

*Advancing the Science of Sealing™*

# Hydraulic Components Technical Manual



**Garlock**  
SEALING TECHNOLOGIES®

an EnPro Industries company

# Garlock Hydraulic Components

Garlock has been the leading manufacturer of industrial sealing products since 1887. The Hydraulic Components division has the experience, technology and products to meet the demanding needs found in today's reciprocating equipment.

- CHEVRON®: the original vee ring packing, now available in Deep Vee Ring design
- Style 9220 GARTHANE® U-Seals: strong, flexible, and durable
- Polytop and SLUDGE-PAK® Sets: unique combinations for difficult service
- Roll Balance Packing: tough steel and aluminum mill packing



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# CHEVRON® Packing

## Automatic Sealing System

Garlock CHEVRON® packing is the original automatic hydraulic and pneumatic design for sealing rods, pistons and plungers. The distinctive and exclusive hinge-like action of each CHEVRON® ring permits immediate reaction even to minor pressure changes. Each individual lip of a CHEVRON® packing set independently reacts to pressure, and automatically effects a seal. The multiple lip configuration automatically distributes pressure and an effective seal along the shaft. The proprietary design of Garlock CHEVRON® packing also permits an automatic reaction to pressure shock and overloads. Once Garlock CHEVRON® packing has been selected and installed, it will seal effectively... and automatically.



## Applications

Since CHEVRON® products have been the industry standard for many years, they can be found as the sealing device in many different types of equipment. Although normally associated with reciprocating applications, CHEVRON® has been used successfully on slow rotating equipment as well.

The most common applications are:

- Accumulators
- Bailing Presses
- Extrusion Presses
- Fluid Transfer Pumps
- Forging Presses
- Homogenizers
- Hydraulic Cylinders
- Injection Molding Presses
- Intensifiers
- Jacks
- Lifts
- Pneumatic Cylinders
- Rubber Molding Presses
- Steam Hammers
- Valve Stem Packing
- Water Flood Pumps

## Features

## Advantages

Multiple sealing lips	<ul style="list-style-type: none"><li>▪ Automatically distribute system pressure</li><li>▪ Offers “back-up” sealing rings</li></ul>
Hinged design	<ul style="list-style-type: none"><li>▪ Vee rings automatically react to increasing/decreasing pressure</li><li>▪ Makes rings easy to install</li></ul>
Wide range of materials and sizes	<ul style="list-style-type: none"><li>▪ Packing can be used in virtually any kind of fluid</li><li>▪ Offers flexibility in design</li></ul>
Special end rings	<ul style="list-style-type: none"><li>▪ Prevent packing extrusion at elevated pressures</li></ul>
Split sets	<ul style="list-style-type: none"><li>▪ Quick installation</li><li>▪ Can be cut from solid rings or coil stock</li></ul>

## Benefits

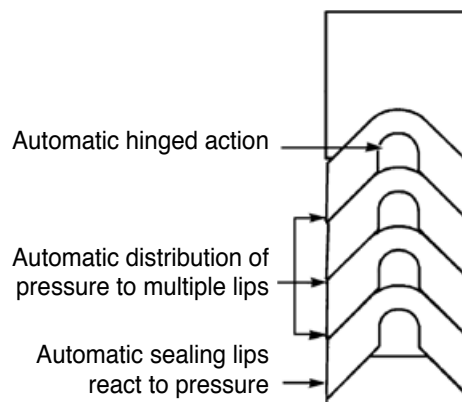
- Elimination of costly seal failure or blowouts
- Reduced installation costs
- Reduced equipment downtime with exact seal specifications
- Extended packing and seal life reduces maintenance and operating costs
- Reduced inventory costs

### WARNING:

Properties/applications shown throughout this brochure are typical. Your specific application should not be undertaken without independent study and evaluation for suitability. For specific application recommendations consult Garlock. Failure to select the proper sealing products could result in property damage and/or serious personal injury.

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# Application Data Sheet

The first step in recommending CHEVRON® products is to determine as much as possible about the operating of the equipment, the stuffing box dimensions, environmental conditions, what product(s) have been used before and any related problems.

The data sheet below is provided to help simplify this process.

## Equipment Type

Cylinder \_\_\_\_\_ Press \_\_\_\_\_ Pump\* \_\_\_\_\_

Other (explain) \_\_\_\_\_

Manufacturer \_\_\_\_\_ Model No. \_\_\_\_\_

## Stuffing Box Data

Shaft, Rod, Ram or Plunger Dia. \_\_\_\_\_

Stuffing Box Bore \_\_\_\_\_

Depth of Box \_\_\_\_\_

Gland,  Adjustable  Nonadjustable

Maximum Gland Entry \_\_\_\_\_

## Operating Conditions

Fluid Type \_\_\_\_\_

Manufacturer's No. \_\_\_\_\_

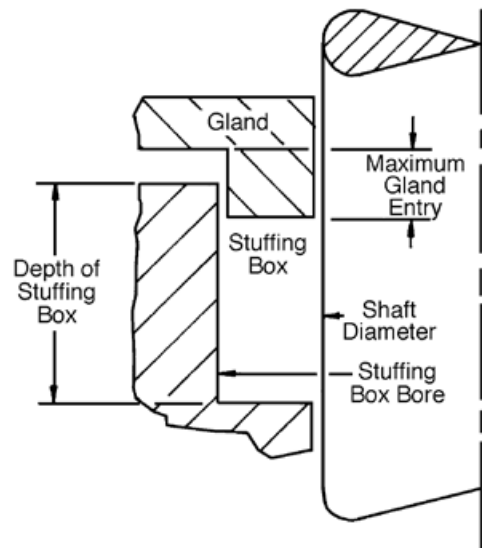
Pressure: \_\_\_\_\_ Min. \_\_\_\_\_ Max.

Temperature: \_\_\_\_\_ Min. \_\_\_\_\_ Max.

Motion: Reciprocating \_\_\_\_\_

Length of Stroke \_\_\_\_\_

Cycles/min. \_\_\_\_\_



To aid in selecting the proper CHEVRON® packing, please refer to the following pages where information on product compatibility, stack height, pressure ranges and clearances is available.

