DEPARTMENT OF THE NAVY
NAVY EXPERIMENTAL DIVING UNIT
PANAMA CITY, FLORIDA 32407-5001

IN REPLY REFER TO:

NAVSEA Task 89-068

NAVY EXPERIMENTAL DIVING UNIT

REPORT NO. 20-90

EVALUATION OF RIX INDUSTRIES OXYGEN COMPRESSOR

MODEL 4N3BG-2.2

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OCTOBER 1990

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UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE			
1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY		3. DISTRIBUTION/AVAILABILITY OF REPORT	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE			
4. PERFORMING ORGANIZATION REPORT NUMBER(S) NEDU Report #20-90		5. MONITORING ORGANIZATION REPORT NUMBER(S)	
6a. NAME OF PERFORMING ORGANIZ. Navy Experimental Diving Unit	6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION	
6c. ADDRESS (City, State, and ZIP Code) Panama City, Florida 32407-5001		7b. ADDRESS (City, State, and ZIP Code)	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Naval Sea Systems Command	6b. OFFICE SYMBOL (If applicable) OOC	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State, and ZIP Code) Washington, D.C. 20362-5101		10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. 89-068 / WORK UNIT ACCESSION NO.	
11. TITLE (Include Security Classification) Evaluation of Rix Industries Oxygen Compressor			
12. PERSONAL AUTHOR(S) Mr. David Sullivan			
13a. TYPE OF REPORT FINAL	13b. TIME COVERED FROM_____ TO_____	14. DATE OF REPORT (Year,Month,Day) October 1990	15. PAGE COUNT 24
16. SUPPLEMENTARY NOTATION			
17. COSATI CODES FIELD / GROUP / SUB-GROUP	18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) Key words: Rix High Pressure Oxygen Compressor Model 4N3BG-2.2		

19. ABSTRACT.In response to reference (1), Navy Experimental Dividng Unit (NEDU) tested the RIX Model 4N38G-2.2 High Pressure Oxygen Compressor from 5 October to 17 October 1990. The purpose of this test was to determine if the equipment was suitable for use by the United States navy (USN) diving community and if so, added to the Approved for Navy Use (ANU) Procurement List. The RIX Model 4N#BG-2.2 met manufacturers specifications for quantity of gas transfered with a quality which met or exceeded purity standards in reference (2). The design and engineering was determined to be adequate. The RIX Model 4N#BG-2.2 Compressor is considered suitable for USN requirements for compressors of this size and type.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION	
☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS		
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL

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CONTENTS

I. INTRODUCTION

Per reference (1) and as detailed in Appendix A, the RIX Industries oxygen compressor Model 4N3BG-2.2, was tested by NEDU. The test was to determine if the compressor would provide suitable breathing gas and a service life satisfying the U.S. Navy requirements for divers oxygen supply compressors.

The RIX Model 4N3BG-2.2 was recieved with the compressor, coolant pump and electric motor mounted and aligned by the manufacturer on the steel bedplate. A volume tank was mounted below the compressor and a hose attached from the tank to the suction inlet on the first stage of the compressor. The discharge was configured to return to the volume tank. A standard 220 cubic foot K bottle of nitrogen was used to supply the constant suction pressure. All stages of the compressor were protected by safety relief valves. A tee was fitted to the discharge of the back pressure regulator. A pressure gauge, thermistor for outlet temperature, and a stop valve with whip for taking gas samples and charging rates were attached to the tee. The coolant temperature thermistor was suspended in the coolant expansion tank.

There are various methods of testing compressor capacities. For this test, NEDU selected an 80 cubic foot SCUBA cylinder (.39 cubic foot floodable volume),as a charging flask and measured the amount of time to fill the cylinder. The compressor was operated a total of 50 test hours. Testing included subjective evaluation of the system operation. Detailed mechanical review of the individual components of the system was beyond the scope of NEDU tasking.

II. EQUIPMENT DESCRIPTION

The RIX Model 4N3BG-2.2 high pressure oxygen compressor (Figure 1) is electric powered. It is belt driven by a Lincoln Electric 5 hp, 230 vac, 60 cycle, Model KM 378 motor. The compressor is a water cooled, oil-less "V"-crosshead, reciprocating type, using 4 cylinders to compress the gas in 3 stages. The four cylinders consist of two first stage pistons, one second stage piston and one third stage piston. The main and connecting rod bearings are all self lubricating, packed with halocarbon grease, and sealed for life. The compressor valves are stainless steel reed type, normally closed and pressure activated open. Pressure gauges are used to monitor suction pressure and first, second, and third stage discharge pressures. Three pressure relief valves are located in the gas system, one after each stage with sequential relief settings of 300, 1000, and 2500 psi. The compressor is provided with three stainless steel heat exchangers, integral with the crankcase; one cools the gas after it has been compressed. The crankcase is cooled as well. The cooling fluid, after passing through the heat exchangers, passes through the water jackets for the 2nd and 3rd stages. A pressure maintaining/non-return valve, maintains 400 psi on the 3rd stage floating piston.

