AVRO AIRCRAFT LIMITED

MALTON, ONTARIO.

BROCHURE O-1

DESCRIPTION OF

OXYGEN SYSTEM

FOR

CF-105

SUPERSONIC ALL WEATHER FIGHTER

CONSISTS OF 7 PAGES

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INDEX OF CONTENTS

ILLUSTRATIONS

1. INTRODUCTION

1.1 Oxygen System Requirements

The CF-105 aircraft is to be fitted with two oxygen systems; designated normal and emergency.

The normal system contains a Lox (liquid oxygen) converter which converts liquid oxygen into gaseous oxygen for crew members' breathing purposes and for inflation of the partial pressure suits. Sufficient oxygen will be carried to cover the longest ferry mission with overload tanks, assuming that the Lox converter has been standing by for a maximum duration of 24 hours after filling. The installation of the system will comply with specification MIL-I-9475 (USAF) where applicable.

The emergency system comprises two separate 20 minutes supply cylinders containing gaseous oxygen, one being mounted on each seat, with provision for manual or automatic selection of the supply; the latter method of selection coming into effect upon ejection of the seat.

1.2 System Design Considerations

It is an inherent feature of Lox converters that a delay of the order of ten minutes is required between filling and the production of gaseous oxygen. It is intended to overcome the effects of this delay, which is unacceptable due to the short turn-around time allowed between missions, by storing filled portable converters in a building set aside for the purpose. This concept requires that filled converters, which are to be removed from storage as required, be designed for easy installation in the aircraft through the use of plug in features, all connections being made automatically. The gaseous oxygen supply connection will be self sealing both on the aircraft and converter side of the joint.

In the interests of weight saving and portability, the converter weight will be kept to a low figure (28.20 lbs. full) and a carrying handle provided.

2. DESCRIPTION OF NORMAL SYSTEM

2.1 Converter (See Figs. 1 & 5)

The 5.0 liter converter consists of a double walled container, the space between the walls being evacuated to form an insulating vacuum, plus the following items which are connected to it by piping:

2. DESCRIPRION OF NORMAL SYSTEM (Continued)

2.1 Converter (See Figs. 1 & 5) (Continued)

Combined fill, vent and build up valve
Pressure closing valve
Pressure relief valve
Quick disconnect supply to aircraft
Quick disconnect overboard vent
Build up coil
Evaporating plate

In addition, sensing elements, used in the quantity gauging system, are mounted within the container, and are connected by wiring to the electrical disconnect.

The complete assembly is mounted on a base which acts as a reference point between the mounting tray in the aircraft and the disconnect points.

2.2 Operation of Converter (See Figs. 1 & 5)

For filling purposes it is intended that the converter be mounted on a tray similiar to the mounting tray in the aircraft. When the supply of liquid oxygen is connected for filling, the combined filler, vent and build-up valve operates in such a manner that the top, or gas side of the converter is vented to atmosphere. Filling is continued until liquid oxygen is seen to be issuing from the vent port.

Removal of the filling connector closes the vent port of the combined filler, vent and build-up valve, and opens the build up portion of the circuit. The liquid then flows out of the container into the build-up tube. Here it gasifies, passes through the pressure closing valve, which at this stage is open, and flows back through the build-up valve to the gas side of the container. This cycle continues until the operating pressure of 300 psi is reached, at which point the pressure activated bellows in the pressure closing valve closes. With the build-up tube thus closed, further liquid flow is through the evaporating plate, where the Lox is converted to gas at a breathable temperature. At this point, the converter is ready for use; gaseous oxygen being available at the aircraft disconnect. A pressure relief valve connected to the overboard vent quick disconnect prevents excessive pressures being built up in the converter system.

2. DESCRIPTION OF NORMAL SYSTEM (Continued)

2.3 Operation of Complete System (See Fig. 2)

When fitting of full converter into the aircraft, it is placed on its tray and then slid forward. This action automatically couples the supply, overboard vent and electrical connections. The converter is then positively locked to the tray by the operation of 2 quick acting catches.

Gaseous oxygen for crew members' use will now be available, the flow being as follows:

Gaseous oxygen from the evaporating plate of the converter flows through the supply connection into the cockpits where it enters the composite leads disconnect at each crew members' seat.

The composite leads disconnect (Ref. Fig. 3) is divided into three parts:

Part 'A' is attached to the crew members oxygen mask and pressure suit.

Part 'B' is attached to the seat.

Part 'C' is attached to the aircraft.

Entering the aircraft part, the gas passes through the crew members' part and out through the seat part. (The connections between the parts of the disconnect are self sealing.) After leaving the composite leads disconnect, the gas flows through the dual check valve.

The dual check valve serves to join the normal supply system and the emergency supply system to the system pressure regulator, preventing interconnection between the two systems.

A pressure gauge is provided in the pilot's cockpit, and is located on the outboard side of the right hand console.

