EOEC/LDEOC Reference Oil SL107 Targets

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December 16, 2019

Performance you can rely on.

Summary

- For most parameters, the difference between the Round Robin mean for 1006 and SL107 is less than 2 standard deviations.
- The magnitude of the offsets, or industry biases, of the 1006 Round Robin means relative to its targets in several instances is greater than one standard deviation.
- Recommend against changing the standard deviations based on the Round Robin.
- Two options for calculating the SL107 targets are presented:
  - Option 1: Simple means of independent samples from Round Robin
  - Option 2: Means of independent samples from Round Robin taking into account realized industry bias based on 1006 Round Robin means.
  - Target values for each Option are on the following slide

Summary (Continued)

Option 1 SL107 Targets

Parameter	EOECF	EOECN	EOECP	EOECS	EOECV
VOLC	0.48	1.74	1.76	33.54	18.83
HARD	8.76	3.11	0.80	-22.19	-9.01
TENS	-71.56	-5.80	2.89	-31.46	-16.57
ELON	-65.71	-35.07	-13.37	-22.00	-34.43
Parameter	LDEOCA	LDEOCF	LDEOCN	LDEOCP	LDEOCS
VOLC	23.72	0.66	1.36	1.80	33.46
HARD	-13.18	4.55	-1.37	-1.49	-22.59
TENS	-20.52	-56.66	3.27	0.15	-32.26

Option 2 SL107 Targets

Parameter	EOECF	EOECN	EOECP	EOECS	EOECV
VOLC	0.44	-0.08	0.20	32.17	18.54
HARD	8.04	1.83	-0.01	-21.68	-7.48
TENS	-71.32	2.80	0.36	-33.75	-15.33
ELON	-58.48	-33.69	-22.58	-24.81	-34.96
Parameter	LDEOCA	LDEOCF	LDEOCN	LDEOCP	LDEOCS
VOLC	24.20	0.68	0.32	2.05	33.88
HARD	-12.73	4.10	-1.18	-0.21	-21.90
TENS	-16.84	-57.40	5.97	2.58	-37.73

Source Data

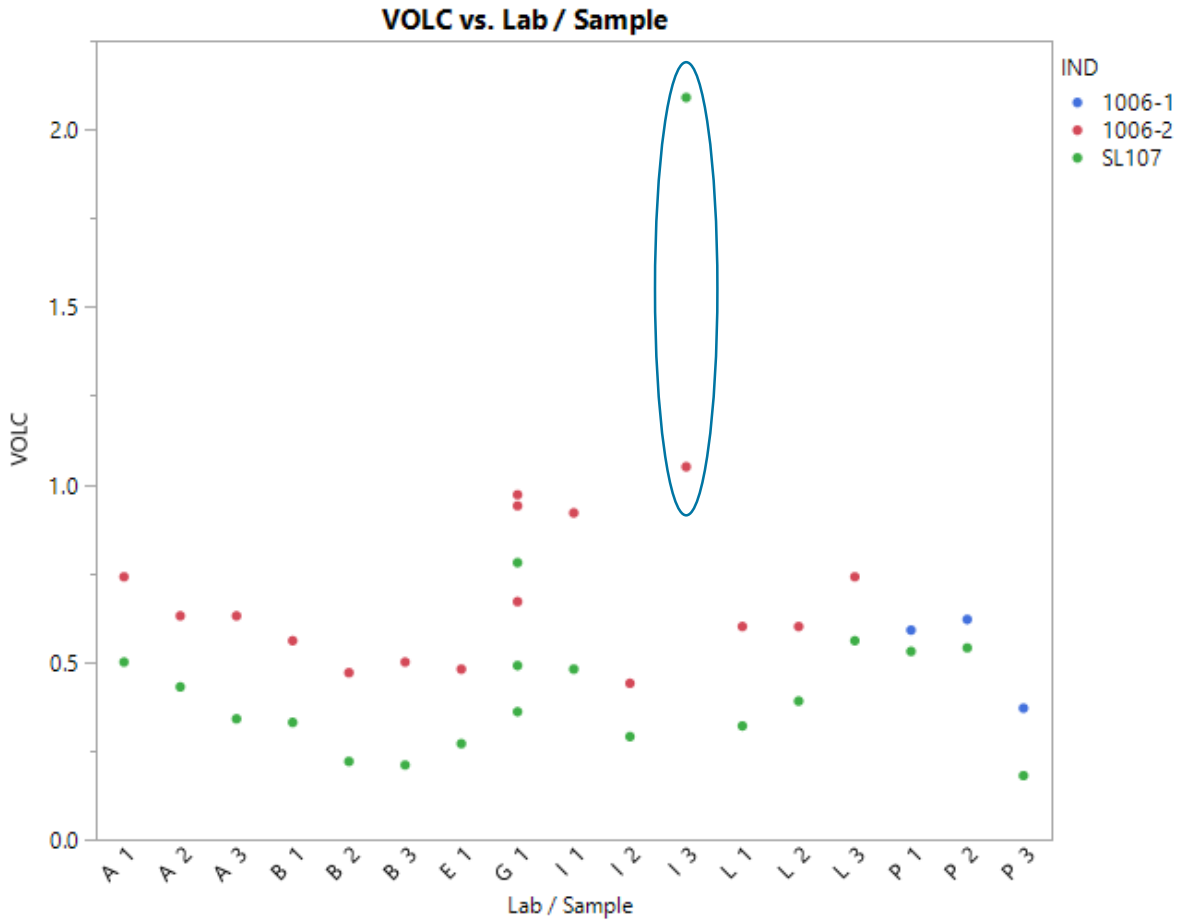
- Samples tested within the same bath at the same time are not considered repeats.
- If a 1006 result for a given parameter is outside the 3 s limits, all parameters for that sample as well as the associated SL107 sample are omitted from the analysis.
- Because targets for 1006-1 and 1006-2 are equivalent, they are not differentiated (modeled as 1006 without regard to batch).
- Any differences due to elastomer batches are disregarded as the targets are the same.

Analysis

- Each parameter was regressed on Lab Sample and Oil.
  - This causes each “sample” to be counted equally.
  - Tests of the same oil performed in the same bath batch are not statistically independent and averaged into a “sample.”
  - “Samples” are statistically independent.
- Statistical outliers are not omitted from the data set as no indication was provided that they were invalid.
- There are 2 options to calculate SL107 targets:
  - Simple means of SL107 from Round Robin testing.
  - Means of SL107 round robin adjusted for current industry bias.
    - Offset = RO 1006 Target Mean – RO 1006 Round Robin Mean
    - Offset is applied to SL107 Target to account for severity difference from Target for industry.
    - This method is used in Engine Testing and is recommended for EOEC and LDEOC.
- Recommend against adopting standard deviation of SL107 obtained from Round Robin as it does not include batch variation.

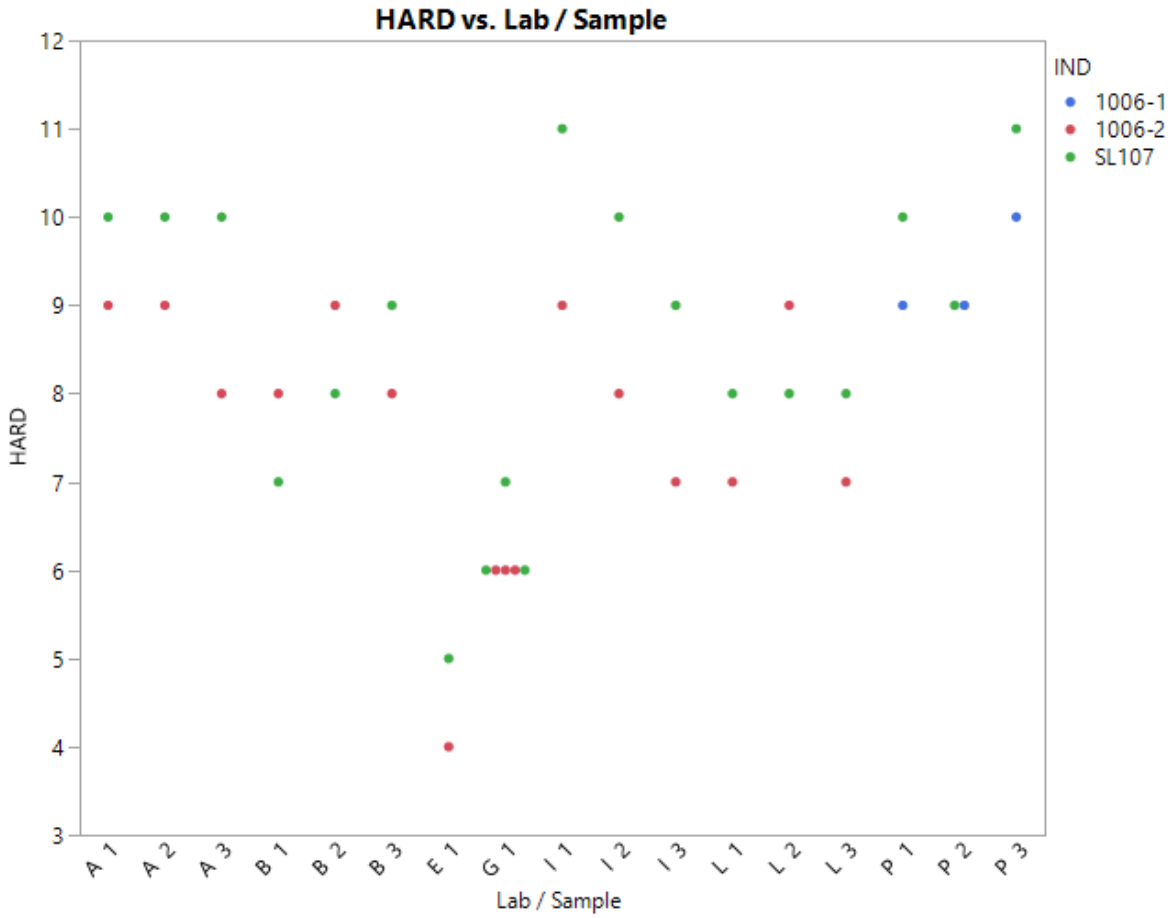
EOECF

EOEC Flouroelastomer - VOLC



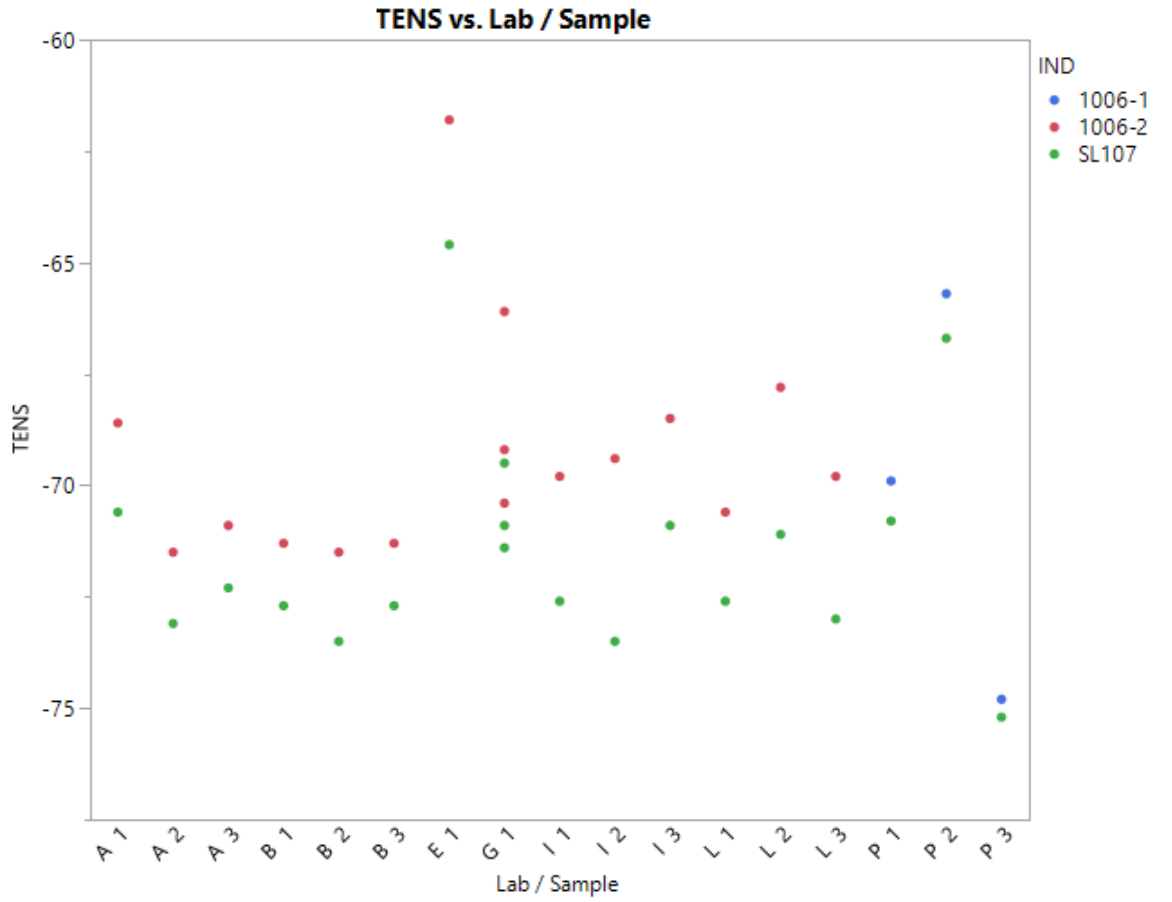
- One pair of results appears to be outliers relative to the rest.
- Other than the apparent outlier pair, VOLC is higher for 1006 than SL107.

EOEC Flouroelastomer - HARD



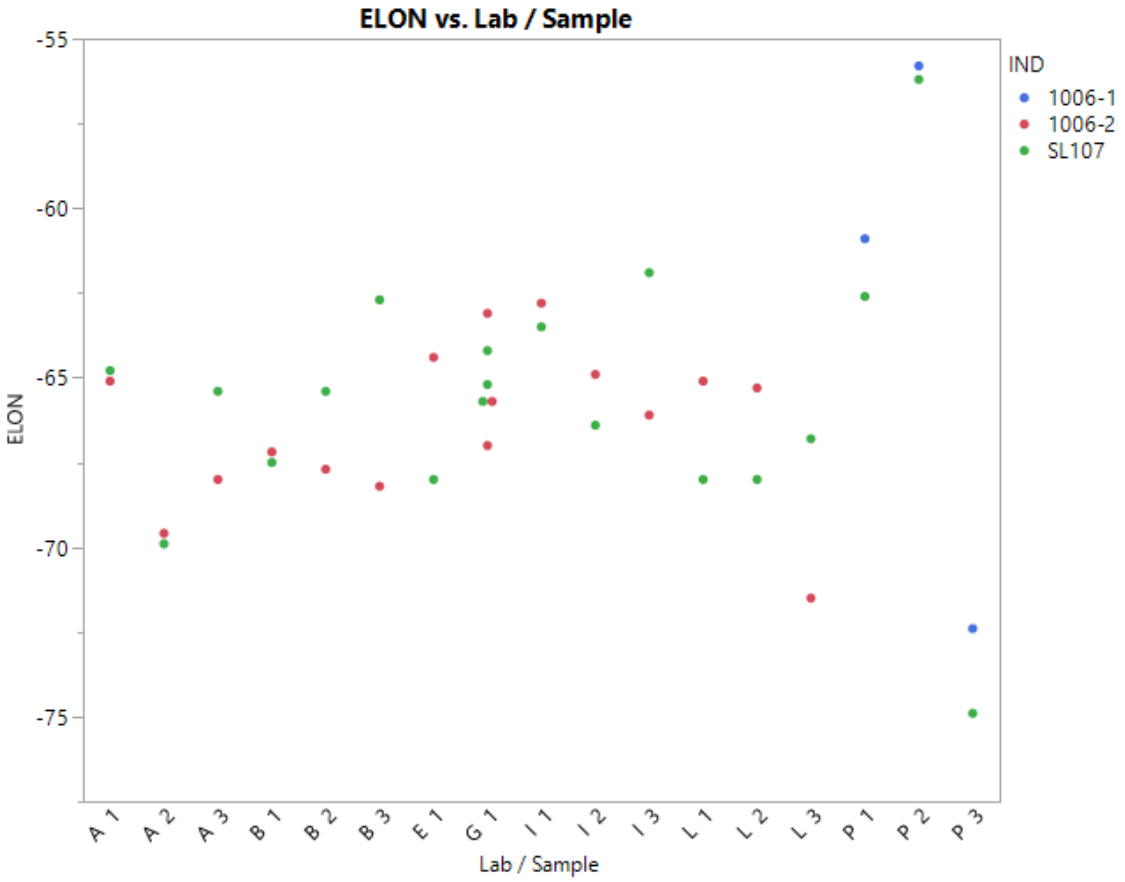
- For most pairs, SL107 is a unit higher in HARD relative to 1006.

EOEC Flouroelastomer - TENS



- For each pair, 1006 is higher (less negative) than SL107.

EOEC Flouroelastomer - ELON



- The Reference Oil correlating to the higher (less negative) ELON is mixed amongst the pairs.

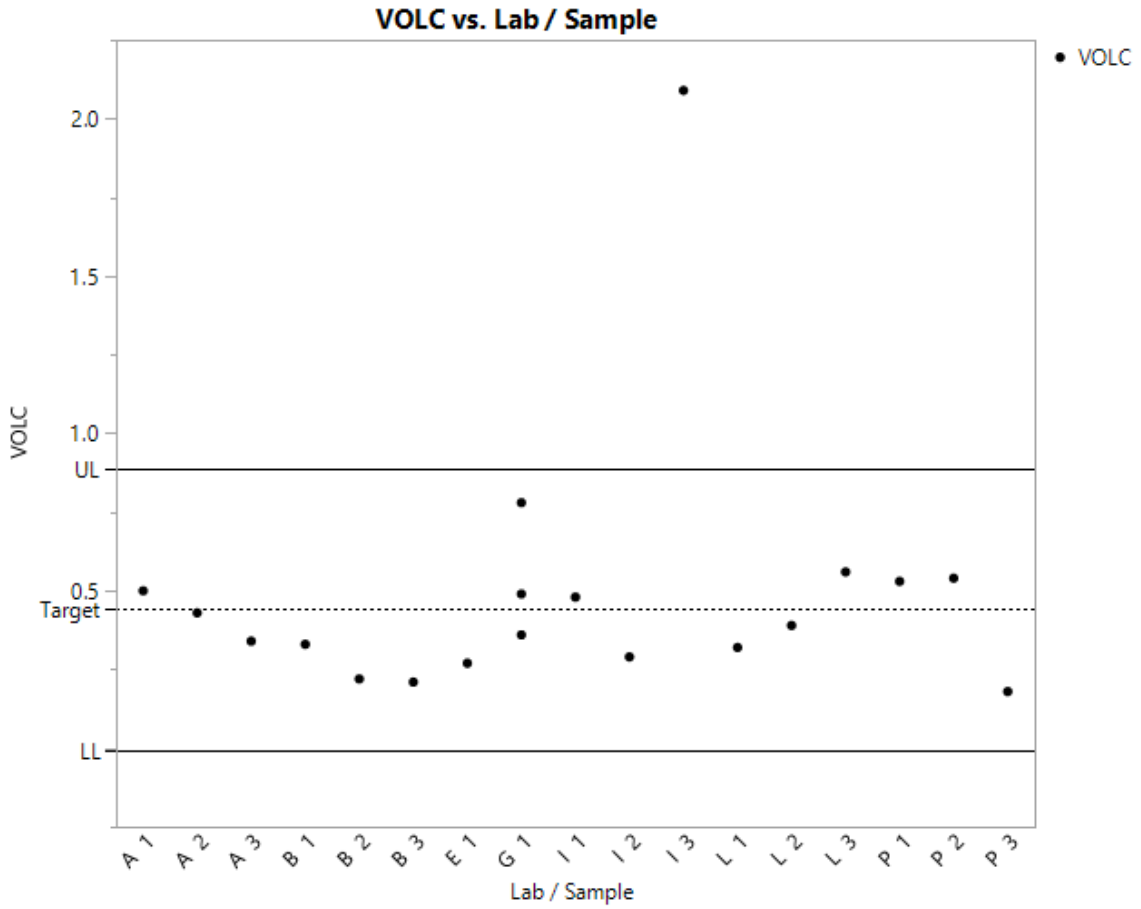
EOEC Fluoroelastomer (EOECF) RO SL107 Target Mean

- Round Robin means for 1006 and SL107 are very similar.
- The magnitude of the Offset for each parameter is less than a standard deviation.
- SL107 standard deviations are less than corresponding 1006 standard deviations except for VOLC.

EOEC Fluoroelastomer (EOECF)

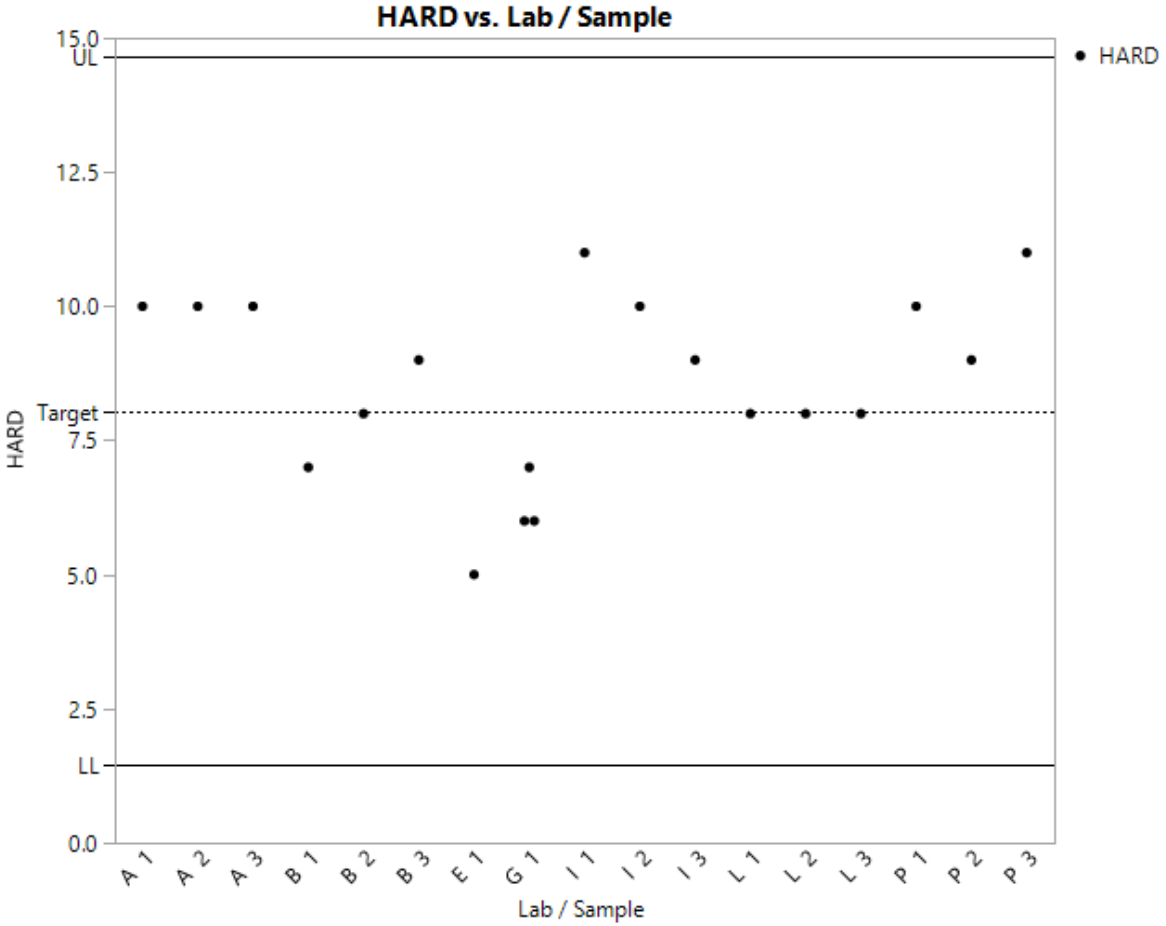
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	0.61	0.15	17	0.64	0.48	-0.03	0.44	0.44
HARD	7.30	2.20	17	8.02	8.76	-0.72	8.04	1.68
TENS	-69.28	5.35	17	-69.52	-71.56	0.24	-71.32	2.61
ELON	-58.69	8.99	17	-65.91	-65.71	7.22	-58.48	3.99

SL107 EOECF VOLC



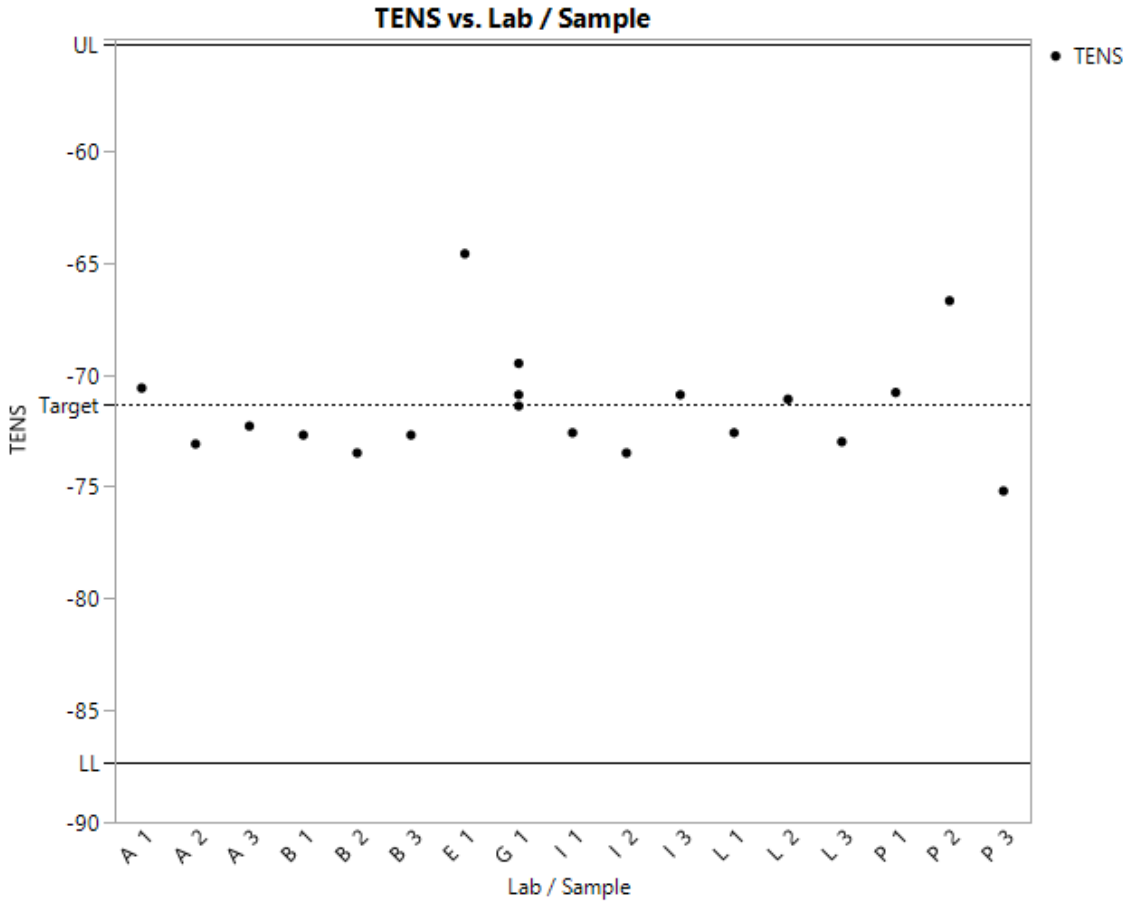
- All VOLC are within the 3 s limits except for Lab I, Sample3.

SL107 EOECF HARD



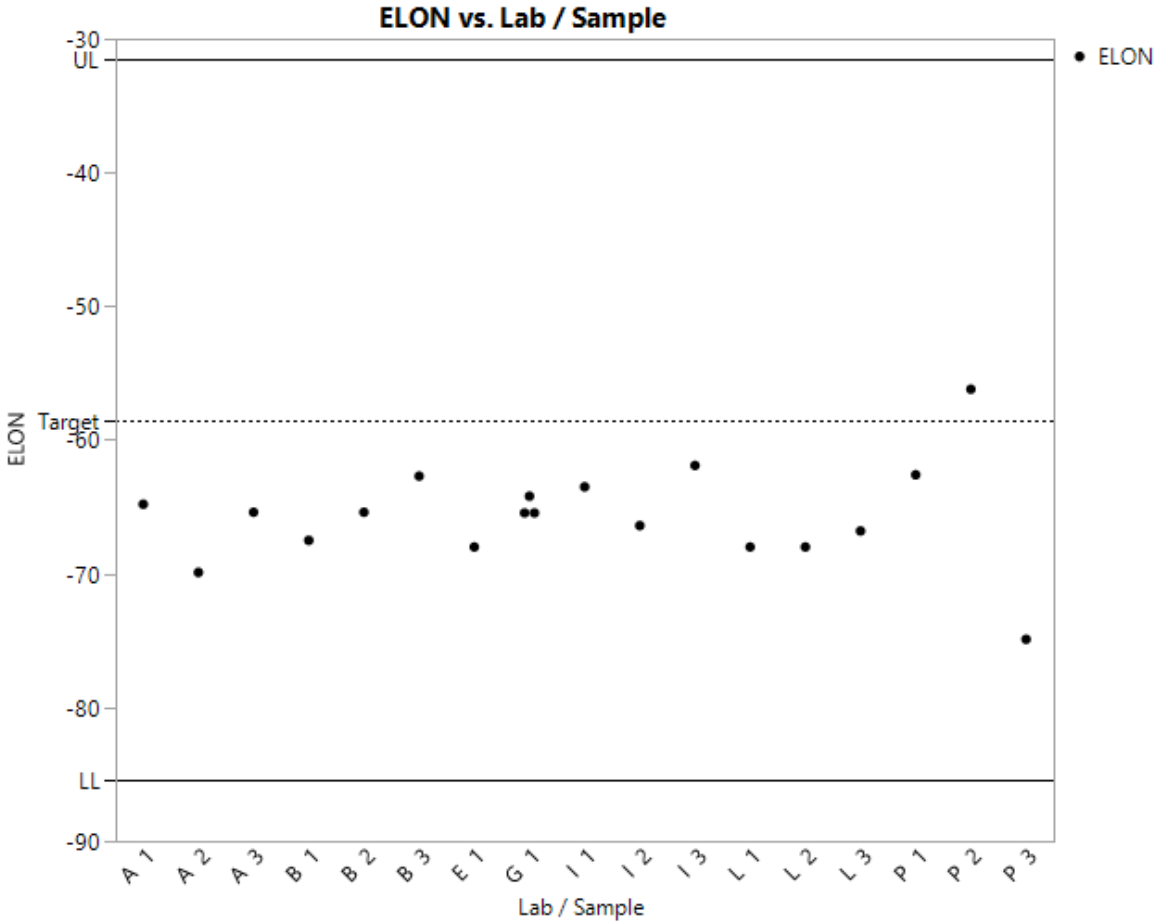
- All SL107 HARD are well within the 3 s limits.

