REVISED BY KAFT ISSUE 12

MO'B MAY-3 1983

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 §192.901 of the CPUC.

RESCISSION

2. Supersedes earlier letter and instructions, including:
   a. Letter, April 2, 1962, R.D. Smith to Division Gas Superintendents, "Working Stresses 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 pressure at which a system may be operated as specified by the Manager of G.S.D. Department.
   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).

* Standard Practice 463-8 gives a complete description of these terms and their application. (S.P. 463-8 is included in the "ENGINEERS ESTIMATORS MANUAL").

APPROVED	CHG.	DATE	DESCRIPTION	BY	CH.	APPD.
	3	2-20-74	Added Footnote Concerning M.A.O.P., M.O.P. and Design Pressure.	MD.	R.N.K.	
	2	2-17-71	Revised Title For Computer Listing, Also Paragraphs 1, 3, & 5e		M.C.	
	1	9-10-70	Revised Par. 5f			

SUPV. BY
DSGN.
DP.
CH.
O.K.
DATE 2-11-69
SCALE NONE

PIPING — DATA SHEET
DESIGN AND TEST REQUIREMENTS
GAS STANDARD
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

SUPERSEDES 084509
SUPERSEDED BY
SHEET NO. 1 OF 4 SHEETS
DRAWING NUMBER 283621
CHANGE 3

DESIGN

6. a. Design criteria stamp must appear on drawings for all facilities where strength testing is required.

   b. When determining MAOP consideration shall be given to:
      i. Future development of the area.
      ii. Current and future Gas Supply Pressures.
      iii. 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 the planned future M.A.O.P. of the line.

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.________

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. Welds must be inspected as required by Std. D-40.

12. a. The test medium shall be one permitted for the design pressure and location class as specified in Appendix A (pg. 4 of this std). 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.

    b. Test Pressure shall not be less than that required by Appendix A 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. Testing of Facilities Damaged by Construction Work

    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.

    A. Mains

    The inspection, repair and testing required for a damaged main 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 mains 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.

    B. Services (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 line 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.

CHG	DATE	DESCRIPTION	BY	CH.	APPD.
6	11-15-75	Revise Section 14 to Reference Std. A 93.1 for Plastic Services.	R.P.	H.E.	
5	8-21-74	Added Note 2, 6a. and 11; [illegible]	A.S.	R.R.K.	
4	9-11-73	Revised Par. 14, 8 and 13.	A.C.	A.K.K.	
9	10-20-79	Revised Paragraph 14 A. a. reference from D-32			
8	1-15-79	Revised Paragraph 11 Reference from Standard D-31; [illegible]			
7	1-22-76	Revised Par. 14.			

APPROVED

SUPV. BY DSGN. DR. CH. O.K. DATE 2-11-69 SCALE NONE	PIPING — DATA SHEET DESIGN AND TEST REQUIREMENTS GAS STANDARD PACIFIC GAS AND ELECTRIC COMPANY SAN FRANCISCO, CALIFORNIA	SUPERSEDES 084509 SUPERSEDED BY SHEET NO. 2 OF 4 SHEETS DRAWING NUMBER 283621 CHANGE 9

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

RECORDS

15. a. For facilities operating above 100 P.S.I., estimate sketches and design drawings shall contain the following information: 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. 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 62-625I shall be marked by person making estimate to indicate that the pipe is over 30% yield and has to be strength tested.

STRENGTH TEST PRESSURE REPORT.

16. A Strength Test Pressure Report (Form 62-492I) 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 or systems 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 62-429I. 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.

TEST RECORDS FOR FACILITIES OPERATING AT UNDER 100 P.S.I.G.

18. For each facility operating at under 100 P.S.I.G., the Test Information shall be recorded in a Box provided on the Work Order Form or the Gas Service Record 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.

