



Regulator Installation and Maintenance Instructions

Model 441-X57 Regulator

Maximum Inlet Pressures

| Regulator Body Type | 441 Body Materials | Max. Working Pressure of Body | Max. Inlet Pressure |
|-------------------------|---|-------------------------------|---------------------|
| Flanged ANSI 250 lb. RF | Ductile Iron (ASTM A395-71 gr 60-40-18) | 575 psi | } 575 psi* |
| Flanged ANSI 300 lb. RF | Cast Steel (ASTM A216-70a gr WCB) | 720 psi | |
| Flanged ANSI 600 lb. RF | Cast Steel (ASTM A216-70a gr WCB) | 1200 psi | |

* Maximum Inlet Pressure for 2" and 3" 441-X57 with 1½" reduced valve is 1000 psi.
Maximum Inlet Pressure for 3" 441-X57 with 2¼" valve is 400 psi.

Installation and Start-Up

- 1 Make sure the inlet and outlet connections are correct. High pressure connects to the regulator inlet. The flow arrow on the body must point downstream.
- 2 Tighten flanged joints evenly.

CAUTION

It is the user's responsibility to assure that all regulator vents and/or vent lines exhaust to a non-hazardous location away from any potential sources of ignition. Where vent lines are used, it is the user's responsibility to assure that each service regulator is individually vented and that common vent lines are not used.

- 3 Before beginning startup, make sure the regulator is correctly connected, adequately supported and pipe joints are tight.
- 4 Note the set-point (set-point is the outlet pressure the regulator is adjusted to deliver). The regulator is factory adjusted to the set-point specified on the order.

CAUTION

During startup a pressure gauge must be used on the piping at the regulator outlet and closely watched. While inlet pressure enters the regulator, outlet pressure must not exceed set-point by more than the small amount needed for lock-up (tight shutoff). If outlet pressure continues to increase above this, close the inlet shutoff valve. The regulator is not closing properly. Make necessary corrections before resuming startup. Regulator must be fully capable of tight lockup.

- 5 Only adjust set-point when gas is flowing through the regulator. Flow should be small (10% of maximum regulator capacity or less). Do not adjust if regulator is locked-up (tight shutoff).

CAUTION

Turn gas on very slowly. If an outlet stop valve is used, it should be opened first. Do not overload the diaphragm with a sudden surge of inlet pressure. Monitor the outlet pressure during start-up to prevent an outlet pressure overload.

- 6 After completing startup, make sure there are no leaks.
- 7 From the ¼" union (60) extend pipe or tubing to the control connection into the outlet piping. The control piping should not be less than ¼" in size and should be adequately protected against breakage (regulators go wide open if the control line is broken).

The regulator will work to deliver the pressure for which it is adjusted at that point in the outlet piping where the control connection is located.

In general, the control connection should be at least eight pipe diameters from the regulator and should be in as straight a run of pipe as possible where turbulence is a minimum.

The control connection should be clean and smooth, free of rough edges, welding "icicles", etc. It should be located on the top or side of the pipe, and the line pitched to drain away from the regulator into the outlet pipe.

Where outlet piping increases in size near the regulator, it is generally preferable to locate the control connection in the larger size.

Union (60) contains a small orifice, approximately 1/16" diameter. This orifice should not be removed. Also, make certain the orifice is open and free of foreign material.

CAUTION

The diaphragm case vent must be positioned to protect against flooding, drain water, ice formation, traffic, tampering, etc. The vent must be protected against nest building animals, bees, insects, etc., to prevent vent blockage and minimize the chances for foreign material from collecting in the vent side of the regulator diaphragm.

- 8 Make certain there are no leaks and all connections are tight.
- 9 Put the regulator into operation as follows:
 - a. Slowly open the downstream control line valve (A).
 - b. Slowly open the downstream block valve (B).
 - c. Very slowly open the upstream block valve (C).

Set the adjusting screw (10) for the required outlet pressure. Turn it clockwise to increase the pressure and counter-clockwise to decrease it. Only make this adjustment when gas is actually flowing through the regulator.

