O_2N_2 SITE
On Site Gas Systems, Inc.
Manufacturers / Designers of Oxygen & Nitrogen Generating Equipment

POGS 33

Portable Oxygen Generation System – 33 LPM

Maintenance Manual

On Site Gas Systems, Inc.
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A BUSINESS INCORPORATED IN THE STATE OF CONNECTICUT, U.S.A.

INTRODUCTION

Objective

- Comprehension of PSA technology and how the Portable Oxygen Generation System works to generate medical oxygen and compressed air.
- To provide understanding of how each component works and contributes to the process.
- How to unpack and setup each component, and identify all of their functional parts.
- Knowledge of the flow of power, air, oxygen and compressed air, and operation of alarm indicators.
- To envision all possible component configurations to deliver oxygen and compressed air.
- Comprehension of safety, warnings and hazardous material issues.
- Knowledge of all maintenance functions for all components: start-up, scheduled and tear-down maintenance.
- How to completely and quickly perform emergency disconnect and emergency pack-up deployment.
- Knowledge of system trouble-shooting: air, power, alarm.

Company Overview

> Our products are designed and built to meet the specific needs of the user, under the supposition that they must operate for decades in the most remote locations in the world, under the harshest extremes of climate, using every possible combination of voltages and hertz. To this end no electronics are used in our products . . . only electro-mechanical devices which can be serviced and replaced with off-the-shelf parts anywhere in the world. There is a wonderful array of electronics and high technology available. But, time and again time-tested technology, simplified and ruggedized for the battlefield, is what ultimately supports war fighters best.

Frank Hursey, President, is a pioneer of PSA technology, directly involved in the development and perfection of the Home Oxygen Generator. The two companies that Frank previously owned were production-based companies of Home Oxygen Concentrators. Frank sold his interest in those companies to start this business. On Site Gas Systems was designed to remain a relatively small, flexible organization so as to change direction easily, as a solutions-based company to meet needs of specific applications. That's why, when we were asked to design and build the original POGS for Bright Star for the Marines, we were able to design and build it in 12 days. That's why, when given two weeks to redesign and reconfigure in a Charlie Horse container, we were able to do it.

The technology and design simplicity we use is the technology Frank developed in the NASA Program. The PSA technology is over 50 years old, and has been proven as rugged and reliable over millions of hours of operation. We take simple fundamental time-tested technology, and simply package and configure it in a way that best suits special needs of specific users. We do this everyday for industry, for the medical community, and now for the military community. If you look at our system and say "nice, but wish I had…" or, "doesn't quite fit our need because," that means that you do not understand our capabilities. The user should be able to look at the system and say, "I like this, but also would like this…" or "I don't need this in it". That is who we are, that is what we do.

Theory of PSA Technology

An Overview:

Oxygen and Nitrogen gas generation from air is a 50-year-old technology. The air we breathe contains 20.9% oxygen and 79% nitrogen. Oxygen generation through Pressure Swing Adsorption (PSA) is nothing more than filtration based on molecule size. Compressed air enters the filter medium, Zeolite, where the oxygen is separated from nitrogen. The Oxygen molecules are released at low pressure, and captured in a surge tank, ready for use.

On Site Gas Systems designs and builds nitrogen and oxygen generators to meet the specific needs of the user, and are used worldwide in over 50 countries. Our President, Frank Hursey, believes in a fundamental philosophy of management and research. He developed his sense of research designing systems for NASA in the Apollo Program. The precept of the early NASA philosophy was to do the job by keeping simple processes simple, and making complex processes less complex. On Site's product reputation and company growth are based on this philosophy.

The Technology:

Pressure Swing Adsorption (PSA) is nothing more than filtration. Filtration counts on the separation of different sized particles to facilitate the process. It is not chemical, produces no waste, and has no hazardous materials or effects. The air around us is 20.9% Oxygen and 79% Nitrogen. Nitrogen molecules are larger and slower than CO, CO_2 and Oxygen molecules. If we are able to separate the larger molecules from the smaller ones, we can isolate, capture and use the filtered Oxygen.

With PSA, we force air into a tank under pressure. This tank, or sieve bed, is filled with the filter medium, Zeolite, which is porous, like pumice or a sponge. The pressurized, excited molecules move actively throughout and around the Zeolite. To gather Oxygen, the Zeolite has porous surfaces, which attract the Nitrogen molecules. As both Oxygen and Nitrogen flow through the Zeolite, the oxygen moves freely past, while the Nitrogen is captured. This is because the Zeolite has an affinity for the Nitrogen.

This process is physical, and not chemical. It does not produce any byproduct, except nitrogen, which is equalized just inches from the outlet port. There are no consumables other than filters. Zeolite sieve lasts approximately 20 years with continuous use. After allowing this separation process to go on for sometime, the free floating Oxygen molecules are released out of the vessel at low pressure, and captured in a surge tank. When the Oxygen has been drawn out of the tank (or sieve bed), the pressure in it is released quickly, allowing the Nitrogen to escape into the air and "cleansing" the Zeolite for the next cycle. The sieve bed is then reflooded with pressurized air, and the cycle begins again.

We use two sieve beds in all of our generators to increase the consistency of the Oxygen delivery. The compressed feed air is fed into one sieve bed, and then the feed swings to pressurize the other sieve bed. The filter medium, Zeolite, adsorbs Nitrogen to make the Oxygen, hence the name Pressure Swing Adsorption.

Glossary

A	Adsorption	Physical absorption of a substance, as in a sponge with water, incorrectly referred to as "absorption", which is deferred as a chemical process.
	ASME	American Society of Mechanical Engineers
C	CE	Conformite Europeere: CE Mark (European Standard)
D	DISS Fitting	Diameter Index Safety System
F	FDA	Food and Drug Administration
H	HEPA	High Efficiency Particulate Air Filter
	High Volume Booster	High Volume Oxygen Booster boosts up to 60 SCFH
	HP	Horse power
L	Lbs	Pounds
	LPM	Liters per Minute
M	Microboost	Oxygen Booster: boosts up to 19 SCFH
	MIL Spec	Military Specification
N	N2	Nitrogen
	NFPA	National Fire Protection Agency
O	O2	Oxygen
P	P&ID	Process and Instrumentation Diagram
	PSA	Pressure Swing Adsorption
	PSIG	Pounds per square inch at gauge
	POGS	Portable Oxygen Generation System
R	RIX	Brand name of Microboost and High-Volume O2 Booster
S	SCFH	Standard cubic feet per hour
	SCFM	Standard cubic feet per minute
U	USP	United States Pharmacopeial
Z	ZMS	Zeolite Molecular Sieve

POGS-33
Portable Oxygen Generation Systems (POGS) – 33 LPM
In Hardigg Military Cases

On Site Portable Oxygen Generator System: POGS – 33 LPM

- FDA Approved: K-020362
- Portable, modular, self-contained, ruggedized for the battlefield.
- Built to Mil Spec T 28800-D, and Manufacturing Standards: ASME, CE, FDA, USP, NFPA.
- Produces up to 33 LPM at a purity of 93 – 95%, with 4 oxygen outlets and 2-Y connectors.
- Produces 20 LPM of Compressed Air with 1 outlet and 1 T-connector.
- Outlet Pressure: 50 PSIG total.
- Fills E-cylinders to 2200 PSIG.
- High Pressure Regulator for emergency backup oxygen.
- Entire system is completely modular and can be piggybacked in parallel or series.
- Feed air compressor, oxygen delivery systems, oxygen booster, and control panel are all "plug-and-play", and interchangeable with other units.
- System is completely stand-alone and built within Hardigg Military Cases. Hardigg Cases meet military and commercial specifications, and are qualified according to MIL-SPEC testing and certification procedures. Components over 100 pounds can be equipped with removable wheels. The Microboost is built within a metal box, and is transported separately.
- Electrics: 208 Volts / 60 Hz / 3 Phase or 220 Volts / 60 Hz / 1 Phase. System can also be manufactured in 50 Hz.
- Entire system, with booster, requires only 4 kilowatts of 208 Volt, 3 phase power, or 220 Volt, single phase power. Without booster, system uses 3.8 kilowatts.
- Deployed and operational in 3 minutes by 2 men.

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Modular Component #1: POGS Generator

- The system process employs field-tested, time-proven PSA technology.
- Fully automatic with pressure switch. Pre-filters and pressure regulator.
- All systems and diagnostics controlled from one central control panel, with gauges, hour meter, and power switch.
- With Feed Air Receiving Tank.
- With Molecular Sieve Beds.
- With Oxygen and Compressed Air HEPA High Purity Filtration.
- With Built-in Oxygen Analyzer: Ceramatec Model: 1100. This is only electronics in system. Includes audible alarm with bypass option. System will still produce and store oxygen with full electronic failure.
- With On Site Oxygen Receiving/Storage Tank, including relief valve, ball valves, gauges and pressure regulator.
- With Carbon Monoxide Detector.
- POGS can be located up to 30 ft. from power source.
- System has 4 lift-points to allow 4-person carry.
- Accessories are stored in Generator lid.
- Electrics: 110 Volts / 60 Hz / 1 Phase
- POGS Generator built within Hardigg Military Case
    - Case dimensions: 51.62"L x 27.62"W x 23.36"H.
    - Case weight: 57.3 lbs.
    - Total component weight: 300 lbs.

Modular Component #2: Feed Air Compressor

- Atlas Copco/Powerex Scroll Compressor.
- Model: SF-4, 5 HP, Oil-free.
- Which produces up to 14.7 SCFM at 100 PSIG.
- Block Size: 14" x 14" x 12", Block Weight: 46 lbs., plus 5 HP Motor.
- Electrics: 208-240 Volts / 60 Hz / 3 Phase OR 220 Volts / 60 Hz / 1 Phase.
- Feed Air Compressor can be located 30 ft. from power source.
- Includes Remote Air Intake Hose for closed loop in Chemical and/or Biological Warfare environment.
- Feed Air Compressor built within Hardigg Military Case.
    - Case dimensions: 29.06"L x 27.00"W x 26.62"H.
    - Case weight: 38.5 lbs.
    - Total component weight: 269 lbs.

Modular Component #3: Microboost

- Rix Microboost, Oil-free.
- Delivery of 19 SCFH / I0 LPM at 2200 PSIG.
- With 5-cylinder high pressure E-cylinder manifold with pigtails.
- With High-Pressure Regulator for emergency backup oxygen.
- With D/E-cylinder holder with CGA540 Oxygen adapter with pigtail for (1) H-cylinder.
- Microboost Weight: 80 lbs.
- Microboost can be located 30 ft. from power source.
- Electrics: 110 Volts / 60 Hz / 1 Phase OR 220 Volts / 50 Hz / 1 Phase
- Microboost built within lightweight steel box.
- Metal Box:
    - Box dimensions: 18"L x 12"W x 24"H.
    - Total component weight: 95 lbs.

<u>OPTIONAL</u> Modular Component: Stand-Alone High Volume Oxygen Booster

- System can use either low-volume Microboost or High-Volume Booster
- Rix Booster Compressor.
- Model: 2PS2B, Oil-free.
- 1.5 HP to boost up to 120 SCFH to 2,200 PSIG.
- With 5-cylinder high pressure E-cylinder or H-cylinder manifold with pigtails.
- With High Pressure Regulator for emergency backup oxygen.
- Used with 2 dedicated POGS units to fill one 2200 PSIG E-cylinder every 14.5 minutes.
- Used with 1 dedicated POGS unit to fill one E-cylinder in 25 minutes.
- Used with 2 dedicated POGS to fill one H-cylinder in 2 hours.
- When used with 1 dedicated POGS, will fill one H-cylinder in 4 hours.
- Compressor Weight: 125 lbs.
- Booster Compressor can be located 30 ft. from power source.
- Electrics: 120 Volts / 60 Hz / 1 Phase OR 220 Volts / 50 Hz / 1 Phase
- Booster Compressor built within Hardigg Military Case
    - Case dimensions: 34.43"L x 27.40"W x 23.37"H
    - Case weight: 49.6 lbs.
    - Total component weight: 274 lbs.
-

Hardware Includes:

- 4 Cannulas with DISS fittings.
- 4 Flowmeters.
- 4 Humidifier bottles and all connecting hardware
- 3 - 30' Oxygen Hoses (green)
- 2 - 30' Compressed Air Hoses (yellow)
- 2 - Y's for Oxygen outlet
- 1 - T for Compressed Air Outlet
- 1 Remote Air Intake Hose

Potential System Configurations:

Basically, the system produces 33 LPM Oxygen and 20 LPM Compressed Air. This total volume of 53 LPM can be divided among ventilators, RIX cylinder-filling booster, and cannulas in any percentage and configuration, which include:

1) 4 cannulas, and fill one 2200 PSIG E-cylinder every 77 minutes.
2) Dedicate system to feed 6 cannulas only.
3) Provide full ventilator operation, feed 4 cannulas, and fill one 2200 PSIG E-cylinder every 3 hours 20 minutes.
4) Provide full ventilator operation, feed 3 cannulas, and fill one 2200 PSIG E-cylinder every 85 minutes.
5) Provide full ventilator operation, feed 0-2 cannulas, and fill one 2200 PSIG E-cylinder every 77 minutes.
6) Feed 5 cannulas, and fill one 2200 PSIG E-cylinder every 85 minutes.
7) Dedicate one POGS to filling cylinders, and fill one 2200 PSIG E-cylinder in 76 minutes.
8) Provide full ventilator operation, and feed 4 cannulas.
9) Dedicate one POGS to filling cylinders by assigning two booster packages, and fill one 2200 PSIG E-cylinder every 38 minutes.

<u>With Optional RIX 2PS2B High Volume Booster:</u>

10) Used with 2 dedicated POGS units to fill one 2200 PSIG E-cylinder every 14.5 minutes.
11) Used with 1 dedicated POGS unit to fill in 25 minutes.

POGS 33 Configurations

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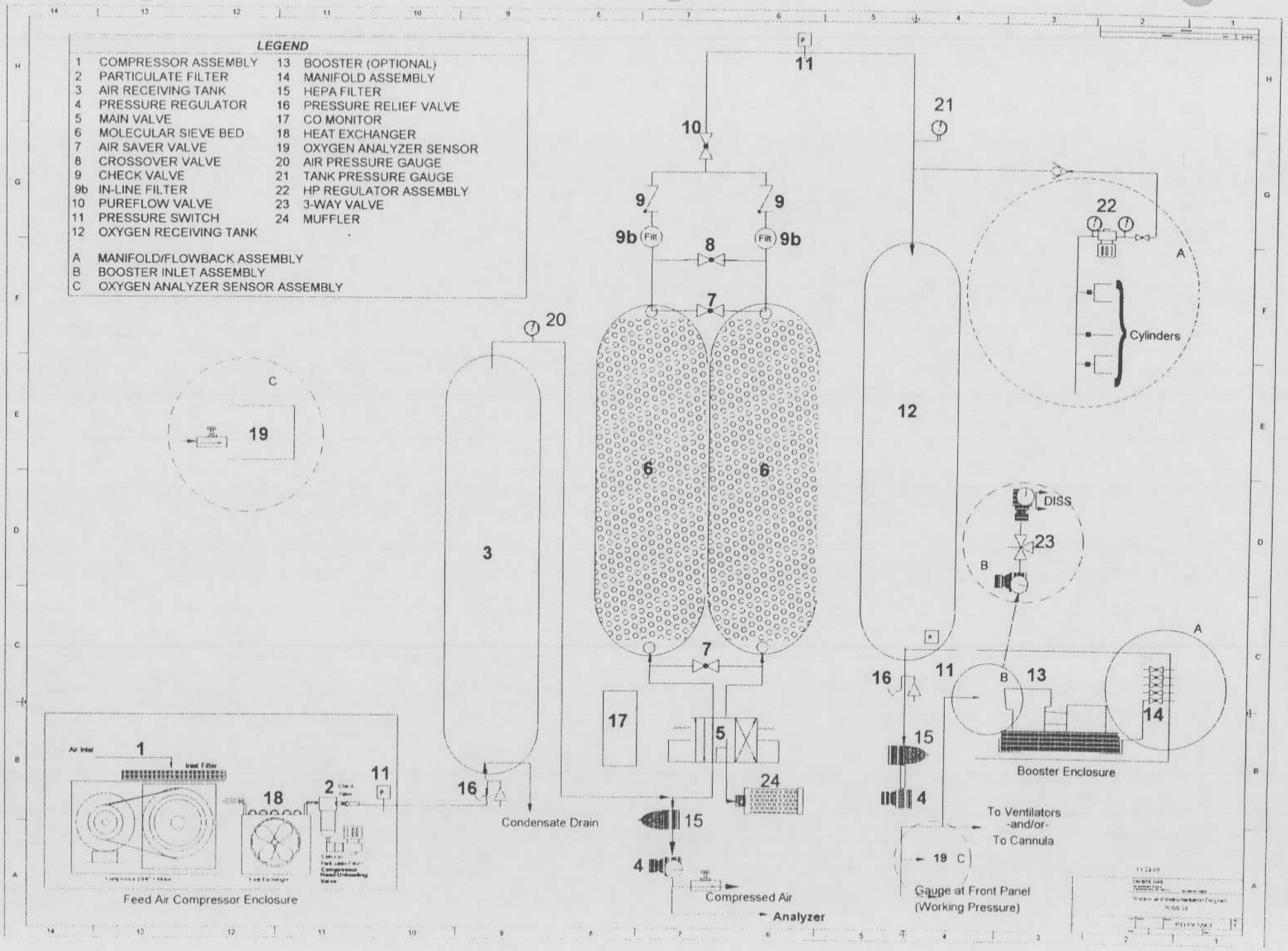
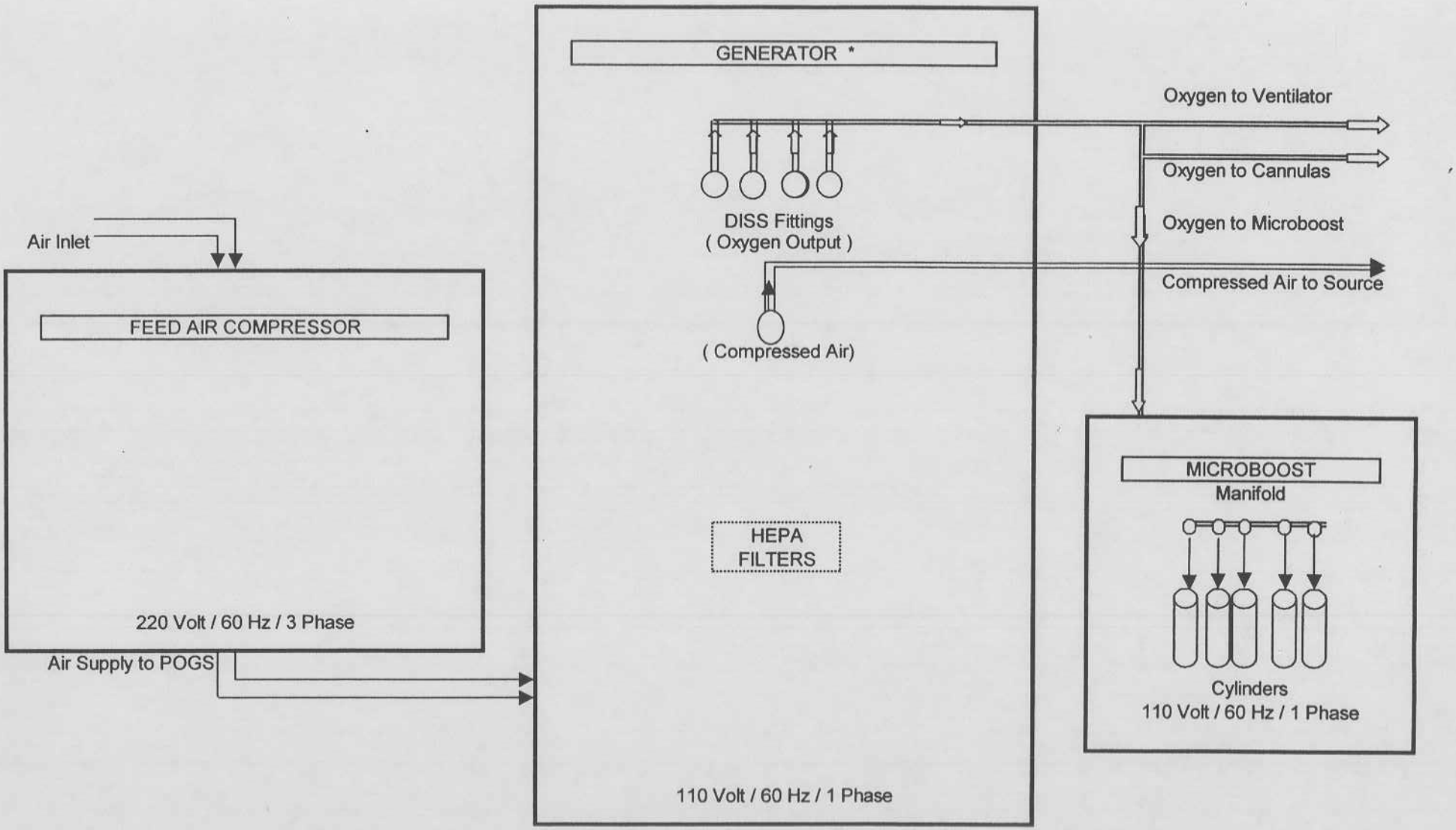
11) Used with 1 dedicated POGS unit to fill in 25 minutes.

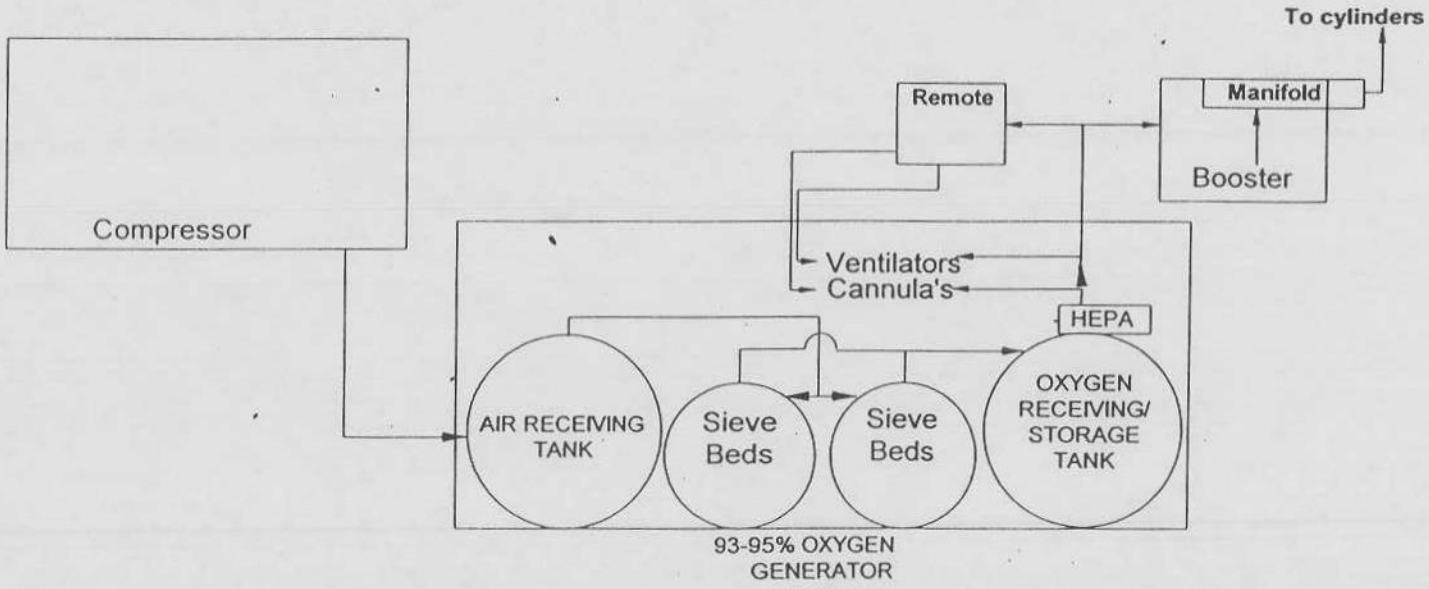

LEGEND
1 COMPRESSOR ASSEMBLY
2 PARTICULATE FILTER
3 AIR RECEIVING TANK
4 PRESSURE REGULATOR
5 MAIN VALVE
6 MOLECULAR SIEVE BED
7 AIR SAVER VALVE
8 CROSSOVER VALVE
9 CHECK VALVE
9b IN-LINE FILTER
10 PUREFLOW VALVE
11 PRESSURE SWITCH
12 OXYGEN RECEIVING TANK
13 BOOSTER (OPTIONAL)
14 MANIFOLD ASSEMBLY
15 HEPA FILTER
16 PRESSURE RELIEF VALVE
17 CO MONITOR
18 HEAT EXCHANGER
19 OXYGEN ANALYZER SENSOR
20 AIR PRESSURE GAUGE
21 TANK PRESSURE GAUGE
22 HP REGULATOR ASSEMBLY
23 3-WAY VALVE
24 MUFFLER
A MANIFOLD/FLOWBACK ASSEMBLY
B BOOSTER INLET ASSEMBLY
C OXYGEN ANALYZER SENSOR ASSEMBLY
Air Inlet
Inlet Filter
Feed Air Compressor Enclosure
Condensate Drain
Compressed Air
Analyzer
Cylinders
DISS
Booster Enclosure
To Ventilators
-and/or-
To Cannula
Gauge at Front Panel
(Working Pressure)

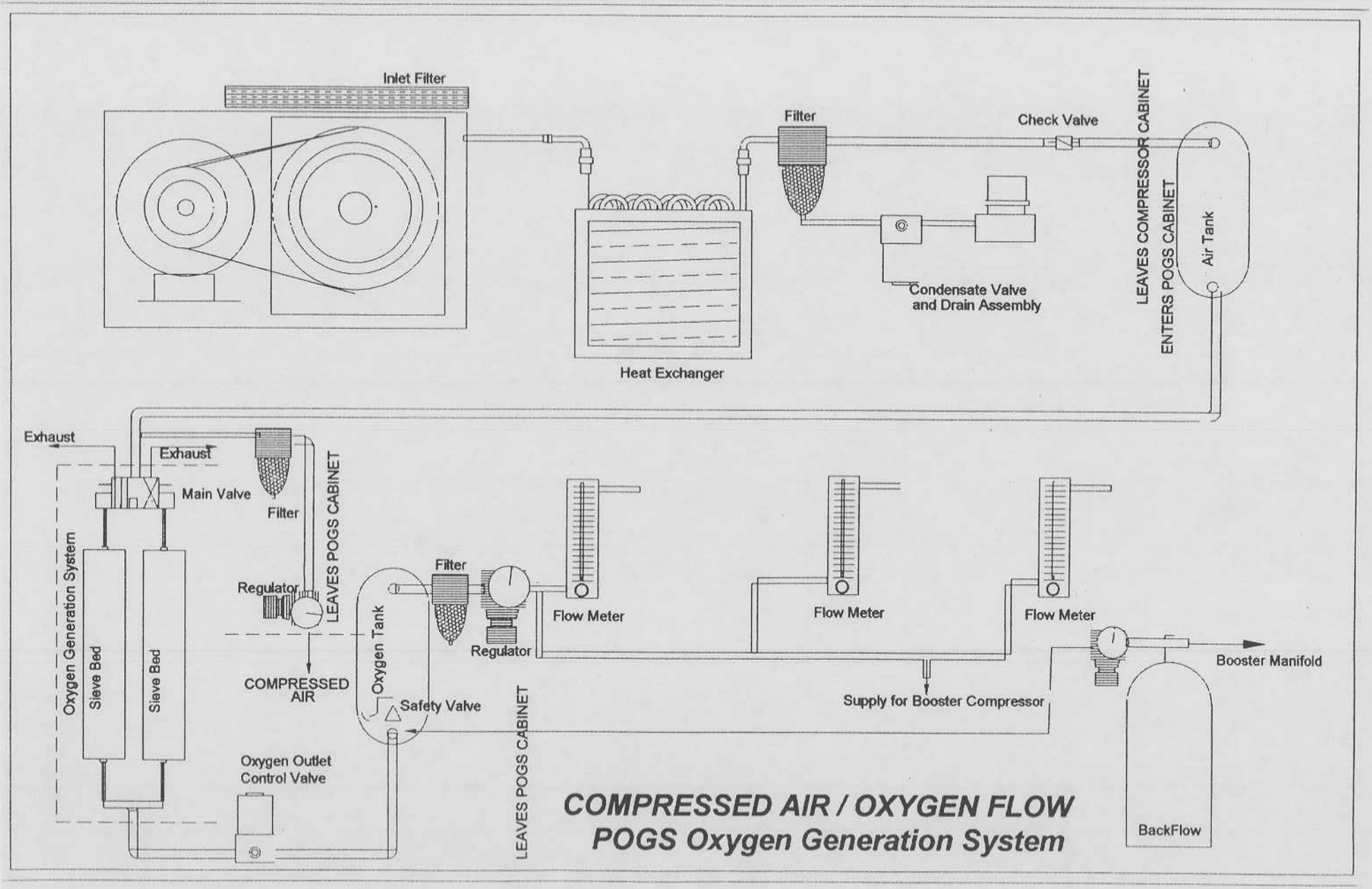
POGS 33 ELECTRICAL AND PNEUMATIC SCHEMATIC



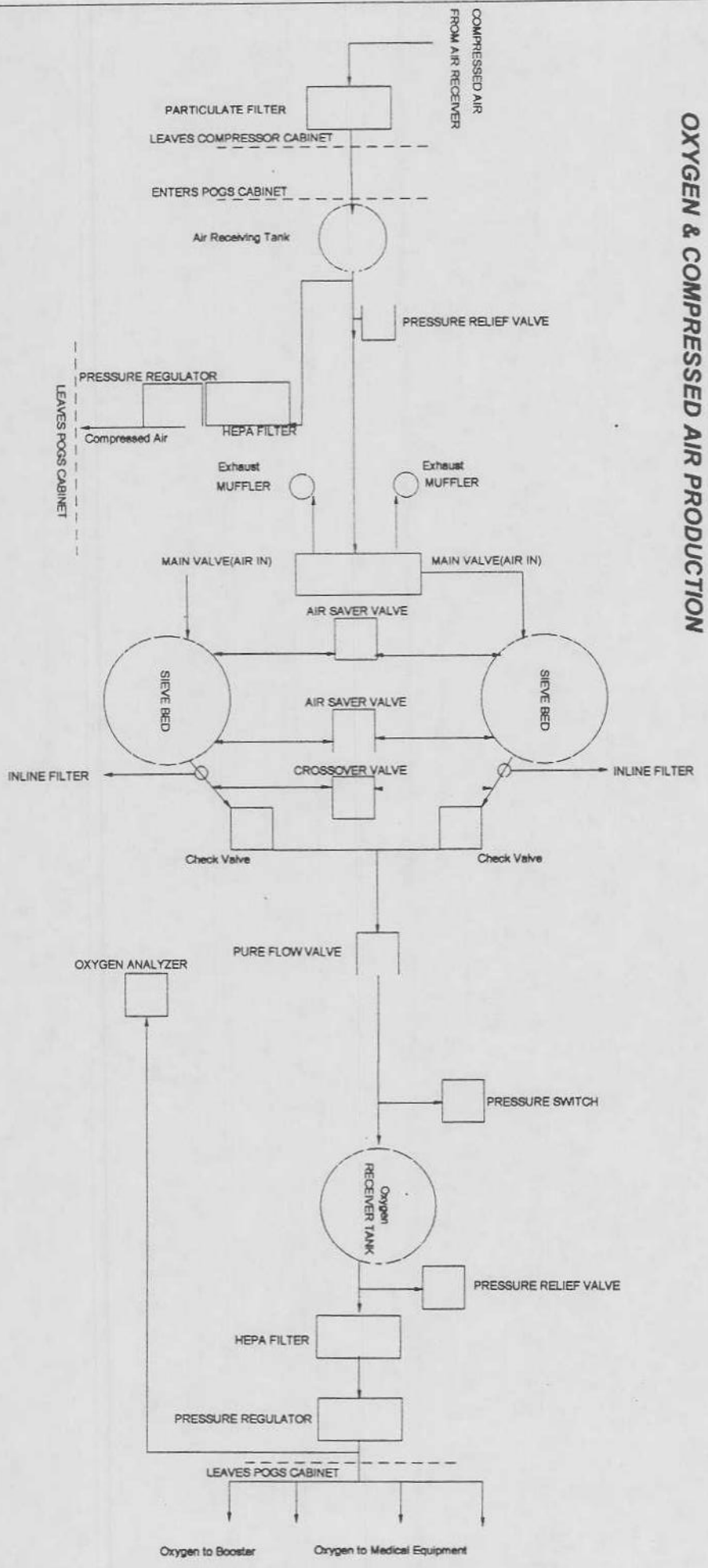
NOTE: * Generator lays down for shipping

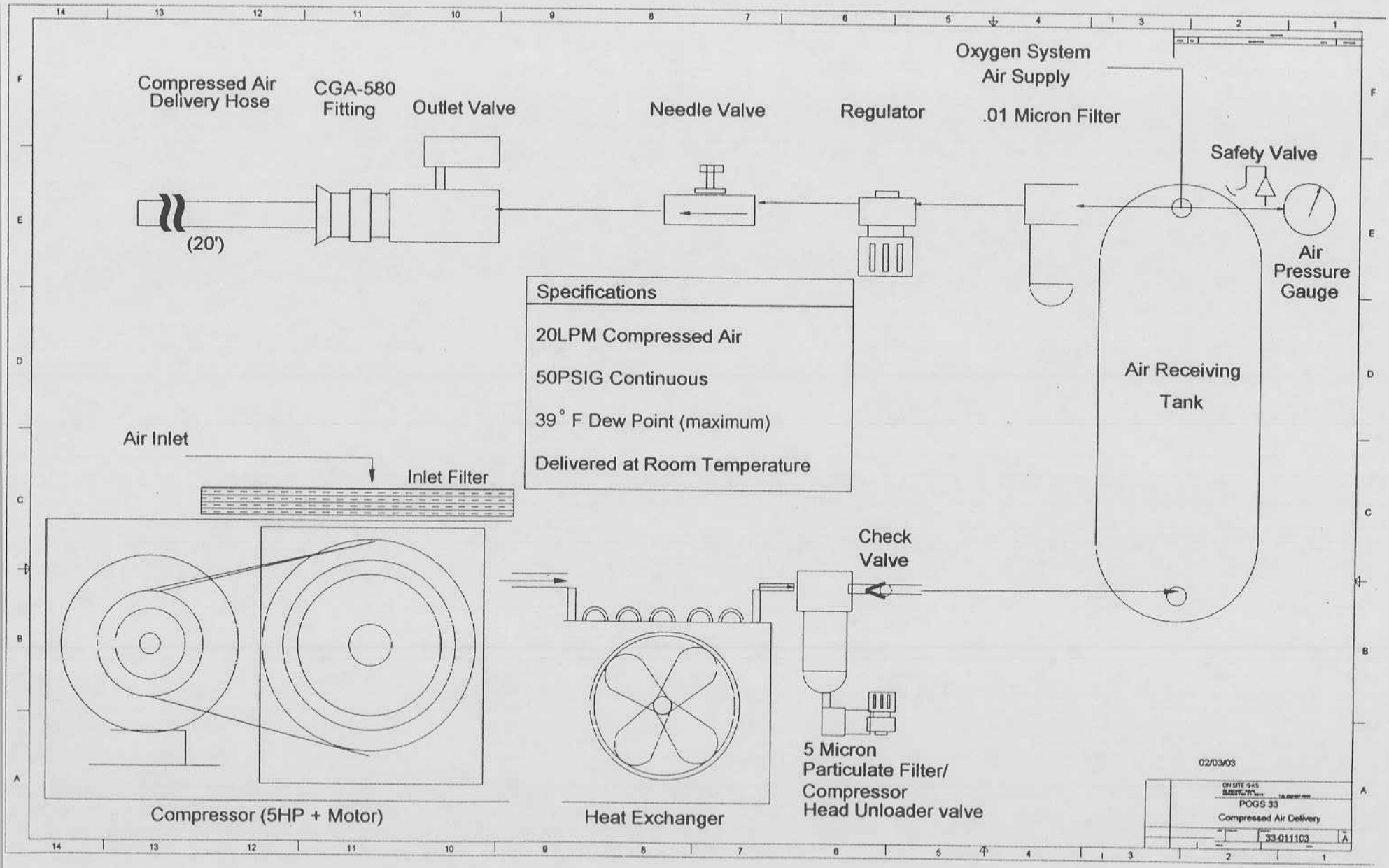
POGS
OXYGEN GENERATOR LAY-OUT




Inlet Filter
Filter
Check Valve
LEAVES COMPRESSOR CABINET
ENTERS POGS CABINET
Air Tank
Condensate Valve
and Drain Assembly
Heat Exchanger
Exhaust
Exhaust
Main Valve
Filter
Oxygen Generation System
Sieve Bed
Sieve Bed
Regulator
LEAVES POGS CABINET
COMPRESSED
AIR
Oxygen Tank
Filter
Regulator
Flow Meter
Flow Meter
Flow Meter
Booster Manifold
Supply for Booster Compressor
Safety Valve
Oxygen Outlet
Control Valve
LEAVES POGS CABINET
BackFlow
COMPRESSED AIR / OXYGEN FLOW
POGS Oxygen Generation System

OXYGEN & COMPRESSED AIR PRODUCTION

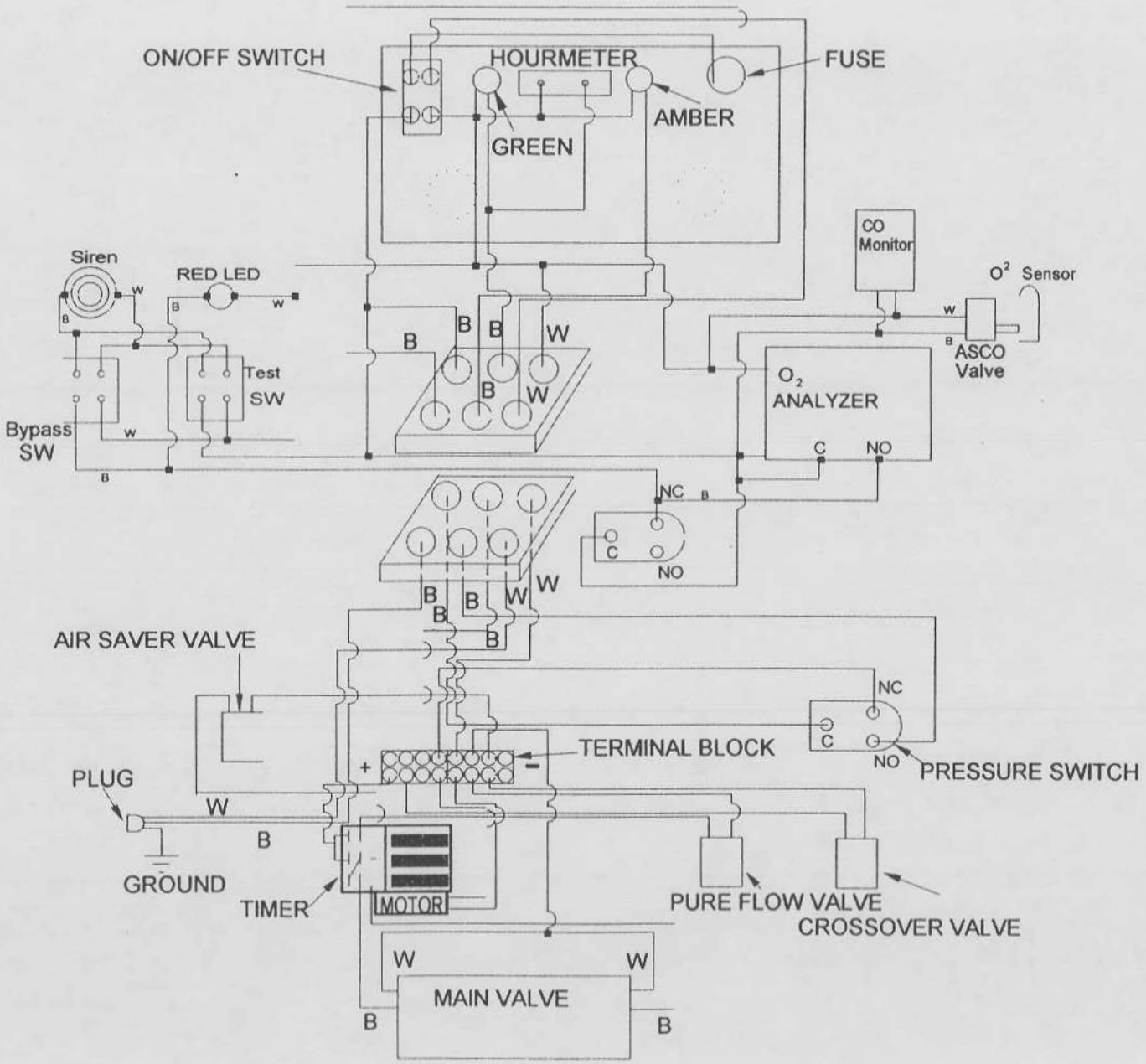


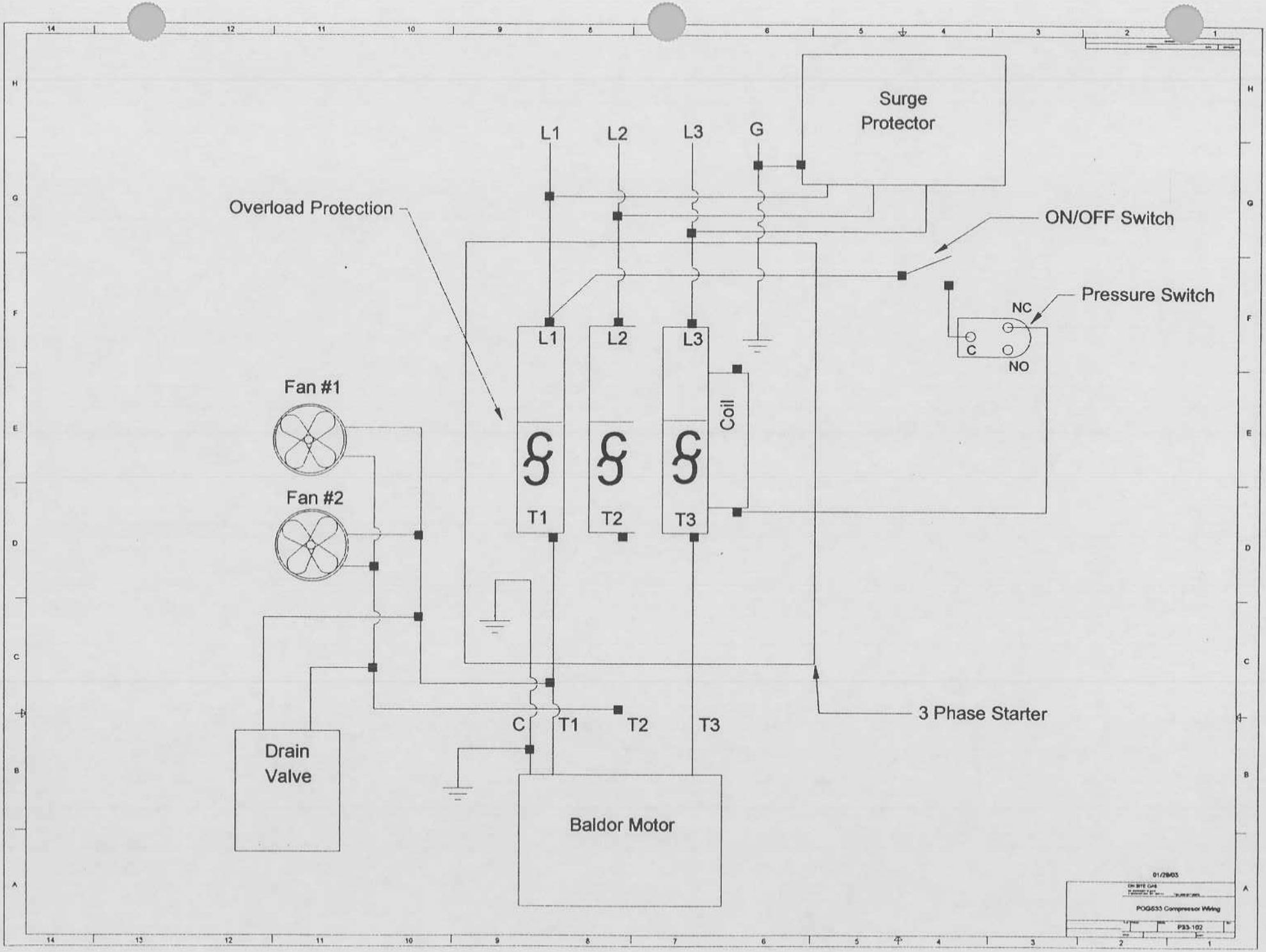

Compressed Air Delivery Hose
CGA-580 Fitting
Outlet Valve
Needle Valve
Regulator
Oxygen System Air Supply
.01 Micron Filter
Safety Valve
(20')
Air Pressure Gauge
Specifications
20LPM Compressed Air
50PSIG Continuous
39° F Dew Point (maximum)
Delivered at Room Temperature
Air Receiving Tank
Air Inlet
Inlet Filter
Check Valve
5 Micron Particulate Filter/ Compressor Head Unloader valve
Compressor (5HP + Motor)
Heat Exchanger
02/03/03
POGS 33
Compressed Air Delivery
33-011103
A

NOT

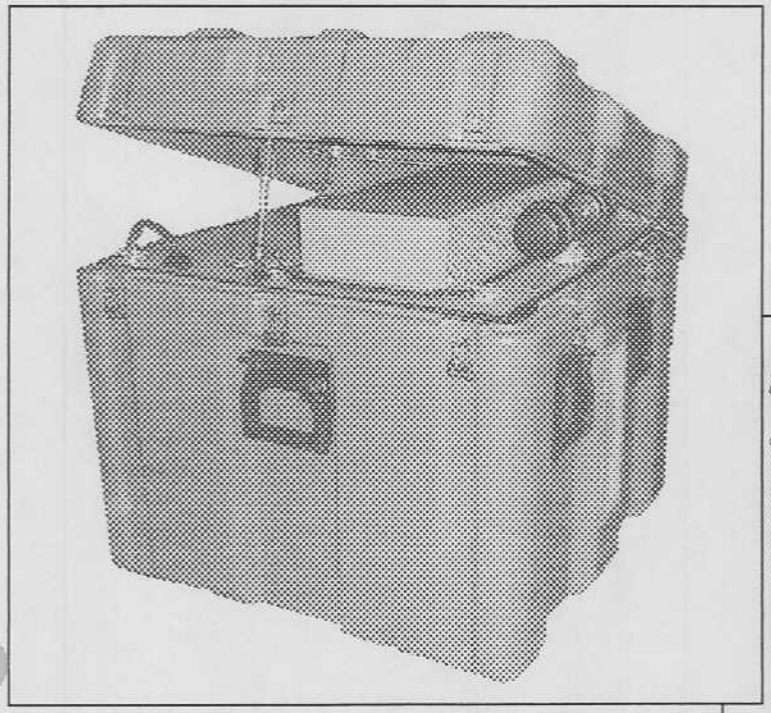
1.) BLACK WIRING (B) IS ALWAYS +

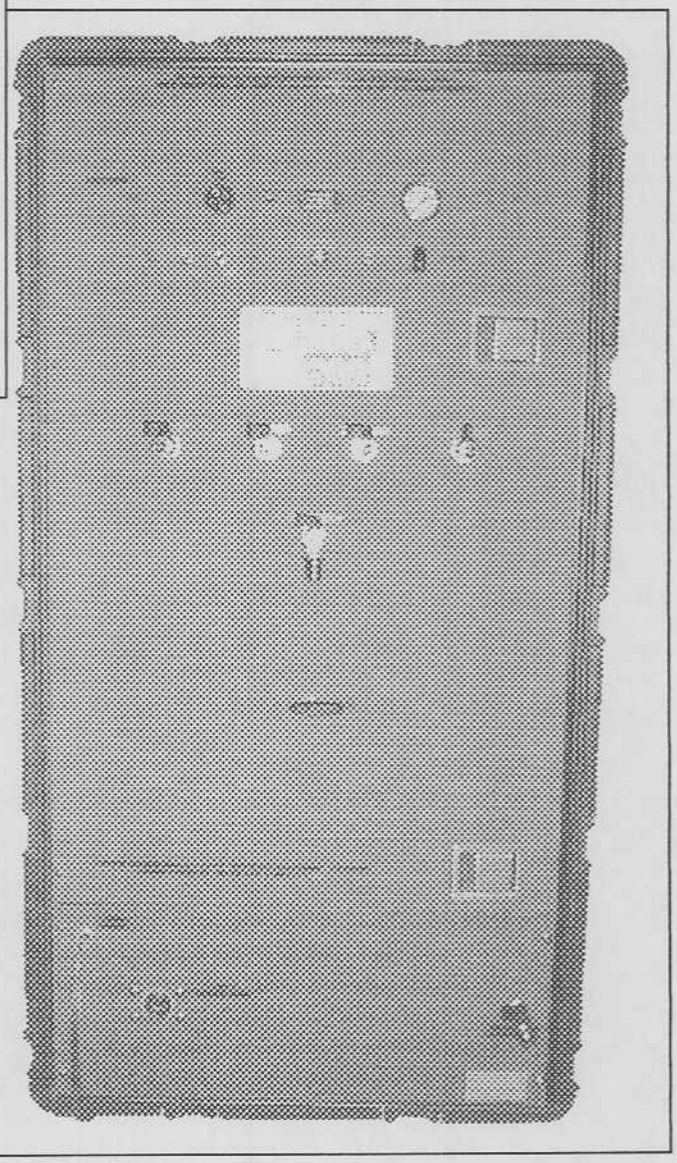
2.) WHITE WIRING (W) IS ALWAYS -

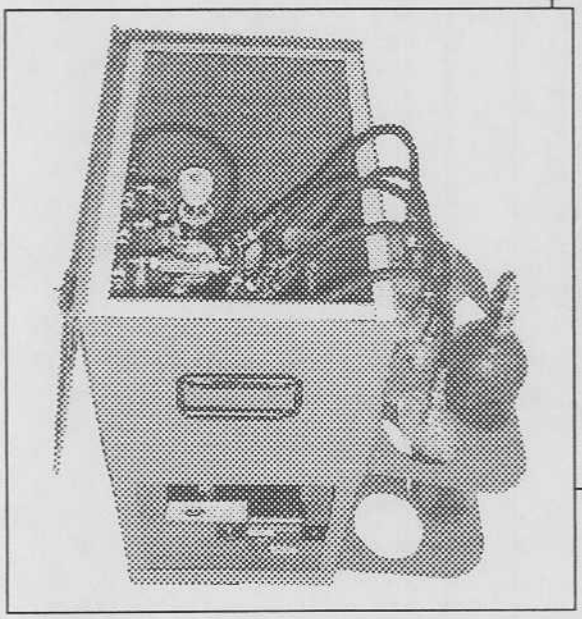



Surge Protector
L1
L2
L3
G
Overload Protection
ON/OFF Switch
Pressure Switch
NC
C
NO
L1
L2
L3
Coil
Fan #1
Fan #2
T1
T2
T3
C
T1
T2
T3
3 Phase Starter
Drain Valve
Baldor Motor
01/28/03
POG633 Compressor Wiring
P33-102

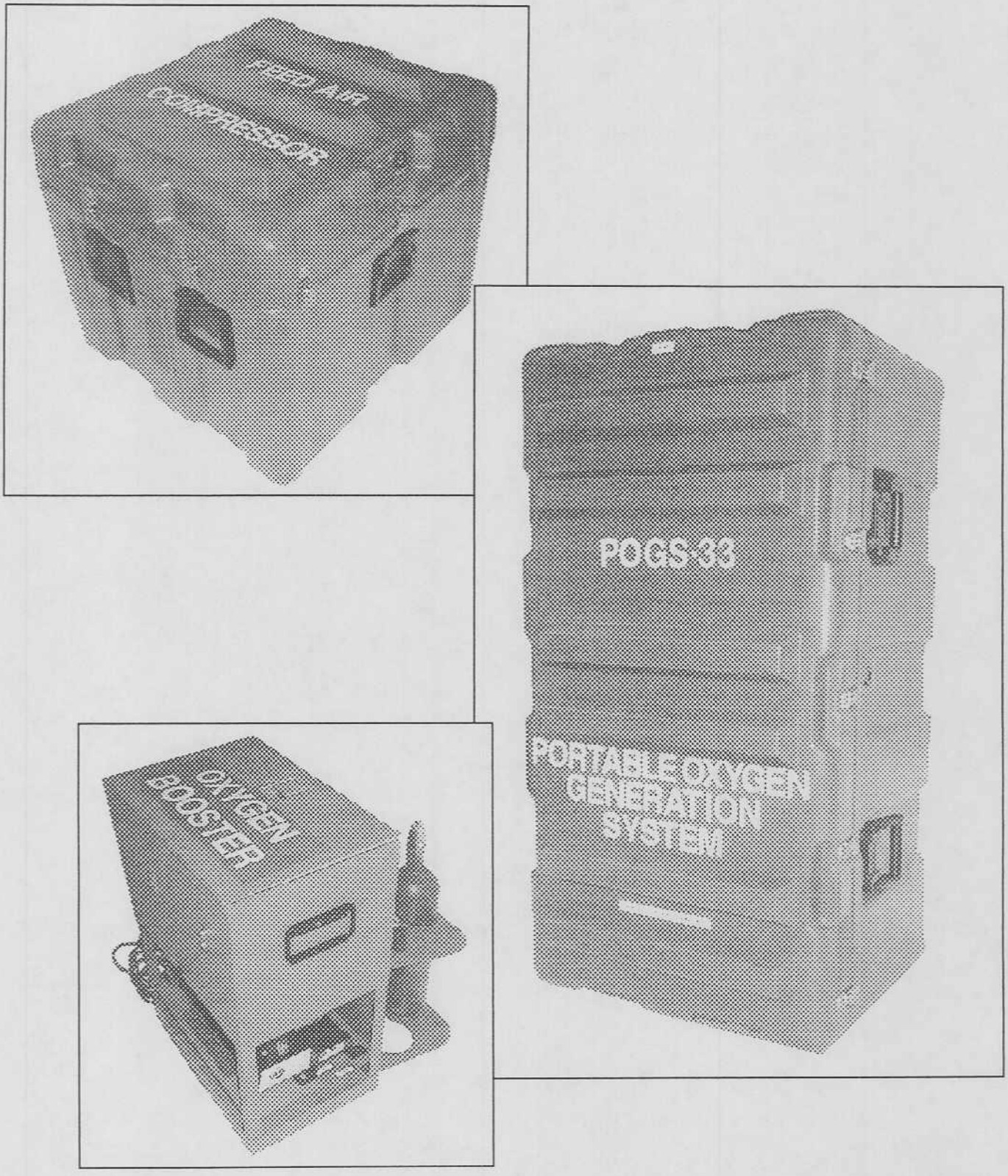
POGS 3.3
Generator, Feed Air Compressor and Oxygen Booster Open







POGS 3.3
Generator, Feed Air Compressor and Oxygen Booster Closed



POGS 33
FREQUENTLY ASKED QUESTIONS

WHAT SAFETY DEVICES ARE INSTALLED ON THE POGS?

The POGS main safety feature is its design that prevents any hazard from occurring that would injure personnel and damage equipment. The internal tanks have pressure relief valves installed that prevent any over-pressurization from occurring. The system has regulators installed that will regulate the pressure throughout the system. Alarms are installed that would give a visual and audible indication for low purity and low pressure situations.

WHAT MAINTENANCE NEEDS TO BE PERFORMED ON THE POGS?

The POGS needs little maintenance to keep it in ideal condition to manufacture oxygen. Maintenance procedures and schedules are contained in the Maintenance Manual.

WILL A POWER SURGE DAMAGE THE SYSTEM?

No, the POGS Oxygen Generator will not be affected by a power surge because there are no electronic parts involved with the oxygen generation process. The installed oxygen analyzer and carbon monoxide monitor may be affected due to the internal electronics, but this will not affect the system performance.

WHERE CAN THE SYSTEM BE INSTALLED?

The system can be run in any location where it is accessible to trained personnel. The feed air compressor can be run outdoors or indoors. The POGS generator can be located up to 30 feet away from the compressor and up to 30 feet from the equipment that is being fed oxygen from the system. The Microbooster can be located up to 30 feet from the POGS.

ARE THERE ANY DANGEROUS GASES IN THE SYSTEM?

No, the generator takes air from the compressor and separates the gas. The exhaust from the POGS is a mixture of Nitrogen (82%), Argon (0.2%), and Oxygen (17.8%). This exhaust dissipates into the atmosphere quickly and will not be detectable outside of the cabinet.

ARE THERE ANY HAZARDOUS MATERIALS IN THE SYSTEM?

No, the POGS 33 has FDA clearance.

WHAT ALARMS ARE ON THE POGS?

- Low Oxygen Content (<93%)
- High Carbon Monoxide (CO) Content (>30ppm)
- Low Flow/Pressure (<33LPM / 50psig)

WHAT REPAIRS CAN BE PERFORMED BY THE CUSTOMER AND WHEN SHOULD THE MACHINE BE RETURNED FOR REPAIR?

The repairs for the POGS are design to be performed so the POGS will be operational in less than an hour from system or component failure. Trained maintenance personnel should perform any necessary repairs using approved repair parts that have been included in the spare parts kit. There is not a repair that could not be performed in the field by trained personnel, so sending the unit back to the manufacturer is not necessary to get the system up and running quickly.

DOES THE FEED AIR COMPRESSOR CASE NEED TO OPEN TO RUN?

Yes, the Feed Air compressor needs to be open to ensure the Air Inlet Filters have a sufficient air flow to produce enough compressed air for the POGS and to prevent any possible over-heating of the compressor and its motor. During inclement weather the Compressor Case can be propped open using the tapered stop located in the top of the case.

HOW LONG DO I NEED TO RUN THE POGS BEFORE I CAN USE OXYGEN?

During the initial start-up the POGS may need to be run up to one hour to reach maximum purity. From that point on oxygen may be used once the desired Oxygen Pressure is reached.

WHAT HAPPENS IF I USE TOO MUCH OXYGEN?

If your demand has increased to exceed the 33LPM called for, the system will experience a drop in oxygen pressure, oxygen purity also will drop, and an alarm will sound. For this reason we suggest the use of the Oxygen Flowback.

WHAT IS THE OXYGEN FLOWBACK FEATURE?

In the event of power failure, the stored cylinder oxygen can be utilized to backflow through the hose to the generator's oxygen outlets.

On Generator:

1. (For green hose that is attached to Booster) remove one green hose-end from its oxygen outlet.
2. Take the same hose-end and connect to the DISS fitting marked "oxygen input from booster" on the front of the generator

On Booster:

1. For the SAME green hose, remove the hose-end from the oxygen booster inlet.
2. Take the same hose-end and connect to pre-set high-pressure regulator.
3. Open ball valve at regulator.
4. Oxygen will flow back to POGS and feed all DISS fittings.

NOTE: When Backflow Oxygen is in use, Compressed Air is NOT available.

DO I NEED TO WAIT BEFORE USING COMPRESSED AIR?

Compressed Air is available for use almost immediately. The Compressed Air is supplied through a filter and regulator that regulate the air from the air receiving tank internal to the POGS generator.

ARE THERE ANY PRECAUTIONS FOR USING THE RIX MICROBOOSTER?

The main precaution in using the microbooster is maintaining oil-free connections due to the danger associated with introducing oil to a high pressure (2200 psig) oxygen line.

WHO IS RESPONSIBLE FOR HOOKING UP SYSTEM?

Trained personnel should make appropriate connections (air hoses, oxygen connections, power, compressed air connections). The Generator, Feed Air Compressor and Microboost each require its own power source, and should be connected in accordance with standard safety practices.

DOES THE SYSTEM NEED TO MONITORED DURING NORMAL OPERATION?

No, the system has the security of an audible alarm should any malfunction occur. A periodic check of gauge readings, connections, visual indications, and power should be performed by trained personnel.

POGS 33 Spare Parts Kit Level 1

Part # POGS33KIT0001

as of November 14, 2002

	Description	Our Order #	Mfr.	Unit Price	Recommended Quantity	Extended Price
Filters, Regulators						
	Particulate Filter Assembly	F26-04-FOO	Wilkerson	$ 67.68	1	$ 67.68
	HEPA Filter Assembly	10H		$ 28.13	2	$ 56.25
	Regulator	R00-02-000	Wilkerson	$ 14.40	1	$ 14.40
	Regulator	R26-04-000	Wilkerson	$ 43.11	1	$ 43.11
Filter Accessories						
	Bowl (F26)	GRP-95-929	Wilkerson	$ 14.91	1	$ 14.91
*	Element, HEPA Filter	1506A		$ 4.20	12	$ 50.40
	Bowl/Guard (F26)	GRP-95-948	Wilkerson	$ 54.86	1	$ 54.86
*	Filter, Intake	C-16352	Thomas	$ 15.00	12	$ 180.00
*	Element, Compressor Intake	5W967	AirHandler	$ 6.35	12	$ 76.20
*	Element, Particulate (F26)	FRP-95-115	Wilkerson	$ 4.40	8	$ 35.16
Electrical Parts						
	Pressure Switch	HC26A214L	ASCO	$ 30.51	2	$ 61.02
	Pressure Switch	HC20A214	ASCO	$ 56.60	1	$ 56.60
	Circuit Breaker	548-1043	Eaton	$ 4.88	1	$ 4.88
	On/Off Switch	676-5501	Carling	$ 7.13	1	$ 7.13
Valves						
	Valve, 1/8"	U8225B004V	ASCO	$ 22.05	1	$ 22.05
	Valve, 1/8"	MAC111B	MAC	$ 27.00	1	$ 27.00
	Valve, 1/2"	SMC201	SMC	$ 70.61	1	$ 70.61
	Main Valve	MAC6631	MAC	$ 330.08	1	$ 330.08
	Pilot Valve	SMC1120	SMC	$ 42.33	1	$ 42.33
	Check Valve, 1/4"	ICV250B-V-1	Generant	$ 8.58	4	$ 34.32
	Relief Valve, 100psi	100psi1/4FIG123	Kingston	$ 5.85	2	$ 11.70
	Ball Valve, 1/4"	33325K21	Dynaquip	$ 7.32	1	$ 7.32
	Needle Valve, 1/8"	4995K11	Deltrol	$ 12.35	1	$ 12.35
Miscellaneous/Other						
	Muffler (3/4")	M07	AtoMuffler	$ 9.90	1	$ 9.90
	Gauge, 0-100 psi		P.I.C.	$ 4.05	1	$ 4.05
	Gauge, 0-100(panel)		P.I.C.	$ 7.13	1	$ 7.13
	Fan, 6"	5N474	Comair	$ 85.88	1	$ 85.88
	Belt, Motor	3L440		$ 6.00	4	$ 24.00
	Remote Air Hose, 15 ft			$ 75.00	1	$ 75.00
	Sensor	C1-16-1000-01-0	Ceramatec	$ 97.50	1	$ 97.50
Accessories						
	Flowmeters	FM104	Western	$ 42.75	2	$ 85.50
TOTAL						$ 1,669.28

NOTE:

* / RED = Maintenance Items, representing a 6 month supply, included in Spare Parts Kit: Level 1

POGS 33 Spare Parts Master List / Kit - Level 2

Part #: POGS33KIT0002

as of November 14, 2002

	Description	Our Order #	Mfr.	Unit Price	Recommended Quantity	Extended Price	
Filters, Regulators							
	Particulate Filter Assembly	**F26-04-FOO**	**Wilkerson**	**$ 67.68**	**1**	**$ 67.68**	
	HEPA Filter Assembly	**10H**		**$ 28.13**	**2**	**$ 56.25**	
	Regulator	**R00-02-000**	**Wilkerson**	**$ 14.40**	**1**	**$ 14.40**	
	Regulator	**R26-04-000**	**Wilkerson**	**$ 43.11**	**1**	**$ 43.11**	
Filter Accessories							
	Bowl (F26)	**GRP-95-929**	**Wilkerson**	**$ 14.91**	**1**	**$ 14.91**	
*	Element, HEPA Filter	1506A		$ 4.20	12	$ 50.40	
	Bowl/Guard (F26)	**GRP-95-948**	**Wilkerson**	**$ 54.86**	**1**	**$ 54.86**	
*	Filter, Intake	C-16352	Thomas	$ 15.00	12	$ 180.00	
*	Element, Compressor Intake	5W967	AirHandler	$ 6.35	12	$ 76.20	
*	Element, Particulate (F26)	FRP-95-115	Wilkerson	$ 4.40	8	$ 35.16	
Electrical Parts							
	Pressure Switch	**HC26A214L**	**ASCO**	**$ 30.51**	**2**	**$ 61.02**	
	Pressure Switch	**HC20A214**	**ASCO**	**$ 56.60**	**1**	**$ 56.60**	
	Circuit Breaker	**548-1043**	**Eaton**	**$ 4.88**	**1**	**$ 4.88**	
	On/Off Switch	**676-5501**	**Carling**	**$ 7.13**	**1**	**$ 7.13**	
Valves							
	Valve, 1/8"	**U8225B004V**	**ASCO**	**$ 22.05**	**1**	**$ 22.05**	
	Valve, 1/8"	**MAC111B**	**MAC**	**$ 27.00**	**1**	**$ 27.00**	
	Valve, 1/2"	**SMC201**	**SMC**	**$ 70.61**	**1**	**$ 70.61**	
	Main Valve	**MAC6631**	**MAC**	**$ 330.08**	**1**	**$ 330.08**	
	Pilot Valve	**SMC1120**	**SMC**	**$ 42.33**	**1**	**$ 42.33**	
	Check Valve, 1/4"	**ICV250B-V-1**	**Generant**	**$ 8.58**	**4**	**$ 34.32**	
	Relief Valve, 100psi	**100psi1/4FIG123**	**Kingston**	**$ 5.85**	**2**	**$ 11.70**	
	Ball Valve, 1/4"	**33325K21**	**Dynaquip**	**$ 7.32**	**1**	**$ 7.32**	
	Needle Valve, 1/8"	**4995K11**	**Deltrol**	**$ 12.35**	**1**	**$ 12.35**	
Miscellaneous/Other							
	Muffler (3/4")	**M07**	**AtoMuffler**	**$ 9.90**	**1**	**$ 9.90**	
	Gauge, 0-100 psi		**P.I.C.**	**$ 4.05**	**1**	**$ 4.05**	
	Gauge, 0-100(panel)		**P.I.C.**	**$ 7.13**	**1**	**$ 7.13**	
	Fan, 6"	**5N474**	**Comair**	**$ 85.88**	**1**	**$ 85.88**	
	Belt, Motor	**3L440**		**$ 6.00**	**4**	**$ 24.00**	
	Remote Air Hose, 15 ft			**$ 75.00**	**1**	**$ 75.00**	
	Sensor	**C1-16-1000-01-0**	**Ceramatec**	**$ 97.50**	**1**	**$ 97.50**	
Accessories							
	Flowmeters	**FM104**	**Western**	**$ 42.75**	**2**	**$ 85.50**	
						$ 1,669.28	**Subtotal**
Optional							
**	Compressor (itself)	SLA05	POWEREX	$ 3,460.00	OPTIONAL	$ 3,460.00	
**	Motor	M3218T	Baldor	$ 288.71	OPTIONAL	$ 288.71	
**	Feed Compressor (system)	CMP33	On Site	$ 11,500.00	OPTIONAL	$ 11,500.00	
**	Oxygen Analyzer	Model 1100	Ceramatec	$ 1,500.00	OPTIONAL	$ 1,500.00	
**	Microboost (system, cylinder filling)		On Site Gas	$ 6,000.00	OPTIONAL	$ 6,000.00	
**	High Volume Booster (system, cylinder filling)	2-PS	RIX	$ 12,950.00	OPTIONAL	$ 12,950.00	
						$ 35,698.71	**Grand Total**

Key:

* / RED = Maintenance Items, representing a 6 month supply, included in Spare Parts Kit: Level 1

** / BLUE = Optional Items, NOT included in Spare Parts Kit: Level 1.

BLACK = Spare Parts, included in Spare Parts Kit: Level 1

RX ONLY

CAUTION

THIS DEVICE FOR SALE BY OR ON THE ORDER OF A PHYSICIAN

On Site Gas Systems, Inc.

PSA Oxygen Generator
Maintenance Manual

P.O.G.S. – 3.3 H

Version A

Updated February 3, 2003

NOTE

TO BE OPERATED BY TRAINED MEDICAL PERSONNEL ONLY

CAUTION

OXYGEN DRAMATICALLY INCREASES THE FLAMMABILITY OF OTHERWISE NONFLAMMABLE ITEMS, SUCH AS SYNTHETIC CLOTHING. CAUTION SHOULD BE USED SURROUNDING THIS SYSTEM. DO NOT SMOKE. DO NOT USE OIL TO CLEAN OR LUBRICATE ANY COMPONENT OF SYSTEM.

Manufactured by:

On Site Gas Systems, Inc.

35 Budney Road, Budney Industrial Park, Newington, CT 06111, USA

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E-mail: info@onsitegas.com - Web site: www.onsitegas.com

TABLE OF CONTENTS

1. INTRODUCTION

Congratulations on your purchase of an On Site Gas Systems, Inc. Pressure Swing Adsorption (PSA) type Oxygen Generator. This simple, turnkey machine provides a cost-effective means for on-site generation of oxygen. The Oxygen Generator is based on using the latest PSA technology and utilizes Zeolite Molecular Sieve (ZMS) to separate the oxygen from the other gases contained in air. The Oxygen Generator uses two beds of ZMS to separate compressed air into a high-pressure oxygen product stream and low-pressure nitrogen enriched waste stream. Particulate filter is included to remove impurities from the feed air. A HEPA filter is placed downstream of oxygen generator. Each Oxygen Generator comes pre-tested and fine tuned to meet the customer specified flow rate at 93 - 95% oxygen purity. (See Diagram 1: P & ID: Process and Instrumentation Diagram.)

Since the system contains very few moving parts, maintenance and repairs are minimal. Maintenance is simple yet necessary. Air compressor and filter maintenance procedures are especially important and should be followed carefully. If the recommended maintenance procedures are followed, your Oxygen Generator will provide you with many years of reliable service. (Separate Maintenance Manual)

1.1 Company Presentation

On Site Gas Systems is established as a world leader in the design and supply of systems for generation of nitrogen and oxygen. We have been manufacturing Nitrogen and Oxygen Generators since 1988. Information about our products and our company can be found at our web site: www.onsitegas.com.

On Site Gas Systems activities include full responsibility for conceptual and detailed engineering design, procurement, fabrication, supply and installation of packages for various industries worldwide.

On Site Gas Systems' Oxygen Generator offers operators the benefits of this advanced, but simple technology. The principle advantages of PSA systems are:

- Compact
- Low weight
- Safe, reliable operation
- Simple maintenance
- Low operating pressure (50 psig vs. 2200 psig for cylinders)
- Ease of operation
- Rapid startup

1.2 Safety Information

The following section outlines the basic safety considerations regarding use of your Oxygen Generator. Please refer to the technical references for additional information.

Read carefully and act accordingly before installing, operating or repairing the unit.

- **The operator must employ safe working practices and rules when operating the Oxygen Generator.**
- **The owner is responsible for maintaining the unit in a safe operating condition.**
- **Always use approved parts when performing maintenance and repairs. Make sure that replacement parts meet or exceed the pressure requirements.**
- **Only authorized, trained and competent individuals must perform installation, operation, maintenance and repair.**

WARNING

Use only materials with compatible pressure rating on product pipelines and components.
All parts must be free of grease/oil.

- **Completely depressurize the generator, tanks, and lines prior to performing any mechanical work, including changing the filters.**
- **Do not use generator in hermetically sealed room due to Nitrogen enriched waste.**
- **The nitrogen enriched waste gas must be vented to the outside or to a large, well-ventilated room to avoid suffocation due to lack of oxygen.**

WARNING

Pressurized gases are contained within the generator and the receiver and product tanks.
High-pressure gases are dangerous and may cause injury or death if handled or used inappropriately.

- **Never allow high-pressure gas to exhaust from an unsecured hose. An unsecured hose may exhibit a whipping action, which can cause serious injury. If a hose should burst during use, immediately close all isolation valves.**

- **Never disable or bypass any safety relief valves on the air receiver or product tanks.**

- **Always make certain that the electrical system is "locked-out" and that the unit is unplugged prior to performing any electrical work.**

- On Site Gas Systems, Inc.

NOTE

If any statement or specification within this booklet, especially with regard to safety, does not agree with legislation or standard industry practices, the more demanding shall apply.

1.3 Limits of Liability

Buyer's exclusive remedy for all claims shall be for damages, and seller's total liability for any and all losses and damages arising out of any cause whatsoever including, without limitation, defects in or defective performance of the system, (whether such claim be based in contract, negligence, strictly liability, other tort or otherwise) shall in no event exceed the purchase price of the system in respect to which such cause arises or, at seller's option, the repair or replacement of such; and in no event shall seller be liable for incidental, consequential or punitive damages resulting from any such cause.

Seller shall not be liable for, and Buyer assumes all liability for, the suitability and the results of using oxygen by itself or in any manufacturing or other industrial process or procedure, all personal injury and property damages connected with the possession, operation, maintenance, other use or resale of the System. Transportation charges for the return of the System shall not be paid unless authorized in advance by Seller.

NOTE

Any modifications made by customer without the consent of ON SITE will void the product purity and output specifications.

1.4 Warranty

The Oxygen Generator, excluding air supply system, is warranted against defects in materials and workmanship, under normal use and operation, as applicable on the warranty listed below. All compressors and dryers are covered by the original equipment manufacturer's warranty.

The On Site Gas Systems Warranty includes the following:

> Free repair or replacement of component parts where defects occur within the first twelve (12) months of operation or twelve (12) months from the date of invoice, whichever comes first.

These warranties shall be null, void, inoperative, and not binding upon On Site Gas Systems, Inc. if a defect or malfunction occurs in the product or any part thereof from any **feed air malfunction, or improper filter element maintenance,** or repair, attempted repair, adjustment or servicing by anyone other than an authorized representative of On Site Gas Systems, **or external causes.** Said warranty shall extend and apply to the Oxygen Generator only while said system is owned and used exclusively by the original purchaser.

NOTE

THERE ARE NO EXPRESS WARRANTIES BY ON SITE GAS SYSTEMS INC, OTHER THAN THOSE SPECIFIED HERE. NO WARRANTY OF TITLE AS PROVIDED IN THE UNIFORM, COMMERCIAL CODE SHALL BE IMPLIED OR OTHERWISE CREATED UNDER THE UNIFORM COMMERCIAL CODE, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY AND WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

1.5 Service Return Policy

If it is necessary to return a system for service, follow the procedure given below. This procedure **must** be followed when returning a system for service.

- If the system cannot be repaired at the site, then the owner must obtain a written **Return Goods Authorization number,** which references the model and serial number, from On Site Gas Systems, Inc. No items will be accepted for service or credit unless prior written authorization has been issued by On Site Gas Systems, Inc.

- All items are to be returned with the original packaging material if possible. Make sure that all items are packaged for safe return to On Site Gas Systems. On Site will not be responsible for damages, which occur in transit. Any damage that occurs to the system because of failure to adhere to this procedure will be the sole responsibility of the customer. Contact On Site Gas Systems, Inc. for a return shipping address.

- Shipping charges must be prepaid on all returns.

2 UNPACKING AND INSPECTING

The contents of the crates should be inspected upon delivery to assure that no damage has taken place during transit. Save the carton and wrapping, as it may be necessary to return the generator in the event of shipping damage. If any components are damaged, the carrier should be notified immediately. The individual pieces should be checked against the packing list. If any discrepancy is found, contact your local distributor, or On Site Gas Systems, Inc. at (860) 667-8888. Please include the model number and the serial number with all correspondence.

3 UTILITY REQUIREMENTS

3.1 Electrical Supply

- The P.O.G.S. unit is designed to work on 110 Volts/ 60 Hz/ 1 phase, 1 AMP.
- The Feed Air Compressor is designed to work on 208-240 Volts / 60 Hz / 3 Phase. The Feed Air Compressor has a surge protector, which guarantees safe operation, even with fluctuations of self-generating power.
- The Microboost / Oxygen Booster is designed to work on 110 Volts / 60 Hz / 1 Phase.

3.2 Site Specifications

- The Feed Air Compressor can be located indoors or outdoors. The cabinet lid must be in the "up" position for adequate cooling.
- The P.O.G.S. oxygen generator should be operated indoors.
- The Microboost or High-Volume Booster should be operated indoors.

4 SYSTEM SETUP

This section provides a step-by-step procedure for easy setup of the P.O.G.S. unit. All connection points are well labeled. (Diagram 2: Electrical and Pneumatic Schematic, and Diagram 3: P.O.G.S. Oxygen Generator Layout)

1. Position the P.O.G.S. generator and air compressor at their use points: you can position the "Feed Air Compressor" up to 30 feet from the P.O.G.S. generator. Air intake for closed-looped air compressor can be remoted to draw air from clean environment without placing compressor in an interior space, making chem.-bio operation both safe and simple.
2. Remove the lid of the P.O.G.S. cabinet.
    a. Stand up the P.O.G.S. cabinet with oxygen analyzer and power switch , etc. towards the top.
3. Lift the air compressor cabinet lid.
    a. Remove the power cord.
    b. Remove the filter and hose from the top of the rainguard.
    c. Lift-up the rainguard: carefully remove the air hose from the compressor interior.
    d. Now install the filter on the rainguard interior ledge.
    e. Close the rainguard.
    f. Secure lid in "up" position with 1 locking telescoping stand-off (pole).
4. Connect the black pneumatic hose from air compressor to the P.O.G.S. (Hose was stored in compressor cabinet)
5. Connect the P.O.G.S and Feed Air Compressor to the electrical power sources:
    a. P.O.G.S. cord stored in POGS interior,
    b. Feed Air Compressor cord stored inside compressor cabinet.
6. Connect the Oxygen Booster power cord to its power source.
7. Connect the Oxygen Booster pneumatic hose to the P.O.G.S. (Green hose stored in P.O.G.S. lid)
8. Pigtails are equipped with yokes for D/E and H/K cylinders, based on your specific order.
9. Attach the oxygen and air flow meters as needed. (Flow meters are in P.O.G.S. lid)
10. Remote Air Intake Hose may be used for the Feed Air Compressor when necessary.
11. Other accessories are stored in POGS lid.

4.1 Oxygen Delivery Setup

Potential System Configuration include:

1. Six (6) cannulas at 5 LPM each
2. Four (4) cannulas at 10 LMP ventilator and / or oxygen booster.
3. Five (5) cannulas with oxygen booster for E-cylinder fill.
4. One (1) to three (3) cannulas with oxygen booster, or ventilator with oxygen booster.
5. Ventilator with oxygen booster.
6. Provides 20 LPM of Compressed Air at 50 PSIG.
7. 1 Microboost can service 1 P.O.G.S. 33 and fill 1 E-cylinder every 77 minutes.
8. 2 Microboosters can service 1 P.O.G.S. 33 and fill 1 E-cylinder every 38 minutes.
9. One (1) Optional RIX 2PS2B-L High-Volume Booster can service 1 dedicated P.O.G.S. 33 unit and fill 1 E-cylinder every 25 minutes.
10. One (1) Optional RIX 2PS2B-L High Volume Booster can service 2 dedicated P.O.G.S. 33 units and fill 1 E-cylinder every 14.5 minutes.

4.2 Oxygen Analyzer

1. Oxygen analyzer is electrically powered by the P.O.G.S. unit power switch.
2. Refer to the owner's manual for calibration of the analyzer.

4.3 Oxygen Booster: Microboost or High-Volume Booster

1. To fill 2200 PSI cylinders, locate "OXYGEN BOOSTER" up to 30 feet from the P.O.G.S. generator. (See Photo)
2. Attach high-pressure cylinders to the pigtails provided. Open the high pressure feed valves and cylinder valves. (See Photo)
3. Turn on the switch marked "BOOSTER POWER", on the Booster Control Section in the P.O.G.S. unit (See Photo).
4. The Oxygen booster will shut down when 2200 PSIG is reached. Close the valves and remove the cylinders.
5. Replace with empty cylinders. Push reset button marked "Booster Restart". (See Photo)
6. If backup cylinder oxygen is required, the Microboost and the High-Volume Booster both contain a Back-Flow Valve. Simply remove one green hose from an oxygen outlet, and connect to the DISS fitting on the front bottom of the P.O.G.S. marked "Oxygen Input from Booster". The other end is already connected to the Flowback Regulator Assembly inside the Booster Cabinet. Turn the Oxygen Flowback Regulator knob to have the oxygen flow from the cylinder manifold back to the generator oxygen tank and out through the Flowmeters. Ensure the pressure of the regulator is set to 50 PSIG. If the usage for oxygen increases, the pressure will drop, sending a quick shot of oxygen to boost the tank pressure to its normal pressure setting. Note: When flowback feature is in operation, Compressed Air is not.

5 SYSTEM OVERVIEW

5.1 Controls and Instrumentation Overview

This section describes the function of each control on the PSA Oxygen Generator.

Controls for supporting equipment, such as the compressor, are not included in this section. Please consult the original manufacturer's instructions, located in the appendices, for further information.

5.1.1 Main Power On/Off Switch (See Photo 13)

This switch supplies power to the Oxygen Generator. The green "P.O.G.S. Power" light is lit when the switch is "ON". The main "P.O.G.S. Power" switch is located on the front of the control panel.

The main "P.O.G.S. Power" switch allows the operator to disconnect power from the generator. PSA cycling will stop immediately whenever the switch is turned "OFF". Oxygen production will stop.

5.1.2 "Operate" Power Light (Green) (See Photo 14)

This green indicator is lit when the "Main Power" switch is "ON".

5.1.3 Alarm Light (Red) for "Oxygen Flow/PSI/Purity" (See Photo 15)

This red indicator is lit when oxygen purity, flow and/or pressure drops below specifications.

5.1.4 "Standby" Light (Amber) (See Photo 16)

This amber indicator is lit when maximum oxygen pressure is reached. The generator restarts when oxygen is used and pressure drops.

5.1.4 Hourmeter (On) (See Photo 17)

Accumulates running time.

5.1.5 Circuit Breaker (See Photo 18)

Power safety device can be reset manually by pushing "pin" in center of switch back in.

5.1.6 On/Off Toggle Switch for "Oxygen Alarm Bypass-Audible" (See Photo 19)

Turns audible alarm on/off.

5.1.8 **"Oxygen PSI" Gauge** (See Photo 20)

The "Oxygen Tank Pressure" gauge monitors the pressure of the oxygen product.

5.1.9 **"Calibrate/Operate" Handle for Oxygen Analyzer** (See Photo 21)

To calibrate oxygen analyzer to room air, simply turn handle to "air". After calibration, return to "oxygen". (See Section 5.2)

5.1.10 **Audible Alarm** (See Photo 22)

Will sound if low purity, flow and/or pressure. Purity alarm is set for 90%, pressure alarm is set for 40 PSIG at the factory.

5.1.11 **Surge Suppressor Indicator Light (Green)**

Indicates that protection is working.

5.1.12 **DISS Fittings for Oxygen and Compressed air Outlets** (See Photo 23)

Oxygen flowmeters are connected here. Open "black" knob to allow oxygen flow to the flowmeter.

5.2 **Product Oxygen Analyzer** (See Photo 24)

The oxygen analyzer receives a small sample flow from the product receiver tank to continuously monitor the product oxygen purity. The oxygen analyzer is equipped with alarms that will be activated when the oxygen content gets too low. The oxygen analyzer display is located on the front of the control panel. The sensor is installed inside the panel. If purity drops below a pre-set value (92.9 set at factory), an audible alarm will sound, and light on analyzer will flash.

5.2.1 **"Calibrate/Operate" for Oxygen Analyzer** (See Photo 21)

Refer to owner's manual for Oxygen Analyzer. In P.O.G.S. unit locate valve handle marked "Calibration." To calibrate, turn this handle with arrow pointing to "AIR." Calibrate to 20.9. Return handle to "OXYGEN."

5.2.2 **Oxygen Alarm** (See Photo 22)

Alarm will sound if purity falls to 90%. A second backup alarm is set at 85%.

5.3 **Carbon Monoxide Alarm** (See Photo 25)

5.3 Carbon Monoxide Alarm (See Photo 25)

Located in POGS cabinet. Should carbon monoxide enter compressor cabinet, it will be transported to the POGS generator and "sensed" at the exhaust ports. If excessive CO, an audible alarm will sound.

