# IAR Lab Operational Plots

By: Stats Group

02-28-18

### **Graph Builder** Valve Cover Blowby Gas Out vs. Cycle Time 100-0-63 31.6 30.4 29.2 TestHr -Smooth Hr10-11 100-0-31.6 30.4 29.2 Hr101-102 Hr195-196 100-0-30.8 65 29.4 100-0-31.6 30.4 29.2 101-0-31.6 30.4 29.2 Cover Blowby Gas Out 61 101-0-31.6 30.4 29.2 62 101-0-30.8 29.4 Valve 101-0-31.6 30.4 29.2 102-0-31.6 30.4 29.2 102-0-31.6 30.4 29.2 102-0-30.8 29.4 102-0-66 31.6 30.4 29.2 12 16 18 20 22 24 26 10 Cycle Time

# **Graph Builder** Abs. Throttle Position vs. Cycle Time 100-0-63 30 25 20 15 30 25 20 15 TestHr -Smooth Hr10-11 Hr101-102 Hr195-196 100-0-64 100-0-65 100-0-99 101-0-61 101-0-101-0-25 20 15 30 25 20 15 30 25 20 15 30 25 20 15 63 101-0-102-0-62 102-0-102-0-65 25 20 15 30 25 20 15 102-0-66 18 20 22 24 26 10 12 16 Cycle Time

#### **Graph Builder** Absolute Load vs. Cycle Time 19000 -13000 -7000 -100-0-TestHr 63 -Smooth Hr10-11 19000 13000 7000 100-0-64 Hr101-102 Hr195-196 100-0-19000 -13000 -7000 -100-0-19000 13000 7000 99 101-0-19000 -13000 -7000 -101-0-19000 13000 7000 Absolute Load 62 101-0-19000 13000 7000 63 101-0-19000 13000 7000 19000 -13000 -7000 -102-0-62 19000 -13000 -7000 -102-0-63 102-0-65 19000 -13000 -7000 -19000 -13000 -7000 -102-0-66 Ó 22 10 12 16 18 20 24 26 Cycle Time

# **Graph Builder** Air Fuel Ratio vs. Cycle Time 19.0 16.5 14.0 100-0-TestHr -Smooth Hr10-11 19.0 16.5 14.0 100-0-64

18

16

Cycle Time

10

8

12

14

20

22

26

Hr101-102 Hr195-196

100-0-65

100-0-

101-0-

101-0-

101-0-63

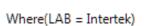
101-0-

102-0-

102-0-63

102-0-

102-0-66



19.0 16.5 14.0

19.0 16.5 14.0

19.0 16.5 14.0

19.0 16.5 14.0

19.0 16.5 14.0

19.0 16.5 14.0

19.0 16.5 14.0

19.0 16.5 14.0

## **Graph Builder** Bank 1 Sensor 1 vs. Cycle Time 100-0-63 TestHr 0.50 -Smooth Hr10-11 100-0-64 Hr101-102 0.50 Hr195-196 100-0-65 0.50 100-0-66 0.50 101-0-61 0.50 101-0-Bank 1 Sensor 1 0.50 0.20 62 101-0-63 0.50 0.20 101-0-64 0.50 0.20 102-0-62 0.50 0.20 102-0-63 0.50 0.20 102-0-65 0.50 102-0-66 0.50 12 24 26 10 14 16 18 20 22

# **Graph Builder** Bank 1 STFT vs. Cycle Time 100-0-63 TestHr 1.0 -0.4 --Smooth Hr10-11 100-0-64 Hr101-102 1.0 0.4 Hr195-196 100-0-1.0 0.4 100-0-1.0 -0.4 -101-0-61 1.0 0.4 101-0-Bank 1 STFT 1.0 0.4 101-0-63 1.0 0.4 101-0-1.0 -0.4 -102-0-62 1.0 -0.4 -102-0-63 1.0 0.4 102-0-65 1.0 0.4 102-0-66 0.4