After adjustment is complete, the locknut (11) should be tightened firmly and the seal cap (1) replaced.
- 10 To shut down, carefully close valves (C), (B) and (A) in that order.

Servicing and Adjustment

1 Before any disassembly of the regulator, make sure it is completely depressured. Pressure must be fully released from the inlet, the outlet and the control line connection. Failure to adequately depressure could result in serious personal injury.

2 Carefully note the location and position of all disassembled parts to be certain reassembly is correct. Inspect each part carefully and replace any that are worn or damaged or otherwise unsatisfactory.

3 Adjustment screw lubrication should be checked whenever the regulator is serviced. Make sure the threads are fully coated with lubricant.

Where there is evidence of thread wear, such as a loose fit or excessive sideplay, the worn parts must be replaced. NOTE: Even at only 10 PSIG outlet pressure, the force exerted on the adjustment screw by spring compression can be great. As a result, failure from worn threads could result in serious personal injury. Therefore, adjustment screw lubrication and thread condition must be given careful attention.

4 Upon completion of servicing, make certain that the regulator installation is entirely free of leaks.

5 A quick visual inspection of the valve can be made by removing inspection plates (38) from the sides of the body. They also provide greatly improved access to the valve when servicing or adjusting.

6 The diaphragm (20), the springs (14), and all other parts from the lower diaphragm plate (22)—and those parts above it—are interchangeable with the 461-X57.

7 Valve and body parts are interchangeable with other 441 Regulators (441-S, 441-57S, 441-VPC, etc.).

8 Use lubricants sparingly and with care to avoid exposing tacky surfaces to the gas stream. Such surfaces could cause accumulation of dirt on close clearance parts.

Use moly or silicone-type lubricants. Avoid the use of petroleum base types.

It is best to avoid lubricating stem (24) or guide (50h). However, a small amount of lubricant on stem O-ring (23) and O-ring (21) will help assure free movement and a tight seal. An application of lubricant to the other O-rings and the tetralseals in the regulator will help assure their tightness.

To Remove Valves

1 Remove seal cap (1), back off adjusting screw (10), remove housing cover (5), and spring (14).

2 Remove bottom plate (33), and side plates (38).

3 Insert an Allen wrench through side inspection opening and loosen Allen screw (50g).

4 Unscrew lower valve assembly and remove through bottom opening (50h unscrews from 50e).

5 Unscrew upper valve assembly and remove through side opening (50e unscrews from 24).

NOTE:

a. If upper valve assembly is too large to remove through side opening, remove it through bottom opening by also removing outlet orifice (29), (remove cap screws (26)

to remove orifice and, if tight, jack out using cap screws in jacking holes).

b. Entire valve assembly may be removed intact through bottom opening by also removing orifice (29). This method leaves the lock-up adjustment undisturbed.

c. Use care with orifice O-ring (27).

6 To disassemble upper and/or lower valve assembly, remove nuts (50a).

To Replace and Adjust Valves

1 Assemble upper valve assembly (parts 50a, 50b, 50c, 50d, 50e, 50g), and lower valve assembly (parts 50a, 50b, 50c, 50d, 50h). Firmly tighten nuts (50a).

2 Insert upper valve assembly and screw into place (50e screws into (24) **but should be loose by 1/2 to 1 turn**).

3 If orifice (29) was removed, reinstall it.

4 Insert lower valve assembly and screw into place by a few turns (50h screws into 50e).

5 Turn upper valve assembly so Allen screw (50g) is accessible through side inspection opening.

6 Make the valve lock-up adjustment as follows:

a. Hold upper valve against its seat. This can be done by hand, reaching through side inspection opening.

b. While holding the upper valve against its seat, screw lower valve assembly upwards until the lower valve also touches its seat. When both upper and lower valves are touching their seats they are correctly adjusted for tight lock-up.

c. Firmly tighten Allen screw (50g). This locks the adjustment by evenly and tightly locking (50h) and (50e) together.

NOTE: If the entire valve assembly was removed intact and Allen screw (50g) has not been loosened, the assembly may be reinstalled without making the lock-up adjustment.

