Table of Contents

29.0 PRESSURE TESTING

29.1 INTRODUCTION

This section contains the design criteria for hydrostatic testing of the gas pipeline as this is the method currently employed by pipeline design codes to demonstrate the integrity of new pipelines. In recognition of the particular challenges of hydrostatic testing in permafrost, ANNGTC may consider, as part of its detailed design and test plan, alternative methods of testing or otherwise demonstrating the integrity of the constructed pipeline.

In this section, criteria are presented for test pressure limitations, durations and siting of test sections. Design procedures describe the testing methods planned and a step-by-step procedure for implementing the test. Alternate test methods and contingency plans are included. Environmental considerations are noted in applicable sections of the Technical Information Supplement.

Specifications and final test procedures are not included in this section. Such subjects as descriptions of dewatering equipment, locations of test segments, identification of sampling ports, and catalogues of water sources will be addressed in the hydrotest plan.

29.2 CODES AND CRITERIA

29.2.1 Codes

- Code of Federal Regulations, Title 18 – Conservation of Power and Water Resources
- Code of Federal Regulations, Title 49 – Transportation, Part 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
- Code of Federal Regulations, Title 40 – Protection of the Environment, Part 125, Criteria and Standards for the National Pollutant Discharge Elimination System.
- Federal Water Pollution Control Act, which led to enactment of the Clean Water Act, Title 4 – Permits and Licenses, Section 402, National Pollutant Discharge Elimination System.
- Federal Right-of-Way Grant for the Alaska Natural Gas Transportation System Alaska Segment, Serial No. F-24538 (December 1, 1980), as such may be updated and/or amended from time to time.
- Federal Energy Regulatory Commission Conditional Certificate of Public Convenience and Necessity, issued on December 16, 1977, as such is finalized.
- Alaska Administrative Code, Title 5 – Fish and Game, Chapter 95, “Fish and Game Habitat”, 5AAC95.010, "Waters Important to Anadromous Fish."
- Alaska Administrative Code, Title 11 – Natural Resources, Chapter 93, “Water Management.”

- Alaska Administrative Code, Title 18 – Environmental Conservation, Chapter 70, "Water Quality Standards."
- Alaska Administrative Code, Title 18 – Environmental Conservation, Chapter 72, "Wastewater Treatment and Disposal."
- Alaska Statutes, Title 16 – Fish and Game

29.2.2 Criteria

- The minimum test pressure will be 125 percent of the maximum operating pressure at the point of highest elevation. The maximum test pressure will not cause a hoop stress that would exceed 110 percent of the specified minimum yield strength (SMYS) of the pipe at the point of lowest elevation.
- The pressure test will be held for a minimum period of 8 hours. Temperature and pressure data will be recorded throughout the duration of the test to verify that there are no leaks.
- The length of test sections will be governed by the following:
  - Maximum and minimum test pressures.
  - Proximity of water sources, available rate of withdrawal and disposal requirements.
  - Location of mainline valves and compressor stations that make a natural division in the mainline.
  - Environmental constraints, e.g., source of water and receiving environments.
- Test section lengths and test water temperatures may be limited in frozen soils to preclude freezing of the test water and to minimize the impact on the thermal stability of surrounding backfill materials.

29.3 DESIGN PROCEDURES

29.3.1 Test Procedures

Test procedures to be developed will address the steps necessary to complete the hydrostatic testing requirements.

29.3.1.1 Internal Cleaning and Inspection

Prior to hydrostatic testing, all mainline test sections will be subjected to a minimum of 2 pigging operations.

- The initial pigging operation will use a cleaning pig to remove any construction-related debris from the gas pipeline.

- The second pigging operation will use a caliper-type instrument pig to locate and record any mechanical damage in the gas pipeline such as ovality, dents, or buckles.

29.3.1.2 Line Fill

Each gas pipeline section to be tested will be filled with clean water obtained from an approved water source, or with water batched to the section from an adjacent pipeline test section. If the water is obtained from a fish stream, the rate of withdrawal from that stream will be controlled to maintain in-stream flow necessary to support spawning, incubation, rearing, migration, over-wintering and survival of fish. The rate of withdrawal from fish streams will not exceed ten percent of the flow at the time of withdrawal. The water intakes will be centered and enclosed in a screened box not to exceed 1/4-inch mesh to minimize fish entrainment and impingement. The box size will be sufficiently large to allow fish to escape intake suction. The through screen velocity at intake shall be designed not to exceed 0.5 fps even when up to 50 percent of the screened area is fouled with debris.

