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December 6, 2017

Darrell Nitschke  
Director of Administration/Executive Secretary  
North Dakota Public Service Commission  
600 East Boulevard, Dept. 408  
Bismarck, ND 58505-0480

**RE: Otter Tail Power Company's 2017 Sample Meter Test Performance Report**

Dear Mr. Nitschke:

Pursuant to North Dakota Rule 69-06-02-28(3), attached are results from the 2017 single-phase kWh sample meter test program for Otter Tail Power Company. There were six groups of meters selected for the 2017 Sample Test. Criterion for selecting the groups, as set forth in the tariff, was based on the time period the meters were purchased, manufacturer and model of meters. The meters were grouped as follow:

1. GE Solid State Meters
2. Itron Solid State Meters
3. GE Electromechanical Meters
4. SI Electromechanical Meters
5. LG Electromechanical Meters
6. GE Model I50S Meters

All groups passed the test and are performing satisfactorily. In 2013, the ABB meters manufactured from 1975 to 1982 failed the sample test. As part of the tariff, the removal of these meters will be complete by the end of the year 2018. All other meter groups that failed the sample test in past years have been removed from service.

Darrell Nitschke  
December 6, 2017  
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An electronic copy of this filing is being sent to you at [dnitschk@nd.gov](mailto:dnitschk@nd.gov) and to [ndpsc@nd.gov](mailto:ndpsc@nd.gov). These items are filed for your information. If you have any questions, please contact me at (218) 739-8878 or [amandelke@otpc.com](mailto:amandelke@otpc.com).

Sincerely,

*/s/ AMY MANDELKE*  
Amy Mandelke  
Load Researcher, Regulatory Administration

ljh  
Enclosures  
By electronic filing





**SAMPLE METER TEST CALCULATION FORM  
METERS IN SERVICE AT OTTER TAIL POWER CO.**

REFERENCE - TABLES A-2, B-3, B-4, B-5, AND EXAMPLE B-3 OF MIL-STD-414.

TYPE OF METERS IN THIS SAMPLE: **GE I70S meters**

LOT SIZE **29775** SAMPLE SIZE n= **100** AQL **2.5**

FL BAR X **99.900** FL SIGMA **0.353**  
LL BAR X **99.503** LL SIGMA **0.707**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL \text{ BAR } X}{FL \text{ SIGMA}}$  =  $\frac{102 - 99.9}{0.353}$  = **5.95** table b-5 calculations

QU=	5.95
n=	100
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL \text{ BAR } X}{LL \text{ SIGMA}}$  =  $\frac{102 - 99.503}{0.707}$  = **3.53**

QU=	3.53
n=	100
P=	<b>0.01400</b>

From Table B-5 = **0.000** % PU FL above 102.0%

**0.014** % PU LL above 102.0 %

ESTIMATE OF LOT BELOW 98.0%

FL QL =  $\frac{FL \text{ BAR } X - 98}{FL \text{ SIGMA}}$  =  $\frac{99.9 - 98}{0.353}$  = **5.38** table b-5 calculations

QL=	5.38
n=	100
P=	<b>0.00000</b>

LL QL =  $\frac{LL \text{ BAR } X - 98}{LL \text{ SIGMA}}$  =  $\frac{99.503 - 98}{0.707}$  = **2.13**

QL=	2.13
n=	100
P=	<b>1.58000</b>

From table B-5 = **0.000** % PL FL below 98.0 %

**1.580** % PL LL below 98.0 %

TOTAL PERCENT DEFECTIVE

Full Load P = PU FL + PL FL      0.000 + 0.000 = **0.000**  
Light Load P = PU LL + PL LL      0.014 + 1.580 = **1.594**

ALLOWABLE PERCENT DEFECTIVE: TABLE B-3      **4.69**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)      99.900 + 1.412      UFL = **101.312**  
LFL = FL BAR X - (4 x FL Sigma)      99.900 - 1.412      LFL = 98.488  
  
ULL = LL BAR X + (4 x LL Sigma)      99.503 + 2.828      ULL = **102.331**  
LLL = LL BAR X - (4 x LL Sigma)      99.503 - 2.828      LLL = **96.675**

Lot is acceptable      **X**      Lot is unacceptable      \_\_\_\_\_

Tested & Reported by: Steve Ness      Approved: \_\_\_\_\_

**SAMPLE METER TEST CALCULATION FORM  
METERS IN SERVICE AT OTTER TAIL POWER CO.**

REFERENCE - TABLES A-2, B-3, B-4, B-5, AND EXAMPLE B-3 OF MIL-STD-414.