5.4 Oxygen Microboost

Typically, part of the system includes an oxygen Microboost. The oxygen booster boosts pressure up to 2200 PSIG. The flow rate for the booster is up to approximately 19 SCFH at 2200 PSIG. One "E" cylinder holds approximate 29 SCFH at 2200 PSIG. One "E" size cylinder will fill in one hour, and seventeen (17) minutes. One can choose to fill anywhere from 1 to 5 cylinders at a time, based on how they will be utilized. If you desire to fill one "E" cylinder quickly, close off the other remaining cylinders. The booster stops automatically when the tank pressure reaches 2200 PSIG.

5.5 Optional High-Volume Oxygen Booster

Your system may include the optional High-Volume Oxygen Booster. It boosts up to 60 SCFH to 2200 PSIG. Used with 1 dedicated P.O.G.S. 33, it can fill 1 E-cylinder every 25 minutes. With 2 dedicated P.O.G.S. 33 units, it will fill 1 E-cylinder every 14.5 minutes.

5.6 Back-Flow Valve

In the event of power failure, the stored cylinder oxygen can be utilized to backflow through the hose to the generator's oxygen outlets.

On Generator:

1. (For green hose that is attached to Booster) remove one green hose-end from its oxygen outlet.
2. Take the same hose-end and connect to the DISS fitting marked "oxygen input from booster" on the front of the generator

On Booster:

1. For the SAME green hose, remove the hose-end from the oxygen booster inlet.
2. Take the same hose-end and connect to pre-set high-pressure regulator.
3. Open ball valve at regulator.
4. Oxygen will flow back to POGS and feed all DISS fittings.

NOTE: When Backflow Oxygen is in use, Compressed Air is NOT available.

6 PRINCIPLES OF OPERATION

The **On Site Oxygen Generator** uses state of the art technology to provide the end user with a reliable source of oxygen. An overview of the operation of the generator is given below. (See Diagram 1: P & ID: Process and Instrumentation Diagram)

The Oxygen Generator is a two-bed adsorber system. The Oxygen Generator consists of two adsorber vessels filled with molecular sieve, a valve assembly, air filters, main pressure regulator, and a product receiver tank. Dry, compressed air (78% Oxygen, 21% Nitrogen, <1% argon) at about 65 psig / 4.5 bar g is passed through the air filters, and then through the air inlet regulator, which reduces the air to the final operating pressure. It is important to maintain the inlet air at the correct pressure; otherwise, generator performance may deviate from design. Clean and dry air is directed to one of the adsorber beds where nitrogen and water vapor is adsorbed faster than oxygen in the pore structure of the molecular sieve, thus increasing the oxygen purity of the product gas stream to 93% - 95%. This product flows out of the top of the adsorber bed, through the pureflo valve, and into the product receiver at a pressure slightly below the feed air pressure.

A portion of the intermediate product produced is directed through the purge orifice. This oxygen is allowed to flow back through the other adsorber sieve bed and out through the exhaust line at atmospheric pressure. This action purges the molecular sieve of nitrogen, and prepares the bed for the next cycle. The pressure in the adsorber vessels is equalized after about 60 – 90 seconds before the next cycle starts. The beds switch roles; the first bed is purged while the second bed produces oxygen product. The active bed will remain on-line until just prior to becoming saturated with nitrogen. When the cycle is completed, the controller will exhaust the saturated bed, and pressurize the fresh adsorber bed. This allows a continuous flow of oxygen gas from the unit for as long as the unit is in operation.

Nitrogen enriched waste gas is piped to the atmosphere through a silencer. Dry oxygen product stream, with the specified max OXYGEN content, exits the adsorber vessels and is stored in a product receiver tank.

7 GENERATOR OPERATION

This section describes the procedure for starting, running, and stopping the Oxygen Generator. The operator should notify personnel in the area that the generator will be started and make sure the startup will not interfere with any other operations.

NOTE
To be operated by trained Medical Personnel Only

7.1 Startup

This section describes the necessary steps of both the initial startup and a normal routine startup. If this is the first time the unit has been started, follow the Initial Startup procedure.

Initial Startup

1. Turn "ON" the Feed Air Compressor power switch. (See Photo 26)

IMPORTANT
Check compressor rotation. Switch 2 wires to reverse rotation.

2. Turn the Power switch "ON" on the P.O.G.S. unit. (See Photo 27)

3. When Oxygen Tank Pressure reaches approximately 52 PSIG, the amber light, marked "STANDBY", should go on and oxygen production will stop. When oxgyen is used and oxygen pressure falls to 50 PSIG, the amber light will go off and oxygen production will resume. (See Photo 16)

4. It takes approximately 45-60 minutes to reach 93% and higher oxygen. After the POGS generator has gone into "standby", connect oxygen flowmeter(s) and set flow up to 15 LPM each, as long as total of 4 Oxygen outlets does not exceed 33 LPM. Continue to flow until 93% oxygen is obtained. The Alarm bypass should be in the "ON" position until 93% is achieved. (See Photo 28)

NOTE
When the Oxygen Generator is turned on for the first time or after a prolonged shutdown period, it is likely that the Product Receiver is full of air.
To purge air from the receiver, run the unit as described above.

7.2 Water Drain (See Photo 29)

IMPORTANT – PERFORM DAILY
Inside POGS is an air tank water drain bottle. Locate black knob. Open slowly and drain water daily. (See Photo 29)

7.3 Normal Startup

Follow this procedure to start the generator for normal operation. If this is the first time the unit has been started, follow the Initial Startup procedure.

1. Turn "ON" Feed Air Compressor.
2. Turn P.O.G.S. Main Power switch to "ON". Observe oxygen purity. If below 93%, attach oxygen flowmeter(s) and set flow up to 15 LPM each, as long as total of 4 oxygen outlets does not exceed 33 LPM. Continue to flow until 93% O_2 or higher is obtained. POGS Generation is now ready for use.

NOTE
If the generator or any part of the system has been opened to the atmosphere, the system must be purged of any residual air to bring the product purity back to spec.

7.4 Shutdown

1. Turn the P.O.G.S. Power switch to "OFF".
2. Turn "OFF" the Feed Air Compressor.

WARNING

The generator will remain pressurized after shut down. Before performing any maintenance or opening any piping systems, always depressurize the system. Failure to do so may result in injuries.

7.5 Oxygen Booster

The oxygen booster is designed to fill high pressure cylinders with oxygen to 2200 PSIG (15.2 BAR).

7.5.1 Microboost or Optional 2PS High-Volume Booster

7.5.1.1 Setup (See Photo 8)

- Connect the "green" oxygen hose from P.O.G.S. to the oxygen booster inlet.
- Connect via a pigtail the black hose on D-, E- or H-cylinder. If an H-cylinder is connected, the special H-cylinder adapter must be connected to the pigtail. Only a qualified technician should replace this adapter! (See Photo 10)
- Open needle valve(s) in line with pigtail being utilized.

7.5.1.2 Startup (See Photo 11)

- Turn power switch "On". Note oxygen pressure gauge. Pressure will increase as cylinder fills. The oxygen booster will stop automatically when 2200 PSIG is reached.

7.5.1.3 Shutdown (See Photo 11)

- Turn "Off" power switch.
- Close all needle valves to pigtails.

7.5.2 Optional 2PS High-Volume Booster Only

7.5.2.1 Features

The 2PS High-Volume Booster has all of the features in 7.5.1 (above).

7.5.2.2 Use with 2 POGS

The 2PS Booster can be used with one or two POGS 33. Attach hose accordingly, and turn lever, as stated in directions mounted on 2PS.

7.5.2.3 Backup Oxygen – Pre-set to 50 PSIG

- In the event of a power failure, the stored cylinder oxygen can be utilized.
- Disconnect the green oxygen hose from the oxygen booster inlet and connect it to pre-set high-pressure regulator located inside booster cabinet.
- Open valve at the regulator. Oxygen will now flow back to P.O.G.S. and feed all DISS Fittings.

*****CAUTION*****

**DO NOT DISCONNECT OR
TURN OFF AIR TO GENERATOR
UNLESS GENERATOR POWER SWITCH
IS TURNED OFF**

8 MAINTENANCE

On Site Gas Systems Generators will provide many years of trouble-free operation if the recommended maintenance is performed thoroughly and regularly. In addition to the procedures given below, the customer must also perform all maintenance recommended by the manufacturers of the component items employed in the On Site Gas Systems Generators. Note that where any component manufacturer specifications are different from those of On Site Gas Systems, the more demanding schedule should be adopted.

WARNING

Read and follow all safety procedures given below and in Section 1.2, Safety Information.

8.1 Maintenance Overview

It is strongly recommended that all maintenance work be recorded in the Maintenance Logbook. This procedure will assure that a good maintenance policy is employed and will provide valuable information should troubleshooting become necessary.

The content of each type of maintenance activity is described below.

WARNING

Before attempting any maintenance or service procedures that may expose the sieve beds to the atmosphere, ensure that the service or maintenance is completed and the sieve beds do not remain exposed for an extended period of time.

WARNING

Before attempting to perform any maintenance procedures, make certain that the air supply is turned OFF, the electrical source is locked-out, and the Oxygen Generator system is depressurized!

WARNING

The interior of the control cabinet contains electrical parts that will produce an electrical hazard if not properly handled. Use extra caution when servicing this equipment to prevent electrical shock Be sure to unplug the power cord before working inside the cabinet.

8.2 Feed Air Compressor Cabinet Filters

8.2.1 Compressor Compartment Filter (See Photo 31)

This filter prevents dust, dirt and particulates from entering the compressor compartment. If dirty, it will restrict airflow. Replace as necessary.

8.2.1.1 Replacement (See Photo 5)

- Remove pin from standoff (pole) bracket. Top can now be fully opened.
- Turn knob and open filter housing. Replace filter and close compartment.
- Reconnect stand off and secure.

8.2.2 Outlet (See Photo 32)

The air exits the cabinet on two sides of the cabinet. There are two mesh filters located here to prevent dust, dirt and particulates from entering the cabinet when the system is "Off".

8.2.2.1 Replacement (See Photo 5)

- Open top of cabinet described in section 8.2.1.1.
- Locate the two filters, remove and replace.
- Close top as described in section 8.2.1.1

8.3 Feed Air Compressor

(Refer to Feed Air Compressor Owner's Manual)

The Oxygen Generator is supplied with air by an air compressor. Proper operation and maintenance are vital to prevent machine failures. The following maintenance schedule is recommended for all compressors purchased from On Site Gas Systems. Specific requirements for the air compressor employed are defined by the manufacturer of the compressor. Moisture from the compressed air is relieved automatically out the bottom of the air compressor cabinet.

8.3.1 Air Inlet Filters (See Photo 33)

Open cabinet top as described in section 8.2.1.1. There are two (2) particulate air filters (black) inside the cabinet. These filters should be inspected periodically (ambient conditions vary) and replaced if they appear to be dirty. To replace, simply unscrew the head, remove the cartridge filter and replace.

8.3.2 Particulate / Water Trap (See Photo 34)

There is one (1) particulate/water trap after-filter located inside the Air Compressor cabinet. It should be replaced every six months: If air hose is connected between compressor and POGS generator, pressure must be relieved before replacing the filter. Pressure can be relieved as follows:

1. Open cabinet top as described in section 8.2.1.1. At bottom left of cabinet is a black handle valve. Open this valve slowly and relieve air pressure (water might also exit).

2. Locate the after-filter housing (marked F26-04-FMO) in the compressor cabinet. Push the tab on the filter bowl assembly of the lower section of the filter housing.

3. Remove the filter bowl assembly. Locate the small white filter element and unscrew retainer holding it in place. Remove the filter and replace. Reinstall the retainer and bowl assembly.

4. Close top.

YEARLY:
Check for leaks on all fittings, using a soap and water solution.

NOTE

Annual leak test maintenance must be done while the generator is operating and all systems are under normal pressure.

8.4 P.O.G.S. Oxygen Generator: Change all filters every 6 months

The P.O.G.S. has two HEPA Filters: one for the Oxygen and one for Compressed Air. Relieve the Oxygen and air pressure before attempting to replace the HEPA filters.

8.4.1 Oxygen Filter (See Photo 35)

Located in bottom section of P.O.G.S., open front panel via two latches at bottom cabinet door. Locate blue HEPA filter housing. Unscrew the base of the filter housing. Unscrew the black retainer and remove the filter element and replace. Reinstall the retainer and bowl assembly.

8.4.2 Compressed Air Filter (See Photo 36)

Located in bottom section of P.O.G.S., open front panel vial two latches. Locate blue HEPA filter housing. Follow same procedure as above to change filter element.

8.4.3 Air Tank (See Photo 37)

Black tank located on the left side, bottom, when facing the P.O. G.S. Generator. DAILY (when in use) water will collect in the bottom and must be dumped. Slowly open the black handle valve at bottom of air tank. Air and water will escape. Close valve when water ceases to exit.

8.4.4 Oxygen Analyzer

Refer to Owner's Manual

8.5 Micro Booster

Refer to Owner's Manual

8.6 Optional High-Volume Oxygen Booster

Refer to Owner's Manual

8.7 Operator's Logbook

An Operator's Logbook encourages documentation of the Oxygen Generator's performance. This information may be extremely helpful if diagnostic work is required and may save many hours of repair time. Please take a few minutes each day to observe the unit operating and record the operating conditions. The few minutes spent recording information may save many hours of work later. A log sheet entry should be made at least once per shift. Completed log sheets should be stored in a safe place.

9 TROUBLE SHOOTING

This section enables the operator to determine the cause of operation problems and suggests remedies for the problems. If there are several likely causes, investigate the simpler solutions first. Regardless of the type of malfunction, a person who is thoroughly familiar with the system performs the troubleshooting best. If further assistance is required, contact your local distributor or On Site Gas Systems Inc.

Symptom	Probable Cause	Corrective Action
Oxygen generator not cycling	Low voltage or low amperage	Check electrical source
	Circuit breaker	Set
	Main power is OFF	Turn Oxygen generator power switch ON.
	Defective wiring	Check wiring connections
Oxygen generator runs continuously; amber light OFF	Defective O_2 pressure switch	Replace switch
	O_2 pressure switch set too high	Reduce standby pressure
	Excessive product usage	Reduce product consumption
	Product line leak	Repair leak
	Cycle pressure too low	Increase air regulator pressure
	Defective wiring	Check wiring connections
	Dirty filters	Replace filter(s)

Symptom	Probable Cause	Corrective Action
Low product flow	Feed air flowrate is too flow	Dirty filter(s): replace
Low product purity	O_2 analyzer malfunction	Check operation and calibration
	Feed pressure too low	Dirty filter(s): replace
	Switching valve not opening / closing (See Photo 38)	Dirty or defective valve; clean or replace
		No pilot signal; check pilot valve using manual override; replace coil or pilot valve
		Tubing plugged or pinched; replace tubing
	Check-valves leak (See Photo 39)	Rebuild or replace check valves
	Muffler plugged (See Photo 40)	Clean muffler
	Product flow too high	Decrease product flow

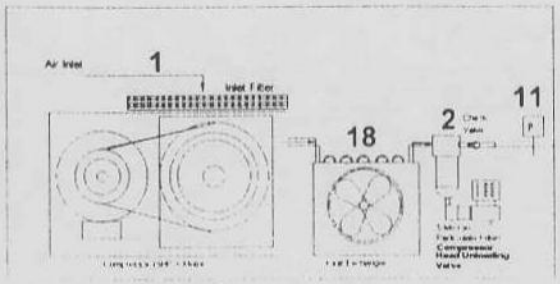
*****CAUTION*****

**DO NOT DISCONNECT OR
TURN OFF AIR TO GENERATOR
UNLESS GENERATOR POWER SWITCH
IS TURNED OFF**

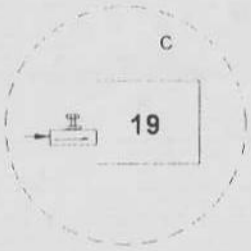
LEGEND

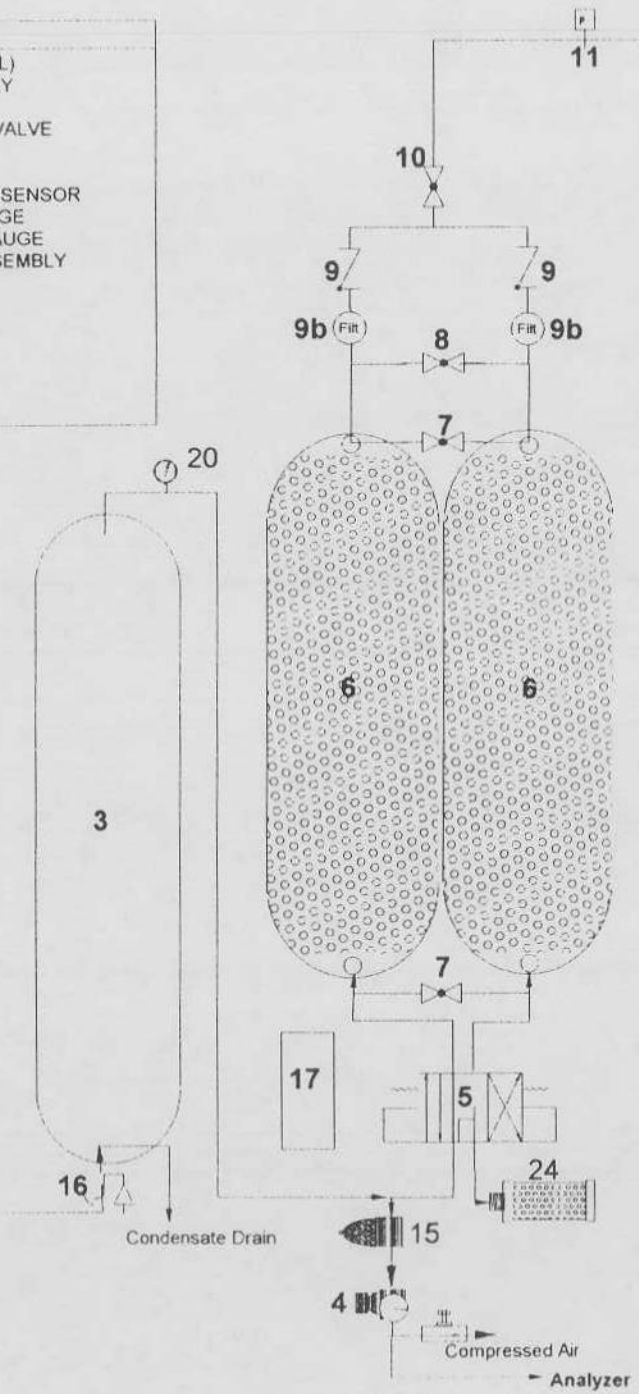
1	COMPRESSOR ASSEMBLY	13	BOOSTER (OPTIONAL)
2	PARTICULATE FILTER	14	MANIFOLD ASSEMBLY
3	AIR RECEIVING TANK	15	HEPA FILTER
4	PRESSURE REGULATOR	16	PRESSURE RELIEF VALVE
5	MAIN VALVE	17	CO MONITOR
6	MOLECULAR SIEVE BED	18	HEAT EXCHANGER
7	AIR SAVER VALVE	19	OXYGEN ANALYZER SENSOR
8	CROSSOVER VALVE	20	AIR PRESSURE GAUGE
9	CHECK VALVE	21	TANK PRESSURE GAUGE
9b	IN-LINE FILTER	22	HP REGULATOR ASSEMBLY
10	PUREFLOW VALVE	23	3-WAY VALVE
11	PRESSURE SWITCH	24	MUFFLER
12	OXYGEN RECEIVING TANK		

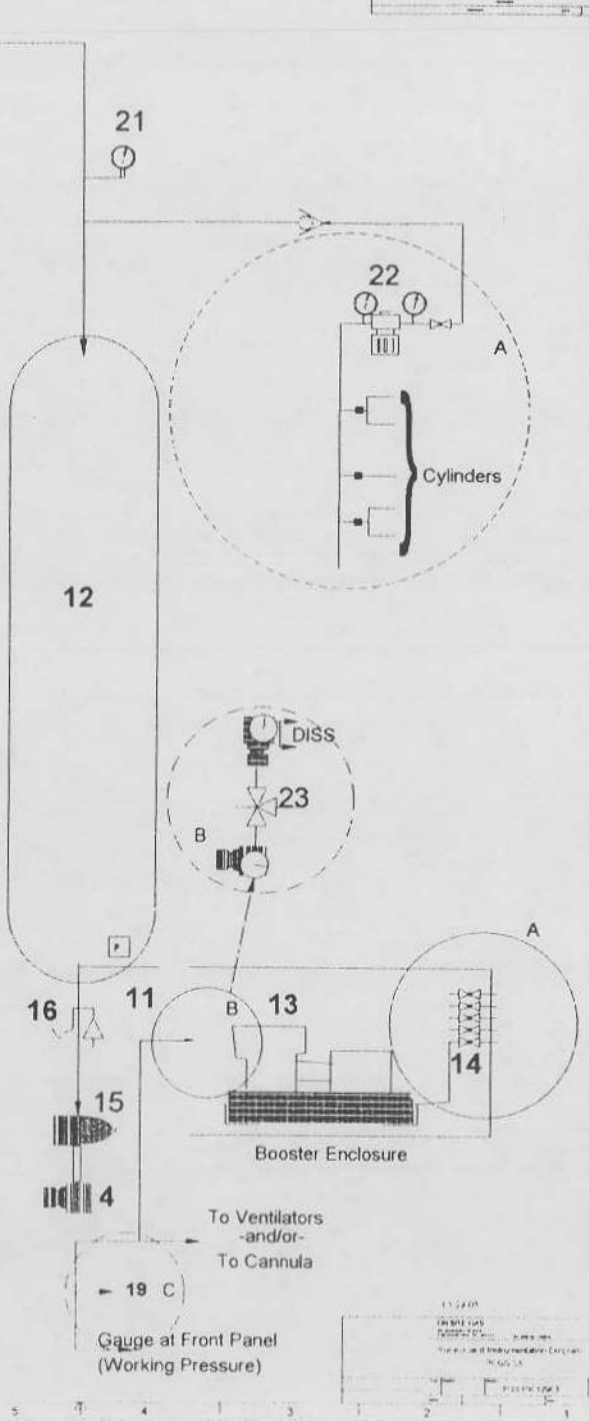
A MANIFOLD/FLOWBACK ASSEMBLY
B BOOSTER INLET ASSEMBLY
C OXYGEN ANALYZER SENSOR ASSEMBLY



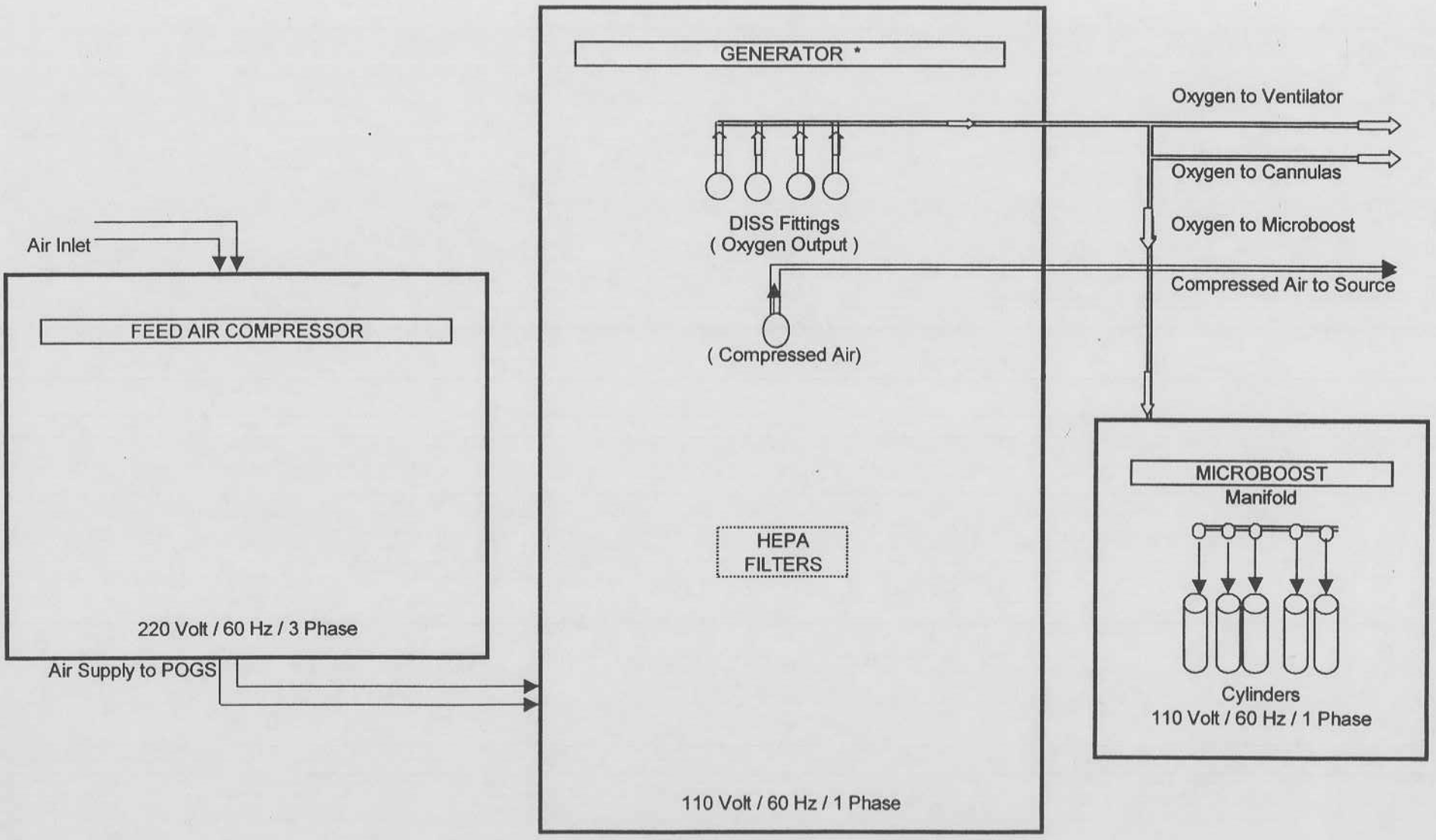
Feed Air Compressor Enclosure







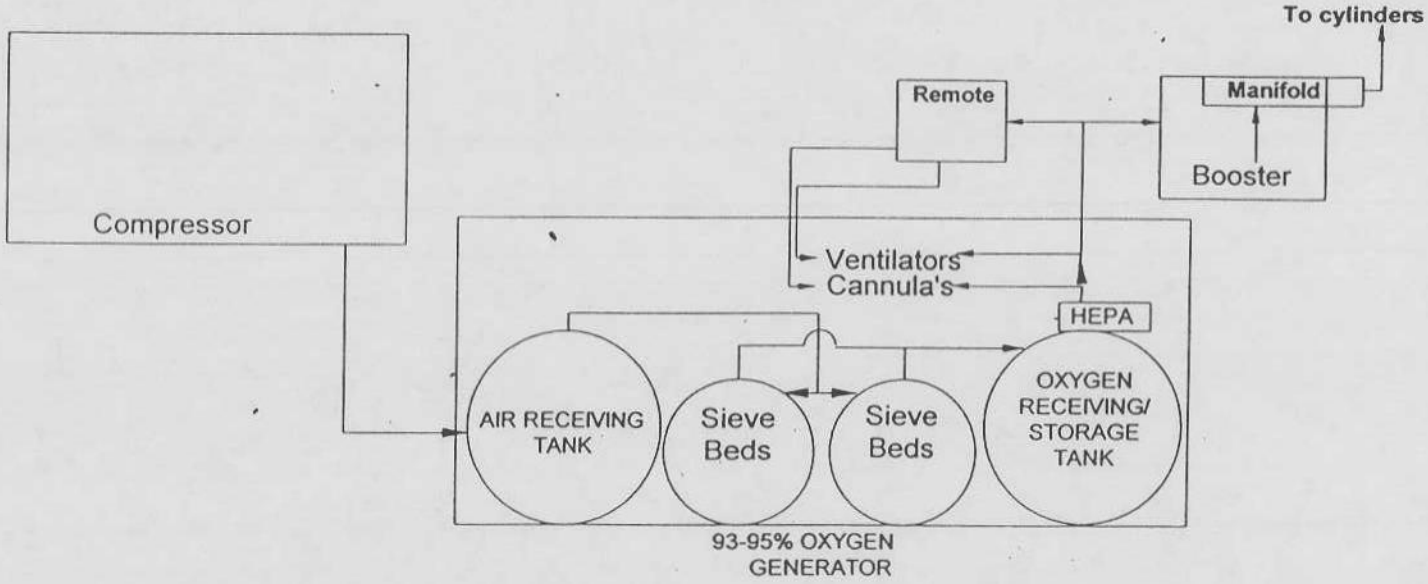
POGS 33 ELECTRICAL AND PNEUMATIC SCHEMATIC

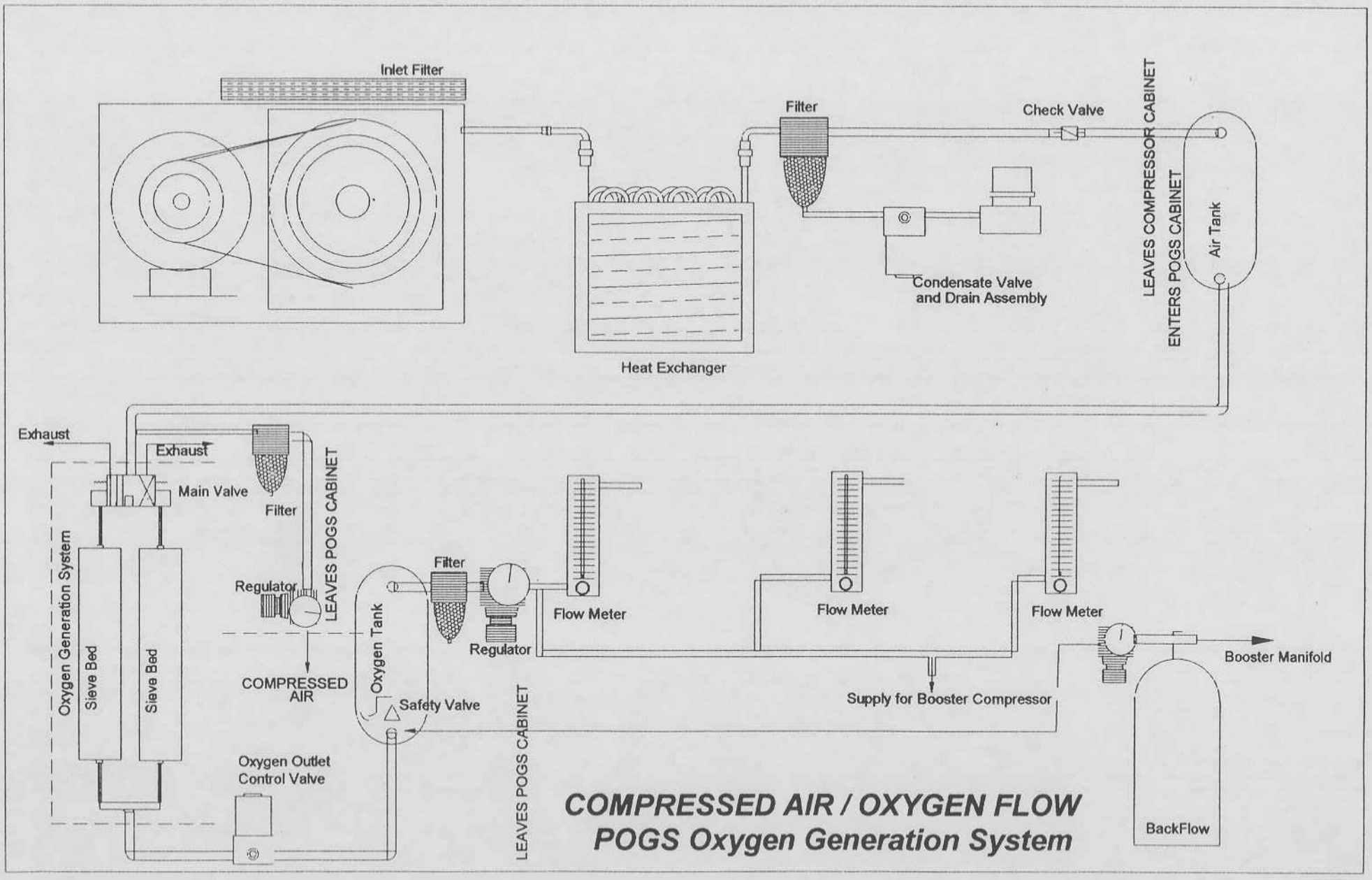


NOTE: * Generator lays down for shipping

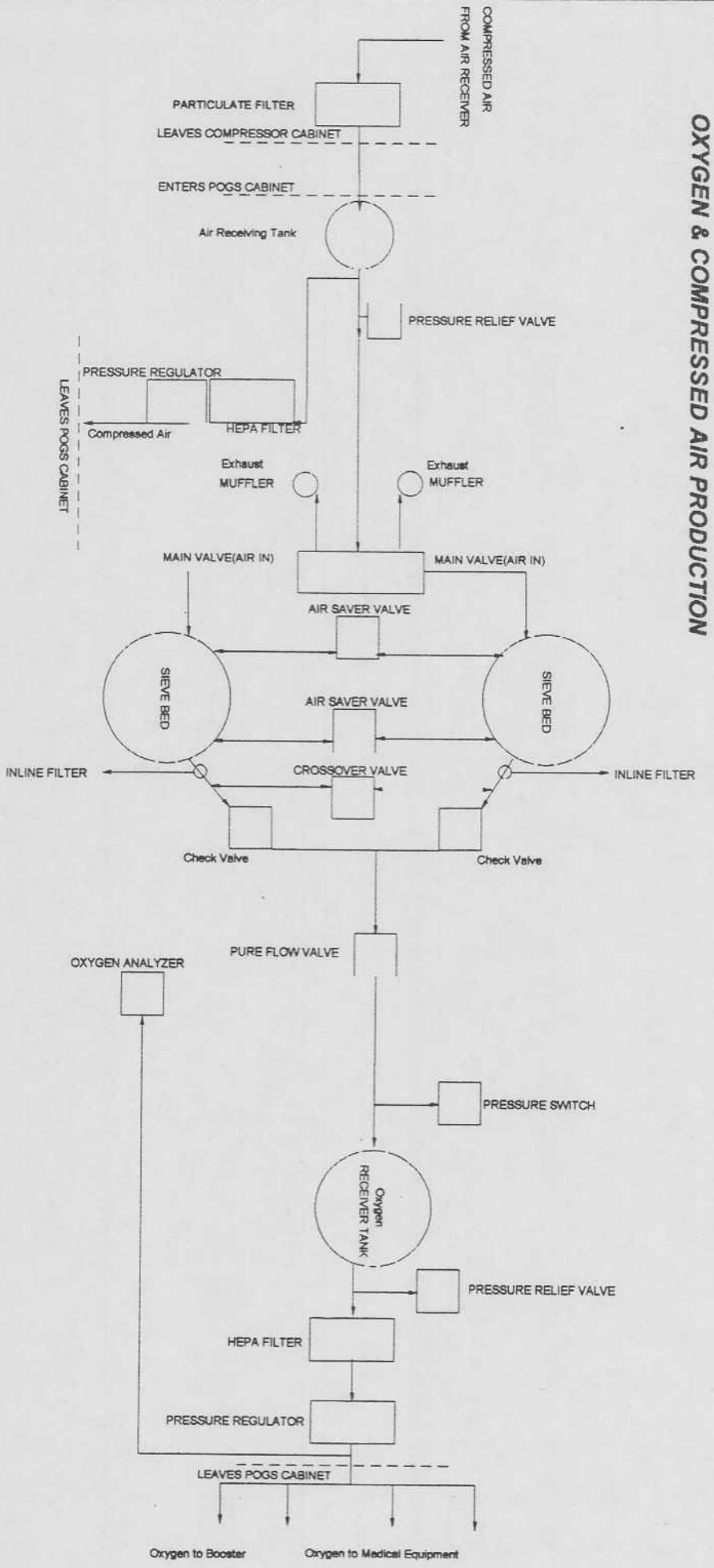
POGS

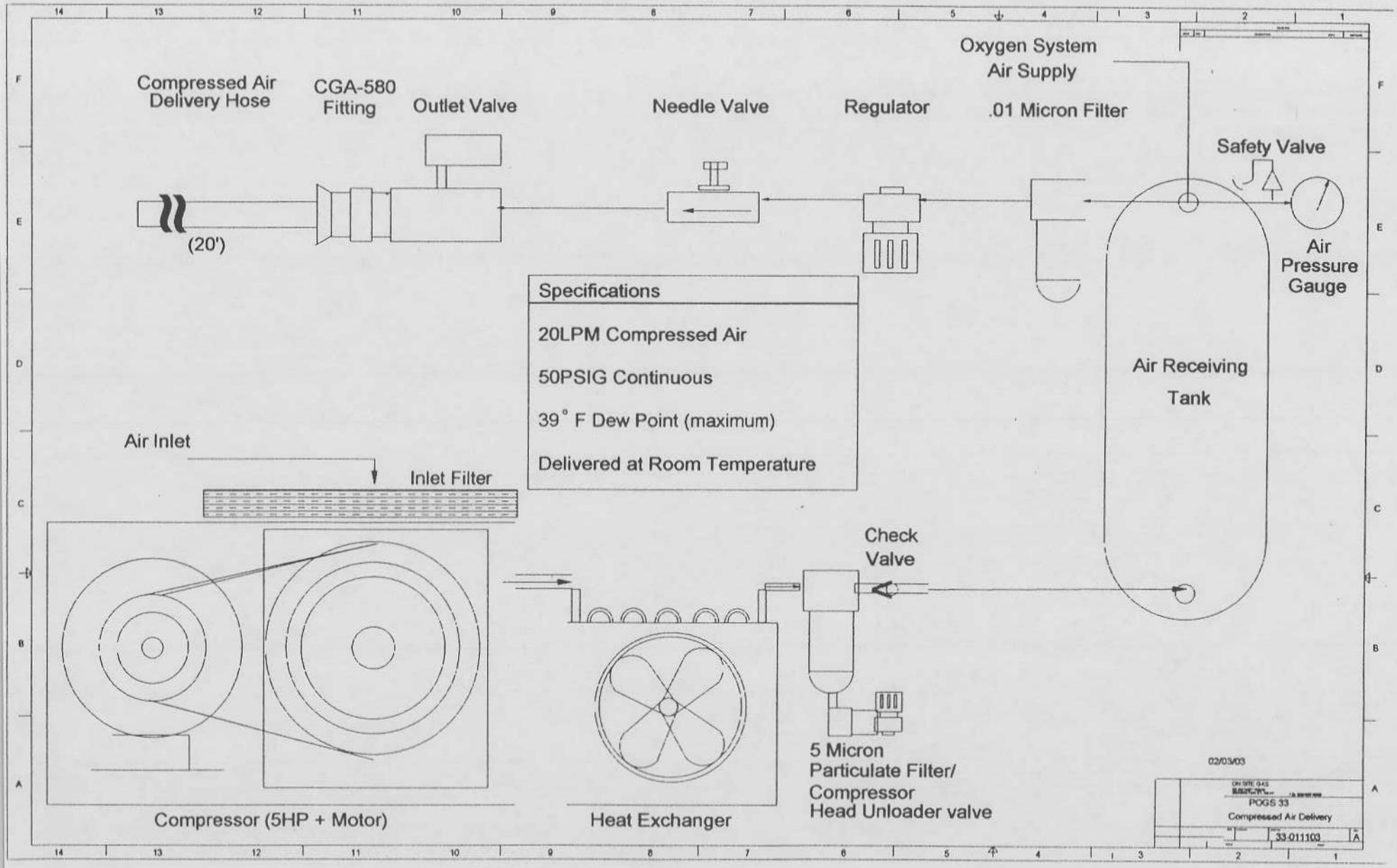
OXYGEN GENERATOR LAY-OUT




Inlet Filter
Filter
Check Valve
LEAVES COMPRESSOR CABINET
ENTERS POGS CABINET
Air Tank
Condensate Valve
and Drain Assembly
Heat Exchanger
Exhaust
Exhaust
Main Valve
Filter
LEAVES POGS CABINET
Oxygen Generation System
Sieve Bed
Sieve Bed
Regulator
COMPRESSED
AIR
Oxygen Tank
Filter
Regulator
Flow Meter
Flow Meter
Flow Meter
Booster Manifold
Supply for Booster Compressor
Safety Valve
Oxygen Outlet
Control Valve
LEAVES POGS CABINET
BackFlow
COMPRESSED AIR / OXYGEN FLOW
POGS Oxygen Generation System

OXYGEN & COMPRESSED AIR PRODUCTION

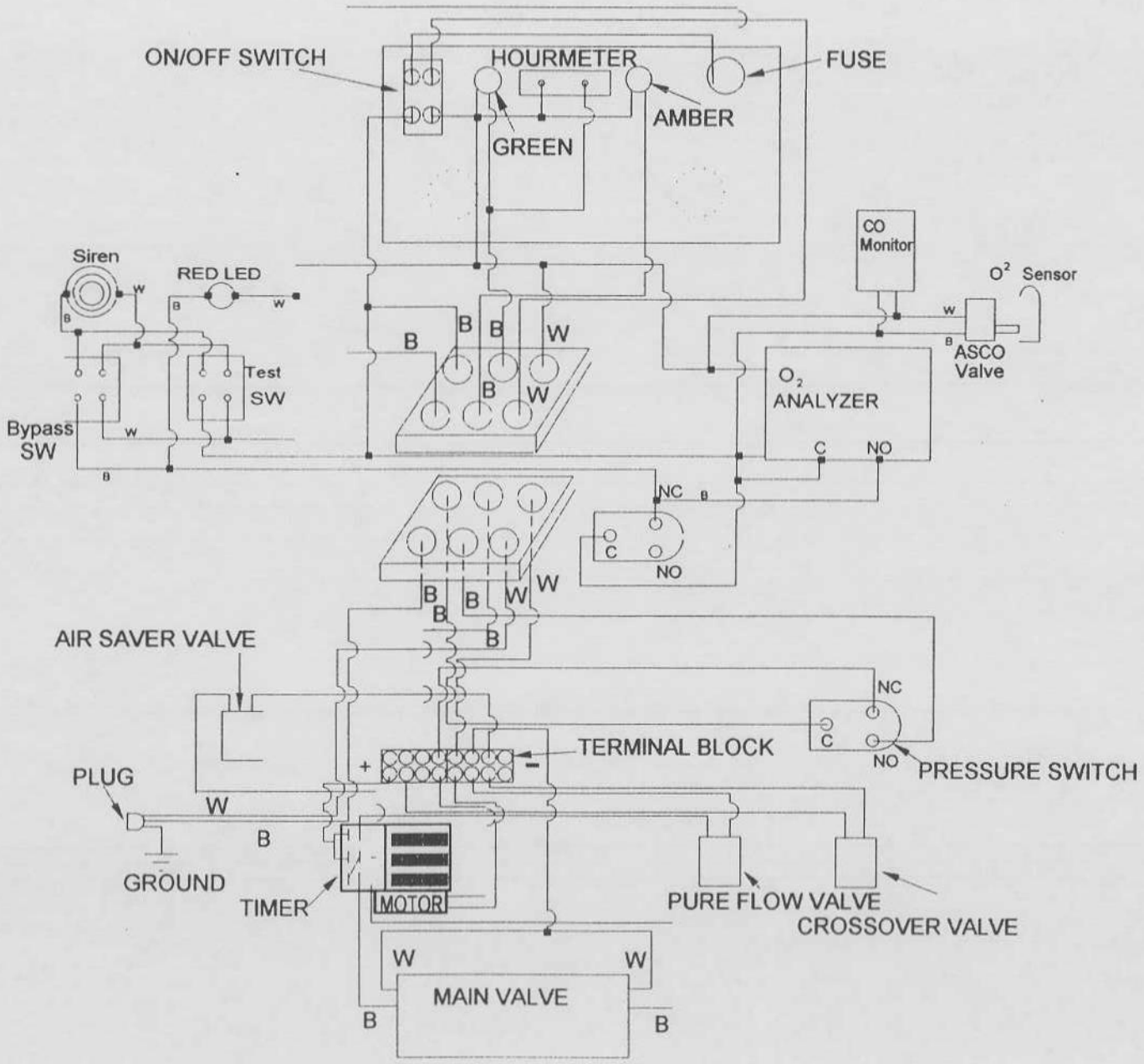


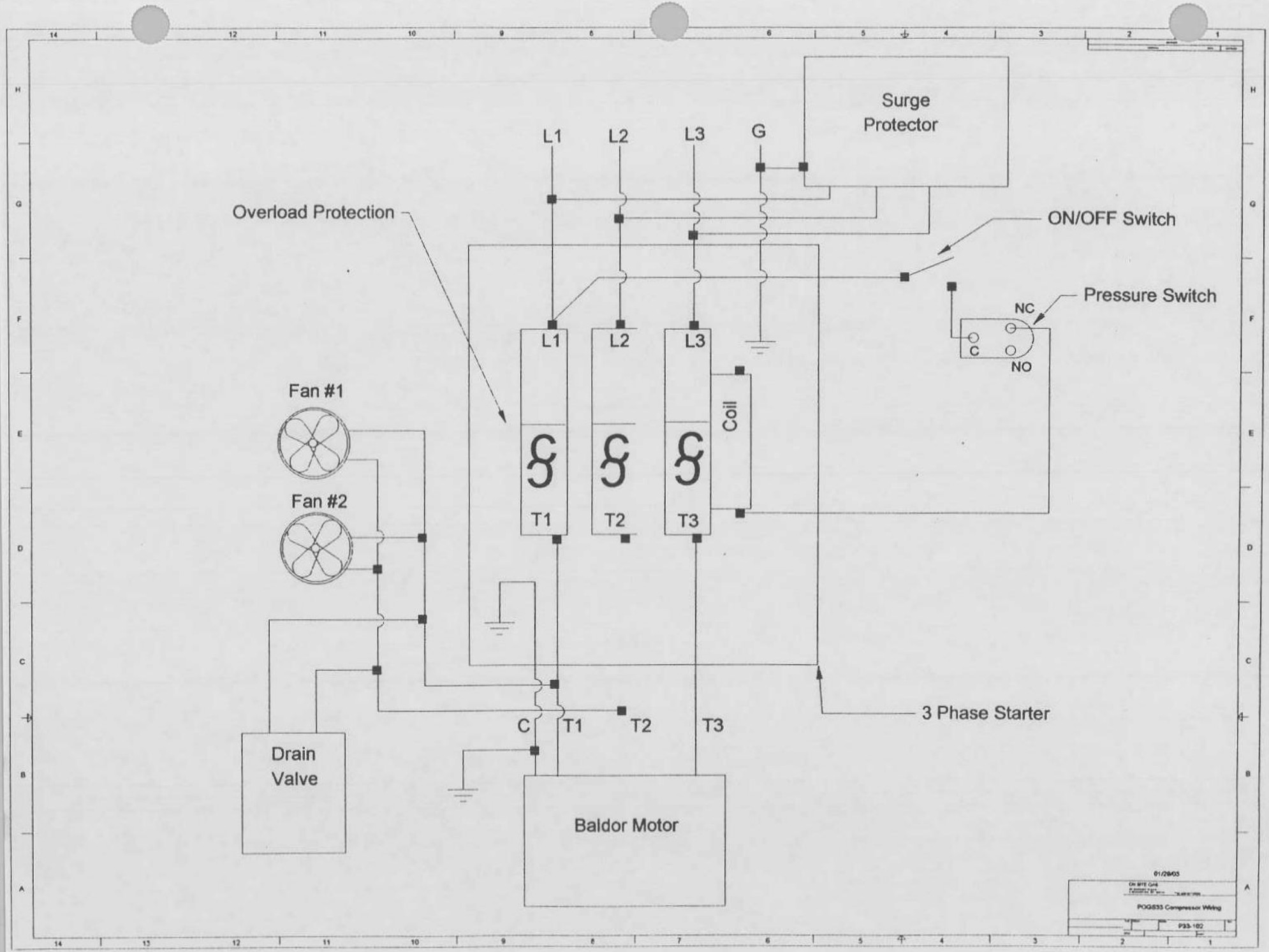

Compressed Air Delivery Hose
CGA-580 Fitting
Outlet Valve
Needle Valve
Regulator
Oxygen System Air Supply
.01 Micron Filter
Safety Valve
(20')
Air Pressure Gauge
Specifications
20LPM Compressed Air
50PSIG Continuous
39° F Dew Point (maximum)
Delivered at Room Temperature
Air Receiving Tank
Air Inlet
Inlet Filter
Check Valve
5 Micron Particulate Filter/ Compressor Head Unloader valve
Compressor (5HP + Motor)
Heat Exchanger
02/03/03
POGS 33
Compressed Air Delivery
33-011103

NOTI

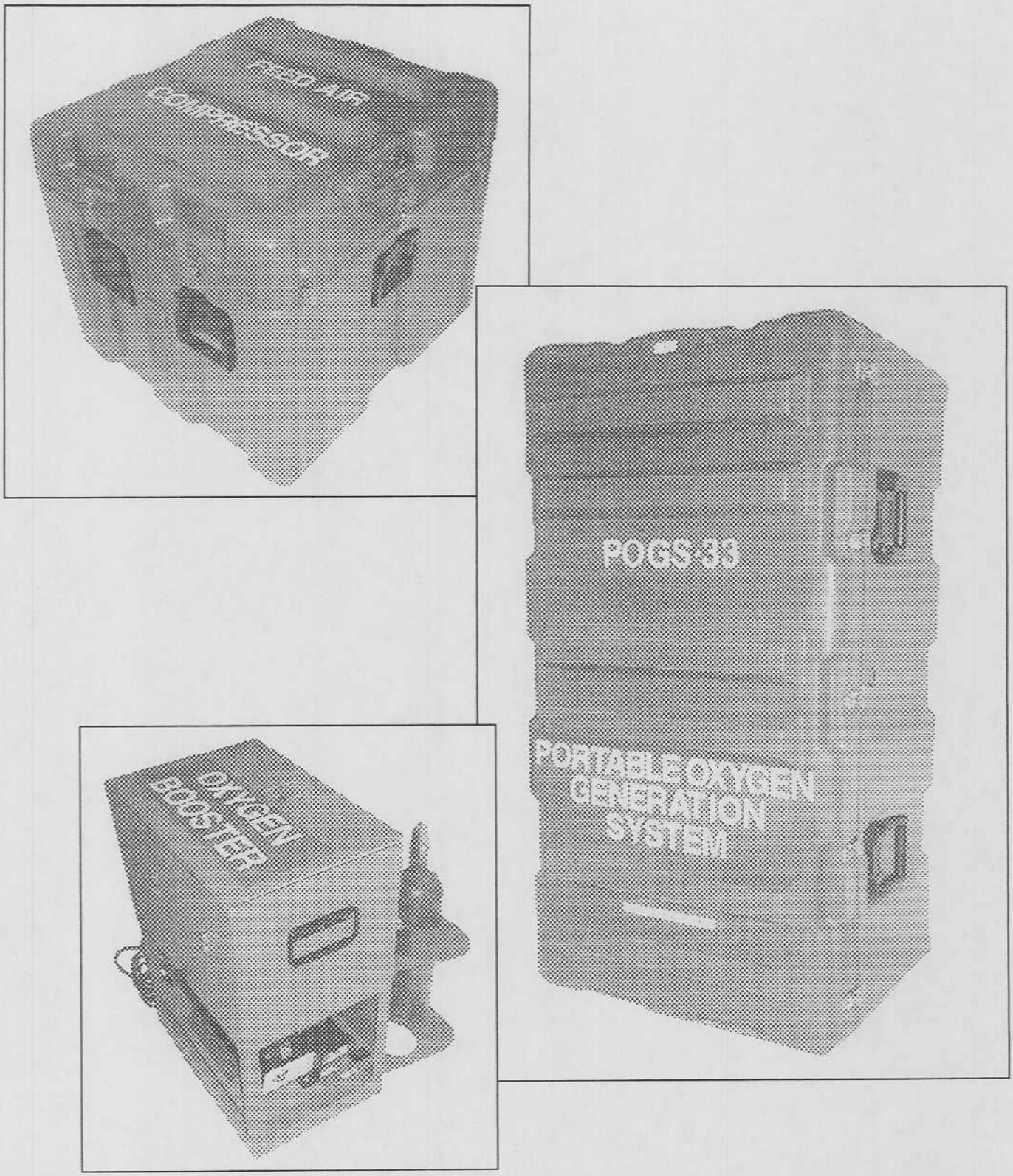
1.) BLACK WIRING (B) IS ALWAYS +

2.) WHITE WIRING (W) IS ALWAYS -

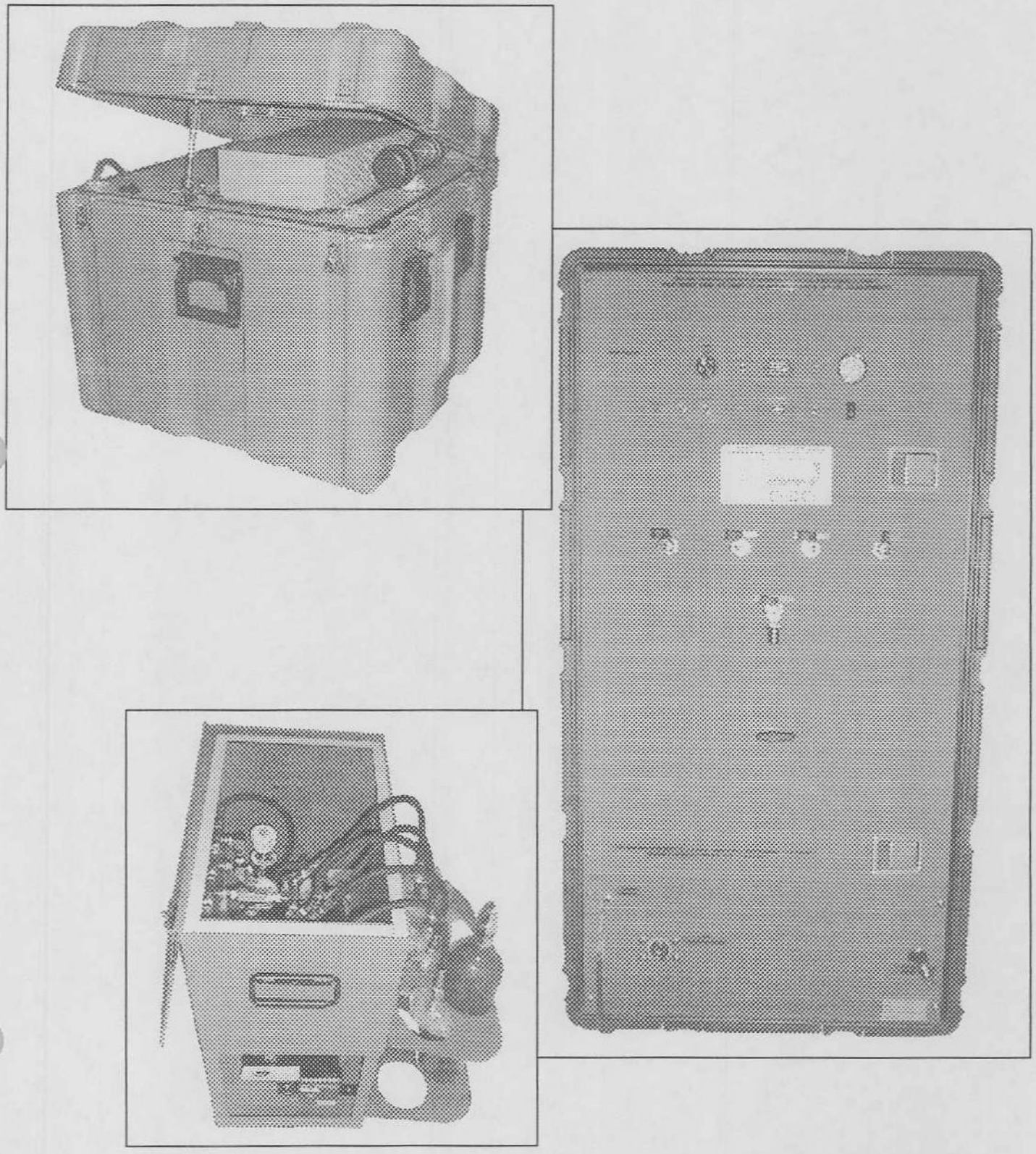



Surge Protector
L1
L2
L3
G
Overload Protection
ON/OFF Switch
Pressure Switch
NC
C
NO
L1
L2
L3
Coil
Fan #1
Fan #2
T1
T2
T3
C
T1
T2
T3
3 Phase Starter
Drain Valve
Baldor Motor
01/29/03
POG833 Compressor Wiring
P33-102

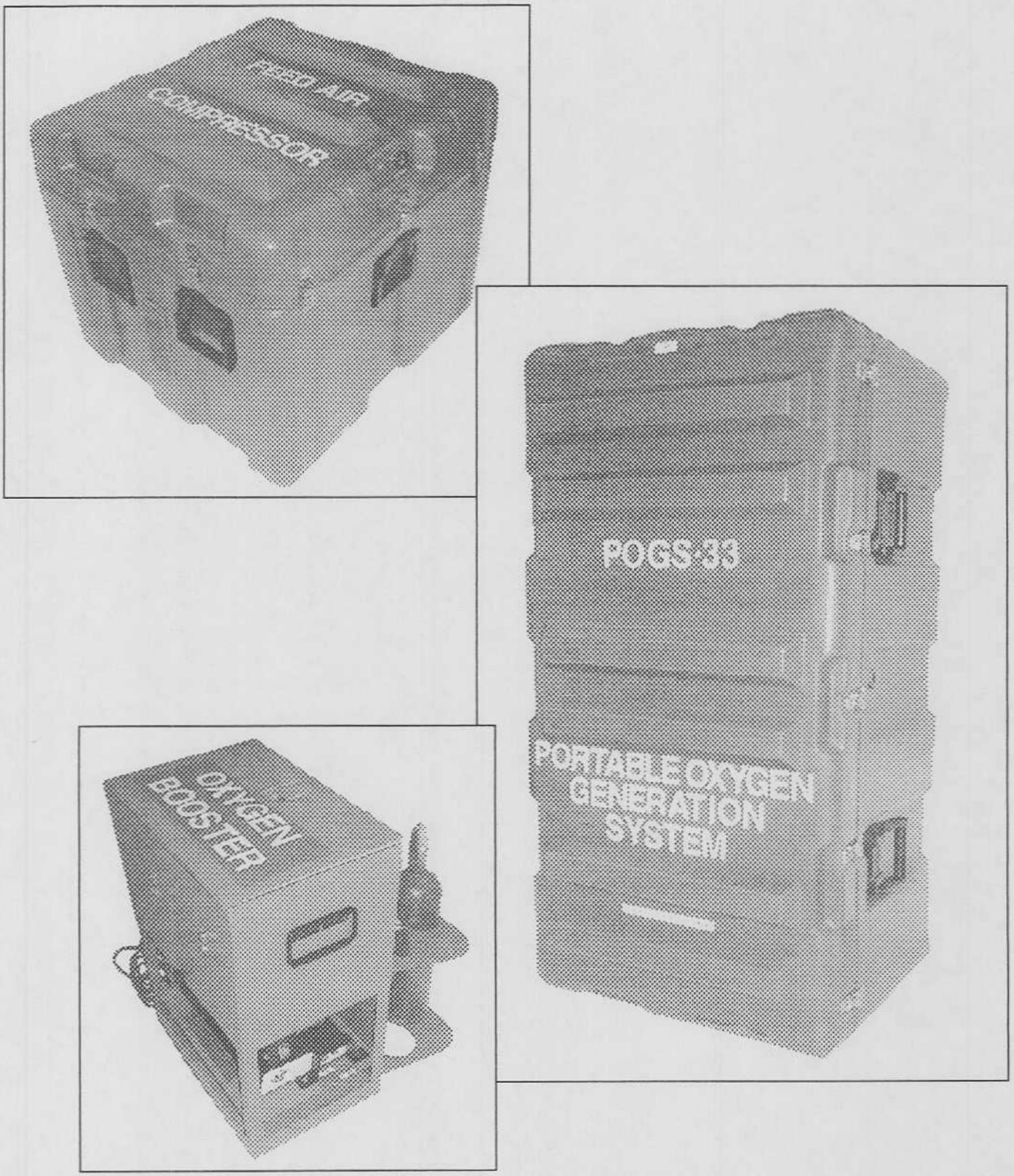
Photograph 1
POGS 3.3
Generator, Feed Air Compressor and Oxygen Booster Closed



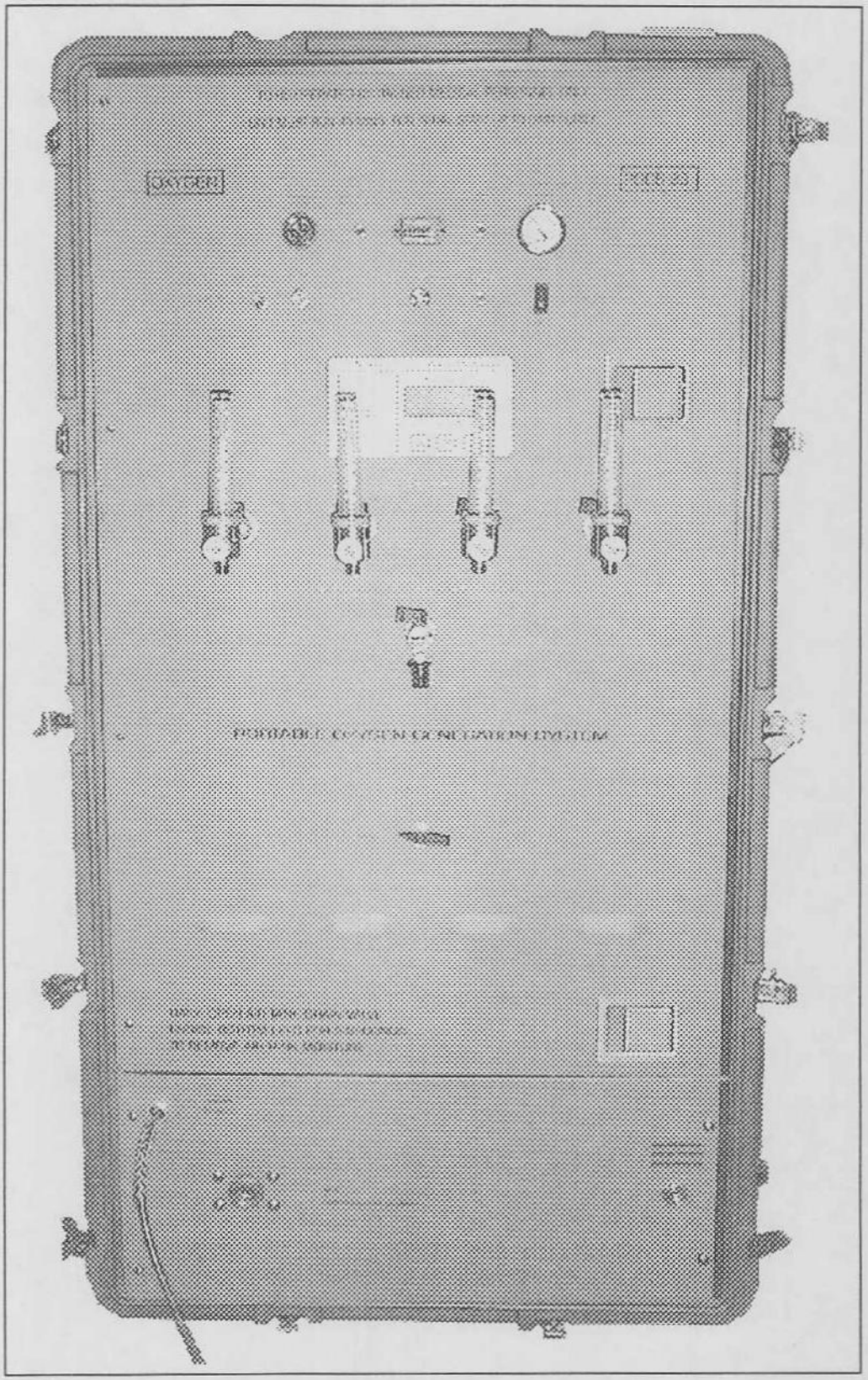
Photograph 2
POGS 3.3
Generator, Feed Air Compressor and Oxygen Booster Open



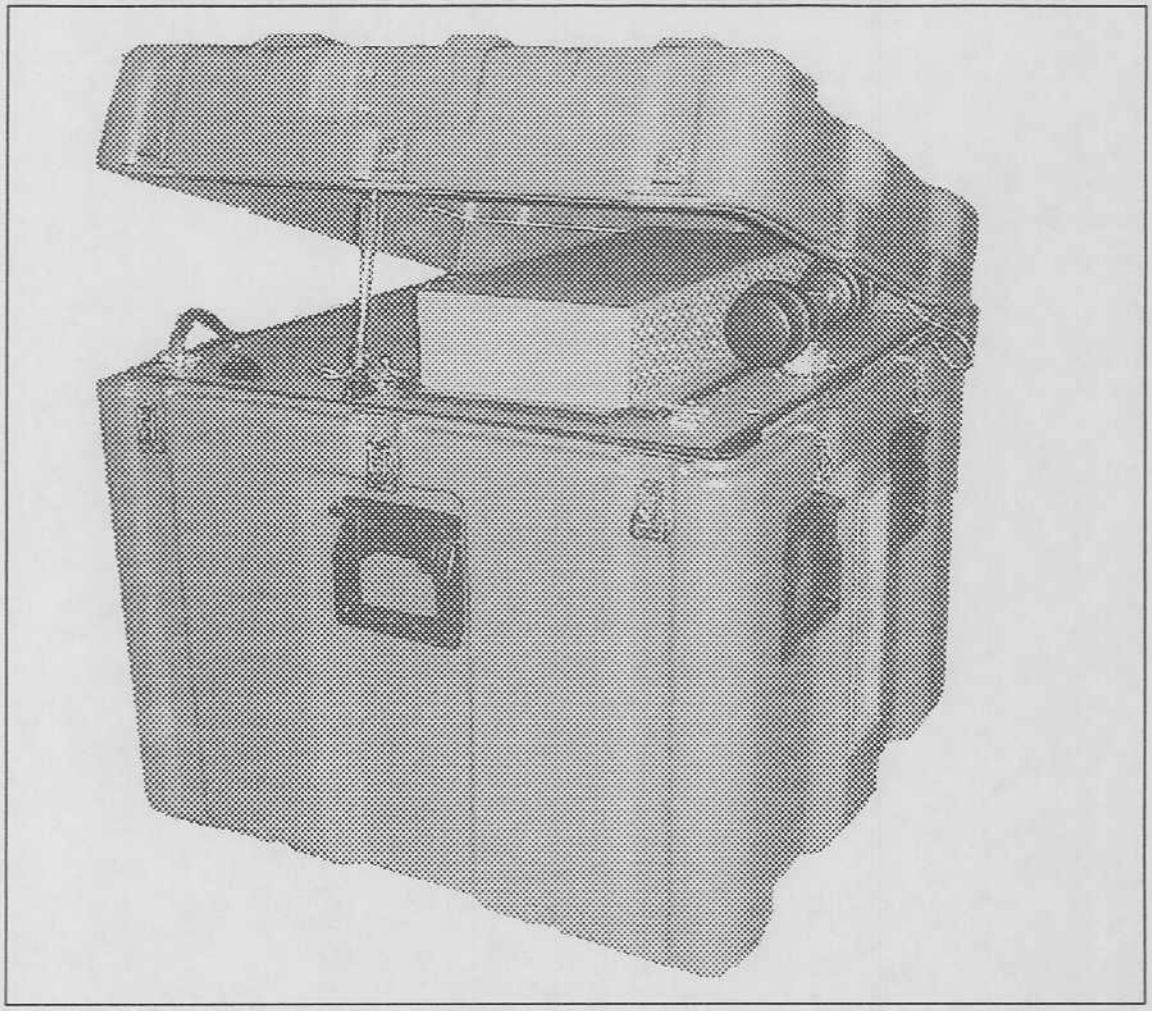
Photograph 3
POGS 3.3
Generator, Feed Air Compressor and Oxygen Booster Closed



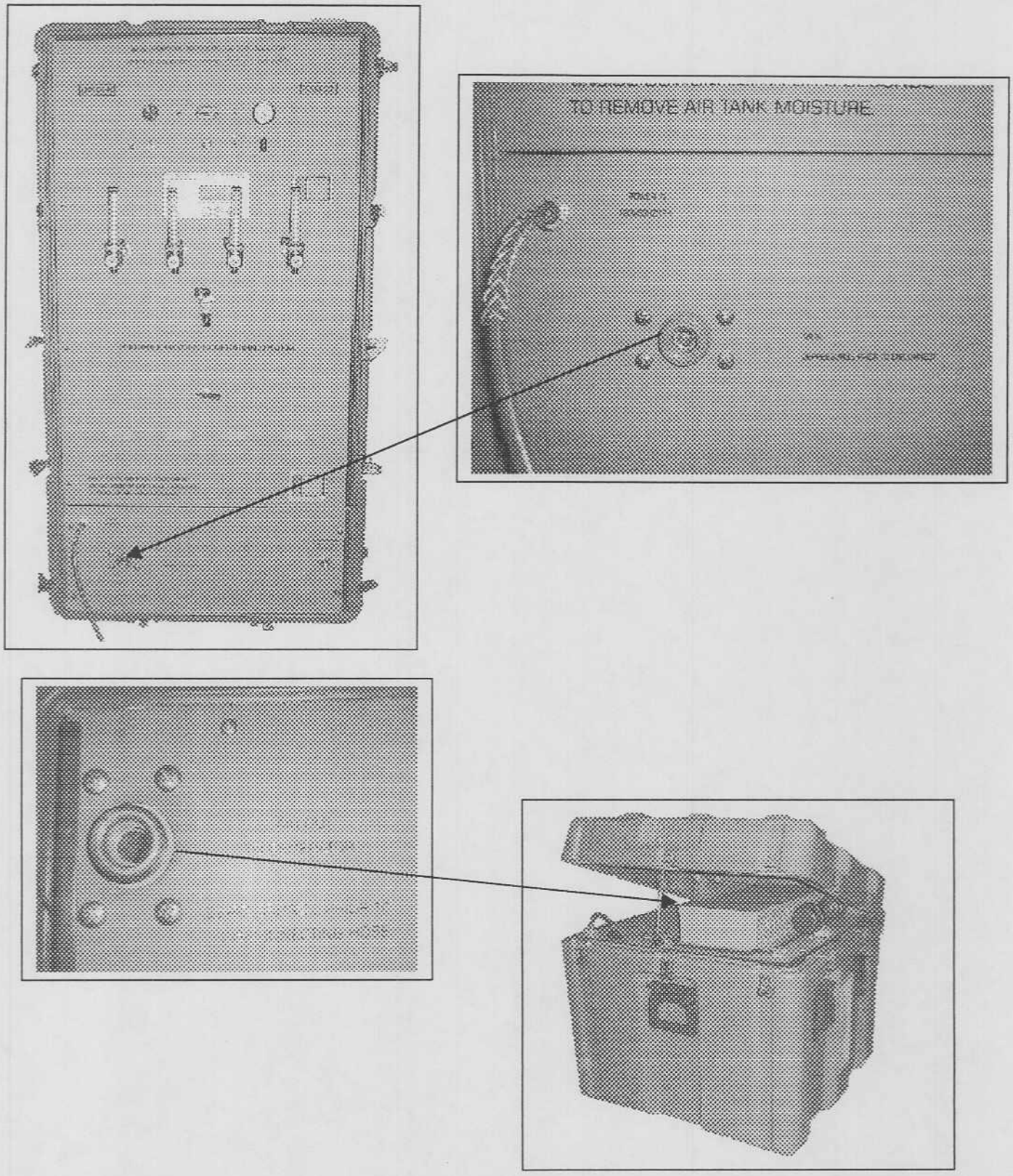
Photograph 4
POGS 3.3
Generator – Open and Upright



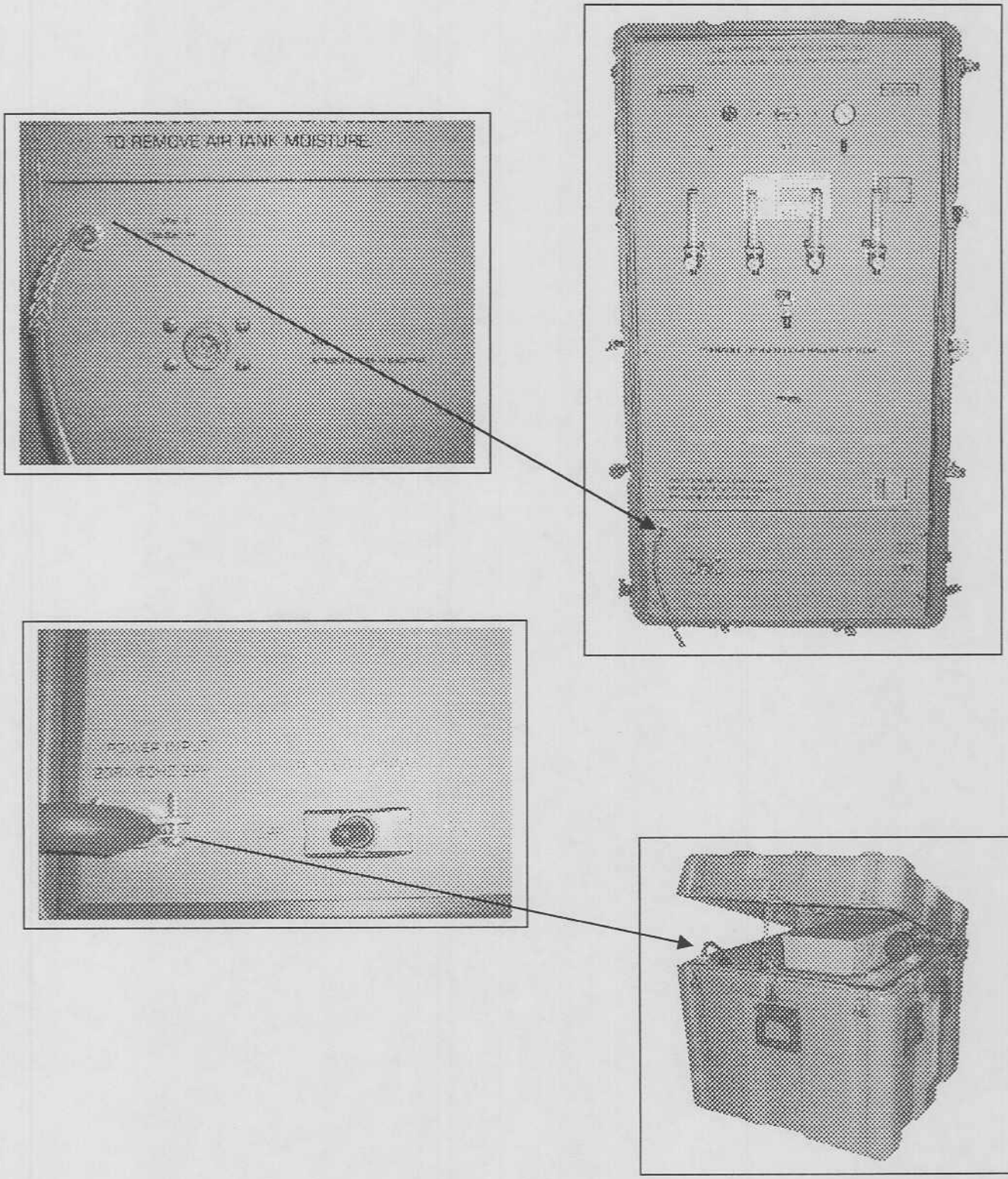
Photograph 5
POGS 3.3
Feed Air Compressor – Lid Open with Standoff



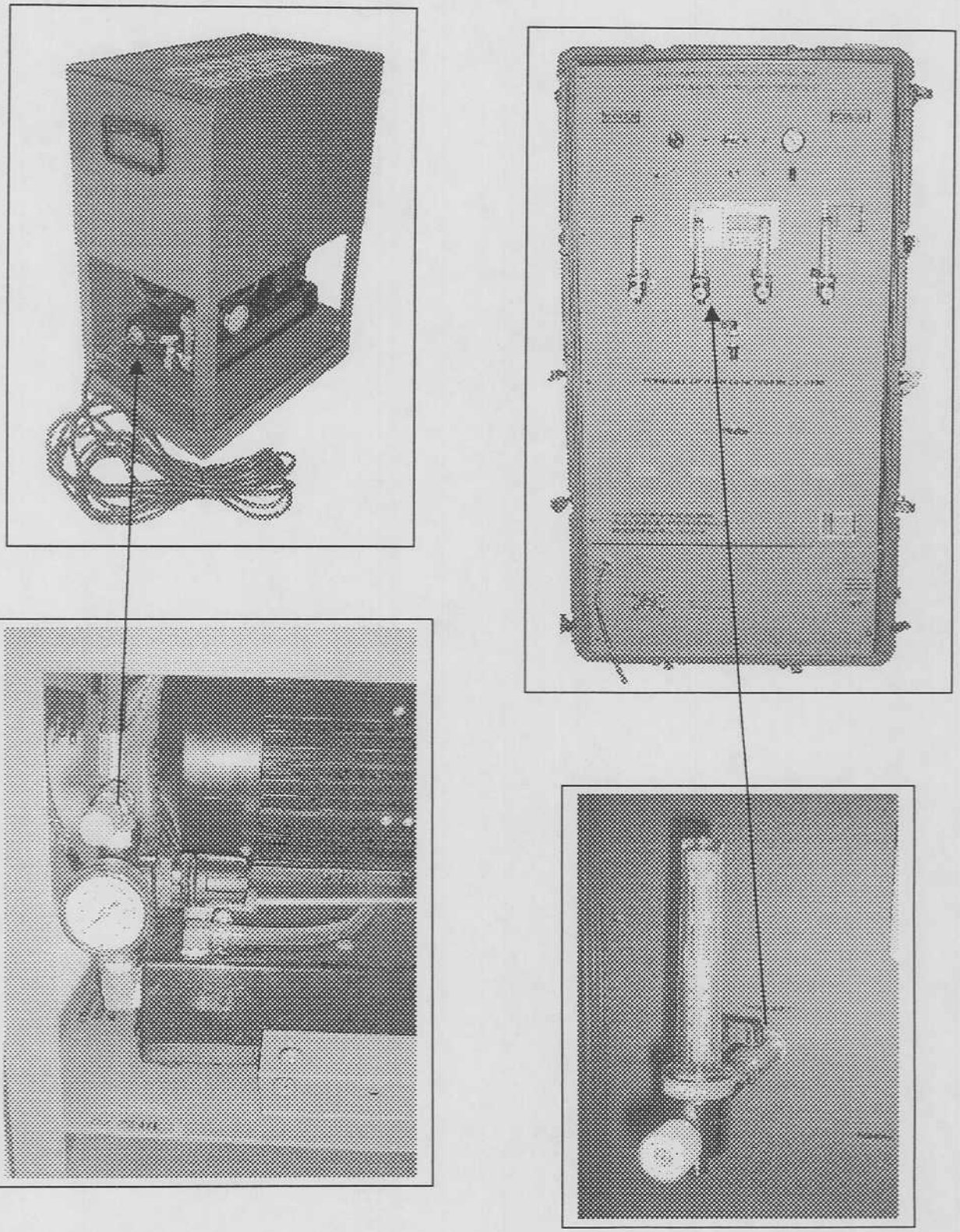
Photograph 6
POGS 3.3
Feed Air Compressor and Generator – Connectors for Air Hose



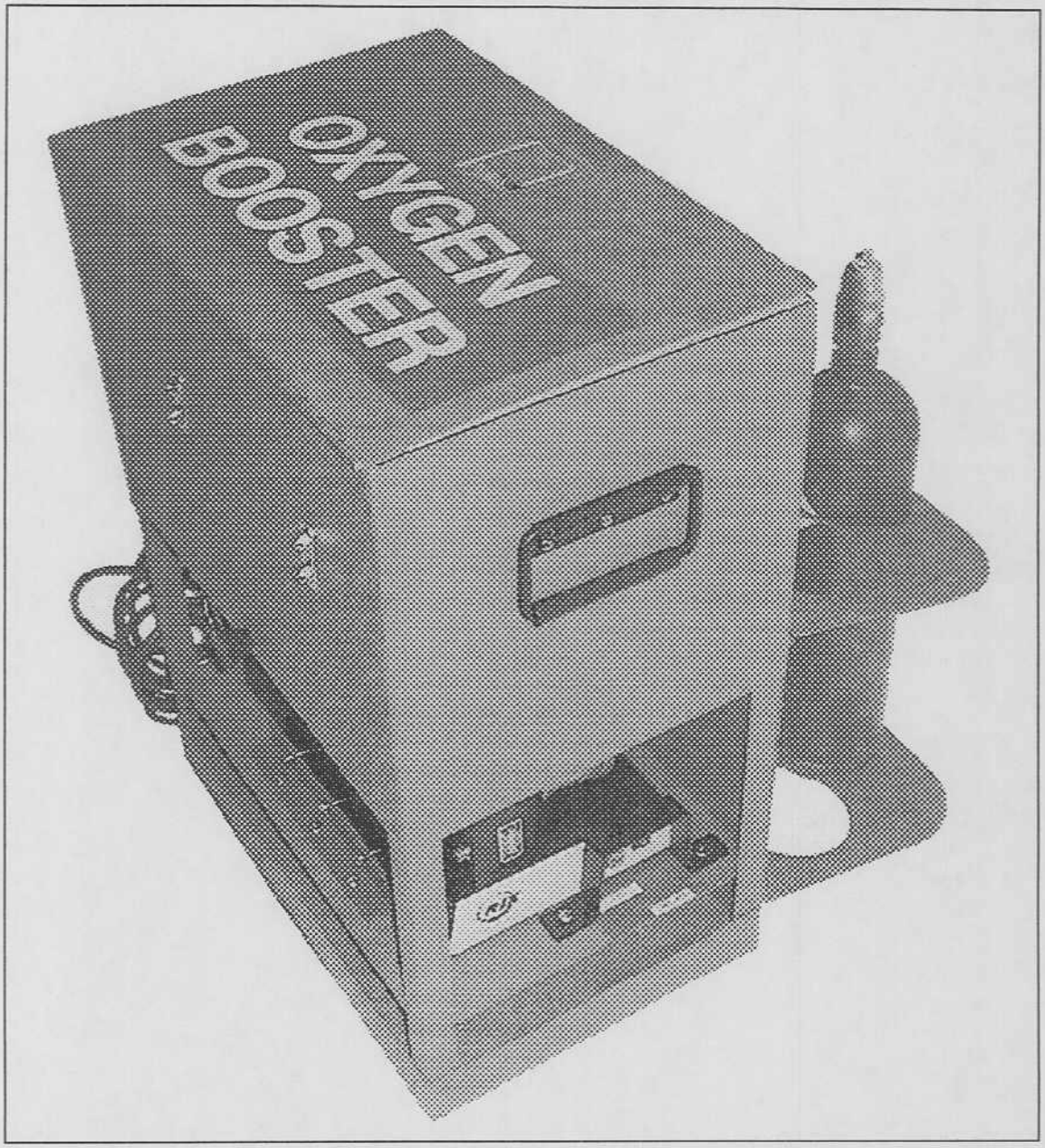
Photograph 7
POGS 3.3
Generator and Feed Air Compressor – Electrical Connections



