

Compression Packing Technical Manual



Garlock
SEALING TECHNOLOGIES®

an EnPro Industries company

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Garlock Compression Packing

The Garlock Compression Packing facility is committed to supplying the highest quality engineered products to industry throughout the world. Garlock packing is designed to give the user the greatest return on initial investment in terms of leakage control, service life, and dependable, cost-effective product.

The facility also houses the Garlock Textile Division, where we continue to research and develop new fiber blends to bring customers a wide array of packings with optimum performance characteristics.

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Engineering Guidelines

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Flexible Graphite Packings

Style 1303-FEP

Superior performance

- Compliance with the most stringent VOC and VHAP emissions regulations
- Thermally conductive; resists heat, pressure and chemicals
- Fire safe
- Dimensionally stable, impervious to gases and fluids
- Non-scoring, self-lubricating, non-hardening
- Ideal for the hydrocarbon, chemical processing and power generation industries

Convenience

- Spool stock reduces inventory and downtime
- Handles easily, retains integrity when cut and formed
- No end rings required

Specifications

| | |
|----------------------|---|
| Construction: | High-purity GRAPH-LOCK® flexible graphite and 0.004" INCONEL* filament |
| Temperature: | -328°F (-200°C) to +850°F (+455°C) atmosphere; to +1,200°F (+650°C) steam |
| pH range: | 0-14 (except strong oxidizers) |
| Pressure: | To 4,500 psi (310 bar) |

*INCONEL® is a registered trademark of Inco Alloys International, Inc.

Style 1304

Tough and versatile

- Handles both rotary and valve service
- Non-hardening, self-lubricating, dimensionally stable
- Easy to cut and install
- Ideally suited for the pulp and paper, mining, primary metals and power generation industries
- Dry running capability—see Stealth Packing, pg 22

Specifications

| | |
|----------------------|--|
| Construction: | Proprietary, high-purity flexible GRAPH-LOCK® braided yarn, encapsulated by an aramid jacket |
| Temperature: | -328°F (-200°C) to +700°F (+370°C) |
| pH range: | 0-14 (except strong oxidizers) |
| Pressure: | To 3,000 psi (200 bar) valves; To 500 psi (34 bar) rotary |
| Shaft speed: | 4,000 fpm (20 m/s) rotary |

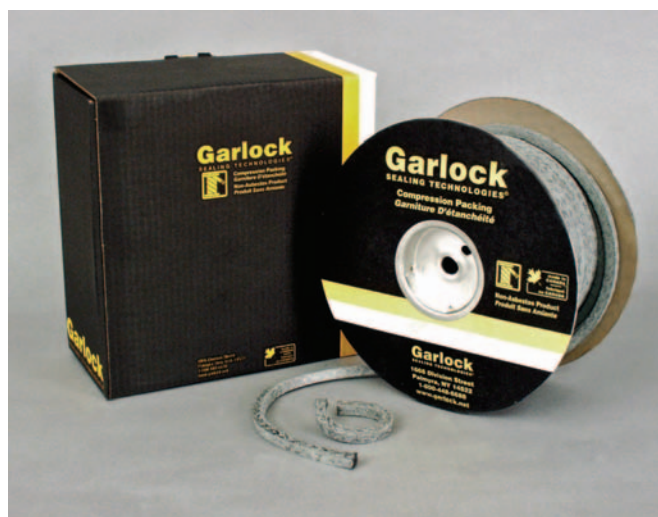
Style 1333-G

Economical and easy to use

- Offset square design makes installation easy; ensures tight seal in worn or oversize stuffing boxes
- All-graphite, PTFE-free construction:
 - Maximizes reliability and stability in high temperatures; also provides excellent chemical resistance
 - Dissipates heat quickly, so equipment runs cooler and requires less flush water
- Graphite filament reinforcement resists extrusion in high pressure applications
- Convenient spool stock reduces inventory, downtime
- Ideal for valves, steam service, rotary applications

Specifications

| | |
|----------------------|---|
| Construction: | Offset square flexible graphite braid reinforced with graphite filament |
| Temperature: | -400°F (-240°C) to +850°F (+455°C) atmosphere; +1,200°F (+650°C) steam |
| pH range: | 0-14 (except strong oxidizers) |
| Pressure: | To 4,000 psi (275 bar) valves, no end rings; To 500 psi (35 bar) rotary |
| Shaft speed: | To 4,800 fpm (23 m/s) rotary |



GRAPH-LOCK® Engineered Sets

The Garlock patented cup and cone design of die-formed graphite rings, used in 9000 EVSP and QUICKSET® 9001 valve packing sets and in DSA series pump packing sets, offers unique advantages:

- I.D. and O.D.-specific pure graphite rings mean low friction and superior sealing at high temperatures
- The cup & cone design increases radial expansion of the sealing rings up to 1/8" (3.2 mm) or more
- Better sealing and room for later adjustment; prolongs the life of the packing
- Varying densities of the graphite rings allow for direct loading of the center seal rings by the gland follower

Flat die-formed rings cannot achieve the superior results of Garlock die-formed cup & cone engineered valve and pump packing sets.

QUICKSET® 9001 *

Top performance and versatility

- Five-ring set of die-formed cup and cone graphite rings and high-density end rings ensure tight seal
- Meets global emissions standards
- Lowest stem friction ever for graphite packing sets means longer equipment life
- Preassembled and ready to install
- No measuring, no cutting, no waste
- Fire Safe

Specifications

| | |
|----------------------|---|
| Construction: | Die-formed cup and cone rings combined with die-formed, high-density Style 1303-Dry end rings with zinc |
| Temperature: | -328°F (-200°C) to +850°F (+455°C) atmosphere; to +1,200°F (+650°C) steam |
| pH range: | 0-14 (except strong oxidizers) |
| Pressure: | To 10,000 psi plus (690 bar) |

* Patent #5,806,858

WARNING:

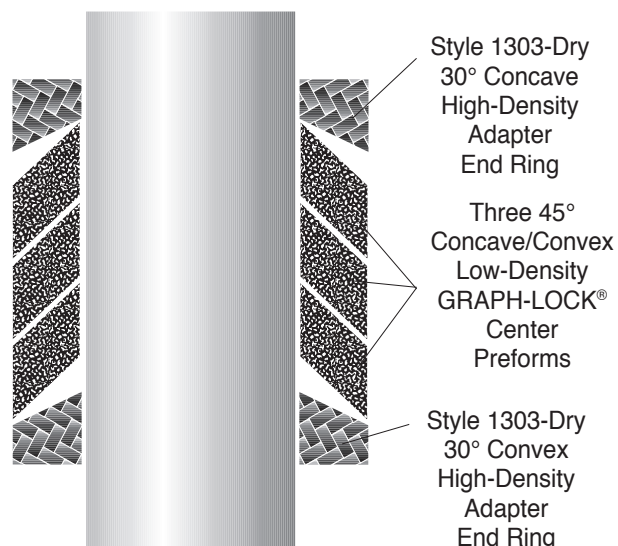
Properties/applications shown throughout this brochure are typical. Your specific application should not be undertaken without independent study and evaluation for suitability. For specific application recommendations consult Garlock. Failure to select the proper sealing products could result in property damage and/or serious personal injury. Performance data published in this brochure has been developed from field testing, customer field reports and/or in-house testing.

Bushing Materials

Garlock recommends the use of bushing materials when stuffing box depths exceed the space required for installation of an effective sealing set.

Recommended materials include:

- 1303-Dry
 - Highly densified rings using the same end material as in QUICKSET® 9001
 - Furnished in square cross sections
 - Particularly useful when valve depth cannot be determined prior to repack
- Carbon
 - Supplied split, drilled and tapped to specified length
 - Available in two standard grades:
 - Style 4525, Grade 250: for commercial use
 - Style 4540, Grade 580: for nuclear applications



QUICKSET® 9001 Typical Ring Arrangement

While the utmost care has been used in compiling this brochure, we assume no responsibility for errors. Specifications subject to change without notice. This edition cancels all previous issues. Subject to change without notice.

GARLOCK is a registered trademark for packings, seals, gaskets, and other products of Garlock.

9000 EVSP* Simplified

Excellent sealing Our best available sealing technology for emissions compliance

- Patented cup and cone design permits selective component compression and controlled radial flow for effective sealing on I.D. and O.D.
- End rings act as wiper rings to restrict graphite particle transfer, prevent extrusion and provide extra resiliency

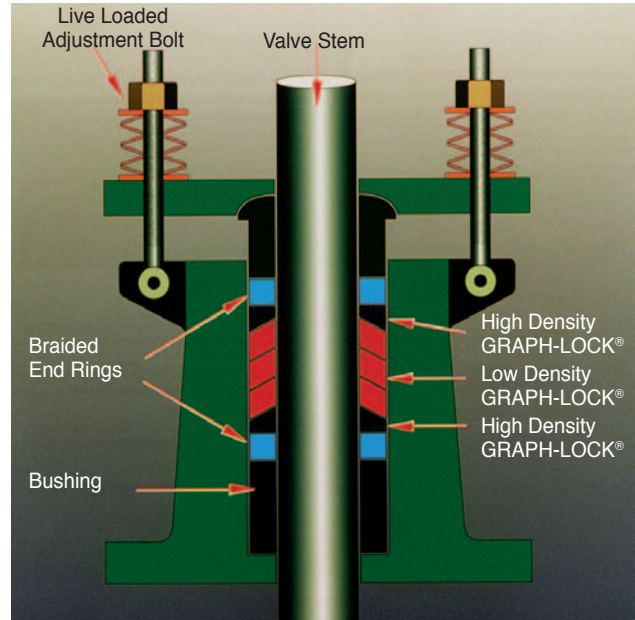
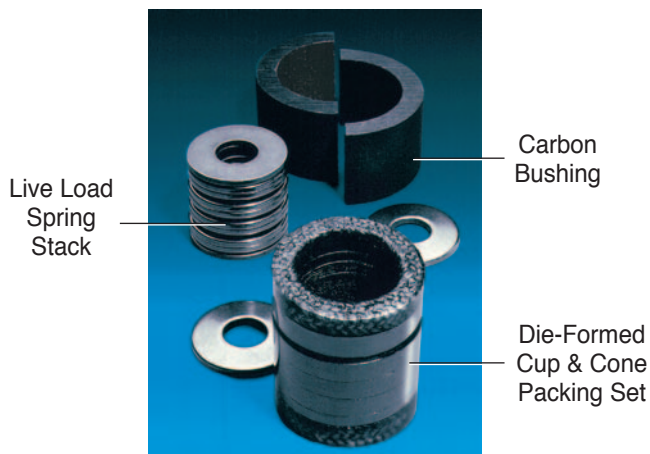
Custom design capability

- Patented cup and cone design provides sealability in valves as shallow as three ring cross sections
- For deep stuffing boxes requiring more than a 7-ring set, machined /split carbon bushings can shorten the box depth
 - Grade 250 (Style #4525) for general services
 - Grade 580 (Style #4540) for nuclear services
- Available in commercial and nuclear grades
- Consult Garlock Applications Engineering with details of your application.
- Fire Safe

Specifications

| | |
|----------------------|--|
| Construction: | GRAPH-LOCK® rings of high-purity diamond texturized graphite tape, in cup and cone configuration; end rings made from Garlock Style 98 |
| Temperature: | -328°F (-200°C) to +850°F (+455°C) atmosphere; to +1,200°F (+650°C) steam |
| pH Range: | 0-14 (except strong oxidizers) |
| Pressure: | To 10,000 psi plus (690 bar) |

* Patent #4,328,974



Live loading

Live loading can provide gland load retention for in-service consolidation of the packing. A set of disc-spring washers placed on each gland stud bolt between the gland flange and gland bolt nut helps exert a continuous compressive force on the gland follower flange and, therefore, on the packing set.

