

C141A



CREW & TROOP OXYGEN SYSTEMS

**443d TECHNICAL TRAINING SQUADRON
443d MILITARY AIRLIFT WING, TNG (MAC)
ALTUS AIR FORCE BASE, OKLAHOMA**

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INTRODUCTION

From this program booklet you will learn facts about the oxygen systems installed on the C-141A aircraft that could very well save your life someday.

This aircraft is equipped with two complete independent oxygen systems; a system for the crew called the crew oxygen system and a system for the personnel riding in the cargo compartment referred to as the troop oxygen system. The troop oxygen system incorporates the therapeutic oxygen system.

During flight the aircraft is normally pressurized and oxygen is not required, however oxygen is stored aboard the aircraft and is immediately available during an emergency.

The systems are discussed in the following sequences and overlapping can be expected in some areas to complete the relationship and "tie-in" between the various units.

1. Crew Oxygen System
2. Troop Oxygen System
 - a. Therapeutic Oxygen System
3. Associated Equipment
 - a. Quick donning masks (crew)
 - b. Troop oxygen system masks (passenger)
 - c. Portable oxygen bottles
 - d. Smoke masks
 - e. Duration charts

C-141 CREW OXYGEN SYSTEM

A. Objectives

Upon completing the crew oxygen system in this booklet you will be able to:

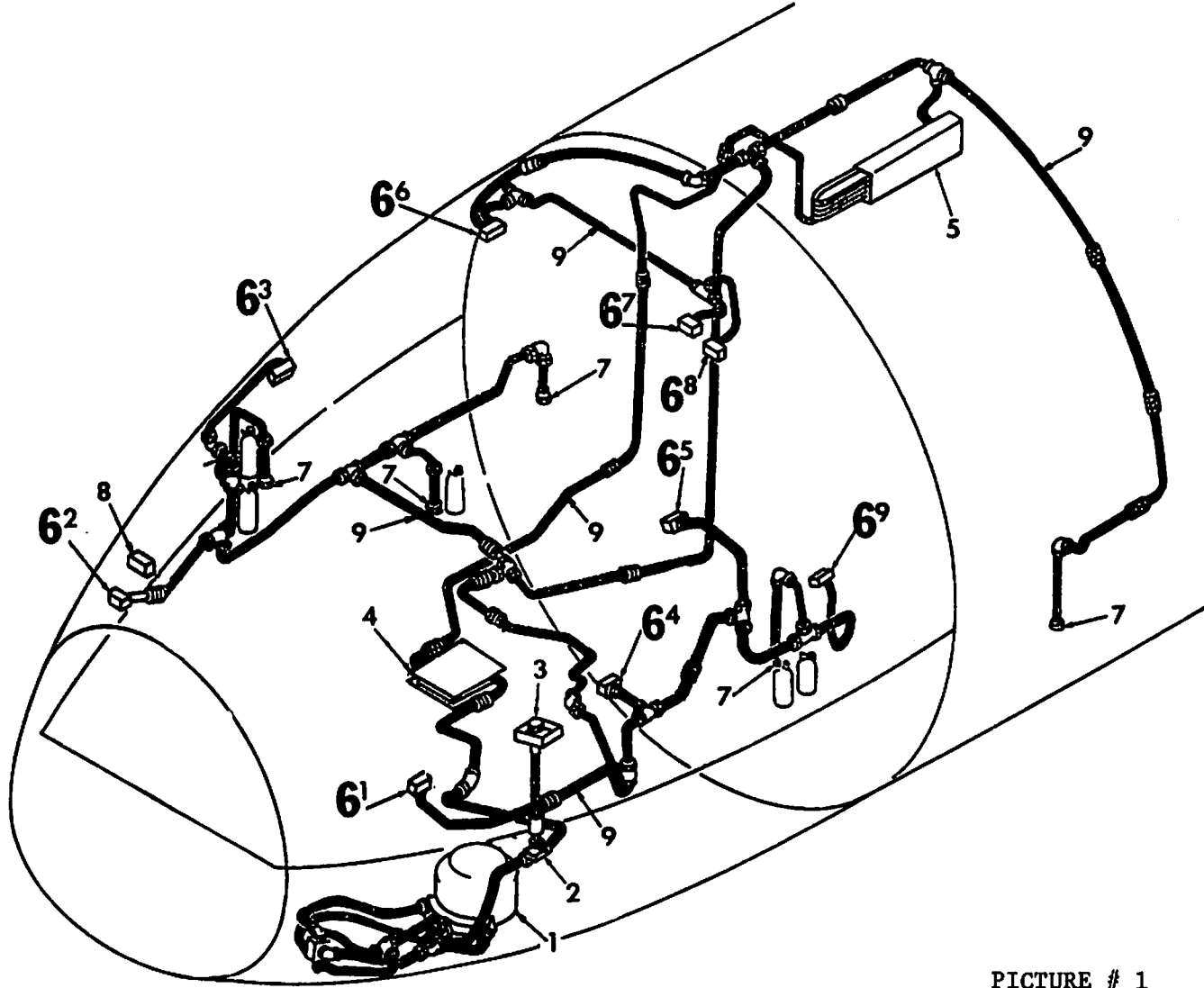
1. State the purpose of the crew oxygen system.
2. Locate the major components.
3. State the purpose of each component.
4. Identify the warning indications.
5. State the capacity of the converter.
6. State the normal system pressure.
7. Identify the toggle levers on the regulator.
8. State the position of the toggle levers during normal pressurization flights.
9. State the purpose of the recharger hoses.
10. Compute oxygen duration using charts from the -1 T.O.

B. Description

During flight the aircraft normally is pressurized and the crew and passengers do not require oxygen except in an emergency. Liquid oxygen is stored aboard the aircraft and is converted to gaseous oxygen and is immediately available in case of:

1. Loss of cabin pressure.
2. Smoke or toxic fumes.
3. Injury or fatigue crew member.

The crew oxygen system consists mainly of a 25 liter converter, a manifold, a system regulator, isolation valve, heat exchanger, warm-up coil, quantity indicator, nine crew oxygen regulators, and five recharger hoses.



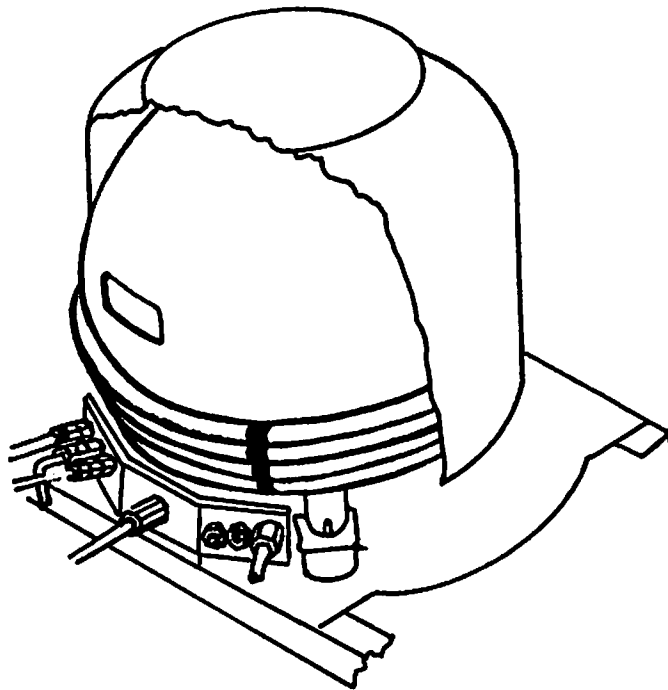
PICTURE # 1

1. Liquid oxygen converter.
2. Manual shutoff valve in wheel well.
3. Manual shutoff valve handwheel located on the aft end of pilot's side console.
4. Heat exchanger - left under deck area.
5. Oxygen warming coil - forward end of cargo compartment.
6. Crew oxygen regulator
7. Portable oxygen bottles and recharger.
8. Liquid quantity indicator on aft end of co-pilot's side console.
9. Oxygen manifold.

- | | |
|----------------|----------------------------|
| 6-1 Pilots | 6-6 Second Engineer |
| 6-2 Co-Pilots | 6-7 Bunk |
| 6-3 Engineers | 6-8 Bunk |
| 6-4 Check Seat | 6-9 Aux crew seat |
| 6-5 Navigators | left of crew entrance door |

The 25 liter (26.425 quarts) liquid oxygen is stored in a converter located in the nose wheel well area on the left side and is inclosed in a fiberglass cover.

The converter is serviced through a combination fill buildup-vent-valve contained in a filler box adjacent to the converter, but is accessible through a door on the left side of the nose of the fuselage. The converter is equipped with a drain valve and is located in the lower left side of the nose wheel well area and vents overboard through the skin adjacent to the filler valve.



