



NONRESIDENT TRAINING COURSE

December 1985



Aircrew Survival Equipmentman 1 & C

NAVEDTRA 14217

Although the words “he,” “him,” and “his” are used sparingly in this course to enhance communication, they are not intended to be gender driven or to affront or discriminate against anyone.

PREFACE

By enrolling in this self-study course, you have demonstrated a desire to improve yourself and the Navy. Remember, however, this self-study course is only one part of the total Navy training program. Practical experience, schools, selected reading, and your desire to succeed are also necessary to successfully round out a fully meaningful training program.

THE COURSE: This self-study course is organized into subject matter areas, each containing learning objectives to help you determine what you should learn along with text and illustrations to help you understand the information. The subject matter reflects day-to-day requirements and experiences of personnel in the rating or skill area. It also reflects guidance provided by Enlisted Community Managers (ECMs) and other senior personnel, technical references, instructions, etc., and either the occupational or naval standards, which are listed in the *Manual of Navy Enlisted Manpower Personnel Classifications and Occupational Standards*, NAVPERS 18068.

THE QUESTIONS: The questions that appear in this course are designed to help you understand the material in the text.

VALUE: In completing this course, you will improve your military and professional knowledge. Importantly, it can also help you study for the Navy-wide advancement in rate examination. If you are studying and discover a reference in the text to another publication for further information, look it up.

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Sailor's Creed

"I am a United States Sailor.

I will support and defend the
Constitution of the United States of
America and I will obey the orders
of those appointed over me.

I represent the fighting spirit of the
Navy and those who have gone
before me to defend freedom and
democracy around the world.

I proudly serve my country's Navy
combat team with honor, courage
and commitment.

I am committed to excellence and
the fair treatment of all."

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AIRCREW SURVIVAL EQUIPMENTMAN 1 & C OCCUPATIONAL STANDARDS

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INSTRUCTIONS FOR TAKING THE COURSE

ASSIGNMENTS

The text pages that you are to study are listed at the beginning of each assignment. Study these pages carefully before attempting to answer the questions. Pay close attention to tables and illustrations and read the learning objectives. The learning objectives state what you should be able to do after studying the material. Answering the questions correctly helps you accomplish the objectives.

SELECTING YOUR ANSWERS

Read each question carefully, then select the BEST answer. You may refer freely to the text. The answers must be the result of your own work and decisions. You are prohibited from referring to or copying the answers of others and from giving answers to anyone else taking the course.

SUBMITTING YOUR ASSIGNMENTS

To have your assignments graded, you must be enrolled in the course with the Nonresident Training Course Administration Branch at the Naval Education and Training Professional Development and Technology Center (NETPDTC). Following enrollment, there are two ways of having your assignments graded: (1) use the Internet to submit your assignments as you complete them, or (2) send all the assignments at one time by mail to NETPDTC.

Grading on the Internet: Advantages to Internet grading are:

- you may submit your answers as soon as you complete an assignment, and
- you get your results faster; usually by the next working day (approximately 24 hours).

In addition to receiving grade results for each assignment, you will receive course completion confirmation once you have completed all the

assignments. To submit your assignment answers via the Internet, go to:

<http://courses.cnet.navy.mil>

Grading by Mail: When you submit answer sheets by mail, send all of your assignments at one time. Do NOT submit individual answer sheets for grading. Mail all of your assignments in an envelope, which you either provide yourself or obtain from your nearest Educational Services Officer (ESO). Submit answer sheets to:

COMMANDING OFFICER
NETPDTC N331
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32559-5000

Answer Sheets: All courses include one “scannable” answer sheet for each assignment. These answer sheets are preprinted with your SSN, name, assignment number, and course number. Explanations for completing the answer sheets are on the answer sheet.

Do not use answer sheet reproductions: Use only the original answer sheets that we provide—reproductions will not work with our scanning equipment and cannot be processed.

Follow the instructions for marking your answers on the answer sheet. Be sure that blocks 1, 2, and 3 are filled in correctly. This information is necessary for your course to be properly processed and for you to receive credit for your work.

COMPLETION TIME

Courses must be completed within 12 months from the date of enrollment. This includes time required to resubmit failed assignments.

PASS/FAIL ASSIGNMENT PROCEDURES

If your overall course score is 3.2 or higher, you will pass the course and will not be required to resubmit assignments. Once your assignments have been graded you will receive course completion confirmation.

If you receive less than a 3.2 on any assignment and your overall course score is below 3.2, you will be given the opportunity to resubmit failed assignments. **You may resubmit failed assignments only once.** Internet students will receive notification when they have failed an assignment--they may then resubmit failed assignments on the web site. Internet students may view and print results for failed assignments from the web site. Students who submit by mail will receive a failing result letter and a new answer sheet for resubmission of each failed assignment.

COMPLETION CONFIRMATION

After successfully completing this course, you will receive a letter of completion.

ERRATA

Errata are used to correct minor errors or delete obsolete information in a course. Errata may also be used to provide instructions to the student. If a course has an errata, it will be included as the first page(s) after the front cover. Errata for all courses can be accessed and viewed/downloaded at:

<http://www.advancement.cnet.navy.mil>

STUDENT FEEDBACK QUESTIONS

We value your suggestions, questions, and criticisms on our courses. If you would like to communicate with us regarding this course, we encourage you, if possible, to use e-mail. If you write or fax, please use a copy of the Student Comment form that follows this page.

For subject matter questions:

E-mail: n315.products@cnet.navy.mil
Phone: Comm: (850) 452-1777
DSN: 922-1777
FAX: (850) 452-1370
(Do not fax answer sheets.)
Address: COMMANDING OFFICER
NETPDTC (CODE N315)
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32509-5237

For enrollment, shipping, grading, or completion letter questions

E-mail: n331@cnet.navy.mil
Phone: Comm: (850) 452-1511/1181/1859
DSN: 922-1511/1181/1859
FAX: (850) 452-1370
(Do not fax answer sheets.)
Address: COMMANDING OFFICER
NETPDTC (CODE N331)
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32559-5000

NAVAL RESERVE RETIREMENT CREDIT

If you are a member of the Naval Reserve, you will receive retirement points if you are authorized to receive them under current directives governing retirement of Naval Reserve personnel. For Naval Reserve retirement, this course is evaluated at 8 points. (Refer to *Administrative Procedures for Naval Reservists on Inactive Duty*, BUPERSINST 1001.39, for more information about retirement points.)

COURSE OBJECTIVES

In completing this nonresident training course, you will demonstrate a knowledge of the subject matter by correctly answering questions on the following: oxygen test; stands, carbon dioxide transfer equipment, sewing machine repair and survival equipment training.

Student Comments

Course Title: Aircrew Survival Equipmentman 1 & C

NAVEDTRA: 140217 **Date:** _____

We need some information about you:

Rate/Rank and Name: _____ SSN: _____ Command/Unit _____

Street Address: _____ City: _____ State/FPO: _____ Zip _____

Your comments, suggestions, etc.:

<p>Privacy Act Statement: Under authority of Title 5, USC 301, information regarding your military status is requested in processing your comments and in preparing a reply. This information will not be divulged without written authorization to anyone other than those within DOD for official use in determining performance.</p>
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NETPDTC 1550/41 (Rev 4-00)

CHAPTER 1

LIQUID OXYGEN CONVERTER TEST STAND 59A120

The PRs perform an enormous amount of testing of oxygen components. Although lower rated personnel perform much of this work, the responsibility for maintaining liquid oxygen converter test stands in top running condition is that of the senior PR. Knowing the functions, daily inspections, and adjustments required to maintain such equipment is essential for the lower rated PRs. This information can be found in the *Aircrew Survival Equipmentman 3 & 2*, Vol 2. However, determining the causes of malfunctions, making major adjustments, and replacing parts are the responsibilities of the First Class and Chief Petty Officer.

This chapter covers the 59A120 Liquid Oxygen Converter test stand shown in figure 1-1.

THE 59A120 TEST STAND

The 59A120 is designed to test all liquid oxygen converters and rigid seat survival kits (RSSK) components used in today's naval aircraft. All instruments, mechanisms, and equipment of the test stand are designed to meet certain criteria. They are designed to meet this criteria even when subjected to the normal pitch and roll of a ship.

The test stand is comprised of a differential pressure gage; three pressure gages; four linear flow elements; a liquid oxygen quantity gage capacitor-type tester; a flowmeter indicator; a bell jar; a heat exchanger; and the necessary integral piping, wiring, hoses, and valves to properly test oxygen components. The performance and technical characteristics of the test stand are shown in table 1-1.

The 59A120 test stand tests liquid oxygen converters, components, and RSSK components

for leaks, flow settings, and quantity gaging. This test stand is designed to test liquid oxygen converter components and accessories to make sure they work properly. The test stand is used to perform periodic preventive maintenance, tests, and adjustments.

PREPARATION FOR USE

Preparing the test stand for use is divided into five separate tasks to be done by the PR or by the on-site metrology calibration team (CAL TEAM). The five tasks and responsible personnel are as follows:

1. Installation—PR
2. Visual Inspection—PR
3. Correction card preparation—CAL TEAM
4. Leakage testing—PR
5. Calibration—CAL TEAM

Procedures for installation, visual inspections, and leakage testing of the 59A120 are done following NAVAIR 13-1-6.4. Procedures for leakage testing are discussed in this chapter; however, they are not to be used in place of the aforesaid NAVAIR manual.

PERIODIC INSPECTIONS

One of the keys to a trouble-free test stand is the performance of periodic inspections on the test stand. By performing the periodic inspections on time, you find troublesome areas before they become problems.



1-2

Table 1-1.—Leading Particulars

Dimensions:	
Length (inches)	20 1/2 inches maximum
Depth (inches)	34.00 inches maximum
Height (inches)	68.00 inches maximum
Weight	460 pounds maximum (20A150)
Technical Characteristics:	
Indicator	Range
Supply Pressure Gauge	0 to 3000 psig oxygen
Low Pressure Test Gauge	0 to 12 oxygen
Test Pressure Gauge	0 to 100 oxygen
Differential Pressure Gauge	0 to 100 inches of H ₂ O
Leakage Linear Flow	0 to 0.52 GPM
Flowmeter Indicator	0 to 10 inches of H ₂ O
Element No. 1	
Element No. 2	
Leakage Linear Flow	0 to 1.0 GPM
Rate Linear Flow	0 to 20 GPM
Element No. 3	
Rate Linear Flow	0 to 120 GPM
Element No. 4	
Capacitor-Type Tester	
Capacitance measuring	0 to 2000 pF in four ranges
range	
accuracy	±0.2% of reading or 0.52% of capacitance measuring range, maximum value of whichever is greater.
Insulation resistance	
measuring	
range	0 to 10,000 megohms in four ranges.
accuracy	±0.15% inch of scale length.
Maximum voltage at test terminals	Less than 20 volts.
terminals	
Electrical resistance of terminals	Less than 500 milliohms
terminals	
Short circuit current of terminals	Less than 500 milliamperes

Table 1-2 lists, by calendar and operating time, the periodic inspections to be performed in the interest of efficient operation.

CLEANING

A clean test stand not only looks neat but it gives better service. A clean stand is essential if leaks are to be located in a timely manner. All external parts of the test stand must be cleaned with oxygen systems cleaning compound Mil-C-81302, Type 1.

When you clean the test stand, be sure the test adapters and connection hoses stored in the accessory tray are also cleaned.

If the front panel of the test stand must be removed for any reason, you must ensure that all gage tester surfaces are free from dust and any other foreign matter. The best way to clean these surfaces is to use clean, low-pressure dry air (about 10 psi is recommended). To clean the interconnecting piping, hoses, and fittings on the test stand, you should use clean, dry air pressure not to exceed 160 psig.

Type 1 Freon is recommended for cleaning the terminals of the Liquid Oxygen Quantity Gage Tester (capacitor type) test stand.

The bell jar on the 59A120 test stand has a sealing O-ring. This O-ring must be cleaned with distilled water and lubricated with a light coat of lubricant Mil G 27617.

Table 1-2.—Periodic Inspection Chart

	Daily	Weekly	Monthly	Every 6 Months
Inspection	or 2 hr.	or 20 hr.	or 200 hr.	
Leak Test		X	X	
Test Pressure Gage (PG-1) Zero	X	X	X	
Low Pressure Test Gage (PG-4) Zero (20A120 only)	X	X	X	
Differential Pressure Gage (DG-1) Zero	X	X	X	
Pressure Regulator Valve (RV-1) Setting		X	X	
Ball Jet Pressure Relief Valve (RV-3) Setting			X	
Accessory Section Pressure Relief Valve (RV-4) Setting			X	
Converter Section Pressure Relief Valve (RV-11) Setting			X	
Test Pressure Gage (PG-1) Adjustment			X	
Low Pressure Test Gage (PG-4) Adjustment (20A120 only)			X	
Differential Pressure Gage (DG-1) Adjustment			X	
Flowmeter Indicator (FC-5) Zero	X	X	X	
Pinest Flow Element (EFM-1, 2, 3, and 4) Calibration			X	
Flowmeter Calibration Kit				X
Pressure Gage Calibration Kit				X
Liquid Oxygen Quantity Gage (Capacitor-Type) Tester				X

34084

WARNING

Never apply oil, grease, or any other material not approved for use in the presence of gaseous and liquid oxygen systems.

CORRECTION CARD PREPARATION AND CALIBRATION

An on-site CAL TEAM must prepare the correction cards and calibrate the 59A120 following NAVAIR 13-1-6.4 procedures. However, because of the operational commitments of today's Navy, you may find yourself with a test stand that needs calibration and correction card corrections when CAL TEAM services are not available. This chapter covers the procedures outlined in the NAVAIR 17-15BC-20 for correction card preparation and calibration.

NOTE: This RTM *does not* authorize you to calibrate the test stand nor does it authorize you to make correction card corrections. These tasks must be authorized by higher authority.

CORRECTION CARDS

Before you operate the 59A120 test stand, individual correction cards for the following components must be prepared: DF-1, PG-1, PG-4, FLM-1, FLM-2, FLM-3, and FLM-4. These correction cards must be prepared prior to calibration of the 59A120 test stand.

To perform calibration and to prepare correction cards, you will need the Flowmeter Calibration Kit and the four graphs that are supplied with the kit for that particular test stand. Each kit will be serialized with the same number as the serial number of the test stand.

To prepare the cards, convert the actual liter-per-minute (lpm) flows to indicated millimeter (mm) flows on cards 4, 5, 6, and 7. Refer to figure 1-2 in the following steps:

1. Using the applicable graph for the flowmeter selected, locate the desired lpm at the bottom of the graph.
2. Trace the selected lpm lineup to where it intersects the graph line.
3. Trace the line from point of intersection to the left-hand edge of the graph to determine mm. Enter this figure in the appropriate column of the correction card.

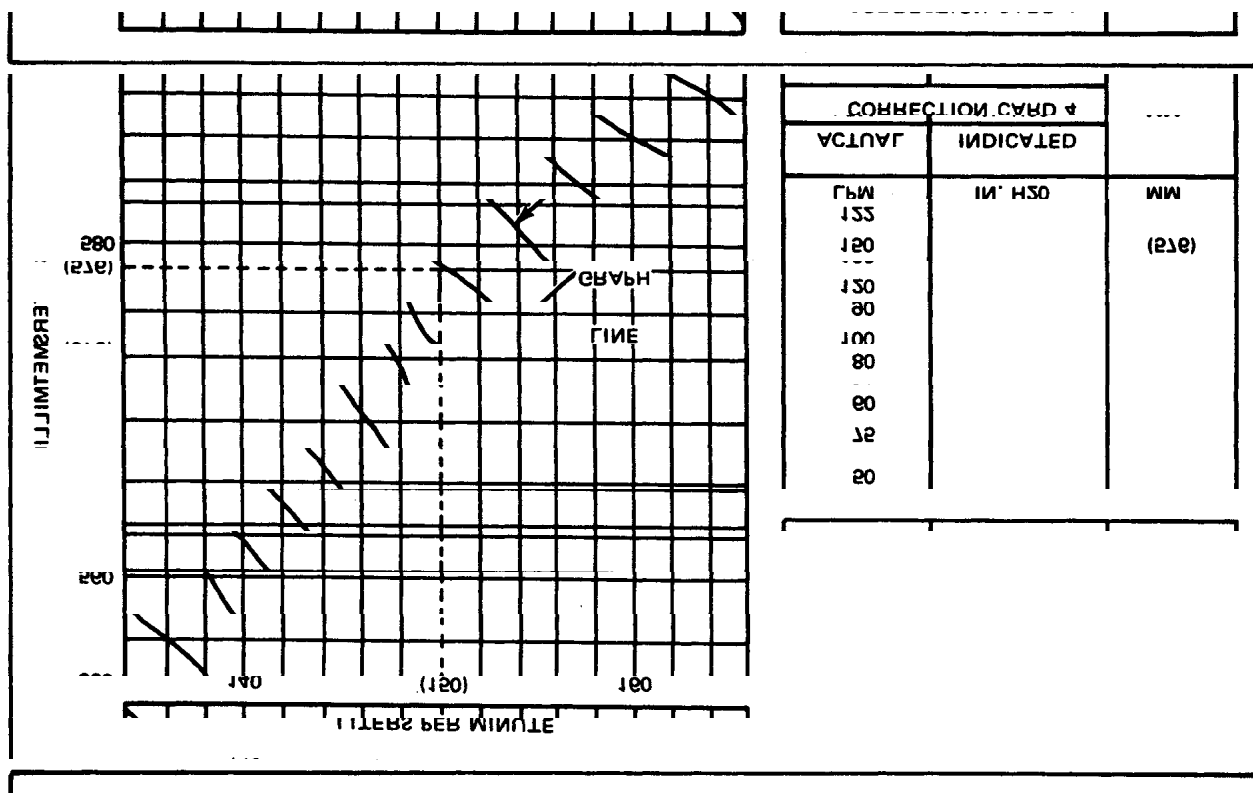


Figure 1-2.—Conversion Example.

4. Using applicable graphs, repeat steps 1 through 3 for all actual flows given on correction cards 4 through 7.

5. Indicated flows (in. H₂O) are entered on the cards when you calibrate the test stand.

Differential Pressure Gage (DF-1)

To prepare the differential pressure gage (DF-1) correction card, refer to figure 1-1 in the following steps:

1. Close system bleed valve V-5 and open the oxygen supply cylinder valve. Connect precision-0-to-100-in. H₂O low-pressure gage 6 (figure 1-3) to bell jar bottom coupling C-1. Open differential pressure shutoff valve V-8.

NOTE: Correction cards will be completed at this time.

2. Slowly open oxygen supply valve V-6 until 100 in. H₂O is indicated on the precision-0-to-100-in. H₂O low-pressure gage.

Compare this gage with the reading displayed on differential pressure gage DF-1.

3. Enter the difference (if any) in the indicated in. H₂O column of correction card number 1.

4. Slowly open system bleed valve V-5 to reduce the pressure indication on the precision-0-to-100-in. H₂O low-pressure gage. Reduce pressure in 20-in. H₂O increments. Enter the corrective differential (if any) at each interval on the correction card.

5. When all entries have been made on the correction card, close oxygen supply valve V-6 and differential pressure shutoff valve V-8.

6. Open system bleed valve V-5 and bleed the system. Disconnect the precision-0-to-100-in. H₂O low-pressure gage.

Test Pressure Gage (PG-1)

To prepare the test pressure gage (PG-1) correction card, proceed as follows:

1. Connect precision-0-to-200-psig pressure gage 4 (figure 1-3) to bell jar bottom coupling C-1.

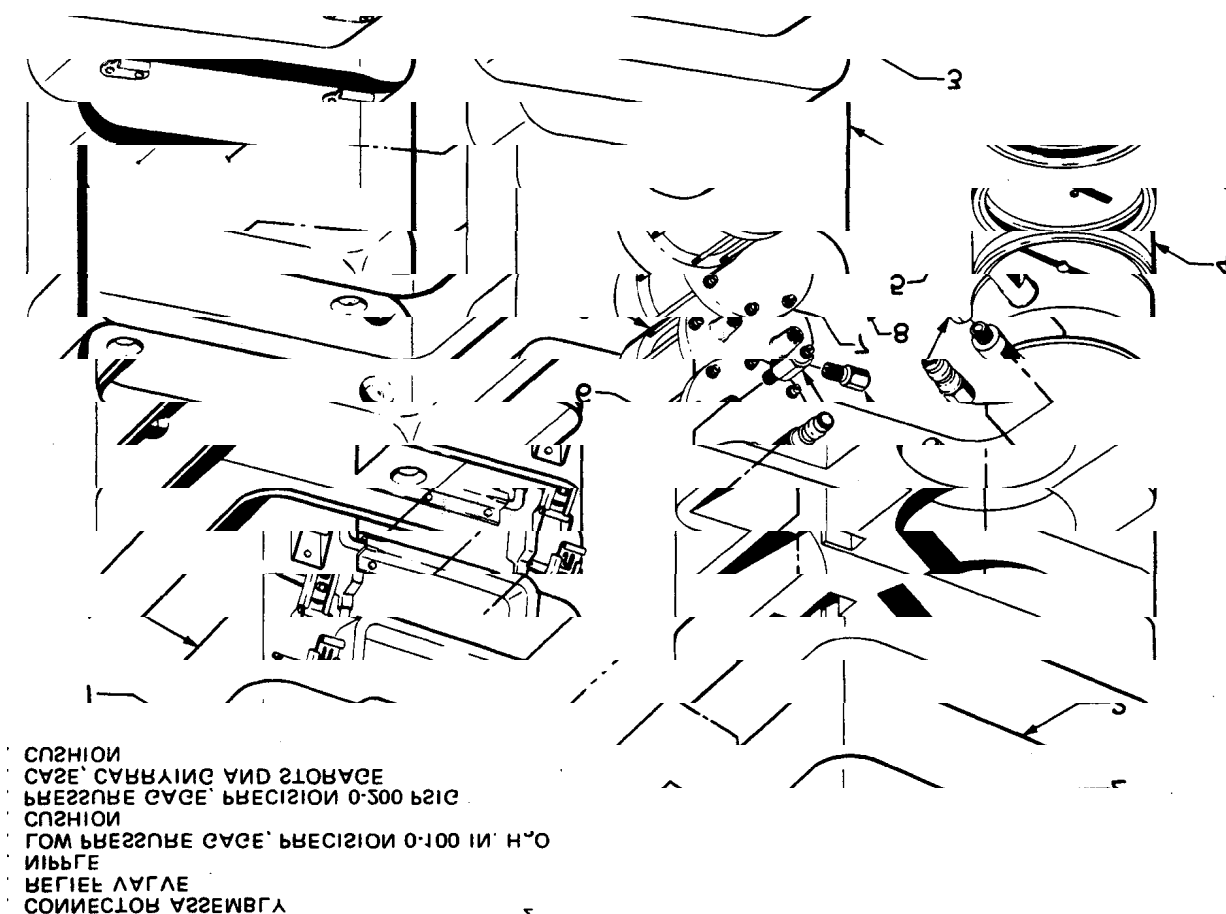


Figure 1-3.—Pressure Gage Calibration Kit.

Close system bleed valve V-5, and open test pressure gage to bell jar valve V-2.

2. Open oxygen supply valve V-6 until 160 psig registers on the precision-0-to-200-psig pressure gage; then close valve V-6.

3. Compare the precision-0-to-200-psig pressure gage reading with pressure registered on test pressure gage PG-1. Enter the corrective differential (if any) in the indicated psig column of test stand correction card number 2.

4. Slowly open system bleed valve V-5 to reduce the pressure registered on the precision-0-to-200-psig pressure gage. Enter the corrective differential (if any) at each specified pressure on the test stand correction card.

5. After all correction card entries have been completed, close system bleed valve V-5 and oxygen supply valve V-6.

Low-Pressure Test Gage (PG-4)

To prepare a low-pressure test gage (PG-4) correction card, proceed as follows:

1. With precision-0-to-200-psig test gage 4 (figure 1-3) still attached to bell jar bottom coupling C-1, open oxygen supply valve V-6 until 7.5 psig is indicated on the precision-0-to-200-psig test gage. The pointer of low-pressure

test gage PG-4 should be at midscale. If the pointer is not at midscale, adjust by turning the adjustment screw on the back of the gage.

2. Slowly open oxygen supply valve V-6 until 14 psig registers on the precision-0-to-200-psig test gage; then close oxygen supply valve V-6. Compare the reading with the indication on low-pressure test gage PG-4. Enter the corrective differential (if any) in the indicated psig column of test stand correction card number 3.

3. Slowly open system bleed valve V-5 and reduce the pressure indicated on the precision-0-to-200-psig pressure test gage in 2-psig increments. At each increment, enter the corrective differential (if any) on the test stand correction card.

4. After all correction card entries have been completed, ensure oxygen supply valve V-6 is closed; then open system bleed valve V-5 and close test-pressure-gage-to-bell-jar valve V-2. Remove the precision-0-to-200-psig test gage from bell jar base coupling C-1.

Linear Flow Elements (FLM-4), (FLM-3), (FLM-2), and (FLM-1)

To prepare the linear flow element correction cards, place the Flowmeter Calibration Kit (shown in figure 1-4) on the test stand counter top; then

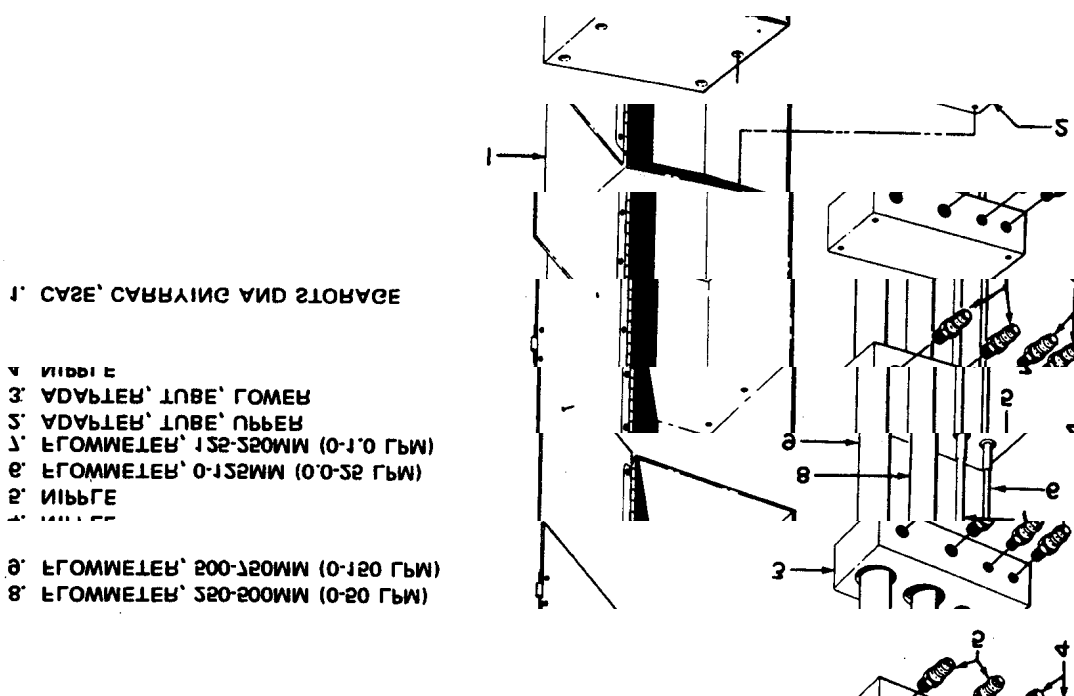


Figure 1-4.—Flowmeter Calibration Kit.

beginning with the 0-to-150-lpm flow element (FLM-4), proceed as follows:

1. Using hose assembly 3 (figure 1-5), connect the top connection of the 500-to-750-mm calibration kit flowmeter 9 (figure 4-4) to test stand flow element connection NIP-4. Using hose assembly 6 (figure 1-5), connect the bottom connection of the calibration kit flowmeter to bell jar base coupling C-1.

2. Set flowmeter selector valve V-1 to the 0-to-150-lpm position. Ensure system bleed valve V-5 is closed.

NOTE: Flows used shall be taken from the mm column of the calibration correction cards. This previously completed column contains flows in millimeters (mm) equivalent to corresponding lpm flows.

3. Using oxygen supply valve V-6, set the flow equivalent to 150 lpm (from correction card number 4) on the 500-to-750-mm calibration kit flow element. The flow, in inches H_2O , will be displayed on flowmeter indicator PG-2. Enter this reading in the indicated in. H_2O column of correction card number 4 opposite the actual mm flow being drawn.

4. Reduce the flow to the next millimeter reading by adjusting oxygen supply valve V-6. Repeat step 3. Continue in this manner until all flows on correction card number 4 have been completed.

5. Close oxygen supply valve V-6 and disconnect the hose and the calibration kit flowmeter from the test stand.

NOTE: Hose assembly 3 (figure 1-5) and hose assembly 6 are used in calibrating all linear flow elements.

6. Connect the top connection of the 250-to-500-mm calibration kit flowmeter to test stand flow element connection NIP-3; connect the bottom connection to bell jar base coupling C-1. Rotate flowmeter selector valve V-1 to the 0-to-50-lpm position. Ensure system bleed valve V-5 is closed.

7. Repeat procedures outlined in steps 3 through 5, using flows given on correction card number 5.

8. Connect the top connection of the 125-to-250-mm calibration kit flowmeter to test stand flow element connection NIP-2; connect the

bottom connection to bell jar coupling C-1. Rotate flowmeter selector valve V-1 to the 0-to-1.0-lpm position. Ensure system bleed valve V-5 is closed.

9. Repeat procedures outlined in steps 3 through 5, using flows given on correction card number 6.

10. Connect the top connection of the 0-to-125-mm calibration kit flowmeter to test stand flow element connection NIP-1; connect the bottom connection to bell jar base coupling C-1. Rotate flowmeter selector valve V-1 to the 0.0-to-0.25-lpm position. Ensure system bleed valve V-5 is closed.

11. Repeat procedures outlined in steps 3 through 5, using flows given on correction card number 7.

12. Disconnect hoses 3 and 6 (figure 1-5) from the calibration kit and test stand. Close oxygen supply cylinder valve V-6 and open system bleed valve V-5 to bleed the test stand. Secure all test stand valves.

TROUBLESHOOTING

A properly working test stand will give you outstanding results while testing oxygen converters. As with any test stand, a small leak in your plumbing system will give you inaccurate readings and may cause you to think you have a defective converter or component. Some parts on the 59A120 test stand must be corrected when they become defective by the on-site meteorology calibration team. You might have a gage that has a pointer which isn't zeroed, or you might have a flow element that consistently reads low. You could also have a gage that provides correct readings over only part of the scale. In such cases, you will need the calibration team's assistance to repair the component.

Upon completion of any maintenance action, you will be required to fill out a Ground Support Equipment Subcustody and Periodic Maintenance Record (OPNAV 4790/50) and a Ground Support Equipment Custody and Maintenance Record (OPNAV 4790/51).

The following problems may occur within your test stand; you, as a senior PR, will be required to fix them. Refer to NAVAIR 17-15BC-20 for parts removal and replacement.

PG-1 Reads Low

The 0-160 psig pressure gage is used to indicate pressure applied to an item under test. Anytime

- | | | |
|-------------------|------------------------|------------------------|
| 8. CABLE ASSEMBLY | 18. CONNECTOR ASSEMBLY | 58. ADAPTER VALVE |
| 7. CABLE ASSEMBLY | 17. ADAPTER ASSEMBLY | 52. ADAPTER VALVE |
| 6. HOSE ASSEMBLY | 16. PLUG ASSEMBLY | 54. ADAPTER VALVE |
| 5. HOSE ASSEMBLY | 15. NIPPLE ASSEMBLY | 53. CONNECTOR ASSEMBLY |
| 4. HOSE ASSEMBLY | 14. CONNECTOR ASSEMBLY | 55. CONNECTOR ASSEMBLY |
| 3. HOSE ASSEMBLY | 13. PLUG ASSEMBLY | 51. CONNECTOR ASSEMBLY |
| 2. HOSE ASSEMBLY | 12. CONNECTOR ASSEMBLY | 50. CONNECTOR ASSEMBLY |
| 1. HOSE ASSEMBLY | 11. CONNECTOR ASSEMBLY | 48. CONNECTOR ASSEMBLY |
| | 10. CONNECTOR ASSEMBLY | |
| | 9. GATE ADAPTER | |

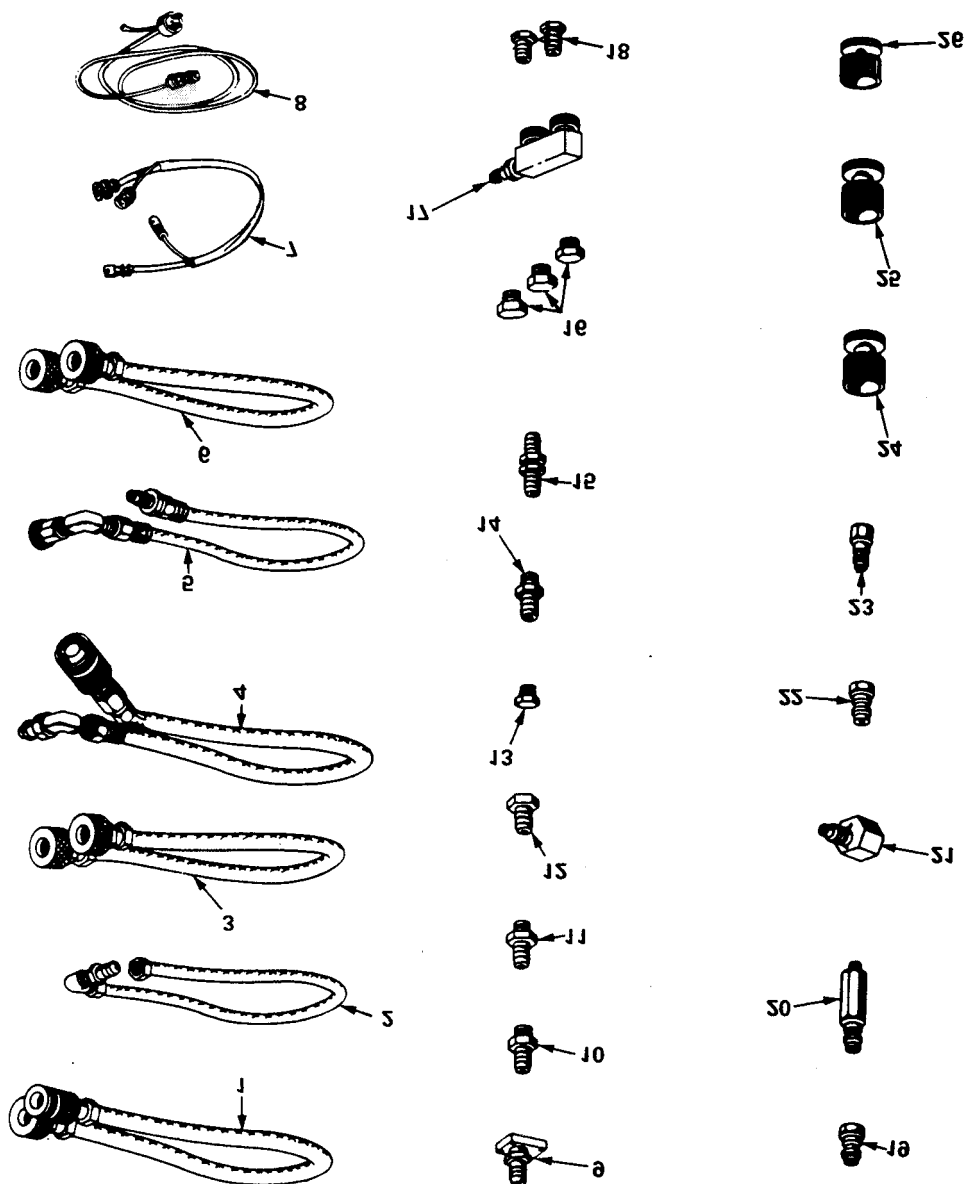


Figure 1-5.—Test Stand Accessories.

this gage consistently reads low, you probably have leaky fittings. To correct this problem, you will need to perform one or two leakage tests.

To perform leakage tests, pressurize the system and apply a soap solution to the various fittings. Escaping gas will form soap bubbles, and you can locate the leaks.

