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January 20, 2021

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

RE: Otter Tail Power Company's 2020 Sample Meter Test Performance Report

Dear Mr. Kahl:

Pursuant to North Dakota Rule 69-09-02-28(3), attached are results from the 2020 single-phase kWh sample meter test program for Otter Tail Power Company. There were nine groups of meters selected for the 2020 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.

Steve Kahl
January 20, 2021
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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 asmith@otpc.com.

Sincerely,

/s/ ANNALISE SMITH
Annalise Smith
Load Researcher, Regulatory Administration

kaw
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: SAMPLE #1 Itron C1S Meters

LOT SIZE	43552	SAMPLE SIZE n=	100	AQL	2.5
FL BAR X	99.959	FL SIGMA	0.105		
LL BAR X	99.904	LL SIGMA	0.106		

ESTIMATE OF LOT ABOVE 102.0%

					table b-5 calculations	
FL QU = $\frac{102 - FL \text{ BAR X}}{FL \text{ SIGMA}}$	$\frac{102 - 99.959}{0.105}$	=	$\frac{2.041}{0.105}$	=	19.44	QU= 19.44
						n= 100
						P= 0.00000
LL QU = $\frac{102 - LL \text{ BAR X}}{LL \text{ SIGMA}}$	$\frac{102 - 99.904}{0.106}$	=	$\frac{2.096}{0.106}$	=	19.77	QU= 19.77
						n= 100
						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%

					table b-5 calculations	
FL QL = $\frac{FL \text{ BAR X} - 98}{FL \text{ SIGMA}}$	$\frac{99.959 - 98}{0.105}$	=	$\frac{1.959}{0.105}$	=	18.66	QL= 18.66
						n= 100
						P= 0.00000
LL QL = $\frac{LL \text{ BAR X} - 98}{LL \text{ SIGMA}}$	$\frac{99.904 - 98}{0.106}$	=	$\frac{1.904}{0.106}$	=	17.96	QL= 17.96
						n= 100
						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	<u>0.000</u>	+	<u>0.000</u>	=	<u>0.000</u>
Light Load P = PU LL + PL LL	<u>0.000</u>	+	<u>0.000</u>	=	<u>0.000</u>
ALLOWABLE PERCENT DEFECTIVE: TABLE B-3					4.69

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma)	99.959 + 0.42	UFL =	<u>100.379</u>
LFL = FL BAR X - (4 x FL Sigma)	99.959 - 0.42	LFL =	<u>99.539</u>
ULL = LL BAR X + (4 x LL Sigma)	99.904 + 0.424	ULL =	<u>100.328</u>
LLL = LL BAR X - (4 x LL Sigma)	99.904 - 0.424	LLL =	<u>99.480</u>

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: Steve Ness Approved: Ben Christenson 1/18/2021

**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: **SAMPLE #2 GE I70S Meters**

LOT SIZE **27130** SAMPLE SIZE n= **100** AQL **2.5**
 FL BAR X **99.866** FL SIGMA **0.312**
 LL BAR X **99.501** LL SIGMA **0.653**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA} = \frac{102 - 99.866}{0.312} = \frac{2.134}{0.312} = \mathbf{6.84}$ table b-5 calculations

QU=	6.84
n=	100
P=	0.00000

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA} = \frac{102 - 99.501}{0.653} = \frac{2.499}{0.653} = \mathbf{3.83}$

QU=	3.83
n=	100
P=	0.00400

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 = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA} = \frac{99.866 - 98}{0.312} = \frac{1.866}{0.312} = \mathbf{5.98}$ table b-5 calculations

QL=	5.98
n=	100
P=	0.00000

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA} = \frac{99.501 - 98}{0.653} = \frac{1.501}{0.653} = \mathbf{2.30}$

QL=	2.30
n=	100
P=	1.00100

From table B-5 = **0.000** % PL FL below 98.0 %
1.001 % 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 $\frac{0.004}{0.004} + \frac{1.001}{1.001} = \mathbf{1.005}$
 ALLOWABLE PERCENT DEFECTIVE: TABLE B-3 **4.69**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) $99.866 + 1.248$ UFL = **101.114**
 LFL = FL BAR X - (4 x FL Sigma) $99.866 - 1.248$ LFL = **98.618**
 ULL = LL BAR X + (4 x LL Sigma) $99.501 + 2.612$ ULL = **102.113**
 LLL = LL BAR X - (4 x LL Sigma) $99.501 - 2.612$ LLL = **96.889**