TYPE OF METERS IN THIS SAMPLE: **J4S and J5S meters**

LOT SIZE **31471** SAMPLE SIZE n= **100** AQL **2.5**  
 FL BAR X **99.404** FL SIGMA **5.051**  
 LL BAR X **99.792** LL SIGMA **0.497**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL\ BAR\ X}{FL\ SIGMA} = \frac{102 - 99.404}{5.051} = \frac{2.596}{5.051} = \mathbf{0.51}$  table b-5 calculations

QU=	0.51
n=	100
P=	<b>30.54000</b>

LL QU =  $\frac{102 - LL\ BAR\ X}{LL\ SIGMA} = \frac{102 - 99.792}{0.497} = \frac{2.208}{0.497} = \mathbf{4.44}$  table b-5 calculations

QU=	4.44
n=	100
P=	<b>0.00000</b>

From Table B-5 = **30.540** % PU FL above 102.0%  
**0.000** % PU LL above 102.0 %

ESTIMATE OF LOT BELOW 98.0%

FL QL =  $\frac{FL\ BAR\ X - 98}{FL\ SIGMA} = \frac{99.404 - 98}{5.051} = \frac{1.404}{5.051} = \mathbf{0.28}$  table b-5 calculations

QL=	0.28
n=	100
P=	<b>38.24000</b>

LL QL =  $\frac{LL\ BAR\ X - 98}{LL\ SIGMA} = \frac{99.792 - 98}{0.497} = \frac{1.792}{0.497} = \mathbf{3.61}$  table b-5 calculations

QL=	3.61
n=	100
P=	<b>0.01000</b>

From table B-5 = **38.240** % PL FL below 98.0 %  
**0.010** % PL LL below 98.0 %

TOTAL PERCENT DEFECTIVE

Full Load P = PU FL + PL FL  $\frac{30.540}{30.540} + \frac{38.240}{38.240} = \mathbf{68.780}$   
 Light Load P = PU LL + PL LL  $\frac{0.000}{0.000} + \frac{0.010}{0.010} = \mathbf{0.010}$   
 ALLOWABLE PERCENT DEFECTIVE: TABLE B-3 **4.69**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $99.404 + 20.204$  UFL = **119.608**  
 LFL = FL BAR X - (4 x FL Sigma)  $99.404 - 20.204$  LFL = **79.200**  
 ULL = LL BAR X + (4 x LL Sigma)  $99.792 + 1.988$  ULL = **101.780**  
 LLL = LL BAR X - (4 x LL Sigma)  $99.792 - 1.988$  LLL = **97.804**

Lot is acceptable \_\_\_\_\_ Lot is unacceptable **X**

Tested & Reported by: Steve Ness Approved: \_\_\_\_\_

**SAMPLE METER TEST CALCULATION FORM  
METERS IN SERVICE AT OTTER TAIL POWER CO.**

REFERENCE - TABLES A-2, B-3, B-4, B-5, AND EXAMPLE B-3 OF MIL-STD-414.

TYPE OF METERS IN THIS SAMPLE: **J4S and J5S OUTLIER**

LOT SIZE **31471** SAMPLE SIZE n= **99** AQL **2.5**

FL BAR X **99.908** FL SIGMA **0.370**  
LL BAR X **99.804** LL SIGMA **0.486**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL\ BAR\ X}{FL\ SIGMA} = \frac{102 - 99.908}{0.37} = \frac{2.092}{0.370} = 5.65$  table b-5 calculations

QU=	5.65
n=	99
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL\ BAR\ X}{LL\ SIGMA} = \frac{102 - 99.804}{0.486} = \frac{2.196}{0.486} = 4.52$

QU=	4.52
n=	99
P=	<b>0.00000</b>

From Table B-5 = **0.000** % PU FL above 102.0%

**0.000** % PU LL above 102.0 %

ESTIMATE OF LOT BELOW 98.0%

FL QL =  $\frac{FL\ BAR\ X - 98}{FL\ SIGMA} = \frac{99.908 - 98}{0.37} = \frac{1.908}{0.370} = 5.16$  table b-5 calculations

