



March 26, 2013

Attention Meter Standards Committee:

The Natural Resources Defense Council (NRDC), Austin Water Utility, San Antonio Water System, and American Water, with the endorsement of East Bay Municipal Utility District and the New York City Department of Environmental Protection, submit this proposal to revise accuracy standards for new water meters to the Meter Standards Committee of the American Water Works Association (AWWA). The proposal aims to tackle the unnecessary waste of water from low-level leaks and improve water system accounting.

AWWA currently has standards for approximately twelve types of water meters; this proposal addresses standards for four of the most common mechanical meters (C-700, C-710, C-708, and C-712). During the development of standard specifications for water meters, adopted in 1921, a committee of the New England Water Works Association and a group of meter manufacturers identified the need for meters to measure flows below the normal operating range and thus specified a requirement for registration accuracy for minimum test flows. And while the minimum registration accuracy has improved slightly in the nearly 100 years the standard has existed (it changed from 90% in the 1921 standard to 95% in 1961), the minimum test flow rates have yet to be updated to reflect advances in meter technology. While AWWA's existing water meter standards include provisions for meter accuracy, we believe this revision to update the meter standards is needed to better reflect enhancements in the design and performance of water meters.

The proposed revisions consist of three simple additions to the current AWWA standards for mechanical meters. First, it adds a column to Table 1. Operating Characteristics that establishes the leak detection test flow rate for each meter size. Additionally, the proposal adds Section 4.2.8.3, which requires an accuracy of at least 80 percent for meter registration at leak detection test flows. Finally, additional text is included in the appendices of the applicable standards to provide information and references on the leak detection flow test procedure, allowing for sampling to establish compliance with the leak detection test, thereby minimizing the potential test burden on manufacturers. The specific language for the proposed revisions to each applicable meter standard is enclosed at Attachment #1. A comparison of the impact this proposed revision will have to meter test times versus simply reducing the flow rate for the current minimum test flow is enclosed as Attachment #2.

The primary driver for the proposed revisions is to help utilities reduce water waste. Water utilities across the country understand that the water they deliver is their greatest asset and recognize the growing importance of improving systems to account for and reduce non-revenue water. AWWA has responded with the publication of the new M-36 Manual *Water Audits and Loss Control Programs* (2009) and free Water Audit software. In addition, many utilities are making substantial investments in Automated Meter Reading (AMR) and Advanced Meter Infrastructure (AMI) in hopes of identifying and addressing customer side leakage. But AMR and AMI systems are only as effective as the meter itself in measuring low flows indicative of

leaks. And the trend toward installation of larger meters for new residential connections, due to recent requirements for the installation of fire sprinklers in new single family homes and outdated methods for estimating appropriate sizing, is exacerbating this problem because the larger the meter the less accurate it is at lower flows. New meters whose accuracy drops off significantly below the current minimum test flow simply conceal hidden leaks from utilities and customers alike.

Revising the current AWWA standards for water meters to address accuracy at low flows will help utilities optimize their investments in water loss reduction strategies. The costs for leaks not captured by meters are socialized to all customers and result in higher rates and more frequent rate increases. These proposed revisions to meter standards will ensure that utilities are supplied with more accurate water meters that can better detect the most elusive of hidden leaks. Stronger accuracy standards will lead to the widespread implementation installation of these better, more accurate meters, and major water savings will follow.

Additionally, preliminary results from ongoing utility studies show a substantial fraction of water use appears to occur at levels below current minimum test flows. Considering the variability in new meter accuracy below current minimum test flows, as demonstrated in the Water Research Foundation's 2011 study "Accuracy of In-Service Water Meters at Low and High Flow Rates", the potential for the recovery of non-revenue water is significant for utilities that install more accurate meters. (A copy of the "Accuracy of In-Service Water Meters at Low and High Flow Rates" study will be supplied upon request, as the electronic file is quite large).

A majority of the meters included in the WRF study, which are currently available for purchase in North America with full product information to the user (utility), are of the type, kind, and quality described in the proposed revised standard. Within the next 30-days, we intend to supply data to demonstrate that meters of the type, kind, and quality described in the proposed revised standard have been on the market for at least 5-years and have documented satisfactory use experience by established water utilities.

