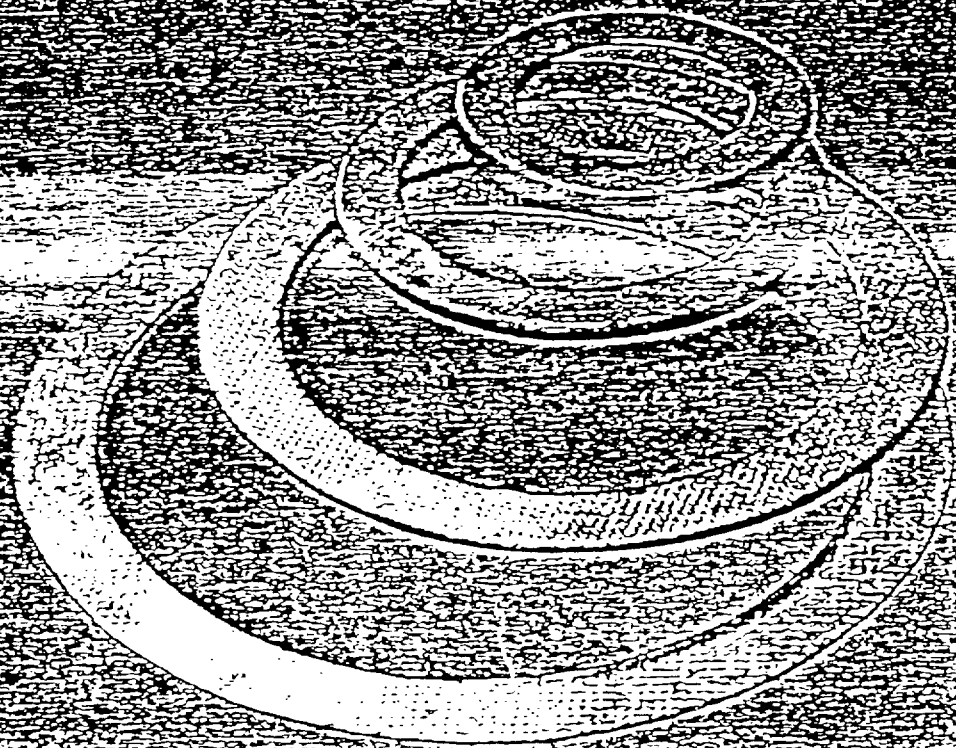
July 19, 1984

GRAFOIL®

METAL-INSERTED GASKETS GRADE GHE

RESILIENT GRAPHITE PLUS A 316 STAINLESS STEEL CORE

FOR PIPE SIZES — 1/2 INCH THROUGH 20 INCHES
FLANGE RATINGS — 150, 300, 600, 900 AND 1500 LBS.
GASKET THICKNESS — 1/32" AND 1/16" INCHES
GASKET O.D. — CENTERED BY BOLTS
SERVICE FROM -400°F TO 1600°F — PRESSURE TO 10,000 PSIG



FEATURING

- LEAK-TIGHT PERFORMANCE UNDER MODERATE BOLT LOADS
- NO COLD FLOW OR CREEP
- NO NEED FOR PRECISION BOLT TIGHTENING
- NO FLANGE STICKING

LAM021978

Description and design data

"Grafoil" metal-inserted gaskets consist of "Grafoil" graphite sheets† mechanically bonded to type 316 stainless steel sheet(s). Depending on the thickness of the gasket required, multiple layers of "Grafoil" graphite and stainless steel are used. This composite construction provides a stronger gasket and in no way affects the excellent corrosion-resistance and high-temperature properties of the graphite component since "Grafoil" graphite is devoid of fillers or resins.

The metal-inserted gaskets are available for pipe sizes from 1/2 to 20 inches, in thicknesses of 1/32 and 1/16 inches for 150, 300, 600, 900 and 1500 pound steel, cast iron or equally hard flanges.* The gaskets are self-centering when positioned by the flange bolts.

Temperature extremes have no adverse effects on "Grafoil" gaskets; dependable performance is assured from 1600° F in neutral or reducing atmospheres, down to -400° F. No cold flow characteristics are exhibited and there is no embrittlement of the "Grafoil" material.

Although "Grafoil" metal-inserted gaskets will not vulcanize or bond to flange surfaces, "Grafoil" graphite particles may adhere in spots to the flange faces. Parting the flanges, however, poses no problem since the laminar construction of the gasket facilitates a clean breakaway. Any residue is readily removed with a wire brush or metal wool.