If factory assistance is required, copy the data sheet section above, fill in the blanks and fax or mail it directly to Garlock Hydraulic Components, fax 866.636.4275.

For other than reciprocating equipment (i.e. rotary, oscillating), contact Garlock for recommendations.

\* See page E-10 for more detailed information on reciprocating equipment.

# Recommended Styles for General Service

Fabric Reinforced Materials									
Style/ Materials of Construction		260RH/ 261RH Cotton Fabric Natural Rubber Rockhard	432/435  Cotton Fabric Nitrile Elastomer	433  Cotton Fabric Butyl Elastomer	532  PolyCotton Fabric Nitrile Elastomer	7960  PolyCotton Fabric Fluoro- elastomer	7532  High Temperature Fabric Nitrile Elastomer	7857RH  Cotton Fabric SBR Elastomer Rockhard	7910  PTFE with Hi-Temp Aramid / Fiber Fabric
Available Forms	Vee-Rings		•	•	•	•	•	•	•
	Adapters	•	• (432)	•	•	•	•	•	
Recom- mended for Use Against	Air	•	•		•			•	•
	Acids	•				•			•
	Aliphatic Solutions	•	•		•	•	•		•
	Alkalies	•		•		•		•	•
	Aromatic Solutions					•			•
	Hydrocarbons	•	•		•	•	•	•	•
	Ketones								•
	Phosphate Esters	•		•			•	•	•
	Steam				• Up to 300°F		• Up to 350°F		•
	Water Glycol	•	•	•	•	•	•	•	•
Water in Oil	•	•		•	•	•	•	•	
Temperature	Minimum	-40°F (-40°C)	-40°F (-40°C)	-40°F (-40°C)	-40°F (-40°C)	-20°F (-29°C)	-30°F (-34°C)	-40°F (-40°C)	Cryogenic
	Maximum	+275°F (+135°C)	+250°F (+121°C)	+250°F (+121°C)	+300°F (+149°C)	+300°F (+149°C)	+325°F (+162°C)	+250°F (+121°C)	+450°F (+232°C)
Heat Resistance		Good	Good	Good	Very Good	Very Good	Very Good	Good	Very Good
Pressure Rating <sup>1</sup>		Medium to High	Low to High	Low to High	Low to High	Low to High	Low to High	Medium to High	Medium to High
Abrasion Resistance		Excellent	Good	Fair	Good	Good	Good	Very Good	Good
Relative Hardness/ Flexibility		Very Hard/ Rigid	Firm but Flexible	Firm but Flexible	Firm but Flexible	Firm/ Very Flexible	Firm but Rigid	Very Hard/ Rigid	Hard
Generally Recommended For		Worn or misaligned equipment where extru- sion resistant adapters are needed.	General hydraulic oils, water emulsions. Multi- purpose.	Straight phosphate- ester fluids having no oil or hydro- carbon additives	Moderate to high temperature, oil or steam.	Chemical service, most fire-resistant fluids.	High temperature, oil or steam.	Excellent for water and high pressure service.	All except very low pH fluids. A problem solver.

1. Pressure ratings are affected by actual condition of equipment, clearances and tolerances, leakage acceptability and other factors. Complete application data could result in slightly different recommendations. Contact the factory with specific questions and/or problems. Other styles available.

## Homogeneous Materials

	8452 Homogeneous Nitrile Elastomer	8455 Homogeneous Silicone Elastomer	9188 Homogeneous Butyl Elastomer	9511 Homogeneous Nitrile Elastomer	9600 Homogeneous Fluoro- elastomer	7500 PTFE	7600 PTFE and Graphite	9003/9005 Glass Filled Nylon MARBLOCK®
	•	•	•	•	•	•	•	
						•	•	•
	•	•	•	•	•	•	•	•
		•	•		•	•	•	
	•			•	•	•	•	•
		•	•		•	•	•	
					•	•	•	
	•	•		•	•	•	•	•
						•	•	
		•	•		•	•	•	•
						•	•	
	•	•	•	•	•	•	•	•
	•	•		•	•	•	•	•
	0°F (-17°C)	-70°F (-57°C)	-40°F (-40°C)	-20°F (-29°C)	-20°F (-29°C)	Cryogenic	Cryogenic	-65°F (-54°C)
	+225°F (+107°C)	+500°F (+260°C)	+250°F (+121°C)	+250°F (+121°C)	+400°F (+204°C)	+500°F (+260°C)	+500°F (+260°C)	+300°F (+149°C)
	Good	Excellent	Good	Good	Very Good	Excellent	Excellent	Good
	Vacuum to Low	Vacuum to Low	Vacuum to Low	Vacuum to Low	Vacuum to Low	Low to Medium	Low to Medium	High
	Good	Fair	Good	Good	Good	Very Good	Very Good	Excellent
	90 Duro Flexible	80 Duro Flexible	90 Duro Flexible	70 Duro Flexible	80 Duro Flexible	Firm/Rigid	Hard/Rigid	Very Hard/Rigid
	MIL-R-3065, General purpose oil, air and water service.	Most fluids except strong acids and alkalis or steam.	Same as style 433. For low pressure service.	General purpose—air, oil and water service.	Low pressure seals in high temperature, and chemical service.	Excellent for all fluids, non-lubricated service or food processing.	Especially suitable for soot blowers.	Excellent bearing material for hydraulic cylinders. Low break-away friction. High strength.

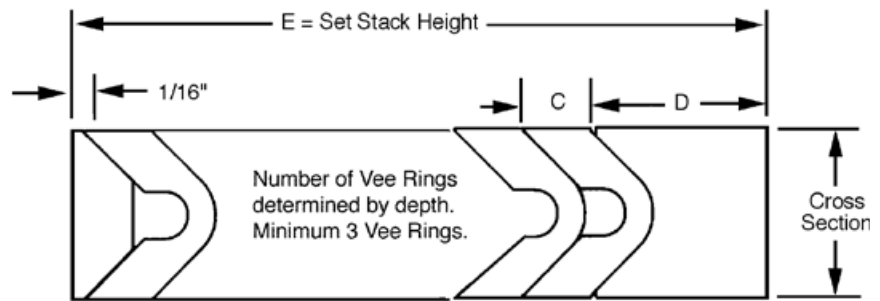
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# CHEVRON® Stack Height Table

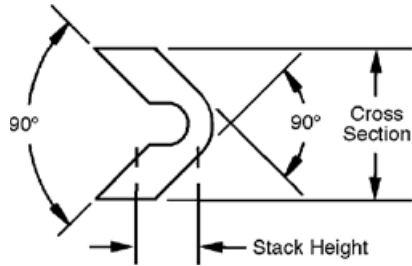


Cross-section	STACK HEIGHT		TOTAL DEPTH "E" (includes the adapter set plus the number of CHEVRON x "C")									
	CHEVRON "C"	Adapter Set "D" + 1/16"	1	2	3	4	5	6	7	8	9	10
	3/16" 0.188"	7/64" 0.109"	5/16" 0.313"	27/64" 0.422"	17/32" 0.531"	41/64" 0.641"	3/4" 0.750"	55/64" 0.859"	31/32" 0.969"	1-5/64" 1.078"	1-3/16" 1.188"	1-19/64" 1.297"
7/32" 0.219"	7/64" 0.109"	5/16" 0.313"	27/64" 0.422"	17/32" 0.531"	41/64" 0.641"	3/4" 0.750"	55/64" 0.859"	31/32" 0.969"	1-5/64" 1.078"	1-3/16" 1.188"	1-19/64" 1.297"	1-13/32" 1.406"
1/4" 0.250"	7/64" 0.109"	5/16" 0.313"	27/64" 0.422"	17/32" 0.531"	41/64" 0.641"	3/4" 0.750"	55/64" 0.859"	31/32" 0.969"	1-5/64" 1.078"	1-3/16" 1.188"	1-19/64" 1.297"	1-13/32" 1.406"
9/32" 0.281"	5/32" 0.156"	11/32" 0.344"	1/2" 0.500"	21/32" 0.656"	13/16" 0.813"	31/32" 0.969"	1-1/8" 1.125"	1-9/32" 1.281"	1-7/16" 1.438"	1-19/32" 1.594"	1-3/4" 1.750"	1-29/32" 1.906"
5/16" 0.313"	11/64" 0.172"	3/8" 0.375"	35/64" 0.547"	23/32" 0.719"	57/64" 0.891"	1-1/16" 1.063"	1-15/64" 1.234"	1-13/32" 1.406"	1-37/64" 1.578"	1-3/4" 1.750"	1-59/64" 1.922"	2-3/32" 2.094"
11/32" 0.344"	3/16" 0.188"	13/32" 0.406"	19/32" 0.594"	25/32" 0.781"	31/32" 0.969"	1-5/32" 1.156"	1-11/32" 1.344"	1-17/32" 1.531"	1-23/32" 0.719"	1-29/32" 1.906"	2-3/32" 2.094"	2-9/32" 2.281"
3/8" 0.375"	3/16" 0.188"	7/16" 0.438"	5/8" 0.625"	13/16" 0.813"	1" 1.000"	1-3/16" 1.188"	1-3/8" 1.375"	1-9/16" 1.563"	1-3/4" 1.750"	1-15/16" 1.938"	2-1/8" 2.125"	2-5/16" 2.313"
13/32" 0.406"	3/16" 0.188"	15/32" 0.469"	21/32" 0.656"	27/32" 0.844"	1-1/32" 1.031"	1-7/32" 1.219"	1-13/32" 1.406"	1-19/32" 1.594"	1-25/32" 1.781"	1-31/32" 1.969"	2-5/32" 2.156"	2-11/32" 2.344"
7/16" 0.438"	15/64" 0.234"	1/2" 0.500"	47/64" 0.734"	31/32" 0.969"	1-13/64" 1.203"	1-7/16" 1.438"	1-43/64" 1.472"	1-29/32" 1.906"	2-9/64" 2.141"	2-3/8" 2.375"	2-39/64" 2.609"	2-27/32" 2.844"
15/32" 0.469"	15/64" 0.234"	9/16" 0.563"	51/64" 0.797"	1-1/32" 1.031"	1-17/64" 1.266"	1-1/2" 1.500"	1-47/64" 1.734"	1-31/32" 1.969"	2-13/64" 2.203"	2-7/16" 2.438"	2-43/64" 2.672"	2-29/32" 2.906"
1/2" 0.500"	15/64" 0.234"	19/32" 0.594"	53/64" 0.828"	1-1/16" 1.063"	1-19/64" 1.297"	1-17/32" 1.531"	1-49/64" 0.766"	2" 2.000"	2-15/64" 2.234"	2-15/32" 2.469"	2-45/64" 2.703"	2-15/16" 2.938"
17/32" 0.219"	15/64" 0.234"	5/8" 0.625"	55/64" 0.859"	1-3/32" 1.094"	1-21/64" 1.328"	1-9/16" 1.563"	1-51/64" 1.797"	2-1/32" 2.031"	2-17/64" 2.266"	2-1/2" 2.500"	2-47/64" 2.734"	2-31/32" 2.969"
9/16" 0.563"	15/64" 0.234"	21/32" 0.656"	57/64" 0.891"	1-1/8" 1.125"	1-23/64" 1.359"	1-19/32" 1.594"	1-53/64" 1.828"	2-1/16" 2.063"	2-19/64" 2.297"	2-17/32" 2.531"	2-49/64" 2.766"	3" 3.000"
5/8" 0.625"	9/32" 0.281"	23/32" 0.719"	1" 1.000"	1-9/32" 1.281"	1-9/16" 1.563"	1-27/32" 1.844"	2-1/8" 2.125"	2-13/32" 2.406"	2-11/16" 2.688"	2-31/32" 2.969"	3-1/4" 3.250"	3-17/32" 3.531"
11/16" 0.688"	9/32" 0.281"	25/32" 0.781"	1-1/16" 1.063"	1-11/32" 1.344"	1-5/8" 1.625"	1-29/32" 1.906"	2-3/16" 2.188"	2-15/32" 2.469"	2-3/4" 2.750"	3-1/32" 3.313"	3-5/16" 3.313"	3-19/32" 3.594"
3/4" 0.750"	21/64" 0.328"	27/32" 0.844"	1-11/64" 1.172"	1-1/2" 1.500"	1-53/64" 1.828"	2-5/32" 2.156"	2-31/64" 2.484"	2-13/16" 2.813"	3-9/64" 3.141"	3-15/32" 3.469"	3-51/64" 3.797"	4-1/8" 4.125"
13/16" 0.813"	21/64" 0.328"	29/32" 0.844"	1-15/64" 1.234"	1-9/16" 1.563"	1-57/64" 1.891"	2-7/32" 2.219"	2-35/64" 2.547"	2-7/8" 2.875"	3-13/64" 3.203"	3-17/32" 3.531"	3-55/64" 3.859"	4-3/16" 4.188"
7/8" 0.875"	3/8" 0.375"	1" 1.000"	1-3/8" 1.375"	1-3/4" 1.750"	2-1/8" 2.125"	2-1/2" 2.500"	2-7/8" 2.875"	3-1/4" 3.250"	3-5/8" 3.625"	4" 4.000"	4-3/8" 4.375"	4-3/4" 4.750"
15/16" 0.938"	3/8" 0.375"	1-1/16" 1.063"	1-7/16" 1.438"	1-13/16" 1.813"	2-3/16" 2.188"	2-9/16" 2.563"	2-15/16" 2.938"	3-5/16" 3.313"	3-11/16" 3.688"	4-1/16" 4.063"	4-7/16" 4.438"	4-13/16" 4.813"
1" 1.000"	13/32" 0.406"	1-1/8" 1.125"	1-17/32" 1.531"	1-15/16" 1.938"	2-11/32" 2.344"	2-3/4" 2.750"	3-5/32" 3.156"	3-9/16" 3.563"	3-31/32" 3.969"	4-3/8" 4.375"	4-25/32" 4.781"	5-3/16" 5.188"
1-1/16" 1.063"	13/32" 0.406"	1-3/16" 1.188"	1-19/32" 1.594"	2" 2.000"	2-13/32" 2.406"	2-13/16" 2.813"	3-7/32" 3.219"	3-5/8" 3.625"	4-1/32" 4.031"	4-7/16" 4.438"	4-27/32" 4.844"	5-1/4" 5.250"
1-1/8" 1.125"	29/64" 0.453"	1-1/4" 1.250"	1-45/64" 1.703"	2-5/32" 2.156"	2-39/64" 2.609"	3-1/16" 3.063"	3-33/64" 3.516"	3-31/32" 3.969"	4-27/64" 4.578"	4-7/8" 4.875"	5-21/64" 5.328"	5-25/32" 5.781"
1-3/16" 1.188"	1/2" 0.500"	1-5/16" 1.313"	1-13/16" 1.813"	2-5/16" 2.313"	2-13/16" 2.813"	3-5/16" 3.133"	3-13/16" 3.813"	4-5/16" 4.313"	4-13/16" 4.813"	5-5/16" 5.313"	5-13/16" 5.813"	6-5/16" 6.313"
1-1/4" 1.250"	1/2" 0.500"	1-3/8" 1.375"	1-7/8" 1.875"	2-3/8" 2.375"	2-7/8" 2.875"	3-3/8" 3.375"	3-7/8" 3.875"	4-3/8" 4.375"	4-7/8" 4.875"	5-3/8" 5.375"	5-7/8" 5.875"	6-3/8" 6.375"