SL107 EOECF TENS



- All SL107 TENS are well within the 3 s limits.

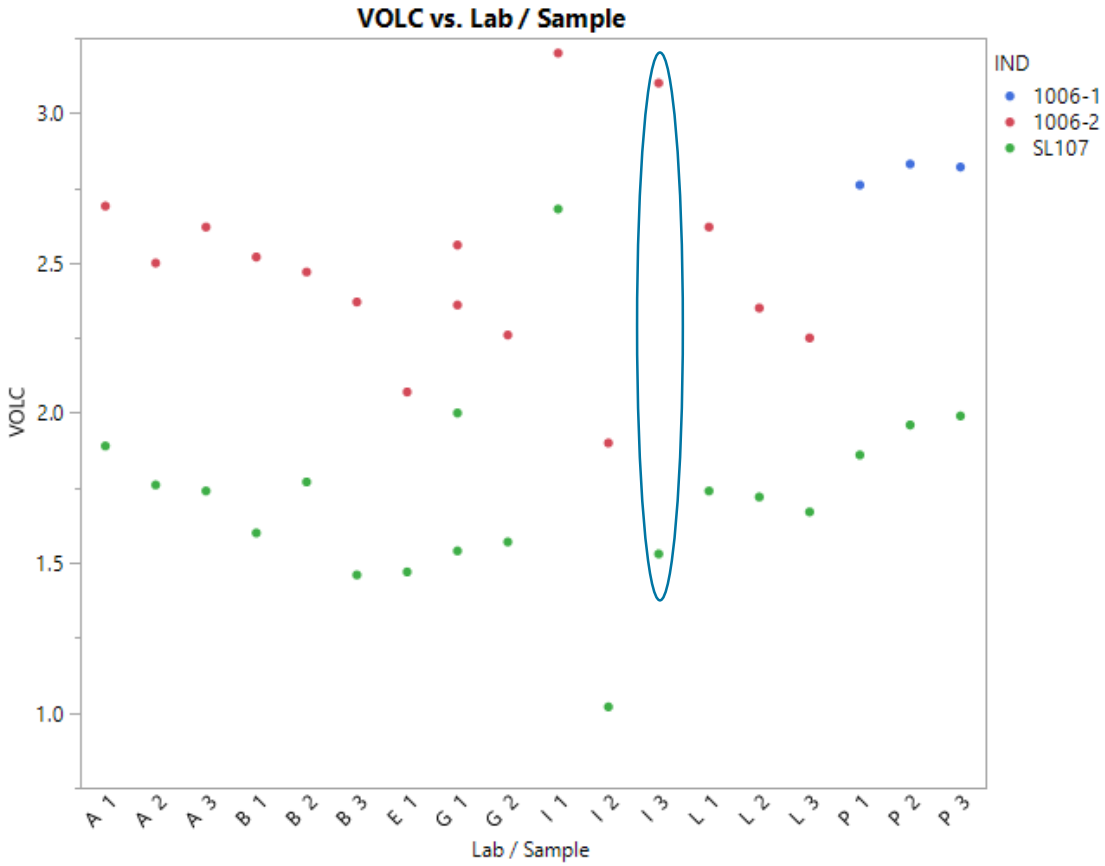
SL107 EOECF ELON



- All SL107 ELON are well within the 3 s limits.

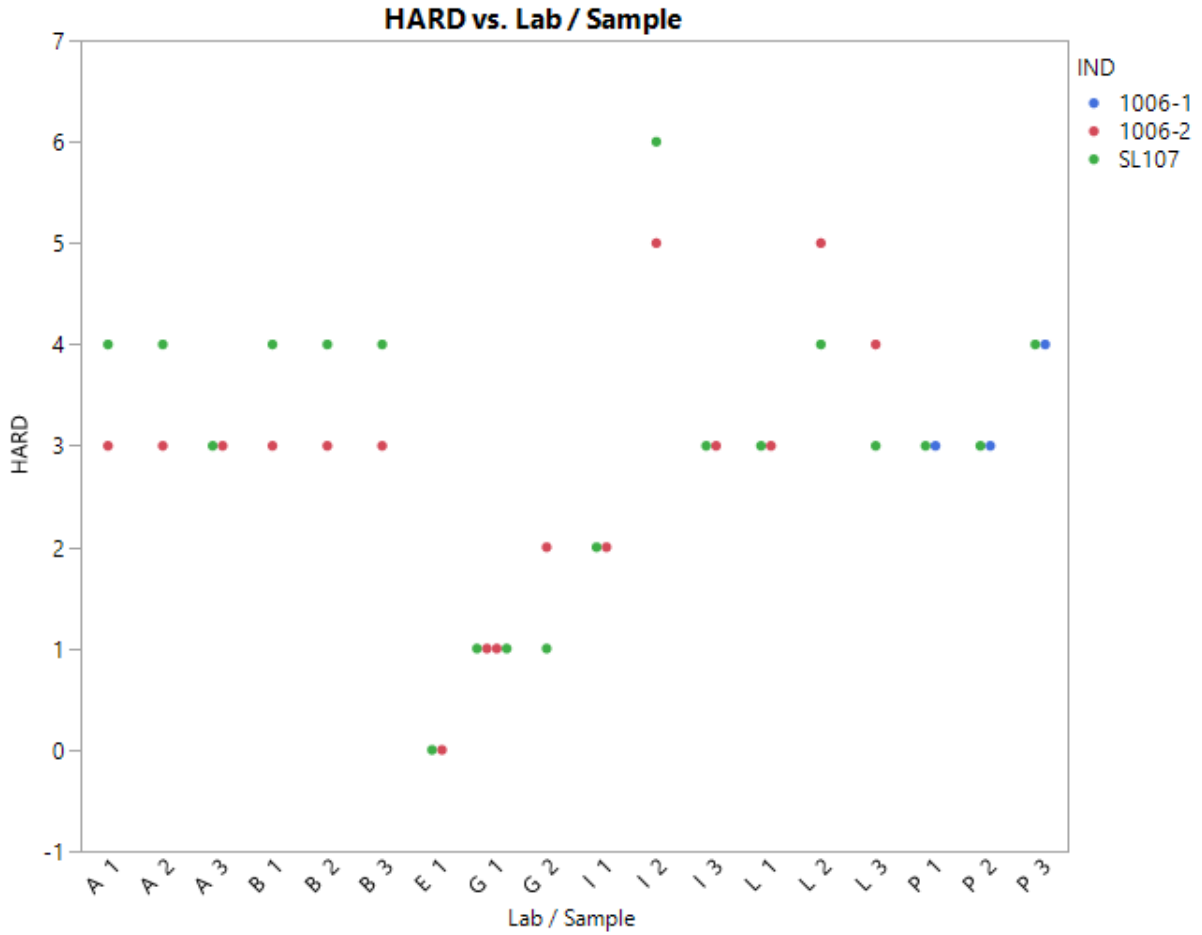
EOECN

EOEC Nitrile - VOLC



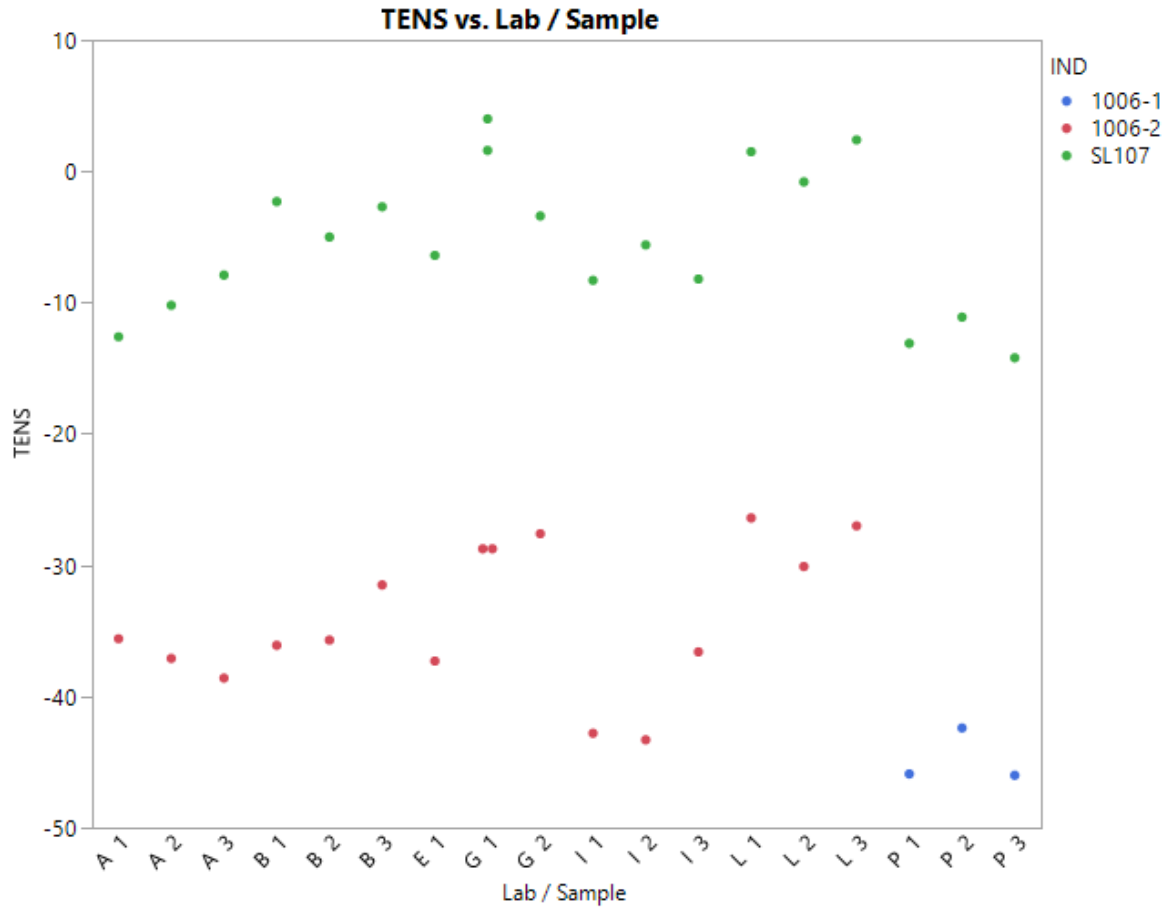
- The difference between 1006 and SL107 for Lab I, Sample 3 is higher than other bath pairs.
- For each bath pair, VOLC for SL107 is lower than 1006.

EOEC Nitrile - HARD



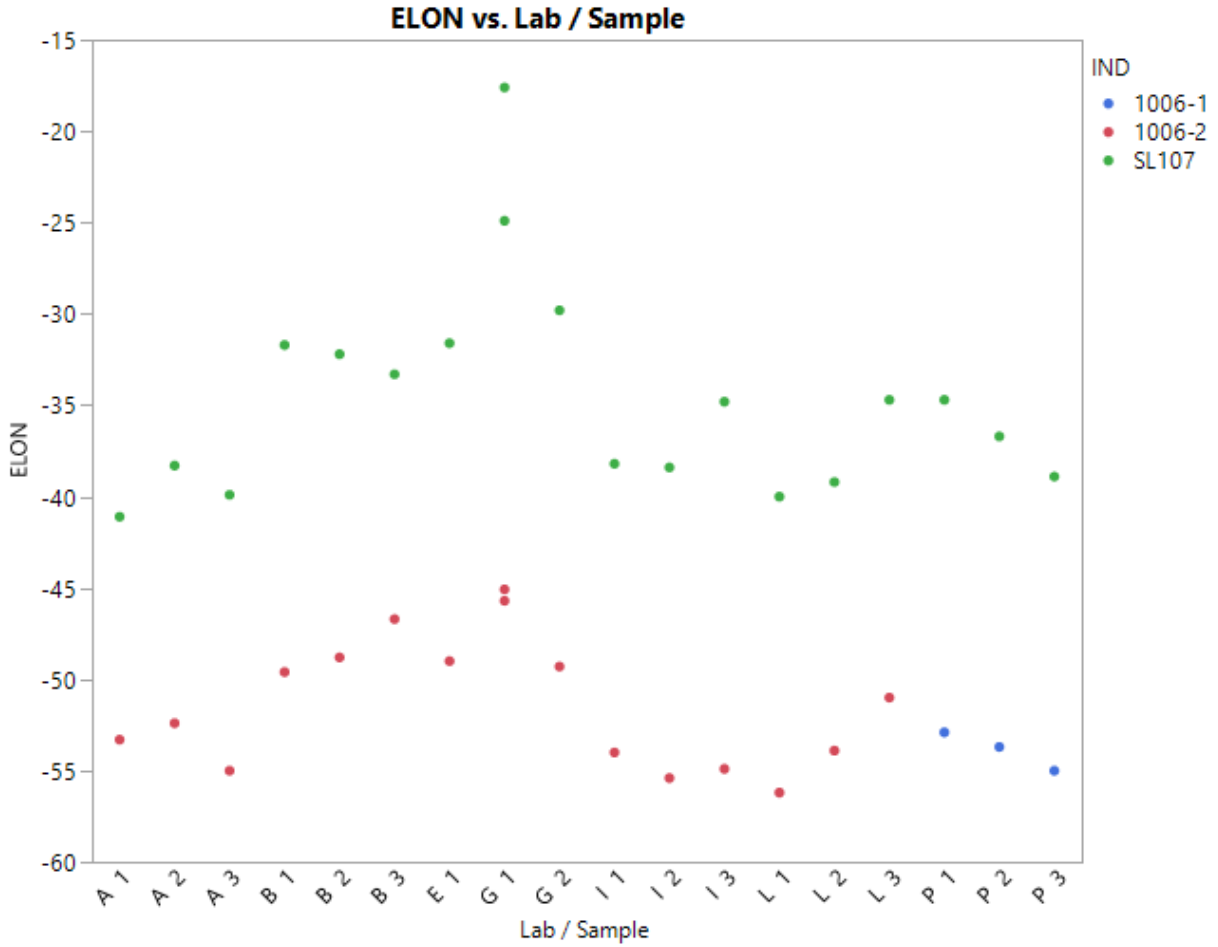
- For each pair, HARD results are within 1.

EOEC Nitrile - TENS



- TENS is higher (less negative) for SL107 than 1006 for each pair.

EOEC Nitrile - ELON



- For each bath pair, ELON is higher (less negative) for SL107 than 1006.

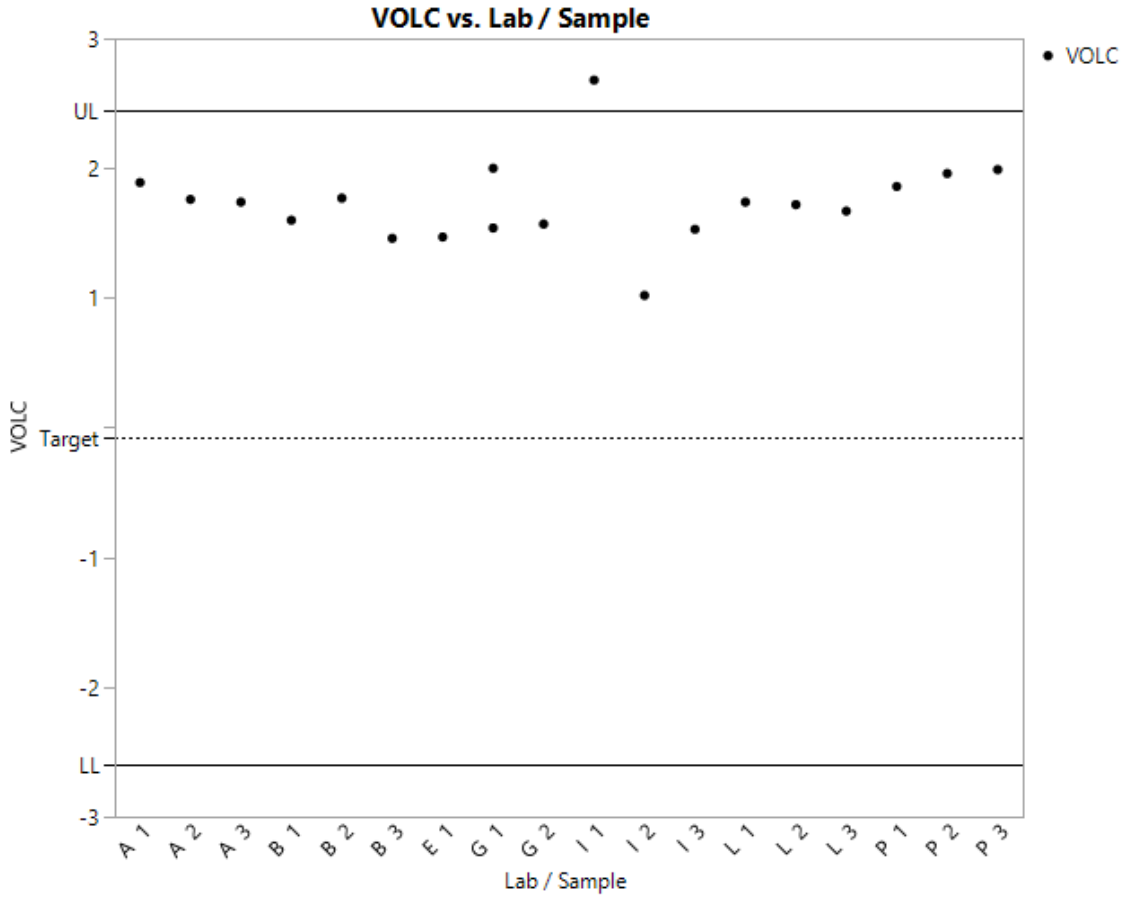
EOEC Nitrile (EOECN) RO SL107 Target Mean

- Round Robin means of VOLC and HARD for 1006 and SL107 are similar but for TENS and ELON are several standard deviations different.
- The magnitude of the Offsets for VOLC and TENS are greater than their standard deviations.
- SL107 standard deviations are less than corresponding 1006 standard deviations.

EOEC Nitrile (EOECN)

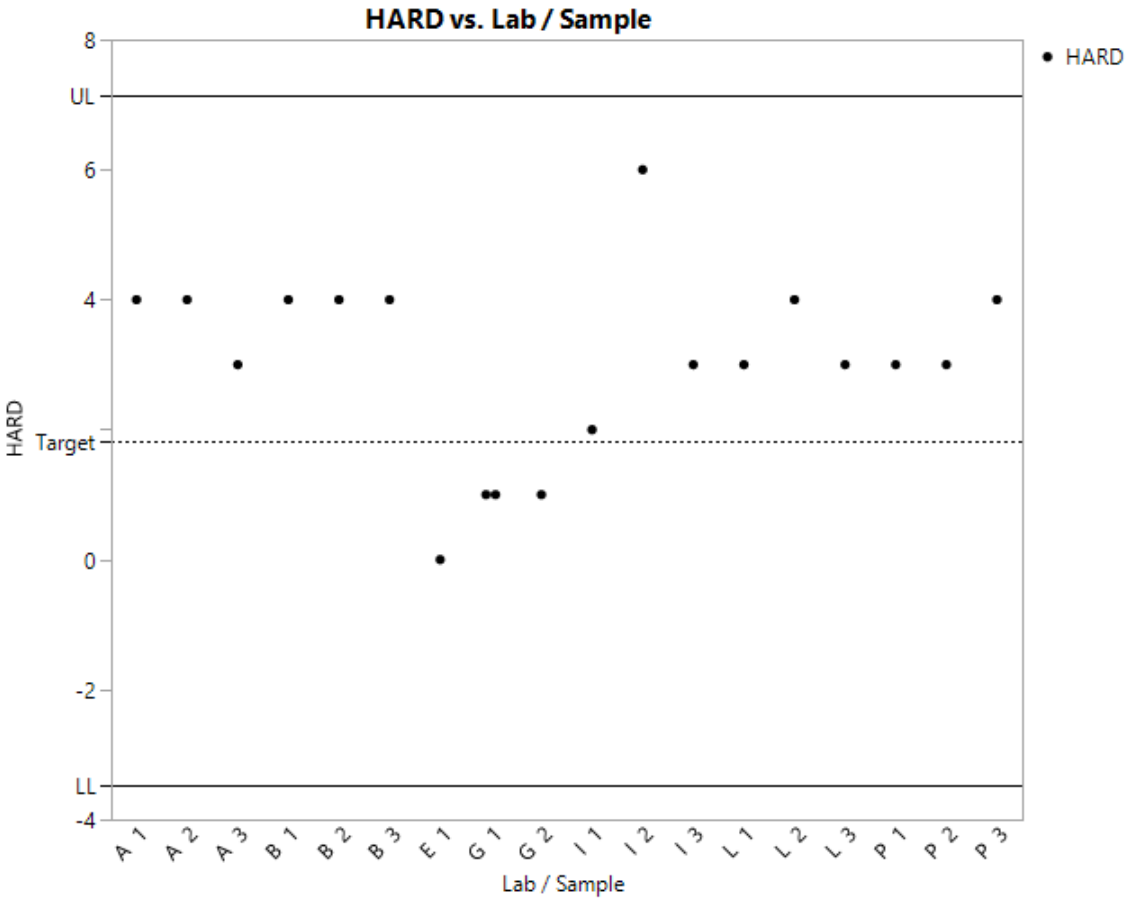
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	0.72	0.84	18	2.54	1.74	-1.82	-0.08	0.33
HARD	1.67	1.77	18	2.95	3.11	-1.28	1.83	1.41
TENS	-27.47	7.33	18	-36.08	-5.80	8.61	2.80	5.22
ELON	-50.86	6.72	18	-52.23	-35.07	1.37	-33.69	4.29

SL107 EOECN VOLC



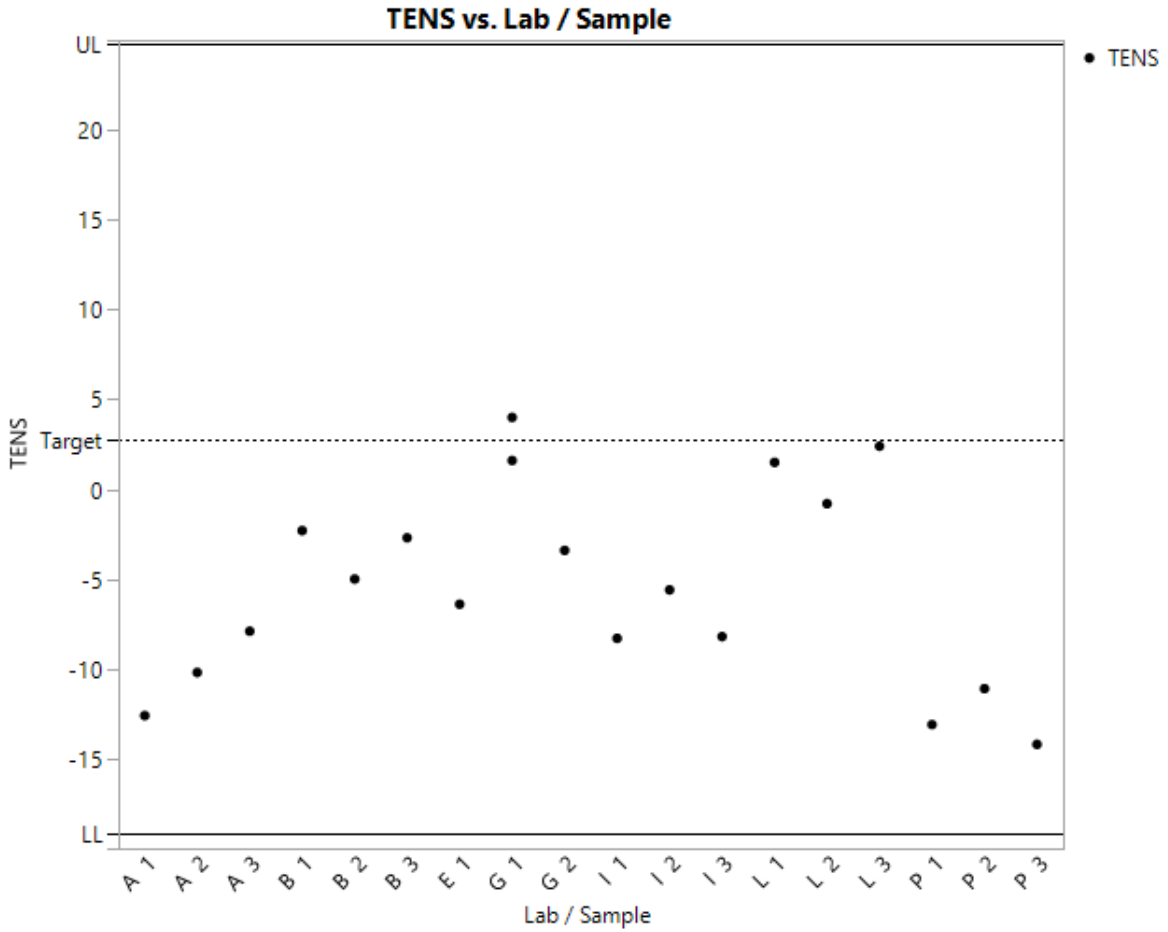
- All VOLC are above the target and Lab I, Sample1 exceeds the 3 s limits.

SL107 EOECN HARD



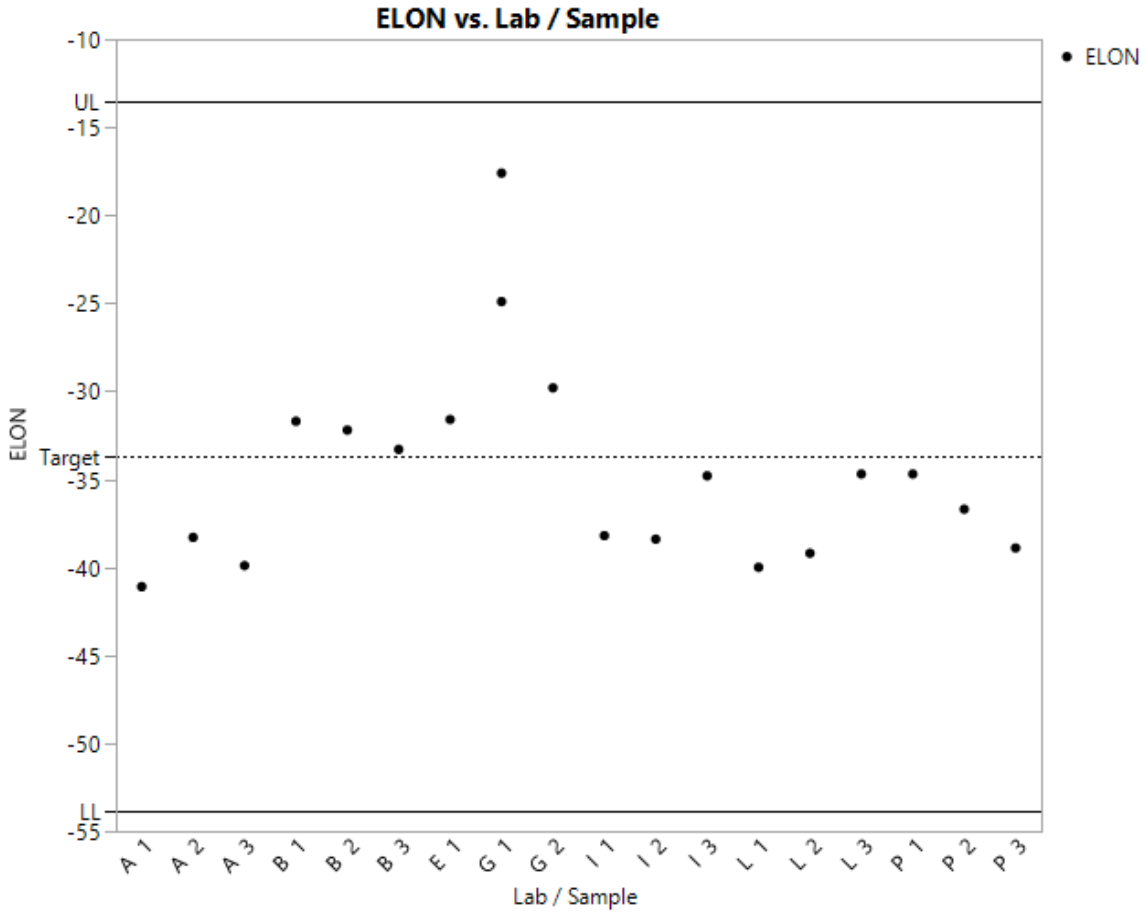
- All SL107 HARD are within the 3 s limits.

SL107 EOECN TENS



- All SL107 TENS are within the 3 s limits though all but 1 are below the target.

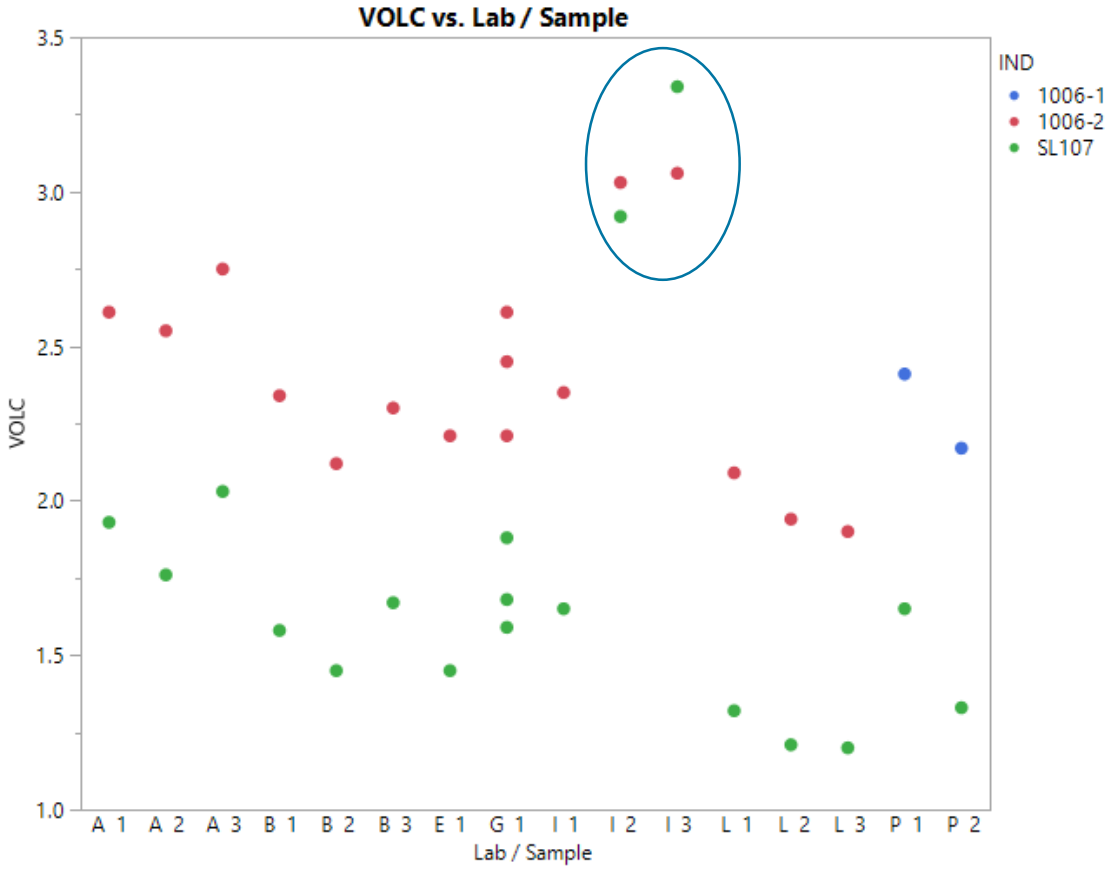
SL107 EOECN ELON



- All SL107 ELON are well within the 3 s limits.

