Pressure Testing of Liquid Petroleum Pipelines

API RECOMMENDED PRACTICE 1110
FOURTH EDITION, MARCH 1997
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- To work with others to resolve problems created by handling and disposal of hazardous substances from our operations.
- To participate with government and others in creating responsible laws, regulations and standards to safeguard the community, workplace and environment.
- To promote these principles and practices by sharing experiences and offering assistance to others who produce, handle, use, transport or dispose of similar raw materials, petroleum products and wastes.
Pressure Testing of Liquid Petroleum Pipelines

Manufacturing, Distribution and Marketing Department
API RECOMMENDED PRACTICE 1110
FOURTH EDITION, MARCH 1997
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FOREWORD

This recommended practice has been prepared by API’s Operation Technical Committee under the General Committee on Pipelines, which is composed of experienced pipeline engineers. This recommended practice suggests procedures for pressure testing new and existing petroleum pipelines.

The purpose of this recommended practice is to increase safety and efficiency by encouraging the petroleum pipeline industry to adopt uniform pressure-testing practices for its liquid petroleum pipeline facilities. This recommended practice recommends procedures to be followed, suggests equipment to be used, and points out factors to be considered during the pressure testing. Liquid petroleum pipelines are pressure tested to verify that their test segments have the requisite structural integrity to withstand normal and maximum operating pressures and to verify that they are capable of liquid containment.

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Suggested revisions are invited and should be submitted to the director of the Manufacturing, Distribution and Marketing Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.
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Pressure Testing of Liquid Petroleum Pipelines

1 Scope

This recommended practice covers the pressure testing of new and existing liquid petroleum pipelines. It recommends minimum procedures to be followed, suggests equipment to be used, and points out factors to be considered during the pressure testing of liquid petroleum pipelines. This recommended practice does not address low pressure pneumatic testing.

This recommended practice suggests procedures that are based on sound engineering judgment, but certain governmental requirements may differ from the procedures set forth in this recommended practice. Such requirements should be fulfilled because this recommended practice is not intended to supersede or override them.

Please be advised that this document does not preclude requalifying a line for liquid service under the provisions of ASME 31.8, Appendix N (as provided for 49 Code of Federal Regulations 195.5 (a) (1) (I)).

2 Referenced Publications

Unless otherwise specified, the most recent editions of the following standards, codes, and specifications shall, to the extent specified herein, form a part of this standard.

ASME1

B31.4 Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols

DOT2

Research and Special Programs Administration (Title 49 Code of Federal Regulations Part 195)

3 Pressure Testing of Liquid Petroleum Pipelines

3.1 DEFINITION

In pressure testing, internal pressure above the normal or maximum operating pressure is applied to a segment of pipeline, under no-flow conditions, for a fixed period of time. A liquid test medium is used to apply the internal pressure.

3.2 CODE REQUIREMENTS FOR PRESSURE TESTING

3.2.1 New Construction and the Replacement of Existing Pipelines

The pressure testing of newly constructed pipelines and replaced segments of existing pipelines should be performed in accordance with ASME B31.4, 49 Code of Federal Regulations Part 195 and any other applicable governmental regulations.

3.2.2 Qualification of Existing Pipelines For a Higher Operating Pressure

The qualification of existing piping systems for an operating pressure higher than the previously established operating pressure should be performed in accordance with ASME B31.4, 49 Code of Federal Regulations Part 195 and any applicable governmental regulations.

3.2.3 Requalification of Existing Pipelines for Continued Operation at the Current Operating Pressure

The requalification of existing piping systems for continued operation at the previously established operating pressure should be performed in accordance with ASME B31.4, 49 Code of Federal Regulations Part 195 and any applicable governmental regulations.