Live loading is recommended where any one of these five criteria is present:

- 5,000 or more complete valve stem actuations are anticipated before the next scheduled repacking, or the valve stem is in a state of constant modulation
- Standard installation procedures cannot be followed
- The valve is critical to the operation of the process
- Multiple thermal cycling of the valve is anticipated due to the process system
- The valve is inaccessible for future adjustment

Our live loading program is specifically designed to compensate for the reduced in-service consolidation needs of today's asbestos-free graphite or carbon-based packing sets. It consists of even numbers of opposing disc-spring washers sandwiched between standard flat washers.

Nuclear Applications

Style G-700

Highest standards

- When used as end rings together with high purity GRAPH-LOCK® rings, G700 is ideal for critical valve applications** in nuclear and power generation industries
- Tested by independent laboratories; compliant with:
 - MIL-P-24583B (SH)
 - General Electric Spec. D50YP12 Rev. 2
- Contains no PTFE or other lubricants
- Non-abrasive; very low coefficient of friction
- Will not fray

Specifications

| | |
|----------------------|--|
| Construction: | Highest grade graphite filament with an exclusive graphite dispersion, in LATTICE BRAID® construction |
| Temperature: | -328°F (-200°C) to +1200°F (+650°C) in steam; +1625°F (+900°C) in free oxygen-exclusive environments such as nitrogen and carbon dioxide; +850°F (+455°C) atmosphere |
| pH range: | 0-14 (except strong oxidizers) |
| Pressure: | To 4,000 psi (275 bar) plus, when used with GRAPH-LOCK® center rings |

* INCONEL® is a registered trademark of Inco Alloys International, Inc.

** Used as end rings ONLY.



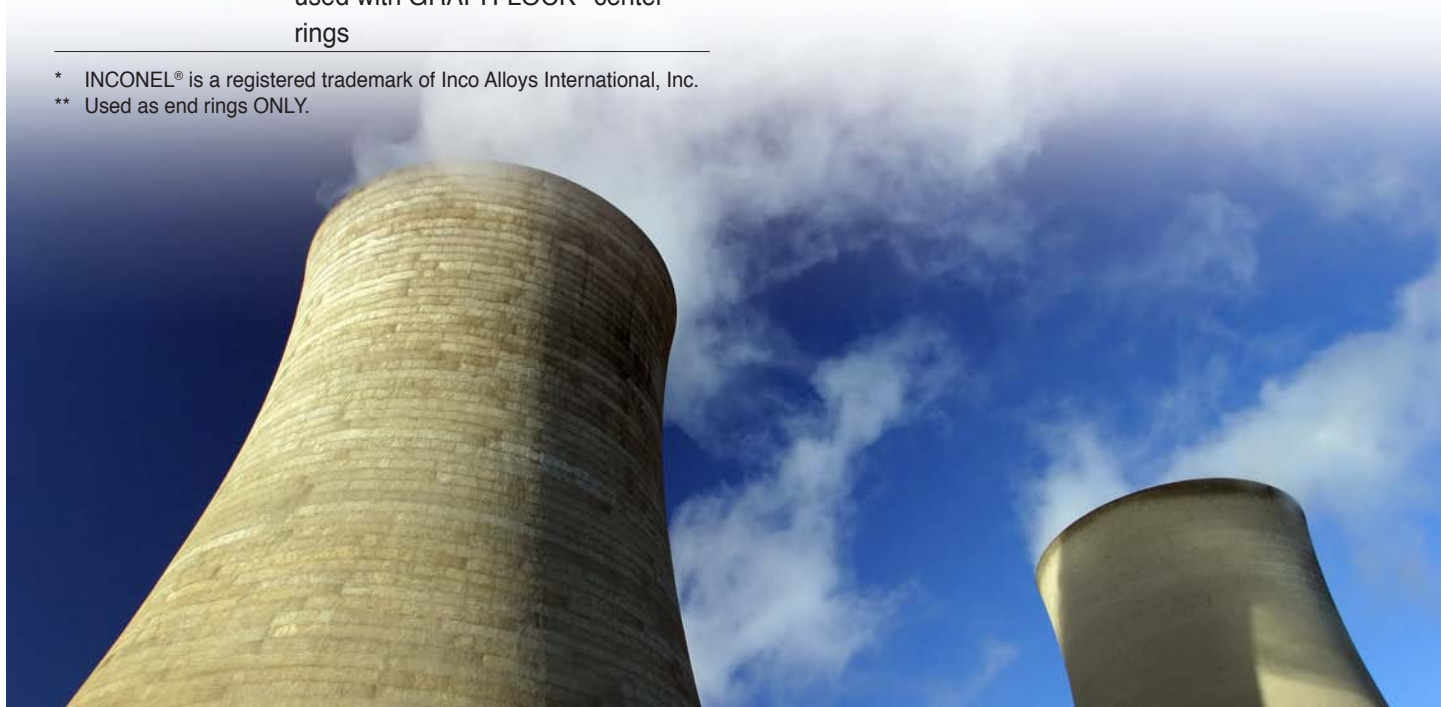
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Pump Packing

Introducing the

HydraJust™

Engineered Sealing System

—the leak-free, no dilution sealing system designed to replace mechanical seals in industrial pumping applications.

Better Than Both — Packing or Mechanical Seals.

Ordinary packing must leak to perform. And common system upsets can spell disaster for mechanical seals. The HYDRA-JUST™ system provides a truly leak-free rotary seal—without the risk of catastrophic failure.

The Choice for Water Reduction.

Because the HYDRA-JUST™ seal provides cool, dry operation with no product dilution, overall water consumption is significantly reduced. And, unlike mechanical seals, it actually works better in high pressure/low flow conditions.

Designed For True Outage-to- Outage Performance.

Engineered from innovative materials, the HYDRA-JUST™ seal has the versatility to handle a wide range of system upsets and excels in the most hostile environments and abrasive conditions for extraordinary long service life.

Easy to Install.

Engineered from innovative materials, the HYDRA-JUST™ seal has the versatility to handle a wide range of system upsets and excels in the most hostile environments and abrasive conditions for extraordinary long service life.

To learn more, visit www.hydrajust.com



Styles 8093 DSA, 8094 DSA

Superior performance

- Patented cup and cone rings expand radially to form a positive seal against both shaft and box bore
- Requires less axial force to effect a seal
- Withstands a wide range of chemicals

Reduced costs

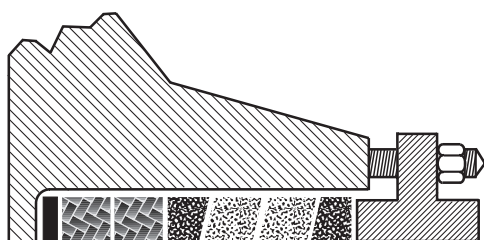
- Reduced equipment wear and maintenance
- Flexible graphite rings conduct heat away from the shaft, so equipment runs cooler and longer
- Significant reduction in leakage





Versatile

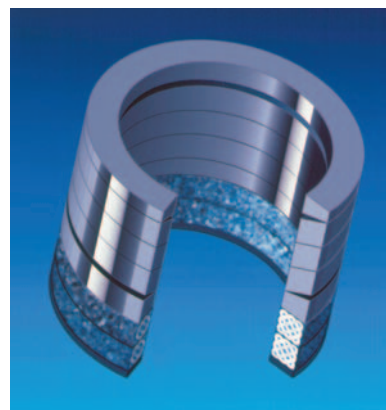
- Style 8093 DSA for service in clean media
- Style 8094 DSA with split lip seal for abrasive service

8093 DSA Specifications

| | |
|----------------------|--|
| Construction: | Typical set: gasket spacer, braided rings, flexible graphite adapters and preforms |
| Media: | Condensate, boiler feed water, light paper stock, white water, feed water |
| Temperature: | To +500°F (+260°C) |
| pH range: | 0-14* (except strong oxidizers) |
| Shaft speed: | To 4,000 fpm plus (20 m/s) |
| Pressure: | To 500 psi (35 bar) |

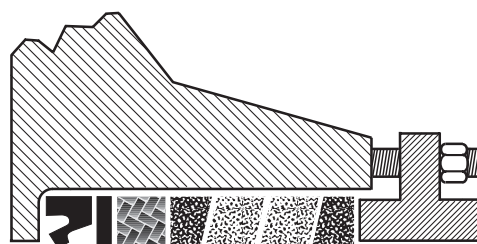







-  Gasket spacer (Style 3530 or G-9900)
-  Braided ring (Style 98, 1304, 5000 or 8921-K)
-  Low density GRAPH-LOCK® preforms
-  High density GRAPH-LOCK® adapters



8094 DSA Specifications

| | |
|----------------------|---|
| Construction: | Typical set: Model 26 lip seal, gasket spacer, braided rings, flexible graphite adapters and preforms |
| Media: | Abrasive service |
| Temperature: | To +200°F (+93°C) |
| pH range: | 2-12* |
| Shaft speed: | To 4,000 fpm plus (20 m/s) |
| Pressure: | To 300 psi (20 bar) |



-  Model 26 lip seal
-  Gasket spacer (Style 3530 or G-9900)
-  Braided ring (Style 98, 1304, 5000 or 8921-K)
-  Low density GRAPH-LOCK® preforms
-  High density GRAPH-LOCK® adapters

* Depends on braid choice

Carbon Packings

Style 98

Tough and versatile

- Low coefficient of friction for longer equipment life
- High thermal conductivity means process runs cooler, and packing lasts longer
- Withstands wide variety of chemicals
- Low chloride certification available

Style 98 Specifications

| | |
|----------------------|--|
| Construction: | LATTICE BRAID® carbon fiber |
| Media: | Acids, strong caustics, hot oils, solvents, boiler feed, condensate water |
| Equipment: | Centrifugal pumps, agitators, ball, globe, gate and plug valve stems, oil drilling and down-hole tools |
| Temperature: | -328°F (-200°C) to +850°F (+455°C) atmosphere; to +1,200°F (+650°C) steam |
| pH range: | 0-14 (except strong oxidizers) |
| Shaft speed: | To 4,000 fpm plus (20 m/s) |
| Pressure: | To 500 psi (35 bar) rotary/centrifugal; To 2,500 psi (173 bar) valves |



CARBAE™ 105 & 108

High performance, low cost

- Excellent cost / use ratio
- Ideal for most industrial equipment
- Compatible with a wide range of chemicals
- Easy to install and remove

Style 105 Specifications

| | |
|----------------------|---|
| Construction: | 95% carbon assay fiber with PTFE coating |
| Media: | Acids, caustics, slurries |
| Equipment: | Centrifugal pumps, mixers, agitators |
| Temperature: | -328°F (-200°C) to +600°F (+316°C) atmosphere; to +1,200°F (+650°C) steam |
| pH range: | 0-14 (except strong oxidizers) |
| Shaft speed: | To 3,000 fpm (15 m/s) |
| Pressure: | To 500 psi (35 bar) rotary/centrifugal |

Style 108 Specifications

| | |
|----------------------|---|
| Construction: | 95% carbon assay fiber with graphite dispersion |
| Media: | Acids, caustics, hot oils, solvents, boiler feed, condensate water |
| Equipment: | Centrifugal pumps, valves, agitators |
| Temperature: | -328°F (-200°C) to +850°F (+455°C) atmosphere; to +1,200°F (+650°C) steam |
| pH range: | 0-14 (except strong oxidizers) |
| Shaft speed: | To 4,000 fpm (20 m/s) |
| Pressure: | To 500 psi (35 bar) rotary/centrifugal; To 2,500 psi (173 bar) valves† |

† No pressure limits have been determined when CARBAE™ 108 is combined as end ring material with die-formed GRAPH-LOCK® center rings in valve installations.