Leakage Test, Accessories Section

To perform the leakage test on the accessories section of the test stand, proceed as follows:

1. Install nipple assembly 14 (figure 1-5) in bell jar bottom coupling C-1. Connect one end of hose 3 (figure 1-5) to the adapter and the other end to differential pressure connection NIP-7.
2. Ensure test-pressure-gage-to-bell-jar valve V-2 is open. Ensure system bleed valve V-5, test pressure gage build-up and vent valve V-10, and differential pressure bleed valve V-7 are closed.
3. Open differential pressure shutoff valve V-8.
4. Open oxygen supply cylinder valve. Open oxygen supply valve V-6 until 160 psig is indicated on test pressure gage PG-1.
5. Close oxygen supply valve V-6. Leakage will be indicated by a drop in pressure on PG-1. Leakage must not be more than 2 psig in 10 minutes.
6. Leave all hoses and valves in their present position.

Leakage Test, Test Stand

To perform the leakage test on the entire test stand, proceed as follows:

1. Open converter supply flow control valve V-9 and test pressure gage build-up and flow valve V-10.
2. Plug converter supply outlet NIP-5 and supply to converter connection NIP-6. Ensure system bleed valve V-5 is closed.
3. Open supply valve V-6 until relief valve V-11 unseats. (Relief valve shall relieve at no more than 120 psig and be leak-tight at 100 psig.) Using system bleed valve V-5, decrease pressure until 100 psig is indicated on test pressure gage PG-1. Close valve V-6. Leakage will be indicated by a drop in pressure on PG-1. Leakage shall be no more than 10 psig in 10 minutes.
4. Bleed the test stand by opening system bleed valve V-5. Close all test stand valves. Remove plugs from converter supply outlet NIP-5 and supply to converter connection NIP-6.

PG-1 Pointer Pegs

Anytime the 0-160 psig pressure gage pegs, it is caused by pressure regulator R-1. This pressure regulator is set to maintain 160 psig with 1800 psig supply pressure applied. If the PG-1 pressure gage pegs, your regulator is delivering pressure above 160 psig and the pressure must be adjusted.

To set oxygen pressure regulator R-1 to maintain 160 psig with 1800 psig supply pressure applied, proceed as follows:

CAUTION

Valves V-2, V-5, V-6, V-7, and V-10 are metering (needle) valves. Overtightening when closing will damage valve seat. Only finger-tight pressure should be used when closing valves.

1. Ensure all test stand valves are closed, and plug bell jar bottom coupling C-1.

WARNING

When you are working with oxygen, make certain that clothing, tubing, fittings, and equipment are free of oil, grease, fuel, hydraulic fluid, or any combustible materials. When oxygen is under pressure, fire or explosion may result when even slight traces of combustible materials come in contact.

2. Open oxygen supply cylinder valve.

NOTE: When setting regulator R-1, a minimum of 1800 psig oxygen pressure should be applied to the regulator.

3. Slowly open test-pressure-gage-to-bell-jar valve V-2, and fully open oxygen supply valve V-6.
4. Loosen the hex locknut located on the front of regulator R-1. Turn the T-handle until 160 psig registers on test pressure gage PG-1. Tighten the hex locknut.
5. Close the oxygen supply cylinder valve and open system bleed valve V-5 to bleed pressure from system. Remove the plug from bell jar bottom coupling C-1.

PG-4 Indicates Low Readings Consistently

The 0-15 psig pressure gage PG-4 measures extremely low pressures from the item under test. This gage is protected from high pressures by gage guard GP-1, which is set between 11 and 14 psig. To locate any leaks in this system, you will need to perform the leakage test described earlier for the test stand. You will not be required to perform the leakage test for the accessories section. In most cases by tightening the necessary fittings, you will be able to remedy the low readings on the PG-1 pressure gage.

Differential Pressure Gage (DF-1) Indicates Low

The 0-100-in. H₂O differential pressure gage is a bellows-operated gage used to indicate differential pressure when the pressure closing and pressure opening valves are tested. The probable cause for low readings on this gage is a leaky shut off differential pressure valve V-8. If you are lucky, you can correct it by tightening the fittings. If this does not solve the problem, you will need to replace the valve.

Bell Jar Leakage

You may also have problems with the bell jar. The bell jar is used for testing components having more than one possible area of leakage. The bell jar consists of the bell jar itself, a relief valve with a range of 5 to 15 psig, and a bell jar coupling. The relief valve is designed to be leakproof at 5 psi and set to relieve at 10 psig.

To perform the leakage test on the bell jar assembly, proceed as follows:

1. Remove hose assembly 3 and nipple assembly 14 (figure 1-5) from the bottom bell jar coupling C-1. Disconnect the opposite end of the hose from differential pressure connection NIP-7.
2. Ensure differential pressure bleed valve V-7, test-pressure-gage-to-bell-jar valve V-2, and system bleed valve V-5 are closed. Open differential pressure shutoff valve V-8.
3. Place the bell jar on the fixture and secure it with a clamp. Plug bell jar top coupling C-2.
4. Slowly open oxygen supply valve V-6 until 100 in. H₂O is indicated on differential pressure gage DF-1. Close valve V-6. Leakage, indicated by a drop in pressure on DF-1, shall not be more than 2 in. H₂O in 10 minutes.

5. Close the oxygen supply cylinder valve and open system bleed valve V-5 to bleed the system.

CAUTION

When the test stand is secured, all valves with the exception of system bleed valve V-5 will be closed. Valve V-5 is left open to prevent accidental build-up of pressure in the system.

6. Secure all test stand valves. Leave system bleed valve V-5 open.

REPAIRING AND REPLACING PARTS

Anytime you have a defective or damaged part, it must be repaired or replaced. Information on part numbers can be found in the NAVAIR 17-15BC-20 manual.

You may on occasion find you have a defective piece of tubing. To replace any tubing installed on this test stand (59A120), remember that you are dealing with high-pressure oxygen. Therefore, you must use tubing with a minimum wall thickness of 0.049 to replace any defective tubing. This tubing may be cut to length and flared to replace any defective portion of tubing.

WARNING

When you work with oxygen systems, never use any parts that have been in contact with oil, grease, or any other material that is not approved for use in the presence of high-pressure oxygen. Fire or explosion may result when even the slightest trace of combustible material comes in contact with pressurized oxygen.

Heat Exchanger Panel

If the heat exchanger panel is defective, it may be replaced. You may replace the panel by disconnecting its connections and removing its seven retaining screws. If a new heat exchanger is used, you may drill or punch holes not exceeding 11/32 inch in diameter in the perimeter, beyond the outer seam welds, for use in mounting. When the holes are drilled at installation, you should be careful to prevent the drill from puncturing the seam welds.

Lubrication

The test stand nor its components require lubrication.

CHAPTER 2

OXYGEN COMPONENT TEST STAND (1172AS100)

The 1172AS100 oxygen test stand shown in figure 2-1 is the key to proper testing of oxygen regulators. A leaky test stand gives improper readings, uses excessive nitrogen, and can be a safety hazard. To ensure this equipment is in

proper operating order is the responsibility of the senior parachute rigger. The senior parachute rigger can easily accomplish this by periodically testing the test stand for leaks and performing daily preventive maintenance.

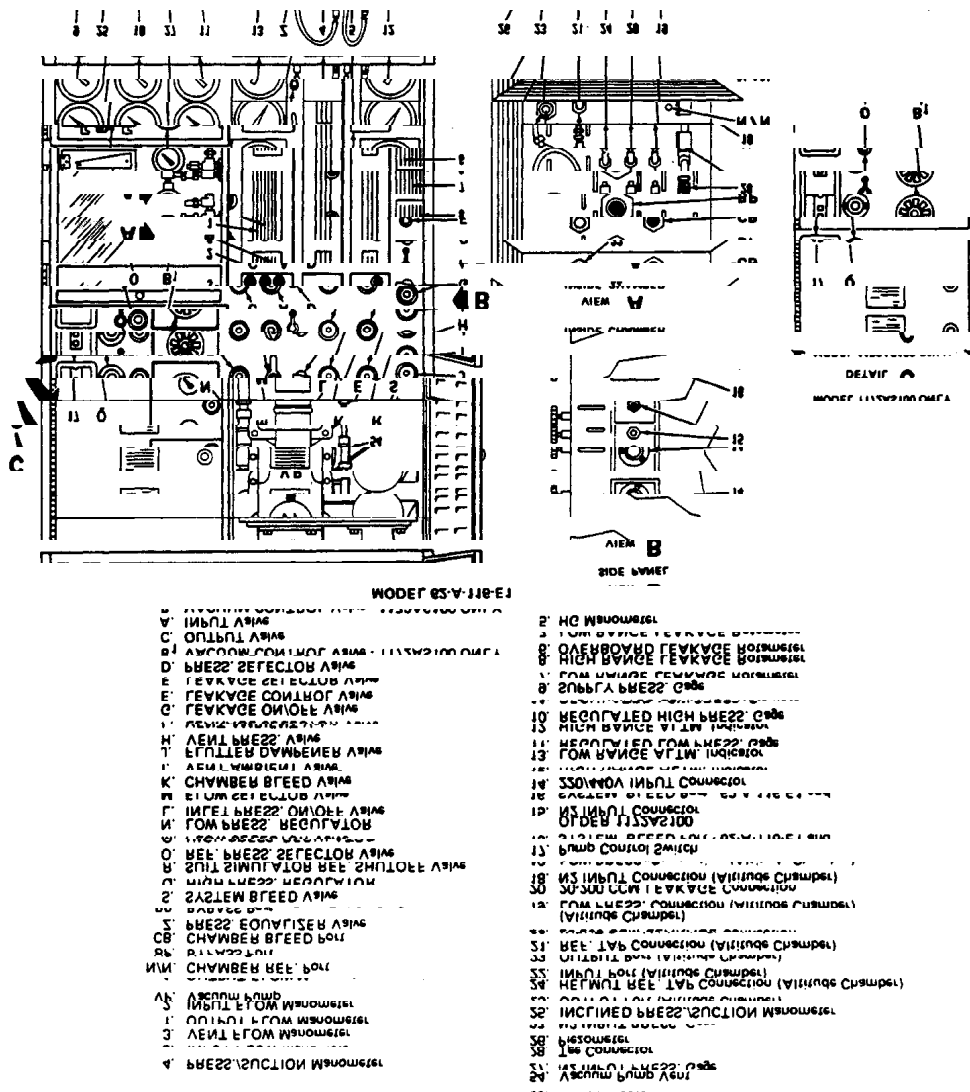


Figure 2-1.—Controls and indicators for oxygen system components test stand model 1172AS100.

PERIODIC INSPECTIONS

Daily, weekly, biweekly, and monthly inspections are required. Detailed instructions are outlined in the NAVAIR 13-1-6.4 and the *Aircrew Survival Equipmentman 3 & 2*, Volume 2.

As you read this chapter, you will notice that we use references such as F, 19, E, and so forth. These reference numbers and letters are found in figure 2-1. Also remember that the 1172AS100 test stand is a modified version of the old 62A116E1 test stand; so don't get them confused.

TROUBLESHOOTING THE 1172AS100 TEST STAND FOR LEAKS

As you have already read, leaks will probably cause you the most problems in troubleshooting. Locating a leak in one system is easier than random troubleshooting all systems for a leak. Nine different systems are incorporated within the 1172AS100 oxygen system component test stand. Some of the systems are interconnected and used simultaneously with other systems; therefore, you must be familiar with each system.

A schematic is provided to assist you in analyzing each system as we cover it. The heavy black lines on each schematic depict that particular system. A few symbols are used on the schematics to identify various test stand components. Figure 2-2 is a list of these symbols.

NOTE: To properly perform the leak checks of the different systems, you must perform each test in sequence or your test stand will not be properly set up for your next test.

SAFETY PRECAUTIONS

Before you attempt to operate the test stand, review the following safety precautions. These safety precautions must be observed before, during, and after the test stand operation.

1. Be sure you secure the test stand properly before opening the supply cylinder valve. Position the high-pressure regulator (Q) to LOAD then to VENT; ensure the low-pressure regulator (N) is backed out and the other valves turned fully to the right.

2. Keep the chamber door closed whenever possible.

3. Keep the test stand doors closed at all times.

4. Keep the test stand work tray closed when it is not in use.

5. Check the pump lubricant prior to turning the pump on.

6. Keep your hands and head clear of belts and pulleys while checking lubricant level.

7. Be sure the test stand is properly grounded (refer to Support Equipment Change 1223).

- 7A. (1172AS100 ONLY) Be sure the test stand is properly grounded using the grounding lug.

8. Never use regulated high pressure and regulated low pressure together.

9. When the oxygen monitor alarm sounds, leave the room.

10. Do not panic when the test stand malfunctions.

11. When you use nitrogen, be sure the room is well ventilated.

12. Use the proper tools for the job you are performing.

13. Avoid breathing pump lubricant and oxygen cleaning compound vapors; avoid lubricant and compound contact with skin or clothing.

14. Avoid breathing mercury vapors; avoid mercury contact with skin or clothing.

15. Secure the test stand completely after use.

16. Never leave test stand unattended while pump is running.

17. When you transport a cylinder, be sure the protective cap is on the cylinder.

SUPPLY NITROGEN SYSTEM

This system supplies a constant source of nitrogen pressure to the other systems within the test stand. It is tested for leaks during the outward leakage test. This test is performed

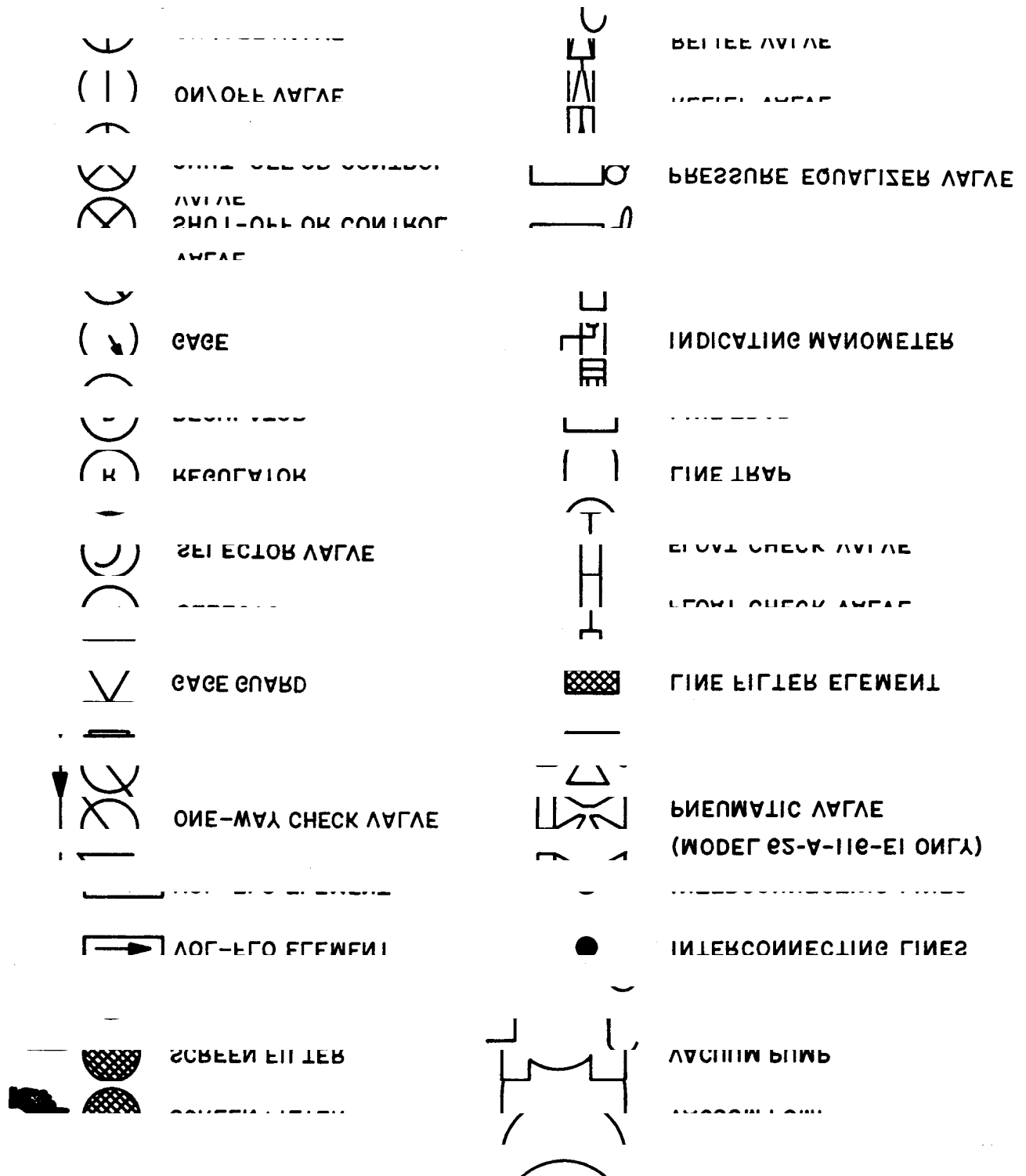


Figure 2-2.—Test stand schematic symbols.

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weekly. In the schematic in figure 2-3, the nitrogen (N_2) supply cylinder is located on the right side of the test stand and is connected to the N_2 input connector. When you open the supply cylinder valve, nitrogen flows to the high-pressure regulator (Q) and the low-pressure regulator (N).

PRESSURIZING THE SUPPLY NITROGEN SYSTEM

The pressure in the supply cylinder is indicated on the supply pressure gage (9). (This gage also tells you when your supply cylinders need replacing.) If you secure all the other valves on the test stand, the system should have no leaks beyond this point. To test for leakage, read the pressure on the supply pressure gage and wait 2 minutes. No drop in pressure should be indicated. At this point, you should leave all valves and connections in their present position. Your supply nitrogen system is pressurized, and you are setup to proceed to the leakage test for the next system.

REGULATED HIGH-PRESSURE SYSTEM

This system supplies regulated high-pressure nitrogen to the following valves, gages, and connections, as shown in figure 2-4.

- High-Pressure Regulator (Q)
- Regulated High-Pressure Gage (10)
- Regulated Low-Pressure Gage (11)
- Gage Guard that protects the Low-Range and High-Range Leakage Rotameters. (Although this is not part of this system, the pressure is allowed to enter through the gage guard set at 170 ± 5 psig.)
- System Bleed Valve (S)
- Vent Pressure Valve (H)
- Inlet Pressure ON/OFF Valve (L)
- Tee Connector (inside chamber) (28)
- N_2 Input Connector (inside chamber) (18)
- Gage Guard for the N_2 input pressure gage (set at 145 ± 5 psig)
- N_2 Input Gage (27)

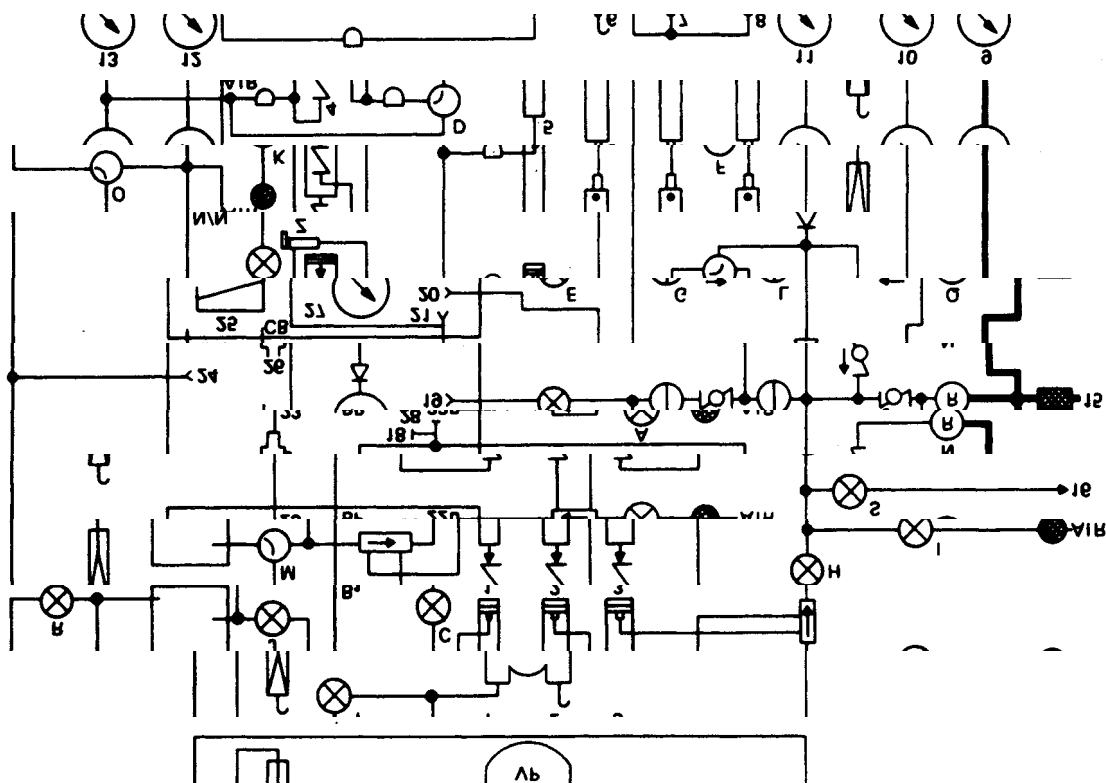


Figure 2-3.—Model 1172AS100 supply nitrogen system.

The system has a range of 250 psig to the pressure capacity of the supply cylinder. When you place the high-pressure regulator in the LOAD position, nitrogen flows through the one-way check valve that protects the back side of the high-pressure regulator. This pressure is indicated on the regulated high-pressure gage (10). It then flows through high-pressure lines to the one-way check valve. Pressure continues to flow to the inlet pressure on/off valve and the system bleed valve. (Ensure this valve is closed; if it is open, it bleeds the system.) Pressure also flows to the vent pressure valves and to a gage guard (F) that protects the low-range and high-range leakage rotameters. This gage guard is set to relieve pressure at 170 ± 5 psig. The regulated low-pressure gage indicates this pressure although it is not part of the system. When you place the inlet pressure on/off valve in the ON position, high-pressure nitrogen flows to the N_2 input connection and the tee connector located inside the chambers. The N_2 input pressure gage indicates its gage guard setting of 145 ± 5 psig. The regulated high-pressure gage indicates the actual pressure at the N_2 input connection and tee connector.

PRESSURIZING THE REGULATED HIGH-PRESSURE SYSTEM

To pressurize this system, turn the high-pressure regulator clockwise to the LOAD position until you have the desired pressure. It will be indicated on the high-pressure gage.

To check the regulated high-pressure system for leaks, you must first cap the N_2 input connection located inside the chamber. Now open the supply cylinder and load the system to 2000 psig using the high-pressure regulator. This is indicated on the high-pressure gage. You should also have a reading of 170 ± 5 psig on the regulated low-pressure gage. This is the setting of your gage guard for the protection of the low-range and high-range leakage rotameters.

Close the supply cylinder and note the pressure on the high-pressure gage. After 2 minutes, reread the pressure. If your system is in good working condition, no drop in pressure should occur.

With the inlet pressure on/off valve closed, you should have no reading on the N_2 inlet pressure gage. If a pressure is registered, it indicates that you have a leak within one or both of your on/off valves (N_2 inlet or leakage).

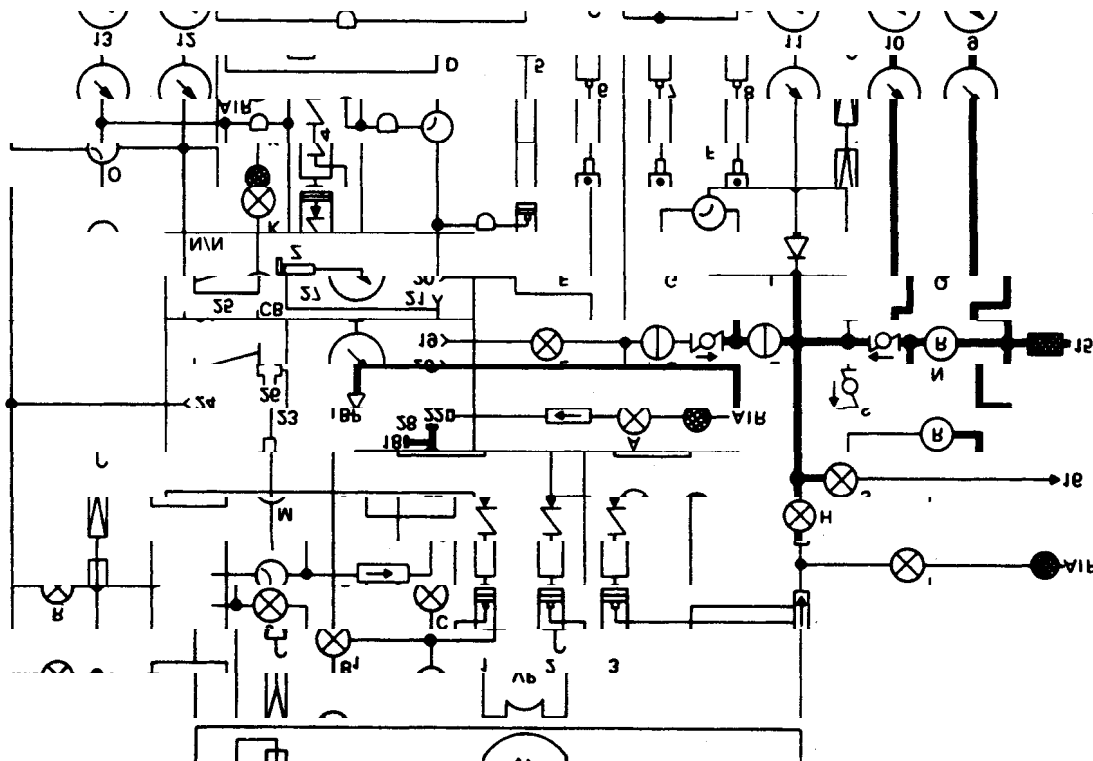


Figure 2-4.—Model 1172AS100 regulated high pressure N_2 system.

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A pressure drop on the regulated low-pressure gage indicates that the leakage on/off valve is leaking. This completes your leakage check. You must bleed the system by turning the high-pressure regulator to the VENT position until the high-pressure gage reads zero and then open the system bleed valve. This bleeds all remaining lines.

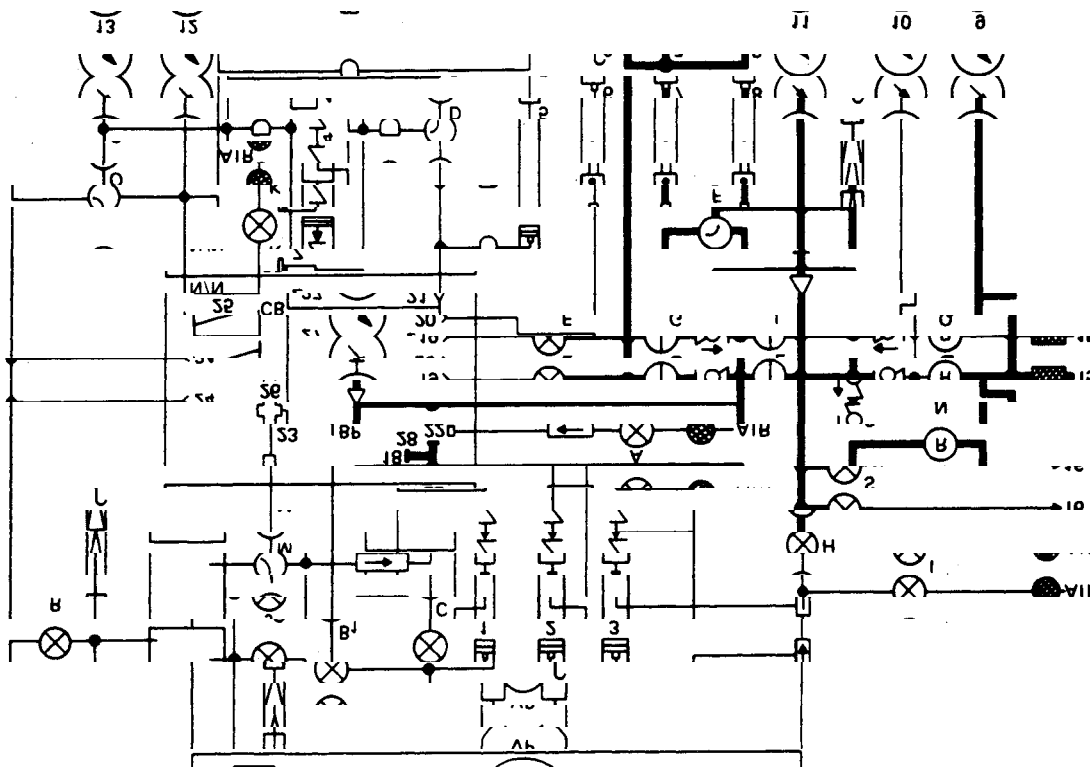
REGULATED LOW-PRESSURE NITROGEN SYSTEM

The purpose of the regulated low-pressure nitrogen system is to supply regulated low-pressure nitrogen to the N_2 input connection and the in-system leakage rotameters. This system, shown in figure 2-5, has a range of 0 to 180 psig. You adjust the pressure by using the mechanically operated low-pressure regulator. When you open the low-pressure regulator, nitrogen flows through the one-way check valve to the back side of the one-way check valve that protects the high-pressure regulator. As nitrogen enters the high-pressure lines, it flows to the inlet pressure on/off valve, the system's bleed valve, the vent pressure valve, and through the gage guard that protects the in-systems leakage rotameters.

(Nitrogen also flows into the rotameters and to the 200- to 230-psig relief valve. However, this is not considered part of the low-pressure system. For the nitrogen to flow to the item under test, you have to open the inlet pressure on/off valve. This allows nitrogen to flow to the input connection inside the chamber where the item under test is connected.

PRESSURIZING THE REGULATED LOW-PRESSURE NITROGEN SYSTEM

When you pressurize the low-pressure nitrogen system, be sure that the N_2 input connection is capped and the supply cylinder valve is open. Turn the leakage selector valve to the HIGH position and the pressure selector valve to the HG position. Turn the inlet pressure and leakage on/off valves to the ON position. Slowly turn the low-pressure regulator clockwise until the regulated low-pressure gage and the N_2 input gage indicate 70 psig. (We use 70 psig because this is the pressure used to calibrate the rotameter system.) At this time, return the inlet pressure on/off valve to OFF. There should be no leakage; but if any leakage occurs, the small ball in the high-range leakage rotameter tube will rise.



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Figure 2-5.—Model 1172AS100 regulated low pressure N_2 system.

Turn the leakage selector valve to LOW RANGE. No leakage should be indicated on the low-range rotameter. Return the leakage-selector valve to HIGH RANGE and the inlet pressure on/off valve to the ON position.

Slowly open the low-pressure regulator until the regulated low-pressure gage indicates 160 psig. (The N_2 input pressure gage should read its gage guard pressure of 145 ± 5 psig). Turn the inlet pressure on/off valve to OFF. No leakage should be indicated on the high-range leakage rotameter. Turn the leakage selector valve to the LOW-RANGE position. No leakage should be indicated on the low-range leakage rotameter. Use the system bleed valve to decrease the pressure to 70 psig. You must turn the low-pressure regulator counterclockwise until 70 psig is maintained. Leave the test stand in this condition; it is set up for you to perform your next leakage test.

ROTAMETER SYSTEM

The purpose of the rotameter system is to determine leakage or to make adjustments to items that require bleed adjustments, such as the 20004 miniature regulator. The system consists of

two in-system rotameters and one overload rotameter as shown in figure 2-6. The source of pressure for the in-system rotameters is the low-pressure regulator (N). You receive your source of pressure for the overboard rotameter from the item under test.

PRESSURIZING THE ROTAMETER SYSTEMS

To use the rotameter system, turn the inlet pressure on/off valve (L) to ON.

NOTE: Before you pressurize the rotameter systems, be sure the leakage selector valve (F) is in the HIGH position. This valve should always be in the HIGH position unless you are using the low-range rotameter to read low readings.

Turn the leakage on/off valve (G) to ON and the inlet pressure on/off valve to OFF. Look at your high-range leakage rotameter. If no leakage is indicated, turn your leakage selector valve (F) to the LOW RANGE position. Check your low-range leakage rotameter for leaks. In both leakage tests if the small ball rises in the

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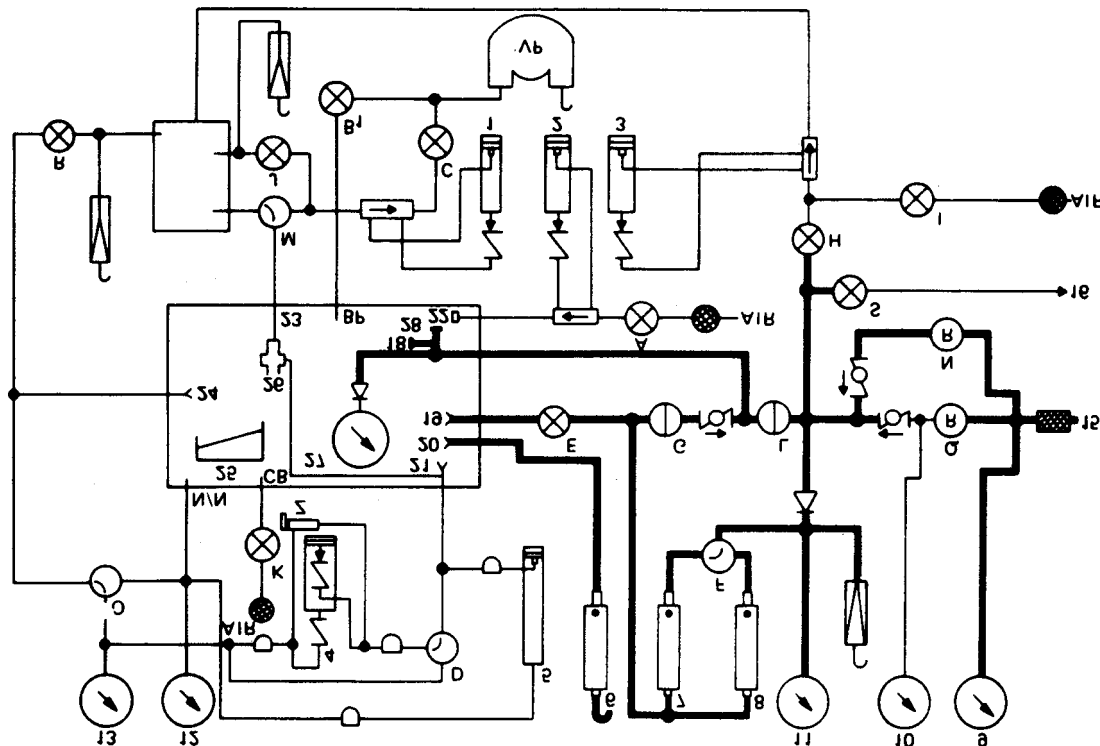


Figure 2-6.—Model 1172AS100 rotameter system.

rotameter tube, it indicates a leak. If no leakage is indicated during this test, continue.

Return the leakage selector valve (F) to the HIGH position and turn the leakage on/off valve (G) to the OFF position. By slightly cracking the cap at the N_2 input connection, you can bleed any pressure indicated on the N_2 input pressure gage (27).

At this time, a line with two bayonet fittings must be attached between the low-pressure connection (19) and the 200-CCM leakage connection (20) inside the chamber. This line is used to check for any leakage through the leakage control valve (E). Leakage is indicated on the overboard rotameter (G). If no leakage is indicated, remove the side attached to the leakage connection (20) and attach it to the reference tap connection (21). (This sets your test stand up to perform the differential pressure system test.) The reference tap connection (21) is also located inside the chamber. Place a cap over the piezometer and turn the pressure selector valve (D) to the H_2O position. Slowly open the leakage control valve (E) until the pressure/suction manometer (4) indicates 9.0 inches of water (in. H_2O). Fully closing this valve (E) may be necessary after you reach 9.0 in. H_2O . No leakage should be indicated on the high-range leakage rotameter (8).

Turn the leakage selector valve (F) to the LOW RANGE position. No leakage should be indicated on the low-range leakage rotameter (7). Close the leakage control valve (E) and turn the leakage selector valve (F) to the HIGH RANGE position. Now disconnect the line at the low-pressure connection (19). Bleed the pressure from the pressure/suction manometer (4); then reconnect the lines.