7 Screw entire valve assembly up (50e screws into 24) until it bottoms. Then **back off 1/2 to 1 full turn — this is important**.

8 Replace side plates (38).

9 Replace bottom plate (33). Match bottom end of (50h) into (32) and then turn bottom plate either way to the first matching bolt hole position. Pin in (32) must be intact.

To Remove Orifices

1 Remove outlet orifice (29) per applicable steps 1 through 5 under section "To Remove Valves," above.

2 Remove inlet orifice (28) as follows:

a. Remove seal cap (1), back off adjusting screw (10), remove housing cover (5) and spring (14).

b. Remove bottom plate (33) and then unscrew valve assembly by grasping (50h) and turning (50e unscrews from 24).

c. Remove diaphragm case assembly by first opening union (60) and removing cap screws (34).

d. Remove cap screws (26) and remove inlet orifice (28). If orifice is tight, jack out cap screws in jacking holes. Use care with O-ring (27).

e. When replacing diaphragm assembly, the threaded connection between (24) and (50e) should be screwed together until it bottoms, and then **backed off 1/2 to 1 turn — this is important**.

CAUTION

Regulators are pressure control devices with numerous moving parts subject to wear that is dependent upon particular operating conditions. To assure continuous satisfactory operation, a periodic inspection schedule must be adhered to with the frequency of inspection determined by the severity of service and applicable laws and regulations.

To Change Spring

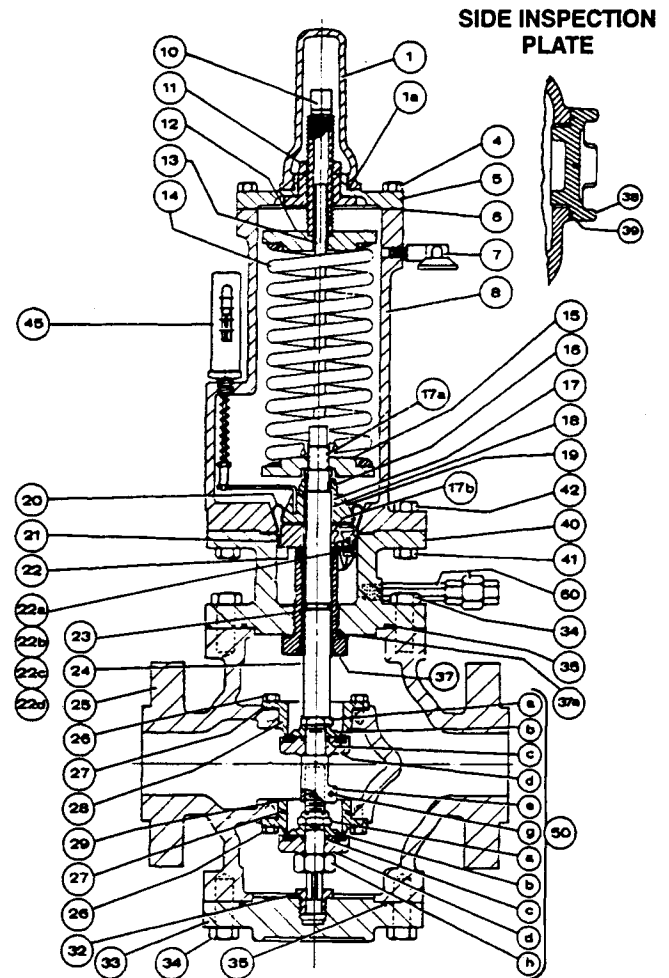
- 1 Remove seal cap (1), back off adjusting screw (10), remove housing cover (5), and remove spring (14).
- 2 Insert the new spring. Be sure it nests correctly onto part (15) and travel indicator bracket (45k) is in place. Also, make a visual inspection of diaphragm (20) before inserting the spring to be sure the roll-out is uniform and in place (use a flashlight, if necessary).
- 3 Complete as per steps 7, 8 and 9 under "To Assemble 441-X57," below.