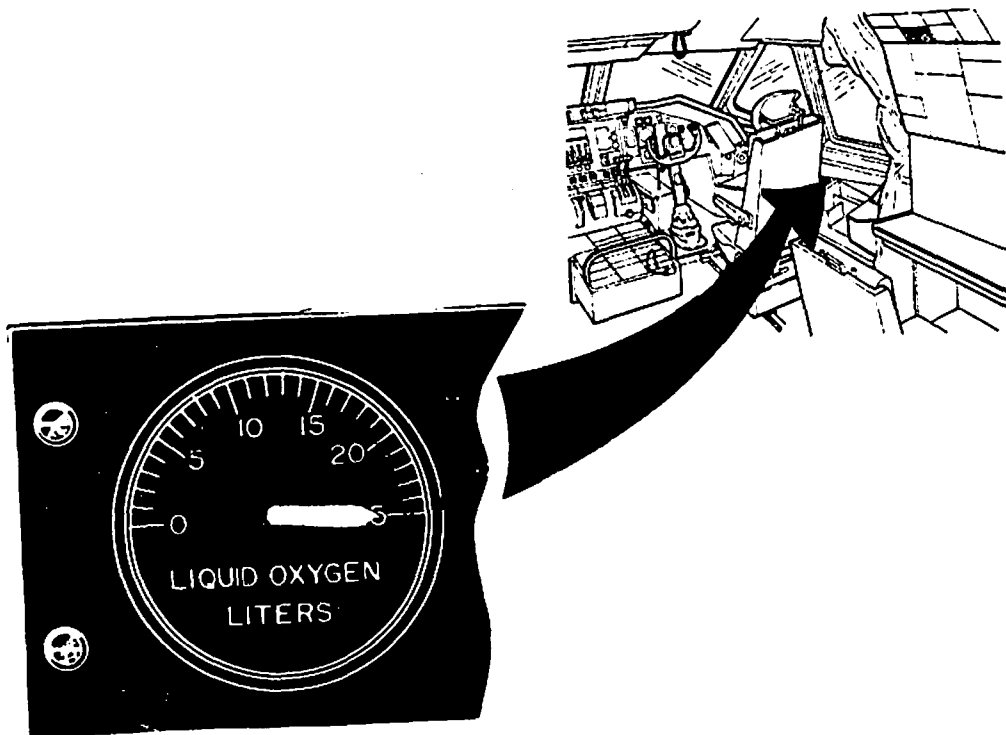
CREW LIQUID OXYGEN CONVERTER

PICTURE #2.

The operation of the combination fill-buildup-vent valve is automatic, and charging of the oxygen system is accomplished automatically upon completion of the filling operation.

The liquid oxygen is converted to gaseous oxygen by the thermal process and pressurizes the manifold through a system pressure regulator and vent valve. The system pressure regulator is an integral part of the fill-buildup-vent valve unit and is set to open when oxygen pressure increases to 300 PSI and closes at pressures below 300 PSI. The purpose of this minimum range setting is to assure sufficient pressure in manifold to service the portable oxygen bottles when needed. Normal system pressure in the manifold ranges from 300 to 430 PSI. A period of at least 30 minutes should be allowed between servicing and takeoff for oxygen stabilization.

This 25 liter converter is equipped with a capacitance type quantity indicator (picture 3) which permits monitoring of the supply of liquid oxygen in the converter, and is located on the aft end of the copilot's side console. This quantity indicator is connected to the annunciator and master caution light warning system and will illuminate when the quantity of the converter decreases to a level of 2.5 liters (10% of total quantity) remaining and alert the pilots that the quantity of oxygen is dangerously low.

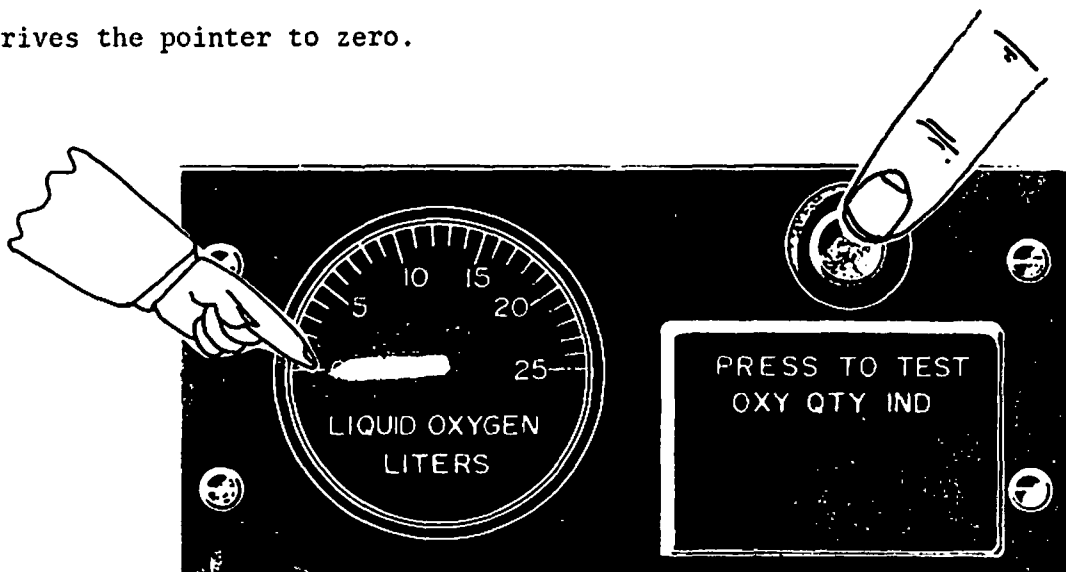


QUANTITY INDICATOR

LOCATED ON AFT END OF CO-PILOT'S SIDE CONSOLE.

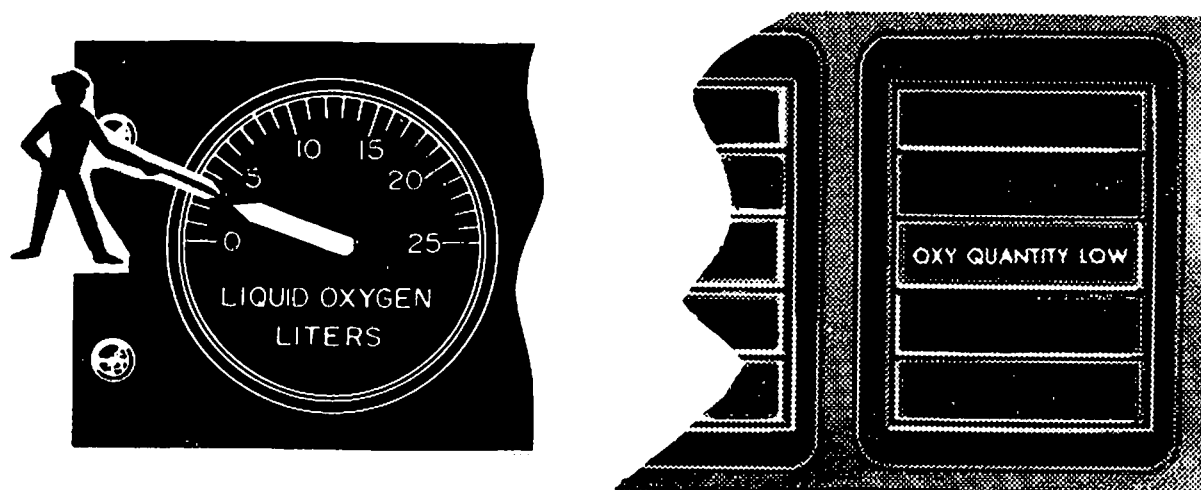
PICTURE #3

A push to test switch adjacent to the indicator, when depressed drives the pointer to zero.



PICTURE #4

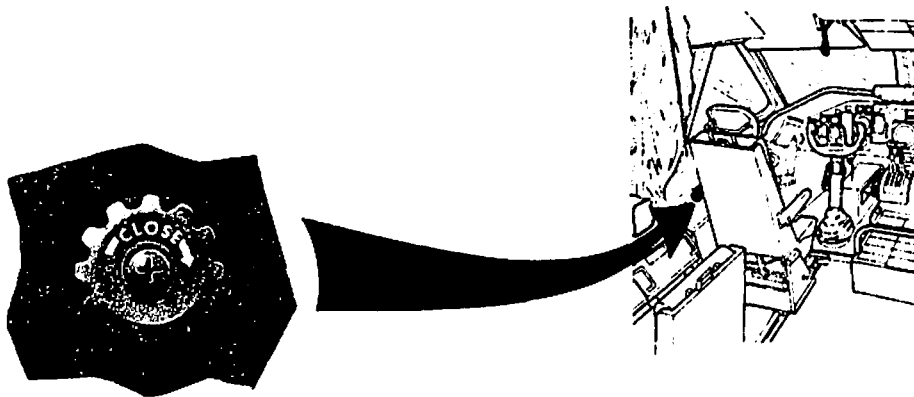
A "push to test" button is located on the quantity indicator panel and is used for functional testing of the quantity indicator. Testing of the indicator can be accomplished in flight as well as on the ground by pushing in on the "push to test" button and held in. The needle in the gage senses an empty converter and seeks zero. Upon reaching 2.5 liters, and a function of the needle, the warning lights, will illuminate. Release the finger from the button and the needle will return to the original quantity in the converter. Upon passing warning range (2.5 liter) level towards full, the warning lights will extinguish.



PICTURE #5

AN OXY QUANTITY LOW warning light located on the pilot's annunciator panel illuminates when the liquid oxygen quantity drops to approximately 2.5 liters.

Down stream from the system pressure regulator and system pressure relief valves but still in the nose wheel area is an oxygen manual shutoff valve. Sometimes this valve is referred to as an oxygen isolation valve; in either case this valve is used to shut off the gaseous oxygen from the

