Onyx Valve Calibrating Machine I & M

Onyx Iso-Rings that are ordered as complete assemblies with gauges and other instruments come from the factory vacuum filled, calibrated, and ready to use. The Onyx Calibrator allows you to check the calibration of a gauge, transmitter, or pressure switch after the system has been installed and operating.

You can re-calibrate instruments attached to an Onyx Iso Ring, but always observe the following rule:

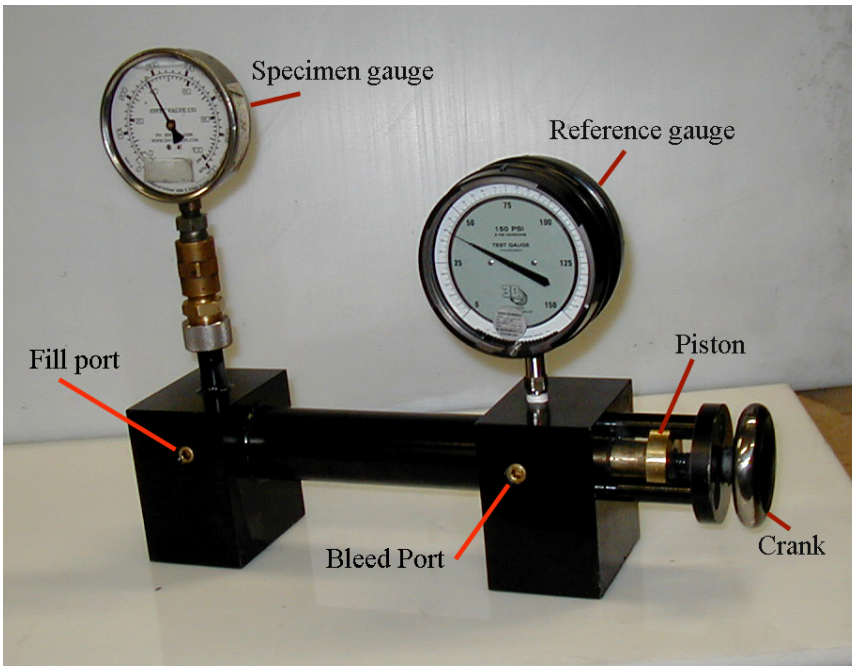
Never Introduce Air into the Instrument Assembly!

Air must be excluded from the device because it will compress to a smaller volume under pressure. This forces the rubber membrane to stretch, introducing error in the gauge reading. Beyond a certain point, the rubber cannot stretch further and pressure indication ceases.

If you are going to check or calibrate a gauge already mounted to an Isolator Ring, then the gauge has already been vacuum filled. If you want to attach a new gauge or other pressure instrument to the Isolator Ring, refer to a separate instruction manual for the correct procedure for preparing instruments for use with the Onyx Isolator Ring.

The Onyx Calibrator must be ordered with a **reference gauge**. This can be either a mechanical test gauge or an electronic gauge. For the calibration procedure to be valid, the reference gauge should be traceable to the NIST (formerly the American National Standards Institute), and the accuracy of the reference gauge must be at least four times better than the instrument you want to check. For example, if you want to calibrate a gauge with a rated accuracy of ±0.50%, the reference gauge should be accurate ±0.125% as a worst case.

Calibrator Operation:



1. The Onyx Calibrating Machine comes pre-filled with 50 Centi-Stoke Silicone instrument oil.

2. Always start with the reference gauge pressure at zero before attaching a specimen gauge or other pressure instrument to the Calibrator.

3. After a specimen gauge, switch or transmitter has been attached to the Calibrating machine, turn the crank clockwise to increase the test pressure. Turn the crank counter-clockwise to decrease the test pressure.

4. The Calibrator reservoir holds enough instrument oil to test numerous gauges. If it consumes enough oil, over time the piston will travel in towards the main housing until it comes up hard against the mechanical stop. When that happens, you have to add oil to the reservoir.

5. To add oil to the calibrator:

6. Turn the crank full counter-clockwise until the piston hits the outboard mechanical stop.

7. Lay the Calibrator on its back so that the fill port and bleed port are facing straight up.

8. Remove the fill plug and bleed plug.

9. Slowly pour fresh oil (50 Centi-Stoke Silicone Instrument Oil, available from Onyx valve Co) into the fill port until it rises into the bleed port. Either port can serve as the fill / bleed port.