To Service Diaphragm

- 1 Remove seal cap (1), back off adjusting screw (10), remove housing cover (5), and remove spring (14).
- 2 Remove bolts (42), and then carefully remove upper diaphragm case (8).
- 3 Turn diaphragm assembly counterclockwise until (24) unscrews from (50e), then remove assembly and inspect diaphragm.
- 4 If a new diaphragm (20) is required, remove nut (16) and disassemble.
- 5 When reassembling, be sure that fabric side of diaphragm (20) will be toward the vent side of the regulator and the rubber side of diaphragm toward the pressure side. The gasket is always placed on the spring side of diaphragm.
- 6 Screw diaphragm assembly back into place (24 screws into (50e) until it bottoms) then **back off 1/2 to 1 full turn — this is important.**
- 7 Fold roll into roll-out diaphragm and then carefully reinstall upper diaphragm case (8). Diaphragm must not be pinched between upper and lower cases, (8) and (40). Also, roll-out loop must be uniformly full and even. It should be in place as shown on the cross-section drawing. Tighten bolts (42) evenly.
- 8 Replace spring, etc., per steps 6 through 9 under "To Assemble 441-X57."

To Assemble 441-X57

- 1 Install orifice (28) through top opening.
- 2 Install valve assembly and orifice (29) per applicable steps 1 through 6 under "To Replace and Adjust Valves" (except that (50e) does not yet screw into (24)).
- 3 Install lower diaphragm case (40).
- 4 Install diaphragm assembly and upper case (8) per steps 5 through 7 under "To Service Diaphragm."



2" AND 3" MODEL 441-X57

- 5 Replace bottom plate (33). Match bottom end of (50h) into (32), and then rotate bottom plate either way to the first matching bolt hole position. Pin in (32) must be intact.
- 6 Insert the spring. Be sure it nests correctly onto part (15) and travel indicator bracket (45k) is in place. Also, make a visual inspection of diaphragm (20) before inserting the spring to be sure the roll-out is uniform and in place (use a flashlight, if necessary).
- 7 Insert top spring button (12). Be sure it is nested correctly on the spring.
- 8 Install housing cover (5). Be sure the lower end of adjusting screw (10) fits into the recess in button (12).
- 9 Set adjusting screw (10) for desired outlet pressure (only adjust when gas is flowing through the regulator), firmly tighten nut (11) and replace seal cap (1).

Spring Ranges

| Outlet Pressure Min. to Max. | Spring Color | Nominal Diaphragm Size (I.D.) |
|---------------------------------|-----------------|----------------------------------|
| 75 to 100 psi | Red | 2 1/2" Diaphragm All Ranges |
| 100 to 175 psi | Brown | |
| 150 to 250 psi | Black | |

Over-pressurization Protection

Protection must be provided for the downstream piping system and the regulator's low pressure chambers to assure against the potential over-pressurization due to a regulator malfunction or a failure of the regulator to lock-up. The allowable over-pressurization is the lowest of the maximum pressures permitted by federal codes, state codes, Equimeter Bulletin RDS-1498, or other applicable standards. The method of providing over-pressure protection could be a relief valve, a monitor regulator, a shut off device or any similar device.

Temperature Limits

The 2" and 3" Model 441-X57 Regulator can be used for flowing temperatures from -20°F to 150°F.

Buried Service

The 2" and 3" Model 441-X57 Regulator *is not* recommended for buried service.

