ADA

GENERATOR SET DURABILITY TESTING

INTERIM REPORT
TFLRF No. 419

by
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Edwin A. Frame

U.S. Army TARDEC Fuels and Lubricants Research Facility
Southwest Research Institute® (SwRI®)
San Antonio, TX

by
Eric Sattler

for
U.S. Army TARDEC
Force Projection Technologies
Warren, Michigan

Contract No. W56HZV-09-C-0100 (WD04–Task XVIII)

January 2012

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SwRI® Project No. 08.14734.04.320

Approved for public release: distribution unlimited

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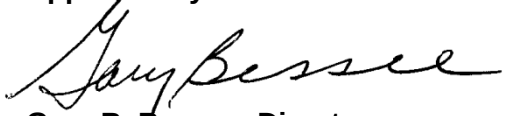
Approved by:



Gary B. Bessee, Director
U.S. Army TARDEC Fuels and Lubricants Research Facility (SwRI®)

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
01-31-2012	Interim Report	July 2010 – December 2011

4. TITLE AND SUBTITLE
Generator Set Durability Testing

5a. CONTRACT NUMBER
W56HZV-09-C-0100

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Hansen, Gregory; Frame, Edwin; Sattler, Eric

5d. PROJECT NUMBER
SwRI 08.14734.04.320

5e. TASK NUMBER
WD 04

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army TARDEC Fuels and Lubricants Research Facility (SwRI®)
Southwest Research Institute®
P.O. Drawer 28510
San Antonio, TX 78228-0510

8. PERFORMING ORGANIZATION REPORT NUMBER
TFLRF No. 419

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army RDECOM
U.S. Army TARDEC
Force Projection Technologies
Warren, MI 48397-5000

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Durability testing according to MIL-STD-705c 695.1a was performed on a variety of tactical quiet generators ranging in capacity from 2kW to 100kW. The testing was performed to assess the performance impact of a new fuel. The fuel was a 50/50 blend of JP-8 and HRJ-8. Although many mechanical and electrical problems occurred during testing, no fuel related failures were reported.

15. SUBJECT TERMS

Generator, TQG, MIL-STD-705c, Durability, Synthetic Fuel, HRJ-8, Reliability

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			19b. TELEPHONE NUMBER *(include area code)*
Unclassified	Unclassified	Unclassified	Unclassified	76	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

EXECUTIVE SUMMARY

At the TARDEC Fuels and Lubricants Research Facility, candidate alternative fuel blend testing was performed on military Tactical Quiet Generators. This is one of several tests used to qualify candidate alternative fuels for use in ARMY and DOD ground equipment. A test fuel blend consisting of 50% JP-8 and 50% synthetic fuel (HRJ-8) was used in two each of seven different generator types. The generators ranged in capacity from 2kW to 100kW. They featured various types of fuel injection systems and high pressure fuel pumps. The cycle performed was the 1500 hour durability cycle as found in MIL-STD-705c 695.1a. Although some generators failed to finish the test due to mechanical and/or electrical problems, there were no reported issues relating to the test fuel. For a list of the generators tested and their completed test hours please refer to Section 11, Table 7.

FOREWORD/ACKNOWLEDGMENTS

The U.S. Army TARDEC Fuel and Lubricants Research Facility (TFLRF) located at Southwest Research Institute (SwRI), San Antonio, Texas, performed this work during the period July 2010 through December 2011 under Contract No. W56HZV-09-C-0100. The U.S. Army Tank-Automotive RD&E Center, Force Projection Technologies, Warren, Michigan administered the project. Mr. Eric Sattler (RDTA-DP M/S 110) served as the TARDEC contracting officer's technical representative. Ms. Patsy Muzzell of TARDEC served as project technical monitor.

Special thanks go to Thomas C. Dooley (RDECOM CERDEC PRD), and his assistant Tolulope O. Oyebode, for their continued support of this work. They have provided the generators for this testing, and also invaluable troubleshooting aid. TFLRF would like to thank Mr. Scott Wills from Ft. Hood, TX who took time out of his family vacation to help troubleshoot a problem on the 100kW generator.

The authors would like to acknowledge the contribution of the TFLRF technical support staff along with the administrative and report-processing support provided by Dianna Barrera.

TABLE OF CONTENTS

Section **Page**

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

ACRONYMS AND ABBREVIATIONS

BOCLE	Ball-On-Cylinder Lubricity Evaluator (ASTM D5001)
BSFC	Brake Specific Fuel Consumption
DCI-4A	Corrosion Inhibitor / Lubricity Improver Fuel Additive
EOT	End of Test
HFRR	High Frequency Reciprocating Rig
HRJ-8	Hydro-Renewable Jet Fuel
JFTOT	Jet Fuel Thermal Oxidation Test
kW	kilo Watts
MEP	Mobile Electric Power
MSEP	Water Separation Test (ASTM D3948)
MTBF	Mean Time Between Failure
ppm	parts per million
S/N	Serial Number
STADIS	Static Dissipative Fuel Additive
TFLRF	TARDEC Fuels and Lubricants Research Facility
CI/LI	Corrosion Inhibitor, Lubricity Improver
MTBF	Mean time between failure
COA	Certificate of Analysis

1.0 INTRODUCTION

The purpose of this testing was to evaluate the operation of tactical quiet generators on a candidate alternative fuel blend consisting of 50/50 by volume of JP-8 and HRJ-8. To do this they must complete the reliability test as outlined in MIL-STD-705c 695.1a. The reliability test is designed to measure the probability that a generator set will perform as intended. Since the generator sets used in this program were already qualified for use, we were only interested in results obtained as they pertained to the fuel system. All other data collected and provided is ancillary to the results of the fuel on the operation of the tactical quiet generators.

2.0 EQUIPMENT

Two of each of the following tactical quiet generators (in Table 1) were used for this program. Some of the generators set up for testing can be seen in Figure 1.

Table 1. Generator Equipment Details

Model	Output [kW]	Engine MFR	Engine Model	TQG Serial Numbers	Fuel Consumption [gal/hr]	Tank Capacity [gal]	Oil Sump [quart]	Coolant [gal]
MEP 531A	2	Yanmar	L48	11318 & 11321	0.33	1.6	1	N/A
MEP 831A	3	Yanmar	L70	FZA15746 & FZA17060	0.35	4	1.25	N/A
MEP 803A	10	Onan	DN4M	FZ35046 & FZ35055	0.97	9	5.9	1.25
MEP 804A	15	Isuzu	C240	FZ60344 & FZ60357	1.5	14	6	3.4
MEP 804B	15	Yanmar	4TNV84T-BGGE	FZ61920 & FZ61946	1.2	14	6	2.8
MEP 805B	30	John Deere	4039T	HX37756 & HX37762	2.43	23	15	3.9
MEP 807A	100	Caterpillar	3126B	100002 & 100013	7.85	66	30	9.5

Figure 1. 10kW and 30kW Generators Ready for Testing

In order to most closely match the load requirements of the test, the load banks (in Table 2) were used at various voltage and power settings.

Table 2. Load Banks

Model	Rated Load	AC Voltage	Load Circuits (kW)
K490	10 kW	120/240 Single Phase	1, 2, 2, 2, 3
LPH100	100 kW	208-240/480 3 Phase	5, 10, 10, 25, 50
LPH400	400 kW	240/480 3 Phase	5, 10, 10, 25, 50, 100, 100, 100

3.0 OPERATING SUMMARY

3.1 Load Steps

The below load schedule (Table 3) allowed for operating the generators 100 hours per week for 15 weeks to make 1500 hours of total operation. The run numbers were operated sequentially and then repeated until completion. The load schedule is derived from MIL-STD-705c 695.1a.

Table 3. Cyclic Load Schedule

Run Number	Percent of Rated Load	Hours at Condition
1	50	24
2	0	4
3	75	24
4	25	24
5	100	24

3.2 Regular Maintenance

It was recommended by Ft. Belvoir to limit regular maintenance to the recommended oil changes when operating the 705c test cycle on almost all of the generators. Depending on the generator set in question the regular oil change interval ranged from 100 to 500 hours. For a few of the sets which were not yet run-in, the first 24 hours of run-in operation was counted with the 1500, and an additional oil change was performed at the 24 hour mark. The 2kW and 3kW generators also received valve clearance checks every 500 hours in addition to the oil changes.

4.0 INSTRUMENTATION

The generator sets were each instrumented with an automated data logger: Campbell Scientific CR3000. Oil temperature, fuel temperature at the high pressure pump inlet, coolant temperature (if applicable), frequency, power output, and ambient conditions were all measured. The data was sampled once for every 5 minutes of run time for the duration of the program. The summary data gathered from the generators during testing can be found in Appendix A.

The oil temperature was either measured in the sump or the galley, if the sump was ill-located for testing. The fuel temperature was measured at the inlet to the injection pump. The coolant was measured at the radiator outlet. Ambient conditions were recorded approximately 20 ft from the nearest generator, but still inside the test facility. Frequency was measured from the L-N (line and neutral) phases and converted to an analog signal using a transformer. The power output was measured using calibrated watt meters.

5.0 FUEL PROPERTIES

The fuel used for this program consisted of a 50/50 blend of HRJ-8 and Jet-A. The blend was additized with 22.5 ppm DCI-4A and 1 ppm STADIS to bring the blend into conformance with the MIL-DTL-83133G specification. A pilot blend was performed in the laboratory at TFLRF prior to the start of testing to determine both fuel properties before and after the additives were used, and to track the accuracy of the blends made in the bulk 4000 gallon run tank. The results of the pilot blend can be seen in Tables 4 and 5. Although the pilot blend is out of spec on the antioxidant and MSEP tests, neither were expected to cause issues with the test. The low AO values are acceptable since the AO quantity is specified to be added at the point of manufacture. The low MSEP values can be attributed to the presence of STADIS in the blend, which is not accounted for in the spec.

The results of all the tank blends, as compared to the pilot blend, can be seen in Table 6.

This program received 3 shipments of both neat Jet-A and neat HRJ-8. Those neat fuel analyses can be seen in Appendix B.

Table 4. 50/50 Pilot Blend

50/50 Pilot Blend by SwRI				
Sample Date				10/12/2010
Physical Properties	**Test Method**	**Specification**		**Result**
		Minimum	**Maximum**	
Density @ 15°C	D 4052	775	840	781.7
Gravity, API @ 60°F		37.0	51.0	49.5
Kinematic Viscosity @ -20°C	D 445		8.0	4.27
Kinematic Viscosity @ 40°C	D 445			1.28
Freezing Point (°C)	D 2386		-47	-69.4
Bulk Modulus	see attached sheets:			BM1
Net Heat of Combustion (MJ/kg)	D 4809	42.8		43.504
Total Acidity (mg KOH/g)	D 3242		0.015	0.007
Electrical Conductivity (pS/m)	D 2624	150	600	924
Additives				
Antioxidant, AO-37 (ppm)	P 487	17	24	10
Static Dissipator, Stadis 450 (ppm)				1
Hydrocarbon Composition				
Aromatics (vol %)	D 1319	8.0	25.0	10.8
Hydrogen Content (mass%)	D 3701	13.4		14.61
Napthalene (vol%)	D 1840		3.0	0.10
Sulfur Content (mg/kg)	D 5453		3000	1.8
Color, Saybolt	D 156	+15		+28
Smoke point (mm)	D 1322	19.0		23.8
Copper Strip Corrosion, 2hr @ 100°C	D 130		No. 1	1B
BOCLE (wear scar diameter)	D 5001			0.543
HFRR (wear scar diameter)	D 6079			0.670
Volatility				
Flash Point (°C)	D 56	38		46.0
Distillation 10% Rec (°C)	D 86		205	171.1
Distillation 50% Rec (°C)		Report		197.2
Distillation 90% Rec (°C)		Report		266.2
Distillation Final BP (°C)			300	276.7
Distillation Residue (vol%)			1.5	1.5
Distillation Loss (vol%)			1.5	0.9
T50-T10 (°C)		15		26.1
T90-T10 (°C)		40		95.1
Cetane Index	D 4737			53.7
Derived Cetane Number	D 6890			47.7
JFTOT	D 3241			
Temperature (°C)		260		260
Tube Deposit Rating (visual)			3	2
dP (mm Hg)			25	0.0
Contaminants				
Existent Gum (mg/100 mL)	D 381		7.0	5.2
Water interface rating	D 1094		1b	1
MSEP	D 3948	80		44
Particulate Matter (mg/L)	D 5452		1.0	-0.2

Table 5. 50/50 Pilot Blend: No. CI/LI

50/50 Pilot Blend by SwRI (no CILI)		
Sample Date		10/12/2010
Physical Properties	**Test Method**	**Result**
BOCLE (wear scar diameter)	D 5001	0.790
HFRR (wear scar diameter)	D 6079	0.690

Table 6. 50/50 Bulk Tank Blends with Comparison

50/50 Bulk Tank Blend by SwRI					
Sample Date		10/27/2010		1/3/2011	
Blended Quantity (gallons)		3618		3100	
Physical Properties	**Test Method**	**Result**	**Compared to pilot blend**	**Result**	**Compared to pilot blend**
Density @ 15°C	D 4052	789.7	1.0%	786.3	0.6%
Kinematic Viscosity @ 40°C	D 445	1.21	-5.8%	1.27	-0.8%
BOCLE (wear scar diameter)	D 5001	0.490	-10.8%	0.530	-2.5%
Sample Date		2/15/2011		4/20/2011	
Blended Quantity (gallons)		3000		3200	
Physical Properties	**Test Method**	**Result**	**Compared to pilot blend**	**Result**	**Compared to pilot blend**
Density @ 15°C	D 4052	778.3	-0.4%	779.6	-0.3%
Kinematic Viscosity @ 40°C	D 445	1.34	4.5%	1.32	3.0%
BOCLE (wear scar diameter)	D 5001	0.580	6.4%	0.590	8.0%
Sample Date		6/8/2011		9/2/2011	
Blended Quantity (gallons)		3200		3560	
Physical Properties	**Test Method**	**Result**	**Compared to pilot blend**	**Result**	**Compared to pilot blend**
Density @ 15°C	D 4052	779.3	-0.3%	779.8	-0.2%
Kinematic Viscosity @ 40°C	D 445	1.41	9.2%	1.31	2.3%
BOCLE (wear scar diameter)	D 5001	0.570	4.7%	0.590	8.0%
Sample Date		10/19/2011		12/1/2011	
Blended Quantity (gallons)		3600		2050	
Physical Properties	**Test Method**		**Compared to**		**Compared to**
		Result	**pilot blend**	**Result**	**pilot blend**
Density @ 15°C	D 4052	775.2	-0.8%	775.5	-0.8%
Kinematic Viscosity @ 40°C	D 445	1.27	-0.8%	1.27	-0.8%
BOCLE (wear scar diameter)	D 5001	0.620	12.4%	0.630	13.8%

6.0 FUEL CONSUMPTION CHECKS

To verify consistent operation of the high pressure fuel pumps, fuel consumption was measured every 500 hours when the generators were operating at full load. The auxiliary fuel line was connected to a small container of fuel on a scale and the fuel consumed was measure over a period of time. To compensate for variations in output power from test to test, the Brake Specific Fuel Consumption (BSFC) was then calculated and can be seen plotted in Figure 2.

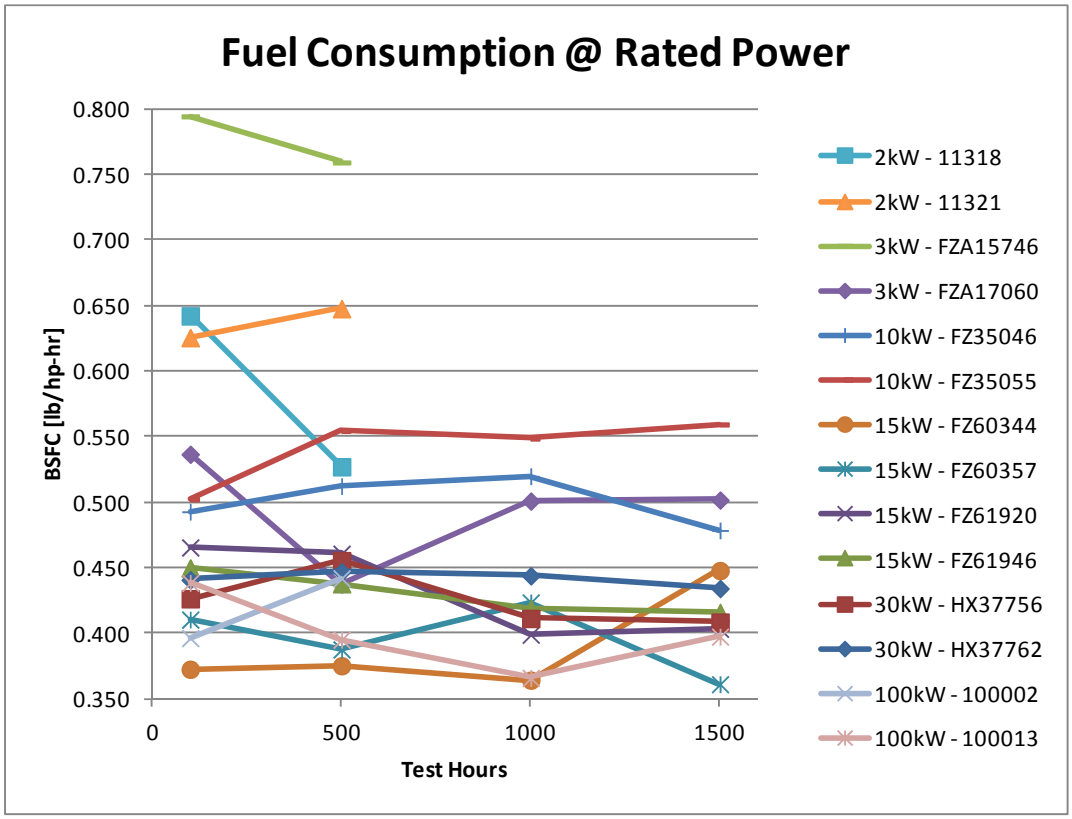


Figure 2. BSFC at Rated Power

The generators only showing the first two data points, were the ones that had mechanical failures prior to test completion. The large differences in fuel consumption between generators of the same type may be attributed to their unknown usage and maintenance history prior to receipt by TFLRF. Please note, the 30kW generators were received in new condition and their fuel consumption values are reasonably close, and trend together, throughout testing.

7.0 OIL ANALYSIS

The oil used for this testing was the current MIL-PRF-2104-H. The used oil analysis generally returned as expected results. There were a few anomalies found as explained below, and the complete oil analysis plots can be found in Appendix C.

The last oil sample for the 2kW S/N 11321 (900 hours: shortly before early EOT) showed 2% soot, whereas normal levels were previously around 0.5%. The cause was undetermined. Possible causes of the increased soot loading may include a change in injection timing, dirty air filter, valve train wear, or injector wear or fouling. For further information, please refer to Section 8.

The last oil sample for the 3kW S/N FZA15746 (1300 hours: shortly before early EOT) showed 160 ppm aluminum, whereas normal levels were previously around 7 ppm. This aluminum is thought to come from the failed pushrod and pushrod tube. For further information, please refer to Section 8.

After 1000 hours, the 15kW S/N FZ60344 started making more soot than usual. Soot levels moved from around 0.5% before 1000 hours, to greater than 2% after 1000 hours. This increase in soot is a direct result of increased soot production in the exhaust, the cause of which may have been a temporarily clogged injector, but was ultimately undetermined and only occurred twice when changing load from 0% to 75% power levels.

There were also a few generators that missed one of their recommended oil change intervals due to operator oversight, but there were no detrimental results, only moderately increased wear metals and soot.

Generator FZ60344 slipped the second oil change from 1000 hours to 1200 hours. Soot increased to 2.4% and wear metals continued to rise normally, but all stayed below 55 ppm.

Generator HX37756 missed the second oil change at 1000 hours entirely. The generator finished the test with soot levels less than 1%, but wear metals continued to rise as reserve base number continued to fall. Iron accumulation in the oil continued to rise linearly, but copper accumulation spiked at 1200 hours. Total wear metals all stayed below 65 ppm by the end of the test.

8.0 FAILURES

There were no fuel related failures during testing, but there were some other failures that will be mentioned (all generators will be listed regardless of failure rate).

Model No.–MEP 531A - 2kW
Serial No.–11318

At 40 hours, the voltage and frequency gauges stopped working. No action was taken, but the gauges were planned to be replaced at the 100 hour mark.

At 92 hours, some wiring inside the control panel burned out. The panel was sent to PM-MEP for diagnostics. A new panel was received and installed. Total repair time was approximately
4 hours.

At 660 hours, the generator shut down. Following the troubleshooting procedures in the TM, the failure was diagnosed as a faulty voltage regulator. A replacement voltage regulator was obtained but the generator failed to engage a load. An early EOT was called. Total repair time was approximately 4 hours.

Mean Time Between Fail (MTBF) = 220 Hours

Model No.–MEP 531A - 2kW

Serial No.–11321

At 476 hours, the hour meter quit working. It was replaced with a spare. Total repair time was approximately 1 hour.

At 600 hours, the generator shut down due to a fault with the oil pressure switch. The contacts on the switch were cleaned and the generator was restarted. Total repair time was approximately 1 hour.

At 680 hours, the generator shut down due to a fault with the oil pressure switch, after further diagnostics, it was found that the oil strainer O-ring was squashed, not allowing the pump to build up oil pressure. The O-ring was replaced. Total repair time was approximately 2 hours.

At 940 hours, the generator shut down due to an undiagnosed electrical failure. An early EOT was called. No action taken.

MTBF = 235 Hours

Model No.–MEP 831A – 3kW

Serial No.–FZA15746

At 850 hours, the muffler bolts failed on the exhaust system causing excessive vibration and broke the muffler off from the exhaust pipe where the two were welded together (Figure 3). The entire exhaust system was replaced. Total repair time was approximately 6 hours.

Figure 3. Muffler and Header Pipe Showing Broken Welds as a Result of the Muffler Bolt Failure

At 860 hours, the nut on one of the head studs became loose causing the head gasket to fail (Figure 4). The rise in temperature inside the TQG case, due to escaping combustion gasses, also caused one of the electric cooling fans to fail. The head gasket was replaced as was the air filter, cooling fan, and cooling fan temperature switch. Total repair time was approximately 4 hours.

Figure 4. Cylinder head showing soot accumulation at gasket failure site on left side of picture

At 1295 hours, the engine was at full load and started to produce large amounts of black smoke from the exhaust. The engine was turned off, allowed to cool down and restarted with no problems. Total repair time was approximately 1 hour.

At 1306 hours, the engine died and would not restart. An early EOT was called and post test analysis showed the failure occurred with the intake side pushrod. The aluminum pushrod was extruded into the steel pushrod cap thereby shortening the pushrod by 3mm (Figure 5). This caused the valve stem cap to dislodge and caused a near complete loss of motion for the intake valve. The injection pump timing was also checked and found to be out of tolerance by a few degrees. The timing was not checked at the beginning of test as it is not a standard maintenance item, so it is unknown whether or not this was a test related failure. Total diagnostic time was approximately 8 hours.

MTBF = 326.5 Hours

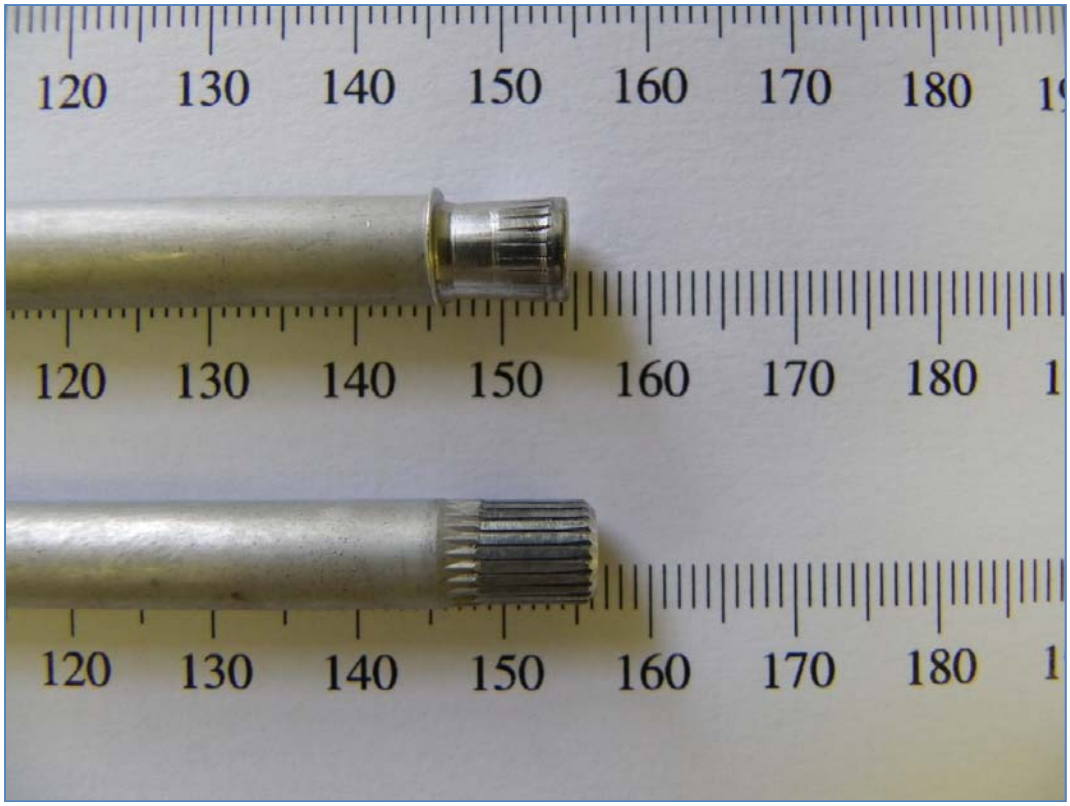


Figure 5. Pushrod length in mm showing failed pushrod at top

Model No.–MEP 831A – 3kW
Serial No.–FZA17060

At 1120 hours, the hour count meter stopped incrementing for approximately 4 hours. At 1124 hours it started working normally again. No action was taken.

MTBF = 1500 Hours

Model No.–MEP 803A – 10kW
Serial No.–FZ35046

No Failures

Model No.–MEP 803A – 10kW
Serial No.–FZ35055

No Failures

Model No.–MEP 804A – 15kW
Serial No.–FZ60344

At 406 hours, the generator shut down on high coolant temperature. The generator was allowed to cool down and it restarted normally.

At 585 hours, the generator shut down on high coolant temperature. The generator was allowed to cool down and it restarted normally. The radiator fan belt was re-tensioned and the coolant was topped off. Total repair time was approximately 30 minutes.

At 1028 hours, the generator started producing heavy black smoke from the exhaust. This coincided with the load change from 0% to 75%. When the load was reduced to 25% at 1056 hours, the smoking ceased. The smoking did not occur at the following 100% load point so the cause may have been a temporarily dirty/clogged injector, but the root cause was not determined.

At 1132 hours, the generator shut down on high coolant temperature. The cause was a broken radiator fan belt. The fan belt was replaced and the coolant was topped off. Total repair time was approximately 30 minutes.

At 1312 hours, the oil pressure gauge started to act erratically. The generator continued to perform normally, so no action was taken. After 1340 hours, the oil pressure gauge started to read normally again.

