Elastomer Compatibility
EOEC Limits Proposals

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Reviewed and Endorsed by Statistics Group

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Fixed Limits Path Forward – Option 1

- Some of the elastomer compatibility limits for EOEC are Variable Limits based on TMC 1006.
- Supply of TMC 1006 is diminishing and a new reference oil SL107 is now being used.
- Instead of using SL107 as a replacement for TMC 1006 in the Variable Limits, Joe Franklin proposed to convert the Variable Limits to Fixed Limits in his presentation to ASTM D02.B in Dec. 2019.
- This analysis follows Joe Franklin's proposal with updated data on 1006-2.
- This method makes it easy for anyone to understand if a test passed or failed

Proposed *Fixed Limits* for EOEC based on 1006-2

- Current Specification Limits

D7216 (Elastomer Compatibility)

Note—These are the *unadjusted specification limits* for elastomer compatibility. Candidate oils shall, however, conform to the *adjusted specification limits*, the calculation of which is described in Annex A4.

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, –3)	(+7, –5)	(+10, –TMC 1006)	(+10, –TMC 1006)
Silicone (VMQ)	(+TMC 1006, –3)	(+5, –TMC 1006)	(+10, –45)	(+20, –30)
Polyacrylate (ACM)	(+5, –3)	(+8, –5)	(+18, –15)	(+10, –35)
Fluoroelastomer (FKM)	(+5, –2)	(+7, –5)	(+10, –TMC 1006)	(+10, –TMC 1006)
Vamac G	(+TMC 1006, –3)	(+5, –TMC 1006)	(+10, –TMC 1006)	(+10, –TMC 1006)

Note—TMC 1006 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC 1006.

- Proposed Fixed Limits

Note – These are the *unadjusted specification limits* for elastomer compatibility. Candidate oils shall, however, conform to the *adjusted specification limits*, the calculation of which is described in Annex A4.

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, -3)	(+7, -5)	(+10, -47)	(+10, -66)
Silicone (VMQ)	(+41, -3)	(+5, -27)	(+10, -45)	(+20, -30)
Polyacrylate (ACM)	(+5, -3)	(+8, -5)	(+18, -15)	(+10, -35)
Fluoroelastomer (FKM)	(+5, -2)	(+7, -5)	(+10, -76)	(+10, -77)
Vamac G	(+25, -3)	(+5, -14)	(+10, -24)	(+10, -40)

Variable Limits Path Forward – Option 2

- The variable limits are more in alignment with the original intent of the elastomer tests.
- Back in the mid 1990's the OEMs met and decided that as long as future oils were no more aggressive to seals than Service Oil 105 they would be OK. Service oil 105 was later renamed TMC 1006.
- Variable limits require looking at more data to determine if a test passed or failed.
- Statistics Group recommends this option.
- With either Option 1 or Option 2 an information letter will complete the full B ballot process before the change is made to D4485

Proposed *Variable Limits* for EOEC based on SL107

- Current Specification Limits

D7216 (Elastomer Compatibility)

Note—These are the *unadjusted specification limits* for elastomer compatibility. Candidate oils shall, however, conform to the *adjusted specification limits*, the calculation of which is described in Annex A4.

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, –3)	(+7, –5)	(+10, –TMC 1006)	(+10, –TMC 1006)
Silicone (VMQ)	(+TMC 1006, –3)	(+5, –TMC 1006)	(+10, –45)	(+20, –30)
Polyacrylate (ACM)	(+5, –3)	(+8, –5)	(+18, –15)	(+10, –35)
Fluoroelastomer (FKM)	(+5, –2)	(+7, –5)	(+10, –TMC 1006)	(+10, –TMC 1006)
Vamac G	(+TMC 1006, –3)	(+5, –TMC 1006)	(+10, –TMC 1006)	(+10, –TMC 1006)

Note—TMC 1006 is the designation for the reference oil used in this test method. This designation represents the original blend or subsequent approved re-blends of TMC 1006.

- Proposed Variable Limits

Note – These are the *unadjusted specification limits* for elastomer compatibility. Candidate oils shall, however, conform to the *adjusted specification limits*, the calculation of which is described in Annex A4.

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, -3)	(+7, -5)	(+10, -SL107-30)	(+10, -SL107-17)
Silicone (VMQ)	(+SL107, -3)	(+5, -SL107)	(+10, -45)	(+20, -30)
Polyacrylate (ACM)	(+5, -3)	(+8, -5)	(+18, -15)	(+10, -35)
Fluoroelastomer (FKM)	(+5, -2)	(+7, -5)	(+10, -SL107+2)	(+10, -SL107)
Vamac G	(+SL107+2, -3)	(+5, -SL107-2)	(+10, -SL107+2)	(+10, -SL107+10)

Data

- Analysis includes LTMS data with validity AC, AG and AO as of August 13, 2021. Extreme outliers were excluded.
- With the proposed fixed limits, 1006-2 probability of pass is ~100% for most parameters and materials.
- With the variable limits based on SL107, the factor was calculated as the difference between the mean targets of 1006-2 and SL107.
- The proposed limits also align with the TMC 1006 calibration limits.

Comparison with Joe Franklin's Proposal in Dec 2019 for Unadjusted Fixed Limits

Current proposal

Elastomer	Spec Limits	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	Current	(+5, -3)	(+7, -5)	(+10, -TMC1006)	(+10, -TMC1006)
	Proposed	(+5, -3)	(+7, -5)	(+10, -47)	(+10, -66)
Silicone (VMQ)	Current	(+TMC1006, -3)	(+5, -TMC1006)	(+10, -45)	(+20, -30)
	Proposed	(+41, -3)	(+5, -27)	(+10, -45)	(+20, -30)
Polyacrylate (ACM)	Current	(+5, -3)	(+8, -5)	(+18, -15)	(+10, -35)
	Proposed	(+5, -3)	(+8, -5)	(+18, -15)	(+10, -35)
Fluoroelastomer (FKM)	Current	(+5, -2)	(+7, -5)	(+10, -TMC1006)	(+10, -TMC1006)
	Proposed	(+5, -2)	(+7, -5)	(+10, -76)	(+10, -77)
Vamac G	Current	(+TMC1006, -3)	(+5, -TMC1006)	(+10, -TMC1006)	(+10, -TMC1006)
	Proposed	(+25, -3)	(+5, -14)	(+10, -24)	(+10, -40)

Dec 2019 proposal

Elastomer	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	(+5, —3)	(+7, —5)	(+10, —38)	(+10, —59)
Silicone (VMQ)	(+37, —3)	(+5, —24)	(+10, —45)	(+20, —30)
Polyacrylate (ACM)	(+5, —3)	(+8, —5)	(+18, —15)	(+10, —35)
Fluoroelastomer (FKM)	(+5, —2)	(+7, —5)	(+10, —71)	(+10, —69)
Vamac G	(+32, —3)	(+5, —17)	(+10, —17)	(+10, —33)

Proposed *Fixed Limits* Comparison with TMC 1006 Calibration Limits

- A reference is run together with the candidate to validate the test. Since some labs are still using TMC 1006, the calibration limits should align with the proposed fixed limits as shown below.

Elastomer	Limits	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	Proposed Spec	(+5, -3)	(+7, -5)	(+10, -47)	(+10, -66)
	TMC 1006 Cal	(+3, -2)	(+7, -4)	(-5, -49)	(-31, -71)
Silicone (VMQ)	Proposed Spec	(+41, -3)	(+5, -27)	(+10, -45)	(+20, -30)
	TMC 1006 Cal	(+41, +23)	(-15, -28)	(-22, -44)	(-5, -43)
Polyacrylate (ACM)	Proposed Spec	(+5, -3)	(+8, -5)	(+18, -15)	(+10, -35)
	TMC 1006 Cal	(+3, -1)	(+4, -7)	(+25, -23)	(+9, -45)
Fluoroelastomer (FKM)	Proposed Spec	(+5, -2)	(+7, -5)	(+10, -76)	(+10, -77)
	TMC 1006 Cal	(+1, 0)	(+14, +1)	(-53, -85)	(-32, -86)
Vamac G	Proposed Spec	(+25, -3)	(+5, -14)	(+10, -24)	(+10, -40)
	TMC 1006 Cal	(+25, +17)	(-6, -12)	(+1, -28)	(-2, -47)

Proposed *Variable Limits* Comparison with SL107 Calibration Limits

- A reference is run together with the candidate to validate the test. Since some labs are still using TMC 1006, the calibration limits should align with the proposed fixed limits as shown below.

Elastomer	Limits	Volume Change, %	Hardness Change, Points	Tensile Strength Change, %	Elongation at Break Change, %
Nitrile (NBR)	Proposed Spec	(+5, -3)	(+7, -5)	(+10, -SL107-30)	(+10, -SL107-17)
	TMC 1006 Cal	(+3, -2)	(+7, -4)	(-5, -49)	(-31, -71)
	SL107 Cal	(+4, -1)	(+7, -3)	(+25, -19)	(-14, -54)
Silicone (VMQ)	Proposed Spec	(+SL107, -3)	(+5, -SL107)	(+10, -45)	(+20, -30)
	TMC 1006 Cal	(+41, +23)	(-15, -28)	(-22, -44)	(-5, -43)
	SL107 Cal	(+41, +23)	(-16, -28)	(-23, -45)	(-6, -44)
Polyacrylate (ACM)	Proposed Spec	(+5, -3)	(+8, -5)	(+18, -15)	(+10, -35)
	TMC 1006 Cal	(+3, -1)	(+4, -7)	(+25, -23)	(+9, -45)
	SL107 Cal	(+2, -2)	(+5, -5)	(+24, -24)	(+4, -49)
Fluoroelastomer (FKM)	Proposed Spec	(+5, -2)	(+7, -5)	(+10, -SL107+2)	(+10, -SL107)
	TMC 1006 Cal	(+1, 0)	(+14, +1)	(-53, -85)	(-32, -86)
	SL107 Cal	(+1, 0)	(+15, +1)	(-55, -87)	(-32, -85)
Vamac G	Proposed Spec	(+SL107+2, -3)	(+5, -SL107-2)	(+10, -SL107+2)	(+10, -SL107+10)
	TMC 1006 Cal	(+25, +17)	(-6, -12)	(+1, -28)	(-2, -47)
	SL107 Cal	(+23, +14)	(-5, -10)	(-1, -30)	(-13, -57)

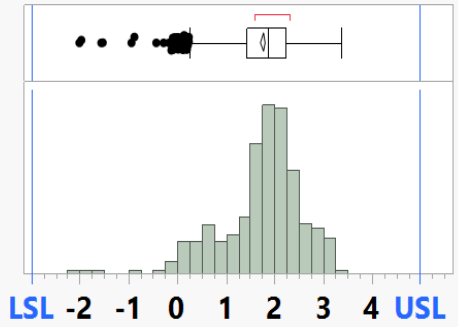
Nitrile (NBR)

Current Limit: VOLC (+5, -3)

- TMC1006

Distributions IND= 1006-1

VOLC

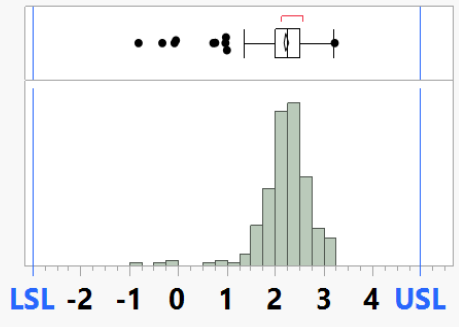


Quantiles		
100.0%	maximum	3.38
99.5%		3.19015
97.5%		3.08
90.0%		2.66
75.0%	quartile	2.23
50.0%	median	1.88
25.0%	quartile	1.44
10.0%		0.58
2.5%		0.02925
0.5%		-0.94885
0.0%	minimum	-2.01

Summary Statistics	
Mean	1.7596084
Std Dev	0.7769226
Std Err Mean	0.0246177
Upper 95% Mean	1.8079171
Lower 95% Mean	1.7112998
N	996

Distributions IND= 1006-2

VOLC



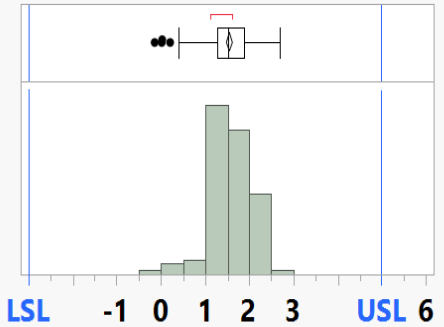
Quantiles		
100.0%	maximum	3.23
99.5%		3.20675
97.5%		3.10375
90.0%		2.75
75.0%	quartile	2.49
50.0%	median	2.25
25.0%	quartile	2.01
10.0%		1.72
2.5%		1.36625
0.5%		-0.23875
0.0%	minimum	-0.81

Summary Statistics	
Mean	2.2310991
Std Dev	0.4651699
Std Err Mean	0.021595
Upper 95% Mean	2.2735354
Lower 95% Mean	2.1886628
N	464

- SL107

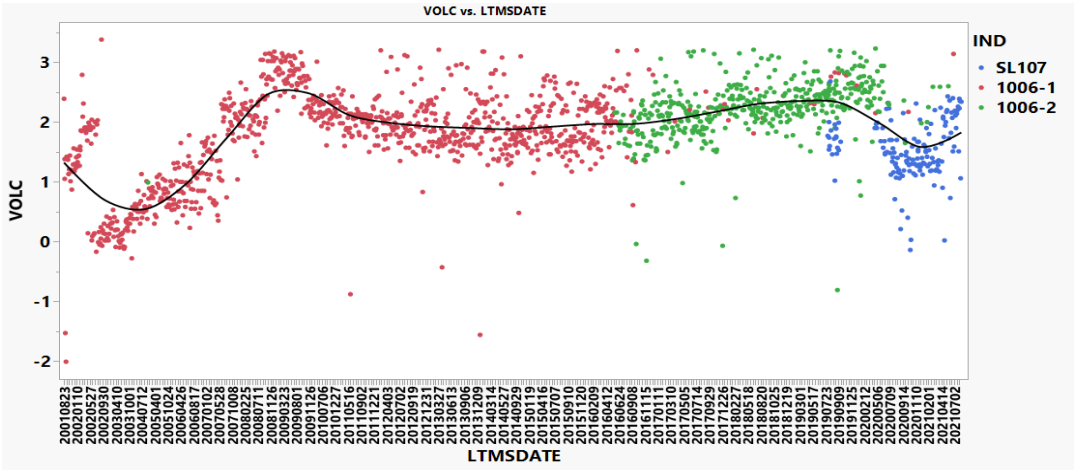
Distributions IND= SL107

VOLC



Quantiles		
100.0%	maximum	2.68
99.5%		2.68
97.5%		2.391
90.0%		2.2
75.0%	quartile	1.9
50.0%	median	1.51
25.0%	quartile	1.28
10.0%		1.106
2.5%		0.192
0.5%		-0.14
0.0%	minimum	-0.14

