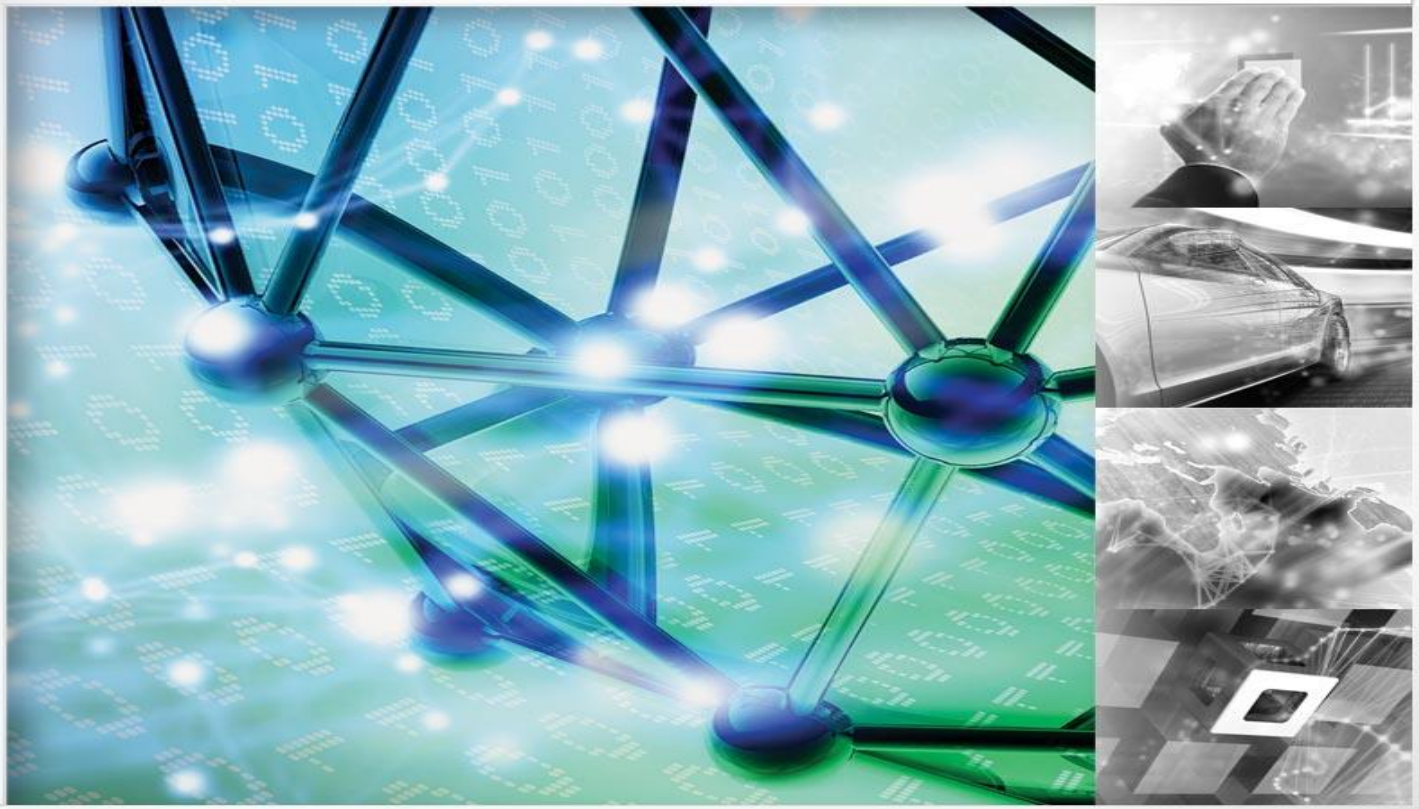


LSPI Precision Matrix Data Plots

Kevin O'Malley
The Lubrizol Corporation
October 4, 2016

© 2016 The Lubrizol Corporation, all rights reserved.

Overview

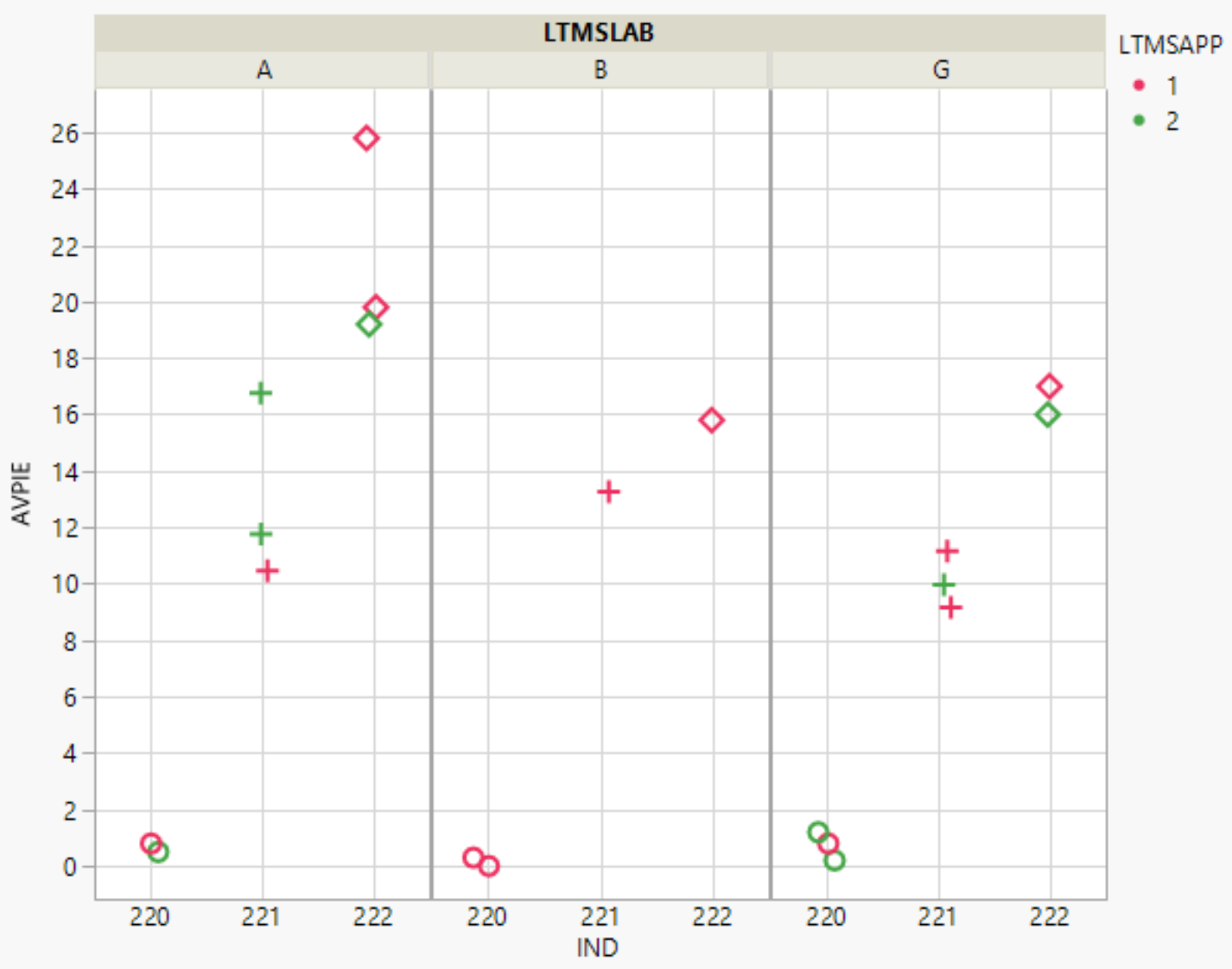
- Data from the 20 precision matrix tests are plotted; Data were obtained from the test run files and LTMS file on the TMC site
  - Results summary data plots start on slide 4
  - Chemical analysis plots start on slide 21
  - Build data plots start on slide 33
  - Operational data plots start on slide 97
- Lab B 2016 hardware tests are not a part of the 20 tests
- Operational data modifications:
  - 119944: coolant In temp removed; bad thermocouple
  - 116220, 114976, and 114978:
    - Barometric pressure was added to pre-intercooler air pressure
- Modifications were made to the reported build data in an effort to standardize the reporting units.

From Frank Faber's 9-19-16 matrix update:

Run Order	B 1	G 1	G 2	A 1	A 2
1	222 114968-LSPI 2016 Hardware	220 114954-LSPI Coolant Thermocouple Cal. Out	222 114960-LSPI Coolant Flow Control Problems	220 ✓ 116220-LSPI	221 ✓ 114973-LSPI
	222 118675-LSPI 2014 Hardware	220 ✓ 116222-LSPI	222 118888-LSPI		
2	220 114962-LSPI 2016 Hardware	221 114956-LSPI Coolant Thermocouple Cal. Out	221 114955-LSPI Coolant Flow Con. Problems	222 ✓ 114976-LSPI	221 ✓ 114974-LSPI
	220 114964-LSPI 2014 Hardware	221 ✓ 114957-LSPI	221 117632-LSPI		
3	220 114963-LSPI 2016 Hardware	221 ✓ 114958-LSPI	220 116223-LSPI Coolant Flow Con. Problems	222 ✓ 114978-LSPI	222 ✓ 114977-LSPI
	220 118365-LSPI 2014 Hardware		220 118369-LSPI		
4	221 114965-LSPI 2016 Hardware	222 ✓ 114961-LSPI	220 117631-LSPI Coolant Flow Con. Problems	221 ✓ 114975-LSPI	220 ✓ 116959-LSPI
	221 114966-LSPI 2014 Hardware		220 119944-LSPI		

© 2016 The Lubrizol Corporation, all rights reserved.

Average LSPI Events by Test



© 2016 The Lubrizol Corporation, all rights reserved.

SUCCESS TOGETHER

Result Summary

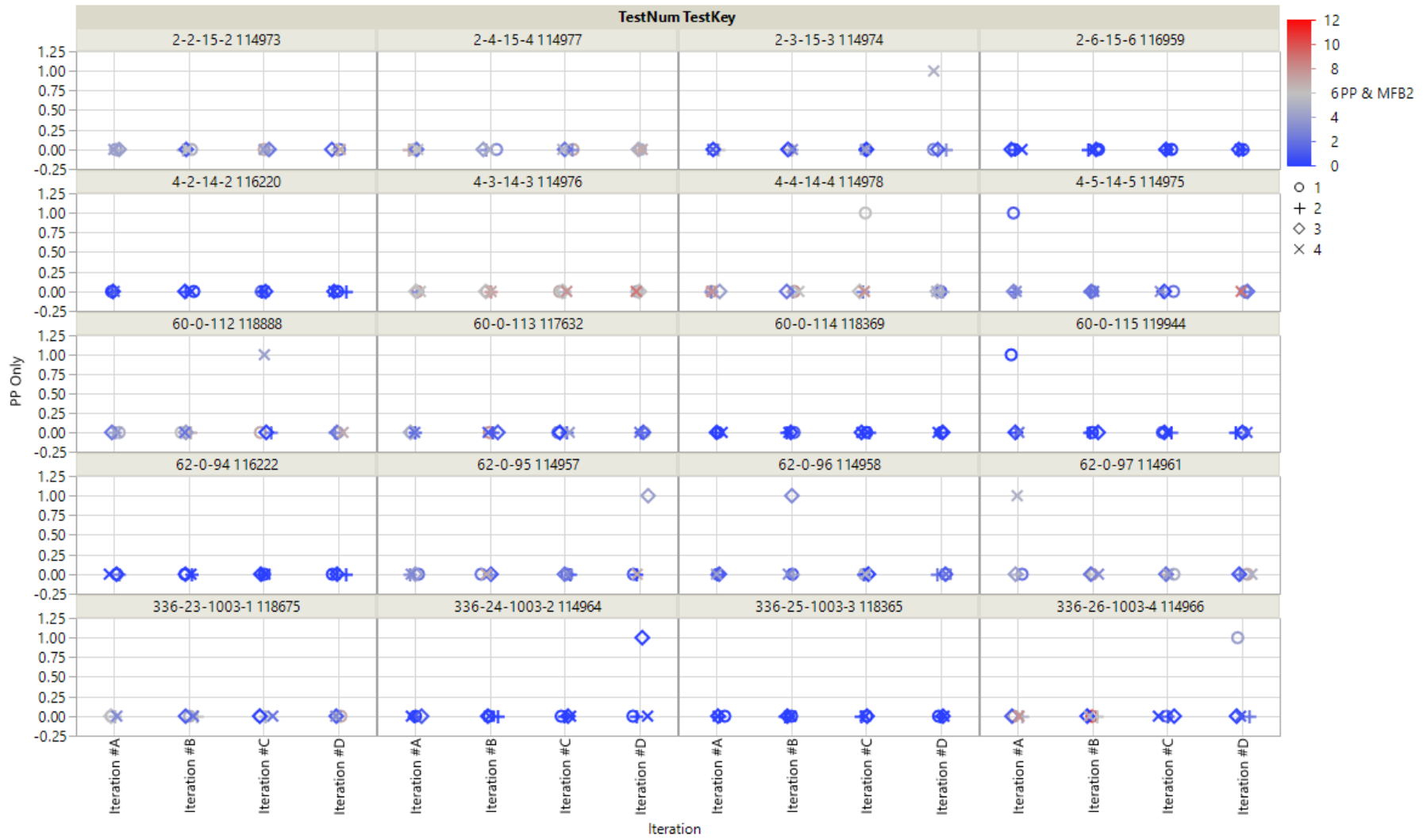
Plots show cycle summary and evaluation criteria data recorded on the “Result Summary” tab of the individual test files uploaded to the TMC site.

Each test is in its own pane with the data colored by the number of LSPI events and symbols for each of the four cylinders.

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder

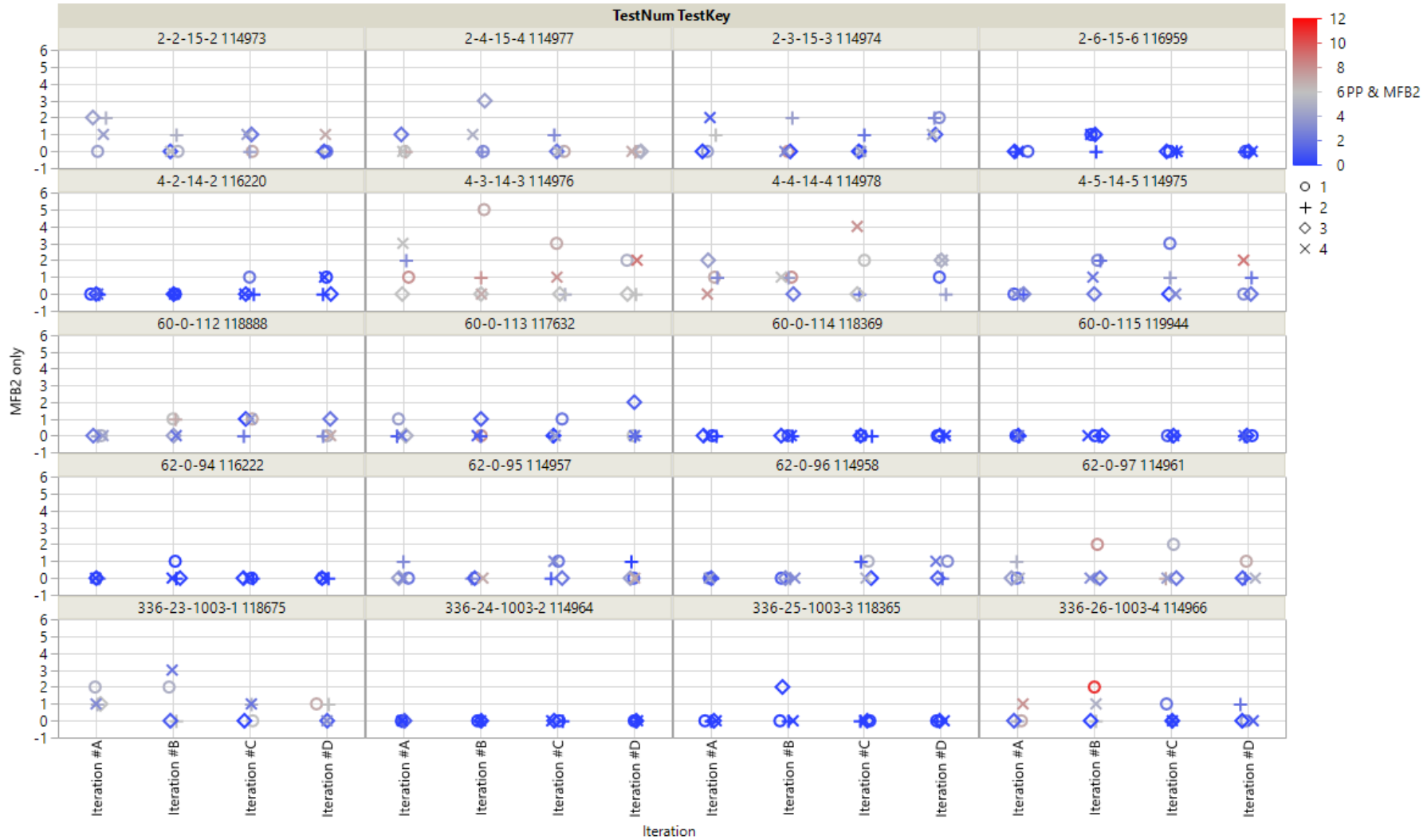


Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder

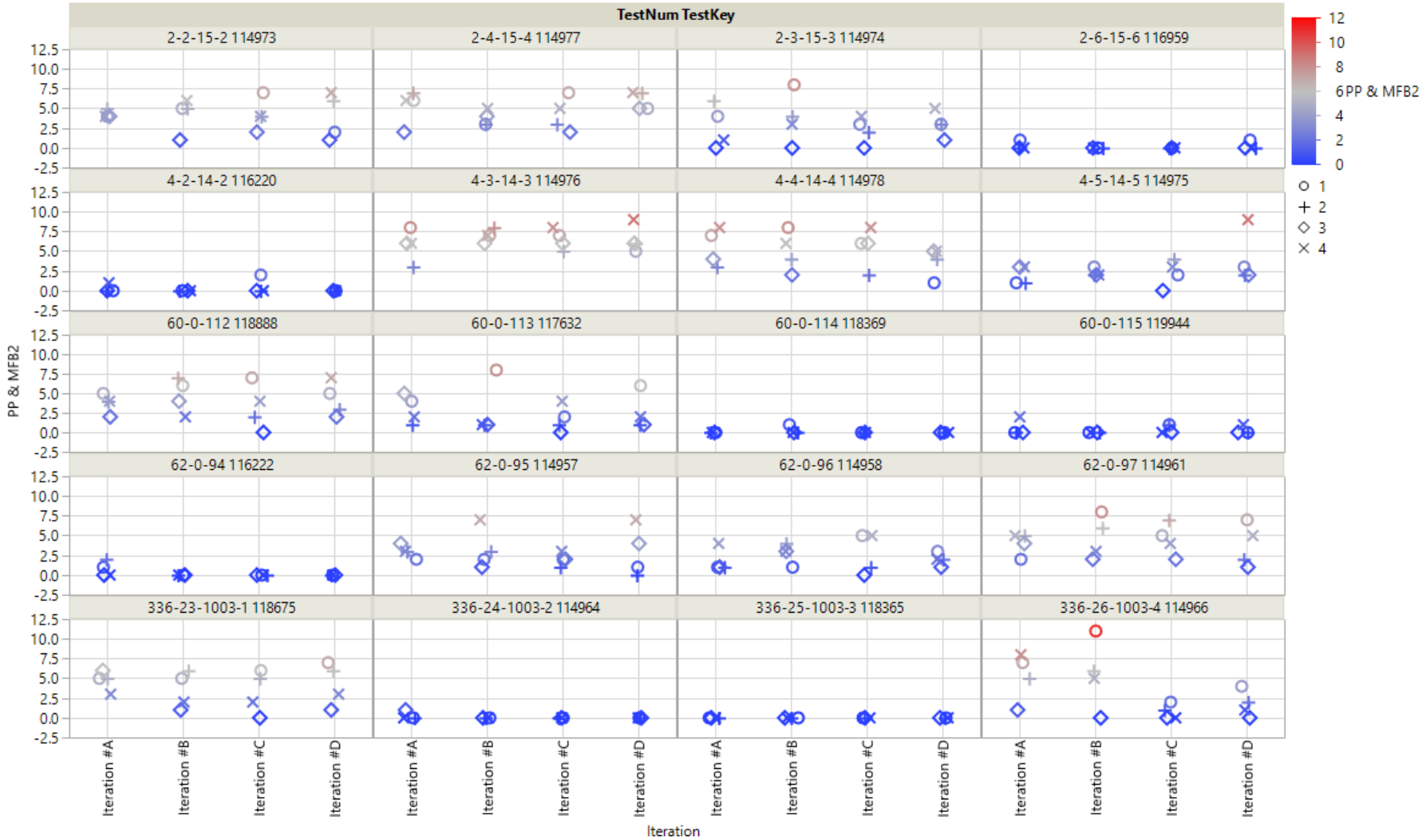


Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder

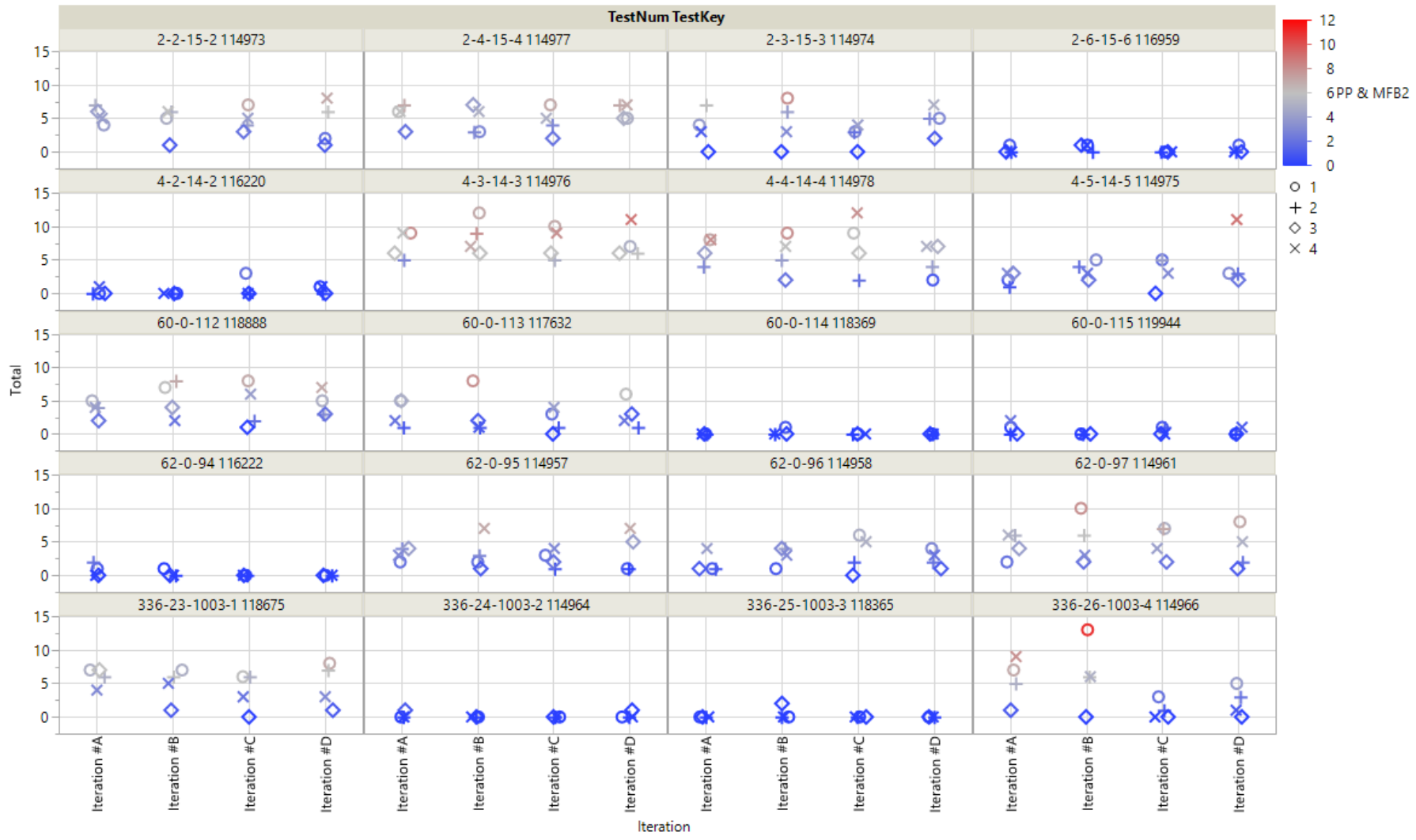


Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder

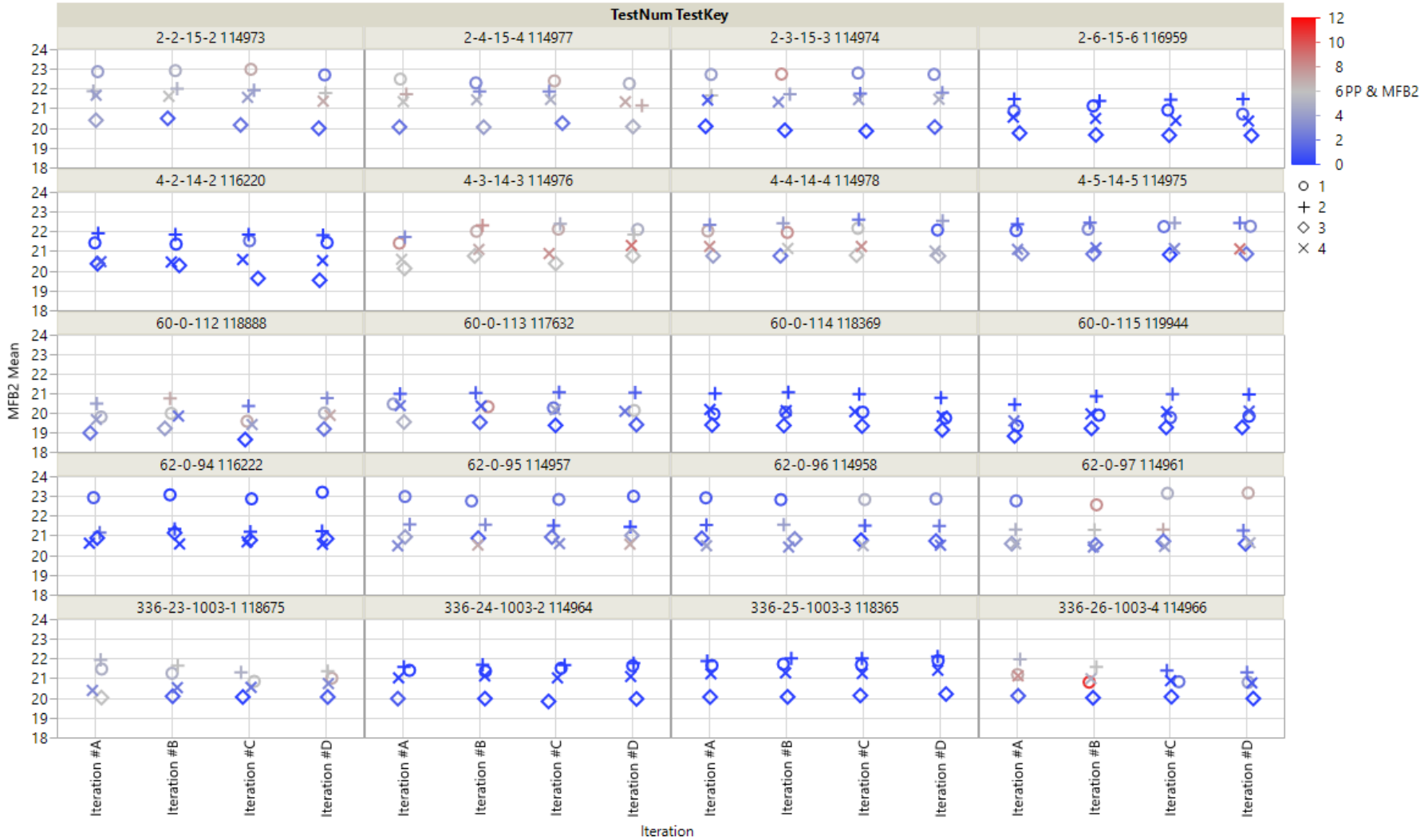


Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder

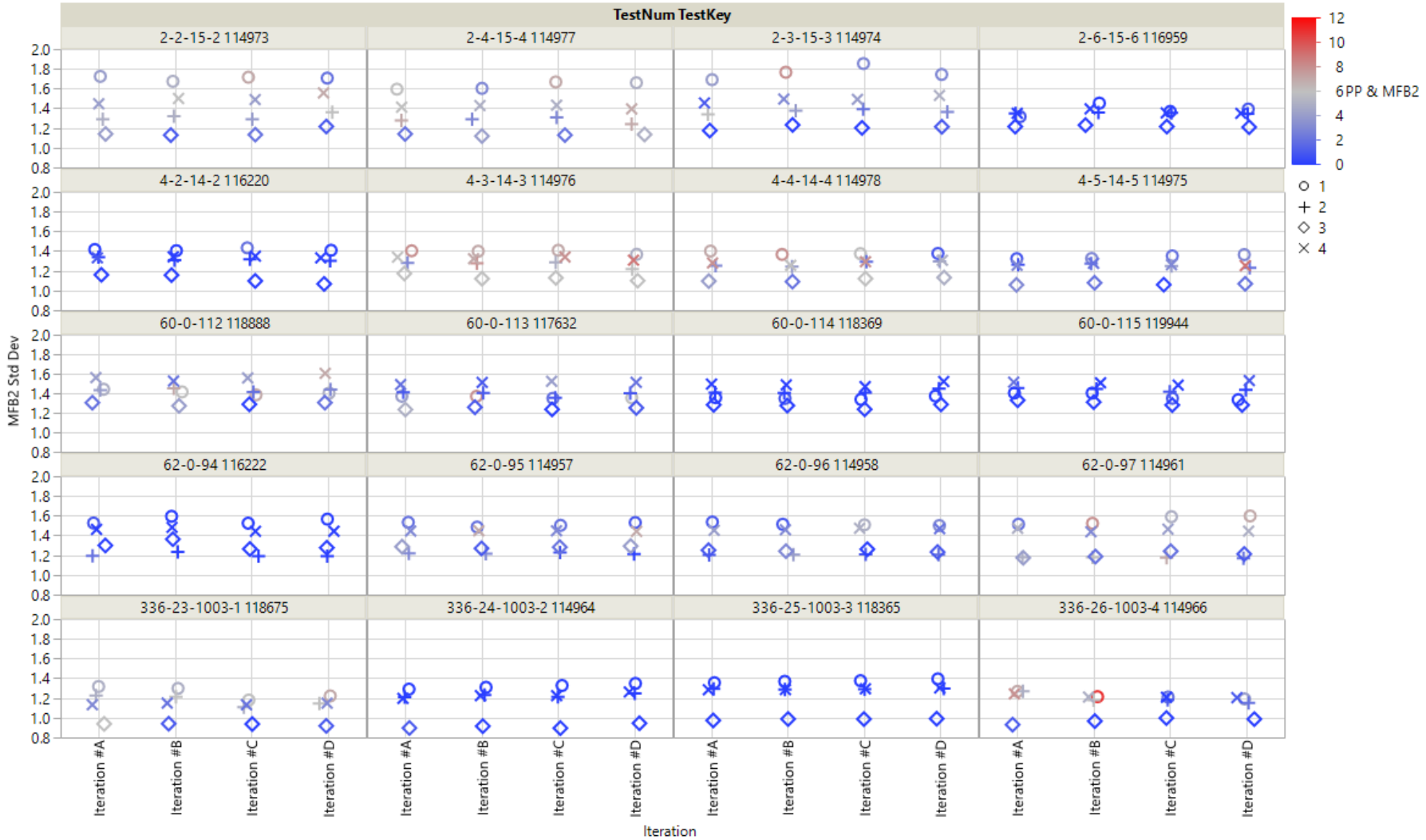


Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder

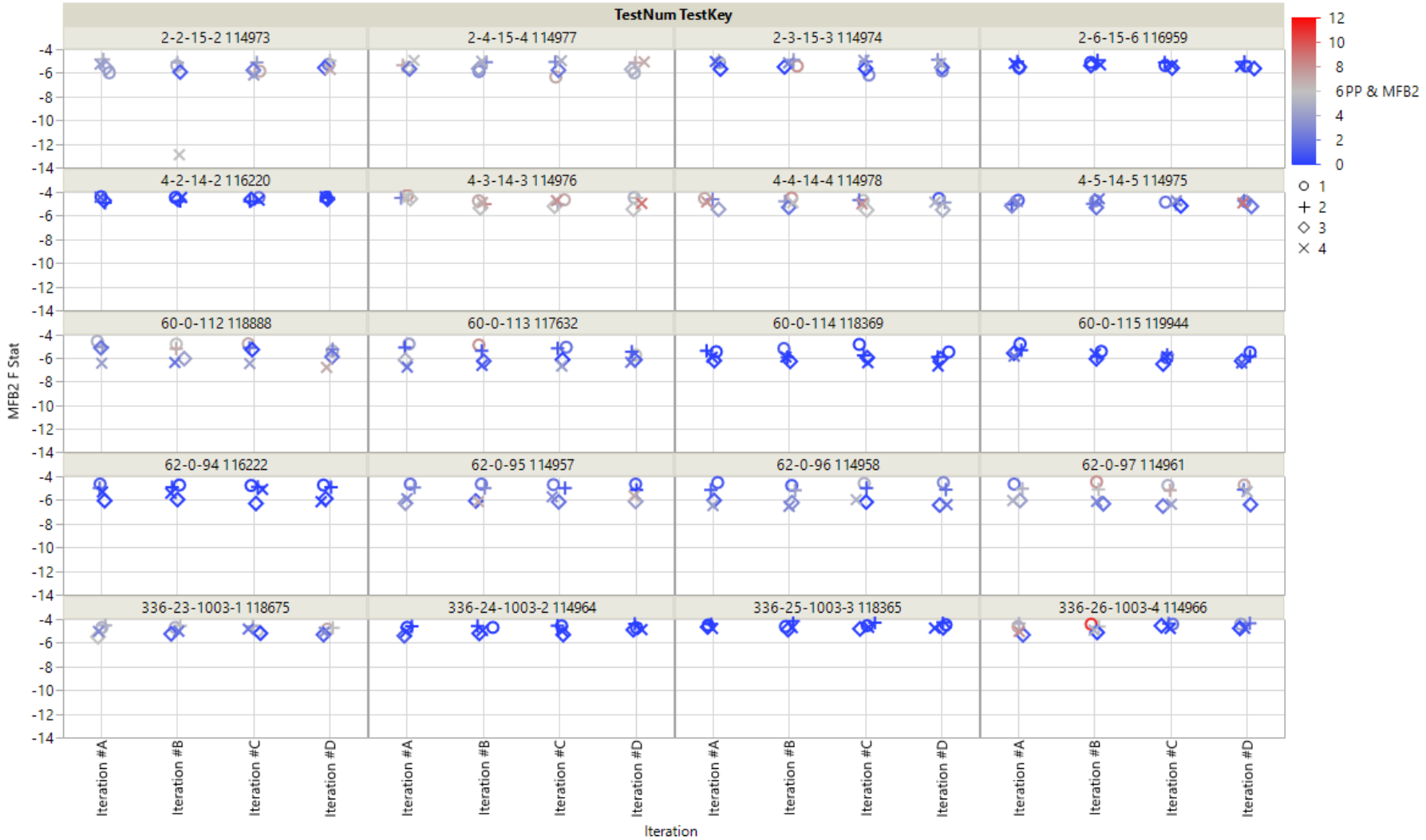


Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder



Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

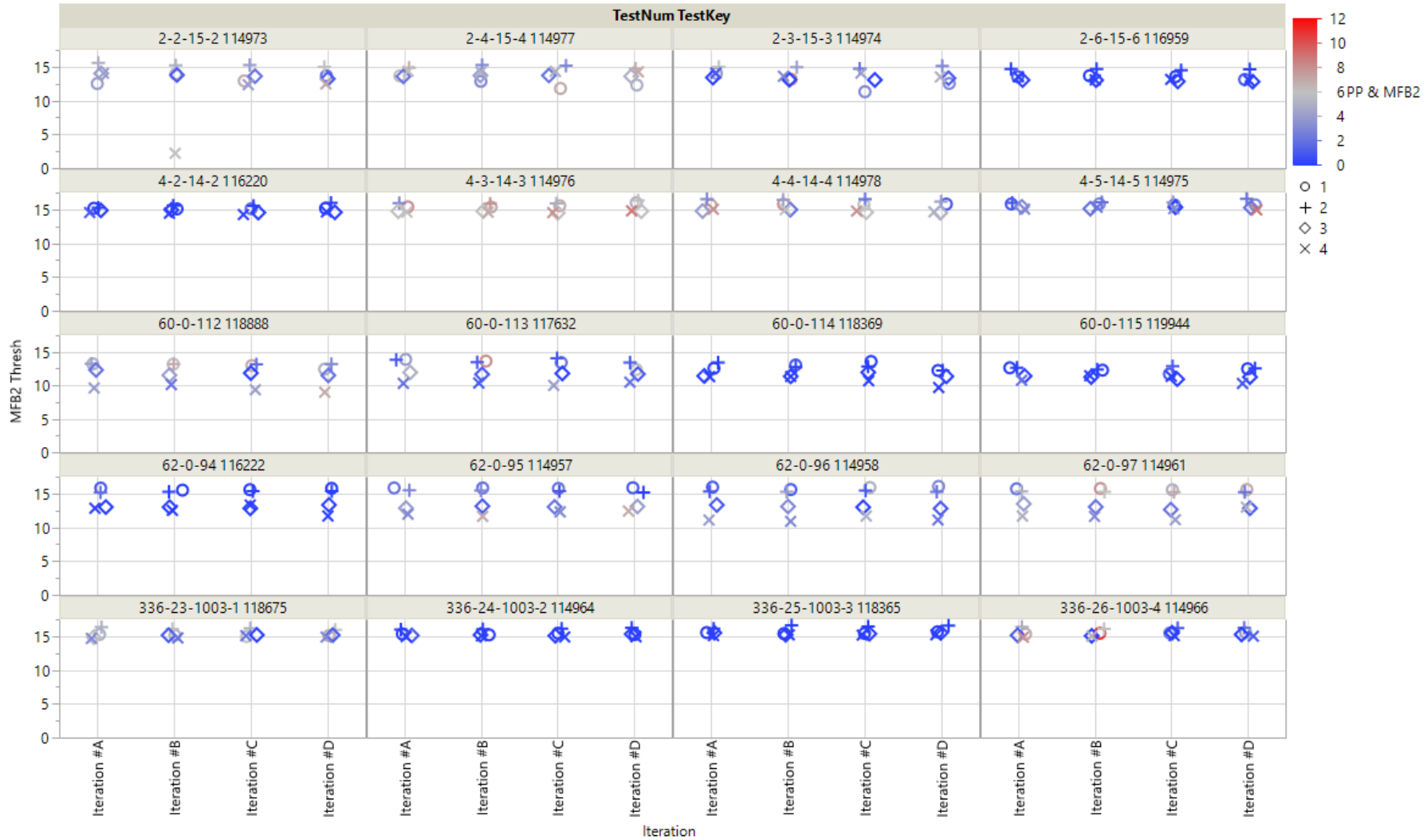
ZOOMED IN

SUCCESS TOGETHER

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder



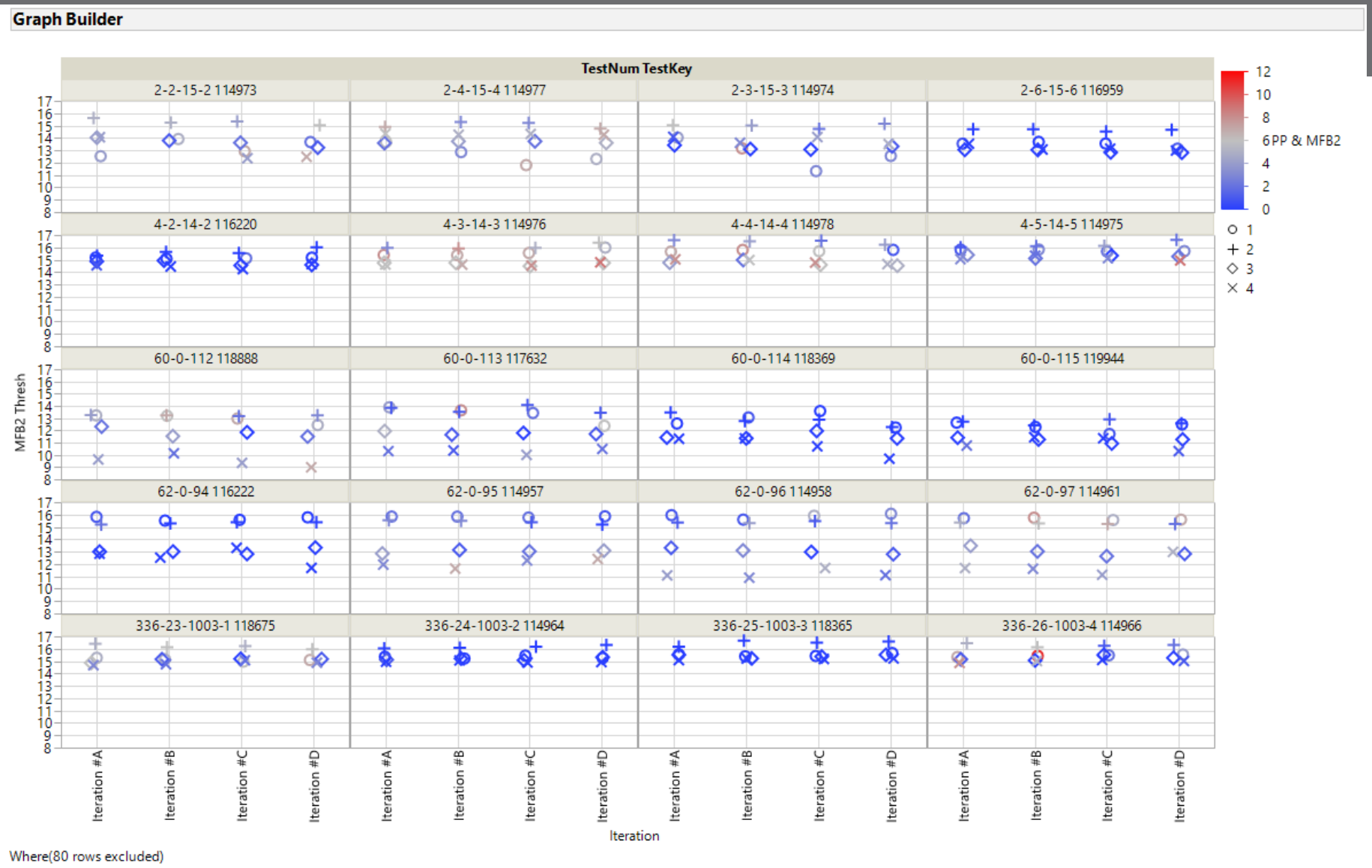
Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

ZOOMED IN

SUCCESS TOGETHER



© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

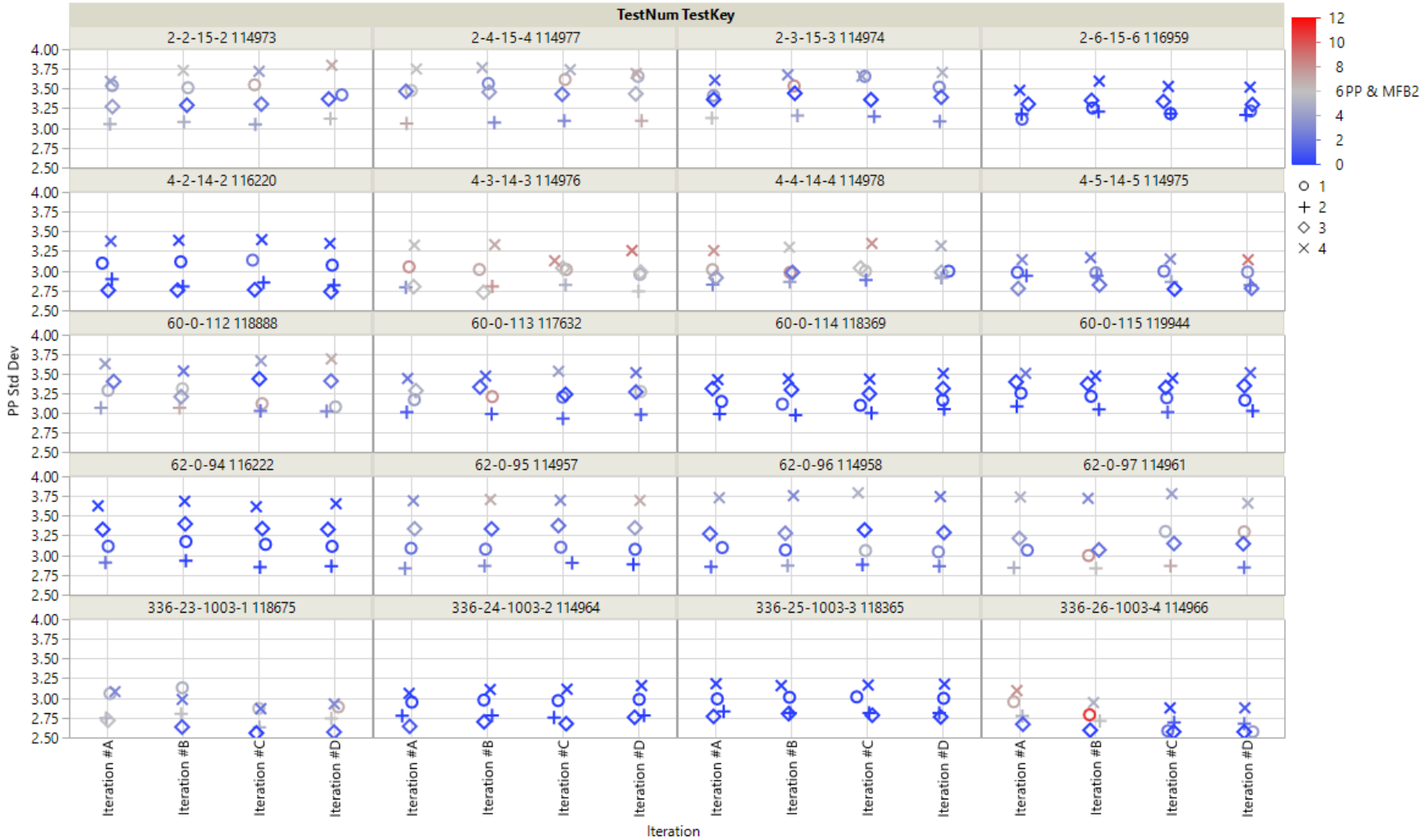
Graph Builder

Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder

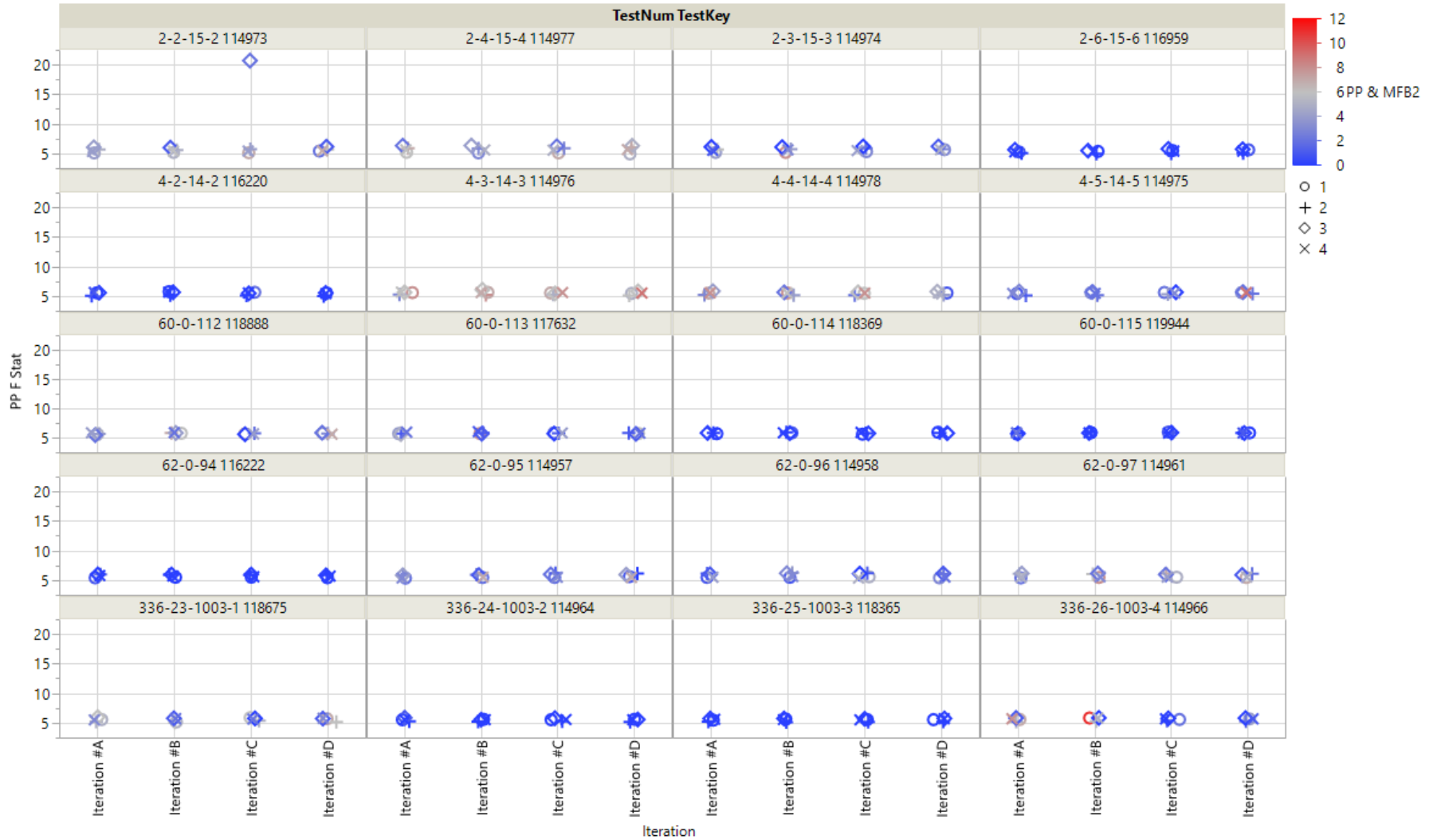


Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder



Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

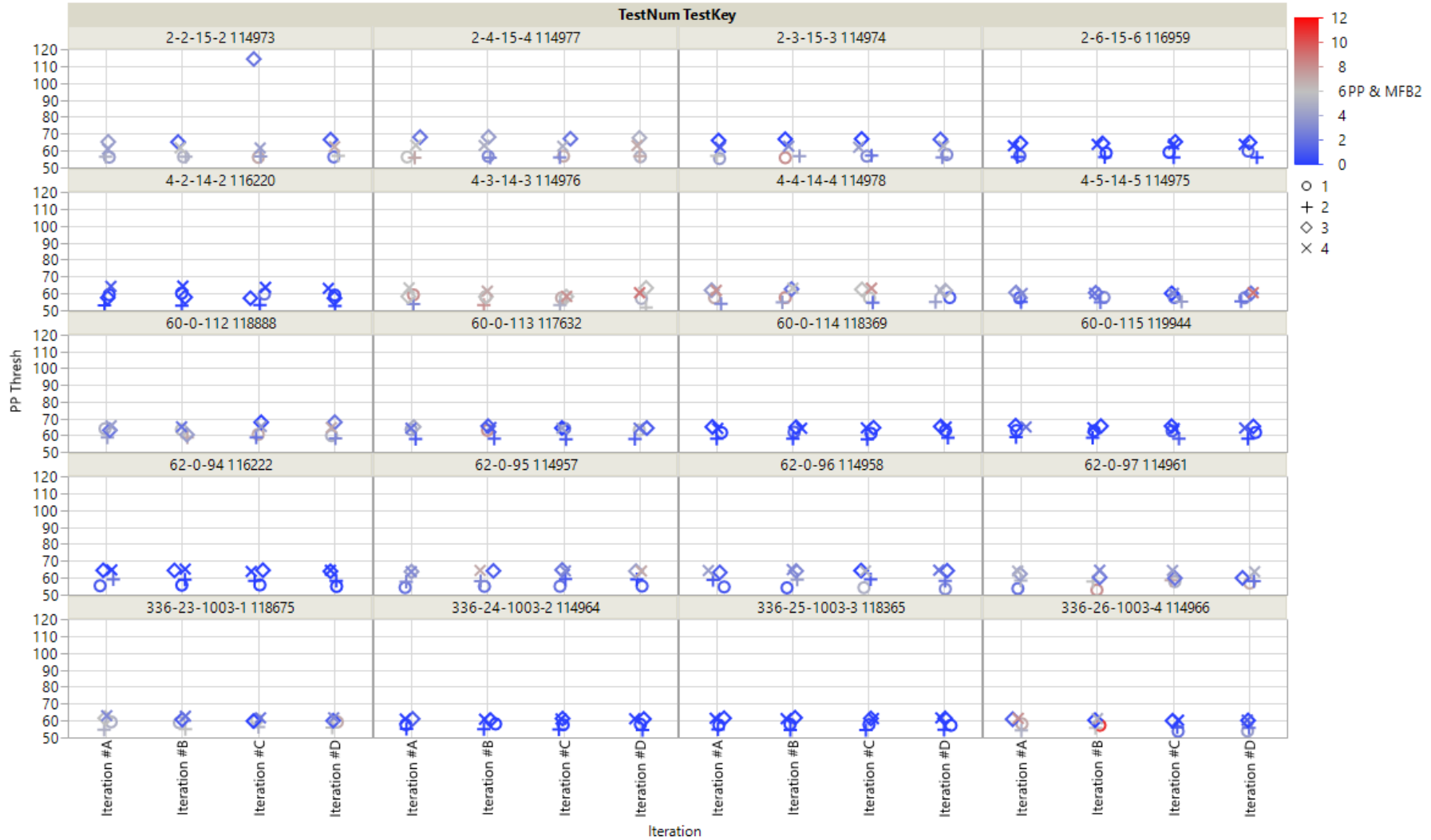
ZOOMED IN

SUCCESS TOGETHER

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder



Where(80 rows excluded)

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

ZOOMED IN

SUCCESS TOGETHER

© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

SUCCESS TOGETHER

Chemical Analysis Data

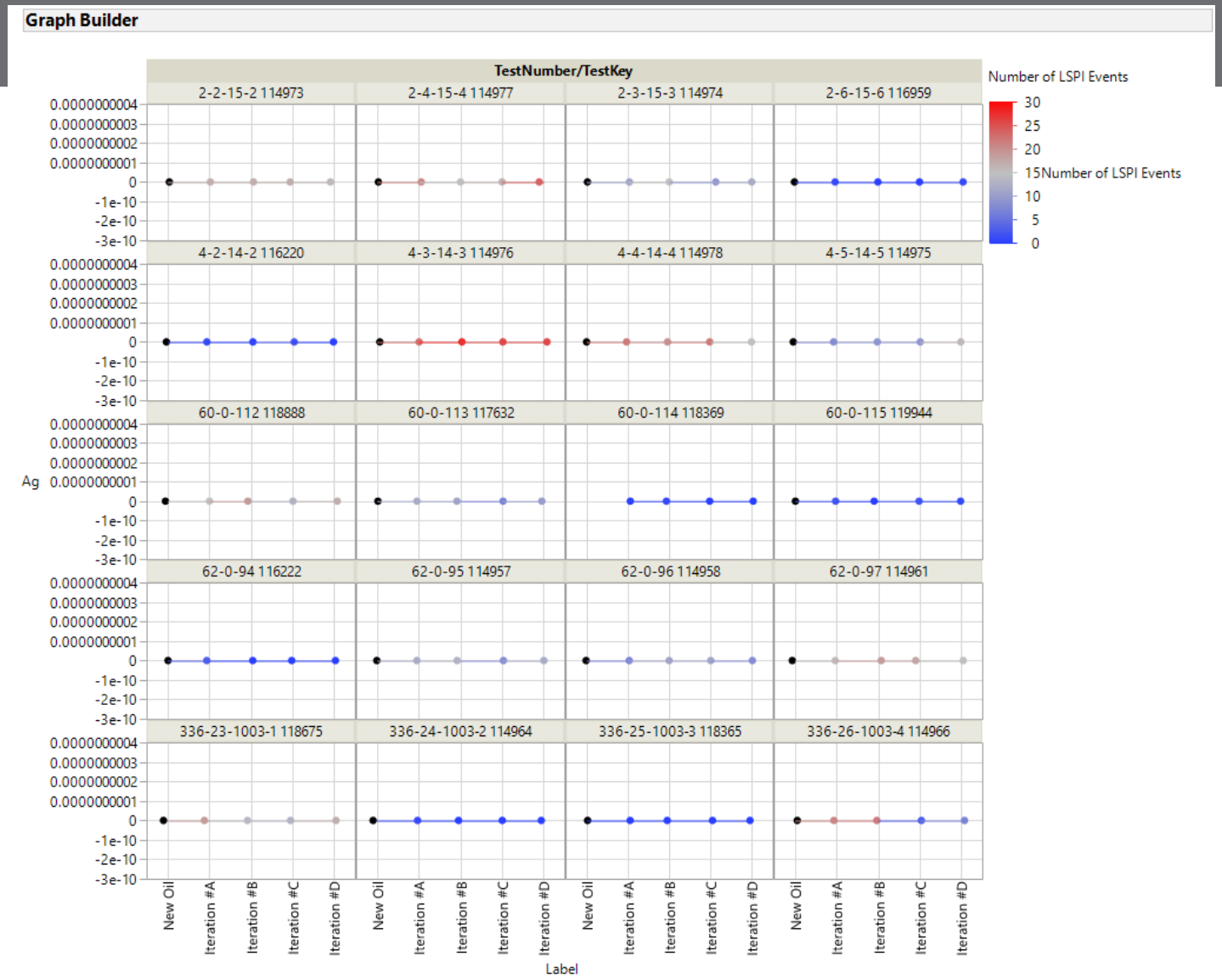
Plots show chemical analysis data recorded in the ltms file on the TMC site.

Each test is in its own pane with the data colored by the number of LSPI events.

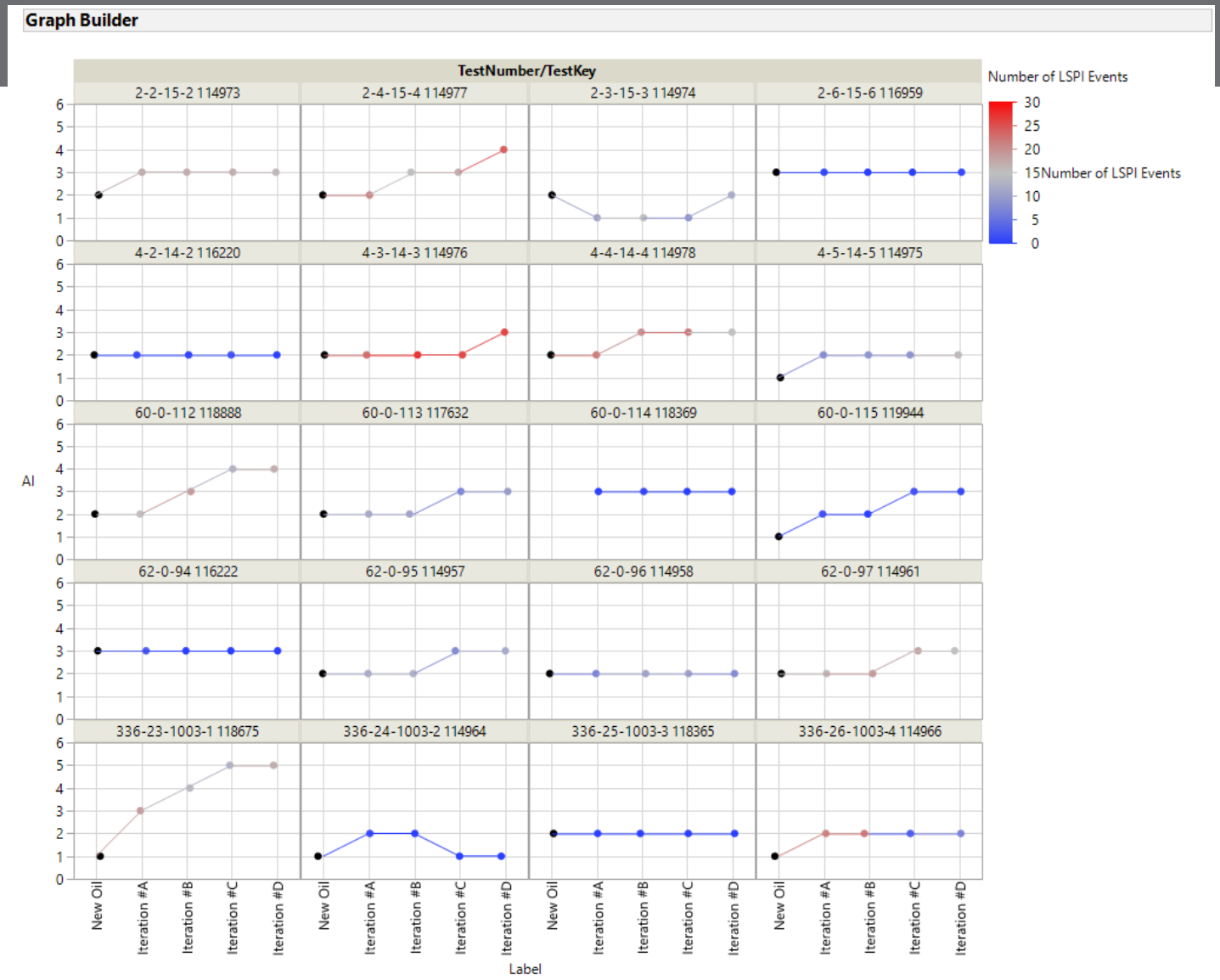
The new oil analyticals are shown alongside the elementals from the four valid iterations of each test.

© 2016 The Lubrizol Corporation, all rights reserved.

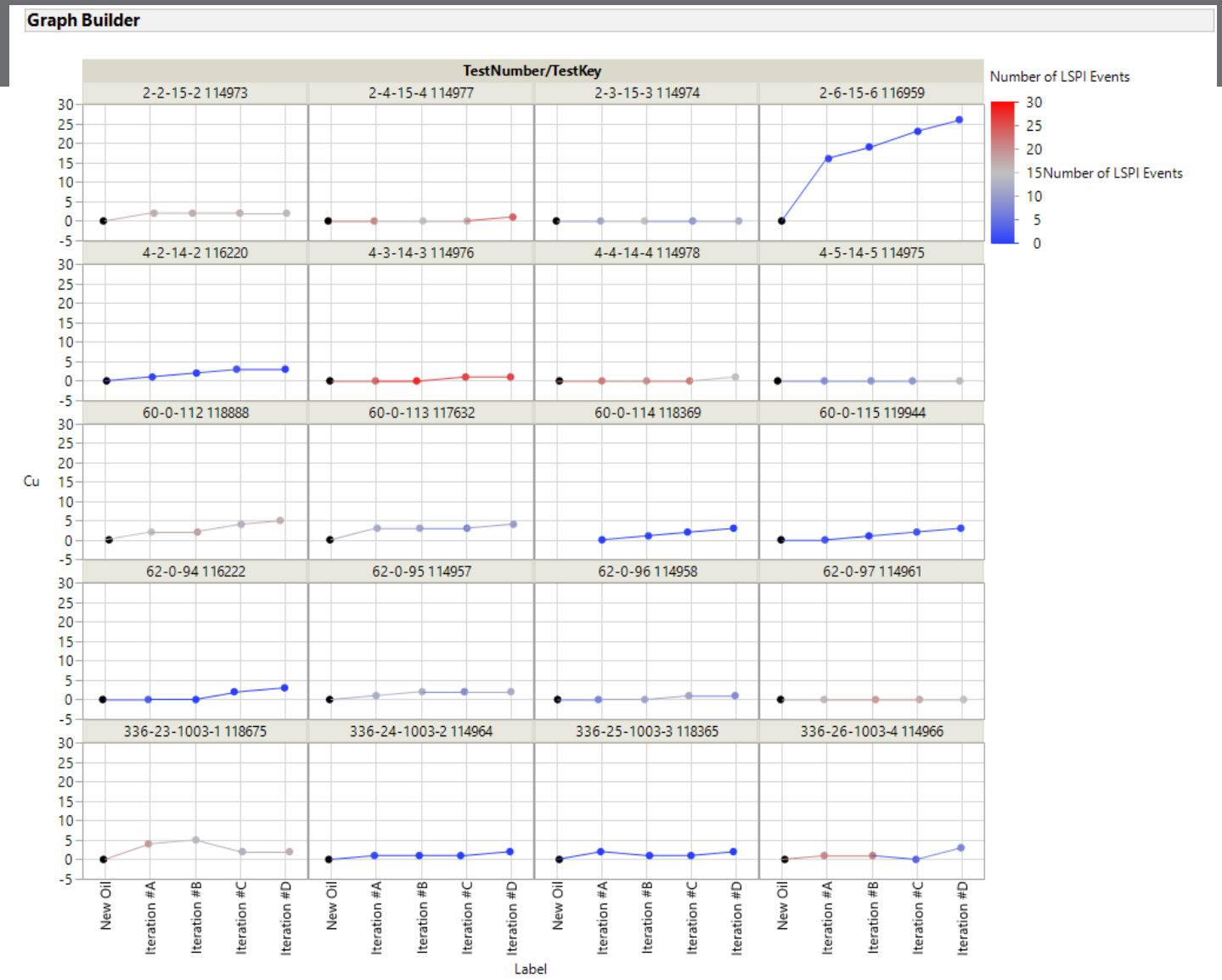
Lubrizol



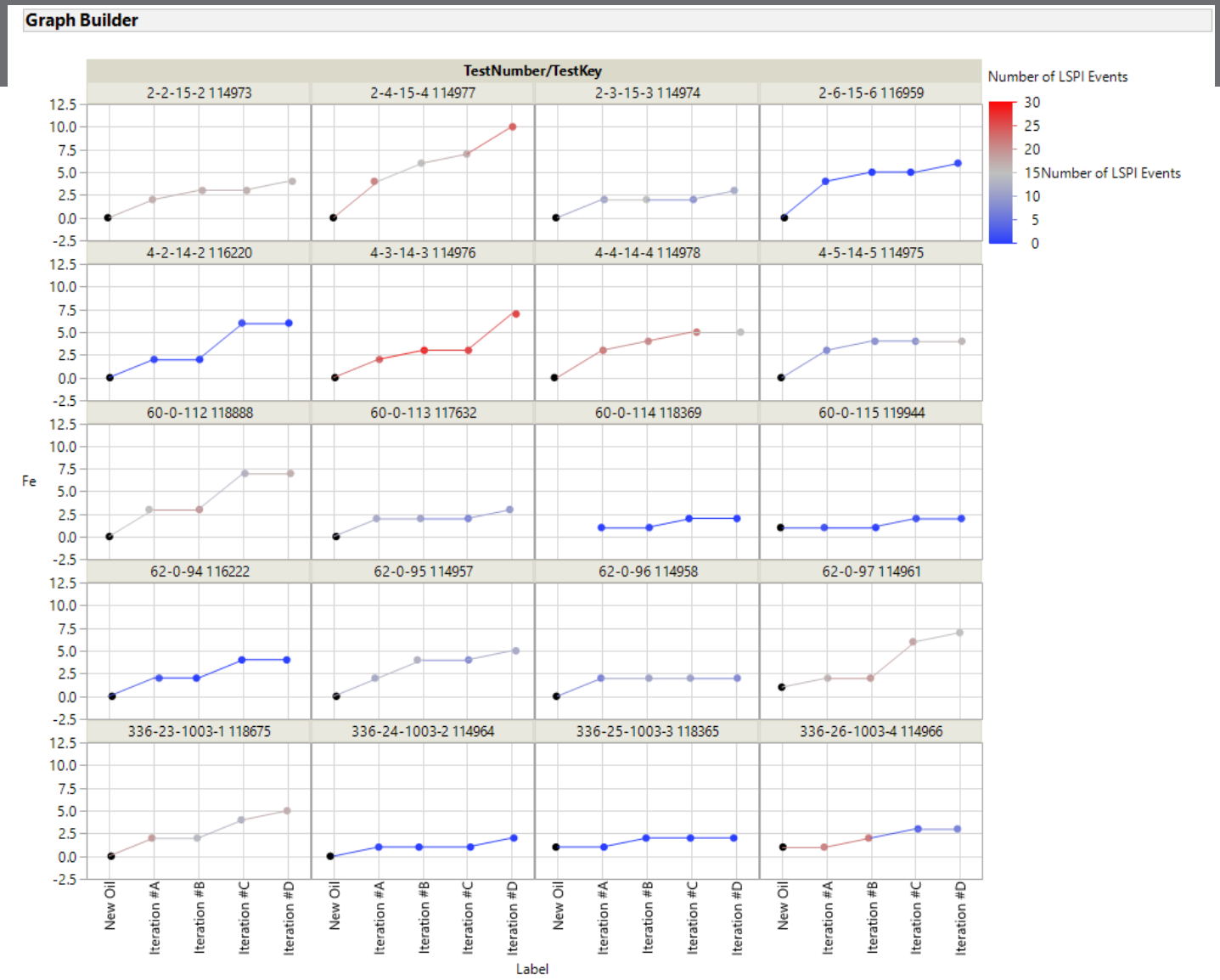
© 2016 The Lubrizol Corporation, all rights reserved.



