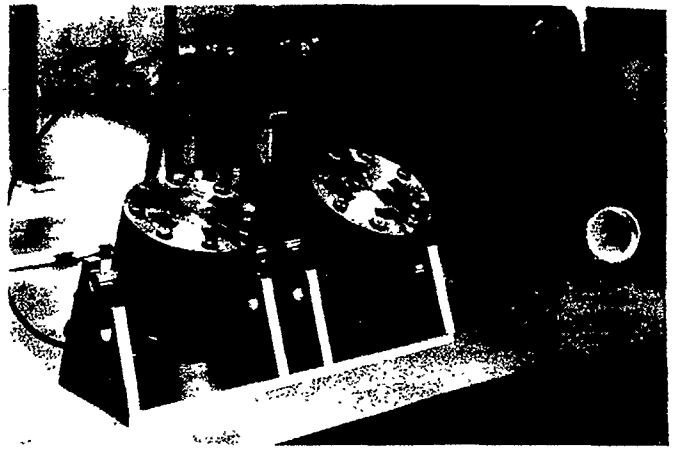
PLAINTIFF'S
EXHIBIT
USX-268

Armstrong

GASKET MATERIALS

Armstrong gasket materials



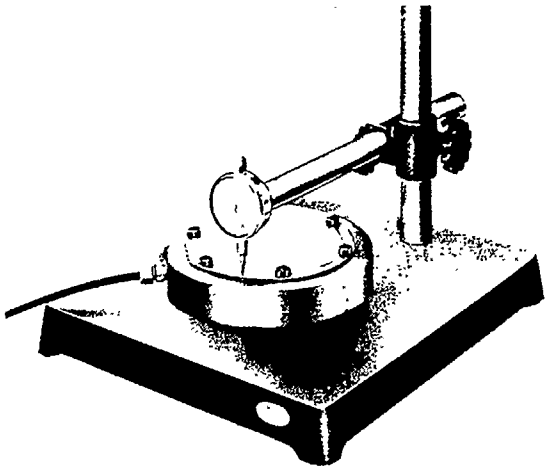
USHO 003063

Effective seals at the lowest cost are best obtained when the flanged joint and the gasket are considered as a unit in the design stage. This is true because design factors such as bolt loads, bolt spacing, flange rigidity, operating temperature, and flange surface finish all affect the sealing performance of the gasket. Factors such as the possible effect of contained fluids, environmental effects, and economic considerations also enter into the task of selecting the right material.

Armstrong Materials

To meet the wide range of industry requirements, Armstrong has developed several classes of resilient gasket materials. These include the Accopac line of asbestos and cellulose fiber sheets, cork-and-rubber compositions, cork compositions, and synthetic rubber materials, including cellular types.

Within these major classes there are a number of individual materials, each with different characteristics or offering some special design advantage. Descriptive information and brief data on characteristics of each are included in this catalog.



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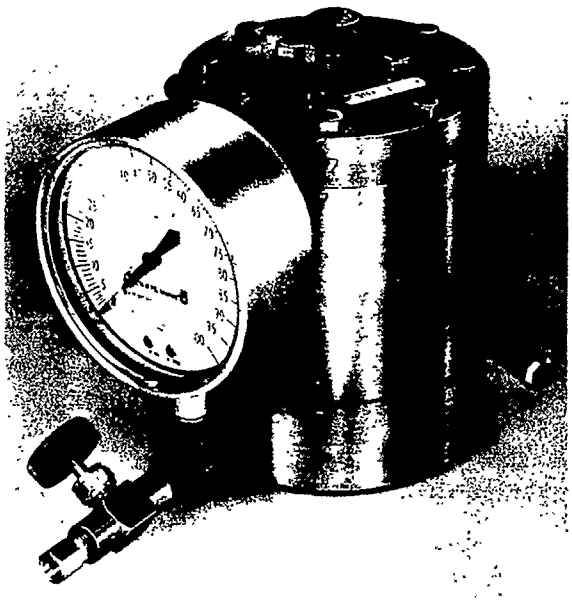


C

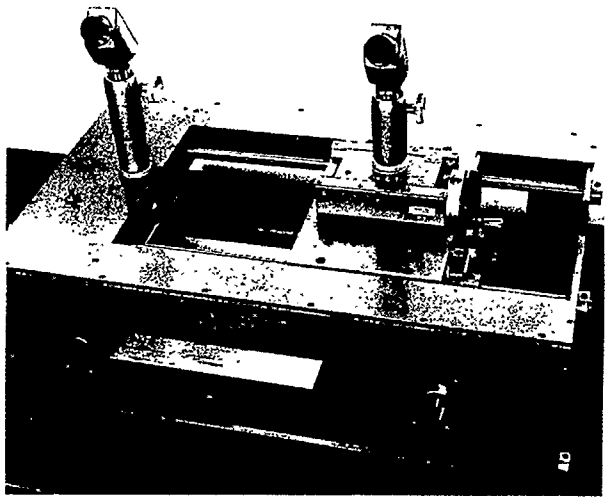
Here are just a few of many devices used for simulated service testing and physical testing of Armstrong gasket materials.

A—Glass flange apparatus permits visual observation through ports of sealing performance of gasket materials under internal pressures from zero to 100 psi.

B—Deflectometer detects and measures flange deflections resulting from internal pressure.

C—Electro-mechanical device tests efficiency of gas or liquid seals at internal pressures up to 100 psi. Unit detects leakage, and with associated equipment measures and records it as a function of time.

D—Dilatometer developed by Armstrong research allows precise measurement of dimensional change in sheet gasket materials.



D

Armstrong
APPROVED
FABRICATOR

USHO 003064

Armstrong Engineering Research

Because flange design and operating conditions affect sealing performance, extensive physical and simulated service testing is a continuous part of Armstrong gasket research. This includes study of factors such as operating temperatures, torque retention problems, flange metals, flange finishes, contained fluids, environmental conditions, and interactions of these factors that might affect sealing.

Much of this engineering information is summarized in the Armstrong Gasket and Flange Design Manual. A copy of this manual will be sent on request. Send your request to the address at the right, or contact your nearest Industry Products Division office. These are listed on the back cover.

Armstrong Approved Fabricators

Before setting final specifications, we suggest you call your Armstrong Approved Fabricator. He may be able to suggest design features that may help you achieve a more effective or more economical seal. And he'll provide test samples of recommended materials.

