NAVY EXPERIMENTAL DIVING UNIT

REPORT NO. 5-94

EVALUATION OF BAUER K-20 DIESEL DRIVE HIGH PRESSURE BREATHING AIR COMPRESSOR

GEORGE D. SULLIVAN

DECEMBER 1993

DEPARTMENT OF THE NAVY
NAVY EXPERIMENTAL DIVING UNIT
321 BULLFINCH ROAD
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IN REPLY REFER TO:

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Approved for public release; distribution unlimited

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

In response to NAVSEA tasking, Navy Experimental Diving Unit (NEDU) evaluated the BAUER K-20 Diesel Drive High Pressure Breathing Air Compressor from Oct 13, 1993 to Nov 02, 1993. This test was to determine if the compressor system, when operating at 5000 PSI, met Navy diving community requirements. Based on the test results NEDU recommends that the compressor not be placed on the Approved for Navy Use list published by NAVSEA 00C.

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CONTENTS

ILLUSTRATIONS

I. INTRODUCTION

In response to NAVSEA tasking[1,2] two BAUER 20 CFM, MODEL K-20, NSN 4310-01-291-8028 Diving Air compressors equipped with Bauer P-5 purification systems were tested by the Navy Experimental Diving Unit (NEDU). The purpose of the test was to:

A. Determine if the compressor and Purification System provides compressed air at the required pressures, flow rates, quality and cleanliness required by the U.S. Navy[3].

B. Determine the adequacy of the manufacturer's information, instructions and guidance for the safe operation and overall management of the compressor.

II. EQUIPMENT DESCRIPTION

A. GENERAL

The BAUER 20 CFM MODEL K-20 high pressure, breathing air compressor (Figure 1) is of a four stage, four cylinder, "X" configuration. The fourth stage cylinder is lubricated by means of a forced-fed lubrication system; the other cylinders and running gear are mist-lubricated.

The BAUER compressor unit consists of compressor block, condensate separator system, purification system, instrument panel, fuel tank, and a diesel engine in a skid-mounted frame.

The drive unit during this test was a Deutz, Model F2L912, 27 hp, air cooled, two-cylinder diesel engine. The engine is designed to start electrically by means of a 12 v battery, or manually with a hand crank. It is equipped with a cold weather starting aid system. A V-belt pulley and hand-operated Rockford clutch transfers rotating torque to the compressor via two V-belts.

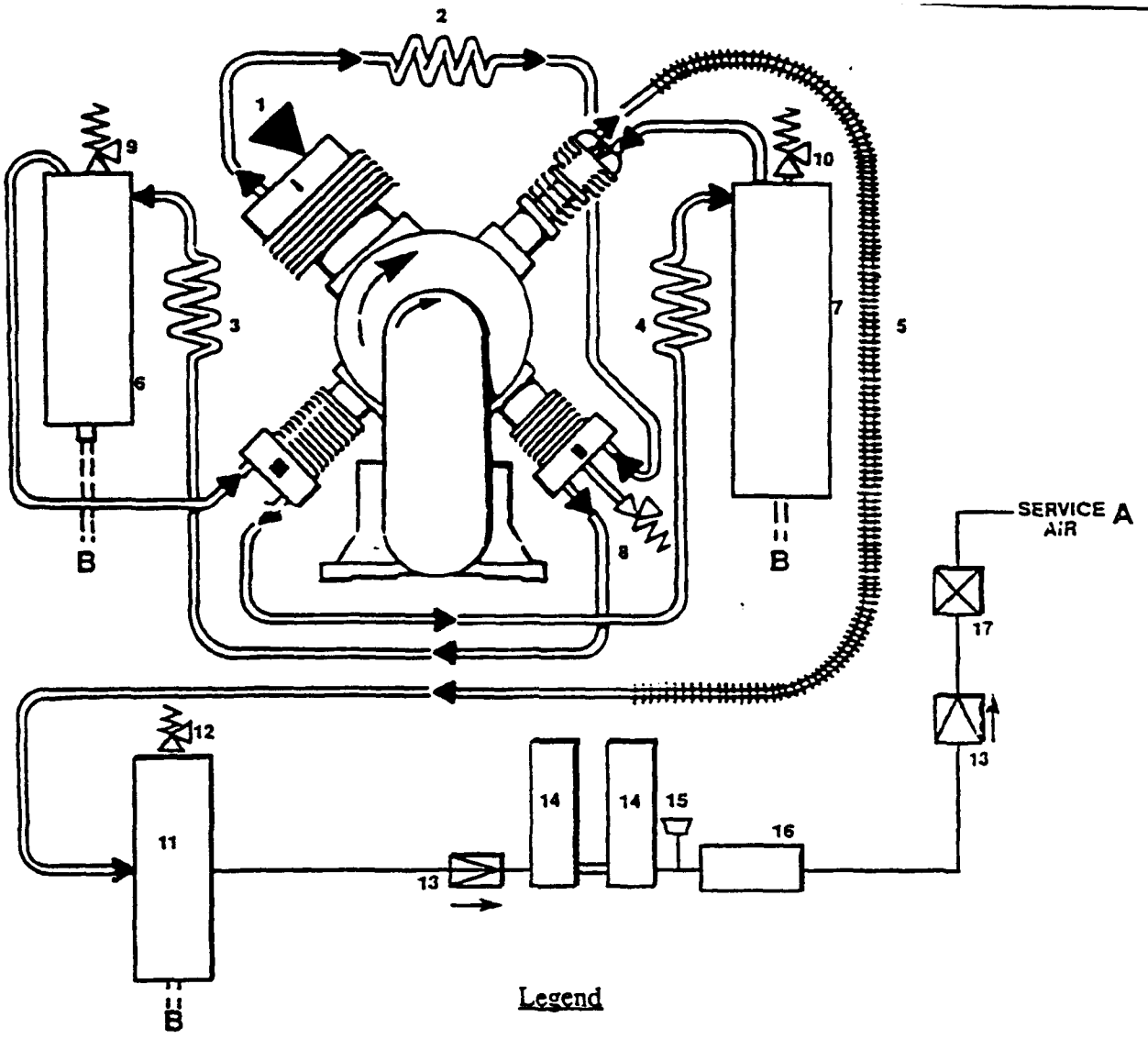
The purification system utilizes two replaceable cartridges (BAUER filter PART No. 058825 with molecular sieve, and PART No. 068416 with activated carbon and hopcalite).

The oil/water separator block is installed between the 2nd, 3rd, and 4th stages. The drawn-off oil/water is maintained in the separator blocks until the condensate drain is manually activated. The oil/water separator block is equipped with a condensate heater for use in cold weather to prevent the condensate from freezing. The separator block requires routine maintenance consisting of periodic draining. Residual oil and water vapors that are not drained manually are removed by the purification cartridge system. The treated air is free of oil, taste, smell, and carbon monoxide.

The BAUER 20 CFM, MODEL K-20 Diving Air Compressor comes with one Technical Manual[4] which is divided into the following sections;

1. Equipment Description and Data
2. Description and Use of the Operator's Controls and Indicators
3. Preventive Maintenance Checks and Services

AIR FLOW DIAGRAM



Legend

1. Intake Filter
2. Intercooler (1st stage)
3. Intercooler (2nd stage)
4. Intercooler (3rd stage)
5. After Cooler
6. Condensate Block (2nd/3rd stage)
7. Interfilter (3rd/4th stage)
8. Interm. Pressure Safety Valve (1st stage)
9. Interm. Pressure Safety Valve (2nd stage)
10. Interm. Pressure Safety Valve (3rd stage)
11. Condensate Block (4th stage)
12. Final Pressure Relief
13. One-Way Valve
14. Filters
15. Bleed Off Valve
16. Pressure Maintaining Valve
17. Service Valve

A Air Outlet

B Condensate Outlet

Note: Condensate Blocks 6, 7, and 11 are actually mounted on a heated condensate drain manifold along with the final separator.

4. Operation Under Normal Conditions
5. Fuel Oil and Lubrication Requirements
6. Unit Troubleshooting Procedures
7. Unit Maintenance Procedures

According to the manufacturer's literature[4], the BAUER, Model K-20 compressor has a capacity of 566 liters per minute (20 scfm) free air delivered. The purification cartridges have an air processing capability for 80 hours of use or six months.