22

20

18

Cycle Time

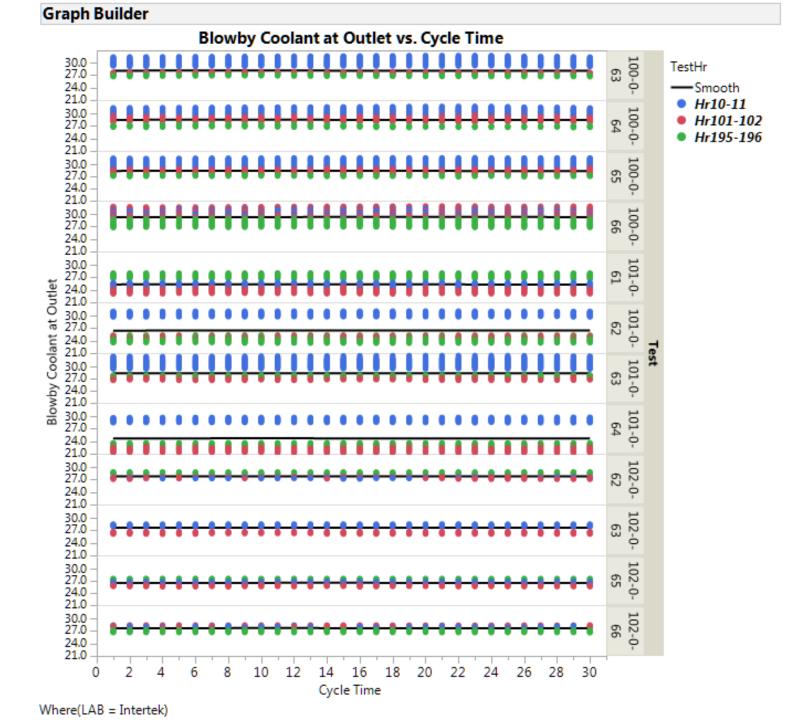
24

26

10

12

#### **Graph Builder Barometric Pressure vs. Cycle Time** 100-0-TestHr 99.0 —Smooth 98.0 Hr10-11 100-0-Hr101-102 99.0 98.5 Hr195-196 98.0 100-0-99.0 98.5 98.0 100-0-99.0 98.5 99 98.0 101-0-99.0 98.5 61 Barometric Pressure 98.0 101-0-99.0 98.5 98.0 101-0-99.0 63 98.5 98.0 101-0-99.0 64 98.5 98.0 102-0-99.0 98.5 98.0 102-0-99.0 98.5 102-0-65 99.0 98.5 98.0 102-0-66 99.0 98.5 98.0 18 12 16 20



# **Graph Builder** Blowby Flow Rate vs. Cycle Time 100-0-63 28 18 8 TestHr -Smooth Hr10-11 100-0-64 28 18 8 Hr101-102 Hr195-196 100-0-28 18 8 100-0-28 18 8 101-0-28 18 8 61 Blowby Flow Rate 101-0-28 18 8 101-0-28 18 8 63 28 18 8 101-0-102-0-62 28 18 8 102-0-63 28 18 8 102-0-65 28 18 8 102-0-66 28 18 8

18

14 16 Cycle Time

12

20

22

# **Graph Builder** Blowby Gas in Oil Separator (IAR Optional) vs. Cycle Time 100-0-63 31.0 29.8 TestHr 28.6 Smooth Hr10-11 100-0-31.0 29.8 Hr101-102 28.6 Hr195-196 100-0-31.0 29.8 28.6 100-0-31.0 29.8 99 Blowby Gas in Oil Separator (IAR Optional) 28.6 101-0-31.0 29.8 61 28.6 101-0-31.0 29.8 28.6 101-0-31.0 29.8 28.6 63 101-0-31.0 29.8 28.6 102-0-31.0 29.8 102-0-31.0 29.8 28.6 102-0-31.0 29.8 28.6 65 102-0-66 31.0 29.8 28.6 20

#### **Graph Builder** Blowby Gas in Oil Separator (Optional) vs. Cycle Time 100-0-63 TestHr 600 300 -Smooth Hr10-11 100-0-64 Hr101-102 600 300 Hr195-196 100-0-600 300 100-0-600 300 Blowby Gas in Oil Separator (Optional) 101-0-61 600 300 101-0-600 300 101-0-600 63 300 101-0-600 300 102-0-62 600 300 102-0-600 300 102-0-65 600 300 102-0-66 600 300 22 10 12 16 18 20 24 14 Cycle Time

#### **Graph Builder** Blowby Temperature (Controlled) vs. Cycle Time 100-0-63 29.30 29.00 TestHr 28.70 —Smooth Hr10-11 29.30 -29.00 -28.70 -100-0-64 Hr101-102 Hr195-196 100-0-29.30 29.00 28.70 65 100-0-29.30 29.00 28.70 101-0-61 Temperature (Controlled) 29.30 -29.00 -28.70 -101-0-29.30 29.00 62 28.70 101-0-29.30 29.00 28.70 Blowby 101-0-29.30 29.00 28.70 102-0-62 29.30 29.00 28.70 102-0-29.30 29.00 28.70 102-0-65 29.30 -29.00 -28.70 -102-0-66 29.30 29.00 28.70 -12 14 16 18 20 22 24 0 8 10 26 Cycle Time

#### **Graph Builder** Brake Mean Effective Pressure vs. Cycle Time 100-0-63 TestHr 2.20 2.00 -Smooth Hr10-11 100-0-2.20 Hr101-102 Hr195-196 100-0-2.20 100-0-2,20 101-0-2.20 Brake Mean Effective Pressure 2.00 101-0-2,20 2,00 101-0-2.20 2.00 101-0-2.20 2.00 102-0-2.20 2.00 102-0-2.20 2.00 102-0-2.20 102-0-66 2.20 26 10 12 16 18 20 22 8

