

1.0 PURPOSE

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To establish a uniform procedure for designing and testing gas piping systems that will meet the requirements of CPUC G.O. 112, §192.101 and §192.501.

2.0 RESCISSION

Supersedes any previous instructions which are contrary to this Standard.

3.0 POLICY AND APPLICATION

All gas piping systems and facilities both new and reconstructed are to be designed and tested in accordance with the requirements of G.O. 112, latest edition. This includes the reinstating of abandoned or temporarily disconnected piping.

*4.0 RESPONSIBILITY

4.1 The Engineer responsible for the design of a facility shall specify the test or tests required, in accordance with this standard. For all facilities to operate at more than 100 psig, the Engineer shall prepared a Strength Test Pressure Report (Form 62-4921) for each test required. Part I - Design Data, shall be filled out to included all applicable information. These reports shall accompany the construction drawings to the field. *o.k.*

4.2 The Supervisor responsible for the construction of the facility shall have the responsibility for testing it in accordance with this standard. Prior to testing any facility which is to operate at greater than 100 psig, the Supervisory shall verify that a Strength Test Pressure Report (Form 62-4921), with Part I (Design Data) completely filled out, is available at the job site. The Supervisory shall verify that the pipe specifications and footages are correct before proceeding with the test. Upon completion of the test, the Supervisor is responsible for the completion of Part II - Test Data, of the Strength Test Pressure Report.

4.3 The Engineer and the Construction Supervisory are responsible to see that all other provisions of CPUC General Order 112 (latest edition) which are applicable, shall be followed when designing, constructing and testing a facility.

5.0 DEFINITIONS

The following definitions shall apply to this Standard:

*Revised

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- 5.1 STRESS is the magnitude of the internal forces that act to change in size or shape, a body acted on by external forces.
- 5.2 OPERATING STRESS is the stress in a pipe or structural member under normal operating conditions.
- 5.3 HOOP STRESS is the stress in a pipe wall, acting circumferentially in a plane perpendicular to the longitudinal axis of the pipe and produced by the pressure of the fluid in the pipe.
- 5.4 DESIGN PRESSURE¹ is the maximum operating pressure permitted by G.O. 112 as determined by the design procedures applicable to the pipe size, wall thickness, material, and location involved.
- 5.5 MAXIMUM ALLOWABLE OPERATING PRESSURE¹ (MAOP) is the maximum pressure at which a gas pipeline segment may be operated in accordance with the provisions of G.O. 112.
- 5.6 MAXIMUM OPERATING PRESSURE¹ (MOP) is the maximum pressure at which a system may be operated as specified by the Manager of Gas System Design Department.
- 5.7 TEST MEDIUM is a substance such as water, air, or gas used to exert an internal pressure to leak or strength test a facility.
- 5.8 TEST PRESSURE is the internal fluid pressure specified for testing.
- 5.9 STRENGTH TEST is a pressure test to prove the mechanical strength of the system.
- 5.10 LEAK TEST is a pressure test to determine the tightness of the system.
- 5.11 CLASS LOCATION is a geographic area as classified and described in G.O. 112, §192.5, and Standard Practice 460-1.
- 5.12 DESIGN FACTOR is the percentage of SMYS to which operating stress must be limited, as further described in G.O. 112, §192.111.
- 5.13 SPECIFIED MINIMUM YIELD STRENGTH (SMYS) is the minimum yield strength prescribed by the specification under which the pipe is manufactured and qualified to be sold.

6.0 DESIGN

- 6.1 Design criteria stamp must appear on drawings for all facilities where strength testing is required.
- 6.2 When determining design requirements to establish this MAOP, consideration shall be given to:
 - 6.2.1 Future development of the area.
 - 6.2.2 Current and future gas supply pressures.

¹Standard Practice 463-8 gives a complete description of these terms and their application. (S.P. 463-8 is included in the "Engineers Estimators Manual.")

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6.2.3. Probability of increase in supply pressure.

6.3 Design Formula for Steel Pipe:

$$P = \frac{2 St}{D} \times F \times E \times T$$

where: P = design pressure, psig
 S = specified minimum yield strength, psi
 D = nominal outside diameter, inches
 t = nominal wall thickness, inches
 F = design factor determined in accordance with §192.111 of G.O. 112
 E = longitudinal joint factor determined in accordance with §192.113 of G.O. 112
 T = temperature derating factor determined in accordance with §192.115 of G.O. 112

extra wall thickness for over burden?