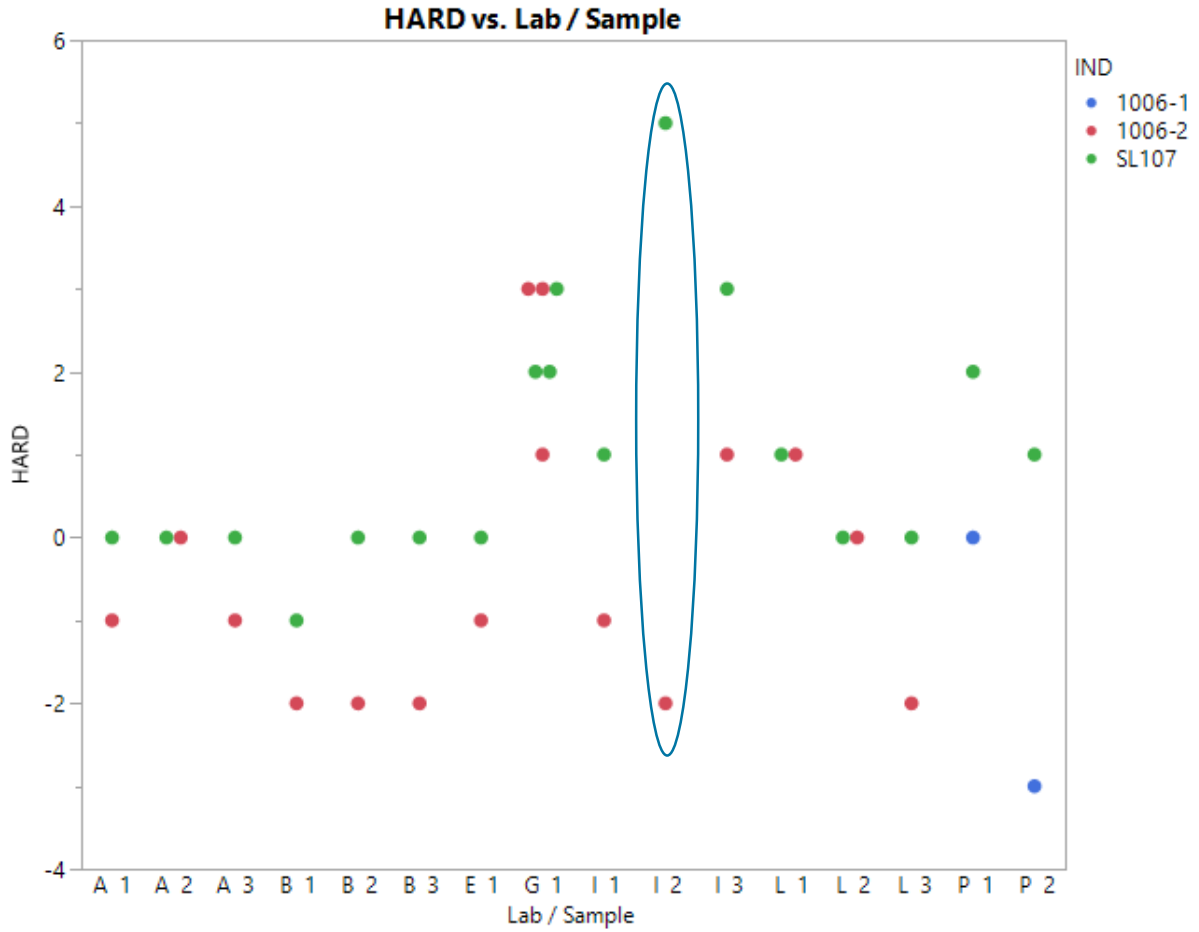
EOEC Polyacrylate (EOECP)

EOEC Polyacrylate - VOLC



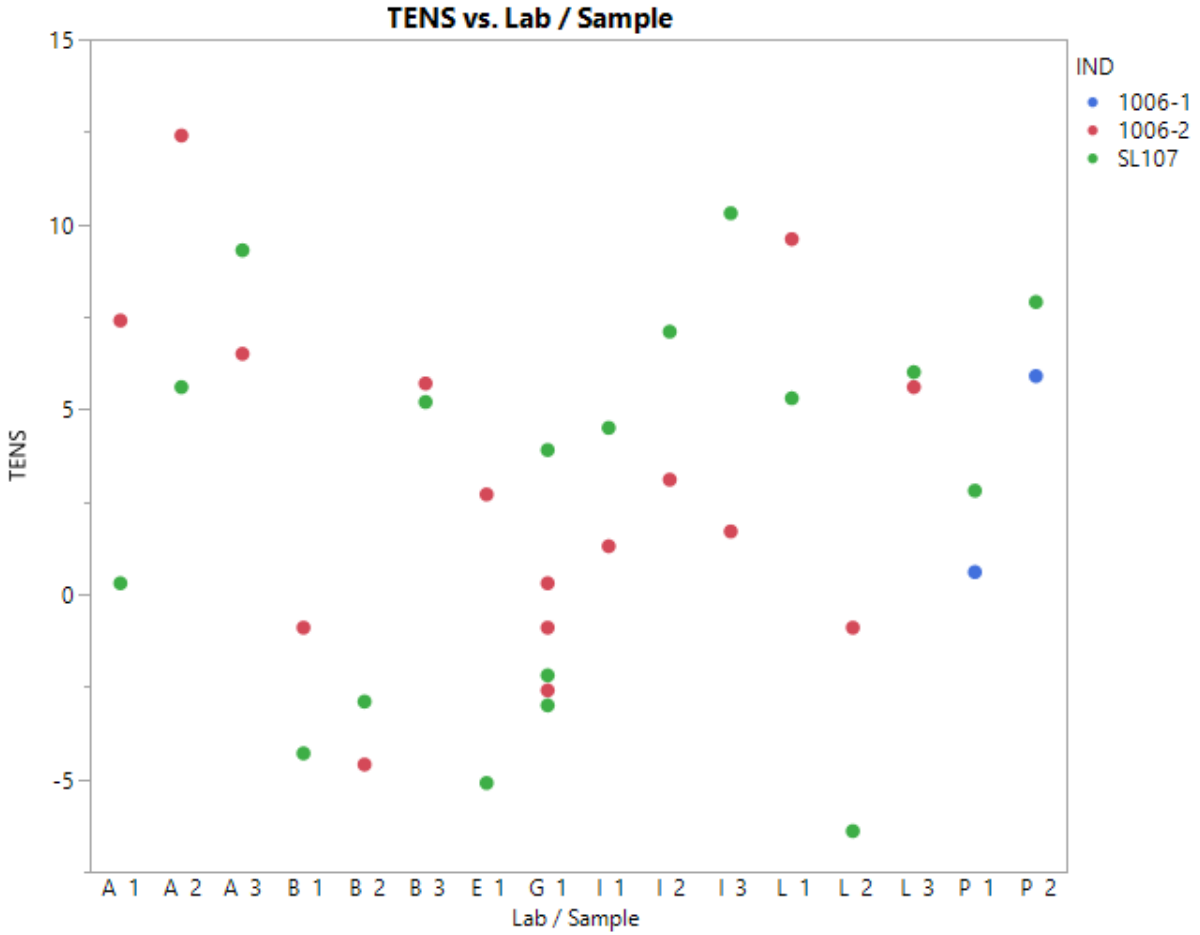
- The difference between 1006 and SL107 for Lab I, Samples 2 and 3 is less than other bath pairs.
- For each bath pair, other than Lab I, Sample 3, VOLC for SL107 is lower than 1006.

EOEC Polyacrylate - HARD



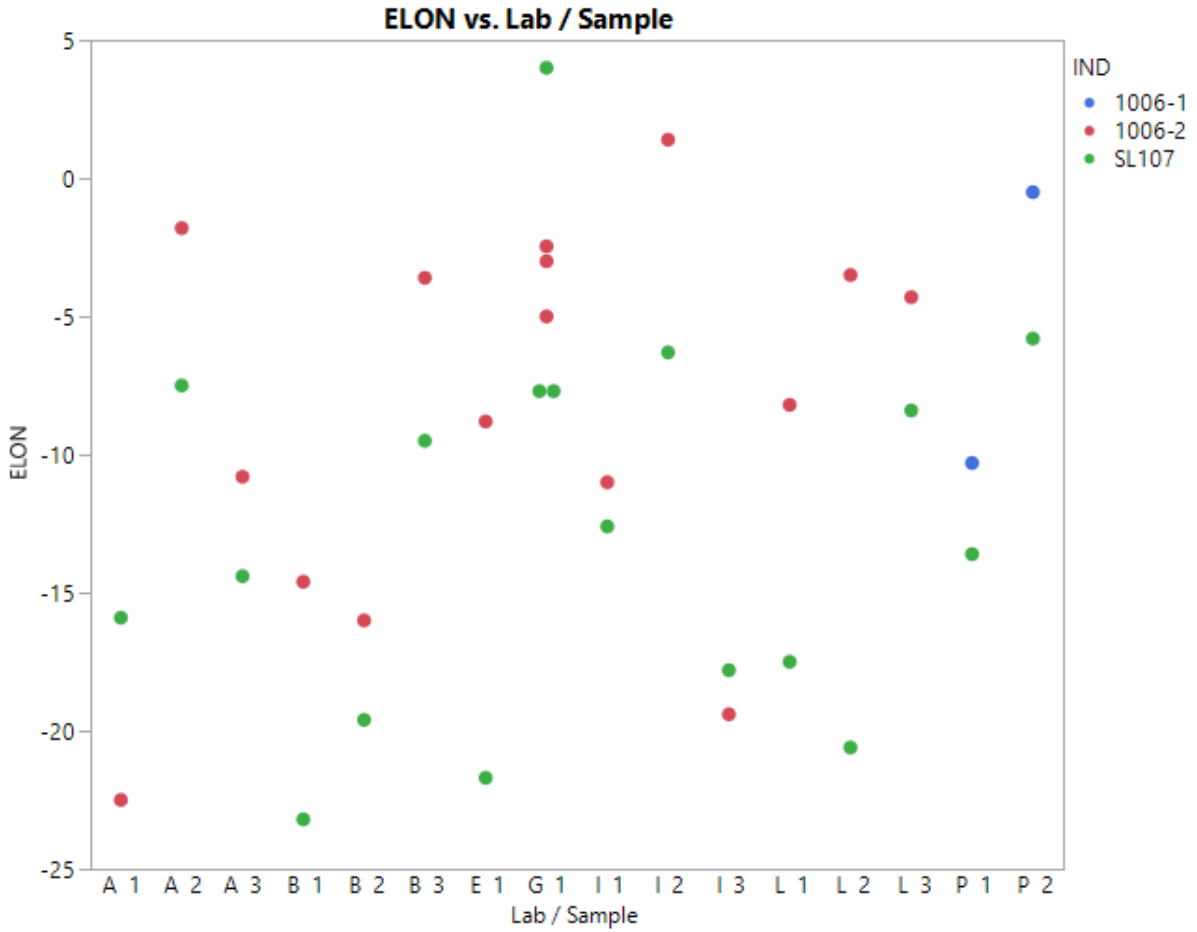
- The difference between SL107 and 1006 for Lab I, Sample 2, is higher than for other bath pairs.

EOEC Polyacrylate - TENS



- Order of TENS for oils amongst pairs differ indicating similarity in Reference Oil means.

EOEC Polyacrylate - ELON



- Order of Elongations for oils amongst pairs differ indicating similarity in Reference Oil means.

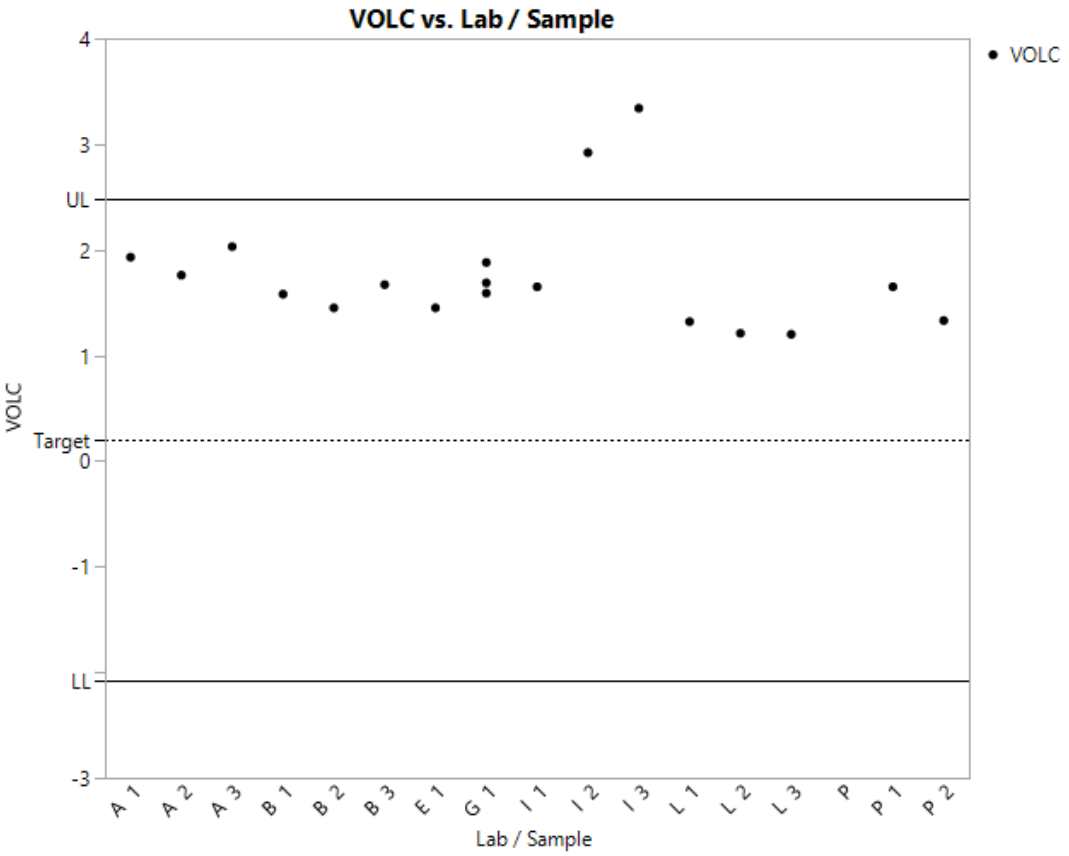
EOEC Polyacrylate (EOECP) RO SL107 Target Mean

- Round Robin means for 1006 and SL107 are each within the corresponding standard deviation.
- The magnitudes of the Offsets for VOLC and ELON are greater than the corresponding standard deviation.
- SL107 standard deviations are less than corresponding 1006 standard deviations.

EOEC Polyacrylate (EOECP)

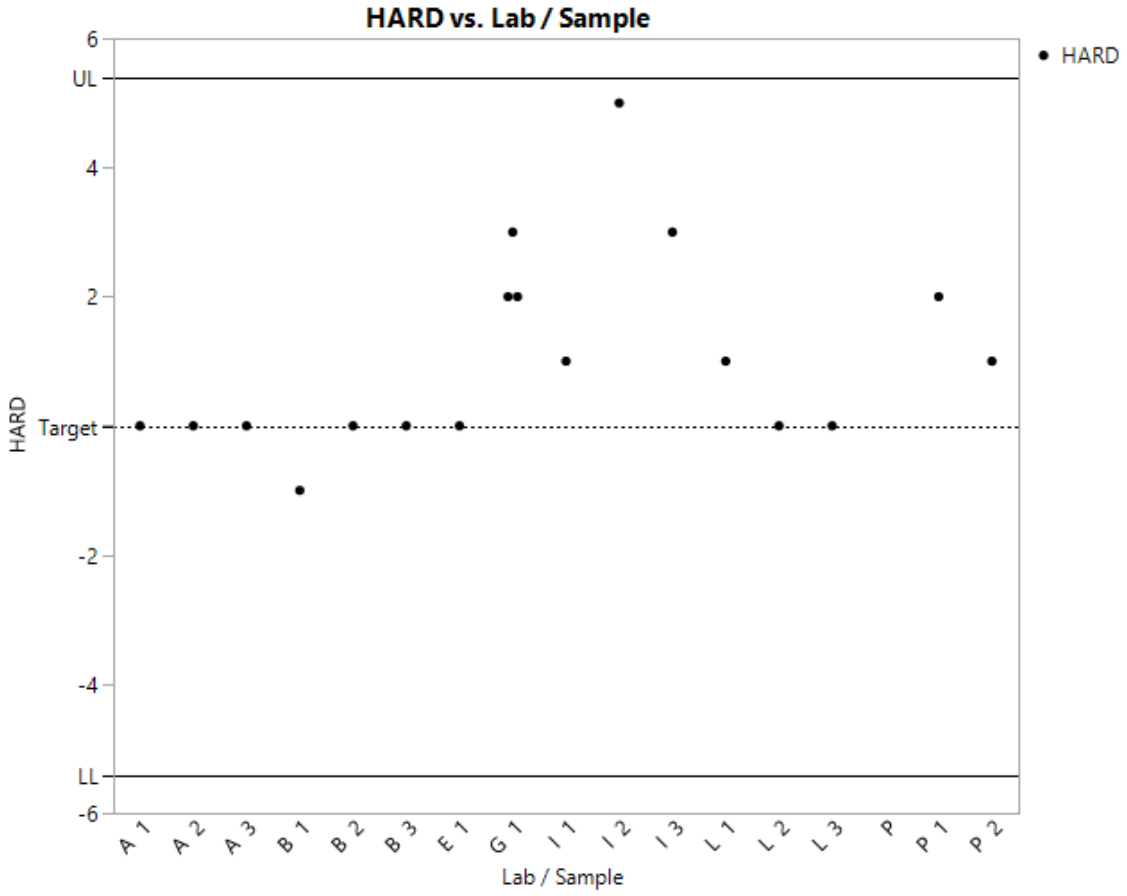
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	0.84	0.76	16	2.40	1.76	-1.56	0.20	0.35
HARD	-1.51	1.80	16	-0.70	0.80	-0.81	-0.01	1.26
TENS	0.84	8.04	16	3.37	2.89	-2.53	0.36	4.45
ELON	-18.07	8.94	16	-8.86	-13.37	-9.21	-22.58	6.96

SL107 EOECP VOLC



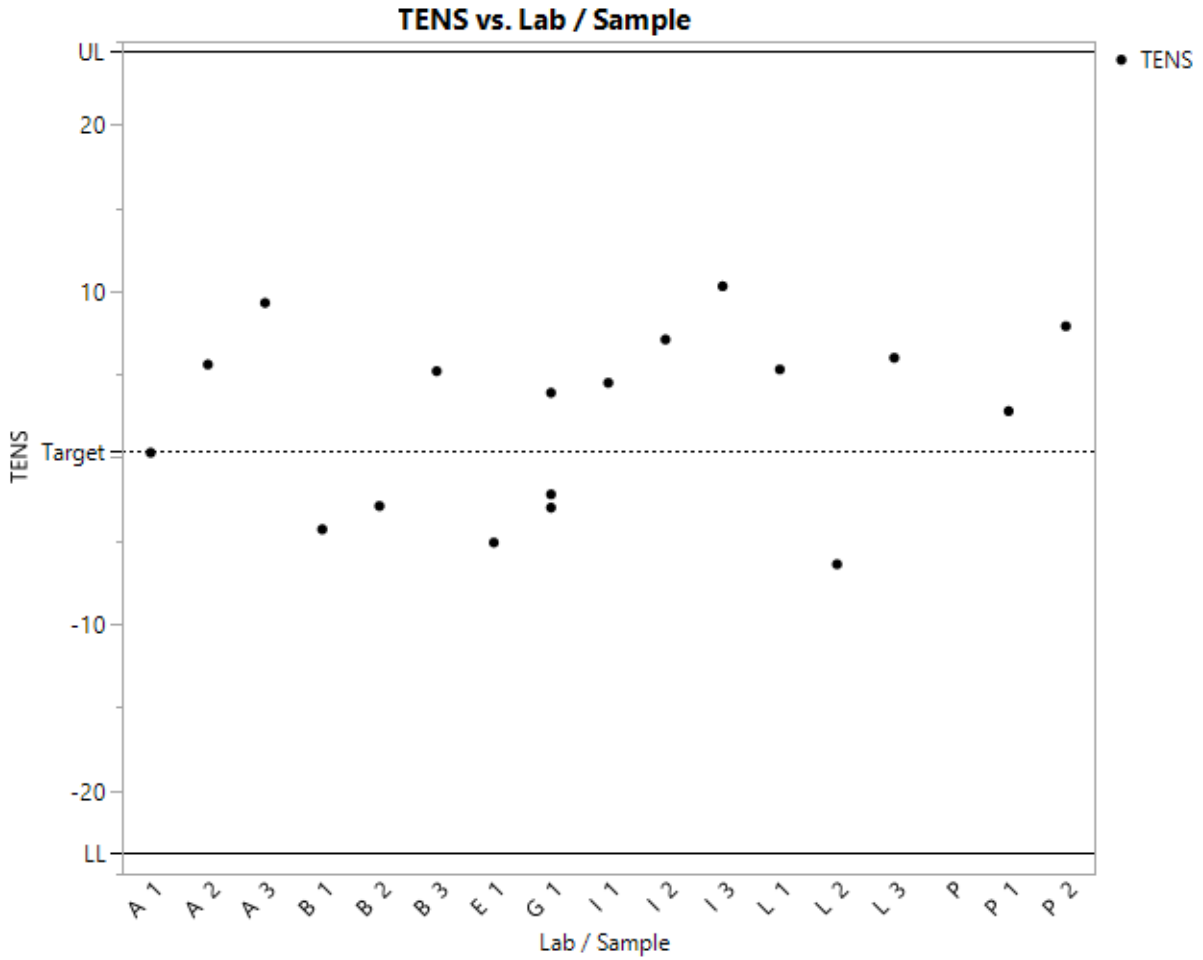
- All VOLC are above the target and Lab I, Samples 2 and 3 exceed the 3 s limits.

SL107 EOECP HARD



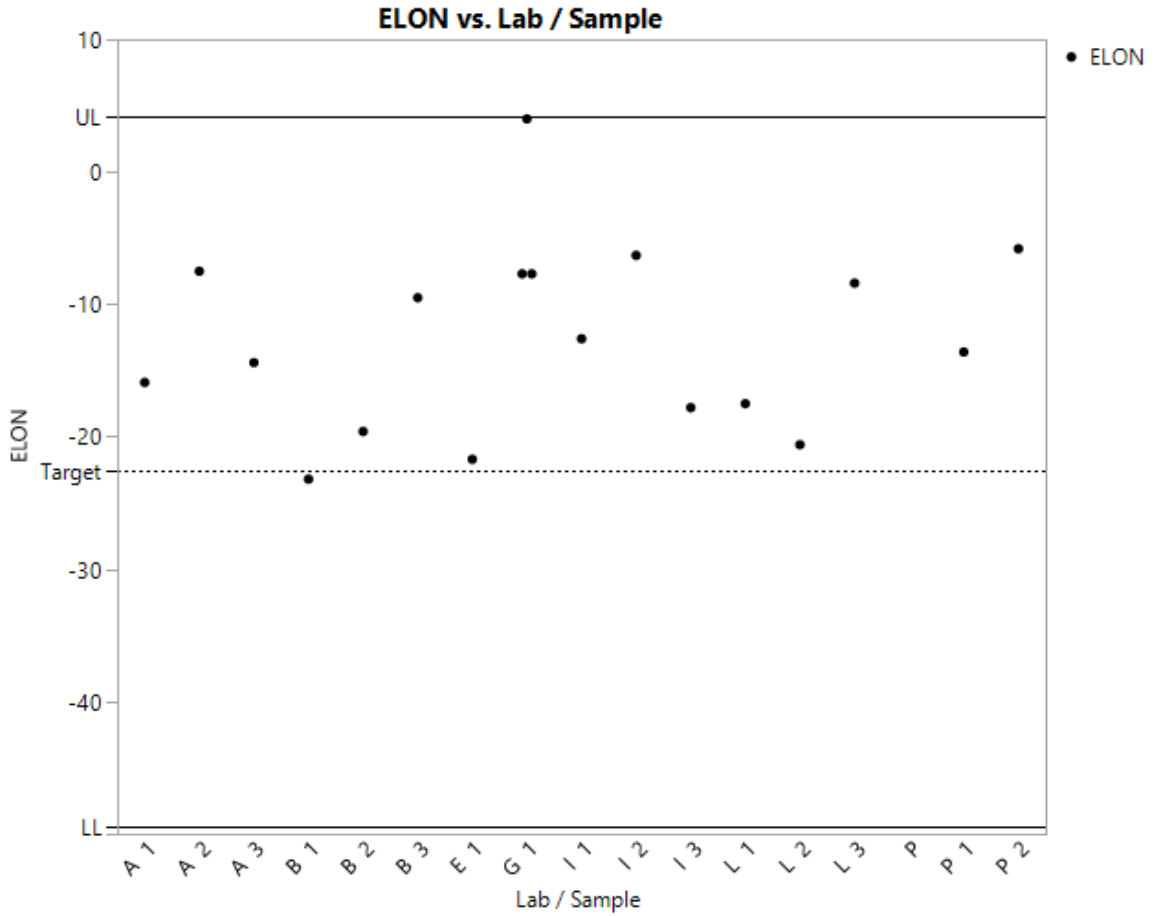
- All SL107 HARD are within the 3 s limits but only 1 of them are below the target.

SL107 EOECP TENS



- All SL107 TENS are well within the 3 s limits.

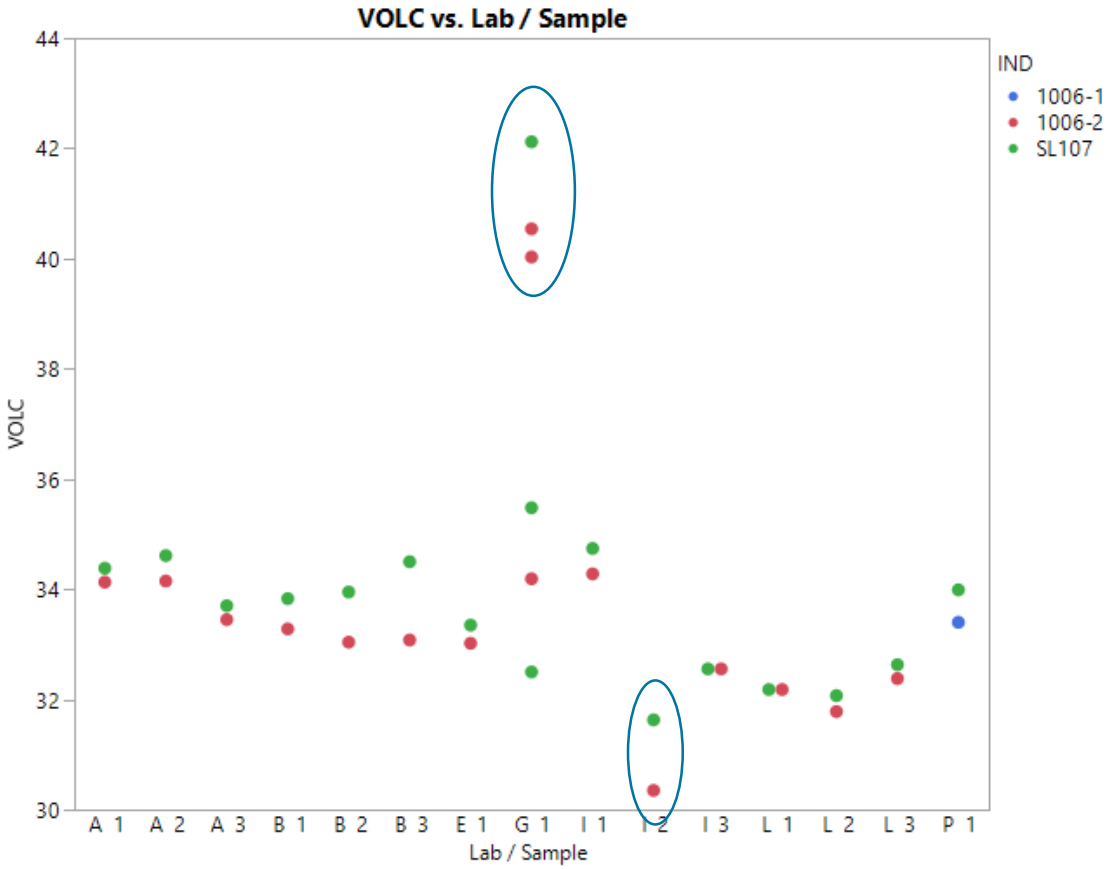
SL107 EOECP ELON



- All SL107 ELON are within the 3 s limits though only 1 is below the target.