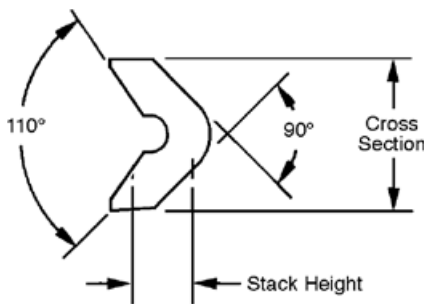
- Notes:**
- Heights are approximate. Exact height cannot be guaranteed.
  - Table applies to fabric-reinforced CHEVRON® sets only.
  - Due to space restrictions we cannot list all of our size capabilities such as large cross sections, metric sizes, optional stack heights, and a multitude of size variations cut from coil.

# Vee Ring and Adapter Designs

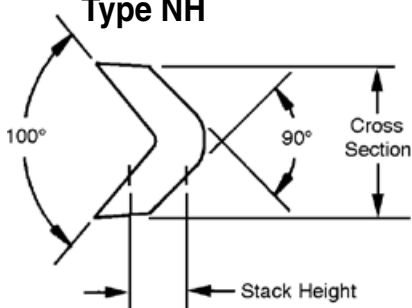
**A. Fabric - Hinge - Type XE**



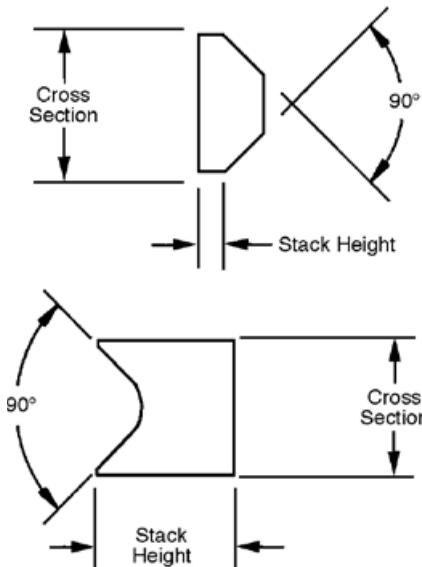
**B. Fabric - Modified Hinge - Type GX**



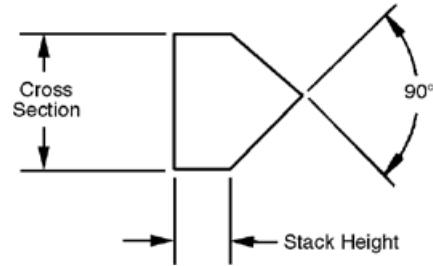
**C. Homogeneous Rubber - No Hinge - Type NH**