Debris and sediment will be prevented from entering the test section being filled by a screen filter or other device placed on the intake.

In order to purge all the air from the test section being filled, displacement pigs will be run ahead of the fill water.

29.3.1.3 Pressurization

A pressure versus volume added plot will be made during the pressurizing of the test section. The plot will start at a pressure equal to 80 percent of the SMYS at the point of lowest elevation and will continue through to the full test pressure.

29.3.1.4 Stabilization

Upon completion of the pressure volume plot, the pressure in the pipe will be allowed to stabilize prior to beginning the hold test. Duration of stabilization will vary depending on actual temperature conditions of each test section.

29.3.1.5 Test Period

Upon stabilization, the test section will be repressurized to the predetermined test pressure, locked-in and held for a minimum period of 8 hours. Temperature and pressure data will be recorded throughout the duration of the test to verify that there are no leaks.

29.3.1.6 Test Equipment

All pressure tests will be performed using prefabricated test manifolds. Testing against closed gas pipeline valves will not be permitted.

29.3.1.7 Instrumentation

Instrumentation will be installed during hydrostatic testing for gathering all data necessary to prove the mechanical integrity of the gas pipeline. The instrumentation will include: pressure recorders, ambient temperature recorders, water temperature recorders and dead weight testing equipment. Data recorded will include water temperature, ground temperature, ambient temperature and test pressure during the filling, stabilization and hold stages of the test. Calibration of instruments will be outlined in the specifications and construction plan.

29.3.1.8 Dewatering

The gas pipeline test section will be dewatered once the successful hydrostatic test has been completed. Dewatering pigs driven by compressed air will be utilized to remove the water. Hydrostatic test planning will include the re-utilization of the test water, from one section to another, where practicable in order to minimize the amount of test water required and the amount of water to dispose of.

During dewatering, water quality will be monitored; however, since the pipe will be internally coated and cleaned prior to filling, the water quality is not expected to differ significantly from the quality of the fill water used.

Discharge of the test water to lands and/or watercourses adjacent to the end of the test segment will follow specific procedures developed to minimize water quality impacts and localized erosion, and will comply with hydrotest discharge permits and approvals to be requested. Such procedures include:

- Where possible, discharge from individual test segments will occur at the segment end farthest from watercourses, if direct discharge into a particular watercourse is of concern.
- Discharge of water into a fish stream shall not cause flow to increase by more than 50 percent or to exceed the mean annual flood, whichever is less.
- Where direct release to a watercourse is used, waterbodies that do not support fish, and waterbodies that do not flow directly into areas supporting fish, will be preferred discharge sites. Fish streams with low flows relative to the discharge rate will be avoided, where practical. Fish use areas, and locations immediately upstream from these, will be avoided especially during spawning and over-wintering.
- Alternatives for discharge into natural surface waters include sterile ponds and lakes, ponded water or sumps in material sites, and excavated sumps and/or percolation areas in floodplains.
- Surface water withdrawn from one watershed will not be discharged directly into a waterbody in a different biologically-isolated watershed unless specifically permitted.
- Design techniques established in Section 11 will be used where discharge may erode bottom and bank materials in receiving waters, and surficial soils on land. In the latter case, the shear resistance of the soil and organic mat will be considered to establish

acceptable rates of release and to design energy dissipation structures including, for example, rock or riprap placed to receive the initial thrust of water.

- Discharges will be controlled so as not to adversely impact fish passage, spawning or overwintering patterns.
- Discharge points will not be located so as to adversely impact thermally sensitive areas or adjacent facilities.
- Quality of discharge water and any receiving waterbodies will be monitored. Monitoring parameters are expected to include suspended solids, turbidity, pH, oil/grease and temperature.

29.3.1.9 Drying

Immediately after the dewatering operation, additional pigs will be run through the test section in order to remove any water remaining in the gas pipeline. To eliminate the possibility of freezing any small quantities of water that may remain in the gas pipeline, the final pigging run may incorporate a small volume of a hygroscopic fluid run between two batching pigs. All such fluid captured at the end of the drying run will be collected for reprocessing or disposal.