6.4 Initial Construction

Design all gas facilities to meet the requirements of the expected future Class location.

6.5 Addition to Existing Facilities

The design requirements for subsequent additions or alterations to existing pipeline facilities shall be at least equivalent to the planned future MAOP of the line.

6.6 Drawings for facilities to be constructed with steel pipe other than that shown in Appendices B, C, D, E, and F shall be submitted to the Gas System Design Department for approval.

6.7 Pressure ratings for fittings, valves, and other piping components shall be equal to or greater than the design pressure established for the piping system.

7.0 INSPECTION

7.1 Welds must be inspected as required by Standard D-40.

7.2 Trench, pipe and pipe coating must be inspected as required by Standard A-36.

8.0 TESTING

8.1 All new, replaced, or reconnected pipelines and facilities transporting natural gas must be tested in accordance with the requirements in this standard. Except as noted in Paragraphs 8.5 and 8.6, the test shall be conducted after the pipeline and/or facilities have been installed.

8.2 The test medium shall be one permitted for the design pressure and Class location as specified in Appendix A. Factors to be considered in the choice of test media, as shown in the table of test requirements (Appendix A) shall include safety, availability, and economy.

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8.3 Test pressure shall not be less than that required by Appendix A to test the tightness and strength of a system. All lines shall be tested in accordance with Appendix A.

**8.4 All pipelines designed to operate at greater than 40% of SMYS are to be tested to a minimum of 90% of SMYS to permit them to continue operation at the established MAOP should a location class change occur. However, a test to 90% of SMYS is not to be used as an alternative to designing a pipeline to meet a higher class location which may reasonably be anticipated to occur in the future.

8.5 For fabricated units and short sections of pipe, that will operate at 30% or more of SMYS, for which a post installation test is impractical; a preinstallation strength test must be conducted by maintaining the pressure at or above the test pressure for at least four hours. This includes short sections of pipe and fabricated units used to replace a damaged section of pipeline. A one hour preinstallation test is required for pipe that will operate at less than 30% of SMYS and above 100 psig. For pipe that will operate at 100 psig or less, a leak test is required.

8.6 Pipe held for emergency use must be tested for a minimum of four hours. A test to 90% of SMYS is recommended.

8.7 Girth welds used to tie-in fabricated units and short sections of pipe shall be inspected as required by Gas Standard D-40.

8.8 Testing of Facilities Damaged by Construction Work

8.8.1 All facilities known or suspected to have been struck during excavation or construction activities must be checked to assure their safety if they are to remain in service.

8.8.1.1 Transmission and Distribution Lines

The inspection, repair, and testing required for a damaged transmission or distribution line will depend on the extent of the damage and other conditions, which can best be determined by the responsible Supervisor in the field. However, adequate steps must be taken either by testing or leak survey to insure that no leakage is present.

- a. Repairs to damaged steel transmission or distribution lines shall be made in accordance with Standard A-65.
- b. Repairs to damaged plastic mains shall be made in accordance with Gas Standard A-93.1.
- c. Special attention shall be given to a damaged casing for a plastic insert, to make certain that the damage did not result in a failure in the plastic at another location remote from the point of contact.

**New paragraph.

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8.8.1.2 Service Lines (including service risers)

- a. If a steel, copper, or other metallic service line or the casing for a metallic insert has been broken, bent, pulled, crushed, or otherwise deformed, the service must be tested from tee to riser in accordance with Appendix A.
- b. Steel, copper, or other metallic service lines or casings for metallic inserts that have been hit but not moved or deformed may be leak surveyed with a leak detector as an alternate check. The survey should include the entire length of the service and adjacent areas as appropriate.

8.8.1.3 See Gas Standard A-93.1 for plastic service lines and plastic inserts.

8.8.1.4 All service risers that have been struck and/or damaged in above ground incidents shall be leak surveyed with a leak detector. The survey shall include the service line adjacent to the customer's building and/or other areas as appropriate.

