VOLUMETRIC DISPLACEMENT OF ASHCROFT DIAPHRAGM SEALS

When a diaphragm seal is attached to a pressure measuring element, the diaphragm must have sufficient displacement to operate the element and a low spring rate to minimize the effect on the unit accuracy. The effect, if any, on the accuracy is due to the fact that the diaphragm adds to the spring rate of the pressure element/seal assembly.

Attached are volumetric spring rate curves for Metal, Viton, and Teflon diaphragm seals. These curves will assist you in selecting the proper diaphragm for the application based on the volumetric displacement of the pressure instrument.

For example, the full range volume displacement of a 4½″ 200 psi Bourdon tube @ approximately 0.01 cubic inches. The graph Fig. 1 for metal diaphragms, shows that approximately 0.3 psi is required to displace the diaphragm 0.01 cubic inches. Therefore, if the diaphragm is properly filled, the diaphragm induced error will be approximately 0.3 psi or 0.2% of range.

The need for recalibration will depend on the required accuracy and the range. Normally, gauges over 200 psi will not require calibration. Gauges with ranges below 200 psi have larger volumetric displacements and may require recalibration to retain the required unit accuracy. A 15 psi Bourdon tube has a full range displacement of approximately 0.02 cubic inches. From the same graph we see that it will take 0.6 psi to actuate the diaphragm. On a 15 psi gauge, 0.6 psi is 4 percent of range. Recalibration will be required.

The solid “Teflon” diaphragm graph Fig. 3 has a lower spring rate than the metal diaphragm, therefore, it has less effect on gauges than metal diaphragms. A Teflon diaphragm, for example, will add only 0.2 psi or 1.3 percent error to a 15 psi gauge. Recalibration should not be necessary on most gauge-seal assemblies using Teflon diaphragm.

Both the metal and solid Teflon diaphragms should be used only with Bourdon tube type instruments, or apparatus with relatively low volume displacements. For applications where larger volumetric displacement are required, (Type 1188 bellows gauges, Barton cells, etc.) an elastomeric “Viton” diaphragm should be used. For example, an 1188 bellows gauge has a volumetric displacement close to 0.08 cubic inch. The curve on Fig. 2 shows that for volumetric displacements up to 0.3 cubic inches, the diaphragm adds no measurable spring rate to the assembly, i.e., the diaphragm does not affect the gauge’s accuracy; recalibration is not necessary.

The vacuum side of the spring rate curves is included on all three graphs so that the curves can be used for both pressure and vacuum applications.

