



# Pipe Plug Operating Instructions

Petersen Products Company

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## 1. Important Safety Instructions

# SAFETY IS EVERYONE'S RESPONSIBILITY

**READ AND UNDERSTAND BEFORE USING PETERSEN® PIPE PLUGS!**

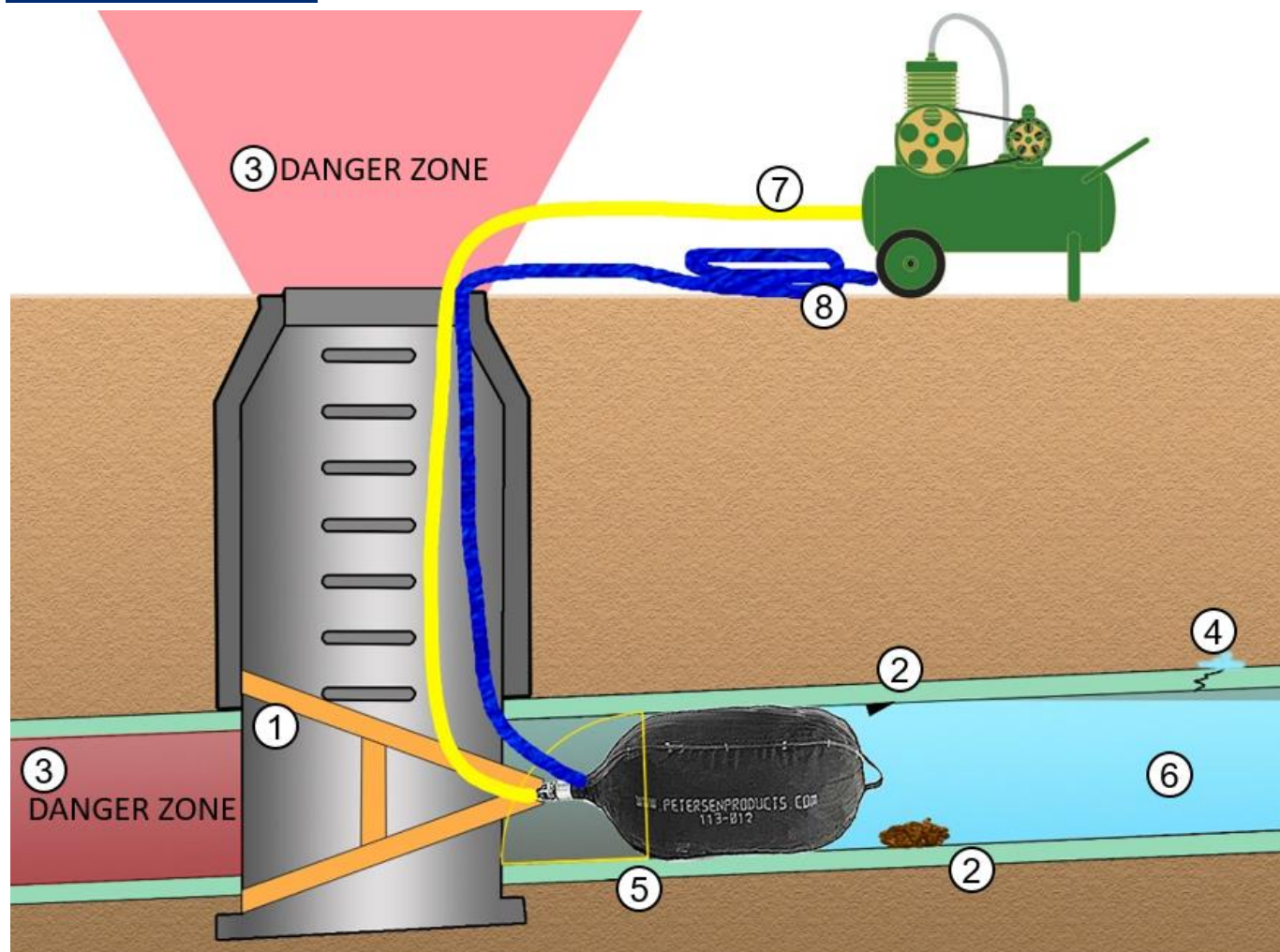
**FAILURE TO COMPLY MAY RESULT IN PROPERTY DAMAGE, SERIOUS INJURY OR DEATH!**



## 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.
- Take extreme care 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 backpressures assume plugs are inserted into clean dry pipes. Dirt in pipes (algae, grease, detergents, mildew, sand, etc.) can considerably decrease the backpressure 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 backpressure 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.
- Consider a mechanical plug anchored to the pipeline to protect people downstream.

