

1.0 Applicability

This document is to be used as the Encana Oil & Gas (USA) Inc. (Encana) practice whenever pressure testing during the Early Life Cycle of Wells (i.e. from spud to commissioning).

2.0 Scope

This Standard Operating Procedure (SOP) establishes the minimum requirements for all temporary and permanent piping and equipment utilized in the early life cycle of wells from spud to commissioning.

This practice conforms to:

- Encana's policies and guidelines
- The Ethos Safety Practices Standard
- U.S. federal regulations
- state regulations
- industry standards

3.0 Core information and requirements

The core information and requirements of this practice include the following;

- 3.1 Definitions
- 3.2 Requirements for Early Live Cycle of Wells Pressure Testing
- 3.3 Pressure Testing Mediums
- 3.4 Pressure Testing Procedure
- 3.5 Pressure Testing Documentation

3.1 Definitions

Hoop Stress - Hoop stress=MAOP / P100% SMYS

- P100% SMYS = 100% Pressure as defined by the specified minimum yield strength (SMYS)

Maximum Allowable Operating Pressure (MAOP) $= (2St/D) \times F \times E \times T$

- S= Grade of Pipe
- t = Pipe Wall Thickness
- D = Pipe Diameter
- F = Design Factor
- E = Longitudinal Joint Factor

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- T = Temperature Derating Factor

Pipe Diameter – Outside Diameter

Pipe Grade – Pipe is graded based on the API 5L and ASME B31.1 Standards

Pipe Wall Thickness – Nominal wall thickness of seamless or welded pipe

Specified Minimum Yield Strength (SMYS) – pressure representing the yield strength of steel pipe measured in thousand pounds per square inch (e.g. X60 pipe has a minimum yield strength of 60,000 psi).¹

3.2 Requirements For Early Life Cycle of Wells Pressure Testing

The following requirements apply to all equipment, including Contractor equipment

- properly pressure tested to meet operating conditions (proof of testing documentation)
- connections properly connected (e.g., torqued to industry / manufacturer specifications)
- piping supports (temporary and permanent) – constructed and installed to industry standards and engineering specifications

3.3 Pressure Testing Mediums

The recommended pressure testing medium is water. If other test mediums are utilized, engineering support and industry standards shall be incorporated to minimize the potential for system failures. Additional safety precautions shall be followed to minimize exposure to all personnel on the job site.

3.4 Pressure Testing Procedure

The following procedures should be used during pressure testing operations:

- i. Pressure testing will be carried out on all temporary equipment and piping before use.
- ii. Before using any equipment, check its pressure rating and ensure that this pressure is not exceeded. All equipment should be clearly marked with its rated working pressure and have a valid certification stamp.
- iii. The Pump Operator with the Encana Supervisor in-charge of the operations will conduct a pre-test safety tour. During this tour, the flow path should be checked as correct for the operation. The status of valves should be checked as open or closed per requirements. Pressure Relief Valves (PRV) and independent pressure limit switches should be installed in the system and checked to prevent over-pressurization.
- iv. Barriers and warning signs must be erected around the working area. These should be monitored by a designated person to prevent entry into the restricted area.
- v. All pressure tests will be preceded by a low pressure test of ~300 psi. The pressure will then be increased slowly and smoothly in steps until the final testing pressure is reached. The standard period for all pressure tests is 10 minutes.
- vi. All pressure tests will be carried out with a pumping system that incorporates a tested PRV set to the required test pressure minus 10%. This PRV will be function tested prior to beginning the series of pressure test operations and will be witnessed by the Encana Supervisor.