Summary Statistics	
Mean	1.5538065
Std Dev	0.4822368
Std Err Mean	0.0387342
Upper 95% Mean	1.6303254
Lower 95% Mean	1.4772875
N	155

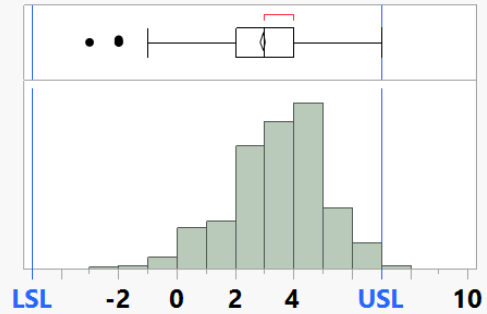


Current Limit: HARD (+7, -5)

- TMC1006

Distributions IND= 1006-1

HARD

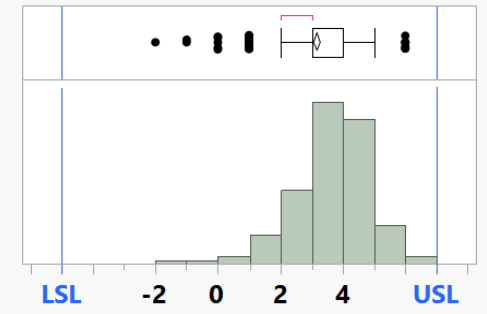


Quantiles		
100.0%	maximum	7
99.5%		6
97.5%		6
90.0%		5
75.0%	quartile	4
50.0%	median	3
25.0%	quartile	2
10.0%		1
2.5%		0
0.5%		-1.01
0.0%	minimum	-3

Summary Statistics	
Mean	2.9618474
Std Dev	1.5859148
Std Err Mean	0.0502516
Upper 95% Mean	3.0604587
Lower 95% Mean	2.863236
N	996

Distributions IND= 1006-2

HARD



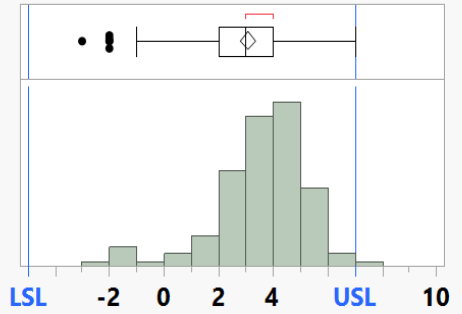
Quantiles		
100.0%	maximum	6
99.5%		6
97.5%		5
90.0%		4
75.0%	quartile	4
50.0%	median	3
25.0%	quartile	3
10.0%		2
2.5%		1
0.5%		-1
0.0%	minimum	-2

Summary Statistics	
Mean	3.174569
Std Dev	1.178332
Std Err Mean	0.0547027
Upper 95% Mean	3.2820653
Lower 95% Mean	3.0670727
N	464

- SL107

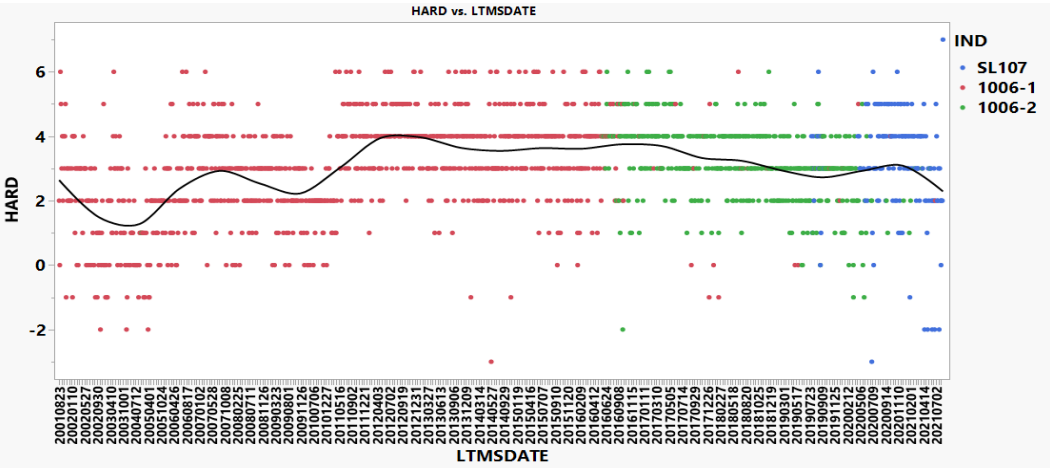
Distributions IND= SL107

HARD



Quantiles		
100.0%	maximum	7
99.5%		7
97.5%		6
90.0%		5
75.0%	quartile	4
50.0%	median	3
25.0%	quartile	2
10.0%		1
2.5%		-2
0.5%		-3
0.0%	minimum	-3

Summary Statistics	
Mean	3.0903226
Std Dev	1.6762967
Std Err Mean	0.1346434
Upper 95% Mean	3.356309
Lower 95% Mean	2.8243362
N	155

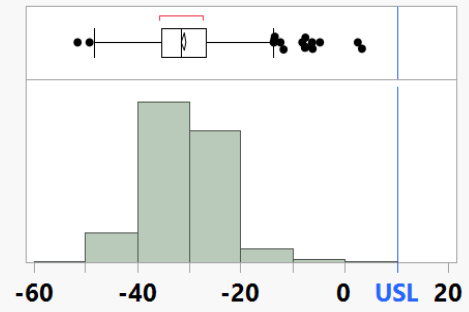


Current Limit: TENS (+10, -TMC 1006)
Proposed Limit: (+10, -47 or –SL107-30)

- TMC1006

Distributions IND= 1006-1

TENS

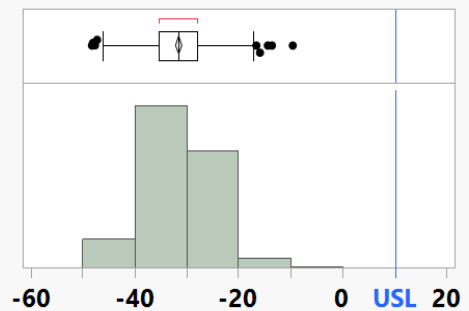


Quantiles		
100.0%	maximum	3.3
99.5%		-6.2985
97.5%		-16.0625
90.0%		-23.3
75.0%	quartile	-26.8
50.0%	median	-31.4
25.0%	quartile	-35.5
10.0%		-39.1
2.5%		-43.36
0.5%		-47.806
0.0%	minimum	-51.5

Summary Statistics	
Mean	-31.06064
Std Dev	6.829825
Std Err Mean	0.2164113
Upper 95% Mean	-30.63597
Lower 95% Mean	-31.48532
N	996

Distributions IND= 1006-2

TENS



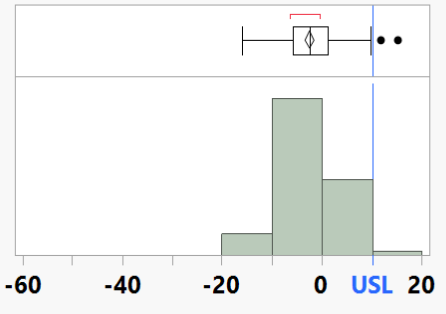
Quantiles		
100.0%	maximum	-9.6
99.5%		-13.86
97.5%		-18.9
90.0%		-24.2
75.0%	quartile	-27.925
50.0%	median	-31.4
25.0%	quartile	-35.375
10.0%		-39
2.5%		-43.8
0.5%		-47.87
0.0%	minimum	-48.2

Summary Statistics	
Mean	-31.48233
Std Dev	6.006378
Std Err Mean	0.2788391
Upper 95% Mean	-30.93438
Lower 95% Mean	-32.03027
N	464

- SL107

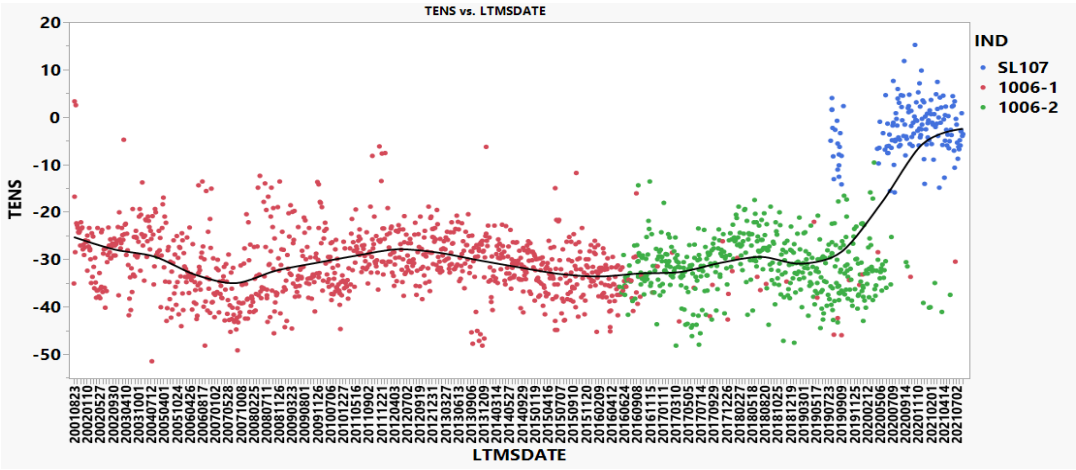
Distributions IND= SL107

TENS



Quantiles		
100.0%	maximum	15.2
99.5%		15.2
97.5%		7.82
90.0%		4.22
75.0%	quartile	1
50.0%	median	-2.6
25.0%	quartile	-5.9
10.0%		-8.84
2.5%		-14.27
0.5%		-15.9
0.0%	minimum	-15.9

Summary Statistics	
Mean	-2.470323
Std Dev	5.2923392
Std Err Mean	0.4250909
Upper 95% Mean	-1.630561
Lower 95% Mean	-3.310085
N	155

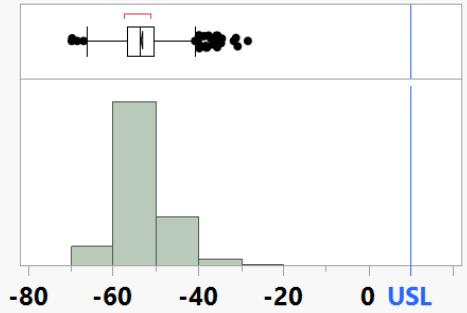


Current Limit: ELON (+10, -TMC 1006)
Proposed Limit: (+10, -66 or –SL107-17)

- TMC1006

Distributions IND= 1006-1

ELON

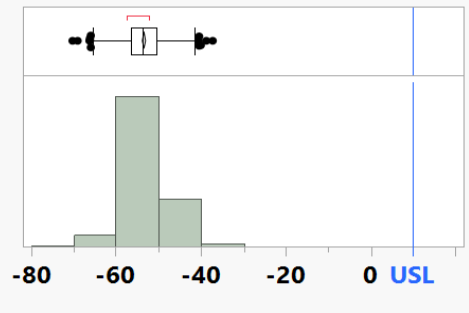


Quantiles		
100.0%	maximum	-28.3
99.5%		-34.358
97.5%		-40.8
90.0%		-46.57
75.0%	quartile	-50.325
50.0%	median	-53.6
25.0%	quartile	-56.7
10.0%		-59.33
2.5%		-62.4075
0.5%		-66.0135
0.0%	minimum	-69.7

Summary Statistics	
Mean	-53.17149
Std Dev	5.392691
Std Err Mean	0.170874
Upper 95% Mean	-52.83617
Lower 95% Mean	-53.5068
N	996

Distributions IND= 1006-2

ELON



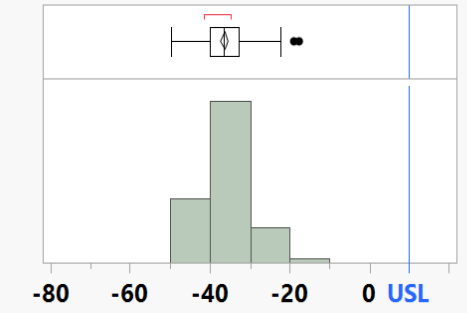
Quantiles		
100.0%	maximum	-37.2
99.5%		-39.1225
97.5%		-42.925
90.0%		-47.2
75.0%	quartile	-50.225
50.0%	median	-53.85
25.0%	quartile	-56.3
10.0%		-58.4
2.5%		-63.9375
0.5%		-68.09
0.0%	minimum	-70.2

Summary Statistics	
Mean	-53.32866
Std Dev	4.8178952
Std Err Mean	0.2236652
Upper 95% Mean	-52.88914
Lower 95% Mean	-53.76819
N	464