A pressure maintaining/non-return valve (which is set between 124 and 134 bars [1,800 and 2,000 psi]) is provided down-stream from the purification filter system. This achieves constant, optimum filtering, moisture separation, fourth stage piston ring expansion/cylinder sealing, and prevents compressed air return from the air storage flasks to the compressor during unit shut down. All four stages of the compressor are protected by safety relief valves. A diagram of the compressor system is provided in Figure 1. The compressor comes with two final system safety valves. The scuba charging whip relief is set at 220 bar (3,200 psig) and the air service line relief is set at 346 bar (5,100 psig).

III. TEST PROCEDURE RESULTS

Two compressor units were tested[5]. For identification purposes they are referred to as compressor (A) and compressor (B).

There are various methods of testing compressor capacities, stability, and reliability[5]. For this compressor evaluation, NEDU chose to continuously run the compressors for extended periods, charging a 87.7 liter (3.1 cuft) cylinder from 0 to 345 bars (0 to 5,000 psig). BAUER purification cartridges (PART No. 058825 and 068416) were used for these tests.

Compressor (A) and all ancillary equipment was received and set up according to manufacturer's instructions. A Cole Palmer Model 8502-14 temperature monitor and Yellow Springs Instruments 700 Series thermistor probes were attached for measuring compressor discharge and ambient temperatures. An Analox carbon monoxide monitor was used to analyze compressor discharge air before and after the filter purification system with the sample flow rate set at 3.0 mL per minute. Nitrogen with a 50.8 PPM mixture of Carbon Monoxide (CO) was used to calibrate the high range of the monitor, and ambient air was used to set the monitor's low range at 0.

A gas mixture of 24.4% carbon monoxide and 75.6% nitrogen was injected into the compressor intake by a Victor Equipment Company manual regulator through a Fisher/Porter flow meter.

The introduction of carbon monoxide was adjusted to maintain 50 PPM of carbon monoxide at the inlet to the central purification system. Appendix A and B shows the recorded data from the Test Log. The unit was operated in an exterior work area, open to ambient temperature and humidity. The testing included subjective evaluation of the system operation but did not include detailed mechanical review of the individual components of the system.

Testing of compressor (A) was suspended at 29.6 test hours because of the failure of the automatic condensate drain (ACD) block securing bolts, excessive vibration, and repeated oil line fitting failure.

Compressor (B) was configured with the testing instrumentation used on compressor (A) and the compressor was operated for a total of 50 hours. Appendix B shows recorded data from the Test Log.

Compressor (A) testing resumed after the mechanical deficiencies were corrected by a factory on-site representative. The following parameters were recorded:

1. Date
2. Time
3. Meter Test Hours
4. Ambient Temperature
5. Compressor Air Discharge Temperature
6. Ambient Humidity
7. Carbon Monoxide PPM (Before/After Filtration)
8. Injected Carbon Monoxide Flow Rate and Percentage
9. Engine Oil Pressure
10. Engine Cylinder Head Temperature
11. Alternator Output Voltage
12. Compressor Oil Pressure
13. Compressor Final Discharge Pressure
14. Service Line Discharge Pressure
15. Cylinder Charging Times

A. AIR DELIVERY

Compressor capacity was determined (27.62 scfm) by calculating the average time between compressor A (673.83 SLPM (28.82 CFM)) and B (747.95 SLPM (26.41 CFM)to charge a (3.1 cuft) floodable volume cylinder from 0 to 345 bars (0 to 5,000 psig). Calculations are shown in Appendix A-10 and B-7.

B. AIR SAMPLING

Air samples were taken from the compressor purification system discharges. The sample on Compressor (A) was taken at 1 hour running time. Two samples were taken on Compressor (B) at the 25 hour and 45 hour test period. Samples were sent to the CSS Laboratory, Code 5130, for purity analysis. Appendix C lists the air sample analysis results. The P-5 purification system was previously evaluated in NEDU tests 91-17, 91-28 and recommended for approval in NEDU reports 08-91 and 12-91.

C. OIL LUBRICATION

At the beginning of the test[5], compressor (A) engine oil level was 1.89 liters (2 quarts) below Full, and the compressor oil was .47 liters (1 pint) below Full. Compressor (B) engine was 2.36 liters (2.5 quarts) below Full, and the compressor was .47 liters (1 pint) below Full. Both units were filled to their prescribed limits. Oil levels were checked at the beginning and end of

each testing period, or every 8 hours. Oil consumption was logged in Appendix A and B. The engine requires 4.7 liters (5 quarts) of Navy symbol 9250. The compressor requires approximately 4.0 liters (4.2 quarts) of MIL-L-17331 2190TEP and MIL-H-17672 (Arctic Temperature) 2135TH lubricating oil.

D. OIL CONSUMPTION

During the 50 hour test[5], a total of 0.47 liters (1 pint) of oil was added to compressor (B) and 0.23 liters (0.5 pint) of oil added to compressor (A). No engine oil was required for either unit.

E. DIESEL FUEL

The diesel engine is fitted with a 49.20 liter (13 US gallon, 10.8 Imperial gallon) fuel tank. Both compressor engines were run at the full factory throttle setting during the entire testing period. Compressor (A) used 206 liters (54.5 gallons, 45.3 imperial gallons) of diesel fuel. The average fuel consumption was 4.12 liters (1.09 gallons, 0.90 imperial gallon) per hour. Compressor (B) used 208 liters (55 gallons, 45.7 imperial gallons) of diesel fuel. The average fuel consumption was 4.16 liters (1.1 gallons, 0.91 imperial gallon) per hour.

F. MAINTENANCE

Scheduled maintenance was performed per the manufacturer's instructions[4]. This included checking the tension of drive belts, the engine/compressor oil levels, lubrication of the clutch throw-out collar, checking the engine oil bath air cleaner every 10 hours. At 24 hours, the engine oil was changed on compressor (A).

IV. OBSERVATIONS/RECOMMENDATIONS

A. Compressor (A) experienced excessive vibration contributing to component failure and complete unit failure at 29.9 hours of operation as listed in (APPENDIX A). A factory representative was called in and determined the vibration was caused by incorrect engine/compressor speed (factory set). Both compressor A and B engine "full throttle" speeds were re-adjusted by the factory representative to within factory specifications (2,100 to 2,300 RPM) then fine tuned to achieve a point of least vibration. This was accomplished at approximately 2,200 RPM as indicated on a mechanical tachometer. There is no mechanical or electrical device installed on the unit to determine or set engine/compressor speed. It is recommended that a tachometer be installed on the diesel engine and instructions provided for correctly setting the engine/compressor speed.

B. The ACD block securing bolts failed from excessive vibration and misalignment of piping. The manufacturer's maintenance manual[4] (page 4-11 step 7) instructs the mechanic to bolt the ACD block to the compressor. Step 8 gives direction to then attach the six tubes to the ACD block. The factory representative (during his repair) first connected the six tubes to the ACD block prior to bolting it to the compressor. He said it helped relieve stress and vibration caused by misalignment. It is recommended that the Technical Manual[4] be changed to reflect the above installation procedure.

C. The oil fill plug on the final line pressure gauge of compressor A fell out. This required replacing the gauge. The factory representative stated this was due to ambient temperature fluctuations. The failure of such instrumentation could cause equipment failure. NEDU recommends the gauges be replaced with gauges that are not subject to failure due to ambient temperature changes.

D. Gauges have no operating parameters listed. Operating parameters should be listed on each instrument i.e., ENGINE OIL PRESS 30 - 90 PSI.

E. The discharged condensation contained oily waste. The drain pipe discharged this oil/water waste on the ground leaving an oil residue and a possible safety hazard. Page 3-22 of the Technical Manual[4] states:

> **The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon the navigable waters of the United States etc.**

Since this compressor could be used on the deck of a vessel, NEDU recommends the condensate drain be piped into a non-pressurized tank that can be emptied in a controlled manner.

F. The fuel filter is the spin off automotive type and is mounted horizontally on the engine. Replacement of this filter can not be accomplished without spilling its contents. The fuel filter should be mounted vertically.

G. Compressor B oil pressure was operating as low as 52 bars (760 psi) (Appendix B). The factory representative stated it was too low and adjusted the oil pressure regulator to 60 bars (880 psi). The Technical Manual[4] page 2-1 states: Pressure normally reads between 51 to 59 bars (750 to 870 psi). It is recommended that the Technical Manual[4] be corrected to reflect the correct parameters.

H. The compressor unit comes with a SCUBA charging connection, fitted with a relief valve set at 224 bars (3300 psi) and connected to a 344 bars (5000 psi) hose whip. Charging a single 2,265 liter (80 cuft) cylinder directly from the compressor would exceed the recommended charging rate[6]. This is noted for the information of all operators.

