

# Revenue Meter Sample Testing Plan - Eversource NH

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## Definitions:

AQL	Acceptance Quality Limit. The AQL defines the worst tolerable average limit for the variable being tested.
Lot	A group of meters that are sufficiently alike to be combined into a common group that is subject to sample testing.
Lot Size	The number of meters in a lot.
Nonconformity	A meter whose test results are not within the stated test limits.
Sampling Plan	A specific plan that states the sample size(s) to be used, and the associated criteria for accepting the lot.
Sample	The selection of meters from the lot to be tested, for a given testing period (typically annual testing periods). Meters in the sample are selected randomly.
Sample Population	The meters subject to Sample Testing, as defined by this plan.
Sample Size	The quantity of meters in the Sample, as determined from the applicable table in ANSI/ASQ Z1.9-2003 for the given Lot Size and AQL.
Variable	The attribute to be tested when determining the pass/fail status of the lot. For revenue metering this shall be the Weighted Average (WA) Percent Registration (accuracy performance of the meter under test).

## Sample Population

The meters subject to sample testing shall include all self-contained meters owned by Eversource and installed in the Eversource NH service area.

## Sample Season

Each sample season shall start on January 1<sup>st</sup> of each year, and run through the end of that year. The sample lot(s), lot size(s), and sample size(s) shall be determined and the sample population(s) selected no later than January 31<sup>st</sup> of each year. Analysis of the results shall be compiled upon completion of the initial sample population testing no later than December 31<sup>st</sup> of that year.

## Lot Categories

Lot categories shall be determined annually at the start of each sample season, typically based on the manufacturer, type, and/or design of meters subject to sample testing. In addition, new lot categories shall be created as appropriate when new meter types are deployed and their designs or production facilities are unique enough to warrant the creation of a new sample lot. Note that the results of prior

sample testing seasons (see section on Corrective Action) may also require the creation of a new lot category.

Based on the installed population of meters as of September 1, 2017, the following example shows lot categories that would be appropriate for Eversource NH:

1. Itron C(N)1S (D) (DR) (R) (T)
2. Itron Bridge C(N)2SO (D)
3. Itron Polyphase Bridge CP2SO
4. GE/Aclara I-210 (+) (C) (CN) (N)
5. All remaining solid state meters (GE/Aclara kV (2) (C) (+); Itron SS1S1D; L&G S4, Elster A1D)
6. All remaining electromechanical meters

### Lot Size

The lot size shall be determined annually at the start of each sample season, based on the quantity of meters installed for each lot category.

As an example, based on the lot categories defined above and the quantity of meters installed as of September 1, 2017, each lot would consist of the following number of meters (approximately):

Lot #	Lot Size	Lot Description
1	482526	Itron C(N)1S (D) (DR) (R) (T)
2	35701	Itron Bridge C(N)2SO (D)
3	14780	Itron Polyphase Bridge CP2SO
4	2638	GE/Aclara I-210 (+) (C) (CN) (N)
5	216	All remaining solid state meters (GE/Aclara kV (2) (C) (+); Itron SS1S1D; L&G S4, Elster A1D)
6	179	All remaining electromechanical meters

### Inspection Levels

Inspection levels shall be determined annually at the start of each sample season per ANSI Z1.9 – 2003 table A-2.

The following table shows sample size codes for each lot, based on use of Inspection Level II, as recommended in ANSI/ASQ Z1.9-2003 for the lot sizes shown in the example above. Also shown is the associated sample size per Table B-3 of ANSI/ASQ Z1.9-2003.

Lot #	Sample Size Code	Sample Size	Lot Description
1	P	200	Itron C(N)1S (D) (DR) (R) (T)
2	N	150	Itron Bridge C(N)2SO (D)
3	M	100	Itron Polyphase Bridge CP2SO

Lot #	Sample Size Code	Sample Size	Lot Description
4	M	100	GE/Aclara I-210 (+) (C) (CN) (N)
5	G	15	All remaining solid state meters (GE/Aclara kV (2) (C) (+); Itron SS1S1D; L&G S4, Elster A1D)
6	G	15	All remaining electromechanical meters

## Sample Selection

The samples for each lot shall be randomly selected from the installed meters subject to sample testing at the time of the sample selection. The quantity selected shall be based on the sample size associated with the sample size code letter as indicated in Table B-3 of ANSI/ASQ Z1.9-2003. Normal selections shall be drawn in January of each sample season. Additional selections deemed necessary (see section on Corrective Action) may be drawn as needed.

## Sample Exclusions

Sample testing is designed to identify performance issues during the normal service life of a meter so that appropriate action can be taken to remediate any non-conforming population of meters. Any meter found to be damaged due to external influences unrelated to normal meter usage, such as tampering, vandalism, or mishandling after removal from service shall therefore be excluded from the test results and another randomly selected meter from that lot shall be substituted for the damaged meter.

## Variable

The variable to be tested is the weighted average (WA) accuracy, in percent registration, per the following formula:

$$WA = (4FL + LL)/5$$

Where FL is the Full Load percent registration and LL is the Light Load percent registration.

## Acceptance Quality Limit (AQL)

Based on ANSI C12.1-2014 section 5.0.3.4.3, and other utilities that have adopted a similar test plan for use in NH, an AQL of 1.0 percent shall be used.

## Test Limits

Based on NHPUC Rule 305.03 (d) (1) as of September 2017, solid state meter lots shall use weighted average accuracy limits of 98% and 101% for the lower and upper percent registration respectively.

Electromechanical meter lots shall use weighted average accuracy limits of 98% and 102% for the lower and upper percent registration respectively.

## Corrective Action

If a lot exceeds the limit for the maximum allowable percent non-conforming, as defined in Table B-3 of ANSI/ASQ Z1.9-2003, then remedial action shall be taken to reduce the population of non-conforming meters within the lot.

ANSI C12.1-2014, section 5.0.3.4.4, provides guidance for corrective action options. Based on those options, Eversource shall take the following corrective actions to remediate the non-conforming meters found during the normal sample testing program:

1. Analyze the non-conforming meters found during the sample testing program and attempt to determine if they belong to an identifiable sub-group, such as a manufacturing date range, manufacturer type, firmware/software/hardware version, etc.
2. If a suspect sub-group is identifiable:
  - a. Create a new lot that targets the sub-group of suspect meters and either;
    - i. Test all meters in the sub-group and repair or retire non-conforming meters, or;
    - ii. Sample test that new lot as soon as practical, but before the end of the next sample testing season.
      1. If the new lot passes its sample testing per normal sample testing limits, no further action is required.
      2. If the new lot fails its sample testing per normal sample testing limits, implement a remedial action plan and either;
        - a. Test all the meters within the suspect sub-group, and repair or retire those that are found to be non-conforming, or;
        - b. Retire all the meters in the sub-group on an accelerated schedule.
3. If a suspect sub-group is not readily identifiable:
  - a. Use the tightened inspection limits specified in Table B-3 of ANSI/ASQ Z1.9-2003 for the non-conforming lot in the next sample season, and;
  - b. Select an additional sample group from the original lot, test them, and repair or retire any meters that are found to be non-conforming, and;
  - c. Analyze any non-conforming meters found in the additional sample group to identify a sub-group of meters that are likely to have a higher rate of non-conformity (if possible) and proceed under step 2, above.