# **Graph Builder** Coolant Delta vs. Cycle Time 100-0-63 TestHr -Smooth Hr10-11 100-0-64 Hr101-102 Hr195-196 100-0-65 100-0-101-0-101-0-Coolant Delta 101-0-101-0-102-0-102-0-102-0-102-0-66

26

10

6

8

12

16

Cycle Time

18

20

22

24

# **Graph Builder** Coolant Inlet Pressure vs. Cycle Time 82 72 62 100-0-63 TestHr -Smooth Hr10-11 82 72 62 100-0-Hr101-102 Hr195-196 100-0-65 72 62 82 72 62 100-0-101-0-82 72 62 Coolant Inlet Pressure 101-0-101-0-101-0-82 72 62 102-0-82 72 62 102-0-82 72 62 102-0-72 62 102-0-66 82 72 62 18 22 10 12 16 20 26 Cycle Time Where(LAB = Intertek)

# **Graph Builder** Coolant Temperature Into Engine vs. Cycle Time 100-0-63 TestHr 53.5 50.5 47.5 -Smooth Hr10-11 100-0-64 Hr101-102 53.5 50.5 47.5 Hr195-196 100-0-65 53.5 50.5 47.5 100-0-53.5 99 50.5 47.5 101-0-61 101-0-62 101-0-63 101-0-53.5 50.5 47.5 102-0-62 53.5 50.5 47.5 102-0-63 53.5 50.5 47.5 102-0-65 53.5 50.5 47.5 102-0-66 53.5 50.5 47.5

18

16

Cycle Time

10

8

12

14

20

22

24

26

# **Graph Builder** Coolant Temperature Out of Engine vs. Cycle Time 100-0-63 52.8 52.1 51.4 50.7 52.8 52.1 51.4 50.7 TestHr -Smooth Hr10-11 100-0-Hr101-102 Hr195-196 100-0-101-0-101-0-101-0-101-0-102-0-102-0-102-0-52.1 51.4 50.7 52.8 52.1 51.4 50.7 26 10 12 16 18 20 22 24 28 8

# **Graph Builder** Crankcase Gas Pressure vs. Cycle Time 100-0-63 TestHr 2.5 0.0 —Smooth Hr10-11 100-0-64 Hr101-102 2.5 0.0 Hr195-196 100-0-2.5 0.0 100-0-2.5 0.0 101-0-61 2.5 0.0 Crankcase Gas Pressure 101-0-2.5 0.0 62 101-0-2.5 63 0.0 101-0-2.5 0.0 102-0-62 2.5 0.0 102-0-63 2.5 0.0 102-0-65 2.5 0.0 102-0-66 2.5 0.0