The crankcase is cooled by the water-glycol coolant system as are the inter- and after-stage heat exchangers. This cooling and lubricating method for the entire system has eliminated all considerations for lubricating oil.

The filtration system consists of three 60 micron in-line particle filters. The external inter-stage and discharge filters are cleaned at 1500 hours run time. The internal inter-stage filter is located in the crankcase and is cleaned at 4500 hours.

III. TEST PROCEDURE

The compressor and all ancillary equipment were set up in accordance with the manufacturer's instructions, and those of Mr. Michael Parker, the Rix representative. A Cole Parmer model 8502-14 temperature monitor and Yellow Springs Instruments 700 series thermistor probes were used. Two thermistors were attached to the unit to measure compressor discharge and coolant temperatures. A third probe measured ambient temperature. A nitrogen supply bottle was attached to the volume/expansion tank to maintain constant suction pressure of 20 psig. The unit was placed in an exterior work area, open to ambient temperature but protected by an awning from direct weather. APPENDIX A contains the complete test plan and the pass/fail criteria used during the evaluation. Appendix B is the test log and contains the recorded data. The following parameters were recorded:

(1) Date
(2) Time
(3) Total meter hours
(4) Total test hours
(5) Suction pressure
(6) All three stage pressures
(7) Discharge gas temperature
(8) Ambient air temperature
(9) Coolant temperature
(10) Coolant level

IV. RESULTS

A. ENDURANCE TEST

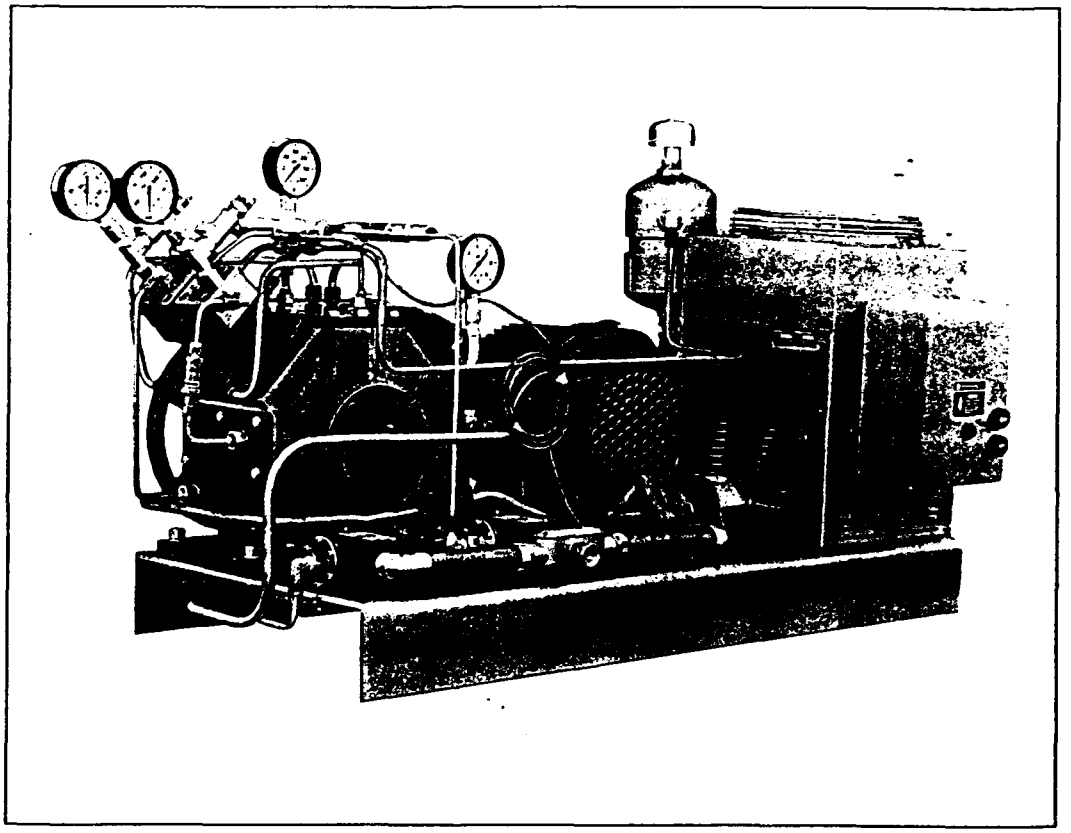
The compressor was operated a total of 50 hours to insure proper functioning and gas sample analysis.