10. Replace the fill and bleed plugs, and return the Calibrator to service.

Mounting and testing a gauge, switch or transmitter:

1. Reduce the pressure in the Calibration machine to zero. If the reference gauge on the Calibration Machine shows positive pressure, turn the crank counter-clockwise until the pressure drops to zero.

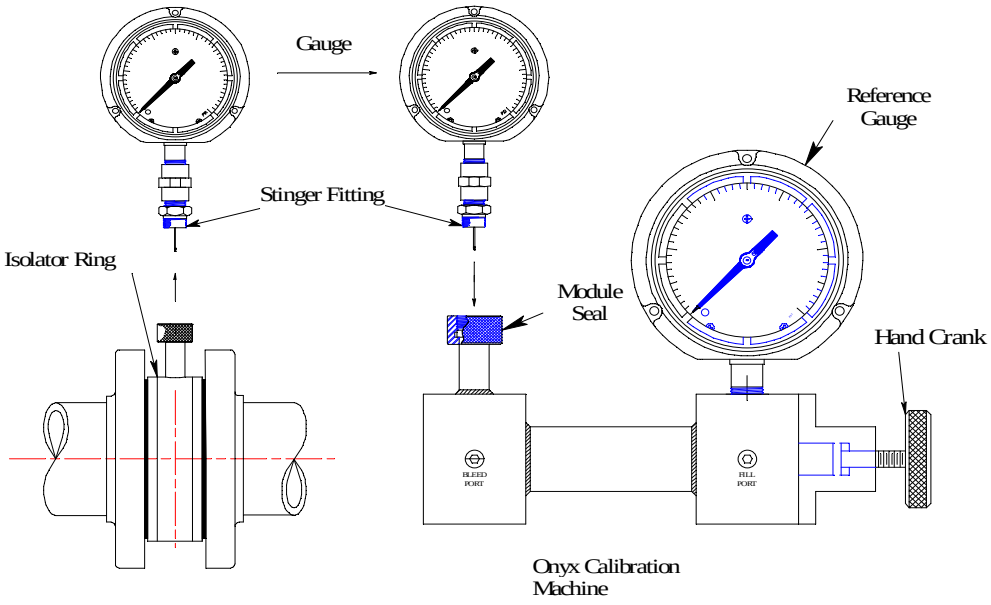
2. In the process piping, momentarily shut off the process pump to reduce the pressure as low as possible.

3. Remove the gauge from the Iso-Ring. Rotate the Lock Ring clock-wise as viewed from above. You should not need any tools to do this. The lock ring should be hand tight, but occasionally it needs a little nudge with a strap wrench or channel-lock pliers to get it started.

4. As you rotate the lock ring with one hand, hold the gauge or other pressure instrument with the other hand. When the Lock Ring is free from the Stinger Fitting, gently lift the gauge (or other pressure measuring device) from the Iso-Ring.

5. **DO NOT UNSCREW THE GAUGE FROM THE STINGER FITTING**

6. Transfer the gauge to the Module Seal adapter on the Calibrator machine as shown below.

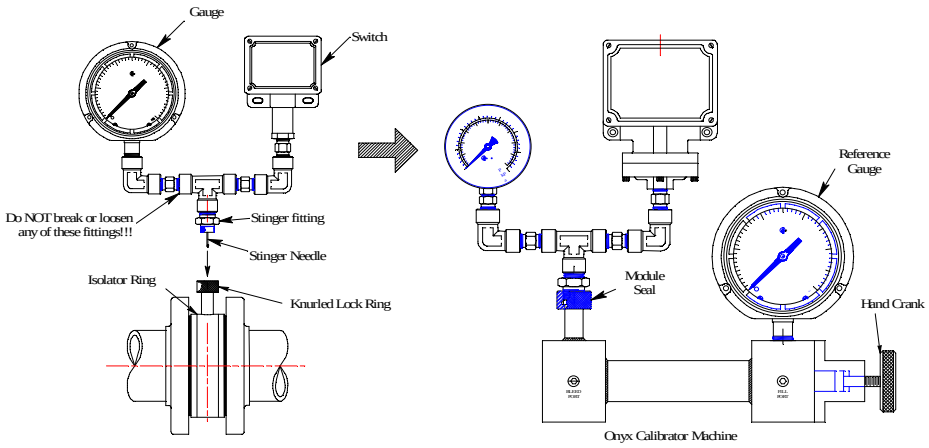


If you want to bring the gauge to another location for calibration:

- Locate the small rubber tip protector. This is supplied in a small zip-lock bag stapled to the Iso-Ring instruction manual. It is black, about 1/2" long. If you cannot find it, a small piece of rubber insulating tape will work fine.