Note: CARBAE™ 108 can be certified to contain less than 200 ppm leachable chlorides on request.

Style 5000

Durable, non-contaminating

- Low abrasion and high chemical resistance for long service
- Ideal where contamination is prohibited, as in pulp and paper industry
- Low chloride certification available
- Style 5000-PBI* offers extra abrasion resistance

Specifications

| | |
|----------------------|---|
| Construction: | LATTICE BRAID® carbon fiber impregnated with PTFE, hi-temp break-in lube |
| Media: | Acids, strong caustics, slurries |
| Equipment: | Slip joints, mixers, agitators, reactors, autoclaves, centrifugal pumps, turbines |
| Temperature: | -328°F (-200°C) to +600°F (+315°C) |
| pH range: | 0-14 (except strong oxidizers) |
| Shaft speed: | To 3,000 fpm plus (15 m/s) |
| Pressure: | To 500 psi (35 bar) rotary/centrifugal |

Graphite Packing Style G-200

High performance

- Withstands elevated temperatures and aggressive chemicals
- Low coefficient of friction reduces shaft wear
- Ideal end ring (with GRAPH-LOCK® center rings) in valve service
- Low chloride certification available

Specifications

| | |
|----------------------|---|
| Construction: | LATTICE BRAID® GARFITE® graphite yarn |
| Media: | Acids, natural petroleum, synthetic oils, solvents, steam, water |
| Equipment: | Boiler feed pumps, agitators, mixers, crystallizers, filters, continuous digesters, reciprocating pump rods |
| Temperature: | -328°F (-200°C) to +850°F (+455°C) atmosphere; to +1,200°F (+650°C) steam |
| pH range: | 0-14 (except strong oxidizers) |
| Shaft speed: | To 4,000 fpm plus (20 m/s) |
| Pressure: | To 500 psi (35 bar) rotary/centrifugal |

SYNTHEPAK® Packings

Superior performance

- Unique spun synthetic fiber; ideal replacement for asbestos
- Excellent for pumps, valves, rods, plungers, rams, expansion joints
- Reduction in shaft and sleeve wear lowers operational costs
- Versatile, multi-use packing means lower inventory stocking costs
- See Styles 8909, 8913, 8921-K, 8922, 8922-PBI on pages A-16, A-17 for specifications



* PBI is a registered trademark of Celanese Corporation.

Blended Packing

GAMUT™ Style 1812

Versatile

- Non-contaminating
- Excellent chemical resistance
- Resists abrasion; non-abrasive to equipment
- Superior blocking system to control leakage
- Break-in lube for easy installation and startup
- Ideal for agriculture, mining, power generation, pulp and paper, and water / waste water industries

Specifications

| | |
|----------------------|---|
| Construction: | LATTICE BRAID® spun NOMEX† and synthetic fiber blend with PTFE and white petrolatum |
| Media: | Water, slurries |
| Equipment: | Pumps |
| Temperature: | -170°F (-110°C) to +500°F (+260°C) |
| pH range: | 1-12†† |
| Shaft speed: | To 2,000 fpm (10 m/s) |
| Pressure: | To 300 psi (20 bar) rotary/centrifugal |

† Nomex is a registered trademark of DuPont

†† Style 1812 should not be used in hot concentrated sulfuric or nitric acids or bases with concentrations greater than 10%.

Style 1925

Premium performance

- Innovative blend of two yarns:
 - Fiber-infused PTFE yarns offer abrasion resistance and thermal stability
 - Exclusive SYNTHETPAK®* yarns retain flexibility and resilience; ensure even load distribution
- Longer packing and equipment life mean significant cost savings

Specifications

| | |
|----------------------|--|
| Construction: | LATTICE BRAID® fiber-infused PTFE yarns and SYNTHETPAK® yarns with PTFE dispersion and snow-white petrolatum break-in lube |
| Equipment: | Pumps |
| Temperature: | -450°F (-270°C) to +500°F (+260°C) |
| pH range: | 1-13 |
| Shaft speed: | To 2,500 fpm (12 m/s) |
| Pressure: | To 300 psi (20 bar) rotary/centrifugal |

* Patent #4,994,303

WARNING:

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PTFE Packings

Style 1965

Superb flexibility & easy handling

- Protects machinery's critical components from abrasive media
- Lowers maintenance and sealing element expenditures
- Product does not extrude and lasts longer in service
- Material flexibility and easy handling mean faster change-out times
- Non-contaminating components keep end product and pump area clean
- Shock resistant withstanding cavitation, pressure surges and other system upsets
- Increased thermal stability conserves water

Specifications

| | |
|----------------------|---|
| Construction: | LATTICE BRAID® fiber-infused PTFE yarns* with Graphite and SYNHEPAK® yarns, PTFE dispersion and snow white petrolatum |
| Equipment: | Pumps |
| Temperature: | -450°F (-270°C) to +500°F (+260°C) |
| pH range: | 1-13 |
| Shaft speed: | 2,500 fpm (10 m/s) |
| Pressure: | 300 psi (20 bar) rotary/centrifugal |

* Patent #4,994,303

Style 5888

Valve stem packing with superior chemical resistance

- High density, dimensionally stable—very little water absorption
- Ideal for valve and slower shaft speed applications
- PTFE dispersion ensures a low friction finish and prevents leakage through the braid
- Resistant to most chemicals

Specifications

| | |
|----------------------|--|
| Construction: | LATTICE BRAID® continuous filament PTFE braid with PTFE dispersion |
| Equipment: | Check and needle valve stems, reciprocating rods, rams and plungers, and rotary applications |
| Temperature: | -450°F (-270°C) to +500°F (+260°C) |
| pH range: | 0-14 |
| Shaft speed: | To 1,000 fpm plus (5 m/s) |
| Pressure: | To 300 psi (20 bar) rotary / centrifugal; To 2,000 psi (138 bar) valves |

Note: For oxygen service, specify Style 5898.

Style 5889

Chemically resistant packing for pumps and rotary equipment

- Preshrunk to avoid packing wear and shaft scoring
- Soft, flexible but very nonporous
- Excellent choice for rotary shaft service

Specifications

| | |
|----------------------|--|
| Construction: | LATTICE BRAID® continuous filament PTFE braid with PTFE dispersion and inert break-in lube |
| Equipment: | Expansion joints, reciprocating rods, rams, plungers, rotary service |
| Temperature: | -450°F (-270°C) to +500°F (+260°C) |
| pH range: | 0-14* |
| Shaft speed: | To 1,500 fpm plus (8 m/s) |
| Pressure: | To 300 psi (20 bar) rotary/centrifugal |

* Not recommended for chlorine service

PTFE Packings



Style 5904

Food grade packing

- Ideal for food processing applications
- Pliable, wear-resistant and dimensionally stable
- Resists most caustic media
- Rugged and non-toxic
- Ingredients conform to USDA requirements and meet FDA Title 21 CFR 172.878, 177.1550, 178.3570 and 178.3620(a)

Specifications

| | |
|----------------------|--|
| Construction: | LATTICE BRAID® PTFE filament |
| Equipment: | Pumps, dryers, cookers, blenders, mixers, and other centrifugal rotary food processing equipment |
| Temperature: | -450°F (-270°C) to +500°F (+260°C) |
| pH range: | 0-14 |
| Shaft speed: | To 1,500 fpm plus (8 m/s) |
| Pressure: | To 300 psi (20 bar) rotary/centrifugal |

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Flush Water Products

Style 1004 Lantern Ring Coil*

Economical and easy to handle

- Costs up to 50% less than OE-supplied lantern rings
- Easily cut with knife or saw, and short lengths splice together, eliminating waste
- Easy to install** and remove from stuffing box—reduces costly downtime
- High-purity PTFE offers chemical resistance in a broad range of rotary services

Specifications

| | |
|----------------------|--------------------------------|
| Construction: | Wear-resistant high-grade PTFE |
| Equipment: | Pumps |
| Temperature: | To +500°F (+260°C) |
| pH range: | 0-14 (except strong oxidizers) |

FLUSH-GARD™ Seal

Reduces flush water

- Throat cavity bushing reduces flush water consumption
- Extends equipment life by protecting sleeve and packing from media attack
- Split design installs easily, without equipment disassembly

Specifications

| | |
|-----------------------|--------------------------------------|
| Construction: | Graphite-filled PTFE |
| Temperature: | -250°F (-157°C) to +450°F (+232°C) |
| Surface speed: | To 2,500 fpm (12.7 m/s) [†] |
| pH range: | 0-14 (except strong oxidizers) |

* U.S. Patent #4,498,681; Canada Patent #1,271,788

** For maximum strength and density, install with slots toward shaft; for maximum gland water flow, install with slots away from shaft.

[†] Above 2,500 fpm, consult Garlock.

^{††} INCONEL is a registered trademark of Inco Alloys International, Inc.

^{†††} PBI is a registered trademark of Celanese Corporation.

Crown Bush Pump Sealing System

Lower your operating costs

- Significantly reduce flush water usage
- Extend packing life
- Reduce sleeve wear
- Flush water distribution optimised to keep contaminants away from the gland packing
- Stainless Steel Crown Bush flow control device resists erosion from abrasive contaminants
- Non-metallic construction available for non-abrasive duties
- Split version available

Applications

- Pulp and paper
- Mining
- Mineral Sands
- Alumina Refining
- Coal Washing



Soot Blower Sets

Exceptional reliability

- Rugged materials for extended service life
- INCONEL⁺⁺ wire reinforcement with-stands high temperatures and pressures
- Die-formed rings ensure accurate fit and simple installation
- Efficient conical design allows outstanding sealing at low gland loads
- Standard sizes for Diamond Power, Copes Vulcan and other soot blowers



GRAPH-LOCK[®] Sets

| | |
|----------------------|--|
| Construction: | Premium density GRAPH-LOCK [®] center rings (87.5 lbs/ft ³ [1,400 kg/m ³]) with 1303-FEP or 98 end rings |
| Temperature: | To +850°F (+455°C) atmosphere, +1,200°F (+650°C) steam |

TORNADO PACK[™] F1

| | |
|----------------------|---|
| Construction: | Style 127-AFP: INCONEL wire reinforced carbon over homogeneous core |
| Temperature: | To +650°F (+345°C) atmosphere, +1,200°F (+650°C) steam |

TORNADO PACK[™] F3

| | |
|----------------------|--|
| Construction: | Style 1298: INCONEL wire reinforced PBI ⁺⁺⁺ over carbon yarn core |
| Temperature: | To +850°F (+455°C) atmosphere, +1,200°F (+650°C) steam |

TORNADO PACK[™] F5

| | |
|----------------------|---|
| Construction: | Style 1303-FEP: INCONEL wire reinforced flexible graphite |
| Temperature: | To +850°F (+455°C) atmosphere, +1,200°F (+650°C) steam |