At 1428 hours, the generator started producing heavy black smoke from the exhaust again. This coincided with the load change from 0% to 75%. When the load was reduced to 25% at 1456 hours, the smoking ceased. The smoking did not occur at the following 100% load point, so the cause may have been a temporarily dirty/clogged injector, but the root cause was not determined.

At 1440 hours, the oil pressure gauge stopped functioning entirely. The gauge was not replaced during the test because the generator continued to perform normally.

MTBF = 214 Hours

Model No.–MEP 804A – 15kW
Serial No.–FZ60357

At 600 hours, the coolant temperature had risen to 205°F, up from a normal operation of 170°F. The coolant was topped off and the radiator fan belt was re-tensioned. Total repair time was approximately 30 minutes.

At 908 hours, the coolant temperature gauge failed. The gauge was not replaced during the test because the external instrumentation was used to monitor coolant temperature.

At 1228 hours, the radiator fan belt was replaced because the tension bracket was all the way out, and the belt was still loose. Total repair time was approximately 30 minutes.

MTBF = 500 Hours

Model No.–MEP 804B – 15kW
Serial No.–FZ61920

At 729 hours, the generator failed on a low fuel indicator. The root cause was with a malfunctioned transistor inside the ‘A9’ float switch module. A new A9 module was acquired and installed. Total repair time was approximately 1 hour.

MTBF = 1500 Hours

Model No.–MEP 804B – 15kW
Serial No.–FZ61946

At 399 hours, the generator failed on a low fuel indicator. The root cause was with a malfunctioned transistor inside the ‘A9’ float switch module. A new A9 module was acquired and installed. Total repair time was approximately 1 hour.

MTBF = 1500 Hours

Model No.–MEP 805B – 30kW
Serial No.–HX37756

No Failures

Model No.–MEP 805B – 30kW
Serial No.–HX37762

No Failures

Model No.–MEP 807A – 100kW

Serial No.–100002

It may be noted that the 100kW generators were of unknown age and were started in 'as-received condition'. This as-received condition included many lines and fittings which were observed to be non-standard. The 100kW generators also came with instrumentation such as thermocouples already attached at various points around the engine. This indicated that they were used in testing programs prior to receipt by TFLRF.

At 140 hours, the fuel shutoff solenoid malfunctioned causing a small fuel spill. The cause of the failure was due to a buildup of rubber particulate from a rotten rubber fuel line. The rubber fuel lines were replaced as was the shutoff solenoid. This failure is deemed not to be fuel related as the failure occurred so soon after starting the test. Total repair time was approximately 3 hours.

At 592 hours, the generator shut down on a low oil pressure alarm. The oil level was checked and 40.92 lbs of oil was added to the engine. No oil leaks were observed, so oil consumption was closely monitored. Total repair time was approximately 1 hour.

At 824 hours, an early EOT was called due to abnormally high oil consumption (Figure 6). Oil consumption at full load was over 0.8 lb/hr. Upon tear down of the engine, a large volume of oil was discovered in the intake manifold. This was traced back to an oil puddle in the bottom of the turbo compressor housing. The turbo was removed and disassembled, but no obvious faults/breaks were found. TFLRF staff did not have access to the turbo specifications and tolerances, so a final root cause could not be determined.

MTBF = 274 Hours

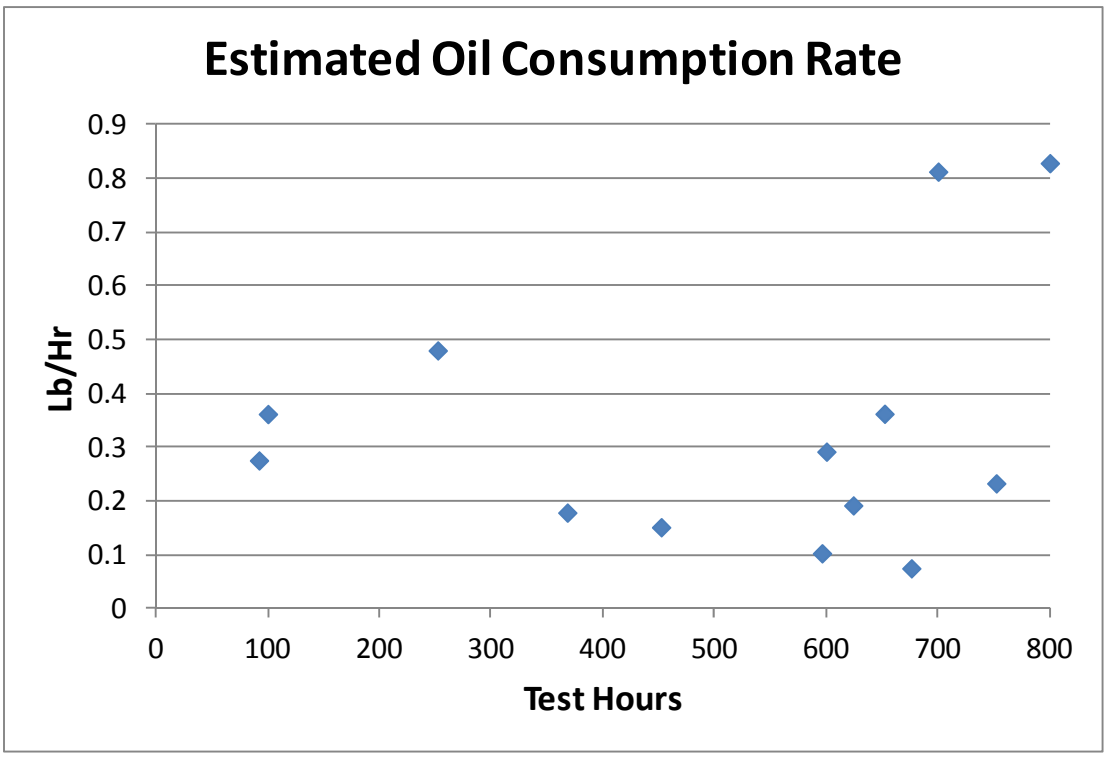


Figure 6. Estimated Oil Consumption Rate for 100kW S/N 100002

Model No.–MEP 807A – 100kW

Serial No.–100013

At 43 hours, the generator shut down due to high coolant temperature. The generator was allowed to cool down and additional fans were brought in to facilitate airflow around the generator and the generator was restarted. Total repair time was approximately 1/2 hour.

At 124 hours, the auxiliary fuel pump failed due to a buildup of rubber particulates in the pump. The rubber fuel lines were replaced as were the pump and shutoff solenoid. This was the same problem as experienced on the other 100kW generator. Total repair time was approximately 3 hours.

At 280 hours, the generator shut down due to high coolant temperature. The ambient temperature in the test area was over 125°F. The generators were allowed to restart once the ambient temperature decreased after sunset. No repairs were made.

At 396 hours, the generator shut down due to high coolant temperature. The ambient temperature in the test area was over 125°F. The generators were allowed to restart once the ambient temperature decreased after sunset. No repairs were made.

It may be noted that both 100kW generators were operated side by side using the paralleling cables so each experienced the same load conditions with respect to ambient temperature. Due to the continued overheating of this generator, there may have been a problem with the cooling system. Both coolant levels were checked periodically and no problems were noted, but extensive maintenance items like thermostat or radiator inspections were not performed, so a root cause of the overheating remained undetermined.

At 710 hours, the generator shut down due to low fuel level. This was likely due to low fuel pressure in the auxiliary supply line. The fuel tank was refilled and the generator was restarted. No repairs were made.

MTBF = 300 Hours

9.0 ADD-ON TESTING: ANALOG DISPLAY METERS

On four of the generators tested, the stock analog meters on the display panels were replaced with new prototype models. This add-on testing was facilitated per PM-MEP to accelerate the qualification process for the prototype analog meters and was approved through TARDEC.

MEP 531A (2kW), 11318: The gauges were installed at 0 hours. They accumulated 40 hours before they stopped working. They were scheduled for replacement at 100 hours. At 92 hours, the wiring in the control box burned out. The control box, with the new style (now burned out) gauges, was shipped back to PM-MEP for diagnostics.

MEP831A (3kW), FZA17060: The gauges were installed at 0 hours. They accumulated 1500 hours total. No problems to report.

MEP 803A (10kW), FZ35046: The gauges were installed at 1000 hours (AC volt, AC amp, Hz, DC Amp). The meters operated 500 hours with no failures. Observations were: thicker needle indicators, fewer divisions per engineering unit, and larger font sizes on the gauges generally made them harder to precisely tune the output of the generator, and reduced the accuracy of the readings as indicated in the hand taken logs.

***MEP 804A (15kW), FZ60344*:** The gauges were installed at 0 hours. They accumulated 1500 hours total. The voltage gauge hunted the entire test (+- 5V), regardless of power output level.

10.0 OTHER OBSERVATIONS AND INVESTIGATIONS

It was observed during testing of the 30kW generators that there were some hard-to-start situations when the generators were off for more than a day. At the time it was unknown whether or not this was a fuel related problem. After the 1500 hours of testing was complete, the fuel tanks were drained and they were filled with diesel fuel. The generators were run for 4 hours to purge the systems of any remaining test fuel, and then were turned off for seven days. When TFLRF staff returned to try starting the 30kW sets, similar hard-to-start issues were encountered. Ambient temperature was above 50°F, and the sets needed to be cranked for over 1 minute before they would start. Casual observation indicated a drain-back problem with the injector lines and injection pump. The actual cause of this hard-to-start issue is not known. Further diagnosis is needed if a root cause is to be determined.

11.0 SUMMARY

A summary of test completion is presented below in Table 7.

Table 7. Summary of Test Completion Status

MIL-STD 705c Summary						
Model	**Output [kW]**	**SN**	**Start Date**	**Hours Completed**	**EOT Date**	**Failure Mode**
MEP 531A	2	11318	8/15/2011	660	1/3/2011	Voltage Regulator
MEP 531A	2	11321	8/15/2011	940	10/25/2011	Electrical Undet.
MEP 831A	3	FZa15746	3/28/2011	1305	9/21/2011	Pushrod/Valve
MEP 831A	3	Fza17060	3/28/2011	1500	7/12/2011	
MEP 803A	10	FZ35046	11/18/2010	1500	3/18/2011	
MEP 803A	10	FZ35055	11/18/2010	1500	3/18/2011	
MEP 804A	15	FZ60344	3/28/2011	1500	7/12/2011	
MEP 804A	15	FZ60357	3/28/2011	1500	7/12/2011	
MEP 804B	15	FZ61920	11/18/2010	1500	3/18/2011	
MEP 804B	15	FZ61946	11/18/2010	1500	3/18/2011	
MEP 805B	30	HX37756	3/28/2011	1500	7/12/2011	
MEP 805B	30	HX37762	11/18/2010	1500	3/18/2011	
MEP 807A	100	100002	8/29/2011	824	10/28/2011	Turbo Oil Leak
MEP 807A	100	100013	8/29/2011	1500	12/30/2011	

There were no fuel related problems during the tests. There were numerous hardware and electrical related issues that plagued certain generators, as well as some storage issues (100kW rotten rubber lines) that caused some start up problems.

Overall, the 2kW and 3kW generators may be described as ‘low quality’ due to the numerous and varied problems experienced with them during tests, including major failures which resulted in early EOT.

It may be noted that the 10kW and 30kW generators were operated with relative ease. Those were the only generator types which experienced no major problems while on test.

Appendix A

Summary Data from Generator Set Instrumentation

Model No. MEP 531A – 2kW

Serial No. 11318

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 1 kW	1.01	0.98	1.01	1.02	1.01	1.02	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Target Power: 0 kW	na	na	na	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	na	na	na	0.00	-0.01	0.00
Target Power: 1.5 kW	1.50	1.01	1.51	1.52	1.50	1.53	1.48	1.47	1.49	na	na	na	1.49	1.48	1.49
Target Power: 0.5 kW	0.51	0.50	0.51	0.50	0.49	0.51	0.50	0.48	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Target Power: 2 kW	1.96	1.67	2.07	1.97	1.94	2.02	na	na	na	1.99	1.98	2.02	1.99	1.98	2.01
Frequency [Hz]	60.3	53.5	63.2	64.6	59.8	153.3	67.9	60.9	189.4	61.4	60.2	66.3	66.8	60.2	189.8
Oil Temp [F]	211.4	163.5	273.6	217.4	181.4	254.5	200.1	169.6	234.0	212.5	158.9	238.7	212.1	173.3	246.1
Fuel Temp [F]	123.6	94.9	168.3	123.8	99.6	153.8	110.5	83.6	142.5	118.6	85.9	139.3	120.7	98.0	148.3
Ambient Temp [F]	92.3	76.4	118.2	97.6	75.0	132.2	88.1	64.8	121.2	87.8	68.1	104.8	93.6	69.9	122.0
Rel. Humidity [%]	44.2%	9.8%	82.9%	34.4%	9.8%	85.4%	37.0%	12.9%	65.6%	44.7%	17.6%	78.9%	32.3%	9.0%	79.9%
Barometer [psi]	14.3	14.3	14.4	14.3	14.2	14.4	14.3	14.2	14.4	14.3	14.3	14.4	14.3	14.2	14.3
NOTES	missed load change						missed load change			Data loss due to weather					

	500 to 600 Hours			600 to 700 Hours		
	Average	Min	Max	Average	Min	Max
Target Power: 1 kW	1.00	0.99	1.00	0.99	0.99	1.00
Target Power: 0 kW	0.00	0.00	0.00	0.00	0.00	0.00
Target Power: 1.5 kW	1.49	1.48	1.50	1.49	1.48	1.49
Target Power: 0.5 kW	0.50	0.50	0.50	0.50	0.50	0.50
Target Power: 2 kW	2.00	1.98	2.01	na	na	na
Frequency [Hz]	68.9	60.2	190.4	68.4	61.2	190.6
Oil Temp [F]	197.0	149.9	235.1	199.0	173.4	219.3
Fuel Temp [F]	102.8	81.6	137.0	111.4	92.8	130.8
Ambient Temp [F]	83.0	54.4	107.6	87.4	71.1	105.5
Rel. Humidity [%]	27.4%	5.5%	70.6%	41.3%	18.6%	72.7%
Barometer [psi]	14.4	14.3	14.4	14.3	14.2	14.4
NOTES				EOT @ 660 hours Voltage Regulator Failure		

Model No. MEP 531A – 2kW

Serial No. 11321

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 1.0 kW	1.02	0.99	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.03	1.02	1.03	0.98	0.98	0.98
Target Power: 0 kW	na	na	na	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Target Power: 1.5 kW	1.52	1.51	1.52	1.52	1.52	1.53	1.53	1.52	1.53	1.53	1.47	1.54	1.46	1.46	1.46
Target Power: 0.5 kW	0.51	0.51	0.51	0.51	0.51	0.52	0.52	0.52	0.53	0.52	0.51	0.52	0.49	0.49	0.49
Target Power: 2.0 kW	2.05	2.03	2.06	2.06	2.05	2.06	2.03	1.85	2.06	1.95	1.69	1.97	1.96	1.91	1.98
Frequency [Hz]	60.3	58.0	62.1	63.1	58.5	123.3	64.8	55.3	123.9	62.7	57.2	123.8	62.2	56.7	123.9
Oil Temp [F]	213.3	173.7	255.7	212.0	157.8	240.8	213.8	178.3	272.1	219.2	177.2	274.9	231.2	172.7	274.4
Fuel Temp [F]	125.9	100.0	154.3	120.7	89.9	137.9	125.6	102.6	181.5	131.6	98.5	173.8	147.8	104.3	179.6
Ambient Temp [F]	77.8	76.4	103.5	78.4	75.7	103.6	78.4	77.5	130.9	69.7	68.4	133.1	82.1	81.5	121.8
Rel. Humidity [%]	48.1%	19.2%	82.9%	53.5%	24.6%	84.4%	40.4%	12.5%	80.1%	15.9%	4.3%	54.8%	27.6%	7.8%	56.4%
Barometer [psi]	14.3	14.3	14.4	14.3	14.2	14.4	14.3	14.2	14.3	14.3	14.3	14.4	14.3	14.2	14.4
NOTES	missed load change														

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 1.0 kW	0.98	0.96	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Target Power: 0 kW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Target Power: 1.5 kW	1.47	1.46	1.47	1.46	1.46	1.47	1.46	1.46	1.47	1.47	1.47	1.48	1.46	1.46	1.47
Target Power: 0.5 kW	0.49	0.49	0.50	0.49	0.49	0.49	0.49	0.49	0.50	0.50	0.49	0.53	na	na	na
Target Power: 2.0 kW	1.97	1.93	1.98	1.97	1.97	1.97	1.97	0.38	1.99	1.99	1.98	1.99	na	na	na
Frequency [Hz]	62.6	56.9	124.0	63.3	59.3	124.6	63.6	57.6	151.9	65.8	59.2	184.7	73.1	60.0	179.1
Oil Temp [F]	221.9	188.7	267.4	209.2	186.3	233.1	209.5	160.7	248.7	197.3	169.3	234.6	201.5	137.5	219.5
Fuel Temp [F]	137.6	113.6	169.7	121.7	101.3	142.4	129.3	86.7	161.8	110.9	82.6	139.0	118.1	84.9	131.8
Ambient Temp [F]	79.2	75.0	132.0	75.2	75.8	121.2	74.7	68.1	122.0	62.1	54.4	111.2	74.8	71.6	107.6
Rel. Humidity [%]	34.8%	9.8%	85.4%	39.1%	12.9%	67.8%	34.8%	9.0%	79.9%	25.0%	5.5%	62.3%	38.6%	19.1%	73.9%
Barometer [psi]	14.3	14.2	14.4	14.3	14.2	14.4	14.3	14.2	14.4	14.3	14.2	14.4	14.4	14.3	14.4
NOTES													EOT @ 940 Hours Undetermined Electrical Failure		

Model No. MEP 831A – 3kW

Serial No. FZA15746

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 1.5 kW	1.56	1.56	1.57	1.54	1.52	1.60	1.53	1.52	1.85	1.48	1.46	1.57	1.51	1.50	1.51
Target Power: 0 kW	-0.01	-0.02	-0.01	-0.02	-0.03	-0.02	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Target Power: 2.25 kW	2.40	2.40	2.41	2.36	2.35	2.36	2.35	2.35	2.36	2.22	2.22	2.22	2.23	2.22	2.23
Target Power: 0.75 kW	0.76	0.76	0.77	0.75	0.75	0.77	0.75	0.75	0.76	0.69	0.68	0.69	0.70	0.69	0.71
Target Power: 2.75 kW	2.71	2.60	2.77	2.63	2.44	2.73	2.69	2.60	2.76	2.73	2.72	2.73	2.77	2.76	2.77
Frequency [Hz]	59.8	59.6	59.8	59.8	59.8	59.8	59.8	59.7	59.9	59.8	59.8	59.8	59.8	59.7	59.8
Oil Temp [F]	187.6	161.9	220.6	198.3	157.2	238.2	199.6	164.2	236.2	202.6	169.0	233.9	200.8	151.0	229.9
Fuel Temp [F]	96.8	70.1	115.2	105.5	74.1	136.2	107.7	74.8	134.7	112.8	80.1	131.9	109.2	81.6	135.6
Ambient Temp [F]	84.9	53.7	113.7	89.4	66.9	125.0	86.3	66.1	114.1	82.5	73.5	101.3	80.5	60.0	105.2
Rel. Humidity [%]	34.4%	13.9%	72.6%	27.2%	4.7%	82.0%	33.6%	6.0%	82.7%	64.4%	33.7%	84.1%	44.7%	4.9%	91.9%
Barometer [psi]	14.3	14.2	14.3	14.3	14.2	14.4	14.3	14.1	14.4	14.2	14.1	14.3	14.2	14.0	14.4
NOTES															

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 1.5 kW	1.62	1.62	1.62	1.49	1.49	1.50	1.45	1.29	1.51	1.49	1.49	1.49	1.65	1.59	1.83
Target Power: 0 kW	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	0.03	0.03	0.03
Target Power: 2.25 kW	2.23	2.22	2.23	2.27	2.27	2.27	2.23	2.23	2.23	2.29	2.13	2.30	2.46	2.44	2.48
Target Power: 0.75 kW	0.70	0.70	0.71	0.72	0.65	0.73	0.71	0.71	0.72	0.86	0.84	0.95	0.83	0.81	0.82
Target Power: 2.75 kW	2.78	2.77	2.78	2.73	2.69	2.74	2.73	2.72	2.73	2.83	2.62	3.10	2.72	2.58	3.21
Frequency [Hz]	59.8	59.7	59.8	59.7	53.7	59.8	59.7	59.7	59.8	59.7	59.6	60.1	59.6	59.6	59.7
Oil Temp [F]	190.0	154.7	229.6	187.5	117.0	219.6	230.0	184.4	280.7	224.5	153.3	283.5	204.0	142.9	227.7
Fuel Temp [F]	95.9	65.8	127.0	93.5	27.2	123.6	128.5	103.6	154.2	125.7	83.0	165.8	109.2	86.4	126.1
Ambient Temp [F]	72.4	52.1	95.1	80.2	65.4	97.5	80.2	70.2	95.5	89.1	77.5	105.0	88.5	75.9	103.6
Rel. Humidity [%]	40.8%	12.4%	84.6%	64.7%	33.8%	89.0%	65.8%	24.5%	85.9%	53.5%	23.1%	82.9%	54.0%	24.6%	82.7%
Barometer [psi]	14.4	14.3	14.5	14.2	14.1	14.3	14.2	14.1	14.3	14.2	14.1	14.4	14.3	14.2	14.4
NOTES										Exhaust bolt, head nut, head gasket failures					

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 1.5 kW	1.51	1.19	1.66	1.57	1.54	1.70	1.60	1.58	1.62	1.67	1.57	1.81
Target Power: 0 kW	0.03	0.03	0.04	0.03	0.03	0.03	na	na	na	na	na	na
Target Power: 2.25 kW	2.31	2.31	2.32	2.39	2.38	2.39	2.46	2.45	2.49	na	na	na
Target Power: 0.75 kW	0.77	0.77	0.78	0.77	0.75	0.86	0.81	0.78	0.82	na	na	na
Target Power: 2.75 kW	2.68	2.66	2.76	na	na	na	2.48	2.14	3.16	na	na	na
Frequency [Hz]	59.6	59.6	59.6	59.6	59.5	59.6	59.6	59.2	59.6	59.6	59.5	59.6
Oil Temp [F]	207.3	172.5	240.7	196.3	156.2	225.1	211.7	100.0	250.7	236.0	184.5	244.8
Fuel Temp [F]	114.3	93.0	132.6	107.0	83.9	127.8	114.6	84.8	132.1	124.2	98.9	133.6
Ambient Temp [F]	94.0	77.5	130.8	98.6	68.4	133.1	106.2	81.5	132.2	114.8	107.2	122.4
Rel. Humidity [%]	40.4%	12.5%	80.1%	17.2%	4.3%	54.8%	25.8%	7.8%	56.4%	18.7%	13.7%	27.0%
Barometer [psi]	14.3	14.2	14.3	14.3	14.3	14.4	14.3	14.2	14.4	14.3	14.3	14.3
NOTES				missed 100% load step						intake side pushrod, head gasket failure 1306 test hours EOT		

Model No. MEP 831A – 3kW

Serial No. FZA17060

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 1.5 kW	1.66	1.66	1.67	1.65	1.64	1.70	1.65	1.64	1.92	1.62	1.62	1.65	1.64	1.63	1.68
Target Power: 0 kW	0.12	0.12	0.12	0.11	0.10	0.12	0.12	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Target Power: 2.25 kW	2.50	2.49	2.51	2.47	2.46	2.49	2.45	2.45	2.46	2.37	2.37	2.38	2.37	2.36	2.37
Target Power: 0.75 kW	0.89	0.88	0.90	0.88	0.88	0.89	0.88	0.88	0.88	0.86	0.85	0.87	0.86	0.85	0.87
Target Power: 2.75 kW	2.84	2.72	2.91	2.72	2.70	2.82	2.83	2.50	2.89	2.84	2.84	2.85	2.88	2.86	2.89
Frequency [Hz]	60.0	59.7	60.0	60.0	59.9	60.0	60.0	59.6	60.0	60.0	60.0	60.0	60.0	59.9	60.0
Oil Temp [F]	202.1	154.4	241.4	202.6	164.5	240.3	202.3	167.5	240.4	208.2	175.1	234.6	208.7	165.6	239.0
Fuel Temp [F]	108.0	68.5	131.1	107.7	73.2	138.6	108.9	74.4	136.2	113.2	79.9	132.5	111.4	82.2	135.1
Ambient Temp [F]	84.9	53.7	113.7	89.4	66.9	125.0	86.3	66.1	114.1	82.5	73.5	101.3	80.5	60.0	105.2
Rel. Humidity [%]	34.6%	13.9%	72.6%	27.2%	4.7%	82.0%	33.6%	6.0%	82.7%	64.5%	33.7%	84.1%	44.7%	4.9%	91.9%
Barometer [psi]	14.3	14.2	14.3	14.3	14.2	14.4	14.3	14.1	14.4	14.2	14.1	14.3	14.2	14.0	14.4
NOTES															

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 1.5 kW	1.70	1.69	1.71	1.63	1.62	1.66	1.62	1.62	1.62	1.63	1.62	1.67	1.62	1.61	1.63
Target Power: 0 kW	0.11	0.10	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.12	0.12	0.13
Target Power: 2.25 kW	2.45	2.45	2.45	2.41	2.41	2.42	2.40	2.39	2.40	2.44	2.43	2.44	2.39	2.38	2.40
Target Power: 0.75 kW	0.87	0.86	0.88	0.86	0.78	0.87	0.86	0.86	0.87	0.88	0.87	0.88	0.86	0.85	0.86
Target Power: 2.75 kW	2.88	2.86	2.93	2.86	2.81	2.88	2.88	2.88	2.89	2.89	2.88	2.90	2.85	2.79	2.94
Frequency [Hz]	60.0	59.9	60.0	59.6	54.4	60.0	60.0	60.0	60.0	60.0	59.9	60.0	60.0	59.9	60.0
Oil Temp [F]	195.3	167.9	226.6	194.4	126.1	229.9	208.4	185.9	231.5	214.2	161.1	245.2	212.1	170.4	243.0
Fuel Temp [F]	99.6	65.0	126.5	94.0	30.3	125.2	112.3	98.2	126.2	118.4	81.3	137.0	115.2	84.0	134.9
Ambient Temp [F]	72.4	52.1	95.1	80.1	65.4	97.5	80.4	70.2	95.5	87.3	75.0	104.0	85.5	71.1	100.9
Rel. Humidity [%]	40.8%	12.4%	84.6%	64.8%	33.8%	89.0%	65.7%	24.5%	85.9%	53.3%	21.4%	82.8%	51.2%	19.4%	87.3%
Barometer [psi]	14.4	14.3	14.5	14.2	14.1	14.5	14.2	14.1	14.3	14.2	14.1	14.3	14.3	14.3	14.4
NOTES															

