L42 Surveillance Panel Meeting minutes
PRI Apollo Room, Warrendale, PA
April 19th, 2006

Attendees:
Cory Koglin
Don Bell
Don Bartlett
Chris Schenkenberger
Jerry Gropp
Brian Koehler
Don Lind
Dale Smith
Bill Sullivan
Salvatore Rea
Mike Follis
Thelma Marougy
Robert Burrow
Harold Chambers
John Dhart

Agenda

Call to Order/Membership review
Approval of Minutes

- February-April TF teleconferences
- February 24th SP teleconference
- IL 06-1

L42-1 Matrix data review
2006 L42 industry hardware order update

- Dana representatives joining by teleconference

Scoring/Bright Burnish discussion
Adjournment

Motion: A motion was passed unanimously (7 approved/0 opposed/0 abstention) to approve the previous three sets of meeting minutes available on the TMC website.

The Chairman informed Surveillance Panel about information letter 06-1. This information letter adopted the L42-1 driveline into the current L42 procedure.

2006 L42 industry hardware order update

- PO's issued from Labs mid July 2005
- Total axle quantity ordered=959
- L42 TF traveled to Lugoff, SC to discuss axle build with Dana personnel-March 28th

- First 10 axles sets were assembled, but the drive side contact pattern is too near toe (L1 to L .5)
    - Upon investigation, it was discovered that while the carriers where made to print, the lack of geometric dimensioning tolerances and the gearset design is the large reason for the drive side pattern not meeting spec.
- Dana's suggestion was to send the gearsets back to Ft. Wayned in order to re-lap the driveside to a L4 pattern which should give an assembled pattern closer to specification (L2/L3 F0, F+1, F-1).
- 10 gearsets were set to Ft. Wayne and the assembled result netted a L1-L3 pattern on the drive side with no change in the coast side pattern. However, the backlash has now increased to .010"-.013". Spec = .004"-.009"
- L42 Task force held a conference call April 11 and decided to present information to SP for review

For auditing purposes, 20 carriers from middle, end and beginning of gear sets were measured and data shared with surveillance panel. This information can be found at the end of this summary XX. Also see the teleconference minutes from April 11th on the TMC website for more information regarding the assembled patterns and post lapped patterns.

Kenny Miller, Don Kreinbring, Steve Bird, and Derek Ottley, all from Dana, joined by teleconference to join the surveillance panel discussion. Kenny Miller summarized the 20 carrier measurement data and described the measuring process.

Hi-Lo hypoid offset spec = 1.499 to 1.502: mean = 1.5010;

- 5 failed (1.5022, 1.5025, 1.4987, 1.5021, 1.5022)

Square spec = 90.0000 to 90.0333: mean = 90.0058;

- 3 failed (89.9982, 89.9929, 89.9982) for a 30% of total of 20 gear sets out of spec.

Carriers made to print, but stack up tolerances excessive on 30% of carriers in batch
discussion on unknown effects of greater backlash on scoring

<u>Harold's opinion</u>: better to stay with DS pattern as is, than to relap and change backlash. He also stated that he would rather have toe pattern than a heel pattern w/backlash. DS contact pattern relevance is unknown, but for sure you don't want more backlash. (Harold)

Kenny Miller spoke with Ken Okamura, and Ken's opinion was that the drive side doesn't matter, and to build as is.

Dana found the source of bad carriers, which where made in Venezuala instead of Morgantown or Smokey mountain like the L37 carriers.

Jerry Gropp asked if a spec is being added for driveside pattern?

Bartlett: TMC and TF is trying to capture the data for correlations, but the TF felt is was the prudent thing to do for this axle build.

Dana action item:
Use the 20 carriers measured at Ft. Wayne & 20 original pinion/rings and assemble the units to perform a DOE. Determine how much the driveside and coast side pattern shifts using the "out of spec" carriers. This will also tell Dana what the gear threshold is for the current tolerances.

3 possible outcomes after finishing DOE

1. DOE shows minimal pattern shift, and if the labs are comfortable, finish the build with the original rings and pinions and live with a driveside pattern towards toe.
2. DOE shows pattern shift on X percentage of assembled gearsets. Remove these gearsets and have new carriers made, but keep the gearsets which show acceptable pattern. Essentially splitting the build into 2 different batches.
3. DOE shows large variation in pattern. Dana needs to find and specify new carriers with the correct dimensions so the assembled pattern is consistent and to specification.

The surveillance panel felt that the best chance for consistent results is a consistent batch, don't introduce variability—split batch or re-lapping is not an option from consensus. Wait for Dana DOE and choose option 1 or 3 above.

L42-1 data matrix review

Review of tasks from February SP meeting

- Agree/commonize upon Cond 1 & 3 (steady state) pinion torque filtering-complete
- Lab A to calculate % deviation on temperature for Conditioning phases-Complete
    - TF to decide on path
- All labs to run coast down times on dyno's with Ram Engine setup-Complete-no significant impact determined

Remember: Focus of torque targets was on shock series 1 and shock series 2. Torque targets where chosen based on the L42 database and the average torque for the 604/637 gear batch (3 of 4 labs).

Recommended Testing Matrix from SP Feb 2006(604/637 gear batch)

6 runs on TMC 116, 2 runs on TMC 112

- Run as a reference period 3 pass oils, 1 fail oil.
- Wait 2-4 days (Do not run any setups, only let engine/controls warm up to temperature and run next series)
- Run again 3 pass oils, 1 fail oil
- Run and report all tests regardless of results (unless uncontrollable situation-power outage, etc)

L42-1 Matrix Data

All of the matrix data can be found at the end of these minutes

L42-1 Matrix statements from Task force

1. 32 test matrix complete
2. Discrimination oil did perform poorly across all labs and at least twice the scoring values of the pass oil.
3. Based on the matrix setup, we did not see any large time effect for torques or scoring
4. If the matrix was a L42 reference sequence, 3 of 4 labs would have changed torques in order to get a more mild scoring result.
5. Labs still able to maintain the torque validity bands of 15% and 10% respectively.
6. Plotting average shock 2 torque vs scoring, the plots do not show a linear relationship.
7. 2 labs saw drive side scoring, this is possibly a higher rate than normal?
8. 1 lab had shock 1 scoring throughout matrix even though proper torque targets were achieved
9. Each lab ran 2 “calibration sequences” for a total of 8 calibrations. 3 of the 8 sets would have yielded acceptable stand calibrations.

Correlations vs severity

1. Contact pattern did not correlate with severity
2. High shock 2 torque values do not necessarily correlate with higher score values
3. Shock 2 starting temperature does not correlate with severity

4. TF reviewed conditioning torque plots. Coast side Conditioning torque did not seem to have any correlation to the coast side scoring values between labs.
5. Possible correlation between drive side conditioning torques and drive side scoring at one lab

The overall feeling and consensus of the SP was that the data was more variable than expected, especially when comparing torque values vs the EOT scoring value. The labs also did not achieve the torque target suggested for Shock 2 (-335lb-ft) as well as expected. The labs felt this was due to the use of a utility axle to run their initial setups on. Typically the utility axle will exhibit 10-30lb-ft more torque than a new axle.

Harold felt strongly that total number of revolutions during conditioning is very important along with the torque values achieved and temperature. The L42-1 draft 17 document does not specify torque values for conditioning or recording of ring/pinion revolutions.

The labs emphasized they reviewed both the min/max torque values achieved during conditioning 2&4 and the time it took to complete these conditioning phases. The labs expressed that no differences could be seen that would correlate to EOT scoring. The data also suggested that within one lab the EOT scoring was quite variable, even though the conditioning phases were run the same.

Action Item: Don Bartlett to volunteer a statistician from LZ to analyze and review data

Action Item: Exxon Mobil will sponsor an experiment at Intertek-Parc to run 8 L42-1 tests back-to-back, using a utility axle, and document all torques. Parc to complete by End of April

Next possible steps

- 604/637 axle batch is starting to get scarce at some labs while others are completely out.
- We've run out of funding for continuing support to develop torque targets at some labs
- Do we declare we have a test, ballot the current TMC document into an ASTM number, and let labs reference their test stands.
- Try to develop torque targets with the next axle batch and run the 604/637 axle batch with L42 rules.

Group felt that the procedure should be accepted as the new L42 test, but that it should be reviewed by the panel members.

Action Item: Chairman to send latest revision of draft 17 out to SP for review and approve at May 9th Meeting in Detroit.

Meeting adjourned: Sullivan/Chambers

044CF100 Audit,

Surveillance Panel Mtg: April 19, 2006

M44 carrier supplied by Danaven, ref. ASTM L-42 test

DATA HIGHLIGHTED IN BLUE ARE PRINT DIMENSIONS

P/N 044CF100
No. of Records = 20
Program: PROG_155_QDAS

Feature:	HI-LO	SQUARE
Upper Spec Limit	1.502	90.0333
Lower Spec Limit	1.499	90.0000

Count	Date / Time	S/N	Results	Results
1	14.04.2006/13:33:21	LOT_A5_051_1	1.4999	90.0002
2	14.04.2006/14:40:19	LOT_A5_051_2	1.5	90.0093
3	15.04.2006/07:11:57	LOT_A6_049_1	1.5021	90.0003
4	15.04.2006/07:35:01	LOT_A6_049_2	1.5015	89.9929
5	14.04.2006/14:26:09	LOT_A6_050_1	1.4996	89.9982
6	14.04.2006/14:32:58	LOT_A6_050_2	1.4991	90.0029
7	14.04.2006/13:49:55	LOT_A6_070_1	1.5005	90.0050
8	14.04.2006/14:47:45	LOT_A6_070_2	1.5011	90.0070
9	15.04.2006/08:16:45	LOT_A6_071_1	1.5018	90.0032
10	15.04.2006/08:24:18	LOT_A6_071_2	1.5022	90.0049
11	15.04.2006/08:38:55	LOT_A6_071_3	1.5017	90.0071
12	15.04.2006/08:47:08	LOT_A6_071_4	1.5020	90.0057
13	15.04.2006/09:20:21	LOT_A6_071_5	1.5020	90.0129
14	15.04.2006/09:53:45	LOT_A6_071_6	1.5007	90.0030
15	14.04.2006/14:10:31	LOT_A6_072_1	1.5025	90.0175
16	14.04.2006/14:17:28	LOT_A6_072_2	1.4987	90.0090
17	15.04.2006/07:27:55	LOT_B6_048_1	1.5014	90.0176
18	15.04.2006/07:53:59	LOT_B6_048_2	1.5007	90.0026
19	15.04.2006/08:01:34	LOT_B6_048_3	1.5012	90.0105
20	15.04.2006/08:09:13	LOT_B6_048_4	1.5012	90.0067

Percent out of specs: 30%

Mean =	1.5010	90.0058°
Range =	1.4987	89.9929°
	1.5025	90.0176°
	-.0018	-.0071°
	+.0020	+.0176°