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: Steve Ness Approved: Ben Christenson 1/18/2021

**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: **SAMPLE #3 Sangamo J5S Meters**

LOT SIZE **19266** SAMPLE SIZE n= **75** AQL **2.5**

FL BAR X **99.899** FL SIGMA **0.380**
LL BAR X **99.698** LL SIGMA **0.621**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL \text{ BAR } X}{FL \text{ SIGMA}}$ = $\frac{102 - 99.899}{0.38}$ = $\frac{2.101}{0.380}$ = **5.53** table b-5 calculations

QU=	5.53
n=	75
P=	0.00000

LL QU = $\frac{102 - LL \text{ BAR } X}{LL \text{ SIGMA}}$ = $\frac{102 - 99.698}{0.621}$ = $\frac{2.302}{0.621}$ = **3.71** table b-5 calculations

QU=	3.71
n=	75
P=	0.00300

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

0.003 % PU LL above 102.0 %

ESTIMATE OF LOT BELOW 98.0%

FL QL = $\frac{FL \text{ BAR } X - 98}{FL \text{ SIGMA}}$ = $\frac{99.899 - 98}{0.38}$ = $\frac{1.899}{0.380}$ = **5.00** table b-5 calculations

QL=	5.00
n=	75
P=	0.00000

LL QL = $\frac{LL \text{ BAR } X - 98}{LL \text{ SIGMA}}$ = $\frac{99.698 - 98}{0.621}$ = $\frac{1.698}{0.621}$ = **2.73** table b-5 calculations

QL=	2.73
n=	75
P=	0.26000

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

0.260 % 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 = $\frac{0.003}{0.003} + \frac{0.260}{0.260} = \frac{0.263}{0.263}$

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) = 99.899 + 1.52 UFL = **101.419**

LFL = FL BAR X - (4 x FL Sigma) = 99.899 - 1.52 LFL = **98.379**

ULL = LL BAR X + (4 x LL Sigma) = 99.698 + 2.484 ULL = **102.182**

LLL = LL BAR X - (4 x LL Sigma) = 99.698 - 2.484 LLL = **97.214**

Lot is acceptable X Lot is unacceptable

Tested & Reported by: Steve Ness

Approved: Ben Christenson 1/18/2021

**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: **OUTLIER SAMPLE #4 Landis & Gyr MS Meters**

LOT SIZE **13483** SAMPLE SIZE n= **74** AQL **2.5**

FL BAR X **99.995** FL SIGMA **0.283**
LL BAR X **99.651** LL SIGMA **0.601**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL \text{ BAR X}}{FL \text{ SIGMA}} = \frac{102 - 99.995}{0.283} = \frac{2.005}{0.283} = \mathbf{7.08}$ table b-5 calculations

QU=	7.08
n=	74
P=	0.00000

LL QU = $\frac{102 - LL \text{ BAR X}}{LL \text{ SIGMA}} = \frac{102 - 99.651}{0.601} = \frac{2.349}{0.601} = \mathbf{3.91}$

QU=	3.91
n=	74
P=	0.00100

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

0.001 % PU LL above 102.0 %

ESTIMATE OF LOT BELOW 98.0%

FL QL = $\frac{FL \text{ BAR X} - 98}{FL \text{ SIGMA}} = \frac{99.995 - 98}{0.283} = \frac{1.995}{0.283} = \mathbf{7.05}$ table b-5 calculations

QL=	7.05
n=	74
P=	0.00000

LL QL = $\frac{LL \text{ BAR X} - 98}{LL \text{ SIGMA}} = \frac{99.651 - 98}{0.601} = \frac{1.651}{0.601} = \mathbf{2.75}$

QL=	2.75
n=	74
P=	0.24300

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

0.243 % 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 $\frac{0.001}{0.001} + \frac{0.243}{0.243} = \mathbf{0.244}$

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) $99.995 + 1.132$ UFL = **101.127**
LFL = FL BAR X - (4 x FL Sigma) $99.995 - 1.132$ LFL = **98.863**
ULL = LL BAR X + (4 x LL Sigma) $99.651 + 2.404$ ULL = **102.055**
LLL = LL BAR X - (4 x LL Sigma) $99.651 - 2.404$ LLL = **97.247**