- Slide the tip protector over the end of the needle. The gauge can now be transported or stored without compromising the vacuum fill.

7. If you have multiple instruments (such as a gauge and switch combination) mounted on the Isolator Ring:



Remove the entire "goal post" assembly in one piece as shown. Follow the same procedure as described above for removing a gauge.

Do NOT break any of the connections between the instruments, and do NOT loosen the connection between the stinger fitting and the piping manifold.

Mount the entire "goal post" assembly to the Calibration Machine as shown.

After calibration, remove the gauge and stinger fitting assembly from the Calibrating Machine. Re-attach the tip protector if the gauge is going to be separated from the Isolator Ring for more than a few minutes.

Return the gauge to the Isolator-Ring. Remove the tip protector and gently re-insert the stinger needle into the support post on the Iso-Ring. Reattach the Lock Ring to the stinger fitting and hand tighten.

Calibration Procedure:

After you have attached the specimen gauge (or the gauge and switch assembly, or a transmitter) to the Calibration Machine:

If you have a **utility gauge:**

This type of gauge is "maintenance free" (can't be fixed or calibrated). The only thing you can do with this type of gauge is verify that it is working, and that it is within its published parameters for accuracy. This is an ANSI grade-B device.

Allowable deviation is ±3% in the bottom third of scale, ±2% in the middle third of scale, and ±3% in the top third of scale. If the gauge is not within these limits, your only option is to discard and replace the instrument.

If you have a **process gauge:**

Calibrating a process gauge is a 3-step procedure:

a) Zero shift

b) Range error

c) Linearity

You also have to check the gauge for hysteresis, but excess hysteresis is not repairable.

ZERO SHIFT:

Zero Shift is a linear deviation of constant value over the entire scale range, and may cause either a plus or minus, indication. This condition is usually caused by a shift of pointer position on the pinion, or by a shift of the dial position.

Sometimes, when there is zero pressure in the gauge, it may read slightly high or low, but it reads correctly at pressures between 5% and 100% of scale. It is usually simpler to leave the zero adjust alone in this case.

Figure 1: Use a bezel wrench to revove the bezel ring

If you decide to recalibrate the zero adjustment on the gauge, you have to remove the lens, as the zero calibration is made through the front of the gauge.

The glass lens is held in place by the bezel ring, so the first step is to remove the bezel ring.

The bezel ring has 8 teeth facing inward to facilitate removal. Use a bezel wrench as shown in figure 1 to engage a pair of opposing teeth and rotate anti-clockwise.

Figure 2: Tapping the bezel ring.

If you don't have a bezel wrench, it ***is*** possible to remove the bezel ring with a screw driver and a SMALL hammer.

Set the screw driver against one of the bezel teeth, and give it a LIGHT tap with the hammer until it breaks loose. This takes an experienced touch to tap the ring free without breaking the teeth off the bezel ring. If you are going to calibrate any significant number of gauges, a bezel wrench is a worthwhile investment.

If the gauge is liquid filled, now you will have to deal with the fill fluid. Once the lens is off, carefully pour the fill fluid into a temporary storage container.

Figure 3: Remove the lens from the gauge.

CORRECTION FOR ZERO SHIFT. Compensation for this condition is accomplished very simply by repositioning the pointer, or on gages with adjustable dials - the dial, to agree with the indication of the reference gauge.