Note: Audit population sorted by serial number

L-42-1 INDUSTRY MATRIX

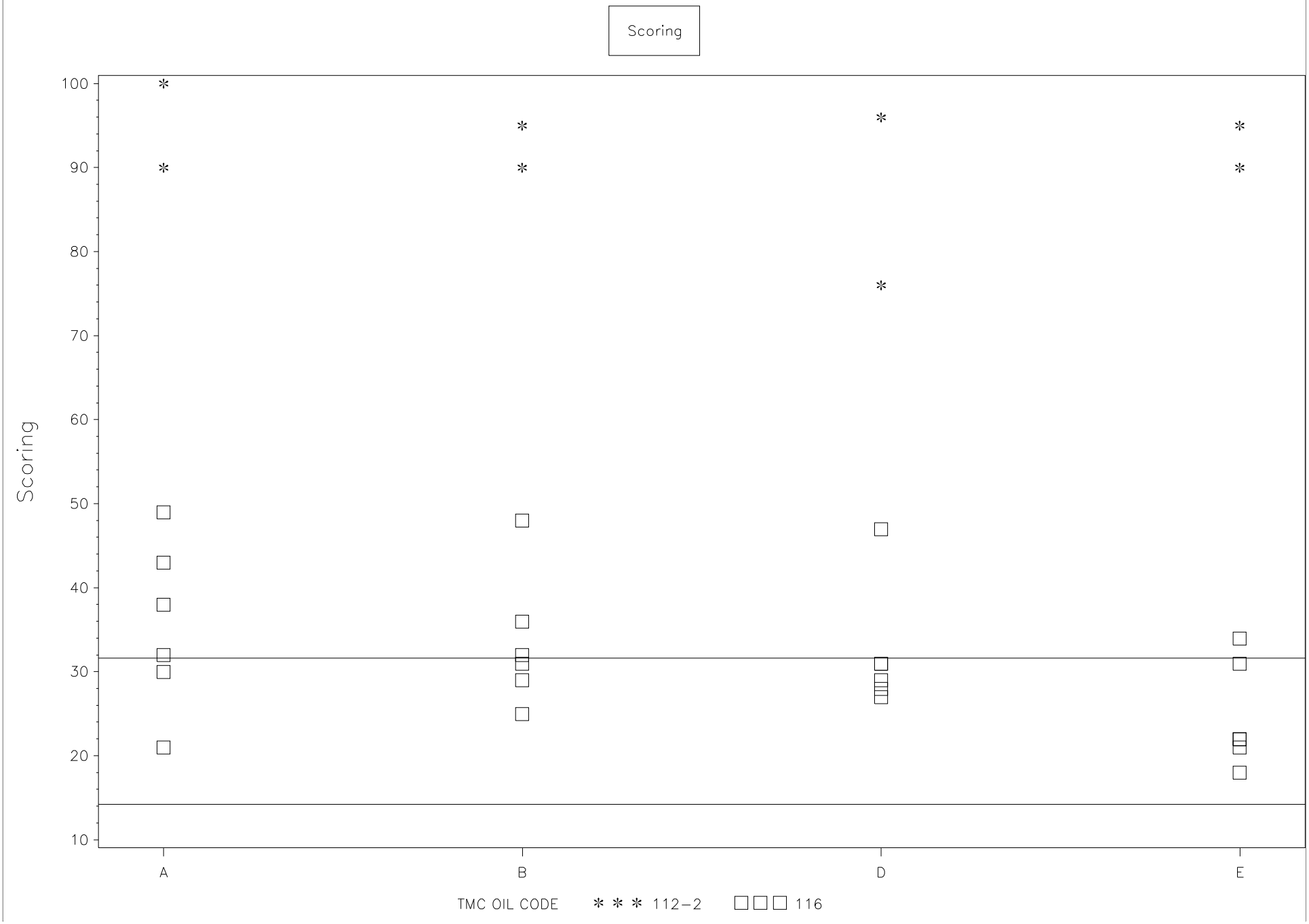
CMIR	LAB	Stand	Run	DTCOMP	VAL	Oil	RINGBAT	P Score	ss1cst min	ss1cst max	ss1sct avg	ss2cst min	ss2cst max	ss2cst avg
57087	D	2A	37	20060404	AG	116	P8L604	28	-107	-72	-93.1	-359	-337	298
57088	D	2A	38	20060404	AG	116	P8L604	29	-98	-70	-78.7	-356	-314	296
57089	D	2A	39	20060404	AG	116	P8L604	31	-98	-73	-83.5	-368	-333	297
54337	D	2A	40	20060404	AS	112-2	P8L604	96	-80	-73	-77.2	-362	-326	295
57090	D	2A	41	20060407	AG	116	P8L604	27	-97	-73	-85.9	-368	-343	291
57091	D	2A	42	20060407	AG	116	P8L604	47	-83	-69	-75.4	-377	-340	298
57092	D	2A	43	20060407	AG	116	P8L604	31	-90	-74	-82.8	-373	-348	293
59200	D	2A	44	20060407	LG *	112-2	P8L604	76	-86	-77	-81.5	-368	-326	300
55994	B	286	93	20060323	AG	116	P8L604	32	-84	-74	-76.9	-360	-325	334
55995	B	286	94	20060323	AG	116	P8L604	36	-84	-78	-80.3	-351	-324	334
57103	B	286	95	20060324	AG	116	P8L604	48	-85	-78	-81	-347	-327	335
41128	B	286	96	20060324	AS	112-2	P8L604	90	-85	-74	-80.4	-332	-317	333
57104	B	286	97	20060329	AG	116	P8L604	31	-88	-78	-82.7	-353	-325	329
57105	B	286	98	20060329	AG	116	P8L604	29	-86	-81	-82.9	-350	-336	330
57106	B	286	99	20060330	AG	116	P8L604	25	-84	-78	-81.2	-346	-323	326
41139	B	286	100	20060330	AS	112-2	P8L604	95	-86	-80	-82.4	-346	-320	326
57730	E	1	1969	20060324	AG	116	P8L604	18	-76	-69	-70.8	-385	-338	268
57731	E	1	1970	20060324	AG	116	P8L604	22	-80	-73	-76.1	-365	-350	266
57738	E	1	1971	20060324	AS	112-2	P8L604	95	-79	-70	-74.9	-382	-345	268
57729	E	1	1968	20060324	AG	116	P8L604	21	-76	-70	-73.7	-371	-335	268
57733	E	1	1973	20060327	MG **	116	P8L604	31	-78	-70	-74.4	-380	-350	270
57734	E	1	1974	20060327	AG	116	P8L604	34	-75	-71	-73.9	-385	-368	267
57739	E	1	1975	20060327	AG	112-2	P8L604	90	-87	-74	-80.9	-381	-359	268
57732	E	1	1972	20060327	MG **	116	P8L604	22	-86	-80	-82.8	-385	-366	269
57716	A	3	5	20060331	LG *	116	P8L604	32	-83	-76	-80	-365	-338	305
57717	A	3	6	20060331	AG	116	P8L604	49	-85	-78	-80.1	-358	-330	303
57718	A	3	7	20060331	AG	116	P8L604	21	-82	-72	-77.6	-360	-327	303
57725	A	3	8	20060331	AS	112-2	P8L604	90	-85	-75	-80.2	-351	-320	304
57720	A	3	10	20060404	AG	116	P8L604	30	-84	-76	-79.8	-345	-289	308
57721	A	3	11	20060404	AG	116	P8L604	43	-82	-75	-77.9	-350	-294	305
57726	A	3	12	20060404	AS	112-2	P8L604	100	-83	-76	-79	-335	-298	304
57719	A	3	9	20060404	MG **	116	P8L604	38	-80	-75	-77.3	-352	-297	311

