

Seq. IIIH Piston Hardware Task Force

Teleconference

Wednesday, June 21, 2017

10:00 – 12:00 EDT

WebEx Information included with Outlook Invite

Agenda (ATTACHMENT 1)

1.) Attendance.

- a. Jason Bowden, Matt Bowden, Charlie Leverett, Addison Schweitzer, Pat Lang, Ankit Chaudhry, Amol Savant, Ed Altman, George Szappanos, Jeff Betz, Bob Campbell, Haiying, Tang, Rich Grundza, Jerry Brys, Todd Dvorak, Sid Clark

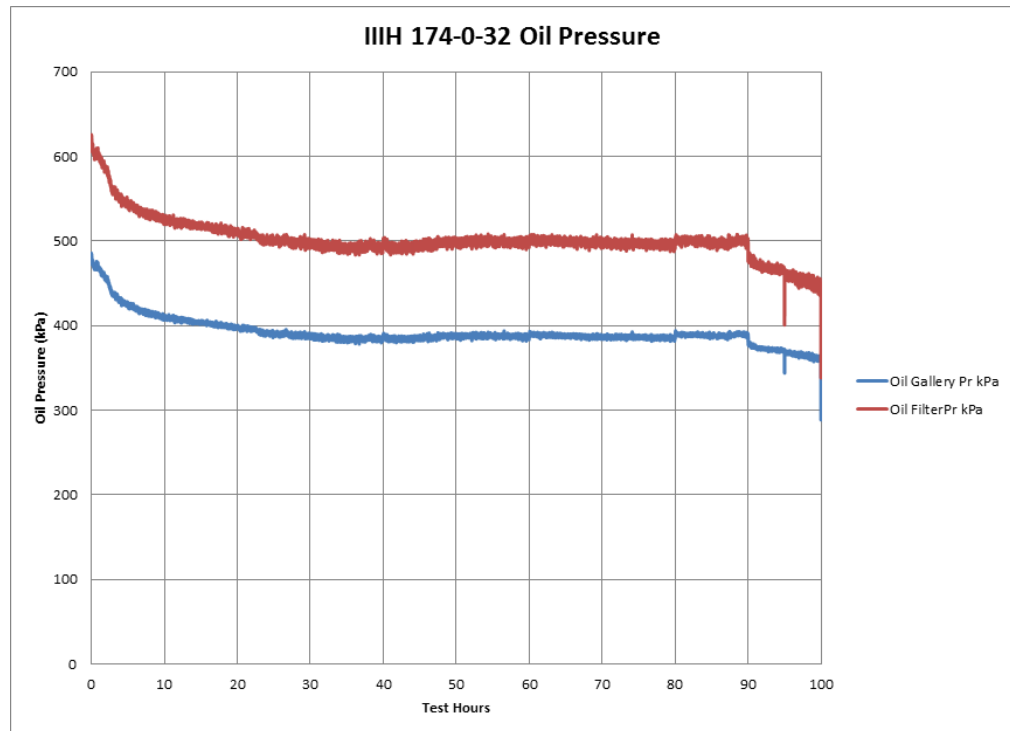
2.) Old Business / Open Action Item Review

- a. **Action Item #1:** Confirm how the JTEC data is being collected. Ankit will survey the labs to have them provide the raw data that is being collected along with each lab's practices for measuring barometric pressure, JTEC flow, temp, etc.)-Ankit Chaudhry. **ONGOING**
 - **6/21/17 Action Item #1:** Afton and Valvoline to send information to Ankit by next meeting
- b. **Action Item #2:** Todd Dvorak will review honing analysis he prepared for the November 2016 Panel meeting comparing the correlation pre and post matrix by lab vs. blowby and output results – Todd Dvorak. **(Confirming if only BC2 piston data was used for this analysis.)-COMPLETE**
- c. **Action Item #3:** Amol will survey the labs to determine how they are insulating the exhaust downpipes and how the exhaust systems are routed. Amol Requests photos from each lab.- Amol Savant-
 - Awaiting response from Southwest.
 - **6/21/17 Action Item #2:** Amol requested photos be provided from Lubrizol, Intertek and Southwest of the exhaust downpipes.
- d. **Action Item #4:** DOE Engine Hour Increase from 90 – 100 hrs. Ed Altman and Addison Schweitzer will develop a procedure for labs to conduct final ratings after 90 hours and then rebuild the engine to run an additional 10 hours and conduct an additional round of ratings. The labs will conduct an oil sample at 95 hours.
 - SwRI test result on 434-2 data was reviewed. **(ATTACHMENT 2)**
 - Result looks promising with regards to PVIS increase. The rate of visc. Increase appears linear and ended at 100 hours with 107.95% PVIS.

- The WPD target for the IIIH is 4.16 and this test had a WPD of 5 at 90HR and 4 at 100HR.
 - We do have to take into account that the oil level from 90 to 100 hours is lower due to the engine disassembly (6-8 oz less oil). The next step will be to run a full length 100 hour test to see what the actual results are without disassembly.
 - The oxidation and nitration shows the oil was beginning to break at 90 hours.
 - The Task Force generally agreed that the data from the three labs is promising, but there are concerns with regards to moving forward with extending the length of the test and what it would entail to implement (matrix, reference testing, etc.) The Task Force also discussed that there may be a need to run additional tests for any of the changes the group is trying to implement as well.
 - Lubrizol will not be running extended length tests at this time. Valvoline may be able to run an extended length reference test the second week of July.
 - **6/21/17 Action Item #3:** Afton to provide Task Force full summary of their 434-2 extended length test.
- e. **Action Item #5:** Lubrizol to conduct screener tests using increased load and speed. The engine will use BC4 hardware, stabilize conditions before adjusting either load or speed. **COMPLETE (ATTACHMENT 3)**
- **6/21/17 Action Item #4:** Lubrizol to provide task Force all operational data for the Load/Speed Experiment for review.
- f. **Action Item #6:** Southwest and Intertek will review possible screener tests with increased ring gaps and report to task force.
- Baseline test currently being conducted on BC4 rings and additional modified ring gap screener is in process. Expect to have additional data by July 5th meeting.
- g. **Action Item #7:** Southwest to conduct study on blowby evacuation system to determine if returning the system to the original configuration during the matrix has an effect on severity.
- Southwest has modified the current blowby configuration to original hose configuration, original fittings, changed nipples and left the current bracket the same. They are currently running a test and expect to have additional data by July 5th.
- h. **Action Item #8:** Labs to fill in DOE Reduced Ring Gap Summary Chart missing data so that the statisticians can review this information. Jason Bowden will receive replies and provide chart to statisticians for review. **COMPLETE**
- **6/21/17 Action Item #5:** Labs to send reference test key and ring gap information for all reference tests to Todd Dvorak by June 28th. Todd will provided a statistical analysis of this data along with the bore measurement information.
 - **6/21/17 Action item #6:** Todd Dvorak will update DOE Reduced Ring Gap chart with reference ring gap data and provide additional Statistical Analysis of

original Ring Gap DOE to determine if this information can help the Task Force select and appropriate ring gap.

- i. **Action Item #9:** Addison will generate oil pressure plot for 436-1 100 hour test. **COMPLETE**



j.

- k. **Action Item #10:** George Szappanos will supply summary of original blowby evacuation system changes to Task Force. **COMPLETE (ATTACHMENT 4)**

3.) New Business

- a. SwRI-Propose no oil additions or limiting the oil additions to increase the severity of the test.
- Ed Altman expressed concerns with regards to shifting when the oils begin to break in the test by changing modifying reducing the oil level.
 - The group discussed the possibility of finding additional information from test development, as this test originally did not have oil adds.
 - **6/21/17 Action Item #7:** SwRI to determine if there is IIH test development data using different oil level volumes or reduced oil additions that could provide further insight into the effect of reduced oil volume on severity.

- b. The task force discussed creating a list of the items we have discussed as potential solutions to returning the severity of the test to matrix levels. The Task Force members would rank each item by preference and provide their insight as to the pros and cons of each items.

- **6/21/17 Action Item #7:** Jason Bowden will create a list of the open items that the Task Force is currently working on as possible solutions to return the test to the Matrix severity levels. The items on this list are as follows (in no particular order):

Extending length
Blowby evacuation system
New batch of hardware
Increased Ring Gap
Speed/Load adjustment
Reduced Oil Add

4.) **New Motion and Action Item Review (ATTACHMENT 5)**

5.) **Meeting adjourn**

Seq. IIIH Piston Hardware Task Force

Teleconference

Wednesday, June 21, 2017

10:00 – 12:00 EDT

WebEx Information included with Outlook Invite

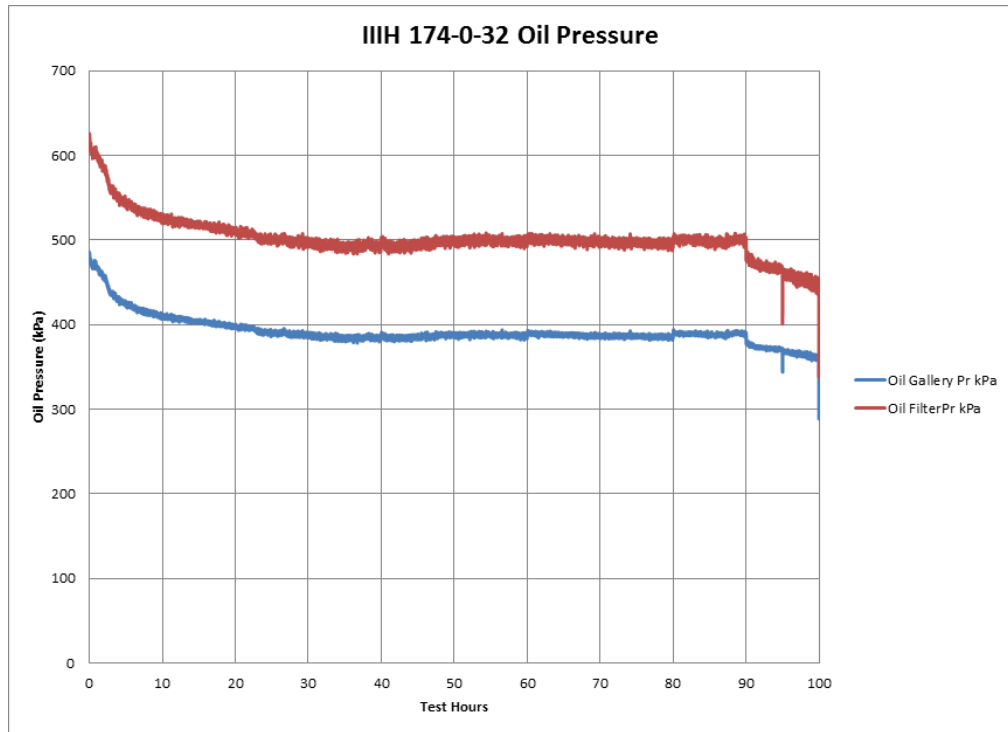
Agenda

1.) Attendance.

2.) Old Business / Open Action Item Review

- a. **Action Item #1:** Confirm how the JTEC data is being collected. Ankit will survey the labs to have them provide the raw data that is being collected along with each lab's practices for measuring barometric pressure, JTEC flow, temp, etc.)-Ankit Chaudhry.
- b. **Action Item #2:** Todd Dvorak will review honing analysis he prepared for the November 2016 Panel meeting comparing the correlation pre and post matrix by lab vs. blowby and output results – Todd Dvorak. **(Confirming if only BC2 piston data was used for this analysis.)**
- c. **Action Item #3:** Amol will survey the labs to determine how they are insulating the exhaust downpipes and how the exhaust systems are routed- Amol Savant-
- d. **Action Item #4:** DOE Engine Hour Increase from 90 – 100 hrs. Ed Altman and Addison Schweitzer will develop a procedure for labs to conduct final ratings after 90 hours and then rebuild the engine to run an additional 10 hours and conduct an additional round of ratings. The labs will conduct an oil sample at 95 hours.
 - i. SwRI test result.
- e. **Action Item #5:** Lubrizol to conduct screener tests using increased load and speed. The engine will use BC4 hardware, stabilize conditions before adjusting either load or speed. All operational data will be captured for review by task force.
- f. **Action Item #6:** Southwest and Intertek will review possible screener tests with increased ring gaps and report to task force.
- g. **Action Item #7:** Southwest to conduct study on blowby evacuation system to determine if returning the system to the original configuration during the matrix has an effect on severity.

- h. **Action Item #8:** Labs to fill in DOE Reduced Ring Gap Summary Chart missing data so that the statisticians can review this information. Jason Bowden will receive replies and provide chart to statisticians for review. **COMPLETE**
- i. **6/14/17 Action Item #9:** Addison will generate oil pressure plot for 436-1 100 hour test. **COMPLETE**



- j.
- k. **6/14/17 Action Item #10:** George Szappanos will supply summary of original blowby evacuation system changes to Task Force. **COMPLETE**

3.) **New Business**

- a. **SwRI-Propose no oil additions or limiting the oil additions to increase the severity of the test.**

4.) **New Motion and Action Item Review**

5.) **Meeting adjourn**

Extended Length Test

SOUTHWEST RESEARCH INSTITUTE®

June 2017

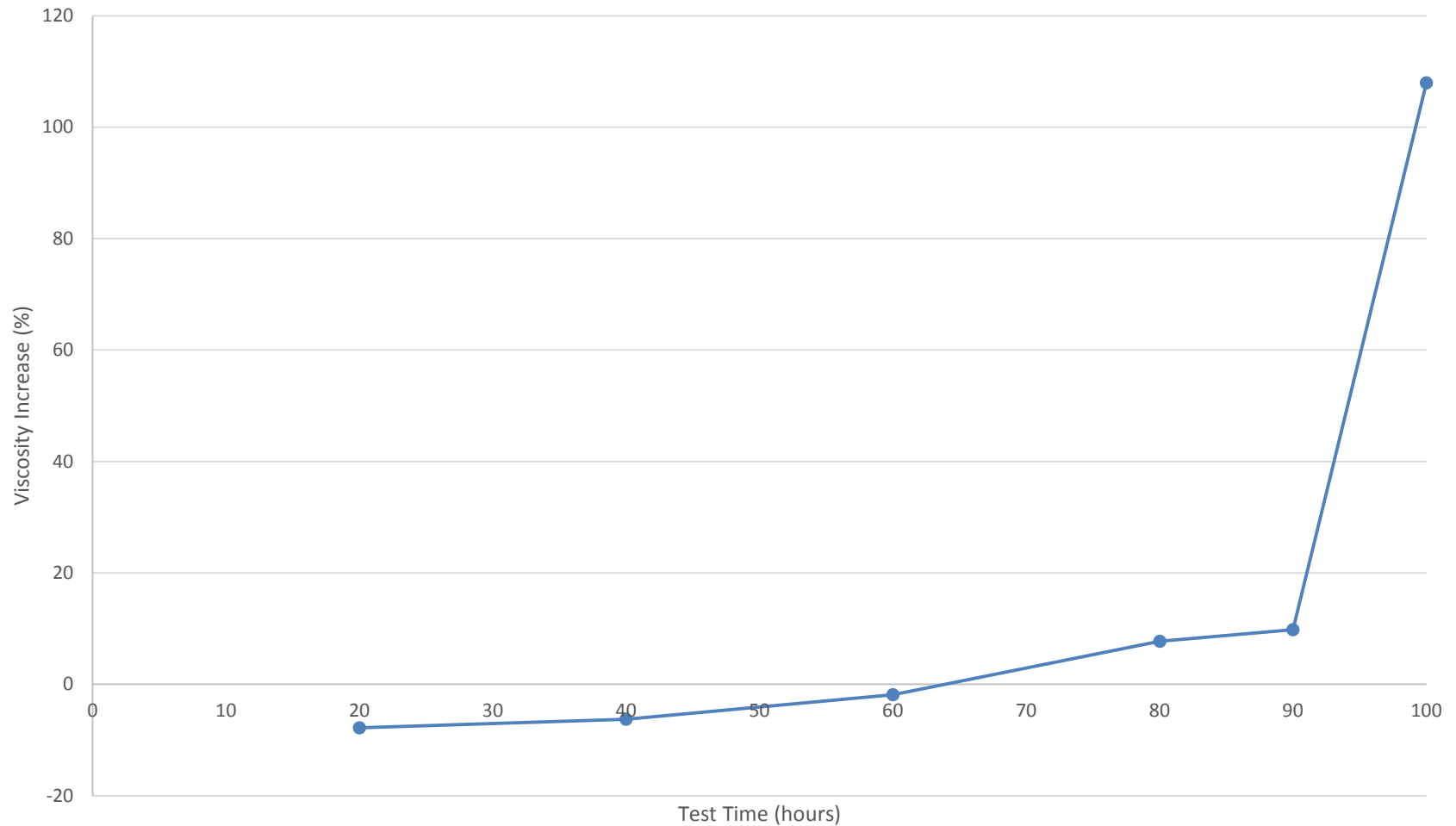


90 – 100 hour results

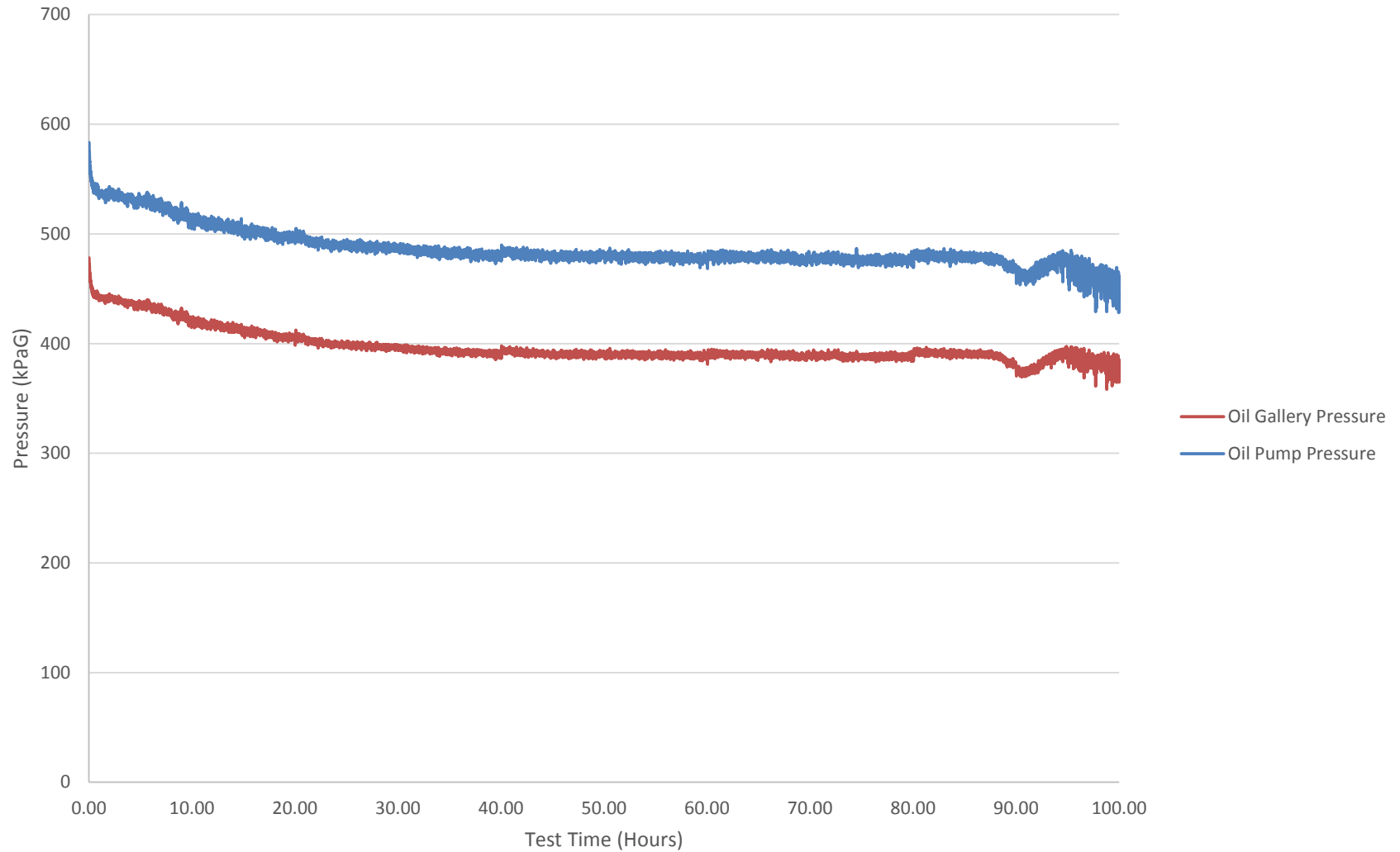
- RO Oil 434-2

Hours	90	95	100
PVIS	9.79 %	62.17 %	107.95 %
WPD	5.00	-	4.00

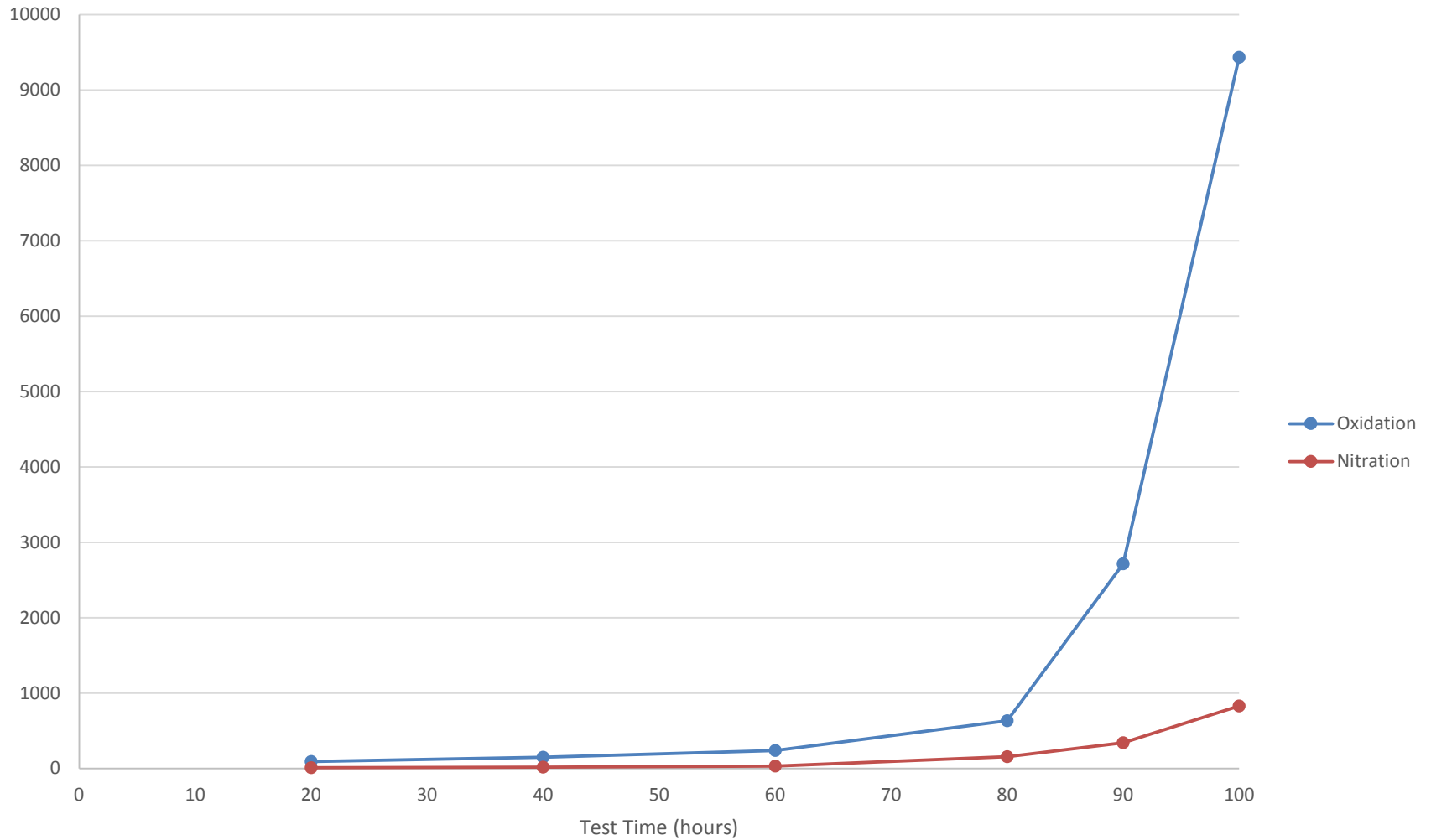
Viscosity Increase



Oil Pressure



Oxidation and Nitration Plot





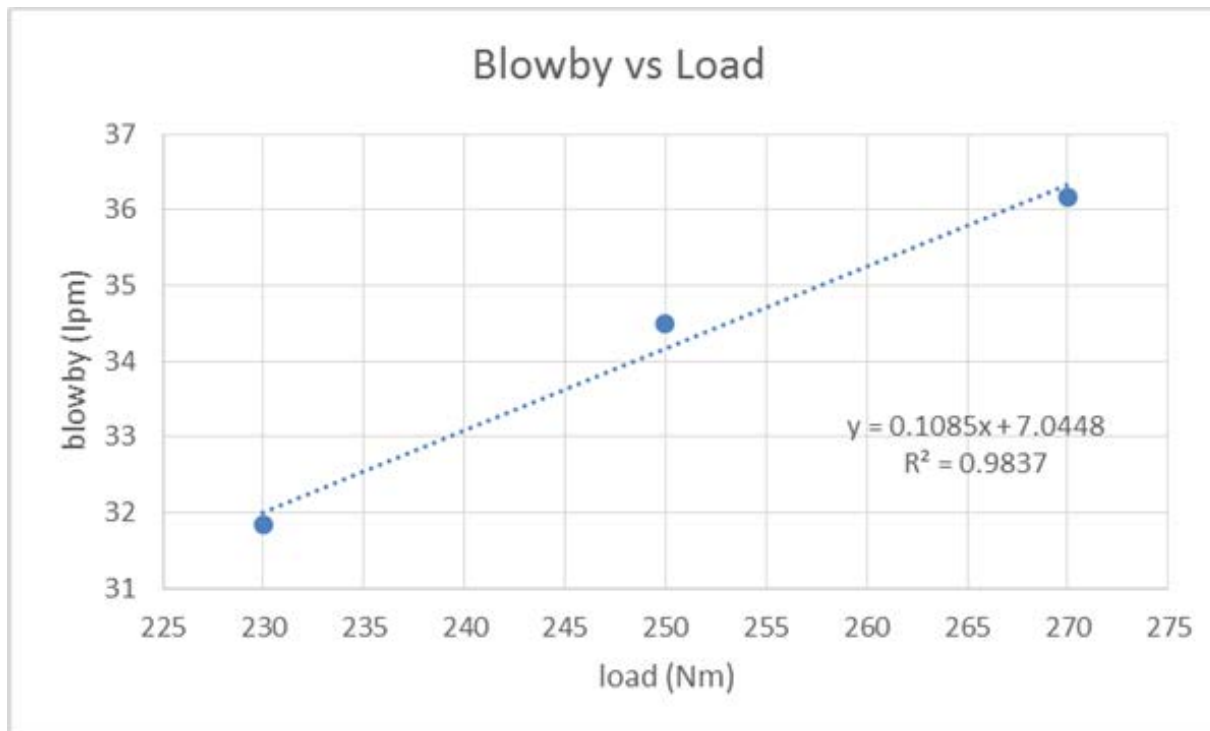
sensitivity of blowby to IIIH test conditions

