
Petersen® 128-Series Multi-Flex™ Hot Tap Plug Installation System Instruction Summary for Air and Water Inflation

Warning!

**Read and understand instructions before using Petersen® Plugs.
Failure to comply may result in property damage, serious injury or death!**

SAFETY IS EVERYONE'S RESPONSIBILITY!

*Very high forces are involved in many pipeline-plugging situations. Forces increase dramatically as pressure and pipe diameter increase. Extreme care must be taken to assure the safe use of any Pipe Plug. Maximum inflation pressure and backpressure limits for Plugs are affected by many factors including pipeline debris, temperature, fluid, and surface condition. **These instructions are general and a competent professional engineer must calculate forces involved and adapt these instructions for the specific project safety requirements. These instructions must be provided to all Petersen® Plug users and workers on the job and they must be trained for proper use.***

1. **General Instructions:** Standard Petersen® Multi-Flex™ Pipe Plugs are made of materials with a very high tensile strength to provide high flexibility, strength, and excellent long term durability. The plugs without a by-pass have a large inflation port to allow inflating with air, nitrogen or water. The by-pass style plugs allow the flow to continue and still have great flexibility. The Multi-Flex™ Plug will provide long service by following industry safety standards and the below specific instructions. Plugs may be ordered for connection and inflation in series.

1.1. **Keep personnel out of area in line with plug ends during use.** This is any area near a line of sight to any part of the plug. Petersen® Inflatable Plugs are not approved pressure vessels and there are many unknown variables that determine pressure characteristics in the pipeline and plug including pipeline debris, temperature, and coefficient of friction of pipe surfaces, especially when slippery substances are involved. Never use where failure may result in injury or significant property damage. Inflation with water is normally much safer than inflation with compressed air.

1.2. **Temperature and Fluid Compatibility:**

1.2.1. **Do not use Standard Plugs with temperatures over 180°F or with chemicals that may attack nylon, nitrile or polyurethane.** Contact Petersen for custom configurations to meet specific temperature or chemical requirements.

1.3. **Inspect the product before and after each use.** Fabric must not be torn, frayed or abraded. End clamps must not protrude over the end of fabric. No structural damage should be apparent. Test air retention by inflating plug inside a pipe. A large diameter plug may be tested in a much smaller diameter pipe.

1.4. **Insert plugs completely into the pipeline.** The maximum inflation and backpressure on the pressure ratings assume plugs are fully inserted in a clean pipe and are only estimates. Pressures are influenced by many factors including the pipe diameter, fluid in the pipe, temperature, and the condition of the pipe surface.

1.5. **Always position the plug where there are no sharp edges or protrusions** that may puncture the plug. **Completely enclose** the plug within the pipe so the entire plug surface area is supported. When not supported in a pipe, the plug will rupture at a much lower pressure.

1.6. **Before installing under water** it may be necessary to first inflate the plug slightly (never more than 10% of the rated inflation pressure) to drive out air between the plies and then to pull a vacuum on the plug. This will reduce buoyancy and allow the plug to sink in water.

2. **Hot Tap Plugging Components:**

2.1. **The Plug Launch Cylinder** is built somewhat longer than the Multi-Flex™ Plug with all its attachments. On one end is a Packing Gland to provide a seal around the Inflation Ram as it is used to push the Multi-Flex™ Plug into the pipeline.

2.2. **The Inflation Ram** is a tube that makes a mechanical connection to the Plug and is used for both inflation and positioning of the Plug.

2.3. **The Tapping Saddle** for the pipeline to be plugged is available for any style pipe and can be supplied by Petersen or others.

2.4. **The Tapping Valve** must have a full port to allow drilling the hot tap and inserting the Plug through the valve.

2.5. **Hot Tapping Equipment** is used to make the hot tap after a nozzle or saddle and valve are installed and pressure tested. Petersen has Hot Tap Drilling Equipment for up to 6" diameter. Larger sizes are available from others.