I. The fuel tank fill opening was directly over the engine exhaust manifold. There was no label warning operators to secure the engine and let it cool before adding fuel. It is recommended that the fuel tank be turned 180° in its mount. This will place the fill opening away from the engine exhaust manifold.

J. The fuel supply line has no shut off valve. It is recommended that a fuel valve be installed.

K. The rubber fuel lines rub against the skid frame. The vibration of the running unit started wearing a hole through the hose. The Army has a field modification which calls for wrapping the hose in canvas wrapping. These compressors were not modified. All compressors should be modified to include a chaffing guard on the fuel lines.

V. CONCLUSIONS

Numerous equipment failures,excessive vibration and maintenance problems occurred during both this evaluation and the one conducted in NEDU test 91-17. After the factory representative worked on both compressor A and B they seemed to operate satisfactory with less vibration than before his adjustments. Thirteen additional hours were logged on each compressor, while charging numerous Army Special Divers Air Support System (SDASS) flasks. The compressors operated satisfactory during this period. The Bauer K-20 compressor was built to the requirements of an Army specification written to provide a compressor to be used in an unusual application. The Army presently has approximately 75 of these units.

The high pressure air compressor delivers air which meets USN standards[3] at an average rate of 782.11 LPM (27.62 CFM) per Appendix A and B. This meets the manufacturer's specifications. However, due to reliability and safety concerns, NEDU is recommending that the BAUER 20 CFM 5000 psi, MODEL K-20, NSN 4310-01-291-8028 not be included on the ANU list[7]. NEDU recommends that no additional compressors be procured.

VI. REFERENCES

1. NAVSEA Task 92-002. Evaluation of commercially available divers air compressors.

2. NAVSEA Task 92-003. Evaluation of Commercially Available Filters for H.P. and L.P. Breathing Air.

3. NAVSEA 0994-LP-001-9010. U.S. Navy Diving Manual Volume 1, Rev 3, Para 5.3.2. Air Purity Standards, 15 December 1988.

4. Army Technical Manual, M-5-4310-389-14 Operator, Unit and Intermediate (Direct Support/General Support) Maintenance Manual.

5. Navy Experimental Diving Unit Test Plan Number 93-34, September 1993.

6. Naval Ships Technical Manual, S9086-SY-STM-010, Chapeter 551 1st Rev. 1 November 1987. Compressed Air Plants and Systems, para 551-4.2.21.

7. NAVSEAINST 10560.2B, Diving Equipment Authorized for Navy Use.

8. U.S. Army Contract Modification Number P00013 dated 23 October 1993. Issued by U.S. Army Aviation & Troop Command AMSAT-A-PSLE Ralph Macias 314-263-2535 4300 Goodfellow Boulevard St. Louis, Mo.83120-1798.

APPENDIX A - Test log

BAUER H.P. COMPRESSOR (A)

DATE 13 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMBI HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMBI TEMP°F	COMP DISCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0800	23.4	64°	64°	70%	-	-	-	-	95	-	+9V	880	1,700	0	-	-	-	-	-	-
0820	23.8	72°	65°	61%	50 PPM	0 PPM	1.10 CC	24.4%	95	-	+9V	870	3,300	3,300	-	-	-	-	-	-
0830	24.0	66°	59°	58%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+9V	870	5,000	5,000	3.4	5,000	0834	-	-	-
0900	24.4	66°	76°	53%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+9V	870	2,300	2,300	3.4	5,000	-	-	-	-
0930	24.9	69°	81°	50%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+9V	870	4,900	4,900	3.4	5,000	-	0930	5,000	:56
1000	25.4	69°	79°	49%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	870	3,100	3,100	-	-	-	-	-	-
1030	25.9	71°	68°	47%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	870	2,000	1,300	-	-	-	-	-	-
1100	26.4	72°	59°	56%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	860	1,800	0	-	-	-	-	-	-
1128	SECURED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1217	STARTED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1230	27.2	74°	83°	58%	50 PPM	0 PPM	1.05 CC	24.4%	95	-	+5V	865	4,600	0	3.4	5,000	1230	-	-	-
1300	27.7	75°	83°	58%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	865	3,300	3,300	3.4	5,000	-	-	-	-
1330	28.2	75°	80°	56%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	865	2,100	2,100	3.4	5,000	-	1312	5,000	:42
1400	28.7	77°	66°	56%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	865	1,900	900	3.4	5,000	1353	-	-	-
1430	29.2	78°	86°	56%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	865	4,400	4,400	3.4	5,000	-	1435	5,000	:42
1443	SECURED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

REMARKS:
0700 STARTED INSTRUMENT CALIBRATION
0730 CHECKED ENGINE & COMPRESSOR OIL (ADDED 2 QT 9250 ENGINE OIL AND 1/2 QT 2190 TEP COMPRESSOR OIL
0735 ADDED 10 GALLONS OF DIESEL FUEL
1128 OIL LEAK ON COMPRESSOR OIL GAUGE SUPPLY LINE (REPLACED SWEDGE LOCK FITTINGS
1305 SERVICE VALVE HAND WHEEL FEEL OFF

APPENDIX A - Test log

BAUER H.P. COMPRESSOR (A)

DATE 14 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMB HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMB TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0835	28.4	68°	54°	95%	50 PPM	0 PPM	1.05 CC	24.4%	100	-	+5V	865	1,900	0	-	-	-	-	-	-
0900	29.8	69°	70°	88%	50 PPM	0 PPM	1.05 CC	24.4%	95	-	+5V	860	2,000	2,000	-	-	-	-	-	-
0930	30.4	70°	60°	89%	48 PPM	0 PPM	1.05 CC	24.4%	95	-	+5V	865	1,900	0	-	-	-	-	-	-
1000	30.8	72°	81°	83%	48 PPM	0 PPM	1.05 CC	24.4%	95	-	+5V	865	3,600	3,600	-	-	-	-	-	-
1030	31.3	73°	79°	77%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	865	2,000	2,000	3.4	5,000	1012	-	-	-
1100	31.8	74°	70°	81%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	865	1,700	1,000	3.4	5,000	-	1053	5,000	:41
1130	32.3	75°	85°	81%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	865	4,400	4,400	-	-	-	-	-	-
1200	32.8	76°	84°	80%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	865	2,800	2,800	-	-	-	-	-	-
1230	33.3	77°	85°	78%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	865	3,000	3,000	-	-	-	-	-	-
1300	33.8	77°	76°	77%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	860	1,750	1,100	-	-	-	-	-	-
1330	34.3	79°	88°	76%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	860	4,600	4,600	-	-	-	-	-	-
1400	34.8	79°	88°	75%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	860	3,100	3,100	-	-	-	-	-	-
1430	35.3	79°	83°	76%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	860	2,100	1,850	-	-	-	-	-	-
1445	SECURED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

REMARKS:
0700 STARTED INSTRUMENT CALIBRATION
0730 CHECKED ENGINE & COMPRESSOR OIL
0735 ADDED 10 GALLONS OF DIESEL FUEL
0835 STARTED ENGINE
1414 ADJUSTED BACK PRESSURE REGULATOR VALVE

APPENDIX A - Test log

BAUER H.P. COMPRESSOR (A)

DATE 15 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMB HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMB TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0741	STARTED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0800	35.8	74°	74°	100%	50 PPM	0 PPM	1.05 CC	24.4%	95	-	+5V	860	2,100	1,750	-	-	-	-	-	-
0830	36.3	74°	69°	97%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	860	2,100	900	-	-	-	-	-	-
0900	36.8	74°	84°	95%	50 PPM	2 PPM	1.05 CC	24.4%	90	-	+5V	860	4,100	4,100	3.4	5,000	0909	-	-	-
0930	37.3	74°	85°	100%	50 PPM	4 PPM	1.05 CC	24.4%	90	-	+5V	860	5,000	5,000	3.4	5,000	-	0950	5,000	:41
1000	37.8	75°	70°	97%	50 PPM	4 PPM	1.05 CC	24.4%	90	-	+5V	860	2,100	900	-	-	-	-	-	-
1030	38.3	75°	86°	95%	50 PPM	3 PPM	1.05 CC	24.4%	90	-	+5V	860	4,400	4,400	-	-	-	-	-	-
1100	38.8	77°	85°	90%	50 PPM	3 PPM	1.05 CC	24.4%	90	-	+5V	860	2,900	2,900	-	-	-	-	-	-
1130	39.3	78°	82°	91%	50 PPM	4 PPM	1.05 CC	24.4%	90	-	+5V	860	2,100	1,900	-	-	-	-	-	-
1200	39.8	78°	89°	90%	50 PPM	4 PPM	1.05 CC	24.4%	90	-	+5V	860	5,000	5,000	-	-	-	-	-	-
1230	40.3	79°	90°	86%	50 PPM	4 PPM	1.05 CC	24.4%	90	-	+5V	860	3,100	3,100	-	-	-	-	-	-
1300	40.8	80°	82°	84%	50 PPM	4 PPM	1.05 CC	24.4%	90	-	+5V	840	2,100	1,400	-	-	-	-	-	-
1305	SECURED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

