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T. O. NO. 03-50-1
A.P. NO. 2159A

# USE OF OXYGEN AND OXYGEN EQUIPMENT

**NOTE: This Title Page is revised to correct Replacement Note in T. O. No. 03-50-1 dated July 1, 1943. Replacement Note should read: This Technical Order replaces T. O. No. 03-50-1 dated June 15, 1942 and T. O. No. 03-50-1A dated November 9, 1942.**

**NOTE: Commanding Officers will be responsible that the information contained in this Technical Order is read and understood by personnel who install and use oxygen equipment. This responsibility will be exercised through the Unit Oxygen Officers as provided in AAF Regulation No. 55-7.**

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Keller-Crescent Co., Evansville, Ind.—11-11-43—50M

*JULY 1, 1943*
*REVISED SEPTEMBER 20, 1943*

Published by authority of the Commanding General, Army Air Forces, and accepted by the Chief of the Bureau of Aeronautics and the Air Council of the United Kingdom. As the text was prepared prior to the adoption of AN Handbook specifications, a Technical Order number is used in lieu of an AN number.



## LIST OF REVISED PAGES ISSUED

*NOTE:* A heavy black vertical line, to the left of the text on revised pages, indicates the extent of the revision. This line is omitted where more than 50 percent of the page is revised.

| Page No. | Latest Revised Date |
|---|---|
| B Deleted | September 20, 1943 |
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| 28 | September 20, 1943 |
| 31 | September 20, 1943 |
| 36 | September 20, 1943 |

This Technical Order Prepared By The Aeromedical Research Laboratory, Engineering Division, Materiel Command, Wright Field, Dayton, Ohio.

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★

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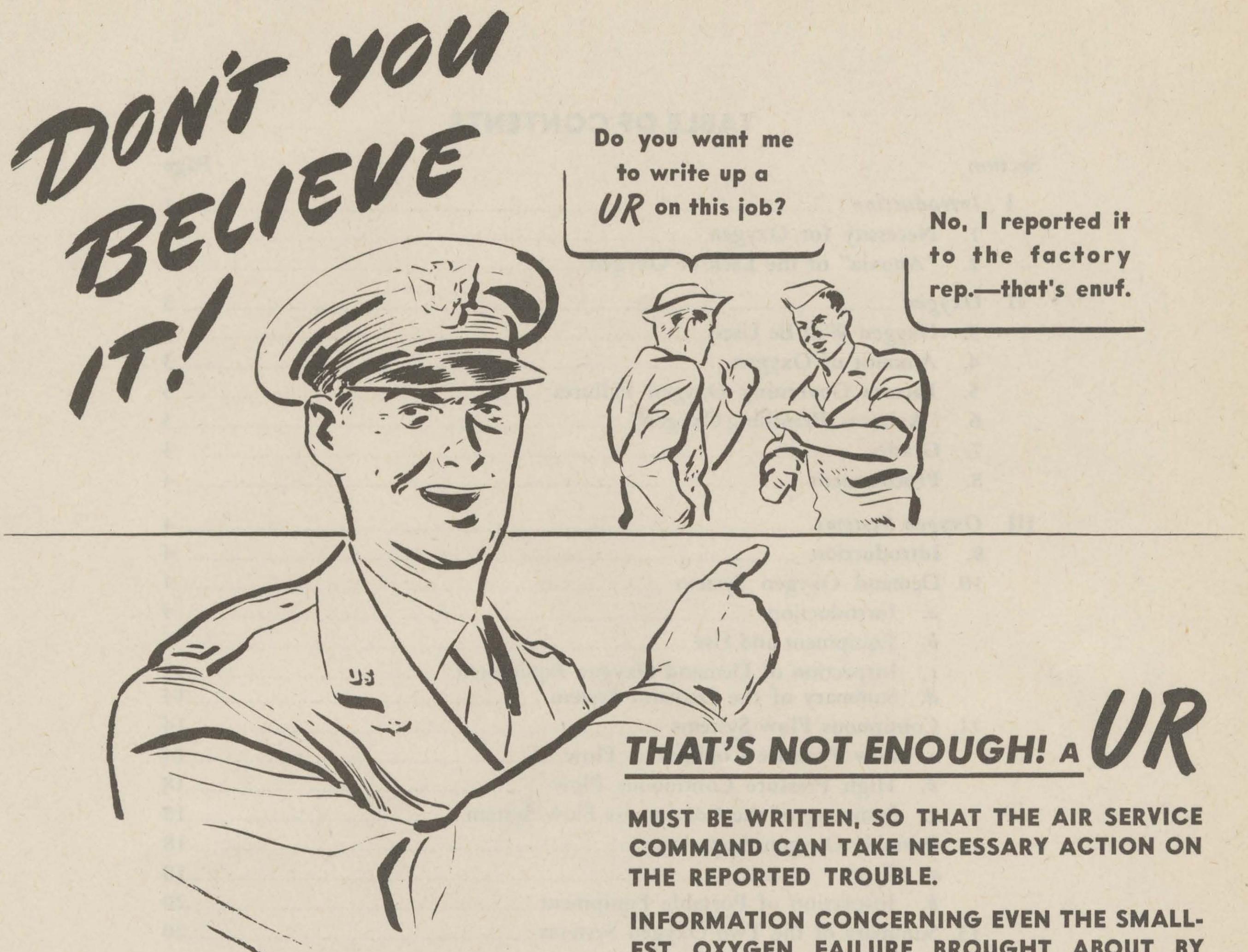
This Technical Order replaces T. O. Nos. 03-50-1, dated June 5, 1942 and 03-50-1A, dated November 9, 1942, revised to include more specific information.

NOTE: Commanding Officers will be responsible that the information contained in this Technical Order is read and understood by personnel who install and use oxygen equipment. This responsibility will be exercised through the Unit Oxygen Officers as provided in AAF Regulation No. 55-7.




## THAT'S NOT ENOUGH! A UR

**MUST BE WRITTEN, SO THAT THE AIR SERVICE COMMAND CAN TAKE NECESSARY ACTION ON THE REPORTED TROUBLE.**

**INFORMATION CONCERNING EVEN THE SMALLEST OXYGEN FAILURE BROUGHT ABOUT BY UNSATISFACTORY EQUIPMENT, USE OF EQUIPMENT, OR INSTRUCTIONS CAN BE OF GREAT VALUE, IF REPORTED IMMEDIATELY.**

In filling out a ***UR*** (AAF Form No. 54) personnel should follow the instructions given in AAF Regulation 15-54. Particular care should be taken to include the following information:

1. ORGANIZATION AND STATION
2. NAME PLATE DATA
3. DATE AND NATURE OF FAILURE
4. TYPE OF AIRPLANE IN WHICH INSTALLED
5. RECOMMENDATIONS

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GROUND LEVEL
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## THE OXYGEN OFFICER

The Unit Oxygen Officer is a relatively new addition to the Army Air Forces and his duties are of utmost importance.

He is to act as technical advisor to the Commanding Officer regarding issue and maintenance of protective flying equipment, flying clothes, helmets, goggles, as well as to make frequent inspection of oxygen equipment and installations, and supervise tests of regulators, check valves, and related equipment.

He shall make available adequate supplies of oxygen equipment and cooperate with the Unit Engineer to insure proper installation, maintenance and servicing of all oxygen equipment. He will be thoroughly familiar with this Technical Order and see that all personnel in his unit who may be required to fly have complete understanding of same.

It is the duty of the Oxygen Officer to see that each oxygen mask fits properly and that it is checked at frequent intervals. He will act as a training officer in emergency procedures and as inspecting officer for the maintenance of emergency installations, such as first aid kits, arctic and jungle kits, life rafts, and functioning of emergency hatches.

Each accident and death of flying personnel caused by malfunctioning oxygen equipment or lack of knowledge in its use shall be reported by letter in triplicate to the Office of The Air Surgeon, Headquarters, Army Air Forces, Washington, D. C., within five days subsequent to the date of the accident or death.

Unsatisfactory equipment shall be reported by the Oxygen Officer on AAF form No. 15-54.

# SECTION I
# INTRODUCTION

## 1. THE NECESSITY FOR OXYGEN.

*a.* A continuous supply of oxygen is essential to life. Man is able to obtain an adequate supply of oxygen as long as he lives at or near sea level. But when he goes to high altitudes in an airplane, he is dependent on an added supply of oxygen. Death will result within a few minutes if oxygen is not available. It is therefore essential that all flying personnel be thoroughly familiar with oxygen equipment and its uses.

*b.* Air is uniform. The percentage of oxygen in the air (approximately 21 percent) is the same at sea level as at an altitude of 70,000 feet. Then, if this is so, why is more oxygen needed at an altitude of 10,000 feet? Here's why:

*c.* Although air is uniform, it has weight and is compressible; therefore we find it thicker nearer the ground. In any cubic measurement of space near the ground there is a greater quantity of air than in the same volume at a higher altitude, although the percentage of oxygen remains the same. *Less air at high altitudes, so less oxygen.* That is the reason why more oxygen has to be taken into the lungs at high altitudes.

*d.* To clarify the picture, imagine a huge pile of mixed straws, half of which are black and half white. The straws on the bottom of the stack have been pressed down and packed so closely together by the weight of the straws on top that a pitchfork full of straws taken from the bottom of the pile has many more straws in it than a fork full taken from the top, *although the mixture will still be the same—half of the straws black and half white.* Now suppose this straw stack is to be used for fuel in heating a furnace, and the white straws will burn better and produce more heat. More white straws will have to be added to a fork full taken from the top of the pile to obtain the same amount of heat that would be obtained from a fork full taken from the bottom. *That is what your oxygen equipment does for you—it adds more oxygen to an insufficient quantity at high altitudes.*

*e.* The amount of oxygen which must be added increases with altitude until at approximately 33,000 feet pure oxygen is necessary, and above 40,000 feet even pure oxygen is not sufficient. Now the question arises—why isn't one hundred percent oxygen sufficient at any altitude? Here is the answer:

*f.* The characteristics of the blood are such that the amount of oxygen that it can take up is dependent on the pressure of oxygen breathed. This is the reason that a pilot suffers from lack of oxygen at 18,000 feet—here the pressure is only half that at sea level. When pure oxygen is breathed above 30,000 feet, all is well until an altitude of about 40,000 feet is reached. At and above that altitude the atmospheric pressure is so low that even breathing 100 percent oxygen will not get a sufficient amount of oxygen into the blood.

*g.* In view of the foregoing we can readily see why it is impossible to fly at any altitude desired, or to fly at high altitudes without the aid of additional oxygen.

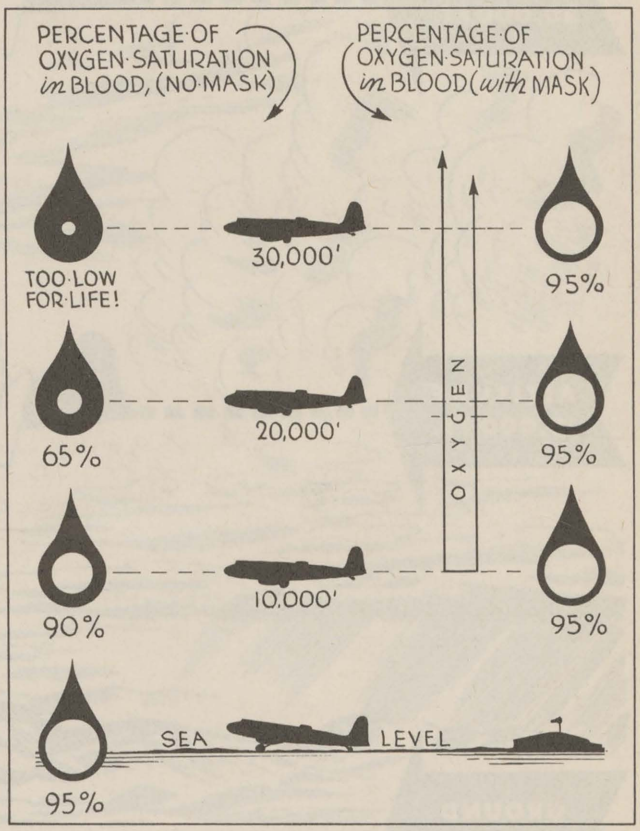
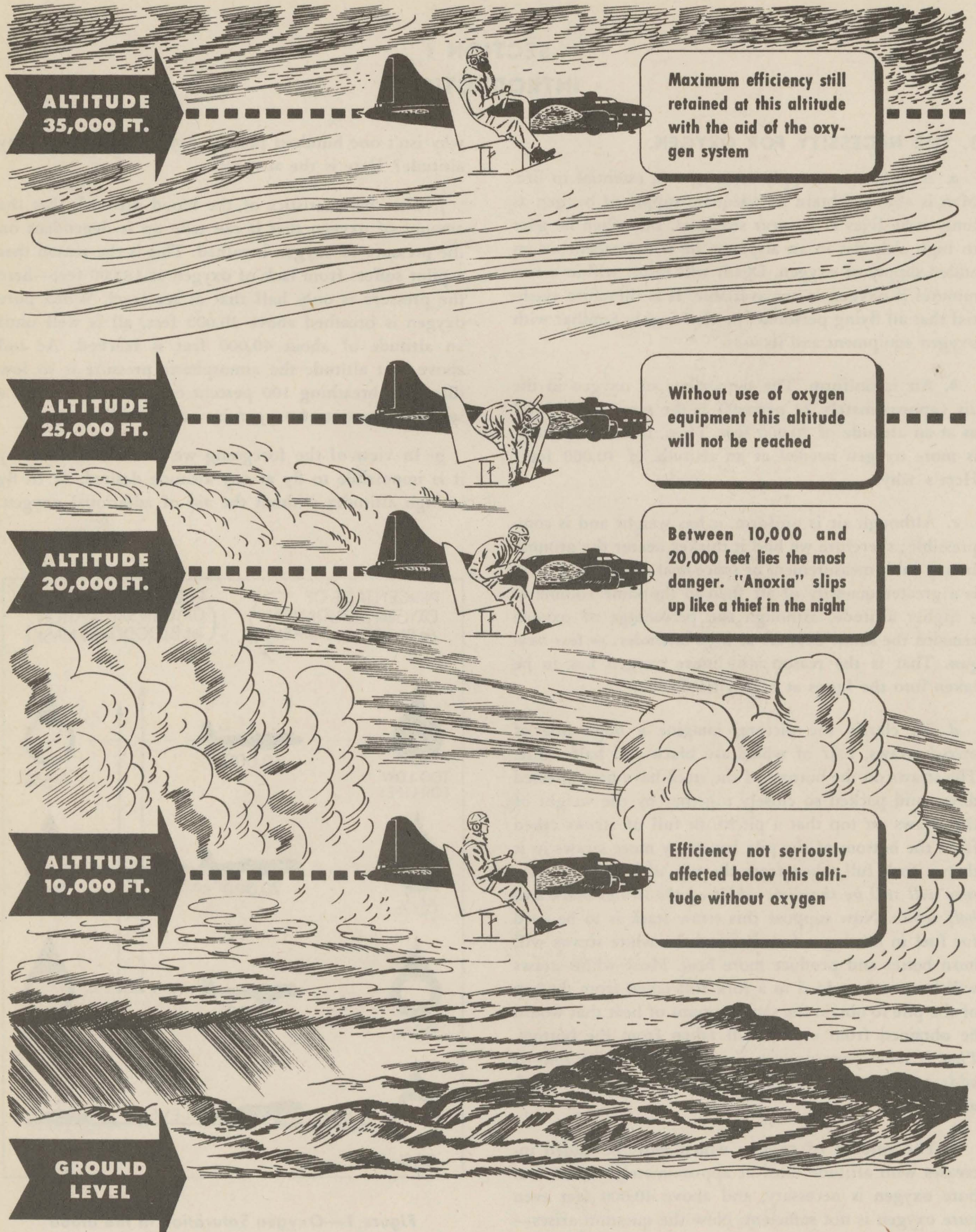



*Figure 1—Oxygen Saturation in the Blood*


ALTITUDE 35,000 FT.
Maximum efficiency still retained at this altitude with the aid of the oxygen system
ALTITUDE 25,000 FT.
Without use of oxygen equipment this altitude will not be reached
ALTITUDE 20,000 FT.
Between 10,000 and 20,000 feet lies the most danger. "Anoxia" slips up like a thief in the night
ALTITUDE 10,000 FT.
Efficiency not seriously affected below this altitude without oxygen
GROUND LEVEL

## 2. "ANOXIA" OR THE LACK OF OXYGEN.

*a.* This is the condition caused by breathing air which contains an insufficient amount of oxygen. Unconsciousness and death can be the result. Some of the milder symptoms of anoxia are: poor vision, incorrect decisions, poor coordination between the brain and muscles, and absent-mindedness. These milder symptoms are difficult to detect during flight, especially since they tend to cause the victim to have a false sense of security. Such conditions are similar to that of a man who has been drinking and doesn't think one more drink will have any noticeable effect, when in reality he has already started to stagger and one more drink will complete the job.

*b.* This false sense of security causes a certain letdown in obeying the rules for use of oxygen. These rules have been set up to give combat flying personnel the utmost of safety and keep them "on top." They are made as a result of extensive laboratory and flight tests which make it possible to detect the slightest symptoms of anoxia.

*c.* Two examples of anoxia recorded in World War 1 by the British War Ministry are: In one report by a British Medical Staff Officer, "An English pilot in a Bristol fighter plane encountered a formation of five German planes at an altitude of 6,000 meters (20,000 feet). He did not recognize the danger, but waved to them in spite of the protests of his observer." Here we have an extraordinary change in the power of judgment. In another report, "An English observer while photographing forgot to change his plates and took eighteen pictures on one plate." This illustrates one of many cases of absent-mindedness.

# SECTION II
# OXYGEN

## 3. OXYGEN WILL BE USED.

*a.* On all flights at 10,000 feet and above.

*b.* From the ground up on all combat or tactical flights at night.

## 4. AMOUNT OF OXYGEN.

The amount of oxygen used by the body increases with physical exertion, during exposure to cold, during excitement, after injury and during bends.* All these factors increase the effects of anoxia and add another reason for following the prescribed rules in the use of oxygen. It is not possible to know with any great degree of accuracy the exact amount of oxygen which will be required for every flight. A certain margin of safety must be allowed. A great excess supply of oxygen would limit the effectiveness of any combat mission by using valuable space and adding weight. Thus, a balance between safety and economy has been taken into account in the installation of oxygen systems in aircraft. Strict observance of the rules for the use of oxygen by flyers will keep this balance in favor of safety. *Use enough oxygen, but do not waste it.*

*A condition produced by exposure to low atmospheric pressure. It is characterized by the formation of nitrogen bubbles in the tissues, blood and other fluids of the body, causing pain in the joints.

## 5. FACTORS GOVERNING OXYGEN FAILURES.

Most oxygen failures are caused by carelessness or lack of knowledge in the use of equipment. These will be stated in the following paragraphs. A complete understanding will mean the safe-guarding of your life as well as the lives of others.

## 6. "AVIATORS' BREATHING OXYGEN."

Aviators' breathing oxygen (Spec. AN-O-1a) is not to be confused with commercial oxygen or hospital oxygen. Commercial and hospital oxygen are essentially the same and both usually contain some water. This kind of oxygen in an aircraft oxygen system is dangerous at low temperatures, as the water may freeze and prevent proper operation of the equipment. All three types, however, may have the same purity. Specification AN-O-1a requires that "the grade of oxygen used shall have a purity of 99.5 percent by volume (dry basis) minimum." This specification calls for two grades of oxygen and these grades are determined by the amount of water present.

## 7. GRADES.

*a.* GRADE A OXYGEN.—In grade A oxygen (dry), the water vapor content is 0.06 milligrams per liter, —59° F. dewpoint. It is odorless and free from all adulterants including drying agents. Even with the manufacturer supplying oxygen to this dryness, as an added

precaution, it should be passed through cartridges which are installed on the recharging cart.

*b.* GRADE B OXYGEN.—Grade B oxygen (wet) is the same as grade A except that the water vapor content is not specified. Before drying, care must be taken to change the drying cartridge in the recharging cart after using sixteen storage cylinders according to T. O. No. 19-1-2.

**CAUTION**

Care will be taken to prevent the oxygen pressure in all oxygen storage cylinders from becoming depleted below a pressure of 50 pounds per square inch to avoid accumulation of moisture in the cylinder. Care will also be taken to insure that dry oxygen is always used in aircraft oxygen systems.