Lot is acceptable **X** Lot is unacceptable

Tested & Reported by: Steve Ness Approved: Ben Christenson 1/18/2021

**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: **SAMPLE #4 Landis & Gyr MS Meters**

LOT SIZE **13483** SAMPLE SIZE n= **75** AQL **2.5**

FL BAR X **99.996** FL SIGMA **0.282**
LL BAR X **99.745** LL SIGMA **1.016**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA} = \frac{102 - 99.996}{0.282} = \frac{2.004}{0.282} = 7.11$ table b-5 calculations

QU=	7.11
n=	75
P=	0.00000

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA} = \frac{102 - 99.745}{1.016} = \frac{2.255}{1.016} = 2.22$

QU=	2.22
n=	75
P=	1.21900

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

1.219 % PU LL above 102.0 %

ESTIMATE OF LOT BELOW 98.0%

FL QL = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA} = \frac{99.996 - 98}{0.282} = \frac{1.996}{0.282} = 7.08$ table b-5 calculations

QL=	7.08
n=	75
P=	0.00000

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA} = \frac{99.745 - 98}{1.016} = \frac{1.745}{1.016} = 1.72$

QL=	1.72
n=	75
P=	4.17000

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

4.170 % 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 $\frac{1.219}{1.219} + \frac{4.170}{4.170} = \frac{5.389}{5.389}$

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) $99.996 + 1.128$ UFL = **101.124**
LFL = FL BAR X - (4 x FL Sigma) $99.996 - 1.128$ LFL = **98.868**
ULL = LL BAR X + (4 x LL Sigma) $99.745 + 4.064$ ULL = **103.809**
LLL = LL BAR X - (4 x LL Sigma) $99.745 - 4.064$ LLL = **95.681**

Lot is acceptable _____ Lot is unacceptable **X**

Tested & Reported by: Steve Ness

Approved: Ben Christenson 1/18/2021

**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: **SAMPLE #5 GE I210 Meters**

LOT SIZE **10551** SAMPLE SIZE n= **75** AQL **2.5**

FL BAR X **99.950** FL SIGMA **0.142**
LL BAR X **99.964** LL SIGMA **0.108**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA} = \frac{102 - 99.95}{0.142} = \frac{2.050}{0.142} = 14.44$ table b-5 calculations

QU=	14.44
n=	75
P=	0.00000

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA} = \frac{102 - 99.964}{0.108} = \frac{2.036}{0.108} = 18.85$

QU=	18.85
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 = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA} = \frac{99.95 - 98}{0.142} = \frac{1.950}{0.142} = 13.73$ table b-5 calculations

QL=	13.73
n=	75
P=	0.00000

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA} = \frac{99.964 - 98}{0.108} = \frac{1.964}{0.108} = 18.19$

QL=	18.19
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 $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \frac{0.000}{0.000}$
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 **4.87**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) $99.950 + 0.568$ UFL = **100.518**
LFL = FL BAR X - (4 x FL Sigma) $99.950 - 0.568$ LFL = **99.382**

ULL = LL BAR X + (4 x LL Sigma) $99.964 + 0.432$ ULL = **100.396**
LLL = LL BAR X - (4 x LL Sigma) $99.964 - 0.432$ LLL = **99.532**

Lot is acceptable X Lot is unacceptable

Tested & Reported by: Steve Ness Approved: Ben Christenson 1/18/2021

**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: **SAMPLE #6 Sangamo J4S Meters**

LOT SIZE **9371** SAMPLE SIZE n= **75** AQL **2.5**

FL BAR X **99.903** FL SIGMA **0.477**
LL BAR X **99.521** LL SIGMA **0.750**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL \text{ BAR } X}{FL \text{ SIGMA}}$ = $\frac{102 - 99.903}{0.477}$ = **4.40** table b-5 calculations

QU=	4.40
n=	75
P=	0.00000

LL QU = $\frac{102 - LL \text{ BAR } X}{LL \text{ SIGMA}}$ = $\frac{102 - 99.521}{0.75}$ = **3.31**

QU=	3.31
n=	75
P=	0.03000

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

0.030 % PU LL above 102.0 %

ESTIMATE OF LOT BELOW 98.0%

FL QL = $\frac{FL \text{ BAR } X - 98}{FL \text{ SIGMA}}$ = $\frac{99.903 - 98}{0.477}$ = **3.99** table b-5 calculations

