

DD13 Scuffing Test TEI Data Review Matrix + 3 Post Matrix Tests Kevin O'Malley The Lubrizol Corporation November 2016



Summary



Kit measurements from 3 post-matrix tests are compared to the measurements observed in the 12 matrix tests

 The 3 post-matrix kit measurement data files are labeled as 105-0031, 105-0031A and 105-031B

The following differences are observed when the 12 matrix tests are compared to the post matrix tests:

- Liners:
 - 105-0031A and 105-031B are on upper end of Ra, Rk, Rvk, and Vo measurements
- Top Ring:
 - All three post-matrix tests generally have
 - larger ring gaps, face peak height location, and face peak height to 0.2mm diff
 - smaller face width, Ra, Rk, Rpk, Rz, and back of ring width
- 2nd Ring:
 - 3 post-matrix tests tend to have lower ring tension
- Oil Ring:
 - 3 post-matrix tests tend to have lower ring tension and 180° from gap rail height differential
 - 105-0031A and 105-031B ring gaps tend to be higher



Liner Differences



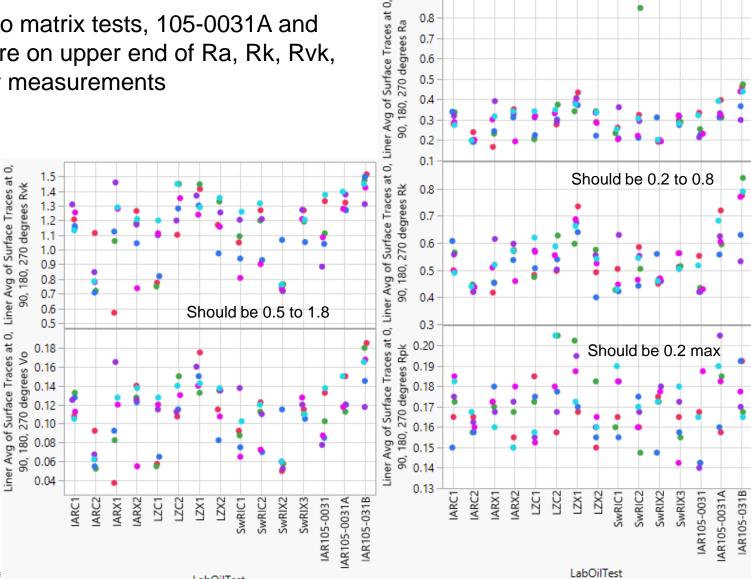
Cylinder

3

5

6

Compared to matrix tests, 105-0031A and 105-031B are on upper end of Ra, Rk, Rvk, and Vo liner measurements



0.8

0.7

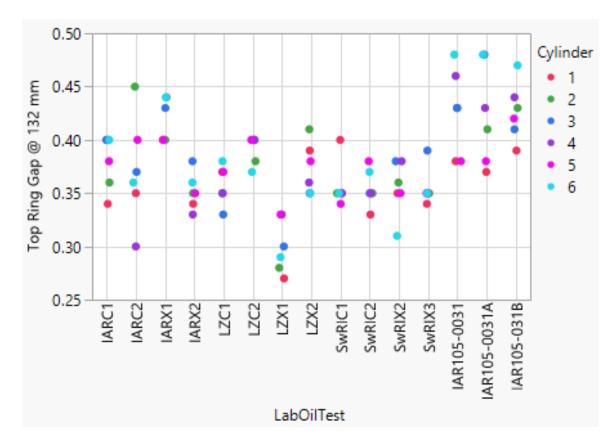
0.6

0.5

Top Ring Differences Ring Gap



105-0031, 105-0031A and 105-031B generally have larger ring gap measurements than observed in the matrix tests

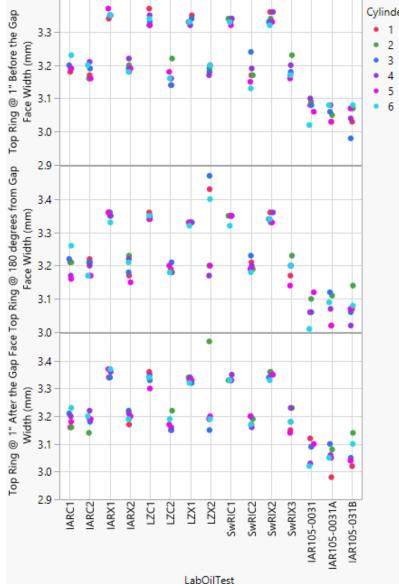




Top Ring Differences Face Width

105-0031, 105-0031A and 105-031B have lower face width measurements than observed in the matrix

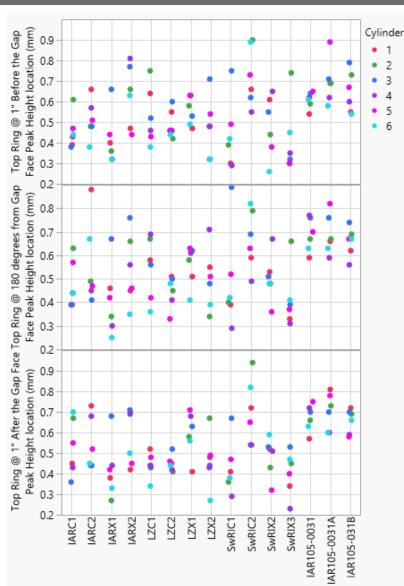




Top Ring Differences Face Peak Height Location

105-0031, 105-0031A and 105-031B have face peak height location measurements on the upper end of what was observed in the matrix

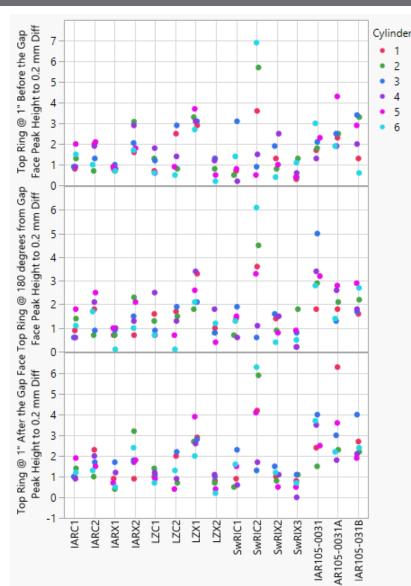
6





Top Ring Differences Face Peak Height to 0.2mm Diff

105-0031, 105-0031A and 105-031B face peak height to 0.2 mm diff measurements are on upper end of measurements observed in the matrix



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Top Ring Differences Ra

105-0031, 105-0031A and 105-031B Ra measurements tend to be on the lower end of measurements observed in the matrix

Top Ring @ 1" After the Gap Top Ring @ 180 degrees from Top Ring @ 1" Before the Gap

Gap Face Ra

0.30

0.25

0.20

0.15

0.35

0.30

0.25

0.20

0.15

0.10

0.30

0.20

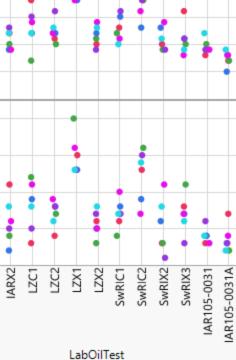
0.15

IARC2 IARX1

IARC1

ace Ra 0.25

Face Ra





IAR105-031B

Cylinder

2

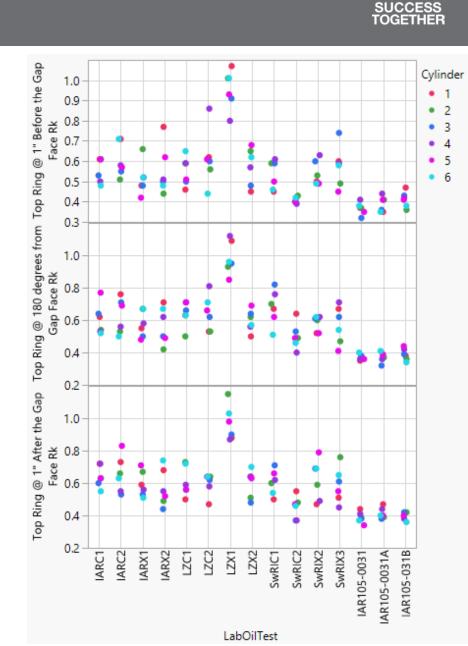
3

4 5

6

Top Ring Differences Rk

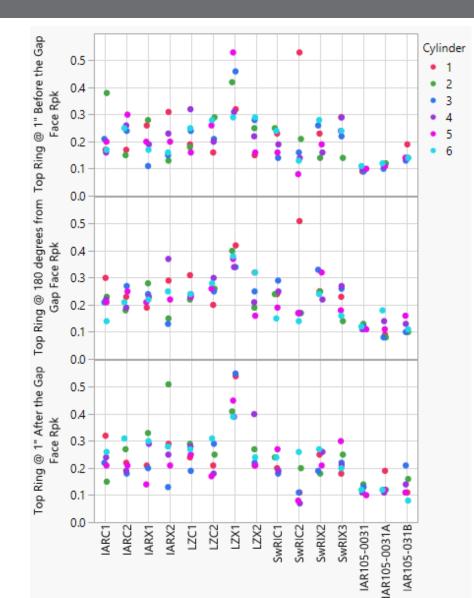
105-0031, 105-0031A and 105-031B Rk measurements are generally lower than those observed in the matrix