**Due to 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. Refer to website.**



1. All pipe plugs must be blocked or anchored adequately against a force equal to the head pressure times the cross-sectional area of the pipe. See [Calculation Formulas](#). Pipelines made of polyethylene, new pipelines with remains of grease or agents, mildew, sand, detergents, etc. directly decrease the coefficient of friction as well as the backpressure values.
2. Debris or protrusions in the pipeline can damage a seal or rupture inflatable plugs. Thoroughly clean the pipeline before insertion of the Pipe plug. Maximum rated pressures assume Pipe plugs are fully inserted into clean dry pipes.
3. NEVER use an inflatable plug when its failure could cause injury or catastrophic damage or as the only means of protection for personnel working downstream. Keep all personnel out of the plug end area – DANGER ZONE – when plug is in use.
4. NEVER use a test pressure greater than the capacity of the weakest pipe or component in the system.
5. Insert the Pipe plug seal surface completely so it is fully supported by the pipeline. Molded rubber pipe plugs expand in diameter and axially, so it must be inserted at least one pipeline diameter beyond the end of the pipe.
6. Stop the pipeline flow before installing any type of Pipe plug.
7. Always attach an inflation extension hose to the Pipe plug so it can be inflated, monitored and deflated at a safe distance outside the danger zone.
8. Use positioning rope or cable to install and remove the Pipe plug. Do not pull on the inflation or pressure monitoring hose to remove the Pipe plug.
9. Do not exceed the pressures on the plug label. Molded rubber plugs must be inflated to the rated pressure shown on plug.





## PERSONNEL SAFETY

1. Due to 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 users and workers on the job.
2. If your pipe plug has a Safety and User Manual, be sure to read and understand it.
3. Properly wear and use all required Personal Protective Equipment (PPE) and Safety equipment, for your application. Common items include eye protection, hardhat, gloves, safety shoes, hearing protection, and protective clothing.
4. Determine if the area is considered a Confined Space. Refer to Occupational Safety and Health Administration (OSHA) (29CFR 1910.146), Safe Confined Space Entry. Follow all federal, local and site specific codes, standards and regulations.

## 2. Basic Rules for Using Any Pipe Plug

- A. Select a Pipe plug manufactured for the actual size, pressure, temperature, and chemical requirements of your application. Consult PPC engineering for more information.
- B. Release the back pressure or equalize pressure on both sides of the pipe plug before installing, deflating and removing.
- C. **NEVER** exceed the maximum rated head pressure for the Pipe plug measured at the pipe invert. See Calculation Formulas.
- D. Use accurate calibrated pressure gauges that agree for measuring the pipeline head pressure.
- E. Mechanical and Molded Rubber Plugs are generally used for testing because fabricated Multi-Flex® style plugs may allow some seepage unless customized for a positive seal.
- F. Before and after use, thoroughly inspect the Pipe plug for surface tears, cuts or any other damage.
- G. **NEVER** use a Pipe plug in a pipe size different from the recommended usage range.

## 3. Inflatable Pipe Plug Rules for Operation

- A. **NEVER** inflate an inflatable plug outside of a pipe beyond 5% of rated pressure or 5 psi, whichever is less. To test the plug for inflation holding, completely enclose it in a containment chamber so the entire surface area is supported.
- B. Use a Kevlar or protective sleeve to help protect the plug if debris in the pipeline cannot be removed.
- C. Inspect the plug, air line hoses and connections to make sure they are not damaged, torn, frayed or leaking.
- D. Always use two accurate pressure gauges that are in good working order for monitoring the plug inflation pressure.
- E. Generally inflate molded rubber and smaller Pipe plugs with air or an inert gas. Since gases are compressible it is often advisable to inflate larger diameter Pipe plugs with water or liquid. Water and inert gas is better than air or oxygen for any flammable environment.
- F. Petersen Multi-Flex® Pipe plug must be inflated to at least twice the pipeline pressure but not more than the rated pressure. Inflate Molded Rubber Pipe plugs up to the rated pressure to properly expand the rubber.
- G. When connecting a pipe plug to a pressure source, use a bleeding type pressure regulator and relief valve to maintain the correct pressure. Changes in temperature, pipeline pressure, atmospheric pressure, and fabric stretching can dramatically impact plug performance.
- H. Inflate the plug slowly to carefully build up the pressure to the maximum rated inflation pressure. Check the inflation pressure every 15 minutes until the pressure stabilizes and then at least hourly thereafter.
- I. **ALWAYS** release pipeline head pressure before deflating the pipe plug and removing from the pipeline with all hoses, ropes, etc..