All Armstrong gasket materials are available through Armstrong Approved Fabricators. This nationwide network of 100 independent businesses offers you the advantages of a local supplier: convenient, personal contact; fast service; and prompt delivery of large or small quantities.

Armstrong fabricators have modern equipment for precision fabrication. They can provide you with data for each Armstrong material and help you in specific selection problems. When you have unusual sealing conditions, your Approved Fabricator can call on the services of the Armstrong Industry Products representative in your area, and through him, the staff of the Armstrong Research and Development Center.

You'll want the extra values that are yours when you deal with your Armstrong Approved Fabricator. Write to us for a list of their locations. Armstrong Cork Company, Industry Products Division, Lancaster, Penna.

Accopac gasket materials

asbestos fiber

BRIEF DATA/ACCOPAC ASBESTOS FIBER MATERIALS

TYPE	COMPOSITION	CHARACTERISTICS	% COMPRESSIBILITY (1000 PSI)*
AS-428	Asbestos, styrene-butadiene rubber (SBR)	Highly compressible asbestos sheets for moderate to heavy-duty service at elevated temperatures.	17–27
AD-838	Asbestos, nitrile-chloroprene rubber (NCR)		17–27
AN-859	Asbestos, nitrile-butadiene rubber (NBR)		17–27
AS-460	Asbestos, styrene-butadiene rubber (SBR)	Asbestos sheets with outstanding sealing characteristics: for service at elevated temperatures. AD-870 and AN-890 are Underwriters' Approved.	12–20
AD-870	Asbestos, nitrile-chloroprene rubber (NCR)		12–20
AN-890	Asbestos, nitrile-butadiene rubber (NBR)		12–20
AN-892	Asbestos, nitrile-butadiene rubber (NBR)	Combines high density with flexibility and conformability with low compressibility. For heavy-duty service at elevated temperatures.	5–15

Forms and sizes Accopac materials are supplied in roll and sheet form in a variety of gauges. Die-cut parts available only from Armstrong Approved Fabricators.

General Properties

Accopac materials are unique among asbestos gasket compounds. They are uniform and homogeneous, tough and flexible, easy to handle even in thinnest gauges.

These unusual characteristics are the result of the way Accopac asbestos sheets are made. In this Armstrong-patented process, the asbestos fibers are refined to eliminate all lumps and bunches. They are then coated uniformly with a latex rubber binder.

The composition of Accopac asbestos materials is indicated by prefix code letters as follows:

A—asbestos fiber
D—nitrile-chloroprene rubber
S—styrene-butadiene rubber
N—nitrile-butadiene rubber

Design Advantages

Uniformity The Armstrong process produces an unusually uniform asbestos sheet because it eliminates clusters of fibers. This eliminates leakage caused by wicking. Uniformity also results in clean die-cutting, without loose fibers to become detached and contaminate fluids.

Economy Accopac asbestos compositions cost from 15% to 30% less than conventional compressed asbestos materials. In addition, the absence of bunched fibers sometimes makes it possible to use thinner gauges of Accopac than would be possible with other asbestos sheets.

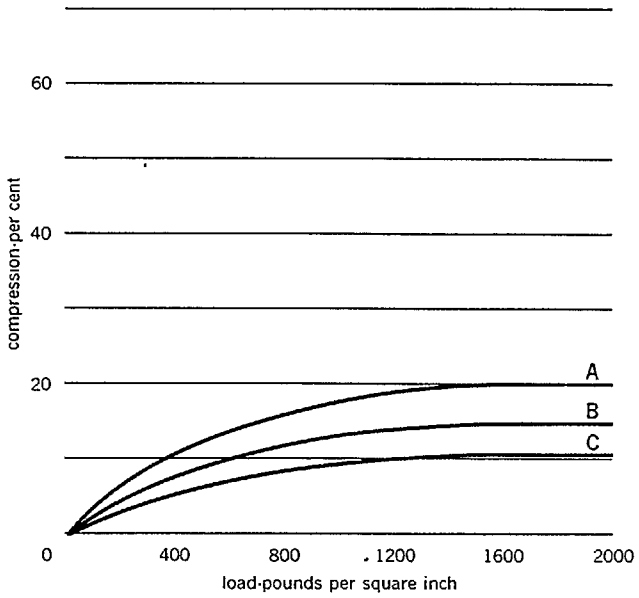
% COMPRESSIBILITY (5000 PSI)*	TENSILE STRENGTH MINIMUM PSI	CURVE
30–40	1300	A
30–40	1400	A
30–40	1600	A
20–30	1600	B
20–30	1700	B
20–30	2000	B
10–17	3000	C

*Tested per ASTM F36 61T (formerly D1147 61T)

DYNAMIC LOAD COMPRESSION CURVES

Curves are typical; variations can be expected in practice. Dynamic values may not agree with values shown in chart at left because of difference in test methods.

Test samples: 1 sq in disc x 1/32" thickness.



Compressibility In general, Accopac asbestos materials are more compressible than other asbestos compositions. This is a design advantage in those cases where compressibility may permit lower bolt loads.

Sealing Characteristics

Asbestos materials have generally higher seal points than other resilient gasket compositions. The seal point for Accopac asbestos sheets ranges from 1500 psi to about 2500 psi, depending on the composition.

Accopac asbestos materials usually will readily conform to and compensate for minor imperfections in flanges.

Environmental Considerations

Temperature Accopac asbestos compositions are designed for moderate to heavy-duty service and have been used at temperatures up to 800F.

Contained fluids Accopac asbestos materials are recommended for sealing the same fluids as are sealed by conventional asbestos materials. (See the selector chart on pages 18 and 19.)

Flange No agents that will stain or corrode flanges are contained in Accopac asbestos compositions.

External These materials are resistant to fungi, moisture, and related conditions of exposure.