Top Ring Differences Rpk

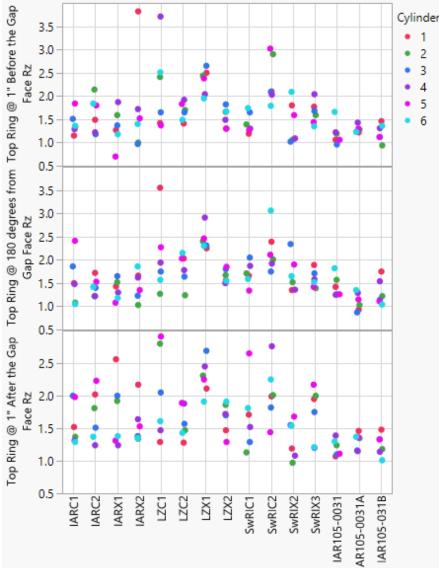
105-0031, 105-0031A and 105-031B Rpk measurements are generally lower than what was observed in the matrix





Top Ring Differences Rz

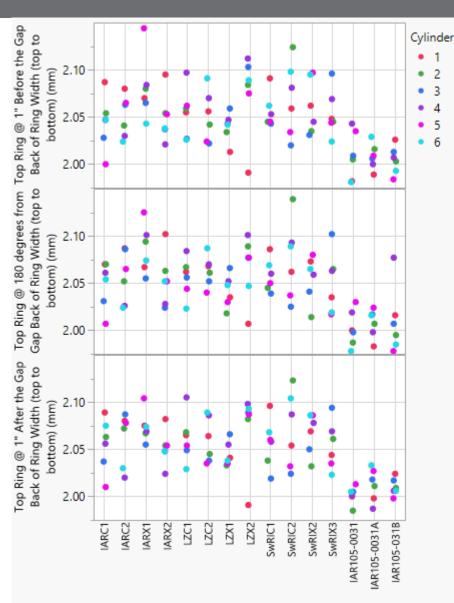
105-0031, 105-0031A and 105-031B Rz 1" after the gap measurements are on the lower end of what was observed in the matrix





Top Ring Differences Back of Ring Width

105-0031, 105-0031A and 105-031B generally have lower back of ring width measurements than what was observed in the matrix

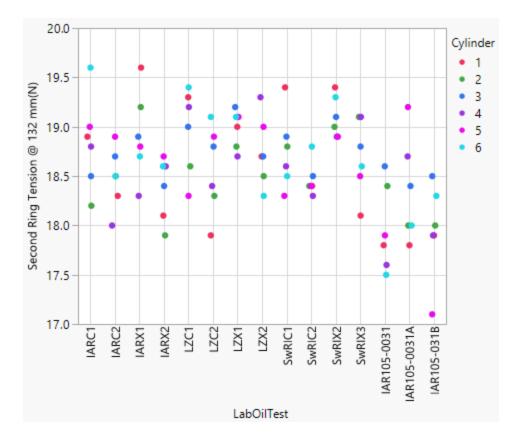




Second Ring Differences Ring Tension @ 132 mm



105-0031, 105-0031A and 105-031B tend to have lower ring tension measurements than the matrix tests



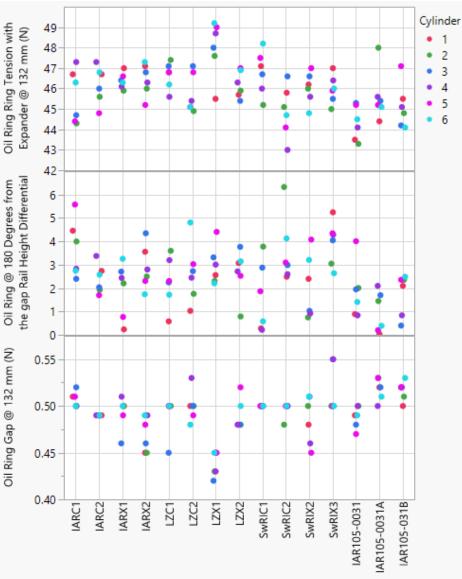


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Oil Ring Differences

105-0031, 105-0031A and 105-031B tend to have lower ring tension & 180° from gap rail height differential measurements compared to the matrix tests

105-0031A and 105-031B have ring gap measurements on the upper end of what was observed in matrix tests



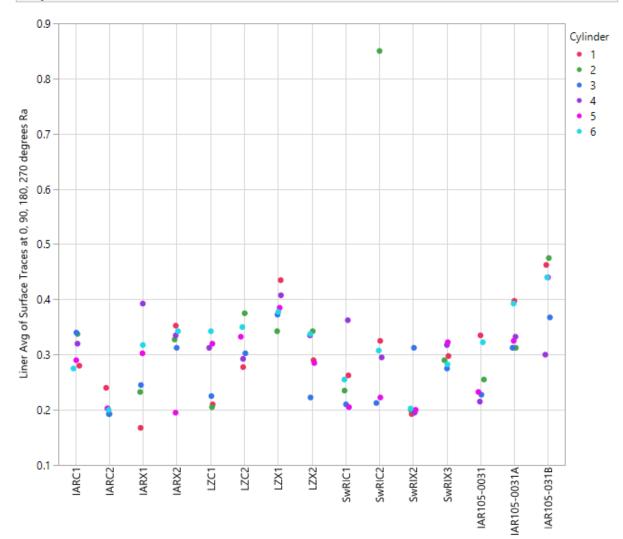




Appendix TEI Measurements

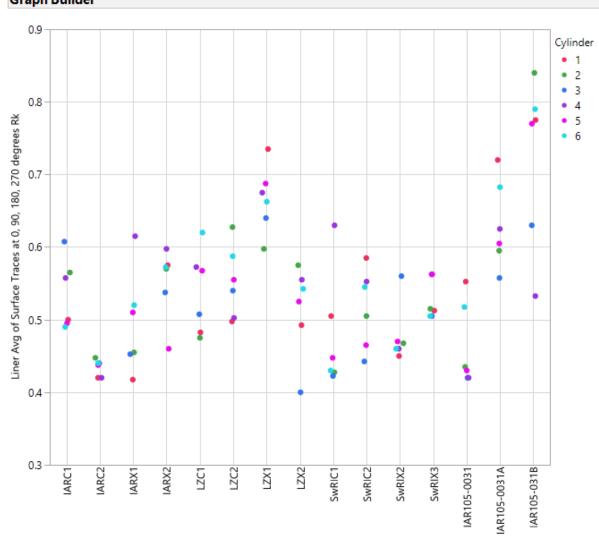












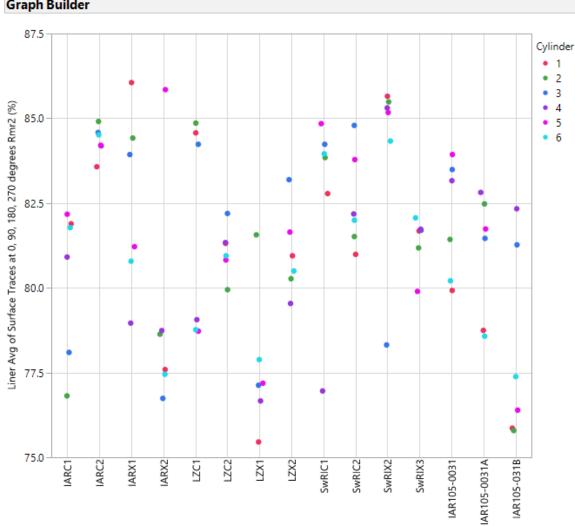




10 Cylinder • 1 • 2 3 • 9 Liner Avg of Surface Traces at 0, 90, 180, 270 degrees Rmr1 (%) • 4 • 5 • 6 8 7. 6 . 5 4 ARC1 ARC2 IARX1 IARX2 LZC1 LZC2 LZX1 LZX2 SwRIC1 SwRIC2 SwRIX2 SwRIX3 IAR105-031B IAR105-0031A IAR105-0031











0.21 Cylinder • 1 • 2 0.20 • 3 • 4 Liner Avg of Surface Traces at 0, 90, 180, 270 degrees Rpk • 5 • 6 0.19 0.18 0.17 0.16 0.15 0.14 0.13 IARC2 LZC2 LZX2 SwRIX2 SwRIX3 **ARC1** IARX1 IARX2 LZC1 LX1 SwRIC1 SwRIC2 IAR105-0031A IAR105-031B IAR105-0031





1.6 Cylinder • 1 • 2 • 3 1.4 • 4 Liner Avg of Surface Traces at 0, 90, 180, 270 degrees Rvk • 5 • 6 1.2 • 1.0 0.8 0.6 0.4 IARC1 IARC2 SwRIC2 IARX1 IARX2 LZC1 LZC2 LZX1 ZX2 SwRIC1 SwRIX2 SwRIX3 IAR105-031B IAR105-0031 IAR105-0031A