## 4. PIPE PLUG INFLATION

### 4.1 Air or Nitrogen Inflation:

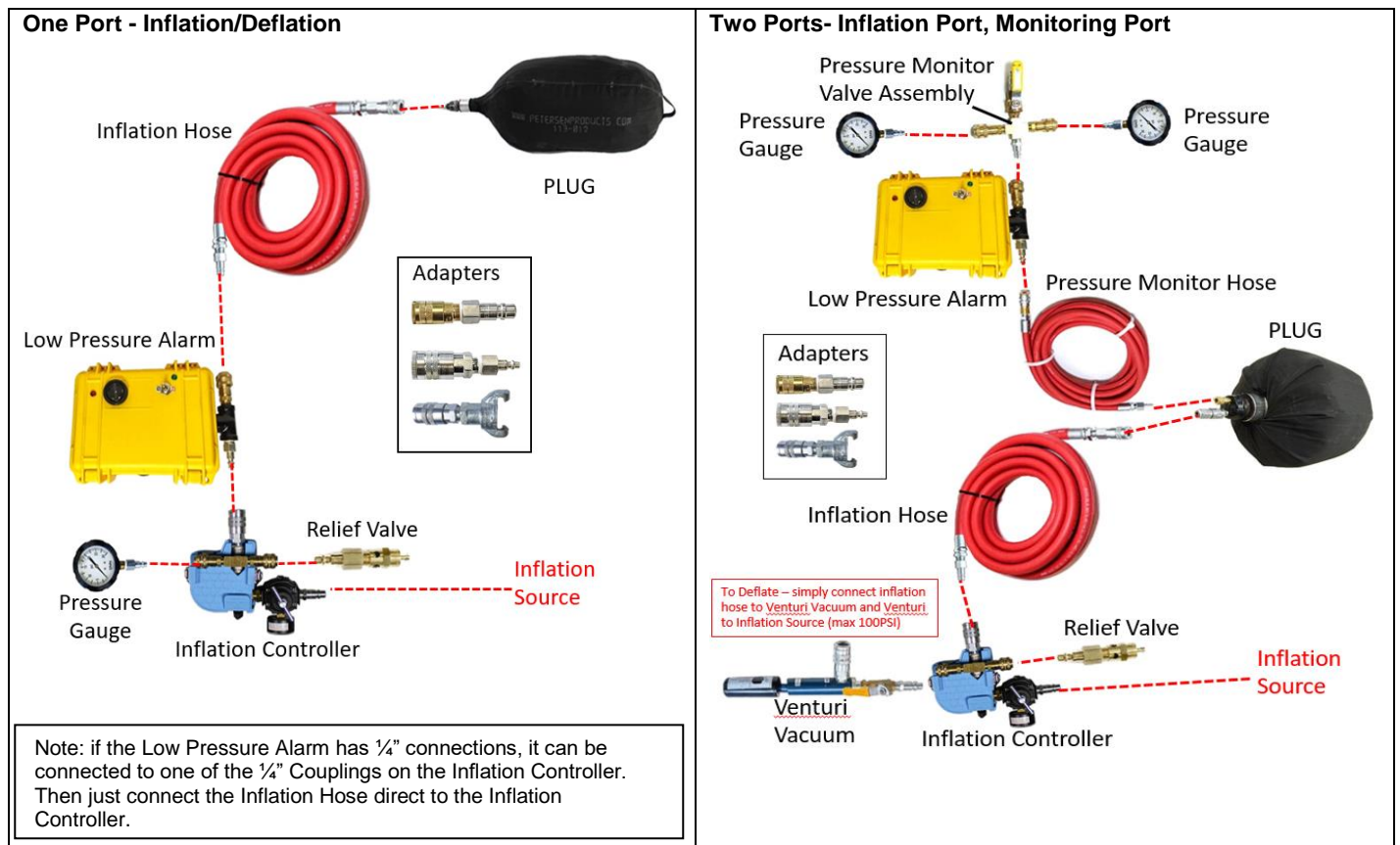
When the Pipe plug is inflated with air or inert gas read the inflation pressure directly from the air pressure gauge regardless of Pipe plug and gauge elevation.

