

## APPENDIX – C

### DOMESTIC COLD WATER METERS

(Agenda Item 7)

#### Pre-Test Inspection

1. Identification.
  - 1.1. Manufacturer's or distributor's name, model and serial number. **G-S.1 [1.10]**
  - 1.2. Verify that devices submitted for test are intended for legally submetered locations. Please review **EPO REF-T Part 1** and utilize the Laboratory or field checklist for submeter pre-test information. If it is not a legal installation do not test the meters.
2. Type approval. **B&P 12500.5**
3. Indicating and recording elements.
  - 3.1. Shall indicate and record if equipped to record in terms of liters, gallons, cubic feet or binary, or decimal subdivisions thereof. **S.1.1.2 [3.36]**
  - 3.2. Value of smallest unit. **S.1.1.3 [3.36]**
    - 3.2.1. 10 gallons.
  - 3.3. Advancement of indicating and recording elements. **S.1.1.4 [3.36]**
    - 3.3.1. Shall be only by the mechanical operation of the meter.

#### Pre-Test Determinations

1. Test equipment. Components must be adequate for precise control of the flow rate.
2. Condition of meter. Test meters removed from service as soon as possible to minimize formation of deposits in the measuring chamber.
3. Inlet PSI and temperature of the test liquid. Tests should not be performed at less than 30 static PSI. Test water should not exceed 80°F.
4. Prover size. Test drafts are determined by the meter size in Table N.4.1. or Table N.4.2. The draft shall be at least equal to one minute's maximum flow rate.  
**Table N.4.1. and N.4.2. [3.36]; N.3 [3.36]**

**NOTE:** If adequate provers are not available, use the Gravimetric Testing of Liquid Meters method outlined in EPO REF-P. Any receiving vessel may be used as long as its capacity accommodates the required drafts.

<b>Table N.4.1. Flow Rate and Draft Size for Water Meters</b>			
<b>Normal Tests</b>			
Meter Size (inches)	Rate of Flow (gal/min)	Maximum Rate	
		Meter Indication/Test Draft	
		gal	ft <sup>3</sup>
Less than 5/8	8	50	5
5/8	15	50	5
3/4	25	50	5
1	40	100	10
1 1/2	80	300	40
2	120	500	40
3	250	500	50
4	350	1 000	100
6	700	1 000	100

<b>Table N.4.2. Flow Rate and Draft Size for Water Meters</b>						
<b>Special Tests</b>						
Meter Size (inches)	Intermediate Rate			Minimum Rate		
	Rate of Flow (gal/min)	Meter Indication/ Test Draft		Rate of flow (gal/min)	Meter Indication/ Test Draft	
		gal	ft <sup>3</sup>		gal	ft <sup>3</sup>
Less than or equal to 5/8	2	10	1	1/4	5	1
3/4	3	10	1	1/2	5	1
1	4	10	1	3/4	5	1
1 1/2	8	50	5	1 1/2	10	1
2	15	50	5	2	10	1
3	20	50	5	4	10	1
4	40	100	10	7	50	5
6	60	100	10	12	50	5

5. Tolerances. Refer to Table T.1 for accuracy limits. **Table T.1 [3.36]**

<b>Table T.1. Accuracy Classes and Tolerances for Water Meters</b>					
Accuracy Class	Application		Acceptance Tolerance	Maintenance Tolerance	Tolerance for Special Tests Conducted at the Minimum Flow Rate
1.5	Water, Other than Multi-Jet Water Meters	Overregistration	1.5%	1.5%	1.5%
		Underregistration	1.5%	1.5%	5.0%
1.5	Water, Multi-Jet Water Meters	Overregistration	1.5%	1.5%	3.0%
		Underregistration	1.5%	1.5%	3.0%

6. Meter placement. Meters may be tested in vertical positions or tilted no more than five degrees from horizontal unless the meters are marked to indicate that they must be installed horizontally and level. However, meters approved and intended for installation in unrestricted orientations may be tested in any manner consistent with the manufacturer's mounting instructions. **G-S.2 [1.10]; G-S.3 [1.10]**

**NOTE:** When testing meters in the vertical position, care must be taken to start and end the test with each meter's most sensitive pointer in an upswing position. When testing cubic foot meters with gallon gage type provers, a 50-gallon test is usually not valid because both readings cannot be made with the dial hand on the upswing (6.684 cubic feet).