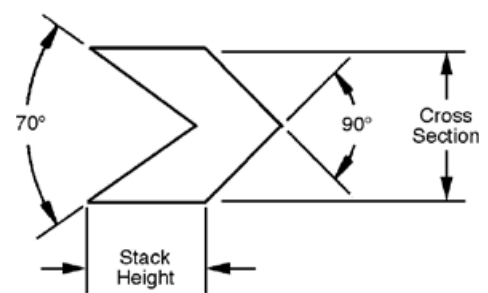
**D. Fabric and Metal Adapters**



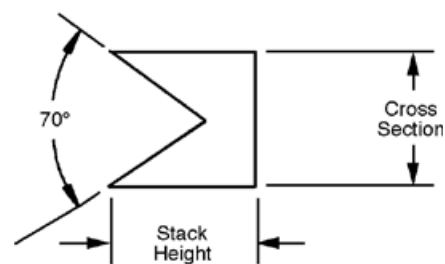
**E. PTFE Male Adapter**



**F. PTFE Vee Ring**



**G. PTFE Female Adapter**



Cross Section	Male (E) Std./J.I.C.	Vee Ring (F) Std./J.I.C.	Female (G) Std. or J.I.C.
0.188	0.075/0.063	0.150/0.083	0.188
0.219	0.088/0.063	0.175/0.083	0.219
0.250	0.100/0.063	0.200/0.083	0.250
0.313	0.125/0.063	0.250/0.140	0.313
0.375	0.150/0.063	0.300/0.156	0.375
0.438	0.175/0.063	0.350/0.197	0.438
0.500	0.200/0.063	0.400/0.197	0.500
0.563	0.225/0.063	0.450/0.197	0.563
0.625	0.250/0.063	0.500/0.250	0.625
0.750	0.300/0.063	0.600/0.297	0.750

*PTFE Stack Heights (inches)*

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# Design Parameters

## Number of Vee Rings by Application

### Piston Applications

Diameter of Cylinder	Zero to 1,000 psi		1,000-2,500 psi		2,500-4,000 psi		4,000 psi and Up	
	Cross Section	Vee Rings per Set	Cross Section	Vee Rings per Set	Cross Section	Vee Rings per Set	Cross Section	Vee Rings per Set
1" to 2"	1/4"	3	1/4"	4	5/16"	4	3/8"	5
2" to 3"	5/16"	3	5/16"	4	5/16"	4	3/8"	5
3" to 6"	3/8"	3	3/8"	4	3/8"	4	3/8"	5
6" to 8"	1/2"	3	1/2"	4	1/2"	4	1/2"	5
8" to 14"	5/8"	3	5/8"	4	5/8"	4	5/8"	5

### Rod, Plunger or Ram Applications

Diameter of Rod Plunger or Ram	Zero to 1,000 psi		1,000-2,500 psi		2,500-4,000 psi		4,000 psi and Up	
	Cross Section	Vee Rings per Set	Cross Section	Vee Rings per Set	Cross Section	Vee Rings per Set	Cross Section	Vee Rings per Set
1" to 3"	1/4"	4	1/4"	5	5/16"	5	5/16"	6
3" to 6"	1/4"	4	5/16"	5	3/8"	5	3/8"	6
6" to 8"	5/16"	4	3/8"	5	1/2"	5	1/2"	6
8" to 14"	3/8"	4	1/2"	5	1/2"	5	5/8"	6
14" to 24"	1/2"	4	5/8"	5	5/8"	5	3/4"	6
24" to 36"	5/8"	4	3/4"	5	3/4"	5	1"	6
36" and Up	3/4"	4	1"	5	1"	5	1"	6

### Recommended Adapters for Pressure Ranges

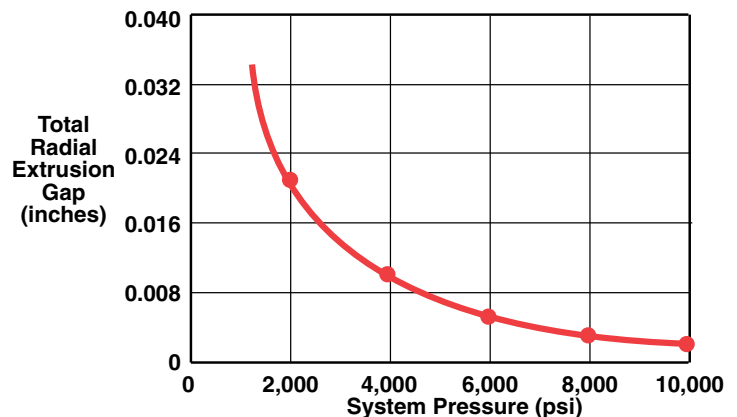
Adapter Type	1,000 psi	2,000 psi	3,000 psi	5,000 psi
Standard Fabric	■	■		
Rockhard Fabric		■	■	
Bronze			■	■
MARBLOCK®	■	■	■	

#### Note:

See Stack Height Table on page E-6 for the height of the Vee rings plus male and female adapter rings per set. This table is for general guidance. Many satisfactory Garlock CHEVRON® packing installations can be made with variations in the recommended equipment or packing guidelines.

## Clearances

If excessive clearance exists between the cylinder wall or the shaft and the component supporting the female adapter, operating pressure will extrude the adapter into the clearance. The greater the pressure and clearance, the more quickly extrusion will occur. In a clean system, where concentricity requirements are met, and where minimum clearances are held, optimum seal life can be expected.



# Deep Vee CHEVRON® Packing

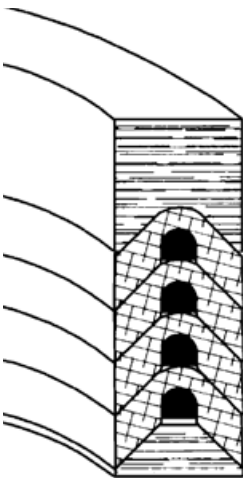
## For Large Diameter, Deep Stuffing Box Applications

- Easier installation—fewer rings required
- Quicker turnaround—rings won't "roll-over" during installation
- Wide variety of styles—choose from the many popular fabric and rubber styles available from Garlock to suit your application
- Few size restrictions—made in our continuous process, so large diameters are no problem
- Most popular cross sections are: 5/8", 3/4", 7/8", 1"

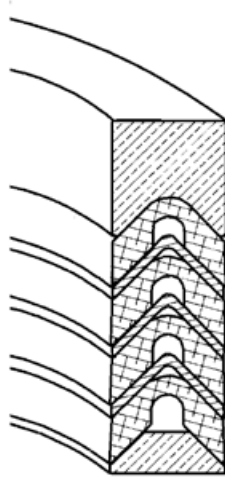
## CHEVRON® Packings for High Pressure Service

In unusually high pressure applications, CHEVRON® packing might need to be reinforced to prevent undue distortion from this extreme pressure. The following are examples of some design considerations that can be used to overcome problems experienced with standard components (such as 432, 433, etc.).

