GAS METER STATISTICAL SAMPLING PROGRAM

Scope

General

- Compliance
- Testing Methodology
- Meter Performance Requirements

Meter Performance

- Random Sampling – Summary
- Meter Families Below Acceptable Threshold Limits
- Meter Families With Insufficiently Sized Samples

This course covers:

- Methodology
- Test Results
- Proceedings of Natural Gas Utilities for Meter Performance Requirements
- In-Service Programs

Compliance

ANSI B109.1 Diaphragm Meters

- Provides recommendations for gas utilities in regards to ***Performance Requirements and In-Service Performance Programs*** for gas meters
- Additional requirements set by state, local agencies, or Company

Performance Testing Requirements

1. New meters & repaired meters – shall be QC/tested with appropriate actions taken to provide assurance that meters conform to stated accuracy requirements

- Initial Accuracy
- Pressure and Leak tests
- Noise and Vibration
- Meters shall be adjusted to an accuracy of 100% within the limits of +1.0% and -2.0% at check (20% to 40% of capacity) and open (80% to 120% of capacity).

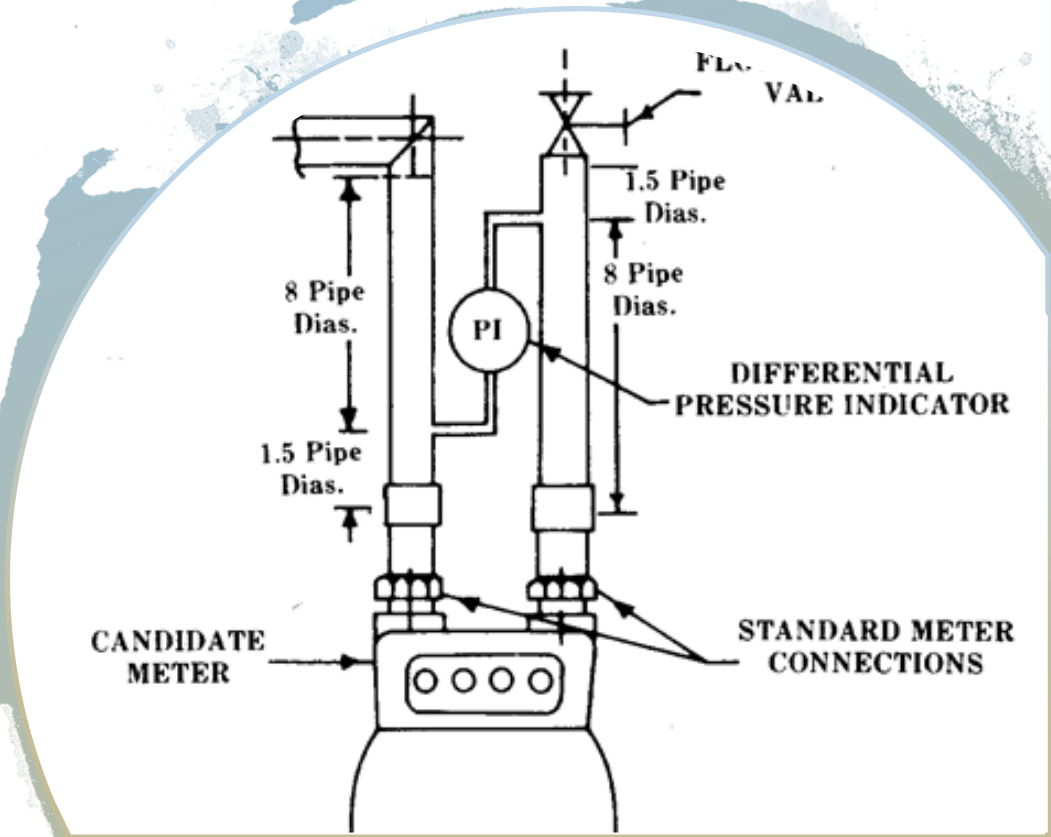
2. Shop survey – test of returned in service meters within Program tolerances

Compliance

Initial Accuracy

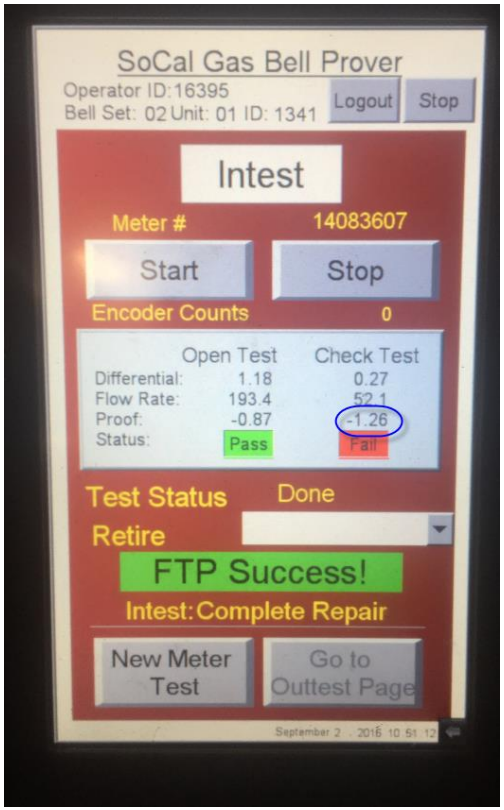
The accuracy of a meter under test:

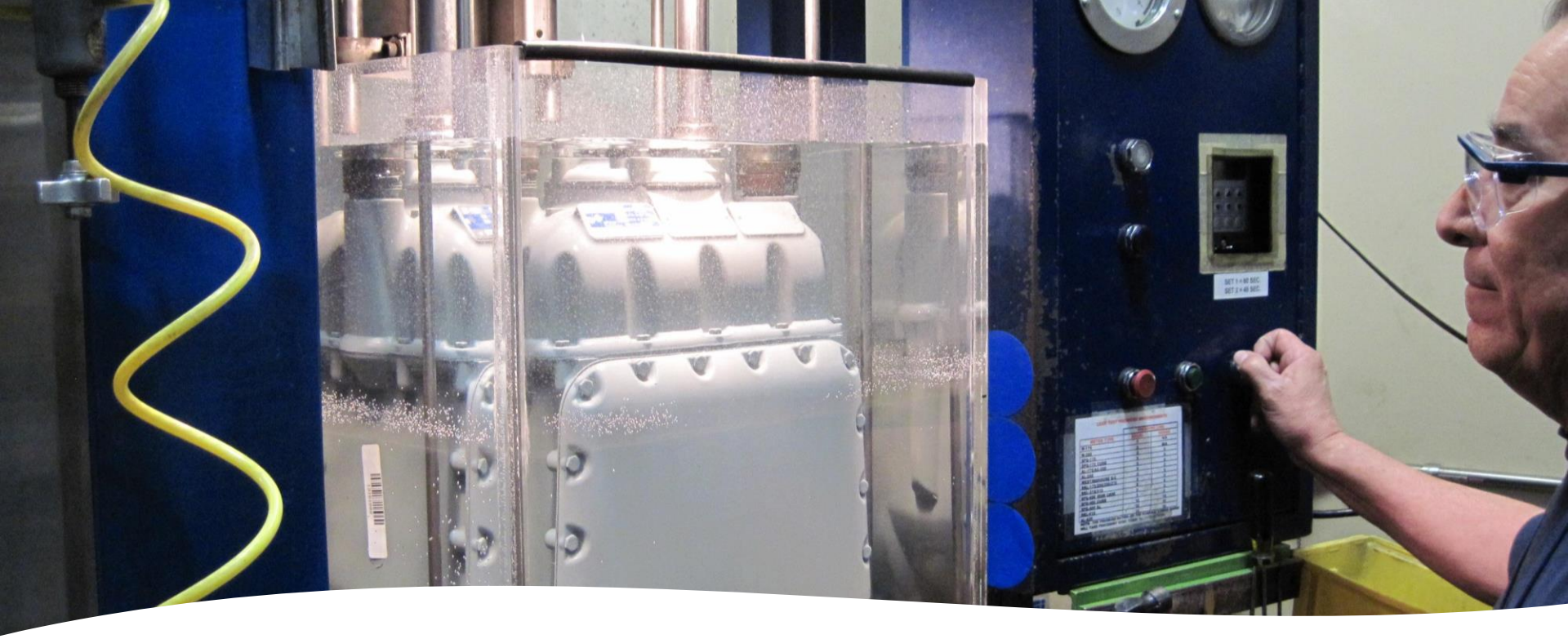
1. Connected in series with a proving standard having sufficient flow rate and pressure capacity
2. Accuracy determined by comparing the registered volume of the proving standard with the registered volume of the meter under test
3. Correction for pressure and temperature differentials must be made where applicable.




Bell Provers Setup

Meter Test Results





Compliance

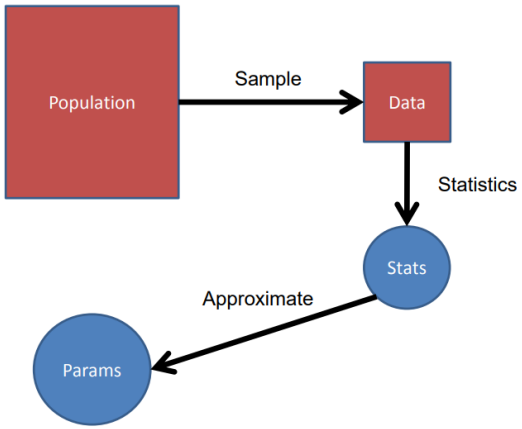
Pressure and Leak Test

1. Each new-type meter shall be tested to establish that it is able to withstand an internal pressure in excess of that to which it may be subjected in actual service. A case pressure test shall be performed on all meters to a minimum pressure of 10 PSIG or at 1.5 times the MAOP, whichever is greater, for cast steel, cast aluminum, and at 2.0 times MAOP for cast and ductile iron case meters.
2. Each new-type meter shall be given a pressure leak test while submerged in water, or a test equivalent in sensitivity, to determine that it is free from leakage.