Accopac gasket materials

cellulose fiber

BRIEF DATA/ACCOPAC CELLULOSE FIBER MATERIALS

TYPE	COMPOSITION	CHARACTERISTICS AND USES
CS-301	Cellulose fiber, cork, and styrene-butadiene rubber (SBR)	A dependable seal in water and high aniline point oil and in other services not involving aromatic fuels and certain solvents; Underwriters' Approved.
CN-705	Cellulose fiber, cork, and nitrile-butadiene rubber (NBR)	Generally suitable for oil, gasoline, and water services; Underwriters' Approved.
CN-888	Cellulose fiber, cork, and nitrile-butadiene rubber (NBR)	A pre compressed material generally suitable for oil, gasoline, gas and water services at normal temperatures; seals at bolt pressures as low as 800 psi. Underwriters' Approved.
N-820	Cellulose fiber and nitrile-butadiene rubber (NBR)	Formulated specifically for heavy-duty flange pressures at elevated temperatures.
N-840	Cellulose fiber and nitrile-butadiene rubber (NBR)	A tough, oil-resistant material having excellent sealing ability at medium flange loads. Underwriters' Approved.
N-852	Cellulose fiber and blend of synthetic rubbers	Low cost, moderate oil-resistant gasket material for medium to heavy-duty flange pressures.
RN-8011	Cellulose fiber and nitrile-butadiene rubber	Highly compressible with high rubber content providing excellent sealing of water and oil at low flange loads
RS-464	Cellulose fiber, styrene-butadiene rubber (SBR)	Low cost, highly compressible material with high rubber content provides excellent sealing of pressurized water at low flange loads.

Forms and sizes Accopac materials are supplied in roll and sheet form in a variety of gauges. Die-cut parts available only from Armstrong Approved Fabricators.

General Properties

Accopac cellulose fiber gasket materials are made by a patented Armstrong process which produces sheets with unusual uniformity, flexibility, dimensional stability, and ease of handling.

In this process, each fiber is coated with a latex binder before the sheet is formed. This produces a much more uniform binder-fiber structure than is possible with methods that add the binder by dip saturation or coating.

As a result of this manufacturing technique, the binders in Accopac materials are not leached out by the action of contained fluids in any recommended application.

The composition of Accopac cellulose materials is indicated by prefix code letters as follows:

C—cork
N—nitrile-butadiene rubber
S—styrene-butadiene rubber

Design Advantages

Dimensional stability Accopac gaskets will not change size appreciably—in the flange or in storage. This stability stems from the latex binders in Accopac. The binders will not be driven off by heat or evaporated by aging; nor will they attract moisture from the atmosphere.

Wide range Accopac cellulose fiber sheets offer designers a variety of physical characteristics that offer efficient, economical solutions to any fiber gasket problem. The line includes dense, extrusion-resistant sheets for heavy-duty installations as well as lighter, more compressible materials for general purpose use.

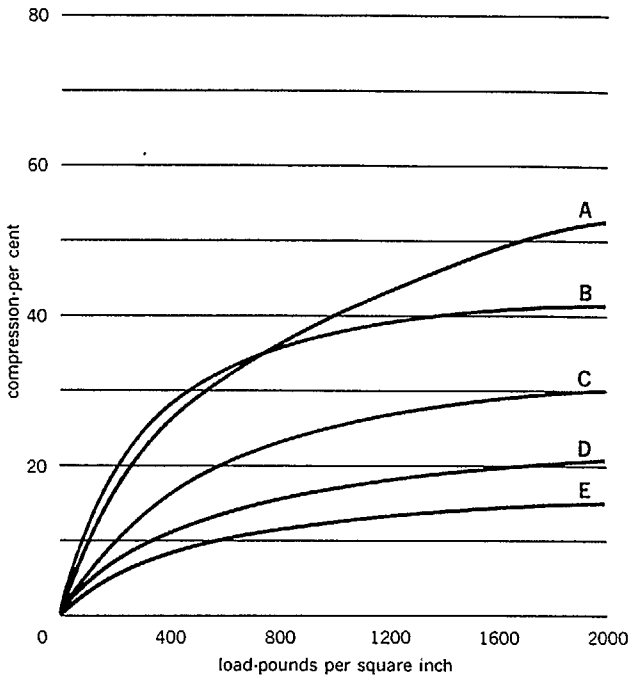
% COMPRESSIBILITY (1000 PSI)*	TENSILE STRENGTH MINIMUM PSI	CURVE
30–45	700	B
30–45	800	B
12–30	1200	C
10–20	2700	D
5–15	3000	E
17–27	1600	C
40–60	220	A
40–60	220	A

*Tested per ASTM F36 61T (formerly D1147 61T)

DYNAMIC LOAD COMPRESSION CURVES

Curves are typical; variations can be expected in practice. Dynamic values may not agree with values shown in chart at left because of difference in test methods.

Test samples: 1 sq in disc x 1/32" thickness.



Economy Accopac cellulose fiber materials offer the double economy of relatively low initial cost and long service life.

Sealing Characteristics

Fiber gasket materials are not essentially impervious in their uncompressed state. They usually require somewhat higher flange loads than other resilient gasket materials.

The seal point for most Accopac cellulose gaskets ranges from 800 psi to 2000 psi. Much higher loads, required by some applications, will not cause crushing or extrusion of Accopac.

Environmental Considerations

Temperature Cellulose fiber Accopac sheets will seal effectively at temperatures up to 300F. This is a higher limit than that recommended for conventionally saturated fiber sheets whose saturants are often adversely affected by temperatures in this range.

Contained fluids The resistance of various Accopac cellulose sheets varies with the type of rubber binder. General recommendations are contained in the selector chart on pages 18–19.

Flange Accopac materials have no ingredients that will tend to corrode flanges, and their nonhygroscopic binders will not encourage electrolytic corrosion where dissimilar metals are joined.

gasket materials

cork-and-rubber

BRIEF DATA/CORK-AND-SYNTHETIC RUBBER COMPOSITIONS

	TYPE	CHARACTERISTICS AND USES	SPECIFIC GRAVITY	SHORE TYPE A HARDNESS	% COMPRESSIBILITY[a]
CHLOROPRENE (CR)	DC-100	General purpose gasket and sealing material: high cork content, minimum side flow.	.80–.90	55–70	20–30 (300 psi)
	DC-113	Firmer than DC-100; high cork content; for narrow gaskets, instrument bezels, etc.	.89–.97	70–85	10–20 (300 psi)
	DC-118	More rubbery material; used where toughness and some side flow are required.	1.20–1.30	65–75	5–15 (300 psi)
	DC-167	Top-quality, soft, highly compressible material for low bolting pressures.	.70–.78	40–55	30–40 (200 psi)
	DC-179	Low cost, highly compressible material similar to DC-167.	.60–.70	50–65	30–45 (200 psi)
	DC-181	Top quality, slightly firmer than DC-167.	.70–.78	50–65	30–40 (300 psi)
	DC-199	Low cost, highly compressible material for general purpose applications.	.80–1.00	55–70	30–45[b] (400 psi)
NITRILE-BUTADIENE (NBR)	NC-478	An economical, resilient, oil-resistant stock for general purpose applications.	.45–.60	30–40	35–50[b] (100 psi)
	NC-709	Soft, highly compressible; for low bolting pressures; maximum oil, solvent resistance.	.65–.75	40–55	30–40 (200 psi)
	NC-710	Like DC-100, but with maximum oil, solvent resistance; Underwriters' Approved.	.80–.90	55–70	20–30 (300 psi)
	NC-711	Like DC-113, but with maximum resistance to oil, solvents; Underwriters' Approved.	.95–1.05	70–85	10–20 (300 psi)
	NC-757	Low cost, highly compressible material similar to NC-709.	.50–.60	55–70	25–45 (200 psi)

