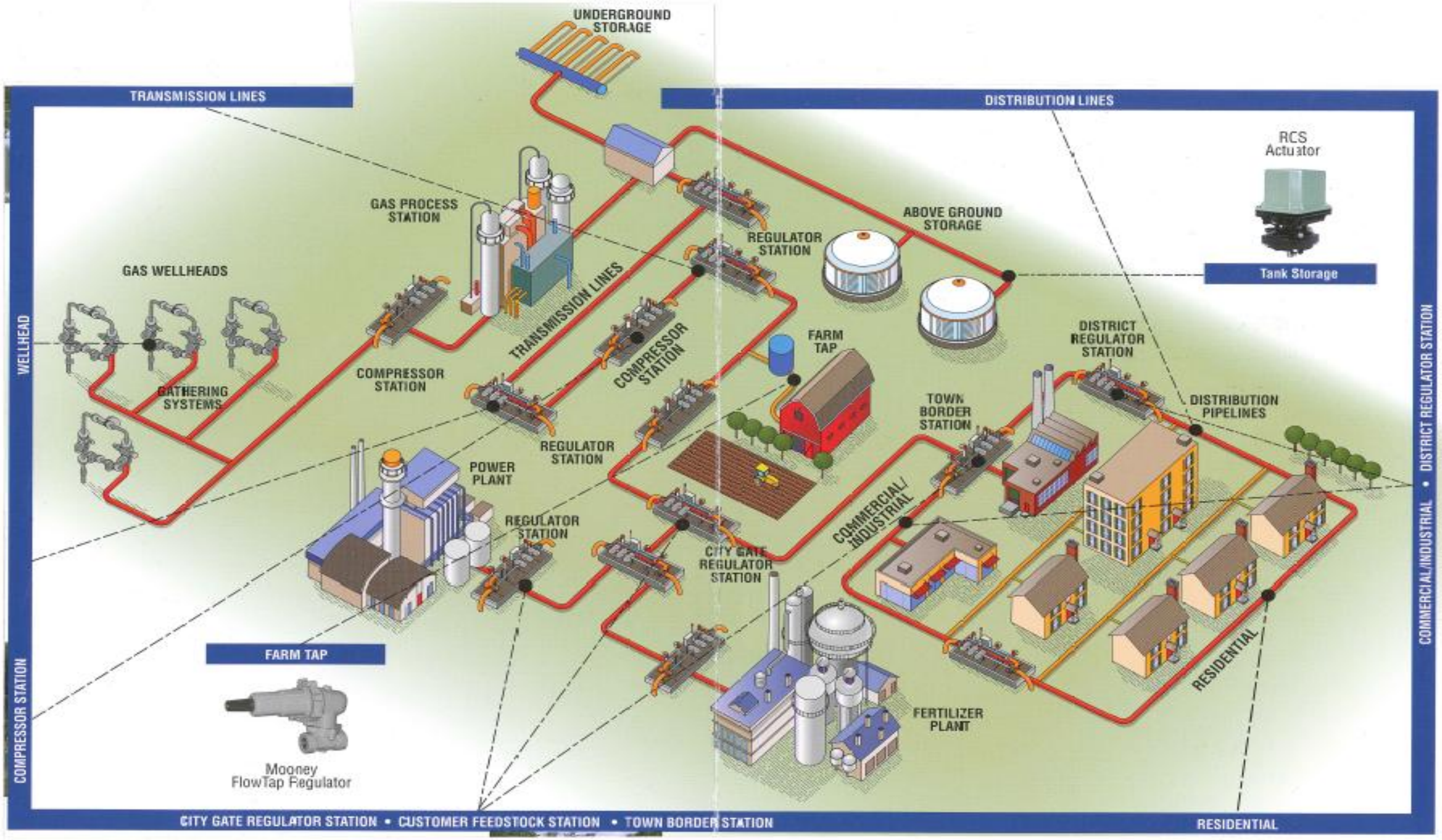
Natural Gas Piping System



Types of Stations

- Town Boarded Station – TBS
  - Normally Transmission pipeline pressure take point or delivery.
    - 500 – 1000 psi inlet to regulators
    - 100 – 200 psi outlet pressures for distribution system feeder.

Types of Stations

- District Regulator Station – DRS
  - Distribution feeder pressure 100 – 200 psig inlet
  - Reduces feeder pressure to distribution - 15 to 60 psig MAOP

Regulator Station Failures

- Besides the obvious –Mechanical Disconnect
  - Physical damage of setting
    - Car Accident
    - Storm damage
    - Vandalism

    - These types of failures will almost always cause a station to fail wide open.

Regulator Station Failures

- What are the Cause's of station upset
  - Most Common
  - Internal Pipeline Contamination
    - Excess Moisture – internal freezing caused by high pressure reduction and the Joules Thompson effect.
    - Iron Oxide (Rust) – erosion of internal components
    - Excess sulfur content – caking on stainless components
    - Hydrates – oils and other liquids
    - Debris – trash, taps shavings, rocks, cans, dirt, Ect.