Noise and Vibration

1. Meter shall be essentially free from noise and vibration.

Compliance



In-Service Performance Programs

- Provide service-life information on which the utility may base a meter program
- The testing, maintenance procedures, meter design, and the level of accuracy specified must be such that a realistic balance exists between the benefits realized from high accuracy levels and the cost of achieving these levels

Test Programs – Statistical sampling and variable plans provide for differences in meter and operating conditions and encourage improvements in meter design and meter maintenance.

- Statistical Sampling – Uses statistical analysis techniques to monitor the accuracy of meters in service.
- Variable Interval – Relies on meter test data for the same purpose, but use different methods.

Records show the number of meters initially installed in each group, subsequent modifications or combinations of groups, and at the end of each year for each group, the number remaining in service, size of test sample, test results and corrective action taken.

Compliance

CPUC General Order No. 58A (State of California)

Section 12 (b) – Installed diaphragm gas meter shall be in good order and have been adjusted to register within one percent (1%) over or two percent (2%) under the prover registration when passing gas at a rate which will cause pressure drop across the meter not to exceed one-half inch of water column (1/2" W.C.).

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.

Section 13 (c) Under certain conditions utilities may be authorized to deviate from Section 13a and use a statistical meter control program based on meter performance as demonstrated by sample testing in lieu of periodic testing of each meter. Applications to deviate shall be based on accepted principles of statistical sampling.

Testing Methodology

Statistical Sampling Program

- Designed to test a selected group of meters that will give a reliable indication of overall meter family accuracy
- Based on accepted statistical techniques and meters must be randomly selected for the test
- Meters are grouped into homogeneous categories - year set, manufacturer, case type, diaphragm material, standard or temperature compensated as well as new or refurbished
- Meters may be further subdivided according to location, age, or other attributes at the time of service

Homogeneous Categories

Control group is a group of meters with similar physical components, operating characteristics, and service life periods. Meters are placed into meter control groups, which are further separated into subgroups and families based on the following criteria:

- ❖ Control Group
  - Set Year
  - Manufacturer
- ❖ Subgroup
  - Case Type
  - Diaphragm
- ❖ Family
  - New or Repaired

Spec ID	Meter Description	Stock Code	SIZE	MAKE	CASE	Diaphragm	AUX	CPR	DRIVE	Repair	FMLY

Spec ID	Meter Description	Stock Code	SIZE	MAKE	CASE	Diaphragm	AUX	CPR	DRIVE	Repair	FMLY

Homogeneous Categories

Meter Performance Requirements

Standard Performance

A meter group is targeted for removal when it satisfies any of the following criteria:

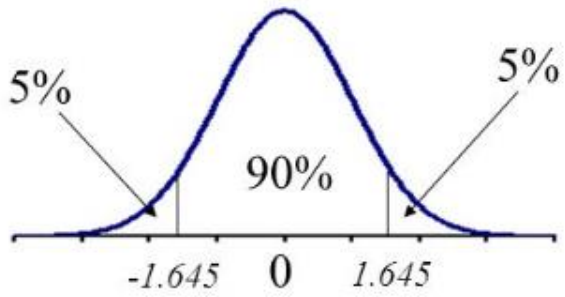
- > 10% of the meters in any given group register more than +2% fast at check test
- > 25% of the meters in any given group do not register within -5% to +2% at check test

Meter Testing Facility

- In accordance with Section 15, Meter Testing Equipment of CPUC GO58A - accuracy of the meter prover sets for diaphragm is +/- 0.5%
- SoCalGas verifies Bell Provers with a Gold Meter traceable to National Institute of Standards and Technology (NIST) in a temperature-controlled environment

Meter Test Equipment

Meter Performance



Random Sampling – Summary

- Confidence internal is computed from statistics of observed data (Test Results).
- The confidence interval is established by the Utility and will dictate the number of random samples needed for each Control Group.
- The confidence level varies from Utilities but should not be less than 90%.