3. EMERGENCY SYSTEM

3.1 Each crew station is equipped with an AN6025AX53 non-shatterable cylinder containing 53.0 cu. in. of gaseous oxygen charged at 2000 psig. This volume is sufficient for a minimum of 20 minutes supply at a rate of 300 litres per hour. The cylinder is mounted on the crew members' seat. A combined pressure gauge, charging valve and manual and automatic trip valve is provided at each cylinder.

3. EMERGENCY SYSTEM (Continued)

3.2 Emergency Oxygen for 'Bail Out' Case

In the case of crew members' ejection, the emergency supply is automatically connected. A lanyard which is fastened to the floor of the cockpit is attached to the manual and automatic trip valve, so that the valve is operated by the action of the seat leaving the aircraft. The aircraft part of the composite leads disconnect then stays with the aircraft (Ref. para. 2.2.1), the crew members' part and the seat part leaving the aircraft, being attached to the crew member and the seat respectively. The port on the crew members' part which normally was connected to the aircraft part is automatically closed by the separation of the two parts.

3.3 Emergency Oxygen-Crew Members Remaining with Aircraft

Should either crew member require the use of emergency oxygen due to an inoperative condition of the normal system, it is obtained by pulling the emergency oxygen release knob which is located on the left hand side of each seat. This action connects the emergency supply container to the regulator via the composite leads disconnect.

4. QUANTITY GAUGING SYSTEM (See Figs. 4 & 7)

4.1 The liquid oxygen gauging system comprises the following components:

(a) Indicator

(b) Amplifier

(c) Sensing Element

(d) Circuit Protectors

(e) Connectors

(f) Wiring Harness

The purpose of the circuit is to measure and indicate the contents of the liquid oxygen container.

Referring to the diagram (Fig. 7), 115 volts 400 cycles are fed into two circuits; namely power rectification and voltage changing. The voltage changing circuit through the transformer T1 reduces the 115 volt supply to 6.3 volts

4. QUANTITY GUAGING SYSTEM (See Figs. 4 & 7) (Continued)

4.1 (Continued)

for heating the 6U8 tube. The rectifier circuit converts the 115 volts 400 cycle supply to 115 volts D.C., through the rectifier SR65MA, for plate voltages for each section of the 6U8 tube.

Condensers 7500 MMF and 5 MFD provide ripple filtering for the plate voltages; resistor 560 IW provides some smoothing, and tube OB2 regulates the final rectification output. A 4.3 megacycle generator consisting of the triode section of the 6U8 tube, 1 meg OHM ½ watt resistor, 4.3 megacycle crystal, 500 MMF condenser, 2.5 millihenry choke is coupled through the 110 MMF condenser to the input of the main amplifier. The main amplifier comprises the 5600 OHM ½ watt resistor, the pentode section of the 6U8 tube, a 47 OHM resistor, 1000 OHM ½ watt resistor and a 2.5 millihenry choke. The output of the main amplifier is coupled through a 200 MMF condenser to the parallel resonant circuit of the sensing element consisting of a 1500 MMFD condenser, a slug tuned 4.3 megacycle coil and compensator condenser C1. The sensing element is shunt connected across the parallel resonant circuit. The sensing element capacitance varies in relation to the volume and density of the liquid oxygen which in turn varies the load on the output of the main amplifier. The variable load on the main amplifier causes a varying voltage to develop across the input circuit to the IM34 rectifier. The rectifier output is connected in series with a parallel series circuit of resistor of 500 OHM (pot), 56000 OHM ½ watt resistor, 1 megohm ½ watt resistor and a 500 OHM trim meter shunt pot forming a voltage divider between the rectifier output and the positive D.C. high voltage. The sensitive 0-200 microampere meter is shunted across the 500 OHM meter trim potentiometer so the meter can be set at an accurate empty or full position when the final check is made on the system in operation.

5. INSTALLATION AND PIPING

5.1 The converter mounting tray is installed in the dorsal on the left hand side of the centre line between STA'S 255.0 and 268.0. It is accessible by removing the detachable portion of the dorsal lying immediately aft of the installation (Ref. Fig. 6). The oxygen supply line and the electrical leads to the quantity gauging system are taken through the navigators' bulkhead. The overboard vent line is taken to a flush outlet point on the skin on the left hand side of the dorsal aft of the navigators' bulkhead.

5. INSTALLATION AND PIPING (Continued)

5.1 (Continued)

Piping in the normal system up to the dual check valve, and from the regulator to the composite leads disconnect is of aluminum alloy, using double flared tube ends in accordance with AND10078.

