FILE NAME: John Crane (JC)

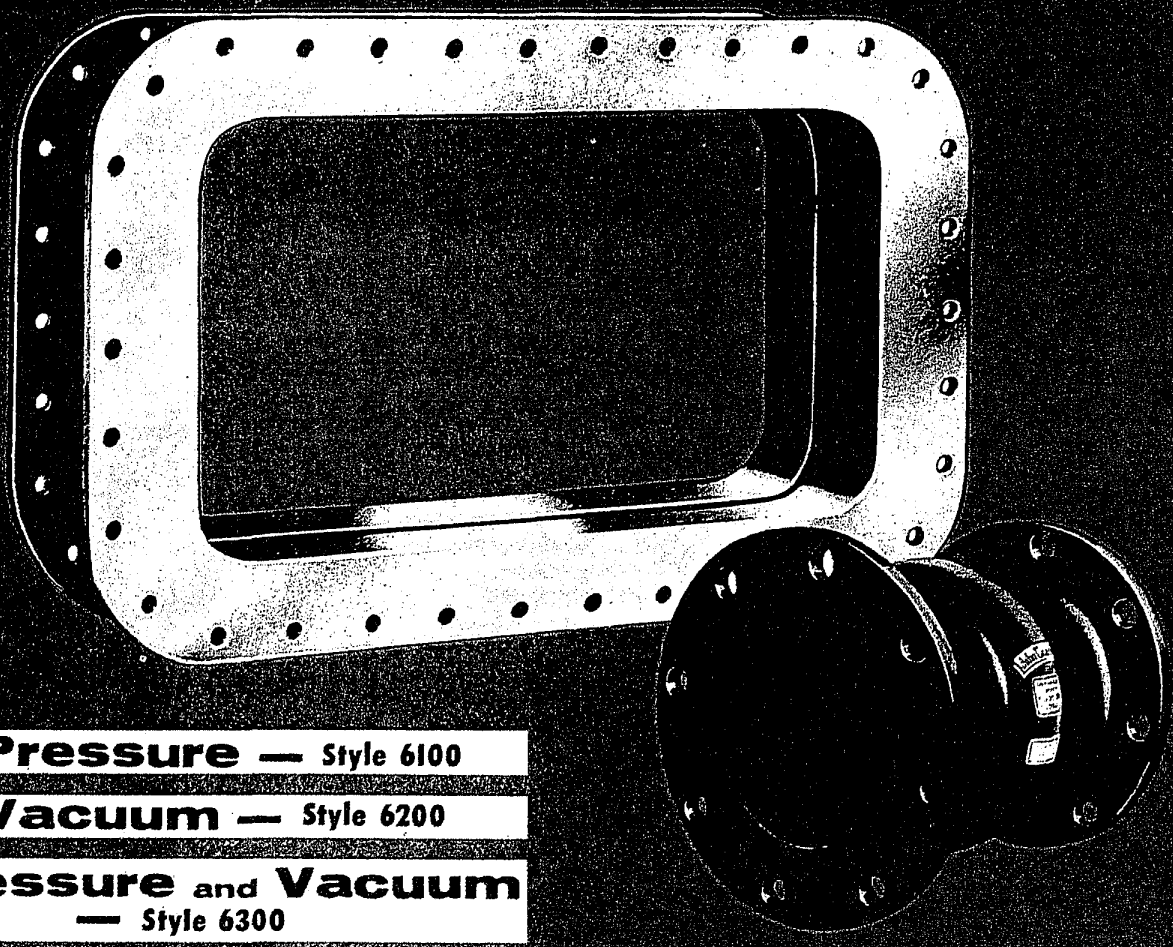
DATE: 0000

DOC#: JC057

DOCUMENT DESCRIPTION: Crane Sales Literature Part IV

John Crane®

RUBBER EXPANSION JOINTS



Pressure — Style 6100

Vacuum — Style 6200

Pressure and Vacuum — Style 6300

John Crane

CRANE PACKING COMPANY

6400 OAKTON STREET, MORTON GROVE, ILLINOIS 60053

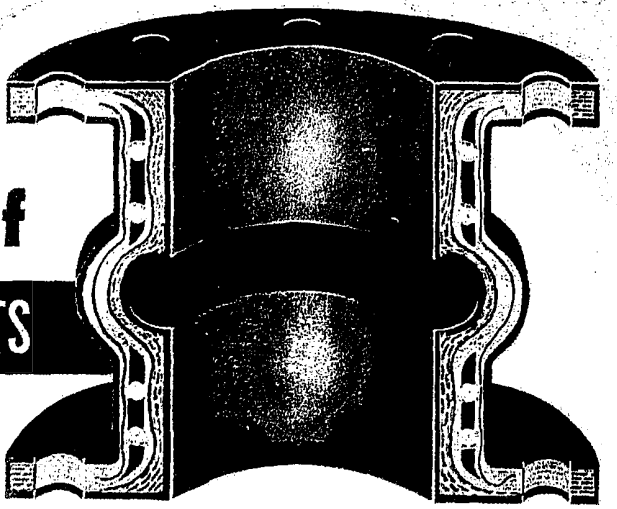
PLANTS IN: Canada, Mexico, Brazil, England, Australia and Japan

JOHN CRANE — RUBBER

. . . for every Industrial and

CONSTRUCTION FEATURES of

JOHN CRANE EXPANSION JOINTS



Neoprene inner liner, a neoprene cover and liner or neoprene throughout depending on the oil resistance required. Flanges are furnished with 125# American Standard Drilling unless otherwise specified.

MATERIALS

John Crane Rubber Expansion Joints are made of a high grade rubber, abrasion-resistant compound specially developed in the John Crane laboratories for the maximum in flexibility and non-set characteristics. This compound is combined with a strong cotton duck. For vacuum, the carcass of the joint is reinforced with steel rings. For applications where oil resisting properties are required, these joints are supplied with a

FLEXIBILITY

The central arch in the body of the expansion joint located at the center point between the two flanges, contributes the major portion of the flexibility of the joint. The characteristics of the materials employed in their manufacture also furnishes a degree of flexibility. But it is this central arch which flexes with the contraction or expansion of the piping and thus relieves the stresses, and vibrations developed in the line. It is this flexibility which also permits the connection of misaligned piping without any line strain.

Should there be excessive sediment in the pipe line, there is always the possibility that this sediment — collecting in the arches of the expansion joints — will make the arches partially or completely inoperative. Where such conditions exist, soft rubber fillers are cemented into the arches to prevent the settling of the sediment while allowing the arches to function.

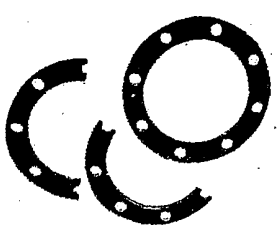
FLANGES

The fabric-reinforced, full-face rubber flanges of every John Crane Rubber Expansion Joint are an integral part of the body of the joint. They provide a tight seal against the corresponding pipe flange and eliminate the need for gaskets. Unless otherwise specified, they are drilled for bolts in accordance with 125# American Standard Drilling.

SERVICE RANGES

Pressure-type Joints operate most satisfactorily at operating pressures, varying with size from 0 *psi* to 150 *psi*. Vacuum-type joints are suitable for a vacuum of 30 in. of mercury.

METAL RETAINING RING



John Crane Rubber Expansion Joints can be supplied with a split and bevelled galvanized steel retaining ring. These are placed directly against the flange of the joint to prevent damage to the rubber flanges by providing a metal contact surface when bolts are tightened. Steel washers are used at the points where the rings are split.

HOW TO ORDER

John Crane Spool-type Expansion Joints are furnished in 3 types:

Style 6100—Pressure
Style 6200—Vacuum
Style 6300—Pressure and Vacuum

see other side for dimensi

EXPANSION JOINTS
Marine Application

JOHN CRANE
RUBBER EXPANSION JOINTS

are recommended for installation on the following types of equipment:

- AIR CONDITIONING
- AIR DUCTS
- AIR INJECTION LINES
- BALLAST LINES FOR SHIPS, Etc.
- AIR & GAS BLOWER LINES
- BRINE TANKS
- CHILLED WATER LINES
- CIRCULATING WATER LINES TO CONDENSERS
- DRY VACUUM LINES
- FORCED DRAFT BLOWER LINES
- HOT WATER LINES
- JET CONDENSERS
- PAPER STOCK LINES
- PUMP SUCTION AND DISCHARGE LINES
- TURBINE-TO-CONDENSER LINES
- VENTILATING SYSTEMS

ADVANTAGES OF
JOHN CRANE RUBBER EXPANSION JOINTS

Because of exceptional features, John Crane Rubber Expansion Joints have many advantages of particular value to industrial and marine users of expansion joints. Some of the outstanding features of these are:

1. They have an exceptionally long life because John Crane uses a high grade of rubber in the joint. This neither cracks or fractures under repeated flexing caused by the contraction or expansion of the pipe line.
2. They are lightweight and can be installed in a minimum of space. On pipe sizes up to 10", only 6" face to face of joint is required.
3. Because of the "live" characteristics of the rubber employed in their manufacture, John Crane Rubber Expansion Joints do not develop a permanent set. Invariably, they return to their full, normal length even after repeated, excessive compressions or expansions.
4. Vacuum-type joints are designed for a vacuum of 30" of mercury. Pressure-type joints are designed for operating pressures from 0 *psi* to 150 *psi*, depending on the size of the joint used.
5. These expansion joints can be used at temperatures up to 180°F. Special types can be manufactured for operating temperatures up to 250°F.
6. Crane engineers have designed these expansion joints so that no gaskets are required between the flanges of the joint and the flanges of the pipe.
7. They do not induce electrolysis nor do they corrode or erode.
8. Crane engineers are available for consultation on special expansion joint application problems.

JOHN CRANE RUBBER EXPANSION JOINTS
are providing trouble free service to

- CENTRAL POWER STATIONS
- FACTORY POWER STATIONS
- CHEMICAL PLANTS
- PUMPING STATIONS
- WATER WORKS
- PUBLIC BUILDINGS
- CHEMICAL POWER STATIONS
- PULP & PAPER MILLS
- SEWAGE DISPOSAL PLANTS
- MINES
- CARGO SHIPS, TANKERS, WARSHIPS, ETC.

Although only standard spool type John Crane Rubber Expansion Joints are described herein, they can be designed and built to meet special conditions involving acids, gases, oils and other chemicals. John Crane Expansion Joints can be had in any of the following types: Spool Type; Tapered Type; Rectangular Type; Oval Type; Offset and Special Shapes . . . all to meet standard or special operating conditions.

CONTROL RODS

Control Rods are required with John Crane Expansion Joints where excessive elongation or compression would produce serious damage to the expansion joint. Control Rods are required under the following conditions:

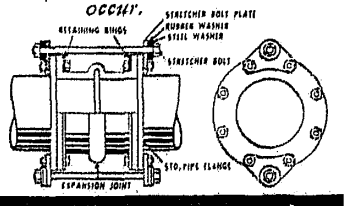
1—On High Pressure Lines *not properly anchored.*

2—On Pipe Systems *with insufficient support.*

3—On Systems *where wide temperature fluctuations occur.*

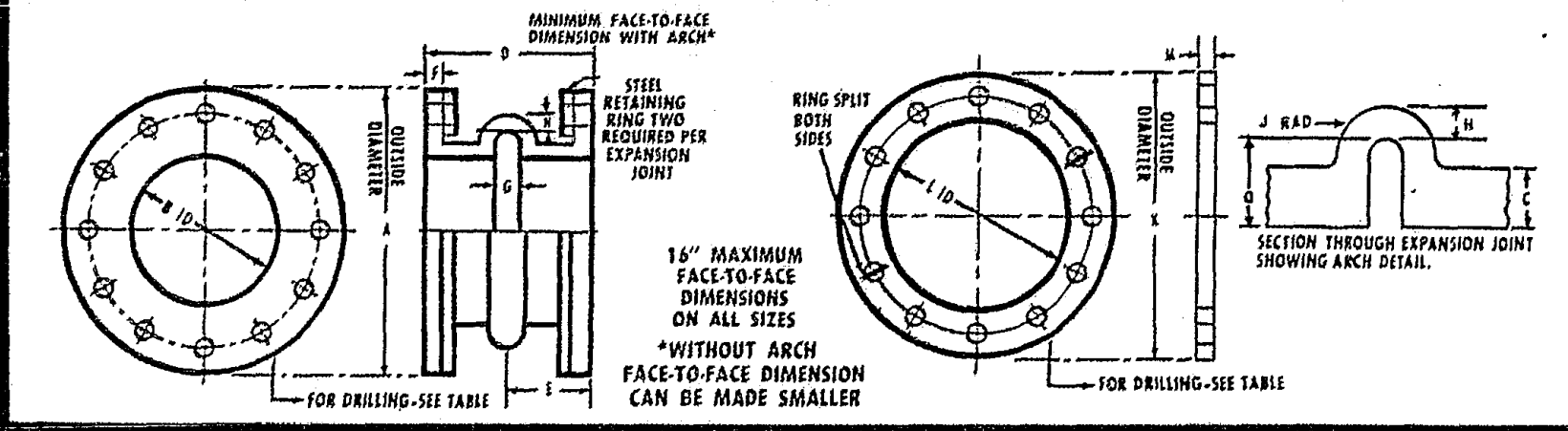
To facilitate and expedite your order or quotation, the following information should be supplied:

1. Type of Service—
   (A) Pressure . . . (C) Pressure & Vacuum . . .
   (B) Vacuum . . . (D) Fluid Handled . . .
2. Pipe Size
3. Face-to-face dimension (D in table on back page)
4. If drilling is to be other than standard, state diameter of the bolt circle, number and size of bolt holes.
5. Quantity of expansion joints required.
6. Quantity of pairs of retaining rings required. (1 set per joint).



ns and charts

Dimensions



Nom. Pipe Sizes	EXPANSION JOINT A	B	C	D	E	F	G	H	J	RETAINING RING Q	K	L	M	Diam. of Bolt Circle	No. of Bolts	Diam. of Bolts	Diam. Drilled Holes	Length of Bolts	Size of Ring Gasket	EST. WEIGHT—LB. Exp. Joint	Ret. Ring
2	6	2	3/4	6	3	9/16	1/2	1/2	3/4	1 1/4	6	3 5/8	3/8	4 3/4	4	5/8	3/4	2 1/2	2 x 4 1/8	4	4
2 1/2	7	2 1/2	3/4	6	3	9/16	1/2	1/2	3/4	1 1/4	7	4 1/8	3/8	5 1/2	4	5/8	3/4	2 3/4	2 1/2x4 7/8	4 1/2	5 1/2
3	7 1/2	3	3/4	6	3	9/16	1/2	1/2	3/4	1 1/4	7 1/2	4 5/8	3/8	6	4	5/8	3/4	2 3/4	3 x 5 3/8	5 1/4	6
4	9	4	7/8	6	3	9/16	1/2	1/2	3/4	1 1/4	9	5 7/8	3/8	7 1/2	8	5/8	3/4	3	4 x 6 7/8	7	7 1/4
5	10	5	7/8	6	3	9/16	1/2	1/2	3/4	1 1/4	10	6 7/8	3/8	8 1/2	8	3/4	7/8	3	5 x 7 3/4	8 1/4	8 3/4
6	11	6	7/8	6	3	5/8	1/2	1/2	3/4	1 1/4	11	7 7/8	3/8	9 1/2	8	3/4	7/8	3 1/4	6 x 8 3/4	9 3/4	10
8	13 1/2	8	7/8	6	3	3/4	3/4	5/8	1	1 1/2	13 1/2	9 7/8	3/8	11 3/4	8	3/4	7/8	3 1/2	8 x 11	15	14
10	16	10	1	8	4	3/4	3/4	11/16	1 1/16	1 1/2	16	12 1/8	3/8	14 1/4	12	7/8	1	3 1/2	10x13 3/8	21	18
12	19	12	1 3/16	8	4	3/4	3/4	11/16	1 1/16	1 1/2	19	14 1/2	3/8	17	12	7/8	1	3 1/2	12x16 1/8	28	25
14	21	14	1 3/16	8	4	7/8	3/4	3/4	1 1/8	2	21	16 1/2	3/8	18 3/4	12	1	1 1/8	4	14x17 3/4	39	28
16	23 1/2	16	1 3/16	8	4	7/8	3/4	3/4	1 1/8	2	23 1/2	18 1/2	3/8	21 1/4	16	1	1 1/8	4	16x20 1/4	45 1/2	35
18	25	18	1 3/16	8	4	7/8	3/4	3/4	1 1/8	2	25	20 1/2	3/8	22 3/4	16	1 1/8	1 1/4	4 1/4	18x21 5/8	50 1/2	34
20	27 1/2	20	1 1/4	8	4	1	7/8	25/32	1 7/32	2	27 1/2	22 5/8	3/8	25	20	1 1/8	1 1/4	4 1/2	20x23 7/8	61	41
24	32	24	1 1/4	10	5	1	7/8	25/32	1 7/32	2	32	26 5/8	3/8	29 1/2	20	1 1/4	1 3/8	5	24x28 1/4	75	53
30	38 3/4	30	1 3/8	10	5	1	1	13/16	1 5/16	2 1/4	38 3/4	32 7/8	3/8	36	28	1 1/4	1 3/8	5 1/2	30x34 1/4	101 1/2	70
36	46	36	1 3/8	10	5	1	1	13/16	1 5/16	2 1/4	46	39	3/8	42 3/4	32	1 1/2	1 5/8	6	36x41 1/4	137 1/2	99
42	53	42	1 1/2	12	6	1 3/16	1 1/8	29/32	1 15/32	2 1/2	53	45 1/4	3/8	49 1/2	36	1 1/2	1 5/8	6 1/2	42x48	182 1/2	127
48	59 1/2	48	1 1/2	12	6	1 3/16	1 1/8	29/32	1 15/32	2 1/2	59 1/2	51 1/4	3/8	56	44	1 1/2	1 5/8	6 1/2	48x54 1/2	211	154 1/2
54	66 1/4	54	1 1/2	12	6	1 3/16	1 1/8	29/32	1 15/32	2 1/2	66 1/4	57 1/4	3/8	62 3/4	44	1 3/4	2	7	54x61	265 1/2	185
60	73	60	1 1/2	12	6	1 3/16	1 1/8	29/32	1 15/32	2 1/2	73	63 1/4	3/8	69 1/4	52	1 3/4	2	7	60x67 1/2	309	221
72	86 1/2	72	1 1/2	12	6	1 3/16	1 1/8	29/32	1 15/32	2 1/2	86 1/2	75 1/4	3/8	82 1/2	60	1 3/4	2	7 1/2	72x80 3/4	385	303

