



Petersen
Products Company

Generic Operating Instructions

Petersen Pipe Plugs

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PETERSEN INFLATABLE PIPE PLUGS

GENERIC OPERATING INSTRUCTION

Read these rules along with instructions for a specific plug series

SAFETY IS EVERYONE'S RESPONSIBILITY!

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

Warning: Very high forces are involved in many pipeline-plugging situations that may cause injury or even death. Forces increase dramatically as pressure and pipe diameter increase. Extreme care must be taken to assure the safe use of any Pipe Plug. Keep personnel out of line with plug ends, unsupported areas of plug, open plugged pipelines, or manholes. This is any area near a line of sight to any part of the plug. Maximum rated back pressures assume plugs are inserted into clean dry pipes. Dirt in pipes (algae, grease, detergents, mildew, sand, etc.) can considerably decrease the back pressure values. Pipelines made of materials with lower coefficient of friction, e.g. polyethylene or new pipelines with remains of grease or agents directly decrease the coefficient of friction as well as the back pressure values. Never use when failure may result in injury or significant property damage. Inflatable devices may not be used as the primary protection for personnel downstream. **Because of the many possible variables these general instructions must be adapted by a competent professional engineer for each specific project. Instructions and training must be provided to all plug users and workers on the job.**

1) BASIC RULES FOR USING MECHANICAL OR INFLATABLE PIPE PLUGS

- a) Wear all required safety equipment such as eye protection, helmet, and protective clothing.
- b) Use confined space procedures and equipment during installation when necessary.
- c) Calculate the head pressure forces plug will be required to restrain; see calculation formulas below.
- d) Select a plug that is manufactured for the actual size, pressure, temperature, and chemical requirements.
- e) Thoroughly clean the pipeline before insertion of the plug or use a Kevlar or other Protective Sleeve available from Petersen to help protect the plug if debris in pipeline cannot be removed.
- f) Stop the pipeline flow before installing any type of plug.
- g) Equalize pressure on both sides of plug before installation and removal.
- h) Insert the plug seal surface completely so it is fully supported by the pipeline. Molded rubber inflatable plugs expand in diameter and axially, so must be inserted at least one pipeline diameter beyond the end of the pipe.
- i) Always position the plug where there are no sharp edges or protrusions that may damage the plug.
- j) Plugs generally must be mechanically anchored against slipping if blocking significant pressure.
- k) Stay clear of any area in line with any part of the plug, open pipeline or manhole when the plug is holding back pressure.
- l) Use two accurate pressure gauges that agree for measuring the pipeline head pressure.
- m) Never exceed the maximum rated head pressure for the plug measured at the pipe invert.
- n) Provide an anchor, support, and/or bracing to secure the plug when back pressure is present.
- o) Before and after each use, clean the plug and inspect for surface tears, cuts or any other damage.
- p) To protect the components, store in clean dry area, away from direct sunlight and in a manner that allows plug to remain dry. Natural rubber components are especially susceptible to deterioration from aging.

2) ADDITIONAL BASIC RULES FOR INFLATABLE PLUGS

- a) Never inflate an inflatable plug outside of a pipe.
- b) Stay clear of any part of the plug when it is inflated.
- c) Control and monitor the plug inflation at a safe distance at the end of hoses.
- d) Always use two accurate calibrated pressure gauges that agree for monitoring the inflation pressure.
- e) Check air line connections and hoses to make sure they are not damaged or leaking.
- f) Never exceed the maximum inflation pressure rating for the plug.
- g) Petersen Multi-Flex™ plug must be inflated to at least twice the pipeline pressure but not more than the rated pressure.
- h) Molded rubber plugs must be inflated up to the rated pressure to properly expand the rubber.
- i) When a pressure source is connected to the plug, use a bleeding type pressure regulator when and a relief valve to maintain the correct pressure when there may be changes in temperature and head pressure.
- j) Plugs with two ports should be inflated through an inflation hose separate from the pressure monitoring hose.
- k) When a pressure source is removed, check the pressure at least every fifteen minutes the first hour and every two hours thereafter.
- l) Molded rubber plugs and smaller Multi-Flex™ Plugs are generally inflated with air or an inert gas. Since gases are compressible it is often advisable to inflate larger diameter plugs with water.
- m) Plugs must be mechanically blocked or tethered from slipping due to pipeline head pressure. Anchor only to rated plug anchor points. Never anchor to plug positioning loops or eyebolts.
- n) Never remove the hoses until all pipeline head pressure is released and the plug deflated.
- o) Deflate the plug completely before removing from the pipeline. A Vacuum Generator may be required for complete deflation to the smallest diameter.
- p) Use positioning rope or cable to install and remove the plug. Do not pull on the inflation or pressure monitoring hose to remove the plug.