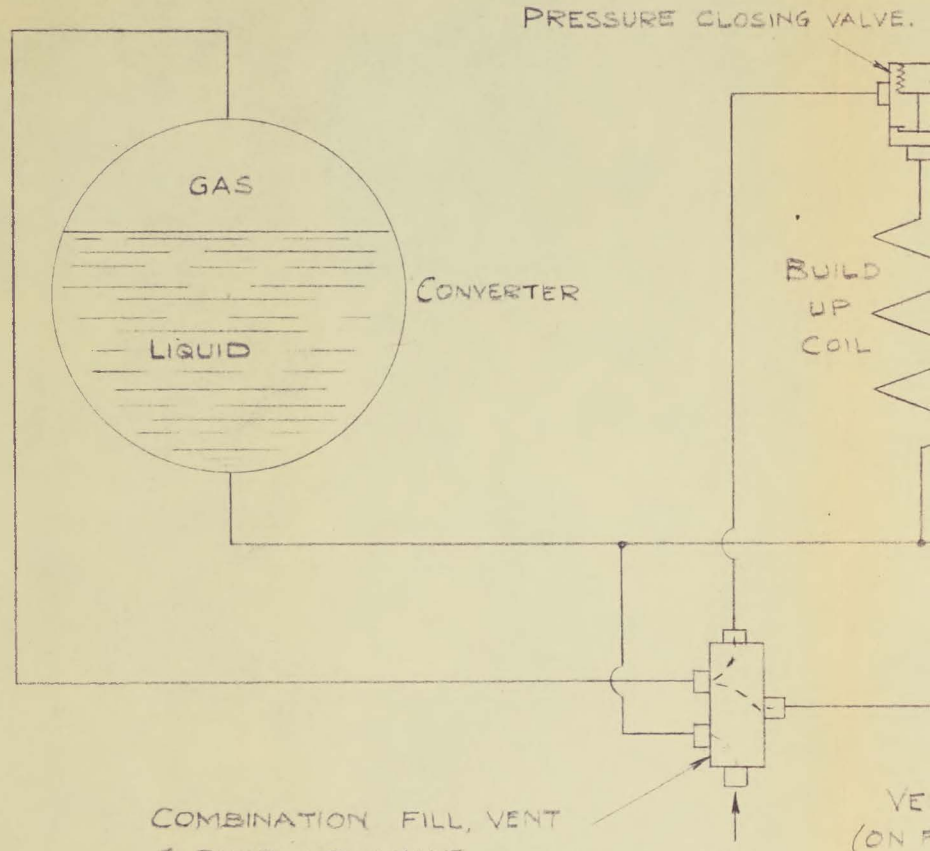
Piping from the emergency container to the double check valve, and from the double check valve to the regulator is of stainless steel, using flared tube ends in accordance with AND10061. Installation is in accordance with MIL-I-9475 (USAF) where applicable.

APPENDIX I

EQUIPMENT LIST

OXYGEN SYSTEM

DESCRIPTION	QTY.	PART No.	SPEC.	MANUFACTURER AND PART No. WHERE APPLICABLE
BOTTLE – EMERGENCY	2	840287 AN6025AX–53	MIL–C–7905A	WALTER KIDDE
CONVERTER – 5 LITRES	1	AVRO 7–2154–14	AVROCAN E329	ARO EQUIP. CORP.
DISCONNECT – COMPOSITE LEADS	2	AVRO 7–2152–11	AVROCAN E269	AVIATION ELECTRIC
GAUGE QUANTITY	1	AVRO 7–2152–12	AVROCAN E269	ARO EQUIP. CORP.
GAUGE – PRESSURE – NORMAL SUPPLY	1	AVRO 7–2152–13	MIL–G–6019A TYPE II	NORDEN–KETAY
GAUGE – PRESSURE – EMERGENCY SUPPLY	2	TYPE L–2	MIL–G–7601A	AVIATION ELECTRIC
TRAY – MOUNTING	1	AVRO 7–2154–15	AVROCAN E329	ARO EQUIP. CORP.
TRANSMITTER – CONVERTER TO QUANTITY GAUGE	1	AVRO 7–2154–16	AVROCAN E329	ARO EQUIP. CORP.
VALVE – AUTO AND MANUAL TRIP	2	AVRO 7–2152–15	AVROCAN E286	
VALVE – H/P CHECK	2	AN–6017–1	MIL–V–5027A	ANTHONY FOSTER