Given the information provided in support of this proposal, we feel that revising the standard to include an additional registration accuracy test for extended low flows indicative of leaks would greatly benefit water utilities and water utility customers alike.

Sincerely,



Tracy Quinn, P.E.  
Natural Resources Defense Council



Dan Strub  
Austin Water Utility



Anastasia Valdes, PMP, GISP  
San Antonio Water System



David Hughes  
American Water

## Attachment #1. Proposed Revisions to AWWA Meter Standards Language

### PROPOSAL: C-700: Cold-Water Meters – Displacement Type, Bronze Main Case

Revise Table 1 by inserting an additional column entitled “Leak Detection Test Flow” as follows:

Meter Size		Safe Maximum Operating Capacity		Maximum Pressure Loss at Safe Maximum Operating Capacity		Recommended Maximum Rate for Continuous Operations		Leak Detection Test Flow		Minimum Test Flow		Normal Test Flow Limits		Maximum Number of Disc Nutations or Piston Oscillations per		
in	(mm)	gpm	(m3/hr)	psi	(kPa)	gpm	(m3/hr)	gpm	(m3/hr)	gpm	(m3/hr)	gpm	(m3/hr)	10 gal	ft3	(0.01m3)
1/2	(13)	15	(3.4)	15	(103)	7.5	(1.7)	1/16	(0.01)	1/4	(0.06)	1-15	(0.2-3.4)	875	657	(231)
1/2 x 3/4	(13 x 20)	15	(3.4)	15	(103)	7.5	(1.7)	1/16	(0.01)	1/4	(0.06)	1-15	(0.2-3.4)	875	657	(231)
5/8	(15)	20	(4.5)	15	(103)	10	(2.3)	1/16	(0.01)	1/4	(0.06)	1-20	(0.2-4.5)	580	435	(154)
5/8 x 3/4	(15 x 20)	20	(4.5)	15	(103)	10	(2.3)	1/16	(0.01)	1/4	(0.06)	1-20	(0.2-4.5)	580	435	(154)
3/4	(20)	30	(6.8)	15	(103)	15	(3.4)	1/8	(0.03)	1/2	(0.11)	2-30	(0.5-6.8)	333	250	(88)
1	(25)	50	(11.4)	15	(103)	25	(5.7)	3/16	(0.04)	3/4	(0.17)	3-50	(0.7-11.4)	153	115	(40)
1 1/2	(40)	100	(22.7)	15	(103)	50	(11.3)	3/8	(0.09)	1 1/2	(0.34)	5-100	(1.1-22.7)	67	50	(18)
2	(50)	160	(36.3)	15	(103)	80	(18.2)	1/2	(0.11)	2	(0.45)	8-160	(1.8-36.3)	40	30	(11)

Add the following underlined new language at the locations indicated:

4.2.8.3 Leak detection flow rate. From the leak detection test flow rate to the minimum test flow rate listed in Table 1, the meter shall register not less than 80 percent and not more than 101 percent of the water that actually passes through it.

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#### APPENDIX B

##### Sec. B.3.3 Accuracy Tests

Meters should be tested for accuracy of registration at flow rates and test flow quantities in accordance with Sec. 4.2.8 of ANSI/AWWA C700 and AWWA Manual M-6, *Water Meters – Selection, Installation, Testing, and Maintenance\**, and as further described herein for the leak detection test. If the purchaser does not have suitable means for testing, the manufacturer should be requested to provide a certificate showing that each meter has been tested for accuracy of registration and that it complies with the accuracy and capacity requirements of ANSI/AWWA C700.

Test flow quantities for the leak detection test are the same quantities specified in Table 5-3 of Manual M-6 for the minimum flow rate test. Certification of compliance with the accuracy requirement of the leak detection test may be based upon the mean of the accuracy values of a sample of meters randomly selected from each batch,\* The number of meters in the sample to be tested should be sufficient to establish a confidence level of 95 percent.

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\* For purposes of this section, a batch consists of the total number of meters of a specific type and size that are shipped from a manufacturer to a distributor or purchaser in a single transaction. If a single transaction encompasses meters manufactured in more than one year, the meters shipped to a purchaser within each year shall constitute a separate batch.