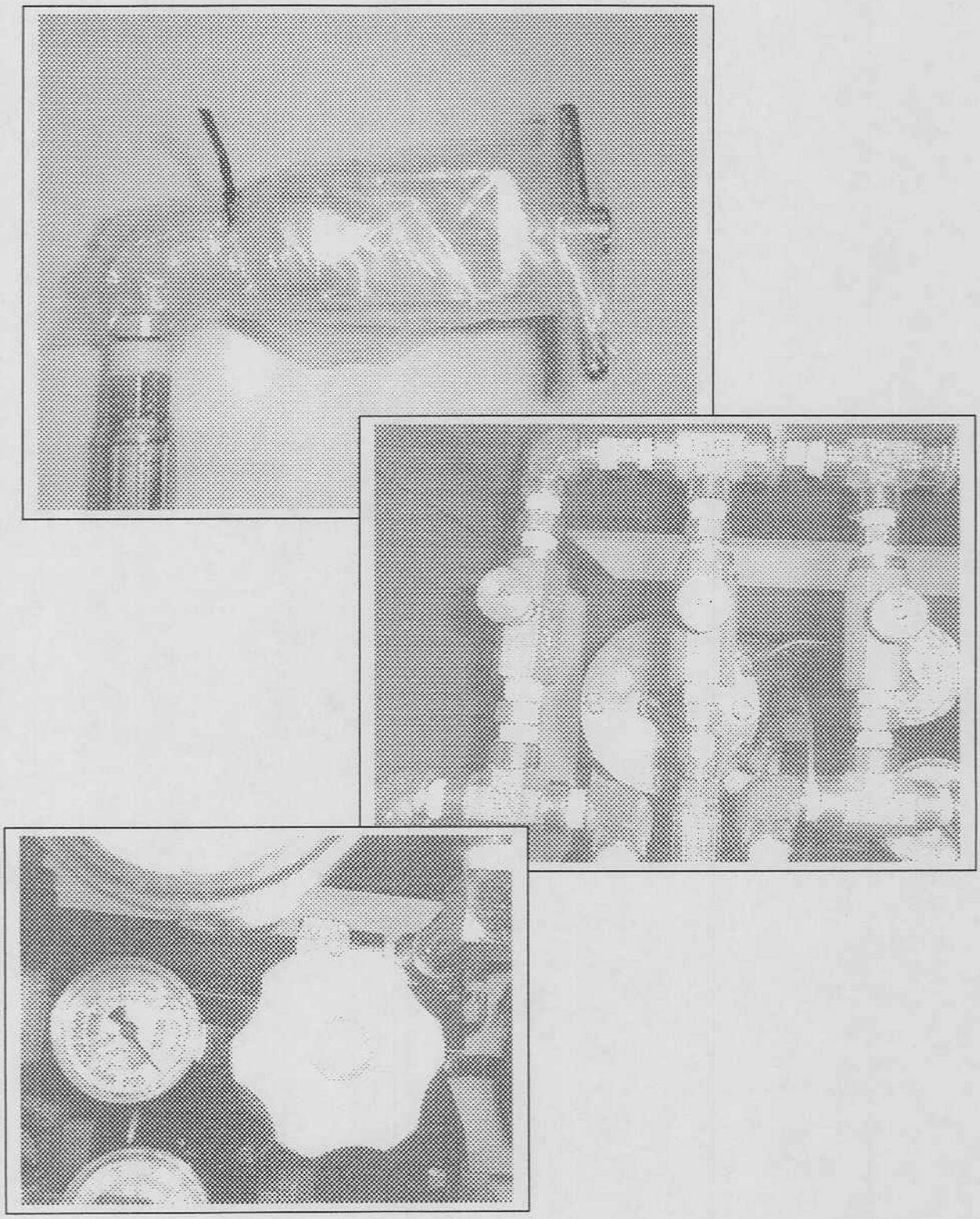
Photograph 8
POGS 3.3
Oxygen Booster and Generator - Oxygen Hose Connections



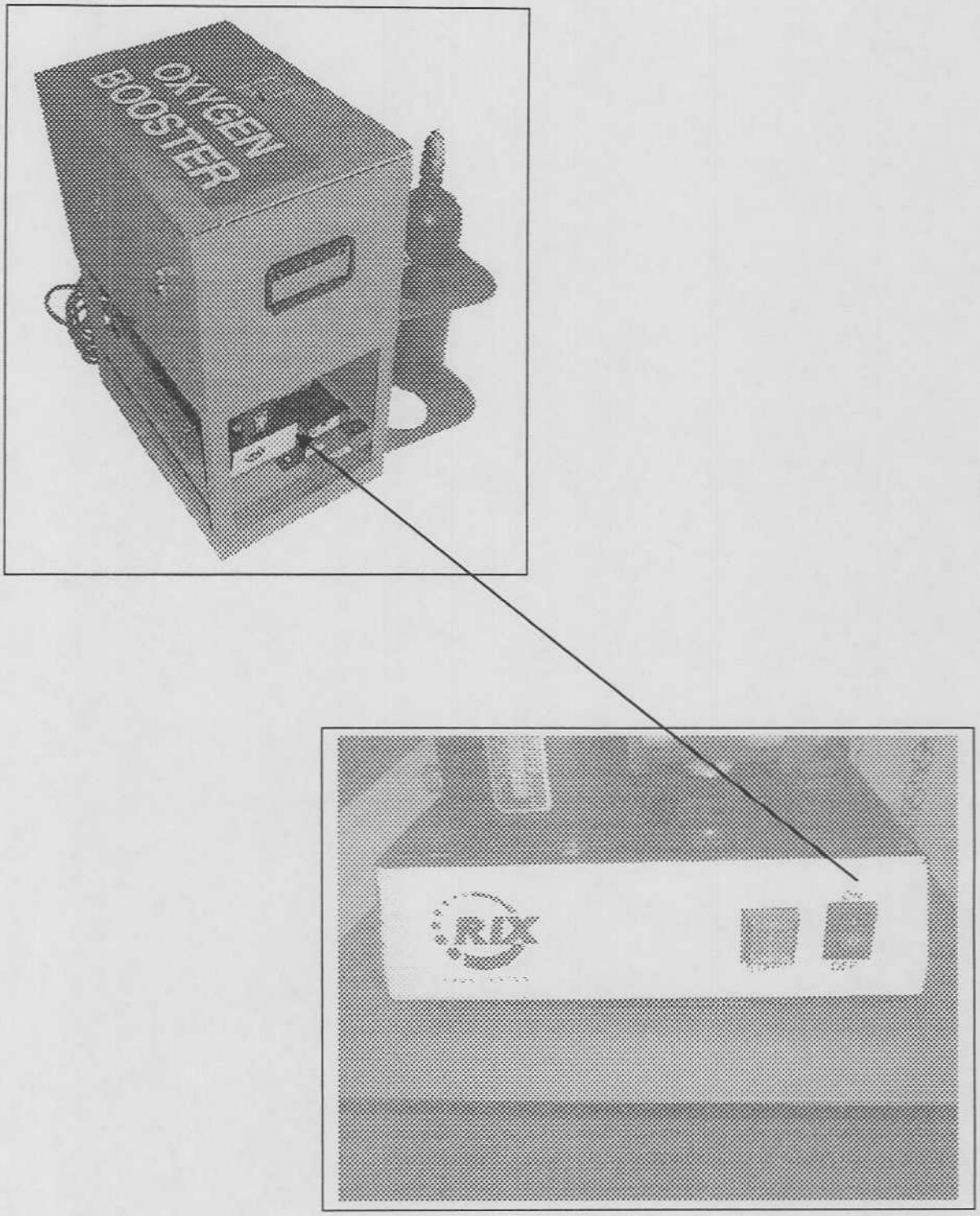
Photograph 9
POGS 3.3
Oxygen Booster



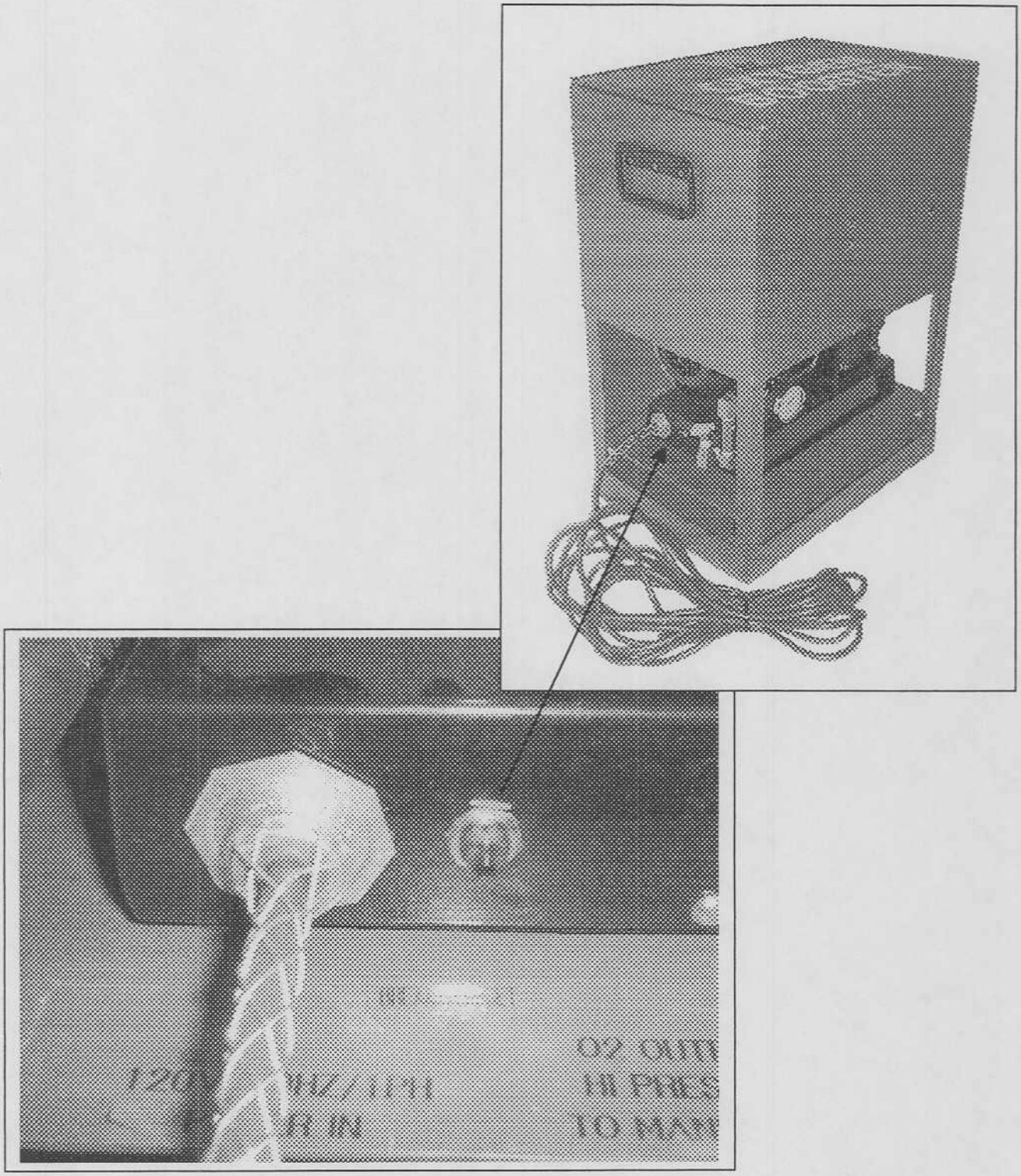
Photograph 10
POGS 3.3
Oxygen Booster – Pigtails and Valves



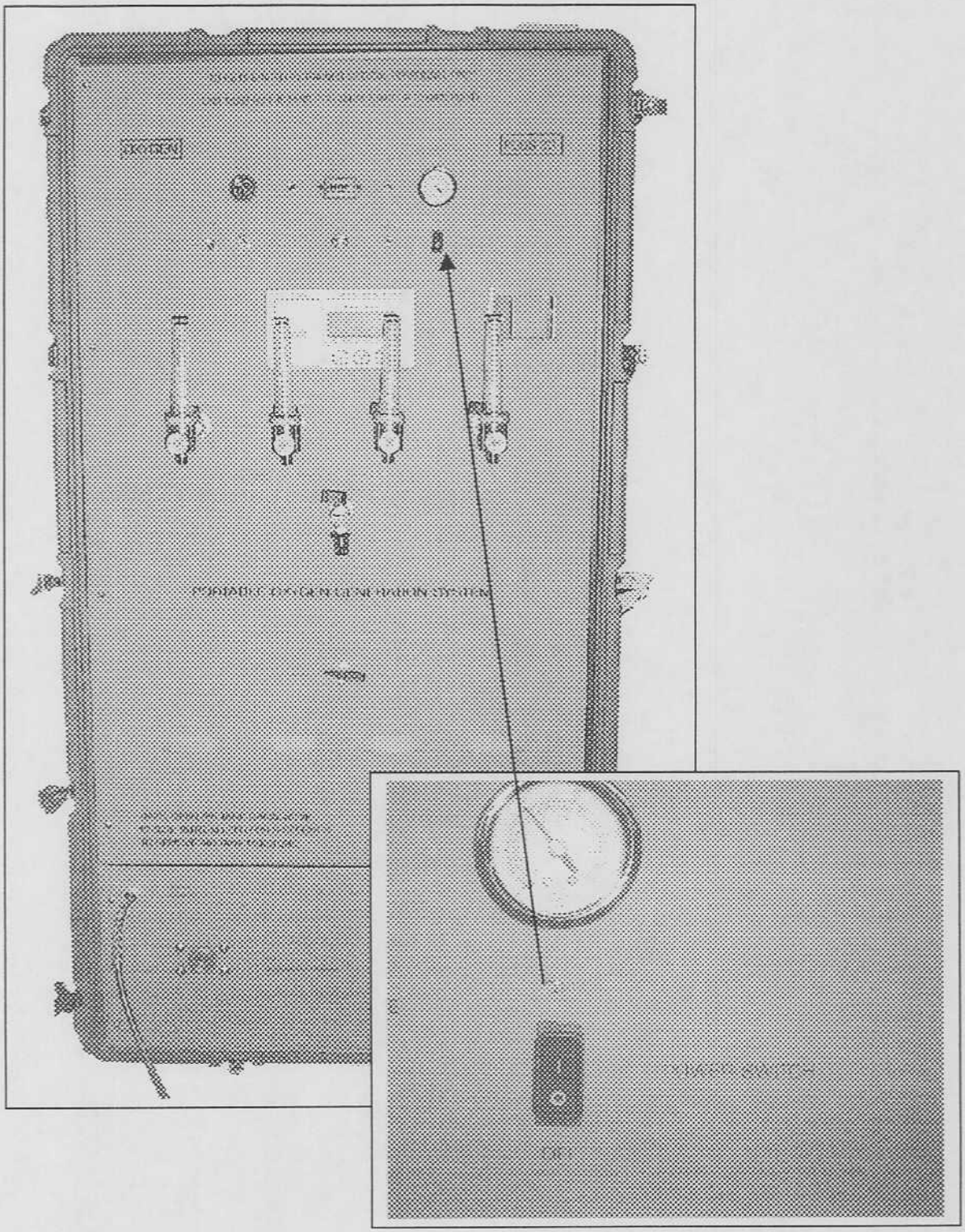
Photograph 11
POGS 3.3
Oxygen Booster – Power Switch



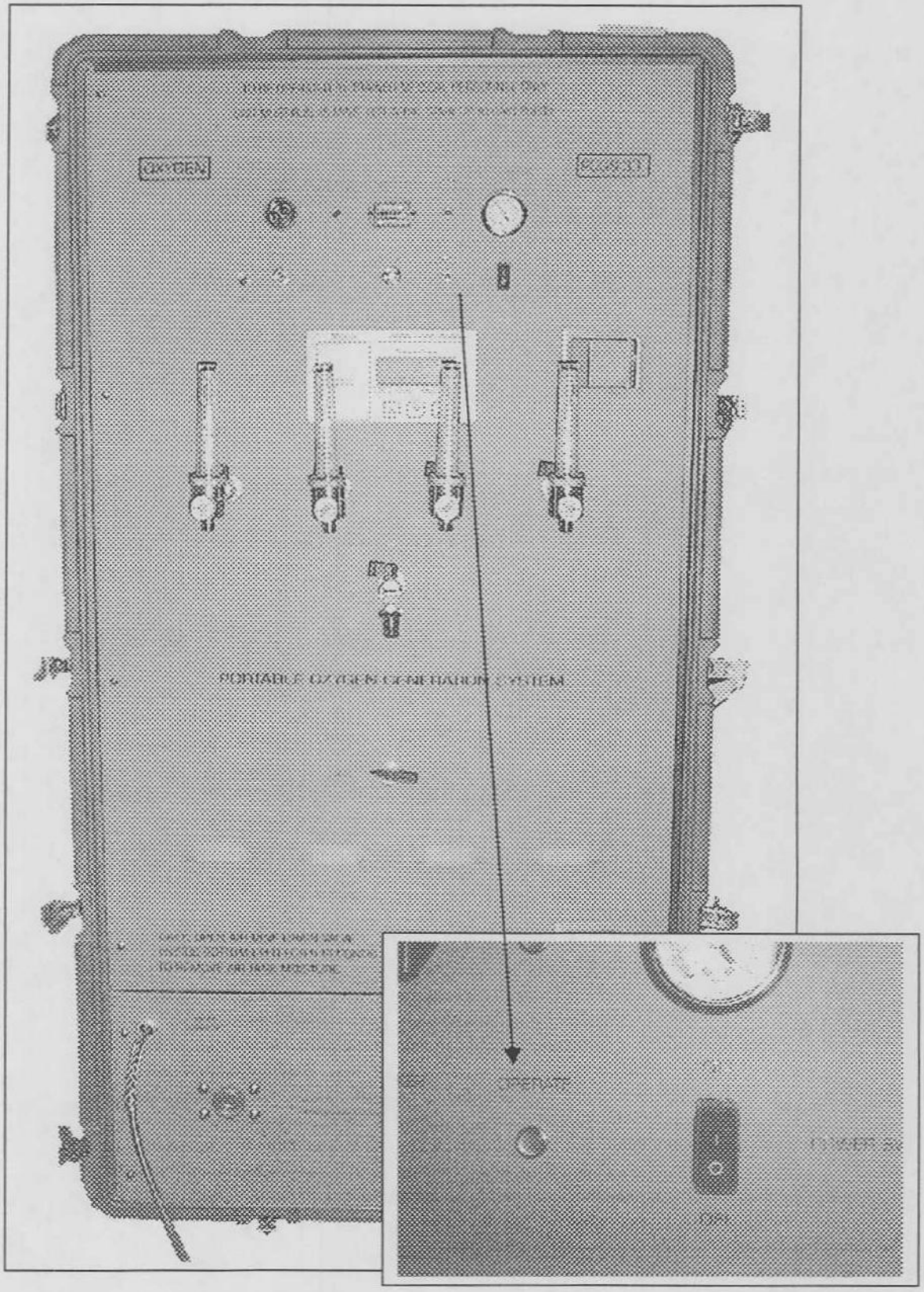
Photograph 12
POGS 3.3
Oxygen Booster – Booster Restart



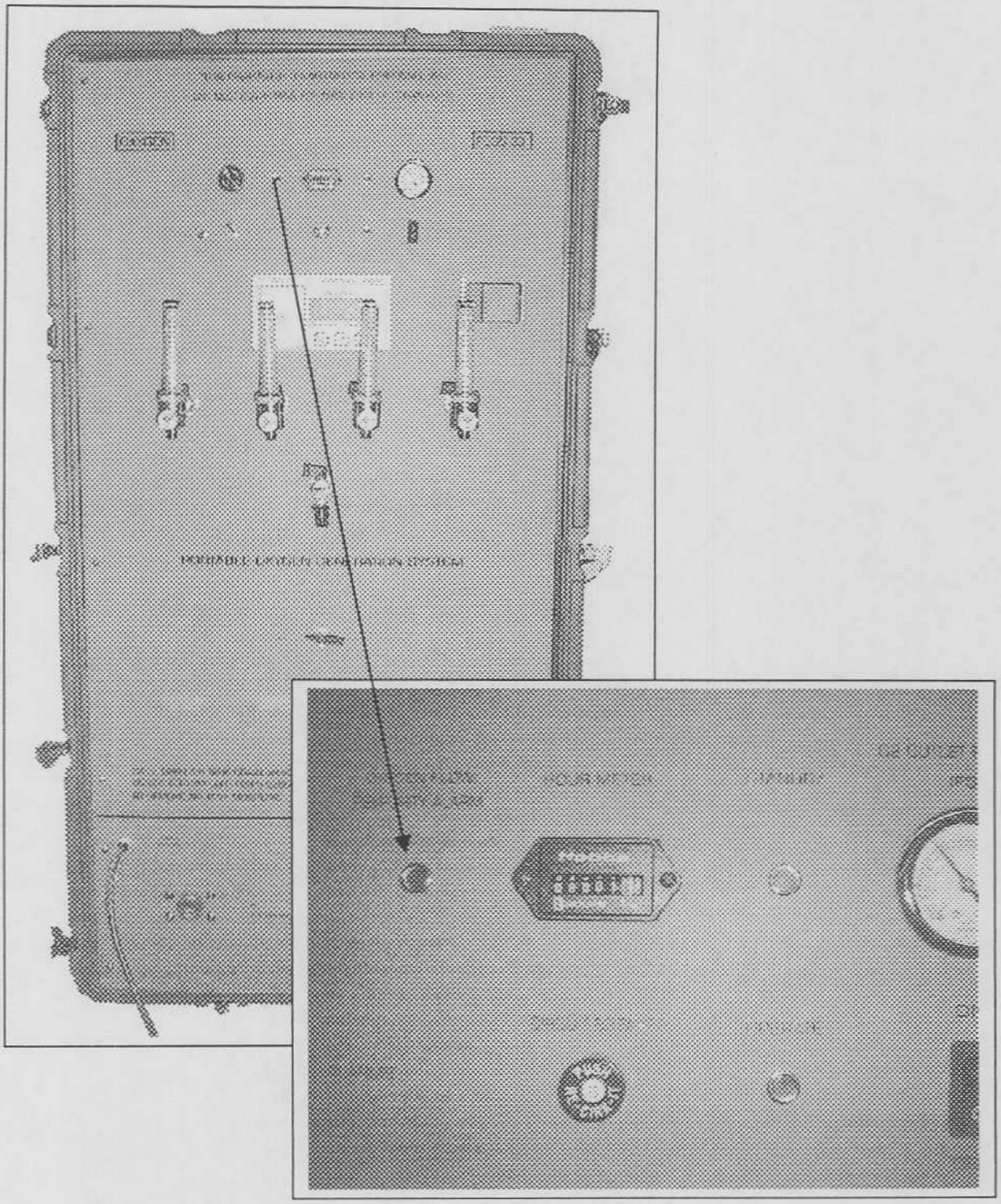
Photograph 13
POGS 3.3
Generator – Main Power Switch



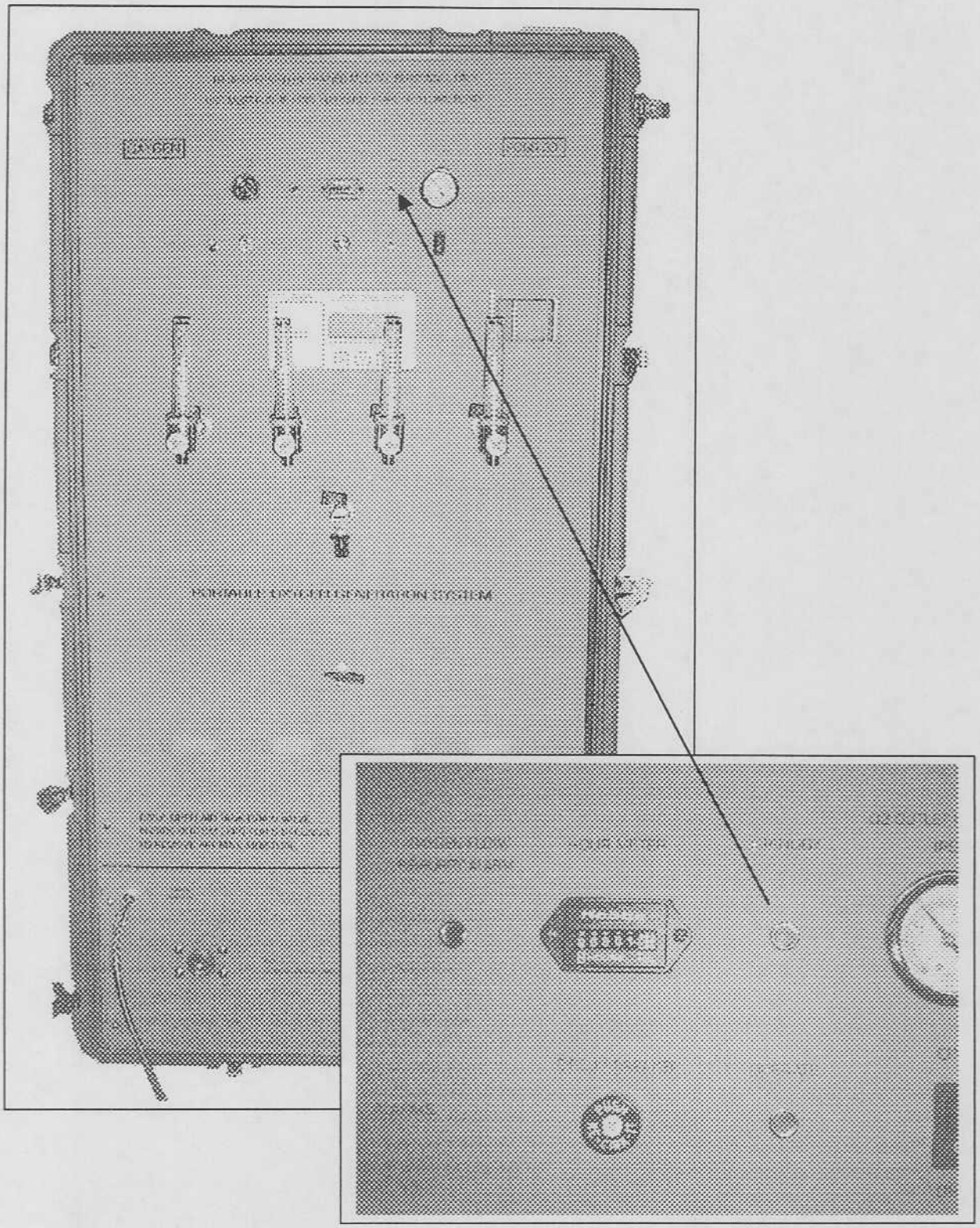
Photograph 14
POGS 3.3
Generator – Power Light: Green



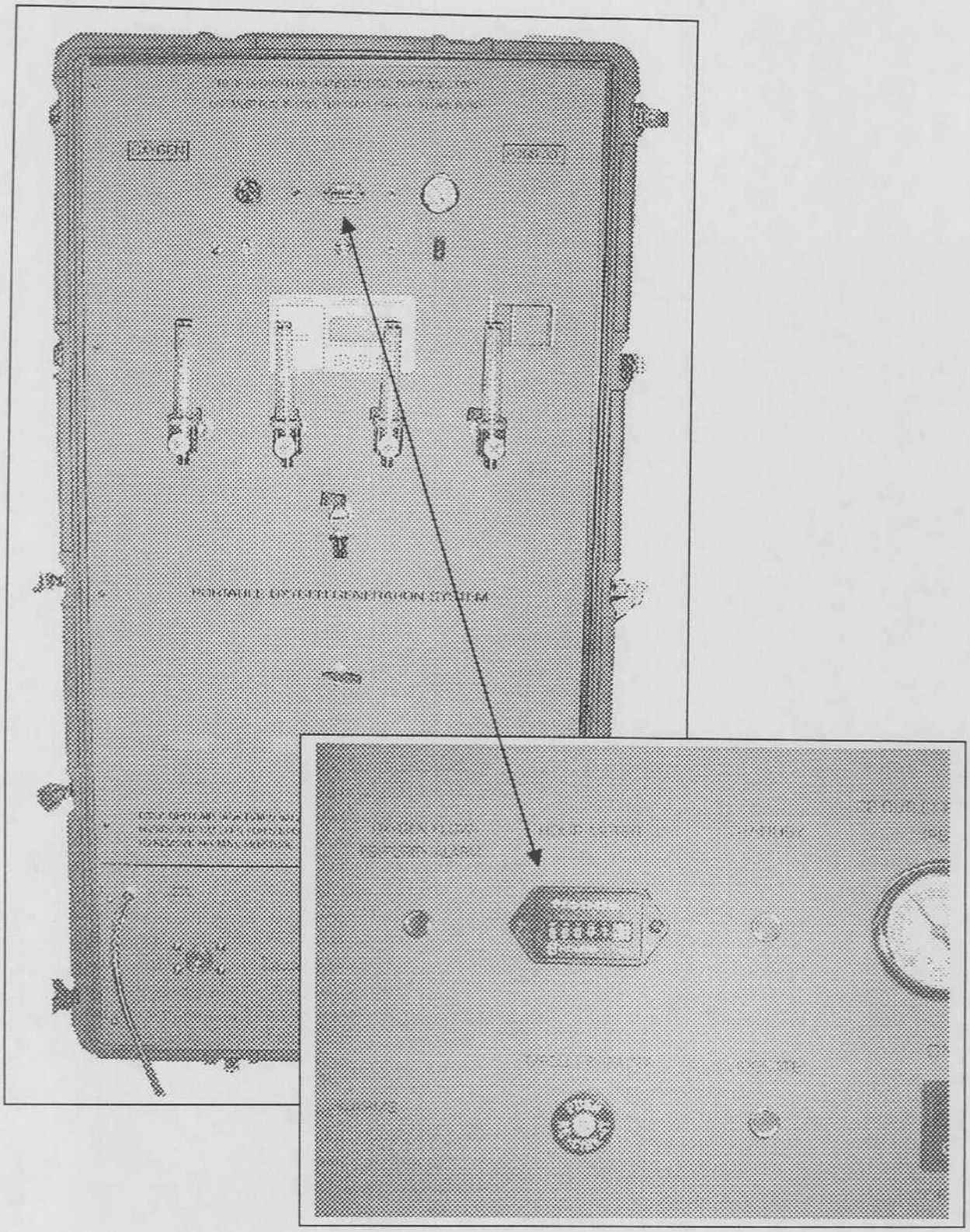
Photograph 15
POGS 3.3
Generator – Alarm Light: Red



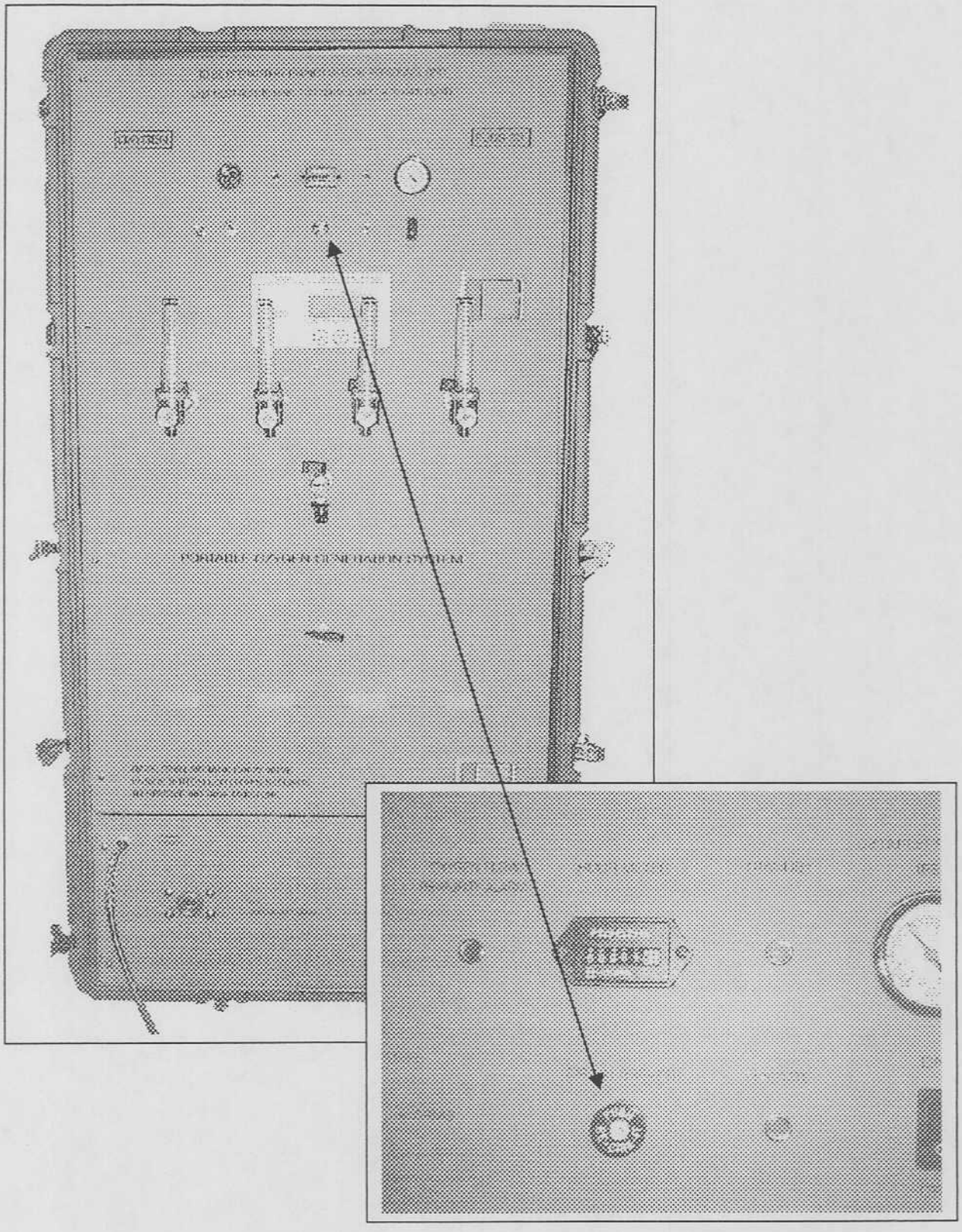
Photograph 16
POGS 3.3
Generator – Standby Light: Amber



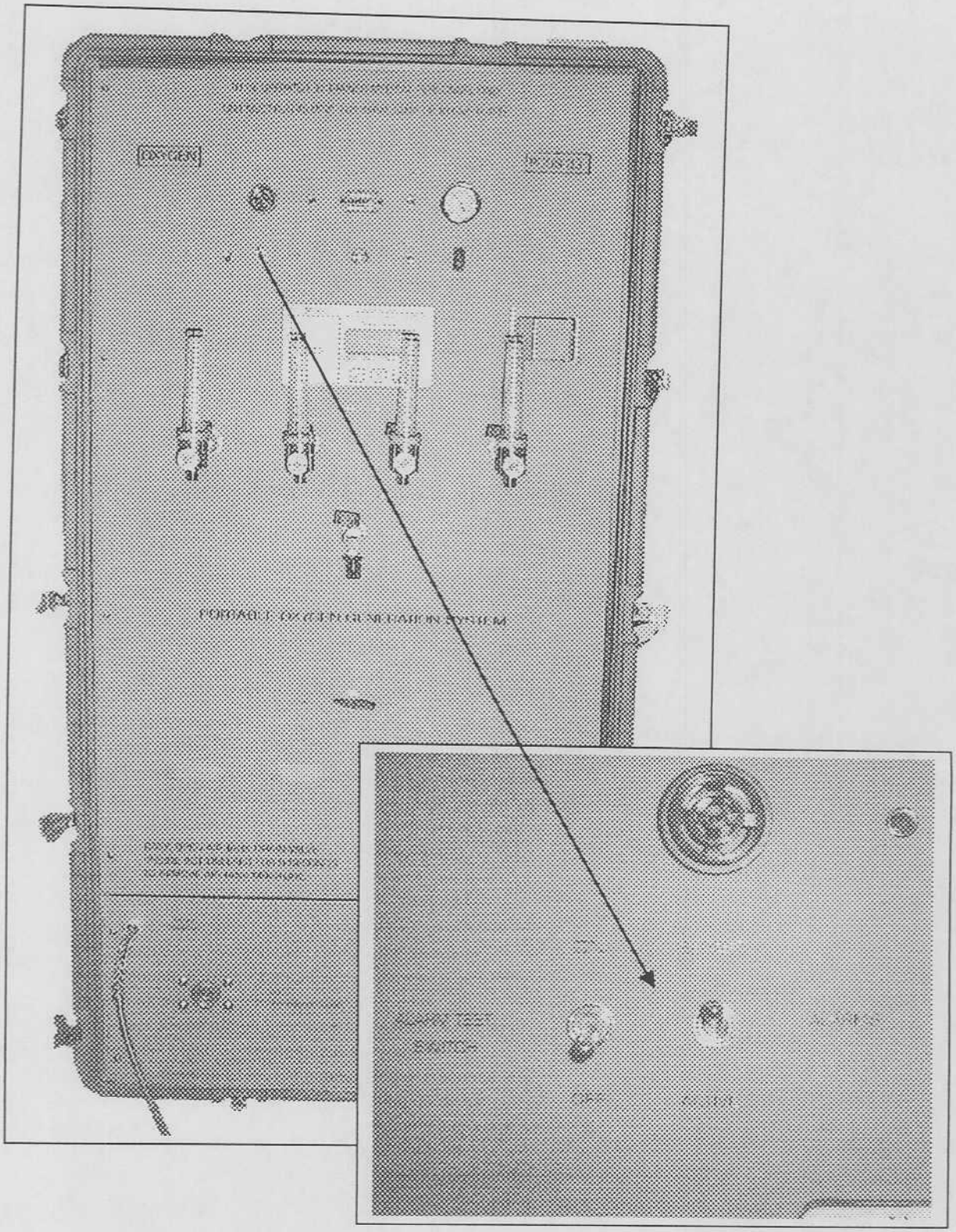
Photograph 17
POGS 3.3
Generator – Hourmeter



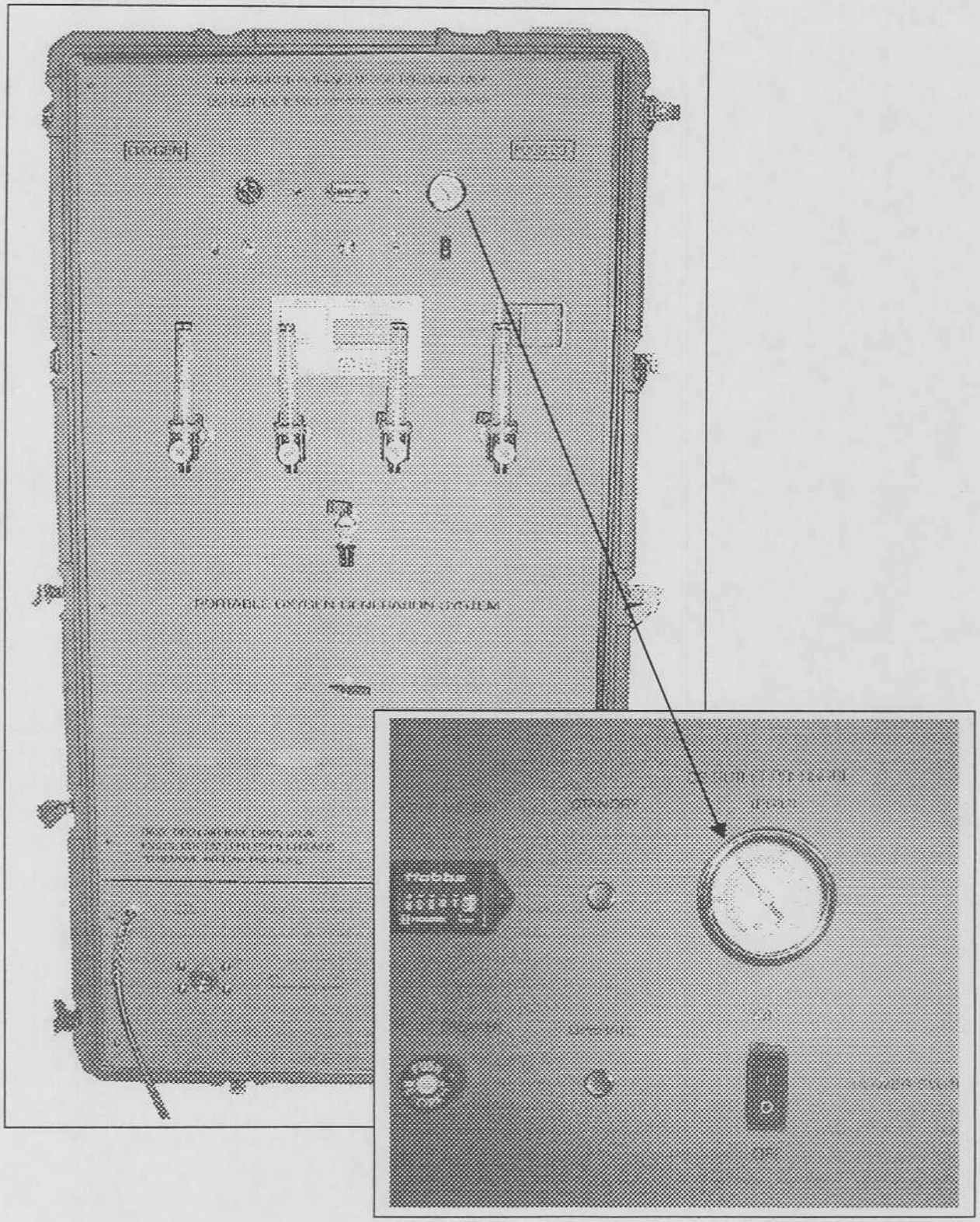
Photograph 18
POGS 3.3
Generator – Fuse



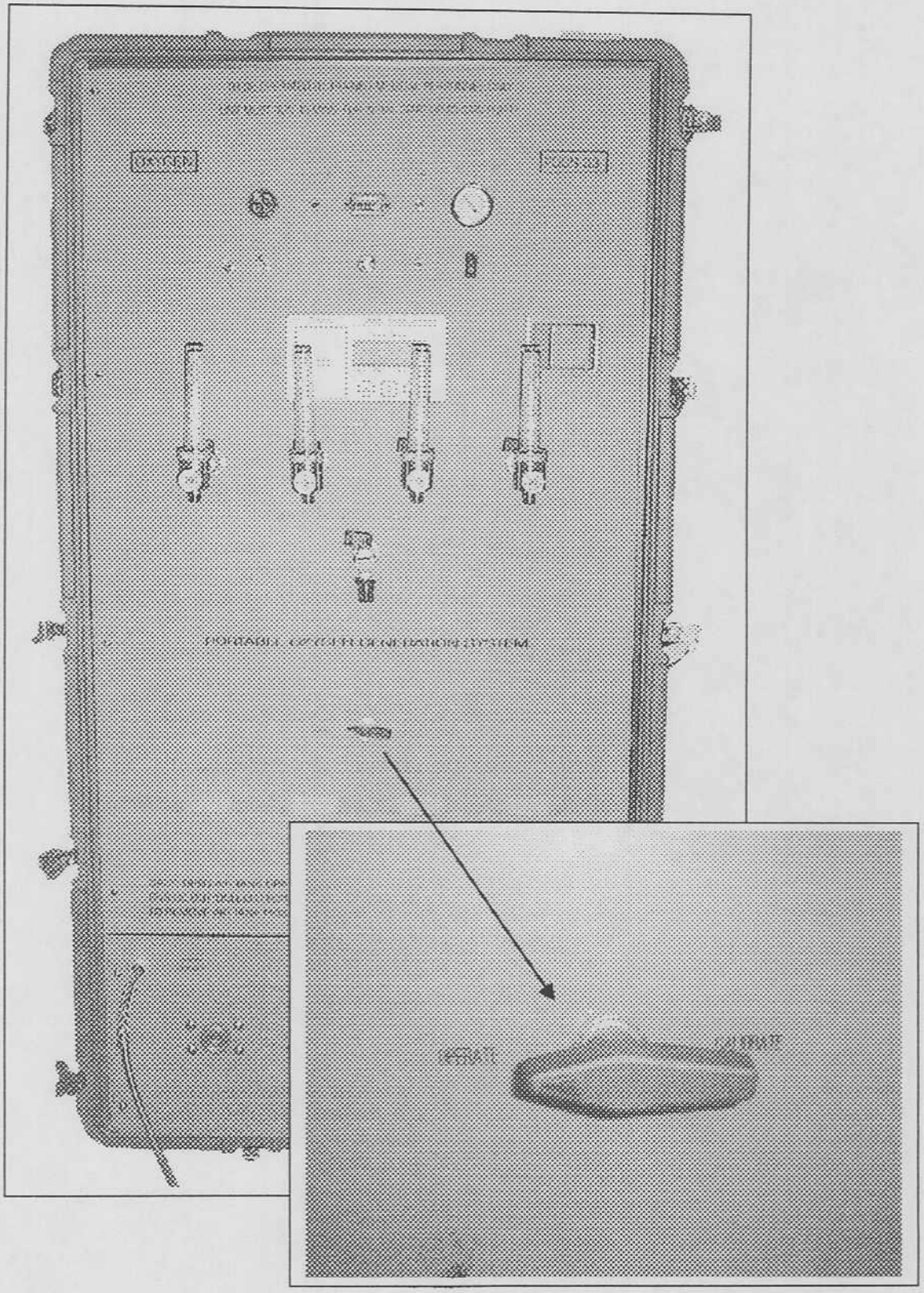
Photograph 19
POGS 3.3
Generator – Toggle Switch



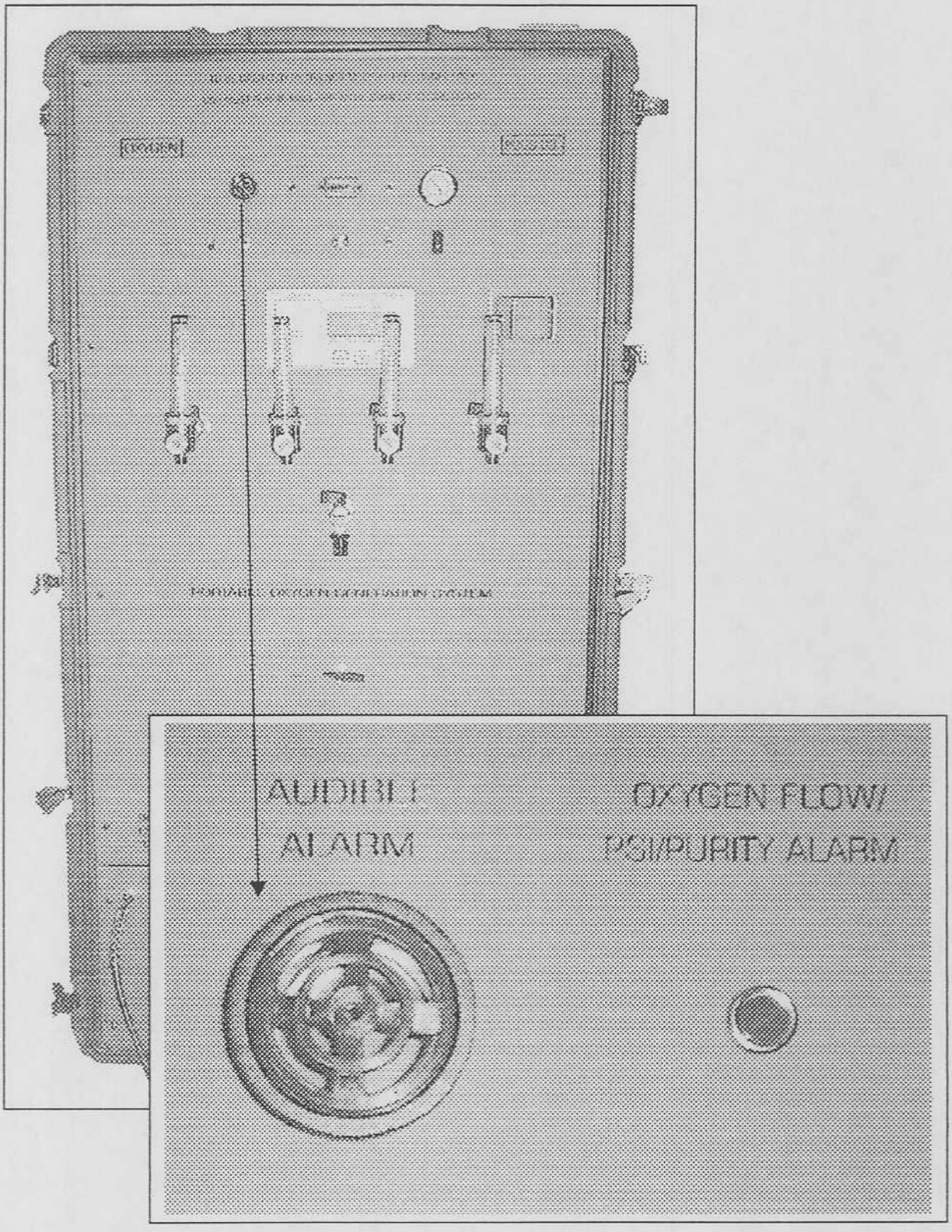
Photograph 20
POGS 3.3
Generator – Oxygen Tank Pressure Gauge



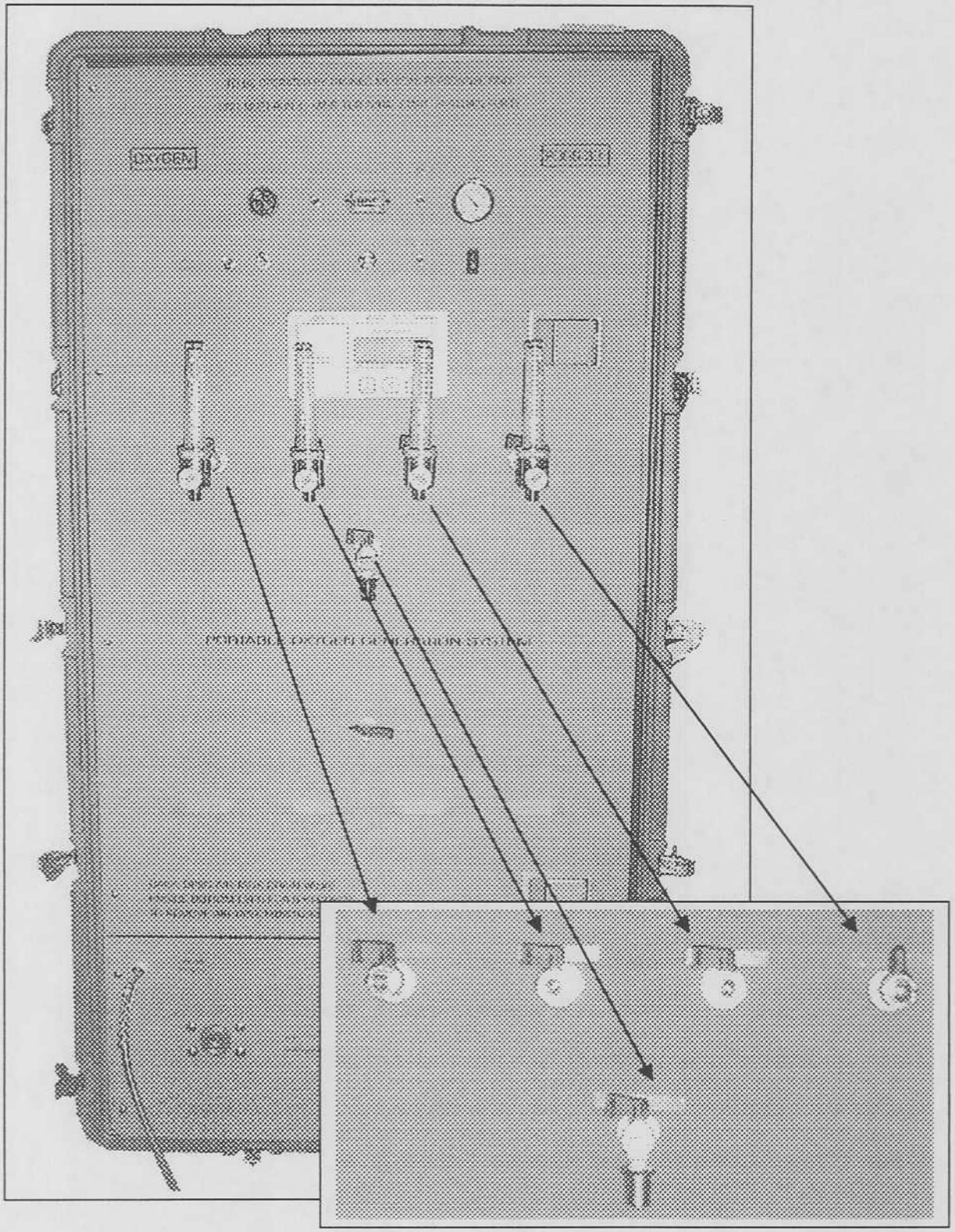
Photograph 21
POGS 3.3
Generator – Calibration Handle



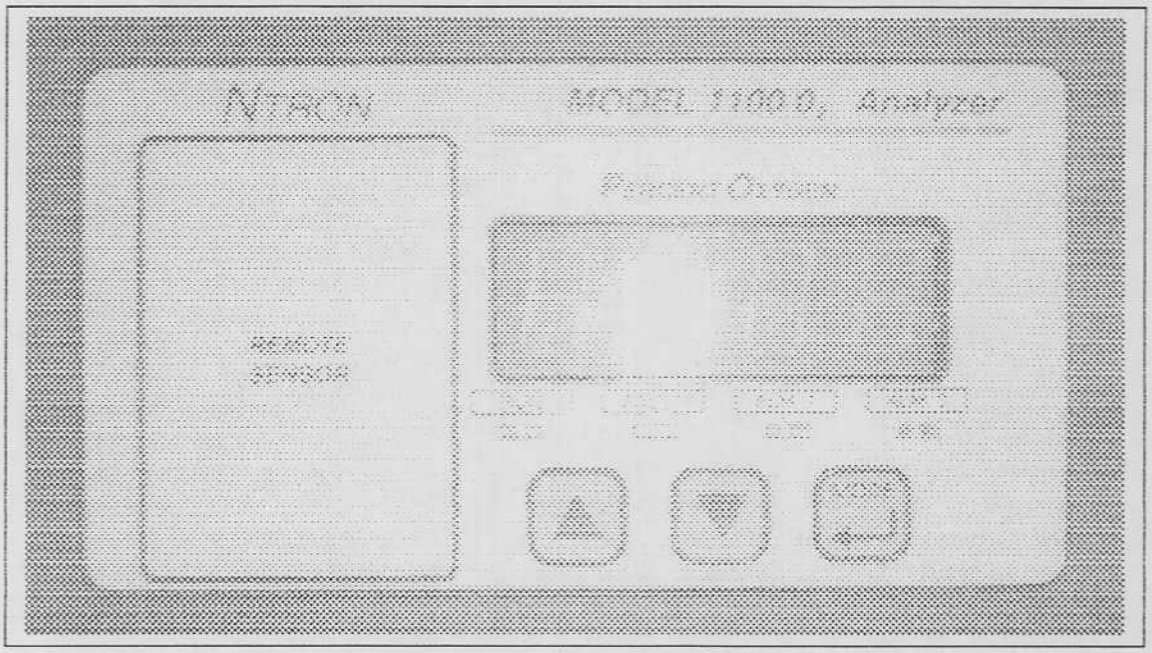
Photograph 22
POGS 3.3
Generator – Audible Alarm

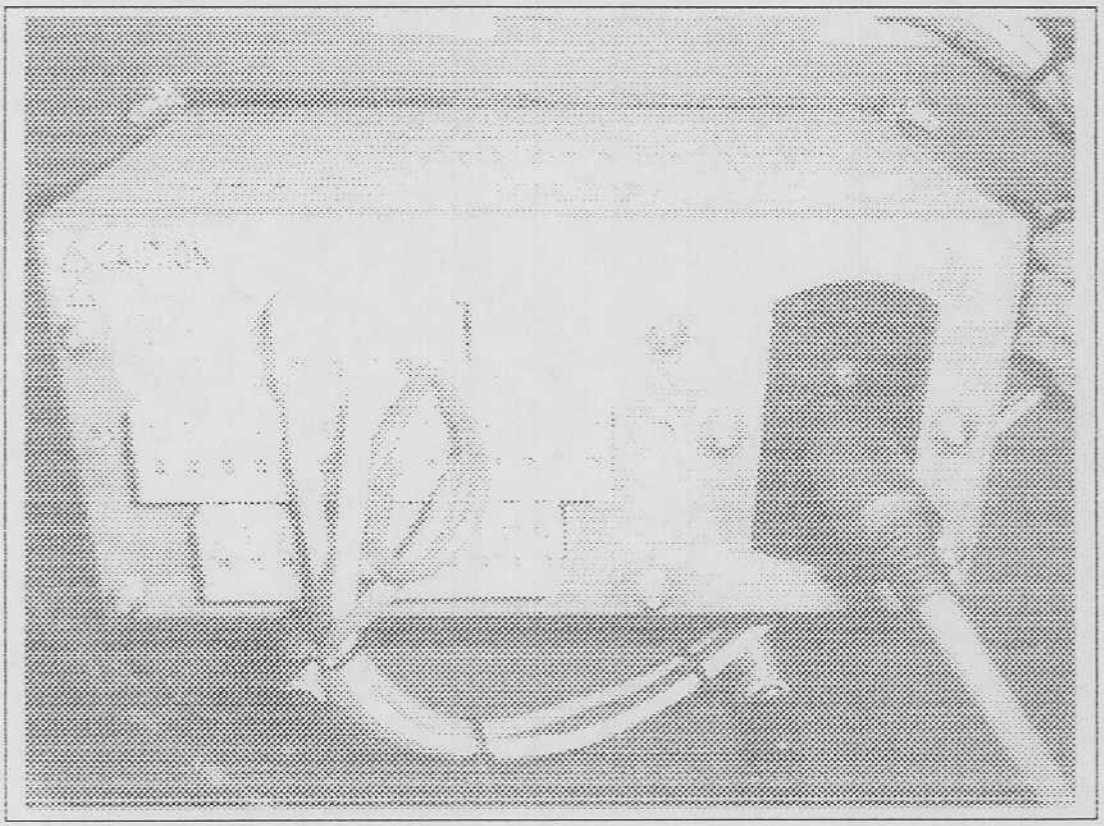


Photograph 23
POGS 3.3
Generator – DISS Fittings

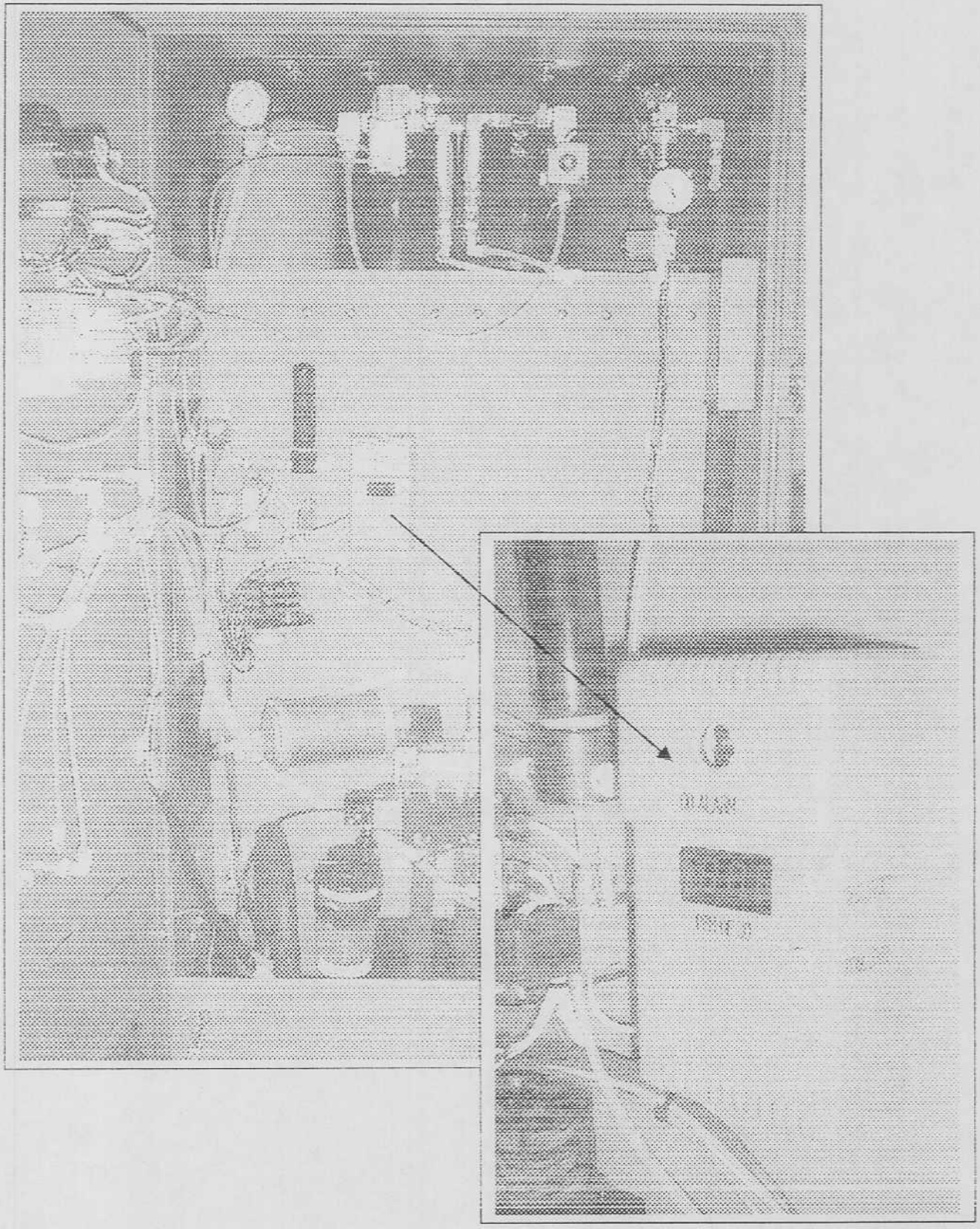


Photograph 24
POGS 3.3
Generator – Oxygen Analyzer: Inside and Outside

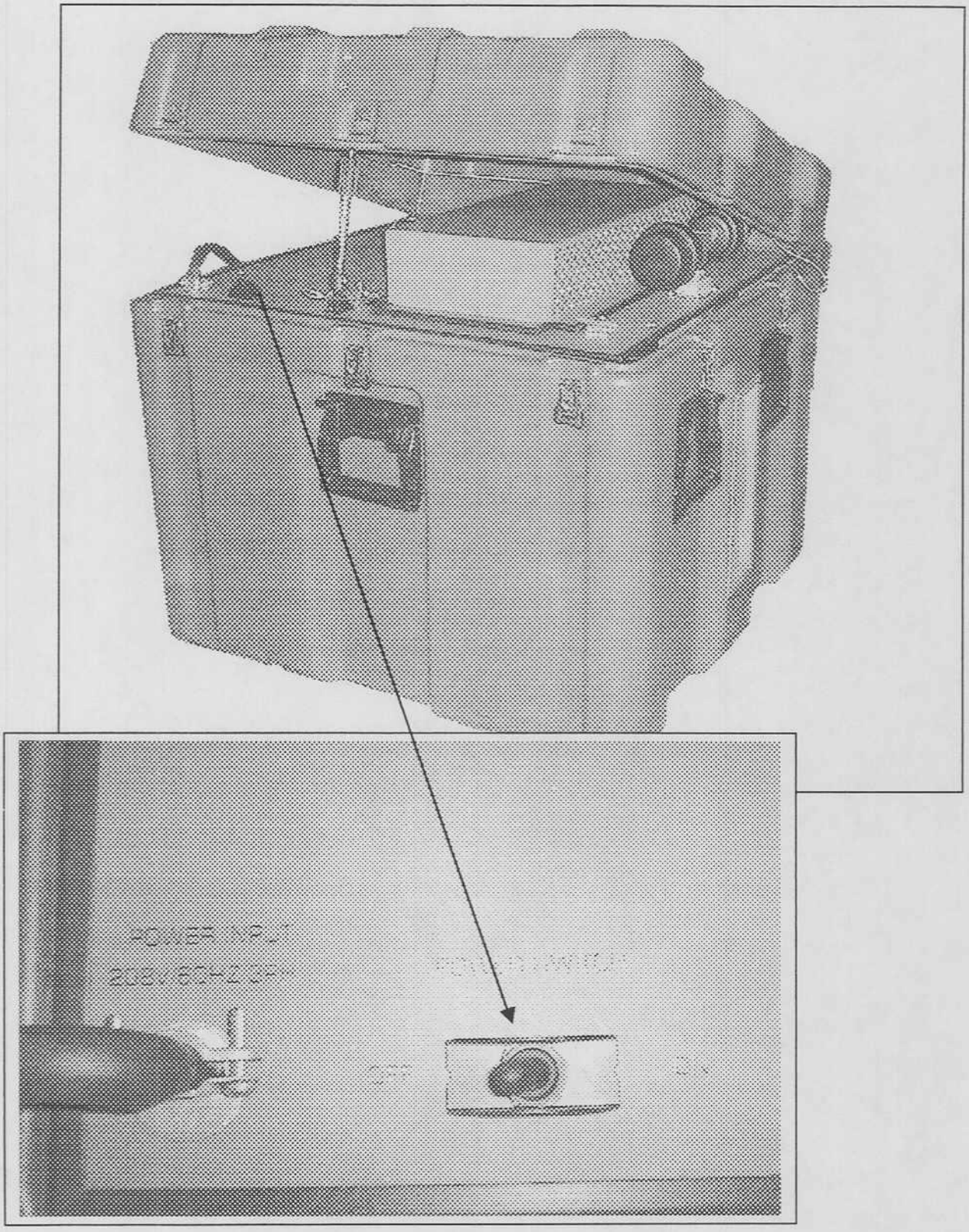




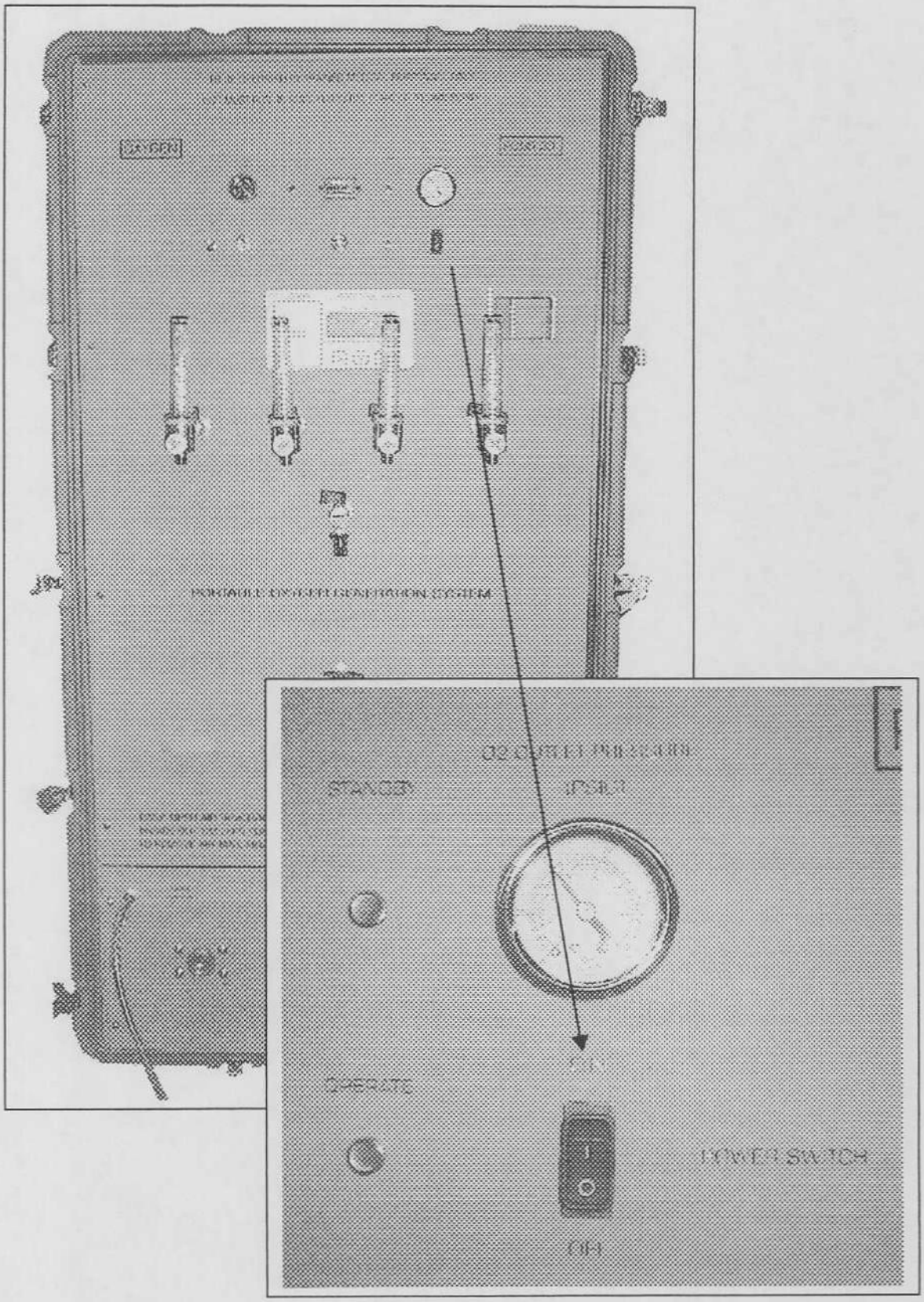
Photograph 25
POGS 3.3
Generator – Carbon Monoxide Alarm



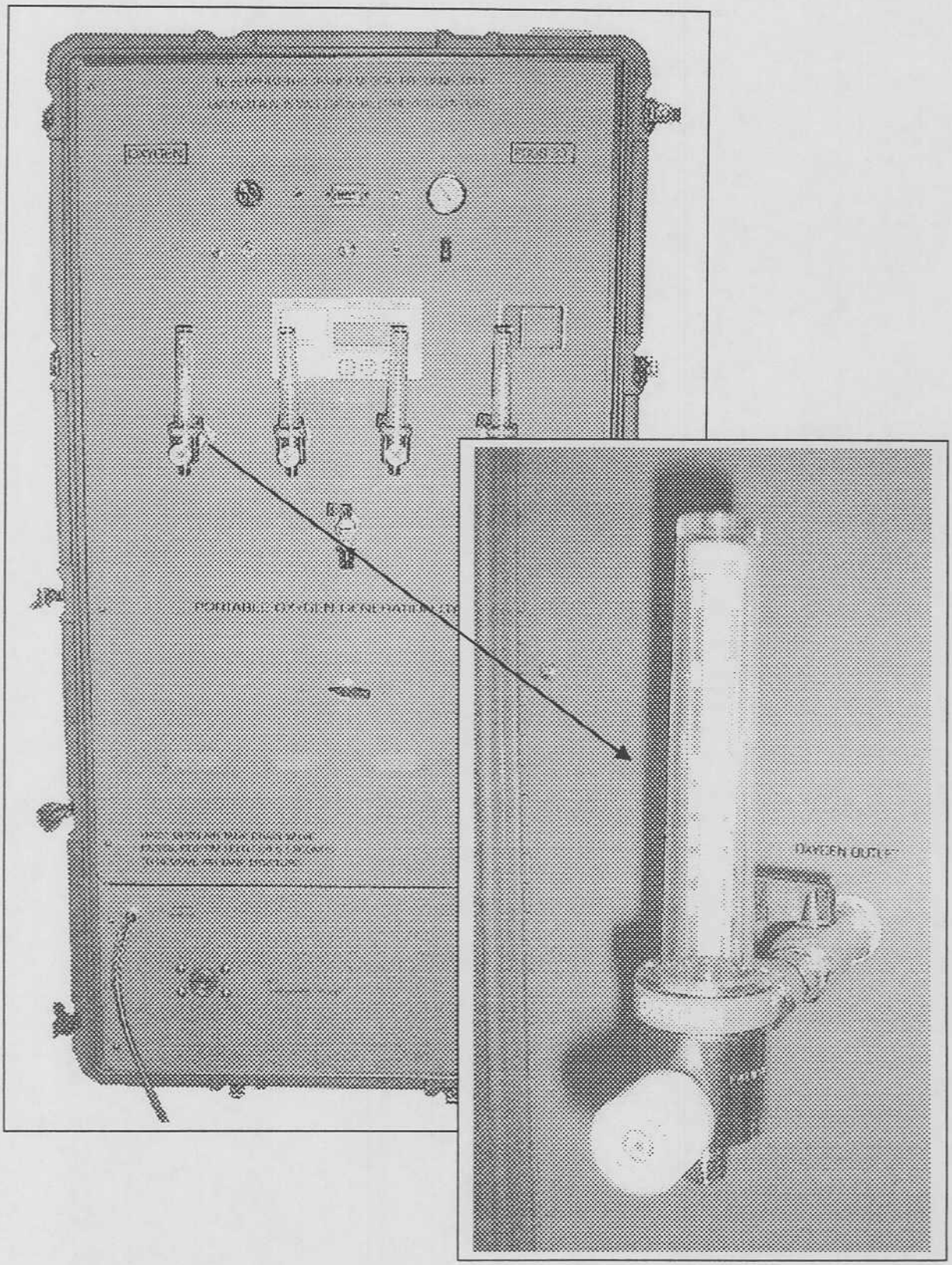
Photograph 26
POGS 3.3
Feed Air Compressor – Power Switch



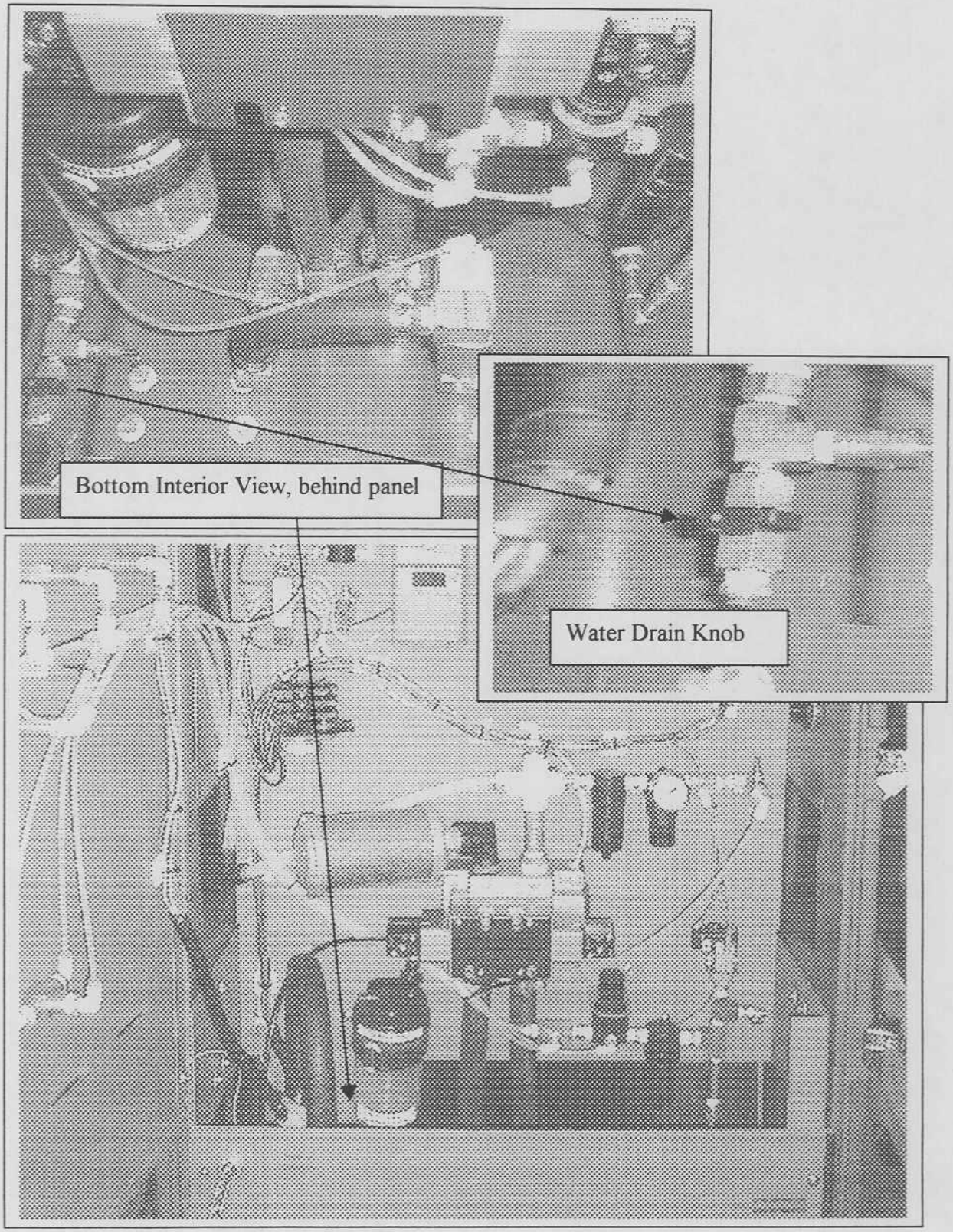
Photograph 27
POGS 3.3
Generator - Flowmeters



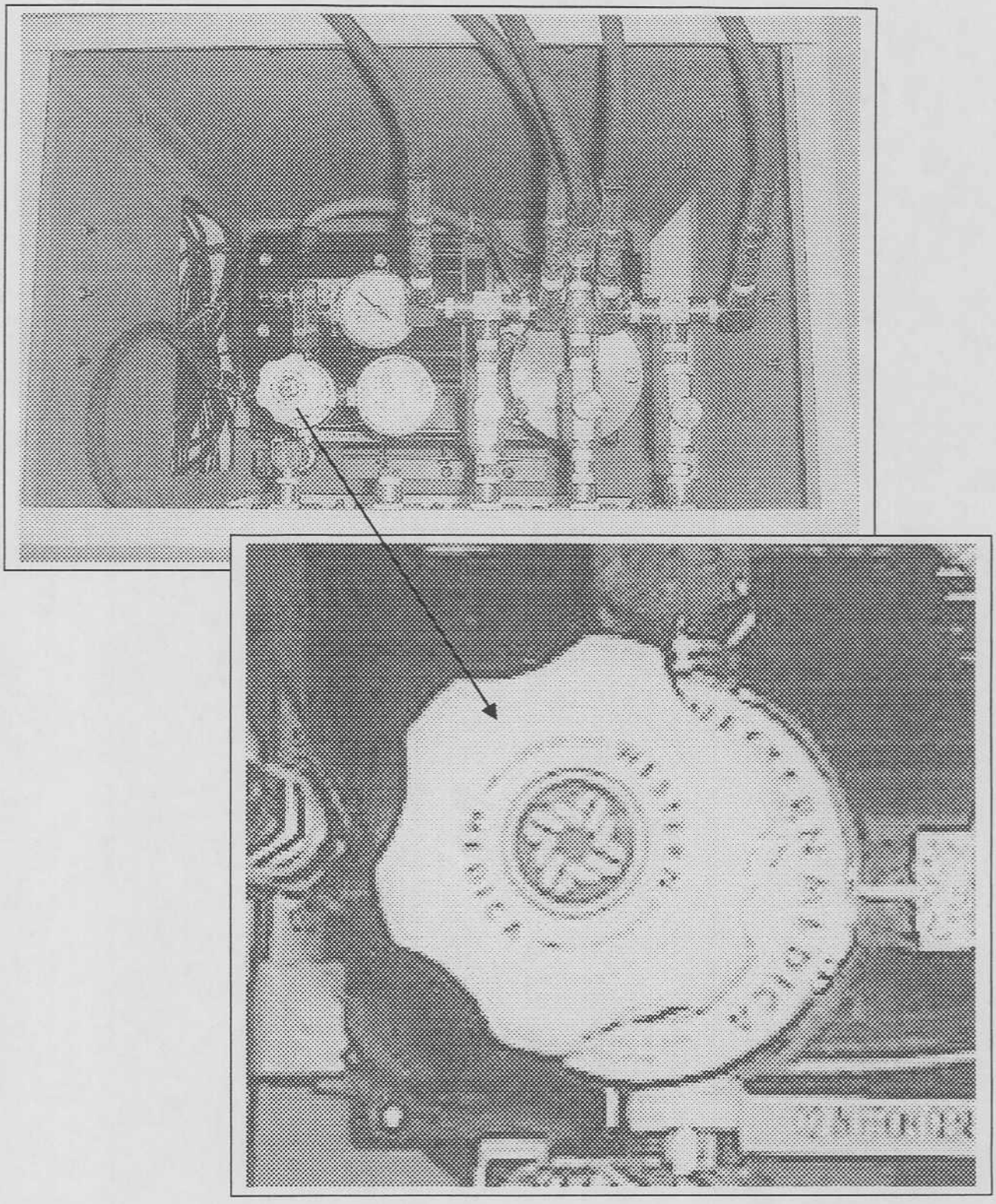
Photograph 28
POGS 3.3
Generator – Flowmeters



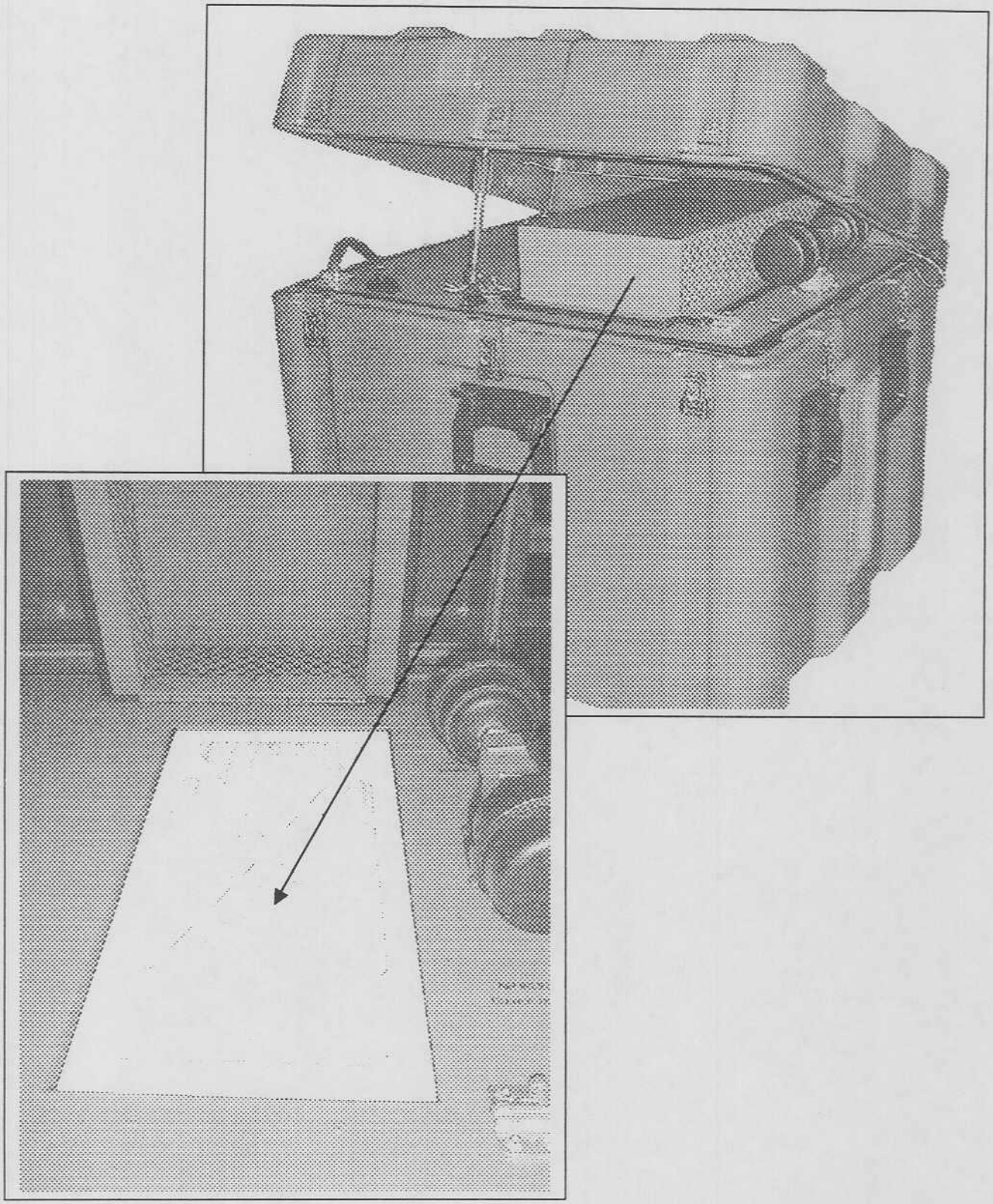
Photograph 29
POGS 3.3
Generator – Water Drain Knob