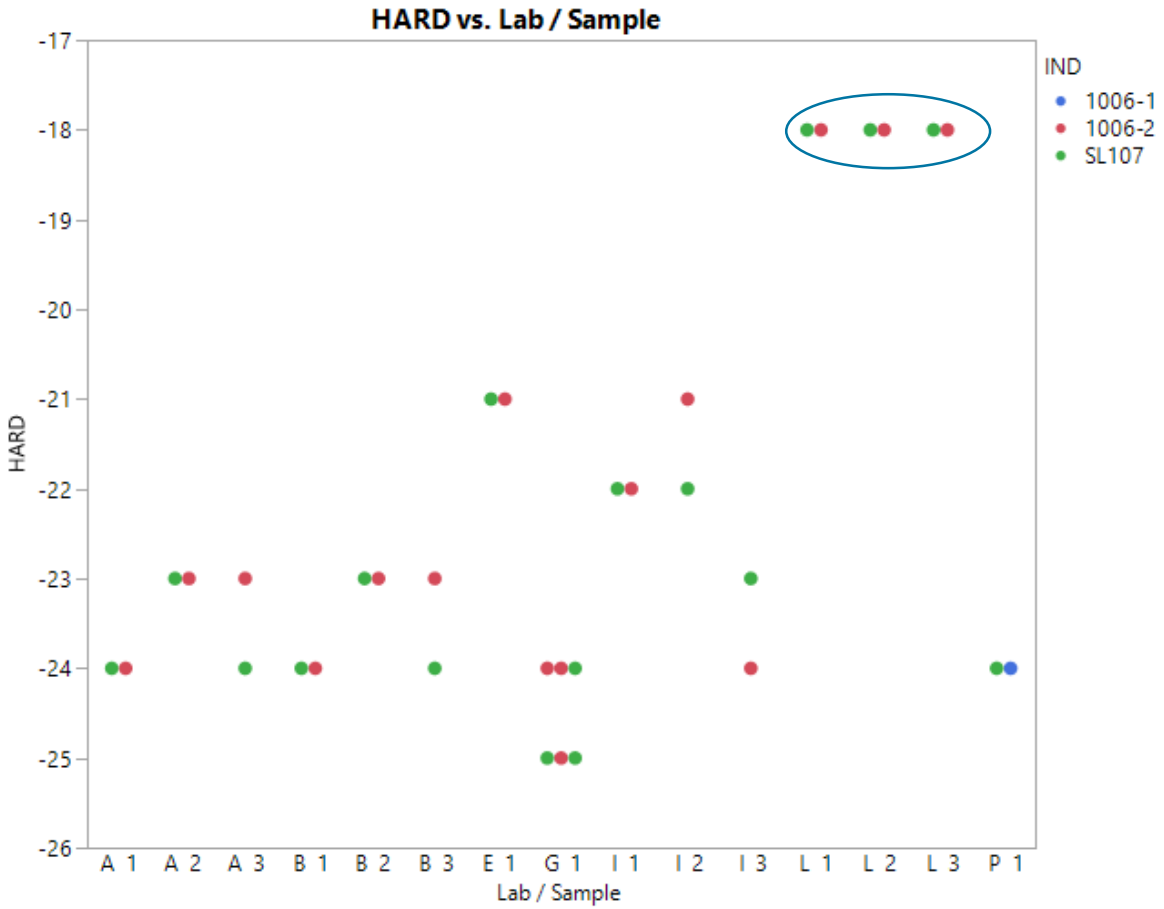
EOEC Silicone (EOECS)

EOEC Silicone - VOLC



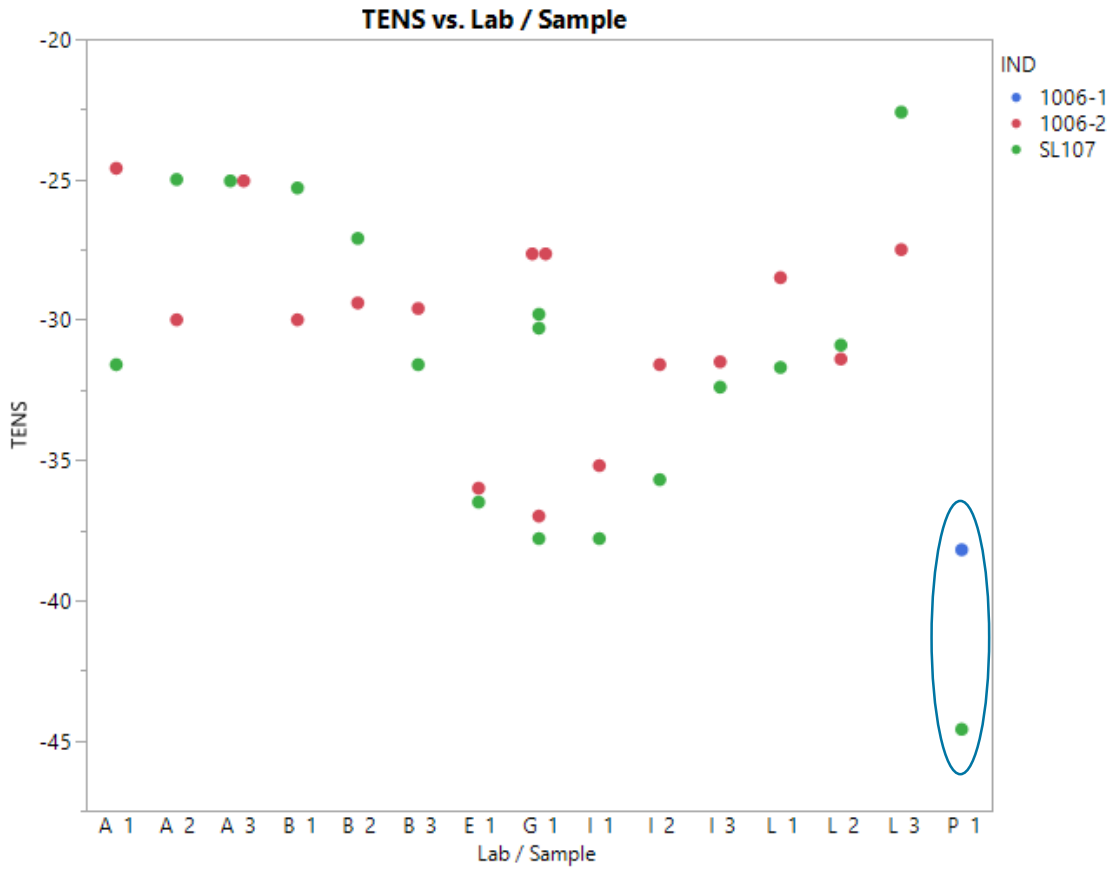
- 3 VOLCs of Lab G, Sample 1 and those of Lab I, Sample 2 are outside the range of the other results.
- The VOLC for SL107 is equal to or higher than that of 1006 for all bath pairs.

EOEC Silicone - HARD



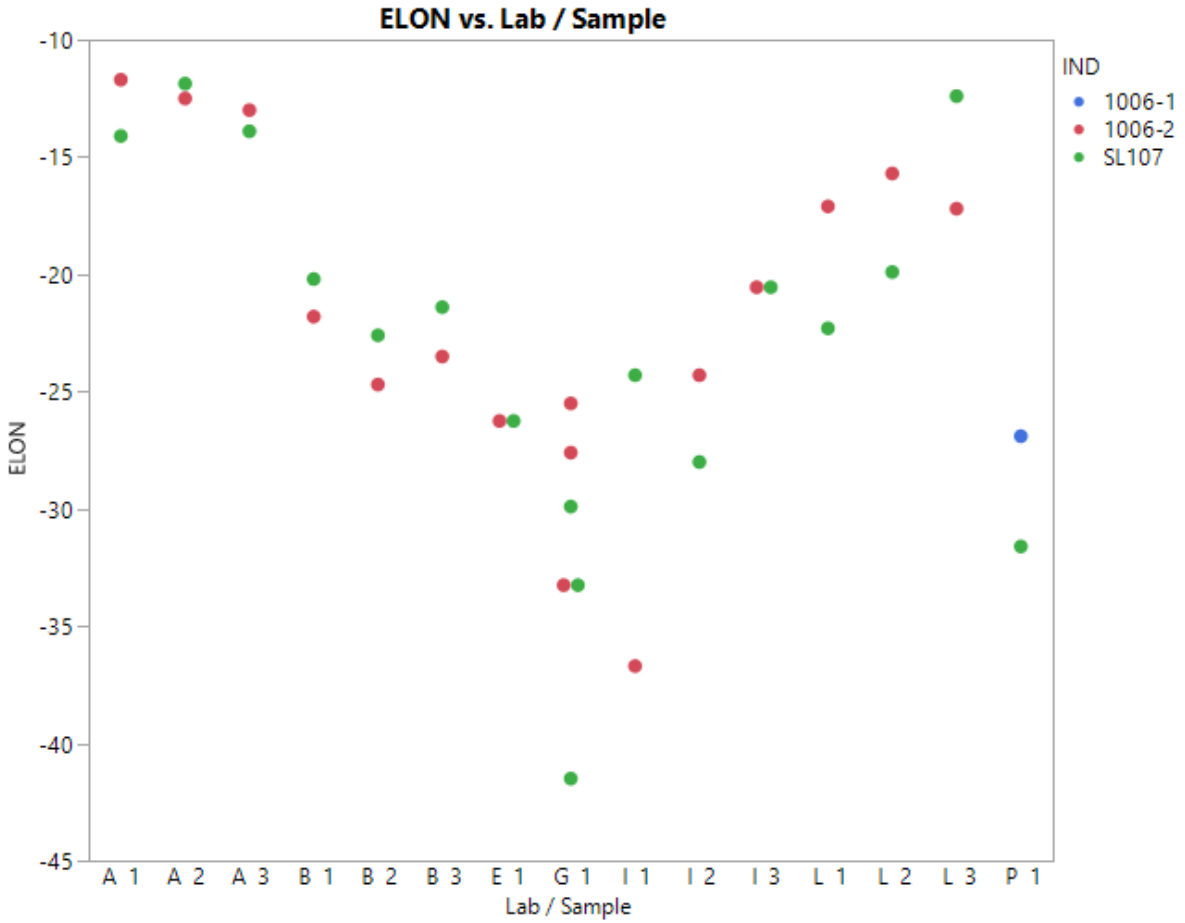
- The results of Lab L are outside the range of the other labs.
- The difference between the Hardness for each bath pair is within 1 unit.

EOEC Silicone - TENS



- Results for Lab P are outside the range of the other labs.
- The Reference Oil correlating to the higher (less negative) TENS is mixed amongst the pairs indicating similarity of means.

EOEC Silicone - ELON



- The Reference Oil correlating to the higher (less negative) ELON is mixed amongst the pairs indicating similarity of means.

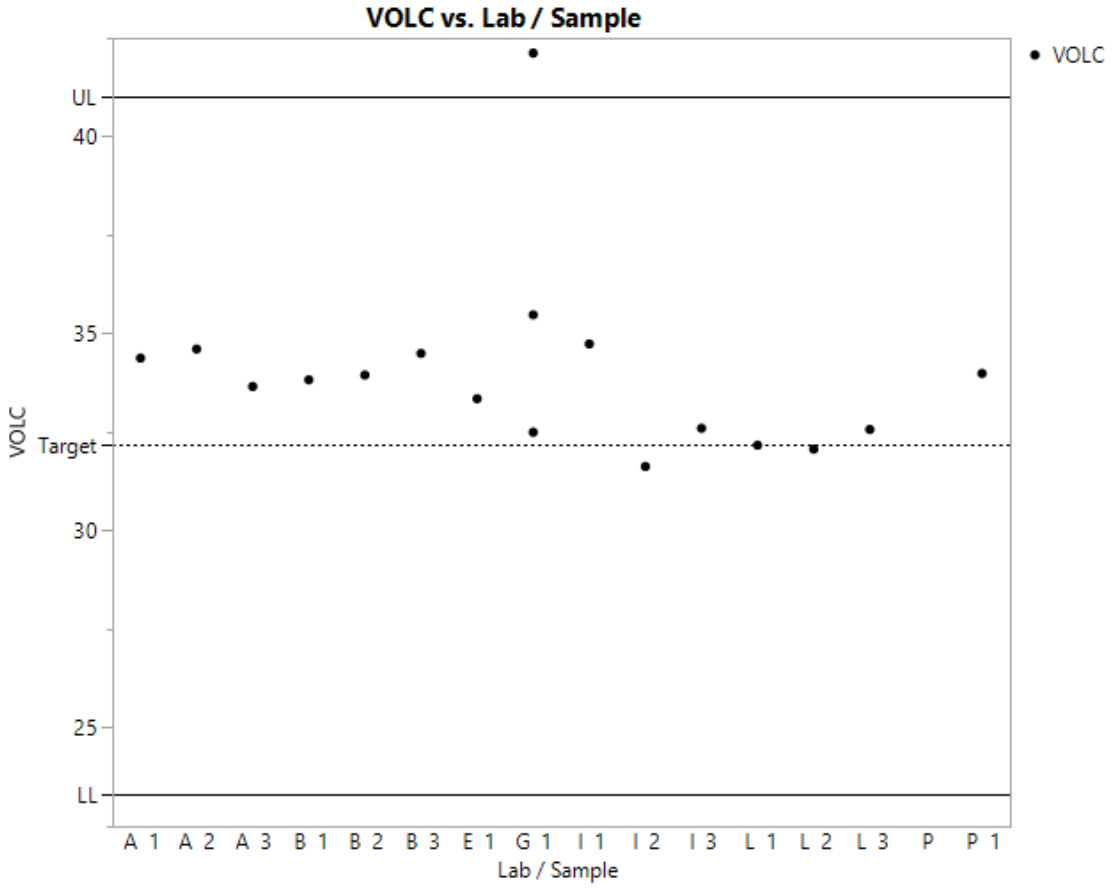
EOEC Silicone (EOECS) RO SL107 Target Mean

- Round Robin means for 1006 and SL107 are very similar.
- The magnitude of the Offset for each parameter is less than the corresponding standard deviation.
- SL107 standard deviations are greater than corresponding 1006 standard deviations except for VOLC.

EOEC Silicone (EOECS)

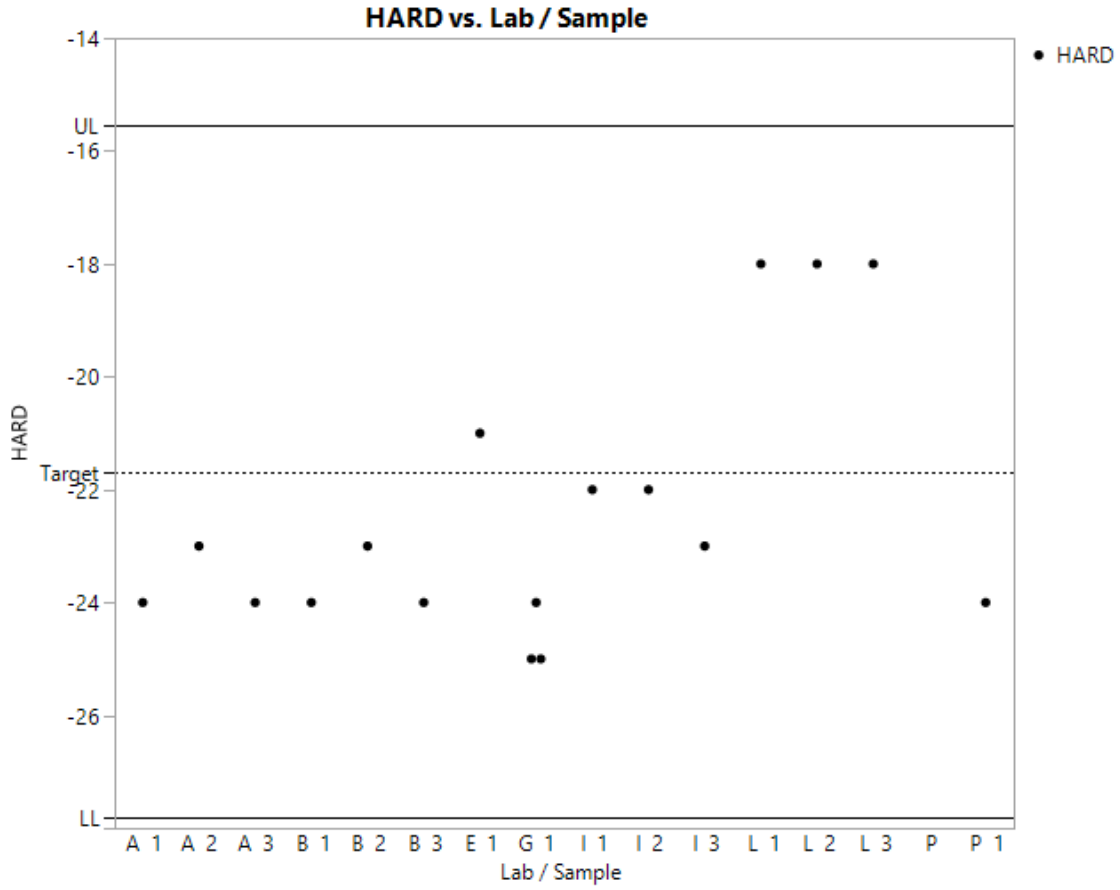
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	32.03	2.95	15	33.40	33.54	-1.37	32.17	2.46
HARD	-21.50	2.04	15	-22.01	-22.19	0.51	-21.68	2.40
TENS	-32.86	3.70	15	-30.56	-31.46	-2.30	-33.75	6.07
ELON	-23.82	6.25	15	-21.01	-22.00	-2.81	-24.81	6.61

SL107 EOECS VOLC



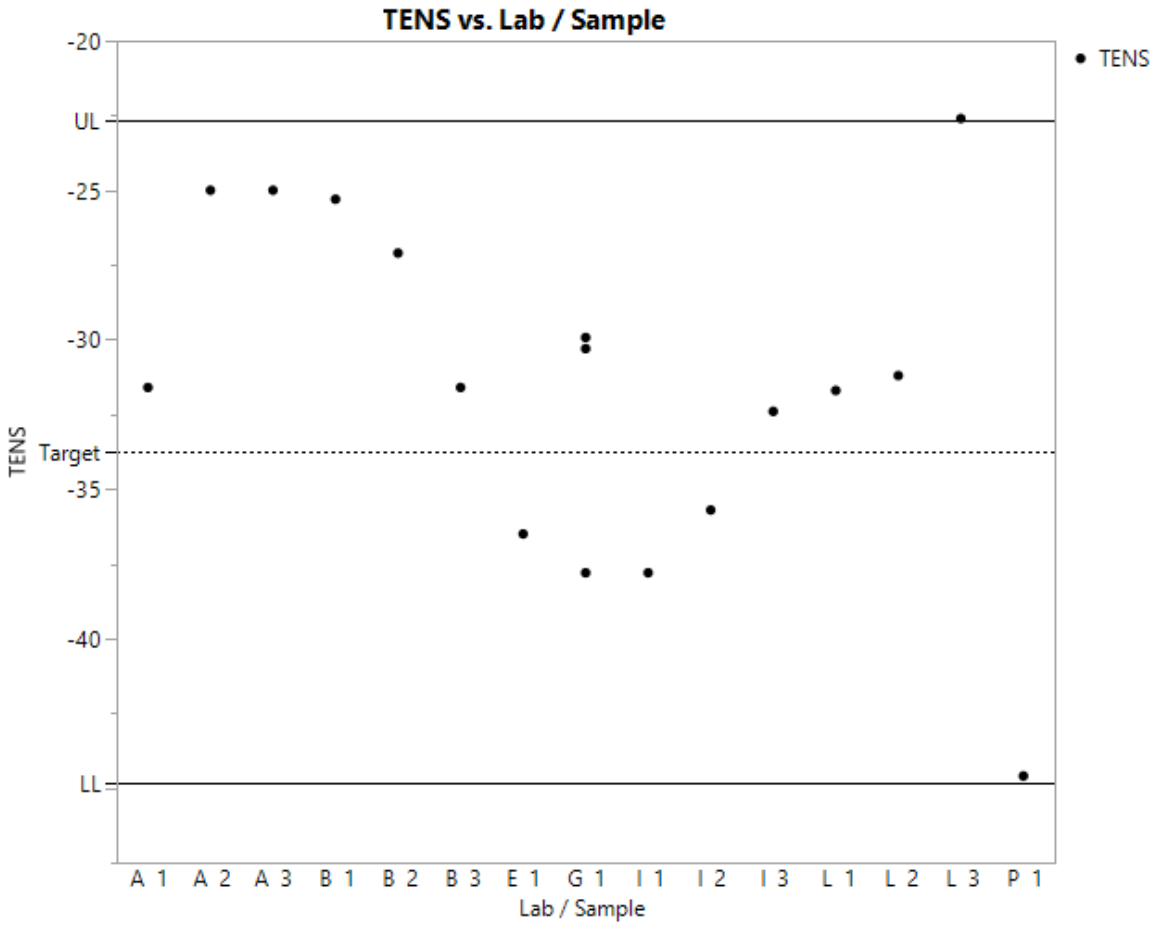
- Most of the VOLC are above the target and 1 of the Lab G results exceeds the 3 s limits.

SL107 EOECS HARD



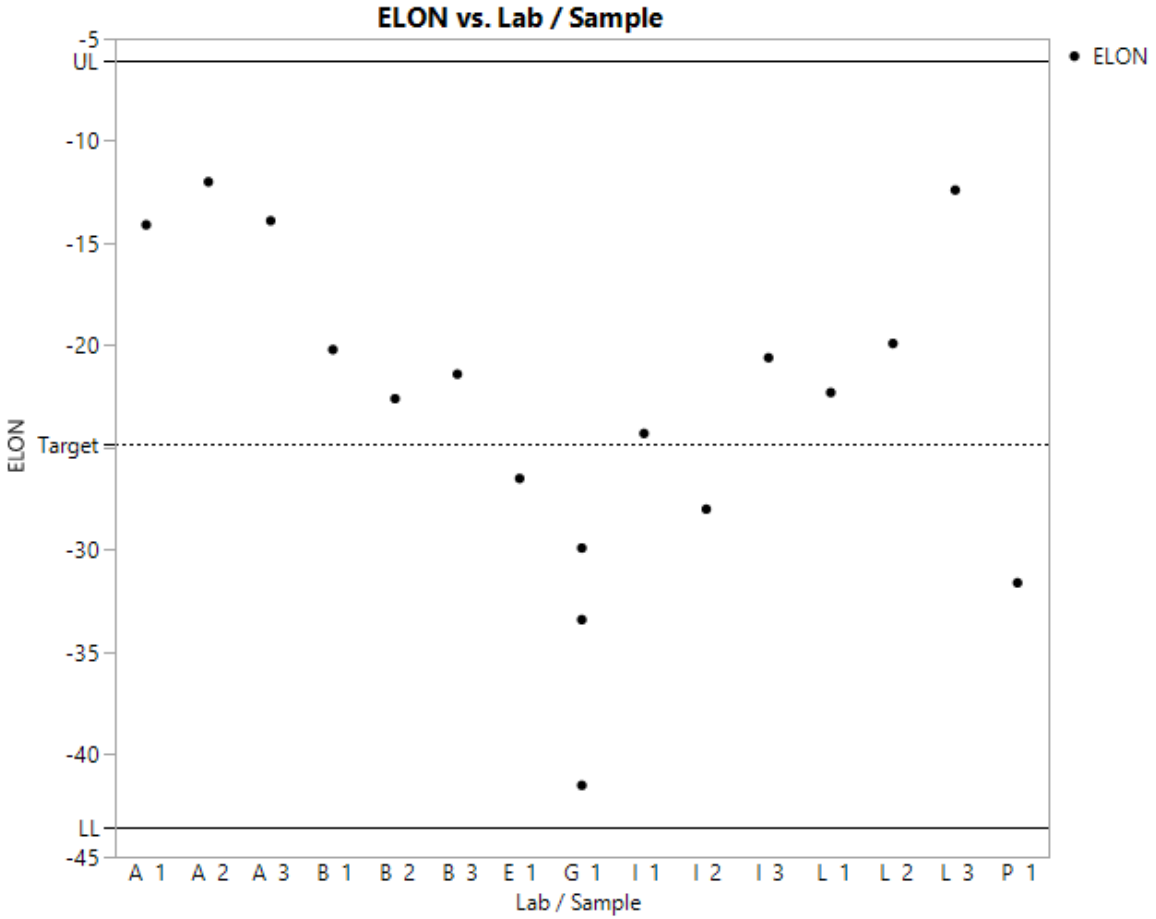
- All SL107 HARD are within the 3 s limits.

SL107 EOECS TENS



- 1 (Lab L, Sample 3) SL107 TENS exceeds the upper 3 s limit and 1 (Lab P, Sample 1) is just above the lower 3 limit.

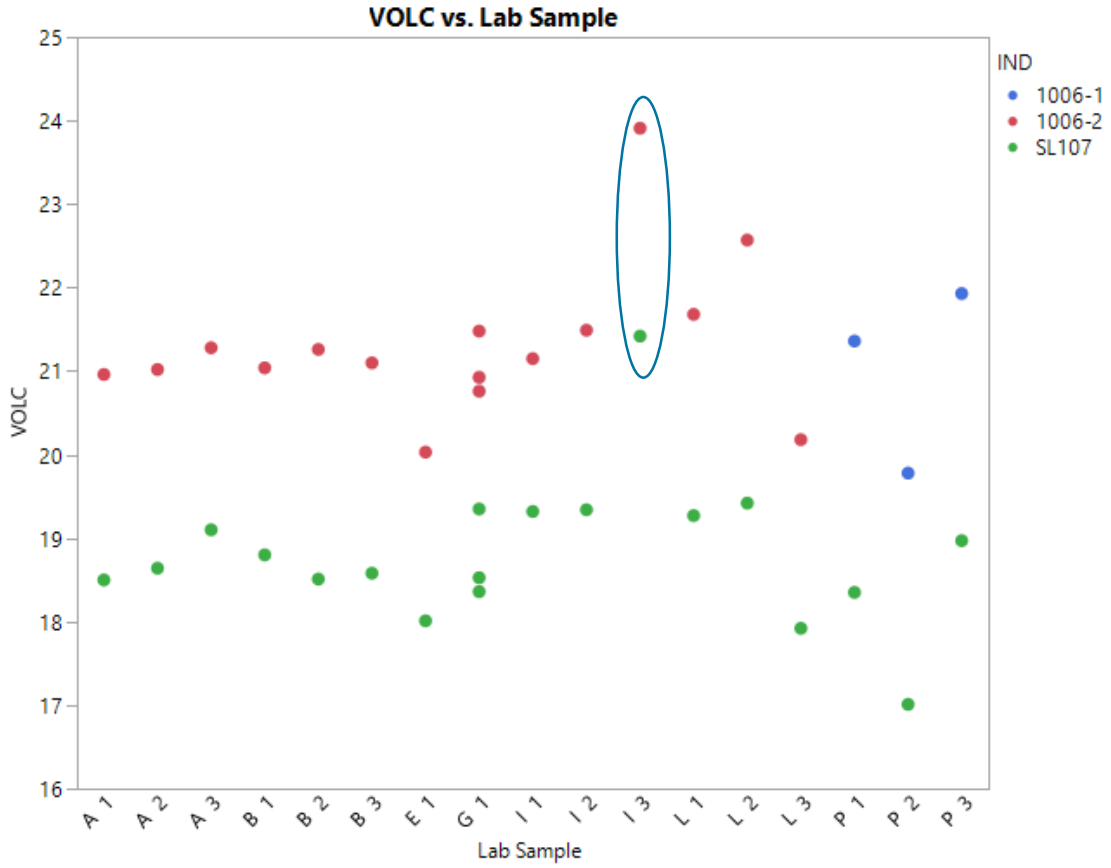
SL107 EOECS ELON



- All SL107 ELON are within the 3 s limits.

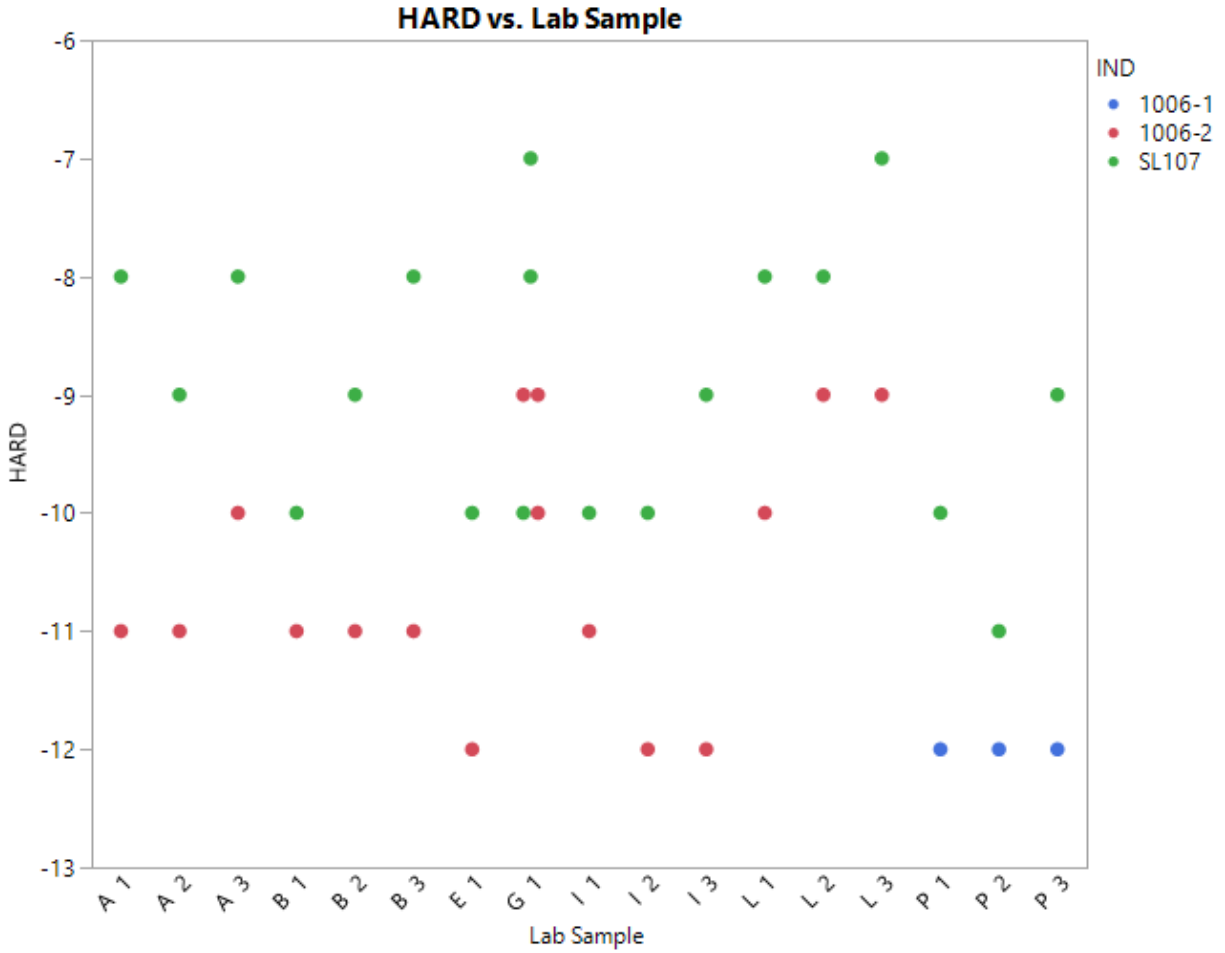
EOEC VAMAC (EOECV)

EOEC VAMAC - VOLC



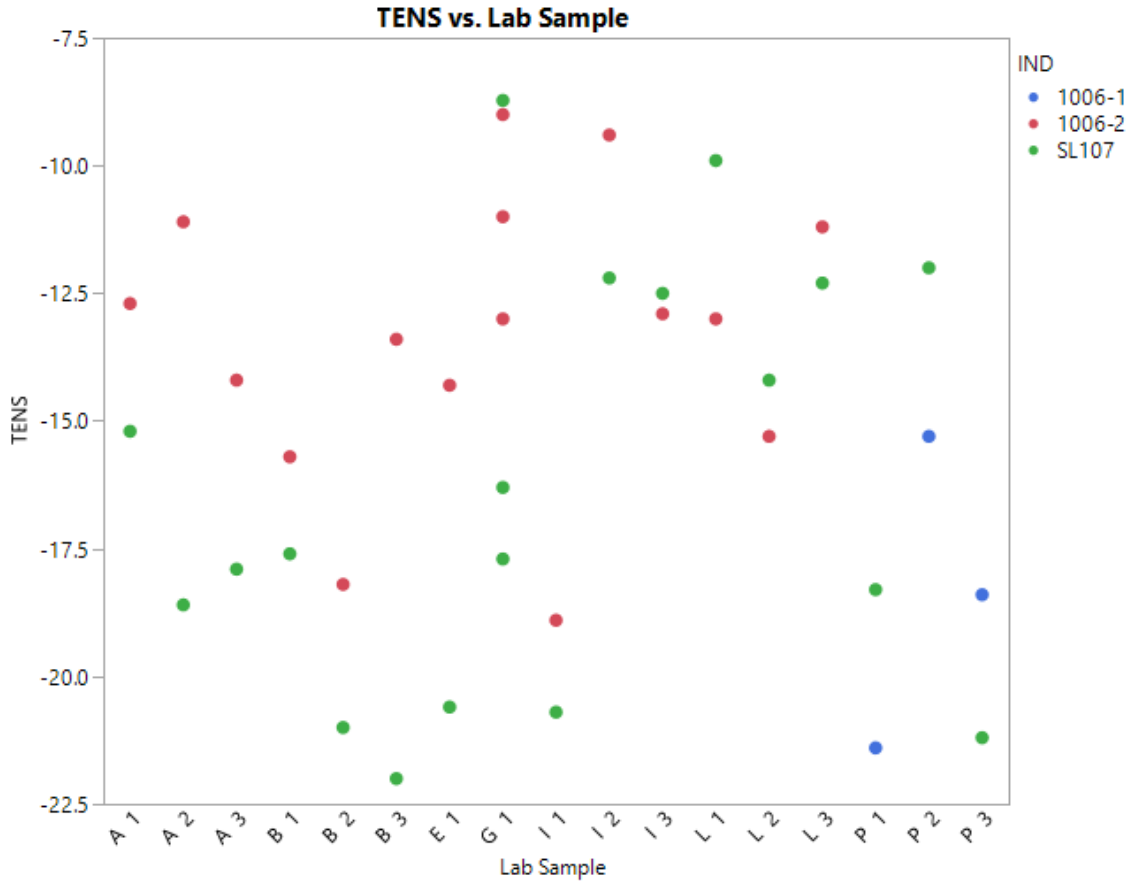
- Volume Changes for Lab I, Sample 3 are outside the ranges for the other samples.
- The VOLC for 1006 is higher than that of SL107 for all bath pairs.