Meter Performance

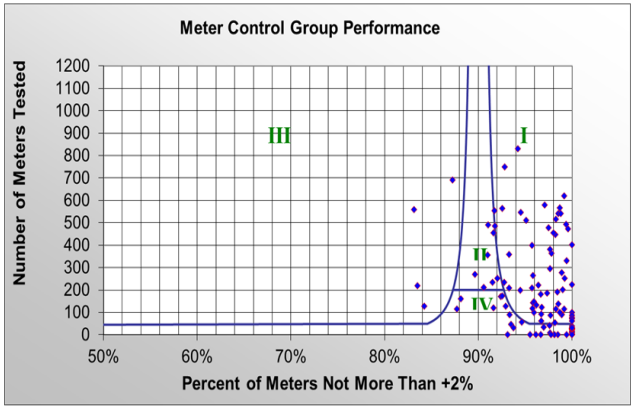
Determination of Meter Control Group Performance

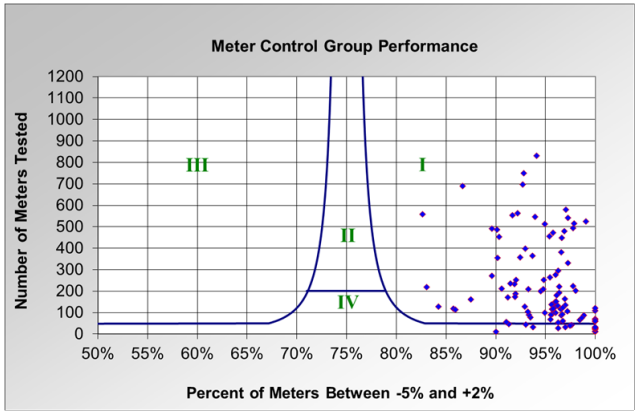
AREA I	• Any meter group for which a sample plot falls in Area 1 on both probability charts will remain in service.
AREA II	• Any group whose plot falls in Area II on either chart will remain in service if the prior year's plot was above standard. If the prior year's plot was below standard, the group will be removed.
AREA III	• Any group whose plot falls in Area III on either chart will be removed.
AREA IV	• If the sample plot falls in Area IV on either chart and the group is ten years or older, additional sample meters will be obtained for a decision to be made under the previous rules or the group will be removed.

Meter Performance

Meter Families Below Acceptable Threshold Limits
and/or
Insufficiently Sized Samples

On occasion, unpredicted out-of-pattern sample results indicating poor group performance may occur too late to have the meter group be included in the planned removals. The validity of such out-of-pattern sample results will be tested as soon as possible and, if valid, any such group will be removed by the end of the following year.





Questions?

ATTACHMENT III, PART A
SUMMARY OF METER PERFORMANCE BY CONTROL GROUP

				Slow		Fast		OK			
Control Group	Group Name	Remaining in Service	Tested This Year	Total	Percent	Total	Percent	Total	Percent	Trend of Group	Comments
199002		962	163	3	1.8	2	1.2	158	96.9	I	Satisfactory
199003		111,512	546	3	0.6	30	5.5	513	94.0	I	Satisfactory
199050		33	33	0	0.0	1	3.0	32	97.0	I	Satisfactory
199101		43,084	277	8	2.9	3	1.1	266	96.0	I	Satisfactory
199102		801	121	4	3.3	1	0.8	116	95.9	I	Satisfactory
199103		36,257	209	0	0.0	14	6.7	195	93.3	I	Satisfactory
199150		11	32	0	0.0	2	6.3	30	93.8	IV	Samples Ordered
199201		28,105	201	2	1.0	2	1.0	197	98.0	I	Satisfactory
199202		455	75	0	0.0	1	1.3	74	98.7	I	Satisfactory
199203		46,993	212	0	0.0	20	9.4	192	90.6	II	Sub-Group Removed
199250		12	23	0	0.0	0	0.0	23	100.0	I	Satisfactory
199301		32,282	192	4	2.1	3	1.6	185	96.4	I	Satisfactory
199302		204	68	0	0.0	0	0.0	68	100.0	I	Satisfactory
199303		10,281	180	1	0.6	6	3.3	173	96.1	I	Satisfactory
199350		16	29	0	0.0	0	0.0	29	100.0	I	Satisfactory
199401		37,339	223	5	2.2	0	0.0	218	97.8	I	Satisfactory
199402		632	43	2	4.7	1	2.3	40	93.0	I	Satisfactory
199403		16,039	91	0	0.0	3	3.3	88	96.7	I	Satisfactory
199501		66,889	479	3	0.6	12	2.5	464	96.9	I	Satisfactory
199502		234	61	0	0.0	0	0.0	61	100.0	I	Satisfactory
199503		5,547	174	1	0.6	13	7.5	160	92.0	IV	Samples Ordered
199601		80,486	525	2	0.4	3	0.6	520	99.1	I	Satisfactory
199602		207	12	0	0.0	0	0.0	12	100.0	IV	Samples Ordered