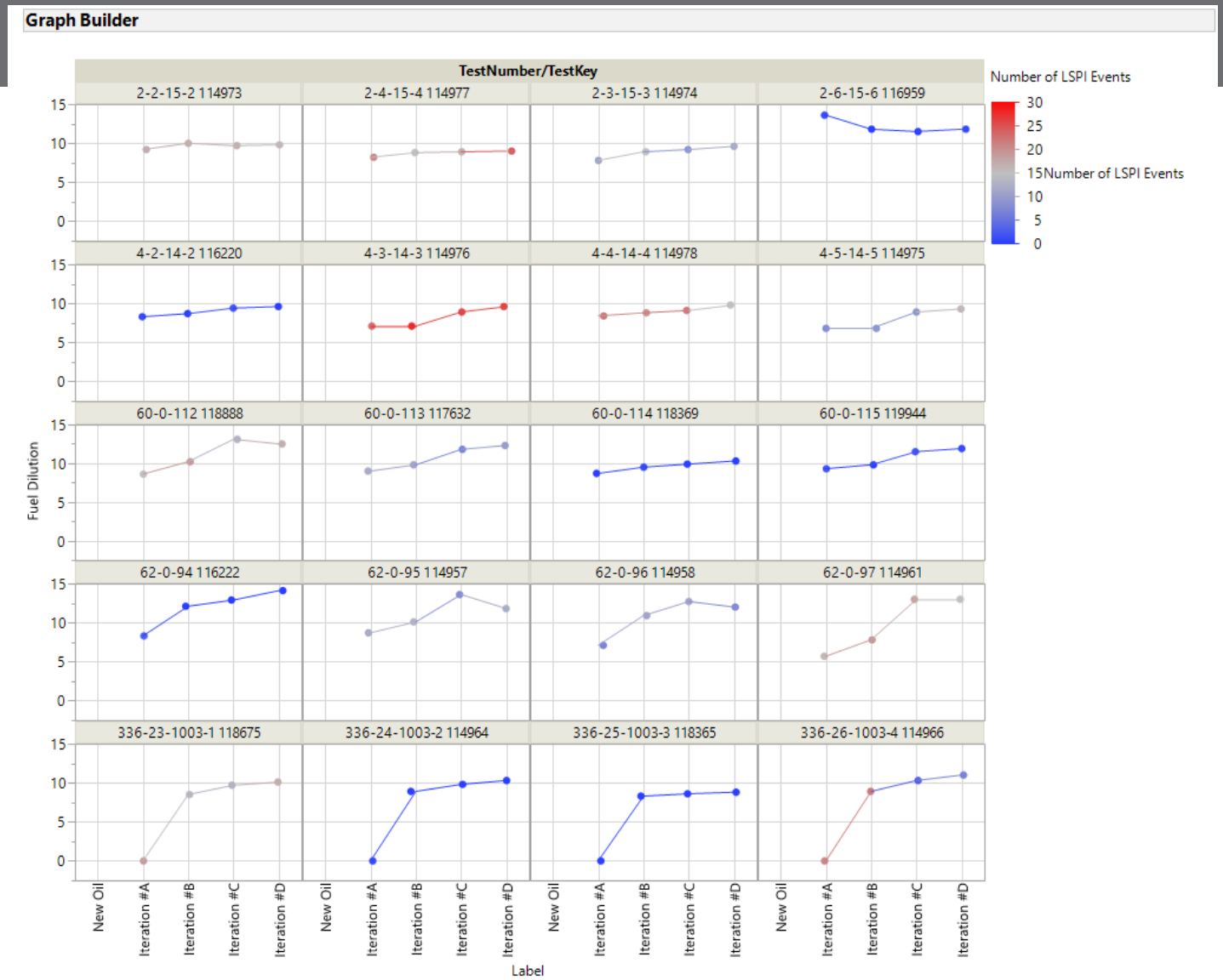
© 2016 The Lubrizol Corporation, all rights reserved.



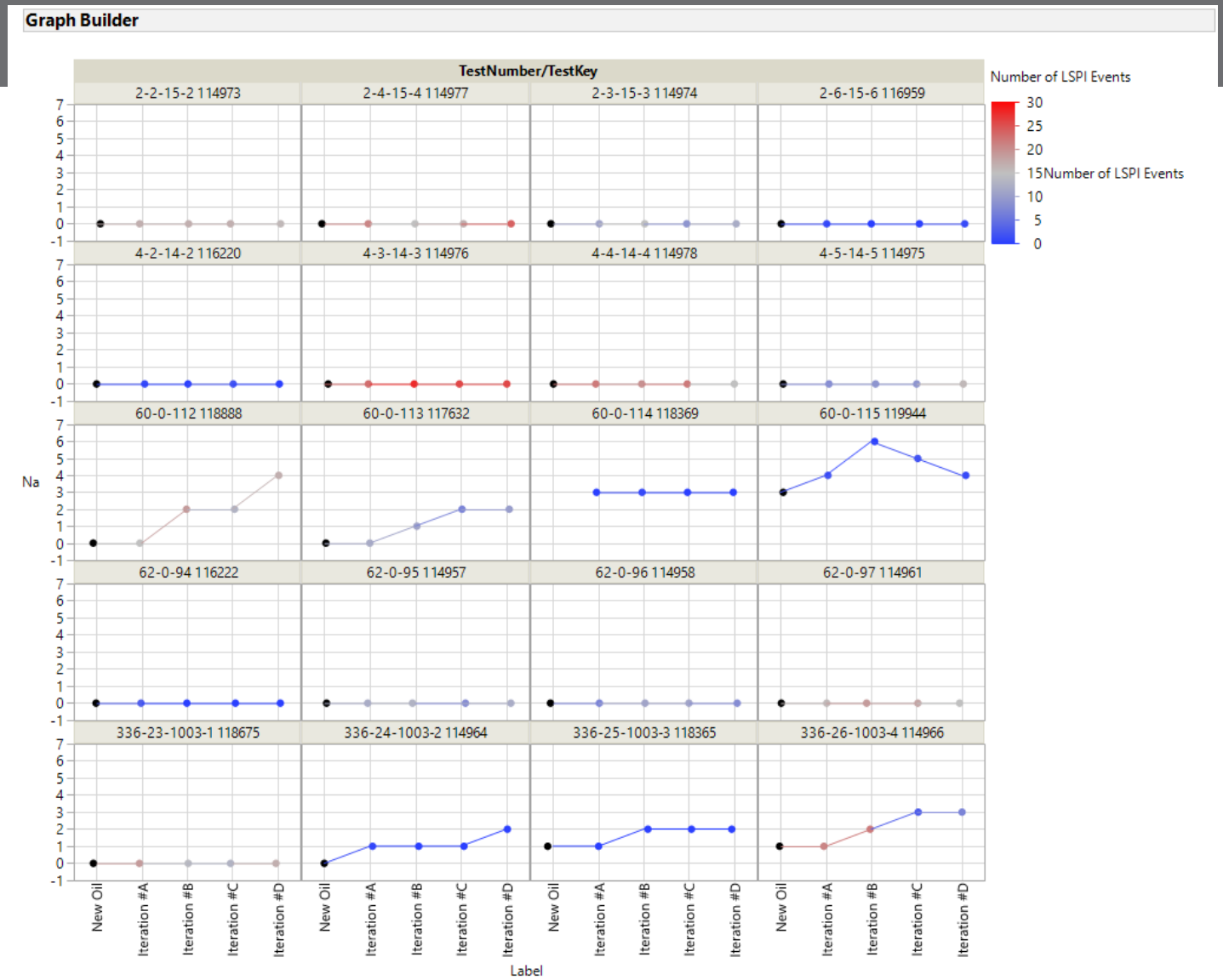
© 2016 The Lubrizol Corporation, all rights reserved.



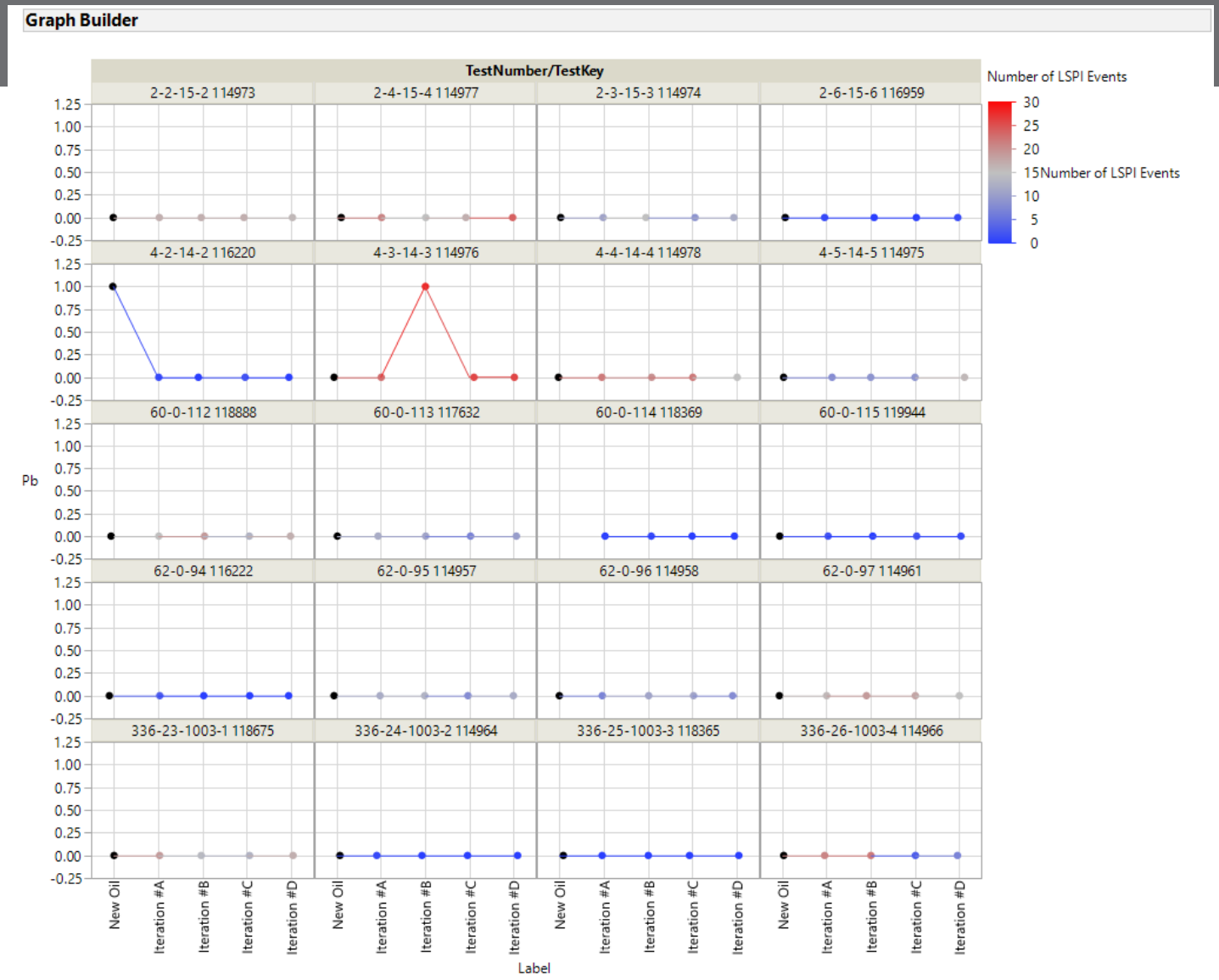
© 2016 The Lubrizol Corporation, all rights reserved.



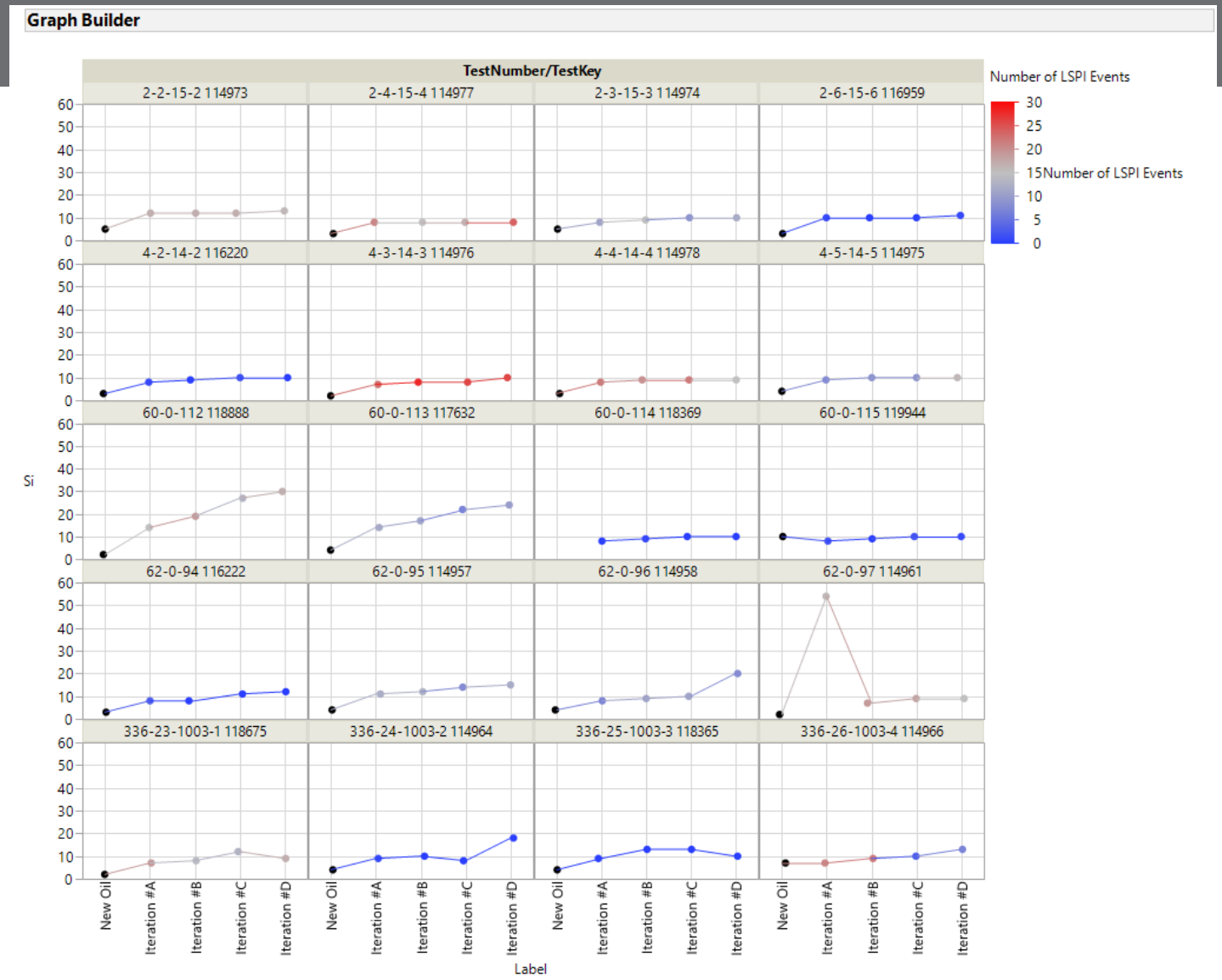
© 2016 The Lubrizol Corporation, all rights reserved.



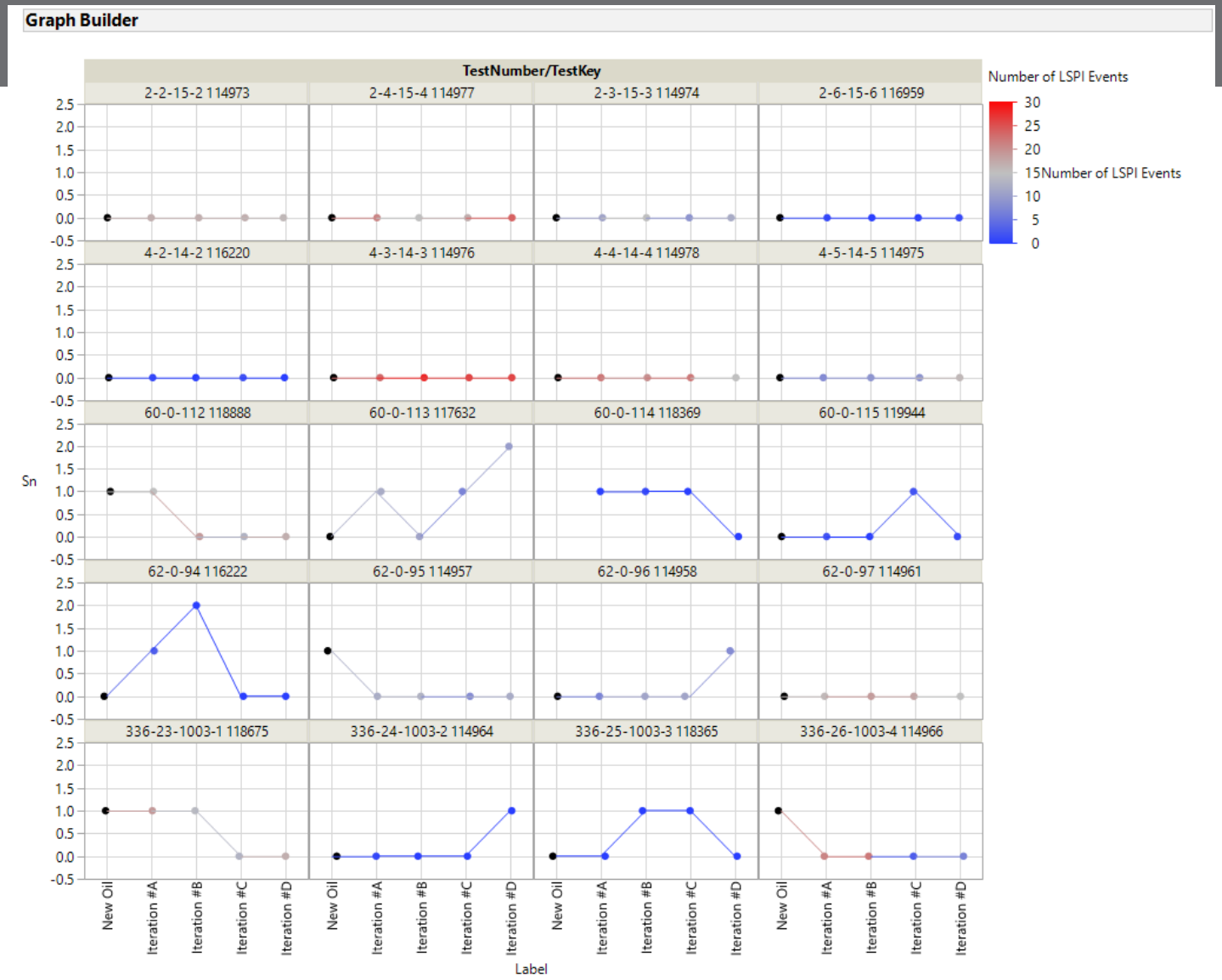
© 2016 The Lubrizol Corporation, all rights reserved.



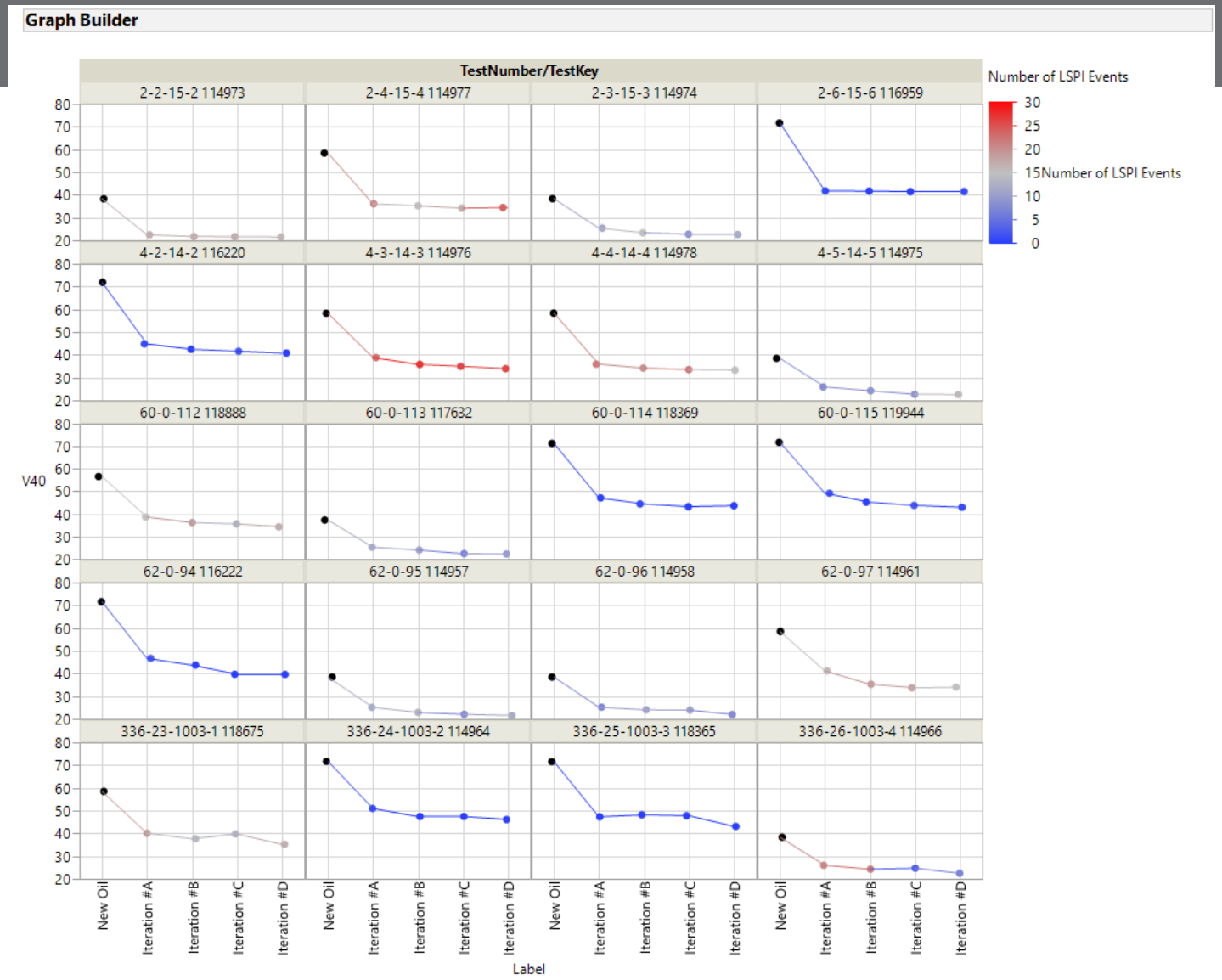
© 2016 The Lubrizol Corporation, all rights reserved.



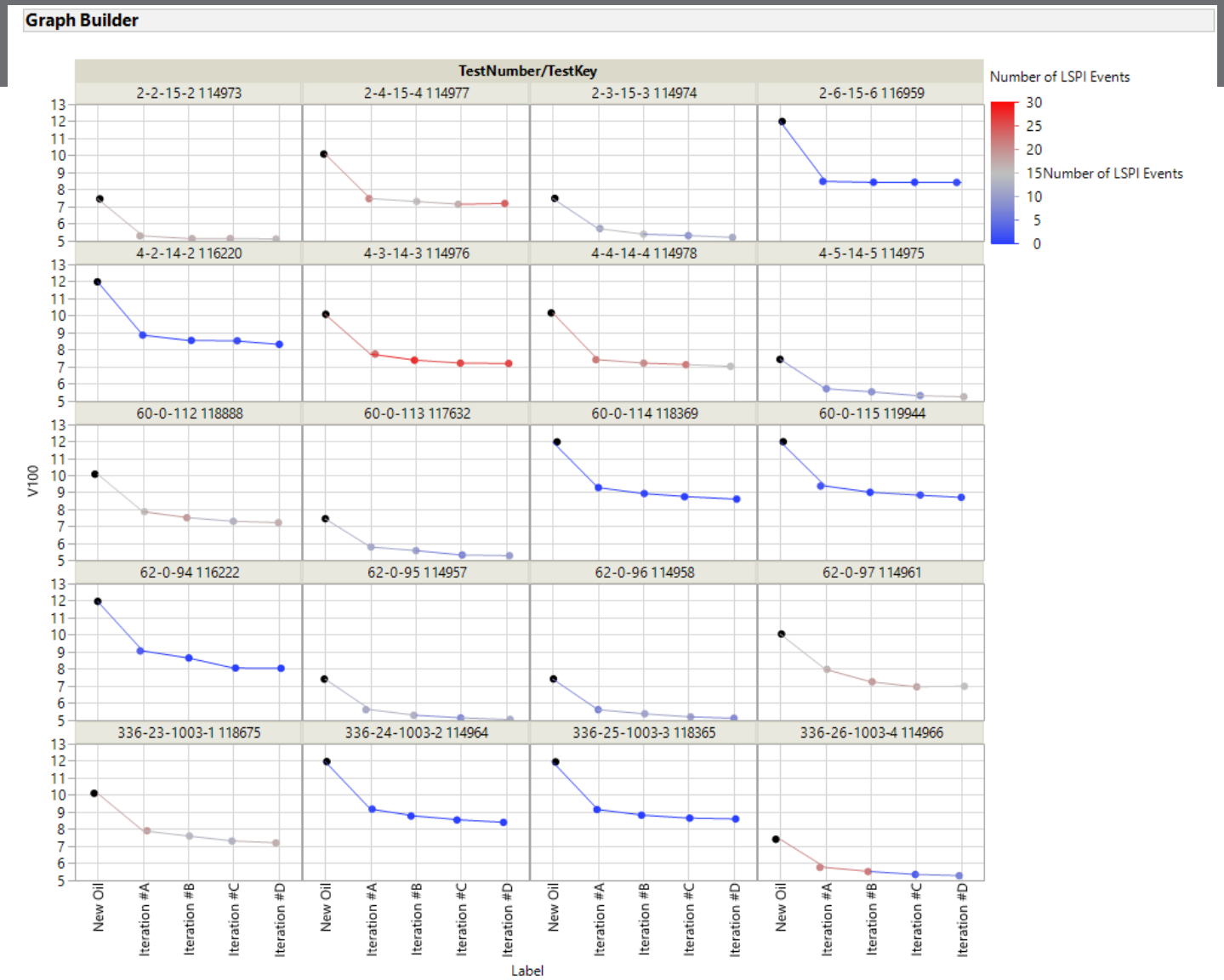
© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.

SUCCESS TOGETHER

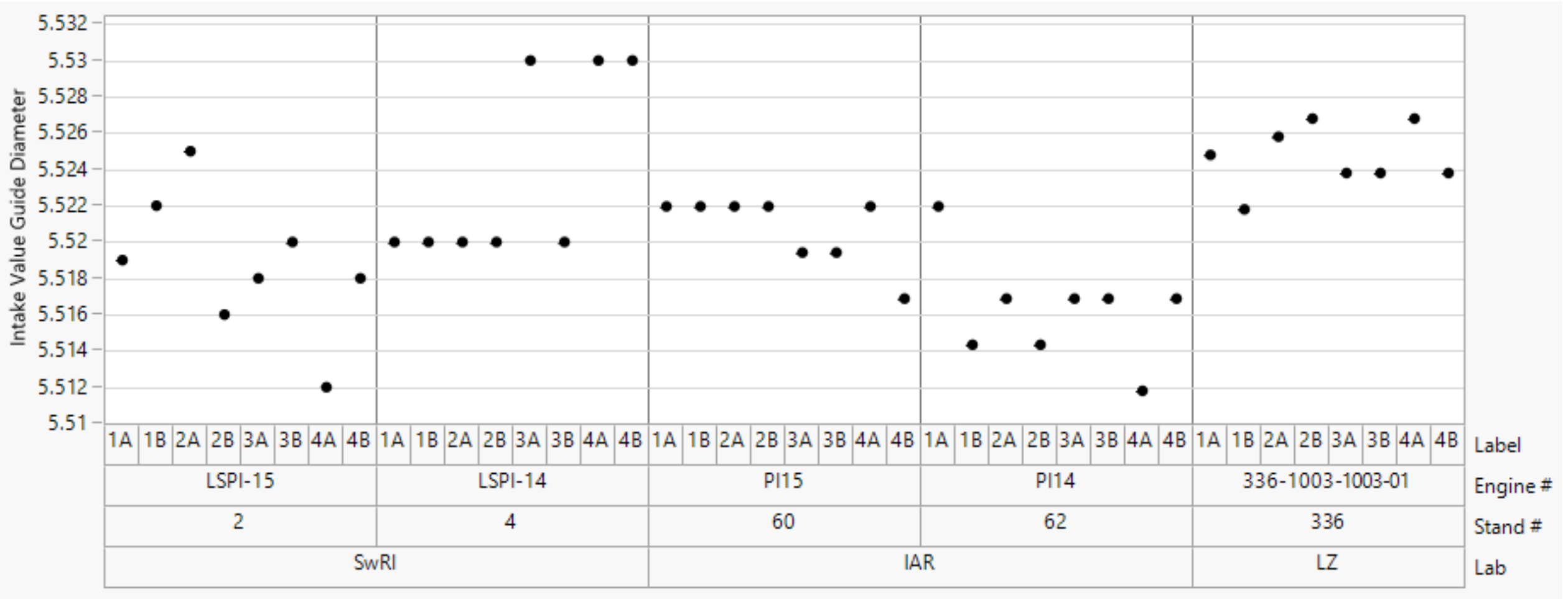
Engine Build Data

Plots show build data recorded in the individual test files uploaded to the TMC site.

Each pane corresponds to one of the engines in the precision matrix.

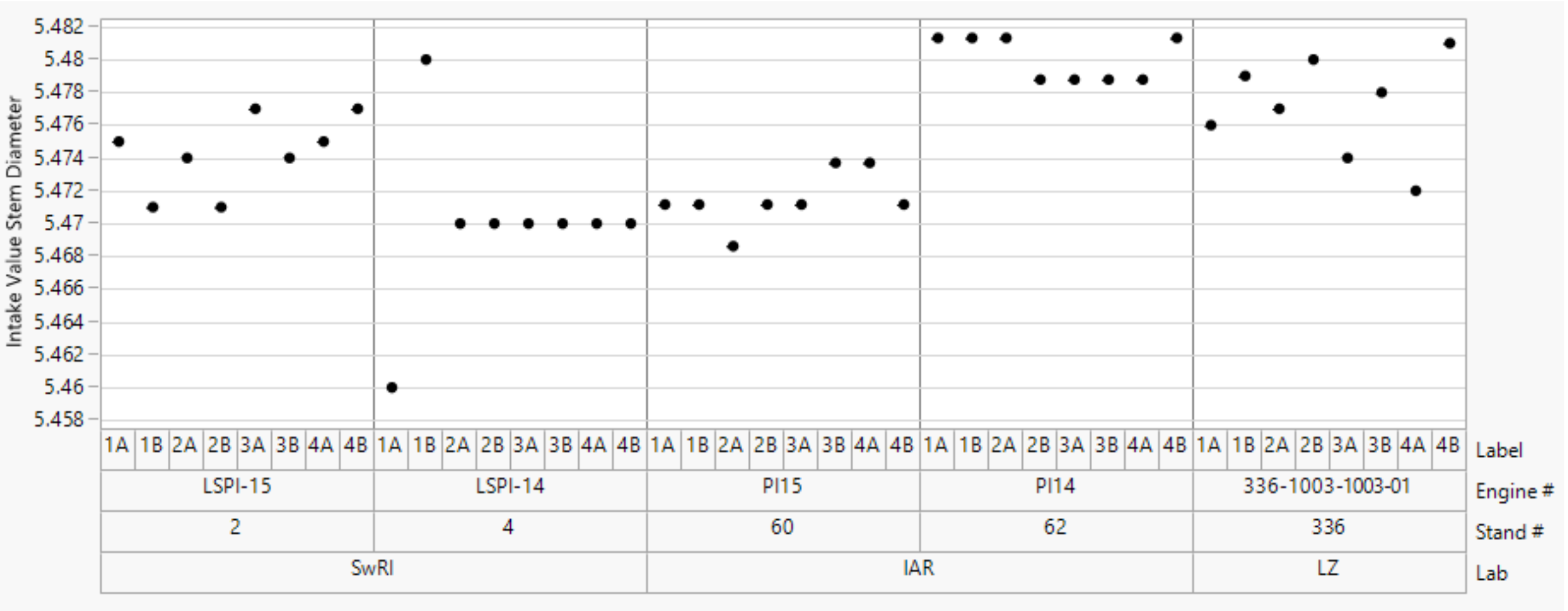
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



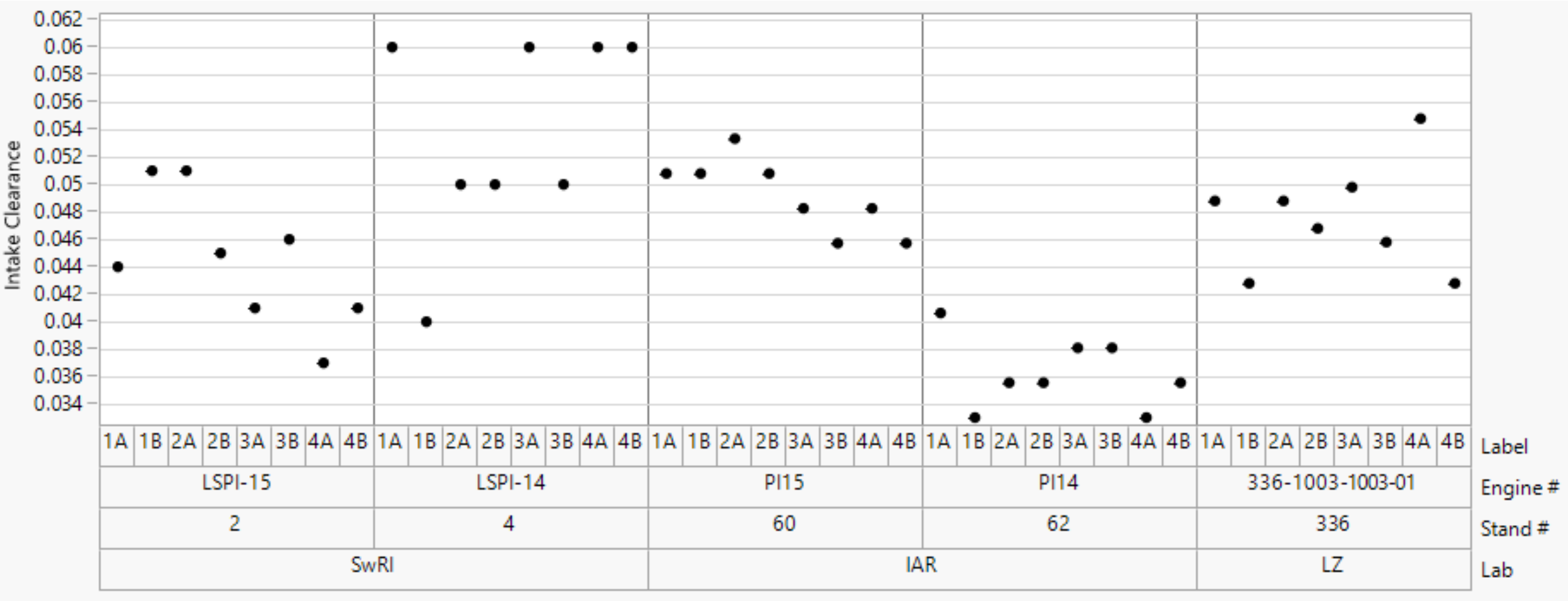
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



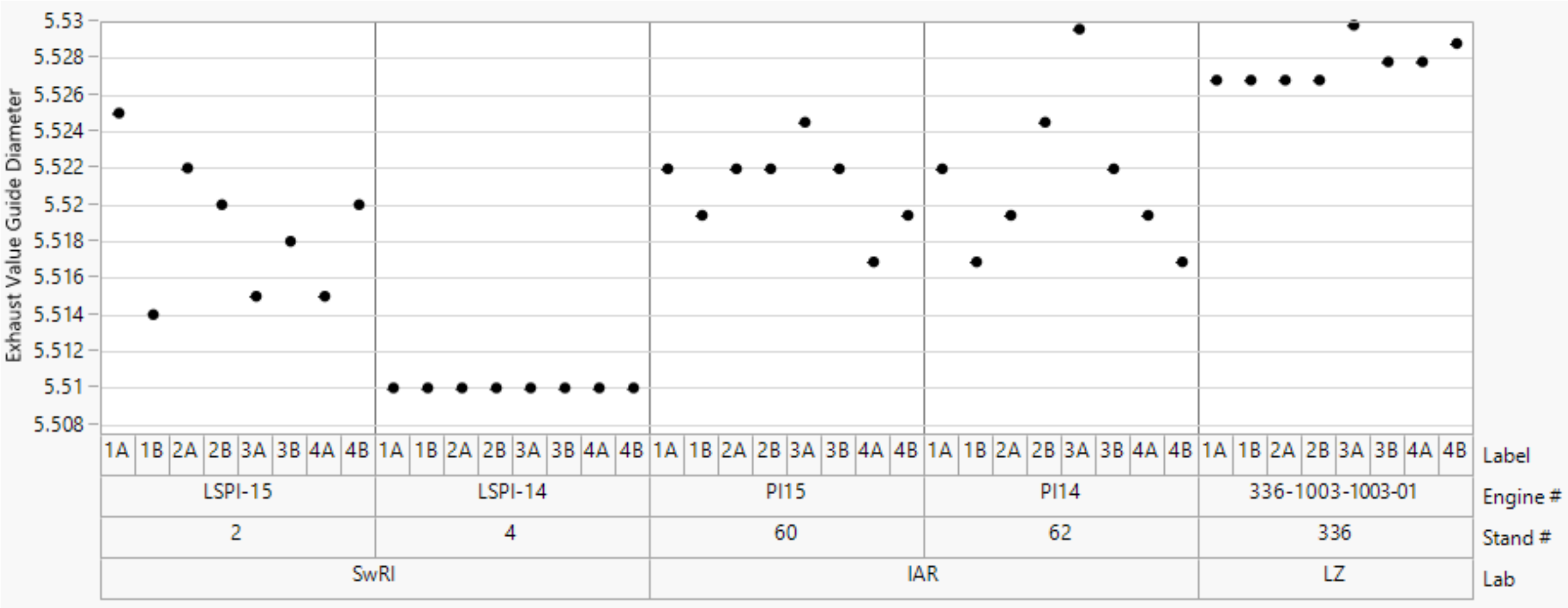
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



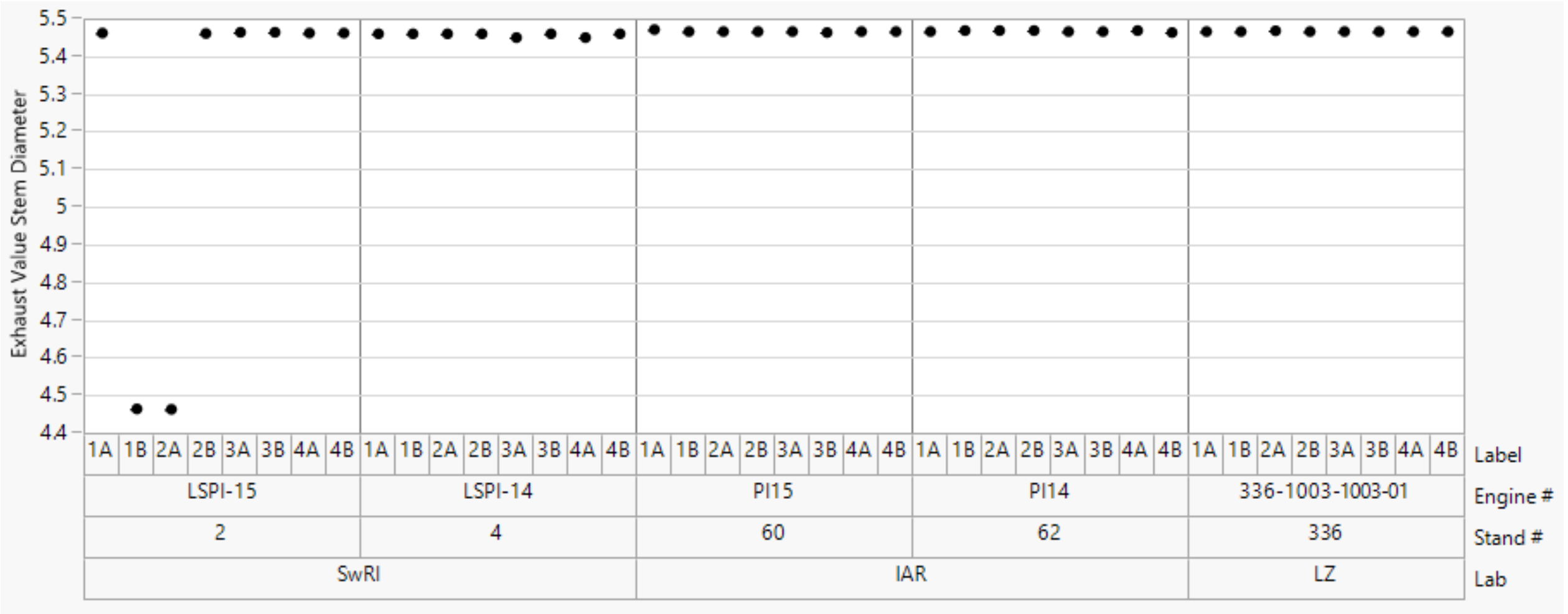
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



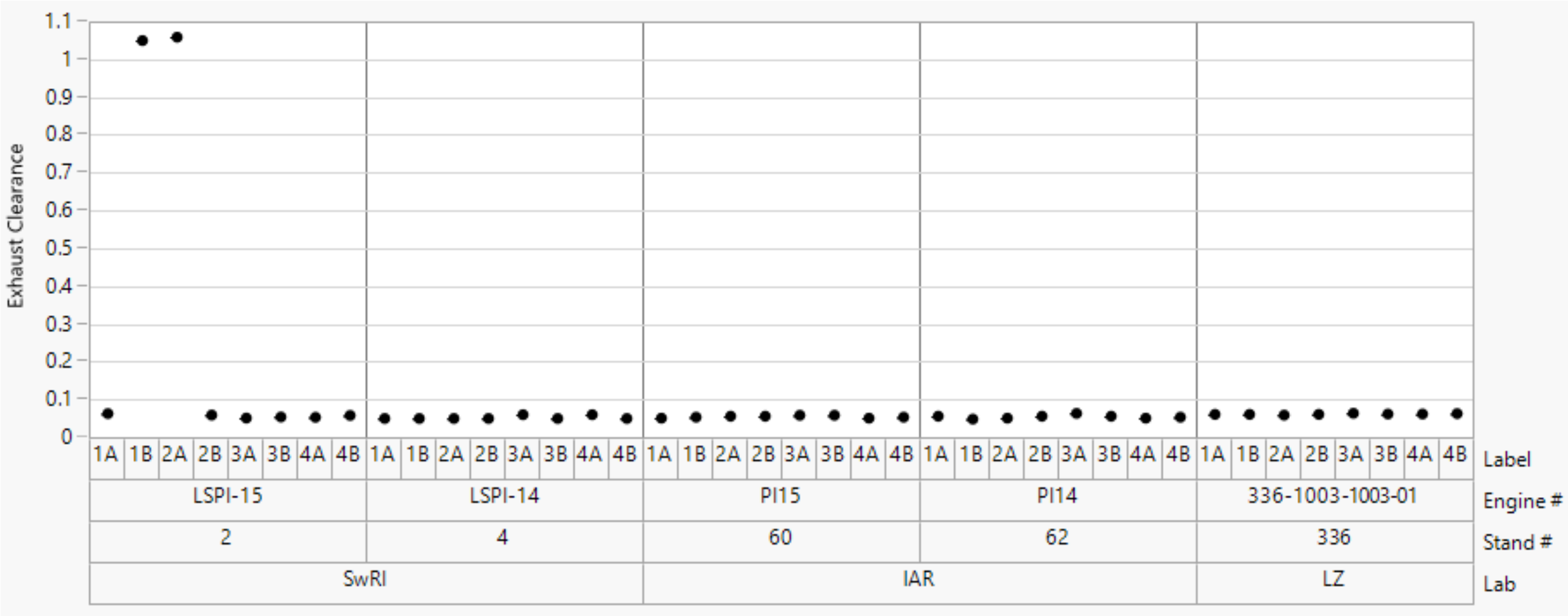
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



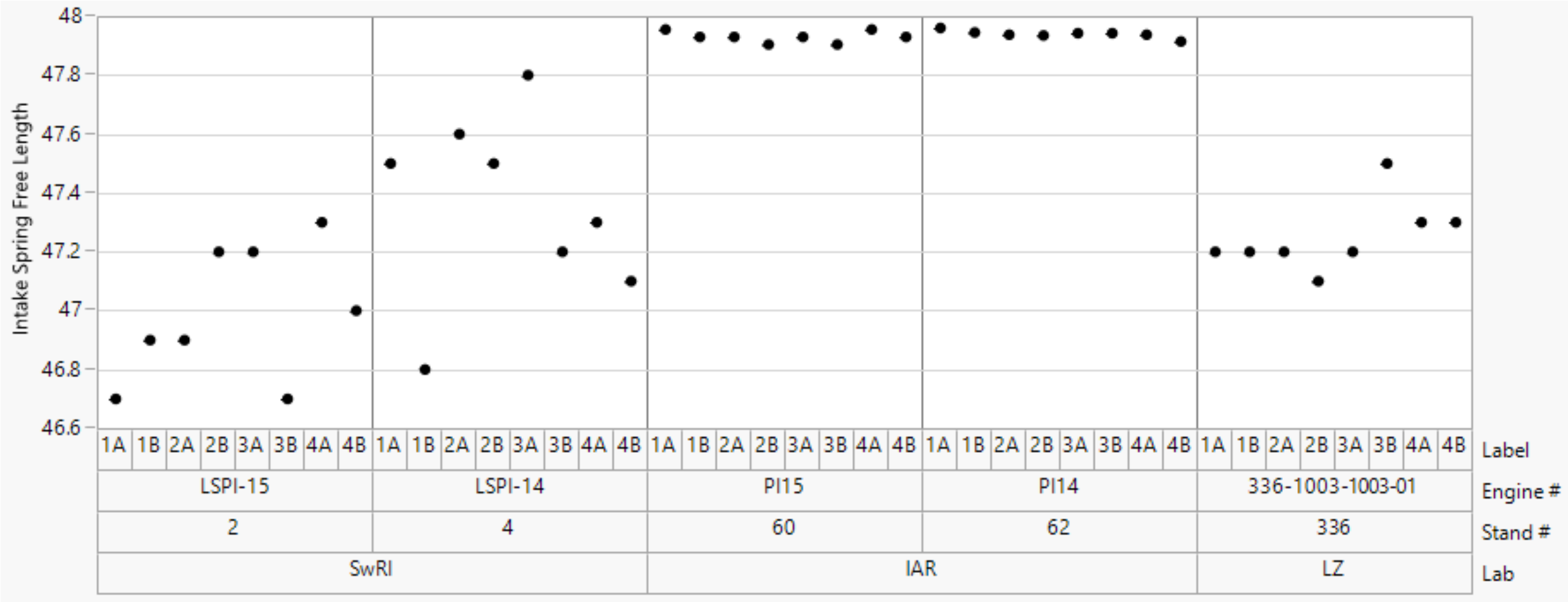
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



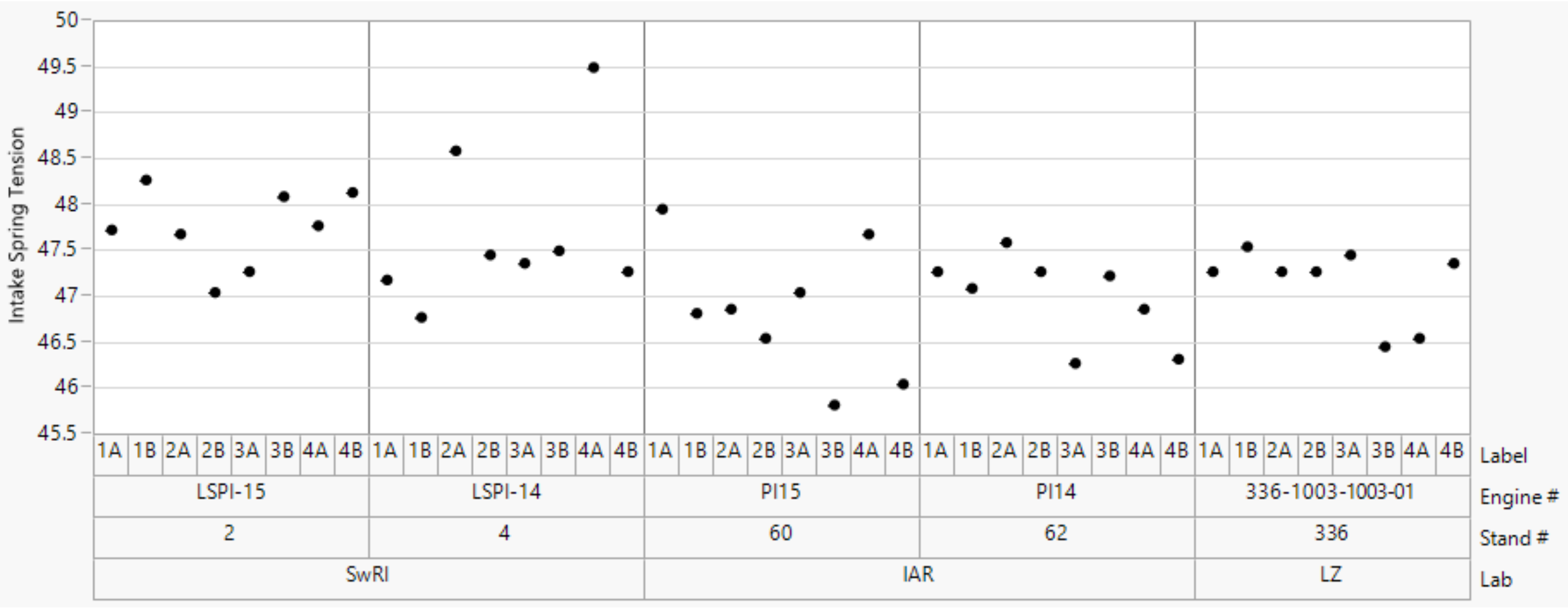
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

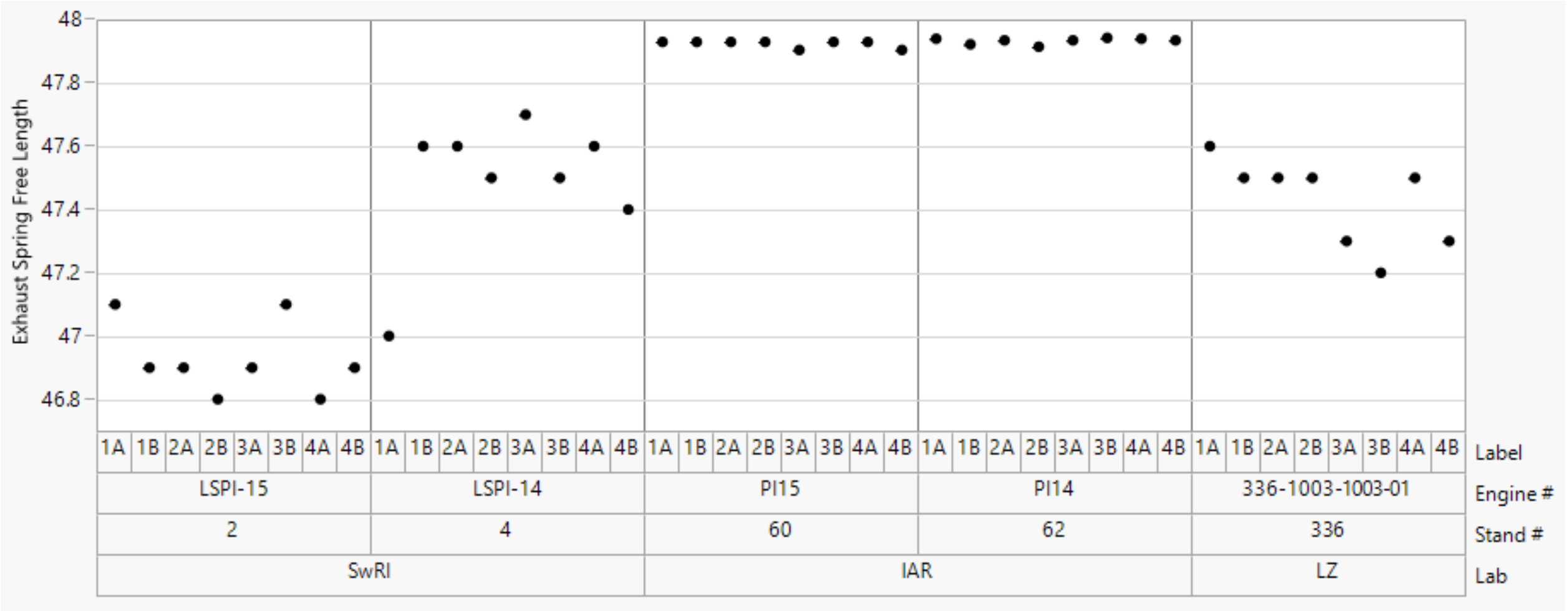


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

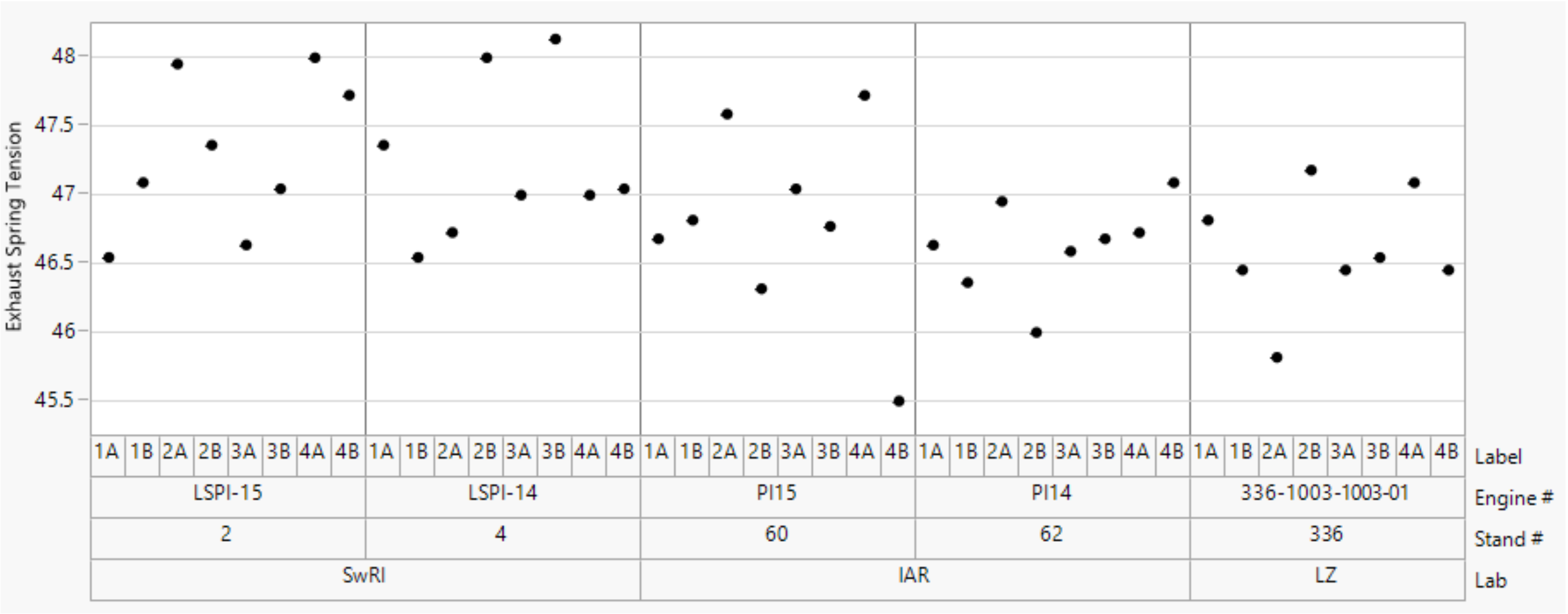


© 2016 The Lubrizol Corporation, all rights reserved.

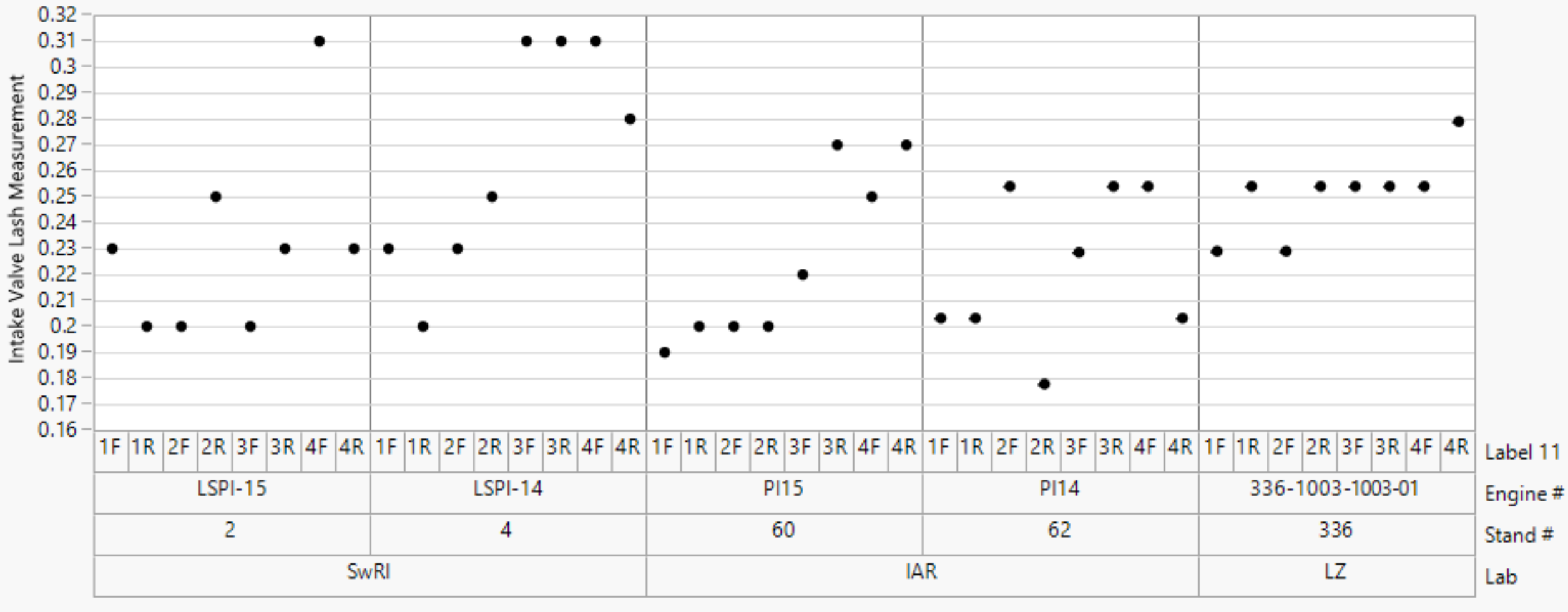


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

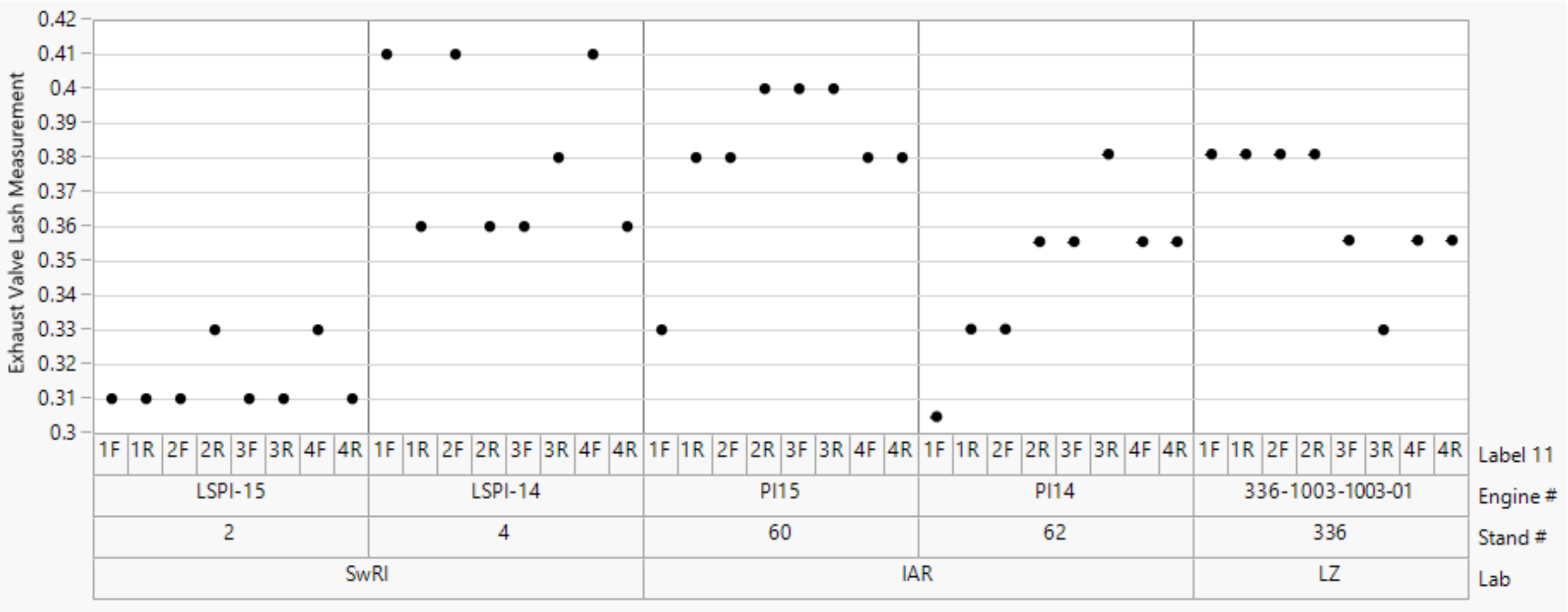


© 2016 The Lubrizol Corporation, all rights reserved.