This catalog is designed to help select appropriate gaskets for your application. Our Technical Service Department will be glad to discuss your particular application and make recommendations.

TYPICAL PROPERTIES "GRAFOIL" METAL-INSERTED GASKETS

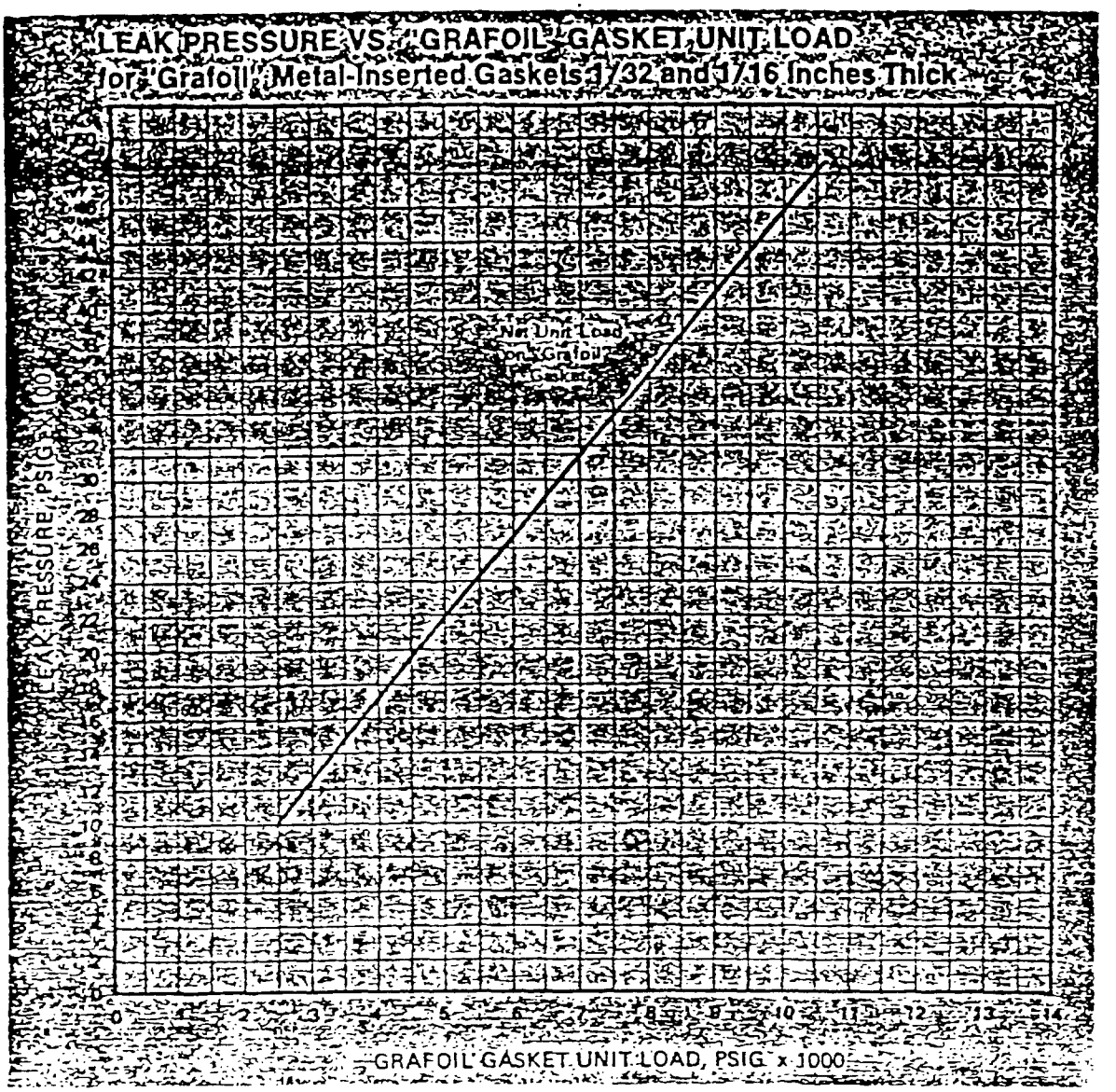
Property	Unit	Value	(Metric)
m factor		2	(2)
y stress	psi	2500	(17 MPa)
Maximum Gasket Unit Load	psi	24,000	(165 MPa)
Maximum Operating Pressure	psi	10,000	(69 MPa)
Functional Temperature Range			
Neutral or Reducing Atmosphere	°F	-400 to 1600	(-200°C to 870°C)
Oxidizing Atmosphere	°F	400 to 850**	(-200°C to 450°C)
Thermal Conductivity at Room Temperature			
Through Thickness	Btu/hr/ft²/°F/ft	2	(3.5 Watts/Meter °C)
Radially	Btu/hr/ft²/°F/ft	85	(175 Watts/Meter °C)
Electrical Resistivity			
Radially	Ohm-cm	4.6×10^{-4}	(4.6×10^{-4} Ohm-Meter)

