

Section 3.36. Water Meters

A. Application

A.1. General. – This code applies to devices used for the measurement of water; generally applicable to, but not limited to, utilities type meters installed in residences or business establishments and meters installed in batching systems.

(Amended 2002)

A.2. Exceptions. – This code does not apply to:

- (a) water meters mounted on vehicle tanks (for which see Section 3.31. Vehicle-Tank Meters); or
- (b) mass flow meters. (Also see Section 3.37. Mass Flow Meters.)
(Added 1994)

B.3. Additional Code Requirements. – In addition to the requirements of this code, Water Meters shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements and of Recorded Representations.

S.1.1. Primary Elements.

S.1.1.1. General. – A water meter shall be equipped with a primary indicating element and may also be equipped with a primary recording element. Such elements shall be visible at the point of measurement or be stored in non-volatile and non-resettable memory. The display may be remotely located provided it is readily accessible to the customer.

(Amended 2002)

S.1.1.2. Units. – A water meter shall indicate and record, if the device is equipped to record, its deliveries in terms of liters, gallons or cubic feet or binary or decimal subdivisions thereof except batch plant meters, which shall indicate deliveries in terms of liters, gallons or decimal subdivisions of the liter or gallon only.

S.1.1.3. Value of Smallest Unit. – The value of the smallest unit of indicated delivery and recorded delivery, if the device is equipped to record, shall not exceed the equivalent of:

- (a) 50 L (10 gal or 1 ft³) on utility type meters, sizes 1 in and smaller; or
- (b) 500 L (100 gal or 10 ft³) on utility-type meters, sizes 1½ in and 2 in; or
- (c) 0.2 L (¹/₁₀ gal or ¹/₁₀₀ ft³) on batching meters delivering less than 375 L/min (100 gal/min or 13 ft³/min); or
- (d) 5 L (1 gal or ¹/₁₀ ft³) on batching meters delivering 375 L/min (100 gal/min or 13 ft³/min) or more.

(Amended 2009)

S.1.1.4. Advancement of Indicating and Recording Elements. – Primary indicating and recording elements shall advance only by the designed operation of the device, as intended by the manufacturer.

(Amended 2021)

S.1.1.5. Return to Zero. – If the meter is so designed that the primary indicating elements are readily returnable to a definite zero indication, means shall be provided to prevent the return of these elements beyond their correct zero position.

S.1.1.6. Proving Indicator. – Utility-type meters shall be equipped with a proving indicator. The individual graduations on a mechanical (analog) proving indicator shall indicate volumes no larger than $\frac{1}{100}$ of the value of the smallest unit of indicated delivery required in S.1.1.3. Value of Smallest Unit. For electronic (digital) proving indications, the smallest unit of volume displayed shall be no larger than $\frac{1}{1000}$ of the value of the smallest unit of indicated delivery required in S.1.1.3. Value of Smallest Unit.
(Added 2009)

S.1.2. Graduations.

S.1.2.1. Length. – Graduations shall be so varied in length that they may be conveniently read.

S.1.2.2. Width. – In any series of graduations, the width of a graduation shall in no case be greater than the width of the minimum clear interval between graduations, and the width of main graduations shall be not more than 50 % greater than the width of subordinate graduations. Graduations shall in no case be less than 0.2 mm (0.008 in) in width.

S.1.2.3. Clear Interval Between Graduations. – The clear interval shall not be less than 1.0 mm (0.04 in). If the graduations are not parallel, the measurement shall be made:

- (a) along the line of relative movement between the graduations at the end of the indicator; or
- (b) if the indicator is continuous, at the point of widest separation of the graduations.

S.1.3. Indicators.

S.1.3.1. Symmetry. – The index of an indicator shall be symmetrical with respect to the graduations, at least throughout that portion of its length associated with the graduations.

S.1.3.2. Length. – The index of an indicator shall reach to the finest graduations with which it is used, the width of the minimum clear interval between graduations, and the width of main graduations shall be not more than 50 % greater than the width of subordinate graduations. Graduations shall in no case be less than 0.2 mm (0.008 in) in width.

S.1.3.3. Width. – The width of the index of an indicator in relation to the series of graduations with which it is used shall not be greater than:

- (a) *the width of the narrowest graduation;** and
[*Nonretroactive as of January 1, 2002]
(Amended 2001)

- (b) the width of the minimum clear interval between graduations.

