



Pressure Monitor and Regulating Station Setup and Operation

This document is provided to explain the setup and operation of a Gas Pressure Monitor Regulating station. The primary function of this set is to safely manage gas pressure down to operating pressure when supply pressure is anticipated to be above 60psi (4.1bar) and less than 300psi (20.7bar). This set will provide a smooth transition to a working backup regulator if the primary regulator fails. Read and understand this document and procedure before starting work with or on this unit. ASK QUESTIONS if you do not understand any part of the setup or operation of this equipment. The instructions in this document are written with the intent that the upstream unit operate as the Monitor and the downstream unit operate as the Working regulator.

This Pressure Monitor Regulating Station should be set in a shop environment and shipped to a project with pressure set to a pressure reflecting reasonable expectation for the project. It is built to NFPA specification with assistance in design from the primary component manufacturer. The Monitor regulator is intended to be in perpetual standby mode, wide open, until outlet pressure begins to exceed its set point. When outlet pressure exceeds the Monitor set point, one of two events has taken place: The control regulator has failed; or the Working Regulator has been adjusted above the Monitor set point.

THIS ASSEMBLY IS NOT DESIGNED TO ACCEPT INLET PRESSURE ABOVE 300psi (20.7bar).

Maximum Safe Working (outlet) Pressure is 55 psi with Monitor set at 60 psi.

How it works:

- Two regulators are connected in series. The upstream regulator is the Monitor unit while the downstream regulator is the Working unit.
- Both regulator sensing lines are connected to the Outlet line downstream of the Working regulator (second regulator in the series).
- In normal operation, the upstream Monitor set point is just a little higher than the downstream Working set point. This lets the Monitor unit stay 100% open during normal operation while the Working unit controls the Outlet pressure.
- If the Working Regulator fails, the Monitor Regulator will immediately assume control at the slightly higher set point, preventing a high pressure surge to the operating equipment.

This assembly is not built for Two Stage Step-Down Operation. Do not attempt to set this Monitor Regulating Station as a Two Stage Step-Down regulating station. Set Points must be within 6psi (0.4bar) of each other.

Specifications:

Compatible with **Propane** or **Natural Gas**.

Maximum Inlet Pressure:	300psi (20.7bar)	DO NOT EXCEED MAXIMUM INLET PRESSURE
Minimum Inlet Pressure:	60psi (4.1bar) Natural gas	
	30psi (2.1bar) Propane Vapor	

Design Outlet Pressure Range:	10psi -- 65psi (0.7bar--4.48bar)
Weight of Assembly:	650 lbs (295.5kg)
Overall Dimensions:	44H x 36W x 54L Inches (1.12H x 0.91W x 1.37L Meters)