### 8. PROCUREMENT.

**NOTE**

*Personnel responsible for procuring the oxygen supply will acquaint themselves with Specification AN-O-1a and T. O. No. 16-20-1, as the following applies only to them.*

*a.* Grade A (dried) oxygen will be procured for breathing purposes in accordance with Specification AN-O-1a. Each station will make local procurement of oxygen for high altitude flights. Unless otherwise specified, procurement will be made in 250 cubic foot storage cylinders. Cylinders, in addition to being marked as specified in T. O. No. 16-20-1 will be marked "Aviators' Breathing Oxygen." Where specification grade A oxygen cannot be procured, the grade B oxygen will be obtained by requisition on the control depot, exchanging empty cylinders, if available, for the like type charged cylinders. All storage cylinders upon depletion will be returned for refilling.

*b.* In theaters of operation, grade B or the best grade of breathing oxygen available will be purchased or generated locally. All oxygen used in theaters of operation will be dried by the use of one or more of the Air Forces standard type purifiers. Mobile oxygen generator equipment, truck mounted, is available for generating oxygen in certain theaters.

# SECTION III
# OXYGEN SYSTEMS

### 9. INTRODUCTION.

There are two types of oxygen systems permanently installed in aircraft at the present time, namely: low pressure demand and continuous flow. Both systems have a working pressure of 400 pounds per square inch. In addition, portable (walk-around) oxygen equipment is provided in heavy bombardment aircraft. The Technical Order Handbook and drawings pertaining to the particular model of airplane will be referred to for details of the oxygen system installed. The demand system is now being installed in all combat planes prior to delivery. General descriptions and illustrations of the oxygen systems installed in aircraft are as follows:

### 10. DEMAND OXYGEN SYSTEM.

*a.* INTRODUCTION.

(1) The demand oxygen system (see figure 2) consists of low pressure, shatterproof oxygen cylinders manifolded together using check valves and distribution lines, filler valve, type A-12 oxygen regulator, pressure gage, pressure signal assembly, indicator lamp, and flow indicator. The system is provided with a filler valve for recharging the system. In addition, a portable recharger hose is required at each crew position in heavy bombardment aircraft for recharging portable (walk-around) oxygen equipment from the oxygen system of the airplane. The demand type mask must be used with this system. For applicable specification numbers and drawing numbers pertaining to this installation refer to Specification 40363, subject: "Installation of Low Pressure Oxygen Equipment in Aircraft," or Section VII of this T. O.

(2) The system is fully automatic and provides the user with the proper amount of oxygen at all altitudes and under all conditions. A demand system, as the name implies, furnishes oxygen only upon demand. That is, every time the user inhales, a sufficient amount of oxygen is delivered to the mask. This new system requires the

# Figure 2
# DEMAND OXYGEN SYSTEM

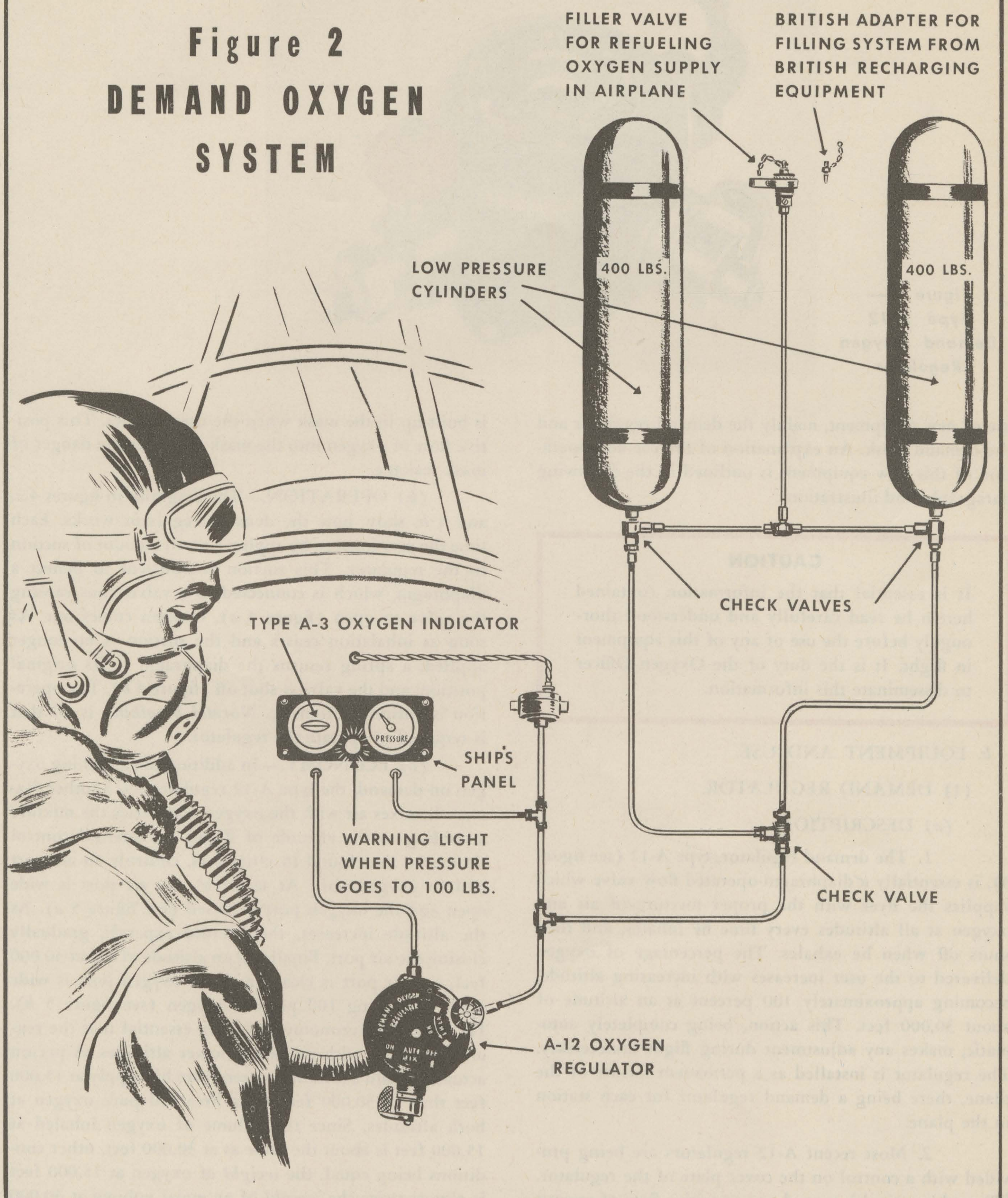



*Figure 2—Diagram of Demand System*

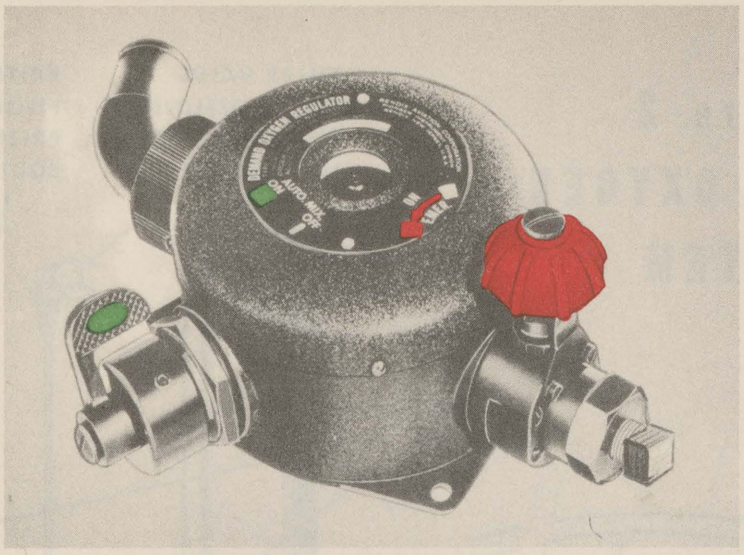



***Figure 3—Type A-12 Demand Oxygen Regulator***

use of new equipment, mainly the demand regulator and the demand mask. An explanation of the use and operation of this new equipment is outlined in the following paragraphs and illustrations.

> **CAUTION**
>
> It is essential that the information contained herein be read carefully and understood thoroughly before the use of any of this equipment in flight. It is the duty of the Oxygen Officer to disseminate this information.

*b.* EQUIPMENT AND USE.

(1) DEMAND REGULATOR.

*(a)* DESCRIPTION.

*1.* The demand regulator, type A-12 (see figure 3), is essentially a diaphragm-operated flow valve which supplies the flyer with the proper mixture of air and oxygen at all altitudes every time he inhales, and then shuts off when he exhales. The percentage of oxygen delivered to the user increases with increasing altitude, becoming approximately 100 percent at an altitude of about 30,000 feet. This action, being completely automatic, makes any adjustment during flight unnecessary. The regulator is installed as a permanent fixture of the plane, there being a demand regulator for each station in the plane.

2. Most recent A-12 regulators are being provided with a control on the cover plate of the regulator. When the control is turned on, a positive flow of oxygen is provided which shuts off only when a slight pressure is built up in the mask when the user exhales. This positive flow of oxygen into the mask decreases the danger of mask leakage.

*(b)* OPERATION.—The diagrams in figures 4 *a.* and 4 *b.* show how the demand regulator works. Each time the user inhales, he applies a small amount of suction to the regulator. This suction is sufficient to deflect a diaphragm, which is connected to a valve, thus causing the valve to open (figure 4 *a*). Oxygen comes out. As soon as inhalation ceases and the suction is no longer applied, a spring returns the diaphragm to its original position, and the valve is shut off (figure 4 *b*). The operation is entirely automatic. *Normal breathing* is all that is required to operate the regulator.

*(c)* ECONOMY.—In addition to furnishing oxygen on demand, the type A-12 regulator has another feature: It mixes air with the oxygen and varies the mixture according to the altitude of flight. An aneroid control similar to that found in altimeters, controls an air port and an oxygen port. At sea level, the air port is wide open and the oxygen port is closed (see figure 5 *a*). As the altitude increases, the aneroid expands, gradually closing the air port. Finally, at an altitude of about 30,000 feet, the air port is closed and the oxygen port is wide open, delivering 100 percent oxygen (see figure 5 *b*). For reasons of economy, it is very essential that the regulator mix air with oxygen at lower altitudes. A person actually would use more oxygen from his supply at 15,000 feet than at 30,000 feet if he breathed pure oxygen at both altitudes. Since the volume of oxygen inhaled at 15,000 feet is about the same as at 30,000 feet, other conditions being equal, the *weight* of oxygen at 15,000 feet is almost twice the *weight* of an equal volume at 30,000 feet because of the difference in *density.*

***These figures show principle of operation only. See Applicable Technical Orders for Actual Mechanisms.***

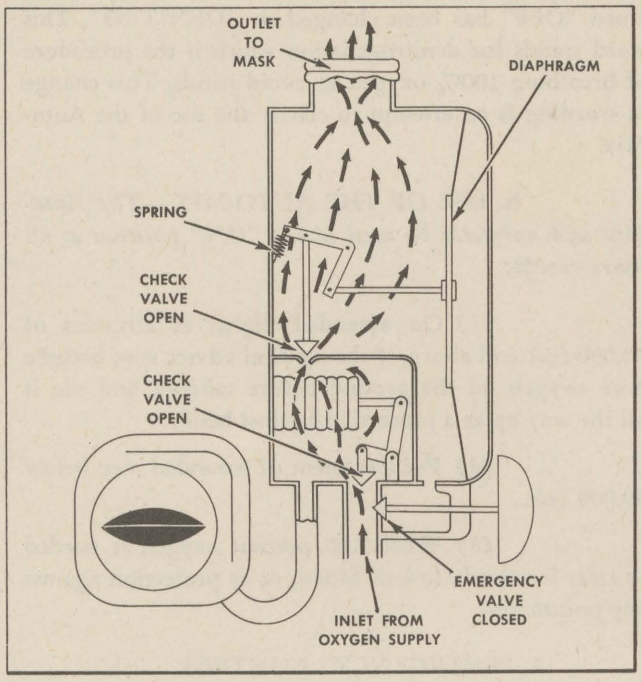



**Figure 4A—Diagram of Operation of Regulator—Inhaling**

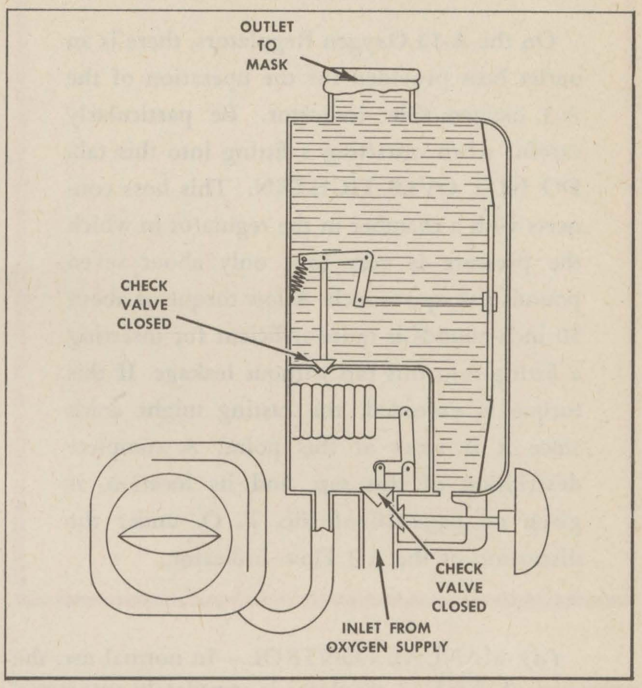



**Figure 4B—Diagram of Operation of Regulator—Exhaling**

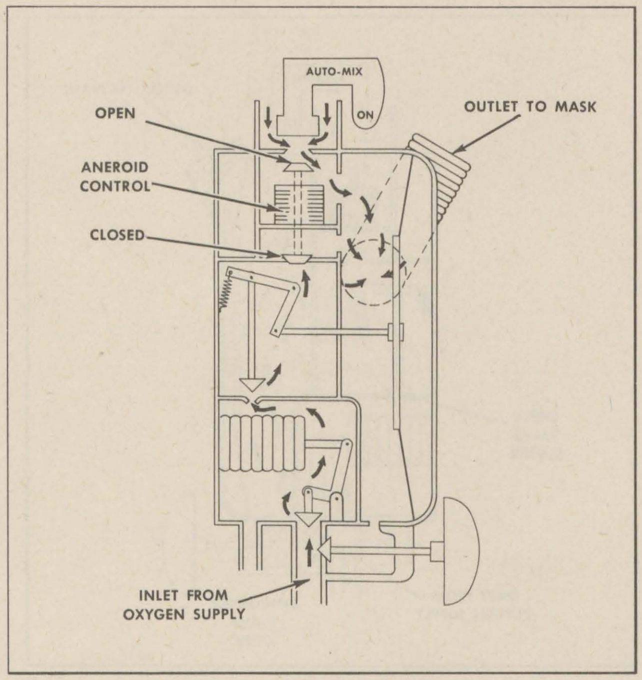



**Figure 5A—Diagram of Operation of Regulator—At Sea Level**

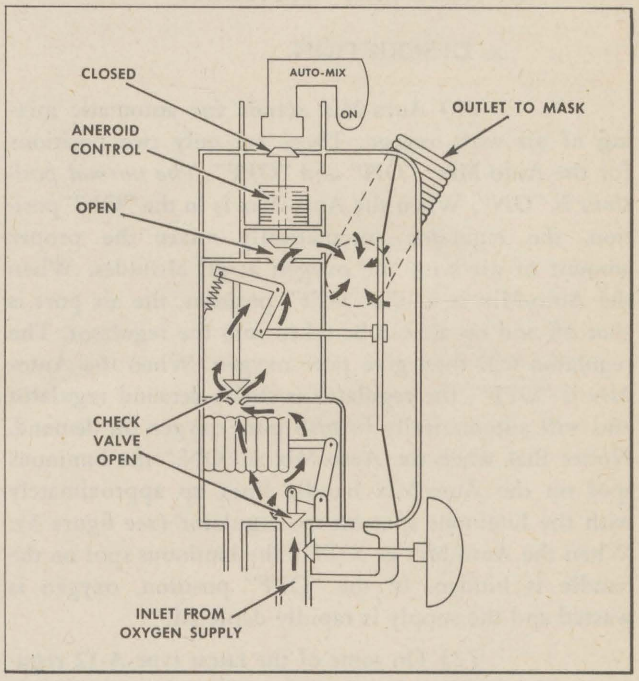



**Figure 5B—Diagram of Operation of Regulator—At 30,000 Ft.**

**CAUTION**

On the A-12 Oxygen Regulators, there is an outlet boss provided for the operation of the A-3 oxygen flow indicator. Be particularly careful when installing a fitting into this tab. DO NOT OVER-TIGHTEN. This boss connects with a chamber in the regulator in which the pressure is very low, only about seven pounds per square inch. A low torque of about 50 inch-pounds is quite sufficient for inserting a fitting into this tap without leakage. If this torque is exceeded, the casting might crack since it is weak at this point. A complete description of this tap, and its location, is given on page 10 of this T. O. under the discussion of the A-3 Flow Indicator.

*(d)* MANUAL CONTROL.—In normal use, the operation of the A-12 regulator is completely automatic. Two manual controls, however, are provided for use in special instances. One of these is labeled "Auto-Mix" and the other "Emergency".

*1.* "AUTO-MIX" CONTROL.

a. DESCRIPTION.

*(1)* Auto-Mix stands for automatic mixing of air with oxygen. There are only two positions for the Auto-Mix: "ON" and "OFF". *The normal positions is "ON".* When the Auto-Mix is in the "ON" position, the regulator automatically mixes the proper amount of air with the oxygen at all altitudes. When the Auto-Mix is in the "OFF" position, the air port is shut off and no air can be taken into the regulator. The regulator will then give pure oxygen. When the Auto-Mix is "OFF", the regulator is still a demand regulator and will automatically furnish pure oxygen on demand. Notice that when the Auto-Mix is "ON," the luminous spot on the Auto-Mix handle lines up approximately with the luminous spot on the regulator (see figure 3). When the Auto-Mix is "OFF", the luminous spot on the handle is hidden. In the "OFF" position, oxygen is wasted and the supply is rapidly depleted.

*(2)* On some of the latest type A-12 regulators, the wording on the cover plate Auto-Mix lever positions has been changed. The word "ON" has been changed to "NORMAL". This is then the normal position for the Auto-Mix lever and it will be left in this position at all times except as herein explained. The word "OFF" has been changed to "DENITRO". This word stands for denitrogenation which is the procedure of breathing 100% oxygen to avoid bends. This change in wording is an attempt to clarify the use of the Auto-Mix.

b. USE OF THE AUTO-MIX.—*The Auto-Mix will normally be used in the "ON" position at all times except:*

*(1)* On extended flights at altitudes of 30,000 feet and above, if the medical advice is to breathe pure oxygen on the ground before take-off and use it all the way up as a protection against bends.

*(2)* For treatment of wounded men below 30,000 feet.

*(3)* When 100 percent oxygen is needed to treat for shock, loss of blood, or as protection against any poison gas.