3.3 TEST MEDIUM

A pressure test should be conducted with water; however, liquid petroleum having a Reid vapor pressure3 less than 7 pounds per square inch absolute may be used as the test medium if all of the following conditions are met:

a. The pipeline or piping segment to be tested is not part of an offshore pipeline or offshore piping facility.

b. The pipeline or piping segment to be tested is not located where a release could adversely impact any environmentally sensitive areas.

c. The pipeline or piping segment to be tested (rated for operation above 275 psig) is outside of cities and/or other highly populated areas.

d. Every building located outside of the owner’s piping facility, but within 300 feet (92 meters) of the pipeline or piping segment to be tested, is unoccupied while the test pressure is greater than or equal to a pressure that produces a hoop stress of 50 percent of the specified minimum yield strength (SMYS).

1American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017.


3Reid vapor pressure is defined as a liquid’s true vapor pressure at 100°F.
e. The pipeline or piping segment to be tested is kept under regular surveillance by pipeline personnel equipped with portable radios or similar equipment to provide continuous communication with the person in charge.

f. Suitable contingency response equipment and personnel for spill cleanup are strategically placed near the pipeline or piping segment to be tested.

g. Test procedures meet all applicable local, state, or federal government regulations.

3.4 EQUIPMENT AND MATERIALS FOR A PRESSURE TEST

Equipment for a pressure test should be properly selected and be in working order. The measurement equipment should be appropriate for the pressures expected during the pressure test. The following equipment may be required for a pressure test:

a. A high-volume pump that fills the line, ensures adequate pressure to overcome head, maintains sufficient velocity to move debris, minimizes interfaces, ensures turbulent flow, and keeps any pigs moving.

b. A test medium supply line filter that ensures a clean test medium.

c. An injection pump that introduces corrosion inhibitors, leak detection dyes or gases, or other chemicals into the test segment if their use is desired.

d. A meter for measuring line fill or a comparable means of measuring it.

e. A variable speed, positive displacement pump that pressurizes the line to a suitable or appropriate level that exceeds the specified test pressure. The pump should have a known volume per stroke and should be equipped with a stroke counter. (A constant-speed pump with a variable flow rate control may be used in lieu of the above if the liquid test medium injected into the pipeline is measured during pressurization.)

f. A relief valve. This may be included to prevent overpressure of the test segment during both the pressurizing activities and the test.

g. A portable tank or transport into which excess test medium can be discharged and from which make-up volumes can be drawn.

h. A pressure sensing and display device that has the pressure range and increment divisions necessary to indicate anticipated test pressures.

i. A deadweight tester or an equivalent pressure sensing device that is capable of measuring in increments of less than or equal to one (1) pound per square inch (6.7 kilopascals). The device should have a certificate of calibration that is not more than one year old at the start of testing or calibrated in accordance with the manufacturer’s recommendations.

j. A continuous-recording pressure measurement device (such as a chart recorder) that provides a permanent record of pressure versus time. This device should be calibrated immediately before each use (using the deadweight tester) or calibrated in accordance with the manufacturer’s recommendations.

k. A test medium temperature sensing and display instrument that is properly calibrated to a range suitable for anticipated test temperatures and can be read in increments of no less than 0.1°F (0.05°C).

l. A continuous-recording temperature measurement device that provides a permanent record of pipeline temperature versus time.

m. Facilities that protect all instrumentation from weather extremes.

n. Equipment that indicates ambient temperature.

o. Electronic pressure/temperature monitoring and recording systems that assist in the analysis of test data. Such systems can be used in lieu of the components listed above provided that the individual pressure sensors included in the systems have a level of sensitivity and can be field calibrated in a manner similar to those instruments listed in Items a through m above.

p. Pigs, scrapers, spheres, and similar devices that clean the test segment and facilitate the removal of air from the line.

q. Temporary manifolds and connections, as needed.

r. Equipment, materials, and fluids that are needed to introduce and displace the test medium from the test segments.

s. Communication equipment that is adequate for coordinating test activities.

t. Equipment that isolates line segments for leak determination and facilitates repair.

u. Replacement pipe, valves, gaskets, and so forth, to replace those that fail during pressure test.

CAUTION: If freeze plugs are used to isolate line segments, special handling techniques should be used to ensure personnel safety. Consideration should be given to nondestructive examination for flaws, toughness, and the ductile-to-brittle transition temperature when selecting the joint for the freeze.

