How Often Should Residential Water Meters Be Replaced? BY KEN MERCER

QUESTION: Budget constraints and a concern about metering inaccuracies have us in a quandary about meter maintenance and replacement. Is there a general rule to help us determine when to replace residential water meters?

ANSWER: Water meters are an important interface between a utility and its customers, assuring that what’s delivered is paid for and vice versa. Water meters also provide valuable information on water usage and can help determine potential losses in the system. With this in mind, a utility should take an active interest in metering and strive to improve its metering practices.

ACCURACY AND PERFORMANCE
Because billable revenue is derived directly from register readings, meter accuracy and performance are vitally important. Inequities arise when water is used but not charged, requiring higher rates for all. Accurate metering resolves this issue and can enhance conservation, especially for customers consuming water at levels in excess of what they were being inaccurately charged for.

The best way to minimize revenue loss and increase customer cost equity is to ensure meters are performing within established parameters. Revenue loss attributable to apparent losses—metering inaccuracies and unauthorized use—can account for as much as 5 percent of a utility’s total revenue, so utilities should strive to find their optimum economic meter replacement age.

Replacing still-accurate water meters is a waste of resources, so budget considerations for revenue savings must be balanced against meter replacement costs. Over a chosen period, the time to restore meter efficiency is when the cost of meter repair or replacement is equal to the loss in revenue from under-registration if such work isn’t done. In other words, the optimum service life of a meter depends on prevailing water rates, rate of meter wear (and loss of accurate registration), repair and maintenance costs, and inflation and discount rates. Many municipalities also charge sewer fees based on potable water consumption, so more accurate metering may also increase revenue in this area.

Finally, implementing strategies to reduce leakage, such as an optimized meter replacement program, may demonstrate better management controls that could improve a utility’s bond rating. Ultimately, there’s no standard time period for meter replacement that can be broadly applied to all utilities.

Displacement Meter Tests
The most frequently used intervals for displacement meter tests are based on meter size.

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Years Between Tests</th>
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<tbody>
<tr>
<td>½ (13)</td>
<td>10</td>
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<tr>
<td>¾ (15)</td>
<td>10</td>
</tr>
<tr>
<td>¾ (20)</td>
<td>8</td>
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<tr>
<td>1 (25)</td>
<td>6</td>
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<tr>
<td>1½ (40)</td>
<td>4</td>
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<tr>
<td>2 (50)</td>
<td>4</td>
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Source: AWWA Standard C700-09, Cold Water Meters—Displacement Type, Bronze Main Case

METER WEAR AND TEST SCHEDULES
Inaccurate meter registration may result from excessive wear (rates and total throughput), extreme temperatures, corrosion, debris, and the presence of entrapped air in the service line. Other contributing factors may include incorrect setting (installation), poor maintenance, improper sizing and selection, and vandalism.

The total quantity of water delivered through a meter is generally considered the main cause of variations in meter accuracy. Meter age is often used as a surrogate of total throughput based on an assumption that the quantity of water delivered is directly proportional to meter age. Meter test intervals for many systems are regulated by utilities’ respective state or public utility commissions. The accompanying table shows the most frequently used intervals for displacement meter tests based on meter size.

Small systems with limited resources may consider a regular meter replacement schedule, replacing some percentage of meters in a given year until all meters are addressed within a cycle corresponding to the intervals in the accompanying table or a similar schedule based on meter type. Alternatively, systems may use a registration limit (e.g., 1 mil gal) as their residential meter replacement criteria.

If specific water-use data can be obtained by operations personnel, a cumulative flow-based meter replacement program is recommended. The following information is also needed to optimize such a meter replacement program:

- Time-of-day flow rates: Monitor a selection of individual houses with a time-of-day flow recorder to determine the percentage of time a household uses water at low-, medium-, and high-flow rates.
- Meter accuracy database: Create a database of meter accuracy at multiple flow rates from a selection of field meters.
- Meter replacement cost estimate: Include all expenses, such as meter cost, labor, etc.
- Residential water use and rates: Calculate these items from the metered
residential usage rate and the charges for water sold.

**METER TEST PROGRAMS**

Residential meters (5/8- and 5/8- × ¾-in.) are typically tested at three levels of flow rates (refer to M6 for specific guidance): most commonly low flow (¼ gpm), medium flow (1–2 gpm), and high flow (15 gpm).

In meter testing, registration accuracy at high-flow rates isn’t as important as at low rates because most water passes through a meter at comparatively low-flow rates. Standard meters have the best accuracy at mid- to high-range flows. For displacement, multijet, propeller, and turbine meters, a typical method of establishing test-flow-percent accuracy is the algebraic sum of 15 percent of low-flow results, 70 percent of intermediate-flow results, and 15 percent of maximum-flow results.

If usage data are available, a targeted approach for meter testing is recommended, in addition to regular meter tests. Indicators for testing include declining long-term trends in average use, high/low use for meter size, low use vs. customer type, and low summer use in seasonal customer categories.

Always replace a meter that isn’t registering. Begin a new meter replacement program with the oldest meters in the highest-rate service area. Before warranties expire, test at least 5 percent of representative meters to confirm they still meet guarantees.

It may not be economically feasible to repair older meters to meet the accuracy requirements of new meters, and repaired meter standards may not be acceptable because of the importance of revenue protection. Many utilities buy new residential meters rather than repair old meters because new ones are fairly inexpensive.

**ADDITIONAL ISSUES**
It’s strongly recommended that utilities perform annual water audits to assess water loss and nonrevenue water condition. Based on these results, if a significant amount of revenue loss isn’t associated with real losses through system leakage, a high probability exists for losses caused by metering inaccuracy.

Proper sizing and installation of water meters is essential to accurate registration. Let customers know if their service will be disrupted during testing. Keep good records of meter inspection, repair, and replacement. Follow all safety precautions.

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**RESOURCES**
- AWWA Standard C700-09, Cold Water Meters—Displacement Type, Bronze Main Case