- SL107

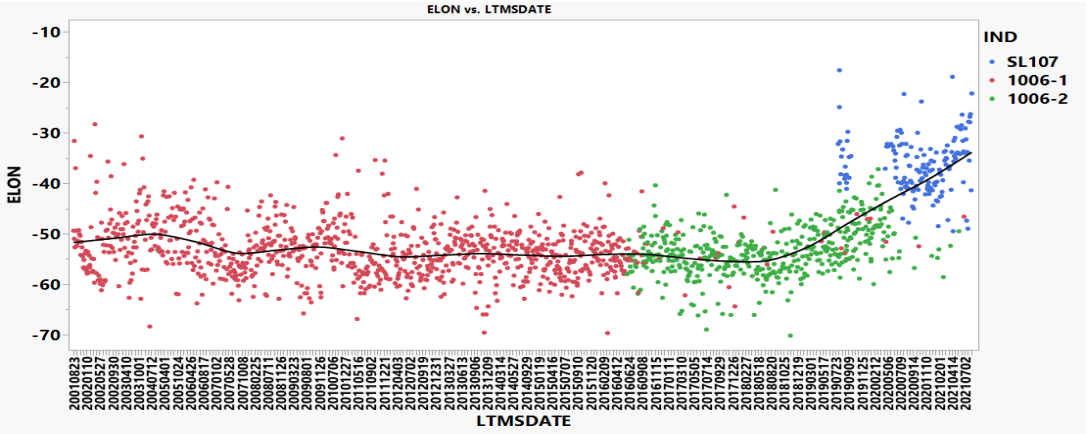
Distributions IND= SL107

ELON



Quantiles		
100.0%	maximum	-17.6
99.5%		-17.6
97.5%		-22.29
90.0%		-29.06
75.0%	quartile	-32.7
50.0%	median	-36.6
25.0%	quartile	-40
10.0%		-42.32
2.5%		-47.87
0.5%		-49.5
0.0%	minimum	-49.5

Summary Statistics	
Mean	-36.25355
Std Dev	5.6859622
Std Err Mean	0.4567075
Upper 95% Mean	-35.35133
Lower 95% Mean	-37.15577
N	155



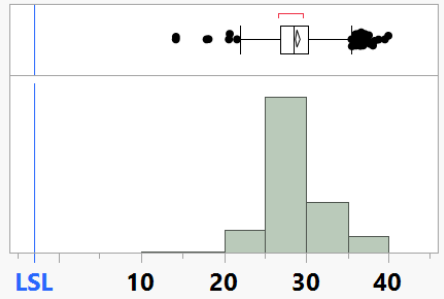
Silicone (VMQ)

Current Limit: VOLC (+TMC 1006, -3)
Proposed Limit: (+41 or +SL107, -3)

- TMC1006

Distributions IND= 1006-1

VOLC

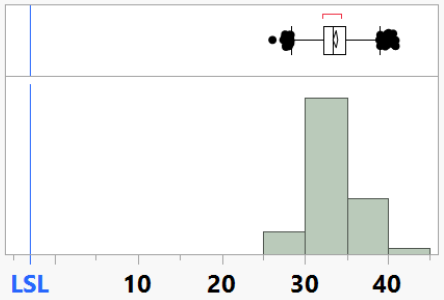


Quantiles		
100.0%	maximum	39.95
99.5%		38.1196
97.5%		36.66
90.0%		33.824
75.0%	quartile	30.28
50.0%	median	28.58
25.0%	quartile	26.85
10.0%		25.184
2.5%		23.436
0.5%		20.0988
0.0%	minimum	14.22

Summary Statistics	
Mean	28.972796
Std Dev	3.4092368
Std Err Mean	0.1103203
Upper 95% Mean	29.189294
Lower 95% Mean	28.756297
N	955

Distributions IND= 1006-2

VOLC



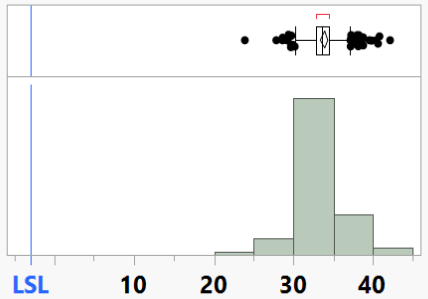
Quantiles		
100.0%	maximum	40.88
99.5%		40.852
97.5%		39.842
90.0%		37.794
75.0%	quartile	34.93
50.0%	median	33.28
25.0%	quartile	32.28
10.0%		30.09
2.5%		28.124
0.5%		27.4776
0.0%	minimum	26.12

Summary Statistics	
Mean	33.660701
Std Dev	2.8235579
Std Err Mean	0.1301027
Upper 95% Mean	33.916356
Lower 95% Mean	33.405046
N	471

- SL107

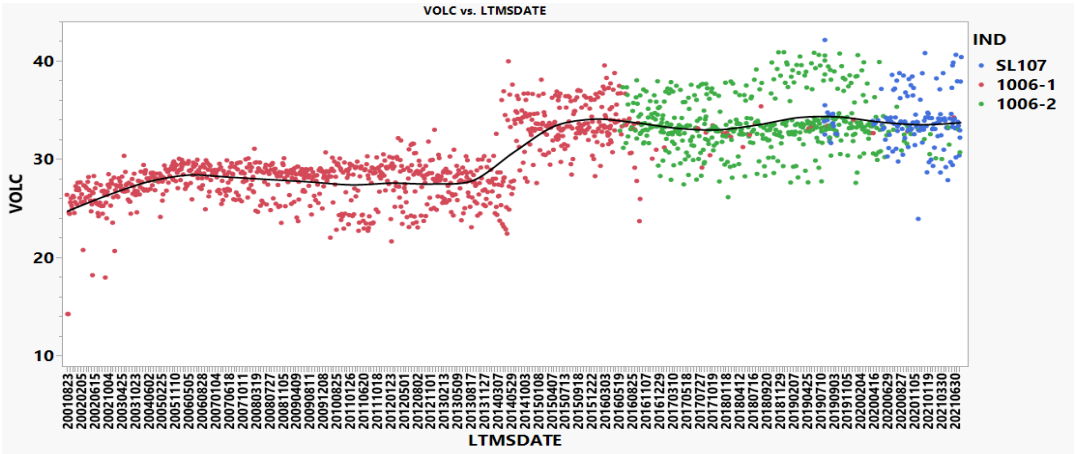
Distributions IND= SL107

VOLC



Quantiles		
100.0%	maximum	42.12
99.5%		42.12
97.5%		40.45475
90.0%		38.035
75.0%	quartile	34.5325
50.0%	median	33.645
25.0%	quartile	32.795
10.0%		30.419
2.5%		28.6435
0.5%		23.91
0.0%	minimum	23.91

Summary Statistics	
Mean	33.85637
Std Dev	2.7470192
Std Err Mean	0.2273449
Upper 95% Mean	34.305708
Lower 95% Mean	33.407032
N	146

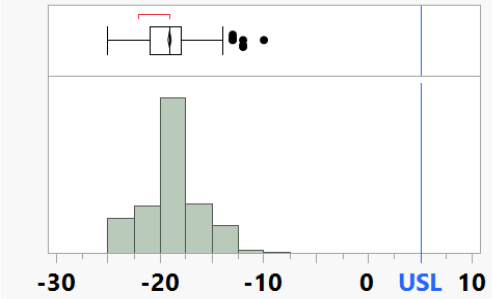


Current Limit: HARD (+5, -TMC 1006)
Proposed Limit: (+5, -27 or –SL107)

- TMC1006

Distributions IND= 1006-1

HARD

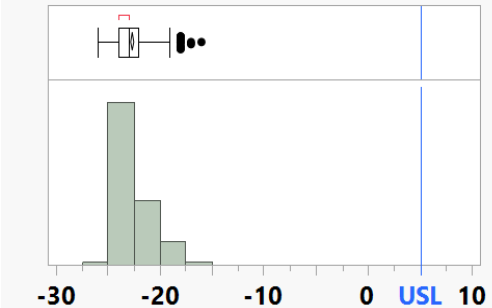


Quantiles		
100.0%	maximum	-10
99.5%		-12.78
97.5%		-14
90.0%		-16
75.0%	quartile	-18
50.0%	median	-19
25.0%	quartile	-21
10.0%		-23
2.5%		-24
0.5%		-25
0.0%	minimum	-25

Summary Statistics	
Mean	-19.09843
Std Dev	2.5914607
Std Err Mean	0.0838577
Upper 95% Mean	-18.93386
Lower 95% Mean	-19.263
N	955

Distributions IND= 1006-2

HARD



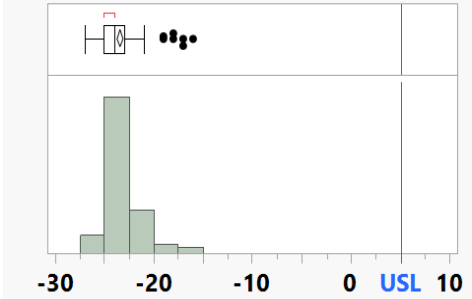
Quantiles		
100.0%	maximum	-16
99.5%		-17
97.5%		-18
90.0%		-20.2
75.0%	quartile	-22
50.0%	median	-23
25.0%	quartile	-24
10.0%		-24
2.5%		-25
0.5%		-25.64
0.0%	minimum	-26

Summary Statistics	
Mean	-22.69639
Std Dev	1.6679608
Std Err Mean	0.0768556
Upper 95% Mean	-22.54537
Lower 95% Mean	-22.84741
N	471

- SL107

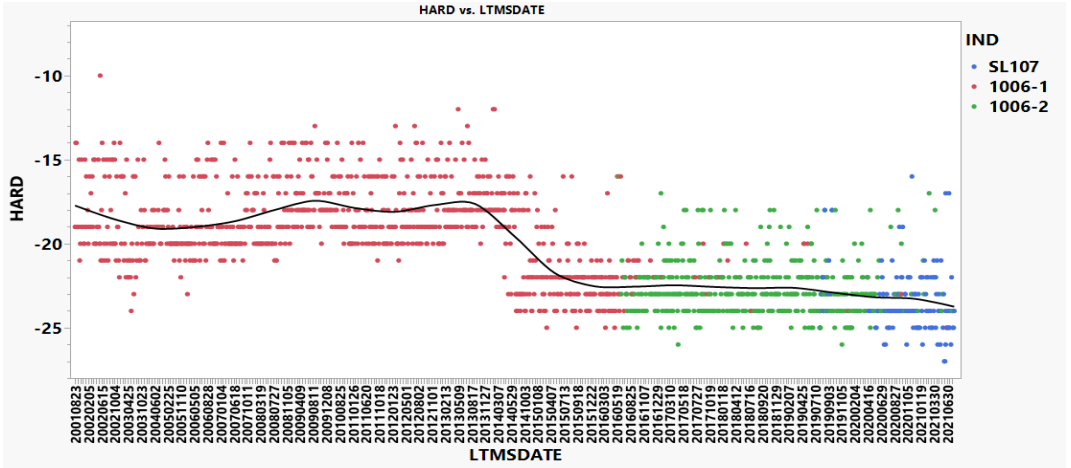
Distributions IND= SL107

HARD



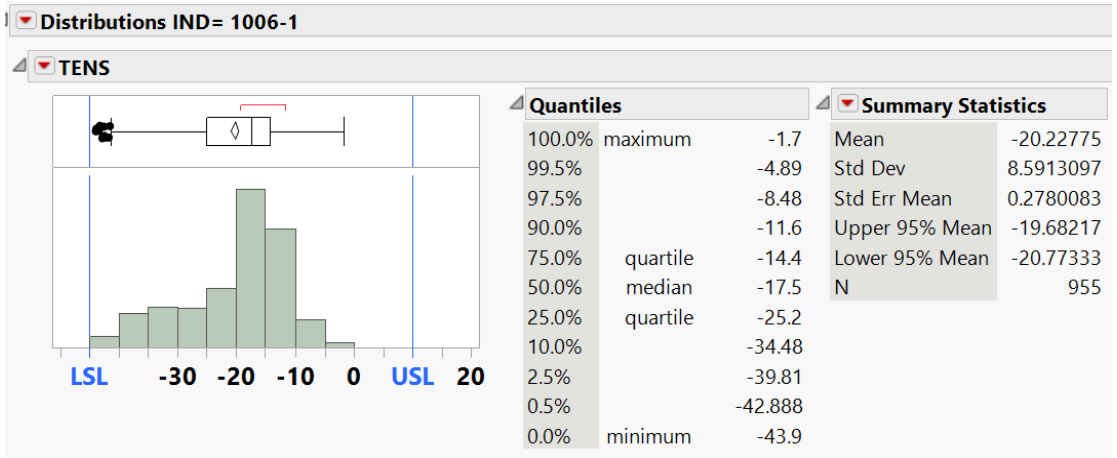
Quantiles		
100.0%	maximum	-16
99.5%		-16
97.5%		-17.675
90.0%		-21
75.0%	quartile	-23
50.0%	median	-24
25.0%	quartile	-25
10.0%		-25
2.5%		-26
0.5%		-27
0.0%	minimum	-27

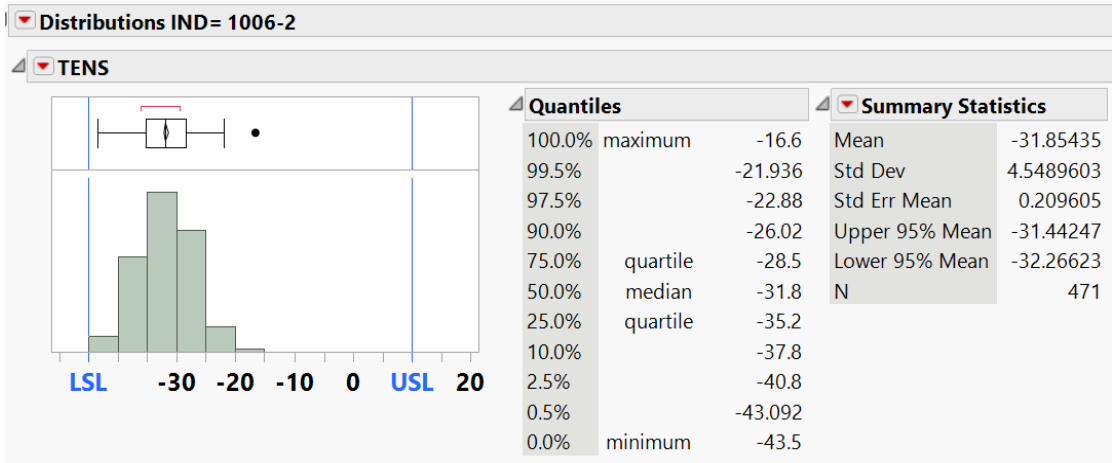
Summary Statistics	
Mean	-23.44521
Std Dev	1.8938405
Std Err Mean	0.1567354
Upper 95% Mean	-23.13542
Lower 95% Mean	-23.75499
N	146