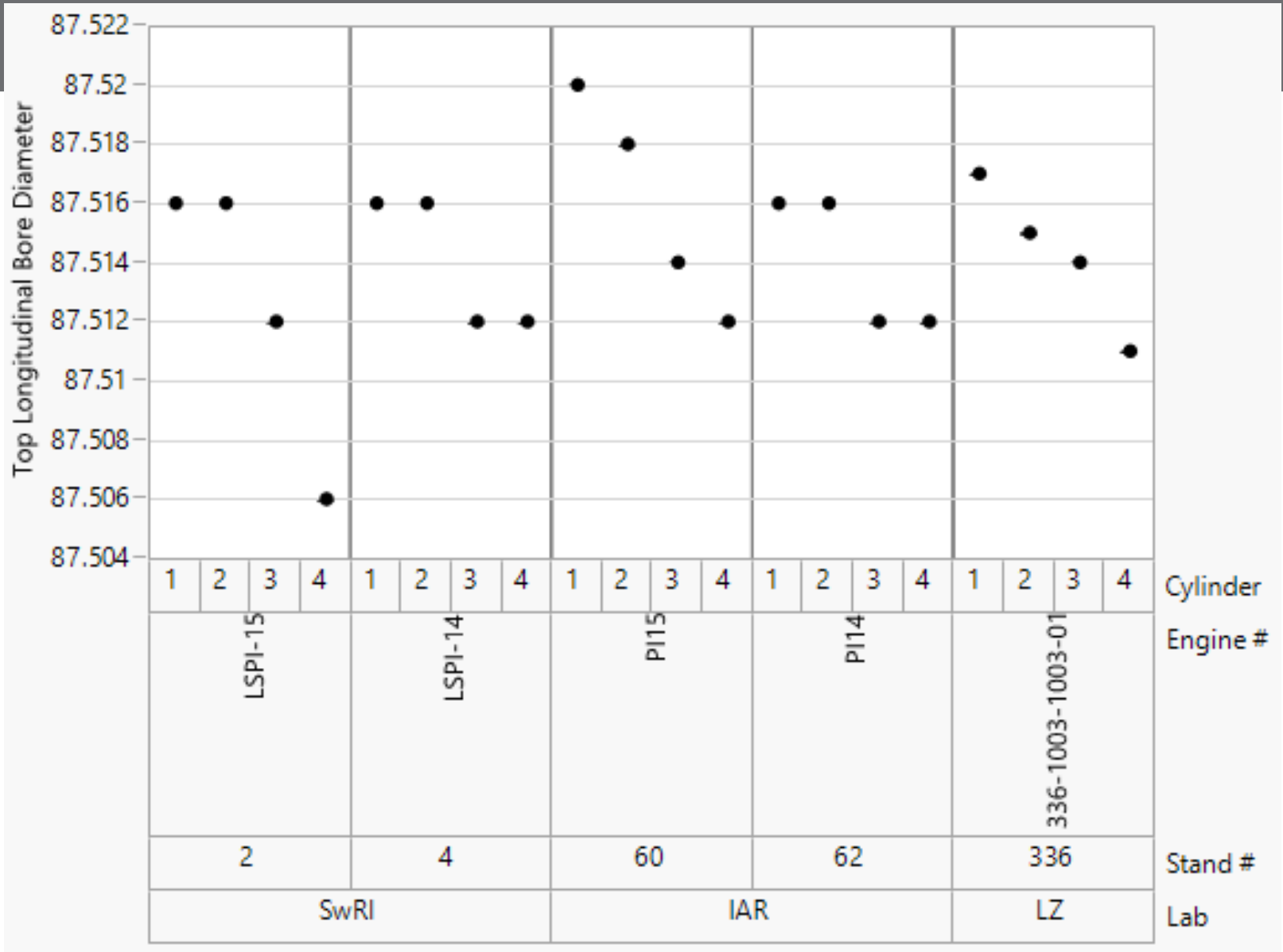
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

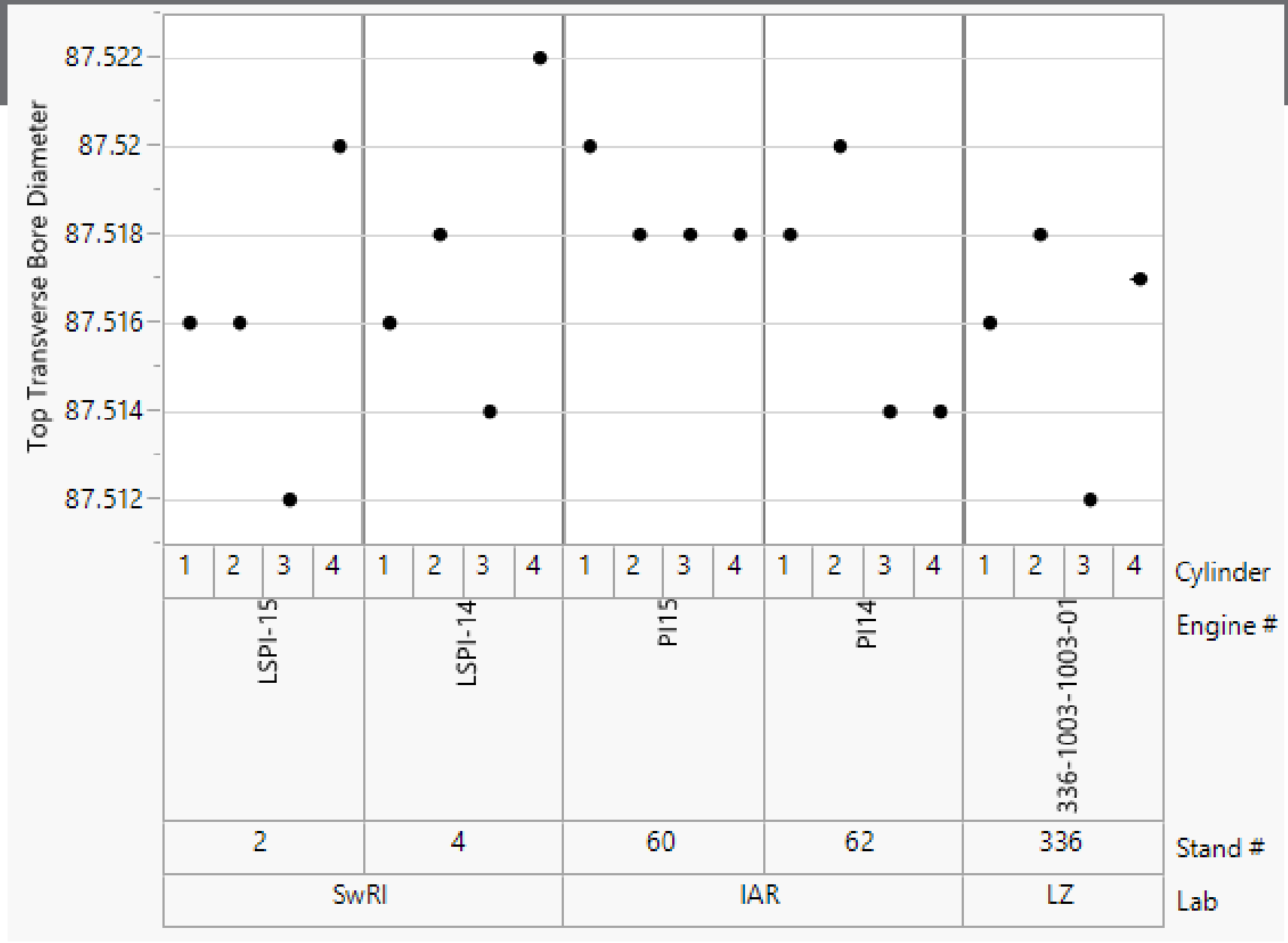


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

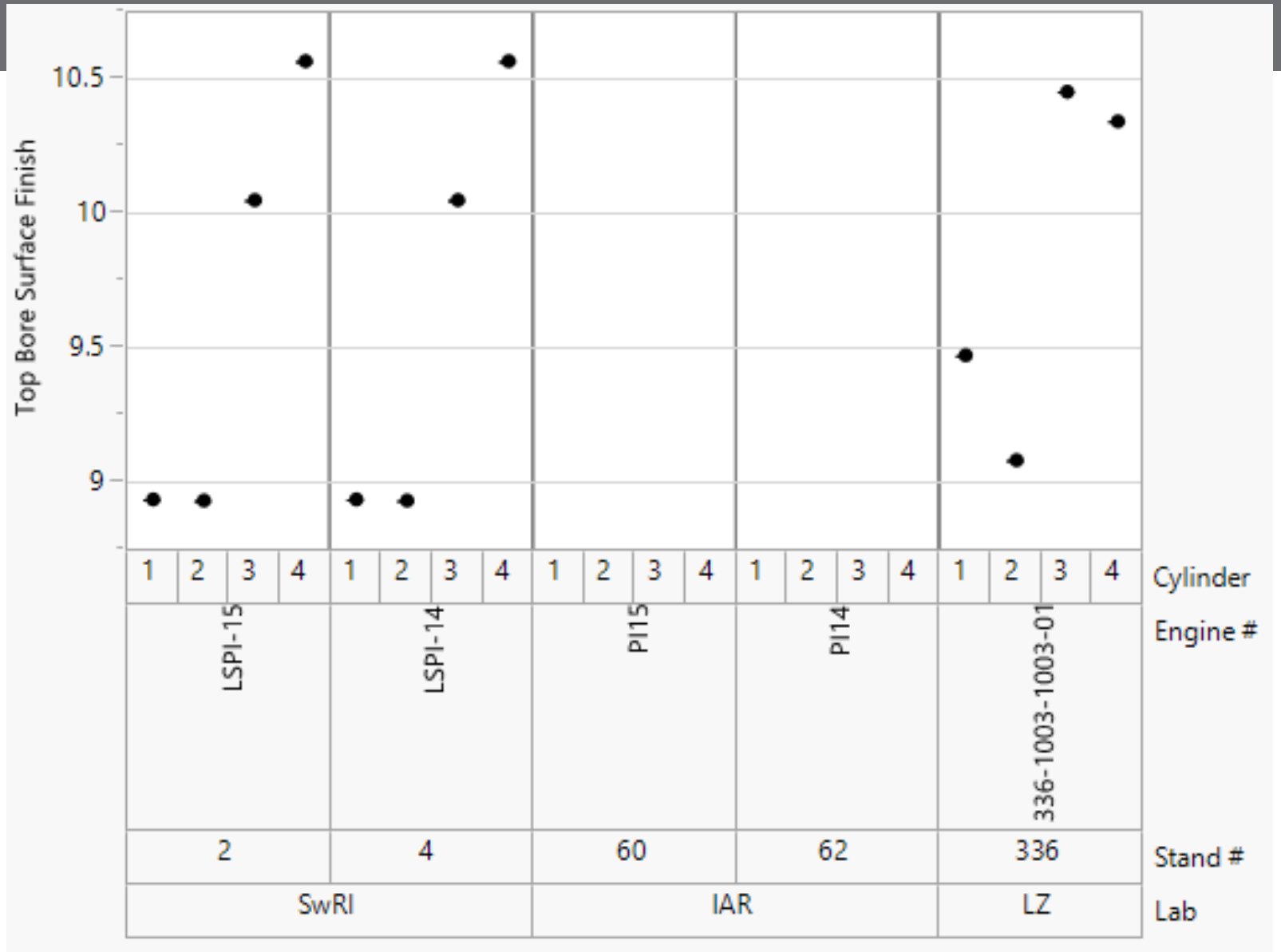


© 2016 The Lubrizol Corporation, all rights reserved.

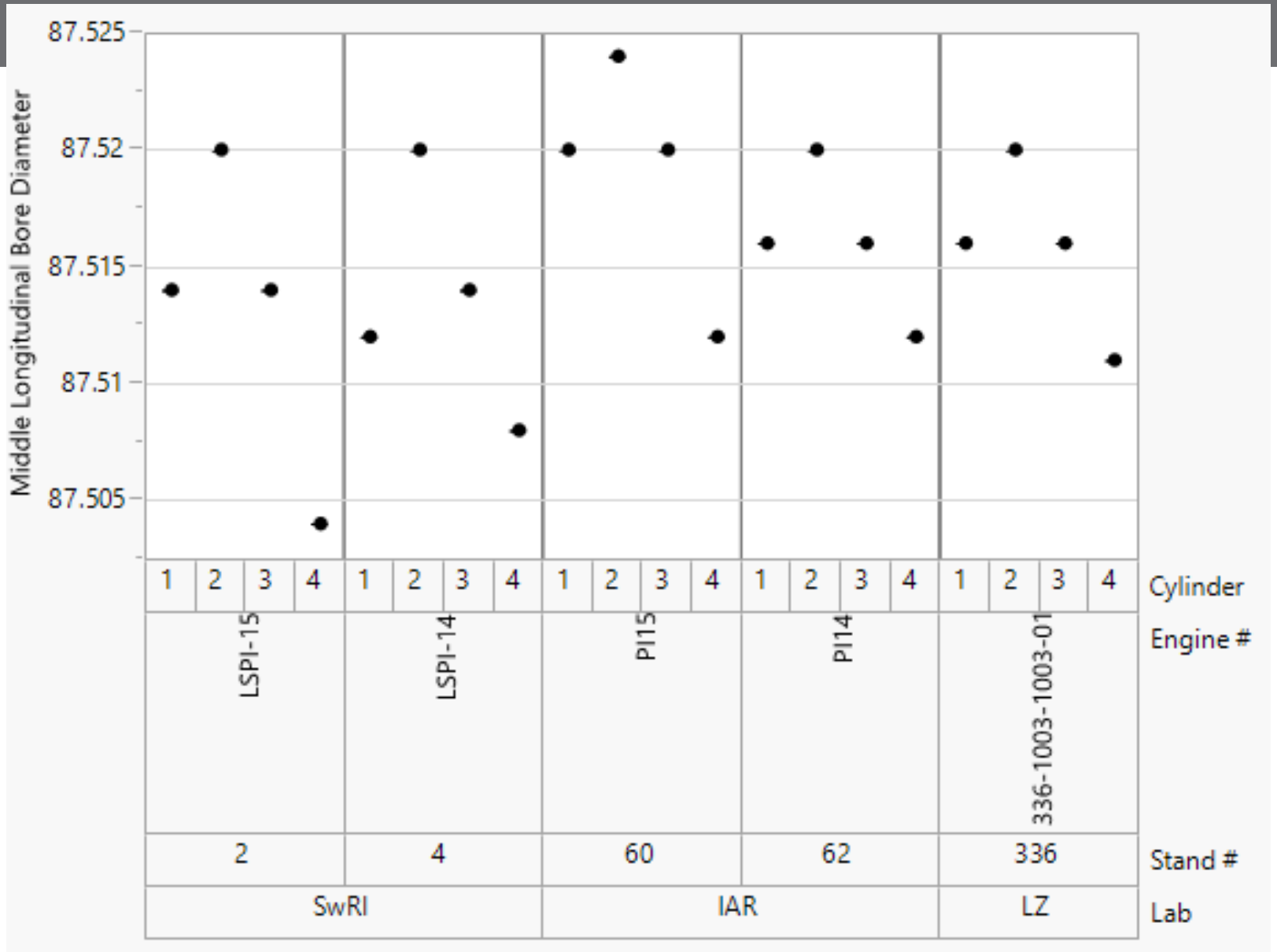


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

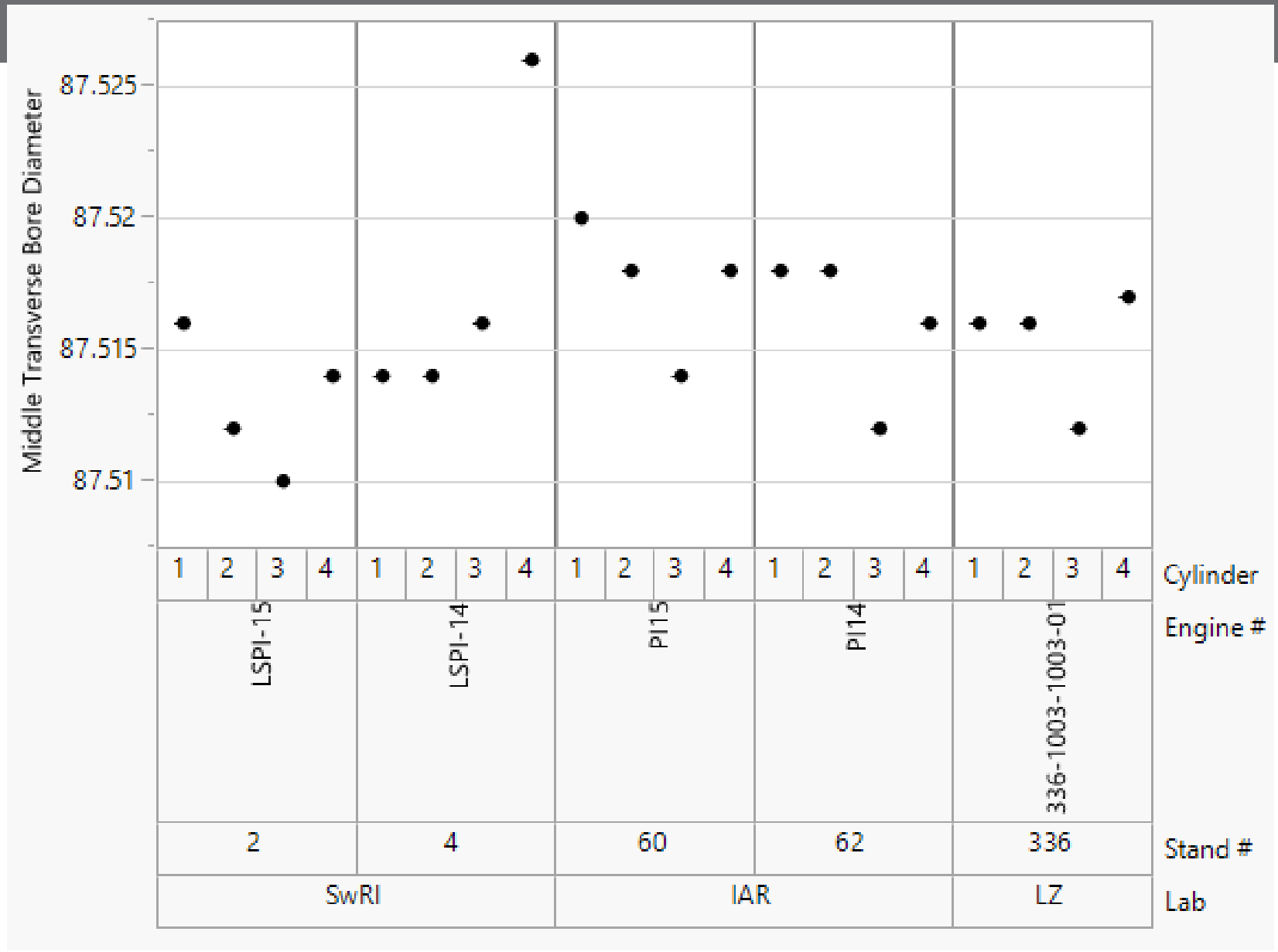


© 2016 The Lubrizol Corporation, all rights reserved.

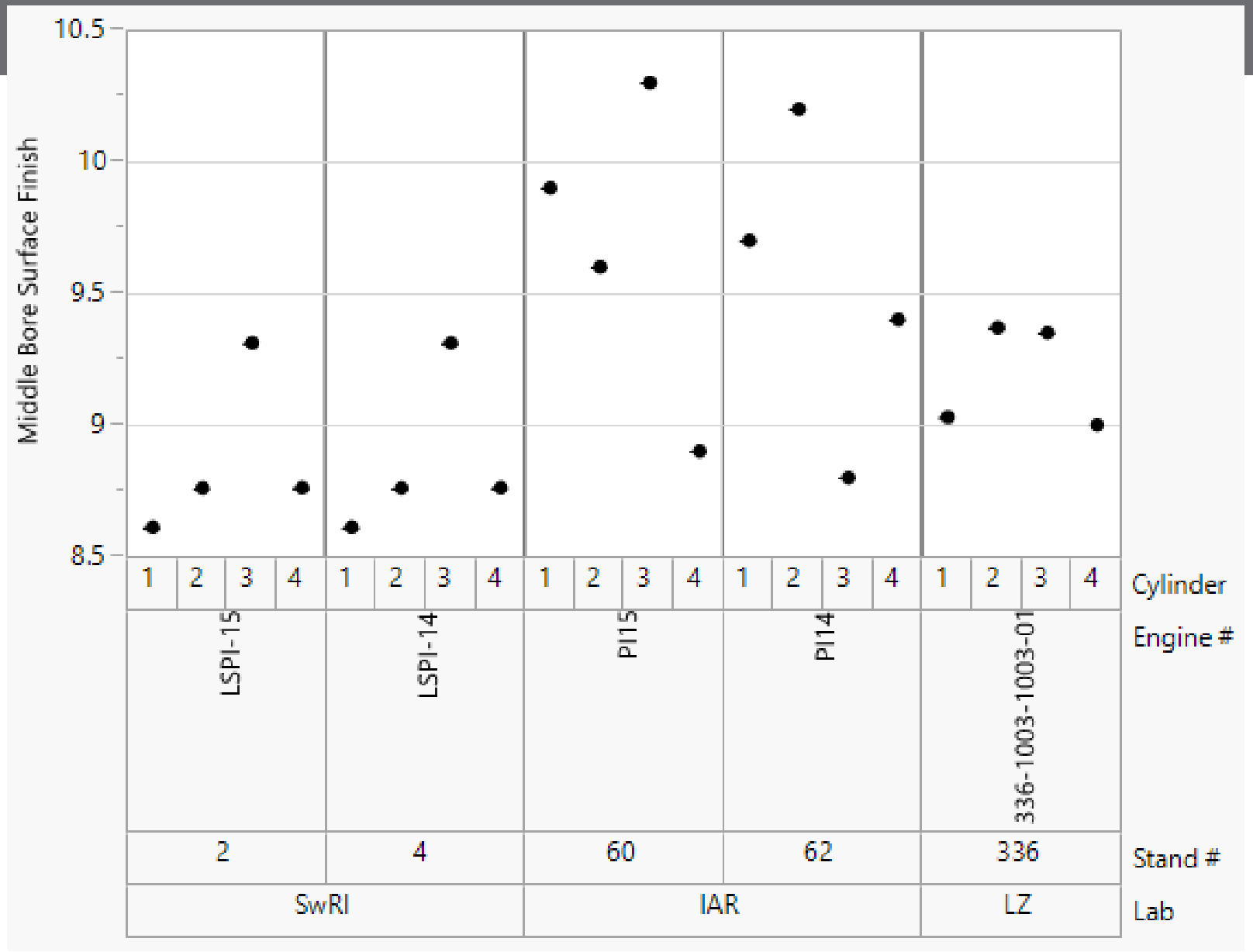


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

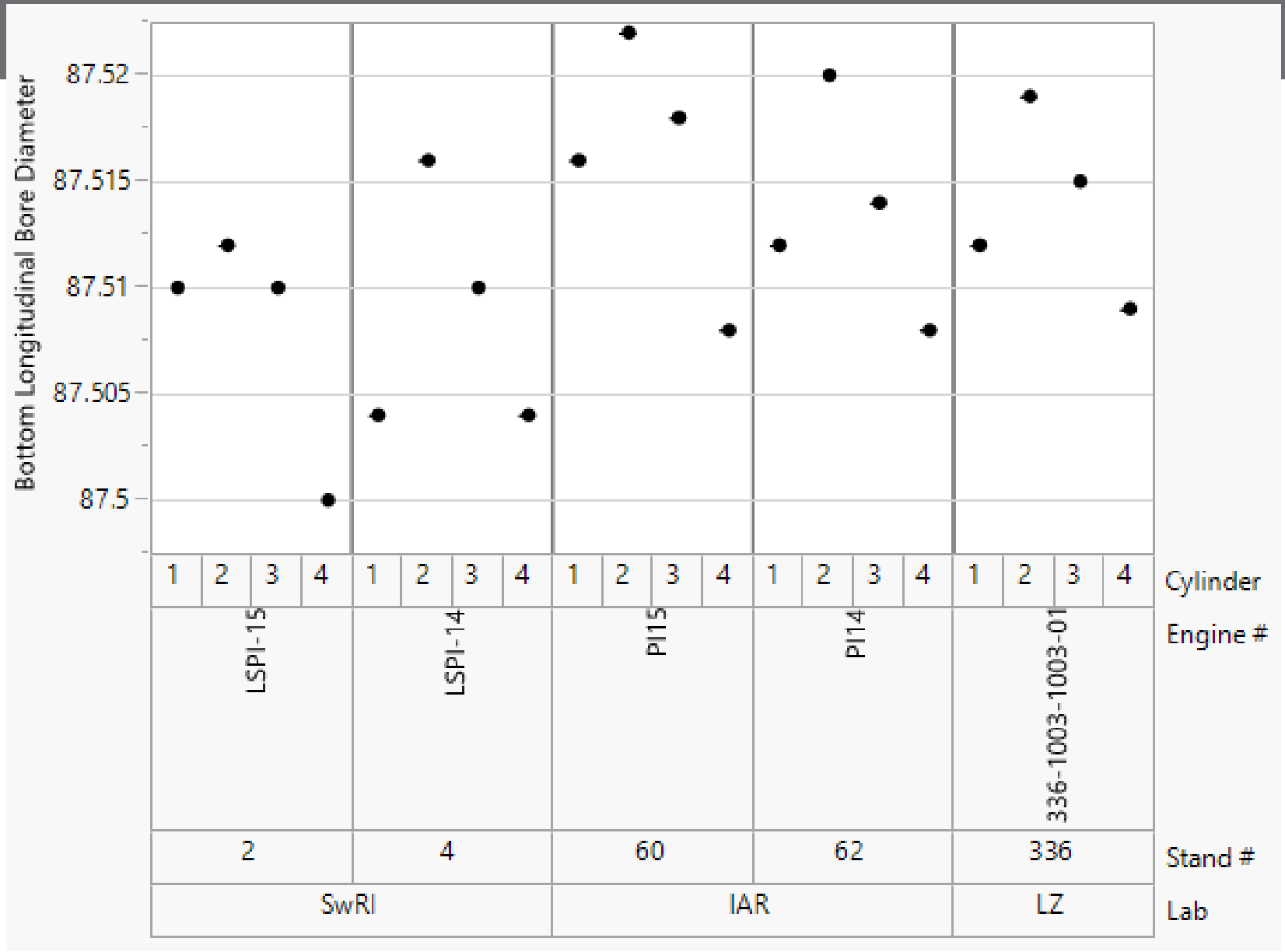


© 2016 The Lubrizol Corporation, all rights reserved.



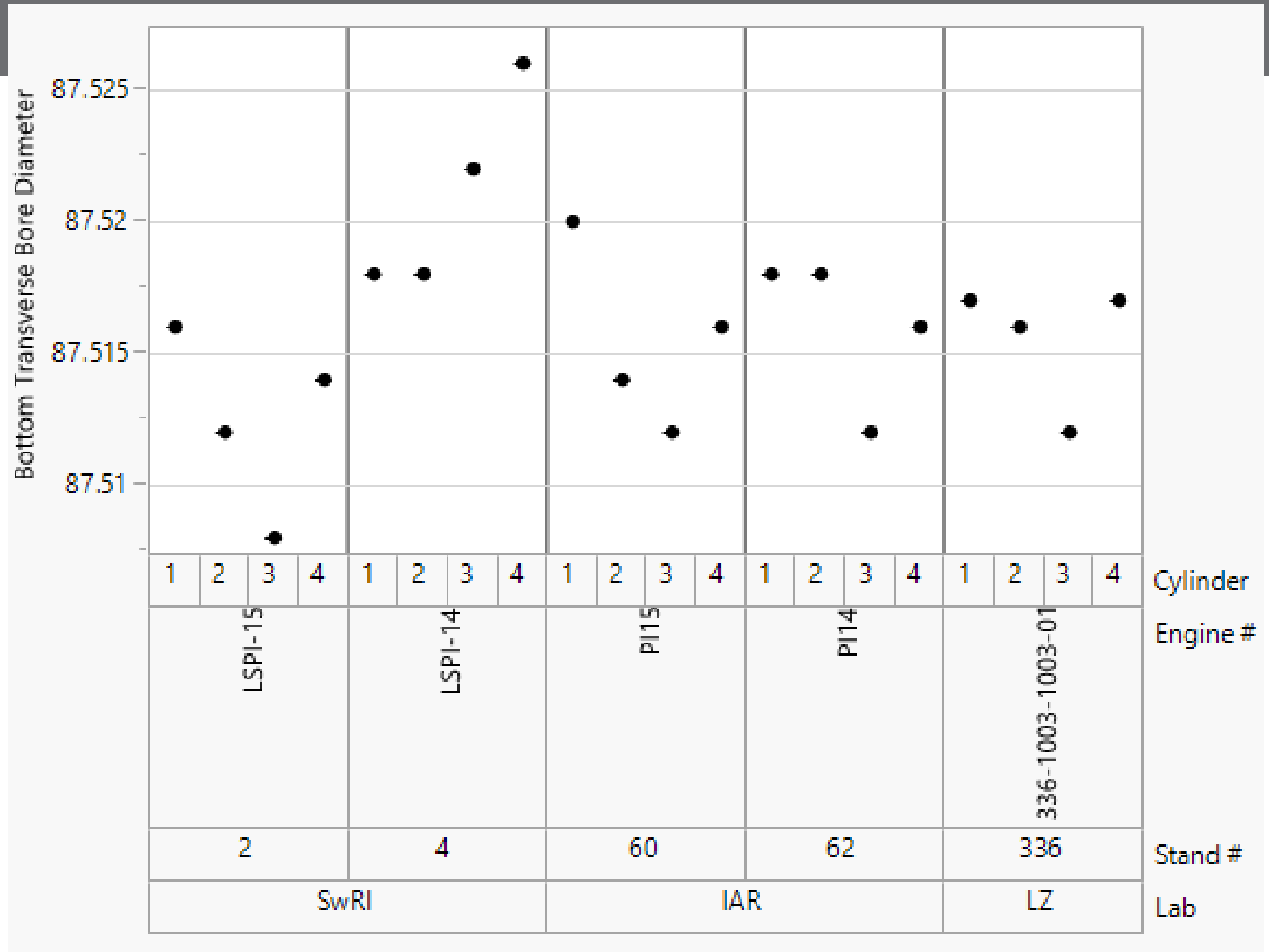
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



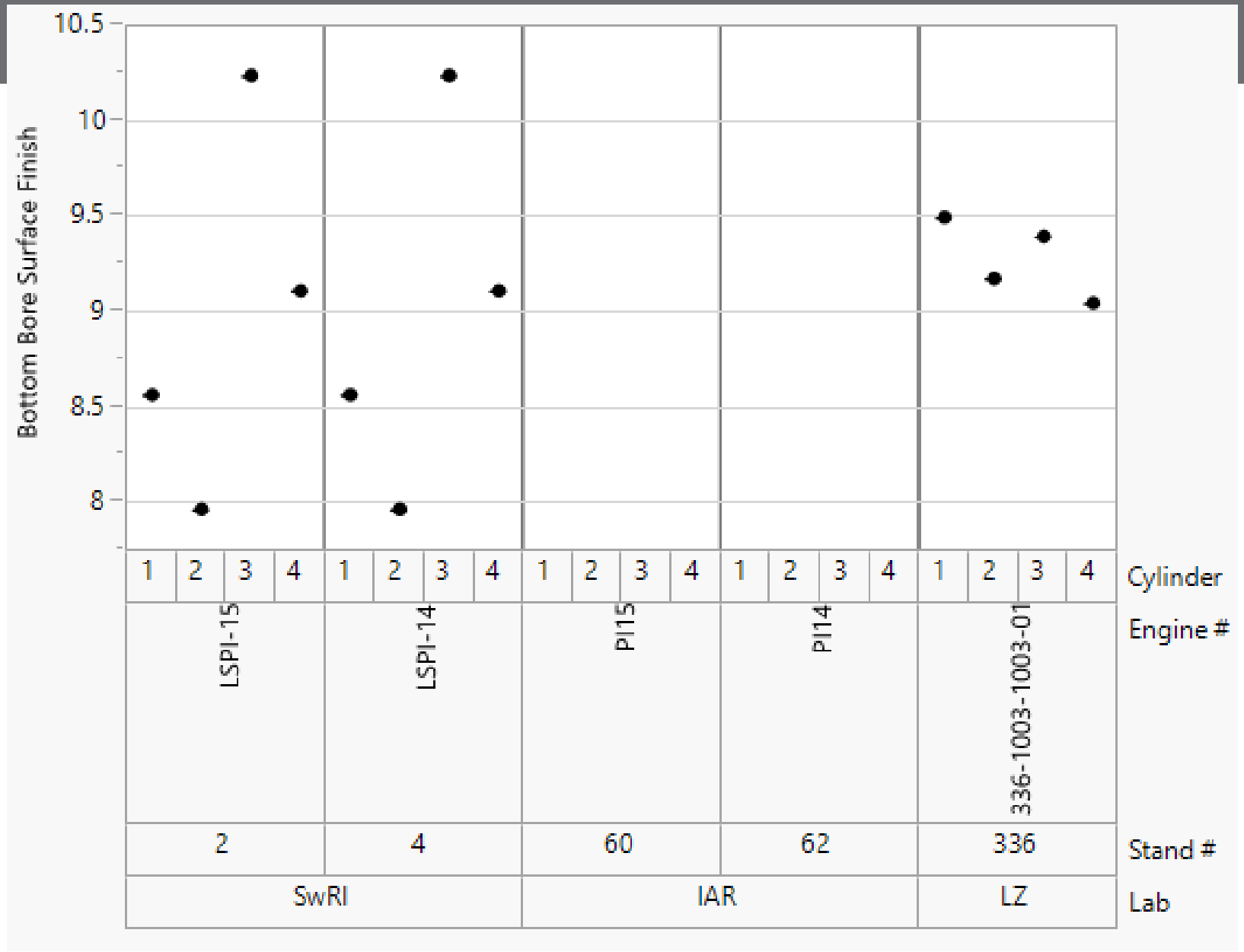
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



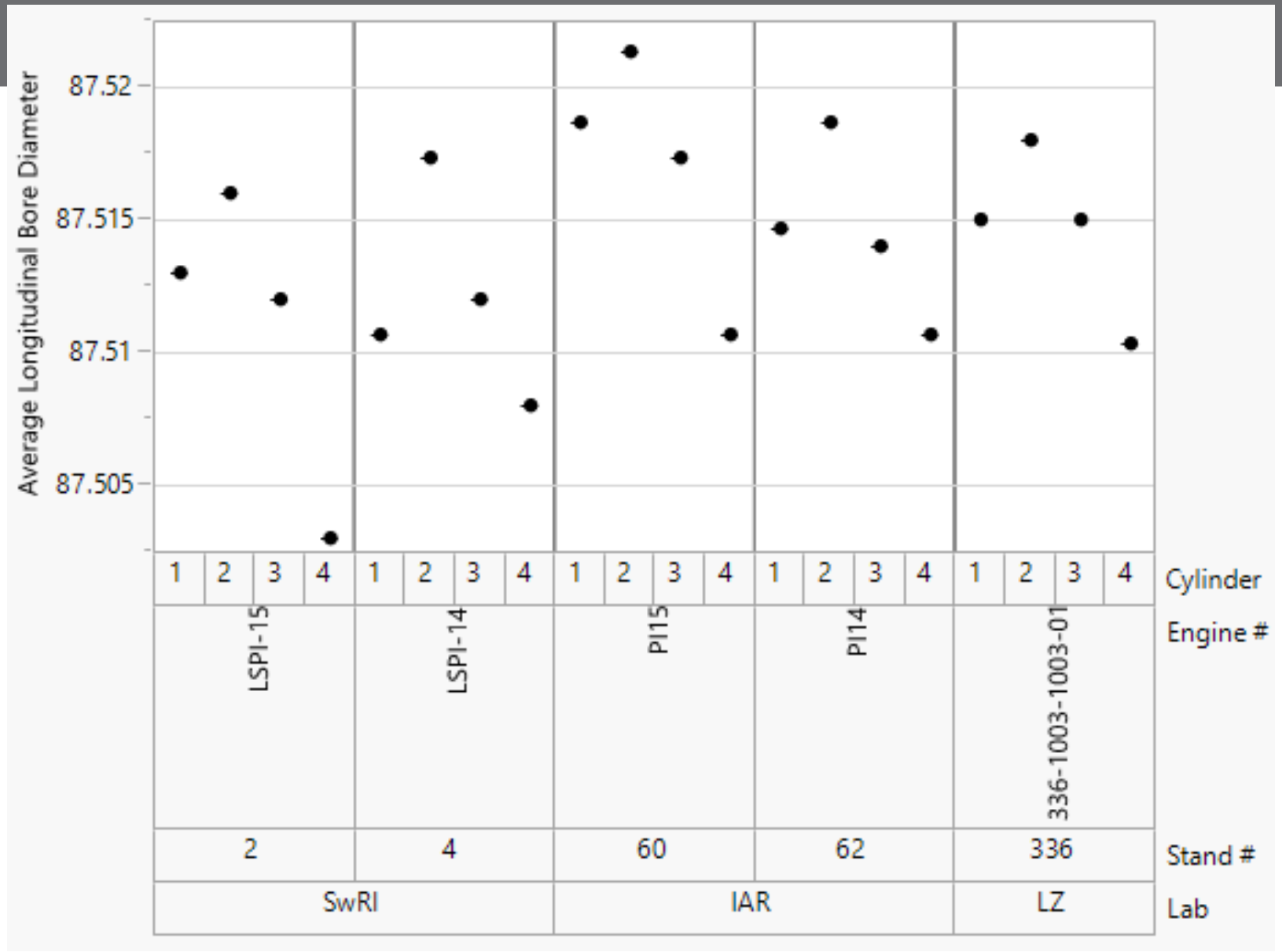
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



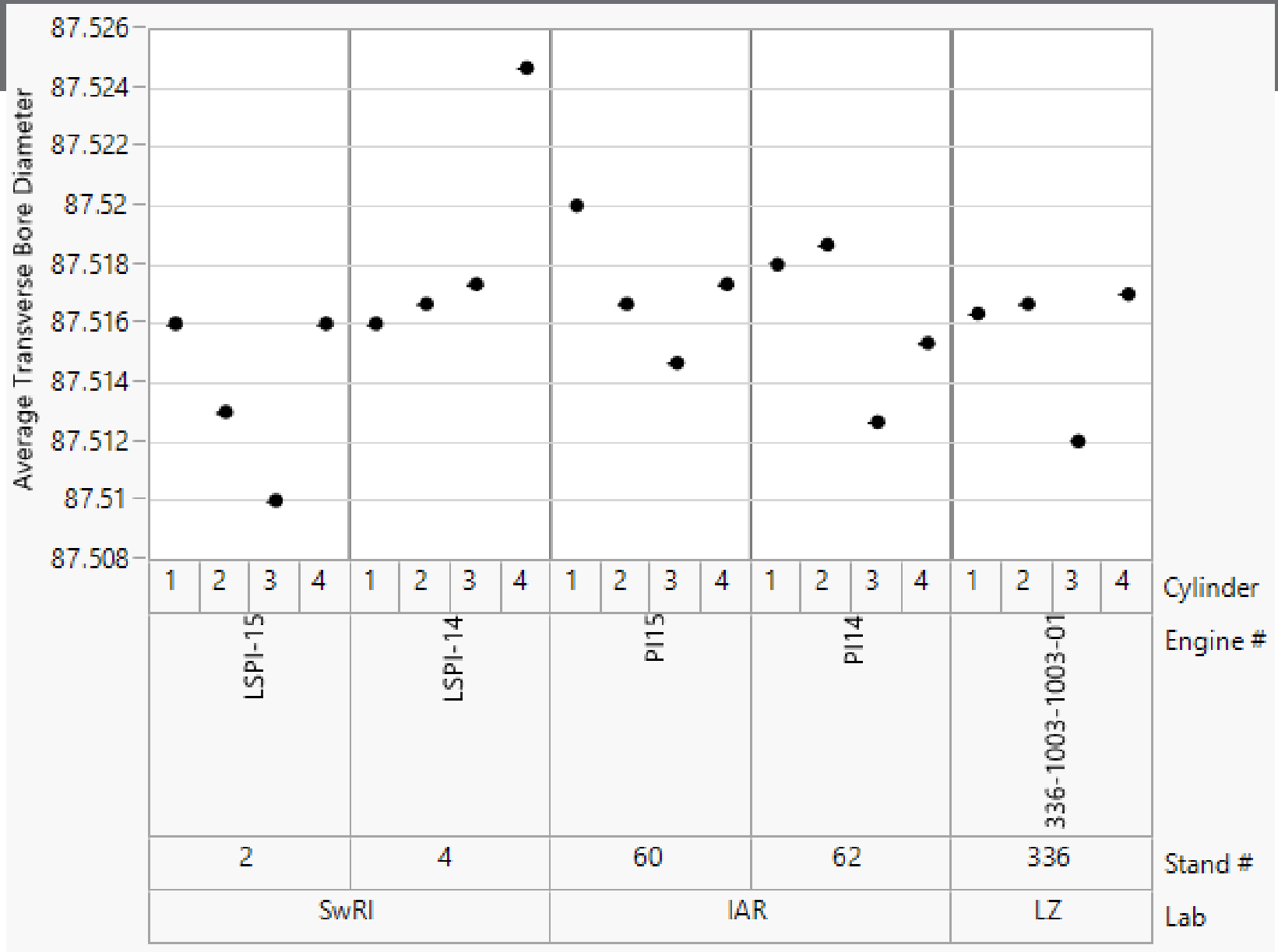
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



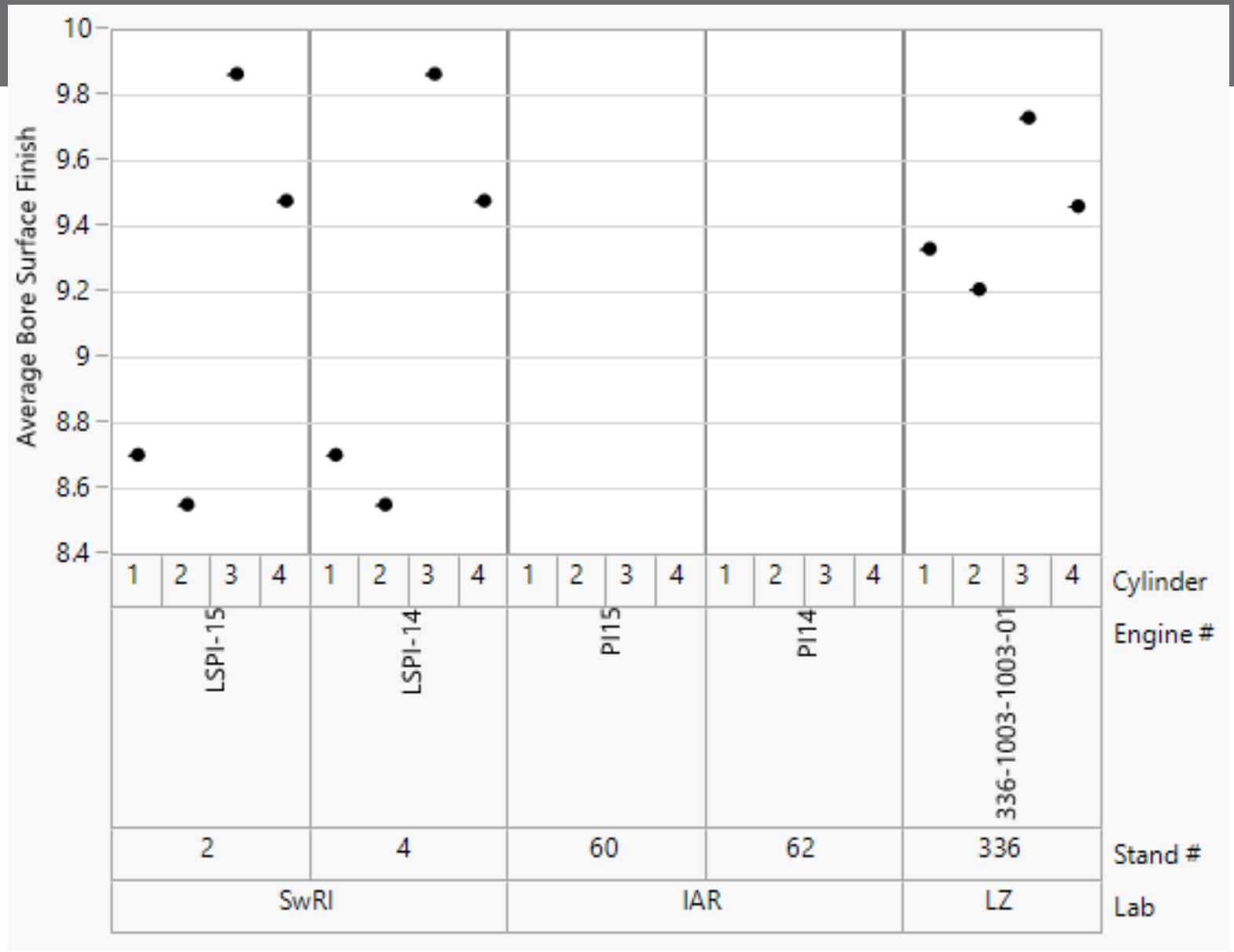
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



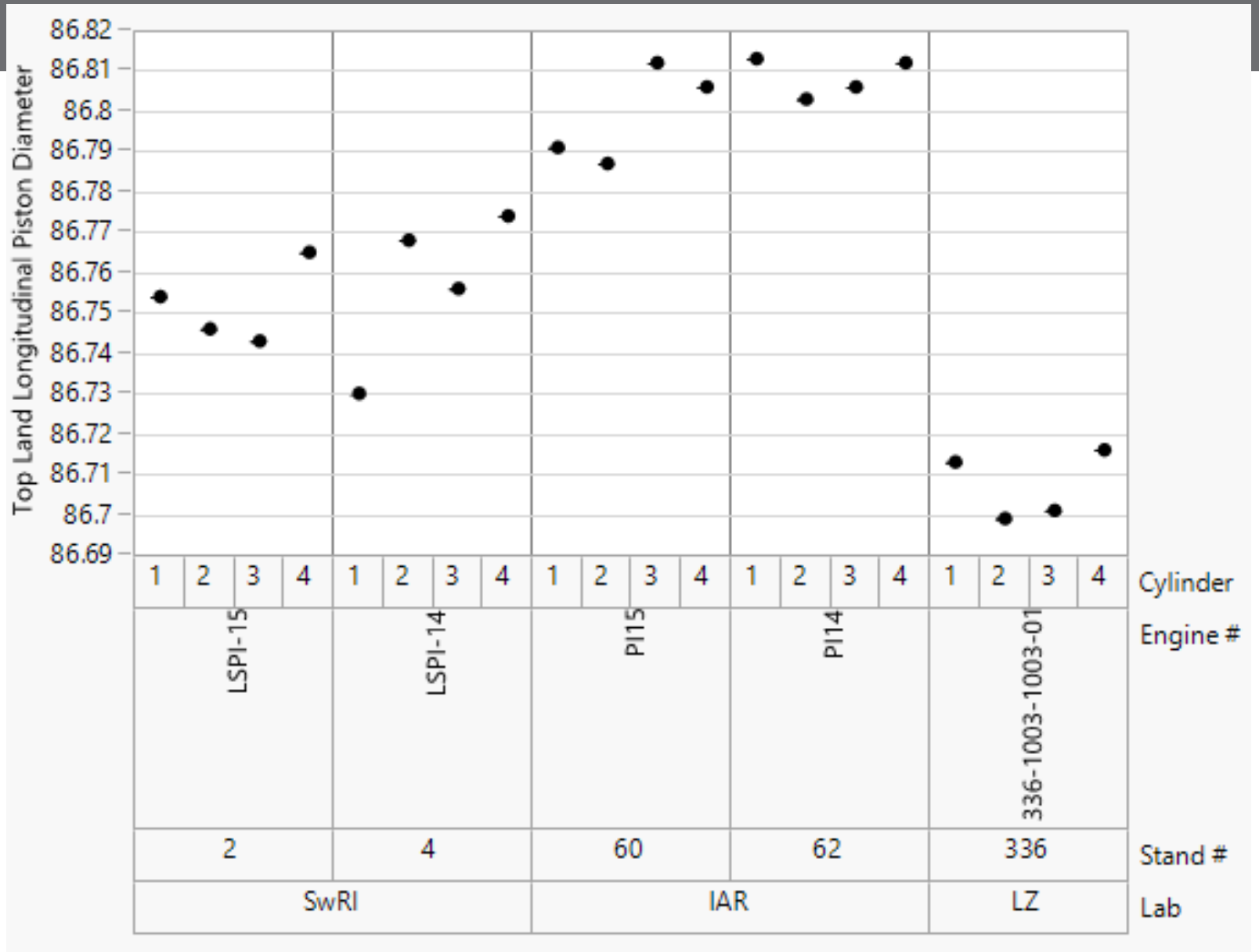
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

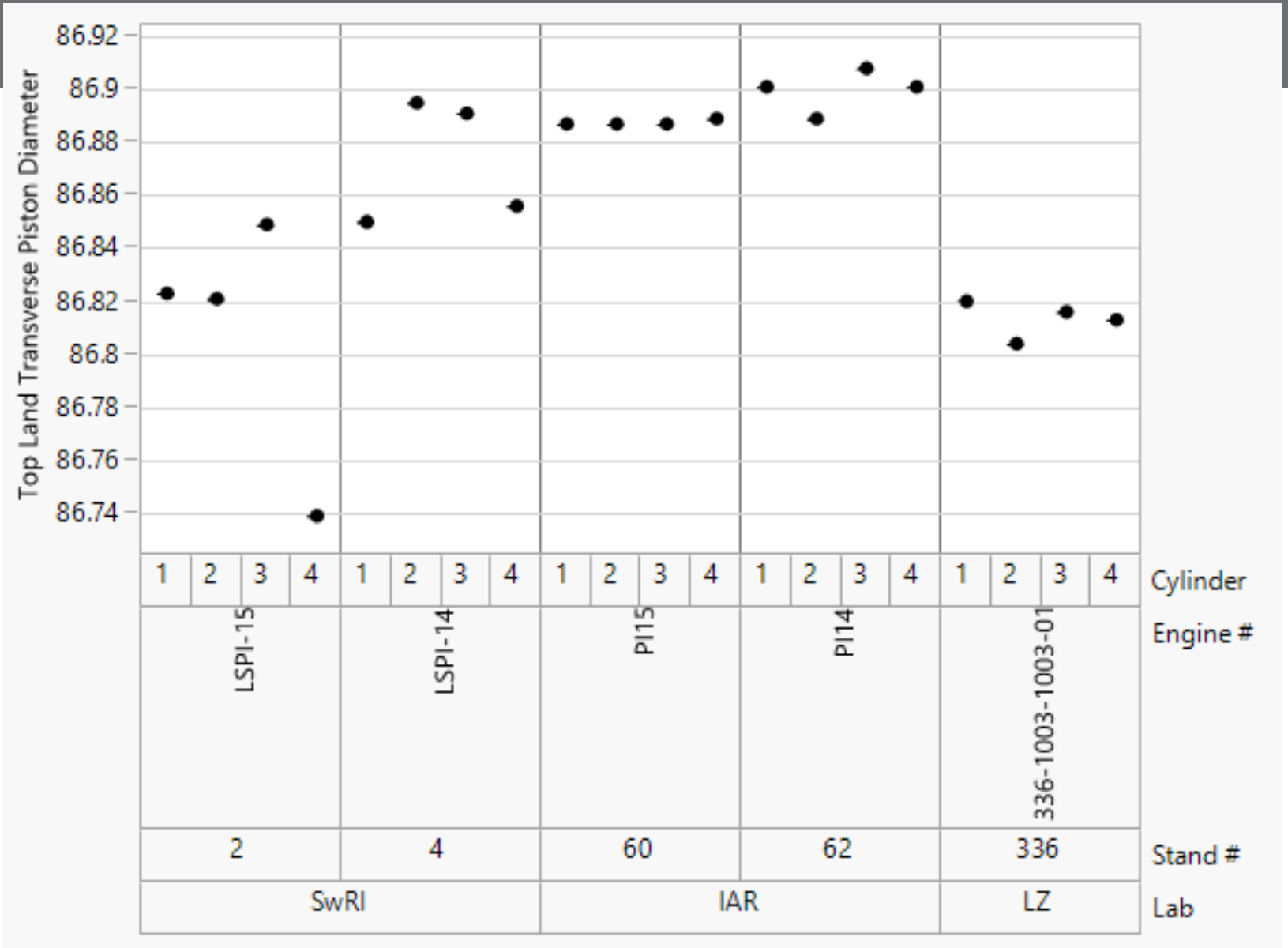


© 2016 The Lubrizol Corporation, all rights reserved.

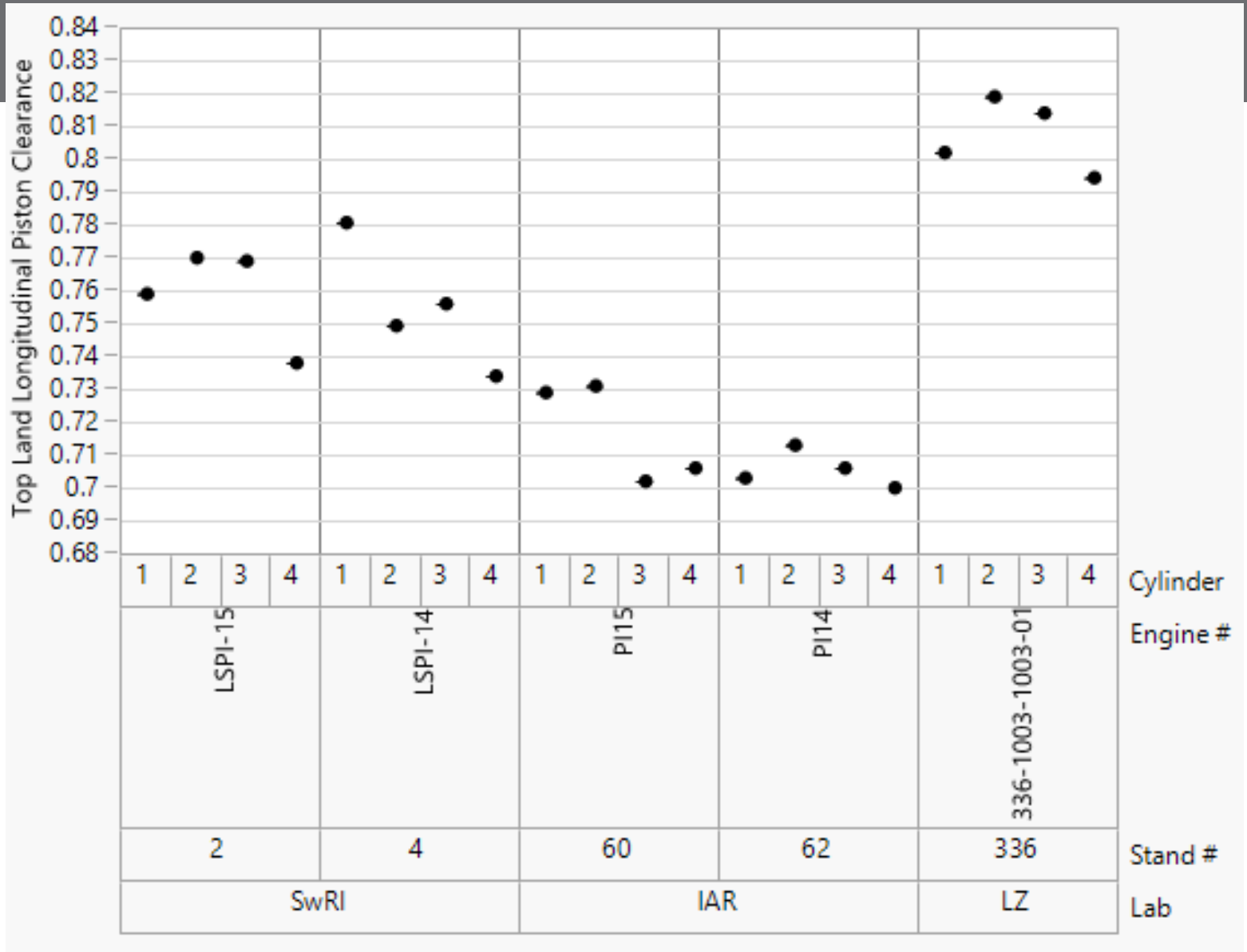
Lubrizol



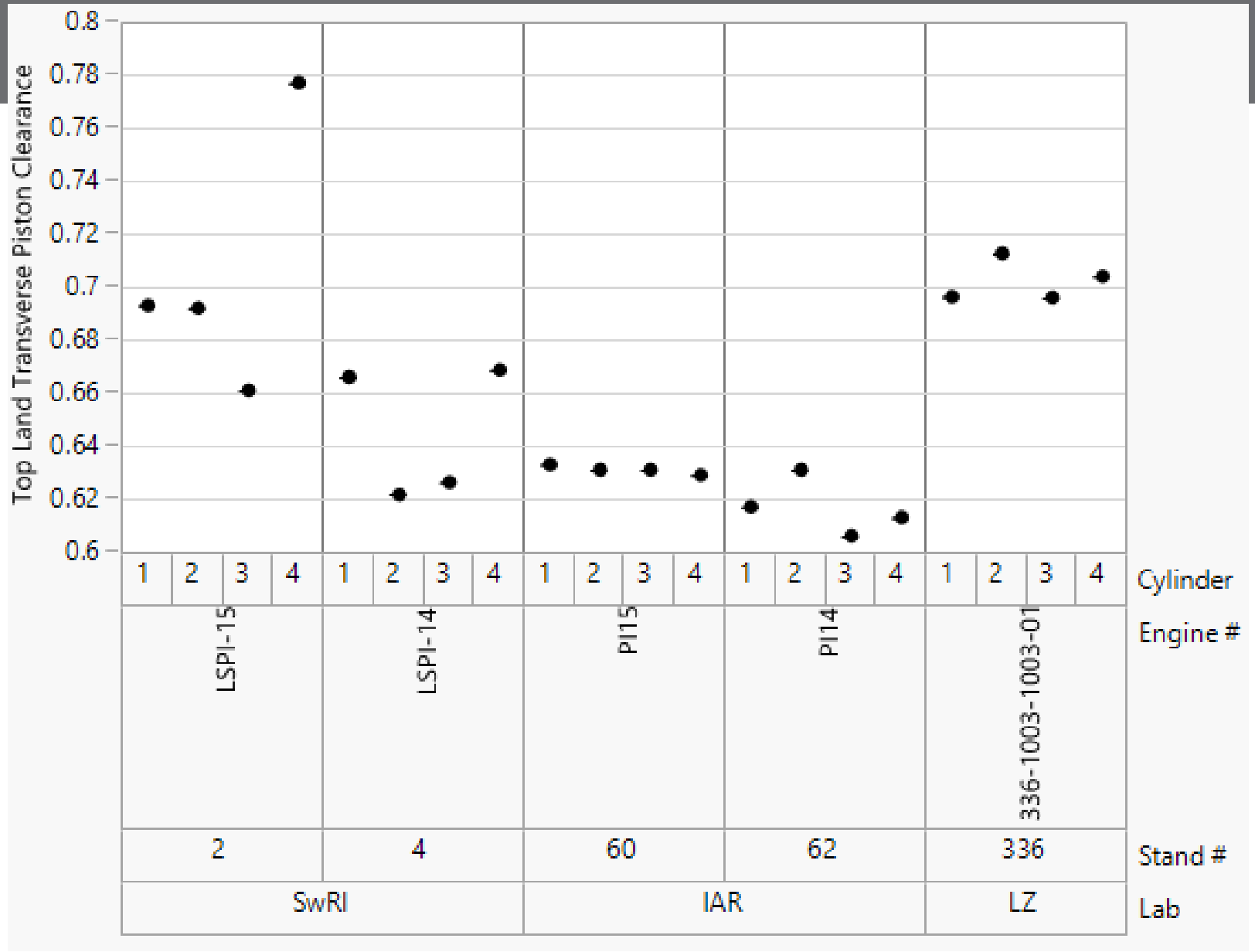
© 2016 The Lubrizol Corporation, all rights reserved.



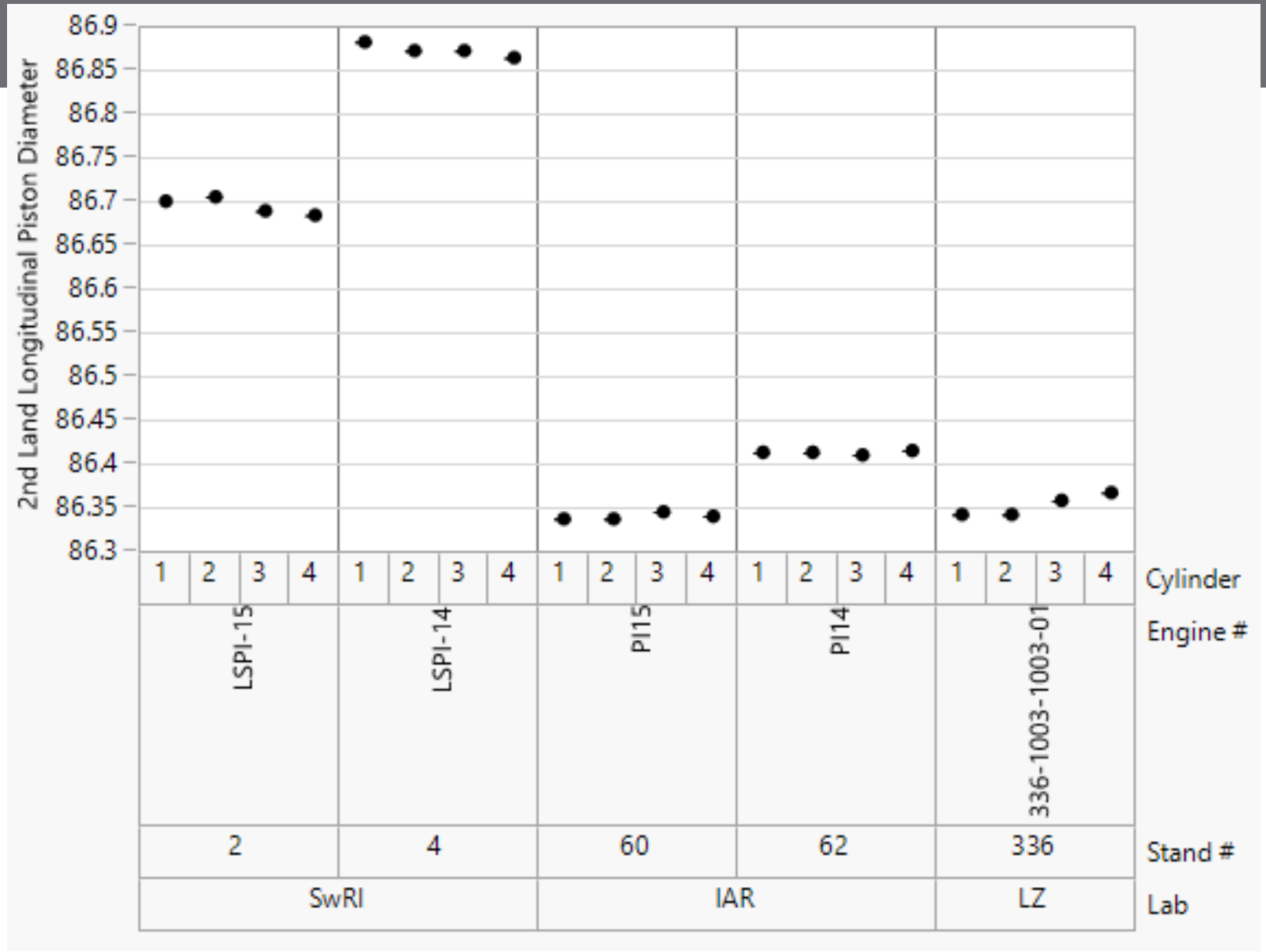
© 2016 The Lubrizol Corporation, all rights reserved.



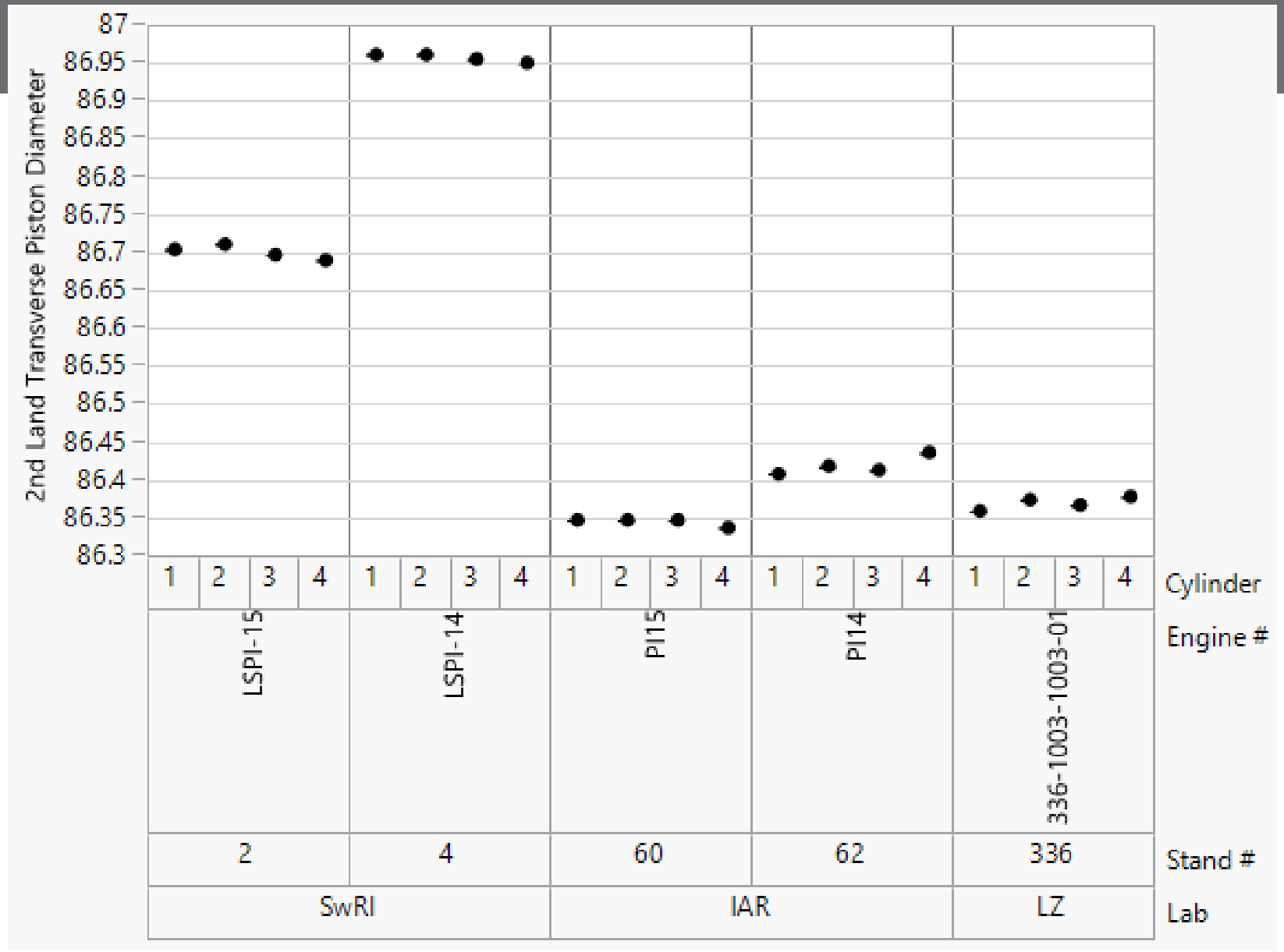
© 2016 The Lubrizol Corporation, all rights reserved.



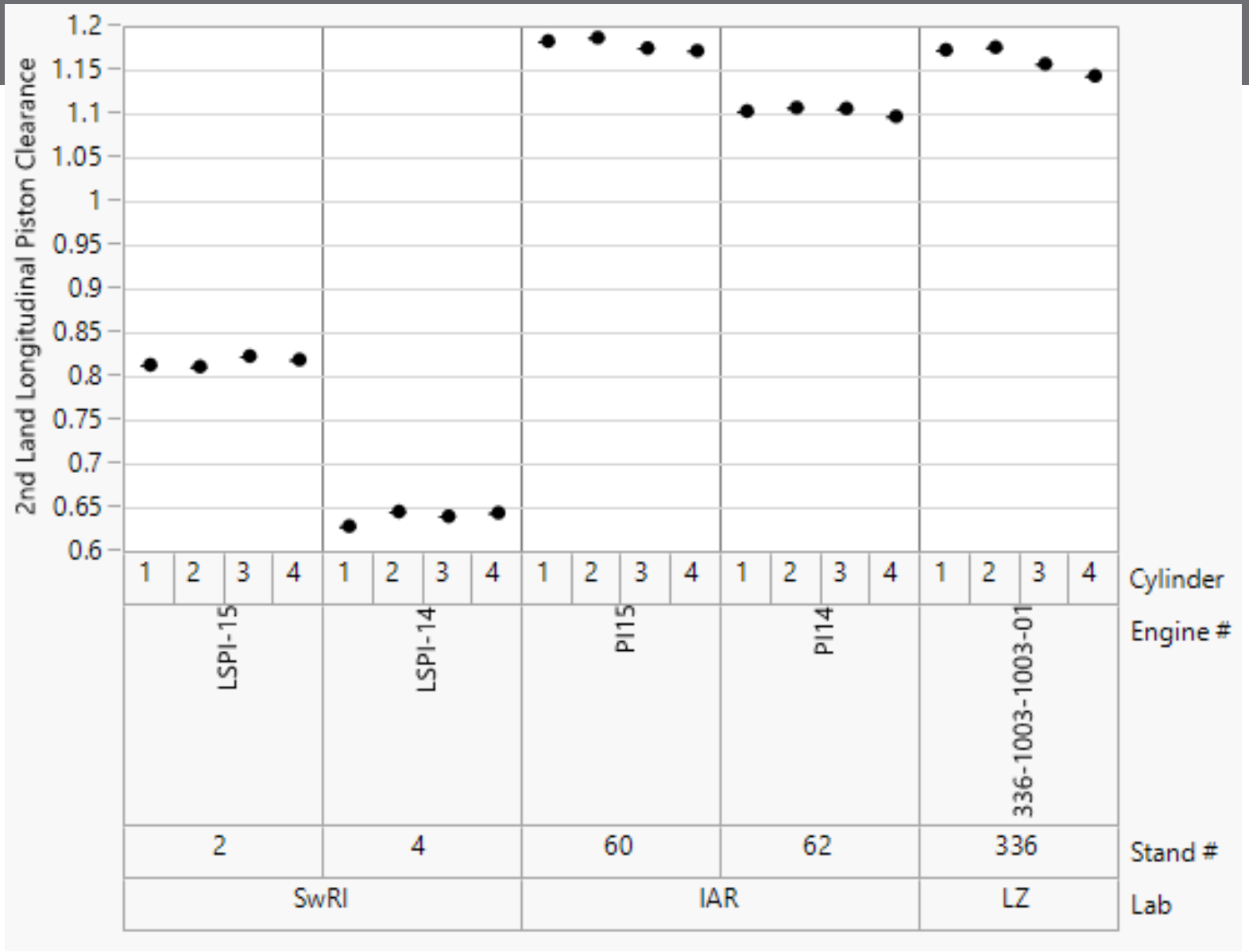
© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.