* (LG) Operationally Invalid

** (MG) Non-interpretable for Drive Side Scoring

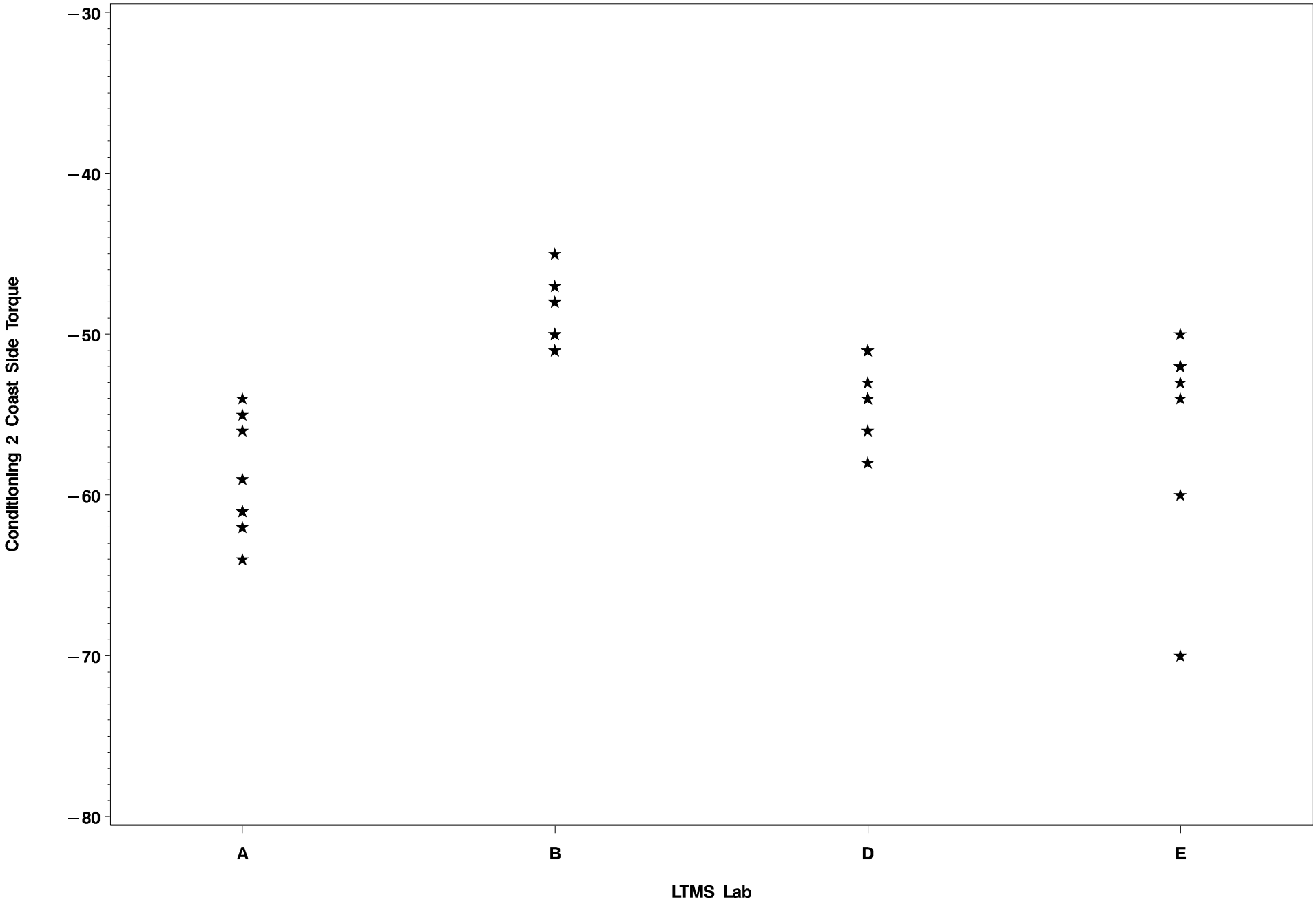
L-42-1 MATRIX RESULTS

Gear Batch V1L637/P8L604



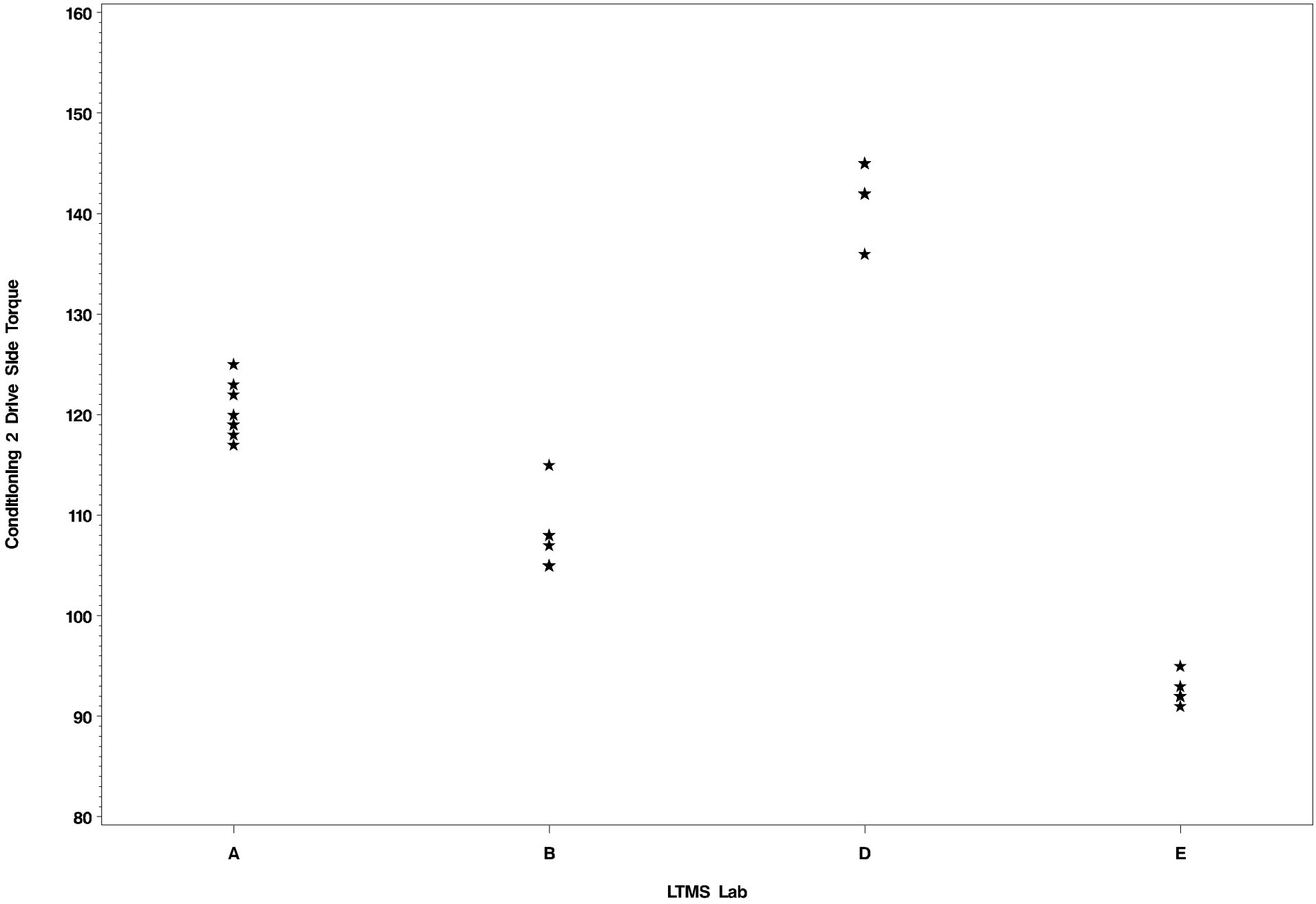
L−42−1 Conditioning 2 Coast Side Torque

Matrix Lab Torque Results



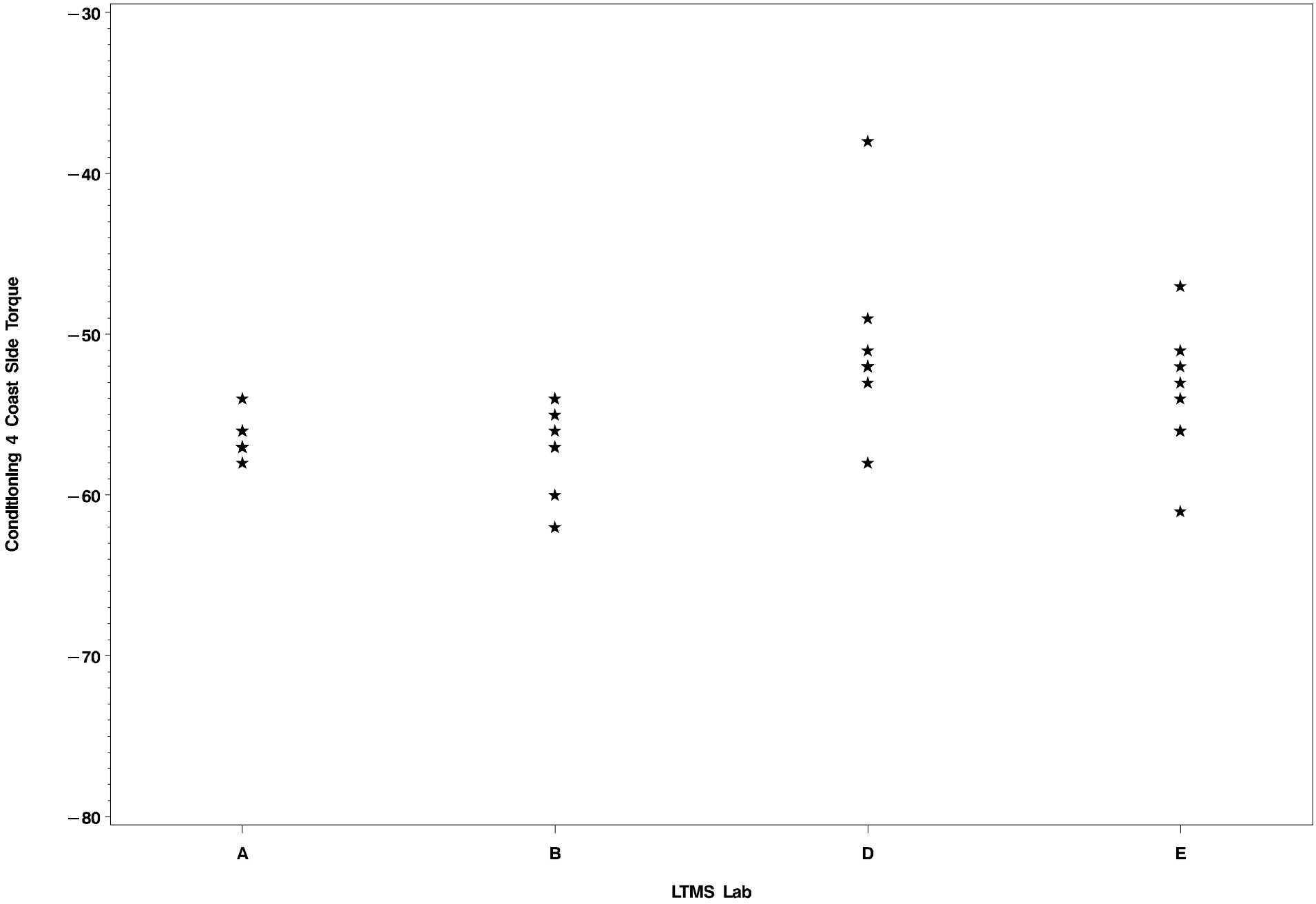
L−42−1 Conditioning 2 Drive Side Torque

Matrix Lab Torque Results



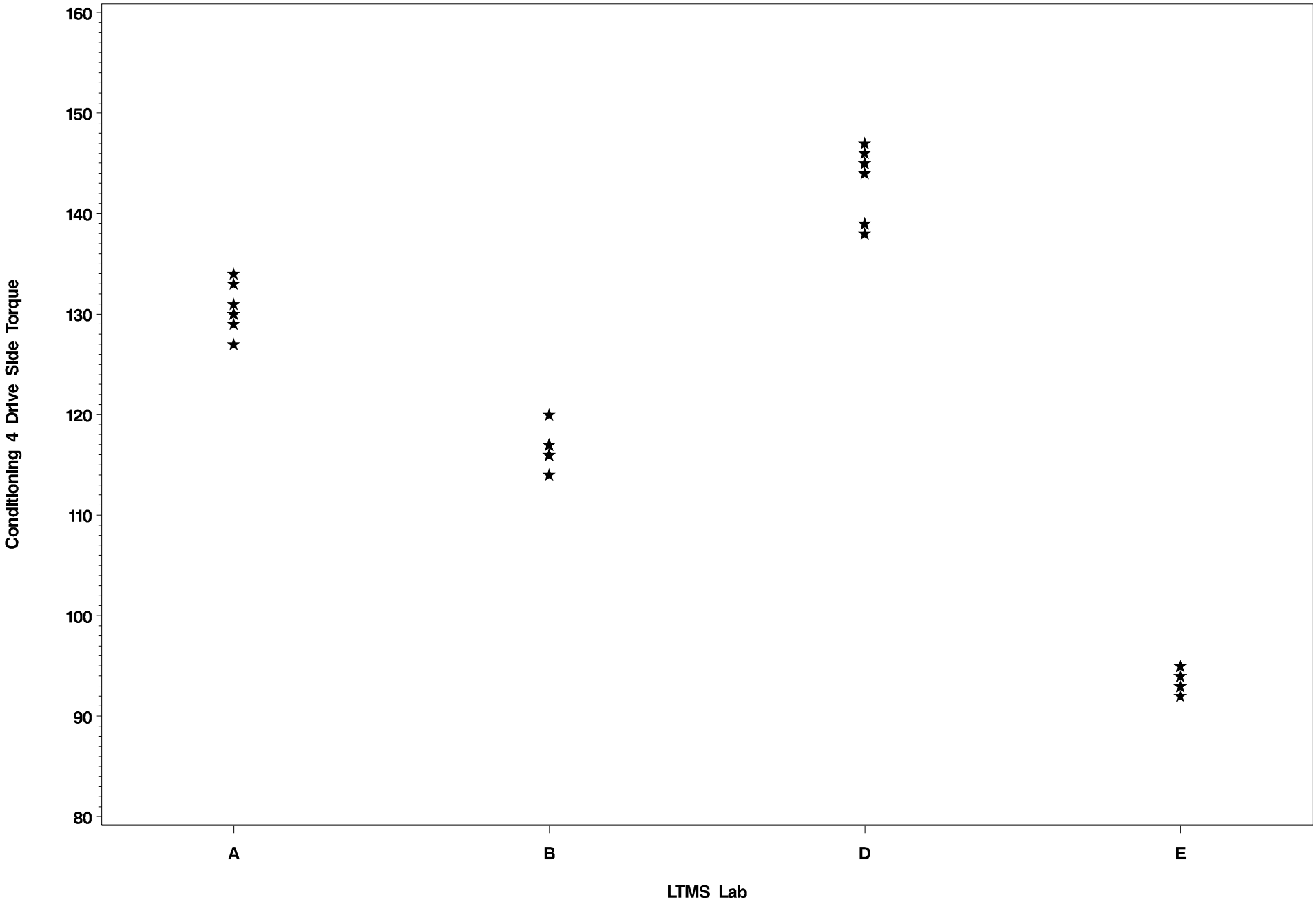