Style Index

| Style | Material Classification | Lubrication | Construction | Rotary | Service | |
|---------------------|--|---|-----------------|--------|---------|-------|
| | | | | | Recip. | Valve |
| 18 | Flax roving | Petrolatum & paraffin | Square braid | X | X | |
| 90 | Flax roving | Marine & petro wax/graphite | Square braid | X | X | |
| 98 | Carbon filament | Graphite dispersion | LATTICE BRAID® | X | X | X |
| 98-PBI ¹ | Carbon filament | Graphite dispersion | LATTICE BRAID® | X | X | |
| 105 (CARBAE™) | Carbon filament | PTFE & snow-white petrolatum | LATTICE BRAID® | X | | |
| 108 (CARBAE™) | Carbon filament | Graphite dispersion | LATTICE BRAID® | X | X | X |
| 127-AFP | INCONEL ³ wire-reinforced spun carbon over homogeneous core | Graphite | Braid over core | | | X |
| G-200 | Graphite filament | Graphite dispersion | LATTICE BRAID® | X | | |
| G-700 ⁴ | Graphite filament | Graphite | LATTICE BRAID® | | | X |
| 740 | Flax roving | Petrolatum & marine wax | LATTICE BRAID® | X | X | |
| 745 | Flax roving | Petrolatum, marine wax, & graphite | LATTICE BRAID® | X | X | |
| 1298 | INCONEL wire-reinforced PBI over carbon yarn core | Graphite & tungsten disulfide | Braid over core | | | X |
| 1300-E | Flexible graphite | None | Square braid | X | | X |
| 1303-FEP | INCONEL filament-reinforced flexible graphite | Graphite dispersion | Square braid | | | X |
| 1333-G | Graphite filament-reinforced flexible graphite | Graphite | Square braid | X | | X |
| 1812 | Spun NOMEX ⁵ / synthetic | PTFE & snow-white petrolatum | LATTICE BRAID® | X | X | |
| 1850 | KYNOL ⁶ | PTFE & snow-white petrolatum | LATTICE BRAID® | X | X | |
| 1925 | Fiber-infused PTFE | PTFE suspensoid and snow-white petrolatum | LATTICE BRAID® | X | | |
| 1965 | Fiber-infused PTFE | Graphite | LATTICE BRAID® | X | | |
| 5000 | Carbon filament | PTFE & snow-white petrolatum | LATTICE BRAID® | X | X | |
| 5000-PBI | Carbon filament w/ PBI corners | PTFE & snow-white petrolatum | LATTICE BRAID® | X | X | |
| 5100 | GFO ⁷ | Silicone | LATTICE BRAID® | X | | X |
| 5200 | Aramid filament | PTFE dispersion | LATTICE BRAID® | X | X | |
| 5413 | Flax roving | PTFE & snow-white petrolatum | Square braid | X | X | |
| 5450 | Fiberglass | None—Graphite on request | LATTICE BRAID® | | | |
| 5481 | Fiberglass | None—Graphite on request | Round braid | | | |

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2. VITON is a registered trademark of DuPont Dow Elastomers

3. INCONEL is a registered trademark of Inco Alloys International, Inc.

4. To be used as end ring material only with GRAPH-LOCK® center rings.

5. NOMEX is a registered trademark of DuPont.

6. KYNOL is a trademark of American Kynol, Inc.

* 0-14 except strong oxidizers

| Temperature | | Pressure (psi) | | Pressure (bar) | | Shaft Speed | | pH |
|--|--|----------------|-------|----------------|-------|-------------|-----|-------|
| Fahrenheit | Centigrade | Rotary | Valve | Rotary | Valve | fpm | m/s | |
| To +220° | To +105° | 150 | | 10 | | 1,200 | 6 | 5-9 |
| To +220° | To +105° | 300 | | 20 | | 1,200 | 6 | 5-9 |
| -328° to +850° atmosphere +1,200° steam | -200° to +455° atmosphere +650° steam | 500 | 2,500 | 35 | 173 | 4,000 | 20 | 0-14* |
| To +650° atmosphere | To +345° atmosphere | 500 | | 35 | | 4,000 | 20 | 1-12 |
| -328° to +600° atmosphere | -200° to +316° atmosphere | 500 | | 35 | | 3,000 | 15 | 0-14* |
| -328° to +850° atmosphere +1,200° steam | -200° to +455° atmosphere +650° steam | 500 | 2,500 | 35 | 173 | 4,000 | 20 | 0-14* |
| +850° atmosphere +1,200° steam | +455° atmosphere +650° steam | | 1,200 | | 82 | | | 1-12 |
| -328° to +850° atmosphere +1,200° steam | -200° to +455° atmosphere +650° steam | 500 | | 35 | | 4,000 | 20 | 0-14* |
| To +850° atmosphere +1,200° steam | To +455° atmosphere +650° steam | | 4,000 | | 275 | | | 0-14* |
| To +220° | To +105° | 150 | | 10 | | 1,200 | 6 | 5-9 |
| To +220° | To +105° | 250 | | 17 | | 1,200 | 6 | 5-9 |
| To +850° atmosphere +1,200° steam | To +455° atmosphere +650° steam | | 4,500 | | 310 | | | 1-12 |
| -328° to +850° atmosphere +1,200° steam | -200° to +455° atmosphere +650° steam | 500 | 3,000 | 35 | 200 | 4,000 | 20 | 0-14* |
| -328° to +850° atmosphere +1,200° steam | -200° to +455° atmosphere +650° steam | | 4,500 | | 310 | | | 0-14* |
| -328° to +850° atmosphere +1,200° steam | -200° to +455° atmosphere +650° steam | 500 | 4,000 | 35 | 275 | 4,800 | 23 | 0-14* |
| -170° to +500° | -110° to +260° | 300 | | 20 | | 2,000 | 10 | 1-12 |
| -170° to +500° | -110° to +260° | 500 | | 35 | | 2,000 | 10 | 1-13 |
| -450° to +500° | -270° to +260° | 300 | | 20 | | 2,500 | 12 | 1-13 |
| -450° to +500° | -270° to +260° | 300 | | 20 | | 2,500 | 12 | 1-13 |
| -328° to +600° | -200° to +315° | 500 | | 35 | | 3,000 | 15 | 0-14* |
| -328° to +600° | -200° to +315° | 500 | | 35 | | 3,000 | 15 | 1-12 |
| -200° to +550° | -130° to +288° | 300 | 2,000 | 20 | 138 | 4,000 | 20 | 0-14* |
| -420° to +500° | -250° to +260° | 500 | | 35 | | 2,500 | 12 | 2-12 |
| To +250° | To +120° | 200 | | 14 | | 1,200 | 6 | 5-9 |
| To +1000° | To +540° | | 10 | | 1 | | | 2-11 |
| To +1000° | To +540° | | 10 | | 1 | | | 2-11 |

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Style Index (cont'd)

| Style | Material Classification | Lubrication | Construction | Service | | |
|------------------------|---|---|--|---------|-------------|-------|
| | | | | Rotary | Recip. | Valve |
| 5888 | PTFE filament | PTFE suspenoid | LATTICE BRAID® | X | X | X |
| 5889 | PTFE filament | PTFE dispersion & silicone | LATTICE BRAID® | X | | |
| 5898 | PTFE filament | PTFE dispersion | LATTICE BRAID® | | | X |
| 5904 | PTFE filament—FDA | PTFE dispersion / mineral oil | LATTICE BRAID® | X | X | |
| 8091 HYDRA- JUST | Dynamic Rotary Sealing Solution | N/A | GYLON® & Graphite Braid with Graphite Cup & Cone | X | | |
| 8093 DSA | Flexible graphite | N/A | Die-formed sets | X | | |
| 8094 DSA | Flexible graphite / Model 26 | N/A | Die-formed sets | X | | |
| 8909 | Spun synthetic | Graphite & petrolatum | Square braid | X | | |
| 8913 | Spun synthetic | Graphite & petrolatum | LATTICE BRAID® | X | | |
| 8921-K | Spun synthetic—aramid filament corners | PTFE suspenoid & snow-white petrolatum | LATTICE BRAID® | X | X | X |
| 8922 | Spun synthetic | PTFE suspenoid & snow-white petrolatum | LATTICE BRAID® | X | X | X |
| 8922-PBI | Spun synthetic / PBI corners | PTFE suspenoid & snow-white petrolatum | LATTICE BRAID® | X | X | |
| 9000 EVSP | Flexible graphite | N/A | Die-formed sets | | | X |
| QUICKSET® 9001 | Flexible graphite | N/A | Die-formed sets | | | X |
| F1 | INCONEL ³ wire-reinforced spun carbon over homogeneous core | Graphite & zinc | Die-formed sets | | Soot blower | |
| F3 | INCONEL wire-reinforced PBI ¹ over carbon yarn core | Graphite & tungsten disulfide | Die-formed sets | | Soot blower | |
| F5 | INCONEL wire-reinforced spun flexible graphite | Graphite dispersion | Die-formed sets | | Soot blower | |
| GRAPH- LOCK® | Flexible graphite | N/A | Die-formed sets, tape | X | | X |
| PM [†] -1 | Spun synthetic | PTFE suspenoid & snow-white petrolatum | LATTICE BRAID® | X | | |
| PM-2 | Spun synthetic | Petroleum oils & graphite | LATTICE BRAID® | X | | |
| PM-3 | Spun synthetic | Petroleum oils & graphite | Square braid | X | | |
| PM-5 | Aramid filament | Silicone | LATTICE BRAID® | X | X | |
| PM-6 | Expanded PTFE/graphite | Silicone | LATTICE BRAID® | X | | |
| PM-6K | Expanded PTFE filament— aramid filament corners | Silicone | LATTICE BRAID® | X | X | |
| PM-7 | PTFE filament | PTFE suspenoid | LATTICE BRAID® | X | X | X |
| PM-8 | PTFE filament | Silicone | LATTICE BRAID® | X | | |

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2. VITON is a registered trademark of DuPont Dow Elastomers
3. INCONEL is a registered trademark of Inco Alloys International, Inc.
4. To be used as end ring material only with GRAPH-LOCK® center rings.
5. NOMEX is a registered trademark of DuPont
6. KYNOL is a trademark of American Kynol, Inc.
7. GFO is a trademark of WL Gore.