9.0 TEST LIMITATIONS ON VALVES

- 9.1 When performing a hydrostatic test on a line, the test pressure to which a valve may be subjected should normally not exceed the manufacturer's shell test pressure, as shown in Gas Standards F-30 and F-40, or as determined by the Gas System Design Department. Where the required MAOP of the line cannot be established because of these limitations, an engineering study shall be made to verify that it is safe to subject the valve to the higher pressure during the test. When making this study, consideration shall be given to the pressure to which the valve was tested by the manufacturer, the age and condition of the valve, and the effect of stresses which may be transmitted to the valve by the pipeline.
- 9.2 When performing a test with air or inert gas, or an uprating with natural gas, the pressure to which a valve may be subjected shall be limited to 110% of the maximum working pressure of the valve. Where the required MAOP of the line cannot be established because of this limitation, the matter shall be reviewed with the Gas System Design Department, to determine whether a higher test pressure may be permitted. This limitation shall not apply to the 100 psig air test on a service line.
- 9.3 When a valve is to be subjected to a test pressure which is greater than its maximum working pressure, it shall normally be in the open position. However, in some cases, with prior approval from the Gas System Design Department, closed valves may be subjected to hydrostatic test pressures exceeding their rated working pressure, depending on the type and condition of the valve and with the limitations that the differential pressure must not exceed the working pressure and the test pressure must not exceed the manufacturer's shell test pressure.

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10.0 RECORDS

- 10.1 For facilities operating above 100 psig, estimate sketches and design drawings shall contain the following information: pipe, fittings, and valve specifications, design pressure, MAOP, Class location, design factor and strength or leak test information. Where more than one size or type is involved, the required information shall be supplied for each size and type.
- 10.2 For facilities operating at or under 100 psig, test information shall be recorded on the gas service record, the estimate sketch, and work order or other authorized forms.
- 10.3 Estimate Form 62-6251 shall be marked by the person making the estimate to indicate if the pipe is to operate at or over 30% of SMYS and has to be strength tested.

11.0 STRENGTH TEST PRESSURE REPORT

A Strength Test Pressure Report (Form 62-4921) is required for each facility operating above 100 psig (see Appendix A). For instructions on completing the Strength Test Pressure Report, refer to Mains-9 of the Engineers-Estimators Manual.

12.0 TEST CHART

- 12.1 A chart record shall be made of the pressure test for all lines or systems being uprated and for new or reinstated facilities to operate at or over 30% of SMYS. The procedure for handling the chart, and the minimum information required on the chart is outlined below:
- 12.1.1 The chart must be designed for the recorder on which it is to be used and must have appropriate scale and time lines.
- 12.1.2 The calibration of the recorder must have been checked.
- 12.1.3 The chart must be set on the correct time at the start of the test. The actual time, date, and initials of the person starting the test must be shown on face of the chart at the start of the test.
- 12.1.4 The chart must show a minimum of eight hours (except where a four hour test is permitted in Appendix A). Any discrepancies should be explained.
- 12.1.5 At the end of the test, the actual time, date, and initials of the person removing the chart must be shown on the face of the chart.
- 12.1.6 The section of pipe under test must be identified on the face of the chart, along with the job number.
- 12.1.7 The following additional information is to be shown on the back of the chart:

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- 12.1.7.1 Job number
 - 12.1.7.2 Location of test
 - 12.1.7.3 Test pressure, date, and duration
 - 12.1.7.4 Size, wall thickness, pipe specification, and length of section tested
 - 12.1.7.5 The serial number of the recorder or other means of identification
 - 12.1.7.6 The date the recorder was last calibrated and serial number of the dead weight tester or other reference standard used.
- 12.1.8 The above information is to be recorded on the chart at the time of the test. After the test is completed, the supervisor is to review the chart and then sign and date it to verify that it complies with the requirements of this Standard.
- 12.1.9 The original of the test chart is to be attached to the original of the Strength Test Pressure Report Form 62-4921. A copy of the test chart is to be attached to each copy of the test report. This record is to be retained for the life of the facility.

13.0 TEST RECORDS FOR FACILITIES OPERATING AT OR UNDER 100 PSIG

For each facility operating at or under 100 psig, the test information shall be recorded in a box provided on the work order form or the gas service form. If these documents are not used, the test information shall be recorded on the as-built copy of the construction drawing. The test record shall be retained for the life of the facility.

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