If you find this system has no leakage, your test stand is set up to perform the differential pressure indicating system leakage test.

DIFFERENTIAL PRESSURE INDICATING SYSTEM

The schematic for the differential pressure indicating system is shown in figure 2-7. The purpose of this system is to sense the difference in pressure between the outlet of the component being tested and the surrounding atmosphere, whether at sea level or altitude. You use this system when you perform safety-pressure, pressure-breathing, and flow-suction tests. Three manometers on the test stand indicate differential pressure: the pressure/suction manometer (4), the HG manometer (5), and the inclined pressure/suction manometer (25).

With the pressure selector valve (D) in the H_2O position, pressure or suction is sensed in the

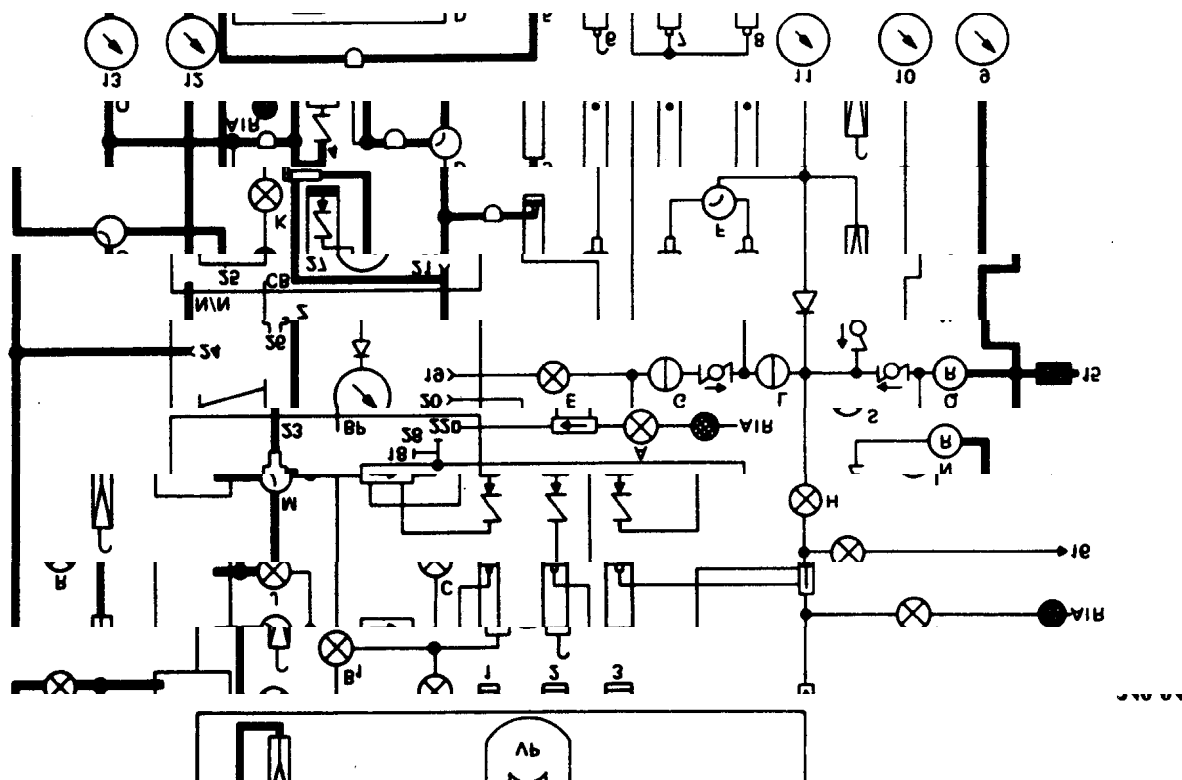


Figure 2-7.—Model 1172AS100 differential pressure indicating system.

piezometer (26) by a line that runs from the reference tap connection (21) to the piezometer (26). The pressure/suction manometer (4) registers that pressure or suction. The pressure also registers on the HG manometer (5).

NOTE: The HG manometer (5) receives pressure or suction from the piezometer regardless of the position of the pressure selector valve (D).

From the pressure/suction manometer (4), the pressure flows through another line trap to a connection at the low-range altimeter (13). It then flows to the reference pressure selector valve (O). With the valve (O) in the ALTITUDE CHAMBER position, differential pressure is transmitted to the chamber reference port (N/N).

Other valves and connections that affect readings on the pressure/suction manometer (4) are the helmet reference tap (24), the suit simulator reference shutoff valve (R), and the pressure equalizer valve (Z).

The helmet reference tap (24) is used when you test the full pressure suit helmet. It gives the differential pressure between the respiratory section and the suit section. When you test the full pressure suit controllers, the suit simulator shutoff valve (R) is used in conjunction with the reference pressure selector valve (O) to give the actual altitudes within the suit. The pressure equalizer valve (Z) equalizes the pressure in the pressure/suction manometer (4) as does the pressure selector valve (D) when the pressure selector valve is placed in the HG position.

PRESSURIZING THE DIFFERENTIAL PRESSURE INDICATING SYSTEM

NOTE: At this point, knowing that 1.0 psig = 2.7.7 in. H₂O or 2.0 in. HG will be helpful to you.

To use the differential pressure indicating system, open the leakage control valve (E) until the pressure/suction manometer (4) indicates 16.0 in. H₂O. Place the leakage selector valve (D) in the HG position. Now close the leakage control valve (E). The system should now be maintaining 16.0 in. H₂O. If the system has a leak, the high-range flowmeter (8) or the low-range flowmeter (7) will indicate it. If the system has no leakage, disconnect the line between the low-pressure connection (19) and the reference tap connection (21); then remove the plug from the piezometer.

To bleed the system, back out on the low-pressure regulator (N) and open the bleed valve (S). After you bleed the system, close the system bleed valve (S). Leave all valves and connections in their present position. Now you are ready to check the vacuum system.

VACUUM SYSTEM

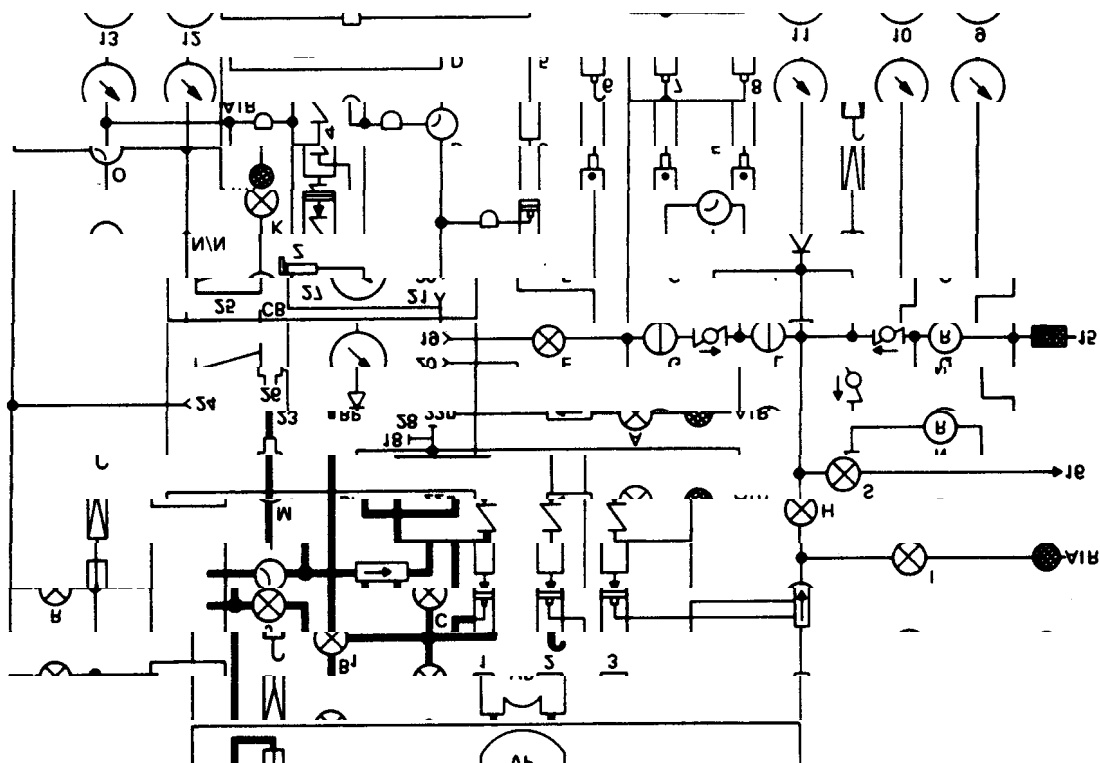
This system (figure 2-8) is used to evacuate the chamber to simulated altitudes. It also allows you to draw flows from any item that you have under test. The vacuum pump is considered the heart of the test stand. It is equipped with a vent that is provided to remove any corrosive vapors from the oil used in the pump. Use MIL-L-83767, Type I. Two valves work in direct conjunction with the pump: the vacuum control valve (B₁) and the output valve (C). The vacuum control valve (B₁) will directly evacuate the chamber to any simulated altitude necessary to test oxygen components. The output valve (C) draws a flow through the item under test.

By using the output valve (C), you can draw a flow through the item under test, through the piezometer (26), the flow selector valve (M), the output vol-o-flo element, and into the vacuum pump. When you place the selector valve (M) in the SUIT SIMULATOR position and open the flutter dampener valve (J), the flow is identical to the flow that occurs when you use the output valve (C), except the flow is drawn through the suit simulator tank.

USING THE VACUUM SYSTEM

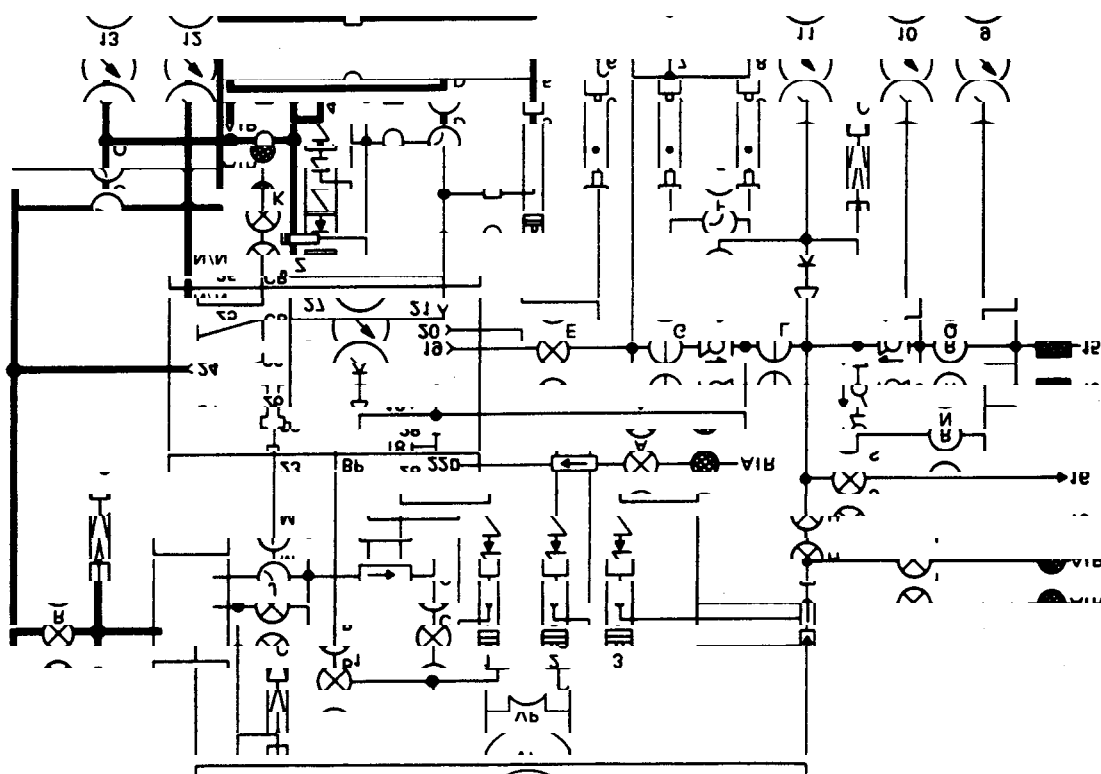
Prior to using the vacuum system, ensure the vacuum pump vent is open one to two full turns. Now turn the vacuum pump to the ON position and close the altitude chamber door. Be sure the reference pressure selector valve (O) is in the chamber position and open the vacuum control valve (B₁). Ascend to 10,000 feet. Watch the altitude indication on the low-range altimeter (13). When you reach the 10,000-foot altitude, stabilize the altitude by closing the vacuum control valve (B₁). You should not see any drop in your altitude. Open the chamber bleed valve (K) and descend to sea level. When you reach sea level, close the bleed valve (K) and turn the flow selector valve (M) to the REGULATOR position. Use the output valve (C) to draw a flow of 6.0 in. H₂O. This flow is drawn from the chamber through the output port (23) and is indicated on the output manometer (I). Ascend to 10,000 feet. Close the output valve (C) and watch the low-range altimeter (13). No drop in altitude should be indicated. Open the chamber bleed valve (K) and descend to sea level. Close valve (K) when you reach sea level.

By having all valves and connections in their present position, you are set up for the altitude sensing system test.



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Figure 2-8.—Model 1172AS100 vacuum system.



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Figure 2-9.—Model 1172AS100 altitude sensing system.

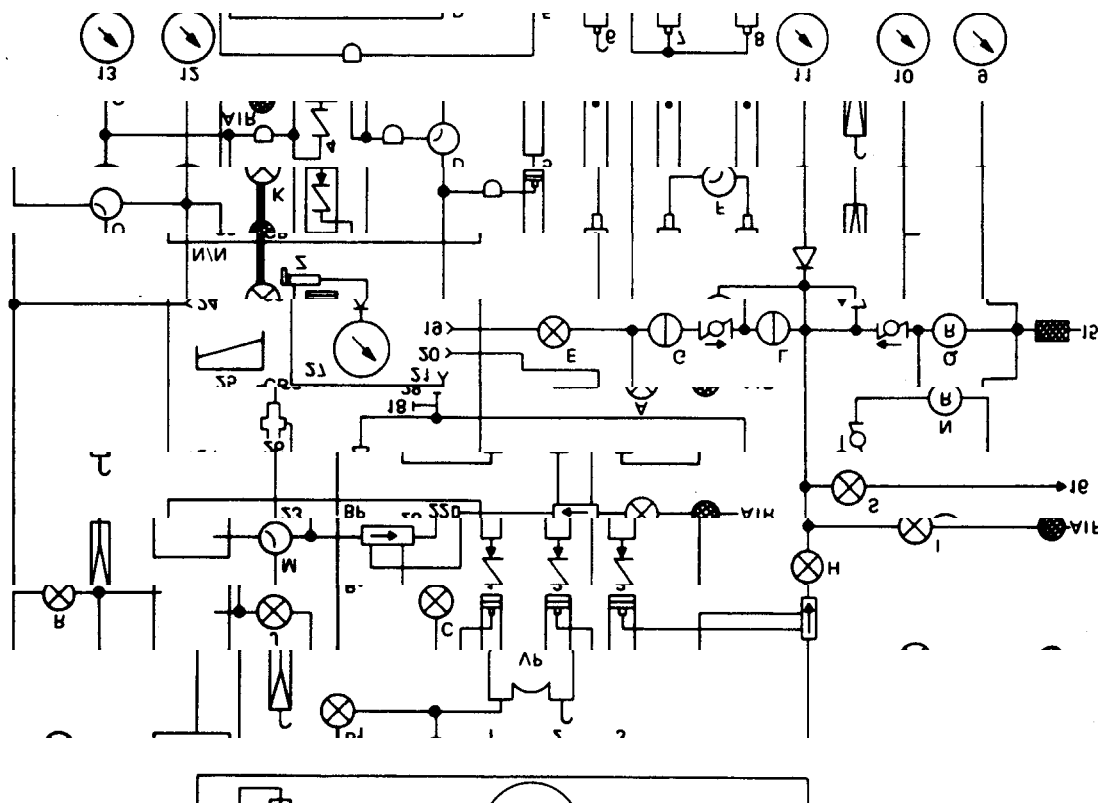


Figure 2-10.—Model 1172AS100 chamber bleed system.

ALTITUDE SENSING SYSTEM

This system (figure 2-9) senses the pressure (less 1 atmosphere) in the altitude chamber or suit simulator tank. In this case, we refer to atmosphere as a unit of pressure equal to 14.69 pounds per square inch. Both the high-range and low-range altimeters are operated by differential pressure. The high-range altimeter (12) senses the altitude inside the chamber through the chamber reference port (N/N). When you place the pressure selector valve (O) in the ALTITUDE CHAMBER position, the low-range altimeter senses the altitude through the same chamber reference port (N/N). The low-range altimeter also senses the pressure inside the suit simulator tank. You must place the reference pressure selector valve (O) in the SUIT SIMULATOR position and open the suit simulator reference shutoff valve (R) for the low-range altimeter to read this pressure.

PRESSURIZING THE ALTITUDE SENSING SYSTEM

When you pressurize the altitude sensing system, be sure the reference pressure selector valve (O) is in the ALTITUDE CHAMBER position and open the vacuum control valve (B_i). When you open the control valve (B_i), ascend to

50,000 feet. The altitude will be indicated on the high-range altimeter (12). Stabilize with control valve B_i at this altitude and check for leaks. Open chamber bleed valve (K) and return to sea level. Close valve (K) when you reach sea level. If you find that the test stand has no leaks at this point, turn the reference pressure selector valve (O) to the SUIT SIMULATOR position; then open the suit simulator reference shutoff valve (R) fully. Place the flow selector valve (M) in the SUIT SIMULATOR position. Now you are ready to ascend to altitude. Open the vacuum control valve (B_i) and ascend to 35,000 feet. This altitude will be indicated on the low-range altimeter (13). Again stabilize with control valve (B_i) and check for leaks. Close the vacuum control valve (B_i) and return to sea level. To setup the test stand for the chamber bleed system test, close the chamber bleed valve (K). Place the reference pressure selector valve (O) in the ALTITUDE CHAMBER position; close the suit simulator shutoff valve (R) and place the flow selector valve (M) in the REGULATOR position. Leave all valves and connections in their present position.

CHAMBER BLEED SYSTEM

The chamber bleed system shown in figure 2-10 is a very simple system used to introduce a

large volume of air into the altitude chamber. When you open the chamber bleed valve (K), ambient air flows into the chamber through the chamber bleed port (CB). The altitude in the chamber drops until the pressure inside the chamber equalizes with the pressure at sea level.

PRESSURIZING THE CHAMBER BLEED SYSTEM

Open the vacuum control valve (B) and ascend to 10,000 feet; then close the valve to stabilize your altitude. A drop in altitude on the low-range altimeter (13) indicates a leak. If there is no drop in altitude, open the chamber bleed valve (K) and descend to sea level. When you reach sea level, close the chamber bleed valve (K). The test stand is now ready to test the flow measuring system.

FLOW MEASURING SYSTEM

This system is the largest and most important system on the test stand. The purpose of the flow measuring system is to measure flows of air, nitrogen, or air/nitrogen mixture from an item

under test. As you can see in figure 2-11, the system consists of vol-o-flow elements, flow indicating manometers, control valves, and selector valves. The flow measuring system is made up of the output, input, and vent flow subsystems. The different subsystems function with the vacuum running.

Output

The output flow system originates at the piezometer (26) and flows through the output port (23) to the flow selector valve (M). It is then directed to either the output vol-o-flow element or the suit simulator tank. When the flow selector valve (M) is placed in the REGULATOR position, the flow is directed to the output vol-o-flow element. The volume of flow is controlled by the output valve (C) and is indicated on the output flow manometer (1). The only time this system is used with the flow selector valve (M) in the SUIT SIMULATOR position is when the full pressure suit breathing regulator is tested.

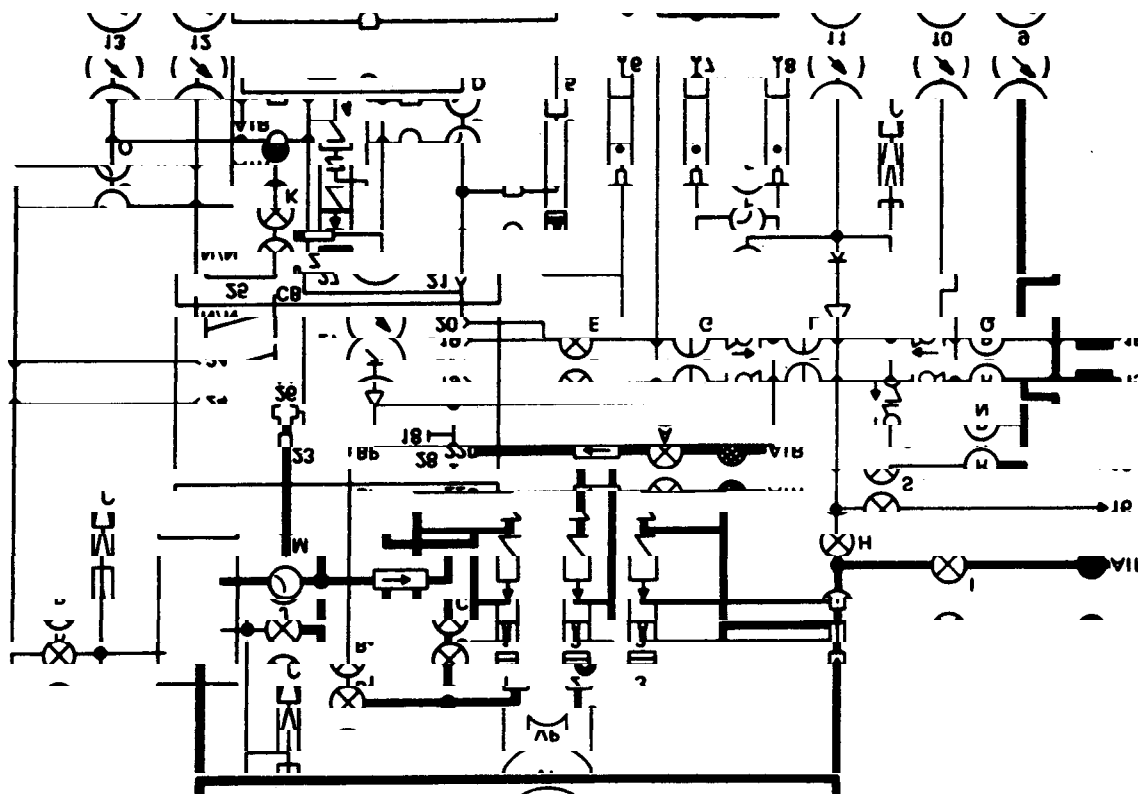


Figure 2-11.—Model 1172AS100 flow measuring system.

Input

The input flow system can only be used with the chamber at altitude. This system originates at the air intake on the face of the test stand. When the input valve (A) is opened, ambient air flows through this valve (A) to the input vol-o-flow element. It then flows through the input flow manometer (2) to the input port (22) inside the chamber. You can control this flow by opening or closing the input valve (A).

VENT FLOW SYSTEM

The vent flow system can originate at either the vent ambient valve (I) or the vent pressure valve (H). Normally, the vent pressure valve (H) is used only when the chamber and suit simulator tank are at sea level. The vent ambient valve (I) can only be used at altitude. When the vent ambient valve (I) is used, air is admitted through an intake port in the rear of the test stand. It then flows through the vent flow vol-o-flow element and is indicated on the vent flow manometer (3). The air then flows to the suit simulator tank. When the flow selector valve (M) is in the SUIT SIMULATOR position, air flows to the output port (23) inside the chamber and continues to the piezometer (26). You may also direct air from the suit simulator tank to the output vol-o-flow element and the output flow manometer (1) by opening the flutter dampener valve (J). The vent pressure valve (H) is used only with low-pressure nitrogen.

To use the flow measuring system, you must convert the actual liter-per-minute (lpm) flows to indicated in. H₂O. You accomplish this with the aid of the input, output, and vent flow graphs supplied with the test stand. See figures 2-12, 2-13, and 2-14. The actual lpm is found at the bottom of the graph. Follow the selected lpm line up to the point where it intersects the air or nitrogen line. From the point of intersection, follow the lpm line to the left-hand side of the graph and determine in. H₂O.

PRESSURIZING THE FLOW MEASURING SYSTEM

Before you start pressurizing the flow measuring system, use the 10,000-foot altitude air line on the input and output graph to convert 100 lpm to in. H₂O. Open the vacuum control valve (B₁), ascend to 10,000 feet, and then close the valve (B₁). Open the output valve (C) to the in. H₂O equivalent of 100 lpm. This flow will be indicated on the output-flow manometer (1). Now, open the input valve (A) to the in. H₂O equivalent of 100 lpm; this flow will be indicated on the input-flow manometer (2). Close valves C and A before you check for leaks. If the system has no leaks, use the bleed valve (K) and return to sea level. Use the nitrogen line on the vent flow graph and convert 150 lpm to in. H₂O.

Use the low-pressure regulator to apply 70 psi. Place the flow selector valve (M) in the SUIT SIMULATOR position. Open the vent pressure valve (H) very slowly to the in. H₂O equivalent of 150 lpm. This will be indicated on the vent flow manometer (3). Now close the vent pressure valve (H). At this time you should convert 150 lpm to in. H₂O using the air line on the vent flow graph.

Place the reference selector valve (O) in the SUIT SIMULATOR position. Now open the suit simulator reference shutoff valve (R) fully and place the flow selector valve (M) in the SUIT SIMULATOR position.

Open the vacuum control valve (B) and ascend to 35,000 feet. Now close down the valve (B) to stabilize the altitude at the same time you are opening the vent ambient valve (I) to the equivalent of 150 lpm. This flow will be indicated on the vent flow manometer (3). Now close the vent ambient valve (I) and the vacuum control valve (B₁).

Secure the test stand as outlined in NAVAIR 13-1-6.4. This completes the tests for the nine different systems. If all the systems checked out, the test stand will give you outstanding service.

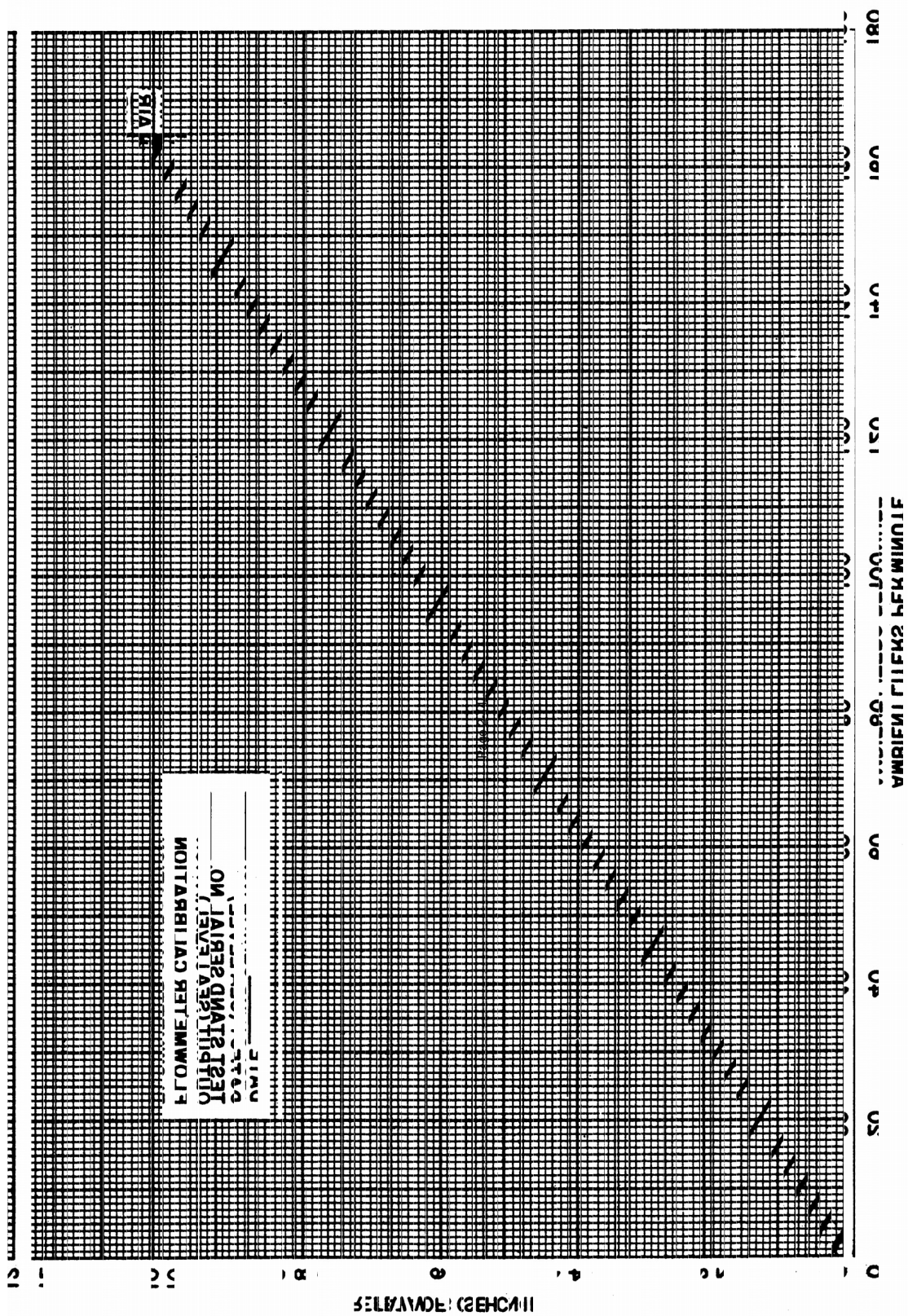
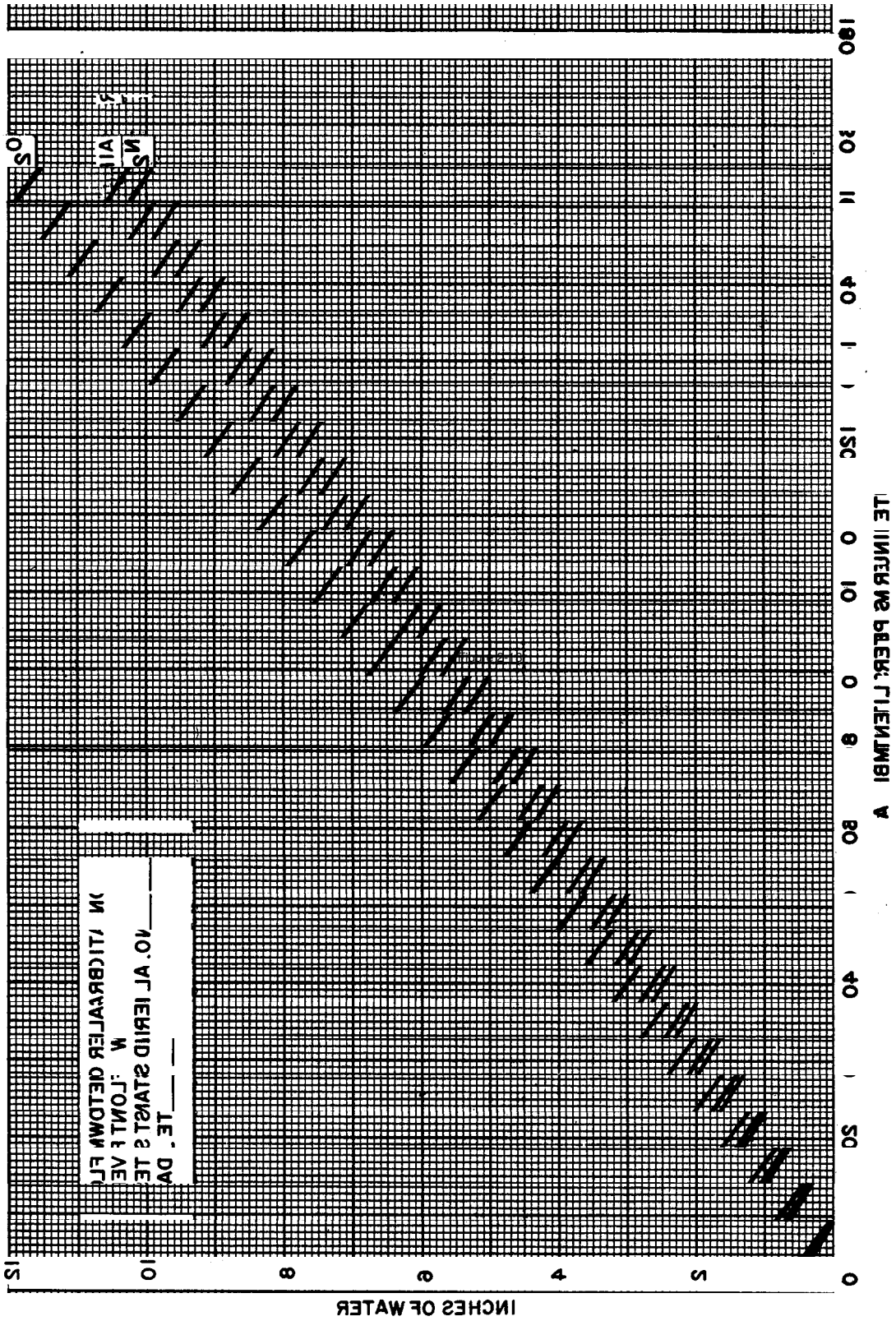


Figure 2-12.—Input graph.

100
100.00

NO. 11 5

Station - On 3-6-5-1961



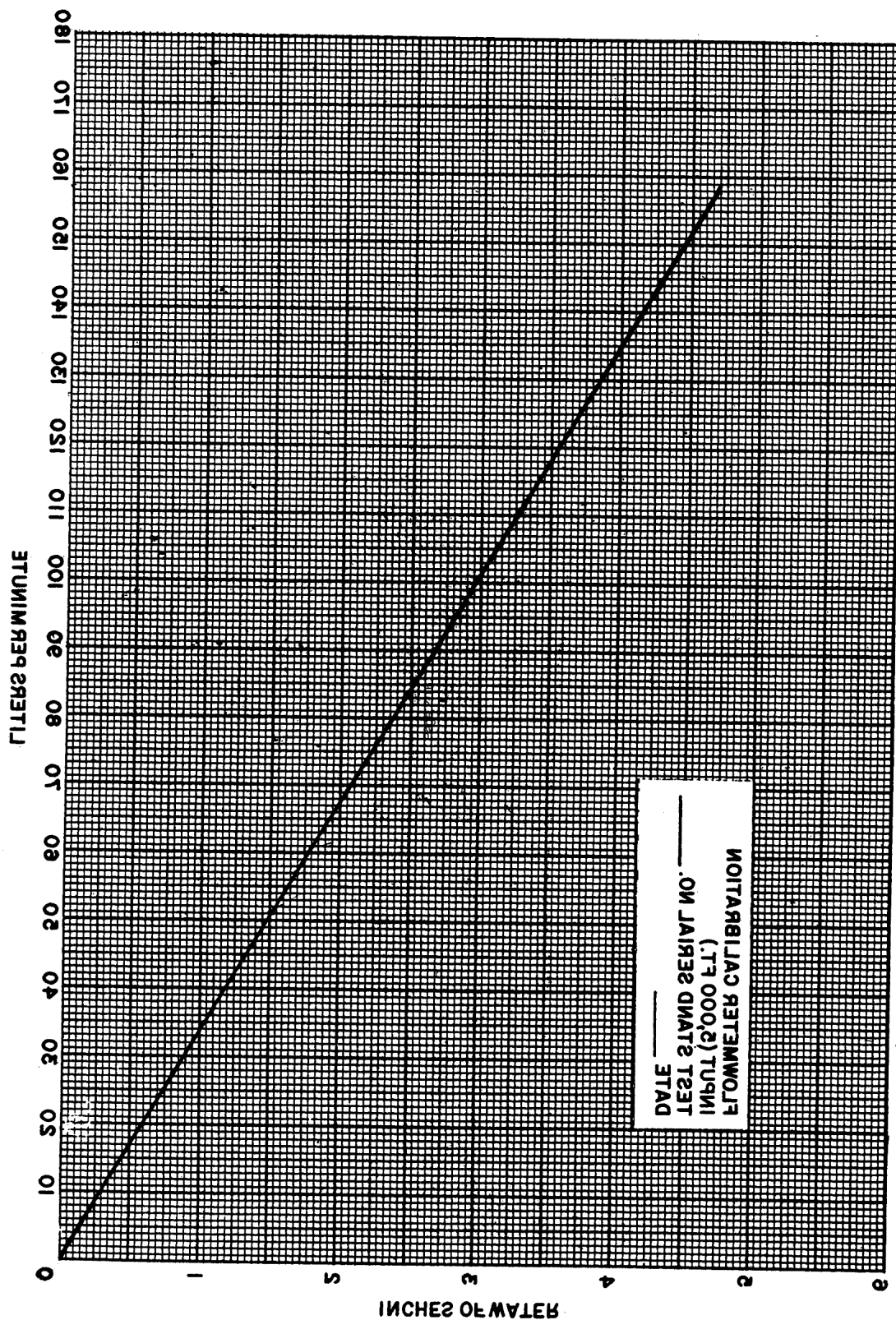


Figure 2-14.—Vent flow graph.

