

# Regulator Orifice Change Procedure

Models 143, 243 and 046 Regulators

**The following orifice changing procedure is to be used in conjunction with the applicable Installation and Maintenance Instructions. It is NOT intended to replace them.**

1. Thoroughly read this entire procedure before attempting to replace an orifice on the Sensus models 143, 243 and 046 regulators. Refer to the following applicable installation and maintenance procedures when servicing the regulators, which may be found at [www.sensus.com](http://www.sensus.com) or by contacting your Sensus distributor.



## CAUTION

**If the regulator is installed in line, make sure the regulator and the external control lines to the regulator have been entirely depressurized before disassembly.**

2. In general, it is not necessary to disconnect the regulator body from the piping in order to change the orifice. However, when disassembling an in-line regulator that has been regulating a flammable gas, it is best to safely purge the remaining gas in the piping to a safe area. If this is not possible, ensure that there are no sources of ignition in the area when disassembling the regulator.



## CAUTION

**When working with regulators that regulate flammable gases, failure to safely purge the pipeline of the flammable gas to a safe location or failure to remove all ignition sources can result in injury and/or property damage.**

3. Carefully note the location and position of all disassembled parts to be certain reassembly is correct. Inspect each part and replace those that are worn, damaged or otherwise unsatisfactory.
4. If the regulator has an external control line, ensure that the control line has also been entirely depressurized before disconnecting. Disconnect the control line from one end of the line to free the diaphragm case assembly from the piping. (For the 243-DOT, the sensing line tubing between the regulator cases will need disconnected, or both regulator diaphragm assembly cases will need removed from their bodies.)



## CAUTION

**Control line must be isolated and depressurized before disconnecting from the regulator or piping.**

5. If the regulator unit utilizes a pilot regulator such as the 243-PL, 243-RPC, 243-RPC-A, or 243-RPC-B, disconnect one end of the pressure loading line running from the body to the pilot regulator in order to free the diaphragm case assembly from the body. When using a load limiting regulator on the 243-RPC, 243-RPC-A and 243-RPC-B, it is best to disconnect the connection of the tubing at the pilot regulator, leaving the load limiting regulator in its present position.



## CAUTION

**If the top of the regulator is pressure loaded from a source other than a pilot provided as part of the regulator itself, ensure that the source is isolated, and the line depressurized before disconnecting the line.**

6. To access the orifice, loosen the diaphragm case assembly from the body. This is accomplished by removing the connecting screws, bolts or nut that holds the case to the body. For the model 143-80 and 046, remove the one large union nut. For the model 243, remove the four union bolts. The 243-RPC, 243-RPC-A, and 243-RPC-B regulators utilize a model 43 power pilot regulator that provides a variable loading pressure on the main diaphragm. This orifice changing procedure does NOT cover changing the orifice in the model 43, and it is NOT recommended to do so. The model 43-PL utilizes an instrument regulator that provides a constant loading pressure on the main regulator diaphragm. The 243-RPC, 243-RPC-A, and 243-RPC-B may also utilize an instrument regulator referred to as a load limiting regulator, and is located between the tubing leading from the body to the 43 power pilot. The orifice changing procedure provided here does NOT apply to changing the orifices in these instrument regulators. The instructions provided are provided for changing the orifice in the model 143, 243 and 046 regulator bodies only.
7. Remove the diaphragm case assembly from the body and set the diaphragm case aside in a safe, clean area, away from processes or areas that could subject the case to dirt, grease, paint, high temperatures, damage, etc. If the regulator has a pressure sensing line or pressure loading line connected to it, ensure that the line is not bent, twisted, or subjected to the above referenced contaminants and conditions.
8. Inspect the orifice presently in the regulator. Check the size and material. For the 243 regulators, also check the angle of the valve. It will either be 10 degree or 30 degree. Check for adverse conditions such as excessive dirt, physical damage, corrosion, and any other abnormalities.
9. Remove the orifice from the body by unscrewing it using the applicable size "thin wall" type, hex socket wrench. The wrench should be in good condition, sharp, free of wear and not rounded. Applicable sizes for the socket wrenches are as follows:
  - 143 and 046 - 1"
  - 243 - 1-5/8"
10. With the orifice removed, clean the orifice area in the body of any dirt and pipe thread sealant. On a Low Pressure Cutoff (LPCO) regulator, be sure that the stem that will be traveling inside the orifice is clean of any dirt.
11. Verify size and material of new orifice. For the 243 regulators, verify the correct angle valve is installed for the regulator and orifice size.