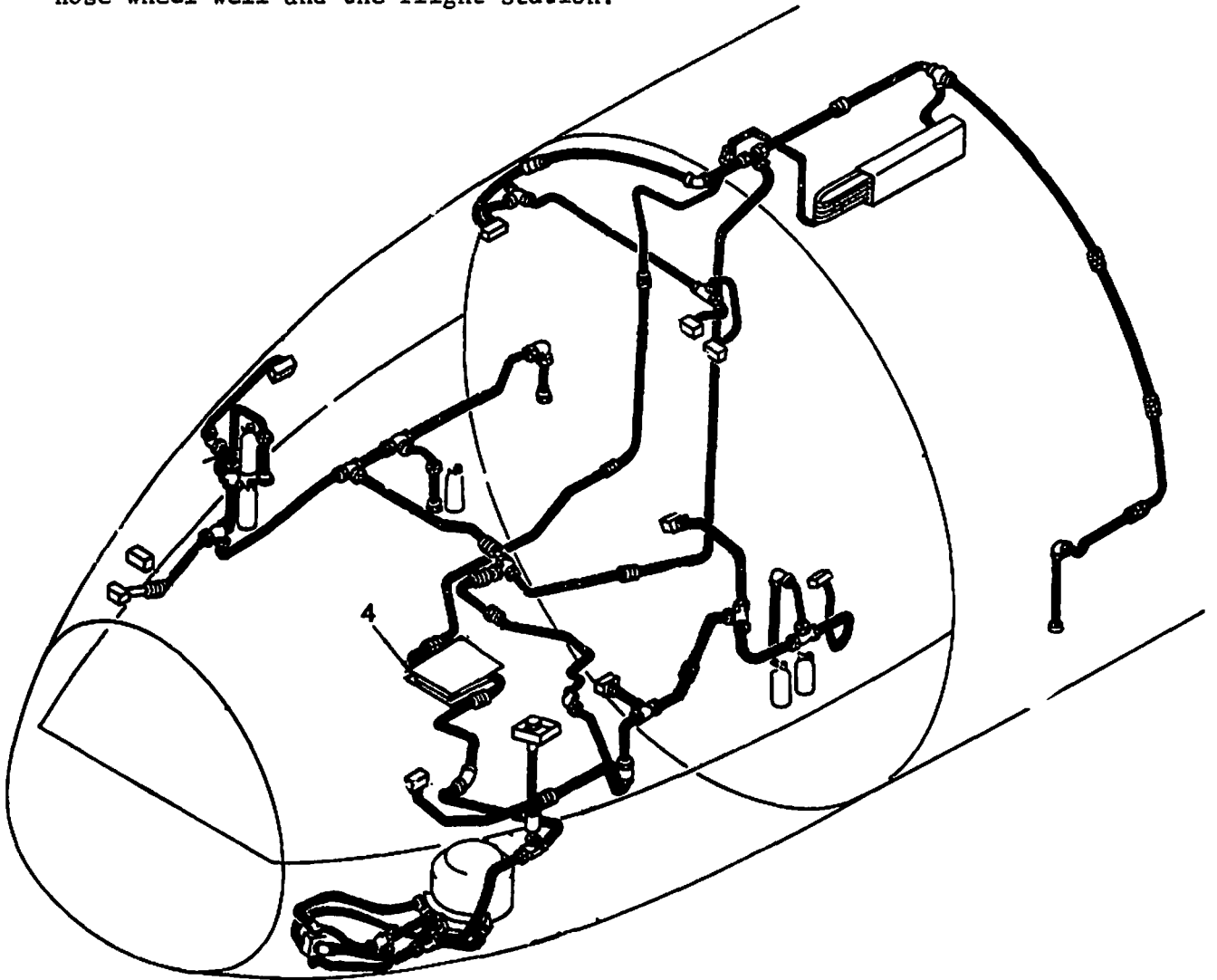


PICTURE #6

A HANDWHEEL located aft of the pilot's side console operates a MANUAL SHUTOFF VALVE which isolates the converter during emergencies or maintenance operation.

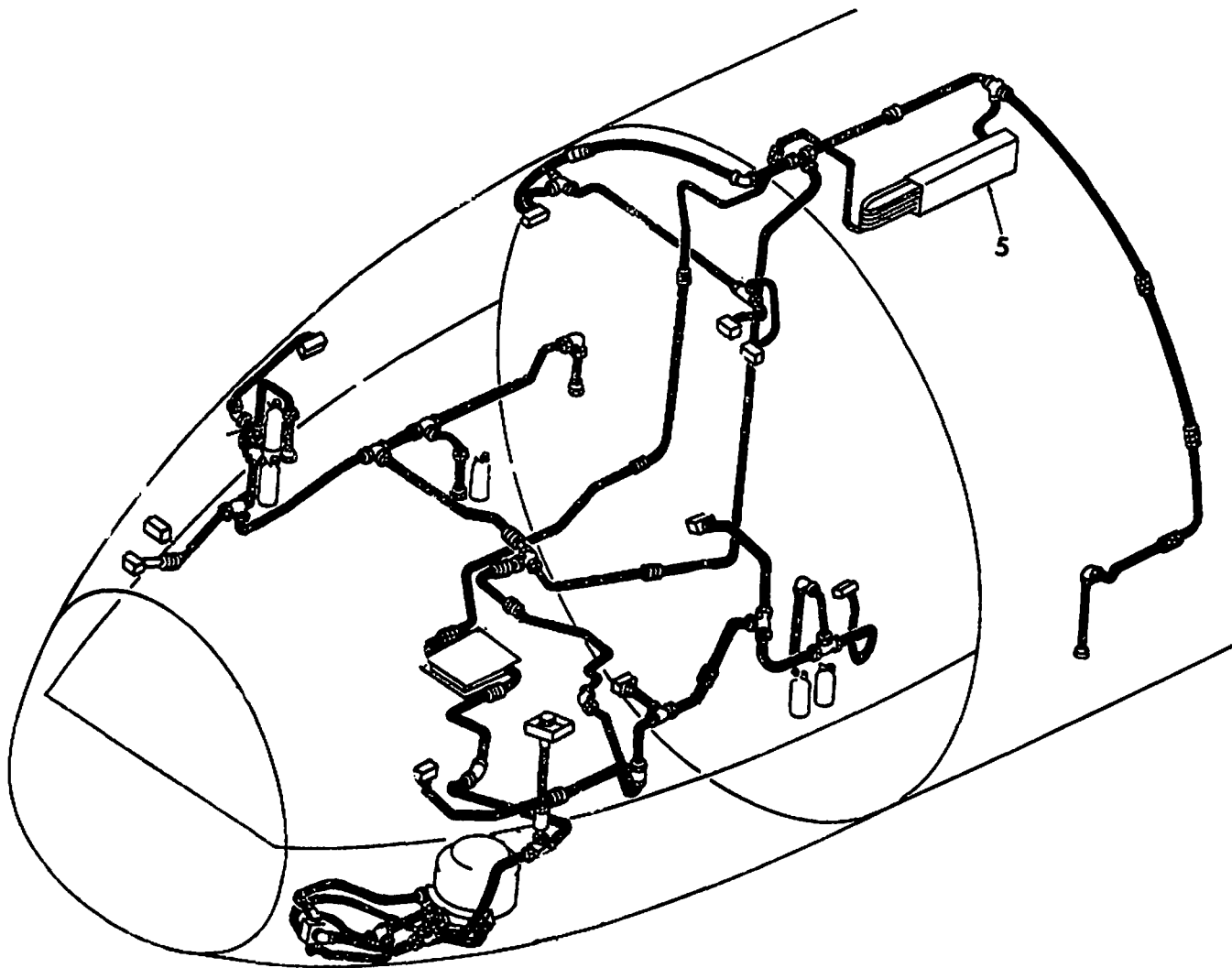
manifold in the event of a down stream leak or fire and/or upon anticipating a crash landing. This isolation valve is operated by a hand wheel located on the aft end of the pilot's side console. The hand wheel is mounted on one end of a long shaft that extends through the rest of the flight station, through the left under deck area, and into the nose wheel area and connects to the shutoff valve. To close the valve the hand wheel is rotated in the clockwise direction. The valve is normally safety wired to the open position with soft, copper wire. This same valve is also used for maintenance activities.

Next in line down stream from the shutoff valve is the heat exchanger, located in the left underdeck area. This area is between the flight station floor and the top of the nose wheel well, otherwise, sandwiched between the nose wheel well and the flight station.



HEAT EXCHANGER LOCATED IN LEFT UNDER DECK AREA PICTURE # 7

This heat exchanger is nothing more than the manifold rolled in a coil allowing the gaseous oxygen to be exposed longer to the warmer ambient temperature. The electronic equipment located in the left underdeck area generates a considerable amount of heat which helps in warming the gaseous oxygen.

