Public Utilities Commission of the State of California

Energy Division

Resolution G-3257
August 5, 1999

Resolution

Resolution G-3257. Sempra Energy on behalf of Southern California Gas Company requests the Commission's approval to adopt a gas meter testing methodology according to Section 14 of General Order 58-A, *Standards for Gas Service in the State of California*. The Commission authorizes Southern California Gas Company to test and confirm rotary gas meter accuracy using the differential pressure testing method but requires Southern California Gas Company to use transfer provers to comply with the ten year retest requirement.

By letter dated March 12, 1999, from Sempra Energy Company.

Summary

On March 12, 1999, Sempra Energy (Sempra) on behalf of Southern California Gas Company (SoCal Gas) requested authority to: (1) adopt differential pressure testing as an acceptable method of testing rotary gas meters for accuracy; and (2) revise its gas meter performance program to accept differential testing as a meter performance tool. This request was submitted in accordance with Sections 13(c) and 14 of General Order 58-A (GO 58-A). On June 3, 1999, SoCal Gas withdrew Part (2).

SoCal Gas needs Commission approval per Section 14 of GO 58-A to adopt the new testing methodology.

This Resolution allows SoCal Gas to use the differential pressure testing methodology, but SoCal Gas is still required to use transfer provers to comply with the requirement to retest every ten years. Differential pressure testing is not mandatory; however, SoCal Gas must adhere to certain terms and conditions when it uses this test method.

Supporting documentation demonstrates the safety, applicability, operational integrity, and technical advantages of the proposed method.

SoCal Gas intends to obtain rotary meter performance data by using the differential pressure testing methodology.

SoCal Gas may eventually use data collected from rotary meter differential pressure testing to pursue Commission approval to deviate from Section 13 (a) of GO 58-A, by extending from ten to fifteen years the transfer prover test intervals for rotary meters.

Background

A rotary meter is a positive displacement device that has fixed, non-wearing and non-contacting internal parts in the measuring chamber, and the static volumetric displacement is constant.

According to its Measurement Technologies Technical Operations, SoCal Gas currently has approximately 46,000 rotary gas meters in service. The proposal is to test rotary meters with rated capacities of 2,000 cubic feet per hour (CFH) or greater with the differential pressure testing methodology; SoCal Gas has approximately 13,500 of this larger capacity meter. These meters serve large residential, small commercial, and industrial customers. They represent approximately 0.28% of the approximately 4.9 million total gas meters in service at SoCal Gas. Small rotary meters (less than or equal to 500 CFH) are not suitable for differential pressure testing.

The latest revision of GO 58-A was approved and became effective on April 12, 1989. Section 12(c), 13(a), and 14 apply to this resolution and read in part as follows:

Section 12(c)

> All gas meters other than diaphragm meters shall be tested for accuracy in accordance with accepted industry standards and practices. Any such test results shall not register less than minus two percent (2%) error or more than plus one percent (1%) error...

Section 13(a)

No gas meter hereafter installed shall be allowed to remain in service more than ten (10) years from the time when last tested without being retested in the manner herein provided, and if found inaccurate, each such meter shall, at the time of each test, be readjusted to be correct within the prescribed limits before being installed.

Section 14

Each gas utility shall adopt and maintain standard methods of testing gas meters. These methods and the facilities used shall be reported to the Commission for approval.

A transfer prover is an integrated computer controlled system for volumetric verification and testing of rotary gas meters. It consists of a master meter, a flow rate controller, and pressure and temperature transducers.

By letter dated March 12, 1999, Sempra on behalf of SoCal Gas requested authority to: (1) adopt differential pressure testing as an acceptable method of testing rotary gas meters for accuracy; and (2) revise its gas meter performance program to accept differential testing as a meter performance tool. This request was submitted in accordance with Sections 13(c) and 14 of General Order 58-A (GO 58-A). On June 3, 1999, SoCal Gas withdrew Part (2).

Commission approval of this testing methodology will allow SoCal Gas to obtain rotary meter performance data by differential pressure testing.

SoCal Gas may eventually use data collected from rotary meter differential pressure testing to pursue Commission approval to deviate from Section 13 (a) of GO 58-A, by extending from ten to fifteen years the transfer prover test intervals for rotary meters.

SoCal Gas currently does not have a meter performance program for rotary style meters, but SoCal Gas is in the process of developing a database using data collected from differential pressure testing of all rotary meters that are scheduled for field inspection and/or testing visits. SoCal Gas submitted a proposed rotary meter field inspection and testing schedule on June 4, 1999.

Three significant variables can affect the accuracy of a rotary meter. They are: (1) changes in static displacement;

(2) changes in impeller clearances; and (3) increases in the meter's internal resistance.