Condensed Parts List 2" and 3" Model 441-X57

| III. No. | Description | Part Number |
|----------|--|---------------|
| 1 | Seal Cap | 090-00-005-02 |
| 1a | Tetraseal (or O-Ring) 1 3/4" x 2" | 904902 |
| 4 | Hex Cap Screw 3/16"-18 x 1" 120,000 tensile, 8 used | 910030 |
| 5 | Top Cap Assembly | 091-16-380-01 |
| 6 | Housing Cover Gasket | 091-00-066-30 |
| 7 | Vent Cap, 1/4" NPT | 137-02-505-02 |
| 10 | Spring Adjusting Screw | 091-00-007-50 |
| 11 | Hex Steel Jam Nut, 7/8"-14 | 903873 |
| 12 | Top Spring Button | 091-00-009-50 |
| 13 | Spring Thrust Rod (Upper) | 091-00-062-50 |
| 14 | Spring, Red 75 to 100 psi | 091-00-021-02 |
| | Spring, Brown 100 to 175 psi | 091-00-021-01 |
| | Spring, Black 150 to 250 psi | 091-00-021-00 |
| 15 | Lower Spring Button | 091-00-009-51 |
| 16 | Elastic Stop Nut 3/4"-16 | 903596 |
| 17 | Diaphragm Stub (Lower) | 091-00-158-50 |
| 17a | Type 2 Groove Pin 1/8" x 3/16" Lg. | 904118 |
| 17b | Thrust Bearing Stainless Steel 3/8" Dia. | 930510 |
| 18 | Diaphragm Stub | 090-00-058-50 |
| 19 | Diaphragm Plate—Upper | 091-00-010-50 |
| 20 | Diaphragm—2 1/2" Roll-Out | 091-00-350-50 |
| 21 | O-Ring, 2 1/8" x 2 1/2" | 934033 |
| 22 | Diaphragm Plate—Lower | 091-00-022-50 |
| 22a | Stainless Steel Ball 1/4" Dia. | 930506 |
| 22b | Soc. Hd. Cap Screw #10-24 x 3/8" Lg. | 939900 |
| 22c | #10 Steel Lockwasher | 904012 |
| 22d | Ball Valve Retaining Ring Washer | 090-16-178-01 |
| 23 | O-Ring, 1 1/8" x 7/8" | 934013 |
| 24 | Diaphragm Connecting Stem, Stainless Steel | 090-00-058-51 |
| 26 | Hex Cap Screw, 1/4"-20 x 1/2" Lg., 120,000 tensile | 910001 |
| 32 | Guide Bushing with Pin, brass | 090-16-385-01 |
| | Guide Bushing with Pin, stainless steel | 090-16-385-03 |
| 34 | Hex Cap Screw, 1/2"-13 x 1 1/4" | 910106 |
| 35 | Tetraseal (or O-Ring), 4 3/8" x 4 5/8" | 904085 |
| 37 | Centerpiece Stem Bushing | 090-16-373-01 |
| 37a | Aluminum Seal Ring | 090-26-178-00 |

2" and 3" Model (continued)

| III. No. | Description | Part Number |
|----------|---|---------------|
| 39 | Tetraseal (or O-Ring), 3 1/4" x 3 1/2" | 904078 |
| 40 | Lower Diaphragm Case, for 250 lb. ductile iron bodies | 090-00-002-51 |
| | Lower Diaphragm Case, for steel bodies | 090-00-002-53 |
| 41 | Hex Steel Nut, 3/8"-16 | 920053 |
| 42 | Hex Steel Bolt, 3/8"-16 x 1 3/4" Lg. 120,000 tensile | 910058 |
| 45 | Travel Indicator Assembly | 091-00-365-83 |
| 50 | Valve Assembly, 1 3/4", brass trim, Polyurethane (red, 65-75 Duro) | 090-16-515-32 |
| | Valve Assembly, 1 1/2" brass trim, Polyurethane (red, 65-75 Duro) | 090-16-515-33 |
| | Valve Assembly, 1 3/4", stainless steel trim, Polyurethane (red, 65-75 Duro) | 090-16-515-52 |
| | Valve Assembly, 1 1/2", stainless steel trim, Polyurethane (red, 65-75 Duro) | 090-16-515-53 |
| 50a | Valve Lock Nut, 3/8"-18 | 905564 |
| 50b | Valve Retainer, standard, steel, 1 3/4" | 090-16-018-00 |
| | Valve Retainer, standard, steel, 1 1/2" | 090-16-018-01 |
| | Valve Retainer, standard, stainless steel, 1 3/4" | 090-16-018-30 |
| | Valve Retainer, standard, stainless steel, 1 1/2" | 090-16-018-31 |
| | Valve Retainer, v-port wings, steel, 1 3/4" | 090-16-012-50 |
| | Valve Retainer, v-port wings, steel, 1 1/2" | 090-16-012-52 |
| | Valve Retainer, v-port wings, stainless steel, 1 3/4" | 090-16-012-53 |
| | Valve Retainer, v-port wings, stainless steel, 1 1/2" | 090-16-012-55 |
| 50c | O-Ring, 3/8" x 1 3/16" | 934012 |
| 50d | Molded Valve, 1 3/4", Polyurethane (red, 65-75 Duro), all trim | 090-16-315-02 |
| | Molded Valve, 1 1/2", Polyurethane (red, 65-75 Duro), all trim | 090-16-315-03 |
| | Molded Valve, 1 3/4", Polyurethane (tan, 85-95 Duro), all trim | 090-16-315-05 |
| | Molded Valve, 1 1/2", Polyurethane (tan, 85-95 Duro), all trim | 090-16-315-04 |
| 50e | Female Valve Stem, brass | 090-16-116-00 |
| | Female Valve Stem, stainless steel | 090-16-116-01 |
| 50g | Adjustment Clamp Screw, Soc. Hd. Screw, 10-24 x 1/2" Lg. | 903486 |
| | Adjustment Clamp Screw, for 1 1/2" valve only | 090-16-046-01 |
| 50h | Male Valve Stem, brass | 090-16-016-01 |
| | Male Valve Stem, stainless steel | 090-16-016-02 |
| 60 | Nipple, Orifice Plug & Union Assembly | 091-00-361-03 |