¹ API Spec 5L – Specification for Line Pipe

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- vii. Where a flow-line requires a pressure relief valve (PRV), the valve should be isolated during the pressure testing to ensure integrity of the line being tested will be above the rating of the PRV.
- viii. The PRV should be set to a maximum pressure of 10% below the rating of the equipment it is to protect.
- ix. In order to ensure that the equipment is protected during the pressure testing, the PRV on the pump itself will also be set to a maximum of 10% below the maximum test pressure of the equipment. For example:
 - x. Pressure tests shall be recorded with a calibrated chart or electronic recorder of suitable range. A calibrated gauge will also be required, independent of the pressure recording device. The charts or print out of the pressure test will be signed and dated by the Pump Operator and the Encana Supervisor and retained in the well file.
 - xi. All PRVs shall be braced and oriented in a direction to prevent exposure to personnel and equipment in the event of a discharge.
 - xii. All high pressure pumps should be equipped with approved automatic overpressure shutdown devices. In the absence of automatic overpressure shutdown devices, PRVs capable of flowrates that will adequately relieve pressure shall be used.
 - xiii. A high-pressure bleed-off line shall be included in the piping configuration and have two plug valves installed in series immediately adjacent to the main line.
 - xiv. The valve closest to the main line shall be the primary valve and shall always be fully open or fully closed. It shall be the first valve to be opened and the last valve to be closed.
 - xv. The secondary valve shall be used as a flow control valve.
 - xvi. Bleed-off line valves shall always be opened slowly to prevent a fluid hammering effect.
 - xvii. Bleed-off lines are to be as straight as possible and correctly secured.
 - xviii. Only solid steel, high pressure pipe shall be used for bleed-off lines.
 - xix. A successful pressure test is defined as a test resulting in no visible leaks and a minimum of 90% of maximum pressure retained for five minutes. No sustained drips or leaks are permissible on any flanges, valves, or swivel joint packing assemblies or weep holes.
 - xx. If a pressure test is not successful, pressure shall be completely bled off the lines, the necessary repairs made with the bleed-off valves open. After repairs have been made, retest the line. Pumping shall not commence until a successful pressure test has been achieved.
 - NOTE - Piping and equipment which fail the pressure test must be removed from service, clearly marked as "Reject" with paint to prevent it being mistakenly used at another site.
 - NOTE – All required Safe Work Permits will be completed prior to pressure testing.
 - CAUTION - Pressure testing against closed valves may result in damage to valves.

3.5 Pressure Testing Documentation

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- name of Company personnel involved in testing
- name of testing company used, if any
- test medium used
- Pressure testing logs,(including test duration, test pressure) / signed and dated
- Pressure testing recording charts (including pressure and temperature) / signed and dated
- List of certified test equipment with documentation (gauges, deadweight/s, etc.)
- a record of any leaks or failures

4.0 Roles, Responsibilities and Accountabilities

USA Division EHS&S	Responsible for developing, implementing, communicating, evaluating, maintaining, and improving this practice. Implementation consists of making this practice available to all staff through Encana's intranet and providing appropriate training materials and system tools for use by the BUs. Evaluation consists of, at a minimum, the performance of Ethos audits within the BUs or sub-business units (SBUs) on a routine basis. Based on the results of audits and requests from staff for modifications, USA Division EHS&S will make appropriate changes to the practice to maintain and improve it.
EHS&S BUs	Responsible for implementing this practice within their respective BU and SBUs.
BU Leadership	Responsible for implementation of this practice in their BU or SBU through providing adequate resources to support the practice.
BU staff	Responsible for following this practice and incorporating its requirements into their work

5.0 Goals, objectives and performance measures

BU performance measures related to this practice, if any, are incorporated into Scorecards. Individual performance measures related to this practice are incorporated into High Performance Contracts.

6.0 Training

The Encana or contractor supervisor is responsible for assuring that each well operator or service provider is competent to pressure test the equipment he or she will use. Refresher training for this practice shall be provided when:

- the operator has been involved in an accident or near-hit incident;
- the operator has received an intervention and evaluation that reveals that he or she is not operating the equipment safely;
- a condition in the workplace changes in a manner that could affect safe operations;
- An evaluation of each operator's performance shall be conducted once every 3 years, at a minimum.

7.0 Resources

BUs shall ensure that appropriate resources are identified, allocated, and verified to ensure this practice is communicated and implemented.

8.0 Associated forms, documents, references, and records

8.1 Forms

8.2 References

- ASME B31.1 – Pipe Grading
- ASME B31.3 – Process Piping
- ASME B31.4 - Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
- API 5L – Pipe Specification
- API 570 – Inspection, Repair Alteration, and Rerating of In-service Piping Systems
- API RP 578 – Positive Material Identification
- API RP 1110 – Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide
- ANSI B31.8S-2001-2002 – Managing System Integrity of Gas Pipelines
- ANSI B16.5 – Flanges
- ANSI B36.10 – Nominal Wall Thickness for Welded and Seamless Pipe
- [Health Hazard Assessment, Control and Surveillance Practice](#)
- [Job Safety Analysis Practice](#)
- [Lockout/Tagout \(Control of Hazardous Energy\) Practice](#)
- Specification for Piping and Valves SARP

8.3 Decision Record and Implementation Plan

The Decision Record documents how this practice was developed and pertinent decisions made during the development. The Implementation Plan documents how the team identified the rollout of this practice including how it was communicated and any identified or developed training. These records can be located by clicking on the links below:

- [Decision Record](#) for the Early Life Cycle of Wells – Pressure Testing Practice
- [Implementation Plan](#) for the Early Life Cycle of Wells – Pressure Testing Practice