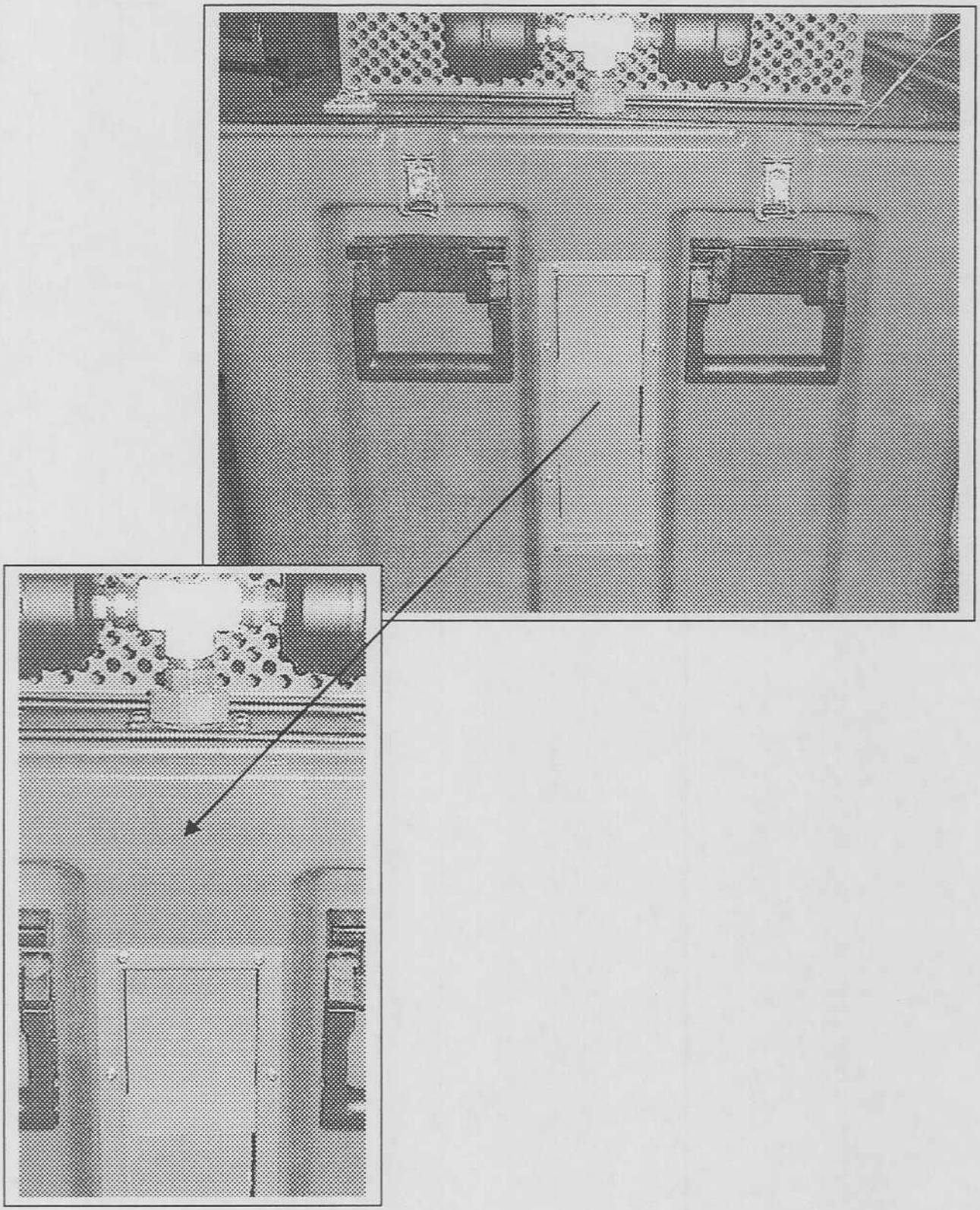
Photograph 30
POGS 3.3
Oxygen Booster – Backup Oxygen: Pressure Regulator Inside Booster



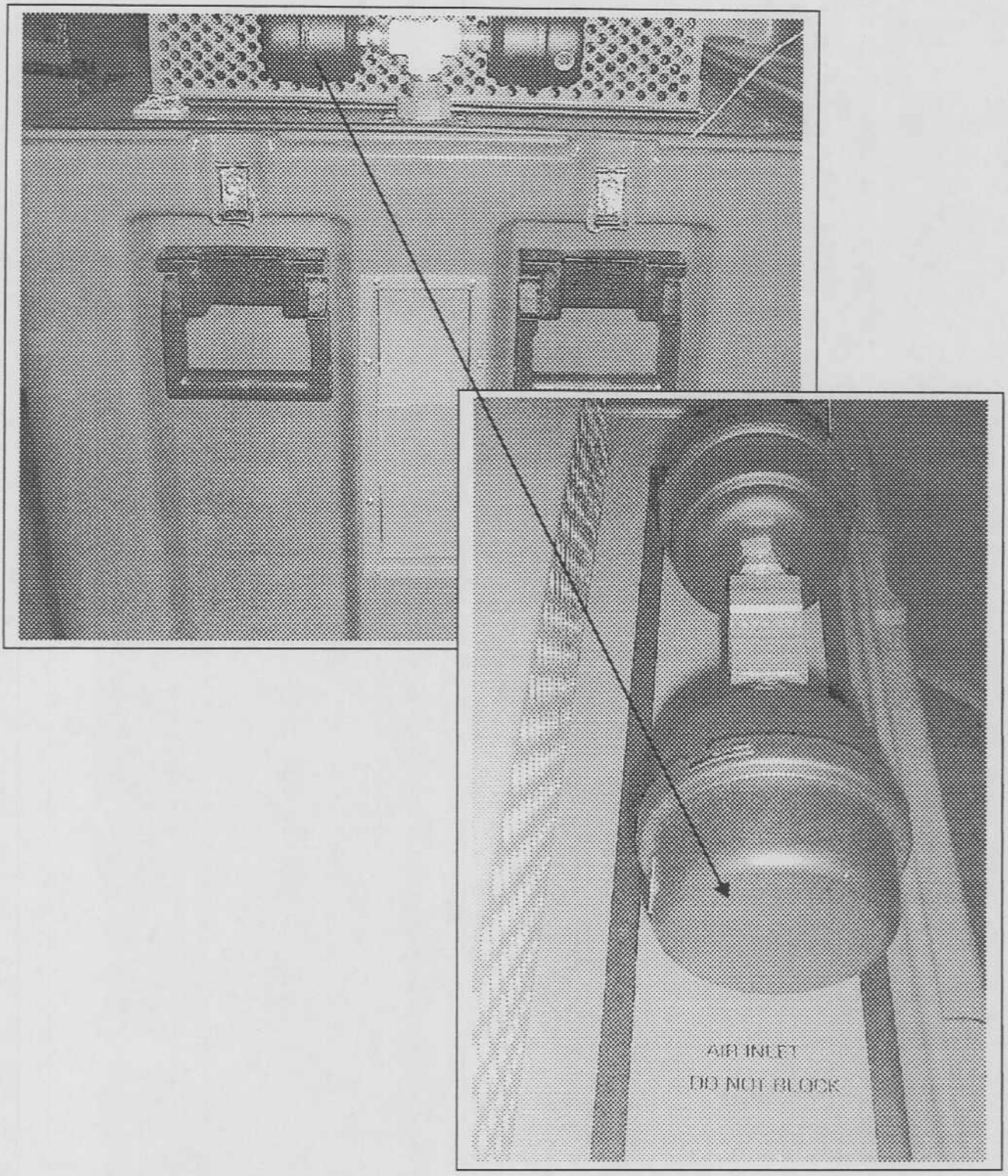
hotograph 31
POGS 3.3
Feed Compressor Compartment Filter Replacement



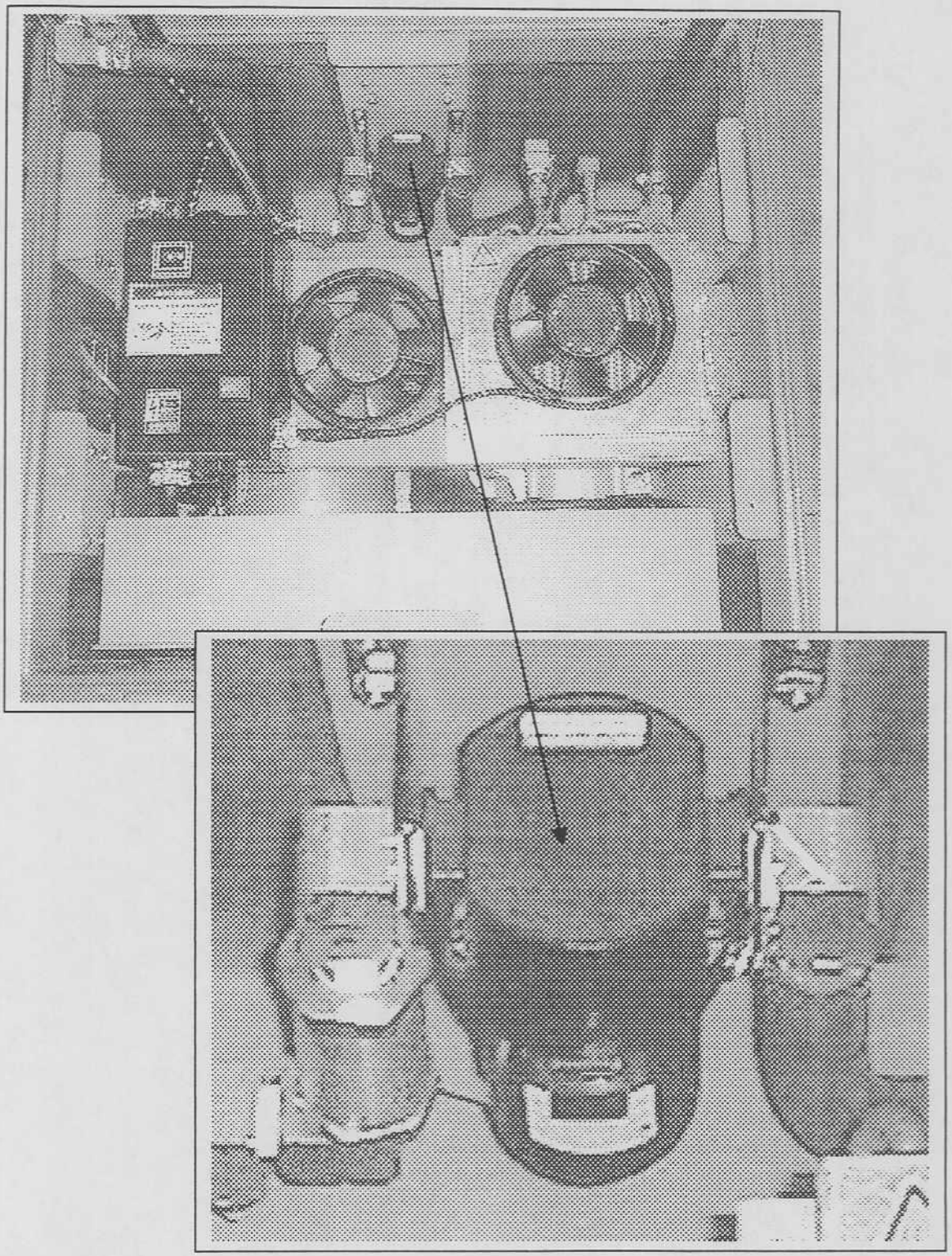
Photograph 32
POGS 3.3
Feed Compressor Outlet Filters Replacement



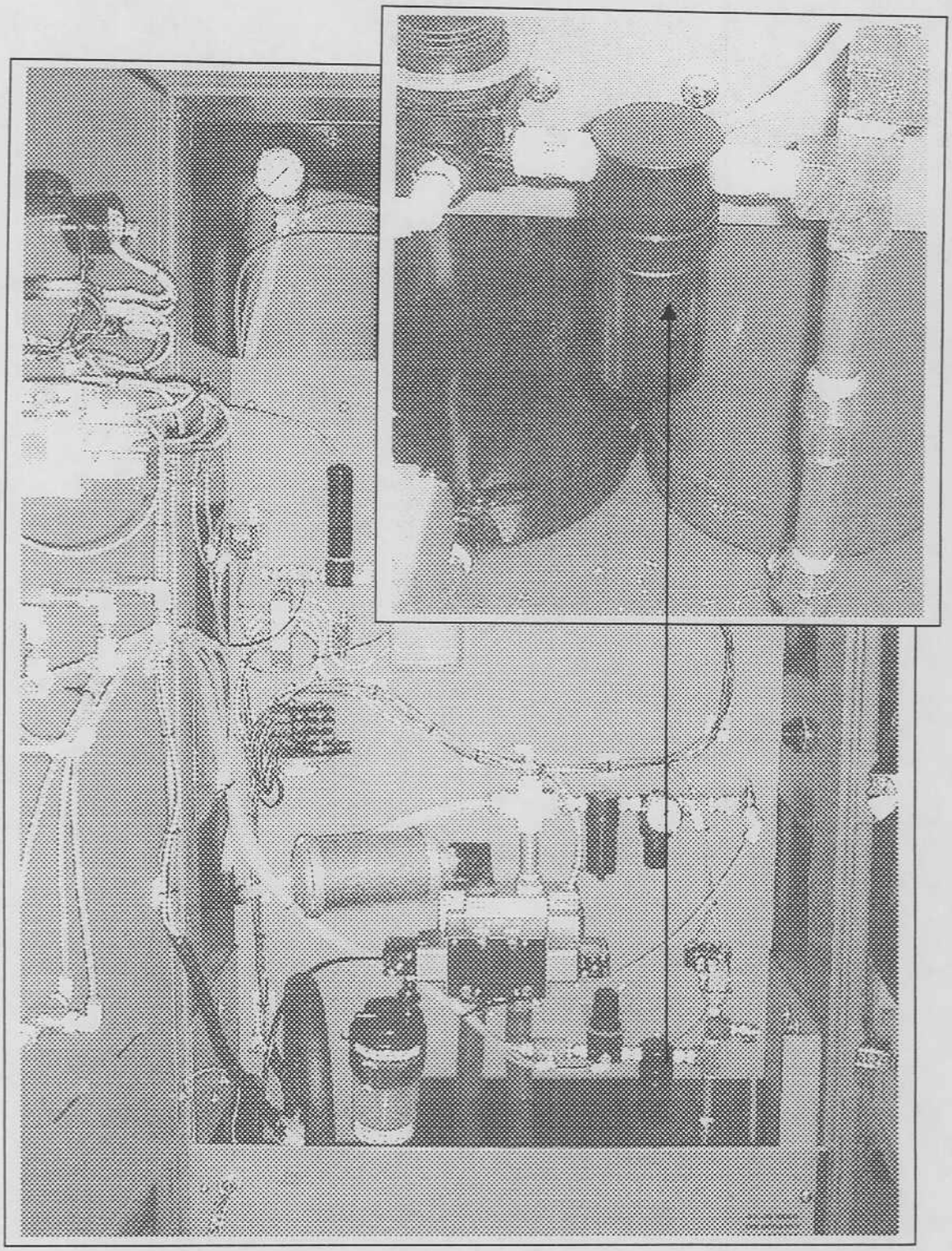
Photograph 33
POGS 3.3
Feed Compressor Air Inlet Filters Replacement



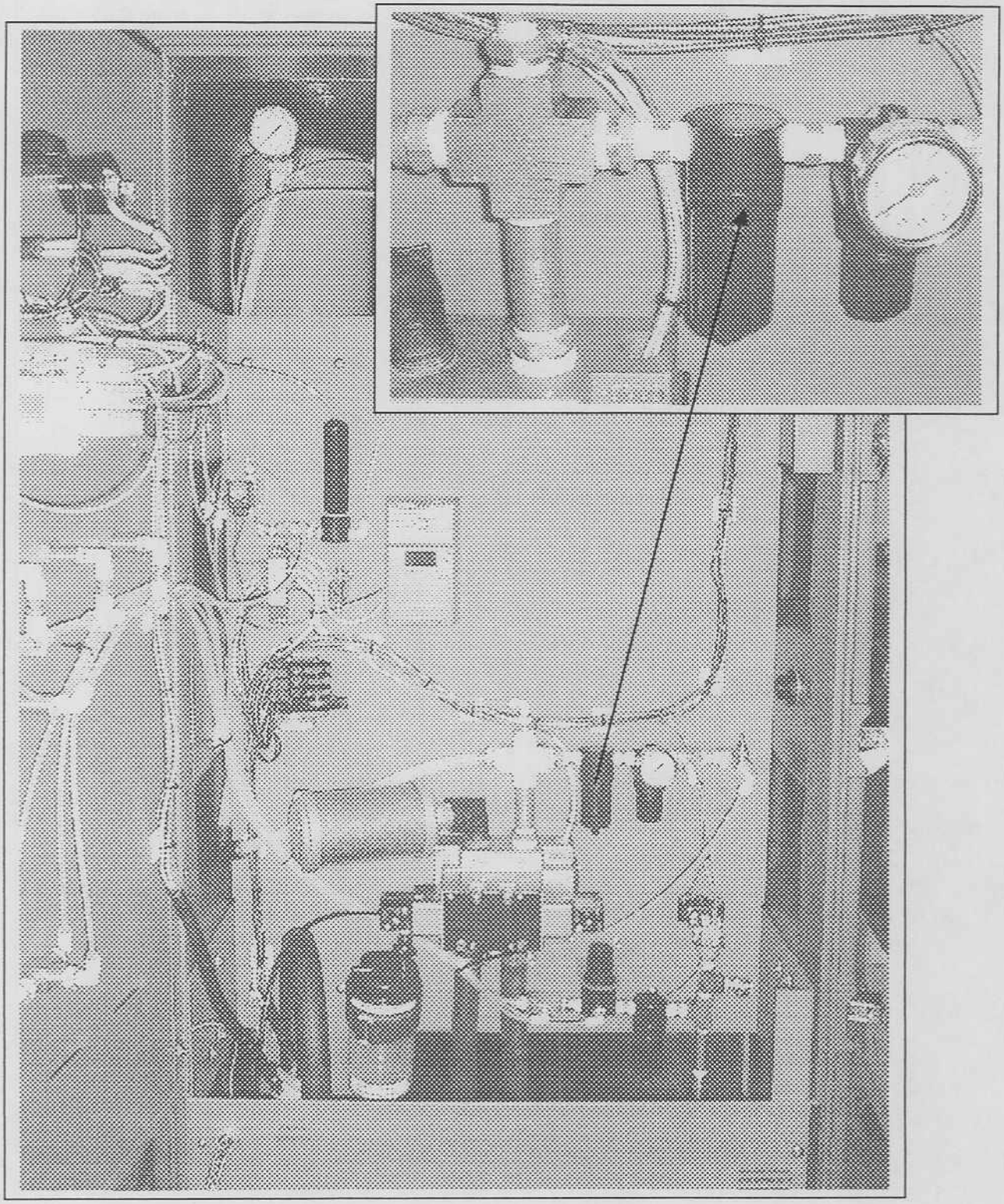
Photograph 34
POGS 3.3
Particulate / Water Trap Replacement



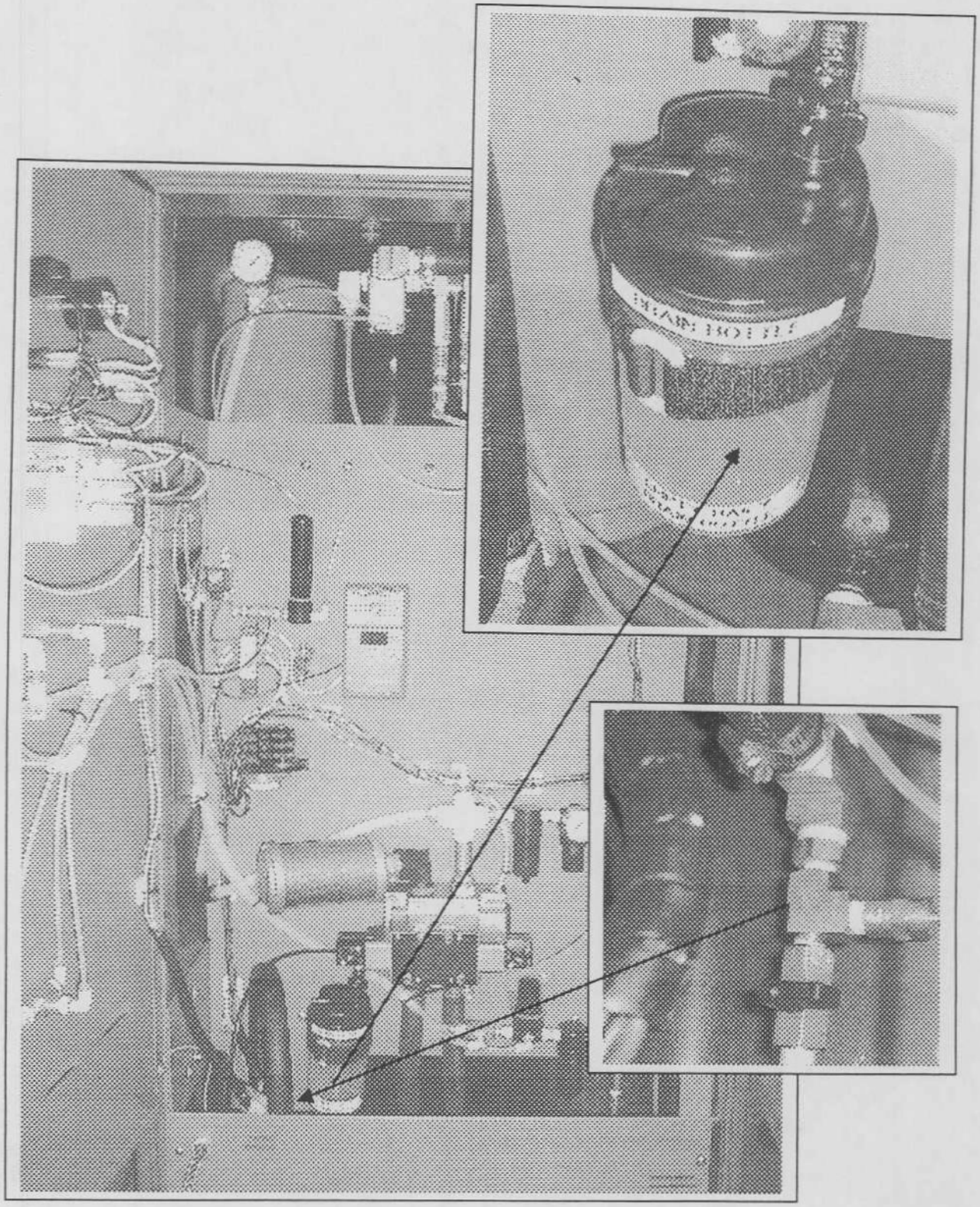
Photograph 35
POGS 3.3
Generator Oxygen HEPA Filter



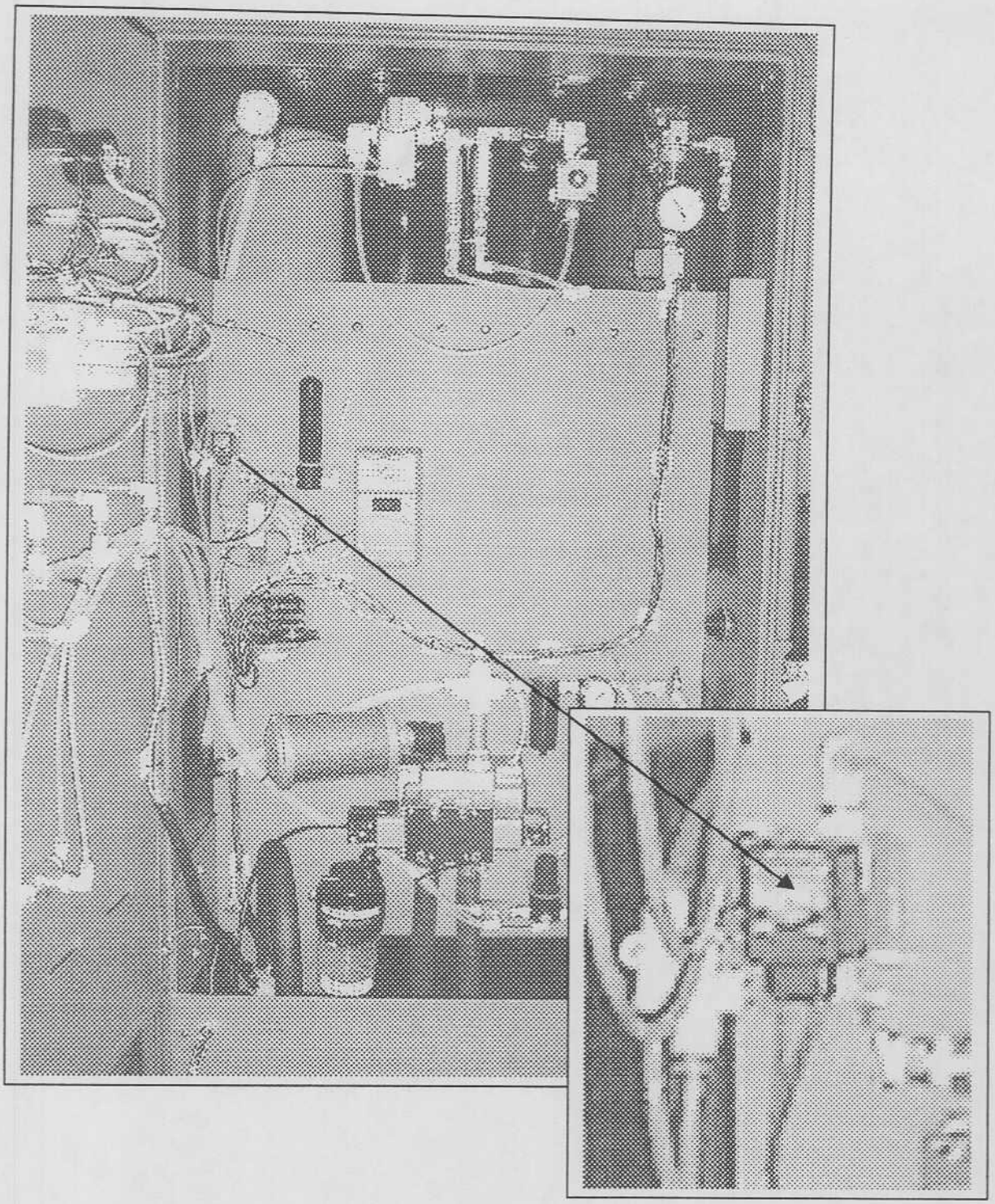
Photograph 36
POGS 3.3
Generator Compressed Air HEPA Filter



Photograph 37
POGS 3.3
Generator Air Tank Water



Photograph 38
POGS 3.3
Generator – Oxygen Analyzer Switching Valve



Photograph 39
POGS 3.3
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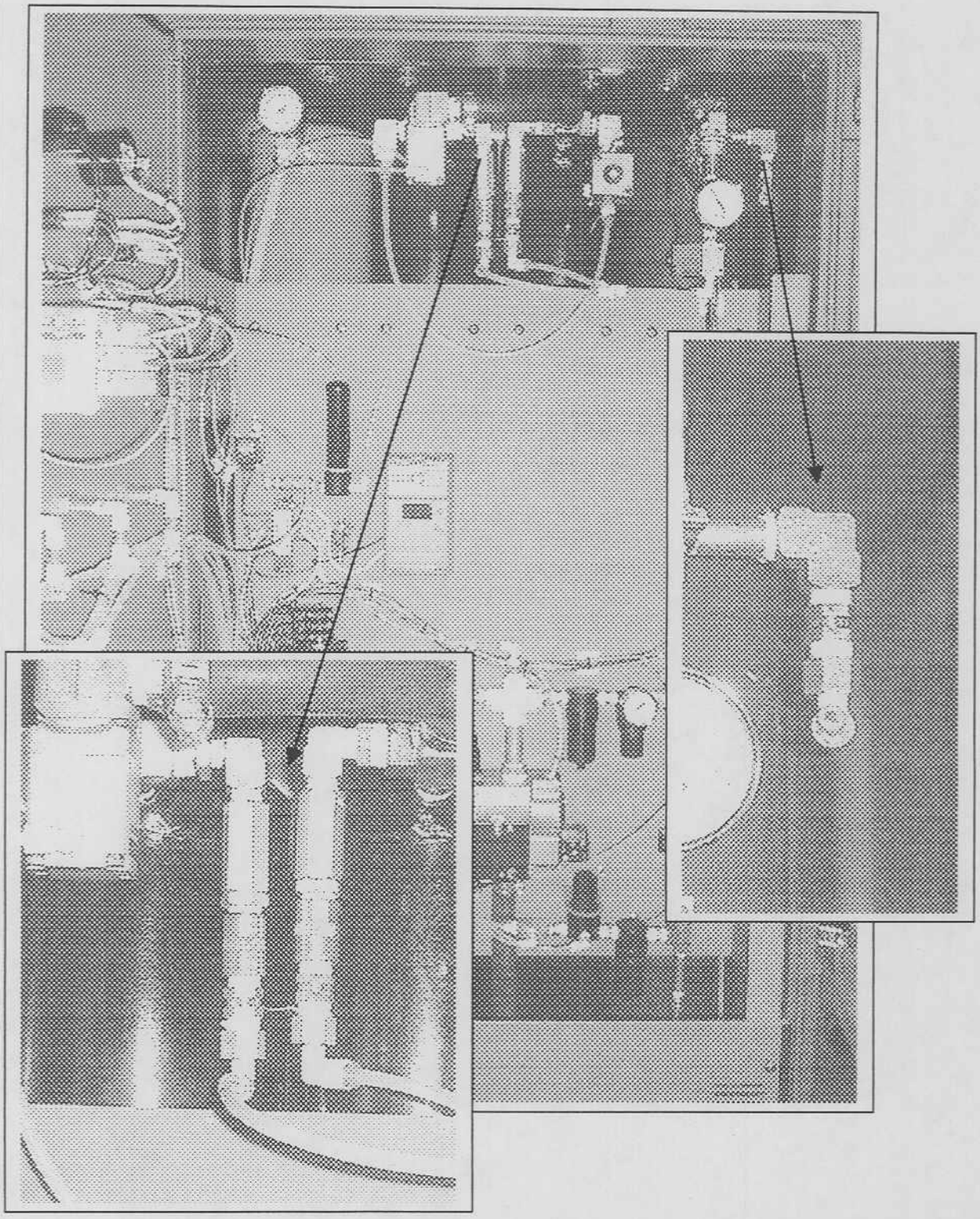

Photograph 40
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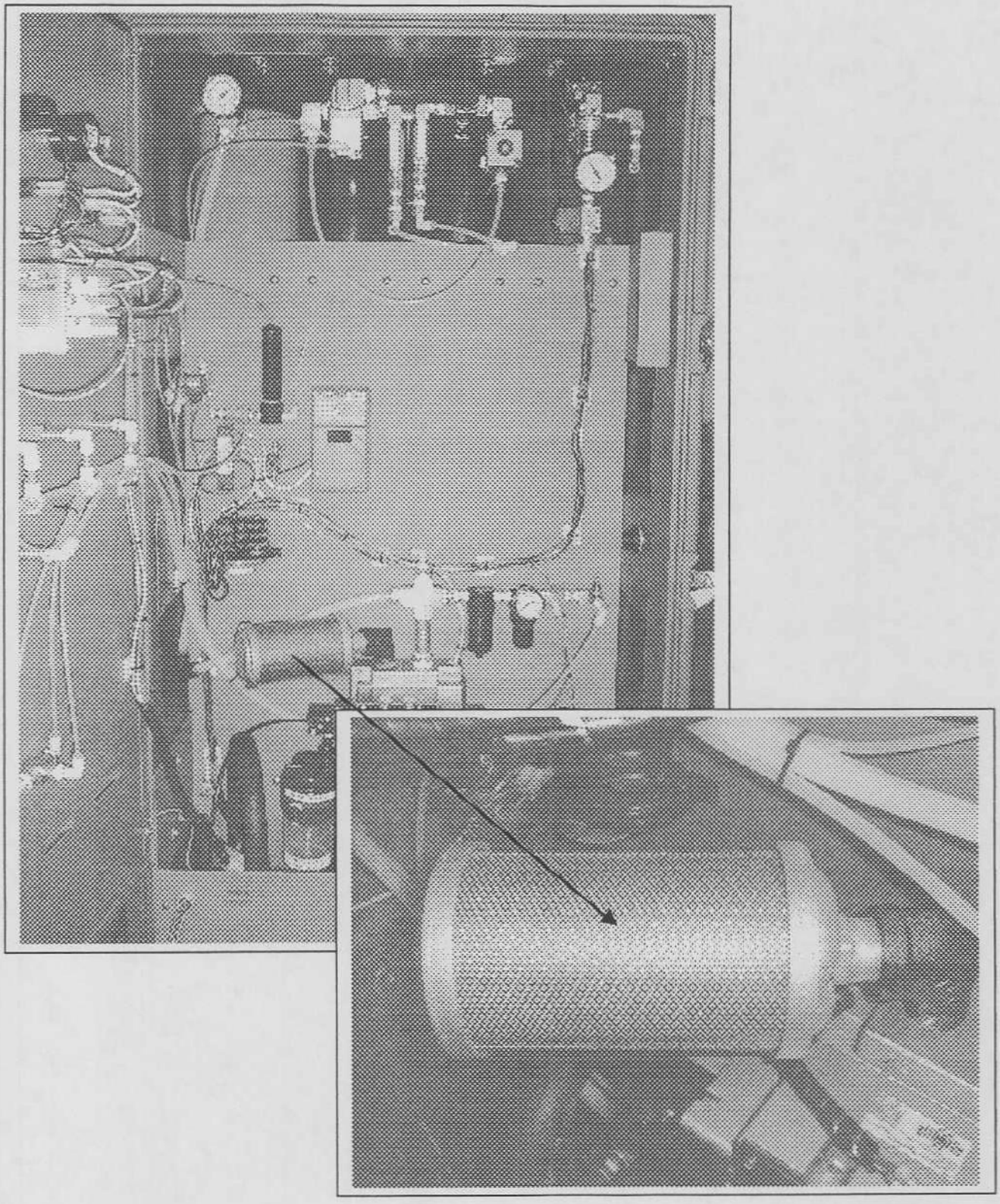
Generator – Muffler for Possible Plug



Oxygen Analyzer

Owners Manual

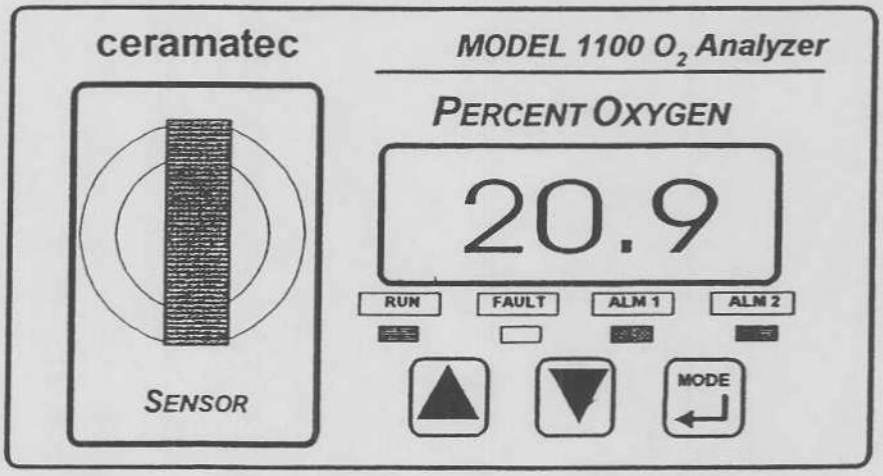
Ceramatec Industrial / Ntron
A Division of Neutronics Inc.
456 Creamery Way
Exton, PA 19341

Ceramatec Industrial / Ntron

MODEL 1100B

COMPACT OXYGEN ANALYZER - PERCENT RANGE

OPERATIONS MANUAL



REVISION 002 October 1998

Introduction

Thank you for purchasing the Model 1100 Compact Series Analyzer for percent range oxygen measurement.

The Model 1100 Compact Analyzer is a user friendly, microprocessor controlled, oxygen measuring instrument. It has many features to offer the user which will be described in this manual. We recommend that all personnel who use this instrument read this manual to become more familiar with its proper operation.

For further detail regarding the maintenance and in-field service of the Model 1100 analyzer, please contact the Ceramatec / Ntron Applications Engineering Department.

If you have questions or comments, we would like to hear from you.

Ceramatec / Ntron Customer Service Department

Ntron Division of Neutronics Inc.
456 Creamery Way
Exton, PA 19341

Tel: (800) 378-2287 (610) 524-8800
Fax: (610) 524-8807
EMAIL: sales@neutronicsinc.com

visit us at .... www.neutronicsinc.com

Product Serial Number

5089IE-18

Table of Contents

For Your Safety:

PLEASE

- ***READ THIS MANUAL IN ITS ENTIRETY BEFORE ATTEMPTING INSTALLATION OR OPERATION!***
  Attempting to operate the Model 1100 without fully understanding its features and functions may result in unsafe conditions.
- Always use protective eye wear and observe proper safety procedures when working with pressurized gases.
- Always remove the shorting clip from the MAXCELL-21 sensor or the freshness seal from the MAX-250E sensor before using.
- Always assure the pressure of gas entering the Model 1100 is 1-3 psig.
- Always calibrate the Model 1100 at an equivalent pressure and flow rate to the measured gas.
- Always calibrate the MODEL 1100 whenever the point of use elevation changes more than 500 feet (i.e.: Mexico City vs. San Diego,...).
- Properly dispose of the oxygen sensor when it has expired.
- Ensure the protective freshness seal has been removed from the sensor before use.
- Ensure the MODEL 1100 has been properly calibrated before use.
- Never expose the analyzer chassis or sensor to water, high humidity or moisture. The analyzer chassis is not watertight.
- Never expose the MODEL 1100 to flame or high temperatures. Never expose the Model 1100 analyzer to flammable gases or vapors. The 1100 is not rated Intrinsically Safe.
- Never expose the MODEL 1100 directly to unregulated gas lines, cylinder gas, ... High gas pressures may cause the oxygen sensor to rupture.
- Ensure the analyzer unit is mounted in an area of free air flow to prevent the chassis from exceeding the operating temperature specifications. Do not mount the analyzer or sensor against hot surfaces. Do not block the ventilation louver on the analyzer chassis.

Figure 1 Model 1100 Specifications August 1998, Rev 1.

Sensor Type:	Galvanic Cell (lead-oxygen battery) Weak Acid or KOH electrolytes available as required for the application. Front access panel or remote mounted.
Measurement	0-1% /0-10% /0-25% /0-50% /0-100% oxygen. May be set to auto range over the upper or lower three indicated ranges or may be set to a fixed range.
Display:	0.75" LED digital display. Resolution: 1% Range: .XX, 10% Range: X.XX, 25% / 50% / 100% Ranges: XX.X Color Coded LEDs for system status: Alarms 1 & 2 = **Red**, System Fault = **Yellow**, System OK & on-line = **Green**
Signal Interface	**Serial Service Port: RS-232 Computer Communications** of the following data: Oxygen Concentration, alarm settings/status, Fault status **Analog Outputs:** Voltage, 0-1 VDC or 0-5VDC or 0-10VDC +/- 0.5% @ 1K input min. Non-isolated 4-20 mA: +/- 0.5% , negative ground (loop is powered by analyzer) maximum loop impedance 500Ω. Range ID Voltage output
Alarm Outputs.	Relay dry contacts rated 5Amp @ 250 VAC, 5 AMP @ 30 VDC Alarm 1 & Alarm 2: Field adjustable Form C, Configurable for Fail Safe or Fail Alarm mode, Ascending or Descending trip. Fault alarm: 1 Form B . Status LEDs for each alarm.
Response Time:	< 15 seconds for 90% response due to step change in oxygen% @ 1 LPM flow
Accuracy:	± 2.0% Full Scale @ constant temperature and pressure ± 5.0% Full Scale over operating temperature and pressure ranges
Warm up Time:	Approximately 20 minutes to reach thermal equilibrium with ambient temperature.
Power:	115/230 VAC, 50/60 Hz., Single Phase, or 12-30 vdc, 5 watts, battery backup:12 vdc
Sample Port:	1/8 inch NPT Female (lower port: sample input, upper port: sample output)
Operating Temperature:	5° to 40° C (31 - 104° F)
Storage Temperature:	-15° to 50° C (5 - 122° F)
Humidity:	0-95% non-condensing
Warranty:	Analyzer: 12 months, MAXCELL-21 sensor: 6 months, MAX-250E sensor: 24 months from date of shipment under normal operating conditions.
Sample Flow:	0.1 to 1.0 SLPM constant (regulated 1 to 3 psig), (note: 0.1 SLPM typical)
Weight:	Less than 2 Lbs
Mechanical:	Faceplate Dimensions: 3.75 inch x 7.00 inch suitable for NEMA type 4, IP66 Cutout Dimensions: 2.91 inch H x 6.20 inch W Electronic Compartment: 2.81 inch H x 5.98 inch W x 3.60 inch Deep, NEMA 1, IP20

Neutronics, whose policy is one of continuous improvements, reserves the right to change specifications and this operation manual's content without notice. **Revision 1, August 1998**

Neutronics Inc.
Warranty Statement

Neutronics warrants to the original purchaser, that the Model 1100 oxygen analyzer is free from defects in material and workmanship for a period of one (1) year from the date of shipment from Neutronics or from one of Neutronics' authorized dealers. Our liability will be limited to the repair or replacement, at our factory, of parts found to be defective within the warranty period, as determined by Neutronics. The parts will be repaired or replaced free of charge if shipped prepaid to the factory in the original shipping carton. This warranty is void if the product has been subject to misuse or abuse, including but not limited to: exposure to water, humidity- temperature- shock or pressure outside of the listed specifications, or has not been operated or installed in accordance with operating and maintenance instructions, for repairs which were not performed by Neutronics or by one of its authorized dealers, or if the identifying markings on the product label have been altered or removed.

The seller assumes no liability for consequential damages of any kind, and the buyer, by acceptance through purchase of this product, will assume all liability for the consequences of its use or misuse by the buyer, his employees, or others.

Neutronics reserves the right to use any materials in the manufacture, repair or service of the products and to modify the design as deemed suitable, in so far as these materials or modifications maintain the stated warranty.

It is the sole responsibility of the buyer / user to determine if this product is suitable for the intended application.

THESE WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, OR IMPLIED INCLUDING WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE .

Intended Use and Important Notes for the Application of the Model 1100

The model 1100 oxygen analyzer was designed to provide the trained operator with useful information relating to the concentration of oxygen. This information may be used in process control or to minimize possible hazardous conditions which may be present in various processes. Before implementation, the user must fully understand the operation and limitations of this instrument as well as the application for its use. The responsibility for the proper application, operation, installation, and maintenance of the model 1100 oxygen analyzer is the sole obligation of the trained operator. The purchaser is required to ensure operators are properly trained in the use of this unit as well as in the possible hazards associated with its use or with the intended application. The purchaser must ensure that all of the proper warnings, labels, instruction manuals, lock outs, redundant components, hazard analysis, and system validation have been completed and provided to the trained operator before implementation of the model 1100 instrument.

CHAPTER 1

Principles of Operation

1.1 General

The Model 1100 *Compact Series* analyzer by Ceramatec Industrial/Ntron offers a cost effective solution in a small package for oxygen measurement and control applications. The Model 1100 is a microprocessor based instrument designed to accurately measure 0.00 to 100% oxygen.

At the heart of the analyzer is a Ceramatec Industrial/Ntron *galvanic cell oxygen sensor*. The Ceramatec Industrial / Ntron sensor assures reliability and fast response for critical measurements. Two styles of oxygen sensors are offered for the model 1100. The standard MAXCELL-21 O2 sensor, is a slim package which is accessible from the front of the analyzer. This option allows easy access for maintenance and replacement. The optional MAX-250E oxygen sensor utilizes a unique weak acid electrolyte which offers long life and is unaffected by CO2 and other acid gases. When used with the Model 1100, the MAX-250E is remote mounted. This allows the sensor to be installed closed to a sampling point for the fastest response time possible. cells, the Model 1100 provides reliable and fast response measurement.

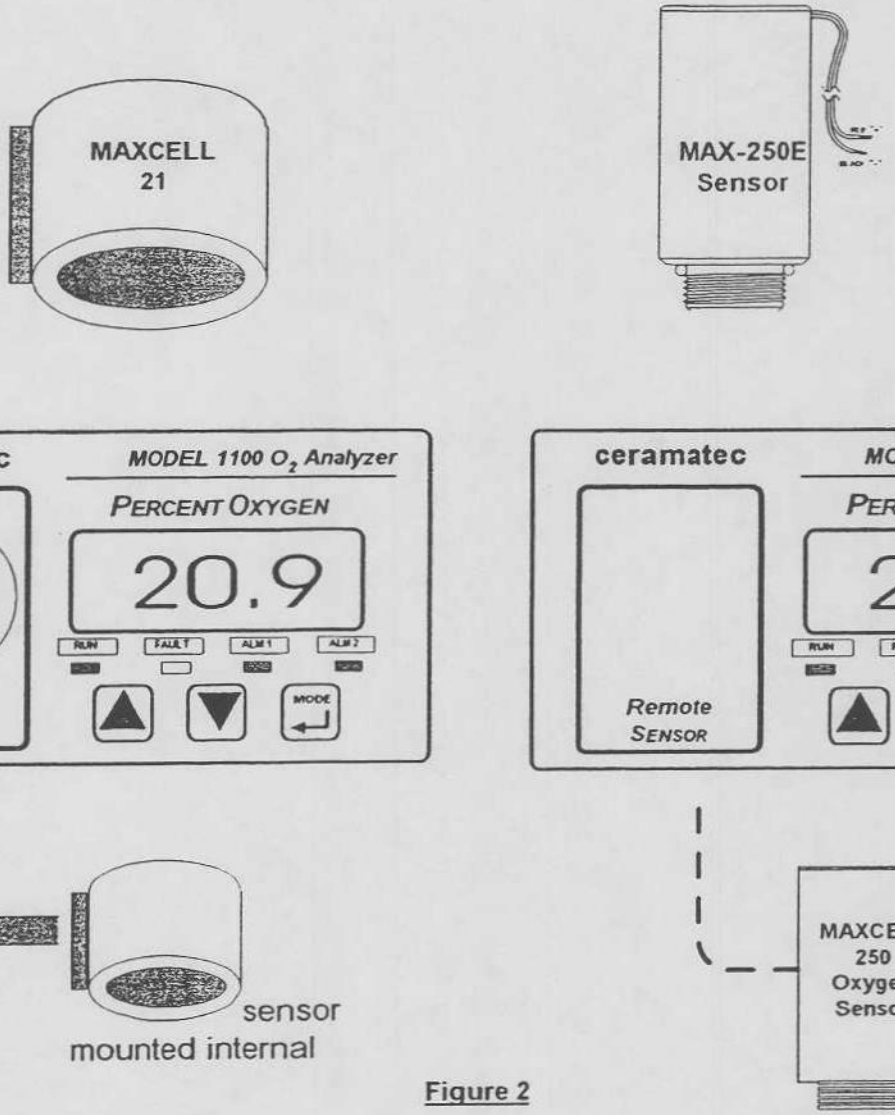
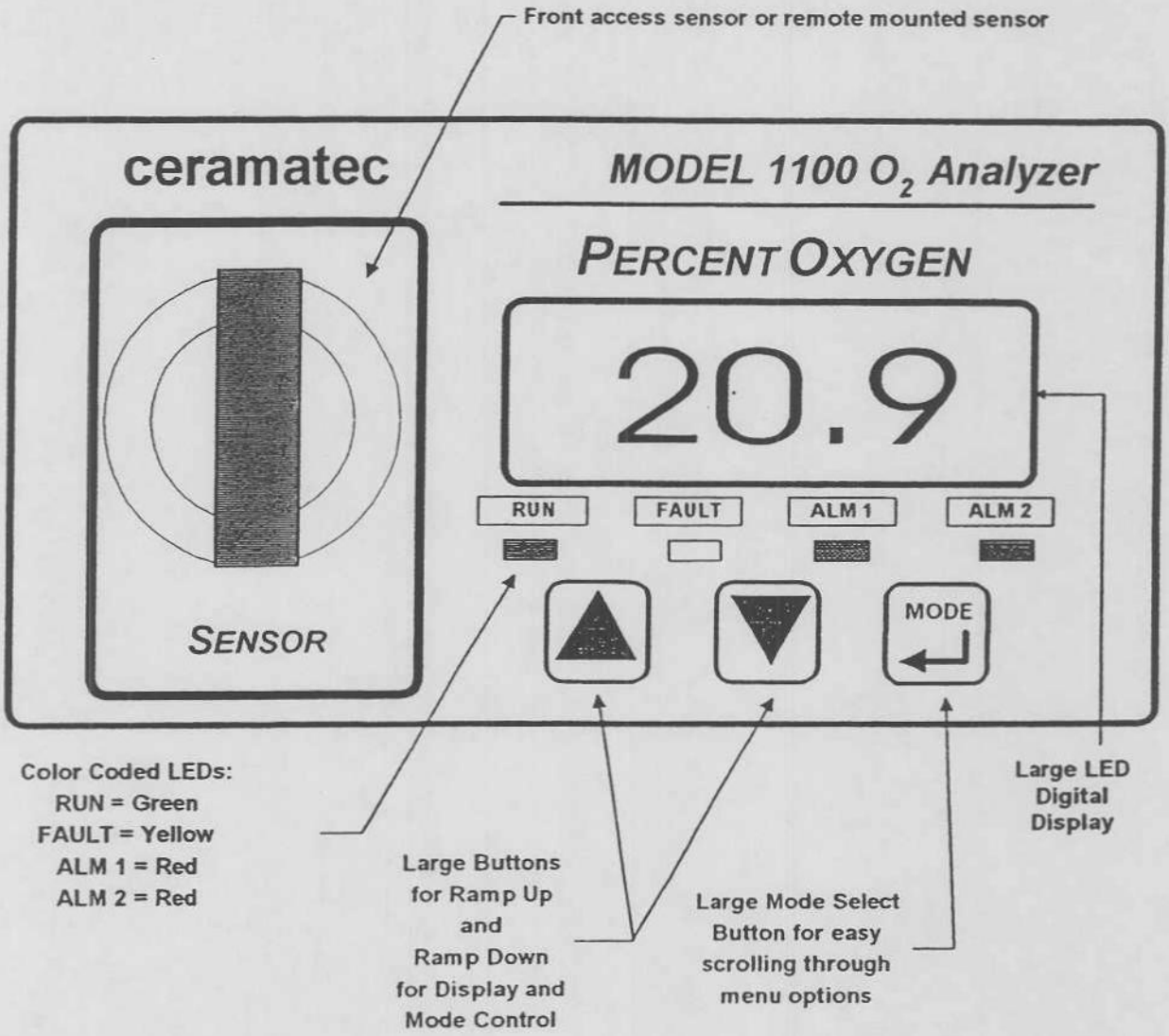


Figure 2

1.2 Features: The *Compact Series* analyzers are designed to be flush mounted to a panel or console. Because of the small size of the Model 1100 analyzer, it can be integrated into a variety of equipment or control panels.

Figure 3 **Main Features of the Model 1100 analyzer :**



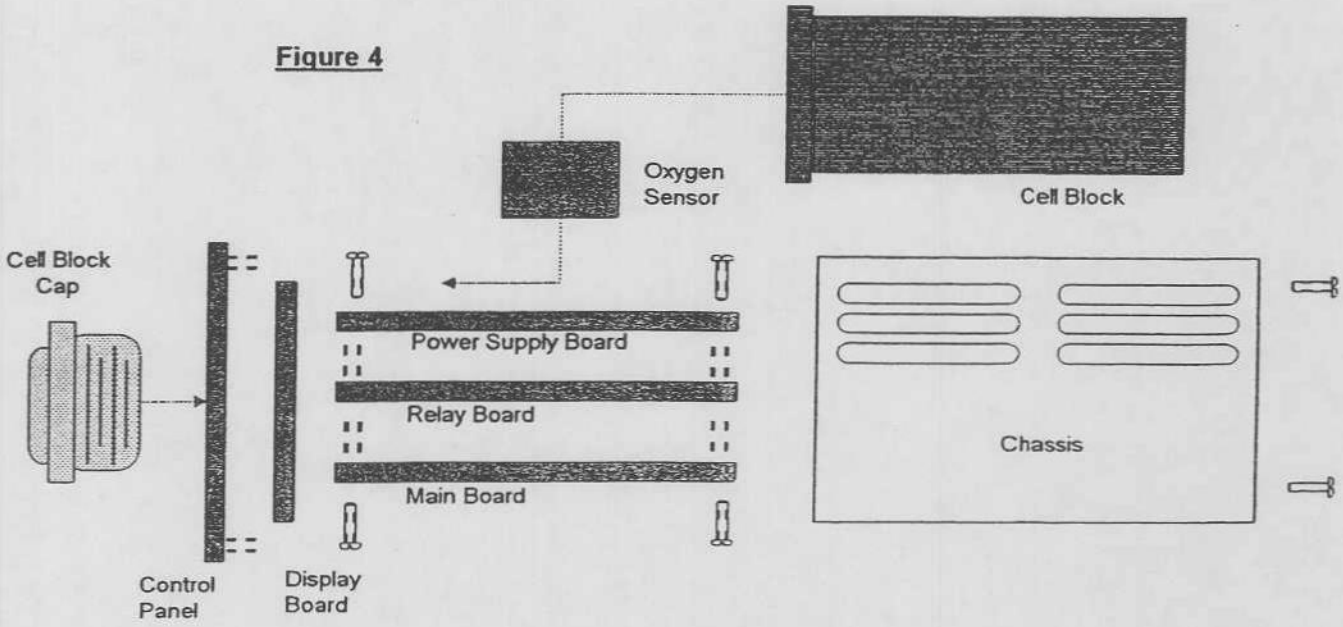
Other Features Include:

- Auto Ranging or Fixed Range Oxygen Measurement (VDC output provided for auto-range identification).
- Uni-Directional Service Port for RS-232 serial interface for connection to a PC, terminal, or printer.
- Two Analog Outputs: 4-20 mA negative ground AND 0-1, 0-5, or 0-10 VDC
- Two Adjustable Alarms with Relay Contacts and a Fault Alarm Contact. The adjustable alarms may be configured Fail-Safe or Non Fail-Safe & as Ascending or Descending Trip

1.3 System Components

The basic components of the model 1100 analyzer are shown below in Figure 4:

Figure 4



1.3.1 Main Board

The microprocessor-based main board controls the operation of the Model 1100 O2 Analyzer. The main board receives the sensor signal, amplifies it, and provides the control and display functions of the analyzer.

1.3.2 Relay Board

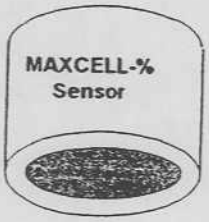
The Relay Board provides dry contacts for alarms 1 & 2 plus the Fault alarm. Alarm 1 & 2 are field adjustable setpoints based on the concentration of oxygen. Alarms 1 & 2 may be factory configured as Ascending or Descending trip AND Fail safe or non-Fail Safe. The default settings are ascending and non-Fail Safe for both alarms 1 & 2. Alarms 1 & 2 are 1 form C (DPDT) relay contacts. The Fault alarm is a 1 Form B (SPST-N/O held closed in RUN) relay contact which is factory configured as Fail Safe and is used for detection of system errors. System errors include Calibration failure, out of Range, A/D error, and software watchdog.

1.3.3 Power Supply: The standard power supply board is designed to take 110/220 VAC 50/60 Hz. as input. The supply is internally fused directly on the board. Optional 10-30VDC power supply is available for installations where a DC voltage is required to power the Model 1100.

1.3.4 Display Board: The Display board is designed to generate a digital indication of the concentration of oxygen. The Display will also indicate error codes.

1.3.5 Control Panel: The Control Panel serves as the main user interface. The Control Panel features the **keypad** (ramp-up, ramp-down, and mode keys) and the **status LEDs** The control panel is designed to be splash and water resistant. At the four corners of the panel are the #8-32 mounting studs which allow flush mounting of the instrument to a control or equipment panel. The gasketed panel is suitable for NEMA type 4 / IP20 environments when properly installed.

1.3.6 Sensor: The sensor is an electrochemical cell which measures partial pressure of oxygen. Whether the sensor is mounted internal or external to the analyzer, it functions the same way. Sample gas is passed by the face of the sensor and an electrical output is generated which is directly proportional and linear to the partial pressure of oxygen in the gas sample.



The MAXCELL-21 and MAX-250E oxygen sensors are lead - oxygen transducers. They are similar in operation to a battery, except that one of the reactants, oxygen is supplied externally to the cell.

The *MAXCELL-21* consists of a lead anode, oxygen cathode, and caustic (KOH) electrolyte. Similarly, the *MAX-250E* oxygen sensor consisting of a lead anode, oxygen cathode, and *weak acid* electrolyte. Oxygen permeates a plastic membrane on the face of the sensor. The oxygen is electrochemically reduced at the cathode. In the both sensors, the current generated is directly proportional to the partial pressure of oxygen at the sensing surface of the cell.

Reactions in the MAXCELL-21 KOH type oxygen sensor occur in the following manner:

Cathode: $O_2 + 2H_2O + 4e \longrightarrow 4OH^-$ (1a)

Anode: $2Pb + 4OH^- \longrightarrow 2PbO + 2H_2O + 4e$ (2a)

Overall: $O_2 + 2\,Pb \longrightarrow 2\,PbO$ (3a)

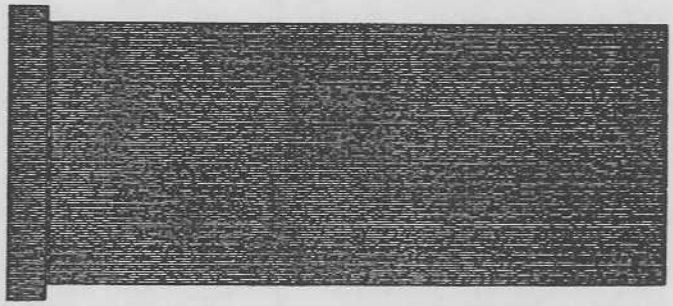
In the MAX-250E sensor using the weak acid electrolyte, the following reaction occurs:

Cathode: $O_2 + 4H^+ + 4e \longrightarrow 2H_2O$ (1b)

Anode: $2Pb + 2H_2O \longrightarrow 2PbO + 4H^+ + 4e$ (2b)

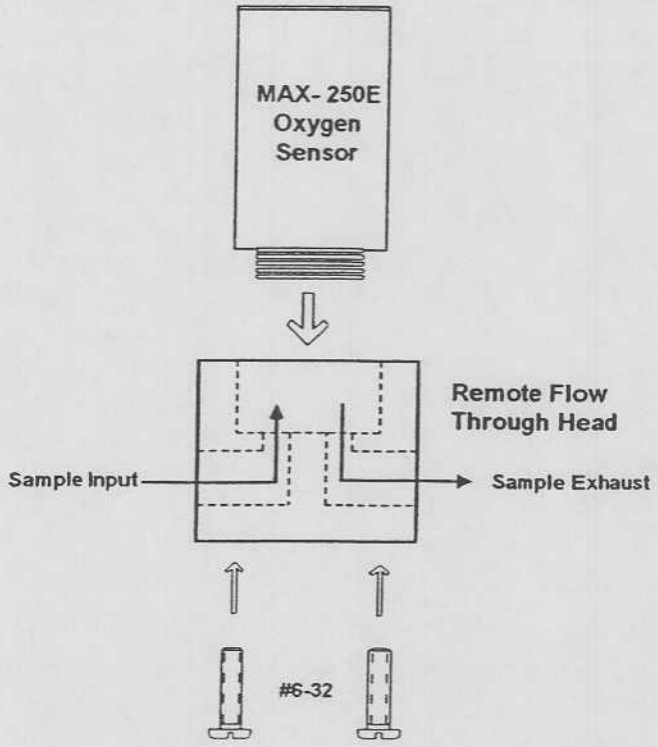
Overall: $O_2 + 2\,Pb \longrightarrow 2\,PbO$ (3b)

Figure 5A: MAXCELL-21 Cell Block



1.3.7 Cell Block and Cell Block Cap: This assembly (for local sensor mounting version) serves as both the receptacle for the sensor as well as the delivery system for the gas sample entering the analyzer. Gas is directed from the sample input port (1/8 inch Female NPT) through a flow restrictor to the face of the oxygen sensor. Oxygen concentration of the gas is determined by the sensor. The gas then passes around the sensor to the sample exhaust port (1/8 inch Female NPT). The Cell Block Cap retains the sensor in the proper downward attitude. (The remote sensor mount features the sensor screwed directly into the flow through head).

Figure 5B MAX-250E Flow Through Head



1.3.8 **Chassis:** The chassis is manufactured of specially coated steel. It is designed to provide a general level of protection against mechanical damage from the local environment. It is also an important component of the ESD shielding design. Since the Model 1100 is a flush mounted system, the portion of the instrument housed in the chassis will be located behind the control panel or embedded within the customer equipment enclosure. The enclosure is general purpose and is not water tight.

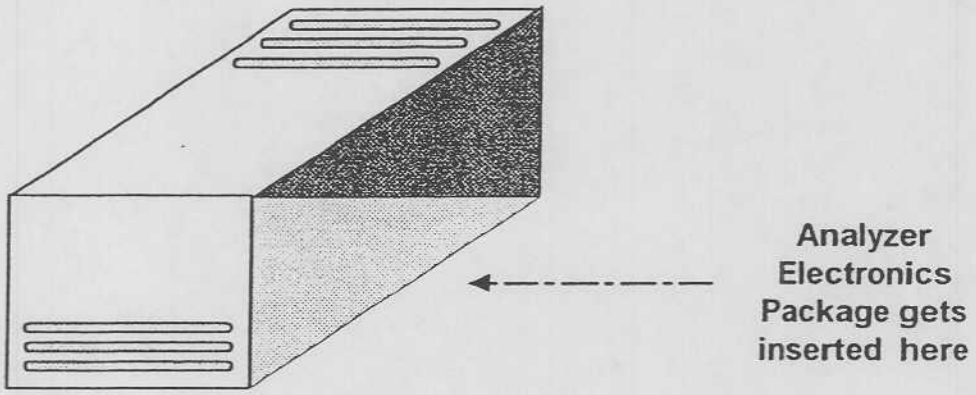
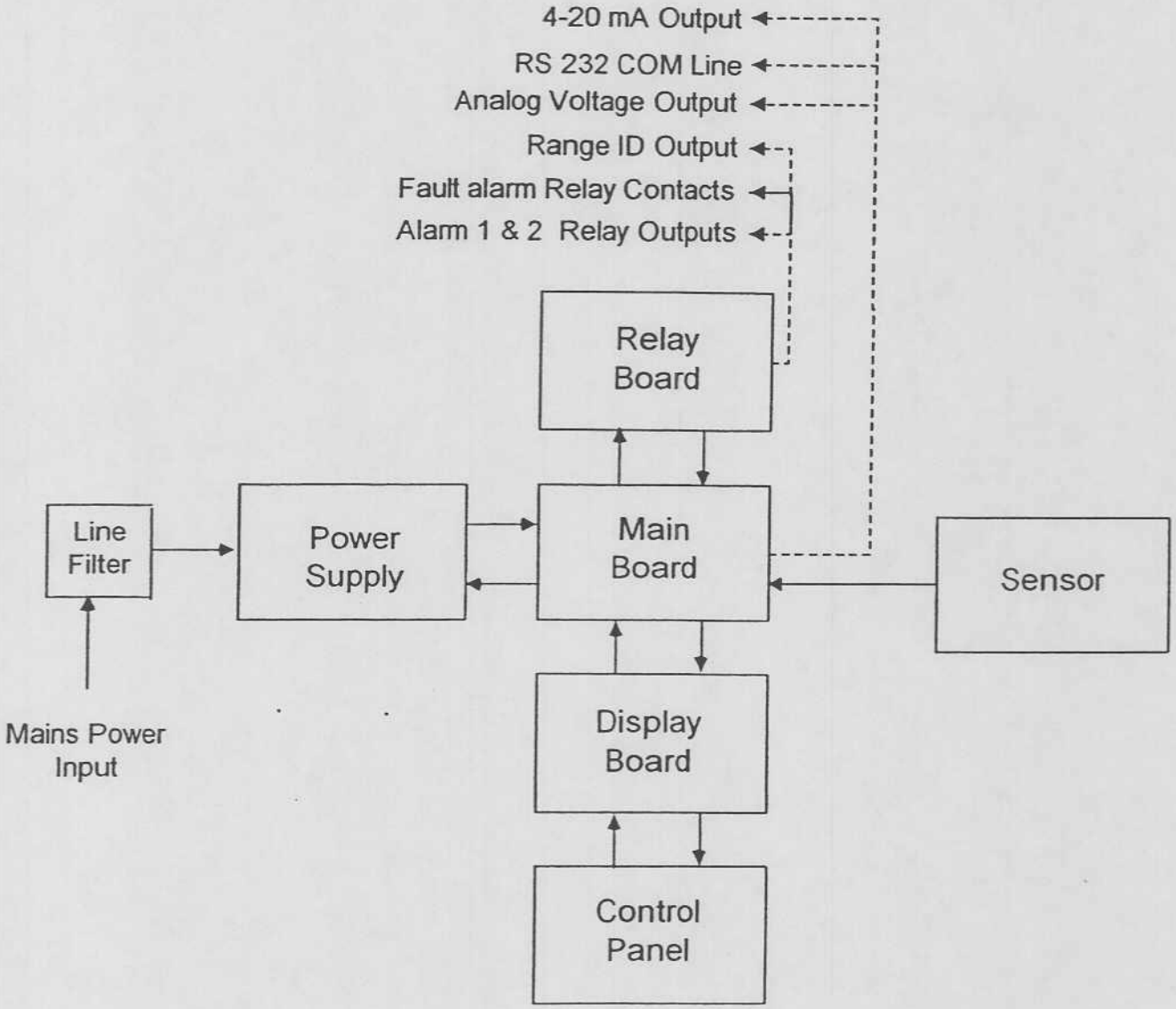


FIGURE 6 Model Chassis

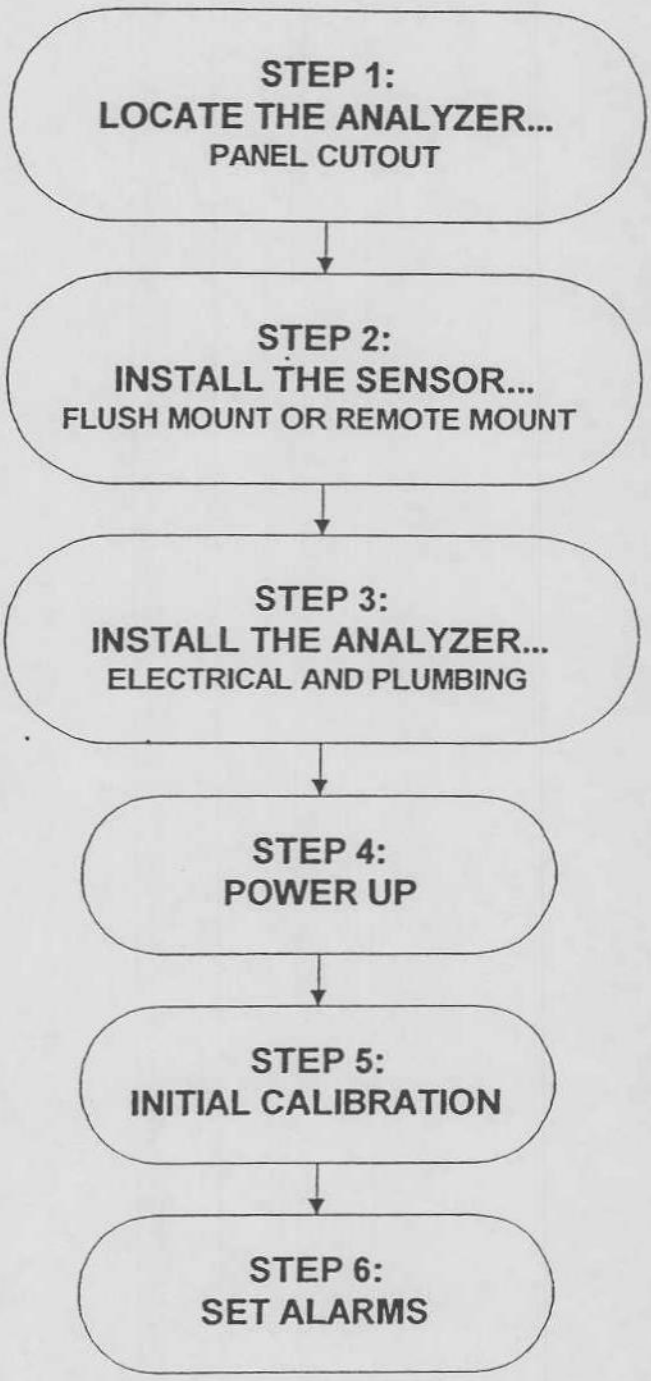
SYSTEM CONFIGURATION
Figure 7



CHAPTER 2

Commissioning the Model 1100

2.1 Installation



2.1.1 STEP 1 Location and Mounting of the Analyzer Unit:

The Model 1100 is designed to be mounted flush to the surface of equipment or on a control panel. Select a suitable location for the Model 1100 analyzer unit where:

- the digital display and status LEDs will be easy to read
- the interface buttons on the display panel will be easy to access
- there is clearance to allow easy access to the sensor
- there is easy and ample space for installation of the electrical and plumbing connections on the rear of the analyzer chassis
- the analyzer (and remote sensor) will not be exposed to water, adverse temperature, or shock. Ensure the analyzer unit is mounted in an area of free air flow to prevent the chassis from exceeding the operating temperature specifications. Do not mount the analyzer or sensor against hot surfaces. Do not block the ventilation louver on the analyzer chassis.
- To maintain a watertight seal on the control panel, ensure that all burrs and deformities at the cutout and mounting holes are removed before insertion of the analyzer unit into the cutout. Ensure that a proper seal is made at the gasket on the model 1100 control panel.

Installation of the analyzer chassis requires four clearance holes for the #8-32 threaded studs and a cutout in the control panel to allow the chassis to slide flush to the panel. Make sure there are no burrs or sharp edges in the cutout or holes which would interfere with the gasket on the analyzer control panel. The gasket ensures a watertight seal around the control panel. The control panel, when properly installed is suitable for NEMA Type 4, IP66 environments. The electronics enclosure is suitable for NEMA Type 1, IP 66 environments.

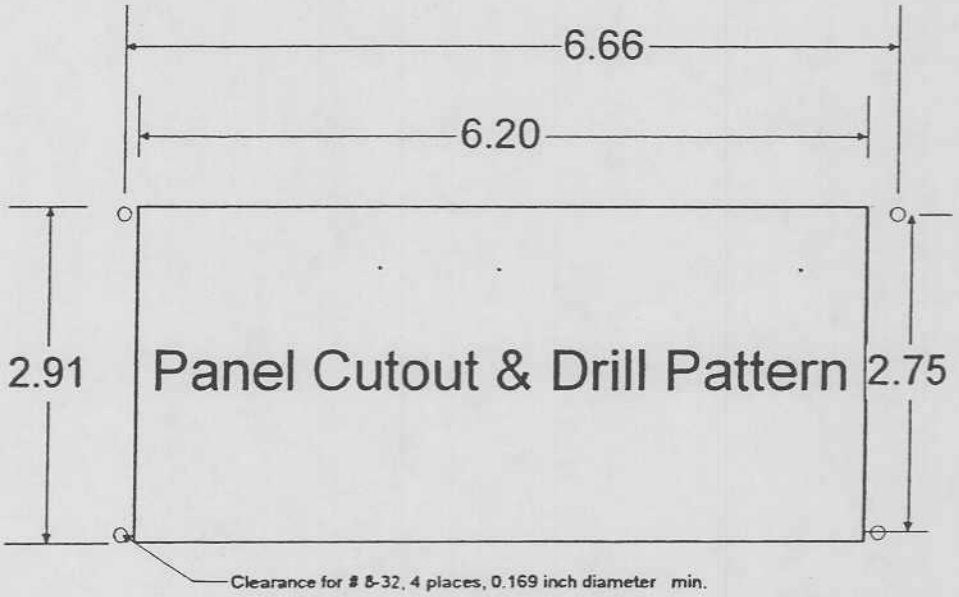
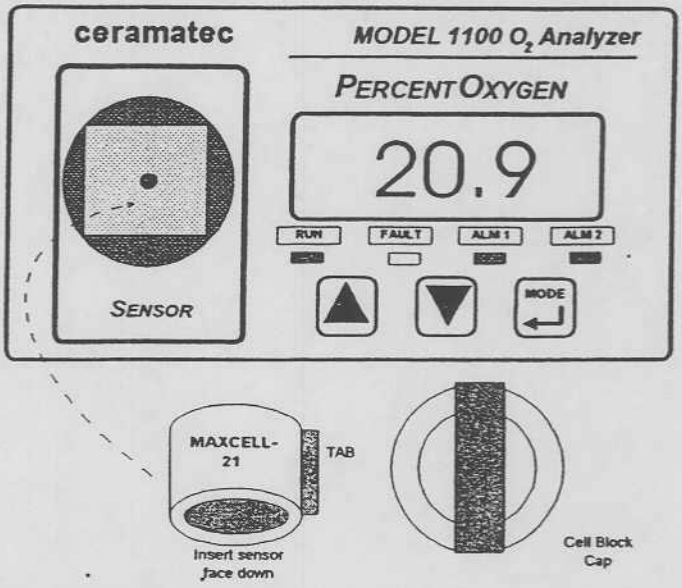


Figure 8 **Dimensions shown in inches**

2.1.2 STEP 2 Install the oxygen sensor:

CAUTION: The Model 1100 oxygen analyzer is available with two sensor options: Front panel access sensor (MAXCELL-21) or remote mounted sensor (MAX-250E). The Front panel access sensor contains caustic electrolyte. The caustic electrolyte sensor has a wide membrane which can be damaged without proper precaution. Take care to prevent any damage occurring to the membrane. The remote mounted sensor contains a weak acid electrolyte (acetic acid similar to *vinegar*). Do not attempt to disassemble the sensor. Any sensor which is leaking electrolyte should be disposed according to local regulations. See material safety data supplied in the Appendix of this manual. Any damaged sensor should be replaced with a new unit.

Figure 9 MAXCELL-21 installation



Front Panel Access Sensor: Unscrew the front cell block cap to access the sensor chamber. The Ceramatec Industrial / Ntron MAXCELL-21 O2 sensor has a small tab at the side of the unit. The tab provides an easy means of holding the sensor while attempting to install it into the cell block. Hold the sensor by the tab with the face of the sensor (membrane side) pointing down. Slide the sensor into place into the cell block. As you insert the sensor, the contact plates at the top of the sensor will ride along two ball contacts built into the top of the cell block. Once the sensor is in place, screw the cell block cap back into place.

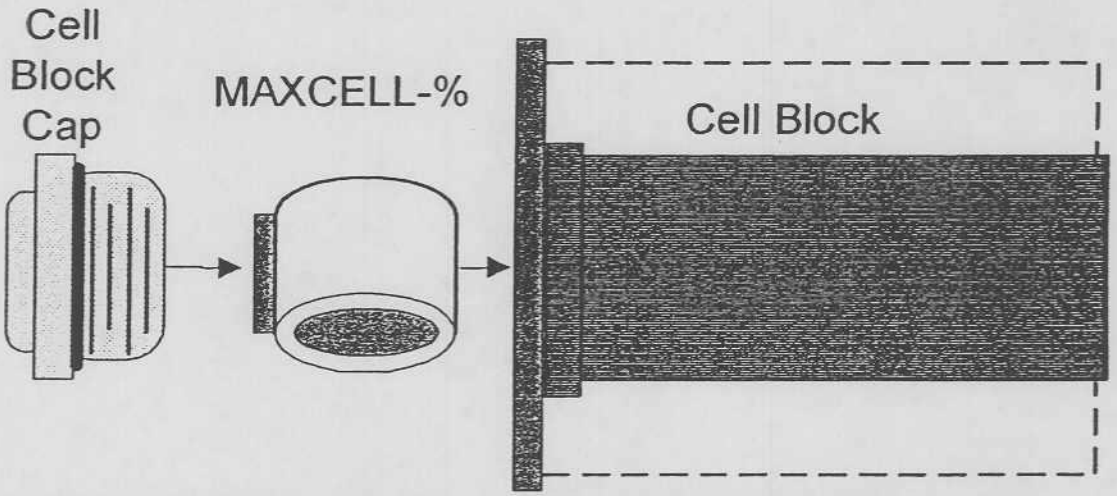
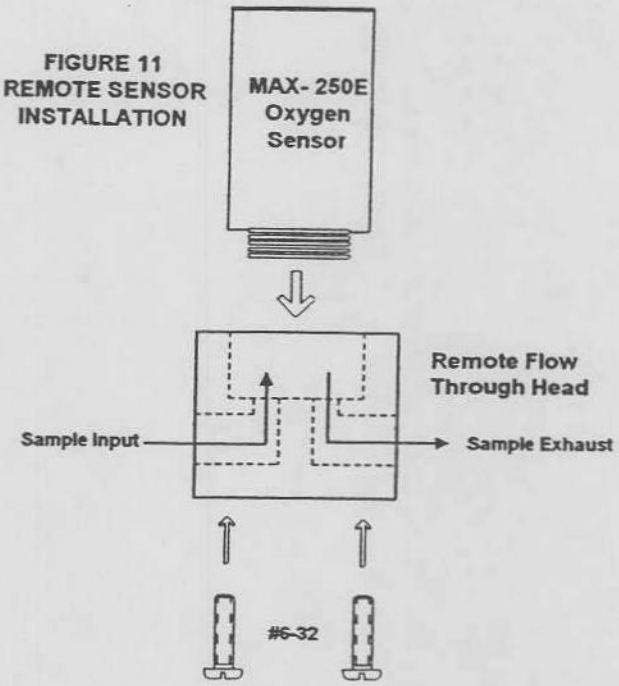


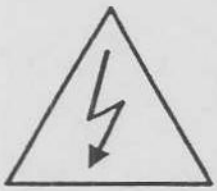
Figure 10 Cut Away View of MAXCELL-21 Sensor Insertion into Analyzer

Remote Mount Sensor: When the Model 1100 is configured for a remote mount sensor, the display panel does not feature a cell block cap. Supplied with the Model 1100 will be a black plastic (Delrin 1.25" diameter) flow through head, a model MAX-250E oxygen sensor, and a 6 foot sensor interface cable. The rear panel of the model 1100 analyzer will be equipped with a female mini-phone jack connector to mate with the supplied sensor cable. Mount the flow through head so that the sensor face is pointing down. The flow through head is machined to accommodate two # 6-32 machine screws (1inch on center). The MAX-250E oxygen sensor screws into the top threaded port of the flow through head. Be certain not to over tighten the screws installed into the plastic flow through head.

FIGURE 11
REMOTE SENSOR
INSTALLATION



2.1.3 STEP 3 Install the Analyzer:



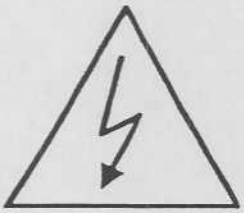
DANGER: Electrical connections on the rear of the Model 1100 oxygen analyzer may have hazardous voltages present once power has been applied to the unit. High voltages may be still remain for a short time even after power has been disconnected from the analyzer. Take care in observing standard electrical practices when making electrical connections to the Model 1100 oxygen analyzer.

DANGER: The model 1100 analyzer is not rated intrinsically safe or explosion proof. Be certain that all flammable and toxic gases are not present in the area where the Model 1100 analyzer will be installed.

CAUTION: The model 1100 housing is not rated water proof. Do not mount the analyzer or the sensor in an area where it may contact water or other liquid elements.

2.1.3.1 ***Install the Plumbing:*** Plumbing connections for the standard Model 1100 are made at the back of the chassis at the cell block. The sample connections for the remote sensor option are made at the sample flow through head. The sample input and exhaust ports are 1/8 inch female NPT. The cell block and flow through head are manufactured of Delrin Plastic. Do not overtighten fittings installed into the sample input and exhaust ports where the threads may be stripped in the Delrin Plastic. The threads of the fittings should be wrapped with 1/4 inch Teflon tape to prevent gas leakage. It is recommended to use 1/4 inch or 1/8 inch tubing for the sample input and exhaust. For best results, the sample pressure should be regulated to 1 to 3 psig at 1 SLPM flow rate. Do not exceed 3 psig at the sample input port. To prevent back pressure on the sensor, the sample exhaust should be vented to atmospheric pressure.

2.1.3.3 Electrical Connections: A label depicting the terminal block arrangement is affixed to the top of the chassis for easy reference during installation and maintenance. The terminal blocks feature screwed terminals. The terminal blocks are removable for ease of wiring or removal of the analyzer module. Please reference the attached sketch showing the detail of the electrical interface terminals and the sampling ports.



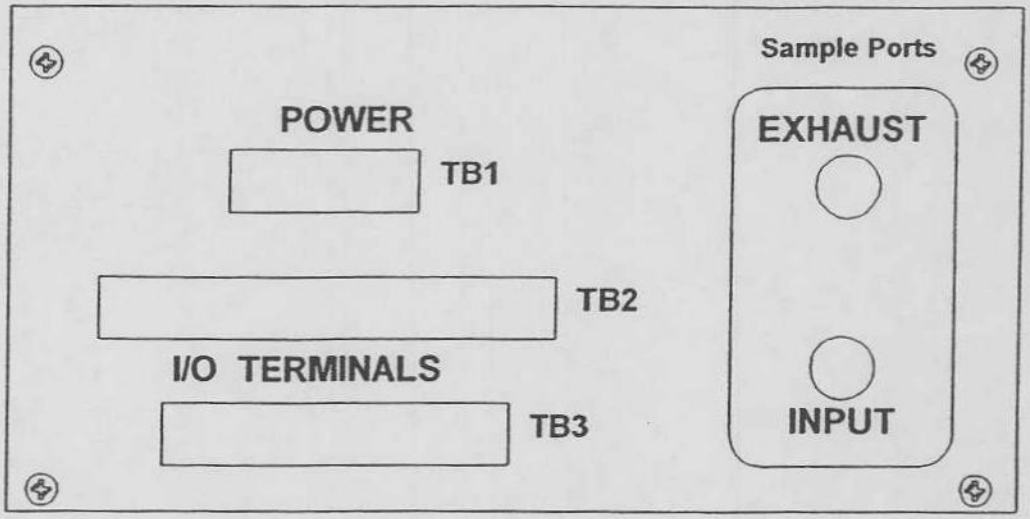
WARNING: Be certain that all power is OFF to the analyzer and associated wiring (cables) before attempting installation. DO NOT WORK WITH LIVE WIRES! Do not leave any exposed wire at the terminal blocks. Before applying power, ensure terminal blocks are fully inserted into the mating connector at the analyzer.

12 volt DC Battery Backup terminals are provided at TB3. These terminals may be connected to a fixed 12 vdc power source to act as back up in case the main VAC power has been lost. The circuit will detect loss of the VAC power and the VDC battery backup will maintain power to the system. Connection to the Battery Backup is not required for normal operation of the analyzer.

To remotely detect the present range of oxygen concentration, the Model 1100 features a 0-10 volt **auto-range identification output**. 1.9 vdc output indicates the lowest range, 3.8 vdc indicates the middle range, and 5.7 vdc indicates the high range ($\pm$ 0.1 vdc).

Main Power Input is available at TB1 terminal block (TOP BLOCK). Alarms and Range ID is available at terminal block TB2 (MIDDLE BLOCK). Battery Backup and Analog/Serial outputs are available at TB3 (BOTTOM BLOCK).

FIGURE 12
REAR OF CHASSIS: ELECTRICAL AND PLUMBING CONNECTIONS



TB1

G - N - H

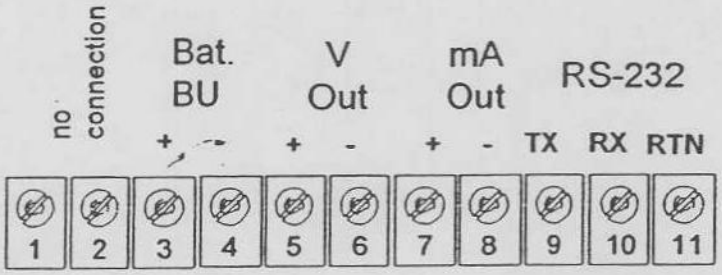
VAC POWER INPUT, 110 / 220 VAC, 50 / 60 Hz.

\- C - V+ -

OR VDC POWER INPUT, 12-35 VDC, (optional)

TB2

TB3



2.2 Start-up

2.2.1 Last Check Before Power Up:

Have you .....

- √ *Mounted the analyzer and sensor in an area where there are no flammable vapors?*
- √ *Mounted the analyzer and sensor away from exposure to rain, dripping water, or hose down?*
- √ *Correctly installed all of the wiring?*
- √ *Correctly installed the sensor?*
- √ *Ensured gas tight plumbing?*
- √ *Connected the sample exhaust to an ambient pressure venting point?*
- √ *Regulated the sample pressure as instructed?*
- √ *Read the manual in its entirety?*

2.2.2 STEP 4 Power Up the unit:

When the instrument is connected to power and turned on, the Model 1100 will go into a self test mode. The digital display and the LEDs will flash on. After approximately 8 seconds, the analyzer will check its current reading and update the digital display and status LEDs. Do not apply gas during power up as varying oxygen concentration may prevent the analyzer from completing a self test upon start up. Though the unit can be immediately used after self test, best stabilization of the sensor signal may be obtained after the instrument has been on for approximately 20 minutes. This will allow the sensor to stabilize and adjust to the ambient temperature.