3.5 TEST PLAN

When planning a pressure test, the following factors should be considered:

a. The maximum operating pressure anticipated for the life of the facility. Tests should normally be planned so that anywhere in the test segment the pressure level does not produce hoop stress near or above the SMYS. If lines are tested at pressures that develop a hoop stress, based on nominal wall thickness, near the SMYS of the pipe, special care shall be taken to prevent the pipe from overstraining. Close examination of engineering documentation, such as mill test reports
and field maintenance reports, can ensure the minimum grade and wall thickness of pipe in the segment. If internal inspection tools surveys were conducted, the data should be carefully reviewed. For tests at pressure levels near the SMYS, consideration should be given to keeping a pressure-volume (P-V) plot during pressurization to prevent yielding of the pipe. The effects of transporting water through the pipeline upon the operating and static pressure profiles should be considered.

b. Compositions of the pipe and piping components in the test segment. Pipe and piping components should be located by their size, wall thickness, grade type, internal design pressure, and elevation profile. The component that controls maximum test pressure should be identified.

c. The shell pressure and flange rating and the location of all pipeline valves, equipment, air vents, and other connections to the segment that will be exposed to the test pressure. Test pressure shall not exceed the manufacturer’s recommended maximum allowable test pressure.

d. The anticipated temperature of the test medium, atmosphere, and ground and the temperature stabilization period of the test medium. Particular care should be taken to prevent freezing of exposed piping during cold weather. Large amounts of exposed piping can result in large temperature-related pressure changes, making a stable test difficult.

e. The test medium’s primary and makeup sources and any inhibited or other treating requirements. State and local codes should be reviewed to determine if regulatory requirements for obtaining source water and for disposing of test water exist.

f. Sampling provisions to ensure (and to document) water quality before the line is filled and again before ultimate disposal occurs.

g. Locations and requirements for test medium disposal.

h. Profile and alignment drawing maps.

i. Safety precautions and procedures for personnel who perform the test.

j. A delineation of the responsibilities of various personnel in the testing organization, especially those who prepare documentation.

k. Precautions and procedures to minimize risk to the public and the environment, especially when a test medium other than water is to be used.

l. Notification of proper authorities, agencies, and potential emergency response personnel, as well as landowners along the right-of-way.

m. A plan for dealing with failures, including equipment, personnel, materials, and inspection.

n. Methods for preserving the fractured surfaces on the failed specimens of pipe.

o. Pressure proof test and pressure leak test acceptance criteria.

p. Procedures and materials used for assisting in leak detection and locating, such as dyes or gases.

q. Potential bleed location.

3.6 TEST PROCEDURE

Before testing begins, a pressure test procedure with explanatory notes and data should be prepared. This detailed procedure should provide the following:

a. A diagram indicating the lengths, elevations, and locations of the test segments, including any tested piping manifolds, and set-up of test equipment. Locate the taps for the pressure recording devices on the pipeline. Do not locate the taps on or near the high pressure fill piping. The taps should be located several feet from the high pressure pump injection point in order for the readings to be accurate during the pressurization process.

b. The test medium to be used, fill rates, and the line fill volumes for filling and at test pressure.

c. Methods for cleaning, decommissioning, filling, and recommissioning test segments.

d. Methods for pressurizing the test segments. These methods should indicate the locations of the injection points with respect to recording locations and should provide the specified minimum and maximum test pressures.

e. Methods for isolating the test segments. These methods should indicate which blinds and plugs to install, valves to remove, and cathodic rectifier systems to be de-energized.

f. The minimum test duration for test segments.

g. Methods for removing and disposing of the test medium.

h. Safety precautions and procedures.

i. An identification of and a specification for the weakest link or controlling component in the test section.

The specified test pressure is the minimum test pressure that should be applied to the most elevated point in the test segment. This elevation is not necessarily that of the deadweight tester; therefore, it should be corrected for elevation difference between the pipeline and deadweight tester. The minimum test pressure should be in accordance with ASME B31.4 and 49 Code of Federal Regulations Part 195.

