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October 2, 2018

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 2018 Sample Meter Test Performance Report**

Dear Mr. Nitschke:

Pursuant to North Dakota Rule 69-06-02-28(3), attached are results from the 2018 single-phase kWh sample meter test program for Otter Tail Power Company. There were nine groups of meters selected for the 2018 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. Itron Solid State C1S Meters
2. GE Electromechanical I70S Meters
3. SI Electromechanical J5S Meters
4. LG Electromechanical MS Meters
5. GE Solid State I210 Meters
6. SI Electromechanical Model J4S Meters
7. GE Solid-State Model I210+ Meters
8. GE Model I50S Meters
9. LG Electromechanical Model MX 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

October 2, 2018

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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) 739-8627 or [mhaagenson@otpc.com](mailto:mhaagenson@otpc.com).

Sincerely,

*/s/ MICHAEL HAAGENSON*

Michael Haagenson

Load Researcher, Regulatory Administration

mmo

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: **Itron C1S meters**

LOT SIZE **38933** SAMPLE SIZE n= **103** AQL **2.5**

FL BAR X **99.996** FL SIGMA **0.206**  
LL BAR X **99.873** LL SIGMA **0.176**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL \text{ BAR X}}{FL \text{ SIGMA}} = \frac{102 - 99.996}{0.206} = \frac{2.004}{0.206} = \mathbf{9.73}$  table b-5 calculations

QU=	9.73
n=	103
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL \text{ BAR X}}{LL \text{ SIGMA}} = \frac{102 - 99.873}{0.176} = \frac{2.127}{0.176} = \mathbf{12.09}$  table b-5 calculations

QU=	12.09
n=	103
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 =  $\frac{FL \text{ BAR X} - 98}{FL \text{ SIGMA}} = \frac{99.996 - 98}{0.206} = \frac{1.996}{0.206} = \mathbf{9.69}$  table b-5 calculations

QL=	9.69
n=	103
P=	<b>0.00000</b>

LL QL =  $\frac{LL \text{ BAR X} - 98}{LL \text{ SIGMA}} = \frac{99.873 - 98}{0.176} = \frac{1.873}{0.176} = \mathbf{10.64}$  table b-5 calculations

QL=	10.64
n=	103
P=	<b>0.00000</b>

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

TOTAL PERCENT DEFECTIVE

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

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $99.996 + 0.824$  UFL = **100.820**  
LFL = FL BAR X - (4 x FL Sigma)  $99.996 - 0.824$  LFL = **99.172**  
ULL = LL BAR X + (4 x LL Sigma)  $99.873 + 0.704$  ULL = **100.577**  
LLL = LL BAR X - (4 x LL Sigma)  $99.873 - 0.704$  LLL = **99.169**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson

**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 **28764** SAMPLE SIZE n= **102** AQL **2.5**

FL BAR X **99.899** FL SIGMA **0.276**  
LL BAR X **99.532** LL SIGMA **0.608**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL \text{ BAR X}}{FL \text{ SIGMA}} = \frac{102 - 99.899}{0.276} = \frac{2.101}{0.276} = \mathbf{7.61}$  table b-5 calculations

QU=	7.61
n=	102
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL \text{ BAR X}}{LL \text{ SIGMA}} = \frac{102 - 99.532}{0.608} = \frac{2.468}{0.608} = \mathbf{4.06}$  table b-5 calculations

QU=	4.06
n=	102
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 =  $\frac{FL \text{ BAR X} - 98}{FL \text{ SIGMA}} = \frac{99.899 - 98}{0.276} = \frac{1.899}{0.276} = \mathbf{6.88}$  table b-5 calculations

QL=	6.88
n=	102
P=	<b>0.00000</b>

LL QL =  $\frac{LL \text{ BAR X} - 98}{LL \text{ SIGMA}} = \frac{99.532 - 98}{0.608} = \frac{1.532}{0.608} = \mathbf{2.52}$  table b-5 calculations