*2.* "EMERGENCY" CONTROL.

a. DESCRIPTION.—The Emergency valve, when turned on, provides a *continuous flow of oxygen into the mask* (see figure 6). It is an emergency device and

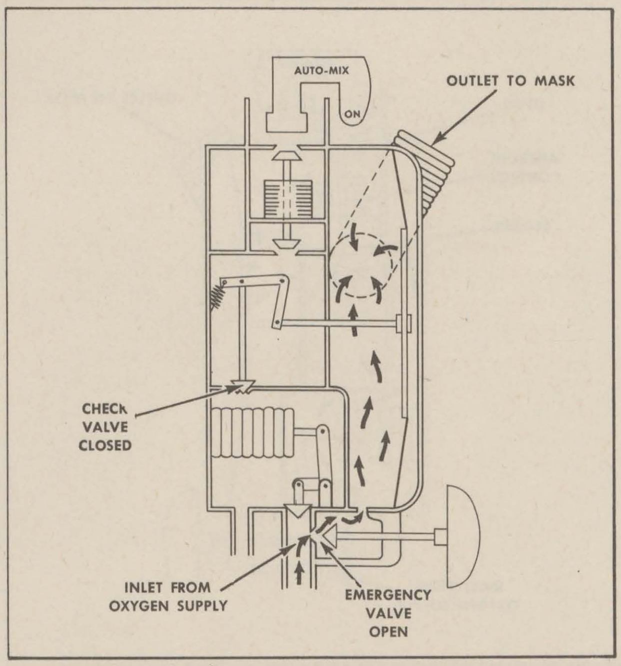



***Figure 6—Diagram of Operation of Regulator Using "Emergency Valve"***

should be used as such. (See next paragraph.) This device rapidly diminishes the supply of oxygen when used, as the flow is continuous and that which is not being used escapes through the outlet vents in the mask. Opening the Emergency valve, *unless absolutely essential,* is wasteful and is comparable to the operation of engines on needlessly rich mixtures.

b. USE. — The Emergency valve will be turned "OFF" at all times except in cases of emergency, such as:

*(1)* The revival of a crew member;

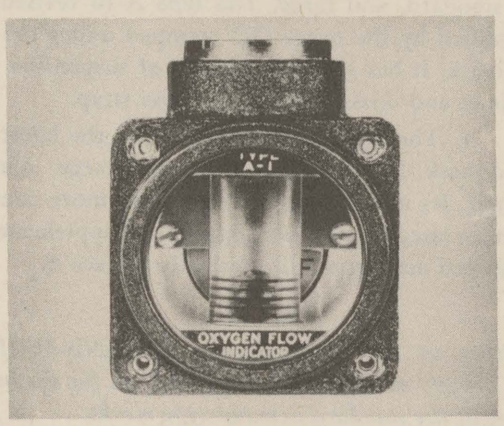
*(2)* In cases of excessive mask leakage;

*(3)* When it is necessary, for any reason, to remove the mask temporarily, such as to: blow the nose, vomit, spit, etc. (The mask should be loosened on one side and held as near to the nose as possible); or,

*(4)* If the demand regulator mechanism fails to function, which may be indicated by the flow indicator's failing to work. In all cases the Emergency valve will not be left turned on longer than absolutely necessary. If the Emergency valve will have to be left open for any length of time, the plane should descend to a lower altitude. The supply of oxygen in the plane is not sufficient to withstand the steady drain this procedure would demand for any great length of time.

**NOTE**

*The Auto-Mix and the Emergency must be used intelligently in order to conserve oxygen. The use of the Auto-Mix in the "OFF" position, or of the Emergency valve, rapidly diminishes the available supply of oxygen. The oxygen supply for high altitude missions can limit the range as certainly as the supply of gasoline limits it. The successful completion of a long, high altitude mission will depend on the economical use of the available oxygen supply. This supply must be conserved.*




**CAUTION**

AN ELEMENT OF DANGER IS INVOLVED IN USING THE AUTO-MIX "OFF". If your oxygen is lost or if the regulator should fail, and you lose consciousness while the AUTO-MIX is "OFF", you are trapped in a closed system, into which air or oxygen might not enter. This is particularly so in Pioneer design regulators. Under these conditions, unless the mask is pulled off or an opening introduced into the system, you may never regain consciousness, even at low altitudes. If, to avoid bends, you are instructed to turn the Auto-Mix "OFF", do so until you reach 30,000 feet and then turn it "ON" since here you already get 100% oxygen. If the Auto-Mix is "OFF" for any other reason extreme caution must be exercised to see that the oxygen flow does not stop. In an emergency, use the EMERGENCY valve. KEEP THE AUTO-MIX IN THE "ON" POSITION AT ALL TIMES UNLESS ABSOLUTELY NECESSARY TO DO OTHERWISE.

(2) FLOW INDICATORS.

*(a)* USE.—Flow indicators show only that oxygen is flowing from the regulator. They do not indicate that enough is flowing. The flyer should not be surprised if the flow indicator shows that no oxygen is flowing from the A-12 regulator when the airplane is on the ground and when the Auto-Mix is "ON". Remember that the regulator is not supposed to add oxygen at ground level; however, some A-12 regulators do supply a small amount of oxygen even at this level.

*(b)* TYPES.—Either of two types of flow indicators are used in conjunction with the A-12 demand regulator:

*1.* The type A-1 Flow Indicator (figure 7) consists of a ball in a transparent tube and is inserted directly in the oxygen supply line to the regulator. When oxygen flows from the regulator, the ball rises in the glass tube. When the flow stops, the ball slowly falls. The ball thus bounces up and down with breathing. When the Emergency is on, the ball rises to the top and remains there as long as the flow continues.

***Figure 7—A-1 Flow Indicator***

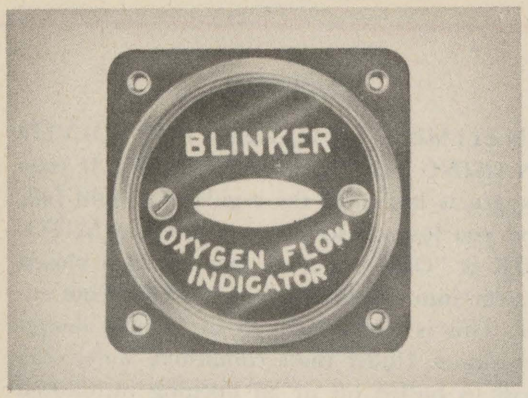



*Figure 8—A-3 Flow Indicator*

2. The type A-3 Flow Indicator (figure 8) blinks open and shut with each breathing cycle of the user. It is operated by variation in pressure in the A-12 regulator and therefore is connected directly to it. With the Pioneer Design A-12, the Flow Indicator opens when inhaling, closes when exhaling and is also closed when not in use. With the Airco Design A-12, the action of this blinker is reversed and it remains open when not in use. Whether starting open or shut, the blinking while breathing is the important thing. When the emergency is on, the indicator does not blink. The type A-12 oxygen regulator contains a tap on the side, to which the type A-3 Oxygen Flow Indicator is connected by means of tubing. On many regulators of the Airco design, this tap is located immediately below the Auto-Mix handle. On the Pioneer regulator the tap is located 180 degrees away. The various A-12 designs are explained in Section IV.

a. In order to bring the location of the tap in the same position on both regulators and thus to make them completely interchangeable as a unit, a Connector Assembly Kit, Aeronautical Equipment Reference No. 46-715, assembled as shown on AAF Drawing 43D3549, is provided. This connector assembly fits on the outside of the regulator and moves over by 180° the position of the outlet for the A-3 flow indicator on the Airco design regulator.

b. On later regulators of the Airco design, the casting is changed and the type A-3 Flow Indicator tap is located in the same place as in the Pioneer regulator without the use of any extra kit. However, on the regulators where the casting has not been changed and the tap for the A-3 Flow Indicator has not been relocated, the Connector Assembly Kit must be used when the type A-3 Flow Indicator is used with Airco design A-12 oxygen regulators.

(3) PRESSURE GAGE AND INDICATOR LAMP.—These are mounted on the same panel with the flow indicator. The pressure gage shows the pressure of oxygen in the supply cylinders for that station. The indicator lamp is lighted up by a pressure-actuated switch in the supply line, and this amber light appears when the supply pressure falls to about 100 pounds per square inch. When the light comes on, only one-seventh of the original supply remains. It must not be overlooked, however, that the amount of pressure indicated by the gage will not represent the oxygen on hand if some of the cylinders have been punctured by gunfire, and deductions must be made for any cylinders lost in this manner. The safe minimum working pressure is 50 p.s.i. The lamp is provided with a dimming adjustment for use in times of blackout.

(4) DEMAND MASK.

*(a)* INTRODUCTION.—The oxygen mask used with the demand system is of a special type that requires very careful selection of size and test of fit. It contains a flapper valve which remains closed when inhaling so that oxygen from the regulator may be taken. Upon exhalation, this valve opens, thus permitting the exhaled gases to exhaust. It is obvious that, should the mask be improperly fitted causing it to leak, instead of drawing the proper amount of oxygen from the regulator, some air will be drawn from the rarefied atmosphere. This will dilute the oxygen in the lungs and will be dangerous. Extreme caution must, therefore, be used in fitting the mask.

*(b)* TYPES.—There are four types of demand masks, namely: types A-9, A-10, A-10 revised, and the A-14.

*1.* The type A-9 mask was made in two sizes, short and long.

*2.* The type A-10 mask is similar to the A-9 but is of improved design. It was made in three sizes: small, standard, and large. This mask may be recognized by the nose strap. (See figure 9.)

*3.* The type A-10 mask revised, (figure 10) is an improved A-10 and is made in four sizes: extra small, small, standard, and large. The type A-10 revised will be identified by the letter "R" stamped under the chin of the mask. It has a simplified type of suspension from the helmet and does not have the nose strap.

*4.* The type A-14 (figure 11) is the latest type demand mask. It is made in three sizes: large, medium, and small. Its advantages are: better fit, more comfort, and better integration with goggles. It supplements the A-10 revised mask and will gradually replace it.

**NOTE**

*Either of two microphones, the ANB-M-C1 (Carbon) or the T-44 (Magnetic) are for use in any of the standard demand type masks.*

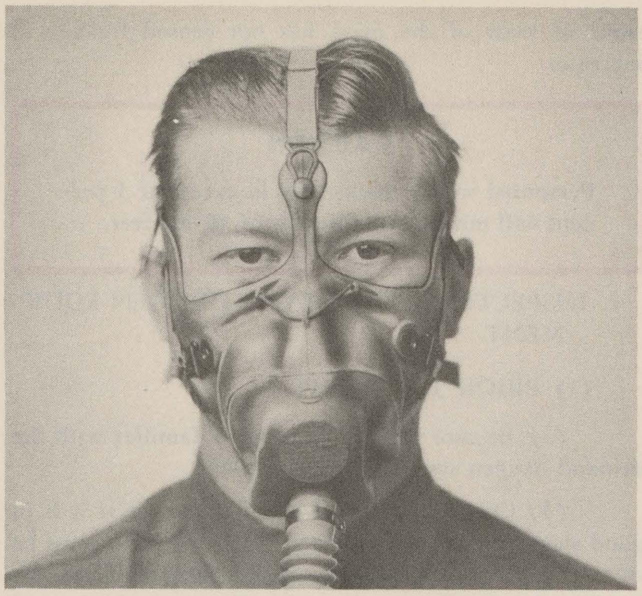


Figure 9—A-10 Oxygen Mask

Figure 10—A-10 (Revised) Oxygen Mask

Figure 11—
A-14
Oxygen Mask

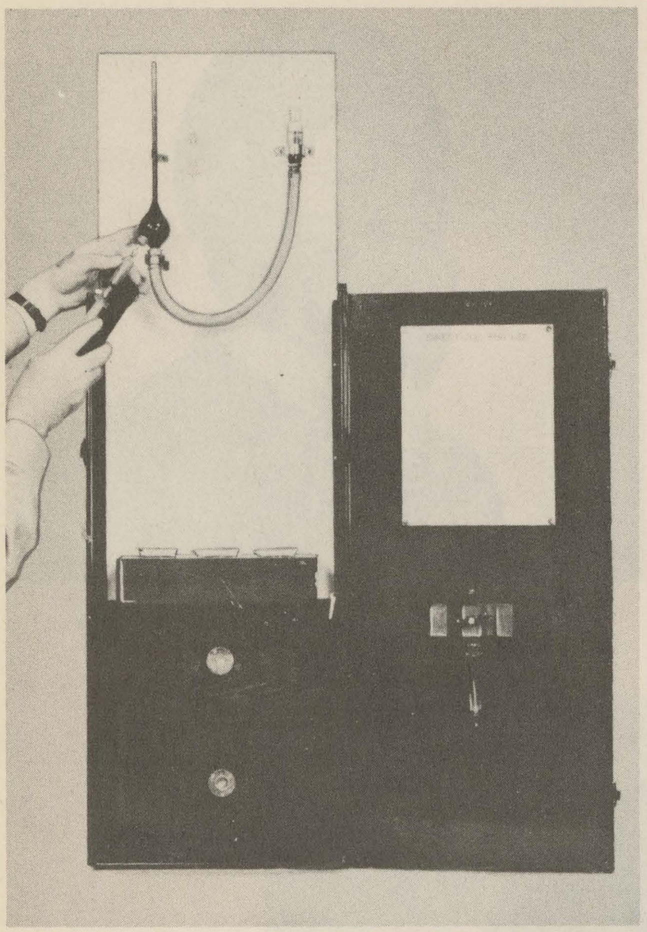


Figure 12—Type K-1 Test Kit

*(c)* FITTING THE DEMAND MASK.

*1.* Most leakage is due to attempts to use masks which do not fit individual faces. The problem of mask fitting is the duty of the Group or Squadron Oxygen Officer who will use the Oxygen Officer's Test Kit, type K-1, Specification 40487, Class 05-B, Stock No. 7800-462000 (figure 12) to determine when proper fit is attained. Figure 13 shows how the test for leakage is made with the syringe.

*2.* A routine procedure of determining mask leakage is to hold the thumb over the end of the inspiratory tube and inhale gently. If the mask does not leak, it will offer resistance to the inhalation and tend to collapse on the face. *Sharp* or *strong* inhalations are deceiving, since they tend to seal the mask on the face. Even gentle inhalation may fail to reveal some leaks. Before the mask is used in flight it shall be tested to determine the exact percentage of leakage by the Oxygen Officer (T. O. 03-50-26). Personnel who periodically fly at altitudes of 30,000 feet or above will have masks frequently tested to make sure that stretching of suspensions or wear of the mask has not caused leakage to increase.

**CAUTION**

Personnel whose masks leak in excess of 5 percent will not exceed altitudes of 30,000 feet.

*c.* INSPECTION OF DEMAND OXYGEN EQUIPMENT.

(1) PRIOR TO FLIGHT.

*(a)* Be sure you are thoroughly familiar with the demand oxygen system in your airplane.

*(b)* Check all parts of the mask to see if it is in good shape and ready for instant use. The mask must be clean. Try it on in the airplane and check for leaks by holding the thumb over the quick disconnect fitting and inhaling normally.

*(c)* Be sure that the rubber gasket is in place on the male quick disconnect fitting.

*(d)* Be sure the male quick disconnect fits snugly in the female connection of the hose from the regulator at your station and at any other station you may use, as well as in the portable units. A pull of about 10 pounds should be required to separate the two. If it does not fit tightly, pry open the prongs on the male with a knife blade until the required adjustment is made. (See figure 14).

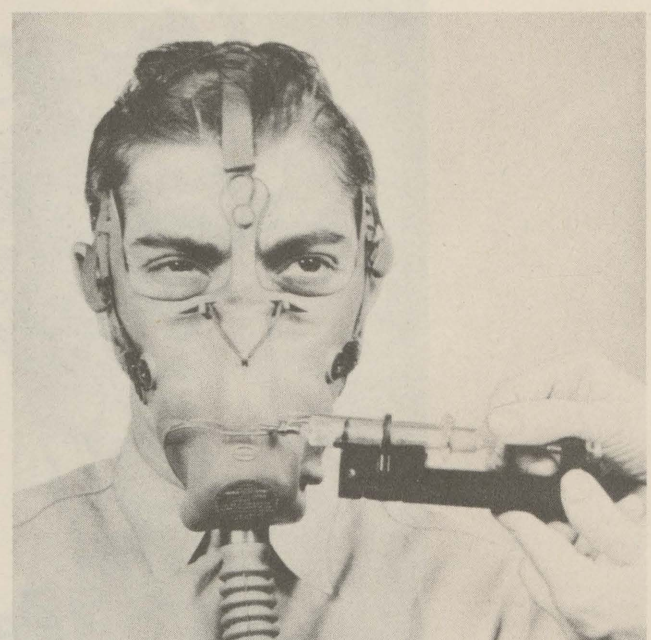


Figure 13—Taking Oxygen Sample from Mask


*(e)* Inspect the hose from the regulator for any damages such as tears, holes and kinks. Be sure all clamps are firmly in place.

*(f)* Clip the oxygen supply hose, by means of its spring clip, onto the clothing or parachute harness close enough to the face to permit free head movement without kinking or pulling of the corrugated mask hose. It is advisable that a fabric tab to hold the clip be sewed to the clothing in the proper place.

*(g)* Be sure the knurled collar at the outlet elbow of the regulator is tight so that the elbow does not turn. (See figure 15). Examine the regulator for any damage; particularly see that the diaphragm is not ruptured or distorted.

*(h)* Open the emergency valve on the regulator and see that you get a large flow. *Never block the outlet when the emergency valve is open;* otherwise the regulator may be damaged and the diaphragm blown out. Turn off the emergency valve firmly.

*(i)* Turn the Auto-Mix to the "OFF" position, breathe normally through the regulator and see that the flow indicator is functioning properly. Turn the Auto-Mix to the "ON" position.

*(j)* Be sure the working pressure of the system is 400 p.s.i. as shown on the pressure gage. It is essential that the pressure be checked at each station, since an individually manifolded system for each crew position is incorporated in some airplanes. The manufacturing tolerance on the accuracy of the gages is such that there may be appreciable difference in the pressure readings, even though the pressure is actually the same for all.

*(k)* If portable equipment is provided, be sure the cylinders are filled to 400 p.s.i. and that they are checked for proper functioning.

*(l)* Bail-out or emergency equipment should be filled to 1800 p.s.i. and ready for instant use.

(2) IN FLIGHT.

*(a)* When the mask is first put on or when it is replaced after temporary removal, always check for leaks by blocking the tubing and inhaling gently. NEVER BLOCK OR PINCH THE TUBING IF THE EMER-

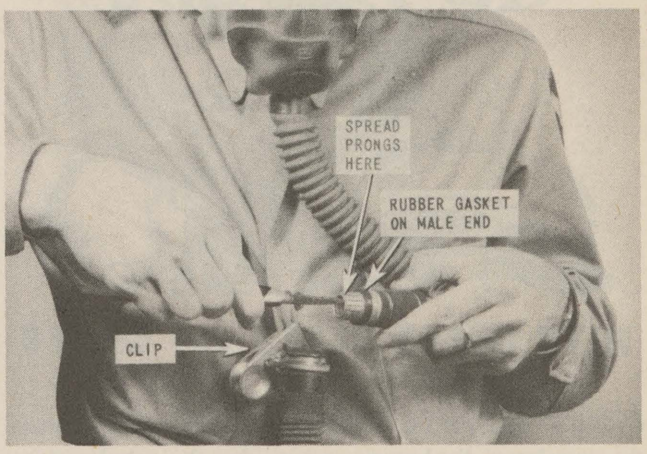



***Figure 14—Adjusting Prongs On Connection for Mask***

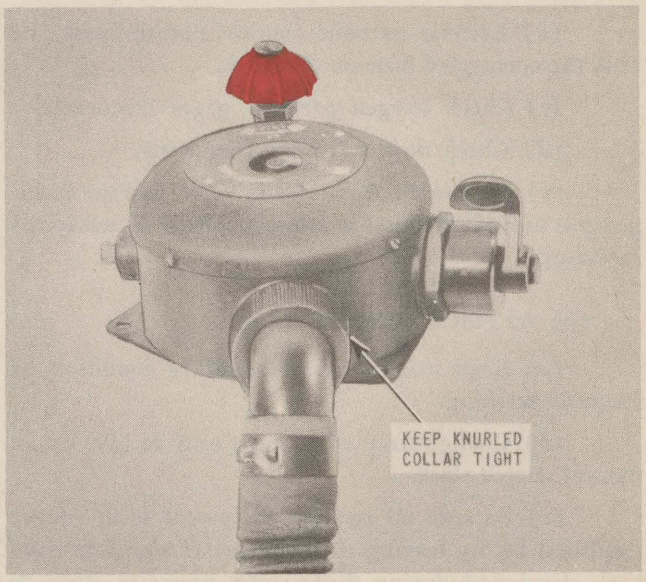



***Figure 15—Showing Knurled Collar On Regulator***


GENCY VALVE IS TURNED ON. This may rupture the regulator diaphragm and render the regulator inoperative. Moisture may freeze in the mask when it is used at freezing temperatures. Ice may be removed by bending the frozen parts with the hands.

*(b)* Exercise extreme caution not to twist and kink the corrugated hose on the mask.

*(c)* Check oxygen pressure gages frequently.

*(d)* Check flow indicators frequently.

*(e)* Be sure the Auto-Mix is "ON" and the Emergency is turned off unless absolutely needed as previously explained.

(3) AFTER EACH FLIGHT.

*(a)* Keep mask in clean, sanitary condition by frequent washing.

*(b)* Change strap adjustment only to take up on natural stretch slack.

*(c)* Be sure all oxygen equipment is in proper condition before leaving the airplane. If any difficulties have developed during flight, take necessary steps to have them corrected.

*(d)* If your final pressure is less than 100 p.s.i., be sure that the supply warning light is on.