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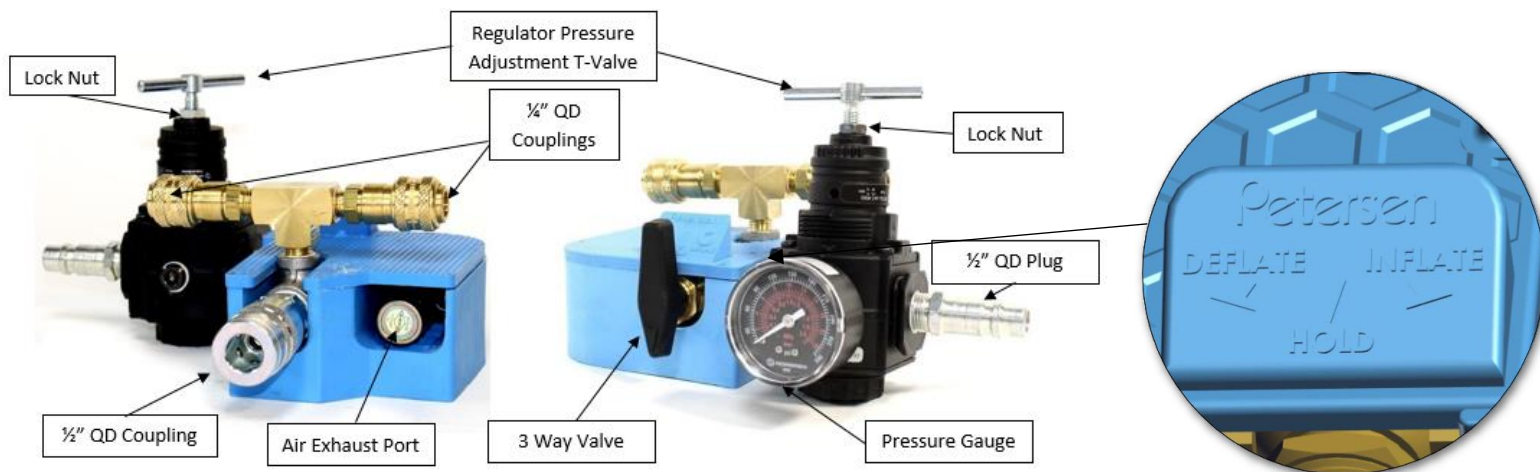
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## Petersen Air Inflation Component Connections



### 4.1.1 Air Inflation Controller



- **1/2" QD Plug** – connect to air inflation source.
- **Regulator Pressure Adjustment T-Valve** – Delivers constant pressure to the plug. The Regulator slowly bleeds any increases in air pressure. The regulator uses a relief-style design. Clockwise to increase and counter clockwise to decrease pressure setting.
- **Lock Nut** – Locks pressure setting.
- **Pressure Gauge** – Displays the actual input pressure reading.
- **3-Way Valve** – Controls the inflation pressure to inflate, hold or deflate out to atmosphere.
- **Air Exhaust Port** – deflates to atmosphere.
- **2x 1/4" QD Couplings** –couplings to connect pressure gauges and pressure relief valves.
- **1/2" QD Coupling** – connect to air inflation hose 1/2" QD plug.

