



HANDLING AND INSTALLATION OF SEALS

The predominant failure mode of subsea housings is seal failure. PREVCO SUBSEA housings employ O-ring seals for vent ports, relief valves, connectors and end cap closures. Analysis of O-ring seals in certain underwater connectors that have been in use for decades show that roughly 8 out of 13 leaks past the O-rings result from improper installation and assembly or from improper quality control and inspection procedures at the time of assembly.¹ Therefore, the care and maintenance of O-ring seals may be the most important component of the assembly process to insure a long and successful operating life. The following abbreviated steps should be followed as a general guide for the handling and installation of O-ring seals. *Note that these steps should be repeated at every assembly; that is remove, inspect and reinstall all O-ring seals prior to each assembly. Dirt and air borne debris (particularly human hair) can often lead to seal failure. Always clean and lubricate seals and components immediately prior to assembly.*

1. **Storage-** NITRILE (BUNA-N) is the PREVCO standard subsea housing seal material. Alternate materials that may be supplied for special applications may have different storage and handling requirements – see manufacturers recommendations. NITRILE is subject to aging damage when exposed to ultraviolet radiation, ozone or elevated temperature. Always store spare seals in a clean environment protected from direct sunlight, ozone and elevated temperatures. Discard any seal with damaged packaging or a cure date that is over 5 years old. *Note: O-ring seals discarded for any reason should be cut completely through with a pair of scissors to prevent accidental re-use.*
2. **Seal Surface Inspection-** Prior to installing O-ring seal, inspect all seal surfaces for cleanliness, proper finish and absence of defects. Surfaces and edges must be free of all contaminants, dirt, nicks, scratches, gouges, marks and burrs. Minor burrs can be removed by “touching” them with 400 grit emery paper, provided that the surface coating is not compromised. Do not install O-rings on components that are not free of burrs or other imperfections.
3. **Clean Seal Surfaces-** Clean sealing surfaces and all surfaces that the O-ring may come in contact with during installation. Use Isopropyl Alcohol for all surfaces other than polyacrylate and polyurethane.
4. **Prepare Seal Surfaces-** Mask any sharp edges over which the O-ring must pass during installation (threads, holes,..etc). Do not mask the seal groove edge.

¹ Sandwith, C. J., O-ring Installation for Underwater Components and Applications, NRL Memorandum Report 4809, April 15, 1982



Apply seal lubricant (see bill of materials in appendix A) as a uniform thin film over entire seal groove and mating seal surface. For long life applications or for added anti-corrosion protection put sufficient lubricant in the groove that the groove will be full after the O-ring is installed.

5. **Seal Inspection-** Verify that packaged seal is the correct part number listed in the bill of materials and remove seal from package. During handling, carefully protect the seal from damage by fingernails, tools, dirt, contamination or chips. Thoroughly inspect seal for cracks, nicks, dents or flat spots that might inhibit sealing. MIL-STD-171 and MIL-STD-413 can be used as guidance. No defects are allowable. Again, any O-ring seals discarded for any reason should be cut completely through with a pair of scissors to prevent accidental re-use.
6. **Seal Preparation-** Clean seal using Isopropyl Alcohol for all materials other than polyacrylate and polyurethane. Apply a thin continuous film of seal lubricant (see bill of materials in appendix A) over the entire O-ring seal surface. While applying the lubricant, pass the entire seal through your fingers several times to insure complete coverage and simultaneously inspect by feeling for defects and debris which might have become trapped in the lubricant.
7. **Installation-** Do not use metal tools to install or remove O-rings from their grooves. Install the O-ring seal in its groove without excessive twisting or stretching. Preferably, O-rings should not be stretched more than 50% of their initial ID. Push the seal down to the bottom of its groove and all the way to the back, if it is a piston seal. Back is defined as the side that the O-ring will be pushed against during assembly. Inspect that the seal is evenly distributed and the same height around the groove. Run a finger completely around the exposed O-ring, feeling for any debris that may have attached to the lubricated surface. Remove excess lubricant or add lubricant, if desired, to fill the groove.

After the above installation steps are completed and prior to the next assembly it is recommended that an independent inspection operation be performed. The goal of this inspection is to provide a redundant check that all O-rings are installed and fitted up in their grooves correctly prior to closing the seal.

8. **O-Ring Removal** – To remove an O-ring from its groove follow the process outlined below. Do not use any metal tools to aid in the removal of O-rings seals as they may damage the sealing surface or the O-ring itself..



Place the index fingers approximately at the 10 and 2 o'clock positions as shown. *Note that some assemblies may require working the O-ring from near the 6 o'clock position to get develop a practical buckle in the O-ring.*



Stretch the o-ring by simultaneously applying inward radial pressure and circumferential translation until the seal buckles as shown.



Grasp the buckled portion of the seal and remove the entire seal from the groove.