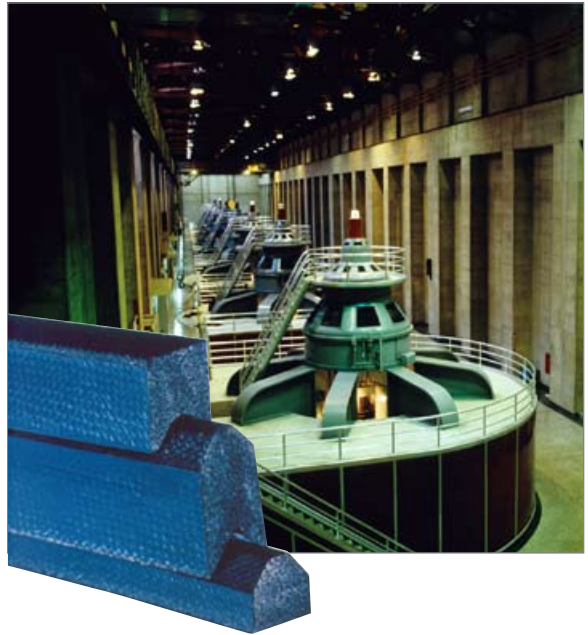
"D" filler rings can be installed in the groove of the hinge-type CHEVRON® Vee Rings to prevent distortion of the packing without interfering with the automatic hinge action of the rings. If the CHEVRON® Vee Rings still tend to telescope into each other, metal separators (lead or bronze) can be installed between the CHEVRON® Vee Rings.



CHEVRON® packing with "D" shaped filler rings.



CHEVRON® packing with metal separators and adapters



**"D" fillers can be used only with 3/8" cross sections and up with hinge type "XE" CHEVRON® rings per illustration A, page E-7.**

When pressure ranges exceed those normally satisfied with standard Style 432, 433 or 532 adapters, the stronger rockhard adapters such as 260RH, 261RH and 7857RH should be considered.

When a problem relates to excessive clearances, as discussed on page E-8, a close tolerance phenolic (Style 155) or bronze bushing installed behind the female adapter will act as additional support and reduce the extrusion gap. A phenolic or bronze female adapter will serve the same purpose.

These configurations have been used successfully to extend the life of CHEVRON® packing sets. However, specific applications should be considered on an individual basis, taking into account the type of equipment, size, temperature, media being sealed, pressure, surface speed, condition of equipment and any other contributing factors.

### WARNING:

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# Seals for Reciprocating Plunger Pump Applications

Garlock has long been a leader in the development of seals and packings for reciprocating equipment. The CHEVRON® trade name for vee packing was registered over 75 years ago; and although it is very popular for use in such applications as hydraulic cylinders and hydraulic presses, it also is capable of providing excellent performance for the demanding service conditions found in plunger pumps.

However, it is important to be able to offer alternative packing recommendations. With hundreds of tooled sizes available in numerous materials, Garlock CHEVRON® provides the options necessary to meet the changing needs of Simplex and Multiplex pumps.

Over the years Garlock has developed styles specifically for plunger pump applications. Although other materials are available, one of the following packing styles will most likely provide satisfactory service:

- 8024:** SBR rubber/cotton fabric, rockhard cure
- 8064:** SBR rubber/cotton fabric, standard cure
- 8140:** SBR rubber/polyester-cotton fabric, rockhard cure
- 8150:** NBR/PTFE/polyester-cotton fabric, standard cure
- 8872:** Nitrile/polyester-cotton fabric

In addition to selecting the proper material for an application, the packing arrangement and design of the other packing set components are equally important. Bronze is the material of choice for male and female adapters or lantern rings to provide plunger alignment through the sealing CHEVRON®, as well as prevent its extrusion. Figures 1 through 4 illustrate some common packing assemblies.

Since stuffing box spaces vary with pump models, it may be necessary to have Garlock design the packing set. The minimum information necessary to do so should include the operating conditions and details of the packing area, which may be best covered by a drawing.

Garlock has the products, experience and quality to satisfy your plunger pump packing needs.

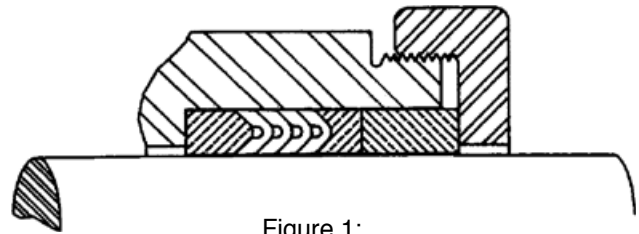


Figure 1:  
Non-lubricated box  
Adjustable CHEVRON® set

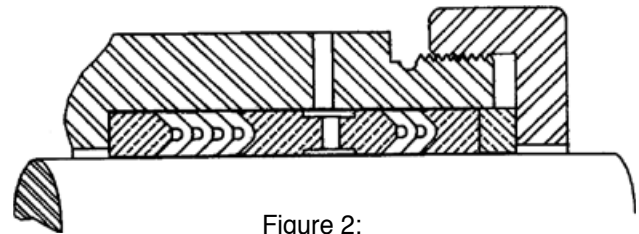


Figure 2:  
Lubricated box  
Adjustable primary and  
secondary CHEVRON® sets

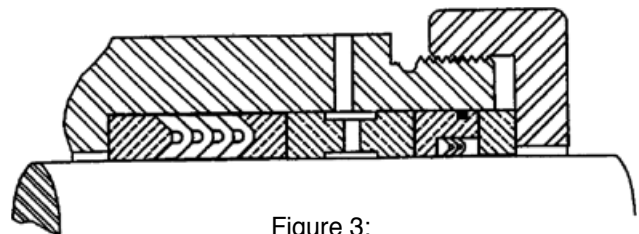


Figure 3:  
Lubricated box  
Adjustable primary CHEVRON® set  
Non-adjustable secondary CHEVRON® set