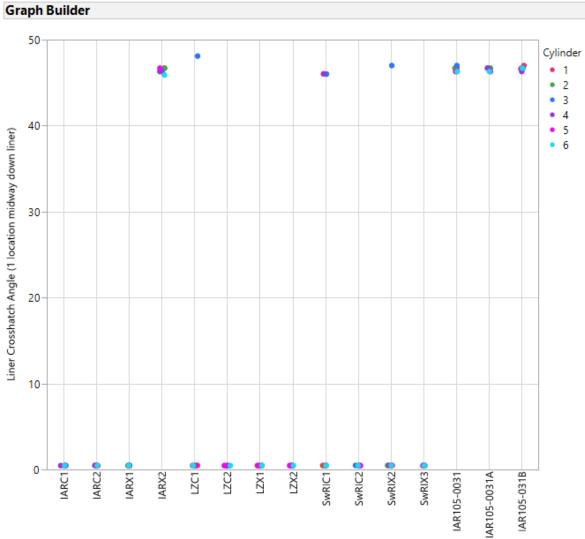




Graph Builder 0.20 Cylinder • 1 • 2 • 3 • 4 Liner Avg of Surface Traces at 0, 90, 180, 270 degrees Vo • 5 • 6 0.15 • 6 • . 0.10 • 0.05 IARC2 IARX1 IARX2-LZC2 ZX2 SwRIX2 SwRIX3 IARC1 LZC1 LZX1 SwRIC1 SwRIC2 IAR105-0031A IAR105-031B IAR105-0031



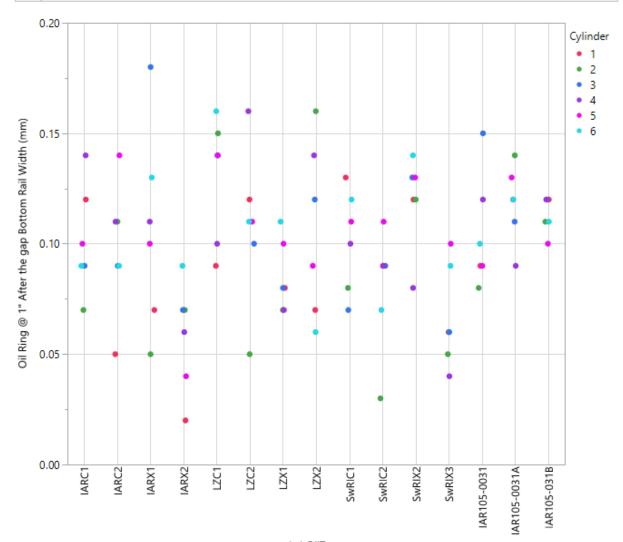
















Graph Builder 2.20 Cylinder • 1 • 2 3 ٠ • 4 • 5 Oil Ring @ 1" After the gap Gap Between Rails (mm) • 6 2.15 2.10 2.05 2.00 IARC1 ARC2 IARX2 LZC2 LZX2 SwRIC1 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LZX1 IAR105-031B IAR105-0031A IAR105-0031



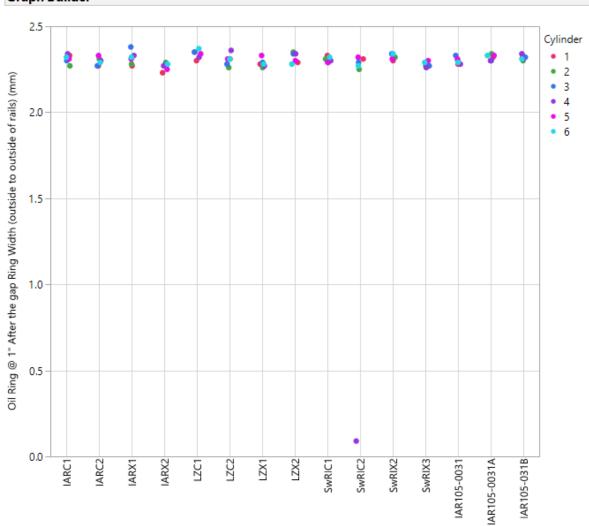


8 Cylinder • 1 • 2 7 • 3 • 4 • 5 Oil Ring @ 1" After the gap Rail Height Differential • 6 6 • 5 . 4 3 2 1 • ٠ • 0 ARC1 IARC2 IARX2 LZC2 ZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LZX1 SwRIC1 IAR105-0031 IAR105-0031A IAR105-031B





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Graph Builder

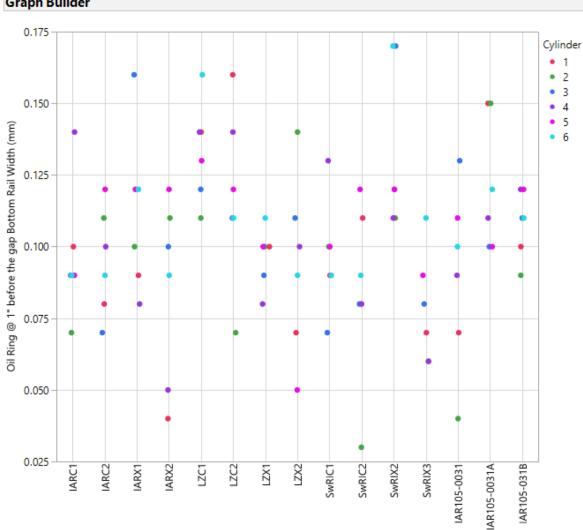


• 1

0.20 Cylinder • 2 • 5 • 6 Oil Ring @ 1" After the gap Top Rail Width (mm) 0.15 0.10 0.05 IARC1 ARC2 IARX2 LZC2 LZX2 SwRIC1 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LZX1 IAR105-031B IAR105-0031A IAR105-0031











Graph Builder 2.175 Cylinder • 1 • 2 • 3 2.150 • 4 • 5 Oil Ring @ 1" before the gap Gap Between Rails (mm) • 6 2.125 2.100 2.075 2.050 2.025 IARC1 IARC2 IARX1 IARX2 LZC2 LZX1 ZX2 SwRIC2 SwRIX2 SwRIX3 LZC1 SwRIC1 IAR105-0031 IAR105-0031A IAR105-031B





6 Cylinder • 1 • 2 • 3 5 • 4 • 5 Oil Ring @ 1" before the gap Rail Height Differential • 6 4 3 2 1 0 IARC2 IARX2 LZC2 LX1 ZX2 SwRIC2 SwRIX2 SwRIX3 ARC1 IARX1 LZC1 SwRIC1 IAR105-0031A IAR105-031B IAR105-0031

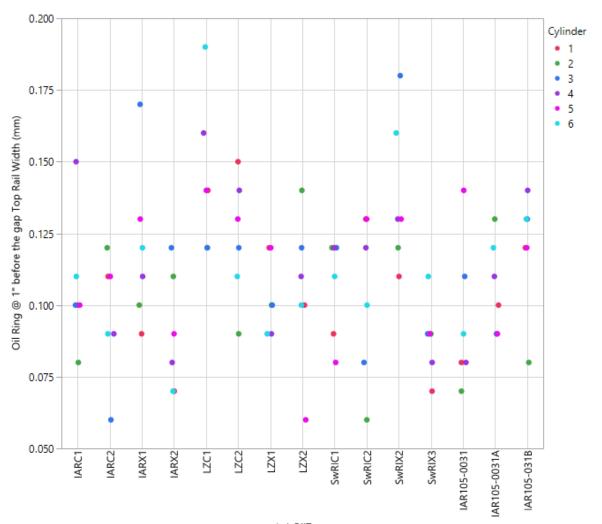




2.400 Cylinder • 1 • 2 Oil Ring @ 1" before the gap Ring Width (outside to outside of rails) (mm) 3 ٠ 2.375 • 4 • 5 • 6 2.350 2.325 2.300 2.275 2.250 IARC2 **ARC1** IARX1 IARX2 LZC1 LZC2 ZX2 SwRIC1 SwRIC2 SwRIX2 SwRIX3 LZX1 IAR105-0031A IAR105-031B IAR105-0031

