15 South Cascade Street
PO Box 496
Fergus Falls, Minnesota 56538-0496
218 739-8200
www.otpco.com (web site)

December 30, 2019

Steve Kahl
Executive Secretary
ND Public Service Commission
600 East Boulevard Avenue
Bismarck, ND 58505-0480

**RE: Otter Tail Power Company's 2019 Sample Meter Test Performance Report**

Dear Mr. Kahl:

Pursuant to North Dakota Rule 69-09-02-28(3), attached are results from the 2019 single-phase kWh sample meter test program for Otter Tail Power Company. There were nine groups of meters selected for the 2019 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.



*An Equal Opportunity Employer*

AN OTTERTAIL COMPANY

An electronic copy of this filing is being sent to you at ndpsc@nd.gov. These items are filed for your information. If you have any questions, please contact me at (218) 739-8401 or asavageau@otpco.com.

Sincerely,

*/s/ ANNALISE SAVAGEAU*
Annalise Savageau
Load Researcher, Regulatory Administration

cjh
Enclosures
By electronic filing

# OTTER TAIL POWER CO.

12/20/2019

## 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 **42423** SAMPLE SIZE n= **102** AQL **2.5**

***FL BAR X*** **99.965** ***FL SIGMA*** **0.146**

***LL BAR X*** **99.895** ***LL SIGMA*** **0.109**

### ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - \textit{FL BAR X}}{\textit{FL SIGMA}}$ $\frac{102 - 99.965}{0.146}$ = $\frac{2.035}{0.146}$ = **13.94**

LL QU = $\frac{102 - \textit{LL BAR X}}{\textit{LL SIGMA}}$ $\frac{102 - 99.895}{0.109}$ = $\frac{2.105}{0.109}$ = **19.31**

table b-5 calculations

| | |
|---|---|
| QU= | 13.94 |
| n= | 102 |
| P= | **0.00000** |

| | |
|---|---|
| QU= | 19.31 |
| n= | 102 |
| P= | **0.00000** |

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 = $\frac{\textit{FL BAR X} - 98}{\textit{FL SIGMA}}$ $\frac{99.965 - 98}{0.146}$ = $\frac{1.965}{0.146}$ = **13.46**

LL QL = $\frac{\textit{LL BAR X} - 98}{\textit{LL SIGMA}}$ $\frac{99.895 - 98}{0.109}$ = $\frac{1.895}{0.109}$ = **17.39**

table b-5 calculations

| | |
|---|---|
| QL= | 13.46 |
| n= | 102 |
| P= | **0.00000** |

| | |
|---|---|
| QL= | 17.39 |
| n= | 102 |
| P= | **0.00000** |

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 0.000 + 0.000 = **0.000**

Light Load P = PU LL + PL LL 0.000 + 0.000 = **0.000**

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

### OUTLIERS

UFL = **FL *BAR X*** + (4 x **FL Sigma**) 99.965 + 0.584 UFL = **100.549**

LFL = **FL *BAR X*** - (4 x **FL Sigma**) 99.965 - 0.584 LFL = 99.381

ULL = **LL *BAR X*** + (4 x **LL Sigma**) 99.895 + 0.436 ULL = **100.331**

LLL = **LL *BAR X*** - (4 x **LL Sigma**) 99.895 - 0.436 LLL = **99.459**

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: *Steve Ness*

Approved: 12/20/2019

# OTTER TAIL POWER CO.

12/20/2019

## 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 **28070** SAMPLE SIZE n= **101** AQL **2.5**

***FL BAR X*** **99.931** ***FL SIGMA*** **0.259**

***LL BAR X*** **99.564** ***LL SIGMA*** **0.499**

### ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA}$ $\frac{102 - 99.931}{0.259}$ = $\frac{2.069}{0.259}$ = **7.99**