Forms and sizes Sheet size 36" x 36". Thicknesses: ¼" to ¾". Lathe-cut rings ⅜" I.D. to 20" O.D. can be cut from DC-100, DC-113, DC-118, DC-167, NC-710, and NC-711. All materials also available in ribbon form. Die-cut parts available only from Armstrong Approved Fabricators.

General Properties

Armstrong cork-and-rubber materials offer many of the advantages of synthetic rubber compounds, with the important additional property of controlled compressibility.

Thus, cork-and-rubber gaskets can often be used in place of straight rubber in applications where the tendency of straight rubber to side flow would be objectionable.

By careful compounding of compressible cork particles in various ratios with noncompressible rubber stocks, Armstrong produces a group of materials with a wide range of firmness.

With these manufacturing techniques, it is possible to produce combinations that are nearly as compressible as cork, or almost as noncompressible as straight rubber. Unsponged cork-and-rubber compounds will compress from 20% to 33% without excessive side flow.

The code letters which prefix numbers of Armstrong cork-and-rubber compounds can be read as follows:

D—chloroprene
R—styrene-butadiene
L—silicone
N—nitrile-butadiene
Y—butyl
C—cork
K—sponged, containing cork

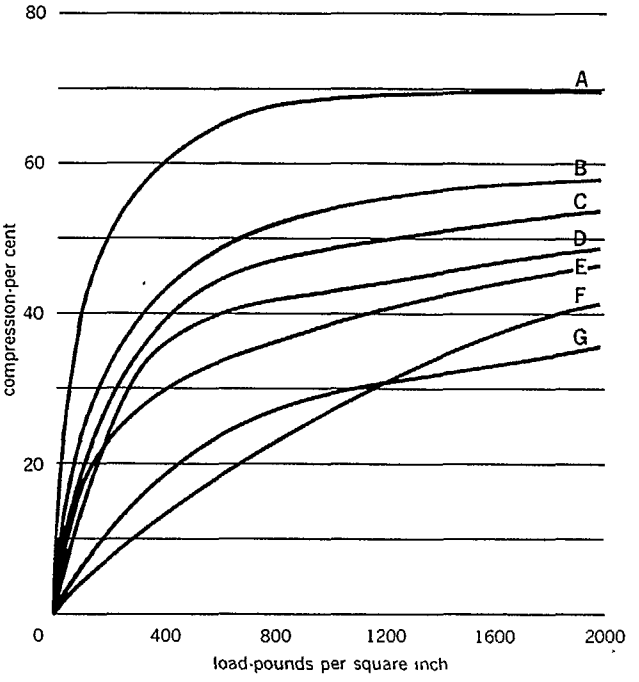
SPECIFICATIONS†		CURVE
ASTM D1170-62T, SAE J90	MIL-C-6183A, TYPE I	
P-2255A	Class 2 Medium	C
P-2254A	Class 2 Firm	G
		F
P-2256A	Class 2 Soft	B
P-2255B		B
		B
		E
		B
P-2246A	Class 1 Soft	B
P-2245A	Class 1 Medium	C
P-2243A	Class 1 Firm	G
P-2245B		B

*Tested according to procedure of MIL-C 6183 A.
†Armstrong materials indicated here are made to meet the listed specifications. Data in this chart based on sheet stock materials.
** Tested according to procedure B, ASTM F36-61T (formerly ASTM D1147-61T).
*** Tested according to procedure F, ASTM F36 61T (formerly ASTM D1147-61T).

DYNAMIC LOAD COMPRESSION CURVES

Curves are typical; variations can be expected in practice. Dynamic values may not agree with values shown in chart at left because of difference in test methods.

Test samples: 6" x 1" x ⅛".



Design Advantages

No side flow Cork-and-rubber materials are especially useful in metal-to-metal joints where the gasket fits into a groove machined into one flange. No allowance need be made for side flow if cork-and-rubber material of the proper firmness is selected.

In addition, the controlled compressibility of cork-and-rubber sometimes makes possible wider tolerances in the metal members. In many cases, lathe-cut cork-and-rubber rings can be used in place of more expensive noncompressible molded rubber O-rings.

High friction The frictional properties of cork are retained in cork-and-rubber compounds and help to reduce extrusion or slippage of the gaskets.

Conformability Cork-and-rubber stocks, including the sponged materials, will easily conform to and compensate for minor flange irregularities. This characteristic is especially useful in stamped or other lightweight assemblies where the available bolt load is usually low.

CONTINUED NEXT PAGE

gasket materials

cork-and-rubber

continued

TYPE	SYNTHETIC RUBBER BASE	CHARACTERISTICS AND USES	SPECIFIC GRAVITY	SHORE TYPE A HARDNESS
LC-800	Silicone (Si)	Remains flexible and resilient over wide range of temperatures. Good electrical characteristics.	.95–1.10	65–75
DK-149	Sponged chloroprene (CR)	Highly compressible, resists fatigue; for cushion pads, low bolt pressure gaskets.	.43–.53	35–50
NK-730	Sponged nitrile-butadiene (NBR)	Similar to DK-149 but with maximum resistance to oils, solvents, aromatic fuels.	.46–.56	30–50
RK-374SGM	Sponged styrene-butadiene (SBR)	Low cost, highly compressible. For automotive tail lamps and non-solvent uses; gray color.	.40–.50	35–50
YK-950	Sponged butyl (IIR)	Butyl-cork sponged material for automotive lamp gaskets; excellent resistance to ozone and moisture; gray color; highly compressible.	.40–.55	20–35
YC-900	Butyl (IIR)	Top-quality gasket material with high resistance to nonflammable hydraulic fluids and high-temperature lubricants.	.72–.82	50–60

Forms and sizes Sheet size 36" x 36". Thicknesses: ¼4" to ¾". Lathe-cut rings ⅜" I.D. to 20" O.D. can be cut from DC-100, DC-113, DC-118, DC-167, NC-710, and NC-711. All materials also available in ribbon form. Die-cut parts available only from Armstrong Approved Fabricators.