B. CHARGE RATES

The data collected provided a complete operational and maintenance log for this test, and was the basis for computing and evaluating all the test results. Compressor charge rates for the gas cylinder used during the test were as follows:

CHARGE	TIME	SUCTION PSI	FLOODABLE VOLUME	CHARGE RATE
MINIMUM:	08 MIN 16 SEC	20 PSIG	.39 CUBIC FEET	8.07 SCFM
MAXIMUM:	07 MIN 07 SEC	25 PSIG	.39 CUBIC FEET	9.37 SCFM

NOTE: The manufacturer advertised a rated output of 3.3-6.6 SFCM oxygen at 2000-2300 PSIG discharge pressure, 68 degrees F inlet with 5-25 PSIG suction pressure. Differences in maximum and minimum delivery rates were the result of the differences in the ambient temperature, heat of compression, and suction pressure at the time the delivery rates were taken.



RIX INDUSTRIES OXYGEN COMPRESSOR
MODEL 4N3BG-2.2

C. NITROGEN SAMPLING

Nitrogen samples were taken from the compressor discharge at hours 1, 25 and 50 and sent to the NCSC Laboratory, Code 5130, for purity analysis. Results are attached as APPENDIX C.

All samples were within limits established by reference (2) with exception of the 1 sample which indicated high hydrocarbon. Upon investigation it was determined that the expansion tank (not a part of the compressor) was contaminated. The 25 and 50 hour samples were taken by bypassing the volume tank.

D. COOLANT

The cooling water expansion chamber overflowed at various times. Overflow only occurred at coolant temperatures over 100 degrees Fahrenheit. The overflow was minimal and considered to be caused by heat expansion of the coolant. The vent cap was removed from the coolant expansion tank and the temperature probe placed in the cap hole. Had the cap been installed it is most probable there would have been no overflow. Coolant level was checked prior to start up daily and temperature was monitored hourly throughout the 50 hour test.

E. MAINTENANCE

There are no manufacturers scheduled maintenance actions to be performed at less than 1500 hours run time on the compressor. Although this compressor system is considered maintenance free until 1500 hours of operation, the coolant level was checked each morning before startup.

V. RECOMMENDATIONS

The vendor and NAVSEA should be contacted prior to purchase, to ensure the unit meets the users needs.

VI. CONCLUSIONS

1. The RIX 4N3BG-2.2 compressor delivers acceptable breathing gas at a capacity which meet's or exceeds the manufacture's specifications.

2. The unit is very sturdy, reliable and readily maintained.

3. The operating and maintenance manual for the compressor is adequate.

4. The RIX 4N3BG-2.2 compressor is suitable for use by the U.S. Navy.

VII. REFERENCES

1. NAVSEA Task 89-068; Evaluate Electric Oxygen Booster Pumps for divers use for ANU list.

2. NAVSEA 0994-LP001-9010, U.S. Navy Diving Manual Vol. 1 Table N-1. Oxygen purity standards.

DEPARTMENT OF THE NAVY
NAVY EXPERIMENTAL DIVING UNIT
PANAMA CITY, FLORIDA 32407-5001

IN REPLY REFER TO:

NAVSEA Task 89-68

NAVY EXPERIMENTAL DIVING UNIT

STANDARD TEST PLAN

EVALUATION OF RIX MODEL 4N3BG-22-P2 ELECTRIC OXYGEN BOOSTER PUMP

TEST PLAN NUMBER 90-17

APRIL 1990

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RECORD OF CHANGES

Except as provided for herein, changes will be made only on the authority of the Commanding Officer, NEDU. A dark vertical line in the left-hand margin indicates the coverage of change.