PRESSURE CLOSING VALVE.
GAS
LIQUID
CONVERTER
BUILD UP COIL
COMBINATION FILL, VENT & BUILD UP VALVE.
FILL

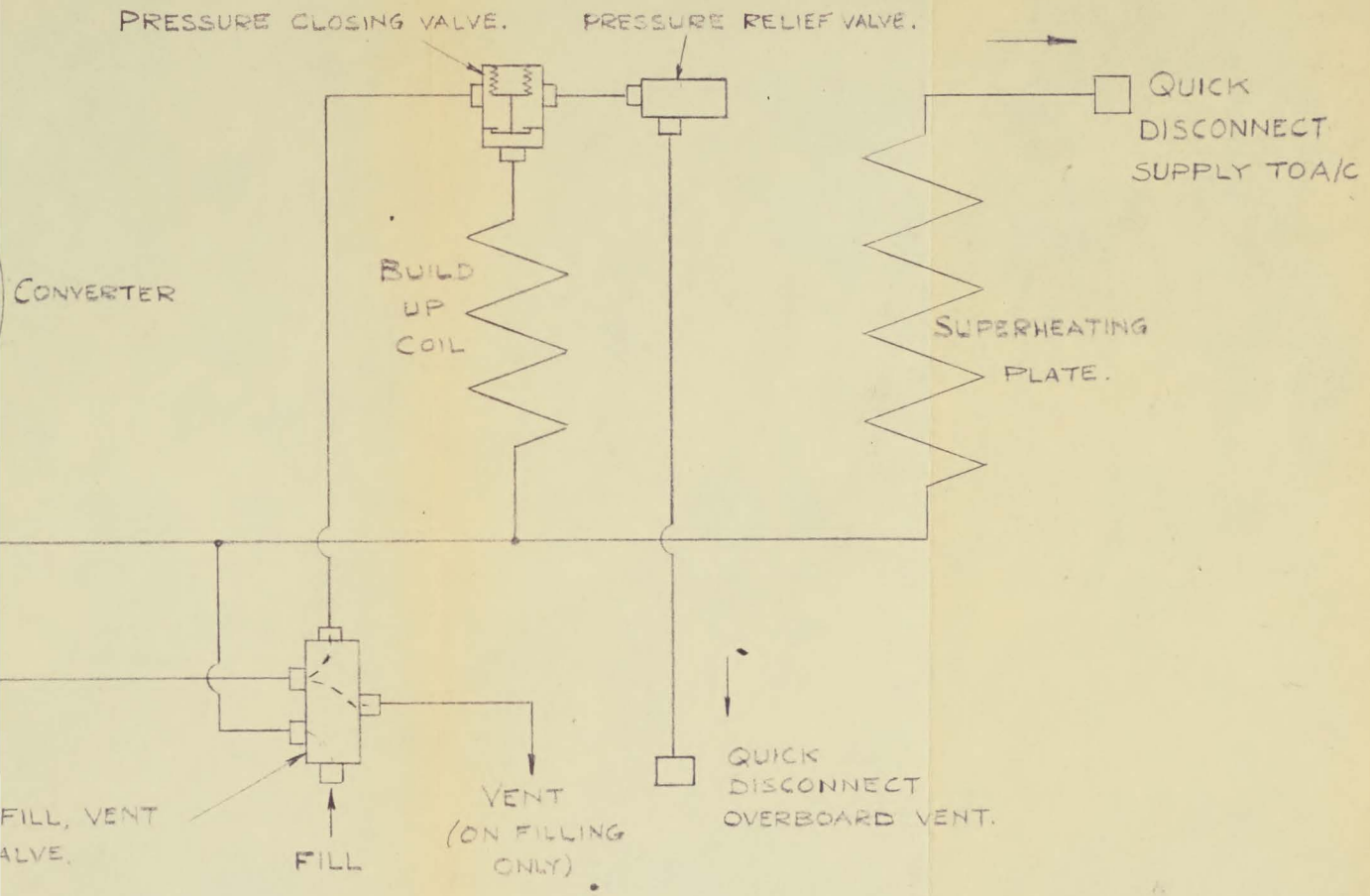
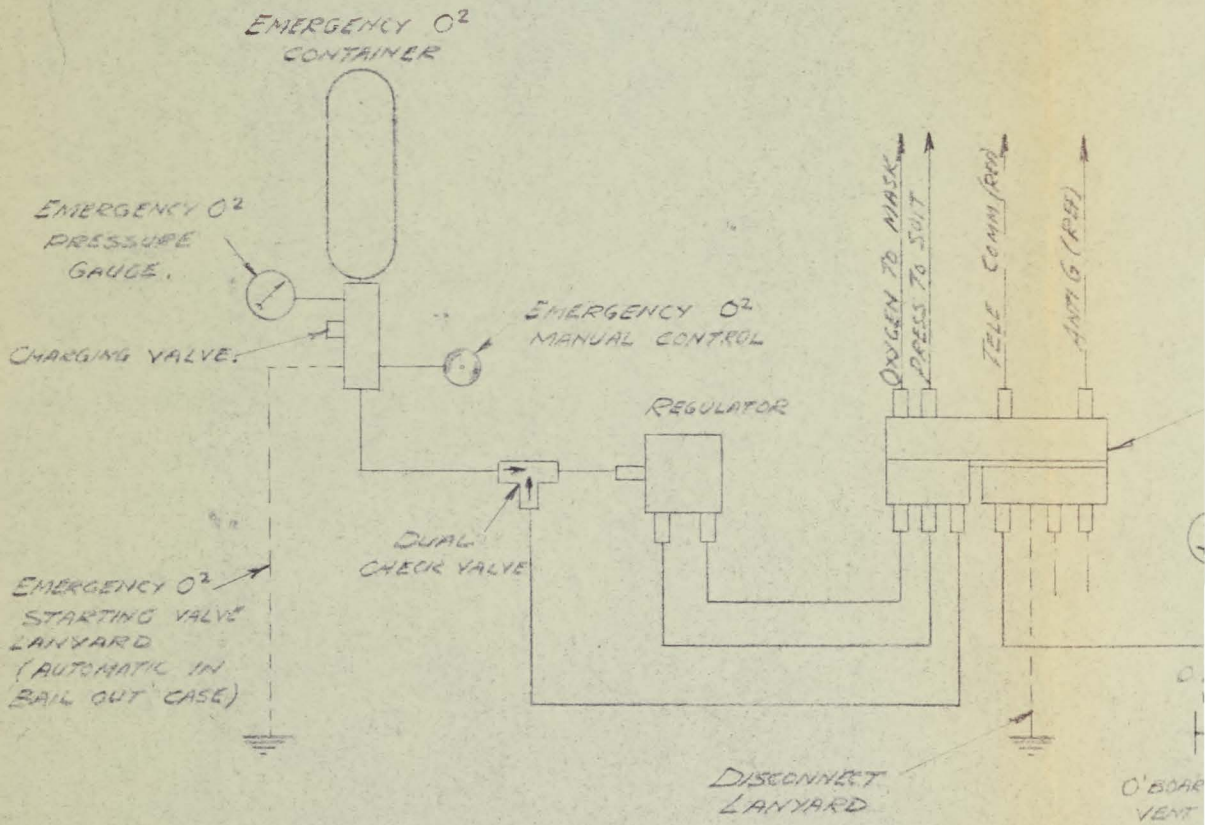