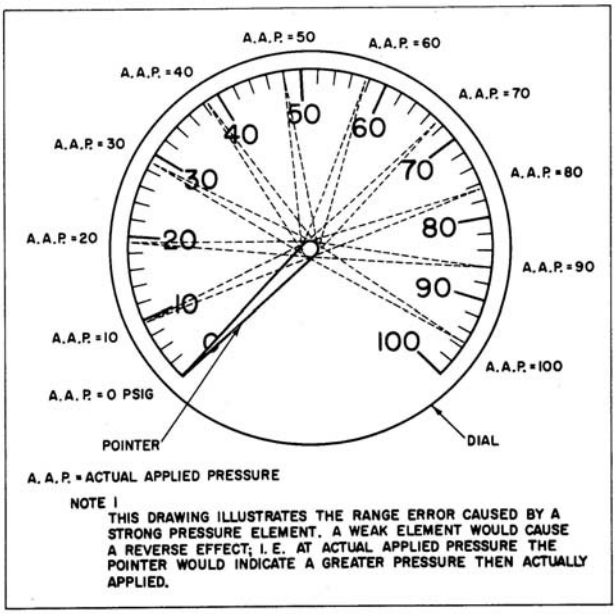
If the gauge is equipped with a micrometer zero adjustment screw, you turn the adjustment screw in the appropriate direction until it reads correctly throughout the entire range. If the gauge does not have a zero adjust micrometer screw, zero adjustment is accomplished by pulling the pointer off the pinion shaft with a pointer jack, and placing it back onto the shaft in the correct position.

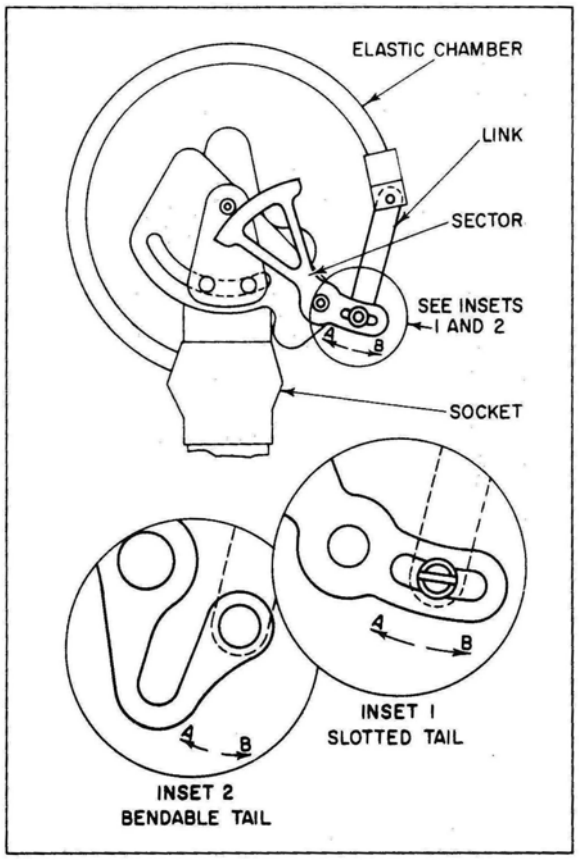
Figure 4: Re-zero the pointer.

RANGE ERROR:

Range Error is the pointer error of increasing, or decreasing, magnitude which is compounded as the pointer traverses the scale from zero to maximum scale indication. At maximum applied scale pressure, this condition causes the pointer to read short of maximum indication if the spring is too strong, or over maximum indication if the spring is weak. Range error is a function of the distance between the center of the arbor (sector pivot point) and the centerline of the linkage, which connects the spring with the sector.

To check for range error, turn the crank on the Calibration Machine clockwise to drive the test pressure up, and counter-clockwise to lower the test pressure back down.





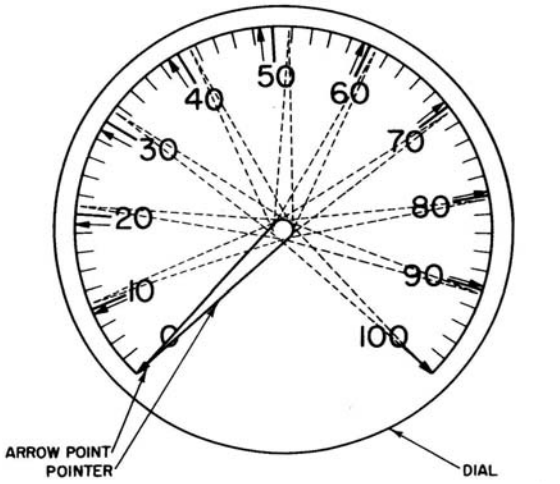
CORRECTION FOR RANGE ERROR. In order to access the linkage to correct a range error, you have to remove the back cover from the gauge.

When the pointer traverses the dial too slowly or too rapidly, the leverage rates at the tail of the sector must be moved to agree with the Bourdon spring's motion.

When the pointer moves too fast, the link screw should be loosened and moved a little at a time in the direction "B". If the pointer moves too slowly, the link should be moved in direction "A" until the indication agrees with the master. W hen properly set, the screw should be tightened securely.