## CAUTION

**The maximum inlet pressure to a regulator is limited by the orifice size. The 243 regulator maximum inlet pressure is also limited by the valve angle. Installation of an orifice and/or valve angle subjected to pressures higher than the rated inlet pressures can result in an unstable operating regulator, high lock-up pressure, and possible absence of lock-up.**

12. Verify the condition of the threads on the orifice and mating threads in the regulator body. If threads are damaged, do not use. Damaged threads could result in a leak path of the upstream pressure to the downstream, preventing lock-up of the regulator.

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13. Inspect the sealing edge of the orifice for any nicks or damage. If there is evidence of nicks or damage, do not use. A sealing edge that is damaged could prevent the valve seat from sealing off the inlet pressure and possibly prevent a positive lock-up of the regulator.
14. Clean the orifice area of the body, including the mating threads for the orifice, of any residual pipe sealant, scale, or other dirt. If possible, blow out the orifice area using an air hose.
15. Apply a moderate amount of thread sealant such as Best-O-Life or Rector Seal #5 to the male threads of the orifice. For the model 046, apply a thread sealant such as Loctite.
16. Place the orifice into center of body and seat it into the body. Using the thin wall type hex socket wrench referenced in step number 9, tighten the orifice in the body to 50 to 60 foot-pounds of torque.



## CAUTION

Orifice damage can occur if the socket slips off of the orifice during the installation process.

17. Clean any excess pipe sealant and any dirt from the body of the regulator. If possible, again blow out the orifice area using an air hose.
18. Again inspect the sealing edge of the orifice to ensure that no damage occurred during the tightening of the orifice into the body.
19. Prepare to reassemble the regulator by ensuring that the tetraseal is in good condition and properly positioned in the body.
20. Reassemble the regulator by reconnecting the diaphragm case assembly to the body, reinserting and tightening the screws, bolts or nut described in step eight above. The screws, bolts or nut should be tightened evenly and firmly, with enough force to hold the regulator diaphragm case in position and create a seal.

The coupling nut on the 143-80 and 046 should be tightened to a torque of 35-50 foot-pounds. The clamping plates of the 243 regulator should be tightened to a torque of 125 inch-pounds.

21. Reconnect any external control lines and pressure loading lines. Ensure that the connection is free from dirt and is adequately tightened.
22. Upon reassembly, make certain that the regulator installation and all joints are entirely free of leaks.
23. If the orifice size and/or valve angle was changed, clearly label on the regulator, the new orifice size and/or valve angle that has been installed in the regulator. The labeling should be capable of withstanding the elements of the environment that is installed. On the cap of the regulator, cover the stamped size of the orifice and/or valve angle that was originally installed. If there are markings of a previous orifice and/or valve change, remove or cover those markings. (A visual inspection of the regulator labeling should inform the person of the size orifice and if applicable, the degree valve angle that is currently installed in the regulator.)



## CAUTION

**A new orifice and/or valve angle may change the maximum allowable inlet pressure rating. Ensure that the application is within the permissible pressure rating.**

24. A change in orifice size or change in degree valve angle can affect the outlet pressure (set point) of the regulator. Therefore, readjust the outlet pressure by referring to the applicable regulator installation and maintenance instructions. Refer to Installation and Start Up for the instructions on adjusting the set point and initial start up after servicing.
25. If the orifice change was performed on an in-line regulator, ensure the proper operation of the regulator by again following the applicable regulator installation and maintenance instructions under the heading of Installation and Start Up.

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