Fatigue resistance Cork-and-rubber compounds have unusual resilience which helps to provide resistance to compression set and other effects of fatigue. They are ideal for applications such as access doors and hatch covers where the gasket is subject to frequent opening and resealing. Cork-and-rubber gaskets are more resistant to aging than their straight rubber counterparts.

Sealing Characteristics

Unsponged cork-and-rubber compounds are essentially impervious because rubber is the continuous phase of the material. This means that all of the available unit loading can be used to establish and maintain intimate contact of the gasket to the flange. The seal points of cork-and-rubber materials are generally among the lowest of all resilient gaskets.

Environmental Considerations

Temperature In general, Armstrong cork-and-rubber materials are suggested for use where temperatures range from −20F to 250F. This range can be widened for Armstrong LC-800, which has a silicone rubber base that permits serv-

% COMPRESSIBILITY	SPECIFICATIONS† ASTM D1170-62T & SAE J90	CURVE
15–25* (400 psi)		G
35–50** (100 psi)	P-2357A	A
35–50** (100 psi)	P-2347A	A
35–50** (100 psi)	P-2367A	A
25–40*** (40 psi)		A
25–40* (300 psi)		D

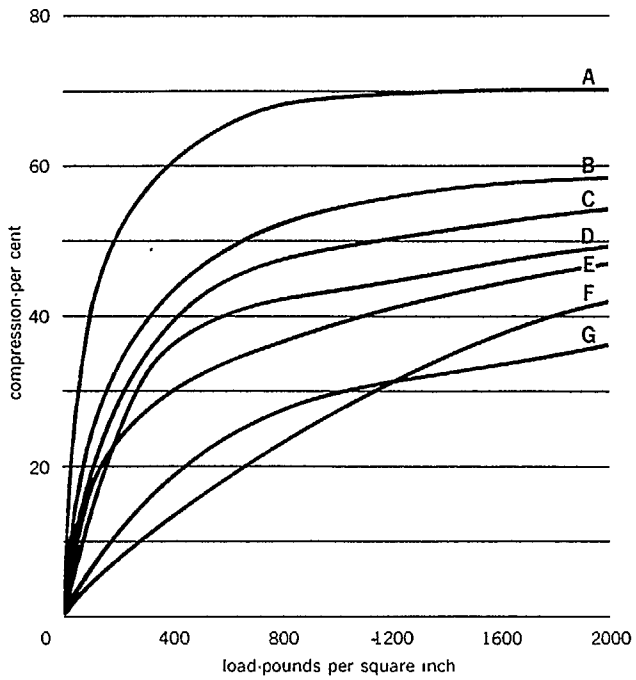
*Tested according to procedure of MIL-C 6183A
**Tested according to Procedure F, ASTM F36 61T (formerly D1147 61T).
***Tested with 1.129" diameter penetrator at total load of 40 pounds.

†Armstrong materials indicated here are made to meet the listed specifications. Data in this chart based on sheet stock materials.

DYNAMIC LOAD COMPRESSION CURVES

Curves are typical; variations can be expected in practice. Dynamic values may not agree with values shown in chart at left because of difference in test methods.

Test samples: 6" x 1" x ⅛".



ice from −65F to approximately 300 F. Arbitrary temperature limits, particularly on the high side, cannot be set. In any doubtful case, consult your Armstrong Approved Fabricator or nearest Industry Products Division office.

Contained fluids Cork-and-rubber compositions have resistance to fluids comparable to the specific rubber on which they are based.

Thus, chloroprene rubber (CR) is normally used with lubricating oils and for general purpose applications where some swell is desired or can be tolerated.

Nitrile-butadiene rubber (NBR) has excellent resistance to high-swell oils and good resistance to gasoline and aromatic solvents.

Butyl rubbers (IIR) provide excellent sealing of nonflammable hydraulic fluids.

Cork-and-rubber materials should not be used to seal acids and bases, because these will attack or degrade the cork particles.

Armstrong

gasket materials

cork compositions

BRIEF DATA/CORK COMPOSITIONS

COMPOSITION	CHARACTERISTICS AND USES
9520	Extra compressible; for glass-to-metal and other light-duty services; resin-bonded equivalent is 507.
9530	This is the most widely used Armstrong cork gasket material; for automotive and similar services; resin-bonded equivalent is 514.
9540	Firmer than 9530; for oil seals. Underwriters' Approved. 9540-BN; resin-bonded equivalent is 523.
9550	Heavy-duty material for oil seal service; Underwriters' Approved. 9550-BN; resin-bonded equivalent is 539.
1155	More dense than 9550; oil seal and similar service; frequently employed for parts of complicated design involving thin sections.
612	Special-purpose extra-conformable composition combining good sealing characteristics with structural imperviousness; made especially for sealing under low flange pressures.
7018	Both materials recommended for use where unusual conformity to flanges is required for sealing. Particularly effective in sealing light-duty, low-load flanges or flanges where high bolt pressures might damage assembly. Highly resistant to fungus growth. Underwriters' Approved.
7051	

Forms and sizes Sheets: up to 28" x 50". Thicknesses: 1/32" and over as specified. Custom-made parts—die-cut and machine shaped.

SPECIFICATIONS

ASTM D1170-62T† and SAE J90†	P-2116A	P-2117A	P-2117B	P-2118A	P-2126A	P-2127A	P-2127B	P-2128A
Armstrong designation	9550	9540	9530	9520	539	523	514	507
	Type I				Type II			
HH-C-576b	Class 3		Class 2	Class 1	Class 3		Class 2	Class 1
MIL-G-12803A (ORD) 24 May 1960	9550 FT	9540 FT	9530 FT	9520 FT	539 FT	523 FT	514 FT	507 FT

† 1/4" to 1/4" thickness.

General Properties

The wide range of physical properties offered by Armstrong cork compositions makes them among the most versatile and widely used resilient gasket materials.

The outstanding feature of cork gaskets is their unique microcellular or fine foam structure, which accounts for several important gasketing properties. These include high compressibility, unusual crush resistance, high friction, a high degree of impermeability under relatively low flange loads.

Compressibility The true compressibility of cork materials makes possible substantial deflections with negligible side flow. They are ideal for confined applications where no relief for side flow can be provided.