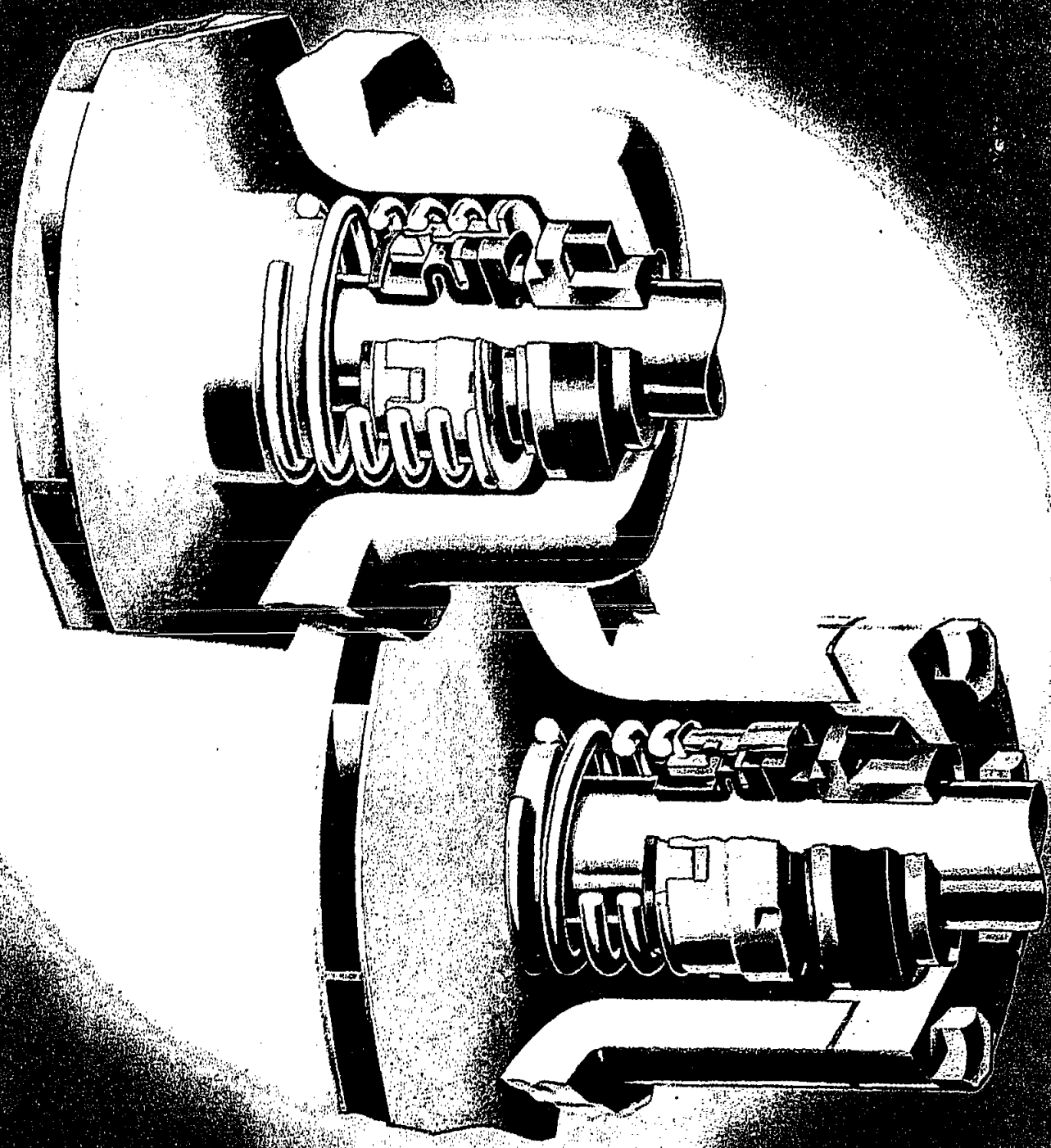
NOMINAL PIPE SIZES		2	2 1/2	3	4	5	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	72
ALLOWABLE AXIAL COMPRESSION INCHES		7/16	7/16	7/16	7/16	7/16	7/16	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16	1 3/16	1 3/16	1 5/16	1 5/16	1	1	1	1	1
ALLOWABLE AXIAL ELONGATION INCHES		1/4	1/4	1/4	1/4	1/4	1/4	3/8	3/8	3/8	3/8	3/8	3/8	7/16	7/16	1/2	1/2	9/16	9/16	9/16	9/16	9/16
ALLOWABLE TRANSVERSE DEFLECTION INCHES		5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16	5/16
RECOMMENDED WORKING PRESSURE psi 200° F. Max. Temp.	STYLE 6100	150	150	150	150	125	125	125	125	125	75	70	70	70	70	50	50	50	50	50	50	40
	STYLE 6300	90	90	90	90	90	90	85	85	85	60	45	45	45	40	40	40	35	35	35	35	35

BULLETIN S-255-3

John Crane

Type 1, Type 2, Type 1-B, Type 2-B

GENERAL PURPOSE SHAFT SEALS



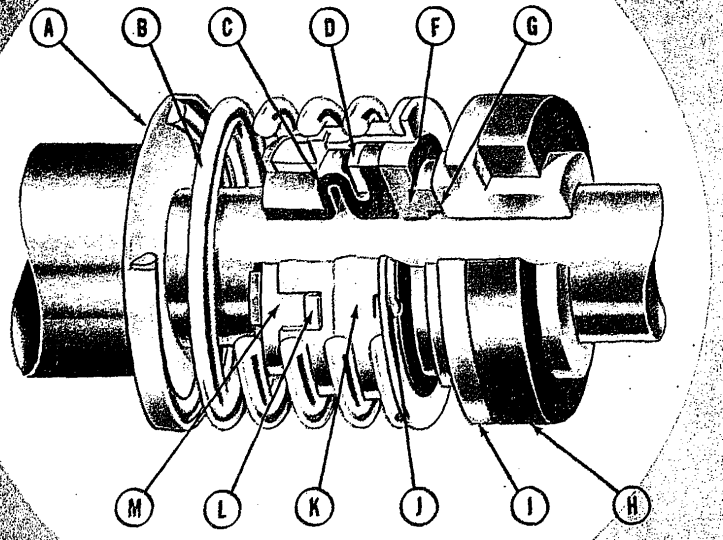
CRANE PACKING COMPANY

6400 OAKTON STREET, MORTON GROVE, ILLINOIS 60053 *(Chicago Suburb)*

In Canada: Crane Packing Company, Ltd., Box 3248, Station C, Hamilton, Ont.
In Mexico: Industrias John Crane de Mexico, S.A. • Poniente 152 #679 Industrial Vallejo, Mexico, D.F.
In Brazil: John Crane Industria E Comercio, Ltda. • Avenida Jurubatuba 600, Sao Bernardo do Campo, S.P.
In Australia: John Crane Mauri Pty., Ltd., 166 Eldridge Road, Bankstown, New South Wales, Australia
In Europe: Crane Packing Ltd., Slough, Bucks, England
In Japan: John Crane Japan, Inc., No. 5, Tenjinbashi-sujl 6-chome, Oyodo-ku, Osaka 531, Japan

OFFICES, WAREHOUSES AND SERVICE THE WORLD OVER

TYPE 1 and TYPE 2 SHAFT SEALS



- A Spring Holder
- B Spring
- C Elastomer Bellows
- D Disc
- F Mating Ring
- G Lapped Sealing Faces
- E Secondary Seal
- Stationary Ring
- J Driving Notch
- K Retainer
- L Driving Band Ear
- M Driving Band

John Crane Types 1 and 2 Bellows Shaft Seals are the most widely used general purpose end-face seals in industry. They are designed for all types of rotating shaft equipment such as: centrifugal, rotating and turbine pumps, agitators, mixers, speed reducers and refrigeration compressors. Both seals will handle all services non-injurious to elastomers. Temperature range is from −40° to +400°F., pressures to 200 psi.

The rotating seal head is factory assembled as a single unit. It consists of a flexible elastomeric bellows, lapped mating ring, retainer, driving band and disc.

The rotating ring mates with a stationary ring. Both faces are precision lapped to prevent leakage and to eliminate break-in runs.

Positive drive within the seal head is achieved by tightly compressing the driving (left) end of the bellows against the shaft with a metal band so that it will rotate with the shaft. Non-slipping is insured by projections on the metal driving band which engage slots in the retainer shell. This retainer shell in turn drives the mating ring by means of interlocking notches.

Spring pressure is transmitted to the mating ring through the retainer, disc and bellows flange. Special bellows construction allows the seal head and mating ring to move freely along the shaft, so that constant contact with the stationary ring is maintained at all times.

The stationary ring is held in an elastomeric secondary seal that eliminates stress distortion of the lapped face during installation and operation.

CONSTRUCTION and DESIGN FEATURES

- Seal is an easy-to-install assembled unit, ready for use.
- Flexible seal head moves freely under spring and hydraulic pressure, automatically compensates for mating ring wear and shaft end play.
- Sealing faces of rotating and stationary rings are lapped to a fine, smooth surface finish and to flatness of .0000232" (2 light bands).
- Reduced contact area of mating ring increases sealing efficiency, reduces power loss due to friction.
- Stationary ring construction prevents distortion of sealing face.
- Gland adjustment is eliminated, maintenance is negligible.
- End-face sealing eliminates shaft wear and sleeve scoring.
- Negligible leakage reduces fire hazard, fumes and waste.
- Bellows type construction eliminates hang-up or fouling due to solids or foreign particles in the pumpage.

APPLICATION DATA

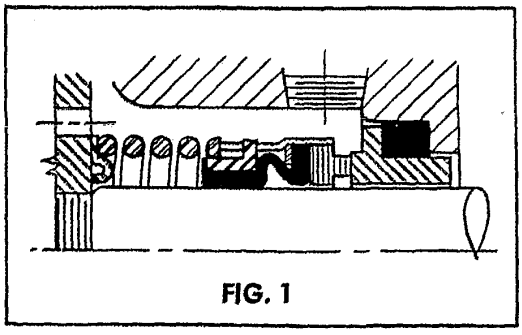


FIG. 1

Type 1 Seal for limited stuffing box diameter. Spring seats against retainer end to provide a small diameter seal unit.

John Crane Types 1 and 2 Shaft Seals can be used for most industrial services at pressures up to 200 psi. (See figures 1 and 2.) A double seal adaption with outside lubrication (as shown in figure 3) is used on installations where high vacuums or extremely abrasive liquids are encountered. Double seals are also recommended where lubrication is inadequate.

For certain installations, when required, Type 1 and 2 Seals can be made stationary while the normally stationary seal is rotated.

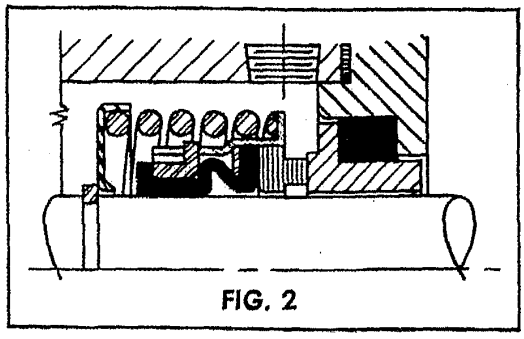


FIG. 2

Type 2 Seal for limited stuffing box length. Spring covers seal head and seats against retainer flange to provide a short seal unit.

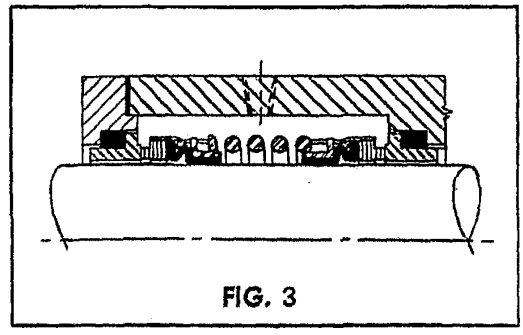


FIG. 3

Double seal installation. Two seal units are incorporated back-to-back in the stuffing box, with an isolating liquid —such as water or oil—lubricating the seal faces.

Typical John Crane Installations

FIG. 1 HELICAL SCREW PUMP

FIG. 2 DIESEL LOCOMOTIVE COOLANT PUMP

FIG. 3 REFRIGERATOR COMPRESSOR

FIG. 4 CLOSE-COUPLED MOTOR MOUNT PUMP

FIG. 5 SHALLOW WELL JET PUMP

FIG. 6 OUTSIDE MOUNTING ON POSITIVE DISPLACEMENT PUMP

FIG. 7 SPEED REDUCER

FIG. 8 SIDE ENTERING AGITATOR

Type 1 and 2 Seals find application throughout the industrial field on an extremely wide range of equipment. They are not limited to just pumps and compressors; in fact, millions of these seals are in service today on scores of different rotary shaft applications such as agitators and speed reducers.

These eight installations have been selected as typical of the diversification of sealing problems which can be solved by these General Purpose Shaft Seals. They illustrate how the Seals can be readily engineered for specific equipment requirements.

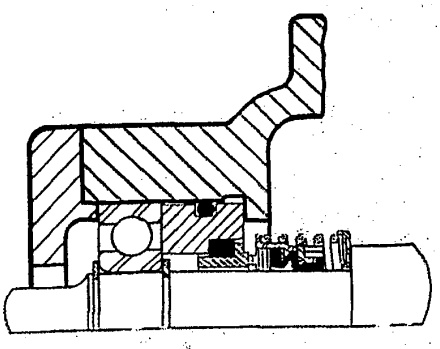


FIG. 1

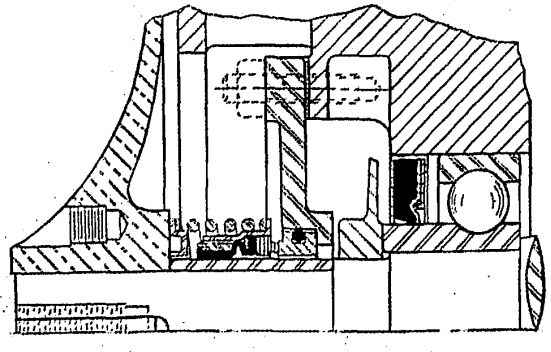


FIG. 2

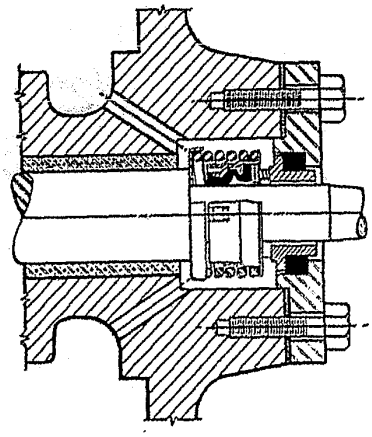


FIG. 3

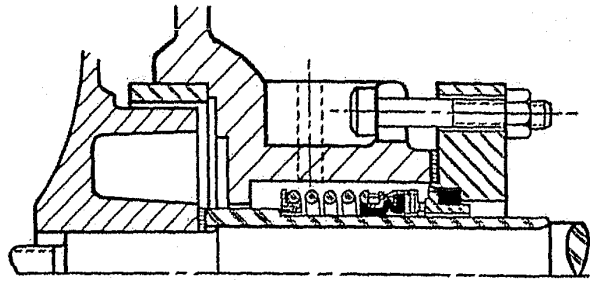


FIG. 4

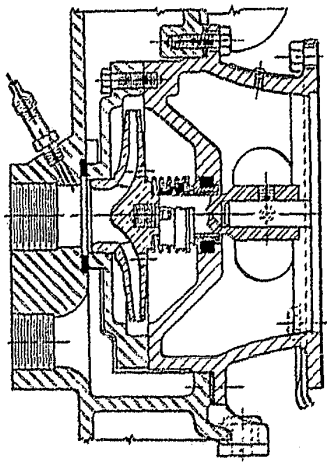


FIG. 5

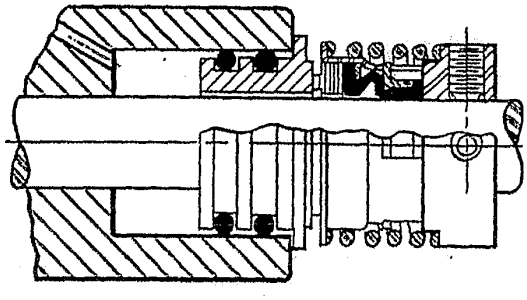


FIG. 6

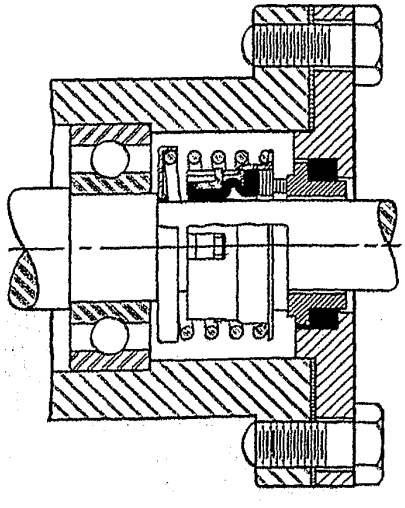


FIG. 7

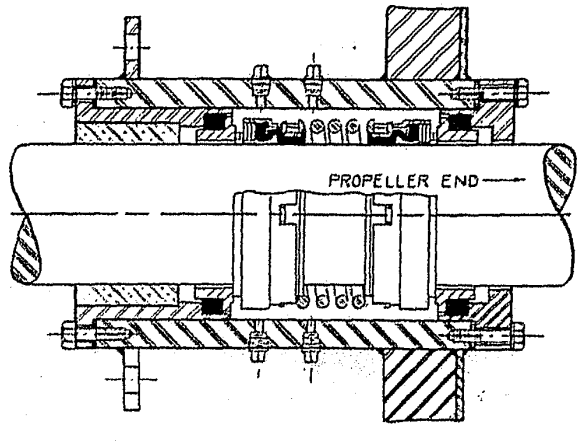


FIG. 8

SPACE REQUIREMENTS TYPE 1 and 2 SHAFT SEALS

The following construction standards are given only as a general guide to space requirements for the JOHN CRANE Type 1 and 2 Seals. The most economical installations result when your dimensions conform to those listed in the table. However if your space allowances vary from these, our Engineering Department can usually adapt the seal to your requirements, or can recommend another JOHN CRANE seal to effectively handle your application.

To assure satisfactory operation, we cannot supply Shaft Seals until the proposed installation has been checked and approved by our Engineering Department.