Maintenance

- Iron oxide, sand, dirt and weld slag can cause visual erosion of the flexible element and/or seat.
- Distillates, CO_2, and aromatic oils can cause loss of elasticity, hardening, blistering and/or swelling of rubber parts such as seals and the flexible element.
- Hydrates and freezing can cause plugging of the restrictor and/or pilot orifice resulting in a fail open or closed situation.

Regulator Types

- Self Operated
  - Sensus/Rockwell 441/461 57S

- Pilot Operated
  - GE – Mooney – Flowgrid and Flowmax, RedQ (grove) - Flexflow,
  - American – Axial flow
  - Fisher – 399, EZR, 1098EGR, 310A

R-1332
Rev. 6

Model 461-X57

High Pressure Regulators with Roll-Out Diaphragm

Equimeter
INCORPORATED

A BTR Metering Systems Company

Taking the measure of tomorrow

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, 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 fabric side of diaphragm **20** will be toward the vent side of the regulator and the rubber side of the diaphragm is toward the pressure side. The gasket is always placed on the spring side of the diaphragm.
6. Screw diaphragm assembly back into place (**24** screws into **50e** until it bottoms) then **back off one-half to one 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 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."
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. 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 100 to 175 psi 150 to 250 psi	Red Brown Black	2½" Diaphragm All Ranges

Over-pressurization Protection

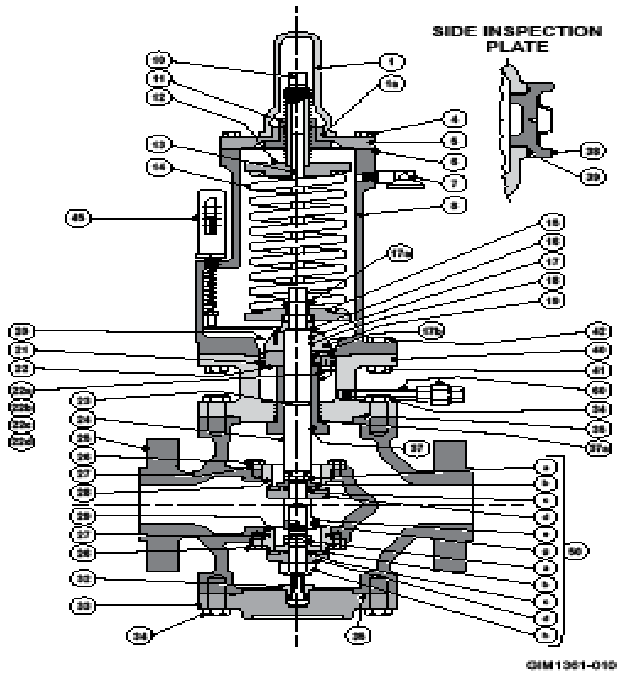
Protection must be provided for the downstream piping system and the regulator's low pressure chambers to ensure against the potential over-pressurization due to a regulator malfunction or a failure of the regulator to lock-up. The allowable over-pressurization is the lowest of the maximum pressures permitted by federal codes, state codes, Sensus Bulletin RDS_1498, or other applicable standards. The method of providing over-pressurization protection could be a relief valve, a monitor regulator, 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

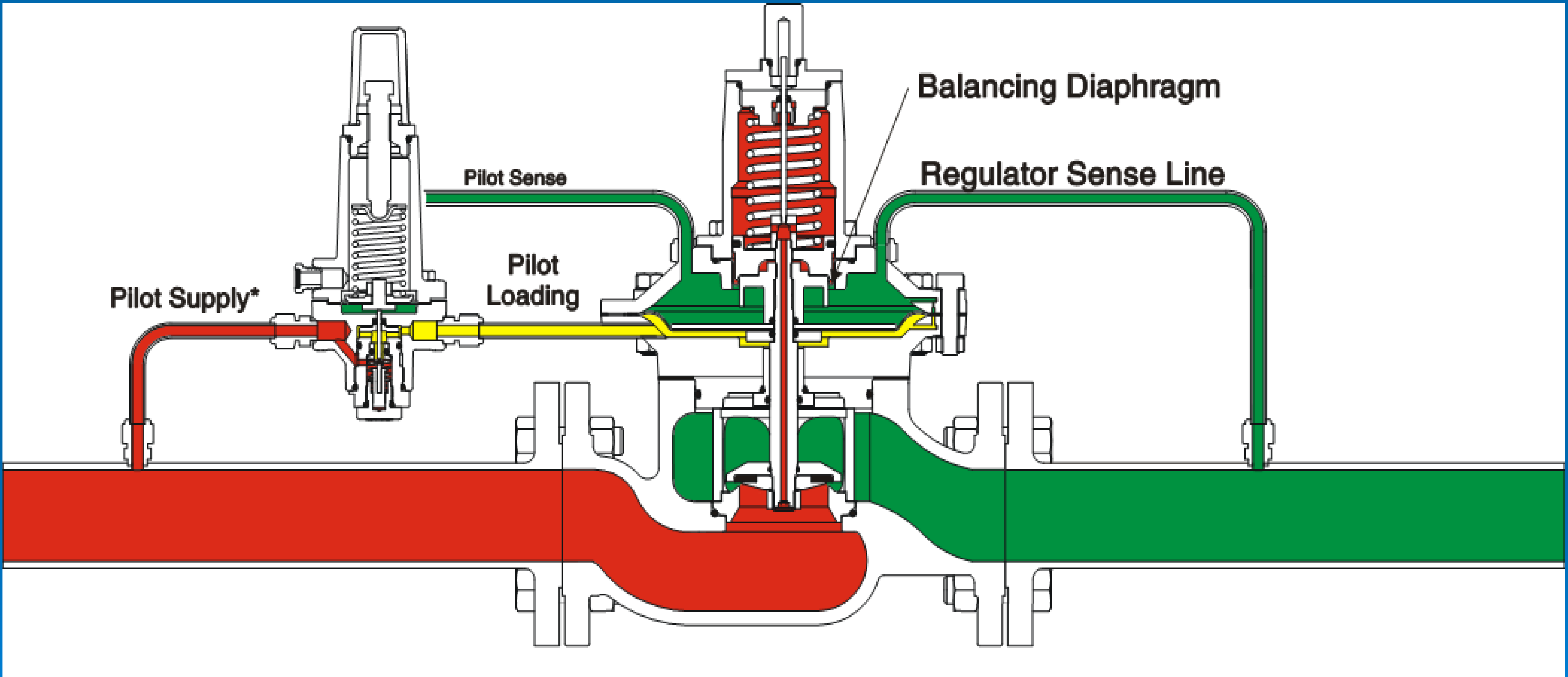
The 2" and 3" Model 441-X57 Regulator ***is not*** recommended for buried service.