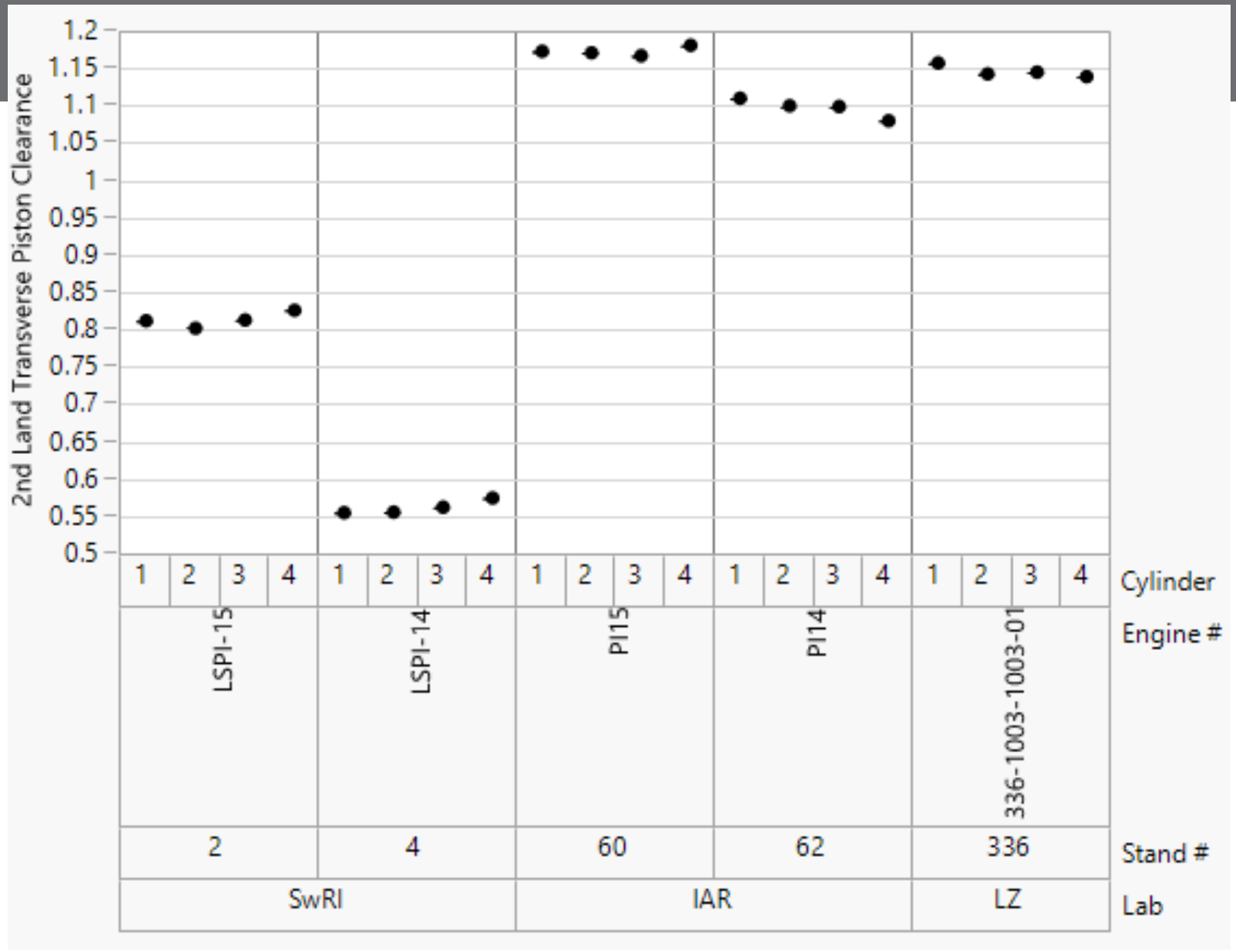


© 2016 The Lubrizol Corporation, all rights reserved.

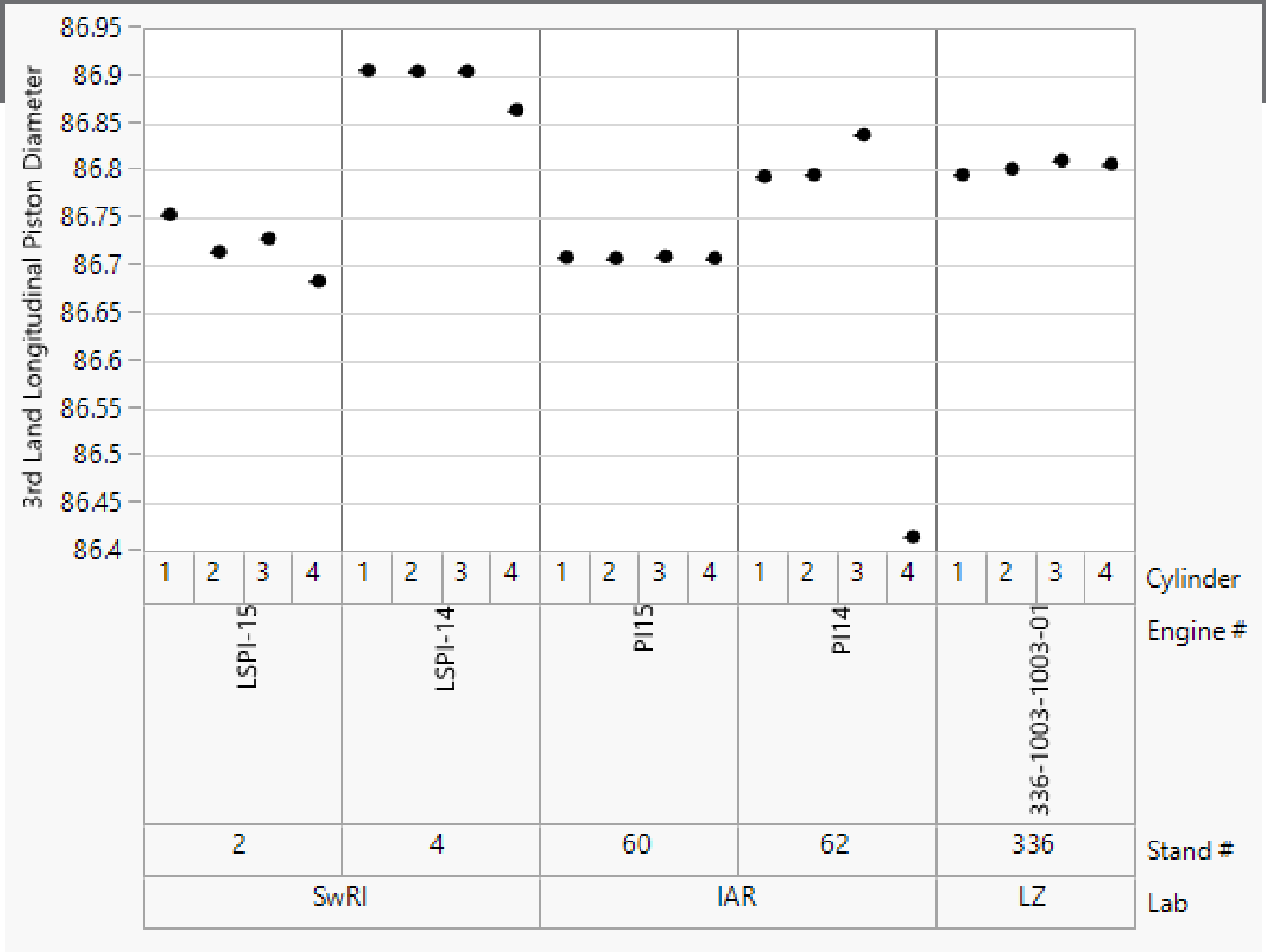


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

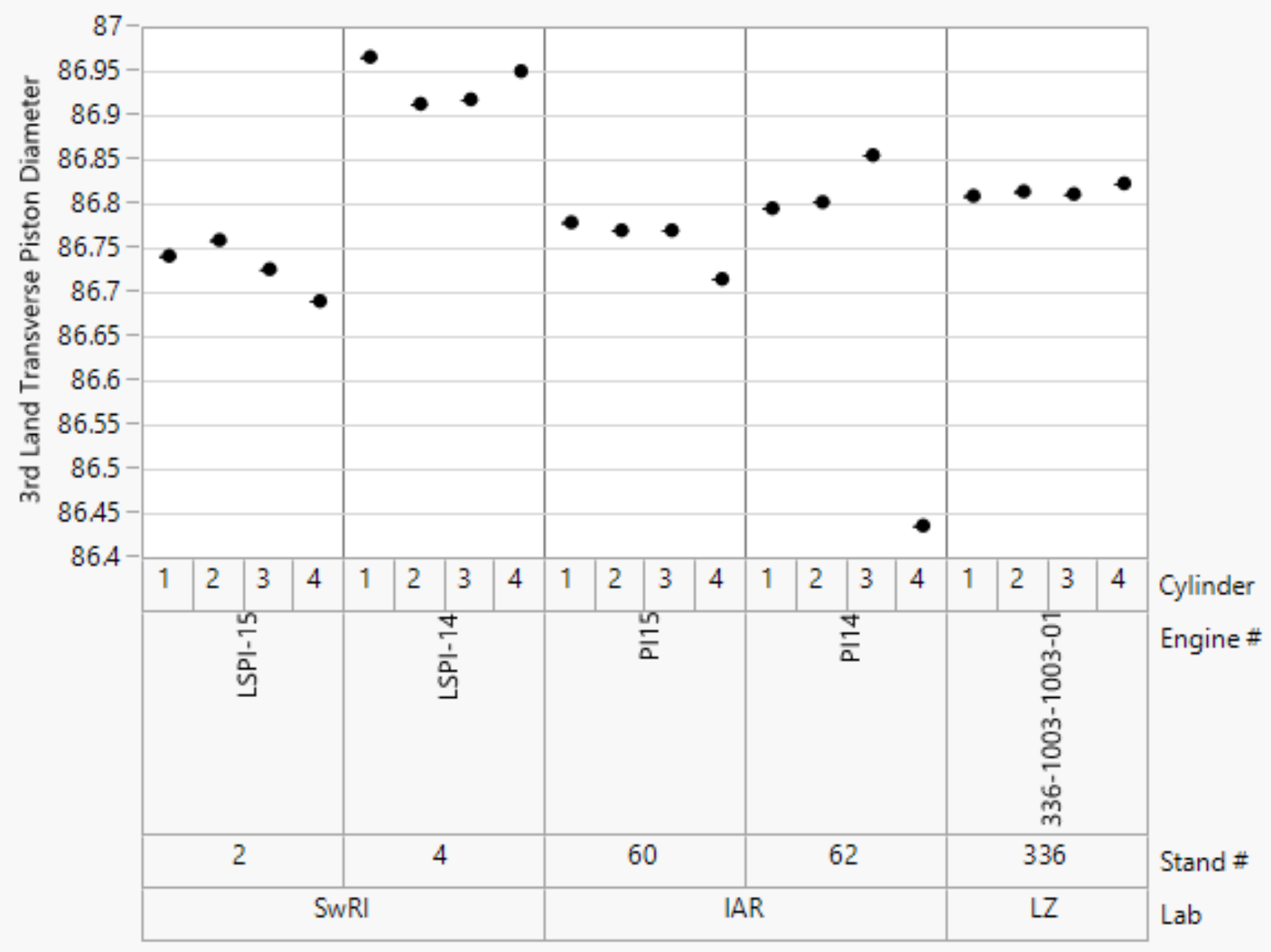


© 2016 The Lubrizol Corporation, all rights reserved.

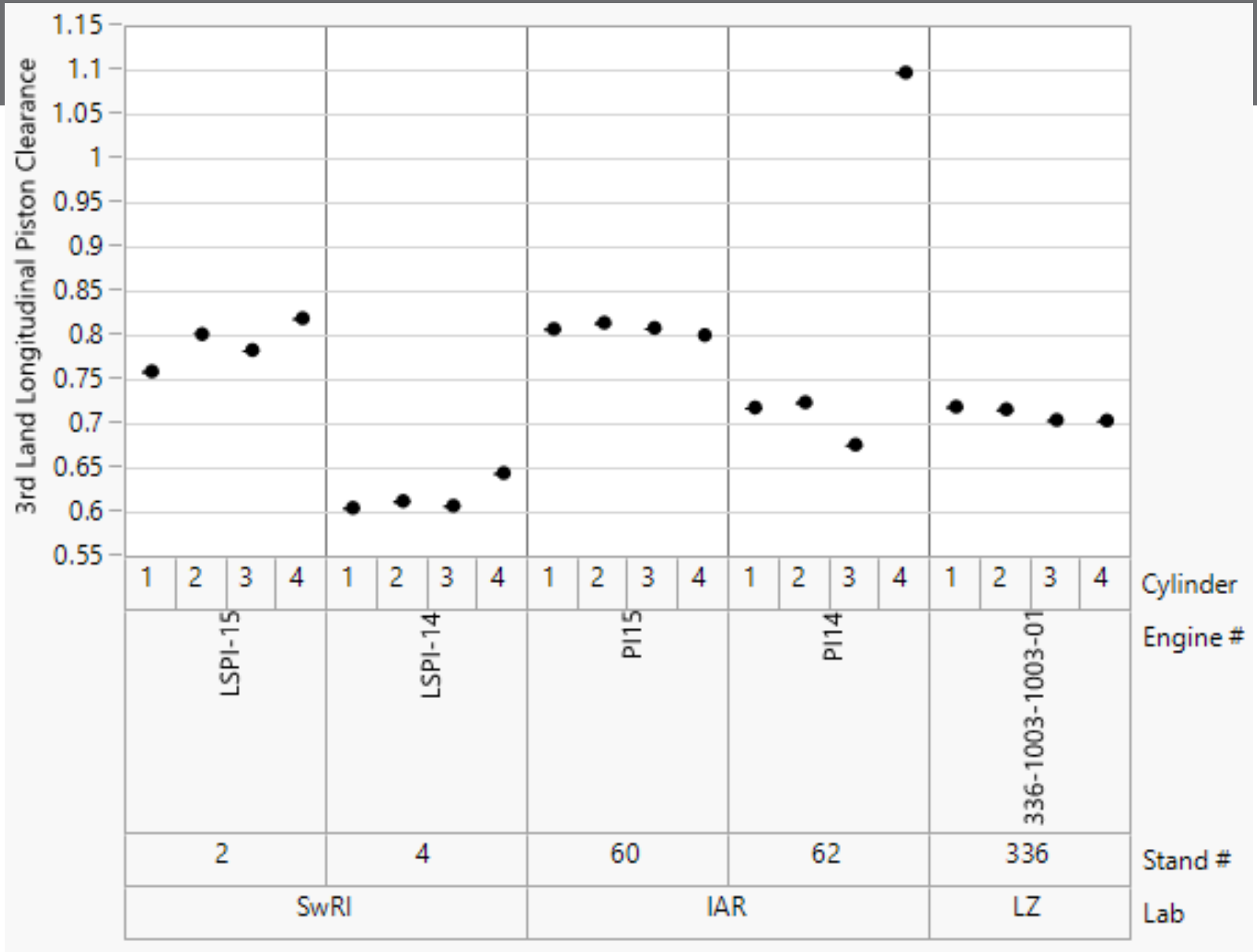


© 2016 The Lubrizol Corporation, all rights reserved.

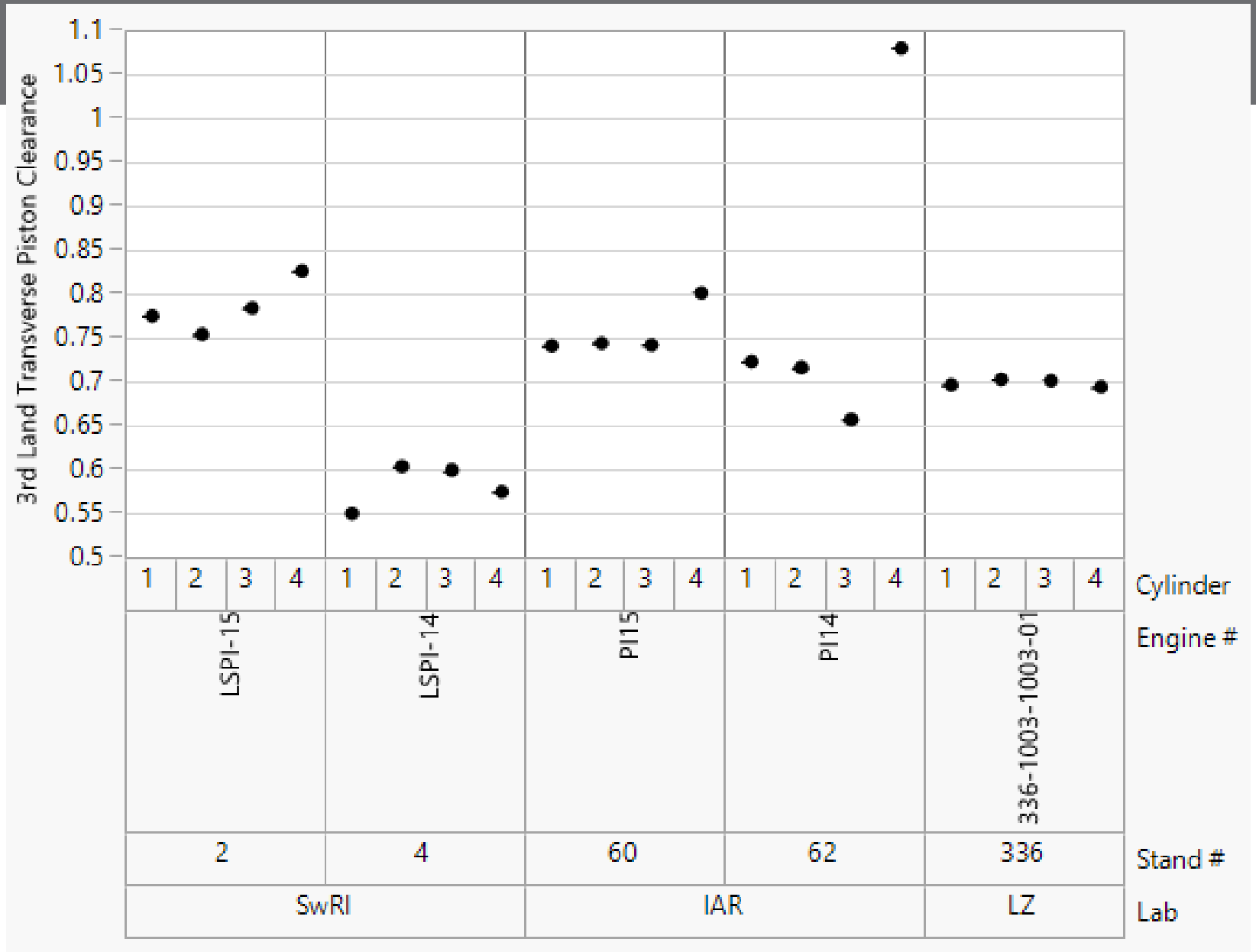
Lubrizol



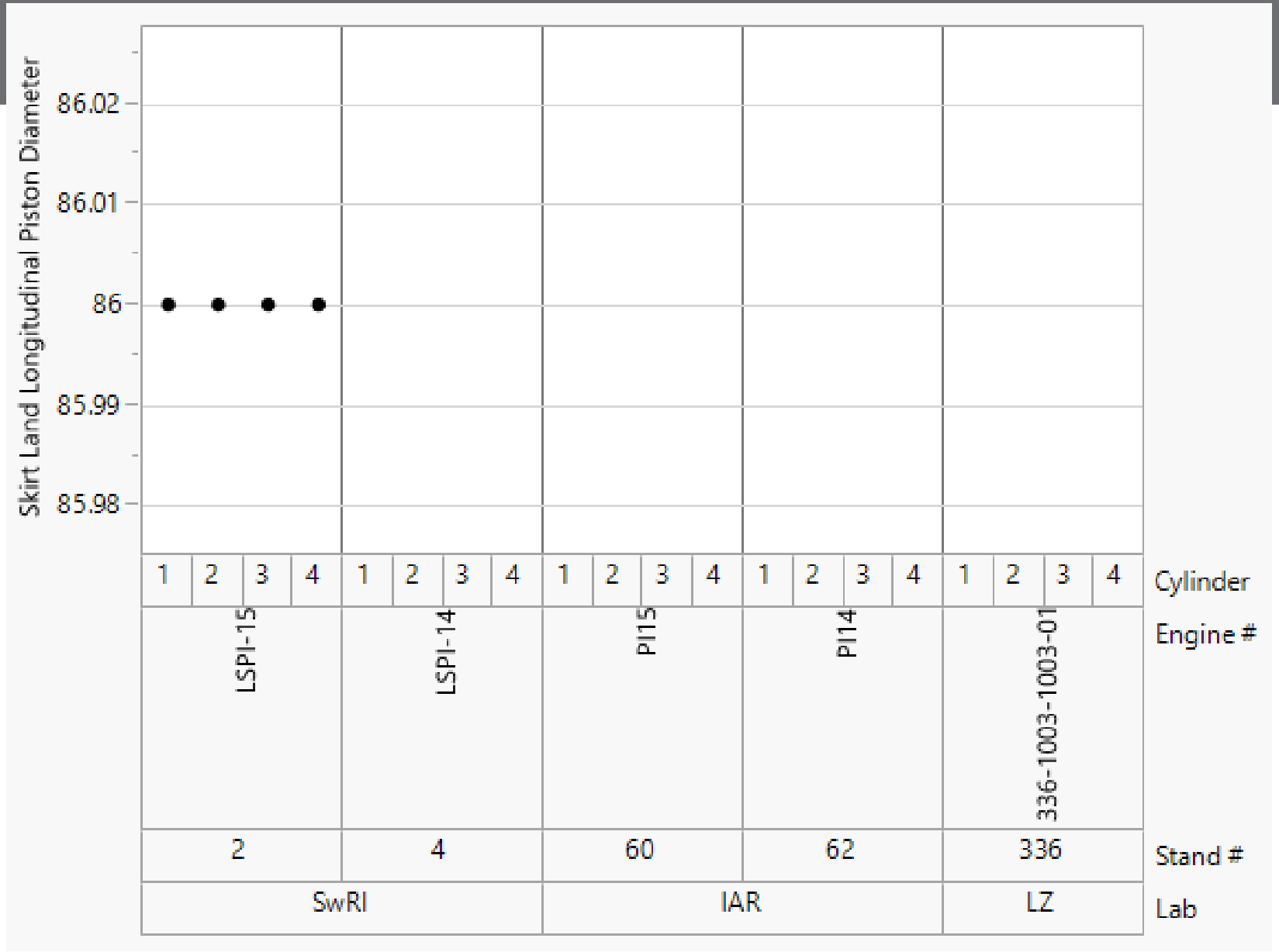
© 2016 The Lubrizol Corporation, all rights reserved.



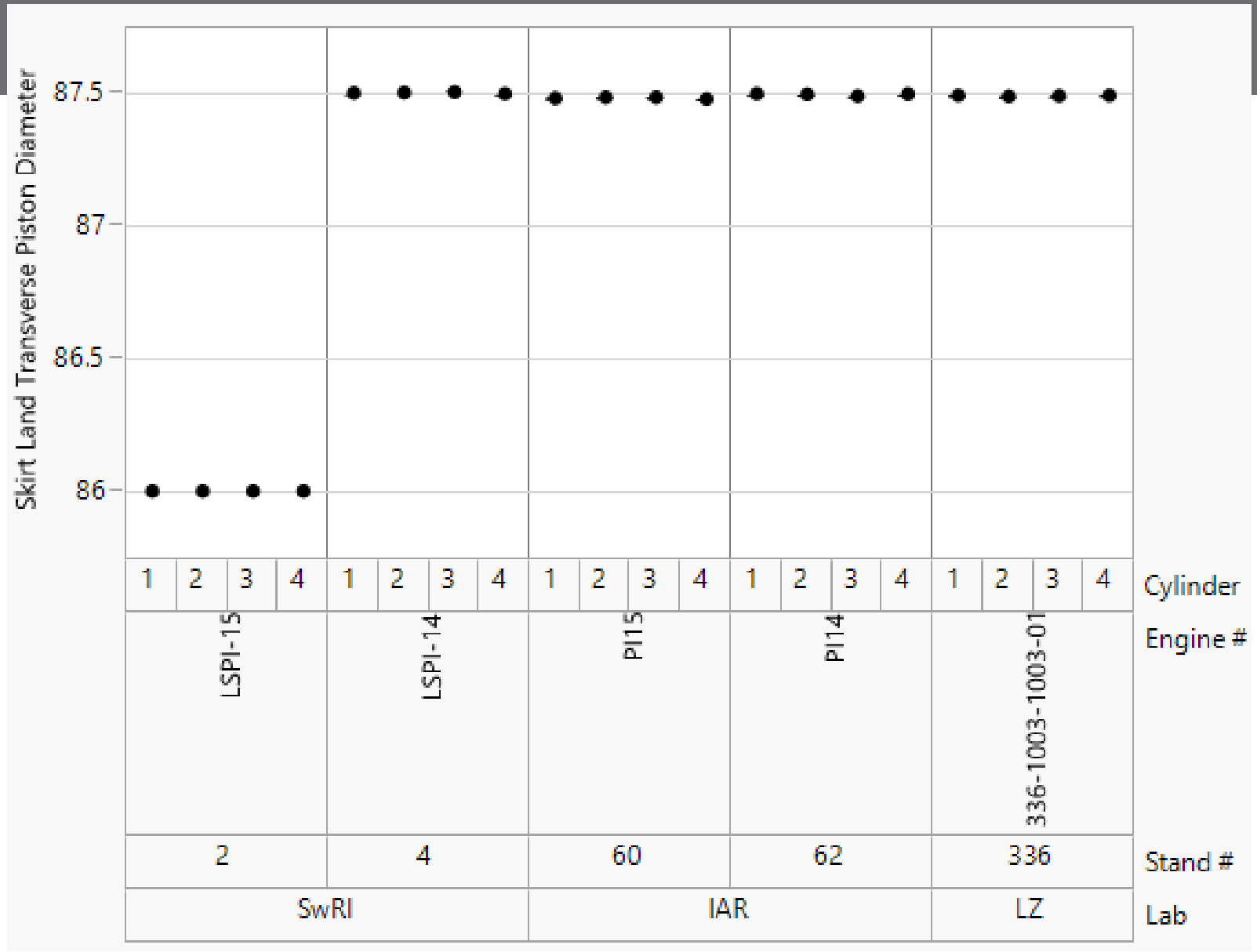
© 2016 The Lubrizol Corporation, all rights reserved.



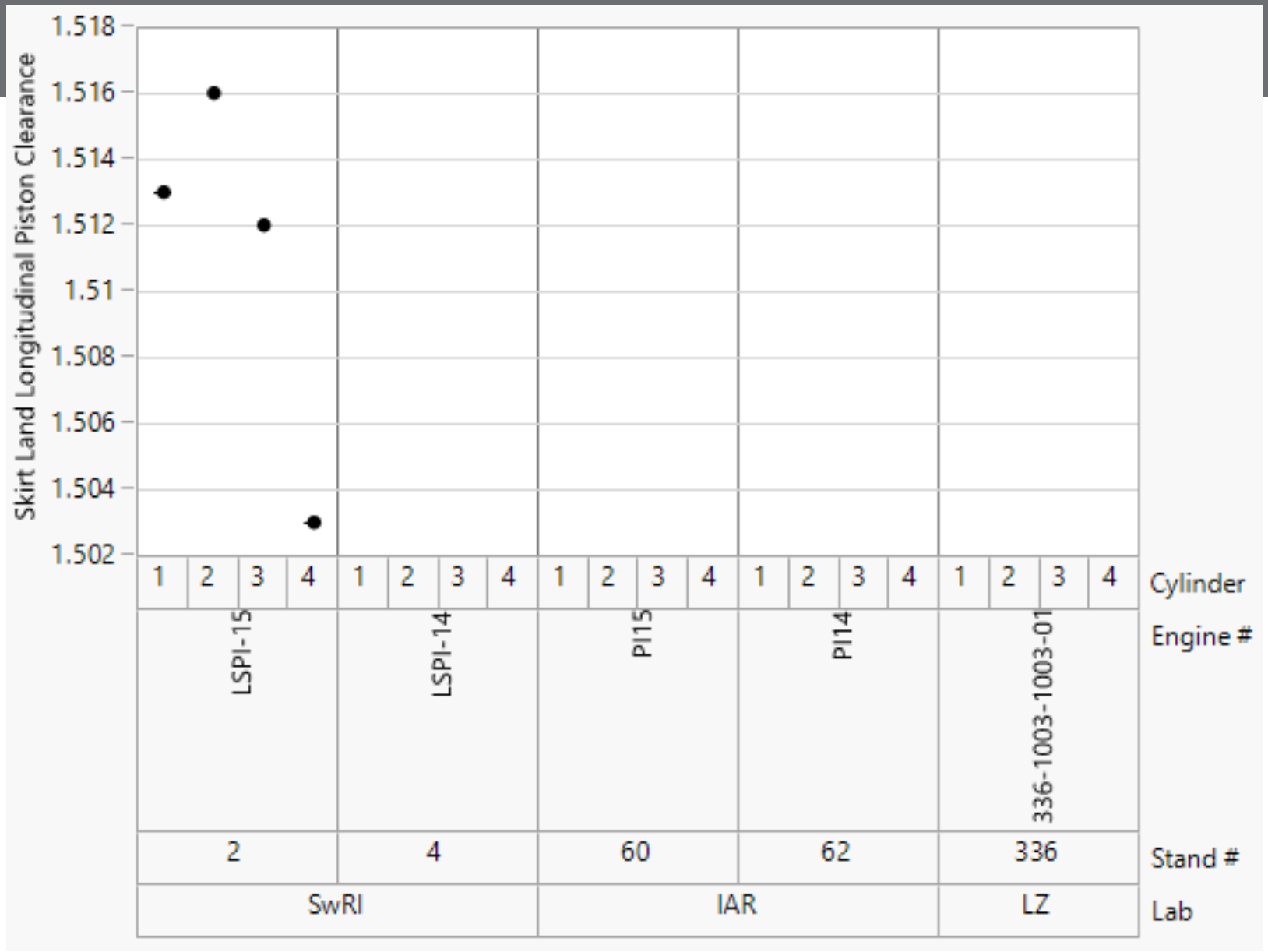
© 2016 The Lubrizol Corporation, all rights reserved.



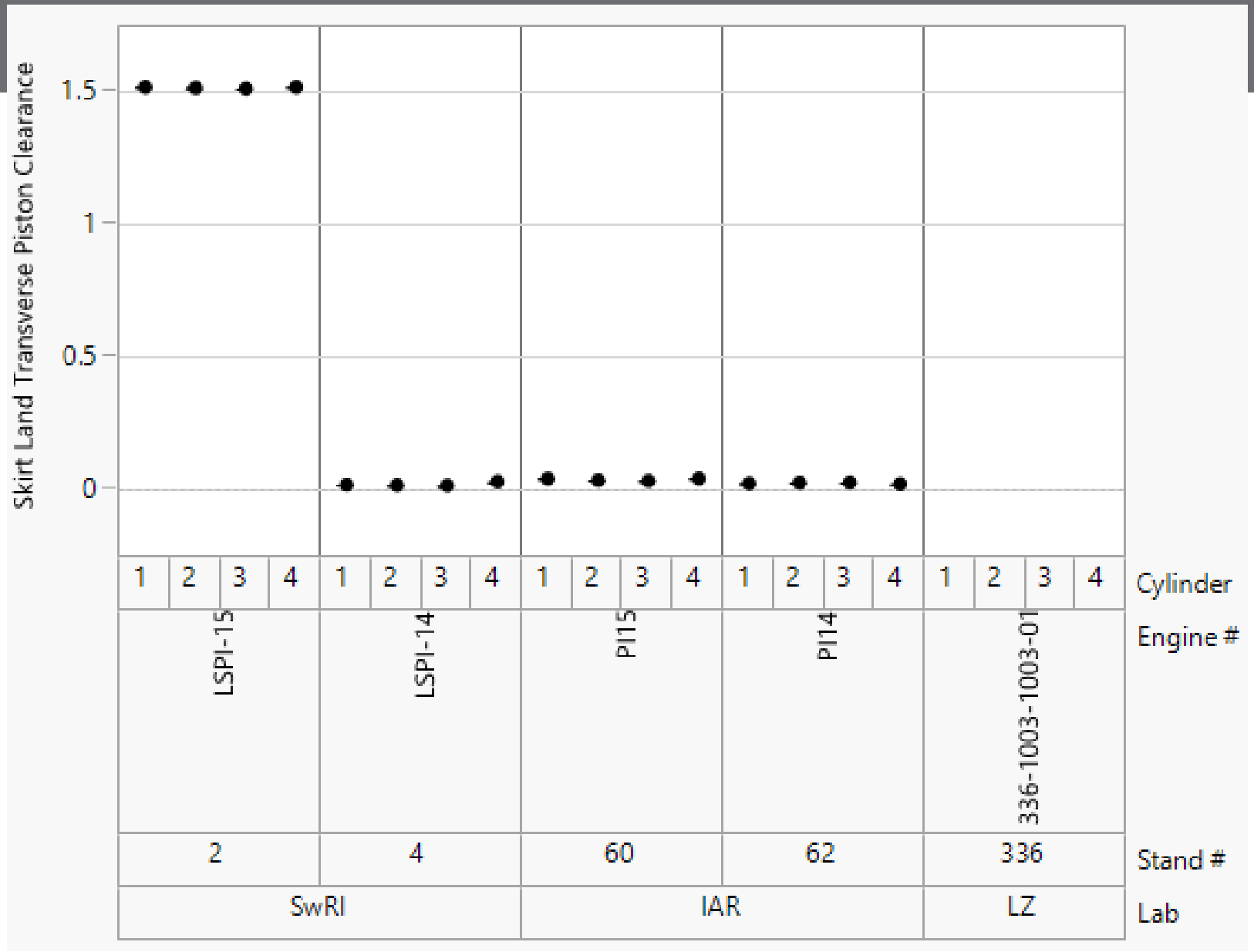
© 2016 The Lubrizol Corporation, all rights reserved.



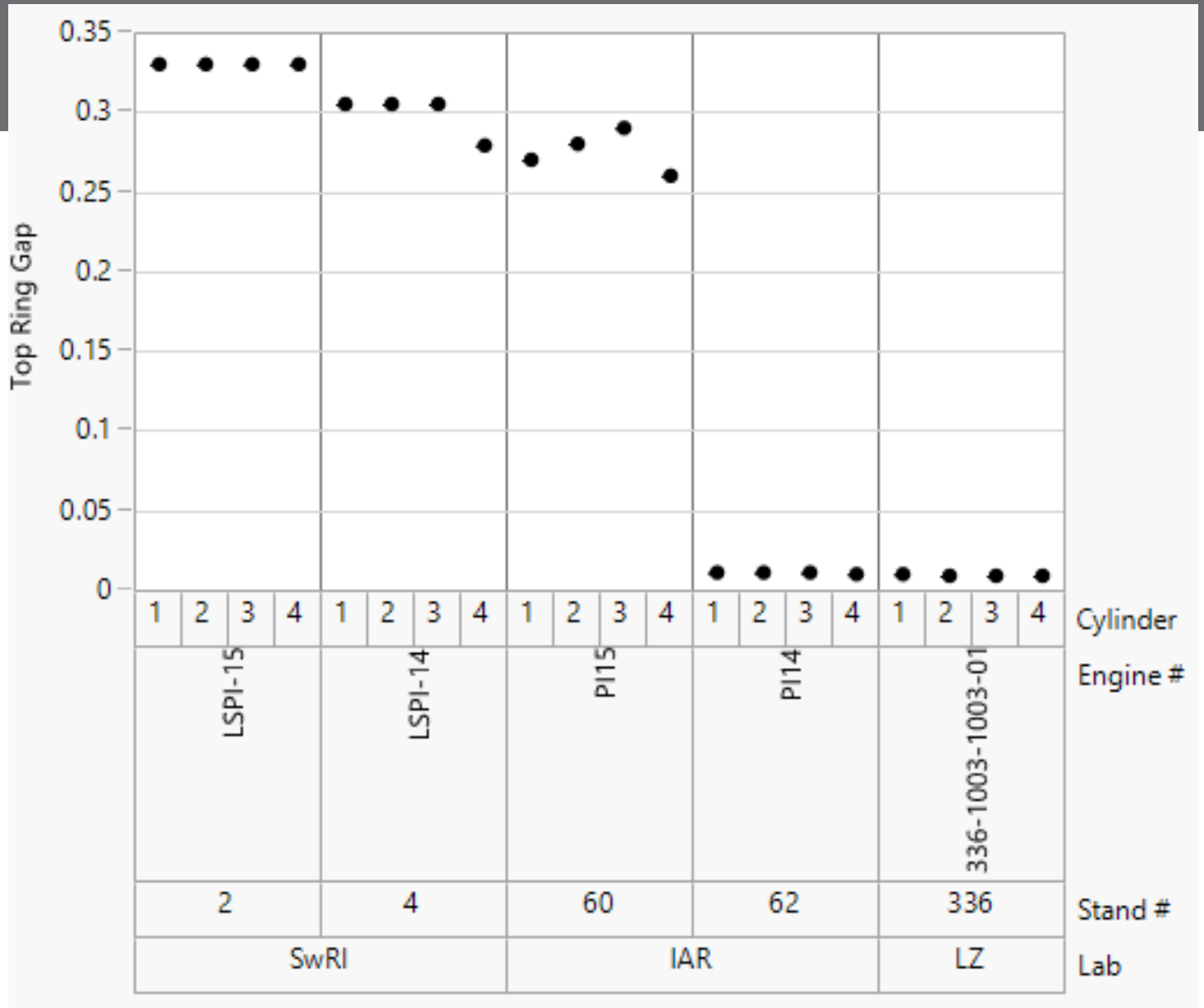
© 2016 The Lubrizol Corporation, all rights reserved.



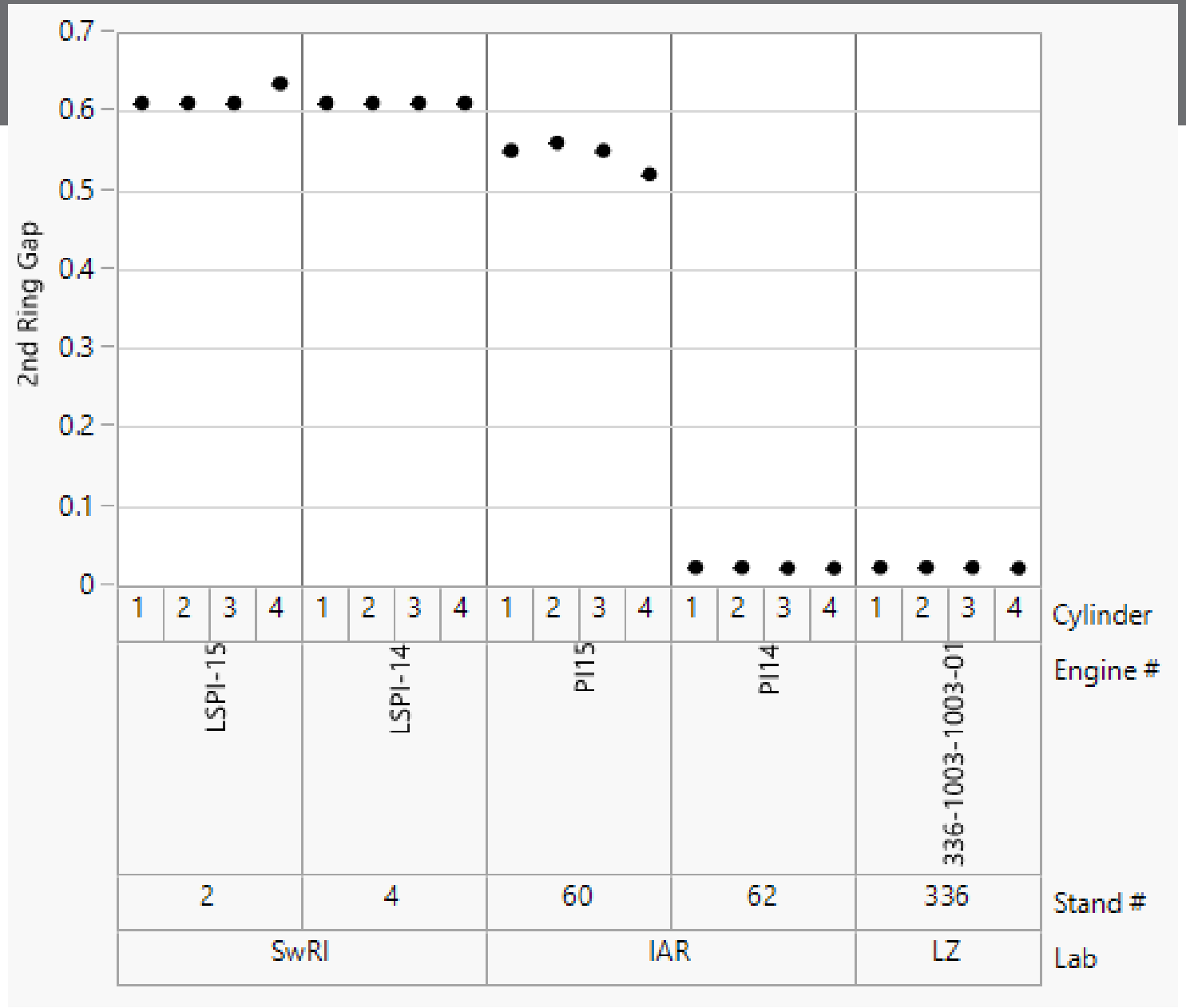
© 2016 The Lubrizol Corporation, all rights reserved.



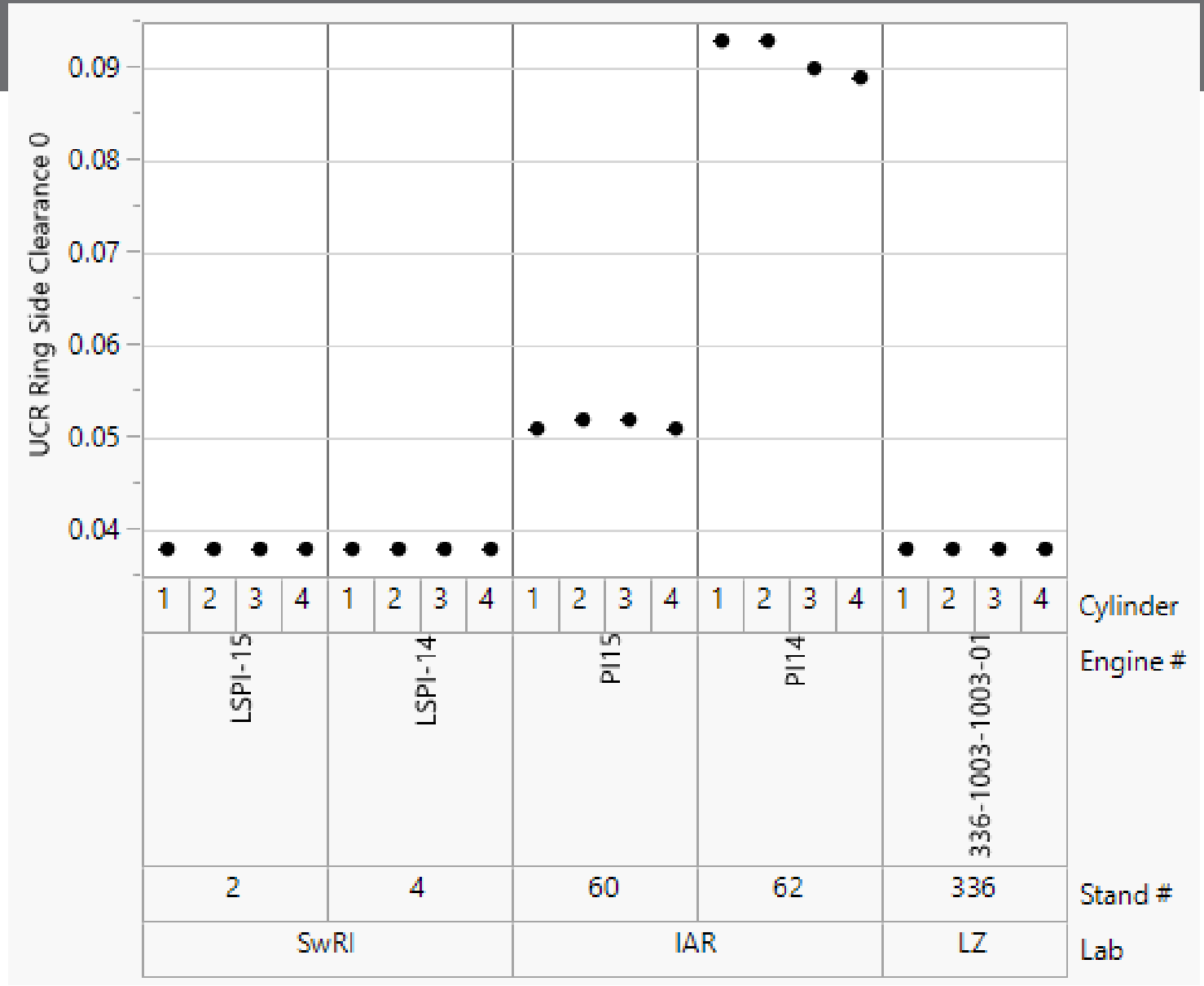
© 2016 The Lubrizol Corporation, all rights reserved.



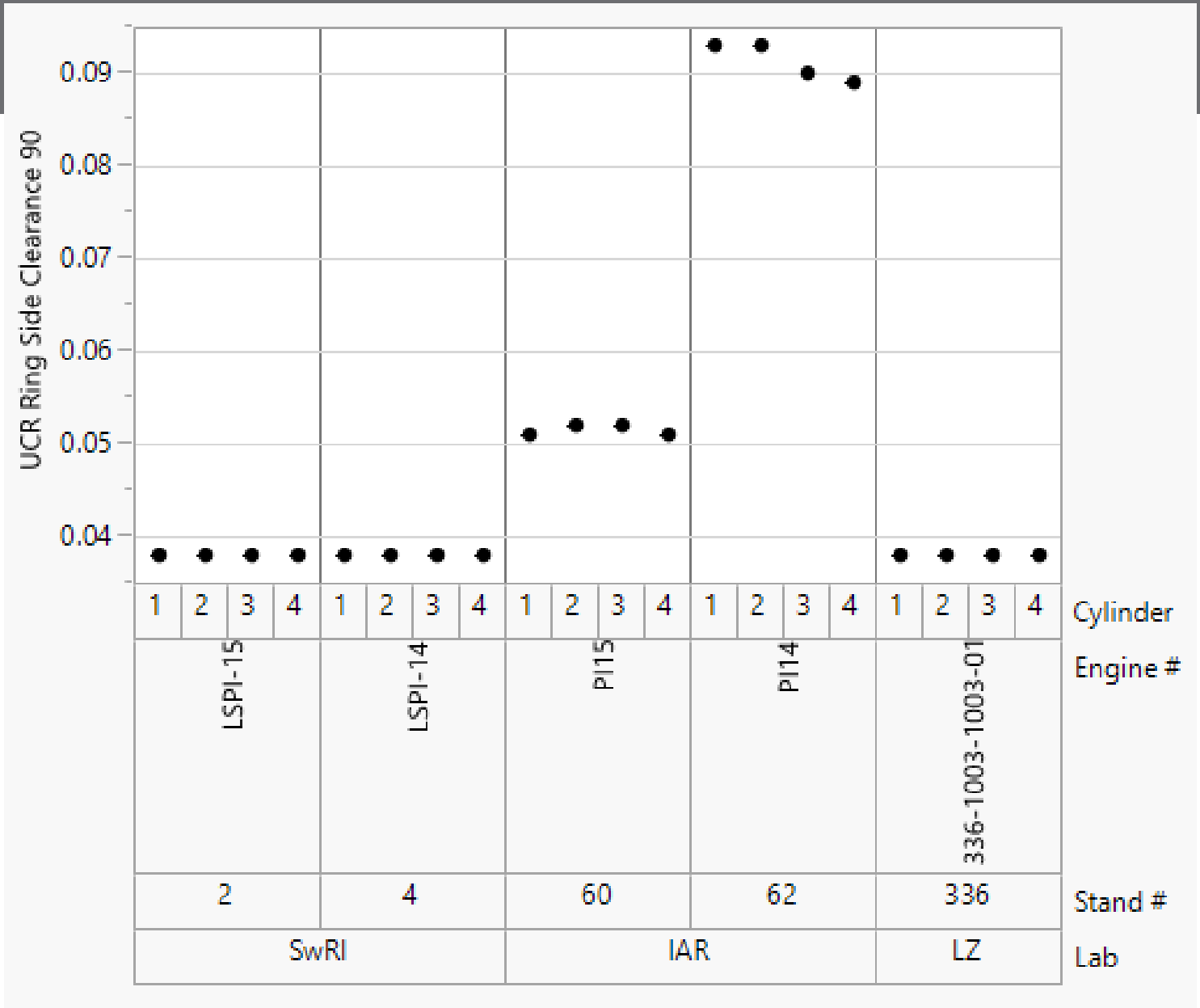
© 2016 The Lubrizol Corporation, all rights reserved.



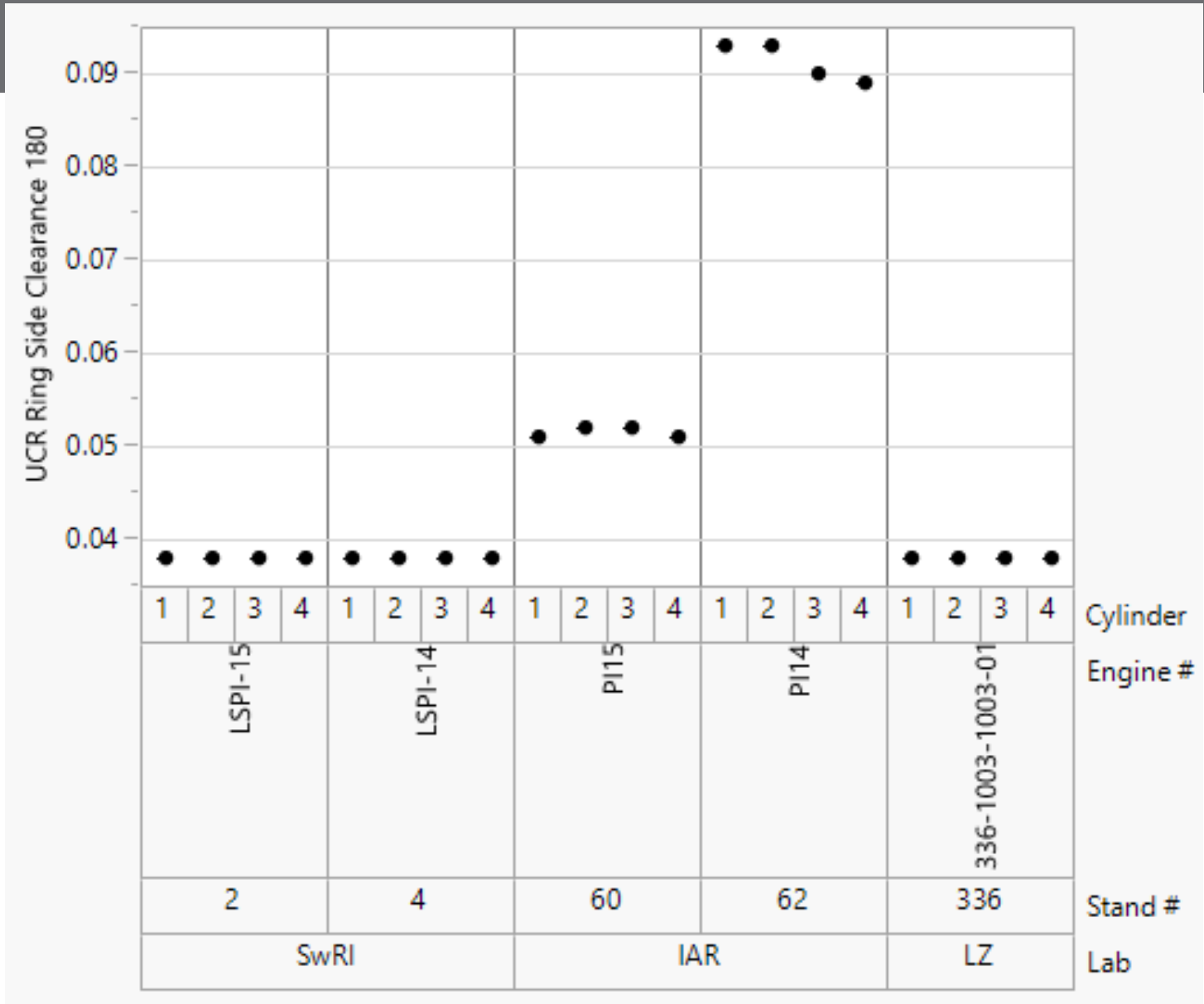
© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.

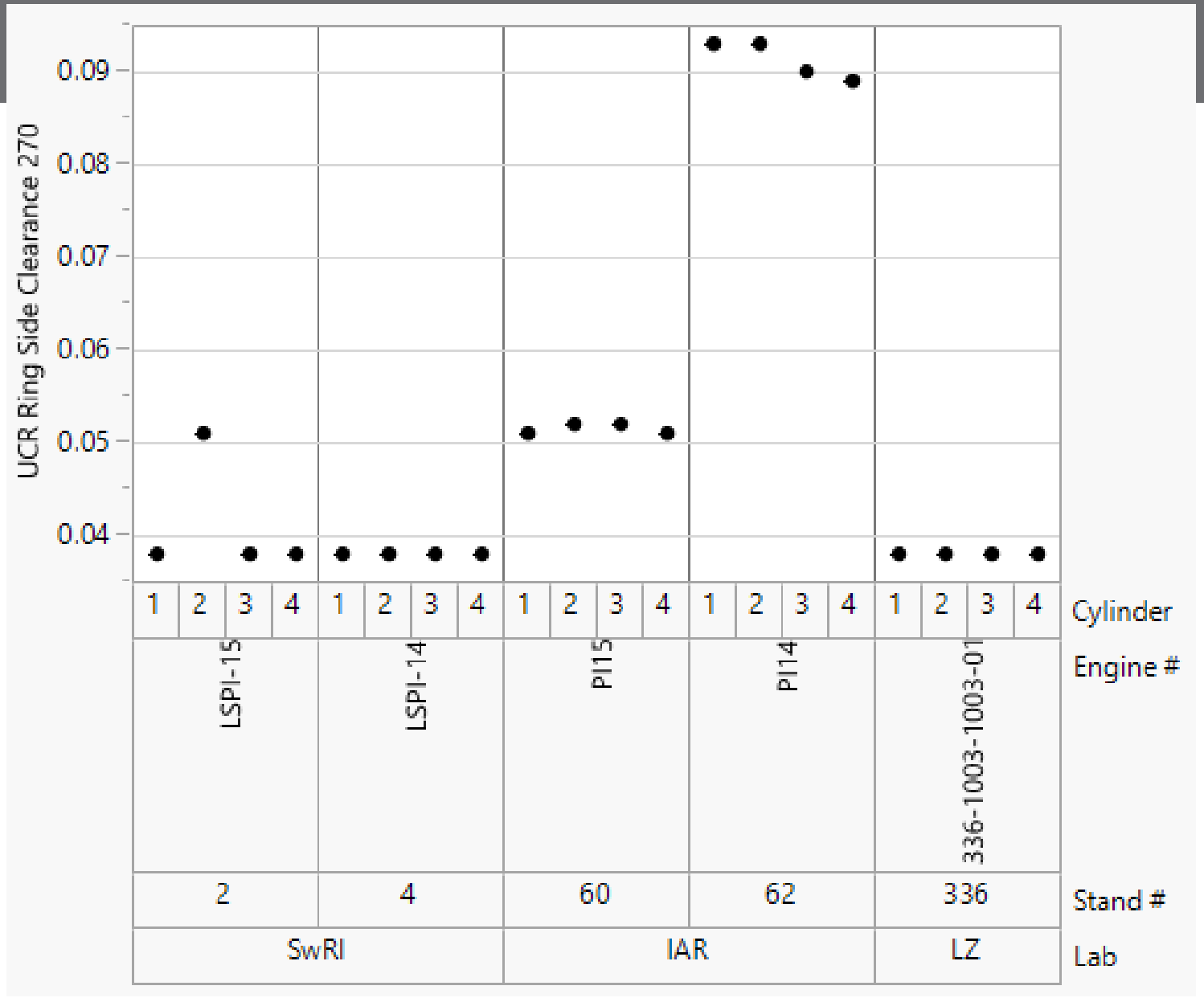


© 2016 The Lubrizol Corporation, all rights reserved.

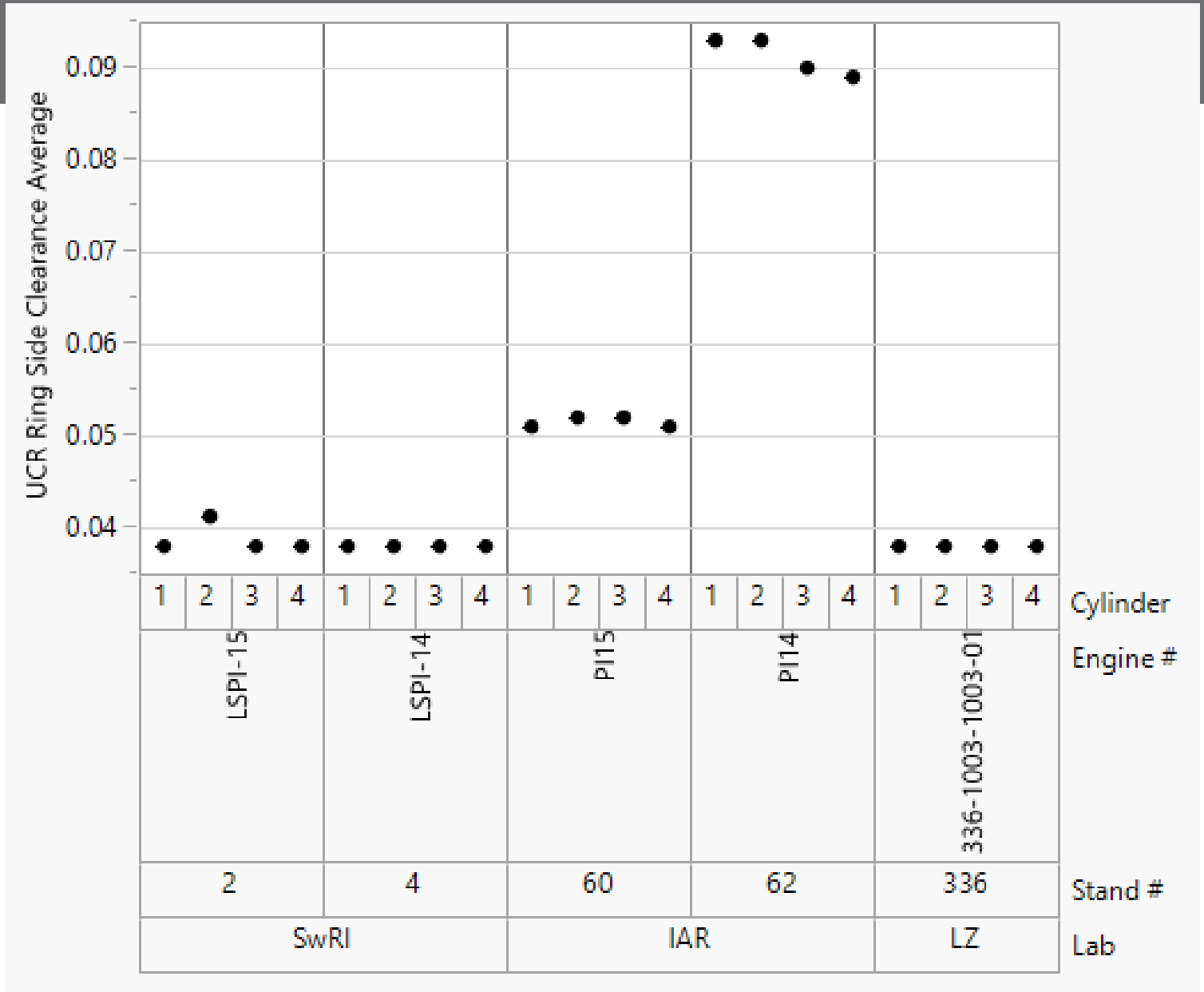


© 2016 The Lubrizol Corporation, all rights reserved.

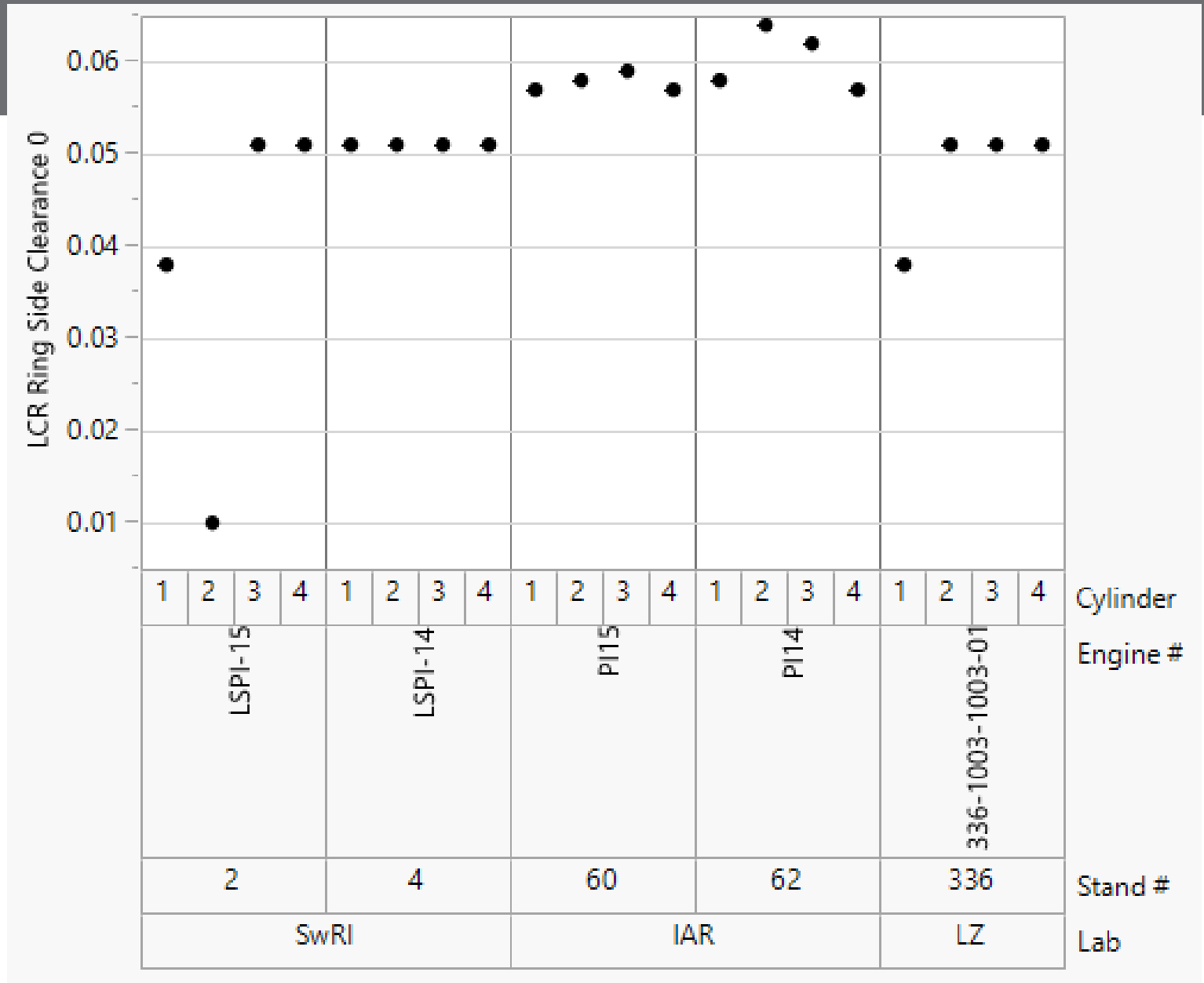
Lubrizol



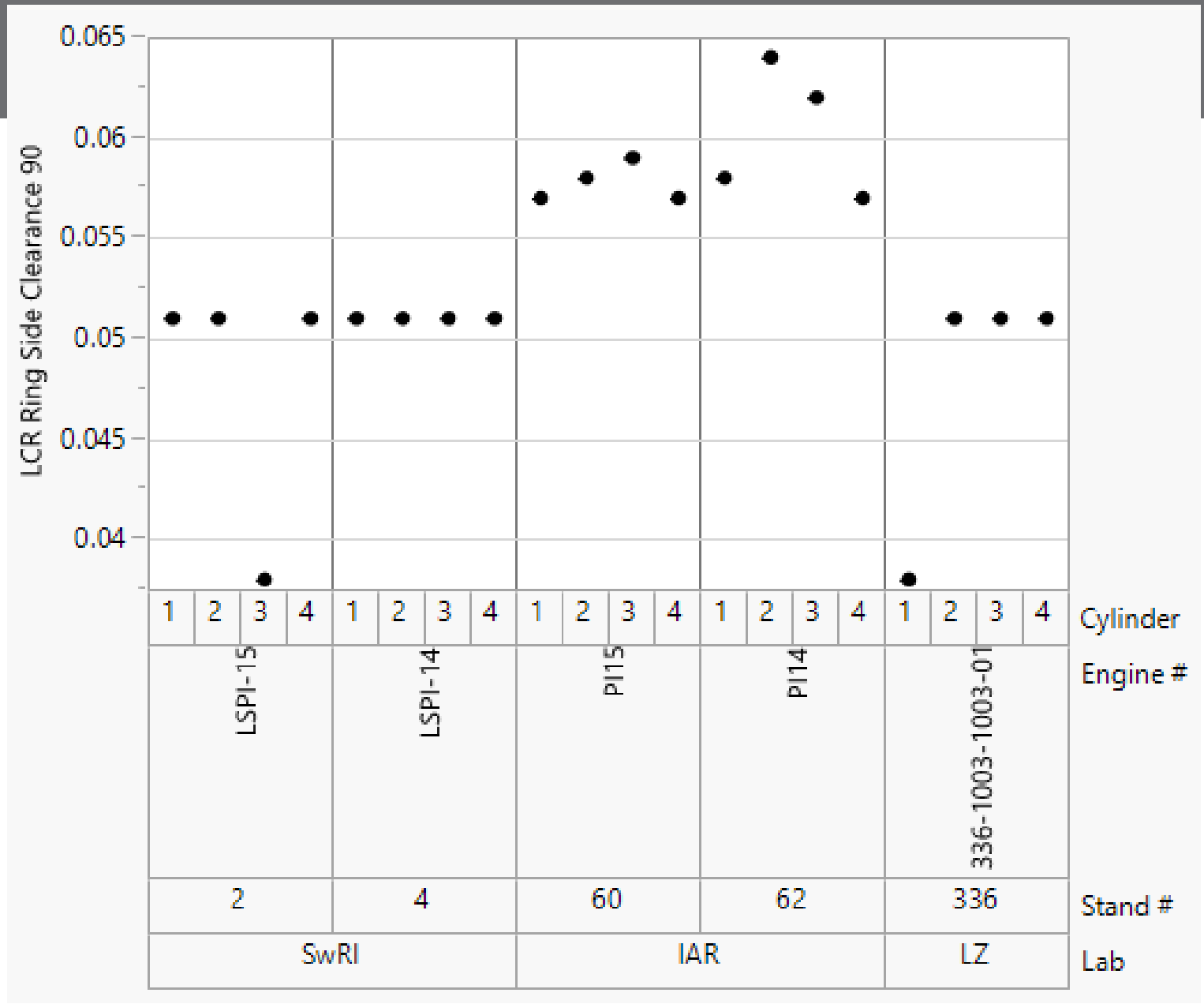
© 2016 The Lubrizol Corporation, all rights reserved.



