

MW-22 PCE

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	2.4	Mean	5.971
Maximum	9.3	Median	5.5
SD	2.335	Std. Error of Mean	0.883
Coefficient of Variation	0.391	Skewness	0.141

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach, refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance, but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$). The Chebyshev UCL often results in gross overestimates of the mean. Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.932	Shapiro Wilk GOF Test	
1% Shapiro Wilk Critical Value	0.73	Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.226	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.35	Data appear Normal at 1% Significance Level	
Data appear Normal at 1% Significance Level			
Note GOF tests may be unreliable for small sample sizes			

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	7.686	95% Adjusted-CLT UCL (Chen-1995)	7.473
		95% Modified-t UCL (Johnson-1978)	7.694

Gamma GOF Test

A-D Test Statistic	0.367	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.215	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			

Gamma Statistics

k hat (MLE)	6.716	k star (bias corrected MLE)	3.933
Theta hat (MLE)	0.889	Theta star (bias corrected MLE)	1.518
nu hat (MLE)	94.02	nu star (bias corrected)	55.06
MLE Mean (bias corrected)	5.971	MLE Sd (bias corrected)	3.011
		Approximate Chi Square Value (0.05)	39.01
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	34.97

Assuming Gamma Distribution

95% Approximate Gamma UCL	8.429	95% Adjusted Gamma UCL	9.402
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Lognormal GOF Test

Shapiro Wilk Test Statistic	0.9	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk Critical Value	0.838	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.249	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.28	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			

Lognormal Statistics

Minimum of Logged Data	0.875	Mean of logged Data	1.711
Maximum of Logged Data	2.23	SD of logged Data	0.444

Assuming Lognormal Distribution

95% H-UCL	9.351	90% Chebyshev (MVUE) UCL	9.06
95% Chebyshev (MVUE) UCL	10.44	97.5% Chebyshev (MVUE) UCL	12.35
99% Chebyshev (MVUE) UCL	16.11		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	7.423	95% BCA Bootstrap UCL	7.3
95% Standard Bootstrap UCL	7.3	95% Bootstrap-t UCL	8.313
95% Hall's Bootstrap UCL	9.289	95% Percentile Bootstrap UCL	7.357
90% Chebyshev(Mean, Sd) UCL	8.619	95% Chebyshev(Mean, Sd) UCL	9.818
97.5% Chebyshev(Mean, Sd) UCL	11.48	99% Chebyshev(Mean, Sd) UCL	14.75

Suggested UCL to Use

95% Student's-t UCL	7.686
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Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

MW-108D PCE

User Selected Options

Date/Time of Computation ProUCL 5.2 2/23/2026 4:05:41 PM
 From File WorkSheet.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

General Statistics

Total Number of Observations	7	Number of Distinct Observations	4
Number of Detects	3	Number of Non-Detects	4
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	0.32	Minimum Non-Detect	0.3
Maximum Detect	0.48	Maximum Non-Detect	0.3
Variance Detects	0.00803	Percent Non-Detects	57.14%
Mean Detects	0.377	SD Detects	0.0896
Median Detects	0.33	CV Detects	0.238
Skewness Detects	1.708	Kurtosis Detects	N/A
Mean of Logged Detects	-0.994	SD of Logged Detects	0.226

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach

refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,

but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes ($n < 7$).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.797	Shapiro Wilk GOF Test
1% Shapiro Wilk Critical Value	0.753	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.365	Lilliefors GOF Test
1% Lilliefors Critical Value	0.429	Detected Data appear Normal at 1% Significance Level
Detected Data appear Normal at 1% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.333	KM Standard Error of Mean	0.0283
90KM SD	0.0611	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.388	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.379	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.418	95% KM Chebyshev UCL	0.456
97.5% KM Chebyshev UCL	0.51	99% KM Chebyshev UCL	0.614

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.535	Anderson-Darling GOF Test
5% A-D Critical Value	0.635	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.402	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.431	Detected data appear Gamma Distributed at 5% Significance Level
Detected Data Not Gamma Distributed at 5% Significance Level		

Gamma Statistics on Detected Data Only

k hat (MLE)	28.53	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0132	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	171.2	nu star (bias corrected)	N/A
Mean (detects)	0.377		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.218
Maximum	0.48	Median	0.186
SD	0.166	CV	0.763
k hat (MLE)	1.196	k star (bias corrected MLE)	0.779
Theta hat (MLE)	0.182	Theta star (bias corrected MLE)	0.28
nu hat (MLE)	16.74	nu star (bias corrected)	10.9
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (10.90, α)	4.512	Adjusted Chi Square Value (10.90, β)	3.357
95% Gamma Approximate UCL	0.526	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.333 SD (KM)	0.0611
Variance (KM)	0.00373 SE of Mean (KM)	0.0283
k hat (KM)	29.67 k star (KM)	17.05
nu hat (KM)	415.3 nu star (KM)	238.7
theta hat (KM)	0.0112 theta star (KM)	0.0195
80% gamma percentile (KM)	0.398 90% gamma percentile (KM)	0.439
95% gamma percentile (KM)	0.476 99% gamma percentile (KM)	0.548

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (238.66, α)	203.9 Adjusted Chi Square Value (238.66, β)	194.2
95% KM Approximate Gamma UCL	0.39 95% KM Adjusted Gamma UCL	0.409

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.807 Shapiro Wilk GOF Test	
10% Shapiro Wilk Critical Value	0.789 Detected Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.361 Lilliefors GOF Test	
10% Lilliefors Critical Value	0.389 Detected Data appear Lognormal at 10% Significance Level	
Detected Data appear Lognormal at 10% Significance Level		
Note GOF tests may be unreliable for small sample sizes		

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.261 Mean in Log Scale	-1.44
SD in Original Scale	0.124 SD in Log Scale	0.473
95% t UCL (assumes normality of ROS data)	0.352 95% Percentile Bootstrap UCL	0.334
95% BCA Bootstrap UCL	0.343 95% Bootstrap t UCL	0.386
95% H-UCL (Log ROS)	0.421	

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.114 KM Geo Mean	0.328
KM SD (logged)	0.159 95% Critical H Value (KM-Log)	1.935
KM Standard Error of Mean (logged)	0.0737 95% H-UCL (KM -Log)	0.377
KM SD (logged)	0.159 95% Critical H Value (KM-Log)	1.935
KM Standard Error of Mean (logged)	0.0737	

DL/2 Statistics

DL/2 Normal	DL/2 Log-Transformed	
Mean in Original Scale	0.247 Mean in Log Scale	-1.51
SD in Original Scale	0.132 SD in Log Scale	0.5
95% t UCL (Assumes normality)	0.344 95% H-Stat UCL	0.414
DL/2 is not a recommended method, provided for comparisons and historical reasons		

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.388
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Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. Recommendations are based upon data size, data distribution, and skewness using results from simulation studies. However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician