FILMTEC Membranes

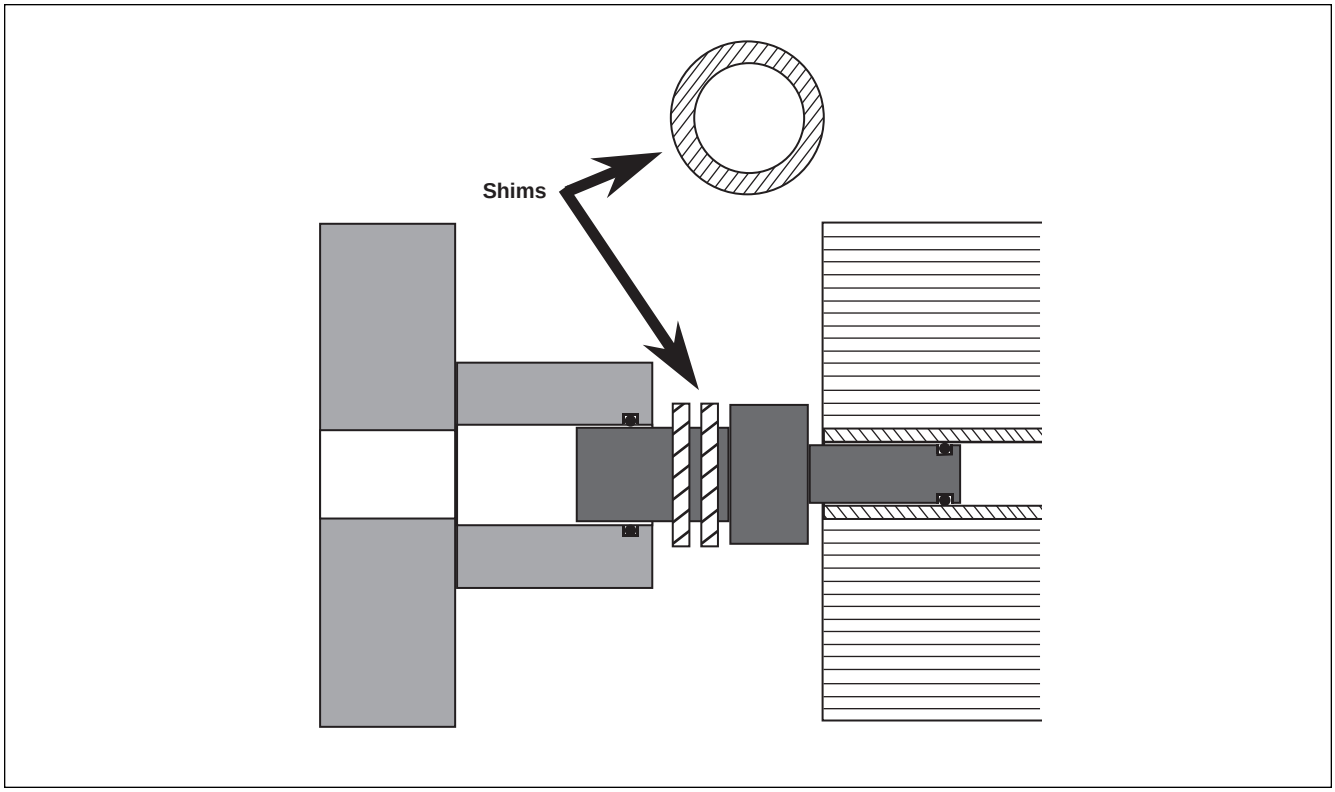
Shimming Elements in Pressure Vessels

Pressure vessels for membrane elements are all built with some excess total inside length to allow for slight variations in the length of the elements. The excess internal length is called freeboard. In operation, the elements can slip back and forth during startup and shutdown, causing wear to the internal seals. Additionally, the pressure vessel elongates when pressurized, which in the most extreme case could push the whole stack of elements off of the lead end adapter, resulting in a severe feed to permeate leak. Shimming the elements in a pressure vessel at the time they are loaded will minimize the shifting that occurs during startups and shutdowns and insures that the adapters are properly seated in the product water tubes of the lead and tail elements.

Shims themselves are plastic spacer rings (like washers), usually about 0.20 inches (5 mm) thick with an inside diameter slightly bigger than the pressure vessel head end of the adapter. Figure 1 shows a drawing of a typical shim and the placement of multiple shims on the adapter between the adapter hub and the pressure vessel head. Shims are always placed on the feed end adapter, keeping the stack of elements tight against the thrust ring and end plug on the brine end of the pressure vessel.

Shims can be purchase from your pressure vessel manufacturer. An alternative is to cut shims from an appropriately sized piece of polyvinylchloride (PVC) pipe. If cut from pipe, the shims must be free of burrs and must be cut parallel and flat to work correctly.

Figure 1. Shim and Placement on Feed End Adapter



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The process of shimming is performed after the membrane elements have been loaded. The element stack should be pushed completely into the vessel such that the downstream element is firmly seated against the thrust ring at the brine end of the vessel. Refer to the pressure vessel manufacturer's instructions on loading elements. From this point the procedure is as follows:

1. Remove the adapter o-ring and head seal from the feed end of these vessel components. This will assure that there is no interference from any of the sealing components and minimize the force required to "seat the head".
2. Remove the head and slide eight 0.20" spacers over the head end of the adapter that fits into the permeate port. Add enough spacers so it is not possible to install the retaining rings.
3. Remove one spacer at a time until you can just install the retaining rings. The slight remaining movement is acceptable.
4. Remove the head and reinstall the adapter o-ring and head seal.
5. Close the vessel per the manufacturer's instructions.

In some extreme cases, when the vessel is very long and stack of elements is short, one may have to shim on both the feed and brine ends of the vessel. Note this only needs to be done when shimming on the feed end only will cause a leak past the end of the adapter and into the permeate port in the pressure vessel head. In this case, shimming is done using the same procedure as above except that shims are added to the brine end adapter first and an equivalent number and thickness of 8-inch diameter shims are added to the thrust ring. If shims need to be added to the brine end of the vessel to center the stack, shims MUST be added to both the adapter and the thrust ring to prevent telescoping damage to the elements in operation.

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