## Attachment #1. Proposed Revisions to AWWA Meter Standards Language

### PROPOSAL: C-710: Cold-Water Meters – Displacement Type, Plastic Main Case

Revise Table 1 by inserting an additional column entitled “Leak Detection Test Flow” as follows:

Meter Size		Safe Maximum Operating Capacity		Maximum Pressure Loss at Safe Maximum Operating Capacity		Recommended Maximum Rate for Continuous Operations		Leak Detection Test Flow		Minimum Test Flow		Normal Test Flow Limits		Maximum Number of Disc Nutations or Piston Oscillations per		
in	(mm)	gpm	(m3/hr)	psi	(kPa)	gpm	(m3/hr)	gpm	(m3/hr)	gpm	(m3/hr)	gpm	(m3/hr)	10 gal	ft3	(0.01m3)
1/2	(13)	15	(3.4)	15	(103)	7.5	(1.7)	1/16	(0.01)	1/4	(0.06)	1-15	(0.2-3.4)	875	657	(231)
1/2 x 3/4	(13 x 20)	15	(3.4)	15	(103)	7.5	(1.7)	1/16	(0.01)	1/4	(0.06)	1-15	(0.2-3.4)	875	657	(231)
5/8	(15)	20	(4.5)	15	(103)	10	(2.3)	1/16	(0.01)	1/4	(0.06)	1-20	(0.2-4.5)	580	435	(154)
5/8 x 3/4	(15 x 20)	20	(4.5)	15	(103)	10	(2.3)	1/16	(0.01)	1/4	(0.06)	1-20	(0.2-4.5)	580	435	(154)
3/4	(20)	30	(6.8)	15	(103)	15	(3.4)	1/8	(0.03)	1/2	(0.11)	2-30	(0.5-6.8)	333	250	(88)
1	(25)	50	(11.4)	15	(103)	25	(5.7)	3/16	(0.04)	3/4	(0.17)	3-50	(0.7-11.4)	153	115	(40)

Add the following underlined new language at the locations indicated:

4.2.8.3 Leak detection flow rate. From the leak detection test flow rate to the minimum test flow rate listed in Table 1, the meter shall register not less than 80 percent and not more than 101 percent of the water that actually passes through it.

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#### APPENDIX B

##### Sec. B.3.3 Accuracy Tests

Meters should be tested for accuracy of registration at flow rates and test flow quantities in accordance with Sec. 4.2.8 of ANSI/AWWA C710 and AWWA Manual M-6, *Water Meters – Selection, Installation, Testing, and Maintenance\**, and as further described herein for the leak detection test. If the purchaser does not have suitable means for testing, the manufacturer should be requested to provide a certificate showing that each meter has been tested for accuracy of registration and that it complies with the accuracy and capacity requirements of ANSI/AWWA C710.

Test flow quantities for the leak detection test are the same quantities specified in Table 5-3 of Manual M-6 for the minimum flow rate test. Certification of compliance with the accuracy requirement of the leak detection test may be based upon the mean of the accuracy values of a sample of meters randomly selected from each batch,\* The number of meters in the sample to be tested should be sufficient to establish a confidence level of 95 percent.

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\* For purposes of this section, a batch consists of the total number of meters of a specific type and size that are shipped from a manufacturer or distributor to a purchaser in a single transaction. If a single transaction encompasses meters manufactured in more than one year, the meters shipped to a purchaser within each year shall constitute a separate batch.

## Attachment #1. Proposed Revisions to AWWA Meter Standards Language

### PROPOSAL: C-708: Cold-Water Meters – Multijet Type

Revise Table 1 by inserting an additional column entitled “Leak Detection Test Flow” as follows:

Meter Size		Safe Maximum Operating Capacity		Maximum Pressure Loss at Safe Maximum Operating Capacity		Recommended Maximum Rate for Continuous Operations		Leak Detection Test Flow		Minimum Test Flow		Normal Test Flow Limits		Maximum Number of Disc Nutations or Piston Oscillations per		
in	(mm)	gpm	(m3/hr)	psi	(kPa)	gpm	(m3/hr)	gpm	(m3/hr)	gpm	(m3/hr)	gpm	(m3/hr)	10 gal	ft3	(0.01m3)
5/8	(15)	20	(4.5)	15	(103)	10	(2.3)	1/16	(0.01)	1/4	(0.06)	1-20	(0.2-4.5)	580	435	(154)
5/8 x 3/4	(15 x 20)	20	(4.5)	15	(103)	10	(2.3)	1/16	(0.01)	1/4	(0.06)	1-20	(0.2-4.5)	580	435	(154)
3/4	(20)	30	(6.8)	15	(103)	15	(3.4)	1/8	(0.03)	1/2	(0.11)	2-30	(0.5-6.8)	333	250	(88)
1	(25)	50	(11.4)	15	(103)	25	(5.7)	3/16	(0.04)	3/4	(0.17)	3-50	(0.7-11.4)	153	115	(40)
1 1/2	(40)	100	(22.7)	15	(103)	50	(11.3)	3/8	(0.09)	1 1/2	(0.34)	5-100	(1.1-22.7)	67	50	(18)
2	(50)	160	(36.3)	15	(103)	80	(18.2)	1/2	(0.11)	2	(0.45)	8-160	(1.8-36.3)	40	30	(11)

Add the following underlined new language at the locations indicated:

4.2.8.3 Leak detection flow rate. From the leak detection test flow rate to the minimum test flow rate set forth in Table 1, the meter shall register not less than 80 percent and not more than 103 percent of the water that actually passes through it.

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#### APPENDIX A

##### Sec. A.2.3 Accuracy Tests

All meters should be tested for accuracy of registration at flow rates and test flow quantities in accordance with Sec. 4.2.8 of ANSI/AWWA C708 and AWWA Manual M-6, *Water Meters – Selection, Installation, Testing, and Maintenance*, and as further described herein for the leak detection test. If the purchaser does not have suitable means for testing, the manufacturer should be requested to furnish a certificate showing that each meter has been tested for accuracy of registration and that it complies with the accuracy and capacity requirements of ANSI/AWWA C708.

Test flow quantities for the leak detection test are the same quantities specified in Table 5-3 of Manual M-6 for the minimum flow rate test. Certification of compliance with the accuracy requirement of the leak detection test may be based upon the mean of the accuracy values of a sample of meters randomly selected from each batch,\* The number of meters in the sample to be tested should be sufficient to establish a confidence level of 95 percent.

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\* For purposes of this section, a batch consists of the total number of meters of a specific type and size that are shipped from a manufacturer or distributor to a purchaser in a single transaction. If a single transaction encompasses meters manufactured in more than one year, the meters shipped to a purchaser within each year shall constitute a separate batch.

**Attachment #1. Proposed Revisions to AWWA Meter Standards Language**

**PROPOSAL: C-712: Cold-Water Meters – Singlejet Type**

Revise Table 1 by inserting an additional column entitled “Leak Detection Test Flow” as follows:

Meter Size		Safe Maximum Operating Capacity		Recommended Maximum Rate for Continuous Operations		Maximum Pressure Loss at Safe Maximum Operating Capacity		Normal Test Flow Limits		Minimum Test Flow		Leak Detection Test Flow	
in	(mm)	gpm	(m3/hr)	gpm	(m3/hr)	psi	(kPa)	gpm	(m3/hr)	gpm	(m3/hr)	gpm	(m3/hr)
5/8	(15)	20	(4.5)	10	(2.3)	15	(103)	1.0-20	(0.2-4.5)	1/4	(0.06)	1/16	(0.01)
5/8 x 3/4	(15 x 20)	20	(4.5)	10	(2.3)	15	(103)	1.0-20	(0.2-4.5)	1/4	(0.06)	1/16	(0.01)
3/4	(20)	30	(6.8)	15	(3.4)	15	(103)	2.0-30	(0.5-6.8)	1/2	(0.11)	1/8	(0.03)
1	(25)	50	(11.4)	25	(5.7)	15	(103)	3.0-50	(0.7-11.4)	3/4	(0.17)	3/16	(0.04)
1 1/2	(40)	100	(23)	50	(11)	15	(103)	1.5-100	(0.34-23)	1/2	(0.11)	1/8	(0.03)
2	(50)	160	(36)	80	(18)	15	(103)	2.0-160	(0.45-36)	1/2	(0.11)	1/8	(0.03)
3	(80)	320	(73)	160	(36)	15	(103)	2.5-320	(0.57-73)	1/2	(0.11)	1/8	(0.03)
4	(100)	500	(110)	250	(55)	15	(103)	3.0-500	(0.68-110)	3/4	(0.17)	3/16	(0.04)
6	(150)	1,000	(220)	500	(110)	15	(103)	4.0-1,000	(0.91-220)	1 1/2	(0.34)	3/8	(0.09)