REMARKS:
0709 STARTED INSTRUMENT CALIBRATION
0730 CHECKED ENGINE & COMPRESSOR OIL
0735 ADDED 10 GALLONS OF DIESEL FUEL

APPENDIX A - Test log

BAUER H.P. COMPRESSOR (A)

DATE 18 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMBI HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMBI TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0620	STARTED ENGINE		-	-	-	-	-	-	100	-	+5V	-	-	-	-	-	-	-	-	-
0630	41.0	75°	71°	91%	47 PPM	0 PPM	1.05 CC	24.4%	95	-	+5V	865	2,100	800	-	-	-	-	-	-
0900	41.5	79°	89°	88%	50 PPM	2 PPM	1.05 CC	24.4%	90	-	+5V	865	2,900	2,900	-	-	-	-	-	-
0930	42.0	80°	72°	84%	50 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	860	2,100	500	3.4	5,000	0924	-	-	-
1000	42.5	82°	91°	82%	48 PPM	0 PPM	1.05 CC	24.4%	90	-	+5V	860	4,200	4,200	3.4	5,000	-	1005	5,000	:41
1030	43.0	84°	90°	74%	49 PPM	2 PPM	1.05 CC	24.4%	90	-	+5V	860	2,300	2,300	-	-	-	-	-	-
1100	43.5	85°	85°	70%	50 PPM	4 PPM	1.10 CC	24.4%	90	160°	+5V	840	2,100	1,200	-	-	-	-	-	-
1130	44.0	86°	97°	69%	50 PPM	0 PPM	1.10 CC	24.4%	90	160°	+5V	860	3,500	3,500	-	-	-	-	-	-
1200	44.5	85°	87°	69%	50 PPM	0 PPM	1.10 CC	24.4%	90	160°	+5V	840	2,100	1,400	-	-	-	-	-	-
1230	45.0	88°	78°	69%	50 PPM	0 PPM	1.10 CC	24.4%	90	160°	+5V	840	2,000	500	-	-	-	-	-	-
1300	45.5	86°	96°	71%	50 PPM	0 PPM	1.10 CC	24.4%	90	160°	+5V	860	3,600	3,600	-	-	-	-	-	-
1330	46.0	85°	85°	71%	50 PPM	0 PPM	1.10 CC	24.4%	90	160°	+5V	840	2,100	1,200	-	-	-	-	-	-
1400	46.5	85°	97°	71%	50 PPM	1 PPM	1.10 CC	24.4%	90	160°	+5V	860	4,800	4,800	-	-	-	-	-	-
1430	47.0	86°	95°	71%	50 PPM	1 PPM	1.10 CC	24.4%	90	160°	+5V	860	3,000	3,000	-		-	-	-	-
1435	SECURED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

REMARKS:
0700 STARTED INSTRUMENT CALIBRATION
0750 CHECKED ENGINE & COMPRESSOR OIL
0755 ADDED 10 GALLONS OF DIESEL FUEL

APPENDIX A - Test log

BAUER H.P. COMPRESSOR (A)

DATE 19 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMB HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMB TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0655	STARTED ENGINE		-	-	-	-	-	-	100	-	+5V	-	-	-	-	-	-	-	-	-
0700	47.0	70°	62°	100%	47 PPM	0 PPM	1.10 CC	24.4%	100	-	+5V	880	2,000	0	-	-	-	-	-	-
0720	47.6	74°	82°	95%	50 PPM	8 PPM	1.10 CC	24.4%	95	-	+5V	865	2,900	2,900	-	-	-	-	-	-
0800	48.1	70°	71°	91%	50 PPM	8 PPM	1.10 CC	24.4%	90	-	+5V	860	2,000	1,500	-	-	-	-	-	-
0816	SECURED TESTING LEAK		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0845	STARTED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0900	48.6	86°	86°	86%	50 PPM	0 PPM	1.10 CC	24.4%	95	-	+5V	865	3,900	3,900	-	-	-	-	-	-
0930	49.1	80°	89°	74%	49 PPM	0 PPM	1.10 CC	24.4%	95	-	+5V	860	2,500	2,500	-	-	-	-	-	-
1000	SECURED TESTING LEAK		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1010	STARTED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1024	SECURED TESTING HOSE		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1120	STARTED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1130	50.1	86°	95°	74%	50 PPM	1 PPM	1.10 CC	24.4%	90	-	+5V	860	4,000	4,000	-	-	-	-	-	-
1200	50.6	85°	95°	75%	46 PPM	1 PPM	1.10 CC	24.4%	90	160°	+5V	845	2,500	2,500	-	-	-	-	-	-
1209	SECURED TESTING HOSE		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1225	STARTED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1250	50.9	86°	98°	71%	48 PPM	1 PPM	1.10 CC	24.4%	90	160°	+5V	860	4,100	4,100	-	-	-	-	-	-
1300	51.3	86°	91°	70%	49 PPM	0 PPM	1.10 CC	24.4%	90	160°	+5V	850	2,100	1,500	-	-	-	-	-	-
1330	51.8	86°	81°	70%	45 PPM	0 PPM	1.10 CC	24.4%	90	160°	+5V	840	1,950	0	-	-	-	-	-	-
1400	52.3	86°	99°	72%	49 PPM	0 PPM	1.10 CC	24.4%	90	160°	+5V	845	2,900	2,900	-	-	-	-	-	-
1430	52.8	86°	97°	71%	49 PPM	0 PPM	1.10 CC	24.4%	90	160°	+5V	840	2,400	2,400	-	-	-	-	-	-
1451	SECURED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

REMARKS
0830 STARTED INSTRUMENT CALIBRATION
0925 CHECKED ENGINE & COMPRESSOR OIL
0940 ADDED 10 GALLONS OF DIESEL FUEL
0956 SECOND OIL LEAK ON COMPRESSOR OIL GAUGE SUPPLY LINE (REPLACED SWEDGE LOCK FITTINGS)
0932 ADJUSTED BACK PRESSURE REGULATOR VALVE
1000 COOLING COIL 3RD STAGE AIR LINE SWEDGE LOCK FITTING LEAKING (TIGHTEN FITTING)
1024 FLEXIBLE INTAKE HOSE WORE THROUGH AT ATTACHMENT POINT (CUT BACK HOSE AND REINSTALLED HOSE)
1200 FLEXIBLE INTAKE HOSE CAME LOOSE AND FELL OFF

APPENDIX A - Test log

BAUER H.P. COMPRESSOR (A)

DATE 20 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMB HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMB TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0755	STARTED ENGINE		-	-	-	-	-	-	100	-	+5V	-	-	-	-	-	-	-	-	-
0800	52.9	79°	75°	88%	50 PPM	0 PPM	1.10 CC	24.4%	95	-	+5V	880	2,100	0	-	-	-	-	-	-
0806	53.0	SECURED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

REMARKS:
0805 SEPARATOR DRAIN BLOCK SECURING BOLTS FAILED CAUSING THE DRAIN BLOCK TO SHAKE UNCONTROLLABLY
0806 SECURED TESTING

APPENDIX A - Test log

BAUER H.P. COMPRESSOR (A)