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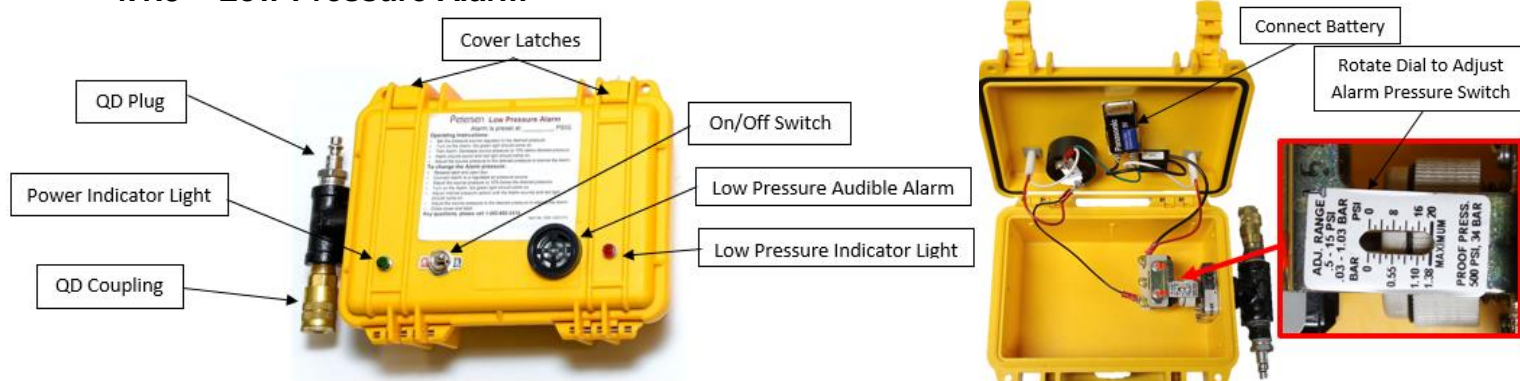
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### 4.1.2 Inflating the Plug using the Inflation Controller

1. Before connecting to 1/2" QD Plug on the Inflation Controller, turn Regulator Pressure Adjustment T-Valve counter clockwise to remove all pressure. Be sure the 3-Way Valve is on the HOLD setting.
2. Connect Air source to 1/2" QD Plug on the Inflation Controller then turn the Regulator Pressure Adjustment T-Valve clockwise to increase and counterclockwise to decrease pressure setting.
3. Always approach the desired pressure from a lower pressure.
4. Connect Inflation Hose 1/2" QD Plug to 1/2" QD Coupling on Inflation Controller. Connect other end of hose with 1/2" QD Coupling to 1/2" QD Plug on the inflatable device.
5. Attach Relief Valve to 1/4" QD Coupling (a pressure gauge may be connected to other 1/4" QD Coupling to verify proper pressure)
6. Turn the 3-Way Valve to INFLATE.
7. Once plug reaches desired pressure, turn 3-Way Valve to HOLD. NOTE: monitor plug pressure very closely until pressure stabilizes – larger plugs may take longer. Be aware of any changes in temperature, pressure or other conditions.
8. To deflate plug, turn 3-Way Valve to DEFLATE. Air/gas will escape through the Air Exhaust Port on the Inflation Controller. NOTE: for larger plugs it is recommended to use a Venturi Vacuum Generator for faster deflation.

### 4.1.3 Low Pressure Alarm



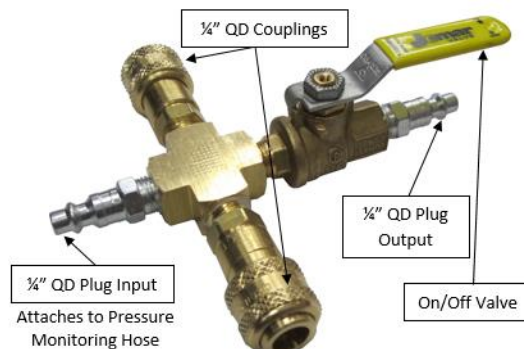
- Alarms are available for 0-15 psi, 10-90 psi, 20-300 psi, and 20-500 psi. The alarm should match the inflation pressure, inflation medium and hose connections.
- Also available in 1/4" Quick Disconnect, 1/2" Quick Disconnect and Cam & Groove (Water Inflation). See website for more info.
- The plug rated pressure should be within the Alarm high and low pressure rating and around the mid-range of the Alarm.
- Never connect the Alarm to a pressure higher than the Low Pressure Alarm high-pressure limit.

