



**American Water Works
Association**

Addendum to
AWWA Manual M6,
Water Meters—Selection, Installation, Testing,
and Maintenance, Fifth Edition
(November 2018)

Purpose

The 2018 Addendum to AWWA Manual M6, Water Meters—Selection, Installation, Testing, and Maintenance, fifth edition, provides guidance to users on testing procedures and related topics for meters conforming to standard ANSI/AWWA C715-18 Cold-Water Meters—Electromagnetic and Ultrasonic Type, for Revenue Applications. This standard was approved by the AWWA Standards Committee on Water Meters on February 19, 2018, approved by the AWWA Board of Directors on June 9, 2018, and made effective on October 1, 2018.

The 2018 Addendum is considered a part of AWWA Manual M6 wherever the manual is referenced by AWWA water meter standards or other documents.

The current edition of AWWA Manual M6, the fifth edition, was published in 2012. The AWWA Water Meter Standards Committee believes that the 2018 Addendum to the manual fills an immediate need by water utilities for up-to-date meter testing procedures and that it was important for this information to be published in the interim, as work is continuing on the sixth edition of the manual.

Background

Historically, AWWA Manual M6 has served as a guide to best practices for water meters, as a companion document to the AWWA water meter standards. From a practical standpoint, the manual is often used as a reference tool by utilities in their meter shops for determining and executing the proper testing procedures for the various meter types and sizes.

As the family of AWWA water meter standards has expanded over the years to include new meter types, AWWA Manual M6 has also grown to include information on these new meters. The common practice has been that Manual M6 includes information on the meter types for which an AWWA standard exists. The fifth edition of the manual, for example, was expanded in 2012 to include information on singlejet-type (ANSI/AWWA C712) and fluidic oscillator-type (ANSI/AWWA C713) meters. The sixth edition will include more information on electromagnetic- and ultrasonic-type (ANSI/AWWA C715) meters, as well as meters for residential fire sprinkler systems in one- and two-family dwellings and manufactured homes (ANSI/AWWA C714).

Testing Procedures

Table 5-3 includes recommended data for testing cold-water meters by the volumetric method, using volumetric tanks, or by the gravimetric method, using weight scales. This data may also be used for testing cold-water meters against a master or reference meter that has a known calibration curve. Accuracy standards for new meters are contained in the latest editions of standards ANSI/AWWA C700, C701, C702, C703, C704, C708, C710, C712, C713, C714, and C715. The modified Table 5-3 issued in this addendum reflects the latest accuracy standards from these AWWA standards.

The following listing provides additional guidance on meter testing, beyond the modifications made in Table 5-3.

1. In testing meters to validate their accuracy (either prior to deployment or after some time in service), note that the testing procedures for electronic meters, may be different from those meters previously placed in service. The manufacturer's recommended testing procedures should be followed. Ignoring these recommendations can invalidate the accuracy results.
2. Electronic meters do not have moving parts and, therefore, are not subject to the same wear and tear as mechanical meters. Although AWWA standards for mechanical water meters provide recommended testing frequencies in the appendix of each standard, recommended testing frequencies are not provided in the appendix of ANSI/AWWA C715. Water quality and other local conditions may affect the performance of electronic meters over time. To assess these site-specific effects, the utility may choose to verify the accuracy of electronic meters at the recommended test frequencies provided in AWWA standards for mechanical meters, until the utility establishes its own criteria based on data collected on its operational experience and local conditions.
3. Some of the smaller electronic meters have minimum rate accuracy requirements at lower flow rates than any of the rates given in other AWWA meter standards (i.e., flow rates lower than 0.25 gpm). In other instances, the minimum rate flow rates of electronic meters may be lower than those of the mechanical meters previously deployed by the utility, for any given line size. Accuracy at these lower flow rates, therefore, might be more difficult to test and verify on the existing utility's meter test bench equipment. Gravimetric systems might provide more sensitivity than volumetric systems. In all cases, the testing equipment must be maintained properly, calibrated periodically, and certified to ensure it is working properly.
4. As discussed in item #3, a utility's testing equipment may not be capable of testing electronic meters reliably at the lower flow rates (particularly for flow rates even lower than the minimums given in ANSI/AWWA C715, if part of the manufacturer's warranted accuracy claims). If this is the case, an independent third-party service company with certified and calibrated equipment along with sound testing protocols may need to be engaged to verify accuracy. As provided in one of the footnotes for the modified Table 5-3 in this addendum, a utility may alternatively increase the minimum test rate flow to stay within the capability of their equipment, while holding the electronic meters to their tighter accuracy requirement at these somewhat higher flow rates. Utilities may also wish to use these somewhat higher flow rates when there are test time constraints.
5. Historically, Table 5-3 has included some caveats in test quantity recommendations, relative to the footnote that has called for "not less than 3 min running." This has been most notable for some of the maximum rate test quantities, which would result in test run times well below three minutes in length. This ambiguity recognizes limitations in the number and size of test tanks with which the utility may be equipped. The footnote further provides that, for reduced test quantities, "the resultant increase in total test

uncertainties and errors need to be recognized.” While mechanical water meters may have been able to accommodate those test quantities in Table 5-3 that result in test times of less than three minutes, this may not be the case for some electronic meters. A special test mode—temporarily increasing the sampling rate for the meter—may be available for some electronic meter designs, to mitigate the test uncertainties associated with test times shorter than three minutes.