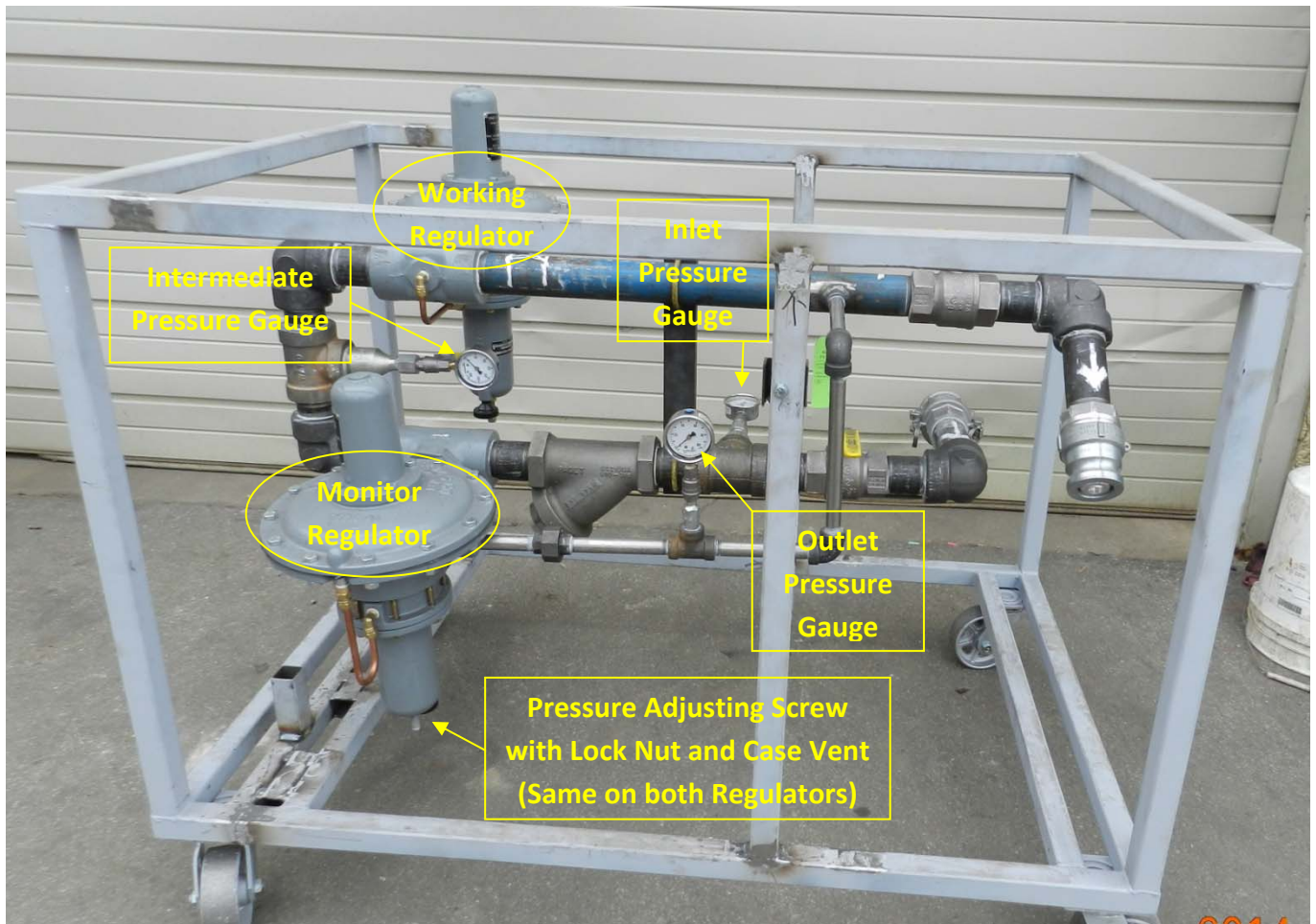
Outlet flow is variable based on Inlet and Outlet pressures. The station is designed to provide an Outlet flow based on propane at 0°F (-17.7°C). Conversion for near equivalent output of natural gas is also shown:

Propane: 30psi (2.1bar) Inlet Pressure + 15psi (1.03bar) Outlet Pressure = 0.5MMbtu to 44MMbtu per hour.

Natural gas: 60psi (4.1bar) Inlet Pressure + 10psi (0.7bar) Outlet Pressure = 0.5MMbtu to 39MMbtu per hour.

Actual flow at last tap in supply system may be lower due to line length, size and number of fittings and taps used. A strainer is incorporated to collect dirt before it gets into the control mechanisms and will affect flow when clogged.

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Field Operation

This set was designed to accommodate propane and natural gas situations, particularly propane because of the high tank/liquid pressure possible.

Operation is simple:

1. Close all valves.
2. Connect the supply.
3. Connect the outlet.
4. Pressurize the unit up to the Outlet ball valve by slowly opening the Inlet ball valve.
5. Check for leaks. Mark any leaks for repair.
6. Verify outlet pressure is close to what is written on the green tag.
7. Open Outlet ball valve slowly and proceed with normal operation.

Operating Notes:

1. The unit is weather-tight as shipped.
2. The Outlet Gauge is installed on the Monitor sensing line. Do not confuse this gauge with the Intermediate gauge installed between the regulating sets.
3. Inlet and Intermediate gauge sets MUST be capable of indicating up to 300psi. Outlet gauge should NEVER read above 65psi in operation.
4. Inlet and Intermediate Gauges should be the same during normal operation. If Intermediate and outlet gauge are the same, one of two scenarios exist: Working Regulator has failed; or Regulators are improperly adjusted.
5. If outlet pressure adjustment is needed during normal operation, it is critical to safe operation that you loosen BOTH lock nuts and turn BOTH pressure set screws the same amount in the same direction at EVERY adjustment. Only one will directly affect outlet pressure—TURN BOTH to maintain the differential between the set points. Tighten both lock nuts when done adjusting.
6. Monitor regulators have a shaft seal that reduces 'blow-by' to a minimum thereby allowing the unit to be in a no-flow state and maintain pressure control. Minimal blow-by may allow downstream pressure to creep up. Best practice to set and verify pressure settings is when a flow has been established.
7. Initial operation and control may take a few seconds as the regulators 'find their mark'. Charge inlet and outlet lines slowly.
8. If the Working regulator fails, the Monitor is set to 'take control'. An immediate pressure increase in the downstream system will be evident and upon inspection of the Monitor station, the intermediate pressure gauge will show the same as the outlet pressure gauge. Continued operation is possible with the knowledge that if the Monitor should fail, the downstream equipment will be subject to a considerable pressure surge.
9. When inlet pressure is unchanged and Intermediate pressure fades after some run time, the strainer may be filling with debris. The system must be shut down and pressure bled to zero before attempting to open the strainer for cleaning.