**NOTE**

*Lend your mask only in extreme emergency.*

*d.* SUMMARY OF THE DEMAND SYSTEM.—The demand system automatically supplies adequate oxygen at altitudes. The mask must fit the face without leakage, thus insuring the inspiration of whatever mixture of air and oxygen is coming from the regulator. On every flight, unless otherwise ordered, the Auto-Mix should be in the "ON" position. This is the correct method for securing greatest economy and also an adequate supply of oxygen. Oxygen equipment should always be checked prior, during and after each flight.

**11. CONTINUOUS FLOW SYSTEMS.**

The continuous flow system does what its name implies, namely, furnishes a constant, continuous flow of oxygen at all times. There are two types of the continuous flow system: low pressure continuous flow (see figure 16) and high pressure continuous flow. General descriptions and illustrations of these systems are as follows:

*a.* LOW PRESSURE CONTINUOUS FLOW.

(1) The oxygen cylinders used in this system are the low pressure type, conforming to Specification 40320 and having a working pressure of 400 p.s.i. The cylinders are manifolded together with 5/16 x .032 inch tubing, conforming to Specification WW-T-799 or WW-T-787 and check valves conforming to Specification 40325. A filler valve is provided for recharging the oxygen system. The demand system however, is now being installed on all combat type airplanes in production.

(2) TYPE A-8B MASK.—This type mask is the standard mask used with the continuous flow system (see figure 17). The essential differences between it and the A-8 and A-8A types are: the means of supension, the incorporation of a microphone pocket and two sponge rubber disks in the turrets. This type mask will freeze at low temperatures. The sponges should be examined at intervals with removal of any ice by squeezing. An extra set of sponge rubber disks should be carried, or better still, an extra mask. A fabric shield over the entire mask (Dwg. 43D14899) is effective in reducing freezing. Always be sure the plug is securely in the bottom of the rebreather bag.

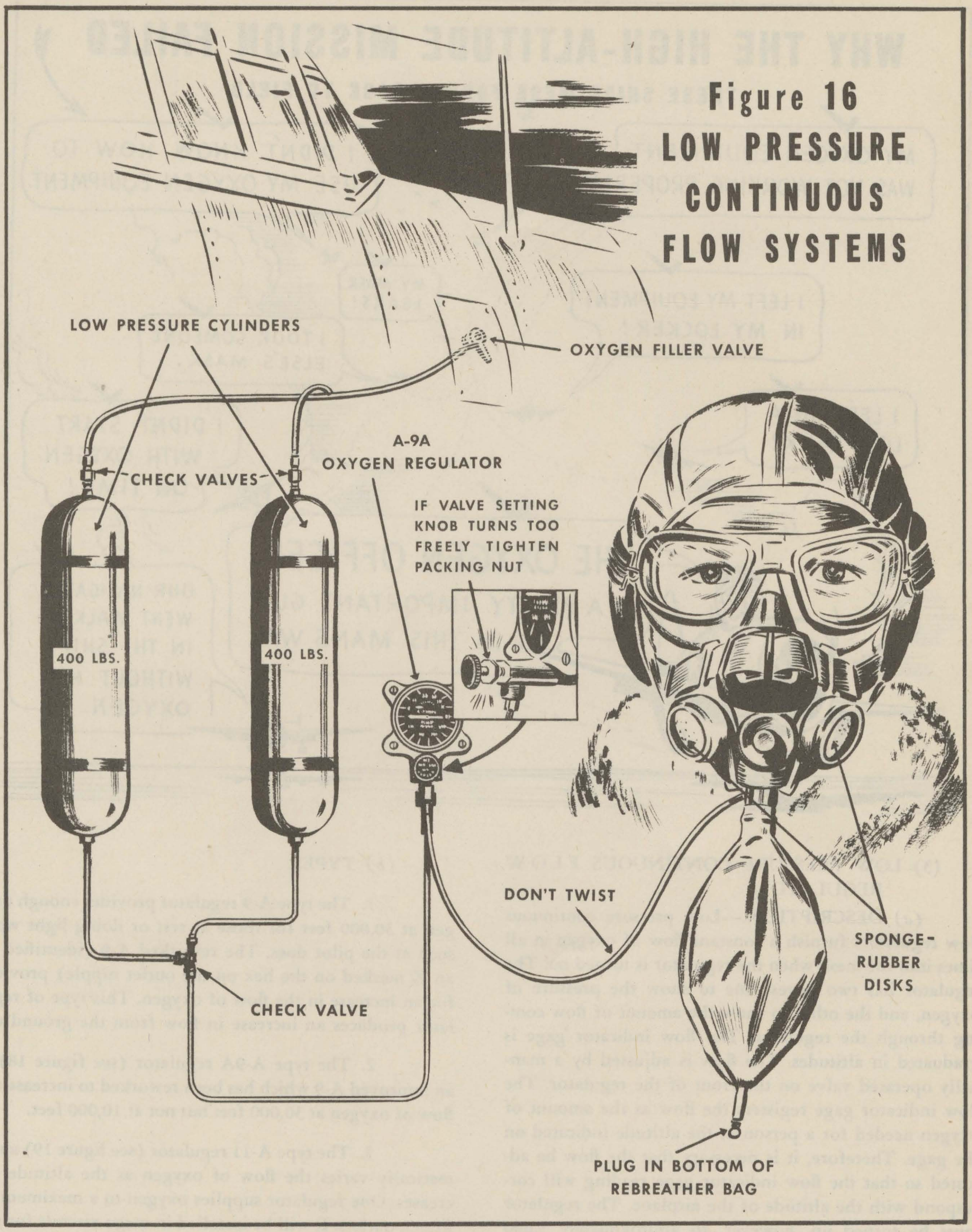
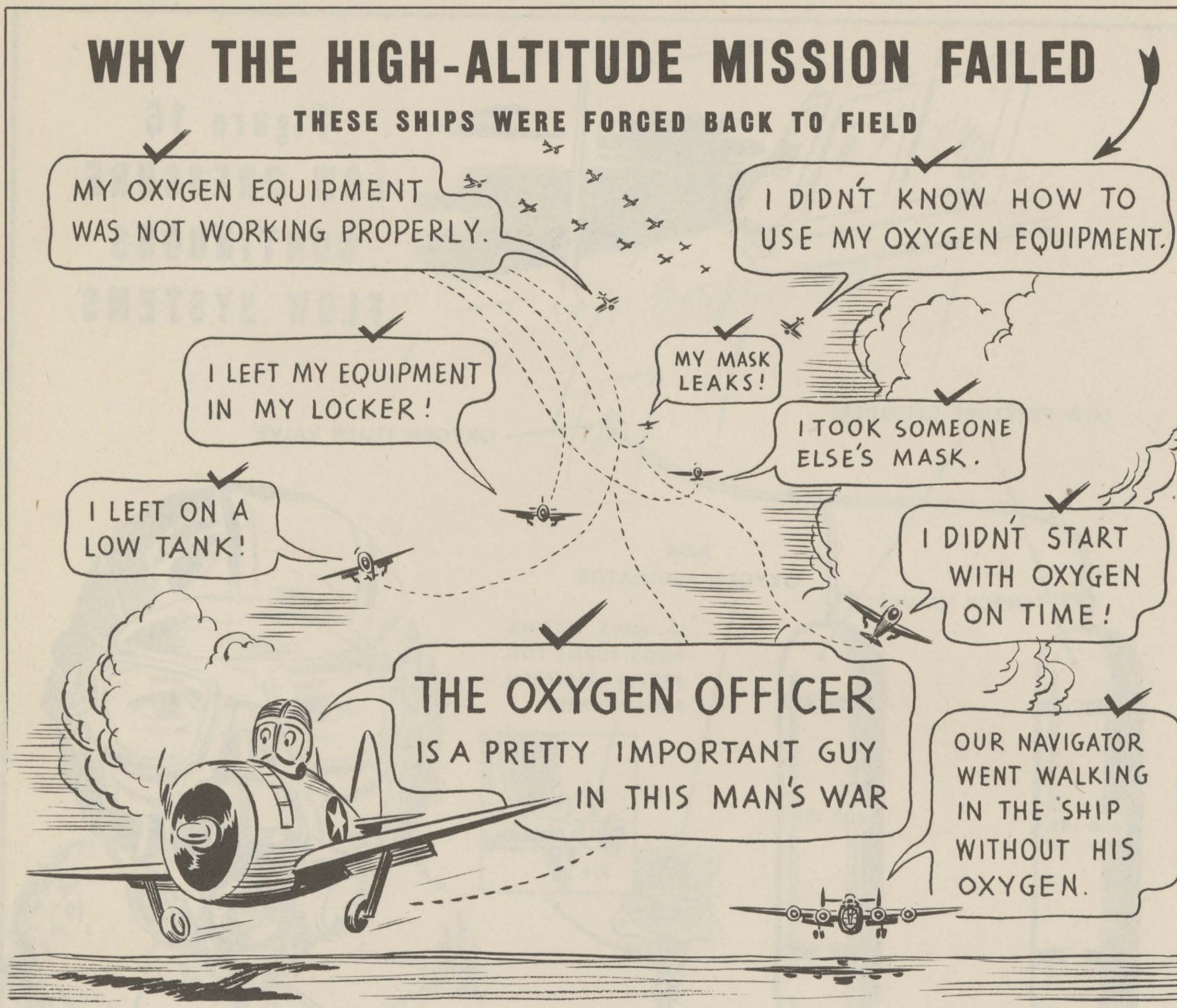



*Figure 16—Drawing of Continuous Flow System*




(3) LOW PRESSURE CONTINUOUS FLOW REGULATOR.

*(a)* DESCRIPTION.—Low pressure continuous flow regulators furnish a constant flow of oxygen at all times into the mask when the regulator is turned on. The regulator has two gages: one to show the pressure of oxygen, and the other to show the amount of flow coming through the regulator. The flow indicator gage is graduated in altitudes. The flow is adjusted by a manually operated valve on the front of the regulator. The flow indicator gage registers the flow as the amount of oxygen needed for a person at the altitude indicated on the gage. Therefore, it is necessary that the flow be adjusted so that the flow indicator gage reading will correspond with the altitude of the airplane. The regulator must be turned up, however, to approximately 5,000 feet above the altitude of the airplane if you are active.

*(b)* TYPES.

*1.* The type A-9 regulator provides enough oxygen at 30,000 feet for those at rest or doing light work such as the pilot does. The reworked A-9 (identified by an X marked on the hex on the outlet nipple) provides for an increase in the flow of oxygen. This type of regulator produces an increase in flow from the ground up.

*2.* The type A-9A regulator (see figure 18) is an improved A-9 which has been reworked to increase the flow of oxygen at 30,000 feet but not at 10,000 feet.

*3.* The type A-11 regulator (see figure 19) automatically varies the flow of oxygen as the altitude increases. One regulator supplies oxygen to a maximum of fifteen outlets. It will be installed in cargo aircraft for use in transporting troops, as shown in Specification 40363.

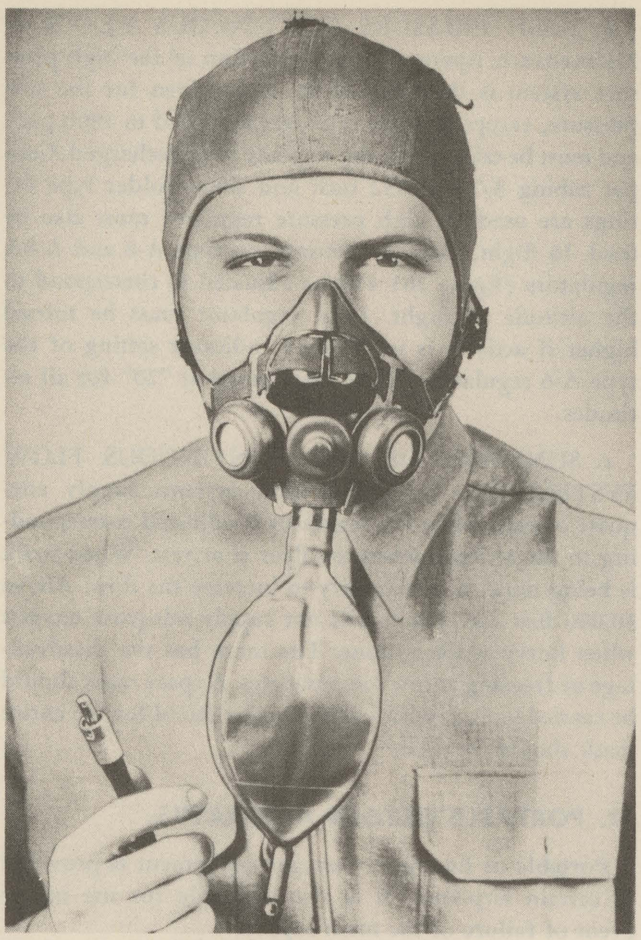


Figure 17—A-8B Oxygen Mask

(4) INSPECTION OF LOW PRESSURE CONTINUOUS FLOW EQUIPMENT.

(*a*) PRIOR TO FLIGHT.

*1.* Check the oxygen pressure. It must be about 400 p.s.i. It is essential that the pressure be checked at each position since some airplanes have separately manifolded systems to each crew position.

*2.* Open the regulator valve temporarily to determine oxygen flow. Check the flow at frequent intervals with ground flow check meter (Spec. 40400, Class 05-B, Stock No. 7800-528100).

*3.* Inspect the mask to determine any defects in the face piece or rebreather bag.

*4.* Check the bayonet connection. Be sure the gasket is in place and that the bayonet connects readily to the regulator outlet.

*5.* Check the suspension to determine the proper adjustments and fitting to the helmet.

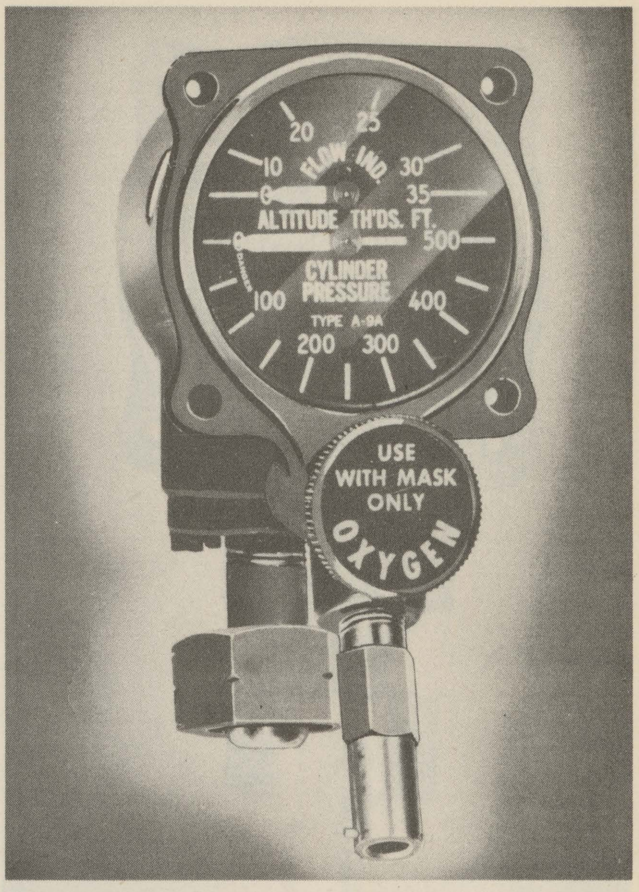



Figure 18—A-9A Regulator

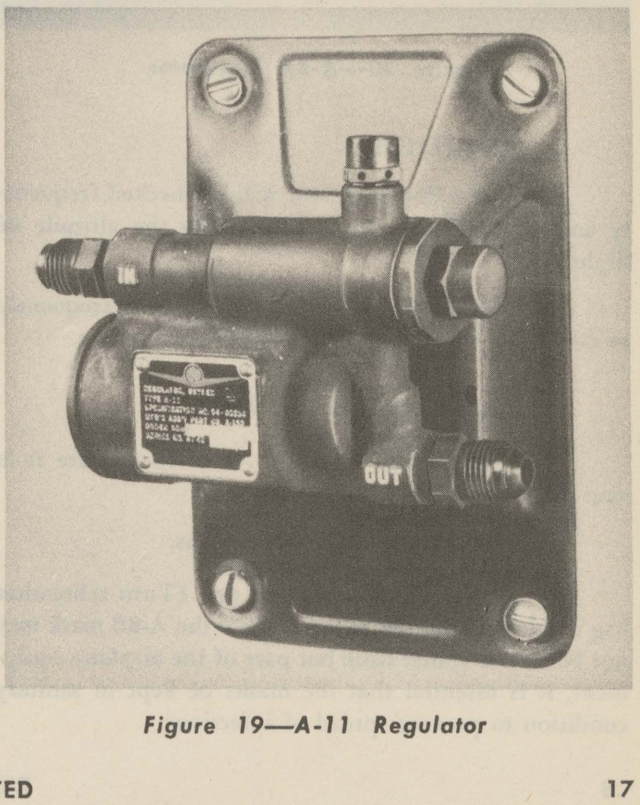



Figure 19—A-11 Regulator

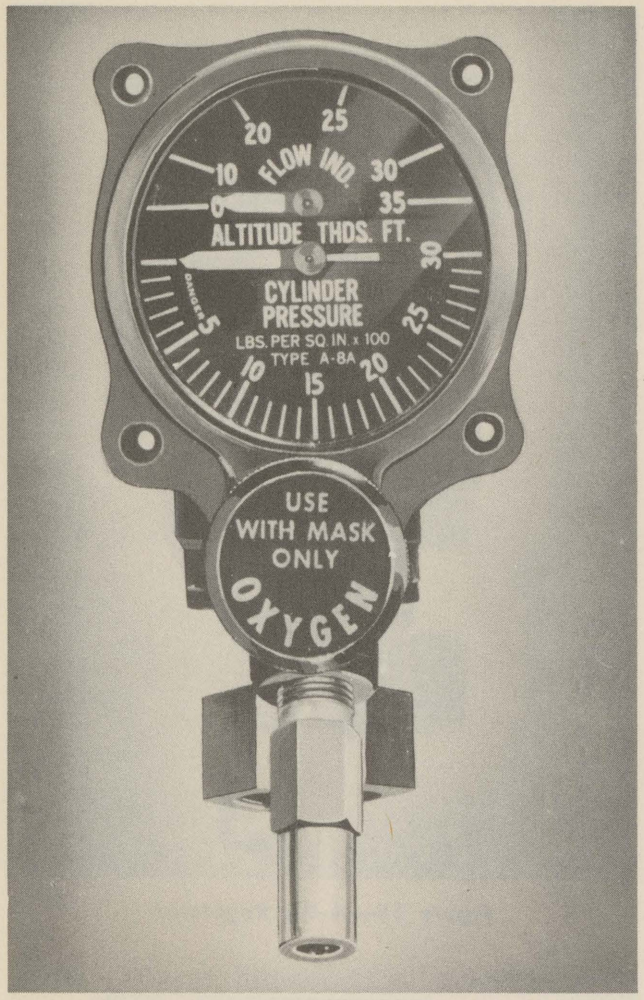



*Figure 20—A-8A Regulator*

*(b)* IN FLIGHT.

*1.* The flow indicator will be checked frequently and kept adjusted to correspond to the altitude of flight.

*2.* The pressure gage will be checked frequently to determine the amount of oxygen in the system.

*(c)* AFTER EACH FLIGHT.

*1.* Check the regulator valve to be sure it is shut off.

*2.* Inspect mask for any defects.

*3.* Wash mask and wipe dry. (Turn rebreather bag inside out in order to dry.) Since the A-8B mask may not be an individual issue but part of the airplane equipment, it is essential that the masks be kept in sanitary condition to prevent spread of infections.

*b.* HIGH PRESSURE CONTINUOUS FLOW.—Maintenance, operation and inspection of the high pressure system is the same as the plan given for the low pressure, except that the cylinders are filled to 1800 p.s.i. and must be taken from the airplane to be recharged. Copper tubing 3/16 x .032 inch and silver solder type fittings are used. A high pressure regulator must also be used. In flight, indicator settings on type A-8 and A-8A regulators (figure 20) will be adjusted to correspond to the altitude of flight. (The regulator must be turned higher if activity is increased.) Indicator setting of the type A-6 regulator will be maintained at "20" for all altitudes.

*c.* SUMMARY OF THE CONTINUOUS FLOW SYSTEM.—The continuous flow systems supply adequate oxygen when the regulator is adjusted corresponding to the altitude when the flyer is at rest. When work is being done, it is necessary to increase the flow. Above 30,000 feet the system will not supply adequate oxygen when heavy work is done. The mask has the disadvantage of freezing at low temperatures. A spare mask should be carried in each position or a fabric shield for the entire mask should be used.