SCALE SHAPE ERROR:

Scale Shape Error is a deviation in linearity which may vary in value and create either a plus and/ or minus indication at various points over entire scale range, even though the indication at the beginning and end of the scale is correct. The condition is a function of the length and position of the linkage, which connects the spring to the sector.

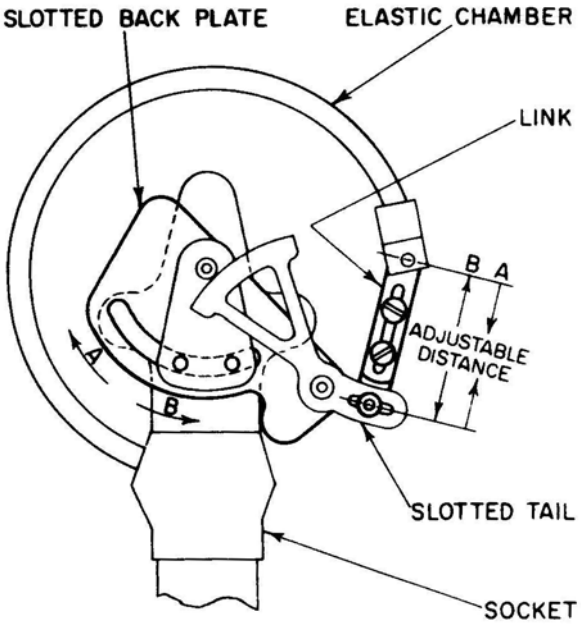


CORRECTION FOR SCALE SHAPE. This adjustment involves rotation of the entire movement, the locking screws of which are usually located at the rear of the gage. Units that do not provide the movement rotation feature may provide for adjustment in the length of the link which has essentially the same effect as rotation of the movement. Gages having lesser accuracy usually do not provide any means of scale shape adjustment.

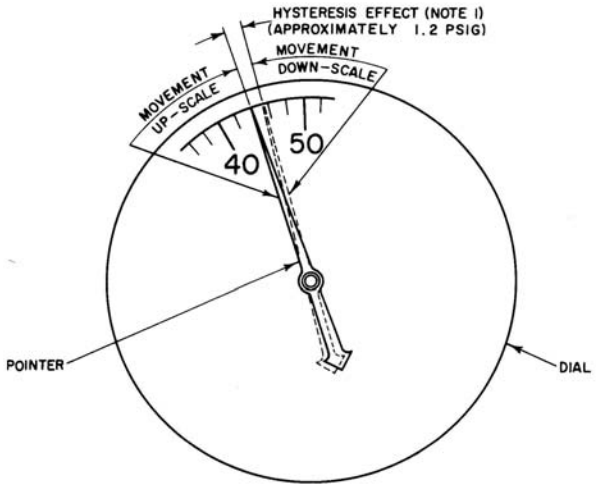
Solid front gages may be calibrated in the case by removing the safety back, which exposes all of the adjustments.

When the errors are increasingly plus for the first 50 per cent of the scale, the complete movement should be rotated in direction "A" as shown below, which has the same effect as shortening the link. Should the gage read increasingly slow for the first 50 per cent of the scale, the movement should be rotated in direction "B", which produces the effect of lengthening the link.

When the pointer travel is evenly divided on both sides of center, the proper angle between the link and sector tail has been established to provide the desired linearity. The locking screws should now be properly tightened to secure this position.



Hysteresis is the variation in pointer position, at any given point, between upscale and downscale indication after light tapping to minimize friction in the mechanism. It is important to understand t hat hysteresis differs from friction in that when hysteresis is present in a gage it cannot be eliminated. This condition will cause the indication to read high on decreasing pressure. Hysteresis is a function of elastic chamber repeatability.



NOTE 1
DEVIATION ILLUSTRATED IS HYSTERESIS EFFECT AT 44 PSIG AFTER TAPPING TO MINIMIZE FRICTION. THE DEVIATION IS USUALLY MAXIMUM AT APPROXIMATELY MID-SCALE.

CORRECTION FOR HYSTERESIS. As stated above, when hysteresis is present it cannot be eliminated. Therefore, there is no mechanical correction which can be made.

Questions?

Contact Onyx Valve Company
David Gardellin
Tel: 856-829-2888 X-12
Fax: 856-829-3080
E: David@onyxvalve.com