*Because the teeth of the tang metal core will indent metals softer than 316 s.s., Grade GHE gaskets are not normally recommended for use with bronze, aluminum or similar flanges.

**The fluid temperature may considerably exceed 850° F providing that the *bulk temperature of the "Grafoil" gasket is 850° F or below, or that the fluid being handled does not come into direct contact with the graphite.* Example: a metal spiral-wound gasket with a "Grafoil" filler material.

†U.S. Patent No. 3,404,061

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Gasket loading vs. leakage pressures

The prime requirement for satisfactory sealing with "Grafoil" metal-inserted gaskets is sufficient unit load on the gasket at all times in one continuous path around the gasket.

If surfaces are maintained flat within 0.005 inches, and are held to a surface finish of 125 RMS or better, "Grafoil" gaskets will seal hydrostatic pressures as shown on the graph above, "Leak Pressure vs. Gasket Unit Load for 'Grafoil' Gaskets." A Net Load of 7,000 psi of dotted line example will seal up 3,150 psi water pressure. The Net Unit Load is that force still exerted on the gasket surface after *all* the forces which tend to relieve the initial unit load are subtracted. One such opposing force is the "piston" action of the sealed pressure on the area within the gasket I.D. Others are bolt stretch, piping stress, and differential thermal expansion. The initial load on "Grafoil" gaskets must be enough to end up, under operating conditions, at or above the Net Unit Load indicated on the graph.

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"GRAFOIL" METAL-INSERTED GASKETS PIPE-SIZE GASKET* DIMENSIONS

Gasket Dimension In Inches → / Pipe Size (In.) ↓	ID	O.D. for AMERICAN STANDARD STEEL FLANGES				
		150 lb	300 lb	600 lb	900 lb	1500 lb
½	27/32	3⅞	2⅛	Same as 300 lb	2½	Same as 900 lb
¾	1-1/16	2¼	2⅝		2¾	
1	1-5/16	2⅝	2⅞		3⅛	
1½	1-29/32	3⅜	3¼		3⅞	
2	2⅜	4⅛	4⅜		5⅛	6⅜
3	3½	5⅜	5⅞		6⅝	
4	4½	6⅞	7⅜	7⅝	8⅛	8½
6	6⅝	8½	9⅞	10¼	11⅜	11⅞
8	8⅝	11	12⅛	12⅝	14⅛	13⅞
10	10¾	13⅜	14¼	15¾	17⅛	17⅞
12	12¾	16⅛	16⅝	18	19⅝	20⅛
14	14	17¾	19⅛	19¾	20½	22¾
16	16	20¼	21¼	22¼	22⅝	
18	18	21⅝	23½			
20	20	23⅞				

*Normally available from stock.

HOW TO INSTALL

1. Remove all projecting particles, scale, and burrs from the flange faces. Small subsurface defects will cause no trouble.
2. Part flanges enough to slide gasket in place, using a few bolts for positioning. Temporary spaces may be advisable.
3. Handle the "Grafoil" gasket with reasonable care to avoid tearing, scratching or bunging.
4. Insert rest of bolts. Draw flanges together evenly. Tighten all nuts hand tight. Increase bolt loading in usual manner until required bolt load is obtained.

HOW TO ORDER

See separate Catalog Section** for pricing and standard packaging. On order, specify size, quantity, catalog number and price.

CUSTOM SIZES

Gaskets with dimensions varying from those shown in the table, can be supplied upon request – please furnish sketch and dimensional data.

G 8819

GRAFOIL is a registered trade mark of Union Carbide Corporation.

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