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## Performance – Repeatability Test

### Application

This test applies to all metering devices. A measuring system that cannot systematically reproduce the same quantity for an identical test quantity cannot be relied upon to provide consistent accurate measurement and cannot be calibrated with any confidence. However, since no system is perfect, some degree of non-repeatability is permissible as provided for by section 263 of the *Weights and Measures Regulations*.

### Guiding Principal

- (a) Repeatability Test shall be performed on all inspections before use in trade, i.e., inspections pursuant to section 8(b) of the Act.
- (b) Repeatability Test for in-service inspections shall be performed on all measuring systems that incorporate a measuring element or chamber that is **not** of the positive displacement (PD) type. Examples of non-PD flow meters are magnetic flow meters, Coriolis (mass) flow meters, and turbine meters.
- (c) Repeatability test for in-service inspections shall be performed on measuring systems incorporating a PD measuring element when the fastest attainable flow rate for the Fast Flow Test does not exceed 40% of the maximum approved flow rate; or, the difference between the results of the Fast Flow Test and the Slow Flow Test exceeds two-fifths (2/5) of the in-service limit of error for the known test quantity being used when evaluating the performance of the measuring system.

### Purpose

The repeatability test is designed to ensure that the volumetric device will deliver, within prescribed limits, the same volume under very similar operating conditions (flow rate, temperature, operation sequence, and test quantity). On PD measuring elements, poor repeatability of results indicates advance wear of the measuring chamber leading to significant inaccuracy. Poor repeatability of a measuring system, regardless of measuring technology, may be caused by such factors as deterioration of the mechanical components that drive a mechanical register or that drive the pulser of an electronic processor/register, failure of a check valve or manifold back flow valve, excessive hose expansion, poor grounding for magnetic flow meters, excessive vibrations and similar installation issues.

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### Performance – Repeatability Test

**Note:** If the inspector did the fast run last, the result can be used as the first run for the repeatability test at the fast flow rate.

The repeatability test requires three consecutive test runs at the same rate of flow. If the results of the two first runs show a difference greater than the repeatability limit of error, a third run is not required. Repeatability tests may be performed at flow rates other than the fast flow rate.

**Legislative Reference:** R.263.

### Procedure

Note the device error for a fast flow test. Proceed as indicated in STP-5.

Repeat the test as closely as possible (conditions) for a minimum of two times (in order to reject) or a maximum of three fast flow tests.

Record the device error after each test.

Calculate the difference between the results as per the example below:

#### First Fast Flow Test

prover volume = 499.1 litres (after prover shell correction)

meter registration = 499.7 litres

Meter error =  $((499.7 - 499.1) / 499.1) \times 100 = +0.12\%$  (over registration)

#### Second Fast Flow Test

prover volume = 499.0 litres

meter registration = 499.3 litres

Meter error =  $((499.3 - 499.0) / 499.0) \times 100 = +0.06\%$  (over registration)

#### Third Fast Flow Test

prover volume = 500.1 litres

meter registration = 499.9 litres

Meter error =  $((499.9 - 500.1) / 500.1) \times 100 = -0.04\%$  (under registration)

Difference between the highest and lowest test result, i.e., 1<sup>st</sup> test vs 3<sup>rd</sup> test:  $0.12\% - (-0.04\%) = 0.16\%$

Repeatability Limit of Error: two-fifths of 0.25%

$0.25\% \times 0.4 = 0.1\%$

In this example, the meter fails the repeatability test.

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### **Performance – Repeatability Test**

#### **Interpretation of Results**

Results must be within two-fifths of the applicable in-service limit of error. In the above example, the device fails.

#### **Revision 1**

The “Application” section was re-worded to enhance the test guidelines and incorporate all liquid meter types; the “Purpose” section was revised accordingly to explain causes of poor repeatability in other meter types and another example was included to illustrate a total of three runs may be required when determining applicable meter repeatability error.

#### **Revision 2**

Part C of the Guiding Principal, where the difference between the results of the fast flow test and the slow flow test are compared, was changed from the absolute value of the in-service limit of error to two-fifth (2/5) of the in-service limit of error. Minor editorial corrections were also made.