FIG. 1

SCHEMATIC-
LIQUID OXYGEN CONVERTER.

BROCHURE 0-1

PILOT


EMERGENCY O² CONTAINER
EMERGENCY O² PRESSURE GAUGE.
CHARGING VALVE.
EMERGENCY O² MANUAL CONTROL
REGULATOR
OXYGEN TO MASK
PRESS TO SUIT
TELE COMM (REF)
ANTI G (REF)
DUAL CHECK VALVE
EMERGENCY O² STARTING VALVE LANYARD (AUTOMATIC IN BAIL OUT CASE)
DISCONNECT LANYARD

SCHEMA

COMPLETE OXYGE

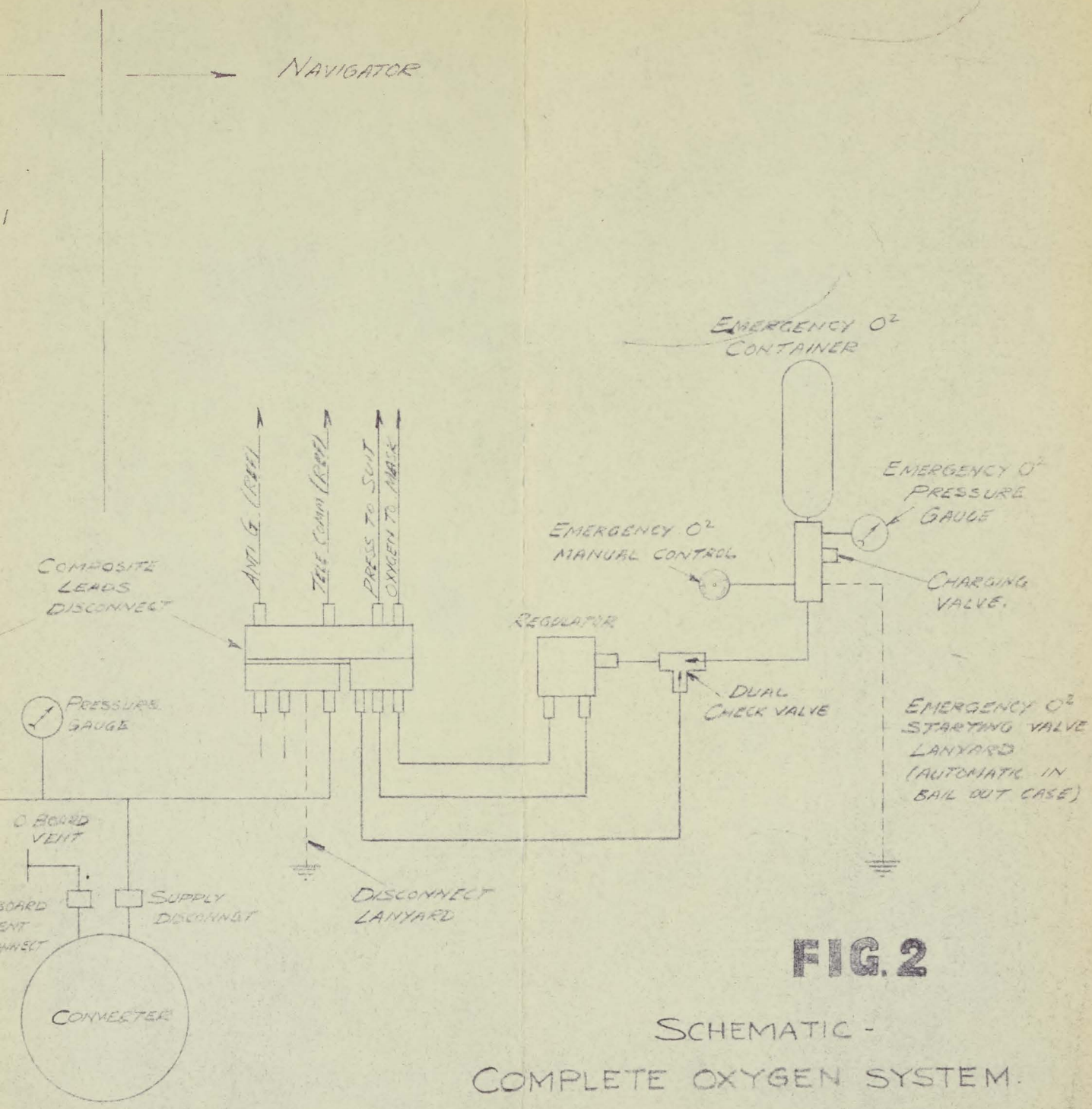
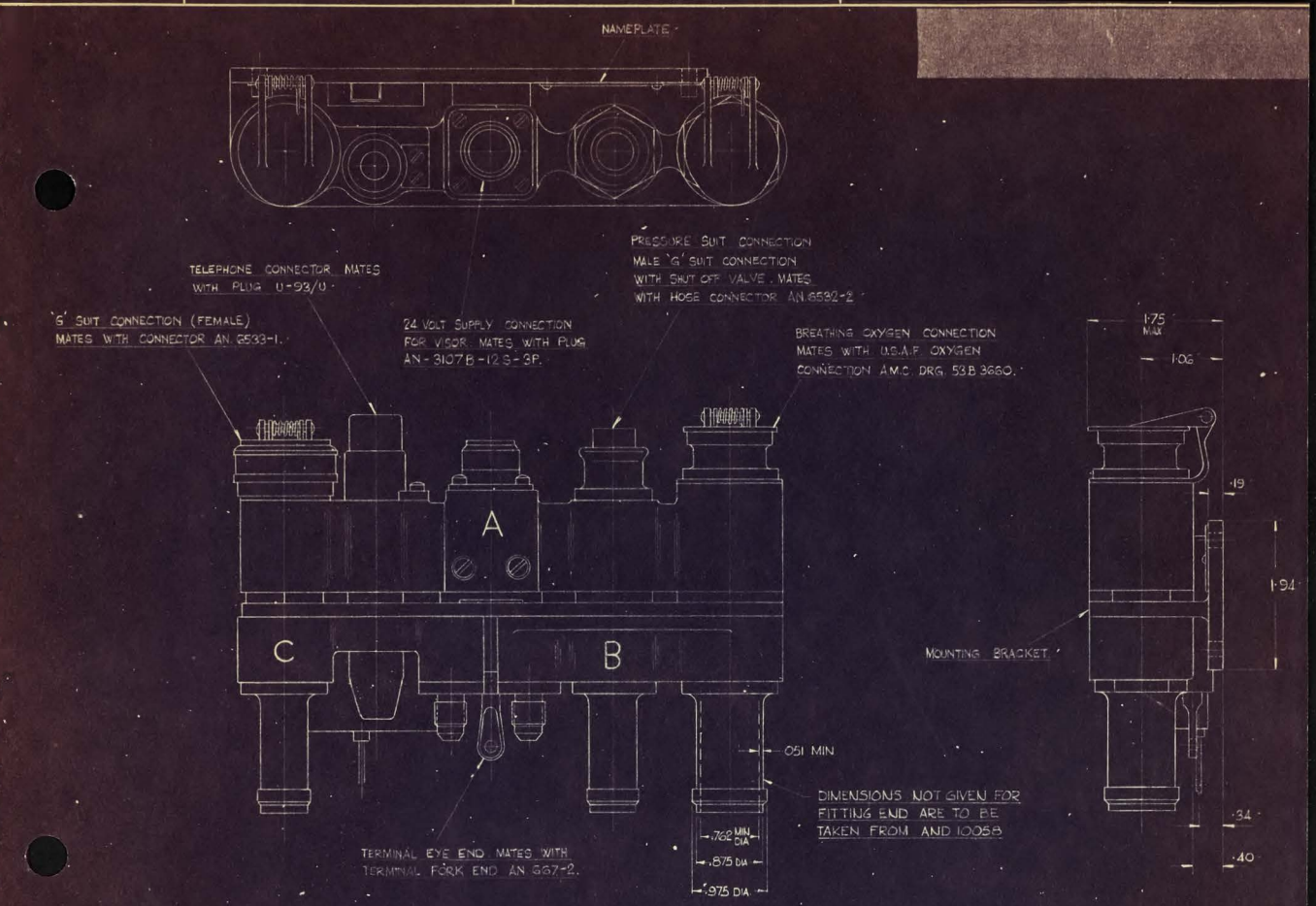


FIG. 2

SCHEMATIC -

COMPLETE OXYGEN SYSTEM.