Meter accuracy (as a percentage of deviation from the actual flow rate) should be the combined accuracy of the rotary meter and auxiliary devices (pressure, temperature compensation, and remote readout equipment), measured at approximately 25 to 100% of the meter's rated capacity. Any such test results shall not register less than minus two percent (2%) or more than plus one percent (1%) error, as defined by Section 12 of GO 58-A.

SoCal Gas is currently using transfer provers to test the accuracy of rotary meters in the field at ten-year or less intervals. A rotary meter is connected in series with a transfer prover of adequate capacity (representative of the customer's regular consumption). The volume registered by the indicator on the rotary meter is compared with the volume indicated by the transfer prover, both corrected to standard pressure and temperature. This test requires a two-man crew for up to two and one-half hours. Auxiliary devices are tested and calibrated separately.

SoCal Gas owns 30 transfer provers and states that they are calibrated every 4 months with a 7M (7000 CFH) calibration prover in its meter repair facility. The manufacturer calibrates the calibration prover in turn using methods of National Bureau of Standards.

Rotary gas meter manufacturers produce characteristic flow versus differential pressure curves for each meter model and size under standard conditions for air. SoCal Gas also produces prover test curves of differential pressures versus flow rates for individual rotary gas meters. The differential pressure testing method measures the difference in pressure from the inlet to the outlet of a rotary gas meter during normal customer consumption and operating conditions. The manufacturer provides pressure taps on the body of each meter. Differential pressure test results are compared with individual prover test curves produced in-house or characteristic differential pressure curves from meter manufacturers. According to the American National Standards Institute (ANSI/ASC B109.3, 1992), if the pressure drop across a rotary type gas displacement meter at a particular flow rate increases less than 50% from the characteristic differential pressure curve, the meter can be assumed accurate within ±1%. Alternatively, corrective action should be taken to return the meter to the normal differential pressure, or it should be

removed from service. A single technician can do this test in about half an hour.

The differential pressure test will not indicate the accuracy of a rotary meter. However, the relative condition of the meter can be determined by comparing a rotary meter's performance with its original performance. Original performance of a rotary meter may be obtained by either: (1) testing the rotary meter with differential pressure testing prior to placing the meter in service, in order to produce original differential pressure curves; or (2) obtaining the manufacturer's differential pressure curves for the model and size of the rotary meter.

American Gas Association (AGA) standards and manufacturer literature of the Dresser Company also state that test results have shown that an increase of up to 50% in differential pressure can be tolerated without affecting meter accuracy at the higher flow rates (25% of rated capacity and above) by more than 1%.

Instead of plotting the differential pressure curves for each rotary gas meter, SoCal Gas uses characteristic curves supplied by meter manufacturers.

Dresser suggests that a five-year differential pressure test interval for rotary gas meters is more than adequate, providing that the gas stream is clean.

A rotary meter is a positive displacement device that has fixed, non-wearing and non-contacting internal parts in the measuring chamber, and the static volumetric displacement is constant. Therefore, theoretically it cannot be fast unless an incorrect gear train is mounted or a major malfunction in the gearing has occurred, which would cause over registration.

The States of Illinois, Iowa, Kentucky, Maryland, New York, Pennsylvania, West Virginia, and Wisconsin, and the federal government of Canada, have formal rulings allowing the differential pressure testing methodology. These states specify from 1 to 10 years of differential pressure testing intervals depending on meter sizes.

Notice

Sempra submitted its request on March 12, 1999, on behalf of SoCal Gas to: (1) adopt differential pressure testing as an acceptable method of testing rotary gas meters for accuracy;

and (2) revise its gas meter performance program to accept differential testing as a meter performance tool. Notice was also made by publication in the Commission Daily Calendar on June 4, 1999.

Protests

No protest is recorded for this request. However, on June 3, 1999, Sempra submitted a letter to withdraw Part (2) of the request.

Discussion

This request should be evaluated on the basis of safety, applicability, operational integrity, and technical advantage.

Safety refers to the security and protection of human beings and property situated at and in the vicinity of the gas meter test sites.

- A transfer prover test requires temporarily bypassing the rotary meter for continued gas service to the customer. This requires breaking the line seal and/or removing the meter. But differential pressure testing can be performed in-line without any gas line reconfiguration. It only requires connecting hoses to pressure taps located on the body of a meter. Hence, differential pressure testing avoids the element of risk associated with gas pressure control during the by-pass operation. Therefore, differential pressure testing is actually safer than the transfer prover method.

Applicability refers to the ease of use and implementation of test methods. This includes any physical constraints due to geographical locations or customer preferences.