29.3.2 Water Sources and Disposal

Water for hydrostatic testing will be obtained from approved sources after a thorough evaluation has been completed. The evaluation will take into account the quality of the water, the quantity of the water available, the rate at which the water may be obtained, and any potential environmental impact. Waterbodies that do not support fish will be preferred intake sites. Streams with low flows relative to the withdrawal rate will be avoided where practical. Fish use areas, especially concentration areas for juvenile fish, over-wintering sites and their upstream water sources (during winter), will be avoided where practical.

Disposal of the test water will be an integral component of the planning phase of the hydrostatic test procedure for each test section. The water quality in the test section, water quality requirements for disposal, volume of water, and environmental impact will be evaluated during this phase.

29.3.3 Testing With Heated Water

Hydrostatic testing of certain portions of the gas pipeline may require the use of heated water. The final identification of these areas will depend on an analysis of backfill soil temperatures and fill water temperatures to be encountered at time of testing. Where required, water will be heated at the fill point to a pre-calculated minimum temperature to supply sufficient stored energy such that the temperature of the water will remain above freezing for the duration of filling, testing, and dewatering operations. A thermal analysis of each test section using heated water will be performed to establish limiting time constraints for the testing operations.

Testing with heated water will include a close monitoring of fill water and backfill temperature for the duration of all testing operations. If any condition causes a potential for freezing of water in the pipeline, procedures will address the requirements for circulating additional heated water in the test section or dewatering the test section immediately.

The temperature of heated water discharging into surface waters will be adjusted as necessary to meet the thermal requirements specified in the Alaska water quality standards. Special procedures will be established to control thermal erosion caused by heated water discharge.

29.3.4 Alternative Testing Technique: Winter Hydrotesting With Freeze Depressant Medium

Hydrostatic testing during winter using a freeze depressant may be utilized in lieu of testing with heated water, if a test procedure and disposal procedure is developed and approved. Test methods and procedures for hydrostatic testing using a freeze depressant medium will utilize, to the extent practical, prior approved testing plans and procedures developed for North Slope transmission and gathering pipelines.

29.3.5 Alternative Testing Technique: Testing With Air or Inert Gas

Test methods and procedures to use air or inert gas for testing may be utilized for testing (see CFR "Subpart J-Test Requirements, Part 192.503 General Requirements") if testing procedures and site-specific safety plans are developed and approved. Testing of certain portions of the pipeline may require the use of air testing.

29.3.6 Alternative Testing Technique: Alternative Methods of Integrity Verification

In recognition of the particular challenges of hydrostatic testing in permafrost, ANNGTC may consider, as part of its detailed design and test plan, alternative methods of demonstrating the integrity of the construct pipeline.

29.3.7 Contingency Plan in Event of Leak or Rupture

If pressure readings indicate that a leak exists in a section of pipe being tested, steps will be taken to locate and repair or replace the damaged pipe and restart the test. The procedure for locating a leak will incorporate the following steps/concepts (as required):

- Visually examining (walking) the line to check for signs of water leakage.
- Using a sonic leak detector.
- Close any mainline valves located in a test section to isolate the leak in a shorter section.
- Dewater, segment (into shorter test sections), refill and, pressurize the test section to isolate the leak in a shorter section.
- Mitigative procedures will be implemented to prevent adverse environmental effects.

If a rupture occurs during testing, the procedure will require immediate action to locate the rupture point, notify the proper authorities and initiate repairs. Dewatering at the rupture site, if required, will be done into the nearest suitable drainage system.

If a leak or rupture occurs in a test section using heated water, all basic procedures will apply with the added provision that ground and water temperature will be closely monitored to detect any possible freezing condition in the gas pipeline. Procedures will address control of potential thermal erosion. If a rupture causes surface soil instability or vegetation damage, the site will be restored as described in Sections 11 and 12.

29.3.8 Pretesting

Major river crossings will be subjected to a hydrostatic test prior to installation. All pretested river crossings will subsequently be retested again after installation.

29.3.9 Aerial Crossing

Aerial crossings designed for loading conditions including hydrostatic test water will be tested as part of the mainline. Aerial crossings designed for loading conditions, excluding hydrostatic test water, may be hydrostatically tested on site prior to installation and/or will be subjected to an air or nitrogen test after installation.