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA}$ $\frac{102 - 99.564}{0.499}$ = $\frac{2.436}{0.499}$ = **4.88**

table b-5 calculations

| | |
|---|---|
| QU= | 7.99 |
| n= | 101 |
| P= | **0.00000** |

| | |
|---|---|
| QU= | 4.88 |
| n= | 101 |
| P= | **0.00000** |

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 = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA}$ $\frac{99.931 - 98}{0.259}$ = $\frac{1.931}{0.259}$ = **7.46**

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA}$ $\frac{99.564 - 98}{0.499}$ = $\frac{1.564}{0.499}$ = **3.13**

table b-5 calculations

| | |
|---|---|
| QL= | 7.46 |
| n= | 101 |
| P= | **0.00000** |

| | |
|---|---|
| QL= | 3.13 |
| n= | 101 |
| P= | **0.06800** |

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

**0.068** % 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 0.000 + 0.068 = **0.068**

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

### OUTLIERS

UFL = **FL *BAR X*** + (4 x **FL Sigma**) 99.931 + 1.036 UFL = **100.967**

LFL = **FL *BAR X*** - (4 x **FL Sigma**) 99.931 - 1.036 LFL = 98.895

ULL = **LL *BAR X*** + (4 x **LL Sigma**) 99.564 + 1.996 ULL = **101.560**

LLL = **LL *BAR X*** - (4 x **LL Sigma**) 99.564 - 1.996 LLL = **97.568**

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: *Steve Ness*

Approved: 12/20/2019

# OTTER TAIL POWER CO.

12/20/2019

## 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 **19929** SAMPLE SIZE n= **80** AQL **2.5**

***FL BAR X*** **99.915** ***FL SIGMA*** **0.476**

***LL BAR X*** **99.843** ***LL SIGMA*** **0.616**

### ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA}$ $\frac{102 - 99.915}{0.476}$ = $\frac{2.085}{0.476}$ = **4.38**

table b-5 calculations

| | |
|---|---|
| QU= | 4.38 |
| n= | 80 |
| P= | **0.00000** |

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA}$ $\frac{102 - 99.843}{0.616}$ = $\frac{2.157}{0.616}$ = **3.50**

| | |
|---|---|
| QU= | 3.50 |
| n= | 80 |
| P= | **0.01300** |

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

**0.013** % PU LL above 102.0 %

### ESTIMATE OF LOT BELOW 98.0%

FL QL = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA}$ $\frac{99.915 - 98}{0.476}$ = $\frac{1.915}{0.476}$ = **4.02**

table b-5 calculations

| | |
|---|---|
| QL= | 4.02 |
| n= | 80 |
| P= | **0.00000** |

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA}$ $\frac{99.843 - 98}{0.616}$ = $\frac{1.843}{0.616}$ = **2.99**

| | |
|---|---|
| QL= | 2.99 |
| n= | 80 |
| P= | **0.10400** |

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

**0.104** % 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 0.013 + 0.104 = **0.117**

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

### OUTLIERS

| | | | |
|---|---|---|---|
| UFL = **FL *BAR X*** + (4 x **FL Sigma**) | 99.915 + 1.904 | UFL = | **101.819** |
| LFL = **FL *BAR X*** - (4 x **FL Sigma**) | 99.915 - 1.904 | LFL = | 98.011 |
| ULL = **LL *BAR X*** + (4 x **LL Sigma**) | 99.843 + 2.464 | ULL = | **102.307** |
| LLL = **LL *BAR X*** - (4 x **LL Sigma**) | 99.843 - 2.464 | LLL = | **97.379** |

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: *Steve Ness*

Approved: 12/20/2019

# OTTER TAIL POWER CO.

12/20/2019

## 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 **14628** SAMPLE SIZE n= **75** AQL **2.5**

***FL BAR X*** **100.054** ***FL SIGMA*** **0.286**

***LL BAR X*** **99.732** ***LL SIGMA*** **0.948**

### ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA}$ $\frac{102 - 100.054}{0.286}$ = $\frac{1.946}{0.286}$ = **6.80**