- * 0-14 except strong oxidizers
- ** Should not be used in chlorine
- *** Pressure and shaft speeds controlled by types of braid used in conjunction with the GRAPH-LOCK® product
- † PM = PACKMASTER®

| Temperature | | Pressure (psi) | | Pressure (bar) | | Shaft Speed | | pH |
|--|--|----------------|--------|----------------|-------|-------------|-----|--------|
| Fahrenheit | Centigrade | Rotary | Valve | Rotary | Valve | fpm | m/s | |
| -450° to +500° | -270° to +260° | 300 | 2,000 | 20 | 138 | 1,000 | 5 | 0-14 |
| -450° to +500° | -270° to +260° | 300 | | 20 | | 1,500 | 8 | 0-14** |
| -450° to +500° | -270° to +260° | 300 | 2,000 | 20 | 138 | 1,000 | 5 | 0-14 |
| -450° to +500° | -270° to +260° | 300 | | 20 | | 1,500 | 8 | 0-14 |
| To 500°F | 200°C | 500 | | 35 | | 4,000 | 20 | 0-14 |
| To +500° | To +260° | 500 | | 35 | | 4,000 | 20 | 0-14* |
| To +200° | To +93° | 300 | | 20 | | 4,000 | 20 | 2-12 |
| -170° to +500° | -110° to +260° | 300 | | 20 | | 1,500 | 8 | 4-10 |
| -170° to +500° | -110° to +260° | 300 | | 20 | | 1,500 | 8 | 4-10 |
| -170° to +550° | -110° to +288° | 500 | 2,500 | 35 | 173 | 2,250 | 11 | 0-12 |
| -170° to +550° | -110° to +288° | 500 | 2,500 | 35 | 173 | 2,500 | 12 | 0-12 |
| -170° to +550° | -110° to +288° | 500 | | 35 | | 2,250 | 11 | 1-12 |
| -328° to +850° atmosphere +1,200° steam | -200° to +455° atmosphere +650° steam | | 10,000 | | 690 | | | 0-14* |
| -328° to +850° atmosphere +1,200° steam | -200° to +455° atmosphere +650° steam | | 10,000 | | 690 | | | 0-14* |
| To +650° atmosphere +1,200° steam | To +345° atmosphere +650° steam | | | | | | | 1-12 |
| To +850° atmosphere +1,200° steam | To +455° atmosphere +650° steam | | | | | | | 1-12 |
| To +850° atmosphere +1,200° steam | To +455° atmosphere +650° steam | | | | | | | 0-14 |
| -328° to +850° atmosphere +1,200° steam | -200° to +455° atmosphere +650° steam | *** | *** | *** | *** | *** | *** | 0-14* |
| -170° to +500° | -110° to +260° | 300 | | 20 | | 1,500 | 8 | 4-10 |
| -170° to +500° | -110° to +260° | 300 | | 20 | | 1,500 | 8 | 4-10 |
| -170° to +500° | -110° to +260° | 200 | | 14 | | 1,000 | 5 | 4-10 |
| -420° to +500° | -250° to +260° | 500 | | 35 | | 2,500 | 12 | 2-12 |
| -200° to +550° | -130° to +288° | 300 | | 20 | | 3,000 | 15 | 0-14** |
| -200° to +550° | -130° to +288° | 500 | | 35 | | 1,900 | 10 | 3-12 |
| -450° to 500° | -270° to +260° | 300 | 2,000 | 20 | 138 | 1,000 | 5 | 0-14 |
| -450° to 500° | -270° to +260° | 300 | | 20 | | 1,500 | 8 | 0-14** |

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Packing Materials

Aramid

These fibers are aromatic polyamides that were given the generic name “aramid.” With excellent resistance to high temperatures and exceptional tensile strength, aramid filaments are considered to be stronger, pound for pound, than steel. Garlock utilizes a variety of these fibers including spun and filament versions. Filament yarns are added to the corners of pump packings for greater resistance to abrasive media.

Carbon/Graphite Filament Packings

Garlock carbon filament products are made from carbon yarns having a 95% minimum carbon assay. Premium products (Styles 98, 98-VC and 5000) use pitch-based yarns, while CARBAE™ Styles 105 and 108 are made from P.A.N.* base yarns. Low friction coefficients are standard for less shaft wear and lower maintenance and replacement costs. Garlock carbon fibers also offer more value per pound than other packings.

Garlock graphite filament products are braided from high-purity graphite filaments with a minimum carbon assay of 99%. They have excellent chemical resistance, are thermally conductive and can be used in extreme temperature and pressure conditions.

Fiberglass

Glass fibers exhibit superior thermal properties, dimensional stability and tensile strength. Glass fibers will not burn, and they dissipate heat more rapidly than organic fibers. The glass fibers most commonly used in compression packings are “E” grade (electrical) and “S” grade (strength). Common solvents, oils, petroleum distillates, bleaches and most organic chemicals do not affect fiberglass.

Flax

Garlock carefully selects quality long-fiber roving yarns, braids them, and then thoroughly impregnates them with the required lubricating agents. They are designed for optimum service in waste and dilute aqueous solutions up to +250°F (+121°C) at low to medium pressures. Industries such as mining, milling, steel, waste/water treatment, marine, and pulp and paper regularly specify these packings for their operations.

GRAPH-LOCK® Products

Made of extremely pure graphite, Garlock GRAPH-LOCK® packing products offer unmatched service in industrial environments where searing temperatures and crushing pressures cause constant failure of conventional packings.

Flexible Graphite Tape Products

GRAPH-LOCK® is self-lubricating, dimensionally stable, impervious to gases and fluids, and corrosion-resistant. GRAPH-LOCK® products offer excellent sealing capabilities under extreme conditions for longer equipment life and less maintenance. It is available in tape and die-formed rings from Garlock Compression Packing and in sheet form from Garlock Sheet Products.

Garlock Compression Packing offers two purity levels of our GRAPH-LOCK® products—commercial grade of 95% and nuclear grade of 99.5%. The nuclear grade material meets General Electric Spec. D50YP12, Rev. 2 dated Oct. 1992; MIL-P-24503B (SH); and can be certified for oxygen service.

Flexible Graphite Braided Products

Garlock offers a variety of high-purity braided flexible GRAPH-LOCK® products as well. We offer a plain braided graphite version (1300), INCONEL** wire-reinforced versions (1303-FEP, 1398, 1399), an aramid-reinforced version (1304), and a graphite filament-reinforced version (1333-G).

MILL-RIGHT® Products

The experience gained over 100 years as a manufacturer has enabled Garlock to develop “Tough Technology” for the MILL-RIGHT® family of packings. Fiber-infused technology starts with yarns produced at our own facility. With the addition of an exclusive blocking and lubricating system, Garlock non-contaminating packings can resist abrasion without being abrasive to equipment and perform successfully throughout a broad range of industries and applications.

* P.A.N.: poly-acrylo-nitrile

** INCONEL is a registered trademark of Inco Alloys International, Inc.

PBI

PBI is a registered trademark of Celanese Corporation, and is an acronym for the term “polybenzimidazole”, a high performance organic fiber. PBI fibers maintain dimensional stability at high temperatures and are compatible in a wide range of chemicals and solvents. Garlock incorporates wire-reinforced PBI yarns in valve stem packings as well as adding spun filament yarns to the corners of pump packings for added strength and abrasion resistance.

PTFE Packings

Garlock starts with the advantage of PTFE—excellent chemical resistance, a wide temperature range, flexibility with toughness—and combines them with the superior LATTICE BRAID® construction to form adaptable, effective packings. High in quality and consistently uniform, they are used extensively in the food processing, chemical, agricultural and petroleum processing industries.

SYNTHEPAK® Products

SYNTHEPAK® packings are a family of remarkable spun synthetic fiber packings created and developed by Garlock for low-cost general industrial service. Since they undergo the same braiding and treatment process as asbestos packings, SYNTHEPAK® packings make an excellent replacement for asbestos. This extremely adaptable fiber has proved superior to many types of conventional packings.

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XPG

The expanded PTFE/Graphite (XPG) yarn system is a unique blend of expanded PTFE filament with a blend of micronized graphite powder. The yarn utilizes a high temperature silicone oil lubricant. It can be used through an extremely wide range of applications including acids, alkalies, aromatic and aliphatic solvents, alcohols, esters, petroleum and synthetic oils, steam, water and aqueous solutions, and air and dry industrial gases.

XPG features good thermal conductivity, speed capability, chemical resistance, low coefficient of friction and low coefficient of thermal expansion, making it excellent for use in pumps, mixers and agitators.

Construction

Compression packings are made in a variety of shapes, sizes and constructions, from a wide range of materials. The following describes the most commonly-used constructions, and the advantages of each.

Braid-Over-Braid (Figure 1)

Round braiding machines braid tubular jackets using yarns, rovings, ribbons and various other materials, either alone or in combination. Size is obtained by braiding jackets one over the other (braid-over-braid). Finished packings can be supplied in round, square or rectangular cross section. Braid-over-braid packings, also known as round braid or multiple braid packings, are relatively dense and are recommended for high-pressure, slow-speed applications such as valve stems, expansion joints, groove gasketing, etc.



Figure 1

Braid-Over-Core (Figure 2)

Finished product is produced by round braiding one or more jackets of yarns, rovings, ribbons or other forms of various materials over a core, which may be extruded, twisted, wrapped or knitted. This construction allows for a wide range of densities and different cross sectional shapes.

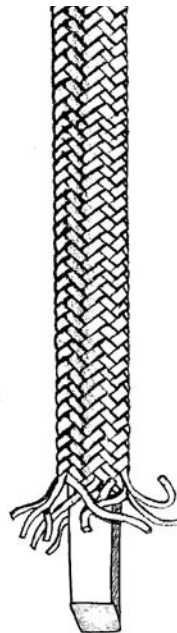


Figure 2

Square Braid (Figure 3)

Yarns, rovings, ribbons and other various materials, either alone or in combination, are processed on equipment where strands pass over and under strands running in the same direction. Resulting packings are usually supplied in square cross section, but rectangular sizes can also be braided by this method. The packing is usually soft and can carry a large percentage of lubricant. Square braided packings are easy on equipment and are generally used for high-speed rotary service at relatively low pressure. The packing's softness makes it ideal for old or worn equipment.



Figure 3

LATTICE BRAID® (Figure 4)

Yarns, rovings, ribbons and other forms of various materials, either alone or in combination, are processed on equipment where the strands crisscross from the surface diagonally through the body of the packing. Each strand is strongly locked by other strands to form a solid integral structure that cannot easily ravel or come apart in service. There are no jackets to wear through, and no plaits to come loose. LATTICE BRAID® packing has a more even distribution of yarn density



Figure 4

throughout and has the potential for improved lubricant retention. The finished packing is relatively dense, but flexible.

LATTICE BRAID® packings are suitable for applications on both reciprocating and centrifugal pumps, agitators, valves, expansion joints and in grooves.

Die-Formed

Many compression packing materials can be supplied in a pre-compressed ring form, which provides controlled density and size.

Mandrel Cut

Rings formed by wrapping braided stock of the required cross section on a mandrel or shaft with a diameter equal to the desired I.D.

Graphite Tape

Flexible graphite tape (ribbon) is manufactured by exfoliating (expanding) and then compressing natural graphite flakes to a specific density. Graphite has almost universal chemical inertness and is naturally lubricious, compactible and resilient, as well as nuclear radiation resistant.

Flexible graphite tape can be die-molded or compressed to form endless true labyrinth rings. Graphite tape packings have a low coefficient of friction, a pH range of 0-14 and are noted for their excellent thermal properties enabling them to be used in applications to 5500°F (3000°C) in non-oxidizing atmospheres. Due to their temperature resistance and density, they make ideal valve packings in steam, VOC, hydrocarbons or chemical applications when used in combination with braided end rings such as Styles 1303-FEP, 98 or G-700.

Material Selection

The proper selection of packing materials is dependent on the operating conditions of the equipment. Six parameters of the equipment must be determined before a proper packing recommendation can be made. The acronym “STAMPS” is commonly used to designate these parameters:

Lubricants

Lubricants are usually added to compression packings when the packings are to be used on rotary equipment where frictional heat is generated. The lubricants provide a resiliency that allows the packing to deform and recover under slight mechanical deficiencies such as shaft deflection. They may also provide interfiber lubricity that reduces frictional heat.

Blocking Agents

Lubricants that act as a fluid barrier by closing the voids that are present in braided materials to prevent leakage through the cross section of the packing.

Single End Coating

A proprietary Garlock process that coats each yarn used in packing prior to the braiding process. This provides a more consistent coating of packing materials for better sealing.

S = Size — cross section

T = Temperature — of media being sealed

A = Application — type of equipment (i.e., pumps, valves, mixers, etc.)