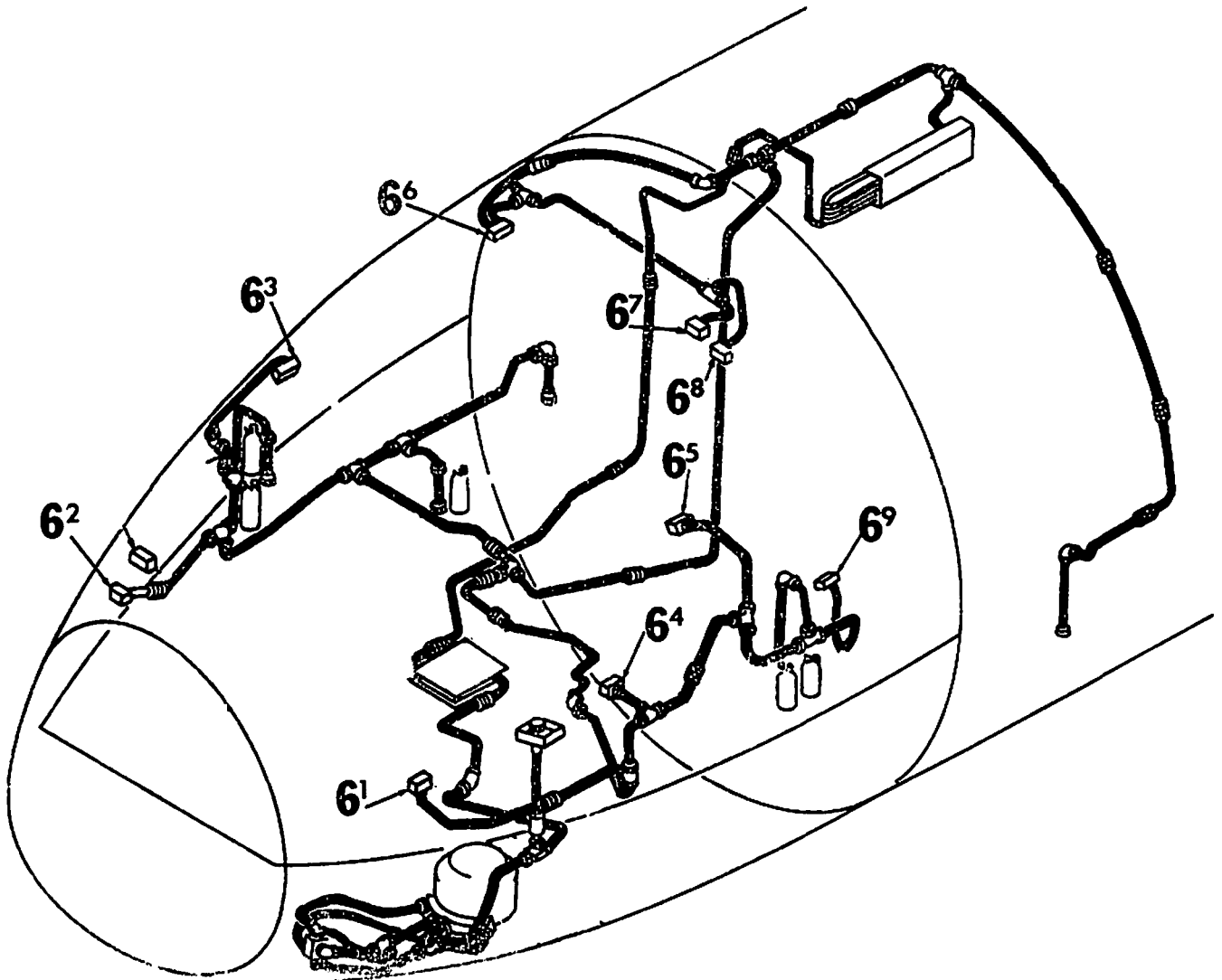


5. OXYGEN WARMING COIL - FORWARD END
OF CARGO COMPARTMENT

PICTURE # 8

So down stream, located in the forward end of the cargo compartment overhead is a warm-up coil - again using only ambient temperature of the cargo compartment to further warm up the gaseous oxygen for comfort breathing.

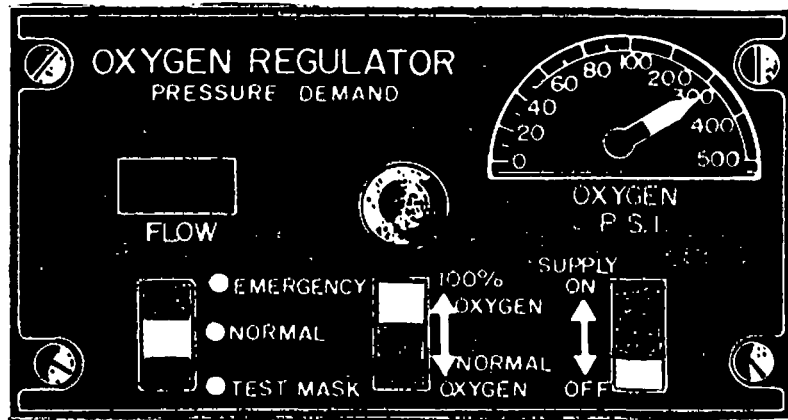
From the warm-up coil the oxygen is routed to nine oxygen regulators.



CREW OXYGEN REGULATORS PICTURE # 9

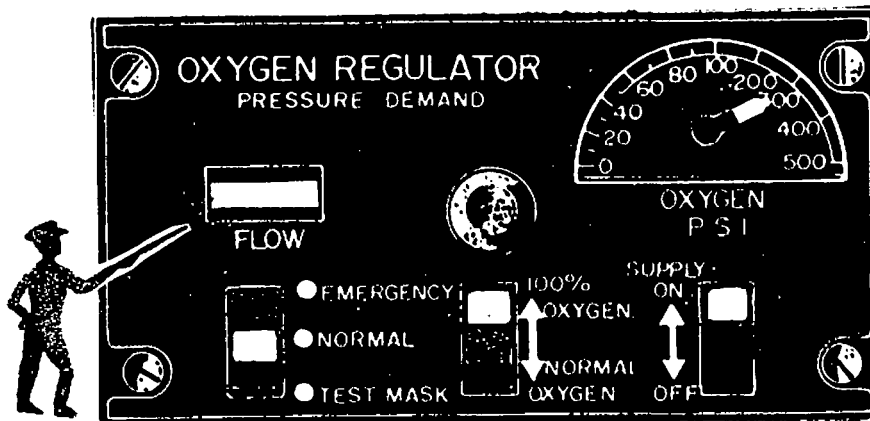
A diluter demand pressure breathing regulator is installed at each of the following stations:

- | | | |
|------------|---------------|---|
| 1. Pilot | 3. Check Seat | 5. Flight Engineer |
| 2. Copilot | 4. Navigator | 6.7.8.9. Lower bunk and auxiliary crew seats. |



PICTURE # 10

A pressure gage 0-500 PSI. Normal system pressure is 300 to 430 PSI.
 A supply lever ON-OFF.



PICTURE # 11

The middle lever is a TWO POSITION DILUTER LEVER (NORMAL and 100% OXYGEN). In "NORMAL OXYGEN" air and oxygen are automatically delivered to the user by the regulator. In "100% OXYGEN" the regulator delivers 100% oxygen to the user.

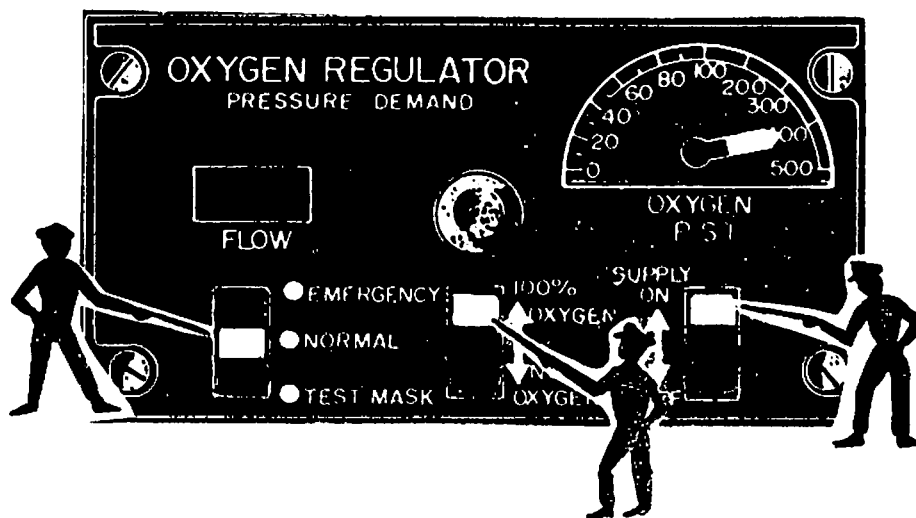
The EMERGENCY LEVER Has three positions:

1. Emergency
2. Normal
3. Test Mask

DURING FLIGHT, the positions of the levers are:

1. Supply lever ON.
2. Diluter lever to 100% OXYGEN
3. Emergency lever to NORMAL.

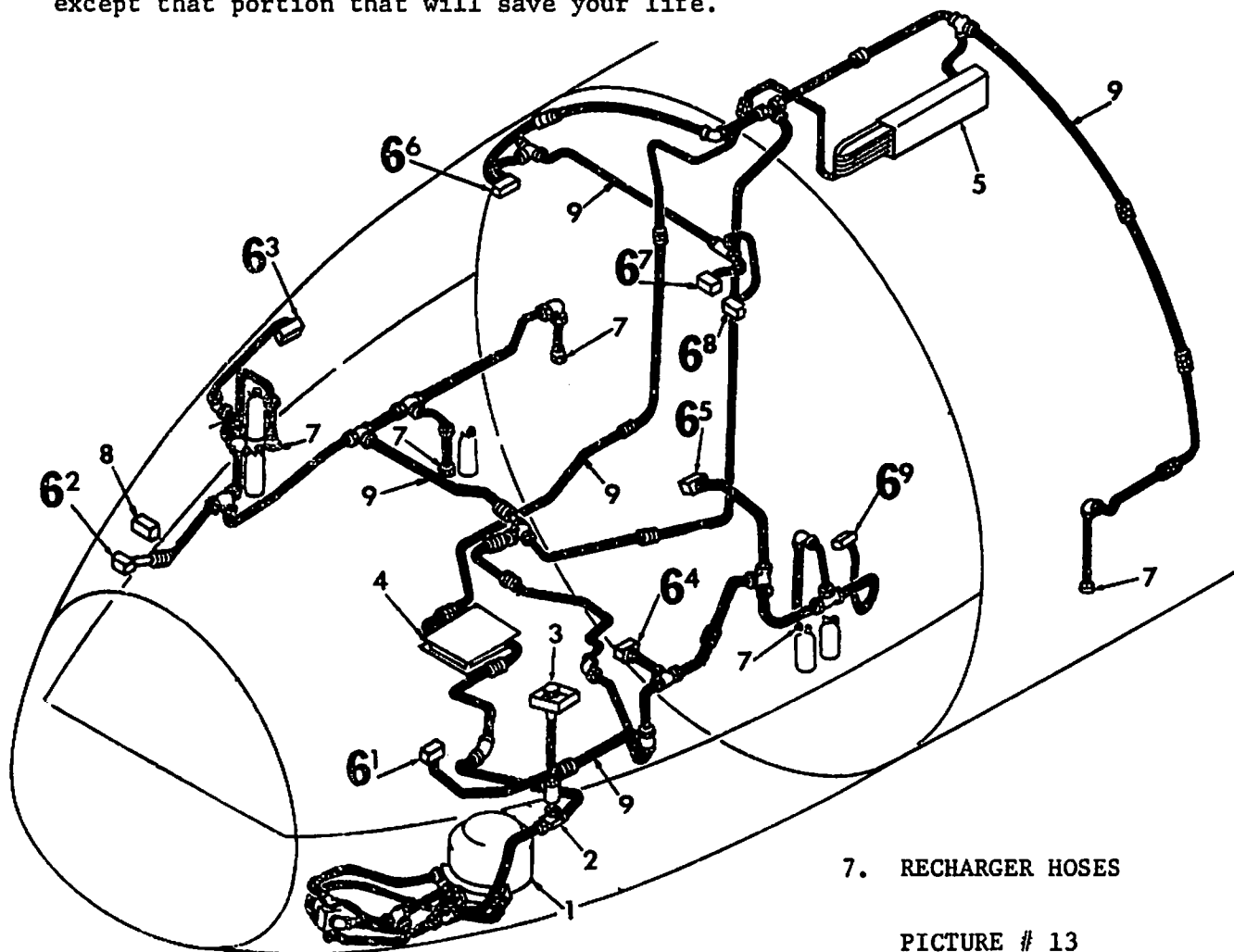
This will allow immediate use of 100% OXYGEN when needed.