BROCHURE 0-1.



COMPOSITE LEADS DISCONNECT

FIG. 3.

BROCHURE 0-1

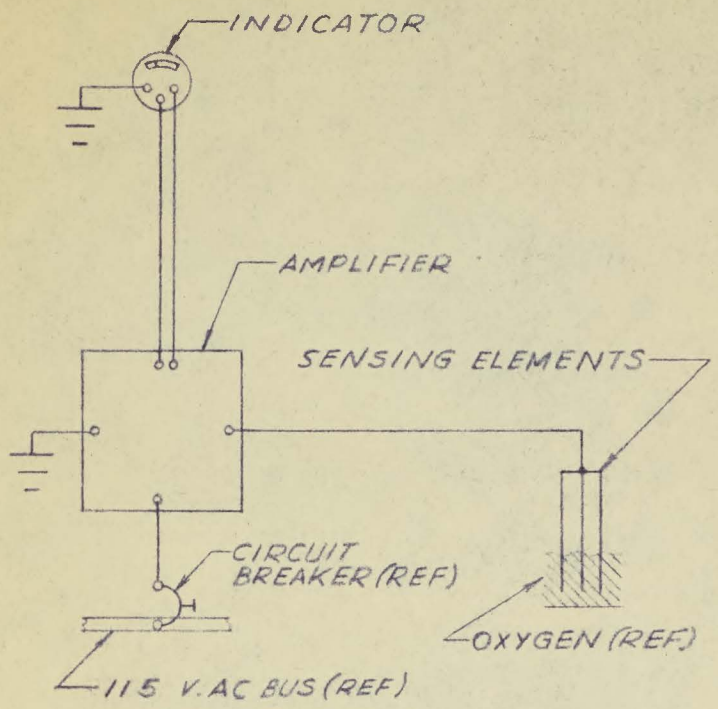
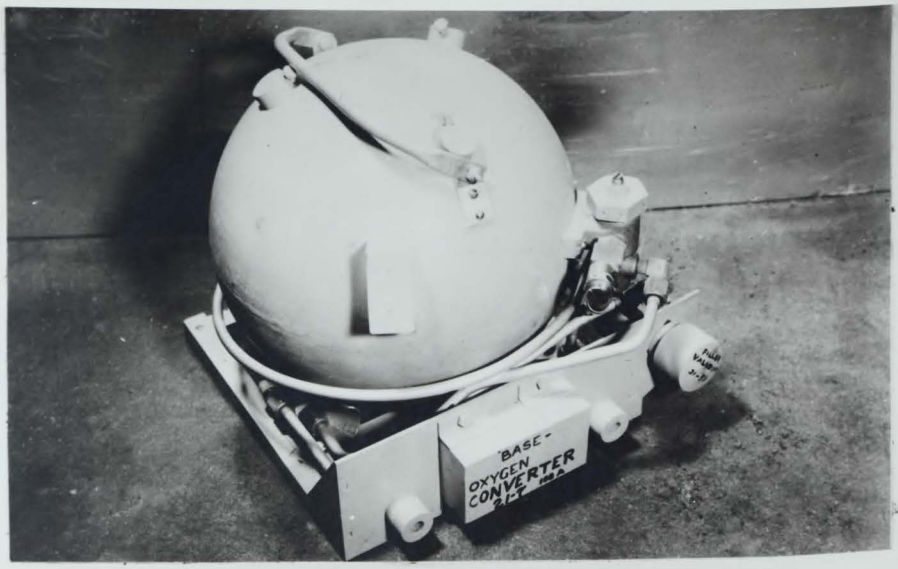
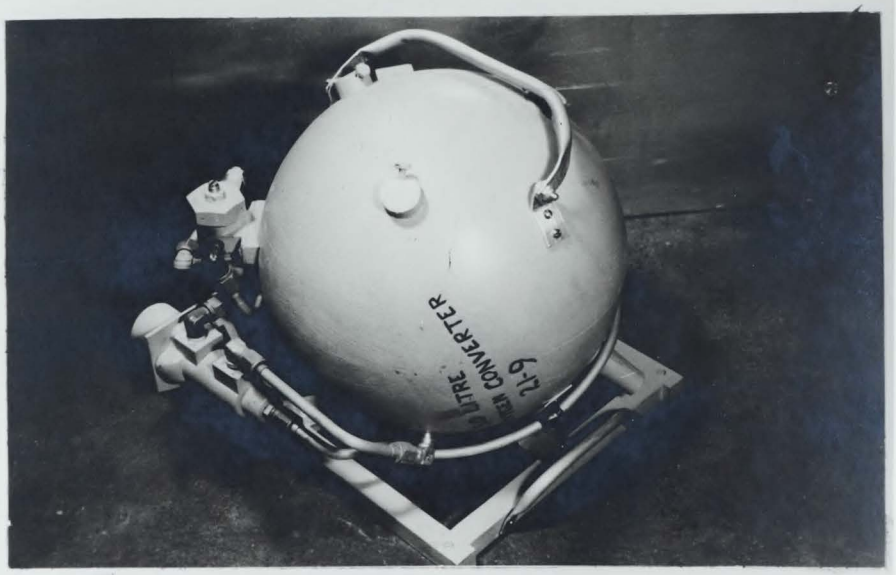


Figure 4

BASIC WIRING DIAGRAM - QUANTITY GAUGING SYSTEM.