2" Model 441-X57

| III. No. | Description | Part Number |
|----------|--|---------------|
| 27 | O-Ring for Orifices | 904832 |
| 28 | 1 3/4" Inlet Orifice, plated steel | 090-16-028-00 |
| | 1 1/2" Inlet Orifice, plated steel | 090-16-028-01 |
| | 1 3/4" Inlet Orifice, stainless steel | 090-16-028-50 |
| | 1 1/2" Inlet Orifice, stainless steel | 090-16-028-51 |
| 29 | 1 3/4" Outlet Orifice, plated steel | 090-16-029-00 |
| | 1 1/2" Outlet Orifice, plated steel | 090-16-029-01 |
| | 1 3/4" Outlet Orifice, stainless steel | 090-16-029-50 |
| | 1 1/2" Outlet Orifice, stainless steel | 090-16-029-51 |

3" Model 441-X57

| III. No. | Description | Part Number |
|----------|---|---------------|
| 27 | O-Ring for Orifices | 950818 |
| 28 | 2 1/8" Inlet Orifice, crs | 090-20-028-00 |
| | 1 3/4" Inlet Orifice, crs | 090-20-028-02 |
| | 1 1/2" Inlet Orifice, crs | 090-20-028-03 |
| | 2 1/8" Inlet Orifice, stainless steel | 090-20-028-50 |
| | 1 3/4" Inlet Orifice, stainless steel | 090-20-028-52 |
| 29 | 1 1/2" Inlet Orifice, stainless steel | 090-20-028-53 |
| | 2 1/8" Outlet Orifice, crs | 090-20-029-00 |
| | 1 3/4" Outlet Orifice, crs | 090-20-029-02 |
| | 1 1/2" Outlet Orifice, crs | 090-20-029-03 |
| | 2 1/8" Outlet Orifice, stainless steel | 090-20-029-50 |
| 50 | 1 3/4" Outlet Orifice, stainless steel | 090-20-029-52 |
| | 1 1/2" Outlet Orifice, stainless steel | 090-20-029-53 |
| | Valve Assembly, 2 1/8", brass trim, Polyurethane (red 65-75 Duro) | 090-20-515-40 |
| 50b | Valve Assembly, 2 1/8", iron trim, Polyurethane (red, 65-75 Duro) | 090-20-515-10 |
| | Valve Retainer, standard, crs, 2 1/8" | 090-20-018-00 |
| 50d | Valve Retainer, standard, stainless steel, 2 1/8" | 090-20-018-30 |
| | Valve Retainer, v-port wings, crs, 2 1/8" | 090-20-012-50 |
| | Valve Retainer, v-port wings, stainless steel, 2 1/8" | 090-20-012-51 |
| | Molded Valve, 2 1/8", Polyurethane (red, 65-75 Duro), all trim | 090-20-315-02 |
| | Molded Valve, 2 1/8", Polyurethane (tan, 85-95 Duro), all trim | 090-20-315-03 |