A detailed analysis of the profile to determine what the pressures will be during the test should be performed so that the pipeline will not be overpressured at points that are at low elevations. Since the test pump and recording equipment are not necessarily at the highest elevation, test personnel should be provided with precise target pressures for the elevation at the pump and recorders.

3.7 LINE FILL AND CLEANING

The line fill operation should perform two functions—clean the line and introduce the necessary test medium into the test segment. It should be noted that pigging operations will not normally remove all hydrocarbons from the piping segment. Before the actual line filling operation, it is advisable to run a sizing pig, caliper or deformation tool in an effort to identify any geometric abnormalities that may exist in the line prior to the test. In addition to running a sizing pig,
consideration should also be given to running a batch/train of cleaning pigs to remove sediments, paraffins, and so forth, from those pipeline segments that are not under a normal pigging program.

The filling operation normally utilizes several different pieces of equipment, including the following:

a. Large volume (relative to line size) fill pump.

b. Filter screens, if a nonmunicipal water supply is used to filter out sediment/contaminants.

c. Flowmeter.

d. Filling pig(s).

e. Portable tank.

The large volume fill pump should be sized such that the fill pigs will travel at a speed that will maintain a tight fit of the pig and, depending on the terrain, reduce the risk of the introduction of air or another compressible mixture behind the fill pigs, thus making a quality test difficult. A minimum of 2 to 3 mph is a suggested starting point. Unless the line fill is occurring with some form of back-pressure, as pigs travel down the line and down a slope, the weight of the column of fluid could cause the pig to travel faster than the filling operation would allow, thus introducing air or gas behind the pig.

If water is used as the test medium, its quality and source should be determined. Water that is not free of sediment and acid may injure the pipe, valves, and equipment, and should not be used unless it is filtered and inhibited. The possible deleterious effect of additives or inhibitors on the processing of liquid petroleum to be transported should be investigated.

A flow meter should be placed in the line so that one can monitor and maintain the design rate of fill. The meter will allow the test personnel to make adjustments as necessary as pressure builds and fill rates drop. It also assists in matching the actual fill volume with the calculated fill volume.

Record the fill medium temperature prior to introduction into the line. This will aid in the determination of line stability.

Pigs or spheres may be inserted to separate the test medium from the rest of the pipeline content. Locators may be inserted in the pigs to track them during the filling process and to ensure that the pigs are where they need to be.

A portable tank is used to make up the difference between the actual water supply and the high volume fill pumps. This may not be necessary if the fill pumps have a direct supply, such as a river.

Excavated segments should be backfilled insofar as practicable before pressurization. The sensor of the recording temperature device(s) should be installed so that it is in contact with the pipeline at a point where it has normal cover and at a distance far enough back from the injection point so that the effect of the exposed piping and make-up injection on temperature is minimal. The backfill around the recording temperature device sensor should be tamped. Insulate, if appropriate, the capillary lines to the temperature recorder, and install the recorder in an insulated box. Large centrifugal pumps and storage tanks will affect the temperature of the test medium. The temperature of the buried line should be recorded until the pressure test is completed.

### 3.8 CONDUCTING THE PRESSURE TEST

#### 3.8.1 Pressurization

Generally, the filling process is completed using a high volume pump. Pressurization above this point is the scope of this section.

Note: Personnel conducting the test should maintain continuous surveillance over the operation to ensure that it is carefully controlled.

The pressurization of the section of pipe to be tested begins once the segment is full of fluid and the appropriate measures have been taken to bleed any and all air or gas out of that section; in other words, the section is packed. Pressurization involves bringing the section of pipe to be tested up from the static pressure after the fill process to the desired test pressure. The following equipment may be necessary to complete this process:

a. High pressure positive displacement pumps.

b. Flow meter and volume accumulator.

c. Deadweight pressure tester.

d. Temperature recorder.

e. Pressure recorder.

f. Portable tank.