CHANGE NO.	AUTHORITY	INSERTION	SECTION	INITIAL

TABLE OF CONTENTS

References:

(a) NAVSEA Task 89-68 Evaluation of Commercially Available Electric Driven Oxygen Compressors.
(b) Rix Compressor model #4N3BG-2.2-P2 Manual

1. Introduction. This test plan provides procedures for standardized evaluation of commercially available electric driven oxygen compressors. The compressors will be evaluated and data compiled during this test to determine their suitability and reliability. A recommendation will be made regarding their possible approval for Navy use (ANU). This particular document is to evaluate the Rix 4N3BG-2.2-P2 oxygen compressor.

Reference (a) directed NEDU to survey the commercial domestic market to determine if currently available high pressure electric driven oxyge compressors are applicable for fleet use. Procure compressor systems as required for evaluation, and make recommendations for inclusion on Approved for Navy Use (ANU) listings.

2. Test Parameters. Evaluation of the compressor will be conducted as follows:

a. Conduct inspection of compressor using manufacturer's instruction manuals (reference (b)) to ensure all parts and material are received and on hand.

b. Inspect for and determine if the following items comply with reference (b), and record results and comments in Annex A:

(1) All instruments and controls are clearly and permanently marked according to their functions.

(2) All controls, gauges and indicators necessary for operation of the compressor are visible and convenient to the operator.

(3) Safety devices are provided. Audible and/or visual warnings function as specified.

(4) Appropriate indicators accurately display liquid level.

(5) All removable components can be removed and properly re-installed in working condition using reference (b) (i.e.,filters).

(6) All drain, trap and safety valve discharge ports will function without splashing, are conveniently located, and are away from operating personnel.

d. Ensure all instrumentation provided by manufacturer have been compared and/or calibrated, and is accompanied with certification.

e. Operate the compressor for one (1) hour using nitrogen under a no load condition.

f. Take gas samples following no-load test run, and have gas analysis conducted.

g. Conduct Testing in accordance with the procedures set forth in section 4. Total compressor running time will be 50 hours.

3. Preliminary Arrangements

a. Arrange for gas analysis to be conducted as required.

b. Prior to the actual test procedure the oxygen compressor system shall be operated then shut down when the system is at maximum pressure and the following steps accomplished:

(1) Hold pressure.

(2) Allow the system to cool to ambient temperature.

(3) After temperature has stabilized, record the storage flask pressure.

(4) After a four hour period, record pressure again.

(5) Leak rate shall be zero.

4. Test Procedure. The following test procedures will be conducted as specified, and the results entered in the log sheets, Annex A.

a. Take air samples at hours 1, 25, 50, and anytime gas quality is questioned.

b. Log the following measurements (if applicable) on the log sheet Annex A:

(1) Date

(2) Time

(3) Compressor meter hour (if applicable)

(4) Total hours running time on compressor (this test)

(5) Coolant level

(6) Coolant temperature

(7) 1st Stage pressure

(8) 2nd Stage pressure

(9) 3rd Stage pressure

(10) 4th Stage pressure

(11) Discharge gas temperature

(12) Ambient air temperature

(13) Flask size and pressure

(14) Remarks

c. The compressor system shall be set to run on a continuous daily basis by adjusting controls and bleed off rate.

d. Compute volume output of the compressor by charging a known volume storage flask to 2500 psig. Log total charging time and calculate charging rate using 25 psig inlet pressure.

e. At the end of the working day the compressor system will be charged up 2500 psig, and the discharge valve secured. Check the system pressure prior to start up the following day. Zero pressure drop allowed (computed for temperature change).

f. Perform maintenance as required by the manufacturer's instruction manuals.

5. Funding Source. NAVSEA OOC Task No. 89-68 (reference (a).

6. Logistical Support. Gas analysis (nitrogen).

7. Personnel Requirements. NEDU Hyperbaric and/or Test and Evaluation Department personnel (1 each).

8. Safety Rules and Emergency Procedures. Safety rules and precautions as outlined in reference (b).

9. Post Test Arrangements. Make all necessary arrangements as previously determined to return compressor system and test fixtures to proper locations.

10. Report Production. Test report and camera ready copy to be written and prepared by the Test Director and submitted for approval to the Commanding Officer via the Task Leader. Estimated publication date is six (6) weeks following completion of testing. Test Directors will be the point of contact for NEDU concerning this test and will be appointed by the Task Leader.

11. Comments and Additional Information. The NEDU Task Leader is responsible for the following:

a. Control and Safety of Systems. All control systems, safety systems and valves shall be activated by making the necessary temporary alterations to the compressor controls and operations whenever such alterations will not result in a risk of damage to the compressor unit. Where a risk is present, the test may be conducted with control systems completely removed from the compressor unit by subjecting control system sensors to other sources of temperature and pressure; for example, the overpressure switches and sensors, high temperature switches and sensors, and other devices designed to operate or protect the system and attending personnel.

b. Termination Criteria. The following is failure criteria for the suitability for the specific compressor system for ANU:

(1) Failure of any component which cannot be corrected in accordance with the recommended schedule of maintenance.