- SoCal Gas currently has approximately 100 technicians maintaining and testing rotary meters. The differential pressure testing methodology is already in use with the current workforce for SoCal Gas when testing gas stream dust filters and strainers for high pressure differentials at large meter installations and district regulator stations.
- The proposed method requires about 1/5 of the time required of the traditional transfer prover method.
- The transfer prover test method requires vehicles of considerable load carrying capacity to transport the

transfer prover and the associated equipment; meanwhile the proposed method requires minimum space to carry small quantities of hand tools, a dial pressure gauge, a portable digital manometer; a stop-watch, and a laptop computer.

- Billing disputes would not be an issue for the differential pressure testing method since line by-pass operations would not be necessary.

Operational integrity refers to the repeatability and accuracy of the test, and calibration of measuring devices.

- The differential pressure test is based on the principle that as the rotating resistance of the meter increases, more energy is absorbed from the flow gas, resulting in an increase in differential pressure. Therefore, under the same test conditions, identical results are obtained. Hence, repeatability is assured.
- There are three significant variables that could affect the accuracy of a rotary meter. They are: (1) changes in static displacement; (2) changes in impeller clearances; and (3) increases in the meter's internal resistance. Although both tests measure changes in these three variables, they use different approaches to arrive at accuracy results. The transfer prover test compares the volume flow rate of a rotary meter directly with a calibrated prover, while the differential pressure test uses an indirect approach of comparing pressure drop at in-line condition with an original in-house or manufacturer's characteristic curve to confirm a meter's accuracy.
- Characteristic curves supplied by the manufacturers used air as the test medium. Since pressure differential is a function of gas density, pressure, and temperature, SoCal Gas developed an empirical formula to convert in-line gas test results to air. This may introduce an error into the result, although they are not significant.
- The transfer prover test requires minimum human intervention after test setup. The differential pressure test requires the operator to time the passage of a predetermined volume of gas as registered on the counter or instrument and record the differential pressure reading; hence, it is more subject to human error.
- Meter or system pressure pulsation may cause fluctuation of the differential pressure readings. Although the proposed use of a digital manometer designed with damping function and average pressure readings may eliminate some of these effects, it could also be a source of error that needs to be considered.
- All the above suggests that the accuracy of differential pressure testing may be influenced by a number of

parameters and may affect the accuracy of the results. However, the Dresser Company, AGA, and ANSI based on past studies, suggest that an increase of up to 50% in differential pressure can be tolerated without affecting meter accuracy at the higher flow rates (25% rated capacity and above) by more than 1%. Therefore, the differential pressure testing method also meets meter accuracy requirements specified under Section 12 of GO 58-A.

- Digital manometers, dial pressure gauges, stopwatches, and transfer provers all can be calibrated by SoCal Gas. Hence, equipment calibration should not be a reason to deny the implementation of differential pressure testing.

Technical advantage refers to the technical superiority of the methods to provide an overall benefit on the inspection and maintenance of the rotary meters.

- After the manufacturer and/or SoCal Gas has established the baseline accuracy curves with a transfer prover, differential pressure tests may be used to confirm the continued accuracy of in-service rotary meters. This encourages and provides SoCal Gas a convenient and efficient means of testing rotary meters at intervals frequent enough to preclude excessive mechanical damage or inaccuracies, but not more frequently than is actually necessary. This is consistent with the concept of reliability centered maintenance. However, the use of empirical formulas, and the indirect approach of measuring pressure differentials to confirm flow rate accuracy, are technical drawbacks.

Differential pressure testing appears to be safe, simple, and meets the GO 58-A, Section 12 (c) accuracy requirement. Hence, the Energy Division recommends that the Commission grant SoCal Gas' request to use differential pressure testing as an acceptable method of testing rotary gas meters for accuracy. Although, differential pressure testing is not a mandatory requirement, SoCal Gas is required to adhere to the terms and conditions of Appendix A of this Resolution whenever it uses this testing methodology.

Comments

This is an uncontested matter in which the Resolution grants the relief requested. Accordingly, pursuant to PU Code Section 311(g)(2), the otherwise applicable 30-day period for public review and comment is being waived.

Findings

1. By letter dated March 12, 1999, Sempra on behalf of SoCal Gas requested authority to: (1) adopt differential pressure testing as an acceptable method of testing rotary gas meters for accuracy; and (2) revise its gas meter performance program to accept differential testing as a meter performance tool. This request was submitted in accordance with Sections 13(c) and 14 of General Order 58-A (GO 58-A). On June 3, 1999, SoCal Gas withdrew Part (2).

2. SoCal Gas currently does not have a meter performance program for rotary style meters, but SoCal Gas is in the process of developing a database using data collected from differential pressure tests of rotary meters that are scheduled for field inspection visits.