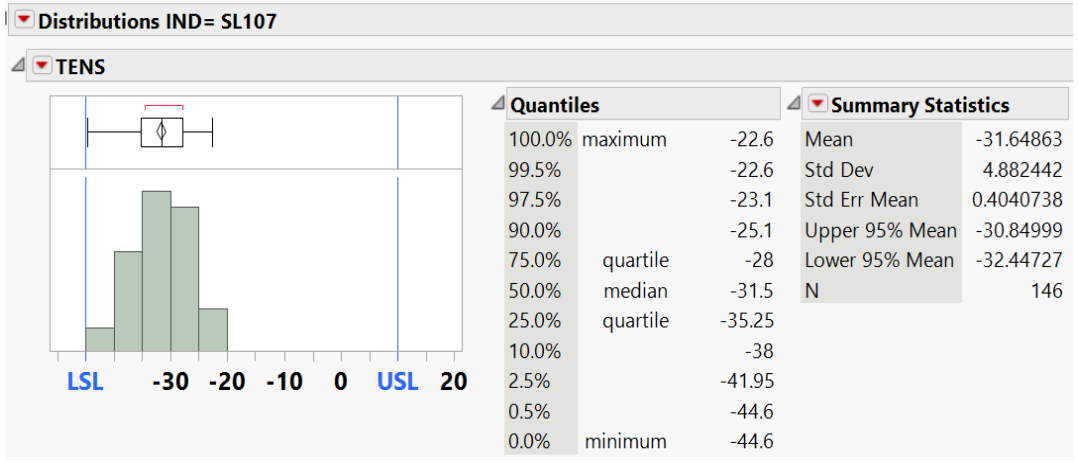
Current Limit: TENS (+10, -45)

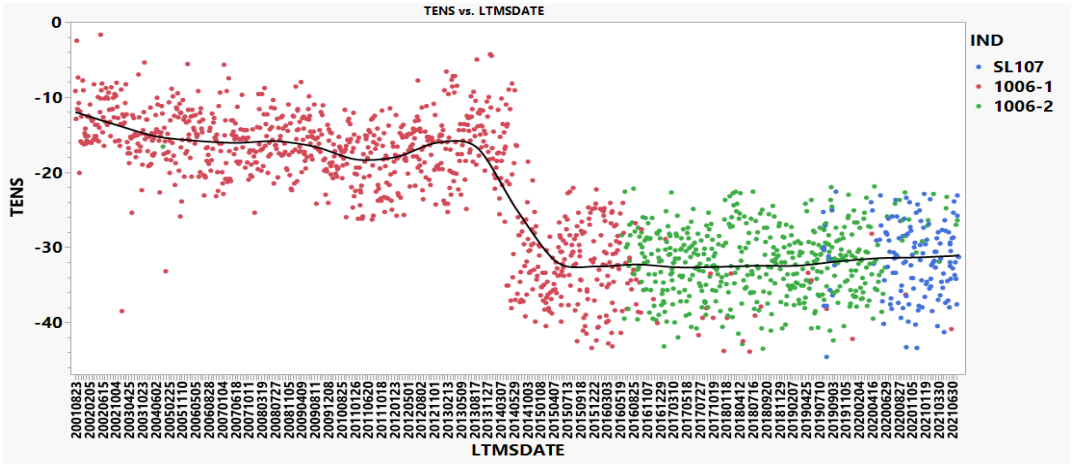
- TMC1006





- SL107



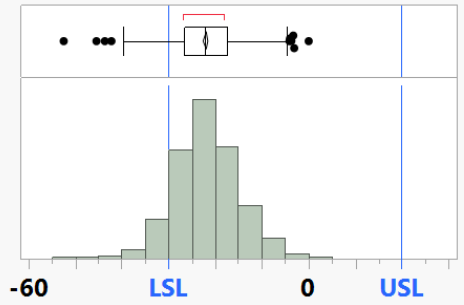


Current Limit: ELON (+20, -30)

- TMC1006

Distributions IND= 1006-1

ELON

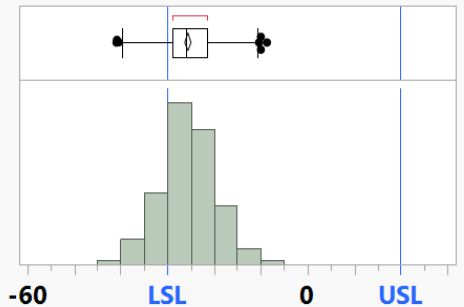


Quantiles		
100.0%	maximum	0
99.5%		-3.934
97.5%		-8.3
90.0%		-13.66
75.0%	quartile	-17.6
50.0%	median	-22.2
25.0%	quartile	-26.5
10.0%		-29.94
2.5%		-34.51
0.5%		-40.328
0.0%	minimum	-52.4

Summary Statistics	
Mean	-22.00325
Std Dev	6.682704
Std Err Mean	0.2162472
Upper 95% Mean	-21.57887
Lower 95% Mean	-22.42762
N	955

Distributions IND= 1006-2

ELON



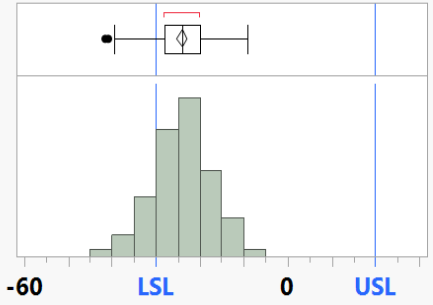
Quantiles		
100.0%	maximum	-8.7
99.5%		-10
97.5%		-12.46
90.0%		-18.2
75.0%	quartile	-21.7
50.0%	median	-25.8
25.0%	quartile	-29
10.0%		-33.2
2.5%		-37.72
0.5%		-40.656
0.0%	minimum	-40.9

Summary Statistics	
Mean	-25.60382
Std Dev	5.8974414
Std Err Mean	0.2717398
Upper 95% Mean	-25.06985
Lower 95% Mean	-26.1378
N	471

- SL107

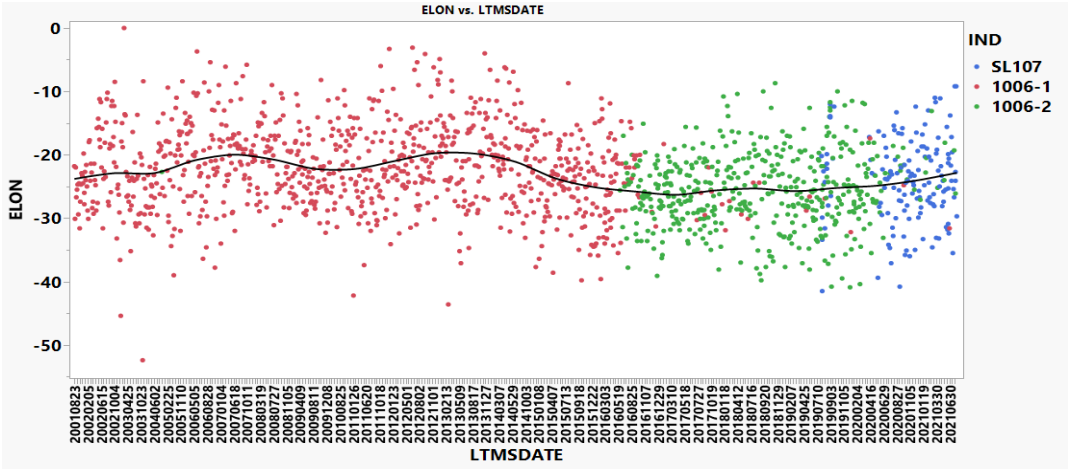
Distributions IND= SL107

ELON



Quantiles		
100.0%	maximum	-9.2
99.5%		-9.2
97.5%		-11.0675
90.0%		-15.34
75.0%	quartile	-19.875
50.0%	median	-24
25.0%	quartile	-28.1
10.0%		-33.23
2.5%		-37.8475
0.5%		-41.5
0.0%	minimum	-41.5

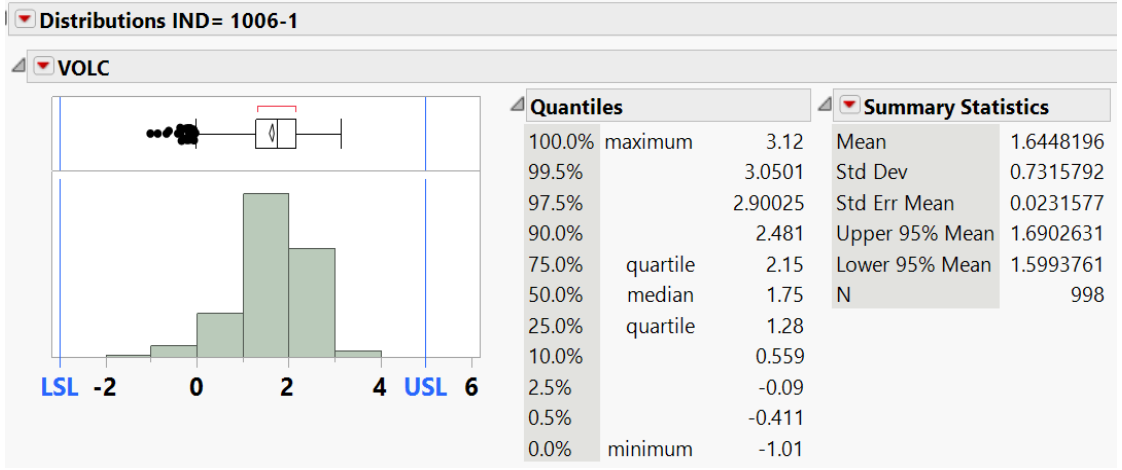
Summary Statistics	
Mean	-24.03288
Std Dev	6.695795
Std Err Mean	0.5541479
Upper 95% Mean	-22.93763
Lower 95% Mean	-25.12813
N	146

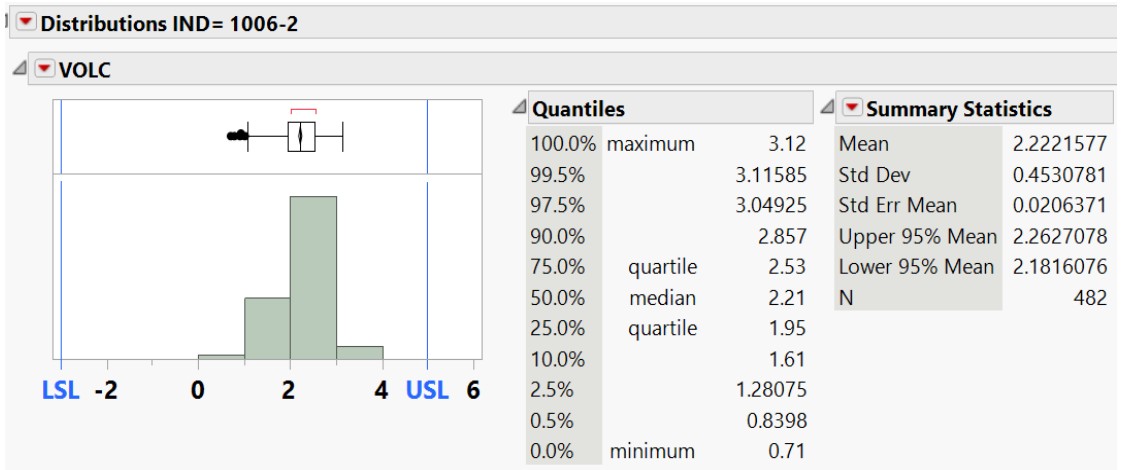


Polyacrylate (ACM)

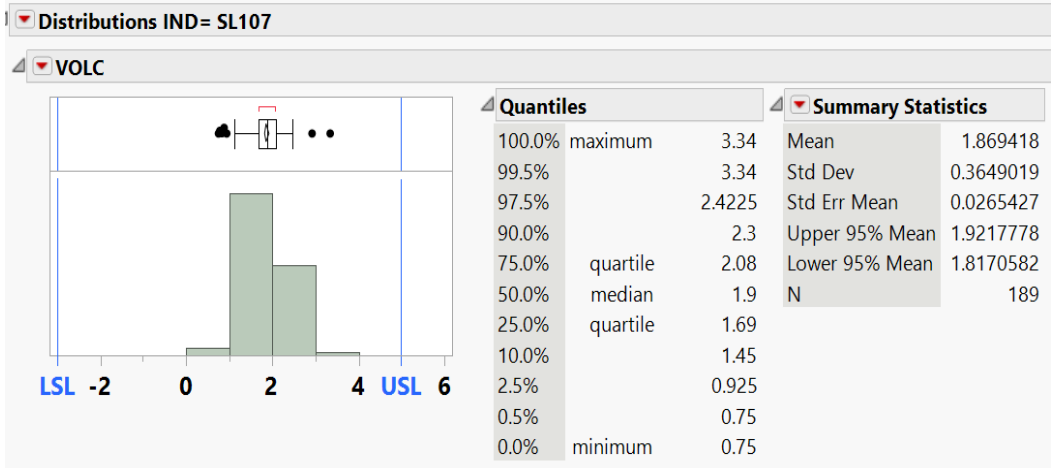
Current Limit: VOLC (+5, -3)

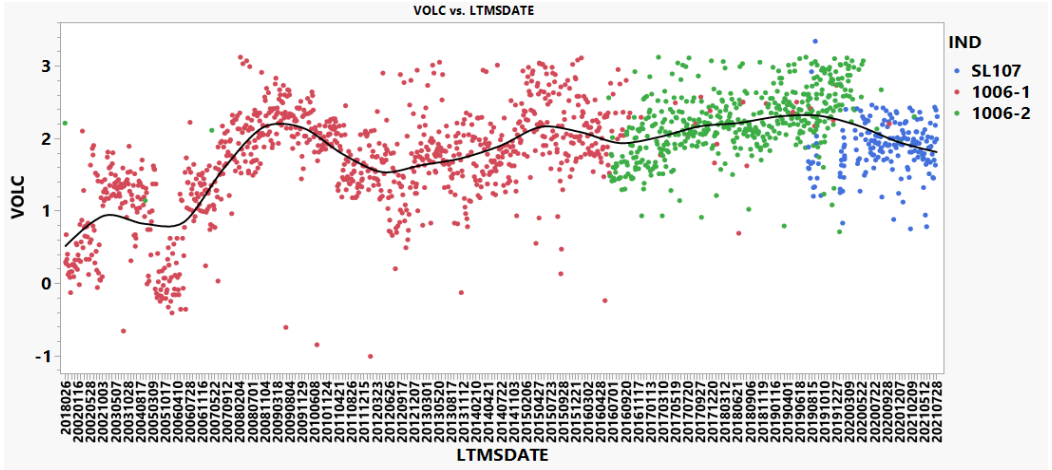
- TMC1006





- SL107



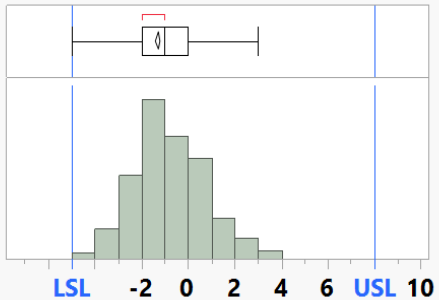


Current Limit: HARD (+8, -5)