CHAPTER 3

CARBON DIOXIDE TRANSFER EQUIPMENT

Two different models of CO₂ transfer units are used by the Navy. This chapter covers the transfer unit Model SC-5 and the Model 4211. The two units are similar to operate but the maintenance requirements listed in the operator's manuals are different.

MODEL SC-5

Figure 3-1 shows the complete transfer unit setup required to perform CO₂ transfers.

All Model SC-5 units are basically the same except for variations in the motor and the

340-105

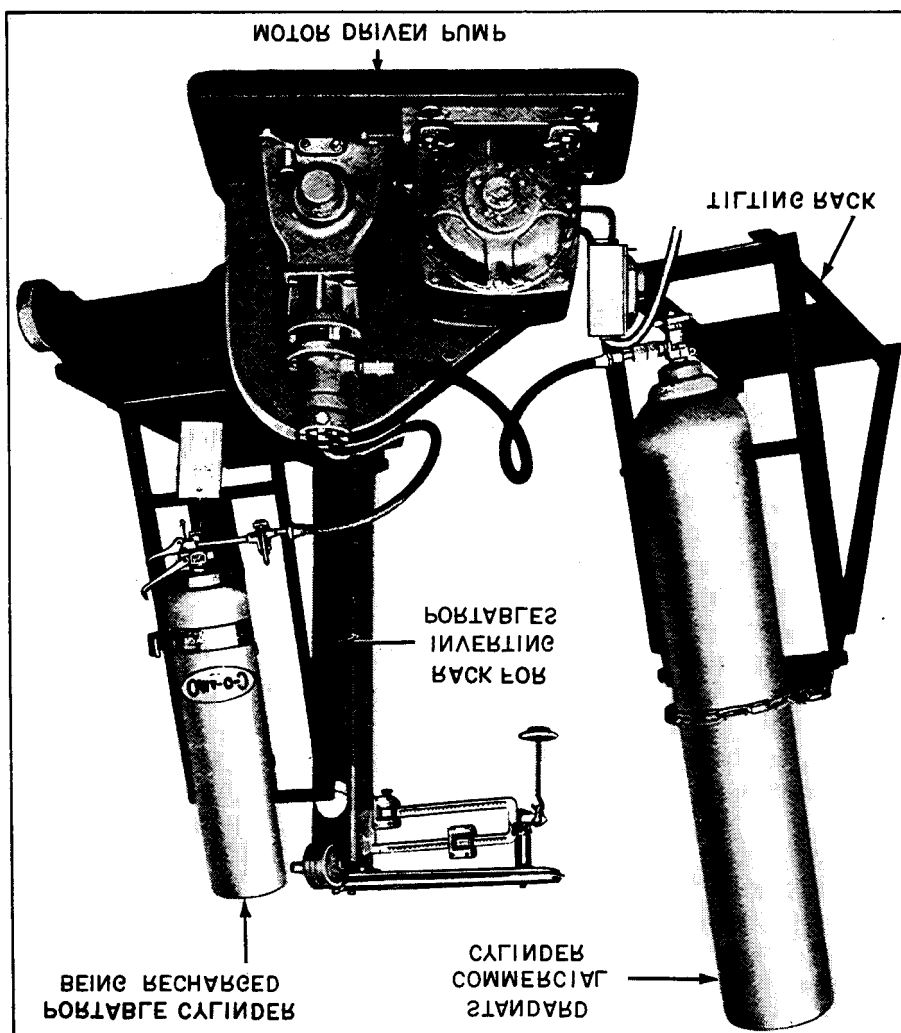


Figure 3-1.—C-O-TWO Transfer Unit.

starter arrangements. This model was previously manufactured by two companies, the C-O-Two Fire Equipment and the Norris Fire and Safety Equipment.

The SC-5 motor is mounted on a sliding, adjustable base so that its position may be altered to take up any slack that may develop in the drive belt.

The SC-5 pump is a single-cylinder design with a working pressure of approximately 3500 pounds per square inch. This unit has the capability of transferring approximately 80 percent or 38 pounds of carbon dioxide from a fully charged 50-pound supply cylinder.

The pump head is fitted with a flangible safety disc. This safety disc is designed to relieve pressure in the pump at 2650 to 3000 pounds per square inch. The safety disc nut prevents any recoil in the event the safety disc ruptures. As you can see in figure 3-2, the safety disc washer is arranged so you can easily replace it.

The lubricating system is an automatic controlled splash type. The oil flow is regulated by a fixed orifice in the oil trough. This action cannot be seen in figure 3-2. A good grade of SAE viscosity #30 automotive oil should be used when you change or add oil.

The drive from the motor to the pump is a combination of V-belt drive pulleys and gears. The small gear and large pulley are assembled together as a unit and are both fitted with ball bearings and mounted on the idler shaft. Both pulleys are carefully balanced. A single guard is secured over both gears and pulleys.

The motor, furnished as standard equipment, is a 1-horsepower capacitor start induction type. It is suitable for operation on either a 110- or 220-volt, single-phase, 60-hertz circuit. (A dc motor is also available.) An enclosed control switch is located on the side of the motor.

INSTALLING AND SERVICING NEW EQUIPMENT

After receiving the equipment, you should examine the components for damage. If the unit is damaged, do not attempt to repair it. Return it to the supply officer for reshipment to the manufacturer.

Since the oil was drained from the crankcase of the pump before it was shipped to the field activities, be sure to fill it with a standard grade of SAE #30 lubricating oil before you start the unit. On pumps equipped with an oil filler plug and measuring stick, fill them only to the upper

groove on the stick. On a unit equipped with an oil cup and no measuring stick, fill it to within one-fourth inch of the top of the cup. Other than the crankcase, only one point on the pump requires lubrication. This point is on the shaft of the idler gear and pulley and is equipped with an Alemite lubrication fitting. In spite of the fact that the pulley shaft was lubricated at the factory, it is advisable to relubricate the area with two or three applications (grease gun shots) of light cup grease before you start the unit. The motor bearings contain enough grease to last for approximately 2 years under average conditions.

Before running the pump, you must find an electric circuit compatible to the motor or install one in the shop. Unless otherwise specified, motors are wired to operate on 110-volt, 60-hertz, single-phase circuits. When 220-volt, 60-hertz, single-phase current is available, the hookup of the motor should be rearranged so that it can run on this circuit. A 220-volt wiring diagram is shown on the nameplate of the motor. The plug on the end of the lead conducting the current to the motor from the power outlet should be equipped with a grounding wire, or third wire, which is usually insulated by a white covering. Regardless of whether a three-pronged plug or a pigtail (coming out of the lead near a two-prong plug, fitted with a clip) is used, the system to which you attach this grounding wire must also be grounded to protect the unit.

WARNING

Before you attempt any work on the electrical circuit, be sure the power source is disconnected.

Always "run-in" a new pump or one that has been idle for a long time. This action, accomplished with the CO₂ hoses disconnected, is performed as a check for lubrication to make certain that all parts are thoroughly treated. After you turn off the pump, wipe off all excess lubricants.

Before you pump carbon dioxide, examine all line connections on both the inlet and outlet hoses. Make certain that all connections between the components are tight. This is important since carbon dioxide is stored under approximately 850 psi at an atmospheric temperature of 70°F. Use a slow, steady pull to tighten connections with a wrench no larger than 12 inches in length.

Figure 3-2.—C-O-TWO Transfer Unit Detail.

The transfer unit pumps carbon dioxide in its liquid phase only. This is true of all CO₂ transfer units. The amount of liquid carbon dioxide contained in a fully charged cylinder varies with the pressure and temperature; therefore, a standard 50-pound cylinder contains approximately 38 pounds of carbon dioxide in its liquid phase and approximately 12 pounds in its gaseous phase at an atmospheric temperature of 70°F. Therefore, the cooler the supply cylinder and the cylinder being recharged, the more efficient the operation of the transfer unit. Consequently, all cylinders should be kept in the coolest location possible. Conversely, the time required to charge an empty cylinder increases with increased temperature of the cylinder. When recharging a smaller cylinder, we found that if you invert the cylinder during the recharging period, it remains cooler and fills faster than it would if placed in an upright position. Larger cylinders should be placed horizontally on the scale when they are being recharged.

After all the liquid carbon dioxide is transferred from the supply cylinder, which is approximately 80 percent of the net contents, the transfer of CO₂ to the cylinder being recharged stops. After this, another fully charged supply cylinder must be used to finish recharging the cylinder to its full-rated capacity. The majority of gas remaining in the other supply cylinder can be used when you recharge another empty cylinder. The gas transfers itself under its own pressure until the pressure in both cylinders is equal. This method is called cascading. Through this method, the most economical use of the contents of the supply cylinder is made.

To prevent expansion of carbon dioxide in the supply hose, and consequently blocking the hose with CO₂ "snow," you should use a valve with an outlet opening of at least one-eighth inch in diameter—preferably three-sixteenths of an inch. Standard supply cylinders in 50-pound sizes are obtainable with or without a syphon tube. When you order cylinders, specify the ones with a syphon tube. Those without syphons must be inverted during the transfer process.

MAINTENANCE

Maintenance must be performed on all carbon dioxide equipment on a periodic basis. These maintenance procedures are discussed in the following paragraphs.

Once Every Month

Check the level of the oil in the crankcase. See that it is within one-fourth inch of the top of the filling cup or to the upper groove in the measuring stick if the unit is so equipped. If you must add any oil, use only a good grade of SAE viscosity #30 automotive crankcase lubricating oil.

Once Every 6 Months

Lubricate the idler shaft. This shaft is equipped with a fitting of the variety that is commonly used in the automotive field. Two or three "shots" of light cup grease will be ample.

Lubricate the gear teeth with a thin coating of light cup grease.

With a small piece of wood, or preferably a small brush, apply a light coating of Vaseline to the piston rod. To do this, dip the brush in Vaseline, hold the brush against the piston rod, and manually rotate the gears until the piston rod is completely and thoroughly coated with Vaseline.

If necessary, tighten the packing at the piston stem. A special wrench is provided for this purpose. Do not tighten excessively. Because of the design of the packing, it must only fit snugly to hold tightly.

Keep the motor commutator clean and maintain a clean surface. Under normal operating conditions, the commutator will require only occasional cleaning with a dry piece of nonlinting cloth. Do not lubricate the commutator.

Every 12 Months

The oil should be drained from the crankcase and replaced with clean, fresh oil of the quality and viscosity specified.

Once Every 2 Years

The bearing housings of the electric motor should be removed and lubricated. To do this, disassemble the bearing housing. Then clean the inside of the housings, the plates or caps, and the bearings with carbon tetrachloride. Wipe off all grease and reassemble all parts except the outer caps or plates. Apply the new grease, either from a tube or by hand, over and between each ball. When you do this, do not apply more than one-half of an ounce of grease at each bearing.

Too much grease may cause excessive bearing temperature and cause the grease to leak out of the housing to the windings.

Piston Rod Packing

Piston rod packing should be replaced once every 2 years.

To replace the piston rod packing, use the following steps:

1. Remove the six bolts on top of the cylinder head. Remove the cylinder head.
2. Loosen the hex nut (figure 3-2) at the bottom of the piston rod.
3. Remove the three bolts that hold the cylinder body to the crosshead guide unit.
4. Raise the cylinder body and unscrew the piston rod from the crosshead so that it clears the base.
5. The piston rod packing is now in a position to be replaced. Remove the locknut from the piston rod and then remove the piston rod packing nut.
6. When you replace the flanged-type packing, remember that the packing nut serves only to hold the packing in place. Tightening the nut excessively will not increase its efficiency; the packing nut should not be forced down tight enough to damage the packing flange.
7. After you replace the packing and packing nut, mount the cylinder body on the crosshead guide. Make certain that the locknut is replaced on the piston rod before you screw it into the crosshead.
8. Screw the piston rod into the crosshead until the top edge of the piston packing is flush with the top of the cylinder body, with the crosshead in the uppermost position (figure 3-2). To check this adjustment, rock the crank back and forth; then tighten the locknut at the bottom of the piston rod.
9. Replace the piston head and tighten all the mounting bolts.

WALTER KIDDE TRANSFER UNIT

The Walter Kidde unit, like the SC-5 is designed and manufactured expressly for the purpose of transferring carbon dioxide in its liquid form from one cylinder to another. The unit is supplied complete with the necessary adapters, recharging valves, safety discs and bushings, nuts, bolts, and washers needed to make connections

to the cylinders and minor adjustments to the unit. Pump Models 4211 and 4211-1 are driven by a three-fourths horsepower motor and are equipped with a safety switch and lead fitted with a plug. Three-prong plugs and three-wire leads should be substituted for the ordinary two-wire and two-prong arrangement. Pump Models 4306 and 4306-1 are driven by a single-cylinder, four-cycle, three-fourths horsepower, air-cooled engine. Figure 3-3 illustrates the Walter Kidde electric recharge unit, Model 4211.

COMPONENTS

The carbon dioxide transfer unit (figure 3-3) consists of the following major components: compressor assembly (5), running gear assembly

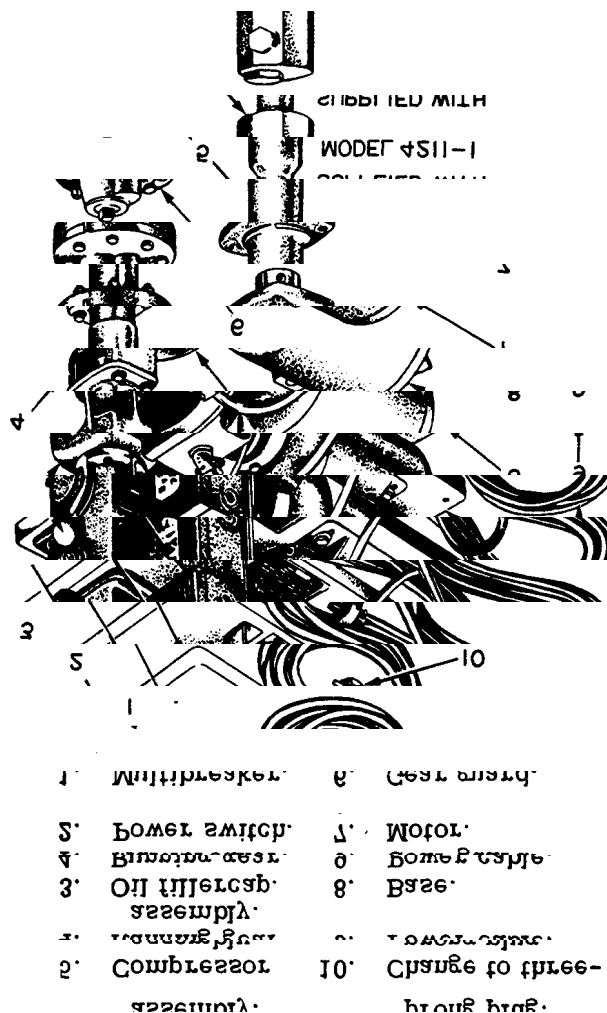


Figure 3-3.—Walter Kidde Electric CO₂ Transfer Unit, Model 4211.

(4), motor (7), multibreaker (1), power cable (9), and base (8). The only difference between the models lies in the type of compressor supplied; however, the compressors are interchangeable between the models. A spare parts kit, recharging transfer fittings, and charging fittings are used in conjunction with the units.

Motor

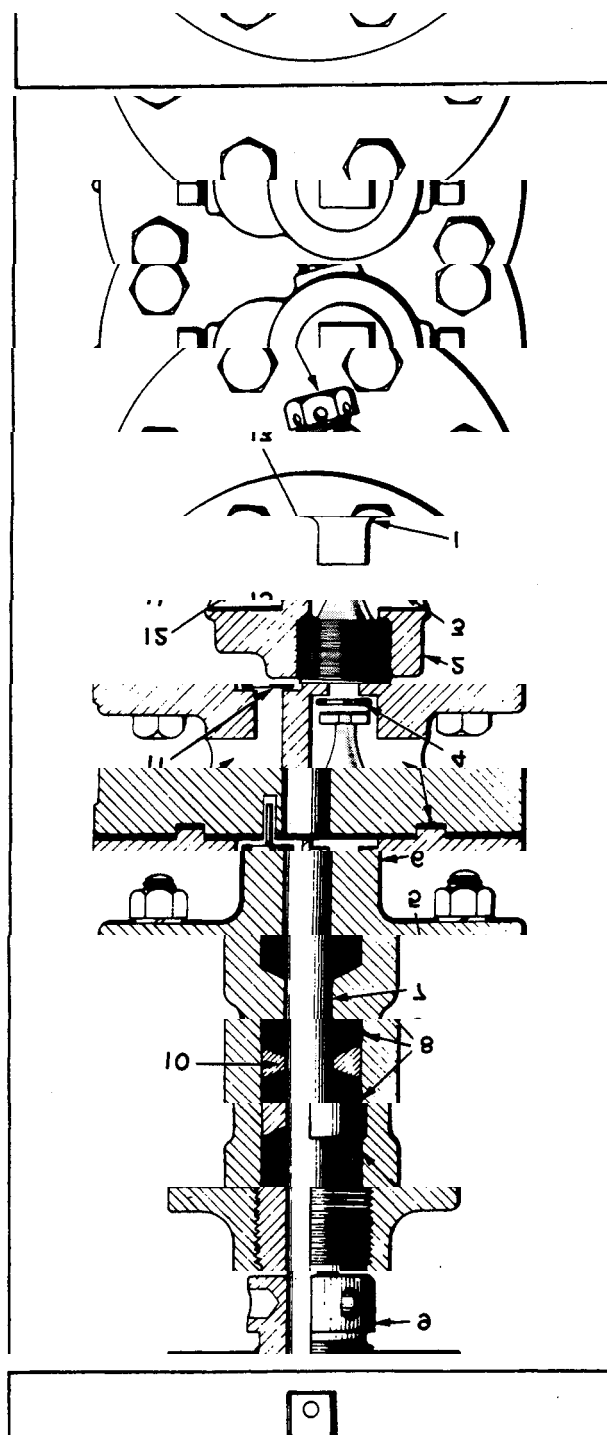
The repulsion start induction single-phase motor, shown in figure 3-3, is a 115- to 230-volt, 60-cycle, three-fourths horsepower unit. It operates at 1750 rpm and draws 9.8 amperes at 115 volts. This type of motor supplies very high starting torque with a very low starting current. In starting, the motor has repulsion motor characteristics; but at running speeds, it functions as an induction motor since the motor windings are automatically short-circuited and the brushes are lifted from the commutator when the operating speed is approached.

Multibreaker

The thermal, magnetic multibreaker, shown in figure 3-3, is a two-pole, 115-volt ac, 20-ampere unit installed to protect the power circuit from overloads. In addition, it acts as a manual ON/OFF switch for the operation of the transfer unit. If the multibreaker trips because of a power overload, you may reset it by placing the switch first to OFF and then to ON.

Compressor Assembly, Model 4211 Carbon Dioxide Transfer Unit

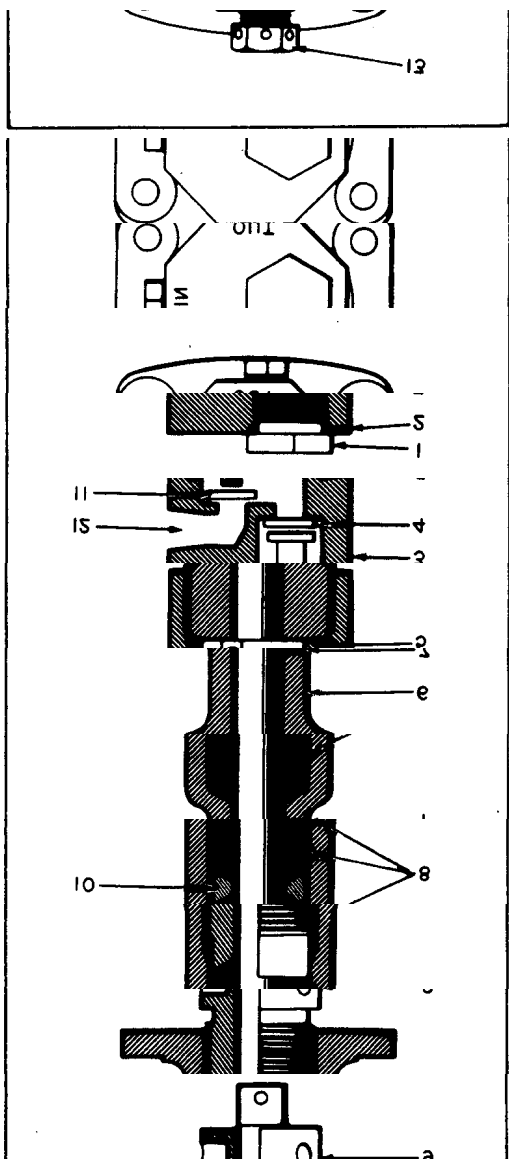
This unit, shown in figure 3-4, is a two-stage, single-action, displacement-type compressor. The running gear assembly actuates the unit and transfers the liquid carbon dioxide from the supply cylinder to the cylinder being recharged. The lower section consists of a cylinder body (6), plunger (7), molded metallic packing (8), spacer (10), and plunger guide (9). The plunger (7), which acts as a piston and transfers the liquid carbon dioxide, is connected to the crosshead of the running gear assembly. The upper section of the unit consists of a cylinder head (2) with an intake and outlet port, an intake valve (11), a discharge valve disc (4), and a discharge valve cap (1). A safety disc and washer, located in the cylinder head behind the safety disc plug (13), releases the carbon dioxide from the compressor when the pressure exceeds the 2650- to 3000-psi range.



- | | |
|-----------------------|----------------------|
| 5' Հանգուի բեւոյ | Բաշխոն |
| 1' Դիսքայնէ ասլաւ ԿՅ | 8' Պոլճեզ արեւոյիլ |
| 2' Ըտէրէ | 11' Մտէրէ ասլաւ |
| 4' Դիսքայնէ ասլաւ զիս | 10' Չիսէ |
| 3' Օղղէ Բուլ | Ժ' Էլլուրէ ճոլճ |
| 7' Էլլուրէ | 13' Չիսէլ զիս Լեւոյն |
| 6' Հանգուի քոզ | 15' Մտէրէ Բուլ |

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Figure 3-4.—Compressor Assembly, Model 4211 Carbon Dioxide Transfer Unit.

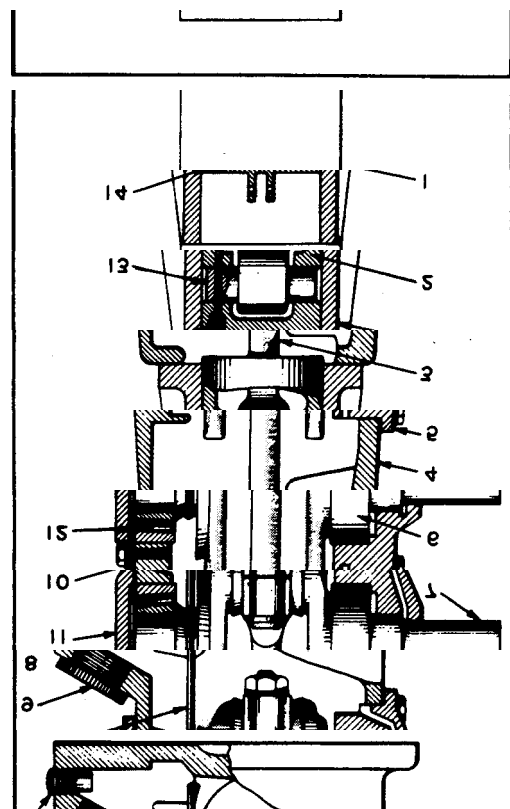


- | | |
|----------------------|-----------------|
| 3' Շաղկապի թափ | 10' Շաղկապի թափ |
| 3' «Օ», Կլիմայի ծառ | 8' Շաղկապի թափ |
| 1' Բացարձակ աղյուսակ | 13' Կլիմայի ծառ |
| 4' Շաղկապի թափ | 11' Կլիմայի ծառ |
| 2' «Օ», Կլիմայի ծառ | 12' Կլիմայի ծառ |
| 14' Շաղկապի թափ | |

Figure 3-5.—Compressor Assembly, Model 4211-1 Carbon Dioxide Transfer Unit.

Compressor Assembly, Model 4211-1 Carbon Dioxide Transfer Unit

This unit, shown in figure 3-5, is functionally similar to the compressor described for the 4211 unit. The lower section of the compressor



- | | |
|-----------------|-----------------|
| 3' Շաղկապի թափ | 10' Շաղկապի թափ |
| 3' Շաղկապի թափ | 8' Շաղկապի թափ |
| 1' Շաղկապի թափ | 13' Կլիմայի ծառ |
| 2' Կլիմայի ծառ | 11' Կլիմայի ծառ |
| 4' Շաղկապի թափ | 12' Կլիմայի ծառ |
| 14' Շաղկապի թափ | |

Figure 3-6.—Running Gear Assembly.

consists of a cylinder body (6), plunger (7), molded metallic packing (8), spacer (10), and plunger guide (9). The upper section of the unit consists of a cylinder head (3) with an inlet and outlet port, an inlet valve check (11), an outlet valve check (4), and a discharge valve cap (1). A safety disc and washer located in the cylinder head behind the safety disc plug (13) releases the carbon dioxide from the compressor when the pressure exceeds the 2650- to 3000-psi range.

Running Gear Assembly

The running gear assembly, shown in figure 3-6, consists of the crankcase (4), crosshead guide (1), crosshead (2), connecting rod (3), and the

crankshaft (7) riding in two roller bearings (6 and 12) mounted in the end plates (5 and 11). Mechanical connection to the motor is made by means of a gear keyed to the crankshaft and meshed with the driving gear on the motor shaft. The two gears are enclosed by the gear guard (6, figure 3-3). Access to the oil reservoir within the crankcase is obtained through the oil filler cap (9). The crankcase can be drained by removing the drain plug (8).

SERVICE AND OPERATIONAL INSTRUCTIONS

Much of this information has been discussed for the Model SC-5 transfer unit and need not be repeated; however, where we note a difference, we will discuss it.

After you uncrate and inspect the unit, make certain that the crosshead clears the packing nut. To do this, turn the master gear attached to the crankshaft. The mechanism must work freely.

Fill the crankcase with a standard grade of SAE #20 motor oil. CAUTION: Do not use any oil or grease in the cylinders or in any of the adapters or hose connections used to convey carbon dioxide. (Since this precaution was not specifically stated in the instructions for the

adapters connected to the SC-5 pumping unit, we are not implying that oil or grease can be used in the adapters of Model SC-5.) In any case, follow the manufacturer's instructions. Do not add to or subtract from anything in the manufacturer's manual. Obviously, however, where the Naval Air Systems Command (NAVAIRSYSCOM) directives are concerned, they will take precedence over the manufacturer's instructions. Walter Kidde instructions direct you to use a 10-inch wrench to tighten all hose-connecting joints. While tightening the hose, you should be careful not to twist them.

A strainer and strainer adapter are inserted into the inlet line (at the supply cylinder) to the pump. They prevent any dirt or metal filings that may accumulate in the supply cylinder from blowing over into the pump and impairing the action of the valves. Knowledge of the function of the strainer is important to you when you analyze the cause of malfunctioning pump valves or other associated parts.

MAINTENANCE

The normal maintenance on this pump is limited to proper lubrication. Figure 3-7 shows

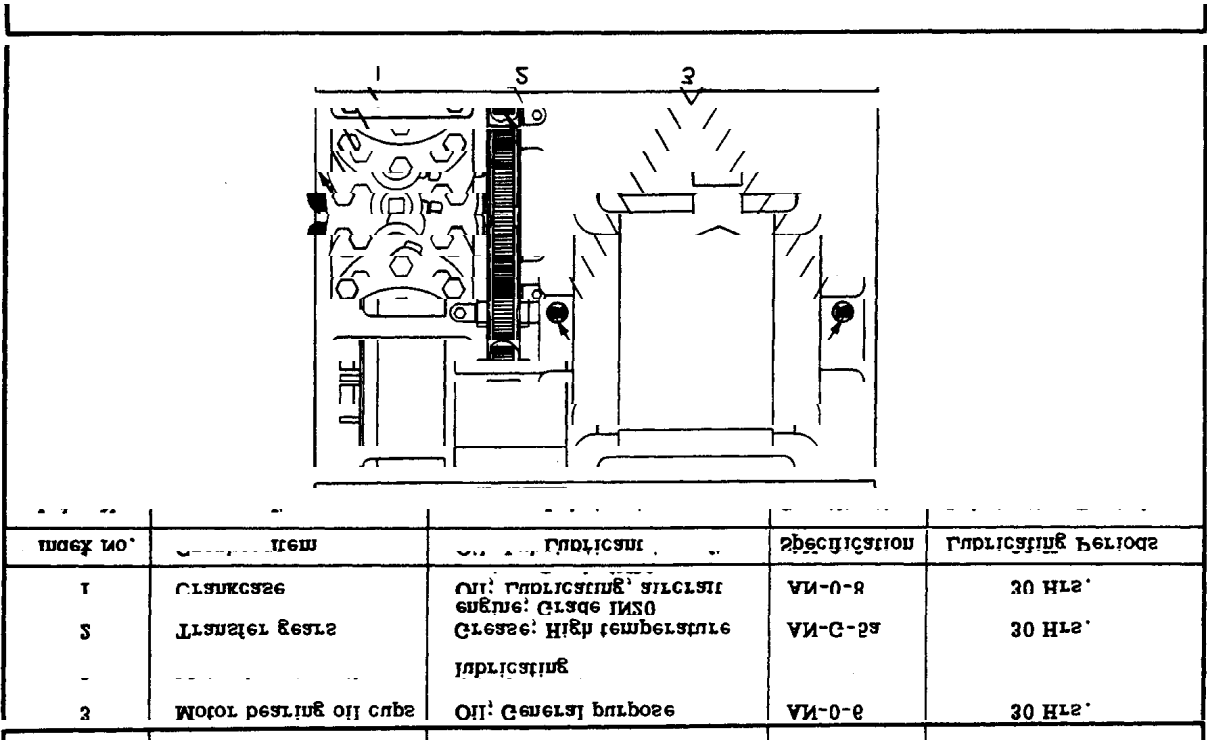


Figure 3-7.—Lubrication points.

the different lubrication points for the Walter Kidde Model 4211 transfer pump. We also recommend you drain the oil in the crankcase after every 150 hours of operation. The crankcase holds 1 pint of SAE #20 lubricating oil.

CAUTION

Do not introduce oil or grease into the compressor assembly or into the adapters or hose connections used to transfer the carbon dioxide.

Troubleshooting

Table 3-1 is from the operating manual for the Walter Kidde unit. It lists possible troubles that may occur during the operation of the carbon dioxide transfer unit, their probable cause, and indicated remedy.

Plunger Packing

Vapor leaks at the plunger packing are sometimes impossible to overcome. An invisible

Table 3-1.—Troubles that may occur during the operation of the carbon dioxide transfer unit, their probable cause, and indicated remedy

SYMPTOM	PROBABLE CAUSE	REMEDY
SUFFICIENT CARBON DIOXIDE NOT TRANSFERRED TO CYLINDER BEING RECHARGED	Plunger cylinder compression less than 10 pounds of carbon dioxide	Use a fully charged plunger cylinder. Measure the starting charged cylinder only to start the charging of empty cylinders.
	Carbon dioxide snow in connecting lines	Stop operation, break connections, remove snow, and clean lines.
	Foreign matter in cylinder	Clean cylinder.
	Foreign matter on inlet valve and discharge valve disc	Remove and clean.
	Plunger inlet valve or discharge valve not closed	Replace.
	Moldy compressor pistons in plunger test assembly	Replace plunger test assembly.
	Plunger or plunger test assembly not in back of induction	Check for correct and complete check for correct and complete.
VAPOR LEAKS	Loose packing	Tighten plunger nut.
	Moldy packing	Replace packing.
	Loose cylinder head	Tighten.
LOWER DOES NOT OPERATE	Defective motor	Check for correct and complete.
	Defective motor	Replace motor.

vapor leak will not affect the performance of the pump; no particular effort need be made to eliminate a leak unless it reaches the point at which it becomes visible. If a leak should develop at the lower end of the plunger, tighten the plunger guide, shown in figure 3-8, with a rod (approximately 3/8 inch by 6 inches). Do not bind the plunger by tightening it too snugly. When you can no longer adjust the tightness of the plunger guide, remove the compressor body from the frame and insert new packing as follows:

1. Unscrew the four bolts that hold the compressor body to the crosshead guide and remove the pin that holds the plunger to the crosshead.

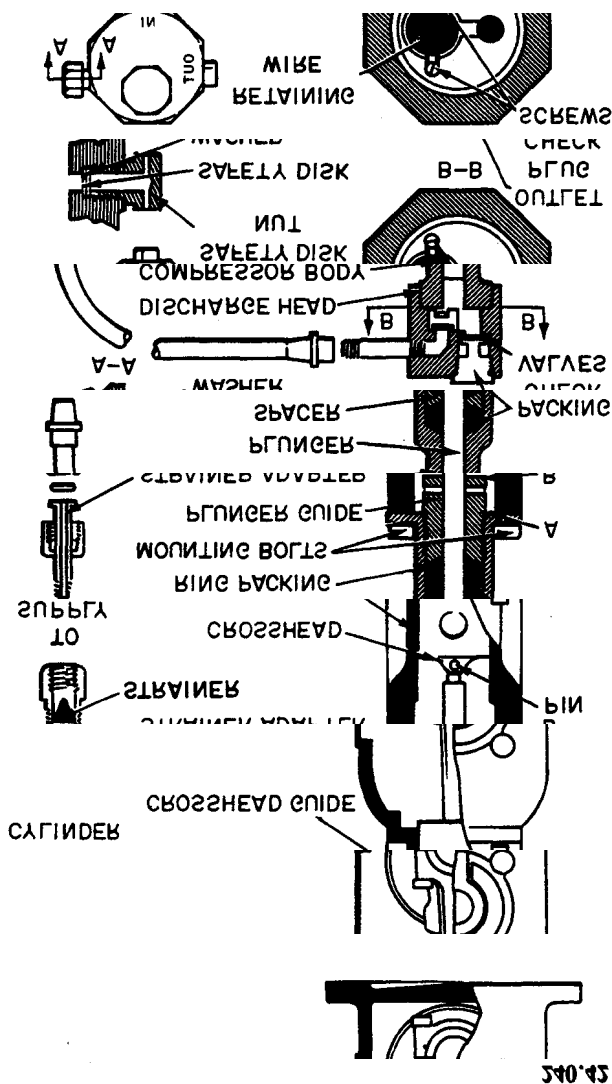


Figure 3-8.—Compressor assembly of the Walter Kidde CO₂ transfer unit.

2. Place the compressor body in a vise and remove the plunger guide and old packing. Insert only the two large pieces of packing and the spacer. Then insert the plunger guide and turn it down as far as possible to compress and form the packing around the plunger. This operation will cause the plunger to bind, but you can free it by turning and working the plunger up and down a few times.

3. Remove the plunger guide and insert the small ring of the packing. Install the packing so that the level fits the packing already in place and the plunger guide. Replace the plunger guide and turn it in until the maximum dimension between the body at point (A) and the end of the plunger guide (B) (figure 3-8) is 1 3/16 inches. If the plunger guide is not screwed in sufficiently, the crosshead will strike the plunger guide. To free the plunger, work it back and forth several times.

