

### SECTION 1: GARLOCK LOW EMISSION PACKING INSTALLATION

These guidelines and instructions are applicable to our valve stem packing products when best sealing is desired for fugitive emission control. Refer to our General Valve Packing Instructions (in Section 2) to find installation instructions for steam or other applications requiring different performance considerations.

#### 1.1 VALVE CONDITION ASSESSMENT

Packing is designed to conform under axial load and generate radial load on stem and inside of the stuffing box. A smooth surface will create best seal with the packing and allow it to consolidate and fill any void properly when loaded by the gland follower. Therefore, it is necessary to assess conditions

of all the parts of the valve involved and fix or replace what is necessary. Here are important features to verify:

»» Inspect Stuffing box and stem: Both should be clean and be free of burrs, pitting, scoring or corrosion on surface. The box bottom should be flat. If box bottom is beveled, we recommend the use of a system compatible braided packing ring to be installed at the bottom of the stuffing box (before the bushing if one is necessary). Unless the bushing is already designed to accommodate the bottom beveled angle of the box.

»» The valve stem surface should be smooth and not present scratches, pits or scores. Any found shall not exceed 0.002" (.051 mm) depth and/or depth-to-width ratio greater than 1.00.

»» Stem surface finish recommended: 16 - 32  $\mu$ inch (0.40 - 0.81  $\mu$ m) AARH. Stuffing box inner surface should be smooth and not present scratches, pits or voids found to be deeper than 0.006" (.152 mm). For best FE sealing, a bore finish: 63  $\mu$ inch (1.60  $\mu$ m) AARH or less is recommended. (Bore finish shall not exceed 125  $\mu$ inch (3.20  $\mu$ m) AARH)

»» Valve stem warpage/runout must be checked over of the entire length of the stem and shall not exceed 0.001 in/in

»» Inspect gland follower and packing bushing or spacer (if applicable). The surface in contact with packing should be flat. The inside diameter (ID) to stem clearance should not exceed .060" (1.52 mm). The outside diameter (OD) to stuffing box bore should not exceed .030" (.76 mm).

»» Inspect Gland flange. It should be straight.

»» Inspect fasteners. These need to be in new or near new condition to ensure that torque load is transferred properly to gland follower and packing set. Gland bolts and nuts shall run freely on the threads. Before fastening and tightening, an anti-seize lubricant needs to be applied on gland nuts and bolts. Use of hardened flat washers is highly recommended to prevent wear and damage to fasteners and gland flange. The lubricant shall not contain any potential volatile organic compounds (VOC).

**CAUTION: Follow plant safety procedures to ensure valve is out of service and can be handled safely before moving forward with installation. Review below instructions carefully before proceeding with packing replacement.**

#### 1.2 STYLE 1303FEP LOW EMISSION DIE-FORMED PACKING SET INSTALLATION

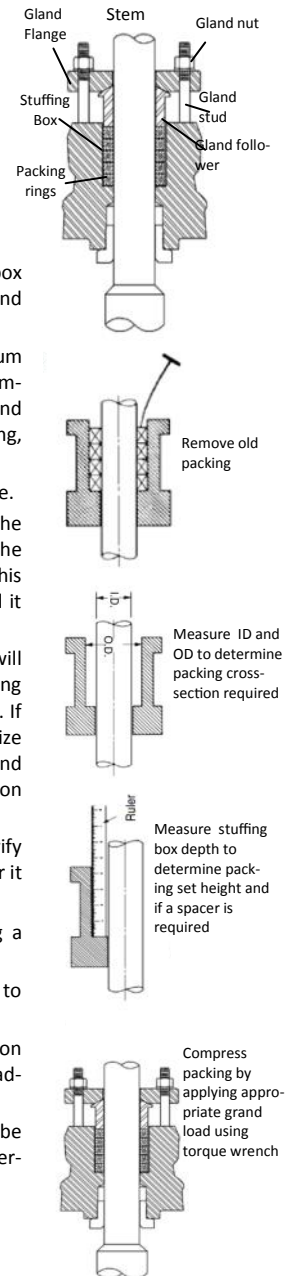
1. Read the instructions entirely before beginning installation.
2. Raise the valve to the full open position. Remove all of the old packing from the stuffing box and dispose properly.
3. Inspect stuffing box for wear and cleanliness. Replace worn parts and clean as required to meet stuffing box condition requirements (see section 1.1- valve condition assessment).
4. Verify fit of packing size by measuring stem diameter (inner dimension) and stuffing box bore diameter (outer dimension). Subtract inner dimension from outer dimension and divide by two for the cross sectional size of packing.
5. Measure the stuffing box depth. Die formed packing will be compressed 25% minimum during install. Use a bushing\* to fill stuffing box if depth is greater than height of uncompressed packing set. A bushing should also be used if the gland follower is short and gland flange could bottom out leaving no room for future adjustment. Garlock 1998 EZ. Bushing, or a split metallic or machined carbon bushing can be used.