10

12

16

Cycle Time

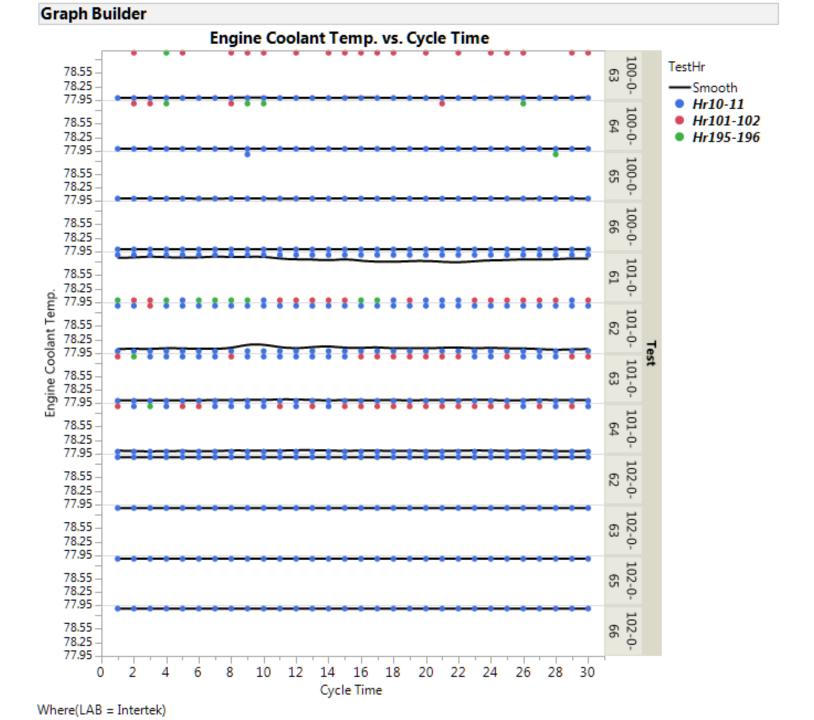
18

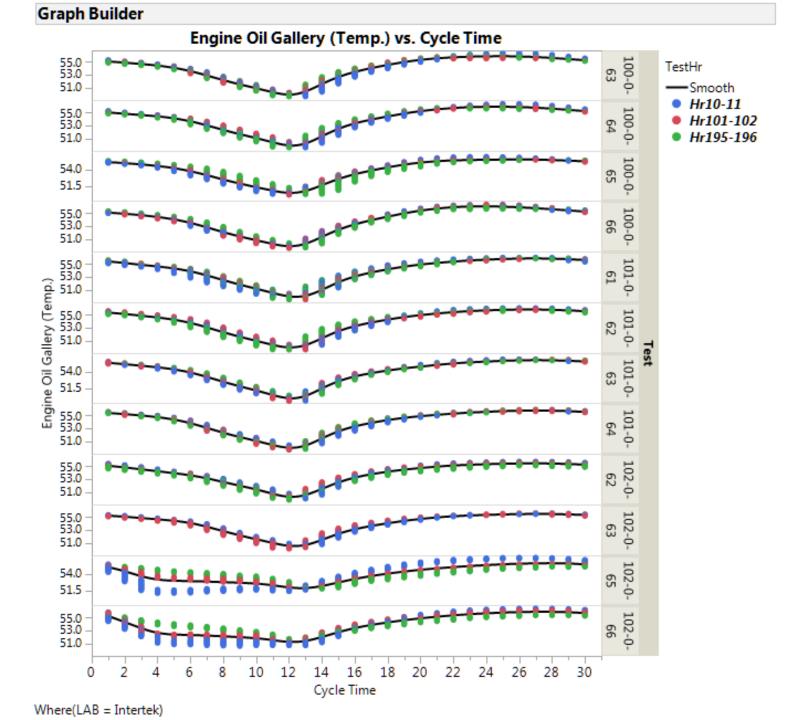
20

22

26

#### **Graph Builder** Engine Coolant Flow Rate vs. Cycle Time 100-0-63 TestHr 80.1 79.5 —Smooth 78.9 Hr10-11 100-0-Hr101-102 80.1 79.5 Hr195-196 78.9 100-0-80.1 79.5 65 78.9 100-0-80.1 79.5 78.9 101-0-80.1 79.5 78.9 80.1 79.5 80.1 78.9 80.1 80.1 80.1 61 101-0-101-0-63 101-0-80.1 79.5 78.9 102-0-62 80.1 79.5 78.9 102-0-80.1 79.5 78.9 102-0-80.1 79.5 78.9 102-0-66 80.1 79.5 78.9 12 16 18 20 22 26 10





# **Graph Builder** Engine Oil Sump (Temp.) vs. Cycle Time 100-0-61.8 60.4 59.0 57.6 TestHr 63 —Smooth Hr10-11 61.8 60.4 59.0 57.6 100-0-Hr101-102 Hr195-196 100-0-60.8 59.2 57.6 61.8 60.4 59.0 57.6 100-0-101-0-61.8 60.4 59.0 57.6 61 Engine Oil Sump (Temp.) 101-0-61.8 60.4 59.0 57.6 101-0-60.8 59.2 57.6 61.8 60.4 59.0 57.6 101-0-61.8 60.4 59.0 57.6 102-0-61.8 60.4 59.0 57.6 102-0-102-0-60.8 59.2 57.6 102-0-61.8 60.4 59.0 57.6 10 12 20 22 26

# **Graph Builder Engine Power vs. Cycle Time** 10.0 -7.0 -4.0 -100-0-63 TestHr -Smooth Hr10-11 10.0 -7.0 -4.0 -100-0-Hr101-102 Hr195-196 100-0-10.0 7.0 4.0 100-0-10.0 -7.0 -4.0 -101-0-10.0 7.0 4.0 101-0-10.0 4.0 10.0 4.0 4.0 4.0 10.0 7.0 4.0 101-0-10.0 -7.0 -4.0 -101-0-10.0 -7.0 -4.0 -102-0-102-0-10.0 -7.0 -4.0 -102-0-10.0 -7.0 -4.0 -102-0-66 10.0 7.0 4.0 10 12 16 18 22 24 26 28 30 14 20 Cycle Time

### **Graph Builder** Engine Speed (Dyno) vs. Cycle Time 3400 2400 1400 100-0-63 TestHr -Smooth Hr10-11 100-0-3400 2400 1400 Hr101-102 Hr195-196 100-0-2800 1600 3400 2400 1400 100-0-3400 2400 1400 101-0-Engine Speed (Dyno) 101-0-3400 2400 1400 101-0-2800 1600 3400 2400 1400 101-0-3400 2400 1400 102-0-3400 -2400 -1400 -102-0-102-0-2800 1600 102-0-66 3400 2400 1400 12 16 18 24 26 28 30 10 14 20 22 Cycle Time