When the index of an indicator extends along the entire length of a graduation, that portion of the index of the indicator that may be brought into coincidence with the graduation shall be of the same width throughout the length of the index that coincides with the graduation.

S.1.3.4. Clearance. – The clearance between the index of an indicator and the graduations shall in no case be more than 1.5 mm (0.06 in).

S.1.3.5. Parallax. – Parallax effects shall be reduced to the practicable minimum.

S.2. Design of Measuring Elements.

S.2.1. Provision for Sealing. – For devices or systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. Devices and Systems Adjusted Using Removable Digital Storage Devices. For parameters adjusted using other means, the following applies.

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that requires the security seal to be broken before an adjustment or interchange can be made of:

- (a) any measuring or indicating element;
- (b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries; and
- (c) any metrological parameter that will affect the metrological integrity of the device or system.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

*Audit trails shall use the format set forth in Table S.2.1. Categories of Device and Methods of Sealing.**

**[Nonretroactive as of January 1, 2019]*

(Amended 2018 and 2019)

Table S.2.1. Categories of Device and Methods of Sealing	
Categories of Device	Method of Sealing
<i>Category 1: No remote configuration capability.</i>	<i>Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.</i>
<i>Category 2: Remote configuration capability, but access is controlled by physical hardware. The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.</i>	<i>The hardware enabling access for remote communication must be on-site. The hardware must be sealed using a physical seal or an event counter for calibration parameters and an event counter for configuration parameters. The event counters may be located either at the individual measuring device or at the system controller; however, an adequate number of counters must be provided to monitor the calibration and configuration parameters of the individual devices at a location. If the counters are located in the system controller rather than at the individual device, means must be provided to generate a hard copy of the information through an on-site device.</i>
<i>Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password). The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.</i>	<i>An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available on demand through the device or through another on-site device. The information may also be available electronically. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not</i>

<i>Table S.2.1. Categories of Device and Methods of Sealing</i>	
<i>Categories of Device</i>	<i>Method of Sealing</i>
	<i>more than 1000 records are required. (Note: Does not require 1000 changes to be stored for each parameter.)</i>

[Nonretroactive as of January 1, 2019]

(Table Added 2018)

S.2.2. Batching Measuring Systems Only.

S.2.2.1. Air/Vapor Elimination, Batching Measuring Systems. – Batching measuring systems shall be equipped with an effective air/vapor eliminator or other automatic means to prevent the passage of air/vapor through the meter. Vent lines from the air/vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 2017)

S.2.2.2. Directional Flow Valves. – Valves intended to prevent reversal of flow shall be automatic in operation.

S.2.3. Multi-Jet Meter Identification. – Multi-Jet water meters shall be clearly and permanently marked as such on the device or identified on the Certificate of Conformance.

(Added 2003)

S.3. Markings

S.3.1. Location of Marking Information; Utility Type Meters. – All required markings, including those required by G-S.1. Identification, shall be either on the meter body or primary indicator.

[Nonretroactive as of January 1, 2013]

(Added 2012)

S.3.2. Meter Size and Directional Flow Marking Information. – A water meter shall be clearly and indelibly marked with the following information:

(a) meter size on the indicator face plate; and

(b) water flow direction.

[Nonretroactive as of January 1, 2022]

(Added 2021)

N. Notes

N.1. Test Liquid. – A meter shall be tested with water.

N.2. Evaporation and Volume Change. – Care shall be exercised to reduce to a minimum, evaporation losses and volume changes resulting from changes to temperature of the test liquid.

N.3. Test Drafts. – Test drafts should be equal to at least the amount delivered by the device in two minutes and in no case less than the amount delivered by the device in one minute at the actual maximum flow rate developed by the installation. The test draft sizes shown in Table N.4.1. Flow Rate and Draft Size for Water Meters Normal Tests, shall be followed as closely as possible.

(Amended 2003)

N.4. Testing Procedures.

N.4.1. Normal Tests. – The normal test of a meter shall be made at the maximum discharge rate developed by the installation. Meters with maximum gallon per minute ratings higher than the values specified in Table N.4.1. Flow Rate and Draft Size for Water Meters Normal Tests may be tested up to the meter rating, with meter indications no less than those shown.