EOEC VAMAC - HARD



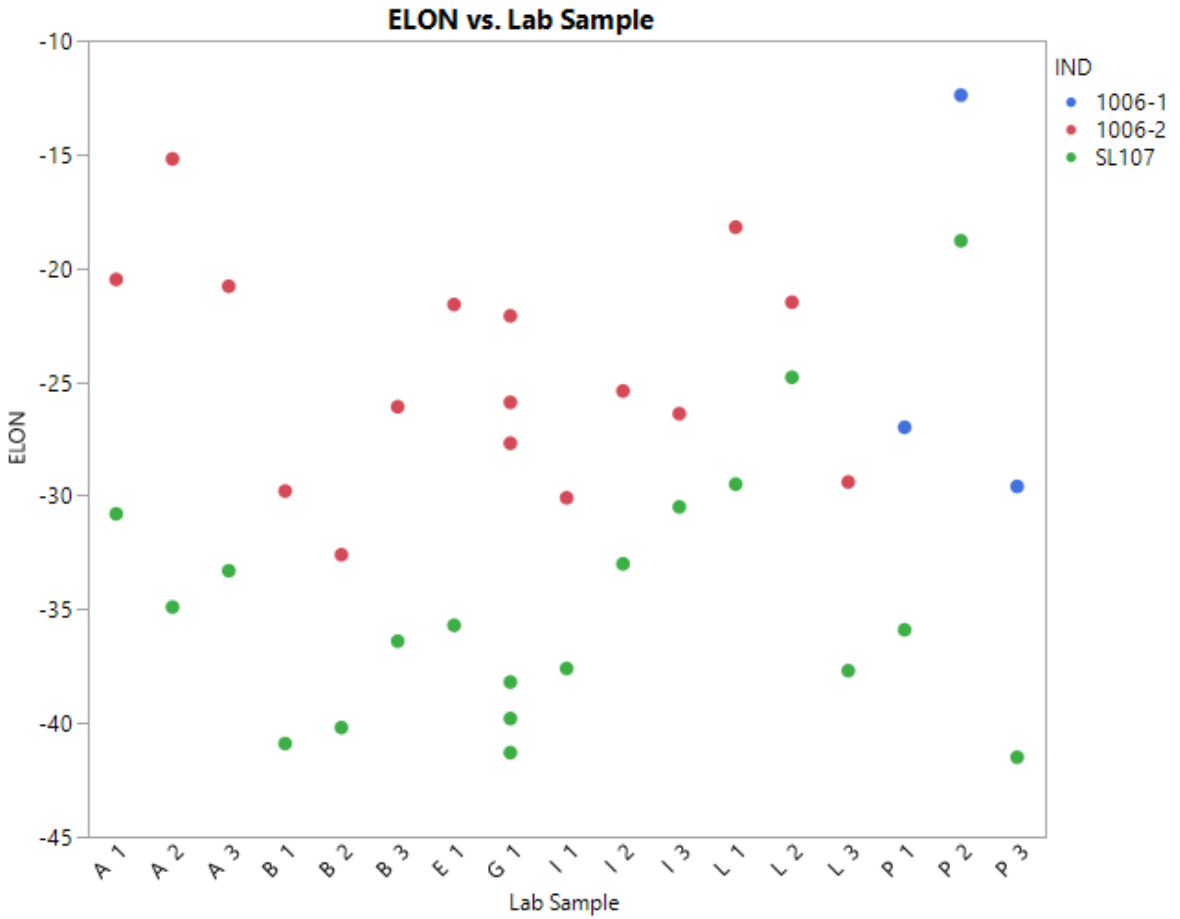
- For each bath pair, the Hardness for SL107 is higher (less negative) than 1006.

EOEC VAMAC - TENS



- The Reference Oil correlating to the higher (less negative) TENS is mixed amongst the pairs indicating similarity in Reference Oil means.

EOEC VAMAC - ELON



- For each bath pair, the ELON of 1006 is higher than that of SL107.

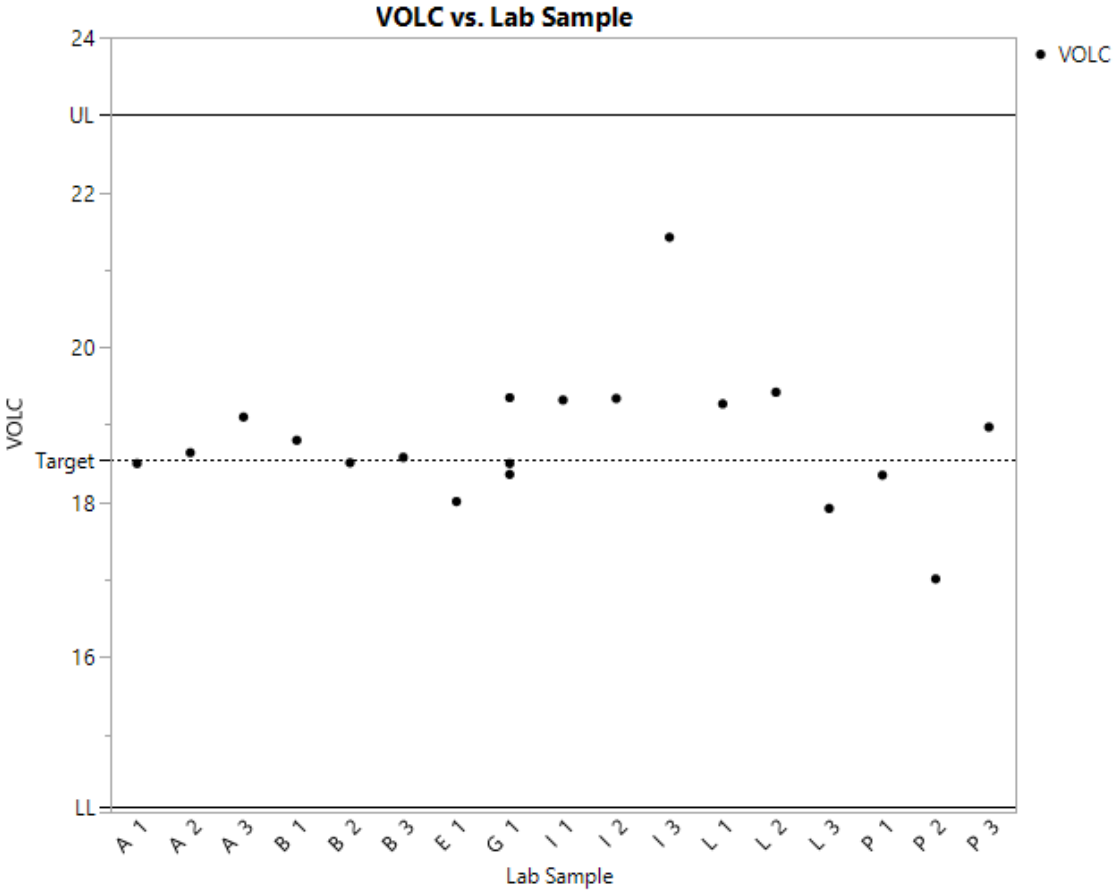
EOEC VAMAC (EOECV) RO SL107 Target Mean

- Round Robin means for 1006 and SL107 differ by more than a standard deviation for each parameter other than TENS.
- The magnitude of the Offset for each parameter is less than a standard deviation except for HARD.
- SL107 standard deviations are less than corresponding 1006 standard deviations except for HARD.

EOEC VAMAC (EOECV)

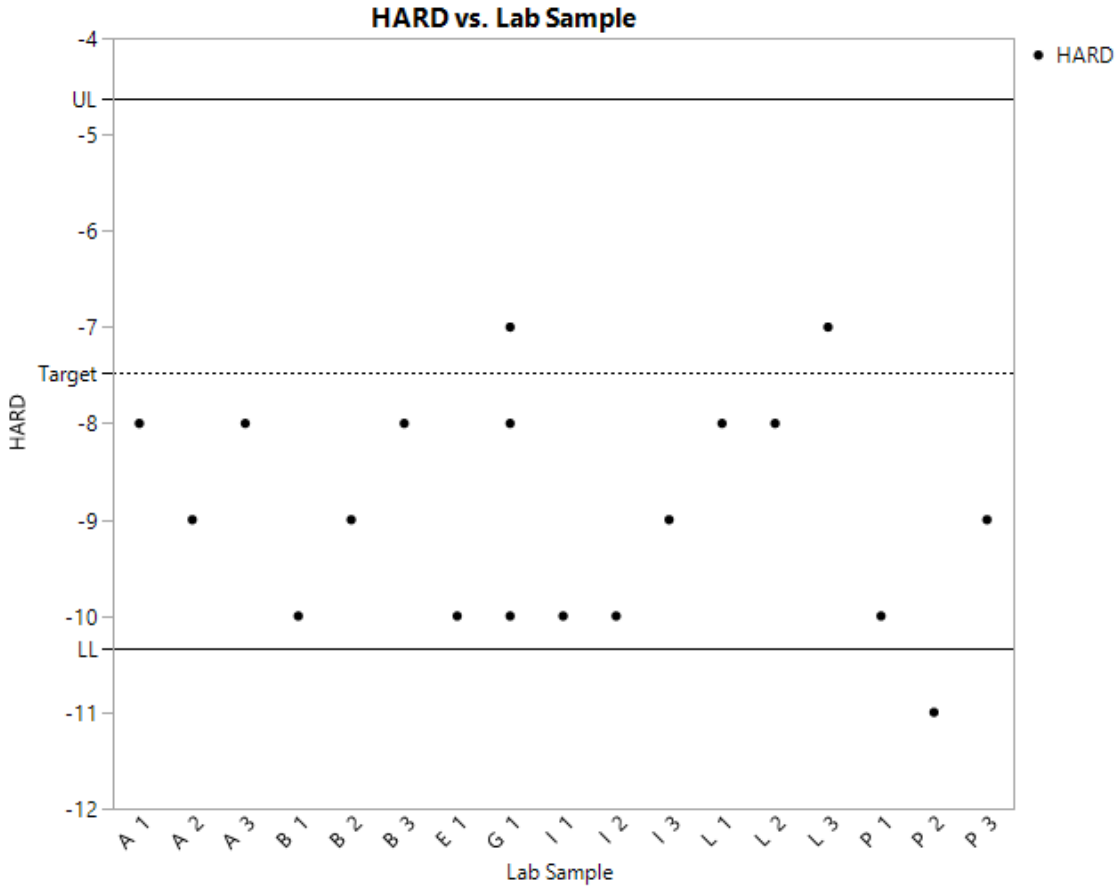
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	20.99	1.49	17	21.27	18.83	-0.28	18.54	0.91
HARD	-9.32	0.95	17	-10.85	-9.01	1.53	-7.48	1.09
TENS	-13.19	4.84	17	-14.43	-16.57	1.24	-15.33	3.88
ELON	-24.51	7.40	17	-23.99	-34.43	-0.52	-34.96	6.09

SL107 EOECV VOLC



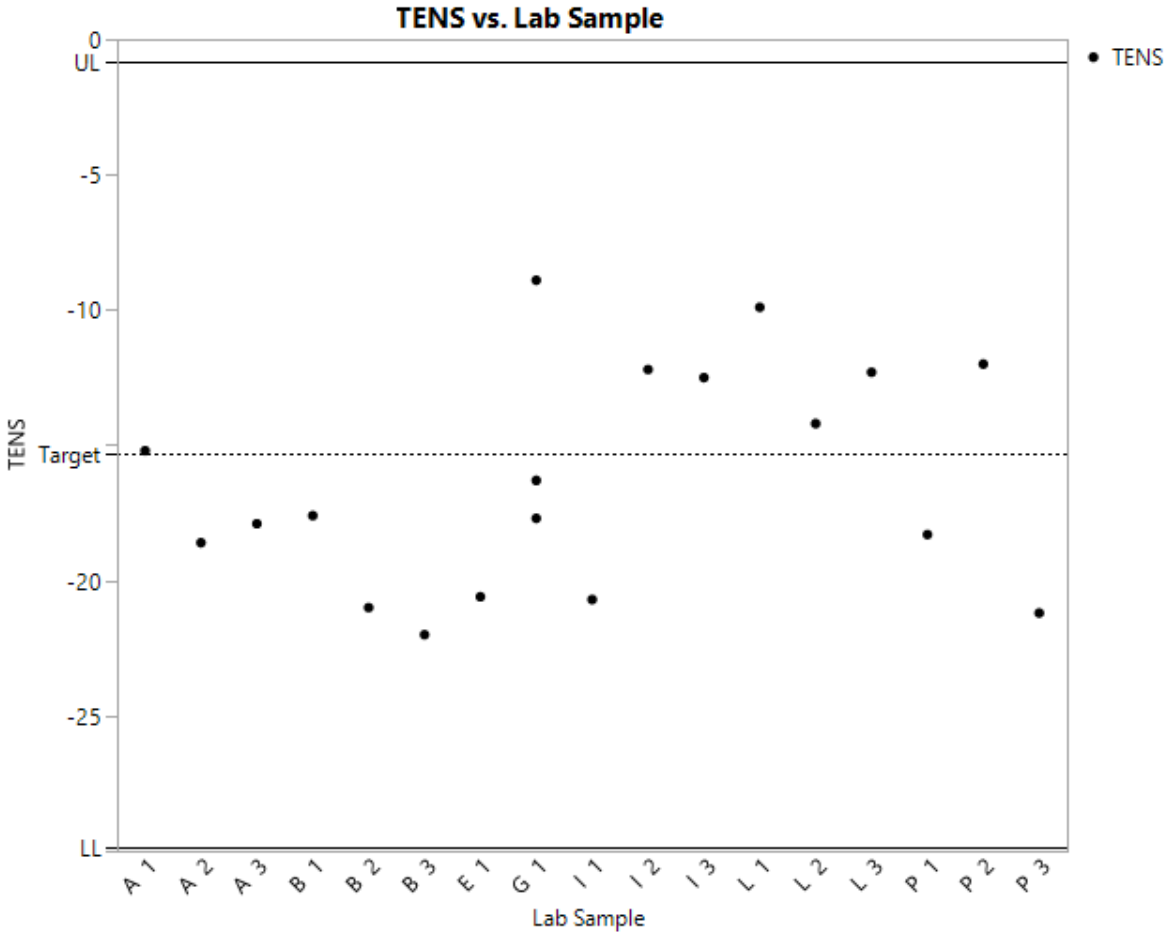
- All SL107 VOLC are well within the 3 s limits.

SL107 EOECV HARD



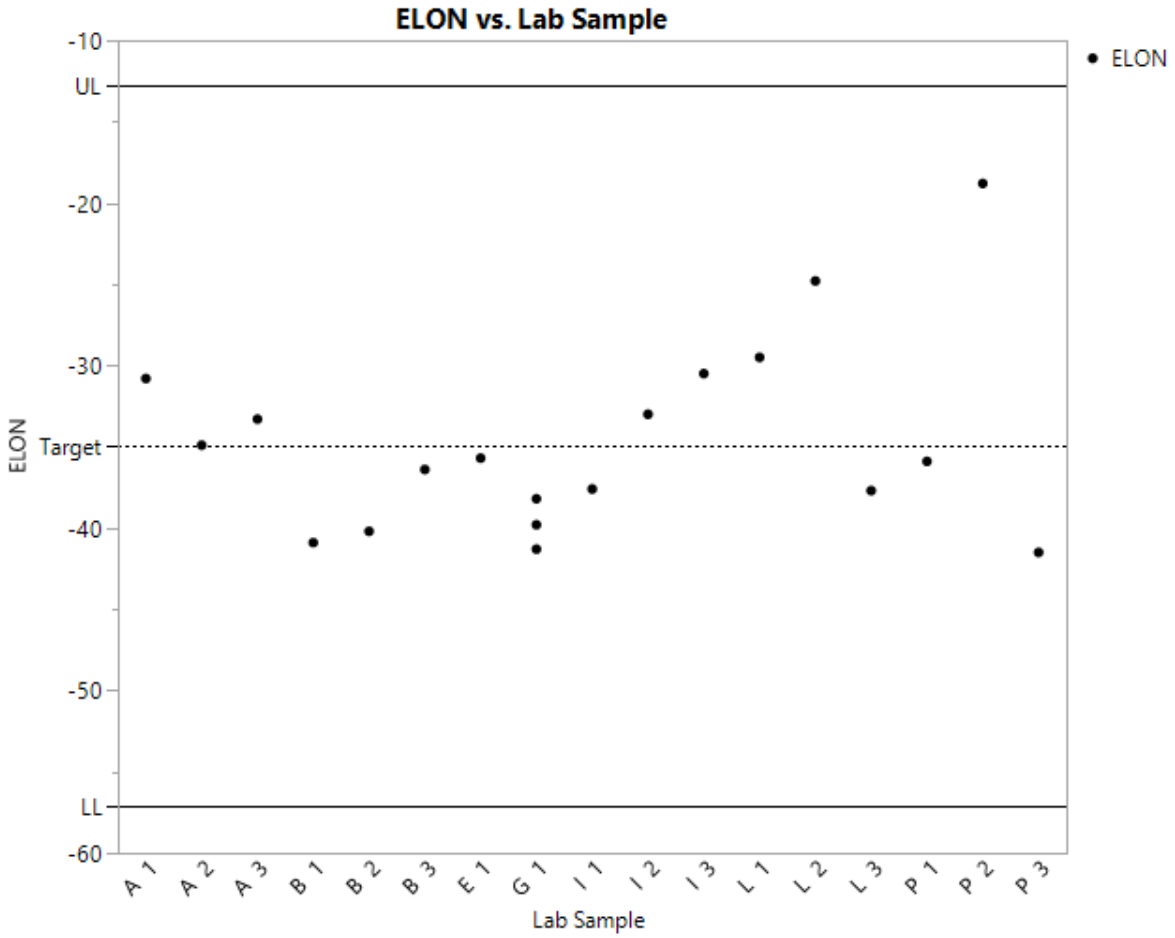
- Most of the SL107 HARD are below the target and Lab P, Sample 2 is outside the 3 s limits.

SL107 EOECV TENS



- All SL107 TENS are well withiin the upper 3 s limits.

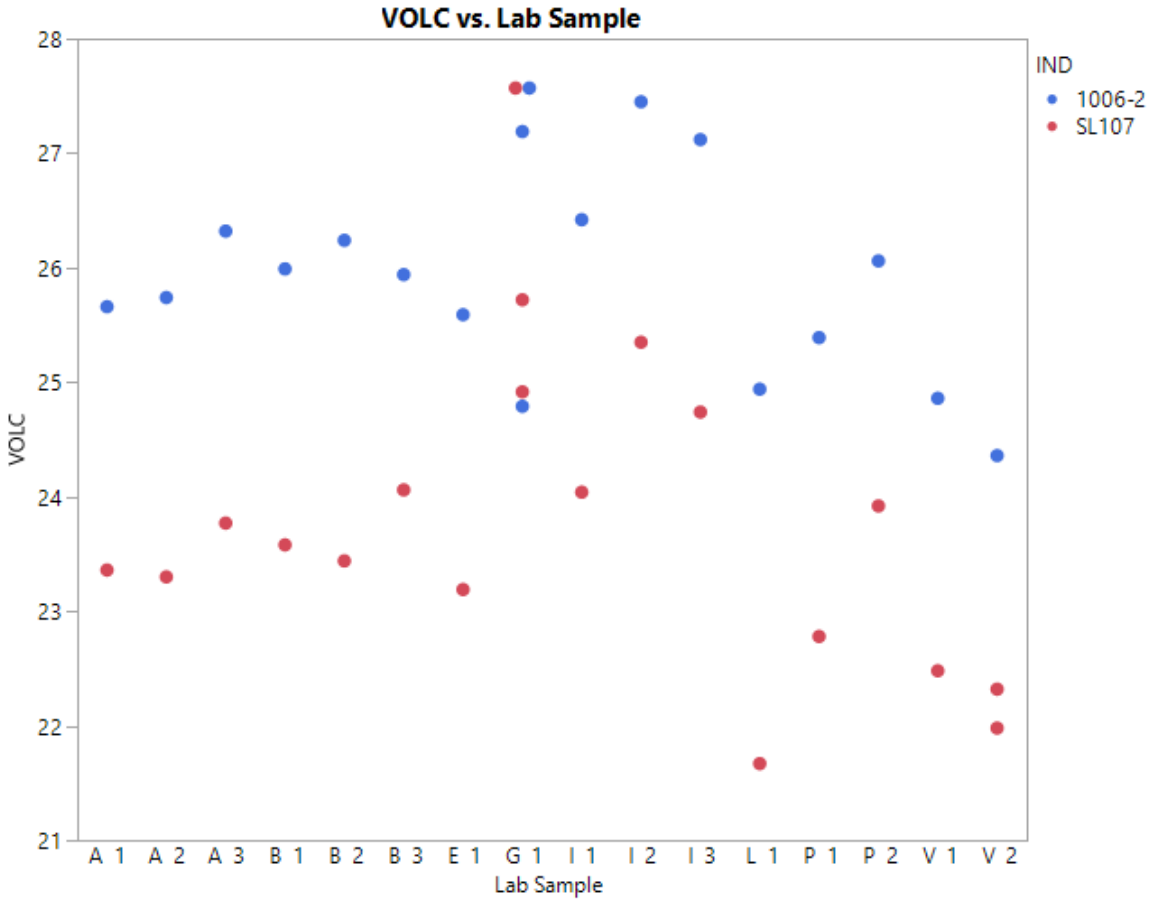
SL107 EOECV ELON



- All SL107 ELON are within the 3 s limits.

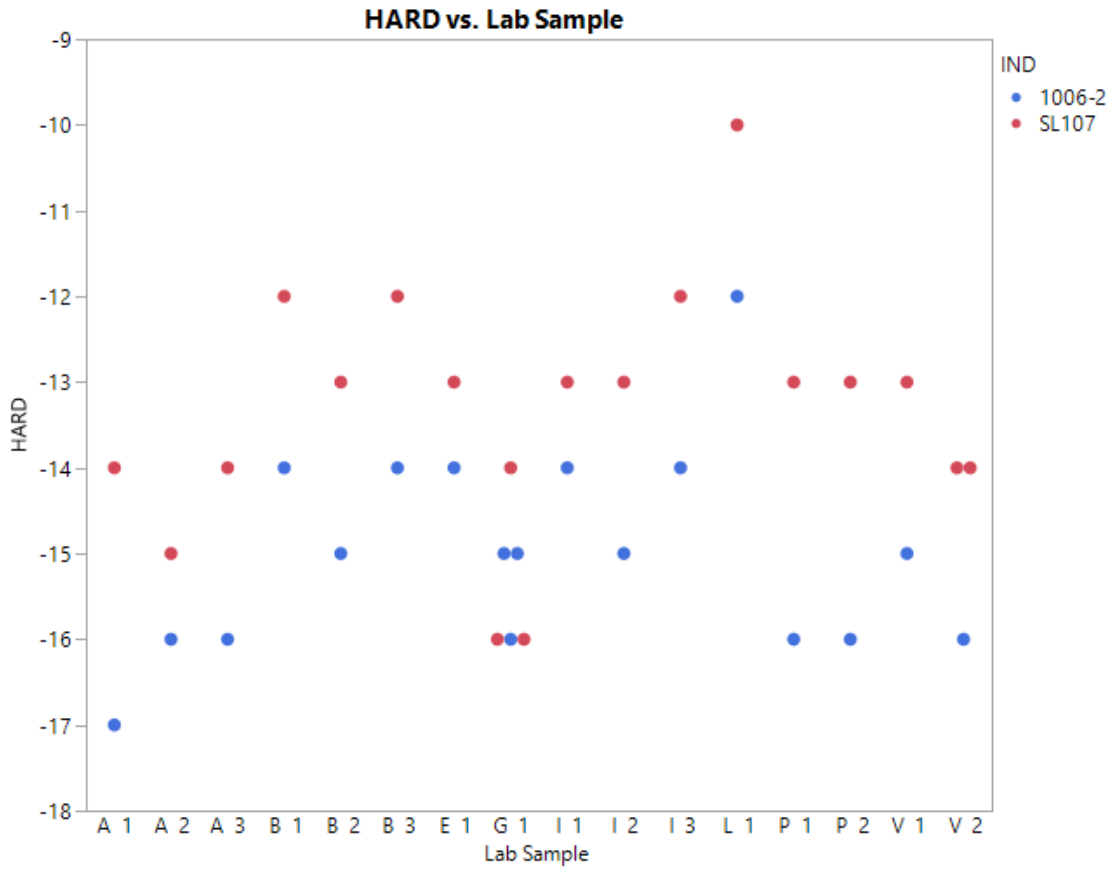
LDEOC Ethylene Acrylate (LDEOCA)

LDEOC Ethylene Acrylate - VOLC



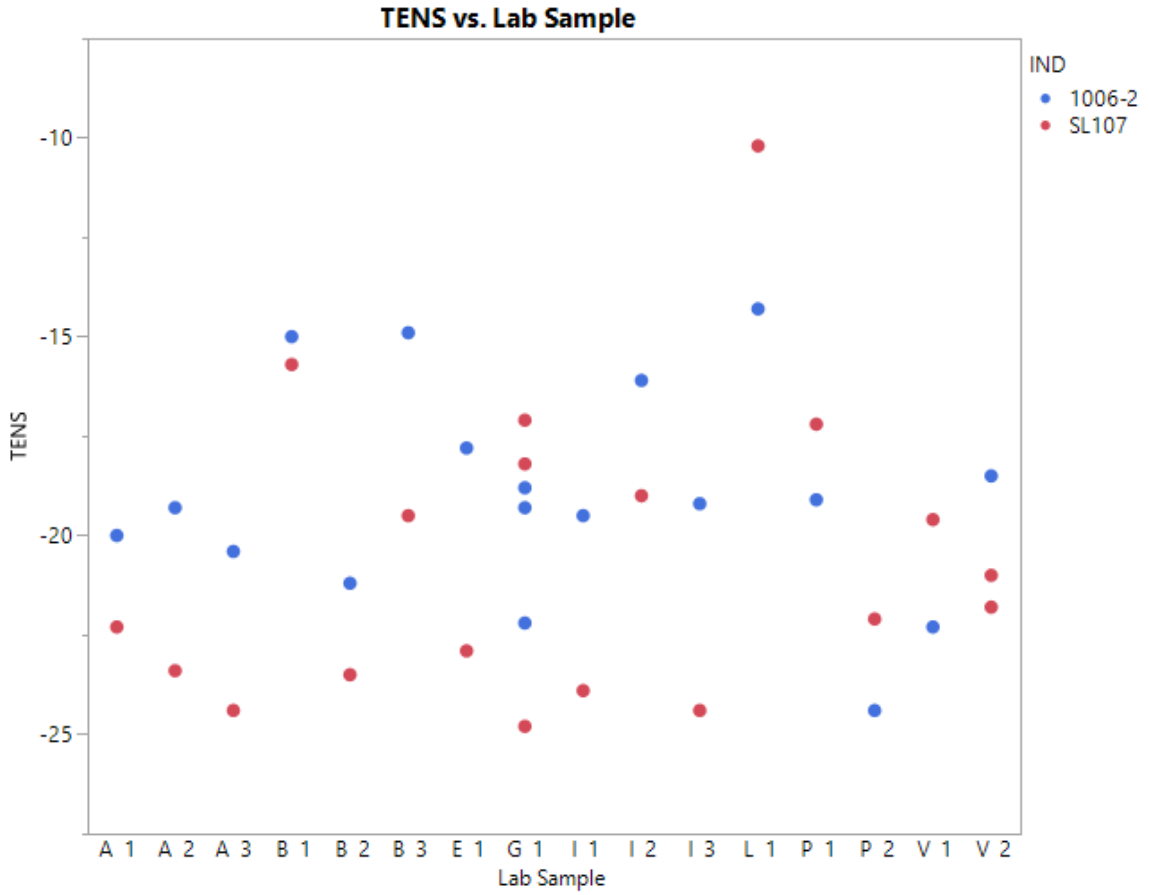
- The VOLC for 1006-2 is higher than that of SL107 for all bath pairs.

LDEOC Ethylene Acrylate - HARD



- The results for Lab L, Sample 1 are out of range relative to the other samples.
- For each bath pair, the HARD for SL107 is higher (less negative) than 1006-2.

LDEOC Ethylene Acrylate - TENS



- The Reference Oil correlating to the higher (less negative) TENS is mixed amongst the pairs indicating similarity in Reference Oil means.