6/2/2017



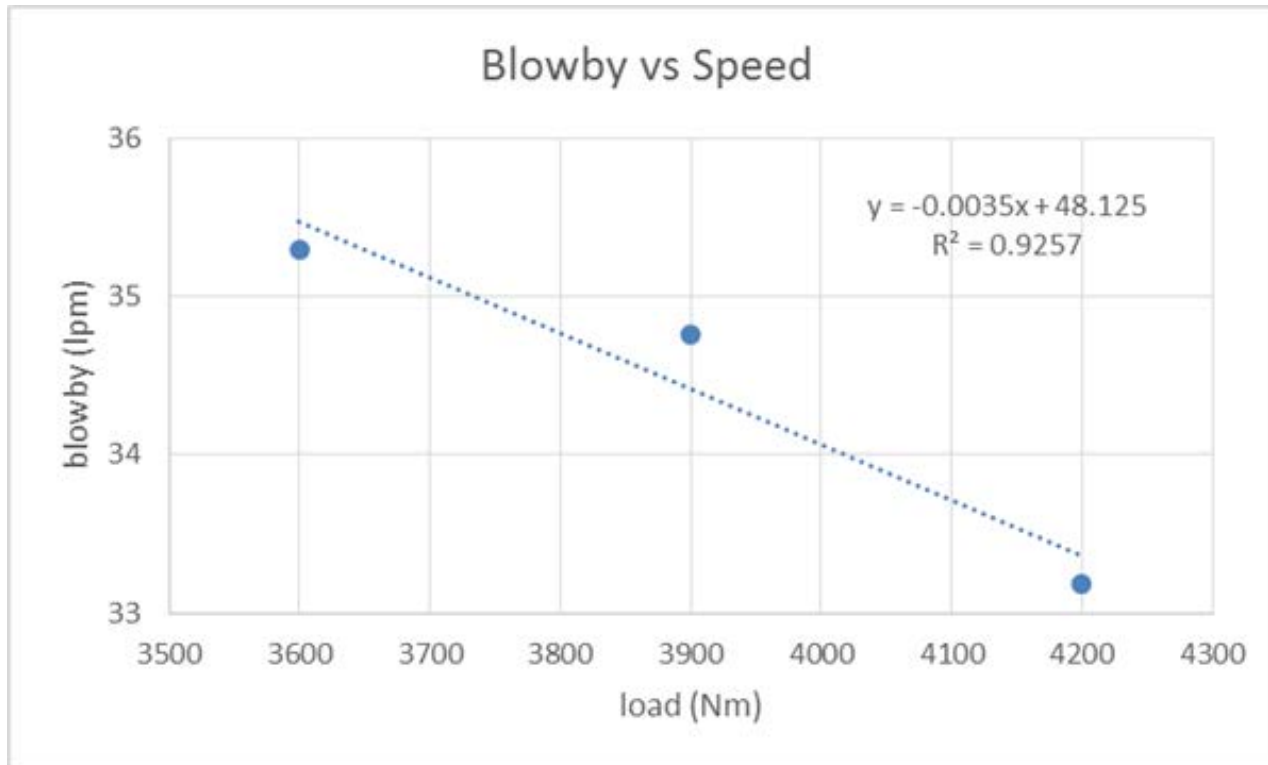
- In an effort to increase PVIS severity on the IIIH test, modifying the test conditions were explored so as to increase blowby
- speed and load were adjusted from setpoints by $\pm 8\%$

- The response to load is on the order of 0.1 lpm/Nm, directly correlated.
- Therefore, a $\pm 8\%$ change in torque corresponds to $\pm 6\%$ change in blowby (almost 1:1).



Speed

- For speed, the response is inverse at 0.4 lpm / 100 rpm.
- So, a $\pm 8\%$ change in speed corresponds to $\pm 3\%$ change in blowby (half of that of Load).



Seq IIH crankcase ventilation system standardization

3/4/2016

Objectives

The presumption is that the primary consideration is how the design impacts oil consumption.

The objective is therefore to standardize the configuration of the blowby ventilation system such that there is consistency in:

- A. The balance of flow between left and right sides
- B. The amount of oil trapped in the system
- C. The tendency of the oil to coalesce and drain back, or escape the system

Practical considerations

- Hose material that's suitable for the application (temperature and oil resistance)
- Robust, positive connections that won't leak or become disconnected
- Easily cleaned and maintained
- Cost effective to manufacture

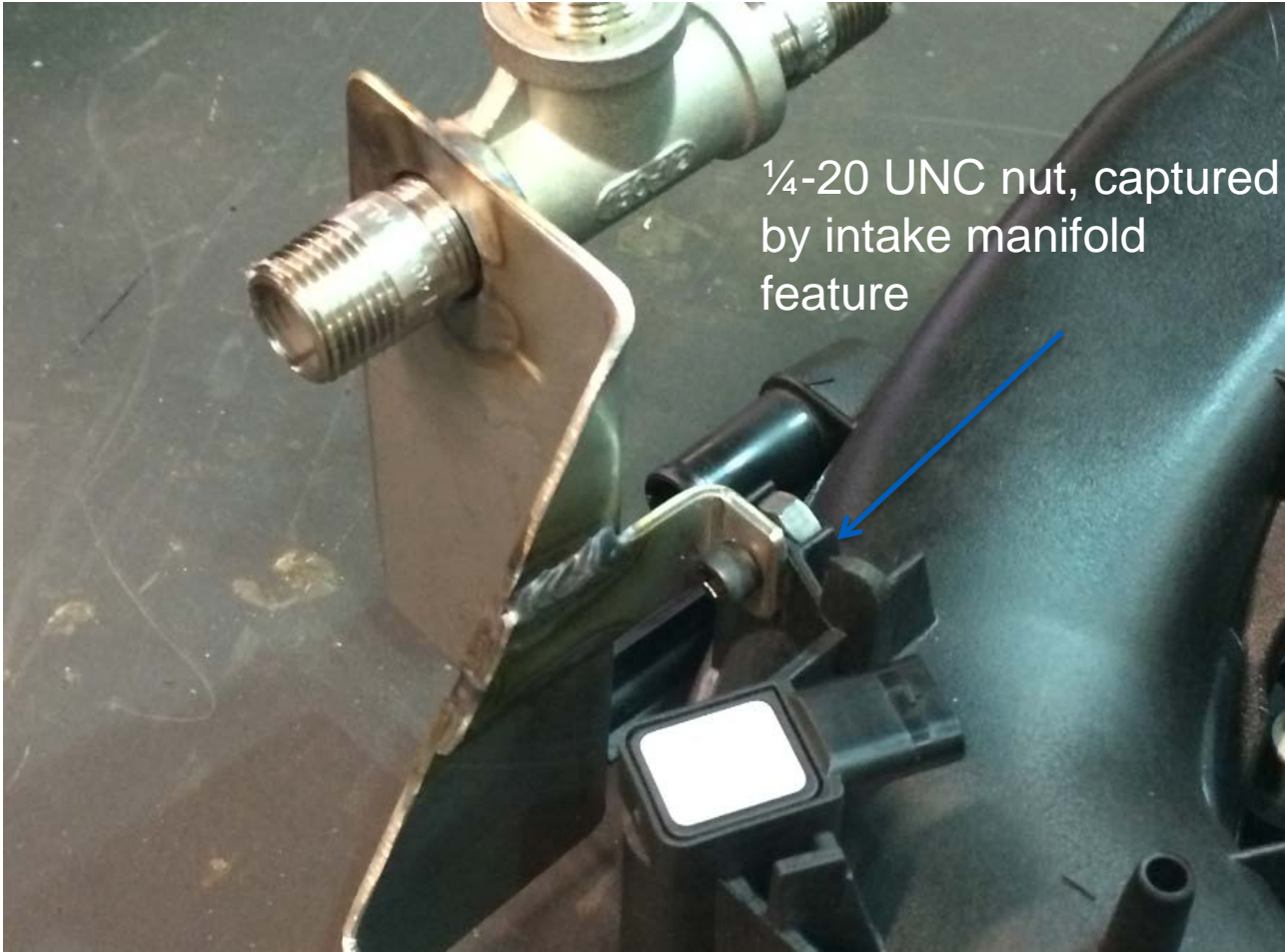
Secondary considerations

- The temperature of the oil / vapor mixture in the hoses might impact tendency of oil to coalesce
 - Standardized hose material
 - No insulation on hose
- Total restriction of the system, and thus the resulting crankcase pressure
 - Although testing has shown that the impact may be negligible on oil consumption, and minimum and maximum pressure should be set
 - This can be impacted by
 - Downstream hose length
 - Downstream hardware (3-way valve, JTEC, etc)
 - Vacuum draw from Aercology system

Support bracket (shown with non-reinforced hoses)







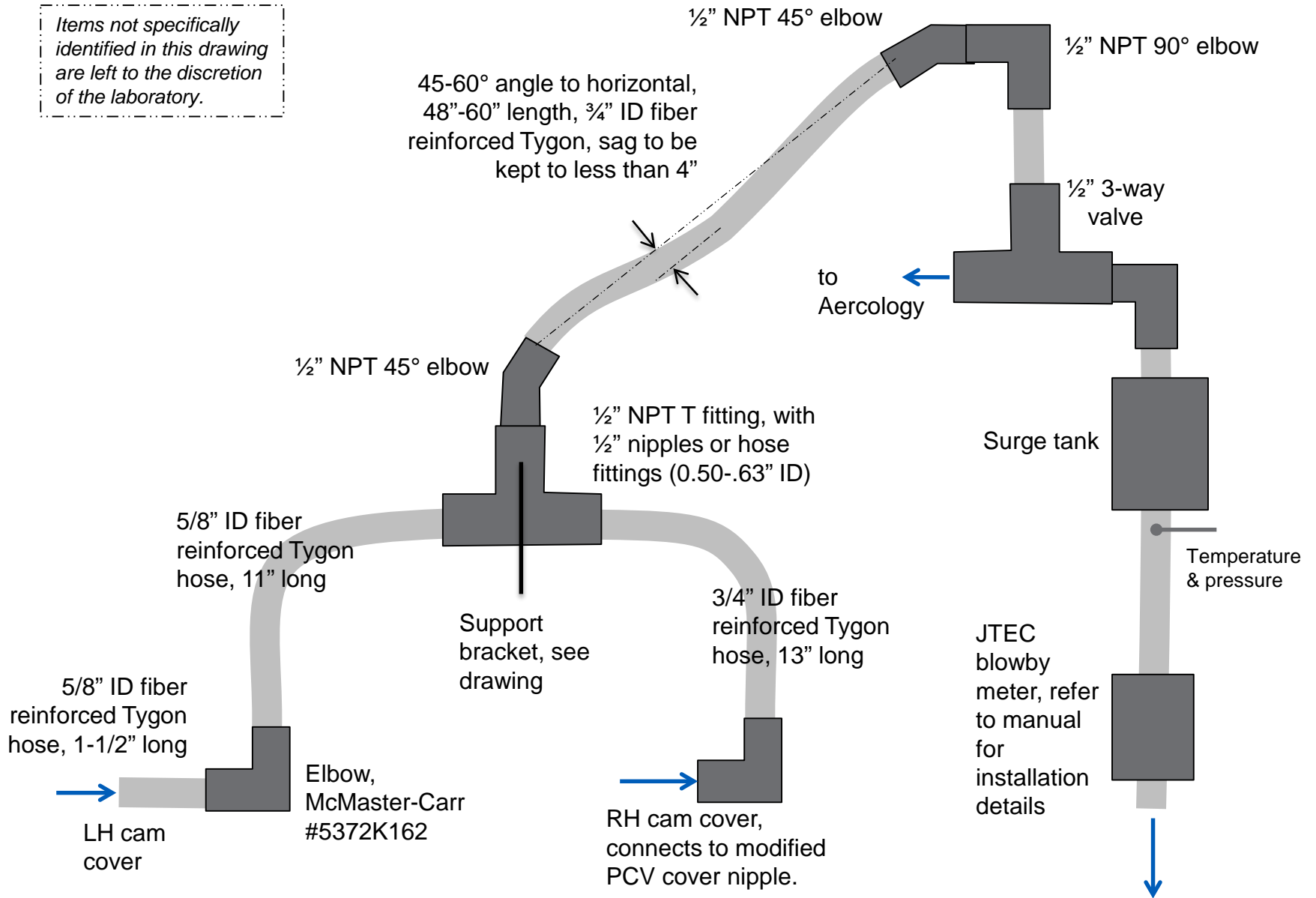
1/4-20 UNC nut, captured
by intake manifold
feature

Design summary

- 5/8" ID x 11" long "Tygon" hose on LH
 - To match elbow and nipple size
- 3/4" ID x 13" long "Tygon" hose on RH
 - To match PCV separator nipple size
- 1/2" NPT stainless steel "T" (0.50" ID)
- 1/2" NPT barbs or machined close nipples to accept the hoses
- 3/4" hose from T going 45° vertically, with no droops or horizontal runs
- Installation of 3-way valve optional

Figure xx Chrysler IIIH Crankcase Ventilation

Items not specifically identified in this drawing are left to the discretion of the laboratory.