4. Replace the compressor body and extend the plunger so that it can be lined up with the crosshead and the pin being replaced. After you connect the end of the plunger with the crosshead, which may have had to be moved to its top position to accomplish the connection, tighten the bolts securely. Turn the master gear several revolutions by hand to make sure the crosshead does not strike the plunger guide.

Safety Disc

Figure 3-4 and 3-5 illustrate the safety disc arrangement located in the discharge body. The method of removal and replacement of the safety disc is self-evident in the illustration; however, never use a disc that is stronger or weaker (tensile strength capacity) than specified.

Cleaning

No foreign matter should be in the areas of recharging pump connections. If a decrease is noted in the amount of carbon dioxide transferred (it should be approximately 80 percent of the supply cylinder), remove the two check valves (figure 3-5) in the compressor head and clean them. To do this, remove the discharge head body (right-hand thread). Then remove two screws and the retaining wire. The inlet check will then be accessible. You can remove the outlet check by unscrewing the plug. Clean both checks and the seat thoroughly.

The strainer on the inlet line (from the supply cylinder) should be cleaned frequently for maximum efficiency of the pump.

NOTE: Remember you are dealing with high-pressure gas. Before attempting to recharge any extinguisher, you should become thoroughly acquainted with the recharging pump and the methods of recharging. Carefully read the instructions that pertain to the recharge pump and be sure all connections are tight at all times.

CO₂ CYLINDERS AND SAFETY DISC

Carbon dioxide cylinders should be charged with "bone-dry" carbon dioxide. Extreme care must be taken in the charging, weighing, sealing, and testing of cylinders.

The safety discs of the cylinders are painted various colors to identify the pressure at which they will rupture. The correct color disc must be used in every case. All cylinders are manufactured in accordance with the requirements of the Interstate Commerce Commission (ICC) as set down by the Bureau of Explosives. These requirements specify that the cylinder be tested to five-thirds of its normal working pressure and that the normal working pressure be stamped on the cylinder immediately following the letters ICC3A. We refer to this procedure as hydrostatic testing. Common cylinder stampings and the corresponding test pressures are as follows:

<u>Cylinder Stamping</u>	<u>Test Pressure</u>	<u>Color of Permissible Disc</u>
ICC 3	3000 psi	White
ICC 3A 1800	3000 psi	White
ICC 3A 2015	3360 psi	White
ICC 3A 2205	3680 psi	White or red
ICC 3A 2300	3840 psi	White or red

You should never use a disc in a valve where it would be working in connection with a different type of safety disc retainer. Never trim a safety disc to fit a valve other than the one for which it was intended.

You will find similar markings on the shoulder of every cylinder.

ICC 3A 1800	W. K. & Co.
221974	10-84
H	

An explanation of these marks follows:

ICC 3A 1800 signifies the specific ICC test procedure followed. The number 1800 indicates the service pressure.

221974 is the cylinder serial number. Some cylinders have one or two letters as part of the serial number. (The U.S. Navy also assigns one of their numbers to all cylinders they purchase. This number has the letters USN accompanying it.) The letter H in a shield is the designation mark of the accredited ICC inspecting laboratory that supervises our tests.

The letters W. K. & Co designate the manufacturer of the cylinder.

The numbers 10-84 mean that the cylinder was tested in October of 1984 and that its next test will be October 1989.

Before any cylinder is recharged, the date must be checked; if more than 5 years has elapsed, the cylinder must be retested hydrostatically. The date of the retest is then stamped on the cylinder directly under the original date. This new date is the one against which future checks should be made.

Remember you are dealing with high-pressure gas. Before recharging any cylinder, you must become thoroughly familiar with the proper procedure for recharging.

When you handle or ship cylinders, the shipping cap should always be assembled on the cylinder. On cylinders where this is not possible, the cylinder should be carefully crated.

Be thoroughly familiar with these procedures before you attempt to recharge any cylinder. A few minutes spent on becoming familiar with the procedure may prevent an accident involving injury to personnel or damage to equipment.

WINTERIZING CARBON DIOXIDE CYLINDERS

The PR is not normally tasked with the responsibility of recharging fire extinguishers and engine fire bottles. However, you may be assigned to an AIMD that supports aircraft that require winterizing of CO₂ cylinders.

All carbon dioxide portable fire extinguishers installed in aircraft and all aircraft carbon dioxide built-in engine fire extinguishers are serviced to operate throughout the temperature range of -65°F to 160°F. The extinguishers are supercharged with the addition of 200 psi of dry, oil-free nitrogen. This servicing of extinguishers is done in connection with the U.S. Air Force winterization program. Extinguishers charged to meet this winterization requirement are identified by a yellow dot, three-fourths of an inch in diameter or larger, on opposite sides of the cylinder. Extinguishers so marked are winterized

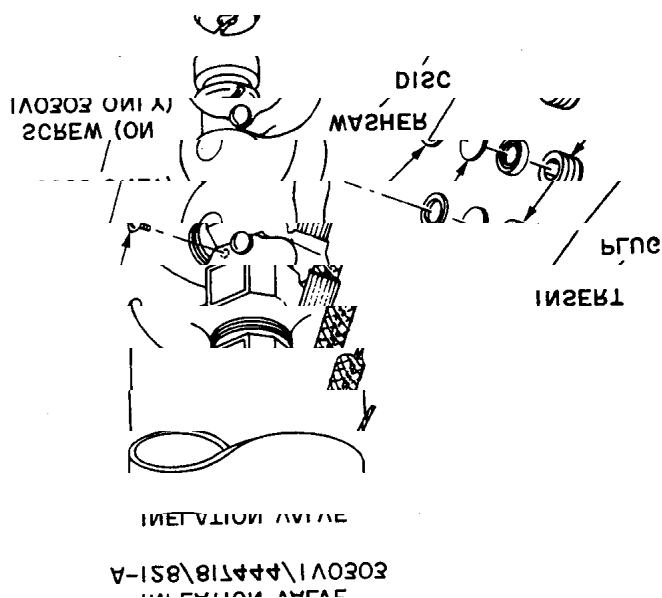
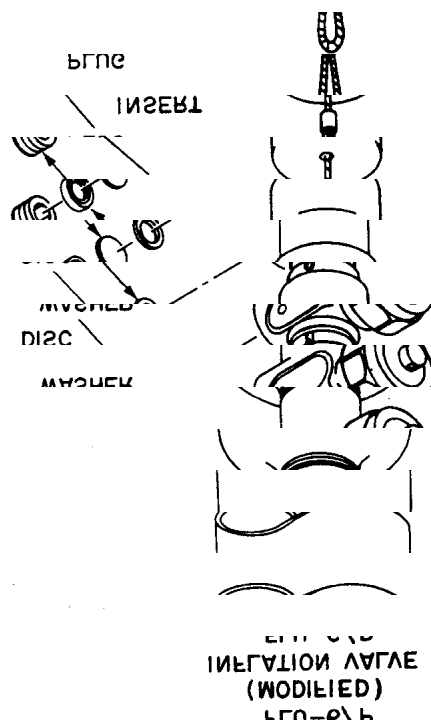
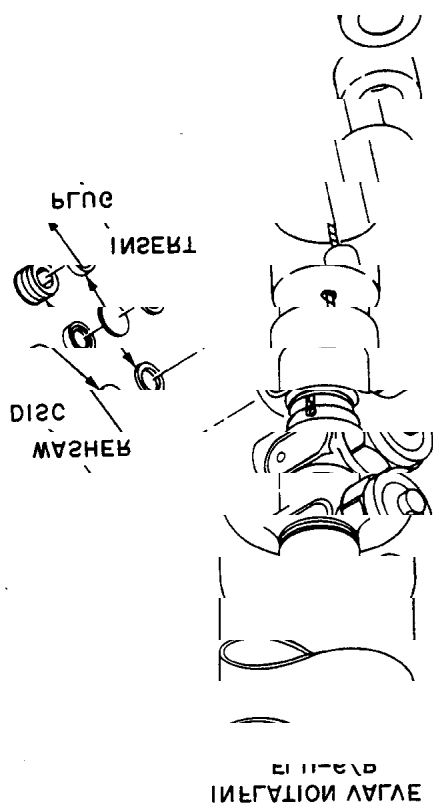


Figure 3-9.—Disassembly of Inflation Valve Safety Disc Assembly.

by the introduction of nitrogen at 200 psi and then the addition of a proper charge of carbon dioxide.

The addition of nitrogen in carbon dioxide cylinders provides additional pressure. This pressure expels the carbon dioxide at extremely cold temperatures (below 0°F) at a much higher rate than would the pressure of the carbon dioxide itself. Winterized cylinders have a carbon dioxide charge less than rated capacity. As a result the total pressure is lower at high temperatures than with rated charge, even though nitrogen has been added. Thus winterized cylinders can be subjected to 160°F without the safety disc rupturing.

REPLACING SAFETY DISCS AND WASHERS ON INFLATION VALVES

If you are not familiar with the flotation equipment, replacing safety discs and washers on the various CO₂ cylinders can be very difficult. You will need some special tools to replace the safety disc and washers on inflation valve assemblies A-128/817444 MIL-V-81722 (Flu-6/P), and MIL-V-25492 (figure 3-9). You will require a torque wrench, a five-sixteenth inch socket, and a piece of hex stock 5/16 x 2

inches long. Once you have these tools, changing the safety disc will be a simple process.

WARNING

Before you perform any work on inflation valves, ensure that CO₂ inflation assemblies are completely discharged. Do not remove the valve or valve safety disc plug from a charged CO₂ assembly. Insert the 5/16- x 2-inch stock into the disc plug and remove the safety disc plug. Then insert the safety disc and washer as shown in figure 3-9. To replace these items, simply reinstall them into the inflation valve. Remember to install new washers and safety discs. Use a torque wrench to make the following torque valve adjustments.

Valve	Torque (lb)
A-18	29
MIL-V-81722 (Flu-6/P)	15-17
MIL-V-25492 (Hood valve)	28-35

NOTE: While you are tightening the safety disc plug, align the insert with the plug.

CHAPTER 4

SEWING MACHINE REPAIR

The Aircrew Survival Equipmentman (PR) is called upon to perform an enormous amount of repair work on parachutes and survival equipment in all types of maintenance activities. Although lower rated personnel perform much of this work, the task of maintaining the sewing machines in top running condition falls to the senior PRs. Qualified sewing machine operators may assist in this work under supervision; however, determining the causes of malfunctions, making major adjustments, and replacing parts are the responsibilities of the first class and chief petty officer.

This chapter explains the rotory-hook (111 W 155) sewing machine and the oscillating-shuttle (31-15) sewing machine. We gave you an overview of these two types of sewing machines in chapter 3 of the *Aircrew Survival Equipmentman 3 & 2*, volume 1; however, as a senior PR, you need more specific information on the basic structure of these two sewing machines. With the information available, you can repair any of these types of machines the Navy uses. We know it is very difficult to find information on sewing machine repair; therefore, you should use this chapter as a reference when working on the alternating-presser-foot sewing machine and the simple oscillating-shuttle sewing machine.

Your shop may have the Consew Model 225, the Juki LU-562, or the Singer Model 111 W 155 sewing machine. These three sewing machines are essentially identical, and all specifications and instructions are the same for all three sewing machines. For simplicity we will use the Singer 111 W 155 as a model for all three sewing machines.

The oscillating-shuttle, Singer 31-15, sewing machine is representative of the second type of sewing machine used by the Navy. The descriptive term *oscillating shuttle* refers to the action of the sewing hook (the way it makes a stitch in unison with the needle). The 31-15 is used for sewing lightweight fabrics and is ideally suited for use in the maintenance of aviation survival equipment. Although the physical size

of other oscillating-shuttle sewing machines may be quite different from the 31-15, such as the large Class 7 machines, their operation and maintenance are very similar.

111 W 155 SEWING MACHINE

The 111 W 155 sewing machine is a single-needle, compound-feed sewing machine with alternating presser feet. This sewing machine makes the standard US 301 lockstitch and sews medium-heavy fabrics. It is equipped with a vertical-axis rotating hook. This sewing machine is classified as a rotory-type sewing machine and is also equipped with two presser feet; one is a vibrating presser foot, and the other one is a lifting presser foot. The front (vibrating) presser foot, the needle, and the feed dogs move in unison. Together they move the cloth away from the operator with each completed stitch. The rear (lifting) presser foot holds the fabric in place while the vibrating presser foot rises and moves forward to start the feeding action for another stitch. This sewing machine is capable of operating at a speed of 3500 stitches per minute (SPM). The stitch regulator provides a range of 3 1/2 to 32 stitches per inch (SPI).

The 111 W 155 is the same sewing machine in most ways as the 111 W 151, except for its alternating presser feet, which give the 111 W 155 a more positive feeding action. The 111 W 155 also has a longer stitch length (3 1/2 SPI instead of 5 SPI) and a higher maximum presser-foot lift (one-half inch instead of three-eighths inch). The 111 W 155 is an ideal sewing machine to use on medium-heavy fabrics such as vinyl and canvas.

This RTM will also include disassembly and assembly of the 111 W 155 sewing machine. To simplify minor repairs to this sewing machine and the 31-15 sewing machine, we have placed our discussion of disassembly and assembly to the rear of the chapter.

PREVENTIVE MAINTENANCE

If the sewing machine becomes sluggish, an accumulation of dust and lint or a loose power belt may be the cause. To prevent the buildup of dust and lint, you should cover the sewing machine when it is not in use.

CLEANING AND OILING

Before you attempt to oil or operate a new sewing machine, clean it with diesel fuel. The diesel fuel removes any corrosion-protective lubricants that may have been placed on the sewing machine at the factory. During normal

maintenance, you may use any approved cleaning solvent to clean the sewing machine.

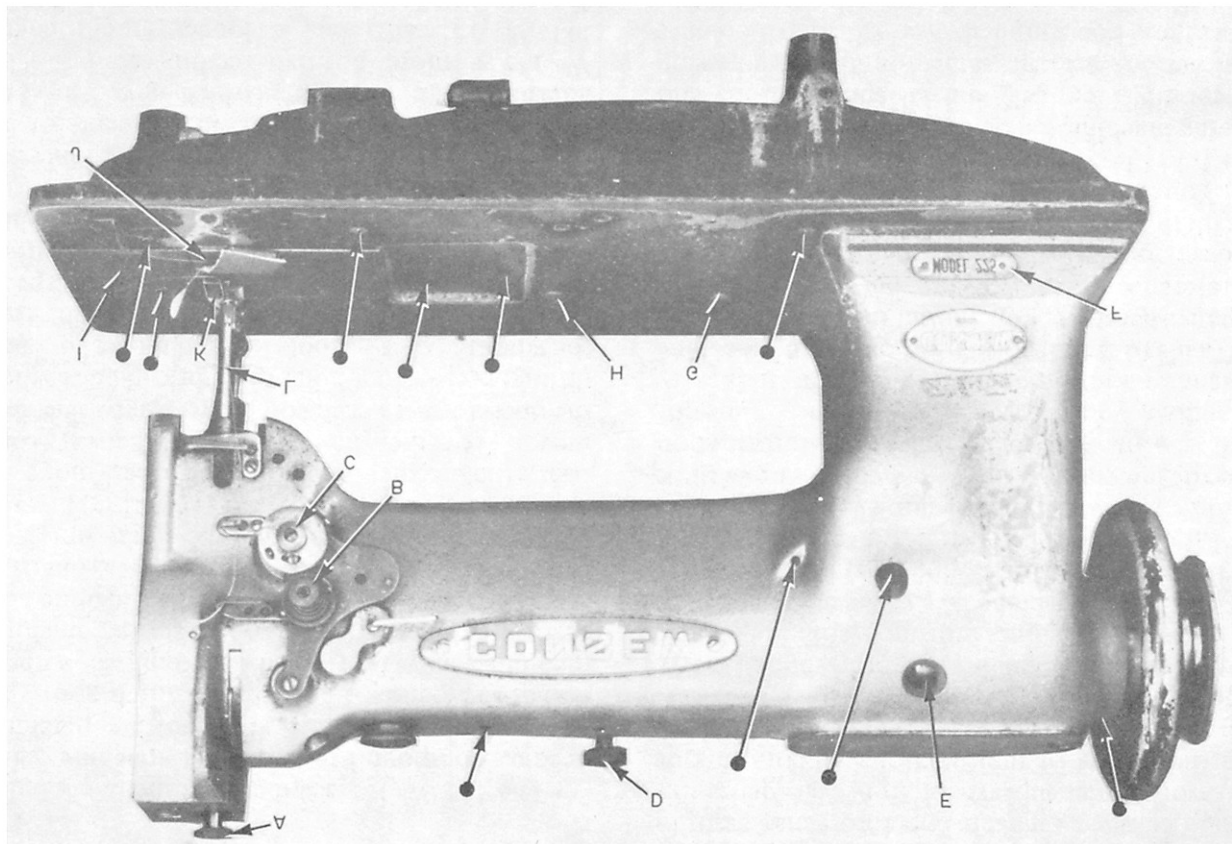
After you use a sewing machine, clean and oil it. A clean and well-oiled sewing machine gives you many hours of trouble-free operation. You may clean hard-to-reach places with a soft-bristle brush or air pressure. Clean the outside of the sewing machine head, the oil pan, the machine stand, and the motor casing with a clean dust cloth or air pressure. Never use air pressure above 25 psi for this purpose.

NOTE: At least once a year, the machine should be thoroughly cleaned and oiled. Figures 4-1 through 4-3 show the oiling points on the 111

● Denotes oiling points

E' Model number
E' Feed indicator dial
D' Presser bar spring regulating screw
C' Thread controller stud (thumb nut)
B' Tension thumb nut
A' Vibrating presser bar thumbscrew

G' Needlebar
K' Presser foot
J' Throat plate
I' Bed slide
H' Feed regulating stud (bushings)
C' Hook-driving shaft lock stud



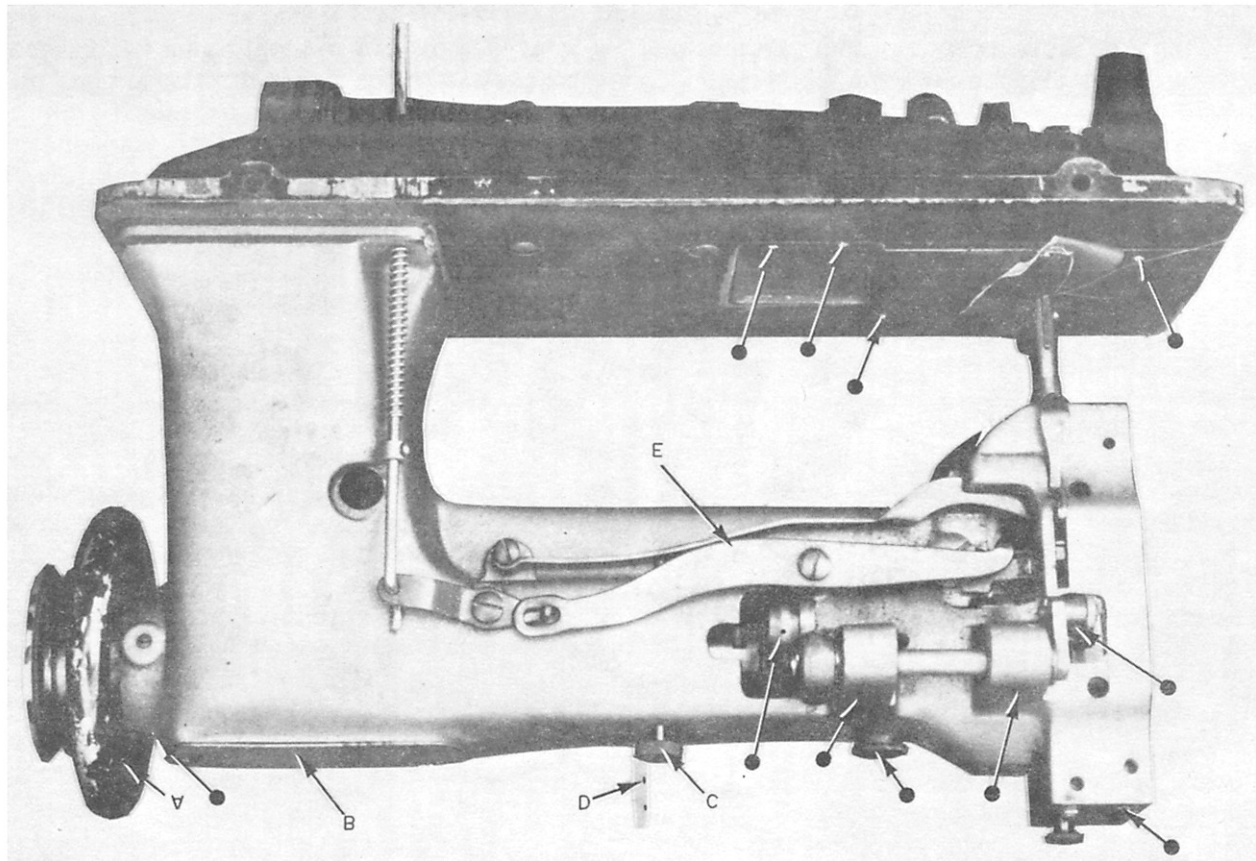
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Figure 4-1.—Front view of Model 225 sewing machine showing oiling points.

● Denotes oiling points

C. Presser bar spring regulating screw
B. Arm cap
A. Balance wheel

E. Knee lift linkage
D. Thread post



239.283

Figure 4-2.—Rear view of Model 225 machine showing oiling points.

W 155 sewing machine. Do not use too much oil; usually 1 drop of oil at each oiling point is sufficient. An excessive amount of oil will soil the project being sewn. We recommend a 10W mineral-base oil. (Use of castor-base oil is no longer required.) If this type of oil is not available through normal supply channels, use the mineral oil or Singer Type B or D.

TIMING THE 111 W 155 MACHINE

Timing is the most important step when you are working on any machine. As you read through the following timing and adjustment sequence, you may find that it has changed from steps you are

accustomed to using. This timing and adjustment section is presented as if you are taking your machine completely apart and reassembling it.

1. Timing the arm shaft with the hook drive shaft

To perform this timing step, you must tilt the sewing machine back on its hinges. Turn the balance wheel toward the operator until the thread take-up lever reaches its highest point. You can do this step by placing the fingers of your left hand on top of the thread take-up lever and turning the balance wheel with your right hand. You should be able to feel the high point of

● Denotes oiling points

C: Needlebar

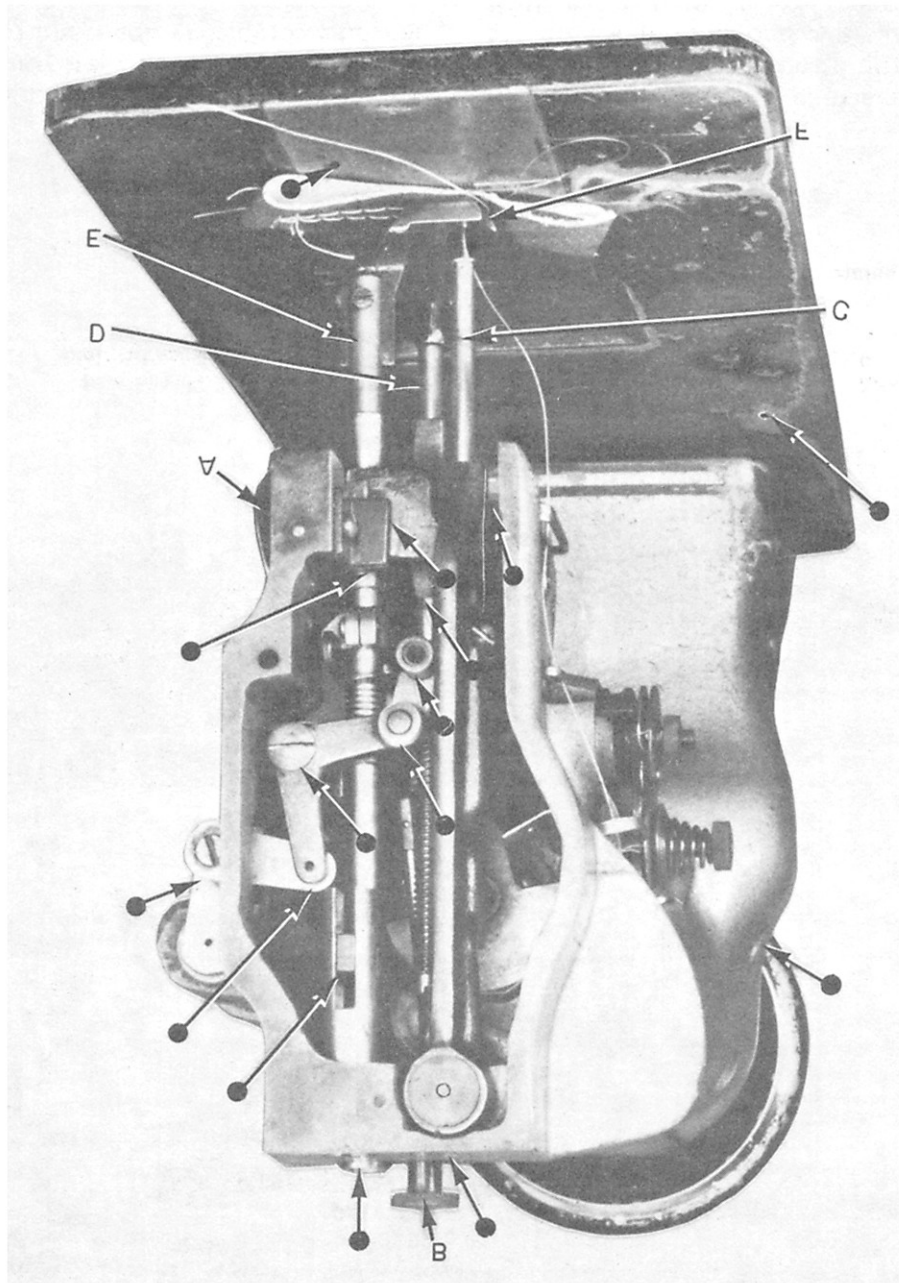
B: Vibrating presser bar thumbscrew

A: Handle for presser foot

E: Presser foot

F: Presser bar

D: Vibrating presser bar



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Figure 4-3.—Side view of Model 225 sewing machine showing oiling points.

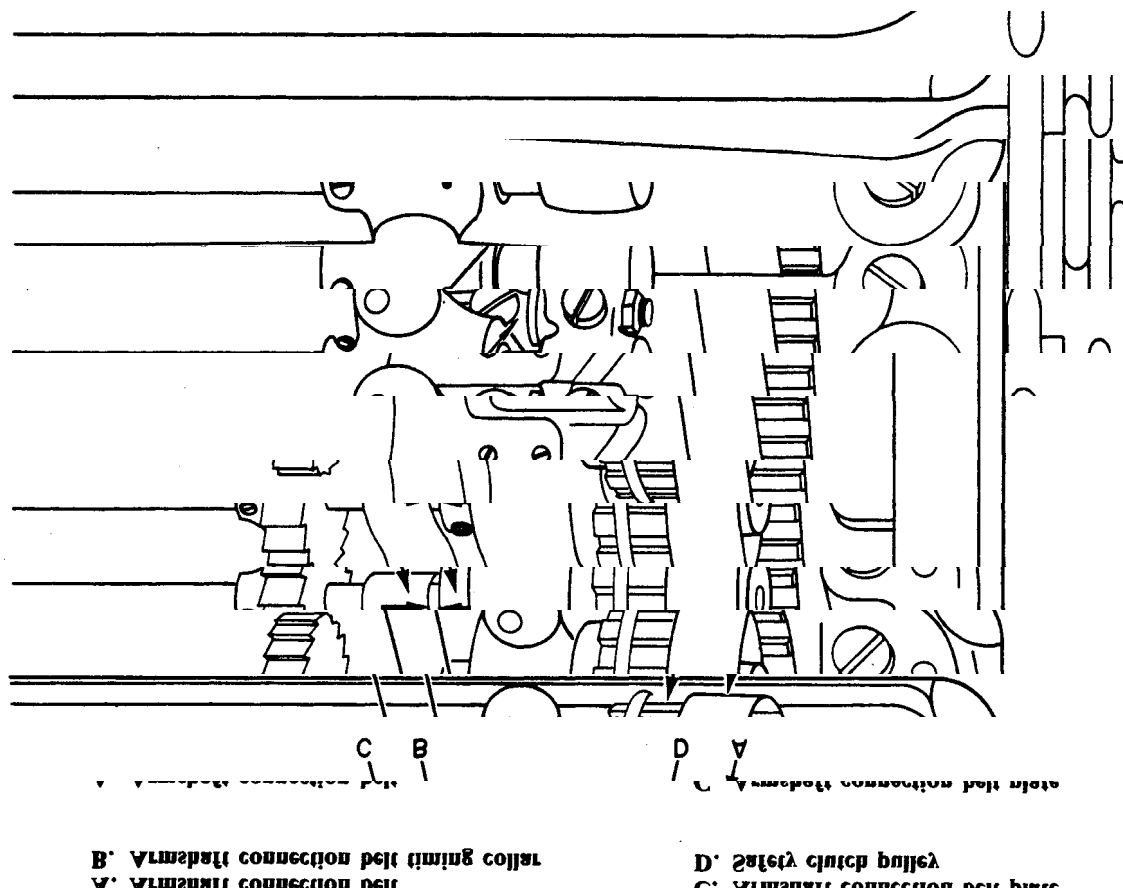


Figure 4-4.—Timing arrows.

the thread take-up lever with your fingers. You must check to ensure the arrows on the timing collar and the timing plate are aligned as shown in figure 4-4 (B) and (C). If the arrows don't match, remove the connection belt from the lower pulley (figure 4-4 [A] and [D]). Now turn the lower pulley by hand until the arrow on the timing collar (figure 4-4 [B]) is in direct line with the arrow on the timing plate (figure 4-4 [C]). Replace the connection belt. This completes this timing point.

2. Setting the feed dog height

Proper feed dog height is necessary to obtain proper feeding action. To set the feed dogs, proceed as follows:

- a. Turn the balance wheel toward the operator until the feed dog reaches its highest point (figure 4-5), and observe the relationship of the feed dog and the throat plate. If the valley between the teeth is level with the top of the throat

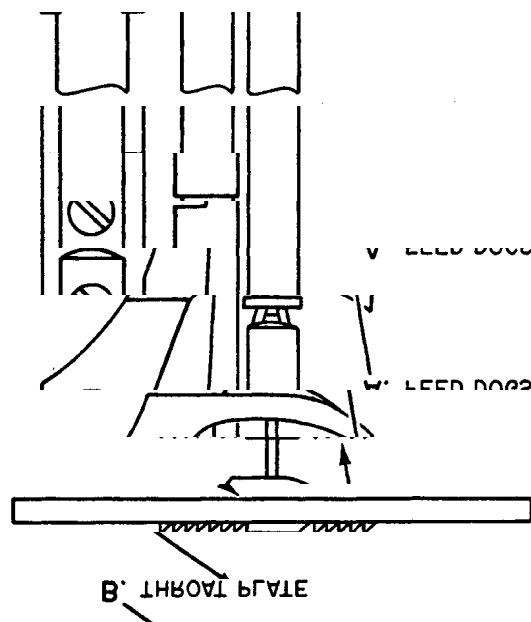


Figure 4-5.—Feed dogs.

plate, the feed dog height is correct; if the valley is not level,

b. Loosen the feed fork screw (figure 4-6 [E], table 4-1, foldout at the end of this chapter), push the feed bar (figure 4-6 [F]) up or down as necessary to obtain the proper feed dog height, and tighten the screw. This completes this timing point.

3. Centering the feeding action

To properly time this class of sewing machine, you must center the feeding action before the hook is timed.

NOTE: Ensure the needlebar rock frame hinge stud and the needlebar rock frame guide bracket are tight to prevent the needle from wandering from side to side or fore and aft.

a. Depress the plunger (figure 4-1 [H]), and turn the balance wheel toward the operator until the plunger drops; keep turning the balance wheel until it stops. This sets the maximum stitch length at 3 1/2 SPI.

b. Turn the balance wheel toward the operator and observe the movement of the feed dogs. If the feed dogs operate properly, consider them properly centered and continue to step 2. If the feed dogs strike the front or the back of the throat plate, proceed as follows:

(1) Loosen the feed-driving crank pinch screw (figure 4-6 [G]), and push the feed dog away from the point where it strikes; then retighten the feed-driving crank pinch screw.

(2) Turn the balance wheel toward the operator until the needle is at its lowest point and observe the relationship of the needle and the hole in the throat plate. If the needle is near the front of the hole but not touching it, proceed to step 4. If the needle needs to be centered, proceed to step 3.

(3) If the needle and throat hole are not properly aligned, loosen the needlebar rock frame rockshaft connection crank pinch screw (figure 4-7 [A], table 4-2, foldout at the end of this chapter) and align the needlebar in the hole of the throat plate; then retighten the screw.

(4) Turn the balance wheel toward the operator and observe the operation of the alternating pressers. If the front foot does not strike the back foot, then the feeding action can be considered to be centered.

4. Timing the hook and the needlebar

In this timing sequence, we will consider that the machine has no timing marks on the needlebar.

a. Remove the throat plate, the feed dog, and the presser feet.

b. Turn the balance wheel toward the operator until the needle is raised three-sixteenths of an inch from its lowest point.

If the point of the hook is in line with the center of the needle, one-sixteenth of an inch above the eye of the needle, and as near to the needle as possible without touching it, then the hook and needlebar can be considered to be in time. If not, proceed to the following steps:

(1) Loosen the pinch screw (figure 4-7 [A]) and move the needlebar (figure 4-7 [B]) to obtain the proper height, as shown in figure 4-7 (C); then retighten the needlebar clamp pinch screw.

(2) Tilt the sewing machine back; loosen the hook saddle pinch screw (figure 4-6 [A]), the hook saddle adjusting screw (figure 4-6 [B]), and the hook drive gear setscrews and spline screws (figure 4-6 [C] and [D]).

(3) Move the hook saddle (figure 4-6 [U]) to the right and the hook drive gear to the left until they are disengaged.

(4) Turn the balance wheel toward the operator until the needle is raised three-sixteenths of an inch from its lowest point.

(5) With the point of the hook in the 7 o'clock position, engage the hook pinion gear and the hook drive gear to align the hook point with the needle. As you engage the hook, it will rotate clockwise, advancing toward the needle until the hook point is centered on the needle. The hook point should be as near as possible to the needle without touching it.

NOTE: The hook guard may be out of adjustment and prevent the hook from being adjusted close enough to the needle; if this is the case, bend the hook guard out of the way enough to allow proper adjustment. See step 8.

(6) Tighten the hook saddle pinch screw and the hook drive gear setscrews and spline screws.

(7) Turn the balance wheel toward the operator to ensure the hook does not strike the needle.

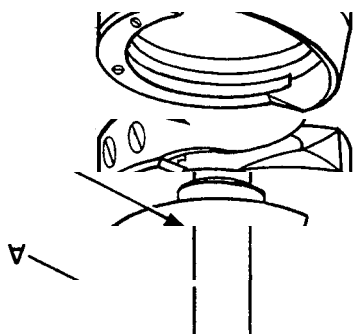


Figure 4-8.—Sewing hook kit.

340'123

(8) The hook guard prevents the sewing hook from striking the needle. Adjust the hook guard (figure 4-8 [A]) by bending it until it is at least as near the needle as the hook point, but does not push the needle.

(9) Install the feed dog, the throat plate, and the presser feet.

NOTE: Ensure the bobbin-case lug (figure 4-9 [A]) is properly engaged in its opening in the bottom of the throat plate (figure 4-9 [B]).

5. Timing the presser-lifting eccentric

The presser-lifting eccentric controls the feeding motion provided by the alternating pressers.