QL=	2.52
n=	102
P=	<b>0.53000</b>

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

TOTAL PERCENT DEFECTIVE

Full Load P = PU FL + PL FL  $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \mathbf{0.000}$   
Light Load P = PU LL + PL LL  $\frac{0.000}{0.000} + \frac{0.530}{0.530} = \mathbf{0.530}$

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $99.899 + 1.104$  UFL = **101.003**  
LFL = FL BAR X - (4 x FL Sigma)  $99.899 - 1.104$  LFL = **98.795**  
ULL = LL BAR X + (4 x LL Sigma)  $99.532 + 2.432$  ULL = **101.964**  
LLL = LL BAR X - (4 x LL Sigma)  $99.532 - 2.432$  LLL = **97.100**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson

**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: **Schlumberger J5S meters**

LOT SIZE **20386** SAMPLE SIZE n= **78** AQL **2.5**

FL BAR X **99.821** FL SIGMA **0.404**  
LL BAR X **99.775** LL SIGMA **0.566**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL\ BAR\ X}{FL\ SIGMA} = \frac{102 - 99.821}{0.404} = \frac{2.179}{0.404} = 5.39$  table b-5 calculations

QU=	5.39
n=	78
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL\ BAR\ X}{LL\ SIGMA} = \frac{102 - 99.775}{0.566} = \frac{2.225}{0.566} = 3.93$

QU=	3.93
n=	78
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 =  $\frac{FL\ BAR\ X - 98}{FL\ SIGMA} = \frac{99.821 - 98}{0.404} = \frac{1.821}{0.404} = 4.51$  table b-5 calculations

QL=	4.51
n=	78
P=	<b>0.00000</b>

LL QL =  $\frac{LL\ BAR\ X - 98}{LL\ SIGMA} = \frac{99.775 - 98}{0.566} = \frac{1.775}{0.566} = 3.14$

QL=	3.14
n=	78
P=	<b>0.05900</b>

From table B-5 = **0.000** % PL FL below 98.0 %  
**0.059** % 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  $\frac{0.000}{0.000} + \frac{0.059}{0.059} = \frac{0.059}{0.059}$

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $99.821 + 1.616$  UFL = **101.437**  
LFL = FL BAR X - (4 x FL Sigma)  $99.821 - 1.616$  LFL = **98.205**  
ULL = LL BAR X + (4 x LL Sigma)  $99.775 + 2.264$  ULL = **102.039**  
LLL = LL BAR X - (4 x LL Sigma)  $99.775 - 2.264$  LLL = **97.511**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson

**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: **Landis & Gyr MS meters**

LOT SIZE **15025** SAMPLE SIZE n= **76** AQL **2.5**

FL BAR X **99.962** FL SIGMA **0.315**  
LL BAR X **99.368** LL SIGMA **0.700**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL \text{ BAR X}}{FL \text{ SIGMA}} = \frac{102 - 99.962}{0.315} = \frac{2.038}{0.315} = \mathbf{6.47}$  table b-5 calculations

QU=	6.47
n=	76
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL \text{ BAR X}}{LL \text{ SIGMA}} = \frac{102 - 99.368}{0.7} = \frac{2.632}{0.700} = \mathbf{3.76}$

QU=	3.76
n=	76
P=	<b>0.00400</b>

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

ESTIMATE OF LOT BELOW 98.0%

FL QL =  $\frac{FL \text{ BAR X} - 98}{FL \text{ SIGMA}} = \frac{99.962 - 98}{0.315} = \frac{1.962}{0.315} = \mathbf{6.23}$  table b-5 calculations

QL=	6.23
n=	76
P=	<b>0.00000</b>

LL QL =  $\frac{LL \text{ BAR X} - 98}{LL \text{ SIGMA}} = \frac{99.368 - 98}{0.7} = \frac{1.368}{0.700} = \mathbf{1.95}$

QL=	1.95
n=	76
P=	<b>2.45000</b>

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

TOTAL PERCENT DEFECTIVE

Full Load P = PU FL + PL FL  $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \mathbf{0.000}$   
Light Load P = PU LL + PL LL  $\frac{0.004}{0.004} + \frac{2.450}{2.450} = \mathbf{2.454}$