Pressurization of the section should occur at a controlled rate to avoid surging the line. Pipe connections should be periodically checked for leaks during pressurization. The flow rate should be monitored and logged for preparation of a pressure-volume P-V plot, if applicable. Calculations indicating the amount of squeeze fluid required to go from the fill pressure to the test pressure should be made prior to the test and given to test personnel. This information aids in determining the tightness of the segment and assists in determining, along with the P-V plot, if leaks have occurred or if the pipe has yielded.

Once 80 to 90 percent of the test pressure is reached, the rate of pressurization should be reduced, especially when the test is at or near 100 percent SMYS. Once the desired test pressure is reached, the equipment should be stopped and isolated from the section. At this point, prior to the start of the test, it may be desirable to have a stabilization period, which would allow both the temperature and pressure to settle.

Note that pressure charts, sensors, and displays only show an approximation of the actual pressure. The charts provide proof of the continuity of the test. The deadweight tester or electronic equipment provides the actual pressure to be recorded.
Keep safety in mind at all times! Pipe maintained at high pressure is dangerous. Test personnel should stand at a safe distance from the test section or stand so that there is something substantial between them and the section being tested.

### 3.8.2 The Test Period

When the test pressure is reached, pumping should stop and all valves and connections to the line should be inspected for leakage. After inspecting for leakage, test personnel should take the time to verify that the specified test pressure is being maintained and temperatures have stabilized. When this verification procedure has been completed, the injection pump should be isolated from the test section. The test period should begin after the injection pump has been stopped, and the system has stabilized. The duration of the test period should be in accordance with ASME B31.4 and 49 Code of Federal Regulations Part 195.

Pressure and temperature should be continuously monitored during the test, and all of the pressure readings should be recorded. Deadweight tester comparisons with pressure recorder readings should be made at the beginning of the test, periodically during the test, and at the end of the test. The results of the deadweight tester checks and temperature readings should be recorded on the pressure and temperature logs within at least 30-minute intervals. Weather changes, such as the development of rain or clouds, that could affect the pressure and temperature recording charts should be documented on the deadweight log. The volume or pressure of any added or subtracted test medium should be documented on the deadweight log, as well as the temperature and pressure at that time and be accounted for in the assessment of the results of the pressure test.

Minor or gradual pressure changes during the test can be a result of residual air in the segment, temperature effects, or leaks through small defects or loose flange connections. Extending the test duration can demonstrate that air and temperature effects have been accounted for.

### 3.8.3 Pressure Test Records

Personnel conducting a pressure test should keep a complete record of the test, including details of the test operation and events such as weather variations, test failures, bleed-offs, repressurizations, and so forth. Any failures that occur during the test should be described in this record. The record should indicate the exact location of each failure, describe the type of failure and its cause, and describe the method of repair. Pipe, fittings, or valves that fail and are replaced should be marked with their pipeline station location and the pressure at which they failed. When appropriate, such materials should be preserved by the operator for failure analysis.

Records of pressure tests are to be maintained by the operator to comply with the requirements of ASME B31.4, 49 Code of Federal Regulations Part 195, and all other applicable governmental regulations. Test records may include, but are not necessarily limited to, the following (Appendix A contains sample forms.):

- Continuous pressure versus time record with appropriate information listed on it (see Figure A-1).
- Continuous temperature versus time record with appropriate information listed on it (see Figure A-2).
- Deadweight calibration certificate.
- Test plan (see 3.5).
- Pressure test record and certification (see Figure A-3) that includes the following:
  1. Qualification calculations (see Figure A-4).
  2. Pressure and temperature log (see Figure A-5).
  3. Record of the failures that occurred during the test and the reason for the failures (see Figure A-6).
  4. Profile of the pipeline that shows the elevation and test sites over the entire length of the test section, if elevation differences in the test section exceed 100 feet (30 meters).
  5. A drawing of any facility piping tested and the limits of the test. These test records should be signed by the responsible parties and retained for the life of the facility or until new test records supersede them.

### 3.9 DISPLACEMENT OF TEST MEDIUM

A carrier may choose to displace test water with liquid petroleum, air, or inert gas. If air or inert gas is to be used, careful consideration must be given to the amount of energy stored in the compressed gas.