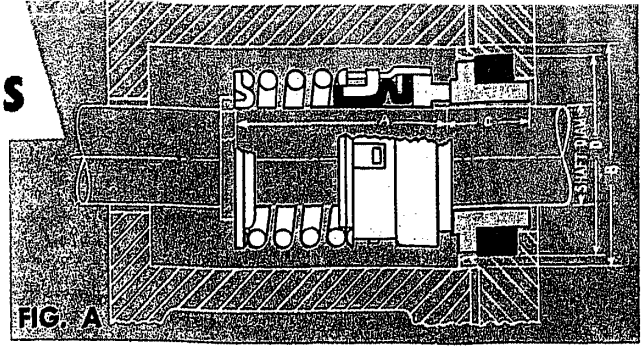


FIG. A

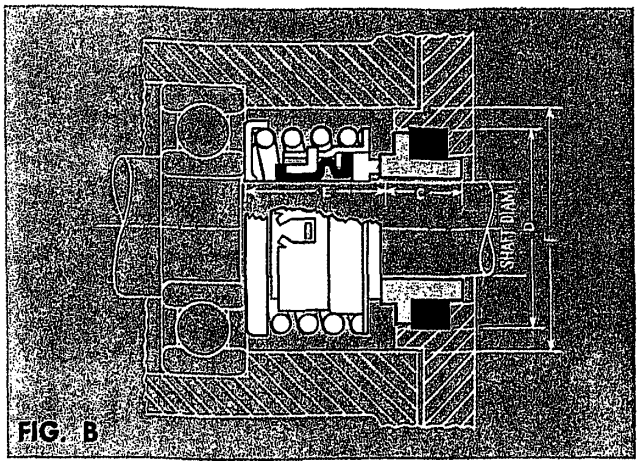


FIG. B

FIG. A

Type 1—Used where the outside diameter must be kept to a minimum and where length is not a limiting factor.

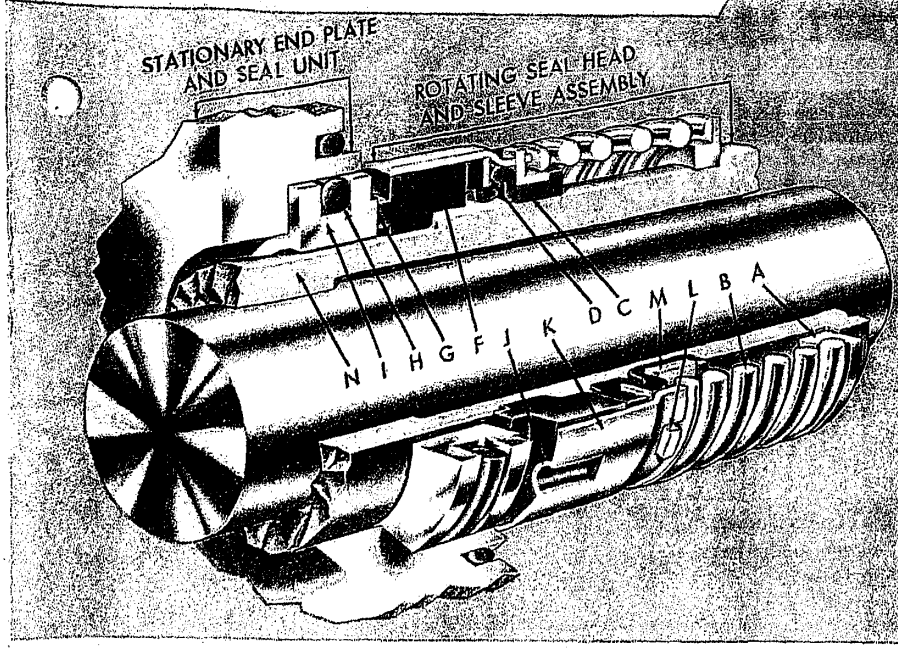
FIG. B

Type 2—Used where length must be kept to a minimum and where diameter is not a limiting factor.

SHAFT DIA.*	A	B	C	D	E	F	SHAFT DIA.*	A	B	C	D	E	F
3/8	1 3/16	1 1/16	3/8	.875	13/16	1 7/32	1 15/16	2 1/8	2 13/16	9/16	2.687	1 1/2	3 1/4
1/2	1 3/16	1 3/16	3/8	1.000	13/16	1 3/8	2	2 1/8	2 15/16	9/16	2.750	1 1/2	3 5/16
5/8	1 5/16	1 11/32	13/32	1.250	7/8	1 9/16	2 1/8	2 3/8	3 1/8	5/8	3.000	1 11/16	3 5/8
1 1/16	1 5/16	1 13/32	13/32	1.312	7/8	1 5/8	2 1/4	2 3/8	3 1/4	5/8	3.125	1 11/16	3 3/4
3/4	1 5/16	1 13/32	15/32	1.375	7/8	1 11/16	2 3/8	2 1/2	3 3/8	5/8	3.250	1 13/16	3 7/8
1 13/16	1 3/8	1 7/16	15/32	1.437	7/8	1 3/4	2 1/2	2 1/2	3 1/2	5/8	3.375	1 13/16	4
7/8	1 3/8	1 21/32	15/32	1.500	15/16	1 13/16	2 5/8	2 3/4	3 3/4	1 1/16	3.375	1 15/16	4 5/16
1 5/16	1 7/16	1 11/16	1/2	1.562	15/16	1 15/16	2 3/4	2 3/4	3 7/8	1 1/16	3.500	1 15/16	4 7/16
1	1 7/16	1 3/4	1/2	1.625	15/16	2	3	2 7/8	4 3/16	1 1/16	3.875	2 1/16	4 11/16
1 1/16	1 5/8	1 13/16	1/2	1.687	15/16	2 1/16	3 1/8	3 1/8	4 7/16	27/32	4.000	2 3/16	5
1 1/8	1 5/8	1 7/8	1/2	1.750	1 1/16	2 1/8	3 1/4	3 1/8	4 9/16	27/32	4.125	2 3/16	5 1/8
1 3/16	1 5/8	1 15/16	1/2	1.812	1 1/16	2 3/16	3 5/16	3 1/8	4 11/16	27/32	4.187	2 3/16	5 3/16
1 1/4	1 5/8	2	1/2	1.875	1 1/16	2 1/4	3 1/2	3 1/8	4 13/16	27/32	4.375	2 3/16	5 1/2
1 3/8	1 11/16	2 1/8	1/2	2.000	1 1/8	2 7/16	3 5/8	3 1/4	4 15/16	27/32	4.500	2 3/16	5 11/16
1 7/16	1 11/16	2 3/16	1/2	2.062	1 1/8	2 1/2	3 7/8	3 3/8	5 3/16	27/32	4.750	2 7/16	6
1 1/2	1 11/16	2 1/4	1/2	2.125	1 1/8	2 9/16	4	3 3/8	5 5/16	27/32	4.875	2 7/16	6 1/8
1 5/8	2	2 1/2	9/16	2.375	1 3/8	2 15/16	4 1/2	4 1/4	6 1/2	1 1/8	5.500	3	7 1/4
1 3/4	2	2 5/8	9/16	2.500	1 3/8	3 1/16	5 3/8	5	7 15/16	1 1/8	6.375	3 3/8	8 3/8
1 7/8	2 1/2	2 3/4	9/16	2.625	1 1/2	3 3/16	5 5/8	5	8 3/16	1 1/8	6.625	3 1/2	8 11/16

*Intermediate and Larger Sizes on Application. All Dimensions Are in Inches.

TYPE 1-B and TYPE 2-B



- A Spring Holder
- B Spring
- C Elastomer Bellows
- D Disc
- F Mating Ring
- G Lapped Sealing Faces
- H "O" Ring Secondary Seal
- I Stationary Ring
- J Driving Notch
- K Retainer
- L Driving Band Ear
- M Driving Band
- N Shaft Sleeve

HYDRAULICALLY BALANCED SHAFT SEALS

For Pressure Applications up to 750 psi.

The John Crane Types 1-B and 2-B Shaft Seals are especially designed for high pressure applications on all types of rotary shaft equipment. They will handle all services non-injurious to elastomers. Temperature range is −40° to +400°F., pressures to 750 psi.

The rotating seal head is a factory assembled single unit. It consists of a balanced carbon mating ring, flexible bellows, driving band and disc. The mating ring and stationary ring are precision lapped to prevent leakage and eliminate break-in runs.

Positive drive within the seal is accomplished by tightly compressing the driving end of the bellows against the sleeve with a metal band so that it rotates with the shaft. Driving band ears engage slots in the retainer shell which in turn drives the mating ring by means of interlocking notches. This prevents stresses on the bellows, and it is free to move axially and radially.

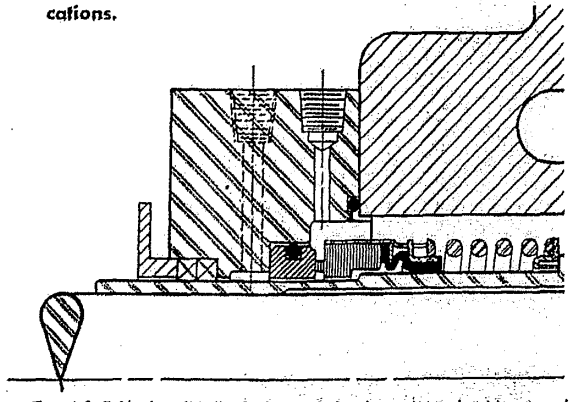
Spring pressure is transmitted to the mating ring through the retainer, disc and bellows flange. The bellows is specially constructed to allow the rotating seal head to move freely along the shaft so that contact with the stationary ring is maintained at all times.

An elastomeric "O" ring serves as a static seal between the counterbore of the end plate and stationary ring. It also prevents rotation of the ring.

The Type 1-B Seal is used where the outside diameter must be kept to a minimum and where length is not a limiting factor. The Type 2-B is recommended where conditions are reversed.

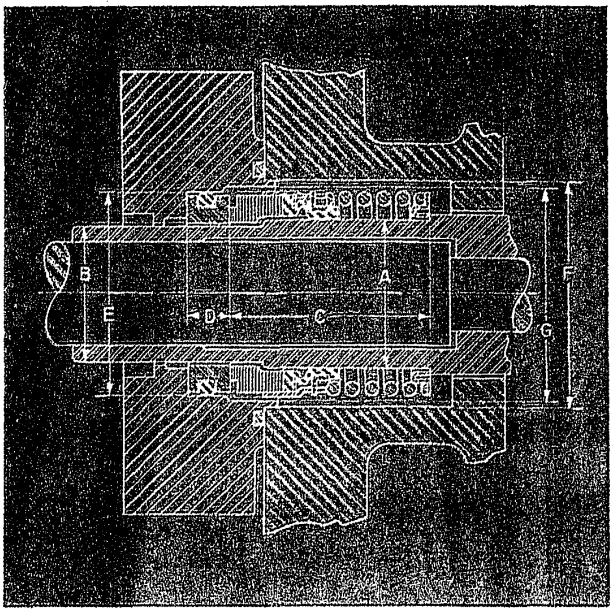
Construction and Design Features

- Stationary ring construction prevents distortion of sealing face.
- Sealing faces of mating ring and stationary ring are lapped to a fine, smooth surface finish and to flatness of .0000232" (2 light bands).
- Raised sealing face of mating ring is specially designed to secure desired pressure balance.
- Ample radial and axial flexibility compensates for shaft movement, tolerances and wear.
- Also available as Type 2-B for limited length applications.



Type 1-B Hydraulically Balanced Seal equipped with quench gland in a pump handling petroleum products.

SPACE REQUIREMENTS TYPE 1-B SEAL



A	B	C	D	E	F	G
1 1/8	1	1 15/16	7/16	1 5/8	1 7/8	1 3/4
1 1/4	1 1/8	1 15/16	7/16	1 3/4	2 1/16	1 15/16
1 3/8	1 1/4	2	7/16	1 7/8	2 1/8	2
1 1/2	1 3/8	2	7/16	2	2 1/4	2 1/8
1 5/8	1 1/2	2 3/8	7/16	2 1/8	2 1/2	2 3/8
1 3/4	1 5/8	2 3/8	1/2	2 3/8	2 5/8	2 1/2
1 7/8	1 3/4	2 1/2	1/2	2 1/2	2 3/4	2 5/8
2	1 7/8	2 1/2	1/2	2 5/8	2 15/16	2 3/4
2 1/8	2	2 3/4	1/2	2 3/4	3 1/8	2 15/16
2 1/4	2 1/8	2 3/4	9/16	3	3 1/4	3 1/16
2 3/8	2 1/4	2 7/8	9/16	3 1/8	3 3/8	3 3/16
2 1/2	2 3/8	2 7/8	9/16	3 1/4	3 1/2	3 5/16
2 5/8	2 1/2	3 1/8	9/16	3 3/8	3 3/4	3 1/2
2 3/4	2 5/8	3 1/8	5/8	3 3/8	3 7/8	3 5/8
2 7/8	2 3/4	3 1/4	5/8	3 1/2	4	3 3/4
3	2 7/8	3 1/4	5/8	3 3/4	4 3/16	3 7/8
3 1/8	2 7/8	3 1/2	5/8	3 3/4	4 7/16	4 1/8
3 1/4	3	3 1/2	5/8	3 7/8	4 9/16	4 1/4
3 3/8	3 1/8	3 1/2	25/32	4	4 11/16	4 3/8
3 1/2	3 1/4	3 1/2	25/32	4 1/8	4 13/16	4 1/2
3 5/8	3 3/8	3 5/8	25/32	4 1/4	4 15/16	4 5/8
3 3/4	3 1/2	3 5/8	25/32	4 3/8	5 1/16	4 3/4
3 7/8	3 5/8	3 3/4	25/32	4 1/2	5 3/16	4 7/8
4	3 3/4	3 3/4	25/32	4 5/8	5 5/16	5

Note: Type 2-B Seal dimensional data available upon request.

ENGINEERING DATA— TYPES 1, 2, 1-B, 2-B SEALS

MATERIALS USED

The various parts for the Types 1, 2, 1-B and 2-B Shaft Seals are standard in design, but can be furnished in a variety of materials best suited for specific services. Based on the requirements, we will recommend the best material for your application.

Flexible Bellows and Stationary Ring: Precision molded of special high grade elastomers. Various synthetic compounds are available to handle such services as oils, hydrocarbons, fresh water, sea water, anti-freezes, refrigerants and many others.

Mating Ring: Teeplelite, carbon, bronze or hardened steel as best suited to operating conditions.

Stationary Ring: Cast iron, bronze, ni-resist, stellite or ceramic.

Spring and Metal Parts: Made of metals best suited to operating conditions.

JOHN CRANE Bellows Shaft Seals are manufactured in such large numbers that we can economically offer a wide variety of standard sizes. However, our extensive experience and reference material in this highly specialized field can be of valuable assistance to you if you contact us in the initial stages of your planning.

Our engineers will draw up a preliminary layout for your study and comments on receipt of the following data:

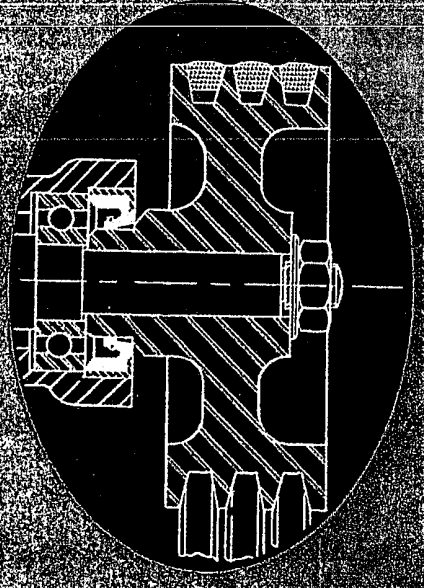
Shaft Diameter ***Fluids Handled*** ***Temperature***
Speed (R.P.M.) ***Pressures***

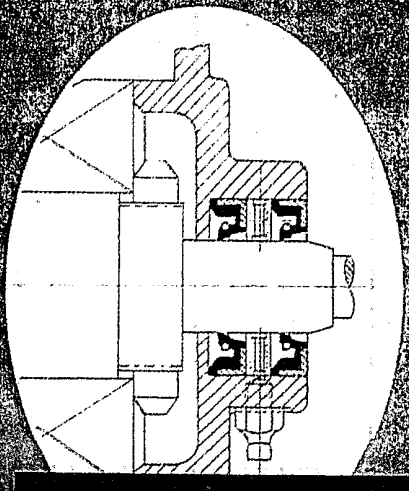
Printed in U.S.A.

John Crane

OIL SEALS

FACILITIES, ENGINEERING AND INSTALLATION





CRANE PACKING COMPANY
6400 OAKTON STREET, MORTON GROVE, ILLINOIS 60053 U. S. A.
OFFICES, WAREHOUSES AND SERVICE DEPOTS THE WORLD OVER



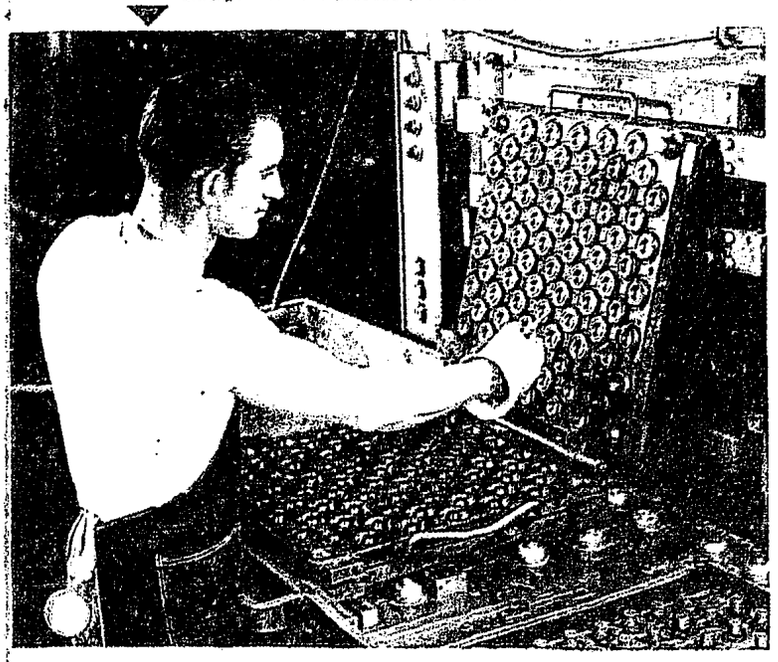
FACILITIES FOR DESIGN, DEVELOPMENT and MANUFACTURING

John Crane Oil Seals are the product of the most modern design, development and manufacturing facilities. Within this structure our sealing engineers, metallurgists, chemists and craftsmen combine their efforts to serve the present and future requirements of industry with better materials and new concepts.

All John Crane Oil Seals are completely bonded for trouble-free performance, long service life and to prevent internal leakage. Compound materials are carefully selected, mixed and batched. Metal cases and/or components are made to heavy duty standards and are available in a wide range of corrosion-resistant materials. Following precision molding and bonding, the seals are subjected to a special finishing process to remove excess flash, then given final inspection and testing under actual operating conditions. Typical procedures and facilities illustrated on these pages are just a few examples of the care and workmanship that goes into these seals from drawing board to finished product.

While maintaining this high level of quality, Crane Packing Company stocks a complete line of standard types and sizes to facilitate prompt delivery and also to pass on to customers the economies of high production. To this end, the use of standard types and sizes is recommended. If this is not possible due to unusual operating conditions, space complications or other factors, our engineers are available to work with you to provide a seal to your exact requirements.