### 4.1.4 Adjusting the Low Pressure Alarm

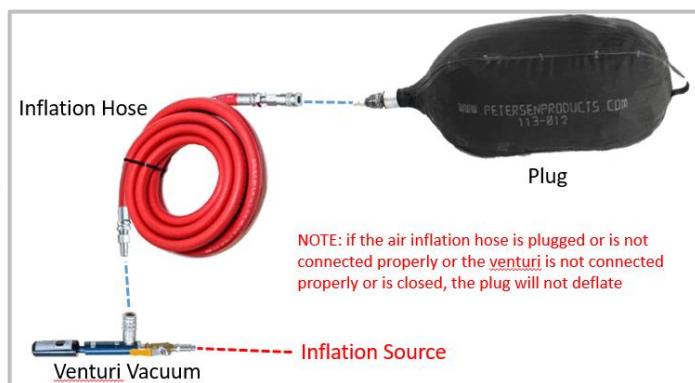
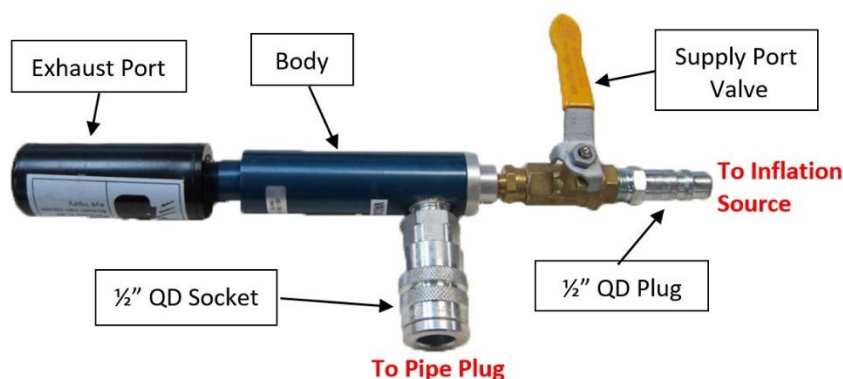
1. Release latches and open the Low Pressure Alarm cover. Connect the 9 Volt DC battery.
2. Adjust the Alarm pressure switch by rotating the dial to 10% below the pipe plug pressure.
3. Close and latch the Low Pressure Alarm cover.
4. Connect Low Pressure Alarm QD Plug to QD Coupling on Inflation Controller and turn the Regulator Pressure Adjustment T-Valve to the desired pressure. For greater redundancy attach a pressure gauge to the Inflation Controller.
5. Turn On the Alarm with the On/Off Switch on the cover. The green light should come on.
6. Decrease the Regulator Pressure Adjustment T-Valve (counter clockwise) to 10% below the desired pressure to sound the alarm and activate red light. Your device is now set.

### 4.1.5 Pressure Monitor Valve Assembly

- Used for pressure monitoring when an inflatable device has a separate pressure monitoring port from the one used for inflation.
- Valve is used for deflation out to atmosphere.
- Two 1/4 inch quick disconnect couplings are for two pressure monitoring gauges and/or a pressure relief valve.
- The 1/4 QD Plug Output is by the On/Off Valve
- The 1/4" QD Plug Input attaches to the Pressure Monitoring Hose



#### 4.1.6 Venturi Vacuum Generator



- Use the Venturi Vacuum Generator to deflate Inflatables faster when the pipeline pressure is not sufficient to force air out.
- The Venturi requires more air to deflate the inflatable than was used to inflate.
- A large volume of air will leave the exhaust port. **NOTE: Personnel should never be in direct line of the exhaust port.**

#### 4.1.7 Deflating with the Venturi Vacuum Generator

1. Close Supply Port Valve on the Venturi Vacuum Generator.
2. Connect the plug Inflation Hose 1/2" QD Plug to the 1/2" QD Coupling on the Venturi Vacuum Generator.
3. Connect the 1/2" QD Plug to the 1/2" QD Coupling on the inflation source (do not exceed 100 PSI).
4. Open the Supply Port Valve.
5. You will hear an audible change in sound when the vacuum pressure increases, indicating the inflatable device is fully deflated. Run the air for an additional 5 minutes to sure all air is expelled from the plug.
6. Close the Supply Port Valve and disconnect the Venturi from the plug Inflation Hose.

### 4.2 Water Inflation:

**NOTE: When using water inflation, the pressure gauge reading needs to be corrected based on the plug depth.**

Water inflation is preferable in larger and higher pressure Pipe 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.