High friction Cork has inherently high friction. This helps to prevent slippage or extrusion of cork gaskets and is of particular importance where flanges are oily.

Economy Cork compositions are among the least expensive of the efficient soft gasketing materials.

Sealing Characteristics

Cork compositions become essentially impermeable at flange pressures of from 400 psi to 1200 psi, depending on their

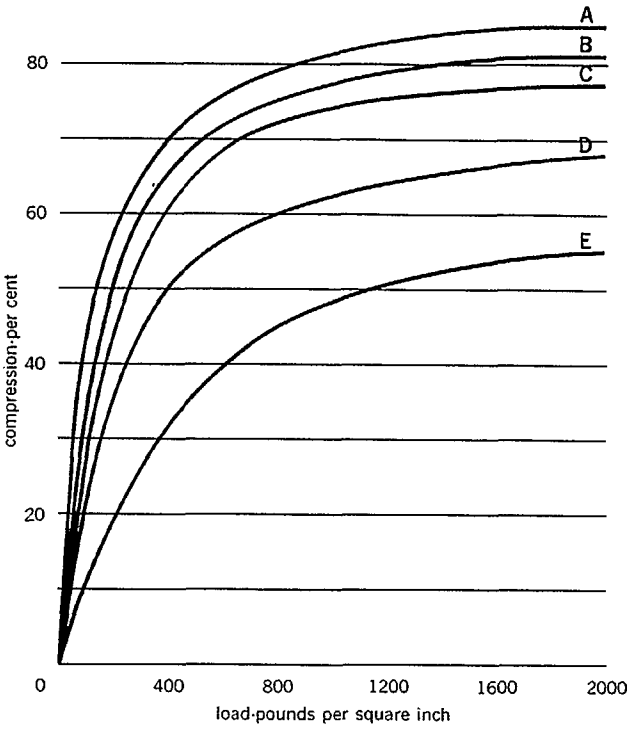
% COMPRESSIBILITY (100 PSI)*	MINIMUM DENSITY LB PER CU FT	CURVE
30–50	14	A
20–40	17	B
15–30	20	C
10–25	24	D
5–15	28	E
30–45	17	B
30–50	16	C
20–40	23	D

*Tested per ASTM F36 61T (formerly D1147-61T).

DYNAMIC LOAD COMPRESSION CURVES

Curves are typical; variations can be expected in practice. Dynamic values may not agree with values shown in chart at left because of difference in test methods.

Test samples: 6" x 1" x ⅛".



density. These materials can also be used with much higher unit loads—4000 psi or higher—without extrusion or rupture.

Cork materials offer a wide range of compressibility and will readily conform to flange surfaces. They are widely used to seal stamped metal flanges.

Environmental Considerations

Temperature Cork is generally recommended for use where sustained temperature at the gasket line does not exceed 250F.

Contained fluids These materials are excellent for sealing lubricating oil and other petroleum derivatives, as well as fluids indicated on the selector chart on pages 18–19. They should not be used to seal inorganic acids, alkalis, or oxidizing solutions.

External For extra resistance to moisture and related conditions of exposure, cork materials with synthetic resin binders will give the best service.

gasket materials

closed cell neoprene (chloroprene) rubber

BRIEF DATA/CLOSED CELL NEOPRENE (CHLOROPRENE) RUBBER

	ARMSTRONG TYPE		
	DE 41	DE-42	DE-43
*Density—lb./cu. ft.	8–12	10–14	13–18
Temperature Resistance, deg. F Low	−30	−30	−30
High Continuous	150	150	150
High Intermittent	200	200	200
Compression Set, maximum, % ASTM Method, 22 hrs. @ 70F (½" sample compressed 50%)	40	30	30
*Compression Deflection, psi (Weight required to compress a 1.129" diameter disc 25%)	2 to 5	5 to 9	9 to 13
Accelerated Aging 7 days @ 158F			
Flexibility (180° bend)	No cracking	No cracking	No cracking
Appearance change	None	None	None
Shrinkage, lineal maximum	5%	5%	5%
Water Absorption by Weight (max.) ASTM Method	5%	5%	5%
Specifications: ASTM D1056-62T and SAE J18 (¼" to ½" thickness)	SCE-41	SCE-42	SCE-43

Forms and sizes Sheets: DE-41 and DE-42 40" x 62". DE-43 40" x 58".
Thicknesses: from 1/16" to 1¼". Die-cut parts available from Armstrong Approved Fabricators.

*May vary according to thickness

Armstrong Closed Cell Neoprene (chloroprene) stocks are flexible, conformable, and highly compressible materials designed for a variety of applications that require a lightweight, shock-absorbing, resilient material. They meet the requirements for SCE-41, SCE-42, and SCE-43 as outlined in ASTM Specification D1056-62T as well as SAE Specification J18.

These new materials are chemically blown to a tight, uniform, closed cell structure. The self-contained cells do not collapse even when the material is shaped to conform to curves and corners. The uniform structure also makes possible clean die-cutting of practically any shape.

Armstrong Closed Cell Neoprenes are impervious to air and water and are resistant to ozone attack and aging. They have been tested against the ASTM D1692 fire test and are rated as self-extinguishing.

Armstrong Closed Cell Neoprenes are available in sheet form or die-cut to your specifications through Armstrong Approved Fabricators.

gasket materials

rubber

BRIEF DATA/RUBBER COMPOUNDS*

BASE	TYPE	CHARACTERISTICS AND USES	SHORE TYPE A HARDNESS (±5)	TENSILE (PSI MINIMUM)	% ELONGATION @ BREAK, MIN.
Chloroprene (CR)	DO-163	Resistant to oils, including 10-C transformer oil; excellent dielectric strength for a stock of this hardness.	65	1200	550
	DO-174	Resistant to heat, oxidation, sunlight, oil, most solvents; excellent water resistance; high electrical resistance.	40	1850	625
	DO-176		60	1875	300
	DO-178		80	1900	150
Nitrile-butadiene (NBR)	NO-734	Excellent resistance to oil, aromatic fuel blends and solvents, low compression-set characteristics: NO-736 is Underwriters' Approved.	40	1725	500
	NO-736		60	1500	350
	NO-748		80	1575	130
	NO-723	Excellent resistance to gasoline, oils, aromatic solvents; Underwriters' Approved.	92	1900	120
	NO-731	High solvent resistance; won't contaminate transformer insulating liquids.	65	1350	350
	NO-746	General purpose compound with good resistance to fuel and lubricating oils.	60	1300	300
	NO-758	Designed to provide non-contaminating seal for non-flammable electrical insulating fluids.	65	2200	250

Forms and sizes Sheets: 18" x 36" available in 1/32", 1/16", 3/32" thicknesses; 36" x 36" available in 1/8" to 1/2" thicknesses (in increments of 1/16"). Also available in ribbon form. Die-cut parts available only from Armstrong Approved Fabricators.