3) PLUG INFLATION PRESSURE CALCULATIONS

a) Air or Nitrogen Inflation:

- (1) When the plug is inflated with air or inert gas read the inflation pressure directly from the air pressure gauge regardless of plug and gauge elevation.

b) Water inflation:

- (1) Water is often preferable in larger and higher pressure plugs because it is not compressible and reduces the risk of explosion. When inflating a plug with a liquid, calculating the actual inflation pressure at the invert is critically important.
- (2) A plug may be inflated immediately with water if the pipeline is at least 1/2 full of water. If not it must be first filled with air and then the air displaced with water.
- (3) The estimated volume of water should be monitored during filling along with the inflation pressure. The gallon capacity is only an estimate but the maximum pressure should not be exceeded.
- (4) Monitoring inflation pressure:
 - (a) The pressure monitoring hose must be completely purged of water for accurate gauge reading. Add 9.79 kPa per meter (.433 psi/foot) the plug inflation hose connection is above the invert. Usually ½ the pipe diameter for end-inflation plugs.
 - (b) If a water filled hose is used to monitor pressure it is important to add to the gauge reading 9.79 kPa per meter (.433 psi/foot) that the pressure gauge is above the plugged pipeline invert.
- (5) **Never exceed the rated plug inflation pressure** measured at the pipeline invert.

4) CALCULATE HEAD PRESSURE FORCE TO BLOCK OR ANCHOR ANY PLUG AGAINST SLIPPING

a) Calculate the total force “F” that the plug must restrain

- (1) $F = P \times S$
- (2) F = force on the plug, P = pipeline pressure, S = cross-sectional area
 - (a) Force “F” on the plug is the plug slipping force.
 - (b) Pressure “P” measured as water column height must be converted to a force over area format for the equation above. As an example, a 10 meter- high (32.8 ft) water column converts to a back pressure of 98.0 kPa (14.5 psi). The configuration or liquid surface area does not affect pressure, only elevation. This pressure is multiplied by the pipe/plug diameter to arrive at the plug slipping force.

- (i) Pressures exerted on a plug are the same for liquid, water or air. Ten (10) psi of water is the same as ten (10) psi of air as one example.
- (ii) Pressures from gases such as air and nitrogen are compressible so far more dangerous than water. Gas will expand to its original atmospheric volume upon release, discharging a slipping plug with much greater force. Use extreme caution!
- (c) The cross sectional area "S" is determined by:
 - (i) $S = \pi r^2$ Where $\pi = 3.14159$ and r (radius) = $\frac{1}{2}$ the pipe inside diameter

5) MAINTENANCE AND CARE

- a) **Clean with detergent and water** after each use, disinfect if necessary. Never clean with solvents or petroleum products!
- b) **Carefully inspect before and after each use** for abrasions, tears, movement of clamps, air leaks or any other sign of deterioration or defect. Large Plugs may be leak-tested in smaller diameter pipes.
- c) **Store in clean dry area** and in a manner that allows Plug to dry.

Petersen has all the equipment required for inflation, deflation, and pressure monitoring.

Contact Petersen with any questions or suggestions relating to the use of any Petersen product