## 12. PORTABLE OXYGEN APPARATUS.

Portable or Emergency oxygen equipment is provided in certain airplanes. It is also available for use in the event of failure of the main supply.

*a.* The following are the various units for use:

(1) In transports, without oxygen for troops and sometimes crew, high pressure continuous flow portable units consisting of the B-1 cylinder, A-8A regulator and canvas carrying sling can be used (Dwg. No. 41G9673).

(2) In other airplanes (late B-25's and B-26's) in which oxygen equipment is not installed, portable oxygen units may be needed for ferry and special missions requiring flight at high altitudes. Low pressure demand portable units for these purposes consist of the F-1 cylinder, A-12 regulator, pressure gage, filler valve, and mask-to-regulator hose.

(3) Heavy bombardment aircraft with low pressure continuous flow oxygen systems will use high pressure continuous flow portable A-2 cylinder, A-8A regulator, and canvas carrying sling (Dwg. No. 41G2437). An alternate can be made up as per Drawing No. 43B16246, using a D-2 cylinder, A-9A regulator, filler valve and canvas carrying sling.

(4) Portable (walk-around) apparatus assembly (figure 21), demand type, is provided in heavy bombardment aircraft having the demand type oxygen system. One

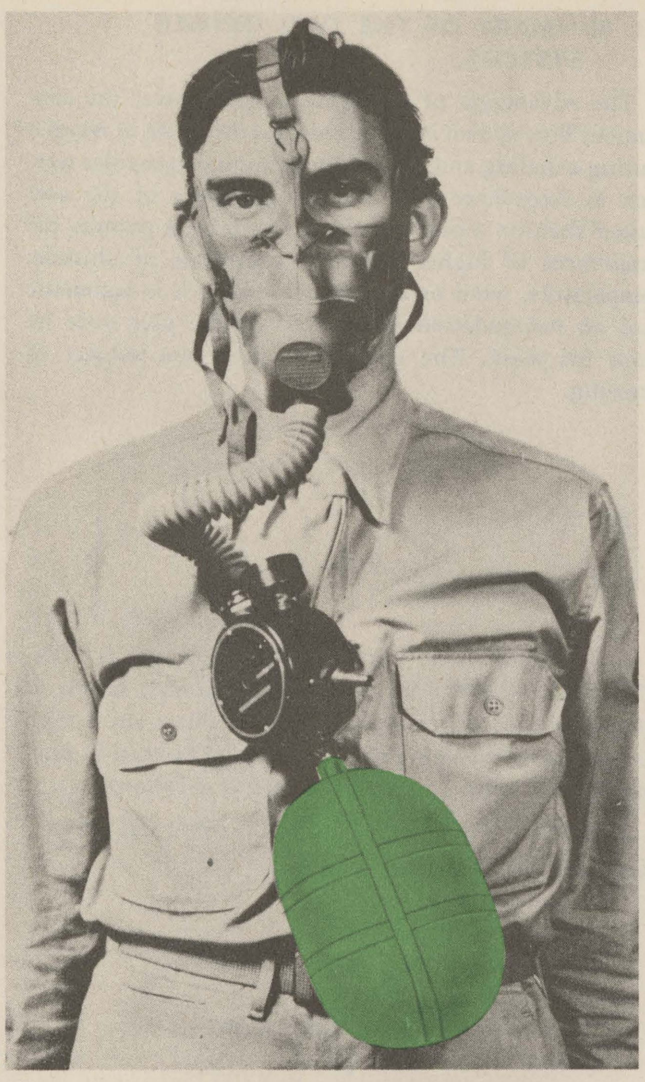


Figure 21—Portable Oxygen Assembly

assembly is available for use by each crew member for moving about in the airplane or in cases of emergency. The assembly (Drawing No. 42D5357) consists of one type A-4 cylinder, and one type A-13 regulator. No sling is required. The assembly is provided with a clip for attachment to clothing or parachute. The type A-13 regulator always gives 100 percent oxygen and is provided with a fitting for recharging the bottle from the portable recharger hose at each station. The bottle will last about six to eight minutes when full. The duration, however, is determined by altitude, pressure and activity; the higher the altitude and pressure, the greater the duration; the greater the activity, the less the duration. Recharge immediately after use. An alternate assembly for longer duration can be made up by using a D-2 cylinder and A-13 regulator with a canvas carrying sling, if necessary (Dwg. No. 43C16247).

(5) The type H-1 (Bail-out) oxygen cylinder (see figure 22) should be carried in turbo supercharged airplanes. It provides an emergency oxgyen supply for pursuit and multiplace airplanes that have no portable equipment. It can also be used for bailing out at high altitudes. Specification 40373, covering the H-1 bail-out cylinder, includes the following: 1 cylinder, type H-1 with high pressure gage, hand-operated valve and tubing with pipestem type mouthpiece. A few precautions should be noted in the use of this equipment, namely: the bottle should be carried in the packet constructed for its use and should be fastened firmly to the flying suit or parachute harness. *Do not* hold cylinder in the hand when jumping from aircraft. The mask must be removed to insert the pipestem and then one should not breathe through the nose.

(6) The type H-2 oxygen cylinder (bail-out, Spec. 40642) is the type H-1 improved. It is used with the mask and a proper plug-in is provided. Oxygen is supplied by pulling a connection or wire that acts in the same manner as the rip cord of a parachute.

Figure 22—H-1 Bail-out Apparatus

*b.* INSPECTION OF PORTABLE EQUIPMENT.—Portable oxygen apparatus will be inspected prior to flight as follows:

(1) Check the type of equipment to determine whether it is the correct type for the airplane and the oxygen masks being used.

(2) Check the oxygen pressure on the portable equipment to be sure the system is fully charged.

(3) Check for proper functioning.

### 13. SUMMARY OF THE TWO OXYGEN SYSTEMS.

The advantages of the demand system over the continuous flow system are: it eliminates the waste of oxygen during exhaling and pause in breathing; it provides oxygen in accordance with physiologic needs of the user rather than on a predetermined schedule; it permits the attainment of higher altitudes; regardless of altitude, temperature, wind or accelerative forces, it is automatic and no manipulation is required by the user once he dons his mask. The demand mask is not subject to freezing.

## SECTION IV

## OXYGEN DURATION OF AIRCRAFT

### 14. INTRODUCTION.

The amount of gas contained in any cylinder is directly proportional to the pressure. This is shown in Graph 1 and Table 1. The state of charge in aircraft oxygen cylinders can then be determined at any time by noting the cylinder pressure. Table 2 gives the internal volume and the free gas capacities of both high and low pressure cylinders. Graphs 2, 3, 4 and 5 give the man hours duration for all regulators and cylinders. By use of the tables and graphs shown herein, the man hour supply of oxygen can be determined in any aircraft oxygen system.

*a.* DURATION OF OXYGEN SUPPLY WITH CONTINUOUS FLOW SYSTEM.—The man hour supply of oxygen may be determined by use of Table 1 and Graph 2. An example showing the procedure to be used in finding the man hour duration of oxygen is as follows:

EXAMPLE FOR USE OF TABLE AND GRAPHS

Assuming the following condition:

System—Low Pressure
Regulators—Type A-9A
Crew—9 men
Cylinders—18, G-1
Altitude—Anticipated flight at 20,000 feet
System Pressure—330 p.s.i.

**TABLE I**

| *State of Charge* | *L. P.** | *H. P.* |
|---|---|---|
| Full | 400 | 1800 |
| 4/5 | 330 | 1480 |
| 3/5 | 260 | 1160 |
| 1/2 | 225 | 1000 |
| 2/5 | 190 | 840 |
| 1/5 | 120 | 520 |
| Empty | 50 | 200 |

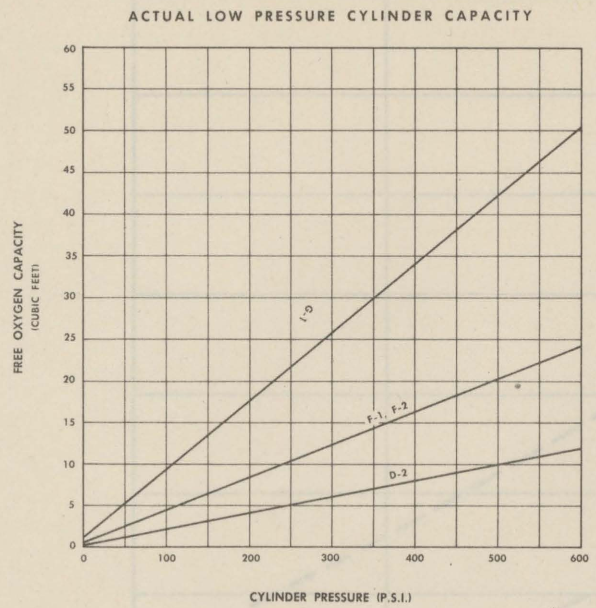
*Low pressure cylinders charged to 425 pounds per square inch will decrease to approximately 400 pounds per square inch in cooling.

**TABLE 2**

**Internal Volume and Free Gas Capacity of Oxygen Cylinders**

| *H. P. Cylinder* | *Internal Volume (Cu. In.)* | *Free Gas Capacity 1800—200 p.s.i. (Cu. Ft.)* | *L. P. Cylinder* | *Internal Volume (Cu. In.)* | *Free Gas Capacity 400—50 p.s.i. (Cu. Ft.)* |
|---|---|---|---|---|---|
| A-2 | 96 | 6.4 | D-2 | 500 | 6.9 |
| B-1 | 295 | 19.6 | F-1, F-2 | 1000 | 13.8 |
| C-1, AN-C-51 | 386 | 25.6 | G-1 | 2100 | 29.0 |
| D-1 | 514 | 34.2 | J-1 | 18000 | 248.0 |
| E-1 | 646 | 42.9 | | | |

Cu. In. = .0164 Liters    Cu. Ft. = 28.32 Liters




*Graph No. 1*

Table 1 shows that at 330 p.s.i., the low pressure cylinder is 4/5 charged. Graph 2 (G-1 cylinder and A-9A regulator) show that a fully charged cylinder will give (approximately) six man hours at 20,000 feet. Then state of charge, 4/5, times 6 man hours gives (approximately) 5 man hours per cylinder at 20,000 feet. Eighteen G-1 cylinders will contain (approximately) 90 man hours, or sufficient oxygen for the crew of 9 men on a 10-hour flight *if no excessive use of oxygen is required.*

*b.* DURATION OF OXYGEN SUPPLY WITH DEMAND SYSTEM.

(1) There are two designs of the type A-12 regulator, namely: Pioneer and Air Reduction Sales design. The latter is sometimes called Airco. The Pioneer regulator is designed and manufactured by Pioneer Instrument Division of Bendix Aviation Corporation. The Airco design is manufactured by the Air Reduction Sales Company, Aro Equipment Corporation, Johnson Fare Box Company, and National Die Casting Company. Both designs conform to the requirements of Specification 40370, although the mechanical construction is different. The outside appearance and the operation of both regulators are very similar. The two regulators are interchangeable in airplane installations.

(2) Because of the difference in internal construction of the two designs, the duration of oxygen is somewhat different at various altitudes, as shown on Graphs 3 and 4. Above 30,000 feet it does not make any difference which instrument is used. Duration of the oxygen supply will be the same because both instruments furnish 100 percent oxygen at altitudes above 30,000 feet. However, below 30,000 feet when air is mixed with the oxygen, it does make a difference which regulator is installed in the airplane because the different designs do not furnish the same concentration of oxygen. At best, these curves can only be considered good approximates as to what actually may be experienced. Such variables, as the different rates of breathing among flying personnel and the greater or less time that the crew might be engaged in active combat on any one mission, will affect the amount of oxygen that is consumed and will shorten or lengthen the duration of supply. The curves should be used as guides, and more information should be gathered from actual experience.

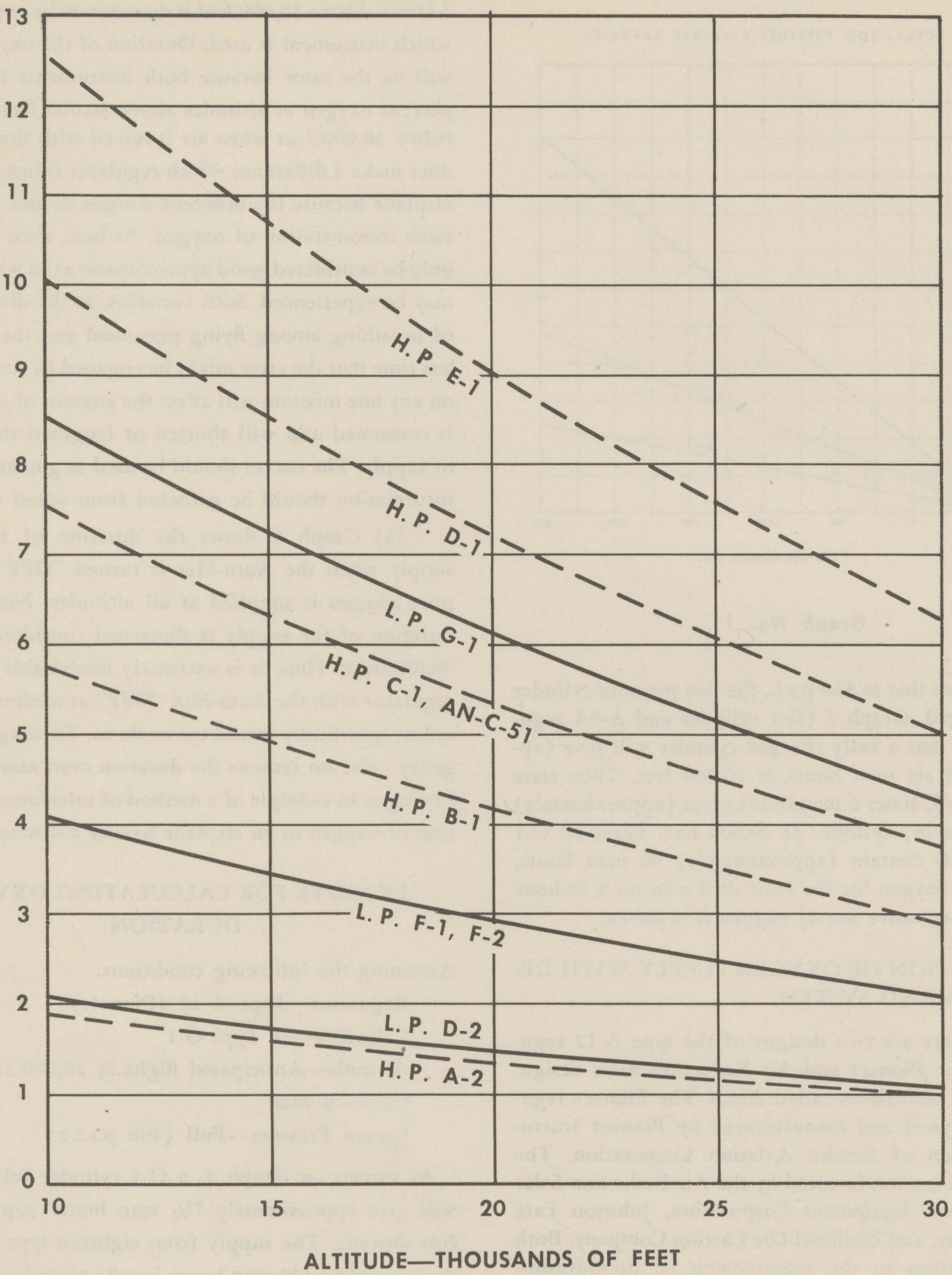
(3) Graph 5 shows the duration of the oxygen supply when the Auto-Mix is turned "OFF" and only pure oxygen is supplied at all altitudes. Note that the duration of the supply is shortened considerably below 30,000 feet. Thus, it is extremely inadvisable to use the regulator with the Auto-Mix "OFF" at medium altitudes unless specifically instructed to do so. Turning the Emergency valve on reduces the duration even more. The following is an example of a method of calculating the duration of oxygen in an airplane having a demand system:

EXAMPLE FOR CALCULATING OXYGEN DURATION

Assuming the following conditions:

Regulator—Type A-12 (Pioneer)
Cylinders—18 Type G-1
Altitude—Anticipated flight at 20,000 feet
Crew—9 Men
System Pressure—Full (400 p.s.i.)

As shown on Graph 4, a G-1 cylinder fully charged will give approximately 7¾ man hours' supply 20,000 feet altitude. The supply from eighteen type G-1 cylinders would be 140 man hours for the aircraft or sufficient oxygen for nine men for 15½ hours. Note that if the regulators were the Airco design, each G-1 cylinder would give only about 4½ man hours' supply at 20,000 feet, as shown on Graph 2. Thus, eighteen cylinders would contain eighty-one man hours at 20,000 feet altitude or nine hours each for nine men.