- TMC1006

Distributions IND= 1006-1

HARD

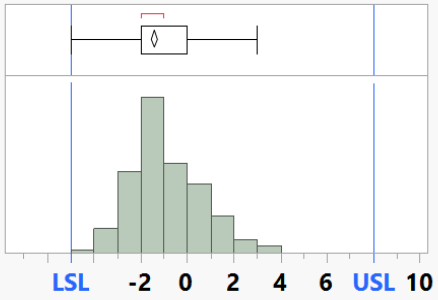


Quantiles		
100.0%	maximum	3
99.5%		3
97.5%		2
90.0%		1
75.0%	quartile	0
50.0%	median	-1
25.0%	quartile	-2
10.0%		-3
2.5%		-4
0.5%		-5
0.0%	minimum	-5

Summary Statistics	
Mean	-1.299599
Std Dev	1.523938
Std Err Mean	0.0482394
Upper 95% Mean	-1.204937
Lower 95% Mean	-1.394262
N	998

Distributions IND= 1006-2

HARD



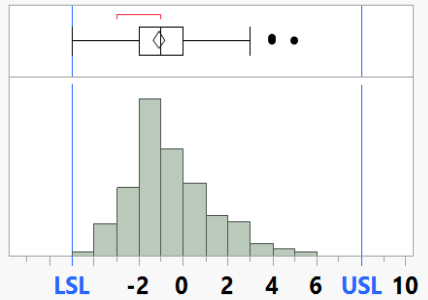
Quantiles		
100.0%	maximum	3
99.5%		3
97.5%		2
90.0%		1
75.0%	quartile	0
50.0%	median	-2
25.0%	quartile	-2
10.0%		-3
2.5%		-4
0.5%		-4.585
0.0%	minimum	-5

Summary Statistics	
Mean	-1.40249
Std Dev	1.5080636
Std Err Mean	0.0686904
Upper 95% Mean	-1.267519
Lower 95% Mean	-1.53746
N	482

- SL107

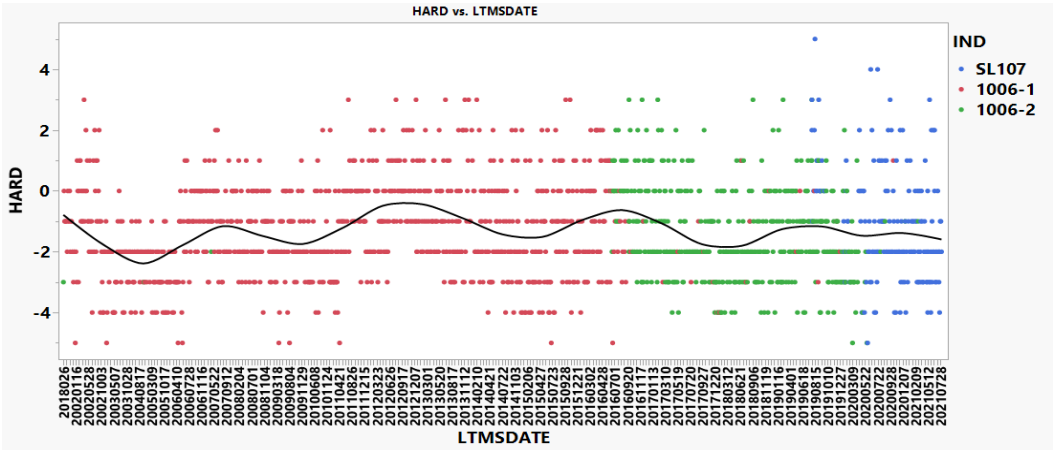
Distributions IND= SL107

HARD



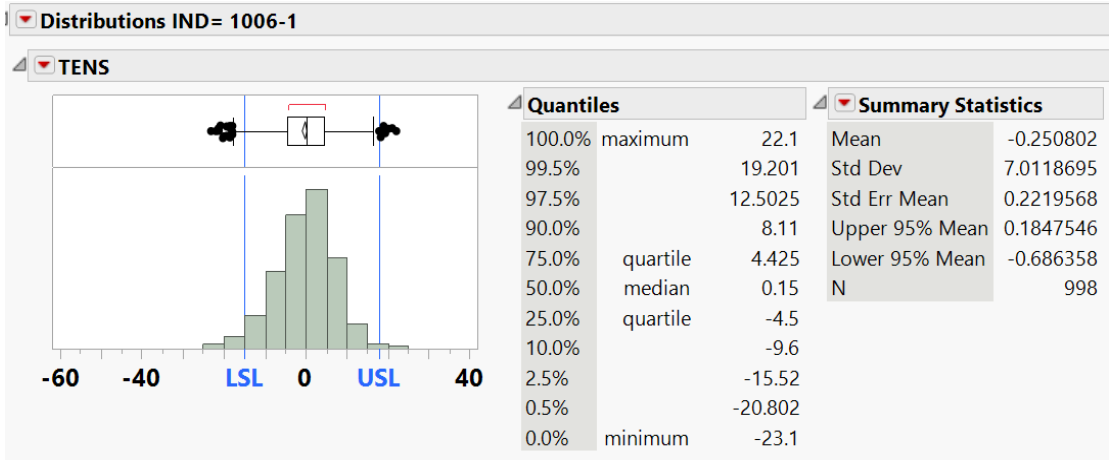
Quantiles		
100.0%	maximum	5
99.5%		5
97.5%		3
90.0%		2
75.0%	quartile	0
50.0%	median	-1
25.0%	quartile	-2
10.0%		-3
2.5%		-4
0.5%		-5
0.0%	minimum	-5

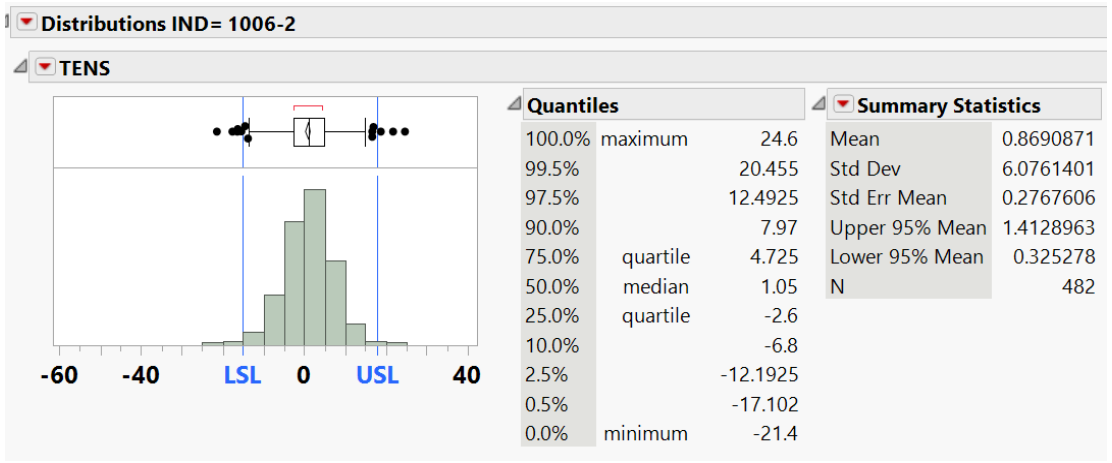
Summary Statistics	
Mean	-1.100529
Std Dev	1.7940355
Std Err Mean	0.1304969
Upper 95% Mean	-0.843103
Lower 95% Mean	-1.357955
N	189



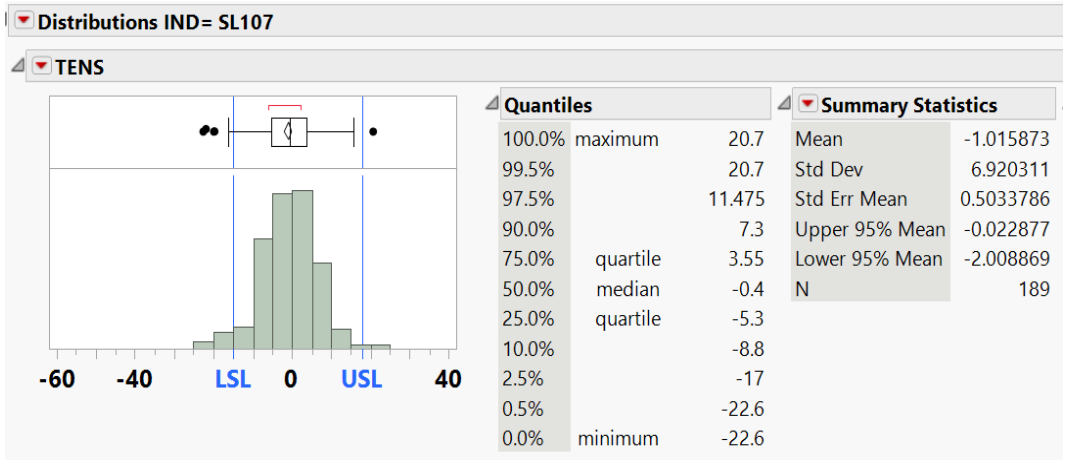
Current Limit: TENS (+18, -15)

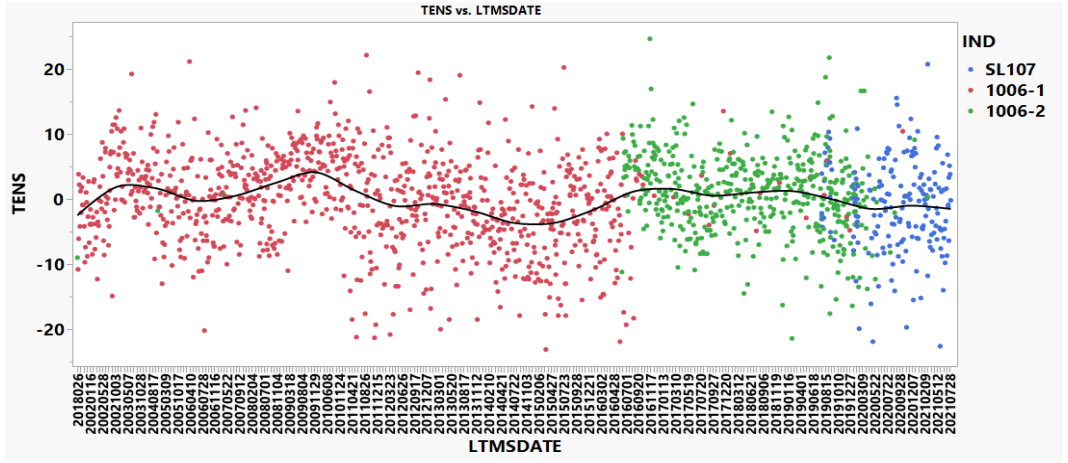
- TMC1006





- SL107



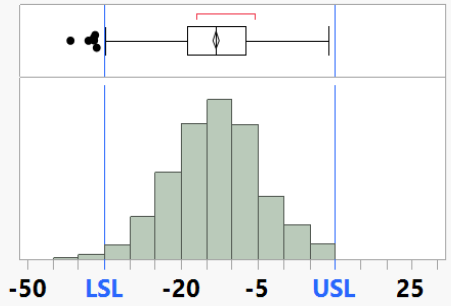


Current Limit: ELON (+10, -35)

- TMC1006

Distributions IND= 1006-1

ELON

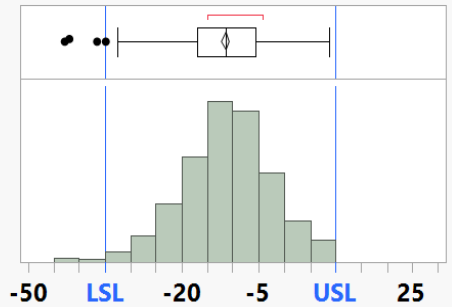


Quantiles		
100.0%	maximum	8.7
99.5%		7.3005
97.5%		4.5
90.0%		-2.08
75.0%	quartile	-7.375
50.0%	median	-13
25.0%	quartile	-18.925
10.0%		-24.3
2.5%		-30.7075
0.5%		-36.701
0.0%	minimum	-41.5

Summary Statistics	
Mean	-13.16703
Std Dev	8.6076291
Std Err Mean	0.2724697
Upper 95% Mean	-12.63235
Lower 95% Mean	-13.70171
N	998

Distributions IND= 1006-2

ELON



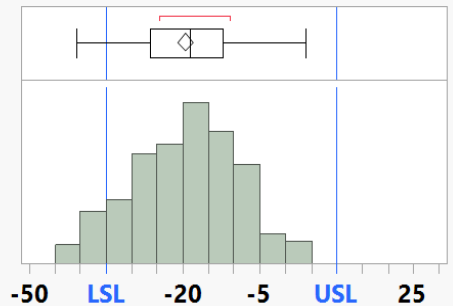
Quantiles		
100.0%	maximum	8.7
99.5%		8.117
97.5%		5.7925
90.0%		-0.5
75.0%	quartile	-5.775
50.0%	median	-11.4
25.0%	quartile	-17.025
10.0%		-23
2.5%		-28.94
0.5%		-39.659
0.0%	minimum	-42.8

Summary Statistics	
Mean	-11.45353
Std Dev	8.6545914
Std Err Mean	0.3942058
Upper 95% Mean	-10.67895
Lower 95% Mean	-12.22811
N	482