3. SoCal Gas is currently using transfer provers to test the accuracy of rotary meters in ten-year or less intervals. This test requires a two-man crew for up to two and one-half hours.

4. Test results have shown that an increase of up to 50% in differential pressure can be tolerated without affecting meter accuracy at the higher flow rates (25% rated capacity and above) by more than 1%.

5. Five-year differential pressure test intervals for rotary gas meters are usually more than adequate, providing that the gas stream is clean.

6. A rotary meter is a positive displacement device that has fixed, non-wearing and non-contacting internal parts in the measuring chamber, and the static volumetric displacement is constant. Therefore, theoretically it cannot be fast unless an incorrect gear train is mounted or a major malfunction in the gearing has occurred, which would cause over registration.

7. There are three significant variables that could affect the accuracy of a rotary meter. They are: (1) changes in static displacement; (2) changes in impeller clearances; and (3) increases in meter's internal resistance.

8. Meter accuracy (as a percentage of deviation from the actual flow rate) should be the combined accuracy of the rotary meter and auxiliary devices, measured at approximately 25 to 100% of the meter's rated capacity. Any such test results shall not register less than minus two percent (2%) or more than plus one percent (1%) error, as defined by Section 12 of GO 58-A.

9. The States of Illinois, Iowa, Kentucky, Maryland, New York, Pennsylvania, West Virginia, and Wisconsin, and the federal government of Canada, have formal rulings allowing the differential pressure testing methodology.

10. Differential pressure testing appears to be safe, simple, and meets the GO 58-A accuracy requirement.

11. The Energy Division recommends that the Commission grant SoCal Gas' request to use differential pressure testing as an acceptable method of testing rotary gas meters for accuracy. Although, differential pressure testing is not a mandatory requirement, SoCal Gas is required to adhere to the terms and conditions of Appendix A of this Resolution whenever it uses this testing methodology.

Therefore, it is ordered that:

1. Sempra Energy's request on behalf of Southern California Gas Company to use differential pressure testing as an acceptable method of testing rotary gas meters for accuracy is approved. Although, differential pressure testing is not a mandatory requirement, SoCal Gas is required to adhere to the terms and conditions of Appendix A of this Resolution whenever it uses this testing methodology.

2. This Resolution is effective today.

I certify that this resolution was duly introduced, passed, and adopted at a conference of the Public Utilities Commission of the State of California held on August 5, 1999, the following Commissioners voting favorably thereon:

Wesley Franklin

WESLEY M. FRANKLIN
Executive Director

RICHARD A. BILAS
President
HENRY M. DUQUE
JOSIAH L. NEEPER
JOEL Z. HYATT
CARL W. WOOD
Commissioners

Appendix A

The following terms and conditions are derived from existing orders of other Public Utilities Commissions, manufacturer recommendations, GO 58-A, and acceptable industrial practices:

- Instruments for measuring differential pressure must be of suitable capacity, together with the necessary accessories, and shall be maintained in proper adjustments so that they will be capable of determining the operating condition of rotary type gas meters.
- Rotary meter shall continue to be tested for accuracy in accordance with accepted industry standards and practices. Any such test results shall not register less than minus two percent (2%) or more than plus one percent (1%) error, as defined by Section 12 of GO 58-A.
- SoCal Gas shall retain either: (1) records of its original differential pressure curves made prior to placing such meters in service and in accordance with recognized and accepted practices; or (2) in lieu of such curves produced by SoCal Gas, a record of the manufacturer's differential pressure curves for the models and sizes. In establishing the original differential pressure curve, the flow rate should be at no less than 25% of the rated capacity of the meter.
- The differential pressure tests shall not replace the requirements set forth in Section 13 (a) of GO 58-A.
- If the differential pressure of a rotary gas meter for a given flow rate is 50% higher than the baseline differential pressure test or the manufacturer's differential pressure test, action shall be taken to verify that meter accuracy still meets requirements specified in section 12(c) of GO 58-A. If the meter is out of accuracy limited as stated in section 12(c) of GO 58-A, and cannot be brought within the above limits by cleaning or repairing the meter, it shall be removed from service and replaced with an accurate meter.
- The differential pressure test should not be used on rotary meters on which the results of a differential pressure would not be conclusive, such as: (1) meters connected to loads which are less than 25% of the rated capacity of the meters; or (2) meters connected to rapidly fluctuating loads.
- When in-service test conditions (temperature, pressure, and specific gravity of gas) are different from the baseline test conditions, test results must be corrected by

substantiated mathematical or empirical formulas.

- An appropriate filtering system shall be in place to ensure that gas stream impurities are not affecting meter performance.