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Field Setup: Field Setup is not necessary if the unit is working properly.

This section is provided to enable proper setup in an 'in-service' environment.

1. Establish and maintain a gas flow through the system.
2. Note pressure on all three gauges. As explained earlier, Normal operation is determined by Inlet and Intermediate gauges showing the same pressure.
3. Loosen lock nut on WORKING regulator, taking care not to break the Case Vent Screen Assembly.
4. Begin turning the Pressure Set Screw OUT of the Working Regulator body.
5. As soon as a change in outlet pressure is noticed, watch Intermediate gauge. It should begin to rise to meet inlet pressure. You have just identified that the regulators were set incorrectly. Next steps will solve the problem and result in a properly adjusted Monitor Regulating set.
6. You may proceed in two different directions from this point. If the project can handle a reduction in outlet pressure, continue to turn the Pressure Set Screw OUT of the Working regulator until the outlet pressure drops not more than 6psi.
7. If the project cannot handle a pressure reduction, you now must set the monitor Regulator and the Working regulator 'on the fly'.
8. Put the monitor into control by turning the WORKING regulator pressure set screw 'INTO' the WORKING regulator body until the Intermediate pressure and Outlet pressure gauges match. Continue turning the WORKING regulator screw 'IN' one complete turn after the pressure has equalized on the Intermediate and Outlet gauges.
9. Now turn the MONITOR regulator pressure set screw to set the MONITOR pressure. This pressure setting should be at least 110% of the desired working pressure and not more than 6psi above it.
 - a. For every quarter turn of the MONITOR pressure regulating screw, turn the WORKING pressure regulating screw the same direction at the same time. This is done to keep the WORKING regulator open during the setup procedure.
10. Once the MONITOR pressure has been set, the Intermediate and Outlet gauges should match. Tighten the lock nut on the MONITOR Pressure Set Screw.
11. Begin turning the WORKING Regulator Pressure Set Screw OUT of the regulator body and watch the Outlet gauge. It should begin to decline as the pressure set screw is turned out. You will likely have to turn it out one full turn to see results, after which each quarter turn will cause a change.
12. As pressure approaches desired set point on the Outlet gauge, the Inlet and Intermediate gauges will begin to synchronize. This is normal as the Monitor regulator opens to try and maintain a pressure higher than the Working regulator is controlling to.
13. When desired Outlet pressure is set on the Working regulator, tighten the lock nut on the pressure set screw.
14. Verify that Set Screws are tight.
15. Verify that outlet pressure is where you set it.
16. Verify the Inlet and Intermediate gauges indicate the same pressure.
17. Mark the pressure settings, the date, and your initials on the green tag attached to the unit. If no green tag is attached, place a new tag.



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Shop Setup

Setup is best done in a shop environment with a gas that can safely be bled to atmosphere, such as compressed air or nitrogen, which will allow changes to be made without attempting to control flammable gas releases. The steps for setup are pretty easy if you understand how the system is supposed to work—re-read the 'How It Works' section on page one and ASK QUESTIONS if you do not understand any part of the setup or operation of this equipment.

1. Gather Tools, Materials, and Services Required
 - a. High pressure gas source, i. e. compressed air at 100psi (6.9bar).
 - b. 6 inch (150mm) or 8 inch (200mm) adjustable wrench.
 - c. 12 inch (300mm) adjustable wrench
 - d. 14 inch (355mm) Pipe wrench.
 - e. Liquid leak detector such as soapy water.
 - f. Adapter with shut-off valve to connect high pressure gas to inlet.
 - g. Adapter with bleed valve to connect to Outlet.
2. Determine desired Outlet pressure and monitor set points.
 - a. Monitor set point should be not less than 110% of desired Outlet pressure and not more than 6psi (0.4bar) above desired Outlet pressure. An example: If desired Outlet pressure is 25 psi (1.7bar), the monitor set point should be around 28psi (1.9bar): $25\text{psi} \times 1.10 = 27.5$ rounded up to 28psi, not to exceed 31psi.
3. Remove the small plug on the strainer and inspect for debris, dust, and dirt. Clean strainer screen and replace plug before proceeding.
4. Connect adapters and compressed air and secure connections.
5. Open the Inlet and Outlet ball valves.
6. Loosen the Pressure Set Screw Lock Nuts, taking care not to damage the Case Vent Screens.
7. Observe the pressure set screws. They should be extended out of the regulator bodies about the same distance.