L−42−1 Conditioning 4 Coast Side Torque

Matrix Lab Torque Results



L−42−1 Conditioning 4 Drive Side Torque

Matrix Lab Torque Results



L-42-1 MATRIX RESULTS

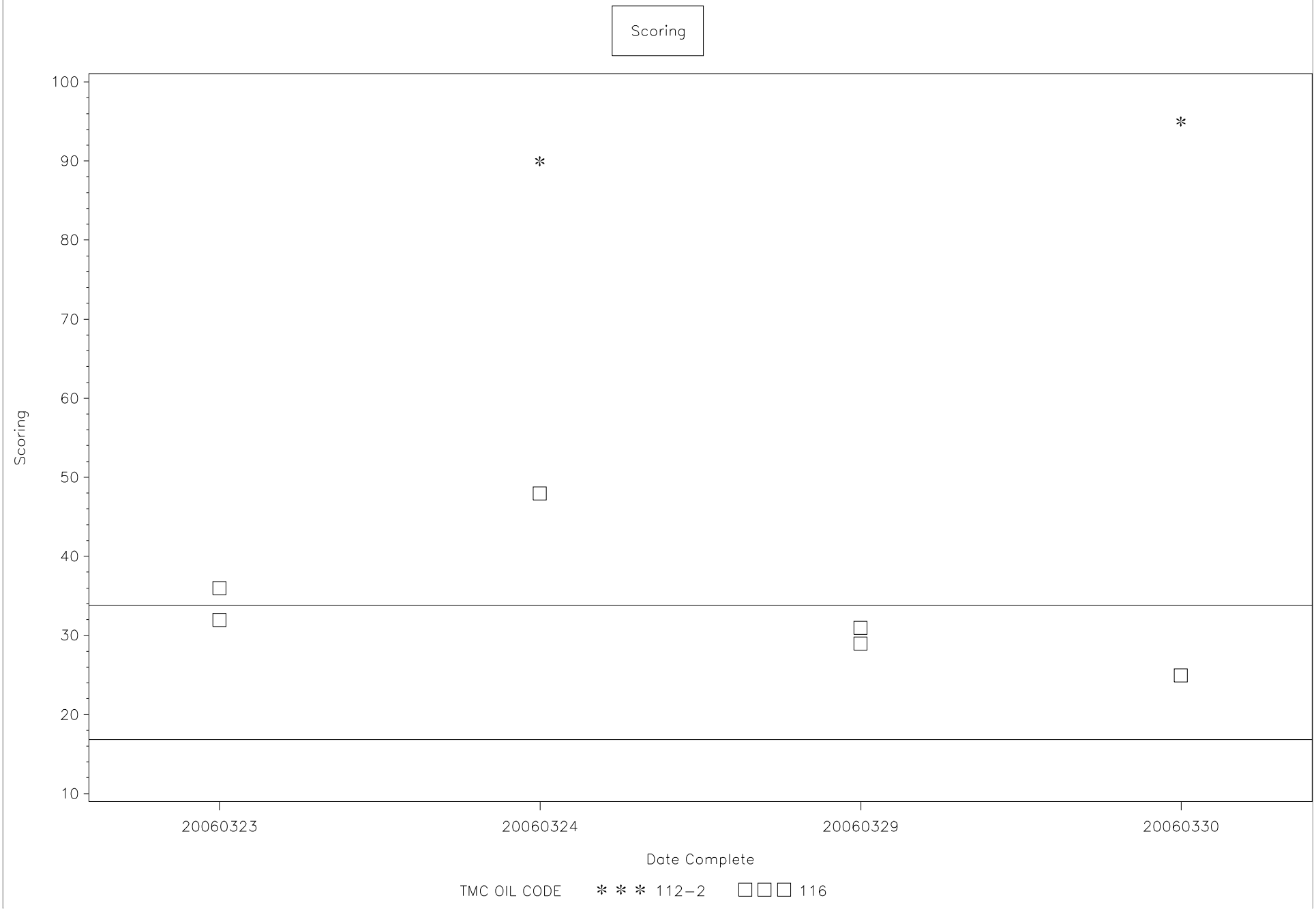
Reference Oils 116 & 112-2

Lab A

L-42-1 MATRIX RESULTS

Reference Oil 116 & 112-2

Lab B



L-42-1 MATRIX RESULTS

Reference Oils 116 & 112-2

Lab D

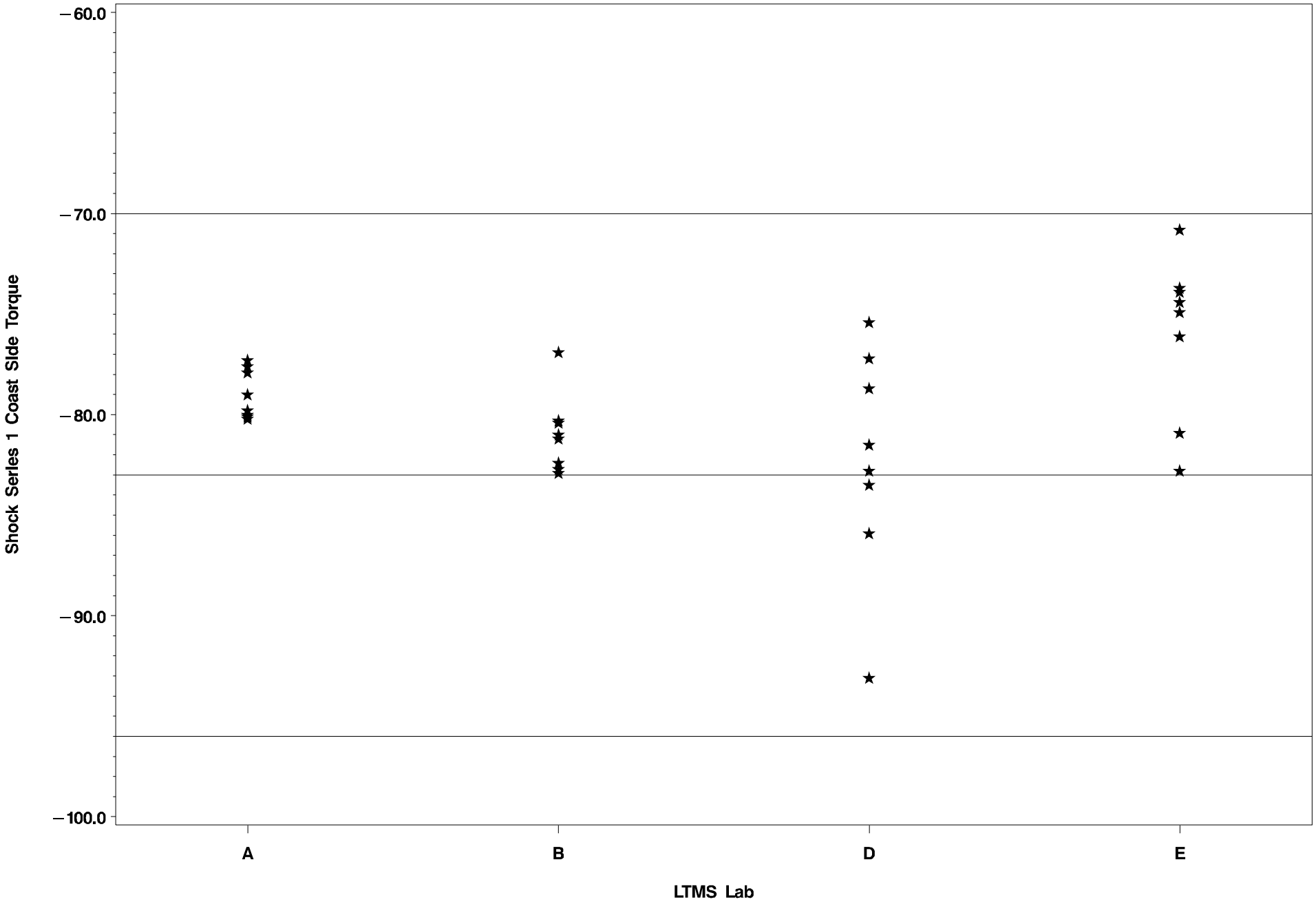
L-42-1 MATRIX RESULTS

Reference Oils 116 & 112-2