Maximum Emergency Pressure

The following are the maximum pressures which the regulator body may be subjected to under abnormal conditions without causing internal damage:

Ductile Iron Body Maximum Inlet Pressure + 60 psi

Cast Steel Body Maximum Inlet Pressure + 100 psi

If body pressure exceeds the above values, the regulator must be removed from service and inspected. Damaged or otherwise unsatisfactory parts must be repaired or replaced before returning the regulator to service.

The maximum pressure which the diaphragm may be subjected to under abnormal conditions without causing internal damage is set-point + 50 psi. If the pressure on the diaphragm exceeds set-point by more than 50 psi, the regulator must be removed from service and inspected. Damaged or otherwise unsatisfactory parts must be repaired or replaced before returning the regulator to service. The set-point is the outlet pressure the regulator is adjusted to deliver.

The maximum pressure that can be safely contained by the diaphragm case is 350 psi. Safely contained means no leakage as well as no bursting.

Before using any of the above data, make sure this entire section is clearly understood.

Other Cases

The 2" and 3" Model 441-X57 Regulators are mainly used on natural gas services; however, this regulator will perform equally well on other gases. When using the 2" and 3" Model 441-X57 Regulators on other gases, the regulator capacities must be adjusted using the following correction factors.

Type of Gas

Correction Factor

Air (specific gravity 1.0) 0.77

Propane (specific gravity 1.53) 0.63

1350 BTU Propane-Air Mixture (specific gravity 1.20) 0.71

Nitrogen (specific gravity 0.97) 0.79

Dry CO₂ (specific gravity 1.52) 0.63

For other non-corrosive gases use the following formula:

$$\text{Correction Factor} = \sqrt{\frac{0.60}{\text{Specific gravity of the gas}}}$$

For use with gases not listed above, please contact your Equimeter representative or Industrial Distributor for recommendations.

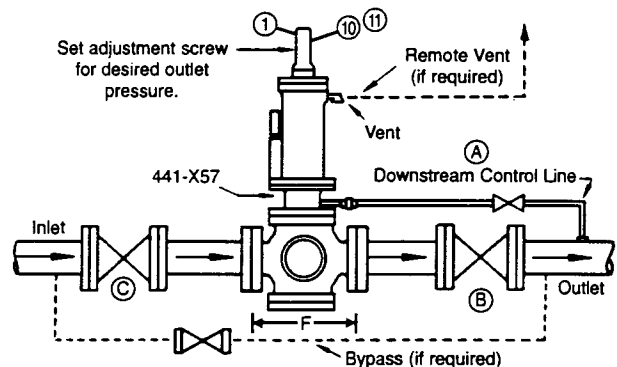
Monitoring

The 2" and 3" Model 441-X57 Regulators make excellent monitors. They can act as standby regulators installed in series which assumes control if a failure in the operating regulator permits the outlet pressure to exceed the set-point. It can be located in either the upstream or the downstream position.

When a 2" or 3" Model 441-X57 Regulator is used to monitor a regulator with an identical inner valve (another 441 Regulator), the total maximum capacity through both regulators can be figured at 70% of the capacity of one regulator alone. This applies with the monitor located either upstream or downstream.

Typical Arrangement and Dimensions

(Indoor or Outdoor Installation)



441-X57

| Regulator Body Type | F (Face to Face) | |
|----------------------|------------------|---------|
| | 2" Pipe | 3" Pipe |
| Flanged ANSI 250 lb. | 10 1/2" | 12 1/2" |
| Flanged ANSI 300 lb. | 10 1/2" | 12 1/2" |
| Flanged ANSI 600 lb. | 11 1/4" | 13 1/4" |



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