PURPOSE

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

RESCISSION

2. Supersedes earlier letter and instructions, including:
   a. Letter, April 2, 1962, R.D. Smith to Division Gas Superintendents, "Marking Estimates for Work on Piping Systems Designed to Operate at Stress Levels Over 20% of the Specified Minimum Yield Strength".
   b. Letter, May 4, 1962, R.D. Smith to Division Gas Superintendents, "Replacement of Pipe in Mains Operating at Stress Levels Over 20% of the Specified Minimum Yield Strength".
   c. Letter, March 25, 1936, R.S. Fuller to Division Managers, calling attention to the serious consequences that may result when main or services are damaged.

POLICY AND APPLICATION

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

RESPONSIBILITY

4. The Supervisor in charge of engineering and installation shall be responsible for design and testing, respectively, of pipe facilities in accordance with this Standard. Other provisions required by G.O. 112C of the CPUC shall be observed.

DEFINITIONS

5. The following definitions shall apply to this Standard:
   a. Stress is the resultant internal force that resists change in size or shape of a body acted on by external forces.
   b. Operating stress is the stress in a pipe or structural member under normal operating conditions.
   c. 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.
   d. Design Pressure is the maximum operating pressure permitted by G.O. 112C as determined by the design procedures applicable to the material and locations involved.
   e. Maximum Allowable Operating Pressure (MAOP) is the maximum pressure at which a gas system may be operated in accordance with the provisions of G.O. 112C.
   f. Maximum Operating Pressure (MOP) is the maximum operating pressure existing in a piping system during a normal annual operating cycle, or as specified by the Manager of G.S.D. DEPT. and in conformance with SP. 463-8.
   g. Test Medium is a substance such as water, air, or gas through which a force acts to leak or strength test a facility.
   h. Test Pressure is the internal fluid pressure specified for testing.
   i. Strength Test is a pressure test to prove the mechanical strength of the system.
   j. Leak Test is a pressure test to determine the tightness of the system.
   k. Location Class is a geographic area as classified and described in G.O. 112C §192.5.
   l. Construction Type is a construction specification for pipeline and mains that fixes the stress levels.
   m. Specified Minimum Yield Strength (SMYS) is the minimum yield strength prescribed by the specification under which the pipe is purchased from the manufacturer (psi).

APPROVED	CHG	DATE	DESCRIPTION	BY	CH.	APPD.
	2	2-17-72	Revised Title For Computer Listing, Also Paragraphs 1, 3, & 5e		M.C.	
	1	9-10-70	Revised Par. 5f.			

SUPV. BY		PIPING — DATA SHEET	SUPERSEDES 084509	
DSGN.		DESIGN AND TEST REQUIREMENTS	SUPERSEDED BY	
DR.		GAS STANDARD	SHEET NO. 1 OF 4 SHEETS	
CH.		PACIFIC GAS AND ELECTRIC COMPANY	DRAWING NUMBER	CHANGE
O.K.		SAN FRANCISCO, CALIFORNIA	283621	2
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DESIGN

6. When determining MAOP consideration shall be given to:

   a. Future development of the area.

   b. Current and future Gas Supply Pressures.

   c. Probability of increase in Supply Pressure.

7. Initial Construction

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

8. Addition to Existing Facilities

   The design requirements for subsequent additions or alterations to existing pipeline facilities shall be at least equivalent to that of the original construction.

9. Facilities designed for either Location Class 1 and 2 or which deviate from the steel pipe specification (Appendix B,C,D,E and F) shall be submitted to the Gas System Design Department for approval.

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

TESTING

11. The test medium shall be one permitted for the design pressure and location class as specified in G.O. 112C §192.503. 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.

12. Test Pressure shall not be less than that required by G.O. 112C §192.501 to test the tightness and strength of a system, except as modified by paragraph 13, all lines shall be tested in accordance with Appendix A.

13. Exceptions:

    Short replacement shall be treated as follows.

    a. Replacement section of pipe shall be subjected to a preinstallation strength test. The section of replacement pipe shall be tested to the pressure required for a new pipeline or main installed in the same location by maintaining the pressure at or above the test pressure for at least four hours. The test may be made on the replacement pipe prior to installation provided all tie-in girth welds are nondestructively tested.

    b. Minimum test duration for pipe to be held for emergency use is four hours. Minimum Test Pressure shall be at least equal to the Test Pressure required for the line in which it is used.

    c. Replacement section of pipe to be operated at less than 30% S.M.Y.S. and over 100 P.S.I.G. shall be given a one hour Preinstallation Leak Test.