## OXYGEN DURATION

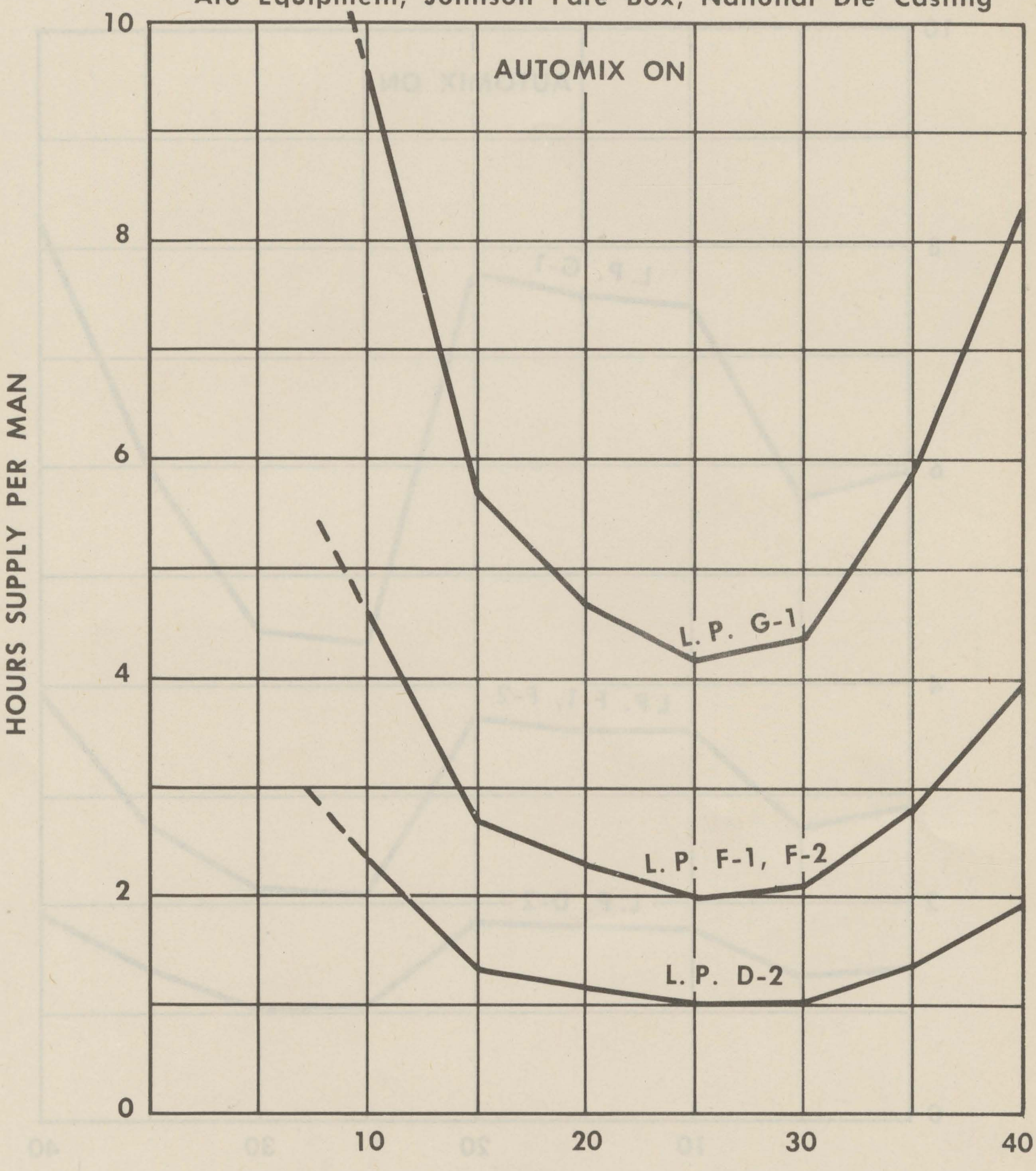
### TYPES A-8A AND A-9A REGULATOR

*Graph No. 2*

# OXYGEN DURATION

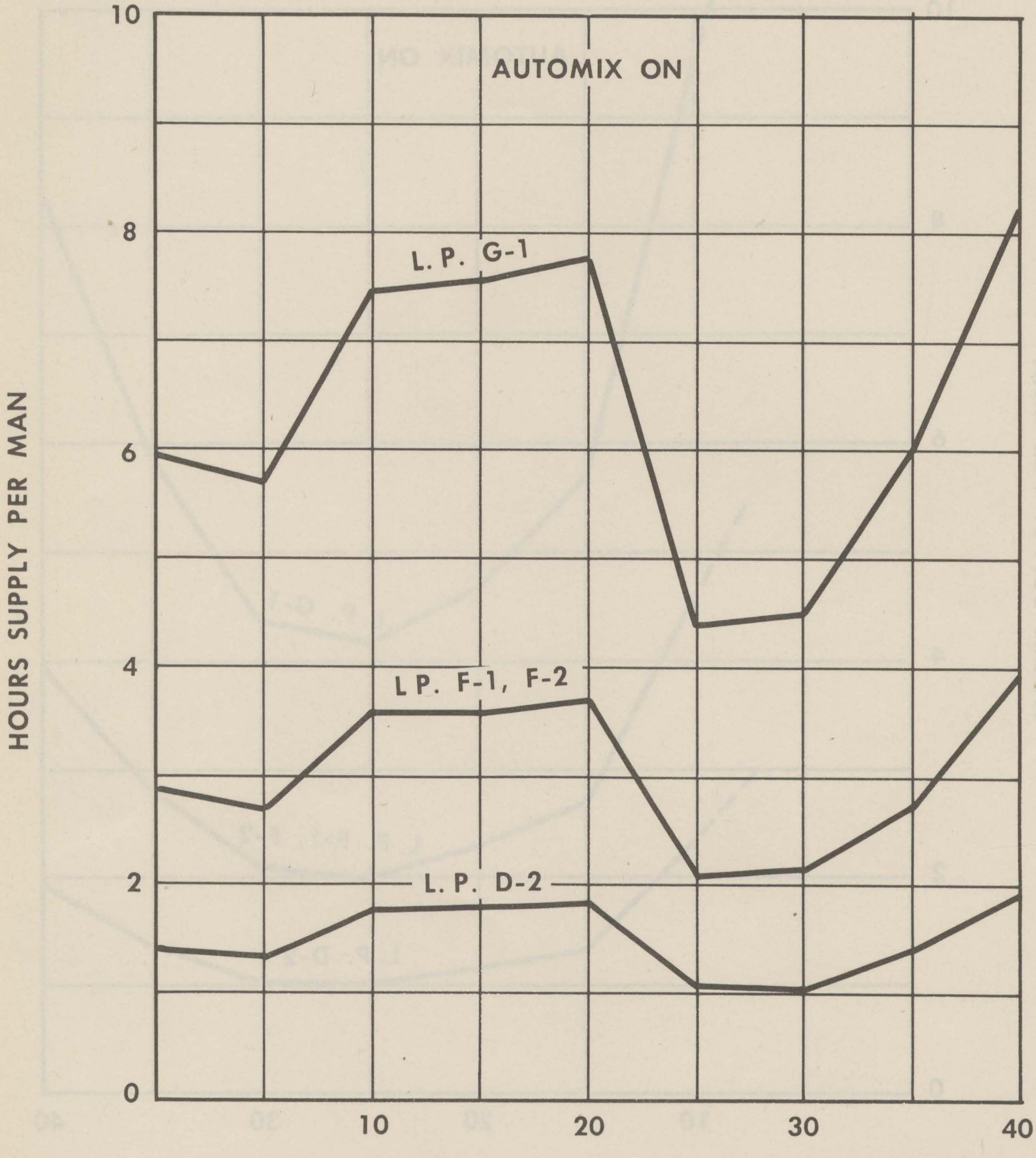
## DEMAND REGULATOR — TYPE A-12

Air Reduction Design Manufactured by Air Reduction, Aro Equipment, Johnson Fare Box, National Die Casting




*Graph No. 3*

# OXYGEN DURATION
## DEMAND REGULATOR — TYPE A-12
### Pioneer Design Manufactured by Pioneer Instrument

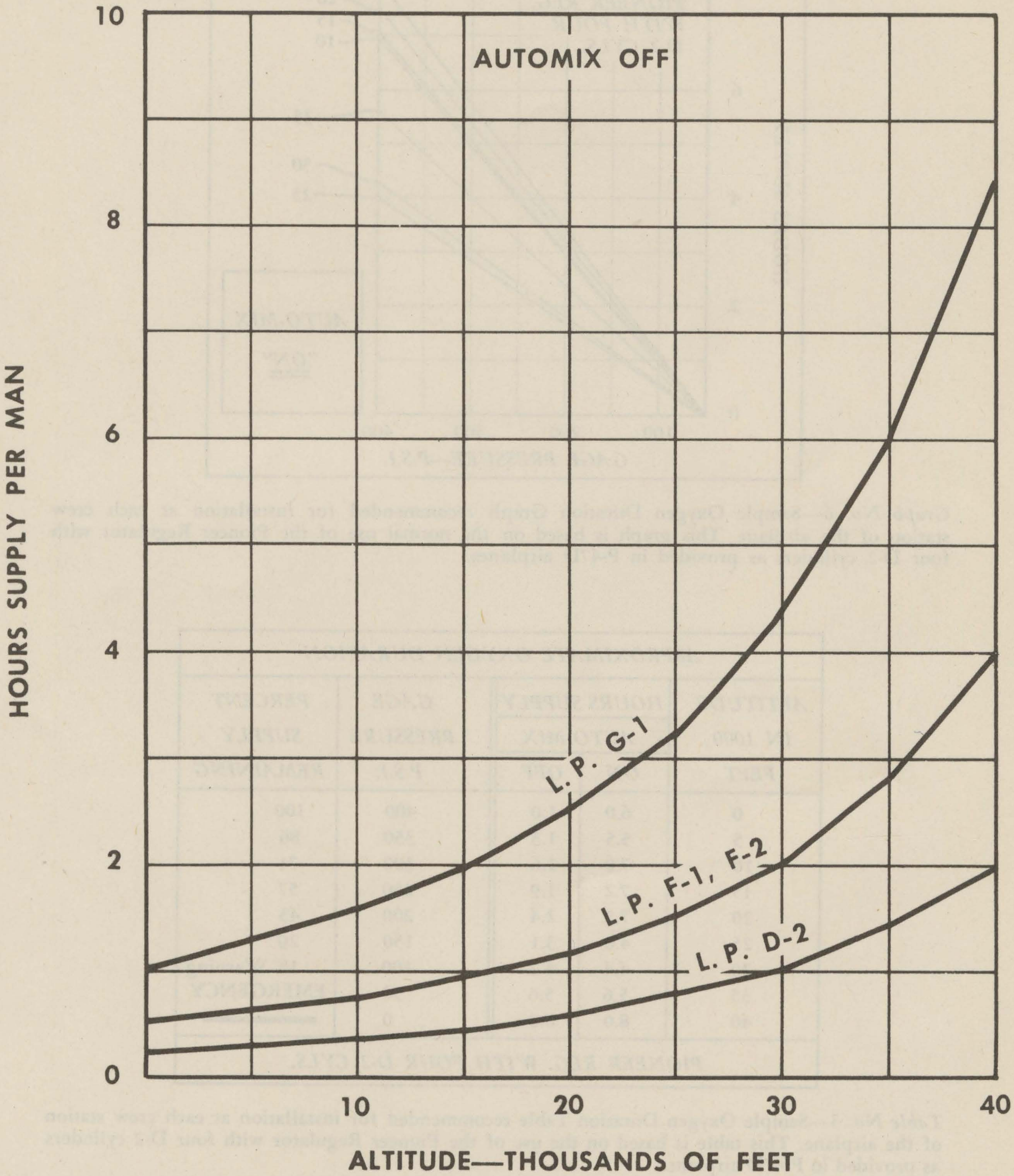



*Graph No. 4*

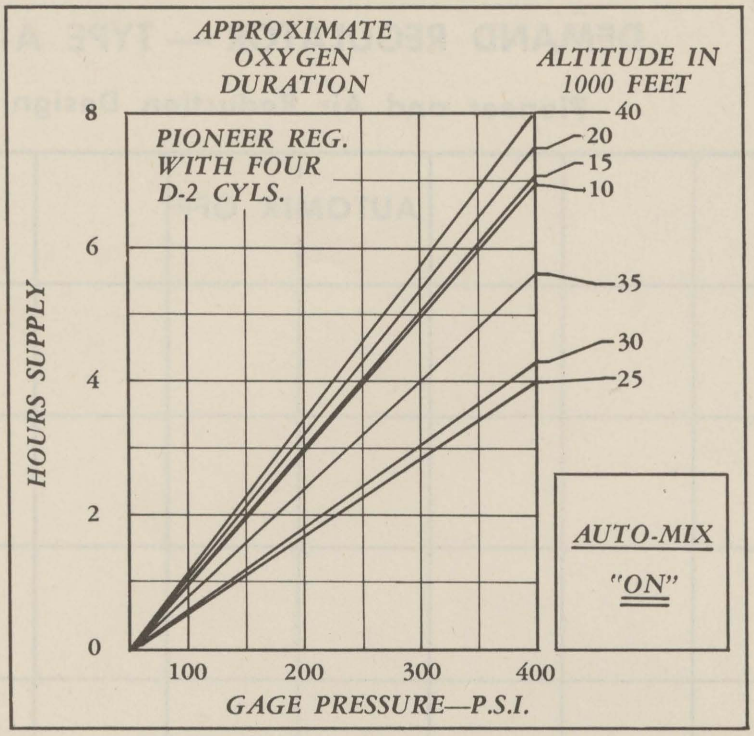
# OXYGEN DURATION

## DEMAND REGULATOR — TYPE A-12

### Pioneer and Air Reduction Design




*Graph No. 5*




*Graph No. 6*—Sample Oxygen Duration Graph recommended for installation at each crew station of the airplane. This graph is based on the normal use of the Pioneer Regulator with four D-2 cylinders as provided in P-47D airplanes.

| *APPROXIMATE OXYGEN DURATION* | | | | |
|---|---|---|---|---|
| *ALTITUDE IN 1000 FEET* | *HOURS SUPPLY AUTO-MIX* | | *GAGE PRESSURE P.S.I.* | *PERCENT SUPPLY REMAINING* |
| | *ON* | *OFF* | | |
| 0 | 6.0 | 1.0 | 400 | 100 |
| 5 | 5.5 | 1.3 | 350 | 86 |
| 10 | 7.0 | 1.6 | 300 | 71 |
| 15 | 7.2 | 1.9 | 250 | 57 |
| 20 | 7.5 | 2.4 | 200 | 43 |
| 25 | 4.0 | 3.1 | 150 | 29 |
| 30 | 4.4 | 4.2 | 100 | 14 Warning |
| 35 | 5.6 | 5.6 | 50 | EMERGENCY |
| 40 | 8.0 | 8.0 | 0 | |
| *PIONEER REG. WITH FOUR D-2 CYLS.* | | | | |

*Table No. 3*—Sample Oxygen Duration Table recommended for installation at each crew station of the airplane. This table is based on the use of the Pioneer Regulator with four D-2 cylinders as provided in P-47D airplanes.

*c.* DURATION CHARTS.

Using the graphs and instructions given, a card can be prepared showing the duration of oxygen in a particular airplane at each interval of 5,000 feet altitude, taking into consideration the number of each type of cylinder and the kind of A-12 regulator installed in the airplane for each station. The card can be installed in a position at each station of the airplane so as to be plainly visible or readily available to the crew member. Graph 6 and table 3 illustrate the type of cards that can be used. It is recommended that both the graph and the table be put on the card. This particular data is for the P-47D airplane.

*d.* TEMPERATURE CHANGES.

When the airplane ascends from ground level, where the temperature might be quite high, to high altitude, where the temperature is very low, there will be a pressure drop in the oxygen system due to temperature changes of the cylinders. The pressure may drop as much as 100 pounds. This does not mean that any oxygen has been lost. All the oxygen is still there and available for use. It is just that the drop in temperature has caused that same volume of gas contained in the cylinders to decrease in pressure.

## SECTION V

## MAINTENANCE


**KEEP OIL AWAY!**


**DON'T OPEN VALVES WHERE THERE IS A FLAME OR ELECTRIC ARCS!**

**WARNING**

Never use a mixture containing oil or grease on any connections, packings, valves, gages or other oxygen equipment. Failure to observe these precautions may result in an explosion.

**CAUTION**

Oxygen should never be discharged in a closed compartment where open flames are present or electrical arcs are likely to occur.

## 15. LOW PRESSURE OXYGEN SYSTEMS.

*a.* All low pressure tubing to be used in replacement will be seamless copper 5/16 inch x .032-inch wall conforming to Specification WW-T-799 or aluminum alloy conforming to Specification WW-T-787. All fittings will be of the AN flared tube type conforming to Specification AN-WW-F-366. AN and 811 type fittings are interchangeable in the 5/16 size.

*b.* All aluminum alloy straight threads will be treated with a suitable anti-seize compound, only if experience shows that the threads are seizing. All brass pipe threads will be sealed with a suitable sealing compound. All aluminum alloy pipe threads will be treated with a suitable combination anti-seize and sealing compound. The compounds will be specifically approved for use in oxygen systems. The approved compounds will be used and applied in accordance with the manufacturers' recommendations. Caution will be exercised to insure that the compounds are carefully and sparingly put only on the male threads, making sure that none enter the tubing.

(1) Approved combination anti-seize and sealing compounds for pipe threads of fittings made of aluminum alloy and other materials are AQUADAG, PIONEER ANTI-SEIZE COMPOUND NO. 2, RECTORSEAL NO. 15, lead coating and tin coating (plating, dipping or tinning).

(2) In emergency only, in the field, when the above-mentioned combination anti-seize and sealing compounds are not available, litharge (yellow lead oxide) and glycerine may be used for sealing pipe threads.

(3) Above compounds shall never be used on flared tube fittings to prevent oxygen leakage. Proper tube flaring and assembly of flared tube fittings is sufficient to prevent leakage.

**NOTE**

*Maintenance of all items in the system will be accomplished in accordance with applicable Technical Orders.*

*c.* Defective cylinders, regulators, indicating instruments and portable apparatus will be returned to instrument repair departments of control depots where the maintenance will be accomplished in accordance with the latest instructions.

*d.* Cylinders are to be kept clean and dry, inside and outside. The type A-4 cylinder is finished with green lacquer, Specification No. AN-TT-L-51 (Reference T. O. No. 03-50-8).

*e.* Whenever cylinders or any other oxygen instruments are removed from the system, all open ends should be plugged. The use of friction tape should be avoided when possible. After the removal of any tape, the surface must be clean and free of any adhesive.

**CAUTION**

Extreme caution must be exercised in the use of oxygen equipment to insure that none of it becomes contaminated with oil or grease. Fire or explosion may result when slight traces of oil and grease are in contact with oxygen under pressure. *Be sure that all lines fittings, instruments, ground equipment and other oxygen items are free from oil, grease and other foreign matter. BE SURE, BE SAFE.*

*f.* When changing instruments at stations in individually manifolded airplanes, the station system oxygen supply may be relieved without losing oxygen in the other individual systems by plugging the British adapter (AAF Drawing No. 42A6950), located in the filler valve box, into the filler valve. This procedure quickly relieves the pressure in the filler lines, thus causing the check valves to separate each individual manifold. The oxygen in the individual system may then be allowed to escape if the emergency valve is opened on the regulator.

## 16. HIGH PRESSURE OXYGEN SYSTEMS.

*a.* Maintenance of high pressure equipment will be the same as that of low pressure equipment unless otherwise stated.

*b.* All tubing for replacement will be copper 3/16 inch x .032-inch wall conforming to Specification WW-T-799, type N. All tubing connections will be AN Standard Nos. 780, 785, 790, 791, 795, 800, and 805 and will be silver soldered to the tubing in accordance with Specification 20019. (Tubing will be removed from the airplane to accomplish silver soldering.)

*c.* All pipe threads will be sealed with an approved sealing compound.

*d.* Cylinders will be recharged in accordance with the instructions contained in T. O. 03-50-2.

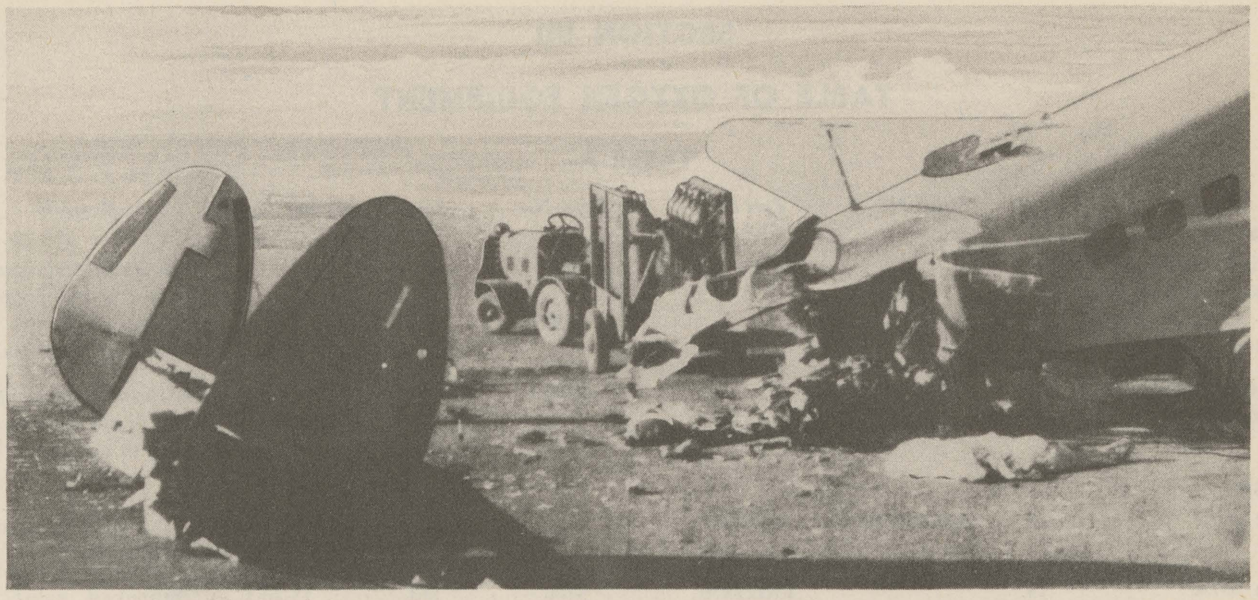


*Figure 23—Photo of Oxygen Accident at Midland, Texas*

**CAUTION**

All low pressure systems have a 400 p.s.i. working pressure. In recharging the system use the Aircraft Oxygen Cylinder Recharger (Drawing 41G5917, T. O. 19-1-2). In recharging, fill to 425 p.s.i. This allows the cylinder to cool down to about 400 p.s.i. The overcharge is necessary, since the cylinders get warm. Do not exceed 450 p.s.i. Be sure a dryer is used and that a pressure reducing regulator is on the recharger. NEVER FILL A LOW PRESSURE SYSTEM FROM A STORAGE CYLINDER WITHOUT A PRESSURE REDUCING REGULATOR TO REDUCE THE HIGH PRESSURE TO THE SAFE WORKING PRESSURE OF THE LOW PRESSURE SYSTEM. The condition shown in figure 23 may happen to you if this rule is not observed.

## SECTION VI

## APPLICABLE DATA

**17. THE FOLLOWING IS APPLICABLE DATA AND INFORMATION ON OXYGEN EQUIPMENT.**

*a.* LITHOGRAPHIC WALL CHARTS.

*b.* The following training films may be obtained by sending a requisition through the unit supply officer to: Commanding General, Air Service Command, Patterson Field, Fairfield, Ohio. Attention: Maintenance Data Section, Training Aids Division Liaison Office.

(1) TF 1-313, Physiology of High Altitude Flying—16 mm. sound.

(2) TF 1-487, Oxygen Equipment: Types and Use at High Altitude—16 mm. sound.

(3) TF 1-488, Oxygen Equipment: Servicing Equipment in Airplane—16 mm. sound.

(4) TF 1-489, Oxygen Equipment: Servicing High Pressure Removal Cylinders—16 mm. sound.

*c.* Reference has been made to the following Technical Orders which contain applicable data and instructions:

(1) T. O. No. 16-20-1, Maintenance of Gas Cylinders.