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 1.5 kW	1.64	1.63	1.65	1.66	1.66	1.67	1.62	1.62	1.70	1.64	1.63	1.64	1.70	1.69	1.71
Target Power: 0 kW	0.13	0.12	0.13	0.12	0.12	0.13	0.13	0.12	0.13	0.13	0.12	0.13	0.13	0.12	0.13
Target Power: 2.25 kW	2.39	2.39	2.40	2.42	2.41	2.43	2.43	2.42	2.44	2.44	2.42	2.45	2.55	2.54	2.55
Target Power: 0.75 kW	0.87	0.87	0.88	0.87	0.87	0.88	0.87	0.87	0.88	0.88	0.87	0.88	na	na	na
Target Power: 2.75 kW	2.90	2.89	2.91	2.83	2.66	2.87	2.68	2.67	2.69	2.92	2.67	2.96	2.93	2.92	2.94
Frequency [Hz]	59.9	59.9	60.0	59.9	59.9	60.0	59.9	59.9	60.2	59.9	59.9	60.0	59.9	59.9	59.9
Oil Temp [F]	215.8	149.8	245.0	215.8	162.2	244.7	210.4	142.2	236.3	214.3	176.4	239.7	214.1	173.0	238.7
Fuel Temp [F]	117.4	85.7	136.2	117.9	82.5	138.5	115.8	85.8	135.4	118.8	87.0	133.3	118.2	82.8	135.7
Ambient Temp [F]	88.1	75.1	104.3	89.6	77.0	108.9	85.5	70.1	105.0	89.0	76.9	104.7	89.0	76.6	103.0
Rel. Humidity [%]	46.5%	19.9%	82.1%	52.1%	19.0%	81.5%	59.8%	28.8%	90.5%	53.5%	27.1%	84.1%	50.7%	22.0%	80.2%
Barometer [psi]	14.3	14.2	14.3	14.2	14.2	14.3	14.2	14.1	14.3	14.3	14.2	14.3	14.3	14.3	14.3
NOTES															

Model No. MEP 803A – 10kW

Serial No. FZ35046

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 5 kW	5.2	2.2	5.3	5.2	4.2	5.3	5.2	4.8	5.3	5.3	5.2	5.3	5.3	5.2	5.3
Target Power: 0 kW	0.1	0.1	0.6	0.1	0.1	0.1	na	na	na	0.1	0.1	0.1	0.1	0.1	0.1
Target Power: 7.5 kW	8.2	6.3	8.3	8.2	7.7	8.3	na	na	na	8.3	8.2	8.4	8.3	8.3	8.3
Target Power: 2.5 kW	3.2	3.1	3.2	3.2	3.1	3.1	3.2	2.4	3.2	3.2	3.1	3.2	3.2	3.2	3.2
Target Power: 10 kW	10.2	10.2	10.3	9.5	0.1	10.3	10.2	10.2	10.3	10.2	10.2	10.3	10.3	10.2	10.3
Frequency [Hz]	60.2	59.4	61.3	60.1	59.3	61.5	60.0	59.7	60.8	59.9	59.8	60.7	60.1	59.7	61.2
Coolant Temp [F]	190.6	184.5	196.8	189.0	177.6	194.8	189.8	175.0	195.6	190.0	184.1	193.6	189.2	149.3	194.5
Oil Temp [F]	173.3	109.5	187.5	164.2	116.4	183.4	168.5	86.7	191.0	168.4	97.5	185.8	166.3	61.4	184.5
Fuel Temp [F]	85.3	53.2	101.6	76.2	55.4	94.6	84.2	63.2	102.5	85.0	48.2	98.2	81.3	52.1	94.2
Ambient Temp [F]	84.3	50.0	108.1	79.2	46.2	103.4	84.6	48.7	107.6	84.4	48.5	112.3	85.3	48.1	99.7
Rel. Humidity [%]	32.5%	5.0%	76.0%	18.1%	6.1%	39.1%	28.5%	11.4%	82.3%	38.1%	19.3%	89.2%	22.1%	6.0%	58.2%
Barometer [psi]	14.3	14.2	14.5	14.4	14.4	14.6	14.3	14.2	14.4	14.3	14.1	14.5	14.3	14.2	14.4
NOTES	Data Recorder Malfunction			Load Bank Failure at 180 hours - replacement			Missed 0% and 75% load step changes								

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 5 kW	5.3	5.3	5.3	5.3	5.3	6.1	5.2	5.2	5.3	5.2	5.2	5.3	5.2	5.2	5.3
Target Power: 0 kW	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.3
Target Power: 7.5 kW	8.3	7.9	8.3	8.3	7.5	8.3	8.2	8.2	8.4	8.4	8.3	8.4	8.3	8.2	8.4
Target Power: 2.5 kW	3.1	3.1	3.1	3.1	3.1	3.8	3.2	3.1	3.2	3.1	3.1	3.1	3.2	3.1	3.2
Target Power: 10 kW	10.3	10.3	10.3	10.3	10.2	10.4	10.2	10.2	10.3	10.4	10.3	10.4	10.3	10.2	10.4
Frequency [Hz]	60.2	59.5	61.0	60.1	59.5	61.0	60.1	59.5	60.9	60.1	59.9	61.2	60.0	58.5	60.4
Coolant Temp [F]	187.9	153.6	192.0	188.3	98.2	193.7	188.4	136.8	193.5	186.7	181.2	192.1	187.2	180.7	192.7
Oil Temp [F]	156.2	62.2	170.3	161.3	57.2	184.9	166.0	60.2	183.5	149.8	95.4	181.6	156.3	88.4	180.4
Fuel Temp [F]	67.3	54.8	75.6	72.9	50.3	100.5	75.8	54.0	91.6	58.8	41.5	100.7	67.6	46.4	93.8
Ambient Temp [F]	61.7	35.3	82.9	71.2	42.2	100.5	76.7	48.0	99.7	43.7	21.4	98.0	57.0	27.2	94.2
Rel. Humidity [%]	25.2%	10.2%	74.1%	35.5%	13.5%	62.9%	18.9%	6.8%	46.1%	42.0%	20.8%	76.6%	31.6%	4.8%	84.5%
Barometer [psi]	14.5	14.3	14.7	14.3	14.2	14.4	14.4	14.3	14.5	14.4	14.2	14.6	14.4	14.3	14.5
NOTES													@ 1000 Hours, New HOYT meters installed for add-on testing		

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 5 kW	5.1	3.2	5.3	5.0	5.0	5.1	5.1	5.0	5.1	5.1	5.1	5.3	5.1	5.1	5.9
Target Power: 0 kW	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Target Power: 7.5 kW	7.9	7.9	8.0	7.9	7.9	7.9	8.0	7.9	8.0	8.0	7.9	8.0	8.0	8.0	8.0
Target Power: 2.5 kW	3.0	3.0	3.0	3.0	3.0	3.0	na	na	na	3.0	3.0	3.2	3.1	3.0	3.0
Target Power: 10 kW	9.8	9.8	9.9	9.8	9.7	9.9	9.9	9.8	9.9	9.9	9.9	10.0	9.9	9.1	9.9
Frequency [Hz]	59.7	59.3	59.9	59.8	59.4	59.9	59.8	59.6	60.0	59.8	59.5	60.0	59.7	59.3	60.1
Coolant Temp [F]	189.7	176.8	195.6	189.7	182.5	192.9	189.6	181.0	194.4	188.7	169.5	196.2	189.8	154.0	216.4
Oil Temp [F]	174.0	82.5	195.3	175.2	149.8	190.6	170.4	147.6	186.8	166.7	83.1	188.1	169.7	92.7	216.6
Fuel Temp [F]	92.5	57.1	108.4	93.7	79.4	105.2	86.2	71.6	98.9	81.2	58.3	102.7	83.7	67.0	104.0
Ambient Temp [F]	84.9	55.7	108.6	89.1	59.8	107.5	77.3	60.6	97.7	68.7	46.5	99.0	70.0	53.8	86.9
Rel. Humidity [%]	42.6%	15.6%	90.8%	30.9%	5.1%	68.8%	30.6%	7.7%	83.9%	41.0%	8.6%	88.0%	61.5%	28.5%	94.3%
Barometer [psi]	14.3	14.3	14.4	14.3	14.2	14.4	14.4	14.3	14.5	14.3	14.2	14.5	14.4	14.3	14.4
NOTES							Data Recorder Malfunction								

Model No. MEP 803A – 10kW

Serial No. FZ35055

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 5 kW	5.2	2.7	5.3	5.2	4.2	5.7	5.2	5.2	5.3	5.2	5.2	5.3	5.2	5.2	6.7
Target Power: 0 kW	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Target Power: 7.5 kW	8.3	8.2	8.3	8.3	7.3	8.3	8.3	8.2	8.3	8.3	8.2	8.3	8.2	8.2	8.3
Target Power: 2.5 kW	3.1	3.1	3.1	3.2	3.0	3.1	3.1	3.0	3.9	3.0	3.0	3.1	3.0	3.0	3.0
Target Power: 10 kW	10.4	10.3	10.5	10.3	10.2	10.4	10.3	10.2	10.4	10.2	10.2	10.3	10.3	10.2	10.4
Frequency [Hz]	60.2	59.5	61.5	59.9	58.7	60.6	59.8	58.0	60.2	60.0	59.7	60.8	59.9	58.8	60.8
Coolant Temp [F]	191.3	185.7	195.3	189.8	181.1	192.6	189.8	181.1	196.9	190.0	175.7	193.8	189.2	161.3	191.6
Oil Temp [F]	179.7	108.9	195.6	167.6	123.3	188.1	166.7	88.4	198.7	172.7	81.7	193.8	169.3	61.2	185.1
Fuel Temp [F]	82.6	51.8	100.6	69.6	48.8	89.8	69.4	46.3	96.3	78.5	58.9	95.0	76.4	44.8	87.6
Ambient Temp [F]	84.2	50.0	108.1	79.6	46.2	103.4	77.8	47.8	104.6	86.2	48.7	112.3	80.9	48.1	99.8
Rel. Humidity [%]	32.4%	5.0%	76.0%	20.5%	6.4%	52.9%	23.0%	6.1%	56.8%	30.3%	14.0%	82.3%	37.8%	21.2%	89.2%
Barometer [psi]	14.3	14.2	14.5	14.4	14.3	14.6	14.4	14.2	14.5	14.3	14.2	14.4	14.3	14.1	14.5
NOTES	Data recorder malfunction														

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 5 kW	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.1	5.2	5.2	5.2	5.3	5.2	5.1	5.3
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 7.5 kW	8.3	8.2	8.4	8.3	8.3	8.3	8.2	8.2	8.3	8.3	8.2	8.4	8.3	8.3	8.3
Target Power: 2.5 kW	3.1	3.0	3.1	3.0	2.9	3.1	3.1	3.0	3.1	3.0	3.0	3.1	3.0	3.0	3.1
Target Power: 10 kW	10.3	10.3	10.4	10.3	10.3	10.3	10.3	10.2	10.4	10.2	10.1	10.3	10.3	10.2	10.5
Frequency [Hz]	59.8	58.4	60.0	60.0	59.4	60.8	59.7	59.4	60.0	59.8	59.3	60.1	59.6	58.9	59.9
Coolant Temp [F]	188.7	157.5	191.3	188.7	150.4	190.9	188.9	185.6	193.5	189.0	172.7	195.8	188.3	172.0	191.0
Oil Temp [F]	166.1	65.1	182.5	156.2	67.1	179.2	164.2	116.3	188.4	165.4	96.4	199.2	144.8	74.2	182.9
Fuel Temp [F]	72.5	51.5	86.8	61.6	49.0	73.3	70.5	42.9	96.1	72.7	47.4	101.3	51.2	34.8	82.8
Ambient Temp [F]	78.5	35.3	99.7	66.4	41.6	87.5	71.1	42.2	100.5	75.7	37.4	98.0	43.7	21.4	94.2
Rel. Humidity [%]	26.5%	6.0%	81.9%	24.5%	10.2%	91.2%	31.5%	8.3%	62.9%	26.8%	6.8%	76.6%	33.0%	4.8%	58.4%
Barometer [psi]	14.4	14.2	14.6	14.5	14.2	14.7	14.3	14.2	14.4	14.4	14.2	14.5	14.5	14.4	14.6
NOTES															

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 5 kW	5.2	5.2	5.3	5.2	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.3	5.2	5.2	5.2
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 7.5 kW	8.3	8.3	8.4	8.2	8.2	8.3	8.2	8.2	8.3	na	na	na	8.3	8.2	8.4
Target Power: 2.5 kW	3.0	3.0	3.1	3.0	3.0	3.0	3.0	3.0	3.1	3.0	3.0	3.0	3.1	3.0	3.1
Target Power: 10 kW	10.2	10.2	10.3	10.2	10.2	10.4	10.2	10.2	10.4	10.2	10.2	10.4	10.2	10.2	10.3
Frequency [Hz]	59.9	58.8	60.6	59.8	59.4	59.9	59.9	59.6	60.1	59.9	59.6	60.1	59.8	59.2	60.0
Coolant Temp [F]	189.0	169.8	194.9	189.5	182.5	196.4	189.2	178.8	195.9	189.1	179.4	197.4	189.2	167.6	194.9
Oil Temp [F]	161.3	80.6	196.7	177.7	107.8	200.5	172.5	94.8	194.6	172.7	95.9	197.3	171.0	96.1	193.6
Fuel Temp [F]	68.6	42.3	101.3	89.9	72.2	104.9	88.3	68.3	103.2	82.9	59.4	98.8	79.8	59.2	101.8
Ambient Temp [F]	60.7	27.2	104.9	86.3	59.8	108.6	85.4	60.4	105.4	74.3	51.9	97.7	67.8	46.5	99.0
Rel. Humidity [%]	36.2%	8.9%	90.8%	40.6%	13.8%	75.7%	29.1%	5.1%	68.8%	46.2%	7.9%	88.0%	36.7%	8.6%	90.1%
Barometer [psi]	14.4	14.3	14.5	14.3	14.2	14.4	14.3	14.2	14.5	14.3	14.2	14.5	14.4	14.2	14.5
NOTES										Data recorder malfunction					

Model No. MEP 804A – 15kW

Serial No. FZ60344

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	8.1	7.2	8.1	7.6	7.6	7.7	8.1	8.0	8.2	7.7	7.6	7.8	7.5	6.1	7.5
Target Power: 0 kW	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Target Power: 11.25 kW	12.4	11.5	12.7	11.7	10.0	11.7	12.1	11.7	12.2	11.5	11.2	11.5	11.4	11.3	11.5
Target Power: 3.75 kW	4.1	4.0	4.2	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.6	3.6	3.6
Target Power: 15 kW	15.8	15.2	16.6	15.8	15.4	15.9	15.3	13.4	15.4	14.9	14.9	15.0	15.2	15.1	15.2
Frequency [Hz]	59.8	59.4	60.0	59.8	59.5	60.7	59.6	59.5	60.0	59.7	59.5	60.0	59.8	59.4	60.0
Coolant Temp [F]	181.2	152.4	208.0	178.8	156.3	207.9	183.7	165.3	218.5	181.4	167.0	206.7	170.1	165.5	215.8
Oil Temp [F]	138.1	87.3	161.6	139.3	79.8	162.6	145.1	86.3	169.7	137.0	105.8	155.5	125.5	92.3	159.5
Fuel Temp [F]	96.0	66.3	119.4	98.5	75.2	120.3	108.2	75.3	126.3	104.9	76.8	120.0	98.7	79.9	121.2
Ambient Temp [F]	87.1	53.7	116.7	89.4	66.9	125.0	86.3	66.2	114.1	82.5	73.5	101.3	80.2	60.0	105.2
Rel. Humidity [%]	32.9%	11.3%	72.6%	27.2%	4.7%	85.5%	33.3%	6.0%	82.7%	64.4%	33.7%	84.1%	44.5%	4.9%	91.9%
Barometer [psi]	14.2	14.2	14.3	14.3	14.2	14.4	14.3	14.1	14.4	14.2	14.1	14.3	14.2	14.0	14.4
NOTES															

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.5	7.5	7.5	7.6	7.5	7.7	7.5	7.2	7.6	7.6	7.6	7.6	7.5	7.5	7.5
Target Power: 0 kW	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Target Power: 11.25 kW	11.4	11.3	11.4	11.9	11.9	11.9	11.3	11.3	11.4	11.3	11.3	11.4	11.5	11.4	11.6
Target Power: 3.75 kW	3.7	3.7	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.7	3.7	3.7
Target Power: 15 kW	15.0	15.0	15.1	15.1	14.9	15.3	14.9	14.8	14.9	15.1	15.1	16.0	15.3	14.9	15.4
Frequency [Hz]	59.7	59.5	59.9	59.6	59.5	59.8	59.6	59.5	59.8	59.5	59.4	59.7	59.5	59.4	59.6
Coolant Temp [F]	173.8	164.4	216.9	174.6	166.8	198.8	169.9	167.0	178.1	171.5	167.1	184.7	171.1	166.1	184.0
Oil Temp [F]	130.6	91.8	149.8	134.6	90.6	150.0	122.8	84.9	137.1	130.3	88.9	145.3	129.0	99.1	144.6
Fuel Temp [F]	90.5	65.4	116.4	100.7	79.7	113.6	94.2	74.4	107.4	102.4	80.2	116.4	100.6	83.3	115.3
Ambient Temp [F]	73.4	52.1	95.1	80.1	65.4	97.5	79.7	63.5	95.5	87.3	75.0	104.0	85.5	71.1	100.9
Rel. Humidity [%]	37.8%	12.4%	84.6%	64.8%	33.8%	89.0%	59.8%	20.6%	85.9%	53.3%	21.4%	82.8%	51.2%	19.4%	87.4%
Barometer [psi]	14.4	14.3	14.5	14.2	14.0	14.5	14.2	14.1	14.3	14.2	14.1	14.3	14.3	14.3	14.4
NOTES															

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.6	7.6	7.6	7.4	7.4	7.5	7.9	7.9	8.0	8.0	7.2	8.0	8.0	7.7	8.1
Target Power: 0 kW	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Target Power: 11.25 kW	11.2	8.7	11.3	11.6	7.1	12.0	12.1	12.1	12.1	12.2	11.9	12.3	12.2	12.2	12.2
Target Power: 3.75 kW	3.7	3.7	3.7	3.8	3.7	3.8	3.9	3.9	3.9	3.9	3.9	3.9	4.1	4.1	4.1
Target Power: 15 kW	15.0	14.9	15.1	15.7	15.3	15.8	16.1	16.1	16.2	15.7	15.7	16.3	15.7	15.7	16.1
Frequency [Hz]	59.5	59.1	60.0	59.7	59.4	60.1	59.6	59.5	59.7	59.6	59.5	59.7	59.6	59.6	59.9
Coolant Temp [F]	173.0	166.8	189.4	172.6	160.9	191.7	171.5	167.6	183.1	178.2	167.0	198.6	178.6	163.2	199.7
Oil Temp [F]	133.5	110.2	149.3	135.0	89.5	154.6	130.3	103.7	142.6	144.5	113.1	162.3	146.8	86.2	161.5
Fuel Temp [F]	104.5	85.8	119.3	105.6	82.4	119.8	101.4	88.2	115.3	110.1	86.4	123.1	107.2	84.2	121.7
Ambient Temp [F]	88.1	75.1	104.3	90.8	77.5	108.9	85.1	70.1	105.0	89.0	76.9	104.7	89.0	76.6	103.0
Rel. Humidity [%]	46.5%	19.9%	82.1%	50.1%	20.1%	81.5%	60.8%	28.8%	90.5%	53.5%	27.1%	84.1%	51.1%	22.0%	80.3%
Barometer [psi]	14.3	14.2	14.3	14.2	14.2	14.3	14.2	14.2	14.3	14.3	14.2	14.3	14.3	14.3	14.3
NOTES															

Model No. MEP 804A – 15kW

Serial No. FZ60357

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.8	7.8	7.8	7.6	7.6	7.6	7.6	7.4	7.7	7.6	7.6	7.6	7.5	7.5	7.9
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 11.25 kW	11.8	11.8	11.9	11.4	11.4	11.5	11.6	11.6	11.8	11.3	11.2	11.5	11.2	11.2	11.3
Target Power: 3.75 kW	3.8	3.7	3.8	3.8	3.8	3.8	3.7	3.7	3.7	3.8	3.8	3.8	3.7	3.6	3.9
Target Power: 15 kW	15.1	10.1	15.3	15.1	15.0	15.1	15.2	15.1	15.4	16.1	16.0	16.1	15.1	15.1	15.2
Frequency [Hz]	60.0	59.3	60.1	59.9	59.5	60.1	59.7	59.6	59.8	59.7	59.6	60.0	59.8	59.0	60.0
Coolant Temp [F]	173.8	165.3	200.8	175.1	164.4	203.8	176.0	164.4	199.3	180.7	166.6	213.5	182.4	166.2	212.3
Oil Temp [F]	131.7	86.0	156.8	135.0	90.0	158.8	137.8	86.6	154.9	141.3	106.4	161.0	142.1	83.3	169.4
Fuel Temp [F]	93.2	65.5	117.5	96.8	74.4	119.1	99.1	75.2	113.5	101.8	79.9	114.8	101.7	79.0	125.9
Ambient Temp [F]	86.0	53.7	116.8	89.4	66.9	125.0	86.4	66.2	114.1	82.5	73.5	101.3	80.4	60.0	105.2
Rel. Humidity [%]	35.0%	11.3%	72.6%	27.2%	4.7%	82.0%	33.7%	6.0%	82.7%	64.5%	33.7%	84.1%	44.8%	4.9%	91.9%
Barometer [psi]	14.3	14.2	14.3	14.3	14.2	14.4	14.3	14.1	14.4	14.2	14.1	14.3	14.2	14.0	14.4
NOTES															

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.8	7.5	7.9	7.6	7.6	7.6	7.6	7.6	7.7	7.6	7.6	7.7	7.5	7.5	7.5
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 11.25 kW	11.2	11.2	11.4	11.6	11.6	11.6	11.3	11.3	11.4	11.3	11.3	11.3	11.7	11.7	11.7
Target Power: 3.75 kW	3.8	3.8	3.8	3.7	3.7	3.8	3.7	3.7	3.8	3.8	3.7	3.8	3.8	3.8	3.8
Target Power: 15 kW	15.1	15.0	15.1	15.1	15.1	15.2	15.5	15.5	15.5	15.2	15.1	15.2	15.0	15.0	15.1
Frequency [Hz]	59.8	59.7	60.0	59.6	59.5	59.9	59.6	59.5	59.7	59.5	59.5	59.6	59.5	59.5	59.6
Coolant Temp [F]	178.0	164.5	211.3	170.0	165.9	188.8	168.5	166.5	174.6	169.8	166.7	181.1	169.7	166.9	179.9
Oil Temp [F]	134.6	74.7	157.4	131.6	92.0	147.5	124.4	100.3	137.0	129.9	90.6	143.8	129.7	102.7	143.2
Fuel Temp [F]	91.5	65.4	110.8	96.5	79.7	107.9	93.2	74.3	104.4	99.5	80.5	112.7	98.3	84.1	111.4
Ambient Temp [F]	72.3	52.1	95.1	80.1	65.4	97.5	79.7	63.5	95.5	87.3	75.0	104.0	85.5	71.1	100.9
Rel. Humidity [%]	40.8%	12.4%	84.6%	64.8%	33.8%	89.0%	59.9%	20.6%	85.9%	53.3%	21.4%	82.8%	51.2%	19.4%	87.3%
Barometer [psi]	14.4	14.3	14.5	14.2	14.0	14.5	14.2	14.1	14.3	14.2	14.1	14.3	14.3	14.3	14.4
NOTES															

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.4	7.4	7.4	7.5	7.4	7.5	7.4	7.4	7.6	7.4	0.0	8.2	7.6	7.6	7.7
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 11.25 kW	11.3	11.3	11.4	11.3	11.3	11.6	11.3	11.3	11.4	11.5	11.3	11.7	11.6	11.6	11.6
Target Power: 3.75 kW	3.7	3.7	3.7	3.7	3.6	3.7	3.7	3.6	3.7	3.8	3.7	3.8	3.7	3.6	3.8
Target Power: 15 kW	15.1	15.1	15.2	15.1	15.0	15.1	15.1	15.1	15.1	15.5	15.5	15.5	15.4	15.4	15.6
Frequency [Hz]	59.6	59.4	59.8	59.6	59.4	59.8	59.5	59.4	59.6	59.4	59.3	59.5	59.4	59.1	59.5
Coolant Temp [F]	171.8	166.6	191.6	175.3	164.9	203.5	170.6	159.7	180.3	172.2	166.8	193.7	178.1	163.9	200.2
Oil Temp [F]	136.5	113.5	154.8	140.4	93.6	161.5	133.0	92.7	152.0	136.2	112.5	154.9	143.0	88.6	157.4
Fuel Temp [F]	104.2	85.7	122.3	105.8	82.4	124.2	101.0	84.2	116.1	104.4	86.7	119.9	108.3	84.7	121.7
Ambient Temp [F]	88.1	75.1	104.3	89.6	77.0	108.9	85.5	70.1	105.0	89.0	76.9	104.7	89.0	76.6	103.0
Rel. Humidity [%]	46.5%	19.9%	82.1%	52.1%	19.0%	81.5%	59.9%	28.8%	90.5%	53.5%	27.1%	84.1%	51.1%	22.0%	80.4%
Barometer [psi]	14.3	14.2	14.3	14.2	14.2	14.3	14.2	14.1	14.3	14.3	14.2	14.3	14.3	14.3	14.3
NOTES															

Model No. MEP 804B – 15kW

Serial No. FZ61920

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.5	5.4	8.0	7.9	7.4	8.3	7.8	7.8	7.8	7.7	7.7	7.8	7.6	7.5	7.8
Target Power: 0 kW	-0.4	-0.5	-0.3	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 11.25 kW	13.3	-0.1	14.4	12.5	11.8	13.0	11.7	11.7	11.8	11.7	11.5	11.8	11.6	11.4	12.1
Target Power: 3.75 kW	4.1	3.0	5.1	4.8	3.8	8.6	3.8	3.7	3.8	3.8	3.7	3.8	3.9	3.7	3.9
Target Power: 15 kW	15.6	0.9	16.0	15.7	13.2	16.0	15.7	15.5	15.8	15.6	15.3	15.8	15.9	15.6	16.4
Frequency [Hz]	59.7	58.6	59.8	59.6	59.4	59.8	59.5	59.3	59.7	59.5	59.3	59.7	59.4	59.3	59.6
Coolant Temp [F]	162.7	155.6	166.3	162.9	147.9	168.7	161.3	150.1	168.2	161.4	157.5	164.9	162.0	156.1	167.2
Oil Temp [F]	192.1	132.8	205.0	193.0	129.8	207.0	187.8	156.6	200.1	186.7	145.8	199.7	189.3	148.6	204.8
Fuel Temp [F]	98.1	64.0	113.0	90.2	61.8	114.3	85.0	51.2	101.0	83.0	48.4	99.7	94.5	59.5	115.1
Ambient Temp [F]	87.9	70.1	109.6	83.2	52.3	105.7	79.6	46.0	103.4	74.7	47.4	95.7	84.1	48.7	107.6
Rel. Humidity [%]	38.8%	18.2%	65.8%	21.7%	7.6%	55.0%	17.3%	5.0%	39.4%	23.6%	6.1%	56.8%	28.5%	11.4%	82.3%
Barometer [psi]	14.3	14.2	14.4	14.3	14.1	14.5	14.4	14.1	14.6	14.4	14.3	14.5	14.3	14.2	14.4
NOTES				@180 hours watt meter failed			@209 hours watt meter repaired								