6. Table 5-3 provides recommended test flow rates. These recommendations are based, in part, on the observation that all meters of the same type (all positive displacement meters, all turbine meters, and so on) will exhibit the same or similar characteristic accuracy curves. This may not be a valid observation for electronic meters, for which distinct calibration algorithms may be in use. As a result, alternate or additional flow test rates may be considered. These would be especially relevant for flow rates given in the manufacturer’s performance claims that significantly exceed the ranges established in AWWA water meter standards.
7. Electromagnetic- and ultrasonic-type electronic meters are inferential in nature, measuring water velocities and inferring volumetric flows based on these velocities. (Many mechanical flow meters are also inferential in nature.) Inferential meters can be susceptible to flow profile disturbances, and to “noisy” flow delivery systems (e.g., pressure pulsations). Care should be taken to ensure that utility test stands do not introduce disturbances or noise at levels that are not representative of those that occur in actual field installations.

For the sixth edition of this manual, expanded information on several aspects of meter testing will be provided; these will include test uncertainties related to testing equipment, test uncertainties related to procedures and practices, and evaluation of accuracy results for meters pulled from service in the field. If users of this manual have any comments, questions, or suggestions regarding this manual, they can contact the AWWA Standards group at standards@awwa.org.

For this 2018 Manual M6 addendum, Table 5-3 of Manual M6, fifth edition (2012) is replaced with the following Table 5-3:

Table 5-3 Test requirements for new, rebuilt, and repaired cold-water meters*
Displacement Meters (ANSI/AWWA C700 and C710)

Size	Maximum Rate (All Meters)			Intermediate Rate (All Meters)			Minimum Rate (New and Rebuilt)			Minimum (Repaired)			
	Flow Rate†	Test Quantity††		Accuracy Limits	Flow Rate**	Test Quantity††		Accuracy Limits	Flow Rate	Test Quantity††		Accuracy Limits	
		gal	ft³			gal	ft³			gal	ft³		gal
in.	<i>gpm</i>			<i>percent</i>				<i>percent</i>	<i>gpm</i>			<i>percent</i>	<i>percent (min)</i>
1/2	8	100	10	98.5–101.5	2	10	1	98.5–101.5	1/4	10	1	95–101	90
1/2 x 3/4	8	100	10	98.5–101.5	2	10	1	98.5–101.5	1/4	10	1	95–101	90
5/8	15	100	10	98.5–101.5	2	10	1	98.5–101.5	1/4	10	1	95–101	90
5/8 x 3/4	15	100	10	98.5–101.5	2	10	1	98.5–101.5	1/4	10	1	95–101	90
3/4	25	100	10	98.5–101.5	3	10	1	98.5–101.5	1/2	10	1	95–101	90
1	40	100	10	98.5–101.5	4	10	1	98.5–101.5	3/4	10	1	95–101	90
1½	50	100	10	98.5–101.5	8	100	10	98.5–101.5	1½	100	10	95–101	90
2	100	100	10	98.5–101.5	15	100	10	98.5–101.5	2	100	10	95–101	90

Multijet Meters (ANSI/AWWA C708)

Size	Maximum Rate (All Meters)				Intermediate Rate (All Meters)				Minimum Rate (New and Rebuilt)				Minimum (Repaired)
	Flow Rate†	Test Quantity††		Accuracy Limits	Flow Rate**	Test Quantity††		Accuracy Limits	Flow Rate	Test Quantity††		Accuracy Limits	Minimum (Repaired)
		gal	ft³			gal	ft³			gal	ft³		
in.	<i>gpm</i>			<i>percent</i>	<i>gpm</i>			<i>percent</i>	<i>gpm</i>			<i>percent</i>	<i>percent (min)</i>
5/8	15	100	10	98.5–101.5	1	10	1	98.5–101.5	1/4	10	1	97–103	90
5/8 x 3/4	15	100	10	98.5–101.5	1	10	1	98.5–101.5	1/4	10	1	97–103	90
3/4	25	100	10	98.5–101.5	2	10	1	98.5–101.5	1/2	10	1	97–103	90
1	35	100	10	98.5–101.5	3	10	1	98.5–101.5	3/4	10	1	97–103	90
1½	70	100	10	98.5–101.5	5	100	10	98.5–101.5	1½	100	10	97–103	90
2	100	100	10	98.5–101.5	8	100	10	98.5–101.5	2	100	10	97–103	90

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