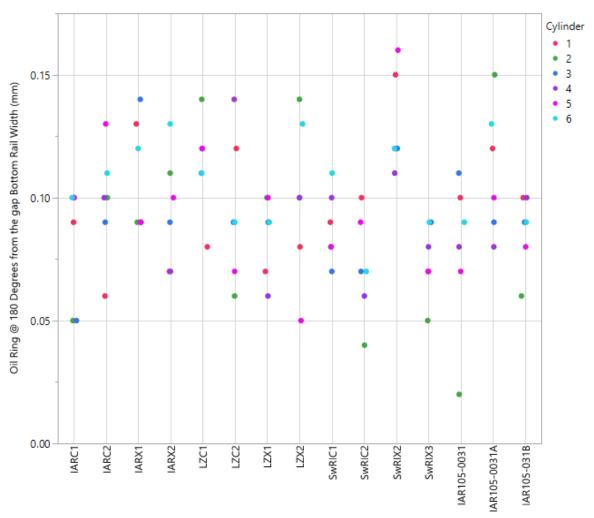














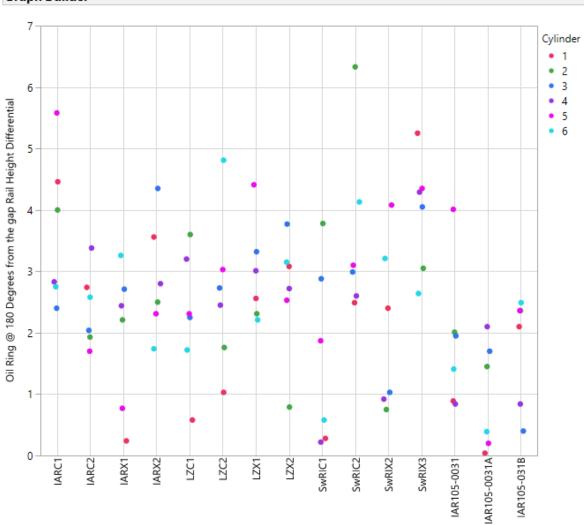


2.175 Cylinder • 1 • 2 3 ٠ 2.150 Oil Ring @ 180 Degrees from the gap Gap Between Rails (mm) • 4 • 5 • 6 2.125 2.100 2.075 2.050 2.025 IARC1 IARC2 LZC2 ZX2 SwRIC1 SwRIC2 SwRIX3 IARX1 IARX2 LZC1 LZX1 SwRIX2 IAR105-0031A IAR105-031B IAR105-0031

Graph Builder







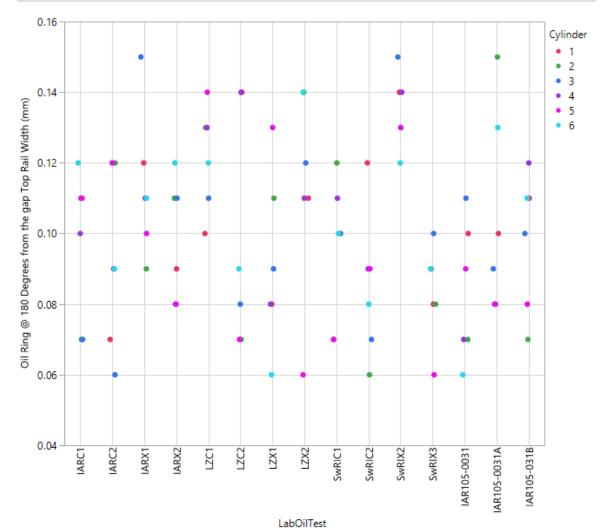




Graph Builder 2.36 Cylinder Oil Ring @ 180 Degrees from the gap Ring Width (outside to outside of rails) (mm) • 1 • 2 • 3 2.34 • 4 • 5 • 6 2.32 ¢ 2.30 2.28 2.26 2.24 IARC2 IARX1 IARX2 LZC1 LZC2 ZX2 SwRIX2 SwRIX3 **ARC1** LZX1 SwRIC1 SwRIC2 IAR105-0031A IAR105-031B IAR105-0031

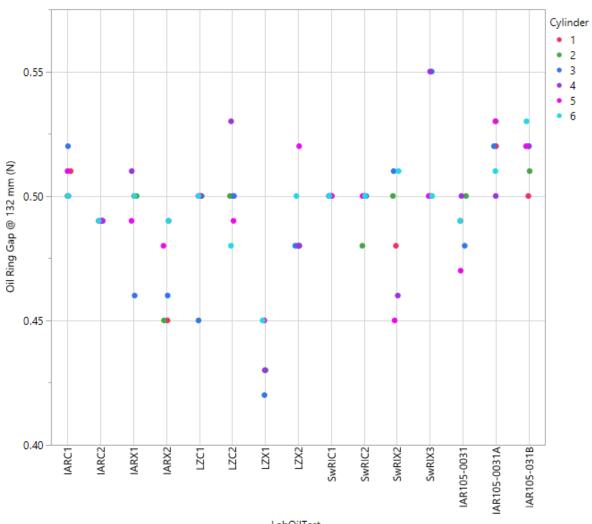
















50 Cylinder • 1 • 2 49 • 3 • 4 • 5 Oil Ring Ring Tension with Expander @ 132 mm (N) • 6 48 47 46 . 45 ٠ 44 43 42 IARC1 IARC2 IARX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LZC2 ZX1 ZX2 SwRIC1 IAR105-0031 IAR105-0031A IAR105-031B

Graph Builder





Graph Builder 2.795 Cylinder • 1 • 2 • 3 2.790 • 4 • 5 • 6 2.785 P-tube Hole Diameter 2.780 2.775 2.770 2.765 IARC1 IARC2 IARX2 LZC2 ZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LZX1 SwRIC1 IAR105-031B IAR105-0031 IAR105-0031A

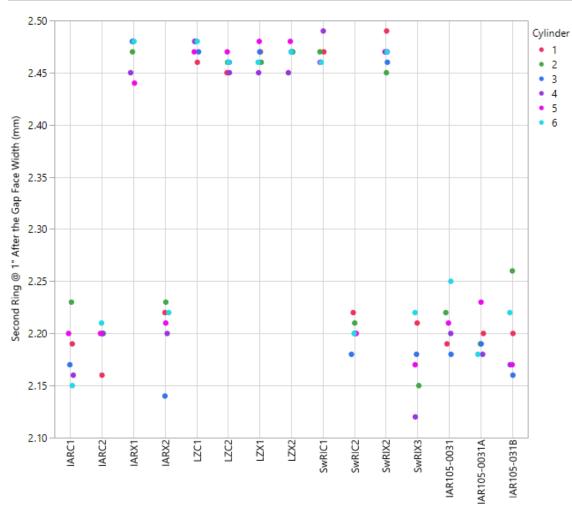




2.7 Cylinder • 1 2 ٠ 2.6 3 ٠ • 4 5 ٠ Second Ring @ 1" After the Gap Base Angle (degrees) • 6 2.5 2.4 2.3 2.2 2.1 2.0 1.9 ARC2 **ARC1** IARX1 IARX2 LZC2 LX1 ZX2 SwRIC1 SwRIC2 SwRIX2 SwRIX3 IAR105-031B LZC1 IAR105-0031 IAR105-0031A











Cylinder • 1 • 2

> • 3 • 4

> • 5 • 6

0.60 0.55 Second Ring @ 1⁼ After the Gap Witness Line Width (mm) 0.50 0.45 0.40 0.35 0.30 0.25

LZC2

LZX1

LZC1

Graph Builder

0.20

IARC1

IARC2

IARX1

IARX2

LabOilTest

ZX2

SwRIC1

SwRIC2

SwRIX2

SwRIX3

IAR105-0031A

IAR105-0031

IAR105-031B

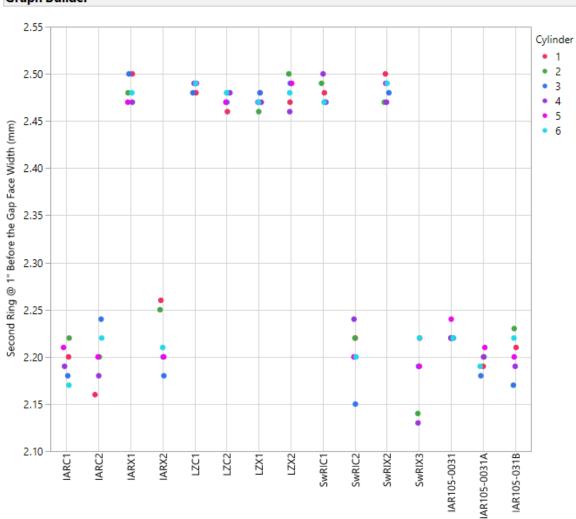




2.8 Cylinder • 1 • 2 . • 3 • 4 2.6 • 5 Second Ring @ 1" Before the Gap Base Angle (degrees) • 6 2.4 2.2 2.0 1.8 IARC1 IARC2 IARX2 ZX2 SwRIC2 SwRIX2 IARX1 LZC2 LX1 SwRIC1 SwRIX3 IAR105-031B LZC1 IAR105-0031 IAR105-0031A







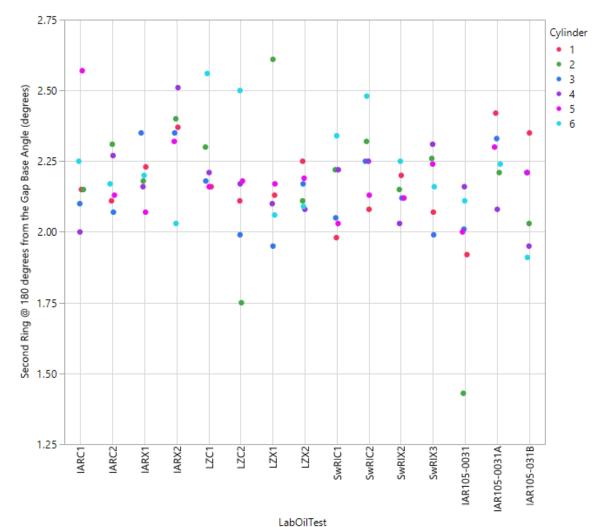
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0.60 Cylinder • 1 • 2 . 0.55 • 3 • 4 Second Ring @ 1" Before the Gap Witness Line Width (mm) • 5 • 6 0.50 • • -0.45 0.40 0.35 0.30 0.25 0.20 IARC1 IARC2 IARX2 ZX2 IARX1 LZC1 LZC2 LX1 SwRIC2 SwRIX2 SwRIX3 IAR105-031B SwRIC1 IAR105-0031 IAR105-0031A