(2) Failure of the gas system, valves or pressure relief valves to operate as specified by reference (b).

(3) A decrease in capacity of the compressor during this performance evaluation.

(4) A discharge gas temperature from any cylinder in excess of manufacturer's specifications or recommendations.

(5) Failure of the gas samples to pass purity air specifications.

(6) Failure of the compressor system to hold pressure; indicating system leakage.

RIX INDUSTRIES OXYGEN COMPRESSOR
MODEL 4N3BG-2.2

DATE 1990	REAL TIME	TOTAL METER HOURS	TOTAL TEST HOURS	COOLANT TEMP	STAGE PRESSURE			SUCT PR	TEMPS		COOL WATER LEVEL	REMARKS
					1	2	3		DSCH	AMBI		
10-05	0900	58	00	87.0	200	790	2050	22	76.2	76.5	FULL	START TEST
10-05	1000	59	1	105.4	210	800	2050	22	85.7	80.1	FULL	1 HOUR GAS SAMPLE
10-05	1100	60	2	107.6	185	750	2050	20	87.4	82.2	FULL	
10-05	1200	61	3	109.8	185	750	2050	19	89.7	84.2	FULL	
10-05	1300	62	4	112.8	185	750	2050	19	92.9	86.9	FULL	
19-05	1400	63	5	114.6	185	750	2050	19	93.9	88.4	FULL	
19-09	0700	63	5	74.2	185	750	2050	18	72.6	72.4	FULL	
10-09	0800	64	6	100.2	185	750	2050	19	79.1	76.4	FULL	
10-09	0900	65	7	106.4	180	750	2050	18	84.0	83.6	FULL	
10-09	1000	66	8	111.6	210	800	2050	22	91.1	86.9	FULL	N2 Sample
10-09	1100	67	9	112.8	210	800	2050	22	92.8	91.1	FULL	
10-09	1200	68	10	112.8	190	750	2050	20	91.9	92.9	FULL	
10-09	1300	69	11	116.6	185	750	2050	20	94.8	95.0	FULL	
10-09	1400	70	12	116.9	185	750	2050	20	96.2	93.6	FULL	

RIX INDUSTRIES OXYGEN COMPRESSOR
MODEL 4N3BG-2.2

DATE 1990	REAL TIME	TOTAL METER HOURS	TOTAL TEST HOURS	COOLANT TEMP	STAGE PRESSURE			SUCT PR	TEMPS		COOL WATER LEVEL	REMARKS
					1	2	3		DSCH	AMBI		
10-10	0700			76.1	200	790	2050	22	63.8	74.0	FULL	
10-10	0800	71	13	102.0	200	790	2050	22	81.6	78.5	FULL	
10-10	0835	CHARGING RATE TIME :7::11					AT	25	O TO 2000 PSIG			
10-10	0900	72	14	101.0	190	790	2050	20	79.0	81.1	FULL	
10-10	1000	73	15	101.6	190	790	2050	20	81.2	80.1	FULL	
10-10	1100	74	16	105.9	190	750	2050	20	83.1	80.5	FULL	
10-10	1200	75	17	103.4	190	750	2050	20	83.2	80.3	FULL	
10-10	1300	76	18	106.1	190	750	2050	20	86.1	84.5	FULL	
10-10	1400	77	19	106.5	190	750	2050	20	85.7	83.3	FULL	
10-11	0700	77	19	68.4	210	800	2100	24	53.8	66.8	FULL	
10-11	0800	78	20	94.5	210	800	2100	24	74.5	68.4	FULL	
10-11	0900	79	21	94.9	190	750	2100	20	68.4	69.1	FULL	
10-11	1000	80	22	94.0	190	750	2100	20	72.7	68.6	FULL	
10-11	1100	81	23	95.2	190	750	2100	20	74.4	70.3	FULL	