Correction factor

To standardize the measured LPM flow, two measures are required:

Blowby gas temp (TC installed just prior to the JTEC)

Absolute pressure at meter (gauge pressure measurement prior to the JTEC + local barometric pressure)

The correction factor is already in many ASTM procedures (and GMOD) for correcting sharp edge orifice flow, and is actually missing from the IIIH draft procedure –

Record the uncorrected blowby flow rate in liters per minute and correct it for an atmospheric pressure of 100 kPa and a temperature of 37.8 °C.

Use the following equation to correct the blowby flow rate:

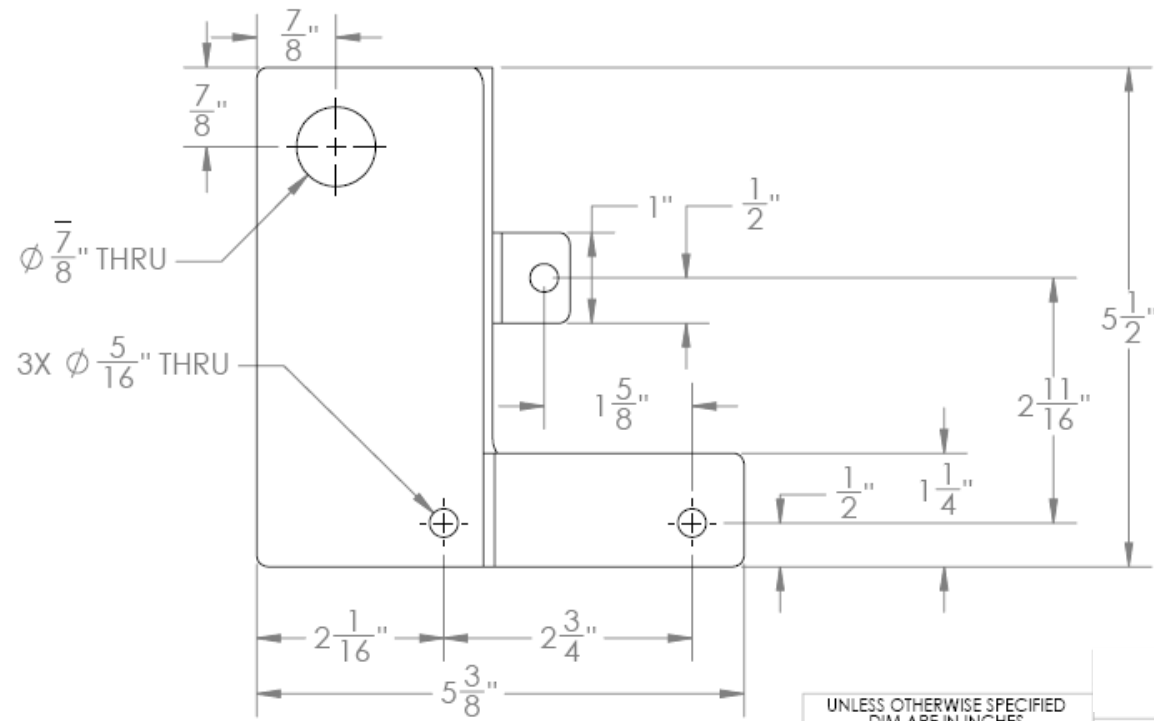
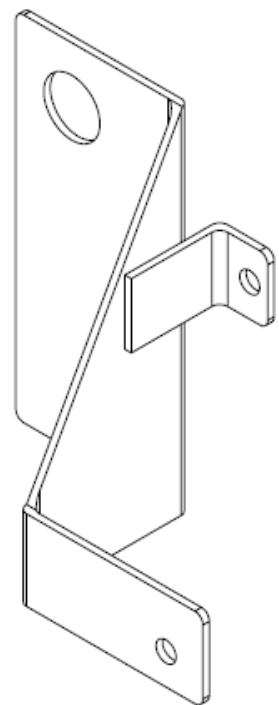
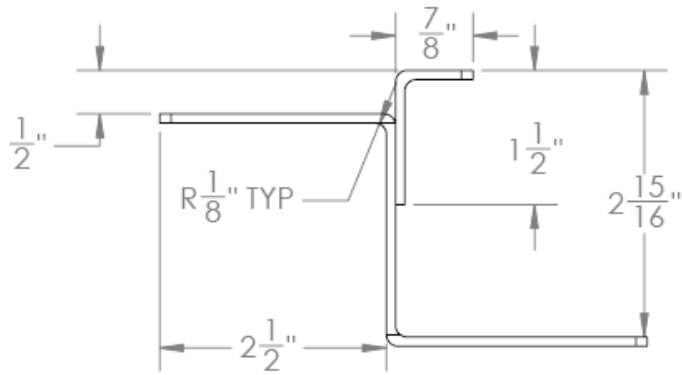
$$CF = (3.1002 * P / (273.15 + T))^{0.5}$$

where:

CF = corrected blowby flow rate, L/min,

P = blowby pressure, kPa, absolute

T = temperature, °C

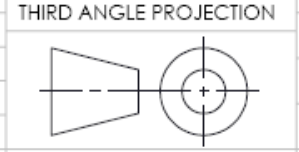


$\phi \frac{7}{8}$ " THRU

$3 \times \phi \frac{5}{16}$ " THRU

DATE	REVISION

UNLESS OTHERWISE SPECIFIED
 DIM ARE IN INCHES
 TOL ON ANGLE $\pm 10^\circ$
 .XX ± 010 .XXX ± 005
 FRACTIONAL $\pm 1/32$
 INTERPRET DIM AND TOL PER ASME
 Y14.5M-1994 GENERAL TOL IAW
 ISO 2768 - c l



CHECKED	
ENG APPR.	
MFG APPR.	
Q.A.	
MATERIAL	10GA STAINLESS STEEL
FINISH	
NEXT ASSY	

TITLE: BRACKET, 3H BLOWBY		REV
SIZE A	DWG. NO. 100133	
SCALE: 1:2	WEIGHT:	SHEET 1 OF 1

JTEC Installation

J-TEC Model VF563AA Setup and Maintenance

INSTALLATION INSTRUCTIONS

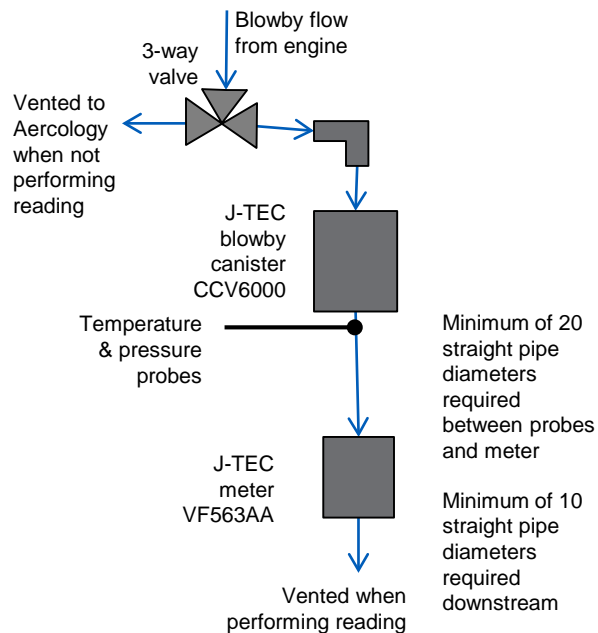
The J-TEC Model VF563AA flow meter should be installed with a minimum of 20 pipe diameters of straight pipe upstream and 10 pipe diameters downstream from the flow meter. For example, a one-inch tube or hose should have 20 inches of straight length immediately before the flow meter inlet tube. This condition provides a more symmetrical flow profile, which is necessary to obtain accurate and repeatable results.