QL=	3.99
n=	75
P=	0.00000

LL QL = $\frac{LL \text{ BAR } X - 98}{LL \text{ SIGMA}}$ = $\frac{99.521 - 98}{0.75}$ = **2.03**

QL=	2.03
n=	75
P=	2.01000

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

2.010 % 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 = 0.030 + 2.010 = **2.040**

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) = 99.903 + 1.908 UFL = **101.811**
LFL = FL BAR X - (4 x FL Sigma) = 99.903 - 1.908 LFL = 97.995
ULL = LL BAR X + (4 x LL Sigma) = 99.521 + 3 ULL = **102.521**
LLL = LL BAR X - (4 x LL Sigma) = 99.521 - 3 LLL = **96.521**

Lot is acceptable **X** Lot is unacceptable _____

Tested & Reported by: Steve Ness

Approved: Ben Christenson 1/18/2021

**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: SAMPLE #7 GE I210+ Meters

LOT SIZE **7364** SAMPLE SIZE n= **51** AQL **2.5**
 FL BAR X **99.899** FL SIGMA **0.061**
 LL BAR X **99.903** LL SIGMA **0.072**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL \text{ BAR } X}{FL \text{ SIGMA}}$ = $\frac{102 - 99.899}{0.061}$ = $\frac{2.101}{0.061}$ = **34.44** table b-5 calculations

QU=	34.44
n=	51
P=	0.00000

LL QU = $\frac{102 - LL \text{ BAR } X}{LL \text{ SIGMA}}$ = $\frac{102 - 99.903}{0.072}$ = $\frac{2.097}{0.072}$ = **29.12**

QU=	29.12
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 = $\frac{FL \text{ BAR } X - 98}{FL \text{ SIGMA}}$ = $\frac{99.899 - 98}{0.061}$ = $\frac{1.899}{0.061}$ = **31.13** table b-5 calculations

QL=	31.13
n=	51
P=	0.00000

LL QL = $\frac{LL \text{ BAR } X - 98}{LL \text{ SIGMA}}$ = $\frac{99.903 - 98}{0.072}$ = $\frac{1.903}{0.072}$ = **26.43**

QL=	26.43
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 = $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \underline{\underline{0.000}}$
 Light Load P = PU LL + PL LL = $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \underline{\underline{0.000}}$
 ALLOWABLE PERCENT DEFECTIVE: TABLE B-3 **5.2**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) = 99.899 + 0.244 UFL = **100.143**
 LFL = FL BAR X - (4 x FL Sigma) = 99.899 - 0.244 LFL = **99.655**
 ULL = LL BAR X + (4 x LL Sigma) = 99.903 + 0.288 ULL = **100.191**
 LLL = LL BAR X - (4 x LL Sigma) = 99.903 - 0.288 LLL = **99.615**

Lot is acceptable X Lot is unacceptable

Tested & Reported by: Steve Ness Approved: Ben Christenson 1/18/2021

**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: **SAMPLE #8 OUTLIER GE I50S Meters**

LOT SIZE **2451** SAMPLE SIZE n= **39** AQL **2.5**

FL BAR X **100.069** FL SIGMA **0.225**
LL BAR X **99.902** LL SIGMA **0.446**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL \text{ BAR X}}{FL \text{ SIGMA}} = \frac{102 - 100.069}{0.225} = \frac{1.931}{0.225} = \mathbf{8.58}$ table b-5 calculations

QU=	8.58
n=	39
P=	0.00000

LL QU = $\frac{102 - LL \text{ BAR X}}{LL \text{ SIGMA}} = \frac{102 - 99.902}{0.446} = \frac{2.098}{0.446} = \mathbf{4.70}$

QU=	4.70
n=	39
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 = $\frac{FL \text{ BAR X} - 98}{FL \text{ SIGMA}} = \frac{100.069 - 98}{0.225} = \frac{2.069}{0.225} = \mathbf{9.20}$ table b-5 calculations

QL=	9.20
n=	39
P=	0.00000

LL QL = $\frac{LL \text{ BAR X} - 98}{LL \text{ SIGMA}} = \frac{99.902 - 98}{0.446} = \frac{1.902}{0.446} = \mathbf{4.26}$

QL=	4.26
n=	39
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 $\frac{0.000}{0.000} + \frac{0.000}{0.000} = \mathbf{0.000}$
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 **5.58**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) $100.069 + 0.9$ UFL = **100.969**
LFL = FL BAR X - (4 x FL Sigma) $100.069 - 0.9$ LFL = **99.169**