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.9	7.9	8.0	7.8	7.7	7.9	7.6	7.2	7.7	7.6	6.9	7.8	7.6	7.4	7.7
Target Power: 0 kW	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Target Power: 11.25 kW	11.7	11.5	12.2	11.5	11.0	12.0	11.5	11.4	11.5	11.6	11.5	11.7	11.5	11.2	11.6
Target Power: 3.75 kW	3.9	3.8	4.5	3.8	3.7	3.8	3.7	3.7	3.7	3.8	3.7	3.8	3.7	3.6	3.8
Target Power: 15 kW	15.7	15.3	15.8	15.2	14.7	15.5	15.4	13.4	15.7	15.5	15.2	15.6	15.4	7.9	15.7
Frequency [Hz]	59.3	59.3	59.4	59.5	59.3	59.9	59.4	59.2	59.6	59.5	58.9	59.6	59.6	59.5	59.6
Coolant Temp [F]	162.0	156.3	166.1	161.9	157.8	166.7	161.5	156.1	163.4	161.5	126.2	166.3	161.3	145.2	165.0
Oil Temp [F]	191.7	162.1	209.0	192.8	144.4	205.3	188.6	134.3	198.7	191.4	105.0	205.3	189.8	136.4	200.2
Fuel Temp [F]	94.1	43.8	110.9	89.4	53.8	103.2	77.1	52.6	92.5	85.8	50.1	106.0	85.2	43.3	107.1
Ambient Temp [F]	84.4	48.5	112.3	85.2	48.1	99.7	61.4	35.4	89.2	72.1	42.2	100.5	67.7	22.6	98.0
Rel. Humidity [%]	38.1%	19.3%	89.2%	22.2%	6.0%	58.2%	24.9%	10.2%	75.2%	25.7%	8.3%	53.8%	31.6%	6.8%	76.6%
Barometer [psi]	14.3	14.1	14.5	14.3	14.3	14.4	14.5	14.2	14.7	14.3	14.2	14.4	14.4	14.2	14.6
NOTES							@ 794 Hrs electronic module A9 replaced due to blown transistor								

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.7	7.6	7.8	7.9	7.8	8.0	7.6	7.5	7.7	7.5	7.4	7.5	na	na	na
Target Power: 0 kW	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	na	na	na
Target Power: 11.25 kW	11.7	11.6	11.8	11.8	11.4	11.9	11.3	10.9	11.4	11.2	8.8	11.4	11.4	11.0	11.6
Target Power: 3.75 kW	3.8	3.6	3.8	3.8	3.6	3.9	3.7	3.7	3.7	3.8	3.6	3.8	3.7	3.6	3.8
Target Power: 15 kW	15.5	15.0	16.0	15.6	15.2	15.8	14.9	14.9	15.1	15.6	15.3	15.7	15.3	15.0	15.4
Frequency [Hz]	59.5	59.3	59.7	59.5	59.3	59.6	59.4	59.2	59.7	59.4	59.2	59.7	59.5	59.3	59.6
Coolant Temp [F]	161.8	157.3	165.0	161.8	149.2	168.3	161.9	158.7	165.4	161.7	157.3	165.1	162.3	157.8	166.5
Oil Temp [F]	189.4	136.2	205.5	191.6	150.3	211.4	193.8	160.6	204.4	193.5	149.8	206.4	194.5	162.5	208.3
Fuel Temp [F]	74.0	51.2	103.5	84.3	60.6	117.6	100.6	68.7	114.1	98.5	70.4	112.5	95.4	59.5	115.0
Ambient Temp [F]	51.7	22.1	94.2	66.7	27.6	106.0	87.2	59.8	108.6	83.6	60.4	105.4	72.3	51.9	99.0
Rel. Humidity [%]	34.3%	4.8%	84.5%	33.3%	8.9%	73.2%	38.6%	13.8%	75.7%	24.3%	5.1%	66.1%	55.3%	21.4%	88.0%
Barometer [psi]	14.4	14.3	14.6	14.4	14.3	14.5	14.3	14.2	14.4	14.3	14.2	14.5	14.2	14.1	14.4
NOTES													Data Recorder Malfunctioned		

Model No. MEP 804B – 15kW

Serial No. FZ61946

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.6	5.4	8.1	6.4	6.0	6.9	7.8	7.8	7.9	7.9	7.8	8.0	7.8	3.8	7.9
Target Power: 0 kW	0.5	0.3	0.5	0.0	-0.1	1.4	0.0	0.0	0.0	0.3	0.0	7.9	0.0	0.0	0.0
Target Power: 11.25 kW	12.6	0.4	16.4	12.8	5.7	13.5	12.3	11.9	12.5	12.1	10.3	12.2	11.9	11.9	12.1
Target Power: 3.75 kW	4.6	3.6	5.7	3.2	0.0	6.1	3.8	3.8	3.9	4.0	3.9	4.7	3.8	3.8	3.8
Target Power: 15 kW	15.1	9.8	15.6	15.3	5.0	17.9	15.7	13.9	16.0	16.1	14.2	16.3	15.8	15.7	15.9
Frequency [Hz]	59.7	58.7	59.8	59.7	59.5	59.8	59.7	59.6	59.9	59.6	59.5	59.9	59.6	59.4	59.8
Coolant Temp [F]	162.4	159.9	167.0	161.3	158.8	164.6	162.1	130.7	164.6	161.7	152.3	164.2	162.0	149.3	169.3
Oil Temp [F]	189.5	171.0	202.7	186.1	157.6	197.6	188.7	113.6	198.4	186.6	152.4	196.3	186.9	147.8	205.7
Fuel Temp [F]	98.9	66.7	112.8	88.2	61.9	104.8	97.6	70.1	111.4	87.1	48.7	104.6	89.0	48.0	115.4
Ambient Temp [F]	87.9	70.1	109.6	80.2	49.9	104.0	84.8	50.0	108.1	79.8	46.0	103.4	84.5	48.4	107.6
Rel. Humidity [%]	38.8%	18.2%	65.8%	24.9%	7.6%	55.7%	31.5%	5.0%	76.0%	20.9%	6.4%	52.8%	22.1%	6.1%	50.4%
Barometer [psi]	14.3	14.2	14.4	14.3	14.1	14.5	14.3	14.2	14.5	14.4	14.3	14.6	14.3	14.2	14.5
NOTES										@399 hours electronic module A9 replaced due to blown transistor					

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	8.1	7.2	8.3	7.9	7.8	7.9	7.7	7.6	7.8	7.7	7.7	7.8	7.7	7.7	7.7
Target Power: 0 kW	na	na	na	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 11.25 kW	12.2	11.9	13.6	12.0	10.3	12.1	11.4	11.4	11.7	11.8	11.7	11.9	11.7	11.6	11.9
Target Power: 3.75 kW	3.9	3.9	3.9	3.7	3.6	4.1	3.8	3.6	3.8	3.9	3.7	15.6	3.6	3.6	3.7
Target Power: 15 kW	16.0	14.2	16.7	15.4	15.0	17.0	15.8	15.7	15.8	15.5	15.2	15.7	15.5	15.1	15.7
Frequency [Hz]	59.6	59.4	59.8	59.5	59.2	59.8	59.7	59.5	59.8	59.7	59.6	59.9	59.7	59.5	59.8
Coolant Temp [F]	162.0	153.1	166.1	161.9	111.7	164.8	161.7	149.4	166.0	161.7	156.9	166.5	161.7	155.7	166.0
Oil Temp [F]	187.5	148.8	196.6	186.3	78.8	196.6	183.9	136.7	193.9	184.1	139.6	201.3	185.1	154.5	197.7
Fuel Temp [F]	92.7	44.4	111.9	90.3	52.1	107.2	82.5	51.2	99.9	78.2	51.7	109.1	83.0	52.6	99.1
Ambient Temp [F]	82.3	48.5	112.3	84.6	48.1	99.8	71.4	35.3	99.7	71.1	50.4	100.5	68.9	42.2	99.7
Rel. Humidity [%]	31.9%	14.9%	82.3%	37.8%	21.2%	89.2%	22.8%	6.0%	75.2%	26.2%	10.2%	78.0%	29.3%	8.3%	62.9%
Barometer [psi]	14.3	14.2	14.5	14.3	14.1	14.4	14.4	14.2	14.7	14.4	14.2	14.7	14.3	14.2	14.4
NOTES	Missed the 0% load step														

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 7.5 kW	7.6	7.5	7.7	7.5	7.5	7.6	7.9	7.9	8.0	7.8	7.6	7.8	7.9	7.8	7.9
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 11.25 kW	11.7	11.6	11.7	11.4	10.7	11.8	12.0	11.9	12.2	12.2	11.7	12.5	11.9	11.6	12.0
Target Power: 3.75 kW	3.7	3.6	4.7	3.8	3.8	3.9	3.8	3.7	3.9	3.8	3.8	3.9	3.8	3.7	3.9
Target Power: 15 kW	15.5	15.0	15.8	15.9	15.8	16.2	15.6	15.4	15.7	15.9	15.8	15.9	16.2	16.0	16.3
Frequency [Hz]	59.7	59.7	59.8	59.7	59.5	59.8	59.5	59.4	59.7	59.6	59.4	59.8	59.5	59.4	59.8
Coolant Temp [F]	161.7	150.0	165.3	161.6	157.3	166.1	161.9	143.8	167.9	162.3	159.2	165.5	162.3	158.0	166.5
Oil Temp [F]	184.5	120.9	193.6	181.7	156.0	196.6	185.0	119.4	204.5	189.0	161.3	201.1	188.4	145.7	200.6
Fuel Temp [F]	82.6	59.0	102.4	72.4	50.7	96.2	82.4	55.3	114.9	98.7	68.6	111.2	97.6	70.1	112.8
Ambient Temp [F]	66.6	21.4	98.0	50.7	22.1	94.2	66.7	27.6	106.1	87.2	59.8	108.6	83.6	60.4	105.4
Rel. Humidity [%]	32.4%	6.8%	76.6%	35.0%	4.8%	84.5%	33.5%	8.9%	90.8%	38.9%	13.8%	75.7%	24.2%	5.1%	66.1%
Barometer [psi]	14.4	14.2	14.6	14.4	14.3	14.6	14.4	14.3	14.5	14.3	14.2	14.4	14.3	14.2	14.5
NOTES															

Model No. MEP 805B – 30kW

Serial No. HX37756

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 15 kW	15.0	15.0	15.1	14.9	14.6	15.0	13.8	13.2	16.3	15.0	13.8	15.1	14.9	14.8	15.0
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 22.5 kW	24.3	24.2	24.3	22.7	22.6	24.4	24.0	22.6	24.2	23.5	22.5	23.7	22.6	22.4	23.0
Target Power: 7.5 kW	7.7	7.7	8.3	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	8.0	7.8	7.7	7.8
Target Power: 30 kW	30.1	30.0	30.1	30.1	30.0	30.2	29.9	29.8	30.1	30.1	30.1	30.2	30.2	30.1	30.3
Frequency [Hz]	60.0	59.8	60.2	60.0	59.8	60.1	59.9	59.7	60.0	60.0	59.7	60.1	59.9	59.6	60.0
Coolant Temp [F]	183.0	176.5	195.4	183.7	169.0	198.3	183.5	159.7	197.6	183.5	179.7	194.8	183.1	161.8	194.9
Oil Temp [F]	94.2	69.2	119.0	100.5	77.0	126.4	103.2	77.2	122.4	107.7	85.1	125.9	103.4	81.6	128.6
Fuel Temp [F]	90.7	65.7	110.3	95.8	75.3	118.1	98.6	74.8	117.2	101.5	75.7	115.7	100.0	79.4	124.3
Ambient Temp [F]	86.2	53.7	113.7	89.4	66.9	125.0	85.3	65.8	114.1	82.5	73.5	101.3	80.5	60.0	105.2
Rel. Humidity [%]	33.7%	13.9%	73.0%	27.2%	4.7%	82.0%	36.3%	6.0%	87.5%	64.4%	33.7%	84.1%	44.7%	4.9%	91.9%
Barometer [psi]	14.3	14.2	14.3	14.3	14.2	14.4	14.3	14.1	14.4	14.2	14.1	14.3	14.2	14.0	14.4
NOTES															

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 15 kW	14.1	14.1	14.4	14.4	14.1	15.0	15.0	14.2	15.1	14.3	14.2	14.7	14.7	14.7	14.8
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 22.5 kW	22.5	22.5	23.5	22.6	22.5	22.6	22.7	21.8	22.7	22.5	22.5	23.3	22.5	22.4	22.9
Target Power: 7.5 kW	7.7	7.7	7.8	7.8	7.7	7.8	7.8	7.8	7.8	7.7	7.7	7.8	7.7	7.7	7.7
Target Power: 30 kW	30.2	30.0	30.2	30.0	29.3	30.1	30.0	29.9	30.0	30.1	30.0	30.1	30.1	29.7	30.2
Frequency [Hz]	60.0	59.9	60.1	60.0	59.8	60.1	60.0	59.9	60.1	60.0	59.8	60.2	59.9	59.8	60.0
Coolant Temp [F]	182.7	167.2	189.0	183.3	171.8	191.8	183.5	179.9	191.2	185.2	174.8	199.3	184.7	177.9	198.8
Oil Temp [F]	91.7	67.0	117.2	103.9	83.7	121.8	103.5	83.2	120.9	109.9	85.6	124.6	108.1	89.7	124.7
Fuel Temp [F]	89.3	64.5	110.5	100.5	79.2	113.5	99.2	72.5	111.6	106.3	80.4	121.4	105.0	83.4	121.4
Ambient Temp [F]	72.4	52.1	95.1	80.1	65.4	97.5	79.7	63.5	95.5	87.3	75.0	104.0	85.5	71.1	100.9
Rel. Humidity [%]	40.8%	12.4%	84.6%	64.8%	33.8%	89.0%	59.9%	20.6%	85.9%	53.3%	21.4%	82.8%	51.2%	19.4%	87.3%
Barometer [psi]	14.4	14.3	14.5	14.2	14.0	14.5	14.2	14.1	14.3	14.2	14.1	14.3	14.3	14.3	14.4
NOTES															

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 15 kW	14.8	14.2	14.8	14.8	14.7	14.8	14.3	11.2	15.1	14.2	14.2	14.3	14.2	14.2	14.3
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 22.5 kW	22.5	22.5	22.7	22.6	22.5	23.6	24.8	24.7	24.9	24.8	24.7	24.8	24.8	24.8	24.8
Target Power: 7.5 kW	7.8	7.7	7.8	7.8	7.7	8.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Target Power: 30 kW	30.1	30.1	30.2	30.1	29.2	30.3	30.5	30.4	30.5	30.5	30.4	30.5	30.1	30.0	30.7
Frequency [Hz]	59.9	59.7	60.1	59.8	59.6	60.0	59.9	59.6	60.0	59.8	59.7	60.0	59.8	59.7	60.0
Coolant Temp [F]	185.3	180.1	202.1	186.2	166.1	208.5	185.1	173.0	198.4	185.6	180.5	200.6	186.3	158.6	202.1
Oil Temp [F]	109.9	94.5	126.4	111.7	85.4	131.2	107.6	86.7	126.7	116.6	95.7	205.4	120.6	86.4	211.8
Fuel Temp [F]	107.7	84.6	124.0	109.2	82.4	128.7	105.3	84.0	121.7	108.9	84.6	122.3	106.5	83.5	123.1
Ambient Temp [F]	88.1	75.1	104.3	89.6	77.0	108.9	85.4	70.1	105.0	89.0	76.9	104.7	88.9	76.6	103.0
Rel. Humidity [%]	46.5%	19.9%	82.1%	52.1%	19.0%	81.5%	60.2%	28.8%	90.5%	53.5%	27.1%	84.1%	51.2%	22.0%	80.4%
Barometer [psi]	14.3	14.2	14.3	14.2	14.2	14.3	14.2	14.1	14.3	14.3	14.2	14.3	14.3	14.3	14.3
NOTES															

Model No. MEP 805B – 30kW

Serial No. HX37762

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 15 kW	14.5	13.5	15.0	14.9	14.8	15.1	14.9	14.8	15.1	15.0	14.0	15.2	15.0	14.1	15.2
Target Power: 0 kW	0.1	0.0	2.4	0.1	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 22.5 kW	22.9	15.2	26.2	22.6	18.3	22.7	25.6	22.8	26.1	23.0	22.7	26.3	23.0	20.8	24.9
Target Power: 7.5 kW	7.8	7.8	14.0	7.8	7.7	11.6	7.6	7.5	9.1	8.0	7.9	10.3	7.8	7.7	10.7
Target Power: 30 kW	29.9	27.8	30.1	30.0	7.8	30.4	29.9	27.4	30.1	28.3	7.9	30.0	29.8	10.8	30.3
Frequency [Hz]	60.0	59.7	60.1	60.0	59.8	60.2	59.9	59.7	60.2	60.0	59.7	60.4	60.0	59.7	60.2
Coolant Temp [F]	183.9	132.8	192.6	183.1	174.4	187.8	184.1	118.3	188.9	183.3	122.5	187.3	183.8	132.7	191.4
Oil Temp [F]	205.7	103.4	216.3	203.6	173.6	211.5	205.2	95.4	212.4	202.3	101.3	209.9	202.7	103.6	215.7
Fuel Temp [F]	99.2	57.1	115.1	89.9	59.9	105.3	97.3	65.5	114.7	86.2	46.7	107.6	85.7	45.6	111.9
Ambient Temp [F]	87.3	56.7	109.6	80.2	49.9	104.0	85.0	50.0	108.1	79.4	42.1	103.4	78.4	44.3	104.6
Rel. Humidity [%]	39.2%	18.2%	75.9%	24.9%	7.6%	64.1%	32.4%	5.0%	76.0%	20.5%	6.4%	52.9%	22.6%	6.1%	56.8%
Barometer [psi]	14.3	14.2	14.4	14.3	14.1	14.5	14.3	14.2	14.5	14.4	14.3	14.6	14.4	14.2	14.5
NOTES															

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 15 kW	14.8	14.0	15.1	14.9	14.1	15.1	14.9	14.1	15.1	14.5	14.3	15.2	15.1	14.7	15.2
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 22.5 kW	24.7	23.0	24.9	25.8	22.5	26.6	22.7	22.6	22.9	23.1	23.0	25.0	22.6	22.6	22.7
Target Power: 7.5 kW	8.5	8.5	8.5	7.8	7.5	8.4	7.6	7.5	7.6	7.8	7.8	7.9	7.8	7.8	7.9
Target Power: 30 kW	30.2	29.9	30.4	30.3	30.2	31.6	30.5	30.3	32.7	30.2	28.8	30.4	30.3	30.1	32.7
Frequency [Hz]	60.0	59.7	60.1	59.9	59.7	60.2	60.0	59.9	60.5	60.1	59.8	60.4	60.1	59.8	60.4
Coolant Temp [F]	184.6	167.8	190.4	184.1	155.9	187.3	183.9	173.1	187.4	183.6	122.2	186.8	184.2	162.5	189.0
Oil Temp [F]	205.8	148.4	215.0	204.1	126.6	211.5	203.1	151.3	209.6	200.8	90.0	211.2	203.1	142.9	214.1
Fuel Temp [F]	95.0	58.8	110.1	88.8	43.1	101.1	86.7	50.0	103.3	75.2	51.1	92.7	84.4	50.0	102.5
Ambient Temp [F]	86.5	48.7	112.3	80.9	42.8	99.8	78.5	35.3	99.7	66.5	40.5	87.5	71.1	42.2	100.5
Rel. Humidity [%]	30.0%	14.0%	82.3%	37.8%	21.2%	89.2%	26.5%	6.0%	75.1%	23.0%	10.2%	90.7%	31.5%	8.3%	62.9%
Barometer [psi]	14.3	14.2	14.4	14.3	14.1	14.5	14.4	14.2	14.6	14.5	14.2	14.7	14.3	14.2	14.4
NOTES															

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 15 kW	14.6	14.5	16.1	15.2	14.7	15.2	14.9	14.2	15.2	15.0	15.0	15.1	14.7	14.7	14.7
Target Power: 0 kW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Target Power: 22.5 kW	23.0	22.9	23.1	25.1	25.0	25.1	26.3	25.5	26.5	22.9	22.8	23.0	25.6	25.5	25.6
Target Power: 7.5 kW	7.9	7.9	7.9	8.6	8.6	8.6	7.8	7.7	8.7	na	na	na	8.8	8.4	8.8
Target Power: 30 kW	30.3	30.1	32.6	30.3	30.1	30.5	30.4	25.8	31.6	30.0	29.9	30.2	29.9	29.8	30.3
Frequency [Hz]	60.0	59.8	60.4	60.2	59.8	60.5	60.0	59.5	60.3	60.0	59.7	60.1	59.9	59.7	60.0
Coolant Temp [F]	184.5	157.9	190.0	183.3	172.8	188.4	184.1	161.9	190.4	185.7	171.9	191.4	185.2	151.4	189.2
Oil Temp [F]	204.1	134.4	216.2	199.3	166.3	212.8	202.1	134.2	216.7	208.1	158.3	217.2	207.0	131.5	215.6
Fuel Temp [F]	87.0	65.2	110.2	65.5	50.5	96.6	77.2	54.8	120.3	100.1	68.3	114.5	99.4	69.7	110.7
Ambient Temp [F]	75.8	37.4	98.0	43.6	21.4	94.2	60.8	27.2	104.9	86.3	59.8	108.6	85.4	60.4	105.4
Rel. Humidity [%]	26.8%	6.8%	76.6%	33.3%	4.8%	62.6%	36.0%	8.9%	90.8%	40.7%	13.8%	75.7%	29.1%	5.1%	68.8%
Barometer [psi]	14.4	14.2	14.5	14.5	14.3	14.6	14.4	14.3	14.5	14.3	14.2	14.4	14.3	14.2	14.5
NOTES										Missed 25% load change					

Model No. MEP 807A – 100kW

Serial No. 100002

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 50 kW	51.4	50.3	52.4	47.5	46.8	50.4	46.2	45.8	46.7	48.4	47.2	50.7	48.7	42.8	49.2
Target Power: 0 kW	3.3	3.1	3.5	2.5	1.0	3.0	-1.4	-1.5	-1.2	3.4	3.3	3.6	1.3	1.2	1.5
Target Power: 75 kW	74.1	73.3	75.3	74.4	69.6	79.2	68.7	68.3	69.1	73.1	72.7	73.5	71.4	71.0	71.8
Target Power: 25 kW	27.8	27.5	28.1	31.3	30.1	32.7	24.8	24.3	25.1	25.5	23.6	27.2	24.8	24.6	25.3
Target Power: 100 kW	99.0	97.0	101.8	92.7	72.7	101.0	86.4	25.2	95.6	92.4	86.8	94.3	90.3	90.1	90.9
Frequency [Hz]	59.6	59.1	60.3	59.8	58.7	60.5	59.3	56.3	59.9	59.2	58.8	59.8	59.4	58.9	60.0
Coolant [F]	203.4	166.7	228.6	199.5	184.2	223.2	196.6	138.3	223.4	195.5	83.0	222.2	192.4	90.0	202.3
Oil Temp [F]	218.0	183.0	244.7	213.6	188.4	237.3	210.5	177.9	237.5	210.3	155.6	236.7	206.9	160.1	219.9
Fuel Temp [F]	129.1	90.2	152.0	129.6	79.8	160.1	136.2	79.5	155.9	120.3	84.7	155.5	115.2	74.8	136.7
Ambient Temp [F]	97.4	78.1	130.9	110.0	76.5	133.1	101.9	81.5	132.0	96.1	75.7	121.2	85.5	64.8	108.6
Rel. Humidity [%]	37.6%	10.9%	80.1%	15.1%	4.3%	44.3%	29.9%	9.8%	56.4%	31.3%	12.9%	84.1%	36.4%	16.2%	65.6%
Barometer [psi]	14.3	14.2	14.3	14.3	14.2	14.4	14.3	14.3	14.4	14.3	14.2	14.4	14.3	14.3	14.4
NOTES															

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 50 kW	na	na	na	49.4	48.8	49.8	48.4	47.8	49.0	47.3	46.5	47.8
Target Power: 0 kW	na	na	na	-1.0	-1.2	-0.6	-0.4	-0.6	0.2	na	na	na
Target Power: 75 kW	73.1	68.2	74.5	69.9	68.9	70.3	69.5	68.9	69.9	na	na	na
Target Power: 25 kW	27.8	27.6	28.0	25.4	24.9	25.6	22.8	22.4	25.5	na	na	na
Target Power: 100 kW	91.0	83.1	97.8	93.9	92.5	96.2	94.3	88.5	95.8	na	na	na
Frequency [Hz]	59.3	58.3	59.8	59.4	57.0	60.1	59.3	58.8	60.0	59.4	59.4	59.4
Coolant [F]	196.5	168.1	225.0	194.0	74.7	214.1	195.2	75.6	221.7	191.4	188.8	195.8
Oil Temp [F]	211.2	187.2	239.6	208.6	124.7	228.6	209.9	130.9	236.3	204.9	197.3	210.2
Fuel Temp [F]	110.3	71.3	133.6	108.4	75.9	134.0	110.6	76.3	130.8	102.9	90.4	125.6
Ambient Temp [F]	93.7	68.4	122.0	85.7	64.2	111.2	87.0	69.4	107.6	66.3	52.8	100.3
Rel. Humidity [%]	37.3%	9.0%	78.2%	22.5%	5.5%	88.2%	39.2%	11.5%	75.9%	48.8%	18.6%	65.0%
Barometer [psi]	14.3	13.9	14.4	14.3	14.2	14.4	14.3	14.2	14.4	14.3	14.2	14.5
NOTES	data loss due to weather									EOT @ 824 Hours due to turbo failure		

Model No. MEP 807A – 100kW

Serial No. 100013

	0 to 100 Hours			100 to 200 Hours			200 to 300 Hours			300 to 400 Hours			400 to 500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 50 kW	50.8	49.9	51.7	54.9	52.1	55.6	56.3	55.7	56.6	54.1	51.8	55.4	53.7	46.3	54.2
Target Power: 0 kW	-1.6	-1.7	-1.4	-0.8	-1.2	0.0	3.1	2.9	3.2	-1.7	-1.8	-1.5	0.4	0.2	0.6
Target Power: 75 kW	76.1	75.1	76.8	76.0	70.6	81.2	81.5	81.4	81.7	77.1	76.6	77.6	78.7	78.4	79.2
Target Power: 25 kW	22.8	22.5	23.1	19.3	18.0	20.7	25.9	25.6	26.3	25.1	21.3	27.1	25.9	25.6	26.3
Target Power: 100 kW	100.6	98.3	102.7	97.8	80.2	106.8	95.6	49.5	98.2	103.4	96.9	105.8	99.3	99.1	99.5
Frequency [Hz]	59.7	59.2	60.4	59.9	58.4	60.6	59.4	56.7	60.0	59.3	58.9	59.9	59.4	59.0	60.1
Coolant [F]	203.5	177.5	229.5	199.6	158.8	228.1	198.1	133.2	229.0	197.5	86.4	228.0	191.4	82.1	213.6
Oil Temp [F]	na	na	na	na	na	na	230.5	211.3	255.5	226.8	160.3	254.7	222.6	168.9	241.7
Fuel Temp [F]	128.8	89.1	148.0	132.4	76.5	154.5	131.4	76.1	152.0	135.6	81.5	152.4	125.7	73.4	146.2
Ambient Temp [F]	97.3	78.1	130.9	110.0	76.5	133.1	101.9	81.5	132.0	96.0	75.7	121.2	86.1	64.8	108.6
Rel. Humidity [%]	37.7%	10.8%	80.1%	15.1%	4.3%	44.3%	29.9%	9.8%	56.4%	31.4%	12.9%	84.1%	36.5%	16.2%	65.6%
Barometer [psi]	14.3	14.2	14.3	14.3	14.2	14.4	14.3	14.3	14.4	14.3	14.2	14.4	14.3	14.3	14.4
NOTES															