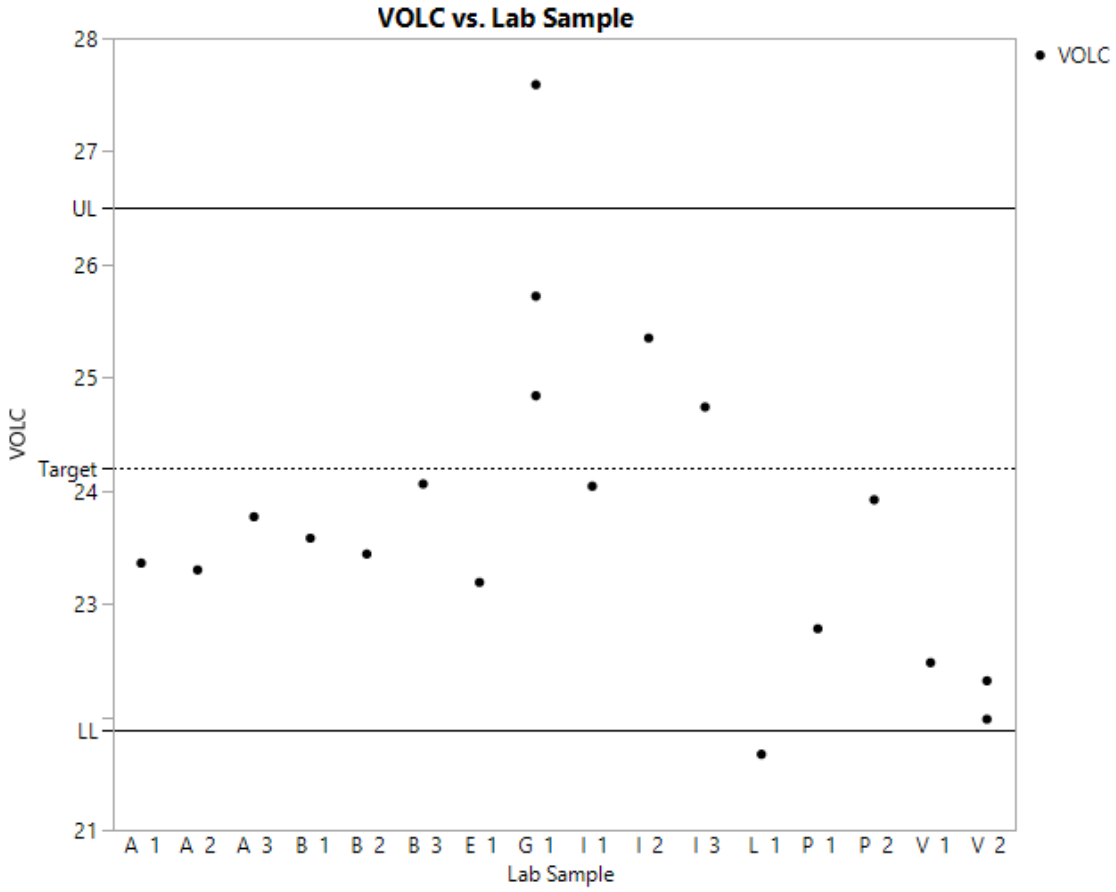
LDEOC Ethylene Acrylate (LDEOCA) RO SL107 Target Mean

- Round Robin means for 1006 and SL107 differ by more than a standard deviation for VOLC and HARD.
- The magnitude of the Offset for each parameter is less than a standard deviation.
- SL107 standard deviations are greater than corresponding 1006 standard deviations.

LDEOC Ethylene Acrylate (LDEOCA)

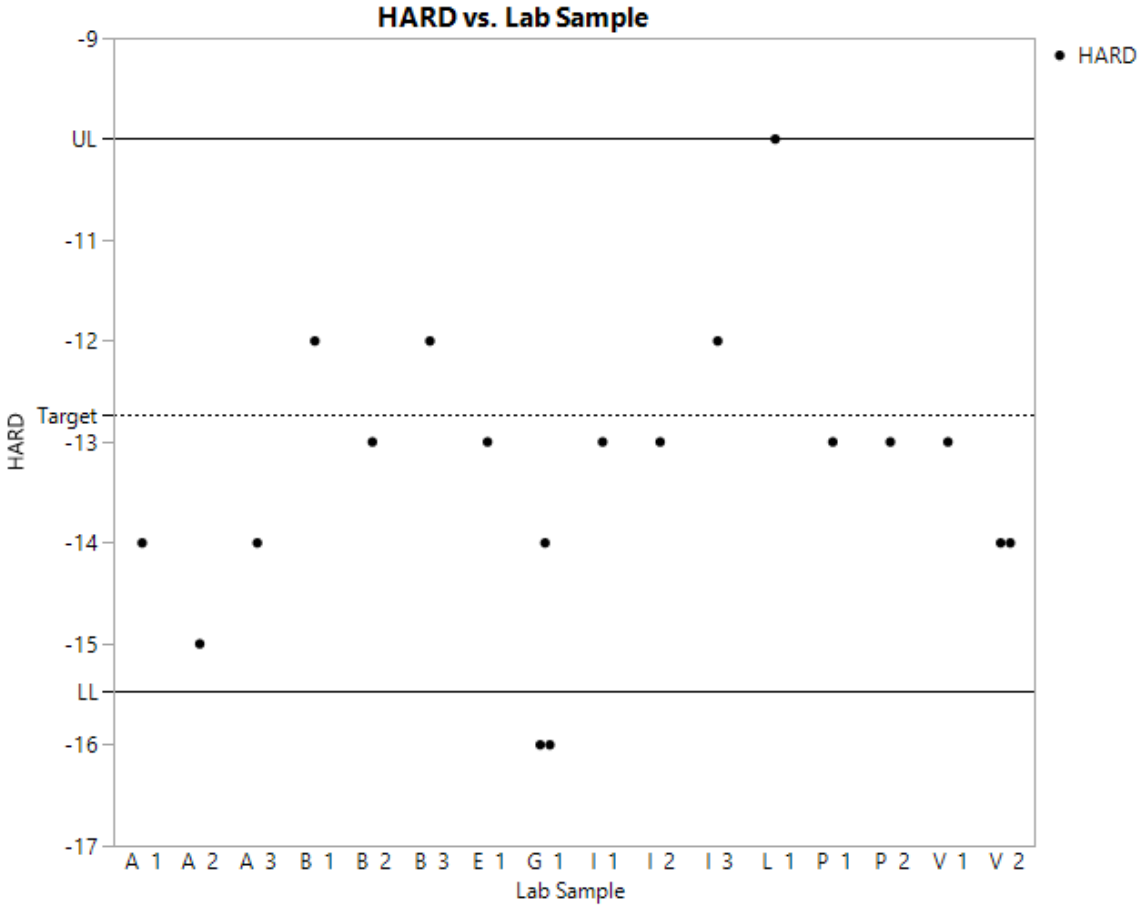
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	26.29	0.77	16	25.81	23.72	0.48	24.20	1.10
HARD	-14.40	0.91	16	-14.85	-13.18	0.45	-12.73	1.36
TENS	-15.3	3.87	16	-18.98	-20.52	3.68	-16.84	3.93

SL107 LDEOCA VOLC



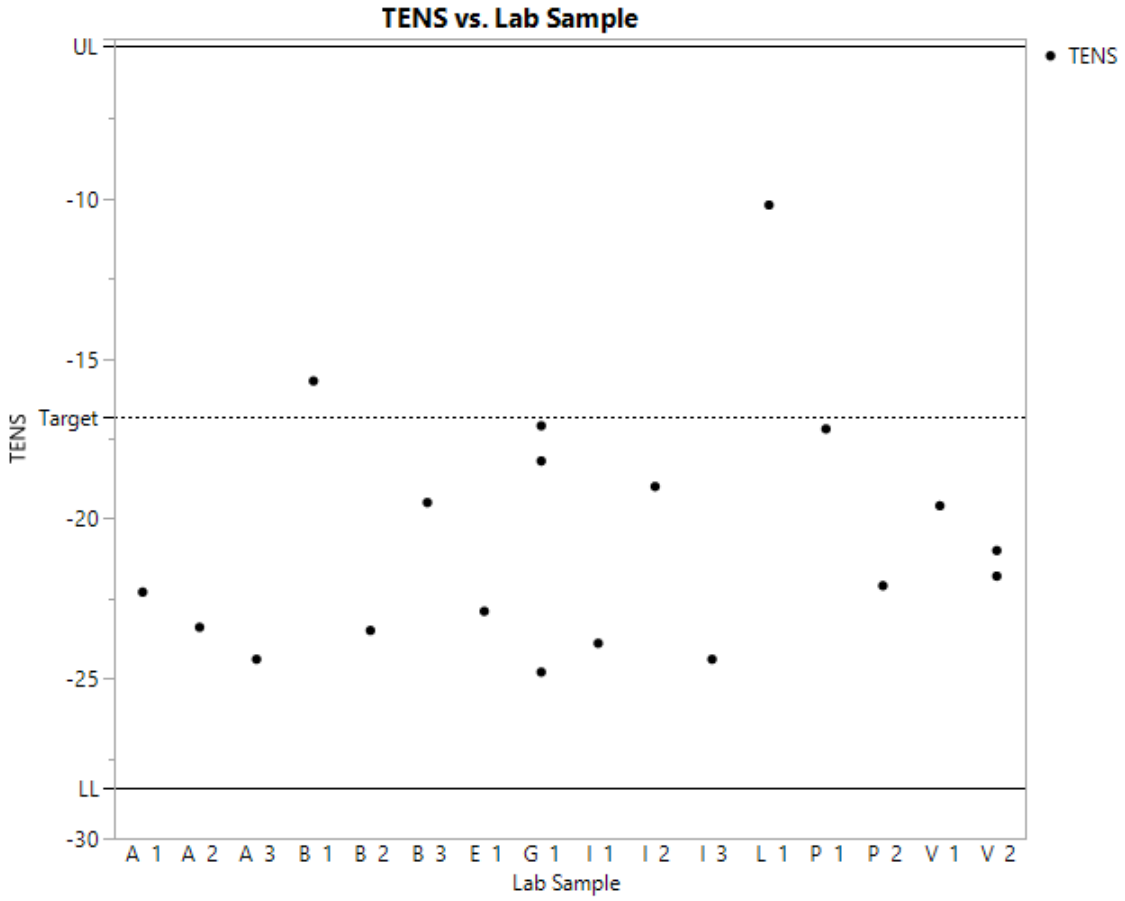
- 2 SL107 VOLC results (1 of Lab G, Sample 1 and Lab L, Sample 1) exceed the 3 s limits.

SL107 LDEOCA HARD



- 2 SL107 HARD results (2 Lab G, Sample 1) are outside the 3 s limits.

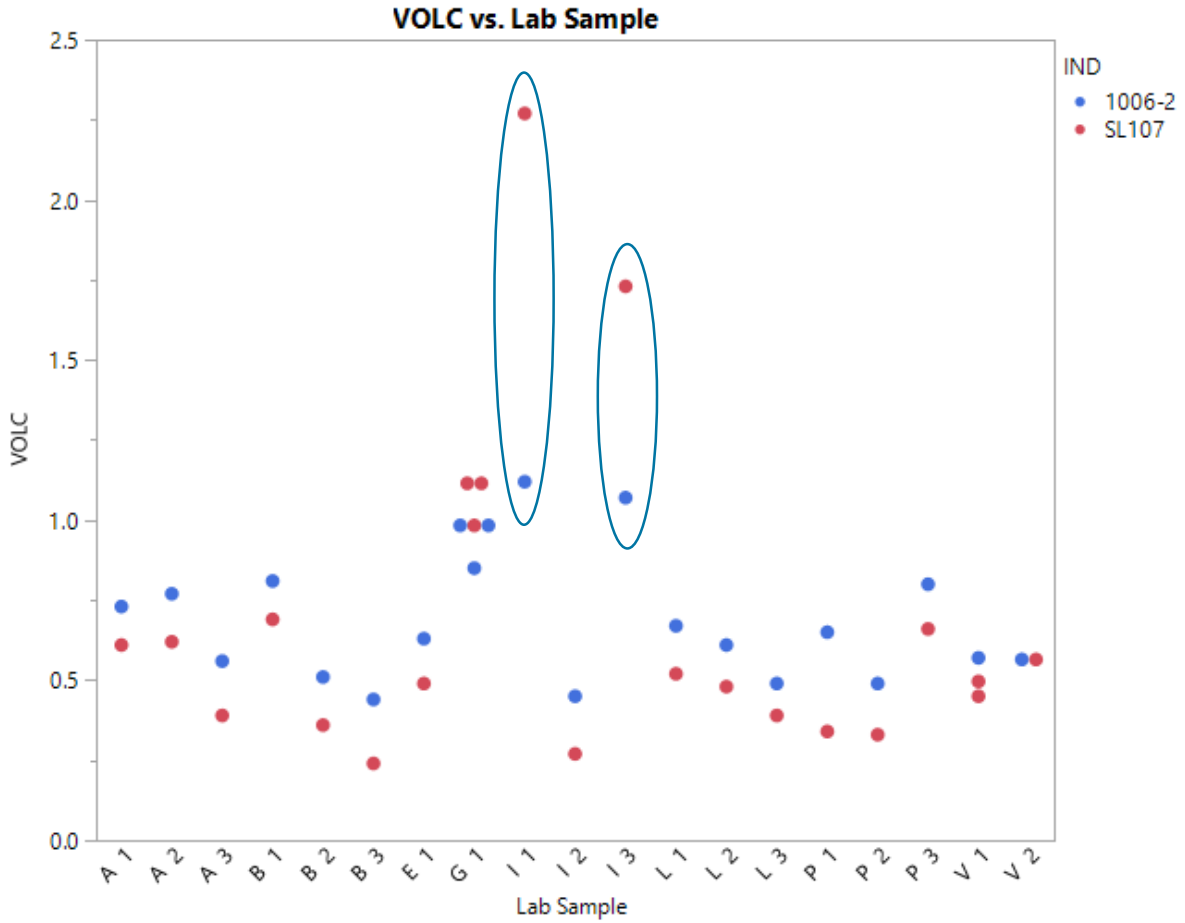
SL107 LDEOCA TENS



- All SL107 TENS results are within the 3 s limits though all but 2 are below target.

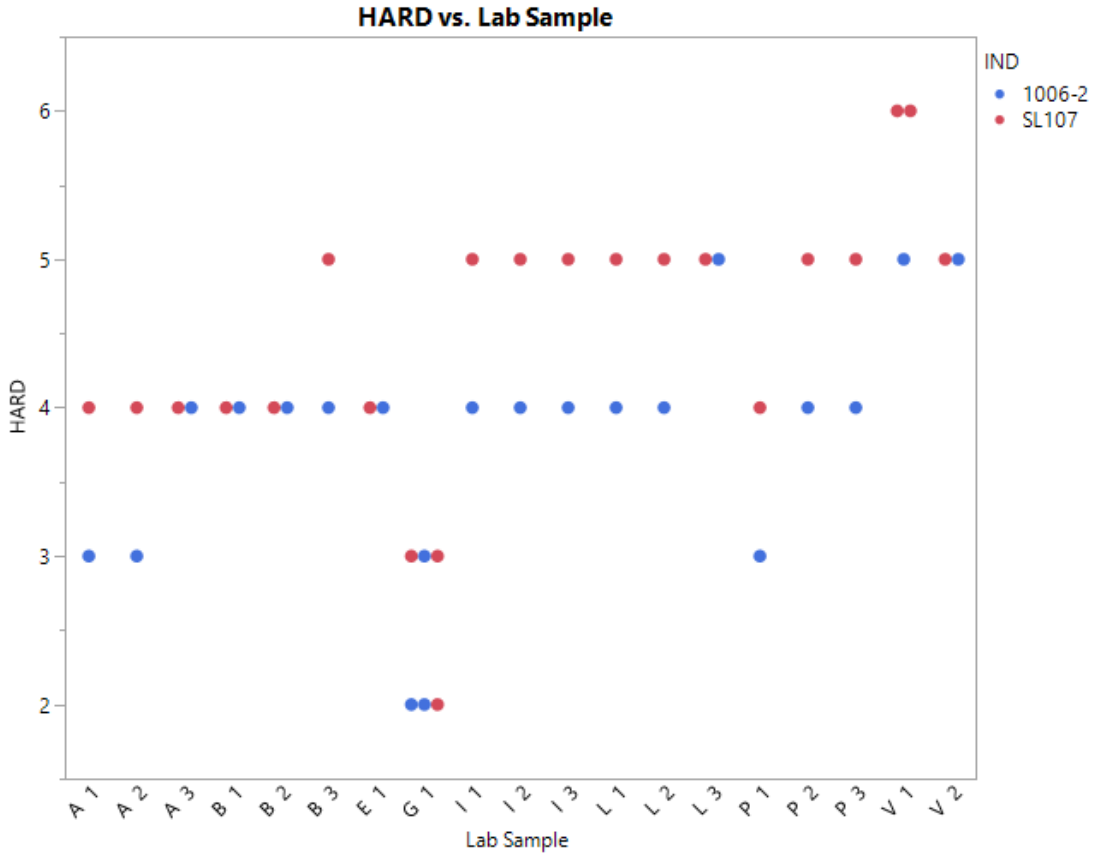
LDEOC Fluoroelastomer (LDEOCF)

LDEOC Fluoroelastomer - VOLC



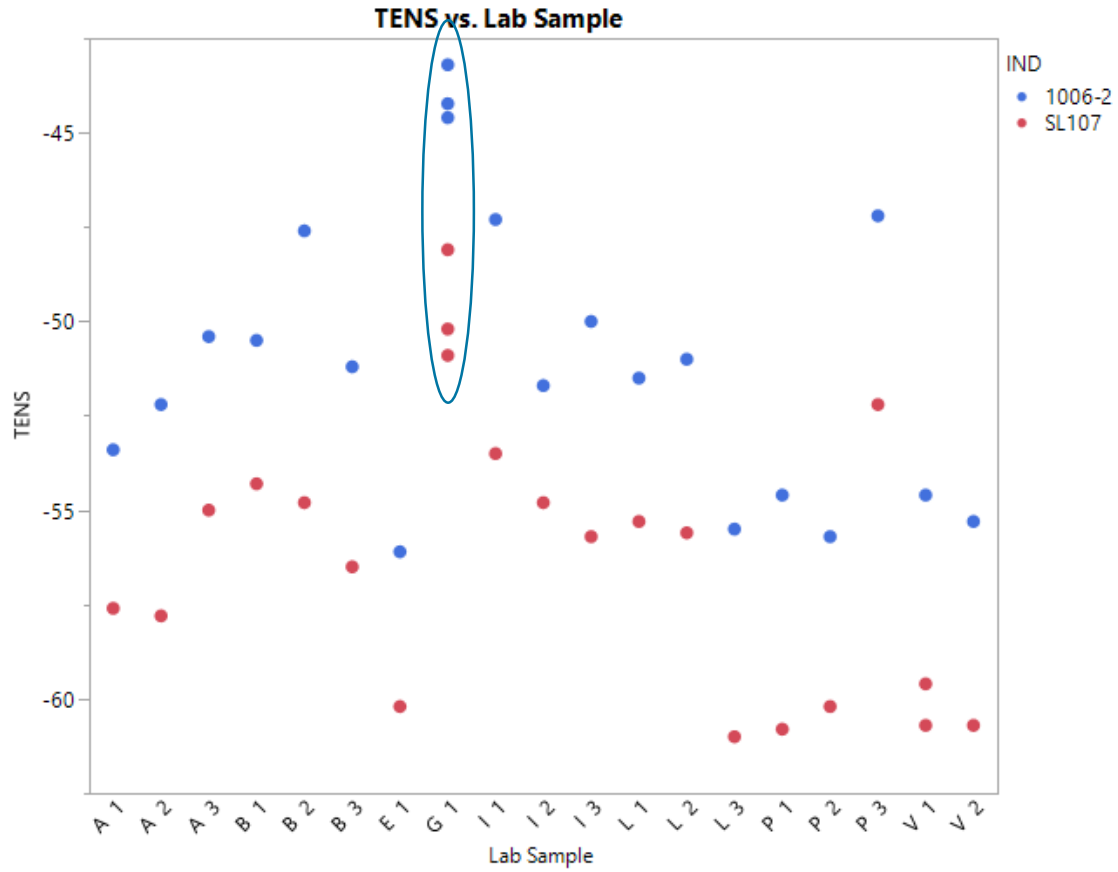
- Lab I, Samples 1 and 3 are outside the range of the other samples for both oils.

LDEOC Fluoroelastomer - HARD



- For each bath pair, the HARD for SL107 is equal to or a unit higher than 1006-2.

LDEOC Fluoroelastomer - TENS



- Lab G TENS results are outside the range of other samples for both oils.
- For each bath pair, TENS is higher (less negative) for 1006-2 than SL107.

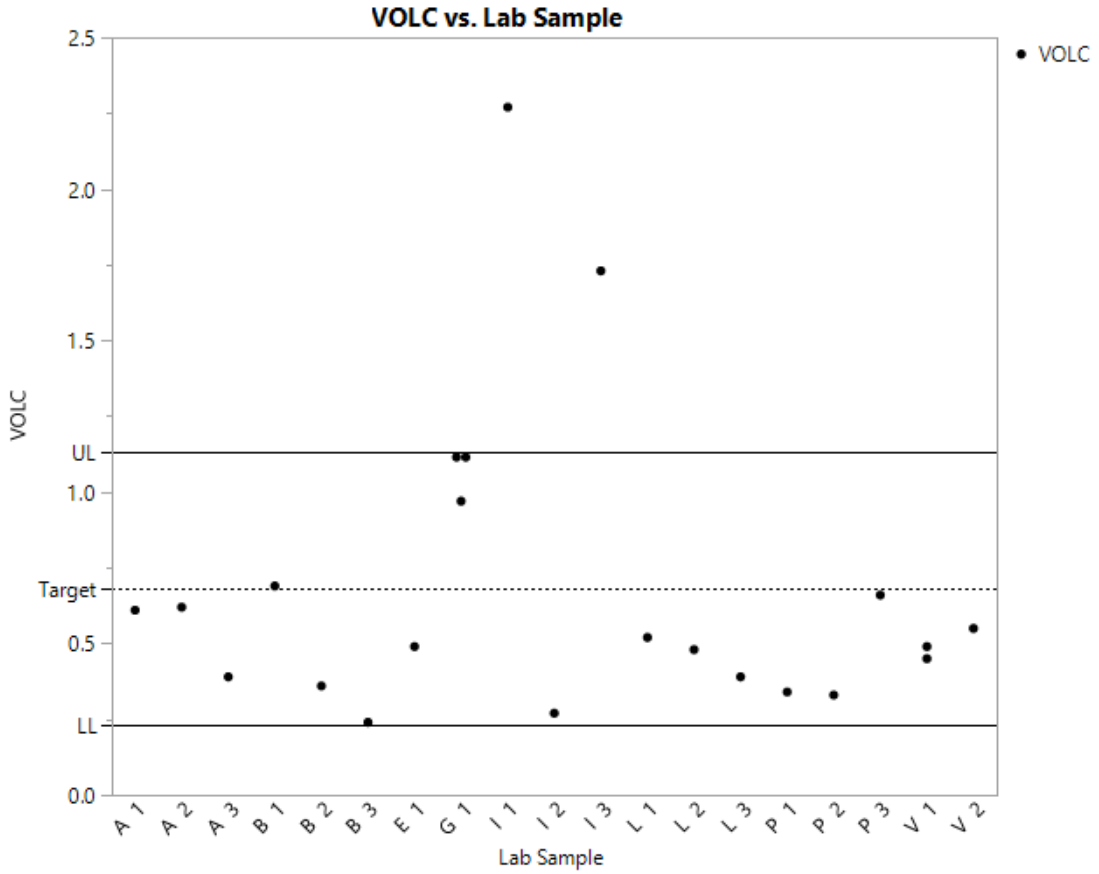
LDEOC Fluoroelastomer (LDEOCF) RO SL107 Target Mean

- Round Robin means for 1006 and SL107 differ by more than a standard deviation for TENS.
- The magnitude of the Offset for each parameter is less than a standard deviation.
- SL107 standard deviations are less than corresponding 1006 standard deviations except for VOLC.

LDEOC Fluoroelastomer (LDEOCF)

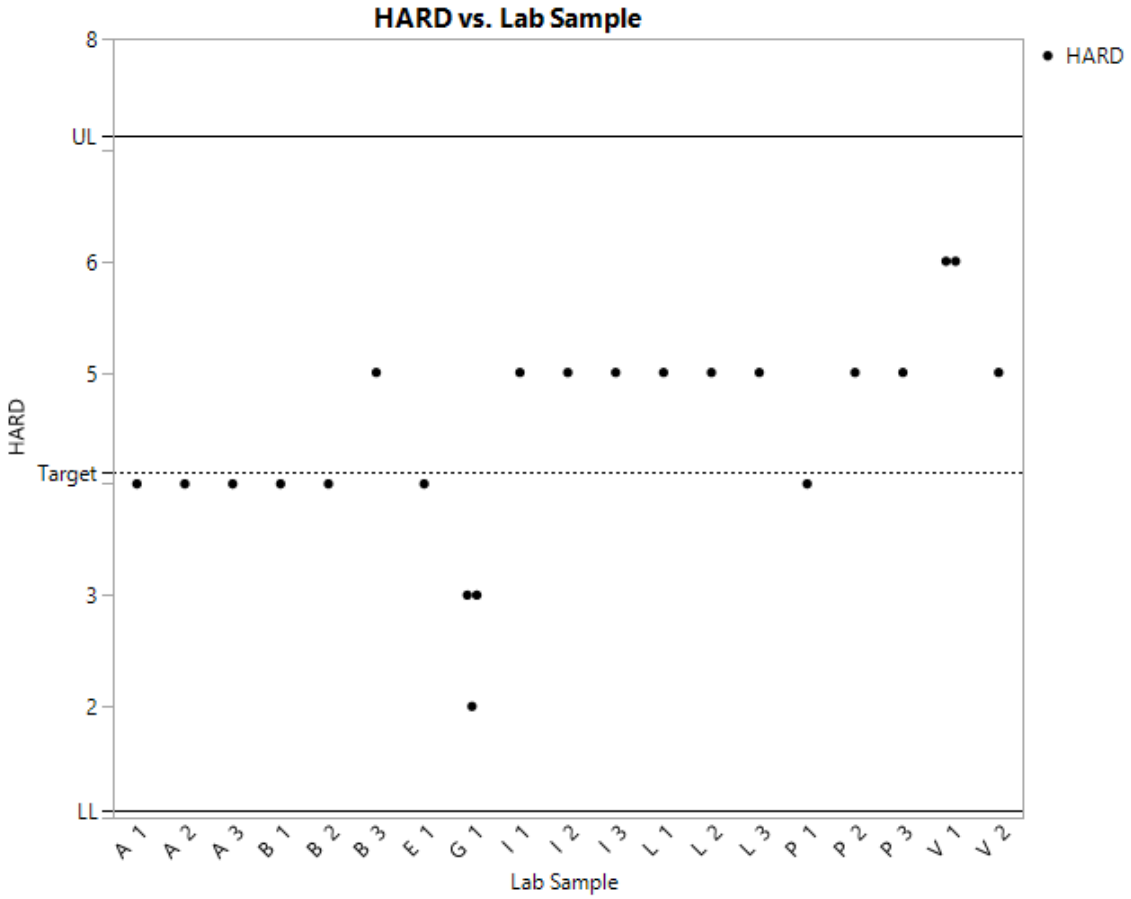
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	0.69	0.15	19	0.67	0.66	0.02	0.68	0.52
HARD	3.47	1.01	19	3.93	4.55	-0.46	4.10	0.69
TENS	-52.28	4.34	19	-51.54	-56.66	-0.74	-57.40	3.14

SL107 LDEOCF VOLC



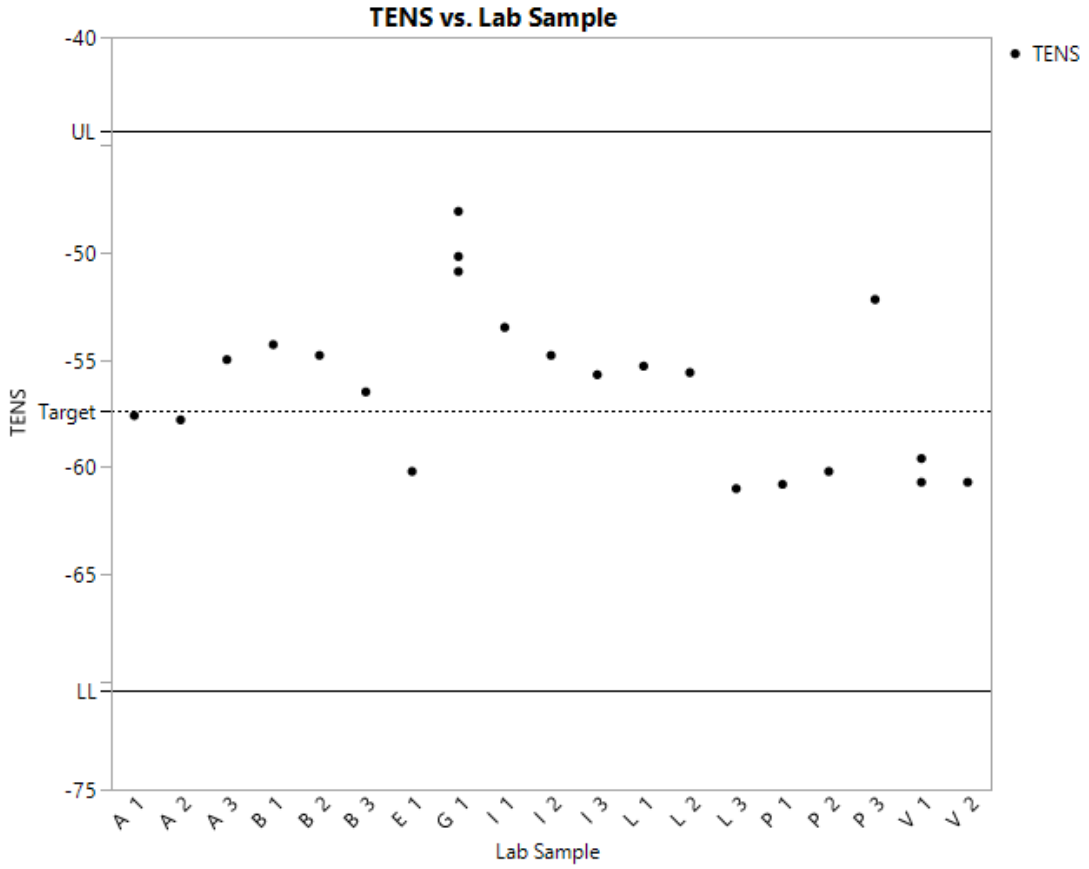
- 2 SL107 VOLC results (Lab L, Samples 1 and 3) exceed the 3 s limits and 4 others are just within the limits.

SL107 LDEOCF HARD



- All HARD results are within the 3 s limits.