### **Graph Builder** Engine Speed (Flywheel) vs. Cycle Time 3400 2400 1400 100-0-63 TestHr -Smooth Hr10-11 100-0-3400 2400 1400 Hr101-102 Hr195-196 100-0-2800 1600 3400 2400 1400 100-0-3400 2400 1400 101-0-Engine Speed (Flywheel) 101-0-3400 2400 1400 101-0-2800 1600 3400 2400 1400 101-0-3400 2400 1400 102-0-3400 -2400 -1400 -102-0-102-0-2800 1600 102-0-66 3400 2400 1400 12 16 18 24 26 28 30 10 14 20 22 Cycle Time

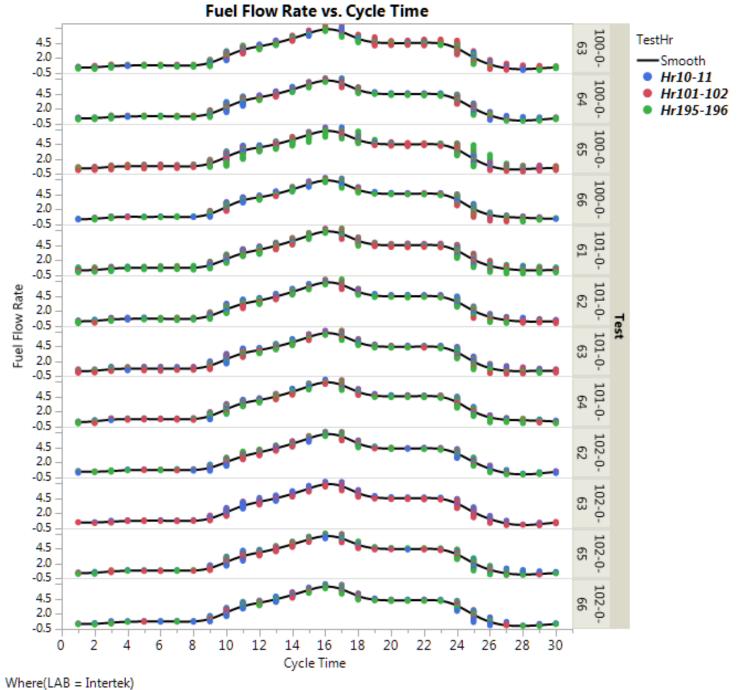
## **Graph Builder Engine Speed vs. Cycle Time** 3400 2400 1400 100-0-63 TestHr -Smooth Hr10-11 100-0-3400 2400 1400 Hr101-102 Hr195-196 100-0-2800 1600 3400 -2400 -1400 -100-0-3400 2400 1400 101-0-101-0-9 3400 2400 2800 2800 1600 3400 2400 1400 101-0-3400 2400 1400 101-0-3400 102-0-2400 1400 102-0-3400 -2400 -1400 -102-0-2800 1600 102-0-66 3400 2400 1400 12 16 18 24 26 28 30 10 14 20 22 Cycle Time

#### **Graph Builder Engine Torque vs. Cycle Time** 100-0-63 TestHr 26.5 24.0 -Smooth Hr10-11 100-0-26.5 Hr101-102 24.0 Hr195-196 100-0-26.5 24.0 100-0-26.5 24.0 101-0-26.5 24.0 26.5 24.0 26.5 24.0 101-0-101-0-101-0-26.5 24.0 102-0-26.5 24.0 102-0-26.5 24.0 102-0-26.5 24.0 102-0-66 26.5 24.0 22 26 10 12 16 18 20 24 8

# **Graph Builder Exhaust Gas Temperature vs. Cycle Time** 100-0-63 530 480 TestHr 430 -Smooth Hr10-11 100-0-530 480 430 Hr101-102 Hr195-196 100-0-65 480 430 100-0-66 530 -480 -430 -101-0-530 480 430 Exhaust Gas Temperature 101-0-530 480 430 101-0-63 480 430 101-0-530 480 430 530 480 430 102-0-530 480 430 102-0-102-0-480 430 530 480 430 102-0-66 26 10 12 18 20 22 24 Cycle Time

