



Procedures

Category: GAS	Procedure: P-G-03 (rev. 6)	Page: 1 of 7
Document(s): S-S-01 and P-S-01	Issue Date: 2014-10-06	Effective Date: 2014-10-06
	Supersedes: P-G-03 (rev. 5)	

Telemetry Device Installation Validation Procedure

1.0 Purpose

The purpose of this procedure is to provide instructions to gas contractors for validating the adequacy, with respect to the effect on metrological performance, of their proposed quality assurance procedures for installing telemetry devices on diaphragm type gas meters in service.

2.0 Scope

2.1 This procedure applies to situations where mechanically coupled telemetry devices are to be installed on diaphragm meters at their operational locations or at a testing facility to simulate the process that will later be used for installing a telemetry device on verified meters in service.

2.2 This procedure applies where:

(a) a single operator will be installing the telemetry devices on the meters both at the testing facility and on meters in service; or

(b) more than one operator will be installing the telemetry devices on the meters both at the testing facility and on meters in service, and where a technical professional thoroughly examines the procedure and determines that there is no possibility for inter-operator variability.

3.0 References

3.1 S-S-01 – Specifications for Random Sampling and Randomization

3.2 P-S-01 – Paired Difference Experimental Procedure

Category: GAS	Procedure: P-G-03 (rev. 6)	Page: 2 of 7
Document(s): S-S-01 and P-S-01	Issue Date: 2014-10-06	Effective Date: 2014-10-06
	Supersedes: P-G-03 (rev. 5)	

4.0 Terminology

For the purposes of this procedure, the following terms and definitions and those in the normative references apply.

Experiment (designed experiment)

Experimental plan selected so as to meet a specific objective.

Replication

Repetition of an experiment more than once for a given group of variables used in regression to predict others variables.

Operator

Person performing the operation of interest in the experiment.

5.0 Procedure

5.1 Document all steps involved in installing the telemetering devices on the meters in a formal procedure based on the instructions and technical judgment of the telemetering device manufacturer, noting items requiring special attention and inspection.

5.2 With reference to Appendix A and the documents identified in the References section, plan and execute the experiment in strict accordance with the criteria and steps identified in the documents.

5.3 In establishing the measured characteristics for the repeatable meters under experiment under initial conditions, test the performance of a representative quantity of meters intended to host the telemetering devices. Using an authorized and documented procedure, record all performance test results for each meter in the applicable appendix in procedure P-S-01.

5.4 Using the formal procedure produced in step 5.1, install the telemetering devices on the meters evaluated in step 5.3.

5.5 Test the performance of the meters with the telemetering devices installed using the same procedure from step 5.3 and record all performance test results for each meter in the applicable appendix in P-S-01.

5.6 Hold meters pending outcome of analysis.

5.7 Analyze the results of the paired differences of the "before" and "after" meter performance data in accordance with reference 3.2.

Category: GAS	Procedure: P-G-03 (rev. 6)	Page: 3 of 7
Document(s): S-S-01 and P-S-01	Issue Date: 2014-10-06	Effective Date: 2014-10-06
	Supersedes: P-G-03 (rev. 5)	

5.8 Investigate any difference exceeding 0.2% by examining the installation of the telemetering device on the host meter and repeating the performance tests. Document the results of this investigation.

5.9 Refine the procedure established in step 5.1 if the investigation performed in step 5.8 identifies procedural shortcomings in steps 5.3 to 5.7.

5.10 Maintain a record of the results of the performance tests, analysis and investigation containing the details found in Appendix B and the applicable appendices in P-S-01.

Category: GAS	Procedure: P-G-03 (rev. 6)	Page: 4 of 7
Document(s): S-S-01 and P-S-01	Issue Date: 2014-10-06	Effective Date: 2014-10-06
	Supersedes: P-G-03 (rev. 5)	

Appendix A – Application of the Paired Difference Experiment Procedure to Telemetering Device Installations on Diaphragm Meters: Notes and Criteria

A.1 General

A.1.1 The paired difference experiment procedure has been designed to be applied under controlled conditions. For the results of the experiment to have any inferential value, all of the conditions need to be met, as documented.

A.1.2 As the application of the paired difference experiment procedure to the installation of telemetering devices occurs under simulated conditions, it is important that the installation procedure used in these simulated conditions, as well as the training of the installer, accurately reflect the steps and techniques that will be used in practice.

A.2 Planning

A.2.1 The meter population shall contain meters which are homogeneous with respect to factors which could possibly have a bearing on the results of the experiment. In the case of the installation of telemetering devices on diaphragm meters, the population shall contain:

- (a) meters produced by a single manufacturer which have been pretested and found to have repeatable¹ performance errors (do not deviate by more than 0.2% from the average of a minimum of five tests);
- (b) a single model of meter, or optionally, more than one model, where each model has identical telemetering device mounting arrangements;
- (c) meters which are in the same condition: either all new or all used (where the population contains a mixture of different vintages of meters, the sample should likewise contain a mixture of those meter vintages);
- (d) a single model of telemetering device produced by the same manufacturer.