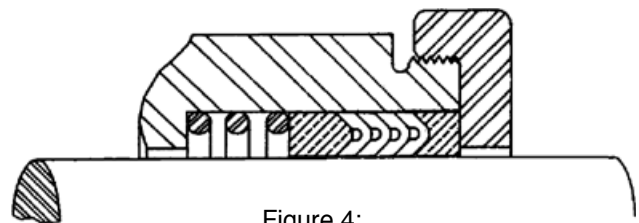


Figure 4:  
Non-lubricated box  
Spring-loaded self-adjusting  
CHEVRON® set

#### WARNING:

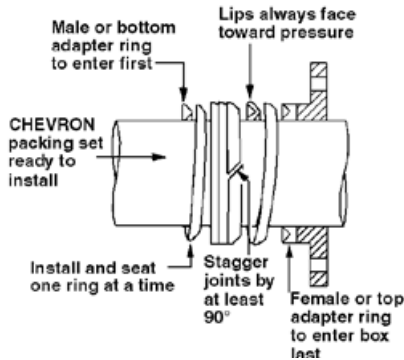
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# CHEVRON® Installation and Adjustment

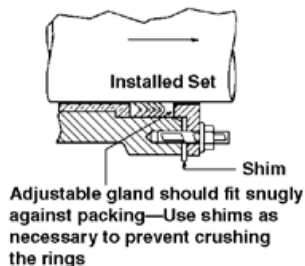
Protect your investment. Do not hang Garlock CHEVRON® packing on nails or under any excessive stack pressure that might deform the concentricity of the product. Do not stock in extreme weather conditions. Avoid constant sunlight. The elastomer compounds used in CHEVRON® packing are highly technical and, while reliable, they are subject to handling stress.



1. Packing on a moving ram should be endless rings, if possible, for best service life.

2. If rams are grooved, worn, rusted or corroded, they should be re-conditioned or replaced. No packing stands up to these conditions. Use boots to protect rams if abrasive dust is a problem.

3. On high pressure jobs, make clearance between rod and gland as close as possible to prevent extrusion.
4. If lubrication is not getting into a Garlock CHEVRON® packing set, the gland may be drawn up too tightly and should be loosened appropriately. To avoid over-tightening and/or cocking of the gland, place a shim under the gland.
5. If a stuffing box is very deep, spacer(s) can be used to take up the space of additional CHEVRON® rings that are not needed. This saves replacement time and cost.
6. Use the correct style. For example, don't use butyl against a petroleum base oil, or a nitrile against a phosphate ester.
7. Use the right size. In emergencies, "off-size" parts can be distorted and made to work for a short period of time, but do not expect them to last or work as efficiently as the correct size.



8. Make sure all rings are seat-ed with no voids in the set.

9. Use lubrication when installing the rings, as it makes installation much easier and helps during the break-in period.

10. Make sure sections of the lips of the rings are not turned over or twisted. This is easy to do, especially in blind installation, and will result in premature leakage and failure.

11. Make sure the packings are facing in the direction of the medium being sealed—whether liquid, air, dust, etc.

12. Consider metal structure. Many times a packing is blamed for leakage when the real culprit is porous metal—either the rod or the housing.

13. Let Garlock help you. Tell us about the application. If a forging press is under shock load, then packing must be a more rugged type, for example. Or, if low pressures are involved, the packing selection must be more flexible than for high pressure.

14. Don't use sharp metal tools like screwdrivers when installing packings. Hardwood tools are best and will not score rod or stuffing box.

For installation of endless CHEVRON® packing, gland pressure should be only sufficient to snug rings within the confining cavity.

On split ring installations, adjustment practice will vary depending on service conditions.

For horizontal packing installations, nominally light gland pressure is necessary to seal the ring joints. Adjustment is made by turns of 1/4 flat on gland bolts.

On vertical applications of split rings, it is desirable to provide increased gland pressure for the effective seal of ring joints.



# 9220 GARTHANE® U-Seals

## Strength/Durability

- Four times the tensile strength / tear resistance of conventional seals
- High modulus counteracts extrusion and shear forces
- Withstands shocks over a wide range of temperatures and pressures
- Exceptional abrasion resistance
- Outstanding endurance under difficult operating conditions

## Flexibility

- Excellent elasticity
- Excellent resilience
- Withstands high degree of deformation

## Temperature and Chemical Resistance

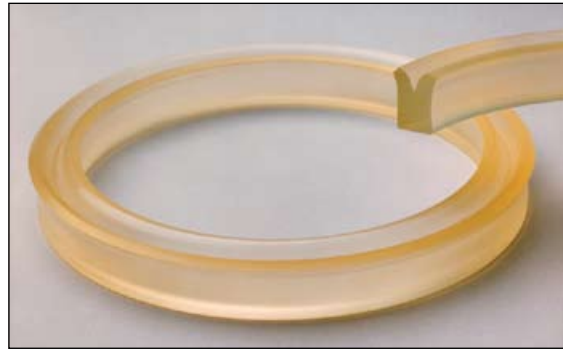
- Excellent for use against petroleum-based fluids to 225°F (107°C), air, warm water and water glycol to 180°F (82°C)
- Withstands dilute acetic and alkaline solutions, aliphatic alcohols and hydrocarbons, salts and solutions of aromatics and solids in concentrations under 80%
- Not recommended for use with very strong oxidizers, highly concentrated acids or bases, pure aromatic compounds, esters, ketones, automotive brake fluid or steam

## Pressure Resistance

- Compounded to withstand a wide range of pressure conditions
  - Normally used as hydraulic cylinder or large ram press seals to 3,500 psi (242 bar)
  - Successfully used for slow-moving equipment to 8,000 psi (552 bar), and static applications to 30,000 psi (2,070 bar) on specially adapted equipment