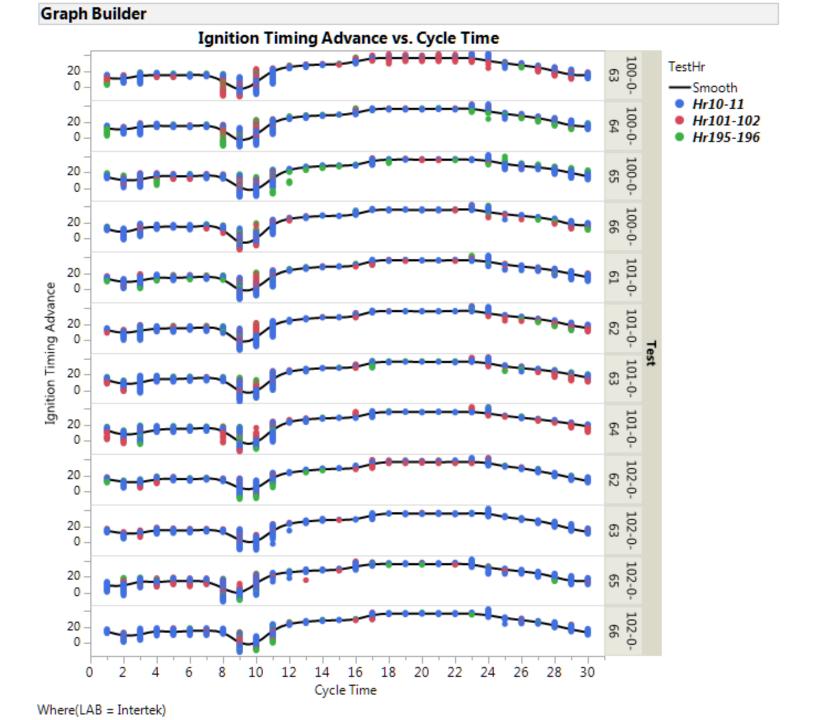
# **Graph Builder Exhaust Pressure vs. Cycle Time** 100-0-63 TestHr 100 94 —Smooth Hr10-11 100-0-64 Hr101-102 100 94 Hr195-196 100 94 100-0-66 100 94 101-0-61 100 94 Exhaust Pressure 101-0-94 101-0-94 101-0-100 94 102-0-62 100 94 102-0-63 100 94 102-0-65 100 94 102-0-66 100 94 22 10 12 16 18 20 24 26 Cycle Time

# Graph Builder



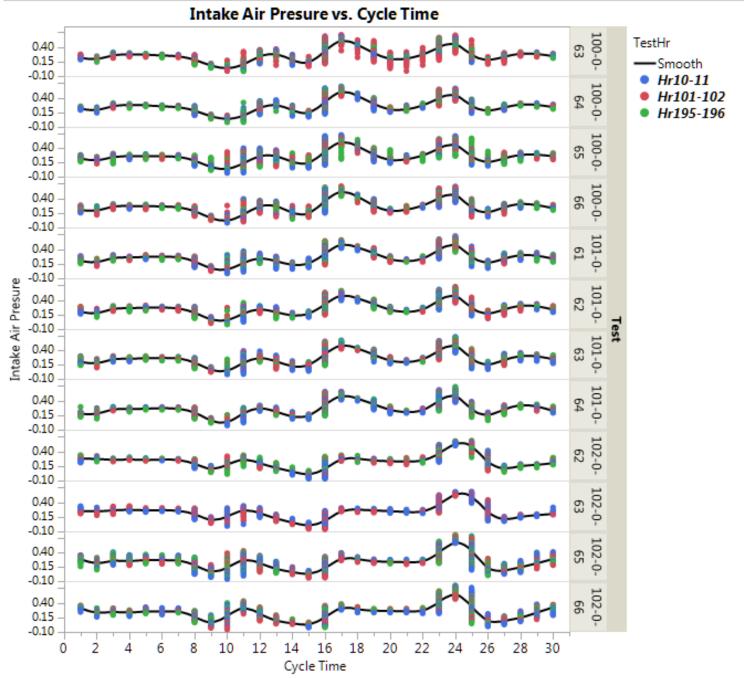
# **Graph Builder** Fuel Rail Pressure vs. Cycle Time 100-0-63 341 335 329 TestHr —Smooth Hr10-11 341 335 329 100-0-Hr101-102 Hr195-196 100-0-65 341 335 329 100-0-341 335 329 101-0-341 335 329 61 Fuel Rail Pressure 101-0-341 335 329 62 101-0-341 335 329 101-0-341 335 329 102-0-62 341 335 329 102-0-63 341 335 329 102-0-341 335 329 102-0-66 341 335 329 10 12 18 20 22 24 26 16

#### **Graph Builder** Fuel Rail Temperature vs. Cycle Time 100-0-63 TestHr 23.6 —Smooth Hr10-11 100-0-64 24.1 Hr101-102 23.6 Hr195-196 100-0-65 24.1 23.6 100-0-66 24.1 23.6 101-0-61 24.1 23.6 24.1 23.6 23.6 23.6 23.6 23.6 101-0-62 101-0-63 101-0-24.1 23.6 102-0-62 24.1 23.6 102-0-63 24.1 23.6 102-0-65 24.1 23.6 102-0-66 24.1 23.6 10 12 16 18 26 Cycle Time Where(LAB = Intertek)