2" AND 3" MODEL 441-X57

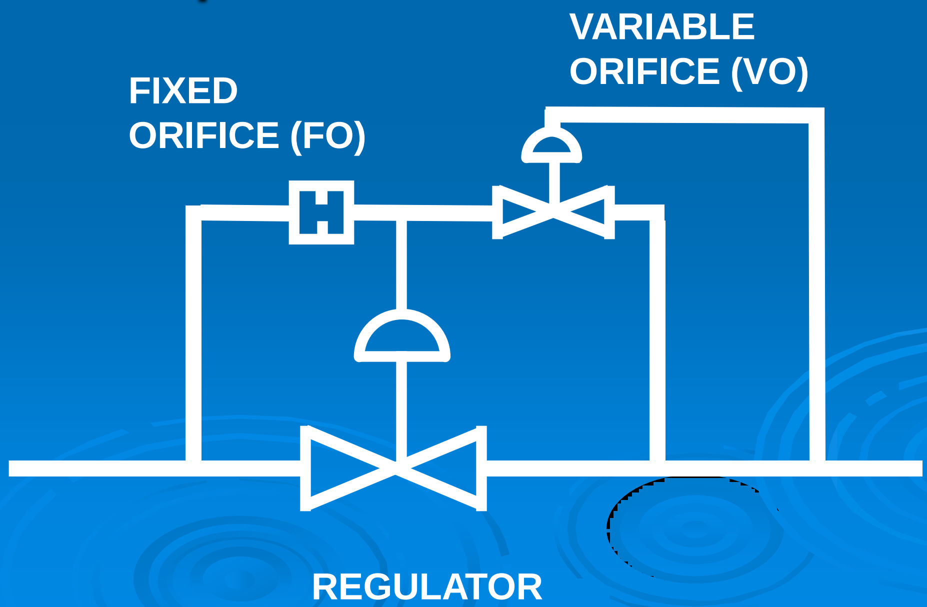
The FlowMax Regulator with Series 20 Pilot

The FlowMax Regulator
Loading Type Pilot System



Pilot Unloading Type Principle of Operation

- Pilot operated (Variable Orifice)
- Unloading Type System
- Pilot and Restrictor work together to form a Pneumatic Amplifier



300 and 600 Series – 2" thru 12"

Axial Flow Valves

Operation, Control Manifold, Capacity Limiter, Control Loops, Installation and Repair Parts List

AMERICAN METER COMPANY

Axial Flow Valve – Operation

Control Passages *(Figure 2)*

The gallery of the valve body has three passages:

1. The inlet pressure normally supplies the control pressure. The inlet supply pressure passage is in the upstream closure and connects with the gallery.
2. The control passage branches into two annular grooves in the valve body. The annular grooves distribute control pressure around the sleeve when the sleeve is in the fully open or closed position.
3. The exhaust or downstream bleed passage is normally used to permit reduction in control pressure when opening the valve. The aspirating capability of this passage insures a fully expanded sleeve with minimal pressure differential.

