Good Measurement & Regulation is NOT just about The Meter and Regulator

Meter & Regulator Station Design
Station Types

- Point of Delivery (POD)
- Power Plant
- Industrial
- Commercial
- Residential
POD – Design Information

- Upstream pipeline MAOP
- Inlet pressure
  - Maximum
  - Average
  - Minimum
- Downstream customer
  - MAOP
  - Test pressure or lowest pressure component
POD – Design Information

- Outlet pressure
  - Maximum
  - Minimum
- Flow rate
  - Maximum
  - Average
  - Minimum
  - Future
- Temperature
Distribution Utilization Capacity

P2/P1 vs Utilized Capacity

OGA Technical Seminar  March 27, 2014
Station Design
Station Design

- Meter selection
  - Range of meter(s)
  - Capacity calculation
  - Capacity tables
  - Single vs. multiple meter runs
  - Meter pressure rating
Station Design

➢ Design pressure rating
  ❖ Upstream
  ❖ Downstream
  ❖ Fixed Factor
  ❖ Meter type AGA design specifications
    o AGA - 3 Orifice meters
    o AGA - 7 Turbine meters
    o AGA - 8 Supercompressibility
    o AGA - 9 Ultrasonic meters
    o AGA - 11 Coriolis meters
Station Design

- Government regulations
  - Code of Federal Regulations title CFR Part 192 Natural Gas
  - American National Standards Institute ASME / ANSI B-31.8 “Gas Transmission and Distribution Piping Systems” used around the world
Critical Components for Measurement & Regulation Design
Flange Pressure Classes

- **ANSI Iron Class (ASTM 126)**

- **Class** | **Pressure**
  - 25  | 45 Psig Class A
  - 125 | 175 Psig Class A & 200 Psig Class B
  - 250 | 400 Psig Class A & 500 Psig Class B
  - 800 | 800 Psig Class B

Operating Temperatures @ -20°F to 150°F (No derating required)
### Flange Pressure Classes

#### ANSI Steel Class

<table>
<thead>
<tr>
<th>Class</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>285 Psig</td>
</tr>
<tr>
<td>300</td>
<td>740 Psig</td>
</tr>
<tr>
<td>400</td>
<td>990 Psig</td>
</tr>
<tr>
<td>600</td>
<td>1480 Psig</td>
</tr>
<tr>
<td>900</td>
<td>2220 Psig</td>
</tr>
<tr>
<td>1500</td>
<td>3705 Psig</td>
</tr>
<tr>
<td>2500</td>
<td>6170 Psig</td>
</tr>
</tbody>
</table>

Operating Temperatures @ -20°F to 100°F (No derating required)
Pressure Take Locations

- **Pressure**
  - At the meter for volumetric correction
  - System monitoring
    - Upstream of M & R settings
    - Downstream of M & R settings
Temperature Take Locations

➢ Temperature

➢ Temperature for volumetric correction generally downstream of the meter (one to five pipe diameters)

➢ Temperature wells
  o Length
  o Size

➢ Gas temperature control (downstream of regulation)
Supercompressibility

Calculation Methods

- NX – 19
  - Nitrogen
  - Carbon Dioxide CO₂

- AGA - 8
  - Detail Characterization Method uses gas analysis
  - Gross Characterization Method Aggregate or gross knowledge of natural gases
Meter Settings

- Blow off sizing
- Multiple meter runs vs. single run
- Run switching
- Flow balance through multiple meter runs
Station Piping

- Sizing
- Configuration
- Welker gas turbulence paper
- Gas velocity
  - Equations
  - Noise
  - Erosion
Measurement & Regulation for FPFM

Fixed pressure factor by:
- Computer
- Meter index

Regulator types
- Self operated
- Pilot operated
- Instrument operated
M & R Buildings

- Doors
- Height
- Space between settings & BLDG walls
- Valve hand wheels
- Foundations
- Electrical classification for gas facilities

(AGA XF0277 Classification of Gas Utility Areas for Electrical Installation Guide)

- Class I, Division 1, Group D
- Class I, Division 2, Group D
Station Layout

- Gates
  - Man
  - Vehicular

- Vehicular barriers

- Drive ways

- Lot surface

- Filters
- Heaters
- Regulation
- Measurement
- Auxiliary equipment
- Odorizers
Questions ?