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ATTACHMENT B

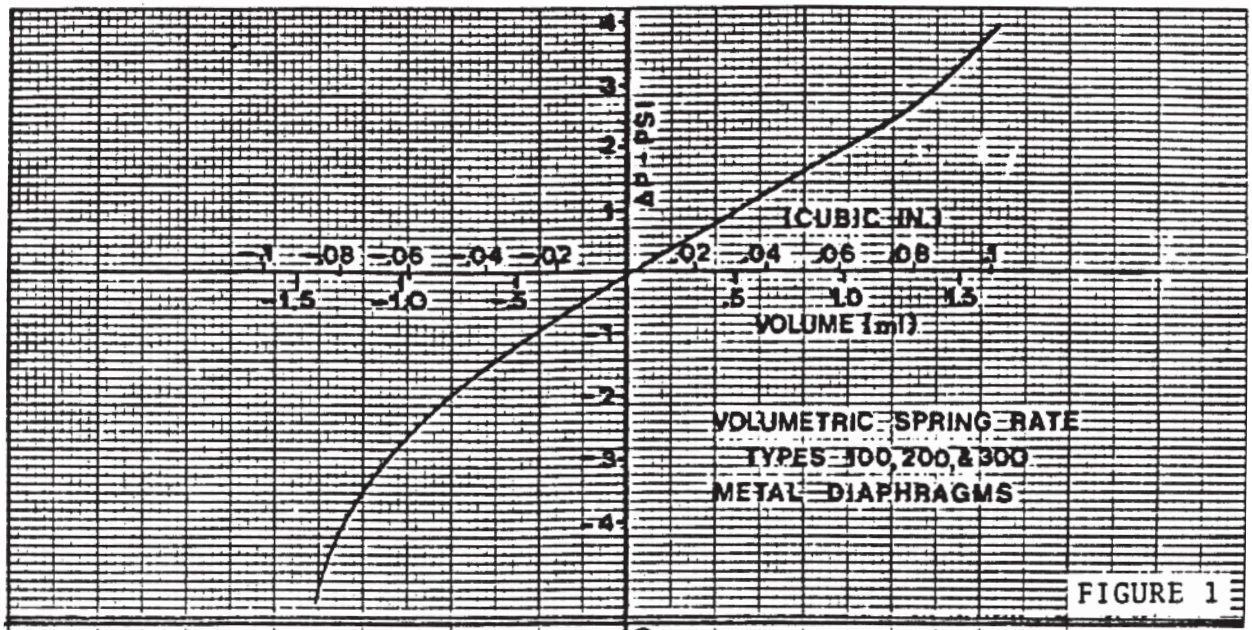

FIGURE 1

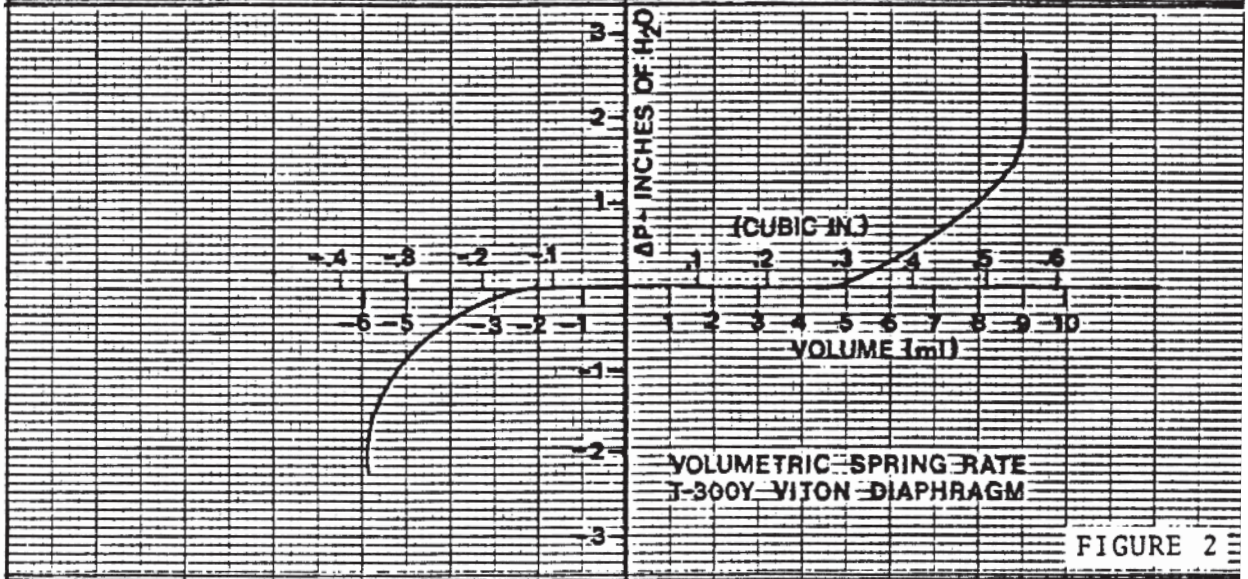

FIGURE 2

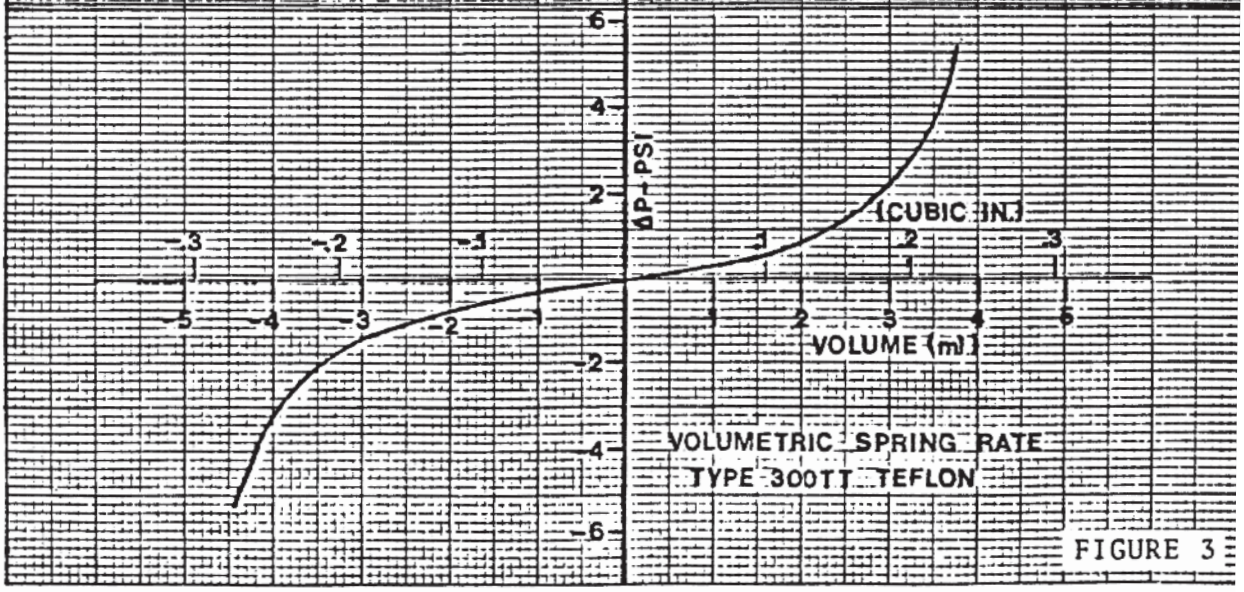

FIGURE 3