RIX INDUSTRIES OXYGEN COMPRESSOR
MODEL 4N3BG-2.2

DATE 1990	REAL TIME	TOTAL METER HOURS	TOTAL TEST HOURS	COOLANT TEMP	STAGE PRESSURE			SUCT PR	TEMPS		COOL WATER LEVEL	REMARKS
					1	2	3		DSCH	AMBI		
10-11	1200	82	24	97.2	190	750	2100	20	76.8	72.1	FULL	
10-11	1300	83	25	101.6	190	750	2100	20	81.2	75.7	FULL	25 HR GAS SAMPLE
10-11	1305	CHARGING RATE TIME :8::16					AT	20	0 TO 2000 PSIG			
10-11	1400	84	26	102.9	185	750	2080	19	82.9	79.7	FULL	
10-12	0600	84	26	87.2	190	750	2100	20	63.9	71.1	FULL	
10-12	0700	85	27	97.7	190	750	2100	20	75.3	72.2	FULL	
10-12	0800	86	28	98.9	190	750	2100	20	76.6	73.6	FULL	
10-12	0900	87	29	98.4	190	750	2100	20	77.0	72.9	FULL	
10-12	1000	88	30	100.1	200	775	2100	20	78.1	74.7	FULL	
10-12	1100	89	31	100.4	200	775	2100	20	78.8	75.6	FULL	
10-12	1200	90	32	101.6	200	775	2100	21	80.4	77.5	FULL	
10-12	1300	91	33	104.1	200	775	2100	21	83.1	82.8	FULL	
10-12	1400	92	34	105.8	200	775	2100	21	84.6	81.8	FULL	

RIX INDUSTRIES OXYGEN COMPRESSOR
MODEL 4N3BG-2.2

DATE 1990	REAL TIME	TOTAL METER HOURS	TOTAL TEST HOURS	COOLANT TEMP	STAGE PRESSURE			SUCT PR	TEMPS		COOL WATER LEVEL	REMARKS
					1	2	3		DSCH	AMBI		
10-15	0700	92	34	76.9	210	800	2100	22	58.5	67.2	FULL	
10-15	0800	93	35	97.1	195	775	2050	20	75.1	72.7	FULL	
10-15	0845	CHARGING RATE TIME :7::15					AT	25	0 to 200 PSIG			
10-15	0900	94	36	101.2	195	775	2100	20	82.3	76.6	FULL	
10-15	1000	95	37	102.3	195	775	2100	20	80.5	80.6	FULL	
10-15	1100	96	38	106.3	195	775	2100	20	85.0	82.2	FULL	
10-15	1200	97	39	110.8	195	775	2100	20	89.9	86.8	FULL	
10-15	1300	98	40	114.2	195	775	2100	20	93.5	88.5	FULL	
10-15	1400	99	41	116.2	195	775	2100	20	95.8	90.0	FULL	
10-15	1430	99.5	41.5	111.4	195	775	2100	20	91.4	86.6	FULL	
10-16	0800	99.5	41.5	70.1	185	775	2100	20	72.0	72.4	FULL	
10-16	0900	100.5	42.5	100.9	190	775	2100	19	78.6	83.1	FULL	
10-16	1000	101.5	43.5	108.3	190	775	2100	20	86.7	83.6	FULL	
10-16	1020	CHARGING RATE TIME :7::07					AT	25	0 TO 2000 PSIG			

RIX INDUSTRIES OXYGEN COMPRESSOR
MODEL 4N3BG-2.2

DATE 1989	REAL TIME	TOTAL METER HOURS	TOTAL TEST HOURS	COOLANT TEMP	STAGE PRESSURE			SUCT PR	TEMPS		COOL WATER LEVEL	REMARKS
					1	2	3		DSCH	AMBI		
10-16	1100	102.5	44.5	108.5	210	800	2100	22	87.2	85.6	FULL	
10-16	1200	103.5	45.5	111.3	200	790	2100	20	90.6	89.5	FULL	
10-16	1300	104.5	46.5	114.6	190	790	2100	20	94.2	91.4	FULL	
10-16	1400	105.5	47.5	114.4	190	790	2100	20	94.2	89.0	FULL	
10-18	0630	105.5	47.5	74.1	215	810	2100	22	60.7	72.7	FULL	
10-18	0700	106	48	96.6	190	780	2100	20	73.1	73.9	FULL	
10-18	0800	107	49	101.1	210	800	2100	22	79.4	75.7	FULL	
10-18	0845	CHARGING RATE TIME :7::07					AT	25	0 TO 2000 PSIG			
10-18	0900	108	50	102.2	190	780	2100	20	80.2	77.7	FULL	50 HOUR SAMPLE

Memorandum 18 October 1990

To: Dave Sullivan, NEDU
From: Glen Deason, Code 5130

Subject: Analysis of nitrogen sample from RIX 4N3BG-2.2 gas compressor; 50 hour sample.

