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, CO2, 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
Model 441-X57 Regulator Installation and Maintenance Instructions

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-off 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 8 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 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 45% 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 nestled 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

<table>
<thead>
<tr>
<th>Outlet Pressure (Min. to Max.)</th>
<th>Spring Color</th>
<th>Nominal Diaphragm Size (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 to 100 psi</td>
<td>Red</td>
<td>21/4” Diaphragm All Ranges</td>
</tr>
<tr>
<td>100 to 175 psi</td>
<td>Brown</td>
<td></td>
</tr>
<tr>
<td>150 to 220 psi</td>
<td>Black</td>
<td></td>
</tr>
</tbody>
</table>

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-1408, or other applicable standards. The method of providing over-pressurization protection could be in the form of 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.
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.

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 pressures. 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 2

Figure 3
Closed Position

Figure 4
Throttling Position

Figure 5
Open Position
Pressure Reducing Schematic - Partial Open
Monitor – Mixed Components
Filter Element
MODEL: YS 12-CI
(CAST IRON)

FEATURES

- 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 liner retention 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 strainer element. Please contact factory for more information.

- EPOXY PAINTED
  All units are epoxy painted to help resist rust and corrosion. Titan SCI 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 WWP-1-2739 for sizes 1/2” through 3”, please specify if necessary.

- NATURAL GAS AND OTHER SPECIAL APPLICATIONS
  Titan was extensively tested the YS12 in gas applications and determined that buna-N gaskets provide superior sealing capabilities for the service. Always specify if a special gasket or screen is required for a specific application.

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 60 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
BILL OF MATERIALS

<table>
<thead>
<tr>
<th>No.</th>
<th>PART</th>
<th>YS 12-CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>Cast Iron A126 Gr. B</td>
</tr>
<tr>
<td>2</td>
<td>Cap</td>
<td>Cast Iron A126 Gr. B</td>
</tr>
<tr>
<td>3</td>
<td>Strainer Element</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>4</td>
<td>Gasket</td>
<td>Grolidale</td>
</tr>
<tr>
<td>5</td>
<td>NPT Plug (Blow-off)</td>
<td>Steel</td>
</tr>
</tbody>
</table>

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

DIMENSIONS AND PERFORMANCE DATA

<table>
<thead>
<tr>
<th>SIZE</th>
<th>in</th>
<th>1/4</th>
<th>3/8</th>
<th>1/2</th>
<th>3/4</th>
<th>1</th>
<th>1 1/4</th>
<th>1 1/2</th>
<th>2</th>
<th>2 1/2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>3.188</td>
<td>3.188</td>
<td>3.188</td>
<td>3.75</td>
<td>4.0</td>
<td>5.0</td>
<td>5.75</td>
<td>7.0</td>
<td>9.25</td>
<td>10.0</td>
</tr>
<tr>
<td>FACE TO FACE</td>
<td></td>
<td>81</td>
<td>81</td>
<td>81</td>
<td>95</td>
<td>102</td>
<td>117</td>
<td>146</td>
<td>178</td>
<td>235</td>
<td>254</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>2.062</td>
<td>2.063</td>
<td>2.063</td>
<td>2.430</td>
<td>2.625</td>
<td>3.375</td>
<td>3.875</td>
<td>4.785</td>
<td>5.875</td>
<td>6.0</td>
</tr>
<tr>
<td>CENTER LINE TO CENTER LINE</td>
<td></td>
<td>52</td>
<td>52</td>
<td>52</td>
<td>52</td>
<td>57</td>
<td>96</td>
<td>98</td>
<td>121</td>
<td>149</td>
<td>152</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>2.375</td>
<td>2.375</td>
<td>2.375</td>
<td>3.0</td>
<td>3.25</td>
<td>4.50</td>
<td>5.0</td>
<td>6.125</td>
<td>7.875</td>
<td>8.0</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>1 1/4</td>
<td>1 1/4</td>
<td>1 1/4</td>
<td>1 3/8</td>
<td>1 3/4</td>
<td>2 7/8</td>
<td>3 1/4</td>
<td>4 1/4</td>
<td>5 1/8</td>
<td>6 0</td>
</tr>
<tr>
<td>NPT</td>
<td></td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>25</td>
<td>40</td>
</tr>
<tr>
<td>BLOW</td>
<td></td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>2.5</td>
<td>3.5</td>
<td>6.0</td>
<td>9.0</td>
<td>14.0</td>
<td>25.5</td>
<td>32.0</td>
</tr>
</tbody>
</table>

Pressure Coefficient

<table>
<thead>
<tr>
<th>SIZE</th>
<th>in</th>
<th>1/4</th>
<th>3/8</th>
<th>1/2</th>
<th>3/4</th>
<th>1</th>
<th>1 1/4</th>
<th>1 1/2</th>
<th>2</th>
<th>2 1/2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Coefficient</td>
<td></td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>1.1</td>
<td>1.6</td>
<td>2.7</td>
<td>4.1</td>
<td>12.3</td>
<td>11.6</td>
<td>14.5</td>
</tr>
</tbody>
</table>

PRESSURE - TEMPERATURE RATINGS

<table>
<thead>
<tr>
<th>ANSI Class 250</th>
<th>A126 Gr. B</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOG (Maximum)</td>
<td>400 PSI @ 150 °F</td>
</tr>
<tr>
<td>Saturated Steam</td>
<td>250 PSI @ 406 °F</td>
</tr>
<tr>
<td>Max Liquid</td>
<td>250 PSI @ 406 °F</td>
</tr>
</tbody>
</table>

STANDARD SCREEN SELECTIONS

<table>
<thead>
<tr>
<th>SIZE</th>
<th>1/4 - 2&quot;</th>
<th>2 1/2 - 3&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid</td>
<td>20 Mesh</td>
<td>36 Mesh</td>
</tr>
<tr>
<td>Screen</td>
<td>20 Mesh</td>
<td>44 Mesh</td>
</tr>
<tr>
<td>Open Area</td>
<td>64</td>
<td>64</td>
</tr>
</tbody>
</table>

REFERENCED STANDARDS & CODES

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME/ANSI B16.4</td>
<td>Cast Iron Threaded Fittings</td>
</tr>
</tbody>
</table>