DATE 27 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMBI HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMBI TEMP°F	COMP DISCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0630	STARTED ENGINE		-	-	-	-	-	-	95	-	+5V	-	-	-	-	-	-	-	-	-
0720	53.9	69°	71°	98%	-	-	-	-	95	-	+5V	863	2,200	500	-	-	-	-	-	-
0748	SECURED ENGINE		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0805	STARTED ENGINE		-	-	-	-	-	-	95	-	+5V	-	-	-	-	-	-	-	-	-
0830	54.7	72°	-	92%	-	-	-	-	90	-	+5V	860	4,600	4,600	-	-	-	-	-	-
0900	55.2	71°	-	71%	-	-	-	-	90	-	+5V	860	2,700	2,700	-	-	-	-	-	-
0930	55.7	75°	-	68%	-	-	-	-	90	-	+5V	860	5,000	5,000	-	-	-	-	-	-
1000	56.2	79°	-	69%	-	-	-	-	90	-	+5V	860	3,600	3,600	-	-	-	-	-	-
1030	57.7	80°	-	66%	-	-	-	-	90	-	+5V	860	3,100	3,100	-	-	-	-	-	-
1100	58.2	86°	-	47%	-	-	-	-	90	160°	+5V	860	2,200	1,700	-	-	-	-	-	-
1130	58.7	86°	-	58%	-	-	-	-	90	165°	+5V	860	2,000	1,600	-	-	-	-	-	-
1200	60.2	87°	-	58%	-	-	-	-	90	165°	+5V	860	4,200	4,200	-	-	-	-	-	-
1230	60.7	85°	-	60%	-	-	-	-	90	165°	+5V	860	4,300	4,300	-	-	-	-	-	-
1300	61.2	85°	-	63%	-	-	-	-	90	165°	+5V	860	2,300	1,800	-	-	-	-	-	-
1330	61.7	84°	-	65%	-	-	-	-	90	160°	+5V	860	5,000	5,000	-	-	-	-	-	-
1400	62.2	83°	-	65%	-	-	-	-	90	160°	+5V	860	4,700	4,700	-	-	-	-	-	-
1430	62.7	85°	-	65%	-	-	-	-	90	-	+5V	860	2,000	800	-	-	-	-	-	-
1432	SECURED TESTING		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-

REMARKS:
NOTE: FINAL PRESSURE GAUGE OIL FILL PLUG WAS MISSING. GAUGE LEAKING OIL AND WAS CHANGED
0630 STARTED INSTRUMENT CALIBRATION
0625 CHECKED ENGINE & COMPRESSOR OIL
0748 SECURED ENGINE FOR OIL CHANGE
0805 OIL CHANGE COMPLETED, STARTED ENGINE
1230 GREASED CLUTCH THROUGH-OUT BEARING
1402 SECURED TESTING

APPENDIX A - Test log

BAUER H.P. COMPRESSOR (A)

DATE 28 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMB HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMB TEMP°F	COMP DISCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0631	STARTED ENGINE		-	-	-	-	-	-	100	-	+10V	-	-	-	-	-	-	-	-	-
0700	60.8	59°	-	82%	-	-	-	-	95	-	+10V	880	2,200	1,400	-	-	-	-	-	-
0730	61.3	59°	-	82%	-	-	-	-	95	-	+5V	875	5,000	5,000	-	-	-	-	-	-
0800	61.8	61°	-	79%	-	-	-	-	95	-	+5V	860	2,200	2,200	-	-	-	-	-	-
0830	62.3	63°	-	74%	-	-	-	-	95	-	+5V	860	2,200	0	-	-	-	-	-	-
0900	62.8	64°	-	70%	-	-	-	-	95	-	+5V	860	5,800	5,800	-	-	-	-	-	-
0930	63.3	70°	-	65%	-	-	-	-	95	-	+5V	860	2,100	600	-	-	-	-	-	-
1000	63.8	72°	-	64%	-	-	-	-	95	-	+5V	860	2,500	2,500	-	-	-	-	-	-
1030	64.3	69°	-	56%	-	-	-	-	95	-	+5V	860	2,200	0	3.4	5,000	1052		-	-
1100	64.8	68°	-	52%	-	-	-	-	95	-	+5V	860	5,800	5,800	-	-	-	1115	5,000	41
1130	65.3	68°	-	64%	-	-	-	-	95	-	+5V	860	2,500	2,100	-	-	-	-	-	-
1200	65.8	69°	-	64%	-	-	-	-	95	-	+5V	860	3,500	3,500	-	-	-	-	-	-
1230	66.3	69°	-	64%	-	-	-	-	95	-	+5V	860	2,200	1,600	-	-	-	-	-	-
1300	66.8	73°	-	63%	-	-	-	-	95	-	+5V	860	4,900	4,900	-	-	-	-	-	-
1330	67.3	73°	-	62%	-	-	-	-	95	-	+5V	860	2,200	1,900	-	-	-	-	-	-
1400	67.8	73°	-	60%	-	-	-	-	95	-	+5V	860	5,000	5,000		-	-	-	-	-
1402	SECURED TESTING			-	-	-	-	-	95	-	-	-			-	-	-	-	-	-

REMARKS:
0630 STARTED INSTRUMENT CALIBRATION
0645 CHECKED ENGINE & COMPRESSOR OIL
0631 STARTED ENGINE & COMPRESSOR
0735 ADDED 10 GALLONS OF DIESEL FUEL

APPENDIX A - Test log

BAUER H.P. COMPRESSOR (A)

DATE 1 NOVEMBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMBI HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN
		AMBI TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0745	STARTED ENGINE		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0800	68.6	43°	-	76%	-	-	-	-	95	-	+5V	880	2,300	1,900	-	-	-	-	-	-
0830	69.1	44°	-	75%	-	-	-	-	95	-	+5V	880	5,000	5,000	-	-	-	-	-	-
0900	69.6	47°	-	71%	-	-	-	-	95	-	+5V	880	4,300	4,300	-	-	-	-	-	-
0930	70.1	48°	-	66%	-	-	-	-	95	-	+5V	880	2,200	1,700	-	-	-	-	-	-
1000	70.6	49°	-	61%	-	-	-	-	95	-	+5V	880	2,100	400	-	-	-	-	-	-
1030	71.1	50°	-	63%	-	-	-	-	95	-	+5V	880	4,000	4,000	-	-	-	-	-	-
1100	71.6	50°	-	63%	-	-	-	-	95	-	+5V	880	3,800	3,800	-	-	-	-	-	-
1130	72.1	50°	-	63%	-	-	-	-	95	-	+5V	880	2,000	100	-	-	-	-	-	-
1200	72.6	51°	-	62%	-	-	-	-	95	-	+5V	880	4,300	4,300	-	-	-	-	-	-
1230	73.1	53°	-	61%	-	-	-	-	95	-	+5V	880	5,000	5,000	-	-	-	-	-	-
1250	SECURED TESTING 50 HR		-	-	-	-	-	-	95	-	-									

REMARKS:
0700 STARTED INSTRUMENT CALIBRATION
0730 CHECKED ENGINE & COMPRESSOR OIL (ADDED 1 PINT COMPRESSOR OIL)
1250 SECURED TESTING COMPRESSOR (A) 50 HR COMPLETED

The mean time for pressurizing an 87.7 liter (3.1 cuft) flask from 0 to 345 bars (0 to 5000 psi, 341.14 ATA) is: $\frac{56+42+42+41+41+41+41}{5} = 44.4$ minutes, therefore, the charging rate is: $\frac{87.7 \times 341.14}{44.4} = 673.83$ SLPM or 28.82 CFM

APPENDIX B - Test log

BAUER H.P. COMPRESSOR (B)