- SL107

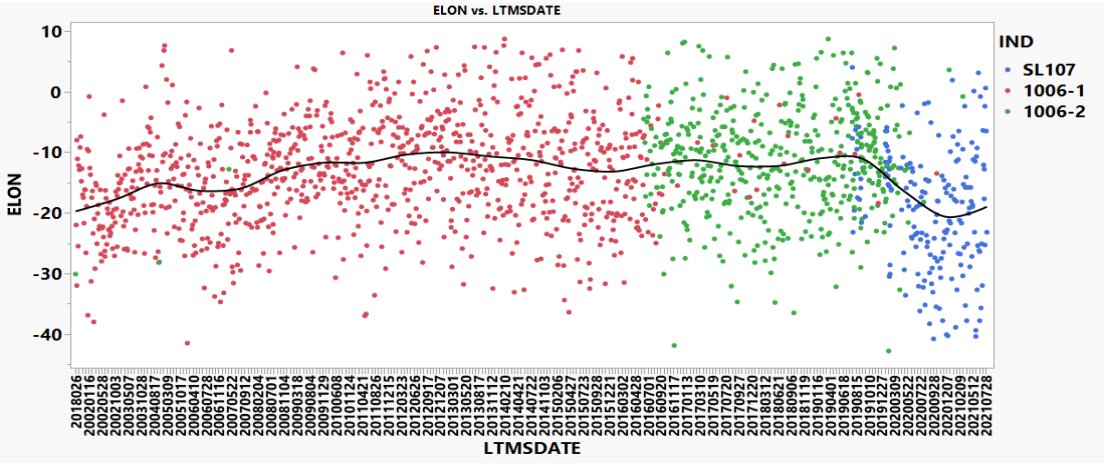
Distributions IND= SL107

ELON



Quantiles		
100.0%	maximum	4
99.5%		4
97.5%		0.225
90.0%		-6.5
75.0%	quartile	-12.2
50.0%	median	-18.6
25.0%	quartile	-26.45
10.0%		-32.7
2.5%		-39.575
0.5%		-40.8
0.0%	minimum	-40.8

Summary Statistics	
Mean	-19.33651
Std Dev	10.025722
Std Err Mean	0.7292639
Upper 95% Mean	-17.89792
Lower 95% Mean	-20.7751
N	189



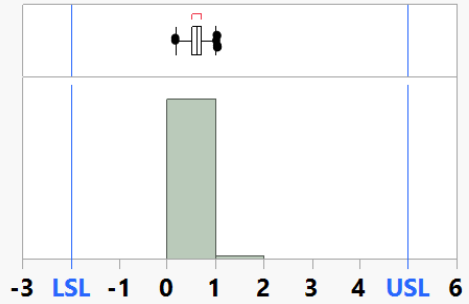
Fluoroelastomer (FKM)

Current Limit: VOLC (+5, -2)

- TMC1006

Distributions IND= 1006-1

VOLC



Quantiles

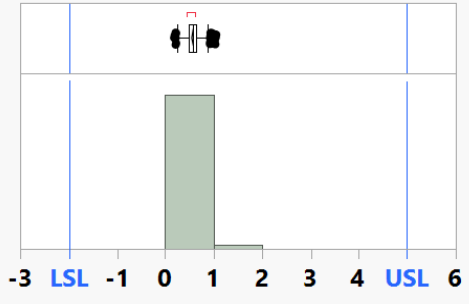
100.0%	maximum	1.05
99.5%		1.04
97.5%		0.95
90.0%		0.83
75.0%	quartile	0.7
50.0%	median	0.6
25.0%	quartile	0.5
10.0%		0.41
2.5%		0.31
0.5%		0.21
0.0%	minimum	0.17

Summary Statistics

Mean	0.6077956
Std Dev	0.159495
Std Err Mean	0.0050487
Upper 95% Mean	0.6177029
Lower 95% Mean	0.5978882
N	998

Distributions IND= 1006-2

VOLC



Quantiles

100.0%	maximum	1.05
99.5%		1.0367
97.5%		0.9735
90.0%		0.744
75.0%	quartile	0.645
50.0%	median	0.56
25.0%	quartile	0.48
10.0%		0.4
2.5%		0.26
0.5%		0.19
0.0%	minimum	0.18

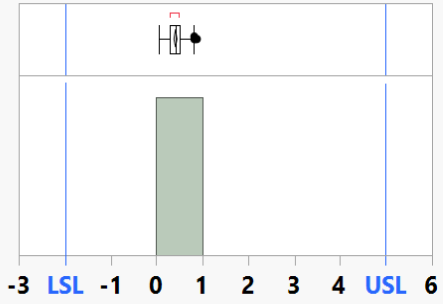
Summary Statistics

Mean	0.5713548
Std Dev	0.1536892
Std Err Mean	0.0071272
Upper 95% Mean	0.5853604
Lower 95% Mean	0.5573493
N	465

- SL107

Distributions IND= SL107

VOLC

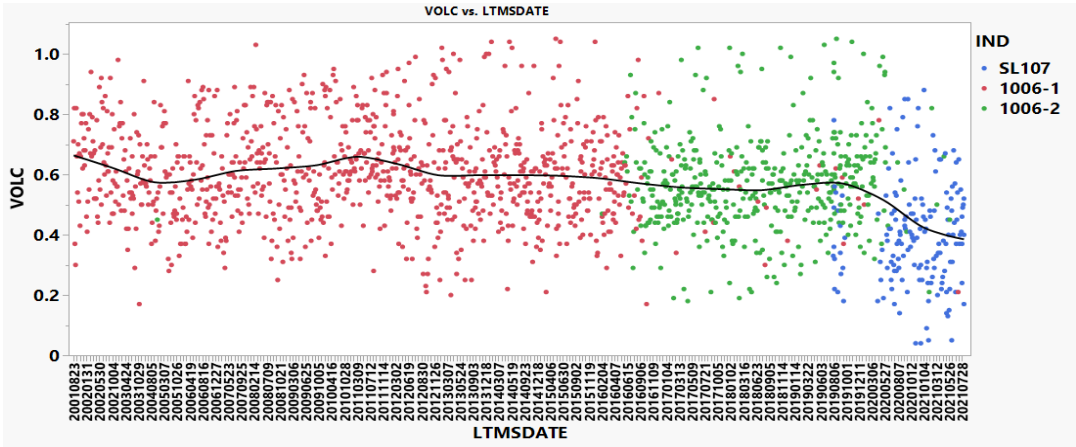


Quantiles

100.0%	maximum	0.88
99.5%		0.88
97.5%		0.82
90.0%		0.65
75.0%	quartile	0.5
50.0%	median	0.4
25.0%	quartile	0.29
10.0%		0.205
2.5%		0.055
0.5%		0.04
0.0%	minimum	0.04

Summary Statistics

Mean	0.4053049
Std Dev	0.1729833
Std Err Mean	0.0135077
Upper 95% Mean	0.4319776
Lower 95% Mean	0.3786322
N	164

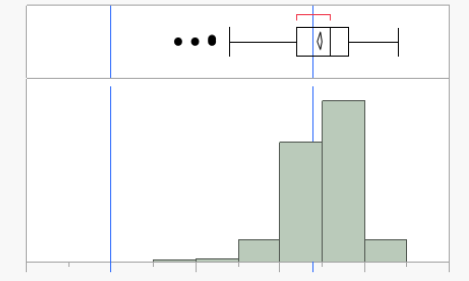


Current Limit: HARD (+7, -5)

- TMC1006

Distributions IND= 1006-1

HARD

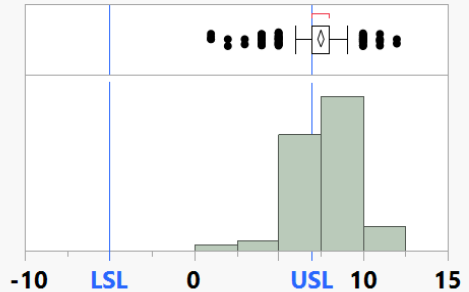


Quantiles		
100.0%	maximum	12
99.5%		11.005
97.5%		10
90.0%		9
75.0%	quartile	9
50.0%	median	8
25.0%	quartile	6
10.0%		5
2.5%		4
0.5%		1.995
0.0%	minimum	-1

Summary Statistics	
Mean	7.3787575
Std Dev	1.7366281
Std Err Mean	0.054972
Upper 95% Mean	7.4866316
Lower 95% Mean	7.2708834
N	998

Distributions IND= 1006-2

HARD



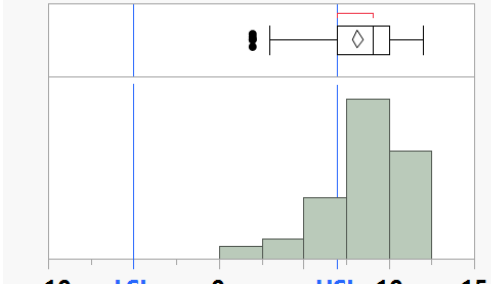
Quantiles		
100.0%	maximum	12
99.5%		11.67
97.5%		10
90.0%		9
75.0%	quartile	8
50.0%	median	8
25.0%	quartile	7
10.0%		6
2.5%		4
0.5%		1
0.0%	minimum	1

Summary Statistics	
Mean	7.511828
Std Dev	1.616313
Std Err Mean	0.0749547
Upper 95% Mean	7.6591207
Lower 95% Mean	7.3645352
N	465

- SL107

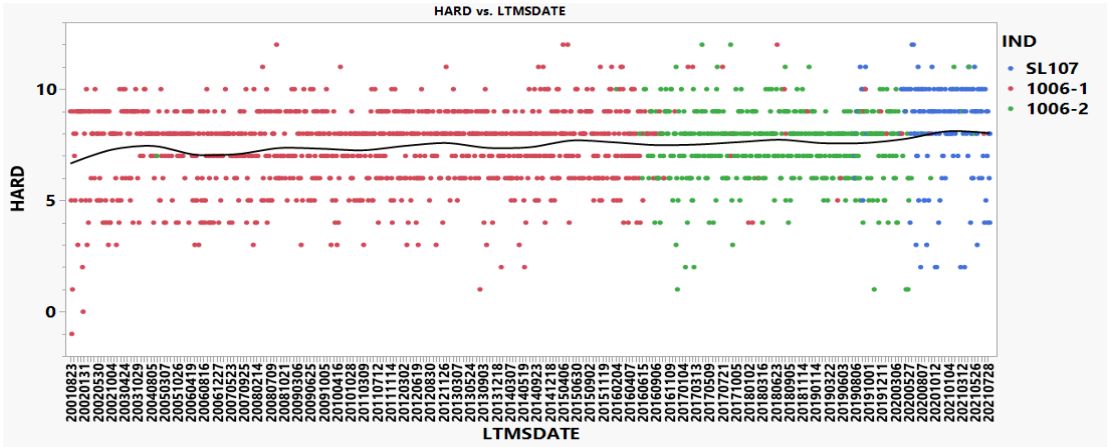
Distributions IND= SL107

HARD



Quantiles		
100.0%	maximum	12
99.5%		12
97.5%		11
90.0%		10
75.0%	quartile	10
50.0%	median	9
25.0%	quartile	7
10.0%		5
2.5%		2
0.5%		2
0.0%	minimum	2

Summary Statistics	
Mean	8.1707317
Std Dev	2.1410672
Std Err Mean	0.1671893
Upper 95% Mean	8.5008677
Lower 95% Mean	7.8405957
N	164

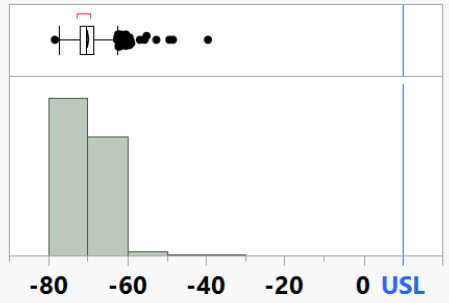


Current Limit: TENS (+10, -TMC 1006)
Proposed Limit: (+10, -76 or –SL107+2)

- TMC1006

Distributions IND= 1006-1

TENS

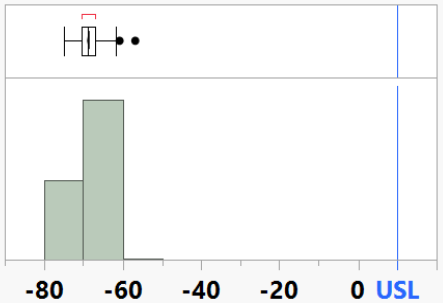


Quantiles		
100.0%	maximum	-39.5
99.5%		-55.0875
97.5%		-61.6975
90.0%		-65.89
75.0%	quartile	-68.4
50.0%	median	-70.5
25.0%	quartile	-72.2
10.0%		-73.3
2.5%		-74.8
0.5%		-76.202
0.0%	minimum	-78.4

Summary Statistics	
Mean	-69.95271
Std Dev	3.4052599
Std Err Mean	0.1077916
Upper 95% Mean	-69.74118
Lower 95% Mean	-70.16423
N	998

Distributions IND= 1006-2

TENS



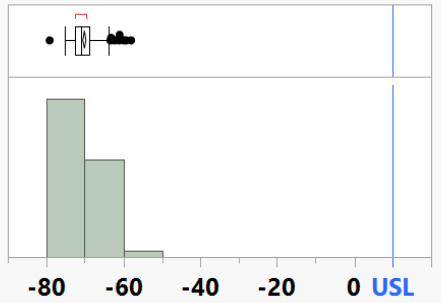
Quantiles		
100.0%	maximum	-56.8
99.5%		-61.097
97.5%		-62.6
90.0%		-65.4
75.0%	quartile	-66.95
50.0%	median	-68.9
25.0%	quartile	-70.7
10.0%		-71.9
2.5%		-73
0.5%		-73.801
0.0%	minimum	-74.9

Summary Statistics	
Mean	-68.68882
Std Dev	2.6152742
Std Err Mean	0.1212804
Upper 95% Mean	-68.45049
Lower 95% Mean	-68.92714
N	465