(2) T. O. No. 03-50-8, Handbook of Instructions Low Pressure Oxygen Cylinders.

(3) T. O. No. 03-50-2, Charging of Oxygen Cylinders, Recharging Assembly.

(4) T. O. No. 19-1-2, Model 02 Portable Oxygen Recharging Assembly.

# SECTION VII

## TABLE OF OXYGEN EQUIPMENT

### TABLE A

| *Item* | *Class* | *Stock No.* | *Part No.* | *Spec. No.* | *Status* | *Applicable T.O.* | *Remarks* |
|---|---|---|---|---|---|---|---|
| **General** | | | | | | | |
| Specification for the Installation of Low Pressure Oxygen Equipment in Airplanes. | | | | 40363 | Std. | | Covers general requirements for low pressure oxygen systems installed in airplanes. |
| Aviators' Breathing Oxygen | 06-B | 7500-826000 | | AN-0-1 | Std. | | Covers requirements for breathing oxygen used in airplanes. |
| **Masks** | | | | | | | |
| Type A-7 | 13 | 8300-595720 | 40G2065 | | Ltd. Std. | 13-20-1<br>13-20-2 | Nasal rebreather continuous flow. |
| Type A-7A | 13 | | 43G22376 | 3166 | Std. | 13-20-1 | Improved nasal rebreather, continuous flow. For troop transport. |
| Type A-8 | 13 | 8300-595730 | 40G6471 | 94-3107 | Ltd. Std. | 13-20-1<br>13-20-4 | Oral-nasal rebreather, continuous flow. |
| Type A-8A | 13 | 8300-595750 | 41A5658 | 94-3107 | Ltd. Std. | 13-20-1<br>13-20-4 | Improved oral-nasal rebreather, continuous flow. |
| Type A-8B | 13 | 8300-595770 | 42G4764 | 94-3107 | Ltd. Std. | 13-20-1<br>13-20-4<br>03-50-4 | Similar to A-8A but with two valve turrets and microphone provisions. For troop transports. |
| Type A-9 long | 13 | 8300-595810 | | 3125 | Std. | 13-20-1 | Demand with four point helmet or head strapping suspension. |
| Type A-9 short | 13 | 8300-595820 | | 3125 | Std. | 13-20-1 | |
| Type A-10—large | 13 | 8300-595840 | | 3134 | Std. | 13-20-1 | Improved demand with five point helmet or head strapping suspension. |
| Type A-10—std. | 13 | 8300-595850 | | 3134 | Std. | 13-20-1 | |
| Type A-10—small | 13 | 8300-595845 | | 3134 | Std. | 13-20-1 | |
| AN Standard | 13 | | AN6001-1 | AN-M-3 | Std. | | Covers continuous flow and demand masks similar to A-10. |
| Type A-10 Revised large | 13 | 8300-595840 | | 3134 | Std. | 13-20-1<br>03-50B-1 | Improved demand with two point helmet suspension. |
| Type A-10 Revised std. | 13 | 8300-595850 | | 3134 | Std. | 13-20-1<br>03-50B-1 | |
| Type A-10 Revised small | 13 | 8300-595845 | | 3134 | Std. | 13-20-1<br>03-50B-1 | |
| Type A-10 Revised extra small | 13 | 8300-595830 | | 3134 | Std. | 13-20-1<br>03-50B-1 | |
| Type A-14 Large | 13 | | | 3163 | Std. | 13-20-1 | Improved demand with three point helmet suspension. |
| Type A-14 Medium | 13 | | | 3163 | Std. | 13-20-1 | |
| Type A-14 Small | 13 | | | 3163 | Std. | 13-20-1 | |

| *Item* | *Class* | *Stock No.* | *Part No.* | *Spec. No.* | *Status* | *Applicable T.O.* | *Remarks* |
|---|---|---|---|---|---|---|---|
| **Mask Microphones** | | | | | | | |
| T-44 Microphone | | 2-B-1644A | | 71-1163 | Std. | 03-50B-1 | Magnetic microphone for use in mask. |
| ANB-M-C1 Microphone | | 2-B-1660 | | 71-1164 | Std. | 03-50B-1 | Carbon microphone for use in mask. |
| **Regulators** | | | | | | | |
| Type A-6 | 03-K | 5500-720000 | | 94-40249 | Ltd. Std. | 03-50A-1 | High pressure, manual, continuous flow for pipe stem. |
| Type A-8 | 03-K | | | 94-40300 | Ltd. Std. | 03-50A-1 | High pressure, manual, continuous flow for mask. |
| | When Stock is exhausted use Type A-8A 5500-717850 | | | | | | |
| Type A-8A | 03-K | 5500-717850 | | 94-40300 | Ltd. Std. | 03-50A-1 | Improved high pressure, manual, continuous flow for mask. |
| Type A-9 | 03-K | | | 94-40319 | Ltd. Std. | 03-50A-1 | Low pressure, manual, continuous flow for mask. |
| | When Stock is exhausted use Type A-9A 5500-721120 | | | | | | |
| Type A-9A | 03-K | 5500-721120 | | 94-40319 | Ltd. Std. | 03-50A-1 | Improved low pressure, manual, continuous flow for mask. |
| Type A-11 | 03-K | 5500-721160 | | 94-40334 | Std. | 03-50A-10<br>03-50A-8 (Airco) | Low pressure, automatic, continuous flow, for use in troop transport. |
| Type A-12 | 03-K | 5500-721200 | | 94-40370 | Std. | 03-50A-5 (Pioneer)<br>03-50A-11 | Low pressure, diluter demand. |
| AN Standard | 03-K | | AN6004-1 | AN-R-5 | Std. | | High pressure diluter demand similar to A-12. |
| Type A-13 | 03-K | 5500-718295-5 | | 94-40382 | Std. | 03-50A-6<br>03-50A-9 | Low pressure 100% oxygen demand on portable unit. |
| AN Standard | | | AN6022-1 | AN-R-11 | Std. | | Low pressure 100% oxygen demand similar to A-13. |
| **Indicating Instruments** | | | | | | | |
| Type A-1 Flow Ind. | 03-K | 5500-513950 | | 40389 | Std. | 03-50-13 | Bouncing ball. |
| Type A-3 Flow Ind. | 03-K | 5500-513975 | | 40427 | Std. | 03-50-19 | Blinking eye. |
| AN Standard | 03-K | | AN6029-1 | AN-I-12 | Std. | | Similar to A-3 flow indicator. |
| Type K-1 Press. Gage | 03-K | 5500-453500 | | 27368 | Std. | 03-50-23 | Indicates pressure of low pressure system. |
| AN Standard | 03-K | | AN6021-1 | AN-G-13 | Std. | | Similar to K-1 gage. |
| Type G-1 Press. Signal | 03-K | 5500-786500 | | 32376 | Std. | 03-50-11 | Lights indicator lamp at 100 p.s.i. |

| Item | Class | Stock No. | Part No. | Spec. No. | Status | Applicable T.O. | Remarks |
|---|---|---|---|---|---|---|---|
| **Indicating Instruments (continued)** | | | | | | | |
| Electrical Connector Plug | 0-3C | 4202— Use Part No. | AN3106-10SL-4S | | Std. | | Straight, Type PA, electrical connection for G-1 Pressure Signal. |
| Indicator Lamp | 0-3C | 4202— Use Part No. | 42B3593-2 | | Std. | | Amber warning lamp assembly without lamp bulb. |
| Lamp AN Standard | 08-B | 8800-465850 | AN3121-2 | | Std. | | Lamp bulb for indicator lamp, 28V., O.17 AMPS, Type C-2 filament, Bulb Type T-3-¼, Trade No. 313 Miniature bayonet single contact, clear. |
| **High Pressure Cylinders** | | | | | | | |
| General | 03-K | | | 94-40244 | Ltd. Std. | 03-50-2, 4 16-20-1, 1A & 4 | General requirements for high pressure cylinders. |
| Type A-2 | 03-K | 5500-341750 | | 94-40302 | Ltd. Std. | 16-20-1, 1A & 4 | 96 cu. in. H. P. |
| Type B-1 | 03-K | 5500-342000 | | 94-40246 | Ltd. Std. | 16-20-1, 1A & 4 | 295 cu. in. H. P. |
| Type C-1 | 03-K | 5500-343000 | | 94-40247 | Ltd. Std. | 16-20-1, 1A & 4 | 386 cu. in. H. P. |
| Type D-1 | 03-K | 5500-344000 | | 94-40248 | Ltd. Std. | 16-20-1, 1A & 4 | 514 cu. in. H. P. |
| Type E-1 | 03-K | 5500-345000 | | 94-40251 | Ltd. Std. | 16-20-1, 1A & 4 | 646 cu. in. H. P. |
| Type H-1 | 03-K | 5500-358160 | | 40373 | Std. | | 20 cu. in. H. P. continuous flow (emergency) bail-out cylinder, includes hand turned valve and pipe stem. |
| Type H-2 | 03-K | | | 40642 | Std. | | 20 cu. in. H. P. continuous flow emergency cylinder with rip-cord release. Used with demand mask. |
| **Low Pressure Cylinders** | | | | | | | |
| General | 03-K | | | 94-40320 | | | General requirements for low pressure cylinders. |
| Type A-4 | 03-K | 5500-358130 | | 94-40376 | Std. | 03-50-8 | 104 cu. in. L. P. |
| Type D-2 | 03-K | 5500-344020 | | 94-40355 | Std. | 03-50-8 | 500 cu. in. L. P. |
| Type F-1 | 03-K | 5500-345100 | | 94-40330 | Std. | 03-50-8 | 1000 cu. in. L. P. |
| Type F-2 | 03-K | 5500-345120 | | 94-40356 | Std. | 03-50-8 | 1000 cu. in. L. P. |
| Type G-1 | 03-K | 5500-345230 | | 94-40321 | Std. | 03-50-8 | 2100 cu. in. L. P. |
| Type J-1 | 03-K | 5500-345500 | | 40407 | Std. | | 18000 cu. in. L. P. |

| Item | Class | Stock No. | Part No. | Spec. No. | Status | Applicable T.O. | Remarks |
|---|---|---|---|---|---|---|---|
| **Valves** | | | | | | | |
| Filler | 03-K | 5500-955330 | 41B5316 | 40326 | Std. | | L. P. valve containing a check valve, through which low pressure system is filled. Also used with portable recharger. |
| AN Standard | 03-K | | AN6024 (-1, -2, -3) | AN-V-14 | Std. | | Similar to Spec. 94-40326 filler valve. |
| Check | 03-K | | | 40325 | Std. | | L. P. valve permitting flow in one direction only. By shutting off, it prevents loss of one part of the system when another part is shot away. |
| Style A | 03-K | 5500-955070 | 43A9021 | 40325 | Std. | | Single check, tube to tube (5/16). |
| Style B | 03-K | 5500-955125 | 43A9026 | 40325 | Std. | | Tee dual check, end pipe thread (1/4), two tubes (5/16). |
| Style C | 03-K | 5500-955128 | 43A9028 | 40325 | Std. | | Tee dual check, side pipe thread (1/4), two tubes (5/16). |
| Style D | 03-K | 5500-955129 | 43A9030 | 40325 | Std. | | Tee dual check, three tubes (5/16). |
| Style E | 03-K | 5500-955600 | 43A9032 | 40325 | Std. | | Cross triple check, four tubes (5/16). |
| Style F | 03-K | 5500-955060 | 43A9034 | 40325 | Std. | | Single check, pipe thread (1/4) to tube (5/16). |
| Style G | 03-K | 5500-955065 | 43A9036 | 40325 | Std. | | Single check, tube (5/16) to pipe thread (1/4). |
| Line | 03-K | 5500-959360 | | 40386 | Std. | | Low pressure hand shut-off valve. |
| Automatic Coupling (tube) | 03-K | 5500-391660 Similar to 22690A 5500-272450 | 41A6006 | | Std. | | Automatic coupling, containing check valve, with 5/16 male flared tube fitting on end. Used with continuous flow rebreather mask in troop transports. |
| Automatic Coupling (pipe) | 03-K | | 43A21601 | | Std. | | Automatic coupling, containing check valve, with 1/8 male pipe thread on end. Used with continuous flow rebreather mask in troop transports. |
| AN Standard | 03-K | | AN6009-1 | | Std. | | Similar to 41A606 automatic coupling. |

| Item | Class | Stock No. | Part No. | Spec. No. | Status | Applicable T.O. | Remarks |
|---|---|---|---|---|---|---|---|
| **Portable Apparatus** | | | | | | | |
| Portable Unit (B-1 cyl.) | 03-K | Procured only as separate Items B-1 Cyl. 5500-342000 A-8A Regulator 5500-717850. Sling Local Manufacture. | 41G9673 | | Ltd. Std. | | High pressure continuous flow, B-1 cyl., A-8A reg. and sling. Used in troop transports in which no oxygen is provided. |
| Portable Unit (A-2 cyl.) | 03-K | Procured only as separate items. A-2 Cyl. with Sling 5500-341750. A-8A Regulator 5500-717850. | 41G2437 | | Ltd. Std. | | High pressure continuous flow, A-2 cyl., A-8A regulator and sling. Walk-around unit for airplanes with H.P. or L.P. continuous flow systems. |
| Portable Unit (D-2 cyl.) | 03-K | Procured only as separate items. Regulator A-9A 5500-721120. Cyl. D-2. 5500-344020. | 43B16246 | | Std. | | Low pressure continuous flow, D-2 cyl., A-9A reg., filler valve and sling. Walk-around unit for airplanes with L.P. continuous flow. |
| Portable Demand Unit (A-4 cyl.) | 03-K | 5500-358118 | 42D5357 | | Std. | | Low pressure demand, A-4 cyl., A-13 reg. Walk-around unit for airplanes with demand system. |
| AN Standard | 03-K | | AN6020-1 | | Std. | | Similar to 42D5357 portable demand unit. |
| Portable Demand Unit (D-2 cyl.) | | | X43B15079 | | Exp. | | Low pressure demand, D-2 cyl., A-13 reg. (with 43C16247 sling if desired. Walk-around unit having 5 times duration of Portable Demand Unit (A-4 cyl.) for airplanes with demand system. |
| Portable Recharger | 03-K | 5500-717450 | 42D7261-24 | | Std. | | Low pressure hose, orifice and filler valve assembly installed in airplanes with demand system. For recharging Portable Demand Unit (A-4 or D-2 cyl.) before and during flight. |
| Bail-out and Emergency | 03-K | | | | | | See Types H-1 and H-2 under High Pressure cylinders. |
| **Ground Servicing Equipment** | | | | | | | |
| Type A-2 Purifier | 19-C | 5126-120-07D | 37G4082 | 94-40266 | Ltd. Std. | 03-50-3 | Oxygen dryer for high pressure cylinders. Used at depots. |

| Item | Class | Stock No. | Part No. | Spec. No. | Status | Applicable T.O. | Remarks |
|---|---|---|---|---|---|---|---|
| **Ground Servicing Equipment (continued)** | | | | | | | |
| Type A-3 Purifier | 19-C | 5126-120-07D | 42D13981 | 40352 | Std. | 19-1-2 | Container for holding one purifier cartridge. Used in recharging cart and trailer. |
| Purifier Cartridge | 24 | 8500-396500 | | 40450 | Std. | 19-1-2 | Dryer element in A-3 Purifier used in recharging cart and trailer. Should be replaced after using 16 storage cylinders. |
| Aircraft Cylinder Recharger | 19-A | 8200-805000 | 41G5917 | 40327 | Std. | 19-1-2 | Recharging cart for low pressure system only. Includes pressure reducing regulator and A-3 purifier. Has 2 storage cylinder capacity. |
| Hose, Low Pressure Flexible | 19-C | 5126-42D | 19277-5-180 | | Std. | | To replace hose on recharger cart 41G5917. |
| Nipple, Adapter | 19-C | 5152-43A | 14288-1 | | Std. | | Must be used with the above hose 42D19277. |
| Type E-1 Servicing Trailer | 19-A | 8200-953500 | 42J14275 | 30155 | Std. | | Recharging trailer for both high and low pressure systems. Includes pressure reducing regulator and two A-3 purifiers. Has 14 storage cylinder capacity. |
| Yoke, Assembly | 03-K | 5500-998500 | Ohio Chemical 250 | | Std. | | For recharging Type H-1 bail-out cylinder. |
| Adapter, Assembly Emergency Cylinder Recharging | 19-A | | Bastian-Blessing 4371-30 | | Std. | | For recharging Type H-2 emergency cylinder. |
| **Adapters** | | | | | | | |
| AN Standard Army or Navy to British Union | 03-K | 5500-005900 | AN6005-1 | | Std. | 03-50-10 | Based on Dwg. 42A-6896, used in filling Army or Navy high pressure cylinders from British recharging equipment. |
| AN Standard British to Army or Navy Union | 03-K | 5500-073000 | AN6006-1 | | Std. | 03-50-10 | Based on Dwg. 42A-6883, used in filling British high pressure cylinders from Army or Navy recharging equipment. |
| AN Standard Navy to Army Union | 03-K | 5500-076000 | AN6007-1 | | Std. | 03-50-10 | Based on Dwg. 42A-6900, used in filling Navy high pressure cylinders from Army recharging equipment. (Navy connections directly fit Army high pressure cylinders and no adapters needed.) |

| Item | Class | Stock No. | Part No. | Spec. No. | Status | Applicable T.O. | Remarks |
|---|---|---|---|---|---|---|---|
| ***Adapters (continued)*** | | | | | | | |
| Army to British Low Pressure Adapter | 03-K | 5500-006050 | 42A6950 | | Std. | 03-50-10 | Used in filling Army low pressure systems from British recharging equipment. Installed with low pressure filler valve in Army airplanes. |
| Army to Navy Low Pressure Adapter | 03-K | 5500-006100 | 42A7543 | | Std. | 03-50-10 | Used in filling Army low pressure systems from Navy recharging equipment. |
| Low Pressure Filler Valve Adapter | 19-C | 5152- | 40A8475 | | Std. | 19-1-2 | Used in filling Army low pressure systems from Army recharging equipment. Provided with 41G5917 recharging cart. |
| AN Standard | 19-C | | AN6027-1 | | Std. | | Similar to 40A8475 adapter. |
| Army Mask to British Outlet Adapter | 03-K | 5500-006950 | 42B13342 | | Std. | 03-50-10 | For use in adapting A-8 series masks to British MKIII series bayonet sockets. |
| **Thread Compounds** | | | | | | | |
| Aquadag | | | Acheson Colloids Corp., Port Huron, Mich. | | Std. | | Combination anti-seize and sealing compound for pipe threads. |
| Pioneer Anti-Seize No. 2 | 06-B | 7500-050800 | Pioneer Inst. Div., Bendix Avia. Corp. Bendix, N. J. | | Std. | | Combination anti-seize and sealing compound for pipe threads. |
| Rectorseal No. 15 | | | Rector Well Equipment Co. Houston, Texas | | Std. | | Combination anti-seize and sealing compound for pipe threads. Non-hardening. |
| Sealing Compound, Oxygen System Fittings, NA2-0306 | | | North American Aviation, Inc., Inglewood, California | | Std. | | Combination anti-seize and sealing compound for pipe threads. |