Once the analyzer has stabilized (20 minutes), apply 1-3 psig compressed instrument air to the sample input port of the analyzer. Allow the reading to stabilize (about 30 seconds for the gas to sweep out the sample lines) and then calibrate the unit.

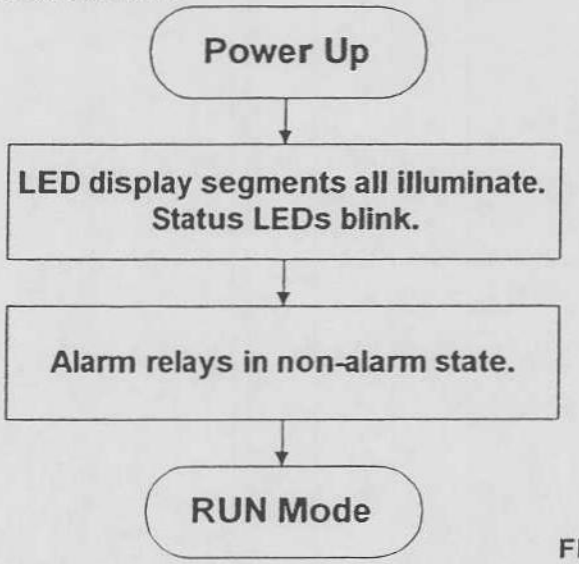


FIGURE 13 POWER UP DIAGRAM

2.2.3 STEP 5 Calibration:

After room air has been applied to the analyzer, press the "MODE" button. It will display "CAL" while depressed. The Green RUN LED will flash. After releasing the button, the display will indicate an oxygen concentration value. Adjust the digital display to read 20.9% oxygen by pressing the UP or Down arrows as required. Press the "MODE" button again to set the "ALM1" and "ALM2" modes as indicated on the display. **See Chapter 3 under "Calibration".**

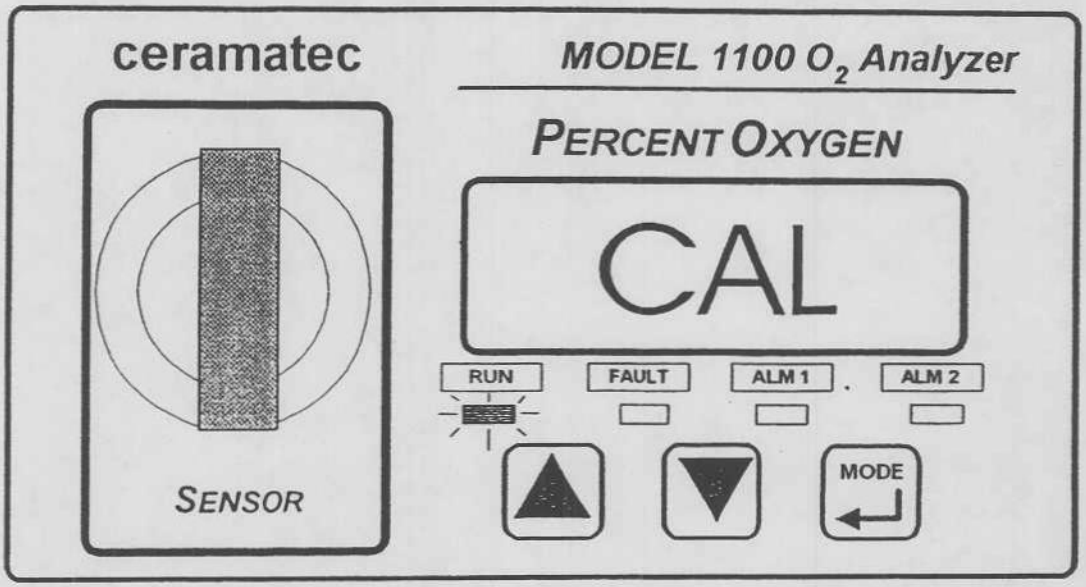


Figure 14 Cal Mode: A look at the Display Panel

The Model 1100 will resume normal RUN mode operation when the UP, DOWN, or MODE buttons have not be pressed within a 120 second period.

2.2.4 STEP 6 Set the Alarms:

After the unit has been calibrated on a known gas source, it is desirable to set the alarm points. Scroll through the menu by pressing the "MODE" button until "ALM1" is displayed. Adjust the up and down buttons accordingly. Then, press the "MODE" button again to scroll to "ALM2". Adjust the display as required. Press the MODE button once again and the unit will return to normal RUN mode. A time-out is built in to the unit. After approximately 120 seconds, if no buttons are pressed, the unit will return to normal RUN mode. **See Chapter 3 under "Set Alarms".**

Notes: The alarms may be configured as Ascending or Descending Trip AND Fail-Safe or Non-Fail-safe. See chapter 3 for a description of the settings and the appendix to find out how to change the factory settings.

The alarms will become active approximately 120 seconds after exiting the calibration mode.

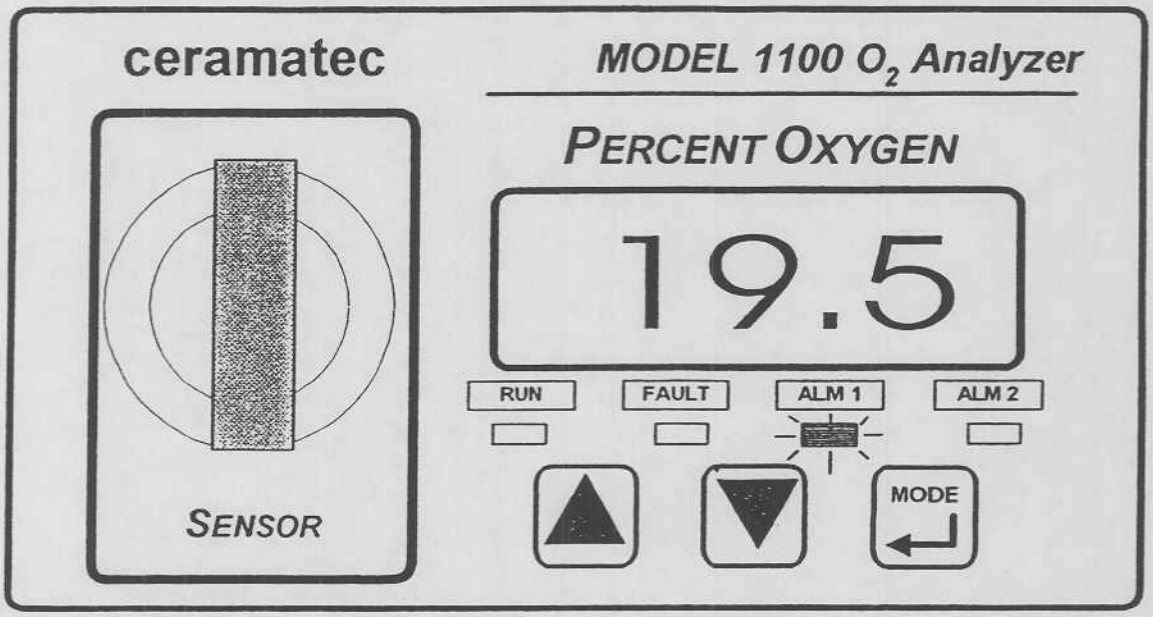
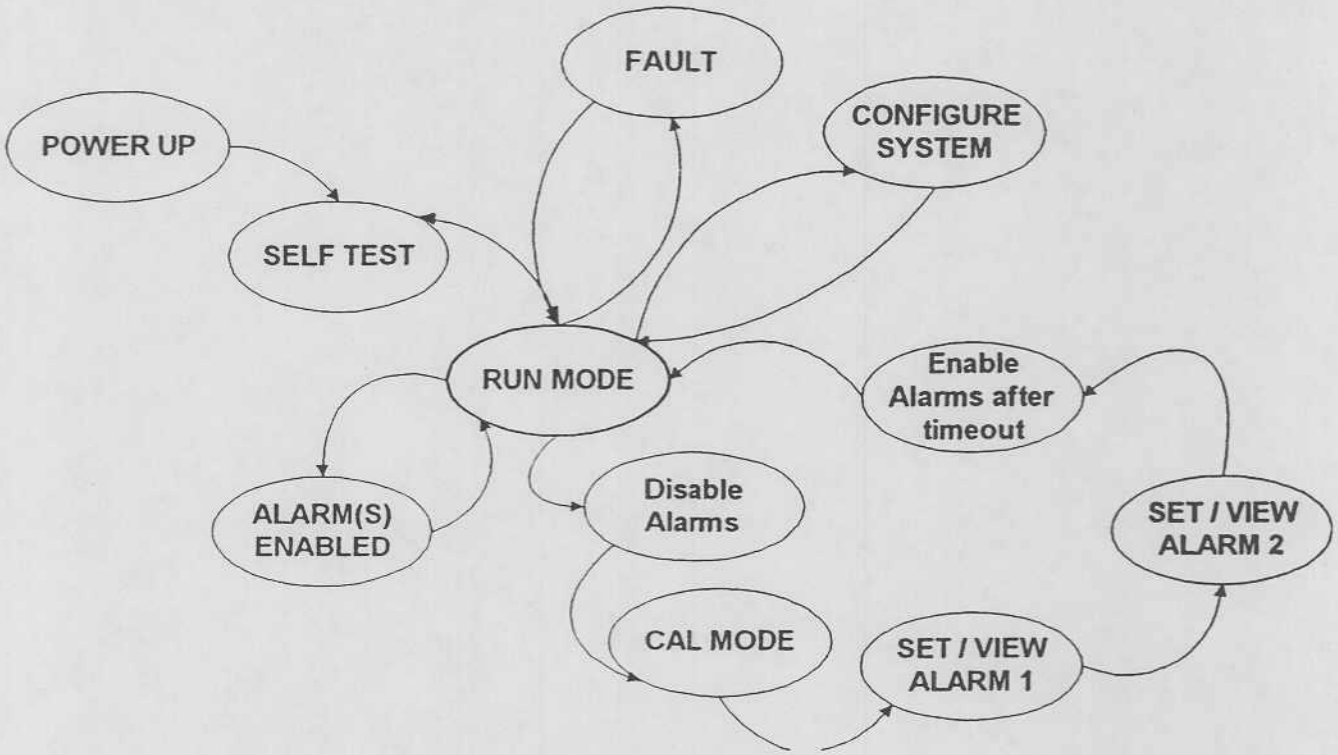


FIGURE 15 SET ALARM MODE: A look at the Display Panel

Figure 16

3.5 MODE DIAGRAM



After the unit has been calibrated on a known gas source, it can be used in normal operation. There are six main modes of operation once the system has been powered up and the self test is completed: **RUN, Calibration, Set Alarms, Alarms Active, Fault, and SELF-TEST (Press-to Test).**

As shown in Figure 16, the modes of operation are accessible once in RUN mode. You can access the Cal or Set alarm modes by pressing the mode switch. CAL and Set Alarm 1 & Set Alarm 2 are sequentially accessed. Alarms active and Fault modes are not accessible manually. The Model 1100 analyzer will determine if an alarm or fault is active, and then the modes will be activated.

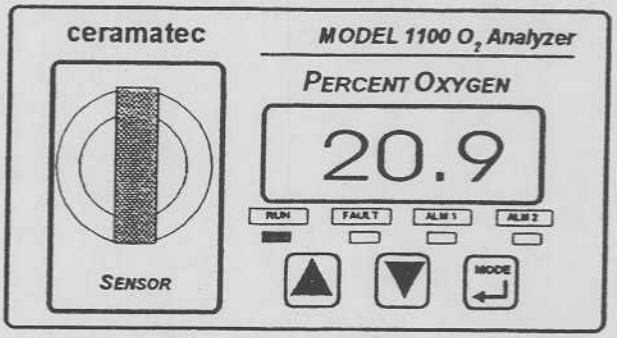
The analyzer has a 120 second time-out. If no buttons are pressed within 120 seconds, the analyzer will resume to normal RUN mode operation.

The alarms are disabled during calibration and alarm set modes.

A description of each mode:

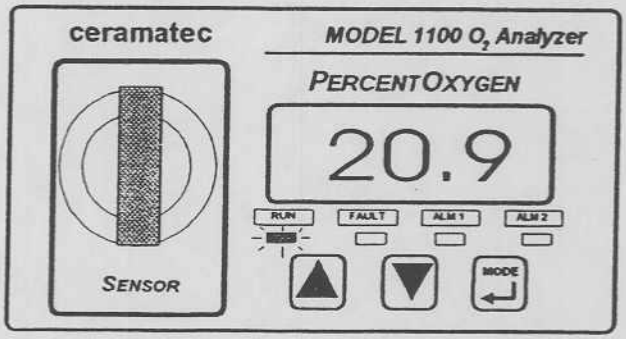
3.1 RUN

Normal RUN mode is indicated by a green LED. The instrument is measuring the concentration of the sample gas and updating the display and outputs accordingly.



3.2 CALIBRATION

Calibration mode allows the oxygen sensor to be tuned to a gas of known oxygen concentration. Enter the cal mode by pressing the mode button once.

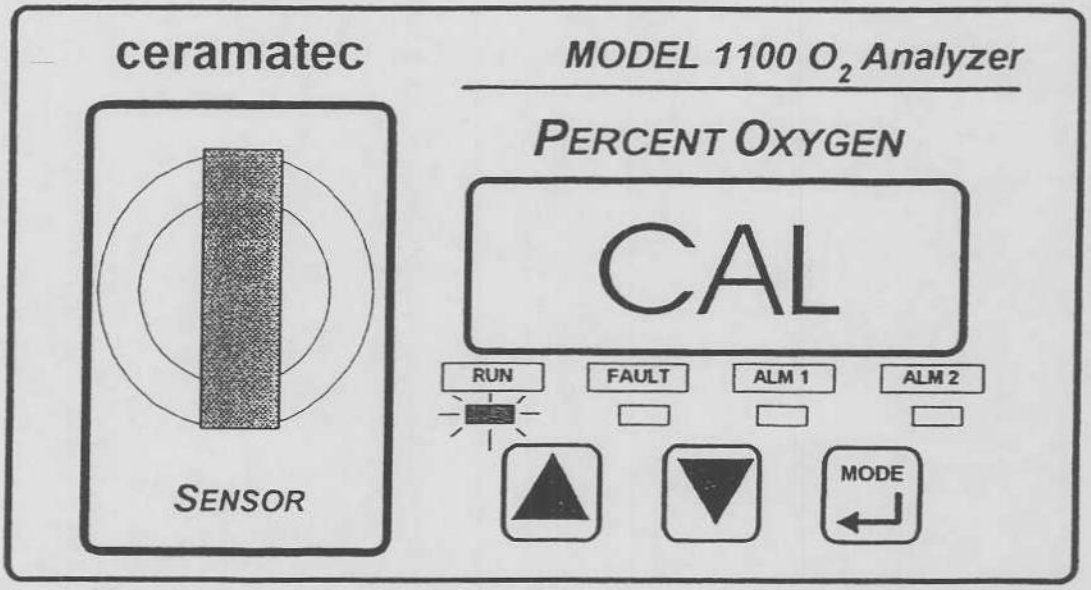


When to Calibrate?

- Whenever the sensor is replaced.
- At least once a month.
- Whenever a FAULT condition is encountered.
- After a POWER UP (wait 20 minutes to reach temperature equilibrium.)
- Whenever you are unsure about a oxygen concentration reading.

How to calibrate the Model 1100 ....

After instrument air has been applied to the analyzer, press the "MODE" button. It will display "CAL" while depressed. The Green RUN LED will flash. After releasing the button, the display will indicate an oxygen concentration value. Adjust the digital display to read 20.9% oxygen by pressing the UP or Down arrows as required. Press the "MODE" button again and scroll past "ALM1" and "ALM2" modes as indicated on the display.



Calibration may be carried out with other certified gases if desired. Merely substitute the desired gas in place of compressed instrument air as described above and carry out the adjustment.

Note: During calibration The Model 1100 will resume normal RUN mode operation when the UP, DOWN, or MODE buttons have not be pressed within a 120 second period.

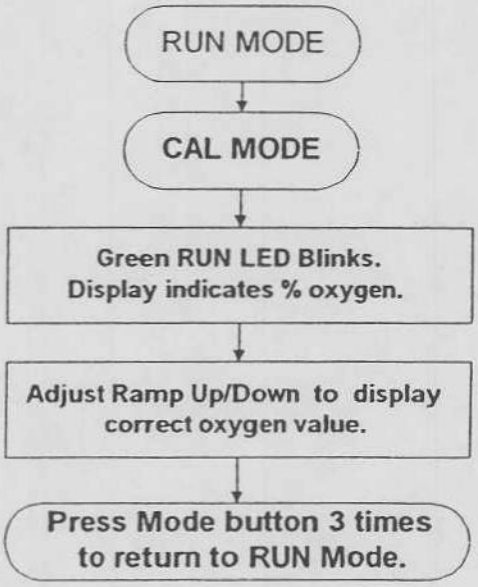


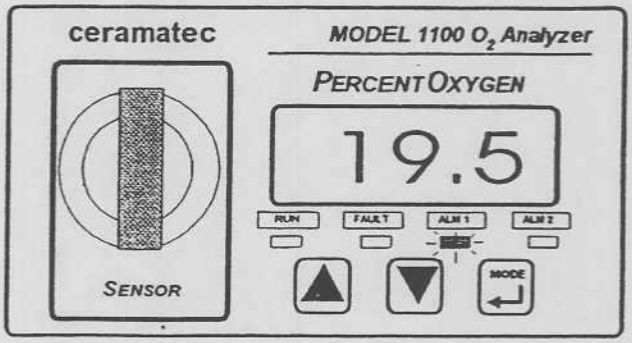
FIGURE 14
CAL MODE DIAGRAM

Calibration gas should be applied to the analyzer at a similar flow rate and pressure to that of the sampled gas. Be sure to allow the calibration gas to flow to the sensor until the display has stabilized. The stabilization period allows time for the calibration gas to flush the gas in the sampling lines. It is recommended to use compressed instrument air for the initial calibration gas. Other calibration gases may be used during normal maintenance periods.

After a regulated stream of instrument air has been applied to the analyzer, press the "MODE" button. It will display "CAL" while depressed. After releasing the button, the display will indicate an oxygen concentration value. Adjust the digital display to read 20.9% oxygen by pressing the UP or Down arrows as required. Press the "MODE" button again and scroll past "ALM1" and "ALM2" modes as indicated on the display.

The Model 1100 will resume normal RUN mode operation when the UP, DOWN, or MODE buttons have not be pressed within a 120 second period.

3.3 SET OR VIEW ALARMS



Alarms 1 & 2 are indicated by a red LED plus dry relay contacts. The alarms will be indicated when the oxygen concentration has violated the threshold criteria of the respective alarm setpoint. The Alarm status will be cleared when the alarm condition has ceased or the unit has entered calibration mode.

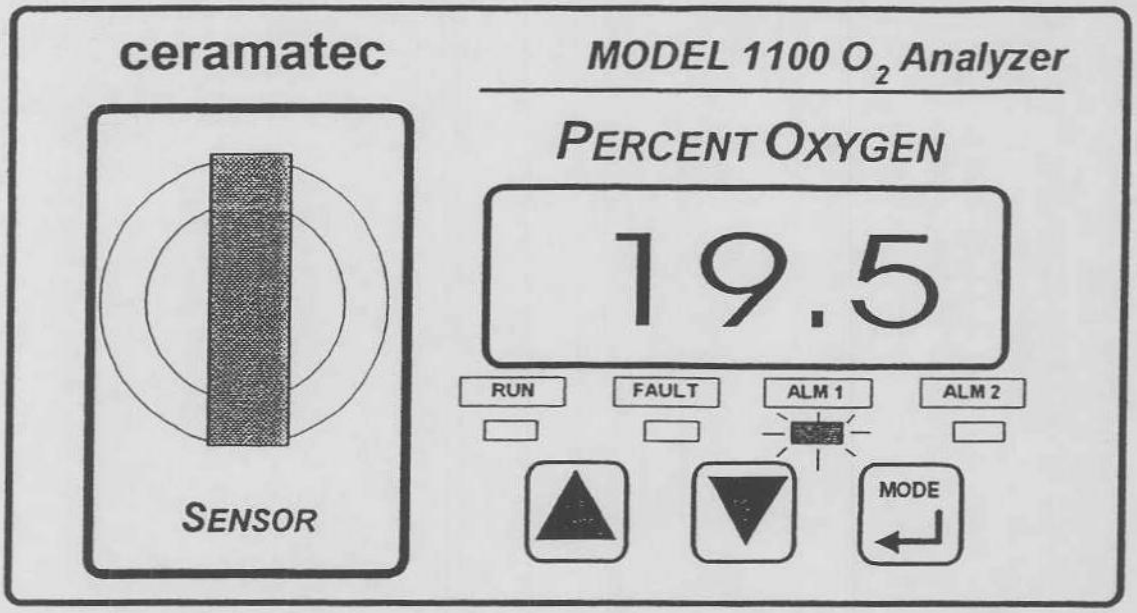
Ascending or Descending Trip? Alarms may be configured with ascending or descending trip. An ascending trip means the alarm will activate due to an increase in oxygen concentration above the setpoint programmed into the Model 1100. Descending trip will cause an alarm to activate due to a decrease in oxygen concentration below the setpoint programmed into the Model 1100. The oxygen concentration setpoints are programmed as described below.

Fail Safe or Non-Fail Safe? Alarms may be configured as fail safe or non-fail safe. This choice is provided to those customers which may prefer an alarm configured in a particular manner for safety reasons. Many companies require alarm conditions to be the same as a power off situation. The premise is a power down situation carries the same importance as an alarm condition.

Will the alarm relay be energized or de-energized? An alarm configured as fail safe will activate in non-alarm conditions (outside of the alarm activate range). The relay coil is energized in non-alarm conditions. In the fail safe configuration, the relay contacts (N/O Vs N/C) in alarm condition are the same as in power off.

In contrast, an alarm configured as Non-Fail Safe will activate in alarm conditions (N/O Vs N/C) . The relay coil is energized in alarm conditions.

What is the factory setting? Alarms 1 & 2 are factory set to non-fail safe and to Ascending trip. These settings may be changed in the field by accessing the main circuit board jumper configurations. Refer to the drawing section in the Appendix section of this manual.



Setting the alarm points:

After the unit has been calibrated on a known gas source, it is desirable to set the alarm points. Scroll through the menu by pressing the "MODE" button until "ALM1" is displayed. Adjust the up and down buttons accordingly. Then, press the "MODE" button again to scroll to "ALM2". Adjust the display as required. Press the MODE button once again and the unit will return to normal RUN mode. A time-out is built in to the unit. After approximately 30 seconds, if no buttons are pressed, the unit will return to normal RUN mode.

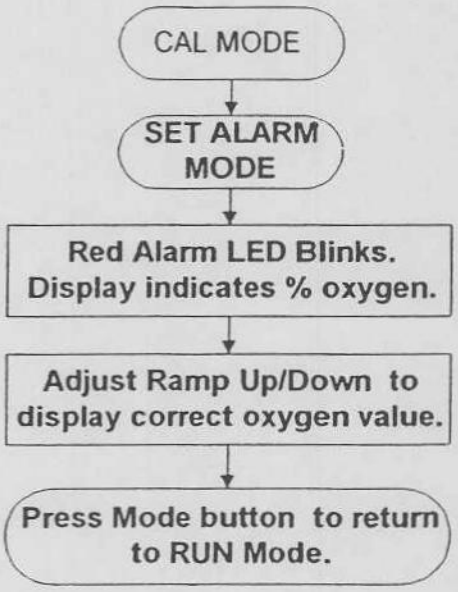
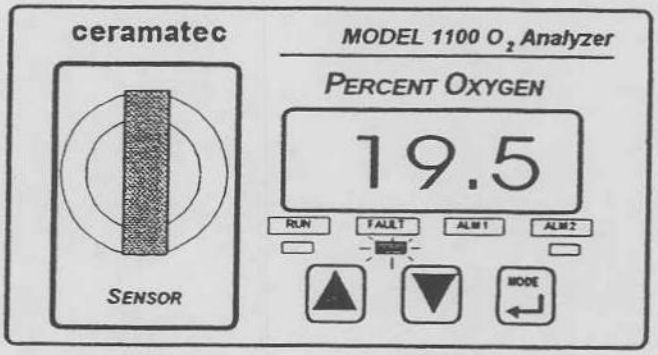


Figure 15: Set Alarms Diagram

3.4 FL – Diagnostic Fault display

The FAULT mode will be indicated when the analyzer has detected a possible problem with calibration, hardware, or software. In addition to the yellow LED, a relay contact (SPST- N/O) is provided. Relay is energized in Fault mode. While in this mode, use the INC and DEC keys to view all the possible faults. A display of 'FL " indicated no fault.



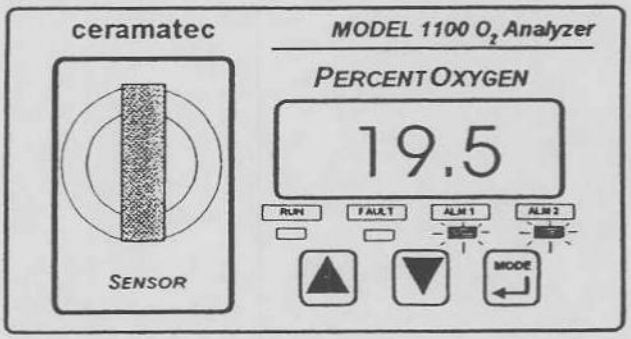
Use the table below to determine the possible fault:

13 User calibration too small
12 User calibration too large
11 Non-native display range (flashing)
10 Sensor appears to be open
8 A concentration reading is not yet available
7 A/D appears to be defective
6 Analog Output Range Underflow
5 Analog Output Range Overflow
3 Device is in setup mode (via serial port)
2 Relays are in standby mode
1 Sensor Heater is warming up

FAULT LED and relay contacts will reset automatically once the error has ceased. The FAULT condition status on the analyzer may be cleared by entering the calibration mode. If the fault has not cleared after calibration, the FAULT LED and relay contact will be re-enabled.

3.5 ALARM ACTIVE MODE: ALARMS 1 or 2 are in alarm state

Alarm Active mode is indicated by a red ALM 1 LED or ALM2 LED. The analyzer has detected an alarm condition as determined by the alarm set up. As you will recall, Alarms 1 & 2 may be configured as ascending or descending trip, Fail-Safe or non Fail-Safe. Furthermore, the user may field set the alarm point to any percentage oxygen within the range of the analyzer. In addition to the red alarm LED, Form C (SPDT) relay contacts are provided for each alarm.



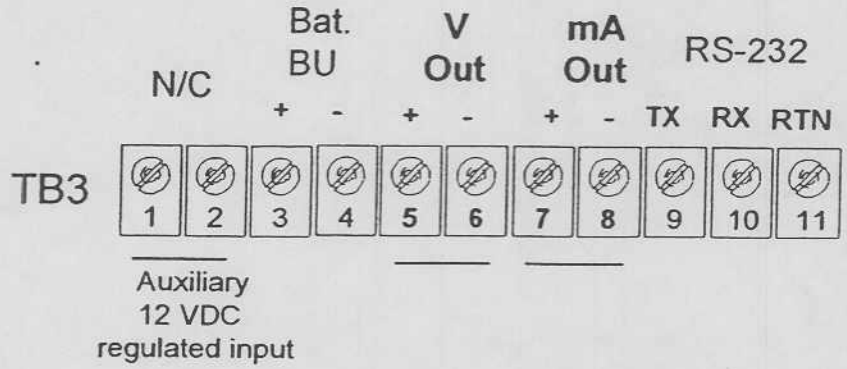
CHAPTER 4

Analog Outputs

The Model 1100 Oxygen Analyzer provides three, non-isolated analog outputs:

- DC Voltage for oxygen concentration: 0-1, 0-5, or 0-10 VDC (jumper selectable)
- DC Current for oxygen concentration: 4-20 mA
- DC Voltage for range Identification:
  1.9 vdc = low range, 3.8 vdc = mid range, 5.7 vdc = high range

Connection to the outputs are made at the terminal blocks on the rear of the analyzer chassis. The terminal blocks are removable for easy installation of the wires. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.



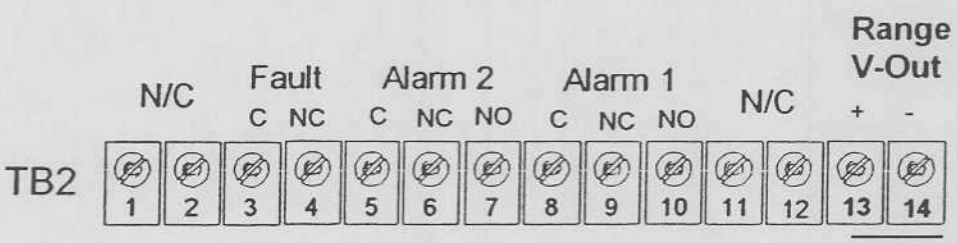
Two wires are required for each output. Individually shielded twisted pairs using stranded wire conductors are suitable for the connections. The shield should be drained to dc ground at the auxiliary equipment.

The voltage and current outputs for oxygen concentration are linear and follow the analyzer display readings.

The default for analog voltage output for oxygen concentration is 0-1 VDC. This is field changeable through PCB jumpers , see the Appendix. The analog voltage output follows the range with 0vdc always = 0% oxygen.

The 4-20 mA output is negative ground, non-isolated. The 4-20 mA output loop power is supplied by the Model 1100 analyzer. The analog current output follows the range with 4 mA always = 0% oxygen.

When the analyzer is configured for auto range mode, it may be necessary to monitor the range ID voltage output. This additional output will identify the current range of oxygen measurement.



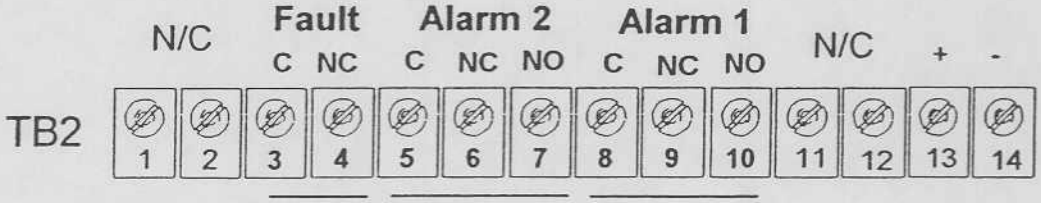
CHAPTER 5

Alarm Outputs

The Model 1100 Oxygen Analyzer provides three alarm outputs:

1. Alarm 1, settable for concentration of oxygen (1 Form C relay contacts SPDT can be configured for fail safe or non-fail safe / ascending or descending trip. See section 3.3)
2. Alarm 2, settable for concentration of oxygen (1 Form C relay contacts SPDT can be configured for fail safe or non-fail safe / ascending or descending trip. See section 3.3)
3. FAULT Alarm , factory set to alarm when a fault is detected (see section 3.4). The fault alarm relay contacts are 1 Form B SPST and is always configured fail-safe.

Connection to the outputs are made at the terminal blocks on the rear of the analyzer chassis. The terminal blocks are removable for easy installation of the wires. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.



CHAPTER 6

Service Port: Serial Communications Interface

The model 1100 features a service port which is accessible for monitoring the analyzer output and for determining the active fault codes. The service port has been designed for communication with a PC based computer (such as a portable notebook computer) over a standard RS-232 serial interface.

6.1 There are three levels of access through the service port:

1. STANDARD ACCESS: ASCII dump to a PC, printer or DAQ and provides basic operator access.
2. ADVANCED LEVEL 1 ACCESS: Allows setup and configuration of alarms, data format...
3. ADVANCED LEVEL 2 ACCESS: Allows access to vital control areas via password.

I. The **standard access** is available to the user via a host computer or printer over a standard RS-232 serial interface. The host computer can forward inquiries about sensor temperature, oxygen concentration, sensor voltage, and other parameters. The host computer may control analyzer electronics, via the communications interface, by turning the communications line on or off.

NOTE! **If a computer is on line with the analyzer, a restart may be accomplished either by simultaneously holding the "mode" and "UP" buttons on the model 1100 analyzer display panel for approximately 10 seconds or by turning the analyzer off and then on.**

The commands are :
"A" returns the Short Software Version
"C" returns the Device Type
"E" returns the Device output in Percent O2
"H" returns the Fault Code
"I" returns the Fault Descriptions
"V" returns the Long Software Version
"@" returns the Ceramatec Industrial / Neutronics Serial Number
S SERFMT=0 Disables RS 232 output
S SERFMT=1 Enables RS 232 output in HUMAN READABLE format
S SERFMT=2 Enables RS 232 output in MACHINE format w/o Checksum
S SERFMT=3 Enables RS 232 output in MACHINE format w/Checksum
S SERFMT=4 Enables RS 232 output in TAB DELIMITED (Excel) format.

The communications Interface can be operated at several BAUD rates, the factory default is 9600 BAUD. To operate the interface, the host sends an ASCII command letter to the analyzer. The host computer then waits for the analyzer to respond. The analyzer responds no later than 0.5 second after it receives the command letter. All responses are terminated with a carriage return. Data will be sent out the RS232 to the host terminal every 1.0 seconds. To end the communication, enter "S SERFMT=0".

There are several timed update formats of the ASCII dump available:

- 0 none — Timed Outputs disabled
- 1 Human — Output tailored to reading by human
- 2 Machine, no checksum — Output tailored to use by a host computer
- 3 Machine w/ Checksum — Output includes a trailing Checksum to insure data integrity
- 4 Tab Delimited — Output for MS EXCEL file format

The default format is **Human readable**. Configuration of the Service Port timed format is available through the advanced level 1 interface. The format of the Human readable data is:
Mode Reading Units ALM1 ALM2 FLT ↵. ***(see notes 1,2,3)***

The format of the **Machine, no checksum** data is:
Concentration Reading/range Device type Code Fault Code Alarm 1 active Alarm 2 active Display range code↵ ***(see notes 1,2,3)***

The format of the **Machine, w/ checksum** data is:
Concentration ReadingRange DeviceType FaultCode Alarm1Active Alarm2Active DisplayRangeCode CRC Checksum ↵ ***(see notes 1,2,3)***

The format of the **Tab Delimited** data is:
Seconds since unit powered on [tab] Mode [tab] Concentration [tab] Range ID [tab] Alarm1Active [tab] Alarm2Active [tab] Fault ↵ ***(see notes 1,2,3)***

Notes:

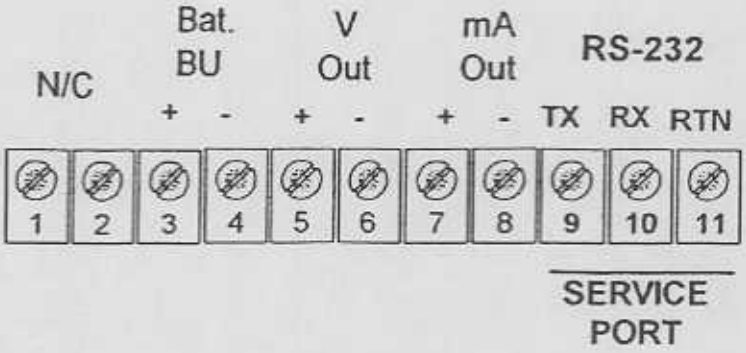
1. *The Fault Code, FLT is output only if active, otherwise, it is deleted from the string.*
2. *The Fault.L code is represented by the Error messages listed in the FAULT section of this manual. The Fault code is bitwise (one bit in the code represents 1 fault). It is a 32 bit number, with fault number 1 (Sensor is warming up) being the most significant bit, which would be 80000000 in hexadecimal. A typical fault code during warm up for a model 1100 would be C0040000 in hex, which would represent fault codes 1, 2 and 14.*
3. *Alarm Active is represented by "1", alarm not active is represented by "0".*

II. The **Advanced Level 1 Access** is available to the user via a PC or directly at the Model 1100 analyzer control panel. Access to level 1 can be accomplished on a PC by typing "setup" when viewing the standard ASCII dump. A series of menus will display on the PC screen allowing access to changing the setup configuration. Some features of this level access may also be initiated directly at the Model 1100 by pressing in the mode button for 5 seconds.

NOTE: Do not attempt advanced level 1 or 2 access without reading "Service Port : Changing the factory settings" section of the appendix.

III. The **Advanced Level 2 Access** is available to the user via a PC by use of a password. This level access allows manipulation of code settings and should only be attempted with direct consultation with our applications engineering staff.

Connection to the Service Port can be made at the terminal blocks on the rear of the analyzer chassis. The terminal blocks are removable for easy installation of the wires. Be certain to match the terminal pins against the terminal ID label on the top of the analyzer chassis.



Access to the Serial Service Port may made through a terminal emulator program such as HYPERTERMINAL available in Windows 95:

Procedure for RS-232 Service Port Interface using *"HYPERTERMINAL"* from Microsoft Windows 95

1. From the Windows menu, select ***"Start"***.
2. Then, select ***"Programs"***.
3. Then, select ***"Accessories"***.
4. Then, select ***"HYPER TERMINAL"***.
5. Double click on the HYPERTERMINAL Icon.
6. Choose name "Model 1100".
7. Choose code: none required.
8. Choose area code: none required.
9. Connect Using:

   Direct to SERIAL COM 1 or SERIAL COM 2 (as applies)
   BPS: 9600 BAUD (factory default, see appendix)
   Data Bits: 8
   Stop Bits: 1
   Parity: none
   Flow Control: none

10. Click "OK"
11. The Model 1100 analyzer will commence sending data via ASCII code dump to the monitor or printer. The information from the analyzer will be sent in ASCII strings at 1 second intervals. Data will be sent in the following factory default format (human readable).

Notes:

If serial communications has not been established with model 1100 analyzer, make certain that the PC SERIAL COM port is functional. This can be accomplished by jumping pins 2&3 on the RS 232 cable leading to the PC. To accomplish this test, disconnect the RS 232 cable from the model 1100 analyzer port and insert a jumper between pins 2&3 on the cable connector or directly at the PC serial COM port. Then, enter a letter from the PC keyboard : push an alpha-character key and then "enter" key. The PC monitor should display the corresponding alpha-characters as they are typed. If the alpha-characters do not echo on the monitor screen, there is a problem with the RS 232 cable, the PC serial COM port, or the HYPERTERMINAL setup.

If the letter does echo on the monitor screen and serial communications with the model 1100 analyzer still has not been established, then pins 2&3 (xmtr & rcv.) may be reversed. First try reversing pins 2 & 3 on the RS - 232 cable connector. Then go back to the beginning of step #1 and try again. If the model 1100 analyzer still does not re-boot, call the Ceramatec Industrial / Neutronics Service Department for further assistance.

CHAPTER 7

Maintenance

Maintenance for the Model 1100 oxygen analyzer is very simple. Apart from the normal maintenance for any instrument such as cleaning the chassis, wiping the display, and replacing the sensor, the Model 1100 does not require any major servicing. Periodic calibration of the sensor on known gas should be performed on a regular basis (see section problems

Recommended Frequency → / Task ↓	At Commissioning	Monthly	Every Year	As Required
Calibrate Sensor	√	√		√
Clean the analyzer chassis and display panel with soft cloth. Make sure the ventilation ports are clear.			√	√
Configure alarms	√			√
Check the analog outputs and RS-232 output against display	√		√	
Install New Oxygen Sensor	√			√ Every 6-9 months for MAXCELL - % sensor Every 2-3 years for MAX-250E sensor

CHAPTER 8

Trouble-Shooting

In some cases problems can be easily diagnosed and corrected. In other cases problems may require the user to return the analyzer to the factory for repair. Contact the customer service department identified at the front of this manual with any questions or when uncertain.

Problem 1: Display reads too high.

Cause: Upset system condition indicates one of the following:

- ⇒ Gas source contamination
- ⇒ Gas delivery system integrity failure
- ⇒ Insufficient time was given to allow a high concentration of oxygen in the sample gas to clear the sample line.

Solution:

- ⇒ Ensure the sample gas source supply is on.
- ⇒ Check gas delivery system for leaks and then repair (tubing connections).
- ⇒ Be certain to allow sufficient time for sample gases to purge out of the sample line when the model 1100 undergoes large step changes from high oxygen to low concentrations of oxygen.

Cause: Improper calibration.

Solution: This can be checked by flowing a certified gas through the analyzer to compare the reading with the O_2 concentration documented on the gas cylinder certification tag. If needed, recalibrate the analyzer as described in Chapter 4.

Problem 2: Display reads too low.

Cause: Improper calibration or sensor is failing.

Solution: Recalibrate and/or install a new sensor as required.

Problem 3: Erratic or intermittent display.

Cause: If line power has been temporarily interrupted, the analyzer will restart itself.

Solution: Provide the analyzer with an un-interuptable power source during critical measuring periods. It is also advisable to provide a power line conditioner in areas where the mains power may experience fluctuations outside of the listed specifications. It is also recommended to install a Lightning Protection Unit (LPU) on the line power when the instrument is to be used in an area where lightning is commonplace and may create a high power surge on the instrument. The practices listed above are not unique to the Model 1100 instrument, but are standard recommended practice for all instrumentation.

Cause: Failure of an electronic component. It is always possible for a component to fail and render the analyzer inoperable. While the Ceramatec Industrial / Ntron Oxygen Analyzer has been designed with rugged components, the possibility of failure is always present.

Solution: In the event of a major component failure, we suggest the device be returned to the manufacturer's facility for repairs. However, in certain instances it may be required to attempt field repairs. Sensors are replaced easily. Major failures such as an electronics board replacement should only be attempted by a trained service technician. It is strongly recommended that the technician reference the model 1100 Service manual for major repairs. The Service manual is available through order with the Ceramatec Industrial / Ntron Customer Service Department.

Appendix

A: Spare Parts Listing

Minor Spare Parts:

VAC Fuses for VAC Power Supply Board

Oxygen Sensor: MAXCELL-21 for front panel access or CAG-250E for remote sensor mount

Operations Manual: 1-16-1011-00-1 or C1-16-1000-01-0

Major Spare Parts:

VAC Power supply: C6-01-1000-02-0

VDC Power Supply (for vdc units)

Front Access Cap for front panel access sensor

Relay Board

Main CPU Board

Replacement terminal blocks: TB1 or TB2 or TB3

Sensor cable for remote sensor option: C6-02-1000-10-0

B: Material Safety Data Sheet (MSDS)

... use as guide only, contact Ceramatec Industrial / Ntron for more information.

1. **Product Identification:** Oxygen sensor, Galvanic Cell Type, Models MAXCELL-21 & MAX-250E
Furnished by Neutronics Inc., 456 Creamery Way, Exton, PA 19341
T: 610-524-8800

2. **Hazardous Ingredients of Solution:**

MAXCELL-21 Sensor: Electrolyte composed of Potassium Hydroxide (KOH)
Anode is Pure lead. Components are encapsulated in a plastic housing.
CAS Numbers: KOH 1310-58-3 Pb 7439-92-1

MAX-250E Sensor: Electrolyte composed of weak acid solution (Acetic Acid)
Lead Acetate, Trihydrate
Anode is pure lead. Components are encapsulated in a plastic housing.
CAS Numbers: Glacial Acetic Acid 64-19-7 Lead Acetate 6080-56-4
Pb 7439-92-1

3. **Health Hazard:** Pb: 0.05 mg/cu.m. OSHA PEL
KOH: 2 mg/cu.m. ACGIH TLV
Acetic Acid, Glacial: 10 PPM OSHA PEL ACGIH/TLV 10 PPM (Stated for 100%)
Lead Acetate, Trihydrate: 0.05 mg/m3 OSHA PEL 0.15 mg/m3 ACGIH/TLV

4. **Physical and Chemical Data:**

	KOH	Pb (pure)	Acetic Acid
Melting Point	-10 to 0°C	328°C	Not Available
Boiling Point	100 to 115°C	1744°C	Not Available
Specific Gravity	1.09 @ 20°C	11.34	Not Available
pH	>14	N/A	3.5 to 4.5
Solubility in Water	Completely	Insoluble	Completely
% Volatiles by Volume	None	N/A	Not Available
Appearance and Odor	Colorless, odorless solution	Grey Metal, odorless	Colorless, Vinegar like odor

5. **Unusual Fire & Explosion hazards:**

Lead acetate decomposes at boiling point and toxic gases are produced. Acetic acid vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to high heat may explode. Sensors are stable under normal operating conditions. Avoid contact of electrolyte on skin and with strong acids or caustics.

6. **Health Hazard Data:**

Lead (use for Lead Acetate & Lead): (TLV/TWA) 0.15 mg/m3 (PEL) 0.05 mg/m3

Toxicity: Intraperitoneal Rate LD 50 for lead acetate trihydrate is 200 mg/Kg

Carcinogenicity: This substance is listed as a NTP anticipated human carcinogen and an IARC animal carcinogen.

Reproductive Effects: None identified

Effects of overexposure:
- Inhalation ..... Tightness and pain in chest,coughing, difficult breathing
- Skin Contact... Irritation
- Eye Contact ... Irritation
- Skin Absorption... May be harmful
- Ingestion ..... Is harmful and may be fatal, headache, nausea, vomiting, dizziness, gastrointestinal irritation
- Chronic Effects .. Anemia, kidney damage, blurred vision, lead build-up, in the central nervous system.

KOH electrolyte: (ACGIH TLV) 2mg/cu.m.

Toxicity: May be harmful or fatal if swallowed Oral LD50 (RAT)=3650 mg/kg

Reproductive Effects: None identified

Effects of overexposure:
- Inhalation ..... unlikely
- Skin Contact... Irritation
- Eye Contact ... Irritation, could result in permanent loss of vision
- Skin Absorption... May be harmful
- Ingestion ..... Is harmful and may be fatal.
- Chronic Effects .. Contact with skin or eyes will cause a burning sensation &/or feel soapy or slippery to touch.

Acetic Acid (concentrated): (TLV/TWA) 25mg/cu.m.

Toxicity: May be harmful or fatal if swallowed Oral LD50 (RAT)=3310 mg/kg

Carcinogenicity: None Identified

Reproductive Effects: None identified

Effects of overexposure:
- Inhalation ..... unlikely
- Skin Contact... Irritation
- Eye Contact ... Irritation, could result in permanent loss of vision
- Skin Absorption... May be harmful
- Ingestion ..... Is harmful and may be fatal.
- Chronic Effects .. Lung damage, teeth damage

7. **Emergency and First Procedures:**

Eye Contact: Immediately flush with water for at least 15 minutes.

Inhalation: Expose to fresh air , inhalation unlikely.

Ingestion: Call a physician. take large amounts of water.

Skin Contact: Immediately flush skin with plenty of water for 15 minutes.

8. **Handling:**

- Wear respiratory, rubber gloves, and eye protection
- **Protective measures during cell replacement:**
  - ◊ Do not remove sensor from shipping container until ready to install
  - ◊ Inspect the sensor for leakage before removal from shipping package. if it is leaking, do not remove from package.
  - ◊ Put on gloves and eye protection when replacing sensor

Note: The above data is based on MSDS provided by the manufacturers of components and by tests conducted by Ceramatec Industrial / Ntron. Ceramatec Industrial / Ntron believes that this information to be accurate and reliable. This information is supplied as reference only. Ceramatec Industrial / Ntron disclaims any liability for damage or injury which results from the use of the data and nothing contained therein shall constitute a guarantee, warranty, or merchantability or representation by Ceramatec Industrial / Ntron Inc. with respect to the data, the product described, or their use for any specific purpose, even if that purpose is known to Ceramatec Industrial / Ntron Inc.

C: Service Port – Changing the factory settings:

The model 1100 features the ability to manually alter the factory setting for serial output format, range selection, alarm relay configuration, analog output, and diagnostics. Changing the factory defaults may be accomplished through four methods:

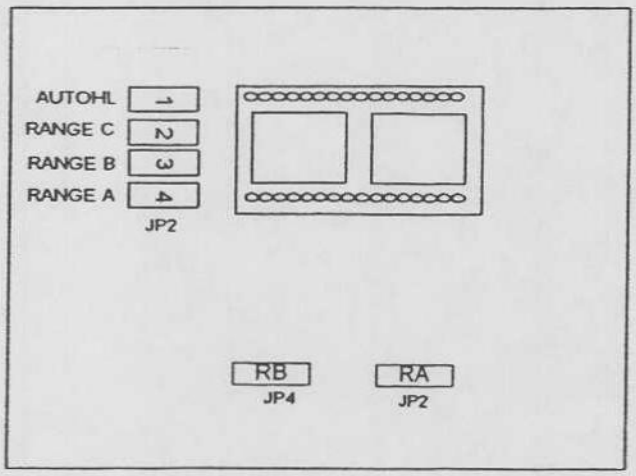
- **Hardware Jumper** selection on the main circuit board..... **OR**
- **Level 1 access through the 1100 keypad..... OR**
- **Level 1 access through serial interface of the service port..... OR**
- **Level 2 access through serial interface of the service port**

C.1 To change the factory settings by accessing the HARDWARE JUMPERS:

Range selection and analog voltage output may be configured using the hardware settings. These changes can also be made directly through the software via the RS-232 interface. Other changes to the factory settings must be made by accessing level 1 software either through the front panel keypad or through the service port serial interface. See C.2 or C.3

1. Make certain that all interface to the model 1100 is disabled at the user device. Make sure that interrupting the alarms, outputs, etc... will not interfere with normal process monitoring or control.
2. Disconnect power from the model 1100 unit.
3. Disconnect the terminal blocks from the rear of the model 1100 chassis. These easily unplug.
4. Remove the screws/lockwashers holding the rear chassis on.. Set these aside for re-assembly. Slide the chassis off.
5. Turn the model 1100 upside down so that the bottom of the main board is face up.
6. Identify the appropriate jumper position. Remove a jumper from the unused position and place into the selected position.... See tables following.
7. Replace the chassis, plumbing, cables, and terminal blocks.
8. Reapply power. Perform a calibration check.
9. Check function of changes to ensure jumpers are recognized by the model 1100.
10. If no problems are noted, continue with normal operation, ELSE, recheck the configuration of jumpers using the steps listed above. If problem persists, contact the service department from the issuing agent.

Fig.C1: Jumper - Location:



Jumper Configuration: Main Board

Bottom View Of Main Board

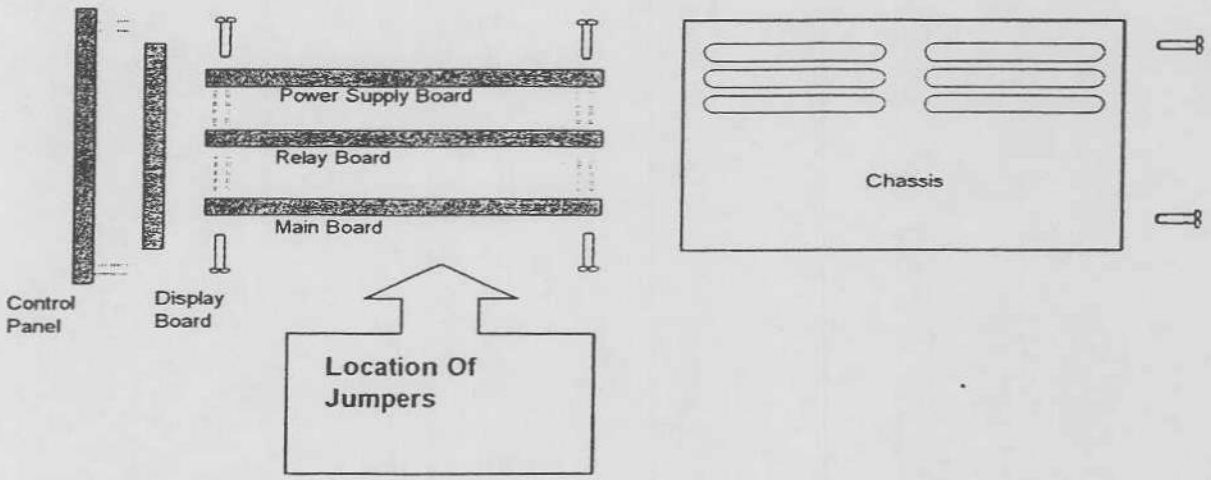
Control Panel Setting	JP2 Jumpers: RANGE SELECT				Function
	AUTO	C	B	A	
8	1	0	0	0	Low Auto Range 0-1/10/25%
9	1	0	0	1	High Auto Range 10-25/50/100%
10	1	0	1	0	Full Auto Range 0-1/10/25/50/100%
1	0	0	0	1	FIXED 1%
2	0	0	1	0	FIXED 10%
3	0	0	1	1	FIXED 25%
4	0	1	0	0	FIXED 50%
5	0	1	0	1	FIXED 100%

TABLE C1: Control Panel setting and Jumpers for Range Select

TABLE C2: ANALOG VDC out jumper

JP4 / JP5 Jumpers		Select Voltage Output Range
RA	RB	
0	1	Vout= 0-1 volt
0	0	Vout= 0-5 volt
1	0	Vout= 0-10 volt

Figure C.2: Accessing the Hardware Jumpers



C.2 To change the factory settings by accessing the Level 1 software at the FRONT PANEL KEYPAD:

In level 1 software (via the front keypad), you can change:

- *Measurement Range: fixed or auto range*
- *Alarm relays are ascending or descending trip*
- *Analog output configuration*
- *Alarm relay operation: Fail safe or Non- Fail safe*
- *Service Port (serial interface) Baud Rate*

Table C3: Operational Table

Range Name	Measured Range	Display	Analog Range	Range Voltage Output
Full Auto Range	0 – 0.99% 1.00% - 9.99% 10.0% - 24.9% 25.0% - 49.9% 50.0%- 100.0%	.XX X.XX XX.X XX.X XXX.X	0...1% 0... 10% 0 ...25% 0 ... 50% 0 ... 100%	5.63 Volts 6.25 6.88 7.50 8.13
LOW Auto Range	0 – 0.99% 1.00% - 9.99% 10.0% - 24.9%	.XX X.XX XX.X	0...1% 0... 10% 0 ...25%	5.63 Volts 6.25 6.88
HIGH Auto Range	10.0% - 24.9% 25.0% - 49.9% 50.0%- 100.0%	XX.X XX.X XXX.X	0 ...25% 0 ... 50% 0 ... 100%	6.88 7.50 8.13
Fixed Range 1%	0 – 0.99%	.XX	0...1%	5.63 Volts
Fixed Range 10%	1.00% - 9.99%	X.XX	0... 10%	6.25 Volts
Fixed Range 25%	10.0% - 24.9%	XX.X	0 ...25%	6.88
Fixed Range 50%	25.0% - 49.9%	XX.X	0 ... 50%	7.50
Fixed Range: 100 %	0-100 %	XX.X	0...100 %	8.13

Procedure to access settings at the 1100 keypad:

1 To configure the 1100 measurement range(s) through the front panel keypad, you must remove all four of the hardware jumpers.

2 To enter the User configuration via the 1100 keypad, Press and hold the MODE button for 10 seconds. The display will show "---". Release the mode button. You are now in the setup mode, **range setting.**

3 The display will show "A 1". Pressing the mode key will scroll through the User configuration Modes.

MODE	INITIAL DISPLAY READING WHEN SCROLLING
USER CONFIGURATION A: SET RANGE	A 0
USER CONFIGURATION 1: ALARM 1 TRIP	1 0
USER CONFIGURATION 2: ALARM 2 TRIP	2 0
USER CONFIGURATION 3: ANALOG OUTPUT	3 0
USER CONFIGURATION 4: SET SERIAL OUTPUT	4 0
USER CONFIGURATION 7: SET ZERO RANGE	7 0
USER CONFIGURATION 8: RESTORE FACTORY SETTINGS	8 0
USER CONFIGURATION E: SET VOLTAGE TO 110 OR 220 vac	E 0
USER CONFIGURATION F: SET FAIL SAFE	F 0
USER CONFIGURATION b: SERIAL BAUD RATE	b 0
FPT: FRONT PANEL TEST	" – " , then " - - - " after 10 seconds

4 The instrument **range** may be selected by the hardware jumpers or by this software range setup. *To use the software setup, you must remove all of the four hardware jumpers.*

In the any fixed range, if the measured concentration is outside of the selected range or outside of the display's ability, the value will be shown in percent oxygen, and the display will flash. Analog Output ranges never extend.

5 **USER CONFIG. A:** Display will read `A 0' **Set RANGE**: see table C1 UNDER "Control Panel Setting"

6 **USER CONFIG. 1: Alarm 1 Trip**: Use the UP and DOWN arrow keys on the 1100 display to change this value

from 0 to 1: 1 = descending alarm 1 0 = ascending alarm 1

7 **USER CONFIG. 2: Alarm 2 Trip** : Use the UP and DOWN arrow keys on the 1100 display to change this value

from 0 to 1: 1 = descending alarm 2 0 = ascending alarm 2

8 **USER CONFIG. 3: Analog output:** 0 = 0.0 to 5.0 vdc, 1 = 0.0 to 10.0 vdc, 2 = 0.0 to 1.0 vdc

9 **USER CONFIG. 4: SERIAL (SERVICE) PORT OUTPUT FORMAT** The Serial Service Port Output can be configured for several output modes.

In the standard access, the PC or printer will receive a steady stream of information via an ASCII dump. Information includes oxygen concentration, alarm status, mode status, and Fault status. There are several timed update formats of the ASCII dump available:

- none — Timed Outputs disabled
- Human — Output tailored to reading by human
- Machine, no checksum — Output tailored to use by a host computer
- Machine w/ Checksum — Output includes a trailing Checksum to insure data integrity
- Tab Delimited — Output uses tabs and may be used by a printer, host computer, or DAQ (EXCEL)

CODE	Serial Output Type
0	None
1	Human
2	Machine No Checksum
3	Machine with Checksum
4	Tab Delimited (Excel)

The default format is **Human readable**. Configuration of the Service Port timed format is available through the advanced level 1 interface. The format of the Human readable data is:
Mode Reading Units ALM1 ALM2 FLT ↵

Machine, no checksum format of data:
Concentration Reading/range Device type Code Fault Code Alarm 1 active Alarm 2 active Display range code↵

Machine, w/ checksum format of data:
Concentration ReadingRange DeviceType FaultCode Alarm1Active Alarm2Active DisplayRangeCode Checksum ↵

10 **USER CONFIG. 7: Zero Range Code**: The model 1100 analyzer allows for a two point calibration.

The first point should be an air cal. The second calibration point, "Zero Range Code" , should be carried out with a certified gas of a concentration of oxygen near or in the range of primary measurement (For example, 0% oxygen in nitrogen). This lower point calibration, or the Zero Point, may be chosen from the list of ranges in the following table:

Table C.4 Zero Range

Entered Value	Range
0	Single Point Calibration
1	0.0 – 50 ppb
2	0.0 – 500 ppb
3	0.0 – 50 ppm
4	0.0 – 500 ppm
5	0.0 – 0.5%
6	0.0 – 5%
7	0.0 – 5%
8	0.0 – 50%
9	18% - 24%

11 USER CONFIG. E: Set Unit Supply Voltage to 110 or 220 VAC (applies only to VAC power supply models). 0 = 110 VAC power, 1 = 220 VAC operation. This setting only affects warm up time at power up of unit. The sensor will warm up quicker in the proper setting, no damage occurs to the unit in the wrong setting.

12 **F: Fail Safe Relays**:

1 = Alarm 1&2 relays are in fail safe mode (relay coils are energized in non-alarm condition, de-energized in powe off or in alarm condition.

0 = Alarms 1 & 2 relays are in non-fail safe mode (relay coils are de-energized in non-alarm condition or in power off, energized in alarm condition.

13 **USER CONFIG. b: Service Port Baud Rate:**

CODE	Baud Rate
0	110
1	300
2	1200
3	2400
4	4800
5	9600
6	19200
7	38400

14 **USER CONFIG. C: CLEAN MODE**

Does not apply to model 1100

15 **USER CONFIG 8: Display shows '8 0' – Restore Factory Settings**

This mode allows the operator to restore the instrument to the factory set points. This includes all calibrations, alarms and baud rates. To perform this function, press the "UP" button until the display shows 8 88, then press the mode button. If you do not wish to perform the factory restore, press the mode button with any other number on the display.

16 FPT - Front panel test

The FPT is available from the keyboard to allow the factory and users to quickly determine if the front panel is working correctly. To enter the FPT, press and hold both the INC and DEC keys. The display will show ' — ' until the INC and DEC keys have been held for 10 seconds. The display will then change to ' —'. Upon entry to the FPT, the serial port will output: "Entering Lamp Test." and the display will begin displaying characters, one at a time. If you press the front panel INC key (or the PCB INC key) the display will show ' UUU'. Pressing the DEC key results in ' ddd' and pressing the MODE key shows ' ==='. To exit the FPT, press and hold both the INC and DEC keys until ' - - -' is shown, then release the INC and DEC keys to resume normal operation.

17 If a computer is on line with the analyzer, a restart may be accomplished either by simultaneously holding the "mode" and "UP" buttons on the model 3100 analyzer display panel for approximately 10 seconds or by turning the analyzer off and then on.

Er.0 Starting a System for the first time

Two identical copies of the system's setup information are stored in the EEPROM. If both copies are damaged (the program determines this by inspecting the CRC16 of the data) the device will refuse to run. ' Er.0' will be displayed on the front panel and the device is locked with the fault light and relay ON.
The only way out of this error is to perform a factory initialization that can be reached through the Setup Mode with a serial terminal.

C.3 To change the factory settings through the Software Interface (RS-232 port):

Use a terminal or terminal emulator (like the Windows 95 HyperTerminal) to interactively test and configure the analyzer. See Section "Service Port" of this manual. Connect your terminal, set the communications parameters to 9600 baud, 8 data bits, 2 stop bits, no parity, no hardware or software handshaking. Terminal emulation must be VT100 or VT200.

Turn on the analyzer's power and wait for the Software Version number to be displayed. The terminal emulator should then display @@@ then the Model, serial number, version number and the baud rate.

. Regardless of the serial output format previously selected, type SETUP and press enter from the Terminal emulator.

The instrument will enter the User Setup Menu and the instrument display will show ' SU '. Follow the on screen prompts to change or configure the instrument. NOTE: the F3 key is the exit button. You will be prompted to save or discard your changes upon exiting.

From this first menu, you have access to general system information, the relay and analog output configurations, the instrument display range, and the operator lockouts etc.:

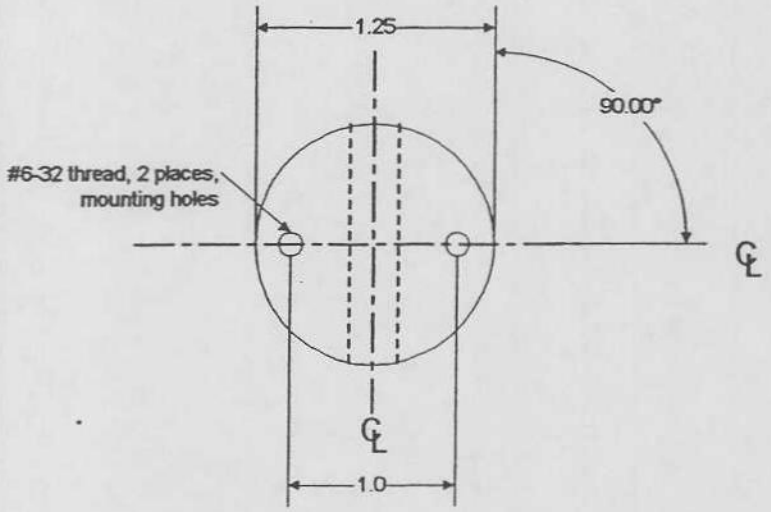
```
                *****> SETUP MAIN MENU <*****              (U00)
Press To Change                          (F3-Exit Setup Mode Now)
- -  ----------------------------------------------

1 I  System Information
2 R  Alarm Relay Setup
3 A  Analog Output Setup
4 G  Display Auto-Range Setup

5 S  Serial (RS-232) Output Setup

6    Operator may change Alarm Setpoints: Yes
7    Operator may change Calibration Reading: Yes
8    Operator may use the User Menu: Yes

9 Z  Assume Low End Calibration when concentration:  5-> 0.0 to  500 PPM

 T   Calibration Mode Auto Return to Run after 120.0 seconds

0 L  220 Volt Line Voltage: No

Q Esc Quit, return to the previous menu

   ->
```

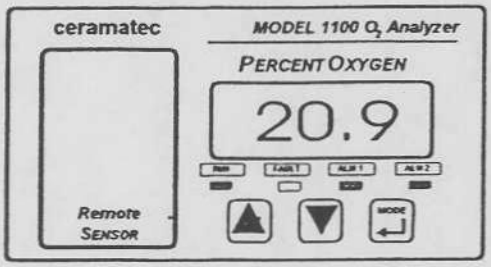
Notes:

- The service port allows more setup and diagnostics choices. Items #6,7,8 in the box above allow you to lockout users from accessing certain features through the model 1100 keypad.
- Item #9 in the box listed on the previous page refers to setting the low end calibration point (or actually, the range of concentration in which the lower end calibration will occur).
- Item #9T in the box on the previous page refers allows you to set the amount of time the alarm relays are disabled after leaving calibration mode. This time is set in total seconds of wait time. The wait time is useful for those instances when the calibration is of a concentration of oxygen which would normally create an alarm condition. By allowing a 120 second wait period, the model 1100 will not enable the alarms for 120 seconds after exiting the calibration mode. Choose a limit of time which will allow sufficient time for the sample tubing to be cleared of the calibration gas and replaced with normal process gas.
- 0 L refers to the mode for setting the operational voltage: 120 or 110 volts AC. **You must select the proper voltage before operating the model 1100.**

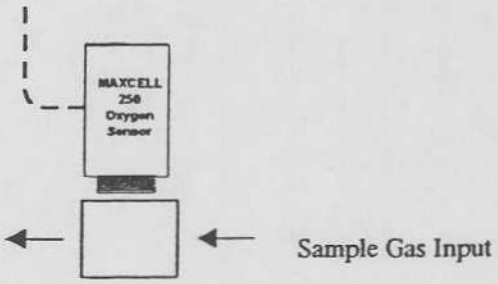
D: Additional Drawings

Remote Flow Though Head Mounting:

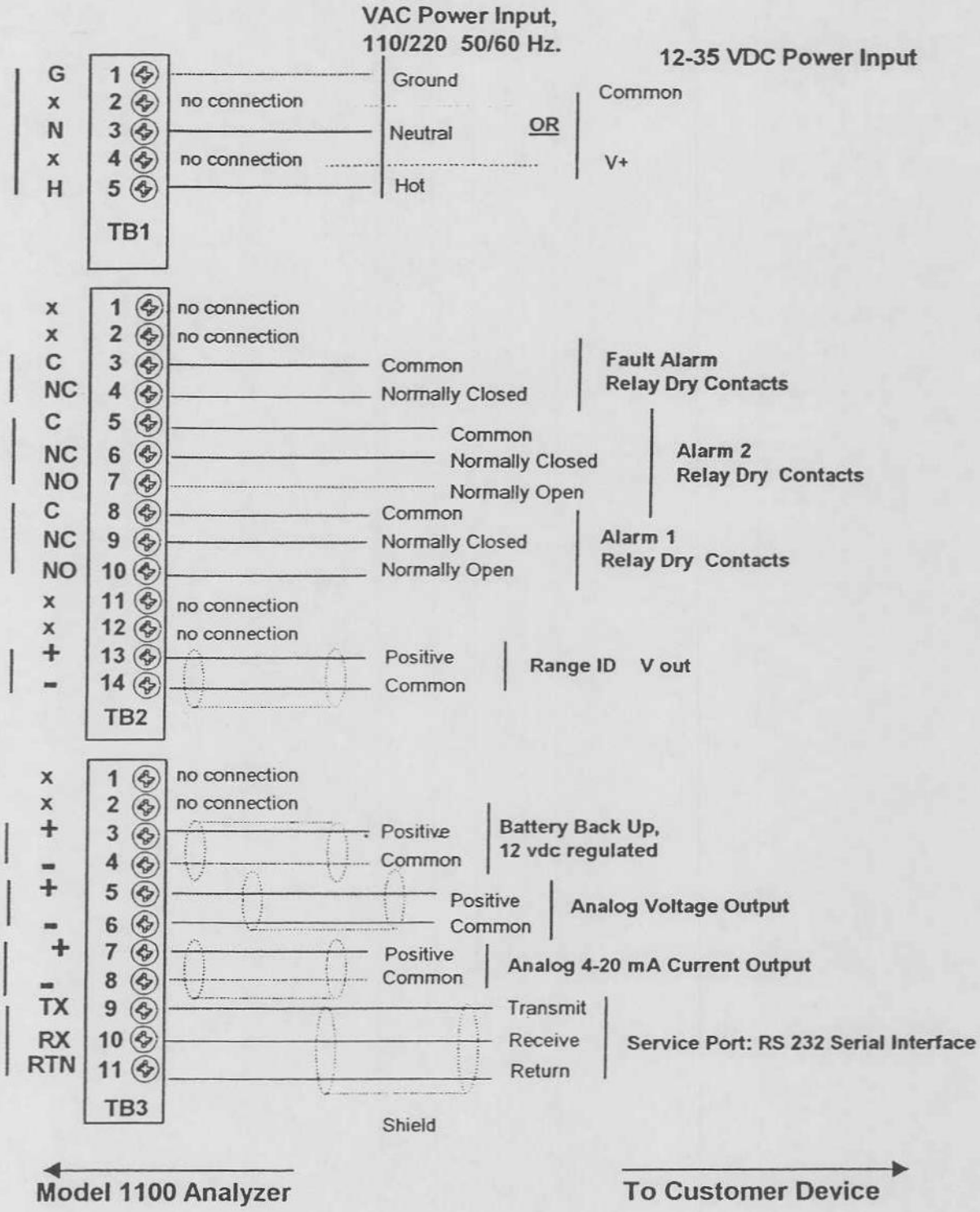




Remote Sensor installation



Wiring Hook-Up diagram, Flush Mounted Sensor Version:

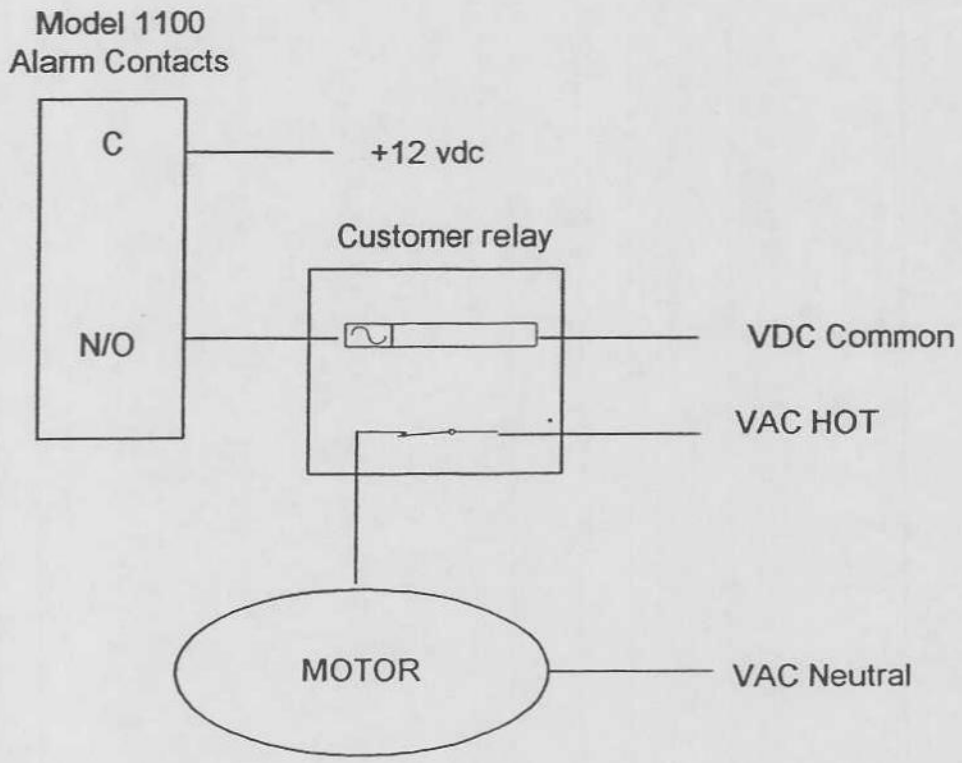


Notes:

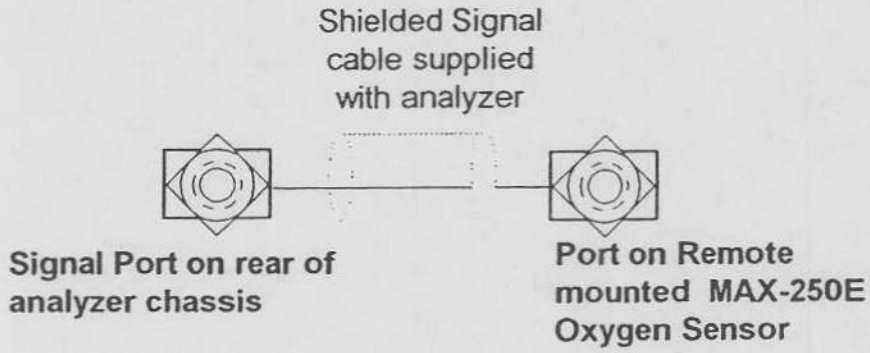
1. Use individually shielded twisted pair cable for connection to Analog outputs & Range ID, Use shielded cable for Service Port (RS-232 serial interface) connection. Min. 24 AWG stranded conductor.
2. Use min. 18 AWG stranded conductor wiring for Mains Power Input connections.

3. Surge devices may be required for driving inductive devices (such as solenoid valves) at the alarm relay contacts.
4. It is recommended to use an externally mounted power relay to drive motors or other large power devices in connection to the alarm relays. See fig. A below:

Figure A: Driving Motors with the alarm relay contacts



Additional Wiring for Remote Sensor Option:



Atlas Copco / Powerex

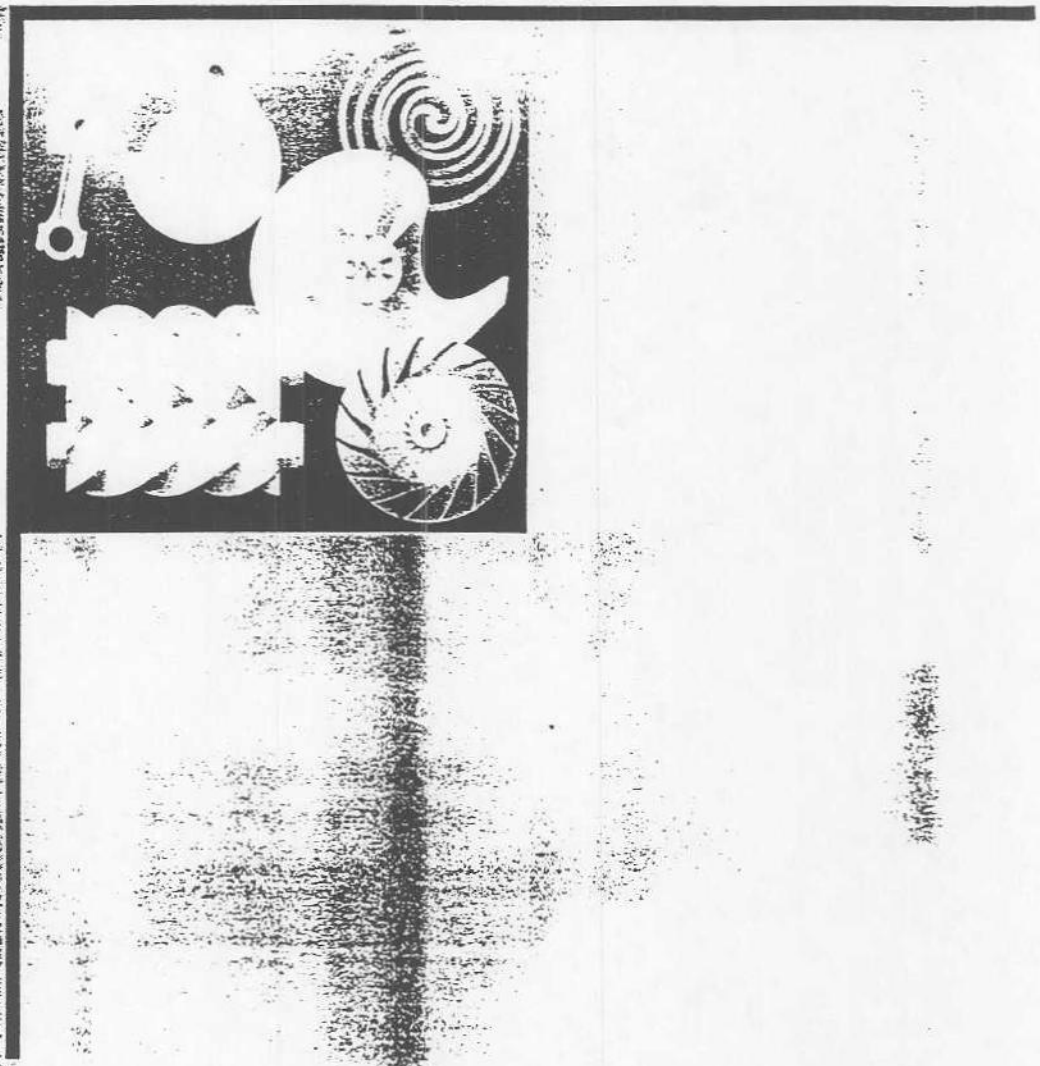
Feed Air Compressor

Owner's Manual

(Different brands, exact same specifications, built by same manufacturer)

Atlas Copco Stationary Air Compressors

SF1 - SF2 - SF4 - SF6T - SF8T



Instruction book

Atlas Copco

OWNERSHIP DATA

Unit type: .....
or type: .....
very date: .....
Service Plan: .....

Owner's machine No.: .....
Unit serial No.: .....
Motor serial No.: .....
First start-up date: .....

Selected lubricants
Compressor: .....
Bearing grease type, electric motor: .....

Capacity: .....

Printed Matter Nos.
Atlas Copco instruction book: .....
Atlas Copco parts list: .....
Atlas Copco logbook: .....

Motor instruction book: .....
Motor parts list: .....

Local Atlas Copco Representative
Name: .....
Address: .....
Telephone: ..... Contact persons: Service: .....
Telex: ..... Parts: .....

SAFETY PRECAUTIONS

To be read attentively and acted accordingly before installing, operating or repairing the unit.

These recommendations apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to the application which are not included herein.

In addition to normal safety rules which should be observed with stationary air compressors and equipment, the following safety directions and precautions are of special importance.

n operating this unit, the operator must employ safe working ices and observe all related local work safety requirements and ordinances.

The owner is responsible for maintaining the unit in a safe operating condition. Parts and accessories shall be replaced if unsuitable for safe operation.

Installation, operation, maintenance and repair shall only be performed by authorized, trained, competent personnel.

Normal ratings (pressures, temperatures, time settings, etc.) shall be durably marked.

Any modification on the compressor shall only be performed in agreement with Atlas Copco and under supervision of authorized, competent personnel.

If any statement in this book, especially with regard to safety, does not comply with local legislation, the stricter of the two shall apply.

These precautions are general and cover several machine types and equipment; hence some statements may not apply to the unit(s) described in this book.

Installation

Apart from general engineering practice in conformity with the local safety regulations, the following directives are specially stressed:

1. A compressor shall be lifted only with adequate equipment in conformity with local safety rules.

   Loose or pivoting parts shall be securely fastened before lifting. It is strictly forbidden to dwell or stay in the risk zone under a lifted ad. Lifting acceleration and retardation shall be kept within safe imits.

   Wear a safety helmet when working in the area of overhead or lifting equipment.

2. Any blanking flanges, plugs, caps and desiccant bags shall be removed before connecting up the pipes. Distribution pipes and connections shall be of correct size and suitable for the working pressure.
3. Place the unit where the ambient air is as cool and clean as possible. If necessary, install a suction duct. Never obstruct the air inlet. Care shall be taken to minimize the entry of moisture with the inlet air.
4. The aspirated air shall be free from flammable fumes or vapours, e.g. paint solvents, that can lead to internal fire or explosion.
5. Air-cooled units shall be installed in such a way that an adequate flow of cooling air is available and that the exhausted air does not recirculate to the inlet.
6. Arrange the air intake so that loose clothing of people cannot be sucked in.
7. Ensure that the discharge pipe from the compressor to the aftercooler or air net is free to expand under heat and that it is not in contact with or close to flammable material.
8. No external force may be exerted on the air outlet valve; the connected pipe must be free of strain.
9. If remote control is installed, the unit shall bear an obvious sign reading:

   DANGER: This machine is remotely controlled and may start without warning.

   As a further safeguard, persons switching on remotely controlled units shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the start equipment.
10. On units with automatic start-stop system, a sign stating **"This machine may start without warning"** shall be attached near the instrument panel.
11. In multiple compressor systems manual valves shall be installed to isolate each compressor. Non-return valves (check valves) shall not be relied upon for isolating pressure systems.
12. Never remove or tamper with the safety devices, guards or insulations fitted on the unit. Every pressure vessel or auxiliary installed outside the unit to contain air above atmospheric pressure shall be protected by a pressure-relieving device or devices as required.

This instruction book describes how to handle the machines to ensure safe operation, optimum efficiency and long service life.

ead this book before putting the machine into operation to ensure correct handling, operation and proper maintenance from the beginning. The maintenance schedule comprises measures for keeping the machine in good condition.

Keep the book available for the operator and make sure that the machine is operated and that maintenance is carried out according to the instructions. Record all operating data, maintenance performed, etc. in an operator's logbook available from Atlas Copco. Follow all relevant safety precautions, including those mentioned on the cover of this book.

Repairs must be carried out by trained personnel from Atlas Copco who can be contacted for any further information.

In all correspondence mention the type and the serial number, shown on the data plate.

For all data not mentioned in the text, see sections "Preventive maintenance schedule" and "Principal data".

The company reserves the right to make changes without prior notice.

Contents

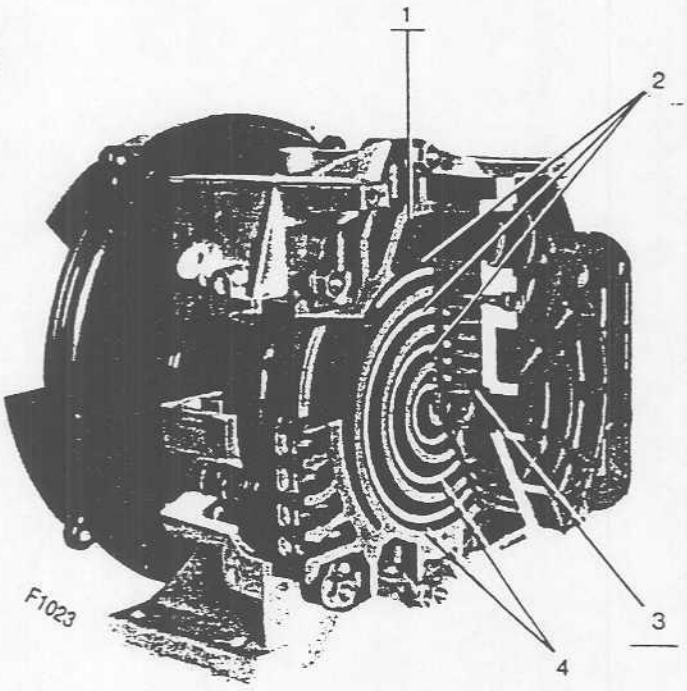
1 LEADING PARTICULARS

1.1 General description

SF are stationary, single-stage, oil-free compressors. They are air-cooled. The power from the drive motor is transmitted to the compressor element through one or two belts.

1.1.1 Compressor element (Fig. 1)

The compressor element consists of a fixed scroll-shaped housing and a scroll-shaped rotor. Air enters the compressor element through inlet opening (1). Once the air is drawn in, the orbiting scroll (4) seals the inlet opening and forces the air into a continuously decreasing space. As scroll (4) keeps orbiting, this process of compression is constantly repeated, resulting in discharging of oil-free compressed air through outlet opening (3).



1. Air inlet
2. Fixed scroll
3. Compressed air outlet
4. Orbiting scroll

Fig. 1. Compressor element

1.1.2 Compressor variants

SF compressors have following main components (Figs. 2 and 3):

- compressor element (E)
- air filter (AF)
- drive motor (M1)
- check valve (CV)
- temperature shut-down switch (TSHH11)
- air cooler (Ca) and cooling fan (FN1)

Check valve (CV) prevents blow-back of compressed air when the compressor is stopped. Temperature shut-down switch (TSHH11) and safety valve (SV) protect the compressor against overheating and overpressure respectively.

SF Standard (Fig. 2a)
Most of the main components are housed in a hinged bodywork top which serves as silencing hood (4). The hood is mounted on a 120 l air receiver (AR) (a 250 l receiver is available as option). A pressure switch (S2), safety valve (SV), air outlet valve (AV), drain valve (Dm) and pressure gauge (Gp) are fitted to the receiver. A circuit breaker (S1) is also provided.