ULL = LL BAR X + (4 x LL Sigma) $99.902 + 1.784$ ULL = **101.686**
LLL = LL BAR X - (4 x LL Sigma) $99.902 - 1.784$ LLL = **98.118**

Lot is acceptable **x** Lot is unacceptable

Tested & Reported by: Steve Ness Approved: Ben Christenson 1/18/2021

**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: **SAMPLE #8 GE I50S Meters**

LOT SIZE **2451** SAMPLE SIZE n= **40** AQL **2.5**

FL BAR X **100.088** FL SIGMA **0.251**
LL BAR X **99.446** LL SIGMA **2.916**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL\ BAR\ X}{FL\ SIGMA} = \frac{102 - 100.088}{0.251} = \frac{1.912}{0.251} = 7.62$ table b-5 calculations

QU=	7.62
n=	40
P=	0.00000

LL QU = $\frac{102 - LL\ BAR\ X}{LL\ SIGMA} = \frac{102 - 99.446}{2.916} = \frac{2.554}{2.916} = 0.88$

QU=	0.88
n=	40
P=	18.98000

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

18.980 % PU LL above 102.0 %

ESTIMATE OF LOT BELOW 98.0%

FL QL = $\frac{FL\ BAR\ X - 98}{FL\ SIGMA} = \frac{100.088 - 98}{0.251} = \frac{2.088}{0.251} = 8.32$ table b-5 calculations

QL=	8.32
n=	40
P=	0.00000

LL QL = $\frac{LL\ BAR\ X - 98}{LL\ SIGMA} = \frac{99.446 - 98}{2.916} = \frac{1.446}{2.916} = 0.50$

QL=	0.50
n=	40
P=	30.95000

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

30.950 % 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 $\frac{18.980}{18.980} + \frac{30.950}{30.950} = \frac{49.930}{49.930}$

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

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) $100.088 + 1.004$ UFL = **101.092**
LFL = FL BAR X - (4 x FL Sigma) $100.088 - 1.004$ LFL = **99.084**
ULL = LL BAR X + (4 x LL Sigma) $99.446 + 11.664$ ULL = **111.110**
LLL = LL BAR X - (4 x LL Sigma) $99.446 - 11.664$ LLL = **87.782**

Lot is acceptable _____ Lot is unacceptable **X**

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**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: **SAMPLE #9 Landis & Gyr MX Meters**

LOT SIZE **735** SAMPLE SIZE n= **30** AQL **2.5**

FL BAR X **99.895** FL SIGMA **0.346**
LL BAR X **99.680** LL SIGMA **0.519**

ESTIMATE OF LOT ABOVE 102.0%

FL QU = $\frac{102 - FL \text{ BAR } X}{FL \text{ SIGMA}}$ = $\frac{102 - 99.895}{0.346}$ = **6.08** table b-5 calculations

QU=	6.08
n=	30
P=	0.00000

LL QU = $\frac{102 - LL \text{ BAR } X}{LL \text{ SIGMA}}$ = $\frac{102 - 99.68}{0.519}$ = **4.47**

QU=	4.47
n=	30
P=	0.00400

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 = $\frac{FL \text{ BAR } X - 98}{FL \text{ SIGMA}}$ = $\frac{99.895 - 98}{0.346}$ = **5.48** table b-5 calculations

QL=	5.48
n=	30
P=	0.00000

LL QL = $\frac{LL \text{ BAR } X - 98}{LL \text{ SIGMA}}$ = $\frac{99.68 - 98}{0.519}$ = **3.24**

QL=	3.24
n=	30
P=	0.01600

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

0.016 % 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 0.004 + 0.016 = **0.020**

ALLOWABLE PERCENT DEFECTIVE: TABLE B-3 **5.86**

OUTLIERS

UFL = FL BAR X + (4 x FL Sigma) 99.895 + 1.384 UFL = **101.279**
LFL = FL BAR X - (4 x FL Sigma) 99.895 - 1.384 LFL = 98.511

ULL = LL BAR X + (4 x LL Sigma) 99.680 + 2.076 ULL = **101.756**
LLL = LL BAR X - (4 x LL Sigma) 99.680 - 2.076 LLL = **97.604**

Lot is acceptable **X** Lot is unacceptable _____

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