A. 50 LITER LIQUID OXYGEN CONVERTER MOCK UP.
3/4 VIEW ON FRONT.



B. 5-0 LITER LIQUID OXYGEN CONVERTER MOCK UP.
3/4 VIEW ON REAR.

FIG. 5
50 LITER LIQUID OXYGEN CONVERTER
MOCK UP

A. MOCK UP OF CONVERTER IN INSTALLED POSITION.

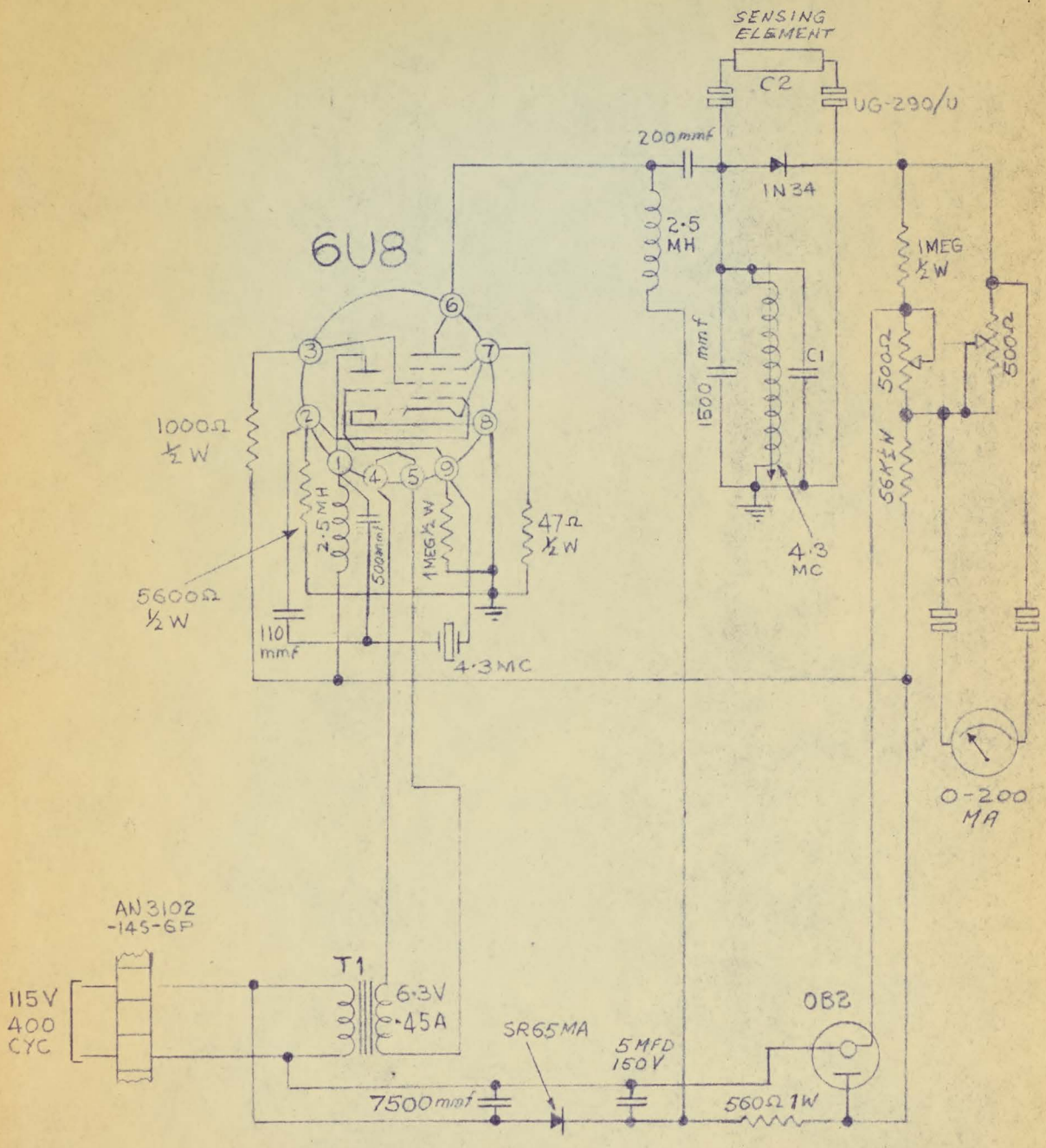
B. CONVERTER IN PROCESS OF REMOVAL.

FIG. 6

INSTALLATION AND REMOVAL
OF CONVERTER.

LIQUID OXYGEN QUANTITY GAUGING SYSTEM

FIG. 7



BROCHURE 0-1