Lab E

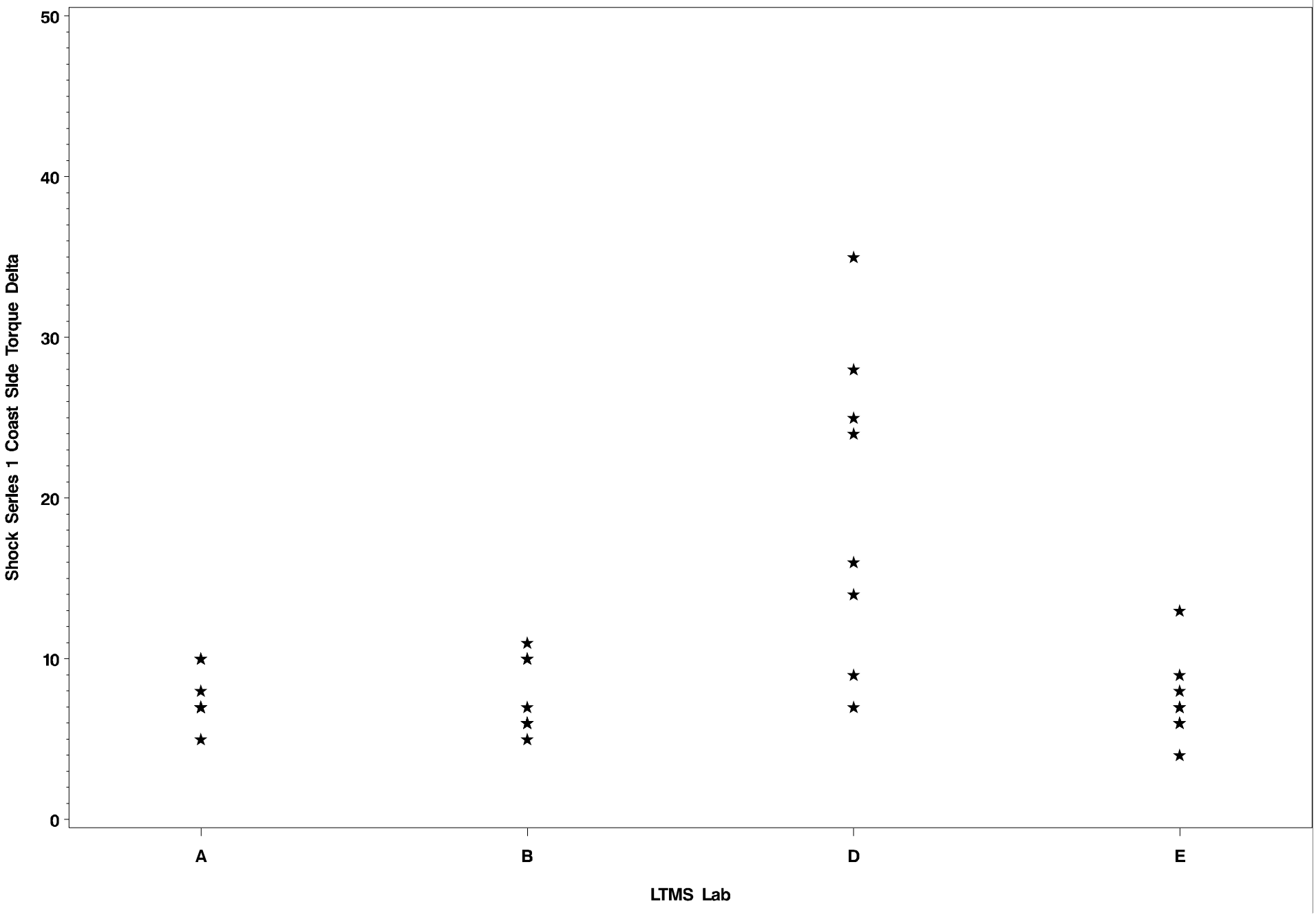
L−42−1 Shock Series 1 Coast Side Torque

Matrix Lab Torque Results



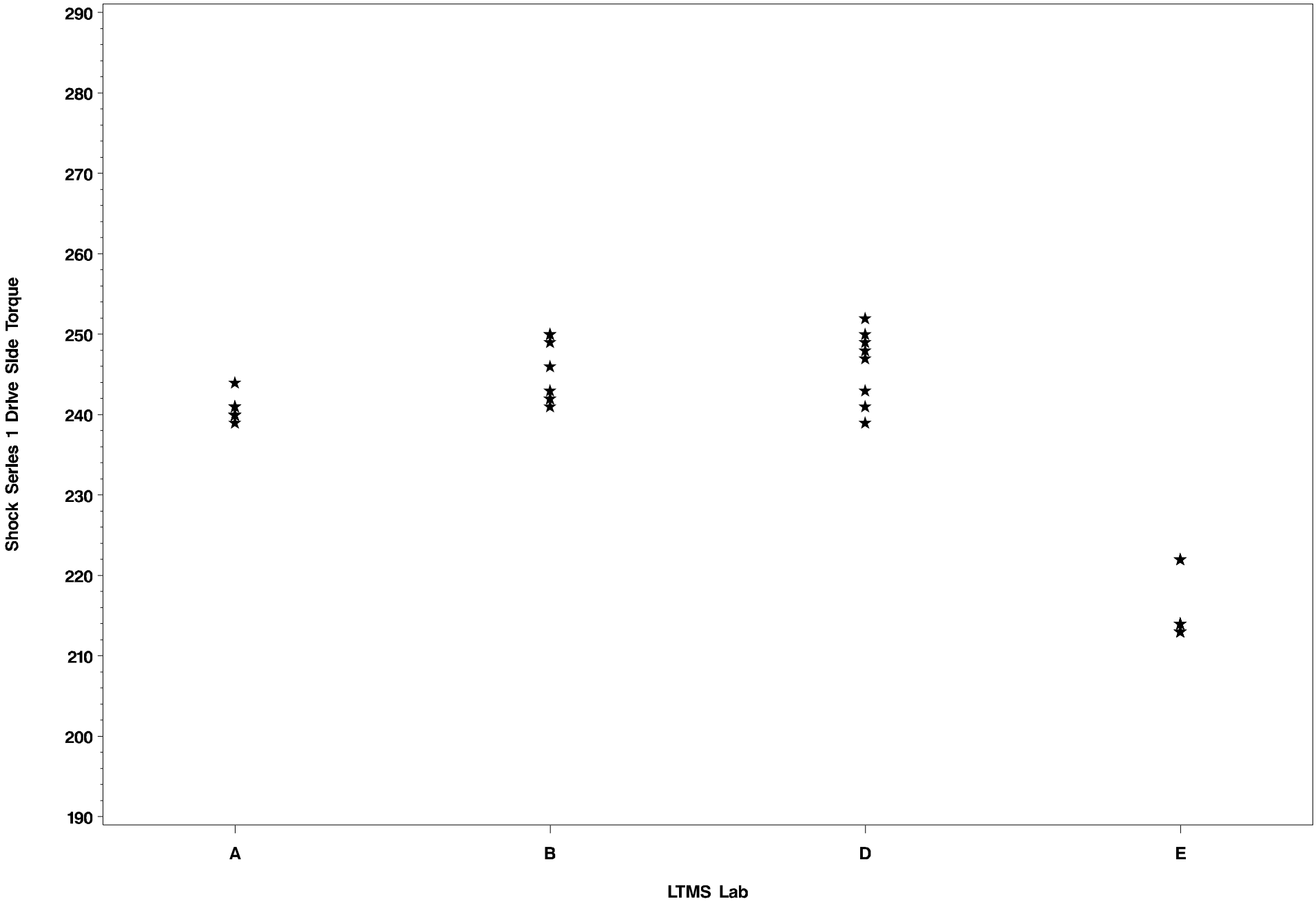
L−42−1 Shock Series 1 Coast Torque Delta

Matrix Lab Torque Results



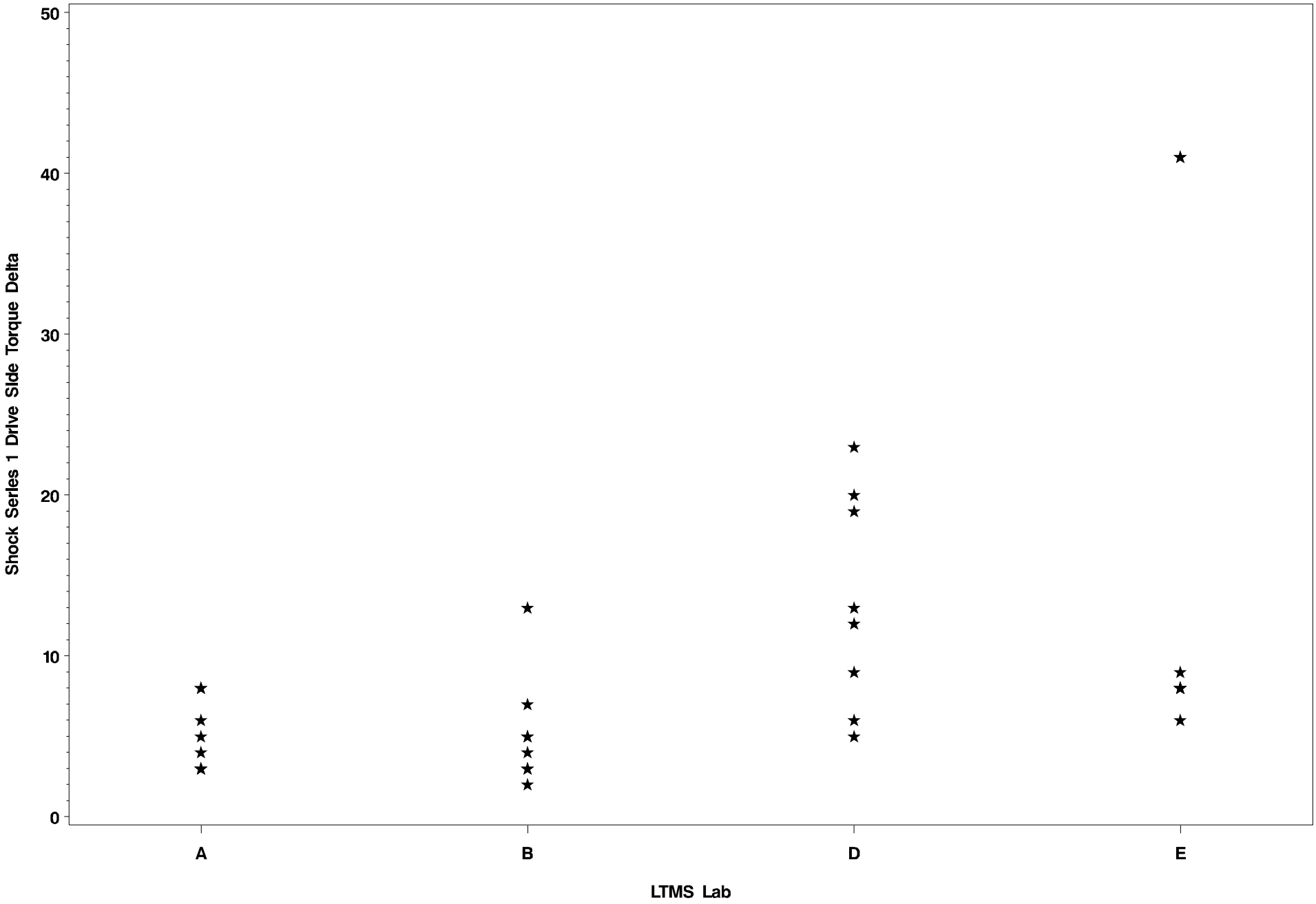
L−42−1 Shock Series 1 Drive Side Torque

Matrix Lab Torque Results



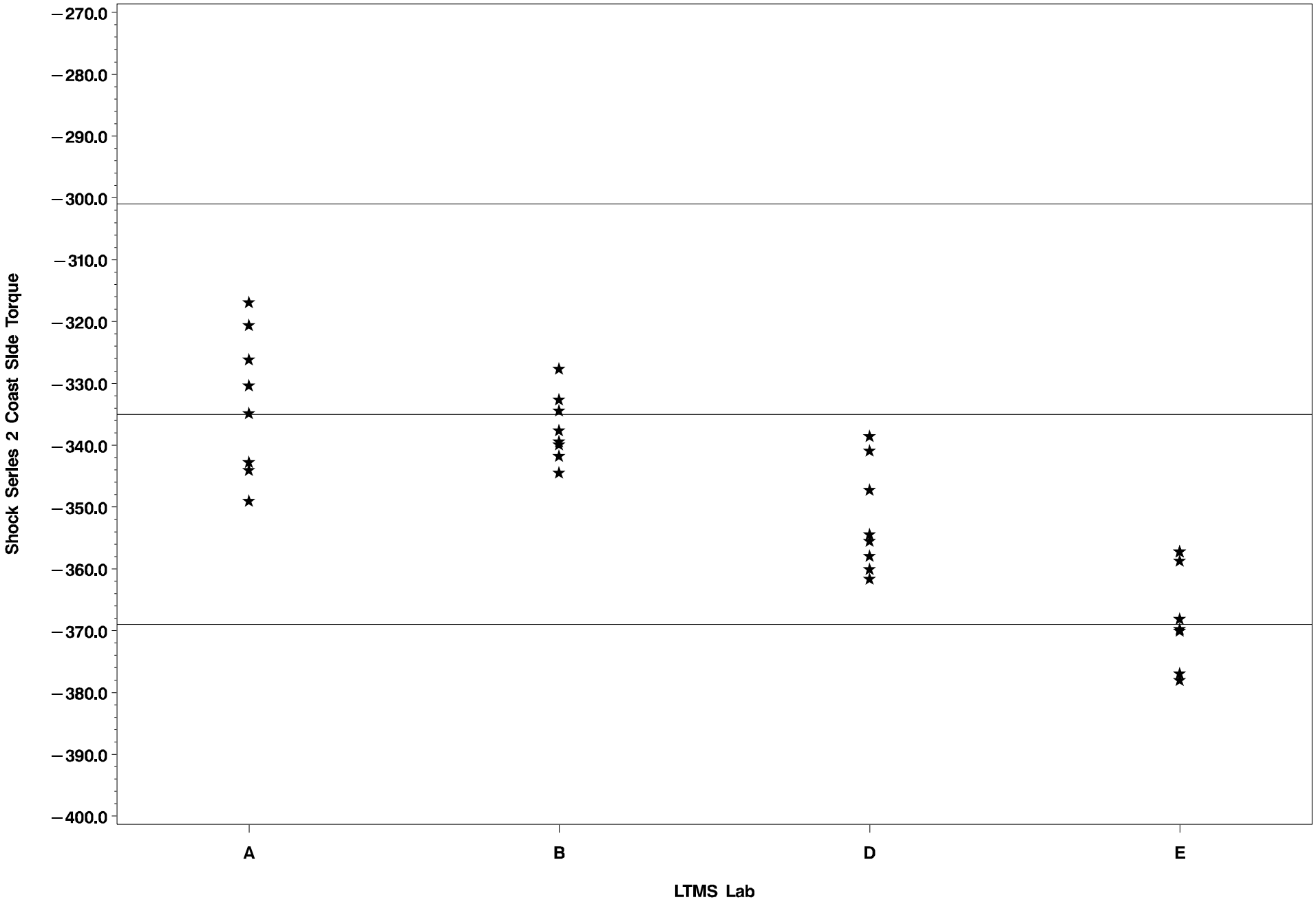
L−42−1 Shock Series 1 Drive Torque Delta