| *Item* | *Class* | *Stock No.* | *Part No.* | *Spec. No.* | *Status* | *Applicable T.O.* | *Remarks* |
|---|---|---|---|---|---|---|---|
| **Thread Compounds (continued)** | | | | | | | |
| Litharge (Yellow Lead Oxide) | 24 | 8500-568000 | | | Std. | | Sealing compound for brass pipe threads, when mixed together to form a paste. Hardens excessively and difficult to separate fittings. Use only if others not available. |
| Glycerine | 24 | 8500-522000 | | 4-1051 | Std. | | |
| AN Standard | | | | AN-C-86 | Std. | | Specifies requirements for combination anti-seize and sealing compounds for high and low pressure systems. |
| **Fittings** | | | | | | | |
| Sleeve; Coupling Copper Silicon | 04-A | 6500-911300 | 811T5CS | | Inactive | | Superseded by AN819-5D. |
| Nut; Sleeve coupling | | | | | | | |
| Alum. alloy | 04-A | 6500-530200 | 811BT5D | | Inactive | | Superseded by AN818-5D. |
| Brass | 04-A | 6500-532300 | 811BT5 | | Inactive | | |
| Nipple; Flared tube and pipe thread thread | | | | | | | |
| Alum. alloy | 04-A | 6500-460200 | 811FT5D | | Inactive | | Superseded by AN816-5D. |
| Brass | 04-A | 6500-461300 | 811FT5 | | Inactive | | |
| Connector; Flared tube and female pipe | | | | | | | |
| Alum. alloy | 04-A | 6500-340050 | 811GT5D | | Inactive | | |
| Brass | 04-A | 6500-340700 | 811GT5 | | Inactive | | |
| Union Flared tube | | | | | | | |
| Alum. alloy | 04-A | 6500-968900 | 811HT5D | | Inactive | | Superseded by AN815-5D. |
| Brass | 04-A | 6500-969700 | 811HT5 | | Inactive | | |
| Elbow; Flared tube and thread 90° | | | | | | | |
| Alum. alloy | 04-A | 6500-379700 | 811CT5D | | Inactive | | Superseded by AN822-5D. |
| Brass | 04-A | 6500-382700 | 811CT5 | | Inactive | | |
| Elbow; Flared tube and pipe thread 45° | | | | | | | |
| Alum. alloy | 04-A | 6500-379030 | 811CT45-5D | | Inactive | | Superseded by AN823-5D. |
| Brass | 04-A | 6500-381000 | 811CT45-5 | | Inactive | | |
| Elbow; Flared tube 90° | | | | | | | |
| Alum. alloy | 04-A | 6500-379680 | 811ET5D | | Inactive | | Superseded by AN821-5D and 833-5D. |
| Tee; Flared tube | | | | | | | |
| Alum. alloy | 04-A | 6500-926250 | 811JT5D | | Inactive | | Superseded by AN824-5D. |
| Brass | 04-A | 6500-927800 | 811JT5 | | Inactive | | |

| Item | Class | Stock No. | Part No. | Spec. No. | Status | Applicable T.O. | Remarks |
|---|---|---|---|---|---|---|---|
| **Fittings (continued)** | | | | | | | |
| Tee; Flared tube with pipe thread on run | | | | | | | |
| Alum. alloy | 04-A | 6500-926880 | 811RT5D | | Inactive | | Superseded by AN826-5D. |
| Brass | 04-A | 6500-931300 | 811RT5 | | Inactive | | |
| Tee; Flared tube with pipe thread on side | | | | | | | |
| Alum. alloy | 04-A | 6500-927050 | 811ST5D | | Inactive | | Superseded by AN825-5D. |
| Brass | 04-A | 6500-932150 | 811ST5 | | Inactive | | |
| Union-Flared tube | | | | | | | |
| Alum. alloy | 04-A | 6500-967215 | AN815-5D | AN-WW-F-366 | Std. | | Supersedes 811HT-5D and 811HT5. |
| Nipple-Flared tube and pipe thread | | | | | | | |
| Alum. alloy | 04-A | 6500-451856 | AN816-5D | AN-WW-F-366 | Std. | | Supersedes 811FT5D and 811FT5. |
| Nut; Sleeve, coupling | | | | | | | |
| Alum. alloy | 04-A | 6500-524030 | AN817-5D | AN-WW-F-366 | Std. | | Used without sleeve. |
| Nut; Coupling | | | | | | | |
| Alum. alloy | 04-A | 6500-496015 | AN818-5D | AN-WW-F-366 | Std. | | Supersedes 811BT5D and 811BT5. |
| Sleeve; coupling | | | | | | | |
| Alum. alloy | 04-A | 6500-909435 | AN819-5D | AN-WW-F-366 | Std. | | Supersedes 811T5D and 811T5CS. |
| Cap; Flared tube | | | | | | | |
| Alum. alloy | 04-A | 6500-282016 | AN820-5 | AN-WW-F-366 | Std. | | For plugging male flared tube fitting. |
| Elbow; Flared Tube 90° | | | | | | | |
| Alum. alloy | 04-A | 6500-361115 | AN821-5D | AN-WW-F-366 | Inactive | | Superseded by AN833-5D. Supersedes 811ET5D and 811ET5. |
| Elbow; Flared tube and pipe threads, 90° | | | | | | | |
| Alum. alloy | 04-A | 6500-361315 | AN822-5D | AN-WW-F-366 | Std. | | Supersedes 811CT5D and 811CT5. |
| Elbow; Flared tube and pipe threads, 45° | | | | | | | |
| Alum. alloy | 04-A | 6500-361215 | AN823-5D | AN-WW-F-366 | Std. | | Supersedes 811CT45-5D and 811CT45-5. |
| Tee; Flared tube | | | | | | | |
| Alum. alloy | 04-A | 6500-919525 | AN824-5D | AN-WW-F-366 | Std. | | Supersedes 811JT5D and 811JT5. |
| Tee; Flared tube with pipe thread on side | | | | | | | |
| Alum. alloy | 04-A | 6500-920038 | AN825-5D | AN-WW-F-366 | Std. | | Supersedes 811ST5D and 811ST5. |
| Tee; Flared tube with pipe thread on run | | | | | | | |
| Alum. alloy | 04-A | 6500-919978 | AN826-5D | AN-WW-F-366 | Std. | | Supersedes 811RT5D and 811RT5. |

| Item | Class | Stock No. | Part No. | Spec. No. | Status | Applicable T.O. | Remarks |
|---|---|---|---|---|---|---|---|
| **Fittings (continued)** | | | | | | | |
| Cross; Flared tube | | | | | | | |
| Alum. alloy | 04-A | 6500-349710 | AN827-5D | AN-WW-F-366 | Std. | | |
| Union-Flared tube bulkhead | | | | | | | |
| Alum. alloy | 04-A | 6500-967262 | AN828-5D | AN-WW-F-366 | Inactive | | Superseded by AN832-5D. |
| Elbow-Flared tube bulkhead 90° | | | | | | | |
| Alum. alloy | 04-A | 6500-361615 | AN829-5D | AN-WW-F-366 | Inactive | | Superseded by AN833-5D. |
| Tee; Flared tube bulkhead | | | | | | | |
| Alum. alloy | 04-A | 6500-919610 | AN830-5D | AN-WW-F-366 | Inactive | | Superseded by AN834-5D. |
| Union-Flared tube bulkhead and Universal | | | | | | | |
| Alum. alloy | 04-A | 6500-967245 | AN832-5D | AN-WW-F-366 | Std. | | Supersedes AN828-5D. |
| Elbow-Flared tube bulkhead and Universal | | | | | | | |
| Alum. alloy | 04-A | 6500-361660-6 | AN833-5D | AN-WW-F-366 | Std. | | Supersedes AN821-5D, AN829-5D, 811ET5D and 811ET5. |
| Tee-bulkhead and Universal flared tube | | | | | | | |
| Alum. alloy | 04-A | | AN834-5D | AN-WW-F-366 | Std. | | Supersedes AN830-5D. |
| Elbow; Street-Bronze | | | | | | | |
| ⅛" pipe thread | 04-A | 6500-390200 | 895-1 | | Inactive | | Superseded by AN914-1D and AN914-1. |
| ¼" pipe thread | 04-A | 6500-390300 | 895-2 | | Inactive | | Superseded by AN914-2D and AN914-2. |
| Elbow; Plain-Bronze | | | | | | | |
| ⅛" pipe thread | 04-A | 6500-356000 | 895-10 | | Inactive | | Superseded by AN916-1D and AN916-1. |
| ¼" pipe thread | 04-A | 6500-356200 | 895-11 | | Inactive | | Superseded by AN916-2D and AN916-2. |
| Elbow; 45°-Bronze | | | | | | | |
| ⅛" pipe thread | 04-A | 6500-357000 | 895-20 | | Inactive | | |
| ¼" pipe thread | 04-A | 6500-357100 | 895-21 | | Inactive | | |
| Tee; Plain-Bronze | | | | | | | |
| ⅛" pipe thread | 04-A | 6500-919100 | 895-30 | | Inactive | | Superseded by AN917-1D and AN917-1. |
| ¼" pipe thread | 04-A | 6500-919105 | 895-31 | | Inactive | | Superseded by AN917-2D and AN917-2. |
| Cross; Plain-Bronze | | | | | | | |
| ⅛" pipe thread | 04-A | 6500-349000 | 895-40 | | Inactive | | Superseded by AN918-1D and AN918-1. |
| ¼" pipe thread | 04-A | 6500-349100 | 895-41 | | Inactive | | Superseded by AN918-2D and AN918-2. |

| Item | Class | Stock No. | Part No. | Spec. No. | Status | Applicable T.O. | Remarks |
|---|---|---|---|---|---|---|---|
| **Fittings (continued)** | | | | | | | |
| Coupling; Round or Hex-Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-342700 | 895-50 | | Inactive | | Superseded by AN910-1D and AN910-1. |
| 1/4" pipe thread | 04-A | 6500-342800 | 895-51 | | Inactive | | Superseded by AN910-2D and AN910-2. |
| Nipple; Close-Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-451000 | 895-60 | | Inactive | | Superseded by AN911-1. |
| 1/4" pipe thread | 04-A | 6500-451100 | 895-61 | | Inactive | | Superseded by AN911-2. |
| Plug; Square Head-Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-625000 | 895-B70 | | Inactive | | Superseded by AN913-1D and AN913-1. |
| 1/4" pipe thread | 04-A | 6500-625100 | 895-B71 | | Inactive | | Superseded by AN913-2D and AN913-2. |
| Reducing bushing | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/4"x1/8" pipe thread | 04-A | 6500-245000 | 895-D80 | | Inactive | | Superseded by AN912-1D. |
| Brass | | | | | | | |
| 1/4"x1/8" pipe thread | 04-A | 6500-246100 | 895-80 | | Inactive | | Superseded by AN912-1. |
| Nipple-Shoulder-Hex | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-452050 | 895-D90 | | Inactive | | Superseded by AN911-1D. |
| 1/4" pipe thread | 04-A | 6500-452150 | 895-D91 | | Inactive | | Superseded by AN911-2D. |
| Brass | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-452000 | 895-90 | | Inactive | | Superseded by AN911-1. |
| 1/4" pipe thread | 04-A | 6500-452100 | 895-91 | | Inactive | | Superseded by AN911-2. |
| Coupling; pipe thread | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-344956 | AN910-1D | AN-WW-F-366 | Std. | | Supersedes 895-50. |
| 1/4" pipe thread | 04-A | | AN910-2D | AN-WW-F-366 | Std. | | Supersedes 895-51. |
| Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-344960 | AN910-1 | AN-WW-F-366 | Std. | | Supersedes 895-50. |
| 1/4" pipe thread | 04-A | 6500-344962 | AN910-2 | AN-WW-F-366 | Std. | | Supersedes 895-51. |
| Nipple; Pipe thread | | | | | | | |
| Alum. alloy | | | | | | | |
| Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-449700 | AN911-1D | AN-WW-F-366 | Std. | | Supersedes 895-D90 |
| 1/4" pipe thread | 04-A | 6500-449720 | AN911-2D | AN-WW-F-366 | Std. | | Supersedes 895-D91 |
| Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-450500 | AN911-1 | AN-WW-F-366 | Std. | | Supersedes 895-60 and 895-90. |
| 1/4" pipe thread | 04-A | 6500-450510 | AN911-2 | AN-WW-F-366 | Std. | | Supersedes 895-61 and 895-91. |
| Bushing, Reducer | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/4"x1/8" pipe thread | 04-A | 6500-244600 | AN912-1D | AN-WW-F-366 | Std. | | Supersedes 895-D80. |
| Bronze | | | | | | | |
| 1/4"x1/8" pipe thread | 04-A | 6500-244700 | AN912-1 | AN-WW-F-366 | Std. | | Supersedes 895-80. |

| Item | Class | Stock No. | Part No. | Spec. No. | Status | Applicable T.O. | Remarks |
|---|---|---|---|---|---|---|---|
| **Fittings (continued)** | | | | | | | |
| Plug; Pipe thread, square-head | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-619104 | AN913-1D | AN-WW-F-366 | Std. | | Supersedes 895-60. |
| 1/4" pipe thread | 04-A | 6500-619105 | AN913-2D | AN-WW-F-366 | Std. | | Supersedes 895-61. |
| Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-619110 | AN913-1 | AN-WW-F-366 | Std. | | Supersedes 895-60. |
| 1/4" pipe thread | 04-A | 6500-619115 | AN913-2 | AN-WW-F-366 | Std. | | Supersedes 895-61. |
| Elbow; Internal and external pipe thread 90° | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-368781 | AN914-1D | AN-WW-F-366 | Std. | | Supersedes 895-1. |
| 1/4" pipe thread | 04-A | 6500-368782 | AN914-2D | AN-WW-F-366 | Std. | | Supersedes 895-2. |
| Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-368800 | AN914-1 | AN-WW-F-366 | Std. | | Supersedes 895-1. |
| 1/4" pipe thread | 04-A | 6500-368810 | AN914-2 | AN-WW-F-366 | Std. | | Supersedes 895-2. |
| Elbow; Internal and external pipe thread 45° | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-368766 | AN915-1D | AN-WW-F-366 | Std. | | |
| 1/4" pipe thread | 04-A | 6500-368767 | AN915-2D | AN-WW-F-366 | Std. | | |
| Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-368772 | AN915-1 | AN-WW-F-366 | Std. | | |
| 1/4" pipe thread | 04-A | 6500-368773 | AN915-2 | AN-WW-F-366 | Std. | | |
| Elbow; Internal pipe threads 90° | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-354708 | AN916-1D | AN-WW-F-366 | Std. | | Supersedes 895-10. |
| 1/4" pipe thread | 04-A | 6500-354710 | AN916-2D | AN-WW-F-366 | Std. | | Supersedes 895-11. |
| Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-357700 | AN916-1 | AN-WW-F-366 | Std. | | Supersedes 895-10. |
| 1/4" pipe thread | 04-A | 6500-357710 | AN916-2 | AN-WW-F-366 | Std. | | Supersedes 895-11. |
| Tee; internal pipe threads | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-920165 | AN917-1D | AN-WW-F-366 | Std. | | Supersedes 895-30. |
| 1/4" pipe thread | 04-A | 6500-920167 | AN917-2D | AN-WW-F-366 | Std. | | Supersedes 895-31. |
| Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-920170 | AN917-1 | AN-WW-F-366 | Std. | | Supersedes 895-30. |
| 1/4" pipe thread | 04-A | 6500-920172 | AN917-2 | AN-WW-F-366 | Std. | | Supersedes 895-31. |
| Cross-internal pipe threads | | | | | | | |
| Alum. alloy | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-348800 | AN918-1D | AN-WW-F-366 | Std. | | Supersedes 895-40. |
| 1/4" pipe thread | 04-A | 6500-348810 | AN918-2D | AN-WW-F-366 | Std. | | Supersedes 895-41. |
| Bronze | | | | | | | |
| 1/8" pipe thread | 04-A | 6500-348950 | AN918-1 | AN-WW-F-366 | Std. | | Supersedes 895-40. |
| 1/4" pipe thread | 04-A | 6500-349050 | AN918-2 | AN-WW-F-366 | Std. | | Supersedes 895-41. |
| **Miscellaneous** | | | | | | | |
| High Press. Flexible Hose | | | | | | | |
| 14 inch | 03-K | 5500-504810 | 42D6957-5-14 | 26579 | Std. | | Rubber hose, in various lengths, for high pressure, with 5/16 flared tube fittings. |
| 24 inch | 03-K | 5500-504815 | 42D6957-5-24 | | | | |
| 48 inch | 03-K | 5500-504820 | 42D6957-5-48 | | | | |
| 72 inch | 03-K | 5500-504825 | 42D6957-5-72 | | | | |

| *Item* | *Class* | *Stock No.* | *Part No.* | *Spec. No.* | *Status* | *Applicable T.O.* | *Remarks* |
|---|---|---|---|---|---|---|---|
| **Miscellaneous *(continued)*** | | | | | | | |
| Low Press. Flexible Hose | | | | | | | |
| 14 inch | 03-K | 5500-504875 | 42D19277-5-14 | 26576 | Std. | | Rubber hose, in various lengths, for low pressure, with 5/16 flared tube fittings. |
| 24 inch | 03-K | 5500-504900 | 42D19277-5-24 | | | | |
| 48 inch | 03-K | 5500-504950 | 42D19277-5-48 | | | | |
| 72 inch | 03-K | 5500-505000 | 42D19277-5-72 | | | | |
| Turret Recharger | 03-K | | 43B18436 | | Std. | | Low pressure hose and filler valve assembly installed in airplanes. For recharging cylinders mounted on turrets. |
| Mask Regulator Tubing | | | | | | | |
| 1 Ft. length | 03-K | 5500-915725 | | 40387 | Std. | | Large diameter, reinforced, flexible tubing attached to A-12 regulator. Has female quick disconnect and clip at one end for demand mask connection. |
| 2 Ft. length | 03-K | 5500-915730 | | 40387 | Std. | | |
| 4 Ft. length | 03-K | 5500-915750 | | 40387 | Std. | | |
| 6 Ft. length | 03-K | 5500-915800 | | 40387 | Std. | | |
| AN Standard | 03-K | | AN6003 (-1, -2) | AN-T-16 | Std. | | Similar to 40387 Mask to Regulator Tubing. |
| Quick Disconnect | | | | | | | |
| Male | 03-K | 5500-391850 | 42B5341-1 | | Std. | | Fitting attached to demand mask. |
| Female | 03-K | 5500-391870 | 42B5341-2 | | Std. | | Fitting attached to mask regulator tubing. |
| AN Standard | 03-K | | AN6002-1 | | Std. | | Similar to 42B5341-2 female. |
| Copper Tubing, Type N | | | | | | | |
| 3/16 x .032 inch | 23-A | 6800-285350 | | WW-T-799 | Std. | | Rigid tubing for high pressure system. |
| 5/16 x .032 inch | 23-A | 6800-285850 | | WW-T-799 | Std. | | Rigid tubing for low pressure system. |
| Aluminum Alloy Tubing | | | | | | | |
| 5/16 x .035 in., soft | 23-A | 6800-153050 | | WW-T-787 | Std. | | Rigid tubing for low pressure system. |
| Mask Coupling | 13 | 8300-214650 | 41A2988 | | Ltd. Std. | | Bayonet fitting on A-8 series masks for connecting to continuous flow regulator or automatic coupling. |
| Mask Shield | 13 | | 43D14899 | | Std. | | Fabric bag for A-8B mask to reduce freezing. |
| Kit Connector Ass'y | 03-K | 5500-525000 | WL-138-A1 | | Std. | | For use with only Airco design A-12 regulators to relocate A-3 flow indicator tap. Aeronautical Equipment Ref. No. 46-715. |

| *Item* | *Class* | *Stock No.* | *Part No.* | *Spec. No.* | *Status* | *Applicable T.O.* | *Remarks* |
|---|---|---|---|---|---|---|---|
| **Miscellaneous *(continued)*** | | | | | | | |
| Type K-1 Oxygen Testing Kit | 05-B | 7800-462000 | | 40487 | Std. | 03-50-26 | Use for testing demand masks for leakage. |
| Meter, Ground Flow Check | 05-B | 7800-528100 | | 40400 | Std. | | Used for testing A-8 and A-9 series regulators for proper flow. |
| Nipple Adapter | | | 43A14288 | | Std. | | Has 1/4 M. pipe thread and 5/16 M. flared tube ends. Used between low pressure cylinder and line. |
| Adapter Fitting (1/8) | | | 43A18438 | | Std. | | Has 1/8 M. pipe thread and 5/16 F. flared tube ends. |
| Adapter Fitting (1/4) | | | 43A12528 | | Std. | | Has 1/4 M. pipe thread and 5/16 F. flared tube ends. |
| Flared Tube Plug | 04-A | | 43A18949 | | Std. | | For plugging flared tube line. Has 5/16 M. flared tube end. |
| Clip Attachment Strap | | Fabricate Locally | 43A17636 | | Std. | | Fabric strap, for installation in demand system airplanes, to which Mask Regulator Tubing is attached when not used. |
| Portable Recharger Clip | | Fabricate Locally | 43A13594 | | Std. | | Spring clip, for installation in demand system airplanes, to which Portable Recharger hose is attached when not used. |
| Demand Regulator Portable Leak Tester | | | 43B15132 (Dwg) | | Std. | | Used for measuring allowable leakage from A-12 demand regulator. |
| Troop System Leak Tester | | | 43B22051 (Dwg) | | Std. | | Method of testing troop system, between A-11 regulator and automatic couplings, for leakage. |
| Carbon Tetrachloride | 24 | 8500-278000 | | 4-503-110 | Std. | | For removing oil and grease in tubing, fittings and other items. Wash thoroughly several times with fresh solution. Blow dry with oxygen before using Isopropyl Alcohol. |
| Isopropyl Alcohol | 24 | 8500-116000 | | 14082 | Std. | | For removing traces of carbon tetrachloride. Wash thoroughly and blow dry with oxygen. |