PICTURE # 12

The C-141 aircraft is equipped with five recharger hoses used to service portable oxygen bottles. The location of the recharger hoses connected to the crew oxygen system (see picture 12) is; a recharger hose located just aft of the navigator's station - left, a recharger hose located just aft of the copilot or just forward of the engineer's seat along with two portable oxygen bottles, a recharger hose along with a portable oxygen bottle and a fire fighter's mask (already hooked up) in the toilet (latrine), a recharger hose just aft of the crew entrance door, and a recharger hose just to the right of the latrine door. A total of five recharger hoses.

You will not be expected to remember any of the foregoing information except that portion that will save your life.



7. RECHARGER HOSES

PICTURE # 13

QUESTIONS

1. The crew oxygen system is equipped with _____ converter(s) and the capacity of the converter(s) is _____.

2. The converter is isolated from the manifold by a shutoff valve located in the nose wheel but is controlled by a hand wheel located _____.

3. A heat exchanger and warm-up coil is installed in the crew oxygen system to warm up the oxygen for comfort breathing and they are located _____ and _____.

4. The crew oxygen system pressure is from _____ to _____.

5. The toggle lever positions during a normal pressurized flight are:
 - A. Supply lever _____
 - B. Diluter lever _____
 - C. Emergency lever _____

6. The crew oxygen system is equipped with _____ regulators.

7. How many recharger hoses are on the flight station? _____

8. What warnings are given when the oxygen quantity becomes low?

1. 1, 25
2. on the aft end of pilot's side console.
3. under deck area, cargo compartment
4. 300, 430 psi
5. A. On
B. 100%
C. Normal
6. 9 oxygen
7. 2
8. Master Caution and Annunciator Lights.

TROOP OXYGEN SYSTEM

The troop oxygen system supplies oxygen to passengers and/or troops riding in the cargo compartment during an emergency and also provides a supply of oxygen independently to the therapeutic oxygen system.

The objectives:

Upon completing the troop oxygen system in this booklet you will be able to:

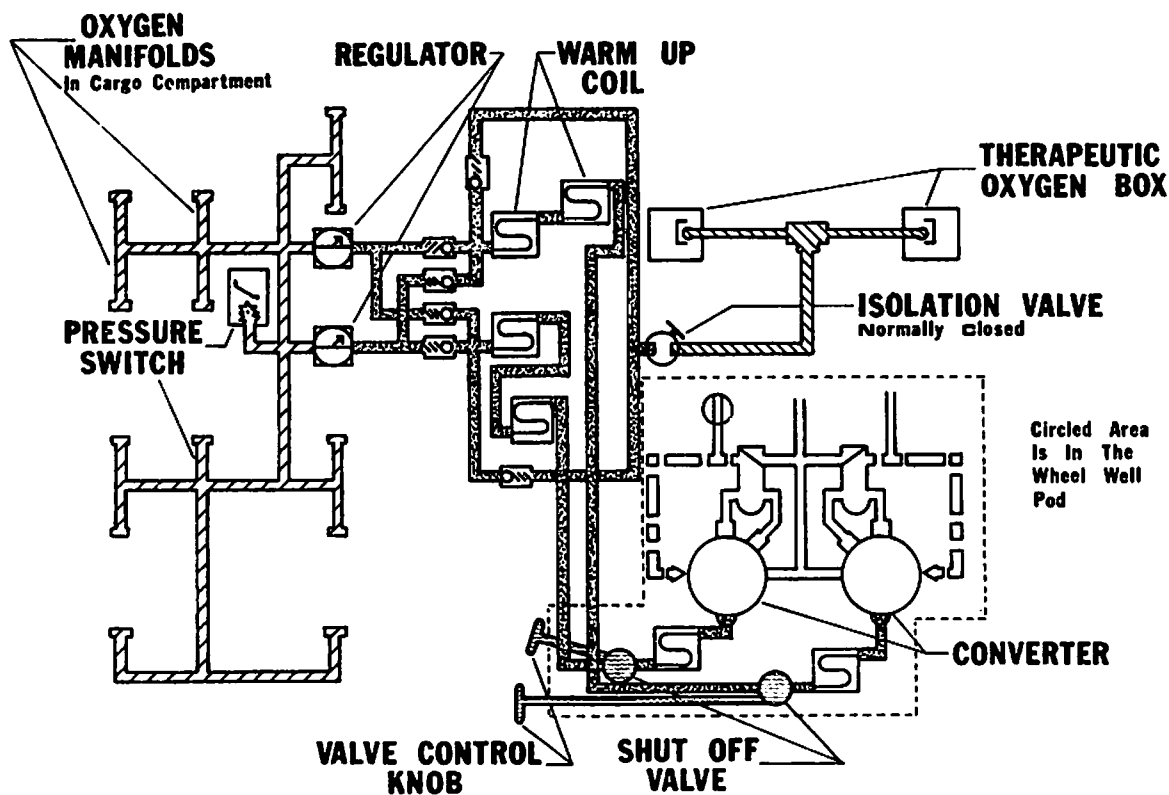
1. State the purpose of the troop oxygen system.
2. Locate the major components.
3. State the purpose of each component.
4. Identify low quantity warning indication.
5. State the capacity of each converter.
6. State how to test the warning indications.
7. State the function of the therapeutic oxygen system.
8. State the location of the recharger hoses.
9. Compute oxygen duration using the charts in -1 T.O.

Description of the Troop Oxygen System

The troop oxygen system is basically the same as the crew oxygen system. The difference being: The Troop System is larger utilizing the continuous flow system, and supplies oxygen independently to the therapeutic oxygen system; whereas the crew oxygen system supply is smaller and supplies oxygen to the crew members only, utilizing the diluter demand oxygen automatic pressure breathing regulators. These two oxygen systems are completely independent of each other.

The supply lines from the converters to the distribution regulators are interconnected through plumbing tees and check valves in a manner that allows each converter to supply oxygen to both distribution regulators. Each distribution regulator supplies oxygen to all three oxygen manifolds. Each distribution regulator is a backup for the other regulator should one fail. Each regulator is capable of supplying maximum flow.