Matrix Lab Torque Results



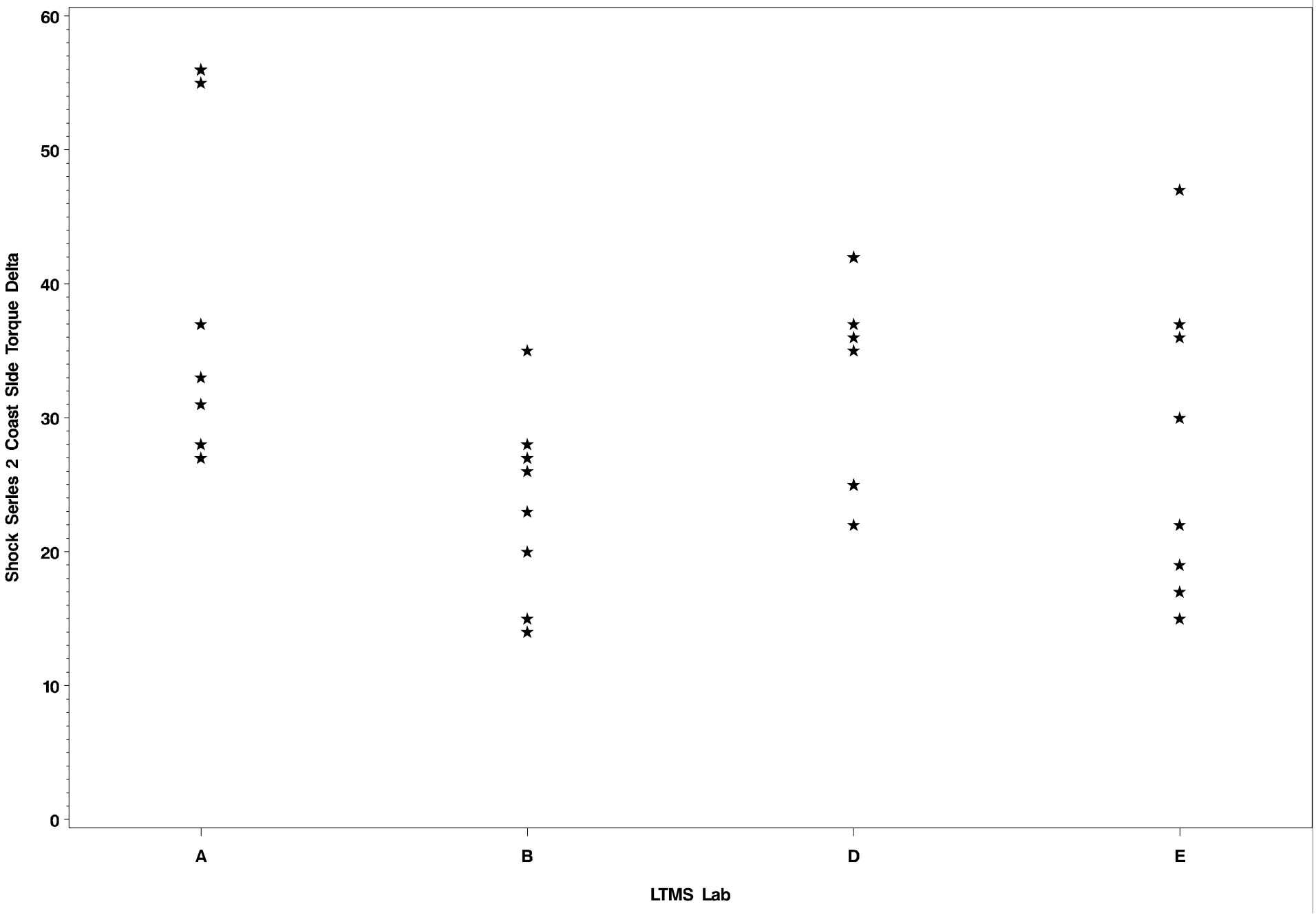
L−42−1 Shock Series 2 Coast Side Torque

Matrix Lab Torque Results



L−42−1 Shock Series 2 Coast Torque Delta

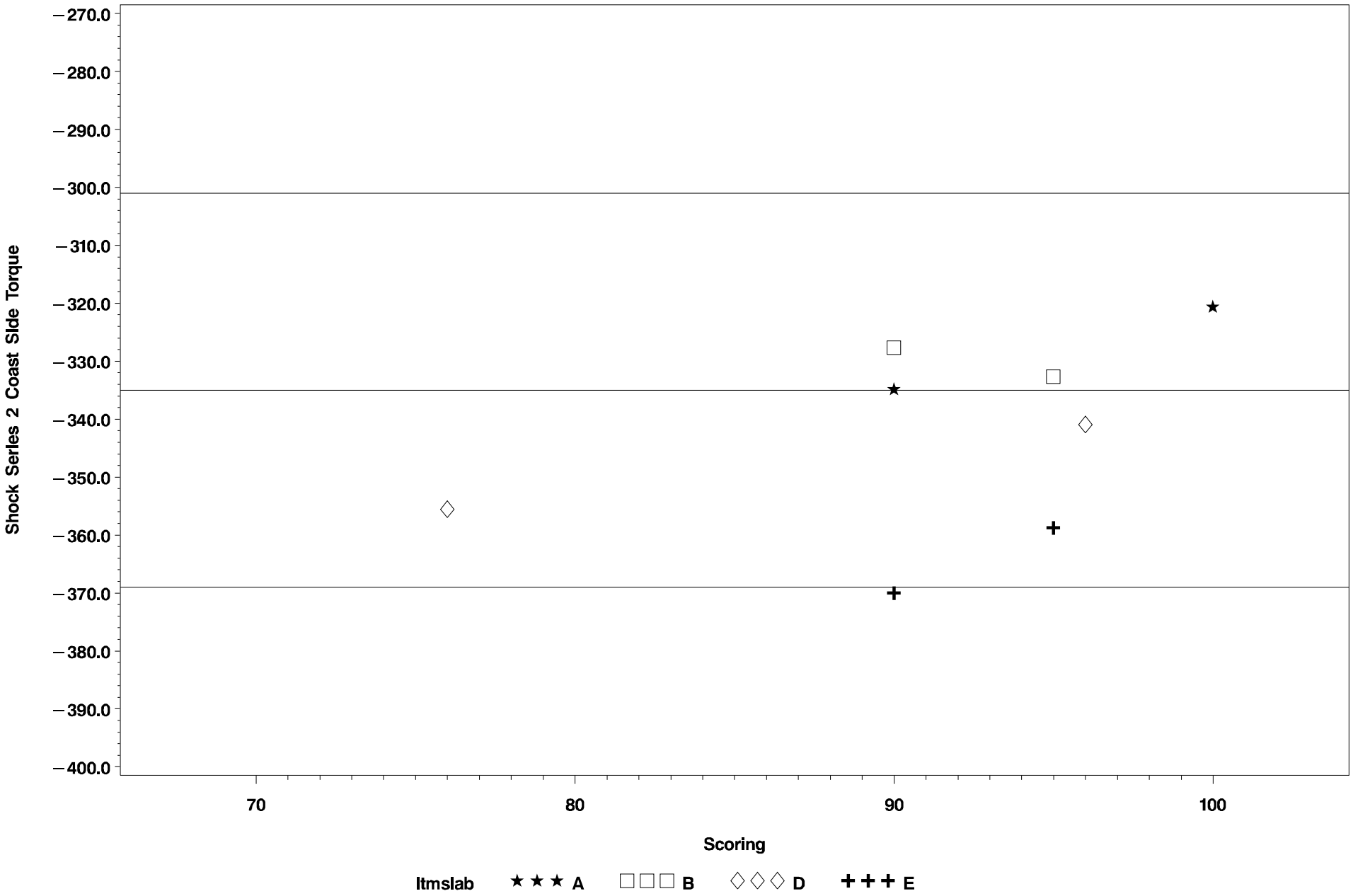
Matrix Lab Torque Results



L−42−1 Shock Series 2 Coast Side Torque

Lab Torque VS Scoring

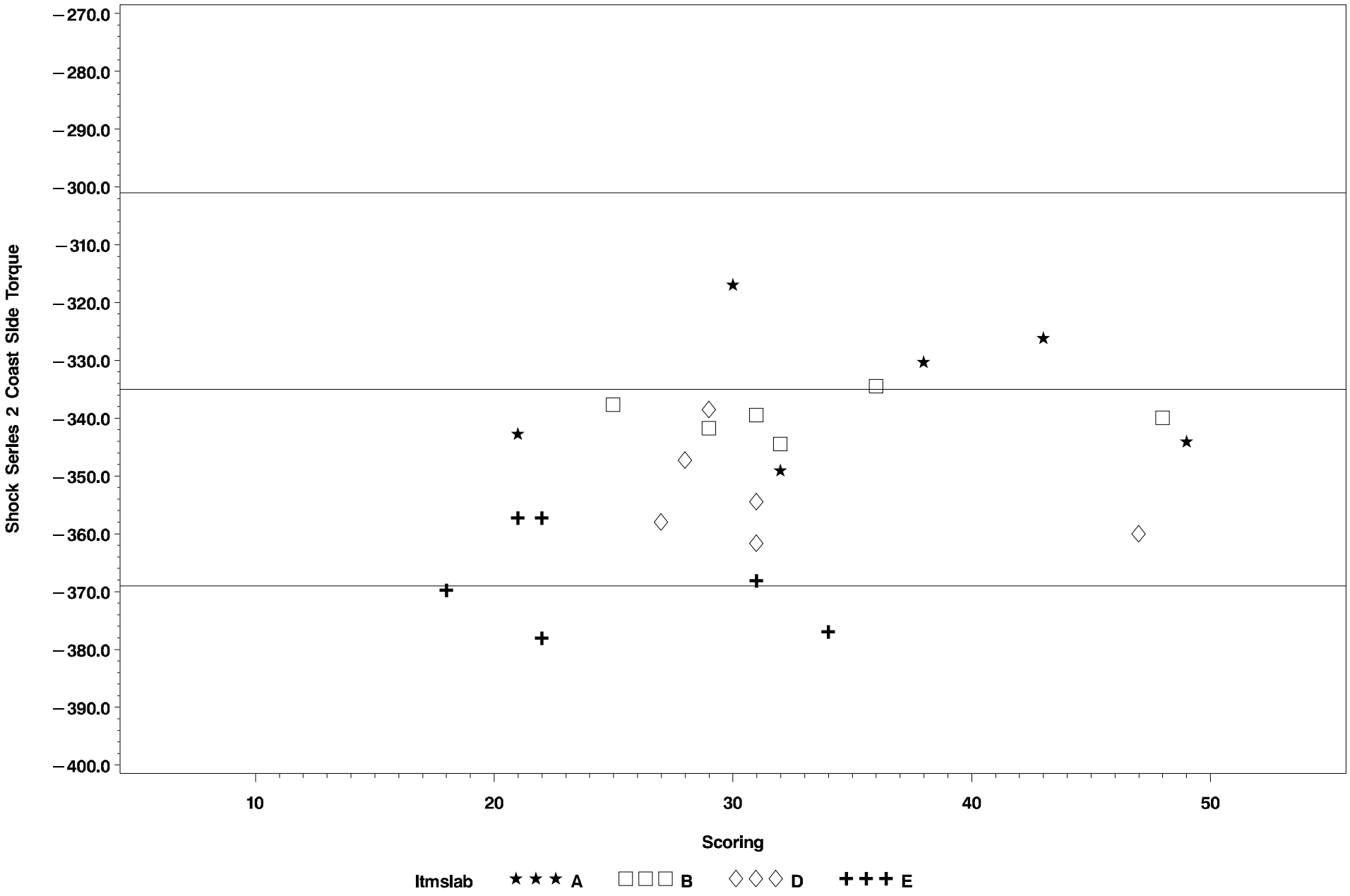
