Gas Distribution Network Codes, Standards: Guidelines

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THE NATURAL GAS INDUSTRY

Production

Transmission

Distribution
Natural Gas Distribution

• Final activity and operation of gas value chain
• Some large industrial, commercial, and power generation end users receive natural gas directly from high pressure gas transmission system.
• Other users receive natural gas from a local distribution company (LDC).
• LDCs are regulated utilities within a specific geographic area
Natural Gas Distribution

- Commences from the downstream flange of Custody Transfer Metering Station of Gas Transmission system at CGS/ TBS/ DRS or Bulk CMS.
- DS network design, implementation and operation are very important as it directly deals with marketing and utilization of Gas.
Natural Gas Distribution

• Two types
• Owned by Private investors, and
• Public gas systems owned by local governments.
• Local Distribution Companies (LDC) links transmission system with to households and businesses through small-diameter distribution pipe lines
Natural Gas Distribution

- Involves moving smaller volumes of gas at much lower pressures over shorter distances to a great number of individual users.

- Smaller-diameter pipe also is used to transport natural gas from the city gate to individual consumers.

- The pressure required to move natural gas through the distribution network is much lower than that found in the transmission pipelines.
Distribution System

- MAOP Transmission pipelines may be as high as 1,500 psi,
- Distribution network usually operate at 4 psi and at times as low as \( \frac{1}{4} \) psi at the customer’s meter.
- Pressure regulation is done at the city gate, as well as scrubbed and filtered to ensure low moisture and particulate content.
- Odorant is injected to gas stream in distribution networks
Natural Gas Distribution

• The delivery point the 'city gate', is an important market center for the pricing of natural gas in large urban areas.

• Utilities take ownership of the natural gas at the city gate, and deliver it to each individual customer's meter.
Natural Gas Distribution System.
Guide Lines For Distribution System Design

- The custody transfer point of gas to distribution network is the City Gate Station (CGS).
- CGS: Regulating and Metering Station regulates pressure of gas from High Pressure of transmission system to intermediate and lower distribution pressure.
- The Design of Pressure Regulation and Metering station usually follow IGE/TD or equivalent codes and standards.
Guide Lines For Distribution System Design

- CGS components – **Inlet Separator (Vane Mist Extractor)**, **Filter Separator**, **Indirect Fired Heaters**, **Regulating and Metering Skids** and **Downstream Separator**
- Sometimes Odorants are injected to gas stream at recommended doses as natural gas is odorless
- **Odorant (usually THT)** helps in detecting leakage in the system as natural gas mixed in a given proportion with air makes explosive mixture.
Guide Lines For Distribution System Design

• Town Border Stations (TBS), District Regulating Stations (DRS) and Customer Metering Stations (CMS) are medium and low pressure forms of CGS. These are Regulating and Metering Stations.

• Gas load survey in gas distribution network command area is conducted taking into account anchor load(s), present demand and future demand growth.

• Design software using these inputs design a comprehensive balanced gas distribution networks for phased construction.
## Typical Network Setup

**Western Victoria Natural Gas Distribution network:**

<table>
<thead>
<tr>
<th>Low Pressures</th>
<th>Medium Pressure</th>
<th>High Pressure 1</th>
<th>High Pressure 2</th>
<th>Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4 - 70kPa</td>
<td>70 - 140kPa</td>
<td>140 - 515kPa</td>
<td>515 - 1050kPa</td>
<td>&gt;1050kPa</td>
</tr>
</tbody>
</table>

![Images of network setup at different pressures]
Natural Gas Distribution

America's Natural Gas Delivery System

Producing Wells

Processing Plant

Interstate Transmission Lines

City Gate Station

Factories and Manufacturers

Compressor Stations

Underground Storage

Supplemental Fuels (LNG, propane) for peak demand days

Distribution Mains (Utility Pipelines)
Approx. 1 Million Miles in US

Regulator/Meter

Households

Businesses (Offices, Hospitals, Hotels, Restaurants)