TROOP OXYGEN SYSTEM

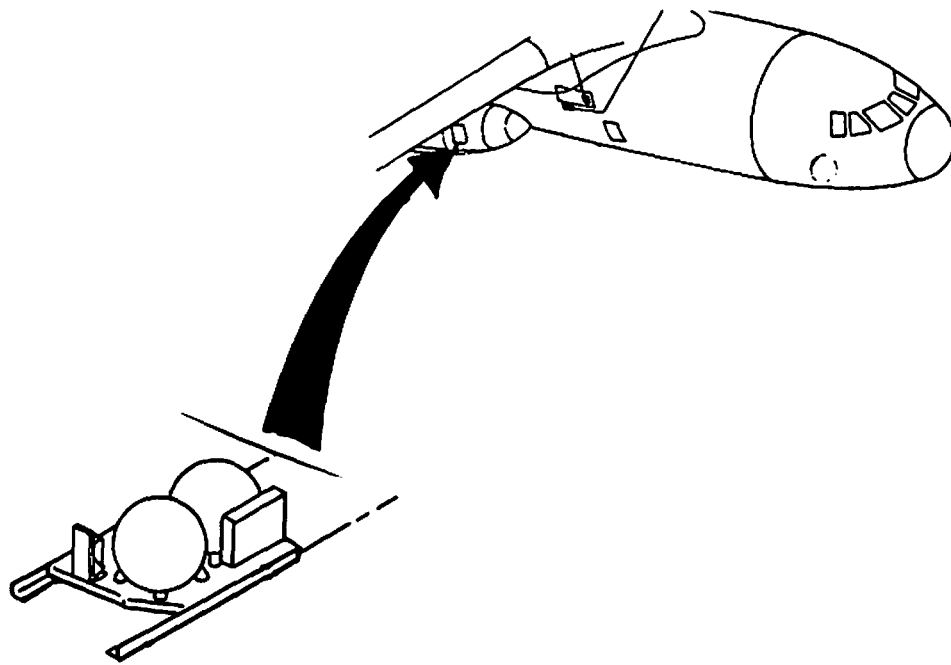


TROOP OXYGEN SYSTEM

PICTURE # 14

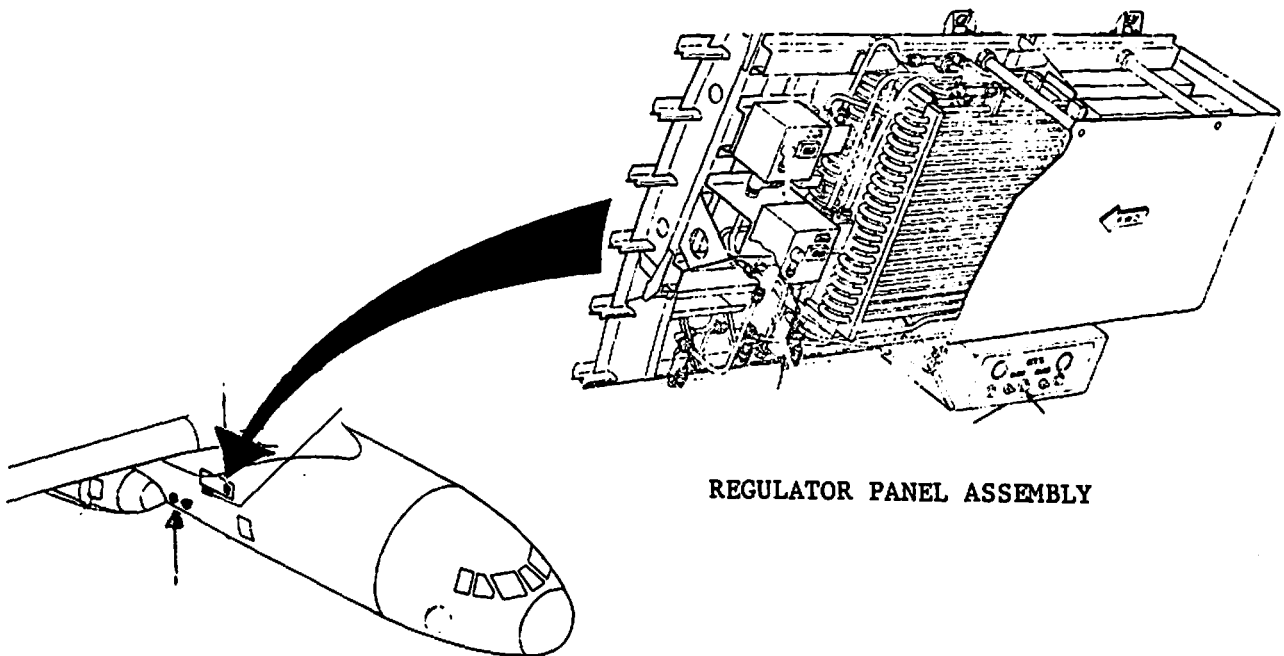
Two troop oxygen converters are located in the forward end of the right wheel well pod. Both converters are mounted on the same portable pallet. Each converter is equipped with a heat exchanger, a fill build-up vent valve, a system pressure regulator and a shutoff valve. The valves are controlled from inside the cargo compartment by small hand wheels, located on the right side of the cargo compartment. This system was designed to operate with one or both bottles, depending on the amount of oxygen required for the mission. Each bottle has a 75 liter capacity (total of 150 liters). NOTE: Both converter shutoff valves are to remain open at all times, even if one converter is installed - the valves can be closed in case of downstream leaks, fire or crash landing.

Supply lines connect the converter pallet assembly to a troop oxygen regulator control panel assembly located in the cargo compartment on the right side, about eye level, forward of the right wheel well area. This assembly incorporates a troop oxygen control panel, two oxygen regulators, warm-up coils, and a therapeutic oxygen shutoff valve. The therapeutic oxygen shutoff valve and the warm-up coils are protected by a fiberglass cover. The two oxygen regulators regulate the flow of oxygen into three oxygen manifolds: a manifold on each side of the cargo compartment, and a manifold overhead. The three manifolds extend almost the entire length of the cargo compartment providing a total of 154 oxygen outlets. The control panels have two quantity indicators, a "push to test" button for each, two low quantity warning lights, one "OXY ON" green light, bailout horn silencing button, and a test switch to test the warning light and bailout horn.



CONVERTER PALLET ASSEMBLY

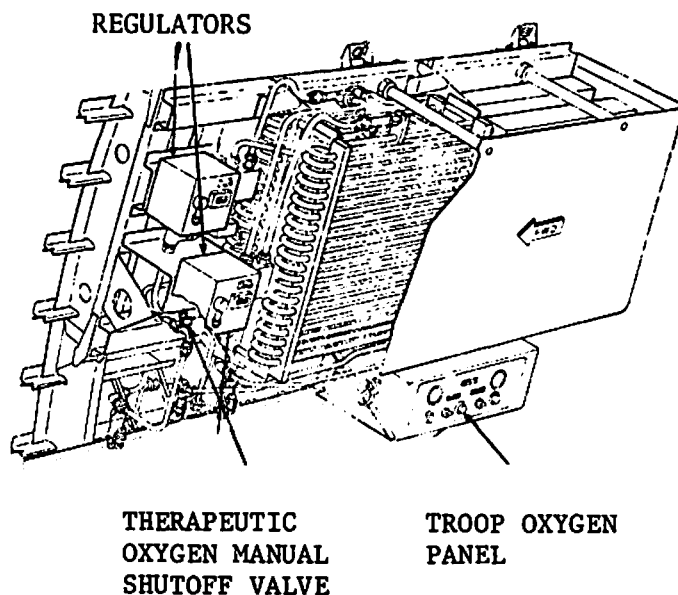
PICTURE # 15



REGULATOR PANEL ASSEMBLY

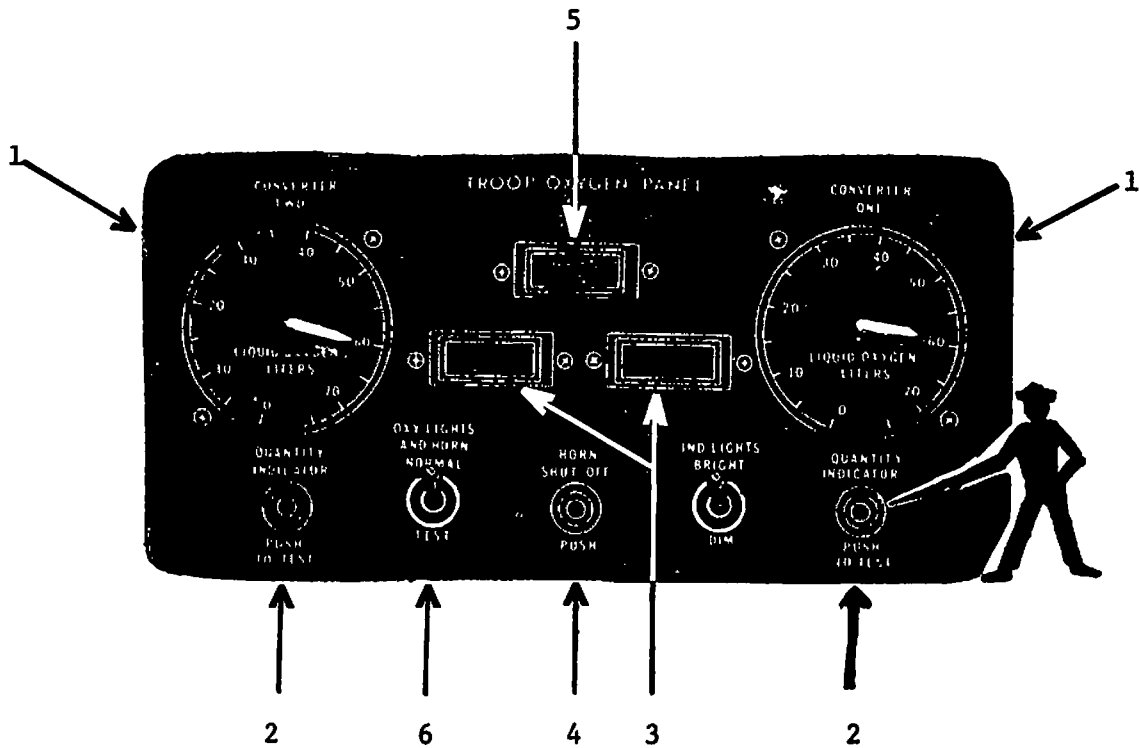
PICTURE # 16

The REGULATOR PANEL ASSEMBLY consists of two continuous flow regulators, four heat exchangers, a troop oxygen panel, and a manual shutoff valve for therapeutic oxygen.



PICTURE # 17

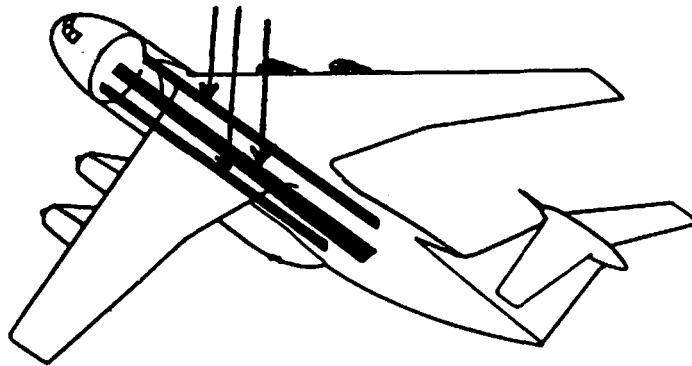
This system operates at a supply pressure from the converter to the distribution regulators located in the cargo compartment at a minimum pressure of 300 PSI. This supply is always available as long as liquid oxygen is in either converter - however there is no pressure gage provided to verify this. The integrity of this system has long been established, therefore a pressure gage is not necessary. The distribution regulators, when activated, will pressurize the three troop oxygen manifolds from approximately 29 PSI at low altitudes to 69 PSI at maximum altitudes, at a volumn flow adequate to supply a continuous flow of oxygen up to 154 passengers.



TROOP OXYGEN PANEL PICTURE # 18

1. Converter Quantity Indicators
2. Push to Test Button
3. Warning Lights for Low Quantity (7.5 liter)
4. Horn Shutoff Button
5. "OXYGEN ON" Light
6. Quantity Warning Oxygen On Lights and Bailout Horn Test Switch

The PERMANENTLY INSTALLED OXYGEN DISTRIBUTION SYSTEM consists primarily of distribution lines running along each side of the cargo compartment and along the center overhead. This system also has two manual shutoff valves which are operated from inside the cargo compartment, and self sealing outlets for attaching oxygen masks.