Modern mechanical presses are used to produce John Crane Oil Seals. Molded under controlled heat and pressure, parts emerge from the presses precise in dimension and contour.



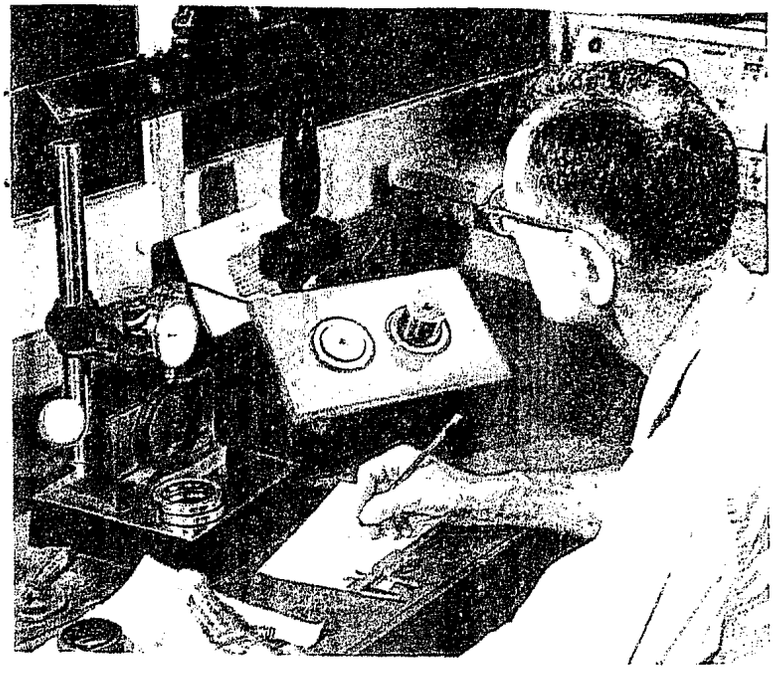


Comparator gauge checks O.D. to I.D. (radial wall variation). This device eliminates the possibility of human error, which can occur when using micrometer reading. Readings from the comparator are identical no matter what operator is using the fixture.



Concentricity fixture, designed for use with optical comparator, gives I.D. to O.D. relations. Accurate and repeatable readings to within .002 can be made using a 10-power lens.

Light box is used for detecting possible lip I.D. defects too minor to be found on standard visual inspection. The slightest imperfection will permit light to pass between the shaft and lip I.D.





G.M.C. Sealectors are used for in-process and final inspection. This device is utilized for the purpose of correlation with our customers who have similar equipment. The Sealector checks lip I.D. and lip opening pressure.

John Crane

OIL SEALS

ENGINEERING DATA

Careful consideration of the operating conditions is of prime importance in seal selection. These conditions can be generally discussed only by considering them separately and giving limiting values for satisfactory seal performance with respect to each individual condition.

SHAFT FINISH

The shaft surface at seal contact should be 10 to 20 RMS, with the lower limit preferred for high speed applications. The type of finish is very important. The most desirable finish results from a fine grind followed by a polishing operation so that the finish is concentric with shaft rotation. Whenever possible, plunge finishing should be used.

SHAFT HARDNESS

The portion of the shaft contacted by the seal should have a minimum hardness of Rockwell C-30. A harder shaft is preferred, if operation is at high speeds or under abrasive conditions.

SHAFT MATERIAL

Plain steel and stainless steels are preferred; however, good chrome plated shafts and sometimes nickel plated shafts are acceptable. The following shaft materials are not satisfactory as far as the seal is concerned: brass, bronze, aluminum, zinc or magnesium.

SHAFT SPEEDS

The maximum speed at which John Crane Oil Seals can safely operate is dependent on other operating conditions such as shaft finish, pressure, lubrication, eccentricity and type of seal.

As the quality of the shaft finish is improved, the speed at which a seal will operate satisfactorily is increased. Also, as eccentricity (or runout) is decreased, operating speeds can be increased. Under normal operating conditions and with adequate lubrication, John Crane Oil Seals will operate satisfactorily at speeds up to 3000 FPM, depending on type of seal recommended. Specific recommendations should be obtained from Crane Packing Company for any unusual combination of high speeds and other operating conditions.

SHAFT ECCENTRICITY

Two types of eccentricity affect seal operation; assembled eccentricity and running eccentricity (runout). Assembled eccentricity is the amount by which the shaft is off center with respect to the bore. It does not vary as the shaft is rotated. Running eccentricity is the amount by which the shaft (at the sealing point) does not rotate about a true center. This is caused by such conditions as misalignment or wear, bending of the shaft, lack of shaft balance or other manufacturing inaccuracies. Running eccentricity is measured by the total movement of an indicator held against the shaft while it is rotated.

The ability of seals to operate satisfactorily under eccentric conditions depends largely on the flexibility of the sealing member. Most seals will take more assembled eccentricity than runout. However, too much assembled eccentricity tends to create higher friction, causing more wear on one side of the seal.

Spring-loaded seals can reasonably be expected to operate satisfactorily under the following total eccentricities. Higher eccentricities can be handled satisfactorily, depending on other operating conditions and type of seal.

MAXIMUM TOTAL ECCENTRICITY (ASSEMBLED & RUNNING)	MAXIMUM FPM
.024	75
.020	150
.017	350
.014	700
.012	1000
.008	2000
.006	3000

Note: For non-spring loaded seals these eccentricities should be reduced by 50%. Also, non-spring loaded seals should be limited to speeds of 2000 FPM maximum.

*Center-Line-Average

PRESSURE

Standard seals are not generally recommended for more than 25 PSI, although they have often been used at higher pressures. If pressures are in excess of 25 PSI, please contact your nearest Crane Packing Company office for engineering recommendations.

TEMPERATURE

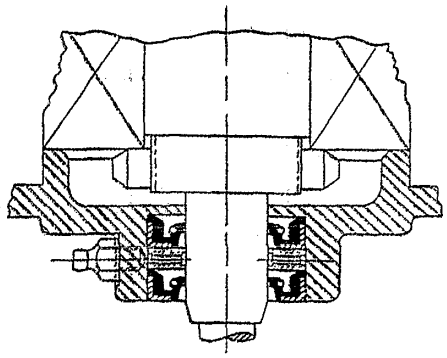
The temperature range over which John Crane Oil Seals will operate satisfactorily depends primarily upon the material of the sealing member. The standard seals indicated in the catalog will operate at temperatures from −65°F. to +225°F. continuously and as high as +250°F. intermittently. On applications where temperatures exceed +250°F. contact Crane Packing Company for specific recommendations.

LUBRICATION

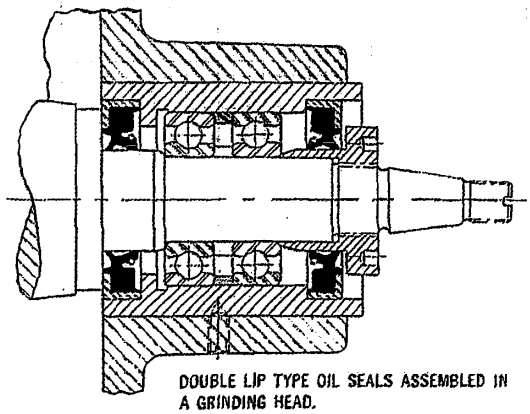
Good lubrication is absolutely necessary for maximum efficiency and long seal life. For this reason, seals should be prelubricated just prior to installation. In many applications it takes several minutes for the lubricant to reach the sealing lip. Seal failures, even those occuring after many hours of operation, can often be traced to lack of prelubrication.

Note: Seal lip interference ranges from 1/16″ to 3/32″ for shaft dias. 1″ to 8″. These values can be increased or decreased to suit unusual operating conditions.

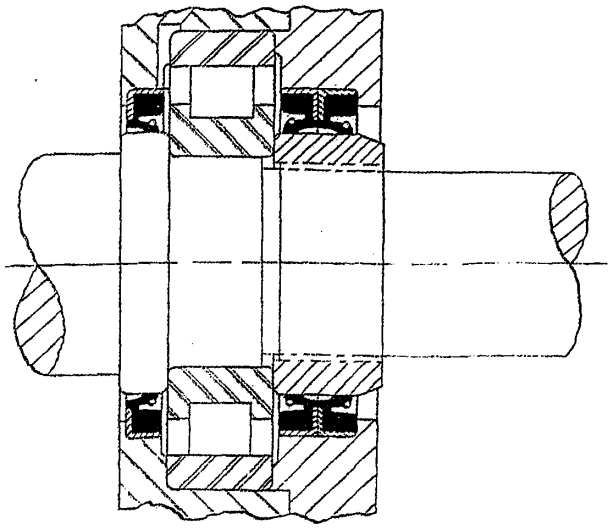
TYPICAL APPLICATIONS



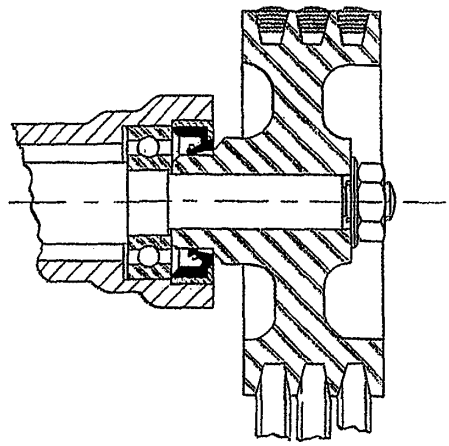
STANDARD TYPE OIL SEALS FITTED IN GANG.



DOUBLE LIP TYPE OIL SEALS ASSEMBLED IN A GRINDING HEAD.



STANDARD TYPE OIL SEALS FITTED AS A SINGLE AND TWIN TYPE ASSEMBLY FOR A 10½″ x 22″ ROTARY COMPRESSOR.



STANDARD TYPE OIL SEAL AS ASSEMBLED ON INPUT SHAFT.

RECOMMENDED PRESS FITS

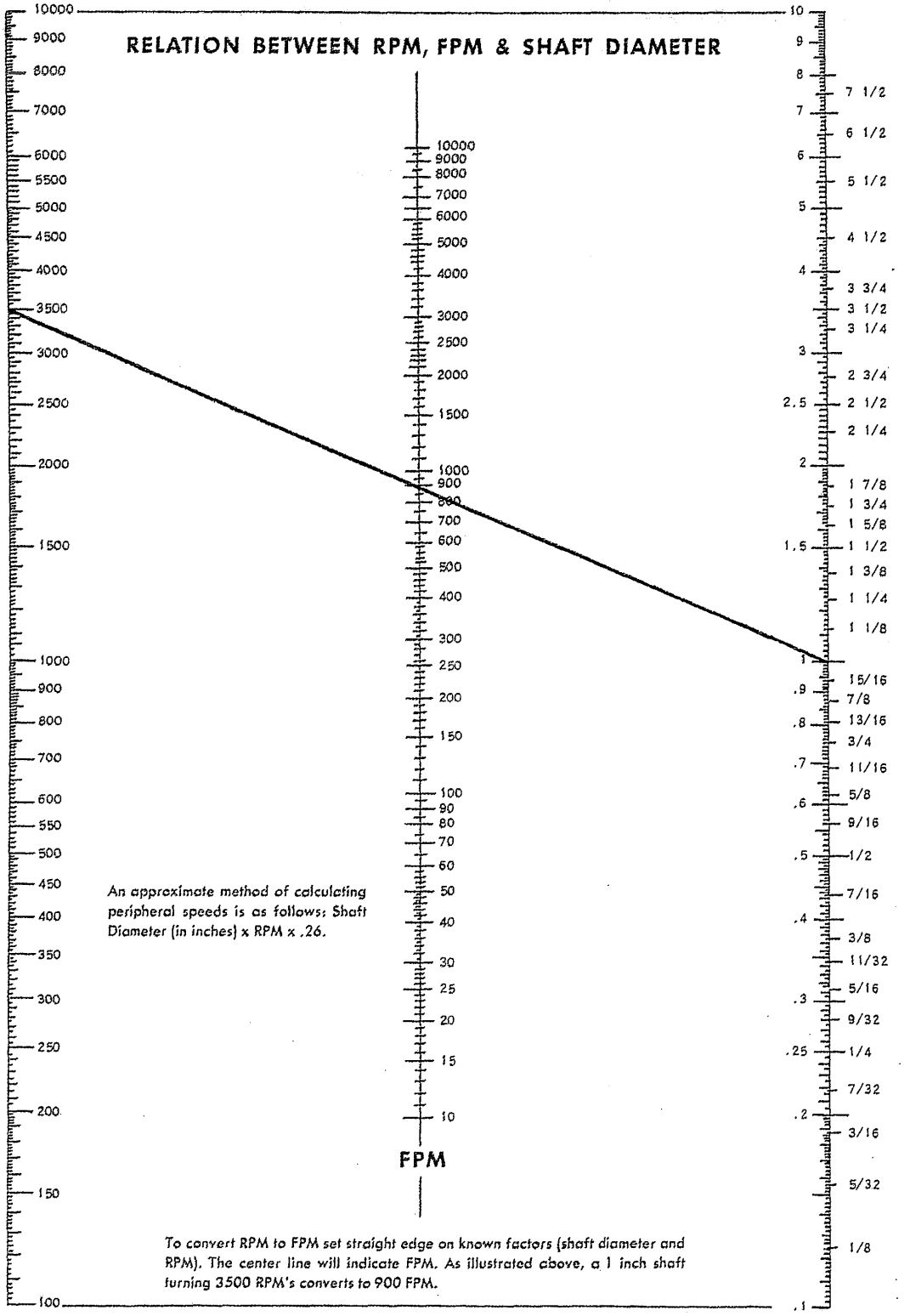
BORE SIZE	TOLERANCE	FOR METAL O.D.	
		Seal O.D. = to bore	Tolerance
Up to 2.999"	±.001	+.004"	±.002
3.00"—4.999"	±.0015	+.005"	±.002
5.00"—5.999"	±.0015	+.006"	±.002
6.00"—6.999"	±.002	+.007"	±.002
7.00"—7.999"	±.002	+.008"	±.002
8.00"—8.999"	±.002	+.009"	±.002
9.00" and Up	±.002	+.010"	±.002

BORE SIZE	TOLERANCE	FOR RUBBER O.D.	
		Seal O.D. = to bore	Tolerance
Up to 2.999"	±.001	+.006"	±.002
3.00"—4.999"	±.0015	+.007"	±.002
5.00"—5.999"	±.0015	+.008"	±.002
6.00"—6.999"	±.002	+.009"	+.002 −.003
7.00"—7.999"	±.002	+.010"	+.002 −.003
8.00"—8.999"	±.002	+.010"	+.002 −.003
9.00" and Up	±.002	+.010"	+.002 −.003

RECOMMENDED SHAFT DIAMETER TOLERANCES

Up to 2.999..... ±.003
5.00 to 5.999..... ±.005
6.00 and up..... ±.008

RELATION BETWEEN RPM, FPM & SHAFT DIAMETER



An approximate method of calculating peripheral speeds is as follows: Shaft Diameter (in inches) x RPM x .26.

To convert RPM to FPM set straight edge on known factors (shaft diameter and RPM). The center line will indicate FPM. As illustrated above, a 1 inch shaft turning 3500 RPM's converts to 900 FPM.

John Crane OIL SEALS

INSTALLATION INSTRUCTIONS

1 Be sure housing bore diameter, bore depth and shaft diameter are correct and within the recommended tolerances. Inspect all surfaces for scratches or nicks.

2 Provide radius or chamfer at housing bore entrance.

3 Be sure sealing lip has not been damaged.

4 Lubricate sealing lip(s) with any light machine oil before installing.

5 Apply a light coat of John Crane PLS Sealing Compound to O.D. of seal to provide a margin of safety against seepage through the pressfit in housing bore. Extreme care must be taken to avoid depositing any compound on the sealing member.

6 Install seal with lip facing medium to be sealed. (The reverse is used only when it becomes more important to exclude a medium than to retain it.)

7 When possible, chamfer end of shaft over which seal must pass; otherwise use a sleeve as illustrated in Fig. 1 or Fig. 2.

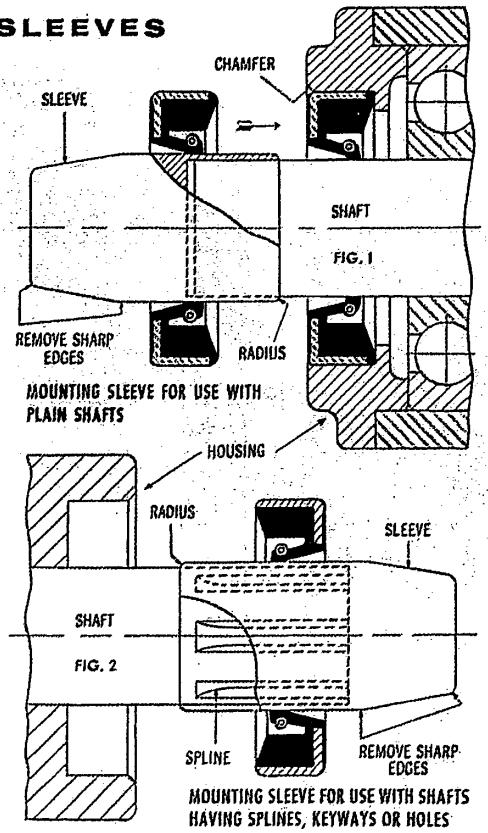
8 Press seal into housing with smooth uniform pressure applied by means of a pressfitting tool. See Figure 3. If shaft is already in place, use a sleeve-type pressfitting tool.

9 Whenever possible, use an arbor press to insert seal into housing. Be sure seal is not cocked when applying pressure. It is desirable to seat seal against a shoulder in the bore to help prevent cocking.

10 When shaft is assembled from reverse side of sealing lip, no special precautions are required other than removing all burrs and sharp corners from shaft. When the shaft enters against the sealing lip, a tapered sleeve must be used made to the dimensions shown in Figure 1. When seal must pass over splines, keyways or holes, use a sleeve as shown in Figure 2. If the use of an assembly sleeve is not possible, the edges of the spline, keyway or holes should be rounded and lubricated with a heavy grease.

11 In cases where the completed machine is painted where seal is exposed, mask area to prevent paint being deposited on shaft and sealing lip. If paint is baked on, be sure temperature does not exceed operating temperature of seal to avoid injury to the sealing member.

SLEEVES

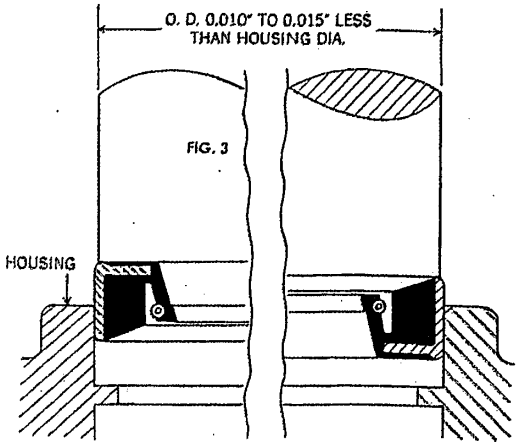


NOTES:

(1) Sleeve wall should be as thin as possible (not more than .040" beyond shaft).