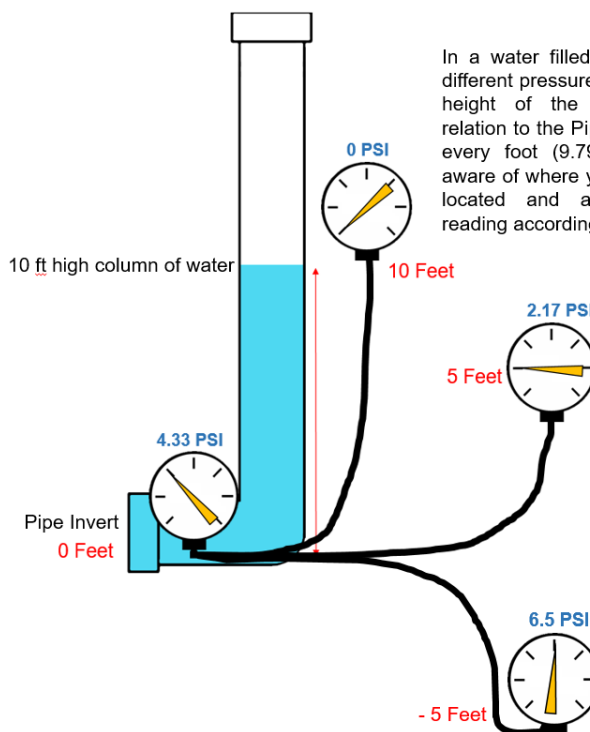
Inflate a Pipe plug immediately with water if the pipeline is at least 1/2 full of water. If not, it must be first be filled with air and then the air displaced with water.

Obtain the approximate number of gallons of water required to fill the plug from the factory to estimate when to stop filling with water. The gallon capacity is only an estimate but the maximum pressure should not be exceeded.

(1) To monitor the inflation pressure with an air hose:

(a) When water is used to fill the plug, air is sometimes used to maintain the inflation pressure.

(b) To monitor the Inflation pressure with an air hose add to the air pressure gauge reading 1.42 psi per meter (.433



In a water filled hose, you will get a different pressure reading based on the height of the Pressure Gauge in relation to the Pipe Invert. 0.433 psi for every foot (9.79kPa per meter). Be aware of where your pressure gauge is located and adjust your pressure reading accordingly.



psi/foot) that the air hose connection on the Plug is above the invert. The air hose must be purged of all water.

(c) Verify the air hose does not have liquid in it by filling the hose completely with air. If partially filled with liquid, the pressure reading will not be valid.

(2) To monitor the inflation pressure with a water hose:

(a) Add to the water pressure gauge reading 0.433 psi/foot (9.79kPa per meter) that the Plug water pressure gauge is above the invert. The water hose and plug must be completely filled with water. Bleed off any air in the hose.

(b) Never exceed the maximum rated plug inflation and head pressure at the pipeline invert.

### 4.3 Special:

Grout filling Multi-Flex™ Pipe plug is permissible. Contact PPC engineering for more information.