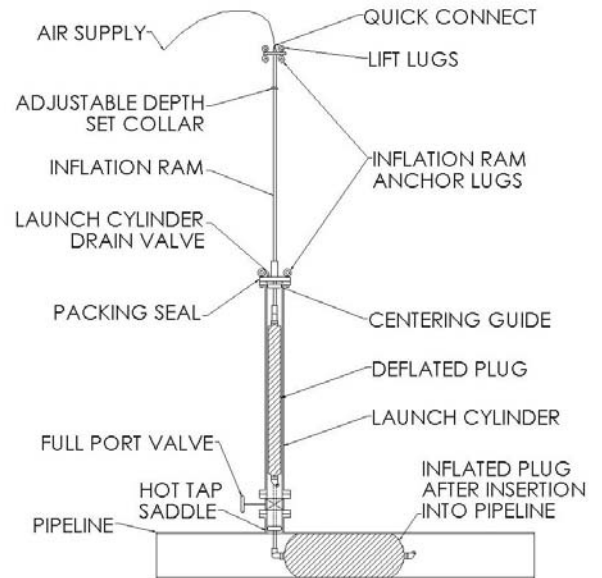
- 2.6. **Inflation Ram Anchor Lugs** are used to anchor Inflation Ram from being pushed out by pipeline pressure.

3. Making the Hot Tap:

- 3.1. **Attach the Tapping Saddle** to the pipeline to be tapped or weld on a nozzle.
- 3.2. **Attach a "full port" Tapping Valve** to the hot tap saddle or nozzle.
- 3.3. **Close the valve and test** the valve and saddle for leaks through the test port on the hot tap saddle or nozzle. If there is no test port, test through the valve before drilling into the pipeline.
- 3.4. **Attach the Hot Tapping Drilling Equipment** to valve.
- 3.5. **Open the valve** completely.
- 3.6. **Open the Chip Removal Valve** on the hot tap drilling machine or the pressure test valve on the hot tap saddle to allow drilling chips to be washed out and to provide a differential pressure to help capture the coupon.
- 3.7. **Drill the Hot Tap Hole** into the pipeline and retract the drill.
- 3.8. **Close the Hot Tap Valve** and check for leaks.
- 3.9. **Remove the Hot Tapping Drilling Equipment.**

4. Pipeline Insertion of Hot Tap Plug:

- 4.1. **Always position the plug where there are no sharp edges or protrusions** that may puncture the plug.
- 4.2. **Examine the Plug and Launch Equipment** to assure they are in good order. Tighten any bolts and nuts to their rated torque. Check all threaded connections and connectors for damage. Large Plugs are inflated through connections to internal Air and Water Hoses.
- 4.3. **The Internal Hoses** (optional) are installed for pumping out water from the lowest point and bleeding off air at the highest point in the Plug. Take care in moving and storing the Plug so the weight of the Inflation Port is not supported by these internal components or there may be damage to the components or Internal Bladder. The Plug must be moved and put into place only when empty and fully deflated.
- 4.4. **Install the Inflation Ram** through the Packing Seal if not already done. Take care not to damage the O-ring Packing Seal. Install entire assembly into Launch Cylinder and secure Packing Seal Flange to Launch Cylinder Flange. Use two Anchor Lugs provided in place of bolts on opposite ends of Flange.
- 4.5. **Fold the Plug** along existing fold lines. Rubber bands or light string that will easily break during inflation may be used to keep Plug folded. Very heavy rubber bands may not allow the Plug to open evenly.
- 4.6. **Attach the Plug to the Inflation Ram.** Hold the Plug Inflation Port securely to prevent damage to the Plug at the Inflation Connection.
 - 4.6.1. When water inflation is required, the Plug is inflated through connections to Air and/or Water Hoses inside the plug. The Internal Hoses are installed for pumping out water from the lowest point and bleeding off air at the highest point in the Plug. Take care in moving and storing the Plug so the weight of the Inflation Ports are not supported by these internal components or there may be damage to the components or Internal Bladder. The Plug must be moved and put into place only when empty and fully deflated.
 - 4.6.2. Mark orientation of Plug bow and Directional Shoe on the inflation end of Inflation Ram to help maintain the plug orientation during insertion.
- 4.7. **Position the Stop Collar** on the Inflation Ram to set the insertion distance to position the center of the Plug at the center of the pipeline.
- 4.8. **Pull the Multi-Flex™ Plug** into the Launch Cylinder with the Inflation Ram.
 - 4.8.1. Alternatively the plug may be installed into the Launch Cylinder after the Launch Cylinder is attached to the pipeline.
- 4.9. **Attach the Plug Launch Cylinder** to the Hot Tap Valve.
 - 4.9.1. **Attach the Inflation Pressure Hose** to the Inflation Ram but **do not apply pressure to the Plug.**
- 4.10. **Open the Hot Tap Valve** and allow the pipeline pressure to equalize in the Launch Cylinder and tapped pipeline.
- 4.11. **Stop the flow** in the pipeline.
- 4.12. **Push the Multi-Flex™ Plug into the pipeline** with the Inflation Ram to the preset Stop Collar position while **maintaining the Plug orientation** with the pipeline.
 - 4.12.1. It may be necessary to jog the plug in and out several times to help it navigate the turn, especially when the tap hole is just larger than the plug. Do not force the plug or inflate it until the Stop Collar is against the Packing Seal indicating the plug is completely in place.
 - 4.12.2. **Insert plugs completely into the pipeline.** The maximum inflation and backpressure on the pressure ratings assume plugs are fully inserted in a clean pipe and are only estimates. Pressures are influenced by many factors including the pipe diameter, fluid in the pipe, temperature, and the condition of the pipe surface.
- 4.13. **Anchor the Inflation Ram** with Anchor Lugs to prevent the pipeline and inflation pressure from pushing the Inflation Ram