SF Skid (Fig. 2b)
Most of the main components are housed in a hinged bodywork top which serves as silencing hood (4). The hood is mounted on a frame (5) allowing installation of the compressor at the required spot.

SF Twin (Fig. 2c)
Two compressor modules are mounted on a 250 l or 475 l air receiver (AR). Each module is provided with the main components as described above and has its own pressure switch (S2) and circuit breaker (S1).

SF Pack (Fig. 3a)
The compressor is enclosed in a sound-insulated bodywork. A control panel, pressure switch (PSR19) and safety valve are provided. An electric cubicle is installed behind the front door.

SF Full-feature (Fig. 3b)
SF Full-feature are SF Pack compressors additionally provided with an air dryer of the refrigerant type. The dryer removes moisture from the compressed air. See section 1.5.

An optional electronically controlled condensate drain valve to flush the receiver at pre-set intervals may be installed.

1.2 Air flow (Figs. 2 and 3)

Air is drawn through air filter (AF) into compressor element (E) and is compressed. Compressed air is discharged through air cooler (Ca) and check valve (CV).

Notes:

SAFETY PRECAUTIONS (continued)

13. Pipework or other parts with a temperature in excess of 80 degrees celsius and which may be accidentally touched by personnel in normal operation shall be guarded or insulated. Other high-temperature pipework shall be clearly marked.
14. If the ground is not level or can be subject to variable inclination, consult Atlas Copco.
15. The electrical connections shall correspond to the local codes. The units shall be grounded and protected against short circuits by fuses.

Operation

1. Air hoses shall be of correct size and suitable for the working pressure. Never use frayed, damaged or deteriorated hoses. Use only the correct type and size of hose end fittings and connections. When blowing through a hose or air line, ensure that the open end is held securely. A free end will whip and may cause injury. Make sure that a hose is fully depressurized before disconnecting it.

   Never play with compressed air. Do not apply it to your skin or direct an air stream at people. Never use it to clean dirt from your clothes. When using it to clean equipment, do so with extreme caution and use eye protection.
2. The compressor is not considered as capable of producing air of breathing quality. For breathing air quality, the compressed air must be adequately purified according to local legislation and standards.
3. Never operate the unit when there is a possibility of taking in flammable or toxic fumes.
4. Never operate the unit at pressures below or in excess of its limit ratings as indicated on the Principal Data sheet.
5. Keep all bodywork doors shut during operation. The doors may be opened for short periods only, e.g. to carry out checks. Wear ear protectors when opening a door.
6. People staying in environments or rooms where the sound pressure level reaches or exceeds 90 dB(A) shall wear ear protectors.
7. Periodically check that:
   a. All guards are in place and securely fastened
   b. All hoses and/or pipes inside the unit are in good condition, secure and not rubbing
   c. There are no leaks
   d. All fasteners are tight
   e. All electrical leads are secure and in good order
   f. Safety valves and other pressure-relief devices are not obstructed by dirt or paint
   g. Air outlet valve and air net, i.e. pipes, couplings, manifolds, valves, hoses, etc. are in good repair, free of wear or abuse
8. If warm cooling air from compressors is used in air heating systems, e.g. to warm up a workroom, take precautions against air pollution and possible contamination of the breathing air.
9. Do not remove any of, or tamper with, the sound-damping material.

Maintenance

Maintenance and repair work shall only be carried out under supervision of someone qualified for the job.

1. Use only the correct tools for maintenance and repair work.
2. Use only genuine spare parts.
3. All maintenance work, other than routine attention, shall only be undertaken when the unit is stopped, the main power supply is switched off and the machine has cooled down. Take positive precaution to ensure that the unit cannot be started inadvertently.

   In addition, a warning sign bearing a legend such as **"work in progress; do not start"** shall be attached to the starting equipment.
4. Before removing any pressurized component, effectively isolate the unit from all sources of pressure and relieve the entire system of pressure.
5. Never use flammable solvents or carbon tetrachloride for cleaning parts. Take safety precautions against toxic vapours of cleaning liquids.
6. Scrupulously observe cleanliness during maintenance and repair. Keep dirt away by covering the parts and exposed openings with a clean cloth, paper or tape.
7. Never weld or perform any operation involving heat near the oil system. Oil tanks must be completely purged, e.g. by steam-cleaning, before carrying out such operations.

   Never weld on, or in any way modify, pressure vessels.

   Whenever there is an indication or any suspicion that an internal part of a machine is overheated, the machine shall be stopped but **no inspection covers shall be opened** before sufficient cooling time has elapsed: this to avoid the risk of spontaneous ignition of the oil vapour when air is admitted.

   Never use a light source with open flame for inspecting the interior of a machine, pressure vessel, etc.
8. Make sure that no tools, loose parts or rags are left in or on the unit.
9. Before clearing the unit for use after maintenance or overhaul, check that operating pressures, temperatures and time settings are correct and that the control and shut-down devices function correctly. If removed, check that the coupling guard of the compressor drive shaft has been reinstalled.
10. Every time the separator element is renewed, examine the discharge pipe and the inside of the oil separator vessel for carbon deposits; if excessive, the deposits should be removed.
11. Protect the motor, air filter, electrical and regulating components, etc. to prevent moisture from entering them, e.g. when steam-cleaning.
12. Make sure that all sound-damping material, e.g. on the bodywork and in the air inlet and outlet systems of the compressor, is in good condition. If damaged, replace it by genuine Atlas Copco material to prevent the sound pressure level from increasing.
13. Never use caustic solvents which can damage materials of the air net, e.g. polycarbonate bowls.
14. The following safety precautions are stressed when handling refrigerant:
    a. Never inhale refrigerant vapours. Check that the working area is adequately ventilated; if required, use breathing protection.
    b. Always wear special gloves. In case of refrigerant contact with the skin, rinse the skin with water. If liquid refrigerant contacts the skin through clothing, **never tear off or remove** the latter; flush abundantly with fresh water over the clothing until all refrigerant is flushed away; then seek medical first aid.
    c. Always wear safety glasses.
15. Protect hands to avoid injury from hot machine parts, e.g. during draining of oil.

Note: With stationary machine units driven by an internal combustion engine, allowance has to be made for extra safety precautions, e.g. spark arrestors, fuelling care, etc. Consult Atlas Copco.

All responsibility for any damage or injury resulting from neglecting these precautions, or by non-observance of ordinary caution and due care required in handling, operating, maintenance or repair, even if not expressly mentioned in this book, will be disclaimed by Atlas Copco.

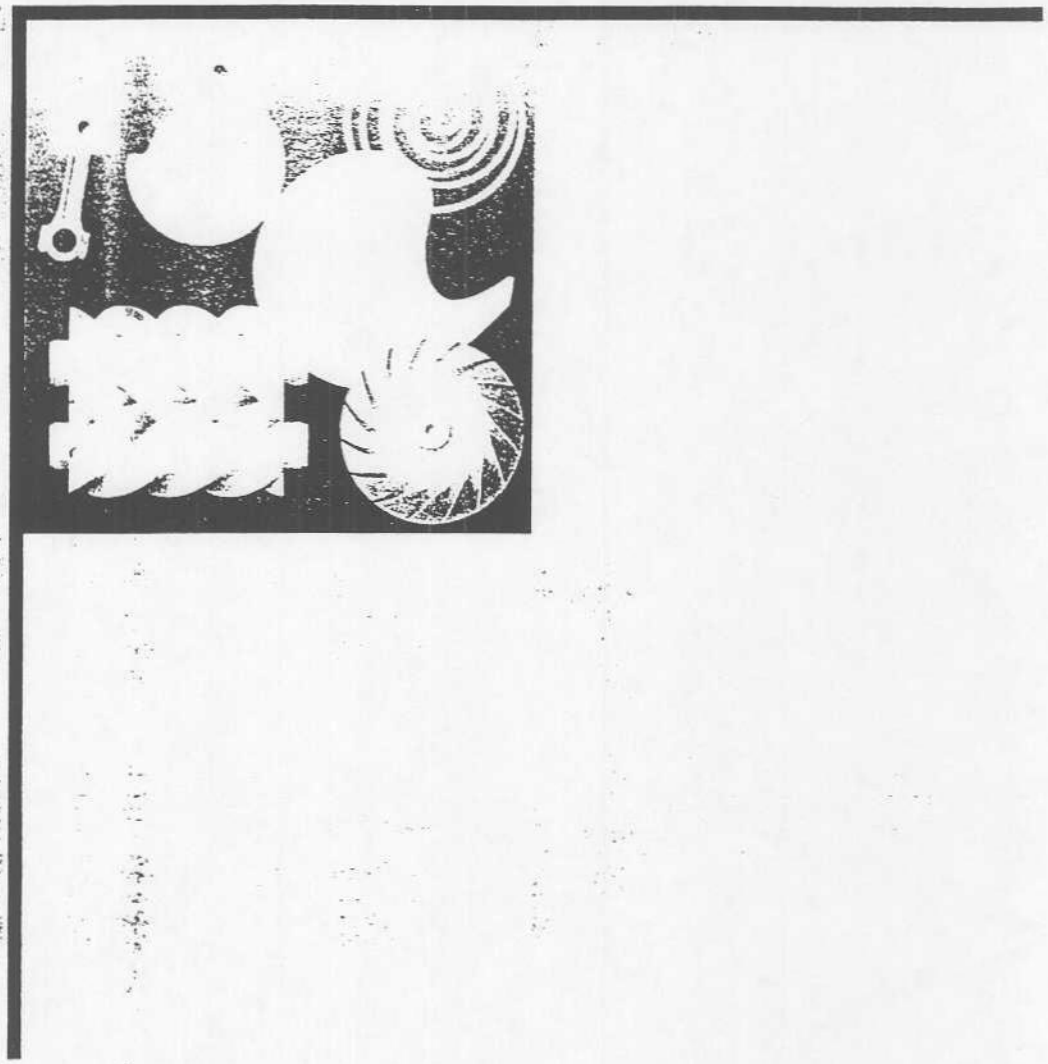
Atlas Copco

Feed Air Compressor

Parts List

Atlas Copco Stationary Air Compressors

SF1 - SF2 - SF4
SF6T - SF8T



Parts list

Atlas Copco

COUNTRY	APPLICABLE CODE / RULE	AUTHORIZED BODY
Australia	AS1210	D .. Department of Industrial Relations (DIR)
Austria	TÜV-WIEN Merkblätter	Ta . Österreichischer Technischer Überwachungs-Verein (ATÜV)
European Union	CE 87/404 directives for simple pressure vessels	CE . Notified bodies are involved as applicable
Danmark	DNV Rules	N .. Det Norske Veritas (DNV)
Finland	SFS-Rules	Tk . Taurus Tarkaskuskeskus (TTK)
France	CODAP '92 - AD Merkblätter	S .. Département Régional de l'Industrie et de la Recherche et de l'Environnement (DRIRE)
Germany	AD Merkblätter	T .. Technischer Überwachungs-Verein (TÜV)
Germany	Normen GerLL	Lg . Germanischer Lloyd's (GerLL)
Great Britain	Lloyd's Register Rules, BS5500	L .. Lloyd's Register of Shipping (L.R.)
Italy	Raccolta's VSR/M/E/S	An . Instituto Superiore per la Prevenzione e la Sicurezza del Lavoro (ISPESL)
Sweden	Swedish Pressure Vessel Code	Sa . Svensk Anläggningsprovning (SA)
Switzerland	Technische Vorschriften für Druckbehälter und Kessel	Sv . Schweizerischer Verein für Druckbehälter Besitzer (SVDB)
United States	ASME Section VIII Div 1, TENA for Coolers	As . American Society of Mechanical Engineers (ASME)
Canada	CEC - Canadian Electrical Code PART1 (C22.1-94 Safety Standard for Electrical Installation)	C .. Canadian Standardization Association (CSA)
United States	NEC - National Electrical Code (NFPA - National Fire Protection Association)	U .. Underwriters Laboratories (UL)

INSTRUCTIONS FOR USE (en)

1 ORDERING PARTS
Always quote the part number, the name and the quantity of the parts required, as well as the type and serial number of the machine.
2 EXPLANATION OF COLUMNS
Ref. - Reference number
Relates a part in list and drawing. Parts without reference number are not shown on the drawing.
Part No. - Part number
If no part number is given the part cannot be obtained as spare part. A part of which the number is followed by a black dot is comprised in the bold printed assembly right above.
Note: An assembly is printed in bold in all columns.
"<<< >>>" directs to consult another list.
When the part number(s) of specific part(s) are placed below the reference/name line a choice must be made based upon the type/version of the machine.
Qty - Quantity
Indicates the quantity of parts related to the reference number. "AR" means "as required": bulk material or quantity to be determined.
Name: Translations of the English part names can be found in printed matter no. 2930 1214 00.
Remarks
Parts belonging to Service Kits are indicated by K1, K2....
Parts of a Service Kit may be spread over several lists.
A letter can indicate a part has been certified according to the listed codes or rules by the indicated authorized body; if a letter is put between brackets the part itself is not certified but must be used on units certified by the authorised body. Dimensions are given in millimeter.
3 AUTHORIZED BODIES: See above English text.

GEBRUIKSAANWIJZING (nl)

1 BESTELLEN VAN ONDERDELEN
Vermeld steeds het onderdeelnummer, de benaming en het aantal van de gewenste stukken, evenals het type en het serienummer van de machine.
2 TOELICHTING BIJ KOLOMMEN
Ref. - Referentienummer: brengt een bepaald onderdeel in de lijst in verband met de tekening. Onderdelen zonder referentienummer worden niet op de tekening getoond.
Part No. - Onderdeelnummer: als er geen onderdeelnummer opgegeven wordt, is het onderdeel niet als wisselstuk verkrijgbaar. Een onderdeel waarvan het nummer gevolgd wordt door een zwarte stip maakt deel uit van de vet gedrukte eenheid er vlak boven.
Opmerking: Een eenheid is in alle kolommen in vet gedrukt.
"<<<>>>" geeft een aanwijzing om een andere lijst te raadplegen.
Als het (de) onderdeelnummer(s) van het (de) specifieke wisselstuk(ken) onder de regel met de referentie/benaming geplaatst is (zijn), moet er een keuze gemaakt worden volgens het type/de uitvoering van de machine.
Qty - Aantal: geeft het aantal onderdelen aan in verband met het overeenstemmend referentienummer. "AR" betekent "As required" (= "zoals vereist"): hoeveelheid of aantal te bepalen.
Name: vertalingen van de Engelse benamingen zijn te vinden in drukwerk nr. 2930 1214 00.
Remarks: onderdelen die deel uitmaken van "Service Kits" worden aangeduid met K1, K2 ...
Onderdelen van een "Service Kit" kunnen verspreid zijn over verschillende lijsten.
Een letter kan aangeven dat een bepaald onderdeel werd geattesteerd volgens de codes of regels van de lijst door het aangegeven gevolmachtigde orgaan; indien een letter tussen haakjes staat, is het onderdeel zelf niet geattesteerd maar moet het wel gebruikt worden op eenheden die geattesteerd zijn door het gevolmachtigde orgaan. De afmetingen worden uitgedrukt in millimeter.
3 GEVOLMACHTIGDE ORGANEN: Zie boven Engelse tekst.

STRUCTIONS D'UTILISATION (fr)

...MANDE DE PIECES DETACHEES
...quer le numéro de pièce détachée, le nom, la quantité de pièces désirée, le type et le numéro de série de la machine.
2 EXPLICATIONS DES COLONNES
Ref. - Numéro de référence: se réfère à une pièce dans la liste et l'illustration. Les pièces sans numéro de référence ne sont pas indiquées dans l'illustration.
Part No. - Numéro de pièce détachée: si le numéro de pièce n'est pas indiqué, la pièce n'est pas livrable comme pièce détachée. Une pièce dont le numéro est suivi d'un point noir est comprise dans l'ensemble dont le numéro est imprimé en gras et situé immédiatement au-dessus.
Note: Un ensemble est imprimé en gras dans toutes les colonnes.
"<<< >>>" indique à consulter une autre liste.
Si le(s) numéro(s) de pièce d'une (des) pièces(s) spécifiques sont placés au-dessous de la ligne de référence/nom, il faut choisir le type/version de la machine.
Qty - Quantité: indique la quantité de pièces concordant avec le numéro de référence. "AR" signifie "comme requis": matériau en vrac ou quantité à déterminer.
Name: Dans l'imprimé No. 2930 1214 00 se trouve la traduction des noms en anglais.
Remarques: les pièces appartenant aux Service Kits sont indiquées par K1, K2...
Les pièces d'un Service Kit sont parfois réparties sur plusieurs listes.
Une lettre peut indiquer si une pièce a été certifiée selon les codes ou règlements spécifiés par l'institution autorisée indiquée; une lettre entre parenthèses signifie que la pièce même n'est pas certifiée mais doit être utilisée sur les groupes certifiés par l'institution autorisée.
Les dimensions sont millimétriques.
3 INSTITUTIONS AUTORISÉES: Voir au-dessus du texte anglais.

GEBRAUCHSANWEISUNG (de)

1 BESTELLEN VON TEILEN
Immer Teilnummer, Bezeichnung und Quantität der erforderten Teile, sowie Typ und Seriennummer der Maschine angeben.
2 DEUTUNG DER SPALTEN
Ref. - Referenznummer: verweist auf ein Teil in der Liste und auf der Zeichnung. Teile ohne Referenznummer sind auf der Zeichnung nicht sichtbar.
Part No. - Teilnummer: falls keine Teilnummer angegeben ist, ist das Teil als Ersatzteil erhältlich. Steht hinter der Teilnummer einen schwarzen Punkt, ist der Teil enthalten fett gedruckte Baugruppe gerade darüber.
Bemerkung: Eine Baugruppe ist fett gedruckt in allen Spalten.
"<<< >>>" bedeutet, daß Sie eine andere Liste nachschlagen mussen.
Steht die Teilnummer unter der Ref./Name Zeile, so muß eine Wahl gemacht werden je nach Typ/Ausführung der Maschine.
Qty - Quantität: gibt die Quantität der Teile in Bezug auf die Referenznummer an. "AR" bedeutet "as required" (nach Bedarf): Bulkmaterial oder Quantität zu bestimmen.
Name: Siehe Drucksache Nr. 2930 1214 00 für die Übersetzungen der englischen Teilbezeichnungen.
Remarks: Teile enthalten in einem Service Kit werden mit K1, K2 ... angegeben.
Die Teile eines Service Kits können über mehrere Listen verbreitet stehen.
Eine Buchstabe gibt an, daß der Teil durch die angegebene zustandige Stelle zertifiziert wurde, den aufgeführten Anordnungen oder Vorschriften entsprechend; steht die Buchstabe zwischen Klammern, bedeutet das, daß der Teil selbst nicht zertifiziert wurde, aber verwendet werden muß auf Maschinen, die durch die zustandige Stelle zertifiziert wurden. Die Abmessungen stehen in Millimeter.
3 ZUSTANDIGE STELLEN: siehe oben.

INSTRUCCIONES PARA EL MANEJO (es)

1 PEDIDO DE PIEZAS
Cite siempre el número de la pieza, la designación y la cantidad de las piezas deseadas, así como el tipo y número de serie de la máquina.
2 EXPLICACION DE LAS COLUMNAS
Ref. - Número de referencia
Establece relación entre una pieza en la lista y el dibujo. Una pieza sin número de referencia no figura en el dibujo.
Part No. - Número de pieza
Si no se indica ningún número de pieza, la pieza no se encuentra disponible en calidad de pieza de repuesto. Una pieza cuyo número va seguido de un punto negro va incluida en el conjunto impreso en letras negritas arriba de la misma.
...a: **Un conjunto va impreso en letras negritas en todas las columnas.**
...<<>>" remite a otra lista.
... (los) número(s) de una pieza específica se hallan debajo de la línea con la referencia/ ...nación, hay que hacerse una selección basada en el tipo/versión de la máquina.
... - Cantidad
Indica la cantidad de piezas referente al número de referencia. "AR" significa "as required" ("según se requiera"): se ha de determinar la cantidad o el material a granel.
Name - Designación
Las traducciones de las designaciones inglesas de las piezas se encuentran en Impreso No. 2930 1214 00.
Remarks - Observaciones
Las piezas que forman parte de equipos de servicio ("Service Kits") están indicados por K1, K2...
Es posible que las partes de un solo "Service Kit" vayan esparcidas por varias listas.
Una letra que le indica que una pieza ha sido certificada por la entidad autorizada indicada

INSTRUKTIONER FÖR ANVÄNDANDE (sv)

1 BESTÄLLNING AV DETALJER
Uppge alltid detaljnummer, benämning och antal på delar som beställes, liksom också maskinens typbeteckning och tillverkningsnummer.
2 FÖRKLARING AV SPALTER
Ref. - Referensnummer
Sätter i relation en särskild detalj i förteckningen och ritningen. Detaljer utan referensnummer visas inte på ritningen.
Part No. - Reservdelsnummer
Om inget reservdelsnummer anges, är detaljen inte tillgänglig som reservdel. En reservdel vilkens nummer följs av en svart prick, ingår i den enhet som är tryckt i fetstil och står direkt ovan.
Anmärkning: En enhet är tryckt i fetstil i alla spalter.
"<<<>>>" anger att en annan förteckning skall konsulteras.
Om de(t) reservdelsnummer på (en) specifik(a) del(ar) placeras nedanför raden med referens/ beteckning skall ett val göras enligt maskinens typ/utförande.
Qty - Antal
Anger antalet detaljer i relation till motsvarande referensnummer. "AR" betyder "As required" (= "som erfordras"): basmaterial eller antal skall bestämmas.
Name: Översättningar på de engelska reservdelsbeteckningarna finns i trycksak nr. 2930 1214 00.
Detaljer som ingår i "Service Kits" anges av K1, K2 ...
Detaljer från en "Service Kit" kan vara spridda över flera förteckningar.
En bokstav kan ange att en detalj har attesterats enligt de koder eller regler som uppförs på listan av det angivna befullmäktigade organet; om en bokstav står inom parentes, har själva detaljen inte attesterats, utan måste användas på enheter som attesterades av det befullmäktigade organet. Dimensioner uttrycks i millimeter.

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Indholdsfortegnelse
Sisällysluettelo

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Compressorelement - motor
Kompressorelement - motor
Kompressorelement - motor
Elément compresseur - moteur
Elemento compresor - motor
Elemento compressore - motore
Kompressorelement - motor
Elemento compressor - motor
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Kompressorielementti/-elementit - motori

Air outlet
Luchtuitlaat
Luftutlopp
Luftauslaß
Sortie d'air
Salida de aire
Mandata dell'aria
Luftafgang
Saida de ar
Luftutløp
Paineilmaputk

Bodywork
Carrosserie
Karosseri
Karosserie
ptage
ocería
pottatura
Karosseri
Carroceria
Kabinett
Kotelo

Cubicle
Kast
Skåp
Schaltschrank
Armoire
Armario
Armadio elettrico
Elskab
Quadro
Skap
Kotelo

Air dryer
Luchtdroger
Lufttorkare
Lufttrockner
Sécheur d'air
Secador de aire
Essiccatore d'aria
Lufttørrer
Secador de ar
Lufttorker
Kuivain

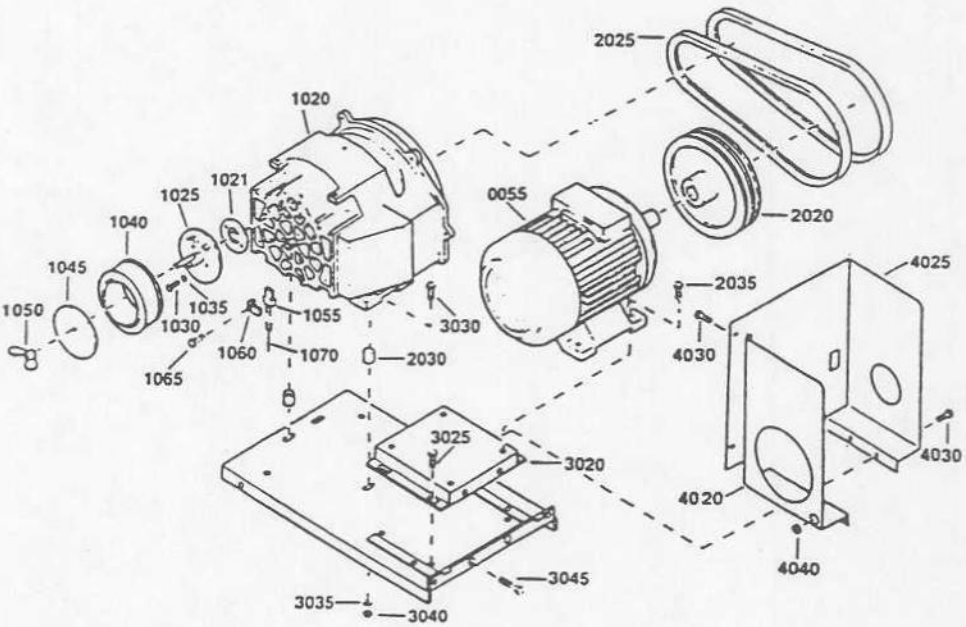
1) Optional / Optie / Valfri / Wahlfrei / Option / Opcional / Opzionale / Valgfri / Opcional / Valgfri / Valinnainen

Compressor element - motor
Compressorelement - motor
Kompressorelement - motor
Kompressorelement - motor
Elément compresseur - moteur
Elemento compresor - motor

Elemento compressore - motore
Kompressorelement - motor
Elemento compressor - motor
Kompressorelement - motor
Kompressorielementti/-elementit - motori

1

SF1-2-4, SF1-2-4 Skid



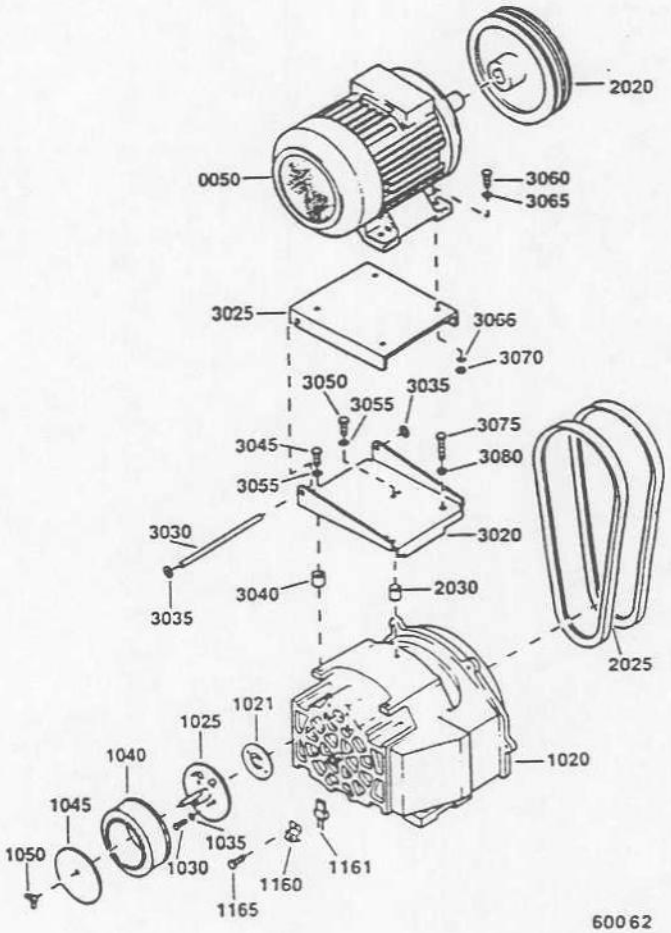
06_0001.1

Ref.	Part number	Qty	Name	Remarks
0055		1	Motor	
	1080 2776 51		SF2 220-240V/380-415V/50Hz 3-phase	
	1080 2776 61		SF4 220-240V/380-415V/50Hz 3-phase	
	1080 3039 11		SF1 220-230V/50Hz 1-phase	
	1080 3039 12		SF1 240V/50Hz 1-phase	
1020		1	Element	
	2989 0140 00		SF1, SF2	K1
	2989 0141 00		SF4	K2
1021	2235 2566 00	1	Gasket	
1025	2235 2567 00	1	Support	
1030	0147 1243 03	2	Hexagon bolt	
1035	0301 2321 00	3	Washer	
1040	1503 0189 00	1	Filter	
1045	2235 2568 00	1	Plate	
1050	0296 1108 02	1	Wing nut	
1055	1089 9343 01	1	Temperature switch	
1060	1089 9343 03	1	Support	
1065	0226 0300 41	1	Screw	
1070	2235 2697 00	1	Cable	
2020		1	Pulley	
	2235 2531 00		SF4-8	
	2235 2532 00		SF2-8	
	2235 2563 00		SF1, SF2-10	
	2235 2570 00		SF4-10	

Ref.	Part number	Qty	Name	Remarks
2025			V-belt	
	1513 0045 12	1	SF2-8	
	1513 0290 12	2	SF4-8	
	1513 0290 17	1	SF1, SF2-10	
	1513 0290 18	2	SF4-10	
2030	2235 2540 01	4	Spacer	SF1, SF2
2035		4	Bolt	
	1619 5337 01		SF4	
	1619 5337 03		SF1, SF2	
3020	2235 2714 00	1	Support	
3025	1619 2766 00	4	Bolt	
3030	0147 1326 03	4	Hexagon bolt	
3035	0301 2335 00	4	Washer	
3040	0266 2110 00	4	Nut	
3045	1619 5337 03	2	Paint strip. bolt	
4020		1	Baffle	1)
	2235 2712 00		SF2-10, SF4-10, SF1	
4025		1	Baffle	
	2235 2711 00		SF2-10, SF4-10, SF1	
4030		6	Bolt	
	1619 5898 01		SF2-10, SF4-10, SF1	
4040		1	Grommet	
	0698 0153 00		SF2-10, SF4-10, SF1	

1) To be lined with / Te bekleden met / Skall bekläs med / Auskleiden mit / A garnir avec / Revestir de / Rivestire con / Skal beklædes / Forrar com / Skal fôres med / Vuorataan :
Foam : 0395 1001 99 (AR) 10 x 2000 x 1500 self-adhesive
Foam : 1079 0003 31 (AR) 25 x 2000 x 1500 self-adhesive

K1	2892 9860 40	1	Tip seal kit
K2	2892 9910 40	1	Tip seal kit


2020
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Compressor element - motor
Compressorelement - motor
Kompressorelement - motor
Kompressorelement - motor
Elément compresseur - moteur
Elemento compresor - motor

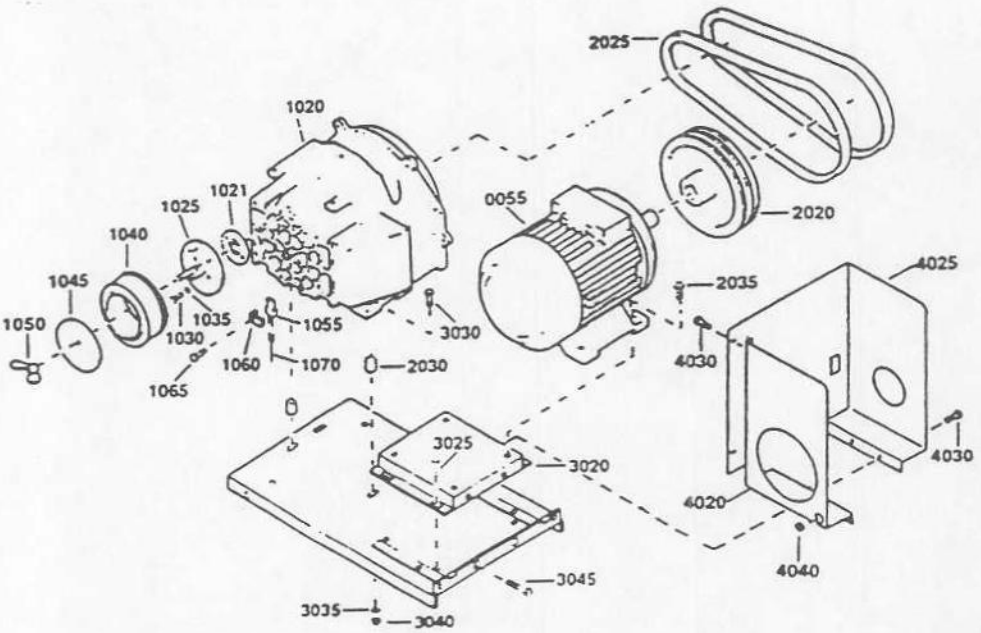
Elemento compressore - motore
Kompressorelement - motor
Elemento compressor - motor
Kompressorelement - motor
Kompressorielementti/-elementit - motori

SF1-2-4 Pack/Full-feature

Ref.	Part number	Qty	Name	Remarks
0050		1	Motor	
	1080 2776 71		SF2-8/10 bar(e) 230V/400V/ 50Hz 3-phase	
	1080 2776 72		SF2-100/125 psig 575V/60Hz 3-phase	
	1080 2776 75		SF2-100/125 psig 230V/460V/ 60Hz 3-phase	
	1080 2776 76		SF4-100/125 psig 200V/60Hz 3-phase	
	1080 2776 81		SF4-8/10 bar(e) 230V/400V/ 50Hz 3-phase	
	1080 2776 82		SF4-8/10 bar(e) 500V/50Hz 3-phase, SF4-100/125 psig 575V/ 60Hz 3-phase	
	1080 2776 85		SF4-100/125 psig 230V/460V/ 60Hz 3-phase	
	1080 2776 86		SF4-100/125 psig 200V/60Hz 3-phase	
	1080 3039 21		SF1-8 bar(e) 230V/50Hz 1-phase	
	1080 3039 17		SF1-100 psig 230V/60Hz 1-phase	
	1080 3039 18		SF2-100/125 psig 230V/60Hz 1-phase	
1020		1	Element	
	2989 0140 00		SF1, SF2	K1
	2989 0141 00		SF4	K2
1021	2235 2566 00	1	Gasket	
1025	2235 2567 00	1	Support	
1030	0147 1243 03	2	Hexagon bolt	
1035	0301 2321 00	3	Washer	
1040	1503 0189 00	1	Filter	
1045	2235 2568 00	1	Plate	
1050	0296 1108 02	1	Wing nut	
1160	1089 9343 03	1	Support	
1161	<<< >>>	1	Temperature switch	1)
1165	0226 0300 41	1	Screw	
2020		1	Pulley	
	2235 2563 00		SF1-8 bar(e) 1-phase, SF2-10 bar(e) 3-phase	
	2235 2532 00		SF2-8 bar(e) 3-phase	
	2235 2531 00		SF4-8 bar(e) 3-phase	
	2235 2570 00		SF4-10 bar(e) 3-phase	
	2235 2659 00		SF1-100 psig 1-phase	
	2235 2532 01		SF2-100 psig 3-phase	
	2235 2532 02		SF2-125 psig 1-phase	
	2235 2626 00		SF4-100 psig 3-phase	
	2235 2531 01		SF4-125 psig 3-phase	
2025		1	V-belt set	
	1513 0289 08		SF1-8 bar(e) 1-phase, SF2-10 bar(e) 3-phase	
	1513 0289 24		SF2-8 bar(e) 3-phase	
	1513 0289 25		SF4-8 bar(e) 3-phase	
	1513 0289 26		SF4-10 bar(e) 3-phase	
	1513 0289 07		SF1-100 psig 1-phase, SF2-125 psig 1-phase	
	1513 0289 27		SF2-100 psig 3-phase	
	1513 0289 28		SF4-100 psig 3-phase	
	1513 0289 29		SF4-125 psig 3-phase	
2030		1	Spacer	
	2235 2540 02		SF1, SF2	
	2235 2540 01		SF4	
3020	2235 2516 00	1	Support	
3025	2235 2517 00	1	Support	
3030	2235 2541 00	1	Round bar	
3035	1079 3353 01	2	Self locking ring	
3040	2235 2540 03	2	Spacer	
3045	0147 1365 03	2	Hexagon bolt	
3050	0147 1364 03	1	Hexagon bolt	
3055	0301 2344 00	3	Washer	
3060	0147 1363 03	4	Hexagon bolt	
3065	0301 2344 00	4	Washer	
3066	0333 3232 00	4	Lockwasher	
3070	0266 2111 00	4	Nut	
3075	0147 1330 12	1	Hexagon bolt	
3080	0266 2110 00	1	Nut	
K1	**2892 9860 40**	**1**	**Tip seal kit**	
K2	**2892 9910 40**	**1**	**Tip seal kit**	

1) See: Cubicles / Zie: Kasten / Se: Skåp / Siehe: Schaltschränke / Voir: Armoires / Véase: Armarios / Vedere: Armadios elettricos / Se: Elskab / Ver: Quadros / Se: Skap / Katso: Kotelo

3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Compressor element - motor
Compressorelement - motor
Kompressorelement - motor
Kompressorelement - motor
Elément compresseur - moteur
Elemento compresor - motor

Elemento compressore - motore
Kompressorelement - motor
Elemento compressor - motor
Kompressorelement - motor
Kompressorielementti/-elementit - motori

SF6-8 Twin

Ref.	Part number	Qty	Name	Remarks
0055			Motor	
	1080 2776 51	1	SF6	2.2 kW
	1080 2776 61	1	SF6	3.7 kW
	1080 2776 61	2	SF8	3.7 kW
1020			Element	
	2989 0140 00	1	SF6	1) K1
	2989 0141 00	1	SF6	2) K2
	2989 0141 00	2	SF8	2) K2
1021	2235 2566 00	2	Gasket	
1025	2235 2567 00	2	Support	
1030	0147 1243 03	4	Hexagon bolt	
1035	0301 2321 00	6	Washer	
1040	1503 0189 00	2	Air filter	
1045	2235 2568 00	2	Plate	
1050	0296 1108 02	2	Wing nut	
1055	1089 9343 01	2	Temperature switch	
1060	1089 9343 03	2	Support	
1065	0226 0300 41	2	Screw	
1070	2235 2697 00	2	Cable	
2020			Pulley	
	2235 2563 00	1	SF6-10	1)
	2235 2570 00	1	SF6-10	2)
	2235 2570 00	2	SF8-10	2)
	2235 2532 00	1	SF6-8	1)
	2235 2531 00	1	SF6-8	2)
	2235 2531 00	2	SF8-8	2)
2025			V-belt	
	1513 0290 16	1	SF6-10	1)
	1513 0290 18	1	SF6-10	2)
	1513 0290 18	2	SF8-10	2)
	1513 0045 12	1	SF6-8	1)
	1513 0290 12	1	SF6-8	2)
	1513 0290 12	2	SF8-8	2)
2030			Spacer	
	2235 2540 01	4	SF6	
2035			Bolt	
	1619 5337 03	4	SF6	1)
	1619 5337 01	4	SF6	2)
	1619 5337 01	8	SF6	2)
3020	2235 2714 00	2	Support	
3025	1619 2766 00	8	Bolt	
3030	0147 1326 03	8	Hexagon bolt	
3035	0301 2335 00	8	Washer	
3040	0266 2110 00	8	Nut	
3045	1619 5337 03	4	Bolt	
4020		1	Baffle	3)
	2235 2712 00		SF6-8, SF8-10	
4025		1	Baffle	
	2235 2711 00		SF6-8, SF8-10	
4030		6	Bolt	
	1619 5898 01		SF6-8, SF8-10	
4040		1	Grommet	
	0698 0153 00		SF6-8, SF8-10	

1) For motor 2.2 kW /
2) For motor 3.7 KW /
3) To be lined with / Te bekleden met / Skall bekläs med / Auskleiden mit / A garnir avec / Revestir de / Rivestire con / Skal beklædes / Forrar com / Skal fôres med / Vuorataan :
Foam : 0395 1001 99 (AR) 10 x 2000 x 1500 self-adhesive
Foam : 1079 0003 31 (AR) 25 x 2000 x 1500 self-adhesive

K1	**2892 9860 40**	**1**	**Tip seal kit**
K2	**2892 9910 40**	**1**	**Tip seal kit**

RIX

Microboost

Owners Manual

(May not be included in your system)

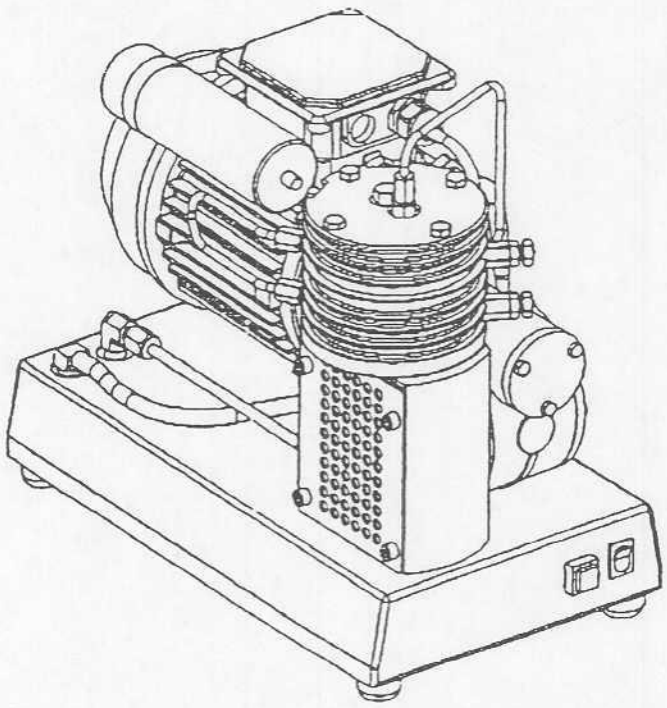
RIX

COMPRESSORS

MICROBOOST

Owner's Manual

MB-115 * MB-230-50 * MB-230-60



November 28, 2000

RIX INDUSTRIES

WARRANTY STATEMENT

Rix Industries warrants all Micoboost compressors for 12 months of operation or eighteen (18) months from date of shipment or 1200 hours of operation, whichever comes first, covering materials and workmanship. This warranty does not cover normal wear or consequential damages.

Rix certifies that all oxygen compressors are suitable for oxygen service and are oxygen clean at shipment. The purchaser takes full responsibility for all components added and for maintaining the oxygen cleanliness of the compressor package.

All warranty work must be conducted at the Rix factory or at a Rix designated service facility. The customer will pay all freight and/or transportation charges.

Rix Dwg A8952

10/21/00

INTRODUCTION

Congratulations on your purchase of the Rix Microboost compressor. We anticipate that with proper care you will get many years of satisfactory performance from this compressor.

This manual is prepared to help you operate this equipment safely and so that you get the most benefit from this package. Please read it carefully.

This equipment is protected by warranty, a copy of which should have been provided separately by your dealer. We suggest that you read the warranty policy to fully understand your coverage and your responsibilities of ownership.

Rix recommends that all servicing be done by trained and qualified personnel. Rix recommends that you contact our offices at 707-747-5900 for a list of qualified service centers.

Rix Industries
4900 Industrial Way
Benicia, CA 94510
Ph. (707) 747-5900
Fax (707) 747-9200

INTRODUCTION

Safety

This electromechanical equipment is designed to produce high-pressure gas. Operating personnel must follow these safety requirements at all times to avoid injury to personnel or damage to property.

Safety warnings are provided in a variety of forms, including:
Safety Labels-located on the equipment
Safety Messages- provided in this manual and preceded by a safety alert label, DANGER, WARNING, CAUTION, and NOTE.

DANGER You will be killed or seriously hurt if you don't follow instructions and equipment damage is certain.

WARNING You may be killed or seriously hurt if you don't follow instructions, and equipment damage is certain.

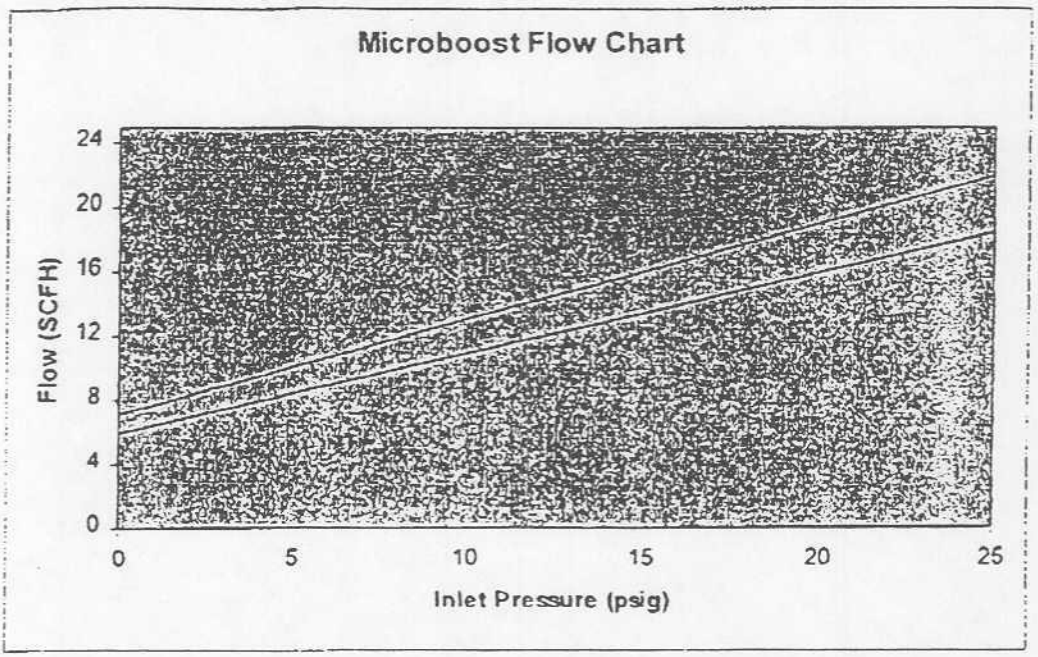
CAUTION You can be hurt if you don't follow instructions, and equipment damage is likely.

NOTE Highlights a certain operation, maintenance condition, or statement, which is useful but not associated with a known hazard (as indicated by a warning or caution).

CONTENTS

PERFORMANCE

The Microboost Compressor is designed to take oxygen at 0-25 psig and compress it to 2200 psig. The discharge flow rate varies with inlet pressure according to the chart below:



Top line 50 Hz Flow
Bottom Line 60 Hz Flow

Inlet Pressure Range	0-25 psig
Discharge Pressure Range	0-2200 psig

This compressor is designed to compress clean, dry oxygen. For other gasses contact Rix Industries.

SAFETY

This electromechanical equipment is designed to produce high pressure gas. Operating personnel must follow these safety requirements at all times to avoid injury to personnel or damage to property.

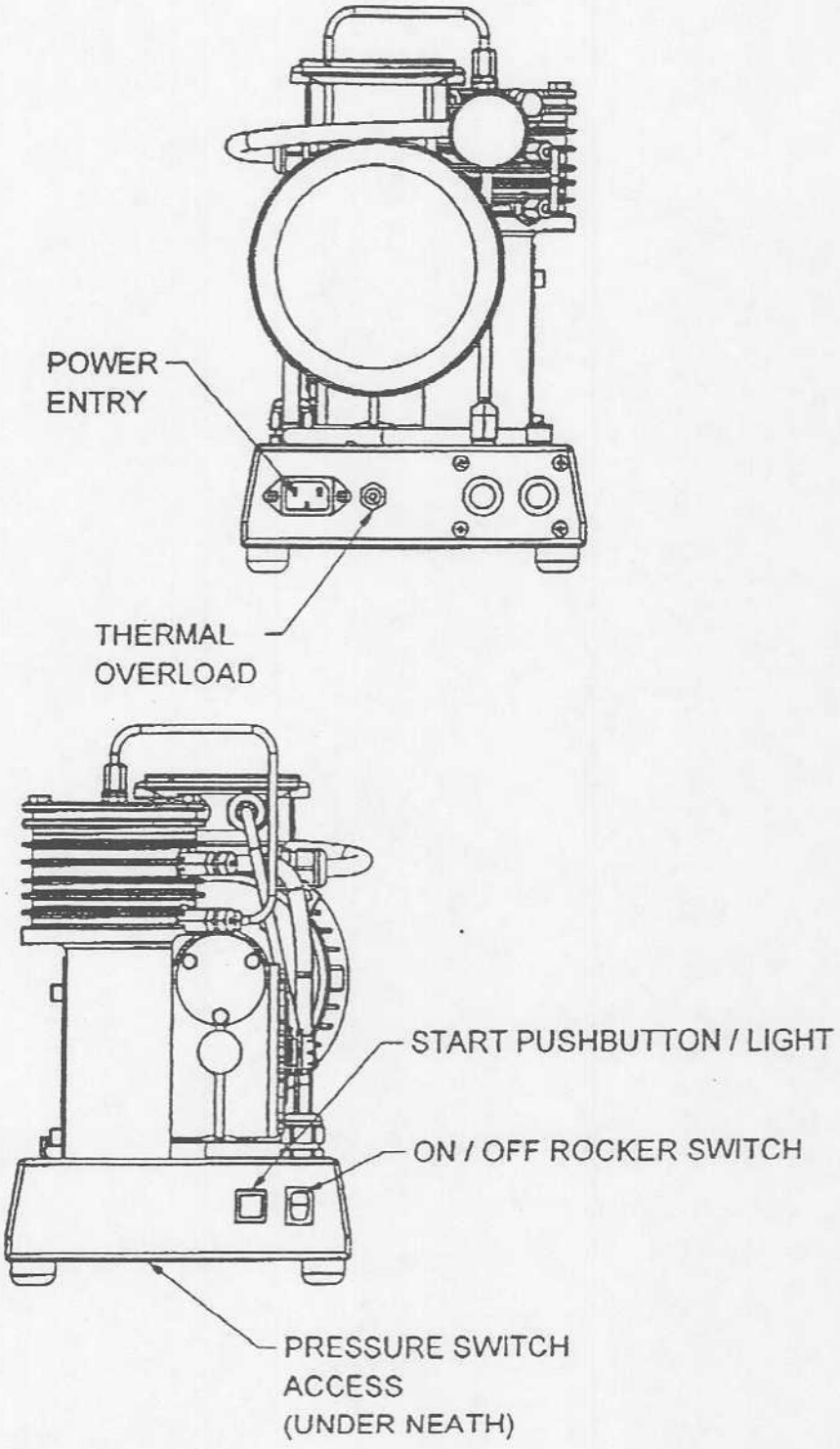
Keep away from live circuits. Do not attempt to replace components or make adjustments unless the power to the compressor has been disconnected and all pressure relieved.

When the compressor operates the motor and compressor surfaces can become very hot and will cause burns if touched.

Never operate with safety devices removed or disabled. This includes guards for moving objects, protection from high temperature surfaces, pressure relief valves, pressure switches, or covers over electrical components.

When compressing oxygen it is critical that surfaces in contact with oxygen be kept clean and free from contamination, especially hydrocarbon contamination or any flammable material. This compressor is shipped oxygen clean and must be maintained that way to avoid the hazard of explosion or fire.

CONTROLS AND FEATURES



CONTROLS AND FEATURES

Power Entry Module
The Microboost is connected to a source of power through the power entry module. This conforms with IEC-320-C13. A power cord suitable for the intended voltage (115 VAC or 230 VAC) and 10 amps should be used to plug the Microboost into the source of power.

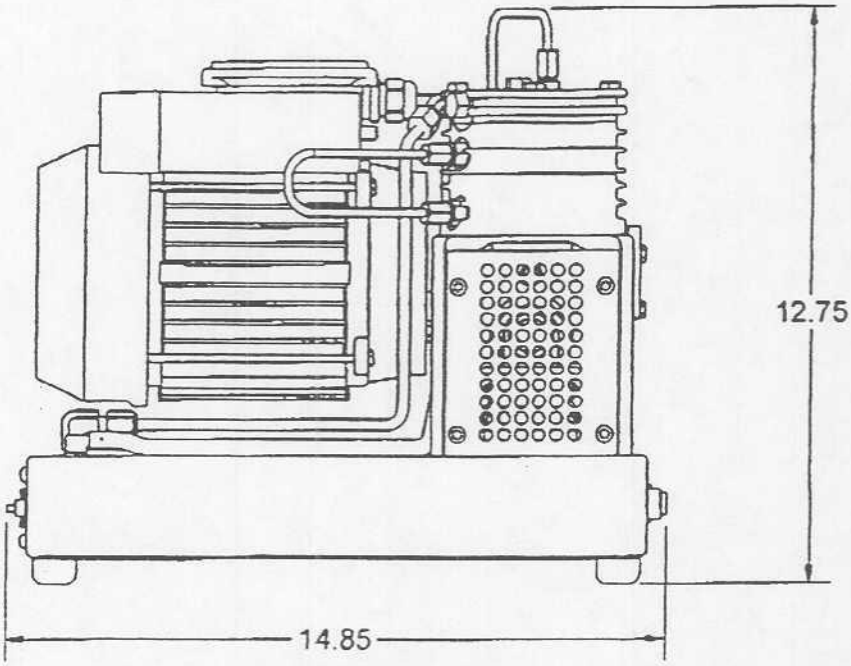
Thermal Overload
A thermal overload is provided to protect the Microboost if the motor amperage draw exceeds 10 amps. If the thermal overload trips it is necessary to reset it by pressing the exposed button.

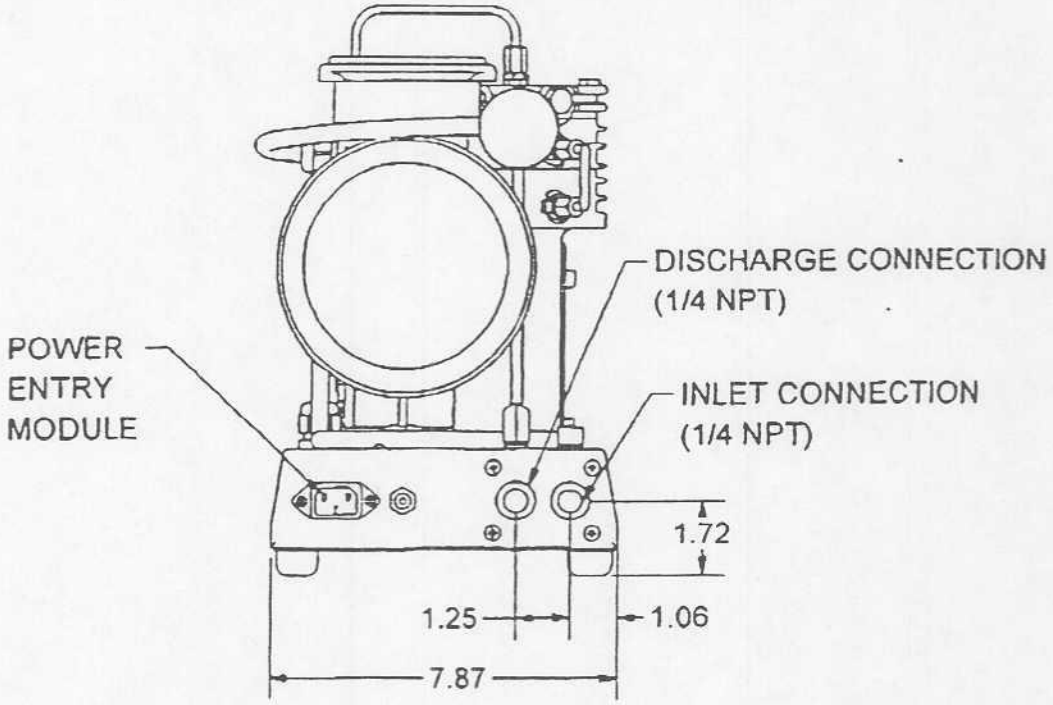
Power On/Off Rocker Switch
A rocker switch is used to turn power on to the Microboost control system. This switch is used to stop the compressor manually when it is running.

Start Pushbutton
A momentary lighted pushbutton is provided for starting the compressor. When the compressor is connected to a source of power and the power on/off switch is in the ON position the Start pushbutton can be pressed to start the compressor motor. The indicating light comes on and indicates that the compressor is running.

Pressure Switch
A pressure switch is provided to automatically stop the compressor when the set pressure is reached. This is usually 2200 psig. The switch is located inside the Microboost base and is accessible for resetting through a rectangular opening provided in the underside cover.

INSTALLATION





INSTALLATION

The Microboost is a free standing package weighing 42 lbs and is meant to be located on a table, shelf, or on the floor. It may also be mounted inside a frame or cabinet as long as sufficient air circulation is provided to prevent overheating. Locate the compressor in an area with good ventilation. An ambient temperature of 90 °F or less is preferable. Circulating air across the compressor with an external fan will make it operate better and last longer.

Rix recommends installing a flow check valve immediately after the compressor discharge to prevent reverse flow.

Rix recommends installing a vent valve at the compressor discharge prior to the check valve to allow the operator to vent all pressure prior to start-up.

Pressure gauges should be installed at the compressor suction and discharge to help in monitoring performance and troubleshooting.

Plug into source of electric power (protected for 15 amp).

Connect the compressor suction to a source of clean gas regulated not to exceed 25 psig.

Connect the compressor discharge to a high pressure cylinder or manifold designed to handle pressures at 2300 psig.

Caution

Exposed surfaces of the motor and compressor can reach 180°F and will cause a burn if touched. Locate the assembly in a safe location where it is protected from human contact.

OPERATION

Compressor Start-up

Check that the power is connected to the compressor.

Check that the compressor suction is connected to a source of clean, dry oxygen gas.

Check that the compressor discharge is connected to a fill system suitable for 2300 psig and that there are no restrictions in the line.

Check that the compressor discharge is relieved of any pressure build-up.

Caution

Do not attempt to start the compressor against discharge pressure. Vent all gas pressure at the compressor discharge prior to starting. If the compressor stalls it is probably because there is residual pressure in the system.

Push the **Power On** rocker switch to the ON position.

Push the **Start** pushbutton, the compressor should come on. Verify that the compressor comes on and the **Start** pushbutton light is illuminated.

Periodically monitor the compressor for proper operation. Observe that there are no leaks or unusual noises. Make sure that there is adequate air circulation around the compressor and that the location temperature where the compressor is operating does not exceed 110 °F.

Compressor Shutdown

Press the On/Off Rocker switch to the OFF position.

Oxygen compression equipment has very special requirements because of the hazards of explosion and fire associated with compressed oxygen. Rix recommends that only qualified and trained personnel work on this equipment. Rix recommends returning the compressor to Rix or to an approved Rix service center when repairs are to be made.

Simple operations such as repairing leaks or replacing valves or relief valves may be done locally by competent mechanics trained in working on oxygen equipment. Care must be taken when handling these parts so that surfaces in contact with oxygen do not become contaminated.

Changing suction and discharge valves (first and second stages)

The compression valves are designed into the tube fittings for the first and second stages suction and discharge. These valves are not designed to be serviceable except by the factory. To replace a valve, remove the fitting nut and tube line and then remove the valve. When reinstalling a valve make sure that the O-ring is in place and is lightly lubricated with oxygen compatible grease such as Krytox. Valves are marked with an "S" for suction and a "D" for discharge. Make sure the proper valve is used when reinstalling. Do not interchange suction and discharge valves. Reinstall the tube line and tighten the tube nut as necessary to eliminate any leakage. Use a soap type leak test fluid to check for leaks while the compressor is running. Tighten just enough to eliminate all leakage.

CAUTION

Do not overtighten as this may damage the sealing surfaces making it more difficult to attain a leak-free joint in the future.

Changing suction valve (third stage)

This suction valve is similar to the first and second stage suction valve but is marked "3S". It should not be interchanged with any other stage valve but otherwise may be serviced the same as the suction valves for the first and second stages.

Changing discharge valve (third stage)

This discharge valve is located under the hex plug on top of the third stage head. It is critically important to keep the internal parts from becoming contaminated and this valve should only be serviced by personnel trained in handling oxygen clean systems. Lightly lubricate the small O-ring on the poppet tip with an oxygen compatible lubricant such as Krytox grease.

Changing relief valves

The relief valves are not meant to be serviced except by the factory. If it becomes necessary they may be replaced with new valves using care so that the surfaces in contact with oxygen do not become contaminated. The first and second stage relief valves are located on the side of the compressor. The third stage or final relief valve is located inside the base of the compressor.

Setting the pressure switch

A pressure switch is located inside the base of the compressor and is factory set at 2200 psig. It is important that the setpoint never exceed this pressure. If it becomes necessary to reset this switch it is accessible through a square shaped cutout in the plate covering the underside of the base. Push the sleeve on the body of the pressure switch back to expose the pressure adjustment mechanism. Insert a flat bladed tool such as a small screwdriver in the slot and rotate the adjustment mechanism clockwise to increase pressure and counterclockwise to decrease it.

TROUBLESHOOTING

Overload trips

If the overload switch trips it is an indication that the compressor is drawing too much current. The likely causes are:

1. A short circuit in the electrical wiring or motor.
2. The compressor is stalled due to starting against pressure.
3. A bearing is failing in the drive system.
4. A problem internal to the compressor has increased the load on the motor.

Relief Valve leaks or relieves

Likely causes:

1. A valve problem (either suction or discharge) in the next higher stage of compression.
2. A damaged seat in the relief valve.

Low flow

Likely causes:

1. A leak in a tube fitting on the compressor.
2. A leaking relief valve.
3. A worn piston seal in the compressor.

Compressor Stalls on start-up

Likely causes:

1. The compressor has residual pressure and is not completely unloaded.
2. Mechanical failure such as a bearing seizure.

Compressor Stalls during operation

Likely cause:

1. Mechanical failure such as a bearing seizure.

Overheating

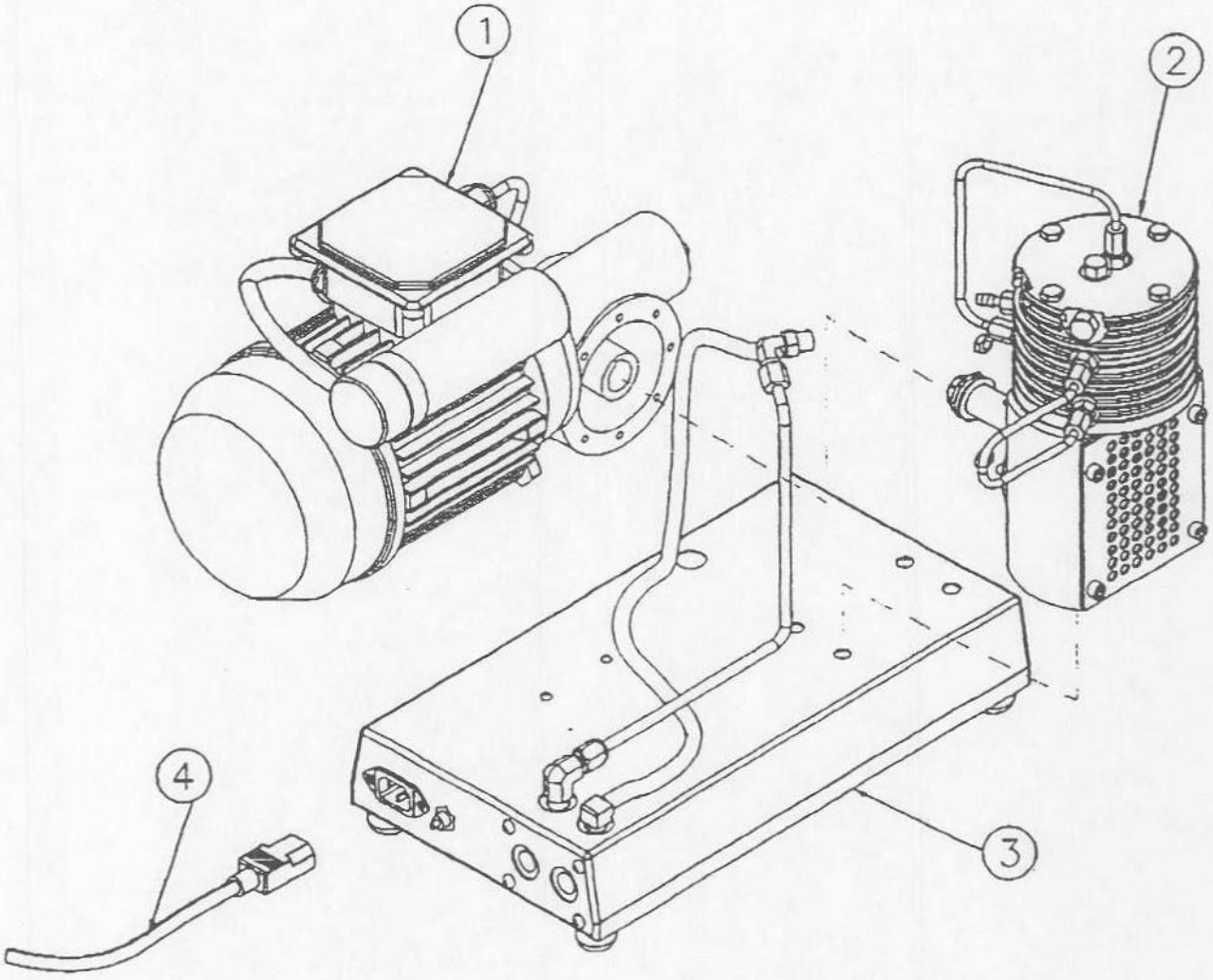
Likely causes:

1. Inadequate air circulation where the compressor is operating.
2. Mechanical failure such as a bearing seizure.

Compressor will not start

1. The compressor pressure is above the pressure switch setting.
2. The motor has overheated and tripped the thermal switch.

PARTS BREAKDOWN



PARTS BREAKDOWN

Compressor Assembly Major Components

MICROBOOST Model MB-115-60
115 V, 60 Hz

ITEM	QTY	PART NUMBER	DESCRIPTION	
1	1	107-5642	MOTOR	
2	1	C-MB	COMPRESSOR	(see separate Parts list, page 16)
3	1	G100-MB	BASE	(see separate Parts list, page 18)
4	1	138-5777	POWER CORD	

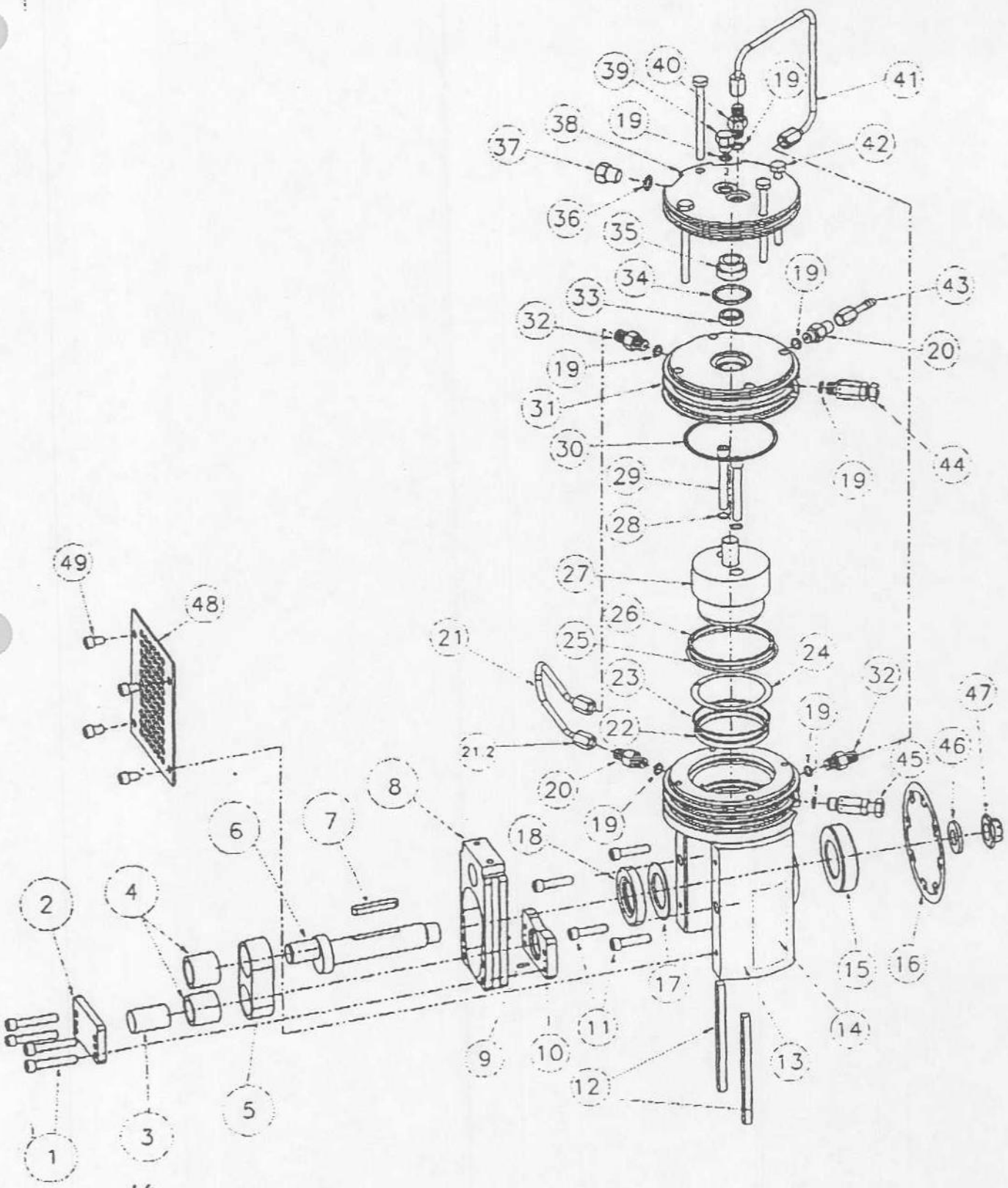
MICROBOOST Model MB-230-60
230 V, 60 Hz

ITEM	QTY	PART NUMBER	DESCRIPTION	
1	1	107-5642	MOTOR	
2	1	C-MB	COMPRESSOR	(see separate Parts list, page 16)
3	1	G100-MB	BASE	(see separate Parts list, page 18)
4	(ref)	N/A	POWER CORD	

MICROBOOST Model MB-230-50
230V, 50 Hz

ITEM	QTY	PART NUMBER	DESCRIPTION	
1	1	107-5643	MOTOR	
2	1	C-MB	COMPRESSOR	(see separate Parts list, page 16)
3	1	G100-MB	BASE	(see separate Parts list, page 18)
4	(ref)	N/A	POWER CORD	

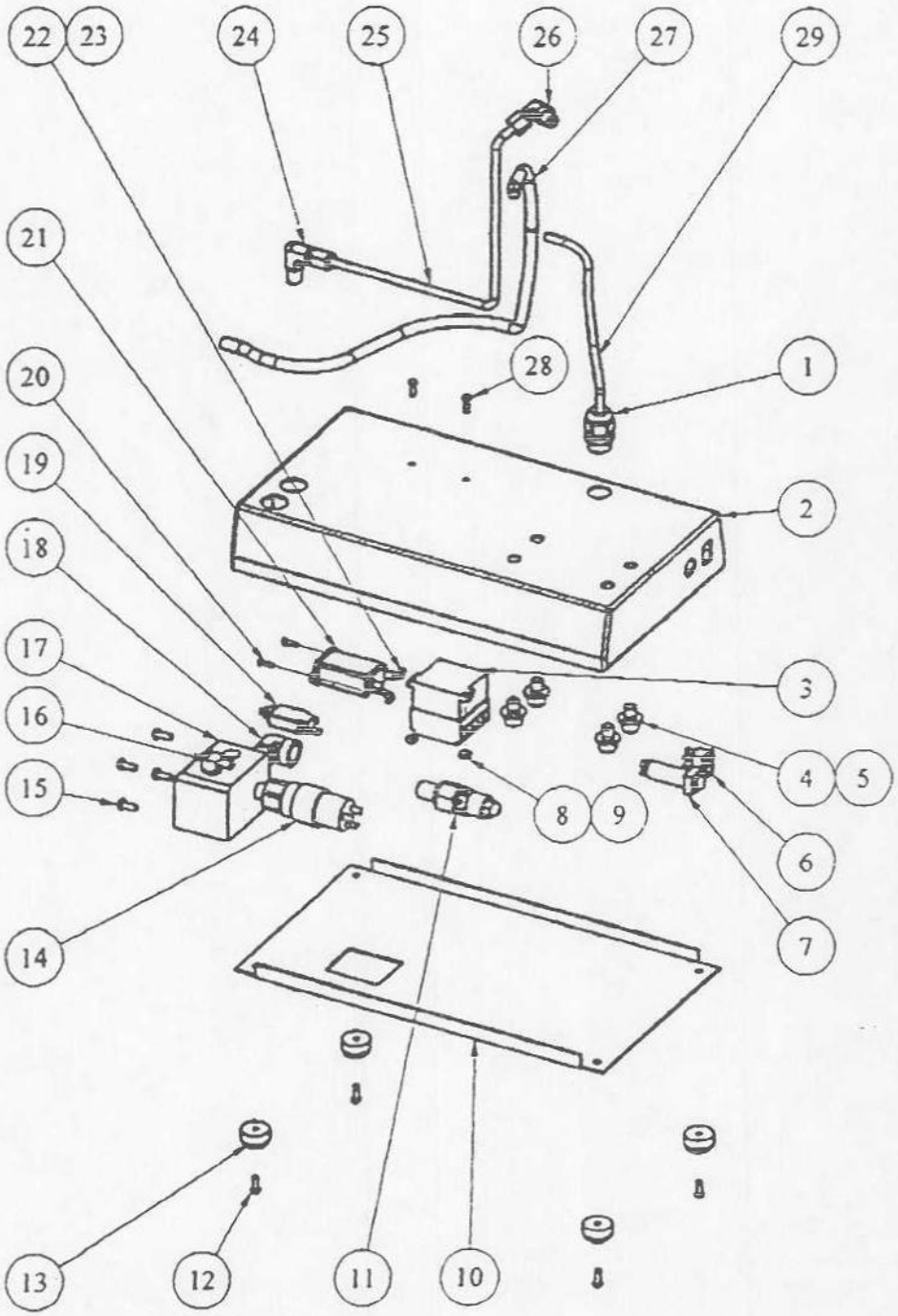
PARTS BREAKDOWN



PARTS BREAKDOWN

Item	Part Number	Qty	Description
1	32-A8787	4	Bolt, Socket Head
2	6-A8781	1	Front Plate
3	27-A8784	1	Shaft
4	181-5704	2	Needle Bearing
5	7-A8782	1	Connecting Rod
6	5-C2832	1	Crankshaft
7	91-A8942	1	Key 6mm x 6mm
8	52-A8779	1	Scotch Yoke
9	17-6037	2	Spring Pin
10	6-A8780	1	Back Plate
11	32-5023	4	Bolt, M6 x 20 mm
12	58-A8484	ref	Guide
13	A100-D3056	1	Crankcase Assembly
14	62-A8509	1	Label, Nameplate
15		ref	Bearing, Gearcase
16		ref	Gasket, Gearcase
17		ref	Washer, Gearcase
18	125-6029	ref	Seal, Gearcase
19	X123-903-5	ref	O-Ring
20	AS15-A8450	2	Suction Valve, 1st,2nd
21	XA455-B7146	1	Tube Line Assy, 1st
22	X125-A8438	1	Seal, 2nd Stage
23	X123-035-5	1	O-ring, 2nd Stage
24	X31-1003	1	Snap ring
25	X125-A8439	1	Seal, 1st Stage
26	X123-038-5	1	O-Ring, 1st Stage
27	X8-C2751	1	Piston,,Compression
28	X20-A8486	2	Washer, Copper
29	X32-1151	2	Bolt, Soc Hd, 1/4-20, 2L
30	X123-146-5	1	O-Ring
31	X1-C2750	1	Cylinder Block, 1st Stage
32	XAD15-A8451	2	Discharge Valve, 1st, 2nd
33	X125-A8440	1	Seal, 3rd Stage
34	X123-120-5	1	O-ring, 3rd Stage Cylinder
35	X63-B7013	1	Cylinder Liner, 3rd Stage
36	X123-904-5	1	O-Ring
37	X54P-4P50NSS	1	Plug
38	X2-B7112	1	Head, Third Stage
39	XAD15-A8576	1	Discharge Valve, 3rd Stage
40	XAS15-A8594	1	Suction Valve, 3rd Stage
41	XA455-B7147	1	Tube Line Assy, 2nd Stg
42	32-1175	4	Bolt, Hex Hd
43	XA54-A8595	1	Fitting Assy, Inlet
44	XA515-A8448	1	Relief Valve, 1st Stage
45	XA515-A8449	1	Relief Valve, 2nd Stage
46	20-5021	1	Washer, AN, 5/8, Steel
47	53-5020	1	Nut, Nylok, 5/8-18
48	38-A8941	1	Plate, Cover
49	32-6040	4	Bolt, Hex Head

PARTS BREAKDOWN



PARTS BREAKDOWN

Base Assembly

Item	Part Number	Qty	Description
1	138-5800	1	Electrical Connector
2	70-D3091	1	Bedplate
3	(see below)	1	Relay, 115 Volt
4	32-4143	4	Bolt, Hex Head, 3/8-16, 1/2L
5	20-4564	4	Washer, Flat, SAE, 3/8
6	76-5470	1	Rocker Switch
7	(see below)	1	Pushbutton, Lighted
8	53-1028	2	Nut, Locking, #6-32
9	20-4028	2	Washer, Flat, SAE, #6
10	38-C2837	1	Plate, Cover
11	515-61	1	Relief Valve, 2300 psi
14	76-5659	1	Pressure Switch
12	32-4555	4	Bolt, Round Head, #8-32, 1/2 L
13	39-5751	4	Feet, Rubber
15	32-4164	4	Bolt, Round Head, #10-24, 1/2 L
16	54P-229-64B	1	Hose Barb Elbow
17	10-B7562	1	Manifold Block
18	54P-1/4CDS	1	Street Elbow
19	163-5706	1	Circuit Breaker
20	32-5778	2	Bolt, Flat Head, #4-40, 3/8 L
21	138-5705	1	Electrical Connector
22	53-4095	2	Nut, Hex, #4-40
23	20-4741	2	Washer, AN #4
24	54P-44CBUSS	1	Elbow, Male
25	455-B7701	1	Tube Line
26	54P-4C5BUSS	1	Elbow, Straight Thread
27	6-4340	20	Tube, Plastic
28	32-4169	2	Bolt, Round Head, #6-32, 1/2 L
29	61-6038	16	Wire, Electrical

Accessory Group 115 Volt, 60 Hz

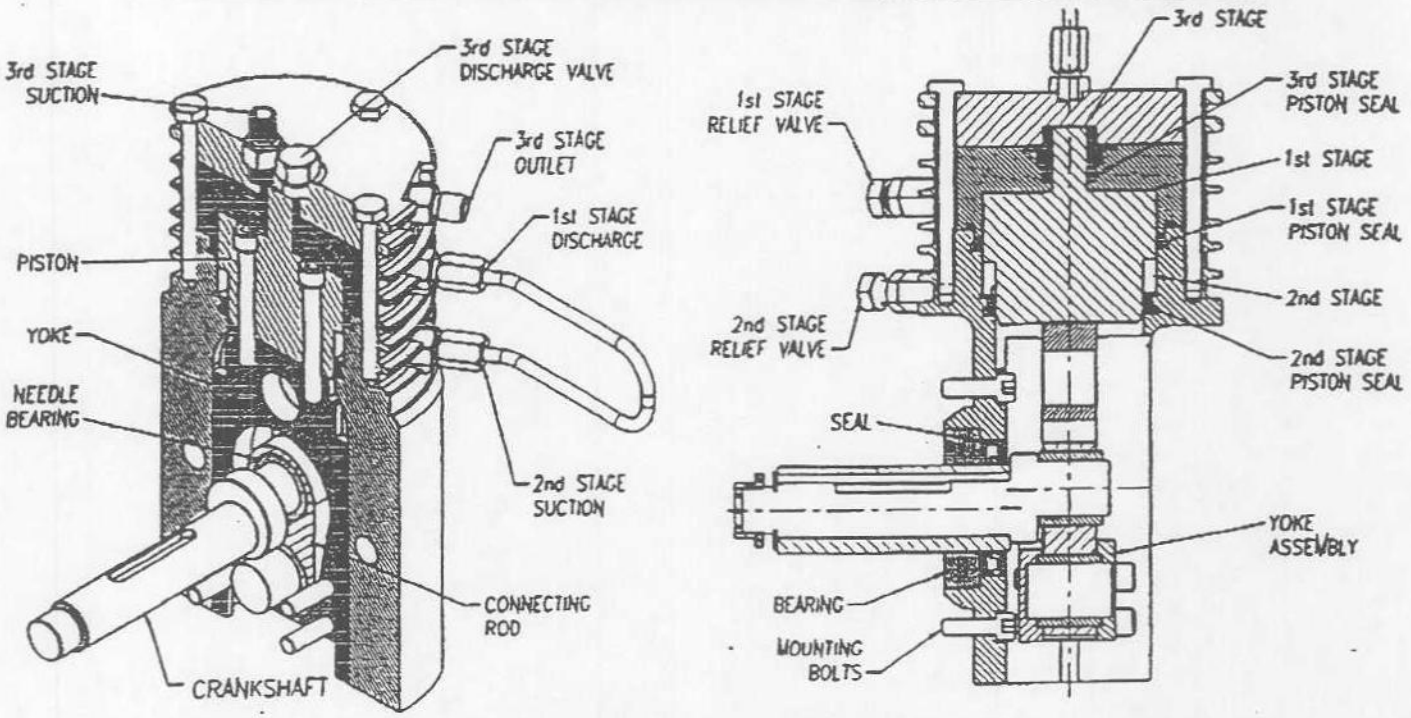
	138-5777	1	Electrical Plug, 115 V, 60 Hz
3	76-5655	1	Relay, 115 Volt
7	76-5657	1	Pushbutton, Lighted

Accessory Group 230 Volt, 60 Hz

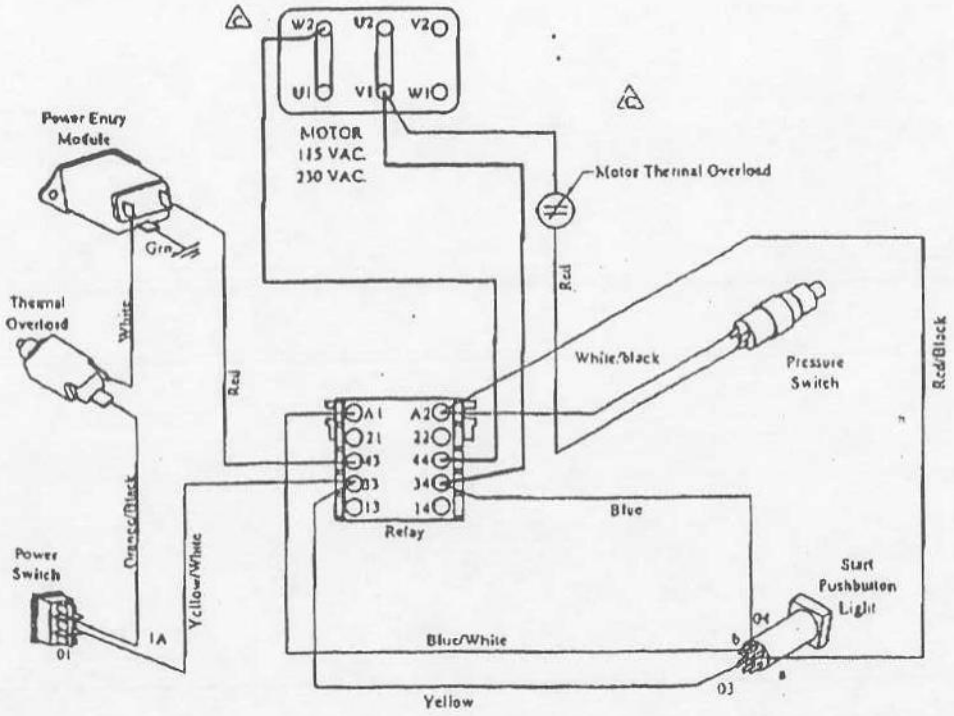
	tbd	1	Electrical Plug
3	76-5655	1	Relay, 230 Volt
7	76-5658	1	Pushbutton, Lighted

Accessory Group 230 Volt, 50 Hz

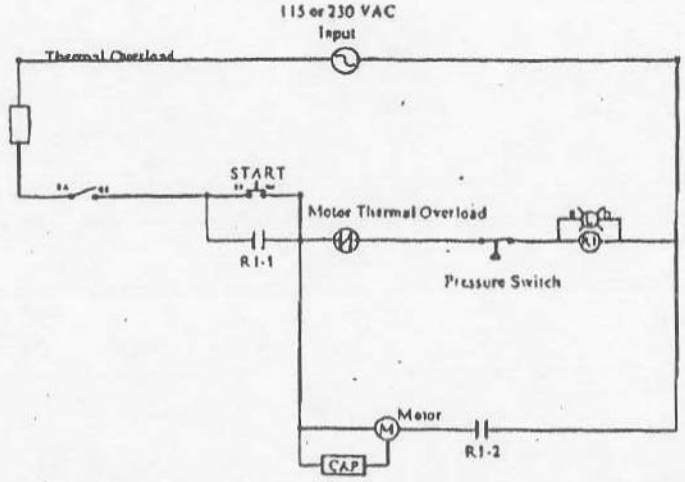
	tbd	1	Electrical Plug
3	76-5655	1	Relay, 230 Volt
7	76-5658	1	Pushbutton, Lighted



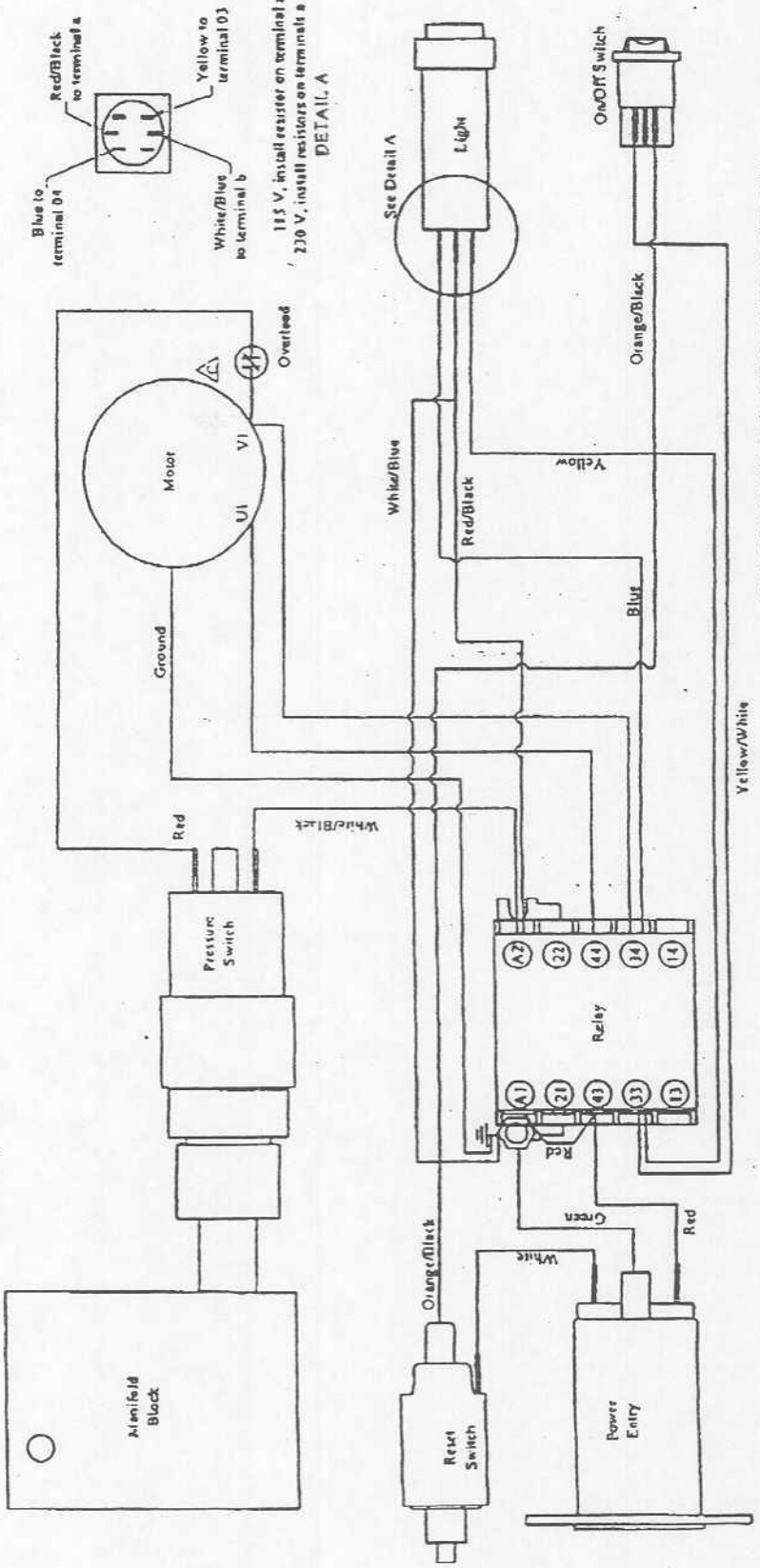
Compression occurs in three stages all configured on a single stepped piston. The first stage is 2.375 inches in diameter and compresses on the upstroke discharging at a pressure about 160 psig. The second stage is located directly under the first stage and has a diameter of 2.00 inches compressing on the downstroke at a pressure of about 800 psig. The third stage is .500 inches in diameter located above the first stage and compresses on the upstroke to the final pressure of 2,250 psig. Each stage is provided with an inlet valve and a discharge valve. These one-way poppet style valves control the direction of gas flow from stage to stage. Relief valves are also provided on each stage to prevent overpressurization in the event of a poppet valve failure. The heat generated during compression is removed in the cylinder block, which has a relatively large thermal mass and cooling fins. Peak gas temperatures are held under 250 °F. A discharge pressure switch shuts the compressor down when the pressure reaches the set pressure of the switch, usually 2,250 psig.