	500 to 600 Hours			600 to 700 Hours			700 to 800 Hours			800 to 900 Hours			900 to 1000 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 50 kW	52.3	51.9	53.3	53.1	52.9	53.5	54.1	45.5	54.6	55.6	55.3	56.1	51.1	51.0	51.2
Target Power: 0 kW	-2.1	-2.3	-2.0	0.8	0.5	1.0	2.2	1.6	2.4	0.1	-0.1	8.5	-0.2	-0.2	-0.1
Target Power: 75 kW	77.5	75.8	82.0	80.3	79.7	80.8	80.7	80.4	81.2	77.1	76.6	77.4	76.7	61.5	77.0
Target Power: 25 kW	22.9	22.6	23.3	25.5	25.2	25.9	28.0	25.3	28.4	28.6	28.5	28.8	28.5	28.2	28.7
Target Power: 100 kW	96.5	88.4	102.7	103.1	74.6	106.1	103.3	96.9	110.8	102.0	101.1	102.5	101.8	101.5	102.0
Frequency [Hz]	59.4	58.6	60.1	59.4	57.0	60.2	59.4	58.9	60.1	59.9	59.2	60.5	59.8	59.2	60.2
Coolant [F]	193.6	99.3	230.6	191.2	76.7	223.6	190.9	78.1	226.5	184.9	81.1	201.4	186.2	126.3	200.9
Oil Temp [F]	224.7	174.8	256.9	222.9	133.9	251.7	223.2	139.3	253.1	217.0	150.4	229.2	216.8	187.2	226.9
Fuel Temp [F]	126.5	68.2	148.2	117.7	75.7	142.2	120.3	75.4	140.3	87.4	64.5	135.3	88.2	69.3	105.6
Ambient Temp [F]	92.4	68.1	122.0	85.7	64.2	111.2	87.0	69.4	107.6	68.1	50.6	100.3	71.4	50.0	89.2
Rel. Humidity [%]	40.8%	9.0%	79.4%	22.5%	5.5%	88.2%	39.2%	11.5%	75.9%	34.9%	9.7%	82.0%	52.4%	14.2%	90.6%
Barometer [psi]	14.3	14.2	14.4	14.3	14.2	14.4	14.3	14.2	14.4	14.4	14.2	14.6	14.3	14.2	14.5
NOTES															

	1000 to 1100 Hours			1100 to 1200 Hours			1200 to 1300 Hours			1300 to 1400 Hours			1400 to 1500 Hours		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Target Power: 50 kW	51.0	50.9	51.2	51.3	51.1	51.6	54.5	54.3	54.8	51.2	51.0	51.3	54.4	54.2	54.5
Target Power: 0 kW	-0.1	-0.1	-0.1	1.9	1.8	1.9	1.9	1.9	2.0	1.9	1.9	1.9	1.9	1.0	2.0
Target Power: 75 kW	77.2	76.7	77.5	76.5	76.3	76.7	76.9	76.6	77.1	77.4	77.3	77.5	76.7	76.5	76.9
Target Power: 25 kW	28.6	26.4	28.9	27.9	27.8	28.0	28.5	28.5	28.8	27.7	27.6	27.8	27.8	27.7	28.0
Target Power: 100 kW	102.0	101.4	102.5	102.3	101.8	102.7	101.5	101.3	102.2	101.6	101.4	102.3	101.8	101.3	102.7
Frequency [Hz]	60.2	59.9	60.6	60.1	59.9	60.7	60.1	59.9	60.6	60.1	59.8	60.6	60.1	59.3	60.2
Coolant [F]	185.7	50.3	201.6	181.7	62.4	194.8	184.2	62.7	206.7	184.5	80.6	193.6	183.2	50.5	202.6
Oil Temp [F]	217.3	105.0	229.7	215.4	160.8	222.1	216.7	132.3	233.5	216.1	146.9	223.0	215.9	105.7	230.0
Fuel Temp [F]	85.7	51.0	105.1	75.3	54.6	100.6	77.4	51.5	98.7	81.8	62.4	97.0	75.8	48.7	96.0
Ambient Temp [F]	76.2	65.2	98.4	na	na	na	73.9	50.0	99.2	69.4	50.5	91.3	74.9	40.6	102.0
Rel. Humidity [%]	67.8%	14.0%	87.4%	na	na	na	50.6%	18.2%	89.7%	51.3%	12.2%	91.3%	25.8%	8.2%	79.3%
Barometer [psi]	14.4	14.2	14.5	14.4	14.3	14.5	14.4	14.3	14.5	14.3	14.2	14.5	14.3	14.3	14.5
NOTES				Instrumentation Malfunction											

Appendix B

Neat Fuel Tables

Jet-A COA by ALCOR PetroLab LLC & SwRI

Sample Date / Shipment Date				10/11/2010	1/24/2011	9/9/2011
	Test	Specification				
Physical Properties	**Method**	**Minimum**	**Maximum**	**Result**	**Result**	**Result**
Density @ 15°C	D 4052	775	840	800.5	794.6	786.6
Gravity, API @ 60°F	D 1298	37.0	51.0	45.2	46.5	48.3
Kinematic Viscosity @ -20°C	D 445		8.0	3.2	3.4	3.06
Freezing Point (°C)	D 2386		-47	-41.1	-68.8	-88.6
Net Heat of Combustion (MJ/kg)	D 4809	42.8		43.129	43.303	43.406
Total Acidity (mg KOH/g)	D 3242		0.015	0.001	0.007	0.002
Electrical Conductivity (pS/m)	D 2624	150	600	385	29	0
Additives						
Antioxidant, AO-37 (ppm)	P 487	17	24	n/a	n/a	n/a
Static Dissipator, Stadis 450 (ppm)				n/a	n/a	n/a
Hydrocarbon Composition						
Aromatics (vol %)	D 1319		25.0	21.5	15.6	14.8
Hydrogen Content (mass%)	D 3701	13.4		13.83	14.01	14.09
Napthalene (vol%)	D 1840		3.0	0.14	0.3	0.14
Sulfur Content (mg/kg)	D 7222		3000	0.6	0.2	101
Color, Saybolt	D 156			+30	+30	+28
Appearance (clear/bright)	D 4176	fail	pass	pass	pass	pass
Smoke point (mm)	D 1322	19.0		31.7	25.7	21.5
Copper Strip Corrosion, 2hr @ 100°C	D 130		No. 1	1a	1a	1a
Volatility						
Flash Point (°C)	D 56	38		50.0	52.7	46.1
Distillation 10% Rec (°C)	D 86		205	172.4	176.5	167.8
Distillation 50% Rec (°C)		Report		183.7	187.1	181.1
Distillation 90% Rec (°C)		Report		204.0	206.8	200.9
Distillation Final BP (°C)			300	240.2	227.5	230.5
Distillation Residue (vol%)			1.5	0.6	0.8	0.8
Distillation Loss (vol%)			1.5	1.4	0.7	0.9
Cetane Index	D 4737			38.9	43.1	44.1
JFTOT	D 3241					
Temperature (°C)		260		260	260	260
Tube Deposit Rating (visual)			3	2	<3	3
dP (mm Hg)			25	0.0	4.0	1.0
Contaminants						
Existent Gum (mg/100 mL)	D 381		7.0	<1.0	<1.0	<1.0
Water interface rating	D 1094		1b	1	1	1
MSEP	D 3948	90		99	95	99
Particulate Matter (mg/L)	D 2276		1.0	0.13	0.39	<1.0

It may be noted that the Jet-A fuel acquired for this testing came from the local pipe line. The three batched purchased were spread over a 1 year time frame and the fuel characteristics all show changes in that time frame. From the changes in density, distillation, aromatics, and sulfur, it would appear that the refinery which made the product had either shifted their process for Jet-A, had switched sources for crude oil, or both.

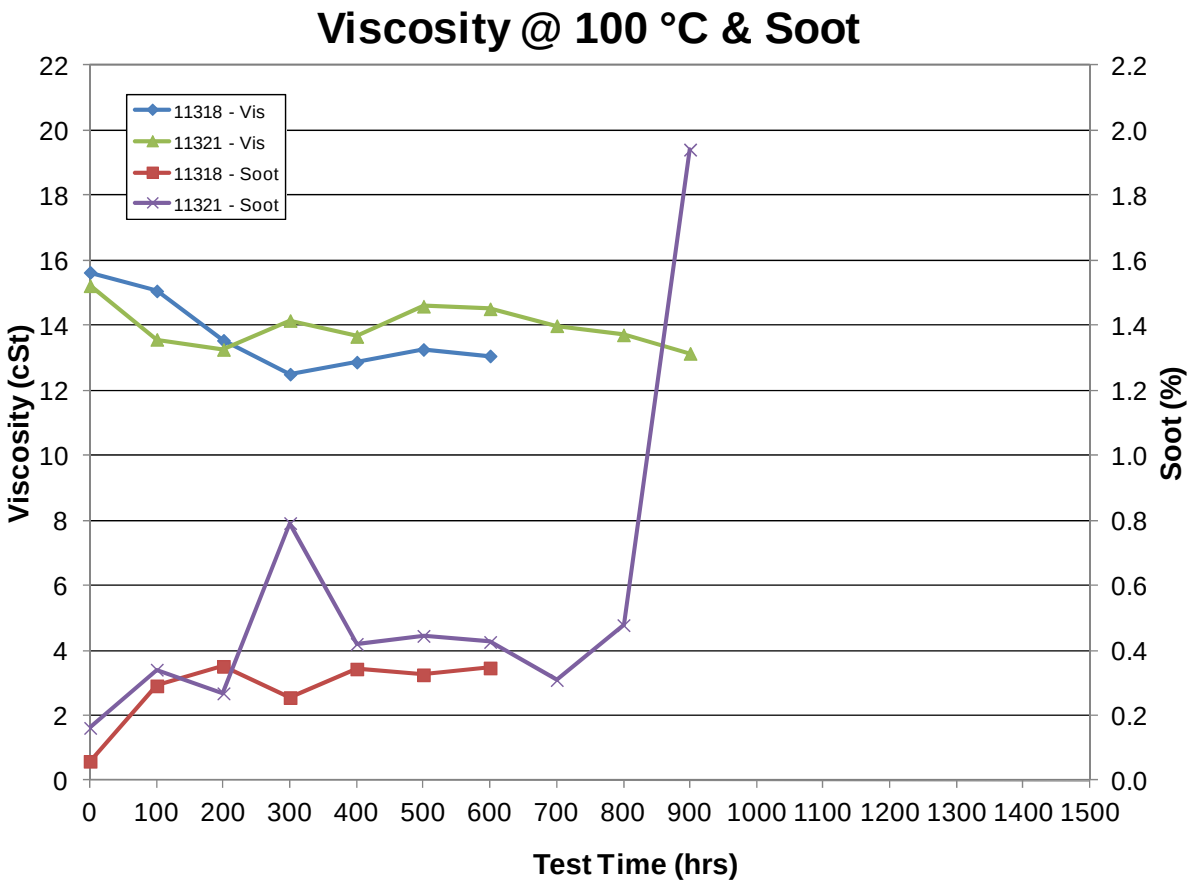
HRJ-8 COA by Centauri Technologies						
Sample Date				10/4/2010	10/6/2010	10/7/2010
	Test	**Specification**				
Physical Properties	**Method**	**Minimum**	**Maximum**	**Result**	**Result**	**Result**
Density @ 15°C	D 1298	751	770	762.8	764.8	762.8
Gravity, API @ 60°F	D 1298	52.0	57.0	54.0	53.5	54.0
Kinematic Viscosity @ -20°C	D 445		8.0	6.098	6.717	6.098
Kinematic Viscosity @ 40°C	D 445	Report		1.538	1.633	1.538
Freezing Point (°C)	D 2386		-47	-56	-56	-56
Net Heat of Combustion (MJ/kg)	D 4809	42.8		43.662	43.576	43.662
Total Acidity (mg KOH/g)	D 3242		0.015	0.004	0.006	0.004
Electrical Conductivity (pS/m)	D 2624	50	600	271	210	271
Additives						
Antioxidant, AO-37 (ppm)	P 487	17	24	20	20	20
Static Dissipator, Stadis 450 (ppm)				1	1	1
Hydrocarbon Composition						
Paraffins [n- and iso-] (mass%)	D 2425	Balance		96	96	96
Cycloparaffins (mass%)			15	4	4	4
Total Aromatics (mass%)			0.5	< 0.3	< 0.3	< 0.3
Carbon and Hydrogen (mass%)	D 5291	99.5		99.9	99.9	99.9
Sulfur Content (mg/kg)	D 5453		15	0.45	0.37	0.45
Nitrogent Content (mg/kg)	D 4629		2	1.3	1.7	1.3
Metals (mg/kg) Ca, Cu, Fe, Mg, Mn, Ni, P, Pb, V, Zn	D 7111		0.1, total	0.05	0.04	0.05
Glass Metals (mg/kg) Na, K, Si, Li	D 7111	Report		0.09	0.08	0.09
Volatility						
Flash Point (°C)	D 56	38	60	44.5	46.5	44.5
Distillation 10% Rec (°C)	D 86		205	165.0	167	165.0
Distillation 50% Rec (°C)		Report		228.0	237.5	228.0
Distillation 90% Rec (°C)		Report		273.0	274	273.0
Distillation Final BP (°C)			300	280.0	281	280.5
Distillation Residue (vol%)			1.5	1.2	1.2	1.2
Distillation Loss (vol%)			1.5	0.9	0.9	0.9
T90-T10 (°C)		22		108.0	107	108.5
Cetane Number	D 613	40.0		60.4	60.3	60.4
JFTOT	D 3241					
Temperature (°C)		280		280	280	280
Tube Deposit Rating (visual)			3	1	1	1
dP (mm Hg)			25	0.0	0.0	0.0
Contaminants						
Water	D 6304		75	42	39	42
Water Separation Index w/o SDA	D 3948	85		100	100	100
Particulate Matter (mg/L)	MIL-DTLM 83133F		1.0	0.53	0.17	0.53
Filtration Time (minutes)			15	6	6	6
Sample Volume (L)		3.79		3.18	3.55	3.18

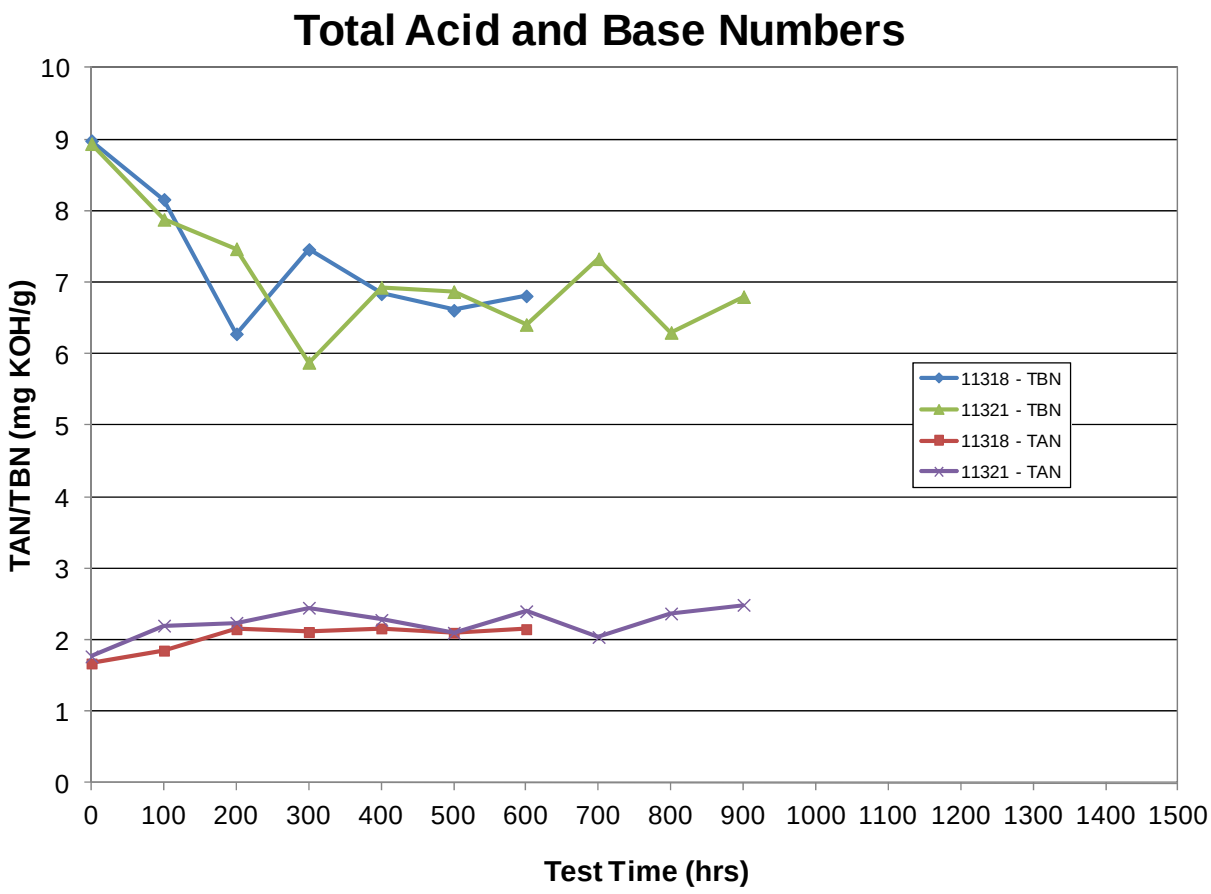
Appendix C

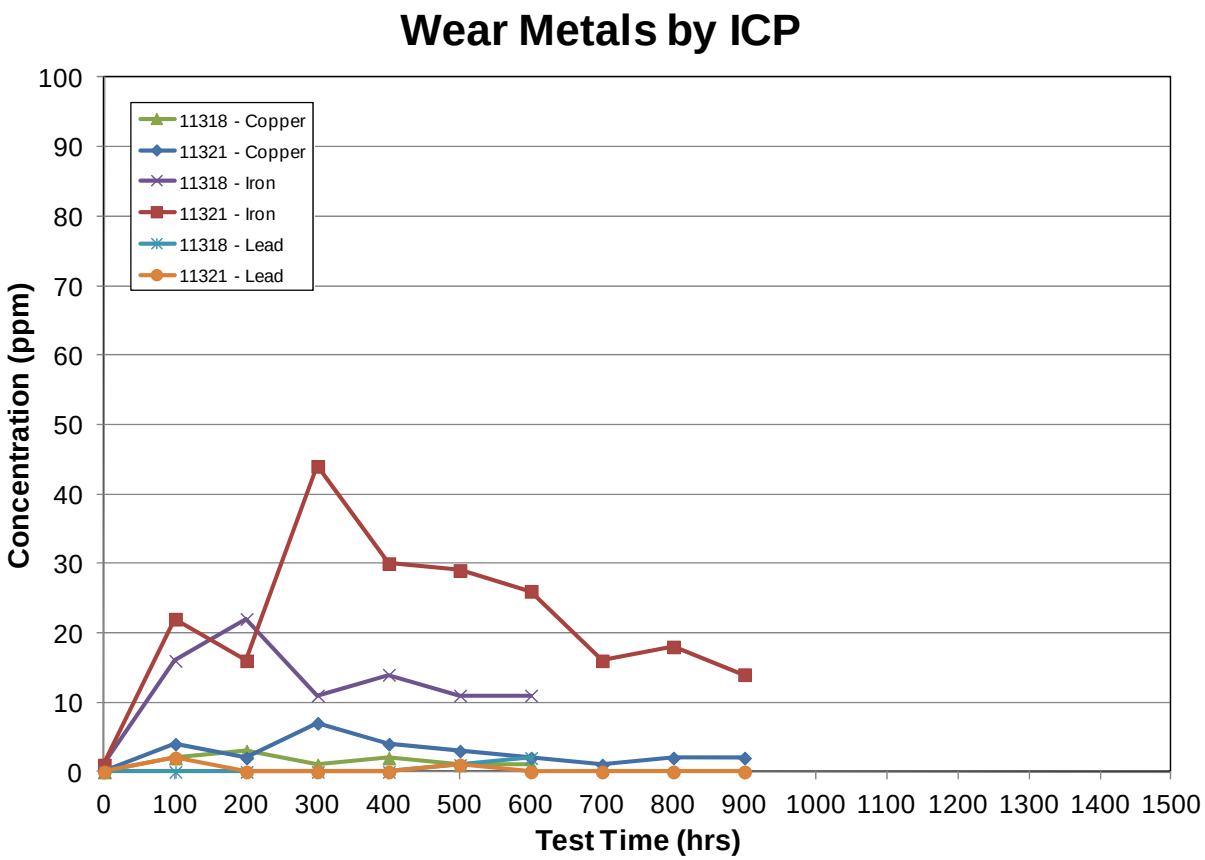
Oil Analysis Plots

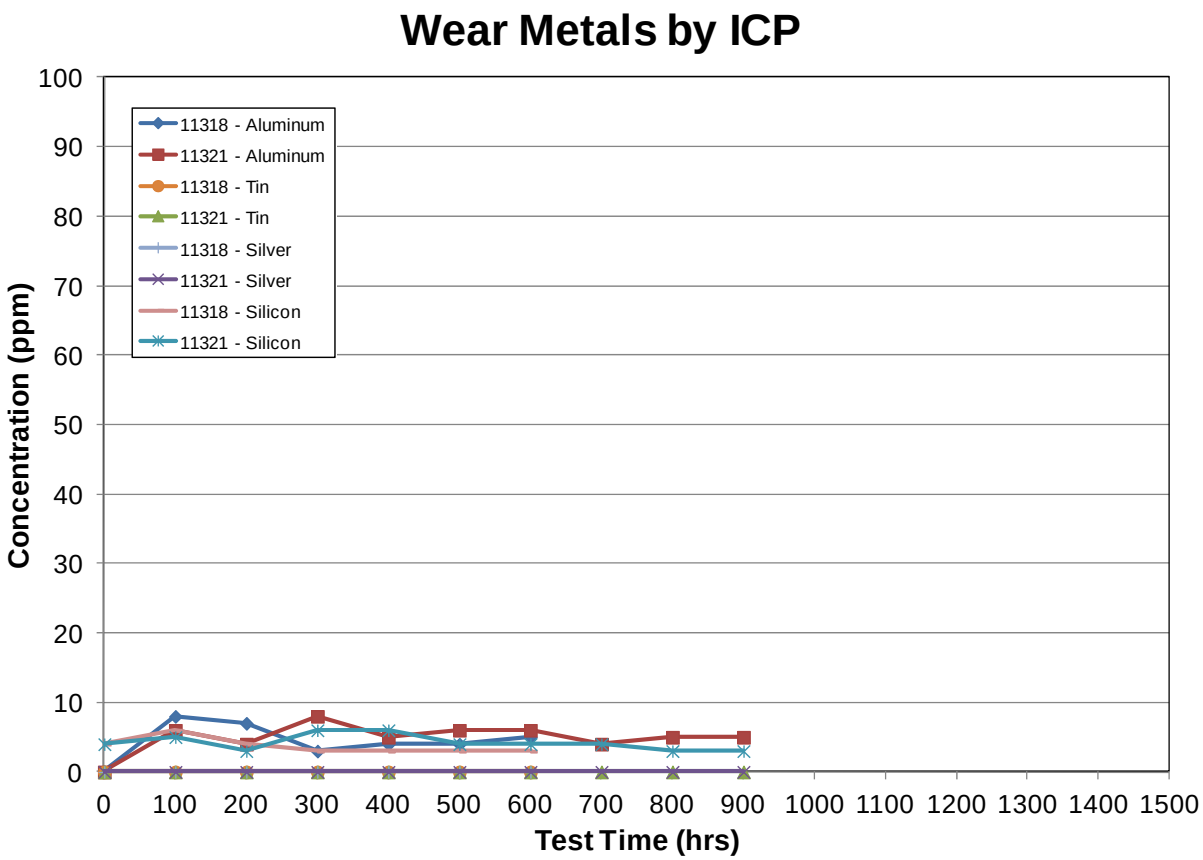
It is important to note, that the zero hour oil sample as seen in all of the following charts, is actually derived from the “new” baseline oil analysis that was performed prior to the start of testing for each group of generators.