M = Media — material being sealed

P = Pressure — of media being sealed

S = Speed — shaft speed in fpm (pumps only)

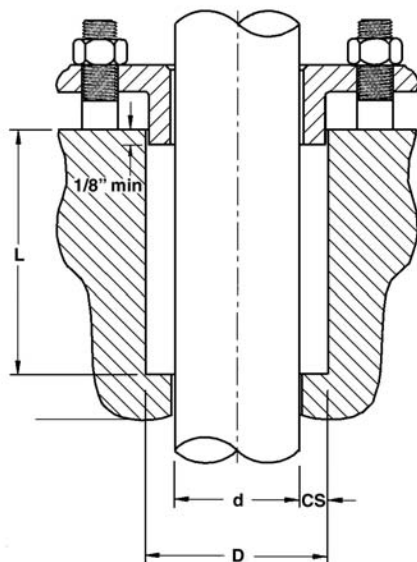
Equipment Condition

No matter what type of equipment you are trying to seal, the condition of the equipment is critical to the success of the packing. Garlock recommends:

Valves

- **Longitudinal scores** on the valve stem are not to exceed 1/32" depth and/or a depth-to-width ratio greater than 1.00.
- **Stem finish** no greater than 32 (micro inches) AARH.
- **Stuffing box finish** is recommended to be 125 (micro inches) AARH.
- **Valve stem warp / runout** must be checked and found not to exceed:

| Stem Diameter | Runout (TIR / ft) |
|---------------------------------------|----------------------|
| Up to and including 1.500" (38.1 mm) | ±0.010" |
| 1.501" to 3.000" (38.1 mm to 76.2 mm) | ±0.020" |
| 3.001" (76.2 mm) and above | ±0.040" |



Stuffing box dimensions

- The bottom of the gland follower should be flat. If box bottom is beveled, Garlock recommends the use of a system-compatible braided packing ring to be installed before the bushing.
- Stuffing box should contain no burrs on the stem and/or box bore walls.

Pumps

- **Runout:** TIR (Total Indicator Runout) not to exceed 0.005".
- **Longitudinal scores:** none should be present on pump shaft or sleeve.

| Shaft Diameter | | Recommended Cross Section (CS) | |
|-----------------------|------------------|--------------------------------|--------|
| Inches | mm | Inches | mm |
| 5/8" to 1-1/8" | (15.8 to 28.6) | 5/16" | (7.9) |
| Over 1-1/8" to 1-7/8" | (28.6 to 47.6) | 3/8" | (9.5) |
| Over 1-7/8" to 3" | (47.6 to 76.2) | 1/2" | (12.7) |
| Over 3" to 4-3/4" | (76.2 to 120.7) | 5/8" | (15.8) |
| Over 4-3/4" to 12" | (120.7 to 304.8) | 3/4" | (19.0) |

$$D = d + (2 \times CS)$$

- **Recommended box depth (L)** = (5.5 to 7.5) x CS
- **Recommended surface finishes:**
 - Stem / Sleeve: 16 to 32 (micro inches) AARH
 - Box Bore: 125 (micro inches) AARH

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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Installation Instructions

Valve Stem Packing

1. Remove all of the old packing from the stuffing box. Clean box and stem thoroughly and examine stem for wear and scoring. Replace stem if wear is excessive. Recommended surface finishes are 32 (micro inches) AARH on the stem, and 125 (micro inches) AARH maximum on the box bore.

2. Measure and record stem diameter, stuffing box bore and box depth. To determine the correct packing size, measure the diameter of the stem (inside the stuffing box area if possible), and the diameter of the stuffing box bore. Subtract the I.D. measurement from the O.D. measurement, and divide the difference by two. This is the required cross-sectional size.

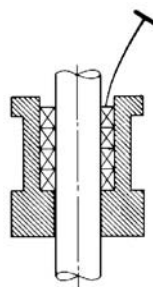
3. Always cut the packing into individual rings. Never wind the packing into a coil in the stuffing box. Rings should be cut with a butt joint. Cut rings by using a spare stem, a mandrel with the same diameter as the stem or a packing cutter. The illustration shows how to use a mandrel to cut packing.

Hold the packing tightly on the mandrel, but do not stretch excessively. Cut the ring and insert it into the stuffing box, making certain that it fits the packing space properly. Each additional ring can be cut in the same manner.

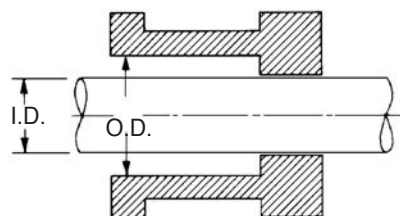
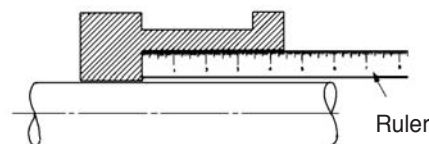
4. Install one ring at a time. Make sure it is clean, and has not picked up any dirt in handling. Seat each ring firmly, making sure it is fully seated before the next ring is installed. Joints of successive rings should be staggered and kept at least 90° apart. When enough rings have been individually seated so that the nose of the gland follower will reach them, individual tamping of the rings should be supplemented by the gland follower. Bring down the gland follower and apply load with the gland bolts.

5. After the last ring is installed, bring down the gland follower and apply 25% to 35% compression to the entire packing set. If possible, record the gland nut torque values and actuate the valve through five (5) complete cycles (ending with the stem in the down position). Retighten the gland bolt nuts to the previously recorded torque value after each full actuation.

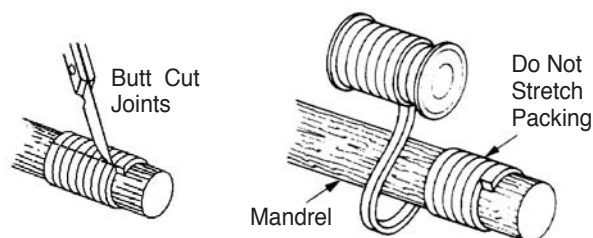
Step 1



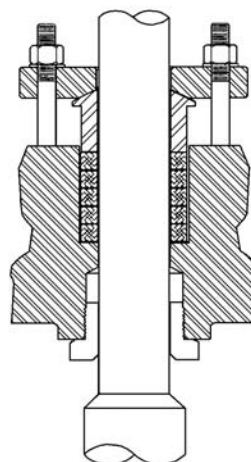
Step 2



Step 3



Steps 4 and 5



Pump Packing

1. Remove all the old packing with packing hooks, being careful not to damage the shaft or sleeve. This means all rings, even the lantern ring and the rings below the lantern. Clean the stuffing box and examine the shaft and sleeve. Replace any worn parts that are scored or deeply grooved.
2. Measure and record shaft diameter, stuffing box bore and box depth. To determine the correct packing size, measure the diameter of the shaft and the stuffing box bore. Subtract the shaft diameter from the bore diameter and divide the difference by two. This is the required cross-sectional size.

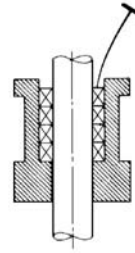
3. Always cut the packing into individual rings. Never wind the packing into a coil in the stuffing box. Rings should be cut with a butt joint. Cut rings by using a mandrel with the same diameter as the shaft in the stuffing box area. If there is no wear, rings can be cut on the shaft outside the stuffing box.

Hold the packing tightly on the mandrel, but do not stretch excessively. Cut the ring and insert it into the stuffing box, making certain that it fits the packing space properly. Each additional ring can be cut in the same manner.

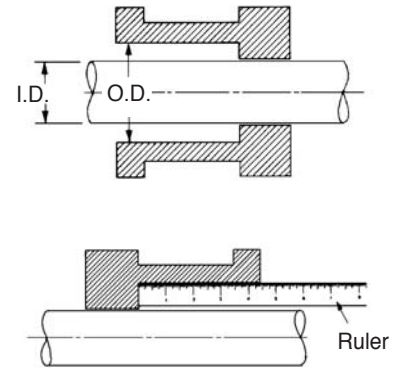
4. Install one ring at a time. Make sure it is clean, and has not picked up any dirt in handling. Lubricate the I.D. of each ring lightly. Start one end and then the other, butted closely. Work around circumference from either or both directions. Joints of successive rings should be staggered and kept at least 90° apart. Each individual ring should be firmly seated with a tamping tool. When enough rings have been individually seated so that the nose of the gland follower will reach them, individual tamping should be supplemented by the gland.

5. If a lantern ring is provided, make sure the lantern ring is installed under the pipe tap hole.
6. After the last ring is installed, bring the follower down on the packing and finger-tighten the gland nuts. Do not jam the packing by excessive gland loading. Start pump, and tighten the bolts until leakage is decreased to a tolerable minimum. Make sure gland bolts are tightened evenly. Stopping leakage entirely at this point will cause the packing to burn up.
7. Allow packing to leak freely upon startup after re-pack. Gradually reducing leakage during the first hour of operation will result in a better seal over a

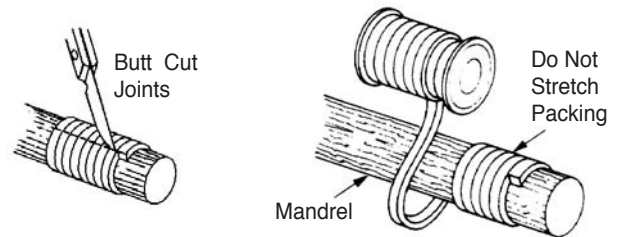
Step 1



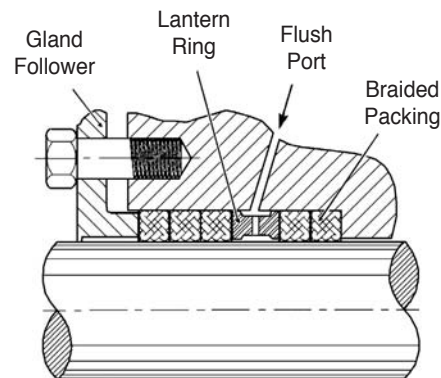
Step 2



Step 3



Steps 5 and 6



longer period of time. Tighten the gland nuts one flat at a time until the desired leakage is obtained, and the pump is running cool.

Testing

Functional Testing

Pump Test Fixtures

Garlock Compression Packing has three different pump test fixture designs used for evaluating pump packing set types and arrangements.

Media: Ambient temperature water
Note: The end suction pump system, due to the dynamics of a closed loop system, can produce water temperatures as high as 160°F (70°C).

Abrasives: Can be introduced into the end suction pump system

Shaft Speeds: From 367 fpm to 2,100 fpm (1.63 m/s to 9.33 m/s)

Packing cross sections: Typically 3/8" (9.5 mm) cross section, but modifications can be made to test up to 5/8" (15.8 mm) cross section.

Stuffing box pressures: 2 psi to 120 psi (0.1 to 8.3 bar)

Note: Pressures above 60 psi (4.1 bar) are achieved by throttling down the discharge flow in the end suction pump.

Stuffing box depths: 1.500" to 2.250" (38.1 mm to 57.2 mm)

High Temperature/Pressure Valve Test Fixtures

The basic design layout for this fixture was produced by Dayton T. Brown (an independent test laboratory in Bohemia, New York) for sanctioned qualification testing by the U.S. Military. Of four test valve positions, two use custom-made valve bonnets in MOV-type test scenarios, and two are standard production block valve bonnets that are hand-actuated.



Garlock Valve Test Fixture

Material Testing

Material Testing Laboratory

The various testing capabilities are often used to check conformance to ISO material and processing specification requirements.

The Garlock Compression Packing facility has the capability to perform a range of in-house chemical and physical testing exercises. These tests are used to qualify or to check the conformance of incoming raw materials as an aid to in-process checks, or as a final qualification check to ensure that finished products meet the customer's agreed-upon specifications. Whenever possible and practical, Garlock performs its testing pro-grams in conformance with existing ASTM procedures.