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA}$ $\frac{102 - 99.732}{0.948}$ = $\frac{2.268}{0.948}$ = **2.39**

table b-5 calculations

| | |
|---|---|
| QU= | 6.80 |
| n= | 75 |
| P= | **0.00000** |

| | |
|---|---|
| QU= | 2.39 |
| n= | 75 |
| P= | **0.75400** |

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

**0.754** % PU LL above 102.0 %

### ESTIMATE OF LOT BELOW 98.0%

FL QL = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA}$ $\frac{100.054 - 98}{0.286}$ = $\frac{2.054}{0.286}$ = **7.18**

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA}$ $\frac{99.732 - 98}{0.948}$ = $\frac{1.732}{0.948}$ = **1.83**

table b-5 calculations

| | |
|---|---|
| QL= | 7.18 |
| n= | 75 |
| P= | **0.00000** |

| | |
|---|---|
| QL= | 1.83 |
| n= | 75 |
| P= | **3.25000** |

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

**3.250** % 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 0.754 + 3.250 = **4.004**

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

### OUTLIERS

| | | | |
|---|---|---|---|
| UFL = **FL *BAR X*** + (4 x **FL Sigma**) | 100.054 + 1.144 | UFL = | **101.198** |
| LFL = **FL *BAR X*** - (4 x **FL Sigma**) | 100.054 - 1.144 | LFL = | 98.910 |
| ULL = **LL *BAR X*** + (4 x **LL Sigma**) | 99.732 + 3.792 | ULL = | **103.524** |
| LLL = **LL *BAR X*** - (4 x **LL Sigma**) | 99.732 - 3.792 | LLL = | **95.940** |

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: *Steve Ness*

Approved: 12/20/2019

# OTTER TAIL POWER CO.

12/20/2019

## 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 **10982** SAMPLE SIZE n= **75** AQL **2.5**

***FL BAR X*** **99.987** ***FL SIGMA*** **0.088**

***LL BAR X*** **99.976** ***LL SIGMA*** **0.090**

### ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA}$ $\frac{102 - 99.987}{0.088}$ = $\frac{2.013}{0.088}$ = **22.88**

table b-5 calculations

| | |
|---|---|
| QU= | 22.88 |
| n= | 75 |
| P= | **0.00000** |

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA}$ $\frac{102 - 99.976}{0.09}$ = $\frac{2.024}{0.090}$ = **22.49**

| | |
|---|---|
| QU= | 22.49 |
| n= | 75 |
| P= | **0.00000** |

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 = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA}$ $\frac{99.987 - 98}{0.088}$ = $\frac{1.987}{0.088}$ = **22.58**

table b-5 calculations

| | |
|---|---|
| QL= | 22.58 |
| n= | 75 |
| P= | **0.00000** |

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA}$ $\frac{99.976 - 98}{0.09}$ = $\frac{1.976}{0.090}$ = **21.96**

| | |
|---|---|
| QL= | 21.96 |
| n= | 75 |
| P= | **0.00000** |

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 0.000 + 0.000 = **0.000**

Light Load P = PU LL + PL LL 0.000 + 0.000 = **0.000**

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

### OUTLIERS

| | | | |
|---|---|---|---|
| UFL = **FL *BAR X*** + (4 x **FL Sigma**) | 99.987 + 0.352 | UFL = | **100.339** |
| LFL = **FL *BAR X*** - (4 x **FL Sigma**) | 99.987 - 0.352 | LFL = | 99.635 |
| ULL = **LL *BAR X*** + (4 x **LL Sigma**) | 99.976 + 0.36 | ULL = | **100.336** |
| LLL = **LL *BAR X*** - (4 x **LL Sigma**) | 99.976 - 0.36 | LLL = | **99.616** |

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: *Steve Ness*

Approved: 12/20/2019

12/20/2019

# OTTER TAIL POWER CO.
## 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 **9753** SAMPLE SIZE n= **75** AQL **2.5**