#### **Graph Builder** Intake Air Humidity vs. Cycle Time 100-0-63 12.0 11.5 TestHr 11.0 —Smooth Hr10-11 100-0-64 12.0 11.5 Hr101-102 Hr195-196 11.0 100-0-11.5 65 11.0 100-0-12.0 11.5 99 11.0 101-0-61 12.0 11.5 11.0 101-0-62 101-0-63 101-0-12.0 11.5 52 11.0 102-0-62 12.0 11.5 11.0 102-0-12.0 11.5 63 11.0 102-0-65 11.5 11.0 102-0-66 12.0 11.5 11.0 10 12 18 22 26 8 16 20 Cycle Time

# Graph Builder



#### 

31.2 30.0

31.2

31.2

31.2

31.2

31.2

31.2

31.2 30.0

30.0

Where(LAB = Intertek)

12

16

Cycle Time

18

20

Temperature 2

Intake Air 30.0 31.2 100-0-

100-0-

101-0-

101-0-

101-0-

101-0-

102-0-

102-0-

102-0-65

102-0-

## **Graph Builder** Intake Air Temperature vs. Cycle Time 100-0-63 32.9 32.2 31.5 TestHr —Smooth Hr10-11 32.9 32.2 31.5 100-0-Hr101-102 Hr195-196 100-0-32.9 32.2 31.5 32.9 32.2 100-0-31.5 101-0-61 32.9 32.2 31.5 Intake Air Temperature 101-0-32.9 32.2 31.5 101-0-32.9 32.2 31.5 63 32.9 32.2 31.5 101-0-32.9 32.2 31.5 102-0-32.9 32.2 31.5 102-0-102-0-32.9 32.2 31.5 102-0-66 32.9 32.2 31.5 10 12 14 16 18 20 22 24 26 8 Cycle Time

# **Graph Builder** Intake Manifold Pressure vs. Cycle Time 100-0-63 TestHr 55 30 5 -Smooth Hr10-11 100-0-64 Hr101-102 55 30 5 Hr195-196 100-0-65 55 30 5 100-0-55 30 5 99 101-0-55 30 5 Intake Manifold Pressure 101-0-55 30 5 101-0-55 30 5 63 101-0-55 30 5 102-0-55 30 5 102-0-55 30 5 102-0-65 55 30 5 102-0-66 55 30 5

20

22

24

26

10

12

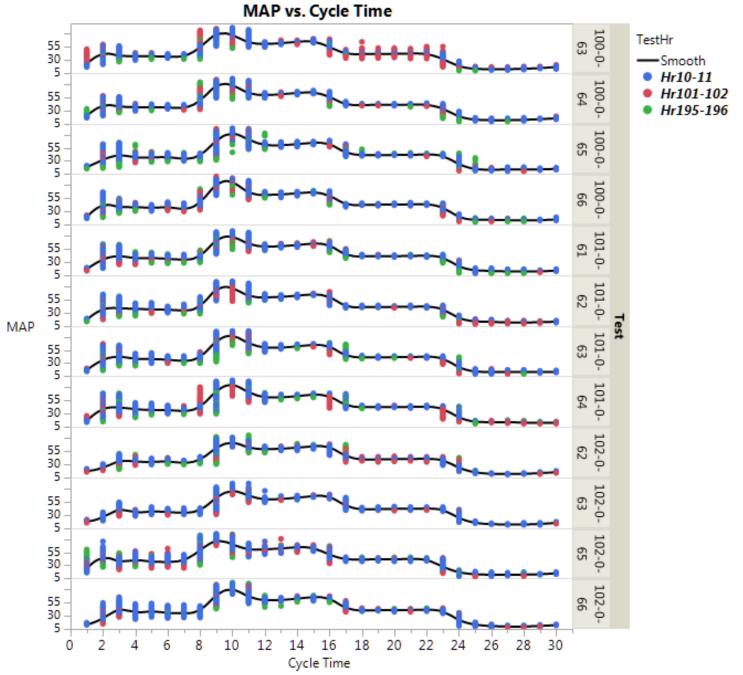
16

Cycle Time

18

## **Graph Builder** Load Cell Temperature vs. Cycle Time 100-0-63 47.4 46.0 TestHr 44.6 -Smooth Hr10-11 100-0-47.4 46.0 Hr101-102 44.6 Hr195-196 100-0-47.4 46.0 44.6 65 100-0-47.4 46.0 66 44.6 101-0-47.4 46.0 61 44.6 Load Cell Temperature 101-0-47.4 46.0 44.6 62 101-0-47.4 46.0 44.6 63 101-0-47.4 46.0 47.4 46.0 44.6 102-0-62 102-0-47.4 46.0 44.6 63 102-0-47.4 46.0 44.6 65 102-0-66 47.4 46.0 44.6 10 12 16 18 20 22 Cycle Time