- a. NEVER pressurize any regulator if the pressure set screw is tightened into the regulator body. There MUST be at least five threads showing outside the lock nut before pressurization.

 - b. If either of the pressure set screws is tightened into the respective regulator body, loosen the lock nut and turn it out to approximately the same distance as the opposing screw.
8. Inspect three pressure gauges.
 - a. All should be in working order and read Zero
 - b. The Inlet and Intermediate gauges must have a working range of 0-300psi, and the Outlet gauge must have a working range of 0-100psi.
 - c. Replace any defective equipment before proceeding.
9. Close the bleed valve on the Outlet adapter and pressurize the assembly. The regulators will take a few seconds to 'balance' and establish control positions.
10. Note the pressure on all three gauges.
 - a. Inlet and intermediate should read the same pressure, while Outlet will read the previously set Outlet pressure.
 - b. If the Intermediate pressure and Outlet pressure are the same, then the Working Regulator has been set higher than the Monitor, or the Working Regulator has failed. The difference is difficult to determine unless a noticeable amount of compressed air is exiting through a Case vent, indicating a failed part. If circumstance and condition indicate a failed part, pressure cannot be set and unit is out of service until repaired.
11. Begin to set Monitor pressure by slowly opening bleed valve to establish enough flow to allow the regulators to assume control of the Outlet pressure. Notice which regulator takes control first by observing the intermediate and Outlet pressure gauges.
 - a. If the Intermediate and Outlet gauges match, the monitor is controlling.
 - b. If the Inlet and Intermediate gauges match, the working regulator is controlling.
 - c. If all three match, "supply to Outlet" flow ratio has equalized. Close the bleed valve enough to maintain a controlled flow during the following steps.



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12. Force the Monitor into control by turning the WORKING regulator pressure set screw 'INTO' the WORKING regulator body until the Intermediate pressure and Outlet pressure gauges match. Continue turning the WORKING regulator screw 'IN' one complete turn after the pressure has equalized on the Intermediate and Outlet gauges.
 - a. If the Intermediate and Outlet pressures were already matched, simply turn the WORKING regulator pressure set screw into the regulator body one full turn.
13. Set the MONITOR pressure.
 - a. Turn the pressure set screw INTO the regulator body to raise the pressure and OUT to lower it. This pressure setting should be at least 110% of the desired working pressure and not more than 6psi above it.
 - b. For every quarter turn of the MONITOR pressure regulating screw, turn the WORKING pressure regulating screw the same direction at the same time. This is done to keep the WORKING regulator open during the setup procedure.
14. Once the MONITOR pressure has been set, the Intermediate and Outlet gauges should match. Tighten the lock nut on the MONITOR Pressure Set Screw.
15. Now it is time to set the WORKING pressure. Maintain compressed air flow through the entire set. Begin turning the WORKING Regulator Pressure Set Screw OUT of the regulator body and watch the Outlet gauge. It should begin to decline as the pressure set screw is turned out. You will likely have to turn it out one full turn to see results, then each quarter turn will cause a change.
16. As pressure approaches desired set point on the Outlet gauge, the Inlet and Intermediate gauges will begin to synchronize. This is normal as the Monitor regulator opens to try and maintain a pressure higher than the Working regulator is controlling to.
17. When desired Outlet pressure is set on the Working regulator, tighten the lock nut on the pressure regulating set screw.
18. Close the bleed valve. The entire assembly will come to working pressure.
19. Wash all joints with soapy water and look for leaks indicated by bubbles. Mark leaks for repair.
20. Close compressed air supply valve.
21. Open bleed valve until pressure gauges read zero.
22. Disconnect compressed air supply and remove adapters.
 - a. Repair all leaks
 - b. Pressure test repairs
23. Attach a tag to the Outlet Pressure Gauge Assembly that shows:
 - a. Unit Serial number
 - b. Date set and tested
 - c. Initials of set and test technician(s)
 - d. Monitor Set Point
 - e. Outlet Set Point
24. Place all tools and adapters in respective storage cabinets.