Add the following underlined new language at the locations indicated:

4.2.8.3 Leak detection flow rate. From the leak detection test flow rate to the minimum test flow rate stated in Table 1, the meter shall register not less than 80 percent and not more than 101.5 percent of the water that actually passes through it.

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APPENDIX A

**Sec. A.2.3 Accuracy Tests**

All meters should be tested for accuracy of registration at flow rates and test flow quantities in accordance with Sec. 4.2.8 of ANSI/AWWA C712 and AWWA Manual M-6, Water Meters – Selection, Installation, Testing, and Maintenance, and as further described herein for the leak detection test. If the purchaser does not have a suitable means for testing, the manufacturer should be requested to provide a certificate showing that each meter has been tested for accuracy of registration and that it complies with the accuracy and capacity requirements of ANSI/AWWA C712.

Test flow quantities for the leak detection test are the same quantities specified in Table 5-3 of Manual M-6 for the minimum flow rate test. Certification of compliance with the accuracy requirement of the leak detection test may be based upon the mean of the accuracy values of a sample of meters randomly selected from each batch.\* The number of meters in the sample to be tested should be sufficient to establish a confidence level of 95 percent.

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\* For purposes of this section, a batch consists of the total number of meters of a specific type and size that are shipped from a manufacturer or distributor to a purchaser in a single transaction. If a single transaction encompasses meters manufactured in more than one year, the meters shipped to a purchaser within each year shall constitute a separate batch.

## Attachment #2. Comparison of Meter Testing Times

- Scenario 1 Add a "leak detection flow test" which will be required to be met by a sample of each "batch" / order.
- Scenario 2 Reduce minimum test flow by a quarter
- Scenario 3 Reduce minimum test flow by half

3/4" meter	Test Flow Quantity <sup>1</sup>	Leak Detection Test		Minimum Flow Rate Test	
	Volume required (gal)	Flow (gpm)	Time (minutes) per test	Flow (gpm)	Time (minutes) per test
Scenario 1	10	1/8	80	1/2	20
Scenario 2	10			1/8	80
Scenario 3	10			1/4	40

<sup>1</sup> Table 5-3 AWWA Manual M-6

Batch Size <sup>a</sup>	Sample Size <sup>b</sup>	Scenario 1			Scenario 2	Scenario 3
		Leak Detection Test (Test applied to sample size)	Current Minimum Flow Rate Test (Test applied to batch size)	Total Testing Time	Reduced Minimum Flow Rate Test	Reduced Minimum Flow Rate Test
		<b>Testing Time (minutes)</b>				
10	10	800	200	1,000	800	400
50	44	3,520	1,000	4,520	4,000	2,000
100	80	6,400	2,000	8,400	8,000	4,000
150	105	8,400	3,000	11,400	12,000	6,000
200	132	10,560	4,000	14,560	16,000	8,000
250	152	12,160	5,000	17,160	20,000	10,000
500	217	17,360	10,000	27,360	40,000	20,000
1,000	278	22,240	20,000	42,240	80,000	40,000
1,500	306	24,480	30,000	54,480	120,000	60,000
2,000	322	25,760	40,000	65,760	160,000	80,000
10,000	370	29,600	200,000	229,600	800,000	400,000

<sup>a</sup> Number of meters of a specific type and size that are shipped from a manufacturer or distributor to a purchaser in a single transaction.

<sup>b</sup> Number of meters required to be tested to meet 95% Confidence Interval.