(2) Lubricate both sleeve and shaft before using.

DRIVING TOOLS



PERFORMANCE CHECK LIST

John Crane Oil Seals provide efficient low-cost operation. However, factors beyond our control may affect efficiency. Therefore, the following check list is offered as an aid to obtaining maximum performance or analyzing troubles.

- Is the proper seal being employed for the application?
- Was the seal lip distorted during installation?
- Was the seal lip installed backwards?
- Was the seal damaged by careless handling before installation?
- Was sealing lip damaged during installation by passing over sharp keyway, splines, threads, burr or a sharp machined edge?
- Was the seal damaged during installation through use of inadequate installation tools or excessive press fit? (Note: check dimension of bore.)
- Was sealing lip properly lubricated at time of installation to prevent damage before lubricant reached lip?
- Is seal being lubricated during operation or during part of its operation?
- Is shaft finish per specification? Are there nicks or scratches present at point of lip contact?
- Is there any pressure buildup at seal due to clogged vents in housing?
- Is leakage actually coming past seal or through some other area such as keyways, gaskets or threads?
- Is there excessive shaft misalignment?
- Is there excessive shaft runout?

Synthetic Rubber Products Used In John Crane Oil Seals

BUNA N (Nitrile Rubber)

A mixture of butadiene and acrylonitrile polymers having good resistance to petroleum-based lubricants and water. It is an excellent general purpose elastomer. This compound can be varied to meet most applications within the scope of its temperature limitations.

NEOPRENE

Neoprene includes a group of chloroprene polymers. It is used in applications requiring medium heat and oil resistance. This compound has excellent weather and ozone resistance, also good resistance to high aniline point lubricant oils. It exhibits high swell in aromatic fuels and low aniline point oils.

POLYACRYLIC

Polyacrylic has resistance to oils with "EP" additives, good resistance to oxygen and ozone and mineral oils, and limited resistance to water. Temperature range is from −10° to +300° F., continuous operation, and to +350° F., intermittent operation.

SILICONE

Silicone can be used at temperatures from −100° to +400° F. It has excellent resistance to compression set and ozone and good resistance to "EP" lubricants and some phosphate-ester based fluids. Low aniline point petroleum oils cause excessive swell. Abrasion-resistance of silicone is poor.

VITON*

Viton has a temperature range from −20° to +400° F. Resistance to petroleum-based lubricants, acids and numerous solvents is good to excellent. Compression set is low, tensile strength good and resistance to ozone excellent.

BUTYL

Butyl is used primarily for phosphate-ester type fire resistant hydraulic fluids. It has fair resistance to compression set, good resistance to acids and corrosive chemicals, but has poor resiliency at room temperature; however this improves significantly at elevated temperatures. Resistance to petroleum oils and hydrocarbons is poor.

TFE

The temperature range of TFE is from −120° to +500° F. It is impervious to the most destructive chemicals, corrosives and alkalis, except molten alkali metals and certain other compounds. TFE used in John Crane Oil Seals is specially blended to obtain maximum stability, resistance to wear and low torque.

CRANELAST†

This hydrocarbon rubber is an elastomer derived from ethylene and propylene. It has a well-balanced combination of properties, including outstanding ozone resistance and excellent resistance to heat, weather, chemicals and abrasion but not petroleum-based oils. It also has high tear and tensile strength and excellent dynamic and low temperature properties.

*DUPONT TRADEMARK
†CRANE PACKING COMPANY TRADEMARK

COMPOUND COMPATABILITY CHART

	(NITRILES) BUNA N	ACRYLATES	SILICONE	FLUORO-ELASTOMERS
Maximum Temperature Conditions	250° F.	300° F.	400° F.	400° F.
Minimum Temperature Conditions	−65° F.	−10° F.	−100° F.	−20° F.
Abrasion Resistance	Good	Fair	Poor	Fair
Air	Good	Good	Good	Good
Ammonia Gas (Cold)	Good	Poor	Fair	Poor
Brake Fluid	Poor	Poor	Poor	Fair
Butane	Good	Good	Fair	Good
Compression Test	Good	Fair	Good	Fair
Engine Oil	Good	Good	Good	Good
EP Lube	Poor	Good	Poor	Good
Freon 12*	Good	Poor	Poor	Fair
Fresh Water	Good	Poor	Good	Good
Fuel Oil	Good	Fair	Poor	Good
Grease	Good	Fair	Fair	Good
Kerosene/Gasoline	Good	Fair	Poor	Good
Ketones	Poor	Poor	Poor	Poor
Perchlorethylene	Fair	Poor	Poor	Good
Petroleum Base Hydraulic Oil	Good	Good	Good	Good
Phosphate Ester	Poor	Poor	Good	Good
SAE 90 (non EP)	Good	Good	Good	Good
Salt Water	Good	Poor	Good	Good
Skydrol 500	Poor	Poor	Good	Poor
MIL-L 2105	Fair	Good	Poor	Good
MIL-L 5606	Good	Good	Fair	Good
MIL-L 6082-A	Good	Good	Good	Good
MIL-L 7808	Fair	Poor	Good	Good

*DUPONT TRADEMARK

USEFUL CONVERSION TABLES

DECIMAL EQUIVALENTS

1/64 .0156	17/64 .2656	33/64 .5156	49/64 .7656
1/32 .0312	9/32 .2812	17/32 .5312	25/32 .7812
3/64 .0468	19/64 .2969	35/64 .5469	51/64 .7969
1/16 .0625	5/16 .3125	9/16 .5625	13/16 .8125
5/64 .0781	21/64 .3281	37/64 .5781	53/64 .8281
3/32 .0937	11/32 .3437	19/32 .5937	27/32 .8437
7/64 .1094	23/64 .3594	39/64 .6094	55/64 .8594
1/8 .125	3/8 .375	5/8 .625	7/8 .875
9/64 .1406	25/64 .3906	41/64 .6406	57/64 .8906
5/32 .1562	13/32 .4062	21/32 .6562	29/32 .9062
11/64 .1719	27/64 .4219	43/64 .6719	59/64 .9219
3/16 .1875	7/16 .4375	11/16 .6875	15/16 .9375
13/64 .2031	29/64 .4531	45/64 .7031	61/64 .9531
7/32 .2187	15/32 .4687	23/32 .7187	31/32 .9687
15/64 .2344	31/64 .4844	47/64 .7344	63/64 .9843
1/4 .25	1/2 .5	3/4 .75	1 1.0

CENTIGRADE—FAHRENHEIT CONVERSION TABLE

°F. = 9/5°C. + 32 = 1.8 (°C. + 17.8)
°C. = 5/9 (°F. − 32)

Converted to Centigrade	Temperature Reading	Converted to Fahrenheit	Converted to Centigrade	Temperature Reading	Converted to Fahrenheit
−62.2	−80	−112.0	65.56	150	302.0
−56.7	−70	− 94.0	71.11	160	320.0
−51.1	−60	− 76.0	76.67	170	338.0
−45.6	−50	− 58.0	82.22	180	356.0
−40.0	−40	− 40.0	87.78	190	374.0
−34.4	−30	− 22.0	93.33	200	392.0
−31.7	−25	− 13.0	98.89	210	410.0
−28.9	−20	− 4.0	104.44	220	428.0
−26.1	−15	+ 5.0	110.00	230	446.0
−23.3	−10	14.0	115.56	240	464.0
−20.6	− 5	23.0	121.11	250	482.0
−17.8	0	32.0	126.67	260	500.0
−15.0	5	41.0	132.22	270	518.0
−12.22	10	50.0	137.78	280	536.0
− 9.44	15	59.0	143.33	290	554.0
− 6.67	20	68.0	148.89	300	572.0
− 3.89	25	77.0	154.44	310	590.0
− 1.11	30	86.0	160.00	320	608.0
1.67	35	95.0	165.66	330	626.0
4.44	40	104.0	171.11	340	644.0
7.22	45	113.0	176.67	350	662.0
10.00	50	122.0	182.22	360	680.0
12.78	55	131.0	187.78	370	698.0
15.56	60	140.0	193.33	380	716.0
18.33	65	149.0	198.89	390	734.0
21.11	70	158.0	204.44	400	752.0
23.89	75	167.0	210.00	410	770.0
26.67	80	176.0	215.56	420	788.0
29.44	85	185.0	221.11	430	806.0
32.22	90	194.0	226.67	440	824.0
35.00	95	203.0	232.22	450	842.0
37.78	100	212.0	237.78	460	860.0
40.56	105	221.0	243.33	470	878.0
43.33	110	230.0	248.89	480	896.0
46.11	115	239.0	254.44	490	914.0
48.89	120	248.0	260.00	500	932.0
51.67	125	257.0	265.56	510	950.0
54.44	130	266.0	271.11	520	968.0
57.22	135	275.0	276.67	530	986.0
60.00	140	284.0	282.22	540	1004.0
			287.78	550	1022.0

INCHES TO MILLIMETERS

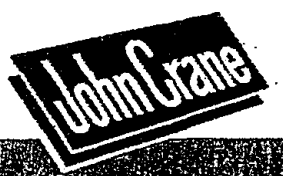
(Basis: 1 Inch = 25.4 Millimeters)

In.	Mm.	In.	Mm.	In.	Mm.	In.	Mm.
1	25.4	26	660.4	51	1295.4	76	1930.4
2	50.8	27	685.8	52	1320.8	77	1955.8
3	76.2	28	711.2	53	1346.2	78	1981.2
4	101.6	29	736.6	54	1371.6	79	2006.6
5	127.0	30	762.0	55	1397.0	80	2032.0
6	152.4	31	787.4	56	1422.4	81	2057.4
7	177.8	32	812.8	57	1447.8	82	2082.8
8	203.2	33	838.2	58	1473.2	83	2108.2
9	228.6	34	863.6	59	1498.6	84	2133.6
10	254.0	35	889.0	60	1524.0	85	2159.0
11	279.4	36	914.4	61	1549.4	86	2184.4
12	304.8	37	939.8	62	1574.8	87	2209.8
13	330.2	38	965.2	63	1600.2	88	2235.2
14	355.6	39	990.6	64	1625.6	89	2260.6
15	381.0	40	1016.0	65	1651.0	90	2286.0
16	406.4	41	1041.4	66	1676.4	91	2311.4
17	431.8	42	1066.8	67	1701.8	92	2336.8
18	457.2	43	1092.2	68	1727.2	93	2362.2
19	482.6	44	1117.6	69	1752.6	94	2387.6
20	508.0	45	1143.0	70	1778.0	95	2413.0
21	533.4	46	1168.4	71	1803.4	96	2438.4
22	558.8	47	1193.8	72	1828.8	97	2463.8
23	584.2	48	1219.2	73	1854.2	98	2489.2
24	609.6	49	1244.6	74	1879.6	99	2514.6
25	635.0	50	1270.0	75	1905.0	100	2540.0

MILLIMETERS TO INCHES

(Basis: 25.4 Millimeters = 1 Inch)

Mm.	In.	Mm.	In.	Mm.	In.	Mm.	In.
1	0.039370	26	1.023622	51	2.007874	76	2.992126
2	0.078740	27	1.062992	52	2.047244	77	3.031496
3	0.118110	28	1.102362	53	2.086614	78	3.070866
4	0.157480	29	1.141732	54	2.125984	79	3.110236
5	0.196850	30	1.181102	55	2.165354	80	3.149606
6	0.236220	31	1.220472	56	2.204724	81	3.188976
7	0.275591	32	1.259843	57	2.244094	82	3.228346
8	0.314961	33	1.299213	58	2.283465	83	3.267717
9	0.354331	34	1.338583	59	2.322835	84	3.307087
10	0.393701	35	1.377953	60	2.362205	85	3.346457
11	0.433071	36	1.417323	61	2.401575	86	3.385827
12	0.472441	37	1.456693	62	2.440945	87	3.425197
13	0.511811	38	1.496063	63	2.480315	88	3.464567
14	0.551181	39	1.535433	64	2.519685	89	3.503937
15	0.590551	40	1.574803	65	2.559055	90	3.543307
16	0.629921	41	1.614173	66	2.598425	91	3.582677
17	0.669291	42	1.653543	67	2.637795	92	3.622047
18	0.708661	43	1.692913	68	2.677165	93	3.661417
19	0.748031	44	1.732283	69	2.716535	94	3.700787
20	0.787402	45	1.771654	70	2.755906	95	3.740157
21	0.826772	46	1.811024	71	2.795276	96	3.779528
22	0.866142	47	1.850394	72	2.834646	97	3.818898
23	0.905512	48	1.889764	73	2.874016	98	3.858268
24	0.944882	49	1.929134	74	2.913386	99	3.897638
25	0.984252	50	1.968504	75	2.952756	100	3.937008



CRANE PACKING COMPANY
6400 OAKTON STREET, MORTON GROVE, ILLINOIS 60053 U.S.A.
OFFICES, WAREHOUSES AND SERVICE DEPOTS THE WORLD OVER

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SEC. 13 | TECHNICAL DATA

BULLETIN NO. P-400-3

John Crane

Packing Recommendations

Technical Data

John Crane

CRANE PACKING COMPANY

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PACKING RECOMMENDATIONS

1. Recommendations are for guidance only and are subject to revisions based on latest available developments.
2. Choice of packing selected must be determined on the basis of known factors covering the application and can cover more than one type of packing used in combination sets, dependent on the following conditions:

   A. Dimensions
   B. Liquid or gas handled
   C. Temperature range
   D. Pressure
   E. Motion
   F. Speed
   G. Cycle
   H. Mechanical conditions
   I. Special requirements

3. For abrasive service it is recommended that a lantern ring be used in conjunction with the packing for longer packing life.
4. Maximum temperatures and pressures are subject to application and can vary, dependent on service conditions involved.
5. Hazardous or toxic liquids or gases are subject to special recommendations.
6. For special services not shown, consult CRANE PACKING COMPANY.

PACKING RECOMMENDATION CHARTS

METALLIC PACKINGS

STYLE	TEMPERATURE	Rotary	Reciprocating	Valve Stem	Mild Acid	Corrosive Acid	Mild Alkalies	Corrosive Alkalies	Water	Steam	Ammonia	Air	Oxygen	Petroleum Oils	Synthetic Oils	Gases	Solvents	REMARKS
100, 100M, 110, 110M	450° F.	●	●	●	●		●		●	●	●	●		●		●		Do Not Use On Bronze Shafts
100AL	1000° F.	●	●	●	●							●		●	●			Shaft Hardness 60 Rockwell C
100AL—Type F	1000° F.			●		●												H. F. Service
100CU	1000° F.	●	●	●					●	●		●		●				Shaft Hardness 60 Rockwell C
140	150° F.	●							●									For Stern Tubes
150	450° F.	●		●	●		●		●	●	●	●		●				
300, 300M	450° F.		●						●	●	●	●				●		

(Cont.)

PACKING RECOMMENDATION CHARTS

PLASTIC PACKINGS

STYLE	TEMPERATURE	Rotary	Reciprocating	Valve Stem	Mild Acid	Corrosive Acid	Mild Alkalies	Corrosive Alkalies	Water	Steam	Ammonia	Air	Oxygen	Petroleum Oils	Synthetic Oils	Gases	Solvents	REMARKS
SS #1, SS #1J	550° F.	●		●	●		●		●	●		●		●		●	●	SS #1 Up To 50 PSI In Rotary Pumps
SS #2, SS #2J	750° F.	●	●	●					●	●	●	●		●		●		
SS #3, SS #3J	550° F.	●		●	●		●		●	●	●	●		●	●		●	
SS #4, SS #4J	550° F.	●		●														No Graphite—Mica Lubricant
SS #5, SS #5J	550° F.	●		●		●		●									●	
SS #6, SS #6J	750° F.	●	●	●					●	●	●			●		●		
SS #2AM	750° F.			●					●	●		●		●	●	●		
SS #4AM	750° F.			●														No Graphite—Mica Lubricant
SS #6AM	750° F.			●					●	●		●		●	●	●		For 1500 PSIG

FABRIC PACKINGS

800	600° F.		●						●	●	●	●		●		●		For Steam Hammer Service
802	600° F.		●						●	●	●	●		●		●		
804	550° F.		●	●								●		●				
804D	750° F.		●	●										●				Hot Oil Pumps
808	600° F.	●		●								●		●				
804M	750° F.	●		●	●				●	●	●	●		●				
804MD	750° F.	●	●											●	●			For Asphalt Service
804MBF	750° F.	●							●	●								For Boiler Feed Service Hi-Temp
810	500° F.	●		●	●		●		●	●	●	●		●			●	

(Cont.)

PACKING RECOMMENDATION CHARTS

FABRIC PACKINGS (Cont.)

STYLE	TEMPERATURE	Rotary	Reciprocating	Valve Stem	Mild Acid	Corrosive Acid	Mild Alkalies	Corrosive Alkalies	Water	Steam	Ammonia	Air	Oxygen	Petroleum Oils	Synthetic Oils	Gases	Solvents	REMARKS
810W	700° F.		●		●		●						●					
814	500° F.			●	●			●	●	●								
815	500° F.		●	●	●			●	●	●								
816	500° F.		●	●	●			●	●	●								
820	250° F.		●						●		●							
821	250° F.		●								●	●		●				
823	350° F.		●						●	●								For Boiler Feed Service
824	350° F.		●											●				Hot Oil Service
829	250° F.		●											●	●			Water Emulsion Oils
830	300° F.		●											●				
832, 835	300° F.		●								●	●				●		Ammonia Service
843, 845	150° F.		●						●		●	●						#845 Rockhard
861	150° F.	●							●					●				
862	150° F.	●							●					●				
863	150° F.	●							●									
865	150° F.	●							●									
866	150° F.	●							●					●				For Stern Tubes
880, 881	600° F.				●		●		●	●		●				●		#881 Designed For Furnace Doors
896	700° F.	●		●		●		●									●	
930	250° F.		●												●			Phosphate Ester Hydraulic Fluid

(Cont.)

PACKING RECOMMENDATION CHARTS

FABRIC PACKINGS (Cont.)

STYLE	TEMPERATURE	Rotary	Reciprocating	Valve Stem	Mild Acid	Corrosive Acid	Mild Alkalies	Corrosive Alkalies	Water	Steam	Ammonia	Air	Oxygen	Petroleum Oils	Synthetic Oils	Gases	Solvents	REMARKS
1320	150° F.	●				●		●			●							
177J	750° F.			●				●	●	●	●		●		●	●		
177J6, 177J7	900° F.			●								●						For Oxygen Service
187J	750° F.			●				●	●	●	●		●	●	●	●		
5810	500° F.	●		●	●		●		●	●	●	●		●	●	●		Interlace Braid

HIGH TEMPERATURE VALVE STEM PACKINGS

177AI	1200° F.			●					●	●	●	●		●				Does Not Have Corrosion Inhibiter
	750° F.			●					●	●	●	●		●				No Wire
187-I, 187-IX	1200° F.			●					●	●	●	●		●	●	●	●	For Up To 2500 PSIG

SPECIAL HIGH TEMPERATURE PACKINGS

1625GF	1000° F.	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	
GRAFOIL*	2500° F.	●		●	●	●	●	●	●	●	●	●		●	●	●	●	*Union Carbide T.M.