1. In accordance with your request of 18 October, the Nitrogen sample delivered to the gas analysis lab was analyzed and found to contain:

Component	Cyl. #49
Nitrogen	100 %
Oxygen	omit
Argon	omit
Carbon Dioxide	omit
Carbon Monoxide	<0.5 PPM
Total Hydrocarbons*	<0.5 PPM
Total Halogens	<0.5 PPM
Methane	<0.1 PPM
Acetylene	<0.1 PPM
Acetone	<0.1 PPM
Freon 113	<0.1 PPM
Methyl Ethyl Ketone	<0.1 PPM
Ethane	<0.1 PPM
Water	OMIT
Ethylene	<0.1 PPM
C4+	<0.1 PPM

*Expressed as methane equivalents.

2. The above sample showed no appreciable contamination; all components were in acceptable range of the USN Nitrogen Purity Standards.

Glen Deason
Chemist

Memorandum 9 October 1990

To: Dave Sullivan. NEDU
From: Glen Deason. Code 5130

Subject: Analysis of nitrogen sample from RIX 4N3BG-2.2 gas compressor. One hour sample.

1. In accordance with your request of 5 October, the Nitrogen sample delivered to the gas analysis lab was analyzed and found to contain:

Component	Gas Compressor
Nitrogen	100 %
Oxygen	omit
Argon	omit
Carbon Dioxide	omit
Carbon Monoxide	1.9 PPM
Total Hydrocarbons*	10.1 PPM
Total Halogens	<0.5 PPM
Methane	2.7 PPM
Acetylene	<0.1 PPM
Acetone	<0.1 PPM
Freon 113	<0.1 PPM
Methyl Ethyl Ketone	<0.1 PPM
Ethane	<0.1 PPM
Water	OMIT
Ethylene	<0.1 PPM
C4+	<1.9 PPM

*Expressed as methane equivalents.

2. The above sample showed no appreciable contamination: all components were in acceptable range of the USN Nitrogen Purity Standards.

Glen Deason

Glen Deason
Chemist

Memorandum 9 October 1990

To: Dave Sullivan, NEDU
From: Glen Deason, Code 5130

Subject: Analysis of nitrogen gas supplied to RIX 4N3BG-2.2 gas compressor. Nitrogen gas did not go through compressor.

1. In accordance with your request of 9 October, the Nitrogen sample delivered to the gas analysis lab was analyzed and found to contain:

Component	Gas Compressor
Nitrogen	100 %
Oxygen	omit
Argon	omit
Carbon Dioxide	omit
Carbon Monoxide	<0.5 PPM
Total Hydrocarbons*	<0.5 PPM
Total Halogens	<0.5 PPM
Methane	<0.1 PPM
Acetylene	<0.1 PPM
Acetone	<0.1 PPM
Freon 113	<0.1 PPM
Methyl Ethyl Ketone	<0.1 PPM
Ethane	<0.1 PPM
Water	OMIT
Ethylene	<0.1 PPM
C4+	<0.1 PPM

*Expressed as methane equivalents.

2. The above sample showed no appreciable contamination; all components were in acceptable range of the USN Nitrogen Purity Standards.

Glen Deason HBB

Glen Deason
Chemist

Memorandum 11 October 1990

To: Dave Sullivan, NEDU
From: Glen Deason, Code 5130

Subject: Analysis of nitrogen sample from RIX 4N3BG-2.2 gas compressor. This was the 25 hour sample.

1. In accordance with your request of 11 October, the Nitrogen sample delivered to the gas analysis lab was analyzed and found to contain:

Component	Cyl. #67
Nitrogen	100 %
Oxygen	omit
Argon	omit
Carbon Dioxide	omit
Carbon Monoxide	<0.5 PPM
Total Hydrocarbons*	<0.5 PPM
Total Halogens	<0.5 PPM
Methane	<0.1 PPM
Acetylene	<0.1 PPM
Acetone	<0.1 PPM
Freon 113	<0.1 PPM
Methyl Ethyl Ketone	<0.1 PPM
Ethane	<0.1 PPM
Water	OMIT
Ethylene	<0.1 PPM
C4+	<0.1 PPM

*Expressed as methane equivalents.