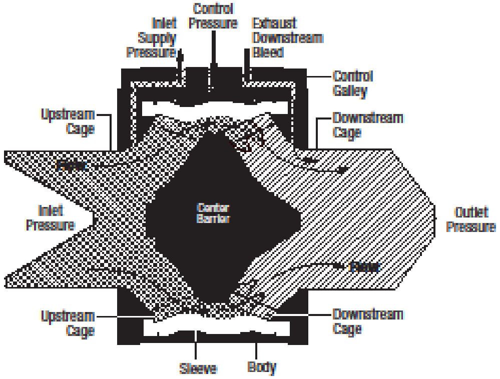


Figure 2

Closed Position *(Figure 3)*

The sleeve is molded to a smaller diameter than the cage diameter. When assembled in the valve, the sleeve exerts a closing preload on the upstream and downstream cages. The inner upstream surface of the sleeve is exposed to inlet pressure applied.

Control pressure (supplied by and equal to the inlet pressure) is against the exterior of the sleeve. The differential pressure on the upstream portion of the sleeve is 0 psi, but the sleeve preload exerts a closing force. The differential across the downstream portion of sleeve is the difference between the upstream and downstream presures. This differential plus the sleeve preload provides the closing force.

Throttling *(Figure 4)*

To open the valve, control pressure must be reduced. A small decrease in the control pressure permits inlet pressure to lift the sleeve from the inlet cage. As the control pressure is further decreased, the central sleeve preload is overcome and the sleeve is peeled progressively away from the downstream cage. Flow through the valve commences when the tapered openings of the outlet cage are uncovered. Further decreases in control pressure uncover a greater area of the outlet cage. Throttling control is maintained when the control pressure reaches equilibrium and flow demand is satisfied.

Open Position *(Figure 5)*

The valve is fully open when the drop in control pressure is sufficient to completely expose the slots in the downstream cage, and the sleeve is fully expanded against the body inner contour.

The control pressure drop is aided by aspiration through the downstream bleed aspiration port. At high rates of flow, the aspirated pressure in the bleed channel can be significantly lower than the downstream pipe line pressure, thereby minimizing the differential between inlet and outlet pressures required for full valve opening.

Axial Flow Valve Components

Three Major Structural Parts and One Moving Part

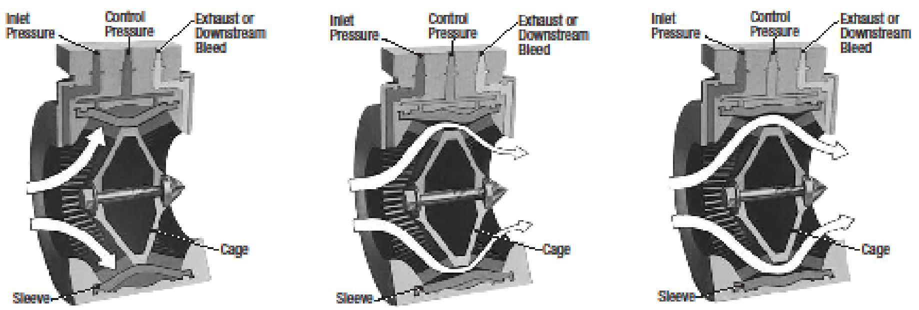
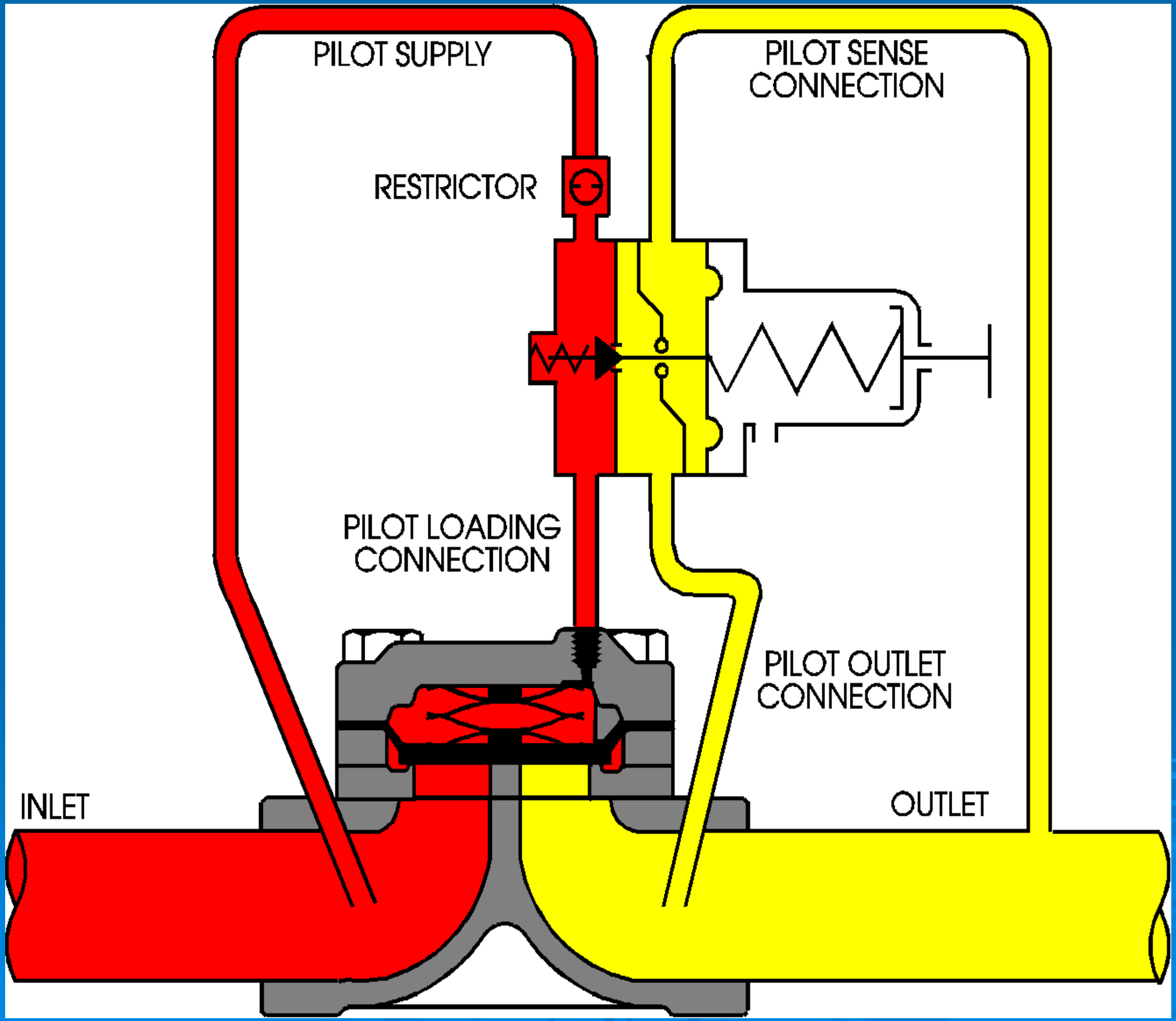