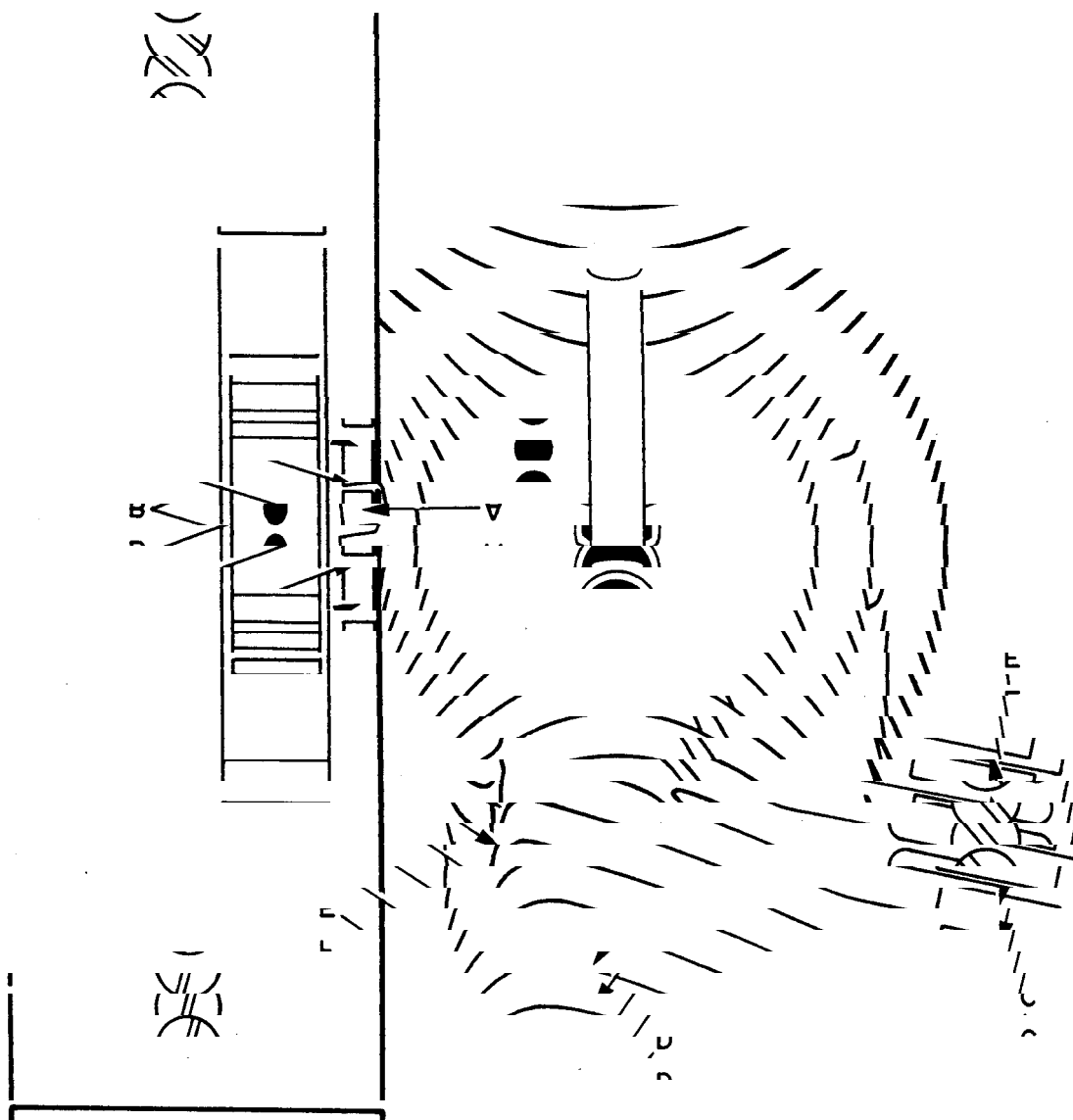


Figure 4-9.—Bobbin case area.

320'124

If the presser-lifting eccentric is not properly timed, it can cause the machine to feed backward or prevent the machine from making the full stitch length.

The maximum stitch length of 3 1/2 SPI should be set while you are making the following adjustments:

a. Turn the balance wheel toward the operator and observe the action of the feed dogs and the front presser. They should meet at the

throat plate height and travel aft together; if they do not, continue to step b.

b. Turn the balance wheel and loosen the two set screws (figure 4-10B [C] and figure 4-10 [A]) on the presser-lifting eccentric.

c. Hold the eccentric to prevent it from turning; then turn the balance wheel a small amount toward the operator and tighten one of the setscrews.

d. Repeat steps b and c until the front foot meets the feed dog at the throat plate height as the balance wheel is turned toward the operator.

e. Ensure both setscrews are tight.

ADJUSTMENTS

For the sewing machine to operate smoothly and to make a proper locking stitch, you must make some minor adjustments. Even though the machine is in time, a single part that is out of adjustment can cause the sewing machine to skip stitches, break thread, fail to feed the material, or make loose stitches.

1. Adjusting the bobbin-case opener

As the hook rotates clockwise, friction on the bobbin-case opener causes the position lug

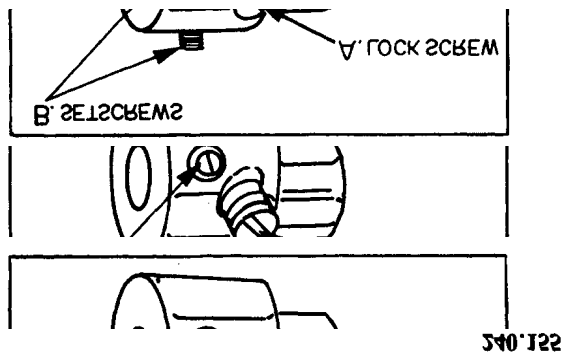


Figure 4-10A.—Presser-lifting eccentric connection link.

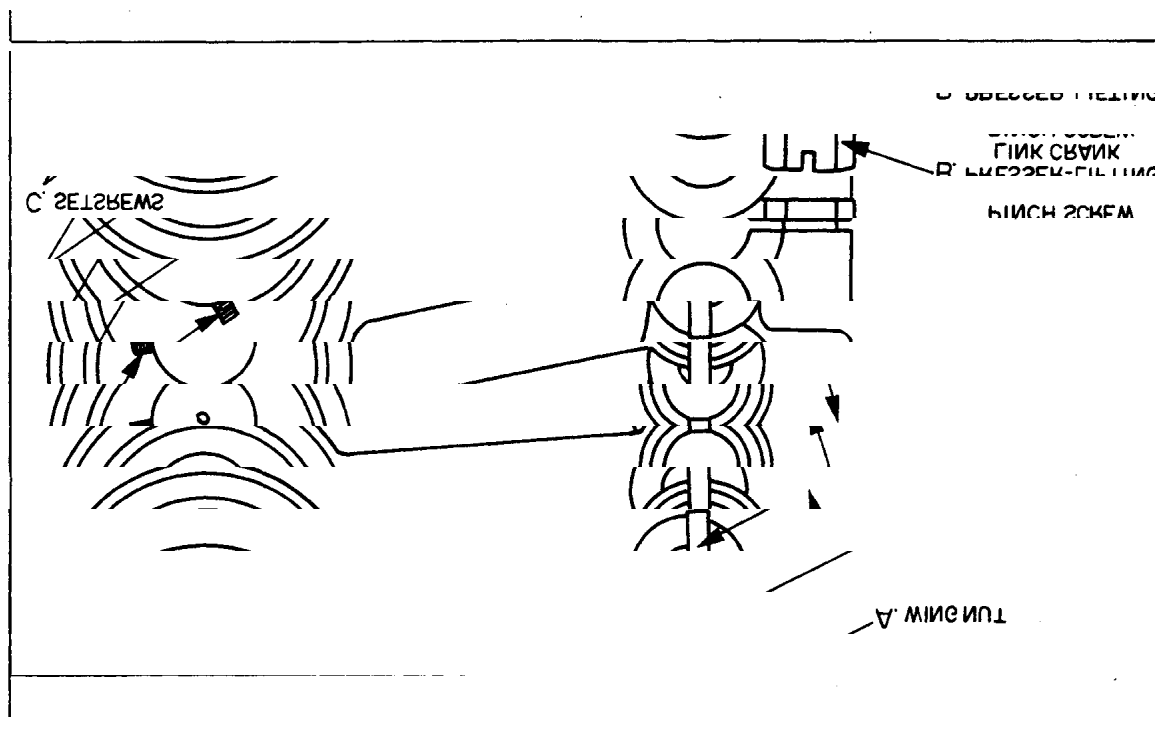


Figure 4-10B.—Presser-lifting eccentric.

(figure 4-9 [A]) to press against the back of its opening. The bobbin-case opener moves the bobbin case counterclockwise to allow the thread to pass around the bobbin-case-opener lug. If the opener is adjusted too tight, damage to many parts may occur; and if the opener is not set tight enough, extreme upper thread tension may be necessary to lock the stitch properly. Adjusting the bobbin-case opener is accomplished as follows:

- a. Turn the balance wheel toward the operator until the bobbin-case-opener lever (figure 4-9 [C]) moves as far to the right as possible.
- b. If the bobbin-case opener (figure 4-9 [D]) has been removed, reinstall it at this time. Do not tighten the adjusting screw (figure 4-9 [E]) at this time.
- c. Place two thicknesses of paper, as a gauge, between the tip of the bobbin-case opener and its projection on the bobbin case.
- d. Move the bobbin-case opener right or left as necessary to cause the bobbin case to move as far to the right as possible without binding.
- e. Tighten the bobbin-case-opener adjusting screw.
- f. Turn the balance wheel toward the operator and observe the operation of the bobbin case and its opener. Ensure no binds are present and that the bobbin case is pulled counterclockwise as far as possible with each rotation of the hook.

2. Adjusting the total relative lift of the alternating pressers

The total relative lift of the alternating pressers referred to here is that the feet lift one-half inch at total lift. Maximum lift of the alternating pressers is set to sew on heavier goods. There are two types of adjustments, and either type may be found on a given machine. The first type of alternating presser (figure 4-10A) is usually found on earlier sewing machines, while the second type of alternating presser (figure 4-10B) seems to be in current manufacture.

a. Adjusting the first type of alternating presser is accomplished as follows:

- (1) Turn the balance wheel toward the operator until the presser-lifting eccentric lock screw (figure 4-10A [A]) is visible inside the opening at the back of the arm of the machine. (See figure 4-11 [A], table 4-3, foldout at end of this chapter.)

NOTE: Figure 4-10A shows two setscrews (B). They are used to hold the presser-lifting eccentric in place on the feed-driving rockshaft. The adjusting screw is not visible in this figure.

- (2) Loosen the lock screw and turn the balance wheel until the adjusting screw is visible in the opening in the back of the arm. (See figure 4-11 [A].)

(3) Turn the adjusting screw counterclockwise to obtain maximum total lift of the pressers.

- (4) Turn the balance wheel toward the operator until the lock screw is visible in the opening in the back of the arm and retighten the lock screw.

b. Adjusting the second type of alternating presser is accomplished as follows:

- (1) Loosen the presser-lifting eccentric adjusting wing nut (figure 4-10B [A]).

(2) Move the assembly up to decrease the lift or down to increase the total lift of the alternating pressers.

- (3) Tighten the wing nut.

3. Adjusting the relative lift of the alternating pressers

The alternating presser feet should each lift to approximately the same height. Do not confuse relative lift with total lift. Here we are adjusting the presser feet to lift to approximately the same height. Adjusting the relative lift of the alternating pressers is accomplished as follows:

a. Turn the balance wheel toward the operator and observe the action of the alternating pressers. If they do not lift equally, proceed to step b.

b. Turn the balance wheel until the foot that lifts too high is just above the throat plate.

c. Loosen the presser-lifting link crank pinch screw (figure 4-11 [B]). The foot should snap down; if it does not, push it down.

d. Tighten the presser-lifting link crank pinch screw.

e. Repeat step a. If necessary repeat steps b through d until the feet lift to the same height.

4. Adjusting the lifting linkage of the alternating pressers

To set the lifting linkage, you must loosen the lifting crank pinch screw (figure 4-11 [B]) and

the presser bar lifting bracket pinch screw (figure 4-11 [C]). Turn the balance wheel toward the operator until the feed dogs rise to meet the forward presser foot at the top of the throat plate. Press the presser bar lifting bracket down to the hand lifting lever (figure 4-11 [D]). Tighten the presser bar lifting bracket pinch screw (figure 4-11 [C]) and the lifting crank pinch screw (figure 4-11 [B]).

5. Adjusting the upper thread-tension-releasing lever

The upper thread-tension release allows the goods to be removed without the needle thread breaking.

a. Lift the presser-lifting lever and observe the thread tension disc. It should separate to release the thread. If not, proceed as follows:

b. Remove the thread controller assembly from the machine as follows:

(1) Remove the thread controller assembly retaining screw (figure 4-6 [I]).

(2) Loosen the thread controller stud setscrew (figure 4-6 [J]).

(3) Pull the thread controller assembly away from the machine.

c. Bend the thread releasing lever (figure 4-12 [B]) away from the thread controller assembly to increase the amount of the release and toward the plate to decrease the tension as needed.

d. Reattach the assembly to the machine and observe the operation. Repeat steps a through d if necessary.

6. Setting the feed indicator disc

Loosen the setscrew in the feed indicator disc (figure 4-1 [E]) so that it spins on the arm shaft. Depress the feed indicator plunger and turn the balance wheel toward you until it drops; keep turning the balance wheel toward you until it stops. The feed-driving eccentric is now set at 3 1/2 SPI.

NOTE: With the plunger engaged, turning the balance wheel toward you decreases the SPI, and turning the balance wheel away from you increases the SPI.

The ideal setting for the indicator disc on the sewing machine is 8 SPI. You accomplish this setting by engaging the plunger and turning the

balance wheel approximately one-fourth of a turn away from you. Release the plunger, make several inches of stitches on a piece of paper, and count the total number of stitches per inch. If you are sewing 8 SPI, depress the plunger and slowly turn the balance wheel toward the operator until the plunger drops.

● Stop.

● Release the plunger and the balance wheel.

● Now turn the feed indicator disc (figure 4-1 [E]) on the arm shaft until 8 shows in the window on the uprise of your machine.

● Tighten the setscrew in the feed indicator disc.

7. Setting the thread controller spring

The thread controller spring prevents the needle from piercing the thread. It takes the slack out of the needle thread until the point of the needle enters the material.

To properly set the tension on the thread controller spring, you must first loosen the thread controller stud setscrew on the tension stud (figure 4-6 [J]). Turn the tension stud counterclockwise for more tension or clockwise for less tension.

A properly adjusted controller spring rests on the thread controller spring stop as the point of the needle enters the material. This action releases all tension on the needle thread.

8. Setting the controller spring stop

You may have to make an adjustment to the controller spring stop to allow the thread controller spring to operate properly. This is a very simple adjustment. By loosening the tension stud screw, shown in figure 4-6 (I), you raise the stop for less action or lower it for more action.

9. Adjusting the thread tension

The thread tension will be the last adjustment required. In most cases, you can make any adjustment required by turning the thumb nut (figure 4-12 [A]) on the needle thread tension disc.

If the stitch is locking on top of the material, turn the nut counterclockwise. This

will loosen the upper thread tension causing the bobbin tension to draw the stitch into the material. A clockwise turn will tighten the upper thread, thus drawing up any stitch that may be locking below the material.

If you cannot correct the tension by adjusting the thread tension disc, adjust the bobbin tension. To do this, tighten or loosen the small screw nearest the center of the spring. This completes all the necessary timing and adjusting on the 111 W 155 sewing machine. If you still have a problem, refer to the troubleshooting portion of this chapter.

TROUBLESHOOTING

While making adjustments or timing the sewing machine, you may overlook a step or a faulty part. The troubleshooting chart (table 4-4) will help you locate and correct most problems.

If the sewing machine is binding (hard to turn), you can locate the problem easily. First, check the feeding action; then set the machine on zero feed and remove the throat plate. Turn the machine by hand. If the bind is still present, remove the arm shaft connection belt. If the bind is located in the hook-driving shaft, the machine will turn freely. Turn the balance wheel by hand. If the bind is located in the arm shaft, the bind will still be present.

SINGER SEWING MACHINES 31-15, 331K1, AND CONSEW C-30

Singer Sewing Machine 31-15, the 331K1, and the Consew C-30 are oscillating-type sewing machines that have a maximum speed of 2,200 stitches per minute. These sewing machines also make the standard lockstitch and are commonly called tailoring machines. As with the 111 W 155

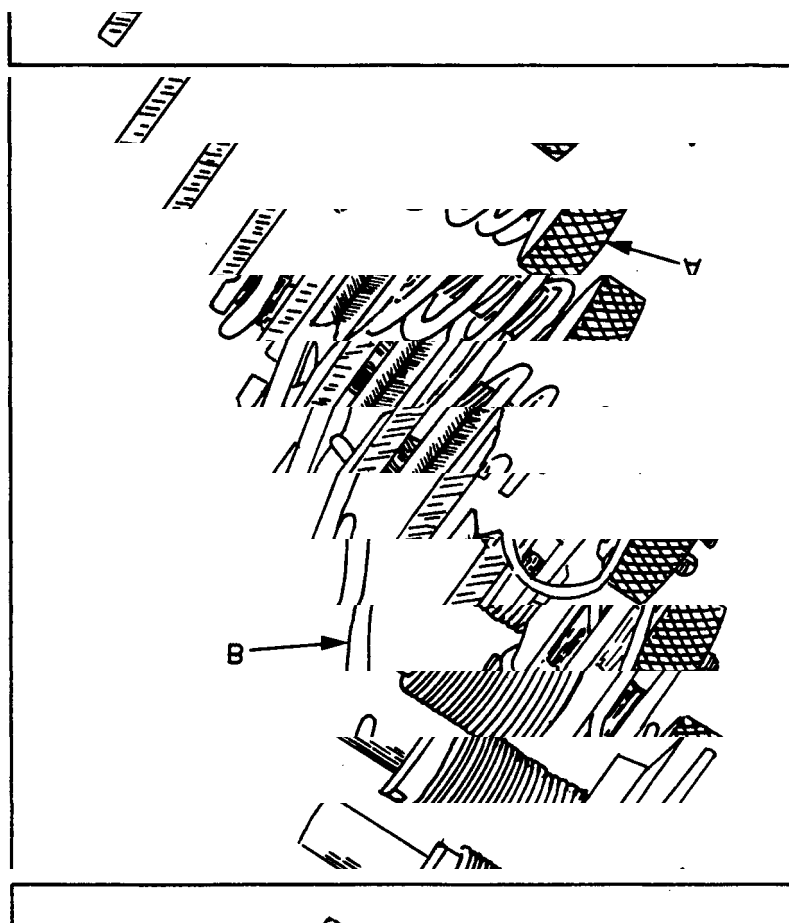


Figure 4-12.—Upper thread unit.

540°128

Table 4-4.—Troubleshooting Chart

A. Troubleshooting Chart

Trouble	Probable Cause	Remedy
THREAD BREAKAGE	Thread controller	Adjust spring tension and/or spring stop.
	Right twist thread	Change to left twist (Z).
	Hook point piercing needle thread	Adjust thread controller spring stop.
	Needle eye too small	Select larger size.
	Burr on needle point	Remove burr or replace needle.
	Too much tension	Adjust tension springs.
	Improper threading sequence	Rethread (check first).
	Thread unwinding incorrectly	Adjust stand and/or spool.
	Thread breaks when clearing work	Adjust tension release. Thread take-up lever not at highest point.
SKIPPED STITCHES	Needlebar improperly set	Reset.
	Needle not all the way into bar	Insert correctly.
	Needle incorrectly aligned	Insert correctly.
	Thread too large large for needle eye	Select correct needle.
	Presser bar maladjusted	Adjust presser bar.
THREAD JAMMING UNDER THROAT PLATE	Operating machine without material	Unthread when running without fabric.
	Failure to hold free ends of thread for first stitches	Maintain pressure.
	Needle thread not between tension discs.	Thread disc.
UPPER THREAD LOOPING UNDER MATERIAL	Feed-driving eccentric improperly adjusted	Adjust eccentric.
	No upper thread tension	Adjust or place thread in tension disc.

Table 4-4.—Troubleshooting Chart-Continued

Trouble	Probable Cause	Remedy
FAILURE TO FEED	Feed-driving crank loose	Tighten Pinch Screw.
STITCHES NOT IN LINE	Insufficient presser foot pressure	Add spring pressure.
	Presser bar improperly set	Adjust presser bar.
	Feed dogs too low	Set height to one full tooth.
MATERIAL DAMAGED BY SCUFFING	Presser foot pressure too great	Reduce pressure.
	Feed dogs too high	Set one full tooth or less.
SLUGGISH OPERATION	Improper oil or accumulation of foreign matter	Clean with recommended solvent.
FAILURE TO MAKE A STITCH	Needle in backwards	Install correctly.
	Needle threaded from wrong side	Thread correctly.
	Wrong variety of needle	Change to correct length needle.
	Bent needle	Change.
	Needle not all the way in the needlebar	Insert correctly.
	Needlebar out of adjustment	Adjust needlebar.
	Shuttle driver pin sheared	Replace pin.
	Shuttle too far from needle	Shim shuttle closer to needle.
1. Stitching Problems		
FAILURE TO MAKE A STITCH	Needle in backwards	Remove and reinstall.
	Machine out of time	Inspect and retune.
	Needle threaded from wrong side	Thread correctly.
	Hook too far away from needle	Reset hook saddle.

Table 4-4.—Troubleshooting Chart-Continued

1. Stitching Problems—Continued

Trouble	Probable Cause	Remedy
FAILURE TO MAKE A STITCH	Wrong variety needle	Change to correct length needle.
	Bent needle	Change.
	Needle not all the way in the needlebar	Insert correctly.
	Safety clutch disengaged	Clear jam and reengage clutch.
SKIPPED STITCHES	Hook too far from needle	Move hook saddle.
	Hook out of time	Retime.
	Needlebar improperly set	Reset.
	Needle not all the way into bar	Insert correctly.
	Needle incorrectly aligned	Insert correctly.
	Thread too large for needle eye	Select correct needle.
THREAD BREAKAGE	Thread controller	Adjust spring tension and/or spring stop.
	Right twist thread	Change to left twist (Z).
	Hook point piercing needle thread	Set hook to needle.
	Needle eye too small	Select larger size.
	Burr on needle point	Remove burr or replace needle.
	Hook out of time (retarded)	Retime.
	Too much tension	Adjust tension springs.
	Improper threading sequence	Rethread (check first).
	Thread unwinding incorrectly	Adjust stand and/or spool.
	Thread breaks when clearing work	Adjust tension release. Thread take-up lever not at highest point.

2. Feeding Problems

FEED FAILURE	Arm shaft not in time with sewing hook driving shaft	Retime by take-up lever and timing plate (timing collar spline screw <u>m</u> <u>u</u> <u>s</u> <u>t</u> be in spline).
	Feed lifting cam fork inverted	Install properly.

Table 4-4.—Troubleshooting Chart—Continued

2. Feeding Problems—Continued

Trouble	Probable Cause	Remedy
FEED FAILURE	Feed-driving crank pinch screw loose	Recenter feed and tighten pinch screw.
	Feed-driving eccentric out of spline	Reset.
	Feed dogs set too high	Reset.
	Set at negative feed	Set for stitching.
FEEDING BACKWARDS	Feed lifting cam out of spline	Reset in spline.
	Feed-driving eccentric out of spline	Reset in spline.
	Presser-lifting eccentric out of time	Time eccentric.
	Timing collar out of spline	Reset in spline and retime machine.
STITCHES NOT IN LINE	Insufficient presser foot pressure	Add spring pressure.
	Feed dogs too low	Set height to one full tooth.
MATERIAL DAMAGED BY SCUFFING	Presser foot pressure too great	Reduce pressure.
	Feed dogs too high	Set one full tooth or less.

3. Miscellaneous Problems

THREAD JAMMING	Operating machine without material	Unthread when running without fabric.
	Failure to hold free ends of thread for first stitches.	Maintain pressure.
	Bobbin-case opener incorrectly set	Readjust opener.
	Needle thread not between tension discs	Thread discs.
	Hook too high	Lower hook.
	Turning balance wheel backwards with needle threaded	Remove jam.
	Thread, dirt, lint under bobbin case	Remove case; clean and replace.

Table 4-4.—Troubleshooting Chart-Continued

3. Miscellaneous Problems—Continued

Trouble	Probable Cause	Remedy
NOT STITCHING AS INDICATED	Indicating disc loose	Reset and tighten.
	Indicating disc incorrectly set	Reset and tighten.
	Automatically changing stitches	Adjust feed eccentric gib.
SLUGGISH	Improper oil or accumulation of foreign matter	Clean with recommended solvent and lubricant.
BINDS	Bobbin-case opener set too close	Set to allow thread passage around bobbin-case lug.
	Arm shaft friction washer missing	Install friction washer.
	Balance wheel improperly set for tolerance	Tighten adjusting screw, back off one-quarter turn, tap with mallet.
	Needlebar too high or too low	Reset in frame.
	Feed-driving connection against eccentric body	Set connection flush with cam.
	Hook guard washer rubbing bobbin-case opener lever link	Replace washer. Adjust hook assembly for tolerance.
	Pinion gear against saddle	Relocate on hook shaft.
	Hook driving gear against saddle	Relocate to center on center line of sewing hook shaft.
	Bobbin-case thread jam	Remove case, clear, and reinstall.
	Feed dogs against throat plate	Adjust to proper height. Adjust to center of throat plate.
	Feed bar hinge stud screw	Adjust for proper operating tolerance.
	Wrong bed slide over sewing hook	Put recessed slide over sewing hook.
	Alternating pressers out of adjustment	Reset.

alternating-pressure-foot sewing machine, we will use the 31-15 sewing machine as a model for these three sewing machines. The 31-15 sewing machine is intended for sewing clothing such as flight suits and is excellent for sewing lightweight canvas up to 8 ounces.

The 31-15 sewing machine has a stitch range of 7 to 32 SPI, a clearance of five-sixteenths of an inch under the presser foot, and uses a drop-feeding action. The major components of the Singer Sewing Machine 31-15 are shown in figure 4-13.

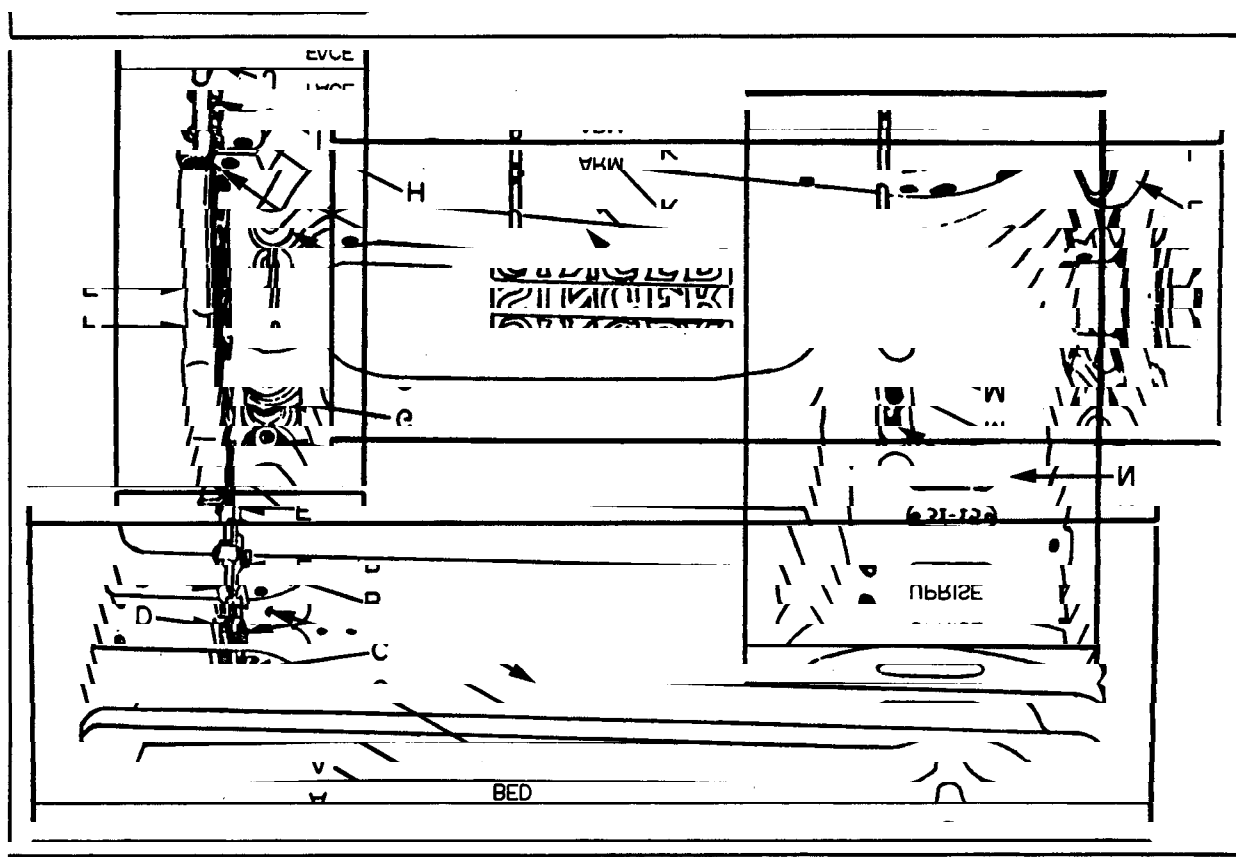
PREVENTIVE MAINTENANCE

Preventive maintenance for the Singer Sewing Machine 31-15 is the same as that for the 111 W 155 sewing machine. Although the preventive

maintenance is the same, the oiling points differ because of the design of the machine. Figures 4-13 through 4-15 show the different oiling points for the 31-15 sewing machine. When you oil this machine, remember 1 drop of a 10W mineral oil at each oiling point is sufficient. Too much oil may soil the project being sewn.

TIMING AND ADJUSTMENTS

The 31-15 sewing machine is the simplest sewing machine in the parachute loft. As with all oscillating-shuttle machines, the main timing point is the needlebar. Once the needlebar is properly set, only minor adjustments are necessary to have a smooth-running sewing machine. Remember you should always refer to the troubleshooting chart before making any adjustment.



A. Bed
B. Presser foot
C. Needle
D. Needle bar
E. Shuttle
F. Needle bar
G. Needle bar
H. Needle bar
I. Needle bar
J. Needle bar
K. Needle bar
L. Needle bar
M. Needle bar
N. Needle bar
O. Needle bar
P. Needle bar
Q. Needle bar
R. Needle bar
S. Needle bar
T. Needle bar
U. Needle bar
V. Needle bar
W. Needle bar
X. Needle bar
Y. Needle bar
Z. Needle bar

A. Bed
B. Presser foot
C. Needle
D. Needle bar
E. Shuttle
F. Needle bar
G. Needle bar
H. Needle bar
I. Needle bar
J. Needle bar
K. Needle bar
L. Needle bar
M. Needle bar
N. Needle bar
O. Needle bar
P. Needle bar
Q. Needle bar
R. Needle bar
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V. Needle bar
W. Needle bar
X. Needle bar
Y. Needle bar
Z. Needle bar

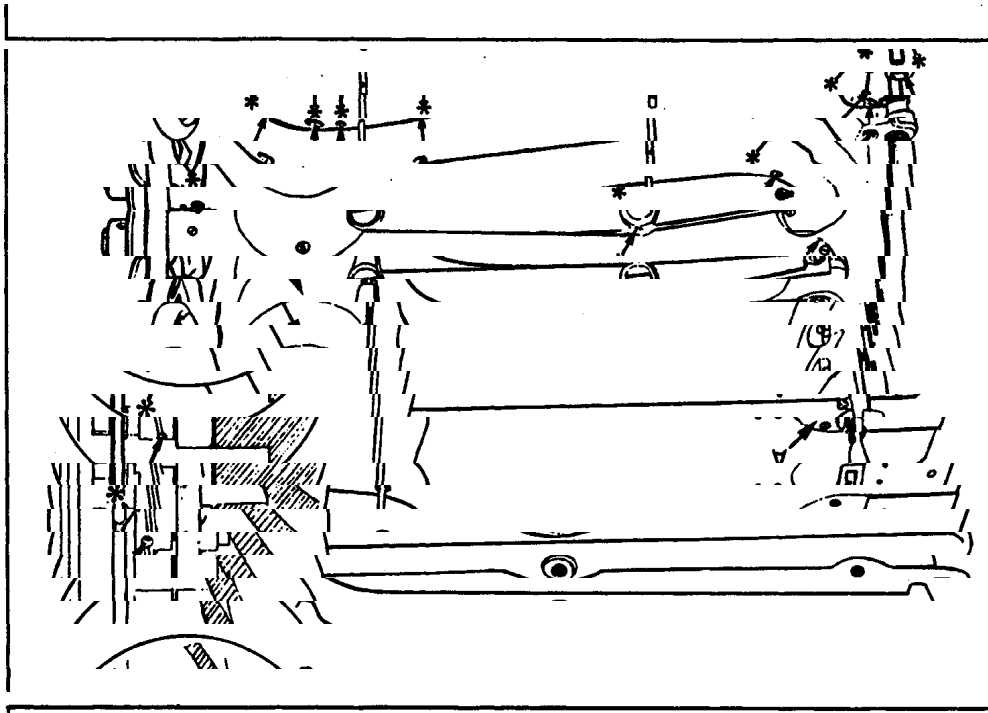
Figure 4-13.—Front view of model 31-15 sewing machine.

Timing the Needle with the Shuttle

When the needle and shuttle are correctly timed, the point of the shuttle on its forward stroke must pass across the center of the diameter of the needle

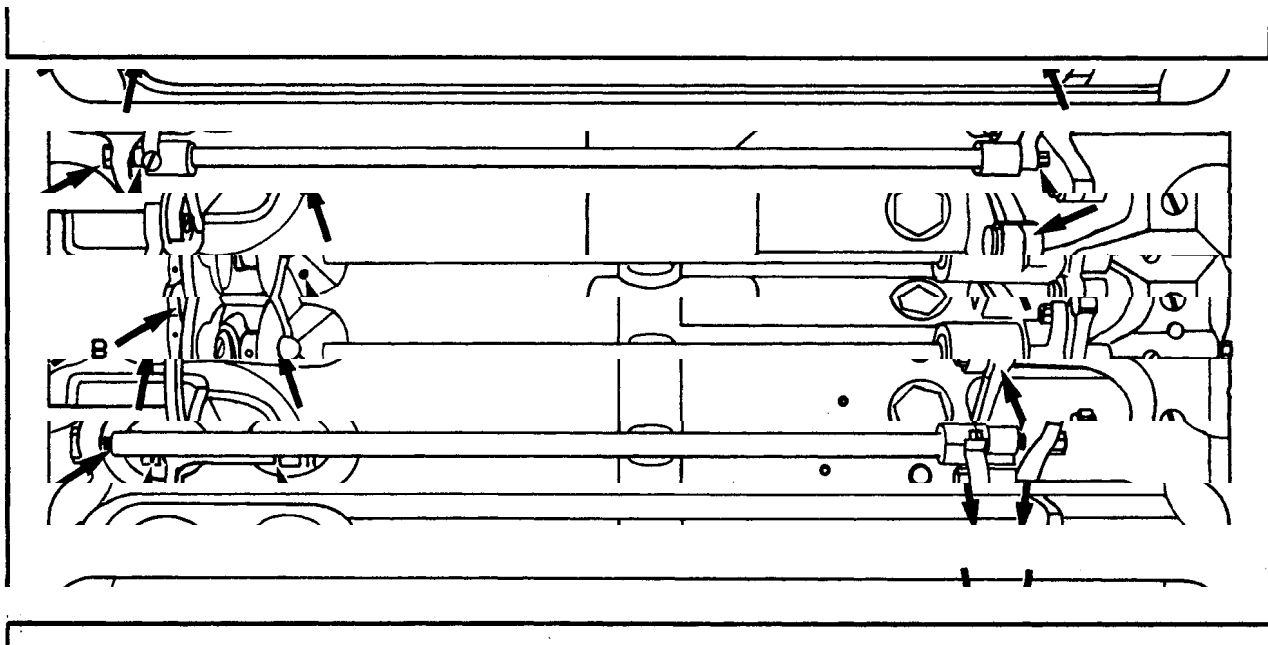
at a point one-sixteenth of an inch above the eye of the needle when the needle is on its upstroke.

To time the machine so the needle and shuttle operate properly, you must proceed as follows: Be sure that the needle is a class 16



530'503

Figure 4-14.—Rear view of oiling points on model 31-15 sewing machine.



530'504

Figure 4-15.—Bottom view of oiling points on model 31-15 sewing machine.