MICROBOOST CIRCUIT DIAGRAM



CAD DRAWING - DO NOT CHANGE MANUALLY



CAD DRAWING - DO NOT CHANGE MANUALLY

RIX

High-Volume Booster

Operations Manual and Parts List

(May not be included in your system)

RIX INDUSTRIES
Air and Gas Compressor Manufacturers
Since 1876

OPERATING INSTRUCTIONS and PARTS LIST for

RIX GAS COMPRESSOR

MODEL NO. 2PS2B-.85

(FOR SPECIFIC PACKAGE INFORMATION,
SEE TABLE ON FOLLOWING PAGE.)

4900 Industrial Way Benicia, CA 94510 USA Phone 707-747-5900 FAX 707-747-9200
email: info@rixindustries.com website: www.rixindustries.com

GENERIC MANUAL FOR
2PS2B-xx COMPRESSOR

This is a generic manual for all of the RIX Model 2PS2B-xx compressors. The various compressors are summarized in the table below.

SPECIFIC PACKAGE INFORMATION FOR THE RIX INDUSTRIES' 2PS2B-xx COMPRESSOR

FLOW (SCFH)	HP	SPEED (RPM)	SUCTION PRESSURE PSIG	VOLTAGE FREQUENCY (HZ)	MODEL NUMBER
30 to 60	1-1/2	190	30 to 70	120 V - 60 HZ 240 V - 50 HZ	2PS2B-L 2PS2B-L50
60 to 120	1-1/2	390	30 to 70	120 V - 60 HZ 240 V - 60 HZ 240 V - 50 HZ	2PS2B-H 2PS2B-HH 2PS2B-H50

Generally speaking the compressors are identical except for differences in the motors, motor sheaves, etc. The parts applicable to each different model are clearly indicated in the parts list.

Overload heaters may vary from compressor to compressor.

Part numbers appropriate to the different options are indicated in the parts list.

Each of the various packages can be mounted in a frame assembly. This is indicated by an "-F" after the model number; e.g., 2PS2B-H-F.

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LIST OF ILLUSTRATIONS

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PART II

MANUFACTURER'S DRAWING AND TECHNICAL INFORMATION FOR:

SERIAL NUMBER PAGE

This manual is applicable to all

RIX Industries
Model 2PS2B Oxygen Compressors
bearing one of the following serial numbers:

9327 AND ABOVE

Also suitable for repair of units prior to serial number 9327

SAFETY SUMMARY

The following is a general safety precaution that is not related to any specific procedure and therefore does not appear elsewhere in this publication. This is a recommended precaution that personnel must understand and apply during many phases of operation and maintenance:

KEEP AWAY FROM LIVE CIRCUITS. Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the electrical enclosures with the voltage supply turned on.

The following WARNINGS and CAUTIONS appear in this manual and are repeated here for emphasis.

CAUTION

Do not operate if safety guards are damaged or removed. (Pg. 1-1)

CAUTION

Do not attempt any repair without first cutting off power at the main breaker switch and consulting cleanliness requirements. In automatic mode, the compressor may start at any time. (Pg. 1-1)

CAUTION

Check relief valves for correct operation at regular periods. Do not reset for any pressure other than that stamped on the valve body. (Pg. 1-1)

CAUTION

Do not bypass the pressure switches. This would eliminate safety features and could result in damage to the compressor (Pg. 1-1)

WARNING

Do not touch discharge gas lines from the cylinders. These are hot and can cause serious burns (Pg. 1-1)

WARNING

Any work to be done on the compressor where the gas stream may be exposed must be done in accordance with Safe Oxygen Equipment Handling Procedures.

No attempt should be made to work on the machine without full knowledge of Oxygen Equipment handling and the potential hazards of contamination. (Pg. 1-3, 4-2, 6-2)

WARNING

Before performing any of the scheduled maintenance tasks in Chapter 4, the compressor should be shut off and tagged Out of Service. This is to prevent an inadvertent start which could cause injury to personnel or damage to the equipment. After completing the maintenance action, the compressor should be restored to full operation and the tags removed. (Pg. 4-1)

WARNING

Discharge pipes, fittings, and port areas can cause painful burns if touched. Always exercise caution around the compressor when it is running or has recently been run. (Pg. 2-1, 2-2)

WARNING

The compressor may start at any time when in automatic mode. Before attempting any repairs or adjustments: de-energize the machine by pushing the STOP button, disconnect power to the system (to avoid shock hazard), vent pressure by opening hand valves down stream and give the discharge piping time to cool down. Discharge lines are hot and can cause burns. (Pg. 4-1, 6-1)

WARNING

Hot discharge lines can produce painful burns. Be careful to avoid making contact with hot pipes while performing tests and repairs. (Pg. 4-3)

RIX INDUSTRIES'

COMPRESSOR WARRANTY

RIX Industries warrants all 2PS2B compressors as follows:

Twelve (12) months of operation or eighteen (18) months from date of shipment or 2,000 hours of operation, whichever occurs first, covering materials and workmanship. Warranty does not cover normal wear or consequential damages.

RIX certifies that all oxygen compressors have been test run on pure oxygen gas at desired pressures and flow rates and that the compressors are oxygen clean at shipment. Purchaser takes full responsibility for all components added to the compressor package that could contaminate the gas stream causing a failure.

All warranty work conducted at RIX facilities at Sparks, Nevada, USA or Oakland, California, USA, at RIX's discretion. All freight and/or transportation charges are to be paid by purchaser.

CHAPTER 1

GENERAL INFORMATION

SAFETY PRECAUTIONS

The following safety precautions apply to the **RIX 2PS2B Compressor**. Proper attention to safety should be maintained whenever operating or servicing this equipment. A complete listing of safety precautions is given in the Safety Summary on Page iv.

Do not operate if safety guards are damaged or removed.

Do not touch discharge gas lines from the cylinders. These are hot and can cause serious burns.

Do not attempt any repair without first cutting off power at the main breaker switch and consulting cleanliness requirements.

Check relief valves for correct operation at regular periods. Do not reset for any pressure other than that stamped on valve body.

Do not bypass pressure switches. This would eliminate safety features and could result in damage to the compressor.

1-1 INTRODUCTION

1-1.1 PURPOSE. The intent of this manual is to provide information pertinent to the operation, maintenance and installation of the high pressure, oil-less, air cooled compressor, RIX Model 2PS2B.

1-1.2 SCOPE. This publication sets forth requirements and procedures for the operation, maintenance and installation of this subject equipment. It also includes descriptive data and tests necessary to achieve a functional understanding of the compressor operation together with its associated flow and control circuitry.

1-2 EQUIPMENT DESCRIPTION

1-2.1 INTENDED USE. The subject oxygen compressor system is designed for use to provide high pressure oxygen for storage or liquification.

1-2.2 OPERATING CHARACTERISTICS. Each compressor produces 2250 psig, 30-120 SCFH oil-less oxygen at a crankshaft speed of 190-390 RPM with 30-70 psig inlet pressure. Each compressor is a reciprocating, two stage opposed, single acting design powered by a 1-1/2 HP motor through a belt drive.

Table 1-1. Reference Data

Descriptive Data	High pressure, air cooled compressor package, RIX Industries oil-less, reciprocating, two stage oxygen compressor.
Functional Characteristics	1-1/2 HP motor 30-120 SCFH oxygen output at 2250 psig pressure with low suction pressure, and high discharge pressure safety shutdown features.
Capabilities & Limitations	Continuous duty, air cooled, non-lubricated.
Rated Outputs	30-120 SCFH oxygen at 2250 psig pressure, 190 or 390 RPM, 68°F oxygen inlet temperature, 30-70 psig inlet pressure, and dry gas. Designed to operate from 35° to 105°F ambient with up to 100 percent relative humidity, and deliver gas at 130°F maximum.

Power Required

1-1/2 HP	120V	190 RPM	60 Hz	12 Amps	2PS2B-L
1-1/2 HP	230V	190 RPM	50 Hz	6 Amps	2PS2B-L50
1-1/2 HP	120V	390 RPM	60 Hz	19 Amps	2PS2B-H
1-1/2 HP	230V	390 RPM	60 Hz	10 Amps	2PS2B-HH
1-1/2 HP	230V	390 RPM	50 Hz	14 Amps	2PS2B-H50

Table 1-2. Equipment, Accessories and Documents Supplied

Item Name or Nomenclature	Overall Dimension	Uncrated Weight & Volume
Compressor, Bare Pump (Including Flywheel)	Length 22 in. Width 14 in. Height 29 in.	Weight - 150 lbs. Volume - 5.4 cu. ft.
Operation, Maintenance & Installation Manual	8.5" x 11" x 0.5"	Weight - 1 lb.

1.3 OXYGEN CLEANLINESS

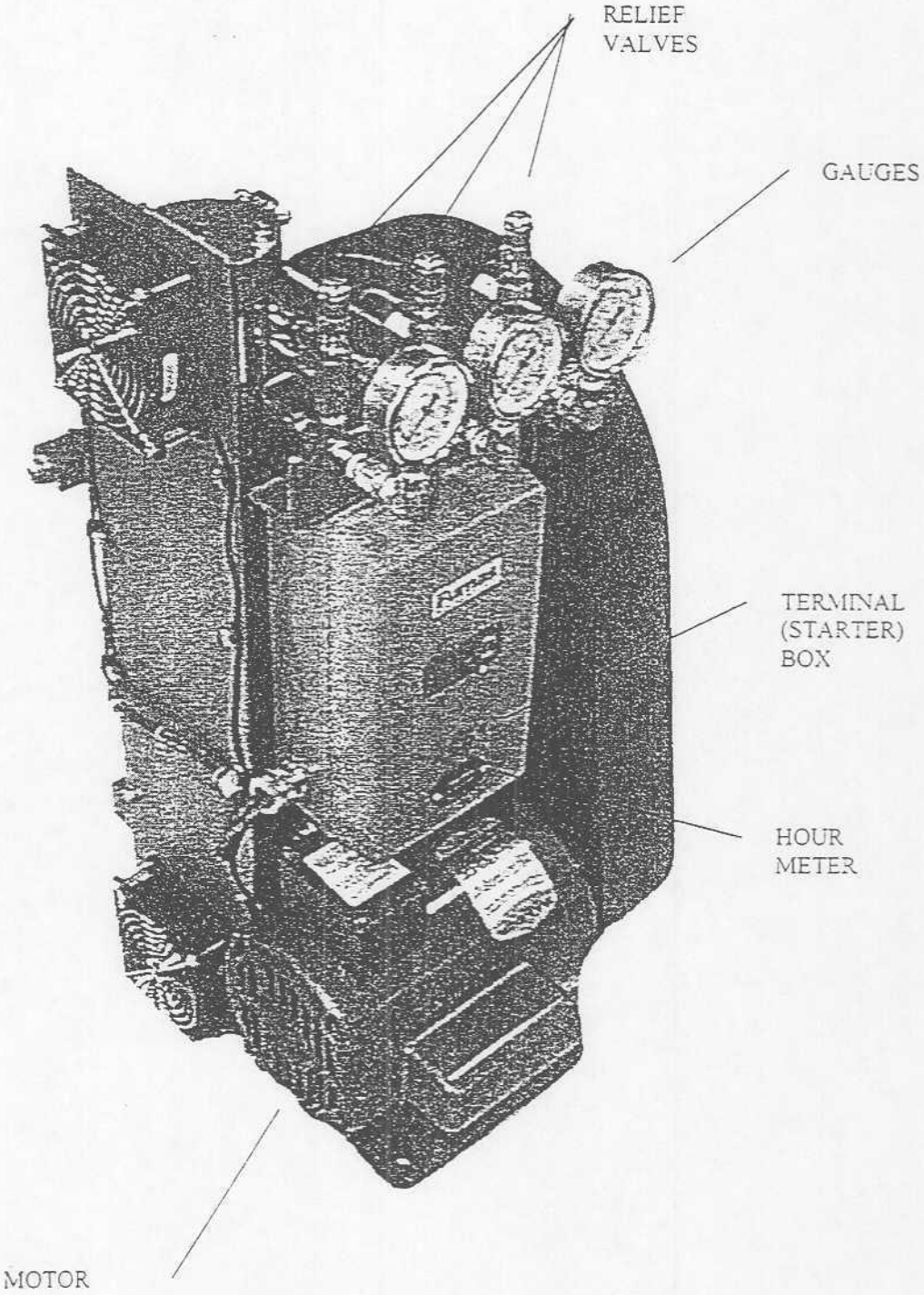
The **RIX 2PS2B Oxygen Compressor** is specially designed and built to safely process pure Oxygen Gas without oxidation or combustion. All compressor parts have been thoroughly cleaned and inspected. Assembly is done in a special cleaning facility and clean room environment with extreme care taken to prevent any combustibles from entering the system.

WARNING

Any work to be done on the compressor where the gas stream may be exposed must be done in accordance with **safe Oxygen Equipment handling procedures.**

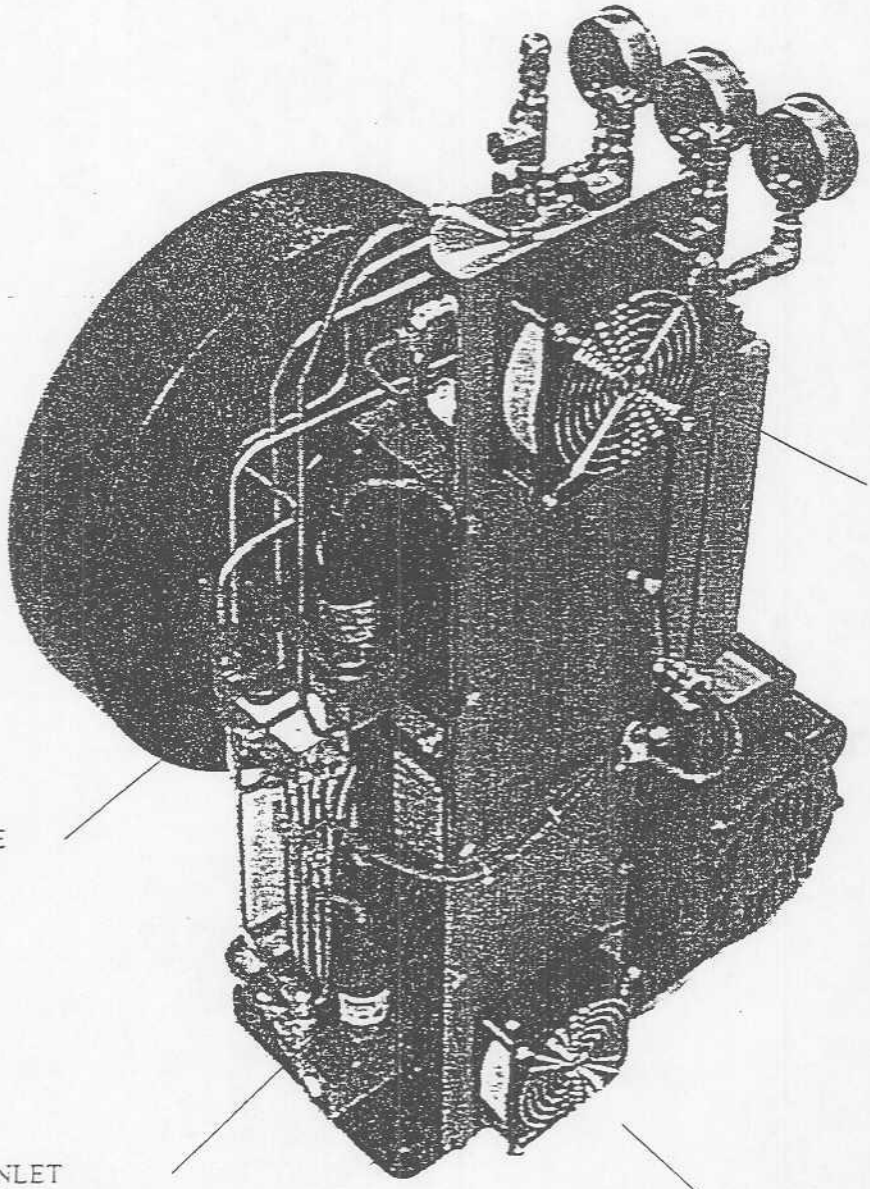
No attempt should be made to work on the machine without full knowledge of Oxygen Equipment handling and the potential hazards of contamination.

NOTE: RIX has established a procedure for working with oxygen machinery. See Part II of this manual, A5858-9



A7780 SHEET 1
REV A 3-19-98

FIG 1-1
MODEL 2PS2B-.85 OXYGEN BOOSTER



A7780 SHEET 2
REV A 3-19-98

FIG 1-1A
MODEL 2PS2B-.85 OXYGEN BOOSTER

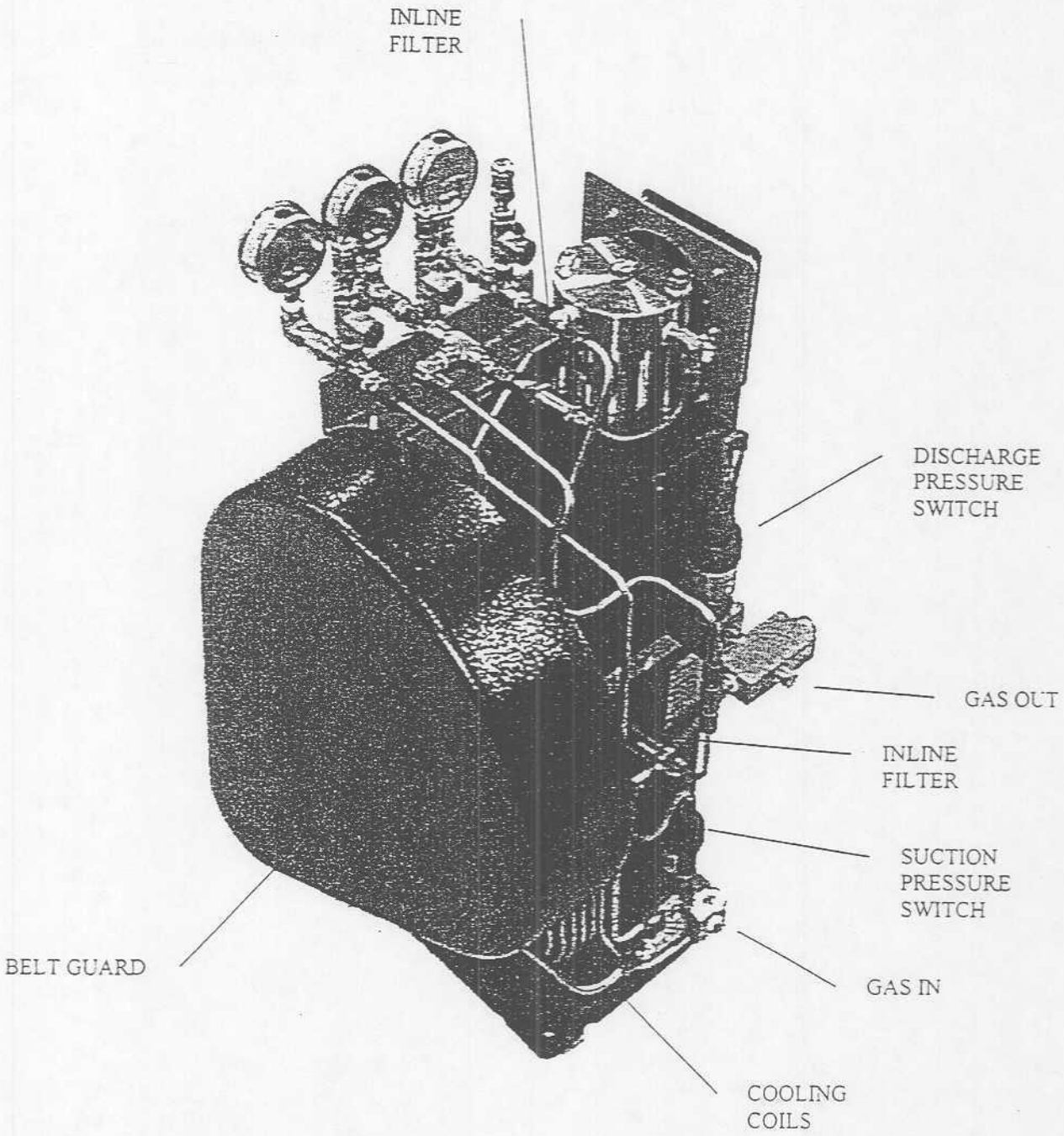


FIG 1-1B
MODEL 2PS2B-.85 OXYGEN BOOSTER

CHAPTER 2

OPERATION

2-1 INTRODUCTION

2-1.1 GENERAL INFORMATION. Built-In safety features, which automatically shut down the compressor if suction pressure is too low or excessive pressure is reached in the second stage discharge line, are included in the system. The low pressure switch senses the pressure in the suction line. The high pressure switch senses the pressure in the discharge line from the aftercooler. Pressure gauges are utilized to measure suction pressure and first and second stage discharge pressures. The gauges left to right are suction pressure, 1st stage pressure and 2nd stage (or discharge) pressure. See Figure 1-1a.

2.2 CONTROLS & INDICATORS

2-2.1 ELECTRIC POWER. The motor controller must be wired to a source of power by a competent electrician in accordance with local and federal codes. Make sure the compressor package is properly grounded. See Electrical Schematic, Figure 3-3.

2-2.2 SAFETY VALVES. Pressure relief valves are provided after each stage. These valves prevent an accidental over-pressurization of the system. The first stage relief valve is set for 700 psig; the second stage is set for 2500 psig. The relief valves are mounted behind their respective gauges. There is an inlet relief valve, set at 75 psig.

WARNING

Discharge pipes, fittings, and port areas can cause painful burns if touched. Always exercise caution around the compressor when it is running or has recently run.

2-2.3 PRESSURE SWITCHES. The compressor will automatically shutdown when the discharge pressure reaches 2250 psig and will restart when it drops (to approximately 1900 psi).

Similarly, when the inlet pressure drops to 25 psig the compressor will stop, and will re-start automatically when it rises again (to approximately 28 psig).

The actuation point of each switch may be adjusted although the re-set dead band, the amount of pressure increase or decrease to reset the switch, is not adjustable.

2-2.4 PRESSURE INDICATORS. Pressure gauges measure the inlet pressure and the first and second stage discharge pressures.

Sensing Point	Normal Pressure Range
Inlet	30-70 Psig
First Stage Discharge	350-600 Psig
Second Stage Discharge	1500-2200 Psig

2-2.5 BACK PRESSURE VALVE. This valve is factory set at 1500 psi and needs no adjustment. If necessary the valve can be adjusted by loosening the jam nut and turning the set screw in or out with a hex wrench. The valve is located in the discharge piping prior to the check valve. See Figure 1-1a.

2-3 OPERATING PROCEDURES

2-3.1 GENERAL. The operator should read and understand the procedures outlined in Table 2-1 through Table 2-4 prior to starting the compressor. The following tables outline the steps necessary for starting and stopping the compressor under both normal and emergency conditions.

WARNING

Discharge pipes, fittings, and port areas can cause painful burns if touched. Always exercise caution around the compressor when it is running or has recently run.

Table 2-1. Operating Procedures - Operator Start

Explanation of Operation	Sequences of Steps Taken to Place the Equipment In Operation
Initial Safety Requirements	Remove beltguard and rotate the compressor flywheel by hand. Visually check to see that there are no obstructions in the way of moving parts or other indications of disorder or disrepair. Replace beltguard.
Connection of Accessory Equipment Necessary for Operations	Permanent installations should have all necessary electrical wiring and piping in place. Piping must be installed in accordance with safe oxygen handling procedures.
Instructions for Obtaining or Confirming Critical Inputs.	Confirm that electrical power is available for running the compressor.
Control Settings and Adjustment Necessary prior to Turn-on	As necessary (customer interfacing). Inlet pressure adjusted and set (minimum 30 psig, maximum 70 psig).
Milestones	Verify inlet pressure on inlet gauge.
Visual or Audible Observations	A slight hissing may occur as inlet gas escapes past the compressor rings.
Operator Checks and Adjustments	Check for leaks.
Operator's Maintenance Actions and Schedules	Service compressor according to guidelines set forth in Chapter 4.

Table 2-2. Operating Procedures - Modes of Operation

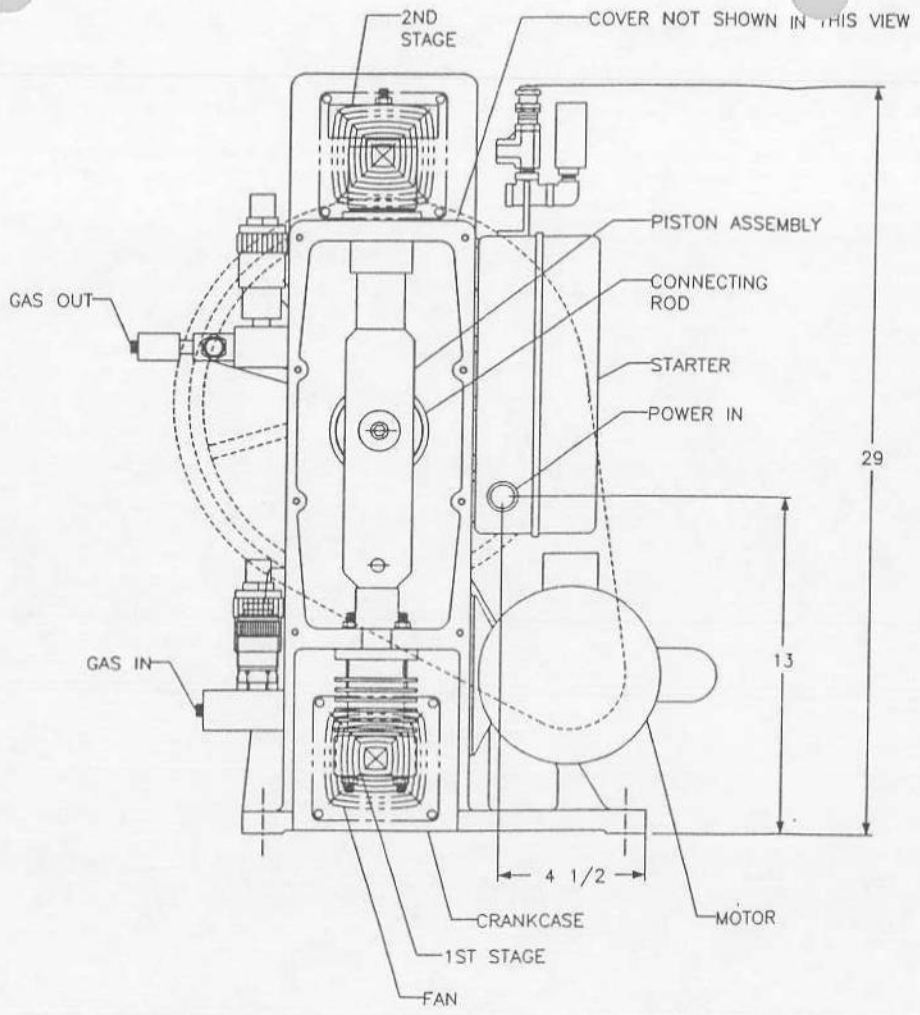
Explanation of Operation	Sequences of Steps Taken to Make the Equipment Operational
Initial Safety Requirements	See Table 2-1 for all steps related to normal start-up.
Connection of Accessory Equipment Necessary for Operations	Confirm that compressor is properly connected to suction and discharge piping. Verify all connections were made in accordance with Safe Oxygen Equipment Handling Procedures.
Instructions for Obtaining or Confirming Critical Inputs	Verify proper power hook up. Verify proper inlet pressure.
Control Settings and Adjustments Necessary Prior to Turn-on	Inlet pressure set 30 psig minimum, 70 psig maximum.
Determination of Operational Readiness	Make sure all safety devices are in place.
Milestones	Put selector switch to AUTO
Visual or Audible Observations	First and 2nd Stage pressures rise. Brief knocking sound lasting less than 10 seconds. Fans (if equipped) start.
Operator Checks & Observations	Verify nominal operating pressures. See Table 6-1.

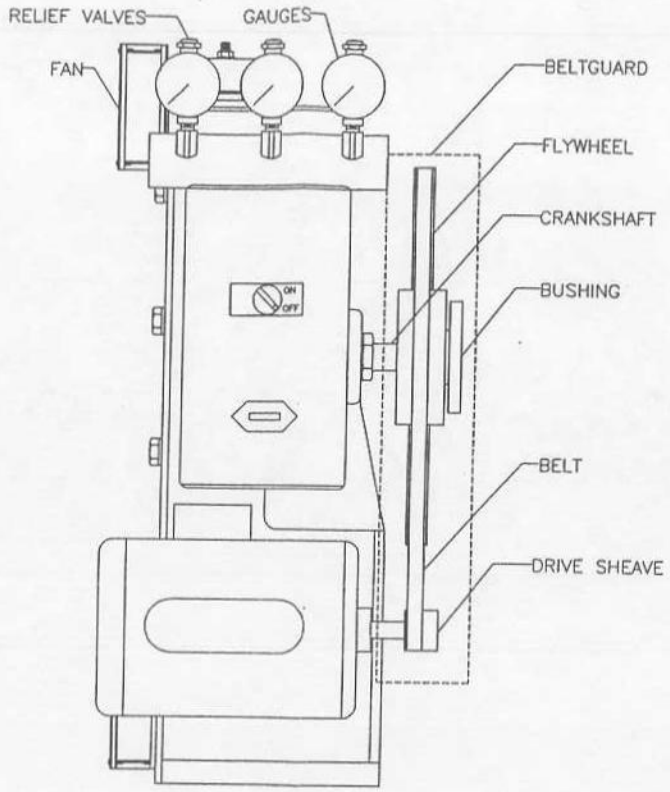
Table 2-3. Operating Procedures - Operator Stop

Explanation of Operation	Sequences of Steps Taken to Shut the Equipment Down
Initial Safety Requirements	Determine that operation of the compressor is no longer required.
Connection of Accessory Equipment Necessary for Operations	None.
Instructions for Obtaining or Confirming Critical Inputs.	None.
Control Settings and Adjustments Necessary prior to Turn-off.	None.
Determination of Operational Readiness.	Compressor may be shut off at any time.
Milestone	Put selector switch to OFF.
Visual or Audible Observations	Observe that motor and compressor wind down and cease running. Observe fans (if equipped) stop.
Operator's Maintenance Actions and Schedules	Shut off main electrical supply. Service compressor according to guidelines set forth in Chapter 4.

Table 2-4. Operating Procedures - Emergency Stop

Explanation of Operation	Sequences of Steps Taken to Shut the Equipment Down
Initial Safety Requirements	None.
Connection of Accessory Equipment Necessary for Operations	None.
Instructions for Obtaining or Confirming Critical Inputs	None.
Control Settings and Adjustments Necessary prior to Shutdown	None.
Determination of Operational Readiness	None.
Milestones	Shut compressor off by putting selector switch to OFF on motor controller.
Visual or Aural Observations	Verify that motor and compressor have stopped. Verify fans (if equipped) have stopped.
Operator Checks and Adjustments	Bleed pressure by loosening a fitting upstream of back pressure valve.
Operator's Maintenance Actions and Schedule.	None. Return unit to normal operation after emergency is over.





APPLIES TO S/N'S PRIOR TO S/N 9521

INSTALLATION ARRANGEMENT

FIGURE 1-2
PAGE 1-7

B5991,
Sheet 1 OF 2

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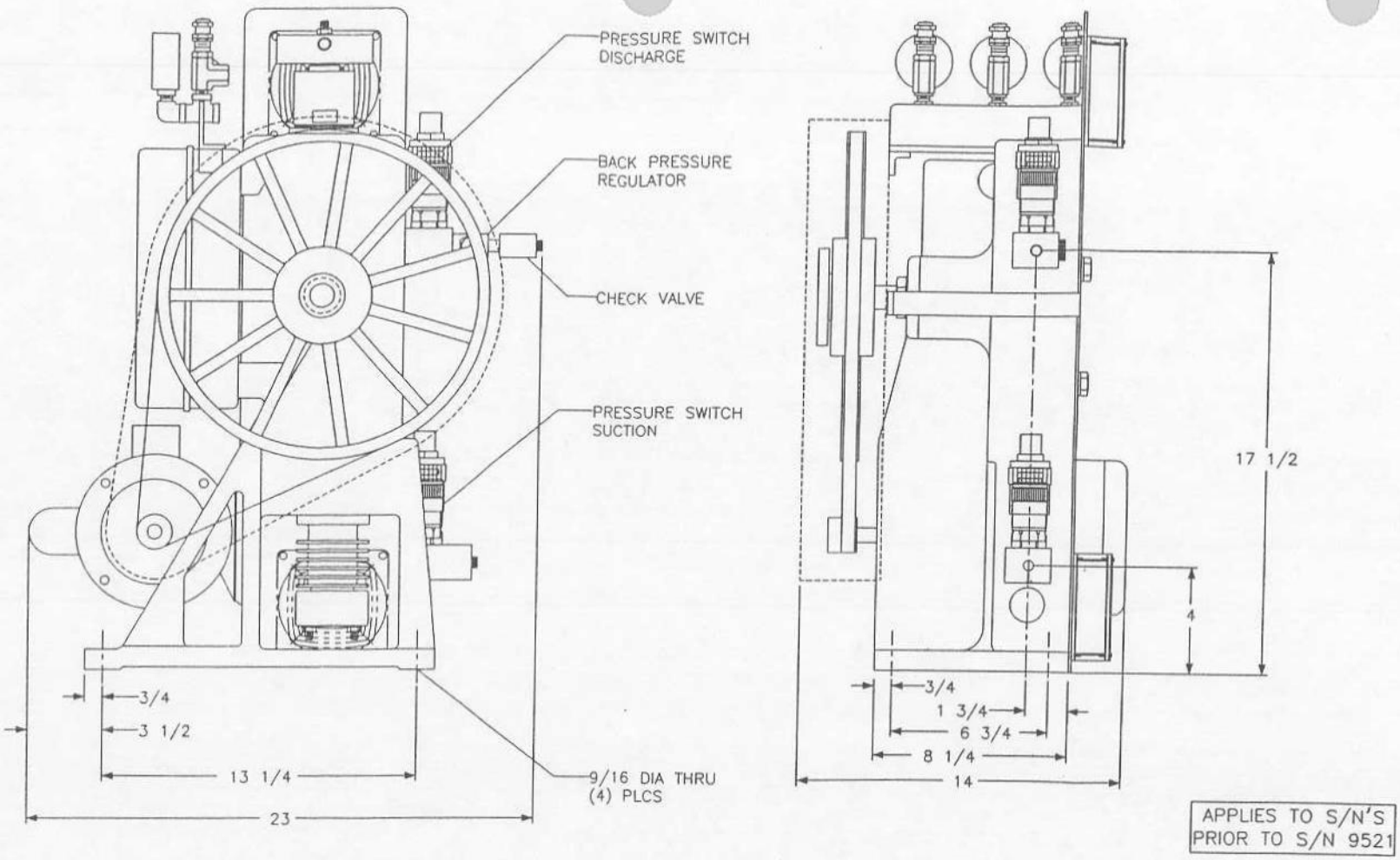

APPLIES TO S/N'S PRIOR TO S/N 9521

INSTALLATION ARRANGEMENT

FIGURE 1-2A
PAGE 1-8

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Sheet 2 OF 2

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CHAPTER 3

FUNCTIONAL DESCRIPTION

3-1 MAJOR COMPONENTS

3-1.1 COMPRESSOR ASSEMBLY. (Figure 3-1) The compressor is an air cooled reciprocating, oil-less, two cylinder, two stage, single-acting, opposed design. The two compression cylinders consist of a 1st stage piston of 1-1/4" diameter, and a 2nd stage 1/2" with a 2" piston stroke. The 1st stage piston assembly is the heart of the compressor. The piston assembly has the 1st stage on the bottom end and the 2nd stage on the top. The pistons for these cylinders use rings of glass & MoS_2 filled Poly-tetrafluoroethylene (TFE or Teflon® plastic) which gives a good seal and is self-lubricating. Linear motion is imparted to the piston assembly from the rotary crankshaft by means of a connecting rod attached to the piston which alternately compresses in its respective cylinder. The 1st stage rider rings guide one end of the assembly while the 1-3/4" diameter rider ring on the 2nd stage end guides the other. The main bearings and connecting rod bearings are all sealed, grease packed for life, and self-lubricating. The compressor valves are stainless steel reed type, normally closed and pressure-activated open.

3-1.2 SENSING INDICATORS. Sensing devices are provided for safety and to aid the operator in troubleshooting.

3-1.2.1 PRESSURE GAUGES. Pressure gauges are utilized to monitor suction pressure as well as first and second stage discharge pressures.

3-1.3 RELIEF VALVES. Two pressure relief valves are located in the gas system, one after each stage. There is also be a relief valve set at 75 psi in the suction piping. These serve to prevent damage to the cylinders and gas lines should excessive pressure build up. The relief valves are preset to 700 and 2500 psi. When the pressure of the gas on the area of the relief valve disc exceeds the spring load, the disc is lifted and the gas relieves to atmosphere. When the pressure is below the rating for the valve, the disc remains seated and no gas escapes.

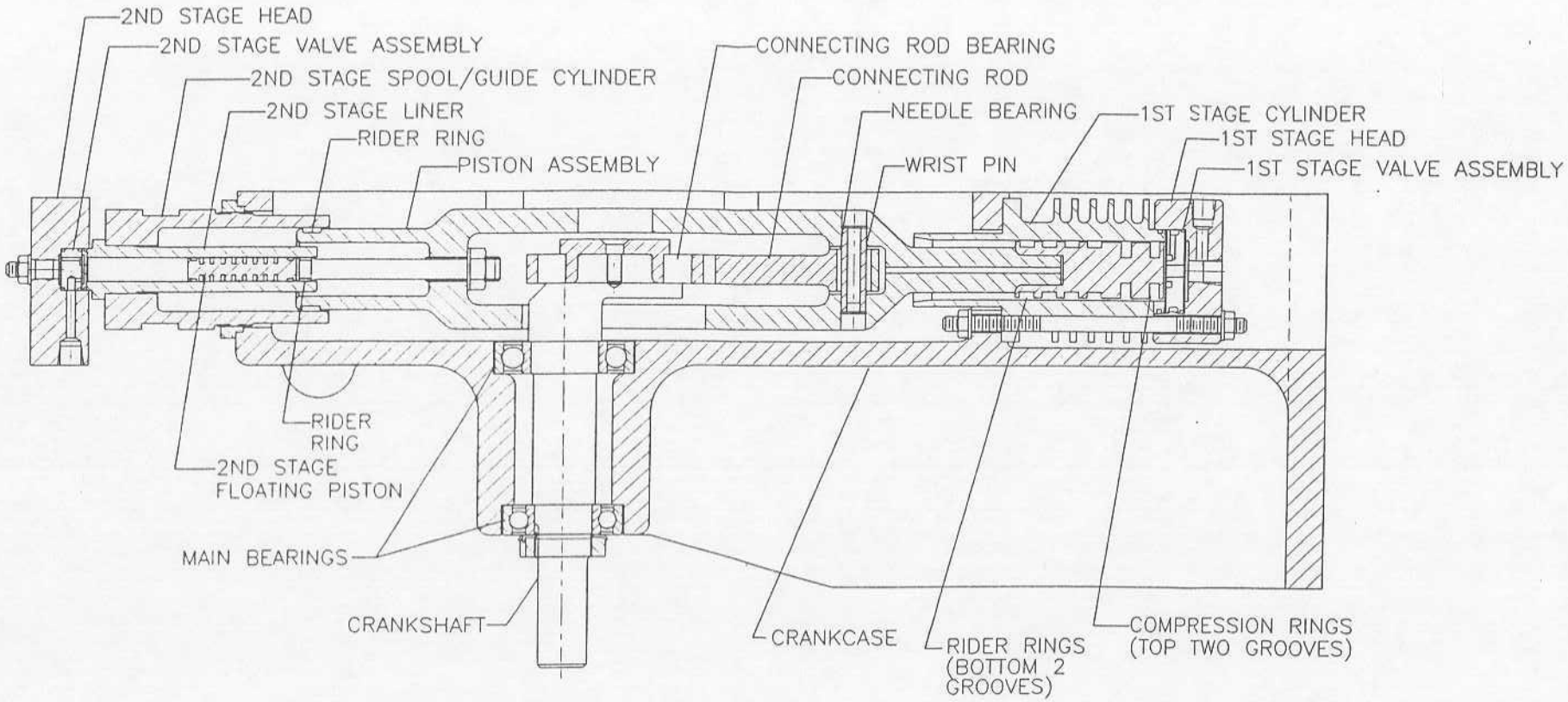
3-1.4 AIR COOLING SYSTEM. The compressor is provided with two stainless steel heat exchangers mounted next to the crankcase: each cools the gas after it has been compressed in its respective stage. Each heat exchanger is made up of stainless steel tubing coils and is sized for passive or forced air cooling depending on compressor horsepower.

3-1.5 DRIVE MOTOR . A 1-1/2 HP motor is used to power the compressor through a belt drive.

3-1.6 BACK PRESSURE VALVE. In the discharge piping is a back pressure valve. This valve is provided to maintain a minimum pressure of 1500 psi on the 2nd stage floating piston. The pressure is required to hold this free floating piston against its piston rod so that the piston will not hit against the valve stop in the 2nd stage head.

3-1.7 FILTER. An interstage filter keeps the system relatively free from small material particles. The mesh size is 60 micron.

3-1.8 PRESSURE SWITCHES. Two pressure switches are provided. One for low suction pressure, the other for high discharge pressure. The suction pressure switch is normally open and closes when the inlet pressure is above 28 psig. If suction pressure drops below this point the compressor will shutdown. The discharge pressure switch is normally closed. The compressor starts and stops automatically under control of these switches.

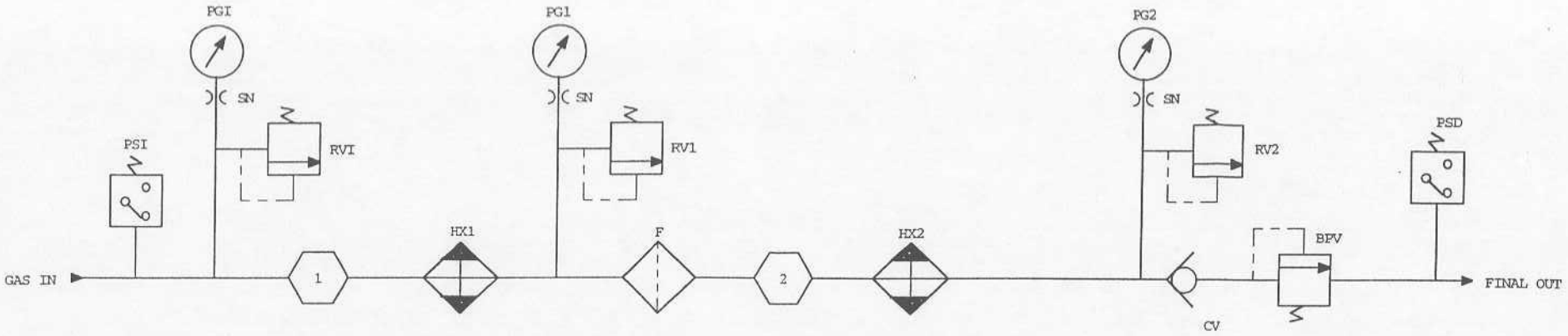


COMPRESSOR ASSEMBLY
2PS2B

B5994

FIGURE 3–1
PAGE 3–2

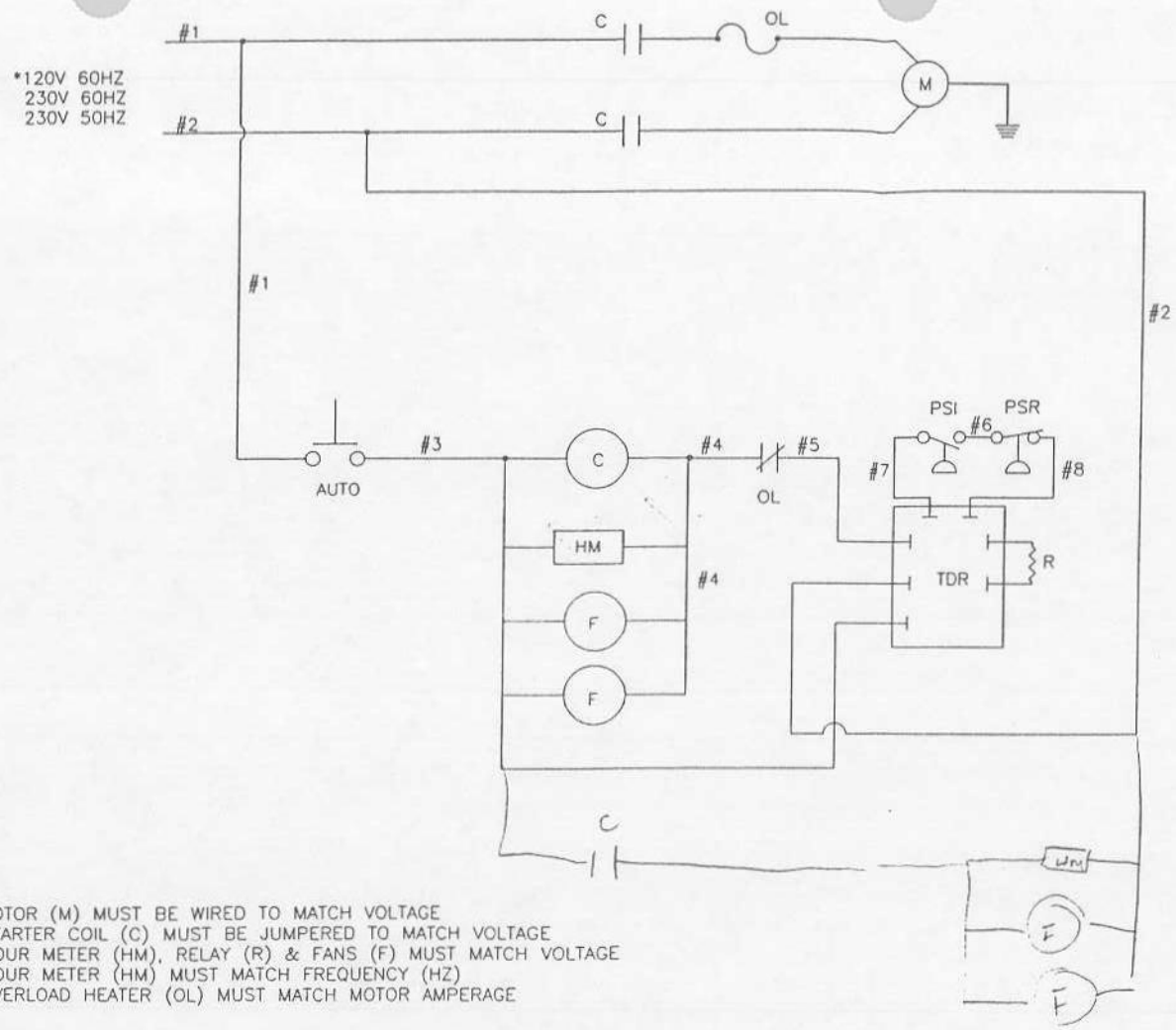
LT	DESCRIPTION		APPROVED
A	A1 WAS - 676, A2 WAS 677	-4	



SYM	QTY	B/M#	P/N	DESCRIPTION
BPV	1	221	X116-464	BACK PRESSURE VALVE
CV	1	222	X615-53	CHECK VALVE
F	2	220	XA77-505	FILTER
HX1	1	TUBING, 1/4 X .035 W. X 36" L., SS		HEAT EXCHANGER, 1ST STAGE
HX2	1	TUBING, 1/4 X .035 W. X 36" L., SS		HEAT EXCHANGER, 2ND STAGE
PGI	1	207	X60-824	PRESSURE GAUGE, INLET
PG1	1	209	X60-826	PRESSURE GAUGE, 1ST STAGE
PG2	1	212	X60-828	PRESSURE GAUGE, 2ND STAGE
PSD	1	219	X76-705	PRESSURE SWITCH, DISCHARGE
PSI	1	224	X76-704	PRESSURE SWITCH, INLET
RVI	1	208	X515-851	RELIEF VALVE, INLET, SET @ 75 PSI
RV1	1	210	X515-852	RELIEF VALVE, 1ST STAGE, SET @ 700
RV2	1	211	X515-855	RELIEF VALVE, 2ND STAGE, SET @ 2500
SN	3	206	X74-401	SNUBBER

Fig. 3-2
Page 3-3

CONTRACT NO.		RIX INDUSTRIES EMERYVILLE, CA. 94608 ON SAN FRANCISCO BAY SINCE 1878	
DRAWN	DM	DATE 97-4-2	TITLE: FLOW SCHEMATIC, 2PS WITH AUTO DISCHARGE SENSING
CHECK	KL	97-4-22	
APPD.	KL	97-4-22	
DESIGN ACTIVITY APPD.		SIZE B	CODE IDENT NO. 28953
SIMILAR TO:		SCALE: NONE	DWG. NO. B5846-1 REV. A
			SHEET 1 OF 1



SYM	DESCRIPTION
TDR	TIME DELAY RELAY
R	RESISTOR, 50 R OHM
PSI	PRESSURE SWITCH INLET, LOW, N.O.
PSR	PRESSURE SWITCH REGULATING, DISCHARGE, HIGH, N.C.
O	OVERLOAD HEATER N.C. (PART OF MOTOR STARTER)
M	MOTOR, ELECTRIC
HM	HOURMETER
F	FAN (HIGH OUTPUT MODULES ONLY)
C	CONTACTOR COIL (PART OF MOTOR STARTER)
AUTO	SELECTOR SWITCH OFF/AUTO (PART OF STARTER)

*MOTOR (M) MUST BE WIRED TO MATCH VOLTAGE
STARTER COIL (C) MUST BE JUMPERED TO MATCH VOLTAGE
HOUR METER (HM), RELAY (R) & FANS (F) MUST MATCH VOLTAGE
HOUR METER (HM) MUST MATCH FREQUENCY (HZ)
OVERLOAD HEATER (OL) MUST MATCH MOTOR AMPERAGE

APPLIES TO S/N'S
PRIOR TO S/N 9521

ELECTRICAL SCHEMATIC
SUCTION AND DISCHARGE
SENSING AUTO START/STOP

FIGURE 3-3
SHEET 3-4

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SHEET 2 OF 2

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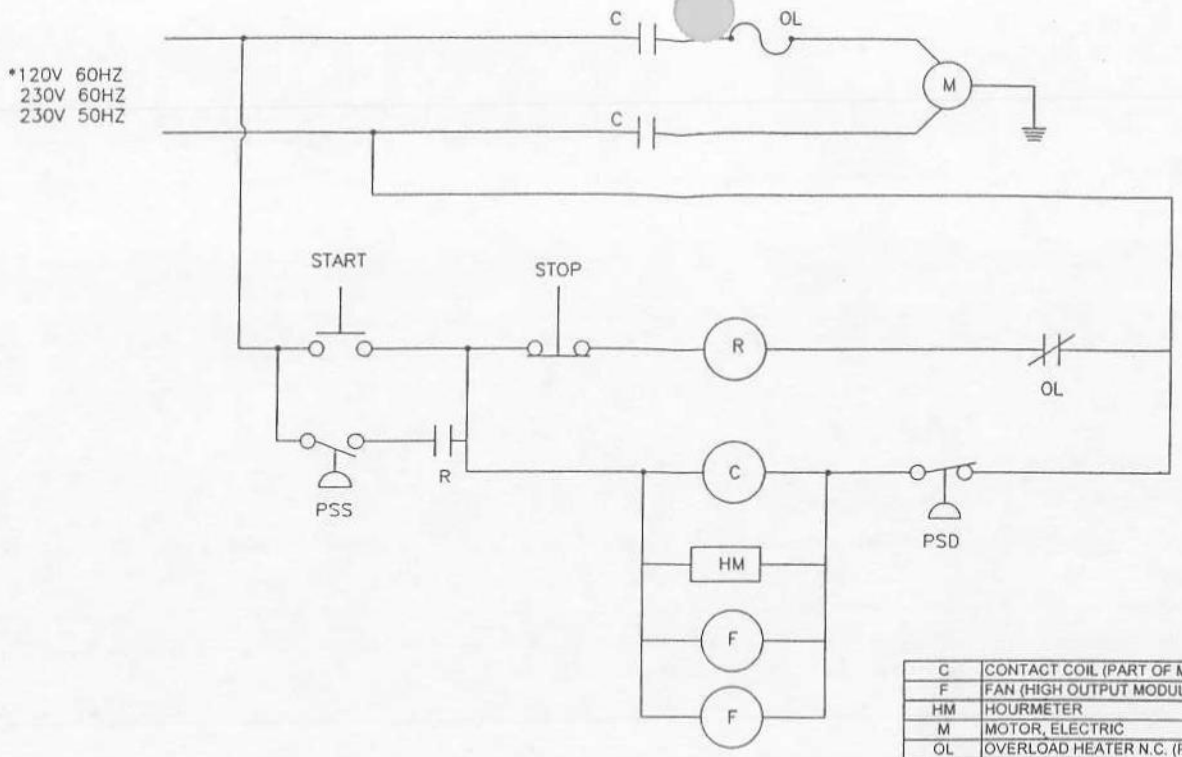

NOTE:
THIS ELECTRICAL SCHEMATIC IS APPLICABLE TO S/N 8815 & EARLIER.

SYM	DESCRIPTION
C	CONTACT COIL (PART OF MOTOR STARTER)
F	FAN (HIGH OUTPUT MODULES ONLY)
HM	HOURMETER
M	MOTOR, ELECTRIC
OL	OVERLOAD HEATER N.C. (PART OF MOTOR STARTER)
PSD	PRESSURE SWITCH DISCHARGE, HIGH, N.C.
PSS	PRESSURE SWITCH SUCTION, LOW, N.O.
R	RELAY/RELAY CONTACT (NORMAL OPEN)
START	PUSHBUTTON N.O.
STOP	PUSHBUTTON N.C.

*MOTOR (M) MUST BE WIRED TO MATCH VOLTAGE
STARTER COIL (C) MUST BE JUMPERED TO MATCH VOLTAGE
HOUR METER (HM), RELAY (R) & FANS (F) MUST MATCH VOLTAGE
HOUR METER (HM) MUST MATCH FREQUENCY (HZ)
OVERLOAD HEATER (OL) MUST MATCH MOTOR AMPERAGE

ELECTRICAL SCHEMATIC
SUCTION AND DISCHARGE
SENSING AUTO START/STOP.

FIGURE 3-3a
SHEET 3-5

B5907
SHEET 1 OF 2

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CHAPTER 4

SCHEDULED MAINTENANCE

4-1 INTRODUCTION

The purpose of this chapter is to provide the operator with the scheduled maintenance required to insure a long service life of the RIX Compressor, Model 2PS2B. This chapter covers the procedures for performing examinations, tests, replacements, preventive maintenance tasks, and overhauls. Material and test equipment requirements are covered in the following paragraphs for each specific task. The chart is arranged with the most frequently performed tasks covered first, the less frequent tasks later. Where maintenance tasks require significant disassembly, they are referenced here for scheduling and explained in Chapter 6 - Corrective Maintenance. Also, any corrective maintenance required as a result of any preventative maintenance inspections is covered in Chapter 6. On a daily basis, visually inspect the operating compressor. Check gas pressures, gas, temperatures, and for any leaks or unusual noises.

WARNING

The compressor may start at any time when in automatic mode. Before attempting any repairs or adjustments, de-energize the machine by putting the selector switch to OFF, disconnect power to the system (to avoid shock hazard), vent pressure by opening hand valves and give the discharge piping time to cool down (discharge air lines are hot and can cause burns).

Table 4-1. Preventive Maintenance

Para.	Operation	Time Intervals in Hours 1000	2000	3000	4000
4-2	Filter Cleaning		X		
4-3	Compressor Valves Inspection and Reconditioning				X
4-4	Pressure Relief Valves				X
4-5	Belt Adjustment		X		
4-6	Gas System Piping		X		
4-7	Bearing Inspection	X			
4-8	Piston Ring Replacement: 1st Stage			X	
	2nd Stage			X	

WARNING

Before performing any of the scheduled maintenance tasks in Chapter 4, the compressor should be shut off and tagged **Out of Service**. This is to prevent an inadvertent start which could cause injury to personnel or damage to the equipment. After completing the maintenance action, the compressor should be restored to full operation and the tags removed.

4-2 FILTER CLEANING

4-2.1 FREQUENCY. Every 2000 hours of running time the external interstage filter should be cleaned. Failing to clean the filter as scheduled may result in improper operation of the compressor valves.

WARNING

Any work done where the gas stream may be exposed must be done in accordance with safe Oxygen Equipment handling procedures. RIX has established a procedure for working with oxygen machinery. See Part II of this manual.

4-2.2 PROCEDURE.

a. Remove external filter shown on Figure 1-1b or Figure 3-2.

b. Clean and thoroughly dry filter following proper procedure for cleaning Oxygen Equipment (See Part II of this manual).

c. Reinstall the filter with the flow in the proper direction.

4-3 COMPRESSION VALVES INSPECTION AND RECONDITIONING.

4-3.1 FREQUENCY. Every 4000 hours the compressor valves should be removed and reconditioned. Step by step procedures for removing and servicing the valves are given in Paragraph 6-4. As a minimum during the 4000 hour maintenance action, the O-rings should be replaced with new parts and the valve seat resurfaced to remove any and all defects.

It is recommended to maintain a stock of spare valves so that servicing can be as simple as possible. This allows the service man to change out the valves and reduce the down time during this maintenance action. The used valves may then be reconditioned as time permits so that they are ready for the next change out.

4-4 PRESSURE RELIEF VALVES.

4-4.1 FREQUENCY. The pressure relief valves should be removed from the compressor and tested for correct set-point every 4000 hours. If a valve fails to lift at its rated pressure, it must be readjusted and if necessary, serviced per Paragraph 6-13.

4-5 BELT ADJUSTMENT.

4-5.1 Belt tension should be checked every 1000 hours of operation or if slipping occurs.

4-5.2 PROCEDURE.

a. Shutdown compressor, disconnect power and bleed off pressure.

b. Remove belt guard.

c. Loosen motor bolts.

d. Push down on motor sheave and tighten motor bolts. Belt should deflect 1/2 - 3/4" at mid span with approximately 10 lb. force.

e. Replace belt guard.

4-6 GAS SYSTEM PIPING.

4-6.1 FREQUENCY. Every 2000 hours of running time or any time the piping system is disturbed, such as during a corrective maintenance action, the piping should be examined for leaks. Any obvious leaks should be dealt with as they are detected. Leak testing the piping requires that the compressor is pressurized, and therefore running.

NOTE

The test is simplified if the compressor is allowed to cool, then restarted, immediately prior to running the leak test, since the hot discharge pipes can boil away the leak test soap solution, making detection of leaks difficult or impossible.

WARNING

Hot discharge lines can produce painful burns. Be careful to avoid making contact with hot pipes while performing tests and repairs.

If a leak is detected, it should be noted or conspicuously marked so that it can be repaired at the next convenient shutdown period.

4-6.2 MATERIALS. A soapy solution in a squirt bottle works best for locating leaks in a gas system. The gaskets and O-rings needed for the specific repair should be on hand prior to attempting to fix a leak.

4-6.3 PROCEDURE.

a. Restart compressor after it has been allowed to cool down. See Chapter 2 - Operation.

b. Systematically move from joint to joint and fitting to fitting in the gas system piping, spraying the leak test solution.

c. Observe for the formation of bubbles. Mark the location of any detected leaks. Large leaks may blow the soap solution away as quickly as it is applied. These may be detected by feel, again being careful of hot discharge lines.

d. Test relief valves by forming a bubble across the outlet opening and observing if the bubble grows.

e. Leaks at fitting joints may, in some cases, be corrected by tightening the joint.

CAUTION

Avoid over-tightening as this can produce distortion and make the problem more severe. If the joint is tight and still leaks, the gasket must be replaced.

f. O-ring joints cannot be corrected by additional tightening. In most every case, the leaking o-ring must be discarded and a new one installed. Always inspect the surfaces that seal against the O-ring for defects and correct them as required.

4-7 BEARING INSPECTION.

4-7.1 FREQUENCY. Every 2000 hours inspect the main ball bearings, connecting rod ball bearing, and connecting rod needle bearing to verify adequate lubrication and smooth rotation. If replacement is necessary, follow the procedures given in Paragraphs 6-8 and 6-9. Failure to replace the bearings could result in a bearing failure which would cause further damage to the compressor.

4-8 PISTON RING REPLACEMENT.

4-8.1 FREQUENCY. Every 3000 hours, the 2nd stage floating piston, including new compression rings, rider rings, and O-rings, should be replaced following the procedures given in Paragraph 6-7. Every 3000 hours the 1st stage rings should be checked and replaced as necessary. If the piston rings are allowed to wear beyond their service life, the compressor output will be reduced, causing more frequent compressor operation and unnecessary wear on other components. There is also the risk of damaging the cylinder walls if the rings wear out completely.

CHAPTER 5

COMPRESSOR TROUBLESHOOTING

5-1 TROUBLESHOOTING

5-1.1 INTRODUCTION. This chapter contains information to allow the technician to locate a malfunction or identify a potential fault with the compressor. The troubleshooting guide is prepared with the most likely and easily diagnosed probable causes listed first. The chart is prepared so that all troubleshooting procedures and diagnostics can be performed on the organizational level. Subsequent repair actions may involve higher levels of maintenance.

Diagrams included elsewhere in this manual may help in diagnosing troubles. For convenience, they are listed here and referenced in the troubleshooting charts.

Table 5-1. Compressor Troubleshooting Guide

CHART 5-1 HIGH PRESSURE TROUBLES

SYMPTOMS	IMMEDIATE ACTION	PROBABLE CAUSE	REMEDY
1. High pressure on 1st stage.	1. Continue running and monitor pressures.	1. Defective suction or discharge valve in the next higher stage.	1. Remove, clean, repair or replace suspect valves as necessary. (Ref. 6-4)
2. First stage relief valve is "popping".	2. Shutdown the compressor.	2. Defective relief valve.	2. Reset or replace the relief valve. (Ref. 6-13)
3. High pressure on 2nd stage.	3. Continue running and monitor pressure.	3. Pressure switch improperly set or inoperative.	3. Reset or replace switch.
4. Second stage relief valve is "popping".	4. Shutdown the compressor.	4. Discharge lines or back pressure valve is restricted.	4. Clean back pressure valve and/or lines.
		5. Defective relief valve.	5. Reset or replace the relief valve. (Ref. 6-13)

CHART 5-2 LOW PRESSURE TROUBLES

SYMPTOMS	IMMEDIATE ACTION	PROBABLE CAUSE	REMEDY
1. Low pressure on 1st stage.	1. Continue running and monitor pressures until a convenient time to shut the compressor down.	1. Worn or broken rings in the 1st stage.	1. Replace piston rings and inspect cylinder for wear or scoring. (Ref. 6-5, 6-7)
		Blown valve O-ring in that stage.	Replace O-ring. (Ref. 6-3, 6-4)
2. Low pressure on 1st stage.		2. Suction or discharge valve on 1st stage is leaking.	2. Clean, repair, or replace suspect valve as necessary. (Ref. 6-4)

CHART 5-3 HIGH TEMPERATURE TROUBLES

SYMPTOMS	IMMEDIATE ACTION	PROBABLE CAUSE	REMEDY
1. Compressor over-heats.	1. Shutdown the compressor.	1. Fans inoperative (if equipped) Insufficient cooling.	1. Repair or replace fans.
2. Excessively high temperature heads or discharge lines.		2. Restriction in piping caused by damage.	2. Inspect piping for kinks and other physical damage and repair.
		3. Faulty compressor valves.	3. Repair or replace. (Ref. 6-4)
		4. High ambient temperature	4. Ventilate area or shutdown until area cools down.

CHART 5-4 REDUCED CAPACITY TROUBLES

SYMPTOMS	IMMEDIATE ACTION	PROBABLE CAUSE	REMEDY
1. Output of compressor is reduced.	1. Continue running; monitor pressures; service unit at first opportunity.	1. Low inlet pressure.	1. Restore to normal pressure.
2. Longer than normal time required to fill receiver.		2. Leaks in piping, heads, heat exchangers, or seals.	2. Locate and repair. (Ref. 4-6)
		3. First stage valves leaking.	3. Check and repair as necessary. (Ref. 6-4)
		4. Loose belt.	4. Tighten to correct tension. (Ref. 6-2)
		5. Worn compression rings.	5. Replace rings. (Ref. 6-7)

CHART 5-5 UNUSUAL NOISE TROUBLES

SYMPTOMS	IMMEDIATE ACTION	PROBABLE CAUSE	REMEDY
1. Loud metallic knock.	1. Try to isolate location of noise.	1. Worn connecting rod needle bearing.	1. Replace connecting rod needle bearing. (Ref. 6-10)
2. Clacking noises from one of the cylinder heads.	2. Check pressure gauges. Shut compressor down if pressures vary from normal.	2. Worn or broken valves.	2. Remove suspect valves and repair or replace them. (Ref. 6-4)
3. Flat, slapping sound when compressor starts and stops.	3. Try to isolate location of noise.	3. Worn piston and/or cylinder liner. Worn rider rings.	3. Remove suspect pistons and cylinder liners and check for wear. Repair as necessary. Replace rider rings. (Ref. 6-7)

NOTE: A soft to moderate knocking sound is normal during operation of the compressor.

CHART 5-6 UNUSUAL VIBRATION TROUBLES

SYMPTOMS	IMMEDIATE ACTION	PROBABLE CAUSE	REMEDY
1. Entire compressor vibrates	1. Stop compressor and correct trouble before restarting.	1. Compressor not properly secured.	1. Tighten mounting bolts.
		2. Piston clearances not properly adjusted.	2. Readjust piston clearances (Ref. 6-14).

CHART 5-7 INABILITY TO START COMPRESSOR

SYMPTOMS	IMMEDIATE ACTION	PROBABLE CAUSE	REMEDY
1. Compressor fails to start.	1. No immediate action.	1. High pressure switch senses high pressure in receiver.	1. Readjust pressure switch if setting is too low. Otherwise wait until there is a drop in receiver pressure that signals a restart.
		Low pressure switch senses low suction pressure	Check to see if system has lost pressure. Increase suction pressure or readjust pressure switch if setting is too high.
2. Overload tripped.	2. Clear fault, press reset button on the motor controller, then attempt restart. (Ref. 2-3)	2. Voltage too low.	2. Restore power and check voltage to the compressor. Reset circuit breakers. Replace fuses as necessary.
		3. Suction pressure too high.	3. Adjust suction pressure.

CHART 5-8 INABILITY TO RESTART COMPRESSOR

SYMPTOMS	IMMEDIATE ACTION	PROBABLE CAUSE	REMEDY
1. Compressor fails to start after recent shutdown.	1. No immediate action.	1. Shutdown was initiated by high pressure switch.	1. Allow pressure at switch to drop, compressor will automatically re-start.
		2. Shutdown was initiated by low pressure switch.	2. Allow inlet pressure to increase. Compressor will automatically re-start.

CHART 5-9 INABILITY TO STOP COMPRESSOR

SYMPTOMS	IMMEDIATE ACTION	PROBABLE CAUSE	REMEDY
1. Compressor does not stop when high pressure set point is reached.	1. Push STOP pushbutton on controller.	1. Improperly set or inoperative pressure switch.	1. Readjust, repair, or replace pressure switch as necessary.
2. Compressor does not stop when selector switch is turned to OFF.	2. Cut power to compressor at main disconnect.	2. Improperly wired or faulty selector switch on controller.	2. Trace circuit wiring in motor controller against wiring diagram. Repair or replace faulty selector switch as necessary.

CHAPTER 6

CORRECTIVE MAINTENANCE

6-1 INTRODUCTION. This chapter presents instructions for all adjustments and repairs to the compressor and its accessory items. All repairable parts and assemblies are covered in this chapter. Scheduled maintenance items are covered in Chapter 4. Where special tools are required, they are called out in the applicable paragraph. This chapter is divided into two sections: Section I, Adjustments, and Section II, Repair.

WARNING

The compressor may start at any time when in automatic mode. Before attempting any repairs or adjustments: de-energize the machine by pushing the **STOP** button, disconnect power to the system (to avoid shock hazard), vent pressure by opening hand valves down stream and give the discharge piping time to cool down. Discharge gas lines are hot and can cause burns.

SECTION I ADJUSTMENTS AND ALIGNMENTS

6-2 BELT AND PULLEYS

6-2.1 ALIGNMENT OF DRIVE PULLEYS. Following any repair to the motor or pulleys (i.e. motor sheave or compressor flywheel), it may become necessary to realign the pulleys. The pulleys are either keyed to the shafts and locked in place with a setscrew or keyed to the shaft and locked in place with tapered hubs. First remove the beltguard. The hub and pulley can be separated by removing the three bolts that hold them together. The bolts can then be used as jacking devices by inserting them in the threaded holes in the hub and tightening sequentially until the pulley breaks loose from the hub. When this happens, the pulley and hub can be slid back and forth on the shaft to achieve alignment. Alignment is measured by laying a straight edge across the outside faces of the pulleys.

To tighten the pulleys after aligning, use the three bolts inserted into the assembly holes (a clearance hole in the hub and a tapped hole in the pulley) or the setscrews. Check alignment and repeat procedure if necessary. Replace beltguard.

6-2.2 TIGHTENING DRIVE BELT. To obtain the proper tension on the belt, use the following procedure:

a. Remove the beltguard.

b. Loosen the motor tie-down bolts at least two turns.

c. Push down on the motor sheave and tighten motor bolts.

d. Correct belt tension allows a 1/2 to 3/4" deflection with a 10 lb. force applied across the belt section at mid-span.

e. Verify motor sheave alignment with flywheel.

f. Replace belt guard.

SECTION II REPAIR

WARNING

Any work to be done on the compressor where the gas stream may be exposed must be in accordance with safe Oxygen Equipment handling procedures.

No attempt should be made to work on the machine without full knowledge of Oxygen Equipment handling and the potential hazards of contamination.

NOTE: RIX has established a procedure for working with oxygen machinery. See Part II of this manual, Oxygen Cleaning Procedure, Dwg. A5858-9.

6-3 CYLINDER HEADS.

6-3.1 GENERAL. There is no scheduled maintenance requirement on the cylinder heads. However, removal is necessary to perform other required maintenance. The procedures for removing the 1st and 2nd stage heads are similar and may be accomplished by disconnecting the piping and removing the retaining bolts.

6-3.2 REMOVE HEAD. (Figures 7-1, -3, -4 and -5)

a. Relieve pressure and allow heads to cool.

b. Disconnect the gas system piping from the head being removed.

c. Remove the retaining nuts; carefully lift the head from the cylinder. When removing the 1st stage head, make sure that the cylinder does not come out of the crankcase with the head. Discard the used O-rings. **NOTE:** It may be necessary to lean back the compressor in order to remove 1st stage head.

6-3.3 INSTALL HEAD.

a. Install new O-rings on the cylinder if installing 1st stage head.

b. Carefully position and orient the head on the cylinder and over the mounting bolts. Tighten in 2 or 3 ft-lbs. increments, using a cross sequence, until 15 ft-lbs. torque is reached on the 1st stage and 15 ft-lbs. on the 2nd stage.

6-4 COMPRESSOR VALVES

6-4.1 GENERAL. Each stage has a valve assembly whose main components are a suction reed, discharge reed and a valve seat. A bad valve, either suction or discharge, in the 2nd stage will usually be indicated by higher pressures than normal on the 1st stage. A bad suction or discharge valve in the 1st stage will cause a loss of flow. Severe usage over long periods of time may result in worn or broken valves which may be destructive if the unit is allowed to operate with them in this condition. Worn or broken valves can be evidenced by clacking noises in the cylinder head. Remove, disassemble, inspect and service the valves every 4000 hours of operation. This may readily be accomplished by removing the cylinder heads.

6-4.2 REMOVAL AND INSTALLATION OF 1ST STAGE VALVE ASSEMBLIES (Figure 7-2)

6-4.2.1 REMOVAL OF SUCTION AND DISCHARGE VALVES.

a. Remove inlet and discharge piping from the head.

b. Remove the nuts which hold down the 1st stage head and drop the head off. Make sure the cylinder does not come out of the crankcase with the head. It may be necessary to lean back the compressor in order to remove head.

c. Remove the suction reed and inspect.

d. Remove the valve seat. Remove the discharge reed. Discard pitted, cracked or broken valves. A scratched or pitted valve seat may need to be lapped

e. Inspect and repair as necessary.

6-4.2.2 INSTALLATION OF SUCTION AND DISCHARGE VALVES.

a. Once the valve reeds have been examined or replaced and the seat has been examined, lapped or replaced, reassemble in reverse order of disassembly.

b. Install discharge reeds and O-ring. A light coating of oxygen compatible grease (RIX P/N 45-114) should be used on the O-ring.

c. Install the valve seat. Push down to engage O-ring properly.

d. Put the suction valve on the valve seat. Install head assembly and torque bolts to 15 ft-lbs.

6-4.3 REMOVAL AND INSTALLATION OF 2ND STAGE VALVE ASSEMBLY. (Figure 7-3)

6-4.3.1 REMOVAL OF THE 2ND STAGE VALVE.

a. Remove the inlet and discharge lines on the 2nd stage head. Remove the two nuts.

b. Lift off head. Remove O-ring, valve stop, suction valve, locating pin and second O-ring. Discard all O-rings.

c. Remove the valve seat from the cylinder head. Removal can be assisted by removing the plug in the head and using an object such as a bolt with a blunt end and putting it through the discharge port in the top of the head and tapping lightly on the seat. Care must be taken not to damage the valve seat.

d. Remove the O-ring, discharge reed and second locating pin.

6-4.3.2 INSTALLATION OF 2ND STAGE VALVES.

CAUTION

When reinstalling valves with O-ring seals, care must be taken to avoid damaging the O-rings. Lubricate the O-ring with oxygen compatible grease. Avoid tilting the valve when installing into the head and apply even finger pressure about the circumference until the valve is completely installed.

a. Apply a light film of oxygen compatible O-ring grease to the new O-rings.

b. Set the discharge valve over the pin in the head and place the first new O-ring in the valve pocket. Refer to Figure 7-4 for proper orientation of the valve.

NOTE: If discharge or suction valves are installed in inverted position, the valve will not be able to open properly.

c. Insert valve seat into head with the pin hole in the discharge side of the seat aligned with the pin in the head. Look through the suction port in the head to check that the locating pin has engaged the hole in the seat and the seat is inserted all the way to the bottom of the head. Be sure valve seat is not inverted (See Figure 7-4).

d. Install O-ring and new pin on suction side of valve seat. Install suction valve, referring to Figure 7-4 for proper orientation.

e. Install valve stop in head and O-ring on valve stop.

f. Reinstall the head using the two capscrews and torque to 15 ft-lbs. Reconnect the inlet and discharge lines.

6-4.4 VALVE INSPECTION AND REPAIR. The valve disassembly, inspection and repair instructions here cover all the compressor valve assemblies. Figures 7-3 and 7-4 should be used as guides for assembly.

a. Inspect the reed valves for cracking or pitting. Remove any deposits from the reeds. A thin impression of a circle should be evident where the reed seals over the valve seat ports. Any radial lines or streaks extending outward from these circles indicate valve leakage.

b. Examine the valve seat carefully for cracks or pits and for leakage past the seat. Streaked marks on the seat also indicate leakage. Replace or repair parts as required.

c. Lap the valve seat on a lapping plate or regrind the valve seat, using a very fine valve grinding compound. When lapping or grinding, remove a minimum of material to just clean up the surface. When the trepans or grooves between sealing surfaces on the valve are reduced to less than .100 inches deep, the seat should be replaced (1st stage only).

d. Carefully clean the valve parts to remove the compression residue and valve grinding compound from the seat.

e. Reassemble the valve in the reverse order of disassembly.

6-5 CYLINDERS.

6-5.1 GENERAL. The compression cylinders must be removed to service the rings and pistons. The 2nd stage has a removable liner. There is no scheduled maintenance required on the cylinders or liner.

6-5.2 REMOVE AND INSTALL 1ST AND 2ND STAGE COMPRESSION CYLINDERS. (Figures 7-1)

a. Remove the cylinder head in accordance with Paragraph 6-3.2.

b. Turn the flywheel by hand to position the piston at bottom dead center (1st stage only).

c. Remove retaining nuts.

d. Use caution to prevent side stress on the piston and rod assembly, slide the cylinder off the piston. It may be necessary to lean back the compressor. Remove and discard the used O-rings.

e. Be careful not to damage the shims.

f. Remove 2nd stage guide cylinder and liner.

NOTE: The 2nd stage piston will remain in the liner when liner is removed. See Paragraph 6-7.

g. Reinstall the compression cylinder and liner in the reverse sequence of removal, using new O-rings.

6-6 CRANKCASE

6-6.1 GENERAL. There is no scheduled maintenance on the crankcase. For crankshaft and main bearing removal, see Paragraph 6-9 and 6-10.

6-7 PISTON RINGS

6-7.1 GENERAL. The compressor is single acting, meaning that in a single crankshaft revolution, suction and compression occur once in each cylinder. In order to accomplish sealing and to deliver oil-less gas, high pressure, glass-filled Teflon (TFE), non-lubed rings are used. A viton expander is used under the compression rings. In addition to the compression rings, glass-filled TFE rider rings are used on each piston to keep the piston centered in the cylinder, preventing metal to metal contact with the cylinder wall. Each piston has compression rings and at least one rider ring. The rings should be inspected for wear and replaced as necessary. See Paragraph 4-8. Rings not meeting the tolerances specified in Table 6-6 should be replaced.

6-7.2 REPLACE PISTON RINGS . (Figure 7-1; see also Figures. 7-3 and 7-5)

a. Remove the cylinder head in accordance with Paragraph 6-3.2.

b. Turn the flywheel by hand to position the piston at bottom dead center.

c. For the 1st stage compression area, the 1st stage cylinder must be removed. (See Paragraph 6-5) For the 2nd stage compression area, the liner is lifted out and the floating piston is pushed from the cylinder.

d. Remove and discard the used rings and expanders.

e. Clean the ring grooves, replace expanders and, by hand, carefully spread a new ring and install in the ring groove. Repeat for each ring, being certain the ends of the spiral fit completely into the groove to insure proper sealing.

f. Discard old rider rings.

g. Install new rider rings on pistons and on piston rod (big end) and follower.

h. Clean and inspect the cylinder liner for wear or damage. Wear must be within the tolerance specified in Table 6-6.

i. Reinstall the cylinder head in accordance with Paragraph 6-3.3.

j. Rotate the flywheel by hand several times to be certain that the parts are free. See Section 6-15 for piston clearance adjustment.

6-8 PISTON ASSEMBLY

6-8.1 GENERAL. The 1st stage piston assembly is connected together with the connecting rod and retaining cap. This may only be removed or installed as an assembled unit.

6-8.2 PROCEDURE.

a. Remove both heads and cylinders (Ref. 6-3 and 6-5).

b. Rotate flywheel to position the 2nd stage (upper end) to the lowest point of its stroke (bottom dead center).

6-8.3 Remove hex screw on bearing plate.

6-8.4 Gently slide assembly outward by pulling connecting rod off of crankshaft allowing neck of piston to pass through slot in crankcase.

6-8.5 Remove connecting rod from piston assembly by removing snap rings and pressing out wrist pin.

6-8.6 Inspect bearings. Replace as necessary.

6-8.7 Installation is reverse of disassembly.

NOTE: Connecting rod and retainer cap must be installed prior to installing piston assembly.

6-9 MAIN BEARINGS

6-9.1 GENERAL. The crankshaft is supported in the crankcase by two main bearings. They are radial ball bearing design, consisting of an inner race, outer race, ball bearings, cage and seals.