Figure 3 Closed Position

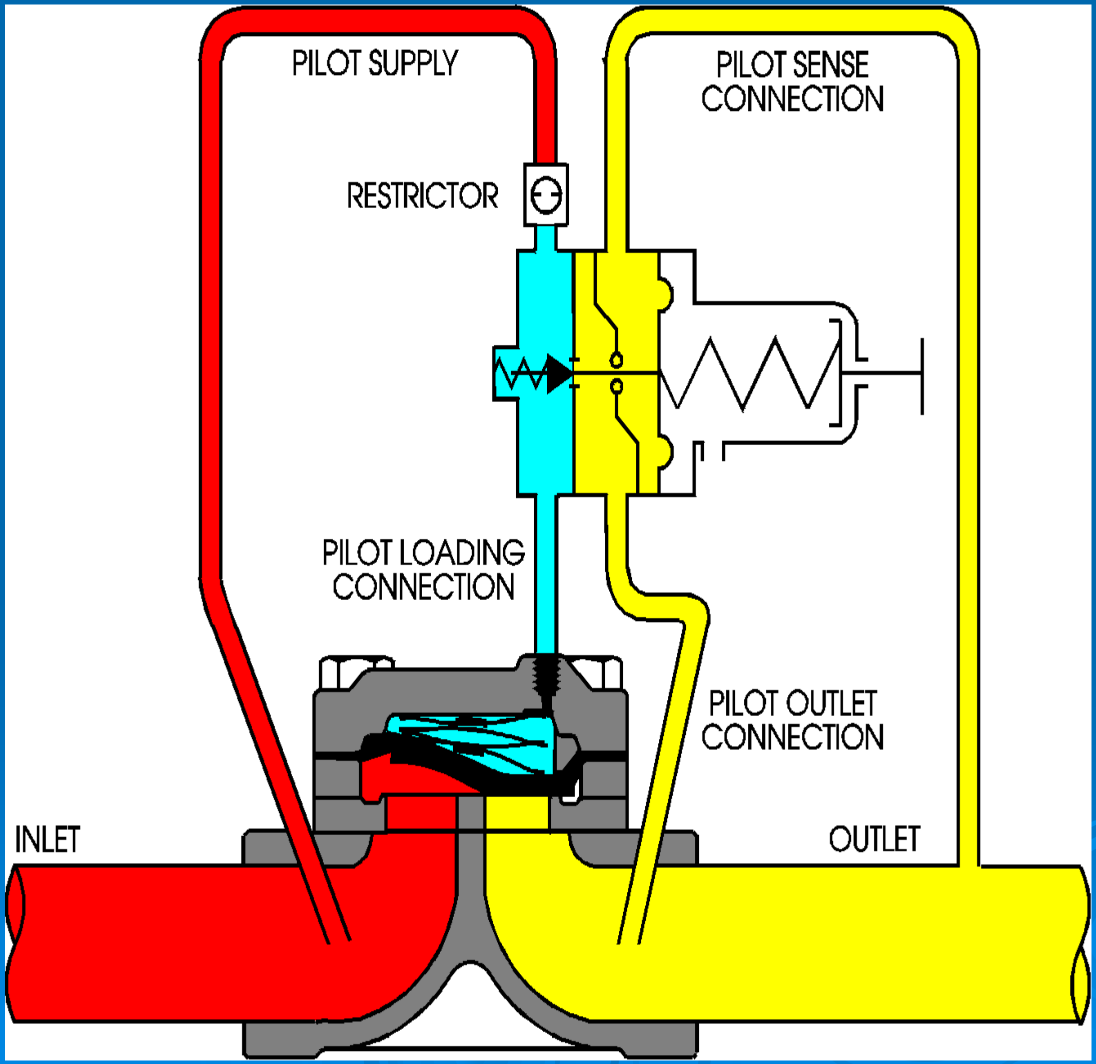
Figure 4 Throttling Position

Figure 5 Open Position

Pressure Reducing Schematic - Closed



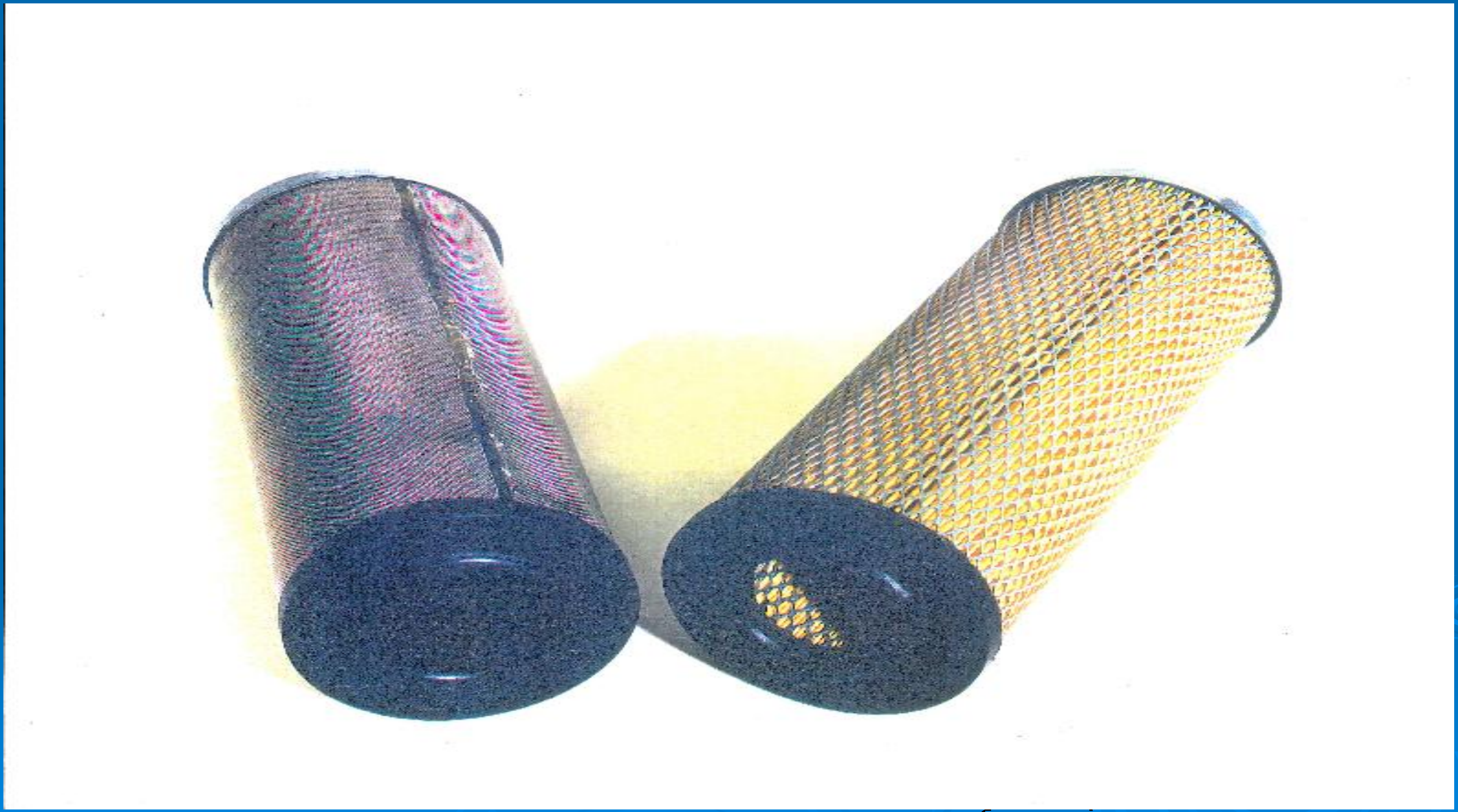
Pressure Reducing Schematic - Partial Open



Monitor – Mixed Components


NOV 4 2004

Filter Element

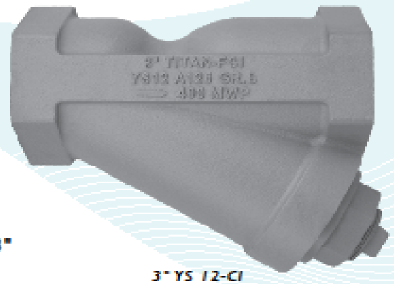


YS12-0212

TITAN FLOW CONTROL, INC.