DATE 26 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMB HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMB TEMP°F	COMP DISCH°F		BEFORE -FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0745	STARTED ENGINE		-	-	-	-	-	-	95	-	+30	-	-	-	-	-	-	-	-	-
0800	21.1	65°	69°	99%	50 PPM	0 PPM	1.10 CC	24.4%	90	-	+5V	800	2,100	0	-	-	-	-	-	-
0830	21.6	65°	71°	97%	50 PPM	0 PPM	1.10 CC	24.4%	90	-	+5V	790	2,100	800	-	-	-	-	-	-
0900	22.1	66°	70°	95%	49 PPM	0 PPM	1.10 CC	24.4%	90	-	+5V	780	2,100	1,500	-	-	-	-	-	-
0930	22.6	66°	67°	94%	49 PPM	0 PPM	1.10 CC	24.4%	90	-	+5V	780	2,300	2,300	-	-	-	-	-	-
1000	23.1	67°	77°	93%	50 PPM	0 PPM	1.10 CC	24.4%	90	-	+5V	780	3,600	3,300	-	-	-	-	-	-
1030	23.6	68°	74°	92%	48 PPM	0 PPM	1.5 CC	24.4%	85	-	+5V	780	2,400	2,100	3.4	5,000	1011	-	-	-
1100	24.1	70°	66°	88%	49 PPM	1 PPM	1.4 CC	24.4%	85	-	+5V	780	2,100	1,800	-	-	-	1051	5,000	:40
1130	24.7	72°	78°	85%	46 PPM	1 PPM	1.4 CC	24.4%	85	-	+5V	780	2,400	2,100	-	-	-	-	-	-
1200	25.1	72°	82°	84%	47 PPM	1 PPM	1.4 CC	24.4%	85	-	+5V	780	4,100	3,800	-	-	-	-	-	-
1230	25.7	74°	79°	83%	47 PPM	1 PPM	1.4 CC	24.4%	85	-	+5V	700	2,200	1,900	-	-	-	-	-	-
1300	26.1	75°	86°	82%	47 PPM	1 PPM	1.4 CC	24.4%	85	-	+5V	780	4,500	4,200	-	-	-	-	-	-
1330	26.7	76°	66°	80%	48 PPM	1 PPM	1.4 CC	24.4%	85	-	+5V	765	2,000	200	-	-	-	-	-	-
1400	27.2	76°	80°	78%	48 PPM	1 PPM	1.6 CC	24.4%	85	-	+5V	800	2,300	1,900	-	-	-	-	-	-
1430	27.6	76°	76°	79%	25 PPM	1 PPM	1.5 CC	24.4%	85	-	+5V	800	2,100	1,100	-	-	-	-	-	-
1500	28.1	76°	87°	76%	46 PPM	1 PPM	1.5 CC	24.4%	80	-	+5V	780	4,300	4,100	-	-	-	-	-	-
1530	28.6	77°	85°	76%	54 PPM	1 PPM	1.5 CC	24.4%	80	-	+5V	800	2,800	2,500	-	-	-	-	-	-
1600	29.1	77°	74°	75%	50 PPM	11 PPM	1.5 CC	24.4%	80	-	+5V	790	2,000	1,100	-	-	-	-	-	-
1630	29.6	79°	90°	78%	50 PPM	10 PPM	1.5 CC	24.4%	80	-	+5V	780	5,200	4,900	-	-	-	-	-	-
1700	30.1	76°	87°	81%	58 PPM	9 PPM	1.5 CC	24.4%	80	-	+5V	780	3,600	3,300	-	-	-	-	-	-
1730	30.6	74°	83°	85%	56 PPM	10 PPM	1.5 CC	24.4%	80	-	+5V	790	2,600	2,400	-	-	-	-	-	-

APPENDIX B - Test log

BAUER H.P. COMPRESSOR (B)

DATE 26 & 27 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMB HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMB TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
1800	31.1	70°	67°	87%	49 PPM	10 PPM	1.5 CC	24.4%	85	-	+5V	780	2,000	200	-	-	-	-	-	-
1830	31.2	73°	66°	90%	48 PPM	10 PPM	1.5 CC	24.4%	85	-	+5V	780	2,000	800	-	-	-	-	-	-
1900	31.8	72°	84°	91%	50 PPM	10 PPM	1.5 CC	24.4%	85	-	+5V	780	5,100	4,900	-	-	-	-	-	-
1930	32.3	72°	82°	93%	54 PPM	13 PPM	1.5 CC	24.4%	85	-	+5V	780	3,600	3,300	-	-	-	-	-	-
2000	32.8	71°	78°	95%	50 PPM	10 PPM	1.5 CC	24.4%	85	-	+5V	780	2,300	1,900	-	-	-	-	-	-
2030	33.3	71°	84°	97%	56 PPM	10 PPM	1.5 CC	24.4%	85	-	+5V	780	5,100	4,800	-	-	-	-	-	-
2100	33.8	72°	83°	97%	53 PPM	10 PPM	1.5 CC	24.4%	85	-	+5V	780	4,000	3,700	-	-	-	-	-	-
2130	34.3	70°	80°	98%	50 PPM	10 PPM	1.5 CC	24.4%	85	-	+5V	780	2,600	2,300	-	-	-	-	-	-
2200	34.8	69°	65°	98%	50 PPM	10 PPM	1.5 CC	24.4%	85	-	+5V	770	2,000	400	-	-	-	-	-	-
2230	35.3	69°	79°	98%	50 PPM	16 PPM	1.5 CC	24.4%	85	-	+5V	780	5,200	4,900	-	-	-	-	-	-
2300	35.8	68°	77°	98%	50 PPM	17 PPM	1.5 CC	24.4%	85	-	+5V	770	2,900	2,600	-	-	-	-	-	-
2330	36.3	69°	78°	99%	50 PPM	19 PPM	1.5 CC	24.4%	85	-	+5V	760	2,500	2,200	-	-	-	-	-	-
2400	36.8	68°	63°	98%	50 PPM	19 PPM	1.5 CC	24.4%	85	-	+5V	760	2,000	500	-	-	-	-	-	-
0030	37.3	69°	80°	98%	50 PPM	17 PPM	1.5 CC	24.4%	85	-	+5V	770	5,000	4,700	-	-	-	-	-	-
0100	37.8	68°	79°	99%	50 PPM	16 PPM	1.5 CC	24.4%	85	-	+5V	760	3,400	3,100	-	-	-	-	-	-
0130	38.3	67°	75°	100%	50 PPM	17 PPM	1.5 CC	24.4%	85	-	+5V	760	2,300	2,000	-	-	-	-	-	-
0200	38.8	67°	62°	105%	50 PPM	19 PPM	1.5 CC	24.4%	85	-	+5V	760	2,000	500	-	-	-	-	-	-

APPENDIX B - Test log

BAUER H.P. COMPRESSOR (B)

DATE 27 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMBI HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMBI TEMP°F	COMP DISCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0230	39.3	66°	78°	100%	50 PPM	19 PPM	1.5 CC	24.4%	85	-	+5V	780	4,900	4,600	-	-	-	-	-	-
0300	39.8	65°	75°	100%	48 PPM	19 PPM	1.5 CC	24.4%	85	-	+5V	770	3,200	3,000	-	-	-	-	-	-
0330	40.3	65°	66°	100%	53 PPM	18 PPM	1.5 CC	24.4%	85	-	+5V	770	2,200	1,600	-	-	-	-	-	-
0400	40.8	65°	76°	100%	51 PPM	16 PPM	1.5 CC	24.4%	85	-	+5V	780	5,100	4,800	-	-	-	-	-	-
0430	40.9	64°	60°	100%	45 PPM	19 PPM	1.5 CC	24.4%	85	-	+5V	790	2,100	1,100	-	-	-	-	-	-
0500	41.4	64°	76°	100%	49 PPM	20 PPM	1.5 CC	24.4%	85	-	+5V	790	4,600	4,300	-	-	-	-	-	-
0530	41.9	63°	75°	100%	50 PPM	20 PPM	1.5 CC	24.4%	85	-	+5V	780	3,400	3,100	-	-	-	-	-	-
0600	42.4	64°	72°	100%	50 PPM	21 PPM	1.5 CC	24.4%	85	-	+5V	780	2,400	2,100	-	-	-	-	-	-
0630	43.0	65°	65°	100%	50 PPM	15 PPM	1.5 CC	24.4%	85	-	+5V	800	2,000	100	-	-	-	-	-	-
0700	43.5	67°	88°	99%	50 PPM	16 PPM	1.5 CC	24.4%	85	-	+5V	800	3,500	3,200	-	-	-	-	-	-
0730	43.7	69°	69°	98%	50 PPM	17 PPM	1.5 CC	24.4%	85	-	+5V	780	5,000	4,700	-	-	-	-	-	-
0800	44.2	69°	76°	95%	48 PPM	18 PPM	1.5 CC	24.4%	85	-	+5V	780	2,600	2,300	-	-	-	-	-	-
0830	44.7	72°	77°	92%	48 PPM	19 PPM	1.5 CC	24.4%	85	-	+5V	780	2,200	1,800	-	-	-	-	-	-
0900	45.2	71°	82°	71%	46 PPM	18 PPM	1.5 CC	24.4%	85	-	+5V	780	5,100	4,800	-	-	-	-	-	-
0930	45.7	75°	65°	68%	46 PPM	17 PPM	1.5 CC	24.4%	85	-	+5V	770	2,000	200	-	-	-	-	-	-
1000	46.2	79°	75°	69%	46 PPM	19 PPM	1.5 CC	24.4%	85	-	+5V	780	2,000	1,100	-	-	-	-	-	-
1030	46.7	80°	84°	66%	46 PPM	17 PPM	1.5 CC	24.4%	85	-	+5V	780	5,500	5,200	-	-	-	-	-	-