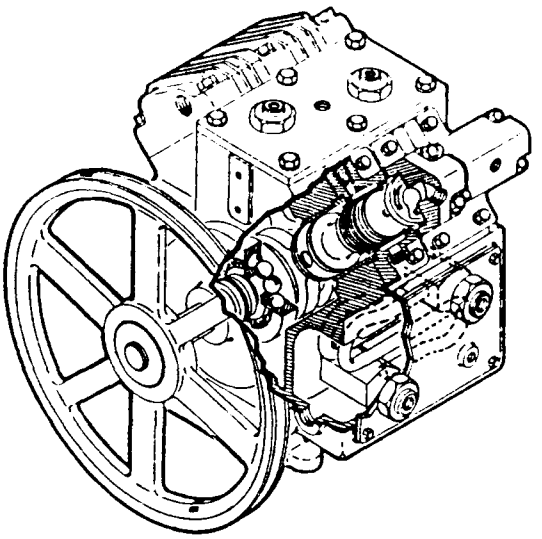
2. The above sample showed no appreciable contamination: all components were in acceptable range of the USN Nitrogen Purity Standards.

Glen Deason HGD

Glen Deason
Chemist

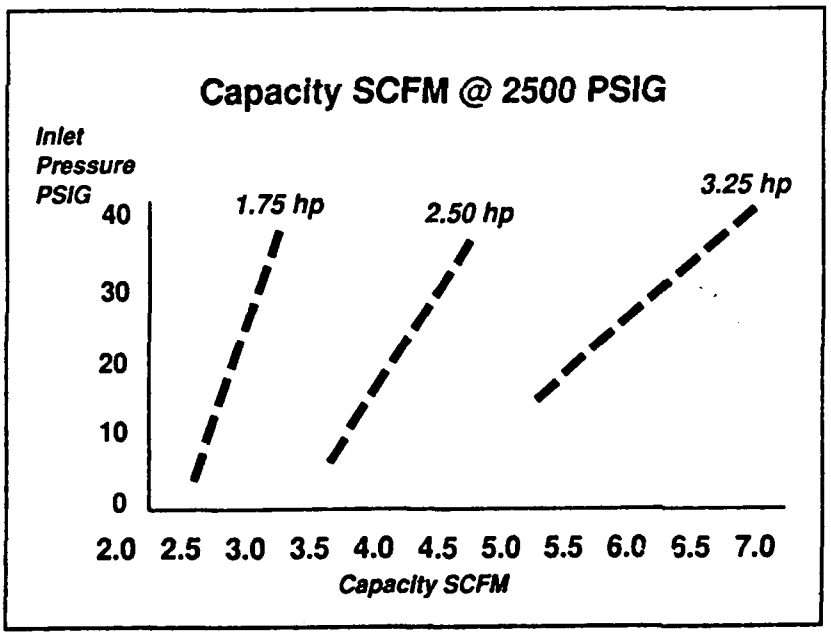
4N3BG Oxygen Compressor

Oxygen Compatible
Oil-Less Design/Sealed Bearings
4 Cylinder "V" Type Reciprocating Piston Design
3-Stages
Sealed Crankcase



Specifications

Size, Bare ..... 14.5"w x 13.25"l x 12.75"h
..... (36.8cm x 33.7cm x 32.4cm)
Size, Mounted Package .... 18"w x 33"l x 17" h
..... (45.7cm x 83.8cm x 43.2cm)
Weight (w/o Flywheel) ..... 85 lbs. (38.6 kg)
Weight (Package)..... 175 lbs. (79.5 kg)
Power ..... 2, 3, or 5 hp motor size
Compressor Speed ..... 400 to 1000 RPM
Suction ..... 5 psig to 40 psig
Max. Discharge, O_2 ..... to 2500 psi
Discharge, Other Gases .... to 3000 psi
Flow Rate ..... 1.7 to 6.7 scfm (100 to 400 scfh)



Standard Components

***Bare Compressor:**
- 4N3BG Compressor
- Innercoolers, watercooled
- Aftercooler, watercooled
- Crankcase, watercooled
- Flywheel
- Stainless Steel Plumbing
- Relief Valves
- Filters
- Oxygen Clean

***Compressor Package:**
- Compressor
- Bedplate
- V-Belt
- Belt Guard
- Motor
- Starter
- Start/Stop Buttons
- Hour Meter
- High Temperature Shutdown
- High Pressure Shutdown
- Low Inlet Pressure Shutdown
- Oxygen Clean

***Optional Closed Circuit Cooling Package:**
- Radiator
- Water Pump
- Electric Fan & Starter
- Bedplate Mounted

**Factory tested on oxygen to customer specifications.*