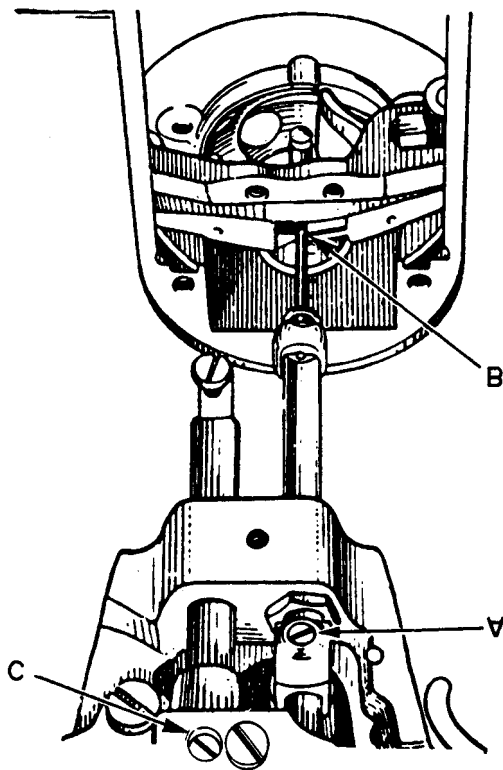


Figure 4-16.—Setting needlebar.

and a variety 87 (16 x 87). Place the needle into the needlebar as far as it will go. Be sure the long thread groove faces the left and the eye of the needle is in line with the shuttle point. Remove the faceplate and loosen the needlebar connecting stud pinch screw (figure 4-16 [A]). Turn the balance wheel toward the operator until the needlebar is on its upstroke and the point of the shuttle is in the center of the eye of the needle. Adjust the needlebar so that the eye of the needle is one-sixteenth of an inch below the shuttle point (figure 4-16 [B]). Now retighten the needlebar connecting stud pinch screw (figure 4-16 [A]).

NOTE: The main timing point for the 31-15 sewing machine is the needlebar.

Adjusting the Feed Dog Height

For average weight material, a full tooth should be visible when the feed dogs are at their highest point. To adjust the feed dog height, you must loosen the feed lifting crank pinch screw (figure 4-17 [A]) in the feed lifting crank and move the feed bar (figure 4-17 [B]) up or down as required. Then you must retighten the feed lifting crank pinch screw.

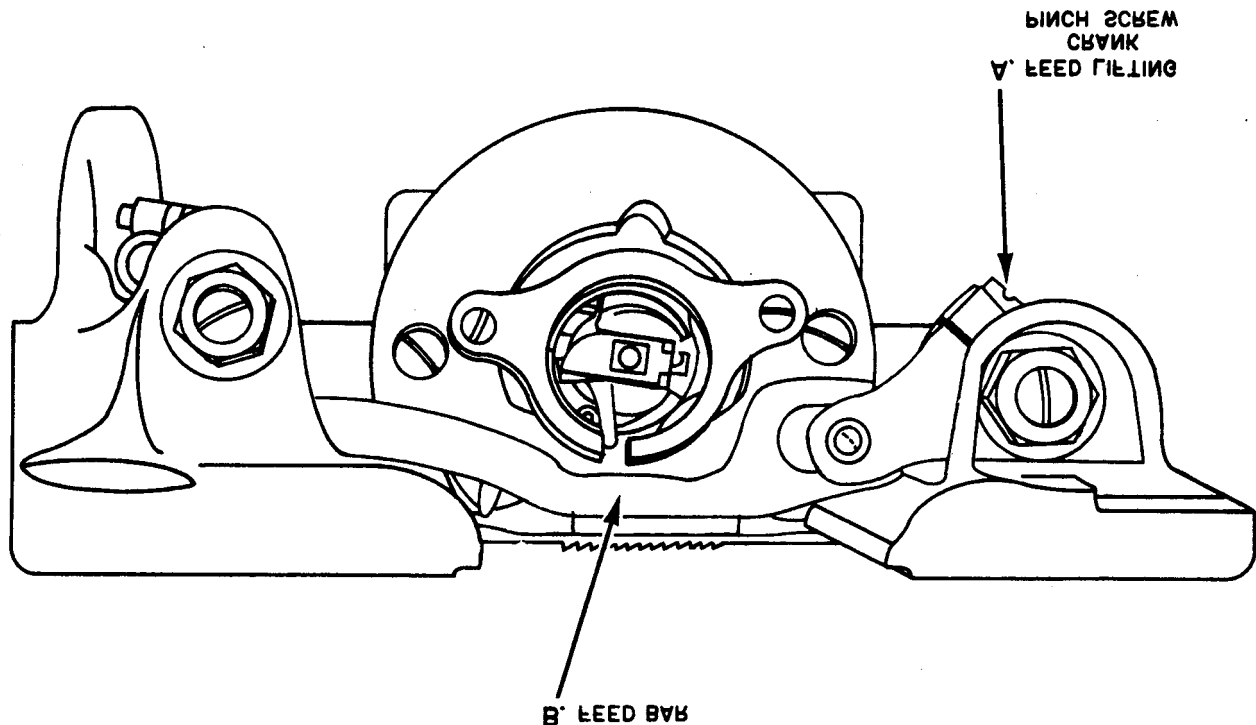


Figure 4-17.—Adjusting feed dogs.

Centering the Feeding Action

Set the sewing machine to its maximum stitch length. Loosen the feed-driving rockshaft crank pinch screw (figure 4-18 [A]). Rotate the feed-driving rockshaft (figure 4-18 [D]) so that the feed dog's movement is an equal distance from the front and rear of the throat plate slots. After you do this, retighten the feed-driving rockshaft crank pinch screw.

Setting Side Play of Feed Dogs

Loosen the adjusting screw locknuts (figure 4-18 [B]). Adjust the feed-driving rockshaft (figure 4-18 [D]) to center the side play of the feed dogs by turning the adjusting screws (figure 4-18 [C]) left or right as needed; then retighten the adjusting screw locknuts. Be sure the adjusting screw locknuts hold the feed-driving rockshaft snugly in place without binding.

Timing the Feed-Driving Eccentric

Timing the feed-driving eccentric is accomplished as follows:

1. Set the stitch regulator to its lowest point. This gives the operator the maximum stitch length of 7 SPI.

2. Rotate the balance wheel toward the operator until the feed dogs complete their movement aft and before they begin to drop. At this point the needle must be entering the material being sewn. If this doesn't occur, the following trial-and-error sequence must be made:

Open the cover located on the rear of the uprise. Rotate the balance wheel until the feed-driving eccentric setscrew becomes visible (figure 4-19 [A]). Loosen this screw. Now place your finger or a screwdriver on the feed-driving eccentric to hold the eccentric in place, and rotate the balance wheel a short distance. Retighten the feed-driving eccentric setscrew. Continue this procedure until the sewing machine complies with step 2.

Setting the Presser Bar

Turn the balance wheel until the feed dogs are just below the top of the throat plate. Loosen the presser bar guide lever setscrew (figure 4-16 [C]). Push the presser firmly against the throat plate, aligning the slot between the toes of the presser foot with the hole in the throat plate. Tighten the presser bar guide lever setscrew. This completes

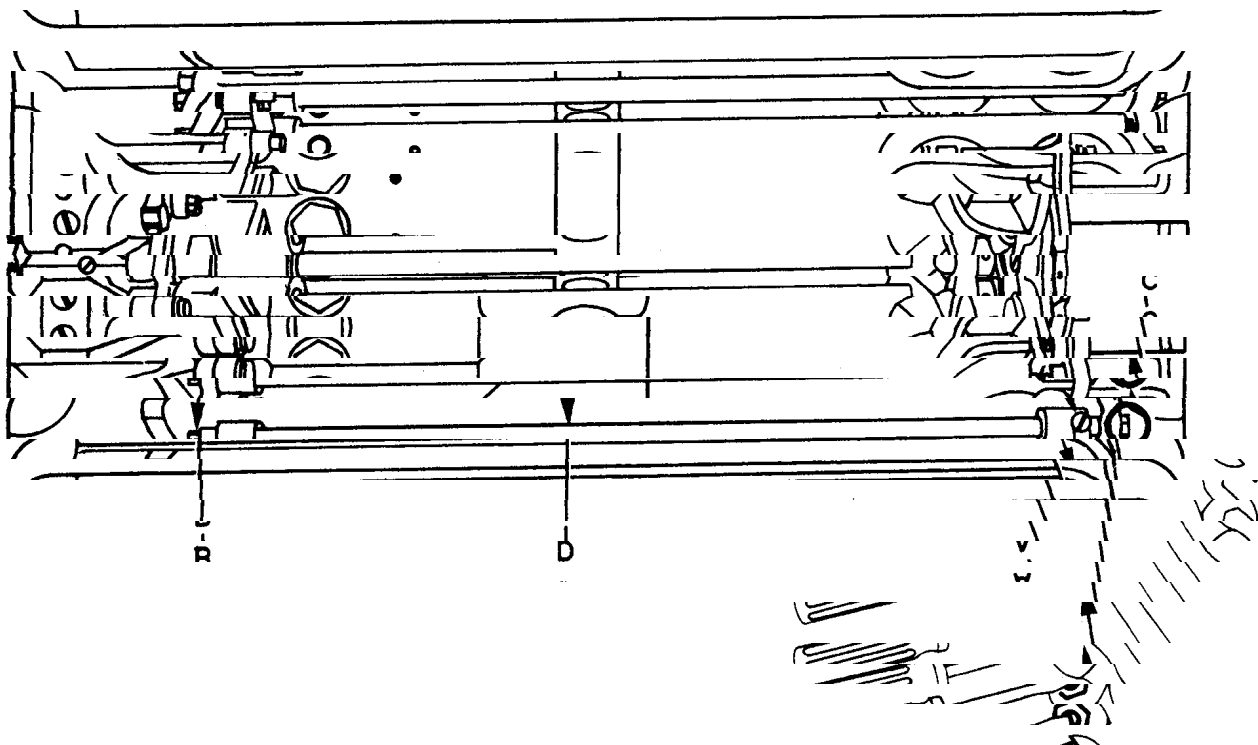


Figure 4-18.—Centering feeding action.

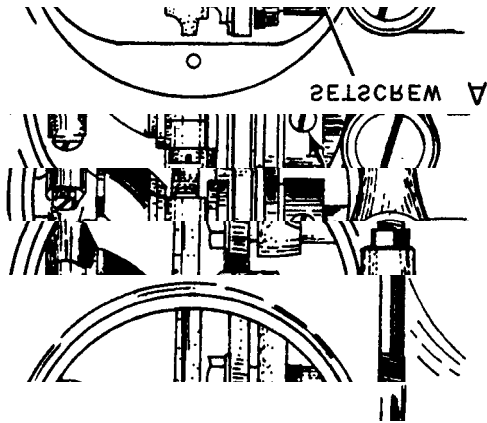


Figure 4-19.—Feed-driving eccentric.

the timing and adjustment procedures for the 31-15 sewing machine.

DISASSEMBLY AND REASSEMBLY OF THE 111 W 155 SEWING MACHINE

You probably will never need to take the 111 W 155 class sewing machine completely apart, but you may need to replace some parts. Therefore, you need to know the procedures for disassembling and reassembling the 111 W 155 sewing machine.

The following are some helpful hints that you should remember while working on disassembly and reassembly of any sewing machine:

- All sewing machine screws have a *case-hardened surface, which must be removed by grinding* should it become necessary to use an easyout to remove the screw.
- Using grinding compound is recommended when you are replacing parts that attach to a shaft. Place a small amount of grinding compound on the shaft and rotate the part on the shaft until it moves freely. (Remove all grinding compound before you reassemble the parts.)
- Oiling is a must in the reassembly of parts. A generous amount of 10W mineral oil is justified when you are replacing parts.
- There is one screw (thread take-up lever retaining screw) on the drop-feed type of sewing

machine that has a left-hand thread. It is found in the face of the machine. This screw is removed by turning it clockwise.

DISASSEMBLY

In this section we discuss the purpose of each part of the 111 W 155 sewing machine and the disassembly and reassembly of each part.

Before disassembling any sewing machine, you should select and clean an area that will allow you to work on your project with a minimum of interruptions. Select your tools, cleaning solvents, and a parts breakdown list; then you are ready to begin your project.

Arm Cap

The arm cap (figure 4-2 [B]) permits inspection of the mechanism of the arm. The arm mechanism is exposed when the arm cap is moved to one side or the other. Remove the arm cap by unscrewing the holding screw and spring washer that attach it to the machine arm; then lift the arm cap from the machine.

Faceplate

The faceplate (figure 4-2 [F]) permits inspection and minor adjustment of the parts in the machine face. The mechanism of the machine face is exposed when the faceplate is moved to one side or the other. Remove the faceplate by removing the thumbscrew at the top of the plate; then move the plate slightly to the left to clear the metal projection at the lower left corner and lift the faceplate from the machine.

Knee Lifter Lifting Lever Hinge Screw

The knee lifter lifting lever hinge screw (figure 4-11 [E]) acts as a hinging point for the knee lifter lifting lever. It is removed from the machine by unscrewing it.

Knee Lifter Lifting Lever

The knee lifter lifting lever (figure 4-11 [F]) acts as an extending arm that attaches the presser bar lifting releasing lever bracket to the knee lifter lifting lever. It carries the motion from the knee lifter lifting lever to the presser bar lifting releasing lever bracket. Remove the knee lifter lifting lever by grasping and moving it outward from the machine.

Presser Bar Spring Support Screw

The presser bar spring-support screw (figure 4-11 [G]) acts as a suspension point for the presser bar spring. The screw is loosened approximately one-fourth of an inch to allow for the removal of the presser bar spring. *Do not remove the presser bar spring-support screw from the machine.*

Presser Bar Spring

The presser bar spring (figure 4-11 [H]) applies a constant pressure to the presser bar. To remove the presser bar spring from the machine, lower the presser feet and then grasp the underside of the spring as near the support screw as possible with two fingers of one hand over two fingers of the other hand. Now slide the spring outward to the head of the support screw, rolling the spring up and out of the machine.

Presser Bar Lifting Releasing Lever Bracket Guide Screw

The presser bar lifting releasing lever bracket guide screw, (figure 4-11 [I]) acts as a track and guide for the presser bar lifting releasing lever bracket. Remove the presser bar lifting releasing lever bracket guide screw by unscrewing it from the machine.

Presser Bar Position Guide

The presser bar position guide (figure 4-7 [D]) acts as a track to control the presser bar position guide lever. To remove the presser bar position guide, you should loosen (six turns) the spline screw on the rear side nearest the face of the machine and push the guide through the recess at the top of the machine head.

Presser Bar Position Guide Lever

The presser bar position guide lever is used to align the presser foot, and it operates in the slot of the presser bar guide.

NOTE: The presser bar position guide does not screw out. Loosen the pinch screw on the presser bar position guide lever (figure 4-11 [K]) by inserting the screwdriver into the opening on the rear side of the machine head. This is necessary to allow movement of the presser bar for the removal of attached parts.

Alternating Presser Foot

The alternating presser foot is the rear presser foot and holds the material in place while the needle and front presser foot move forward making another bight. To remove the rear presser foot, you unscrew the presser foot position screw on the left side of the presser bar. Raise the presser bar to its highest position and remove the foot from the rear.

Presser Bar Spring Bracket

The presser bar spring bracket (figure 4-7 [E]) transfers the tension from the presser bar spring to the presser bar. To loosen the presser bar spring bracket from the presser bar, insert the screwdriver through the lower opening provided in the back of the face of the machine. Loosen the presser bar lifting bracket pinch screw (figure 4-11 [C]). Remove the presser bar lifting bell crank retaining screw and lifting bell crank (figure 4-7 [F] and [G]). Now remove the presser bar (figure 4-7 [M]) in a slow upward motion.

Presser-Lifting Bell Crank

The presser-lifting bell crank alternately applies lift to the presser feet. Remove the presser-lifting bell crank retaining screw (figure 4-7 [F]) and then extract the bell crank (figure 4-7 [G]) from the machine.

Presser Bar Lifting Bracket

The presser bar lifting bracket is alternately a hinge point and lifting point for the two presser bars. It is also the controlling part for the presser feet while work is being inserted and removed, and it gives support to the thread tension release slide.

CAUTION

If binding should occur while you are removing the presser bar, insert a screwdriver into the lower slot of the presser bar and rotate it while applying upward motion on the presser bar.

When you remove the presser bar, the following parts will fall off: the presser bar spring bracket (figure 4-7 [E]), the releasing bracket, the releasing bracket spring, the lifting bracket, and the guide lever.

● Now remove the vibrating presser bar connecting link (figure 4-7 [N]) from the face of the machine.

● Loosen the presser-lifting link crank pinch screw (figure 4-11 [B]). Rotate the presser-lifting rockshaft (figure 4-11 [M]) away from the machine about 90 degrees. Remove the presser-lifting bell crank connection from its stud. Now remove the presser-lifting rockshaft; then remove the presser-lifting link crank (figure 4-11 [P]) from its connection link.

Needlebar Rock Frame Position Bracket

The needlebar rock frame position bracket (figure 4-7 [H]) holds the needlebar rock frame in position and prevents any side-to-side play. To remove the needlebar rock frame position bracket, you remove the holding screw and withdraw the bracket from the machine.

Tension Release Rod

The tension release lever rod releases the tension on the thread. This allows the thread to be pulled freely when you remove material from the machine. When the presser bar is lifted, the shoulder on the arm of the presser bar lifting releasing slide bracket presses the tension release rod, thereby releasing the tension on the thread. You remove the tension release rod by tilting the machine backward and allowing the rod to slide from its recess. Unscrew and remove the vibrating presser foot tension spring adjustment thumb-screw (figure 4-11 [Q]). At this point, you can remove the vibrating presser foot (figure 4-11 [R]).

Vibrating Presser Foot

The vibrating presser foot is the foremost foot. It moves fore and aft as well as up and down, and combines its actions with that of the needle and the feed dogs.

Needlebar Rock Frame Hinge Stud

The needlebar rock frame hinge stud (figure 4-7 [I]) acts as a hinging point for the needlebar rock frame. To remove the needlebar rock frame hinge stud, you loosen the setscrew on the top of the machine head; then you press the hinge stud out through the face of the machine.

Needlebar Rock Frame Assembly

The needlebar rock frame assembly (figure 4-7 [O]) consists of seven major parts: the needlebar connecting stud, the needlebar, the needlebar rock frame, the needlebar rock frame slide block, the vibrating presser bar, the vibrating presser bar spring, and the presser bar spring guide rod. To remove the needlebar rock frame assembly, you grasp it and withdraw it from the face of the machine.

Needlebar Connecting Link Oil Guard

The needlebar connecting link oil guard (figure 4-11 [J]) prevents oil from being thrown through the thread take-up lever groove. To remove the needlebar connecting link oil guard, you insert the screwdriver in the opening in the rear of the machine face, remove the holding screw and then remove the oil guard.

Take-up Lever Hinge Stud

The take-up lever hinge stud acts as a hinging point for the thread take-up lever. To remove the take-up lever hinge stud, first you loosen the setscrew located three-fourths of an inch to the right of the thread take-up lever; then you insert the screwdriver in the oil hole and push the take-up lever hinge stud out through the face of the machine.

Thread Take-up Lever

The thread take-up lever pulls the slack out of the needle thread to lock the stitch in the goods being sewn. To remove the thread take-up lever, you turn the balance wheel until the needlebar connecting link is at its lowest position; then withdraw the thread take-up lever through the face of the machine.

Thread Take-up Lever Driving Stud

The thread take-up lever driving stud transfers power and motion from the needlebar connecting link to the thread take-up lever. The thread take-up lever driving stud is attached to the thread take-up lever; they are removed from the machine at the same time.

Needlebar Connecting Link

The needlebar connecting link (figure 4-7 [J]) changes the rotary motion of the needlebar crank

to the vertical motion of the needlebar. Remove the needlebar connecting link by grasping it and then withdrawing it from the face of the machine.

Balance Wheel Adjusting Screw

The balance wheel adjusting screw (figure 4-11 [L]) eliminates end play in the balance wheel and arm shaft. Remove the balance wheel adjustment screw.

Balance Wheel

The balance wheel (figures 4-6 [R] and 4-11 [N]) transfers the motion and power from the one-third-horsepower electric motor to the arm shaft. To remove the balance wheel, you must first loosen the two setscrews attaching it to the arm shaft; then you withdraw it from the machine.

NOTE: The balance wheel is very fragile. Do not hit it with a hammer to remove it.

Arm Shaft Connection Belt

The arm shaft connection belt (figure 4-4 [A]) transfers the power and motion from the arm shaft connection belt pulley to the safety clutch pulley. To remove the arm shaft connection belt, you insert a small screwdriver along the left edge and slide the belt from the safety clutch pulley.

Arm Shaft Connection Belt Pulley Position Screw

The arm shaft connection belt pulley position screw holds the pulley in a fixed position. The arm shaft connection belt pulley position screw is the larger of the two screws on the pulley. The smaller screw is a setscrew. It must be loosened but not removed from the pulley. Remove the arm shaft connection belt pulley position screw by unscrewing it.

NOTE: For machines with ball bearings, the arm shaft arm bushing setscrews are located just to the right of the connection belt pulley. They secure the arm shaft bushing to the arm shaft. These screws are not removed from the bushing; however, they must be loosened for the arm shaft to be removed.

The Presser-Lifting Eccentric

The presser-lifting eccentric supplies the lift for the alternating presser feet. Free the

presser-lifting eccentric by loosening the two presser-lifting eccentric setscrews located through the opening in the rear of the arm (figure 4-11 [A]). You must rotate the balance wheel to loosen the second screw. Be sure the eccentric rotates freely on the shaft.

Feed Indicator Disc

The feed indicator disc shows the operator the number of stitches per inch the machine is sewing. It also allows the operator to set the machine to sew a desired number of stitches per inch. Loosen the feed indicator disc setscrew and ensure the disc will rotate freely on the shaft.

Needlebar Crank

The needlebar crank transfers the motion and power from the arm shaft to the needlebar by the needlebar driving stud. Do not remove the needlebar crank from the arm shaft.

Needlebar Connecting Link Stud

The needlebar connecting link stud transfers the motion and power from the needlebar crank to the needlebar connecting link. Do not remove the needlebar connecting link stud from the arm shaft.

Needlebar Crank Friction Washer

The needlebar crank friction washer acts as a bearing surface between the needlebar crank and the front arm shaft bushing. In some cases the needlebar crank friction washer remains with the machine upon removal of the arm shaft bushing. If this occurs, insert the index finger in the arm shaft recess and remove the washer.

NOTE: The operator must be especially careful when assembling the machine to be certain the needlebar crank friction washer is returned to the arm shaft. Absence of the needlebar crank friction washer will cause the machine to bind.

Arm Shaft

The arm shaft (figure 4-11 [O]) acts as a carrier for, and transfers the power and motion to, the arm shaft connection belt pulley, the feed indicator disc, the needlebar crank friction washer, and the needlebar crank. To remove

the arm shaft, grasp it with the left hand and withdraw it from the face of the machine.

Right- and Left-Hand Bed Slide Plates

The bed slide plates allow for inspection and maintenance of the bobbin assembly. The right-hand bed slide has a cutout on the bottom side. This cutout allows the needle thread to pass over the bobbin case without jamming.

Throat Plate

The throat plate acts as a guide for the feed dog and provides a firm foundation over which the material may flow while the stitch is being made. The throat plate does not need to be removed from the machine.

Needlebar Rock Frame Rockshaft

The needlebar rock frame rockshaft carries the feeding motion and power from the feeding mechanism in the bed of the machine to the needlebar rock frame. To remove the needlebar rock frame rockshaft, you insert the screwdriver in the opening in the rear of the uprise and loosen the needlebar rock frame rockshaft crank pinch screw. Remove the needlebar rock frame rockshaft from the face of the machine.

Needlebar Rock Frame Rockshaft Crank and Connection

The needlebar rock frame rockshaft crank and connection transfers the feeding motion and power from the feed-driving rockshaft crank to the needlebar rock frame rockshaft. To remove the needlebar rock frame rockshaft crank and connection, you loosen the pinch screw at the feed-driving rockshaft crank (figure 4-6 [G]). Then you grasp the feed-driving rockshaft crank (figure 4-6 [H]), slide it to the right to remove it from the feed-driving rockshaft, and withdraw it from the machine. In so doing, the needlebar rock frame rockshaft crank and connection parts are also removed. The parts removed remain as an assembly.

Feed-Driving Rockshaft Crank

The feed-driving rockshaft crank transfers the feeding motion of the feed-driving rockshaft to the needlebar rock frame rockshaft crank and connection. The feed-driving rockshaft crank is

removed simultaneously with the needlebar rock frame rockshaft crank and connection.

Feed-Lifting Cam Fork

The feed-lifting cam fork gives the feed dog its up and down motion during the feeding operation. To remove the feed-lifting cam fork, you unscrew the feed-lifting cam fork screw (figure 4-6 [E]), tilt the fork toward the operator, and withdraw it.

Feed-Driving Rockshaft

The feed-driving rockshaft (figure 4-6 [L]) coordinates the feeding motion of the feed dog and the feeding of the needle. To remove the feed-driving rockshaft, proceed in the following manner (refer to figure 4-6):

- Loosen the hook saddle adjusting screw (figure 4-6 [B]).

- Loosen the hook saddle pinch screw (figure 4-6 [A]).

- Slide the hook saddle to the right as far as possible.

- Loosen the feed-driving rockshaft crank pinch screw (figure 4-6 [G]).

- Loosen the setscrews on each of the feed-driving rockshaft stop collars (figure 4-6 [M]).

- Lift the feed bar toward the operator until it reaches a stop position. Move the bar to the left until it strikes the bed of the machine. Lift the bar upward to clear the bed of the machine and continue moving it to the left until the right end of the shaft reaches the feed-driving crank; this action forces the right feed-driving rockshaft stop collar from the rockshaft. Continue moving the rockshaft to the left until it clears the left stop collar. Withdraw the rockshaft from the machine.

Feed-Driving Rockshaft Stop Collars

The feed-driving rockshaft stop collars and setscrews (figure 4-6 [M]) act as retainers on each end of the feed-driving rockshaft to prevent any side-to-side play. The feed-driving rockshaft stop collars are removed in conjunction with the feed-driving rockshaft.

Feed Bar

The feed bar (figure 4-6 [F]) transfers the power and motion from the feed-driving rockshaft to the feed dog.

Feed Dog

The feed dog aids the needle in feeding the material to the machine. It is attached to the feed bar.

Hook-Driving Shaft and Attached Parts

The removal of the hook-driving shaft (figure 4-6 [N]) begins with the loosening of the attached parts, starting from the right and working to the left.

- Loosen the setscrew and the spline screw in the hook-driving shaft bearing collar. (See figure 4-6 [O].)

- Loosen the two setscrews in the hook-driving shaft lock ratchet. (See figure 4-6 [P].)

NOTE: Machines fitted with cast iron bushings instead of ball bearings will have only one spline screw.

- Loosen the spline screw and the setscrews in the feed-driving eccentric. (See figure 4-6 ([Q]).)

- Loosen the hook saddle pinch screw (figure 4-6 [A]).

- Loosen the two setscrews in the hook-driving gear.

- Loosen the spline screw in the feed-lifting eccentric (figure 4-6 [T]).

NOTE: After you loosen the spline screw and the setscrews, each part must rotate freely on the shaft.

Safety Clutch Pulley

The purpose of the safety clutch pulley (figure 4-4 [D]) is twofold. First, it is used to transfer the power and motion from the arm shaft connection belt to the hook-driving shaft; second, it protects the hook from being damaged by disengaging when the hook is jammed. To remove the safety

clutch pulley, you loosen the two setscrews (figure 4-6 [S]) that attach the safety clutch pulley to the hook-driving shaft and withdraw the pulley.

Feed-Lifting Eccentric

The feed-lifting eccentric (figure 4-6 [T]) supplies a lifting motion to the feed-lifting eccentric fork. Remove the feed-lifting eccentric by moving the hook-driving shaft to the right until it clears the feed-lifting eccentric, thus allowing the eccentric to drop from the shaft.

Hook-Driving Gear

The hook-driving gear converts the longitudinal motion in the hook-driving shaft to the horizontal motion on the sewing hook. Remove the hook-driving gear by moving the hook-driving shaft to the right until it clears the hook-driving gear, thus allowing the hook-driving gear to drop from the shaft.

Feed-Driving Eccentric

The feed-driving eccentric sets up the motion and controls the feeding mechanism of the sewing machine. Remove the feed-driving eccentric by moving the hook-driving shaft to the right until it clears the feed-driving eccentric, thus allowing it to drop from the shaft.

Feed-Driving Connection

The feed-driving connection carries the feeding motion to the feed-driving crank. Remove the feed-driving connection simultaneously with the feed-driving eccentric. Remove the connection from the eccentric by withdrawing it from the eccentric.

Feed-Driving Crank

The feed-driving crank transfers the feeding motion from the feed-driving connection to the feed-driving rockshaft. The feed-driving crank is attached to the feed-driving connection and is removed from the sewing machine when you remove the feed-driving connection.

Hook-Driving Shaft Lock Ratchet

The hook-driving shaft lock ratchet locks the hook-driving shaft in position while you set the safety clutch. Remove the hook-driving shaft

lock ratchet by moving the hook-driving shaft to the right until it clears the hook-driving shaft lock ratchet, thus allowing it to drop from the shaft.

Arm Shaft Connection Belt Timing Collar and Hook-Driving Shaft Ball-Bearing Collar

The arm shaft connection belt timing collar and the hook-driving shaft ball-bearing collar are the initial timing points on the machine. ***Do not remove these parts from the machine.*** In machines fitted with cast iron bushings, the timing collar will fall off as the shaft is withdrawn.

Hook-Driving Shaft

The hook-driving shaft (figure 4-6 [N]) transfers power and motion to the units attached to it. To remove the hook-driving shaft, you grasp it and withdraw it to the right.

Bobbin-Case Opener

The bobbin-case opener (figure 4-9 [D]) acts as a lever to pull the bobbin case back from the throat plate. It allows the needle thread to pass between the bobbin case and the throat plate. To remove the bobbin-case opener, you unscrew the adjusting screw (figure 4-9 [E]) and lift it from the hook saddle assembly.

Hook Saddle Screw

The hook saddle screw (figure 4-6 [B]) holds the hook saddle assembly in place. Unscrew the hook saddle screw to remove it.

Hook Saddle Assembly

The hook saddle assembly (figure 4-6 [U]) forms the lower half of the stitch. To remove the hook saddle assembly, unscrew the hook saddle screw and loosen the hook saddle pinch screw (figure 4-6 [A]). Draw the hook saddle assembly slightly toward the operator, slide it to the left until it clears the center hook-driving shaft bushing, and withdraw it from the machine. This completes the disassembly of the sewing machine.

REASSEMBLY

Before reassembling the sewing machine, you will need some grinding compound to smooth parts that may have surface rust or small burrs.

A small amount of grinding compound on the surface is sufficient. Rotate the two parts until they move freely. You will also need some 10W mineral oil to lubricate all moving parts. After you accomplish these tasks, proceed as follows to reassemble the sewing machine.

Hook Saddle Assembly

To replace the hook saddle assembly, hold it in an upright position with the saddle clamp facing the bed of the machine; then place the saddle clamp on the edge of the center hook-driving shaft bushing. Swing the hook saddle assembly toward the bed of the machine and slide it to the right and into place in the opening in the casting.

Hook Saddle Screw

With the hook saddle assembly as far to the right as it will go, replace the hook saddle screw and tighten it.

Bobbin-Case Opener

Lift the machine to the upright position. Replace the bobbin-case opener so that the curved end points toward the bobbin case. Replace the bobbin-case opener adjusting screw and tighten it.

Hook-Driving Shaft

Tilt the machine forward. In replacing the hook-driving shaft, you should note that it has five splined grooves. One of the splined grooves is located at one end of the shaft. Insert the end without a splined groove into the right hook-driving shaft bearing.

Hook-Driving Shaft Lock Ratchet

As the hook-driving shaft is pushed toward the left, or face, of the machine, replace the hook-driving shaft lock ratchet so that the flange with the setscrews faces the left of the machine.

Feed-Driving Connection and Feed-Driving Crank

Hold the feed-driving eccentric with the flange and spring to the right; then place the feed-driving connection, with the feed-driving crank attached, over the cam on the feed-driving eccentric. Be sure the oiling felt faces upward and the crank is toward the operator.

Feed-Driving Eccentric

Holding the feed-driving eccentric in the same manner as stated above, you replace it on the hook-driving shaft.

Hook-Driving Gear

Push the hook-driving shaft through the center hook-driving shaft bushing. Replace the hook-driving gear so that the flange with the setscrews is facing toward the left.

Feed-Lifting Eccentric

Place the feed-lifting eccentric on the hook-driving shaft and slide the hook-driving shaft into the front hook-driving shaft bushing, leaving approximately 2 inches of the hook-driving shaft extended to the right of the rear hook-driving shaft bushing.

Safety Clutch Pulley

Replace the safety clutch pulley so that the safety clutch hook-driving shaft stop collar, with the screws in it, is flush with the right end of the hook-driving shaft. Turn the safety clutch pulley until the spline screw marked with the letter *S* is positioned over the spline in the hook-driving shaft. Tighten the spline screw and the setscrew.

Feed-Driving Rockshaft

The cylinder end of the feed-driving rockshaft is placed from the left into the feed-driving rockshaft bushing. The flat side of the feed-driving rockshaft stop collar is placed flush with the bushing, and the rockshaft is moved forward to enter the stop collar. The feed-driving crank is placed next to the stop collar, and the rockshaft is moved forward to enter the crank. The remaining stop collar is placed on the rockshaft with the flat side to the right. The rockshaft (with the base of the feed bar toward the operator) is moved through and 1 inch past the right bushing. Holding the base of the feed bar toward you, rotate the rockshaft downward toward the bed of the machine and fit the feed dog into the throat plate.

Place the feed-lifting eccentric fork over the feed-lifting eccentric and fit the base of the feed bar into the slot at the top of the feed-lifting eccentric fork. When the feed-lifting eccentric fork is in position, the rounded end of the fork

will be facing you. To secure the feed-lifting eccentric fork to the feed dog, you must place the feed eccentric fork screw into the space provided and tighten it.

The feed-driving rockshaft crank is attached to the needlebar rock frame rockshaft crank and connection. To replace it, insert the needlebar rock frame rockshaft crank and connection with the curved portion upward and the crank hanging down into the arm through the opening in the bed of the machine. Slide the feed-driving rockshaft crank over the feed-driving rockshaft. *Do not tighten the crank.* Ensure all other screws are tight.

This completes the assembly of the parts in the bed of the machine. Now we will assemble the parts located in the arm of the machine.

Needlebar Rock Frame Rockshaft

(At this point, the machine is placed in an upright position.) Place the needlebar rock frame rockshaft in the lower bushing in the face of the machine. Push it through until the end of the shaft is flush with the bushing in the arm of the machine. This may be viewed through the opening in the top of the machine arm. Place the screwdriver through the opening in the right side of the machine arm and engage the needlebar rock frame rockshaft crank. Lift the crank with the screwdriver so that it is on line with the needlebar rock frame rockshaft. With the left hand, push the rockshaft through the crank. *Do not tighten the crank.*

Arm Shaft

In replacing the arm shaft, be certain that the needlebar crank friction washer is on the shaft. Insert the arm shaft in the top bushing in the face of the machine; then push it through until it can be seen through the opening located on the rear of the machine arm.

Presser-Lifting Eccentric Connection Link

Insert the larger end of the presser-lifting eccentric connection link (figure 4-10A) with the oil holes facing up. Slowly push the arm shaft through the arm of the machine until you can see the arm shaft at the opening on the top of the machine nearest the balance wheel.

Presser-Lifting Eccentric

Place the presser-lifting eccentric (figure 4-10B) onto the arm shaft with the small end toward the face of the machine. At this time, slide the presser-lifting eccentric toward the face until it goes inside the connecting link.

Feed Indicator Disc

The feed indicator disc is placed on the arm shaft, through the opening in the top of the machine arm, so that the numbers on the disc may be read right side up. Push the arm shaft through the disc about 1 inch.

Arm Shaft Pulley and Arm Shaft Connection Belt

The arm shaft connection belt acts as a sling for the arm shaft pulley. Use the belt and lower the pulley through the opening in the top of the machine arm. Now turn the belt, while aligning the pulley with the arm shaft, and insert the shaft through the pulley. Be sure you push the shaft through as far as it will go.