Matrix Reference Oil 112−2 Results



L−42−1 Shock Series 2 Coast Side Torque

Lab Torque VS Scoring

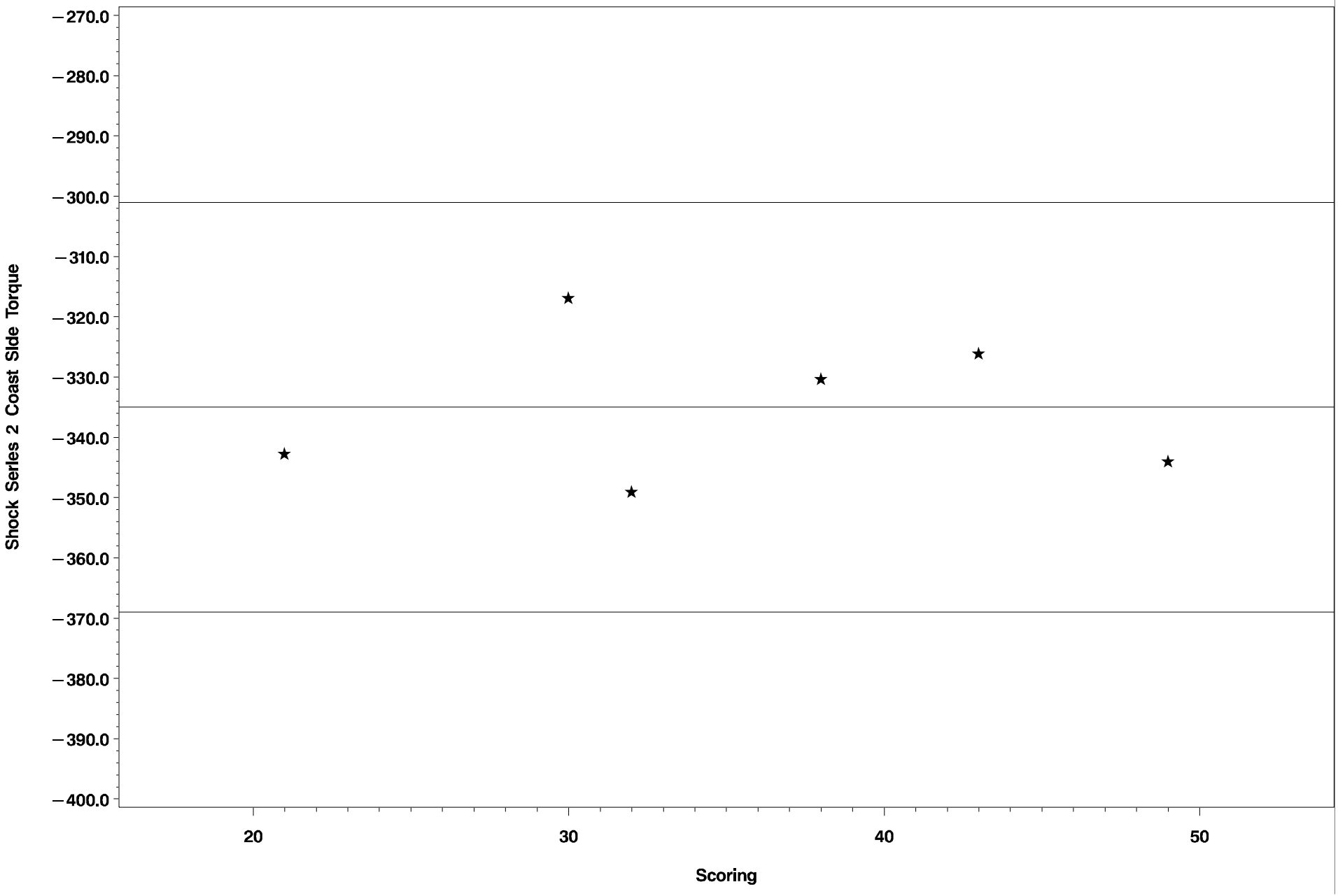
Matrix Reference Oil 116 Results



L−42−1 Shock Series 2 Coast Side Torque

Torque VS Scoring (Lab A)

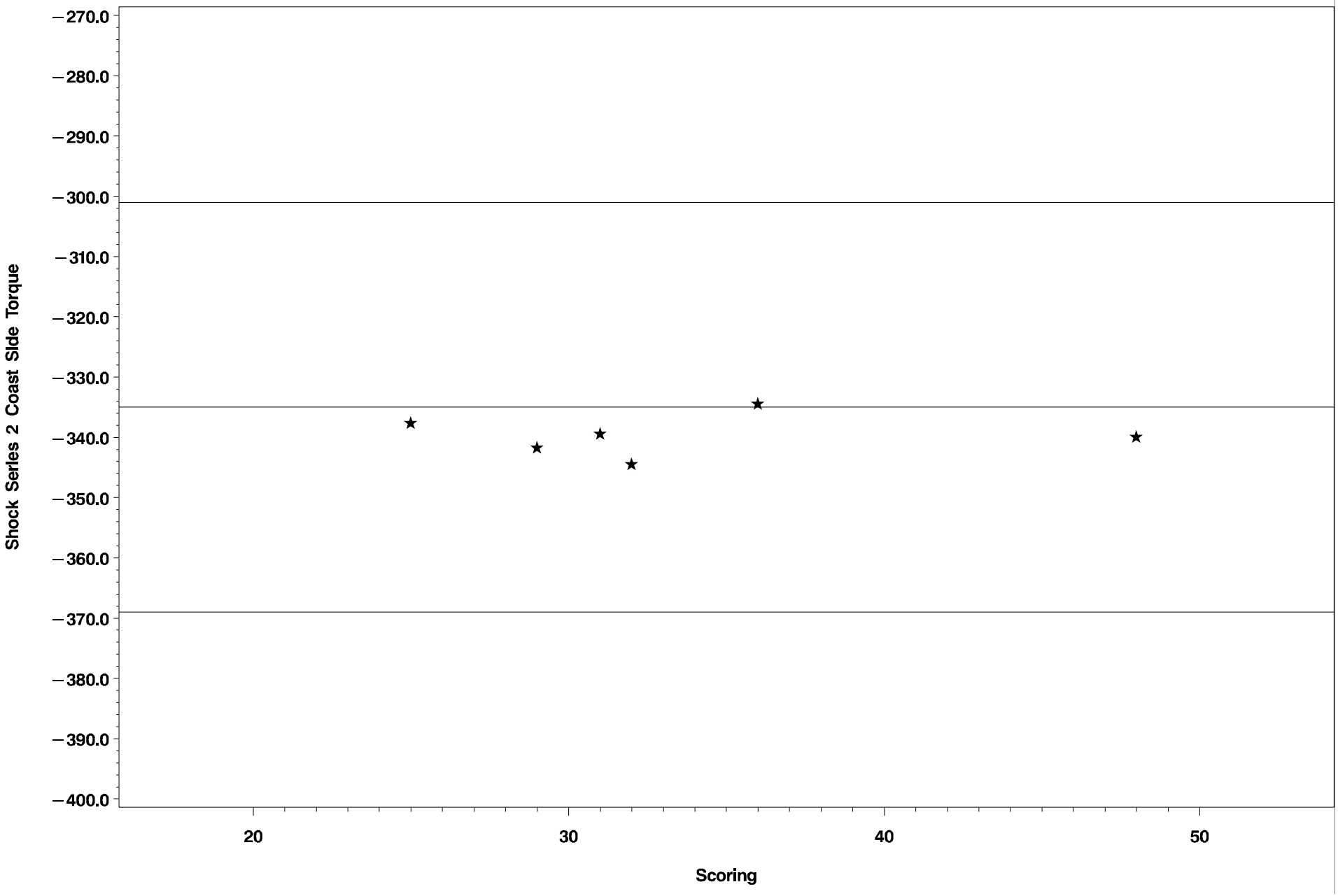
Matrix Reference Oil 116 Results



L−42−1 Shock Series 2 Coast Side Torque

Torque VS Scoring (Lab B)