## Benefits

- Increased seal life and performances
- Less equipment downtime
- Fewer sizes save inventory expense
- Eliminates chance of costly premature equipment failure



Features	Advantages
90 Durometer Urethane	<ul style="list-style-type: none"><li>▪ High tensile strength</li><li>▪ High tear resistance</li></ul>
Reverse bevel lip design	<ul style="list-style-type: none"><li>▪ Less friction</li><li>▪ Responds immediately to pressure</li></ul>
Balanced design	<ul style="list-style-type: none"><li>▪ Can function as a rod or piston seal</li></ul>
Clear Urethane	<ul style="list-style-type: none"><li>▪ No hidden defects in seal</li></ul>
Extensive tooling list	<ul style="list-style-type: none"><li>▪ Greater size availability — both inch and metric</li></ul>

## Recommended Tolerances and Finishes

- Shaft hardness: 30 Rockwell C (minimum)
- Groove length (axial): Height of U-seal plus 10% of cross section (0.032 minimum)
- Dynamic surface finish: 10 to 20 RMS  
Tolerance:  $\pm 0.003$  (maximum)
- Static surface finish: 60 RMS (maximum)  
Tolerance:  $\pm 0.005$  (maximum)



Standard Design  
Cross Section



Metric Design  
Cross Section

# Polytop Sets

These unique set configurations have found widespread popularity due to their high sealing efficiency.

A Garlock Polytop CHEVRON® set utilizes both squeeze and multiple lip type seals. Used in a set configuration, these two proven designs combine to provide maximum sealing performance.

Squeeze seals, such as the Garlock 9220 polyurethane U-Seal, provide excellent low pressure sealing performance. Lip seals, such as Garlock 432 CHEVRON®, provide low friction rates while maintaining responsiveness to pressure fluctuations.

Compounded from the highest quality urethane, the Garlock 9220 U-Seal is strong and abrasion-resistant. In the Polytop configuration, it replaces the traditional top adapter used with vee sets and provides an additional sealing lip.

The fabric and rubber composition of Garlock 432 CHEVRON® provides a strong, yet flexible, sealing system that dampens any pressure surges.

Unlike typical vee sets, Garlock Polytop sets need no axial preload or adjustment after startup, virtually eliminating the fear of catastrophic failure.



## Polytop Sets and SLUDGE-PAK® Packing

Polytop sets and SLUDGE-PAK® are similar in design because they combine different styles of packing. In performance, where it counts, these unique sets offer some significant features and benefits.

# SLUDGE-PAK® Packing



## For Vertical Sludge Pumps

These unique, combination sets from Garlock for use in Carter, Marlow, Komline Sanderson and Passavant vertical sludge pumps have gained wide acceptance in the waste treatment industry.

SLUDGE-PAK® hydraulic packing sets are designed to reduce the friction and abrasion so often associated with vertical sludge pumps. This unique packing arrangement decreases the chance of scoring plungers as might occur with the use of a packing set consisting only of braided packing.

The set's function is based upon the qualities of three types of packing. In the bottom of the stuffing box is Style 8921-K. Next is Style 432 CHEVRON® sealing rings. Topping off the set is a Style 9220 GARTHANE® (urethane) U-seal.

Garlock SLUDGE-PAK® packing is the best of three worlds... braided packing, CHEVRON® rings and urethane U-seals. The performance is unbeatable and necessary in today's waste treatment industry.

### Features

The best properties of each component improve sealability

Combined styles react better to varying pressure conditions

Individual components do not cause equipment damage

### Benefits

▪ Longer life, fewer repacks

▪ Less chance of costly premature failure

▪ Reduces expensive downtime and wear on spare parts

# Roll Balance

## Unique combination sets for the steel and aluminum industries

Roll Balance is commonly found in mills where molten metal slab is reduced to a gauged strip.

Roll Balance sets consist of a CHEVRON® set or a GARTHANE® U-seal to act as the sealing component, and a special diagonal cut ring to act as a piston bearing and anti-extrusion ring for the CHEVRON® set or U-seal.

As pressure is applied, the 155 diagonal cut ring acts in opposite outward directions for positive support of the piston, while reducing the extrusion gap behind the CHEVRON® set or GARTHANE® U-seal.



## Features Advantages

9220 U-seal	<ul style="list-style-type: none"><li>▪ Reverse bevel lip</li><li>▪ Balanced design</li><li>▪ Clear 90 Duro urethane composition</li></ul>
155 diagonal cut ring	<ul style="list-style-type: none"><li>▪ Bearing/backup ring</li><li>▪ Prevents extrusion by closing gap</li></ul>

## Benefits

- Product loss minimized
- Prolonged packing life reduces overall labor costs
- Less equipment downtime
- Reduced cylinder wear, lower operational costs
- Available in sizes to fit most Mesta, United and Blaw-Knox roll balance cylinders
- Complete set is asbestos-free

## Specifications

**Pressures:** 3,000 psi (205 bar) average operating with surges exceeding the operating pressure

**Temperature:** 150°F (65°C) to 200°F (95°C)

**Medium:** Hydraulic oil with the presence of water



# More than just great products...

**Beyond offering you the widest available range of products for packing and sealing, Garlock enhances the value of its products with technical services and comprehensive training programs:**

- ISO 9001:2000 registration for Industrial Gasketing, Industrial Packing, KLOZURE® Oil Seals, Bearing Protectors, and Mechanical Seals, Expansion Joints, Hydraulic Components, and Industrial Rubber Products.
- A global network of stocking Authorized Garlock Distributors.
- Factory sales representatives and applications engineers available for problem solving when and where it is needed.
- Toll-free 800 telephone and fax numbers for immediate product information.
- In-plant surveys of equipment and processes, providing the customer with recommendations to identify and eliminate sealing and packing problems before they start.
- The most sophisticated and most comprehensive test facilities available.
- Technical field seminars on all Garlock products.
- Factory-sponsored product training programs, including hands-on seminars, to ensure that Garlock representatives and their distributor personnel are the best in the industry.
- Technical Bulletins to keep you up-to-date on product enhancements and changes.

**Customers who specify Garlock fluid sealing products get, at no extra cost, the high quality support needed to run a profitable operation.**

## AUTHORIZED REPRESENTATIVE

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