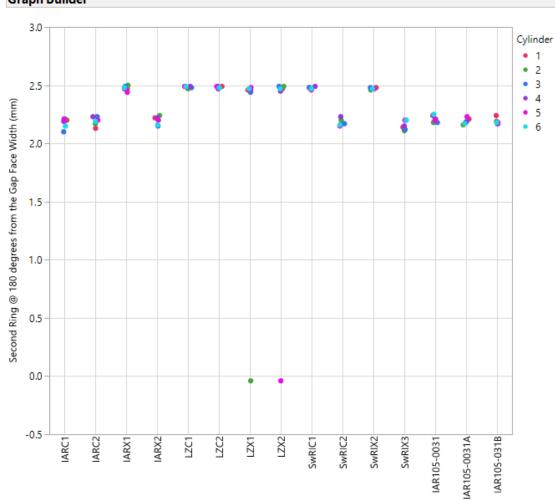
















0.6 Cylinder • 1 • 2 • 3 Second Ring @ 180 degrees from the Gap Witness Line Width (mm) • 4 -0.5 • 5 ٠ • 6 0.4 0.3 0.2 0.1 ARC2 IARX2 **ARC1** IARX1 LZC1 LZC2 LZX1 ZX2 SwRIC1 SwRIC2 SwRIX2 SwRIX3 IAR105-0031A IAR105-031B IAR105-0031

Graph Builder

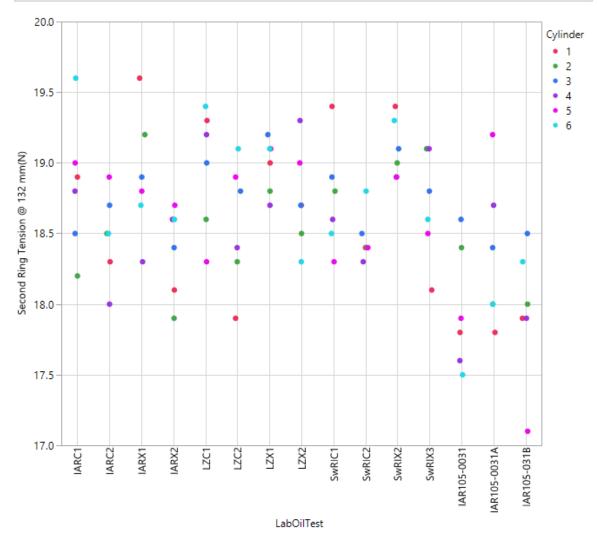




2.0 Cylinder • 1 • 2 • 3 • 4 • 5 • 6 1.5 Second Ring Gap @ 132 mm 1.0 8 õ 0.5 ARC2 IARX2 LZX2 SwRIX2 SwRIX3 ARC1 IARX1 LZC1 LZC2 LZX1 SwRIC1 SwRIC2 IAR105-0031A IAR105-031B IAR105-0031

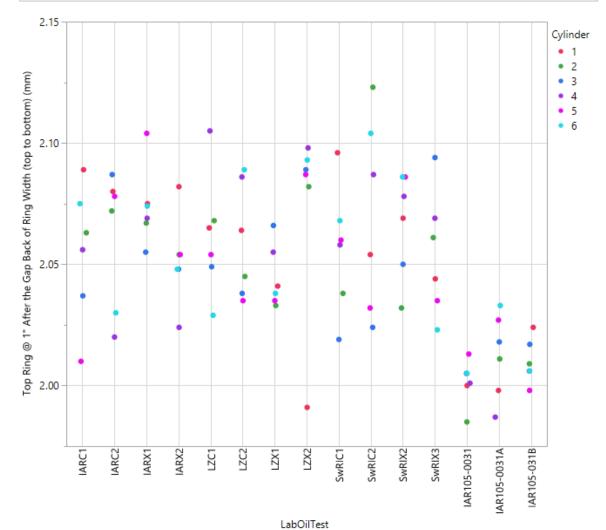
















1.0 Cylinder • 1 • 2 0.9 • 3 Top Ring @ 1" After the Gap Face Peak Height location (mm) • 4 • 5 • 6 0.8 0.7 . 0.6 0.5 0.4 0.3 0.2 **IARC1** IARC2 IARX2 LZC2 ZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LZX1 SwRIC1 IAR105-0031A IAR105-031B IAR105-0031





7 Cylinder • 1 • 2 6 • 3 • Top Ring @ 1" After the Gap Face Peak Height to 0.2 mm Diff • 4 • 5 • 6 5 4 3 . 2 2 . 0 -1 IARC1 ARC2 IARX2 LZC2 LZX1 LZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 SwRIC1 IAR105-031B IAR105-0031A IAR105-0031

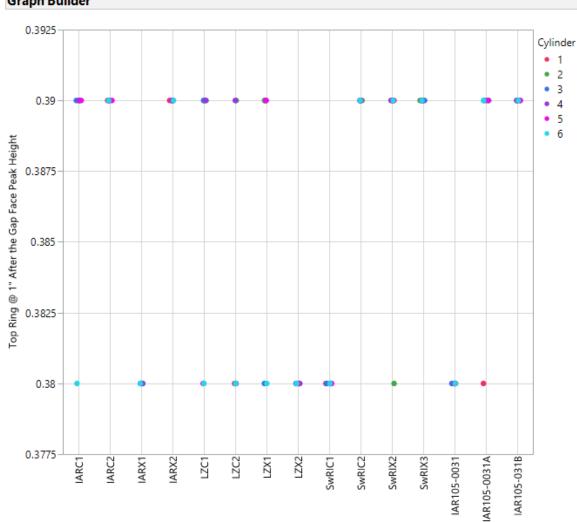




45 Cylinder • 1 • 2 • 3 Top Ring @ 1" After the Gap Face Peak Height to 2.75 mm Diff • 4 40 • 5 • 6 35è . 30-25 • 20 IARC2 LZC2 ZX2 SwRIX3 **ARC1** IARX1 IARX2 LZC1 LZX1 SwRIC1 SwRIC2 SwRIX2 IAR105-0031A IAR105-031B IAR105-0031

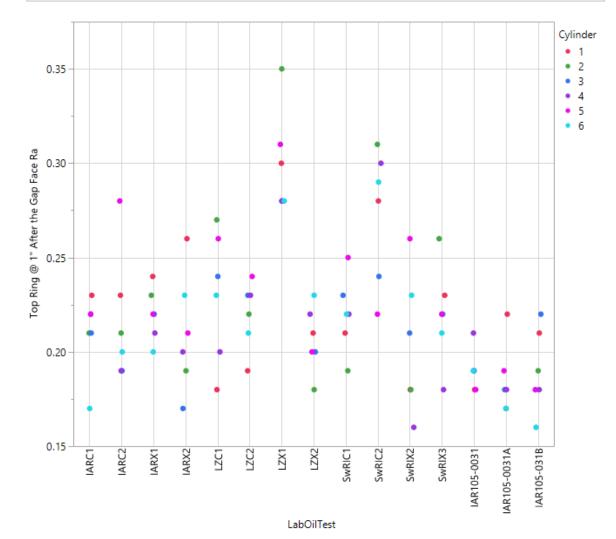
















Graph Builder 1.2 Cylinder • 1 • 2 • 3 • 4 1.0 • 5 • 6 Top Ring @ 1" After the Gap Face Rk 0.8 0.6 0.4 0.2 ARC1 ARC2 IARX2 LZC2 LZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LX1 SwRIC1 IAR105-0031 IAR105-0031A IAR105-031B

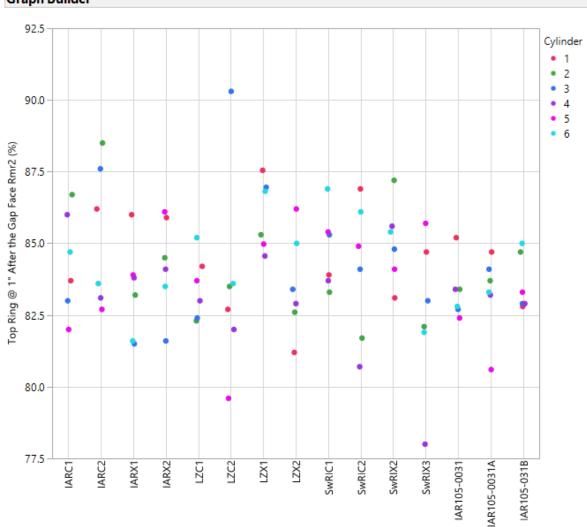
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17.5 Cylinder • 1 • 2 • 3 15.0 • 4 • 5 • 6 Top Ring @ 1" After the Gap Face Rmr1 (%) 12.5 • 10.0 7.5 b 5.0 2.5 IARC1 IARC2 IARX2 LZC2 LZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LZX1 SwRIC1 IAR105-0031 IAR105-0031A IAR105-031B