QL=	5.16
n=	99
P=	<b>0.00000</b>

LL QL =  $\frac{LL\ BAR\ X - 98}{LL\ SIGMA} = \frac{99.804 - 98}{0.486} = \frac{1.804}{0.486} = 3.71$

QL=	3.71
n=	99
P=	<b>0.00600</b>

From table B-5 = **0.000** % PL FL below 98.0 %

**0.006** % PL LL below 98.0 %

TOTAL PERCENT DEFECTIVE

Full Load P = PU FL + PL FL  $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \frac{0.000}{0.000}$   
Light Load P = PU LL + PL LL  $\frac{0.000}{0.000} + \frac{0.006}{0.000} = \frac{0.006}{0.000}$

ALLOWABLE PERCENT DEFECTIVE: TABLE B-3 **4.69**

**OUTLIERS**

UFL = FL BAR X + (4 x FL Sigma)  $99.908 + 1.48$  UFL = **101.388**  
LFL = FL BAR X - (4 x FL Sigma)  $99.908 - 1.48$  LFL = **98.428**  
ULL = LL BAR X + (4 x LL Sigma)  $99.804 + 1.944$  ULL = **101.748**  
LLL = LL BAR X - (4 x LL Sigma)  $99.804 - 1.944$  LLL = **97.860**

Lot is acceptable     X     Lot is unacceptable                     

Tested & Reported by: Steve Ness Approved:

**SAMPLE METER TEST CALCULATION FORM  
METERS IN SERVICE AT OTTER TAIL POWER CO.**

REFERENCE - TABLES A-2, B-3, B-4, B-5, AND EXAMPLE B-3 OF MIL-STD-414.

TYPE OF METERS IN THIS SAMPLE: **MS and MX meters**

LOT SIZE **16483** SAMPLE SIZE n= **75** AQL **2.5**

FL BAR X **99.995** FL SIGMA **0.257**  
LL BAR X **99.532** LL SIGMA **0.683**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL\ BAR\ X}{FL\ SIGMA} = \frac{102 - 99.995}{0.257} = \frac{2.005}{0.257} = 7.80$  table b-5 calculations

QU=	7.80
n=	75
P=	0.00000

LL QU =  $\frac{102 - LL\ BAR\ X}{LL\ SIGMA} = \frac{102 - 99.532}{0.683} = \frac{2.468}{0.683} = 3.61$

QU=	3.61
n=	75
P=	0.00800

From Table B-5 = **0.000** % PU FL above 102.0%  
**0.008** % PU LL above 102.0 %

ESTIMATE OF LOT BELOW 98.0%

FL QL =  $\frac{FL\ BAR\ X - 98}{FL\ SIGMA} = \frac{99.995 - 98}{0.257} = \frac{1.995}{0.257} = 7.76$  table b-5 calculations

QL=	7.76
n=	75
P=	0.00000

LL QL =  $\frac{LL\ BAR\ X - 98}{LL\ SIGMA} = \frac{99.532 - 98}{0.683} = \frac{1.532}{0.683} = 2.24$

QL=	2.24
n=	75
P=	1.15400

From table B-5 = **0.000** % PL FL below 98.0 %  
**1.154** % PL LL below 98.0 %

TOTAL PERCENT DEFECTIVE

Full Load P = PU FL + PL FL  $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \underline{0.000}$   
Light Load P = PU LL + PL LL  $\frac{0.008}{0.008} + \frac{1.154}{1.154} = \underline{1.162}$

ALLOWABLE PERCENT DEFECTIVE: TABLE B-3 **4.87**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $99.995 + 1.028$  UFL = **101.023**  
LFL = FL BAR X - (4 x FL Sigma)  $99.995 - 1.028$  LFL = **98.967**  
ULL = LL BAR X + (4 x LL Sigma)  $99.532 + 2.732$  ULL = **102.264**  
LLL = LL BAR X - (4 x LL Sigma)  $99.532 - 2.732$  LLL = **96.800**

Lot is acceptable X Lot is unacceptable \_\_\_\_\_

Tested & Reported by: Steve Ness Approved: \_\_\_\_\_