- SL107

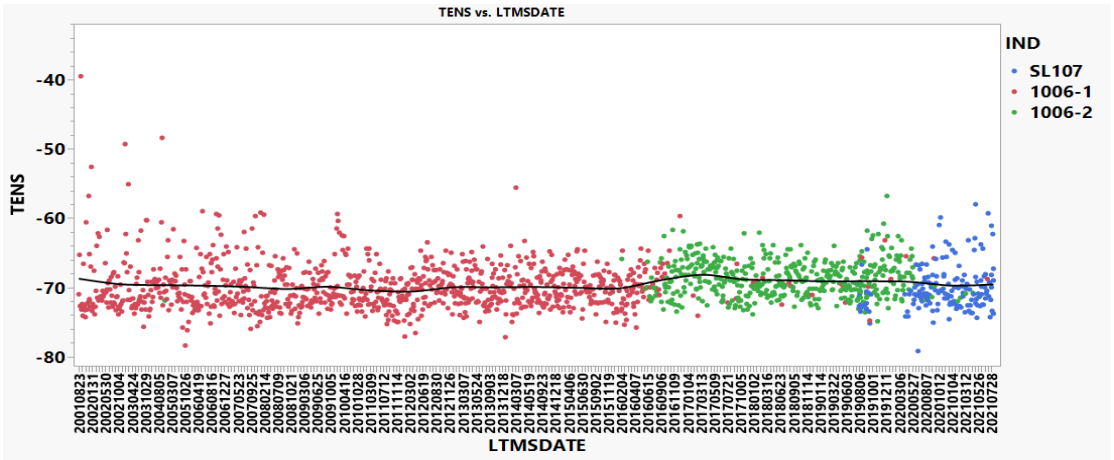
Distributions IND= SL107

TENS



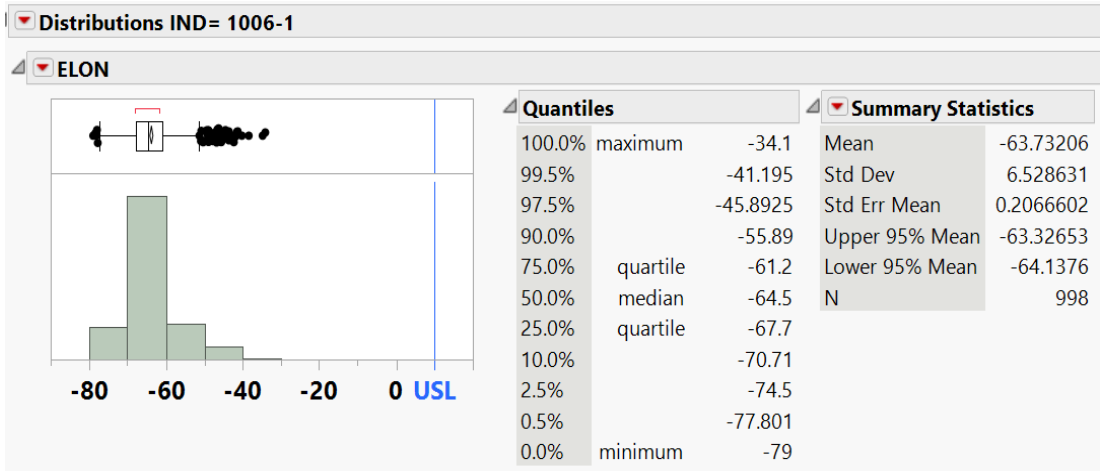
Quantiles		
100.0%	maximum	-58
99.5%		-58
97.5%		-61.0125
90.0%		-64.8
75.0%	quartile	-68.925
50.0%	median	-70.9
25.0%	quartile	-72.375
10.0%		-73.4
2.5%		-74.575
0.5%		-79.2
0.0%	minimum	-79.2

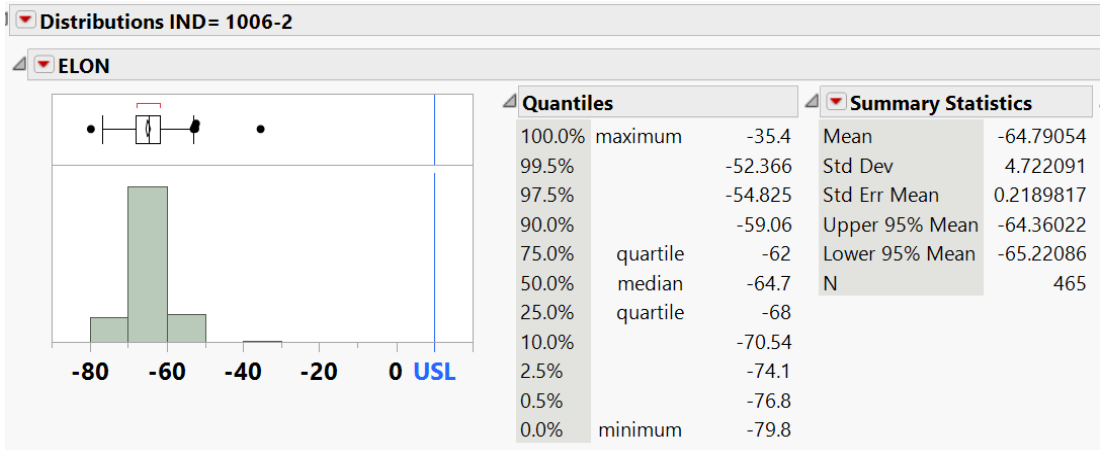
Summary Statistics	
Mean	-70.0878
Std Dev	3.302514
Std Err Mean	0.257883
Upper 95% Mean	-69.57858
Lower 95% Mean	-70.59703
N	164



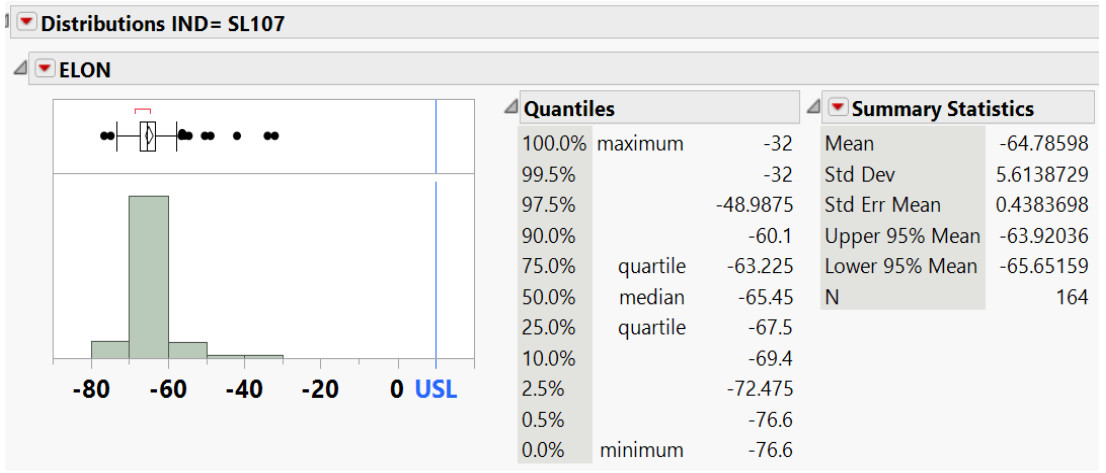
Current Limit: ELON (+10, -TMC 1006)
Proposed Limit: (+10, -77 or –SL107)

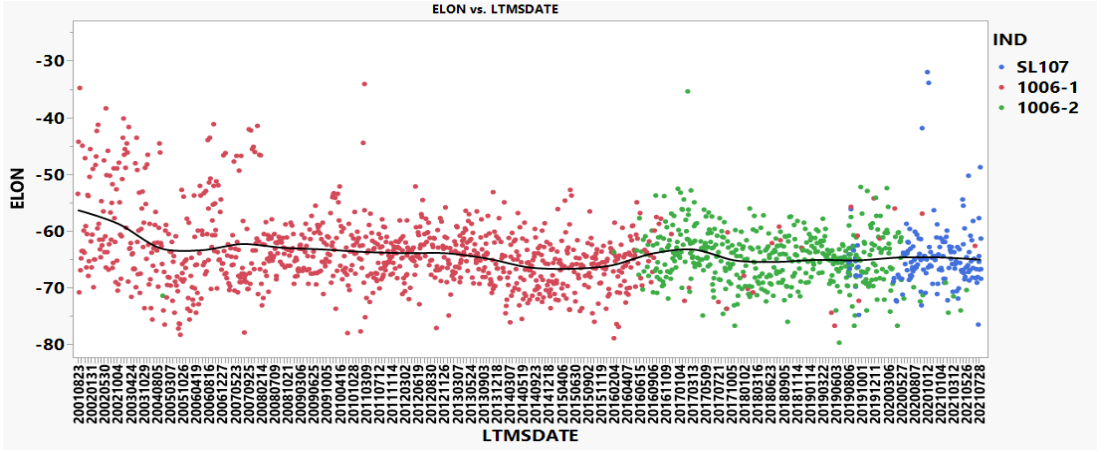
- TMC1006





- SL107





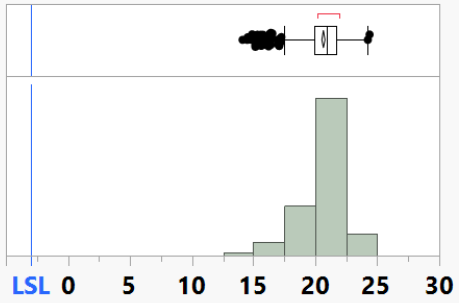
Vamac G

Current Limit: VOLC (+TMC 1006, -3)
Proposed Limit: (+25 or +SL107+2, -3)

- TMC1006

Distributions IND= 1006-1

VOLC

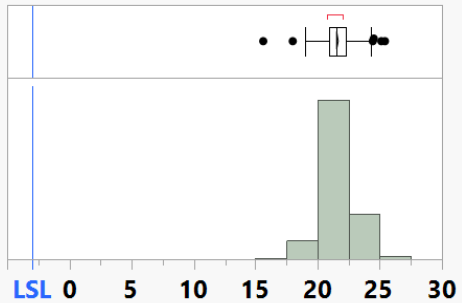


Quantiles		
100.0%	maximum	24.38
99.5%		23.9716
97.5%		23.2855
90.0%		22.446
75.0%	quartile	21.63
50.0%	median	20.84
25.0%	quartile	19.905
10.0%		18.804
2.5%		15.774
0.5%		14.6547
0.0%	minimum	14.11

Summary Statistics	
Mean	20.626999
Std Dev	1.6729995
Std Err Mean	0.0586747
Upper 95% Mean	20.742171
Lower 95% Mean	20.511827
N	813

Distributions IND= 1006-2

VOLC



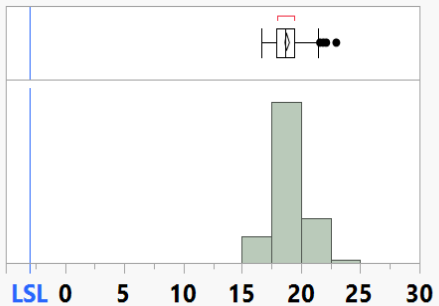
Quantiles		
100.0%	maximum	25.42
99.5%		25.1449
97.5%		24.15
90.0%		23.039
75.0%	quartile	22.295
50.0%	median	21.49
25.0%	quartile	20.88
10.0%		20.195
2.5%		19.4275
0.5%		18.24245
0.0%	minimum	15.61

Summary Statistics	
Mean	21.579956
Std Dev	1.1699691
Std Err Mean	0.0551529
Upper 95% Mean	21.688345
Lower 95% Mean	21.471566
N	450

- SL107

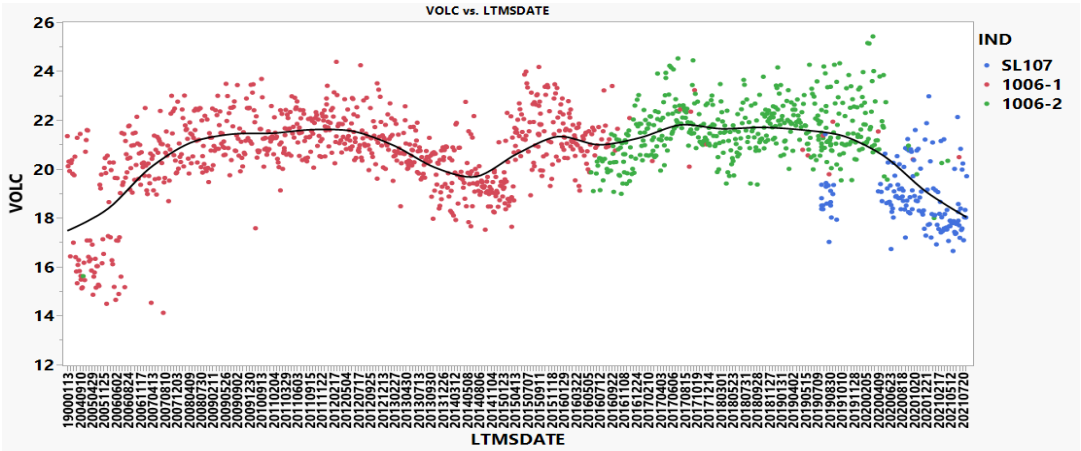
Distributions IND= SL107

VOLC



Quantiles		
100.0%	maximum	22.97
99.5%		22.97
97.5%		21.667
90.0%		20.801
75.0%	quartile	19.3475
50.0%	median	18.62
25.0%	quartile	17.88
10.0%		17.447
2.5%		16.9825
0.5%		16.64
0.0%	minimum	16.64

Summary Statistics	
Mean	18.816419
Std Dev	1.2399216
Std Err Mean	0.1019209
Upper 95% Mean	19.017838
Lower 95% Mean	18.614999
N	148

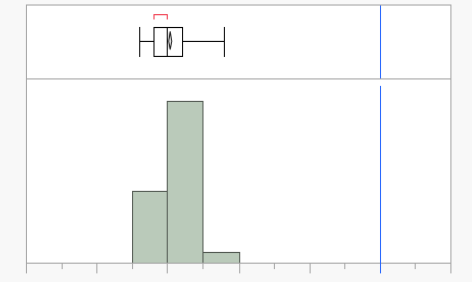


Current Limit: HARD (+5, -TMC 1006)
Proposed Limit: (+5, -14 or –SL107-2)