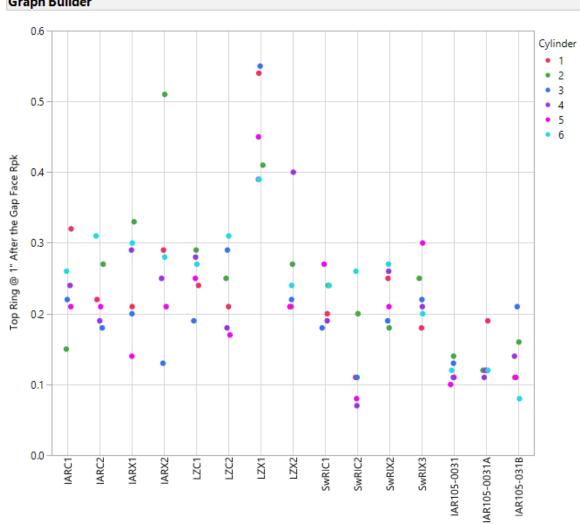


















2.00 Cylinder • 1 • 2 • 3 • 4 1.75 • 5 • 6 Top Ring @ 1" After the Gap Face Rvk 1.50 • 1.25 ? 1.00 0.75 SwRIX3 IARC1 IARC2 IARX2 LZC2 ZX2 IARX1 LZC1 LZX1 SwRIC1 SwRIC2 SwRIX2 IAR105-031B IAR105-0031 IAR105-0031A

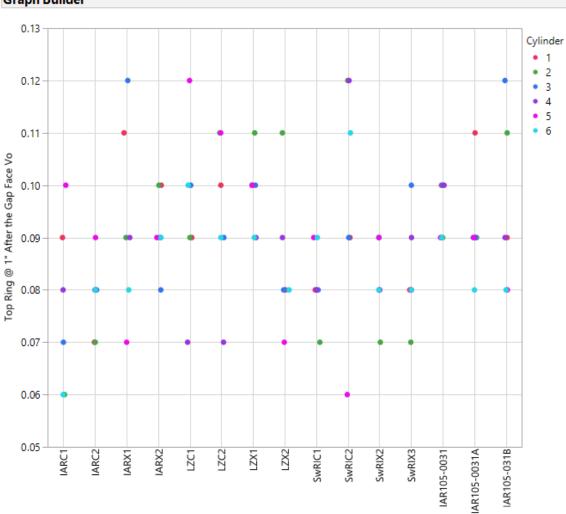




3.0 Cylinder • 1 • 2 • 3 • 4 2.5 • 5 • 6 Top Ring @ 1" After the Gap Face Rz ٠ 2.0 1.5 e 1.0 0.5 ARC2 IARX2 LZC2 LZX2 SwRIX2 SwRIX3 **ARC1** IARX1 LZC1 LZX1 SwRIC1 SwRIC2 IAR105-0031A IAR105-031B IAR105-0031











3.5 Cylinder • 1 • 2 • 3 3.4 • 4 • 5 • • 6 Top Ring @ 1" After the Gap Face Width (mm) 68 Ċ1 2 3.3 3.2 c • 4 ¢ ž 3.1 3.0 2.9 ARC2 IARX2 LZC2 LZX2 SwRIC2 SwRIX2 SwRIX3 **ARC1** IARX1 LZC1 LZX1 SwRIC1 IAR105-0031A IAR105-031B IAR105-0031

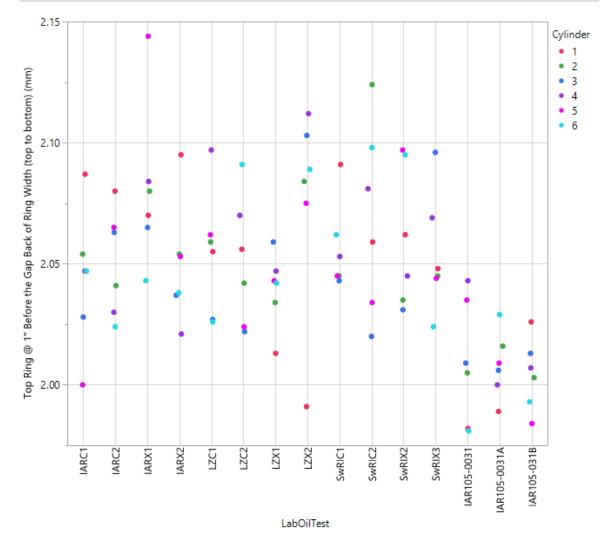




4.725 Cylinder • 1 • 2 • 3 4.700 Top Ring @ 1" After the Gap Ring tickness (front to rear) (mm) • 4 • 5 • 6 4.675 4.650 4.625 4.600 4.575 ARC1 ARC2 IARX1 IARX2 LZC1 LZC2 LZX1 ZX2 SwRIC1 SwRIC2 SwRIX2 SwRIX3 IAR105-0031A IAR105-031B IAR105-0031











1.0 Cylinder • 1 • 2 0.9 • 3 Top Ring @ 1⁼ Before the Gap Face Peak Height location (mm) • 4 • 5 • 6 0.8 0.7 0.6 0.5 0.4 0.3 0.2 ARC2 IARX2 ZX2 SwRIX2 **ARC1** IARX1 LZC1 LZC2 LZX1 SwRIC1 SwRIC2 SwRIX3 IAR105-0031A IAR105-031B IAR105-0031

Graph Builder





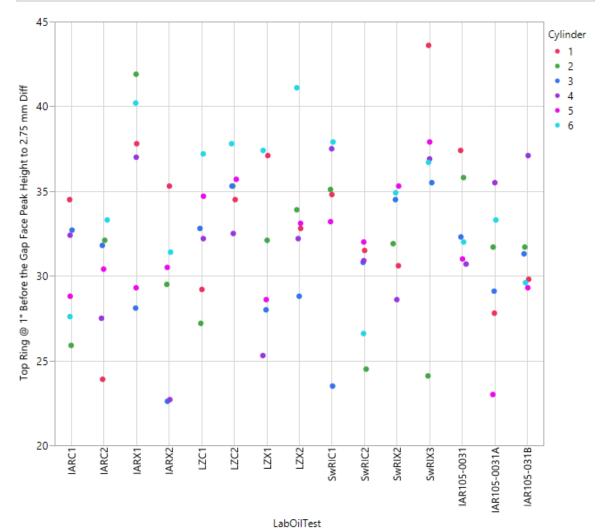
8 Cylinder • 1 • 2 7 • 3 Top Ring @ 1" Before the Gap Face Peak Height to 0.2 mm Diff • 4 • 5 • 6 6 5 4 Ċ0 . 3 ٠ 2 ٩ 1 é 0 ARC2 IARX2 LZC2 ZX2 SwRIC1 SwRIC2 SwRIX2 SwRIX3 **ARC1** IARX1 LZC1 LX1 IAR105-031B IAR105-0031A IAR105-0031

LabOilTest



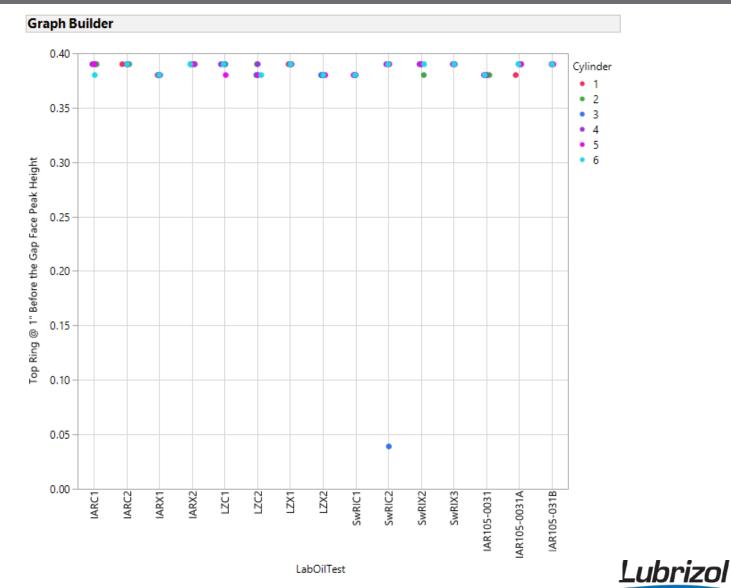
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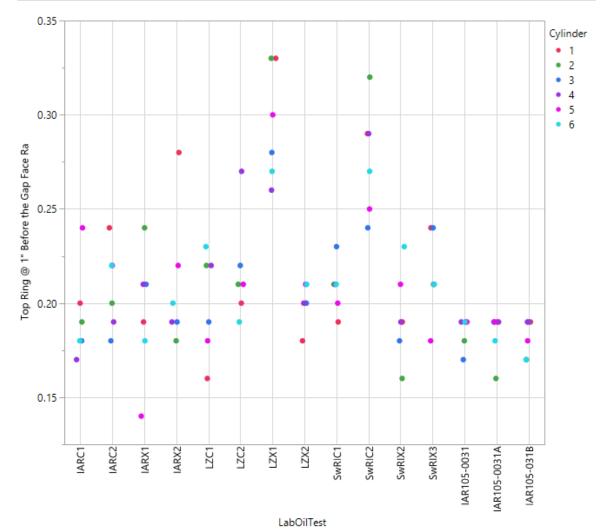
