Model No. MEP 531A – 2kW
Serial No. 11318 & 11321



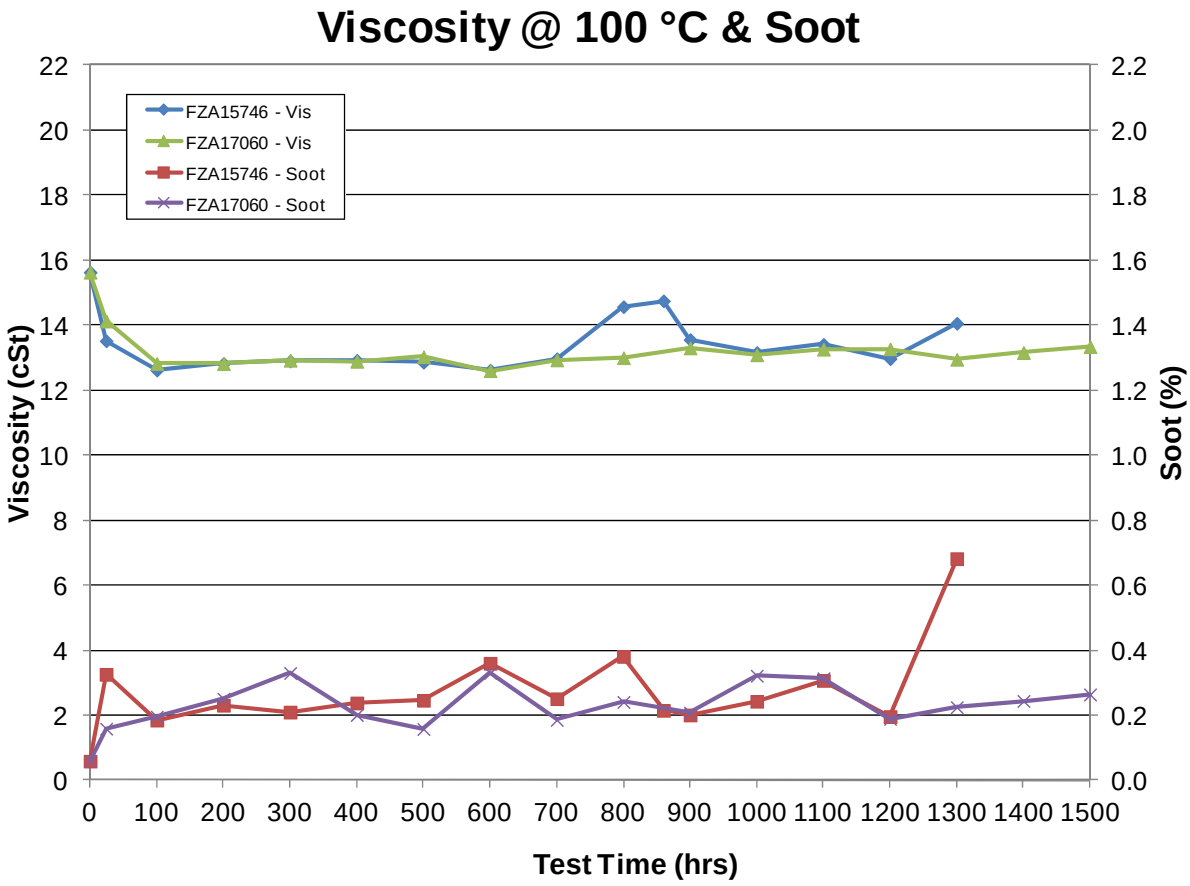

Total Acid and Base Numbers
TAN/TBN (mg KOH/g)
Test Time (hrs)
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
11318 - TBN
11321 - TBN
11318 - TAN
11321 - TAN

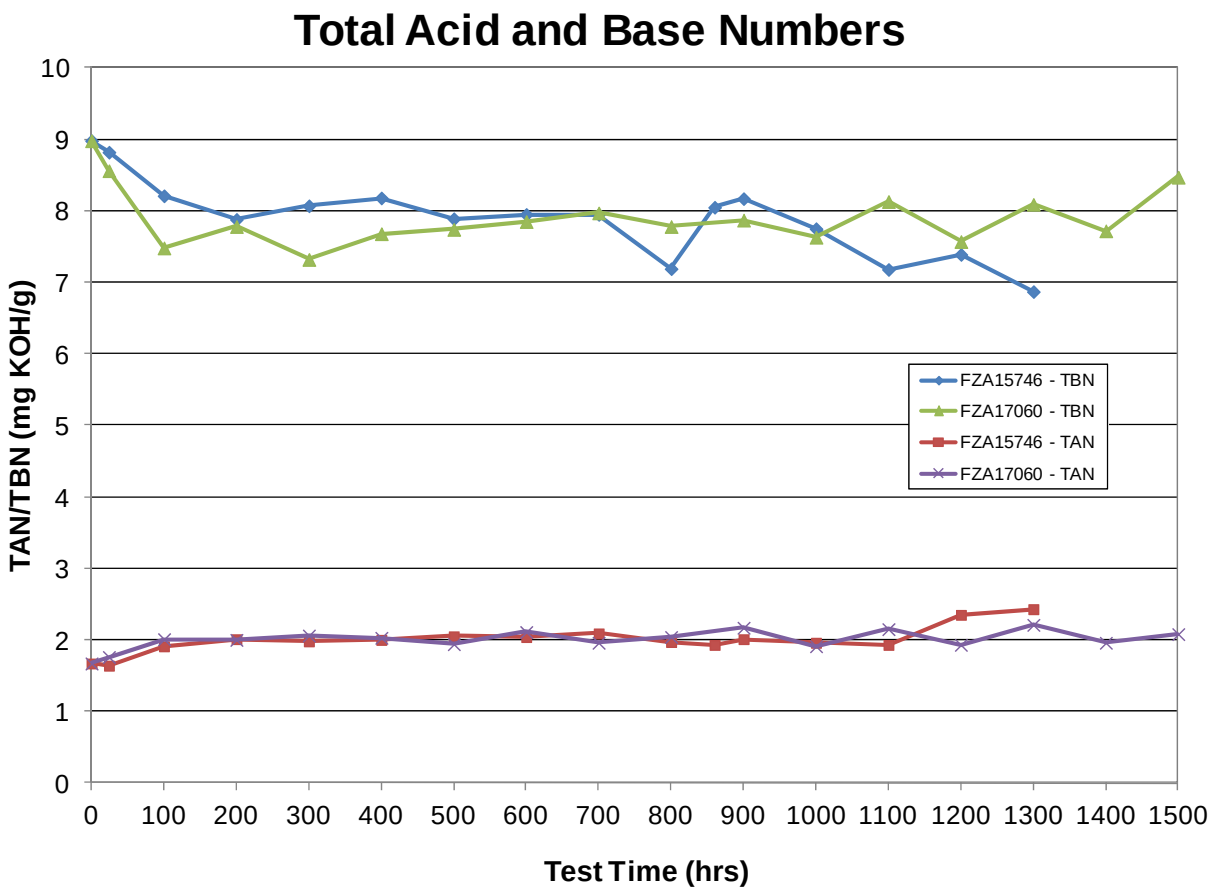

Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
11318 - Copper
11321 - Copper
11318 - Iron
11321 - Iron
11318 - Lead
11321 - Lead
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

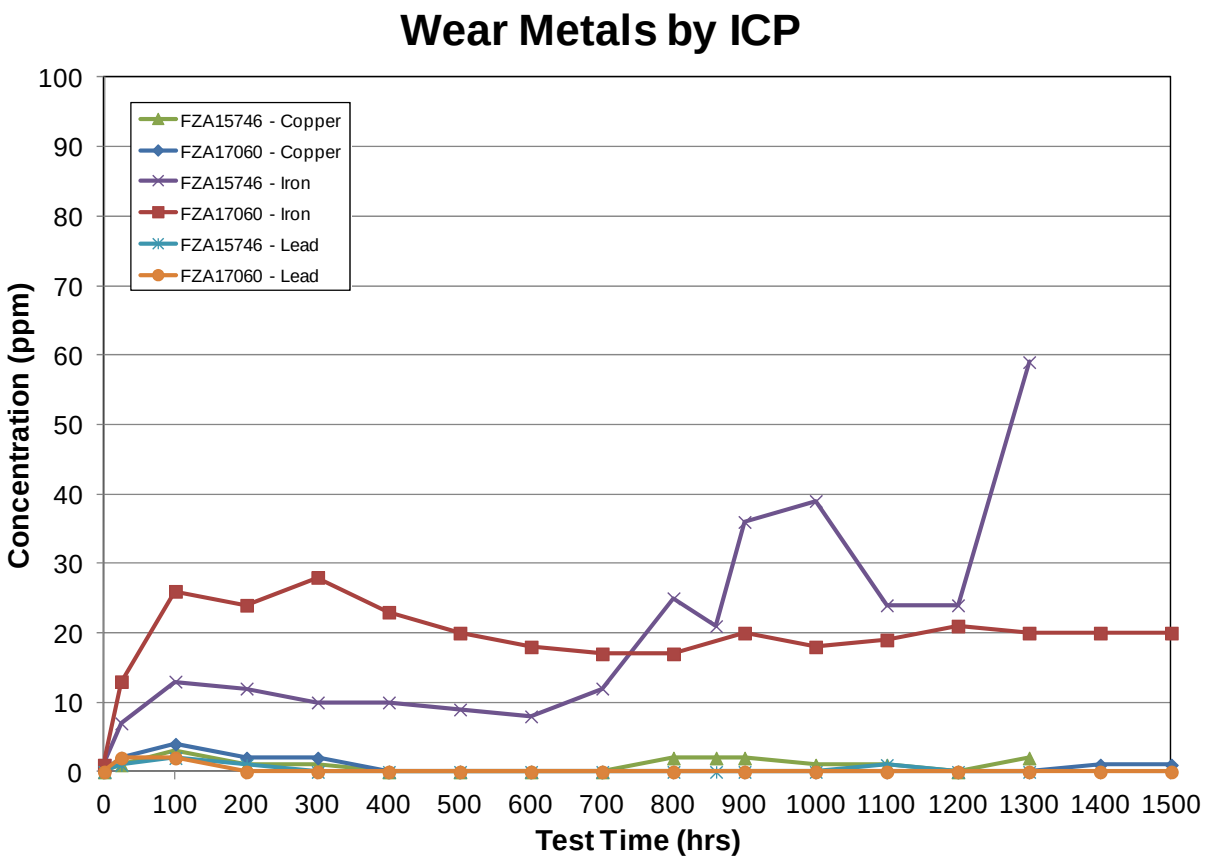

Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
11318 - Aluminum
11321 - Aluminum
11318 - Tin
11321 - Tin
11318 - Silver
11321 - Silver
11318 - Silicon
11321 - Silicon
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

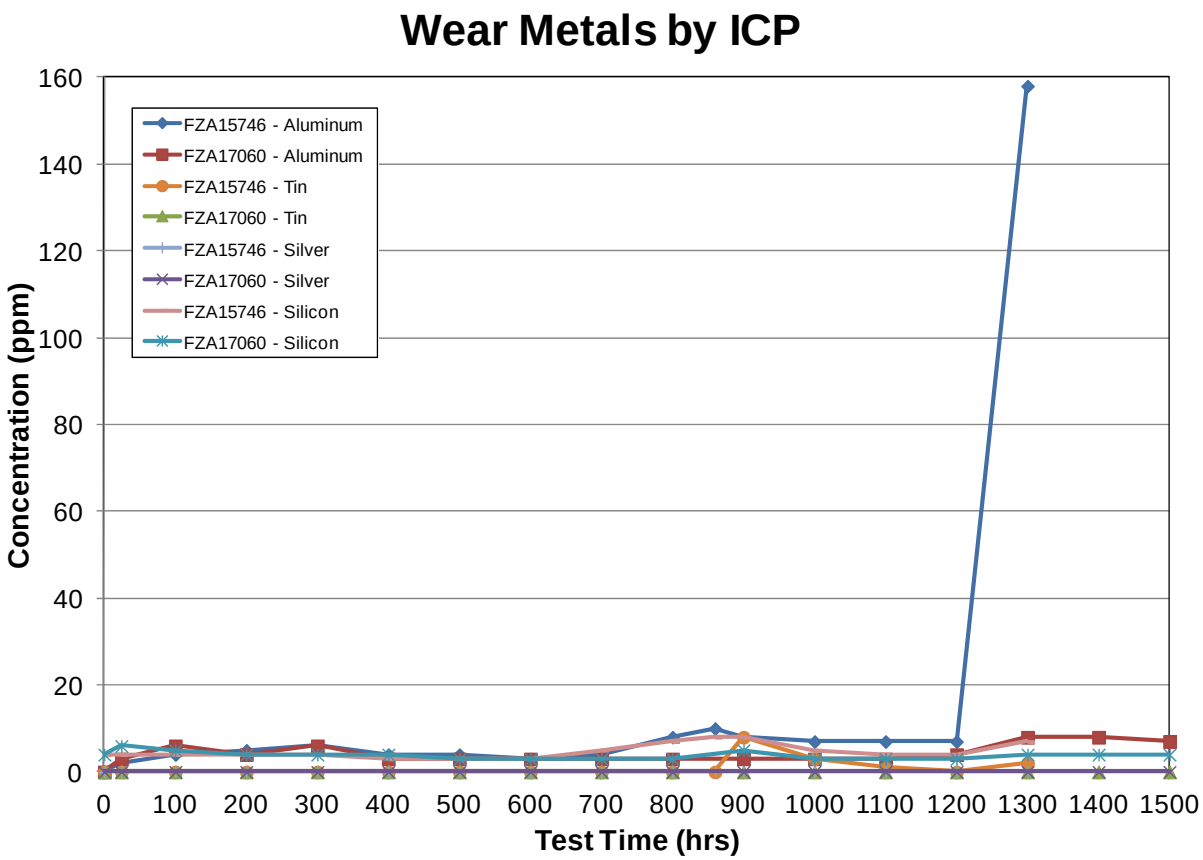
Model No. MEP 831A – 3kW

Serial No. FZA15746 & FZA17060



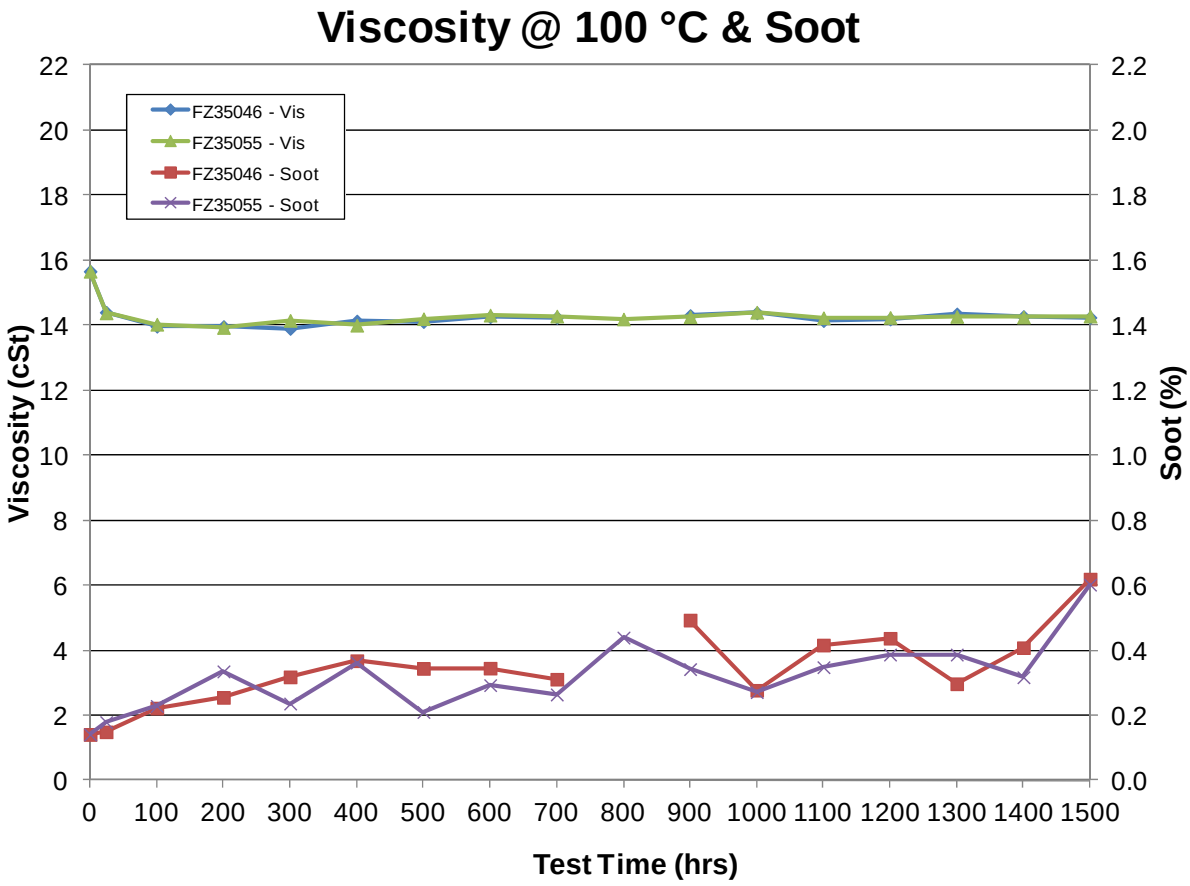

Total Acid and Base Numbers
TAN/TBN (mg KOH/g)
Test Time (hrs)
FZA15746 - TBN
FZA17060 - TBN
FZA15746 - TAN
FZA17060 - TAN
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

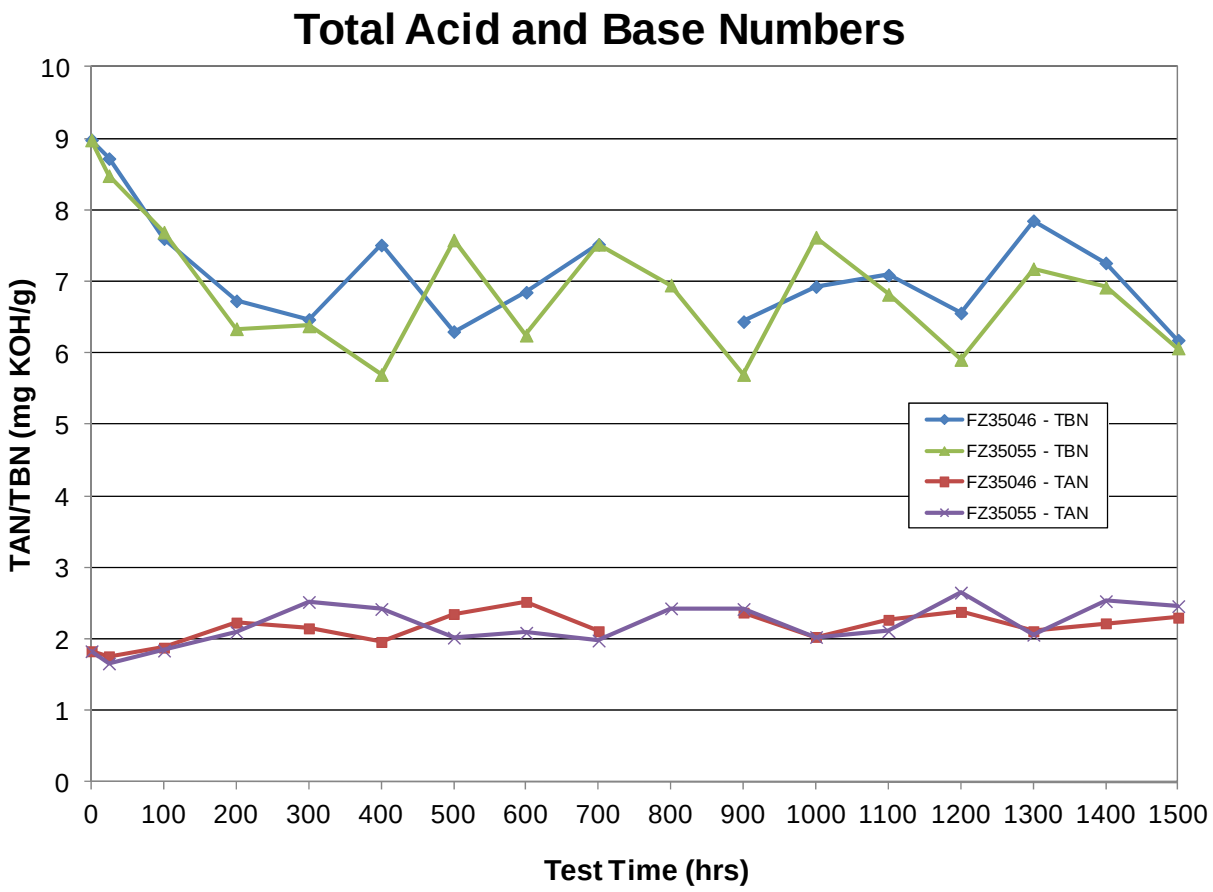

Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
FZA15746 - Copper
FZA17060 - Copper
FZA15746 - Iron
FZA17060 - Iron
FZA15746 - Lead
FZA17060 - Lead
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

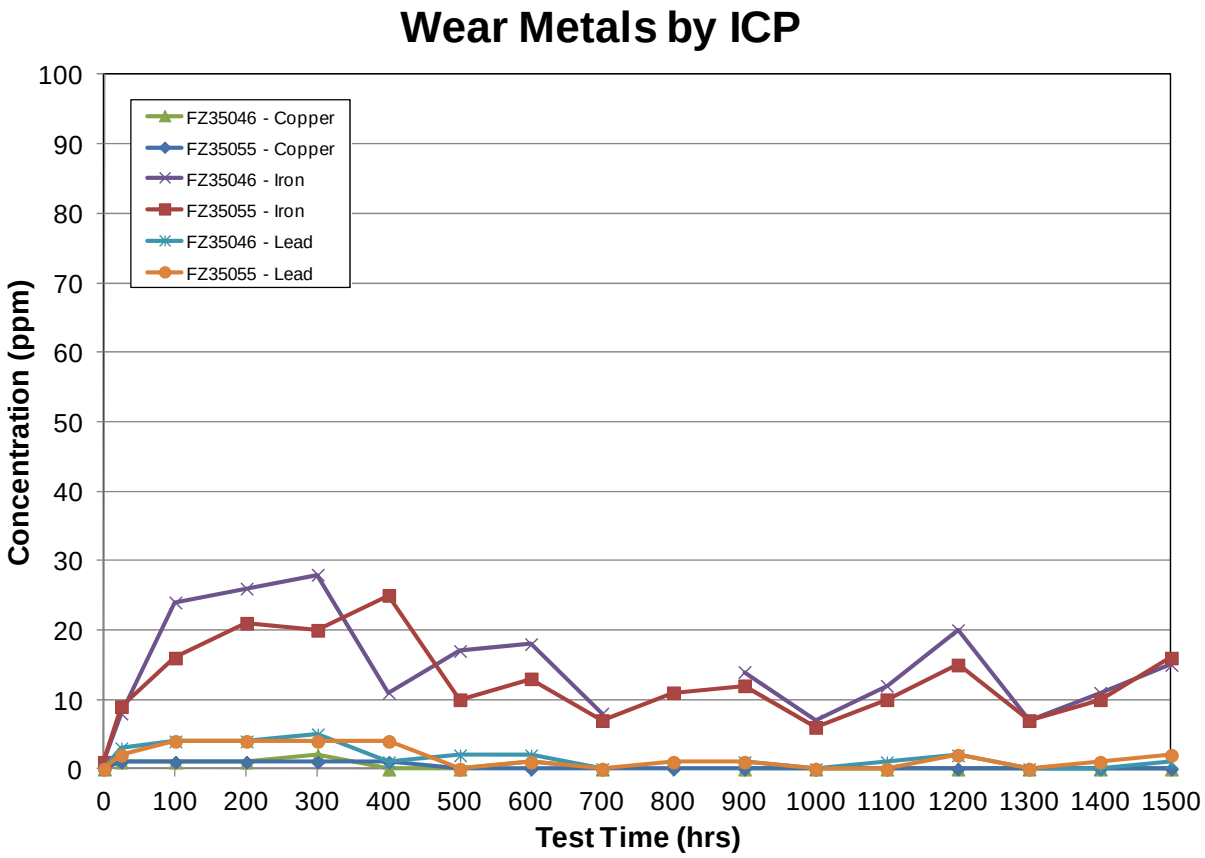

Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
FZA15746 - Aluminum
FZA17060 - Aluminum
FZA15746 - Tin
FZA17060 - Tin
FZA15746 - Silver
FZA17060 - Silver
FZA15746 - Silicon
FZA17060 - Silicon
0
20
40
60
80
100
120
140
160
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

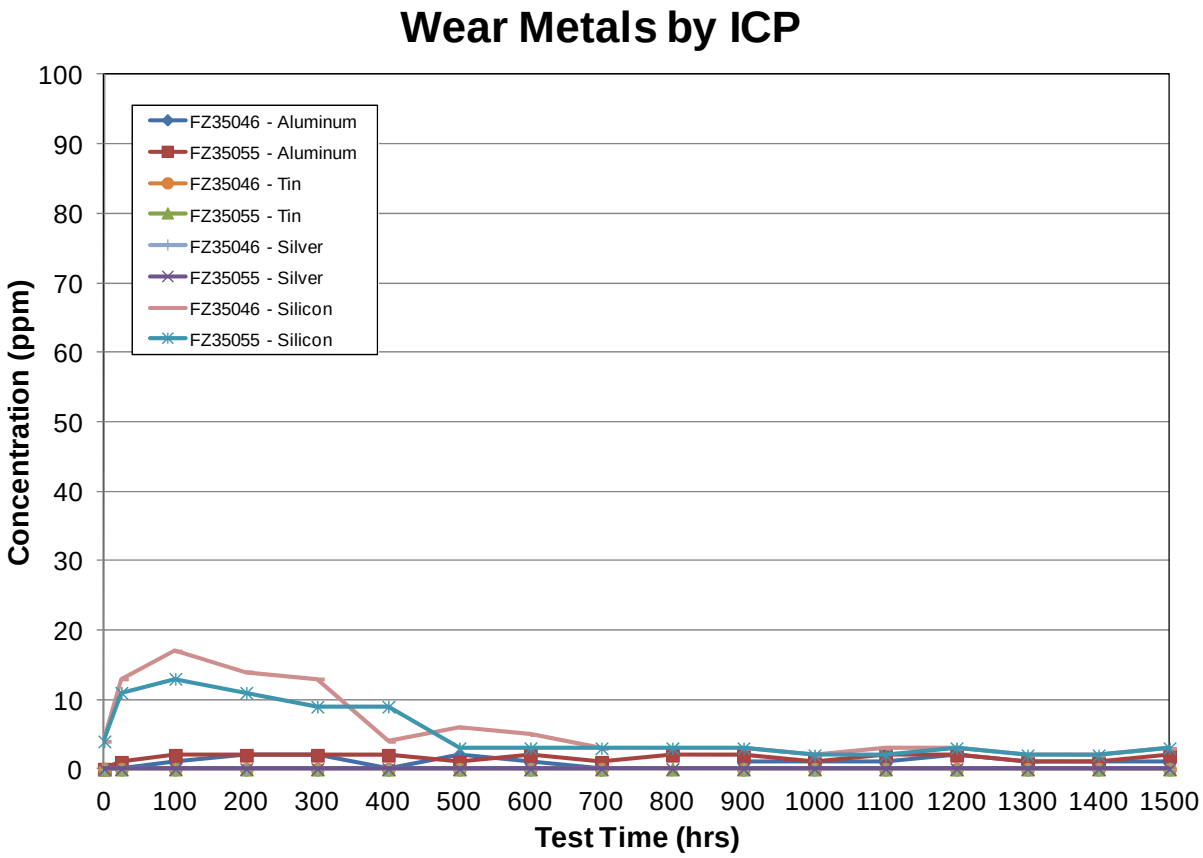
Model No. MEP 803A – 10kW

Serial No. FZ35046 & FZ35055



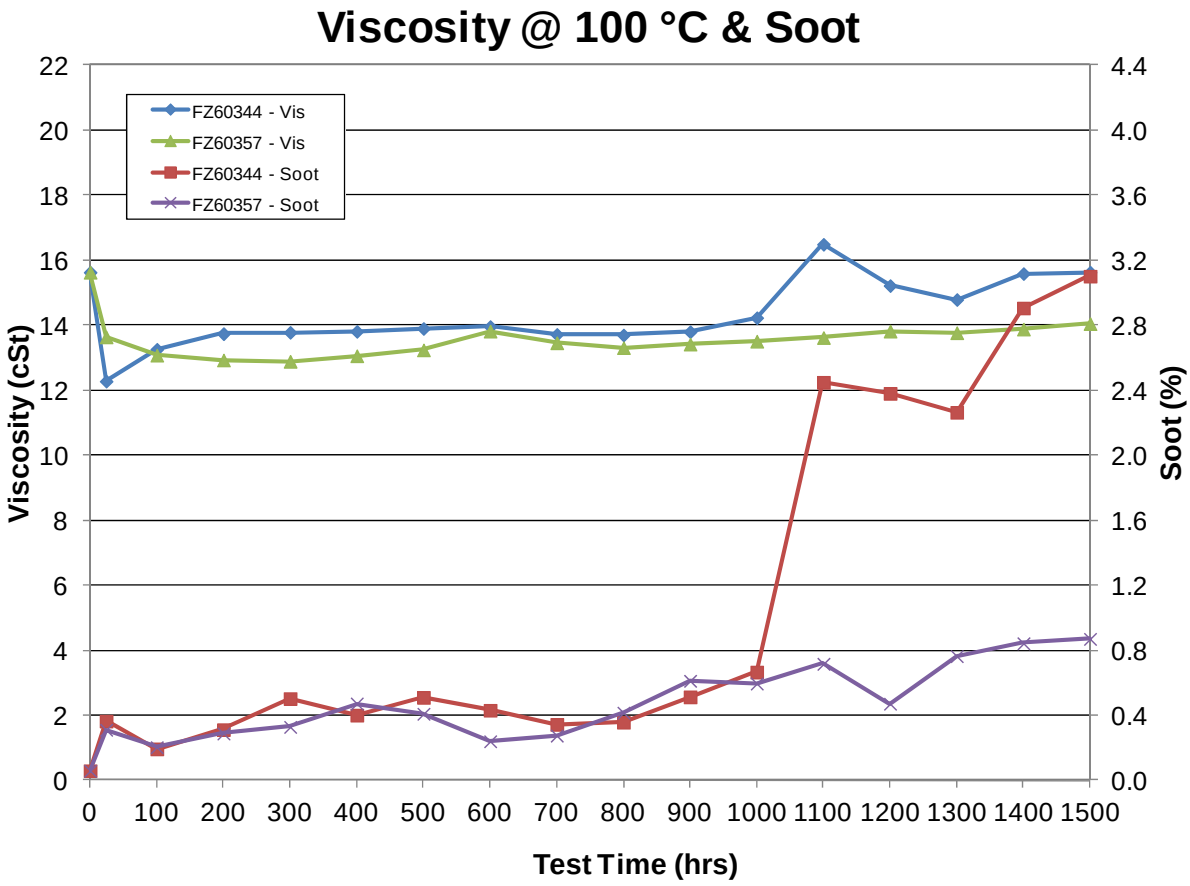

Total Acid and Base Numbers
TAN/TBN (mg KOH/g)
Test Time (hrs)
FZ35046 - TBN
FZ35055 - TBN
FZ35046 - TAN
FZ35055 - TAN
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