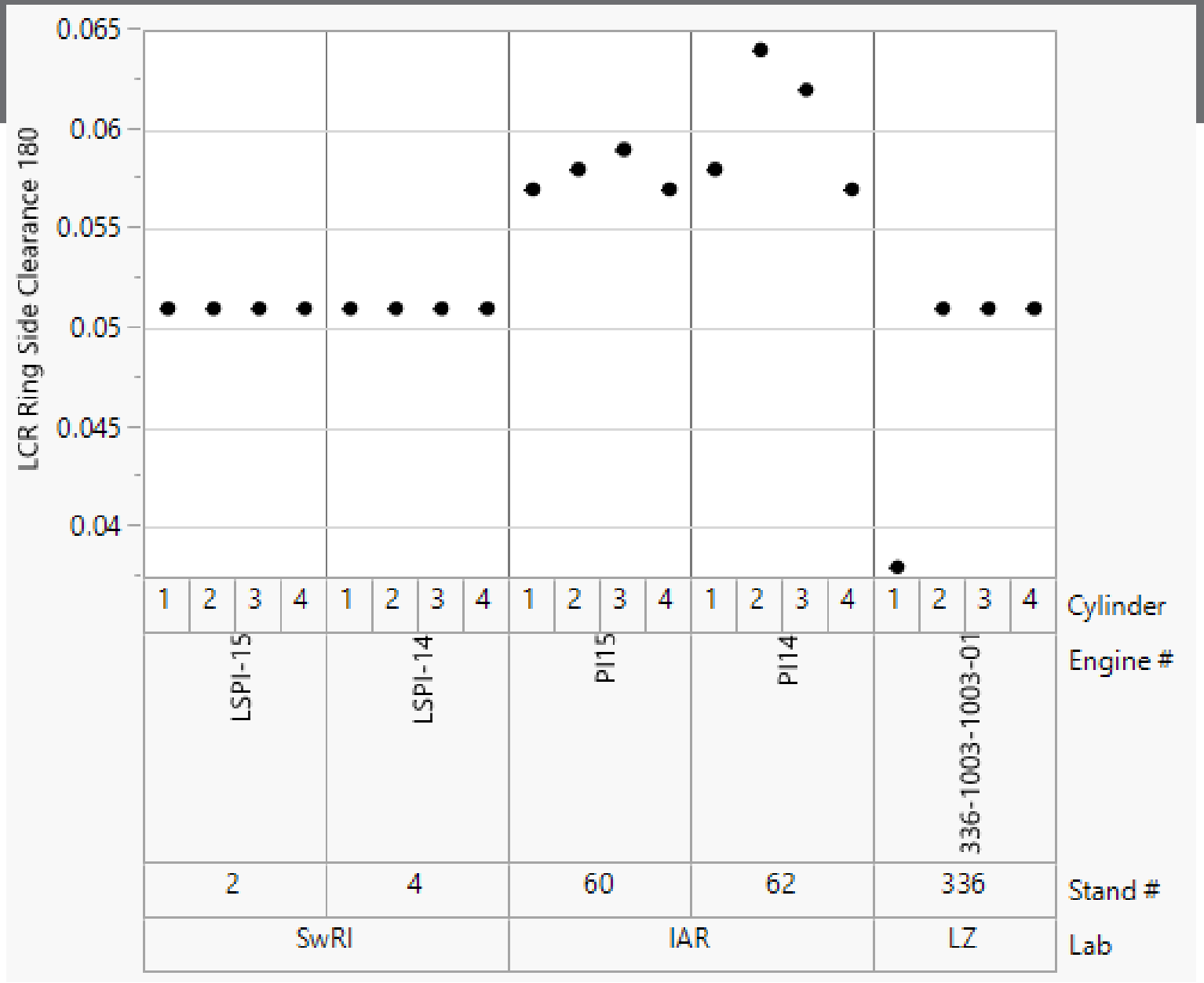
© 2016 The Lubrizol Corporation, all rights reserved.



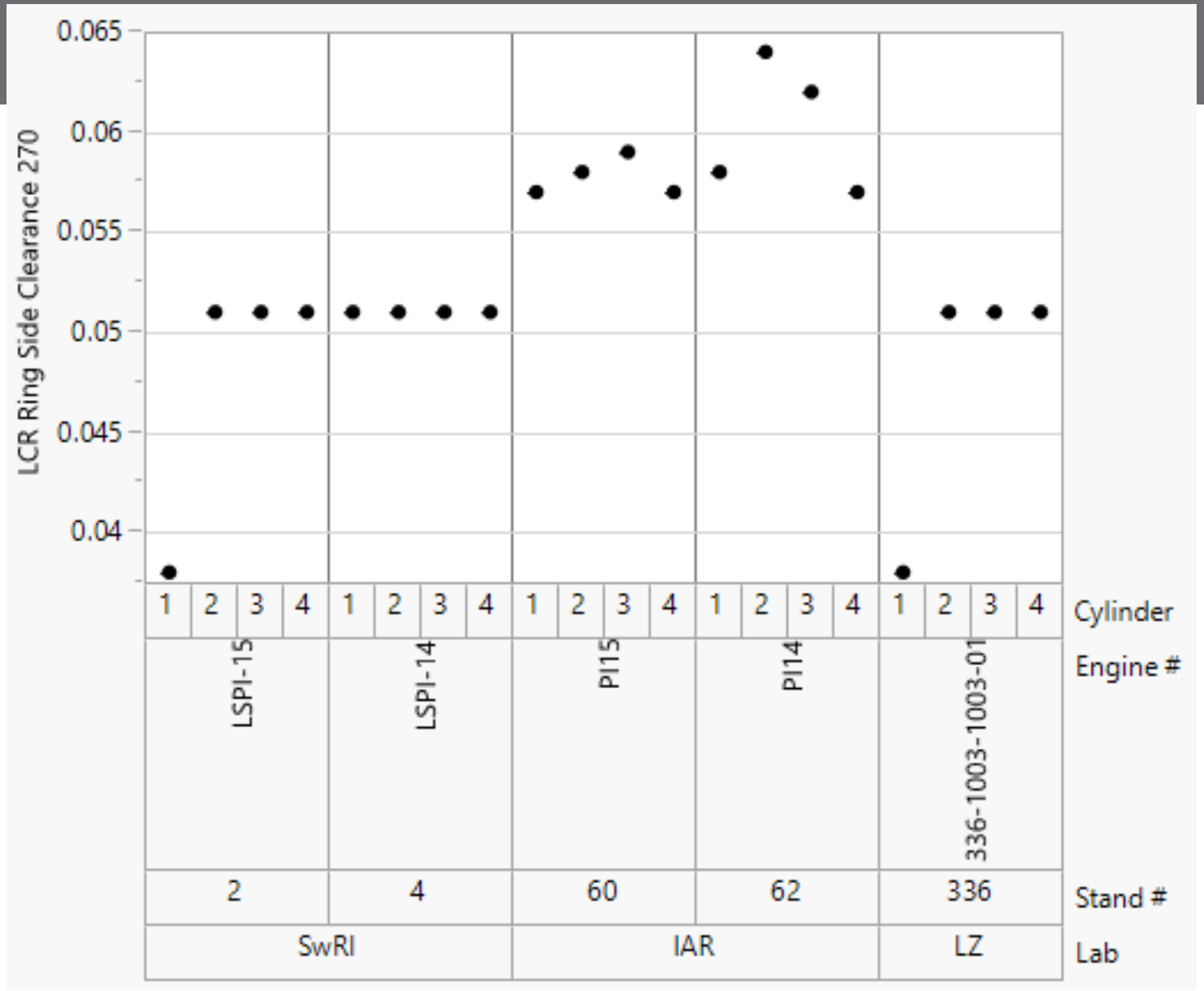
© 2016 The Lubrizol Corporation, all rights reserved.



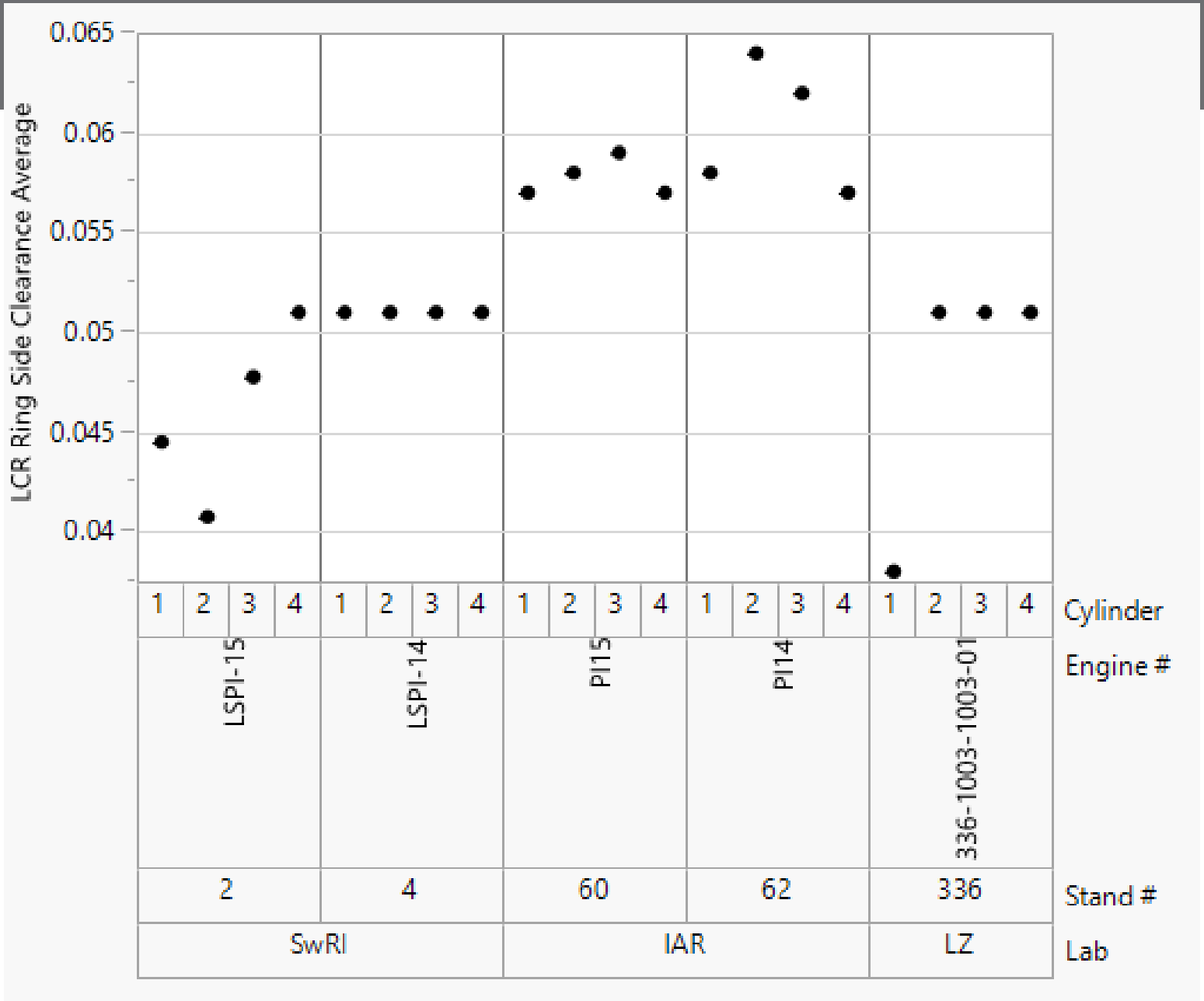
© 2016 The Lubrizol Corporation, all rights reserved.



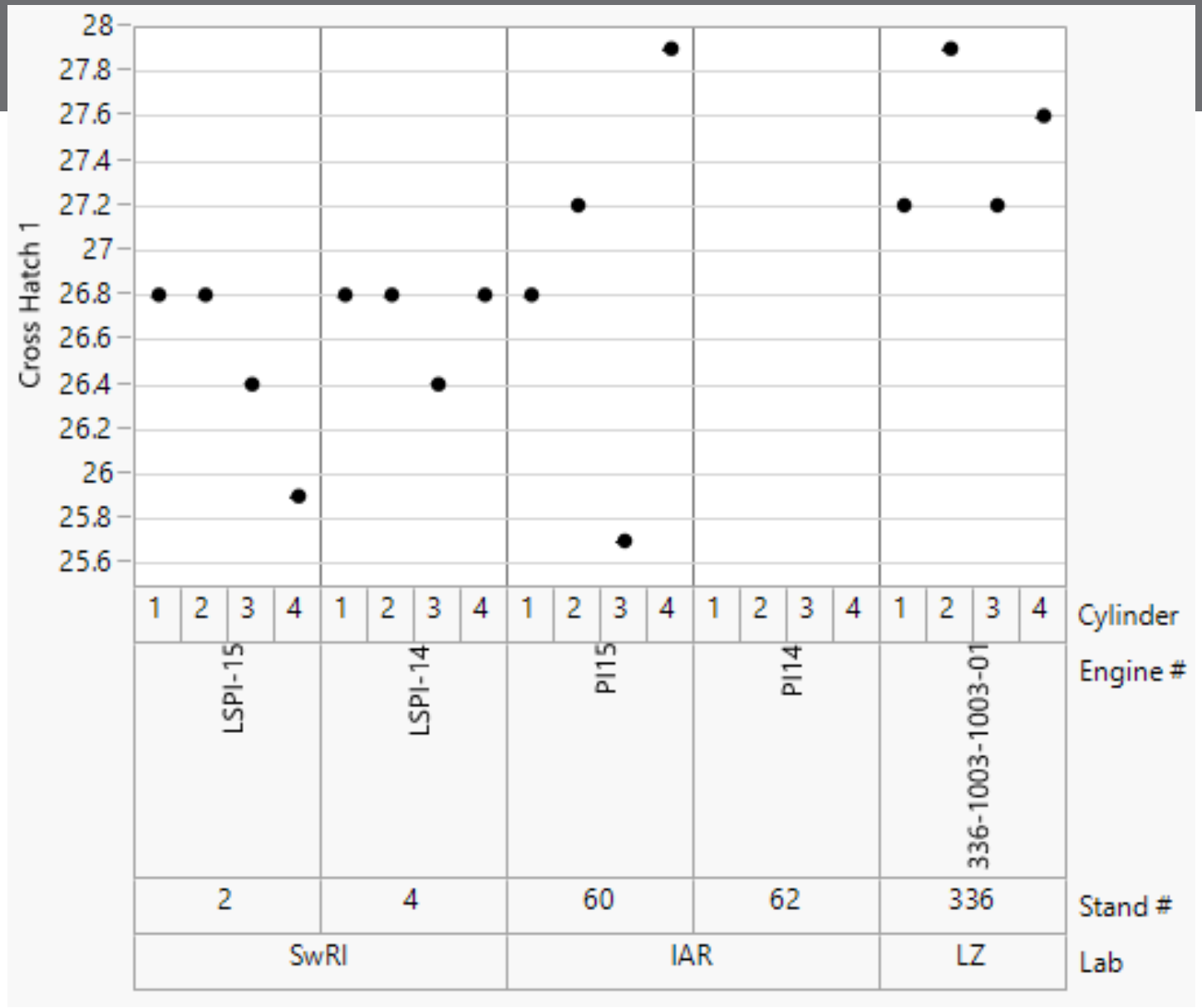
© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.

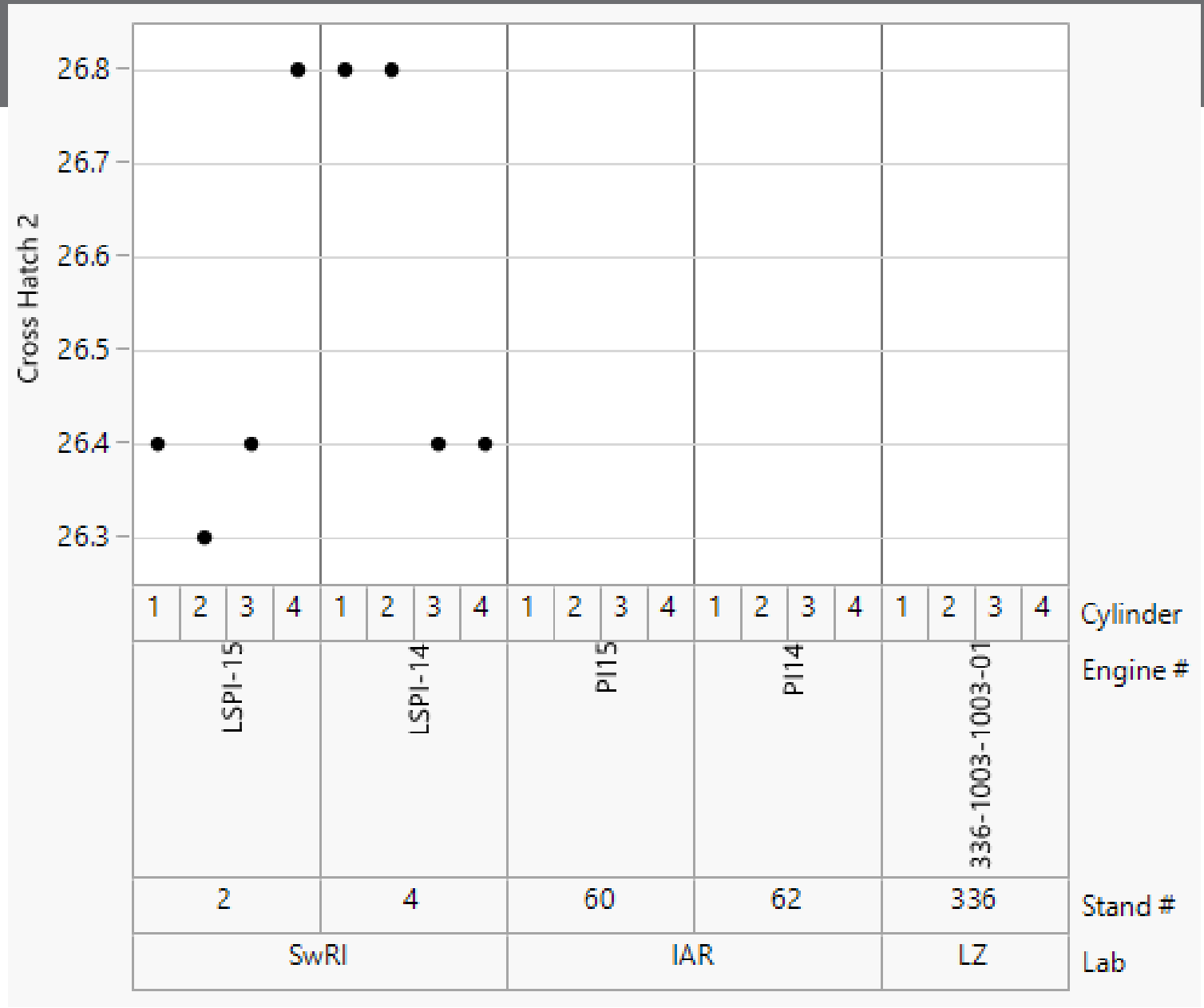


© 2016 The Lubrizol Corporation, all rights reserved.

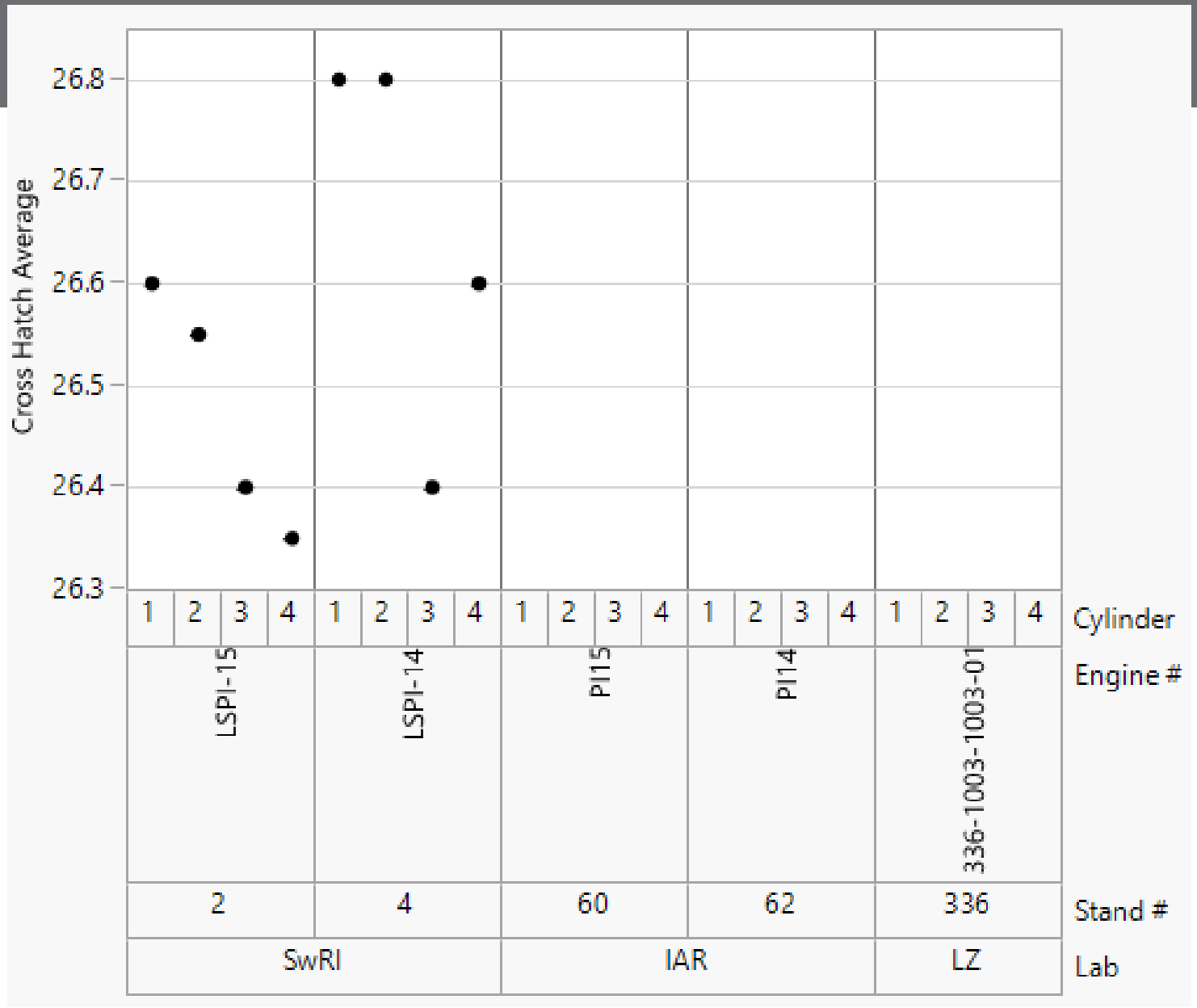


© 2016 The Lubrizol Corporation, all rights reserved.

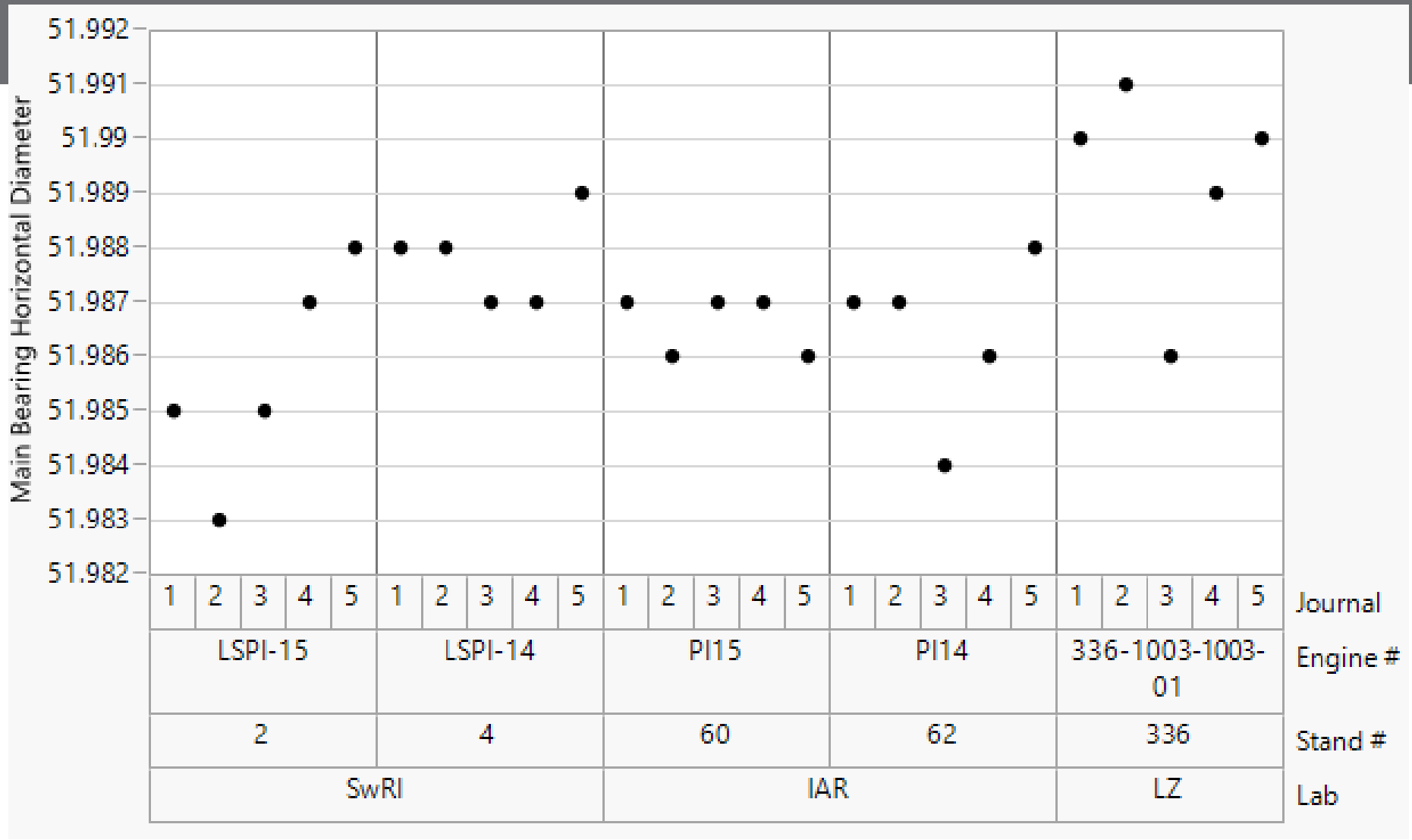
Lubrizol



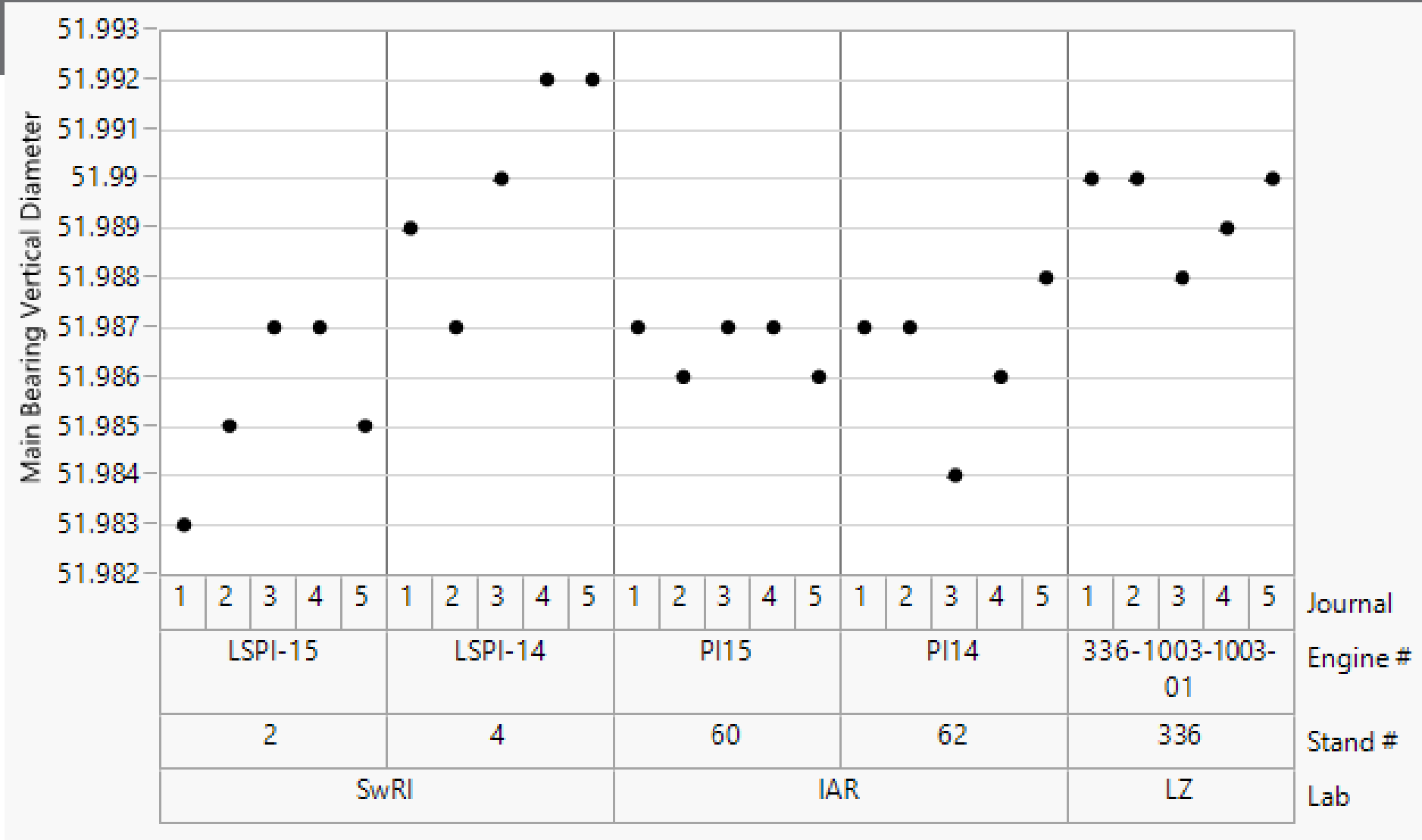
© 2016 The Lubrizol Corporation, all rights reserved.



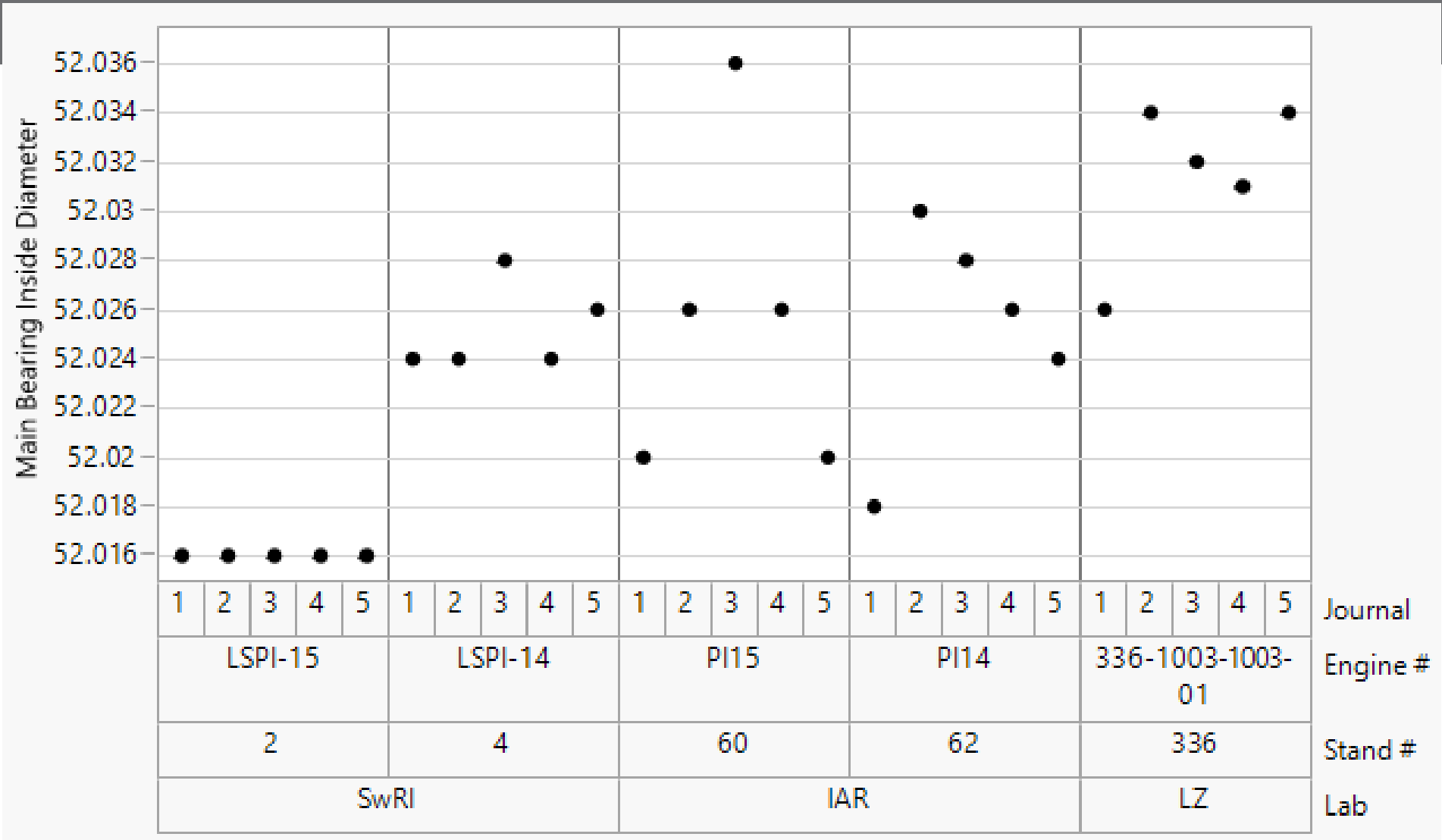
© 2016 The Lubrizol Corporation, all rights reserved.



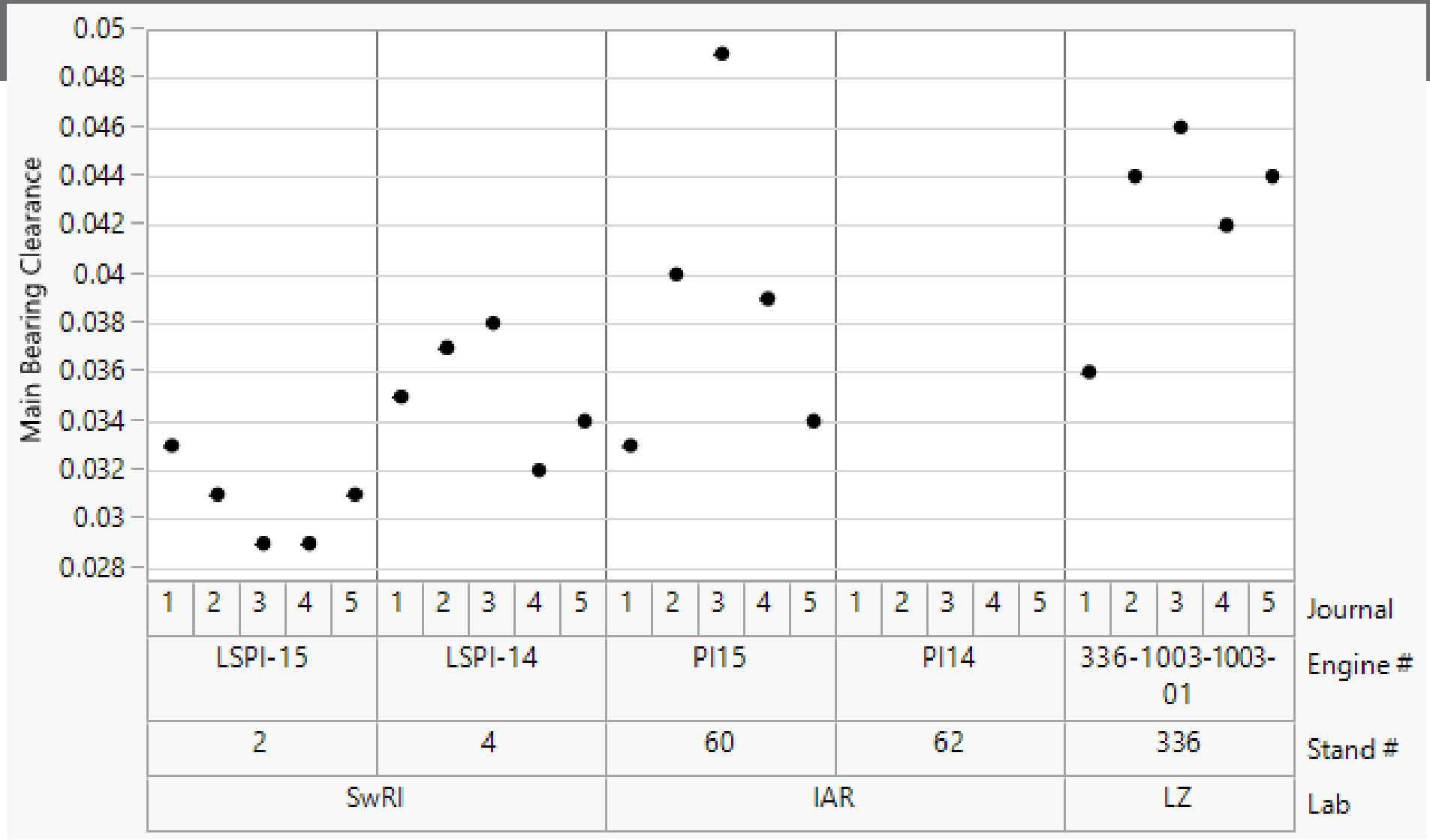
© 2016 The Lubrizol Corporation, all rights reserved.



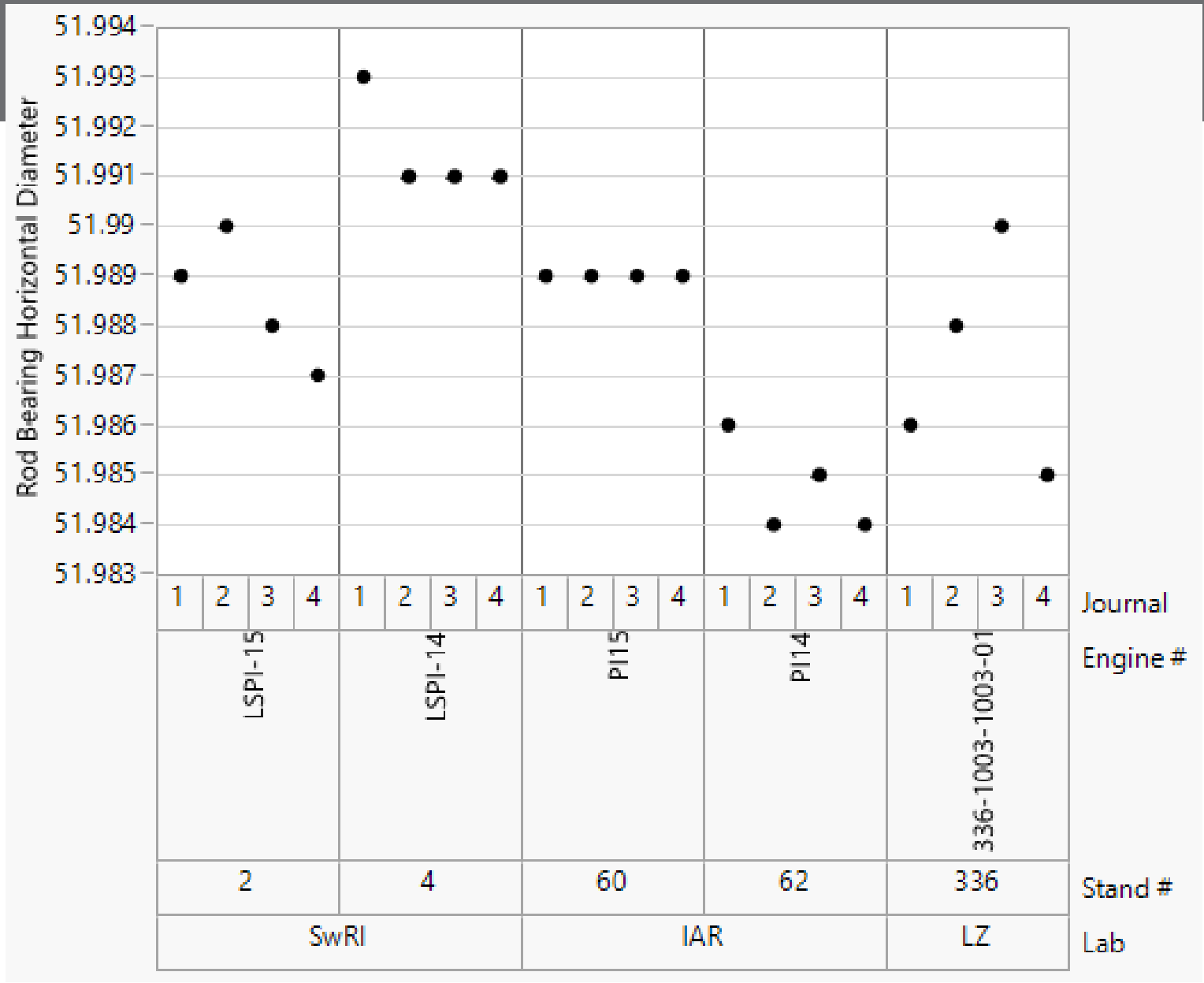
© 2016 The Lubrizol Corporation, all rights reserved.



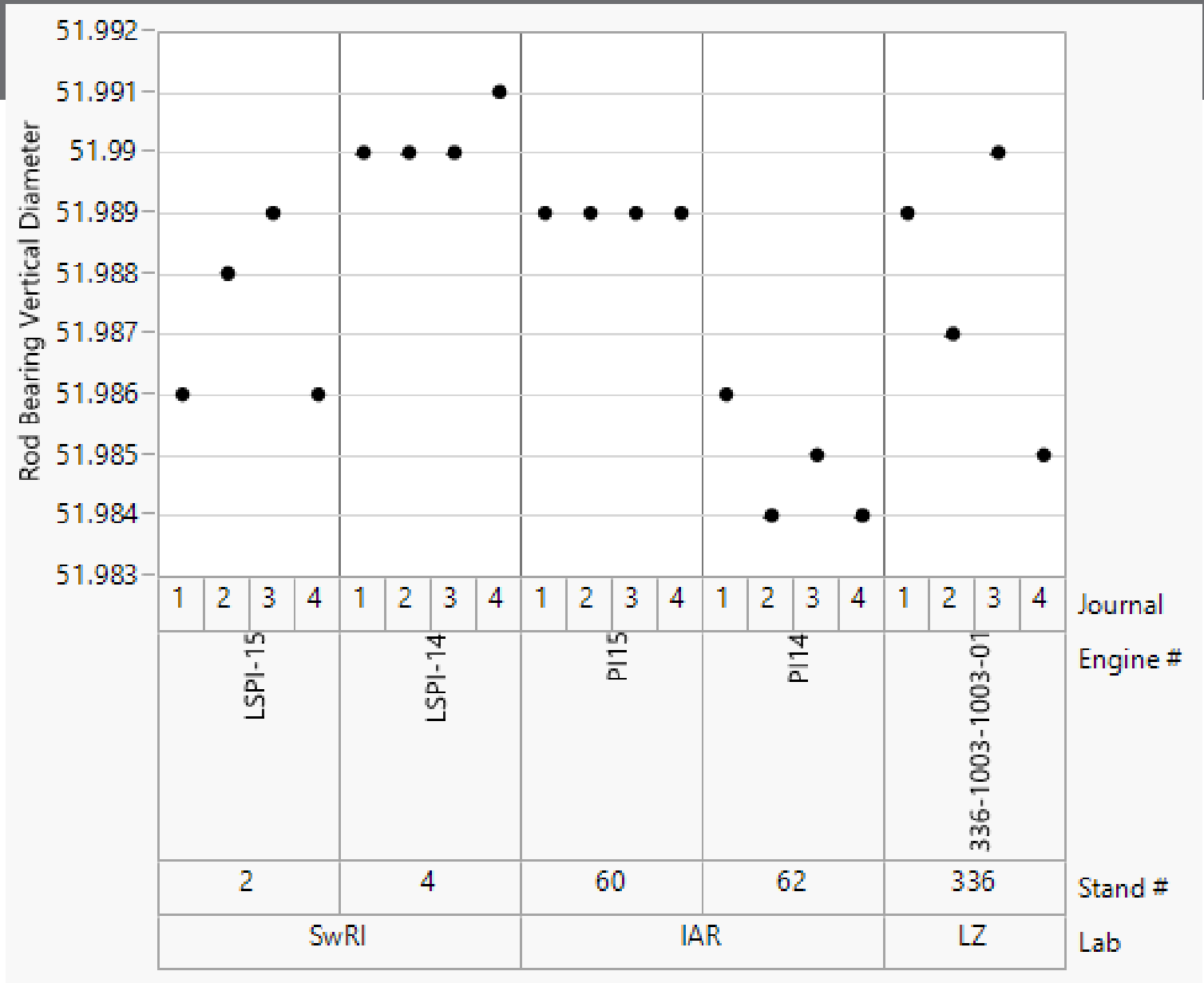
© 2016 The Lubrizol Corporation, all rights reserved.



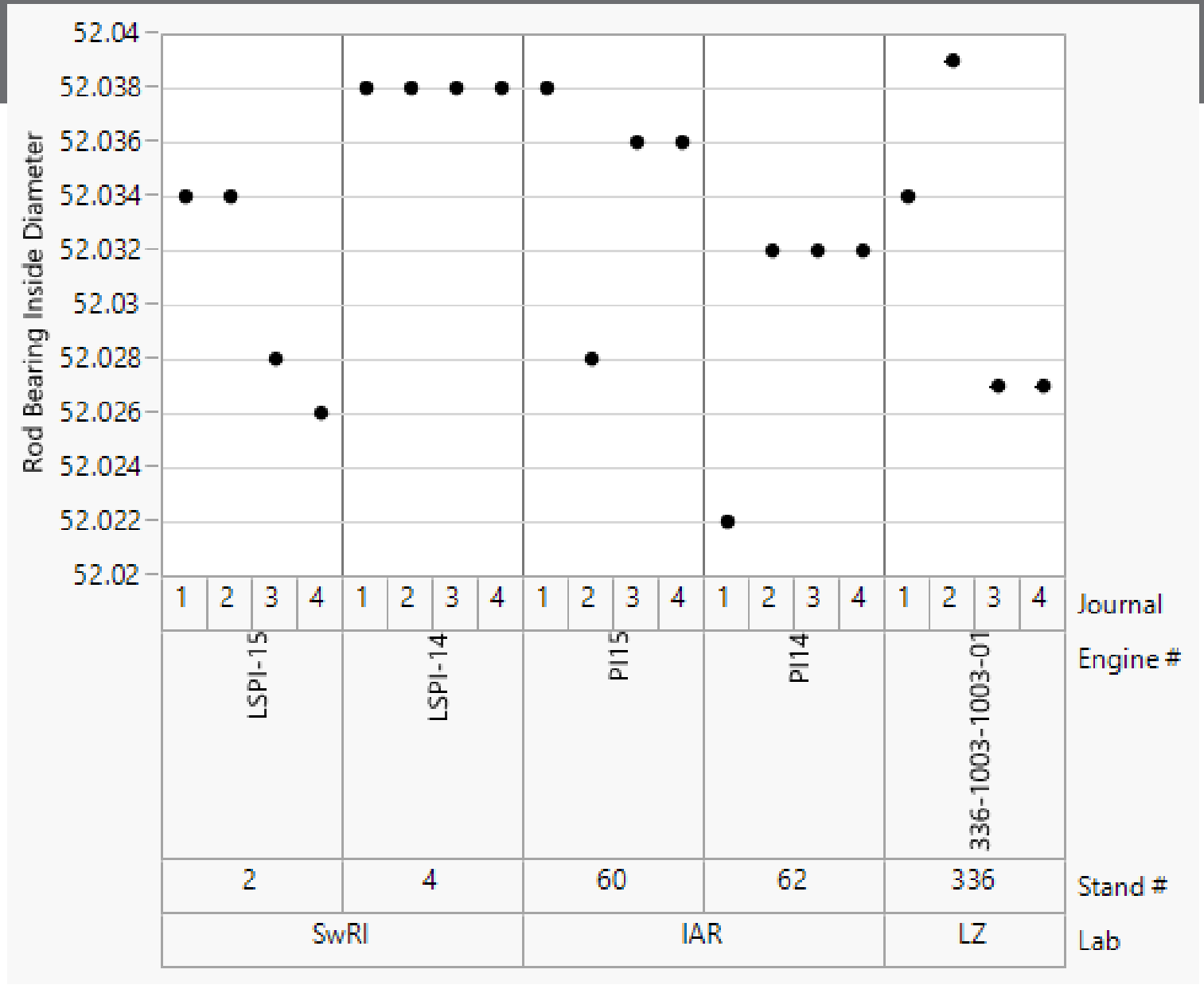
© 2016 The Lubrizol Corporation, all rights reserved.



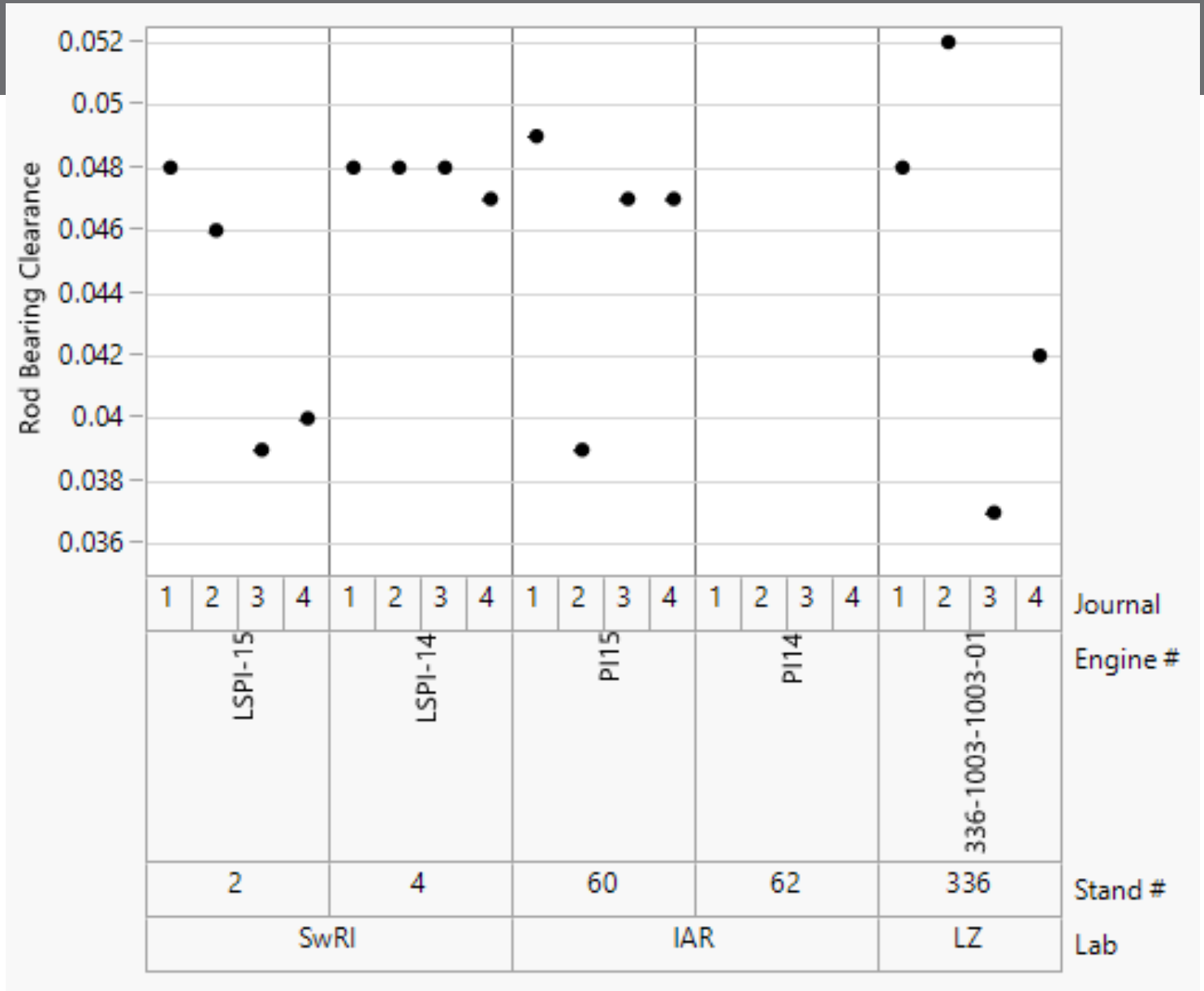
© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.

Operational Data

Plots show operational data recorded in the individual test reports uploaded to the TMC site.

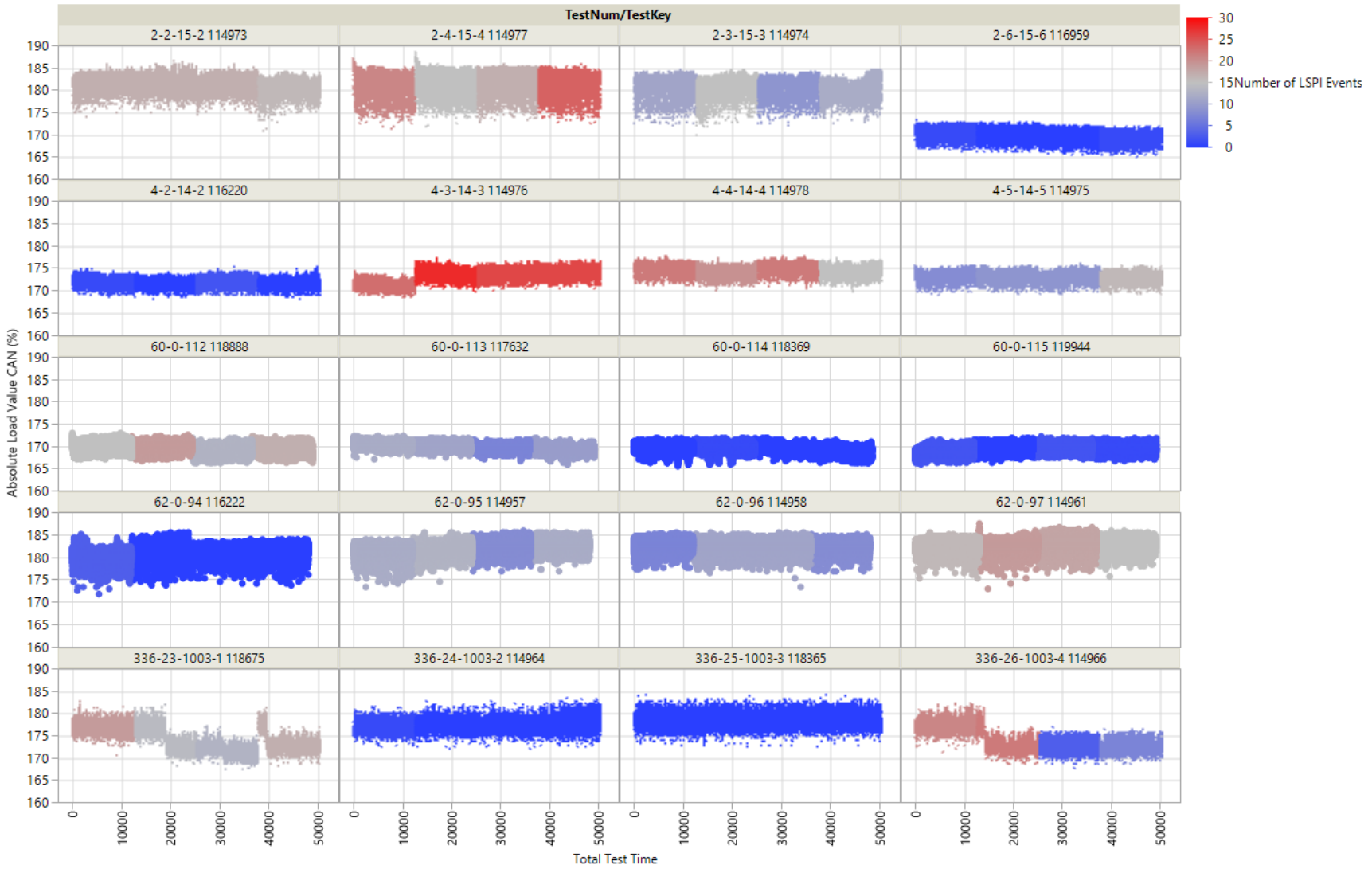
These operational data are associated with the four valid iterations of each test.

Each pane corresponds to a single precision matrix test.

The data are colored by the number of LSPI events.

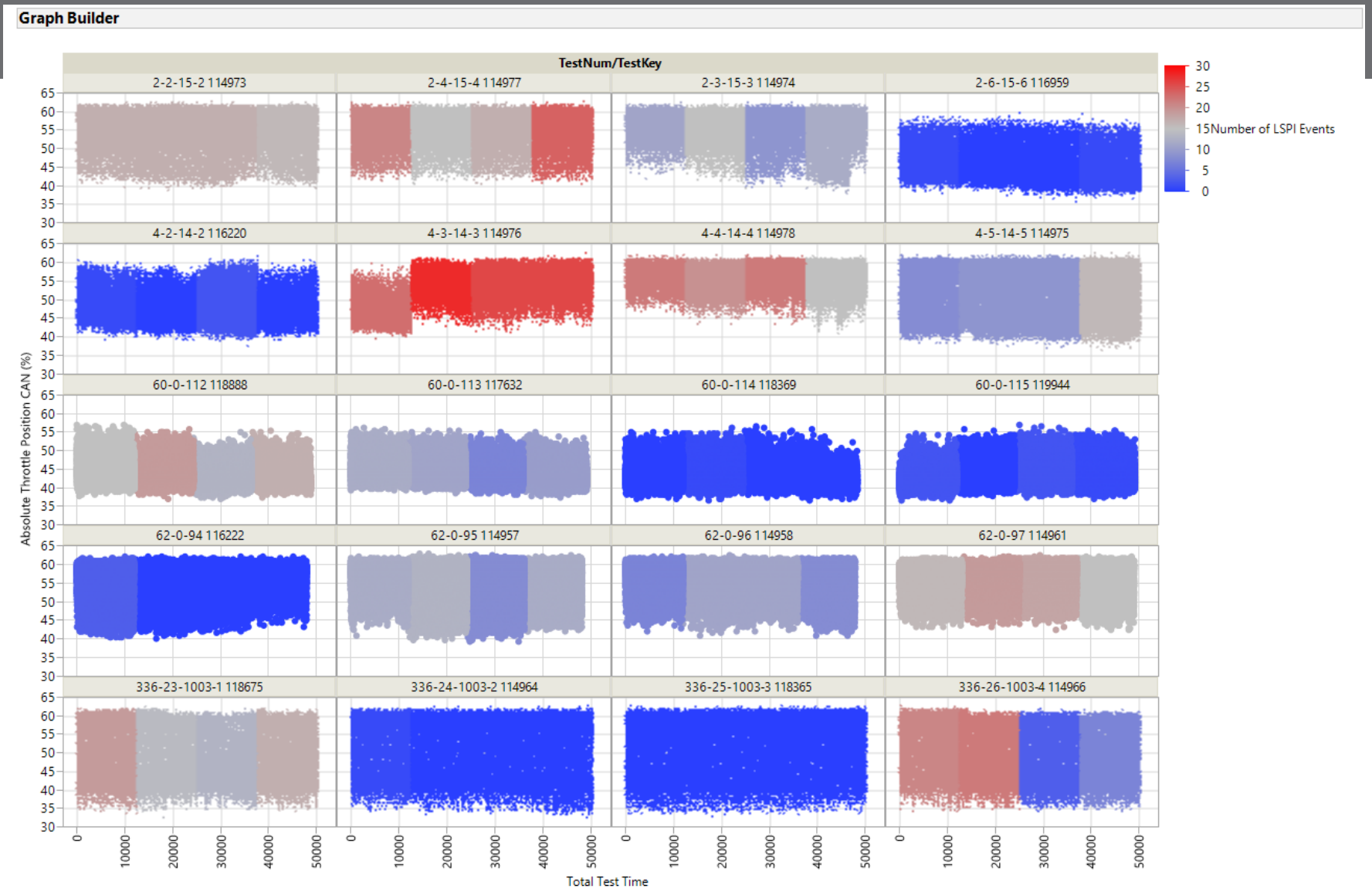
© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder

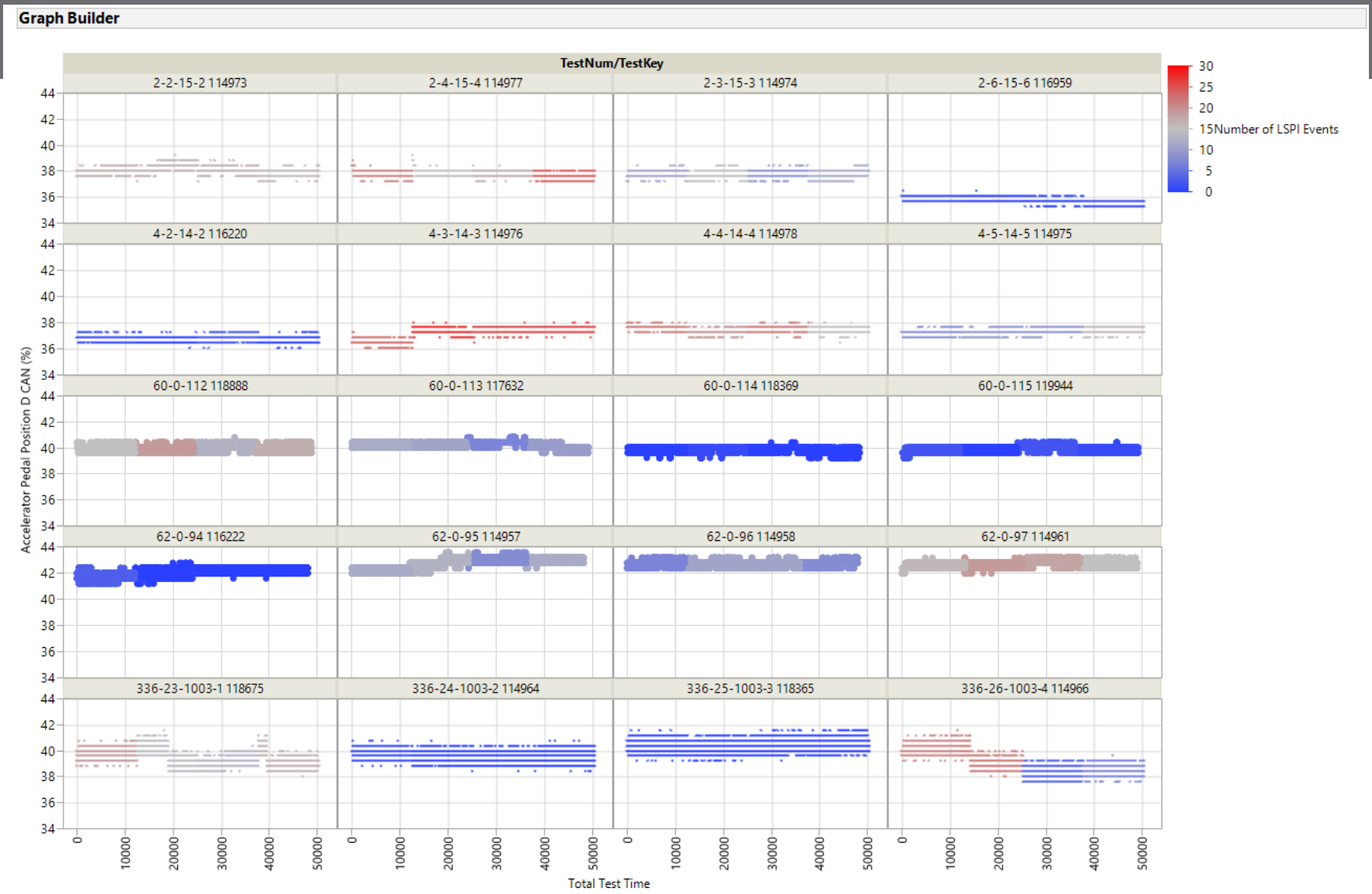


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

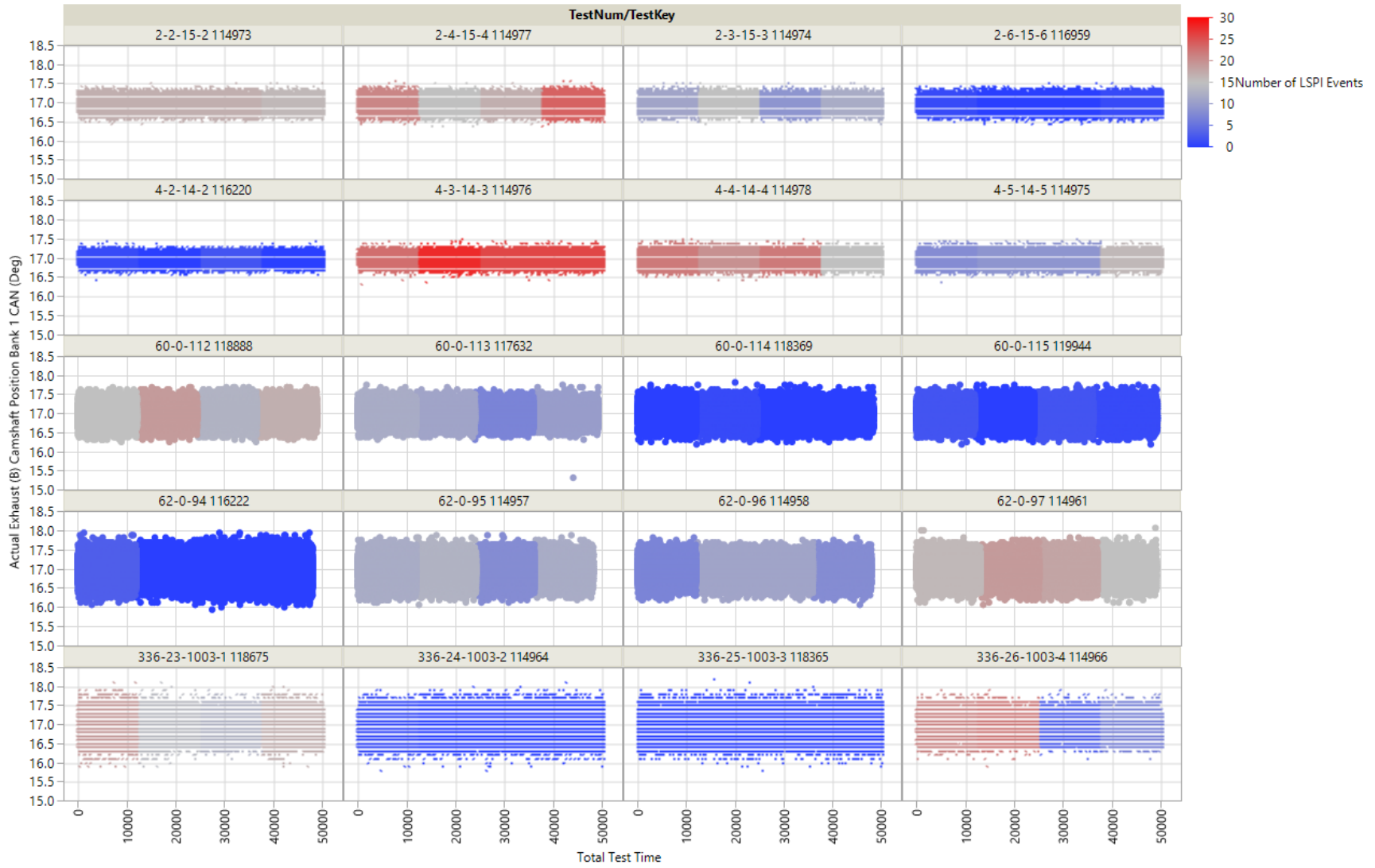


© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder

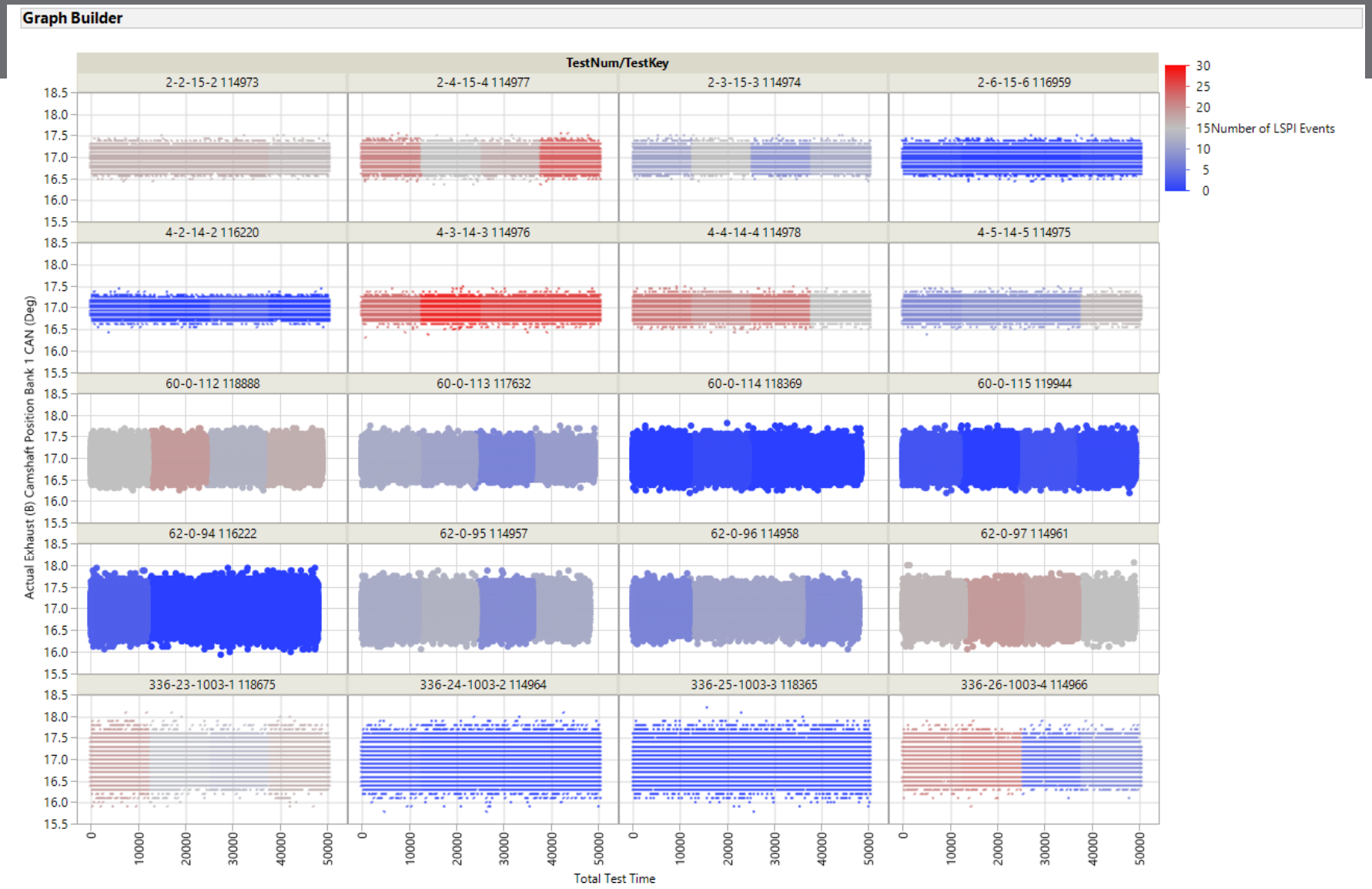


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

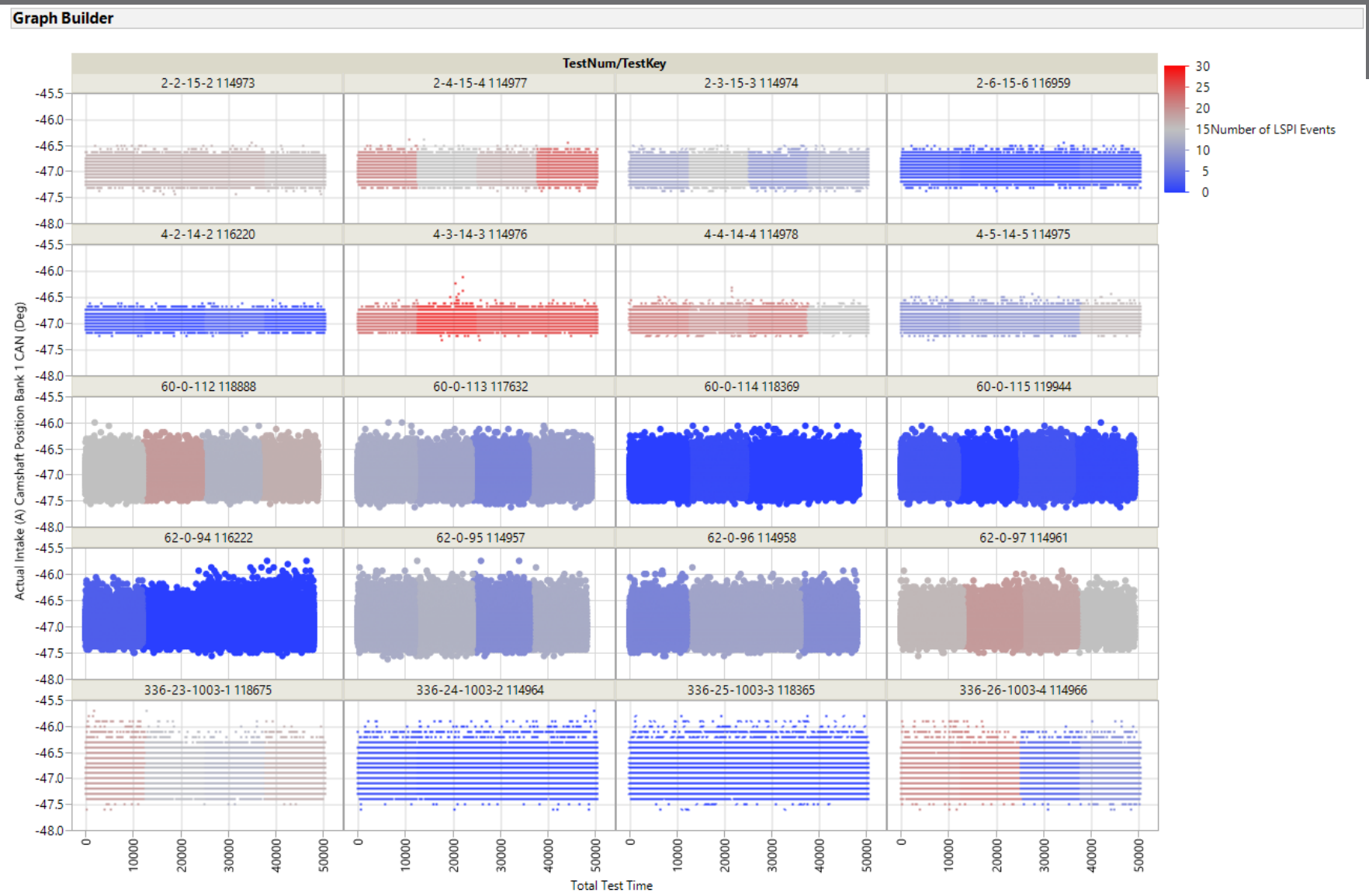
ZOOMED IN

SUCCESS TOGETHER



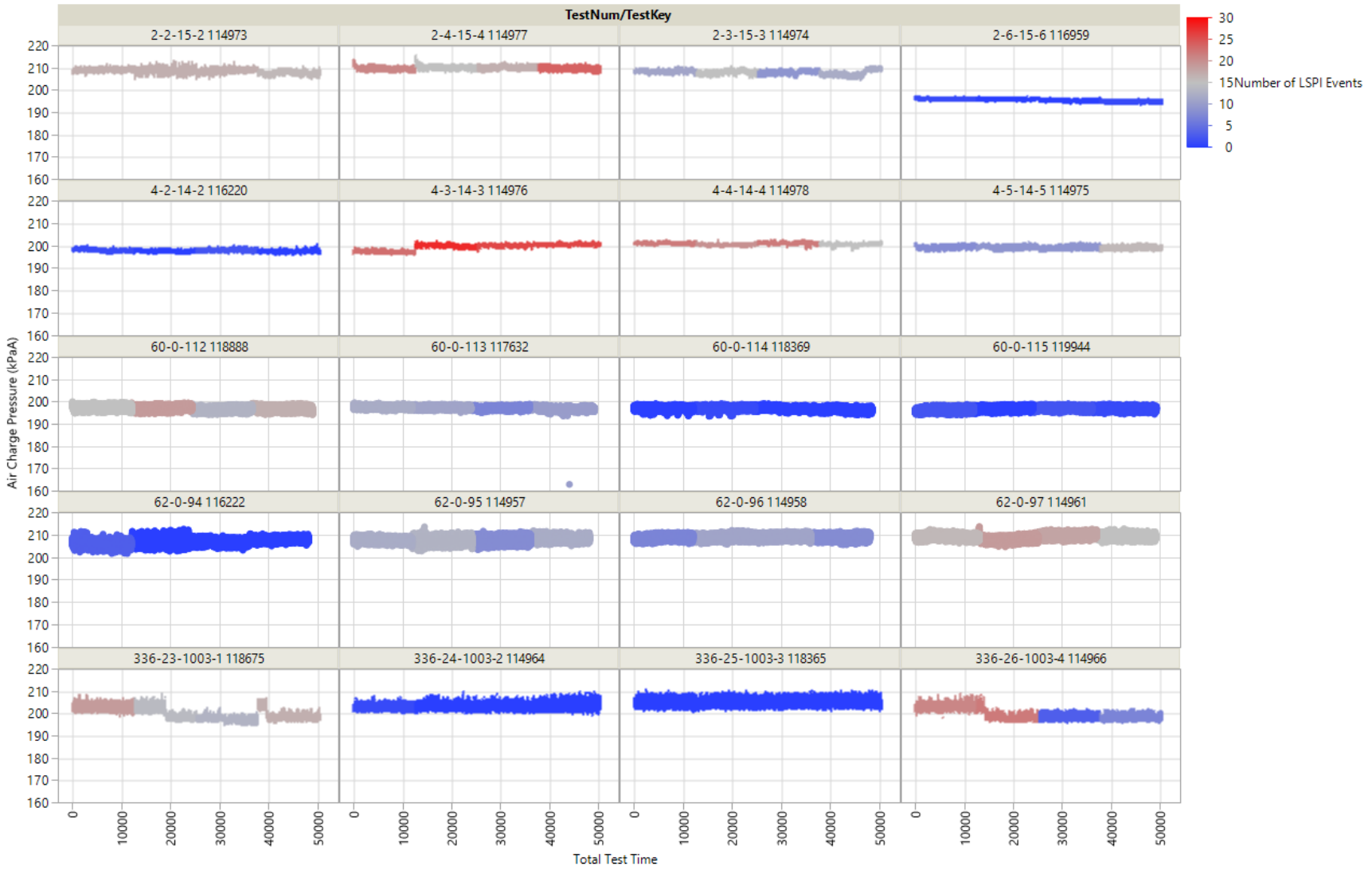
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



© 2016 The Lubrizol Corporation, all rights reserved.