1.1 Cylinder • 1 • 2 1.0 • 3 • 4 • 5 • 6 0.9 Top Ring @ 1" Before the Gap Face Rk 0.8 0.7 0.6 -0.5 0.4 0.3 IARC1 ARC2 IARX2 LZC2 LZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LZX1 SwRIC1 IAR105-0031 IAR105-0031A IAR105-031B



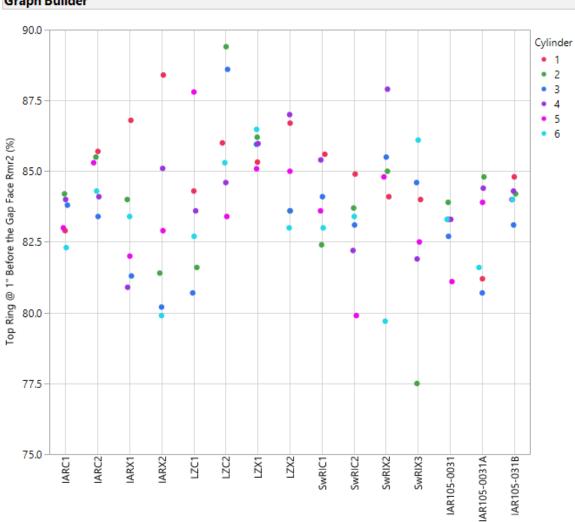


17.5 Cylinder • 1 • 2 • 3 • 4 15.0 • 5 • 6 Top Ring @ 1" Before the Gap Face Rmr1 (%) 12.5 10.0 7.5 5.0 ARC2 IARX1-IARX2 LZC2 LZX2 SwRIX2 SwRIX3 **ARC1** LZC1 LZX1 SwRIC1 SwRIC2 IAR105-0031A IAR105-031B IAR105-0031

Graph Builder

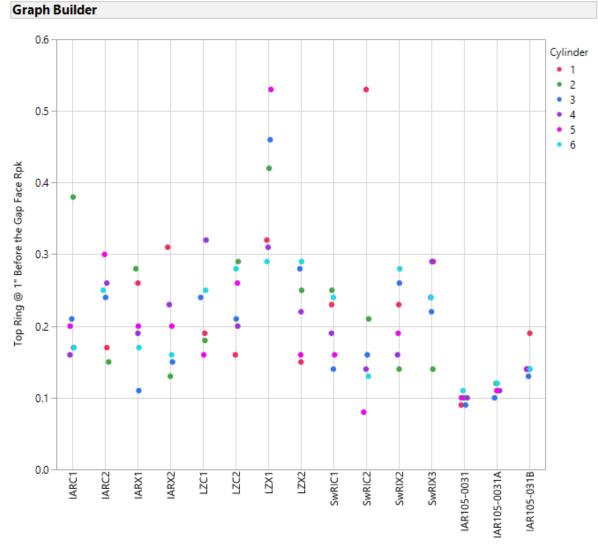












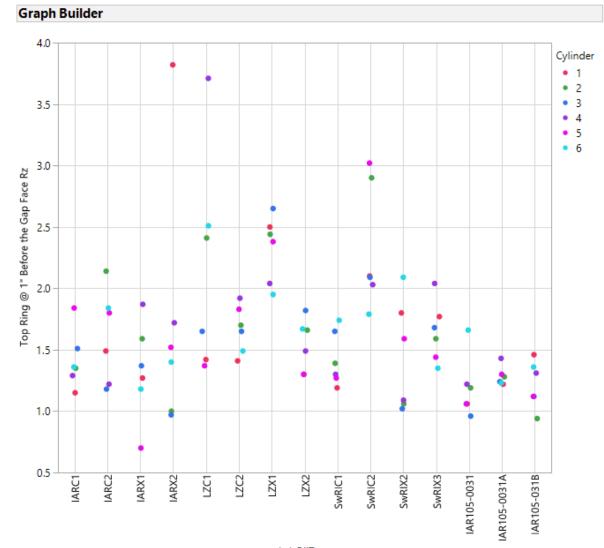




Graph Builder 2.00 Cylinder • 1 • 2 • 3 • 4 1.75 • 5 • 6 Top Ring @ 1" Before the Gap Face Rvk 1.50 ٠ 1.25 1.00 0.75 IARX1 SwRIX3 IARC1 ARC2 IARX2 LZC2 ZX2 SwRIC2 LZC1 LX1 SwRIC1 SwRIX2 IAR105-0031A IAR105-031B IAR105-0031

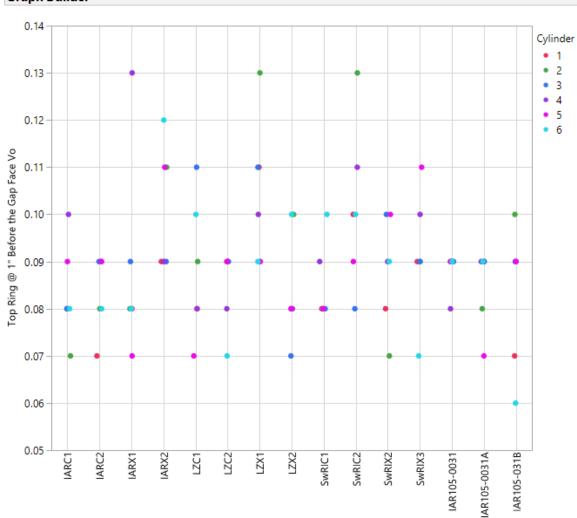






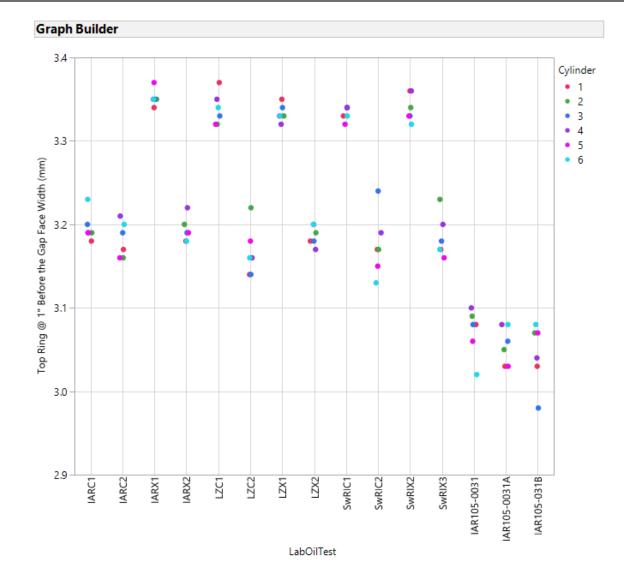










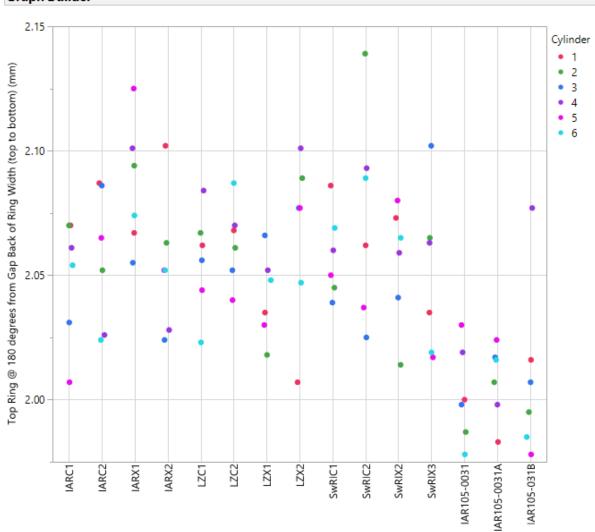




4.69 Cylinder • 1 • 2 4.68 3 ٠ Top Ring @ 1" Before the Gap Ring tickness (front to rear) (mm) • 4 • 5 • 6 4.67 4.66 4.65 4 4.64 4.63 4.62 4.61 **ARC1** ARC2 IARX2 LZC2 LZX1 LZX2 SwRIC1 SwRIC2 SwRIX2 SwRIX3-IARX1 LZC1 IAR105-031B IAR105-0031A IAR105-0031









