

**PROPOSED SAMPLE METER TESTING PLAN FOR NOLIN
RURAL ELECTRIC COOPERATIVE CORPORATION'S
SINGLE PHASE CLASS 200 AND 320 METERS**

Nolin Rural Electric Cooperative Corporation
Elizabethtown, Kentucky

Prepared by
Kevin Mara, P.E.
GDS Associates, Inc.
June 19, 2016

PROPOSAL FOR SINGLE-PHASE CLASS 200 AND 320 SAMPLE METER TESTING

INTRODUCTION

Nolin Rural Electric Cooperative Corporation (Nolin) is an electric distribution cooperative located in central Kentucky. Nolin is presently on schedule with its eight-year meter testing program. By adopting a sample meter testing program, Nolin will take a significant step towards maximizing efficiency in the single-phase meter reading and testing area of its operation. It is the purpose of this proposal to demonstrate the methods used and the cost savings achieved in sample testing.

RULES AND REGULATIONS

Kentucky Public Service Commission (PSC) rules regulations outline the required method and techniques of sample meter testing. Nolin will implement the sample meter testing plan as submitted in this application

PROCEDURE

No meter shall remain in service without periodic test for a period longer than twenty-five (25) years. Therefore at least 2% of all meters will be tested annually.

In addition to the 2% tested annually, Nolin's statistical meter sample testing will follow **American National Standard Institute ANSI/ASQC Z1. 9-2003 (Sampling Procedures and Tables for Inspection)**. Each test group will be randomly sampled by a computerized process. The Nolin RECC will use an Excel spreadsheet to randomly select meters from each test group.

The **Acceptance Quality Level (AQL)** is defined as the quality level that is the worst tolerable product average when a continuing series of lots is submitted for acceptance sampling.

Due to the $\pm 2\%$ limits, the sample groups shall be tested using an **AQL of 2.5**. This value can be found in **Table A-1**. The upper and lower 2% limits require the use of the Double Specification Limit method as outlined in this ANSI Standard.

As shown in the table below, meters will be divided into separate homogeneous groups based upon manufacturer and type. Similar meters may be further divided by serial number break points. Newly purchased and/or installed meters will be added to the proper group and will be eligible for sample testing the following year. New groups may be added to maintain group size limitation of 1,000 meters. **Table A-2** provides the Sample Size Code Letters that are then to be referenced in **Table B-3**. The "Normal Inspection" portion of the **Table B-3** is then used to determine the sample size for each test group.

PROCEDURE (cont.)

	Manufacturer	Type	Class	Population
1	GE	I210+	200	34,523*
2	GE	I210+	320	1,560*

***The maximum population of any group will not exceed 1,000 with groups listed above being divided into lots of 1,000 based on serial number.**

Randomly selected meters (lot) from each group will be tested in the field. If damaged or non-registering meters have issues that are not a manufacturer's defect or meter was exposed to abnormal conditions, these meters will be replaced by another random selection.

The meters will be tested under full load, and light load.

Watthour meter shall retired when the error in registration exceeds 1% at either light load or full load.

For each lot, calculations will be based on the Double Specification Limit Variability Unknown-Standard Deviation Method. Full Load and light load test results will be evaluated. **Example B-4** in **ANSI/ASQC Z1. 9-2003** demonstrates this calculation method. **Table B-3** is included in this proposal.

An annual report (showing each group's performance) and a copy of the manufacturer's new meter test data will be provided.

Lot performance shall be deemed acceptable if the full-load and light-load performance of the meters within the lot meet the acceptability criteria of the **ANSI** standard. When a group is classified as failed, Nolin RECC will test the entire control group of meters within 18 months once it has failed the applicable governing standard for the control group.

If Nolin RECC should suffer an operational hardship due to this requirement, a request for deviation may be filed.

Nolin RECC will sample test new meters using an Inspection Level I and an AQL 1.0.

PROCEDURE (cont.)

ANSI Part A7, Sample Selection, from the standard, states that **Inspection Level, General II**, shall be used for the discrimination level. Unless otherwise required by the PSC, this level will be in effect for the Nolin RECC program.