A typical connection to the flow meter is made by placing flexible hose onto the outside of the inlet tube and outlet tube.

Install the flow meter vertical with flow into the top and out the bottom to encourage liquids to drain out of the flow meter.

Install a CCV6000 filter canister (or buffer chamber) in the pipe between the crankcase and the flow meter to minimize the effect of pulsating flows, and collect oil and water droplets to keep the flow meter cleaner.

A typical J-TEC Model VF563AA flow meter and CCV6000 filter canister with three-way valve is shown below in Figure B:



CLEANING AND MAINTENANCE

The inside of the flow tube and strut must be kept clean. This cleaning procedure is to be completed prior to every test start.

To clean the flow tube and strut, gently brush the inside of the tube with a soft brush or cotton swab. A solvent cleaner, such as a brake parts cleaner that degreases and leaves no residue, may be used to loosen deposits. Ensure the solvent is compatible with aluminum, viton, and Teflon.

DO NOT use wire brushes or use high-pressure liquids. These may cause damage to the transducers.

Sequence IIIH Task Force to Improve Precision

1/20/2016

summary of discussions held on 12/16, 12/22, 1/6, 1/12, and 1/19

Review of followup test by Lab D on RO434

- continued mild result
- in depth data review comparing operational data
- no apparent relationship with any measured parameter
- CONCLUSION: the source of the variability is with a parameter either not being measured, or not being measured accurately
- ACTION: continue to search for the source of variability (in process)

Discussion about stand differences

- ACTION: Ed to send photos of stand and engine (done)
- ACTION: Labs to provide photos of crankcase ventilation system (done)
- CONCLUSION: Discovered differences between labs that might affect the restriction and flow of blowby gas
- ACTION: task force to revise procedure to standardize the hardware (in process)
- Ed feels that other parts of the test stand and engine should also be reviewed
- ACTION: labs to provide photos of entire stand for review by the TF (done)
- CONCLUSION: some instrumentation placement issues discovered, but nothing significant

Discussion about engine operation difficulties

- Several labs have experienced issues with engine “de-rate” or “limp home mode”
- ACTION: need Chrysler’s help to understand problem and implement a robust solution (in process)
- ACTION: labs to capture ECU parameters by monitoring the CANbus (in process)
- ACTION: need Chrysler’s help to capture proprietary parameters related to oil pressure, oil temp, and oil pressure solenoid position (in process)

Discussion regarding engine build differences

- CONCLUSION: Round robin measurements of cylinder bore diameter and surface finish show minor differences; measurement resolution may prohibit a more thorough understanding
- ACTION ITEM: Statistical analysis of surface finish data to determine lab consistency and/or impact on OC or test severity didn’t reveal any issues (done by SWRI)
- ACTION ITEM: labs to bore/hone a block and send to Jeff Betz at Chrysler for measurement (in process)
- ACTION ITEM: review of the surface finish data suggests that new limits need to be established for Rz and Rzk to address consistently out of spec measurements (in process)
- ACTION ITEM: the TF is planning a build workshop sometime in the next month (in process)

Discussion on engine swapping between labs

- ACTION: the group suggested that SWRI should build an engine that Afton would run which might reveal whether the severity issue is engine-build or test operation related (in process)
- During the 1/6 Seq III SP call Afton voiced their concern that the test would not be valuable
- ACTION: on 1/8 an alternate suggestion was offered by LZ to run an engine built by Afton
- During the 1/12 TF call Afton believed that continued review of the test stands should be done first
- ACTION: 1/14 Afton has agreed to perform the engine swap with SWRI (in process)

TF team: Szappanos, Altman, Haumann, Schweitzer, Savant, Grundza, Chaudhry, Bowden, OMalley, Clark, Tang, Leverett, Brys

Seq. IIIH Severity Task Force

Motion and Action Items

June 21, 2017

Motions:

None

Action Items:

Prior Ongoing Action Items:

- **Action Item #1:** Confirm how the JTEC data is being collected. Ankit will survey the labs to have them provide the raw data that is being collected along with each lab's practices for measuring barometric pressure, JTEC flow, temp, etc.)-Ankit Chaudhry. **ONGOING.**
- **Action Item #2:** Amol will survey the labs to determine how they are insulating the exhaust downpipes and how the exhaust systems are routed- Amol Savant- **ONGOING.**
- **Action Item #3:** DOE Engine Hour Increase from 90 – 100 hrs. Ed Altman and Addison Schweitzer will develop a procedure for labs to conduct final ratings after 90 hours and then rebuild the engine to run an additional 10 hours and conduct an additional round of ratings. The labs will conduct an oil sample at 95 hours. **ONGOING.**
- **Action Item #4:** Southwest and Intertek will review possible screener tests with increased ring gaps and report to task force. **ONGOING.**
- **Action Item #5:** Southwest to conduct study on blowby evacuation system to determine if returning the system to the original configuration during the matrix has an effect on severity. **ONGOING.**

New Action Items from June 21st Meeting

- **6/21/17 Action Item #1:** Afton and Valvoline to send information to Ankit by next meeting
- **6/21/17 Action Item #2:** Amol requested photos be provided from Lubrizol, Intertek and Southwest of the exhaust downpipes.
- **6/21/17 Action Item #3:** Afton to provide Task Force full summary of their 434-2 extended length test.

- **6/21/17 Action Item #4: Lubrizol to provide task Force all operational data for the Load/Speed Experiment for review.**

- **6/21/17 Action Item #5: Labs to send test key and ring gap information for all reference tests to Todd Dvorak by June 28th.**

- **6/21/17 Action item #6: Todd Dvorak will update DOE Reduced Ring Gap chart with reference ring gap data and provide additional Statistical Analysis of original Ring Gap DOE to determine if this information can help the Task Force select and appropriate ring gap.**

- **6/21/17 Action Item #7: SwRI to determine if there is IIH test development data using different oil level volumes or reduced oil additions that could provide further insight into the effect of reduced oil volume on severity.**

- **6/21/17 Action Item #7: Jason Bowden will create a list of the open items that the Task Force is currently working on as possible solutions to return the test to the matrix severity levels.**

The items on this list are as follows (in no particular order):

- Extending length**
- Blowby evacuation system**
- New batch of hardware**
- Increased Ring Gap**
- Speed/Load adjustment**
- Reduced Oil Add**