14. Damaged service lines shall be repaired if nesessary, and then tested in accordance with Appendix A.

RECORDS

15. a. For facilities operating above 100 P.S.I., estimate sketches and design drawings shall contain the following information:

DESIGN CRITERIA:

LOCATION CLASS_____

DESIGN FACTOR _____

D.P._____% SMYS_____

MAOP_____% SMYS_____

STRENGTH TEST PRESSURE

MAX._____ PSIG _____ %SMYS

MIN._____ PSIG _____ %SMYS

_____ PSIG = 90% SMYS

TEST FLUID_____

PIPE SPEC._____

O.D._____

W.T._____

Where more than one size or type of pipe is involved, the Required Information shall be supplied for each size or type. Where several sizes are involved the Information should be provided in Tabular Form.

b. Leak Test Information shall be recorded on the gas service record, the estimate sketch, and work order or other authorized form for Facilities operating under 100 P.S.I.G.

c. Estimate Form 62-6251 shall be marked by person making estimate to indicate that the pipe is over 30 yeld and has to be strength tested.

APPROVED						
	3	1-22-73	Revised Paragraph 3 and 13; Added Paragraph 14 and 15.	H.N.K.		
	2	2-17-72	Revised Title For Computer Listing & Paragraphs 11, 12 & K.		M.C.	
	1	9-10-70	Revised Par. 13a			
	CHG	DATE	DESCRIPTION	BY	CH.	APPD.

SUPV. BY		PIPING — DATA SHEET	SUPERSEDES 084509
DSGN.		DESIGN AND TEST REQUIREMENTS	SUPERSEDED BY
DR.		GAS STANDARD	SHEET NO. 2 OF 4 SHEETS
CH.		PACIFIC GAS AND ELECTRIC COMPANY	DRAWING NUMBER 283621
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STRENGTH TEST PRESSURE REPORT.

16. A Strength Test Pressure Report (Form 62-4921) is required for each facility operating at over 100 P.S.I.G. (See Appendix A).
    a. Part I of the Strength Test Pressure Report shall be filled out by the Project Engineer or the Gas System Design Department.
    b. Part II of the Strength Test Pressure Report shall be filled out by the person supervising the test in the field, at the time the Test is performed.
    c. A copy of the completed Strength Test Pressure Report shall be filed with the completed Foreman's Copy of the Estimate, along with a copy of the Test Chart (where required). These shall be retained for the life of the facility. Distribute other copies as indicated on the Form.

TEST CHART

17. A Chart Record shall be made of the Pressure Test for new facilities to operate at over 30% S.M.Y.S. and for all lines being uprated. The procedure for handling the Chart, and the minimum information required on the Chart is outlined below:
    a. The Chart must be designed for the recorder on which it is to be used, and must have appropriate scale and time lines.
    b. The calibration of the recorder must have been checked.
    c. 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 Chart at the start of the test..
    d. The Chart must show a minimum of eight hours (except where four hours test is permitted in Appendix A.). Any discrepancies should be explained.
    e. 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.
    f. The section of pipe under test must be identified on the face of the Chart, along with the Job Number.
    g. The following additional information is to be shown on the back of the Chart.
        I. Job Number
        II. Location of test.
        III. Test Pressure, date and duration.
        IV. Size, wall thickness, pipe specification and length of section tested.
        V. The serial number of the recorder or other means of identification.
        VI. The date the recorder was last calibrated and s/n of the dead weight tester used.
    h. The above information is to be recorded on the Chart at the time of the test. After the test is completed, the foreman is to review the Chart and then sign and date it.
    i. The original of the Test Chart is to be attached to the original of the Test Report Form 62-4291. 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.

APPROVED						
	2	1-25-73	Paragraph 15 Removed, Paragraph 16 and 17 Added, Drawing Redrawn.	A.N.K.	M.C.	
	1	2-17-72	Revised Title For Computer Listing & Revised Design Criteria		M.C.	
	CHG	DATE	DESCRIPTION	BY	CH.	APPD.

SUPV. BY	PIPING — DATA SHEET	SUPERSEDES 084509	
DSGN.	DESIGN AND TEST REQUIREMENTS	SUPERSEDED BY	
DR. [redacted]	GAS STANDARD	SHEET NO. 3 OF 4	SHEETS
CH. M.C.	PACIFIC GAS AND ELECTRIC COMPANY	DRAWING NUMBER	CHANGE
O.K. [redacted]	SAN FRANCISCO, CALIFORNIA	283621	2
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TEST REQUIREMENTS FOR PIPELINES, MAINS, SERVICES AND OTHER FACILITIES.