A.2.2 It is not required that the meter population only contain meters having the same type of register (i.e. clock dial type versus direct-read odometer type). Where the population contains a mixture of meters having both register types, it is recommended that the sample be selected to include both register types, and the test results analyzed to determine whether a need exists to separate the population according to register type.

Note¹: Meters that are not repeatable before the installation of the automatic meter reading (AMR) device will not be repeatable after its installation. They have factors other than the installation of the AMR device affecting the results and cannot form part of the sample, as the application of ISO 3301:1975 is dependent on the validity of the hypothesis that there is no systematic difference between the two sets of tests other than the systematic difference under test (installation of the AMR device).

Category: GAS	Procedure: P-G-03 (rev. 6)	Page: 5 of 7
Document(s): S-S-01 and P-S-01	Issue Date: 2014-10-06	Effective Date: 2014-10-06
	Supersedes: P-G-03 (rev. 5)	

A.2.3 The nature of the change that will be introduced to the population under experiment shall be defined in specific terms. In the case of the current experiment, the change being introduced is the installation of the telemetering device on a meter by trained personnel using a specific documented procedure. Details of the training and the installation procedure form part of the definition.

A.2.4 The characteristics of interest in the current experiment are the volumetric accuracy of the meters at the two test points of 45% ($\pm 5\%$) and 145% ($\pm 5\%$) of the meter's 0.5-inch water column differential pressure rated capacity, measured both before and after the installation of the telemetering device.

A.2.5 For the initial conduct of the experiment, the sample size shall be fixed at 30 meters and the number of replicated measurements shall be five (5). The required sample size shall be reviewed for adequacy and effectiveness as data is accumulated.

A.2.6 The above planning details and associated procedures shall be documented before conducting the rest of the experiment.

A.3 Sample Selection and Preparation

A.3.1 Samples shall be randomly selected from a defined listing of a representation of the meter population under study, using the method specified in the documents cited in the References section. Where the population contains a mixture of meters having differing characteristics (e.g. different meter models, vintages, register types, etc.), the population list(s) used for random sampling should be formatted such that the sample selection process will yield a sample group containing a mixture of these differing meter characteristics.

A.3.2 Each sample meter shall be conditioned to stabilize its performance prior to commencing the volumetric accuracy tests, both before and after installation of the telemetering device. This conditioning shall include acclimatizing the sample meters to the temperature of the test room for a specified period of time and circulating a specified amount of air at test conditions through each meter. Each meter shall be conditioned in the same manner.

A.3.3 The details of the sample selection and preconditioning shall be documented in a procedure before conducting the rest of the experiment.

Category: GAS	Procedure: P-G-03 (rev. 6)	Page: 6 of 7
Document(s): S-S-01 and P-S-01	Issue Date: 2014-10-06	Effective Date: 2014-10-06
	Supersedes: P-G-03 (rev. 5)	

A.4 Sample Evaluation

A.4.1 Each sample meter shall be tested in the same manner using the same number of replicated tests for each verification test point. The duration of each volumetric test shall be the same and shall be sufficient to produce an accuracy resolution of 0.1%. Each "before" and "after" test of a sample meter's accuracy shall be performed using the same measuring apparatus.

A.4.2 The measuring apparatus used for the testing shall be selected so as to be repeatable and responsive to different levels of meter accuracy as per Measurement Canada's evaluation procedures.

A.4.3 For each meter, the period of time between the completion of the "before" and "after" tests shall be minimized so as to reduce the risk of uncontrolled factors affecting the results of the experiment.

A.4.4 Where more than one measuring apparatus is used in the experiment, the "before" and "after" tests, for each meter, shall be performed using the same measuring apparatus.

A.4.5 All measurement test results shall be carefully documented, as soon as they are obtained, in the applicable appendix in procedure P-S-01.

A.4.6 The details of the sample evaluation shall be documented in a procedure before conducting the rest of the experiment.

Category: GAS	Procedure: P-G-03 (rev. 6)	Page: 7 of 7
Document(s): S-S-01 and P-S-01	Issue Date: 2014-10-06	Effective Date: 2014-10-06
	Supersedes: P-G-03 (rev. 5)	

Appendix B – Record of Experimental Findings

B.1 General

A formal record shall be prepared and maintained by the organization performing the experiment, in accordance with this appendix.

B.2 Record Content

The record shall have the following content:

- (a) **Purpose** – a statement describing what the experiment is intended to achieve.
- (b) **Scope** – a statement defining the situations to which the findings of the experiment are intended to apply.
- (c) **Methodology** – a description of the methods used in planning and executing the experiment, including details of population definition, sample selection, testing and test conditions, and analytical techniques used.
- (d) **Apparatus** – a description of the test equipment or measurement standards used to perform the tasks required by the procedure.
- (e) **Observations** – an itemization of observations and comments resulting from the conduct of the experiment which may have a bearing on the interpretation or validity of results.
- (f) **Analysis** – a presentation of intermediate and final results due to application of the analytical technique.
- (g) **Conclusions** – a statement of the specific conclusions of the experiment as well as general conclusions with rationale if the results are to apply to a population of devices.
- (h) **Appendices** – information generated from or used in the experiment, including data from tests and procedures referenced in the methodology.