OXYGEN DISTRIBUTION MANIFOLDS

PICTURE # 19

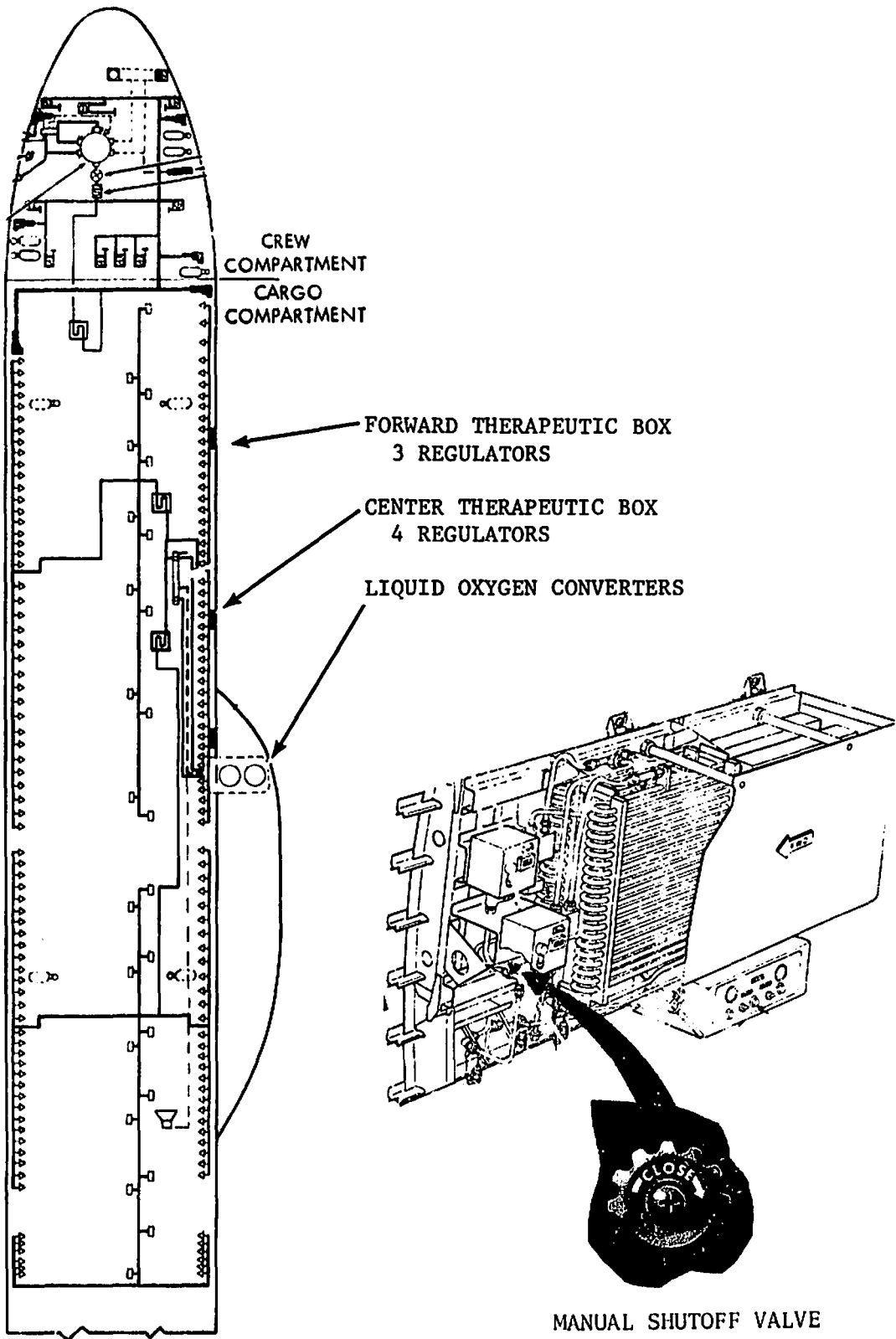
Aneroid type valves located in the distribution regulators are pre-set to open automatically upon sensing cabin altitudes (not aircraft altitude) of between 12,500 feet and 14,000 feet, pressurizing the three troop oxygen manifolds, and supplying constant flow of oxygen through each mask connected to the manifold. Pressure in the manifold activates a pressure switch located in the manifold and sounds the bailout horn, turns on the cargo white lights to full bright and illuminates an "OXYGEN ON" green light on the control panel. The bailout horn alerts the passengers that cabin pressure is being lost. The cargo lights are illuminated to full bright, regardless of the position of the light switch to make certain there is light to see how to don the oxygen masks, and to monitor each passenger's state of being. The "OXYGEN ON" light assures the loadmaster that manifolds are pressurized. The bailout horn can be, and normally is, silenced by pushing in on a button located on the bottom center of the control panel. The cargo lights remain on and will remain on full bright as long as the manifolds are pressurized. The "OXYGEN ON" light will also remain on as long as the manifolds are pressurized, but no warning as such to the flight station - there are other means to inform the pilots.

When the aneroid in the distribution regulators senses a cabin altitude of 11,500 feet, either by reestablishing pressurization or descending the aircraft through this altitude, the regulators will shutoff automatically, shutting off the "OXYGEN ON" light and allowing the cargo light to return to the condition the switches are selected. The regulators can be activated anytime, by turning a toggle lever type switch on the regulator to "ON". The bailout horn will sound cargo lights and oxygen on lights will illuminate.

The oxygen quantity low warning indication light illuminates at 10% total quantity, 7.5 liters.

Provisions for installation of SEVEN OXYGEN REGULATORS in two THERAPEUTIC BOXES, for patients, are located on the FORWARD and CENTER RIGHT SIDE of the cargo compartment. When regulators are installed a MANUAL SHUTOFF valve on the troop oxygen regulator panel allows oxygen flow to the patients from the troop converters. The forward box has provisions for three regulators. The aft box has provisions for four regulators.

The therapeutic oxygen system is supplied with oxygen from the troop oxygen system supply lines through a manual shutoff valve. When the shutoff valve is opened, the therapeutic oxygen manifold is pressurized at a minimum pressure of 300 PSI. The shutoff valve is normally closed when therapeutic oxygen is not required.



PICTURE # 20

Three portable oxygen bottle recharger hoses are installed on the therapeutic oxygen manifold and are located at stations 888, 1040, and 1188 on the right side of the cargo compartment. To service portable oxygen bottles from these outlets the manual shutoff valve must be opened - so on the way to the aft end of the cargo compartment, using a portable oxygen bottle, open the valve.

FLIGHT CREW QUICK DON OXYGEN MASKS

Each crew position is equipped with a quick don oxygen mask that is aircraft equipment. The oxygen mask suspension assembly is constructed in a manner that the mask is donned with headset on and the change over from microphone in headset to microphone in mask, is made automatically. Both microphones on at the same time create a condition that drowns out conversation. The masks are cleaned and adjusted for fit prior to flight. The mask is donned by taking the face mask in hand as you would a bill of a baseball cap. Place the suspension assembly above the head, hook the nape of the assembly on the base of the head, and pull mask assembly forward to the limit of the tensioner and then straight down. When the mask is released, the springs in the tensioner will snug the mask to the face. Adjustments for size are made at the nape bracket of the suspension assembly by adjusting the sizing strap.

Troop oxygen system masks for passengers riding the cargo compartment are furnished oxygen by using a mace mold plastic mask connected to an oxygen manifold with a plastic tube. When the oxygen manifolds are pressurized and a mask is connected, a constant flow of oxygen exists.

The crew member monitoring the passenger will connect only the masks required. An unused connected mask is losing oxygen.

PORTABLE OXYGEN BOTTLES

Portable oxygen bottles are placed aboard an aircraft to supplement the regular oxygen system in an emergency and/or to facilitate movements within the aircraft at high altitudes unpressurized. There are four portable oxygen bottles on the flight station. Two are located behind the navigator station at the left auxiliary crew set along with a recharger hose. Two are located behind the copilot's seat along with a recharger hose.

(1) A portable oxygen bottle, a fire fighter's mask connected to the oxygen bottle and a recharger hose are located in the latrine to support a crew member should he be stranded there in an aircraft depressurization.

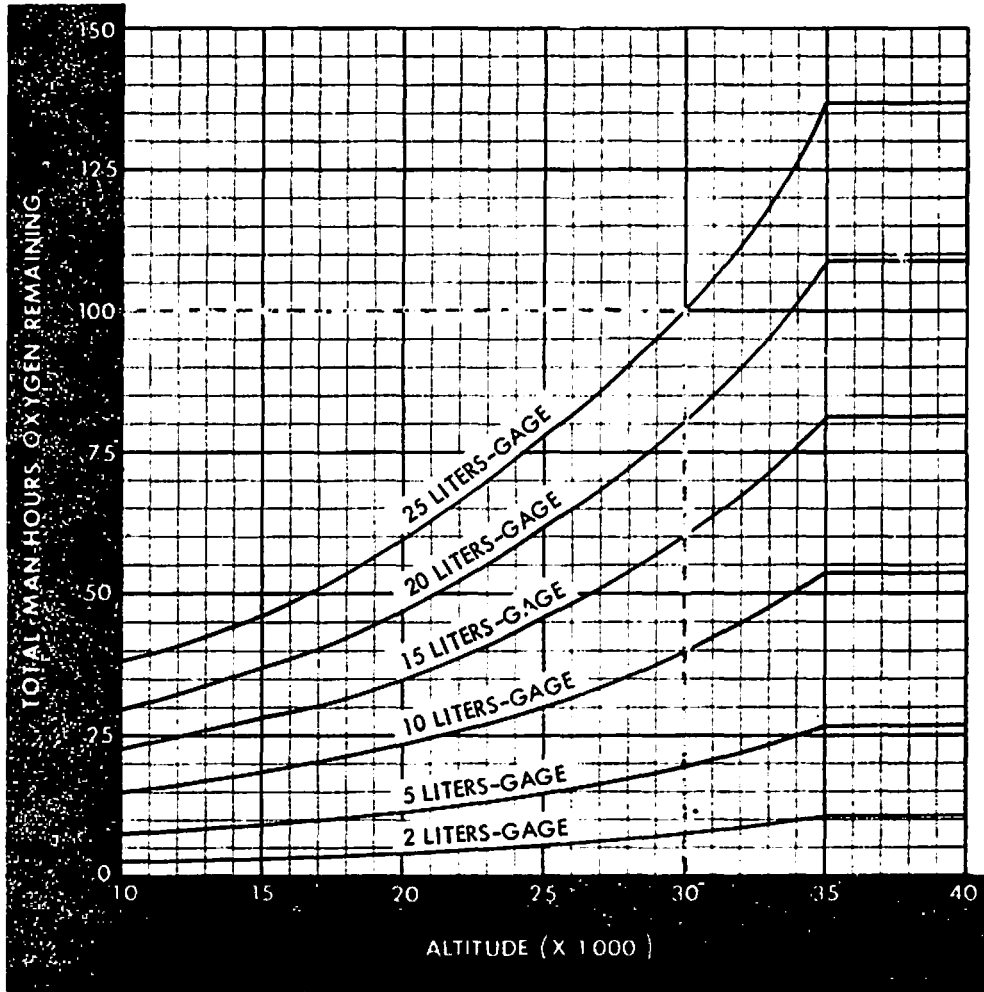
(2) Six bottles are carried in the cargo compartment. Two bottles are located in the overhead storage rack (crew rest) area and each bottle is equipped with an oxygen mask. A bottle is located immediately aft of the crew entrance door on the side of the fuselage and a bottle is mounted on the opposite side of the fuselage. Two more bottles are located immediately aft of the right troop door inside the compartment formed by the vertical support beam. The lower bottle is equipped with a smoke mask.