\*If help is required for appropriate bushing sizing please consult Garlock representative.

6. Install one ring at a time seating each ring firmly. Insert first ring of packing into the stuffing box, noting the location of the ring seam. Push this ring down till it contacts the bottom of the stuffing box. Install the second ring of packing, offsetting the seam of this ring by 90 degrees clockwise from that of the previous ring. Push this ring down until it contacts the ring below it. Do not lubricate the packing rings.
7. Apply compression to the lower rings in the set when possible. If the gland follower will reach down to contact the second ring, then use it to apply compression by tightening down on the gland bolts to the Minimum Recommended Torque (see below equation). If the gland follower does not contact the second packing ring, then insert a proper size bushing in the stuffing box and again, apply compression by tightening down on the gland bolts to the minimum recommended torque. Remove this bushing after the compression step.
8. Follow steps 6), 7) to install 2 more rings, carefully offsetting the seam as indicated. Verify that the gland follower is equally centered around the stem during tightening process or it will result in side loading the packing and/or possible contact with the stem.
9. Install final ring and apply recommended load to packing set with gland nuts using a torque wrench\*\*. Alternately tighten the nuts until the desired torque is reached.

\*\*If a torque wrench is not readily available, a work around compromise would be to apply 30% compression to the set.

10. Check to make sure there is a minimum of 0.125" (3.2 mm) gland follower penetration into the stuffing box and that there is sufficient gland follower remaining for future adjustment.
11. Perform a cycle and adjust procedure (see below Section 1.3). Gland nut torque should be re-checked and re-adjusted if necessary within 2 weeks after putting the valve into service.
12. Attach a tag to the valve for recording:
  - a. Final gland nut torque – manufacturers recommended load
  - b. Date of the completed installation
  - c. Date of the follow-up gland nut torque check and measured or re-torque load if applicable.



# Valve stem packing installation instructions

## Style 1303-FEP

### 1.3 CYCLE AND ADJUSTMENT PROCEDURE

To ensure an even compressive load throughout set:

The cycle and adjust procedure will reduce the likelihood of gland load loss over time. This procedure bolsters distribution of the compressive load (axial load) throughout the packing set and be converted into radial sealing stress by each packing ring. Optimal radial stress will be reached when gland load remains stable.

1. Install and compress packing set per guidelines and instructions (above).
2. Raise the valve stem to full open (up) position.
3. Check torque on gland stud nuts to establish a reference torque (this will be the torque applied that was calculated by using the recommended torque calculation formula gland load).
4. Actuate the stem through 3 full cycles.
5. Check the stud nut torque. If there has been any torque loss, alternately retighten the nuts to the reference value established above (step 3) or until the desired torque is reached.
6. Repeat steps 4 and 5 until no significant torque loss occurs after actuation.

### EQUATION FOR RECOMMENDED TORQUE - GLAND LOAD\*

$$\text{Torque} = 111.3 (D^2 - d^2) (\emptyset) / B$$

Where:

T = Torque on each bolt (FT-LBS)

D = Bore diameter (inches)

d = Stem Diameter (inches)

$\emptyset$  = Gland bolt diameter (inches)

B = Number of gland bolts

\*The torque calculated by this equation will yield a gland load of 8500 psi.

A detailed explanation of the torque calculation can be found in Low Emission Packing Owner's Manual - Appendix A. This document is available on-line

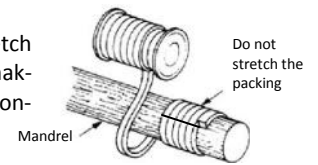
## SECTION 2: GENERAL VALVE STEM PACKING INSTALLATION INSTRUCTIONS

These general guidelines and instructions are applicable to our valve stem packing products used in steam or other applications not requiring fugitive emission control.

Refer to our Low Emission packing installation instructions in Section 1, when fugitive emission control is most important consideration.

1. Remove all of the old packing from the stuffing box.
2. 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.
3. 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.
4. 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.

5. 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.



6. 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.
7. 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.

**CAUTION:** Follow plant safety procedures to ensure valve is out of service and can be handled safely before moving forward with installation. Review below instructions carefully before proceeding with packing replacement.