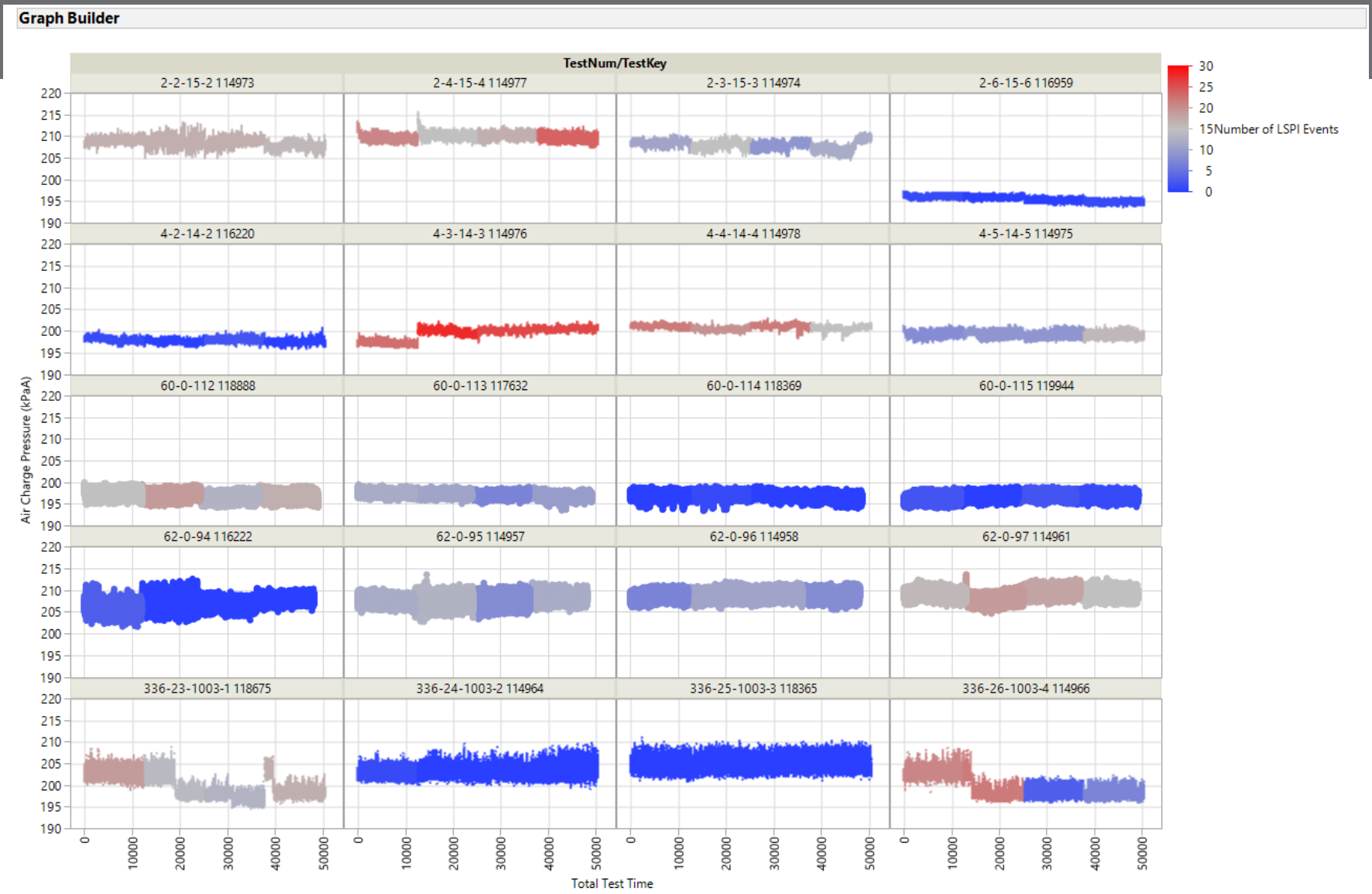
Graph Builder



© 2016 The Lubrizol Corporation, all rights reserved.

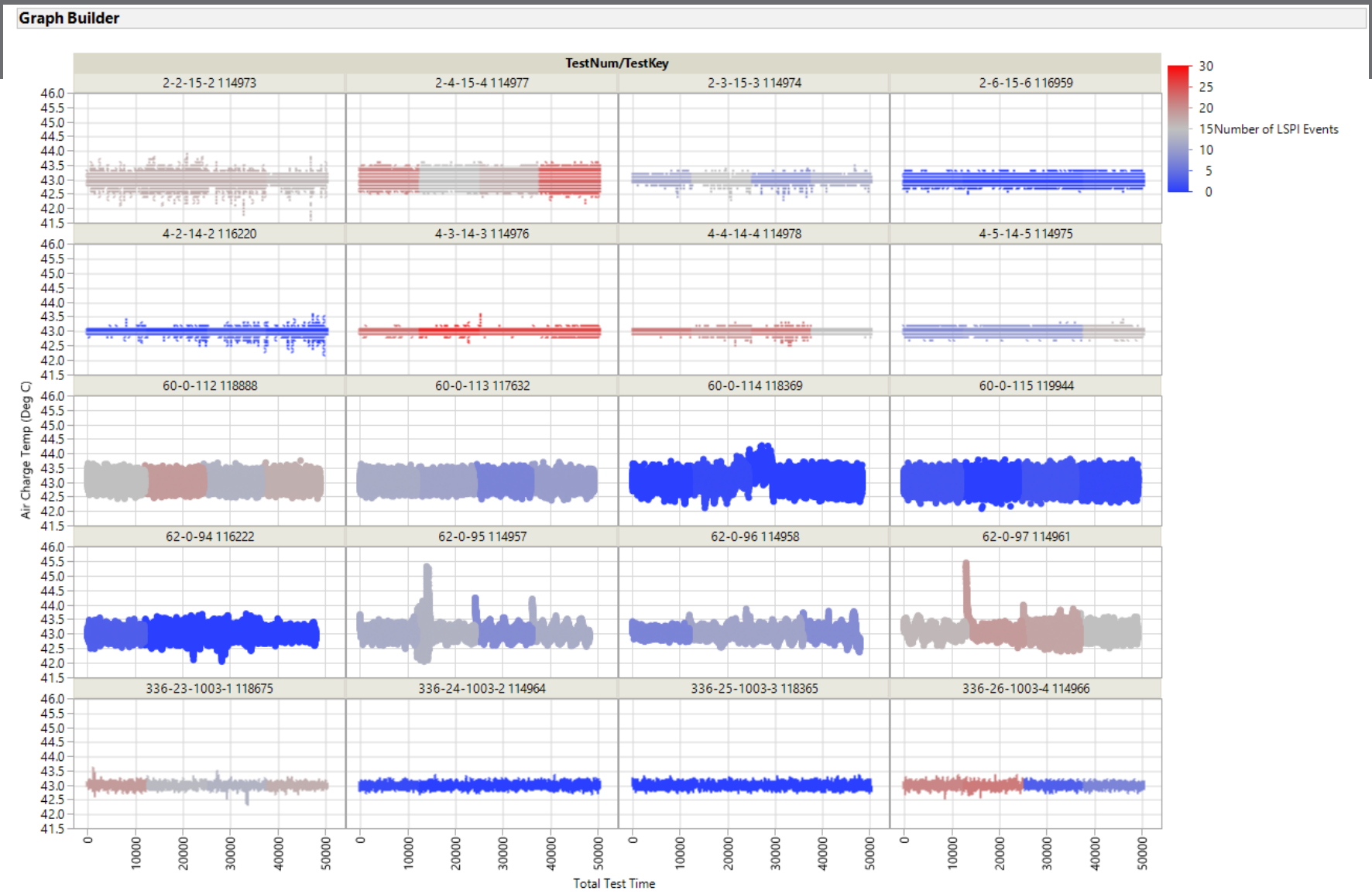
ZOOMED IN

SUCCESS TOGETHER

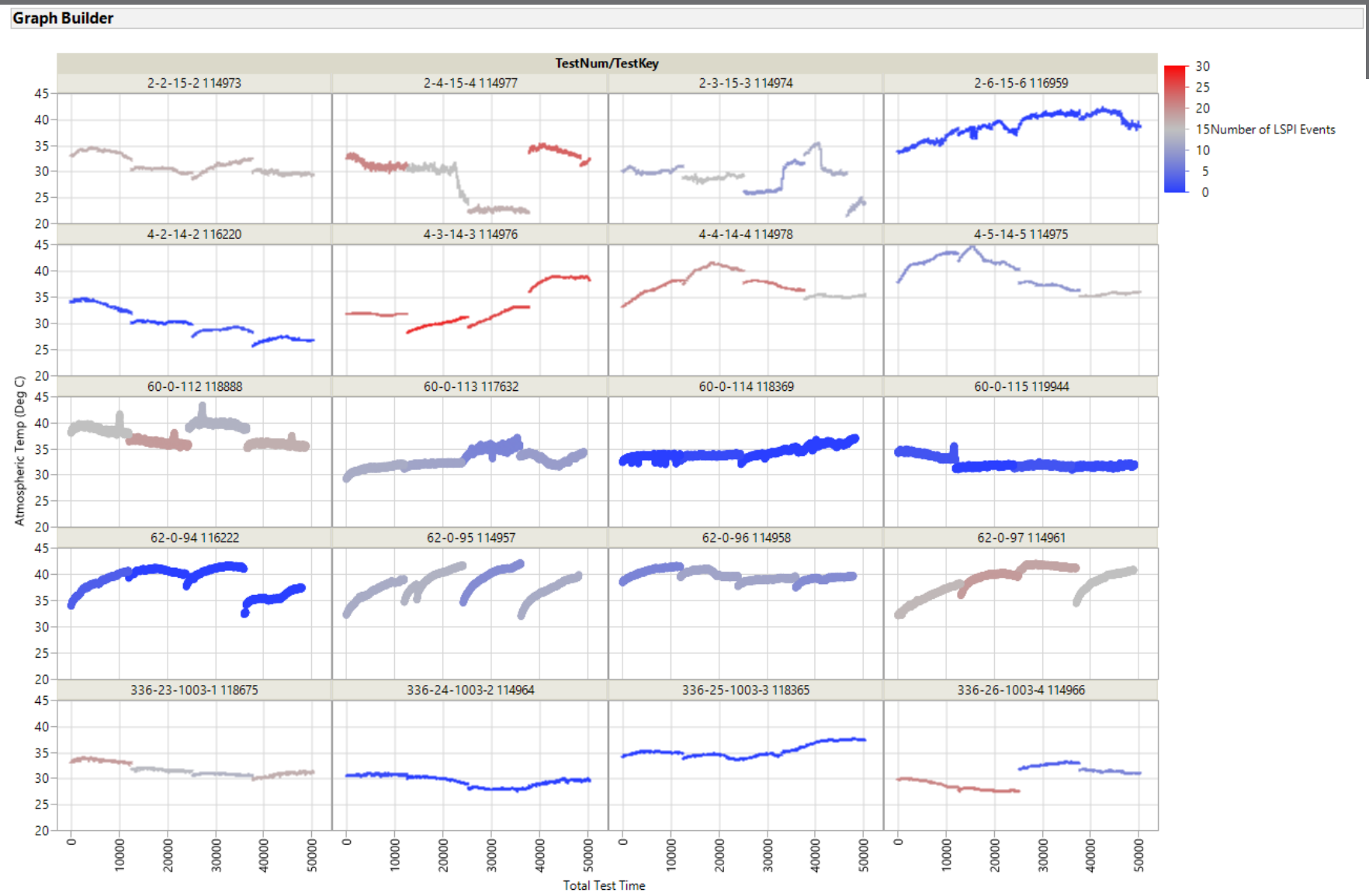


© 2016 The Lubrizol Corporation, all rights reserved.

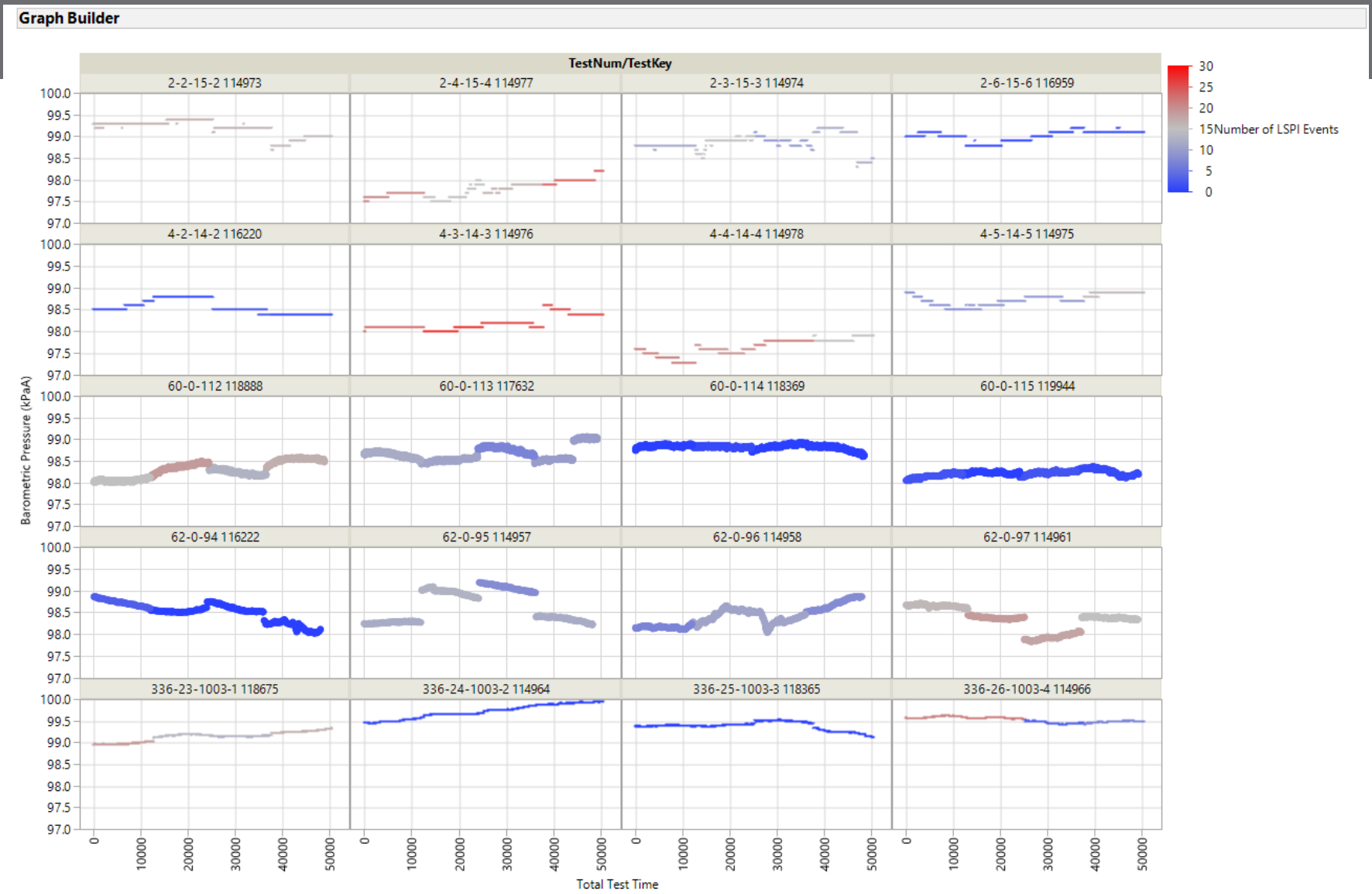
Lubrizol



© 2016 The Lubrizol Corporation, all rights reserved.

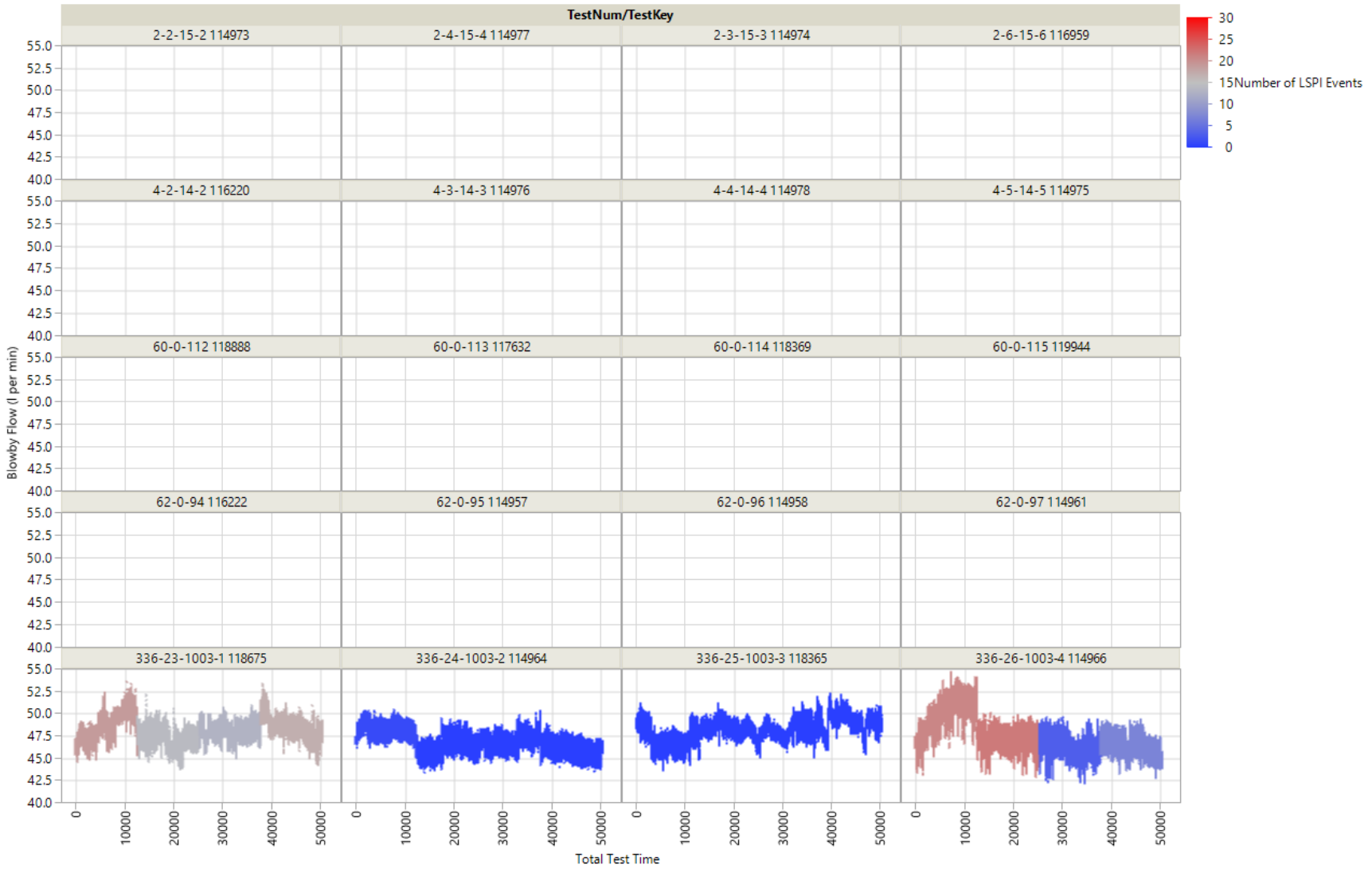


© 2016 The Lubrizol Corporation, all rights reserved.



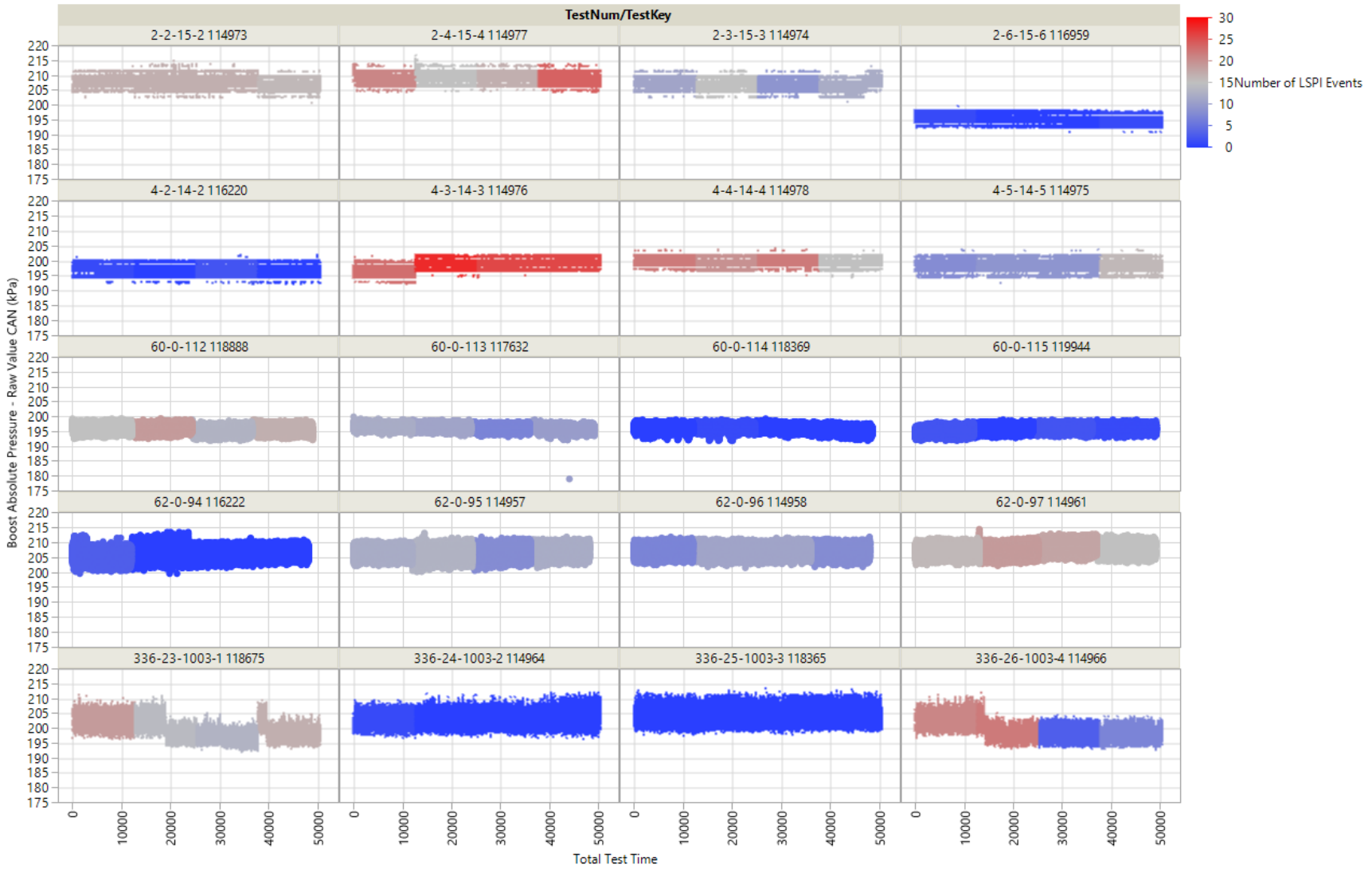
© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder



© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder



© 2016 The Lubrizol Corporation, all rights reserved.

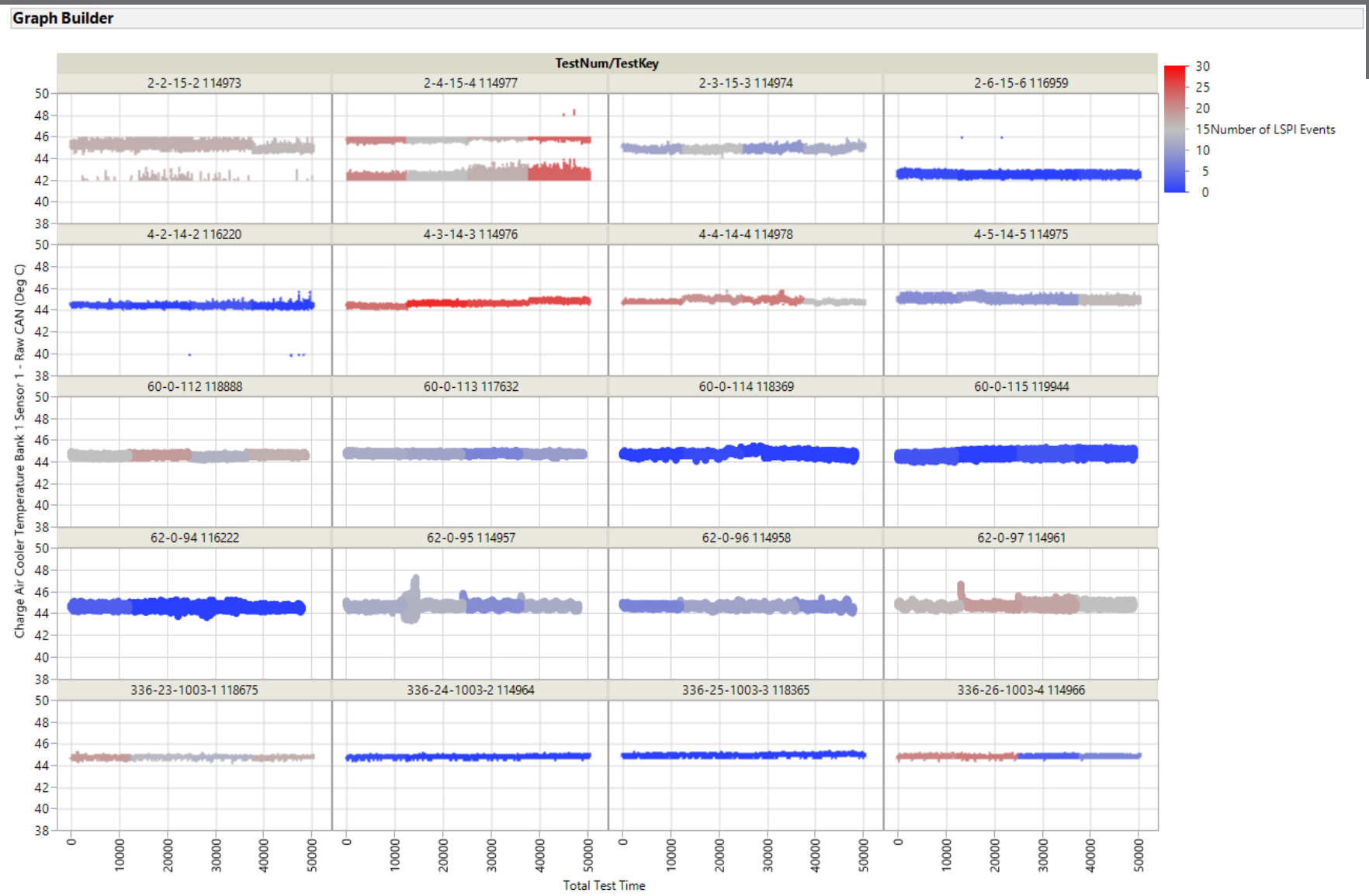
Lubrizol

ZOOMED IN

SUCCESS TOGETHER

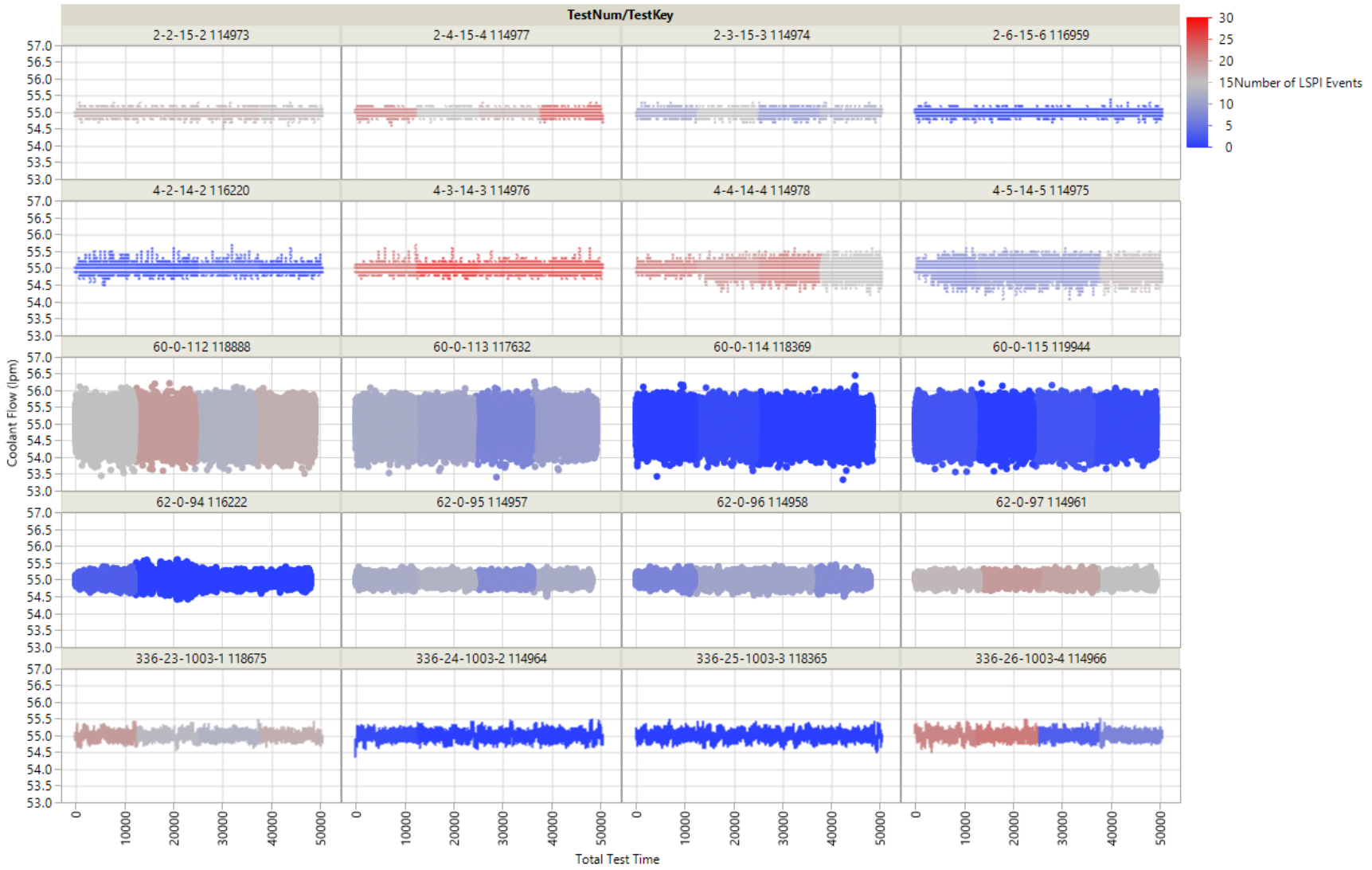
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



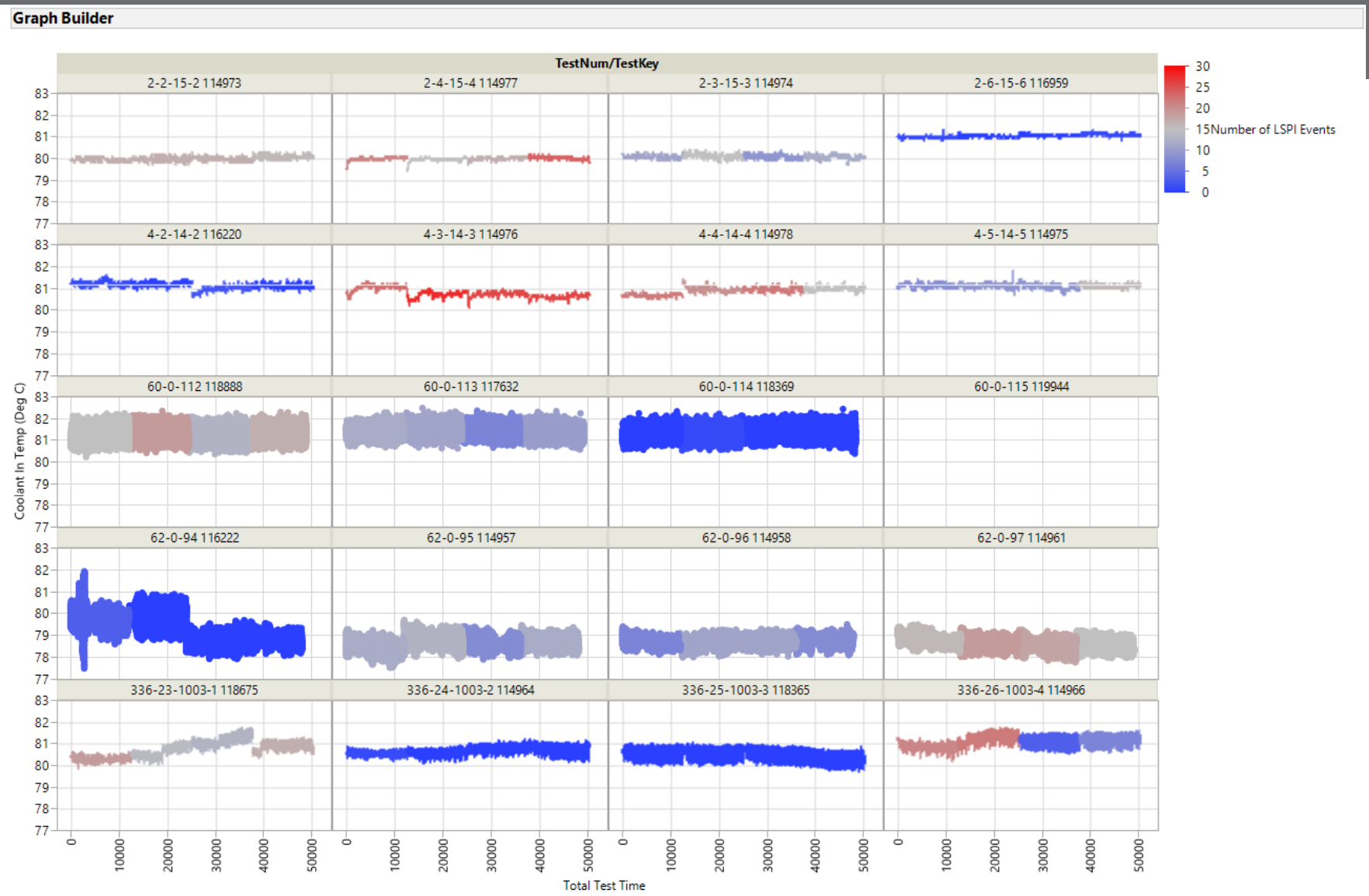
© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder

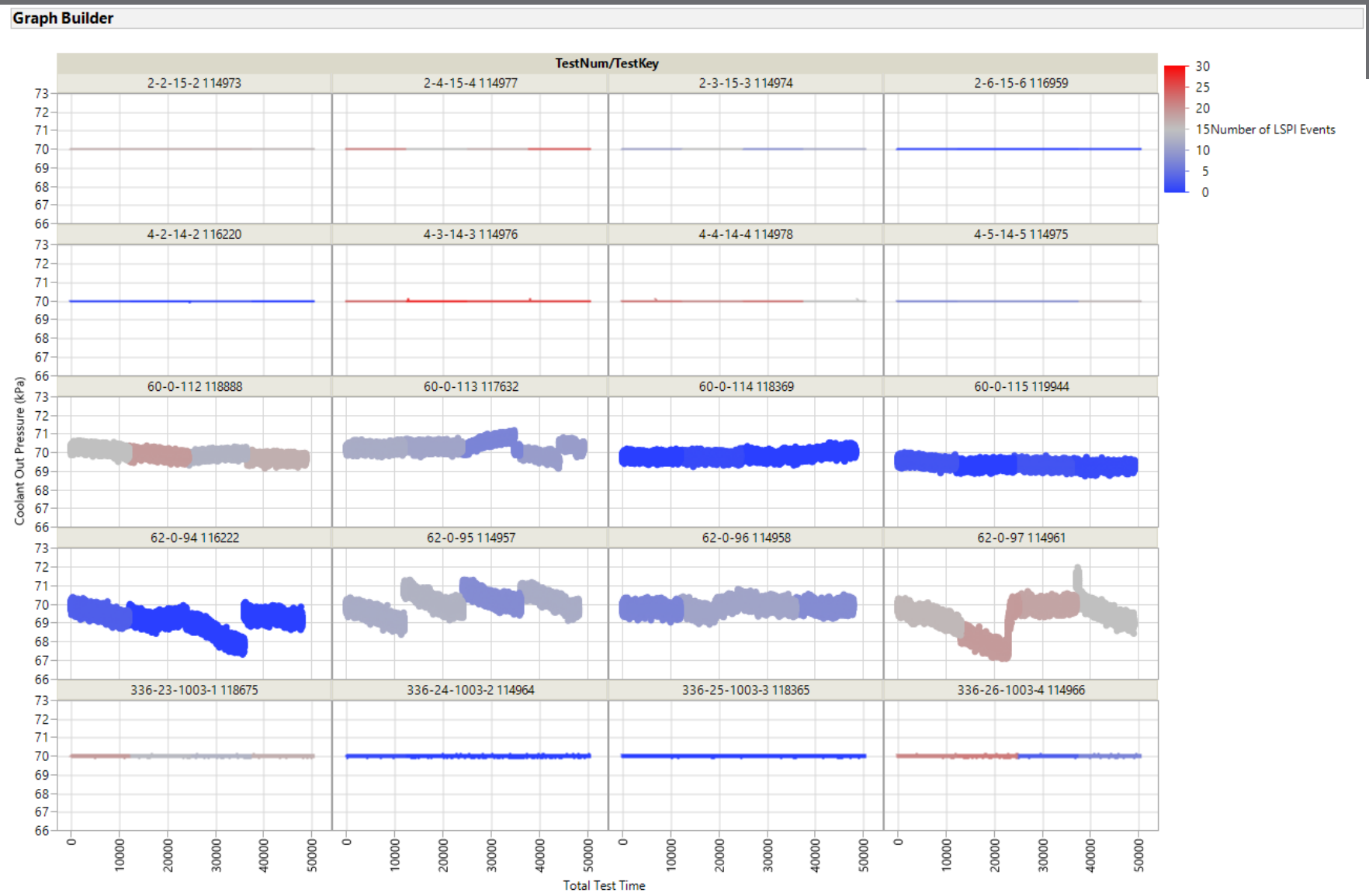


© 2016 The Lubrizol Corporation, all rights reserved.

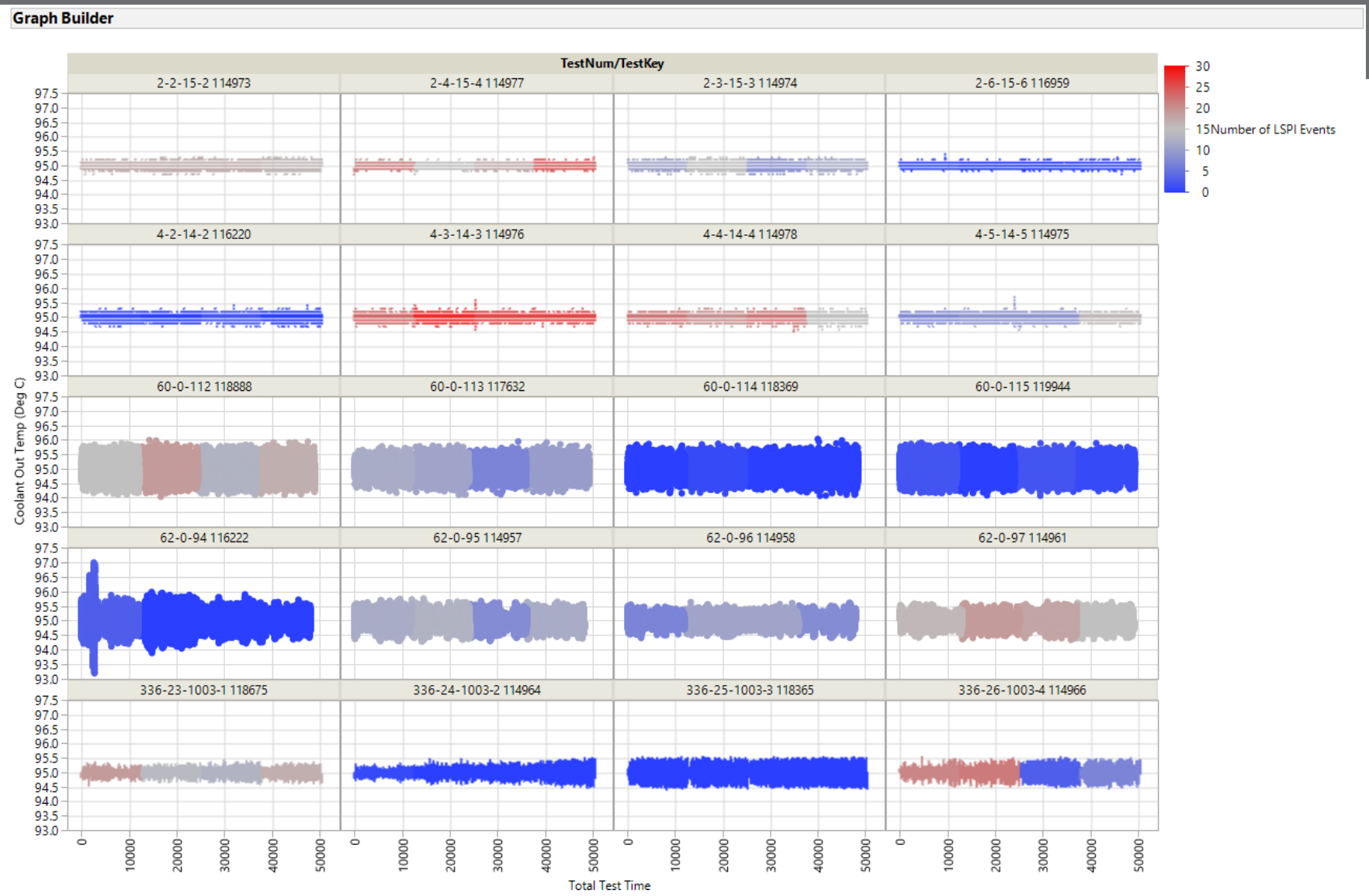
Lubrizol



© 2016 The Lubrizol Corporation, all rights reserved.

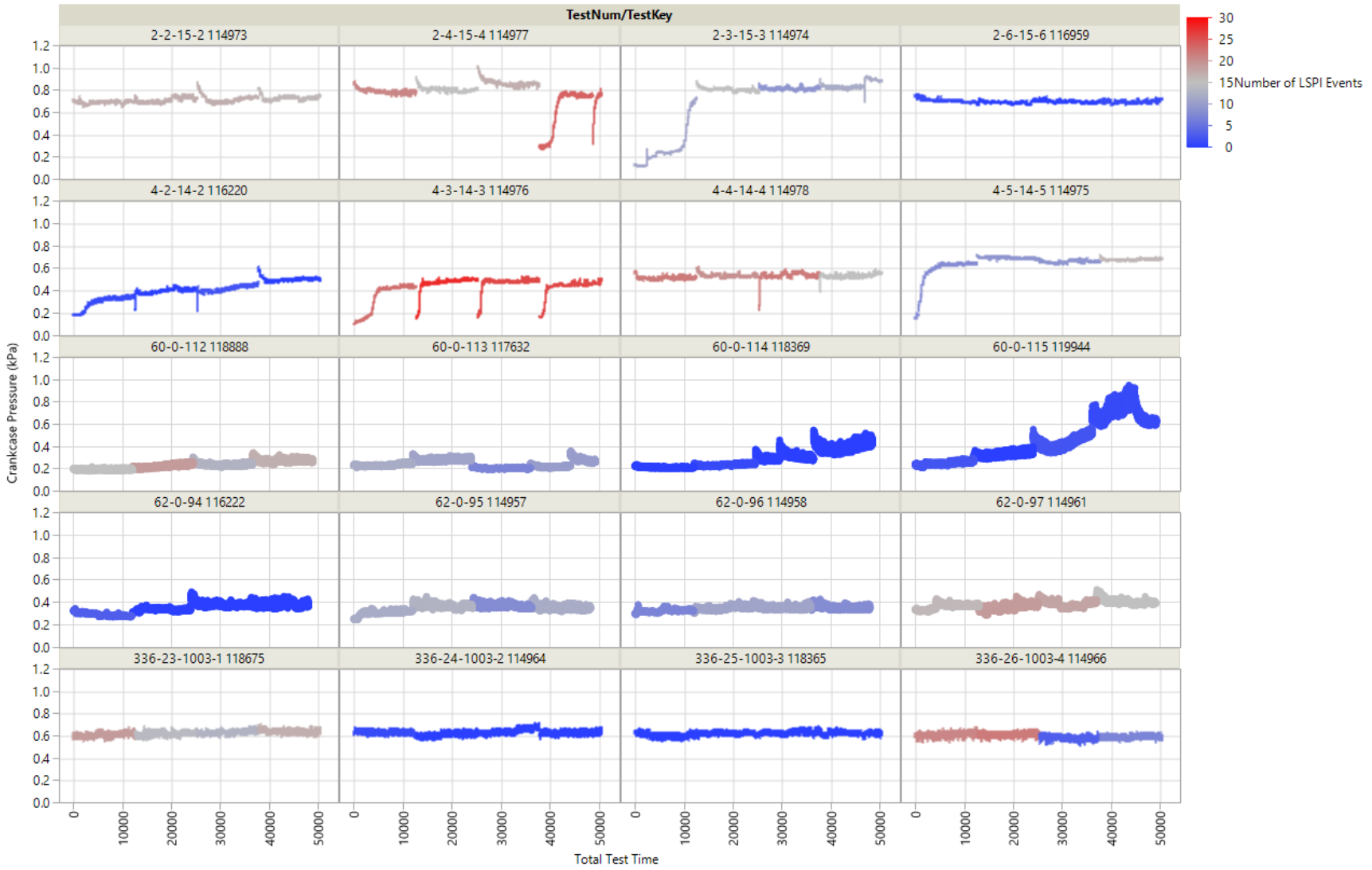


© 2016 The Lubrizol Corporation, all rights reserved.



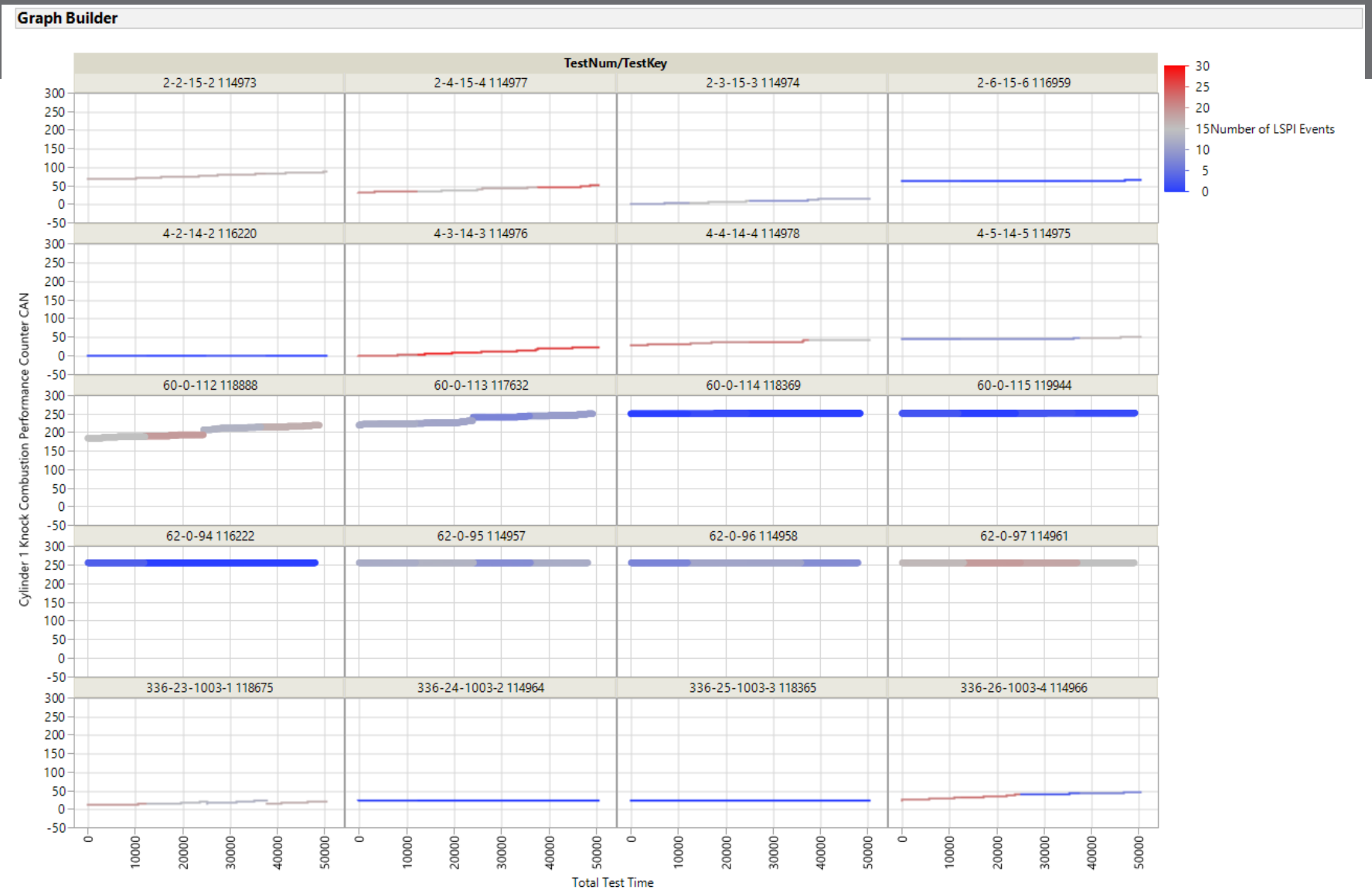
© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder



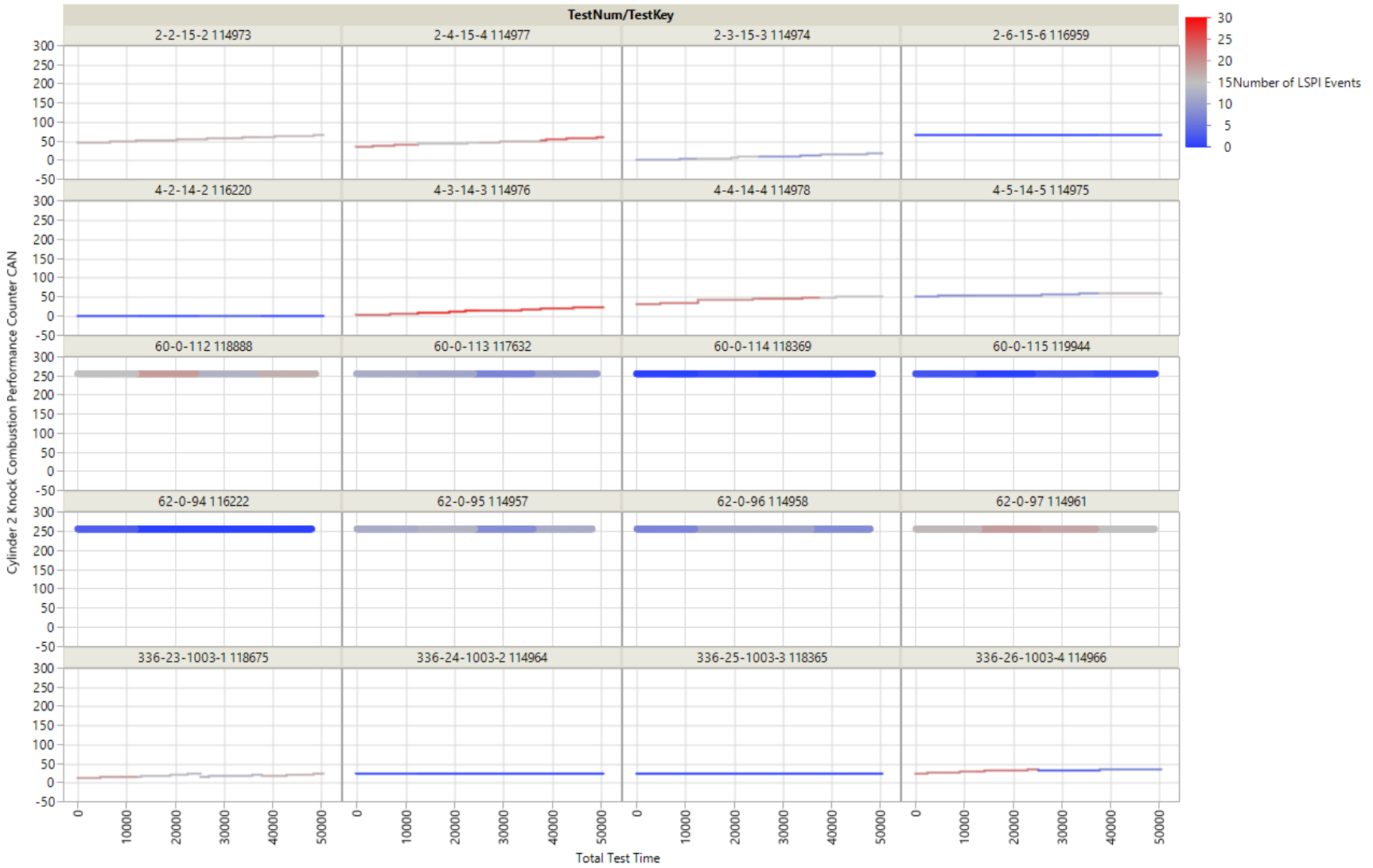
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



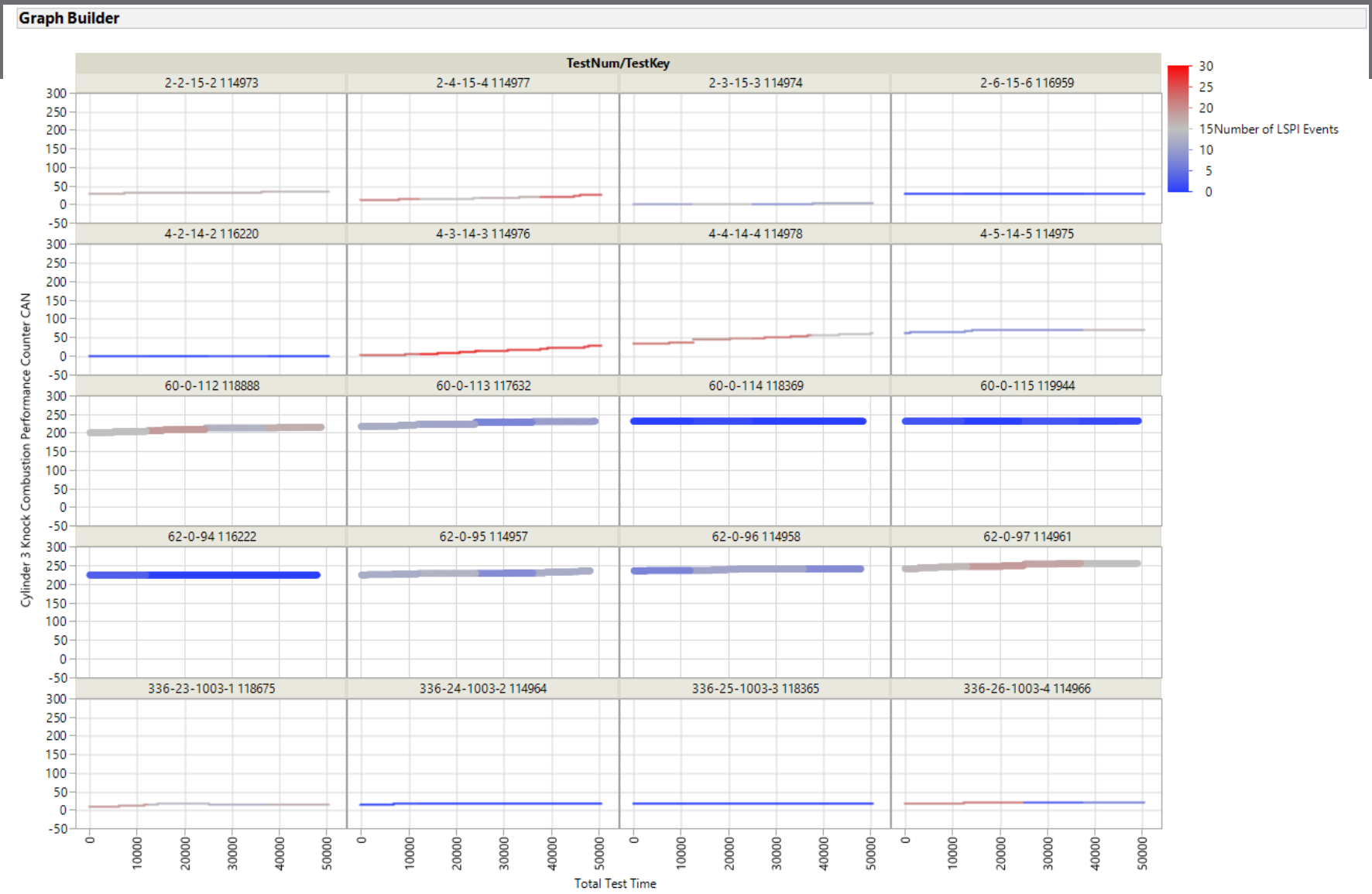
© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder



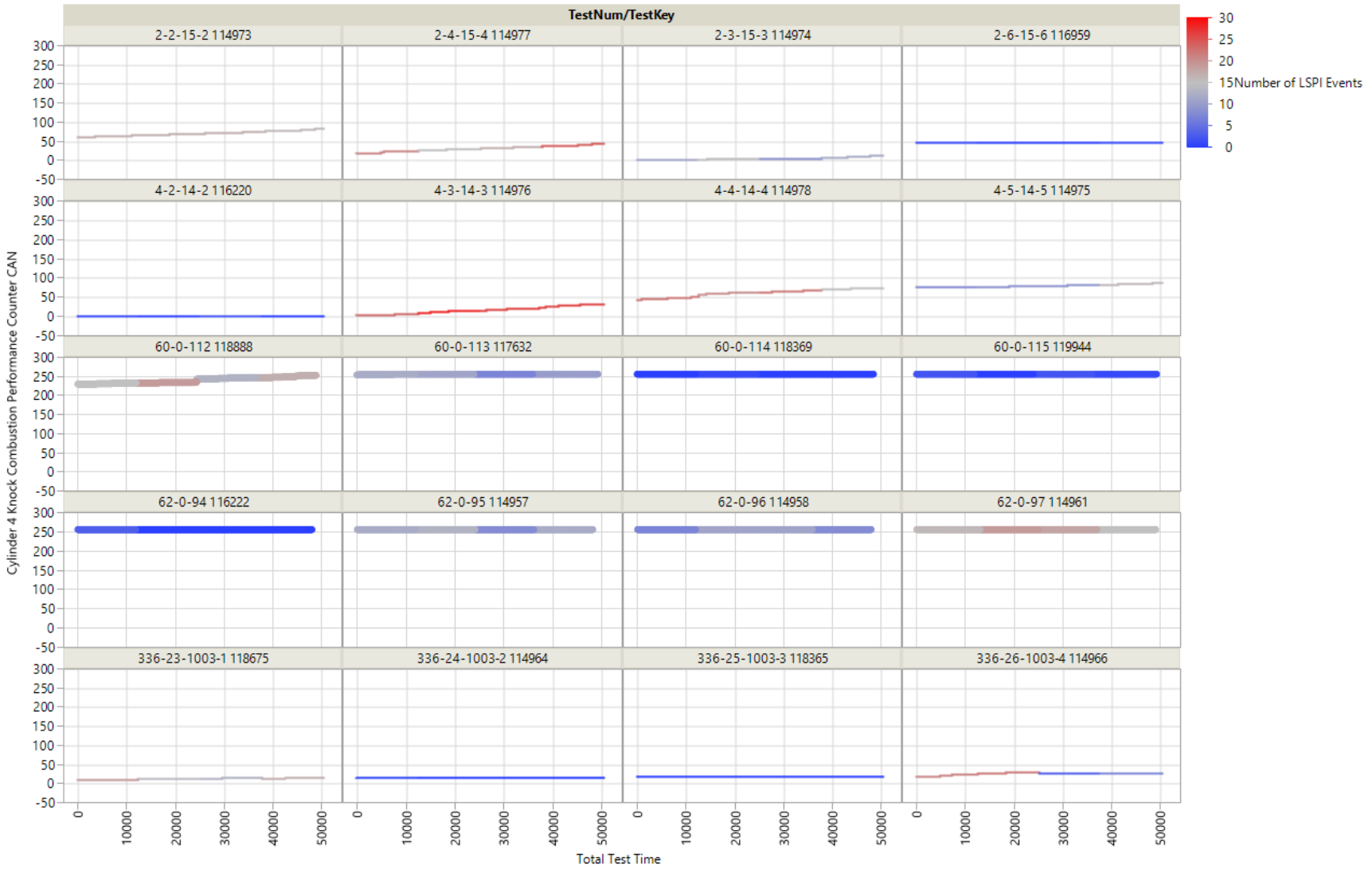
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

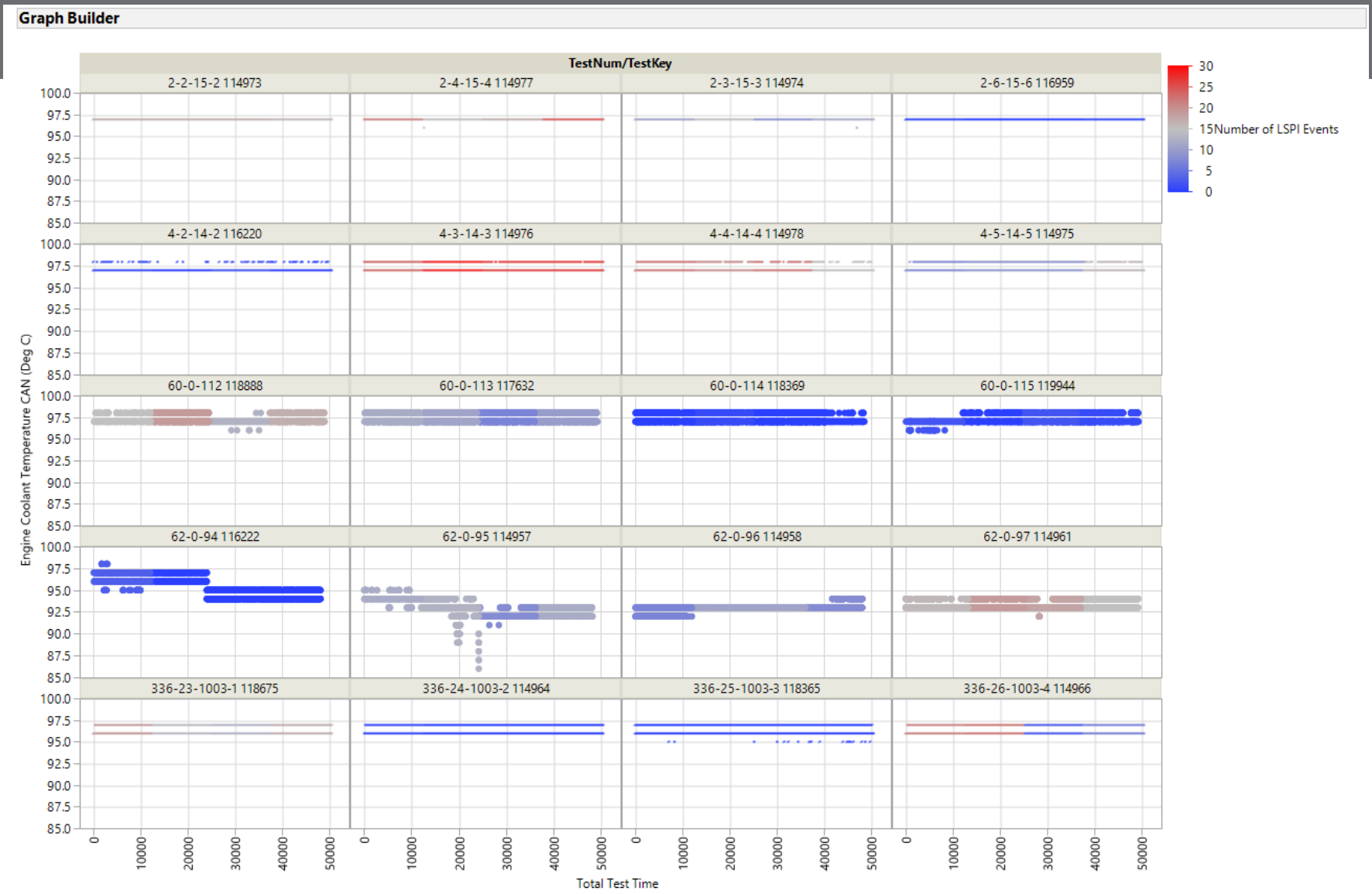


© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder

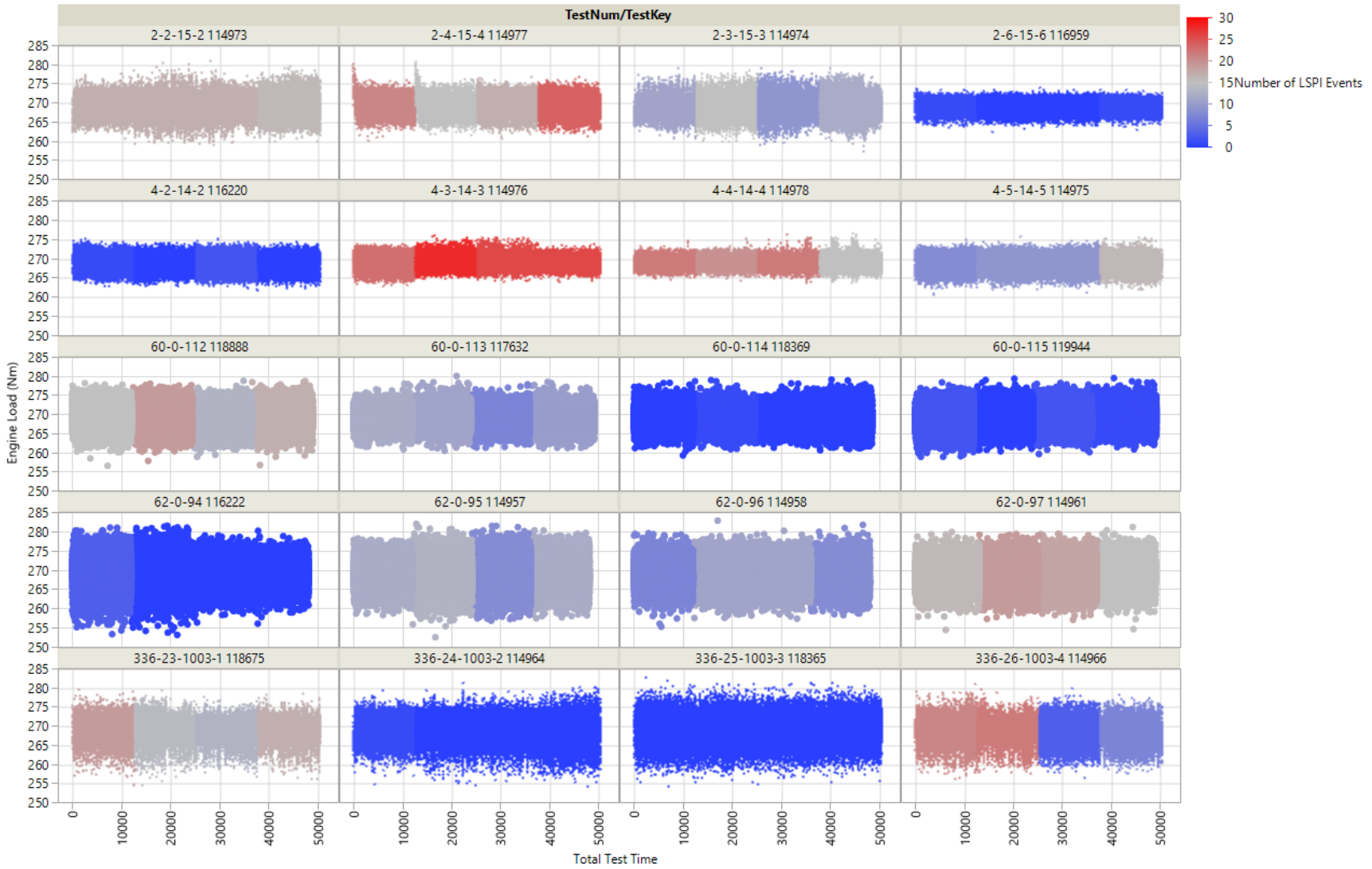


© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.

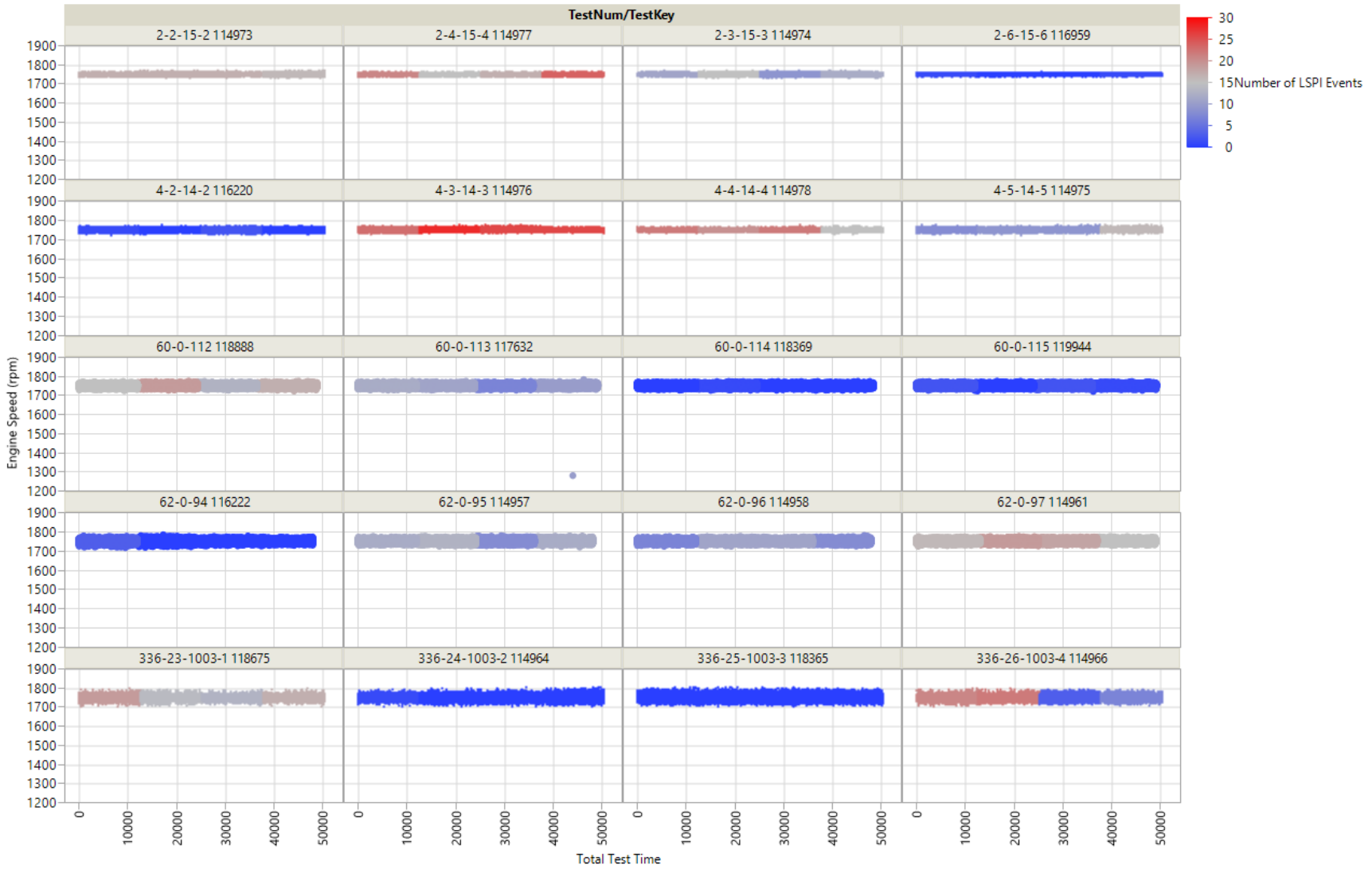
Graph Builder



© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

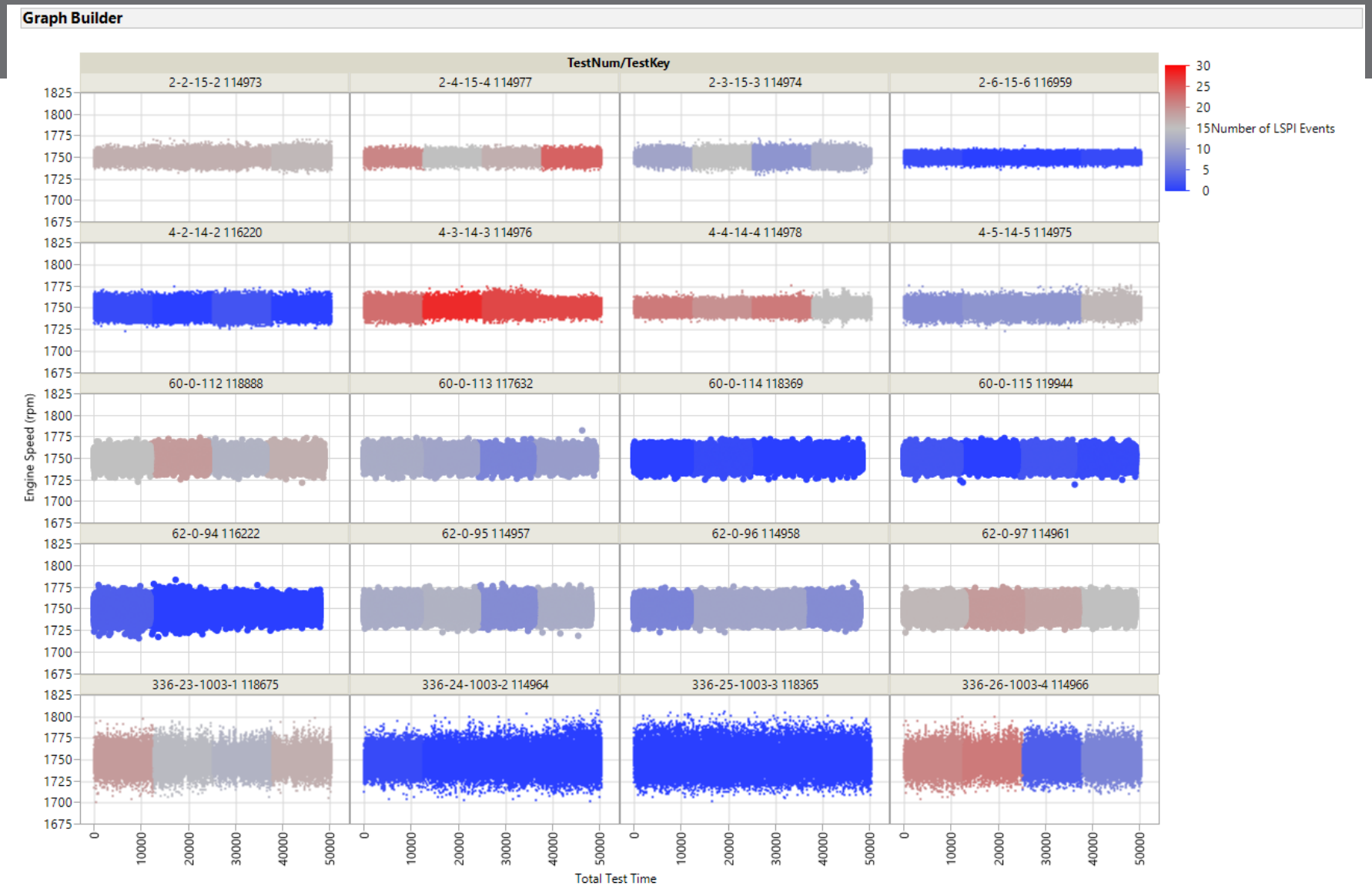
Graph Builder



© 2016 The Lubrizol Corporation, all rights reserved.

ZOOMED IN

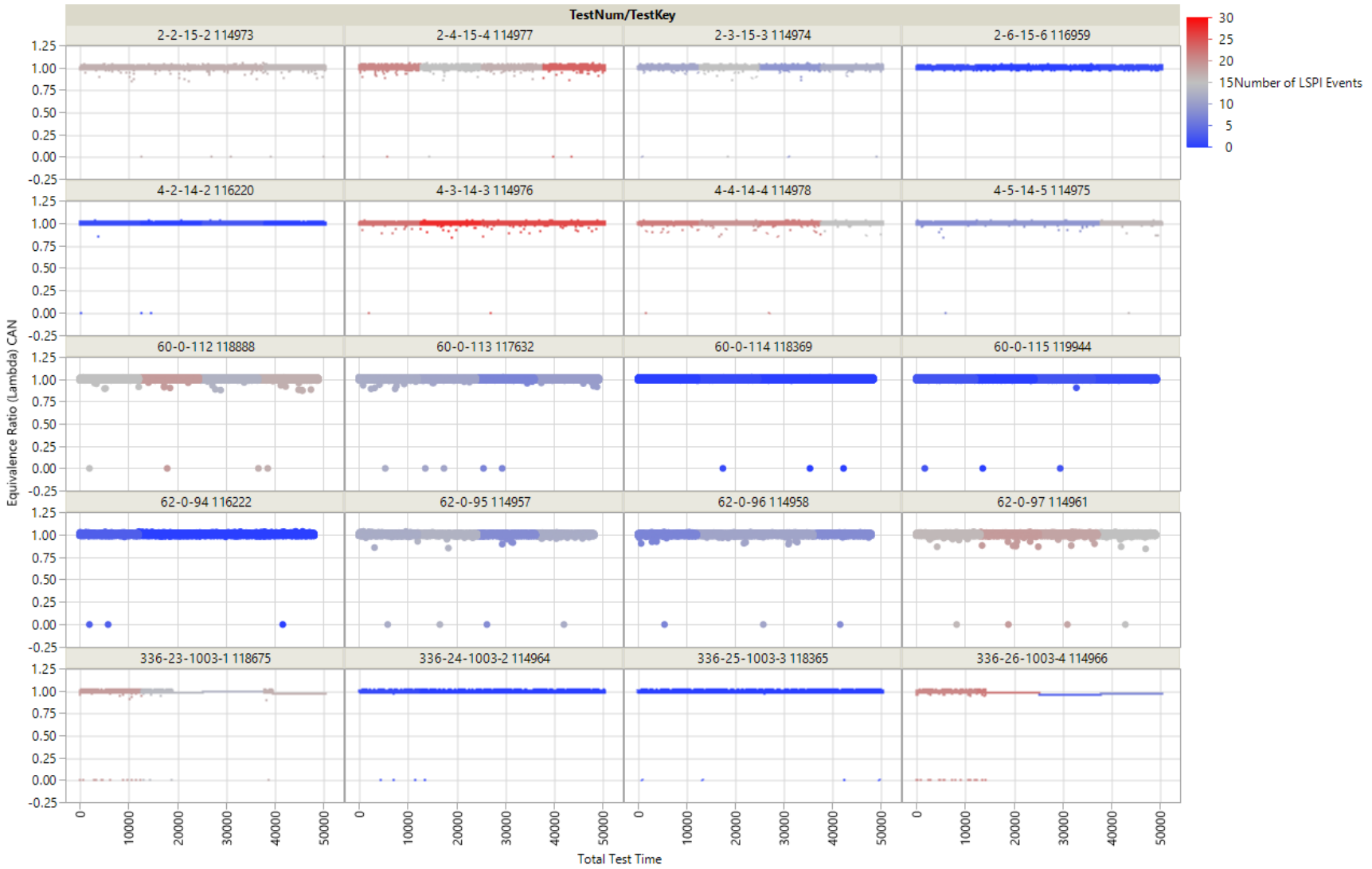
SUCCESS TOGETHER



© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

Graph Builder

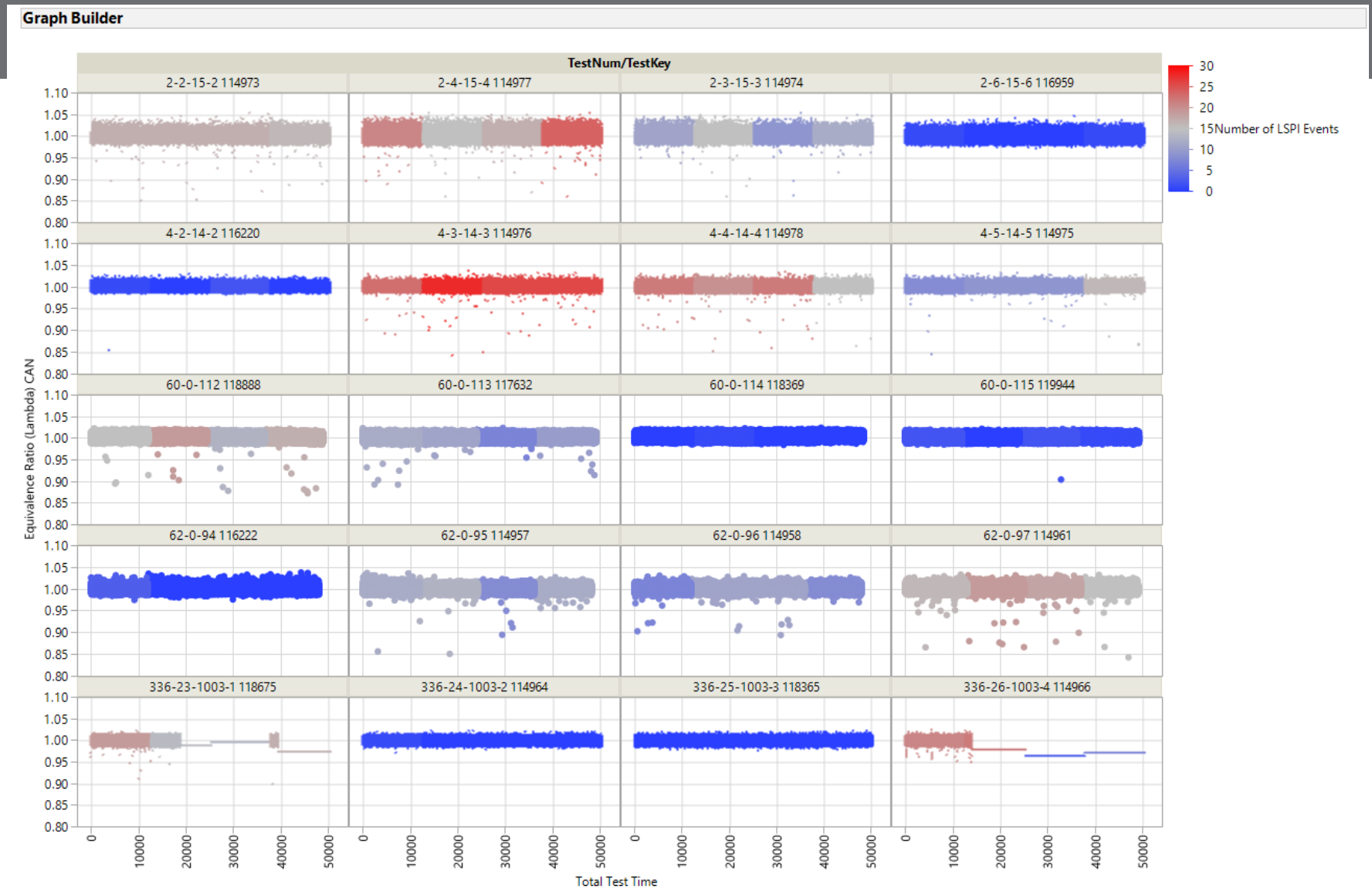


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

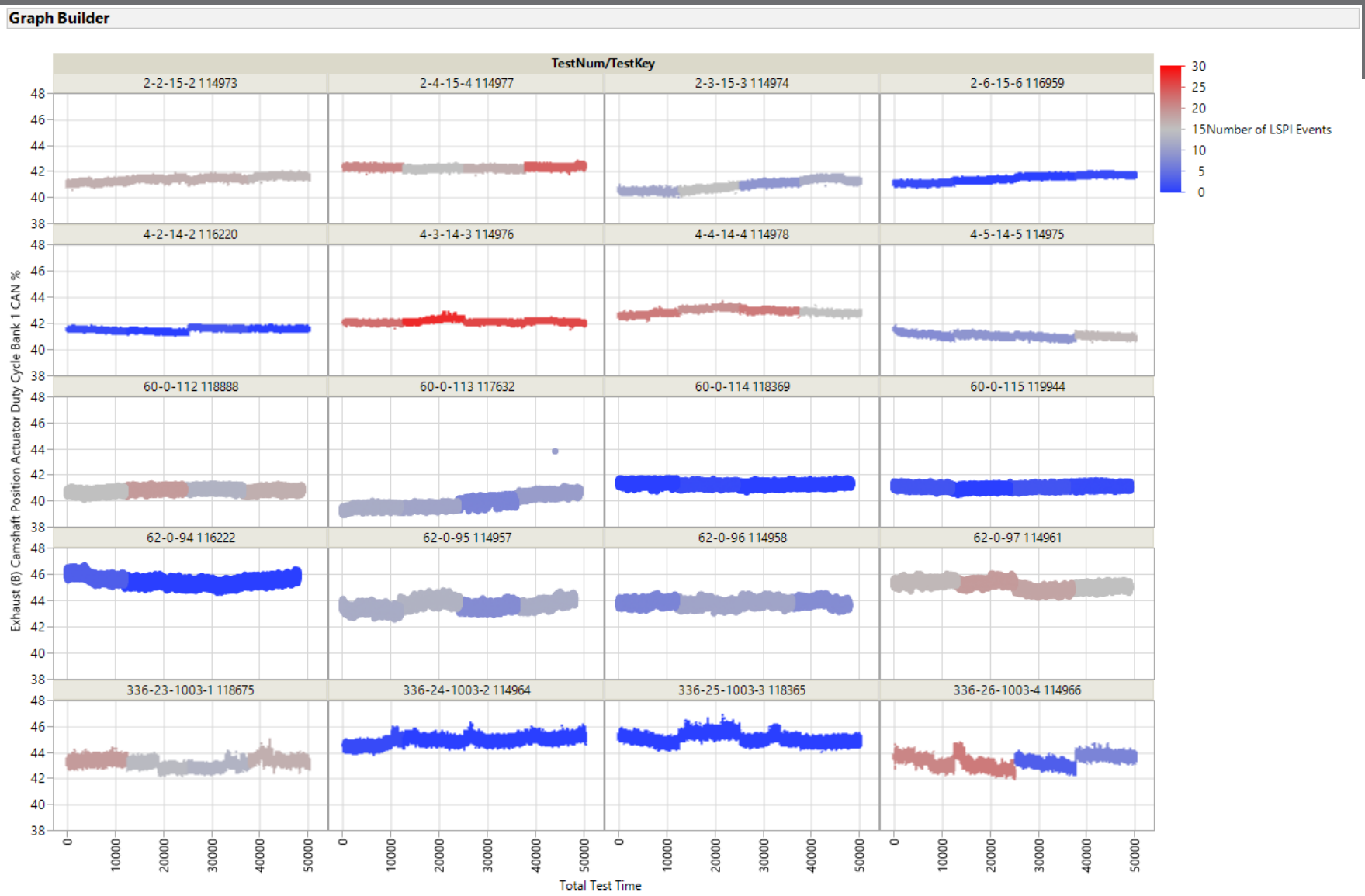
ZOOMED IN

SUCCESS TOGETHER



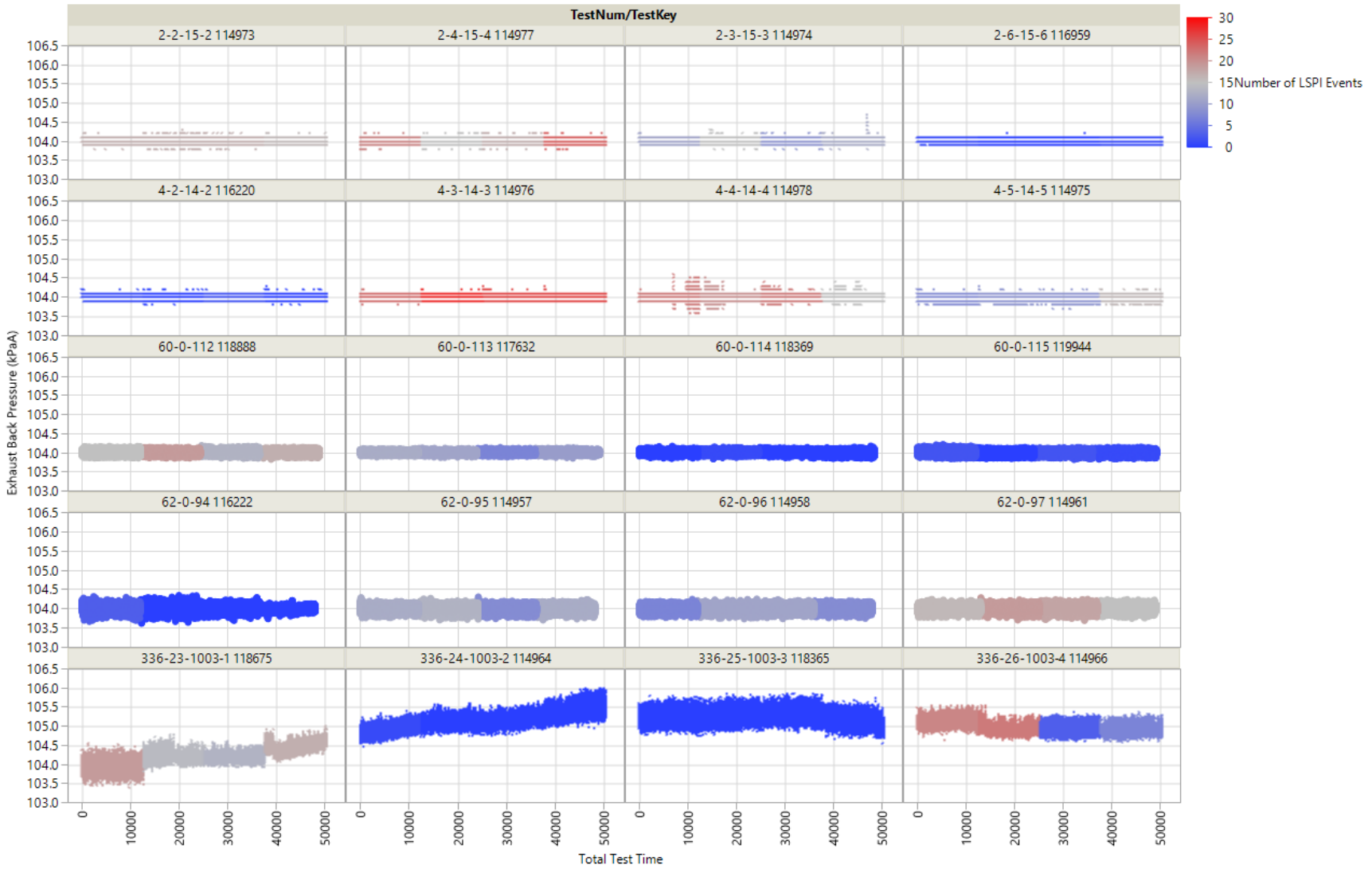
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



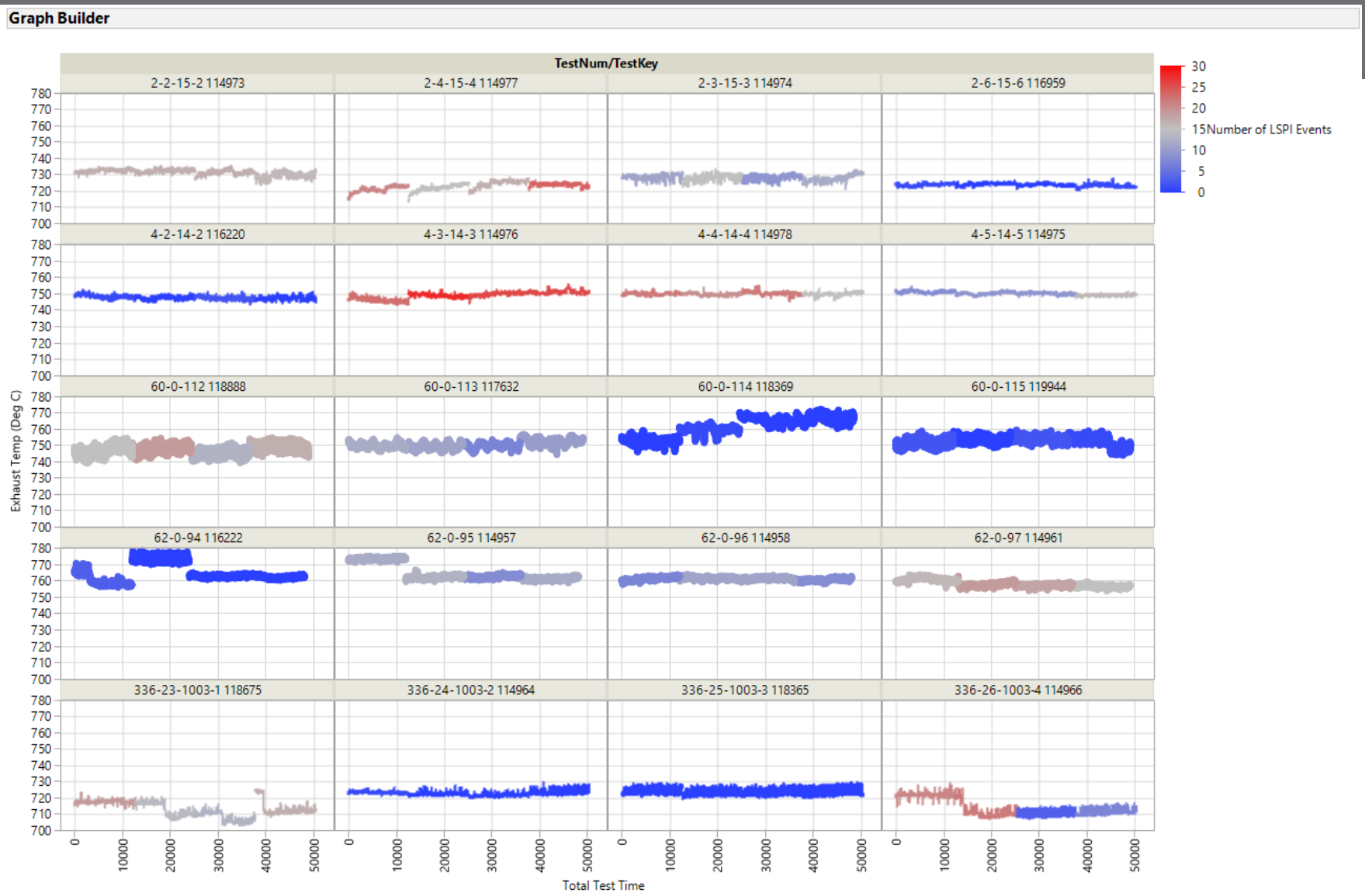
© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder

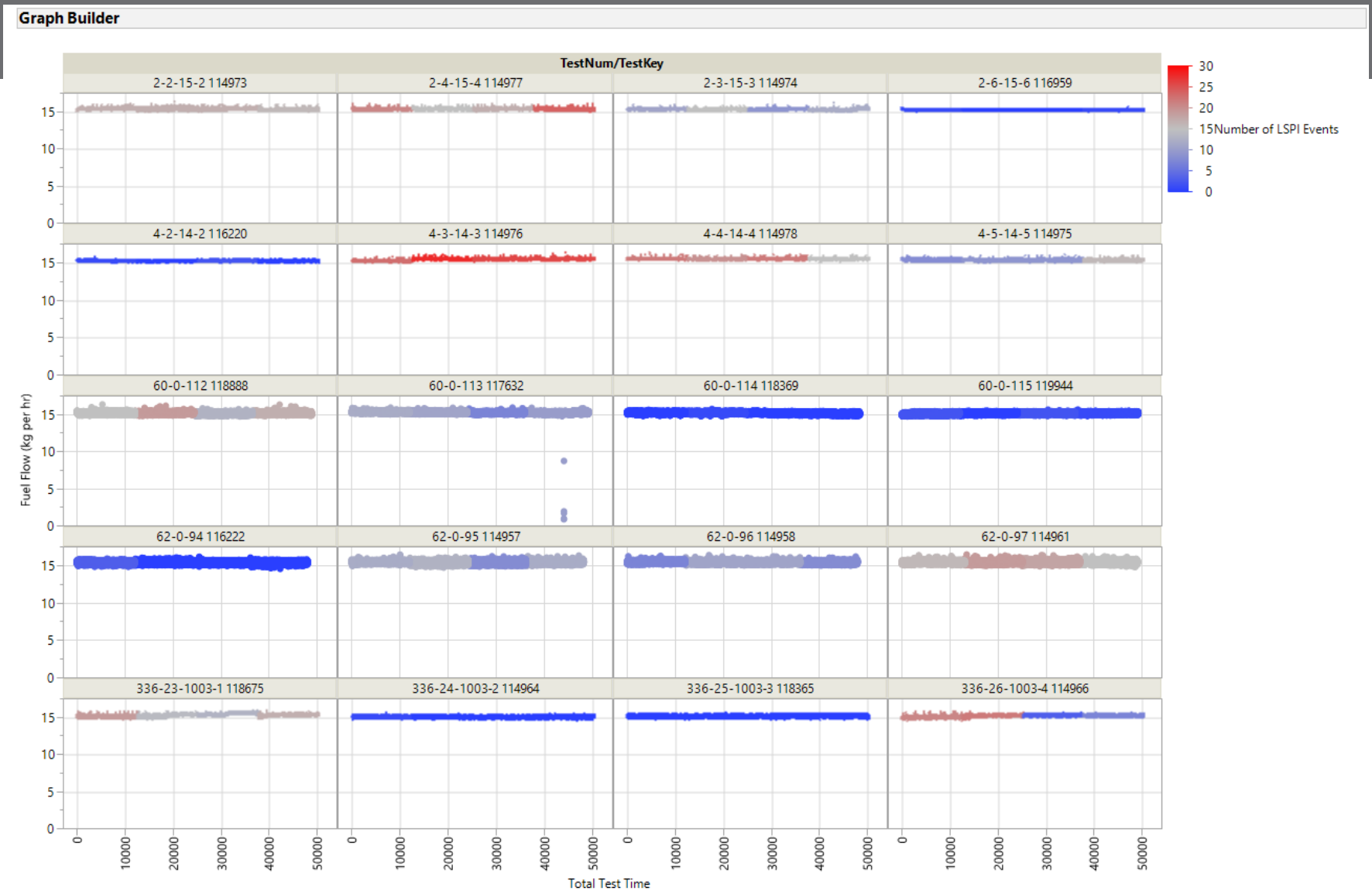


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



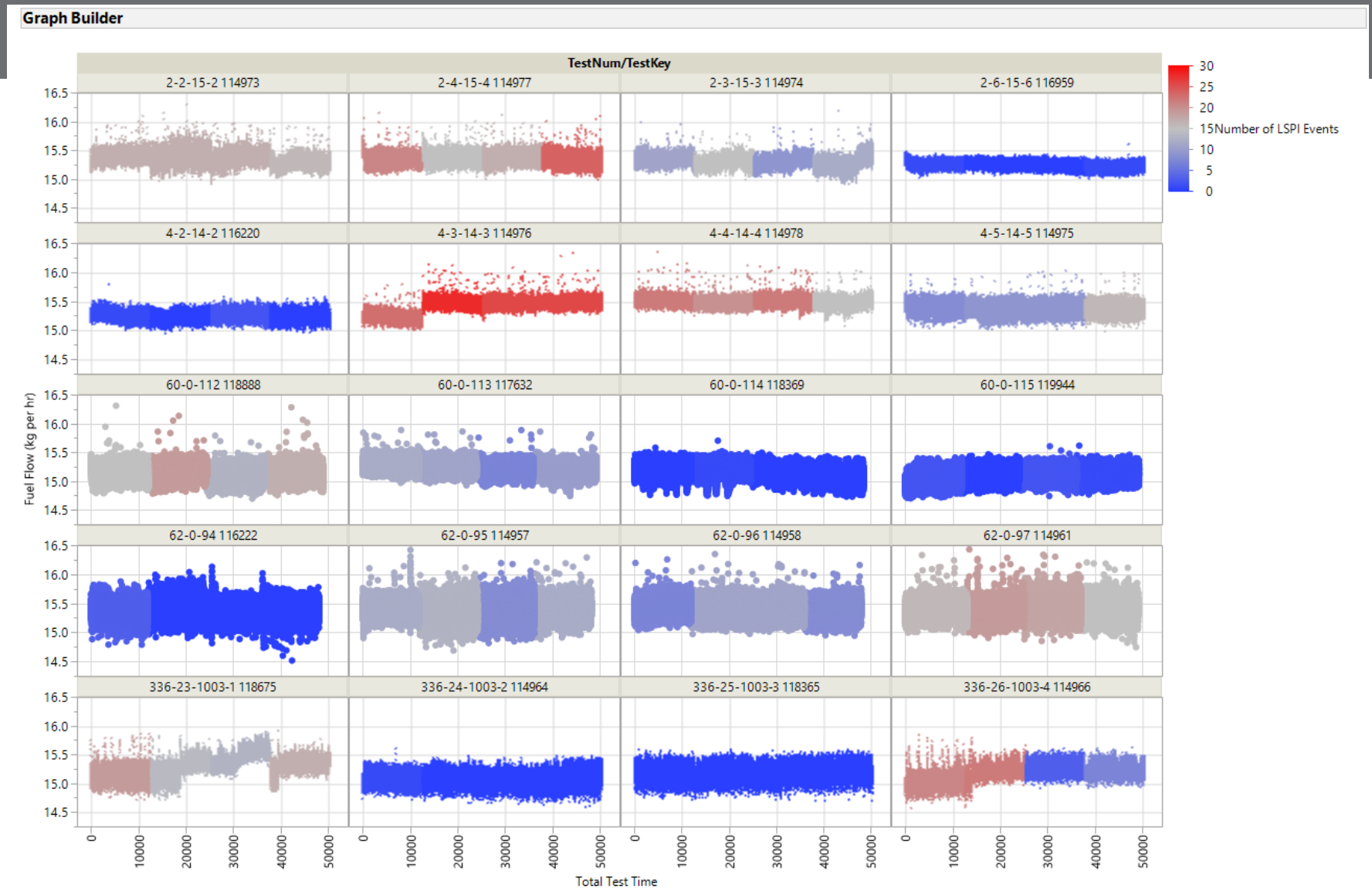
© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.

ZOOMED IN

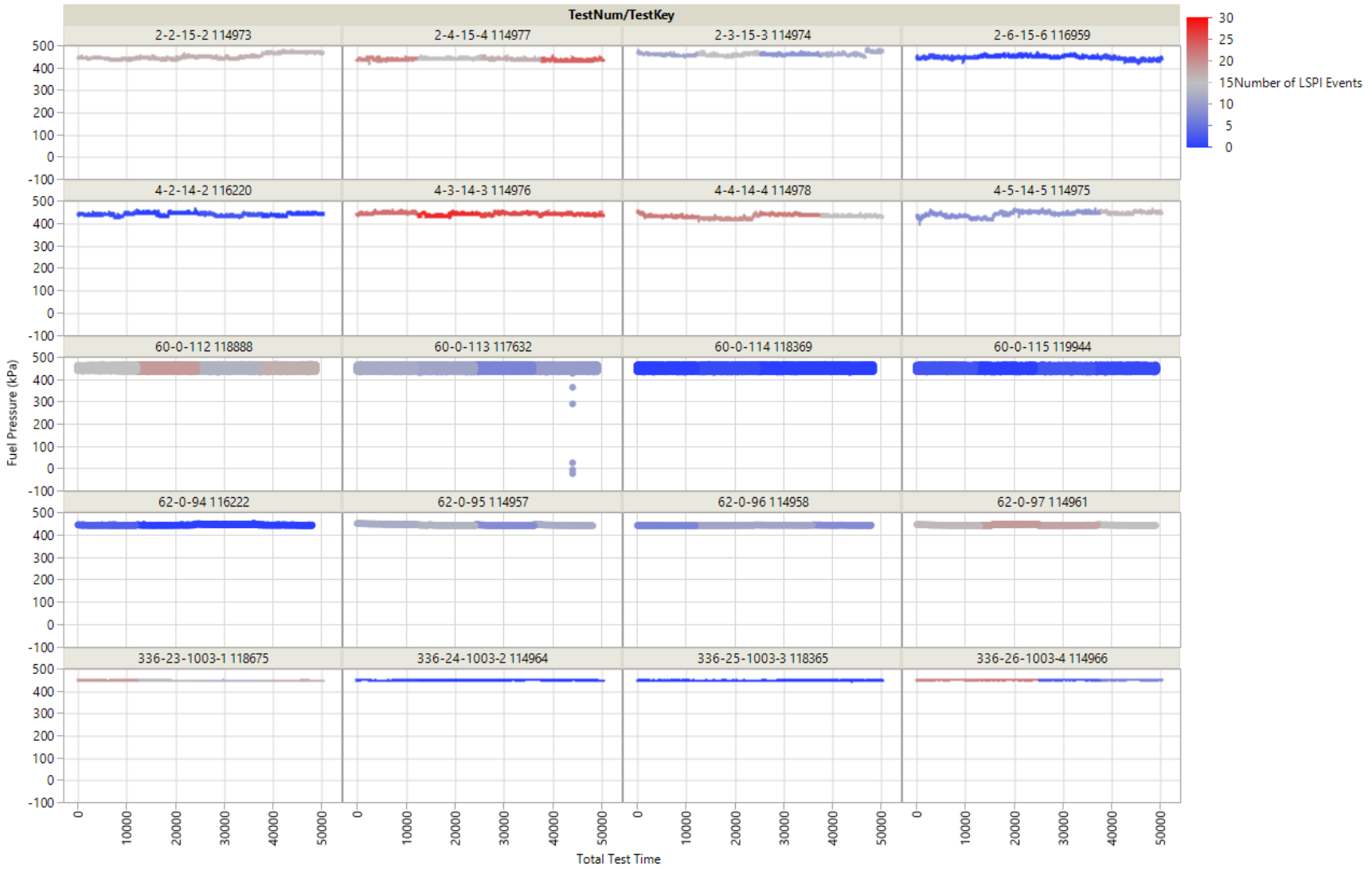
SUCCESS TOGETHER



© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

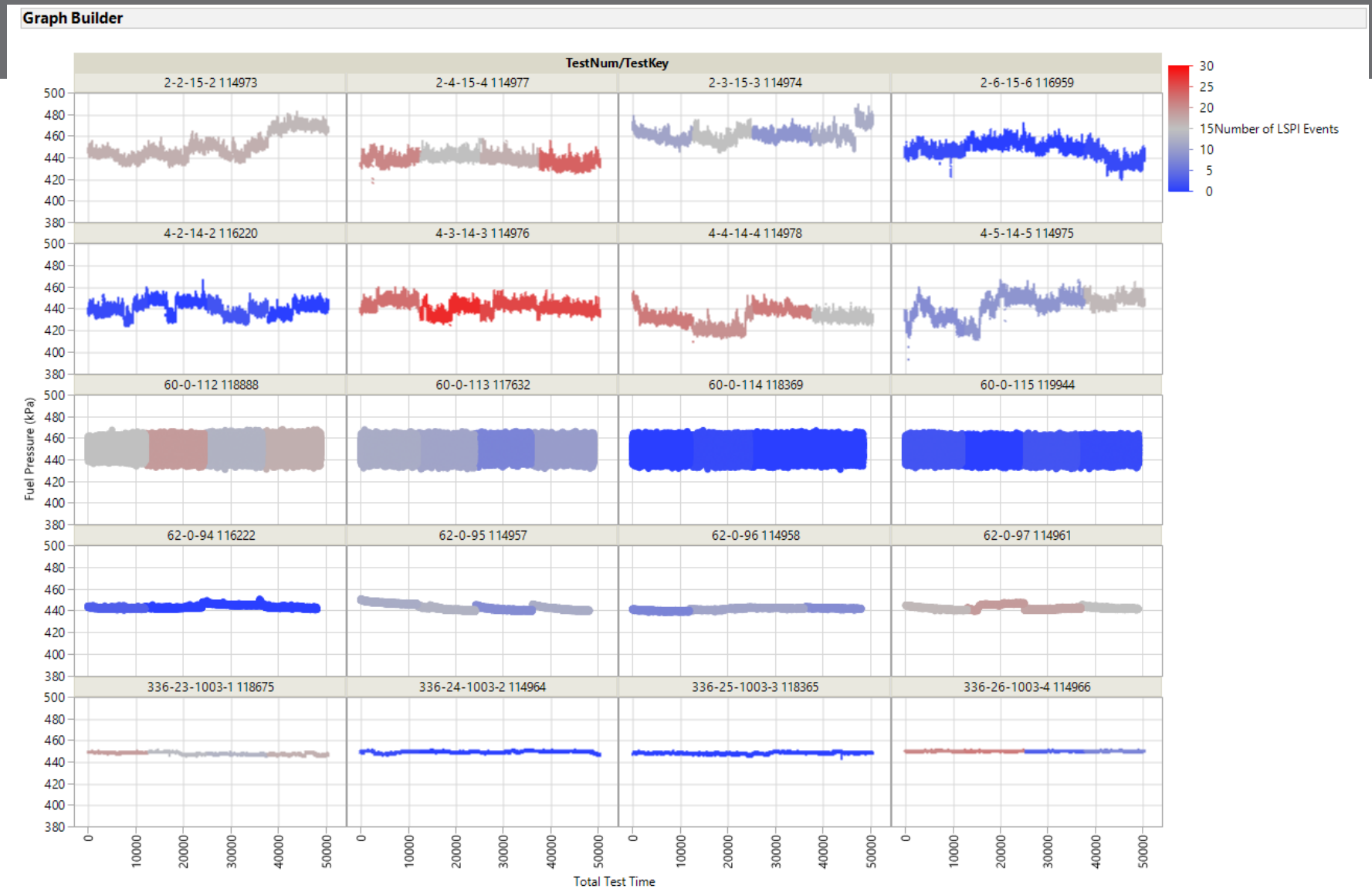
Graph Builder



© 2016 The Lubrizol Corporation, all rights reserved.

ZOOMED IN

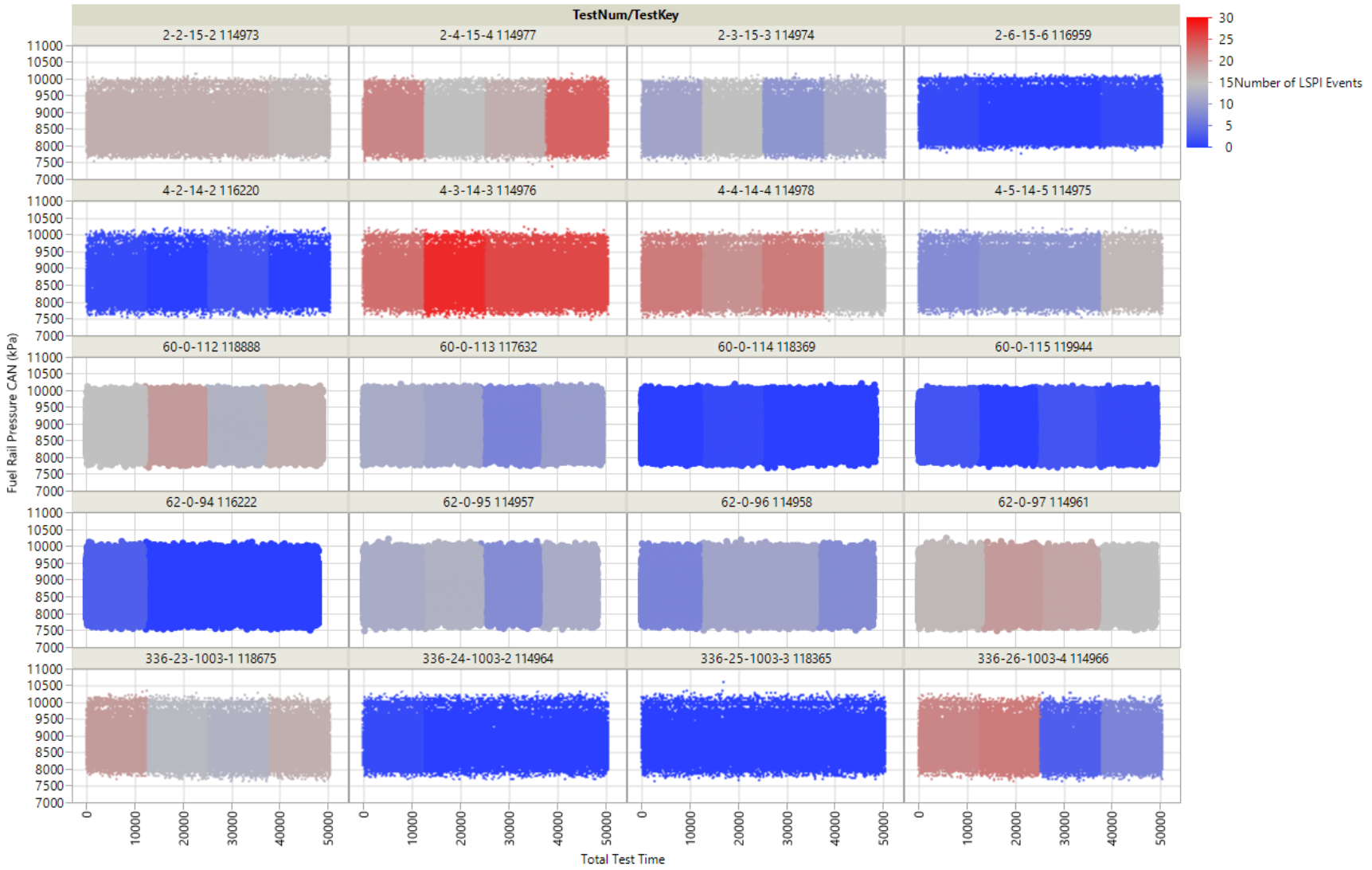
SUCCESS TOGETHER



© 2016 The Lubrizol Corporation, all rights reserved.

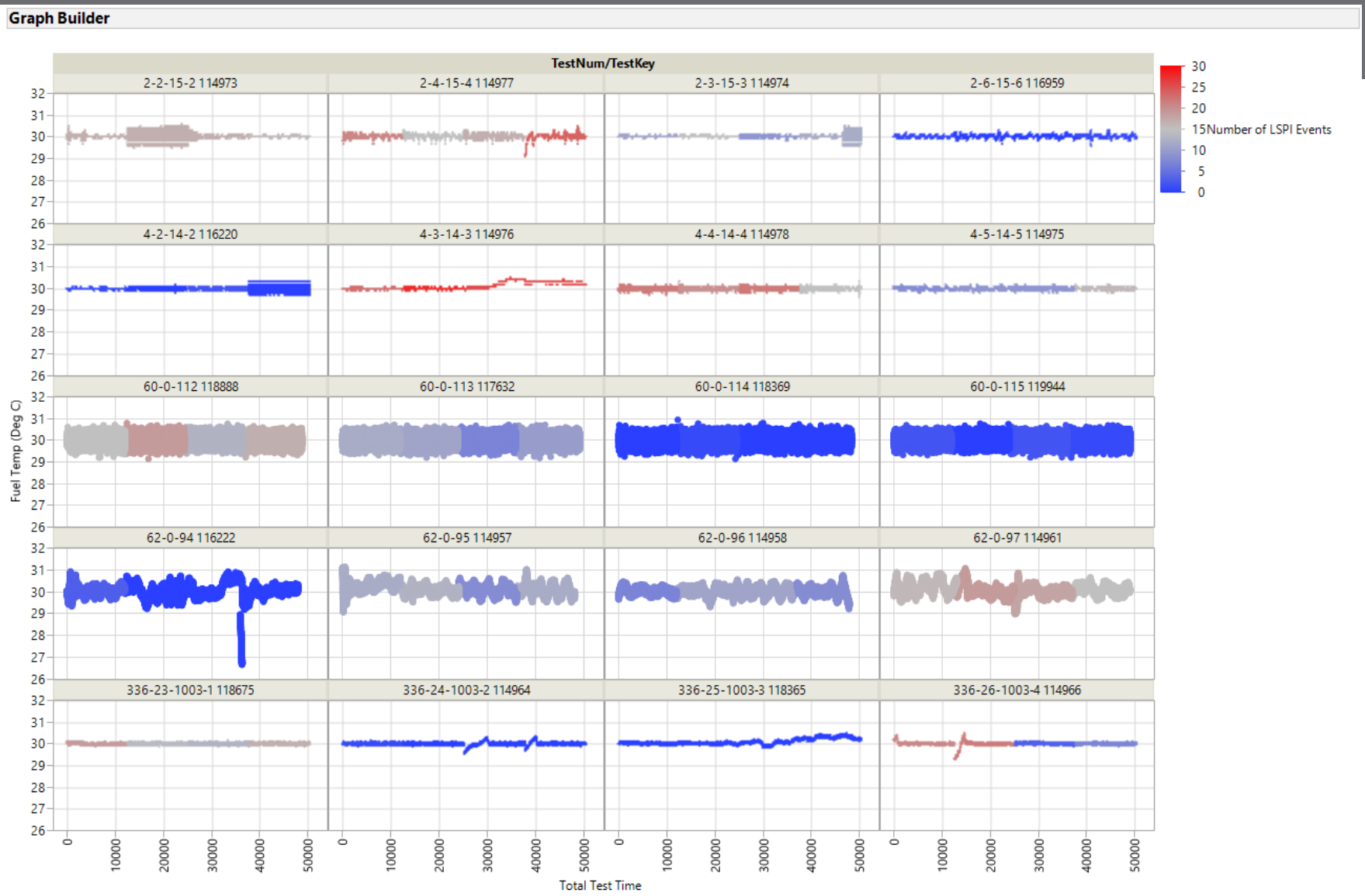
Lubrizol

Graph Builder



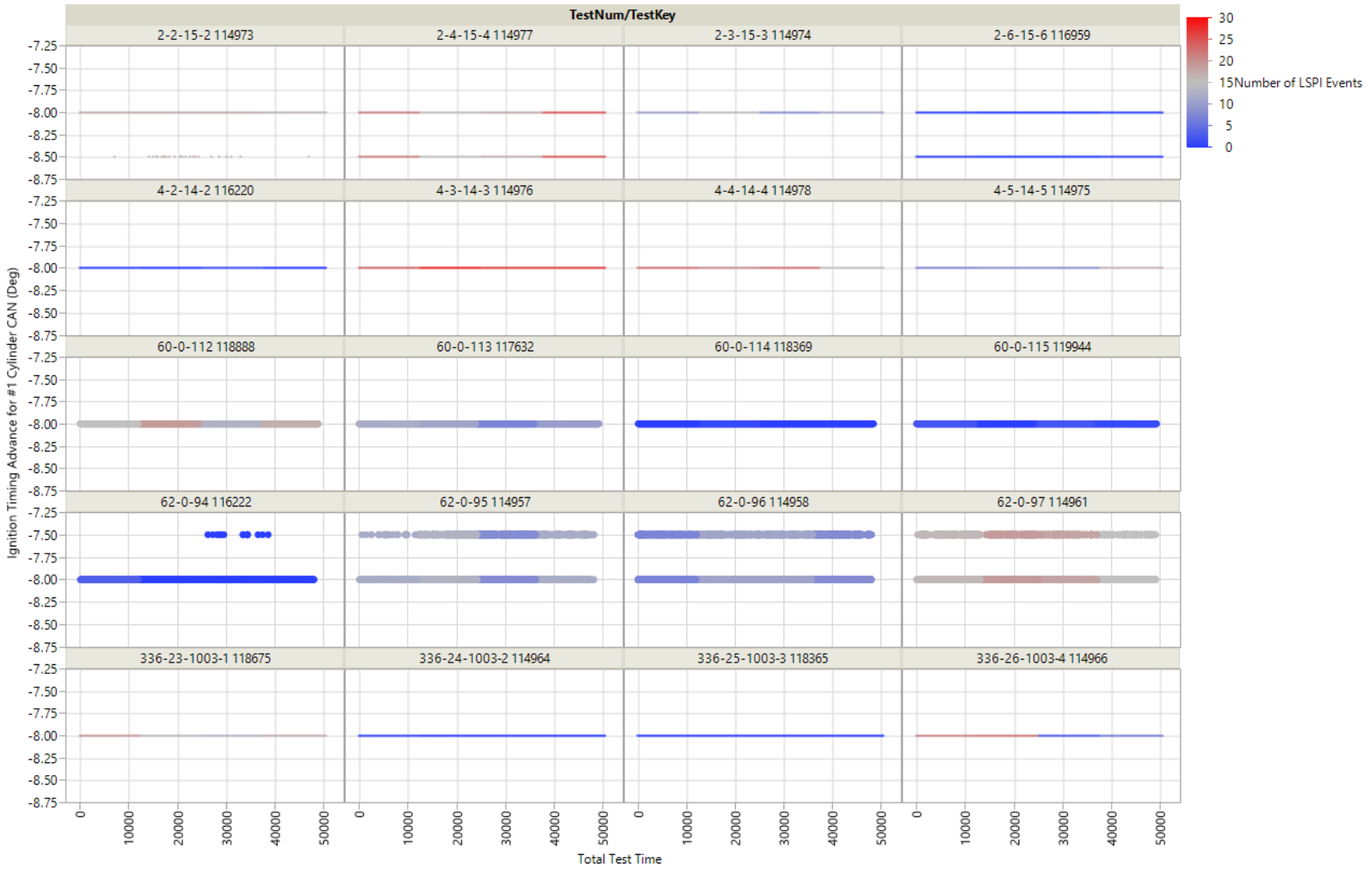
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

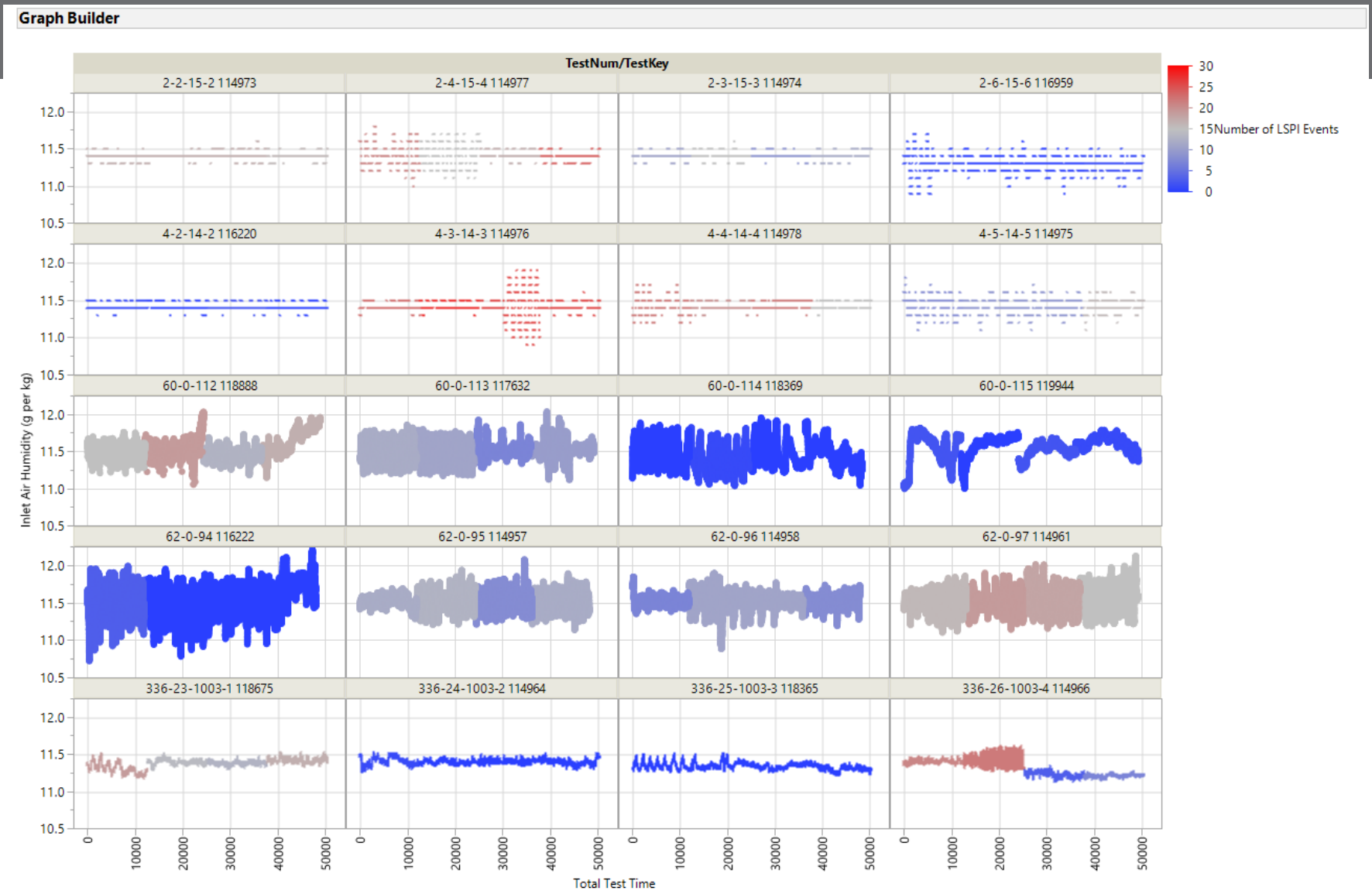


© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder

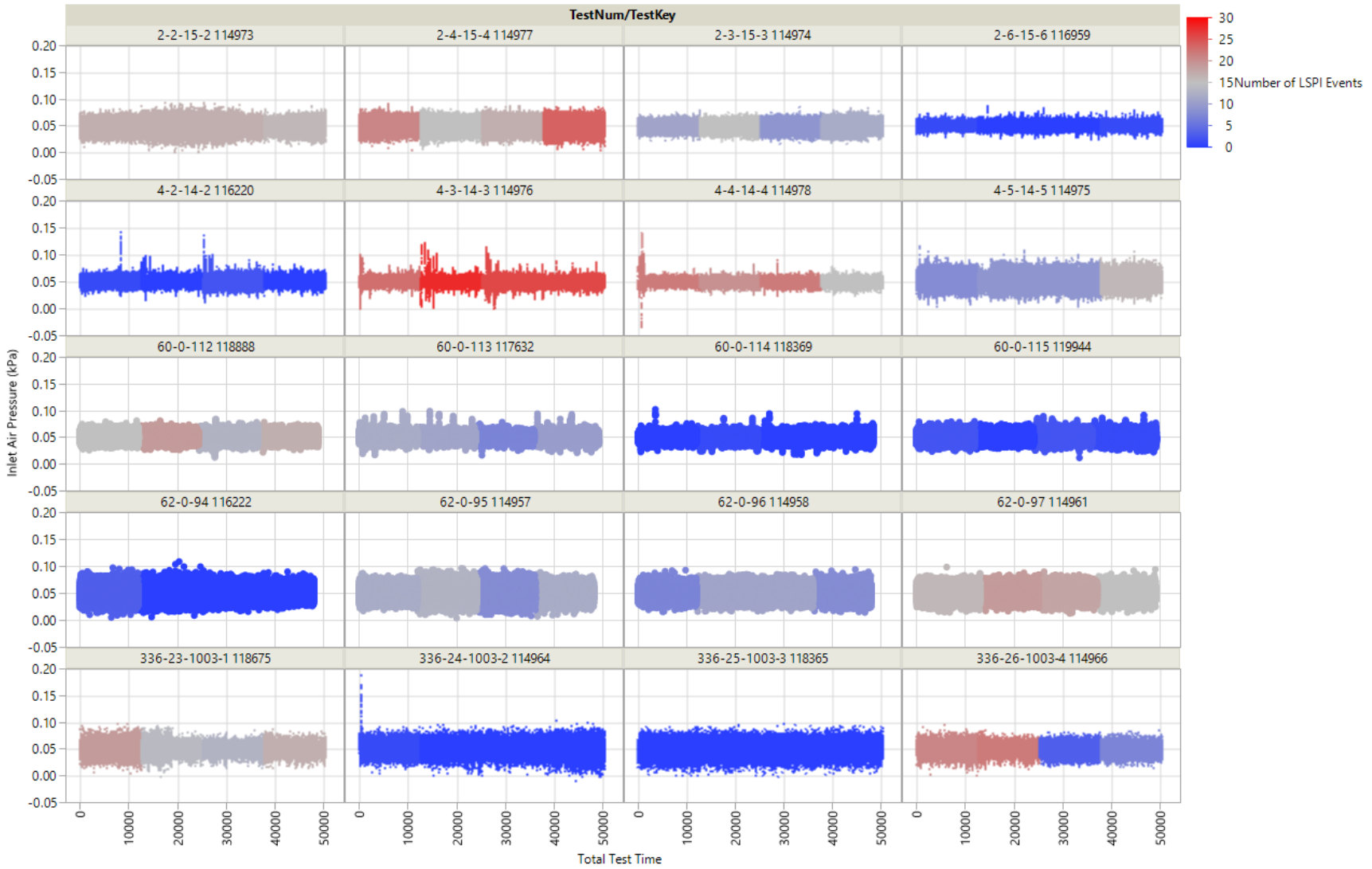


© 2016 The Lubrizol Corporation, all rights reserved.