Examples of testing capabilities are:

- Wet chemical testing
- Weight loss determination
- Exposure—radiation, argon, etc.
- Yields—braid, ring
- Tensile strength
- Density determinations

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Gasket Spacers

Gasket spacers are used in conjunction with braided packing rings to:

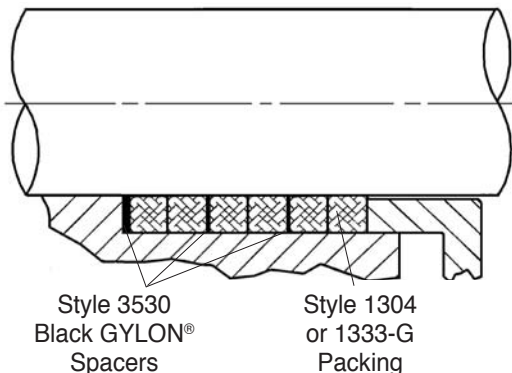
- Close up the clearances around the inside diameter of the packing set, keeping solid particles from progressing through the packing set along with the liquid leakage
- Act as a throttle bushing and reduce the pressure on the outboard side of the spacer, in applications where the leakage rate is relatively high
- Keep the packing from extruding beyond the stuffing box bottom, where there are excessive clearances between the I.D. of the stuffing box bottom and the shaft O.D. (This problem may occur through wear, corrosion, or simply the way a piece of equipment is manufactured)

In applications involving high stuffing box pressures (particularly reciprocating pumps) gasket spacers are also used to:

- Reduce the amount of leakage that occurs through the body of the braid, by forcing leakage to the I.D. of the packing set and eliminating O.D. leakage
- Keep the packing square, restrict packing movement, and prevent packing rollover and premature failure caused by excessive frictional forces

Stealth Packing Set* Option

- Optimal dry running situation—eliminate flush and lantern ring
- Combines Garlock Style 3530 GYLON® spacers with Style 1304 or 1333-G cut rings
- Contact Applications Engineering for details



Stealth Packing Set Spacer and Ring Arrangement

* Patent pending

Gland Load

Garlock recommends using one of these two methods to determine the proper gland load on a valve packing set.

Percent Compression Method

This method simply determines the distance the set should be compressed in order to achieve a seal. The recommended percent compression varies with packing style.

- | | |
|--------------------------------|-----------------|
| ■ 9000-EVSP Simplified | 30% compression |
| QUICKSET® 9001 | 30% compression |
| ■ 70#/ft³ density GRAPH-LOCK® | 25% compression |
| 70#/ft³ density #98 sets | 25% compression |
| ■ 90#/ft³ density GRAPH-LOCK® | 20% compression |
| 90#/ft³ density #98 sets | 20% compression |
| ■ Garlock braided packing only | 25% compression |

In cases where the system pressure is very high (over 2,500 psi or 72 bar), higher compression may be required to achieve a seal.

Predetermined gland bolt torque method

This method determines a more precise gland load. The bolt torque depends upon packing size, gland bolt size, packing style system pressure, and the number of bolts. The gland studs and nuts must be in good condition, cleaned with a wire brush and well-lubricated with a suitable grease.

Use the following equation to determine the appropriate bolt torque:

$$\text{Bolt torque} = \frac{(\text{Bore dia.}^2 - \text{Stem dia.}^2) \times (\text{Gland bolt dia.}) \times (\text{Load factor})}{76.39 \times (\text{No. of bolts})}$$

Where: Bolt torque is in ft. lbs.

Bore, stem, and bolt diameters are in inches

Load factor is in psi

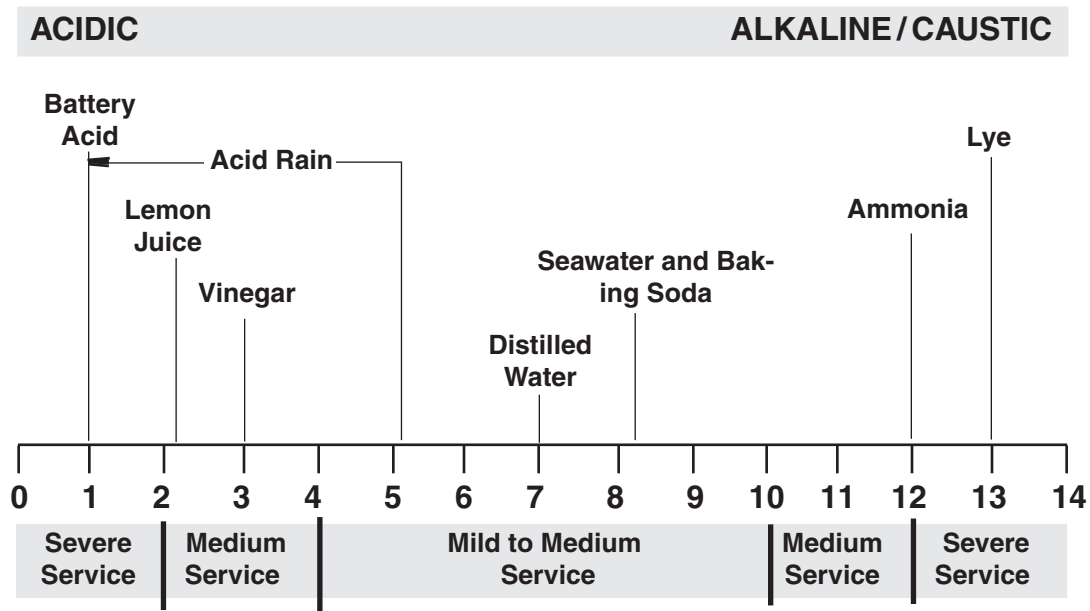
The load factor is determined by the following:

- For a 9000-EVSP Simplified set, a 9001 QUICK-SET® or a Style #98 and GRAPH-LOCK® set:
LF = 1.5 system pressure or 3,800 psi (whichever is greater)
- When using any other Garlock packing:
LF = 1.5 system pressure or 5,500 psi (whichever is greater)

pH Values

The scientific shorthand for indicating the level of acidity or alkalinity of a substance is the pH value. The

scale is logarithmic, making lye, at 13, ten times as alkaline as ammonia at 12.



Common Oxidizers

Oxidizers act as a catalyst and cause hydrocarbons to combine with oxygen and cause breakdown of the fiber. Here is a partial listing of the most commonly used strong oxidizers. (A complete listing is available from Garlock Applications Engineering.)

- (a) Fluorine, used as an oxidizer or rocket fuel.
- (b) Sulfur Trioxide, used to make sulfuric acid.
- (c) Aqua Regia (nitric and hydrochloric acid), used to dissolve metals.
- (d) Sodium Peroxide, used in dyeing, paper and oxygen generation.
- (e) Oleum (fuming sulfuric), used in detergent and explosive manufacturing.
- (f) Perchloric Acid, used in the manufacturing of explosives, esters and medicine.
- (g) Sulfuric Acid, greater than 75% and over 250°F, the most widely-used industrial chemical.
- (h) Chloric Acid, greater than 10% and over 200°F, ignites organic materials on contact.
- (i) Ferric Chloride, greater than 50% and over 200°F, used for sewage treatment, photography, medicine, etching, feed additives and oxidizing disinfectant.
- (j) Nitric Acid, used in fertilizer, explosives, etching, medicine, dyeing and drugs.
- (k) Chlorous Acid, greater than 10% and over 200°F.
- (l) Iodine, greater than 5% and over 200°F, used in soaps, medicine, some lubricants, dyes and salt.
- (m) Hydrofluoric Acid, greater than 40% and over 200°F, used for pickling, purification, dissolving ores, cleaning castings, etching, cleaning stone and brick, and fermentation.
- (n) Sodium Hypochlorite, greater than 5%, used in textiles, water purification and bleaching pulp and paper.
- (o) Sodium Chlorate, greater than 5%, used as bleach for paper pulp, medicine and leather textiles.
- (p) Calcium Chlorate, greater than 5%, used in pyrotechnics and photography.