SMOKE MASKS

There are six smoke masks strategically located through out the aircraft. Four are located on the flight station, two behind the pilot and two behind the copilot. One mask is in the latrine connected to the portable oxygen bottle and one mask is in the aft end on the right side of the cargo compartment connected to a portable oxygen bottle.

DURATION CHARTS

CREW OXYGEN SYSTEM REGULATOR SETTING - '100%'



EXAMPLE

GIVEN:

CREW OF 8 MEN
ALTITUDE = 30,000 FT
OXYGEN INDICATOR READING = 25 LITERS GAGE

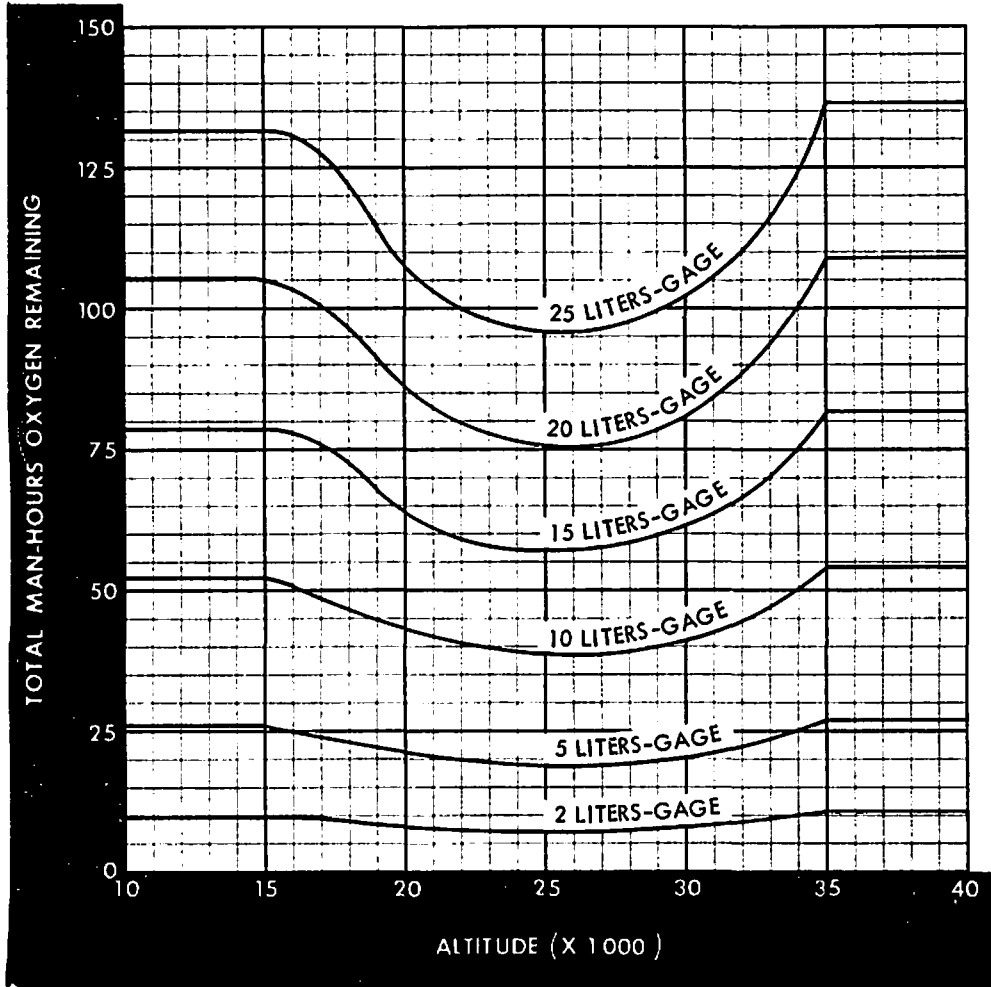
FIND:

OXYGEN DURATION

SOLUTION:

ENTER CHART AT 30,000 FT AND PROCEED VERTICALLY TO THE 25 LITERS-GAGE CURVE. READ TO THE LEFT ON TOTAL MAN HOURS OXYGEN REMAINING = 100 TOTAL MAN HOURS. DIVIDE TOTAL MAN HOURS BY THE NUMBER OF CREW MEMBERS = 12.5 HOURS OXYGEN DURATION.

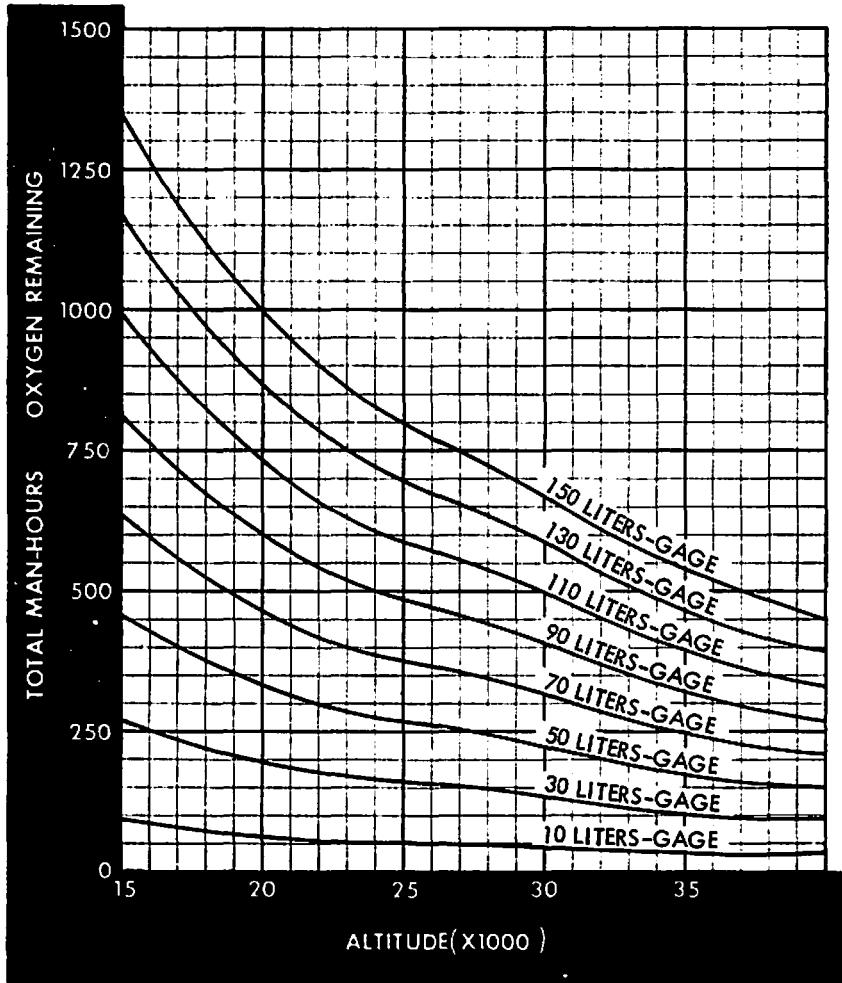
CREW OXYGEN SYSTEM REGULATOR SETTING - 'NORMAL'



NOTE

CURVES ARE FOR TOTAL HOURS OXYGEN SUPPLY PER GAGE READING. SEE EXAMPLE PROBLEM ON SHEET 7 FOR OXYGEN DURATION SAMPLE PROBLEM.

TROOP SYSTEM



NOTE

CURVES ARE FOR TOTAL HOURS
OXYGEN SUPPLY PER GAGE
READING. SEE EXAMPLE PROBLEM
ON SHEET 1 FOR OXYGEN DURATION
SAMPLE PROBLEM.

DURATION CHARTS
COMPUTE OXYGEN DURATION

100% OXYGEN

Problem One

Eight Crew members

25 liters

20,000 feet unpressurized

Answer: 60 manhours = $60 \div 8 = 7 \frac{1}{2}$ hours

Problem Two

Eight crew members

25 liters

35,000 feet unpressurized

Answer: 137 manhours = $137 \div 8 = 17.07$

You have completed the TROOP OXYGEN SYSTEM. Now, complete the troop oxygen system review below.

1. Two _____ liter liquid oxygen converters are located in the right hand _____.
2. The troop oxygen regulators installed in the cargo compartment supply _____ pressure for breathing.
3. The troop oxygen regulators open _____ at 12,000 to 14,500 ft altitude, but may be _____ operated at any _____.
4. A LOX QTY LOW light for each troop converter comes on at _____.
5. The therapeutic oxygen system provides oxygen for _____ that requires therapeutic treatment.
6. A crew member using a portable oxygen bottle in the center part of the cargo compartment can service the bottle from the _____ system.

Key

1. 75, main wheel pod.
2. adequate.
3. automatically, manually, altitude.
4. 7.5 liters
5. hospital patients
6. therapeutic

T H E E N D