Table A-1¹
AQL Conversion Table

For specified AOL values falling within these ranges			Use this AQL value
—	to	0.109	0.10
0.110	to	0.164	0.15
0.165	to	0.279	0.25
0.280	to	0.439	0.40
0.440	to	0.669	0.65
0.700	to	1.09	1.0
1.10	to	1.64	1.5
1.65	to	2.79	2.5
2.80	to	4.39	4.0
4.40	to	6.99	6.5
7.00	to	10.9	10.0

Table A-2²
Sample Size Code Letters

Lot Size			Inspection Levels				
			Special		General		
			S3	S4	I	II	III
2	to	8	B	B	B	B	C
9	to	15	B	B	B	B	D
16	to	25	B	B	B	C	E
26	to	50	B	B	C	D	F
51	to	90	B	B	D	E	G
91	to	150	B	C	E	F	H
151	to	280	B	D	F	G	I
281	to	400	C	E	G	H	J
401	to	500	C	E	G	I	J
501	to	1,200	D	F	H	J	K
1,201	to	3,200	E	G	I	K	L
3,201	to	10,000	F	H	J	L	M
10,001	to	35,000	G	I	K	M	N
35,001	to	150,000	H	J	L	N	P
150,001	to	500,000	H	K	M	P	P
500,001	and	over	H	K	N	P	P

¹ From ANSI/ASQ Z1.9-2003 (R2013) – SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY VARIABLES FOR PERCENT NONCONFORMING

² From ANSI/ASQ Z1.9-2003 (R2013) – SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY VARIABLES FOR PERCENT NONCONFORMING

PROCEDURE (cont.)

Table B-3³

Master Table for Normal and Tightened Inspection for Plans Based on Variability Unknown
(Double Specification Limit and Form 2 – Single Specification Limit)

Sample Size Code Letter	Sample Size	Acceptance Quality Limits (normal inspection)											
		T	.10	.15	.25	.40	.65	1.00	1.50	2.50	4.00	6.50	10.00
		M	M	M	M	M	M	M	M	M	M	M	M
B	3	↓	↓	↓	↓	↓	↓	↓	↓	7.59	18.86	26.94	33.69
C	4	↓	↓	↓	↓	↓	↓	1.49	5.46	10.88	16.41	22.84	29.43
D	5	↓	↓	↓	↓	0.041	1.34	3.33	5.82	9.80	14.37	20.19	26.55
E	7	↓	0.005	0.087	0.421	1.05	2.13	3.54	5.34	8.40	12.19	17.34	23.30
F	10	0.077	0.179	0.349	0.714	1.27	2.14	3.27	4.72	7.26	10.53	15.17	20.73
G	15	0.186	0.311	0.491	0.839	1.33	2.09	3.06	4.32	6.55	9.48	13.74	18.97
H	20	0.228	0.356	0.531	0.864	1.33	2.03	2.93	4.10	6.18	8.95	13.01	18.07
I	25	0.250	0.378	0.551	0.874	1.32	2.00	2.86	3.97	5.98	8.65	12.60	17.55
J	35	0.253	0.373	0.534	0.833	1.24	1.87	2.66	3.70	5.58	8.11	11.89	16.67
K	50	0.243	0.355	0.503	0.778	1.16	1.73	2.47	3.44	5.21	7.61	11.23	15.87
L	75	0.225	0.326	0.461	0.711	1.06	1.59	2.27	3.17	4.83	7.10	10.58	15.07
M	100	0.218	0.315	0.444	0.684	1.02	1.52	2.18	3.06	4.67	6.88	10.29	14.71
N	150	0.202	0.292	0.412	0.636	0.946	1.42	2.05	2.88	4.42	6.56	9.86	14.18
P	200	0.204	0.294	0.414	0.637	0.945	1.42	2.04	2.86	4.39	6.52	9.80	14.11
		.10	.15	.25	.40	.65	1.00	1.50	2.50	4.00	6.50	10.00	
Acceptance Quality Limits (tightened inspection)													

³ From ANSI/ASQ Z1.9-2003 (R2013) – SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY VARIABLES FOR PERCENT NONCONFORMING

COST SAVINGS/CONCLUSION

A substantial reduction in cost will be achieved by implementing the sample meter test method. Once the program is established, only a small percentage of the present labor and testing efforts will be required. This reduction results in a cost savings without compromising single-phase revenue metering accuracy.

Cost Savings to Nolin RECC due to a change to Metering Sample Testing

Assumptions:

Current practice is to test approximately 4,510 meters annually

Contract pricing to test single-phase meter \$6

One full time Nolin RECC meter tech supports meter testing

Test 1,365 sample meters annually

Test 2% meters to insure all meters tested within 25 years

In field testing is \$35 per meter

Current Annual Costs

	Quantity	Cost to Test	Annual Cost
Number of meters	4,510	\$6.00	\$27,060.00
Full time Meter Tech fully burdened cost			147,201.60
Annual Cost of Testing meters			<u>\$174,261.60</u>
Cost of Testing meters over 8 year cycle			<u>\$1,304,092.80</u>

Proposed Sample Testing Costs

	Quantity	Cost to Test	Annual Cost
Number of meters for Sampling Plan	1295	\$35.00	\$45,325.00
2% oldest meters in population	722	\$35.00	\$25,270.00
Annual Cost of Testing meters			<u>\$70,595.00</u>
Cost of Testing meters over 8 year cycle			<u>\$ 564,760.00</u>

Potential Savings over 8 year cycle

\$829,332.80