## Tests

1. Wet test measure.
  - 1.1. For 10-gallon test measure or smaller, unless equipped with discharge valve, allow to drain 10 seconds after main flow ceases. **NIST Handbook 105-3**
  - 1.1. For test measures equipped with a discharge valve, allow to drain 30 seconds after main flow ceases. **NIST Handbook 105-3**

**NOTE: Initially flow a minimum of 10 cubic feet (74.805 gallons) of water through the meters under test to remove any air that may be trapped in the meters before conducting official tests.**

2. Test drafts.
  - 2.1 Normal tests shall be made at the maximum flow rate allowed shown in Table N.4.1. **N.4.1. [3.36]**
  - 2.2. Special tests may be made at the flow rates given in Table N.4.2. **N.4.1. [3.36]**
  - 2.3. Repeatability. When multiple tests are conducted at approximately the same flow rate, the range of the test results shall not exceed 0.6 % for tests performed at the normal and intermediate flow rates, and 1.3 % for tests performed at the minimum flow rate, and each test shall be within the applicable tolerance. **T.1.1. [3.36]**
3. Test procedure.
  - 3.1. Secure meter(s) in the test unit. When testing multi-jet meters, maintain a distance between meters at least equal to 5 diameters of the inlet bore of the meter.
  - 3.2. Open outlet valve between test unit and prover.
  - 3.3. Gradually open the water supply valve to the test unit and fill prover.
  - 3.4. Close outlet valve and drain prover. (Use the following procedure for provers equipped with discharge valves.)
    - 3.4.1. Open discharge valve of prover.
    - 3.4.2. Allow to drain 30 seconds after main flow ceases.
    - 3.4.3. Close discharge valve of prover.

- 3.5. Record meter reading(s). See NOTE under Pre-Test Determination #6.
- 3.5. If test unit is equipped with bleeder valves, the meter(s) test indicator may be set to a reference mark.
- 3.7. Open outlet valve rapidly (but not instantly) to the desired rate.
- 3.8. When using a graduated narrow neck prover fill the prover to a point near the required test quantity needed for the test and close the outlet valve in one deliberate motion.

If you are using a galvanized Ford 1 or 10 cubic foot prover the test must be stopped exactly at the nominal value (i.e., 100 gallons or 10 cubic feet etc.). Ford wide neck provers are not linear and are only certified at the following values:

1 cubic foot prover – 5 gallons, 10 gallons, and 1 cubic foot  
10 cubic foot prover – 50 gallons, 100 gallons, and 10 cubic feet

- 3.9 Record prover reading and meter reading(s), then apply tolerances from Table T.1.

Difference between meter readings at the end and beginning of a test draft is “metered quantity”.

$$\frac{\text{Metered Quantity} - \text{Prover Reading}}{\text{Prover Reading}} \times 100 = \text{Meter Percent Error in Registration}$$

Underregistration calculation example:

Overregistration calculation example:

- 4. Printer and remote display operation. If system is equipped with a printer or additional displays, check during tests to determine printer readability and agreement with meter indicator readings.  
**G-S.5.6 [1.10], G-S.5.2.2 [1.10]**
- 5. Meter removal. When tests are completed, use the following procedures for removal of meter(s) from test unit.
  - 5.1 Close inlet valve first.
  - 5.2 Open the outlet valve to release line pressure.
  - 5.3 Remove meter(s).

WATER METER TEST REPORT

1 Cubic Foot = 7.48052 Gallons  
 1 Gallon = 0.1337 Cubic Feet  
 10 Gallons = 1.337 Cubic Feet  
 15 Gallons = 2.005 Cubic Feet  
 50 Gallons = 6.684 Cubic Feet

DATE : \_\_\_\_\_  
 INSPECTOR : \_\_\_\_\_  
 PARK OWNER: \_\_\_\_\_  
 METER MFG : \_\_\_\_\_

CPM = Cu. Ft./Min. x 7.48052

METER SERIAL	TYPE	GAL ----- CU. FT.	END READING ST. READING DIFFERENCE	GPM	PERCENT ERROR	REMARKS	O/O
		GAL. ----- CU. FT.	ST.				
		GAL. ----- CU. FT.	ST.				
		GAL. ----- CU. FT.	ST.				
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		GAL. ----- CU. FT.	ST.				

Note: An excel spreadsheet may be available from the Sacramento LMD Laboratory.