Bolt Torques for Die-Formed Graphite Sets

| | | Bore Diameter (inches) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Stem Diameter (inches) | | | | | | | | | | | |
|-------|----|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------------------------|-------|-------|-------|-------|-----|-----|-----|-----|-----|-----|-----|
| | | 0.375 | 0.438 | 0.500 | 0.563 | 0.625 | 0.688 | 0.750 | 0.813 | 0.875 | 0.938 | 1.000 | 1.063 | 1.125 | 1.188 | 1.250 | 1.313 | 1.375 | 1.438 | 1.500 | 1.563 | 1.625 | 1.688 | 1.750 | 1.813 | 1.875 | 1.938 | 2.000 | 2.063 | 2.125 | 2.188 | 2.250 | 2.313 | 2.375 | 2.438 | 2.500 | | | | | | | |
| 0.625 | 6 | 5 | 3 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.688 | 8 | 7 | 6 | 4 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.750 | 10 | 9 | 8 | 6 | 4 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.813 | 13 | 12 | 10 | 9 | 7 | 5 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.875 | 16 | 14 | 13 | 11 | 9 | 7 | 5 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.938 | 18 | 17 | 16 | 14 | 12 | 10 | 8 | 5 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.000 | 21 | 20 | 19 | 17 | 15 | 13 | 11 | 8 | 6 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.063 | 25 | 23 | 22 | 20 | 18 | 16 | 14 | 12 | 9 | 6 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.125 | 28 | 27 | 25 | 24 | 22 | 20 | 17 | 15 | 12 | 10 | 7 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.188 | 32 | 30 | 29 | 27 | 25 | 23 | 21 | 19 | 16 | 13 | 10 | 7 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.250 | 35 | 34 | 33 | 31 | 29 | 27 | 25 | 22 | 20 | 17 | 14 | 11 | 7 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.313 | 39 | 38 | 37 | 35 | 33 | 31 | 29 | 26 | 24 | 21 | 18 | 15 | 11 | 8 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.375 | 44 | 42 | 41 | 39 | 37 | 35 | 33 | 31 | 28 | 25 | 22 | 19 | 16 | 12 | 8 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.438 | | 47 | 45 | 44 | 42 | 40 | 37 | 35 | 32 | 30 | 27 | 23 | 20 | 16 | 13 | 9 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.500 | | | 50 | 48 | 46 | 44 | 42 | 40 | 37 | 34 | 31 | 28 | 24 | 21 | 17 | 13 | 9 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.563 | | | | 53 | 51 | 49 | 47 | 44 | 42 | 39 | 36 | 33 | 29 | 26 | 22 | 18 | 14 | 9 | 5 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.625 | | | | | 58 | 56 | 54 | 52 | 49 | 47 | 44 | 41 | 38 | 34 | 31 | 27 | 23 | 19 | 14 | 10 | 5 | | | | | | | | | | | | | | | | | | | | | | |
| 1.688 | | | | | | 61 | 59 | 57 | 54 | 52 | 49 | 46 | 43 | 39 | 36 | 32 | 28 | 24 | 19 | 15 | 10 | 5 | | | | | | | | | | | | | | | | | | | | | |
| 1.750 | | | | | | | 64 | 62 | 60 | 57 | 54 | 51 | 48 | 45 | 41 | 37 | 33 | 29 | 25 | 20 | 15 | 10 | 5 | | | | | | | | | | | | | | | | | | | | |
| 1.813 | | | | | | | | 68 | 65 | 63 | 60 | 57 | 54 | 50 | 47 | 43 | 39 | 35 | 30 | 26 | 21 | 16 | 11 | 6 | | | | | | | | | | | | | | | | | | | |
| 1.875 | | | | | | | | | 73 | 71 | 68 | 66 | 63 | 59 | 56 | 52 | 49 | 45 | 40 | 36 | 31 | 27 | 22 | 17 | 11 | 6 | | | | | | | | | | | | | | | | | |
| 1.938 | | | | | | | | | | 77 | 74 | 72 | 68 | 65 | 62 | 58 | 55 | 51 | 46 | 42 | 37 | 33 | 28 | 23 | 17 | 12 | 6 | | | | | | | | | | | | | | | | |
| 2.000 | | | | | | | | | | | 80 | 78 | 75 | 71 | 68 | 64 | 61 | 57 | 52 | 48 | 44 | 39 | 34 | 29 | 23 | 18 | 12 | 6 | | | | | | | | | | | | | | | |
| 2.063 | | | | | | | | | | | | 84 | 81 | 78 | 74 | 71 | 67 | 63 | 59 | 54 | 50 | 45 | 40 | 35 | 30 | 24 | 18 | 12 | 6 | | | | | | | | | | | | | | |
| 2.125 | | | | | | | | | | | | | 87 | 84 | 81 | 77 | 73 | 69 | 65 | 61 | 56 | 52 | 47 | 41 | 36 | 31 | 25 | 19 | 13 | 7 | | | | | | | | | | | | | |
| 2.188 | | | | | | | | | | | | | | 94 | 91 | 88 | 84 | 80 | 76 | 72 | 68 | 63 | 58 | 53 | 48 | 43 | 37 | 32 | 26 | 20 | 13 | 7 | | | | | | | | | | | |
| 2.250 | | | | | | | | | | | | | | | 98 | 94 | 91 | 87 | 83 | 79 | 75 | 70 | 65 | 60 | 55 | 50 | 44 | 38 | 33 | 26 | 20 | 14 | 7 | | | | | | | | | | |
| 2.313 | | | | | | | | | | | | | | | | 102 | 98 | 94 | 90 | 86 | 82 | 77 | 72 | 67 | 62 | 57 | 51 | 46 | 40 | 34 | 27 | 21 | 14 | 7 | | | | | | | | | |
| 2.375 | | | | | | | | | | | | | | | | | 105 | 101 | 97 | 93 | 89 | 84 | 80 | 75 | 69 | 64 | 59 | 53 | 47 | 41 | 34 | 28 | 21 | 14 | 7 | | | | | | | | |
| 2.438 | | | | | | | | | | | | | | | | | | 109 | 105 | 101 | 97 | 93 | 89 | 84 | 80 | 75 | 69 | 64 | 59 | 53 | 47 | 41 | 34 | 28 | 21 | 14 | 7 | | | | | | |
| 2.500 | | | | | | | | | | | | | | | | | | | 113 | 109 | 105 | 101 | 96 | 92 | 87 | 82 | 77 | 72 | 66 | 60 | 54 | 48 | 42 | 35 | 29 | 22 | 15 | 7 | | | | | |
| 2.563 | | | | | | | | | | | | | | | | | | | | 117 | 113 | 108 | 104 | 99 | 95 | 90 | 85 | 79 | 74 | 68 | 62 | 56 | 50 | 43 | 36 | 30 | 22 | 15 | 8 | | | | |
| 2.625 | | | | | | | | | | | | | | | | | | | | | 120 | 116 | 112 | 107 | 103 | 98 | 92 | 87 | 82 | 76 | 70 | 64 | 58 | 51 | 44 | 37 | 30 | 23 | 16 | 8 | | | |
| 2.688 | | | | | | | | | | | | | | | | | | | | | | 129 | 124 | 120 | 115 | 111 | 106 | 101 | 95 | 90 | 84 | 78 | 72 | 66 | 59 | 52 | 45 | 38 | 31 | 24 | 16 | | |
| 2.750 | | | | | | | | | | | | | | | | | | | | | | | 133 | 128 | 124 | 119 | 114 | 109 | 103 | 98 | 92 | 86 | 80 | 74 | 67 | 61 | 54 | 47 | 39 | 32 | 24 | | |
| 2.813 | | | | | | | | | | | | | | | | | | | | | | | | 137 | 132 | 127 | 122 | 117 | 112 | 106 | 101 | 95 | 89 | 82 | 76 | 69 | 62 | 55 | 48 | 40 | 33 | | |
| 2.875 | | | | | | | | | | | | | | | | | | | | | | | | | 141 | 136 | 131 | 126 | 121 | 115 | 109 | 103 | 97 | 91 | 84 | 78 | 71 | 64 | 56 | 49 | 41 | | |
| 2.938 | | | | | | | | | | | | | | | | | | | | | | | | | | 150 | 145 | 140 | 135 | 129 | 124 | 118 | 112 | 106 | 100 | 93 | 87 | 80 | 73 | 65 | 58 | 50 | |
| 2.998 | | | | | | | | | | | | | | | | | | | | | | | | | | | 154 | 149 | 144 | 138 | 133 | 127 | 121 | 115 | 109 | 102 | 96 | 89 | 82 | 74 | 67 | 59 | |
| 3.063 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 158 | 153 | 148 | 142 | 136 | 130 | 124 | 118 | 112 | 105 | 98 | 91 | 84 | 76 | 68 | |
| 3.125 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 162 | 157 | 152 | 146 | 140 | 134 | 127 | 121 | 114 | 107 | 100 | 93 | 85 | 77 | |
| 3.188 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 172 | 167 | 161 | 155 | 150 | 143 | 137 | 131 | 124 | 117 | 110 | 103 | 95 | 87 |
| 3.250 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 177 | 171 | 165 | 159 | 153 | 147 | 140 | 134 | 127 | 120 | 112 | 105 | 97 |
| 3.313 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 181 | 175 | 169 | 163 | 157 | 150 | 144 | 137 | 130 | 122 | 115 | 107 |
| 3.375 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 185 | 180 | 173 | 167 | 161 | 154 | 147 | 140 | 133 | 125 | 117 |
| 3.438 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 189 | 184 | 177 | 171 | 164 | 157 | 150 | 143 | 136 | 128 | 120 |
| 3.500 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Torque in ft-lbs per inch of bolt diameter
To estimate stud torque required for 3,800 psi gland load, multiply gland stud diameter by the number in the table corresponding to the correct stem and bore diameters.

- Notes:

1. This table yields ft.-lb. torque values corresponding to a 3,800 psi gland load. This is not a suitable gland

Ordering Information

Braided Packing

Sizes

| Inches | mm | Inches | mm |
|--------|-----------|--------|-------------|
| 1/8 | 3 x 3 | — | 12 x 12 |
| — | 4 x 4 | 1/2 | 12.7 x 12.7 |
| 3/16 | 5 x 5 | 9/16 | 14 x 14 |
| — | 6 x 6 | 5/8 | 16 x 16 |
| 1/4 | 6.5 x 6.5 | 11/16 | 18 x 18 |
| 5/16 | 8 x 8 | 3/4 | 19 x 19 |
| 3/8 | 9.5 x 9.5 | 13/16 | 20 x 20 |
| — | 10 x 10 | 7/8 | 22 x 22 |
| 7/16 | 11 x 11 | 1 | 25 x 25 |

Note: Additional cross-sections available on request.

Die-Formed Rings

Garlock can produce die-formed rings in more than 5,000 sizes. When placing your order, specify the I.D., the O.D., the ring/set height (and density if necessary).



RPM / FPM Conversion Table

| | | Shaft Rotary Speed (RPM) | | | | | | | | | | | | |
|---------------------|--------|--------------------------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 100 | 300 | 500 | 1,000 | 1,500 | 1,750 | 2,000 | 2,500 | 3,000 | 3,600 | 4,000 | 4,500 | 5,000 |
| Shaft Diameter (in) | 0.500 | 13 | 39 | 65 | 131 | 196 | 229 | 262 | 327 | 393 | 471 | 524 | 589 | 654 |
| | 0.750 | 20 | 59 | 98 | 196 | 295 | 344 | 393 | 491 | 589 | 707 | 785 | 884 | 982 |
| | 1.000 | 26 | 79 | 131 | 262 | 393 | 458 | 524 | 654 | 785 | 942 | 1,047 | 1,178 | 1,309 |
| | 1.250 | 33 | 98 | 164 | 327 | 491 | 573 | 654 | 818 | 982 | 1,178 | 1,309 | 1,473 | 1,636 |
| | 1.500 | 39 | 118 | 196 | 393 | 589 | 687 | 785 | 982 | 1,178 | 1,414 | 1,571 | 1,767 | 1,963 |
| | 1.750 | 46 | 137 | 229 | 458 | 687 | 802 | 916 | 1,145 | 1,374 | 1,649 | 1,833 | 2,062 | 2,291 |
| | 2.000 | 52 | 157 | 262 | 524 | 785 | 916 | 1,047 | 1,309 | 1,571 | 1,885 | 2,094 | 2,356 | 2,618 |
| | 2.500 | 65 | 196 | 327 | 654 | 982 | 1,145 | 1,309 | 1,636 | 1,963 | 2,356 | 2,618 | 2,945 | 3,272 |
| | 3.000 | 79 | 236 | 393 | 785 | 1,178 | 1,374 | 1,571 | 1,963 | 2,356 | 2,827 | 3,142 | 3,534 | 3,927 |
| | 3.500 | 92 | 275 | 458 | 916 | 1,374 | 1,604 | 1,833 | 2,291 | 2,749 | 3,299 | 3,665 | 4,123 | 4,581 |
| | 4.000 | 105 | 314 | 524 | 1,047 | 1,571 | 1,833 | 2,094 | 2,618 | 3,142 | 3,770 | 4,189 | 4,712 | 5,236 |
| | 5.000 | 131 | 393 | 654 | 1,309 | 1,963 | 2,291 | 2,618 | 3,272 | 3,927 | 4,712 | 5,236 | 5,890 | |
| | 6.000 | 157 | 471 | 785 | 1,571 | 2,356 | 2,749 | 3,142 | 3,927 | 4,712 | 5,655 | | | |
| | 7.000 | 183 | 550 | 916 | 1,833 | 2,749 | 3,207 | 3,665 | 4,581 | 5,498 | | | | |
| | 8.000 | 209 | 628 | 1,047 | 2,094 | 3,142 | 3,665 | 4,189 | 5,236 | | | | | |
| | 9.000 | 236 | 707 | 1,178 | 2,356 | 3,534 | 4,123 | 4,712 | 5,890 | | | | | |
| | 10.000 | 262 | 785 | 1,309 | 2,618 | 3,927 | 4,581 | 5,236 | | | | | | |

Compression Packing Application Data Form

Customer _____

Phone _____
Email _____

Submitted by _____

Date _____
Fax _____

Service Conditions

Shaft speed _____ rpm (or) _____ fpm
Temperature _____ °F (or) _____ °C
Pressure _____ psi (or) _____ bar
Media (What is being sealed) _____ pH _____

Equipment

Specify pump, valve, mixer, etc. _____

Shaft dia. _____ Bore dia. _____ Box depth _____
General condition of equipment and environment _____

Packing

What is presently being used? _____
Any problems with this material? _____

Comments _____

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- Factory sales representatives and applications engineers available for problem solving when and where it is needed.
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- Factory-sponsored product training programs, including hands-on seminars, to ensure that Garlock representatives and their distributor personnel are the best in the industry.
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