CHEMICAL PACKINGS—BRAIDED TYPES

C-06	550° F.	●	●	●	●		●		●	●	●	●		●	●	●	●	
C-08	550° F.			●					●	●	●			●				Inconel Wire Inserted
C-12	550° F.	●	●	●	●		●		●	●	●	●		●				
C-28	550° F.	●		●	●		●		●	●	●	●		●	●			
C-58, C-60	550° F.	●	●	●	●		●		●	●	●	●		●	●	●	●	

(Cont.)

PACKING RECOMMENDATION CHARTS

STYLE	TEMPERATURE	Rotary	Reciprocating	Valve Stem	Mild Acid	Corrosive Acid	Mild Alkalies	Corrosive Alkalies	Water	Steam	Ammonia	Air	Oxygen	Petroleum Oils	Synthetic Oils	Gases	Solvents	REMARKS
CHEMICAL PACKINGS—BRAIDED TYPES (Cont.)																		
C-94	600° F.	●		●						●			●					AAAA Yarn For Oxygen Service
C-994	600° F.	●		●									●					Nuclear Service Packing Low Chloride Content—Must Be Specified
704	550° F.	●		●	●	●	●	●					●				●	
706	550° F.	●		●	●	●	●	●									●	Special Acid Resistant Lubricant
710	550° F.	●		●	●	●	●	●										
712	550° F.	●		●	●	●	●	●										
C-1030	550° F.	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
C-1040	550° F.	●	●	●		●		●									●	
C-1045	550° F.	●	●	●		●		●	●	●	●	●	●			●	●	
C-1050	550° F.	●	●	●	●	●	●	●	●	●	●	●				●	●	
CHEMICAL PACKINGS—MACHINED AND MOLDED TYPES																		
CVU-CVH	550° F.		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
SHEET PACKINGS																		
333	800° F.				●		●		●	●	●	●						For Super-Heated Steam
2150	750° F.				●		●		●	●	●	●						
2157	700° F.								●	●	●	●						
888	700° F.													●	●	●		Contains No Free Sulphur
222	750° F.													●	●	●		
2112	700° F.					●		●									●	

(Cont.)

PACKING RECOMMENDATION CHARTS

SHEET PACKINGS (Cont.)

STYLE	TEMPERATURE	Rotary	Reciprocating	Valve Stem	Mild Acid	Corrosive Acid	Mild Alkalies	Corrosive Alkalies	Water	Steam	Ammonia	Air	Oxygen	Petroleum Oils	Synthetic Oils	Gases	Solvents	REMARKS
555	150° F.								●	●		●						
557	150° F.								●	●		●						
666	150° F.								●	●		●						Wire Reinforced
777	250° F.				●		●		●		●	●		●		●		
999	275° F.													●			●	
997	250° F.				●		●		●		●	●		●		●		
998	250° F.													●			●	
444	250° F.								●	●	●	●		●		●		
2000	400° F.				●		●				●	●				●		Silicone Sheet
68-C	500° F.				●	●	●	●	●	●	●	●	●	●	●	●	●	TFE Sheet

	Packing Styles	pH Value	Service Recommendation
PACKING SELECTION CHARTS For guidance only. Contact factory for more specific recommendations.	1625GF, Grafoil*, C-1045, CVU, CVH	14	Maximum Caustic
	C-1050, 704, 706, C-1030, SS #5	11, 12, 13	Severe Caustic
	896, C-06, C-94, 5810, 177AI, 187-I, SS #1, SS #3, 101M	8, 9, 10	Mild Caustic
	810, 5810, C-12, C-06, C-94, 187-I	7	Neutral
	C-06, C-12, C-94, 810, 5810, 100M, SS #1, SS #3	3, 4, 5, 6	Mild Acid
	704, C-1045, C-1050, 1625GF	1, 2	Severe Acid
	1625GF, Grafoil*, C 1045, CVU, CVH	0	Maximum

PRESSURE/TEMPERATURE RANGE—VALVE PACKING

Pressure PSIG	TEMPERATURE °F.						
	100°/300°	300°/450°	450°/600°	600°/750°	750°/850°	850°/950°	950°/1200°
Up to 300	A thru K	A thru K	A thru J	A thru H	A thru G	A,B,C,D,F,L	A,C,D,F,L
300 to 600	A thru K	A thru K	A thru G,I,J	A thru G	A thru F	A,B,C,D,F,L	A,C,D,F,L
600 to 900	A thru K	A thru F	A thru F,I,J,	A thru F	A thru F	A,B,C,D,F,L	A,F,L
900 to 1500	A,B,C,F	A,B,C,F	A,B,C,F	A,B,F,L	A,F,L	A,F,L	A,F,L
1500 to 2500	A,B,C,F	A,B,C,F	A,B,C,F	A,B,F,L	A,F,L	A,F,L	A,F,L

LETTER KEY TO PACKING STYLES (See Chart Above)

Styles 101CU, 550—A
Style 101AL —B
Style SS #6AM —C
Style 1625GF —D
Styles 810, 5810 —E
Styles 187-I, 177AI —F
Styles SS #1J, SS #3J —G
Styles SS #1, SS #2, SS #3—H
Styles C-1030, C-1045, C-1050—I
Styles C-06, C-12 —J
Styles 100M, 110M —K
Style Grafoil* —L

PRESSURE RANGE—PACKINGS IN PUMPS AND OTHER TYPE ROTARY SHAFT APPLICATIONS

STYLES	PRESSURES PSIG								REMARKS
	50	100	125	150	175	200	225	250	
SS #1, SS #2, SS #3									Plastic Type Packing
SS #1J, SS #3J, SS #6AM									Jacket Is Asbestos Yarn
1625GF									Graphited Filament Yarn
810, 5810, 804									5810 Interlace Braid
C-1045, C-1050 C-58, C-60									TFE Filament And TFE Dispersion Packings
805MBF, 100AL 100CU									Use On Shafts 500 Brinnel Hardness
101M-SS #1 Combination Grafoil*									Higher Pressures Can Be Handled. See Note No. 3

NOTES: 1. Pressure Ratings of Packings Based On Following Conditions: Water—Ambient Temperature Stainless Steel Shaft 2½" Dia. 3600 RPM.

2. Maximum Speed of Shaft For Controlled Leakage Is 4000-5000 FPM.

3. Charts Are For Reference Only. For Specific Recommendation Contact Crane Packing Company.

*Union Carbide Corporation T.M.

CRANE PACKING COMPANY

CENTIGRADE—FAHRENHEIT CONVERSION TABLE

Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
−100	−148	100	212	300	572	500	932	700	1292	900	1652
− 95	−139	105	221	305	581	505	941	705	1301	905	1661
− 90	−130	110	230	310	590	510	950	710	1310	910	1670
− 85	−121	115	239	315	599	515	959	715	1319	915	1679
− 80	−112	120	248	320	608	520	968	720	1328	920	1688
− 75	−103	125	257	325	617	525	977	725	1337	925	1697
− 70	− 94	130	266	330	626	530	986	730	1346	930	1706
− 65	− 85	135	275	335	635	535	995	735	1355	935	1715
− 60	− 76	140	284	340	644	540	1004	740	1364	940	1724
− 55	− 67	145	293	345	653	545	1013	745	1373	945	1733
− 50	− 58	150	302	350	662	550	1022	750	1382	950	1742
− 45	− 49	155	311	355	671	555	1031	755	1391	955	1751
− 40	− 40	160	320	360	680	560	1040	760	1400	960	1760
− 35	− 31	165	329	365	689	565	1049	765	1409	965	1769
− 30	− 22	170	338	370	698	570	1058	770	1418	970	1778
− 25	− 13	175	347	375	707	575	1067	775	1427	975	1787
− 20	− 4	180	356	380	716	580	1076	780	1436	980	1796
− 15	5	185	365	385	725	585	1085	785	1445	985	1805
− 10	14	190	374	390	734	590	1094	790	1454	990	1814
− 5	23	195	383	395	743	595	1103	795	1463	995	1823
0	32	200	392	400	752	600	1112	800	1472	1000	1832
5	41	205	401	405	761	605	1121	805	1481	1005	1841
10	50	210	410	410	770	610	1130	810	1490	1010	1850
15	59	215	419	415	779	615	1139	815	1499	1015	1859
20	68	220	428	420	788	620	1148	820	1508	1020	1868
25	77	225	437	425	797	625	1157	825	1517	1025	1877
30	86	230	446	430	806	630	1166	830	1526	1030	1886
35	95	235	455	435	815	635	1175	835	1535	1035	1895
40	104	240	464	440	824	640	1184	840	1544	1040	1904
45	113	245	473	445	833	645	1193	845	1553	1045	1913
50	122	250	482	450	842	650	1202	850	1562	1050	1922
55	131	255	491	455	851	655	1211	855	1571	1055	1931
60	140	260	500	460	860	660	1220	860	1580	1060	1940
65	149	265	509	465	869	665	1229	865	1589	1065	1949
70	158	270	518	470	878	670	1238	870	1598	1070	1958
75	167	275	527	475	887	675	1247	875	1607	1075	1967
80	176	280	536	480	896	680	1256	880	1616	1080	1976
85	185	285	545	485	905	685	1265	885	1625	1085	1985
90	194	290	554	490	914	690	1274	890	1634	1090	1994
95	203	295	563	495	923	695	1283	895	1643	1095	2003

Conversion Formulas

$$C = 5/9\ (F-32)$$

$$F = (9/5)C+32$$

NOTE: *When using readings below zero, carry negative sign in formula.*

STEAM TABLE

Gauge Press. Lbs.	Temp. Deg.F.	Gauge Press. Lbs.	Temp. Deg.F.	Gauge Press. Lbs.	Temp. Deg.F.	Gauge Press. Lbs.	Temp. Deg.F.	Gauge Press. Lbs.	Temp. Deg.F.	Gauge Press. Lbs.	Temp. Deg.F.
0	212.0	88	329.7	174	376.9	350	435.7	1060	553.5	1920	631.0
2	218.5			176	377.8	355	437.0	1080	555.8	1940	632.5
4	224.4	90	331.2	178	378.7	360	438.3			1960	633.9
6	229.6	92	332.6			365	439.5	1100	558.0	1980	635.4
8	234.7	94	333.9	180	379.6	370	440.8	1120	560.1		
		96	335.1	182	380.5			1140	562.5	2000	636.8
10	239.4	98	336.6	184	381.4	375	442.0	1160	564.6	2020	638.2
12	243.7			186	382.1	380	443.3	1180	566.6	2040	639.5
14	247.8	100	337.8	188	383.0	385	444.6			2060	640.9
16	251.6	102	339.1			390	445.8	1200	568.8	2080	642.4
18	255.4	104	340.5	190	383.7	395	447.1	1220	570.7		
		106	341.6	192	384.6			1240	572.9	2100	643.6
20	258.8	108	342.9	194	385.3	400	448.2	1260	574.9	2120	645.1
22	262.0			196	386.2	420	452.8	1280	576.9	2140	646.2
24	265.3	110	344.1	198	387.0	440	457.3			2160	647.8
26	268.3	112	345.4			460	461.7	1300	578.8	2180	649.0
28	271.2	114	346.5	200	387.9	480	466.0	1320	580.8		
		116	347.7	205	389.8			1340	582.8	2200	650.3
30	274.1	118	348.8	210	391.6	500	470.1	1360	584.6	2220	651.7
32	276.8			215	393.6	520	474.1	1380	586.6	2240	653.0
34	279.3	120	350.1	220	395.4	540	477.9			2260	654.3
36	281.8	122	351.1			560	481.6	1400	588.4	2280	655.5
38	284.4	124	352.2	225	397.2	580	485.2	1420	590.4		
		126	353.5	230	399.0			1440	592.2	2300	656.8
40	286.7	128	354.6	235	400.8	600	488.8	1460	594.0	2320	658.0
42	289.0			240	402.6	620	492.3	1480	595.8	2340	659.3
44	291.2	130	355.6	245	404.4	640	495.7			2360	660.6
46	293.5	132	356.7			660	499.1	1500	597.6	2380	661.8
48	295.5	134	357.8	250	406.0	680	502.3	1520	599.2		
		136	358.9	255	407.7			1540	601.0	2400	663.1
50	297.7	138	359.8	260	409.3	700	505.6	1560	602.6	2420	664.2
52	299.7			265	410.5	720	508.6	1580	604.4	2440	665.4
54	301.6	140	360.0	270	412.5	740	511.7			2460	666.7
56	303.6	142	361.9			760	514.6	1600	606.0	2480	667.9
58	305.4	144	362.8	275	414.1	780	517.5	1620	607.8		
		146	363.9	280	415.8			1640	609.4	2500	669.0
60	307.4	148	364.8	285	417.2	800	520.3	1660	611.1	2520	670.3
62	309.2			290	418.8	820	523.2	1680	612.7	2540	671.5
64	310.8	150	365.9	295	420.3	840	525.9			2560	672.8
66	312.6	152	366.8			860	528.6	1700	614.3	2580	673.7
68	314.2	154	367.9	300	421.7	880	531.3	1720	615.9		
		156	368.8	305	423.1			1740	617.4	2600	675.0
70	316.0	158	369.7	310	424.6	900	534.0	1760	619.9	2620	676.0
72	317.7			315	426.2	920	536.5	1780	620.6	2640	677.3
74	319.3	160	370.6	320	427.5	940	539.1			2660	678.4
76	320.9	162	371.7			960	541.6	1800	622.0	2680	679.5
78	322.3	164	372.6	325	428.9	980	544.1	1820	623.7		
		166	373.5	330	430.3			1840	625.1	2700	680.5
80	323.8	168	374.4	335	431.6	1000	546.4	1860	626.5	2750	683.2
82	325.4			340	433.0	1020	548.8	1880	628.2	2800	686.1
84	326.8	170	375.3	345	434.3	1040	551.1			2850	688.6
86	328.3	172	376.2					1900	629.6	2900	691.3

STEAM TABLE—INCHES OF MERCURY, VACUUM

Abs. Press Lbs.	Inches Hg. Vacuum	Temp.	Abs. Press Lbs.	Inches Hg. Vacuum	Temp.	Abs. Press Lbs.	Inches Hg. Vacuum	Temp.	Abs. Press Lbs.	Inches Hg. Vacuum	Temp.
1	2.04	101.7	2.0	4.08	126.1	6.0	12.2	170.1	11.0	22.4	197.7
1.2	2.44	107.9	2.2	4.48	129.6	7.0	14.2	176.8	12.0	24.0	202.0
1.4	2.85	113.3	3.0	6.10	141.5	8.0	16.3	182.9	13.0	26.5	205.9
1.6	3.26	118.0	4.0	8.15	153.0	9.0	18.3	188.3	14.0	28.5	209.6
1.8	3.66	122.2	5.0	10.2	162.2	10.0	20.2	193.2	14.7	30.0	212.0

FRACTIONS, WITH DECIMAL AND MILLIMETER EQUIVALENTS

Fraction	Decimal Equivalent	Millimeter Equivalents
4ths and 8ths		
1/8	.125	3.175
1/4	.250	6.350
3/8	.375	9.525
1/2	.500	12.700
5/8	.625	15.875
3/4	.750	19.050
7/8	.875	22.225
16ths		
1/16	.0625	1.588
3/16	.1875	4.763
5/16	.3125	7.938
7/16	.4375	11.113
9/16	.5625	14.288
11/16	.6875	17.463
13/16	.8125	20.638
15/16	.9375	23.813
32nds		
1/32	.03125	.794
3/32	.09375	2.381
5/32	.15625	3.969
7/32	.21875	5.556
9/32	.28125	7.144
11/32	.34375	8.731
13/32	.40625	10.319
15/32	.46875	11.906
17/32	.53125	13.494
19/32	.59375	15.081
21/32	.65625	16.669
23/32	.71875	18.256
25/32	.78125	19.844
27/32	.84375	21.431
29/32	.90625	23.019
31/32	.96875	24.606
64ths		
1/64	.015625	.397
3/64	.046875	1.191
5/64	.078125	1.984
7/64	.109375	2.778
9/64	.140625	3.572
11/64	.171875	4.366
13/64	.203125	5.159
15/64	.234375	5.953
17/64	.265625	6.747
19/64	.296875	7.541
21/64	.328125	8.334
23/64	.359375	9.128
25/64	.390625	9.922
27/64	.421875	10.716
29/64	.453125	11.509
31/64	.484375	12.303
33/64	.515625	13.097
35/64	.546875	13.891
37/64	.578125	14.684
39/64	.609375	15.478
41/64	.640625	16.272
43/64	.671875	17.066
45/64	.703125	17.859
47/64	.734375	18.653
49/64	.765625	19.447
51/64	.796875	20.241
53/64	.828125	21.034
55/64	.859375	21.828
57/64	.890625	22.622
59/64	.921875	23.416
61/64	.953125	24.209
63/64	.984375	25.003

10 mm. = 1 cm. = 0.3937 in.
10 cm. = 1 dm. = 3.937 in.
10 dm. = 1 m. = 39.37 in.

TABLE OF DECIMAL EQUIVALENTS OF MILLIMETERS

1 in. = .254 m
1 ft. = .3048 m
1 yd. = .9144 m

mm.	Inches	mm.	Inches	mm.	Inches	mm.	Inches	mm.	Inches	mm.	Inches
1 =	.03937	16 =	.62992	31 =	1.22047	46 =	1.81102	61 =	2.40157	76 =	2.99212
2 =	.07874	17 =	.66929	32 =	1.25984	47 =	1.85039	62 =	2.44094	77 =	3.03149
3 =	.11811	18 =	.70866	33 =	1.29921	48 =	1.88976	63 =	2.48031	78 =	3.07086
4 =	.15748	19 =	.74803	34 =	1.33858	49 =	1.92913	64 =	2.51968	79 =	3.11023
5 =	.19685	20 =	.78740	35 =	1.37795	50 =	1.96850	65 =	2.55905	80 =	3.14960
6 =	.23622	21 =	.82677	36 =	1.41732	51 =	2.00787	66 =	2.59842	82 =	3.22834
7 =	.27559	22 =	.86614	37 =	1.45669	52 =	2.04724	67 =	2.63779	84 =	3.30708
8 =	.31496	23 =	.90551	38 =	1.49606	53 =	2.08661	68 =	2.67716	86 =	3.38582
9 =	.35433	24 =	.94488	39 =	1.53543	54 =	2.12598	69 =	2.71653	88 =	3.46456
10 =	.39370	25 =	.98425	40 =	1.57480	55 =	2.16535	70 =	2.75590	90 =	3.54330
11 =	.43307	26 =	1.02362	41 =	1.61417	56 =	2.20472	71 =	2.79527	92 =	3.62204
12 =	.47244	27 =	1.06299	42 =	1.65354	57 =	2.24409	72 =	2.83464	94 =	3.70078
13 =	.51181	28 =	1.10236	43 =	1.69291	58 =	2.28346	73 =	2.87401	96 =	3.77952
14 =	.55118	29 =	1.14173	44 =	1.73228	59 =	2.32283	74 =	2.91338	98 =	3.85826
15 =	.59055	30 =	1.18110	45 =	1.77165	60 =	2.36220	75 =	2.95275	100 =	3.93700

Water Heads and Equivalent Pressures

lb/sq. in. = .4331 × ft.