*All tests in accordance with procedures listed in ASTM D2000 64T.

SPECIFICATIONS

MIL-R-15624D		Class 1 DO-174			
MIL-R-1149A(2)	Type I	Class 1 DO-174 Class 5 NO-734	Type II	Class 5 NO-731 NO-736 NO-746	

General Properties

Armstrong rubber materials are special formulations designed to provide a range of physical characteristics to meet the various requirements of resilient gasketing applications.

These materials are based on either chloroprene or nitrile-butadiene rubbers and are available in a range of densities, tensile strengths, and elongations.

The rubbers on which these materials are based can be identified by code letters as follows: D—chloroprene; N—nitrile-butadiene. In all cases, the O indicates the absence of cork.

Design Advantages

Extensibility Rubber materials can be stretched over projections or shoulders and thus help to simplify assembly in some applications.

Noncompressibility The tendency for rubber materials to side flow is an advantage in applications where it is desired to have the gasket flow into threads or recesses.

Sealing Characteristics

Rubber materials are essentially impermeable in their uncompressed state. Generally, these materials require less sealing load than other resilient materials. To effect a seal, enough flange pressure should be available to provide a deflection of from 10% to 20% in the gasket.

As a rule, it is best not to deflect straight rubber compounds more than 20%, since higher loading may induce compression set or hasten other effects of fatigue.

Environmental Considerations

Temperature In general, Armstrong rubber compounds are suggested for use in a temperature range of from −20F to 250F.

Arbitrary limits, particularly on the high side, cannot be established. For recommendations on specific applications, consult your Armstrong Approved Fabricator or nearest Industry Products Division office.

Contained fluid Nitrile-butadiene stocks offer excellent resistance to oil, aromatic fuels, blends, and solvents. Chloroprene compounds are also moderately resistant to oils and solvents. For suggestions on specific fluids, consult the selector chart on pages 18–19.

External These materials are resistant to sunlight, ozone, weathering, and related effects of exposure. The chloroprene compounds excel in this respect.

Armstrong

cushioning material

cork-and-rubber

Tape, die-cut parts, rolls, ribbons

Armstrong DK-153 is a cork-and-sponged-rubber composition that combines lasting resilience with high surface friction. It is used to eliminate squeaks, to cushion fragile parts, to make slippery surfaces non-skid, and to absorb shock or relative motion between adjoining parts of an assembly. A new polyethylene backing—in distinctive silver tone—protects DK-153's strong, pressure sensitive adhesive until the moment you're ready to use it. It is also available without adhesive backing, as DK-154.

Cushions fragile parts

Resilient DK-153 cushions fragile parts and prevents injury to easily marred surfaces. Used as a bumper pad on video tubes and as cushion strips on glass basketball backboards, it absorbs mechanical shocks that might damage these units. DK-153 will not stain or corrode the surface with which it is in contact.

Eliminates squeaks

Wherever adjacent parts rub, the resilient cork-and-rubber composition of Armstrong DK-153 prevents abrasion, squeaks, and rattles. Its adhesive backing holds DK-153 tightly to one adjoining member while its high-friction surface tends to snub movement in the opposite member. The relative motion that may remain is absorbed within the resilient DK-153 composition itself.

Makes units non-skid

On dial telephones, business machines, and small appliances, the high surface friction of Armstrong DK-153 prevents slippage on polished desks and counters. Strips of DK-153 on file drawer bottoms help to keep file folders upright.

Weatherproofs

Armstrong DK-153 forms a tight seal against moisture and dust in such things as parking meters, electric lanterns, and automatic vending machines. In such applications, the cushioning effect of DK-153 also helps to prevent breakage of glass.

Simplifies assembly

DK-153 saves time and simplifies assembly wherever it is used. To apply, simply strip off the protective backing and press the material into place. Its pressure-sensitive adhesive will stick instantly—and tightly—to any clean, dry surface. DK-153 is ideally suited to assembly line production.

Government specification

Armstrong DK-153 is made to meet Military Specification MIL-T-6841C.

Forms and sizes DK-153 is available in 100-foot rolls in any width up to 36" and in 1/32" to 3/16" thicknesses. Forms: rolls, cut strips, and ribbons. Die-cut parts available only from Armstrong Approved Fabricators. It is also available without adhesive, as DK-154.

friction materials

resilient

BRIEF DATA/RESILIENT FRICTION MATERIALS

	TYPE	COEFFICIENT OF FRICTION	TYPICAL APPLICATIONS AND REMARKS
Cork materials	FM-21	.90 dry .11 wet	Developed specifically for multiple disc clutches in automatic transmissions: oilproof, with excellent resistance to oil-water mixtures; very high resistance to wear and fade in wet applications.
	366	1.10 dry	A high friction facing for dry applications only, widely used in light-duty clutches and brakes where an approach to a positive engagement is desired.
	975	.85 dry .10 wet	Used extensively in automotive transmissions; oilproof; excellent resistance to compression set, good wear resistance in wet applications; also used in many light-duty dry applications.
	1463	.90 dry	Successfully used for many years for clutches and brakes on looms, washing machines, and similar equipment; soft, smooth engagement characteristics.
Cork and rubber	NC-733	1.00 dry .15 to .17 wet	Developed for "direct drive" plates in automotive transmissions where a smooth, non-shock engagement is essential; also used in washing machines and industrial tools; recommended where facing pressure is below 90 psi, wet friction value shown here is at 45 psi on plate 9⅛" O.D., 6¼" I.D., with six ⅛" radial slots.
Fiber	FM-88	.40 to .45 dry	Used for clutch-brake materials in light-duty machine tools, coil winders, and industrial sewing machines where quiet, chatter-free operation is required.

Armstrong resilient friction materials are available for a wide range of wet or dry friction applications. When correctly used these compounds operate successfully on jobs ranging from instrument chart drives to heavy-duty transmissions in road graders and tractors.

These materials have high coefficients of friction. When running dry, certain of them approach a quick, positive engagement; others can be slipped to permit smooth and shock-free engagement.