"Y" (WYE) STRAINER ◆ ANSI CLASS 250

CAST IRON ◆ THREADED ENDS



3" YS 12-CI

MODEL: YS 12-CI

(CAST IRON)

FEATURES

SIZE RANGE : 1/4" ~ 3"

◇ **LARGE STRAINING CAPACITY**
WITH ITS LARGE BODY AND SIZABLE STRAINING ELEMENT, THE YS12 PROVIDES EXCELLENT OPEN AREA RATIOS THAT ARE TYPICALLY TWO-AND-A-HALF TIMES LARGER THAN THE CORRESPONDING PIPELINE.

◇ **PRECISION MACHINED SEATS**
PRECISION MACHINED SCREEN SEATS IN BOTH THE BODY AND CAP HELP TO ENSURE ACCURATE POSITIONING OF THE SCREEN DURING REASSEMBLY AFTER CLEANING. ALSO, THE MACHINED BODY SEATS ENABLE FINER FILTRATION BY PREVENTING DEBRIS BYPASS.

◇ **SELF-CLEANING CAPABILITY**
WITH A TAPPED NPT BLOW-OFF CONNECTION, THIS UNIT CAN BE FITTED WITH A BLOW-DOWN VALVE WHICH FACILITATES CLEANING OF THE STRAINING ELEMENT. PLEASE CONTACT FACTORY FOR MORE INFORMATION.

◇ **EPOXY PAINTED**
ALL UNITS ARE EPOXY PAINTED TO HELP RESIST RUST AND CORROSION. TITAN FCI ALSO OFFERS EPOXY COATING AS AN OPTION FOR THE YS12.

◇ **THREADED CAP**
TITAN'S YS12 HAS STRAIGHT THREADS TO PERMIT EASY CAP REMOVAL FOR CLEANING AND PROPER ALIGNMENT WHEN REASSEMBLING STRAINER.

◇ **TYPE I MILITARY SPECIFICATION**
WHEN FURNISHED WITH A BRONZE BLOW OFF PLUG, THE YS12 MEETS MILITARY SPECIFICATION WW-S-2739 FOR SIZES 3/8" THROUGH 3". PLEASE SPECIFY IF NECESSARY.

◇ **NATURAL GAS AND OTHER SPECIAL APPLICATIONS**
TITAN HAS EXTENSIVELY TESTED THE YS12 IN GAS APPLICATIONS AND DETERMINED THAT BUNA-N GASKETS PROVIDE SUPERB SEALING CAPABILITIES FOR THE SERVICE. ALWAYS SPECIFY IF A SPECIAL GASKET OR SCREEN IS REQUIRED FOR A SPECIFIC APPLICATION.

TECHNICAL

PRESSURE/ TEMPERATURE RATING CI-ASTM A126 GR. B - CLASS 250 **YS 12-CI (THREADED)**	
WOG (Non-shock):	400 PSI @ 150 °F
Saturated Steam:	250 PSI @ 406 °F
Maximum Liquid:	250 PSI @ 406 °F

* *The above listed temperatures are theoretical and may vary during actual operating conditions.*

APPLICATIONS

GENERAL APPLICATION: Y-STRAINERS ARE INSTALLED IN A PIPING SYSTEM TO REMOVE UNWANTED DEBRIS FROM THE PIPELINE, PROTECTING EXPENSIVE EQUIPMENT DOWNSTREAM SUCH AS PUMPS, METERS, SPRAY NOZZLES, COMPRESSORS, AND TURBINES. THEY CAN BE PLACED IN A HORIZONTAL OR VERTICAL PIPELINE AS LONG AS THE SCREEN IS IN A DOWNWARD POSITION. STRAINING IS ACCOMPLISHED VIA AN INTERNAL PERFORATED OR MESH LINED STRAINING ELEMENT, THE SIZE OF WHICH SHOULD BE DETERMINED BASED ON THE SIZE OF THE SMALLEST PARTICLE TO BE REMOVED.

SERVICING: THE STRAINING ELEMENT NEEDS REGULAR CLEANING TO PREVENT DEBRIS BUILD UP. IT IS NOT ADVISABLE TO ALLOW THE DIFFERENTIAL PRESSURE TO INCREASE BY 20 PSI. ALTHOUGH CLEANING NORMALLY REQUIRES THE REMOVAL OF THE STRAINING ELEMENT, INSTALLING AND USING A TITAN BLOW-OFF DRAIN VALVE CAN INCREASE THE TIME BETWEEN CLEANINGS.

The above data represents common market and service applications. No representation or guarantee, expressed or implied, is given due to the numerous variations of concentrations, temperatures and flow conditions that may occur during actual service.

TITAN FLOW CONTROL, INC.

YOUR PIPELINE TO THE FUTURE!