APPENDIX B - Test log

BAUER H.P. COMPRESSOR (B)

DATE 27 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMBI HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMBI TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
1100	47.2	86°	87°	47%	48 PPM	13 PPM	1.0 CC	24.4%	85	-	+5V	760	2,200	1,400	-	-	-	-	-	-
1130	47.5	87°	92°	38%	47 PPM	10 PPM	1.0 CC	24.4%	80	160	+5V	780	2,100	1,200	-	-	-	-	-	-
1200	48.0	87°	100°	38%	46 PPM	9 PPM	1.0 CC	24.4%	80	165	+5V	780	4,400	4,100	-	-	-	-	-	-
1230	48.5	83°	99°	60%	47 PPM	8 PPM	1.0 CC	24.4%	80	165	+5V	780	4,300	4,000	-	-	-	-	-	-
1300	49.0	83°	86°	65%	49 PPM	8 PPM	1.0 CC	24.4%	80	165	+5V	760	2,100	1,300	-	-	-	-	-	-
1330	49.5	84°	97°	65%	49 PPM	7 PPM	1.0 CC	24.4%	80	160	+5V	780	4,900	4,600	-	-	-	-	-	-
1400	50.0	83°	94°	65%	49 PPM	8 PPM	1.0 CC	24.4%	80	160	+5V	780	4,000	4,300	-	-	-	-	-	-
1430	50.5	85°	87°	65%	45 PPM	7 PPM	1.0 CC	24.4%	80	-	+5V	820	2,200	1,300	-	-	-	-	-	-

REMARKS:
26 OCTOBER
0700 STARTED INSTRUMENT CALIBRATION
0715 CHECKED ENGINE & COMPRESSOR OIL (ADDED 2 1/2 QUARTS 9250 TO ENGINE AND 1 PINT 2190TEP TO COMPRESSOR
0720 ADDED 12 GAL DIESEL FUEL
0746 STARTED ENGINE AND COMPRESSOR
1100 ADJUSTED "V" DRIVE BELTS AND CHECKED ENGINE & COMPRESSOR OIL
1400 GREASED CLUTCH BEARING
2200 ADDED 10 GAL DIESEL FUEL
27 OCTOBER
0700 ADDED 10 GAL DIESEL FUEL
1230 GREASED CLUTCH BEARING
1420 ADJUSTED COMPRESSOR OIL REGULATOR
0400 GREASED CLUTCH BEARING, CHECKED ENGINE & COMPRESSOR OIL
1431 SECURED TESTING

APPENDIX B - Test log

BAUER H.P. COMPRESSOR (B)

DATE 28 OCTOBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMB HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMB TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0630	STARTED ENGINE		-	-	-	-	-	-	95	-	+5V	-	-	-	-	-	-	-	-	-
0700	50.6	59°	56°	82%	50 PPM	12 PPM	1.1 CC	24.4%	95	-	+5V	880	2,100	900	-	-	-	-	-	-
0730	50.9	60°	66°	82%	50 PPM	15 PPM	1.1 CC	24.4%	90	-	+5V	880	2,600	2,300	3.4	5,000	1011	-	-	-
0800	51.4	61°	59°	79%	50 PPM	12 PPM	1.1 CC	24.4%	85	-	+5V	860	1,000	0	-	-	-	1051	5,000	40
0830	51.9	63°	71°	74%	48 PPM	15 PPM	1.1 CC	24.4%	85	-	+5V	860	3,400	3,100	-	-	-	-	-	-
0900	52.4	64°	72°	70%	49 PPM	14 PPM	1.1 CC	24.4%	85	-	+5V	860	2,900	2,600	-	-	-	-	-	-
0930	52.9	70°	75°	63%	49 PPM	15 PPM	1.1 CC	24.4%	85	-	+5V	860	3,000	2,700	-	-	-	-	-	-
1000	53.4	72°	75°	64%	50 PPM	16 PPM	1.1 CC	24.4%	85	-	+5V	860	3,100	2,800	-	-	-	-	-	-
1050	53.9	69°	68°	56%	50 PPM	15 PPM	1.1 CC	24.4%	85	-	+5V	860	2,000	0	3.4	5,000	1052	-	-	-
1100	54.4	68°	77°	52%	50 PPM	17 PPM	1.1 CC	24.4%	85	-	+5V	860	3,700	3,400	-	-	-	1112	5.000	40
1130	54.9	68°	74°	64%	50 PPM	19 PPM	1.1 CC	24.4%	85	-	+5V	840	2,300	1,900	-	-	-	-	-	-
1200	55.4	69°	78°	64%	50 PPM	18 PPM	1.1 CC	24.4%	80	-	+5V	840	3,800	3,500	-	-	-	-	-	-
1230	55.9	69°	74°	64%	50 PPM	15 PPM	1.1 CC	24.4%	80	-	+5V	840	2,100	1,600	-	-	-	-	-	-
1300	56.4	74°	83°	63%	50 PPM	14 PPM	1.1 CC	24.4%	80	-	+5V	840	5,900	5,000	-	-	-	-	-	-
1330	56.9	73°	82°	62%	50 PPM	8 PPM	1.1 CC	24.4%	80	-	+5V	840	2,300	1,900	-	-	-	-	-	-
1400	57.4	73°	61°	60%	50 PPM	10 PPM	1.1 CC	24.4%	80	-	+5V	840	2,000	0	-	-	-	-	-	-

REMARKS:
0630 ADDED 7 GAL DIESEL FUEL
0640 CHECKED ENGINE & COMPRESSOR OIL
0645 GREASED CLUTCH BEARING
0705 SECURED ENGINE FOR OIL CHANGE (COULD NOT REMOVE OIL DRAIN PLUG USING 5' CHEATER BAR
0718 STARTED ENGINE
1401 SECURED TESTING

APPENDIX B - Test log

BAUER H.P. COMPRESSOR (B)

DATE 1 NOVEMBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMBI HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN.
		AMBI TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0744	STARTED ENGINE		-	-	-	-	-	-	95	-	+5V	-	-	-	-	-	-	-	-	-
0800	58.1	43°	45°	76%	50 PPM	8 PPM	1.0 CC	24.4%	95	-	+5V	890	2,200	1,600	-	-	-	-	-	-
0830	58.6	44°	52°	75%	50 PPM	7 PPM	1.0 CC	24.4%	90	-	+5V	880	5,300	5,000	-	-	-	-	-	-
0900	59.1	47°	56°	71%	50 PPM	10 PPM	1.0 CC	24.4%	85	-	+5V	880	4,900	4,600	-	-	-	-	-	-
0930	59.6	48°	54°	66%	50 PPM	8 PPM	1.0 CC	24.4%	85	-	+5V	880	5,000	2,700	-	-	-	-	-	-
1000	60.1	49°	40°	62%	50 PPM	10 PPM	1.0 CC	24.4%	85	-	+5V	880	2,000	700	-	-	-	-	-	-
1030	60.6	50°	59°	63%	50 PPM	15 PPM	1.0 CC	24.4%	85	-	+5V	880	4,600	4,300	-	-	-	-	-	-
1100	61.1	50°	59°	63%	50 PPM	20 PPM	1.0 CC	24.4%	85	-	+5V	880	3,700	3,400	-	-	-	-	-	-
1130	61.6	50°	56°	63%	50 PPM	18 PPM	1.0 CC	24.4%	85	-	+5V	860	2,000	100	-	-	-	-	-	-
1200	62.1	51°	61°	62%	50 PPM	18 PPM	1.0 CC	24.4%	85	-	+5V	860	5,900	5,600	-	-	-	-	-	-
1230	62.6	54°	63°	61%	50 PPM	19 PPM	1.0 CC	24.4%	85	-	+5V	860	4,500	4,200	-	-	-	-	-	-
1300	63.1	53°	50°	60%	50 PPM	19 PPM	1.0 CC	24.4%	85	-	+5V	860	2,000	1,000	-	-	-	-	-	-
1330	63.6	54°	56°	60%	50 PPM	19 PPM	1.0 CC	24.4%	85	-	+5V	860	3,800	3,500	-	-	-	-	-	-
1400	64.1	55°	65°	59%	50 PPM	19 PPM	1.0 CC	24.4%	85	-	+5V	860	5,000	4,700	-	-	-	-	-	-
1430	64.6	55°	60°	59%	50 PPM	19 PPM	1.0 CC	24.4%	85	-	+5V	860	2,500	1,900	-	-	-	-	-	-
1431	SECURED TESTING		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