***FL BAR X*** **99.858** ***FL SIGMA*** **0.415**

***LL BAR X*** **99.694** ***LL SIGMA*** **0.622**

### ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA}$ $\frac{102 - 99.858}{0.415}$ = $\frac{2.142}{0.415}$ = **5.16**

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA}$ $\frac{102 - 99.694}{0.622}$ = $\frac{2.306}{0.622}$ = **3.71**

table b-5 calculations

| | |
|---|---|
| QU= | 5.16 |
| n= | 75 |
| P= | **0.00000** |

| | |
|---|---|
| QU= | 3.71 |
| n= | 75 |
| P= | **0.00500** |

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

**0.005** % PU LL above 102.0 %

### ESTIMATE OF LOT BELOW 98.0%

FL QL = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA}$ $\frac{99.858 - 98}{0.415}$ = $\frac{1.858}{0.415}$ = **4.48**

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA}$ $\frac{99.694 - 98}{0.622}$ = $\frac{1.694}{0.622}$ = **2.72**

table b-5 calculations

| | |
|---|---|
| QL= | 4.48 |
| n= | 75 |
| P= | **0.00000** |

| | |
|---|---|
| QL= | 2.72 |
| n= | 75 |
| P= | **0.26900** |

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

**0.269** % 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 0.005 + 0.269 = **0.274**

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

### OUTLIERS

UFL = **FL *BAR X*** + (4 x **FL Sigma**) 99.858 + 1.66 UFL = **101.518**

LFL = **FL *BAR X*** - (4 x **FL Sigma**) 99.858 - 1.66 LFL = 98.198

ULL = **LL *BAR X*** + (4 x **LL Sigma**) 99.694 + 2.488 ULL = **102.182**

LLL = **LL *BAR X*** - (4 x **LL Sigma**) 99.694 - 2.488 LLL = **97.206**

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: *Steve Ness*

Approved: 12/20/2019

# OTTER TAIL POWER CO.

12/20/2019

## 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 **6739** SAMPLE SIZE n= **51** AQL **2.5**

***FL BAR X*** **99.920** ***FL SIGMA*** **0.066**

***LL BAR X*** **99.919** ***LL SIGMA*** **0.076**

### ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA}$ $\frac{102 - 99.92}{0.066}$ = $\frac{2.080}{0.066}$ = **31.52**

table b-5 calculations

| | |
|---|---|
| QU= | 31.52 |
| n= | 51 |
| P= | **0.00000** |

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA}$ $\frac{102 - 99.919}{0.076}$ = $\frac{2.081}{0.076}$ = **27.38**

| | |
|---|---|
| QU= | 27.38 |
| n= | 51 |
| P= | **0.00000** |

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 = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA}$ $\frac{99.92 - 98}{0.066}$ = $\frac{1.920}{0.066}$ = **29.09**

table b-5 calculations

| | |
|---|---|
| QL= | 29.09 |
| n= | 51 |
| P= | **0.00000** |

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA}$ $\frac{99.919 - 98}{0.076}$ = $\frac{1.919}{0.076}$ = **25.25**

| | |
|---|---|
| QL= | 25.25 |
| n= | 51 |
| P= | **0.00000** |

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 0.000 + 0.000 = **0.000**

Light Load P = PU LL + PL LL 0.000 + 0.000 = **0.000**

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

### OUTLIERS

| | | | |
|---|---|---|---|
| UFL = **FL *BAR X*** + (4 x **FL Sigma**) | 99.920 + 0.264 | UFL = | **100.184** |
| LFL = **FL *BAR X*** - (4 x **FL Sigma**) | 99.920 - 0.264 | LFL = | 99.656 |
| ULL = **LL *BAR X*** + (4 x **LL Sigma**) | 99.919 + 0.304 | ULL = | **100.223** |
| LLL = **LL *BAR X*** - (4 x **LL Sigma**) | 99.919 - 0.304 | LLL = | **99.615** |