Test medium may be displaced with spheres, squeegees, or other pigging devices. When water is displaced, it should be disposed of in accordance with all applicable government environmental regulations. It should be noted, though, that all of the test water may have to be stored until permits are received for ultimate disposal. Product quality or internal corrosion control requirements may dictate that a pipeline drying regimen be conducted after the water is displaced.
APPENDIX A—TEST RECORDS
### SAMPLE PRESSURE RECORD

| Description of instrument (make/model) | Company ____________________________ |
| Serial number of instrument | System ____________________________ |
| Test section no. | ____________________________ miles |
| MP ___________ to MP ___________ Station no. ___________ to Station no. ___________ |
| Location of chart recorder MP ___________ Station no. ___________ |
| Start: Time ____________________________ Date ___________ |
| End: Time ____________________________ Date ___________ |
| Contractor rep. | Title ____________________________ Date ___________ |
| Pipeline company rep. | Title ____________________________ Date ___________ |
| Project engineer | Title ____________________________ Date ___________ |

**Notes:**
- **MP** = mile post.
- This pressure information should be included on the permanent record of pressure versus time. Placing this information on a stick-on label and sticking the label to the permanent record might be considered.

**Figure A-1—Sample Pressure Record**

### SAMPLE TEMPERATURE RECORD

| Description of instrument (make/model) | Company ____________________________ |
| Serial number of instrument | System ____________________________ |
| Test section no. | ____________________________ miles |
| MP ___________ to MP ___________ Station no. ___________ to Station no. ___________ |
| Location of chart recorder MP ___________ Station no. ___________ |
| Start: Time ____________________________ Date ___________ |
| End: Time ____________________________ Date ___________ |
| Contractor rep. | Title ____________________________ Date ___________ |
| Pipeline company rep. | Title ____________________________ Date ___________ |
| Project engineer | Title ____________________________ Date ___________ |

**Notes:**
- **MP** = mile post.
- This temperature information should be included on the permanent record of temperature versus time. Placing this information on a stick-on label and sticking the label to the permanent record, or using a rubber stamp, might be considered.

**Figure A-2—Sample Temperature Record**
**SAMPLE PRESSURE TEST RECORD AND CERTIFICATION**

<table>
<thead>
<tr>
<th>Test section</th>
<th>Date</th>
</tr>
</thead>
</table>

Company __________________________ System __________________________

Description from __________________________ to __________________________

New construction ☑ Replacement or relocation ☐ Pipeline ☐ Station ☐

Test medium: water ☐ Other ☑ Inhibitor ☐

Design data code: ☑ B31.4 ☐ B31.8 (Appendix N) ☐ Other _____

### Pipe design data

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<th>Specification and grade</th>
<th>Weld joint factor</th>
<th>Design factor</th>
<th>OD</th>
<th>Wall thickness</th>
<th>SMYS</th>
<th>Design pressure</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Pressure test:
- Test pressure should be as follows:
  - Minimum at high point % SMY
  - Maximum at low point % SMY

Elevations:
- Low point
- High point
- DWT

Specifications:
- Date of test:
- Duration of test:
- Testing and recording witnessed by __________________________ Date __________________________
- Company __________________________ Title __________________________
- Company representative __________________________ Title __________________________

Testing pressure:
- Maximum at low point
- Minimum at high point
- Qualified to operate at

Report checked by __________________________ Date __________________________
- Approved by __________________________ Time __________________________
- Testing company __________________________

Attached documents:
- Pressure record ☑
- Pressure and temperature log ☐
- Temperature record ☐
- Test instrument calibration data ☑
- Sketch or diagram ☐
- Qualification calculations ☐
- Profile ☑
- Failure records ☐

Comments:
___________________________________________
___________________________________________
___________________________________________
___________________________________________

Notes:
- OD = outside diameter, SMYS = specified minimum yield strength, SMY = specified minimum yield, DWT = deadweight tester.
- For test sections containing more than one type of pipe, the maximum test pressure at low point and minimum test pressure at high point and resulting SMYS need to be calculated for each type of pipe.