REMARKS;
0700 ADDED 10 GAL DIESEL FUEL
0715 CHECKED ENGINE & COMPRESSOR OIL
0725 GREASED CLUTCH BEARING
1431 SECURED TESTING

APPENDIX B - Test log

BAUER H.P. COMPRESSOR (B)

DATE 2 NOVEMBER 1993

REAL TIME	METER HOURS	TEMPS °F		AMBI HUMID %	CO/PPM CONCENTRATION		CO INJECTED INTO COMP. INTAKE		ENG OIL PRESS	CYL HEAD TEMP °F	AMP METER VOLTS	COMP OIL PRESS	FINAL LINE PSI	SERVICE LINE DISCH PSI	CHARGED CYLINDER SIZE		CYLINDER CHARGING INFORMATION			CYL FILL TIME MIN
		AMBI TEMP°F	COMP DSCHG°F		BEFORE FILTER	AFTER FILTER	FLOW RATE	GAS %							RATED CUFT	RATED PSI	START TIME	END TIME	END PSI	
0655	STARTED ENGINE		-	-	-	-	-	-	95	-	+5V	-	-	-	-	-	-	-	-	-
0700	64.7	50°	54°	67%	50 PPM	18 PPM	1.1 CC	24.4%	95	-	+5V	890	2,200	0	-	-	-	-	-	-
0730	65.2	50°	56°	67%	50 PPM	19 PPM	1.1 CC	24.4%	90	-	+5V	880	2,300	1,900	-	-	-	-	-	-
0800	65.7	56°	62°	66%	50 PPM	28 PPM	1.1 CC	24.4%	85	-	+5V	880	4,200	3,900	-	-	-	-	-	-
0830	66.2	60°	65°	64%	46 PPM	27 PPM	1.1 CC	24.4%	85	-	+5V	860	2,700	2,400	-	-	-	-	-	-
0900	66.7	62°	66°	63%	48 PPM	24 PPM	1.1 CC	24.4%	85	-	+5V	860	4,000	3,700	-	-	-	-	-	-
0930	67.2	56°	55°	62%	49 PPM	26 PPM	1.1 CC	24.4%	85	-	+5V	840	1,900	1,000	-	-	-	-	-	-
1000	67.7	57°	65°	60%	50 PPM	27 PPM	1.1 CC	24.4%	85	-	+5V	840	2,900	2,600	-	-	-	-	-	-
1030	68.2	58°	68°	61%	50 PPM	27 PPM	1.1 CC	24.4%	85	-	+5V	840	5,100	4,800	-	-	-	-	-	-
1100	68.7	59°	57°	61%	50 PPM	28 PPM	1.1 CC	24.4%	85	-	+5V	840	2,000	1,000	-	-	-	-	-	-
1130	69.2	59°	78°	60%	-	-	-	-	85	-	+5V	840	1,800	1,000	-	-	-	-	-	-
1200	69.7	60°	69°	59%	-	-	-	-	85	-	+5V	840	3,900	3,500	-	-	-	-	-	-
1230	70.2	60°	70°	59%	-	-	-	-	85	-	+5V	840	2,000	1,700	-	-	-	-	-	-
1300	70.7	60°	71°	58%	-	-	-	-	85	-	+5V	840	3,500	3,200	-	-	-	-	-	-
1330	71.2	SECURED TESTING		-	-	-	-	-	85	-	+5V	840	5,300	5,000	-	-	-	-	-	-

REMARKS;
0630 CHECKED ENGINE & COMPRESSOR OIL (ADDED 1 PINT COMPRESSOR OIL)
0635 GREASED CLUTCH BEARING
0640 ADDED 10 GAL DIESEL FUEL
0655 STARTED ENGINE
0830 AIR SAMPLE TAKEN
1200 SECURED CO INJECTION
1330 SECURED TESTING, 50 HR.

The mean time for pressurizing an 87.7 liter (3.1 cuft) flask from 0 to 345 bars (0 to 5000 psi, 341.14 ATA) is: $\frac{40+40+40}{3}$ = 40 minutes, therefore, the charging rate is: $\frac{87.7 \times 341.14}{40}$ = 747.95 SLPM or 26.41 CFM

MEMORANDUM 14 October 1993

From: G. Deason, Code 2530
To: Dave Sullivan, NEDU

Subj: Analysis of air sample from Bauer K-20 compressor (1 hour evaluations).

1. In accordance with your request, the air sample received at the gas analysis lab was analyzed and found to contain:

Standard Components

Components	Level	Limit
Oxygen	21.0%	20-22%***
Nitrogen	78.1%	NONE***
Argon	0.9%	NONE***
Carbon Dioxide	63.0 PPM	1000 PPM***
Total Hydrocarbons*	1.8 PPM	25 PPM**
Carbon Monoxide	<0.5 PPM	20 PPM**
Methane	1.8 PPM	1000 PPM**
Acetone	<0.1 PPM	200 PPM***
Benzene	<0.1 PPM	1 PPM***
Chloroform	<0.1 PPM	1 PPM***
Ethanol	<0.1 PPM	100 PPM***
Freon 113	<0.1 PPM	10 PPM***
Freon 11	<0.1 PPM	100 PPM***
Freon 12	<0.1 PPM	100 PPM***
Freon 114	<0.1 PPM	100 PPM***
Isopropyl Alcohol	<0.1 PPM	1 PPM***
Methanol	<0.1 PPM	10 PPM***
Methyl Chloroform	<0.1 PPM	30 PPM***
Methyl Ethyl Ketone	<0.1 PPM	20 PPM***
Methyl Isobutyl Ketone	<0.1 PPM	20 PPM***
Methyl Chloride	<0.1 PPM	25 PPM***
Toluene	<0.1 PPM	20 PPM***
Trimethyl Benzenes	<0.1 PPM	3 PPM***
Xylenes	<0.1 PPM	50 PPM***

Other Components

Component	Level	Limit
C4+	<0.1 PPM	<0.1 PPM

*Expressed as methane equivalents.
**Limits from process instruction #0558-839.
***Limits from Navy Dive Manual; Vol 2, Rev 3.
****OSHA Final Rule limits published as of July 1992 (not specified in Navy Dive Manual.)

2. The sample showed no appreciable contamination. All components were within the acceptable range.

Glen Deason
Chemist

Memorandum 27 October 1993

To: Dave Sullivan, NEDU

From: Glen Deason, Code 2530

Subject: Analysis of air sample from the Bauer K-20 #B compressor evaluation test, 25 hour sample.

1. In accordance with your request, the air sample delivered to the gas analysis lab was analyzed and found to contain:

Standard Components

Component	Level	Limit
Oxygen	21%	20-22%***
Nitrogen	78.1%	NONE***
Argon	0.9%	NONE***
Carbon Dioxide	505 PPM	1000 PPM***
Total Hydrocarbons*	1.9 PPM	25 PPM**
Carbon Monoxide	21.6 PPM	10 PPM**
Methane	1.9 PPM	1000 PPM**
Acetone	<0.1 PPM	200 PPM***
Benzene	<0.1 PPM	1 PPM***
Chloroform	<0.1 PPM	1 PPM***
Ethanol	<0.1 PPM	100 PPM***
Freon 113	<0.1 PPM	100 PPM***
Freon 11	<0.1 PPM	100 PPM***
Freon 12	<0.1 PPM	100 PPM***
Freon 114	<0.1 PPM	100 PPM***
Isopropyl Alcohol	<0.1 PPM	1 PPM***
Methanol	<0.1 PPM	10 PPM***
Methyl Chloroform	<0.1 PPM	30 PPM***
Methyl Ethyl Ketone	<0.1 PPM	20 PPM***
Methyl Isobutyl Ketone	<0.1 PPM	20 PPM***
Methylene Chloride	<0.1 PPM	25 PPM***
Toluene	<0.1 PPM	20 PPM***
Trimethyl Benzenes	<0.1 PPM	3 PPM***
Xylenes	<0.1 PPM	50 PPM***

Other Components

Component	Level	Limit
NONE		
C4+	<0.1 PPM	NONE

*Expressed as methane equivalents.
**Limits taken from process instruction #0558-839.
***Limits taken from Navy Dive Manual; Vol. 2, Rev. 3.
**** OSHA Final Rule limits published as of July 1992 (not specified in Navy Dive Manual).

2. The above sample showed appreciable contamination; all components were not within the acceptable range.

Glen Deason
Chemist