## 5. Calculating the Total Force that a Pipe Plug must Restrain

$$F = S \times P$$

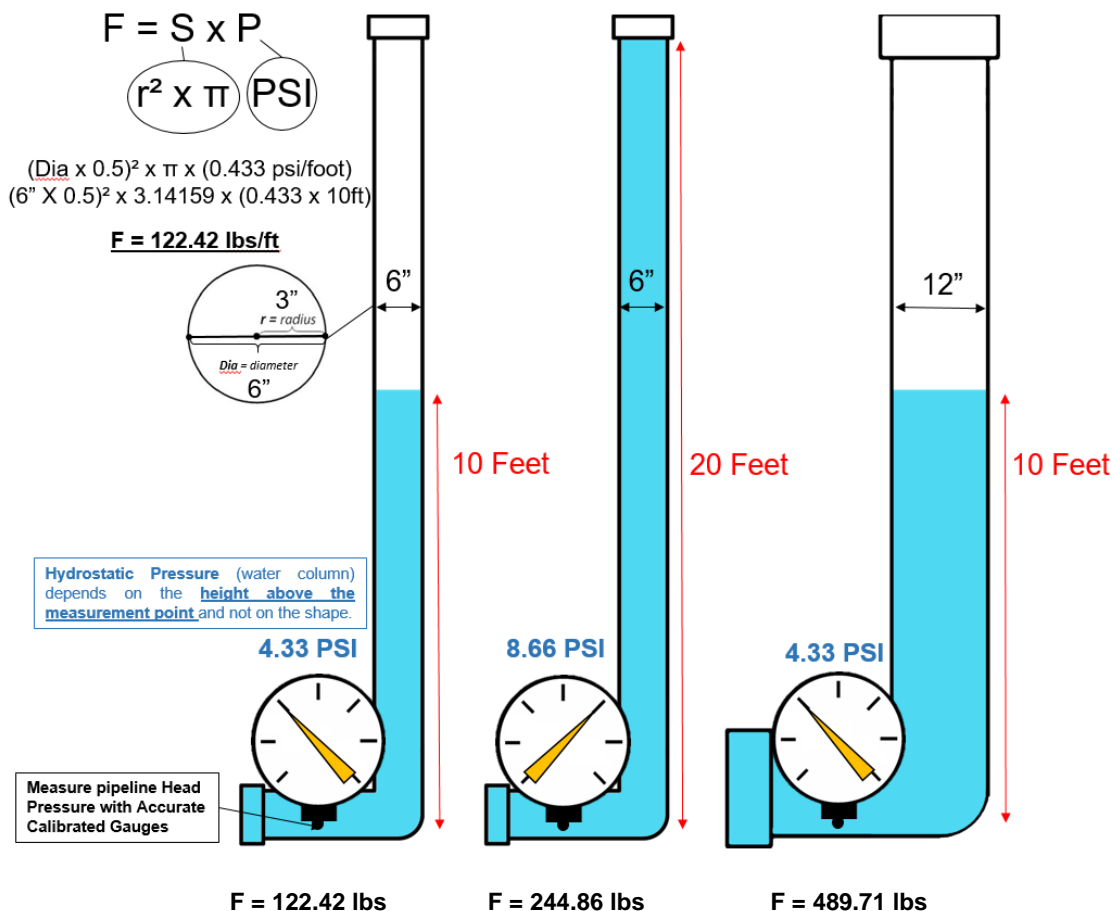
F = force on the Pipe plug (lbs.) pipe plug slipping force

$S = (\pi \times r^2) =$  pipe cross-sectional area (in<sup>2</sup>),  $\pi = 3.14159$ , r is the Radius or ½ the diameter (inches)

P = pipeline pressure (psi), water column height must be converted to a force over area

As an example, a 10 foot water column converts to a back pressure of 4.33 psi (29.3 kPa). The configuration or liquid surface area does not affect pressure, only elevation.

Pressures exerted on a Pipe 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. **Use extreme caution!** Pressures from gases such as air and nitrogen are compressible and store energy, making them far more dangerous than water. As a result, the Pipe plug has a much greater force when discharging a slipping Pipe plug since gas will expand to its original atmospheric volume upon release.





## 6. MAINTENANCE AND CARE

- a) Deflate the plug completely. If water inflation is used pump out the water or hang vertically and drain. Water will not damage the plug but it will make it harder to reuse.
- b) Clean the plug. Use laundry type detergent if necessary and rinse with clean water.
- c) Store in a clean dry area out of sunlight.
- d) SBR molded rubber plugs may be sprayed with silicone to help slow deterioration over time. Natural rubber components are especially susceptible to deterioration from aging.
- e) Multi-Flex® Plugs use synthetic materials that have a much longer life in normal atmosphere.
- f) Plugs may be inflation tested outside of a pipeline for leaks to no more than 5% of the rated inflation pressure or 5 psi, whichever is less.
- g) Multi-Flex® Plugs may have air trapped between their multiple plies thus while a soap bubble test may indicate a leak in pipe or hose connection, bubbles on the outer ply may indicate air escaping between the plies immediately after inflation.
- h) Multi-Flex® Plug leak test requires monitoring the inflation pressure over time after the pressure has stabilized.

### INSPECT PLUG FOR SIGNIFICANT WEAR OR DAMAGE



**CUTS**



**ABRASIONS**



**PUNCTURES**



**BULGES**



**LOOSE OR DAMAGED FITTINGS**



**COMPONENTS AND LEAKS**

**Do Not Use the Product if there is significant wear or damage. Return to Petersen for evaluation.**

Petersen has the equipment for inflation, deflation, and pressure monitoring for all Inflatable Pipe plug Systems

Contact Petersen with any questions or suggestions about the use of any Petersen Product.