- TMC1006

Distributions IND= 1006-1

HARD

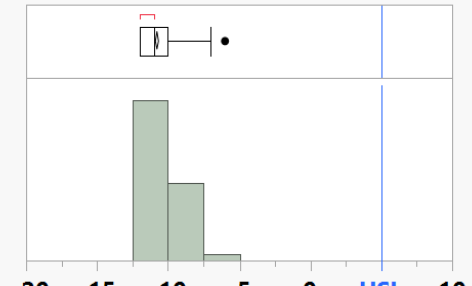


Quantiles		
100.0%	maximum	-6
99.5%		-6
97.5%		-7
90.0%		-8
75.0%	quartile	-9
50.0%	median	-10
25.0%	quartile	-11
10.0%		-12
2.5%		-12
0.5%		-12
0.0%	minimum	-12

Summary Statistics	
Mean	-9.832718
Std Dev	1.332268
Std Err Mean	0.0467247
Upper 95% Mean	-9.741003
Lower 95% Mean	-9.924434
N	813

Distributions IND= 1006-2

HARD



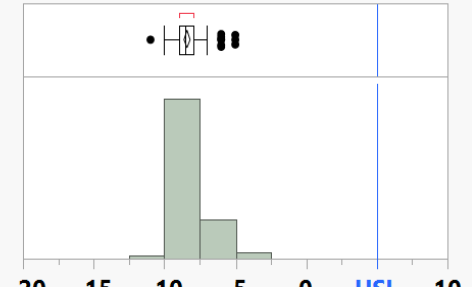
Quantiles		
100.0%	maximum	-6
99.5%		-7
97.5%		-8
90.0%		-9
75.0%	quartile	-10
50.0%	median	-11
25.0%	quartile	-12
10.0%		-12
2.5%		-12
0.5%		-12
0.0%	minimum	-12

Summary Statistics	
Mean	-10.76222
Std Dev	1.2156714
Std Err Mean	0.0573073
Upper 95% Mean	-10.6496
Lower 95% Mean	-10.87485
N	450

- SL107

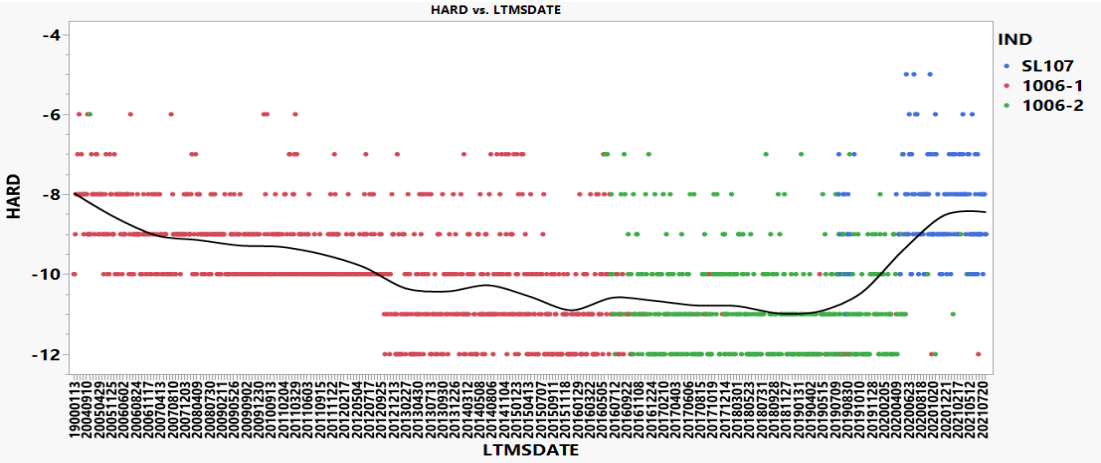
Distributions IND= SL107

HARD



Quantiles		
100.0%	maximum	-5
99.5%		-5
97.5%		-5.725
90.0%		-7
75.0%	quartile	-8
50.0%	median	-8.5
25.0%	quartile	-9
10.0%		-10
2.5%		-10
0.5%		-11
0.0%	minimum	-11

Summary Statistics	
Mean	-8.385135
Std Dev	1.1810502
Std Err Mean	0.0970817
Upper 95% Mean	-8.193279
Lower 95% Mean	-8.576991
N	148

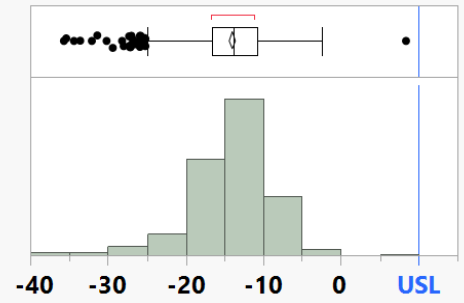


Current Limit: TENS (+10, -TMC 1006)
Proposed Limit: (+10, -24 or –SL107+2)

- TMC1006

Distributions IND= 1006-1

TENS

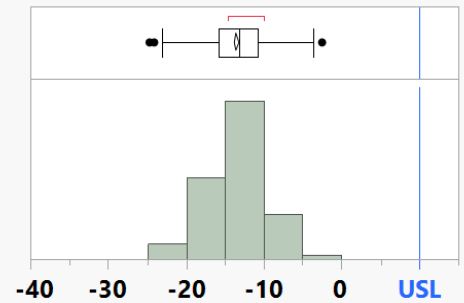


Quantiles		
100.0%	maximum	8.4
99.5%		-3.707
97.5%		-5.8
90.0%		-8.4
75.0%	quartile	-10.8
50.0%	median	-13.7
25.0%	quartile	-16.5
10.0%		-19.8
2.5%		-25.865
0.5%		-33.495
0.0%	minimum	-35.7

Summary Statistics	
Mean	-13.98905
Std Dev	4.8591583
Std Err Mean	0.1704181
Upper 95% Mean	-13.65454
Lower 95% Mean	-14.32356
N	813

Distributions IND= 1006-2

TENS



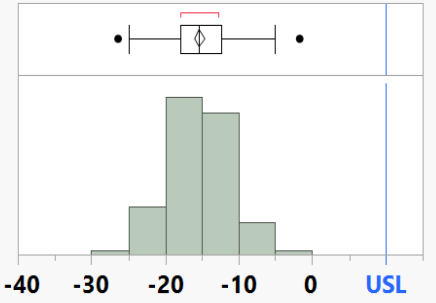
Quantiles		
100.0%	maximum	-2.5
99.5%		-3.7785
97.5%		-6.6825
90.0%		-9
75.0%	quartile	-10.9
50.0%	median	-13.2
25.0%	quartile	-15.825
10.0%		-18.49
2.5%		-21.3725
0.5%		-23.845
0.0%	minimum	-24.7

Summary Statistics	
Mean	-13.49778
Std Dev	3.7078914
Std Err Mean	0.1747917
Upper 95% Mean	-13.15427
Lower 95% Mean	-13.84129
N	450

- SL107

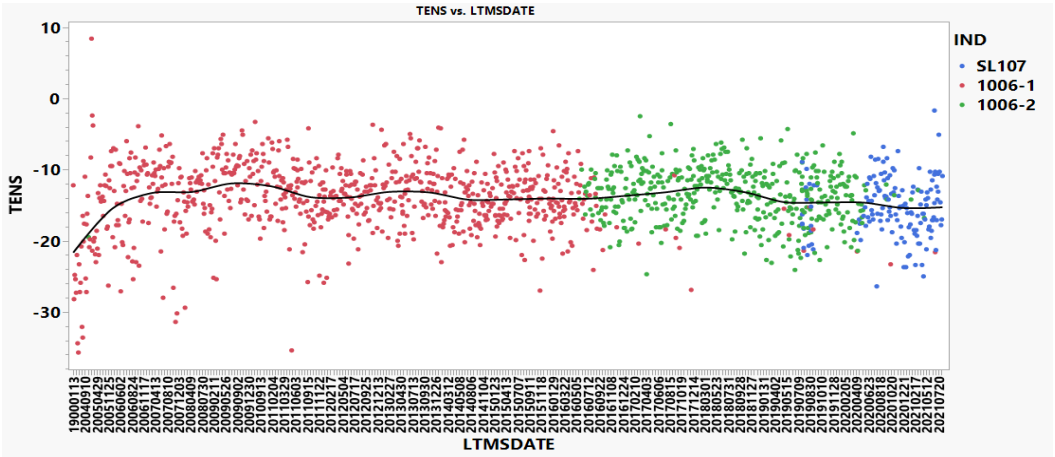
Distributions IND= SL107

TENS



Quantiles		
100.0%	maximum	-1.7
99.5%		-1.7
97.5%		-7.235
90.0%		-10.28
75.0%	quartile	-12.5
50.0%	median	-15.4
25.0%	quartile	-17.9
10.0%		-20.52
2.5%		-23.7
0.5%		-26.4
0.0%	minimum	-26.4

Summary Statistics	
Mean	-15.29257
Std Dev	4.1356932
Std Err Mean	0.3399519
Upper 95% Mean	-14.62074
Lower 95% Mean	-15.96439
N	148

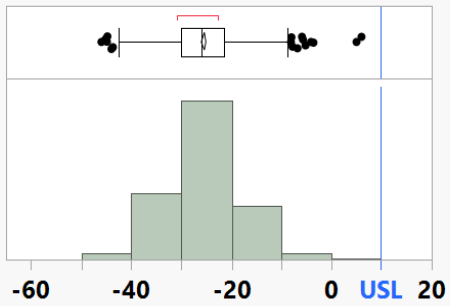


Current Limit: ELON (+10, -TMC 1006)
Proposed Limit: (+10, -40 or –SL107+10)

- TMC1006

Distributions IND= 1006-1

ELON

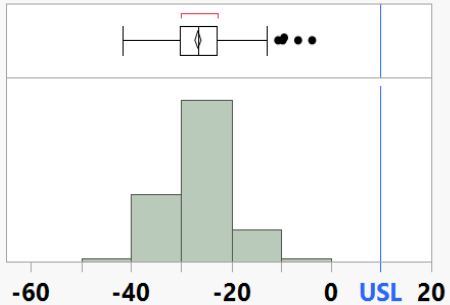


Quantiles		
100.0%	maximum	6
99.5%		-4.177
97.5%		-10.935
90.0%		-16
75.0%	quartile	-21.4
50.0%	median	-25.9
25.0%	quartile	-29.95
10.0%		-33.8
2.5%		-39.93
0.5%		-44.744
0.0%	minimum	-46

Summary Statistics	
Mean	-25.4599
Std Dev	7.1111559
Std Err Mean	0.2493991
Upper 95% Mean	-24.97036
Lower 95% Mean	-25.94944
N	813

Distributions IND= 1006-2

ELON



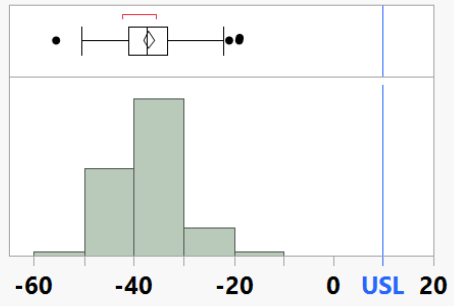
Quantiles		
100.0%	maximum	-3.8
99.5%		-7.314
97.5%		-14.455
90.0%		-19
75.0%	quartile	-22.9
50.0%	median	-26.6
25.0%	quartile	-30.4
10.0%		-34.98
2.5%		-39.1175
0.5%		-40.7725
0.0%	minimum	-41.6

Summary Statistics	
Mean	-26.64178
Std Dev	6.0379488
Std Err Mean	0.2846316
Upper 95% Mean	-26.0824
Lower 95% Mean	-27.20115
N	450

- SL107

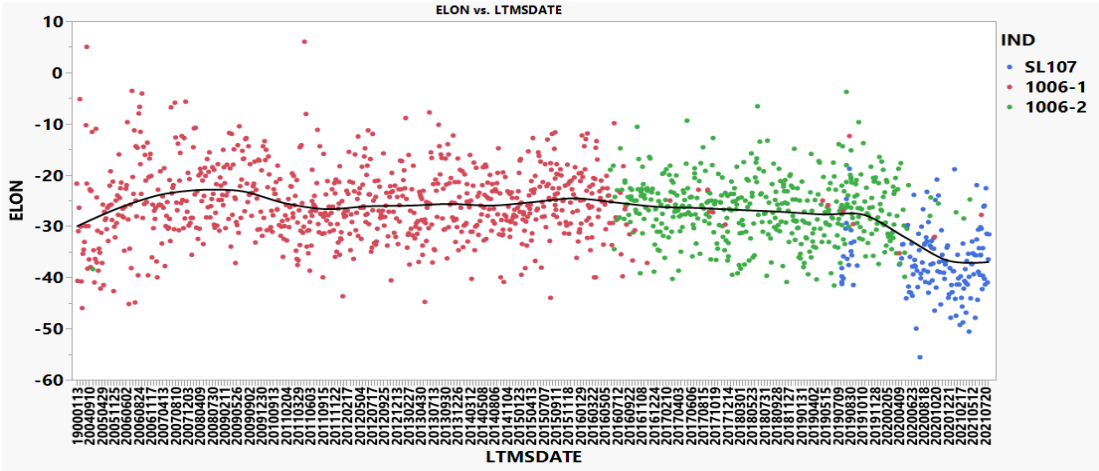
Distributions IND= SL107

ELON



Quantiles		
100.0%	maximum	-18.8
99.5%		-18.8
97.5%		-21.6975
90.0%		-29.38
75.0%	quartile	-33.425
50.0%	median	-37.5
25.0%	quartile	-41.1
10.0%		-44.11
2.5%		-49.4925
0.5%		-55.6
0.0%	minimum	-55.6

Summary Statistics	
Mean	-37.03649
Std Dev	6.4416919
Std Err Mean	0.5295038
Upper 95% Mean	-35.99006
Lower 95% Mean	-38.08291
N	148



- After discussion will someone make a motion to accept:

Option 1 Fixed Limits

or

Option 2 Variable Limits

or

- Propose another option as a path forward for HD elastomer testing

- The motion needs to include updating the annexes.

Thank you!