Air/Vacuum Release Valves

* A Neglected Maintenance Item *

Establishing an Effective Preventative Maintenance Program

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Some Background on MHOG
Collection System Statistics

- 121 Air Release Valves
- 50 Miles of Force Main
- 45 Pumping Stations
- 629 Low Pressure Grinder Systems
- 11 Duplex Grinder Stations
Importance of Air Release Operation
The researchers reviewed inspection technology tools for pressure pipelines that could be used for visual investigation, structural integrity, and operational testing. The benefits of using these tools include:

- Provides a detailed review of the pipeline network.
- Includes case studies of common pipe failures.
- Includes a review of current inspection technologies and their limits.
- Provides guidelines for the implementation of force main within condition assessment management programs.

**Related Products**

An Examination of Innovative Practices in Wastewater System Design and Operation.

**Inspection Guidelines for Wastewater Force Mains**

Pressure surges are abrupt increases in operating pressure in force mains which typically occur during pump start-up and shut-off. Pressure surges may have negative effects on force main integrity but can be reduced by proper pump station and pipeline design.

Force mains should be designed so that they are always full and pressure in the pipe is greater than 69 kiloPascals (10 pounds per square inch) to prevent the release of gases. Low and high points in the vertical alignment should be avoided; considerable effort and expense are justified to maintain an uphill slope from the lift station to the discharge point. High points in force mains trap air, which reduces available pipe area, causes non-uniform flow, and creates the potential for sulfide corrosion. Gas relief and vacuum valves are often installed if high points in the alignment of force mains cannot be avoided, while blowoffs are installed at low points.
Pressurized Pipeline Always Contains Air

- **Sources of Air**
  - Mechanical
    - Pumps, Valves, Fittings
  - Pipe Initially Full of Air
    - Importance of Start Up Procedures
  - Water is 2% Air
    - 1,000 LF Pipeline Potential for 20 LF Air Slug

- **Air Accumulates at System High Points**
  - Air is Lighter Than Water
Air Control during Pipeline Filling & Pressurized Operation
Types of Air Valves

- Air Release Valves
  - Small Orifice to Release Air Continuously During Pipeline Operation
  - Limited Capacity for Admitting and Exhausting Air
- Air/Vacuum Valve
  - Admit Large Volumes of Air to Prevent Vacuum
- Combination Air Valves (ARVV)
  - Functions of Both Air Release and Air/Vacuum
  - Contains Both Small Air Release Orifice and Larger Air/Vacuum Port in One Assembly
  - Recommended for Use in Wastewater Force Mains
Types and Results of Air Release Failure
Types of Failures

• Clogs
  – Grease & Debris
• Corrosion
  – Valves, Nipples, Air Releases
• Mechanical
  – Failure of Moving Parts Due to Pressure and Wear
• Engineering or Installation
Clogs
Mechanical Failure
Engineering or Installation

Air Release Valve
Results of Failures

- Sanitary Sewer Overflows (SSOs)
- Reduced Pumping Efficiency
- Odor and Noise Complaints
- Force Main Breaks
SSO’s
Reduced Pumping Efficiency

[Graph showing decreased efficiency over time]

[Table data comparing pump station drawdown data for different depths and times, with highlighted values indicating significant changes]
Odor Complaints
Force Main Breaks
Design and Maintenance Improvements
Design Changes

• Components and Specifications

• Elimination During Design

• Proper Sizing for Application
Changes to Our Specs

- Improved Connection to Force Main
  - Replaced GV with Ball Valve
  - Included Test/Flushing Connection
  - Increased Accessibility
- Specified Stainless Steel
- Tapping Sleeve Vs Tee
Elimination
Proper Sizing

• Each Manufacturer Has Unique Design Criteria

Work with Manufacturer to Size Each Valve

• Typical Data Needed to Size:
  – Flow Rate
  – Pipe Diameter
  – Pipe Operating Pressure
  – Pressure Differential Across Valve
  – Volume of Air to Exhaust
Typical ARVV’s Maintenance

• Six Month Inspections

• Flushing and, if Necessary, Disassemble

• Test Vent and Vacuum with Pump in Operation
Noise & Odor Control Innovations
Managing the Data
Air Release Inspection: SAR-0040

Field Comments

Inspection Date

Initial Test

Air Release Flushed

Air Release Valve Changed

Final Test

Maintenance_Required
Air Release: SAR-0104

Date Inspected: 6/1/2018 10:05 AM

Inspection Status:
- Inspection Passed
- Inspection Failed - Rectified
- Inspection Failed - Revisit
- Not Inspected
Operations Dashboard
Conclusions
Conclusions

• Proper Air Release Installation and Maintenance
  – Starts at Design
    • Proper Materials, Size, and Location Reduce Maintenance
  – Frequent Flushing and Cleaning Is Safer, Saves Time, & Saves Money

• Air Release Maintenance Is Critical to:
  – Proper Pump Station and Force Main Operation
  – Avoiding Environmental Impacts
  – Avoiding Damage to Force Main Components
  – Reducing Customer Complaints
Video Acknowledgements

http://www.bermad.com/knowledge/waterworks/

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