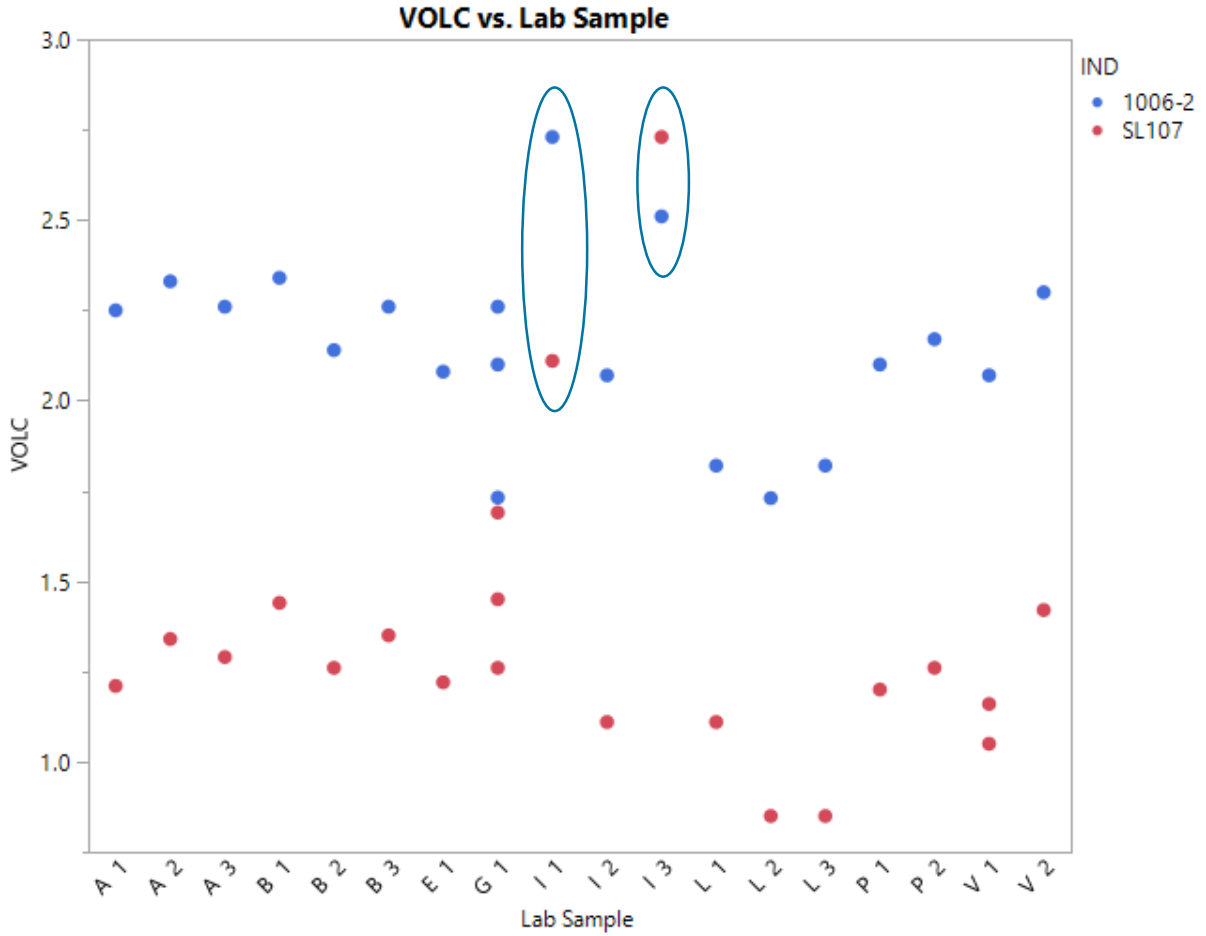
SL107 LDEOCF TENS



- All SL107 TENS results are within the 3 s limits.

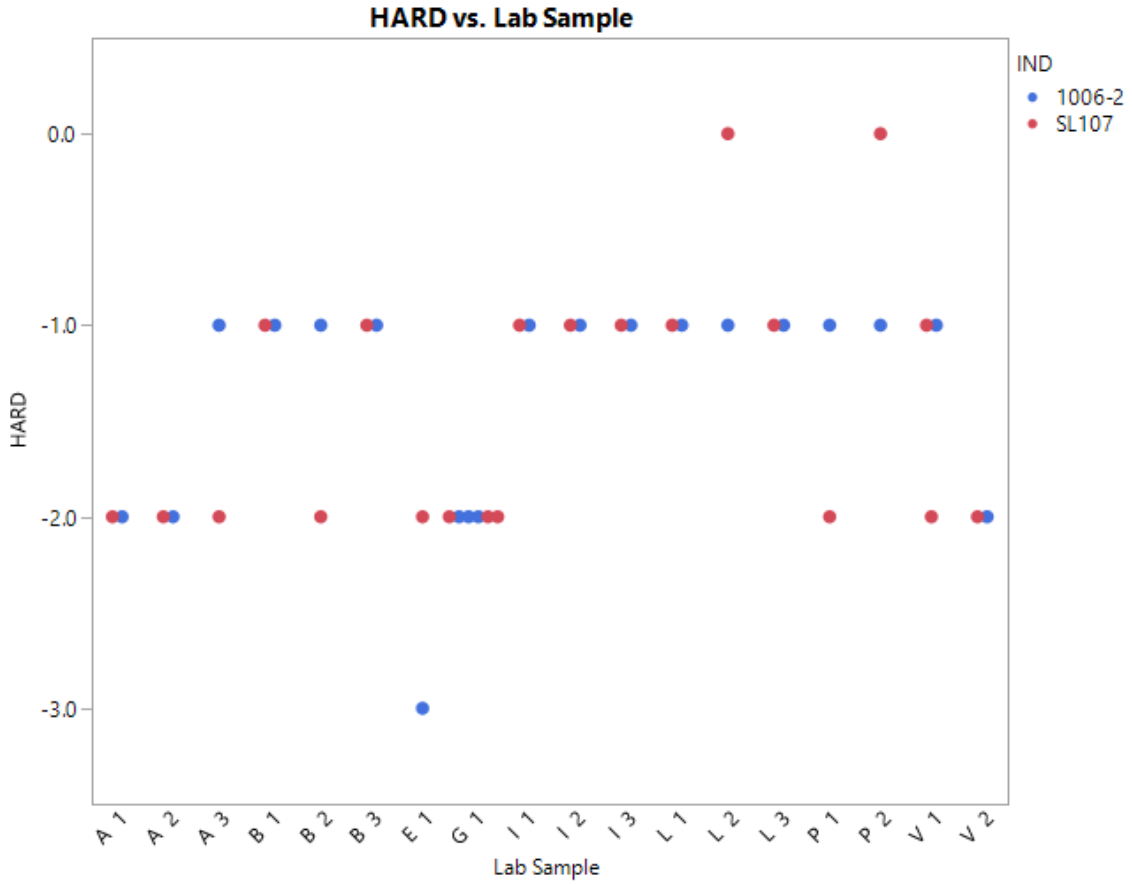
LDEOC Nitrile (LDEOCN)

LDEOC Nitrile - VOLC



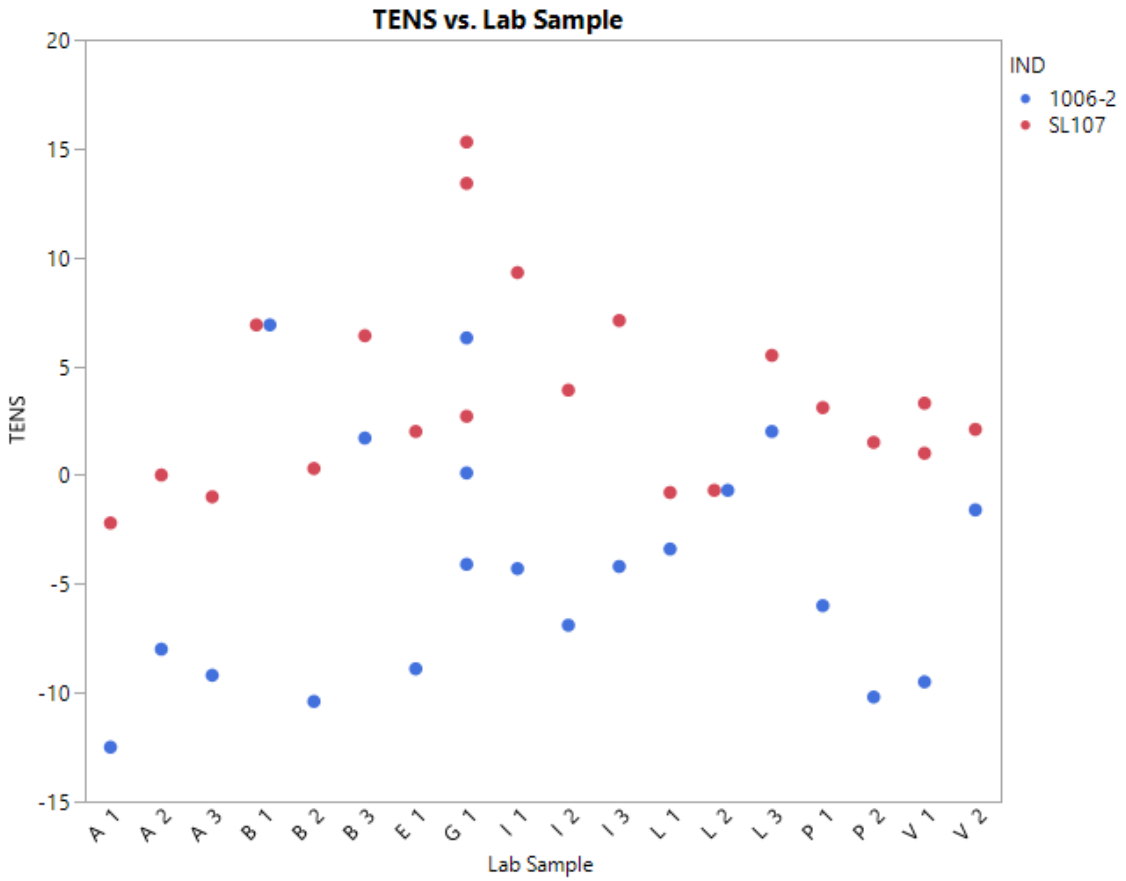
- Lab I, Samples 1 and 3 are outside the range of the other samples for both oils.

LDEOC Nitrile - HARD



- For each bath pair, HARD for the 2 oils is no more than a unit different.

LDEOC Nitrile - TENS



- For each bath pair, TENS is equal to or higher (less negative) for SL107 relative to 1006-2.

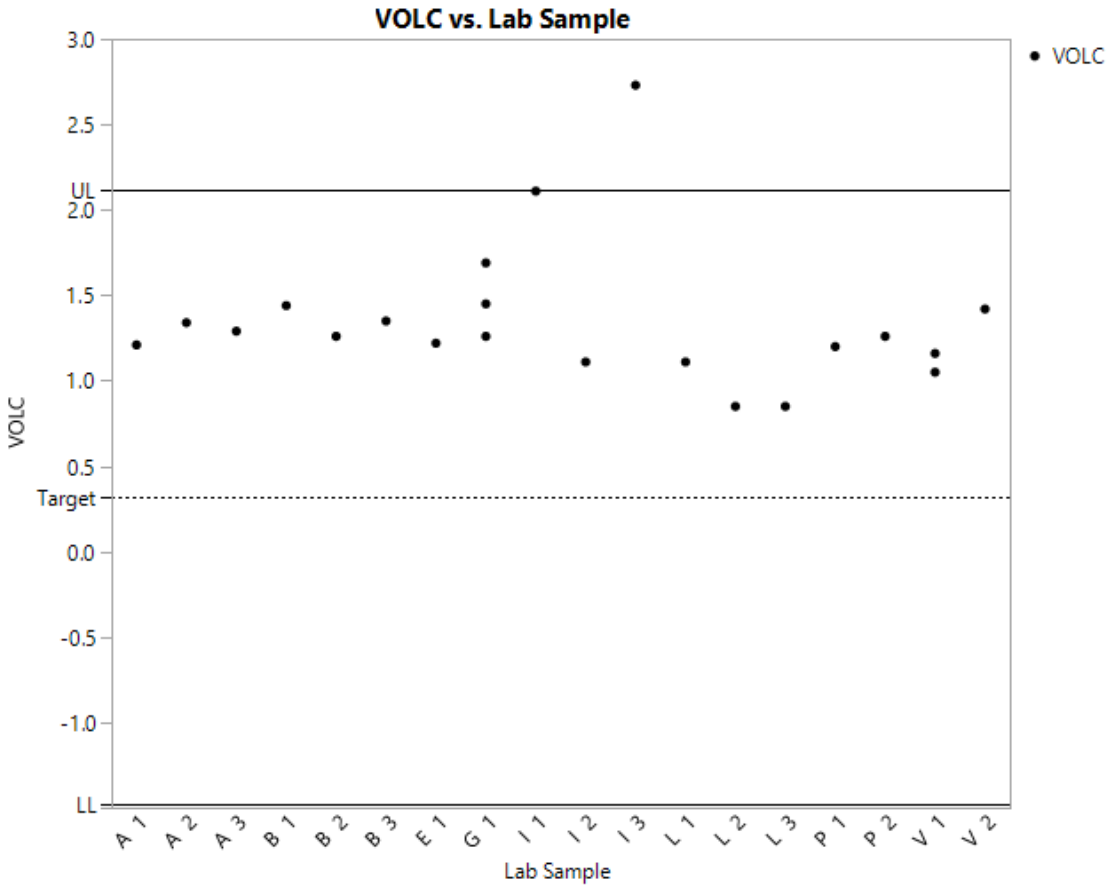
LDEOC Nitrile (LDEOCN) RO SL107 Target Mean

- Round Robin means for 1006 and SL107 differ by more than a standard deviation for VOLC and TENS.
- The magnitude of the Offset for each parameter is greater than a standard deviation for VOLC.
- SL107 standard deviations are less than corresponding 1006 standard deviations except for VOLC.

LDEOC Nitrile (LDEOCN)

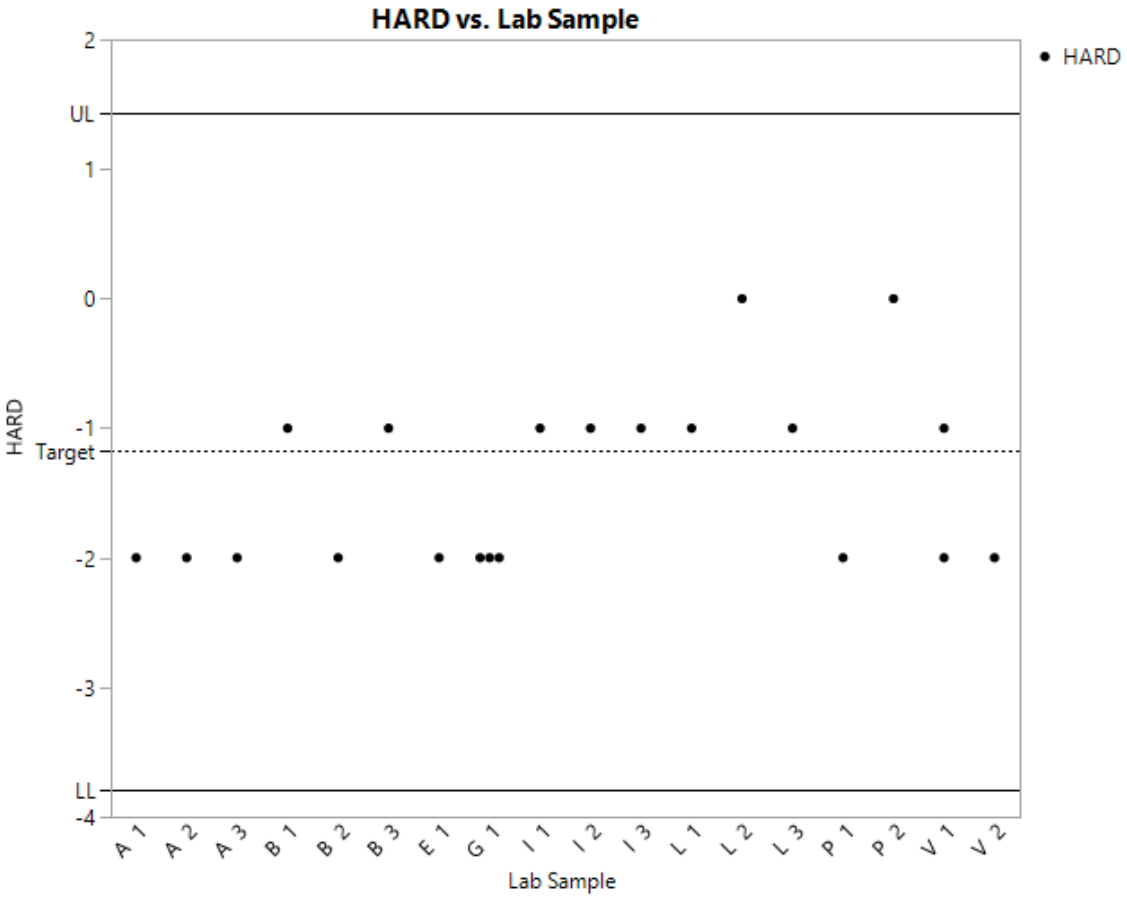
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	1.11	0.60	18	2.15	1.36	-1.04	0.32	0.44
HARD	-1.15	0.87	18	-1.34	-1.37	0.19	-1.18	0.70
TENS	-2.08	4.87	18	-4.78	3.27	2.70	5.97	4.15

SL107 LDEOCN VOLC



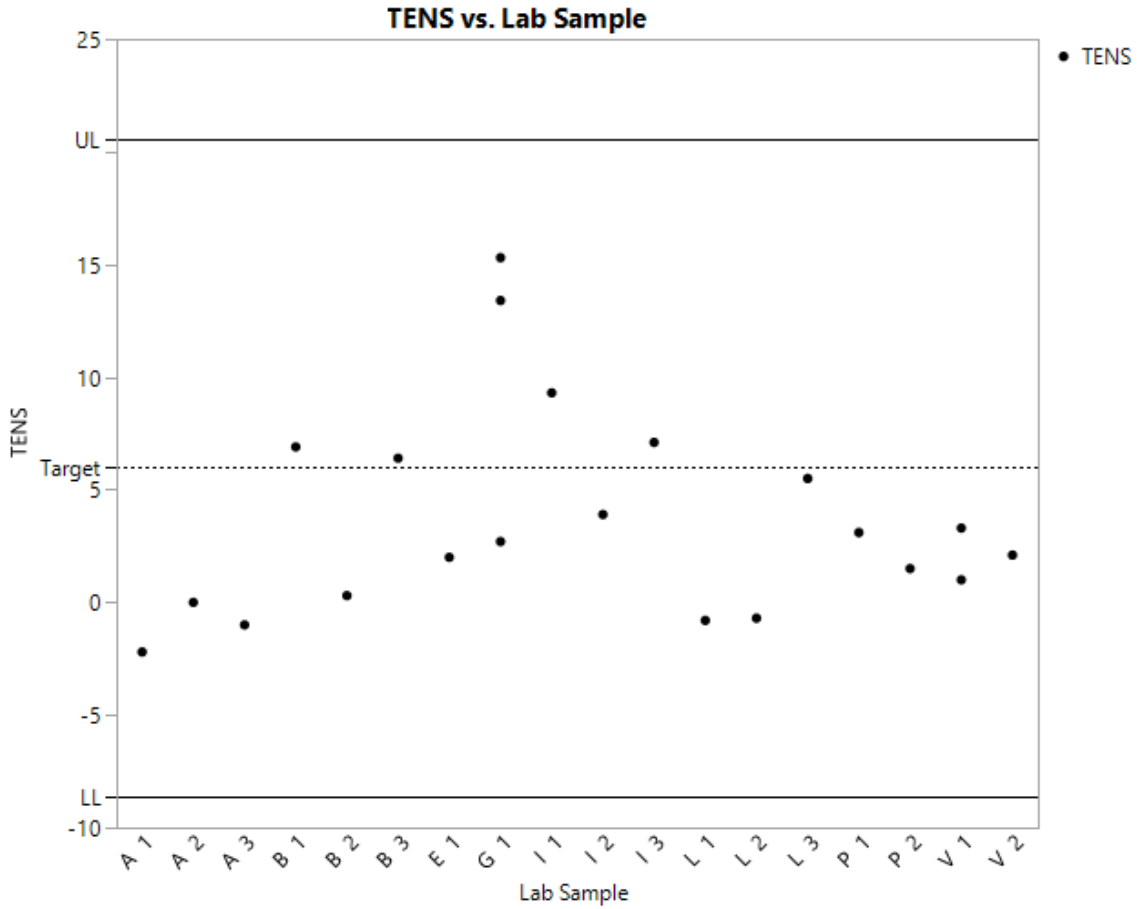
- 1 SL107 VOLC result (Lab I, Sample 3) exceeds the 3 s limits and 1 other (Lab I, Sample 1) is just within the limits.
- All Sl107 VOLC results are above the target.

SL107 LDEOCN HARD



- All SL107 HARD results are well within the 3 s limits.

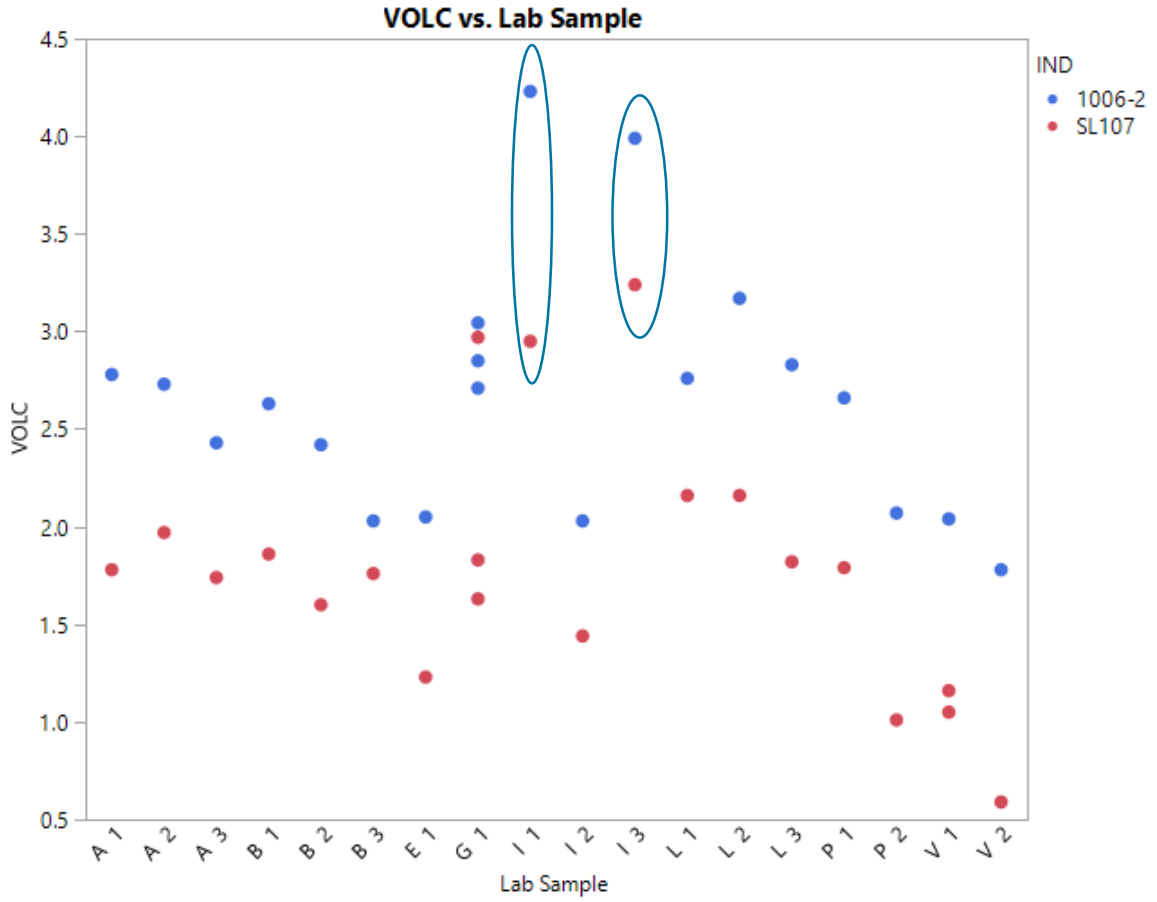
SL107 LDEOCN TENS



- All SL107 TENS results are within the 3 s limits.

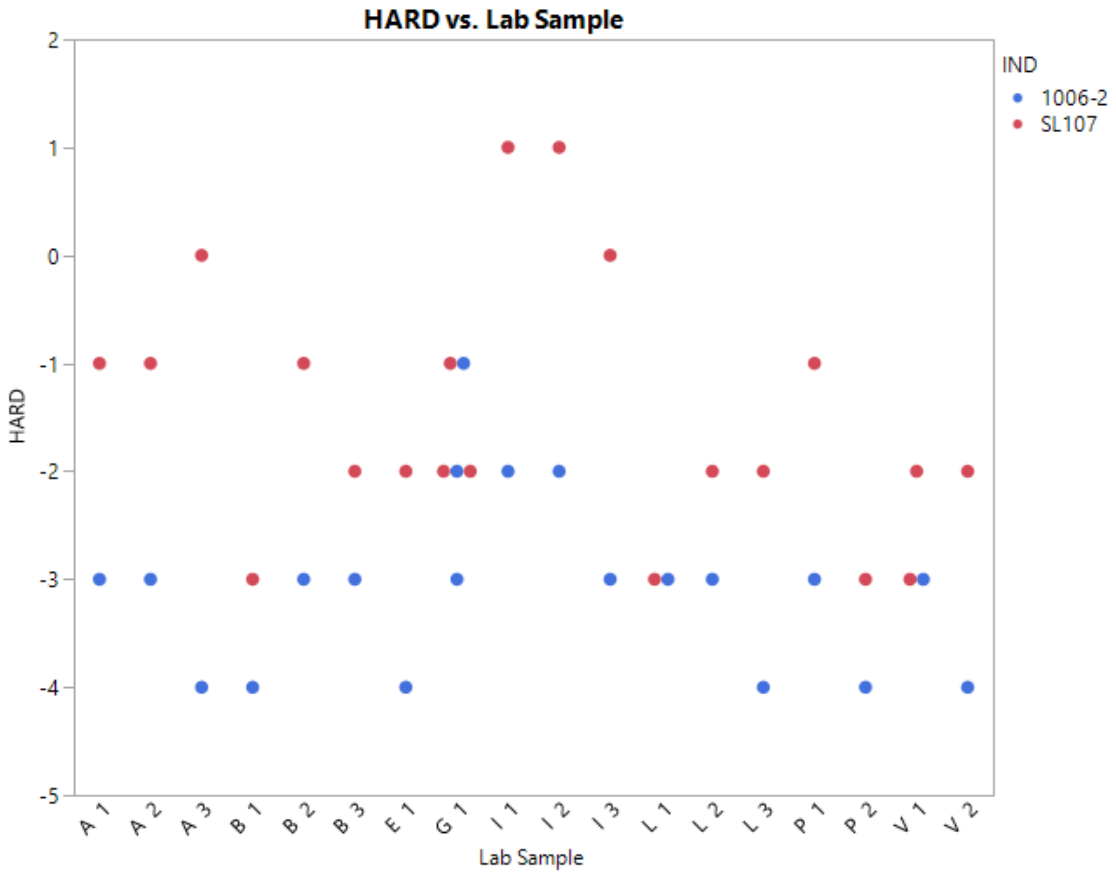
LDEOC Polyacrylate (LDEOCP)

LDEOC Polyacrylate - VOLC



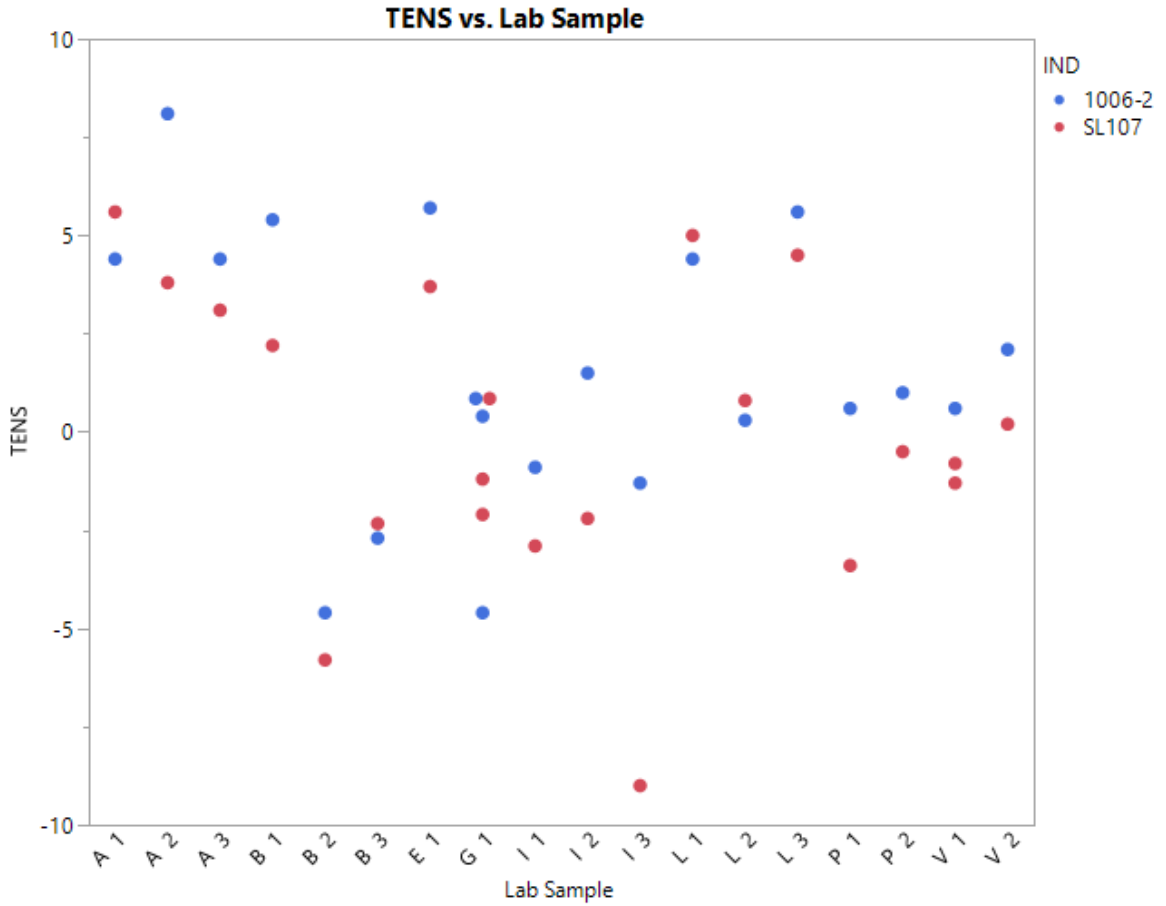
- Lab I, Samples 1 and 3 are outside the range of the other samples for both oils.

LDEOC Polyacrylate - HARD



- For each bath pair, HARD for SL107 is equivalent or higher than 1006-2.

LDEOC Polyacrylate - TENS



- The Reference Oil correlating to the higher (less negative) TENS is mixed amongst the pairs indicating similarity in Reference Oil means.