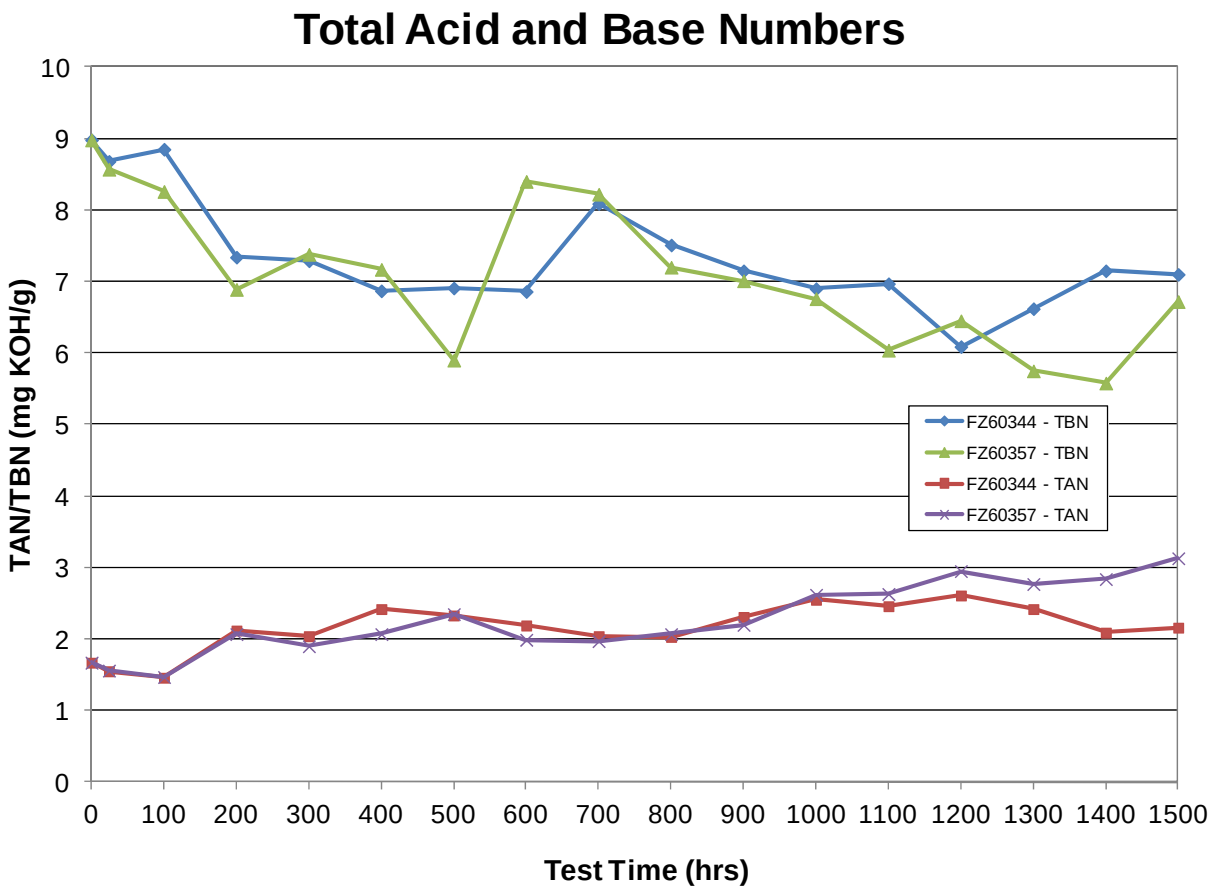

Wear Metals by ICP
FZ35046 - Copper
FZ35055 - Copper
FZ35046 - Iron
FZ35055 - Iron
FZ35046 - Lead
FZ35055 - Lead
Concentration (ppm)
Test Time (hrs)
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

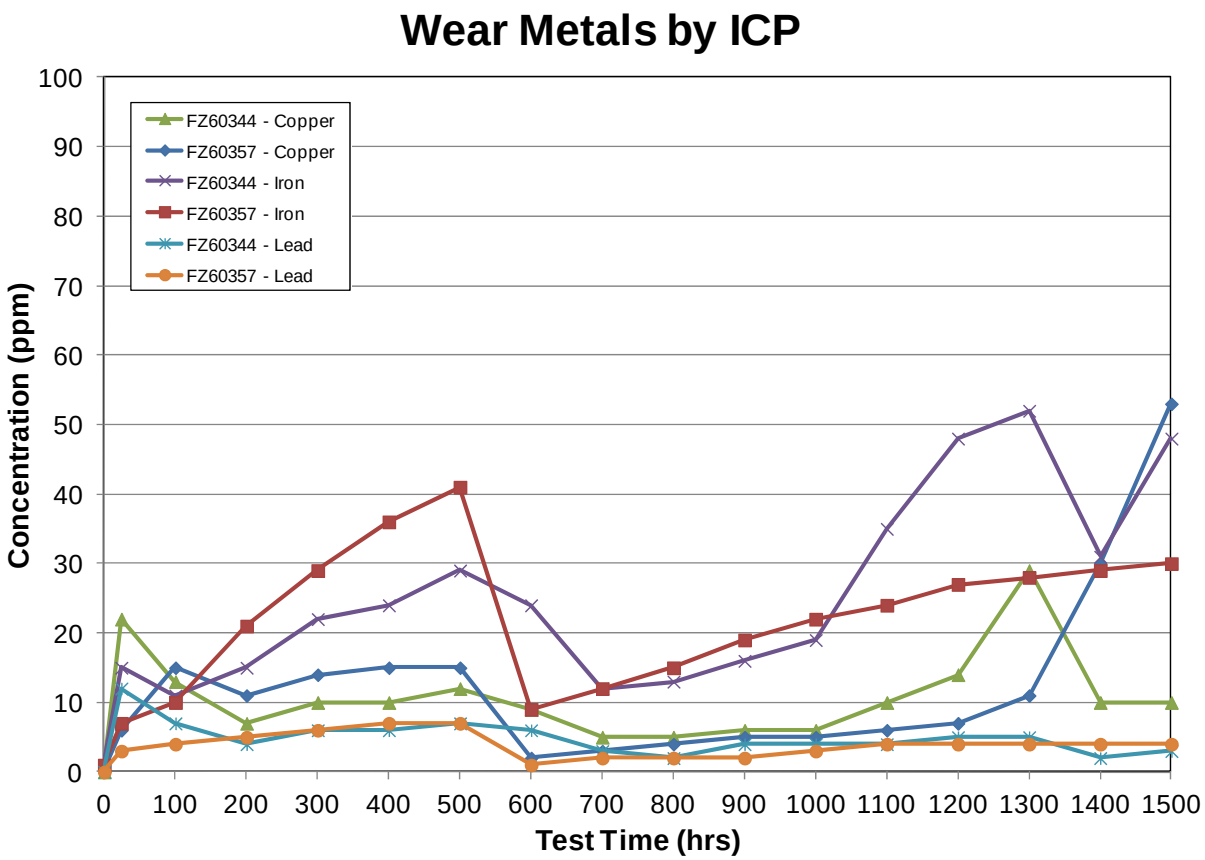

Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
FZ35046 - Aluminum
FZ35055 - Aluminum
FZ35046 - Tin
FZ35055 - Tin
FZ35046 - Silver
FZ35055 - Silver
FZ35046 - Silicon
FZ35055 - Silicon
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

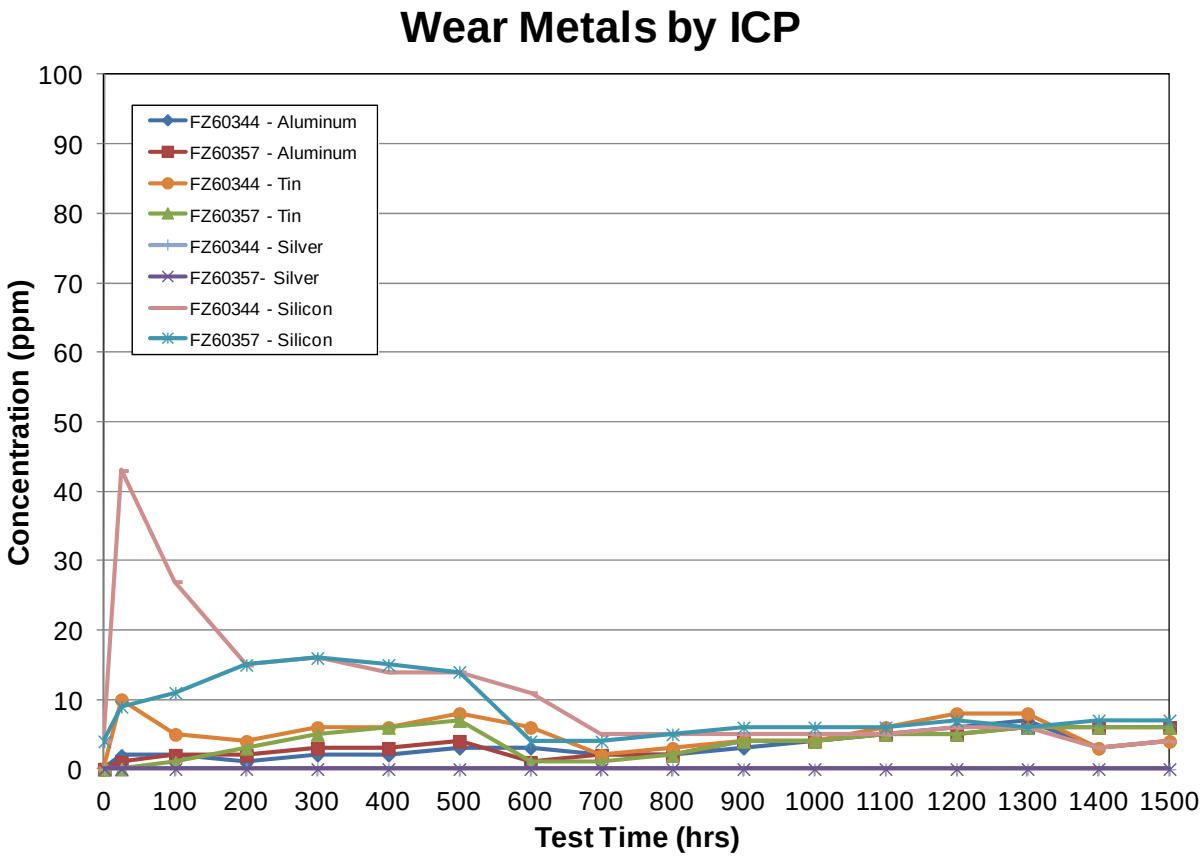
Model No. MEP 804A – 15kW

Serial No. FZ60344 & FZ60357



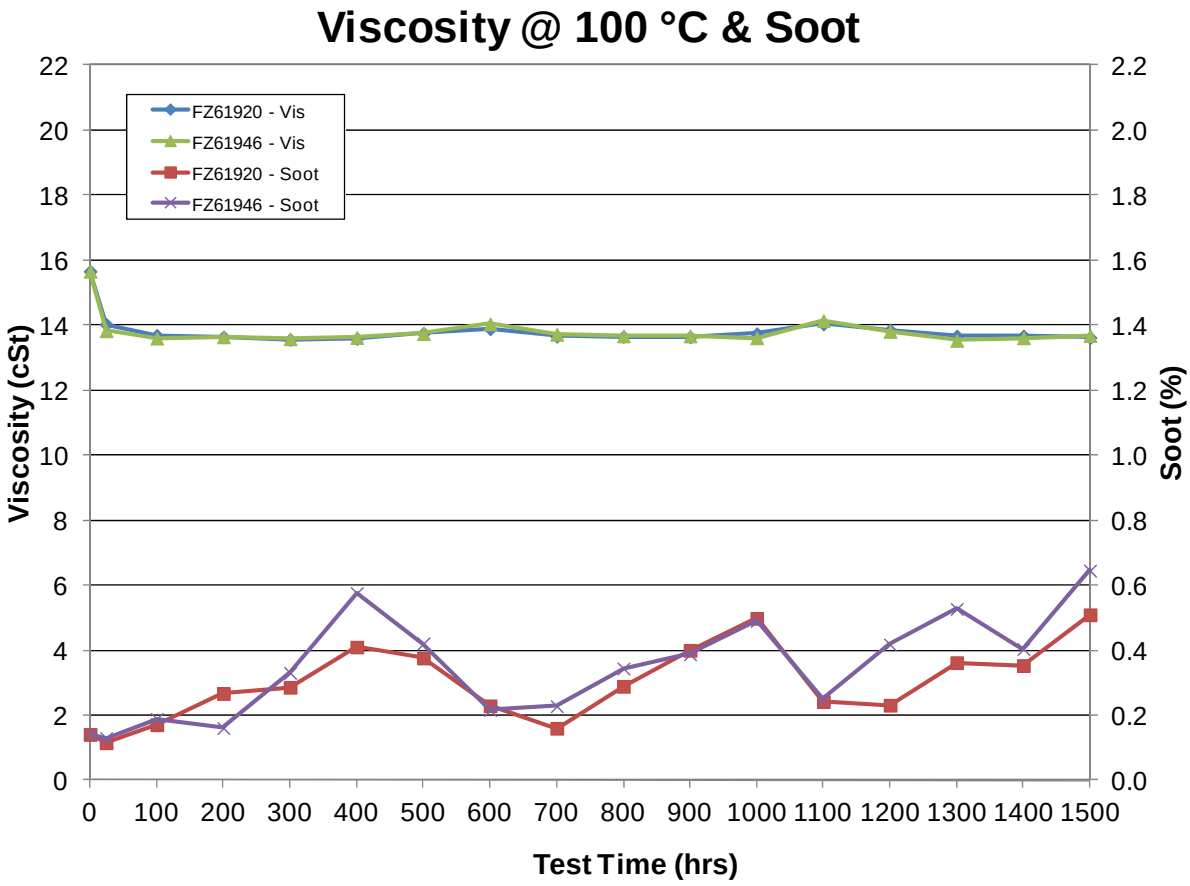

Total Acid and Base Numbers
TAN/TBN (mg KOH/g)
Test Time (hrs)
FZ60344 - TBN
FZ60357 - TBN
FZ60344 - TAN
FZ60357 - TAN
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

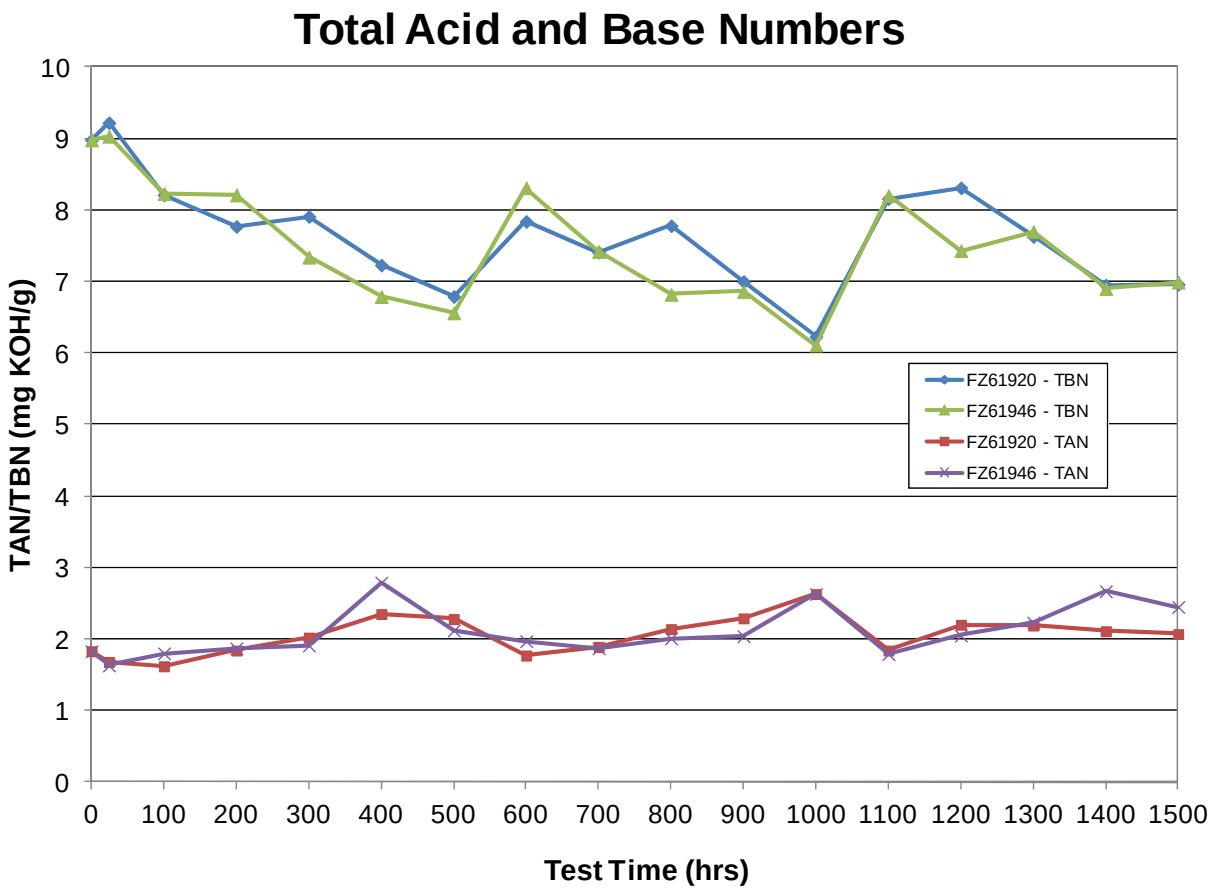

Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
FZ60344 - Copper
FZ60357 - Copper
FZ60344 - Iron
FZ60357 - Iron
FZ60344 - Lead
FZ60357 - Lead
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

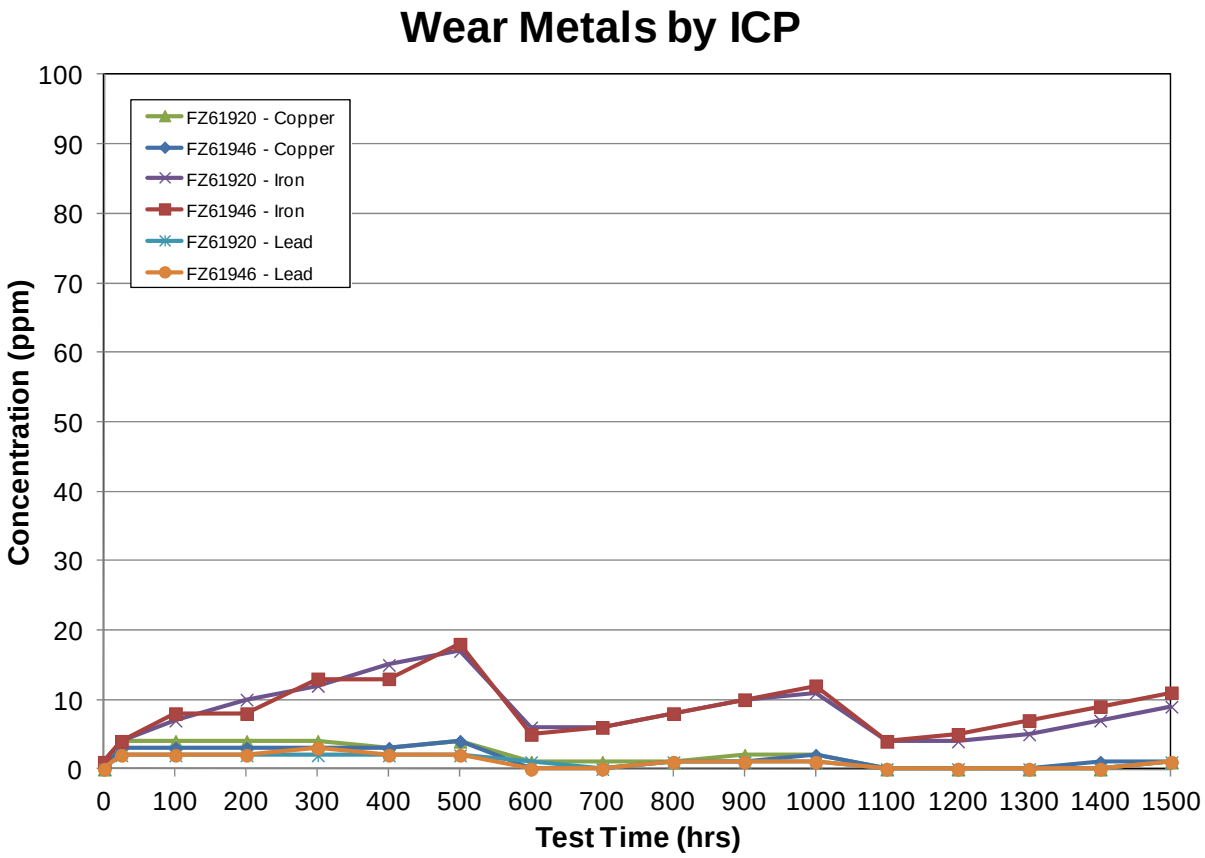

Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
FZ60344 - Aluminum
FZ60357 - Aluminum
FZ60344 - Tin
FZ60357 - Tin
FZ60344 - Silver
FZ60357- Silver
FZ60344 - Silicon
FZ60357 - Silicon
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

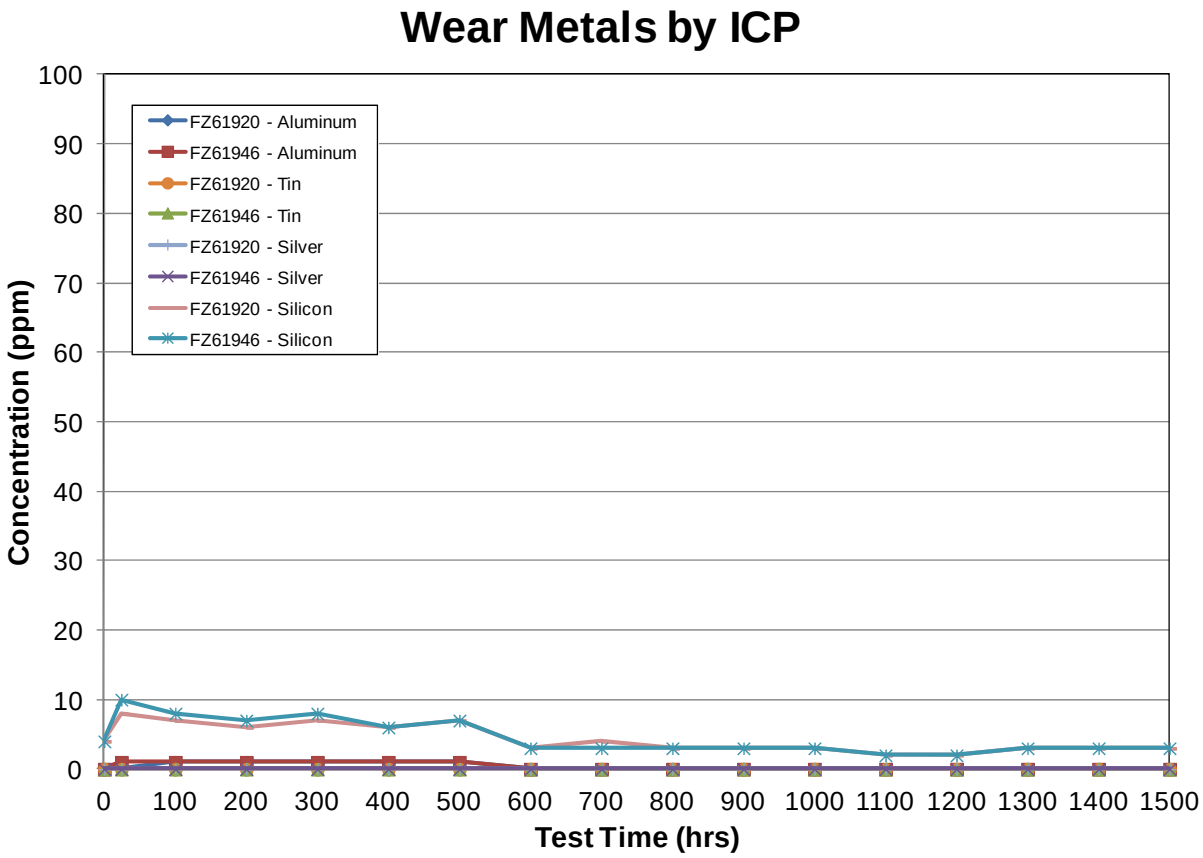
Model No. MEP 804B – 15kW

Serial No. FZ61920 & FZ61946



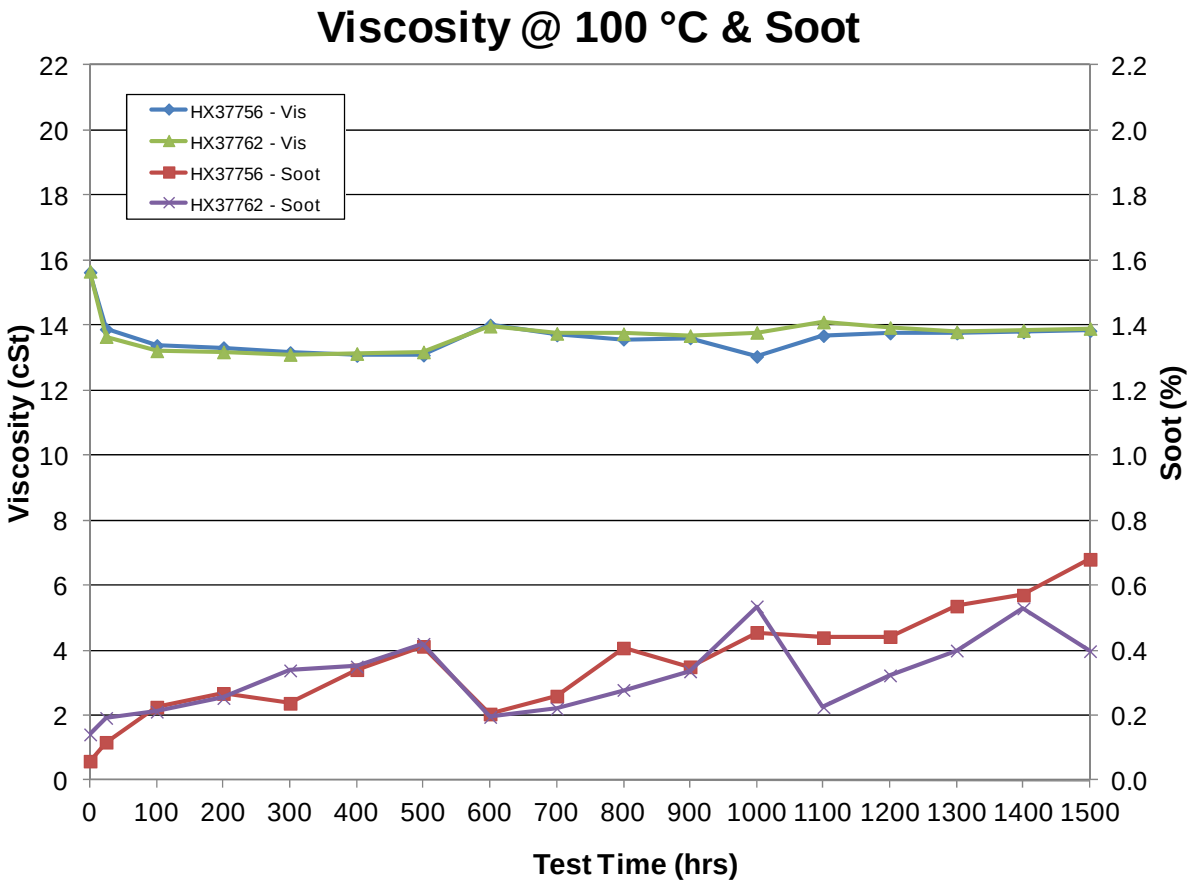

Total Acid and Base Numbers
TAN/TBN (mg KOH/g)
Test Time (hrs)
FZ61920 - TBN
FZ61946 - TBN
FZ61920 - TAN
FZ61946 - TAN
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