Table is based on water at 39.2°F.

Head Feet	Pressure P.S.I.	Head Feet	Pressure P.S.I.	Head Feet	Pressure P.S.I.
1	0.43	100	43.31	450	195.00
5	2.16	110	47.64	475	205.77
10	4.33	120	51.98	500	216.58
15	6.49	130	56.31	525	227.42
20	8.66	140	60.64	550	238.25
25	10.82	150	64.97	575	249.09
30	12.99	160	69.31	600	259.90
35	15.16	170	73.64	625	270.73
40	17.32	180	77.97	650	281.56
45	19.49	190	82.30	675	292.40
50	21.65	200	86.63	700	303.22
55	23.82	225	97.46	725	314.05
60	25.99	250	108.29	750	324.88
65	28.15	275	119.12	775	335.72
70	30.32	300	129.95	800	346.54
75	32.48	325	140.79	850	368.20
80	34.65	350	151.61	900	389.86
85	36.82	375	162.45	1000	433.18
90	38.98	400	173.27	2000	866.3
95	41.15	425	184.10	3000	1299.5

SPECIFIC GRAVITY OF COMMON LIQUIDS

LIQUID	Boiling Point at Atmos. Press. °F	Specific Gravity		LIQUID	Boiling Point at Atmos. Press. °F	Specific Gravity	
		Temp. °F	Water at 4°C = 1			Temp. °F	Water at 4°C = 1
Acetone	133	68	.792	Fuel Oil, No. 1	—	60	.82-95
Alcohol, butyl-n	243	68	.81	Fuel Oil, No. 2	—	60	.82-95
Alcohol, ehtyl-n (grain)	172	68	.789	Fuel Oil, No. 3	—	60	.82-95
Alcohol, methyl-n (wood)	151	68	.79	Fuel Oil, No. 5	—	60	.82-95
Ammonia (liquid)	−28	0	.662	Fuel Oil, No. 6	—	60	.82-95
Automobile crankcase oils	—	60	.88-94	Gasoline, typical, Sample (a)	—	60	.74
Beer	—	60	1.01	Sample (b)	—	60	.72
Benzol (Benzene)	176	68	.879	Sample (c)	—	60	.68
Brine, calcium chloride, 25%	—	60	1.23	Glycerine, 100%	554	68	1.26
Brine, sodium chloride, 25%	—	60	1.19	Kerosene	—	60	.78-.82
Butane	31	20	.579	Mercury	675	68	13.55
				Milk	—	68	1.02-1.04
Carbon tetrachloride	170	68	1.594	Petroleum ether (benzine)	—	60	.64
Castor Oil	—	68	.96	Propane	−44.5	20	.503
Chloroform	142	68	1.489				
Ethylene Glycol	387	68	1.115	Sulfuric acid, 100%	640	68	1.83
				Sulfuric acid, 95%	—	68	1.83
Freon 11	—	70	1.49	Sulfuric acid, 60%	—	68	1.50
Freon 12	—	70	1.33	Water (fresh)	212	60	1.0
Freon 21	—	70	1.37	Water (sea)	—	60	1.03

DIMENSIONS OF GASKETS FOR LOW AND MEDIUM PRESSURE FLANGES
A.S.A. STANDARD

Pipe Size	Flange ASA Rating in lbs.	Ring Gaskets		Full-Faced Gaskets	
		Old Standard	New Standard	Old Standard	New Standard
3/4"	150	3/4" x 2 1/4"	1 1/16" x 2 1/4"	3/4" x 3 7/8"	1 1/16" x 3 7/8"
	300	3/4" x 2 5/8"	1 1/16" x 2 5/8"	3/4" x 4 5/8"	1 1/16" x 4 5/8"
1"	150	1" x 2 5/8"	1 5/16" x 2 5/8"	1" x 4 1/4"	1 5/16" x 4 1/4"
	300	1" x 2 7/8"	1 5/16" x 2 7/8"	1" x 4 7/8"	1 5/16" x 4 7/8"
1 1/4"	150	1 1/4" x 3"	1 21/32" x 3"	1 1/4" x 4 5/8"	1 21/32" x 4 5/8"
	300	1 1/4" x 3 1/4"	1 21/32" x 3 1/4"	1 1/4" x 5 1/4"	1 21/32" x 5 1/4"
1 1/2"	150	1 1/2" x 3 3/8"	1 29/32" x 3 3/8"	1 1/2" x 5"	1 29/32" x 5"
	300	1 1/2" x 3 3/4"	1 29/32" x 3 3/4"	1 1/2" x 6 1/8"	1 29/32" x 6 1/8"
2"	150	2" x 4 1/8"	2 3/8" x 4 1/8"	2" x 6"	2 3/8" x 6"
	300	2" x 4 3/8"	2 3/8" x 4 3/8"	2" x 6 1/2"	2 3/8" x 6 1/2"
2 1/2"	150	2 1/2" x 4 7/8"	2 7/8" x 4 7/8"	2 1/2" x 7"	2 7/8" x 7"
	300	2 1/2" x 5 1/8"	2 7/8" x 5 1/8"	2 1/2" x 7 1/2"	2 7/8" x 7 1/2"
3"	150	3" x 5 3/8"	3 1/2" x 5 3/8"	3" x 7 1/2"	3 1/2" x 7 1/2"
	300	3" x 5 7/8"	3 1/2" x 5 7/8"	3" x 8 1/4"	3 1/2" x 8 1/4"
4"	150	4" x 6 7/8"	4 1/2" x 6 7/8"	4" x 9"	4 1/2" x 9"
	300	4" x 7 1/8"	4 1/2" x 7 1/8"	4" x 10"	4 1/2" x 10"
5"	150	5" x 7 3/4"	5 9/16" x 7 3/4"	5" x 10"	5 9/16" x 10"
	300	5" x 8 1/2"	5 9/16" x 8 1/2"	5" x 11"	5 9/16" x 11"
6"	150	6" x 8 3/4"	6 5/8" x 8 3/4"	6" x 11"	6 5/8" x 11"
	300	6" x 9 7/8"	6 5/8" x 9 7/8"	6" x 12 1/2"	6 5/8" x 12 1/2"
8"	150	8" x 11"	8 5/8" x 11"	8" x 13 1/2"	8 5/8" x 13 1/2"
	300	8" x 12 1/8"	8 5/8" x 12 1/8"	8" x 15"	8 5/8" x 15"
10"	150	10" x 13 3/8"	10 3/4" x 13 3/8"	10" x 16"	10 3/4" x 16"
	300	10" x 14 1/4"	10 3/4" x 14 1/4"	10" x 17 1/2"	10 3/4" x 17 1/2"
12"	150	12" x 16 1/8"	12 3/4" x 16 1/8"	12" x 19"	12 3/4" x 19"
	300	12" x 16 5/8"	12 3/4" x 16 5/8"	12" x 20 1/2"	12 3/4" x 20 1/2"
14"	150	14" x 17 3/4"	14" x 17 3/4"	14" x 21"	14" x 21"
	300	14" x 19 1/8"	14" x 19 1/8"	14" x 23"	14" x 23"
16"	150	16" x 20 1/4"	16" x 20 1/4"	16" x 23 1/2"	16" x 23 1/2"
	300	16" x 21 1/4"	16" x 21 1/4"	16" x 25 1/2"	16" x 25 1/2"
18"	150	18" x 21 5/8"	18" x 21 5/8"	18" x 25"	18" x 25"
	300	18" x 23 1/2"	18" x 23 1/2"	18" x 28"	18" x 28"
20"	150	20" x 23 7/8"	20" x 23 7/8"	20" x 27 1/2"	20" x 27 1/2"
	300	20" x 25 5/8"	20" x 25 5/8"	20" x 30 1/2"	20" x 30 1/2"
24"	150	24" x 28 1/4"	24" x 28 1/4"	24" x 32"	24" x 32"
	300	24" x 30 3/8"	24" x 30 3/8"	24" x 36"	24" x 36"
26"	150	26" x 30 1/2"	26" x 30 1/2"	26" x 34 1/4"	26" x 34 1/4"
	300	26" x 32 7/8"	26" x 32 7/8"		
28"	150	28" x 32 3/4"	28" x 32 3/4"	28" x 36 1/2"	28" x 36 1/2"
	300	28" x 35 3/8"	28" x 35 3/8"		
30"	150	30" x 34 5/8"	30" x 34 5/8"	30" x 38 3/4"	30" x 38 3/4"
	300	30" x 37 1/2"	30" x 37 1/2"		

CIRCUMFERENCES AND AREAS OF CIRCLES

Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area	Diam.	Circ.	Area
			7	21.99	38.484	15	47.12	176.71	23	72.25	415.47	31	97.38	754.76	39	122.5	1194.5
1/32	.0981	.00076	1/8	22.38	39.871	1/8	47.51	179.67	1/8	72.64	420.00	1/8	97.78	760.86	1/8	122.9	1202.2
1/16	.1963	.00306	1/4	22.77	41.282	1/4	47.90	182.72	1/4	73.04	424.55	1/4	98.17	766.99	1/4	123.3	1209.9
3/32	.2926	.01227	3/8	23.16	42.718	3/8	48.30	185.66	3/8	73.43	429.13	3/8	98.56	773.14	3/8	123.7	1217.6
1/8	.3890	.02761	1/2	23.56	44.178	1/2	48.69	188.69	1/2	73.82	433.73	1/2	98.96	779.31	1/2	124.0	1225.4
1/4	.7854	.04908	5/8	23.95	45.663	5/8	49.08	191.74	5/8	74.21	438.30	5/8	99.35	785.51	5/8	124.4	1233.1
3/8	.9817	.07669	3/4	24.34	47.173	3/4	49.48	194.82	3/4	74.61	432.01	3/4	99.74	791.73	3/4	124.8	1240.9
1/2	1.178	.1104	7/8	24.74	48.707	7/8	49.87	197.73	7/8	75.00	447.69	7/8	100.1	797.97	7/8	125.2	1248.7
5/8	1.374	.1503															
3/4	1.570	.1963	8	25.13	50.265	16	50.26	201.06	24	75.39	452.39	32	100.5	804.24	40	125.6	1256.6
7/8	1.767	.2485	1/8	25.52	51.848	1/8	50.65	204.21	1/8	75.79	457.11	1/8	100.9	810.45	1/8	126.0	1264.5
1/8	1.963	.3097	1/4	25.91	53.456	1/4	51.05	207.39	1/4	76.18	461.86	1/4	101.3	816.86	1/4	126.4	1272.3
1 1/16	2.159	.3712	3/8	26.31	55.088	3/8	51.44	210.59	3/8	76.57	466.63	3/8	101.7	823.21	3/8	126.8	1280.3
1/4	2.356	.4417	1/2	26.70	56.745	1/2	51.83	213.82	1/2	76.96	471.43	1/2	102.1	829.57	1/2	127.2	1288.2
1 3/16	2.552	.5184	5/8	27.09	58.426	5/8	52.22	217.07	5/8	77.36	476.25	5/8	102.4	835.97	5/8	127.6	1291.2
1/8	2.748	.6013	3/4	27.47	60.132	3/4	52.62	220.35	3/4	77.75	481.10	3/4	102.8	842.39	3/4	128.0	1304.2
1 5/16	2.945	.6902	7/8	27.88	61.862	7/8	53 01	223.65	7/8	78.14	485.97	7/8	103.2	848.83	7/8	128.4	1312.2
1	3.141	.7854	9	28.27	63.617	17	53.40	226.98	25	78.54	490.87	33	103.6	855.30	41	128.8	1320.2
1/8	3.534	.9940	1/8	28.66	65.396	1/8	53.79	230.33	1/8	78.93	495.79	1/8	104.0	861.79	1/8	129.1	1328.3
1/4	3.927	1.227	1/4	29.05	67.200	1/4	54.19	233.70	1/4	79.32	500.74	1/4	104.4	868.30	1/4	129.5	1336.4
3/8	4.319	1.484	3/8	29.45	69.029	3/8	54.58	237.10	3/8	79.71	505.71	3/8	104.8	874.88	3/8	129.9	1344.5
1/2	4.712	1.767	1/2	29.84	70.882	1/2	54.97	240.52	1/2	80.10	510.70	1/2	105.2	881.41	1/2	130.3	1352.6
5/8	5.105	2.073	5/8	30.23	72.759	5/8	55.37	243.97	5/8	80.50	515.72	5/8	105.6	888.00	5/8	130.7	1360.8
3/4	5.497	2.405	3/4	30.63	74.662	3/4	55.76	247.45	3/4	80.89	520.70	3/4	106.0	894.61	3/4	131.1	1369.0
7/8	5.890	2.761	7/8	31.02	76.588	7/8	56.16	250.94	7/8	81.28	525.83	7/8	106.4	901.25	7/8	131.5	1377.2
2	6.283	3.141	10	31.41	78.539	18	56.54	254.46	26	81.68	530.92	34	106.8	907.92	42	131.9	1385.4
1/8	6.675	3.546	1/8	31.80	80.515	1/8	56.94	258.01	1/8	82.07	536.04	1/8	107.2	914.61	1/8	132.3	1393.7
1/4	7.068	3.976	1/4	32.20	82.516	1/4	57.33	261.58	1/4	82.46	541.18	1/4	107.5	921.32	1/4	132.7	1401.9
3/8	7.461	4.430	3/8	32.59	84.540	3/8	57.72	265.18	3/8	82.85	546.35	3/8	107.9	928.06	3/8	133.1	1410.2
1/2	7.854	4.908	1/2	32.98	86.590	1/2	58.11	268.80	1/2	83.25	551.54	1/2	108.3	934.82	1/2	133.5	1418.6
5/8	8.246	5.411	5/8	33.37	88.664	5/8	58.51	272.44	5/8	83.64	556.76	5/8	108.7	941.60	5/8	133.9	1426.9
3/4	8.639	5.939	3/4	33.77	90.762	3/4	58.90	276.11	3/4	84.03	562.00	3/4	109.1	948.41	3/4	134.3	1435.3
7/8	9.032	6.491	7/8	34.16	92.885	7/8	59.29	279.81	7/8	84.43	567.26	7/8	109.5	955.25	7/8	134.6	1443.7
3	9.424	7.068	11	34.55	95.033	19	59.69	283.52	27	84.82	572.55	35	109.9	962.11	43	135.0	1452.2
1/8	9.817	7.669	1/8	34.95	97.205	1/8	60.08	287.27	1/8	85.21	577.87	1/8	110.3	968.99	1/8	135.4	1460.6
1/4	10.21	8.295	1/4	35.34	99.402	1/4	60.47	291.03	1/4	85.60	583.20	1/4	110.7	975.90	1/4	135.8	1469.1
3/8	10.60	8.946	3/8	35.73	101.62	3/8	60.86	294.83	3/8	86.00	588.57	3/8	111.1	982.84	3/8	136.2	1477.6
1/2	10.99	9.621	1/2	36.12	103.86	1/2	61.26	298.64	1/2	86.39	593.95	1/2	111.5	989.80	1/2	136.6	1486.1
5/8	11.38	10.320	5/8	36.52	106.13	5/8	61.65	302.48	5/8	86.78	599.37	5/8	111.9	996.78	5/8	137.0	1494.7
3/4	11.78	11.044	3/4	36.91	108.43	3/4	62.04	306.35	3/4	87.17	604.80	3/4	112.3	1003.7	3/4	137.4	1503.3
7/8	12.17	11.793	7/8	37.30	110.75	7/8	62.43	310.24	7/8	87.57	610.26	7/8	112.7	1010.8	7/8	137.8	1511.9
4	12.65	12.566	12	37.69	113.00	20	62.83	314.16	28	87.96	615.75	36	113.0	1017.8	44	138.2	1520.5
1/8	12.95	13.364	1/8	38.09	115.46	1/8	63.22	318.09	1/8	88.35	621.26	1/8	113.4	1024.9	1/8	138.6	1529.1
1/4	13.35	14.186	1/4	38.48	117.85	1/4	63.61	322.06	1/4	88.75	626.79	1/4	113.8	1032.0	1/4	139.0	1537.8
3/8	13.74	15.033	3/8	38.87	120.27	3/8	64.01	326.05	3/8	89.14	632.35	3/8	114.2	1039.1	3/8	139.4	1546.5
1/2	14.13	15.904	1/2	39.27	122.71	1/2	64.40	330.06	1/2	89.53	637.94	1/2	114.6	1049.3	1/2	139.8	1555.2
5/8	14.52	16.800	5/8	39.66	125.18	5/8	64.79	334.10	5/8	89.92	643.54	5/8	115.0	1053.5	5/8	140.1	1564.0
3/4	14.92	17.720	3/4	40.05	127.67	3/4	65.18	338.16	3/4	90.32	649.18	3/4	115.4	1060.7	3/4	140.5	1572.8
7/8	15.31	18.665	7/8	40.44	130.19	7/8	65.58	342.25	7/8	90.71	654.83	7/8	115.8	1067.9	7/8	140.9	1581.6
5	15.70	19.635	13	40.84	132.73	21	65.97	346.36	29	91.10	660.52	37	116.2	1075.2	45	141.3	1590.4
1/8	16.10	20.629	1/8	41.23	135.29	1/8	66.36	350.49	1/8	91.49	666.22	1/8	116.6	1082.4	1/8	141.7	1599.2
1/4	16.49	21.647	1/4	41.62	137.88	1/4	66.75	354.65	1/4	91.89	671.95	1/4	117.0	1089.7	1/4	142.1	1608.1
3/8	16.88	22.690	3/8	42.01	140.50	3/8	67.15	358.84	3/8	92.28	677.71	3/8	117.4	1097.1	3/8	142.5	1617.0
1/2	17.27	23.758	1/2	42.41	143.13	1/2	67.54	363.05	1/2	92.67	683.49	1/2	117.8	1104.4	1/2	142.9	1625.9
5/8	17.67	24 850	5/8	42.80	145.80	5/8	67.93	367.28	5/8	93.06	689.29	5/8	118.2	1111.8	5/8	143.3	1634.9
3/4	18.06	25.967	3/4	43.19	148.48	3/4	68.32	371.54	3/4	93.46	695.12	3/4	118.6	1119.2	3/4	143.7	1643.8
7/8	18.45	27.108	7/8	43.58	151.20	7/8	68.72	375.82	7/8	93.85	700.98	7/8	118.9	1126.6	7/8	144.1	1652.8
6	18.84	28.274	14	43.98	153.93	22	69.11	380.13	30	94.24	706.86	38	119.3	1134.1	46	144.5	1661.9
1/8	19.24	29.464	1/8	44.37	156.69	1/8	69.50	384.46	1/8	94.64	712.76	1/8	119.7	1141.5	1/8	144.9	1670.9
1/4	19.63	30.679	1/4	44.76	159.48	1/4	69.90	388.82	1/4	95.03	718.69	1/4	120.1	1149.0	1/4	145.2	1680.0
3/8	20.02	31.919	3/8	45.16	162.29	3/8	70.29	393.20	3/8	95.42	724.64	3/8	120.5	1156.6	3/8	145.6	1689.1
1/2	20.42	33.183	1/2	45.55	165.13	1/2	70.68	397.60	1/2	95.81	730.61	1/2	120.9	1164.1	1/2	146.0	1698.2
5/8	20.81	34.471	5/8	45.94	167.98	5/8	71.07	402.03	5/8	96.21	736.61	5/8	121.3	1171.7	5/8	146.4	1707.3
3/4	21.20	35.784	3/4	46.33	170.87	3/4	71.47	406.49	3/4	96.60	742.64	3/4	121.7	1179.3	3/4	146.8	1716.5
7/8	21.57	37.122	7/8	46.73	173.78	7/8	71.86	410.97	7/8	96.99	748.69	7/8	122.1	1186.9	7/8	147.2	1725.7