DESIGN PRESSURE	30% S.M.Y.S. OR MORE		UNDER 30% S.M.Y.S. AND OVER 100 P.S.I.	100 P.S.I. TO 1 P.S.I. OR LESS	PLASTIC (SEE NOTE 9)
	PIPELINE	FABRICATED UNITS, SHORT SECTIONS OF PIPE, PRETESTED PIPE (SEE NOTE 5 FOR LIMITATION)			
TYPE OF TEST	STRENGTH	STRENGTH	LEAK	LEAK	STRENGTH
TEST MEDIUM	WATER, AIR, INERT GAS OR GAS (SEE NOTES 1 AND 2)	WATER, AIR, INERT GAS OR GAS (SEE NOTES 1 AND 2)	WATER, AIR, INERT GAS OR GAS (SEE NOTES 1 AND 2)	AIR OR GAS	AIR OR GAS
MAXIMUM TEST PRESSURE (SEE NOTES 1 AND 2)	100% S.M.Y.S. OR FACTORY TEST PRESSURE OF FITTING (SEE NOTES 3 AND 4)	100% S.M.Y.S. OR FACTORY TEST PRESSURE OF FITTING (SEE NOTES 3 AND 4)	1.5 X DESIGN PRESSURE (SEE NOTE 3) (11)	100 P.S.I.	3 X DESIGN PRESSURE
MINIMUM TEST PRESSURE	1.5 X DESIGN PRESSURE (SEE NOTE 4)	1.5 X DESIGN PRESSURE (SEE NOTE 4)	1.5 X DESIGN PRESSURE	100 P.S.I.	100 P.S.I. OR 1.5 X M.A.O.P., WHICHEVER IS GREATER
DURATION OF TEST	8 HOURS MINIMUM	4 HOURS MINIMUM	1 HOUR MINIMUM	5 MINUTES	5 MINUTES (SEE NOTE 6)
TEST CHART REQUIRED	YES (SEE NOTE 8)	YES (SEE NOTE 8)	NO (SEE NOTE 10)	NO (SEE NOTE 10)	NO (SEE NOTE 10)

NOTES: (1) Maximum Test Pressure permitted, expressed as a percent of S.M.Y.S.-

Location Class	1	2	3	4
Air or Inert Gas	80	75	50	40 (SEE NOTE 7)
Gas	80	30	30	30
WATER	See Above.			

(2) Safety - when testing with air, inert gas or gas, the pressure shall be held at about 100 P.S.I. and observed for leakage before raising to the required test value.
(3) Maximum test capabilities of fittings such as valves and elbows must be examined when testing.
(4) It is the intent to test all facilites designed to operate at over 50% S.M.Y.S. at a pressure over 90% of S.M.Y.S. and as close to S.M.Y.S. as practical. There may be instances, as in item 3, where pressure shall be limited, but in no case shall it be less than 1.5 D.P. (Except Class 1 Construction, which is 1.25 D.P.). Facilities to operate at under 50% S.M.Y.S. shall be tested to a minimum of 1.5 X M.A.O.P.
(5) Where practical, all facilities must be tested as a unit, after installation. For fabricated units and short sections of pipe, for which a post installation test is impractical, a preinstallation strength test must be conducted by maintaining the pressure at or above the minimum required for at least four hours.
(a) A short section of pipe is defined as one pipe length or less.
(b) A fabricated unit is made up of two or more fittings and/or pieces of pipe joined together.
(6) Hold at test pressure for as long as practical. If not gassed up immediately following test, retest before gassing up.
(7) Air or inert gas should not be used to test at over 50% S.M.Y.S. unless a test with water is completely impracticable. When it is necessary to use air or inert gas at over 50% S.M.Y.S., buildings within 300' of pipeline must be evacuated.
(8) Test Charts must be completed and retained as outlined in A-34, page 3.
(9) Temperature of thermoplastic material must not be more than 100°F during the test.
(10) Table indicates Test Chart Requirements for new facilities. Test Charts are required for All uprating jobs, no matter what the Operating Pressure of the line.

(11)

APPROVED	CHG	DATE	DESCRIPTION	BY	CH.	APPD.
	4	2-17-72	Revised Title For Computer Listing, Change To 30 SMYS & Note 4		M.C.	JKK.
	3	1-71	Added Note 7, Revised Wording Under 20% And Duration Of Test.			JFF.
	2	10-70	Redrawn			JFF.
	5	1-24-73	Drawing Revised and Redrawn.	A.N.K.		

SUPV. BY	PIPING — DATA SHEET	SUPERSEDES 084509	
DSGN.	DESIGN AND TEST REQUIREMENTS	SUPERSEDED BY	
DR.	GAS STANDARD	SHEET NO. 4 OF 4 SHEETS	
CH.	PACIFIC GAS AND ELECTRIC COMPANY	DRAWING NUMBER	CHANGE
O.K.	SAN FRANCISCO, CALIFORNIA	283621	5
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