back out of the Launch Cylinder.

- 4.14. **Calculate the forces** on the Inflation Ram in advance to determine the anchoring requirements (pipeline psi times sq. in. of ram diameter).

5. Plug Inflation:

- 5.1. **Warning:** Maximum head pressures that a pipe plug may restrain can only be estimated. Slippage is influenced by many factors including fluid in the pipe, coefficient of pipeline friction, pressure required to inflate the plug, and accuracy of pressure gauges. Generally, a Multi-Flex™ Inflatable Plug inserted fully into pipeline will begin slipping between 50% and 80% of the inflation pressure if it has an inflated pipe contact length of 1 ½ times the diameter, but even a head of 50% of the inflation pressure may cause slippage with some liquids. The inflation pressure is also subject to temperature change and debris or protrusions in the pipeline that could rupture the plug. The inflation pressure should be monitored and plugs anchored and/or mechanically blocked when slippage may cause property damage or injury. NEVER use a test pressure greater than the capacity of the weakest pipe or component in the system. NEVER use an inflatable plug when its failure would cause injury or significant damage.
- 5.2. **Petersen® Inflation Controllers and Pressure Alarms** are available for all plugs.
- 5.3. When a pressure source is removed, **check the pressure** at least every fifteen minutes the first hour and every two hours thereafter.
- 5.4. **Stop the flow** in the pipeline.
- 5.5. **Use an inflation hose** long enough to allow inflation from a safe area.
- 5.6. **The Plug may be inflated with water, air or nitrogen.** Never exceed the Maximum Plug Inflation Pressure at the pipeline invert. Please read and understand these inflation pressure monitoring instructions to prevent under- or over-inflation of the Plug.
- 5.7. **Air Inflation:** Use a bleeding/relieving type pressure regulator and a relief valve to maintain the correct pressure with changing temperature and head pressure. A relieving style pressure regulator and/or pressure relief valve must compensate for these factors and prevent over-inflation that could rupture the plug.
- 5.7.1. Check the calibration of the pressure gauge before using.
- 5.8. **Water Inflation:** When inflating with water the Plug should first be inflated with air to stretch out all the plies of the Plug and then inflated with water as the air is released. **Use an approved back-flow preventive device** when a potable water source is used as an inflation pressure source.
- 5.9. **Inflate the plug using a relieving style pressure regulator** and pressure relief valve to maintain proper inflation pressure. Never inflate more than the maximum pressure rating. Changes in temperature, pipeline pressure, atmospheric pressure, and fabric stretching can dramatically change the plug pressure.