CONVERSION TABLES FOR HARDNESS RATINGS

Rockwell C	Rockwell A	Rockwell B	Brinell	Brinell	Shore Scleroscope	Tensile Strength	Rockwell C	Rockwell A	Rockwell B	Brinell	Brinell	Shore Scleroscope	Tensile Strength
Brale 150 Kg. Load	Brale 60 Kg. Load	1/16" Ball 100 Kg. Load	10mm. Ball 3000 Kg. Dia. of Impression			1000 Lbs. Per Sq. In.	Brale 150 Kg. Load	Brale 60 Kg. Load	1/16" Ball 100 Kg. Load	10mm. Ball 3000 Kg. Dia. of Impression			1000 Lbs. Per Sq. In.
80	92.0	—	—	—	—	—	35	68.0	109	3.35	331	46	160
79	91.5	—	—	—	—	—	34	67.5	108	3.40	321	45	155
78	91.0	—	—	—	—	—	33	67.0	108	3.45	311	44	150
77	90.5	—	—	—	—	—	32	66.5	107	3.50	302	43	146
76	90.0	—	—	—	—	—	31	66.0	106	3.55	293	42	142
75	89.5	—	—	—	—	—	30	65.5	105	3.60	285	40	138
74	89.0	—	—	—	—	—	29	65.0	104	3.65	277	39	134
73	88.5	—	—	—	—	—	28	64.5	104	3.70	269	38	131
72	88.0	—	—	—	—	—	27	64.0	103	3.75	262	38	128
71	87.0	—	—	—	—	—	26	63.5	102	—	258	37	127
70	86.5	—	2.20	780	106	384	25	63.0	102	3.80	255	37	125
69	86.0	—	—	760	103	370	24	62.5	101	3.85	248	36	122
68	85.5	—	2.25	745	100	368	23	62.0	101	3.90	241	35	119
67	85.0	—	—	725	97	360	22	61.5	100	—	238	34	118
66	84.5	—	2.30	712	95	352	21	61.0	99	3.95	235	34	116
65	84.0	—	—	697	93	345	20	60.0	98	4.00	229	33	113
64	83.5	—	2.35	682	91	337	—	59.5	97	4.05	223	32	110
63	83.0	—	—	668	89	330	—	59.0	96	4.10	217	31	107
62	82.5	—	2.40	653	87	324	—	58.0	95	4.15	212	31	104
61	81.5	—	—	640	86	318	—	57.5	94	4.20	207	30	101
60	81.0	—	2.45	627	84	311	—	57.0	93	4.25	202	30	99
59	80.5	—	—	615	82	305	—	56.5	92	4.30	197	29	97
58	80.0	—	2.50	601	81	298	—	56.0	91	4.35	192	28	95
57	79.5	—	—	590	80	293	—	55.5	90	4.40	187	28	93
56	79.0	—	2.55	578	78	287	—	55.0	89	4.45	183	27	91
55	78.5	—	—	567	77	282	—	54.0	88	4.50	179	27	89
54	78.0	120	2.60	555	75	276	—	53.5	87	4.55	174	26	87
53	77.5	120	—	545	74	271	—	53.0	86	4.60	170	26	85
52	77.0	119	2.65	534	72	266	—	52.5	85	4.65	166	25	83
51	76.5	119	2.70	514	70	256	—	52.0	84	4.70	163	25	82
50	76.0	118	2.75	495	67	247	—	51.0	83	4.75	159	24	80
49	75.5	117	2.80	477	65	238	—	50.5	82	4.80	156	24	78
48	74.5	117	—	470	64	233	—	50.0	81	4.85	153	23	76
47	74.0	116	2.85	461	63	229	—	49.5	80	4.90	149	23	75
46	73.5	115	2.90	444	61	220	—	49.0	79	4.95	146	22	74
45	73.0	115	2.95	429	59	212	—	48.5	78	5.00	143	22	72
44	72.5	114	3.00	415	57	204	—	48.0	77	5.05	140	21	71
43	72.0	114	—	408	56	200	—	47.0	76	5.10	137	21	70
42	71.5	113	3.05	401	55	196	—	46.5	75	5.15	134	21	68
41	71.0	112	3.10	388	54	189	—	46.0	74	5.15	134	21	68
40	70.5	111	3.15	375	52	182	—	45.5	73	5.20	131	20	67
39	70.0	111	3.20	363	51	176	—	45.0	72	5.20	131	20	66
38	69.5	110	3.25	352	49	170	—	44.5	71	5.25	128	20	65
37	69.0	110	—	346	48	167	—	44.0	70	5.30	126	20	64
36	68.5	109	3.30	341	47	165							

Conversion Factors

Cubic feet × 1,728 = cubic inches
Cubic yards × 27 = cubic feet
1 U. S. Gallon = 231 cubic inches = 8.336 lbs. water
1 cubic foot = 7.4805 U. S. Gallons = 62.355 lbs. at 62° F.
Pressure of 1 lb. per sq. in. = 2.042 inches of mercury at 62° F.
Pressure of 1 lb. per sq. in. = 2.309 feet of water at 62° F.
1 horsepower = 33,000 foot pounds per minute
1 meter = 39.37 inches = 3.281 feet
1 kilogram = 2.205 pounds
1 liter = 1,000 grams of water = 1.0567 qts. or 0.2642 gal.

CORROSIVES

Handled Dependably, Economically by

"GRAFOIL"

GASKETS and PACKING

"Grafoil" Gaskets and Packing* are all-graphite products containing no resin binders or organic fillers. Their outstanding resistance to corrosion, even at high temperature, and their ability to retain compressibility at all temperatures, recommend them for service in the many inorganics and organics listed. In addition, "Grafoil" Gaskets and Packing are performing successfully in a number of unusual applications—in some cases, they are the *only* materials which have been able to withstand certain rigorous service demands. Here are examples of just a few field installations:

- Gaskets in molten aluminum at 1350°F and 5000 psig pressure
- Gaskets in reactor handling lethal gas at 790°F and 55 psig pressure
- Packing in a boiler feed water centrifugal pump, 350°F
- Gaskets in piping conveying molten plastics at 600°F and 600 psig pressure

Whatever your requirements for gasket and packing materials, ask for our recommendation. Chances are we can help solve your problem with "Grafoil" products for economical long-life and dependable service.

Chemical Reagent	Concentration Per Cent	Fluid Temperature up to °F
ACIDS		
Acetic acid	All	All
Acetic anhydride	100	All
Arsenic acid	All	All
Boric acid	All	All
Carbonic acid	All	All
Chromium trioxide, aq. soln.	0-10	200
Citric acid	All	All
Formic acid	All	All
Hydrobromic acid	All	All
Hydrochloric acid	All	All
Hydrofluoric acid	0-48	All
Hydrofluoric acid	48-60	All
Hydrofluoric acid	Over 60	All
Hydrofluosilicic acid	0-20	All
Hydrogen chloride	All	All
Hydrogen sulfide-water	All	All
Lactic acid	All	All
Monochloracetic acid	100	All
Nitric acid	0-10	185
Nitric acid	10-20	140
Nitric acid	Over 20	100
Oleic acid	100	All
Oxalic acid	All	All
Phosphoric acid	0-85	All
Stearic acid	100	All
Sulfur dioxide	All	All
Sulfuric acid	0-70	All
Sulfuric acid	70-85	338
Sulfuric acid	85-90	300
Sulfuric acid	90-93	160
Sulfuric acid	93-95	160
Sulfuric acid	Over 95	Not Rec.
Sulfurous acid	All	All
Tartaric acid	All	All
ALKALIES		
Ammonium hydroxide	All	All
Monoethanolamine	All	All
Sodium hydroxide	6-67	All
Sodium hydroxide	67-80	All
Sodium hydroxide	100	All
SALT SOLUTIONS		
Alum	All	All
Aluminum chloride	All	All
Ammonium bifluoride	All	All
Ammonium bisulfate	All	All
Ammonium sulfate	All	All
Ammonium thiocyanate	0-63	All
Arsenic trichloride	100	All
Calcium chlorate	0-10	140
Calcium hypochlorite	All	90
Copper sulfate	All	All
Cupric chloride	All	All
Ferric chloride	All	All
Ferrous chloride	All	All
Ferrous sulfate	All	All
Manganous sulfate	All	All
Nickel chloride	All	All
Nickel sulfate	All	All
Phosphorous trichloride	100	All
Sodium chloride	All	All
Sodium chlorite	0-4	Room
Sodium hypochlorite	0-25	Room
Stannic chloride	All	All
Sulfur monochloride	100	All
Zinc ammonium chloride	All	All
Zinc chloride	All	All
Zinc sulfate	All	All
HALOGENS, AIR, WATER		
Air	—	740
Bromine	100	Room
Bromine water	All	Room
Chlorine-dry	100	All
Chlorine dioxide	—	158
Chlorine water	All	Room
Fluorine	100	300
Iodine	100	Room
Steam	—	1200
Water	—	All

*U.S. Patent No. 3,404,061

Chemical Reagent	Concentration Per Cent	Fluid Temperature up to °F
HEAT TRANSFER FLUIDS		
"Dowtherm" (All types)	100	All
Petroleum-Oil Based	100	All
"Therminol" (All types)	100	All
"Ucon" (All types)	100	All
ORGANIC COMPOUNDS		
Acetone	0-100	All
Amyl alcohol	100	All
Aniline	100	All
Aniline hydrochloride	0-60	All
"Aureomycin"	100	All
Benzene	100	All
Benzene hexachloride	100	All
Benzyl sulfonic acid	60	All
Butyl alcohol	100	All
Butyl "Cellosolve"	0-100	All
Carbon tetrachlori .e	100	All
"Cellosolve" solv nt	0-100	All
Chloral hydrate	—	All
Chlorethylbenzene	100	All
Chloroform	100	All
"Deoxidine"	—	140
Dichloropropionic acid	90-100	338
Diethanolamine	All	All
Dioxane	0-100	All
Ethyl alcohol	0-100	All
Ethyl chloride	All	All
Ethylene chlorohydrin	0-8	All
Ethylene dibromide	100	All
Ethylene dichloride	100	All

Chemical Reagent	Concentration Per Cent	Fluid Temperature up to °F
Ethyl mercaptan-water	Saturated	All
Fatty acids	All	All
Folic acid	All	All
Refrigerants 11 and 12	100	All
Gasoline	100	All
Glycerine	0-100	All
Isopropyl acetate	100	All
Isopropyl alcohol	0-100	All
Isopropyl ether	100	All
Kerosene	100	All
Mannitol	All	All
Methyl alcohol	0-100	All
Methyl isobutyl ketone	100	All
Monochlorbenzene	100	All
Monovinyl acetate	All	All
Octyl alcohol	100	All
Paradichlorbenzene	100	All
Paraldehyde	100	All
Tetrachlorothane, sym.	100	All
Trichlorethylene	100	All
Xylene	All	All
MIXTURES		
Acidified starch solutions	All	All
Amino acid plus hydrochloric and sulfuric acids	—	All
Ammonium persulfate plus sulfuric acid	25 20	Room

Chemical Reagent	Concentration Per Cent	Fluid Temperature up to °F
Anodizing solutions	All	All
Butyl acrylate plus acrylic acid	All	All
Calcium chloride plus calcium chlorate	30 10	140
Chlorinated ethyl alcohols	All	All
Chrome plating soins.	All	Room
Cresylic acid plus sulfuric acid	—	All
Electropolishing solutions (sulfuric plus phosphoric acids)	All	140
Hydrochloric acid sat. with chlorine	Over 20 All	All
Nickel plating soins. (chloride)	All	All
Nickel plating soins. (sulfate)	All	All
Nitric acid plus hydrofluoric acid	15 5	140
"Parkerizing" solution	All	All
Rayon spin bath	All	All
Sodium hypochlorite plus sodium hydroxide	25	200
Sulfuric acid plus nitric acid	96 .03	Not Rec.

PRODUCT and PRICING
"Grafoil" Gaskets and Packing

Gaskets—Standard 0.015 inch thick gaskets with raised face OD and ID dimensions for pipe sizes 1 to 20 inches are in stock. Gaskets having thicknesses of 1/32, 1/16 and 1/8 inch can be made to order in two to four weeks. The maximum diameter of a monolithic piece is 23½ inches. Larger fabricated gaskets can be made to order.

Packing—Any ID to OD configuration can be made providing the thickness does not exceed the radial width of the packing. For all applications where no external lubricant or coolant is used, 70 lb/cu ft material is recommended.

"Grafoil" is a registered trademark of Union Carbide Corporation

CRANE PACKING COMPANY
6400 OAKTON STREET, MORTON GROVE, ILLINOIS 60053 *(Chicago Suburb)*
In Canada: Crane Packing Company, Ltd., Box 3246, Station C, Hamilton, Ont.
In Mexico: Industrias John Crane de Mexico, S.A. • Poniente 152 •679 Industrial Vallejo, Mexico, D.F.
In Brazil: John Crane Industria E Comercio, Ltda. • Avenida Jurubatuba 600, Sao Bernardo do Campo, S.P.
In Australia: John Crane Mauri Pty., Ltd., 185 Eldridge Road, Bankstown, New South Wales, Australia
In Europe: Crane Packing Ltd., Slough, Bucks, England
In Japan: John Crane Japan, Inc., No. 28, Tsuboya-cho 2-chome, Kita-ku, Osaka 530, Japan
OFFICES, WAREHOUSES AND SERVICE THE WORLD OVER

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5M673

Bulletin No. P-402
Lithographed in U.S.A.

Form P-33(

PACKING DATA SHEET

EQUIPMENT DATA

Name of Unit _____

Mfg. of Unit _____

Serial No. _____

Model No. _____

Item No. _____

Size and Type _____

Material Construction of Unit _____

_____

OPERATION DATA

Pumps, Mixers, etc.

Shaft Speed (RPM) _____

Rod or Plunger Speed –

- Strokes per min. _____
- Length of stroke _____

Shaft or Rod Material _____

Shaft or Rod Hardness _____

Suction Pressure _____

Discharge Pressure _____

Temp. Range degrees F. _____

Product Handled _____

_____

Specific Gravity _____

Percent Concentration _____

If Abrasive (explain) _____

_____

Valves

Stem Material _____

Stem Hardness _____

Temp. Range degrees F. _____

Pressure _____

Product Handled _____

Specific Gravity _____

Percent Concentration _____

If Abrasive (explain) _____

DIMENSION DATA
(See Drawing at Right)

A. Shaft, Stem or Rod Dia.: _____

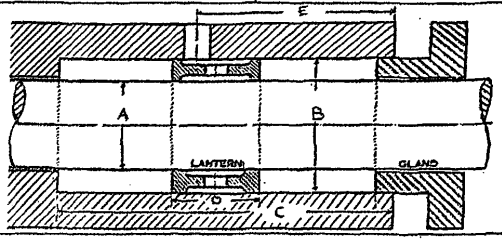
B. Stuffing Box Bore _____

C. Stuffing Box Depth _____

D. Lantern Width _____

E. Location of Lantern Oil Hole _____

_____



Name of Company _____

Address _____ City _____ State _____

Name of Individual _____ Title _____

Printed in U.S.A.

JOHN CRANE
MECHANICAL PACKING DIVISION
CRANE PACKING COMPANY
6400 OAKTON STREET · MORTON GROVE, ILLINOIS

FORM NO. P-245

HYDRAULIC PACKING DATA SHEET

☐ (O.E.M.)
☐ (MAINT.)

Customer _____

Address _____

Name of Individual _____ Title _____

Type of Equipment _____

Cylinder Function _____

OPERATING CONDITIONS

Fluid _____

Pressure: _____

Operating _____

Max. _____ Min. _____

Shock _____

Temperature: _____

Operating _____

Max. _____ Min. _____

Motion: _____

Reciprocating _____

Other _____

Length of Stroke _____

Speed _____

Customer's Dwg. No. _____

Prints attached? _____

ROD DATA

GIVE ACTUAL DIMENSIONS WITH TOLERANCES

Rod Diameter _____

Material _____

Finish _____

Stuffing Box Bore _____

Depth of Box _____

Gland: _____

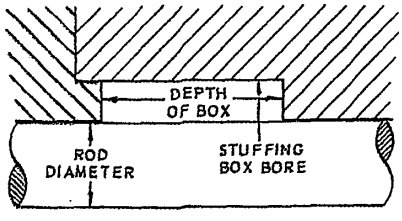
Adjustable _____

Non-Adjustable _____

Type Packing Preferred _____

_____

Yearly Usage _____



PISTON DATA

Piston O. D. _____

Cylinder Bore _____

Bore Finish _____

Groove Diameter _____

Groove Length _____

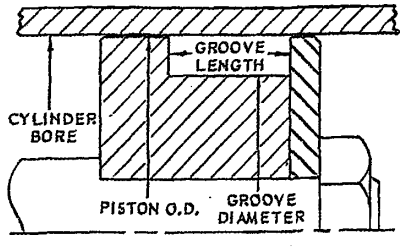
Piston Material _____

Double or Single Acting _____

Type Packing Preferred _____

_____

Yearly Usage _____



REMARKS OR PROBLEMS

_____

_____

_____

(Use Reverse Side for Sketches)

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MECHANICAL PACKING DIVISION
CRANE PACKING COMPANY
6400 OAKTON STREET • MORTON GROVE, ILLINOIS