(Amended 1990, 2002, and 2003)

Table N.4.1. Flow Rate and Draft Size for Water Meters Normal Tests			
Meter Size (inches)	Rate of Flow (gal/min)	Maximum Rate	
		Meter Indication/Test Draft	
		gal	ft³
Less than ⁵ / ₈	8	50	5
⁵ / ₈	15	50	5
³ / ₄	25	50	5
1	40	100	10
1½	80	300	40
2	120	500	40
3	250	500	50
4	350	1000	100
6	700	1000	100

(Table Added 2003)

N.4.2. Special Tests. – Special tests to develop the operating characteristics of meters may be made according to the rates and quantities shown in Table N.4.2.a. Flow Rate and Draft Size for Water Meters Special Tests and Table N.4.2.b. Flow Rate and Draft Size for Utility Type Water Meters Special Tests.

(Amended 2003 and 2010)

Table N.4.2.a. Flow Rate and Draft Size for Batching Water Meters Special Tests						
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 ³		gal	ft ³
Less than or equal to $\frac{5}{8}$	2	10	1	$\frac{1}{4}$	5	1
$\frac{3}{4}$	3	10	1	$\frac{1}{2}$	5	1
1	4	10	1	$\frac{3}{4}$	5	1
$1\frac{1}{2}$	8	50	5	$1\frac{1}{2}$	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

(Table Added 2003) (Table Amended 2010)

Table N.4.2.b. Flow Rate and Draft Size for Utility Type Water Meters Special Tests						
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 ³		gal	ft ³
Less than $\frac{5}{8}$	2	10	1	$\frac{1}{4}$	5	1
$\frac{5}{8}$	2	10	1	$\frac{1}{4}$	5	1
$\frac{5}{8} \times \frac{3}{4}$	2	10	1	$\frac{1}{4}$	5	1
$\frac{3}{4}$	3	10	1	$\frac{1}{2}$	5	1
1	4	10	1	$\frac{3}{4}$	5	1
$1\frac{1}{2}$	8	100	10	$1\frac{1}{2}$	100	10
2	15	100	10	2	100	10

(Table Added 2010)

N.4.3. Batching Meter Tests. – Tests on batching meters should be conducted at the maximum and intermediate rates only.

N.4.4. Repeatability Tests. – Tests for repeatability should include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained. When conducting the tests, the minimum flow rate shall be at least the minimum rate specified in Table N.4.2.a. Flow Rate and Draft Size for Batching Water Meters Special Tests, and the maximum discharge rates shall not exceed the maximum discharge rate developed under the conditions of the installation.

(Amended 2019)

T. Tolerances

T.1. Tolerance Values. – Maintenance and acceptance tolerances shall be as shown in Table T.1. Accuracy Classes and Tolerances for Water Meters.

Table T.1. Accuracy Classes and Tolerances for Water Meters					
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 %

(Table Added 2003)

(Amended 2003)

T.1.1. Repeatability. – When multiple tests are conducted at approximately the same flow rate, each test shall be within the applicable tolerances and the range of test results shall not exceed the values shown in Table T.1.1. Repeatability. Also see N.4.4. Repeatability Tests.

(Added 2002) (Amended 2010)

Table T.1.1. Repeatability		
	Batching Meters	Utility-Type Meters
Normal Flow Rates	0.6 %	0.6 %
Intermediate Flow Rates	0.6 %	2.0 %
Minimum Flow Rate	1.3 %	4.0 %

(Table Added 2010)

UR. User Requirements

UR.1. Batching Meters Only.

UR.1.1. Strainer. – A filter or strainer shall be provided if it is determined that the water contains excessive amounts of foreign material.

UR.1.2. Siphon Breaker. – An automatic siphon breaker or other effective means shall be installed in the discharge piping at the highest point of outlet, in no case below the top of the meter, to prevent siphoning of the meter and permit rapid drainage of the pipe or hose.

UR.1.3. Provision for Testing. – Acceptable provisions for testing shall be incorporated into all meter systems. Such provisions shall include a two-way valve, or manifold valving, and a pipe or hose installed in the discharge line accessible to the proper positioning of the test measure.

UR.2. Accessibility of Customer Indication. – An unobstructed standing space of at least 76 cm (30 in) wide, 91 cm (36 in) deep, and 198 cm (78 in) high shall be maintained in front of an indication intended for use by the

customer to allow for reading the indicator. The customer indication shall be readily observable to a person located within the standing space without necessity of a separate tool or device.

(Added 2008)