Oil-immersed resilient friction materials engage smoothly and can accommodate fairly large speed differences between driving and driven units without wear on the facing.

Since the requirements of friction drives vary so widely, we suggest that you call in your Armstrong representative when your unit is in the design stage. Data accumulated during years of research may provide a quick answer to your resilient clutch facing problem.

Armstrong is equipped at its Pittsburgh Plant to do the assembly work of bonding friction surfacing materials to customer-supplied clutch plates of metal or plastic. A high-strength Armstrong thermosetting adhesive, cured under heat and pressure, is used for this work.

Armstrong resilient friction materials are available die-cut to your specifications through Armstrong Approved Fabricators.

resilient gaskets

resistance to common fluids

Liquid or gas to be sealed		Acetone	Acetylene	Acids (Inorganic)	Air	Alcohol—Amyl, Butyl, Ethyl, or Methyl	Alkalis	Ammonia	Aniline	Animal Fats and Oils	Benzene (Benzol)	Bunker Oil	Butane	Butyl Acetate	Carbolic Acid (Phenol)	Carbon Dioxide	Carbon Tetrachloride	Chlorinated Solvents	Chlorine	Cresol	Dibutyl Phthalate	Dow Corning 200	Ether	Ethyl Acetate	Ethylene Glycol	Formaldehyde	Freon 12	Freon 22	Fuel Oil
Cork compositions		S	U	U	S	F	U	U	U	S	S	S	S	S	F	S	S	S	U	U	S	S	S	S	S	S	F	S
Cork-and-rubber compositions	Chloroprene (CR)	S	S	U	S	S	U	U	U	F	U	F	F	F	U	S	U	U	U	U	S	U	F	S	S	F	S	F
	Nitrile-butadiene (NBR)	U	S	U	S	S	U	U	U	S	F	S	S	U	U	S	F	U	U	S	U	S	S	U	S	S	U	U	S
	Styrene-butadiene (SBR)	S	F	U	S	S	U	U	S	S	U	F	F	U	U	S	U	U	U	U	F	S	U	U	S	S	S	S	F
	Butyl (IIR)	S	S	U	S	S	U	U	S	F	U	U	U	S	U	S	U	U	U	S	S	S	S	S	S	S	U	U	U
Rubber compounds	Chloroprene (CR)	S	S	S	S	S	S	S	U	S	U	F	F	F	F	S	U	U	BA	U	U	S	U	F	S	S	S	S	S
	Nitrile-butadiene (NBR)	U	S	F	S	S	S	S	U	F	F	S	S	U	U	S	F	U	U	U	U	S	F	U	S	S	S	U	S
Accopac fiber sheet materials	Nitrile-butadiene (NBR)	U	S	U	S	F	U	S	U	S	F	S	S	F	U	S	F	F	U	U	F	S	S	F	S	S	S	S	S
	Styrene-butadiene (SBR)	F	U	U	S	S	U	S	F	F	U	U	U	S	U	S	U	U	U	U	S	S	U	S	S	S	S	S	F
	Chloroprene (CR)	S	S	U	S	S	U	S	U	S	F	S	F	F	U	S	F	F	U	U	F	S	F	F	S	S	S	S	S

Key: S = Satisfactory
F = Fair
BA = Best material available, though not completely satisfactory
U = Unsatisfactory

Gas, Illuminating	Gasoline	Glycerine	Greases	Hydrochloric Acid	Hydrogen	Hydrogen Peroxide	Hydrogen Sulphide	Inks	Kerosene	Lacquers and Thinners	Lubricating Oil	Methyl Ethyl Ketone	Naphtha	Nitric Acid (Dilute)	Nitro Benzene	Oxygen	Ozone	Paints and Varnishes	Perchloroethylene	Phenol	Phosphoric Acid—60%	Propane	Propylene Glycol	Silicone Oil	Soap	Sodium Silicate	Steam	Sulphur Dioxide	Sulphuric Acid (Dilute)	Tar	Toluol	Trichloroethylene	Turpentine	Vegetable Oils	Water	Water, Sea	Xylol
S	S	S	S	U	S	U	S	S	S	S	S	F	S	U	S	S	S	S	S	U	U	S	S	U	F	F	U	F	U	F	S	U	S	S	F	F	S
S	F	S	S	U	S	U	F	S	F	F-U	S	U	S	U	U	S	S	F	U	U	S	S	S	U	F	F	U	U	U	F	U	U	U	F	F	F	U
S	S	S	S	U	S	U	F	S	S	F-U	S	U	S	U	U	S	U	S	F	U	S	S	S	U	F	F	U	U	U	F	F	U	S	S	F	F	F
F	U	S	F	U	S	U	F	S	U	F-U	U	S	U	U	F	S	U	U	U	F	S	F	S	F	F	F	U	U	U	U	U	U	U	F	F	F	U
U	U	S	F	U	S	U	S	S	U	F-U	U	S	U	U	S	S	S	U	U	S	S	F	S	S	F	F	U	U	U	U	U	U	U	F	F	F	U
S	F	S	S	F	S	S	S	S	F	F-U	S	U	U	BA	U	S	F-S	F	U	U	S	S	S	U	S	S	F	F	BA	S	U	U	U	F	S	S	U
S	S	S	S	F	S	S	S	S	S	F-U	S	U	F	BA	U	S	U	S	F	U	S	S	S	U	S	S	F	F	BA	S	F	U	F	S	S	S	F
S	S	S	S	U	S	U	S	S	S	S	S	U	S	U	U	S	S	S	U	U	U	S	S	U	S	S	S*	U	U	S	F	U	S	S	S	S	S
U	U	S	S	U	S	U	S	S	F	U	F	F	U	U	F	S	S	F	U	F	U	U	S	F	S	S	S*	U	U	S	U	U	U	S	S	S	U
S	F	S	S	U	S	U	S	S	S	F	S	S	F	U	U	S	S	S	U	U	U	S	S	U	S	S	S*	U	U	S	F	U	F	S	S	S	F

* Asbestos Fiber Sheets only.

The various classes of Armstrong gasket materials are listed in these tables, together with an indication of their resistance to common industrial fluids.

No such list, of course, can reflect all variables and preferences. Beyond that, a decision to choose a particular gasket material should not be made apart from the various mechanical factors of the joint. For these reasons, this list can be only a very general indication.

We will be glad to make suggestions on specific sealing problems.

USHO 003080

Armstrong