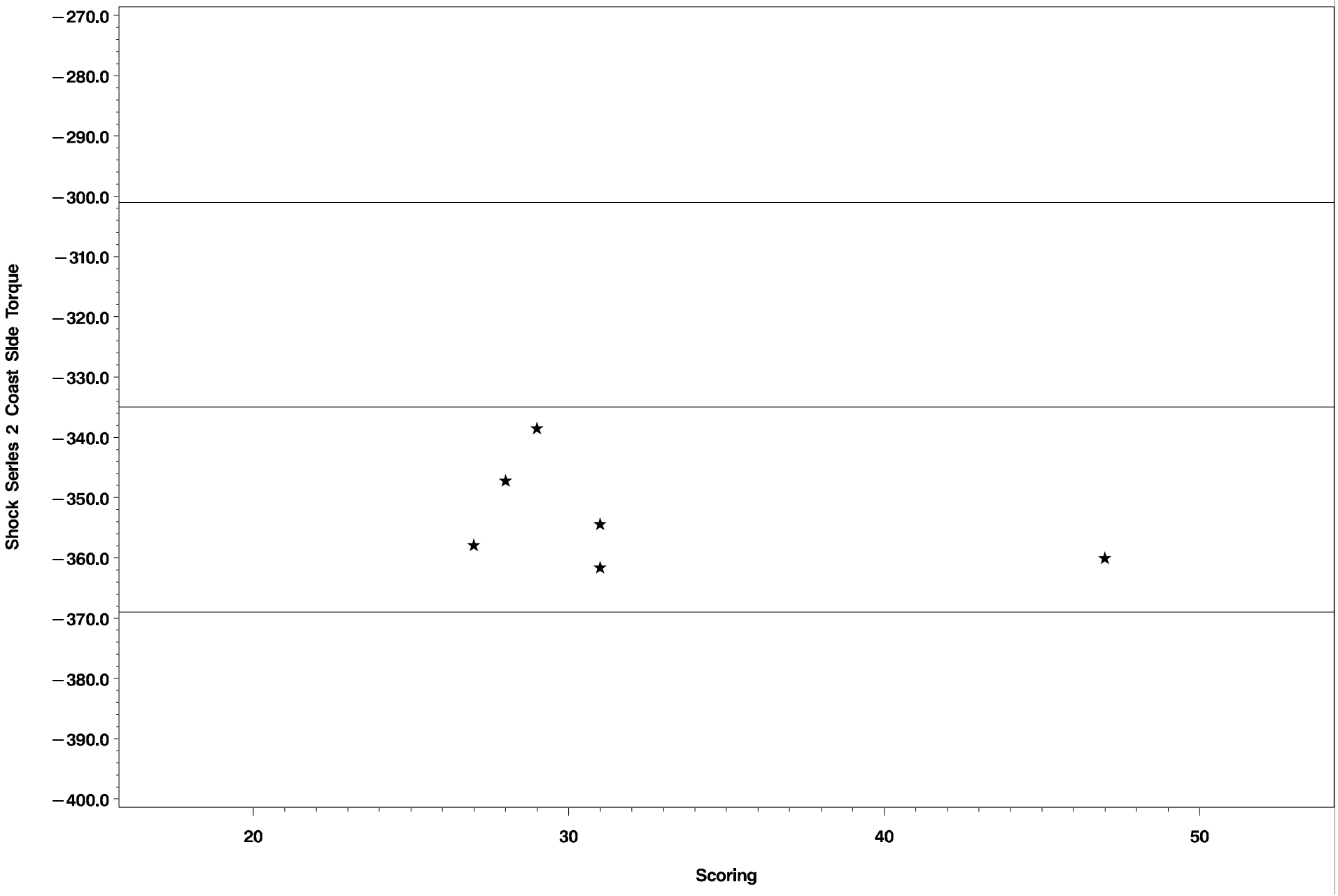
Matrix Reference Oil 116 Results



L−42−1 Shock Series 2 Coast Side Torque

Torque VS Scoring (Lab D)

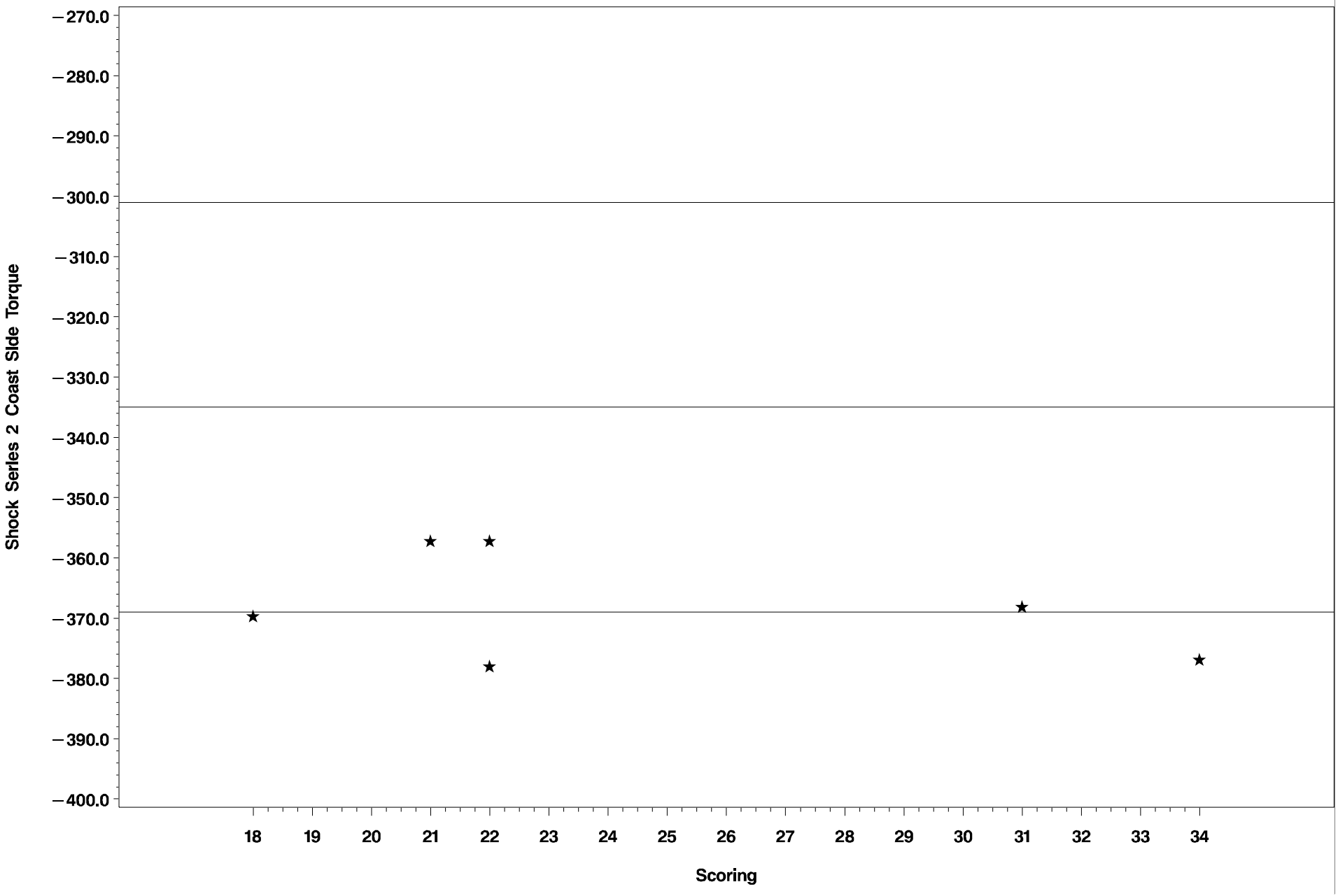
Matrix Reference Oil 116 Results



L−42−1 Shock Series 2 Coast Side Torque

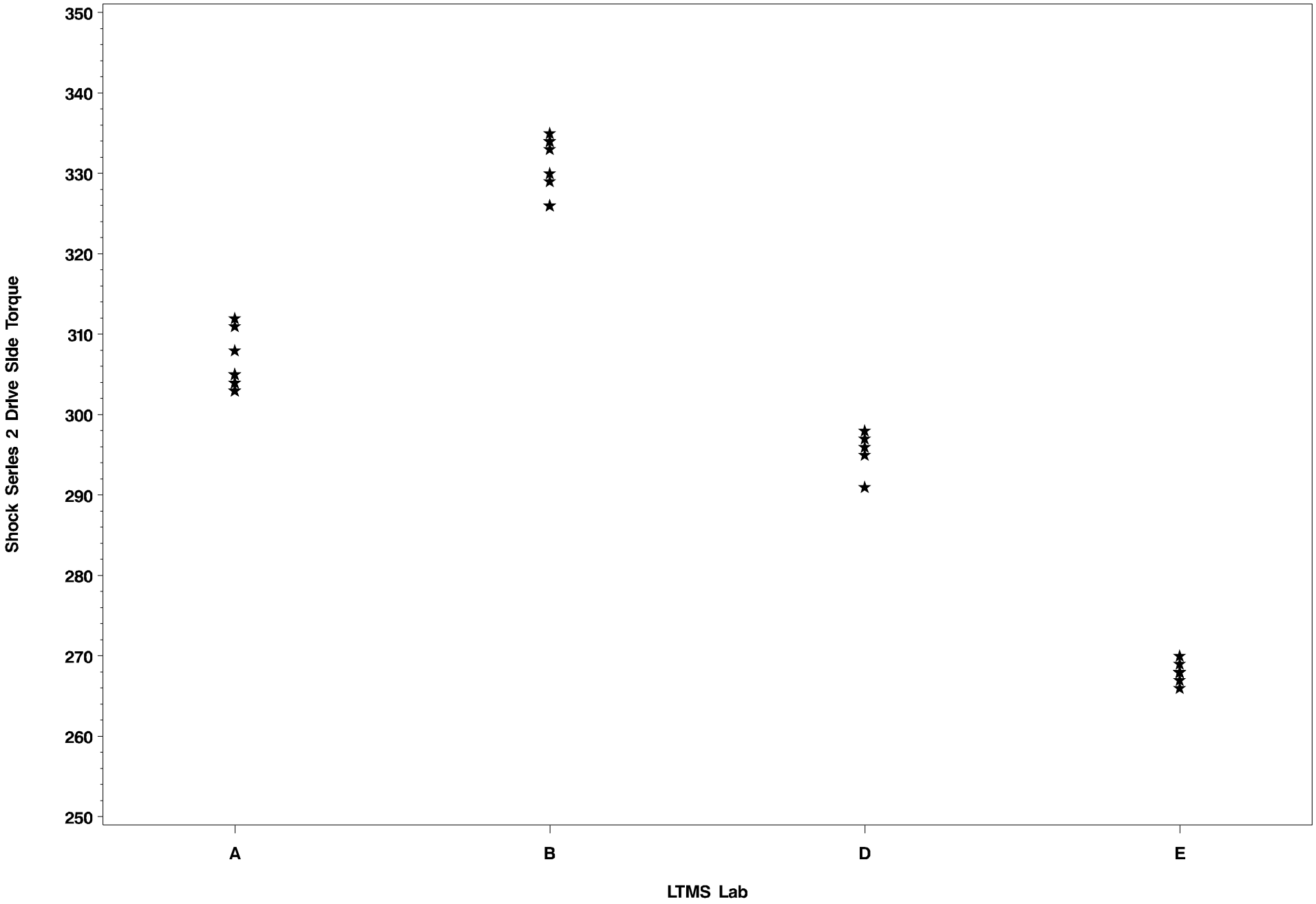
Torque VS Scoring (Lab E)

Matrix Reference Oil 116 Results



L−42−1 Shock Series 2 Drive Side Torque

Matrix Lab Torque Results



L−42−1 Shock Series 2 Drive Torque Delta

Matrix Lab Torque Results