# Graph Builder



# **Graph Builder** Oil Gallery Pressure vs. Cycle Time 100-0-TestHr 230 160 90 -Smooth Hr10-11 100-0-Hr101-102 230 -160 -90 -Hr195-196 100-0-65 230 160 90 100-0-230 -160 -90 -101-0-230 160 90 Oil Gallery Pressure 101-0-230 160 90 101-0-230 160 90 101-0-230 -160 -90 -102-0-230 160 90 102-0-230 -160 -90 -102-0-230 160 90 102-0-66 230 160 90 10 12 22 26 28 30 16 18 20 24 Cycle Time

Where(LAB = Intertek)

# **Graph Builder** Pedal Position vs. Cycle Time 100-0-63 32 26 20 TestHr -Smooth Hr10-11 32 26 20 100-0-64 Hr101-102 Hr195-196 100-0-65 32 26 20 32 -26 -20 -100-0-32 26 20 101-0-32 26 20 101-0-32 26 20 102-0-32 -26 -20 -102-0-102-0-65 32 26 20 32 26 20 102-0-66 0 18 20 22 10 12 16 24 26 Cycle Time

## **Graph Builder** Rocker Cover Coolant Flow Rate vs. Cycle Time 100-0-63 121.4 -120.0 -118.6 -TestHr Smooth Hr10-11 100-0-64 121.4 120.0 118.6 Hr101-102 Hr195-196 100-0-121.4 120.0 118.6 65 100-0-121.4 120.0 118.6 101-0-61 Cover Coolant Flow Rate 121.4 120.0 118.6 101-0-121.4 120.0 118.6 62 101-0-121.4 120.0 118.6 63 Rocker 101-0-121.4 120.0 118.6 102-0-121.4 120.0 118.6 62 102-0-121.4 -120.0 -118.6 -102-0-65 121.4 120.0 118.6 102-0-66 121.4 -120.0 -118.6 -16 18 20 22 0 12 14 24 26

Cycle Time

## **Graph Builder** Rocker Cover Coolant In Temp. vs. Cycle Time 100-0-63 TestHr 19.75 -19.45 --Smooth Hr10-11 100-0-Hr101-102 19.75 64 Hr195-196 19.45 100-0-19.75 19.45 100-0-19.75 19.45 101-0-Cover Coolant In Temp 19.75 61 19.45 101-0-19.75 62 19.45 101-0-19.75 63 19.45 9 19.75 2 19.45 101-0-102-0-62 19.75 19.45 102-0-63 19.75 19.45 102-0-65 19.75 19.45 102-0-66 19.75 19.45 12 18 20 24 26 16 Cycle Time Where(LAB = Intertek)

#### **Graph Builder** Rocker Cover Coolant Out Temp. vs. Cycle Time 100-0-63 TestHr 19.90 19.60 -Smooth Hr10-11 100-0-Hr101-102 19.90 19.60 Hr195-196 100-0-19.90 19.60 100-0-19.90 19.60 101-0-Rocker Cover Coolant Out Temp. 19.90 61 19.60 101-0-19.90 62 19.60 101-0-19.90 63 19.60 101-0-19.90 19.60 102-0-62 19.90 19.60 102-0-63 19.90 19.60 102-0-65 19.90 19.60 102-0-66 19.90 19.60 22 14 16 18 20 24 26 10 12 Cycle Time Where(LAB = Intertek)

## **Graph Builder** Test Cell Air Temperature vs. Cycle Time 100-0-63 TestHr 28 23 Smooth Hr10-11 100-0-Hr101-102 28 23 Hr195-196 100-0-28 23 18 100-0-28 23 18 101-0-61 Test Cell Air Temperature 101-0-101-0-28 23 18 101-0-28 23 18 102-0-28 23 18 102-0-28 23 18 102-0-65 23 18 102-0-28 23 18 18 16 Cycle Time

### **Graph Builder** Total Fuel Used vs. Cycle Time 400000 280000 100-0-TestHr 63 160000 Smooth Hr10-11 400000 280000 100-0-64 Hr101-102 Hr195-196 160000 100-0-65 400000 280000 160000 400000 280000 100-0-160000 101-0-61 400000 -280000 -160000 400000 280000 101-0-Total Fuel Used 62 160000 101-0-400000 280000 160000 63 400000 280000 101-0-160000 400000 280000 102-0-62 160000 400000 -280000 -102-0-63 160000 102-0-65 400000 280000 160000 400000 -280000 -102-0-66 160000 18 20 22 24 26 10 12 Cycle Time Where(LAB = Intertek)