CHG	DATE	DESCRIPTION	BY	CH.	APPD.
4	7-22-76	Retyped due to expansion of Par 14.			
3	2-20-74	Added Paragraph 18.	A.C.	A.N.K.	
2	1-25-73	Paragraph 15 Revised, Paragraph 16 and 17 Added, Drawing Redrawn	D.N.K.	M.C.	
5	3-11-80	Revised Paragraph 15b. And 18.			

APPROVED

SUPV. BY
DSGN.
DR. A.N.KNIAZEFF.
CH. M. C.
O.K. M. Calleros
DATE 2-11-69
SCALE NONE

PIPING — DATA SHEET
DESIGN AND TEST REQUIREMENTS
GAS STANDARD
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

SUPERSEDES 084509
SUPERSEDED BY
SHEET NO. 3 OF 4 SHEETS
DRAWING NUMBER 283621
CHANGE 5

TEST REQUIREMENTS FOR PIPELINES, MAINS, SERVICES, INSTRUMENT LINES SUBJECTED DIRECTLY TO GAS PRESSURES, AND OTHER FACILITIES

DESIGN PRESSURE (D.P.)	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 (INCLUDING FABRICATED UNITS) TESTED IN PLACE	FABRICATED UNITS, SHORT SECTIONS OF PIPE, PRETESTED PIPE (SEE NOTE 5 FOR LIMITATION)	INCLUDING FABRICATED UNITS AND SHORT SECTIONS OF PIPE, EITHER PRE-TESTED OR TESTED IN PLACE.		
TYPE OF TEST	STRENGTH	STRENGTH	LEAK	LEAK	STRENGTH
TEST MEDIUM	WATER, AIR, INERT GAS OR GAS (SEE NOTES 1,2, AND 14)	WATER, AIR, INERT GAS OR GAS (SEE NOTES 1,2 AND 14)	WATER, AIR, INERT GAS OR GAS (SEE NOTES 1,2 AND 14)	AIR OR GAS (SEE NOTE 14)	AIR OR GAS (SEE NOTE 14)
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)	(SEE NOTES 3 & 11)	110 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.	100PSI (SEE NOTE 13) 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 8)
TEST RECORDS REQUIRED (SEE NOTE 12) — FORMS REQUIRED	COMPLETED STRENGTH TEST PRESSURE REPORT	COMPLETED STRENGTH TEST PRESSURE REPORT	COMPLETED STRENGTH TEST PRESSURE REPORT	COMPLETE BOX ON M.O. FORM OR GAS SERVICE RECORD FORM	COMPLETE BOX ON M.O.FORM OR GAS SERVICE RECORD FORM
TEST RECORDS REQUIRED (SEE NOTE 12) — TEST CHART	YES (SEE NOTE 6)	YES (SEE NOTE 6)	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	90	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 CLOSURES MUST BE EXAMINED WHEN TESTING.
(4) IT IS THE INTENT TO TEST ALL FACILITIES DESIGNED TO OPERATE AT OVER 30% S.M.Y.S. AT A PRESSURE OVER 30% 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 30% S.M.Y.S. SHALL BE TESTED TO A MINIMUM OF 1.5 X D.P.
FOR FACILITIES OPERATING AT 40% TO 50% OF S.M.Y.S., CONSIDERATION SHOULD BE GIVEN TO TESTING TO OVER 50% OF S.M.Y.S., IF THERE IS A POTENTIAL FOR HIGH RISE CONSTRUCTION. HOWEVER, SUCH TESTING IS NOT AN ALTERNATIVE FOR CONSTRUCTION OF NEW OR REPLACEMENT FACILITIES TO MEET EXPECTED FUTURE LOCATION CLASS REQUIREMENTS (SEE PAGE 2, PAR. 7 OF THIS STANDARD).