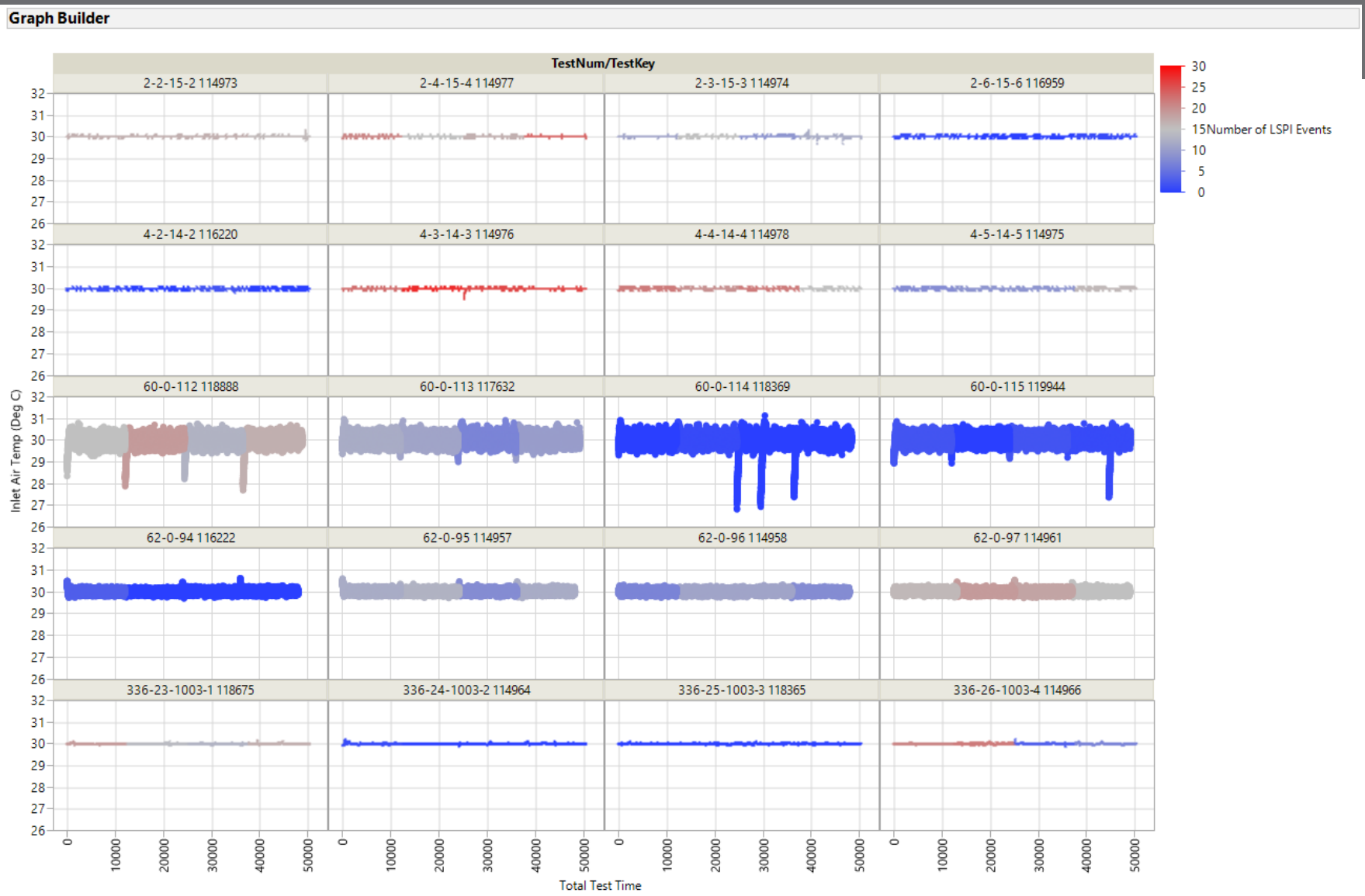


© 2016 The Lubrizol Corporation, all rights reserved.

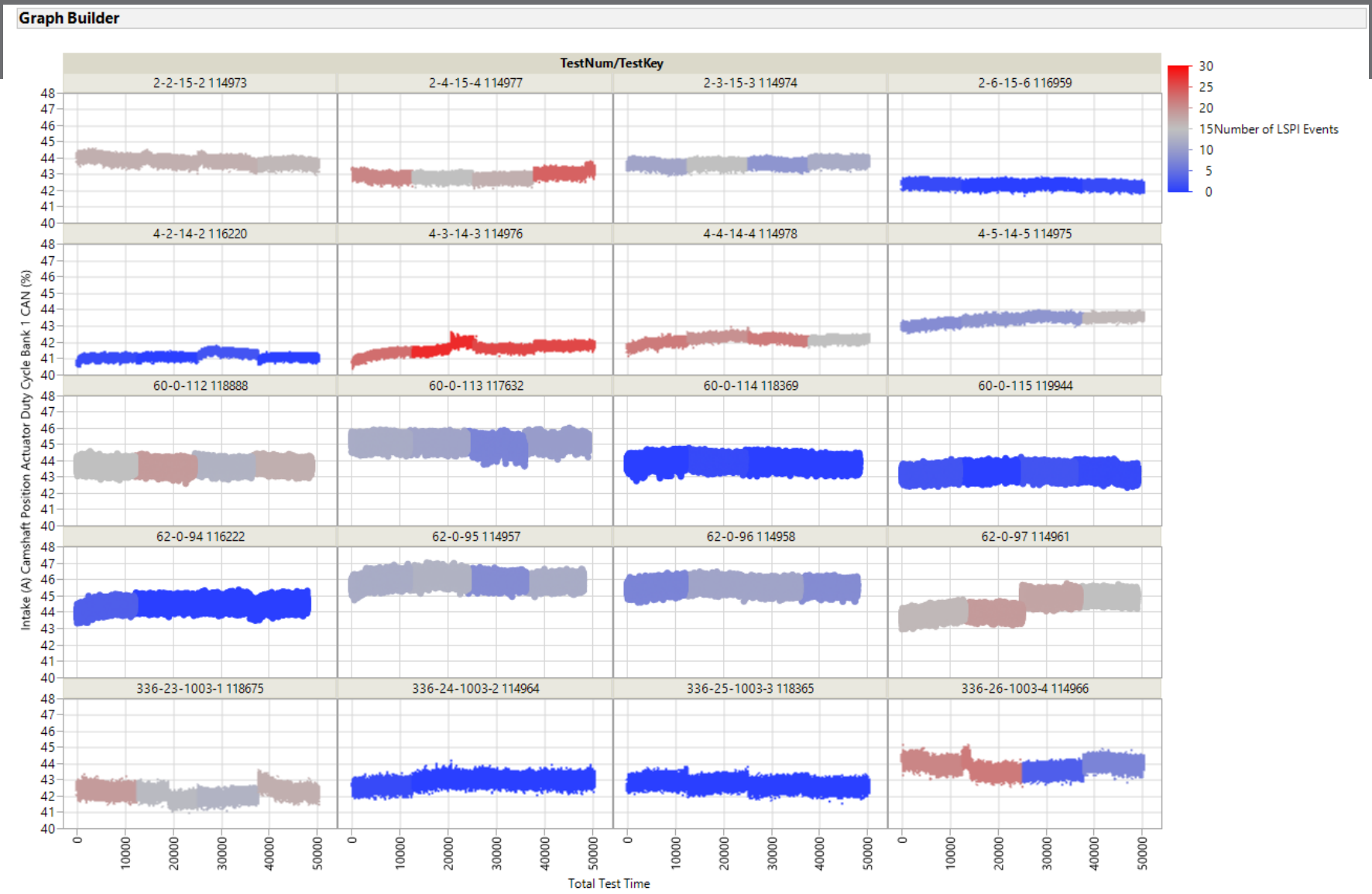
Graph Builder



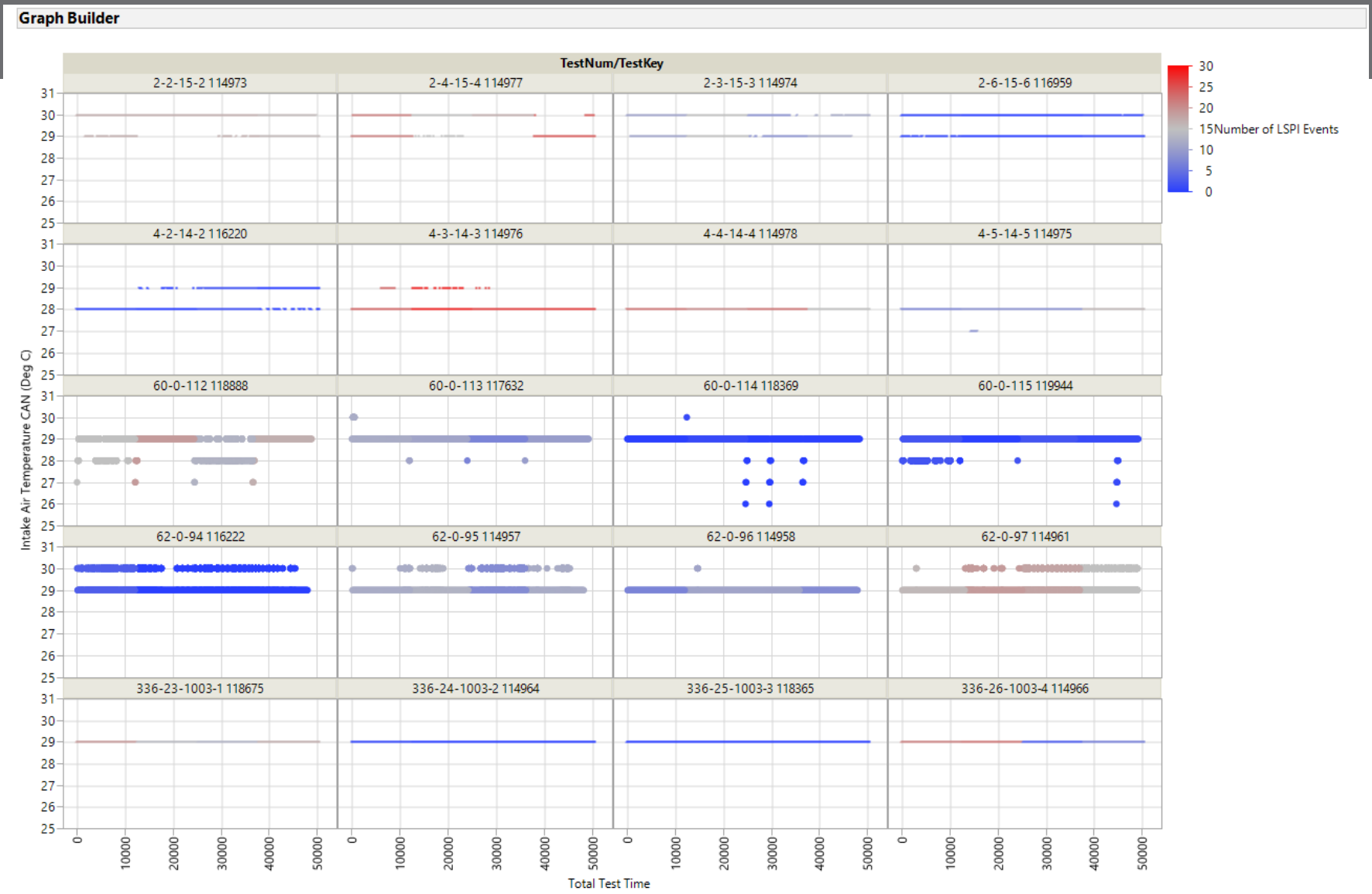
© 2016 The Lubrizol Corporation, all rights reserved.



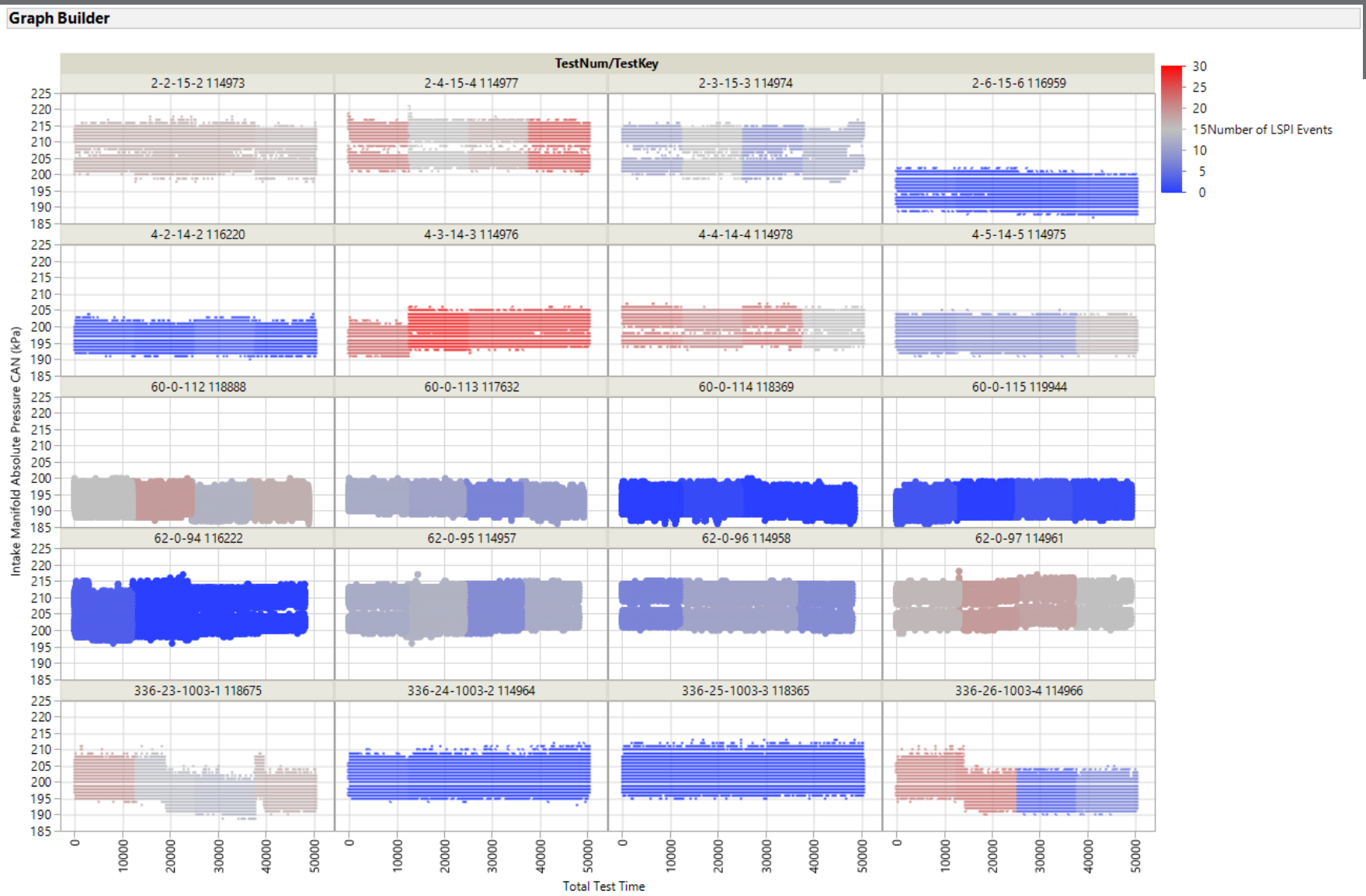
© 2016 The Lubrizol Corporation, all rights reserved.



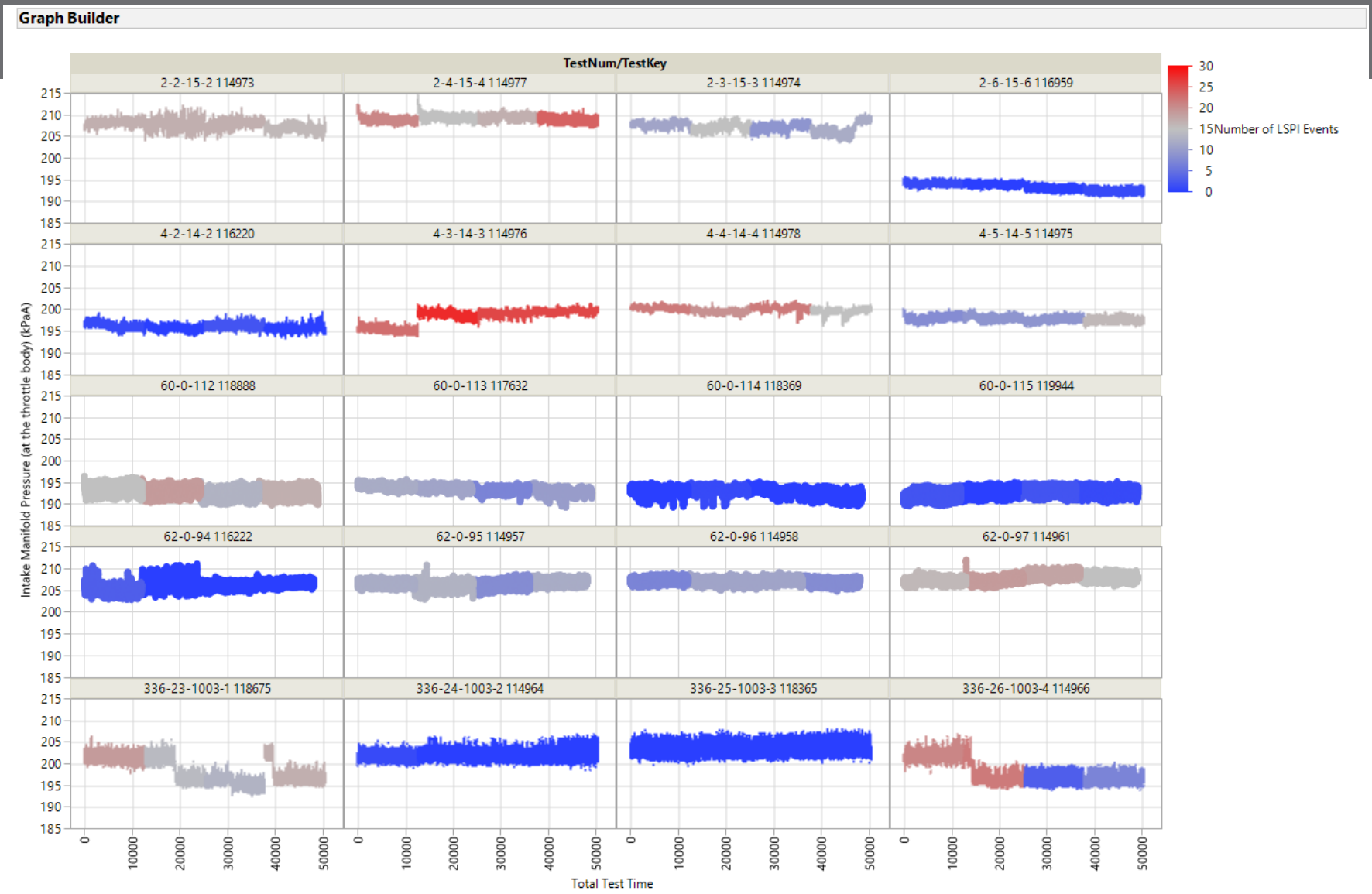
© 2016 The Lubrizol Corporation, all rights reserved.



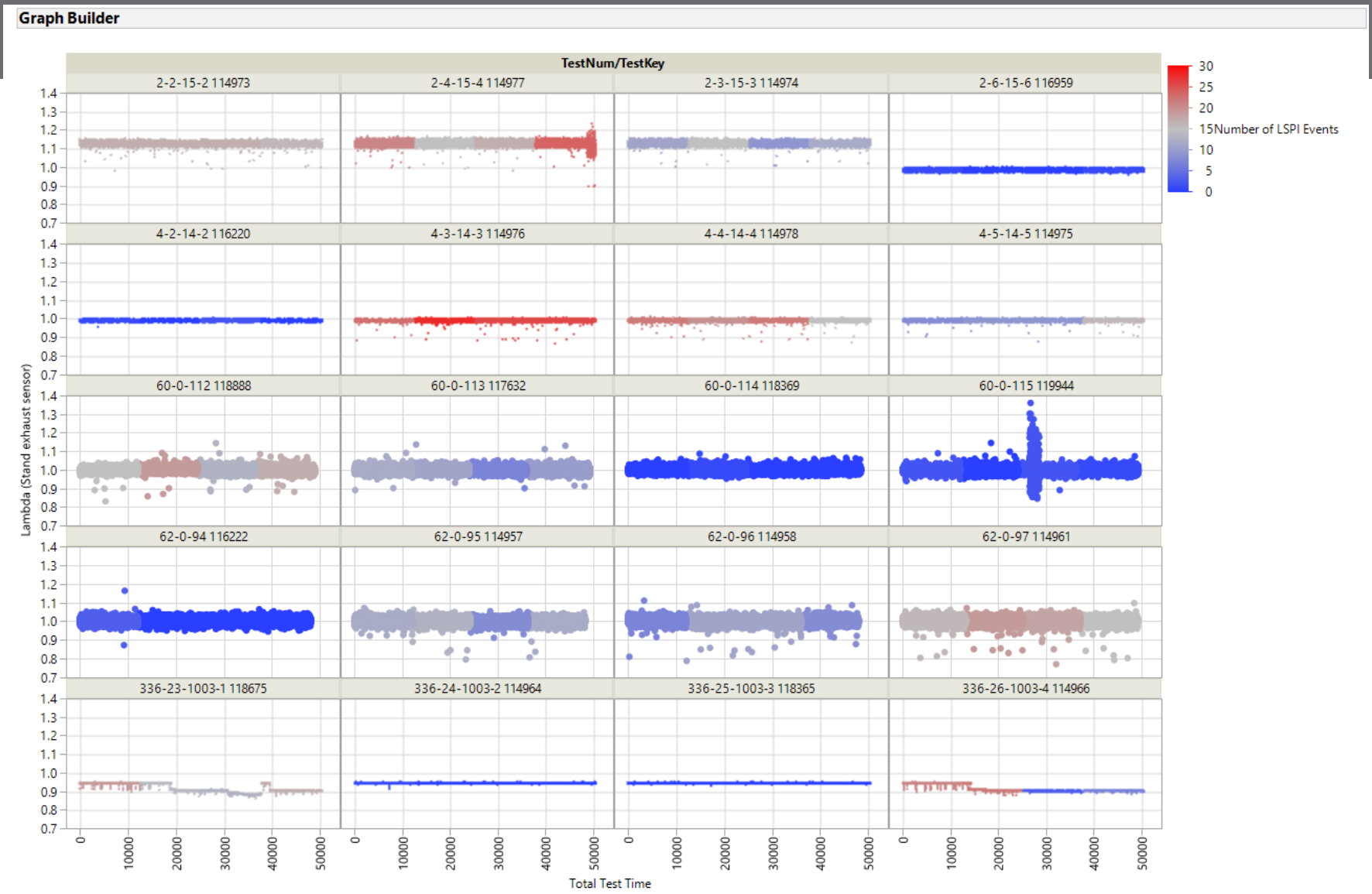
© 2016 The Lubrizol Corporation, all rights reserved.



© 2016 The Lubrizol Corporation, all rights reserved.

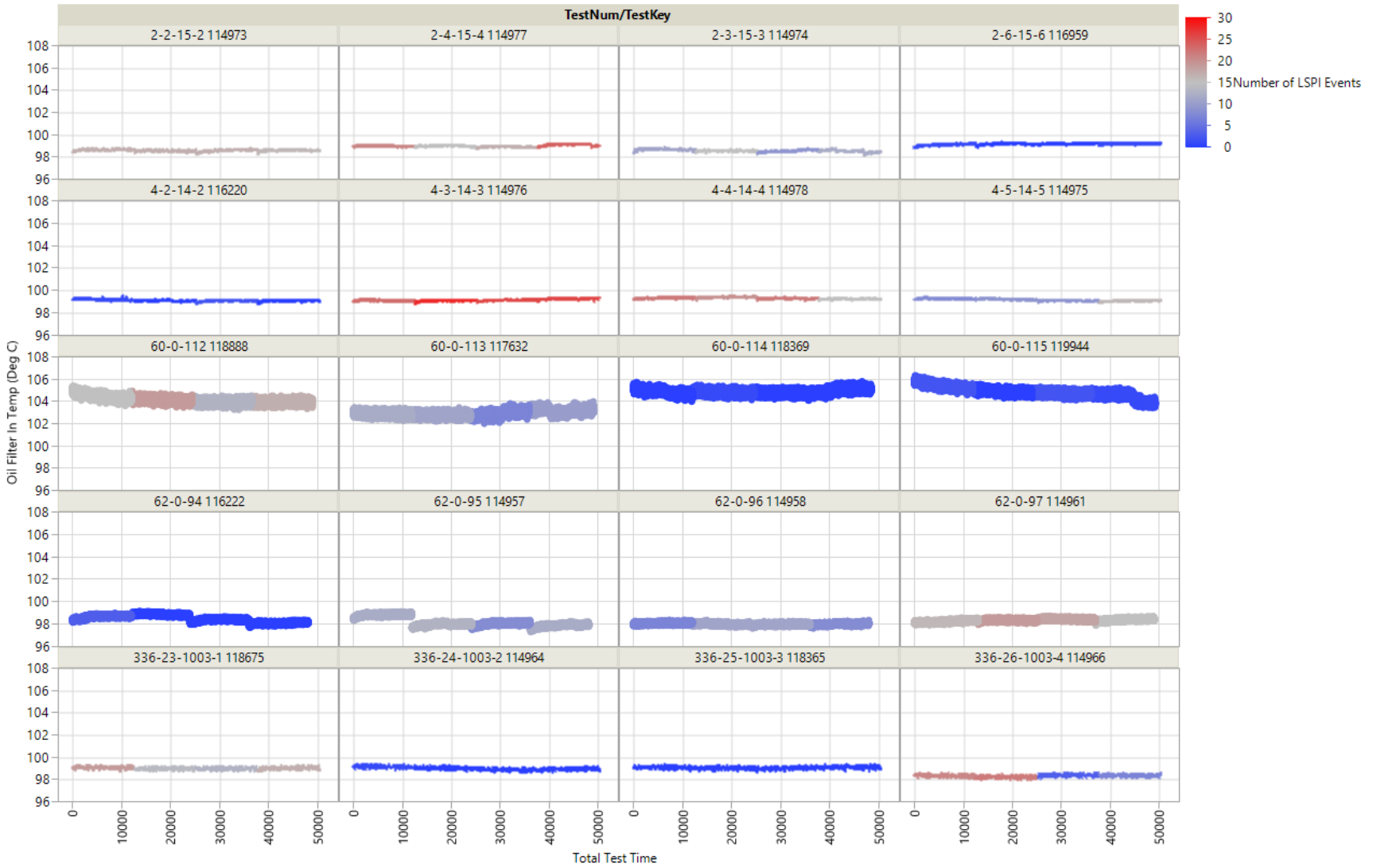


© 2016 The Lubrizol Corporation, all rights reserved.



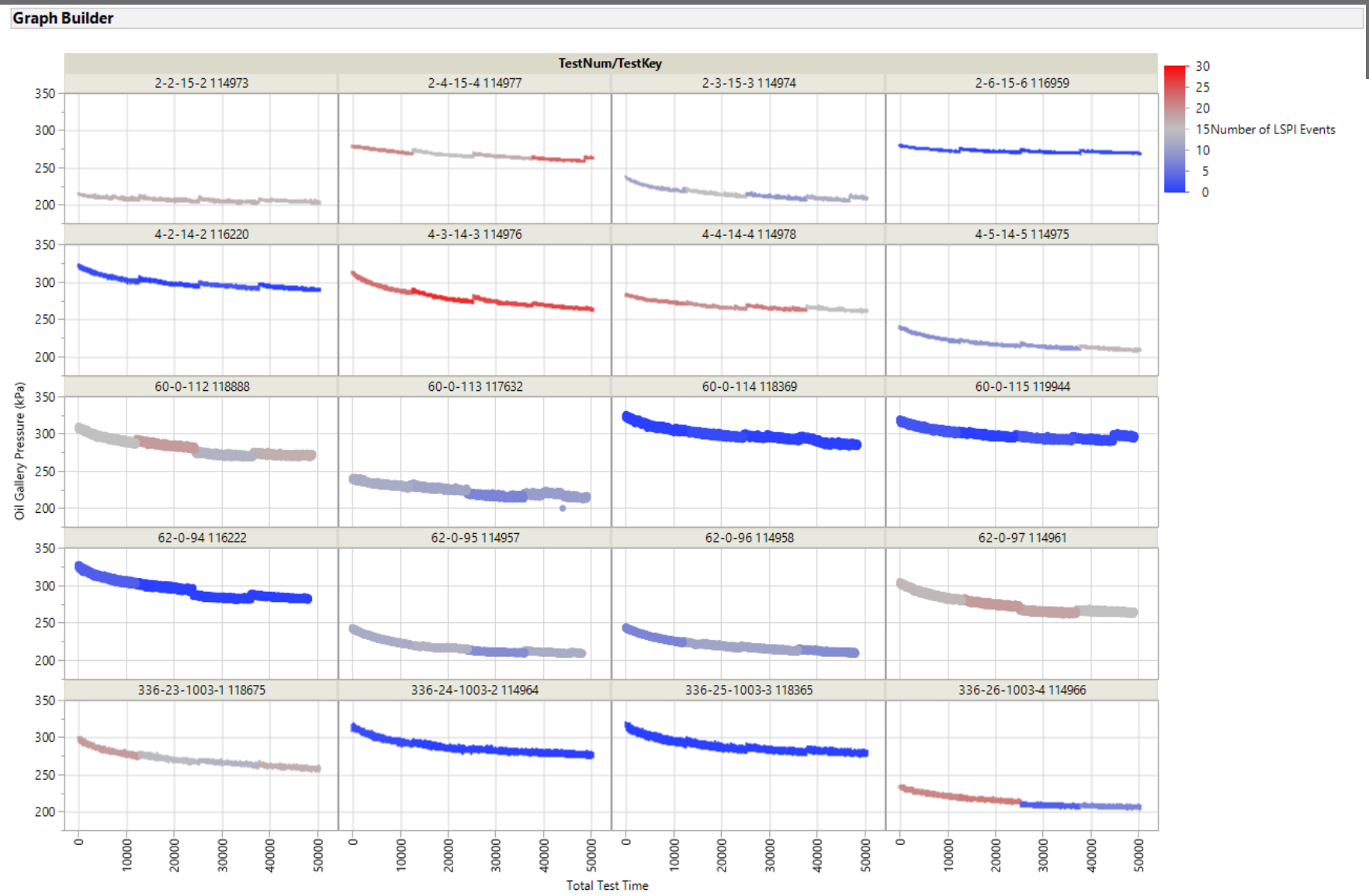
© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder



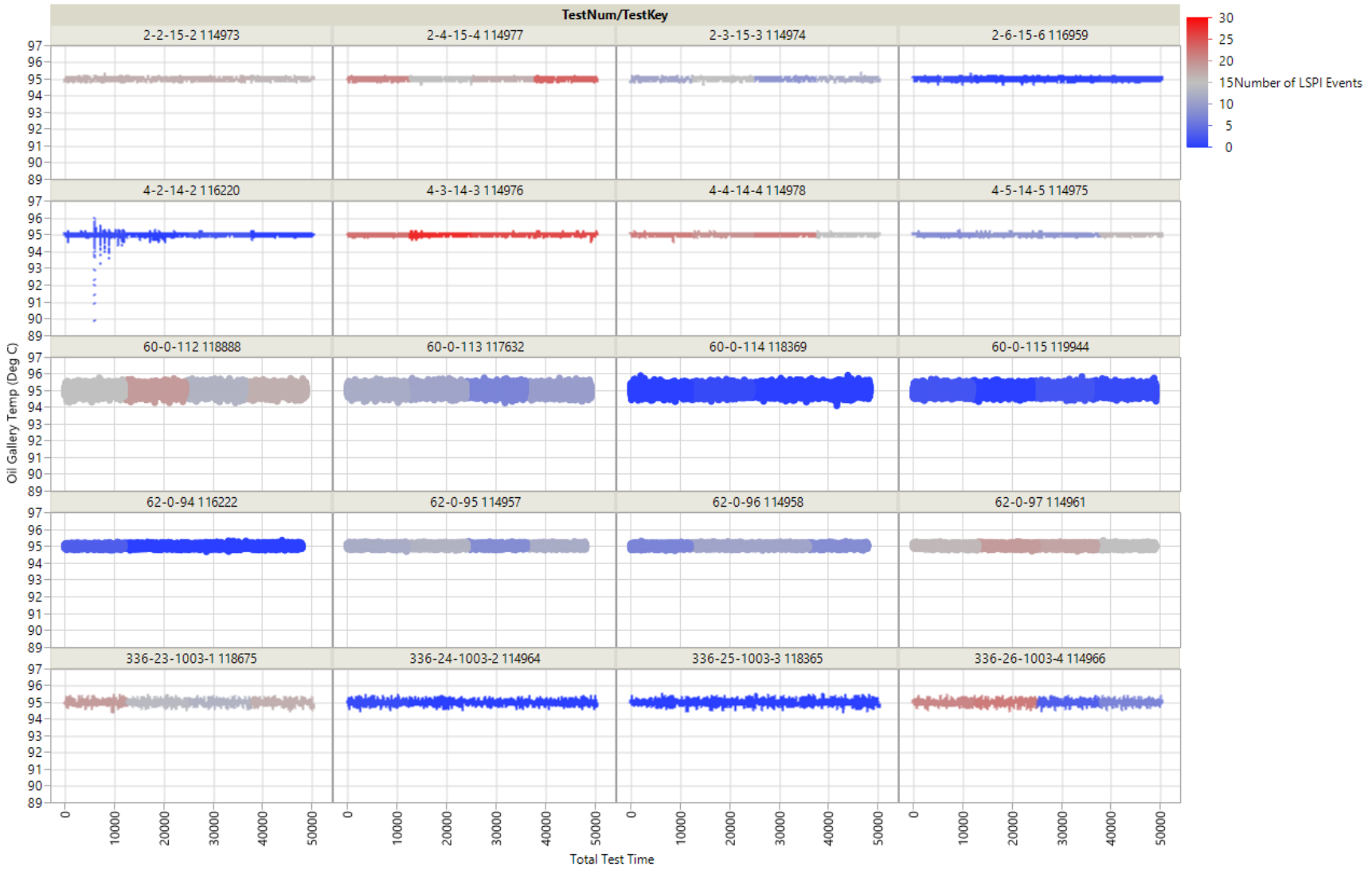
© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder

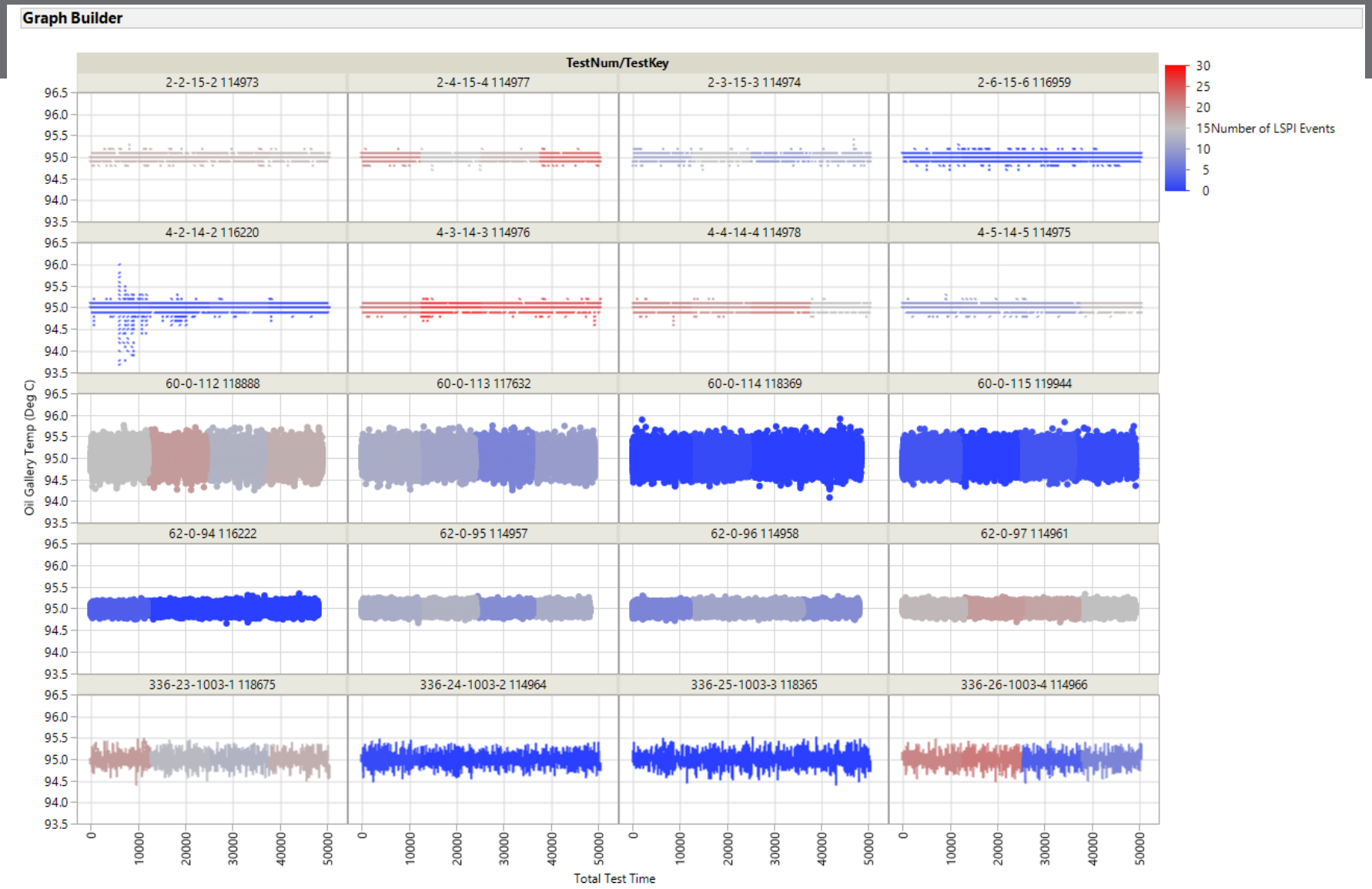


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

ZOOMED IN

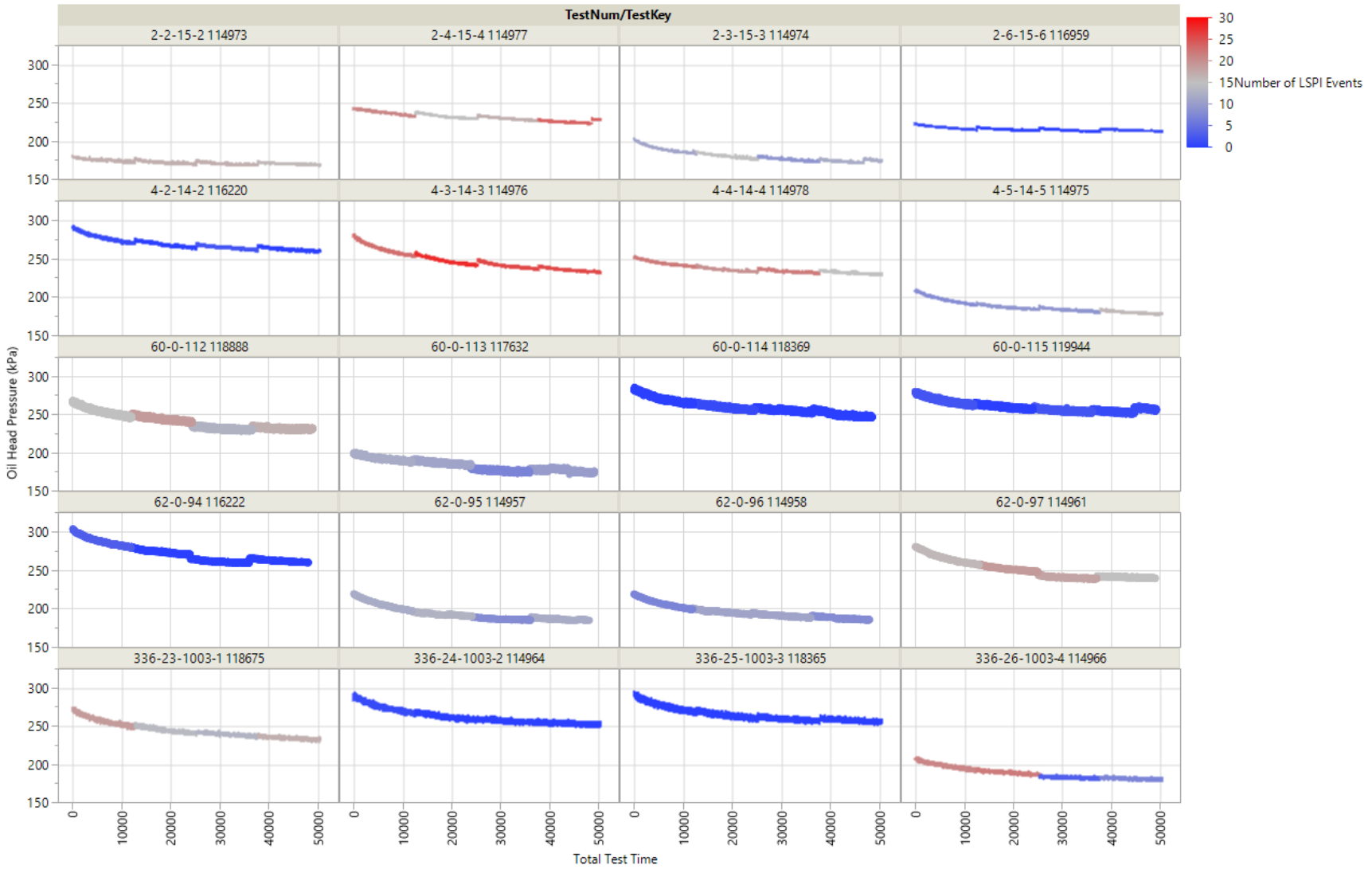
SUCCESS TOGETHER



© 2016 The Lubrizol Corporation, all rights reserved.

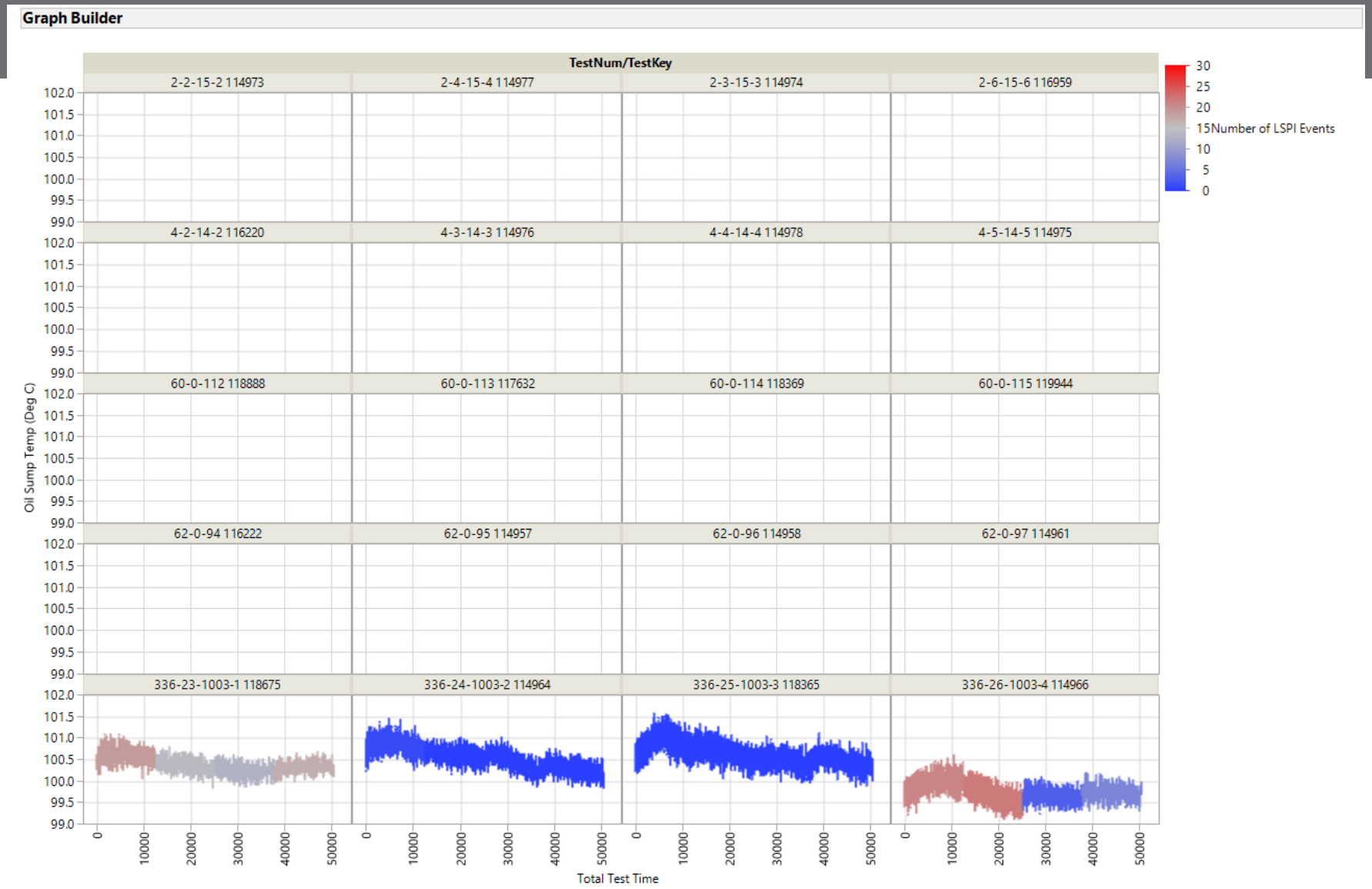
Lubrizol

Graph Builder

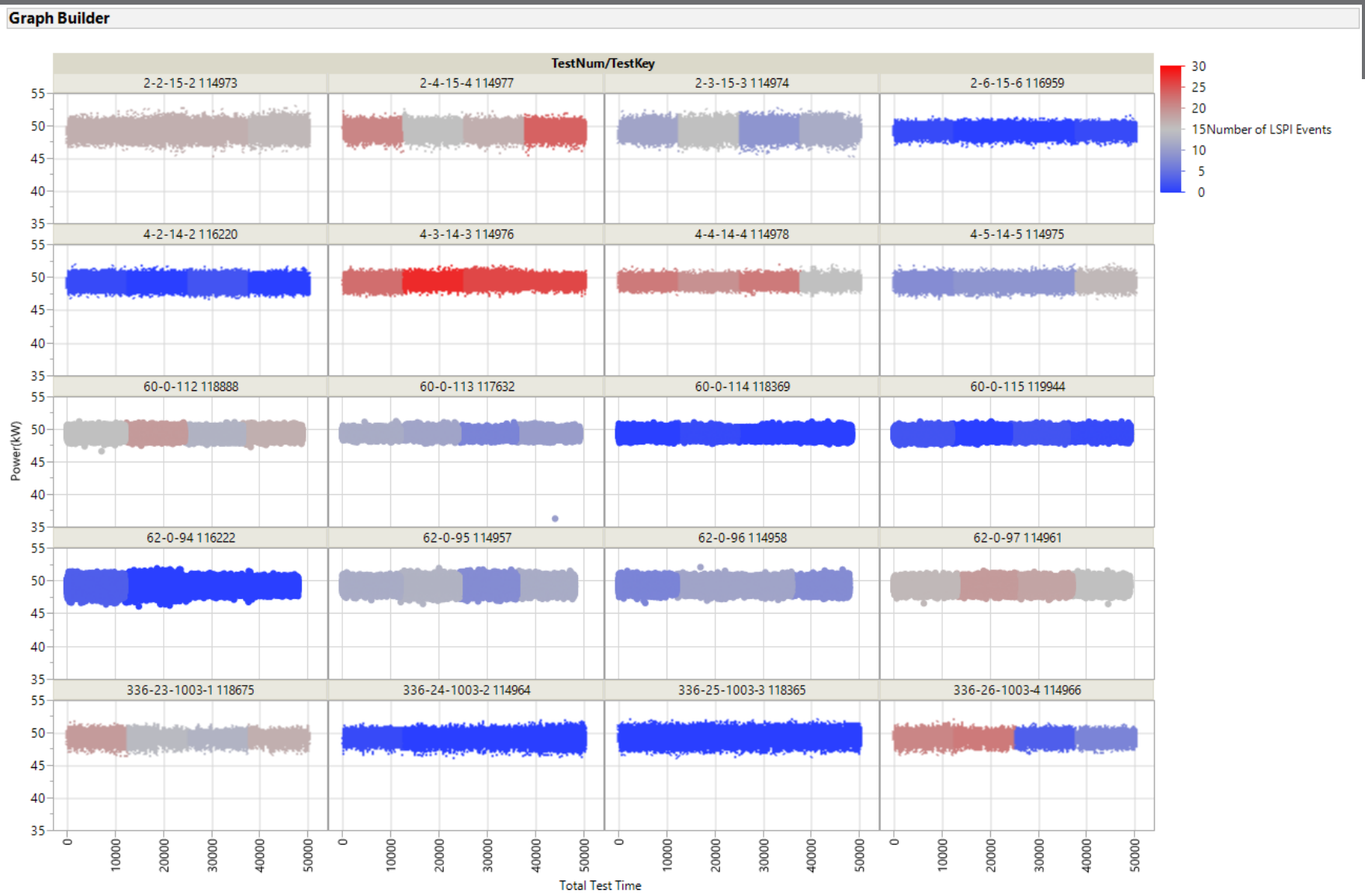


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

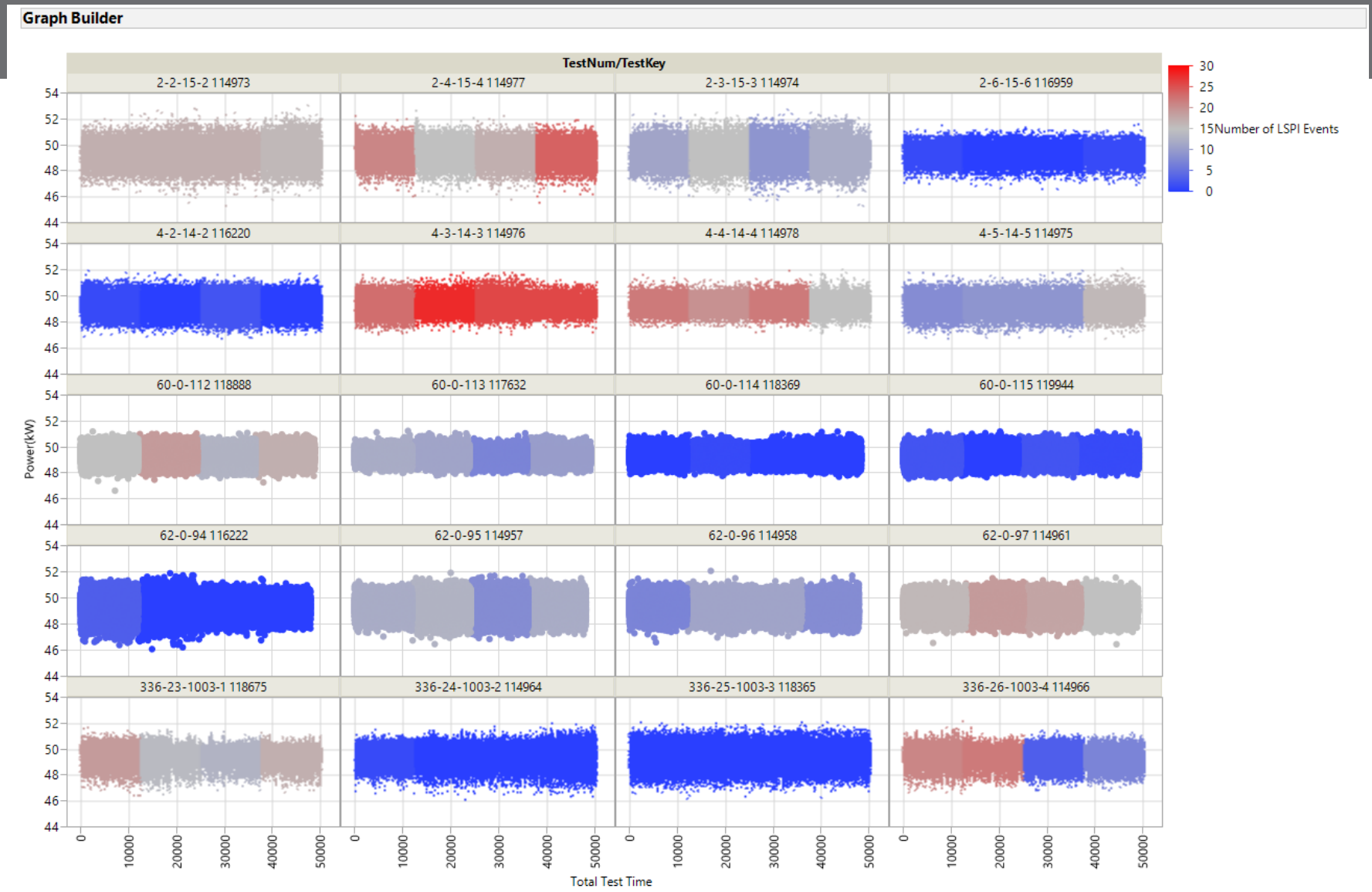


© 2016 The Lubrizol Corporation, all rights reserved.



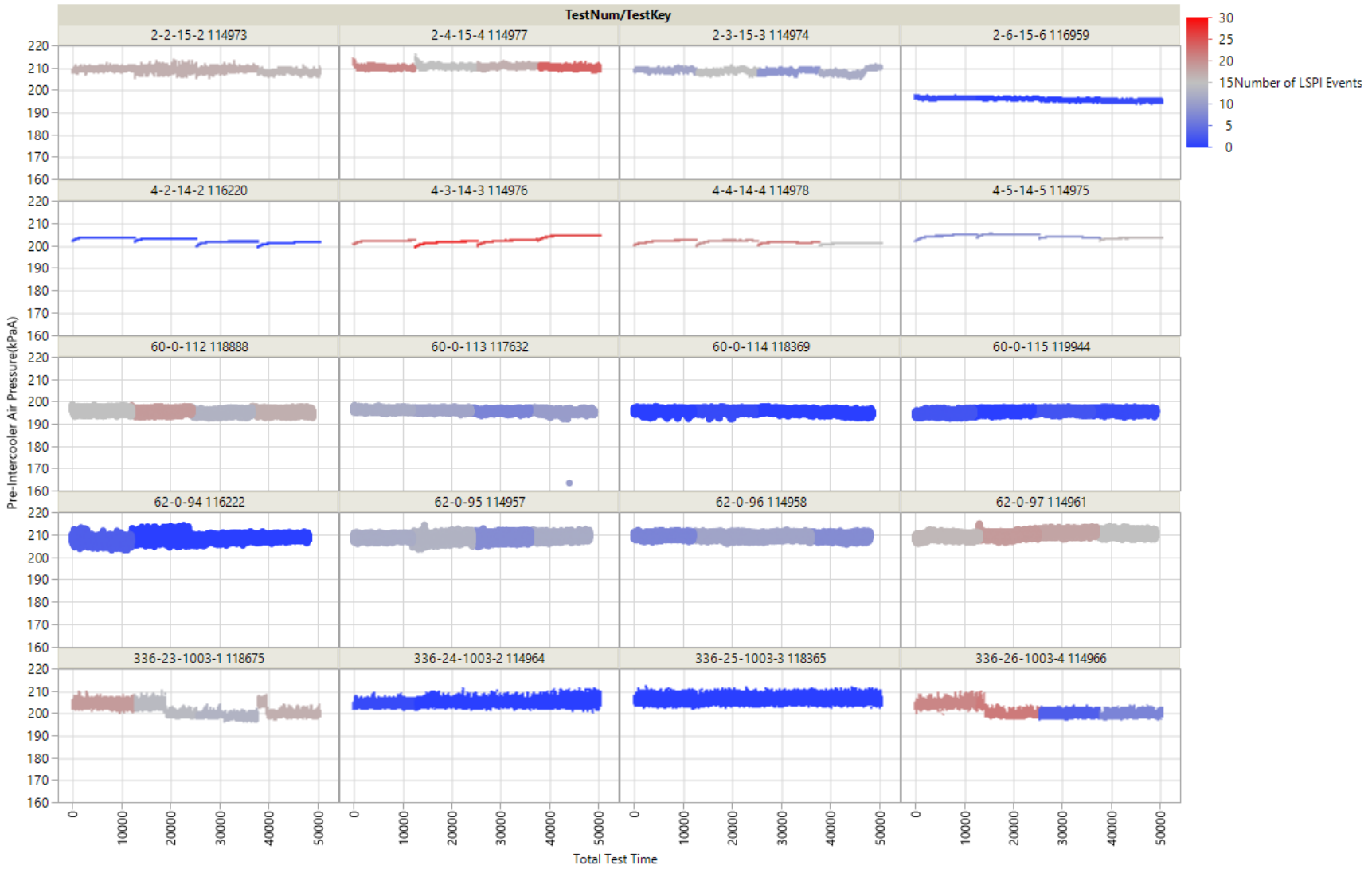
© 2016 The Lubrizol Corporation, all rights reserved.

ZOOMED IN



© 2016 The Lubrizol Corporation, all rights reserved.

Graph Builder

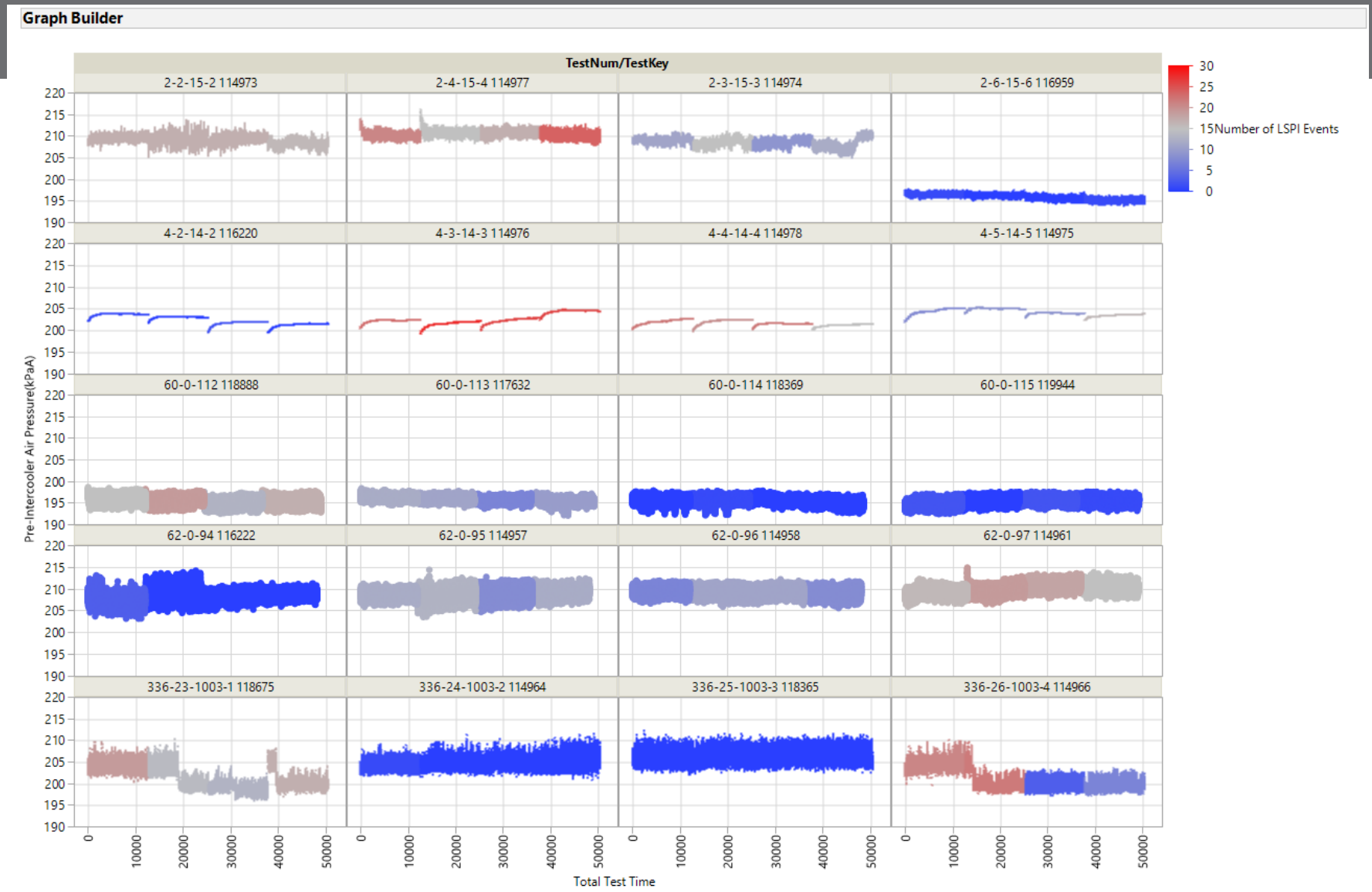


© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol

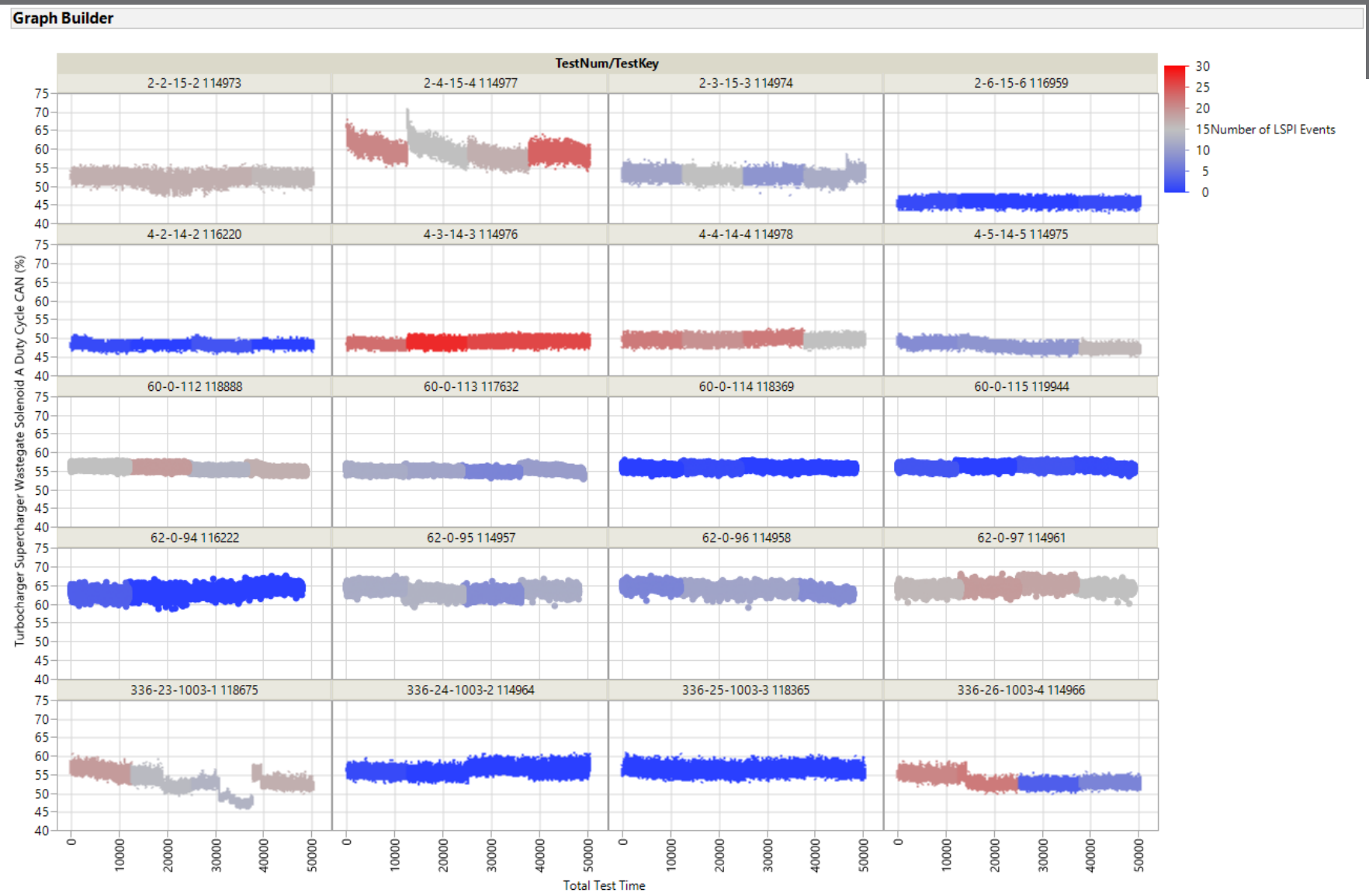
ZOOMED IN

SUCCESS TOGETHER



© 2016 The Lubrizol Corporation, all rights reserved.

Lubrizol



© 2016 The Lubrizol Corporation, all rights reserved.