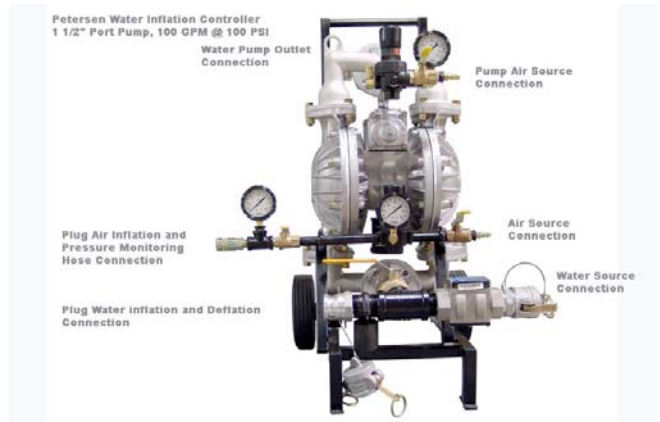


6. Plug Inflation Pressure Monitoring:

- 6.1. **Add .433 psi to the pressure gauge reading per foot of gauge elevation** above the invert of the plugged pipeline when measuring pressure on a hose and plug filled with water.
- 6.2. **Add .433 psi to the pressure gauge reading for every foot of Plug diameter** to determine the psi at the pipeline invert when measuring pressure with a gauge on a hose filled with air.
- 6.3. Verify the air hose does not have liquid in it by filling it completely with air. If the hose and plug are completely filled with water raising and lowering the gauge will change the gauge pressure reading. If partially filled, this test is not valid.
- 6.4. When water is used to fill the Plug, add air to the Plug to maintain the inflation pressure. The air pressure gauge will read the pressure at the top of the pipeline if the hose is completely filled with air. Add .433 psi to the water hose gauge per foot of elevation above the invert to determine the pressure at the invert.
- 6.5. The approximate number of gallons of water required to fill the Plug may be obtained from the factory to estimate when to stop filling with water to complete inflation with air. Alternatively, stop filling the Plug when the water pressure at the pipeline invert approaches the pipeline head pressure if the pipe is filled with water, or 20% of the rated pressure if the pipe is not filled with water. Complete inflation with air.

7. Petersen® Inflation Deflation Controllers:

- 7.1. **Water Inflation Deflation Controllers** with up to 100 gpm 18' maximum lift pump are available. The Water Inflation Control Section allows for inflation (also deflation if a pump is included) with water. It includes a Water Flow Totalizer to monitor the quantity of water used, a Water Pressure Gauge, and a Valve to control the water flow to and from the Plug.
- 7.2. **Air Inflation Bleed-Off and Controller** includes an Air Regulator, Pressure Gauge, relief valve, and valves to monitor the inflation pressure and a three way valve for deflation.
- 7.3. **Low Pressure Alarm:** An audible low pressure alarm is available from Petersen.



7.4. **Hose Connections for a Plug with a Water and an Air Inflation Port:**

- 7.4.1. Connect an Air Hose between the Plug air connection and the Air Inflation Controller.
- 7.4.2. Connect the Low Pressure Monitoring Alarm to the Plug air connection.
- 7.4.3. Connect an Air Hose between the Air Inflation Controller and the air supply. (Air supply hose may also be used for operating the Diaphragm Pump to deflate the Plug.)
- 7.4.4. Connect a Water Hose between the Plug and the Water Inflation Connection on the Water Inflation Deflation Controller.
- 7.4.5. Connect a Water Hose between the water source and the Water Source Connection on the Inflation Deflation Controller.
- 7.4.6. Connect a Water Hose between the Water Pump Outlet and the water drain for pumping water out of the Plug. This could be the same hose as used for the water source.