**Figure A-3**—Sample Pressure Test Record and Certification
## SAMPLE QUALIFICATION CALCULATIONS

<table>
<thead>
<tr>
<th>Company</th>
<th>System</th>
</tr>
</thead>
</table>

**Pipeline Data (at controlling location)**

<table>
<thead>
<tr>
<th>Internal pressure at SMYS</th>
<th>psi</th>
</tr>
</thead>
</table>

**Test medium**: Fresh water? (Yes, at 0.433 psi/ft) (No) Other at psi/ft

**Design test pressure**: Maximum psi Minimum psi

**Test section number**: From station (MP) to station (MP)

**Time and dates**: From (Time) to (Time) hours (Date) to (Date) hours

**Deadweight tester data**

<table>
<thead>
<tr>
<th>Location: Station (MP)</th>
<th>Elevation ft</th>
</tr>
</thead>
</table>

**Tester pressure**: Beginning psi ending psi minimum psi

**Acceptable?** (Yes) (No)

**Use tester pressure of** psi at station Elevation ft

### Minimum Pressure in Test Section

<table>
<thead>
<tr>
<th>Location: Station (MP)</th>
<th>Elevation ft</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>(H)</th>
<th>(E)</th>
<th>(H) – (E)</th>
</tr>
</thead>
</table>

| Pressure at highest elevation: |
| Tester pressure – (Difference in elevation x psi/ft) |
| = (P) – (H) x (E) |

<table>
<thead>
<tr>
<th>(H)</th>
<th>(E)</th>
<th>(H) – (E)</th>
</tr>
</thead>
</table>

| Minimum test pressure |
| = (P) |

<table>
<thead>
<tr>
<th>% SMYS</th>
</tr>
</thead>
</table>

### Maximum Pressure in Test Section

<table>
<thead>
<tr>
<th>Location: Station (MP)</th>
<th>Elevation ft</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>(H)</th>
<th>(E)</th>
<th>(H) – (E)</th>
</tr>
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</table>

| Pressure at highest elevation: |
| Tester pressure – (Difference in elevation x psi/ft) |
| = (P) – (H) x (E) |

<table>
<thead>
<tr>
<th>(H)</th>
<th>(E)</th>
<th>(H) – (E)</th>
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</thead>
</table>

| Maximum test pressure |
| = (P) |

<table>
<thead>
<tr>
<th>% SMYS</th>
</tr>
</thead>
</table>

**Maximum allowable operating pressure in this test section = 72% SMYS = psi or 80% minimum test pressure = psi or controlling component (circle whichever is lowest).**

Calculated by Approved by

**Remarks**

**Date**

**Notes**: OD = outside diameter, wt = wall thickness, SMYS = specified minimum yield strength, MP = mile post, p = pressure, E = elevation, H = highest, L = lowest.

For test sections containing more than one type of pipe, the 72-percent SMYS minimum test pressure and resulting percentage of SMYS need to be calculated for each type of pipe and used in determining the maximum allowable operating pressure.

---

**Figure A-4—Sample Qualification Calculations**
# SAMPLE PRESSURE AND TEMPERATURE LOG

**Company:**

**System:**

---

**Test section no.** ______________

**From station no.** ______________ to station no. ______________

**Pressure/temperature sensor station no.** ______________

**Start of test period:**
- **Time:**
- **Date:**

**End of test period:**
- **Time:**
- **Date:**

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Figure A-5—Sample Pressure and Temperature Log
## SAMPLE PRESSURE TEST RECORD OF FAILURE

Company ________________________________
System ________________________________
Line section ______________________________
From station no. __________________ to station no. __________________

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Leak Station No.</th>
<th>Leak Elevation</th>
<th>Leak (psi)</th>
<th>Deadweight Elevation</th>
<th>Deadweight (psi)</th>
<th>Deadweight Station</th>
<th>Failure Description</th>
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Figure A-6—Sample Pressure Test Record of Failure