Tel: 910-735-0000 ◇ Fax: 910-738-3848 ◇ titan@titanfci.com ◇ www.titanfci.com
290 Corporate Drive ◇ PO Box 7408 ◇ Lumberton, NC 28358

TITAN FLOW CONTROL, Inc.
290 Corporate Drive
Lumberton, NC 28358
Tel: 910.735.0000
E-mail: titan@titanfci.com
Web: www.titanfci.com
Fax: 910.738.3848

"Y" (WYE) STRAINER

YS 12-CI - (Cast Iron)

Threaded Ends • Cast Iron • ANSI Class 250

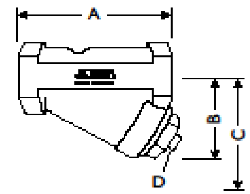
ANSI Class 250

BILL OF MATERIALS [1]

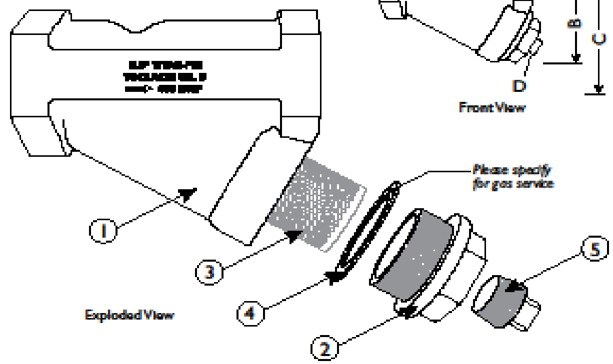
No.	PART	YS 12-CI
1	Body [2]	Cast Iron A126 Gr. B
2	Cap	Cast Iron A126 Gr. B
3	Straining Element [3]	Stainless Steel [6]
4	Gasket [3] [4]	Grafoil
5	NPT Plug (Blow-off) [5]	Steel

1. Bill of Materials represents standard materials. Equivalent or better materials may be substituted at the manufacturer's discretion.
2. All units are epoxy painted.
3. Denotes recommended spare parts.
4. Contact Titan for special gaskets materials, including Buna-N or Viton, for natural gas, hot air, or other applications.
5. The YS12 can be furnished with bronze blow-off plug to meet Military Specification WW-S-2739. Contact factory.
6. Stainless Steel Straining Element is available in Type 304 and Type 316 Stainless Steel. A wide range of wire mesh and perforated screens are available. See "Standard Screen Selections" chart below for standard perforations and meshes. Please specify if a non-standard screen is required.

Illustrations are representative of a 2" YS12-CI. Please ask for certified drawings when required.



Front View



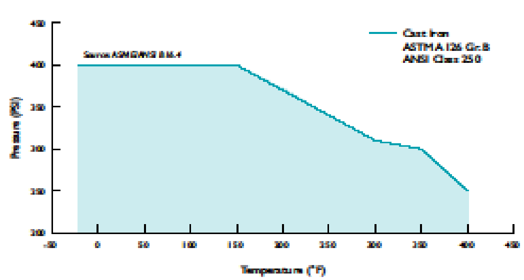
Exploded View

DIMENSIONS AND PERFORMANCE DATA [1]

SIZE		1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
SIZE	mm	8	10	15	20	25	32	40	50	65	80
A DIMENSION FACE TO FACE [2]	in	3.188	3.188	3.188	3.75	4.0	5.0	5.75	7.0	9.25	10.0
	mm	81	81	81	95	102	127	146	178	235	254
B DIMENSION CENTER LINE TO BOTTOM	in	2.063	2.063	2.063	2.438	2.625	3.375	3.875	4.75	5.875	6.0
	mm	52	52	52	62	67	86	98	121	149	152
C DIMENSION SCREEN REMOVAL	in	2.375	2.375	2.375	3.0	3.25	4.25	5.0	6.125	7.875	8.0
	mm	60	60	60	76	83	108	127	156	200	203
D NPT Plug BLOW-OFF	in	1/4	1/4	1/4	3/8	3/8	3/4	3/4	1	1 1/2	1 1/2
	mm	8	8	8	10	10	20	20	25	40	40
APPROXIMATE ASSEMBLED WEIGHT	lb	1.5	1.5	1.5	2.5	3.5	6.0	9.0	14.0	25.5	32.0
	kg	0.7	0.7	0.7	1.1	1.6	2.7	4.1	6.3	11.6	14.5
Flow Coefficient	C_v	0.7	2	8	15	22	38	42	70	110	160

1. Dimensions and weights are for reference only. When required, request certified drawings.
2. Face to face values have a tolerance of ±0.06 in (±2.0 mm).

PRESSURE - TEMPERATURE RATINGS



PRESSURE - TEMPERATURE RATING

ANSI Class 250	A126 Gr. B
WOG (Non-shock):	400 PSI @ 150 °F
Saturated Steam:	250 PSI @ 406 °F
Max Liquid:	250 PSI @ 406 °F

STANDARD SCREEN SELECTIONS

Size	Liquid	Open Area	Steam	Open Area
1/4" – 2"	20 Mesh	51.8%	30 Mesh	44.8%
2 1/2" – 3"	1/16 (.0625)	41%	3/64 (.045)	36%

REFERENCED STANDARDS & CODES

CODE	DESCRIPTION
ASME/ANSI B16.4	Cast Iron Threaded Fittings