7.5. **Water Inflation Deflation Controller Plug Inflation Procedure:**

- 7.5.1. Turn on the valves for the air source. Adjust the Air Inflation/Bleed-Off Regulator to the required pressure.
- 7.5.2. Turn on the Plug Air Inflation Valves and begin filling the Plug with air. If only air inflation is desired fill Plug to the rated pressure. If the Plug will later be filled with water, air inflate Plug to the highest of either 110% of pipeline head pressure or 10% of the rated inflation pressure of Plug. Never exceed rated Plug inflation pressure.
- 7.5.3. Verify Air Inflation Regulator is set to the actual inflation pressure of the Plug taking into consideration the pressure monitoring calculations above.
- 7.5.4. To replace air with water, turn on the Water Inflation Connection Valve to begin filling the Plug with water. Air will bleed off through the Air Inflation Regulator as the Plug fills. Monitor the Air Pressure Inflation Hose and never allow the pressure to exceed the rated pressure of the Plug.
- 7.5.5. Fill the Plug to the gallon capacity provided with the Plug. Remember, that any water in the air hose will result in the gauge pressure reading too low by .433 psi for each foot of water head in the hose above the pipeline invert.

8. **Inflation Summary:**

- 8.1. A plug should generally be first filled with air to slightly over the head pressure to stretch out the plug. The air then may be displaced with water to the rated pressure.
- 8.2. When measuring pressure on a hose filled with water, add .433 psi to the gauge reading per foot of hose water elevation above the invert of the plugged pipeline. When the hose is completely filled with water, raising and lowering the gauge will change the gauge pressure reading. If the hose is only partially filled with water this test is not valid.
- 8.3. After water is used to fill the Plug, air should be added to maintain the inflation pressure. The air pressure gauge will read the pressure at the highest point in the plug if the hose is completely filled with air. When measuring pressure with a gauge on a hose filled with air, add .433 psi to the gauge reading for every foot of Plug diameter to determine the psi at the pipeline invert. The air hose cannot have any water in it, it must be completely filled with air to correctly monitor pressure with an air hose.

9. **Deflation and Removal of Multi-Flex™ Plug:**

- 9.1. **Equalize the differential head pressure** on each side of the Plug. If a plug is deflated while under pipeline head pressure, the head pressure will propel it down the pipeline with tremendous force if not securely anchored.
- 9.2. **Deflate the Plug.**
 - 9.2.1. If the Water Inflation Deflation Controller with a pump is used, move the Plug Inflation Hose to the water inlet of the Controller. Cap the water outlet and open valve to pump. You may want to connect a discharge hose to the pump outlet. Connect the air supply to the Air Connection on the Pump Pressure Regulator. Regulate the pumping rate with the Pump Air Regulator.
 - 9.2.2. A vacuum pump may also be used to deflate the Plug if it was inflated with only air, or air may be introduced into the Plug to evacuate water. Never exceed the pressure rating of the Plug.
 - 9.2.3. Complete deflation is indicated by a substantial drop in flow rate (<1 gpm) and an audible change in the sound of the pumping action.
- 9.3. **Pull the Plug back** into the Launch Cylinder after it is deflated completely. The Purge Valve on the Launch Cylinder may be opened to relieve pressure and help move the Plug back into the Launch Cylinder. A winch may be helpful on large plugs to pull out the Inflation Ram.
- 9.4. **Close the Hot Tap Valve.**
- 9.5. **Bleed off the pressure in the Launch Cylinder.**
- 9.6. **Remove the Plug Launch Cylinder and Multi-Flex™ Plug.**

10. **Maintenance, Care, and Storage:**

- 10.1. **Carefully inspect before and after each use** for abrasions, tears, slippage of clamps or flanges, air leaks or any other sign of deterioration or defect. Large plugs may be leak-tested in smaller diameter pipes.
- 10.2. **Inflate to under 10% of rated inflation pressure** to check for leaks.
- 10.3. **Return to Petersen for repair.** Destroy the product if there are more than minor punctures, tears or abrasions that are not easily repairable.
- 10.4. **Clean with detergent and water** after each use, disinfect if necessary. Never clean with solvents or petroleum products!
- 10.5. **For maximum durability, store in clean dry area,** away from direct sunlight and in a manner that allows plug to remain dry.