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: *Steve Ness*

Approved: 12/20/2019

# OTTER TAIL POWER CO.

12/20/2019

## 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 **2589** SAMPLE SIZE n= **45** AQL **2.5**

***FL BAR X*** **100.085** ***FL SIGMA*** **0.318**

***LL BAR X*** **99.968** ***LL SIGMA*** **0.669**

### ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA}$ $\frac{102 - 100.085}{0.318}$ = $\frac{1.915}{0.318}$ = **6.02**

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA}$ $\frac{102 - 99.968}{0.669}$ = $\frac{2.032}{0.669}$ = **3.04**

table b-5 calculations

| | |
|---|---|
| QU= | 6.02 |
| n= | 45 |
| P= | **0.00000** |

| | |
|---|---|
| QU= | 3.04 |
| n= | 45 |
| P= | **0.07200** |

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

**0.072** % PU LL above 102.0 %

### ESTIMATE OF LOT BELOW 98.0%

FL QL = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA}$ $\frac{100.085 - 98}{0.318}$ = $\frac{2.085}{0.318}$ = **6.56**

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA}$ $\frac{99.968 - 98}{0.669}$ = $\frac{1.968}{0.669}$ = **2.94**

table b-5 calculations

| | |
|---|---|
| QL= | 6.56 |
| n= | 45 |
| P= | **0.00000** |

| | |
|---|---|
| QL= | 2.94 |
| n= | 45 |
| P= | **0.10700** |

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

**0.107** % 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 0.072 + 0.107 = **0.179**

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

### OUTLIERS

| | | |
|---|---|---|
| UFL = **FL *BAR X*** + (4 x **FL Sigma**) | 100.085 + 1.272 | UFL = **101.357** |
| LFL = **FL *BAR X*** - (4 x **FL Sigma**) | 100.085 - 1.272 | LFL = 98.813 |
| ULL = **LL *BAR X*** + (4 x **LL Sigma**) | 99.968 + 2.676 | ULL = **102.644** |
| LLL = **LL *BAR X*** - (4 x **LL Sigma**) | 99.968 - 2.676 | LLL = **97.292** |

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: *Steve Ness*

Approved: 12/20/2019

# OTTER TAIL POWER CO.

12/20/2019

## 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 **796** SAMPLE SIZE n= **35** AQL **2.5**

***FL BAR X*** **99.908** ***FL SIGMA*** **0.371**

***LL BAR X*** **99.744** ***LL SIGMA*** **0.489**

### ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA}$ $\frac{102 - 99.908}{0.371}$ = $\frac{2.092}{0.371}$ = **5.64**

table b-5 calculations

| | |
|---|---|
| QU= | 5.64 |
| n= | 35 |
| P= | **0.00000** |

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA}$ $\frac{102 - 99.744}{0.489}$ = $\frac{2.256}{0.489}$ = **4.61**

| | |
|---|---|
| QU= | 4.61 |
| n= | 35 |
| P= | **0.00000** |

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 = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA}$ $\frac{99.908 - 98}{0.371}$ = $\frac{1.908}{0.371}$ = **5.14**

table b-5 calculations

| | |
|---|---|
| QL= | 5.14 |
| n= | 35 |
| P= | **0.00000** |

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA}$ $\frac{99.744 - 98}{0.489}$ = $\frac{1.744}{0.489}$ = **3.57**

| | |
|---|---|
| QL= | 3.57 |
| n= | 35 |
| P= | **0.00300** |

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

**0.003** % 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 0.000 + 0.003 = **0.003**

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

### OUTLIERS

UFL = **FL *BAR X*** + (4 x **FL Sigma**) 99.908 + 1.484 UFL = **101.392**

LFL = **FL *BAR X*** - (4 x **FL Sigma**) 99.908 - 1.484 LFL = 98.424

ULL = **LL *BAR X*** + (4 x **LL Sigma**) 99.744 + 1.956 ULL = **101.700**

LLL = **LL *BAR X*** - (4 x **LL Sigma**) 99.744 - 1.956 LLL = **97.788**

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: *Steve Ness*

Approved: 12/20/2019