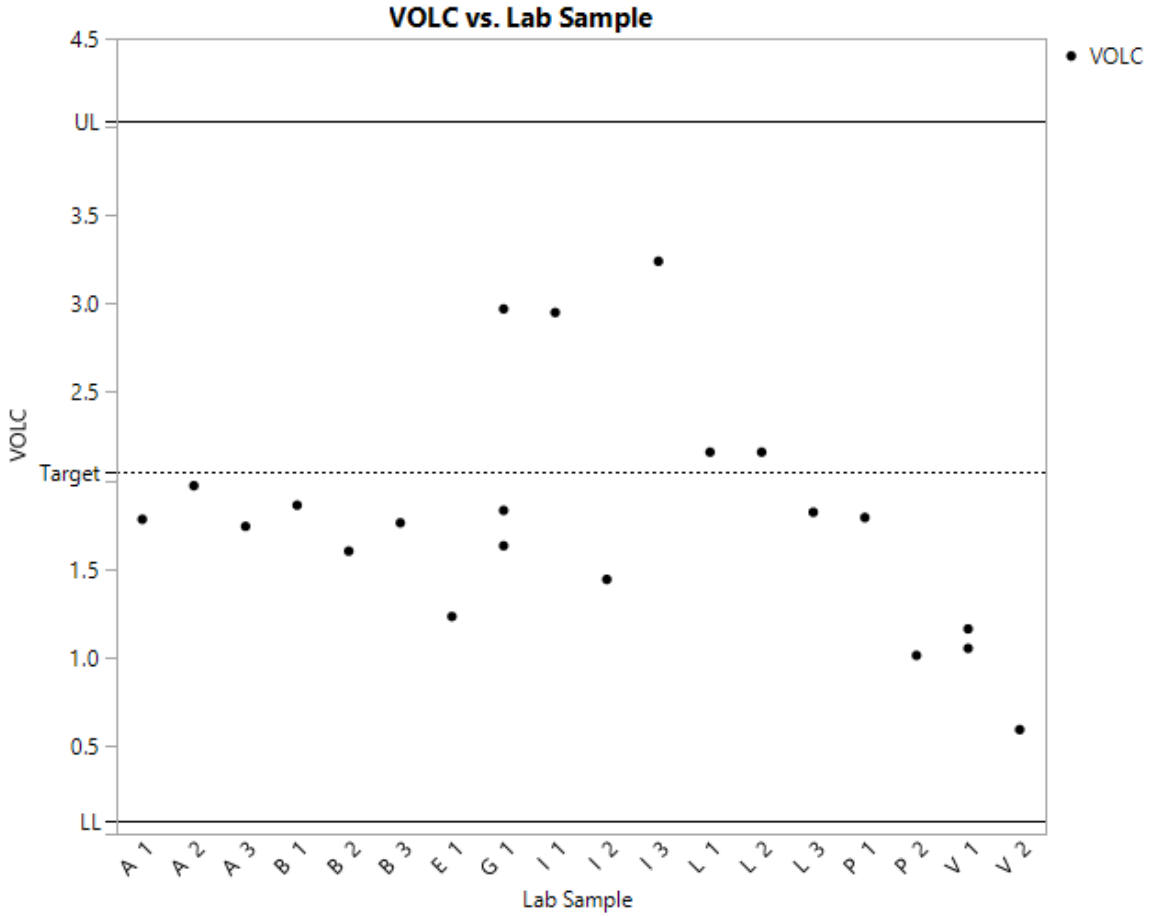
LDEOC Polyacrylate (LDEOCP) RO SL107 Target Mean

- Round Robin means for 1006 and SL107 differ by more than a standard deviation for VOLC and HARD.
- The Offset for each parameter is less than a standard deviation.
- SL107 standard deviations are less than corresponding 1006 standard deviations except for VOLC.

LDEOC Polyacrylate (LDEOCP)

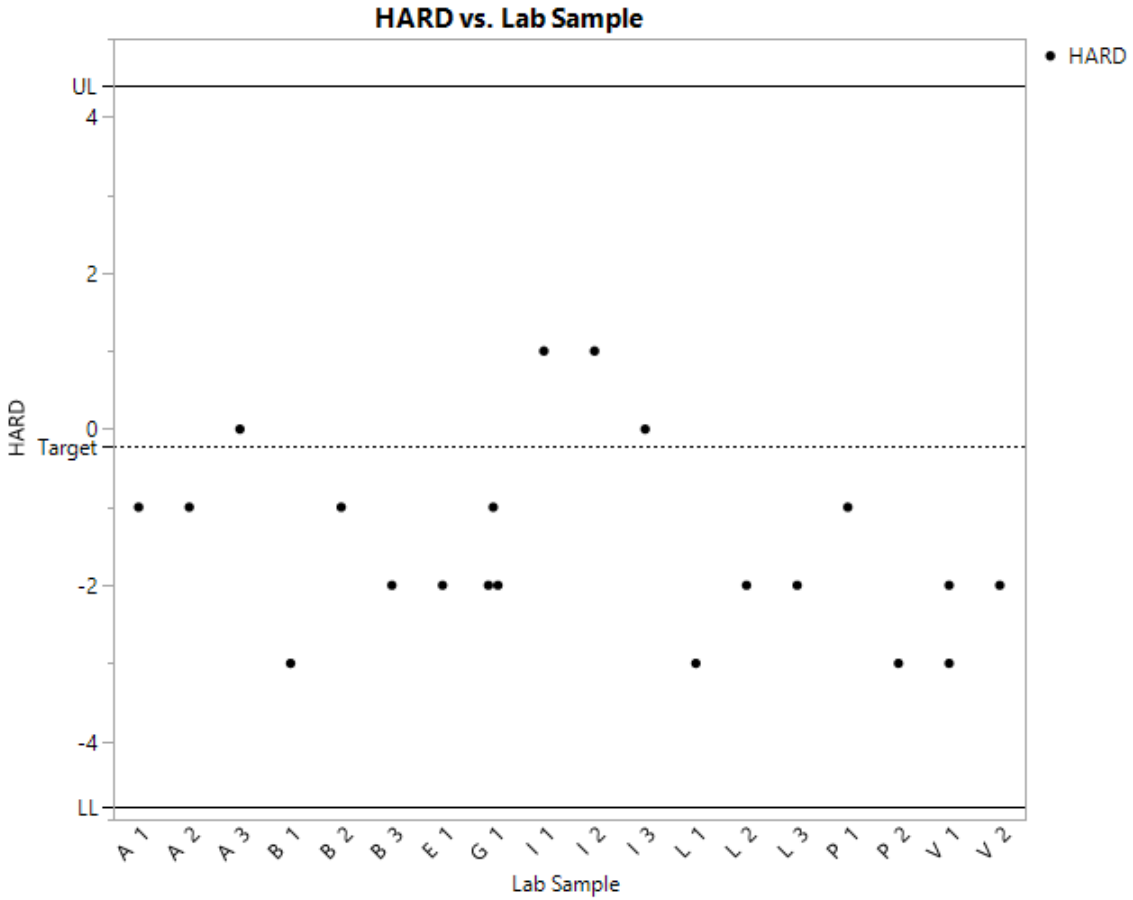
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	2.88	0.66	18	2.63	1.80	0.25	2.05	0.63
HARD	-1.82	1.54	18	-3.10	-1.49	1.28	-0.21	1.29
TENS	4.19	8.44	18	1.76	0.15	2.43	2.58	3.96

SL107 LDEOCP VOLC



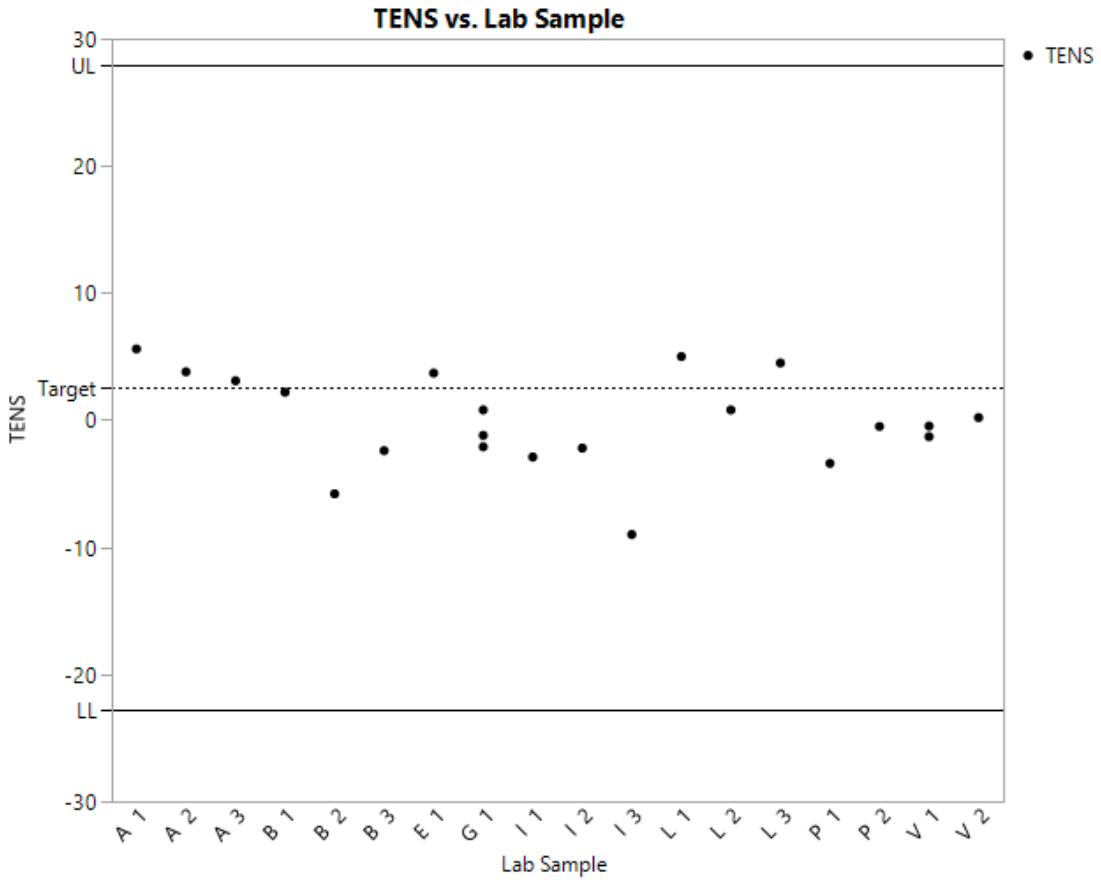
- All Sl107 VOLC results are within the 3 s limits.

SL107 LDEOCP HARD



- All SL107 HARD results are within the 3 s limits.

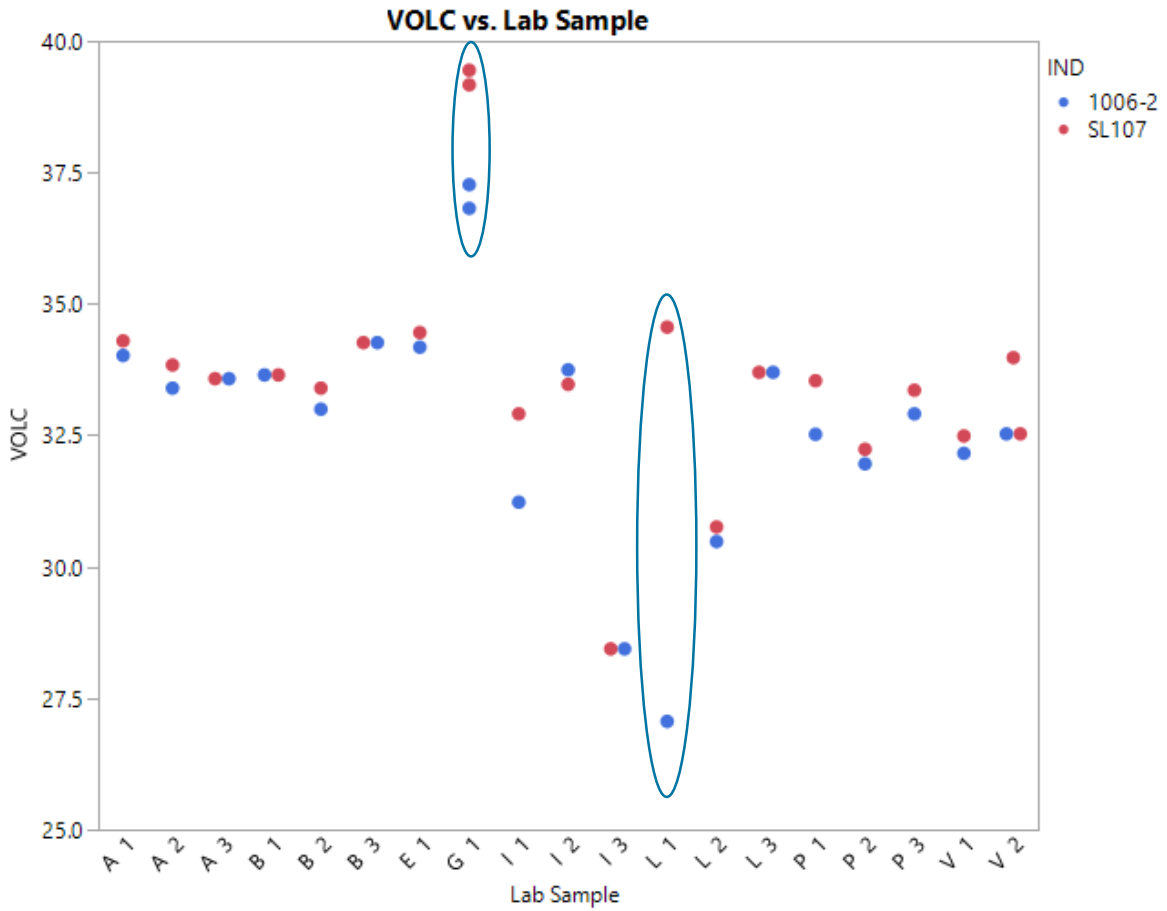
SL107 LDEOCP TENS



- All SL107 TENS results are well within the 3 s limits.

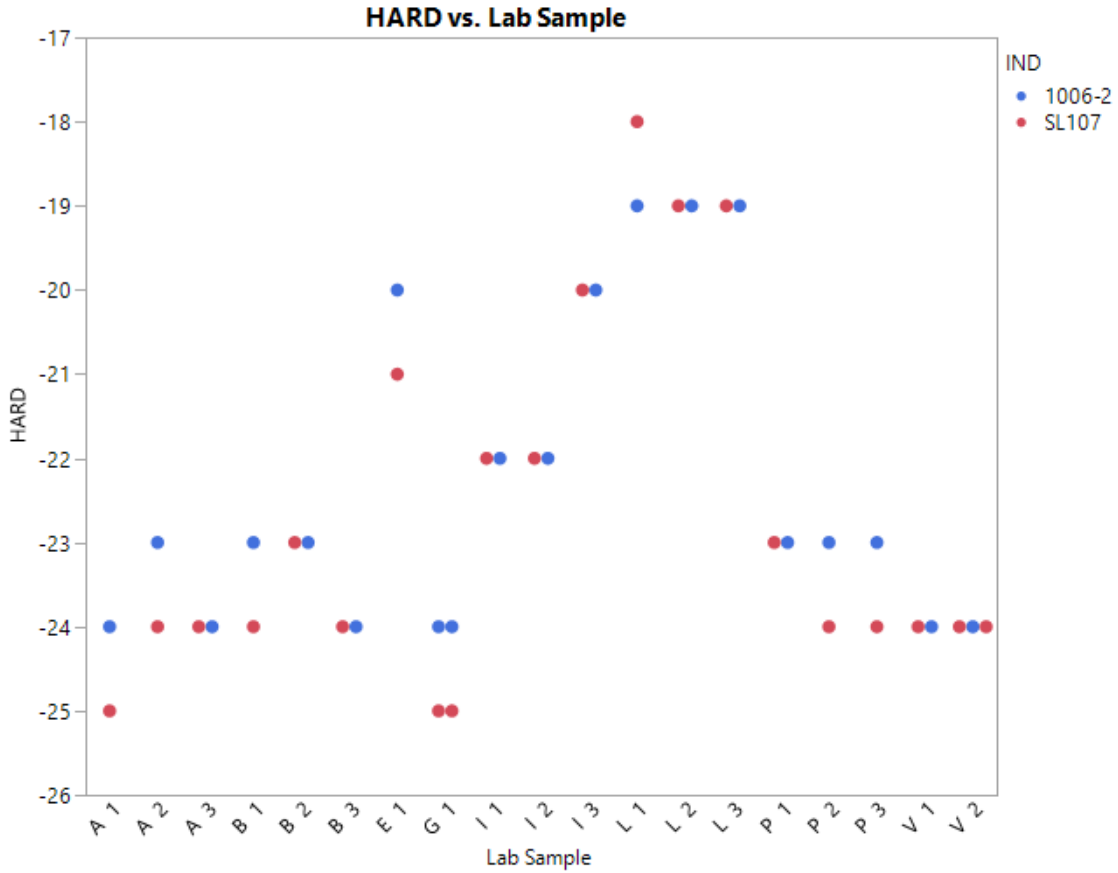
LDEOC Silicone (LDEOCS)

LDEOC Silicone - VOLC



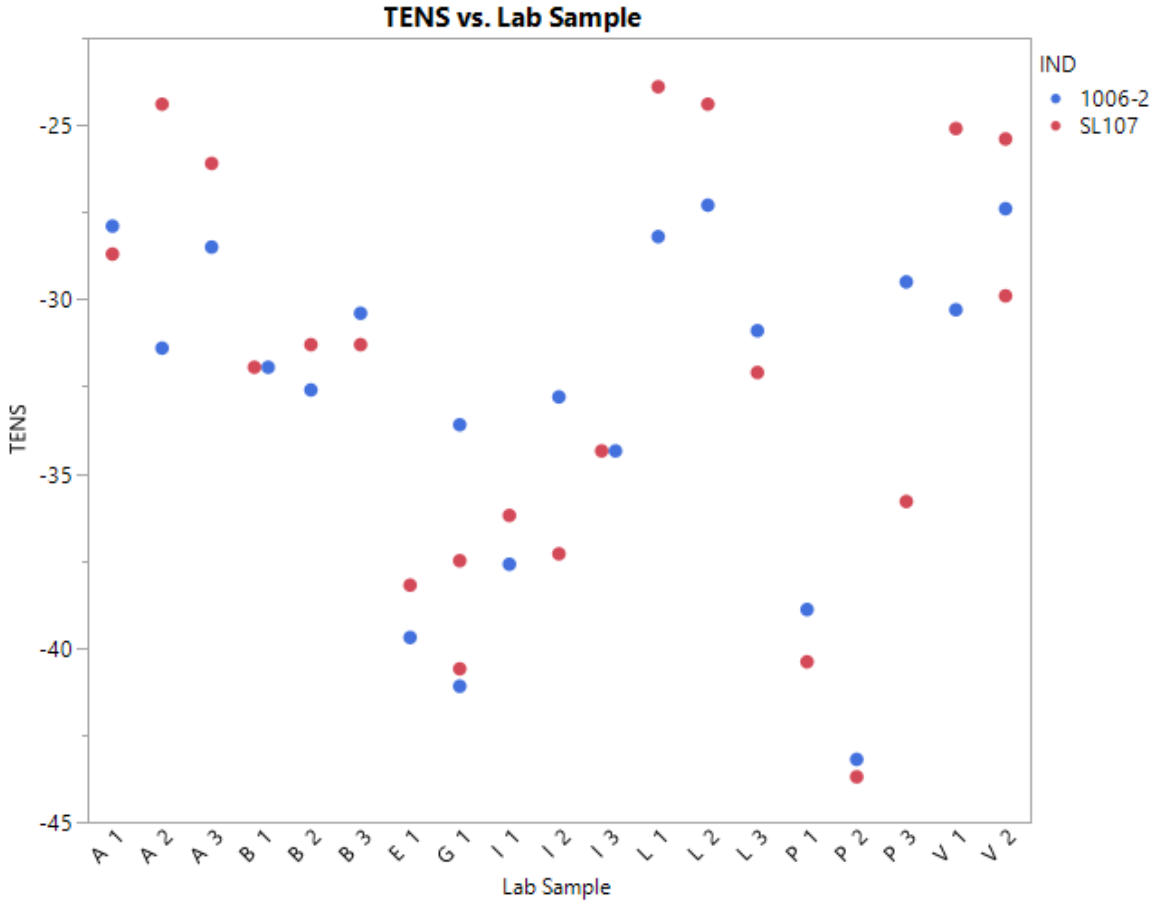
- Lab G, Sample 1 results are outside the range of the other samples for both oils.
- Lab I, Sample 1 has the highest difference of VOLC within a bath pair.

LDEOC Silicone - HARD



- For each bath pair, HARD is within a unit for SL107 and 1006-2.

LDEOC Silicone - TENS



- The Reference Oil correlating to the higher (less negative) TENS is mixed amongst the pairs indicating similarity in Reference Oil means.

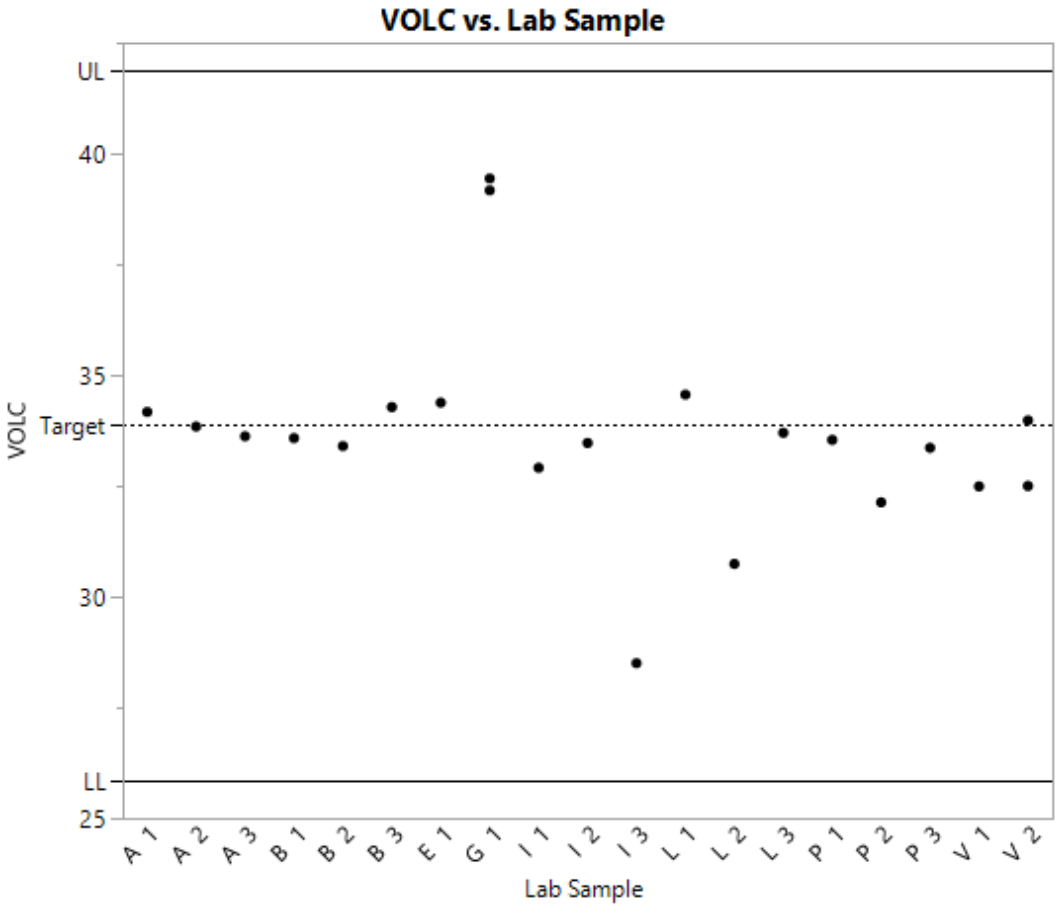
LDEOC Silicone (LDEOCS) RO SL107 Target Mean

- Round Robin means for 1006 and SL107 are very similar.
- The Offset for each parameter are less than a standard deviation except for TENS.
- SL107 standard deviations are greater than corresponding 1006 standard deviations except for VOLC.

LDEOC Silicone (LDEOCS)

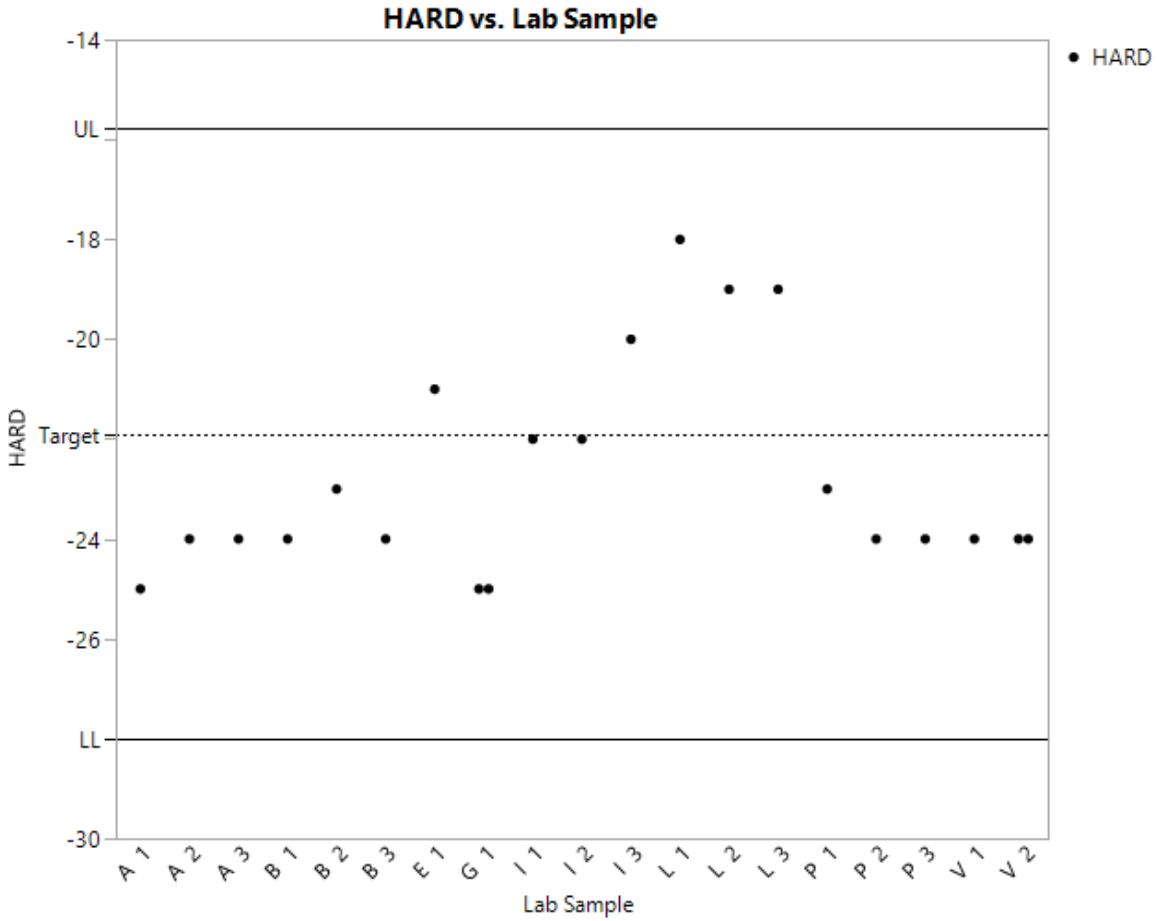
Parameter	1006 Targets		Sample Size	Round Robin Means		1006 Offset	SL107	
	Mean	Std Dev		1006	SL107		Target (Mean)	Std Dev
VOLC	32.99	2.67	19	32.58	33.46	0.41	33.88	1.99
HARD	-21.56	2.04	19	-22.25	-22.59	0.69	-21.90	2.17
TENS	-38.06	3.79	19	-32.60	-32.26	-5.46	-37.73	6.06

SL107 LDEOCS VOLC



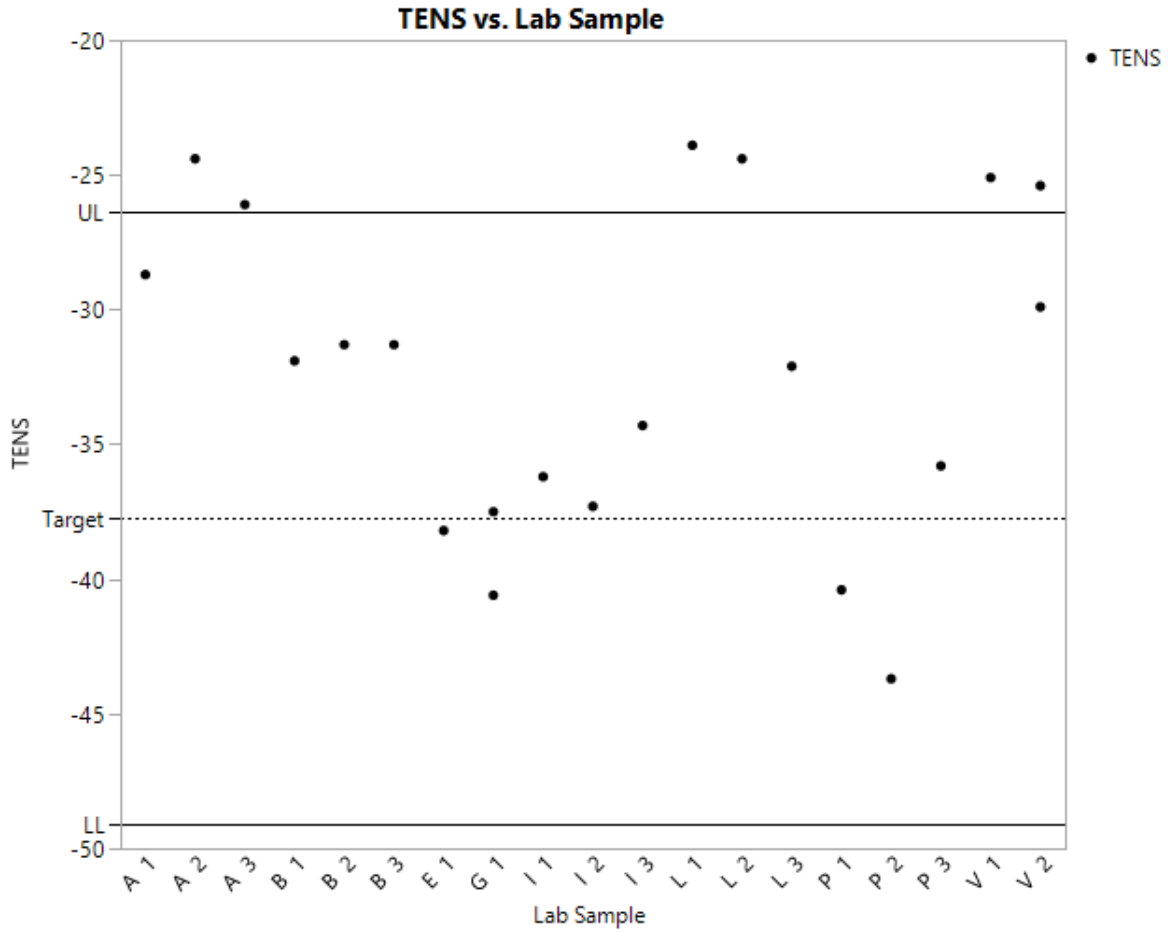
- All SL107 VOLC results are within 3 s limits.

SL107 LDEOCS HARD



- All SL107 HARD results are within 3 s limits.

SL107 LDEOCS TENS



- 6 of the SL107 TENS results exceed the 3 s limits.

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