6-9.2 REMOVE MAIN BEARINGS.

a. Remove piston assembly in accordance with Paragraph 6-8.

b. Remove flywheel, reference Paragraph 4-5.

Bend down locking tab on lockwasher and remove bearing nut. Special tool required.

d. Heat bearing housing (piston side) and push out crank.

NOTE: Flywheel side bearing stays in housing.

e. Heat outboard bearing housing and push out bearing from far end using suitable fixture.

6-9.3 INSTALL MAIN BEARINGS.

a. Slide new main bearing onto the crankshaft. Verify that the bearing is pressed up against the shoulder on the crankshaft

b. Slide each crankshaft into the crankcase. (Heating may be required.)

c. Install out board bearing (flywheel side).

d. Install new lockwasher with bearing nut and torque to 50 ft.-lb.

6-10 CONNECTING ROD BEARINGS.

6-10.1 GENERAL. The connecting rod is cast aluminum, with a closed eye at the upper larger and lower ends. The smaller closed eye has a needle bearing around the wrist pin. The larger closed eye has a ball bearing around the crankshaft. These bearings are supplied by RIX grease packed for life with oxygen compatible grease. At specified intervals all the bearings are replaced. If the clearances are not within the tolerances specified in Table 6-6, the wrist pin should be replaced.

6-10.2 REPLACE CONNECTING ROD BEARING SETS. (Figures 7-1)

a. Remove the piston assembly per Paragraph 6-8.

b. With a pair of snap ring pliers, remove snap rings from wrist pin bore.

c. Remove the wrist pin by pushing it through the needle bearings from one side of the piston to the other (may require a press). The piston may have to be heated to allow the wrist pins to slide through.

d. Remove the connecting rod from piston assembly.

e. Remove retaining plate from connecting rod bearing.

f. Press needle bearing out of small end of connecting rod.

g. The large end connecting rod ball bearing has a shrink fit. Therefore, the connecting rod should be heated in an oven to 300°F so that the ball bearings will slip out of the connecting rods.

h. To install new ball bearings, heat connecting rods to 300°F in an oven. Once heated, lay the large end of the connecting rod on a flat surface and slip the ball bearing into the bore in the connecting rod. Allow to cool for a shrink fit.

i. Press a new needle bearing packed with Oxygen compatible grease into the small end of the connecting rod. Be sure to press against the stamped end (end with identification markings) of needle bearing.

j. Assemble the connecting rod into the piston by pushing the wrist pin through the piston and needle bearing in the connecting rod. The piston may have to be heated to allow the wrist pin to slide through.

k. Put snap rings into the grooves in the pistons.

l. Install the retaining plate in the connecting rod bearing.

6-11 BELT DRIVE

6-11.1 GENERAL. There is no scheduled replacement of the belt. Replacement is on an as-required basis when it becomes frayed or broken.

6-11.2 COMPRESSOR DRIVE BELT. The belt is a flat multi-vee ribbon belt. It is suitable for small radius bends such as that around the motor drive sheave.

6-11.2.1 Belt Removal.

a. Loosen the four motor tie-down bolts at least two turns.

b. Slide the motor toward the flywheel by lifting the motor.

c. Roll the belt off the sheaves

6-11.2.2 Belt Replacement.

a. To replace the belt, reverse order of above procedure.

b. Adjust belt tension per Paragraph 6-2.2.

6-12 HEAT EXCHANGERS

6.12.1 GENERAL. There is no scheduled maintenance on the heat exchangers. Should fouling occur, the heat exchangers should be disassembled and cleaned.

6-13 PRESSURE RELIEF VALVES

6-13.1 GENERAL. Three relief valves are plumbed into the compressor piping to protect the components from excessive pressure. They are located at the inlet and after each stage, as shown on Figure 1-1 or Figure 3-1. All set pressures are given in Table 6-2. Follow the procedure detailed here for corrective maintenance for the three relief valves on the compressor.

6-13.2 REMOVAL. Unscrew and remove the safety valve from the compressor. Disassemble the safety valve as follows.

6-13.3 DISASSEMBLY. (See Section II, Dwg. A5625)

a. Unscrew the lock nut and remove the adjustment cap, exposing the spring. Remove the spring and unscrew the bonnet. Remove poppet and seals from lower body.

b. Wash thoroughly per Oxygen Cleaning Specifications. Replace spring if broken or if compressed length prohibits adjustment to the proper pressure range.

c. Inspect all parts for flaws and examine the seat for deficiencies that may cause leakage. Replace all seals and any defective parts.

6-13.4 REASSEMBLY. (See PART II, Dwg. A5625)

a. Insert poppet seal O-ring, insert, clamp disc, clamp nut, poppet, upper seal ring retainer, upper seal ring, bonnet seal O-ring, bonnet, spring, locknut and adjustment cap. Connect the assembly to a variable source of clean nitrogen pressure with an accurate pressure gauge.

b. Apply 700 psig or 2500 psig clean nitrogen (depending on which valve is being set), and adjust the spring until the valve releases at that pressure.

6-13.5 INSTALLATION. Screw the safety valve into the proper location on the compressor, using Teflon tape on the threads. Run the compressor and check for leaks, using a soap bubble solution.

6-14 PISTON CLEARANCE ADJUSTMENT

6-14.1 GENERAL. Prior to adjusting each piston, rotate the crankshaft to bring its respective piston to the top of its stroke. Note: The 1st stage is at the top of its compression stroke when the piston is all the way down.

6-14-2 ADJUSTMENT. 1st Stage

a. To adjust the 1st stage piston clearance remove the 1st stage head.

b. While holding the cylinder firmly in place rotate crankshaft to assure piston is all the way down.

c. Measure the clearance between the piston and the top of the cylinder. Proper clearance is .011" to .015".

d. Shims can be added or removed to reach the specified clearance.

NOTE: The clearance is factory set and should not need adjustment unless one or more parts are replaced (cylinder, piston assembly, connecting rod, crankshaft or crankcase).

e. Replace head.

6-14-3 ADJUSTMENT. 2nd Stage

a. To adjust the 2nd stage piston clearance remove the 2nd stage head.

b. While holding the cylinder firmly in place rotate crankshaft to assure piston is all the way up.

c. Measure the clearance between the piston and the top of the cylinder liner. Proper clearance is .012" to .016".

d. Rotate the spool/guide cylinder to reach the specified clearance.

NOTE: The clearance is factory set and should not need adjustment unless one or more parts are replaced (cylinder, liner, floating piston assembly, connecting rod, crankshaft or crankcase).

e. Replace head.

Table 6-1. Normal Operating Pressure Ranges

	Pressure
Inlet	30-70 psig
1st Stage	350-600 psig
2nd Stage	1500-2200 psig

If pressures do not fall within the above ranges, check the troubleshooting charts, Chapter 5, for corrective action.

Table 6-2. Relief Valve Settings

	Pressure
Suction	75 psig
1st Stage	700 psig
2nd Stage	2500 psig

Table 6-3. Operating Temperatures

	Normal Range °F
1st Stage Discharge Gas	280 - 360
1st Stage Discharge After Cooler	100 - 140
2nd Stage Discharge Gas	180 - 240
2nd Stage Discharge After Cooler	110 - 150

The above operating temperature is for a water temperature range of 50°F to 100°F.

Table 6-4. Wrench Torques (Oiled Threads)

	Foot Pounds
Retaining Cap Screw	15
Crankcase Cover Bolts	8
Heat Exchanger Clamps	6
1st Stage Cylinder Nuts	15
1st Stage Head Nuts	30
2nd Stage Cylinder Nuts	15
2nd Stage Head Nuts	15
Compressor Mounting Bolts	50
Crankshaft Bearing Nut	50

Table 6-5. Control Switch Settings

Description	Adjustable Range	Shutdown Setting	Re-start Setting
Low Pressure Switch	3 - 100 psig	25 psig	28 psig
High Pressure Switch	275 - 8000 psig	2200 psig	1900 psig

Table 6-6. Clearances and Tolerances

(Refer to Figures 7-1 thru 7-8)

Indicator	Nominal Dimensions	Wear Limit
Bearings		By inspection for knocking or rough running.
Connecting Rod, Lower Bore	3.146 Dia.	.001 in. Dia. Max.
Connecting Rod, Upper Bore	.687 Dia.	.001 in. Dia. Max.
Wrist Pins	.5000 Dia.	.0005 in. Dia. Max.
Pistons: 1st Stage	1.25 Dia.	1.21 Dia. Min.
2nd Stage	0.50 Dia.	.498 Dia. Min.
		(Pistons do not wear under normal conditions. Rider rings are used to prevent the piston from contacting the cylinders.)
Rider Rings:		
1.75 in. Dia.	.110 Thick	.020 in. Radial wear
1.25 in. Dia.	.118 Thick	.010 in. Radial wear
.50 in. Dia.	.057 Thick	.003 in. Radial wear
Piston Rings:		
1st - .125	Radial Thick	When average radial wear is 2/3 of ring or blow-by occurs
2nd - .065	" "	
Cylinder Liners	1.251 Dia.	.002 in. Diametral wear
	.501 Dia.	.002 in. Diametral wear
Valve Plates, (see Figures 7-6 thru 7-8)	1st -.025" Thick 2nd-.010" Thick	.002 in. wear or when pitted enough to cause insufficient seating
Valve Seats, (see Figures 7-6 thru 7-8)	Pitted or Streaked	.010 in. wear or when pitted enough to cause insufficient seating

CHAPTER 7

COMPRESSOR PARTS LIST

7.1 INTRODUCTION.

The parts listed here cover all **RIX Model 2PS2B Compressors** identified by the Serial Numbers shown on the Serial Number Page of this manual. Column 1 gives the figure and index number. The part number is listed in Column 2, followed by a quantity and description in Columns 3 and 4. An **"X"** at the beginning of any part number signifies "Oxygen Clean". Spare parts with this designation are specially cleaned and supplied in oxygen clean sealed plastic bags. All are supplied through **RIX Industries, Code 28953, 4900 Industrial Way, Benicia, CA 94510; Telephone 707-747-5900, FAX 707-747-9200.**

TABLE 7-1. COMPRESSOR PARTS LIST

Figure & Index No.		Part No.	Qty.	Description
		Omitted numbers not included in this Assembly.		
7-1	**1a**	X2-B5632	1	Cylinder Head **(S/N'S PRIOR TO 9386)**
7-1	**1b**	X2-B6932	1	Cylinder Head **(S/N'S 9386 OR LATER)**
	Note: Head **1a** can be used with cylinder **4a** only; Head **1b** can be used with cylinder **4b** only.			
7-1	**2**	XAO15-A5565	1	Valve Assembly, 2nd Stage (Incls. 1-5)
7-2	-1	X15-B2706	2	Reed Valve
7-2	-2	X123-018-5-90	3	O-ring
7-2	-3	X15-B3570	1	Valve Seat
7-2	-4	X15-A4151	1	Valve Stop
7-2	-5	X17-758	2	Pin
7-1	**3**	X1-B5770	1	Cylinder, Spool/Guide
7-1	**4a**	X1-B5773	1	Cylinder, 2nd stg **(S/N'S PRIOR TO 9386)**
7-1	**4b**	X1-B6931	1	Cylinder, 2nd stg **(S/N'S 9386 OR LATER)**
	Note: Cylinder **4a** can be used with head **1a** only; Cylinder **4b** can be used with head **1b** only.			
7-1	**5**	X18-C1147-14-1G	1	Rider Ring, 1-3/4"
7-1	**6**	XA8-B5778	1	Piston Assembly, 1st Stage (Incls. 1-4)
7-3	-1	XA8-D2974	1	Piston (S/N 9327 and Later)
7-3	-1	XAB-D2475	1	Piston (Prior to S/N 9327)
7-3	-2	X3-B5774	1	Rod, Follower
7-3	-3		1	Flat Washer, 1/2 SS
7-3	-4		1	Jam Nut, 1/2-20UNF SS
7-1	**10**	X123-030-5	1	O ring
7-1	**11**	38-A7547	1	Bearing Plate
7-1	**12**	34-746	1	Screw, Flat Head Socket, 5/16-24UNF x 3/4" Lg.

TABLE 7-1. COMPRESSOR PARTS LIST (Continued)

Figure & Index No.		Part No.	Qty.	Description
7-1	**13**	X181-728	1	Bearing, Rod
7-1	**14**	7-B5625	1	Connecting Rod
7-1	**15**	X181-7	1	Bearing
7-1	**16**	X17-A8518	1	Wrist Pin (S/N 9327 and Later)
7-1	**16**	X17-A2104-1	1	Wrist Pin (Prior to S/N 9327)
7-1	**17**	31-10	2	Ring, Snap
7-1	**18**	22-A7797	A/N*	Shim
7-1	**19**	X1-D2574	1	Cylinder, 1st. Stage
7-1	**20**	X2-C2429	1	Head
7-1	**21**	XA15-A7798	1	Valve Assembly, 1st Stage (Incls. 1-4)
7-4	-1	X15-B5840	1	Reed Valve, Suction
7-4	-2	X123-030-5	1	O-ring
7-4	-3	X15-B5831	1	Valve Seat
7-4	-4	X15-B5878	1	Reed Valve, Discharge
7-1	**22**	105-C1993-35	4	Stud, Threaded
7-1	**23**	53-45	8	Hex Nut, 5/16UNF Stl. Pltd.
7-1	**24**	20-692	8	Washer, Flat, 5/16 NOM. SAE Stl. Pltd.
7-1	**25**	X18-C1791-10G	2	Compression Ring, 1 1/4"
7-1	**26**	X123-313-5	2	O-ring
7-1	**27**	X18-B2117-2G	2	Rider Ring, 1 1/4"
7-1	**28**	100-D2537	1	Crankcase
7-1	**29**	53-610	1	Lock Nut
7-1	**30**	20-606	1	Lock Washer
7-1	**31**	5-C2381	1	Crankshaft
7-1	**32**	181-604	1	Bearing
7-1	**33**	181-26	1	Bearing
7-1	**34**	X18-A2750-5G	1	Rider Ring, 1/2" Dia.
7-1	**35**	64-B5768	1	Ring, Mounting, 2nd Stage
7-1	**36**	XA508-A7783	1	Piston Assembly, 2nd Stage (Incls. 1-5)
7-5	-1	X18-A2750-3G	2	Rider Ring, 1/2"
7-5	-2	X63-A5549	1	Sleeve Tool
7-5	-3	X18-C1791-4G	8	Compression Ring, 1/2"
7-5	-4	X123-011-5	8	O-ring
7-5	-5	X508-B5928	1	Piston

* As needed - quantity 1 to 4 for .012 clearance.

TABLE 7-2. ACCESSORY PARTS LIST

Figure & Index No.	Part No.	Qty.	Description

2PS2B-L Low Speed 120V 60 Hz

(Option Packages begin on Page 7-4)

Using the 2PS2B-L as the common Accessory Parts List, develop Option Packages by making listed substitutions and/or additions to the following list.

Omitted numbers not included in this Assembly.

7-6	**201**	107-1035	1	Motor 1 1/2 HP
7-6	**202**	113-703	1	Hour Meter 120VAC, 60 Hz
7-6	**203**	38-C2384	1	Cover, Crankcase
7-6	**204**	76-1263	1	Electric Starter
7-6	**205**	776-H41	1	Heater, Motor Starter
7-6	**206**	X74-401	3	Gauge Snubber
7-6	**207**	X60-824	1	Gauge, 0-160 Psi
7-6	**208**	X515-851	1	Relief Valve, Set @ 75 Psig
7-6	**209**	X60-826	1	Gauge, 0-1000 Psi
7-6	**210**	X515-852	1	Relief Valve, Set @ 700 Psig
7-6	**211**	X515-855	1	Relief Valve, Set @ 2500 Psig
7-6	**212**	X60-828	1	Gauge, 0-4000 Psi
7-6	**213**	XA40-B5850	1	Bracket, Pressure Gauge
7-6	**214**	A156-D2576	1	Belt Guard
7-6	**215**	36-6J140Q	1	Flywheel
7-6	**216**	11-100Q1	1	Bushing, Flywheel
7-6	**217**	41-520J6	1	Belt
7-6	**218**	36-6J15	1	Motor Sheave
7-6	**219**	X76-705	1	Pressure Switch, High Discharge
7-6	**220**	XA77-505	2	Filter
7-6	**221**	X116-464	1	Back Pressure Regulator
7-6	**222**	X615-53	1	Check Valve
7-6	**223**	40-A7802	1	Bracket, Belt Guard
7-6	**224**	X76-704	1	Pressure Switch, Low Inlet
7-6	**225**	61-164	2	Harness, Fan Plug Chord
7-6	**226**	42-112	2	Fan, Electric
7-6	**227**	156-153	3	Fan Guard
7-6	**228**	62-A7122-1	1	Nameplate
7-6	**229**	62-403	1	Label: RIX WORLD

TABLE 7-2. ACCESSORY PARTS LIST (Continued)

Figure & Index No.		Part No.	Qty.	Description
7-6	230	62-A7278-3	1	Label: TRAINED PERSONNEL
7-6	231	62-A7507	1	Label: CLEANED FOR O_2 SERVICE BY TRAINED PERSONNEL
7-6	232	62-A7507-1	1	Label: SEE OPERATING INSTRUCTIONS
7-6	233	62-A7514	1	Label: RIX Address
7-6	234	138-416-1	1	Terminal Strip
7-6	235	62-A7634-3	1	Label: Suction
7-6	236	62-A7634-4	1	Label: 1st Stage
7-6	237	62-A7634-5	1	Label: 2nd Stage
7-6	238	X10-A7947	1	Manifold, Discharge
7-6	239	X10-A7946	1	Manifold, Suction
7-6	240	40-A8463	1	Bracket, Lifting Eye
7-6	241	76-1278	1	TIME Delay Relay
7-6	242	167-1005	1	Resistor, 50 k Ohm

Option Packages

(The 2PS2B-L Accessory List begins on Page 7-3)

Using the 2PS2B-L as the common Accessory Parts List, develop Option Packages by making listed substitutions and/or additions to the "-L" list.

For the **2PS2B-L50 Low Speed 240V 50 Hz,** substitute the following:

7-6	201	107-1046	1	Motor 1 1/2 HP, 1725 RPM
7-6	202	113-711	1	Hour Meter, 240VAC 50 Hz
7-6	205	776-H34	1	Overload Heater, Starter
7-6	218	36-6J18	1	Sheave, Motor
7-6	226	42-113	2	Fan, Electric
7-6	241	76-1276	1	Time Delay Relay

For the **2PS2B-H High Speed 120V 60 Hz,** substitute the following:

7-6	201	107-489	1	Motor 1-1/2 HP, 3450 RPM

Figure & Index No.	Part No.	Qty.	Description

Option Packages (Continued)

(The 2PS2B-L Accessory List begins on Page 7-3)

Using the 2PS2B-L as the common Accessory Parts List, develop Option Packages by making listed substitutions and/or additions to the "-L" list.

For the **2PS2B-H50 High Speed 240V 50 Hz,** substitute or add the following:

7-6	**201**	107-489	1	Motor, 2850 RPM
7-6	**202**	113-711	1	Hour Meter, 240VAC 50 Hz
7-6	**205**	776-H35	1	Overload Heater, Starter
7-6	**218**	36-6J18	1	Sheave, Motor
7-6	**226**	42-113	2	Fan, Electric
7-6	**241**	76-1276	1	Time Delay Relay

For the **2PS2B-HH High Speed 240V 60 Hz,** substitute or add the following:

7-6	**201**	107-489	1	Motor, 3450 RPM
7-6	**202**	113-702	1	Hour Meter 240VAC 60 Hz
7-6	**205**	776-H32	1	Overload Heater, Starter
7-6	**226**	42-113	2	Fan, Electric
7-6	**241**	76-1276	1	Time Delay Relay

For the **2PS2B-##-F Frame Assembly Option,** add the following:

7-8	**250**	70-C2549	1	2PS Stand (Incls. 4 Rubber Casters)
7-8	**251**		4	Hex Head Cap Screw 1/2-13NC x 1-1/4" Long, Pltd. Stl.
7-8	**252**		8	Flat Washer 1/2" Pltd. Stl.
7-8	**253**		4	Hex Nut 1/2-13NC Pltd. Stl.
7-9	**254**	854-823	Ref.	Rubber Casters (Part of Item 250)

TABLE 7-3. PLUMBING PARTS LIST

Figure & Index No.		Part No.	Qty.	Description
		Omitted numbers not included in this Assembly.		
		All of the plumbing parts appear on the Plumbing Schematic, Figure 7-7, sheets "a", "b" or "c". Below the only reference made is to the particular letter of Figure 7-7.		
a,b	**301**	X54P-1/4MROSS	2	Tee Street, 1/4NPT
a	**302**	X55-D2621-2	1	Gauge Line, Inlet Pressure
a	**303**	X55-D2621-4	1	Line, 1st Stage Inlet
a,b,c	**304**	X54P-1/4CDSS	3	Street Elbow, 45°
c	**305**	X54P-1/4FFSS	2	Nipple, 1/4NPT
a,b,c	**306**	X54P-44FBUSS	4	Connector, Male
a,b	**307**	X54P-44CBUSS	3	Elbow 1/4T x 1/4NPT
c	**308**	X54P-4CBUSS	1	Male Elbow
a	**309**	X54P-6FBUSS	2	Connector, 3/8T x 1/4
c	**310**	X54P-444SBUSS	1	Tee, Male
b	**311**	X54P-4P50NSS	2	Plug, Hex Straight Thread
b	**312**	X123-904-3	2	O-ring
b	**320**	XA40-B5871	1	Bracket Assembly
b	**321**	X55-D2621-6	1	Line, Filter Inlet
b	**322**	X55-D2621-5	1	Line, 2nd Stage Inlet
b	**323**	X55-D2621-1	1	Line, 1st Stage Cooling Coil
c	**324**	X55-D2621	1	Line, 2nd Stage Cooling Coil
c	**325**	X55-D2621-3	1	Line, 2nd Stage Gauge
a,c	**326**	X54P-1/4HHPB	2	Plug, Hex. NPT
c	**327**	X455-D2621-7	1	Line, Filter 2nd Stage

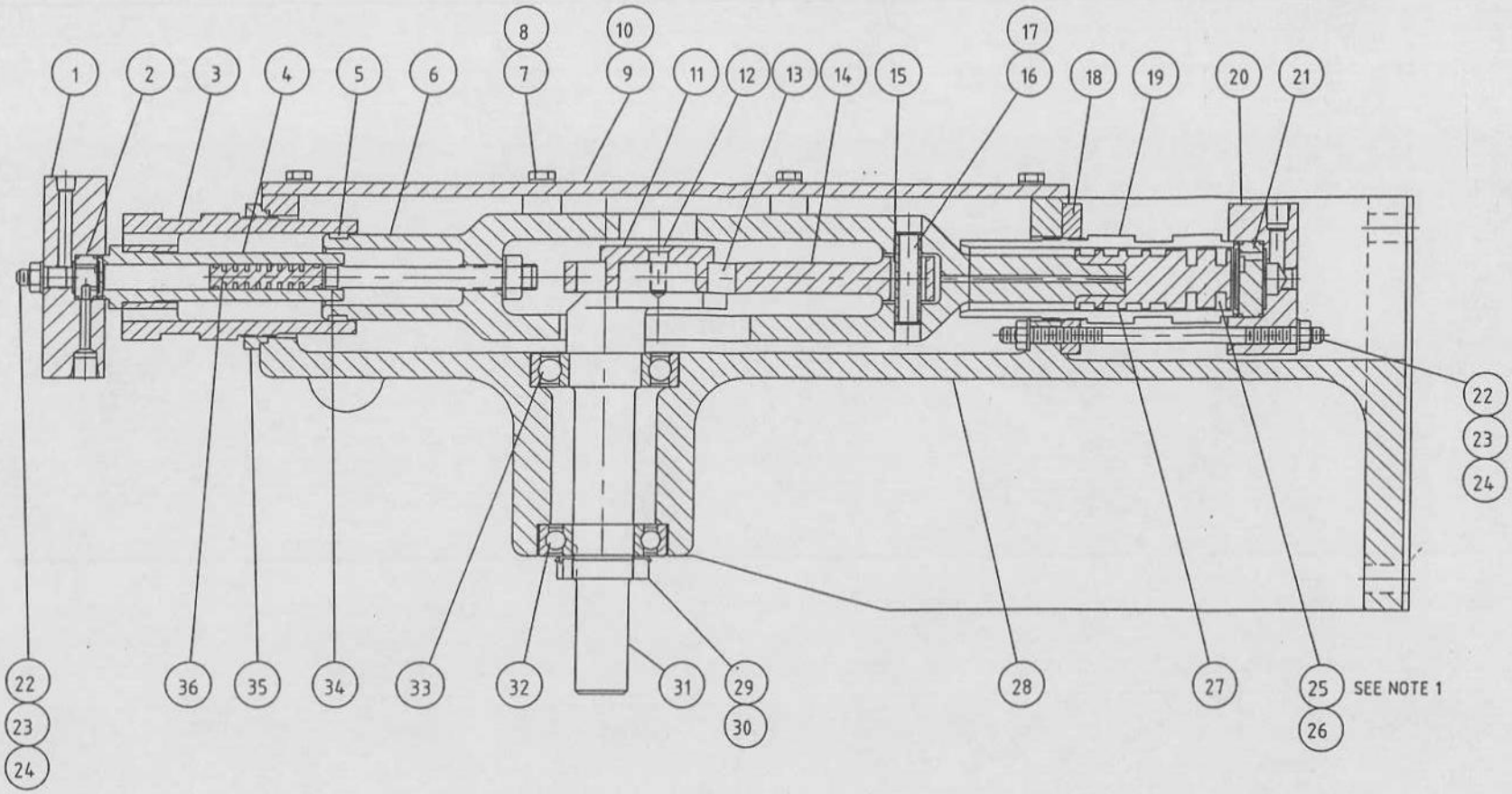
TABLE 7-4. HARDWARE PARTS LIST

Figure & Index No.	Part No.	Qty.	Description

Omitted numbers not included in this Assembly.

2PS2B All Models

7-6	**501**	34-715	17	Cap Screw, Hex Head, 1/4-20 x 1/2" Lg. Pltd. Stl.
7-6	**502**	32-1134	2	Bolt, Hex Head
7-6	**503**	34-668	4	Cap Screw, Hex Head, 5/16-18 x 3/4" Lg. Pltd. Stl.
7-6	**504**	20-669	20	Flat Washer, 1/4" Pltd. Stl.
7-6	**505**	53-54	3	Nut, 1/4-20 Pltd. Stl.
7-6	**506**	20-657	6	Flat Washer, 5/16" Pltd. Stl.
7-6	**507**	34-749	16	Phillips Pan Head Self-Drilling Screw #8-18 x 1/2" Lg.
7-6	**508**	34-1002	Ref.	Screw Sheet Metal #10 x 1/2", Pan Head, S/S.
7-6	**509**	34-750	2	Screw, Flat Socket Head, 5/16-18NC x 1" Pltd. Stl.
7-6	**510**	34-752	2	Screw, #10-32 X 3/8 Long Pltd. Stl.
7-6	**511**	34-751	1	Ground Screw, Self Tapping Hex Head #10-32 X 3/8 Long Pltd. Stl.
7-6	**512**	319-64	7	Tubing Clamp
7-6	**513**	138-614	2	Elbow, 90°
7-6	**514**	138-449	2	Cord Connector
7-6	**515**	138-606	2	Lock Nut, Conduit
7-6	**516**	34-688	1	Screw
7-6	**517**	34-716	2	Screw

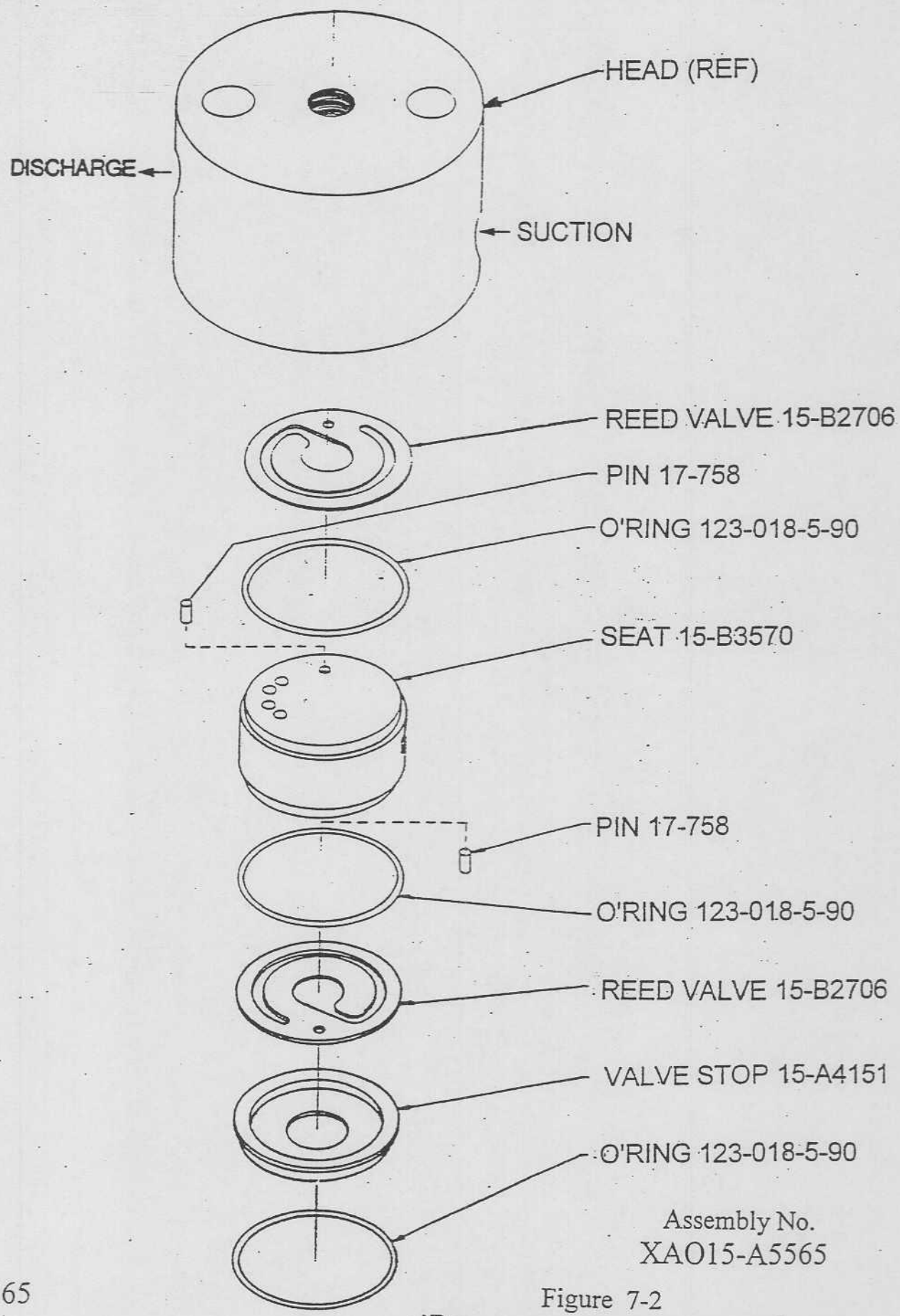


NOTE:
1) INSTALL COMPRESSION RINGS IN TOP TWO GROOVES ONLY.

B5989

CROSS SECTION
2PS2B

FIGURE 7-1
PAGE 7-8



Assembly No.
XAO15-A5565

A5565

Figure 7-2
2ND STAGE VALVE ASSEMBLY

NOTE: ORDER ALL PARTS WITH THE PREFIX "X"

Revision History			
LTR	Description		Approved

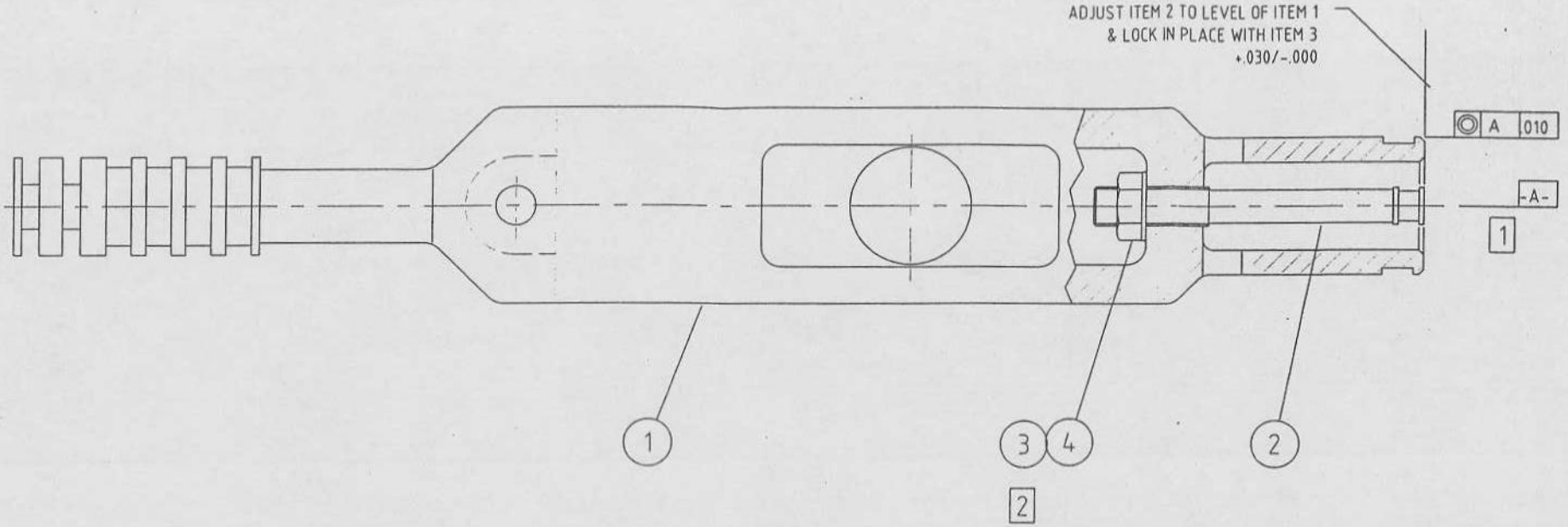
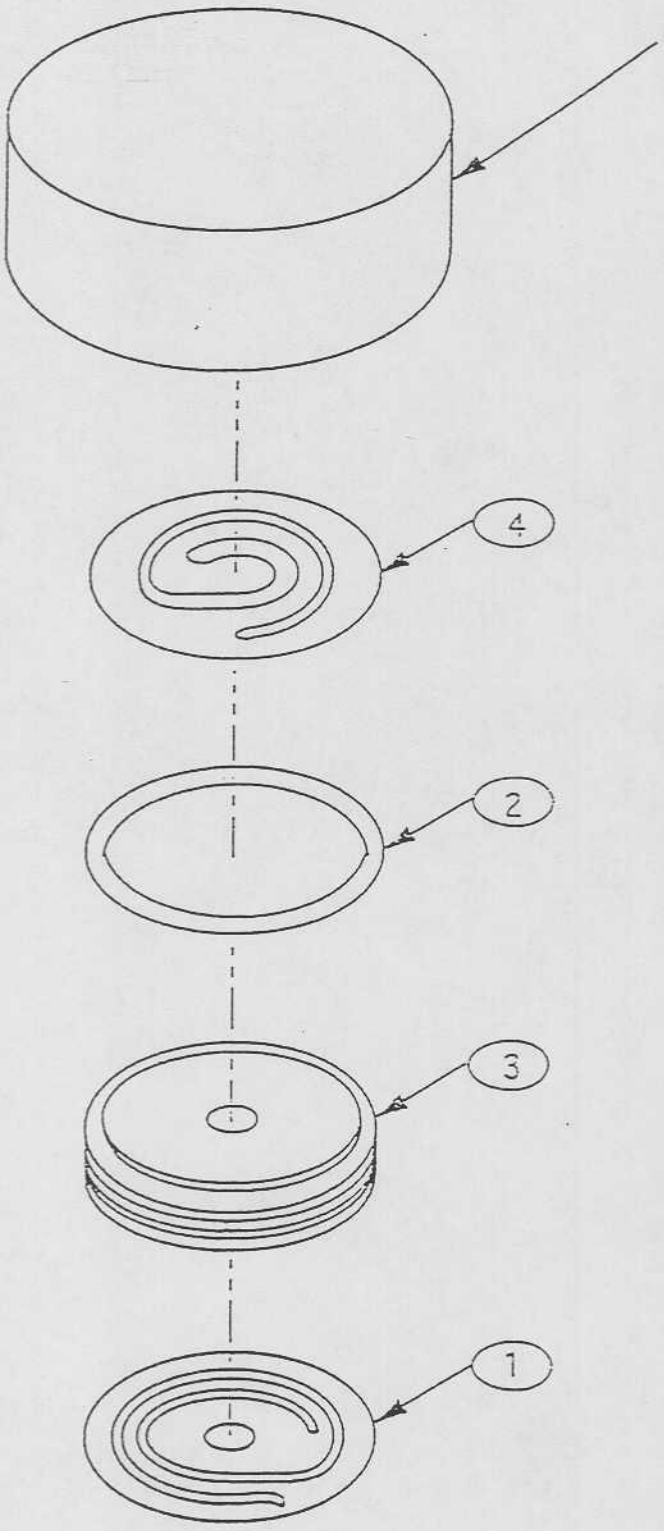


Fig 7-3
Page 7-10

NOTES:
1. Q.C. REFERENCE CALL OUT.
2. USE LOCKTITE #680 AND TORQUE TO 25 FT. LB.

Proprietary Drawing: This drawing and the information and data contained herein are the confidential and proprietary property of RIX Industries and may not be used, copied, reproduced or disclosed for any purpose, without the written permission of RIX Industries.	Tolerances (Unless Otherwise Noted): Decimal .X ± .1, .XX ± .03, .XXX ± .010, .XXXX ± .001; Fractions ± 1/16; Welds ± 1/32; Chamfers ± 5°; Angles ± 2°; Cast ± 1/8; (X.XXX) = Reference Dimension; See Notes For More Information; Do Not Scale | Dims In Inches; Material; Finish XXX	Contract No.	RIX INDUSTRIES, AIR AND GAS COMPRESSOR MANUFACTURERS ON SAN FRANCISCO BAY SINCE 1878, 4900 INDUSTRIAL WAY, BENICIA, CA 94510 USA, PHONE 707-747-3900 FAX 707-747-9200
Third Angle Projection	Drawn DWR Date 00-05-31; Checked JAC Date 00-07-13; Approved DKI Date 00-07-13; DESIGN ACTIVITY APPD.; SIMILAR TO:	Title: PISTON ASSEMBLY 2PS2B	Size B; Code ID. No. 28953; Drawing No. B5778; Rev. —; Scale NONE; Part No.; Sheet 1 OF 1



Assembly P/N XA15-A7798

NOTE: ORDER ALL PARTS WITH THE PREFIX "X"

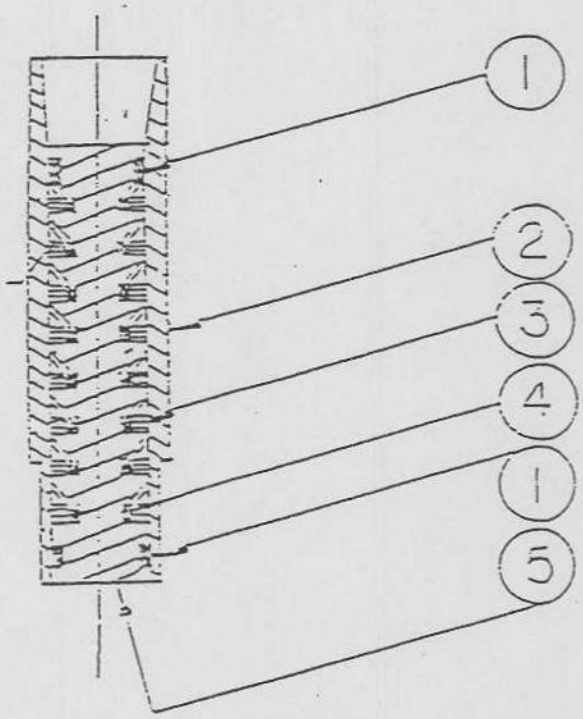
ITEM	QTY.	PART NO.	DESCRIPTION
4	1	15-B5878	Reed Valve-Discharge
3	1	15-B5831	Valve Seat
2	1	123-030-5	O-ring
1	1	15-B5840	Reed Valve-Suction

Figure 7-4

A7798A

1ST STAGE VALVE ASSEMBLY

NOTE: DIRECTION OF HOLES MUST BE UPWARD WHEN PISTON IS INSTALLED IN SLEEVE.



Assembly Part No. XA508-A7783

NOTE: ORDER ALL PARTS WITH THE PREFIX "X"

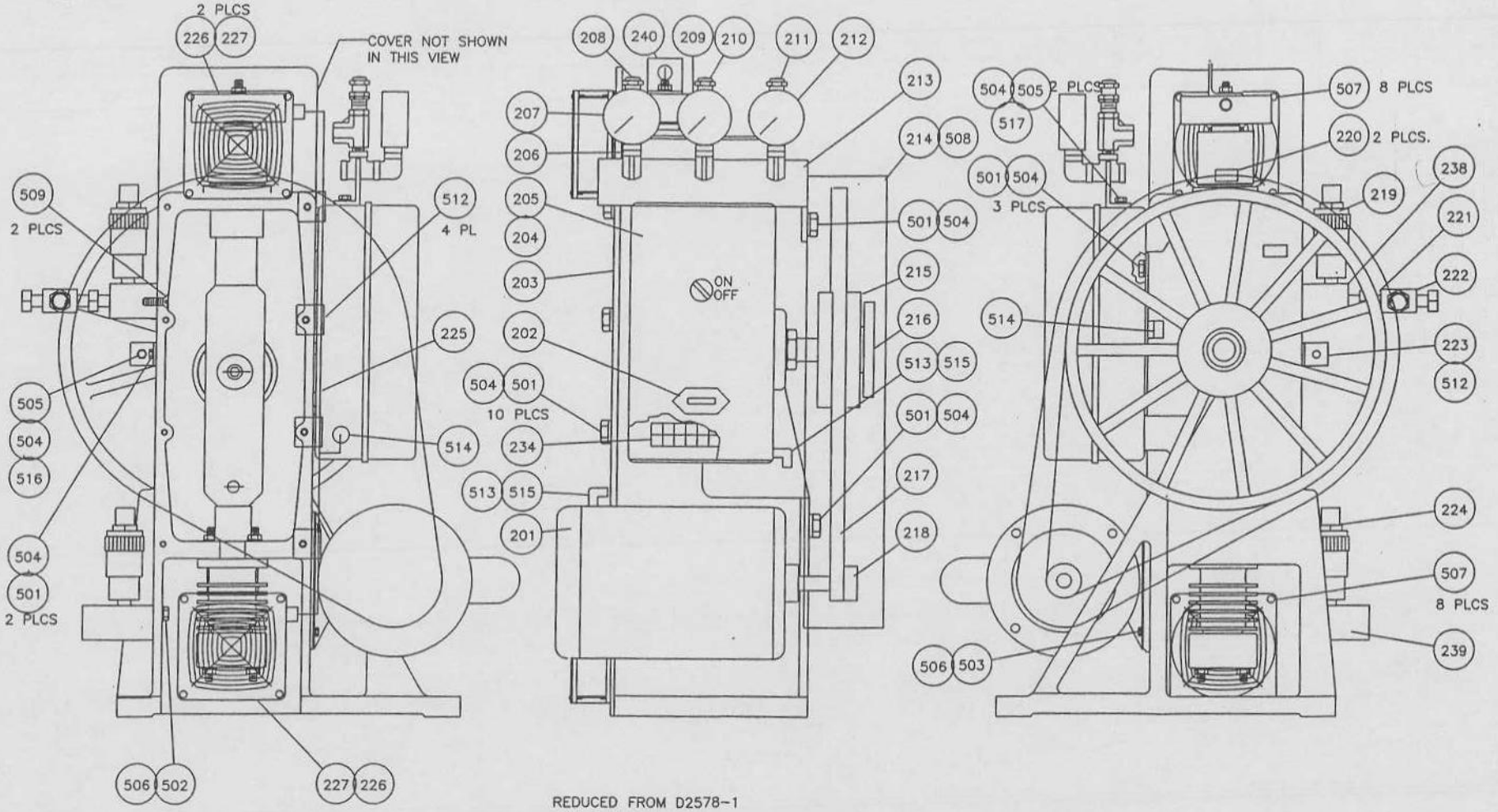
ITEM	QTY.	PART NO.	DESCRIPTION
5	1	508-B5928	Piston
4	8	123-011-5	O-ring
3	8	18-C1791-4G	Compression Ring
2	1	63-A5549	Piston Sleeve Tool
1	2	18-A2750-3G	Rider Ring

NOTES:
1. INSURE .08 TO .15 RIDER RING GAP.
2. INSERT PISTON ASSEMBLY IN THE SLEEVE TOOL AS SHOWN. TAP ENDS AND MARK WITH P/N XA508-A7783.

Figure 7-5

2ND STAGE PISTON ASSEMBLY

A7783



REDUCED FROM D2578-1

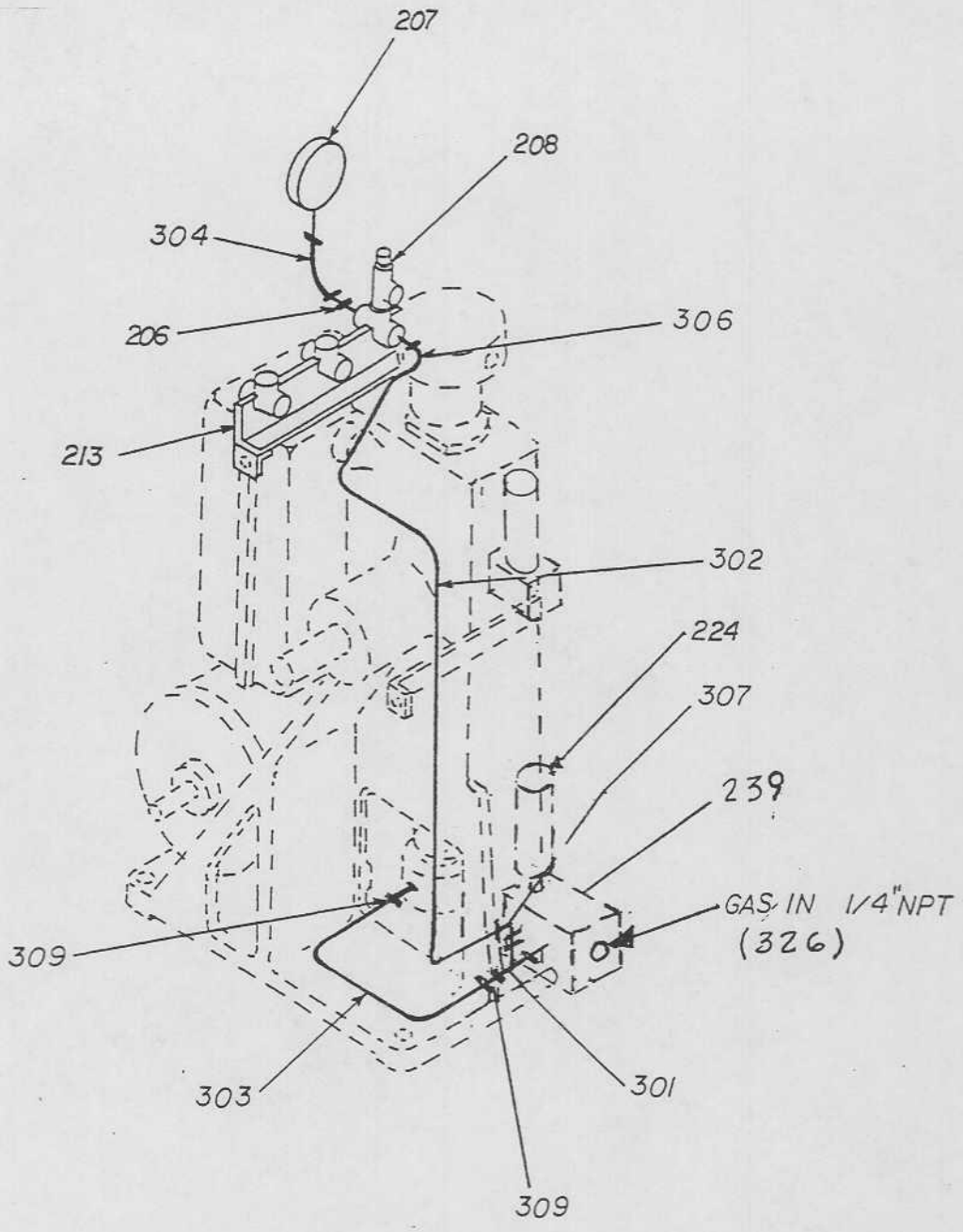
APPLIES TO S/N'S PRIOR TO S/N 9521

ACCESSORIES DRAWING

B5993

FIGURE 7-6
SHEET 7-13

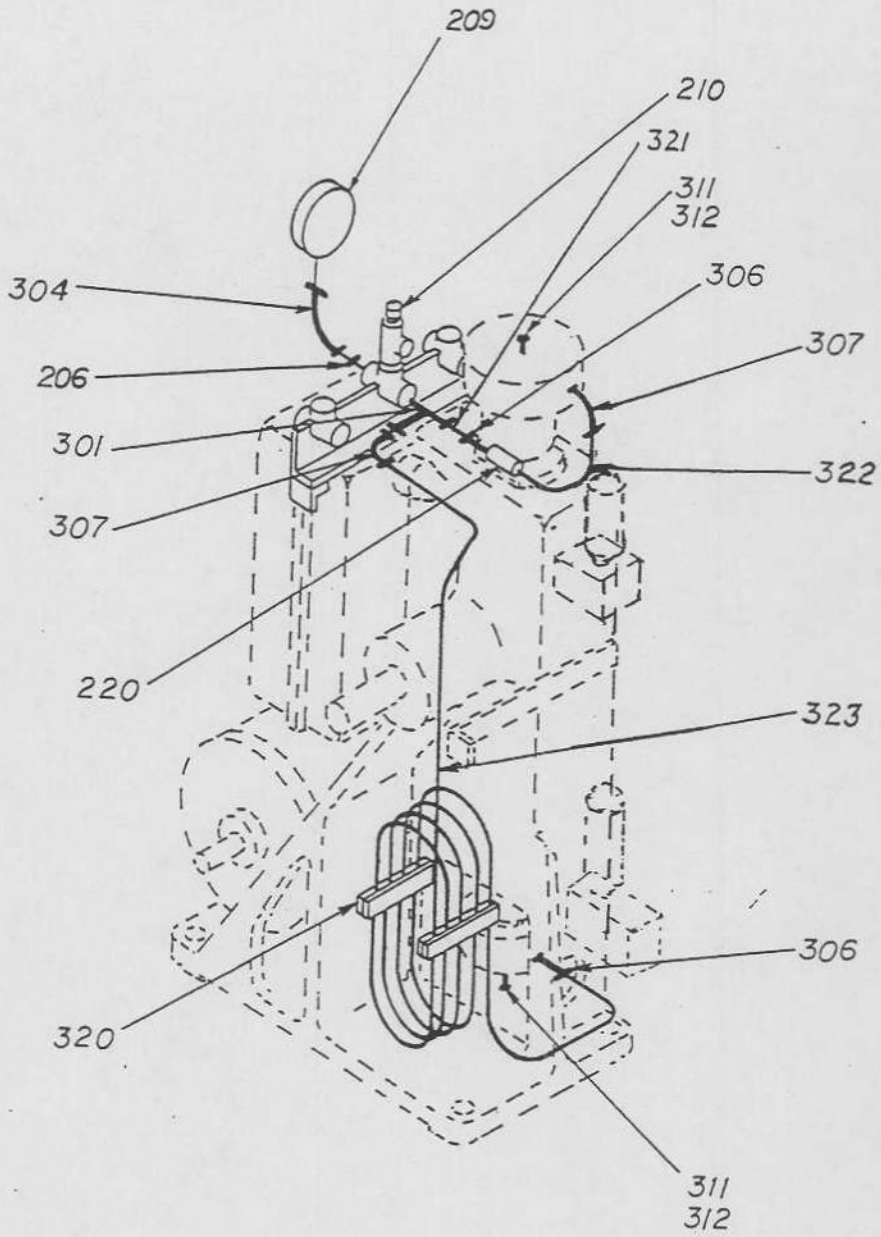
REVISED 5/99



2P PLUMBING INSTALLATION
SUCTION

FIGURE 7–7a
PAGE 7–14

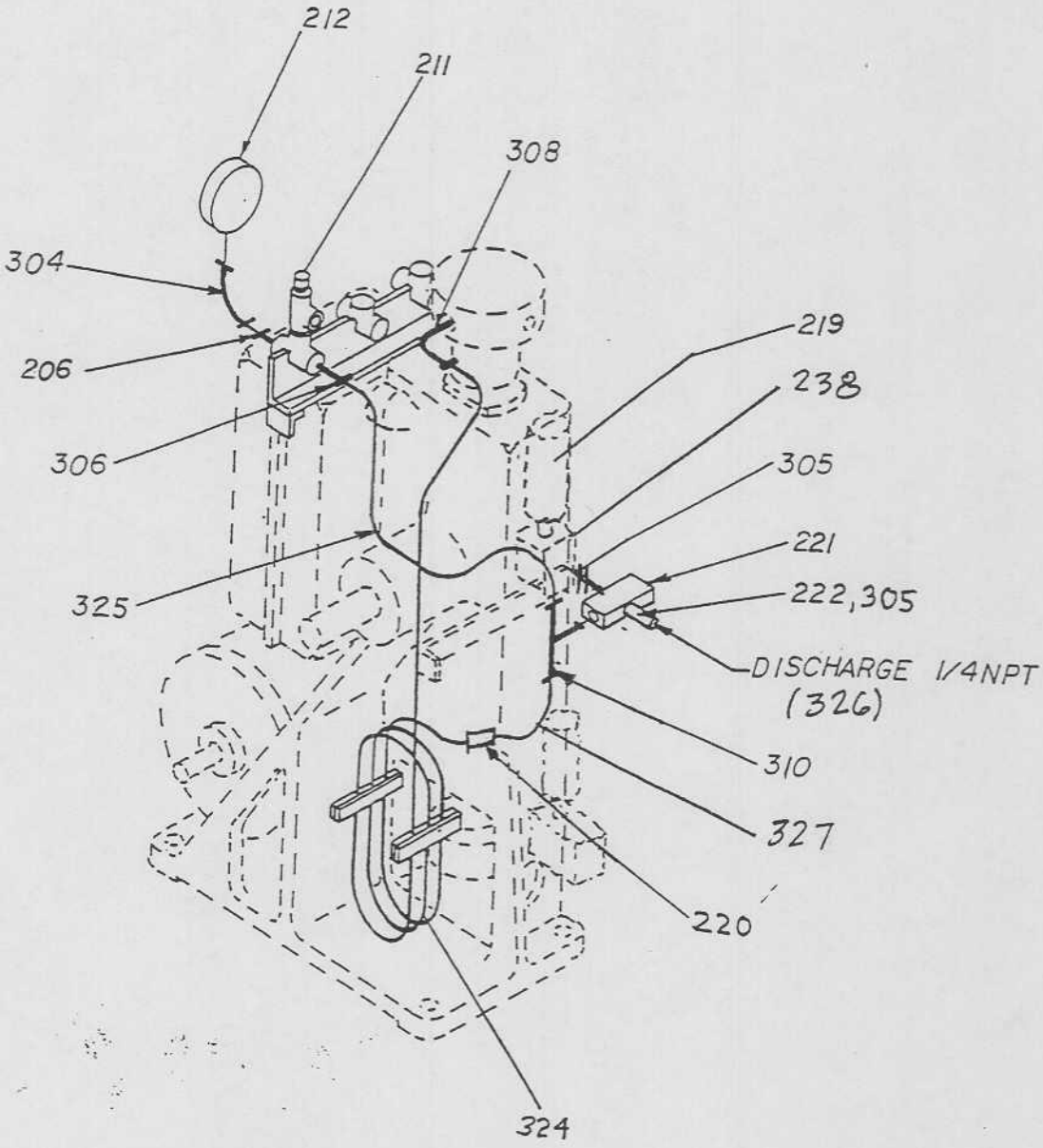
A7750
SHT.1 OF 3



2P PLUMBING INSTALLATION
1ST STAGE DISCHARGE

FIGURE 7–7b
PAGE 7–15

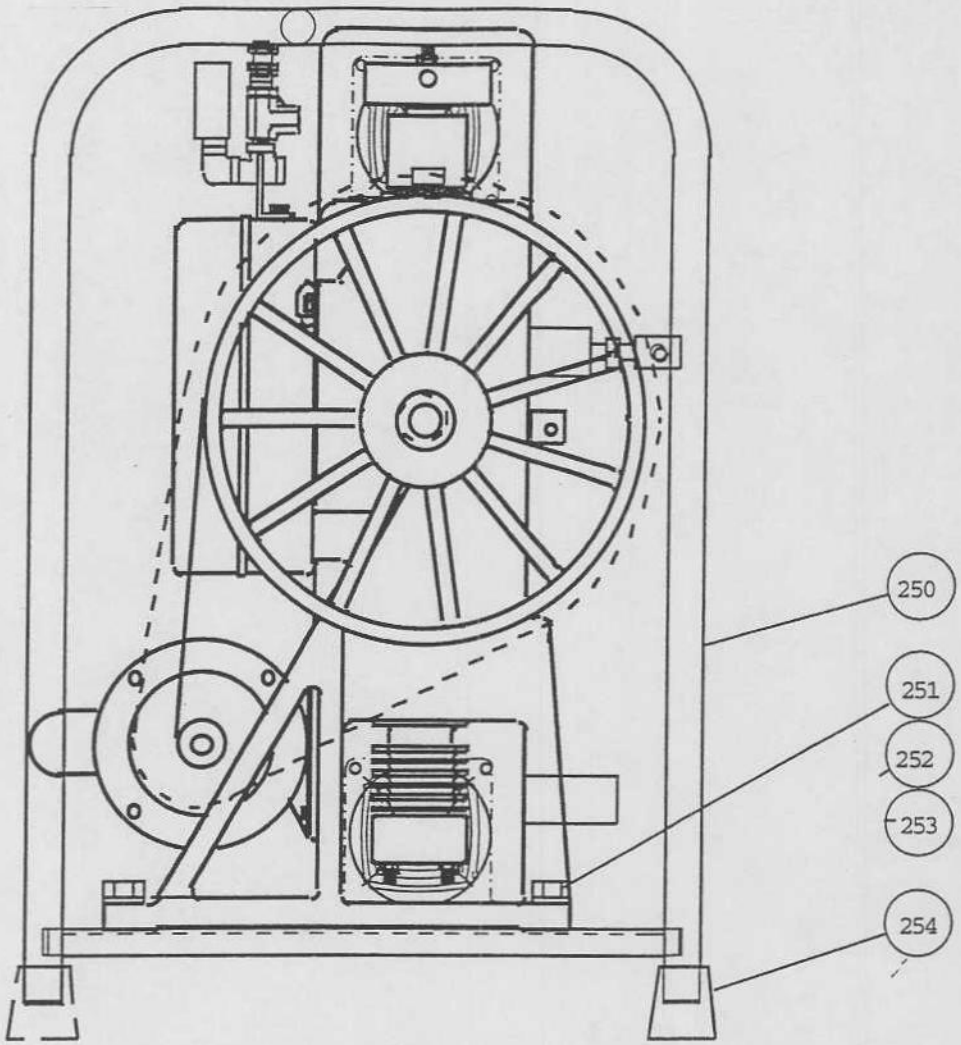
A7750
SHT. 2 OF 3



2P PLUMBING INSTALLATION
2ND STAGE DISCHARGE

FIGURE 7–7c
PAGE 7–16

A7750
SHT. 3 OF 3



ITEM	QTY	P/N	DESCRIPTION
250	1	70-C2549	2PS FRAME
251	4		HEX HEAD BOLT 1/-13NC X 1 1/4 LG PL STL
252	8		FLAT WASHER 1/2 SAE PL STL
253	4		HEX NUT 1/2-13NC PL STL
254	4 REF	854-523	RUBBER CASTER (PART OF ITEM 250)

2PS FRAME ASSEMBLY

Figure 7-8

PART II
MANUFACTURER'S DRAWINGS
AND
TECHNICAL LITERATURE

Drawings appear in numerical order

OXYGEN CLEANING PROCEDURE

1. PURPOSE

This procedure sets forth the cleaning requirements for oxygen compressors being built or repaired at RIX Industries, and for components being supplied by RIX Industries for use on oxygen compressors.

2. OBJECTIVE

Oxygen equipment and systems, including all components and parts thereof, must be adequately cleaned to remove harmful contamination prior to the introduction of oxygen. Harmful contamination would include materials such as oils, greases, paper, fiber, rags, wood pieces, solvents, weld slag, dirt and sand which, if not removed, could cause a combustion reaction in an oxygen atmosphere or result in an unacceptable product purity.

3. PRECLEANING

Parts having a heavy coating of foreign substances, such as scale, dirt, grit, solid objects and hydrocarbons shall require an initial cleaning.

3.1 Cleaning may be accomplished by grinding, wire brushing, blast cleaning, sweeping, vacuuming, swabbing, washing, etc. Care shall be exercised when mechanically cleaning machined and/or critical surfaces.

3.2 Washing to remove heavy accumulations of foreign substances shall be done using trisodium phosphate in hot water in accordance with the following:

3.2.1 Mix TSP in the ratio of 1/4 pound per gallon boiling water. Scrub parts with suitable brushes (metallic bristle brushes shall not be used on critical surfaces) until all traces of foreign substances are removed.

3.2.2 In case of stubborn or persistent coatings, continued boiling of the solution may be necessary to accomplish complete removal.

3.2.3 Flush all parts thoroughly with large quantities of clean fresh water, and thoroughly dry by means of clean dry air.

3.2.4 These parts are now ready for final cleaning.

4. FINAL CLEANING

Parts or components which have been cleaned as outlined above, slightly soiled parts, and parts which have become contaminated by exposure shall be subjected to this final cleaning procedure.

Parts which have failed inspection after final cleaning and have been subjected to additional cleaning as outlined elsewhere herein shall go through the Final Cleaning Procedure again. All final cleaning shall be performed in the cleaning area of the Cleaning Station prior to being moved to the inspection and assembly area.

4.1 Parts shall be soaked in hot detergent solution with brushing where necessary to insure solution reaching all surfaces. Piping and component interiors can be cleaned by pulling long handled brushes through or working with brushes from all access openings. Joy detergent to be mixed approximately 1/4 - 1/2 oz. per 2 gallons of water to create 1-inch suds on surface of water.

4.2 Flush all surfaces with large quantities of clean, fresh water and thoroughly dry by blowing with clean, dry air. Surgically clean gauze bandages can be used to assist in cleaning inaccessible areas.

4.3 These parts shall then be inspected.

5. INSPECTION

After final cleaning, all parts shall be visibly clean and free of all oil, grease, and objectionable fluorescent material. Visibly clean is defined to mean the freedom of the surface from particulate matter and from all films other than known harmless films. Methods for inspection for cleanliness are:

5.1 WHITE LIGHT OBSERVATION – Observations must be made with the naked eye or with corrective lenses at a distance of approximately 18 inches, and with light of sufficient intensity (minimum 200 watts) to illuminate the area being inspected. No magnifying lenses are to be used except to further identify a contaminant. Visual observation is limited to use where the surfaces to be inspected are accessible. (This does not preclude the use of non-magnifying inspection aids). Examination shall show no visible evidence of moisture, rust, corrosion, scale, slag, weld spatter, organic materials (oil, grease, crayon, paint, etc.), or any other foreign matter. Contamination shall be cause for re-cleaning.

5.2 ULTRAVIOLET LIGHT INSPECTION – The ultraviolet light source shall have a wave length of 3200 to 3800 angstroms and be used in a darkened area. Ultraviolet light inspection shall be used as an aid to detect some organic materials, such as oils, grease, and resin solder fluxes. Evidence of unidentifiable fluorescence is cause for rejection.

NOTE

There are items which fluoresce that are not contaminants. Therefore, it must be determined that the material causing fluorescence is actually a cause for rejection. A recommended check is to wipe the fluorescent material, if it smears or is removed, the item shall be re-cleaned. Unidentifiable fluorescing material shall not be used.

5.3 WIPE TEST – This test is used to detect contaminants on visually inaccessible areas as an aid in the above visual inspections. The surface is rubbed lightly with surgically clean gauze bandage which is examined under white and ultraviolet light. The area should not be rubbed hard enough to remove any oxide film as this could be confused with surface contamination.

5.4 RECORD KEEPING – Inspection status of parts, subassemblies, and assemblies shall be maintained by the use of Inspection Tags QC-009 and In-Process Inspection Record QC-003. All records and files pertaining to inspection shall be maintained in accordance with the Quality Assurance

6. SUPPLEMENTAL CLEANING

When inspection reveals contamination after repeated final cleaning, these parts will require supplemental cleaning. This may be accomplished by using the pre-cleaning procedure or the following procedure, as inspection dictates.

6.1 STEAM CLEANING – Steam cleaning assisted by the use of a heavy duty steam detergent is especially useful in removing contaminants, such as dirt, oil and loose scale.

6.1.1 The portable steam cleaner shall be used by first saturating the part with steam for the heat effect. Then the detergent steam mix shall be used so the chemical and "abrasive" action will dispense, emulsify, and flush contaminants.

6.1.2 Thoroughly dry all surfaces by blowing with clean, dry nitrogen, or clean, dry air.

6.2 SOLVENT WASHING - The solvent to be used is 111 Trichloroethane (SPRAYON Hi-Tech 00747 Safety Solvent and Degreaser (Ref.) or equal). Prior to use note the safety precautions on the outside of the can.

6.2.1 Parts shall be thoroughly sprayed with 111 Trichloroethane with brushing where necessary to insure solvent reaching all surfaces. Piping and component interiors can be cleaned by pulling long-handled brushes through or working with brushes from all access openings.

6.2.2 Thoroughly dry all surfaces by blowing with clean, dry nitrogen or clean, dry air.

6.3 INSPECTION – Visual inspection shall be conducted on parts after supplemental cleaning. Those parts having no indication of foreign substances shall be returned to the cleaning station for final cleaning. Parts indicating the presence of foreign substances shall be subjected to repetitive supplemental cleaning.

7. PROTECTION FROM RECONTAMINATION

Once a piece of equipment has been cleaned for oxygen service and the cleaning agent completely removed from the equipment, it shall be suitably protected to prevent recontamination during storage and prior to being placed in service.

7.1 STORAGE – Components or parts which will not immediately be assembled into the compressor shall be protected by sealing in clean plastic bags, taping all bags, taping all openings closed, and any other method necessary to prevent contamination. Care shall be used in handling components to prevent contamination by means of dirty hands, setting on dirty surfaces, or any other procedure which would negate the cleaning efforts.

These packages shall be affixed with the Oxygen Service labels applied to the outside of each innermost package. The shelf area provided in the cleaning facility shall be utilized for storage of these parts. Larger parts may require storage in a clean segregated area elsewhere in the plant.

7.2 ASSEMBLY PRACTICES - To protect equipment from recontamination during assembly, it is imperative that strict adherence to the following practices be observed.

7.2.1 The mechanics must have clean clothes, gloves, and tools. Hair caps will be worn.

7.2.2 All assembly will be conducted in the assembly area of the cleaning station.

7.2.3 Incomplete assembly work shall be covered with clean plastic bags. All gas passage openings shall be capped and/or plugged as necessary.

7.2.4 All tools, clothing, bags, etc., used in the assembly process shall be cleaned and inspected as necessary to prevent contamination of the parts and equipment.

7.3 DISASSEMBLY AND REPAIR PRACTICES - To prevent equipment from recontamination during disassembly and repair, it is imperative that strict adherence to the following practices be observed.

7.3.1 When attempting disassembly or repair of the equipment, the mechanic may choose to remove the suspect part or assembly from the equipment without first moving the equipment to the Cleaning Station if:

1. The disassembly or repair does not require extensive part removal (e.g. a single head assembly or heat exchanger).

2. The area is relatively clean no blowing dust or oil vapor in air.

3. The exposed, clean surfaces or components can be easily and completely bagged immediately after part or assembly is removed.

4. Quality Assurance Inspector is present during all operations outside of the Cleaning Station.

7.3.2 The mechanic must have clean gloves and tools and relatively clean clothes.

7.3.3 When the part or assembly is removed, the exposed clean surfaces or connections on the part being removed and the machine are immediately covered by oxygen clean bags and taped in place.

7.3.4 The part or assembly is transported to the cleaning station, and its surface is cleaned before allowing it into the clean assembly area.

7.3.5 Repairs are carried out per Section 7.2.

7.3.6 Repaired part or assembly must have exposed clean surfaces or connections covered by oxygen clean bags.

7.3.7 Transport repaired part, assembly, or clean replacement part to machine.

7.3.8 Mechanic must have clean gloves, tools and relatively clean clothes.

7.3.9 Remove oxygen clean bags from part or assembly and machine and immediately put part or assembly in place. Tighten fasteners as necessary.

8. GENERAL INSTRUCTIONS

8.1 The ventilation system must be in operation at all times when cleaning and/or assembly procedures are being performed within the Cleaning Station.

8.2 All personnel entering the facility must be inspected to insure a certain degree of cleanliness to prevent contamination of the facility.

8.3 RIX will provide clean:

8.3.1 Shop coats

8.3.2 Cleaning gloves

8.3.3 Hair caps

8.3.4 Goggles and face shields

This protective clothing must be used when cleaning and assembling equipment.

8.4 All material entering the facility must pass through the cleaning area and be inspected prior to entering the assembly area. Completed units must be completely sealed and/or protected prior to being removed from the assembly area.

8.5 All preliminary cleaning and steam cleaning shall be conducted in an open area away from the cleaning station.

8.6 All water used in the facility shall pass through the installed filter.

9. SAFETY PRECAUTIONS

All personnel involved shall be instructed in the safe use of the cleaning agents employed, including any hazards associated with the use of these agents. Material Safety Data Sheets shall be posted in the Cleaning Station.

9.1 111 Thichloroethane (main ingredient Methyl Chloroform) is a non-flammable solvent, however spraying into an open flame can cause toxic fumes. The American Conference of Governmental Industrial Hygienists (ACGIH) states that the threshold limit value (TLV) (a concentration of solvent vapor in air to which nearly all workers may be repeatedly exposed, 8 hours per day, 5 days per week, without adverse affect) for Methyl Chloroform is 350 ppm.

9.1.1 The vapor can be harmful and it should be used in a well-ventilated area. Avoid breathing of vapor or spray mist and prolonged contact with the skin.

9.1.2 If normal ventilation is not adequate, portable blowers should be used. The atmosphere should be monitored by an industrial hygienist or safety officer to insure safe limits (350 ppm) are not exceeded.

9.1.3 Since this product dissolves natural oil and is absorbed through the skin, contact with skin shall be avoided; protective clothing, goggles and neoprene gloves shall be worn. If contact occurs, the area shall be washed with soap and water.

9.2 TSP (trisodium phosphate) should be used with the protective procedures outlined in paragraph 9.1.1.

9.2.1 If any cleaning compounds are taken internally, a physician should be contacted immediately.

9.2.3 Do not soak aluminum parts in TSP or leave solution in aluminum.

9.3 Joy detergent is classified as hazardous because it has a flash point of 132°F as measured by the closed-cup method. It does not sustain combustion nor does it pose a significant hazard.

9.3.1 Protective procedures noted in paragraph 9.1.3 shall be followed.

9.3.2 May cause mild, transient eye irritation if accidentally spilled in the eyes. Prolonged skin contact with concentrated material may be irritating.

9.4 Steam cleaner detergent is classified as a noncombustible and nonhazardous material. It can cause eye irritation. Skin irritation may result from prolonged exposure.

9.4.1 Protective procedures as noted in paragraph 9.1.3 shall be followed.

10. CLEANING AND SETTING OF RELIEF VALVES FOR OXYGEN USE

(REF. Check List: Cleaning and setting of relief valves for Oxygen Use, A7755.)

10.1 Valves to be completely disassembled.

10.2 All components to be cleaned per this oxygen cleaning procedure.

10.3 Valves to be re-assembled in the RIX cleaning station.

10.4 Cap all openings and move valves to relief valve setting area in main Q.C. room.

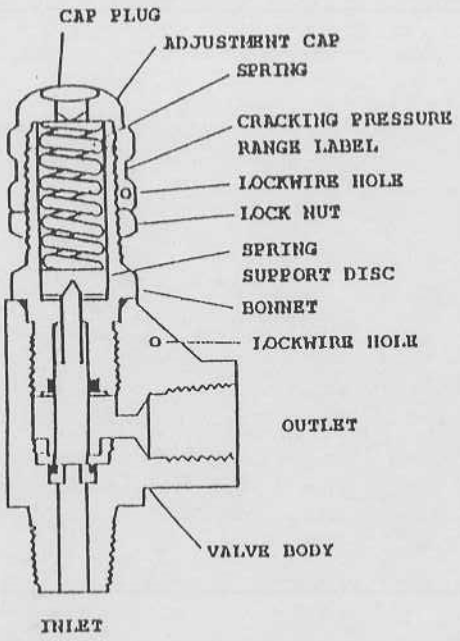
10.5 Valves will be set to their required pressure range using clean distilled water as setting media and for flushing purposes.

10.6 Inspect inlet port using "black-light" per section 5 — cap port and seal in heat sealed bag.

10.7 Generate an inspection record for each RIX sales order/contract.

Patent Pending

"R3A" Series Externally Adjustable Relief Valve



Spring Installation

CAUTION

Relieve system pressure before replacing spring.

1. Loosen lock nut and remove adjustment cap from bonnet.
2. Remove existing spring (if necessary).
3. Make sure all components are clean.

NOTE: Spring support disc must be in place before spring is installed.

4. Install the proper spring for desired cracking pressure range.
5. Replace existing cracking pressure range label with new label. Check this label against spring identification table for proper cracking pressure range.
6. Screw adjustment cap onto bonnet.
7. Rotate adjustment cap to set desired cracking pressure. Test - repeat adjusting procedure as necessary to obtain desired cracking pressure.
8. Tighten lock nut against the adjustment cap.
9. If required , lockwire the setting by using lockwire holes in adjustment cap and valve body.

Manual Override Conversion

NOTE: Maximum system pressure for manual override option is 1500 PSI (10,300 kPa)

CAUTION

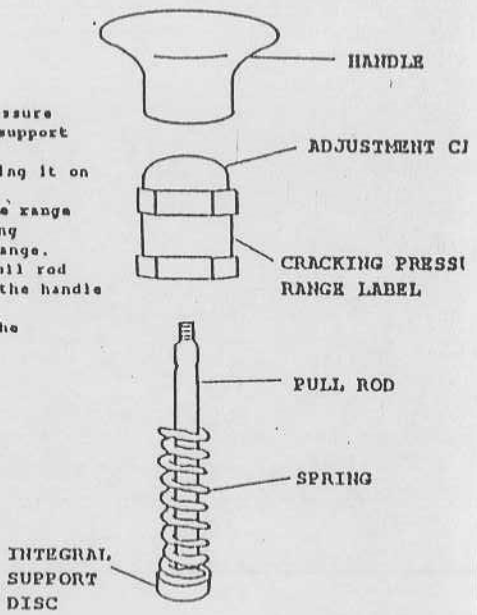
Relieves system pressure before installing manual override kit.

1. Loosen lock nut and remove adjustment cap from bonnet.
2. Remove cap plug from adjustment cap.
3. Remove existing spring and spring support disc.
4. Place the proper spring for desired cracking pressure range over the pull rod, resting it on the integral support disc.
5. Place the adjustment cap over the pull rod, resting it on top of the spring.
6. If applicable, replace existingcracking pressure range lable with new label. Check the label against spring identification table for proper cracking pressure range.
7. Screw handle onto the threaded portion of the pull rod finger tight. Torque the set screw on the side of the handle to 20 in-lbs with 5/64" hex key wrench.
8. Install assembly into valve bonnet and engage the adjustment cap threads.

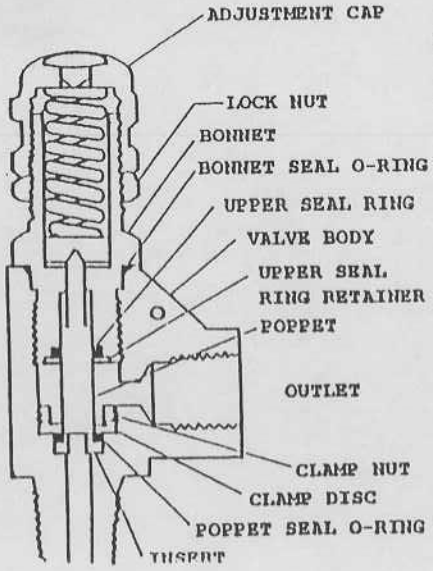
PROCEED WITH STEPS 7 THROUGH 9 IN "SPRING INSTALLATION" SECTION TO SET DESIRED CRACKING PRESSURE.

SPRING KIT IDENTIFICATION

SPRING KIT PART NUMBER	NOMINAL CRACKING PRESSURE RANGE PSI	(kPa)	COLOR CODE
177-R3A-K1-A	50-350	340-2,400	Blue
177-R3A-K1-B	350-750	2,400-5,150	Yellow
177-R3A-K1-C	750-1500	5,150-10,300	Purple
177-R3A-K1-D	1500-2250	10,300-15,500	Orange
177-R3A-K1-E	2250-3000	15,500-20,600	Brown
177-R3A-K1-F	3000-4000	20,600-27,500	White
177-R3A-K1-G	4000-5000	27,500-34,400	Red
177-R3A-K1-H	5000-6000	34,400-41,300	Green



SEAL REPLACEMENT INSTRUCTIONS



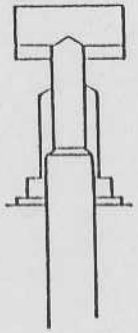
Contents

- 1 Upper Seal Ring
- 1 Upper Seal Ring Retainer
- 1 Bonnet Seal O-ring
- 1 Poppet Seal O-ring

Disassembly and Seal Removal

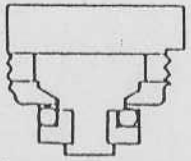
1. Remove valve from system
2. Loosen adjustment cap to relieve spring pressure.
3. Remove bonnet from valve body.

Upper Seal Ring Replacement



4. Pull poppet down to remove
5. Remove Upper Seal Ring Retainer with suitable tool - being careful not to damage bore.
6. Remove Upper Seal Ring
7. Make sure all parts are clean before replacing.
8. Install new Upper Seal Ring (Lubricate with system compatible lubricant)
9. Install new Upper Seal Ring Retainer. *(Make sure teeth are pointing away from Upper Seal Ring).*
10. Insert poppet into bonnet through Upper Seal Ring until it bottoms.

Poppet Seal O-ring Replacement



4. Unscrew clamp nut with 5/16" hex key wrench
5. Remove Poppet Seal O-ring. Insert and clamp disc by pushing a suitable tool up through inlet port
6. Make sure all parts are clean before replacing
7. Install new Poppet Seal O-ring onto Insert. (Lubricate Poppet Seal O-ring with system compatible lubricant)
8. Place Poppet Seal O-ring and Insert assembly into valve body (Poppet Seal O-ring facing up) until Insert bottoms on shoulder of inlet port.
9. Place the clamp disc on top of Poppet Seal O-ring (See drawing for correct orientation)
10. Screw in clamp nut 1/8 turn past snug.

NOTE: To insure correct orientation of parts during assembly it may be helpful to place parts onto a thin object and insert into valve.

Reassembly and Installation

11. Remove and replacebonnet seal O-ring (Lubricate with system compatible lubricant).
12. Install bonnet into valve body and torque to 600 in.-lbs.
13. Install in system
14. Set desired cracking pressure and tightenlock nut.

Part Number Reference
For Viton O-ring VI-R3AK2
For Buna O-ring BUR3A-K2
For Neoprene O-ring NEO-R3A-K2
For Ethylene Propylene O-ring EP-R3A-K2

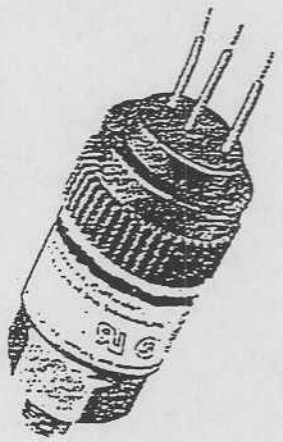
A5622

P/N X76-704
P/N X76-705

Field Adjustable Pressure Switch

Operating Characteristics

Range	Pressure Setting Range				Approx. Actuation Value (Differential)	Proof Pressure
	Decreasing		Increasing			
	Min.	Max.	Min.	Max.		
30" Hg (Vac)	1" Hg	25" Hg	6" Hg	30" Hg	1-6" Hg	30 psi
15	2.5	12.3	3	15	.5-2.2	1000
35	5	31	6	35	1.0-4.0	1000
50	8.5	44	10	50	1.5-6.0	1000
125	22.5	112	25	125	2.5-12	1000
250	70.0	220	80	250	10-30	1000
500	110	440	130	500	20-60	1000
600	190	450	250	600	60-150	7000
1700	360	1450	430	1700	70-250	7000
4400	1450	3900	1650	4400	200-500	7500
7500	3650	6700	4000	7500	350-800	12000



Detail Data

Electrical Connection — Free leads approximately 12" long.

Pressure Connection — 1/4" NPT male.

Temperature Range — 96201 series = —40° to 185°F.
96211 series = —20° to 185°F
(-9°F Min. as noted)
96221 series = 0° to 185°F

Wetted Materials

96201 series	96211 & 96221 series
Body — Brass	Body — Brass
Seals — Buna N o'ring	Diaphragm — Buna N
Piston — Stainless steel	

Housing — Open type plastic housing.

Approvals/Listings — UL and CSA recognized.

Optional Modifications

Electrical — See Optional Modification Page.

Wetted Material — Body: Stainless steel. To specify, add suffix -SS to catalog number.

Diaphragm/Seal — Other compounds available. Consult factory.

Process Connection — 7/16-20 SAE type male straight threads with o'ring seal, add suffix -P1.
1/4" BSP male straight threads with o'ring seal, add suffix -P2.

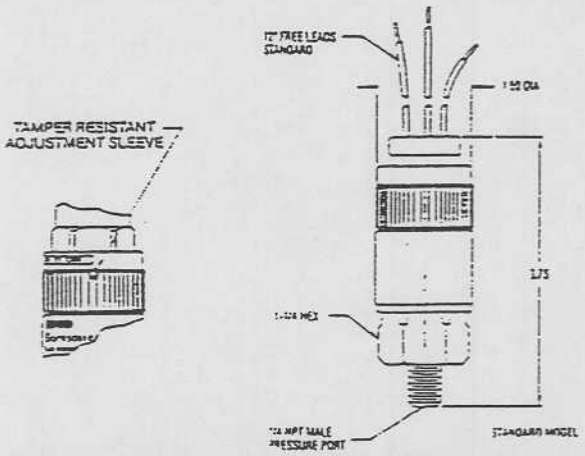
Tamper Resistant Screw — Add prefix "T" to catalog number.

Adjustment Instructions

Positive Pressure — Secure hex body with open end wrench. Hand turn adjustment sleeve clockwise to increase, counterclockwise to decrease set point.

Vacuum Pressure — Secure hex body with open end wrench. Hand turn adjustment sleeve counterclockwise to increase, clockwise to decrease set point.

Ordering Instructions — To ensure correct switch is furnished, always specify full catalog number (including required modifications), set point (increasing or decreasing) and service. Example: 96211-882-SS-T2 set at 15 psi increasing. Service, Dry Nitrogen.



General Description

The 96201 series switch utilizes a sealed piston sensor. The 96211 and 96221 series switches use a diaphragm piston sensor. These switches offer field adjustable set points. The differential is fixed and varies with pressure setting.

Electrical Connections include free leads as standard with optional screw terminals, DIN type connector or 1/2" NPT conduit connector, (male or female).

They are environmentally sealed and are resistant to shock and vibration. Designed to deliver millions of maintenance free cycles, the sealed piston and diaphragm piston designs are ideally suited for harsh environments.

WIRE CODE	PRESSURE	VACUUM
Lead	Color	Color
Normally Closed	Blue	Red
Common	Purple	Purple
Normally Open	Red	Blue

ELECTRICAL RATING			
Limit Switch Class	Voltage (Volts)	Maximum Continuous Current (Amps)	
		Resistive	Inductive
BB	125/250 VAC	5	5
CC	125/250 VAC	10	10

All models incorporate Underwriters' Laboratories, Inc. listed and CSA approved single pole double throw snap-action switches.

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