(5) ALL FACILITIES DESIGNED TO OPERATE AT 30% OR MORE OF SMYS SHALL BE TESTED AS A UNIT FOR A MINIMUM OF EIGHT HOURS, AFTER INSTALLATION, EXCEPT FOR FABRICATED UNITS OR SHORT SECTIONS OF REPLACEMENT PIPE FOR WHICH A POST INSTALLATION TEST IS IMPRACTICAL. FABRICATED UNITS FOR WHICH A POST INSTALLATION TEST IS IMPRACTICAL, SHALL BE TESTED AFTER COMPLETION AND BEFORE INSTALLATION, FOR A MINIMUM OF FOUR HOURS. THIS TEST IS REQUIRED EVEN WHEN PRETESTED PIPE WAS USED TO FABRICATE THE UNIT. SHORT SECTIONS OF REPLACEMENT PIPE SHALL BE TESTED FOR A MINIMUM OF FOUR HOURS, PRIOR TO INSTALLATION. THIS TEST MAY BE CONDUCTED IMMEDIATELY PRIOR TO INSTALLATION, OR BY PRETESTING THE PIPE AND RETAINING IT FOR EMERGENCY USE. FOR GAS STANDARD A-34, THE FOLLOWING DEFINITIONS SHALL APPLY:
(a) A SHORT SECTION OF PIPE IS DEFINED AS ONE PIPE LENGTH OR LESS.
(b) A FABRICATED UNIT SHALL CONSIST OF TWO OR MORE FITTINGS AND/OR PIECES OF PIPE JOINED TOGETHER. WHERE MORE THAN 40 FEET OF PIPE IS INVOLVED, THERE SHALL BE A FULL EIGHT HOUR TEST.
FOR EMERGENCY REPAIRS, SOME EXCEPTIONS MAY BE PERMITTED, BUT ONLY WITH THE APPROVAL OF THE GAS SYSTEM DESIGN DEPARTMENT.
(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 30% S.M.Y.S., UNLESS A TEST WITH WATER IS COMPLETELY IMPRACTICABLE. WHEN IT IS NECESSARY TO USE AIR OR INERT GAS AT OVER 30% 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 2.
(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) FOR FACILITIES OPERATING AT UNDER 30% S.M.Y.S. AND OVER 100 P.S.I., THE MAXIMUM TEST PRESSURE IS TO BE DETERMINED BY THE PROJECT ENGINEER. A REASONABLE DIFFERENTIAL BETWEEN MAXIMUM AND MINIMUM TEST PRESSURES SHOULD BE ALLOWED, CONSIDERING ELEVATION DIFFERENTIALS AND NOTE 3.
(12) ALL TEST RECORDS MUST BE RETAINED FOR THE LIFE OF THE FACILITY.
(13) SDR 21 PIPE TO BE TESTED TO 90 P.S.I.G. MINIMUM.
(14) TESTING USING WATER, AIR OR INERT GAS IS NOT PERMITTED WHERE THE TEST SECTION IS ISOLATED FROM AN OPERATING LINE ONLY BY A CLOSED VALVE, SQUEEZE OFF EQUIPMENT OR PLUGGING EQUIPMENT, WHICH COULD PERMIT THE TEST MEDIUM TO LEAK INTO THE OPERATING LINE. WHERE A TEST MUST BE CONDUCTED USING ONE OF THESE METHODS OF ISOLATING THE TEST SECTION, THE TEST MUST BE CONDUCTED USING NATURAL GAS AS THE TEST MEDIUM. WHEN CONDUCTING SUCH A TEST, THE LIMITATIONS CONTAINED IN NOTE 1 MUST BE OBSERVED.

CHG	DATE	DESCRIPTION	BY	CK.	APPD.
10	1-16-79	REVISED NOTE 5			
11	11-2879	Added Note 14			
9	1-13-77	Added "Instrument Lines Subjected Directly to Gas Pressure" to Title of Chart	R.A.	MJP	
4	2-17-72	Revised Title for Consumer Listing, Change To 30 SMYS & Note 4		M.C.	W.F.A.

APPROVED

SUPV. BY
DSGN.
DR.
CH.
O.K.

DATE 2-11-69
SCALE NONE

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CHANGE 11