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $99.962 + 1.26$  UFL = **101.222**  
LFL = FL BAR X - (4 x FL Sigma)  $99.962 - 1.26$  LFL = **98.702**  
ULL = LL BAR X + (4 x LL Sigma)  $99.368 + 2.8$  ULL = **102.168**  
LLL = LL BAR X - (4 x LL Sigma)  $99.368 - 2.8$  LLL = **96.568**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson

**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: **Landis & Gyr MS meters**

LOT SIZE **15025** SAMPLE SIZE n= **77** AQL **2.5**

FL BAR X **99.973** FL SIGMA **0.326**  
LL BAR X **99.477** LL SIGMA **1.181**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL \text{ BAR } X}{FL \text{ SIGMA}}$  =  $\frac{102 - 99.973}{0.326}$  = **6.22** table b-5 calculations

QU=	6.22
n=	77
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL \text{ BAR } X}{LL \text{ SIGMA}}$  =  $\frac{102 - 99.477}{1.181}$  = **2.14** table b-5 calculations

QU=	2.14
n=	77
P=	<b>1.51000</b>

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

ESTIMATE OF LOT BELOW 98.0%

FL QL =  $\frac{FL \text{ BAR } X - 98}{FL \text{ SIGMA}}$  =  $\frac{99.973 - 98}{0.326}$  = **6.05** table b-5 calculations

QL=	6.05
n=	77
P=	<b>0.00000</b>

LL QL =  $\frac{LL \text{ BAR } X - 98}{LL \text{ SIGMA}}$  =  $\frac{99.477 - 98}{1.181}$  = **1.25** table b-5 calculations

QL=	1.25
n=	77
P=	<b>10.52000</b>

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

TOTAL PERCENT DEFECTIVE

Full Load P = PU FL + PL FL =  $\frac{0.000}{0.000} + \frac{0.000}{0.000}$  = **0.000**  
Light Load P = PU LL + PL LL =  $\frac{1.510}{1.510} + \frac{10.520}{10.520}$  = **12.030**

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) = 99.973 + 1.304 UFL = **101.277**  
LFL = FL BAR X - (4 x FL Sigma) = 99.973 - 1.304 LFL = **98.669**  
ULL = LL BAR X + (4 x LL Sigma) = 99.477 + 4.724 ULL = **104.201**  
LLL = LL BAR X - (4 x LL Sigma) = 99.477 - 4.724 LLL = **94.753**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson

**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 I210 meters**

LOT SIZE **11370** SAMPLE SIZE n= **81** AQL **2.5**

FL BAR X **100.000** FL SIGMA **0.087**  
LL BAR X **100.002** LL SIGMA **0.085**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL \text{ BAR } X}{FL \text{ SIGMA}}$  =  $\frac{102 - 100}{0.087}$  =  $\frac{2.000}{0.087}$  = **22.99** table b-5 calculations

QU=	22.99
n=	81
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL \text{ BAR } X}{LL \text{ SIGMA}}$  =  $\frac{102 - 100.002}{0.085}$  =  $\frac{1.998}{0.085}$  = **23.51**

QU=	23.51
n=	81
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 =  $\frac{FL \text{ BAR } X - 98}{FL \text{ SIGMA}}$  =  $\frac{100 - 98}{0.087}$  =  $\frac{2.000}{0.087}$  = **22.99** table b-5 calculations

QL=	22.99
n=	81
P=	<b>0.00000</b>

LL QL =  $\frac{LL \text{ BAR } X - 98}{LL \text{ SIGMA}}$  =  $\frac{100.002 - 98}{0.085}$  =  $\frac{2.002}{0.085}$  = **23.55**

QL=	23.55
n=	81
P=	<b>0.00000</b>

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

TOTAL PERCENT DEFECTIVE

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

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) = 100.000 + 0.348 UFL = **100.348**  
LFL = FL BAR X - (4 x FL Sigma) = 100.000 - 0.348 LFL = **99.652**  
ULL = LL BAR X + (4 x LL Sigma) = 100.002 + 0.34 ULL = **100.342**  
LLL = LL BAR X - (4 x LL Sigma) = 100.002 - 0.34 LLL = **99.662**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson

**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: **Schlumberger J4S meters**

LOT SIZE **10064** SAMPLE SIZE n= **77** AQL **2.5**

FL BAR X **99.867** FL SIGMA **0.397**  
LL BAR X **99.674** LL SIGMA **0.710**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL \text{ BAR X}}{FL \text{ SIGMA}} = \frac{102 - 99.867}{0.397} = \frac{2.133}{0.397} = \underline{\underline{5.37}}$  table b-5 calculations

QU=	5.37
n=	77
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL \text{ BAR X}}{LL \text{ SIGMA}} = \frac{102 - 99.674}{0.71} = \frac{2.326}{0.710} = \underline{\underline{3.28}}$  table b-5 calculations

QU=	3.28
n=	77
P=	<b>0.03400</b>

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

ESTIMATE OF LOT BELOW 98.0%

FL QL =  $\frac{FL \text{ BAR X} - 98}{FL \text{ SIGMA}} = \frac{99.867 - 98}{0.397} = \frac{1.867}{0.397} = \underline{\underline{4.70}}$  table b-5 calculations

QL=	4.70
n=	77
P=	<b>0.00000</b>

LL QL =  $\frac{LL \text{ BAR X} - 98}{LL \text{ SIGMA}} = \frac{99.674 - 98}{0.71} = \frac{1.674}{0.710} = \underline{\underline{2.36}}$  table b-5 calculations

QL=	2.36
n=	77
P=	<b>0.82300</b>

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

TOTAL PERCENT DEFECTIVE

Full Load P = PU FL + PL FL  $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \underline{\underline{0.000}}$   
Light Load P = PU LL + PL LL  $\frac{0.034}{0.034} + \frac{0.823}{0.823} = \underline{\underline{0.857}}$

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $99.867 + 1.588$  UFL = **101.455**  
LFL = FL BAR X - (4 x FL Sigma)  $99.867 - 1.588$  LFL = **98.279**  
  
ULL = LL BAR X + (4 x LL Sigma)  $99.674 + 2.84$  ULL = **102.514**  
LLL = LL BAR X - (4 x LL Sigma)  $99.674 - 2.84$  LLL = **96.834**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson

**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 I210+ meters**

LOT SIZE **5994** SAMPLE SIZE n= **77** AQL **2.5**

FL BAR X **99.885** FL SIGMA **0.059**  
LL BAR X **99.896** LL SIGMA **0.058**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL \text{ BAR } X}{FL \text{ SIGMA}}$  =  $\frac{102 - 99.885}{0.059}$  =  $\frac{2.115}{0.059}$  = **35.85** table b-5 calculations

QU=	35.85
n=	77
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL \text{ BAR } X}{LL \text{ SIGMA}}$  =  $\frac{102 - 99.896}{0.058}$  =  $\frac{2.104}{0.058}$  = **36.28** table b-5 calculations

QU=	36.28
n=	77
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 =  $\frac{FL \text{ BAR } X - 98}{FL \text{ SIGMA}}$  =  $\frac{99.885 - 98}{0.059}$  =  $\frac{1.885}{0.059}$  = **31.95** table b-5 calculations

QL=	31.95
n=	77
P=	<b>0.00000</b>

LL QL =  $\frac{LL \text{ BAR } X - 98}{LL \text{ SIGMA}}$  =  $\frac{99.896 - 98}{0.058}$  =  $\frac{1.896}{0.058}$  = **32.69** table b-5 calculations

QL=	32.69
n=	77
P=	<b>0.00000</b>

From table B-5 = **0.000** % PL FL below 98.0 %  
**0.000** % 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  $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \frac{0.000}{0.000}$

ALLOWABLE PERCENT DEFECTIVE: TABLE B-3 **5.2**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $99.885 + 0.236$  UFL = **100.121**  
LFL = FL BAR X - (4 x FL Sigma)  $99.885 - 0.236$  LFL = **99.649**  
ULL = LL BAR X + (4 x LL Sigma)  $99.896 + 0.232$  ULL = **100.128**  
LLL = LL BAR X - (4 x LL Sigma)  $99.896 - 0.232$  LLL = **99.664**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson

**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 I50S meters**

LOT SIZE **2732** SAMPLE SIZE n= **47** AQL **2.5**

FL BAR X **100.070** FL SIGMA **0.252**  
LL BAR X **99.932** LL SIGMA **0.592**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL\ BAR\ X}{FL\ SIGMA} = \frac{102 - 100.07}{0.252} = \frac{1.930}{0.252} = 7.66$  table b-5 calculations

QU=	7.66
n=	47
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL\ BAR\ X}{LL\ SIGMA} = \frac{102 - 99.932}{0.592} = \frac{2.068}{0.592} = 3.49$

QU=	3.49
n=	47
P=	<b>0.00700</b>

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

ESTIMATE OF LOT BELOW 98.0%

FL QL =  $\frac{FL\ BAR\ X - 98}{FL\ SIGMA} = \frac{100.07 - 98}{0.252} = \frac{2.070}{0.252} = 8.21$  table b-5 calculations

QL=	8.21
n=	47
P=	<b>0.00000</b>

LL QL =  $\frac{LL\ BAR\ X - 98}{LL\ SIGMA} = \frac{99.932 - 98}{0.592} = \frac{1.932}{0.592} = 3.26$

QL=	3.26
n=	47
P=	<b>0.02300</b>

From table B-5 = **0.000** % PL FL below 98.0 %  
**0.023** % 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  $\frac{0.007}{0.007} + \frac{0.023}{0.023} = \frac{0.030}{0.030}$

ALLOWABLE PERCENT DEFECTIVE: TABLE B-3 **5.58**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $100.070 + 1.008$  UFL = **101.078**  
LFL = FL BAR X - (4 x FL Sigma)  $100.070 - 1.008$  LFL = **99.062**  
ULL = LL BAR X + (4 x LL Sigma)  $99.932 + 2.368$  ULL = **102.300**  
LLL = LL BAR X - (4 x LL Sigma)  $99.932 - 2.368$  LLL = **97.564**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson

**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: **Landis & Gyr MX meters**

LOT SIZE **864** SAMPLE SIZE n= **48** AQL **2.5**

FL BAR X **99.821** FL SIGMA **0.345**  
LL BAR X **99.659** LL SIGMA **0.381**

ESTIMATE OF LOT ABOVE 102.0%

FL QU =  $\frac{102 - FL \text{ BAR X}}{FL \text{ SIGMA}} = \frac{102 - 99.821}{0.345} = \frac{2.179}{0.345} = \mathbf{6.32}$  table b-5 calculations

QU=	6.32
n=	48
P=	<b>0.00000</b>

LL QU =  $\frac{102 - LL \text{ BAR X}}{LL \text{ SIGMA}} = \frac{102 - 99.659}{0.381} = \frac{2.341}{0.381} = \mathbf{6.14}$  table b-5 calculations

QU=	6.14
n=	48
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 =  $\frac{FL \text{ BAR X} - 98}{FL \text{ SIGMA}} = \frac{99.821 - 98}{0.345} = \frac{1.821}{0.345} = \mathbf{5.28}$  table b-5 calculations

QL=	5.28
n=	48
P=	<b>0.00000</b>

LL QL =  $\frac{LL \text{ BAR X} - 98}{LL \text{ SIGMA}} = \frac{99.659 - 98}{0.381} = \frac{1.659}{0.381} = \mathbf{4.35}$  table b-5 calculations

QL=	4.35
n=	48
P=	<b>0.00000</b>

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

TOTAL PERCENT DEFECTIVE

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

ALLOWABLE PERCENT DEFECTIVE: TABLE B-3 **5.57**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)  $99.821 + 1.38$  UFL = **101.201**  
LFL = FL BAR X - (4 x FL Sigma)  $99.821 - 1.38$  LFL = **98.441**  
ULL = LL BAR X + (4 x LL Sigma)  $99.659 + 1.524$  ULL = **101.183**  
LLL = LL BAR X - (4 x LL Sigma)  $99.659 - 1.524$  LLL = **98.135**

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

Tested & Reported by: Steve Ness Approved: Ben Christenson