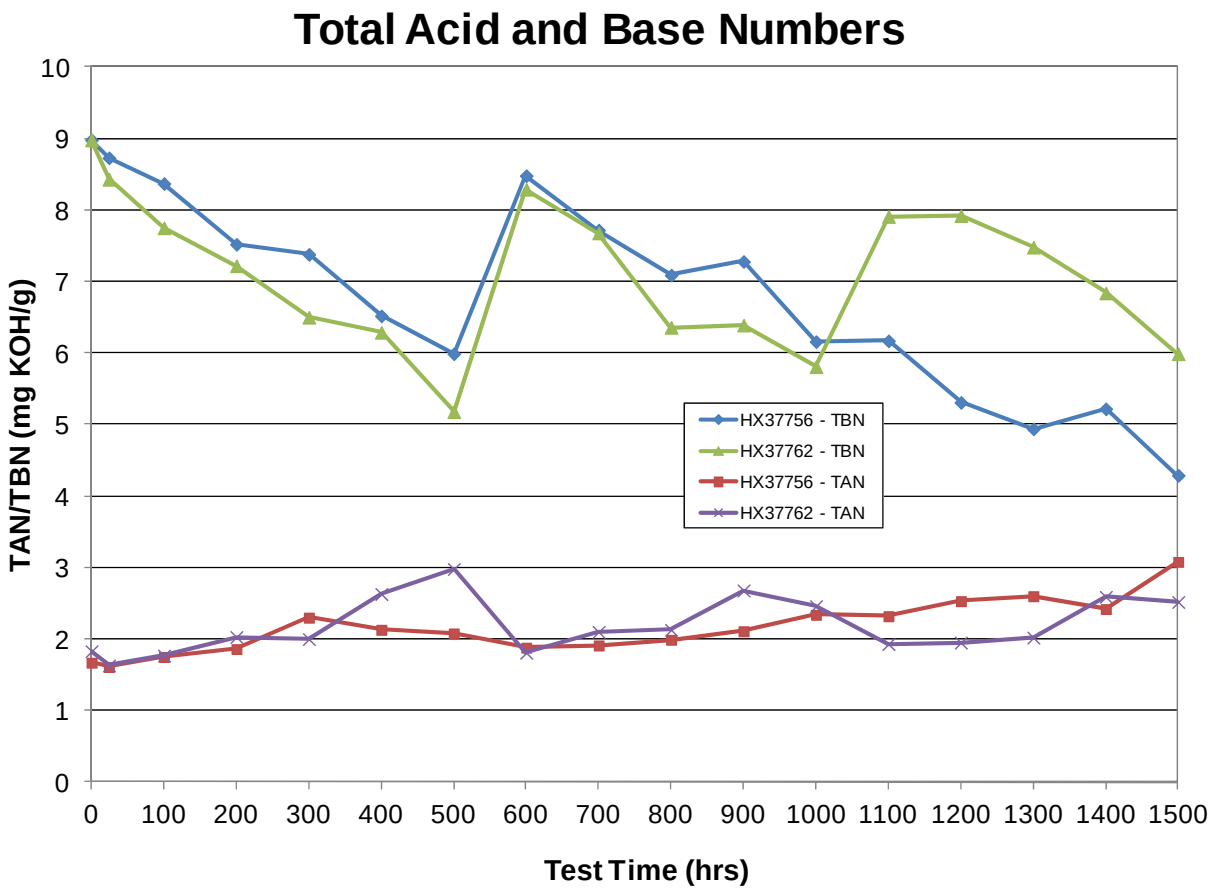

Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
FZ61920 - Copper
FZ61946 - Copper
FZ61920 - Iron
FZ61946 - Iron
FZ61920 - Lead
FZ61946 - Lead
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

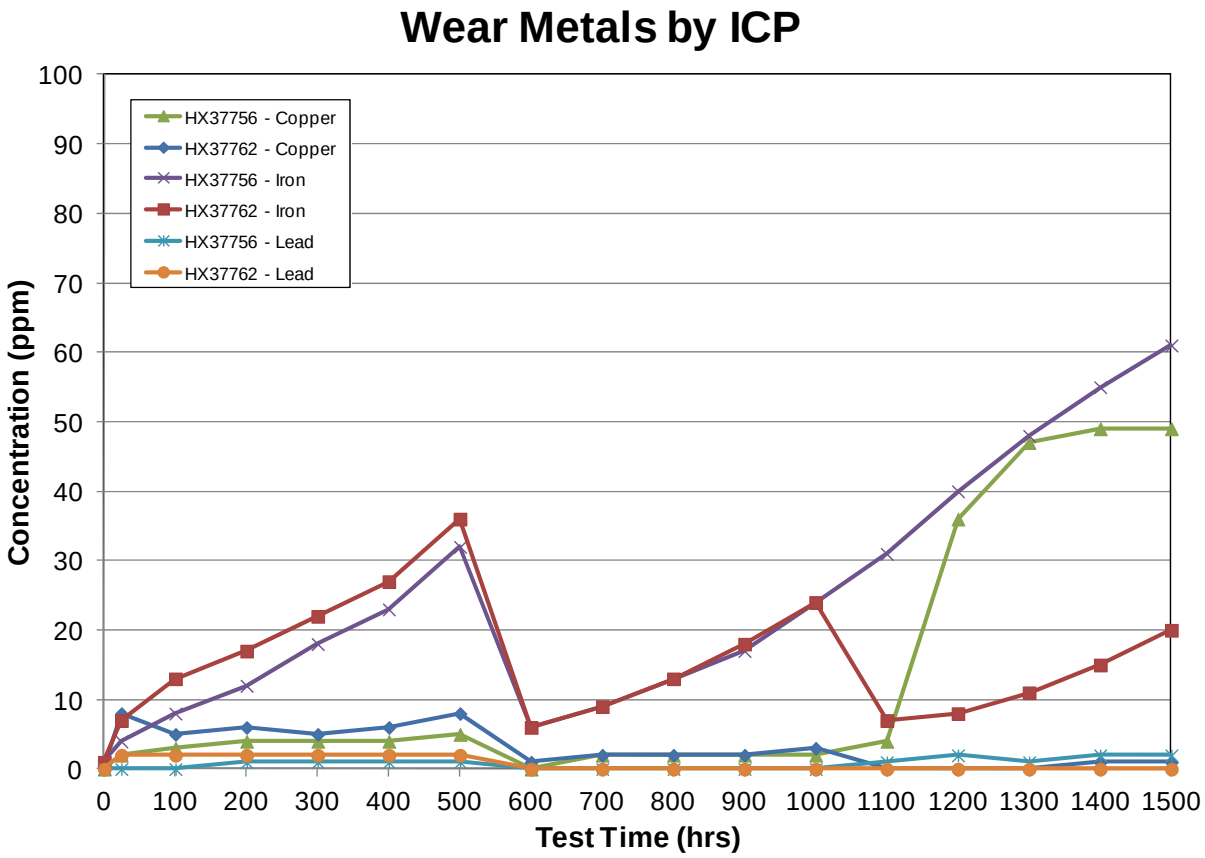

Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
FZ61920 - Aluminum
FZ61946 - Aluminum
FZ61920 - Tin
FZ61946 - Tin
FZ61920 - Silver
FZ61946 - Silver
FZ61920 - Silicon
FZ61946 - Silicon
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

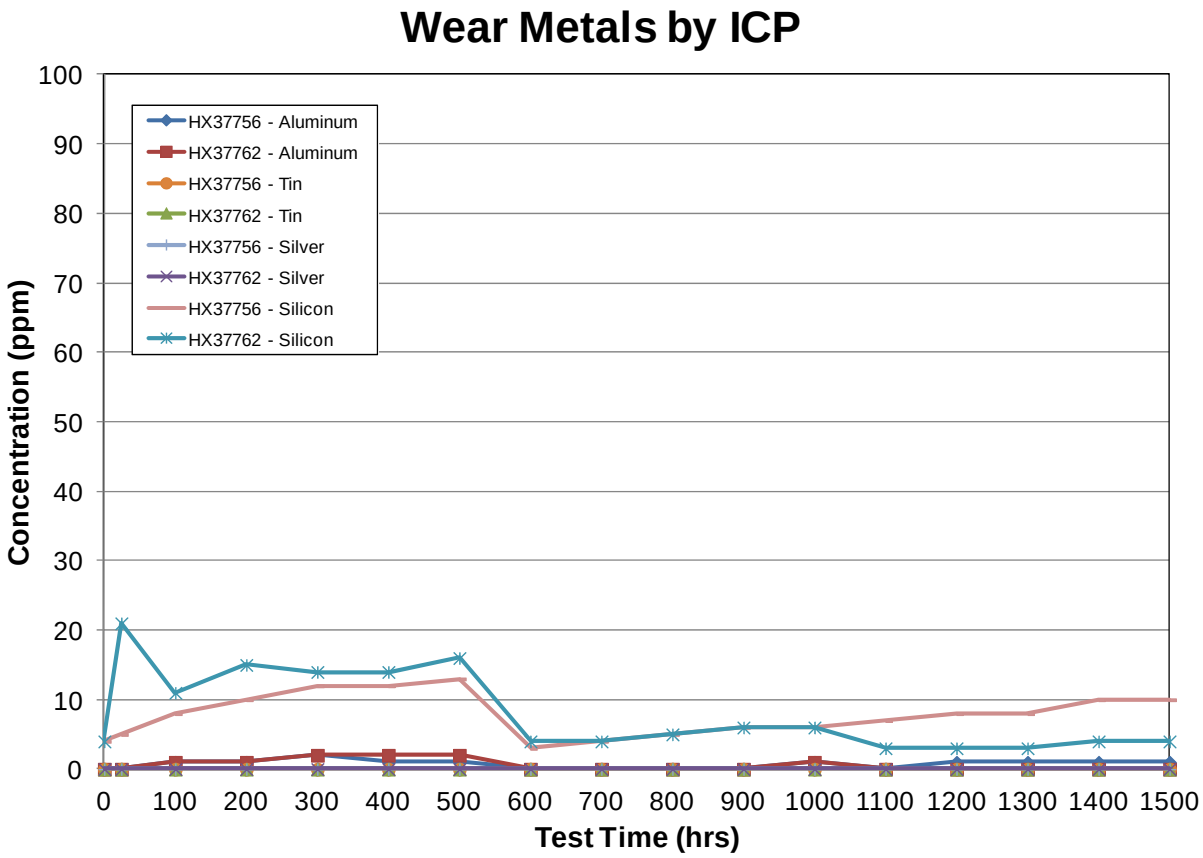
Model No. MEP 805B – 30kW

Serial No. HX37756 & HX37762



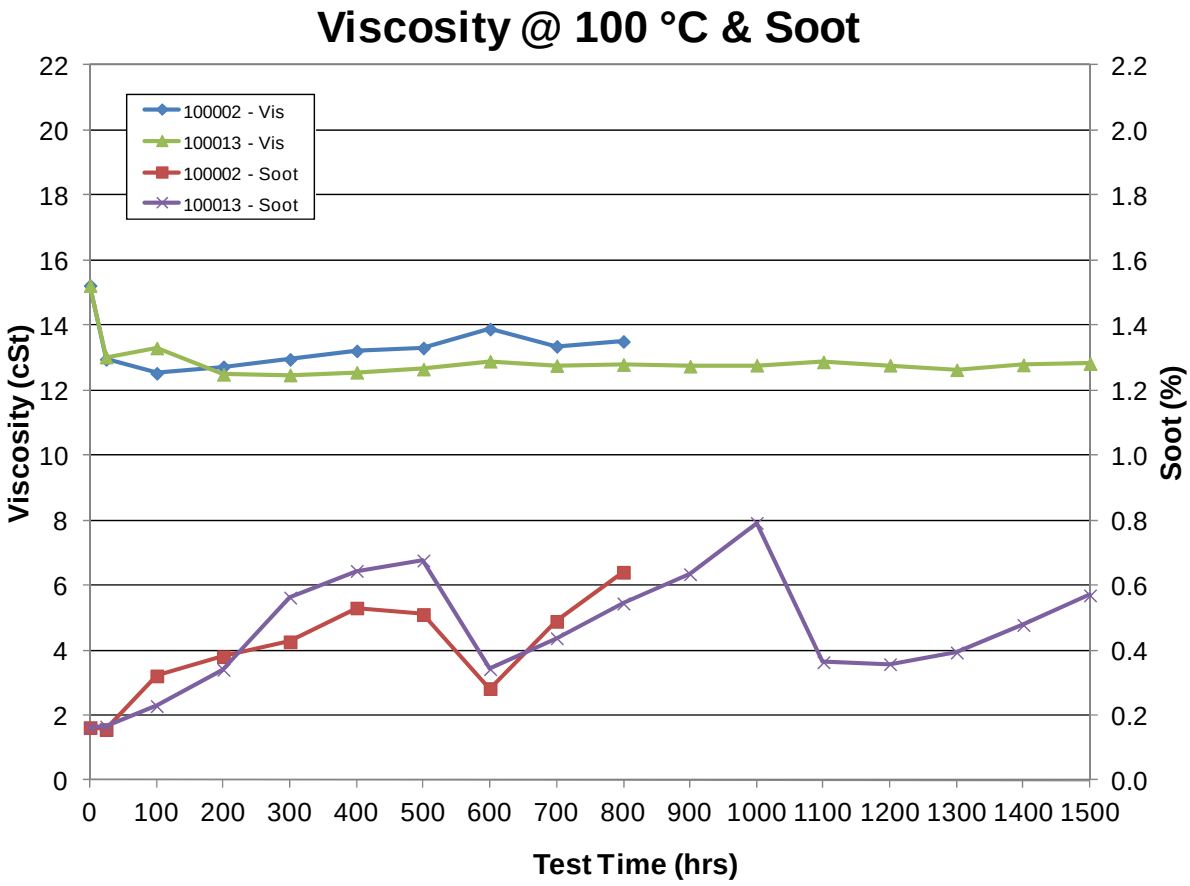

Total Acid and Base Numbers
TAN/TBN (mg KOH/g)
Test Time (hrs)
HX37756 - TBN
HX37762 - TBN
HX37756 - TAN
HX37762 - TAN
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

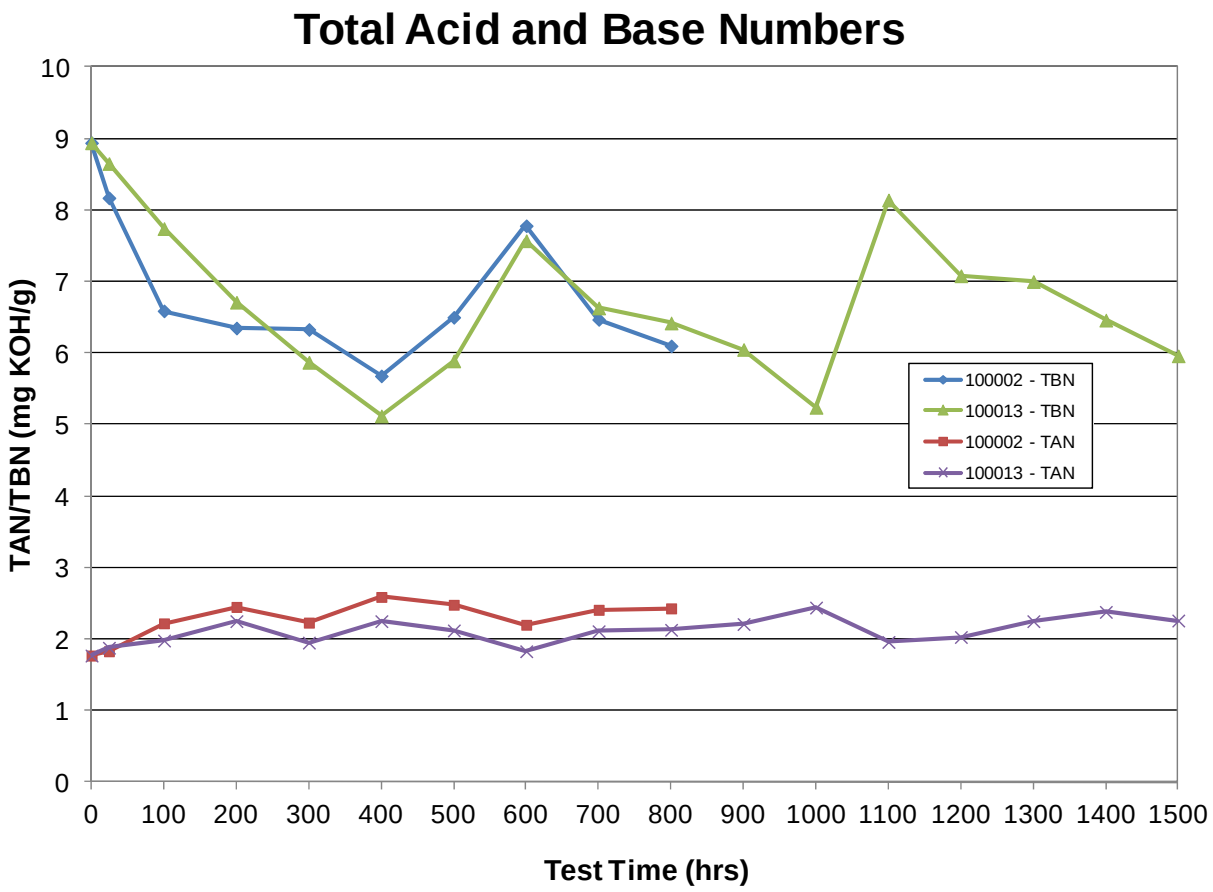

Wear Metals by ICP
HX37756 - Copper
HX37762 - Copper
HX37756 - Iron
HX37762 - Iron
HX37756 - Lead
HX37762 - Lead
Concentration (ppm)
Test Time (hrs)
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500

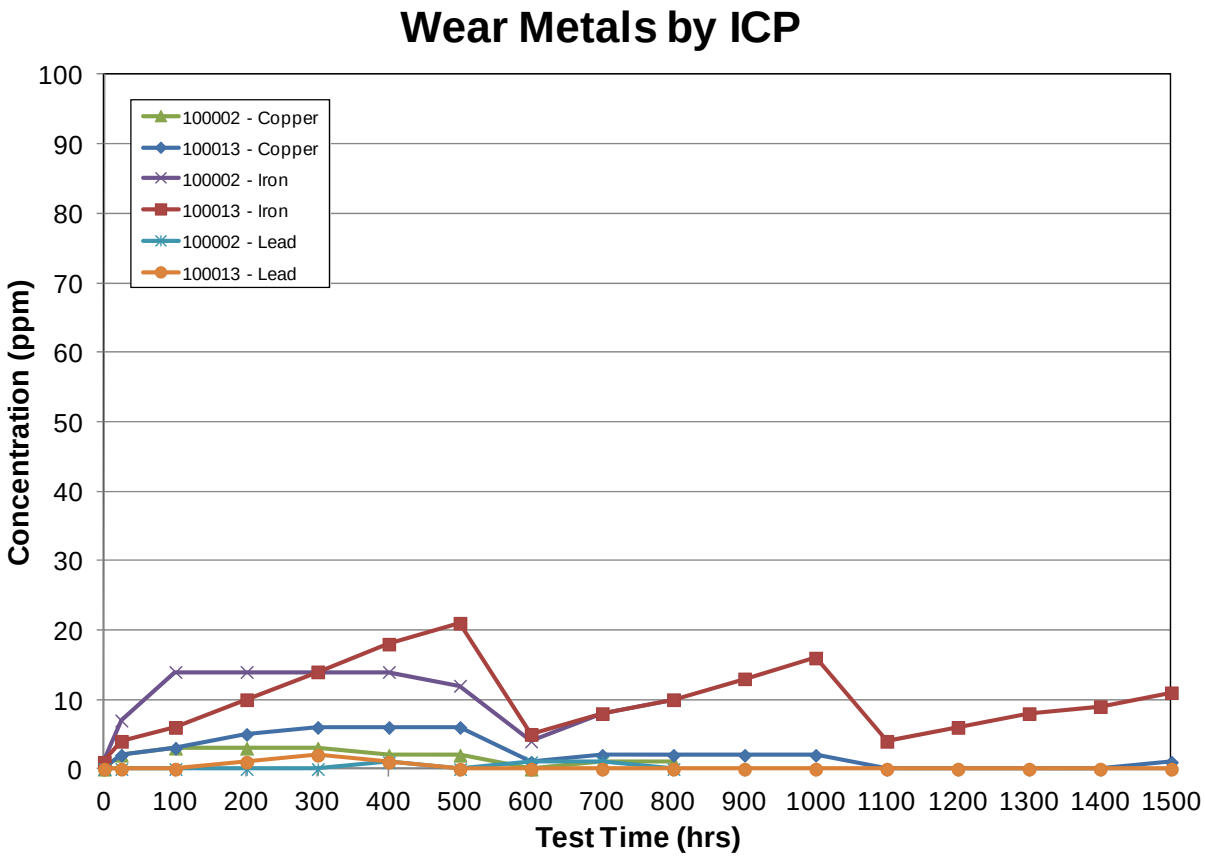

Wear Metals by ICP
HX37756 - Aluminum
HX37762 - Aluminum
HX37756 - Tin
HX37762 - Tin
HX37756 - Silver
HX37762 - Silver
HX37756 - Silicon
HX37762 - Silicon
Concentration (ppm)
100
90
80
70
60
50
40
30
20
10
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Test Time (hrs)

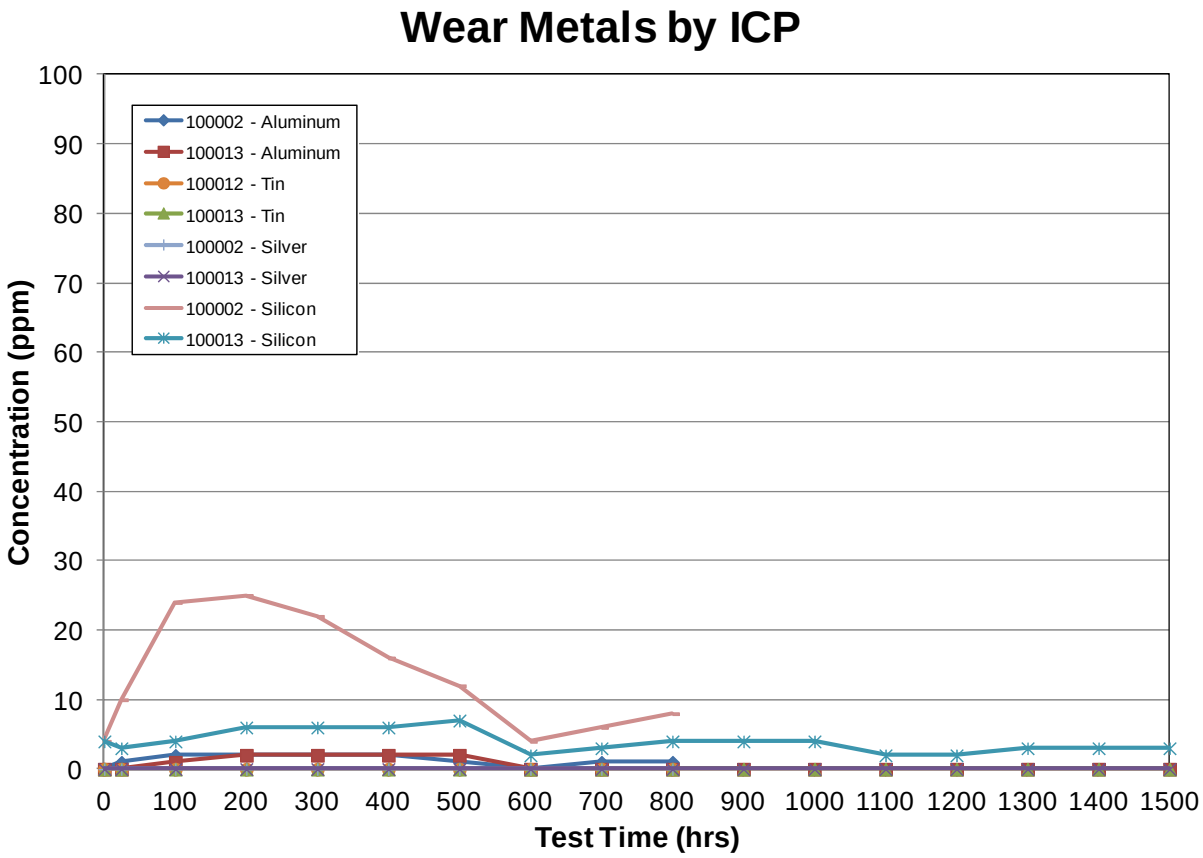
Model No. MEP 807A – 100kW

Serial No. 100002 & 100013




Total Acid and Base Numbers
TAN/TBN (mg KOH/g)
Test Time (hrs)
100002 - TBN
100013 - TBN
100002 - TAN
100013 - TAN
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500


Wear Metals by ICP
100002 - Copper
100013 - Copper
100002 - Iron
100013 - Iron
100002 - Lead
100013 - Lead
Concentration (ppm)
Test Time (hrs)
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500


Wear Metals by ICP
Concentration (ppm)
Test Time (hrs)
100002 - Aluminum
100013 - Aluminum
100012 - Tin
100013 - Tin
100002 - Silver
100013 - Silver
100002 - Silicon
100013 - Silicon
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500