Source: American Gas Association
## Distribution Summary

<table>
<thead>
<tr>
<th>Domestic &amp; Commercial Consumers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field &amp; District</td>
</tr>
<tr>
<td>City Gates</td>
</tr>
<tr>
<td>Compressor Stations</td>
</tr>
<tr>
<td>Processing Plant</td>
</tr>
<tr>
<td>Basin</td>
</tr>
</tbody>
</table>
Pressure Regulation Stations

City Gates:
Transmission → High Pressure
6,500kPa → 450kPa

Field Regulation:
High Pressure → Medium Pressure
450kPa → 140kPa

District Regulation:
High pressure → Low Pressure
450kPa → <70kPa
Example: Pressure Regulation Station

Purpose: High Pressure reduced to Medium Pressure

1. Pressure reduction
2. Flow rate

Inlet Pressure: 450kPa
Pipelines: HDPE

Required Pressure: 70kPa
Pipelines: Steel
Example: Pressure Regulation Station

Purpose: High Pressure reduced to Medium Pressure
Small Pressure Regulating & Metering Station.
Example: Pressure Regulation Station
Example: Pressure Regulation Station

AXIAL FLOW REGULATORS

Closed position
Throttling position
Full open position

450kPa
70kPa
Example: Pressure Regulation Station

CRITICAL STATION ALARMS:

1. Pressure **TOO HIGH** at outlet

2. Pressure **TOO LOW** at outlet
Example: Pressure Regulation Station

Options for recovery: 3 Stages of protection

- Primary Monitor (2 Stage Regulation)
- Dual Leg Regulator Lines
- Slam Shut Setup
Example: Pressure Regulation Station

Case 1: HIGH outlet pressure
Example: Pressure Regulation Station

Case 2: **LOW** outlet pressure
Examples : Bangladesh

• Chittagong is the major industrial and the largest port city of Bangladesh which has very well designed Gas Distribution Network or City Gas System

• Custody of Gas from Gas Transmission System or Natural Gas Grid is transferred at City Gate Station of Gas Transporter at an intermediate pressure of 350 PSIG

• The LDC receives gas through a City Gas Ring Main circling the city along the periphery.
Examples: Bangladesh

- The ring main has five IP DRS which feeds secondary distribution networks at 150 PSIG
- Ring main also has 8 high Pressure CMS which feeds two large Urea Fertilizer Plants, three large power plants, One Crude Oil Refinery, One Major Export Processing Zone of Industries, One Paper and Rayon Mill
- On the secondary distribution system there exists 17 IPDRS regulating pressure to 60 Psig at which the distribution system for thousands of industrial, commercial and domestic consumers draw upon
Codes and Standards of Gas Distribution Networks

• Gas Standards (Gas Supply and System Safety) Regulations 2000
• The Gas Standards (Gas Supply and System Safety) Regulations 2000 In Australia and New Zealand came into effect on 2 August 2000. The regulations mandate the following standards:
  • AS/NZS 1596 "The storage and handling of LP Gas"
  • AS 1697 "Installation and maintenance of steel pipe systems for gas"
Codes and Standards

- AS 3723 "Installation and maintenance of plastic pipe systems for gas"
- AS/NZS 4645 "Coal distribution networks"
- AS 4565 "Specification for general purpose natural gas"
- AS 4670 "Commercial propane and commercial butane for heating purposes"
Safety and HSE

• Natural Gas is tasteless, odorless and colorless
• A given proportion 1:8 NG with Air makes explosive mixture and can trigger disaster if it gets a spark
• The distribution network requires
  • Designing following standard codes and practices
  • Only prescribed materials of required specifications must be used in construction
• Steel Pipeline Networks must have corrosion protection system in place and monitored
Safety and HSE

- Specially when working in confined spaces additional care must be taken to evacuate the place of accumulated gas from the area due to possible leakage.
- City gas network must be regularly odorized at prescribed doses.
- Regular leakage surveys must be done and remedial actions taken.
- CGS/DRS/TBS /CMS must have standby streams for redundancy.