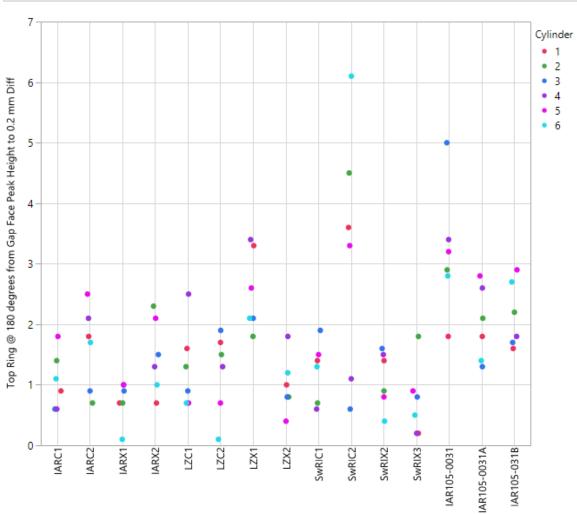


0.9 Cylinder • 1 • 2 • 3 0.8 Top Ring @ 180 degrees from Gap Face Peak Height location (mm) • 4 • 5 • 6 0.7 ۰ Te 0.6 0.5 . 0.4 ò 0.3 0.2 ARC2 IARX2 SwRIX2 **ARC1** IARX1 LZC1 LZC2 LZX1 ZX2 SwRIC1 SwRIC2 SwRIX3 IAR105-0031A IAR105-031B IAR105-0031

Graph Builder



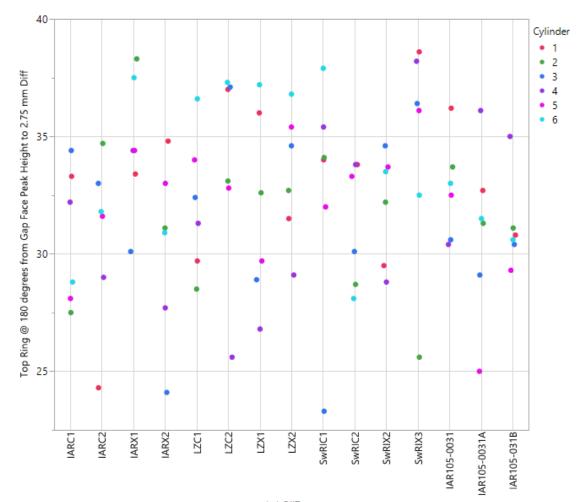
















Lubrizol

0.395 Cylinder • 1 2 ٠ 3 ٠ 0.390 4 ٠ 5 ٠ Top Ring @ 180 degrees from Gap Face Peak Height • 6 0.385 0.380 0.375 0.370 0.365 IARC1 IARC2 IARX2 LZC2 ZX2 SwRIX2 SwRIX3 IARX1 LZC1 LZX1 SwRIC1 SwRIC2 IAR105-031B IAR105-0031 IAR105-0031A

LabOilTest





0.40 Cylinder • 1 2 ٠ 3 ٠ 0.35 • 4 5 ٠ • 6 Top Ring @ 180 degrees from Gap Face Ra 0.30 0.25 Ċ 0.20 ٠ 0.15 0.10 IARC1 IARC2 IARX2 LZC1 LZC2 ZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LX1 SwRIC1 IAR105-031B IAR105-0031 IAR105-0031A





1.2 Cylinder • 1 • 2 • 3 • 4 1.0 • 5 • 6 Top Ring @ 180 degrees from Gap Face Rk ٠ 0.8 0.6 0.4 ٠ 0.2 ARC2 IARX2 LZC2 LZX2 SwRIX2 SwRIX3 **ARC1** IARX1 LZC1 LZX1 SwRIC1 SwRIC2 IAR105-0031A IAR105-031B IAR105-0031





14 Cylinder • 1 • 2 13 • 3 • 4 • 5 12 Top Ring @ 180 degrees from Gap Face Rmr1 (%) • 6 ó 11 10 ė ٠ Ċ 9 ٩ -8 7 e 6 5 IARC1 IARC2 IARX2 LZC2 LZX1 LZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 SwRIC1 IAR105-031B IAR105-0031A IAR105-0031

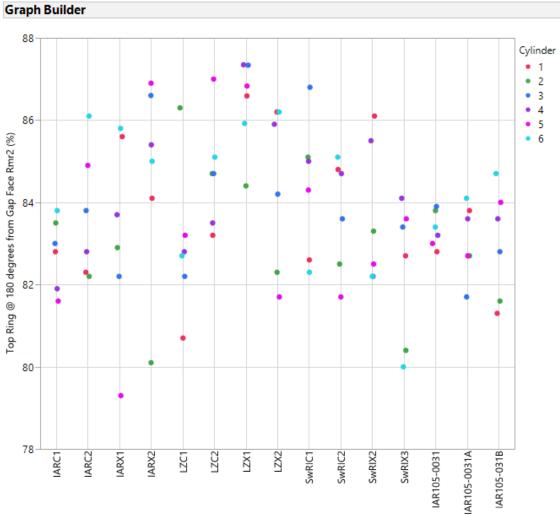
Graph Builder

LabOilTest



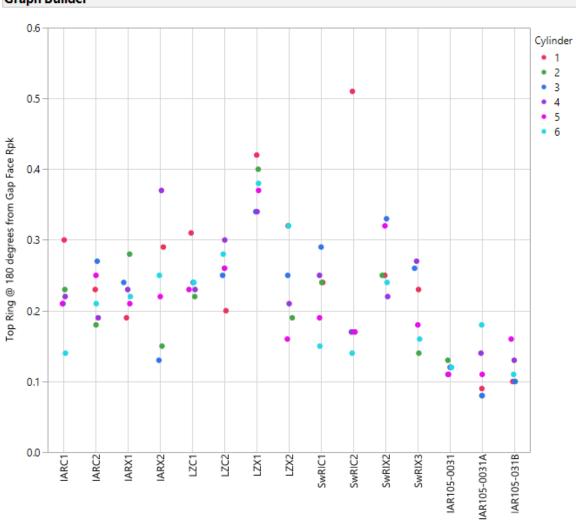
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Graph Builder 1.8 Cylinder • 1 • 2 • 3 1.6 • 4 • 5 • 6 Top Ring @ 180 degrees from Gap Face Rvk 1.4 é 1.2 1.0 0.8 0.6 SwRIX2 **ARC1** ARC2 IARX1 IARX2 LZC1 LZC2 LX1 ZX2 SwRIC1 SwRIC2 SwRIX3 IAR105-031B IAR105-0031 IAR105-0031A





Graph Builder 4.0 Cylinder • 1 2 ٠ 3 3.5 ٠ • 4 5 ٠ • 6 Top Ring @ 180 degrees from Gap Face Rz 3.0 2.5 ¢ 2.0 1.5 1.0 0.5 ARC2 IARC1 IARX1 IARX2 ZX2 LZC1 LZC2 LX1 SwRIC1 SwRIC2 SwRIX2 SwRIX3 IAR105-031B IAR105-0031 IAR105-0031A



0.14 Cylinder • 1 • 2 0.13 • 3 • 4 • 5 0.12 • 6 Top Ring @ 180 degrees from Gap Face Vo 0.11 0.10 0.09 0.08 0.07 0.06 0.05 IARC1 IARC2 IARX2 LZC2 ZX2 SwRIC2 SwRIX3 IARX1 LZC1 LZX1 SwRIC1 SwRIX2 IAR105-031B IAR105-0031 IAR105-0031A

Graph Builder





3.5 Cylinder • 1 • 2 • 3 • 4 3.4 • 5 Top Ring @ 180 degrees from Gap Face Width (mm) • 6 ٠ ē ٠ ÷ 3.3 Ó 3.2 ٠ -3.1 3.0 IARC1 IARC2 IARX2 LXX1 LZX2 SwRIC2 SwRIX2 SwRIX3 IARX1 LZC1 LZC2 SwRIC1 IAR105-0031 IAR105-0031A IAR105-031B

Graph Builder





4.750 Cylinder • 1 • 2 Top Ring @ 180 degrees from Gap Ring tickness (front to rear) (mm) 3 • 4.725 4 ٠ 5 • • 6 4.700 4.675 . 4.650 4.625 4.600 IARC1 IARX2 LZC2 SwRIC2 SwRIX2 SwRIX3 IARC2 IARX1 LZC1 LZX1 ZX2 SwRIC1 IAR105-0031A IAR105-031B IAR105-0031

Graph Builder



0.50 Cylinder • 1 • 2 • 3 • 4 0.45 • 5 • 6 ٠ • . Top Ring Gap @ 132 mm 0.40 0.35 0.30 0.25 IARC1 IARC2 IARX2-LZC2 ZX2 SwRIX3 IARX1 LZC1 LZX1 SwRIC1 SwRIC2 SwRIX2 IAR105-0031 IAR105-0031A IAR105-031B

Graph Builder





31 Cylinder • 1 • 2 • 3 30 • 4 • 5 • 6 Top Ring Tension @ 132 mm(N) 29 28 27 . 26 25 IARC1 IARC2 IARX1 IARX2 LZC2 ZX1 ZX2 SwRIC1 SwRIX2 SwRIX3 LZC1 SwRIC2 IAR105-0031A IAR105-031B IAR105-0031

Graph Builder





Working together, achieving great things

When your company and ours combine energies, great things can happen. You bring ideas, challenges and opportunities. We'll bring powerful additive and market expertise, unmatched testing capabilities, integrated global supply and an independent approach to help you differentiate and succeed.