Arm Shaft Connection Belt Pulley Position Screw

To replace the arm shaft connection belt pulley position screw, you hold the arm shaft in position with the left hand and move the arm shaft pulley to the left. Turn the arm shaft until the hole is facing up. Now turn the pulley until the hole for the position screw is facing up. Move the pulley to the right, aligning the two holes, and insert the position screw. Tighten the remaining setscrew in the pulley.

Balance Wheel

Before you replace the balance wheel, turn the arm shaft until the groove in the shaft is facing upward. Place the balance wheel on the arm shaft. Now turn the wheel toward the operator until the second screw is directly in line with the groove. Tighten the screw in place. Tighten the remaining setscrew.

Balance Wheel Adjusting Screw

Place the balance wheel adjusting screw in the end of the arm shaft and tighten it. Loosen it one-quarter turn and strike it with a sharp blow

using a rawhide mallet. See that the balance wheel turns freely and that there is no play. If the balance wheel does not turn, or if it turns and there is side-to-side play, repeat the procedure.

CAUTION

This balance wheel is made of cast iron or aluminum and will break if you hit it directly with the mallet.

If the screw can be removed by using your thumb and forefinger, it will be necessary to spread the end of the screw. To do this, remove the screw and spread the end of it with a screwdriver. Replace the screw and run it down until it touches the balance wheel. It should then be tightened snugly when you try to remove it with your fingers.

Alternating Presser Driving Rockshaft

Slide the rockshaft into the rear of the machine through the two bushings. Attach the presser-lifting link crank to the link projecting from the arm. Continue sliding the rockshaft through the crank. Set the machine on its balance wheel end. Install the bell crank link on the rockshaft stud (oil holes up). Install the oil guard into the face at this time.

Needlebar Connecting Link

Turn the balance wheel until the needlebar connecting link stud is at its lowest position. Grasp the needlebar connecting link so that the double cylinders are up. Place the larger of the two cylinders over the needlebar connecting link stud, and ensure that the flush end of the cylinders are facing outward.

Take-up Lever Driving Stud

Place the cylinder of the take-up lever driving stud over the piston of the take-up lever.

Take-up Lever

Grasp the take-up lever with the piston of the take-up lever driving stud and the cylinder of the take-up lever facing the face of the machine. Fit the lever into the slot designed for its operation; at the same time insert the take-up lever driving stud into the remaining cylinder of the needlebar connecting link.

Thread Take-up Lever Hinge Stud

Align the cylinder of the thread take-up lever with the recess for the hinge stud. Before you insert the hinge stud, turn the hinge stud and note the flat machined surface running the length of the stud. Replace the stud with the machined surface up. Install the setscrew.

Needlebar Rock Frame Assembly

Hold the needlebar rock frame in the left hand with the rounded end up and the straight side facing left. Insert the slide block in the space provided with the oil hole facing up.

Before you insert the needlebar rock frame assembly, turn the balance wheel until the needlebar connecting link is at its lowest position. Insert the assembly into the face of the machine so that the connecting stud enters the connecting link and the slide block is placed over the projection on the needlebar rock frame rockshaft. At the same time, the vibrating presser barspring guide rod with the spring attached must be positioned into the hole at the top of the face. Hold the assembly in position.

While you are holding the assembly in position, insert the hinge stud so that the flat surface is up. Install and tighten the setscrew.

Install the needlebar rock frame. Position bracket in position and tighten it in place.

Thread Tension Release Lever Rod

Insert the thread tension release lever rod in the hole in the back of the machine head so that the rounded end is facing toward the operator.

Presser Bar

Insert the presser bar through the upper bushing located in the top of the machine head, about 3 1/2 inches. Place the presser bar position bar guide lever so that the pinch screw is to the rear and the arm is to the left. At this time the lifting-and-releasing unit must be installed. It consists of a lifting bracket, a releasing bracket, and a spring that separates the two parts. While you are holding the unit together, place it into the face so that the two long levers cover the releasing rod. Now twist the presser bar down through the unit. Before you lower the presser bar through the lower bushing, insert the presser bar spring bracket with the slot up. Lower the presser bar through the lower bushing. Turn it so that the

unthreaded end of the hole faces left. Insert the presser foot in the slot. Replace the screw and tighten it.

Presser Bar Position Guide

Place the slotted end of the presser bar position guide through the opening in the top of the machine head so that it fits over the arm of the presser bar position guide lever. When you complete this step, the top of the presser bar position guide will be flush with the top of the machine head. Tighten the spline screw in the rear of the head.

Presser Bar Spring

Tilt the machine down and place the long curved end of the presser bar spring through the opening in the back of the machine head and into the slot in the presser bar spring bracket. Place the small curved end over the presser bar spring-support screw. Push it down and under the presser spring-regulating screw. Tighten the presser bar spring-support screw. Install the large guide screw.

NOTE: Preadjust the spring bracket with the presser foot firmly on the throat plate, and make sure the foot is straight. Raise the presser bar spring bracket about one-eighth inch and tighten the pinch screw.

- At this time, adjust the presser bar guide lever one-quarter inch up from the bottom of the guide as in figure 4-7 (K).

- Tighten the pinch screw (figure 4-11 [B]).

Front Presser Bar Connecting Link

Place the large end of the line on the front presser bar stud.

Bell Crank

The bell crank has three attachment points: (1) the bell crank connection link, (2) the lifting lever bell crank stud, and (3) the front presser bar connecting link stud. All three must be engaged at the same time. Install and tighten the retaining screw.

Front Presser Foot and Presser Pressure-Regulating Thumbscrew

Install the foot on the front presser foot and the regulating screw on the top of the face.

Knee Lifter Lifting Lever

Replace the knee lifter lifting lever so that the slotted end fits over the projection on the knee lifter connection lever. The projection on the curved end of the knee lifter lifting lever fits under the presser bar releasing bracket.

Knee Lifter Lifting Lever Hinge Screw

Align the hole in the knee lifter lifting lever with the corresponding hole in the machine

arm; then insert the hinge screw. Make certain the screw, including the shoulder, is fully inserted.

Faceplate

Insert the thumbscrew and secure it.

Arm Cap

Replace the arm cap and the spring washer on the machine arm and screw them in place.

This completes the reassembly of the 111 W 155 sewing machine. It will be necessary to make a few minor adjustments or retune this machine. Timing and adjustment are covered at the beginning of this chapter.

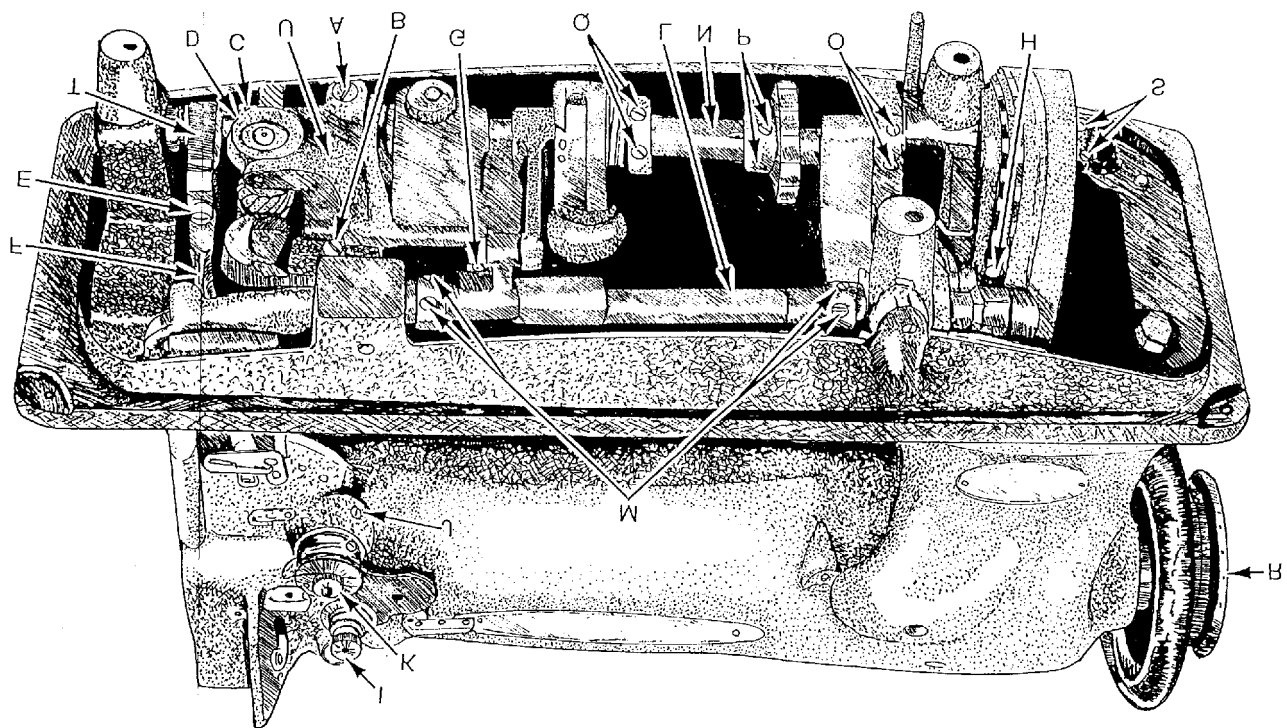


Table 4-1.—Nomenclature for figure 4-6

A. Hook Saddle Pinch Screw	L. Feed-Driving Rockshaft
B. Hook Saddle Screw	M. Feed-Driving Rockshaft Stop Collars and Setscrews
C. Hook Drive Gear Setscrew	N. Hook-Driving Shaft
D. Hook Drive Spline Screw	O. Hook-Driving Shaft Bearing Collar Setscrews
E. Feed Fork Screw	P. Hook-Driving Shaft Lock Ratchet Setscrews
F. Feed Bar	Q. Feed-Driving Eccentric Setscrews
G. Feed-Driving Rockshaft Crank Pinch Screw	R. Balance Wheel
H. Feed-Driving Rockshaft Crank Pinch Screw	S. Safety Clutch Hook-Driving Shaft Position Collar Setscrew
I. Thread Controller Assembly Retaining Screw	T. Feed-Lifting Eccentric
J. Thread Controller Stud Setscrew	U. Hook Saddle Assembly
K. Thread Controller Thumb Nut	

Figure 4-6.—Bottom view of Model 225.

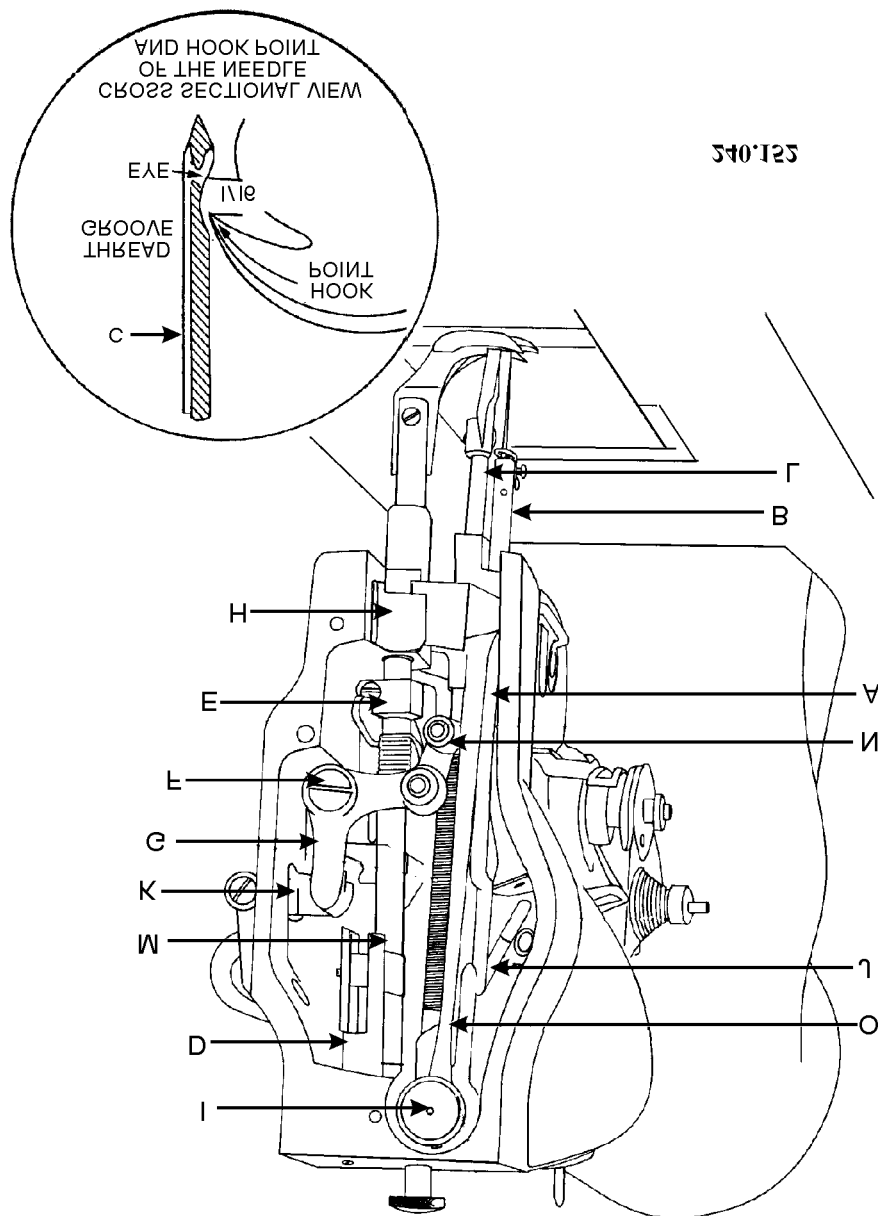


Table 4-2.—Nomenclature for figure 4-7

- A. NEEDLEBAR ROCK FRAME ROCKSHAFT CONNECTION CRANK PINCH SCREW
- B. NEEDLEBAR
- C. NEEDLEBAR POSITION HEIGHT
- D. PRESSER BAR POSITION GUIDE
- E. PRESSER BAR SPRING BRACKET
- F. PRESSER-LIFTING BELL CRANK RETAINING SCREW
- G. PRESSER LIFTING BELL CRANK
- H. NEEDLEBAR ROCK FRAME POSITION BRACKET
- I. NEEDLEBAR ROCK FRAME HINGE STUD
- J. NEEDLEBAR CONNECTING LINK
- K. PRESSER BAR GUIDE LEVER
- L. VIBRATING PRESSER BAR
- M. PRESSER BAR
- N. VIBRATING PRESSER BAR CONNECTING LINK
- O. NEEDLE ROCK FRAME ASSEMBLY

Figure 4-7.—Face view of Model 225

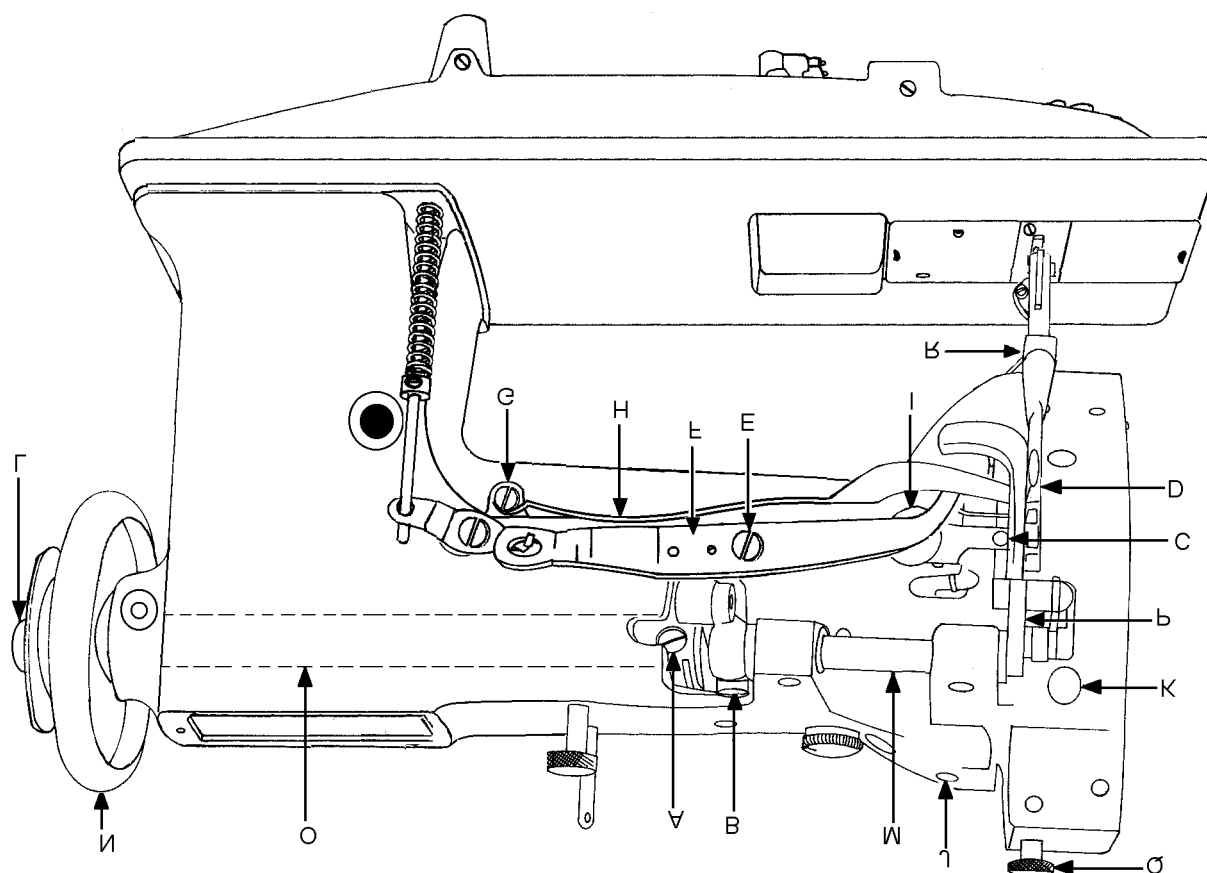


Table 4-3.—Nomenclature for figure 4-11

A. PRESSER-LIFTING ECCENTRIC SETSCREWS	J. NEEDLEBAR CONNECTING LINK OIL GUARD
B. PRESSER-LIFTING LINK CRANK PINCH SCREW	K. PRESSER BAR GUIDE LEVER PINCH SCREW
C. PRESSER BAR LIFTING BRACKET PINCH SCREW	L. BALANCE WHEEL ADJUSTING SCREW
D. LIFTING SCREW	M. PRESSER-LIFTING ROCKSHAFT
E. KNEE LIFTER LIFTING LEVER HINGE SCREW	N. BALANCE WHEEL
F. KNEE LIFTER LIFTING LEVER	O. ARM SHAFT
G. PRESSER BAR SPRING-SUPPORT SCREW	P. PRESSER-LIFTING LINK CRANK
H. PRESSER BAR SPRING	Q. VIBRATING PRESSER FOOT TENSION SPRING ADJUSTMENT THUMBSCREW
I. PRESSER BAR LIFTING RELEASING LEVER BRACKET GUIDE SCREW	R. VIBRATING PRESSER BAR

Figure 4-11.—Rear view Model 225.

CHAPTER 5

AIRCREW SURVIVAL EQUIPMENT TRAINING

During the Southeast Asian conflict, a precedent of immediate rescue was established. The average period of individual, isolated survival for aircrew members that were rescued was 6 hours. The average time in the southwest Pacific during World War II was 48 hours in 85 percent of the cases reported. The marked reduction in times can be attributed to a number of factors, including aircrew familiarity with equipment, efficiency of air rescue and/or recovery forces, more effective communications devices, rotary-wing rescue vehicles, and most significantly, the prevailing low-threat air environment. However, in a future major conflict, the United States cannot expect to have the same air superiority that it had in Southeast Asia.

The United States now anticipates a sophisticated high-threat air environment with a wide spectrum of antiaircraft weapons. We can expect greater combat losses with more downed aircraft and aircrew members. The fate of search and rescue (SAR) helicopters and their support aircraft is in doubt against an enemy equipped with modern air defense weapons. Thus, U.S. military personnel must be prepared both mentally and physically for long-term solitude, as well as group survival, with all of the problems involved, until rescue can be effected.

The basic skills for survival have never changed. The will to live and survive is still the most important single factor in bringing aircrewmen home alive.

Today's survival equipment used by aircrewmen has been improved over the past 10 years to a point where, with a little common sense and proper instruction on its use, the aircrewman has a better chance of survival than ever before.

Until now you have inspected, tested, and packed survival items. Maybe on occasions you have been required to give a lecture on the use of survival items. As a first class or chief petty officer, it is essential that you be familiar with survival equipment and ensure flight personnel are trained in its use. The following manuals and

instructions will aid you in your research for information about the survival environment and equipment usage. NWP 19-1 is the Navy's SAR manual. This manual describes all aspects of search, rescue, and the equipment used in rescue operations. The NAVAIR 00-80T-101, *Survival Training Manual*, is a recently published manual with which you may not be familiar. It describes the use of survival equipment and rescue devices carried by Navy aircrewmen and SAR vehicles. This includes electronic, pyrotechnic, and survival equipment, as well as specialized SAR rescue equipment. *The NATOPS General Flight and Operating Instructions*, OPNAVINST 3710.7, provides general information about minimum requirements for aircrew personnel protection equipment and training.

SEA SURVIVAL

Most naval aircraft are equipped for and routinely fly over water; so chances are, a high percentage of our survival situations will involve the sea. All aircrewmen flying in naval aircraft have received training in water survival, and most are good swimmers. You will not be involved in teaching swimming. Your job is to instruct the aircrewman in the use of available survival equipment.

If you are to survive in the sea, you will have to remain calm and use sound judgment; panic will be your worst enemy. Mental preparation and practice will allow you to use your fear constructively. You should mentally rehearse your actions many times so that when you are forced to act, it will be from conditioned reflex. By the time you reach the water, whether by parachute or crash landing, you will know your situation and begin to apply established priorities. It is beyond the scope of this text to attempt to detail every survival scenario. However, you will improve your chances to survive in the sea, despite the variable factors such as environmental conditions, sea

state, and physical condition, by using common sense in applying the following priorities to meet your unique situation:

1. Flotation
2. First aid
3. Shelter

4. Location
5. Water
6. Food

FLOTATION

It stands to reason flotation should be your highest priority when you enter the sea. There are

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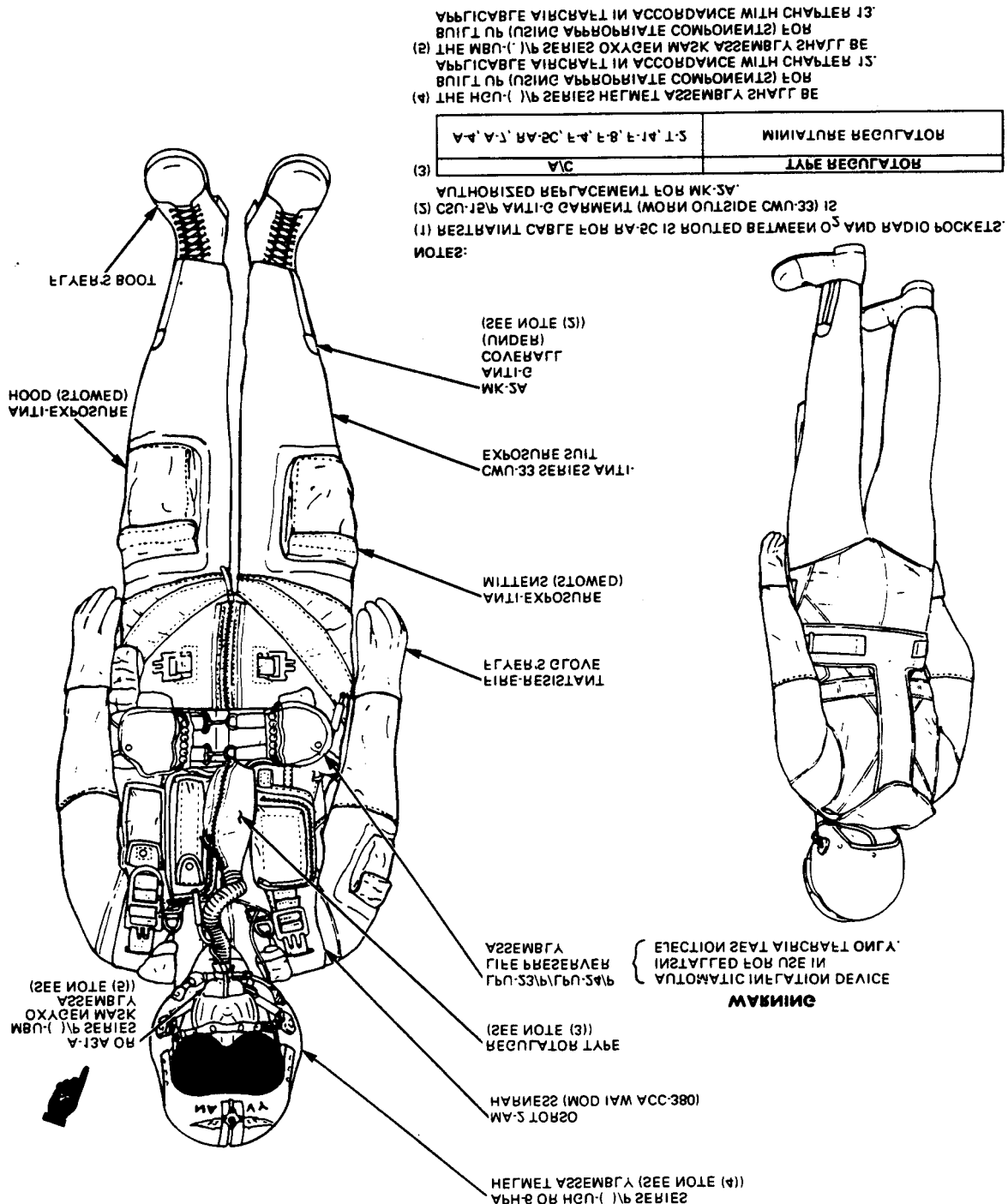


Figure 5-1.—Personal survival equipment.

a number of ways to stay afloat. Figure 5-1 shows the personal equipment worn by the VA, VF, or VS aircrewman. The primary flotation device shown is the LPU life preserver; however, a closer look reveals that the aircrewman is also wearing an anti-g suit. This g suit is an excellent flotation device itself. When the aircrewman orally inflates the g suit, it provides additional emergency flotation.

NOTE: In the event the g suit becomes the only flotation device, it should be removed from the legs and worn as water wings. If left on the legs and inflated, it could cause the aviator to become inverted in the water (head down).

Life Preservers

Many different types of life preservers are used by naval aviation personnel. The Mk-1 is used by maintenance personnel working aboard

ship. The LPU-30/P is used as a substitute for the LPP life preserver aboard carrier-onboard-delivery (COD) and vertical-onboard-delivery (VOD) aircraft. The LPP life preservers are worn by passengers flying in naval aircraft. The LPA-2B and the LPU-21B/P are worn by aircrewmen flying in nonejection-seat-equipped aircraft. The LPU-23A/P and the LPU-24A/P are worn by aircrewmen flying in ejection-seat-equipped aircraft. These two life preservers are equipped with automatic inflation systems in addition to the manual actuation systems. The FLU-8A/P automatic inflation feature will be explained later in this chapter.

Each of the life preservers we will discuss is equipped with CO₂ cylinders that will inflate the preserver once it is actuated. Manual activation of the CO₂ cylinders on life preservers requires only a simple pull on the beaded handle or toggle shown in figure 5-2. Life preservers inflate

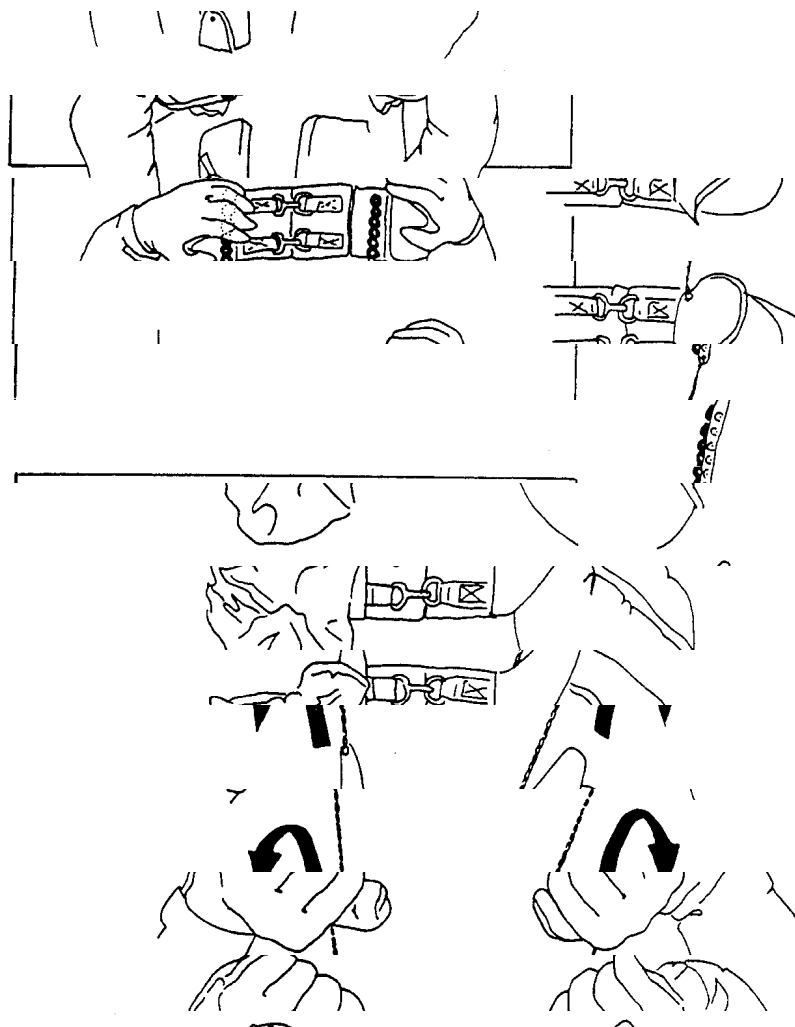


Figure 5-2.—LPA inflation.

to their designed shape within 30 seconds; however, depending on ambient temperature, they may require additional air pressure. Air pressure can be added by unscrewing the locking device, pushing in on the valve, and blowing air into the preserver through the oral inflation tube. The LPU-23A/P or the LPU 24A/P life preserver assemblies have an automatic inflation device designated the FLU-8A/P.

The FLU-8A/P automatic inflation assembly consists of a body assembly and a sensor housing. The body assembly contains a cartridge, piercing pin, spent-cartridge indicator, firing check port, packing loop, cam lever, lanyard assembly, and nylon release pin. The body assembly also provides for the attachment of a charged CO₂ cylinder. The sensor housing contains an electronic circuit, two batteries, and a sensor plug assembly containing the battery contact spring and the sensor pin. The inflation devices are attached to each valve stem located on the waist lobes. In addition, a beaded handle with a manual inflation lanyard is connected to each inflation device.

NOTE: The FLU-8A/P can be operated either manually or automatically, although the manual mode is considered the primary mode.

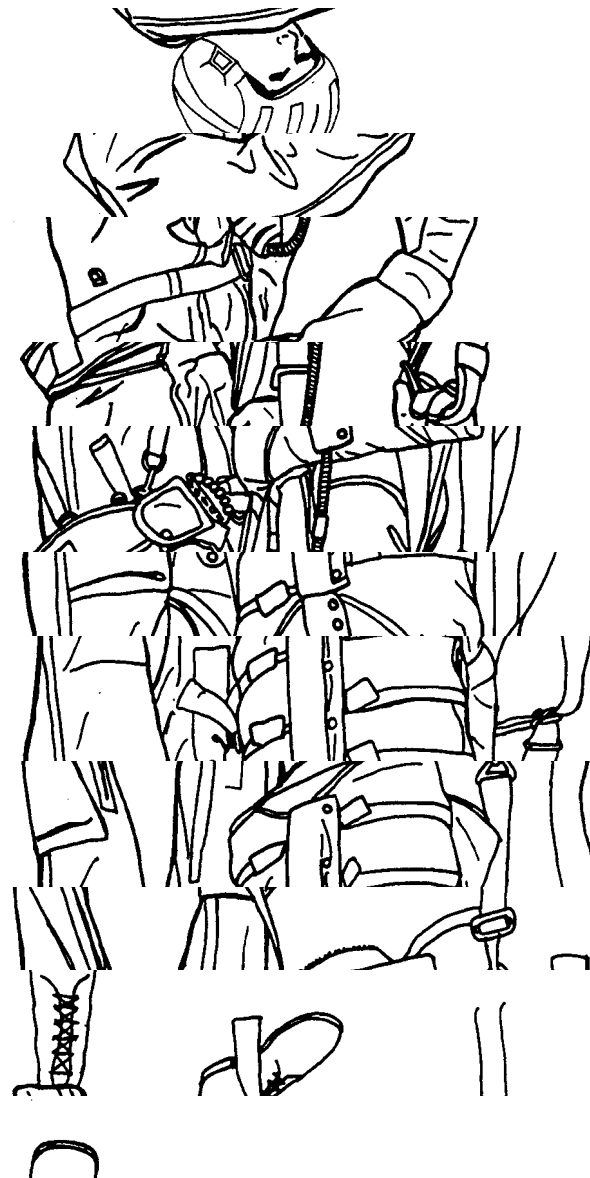
MANUAL MODE.— The attached lanyard assembly, when pulled, rotates the cam lever, releasing the packaging loop lanyard from the nylon release pin and forcing the piercing pin into the diaphragm of the CO₂ cylinder. The CO₂, under pressure, is forced through the body of the device to inflate the life preserver.

AUTOMATIC OPERATION.— The secondary operating mode is automatic. Upon immersion in freshwater or salt water, a conducting path is established between the sensor pin and the case, completing the electrical circuit. A resistance network requires the conductivity of the water to be at an established minimum. If the conductivity is present, two series-connected, dry-storage batteries energize the electronic circuit, which then discharges to fire the cartridge. Ballistic energy, produced by the burning cartridge, forces the spent-cartridge indicator pin into the firing check port and propels the piercing pin into the diaphragm of the CO₂ cylinder. As the piercing pin moves forward, the packaging loop lanyard is released from the body of the inflator. The CO₂, under pressure, is forced

through the body of the device to inflate the life preserver.

NOTE: The FLU-8A/P is an emergency backup system. Always, if possible, manually inflate the LPU prior to water entry.

These life preservers provide buoyancy that ranges from 29 to 65 pounds. This may confuse the aircrewmembers; so it should be pointed out that this is the minimum buoyancy the preserver provides and that the natural buoyancy of the body provides additional



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Figure 5-3.—Aircrewman grasping shoulder straps.

buoyancy. An LPP life preserver that provides a buoyancy of 29 pounds is more than sufficient to keep a 200-pound man afloat for an indefinite length of time.

OPERATIONAL DIFFICULTIES OF LIFE PRESERVERS.— With all the equipment worn by aviators, life preservers must completely inflate to provide the buoyancy necessary to keep them afloat.

Partial inflation of the collar lobe on the LPA and LPU life preservers is a reported problem. Improper functioning of the hook-and-pile tapes that hold the collar lobes in the packed condition causes this problem. If the hook-and-pile tapes fail to open, simply pull them apart and the preserver will fully inflate the collar lobe.



Figure 5-4.—Aircrewman slinging parachute onto back.

BAILOUT PROCEDURES USING THE FOUR-LINE RELEASE AND THE LPA LIFE PRESERVER.— Each aircraft has its own bailout procedure. The Naval Air Training and Operating Procedures Standardization (NATOPS) manual outlines the emergency procedures for each aircraft. We will discuss the emergency egress procedures for the P-3 aircraft.

When the command is given to bail out, the aircrewmembers don their parachutes. We are using the NB-8 personal parachute to describe the bailout procedures. Grasp the shoulder straps as shown in figure 5-3 and place the parachute onto your back (fig. 5-4). Use the quick-release snap and the V-ring to attach the chest strap in place (fig. 5-5).

When you are donning the parachute over the LPA/LPU life preserver, be sure the harness



Figure 5-5.—Aircrewman attaching quick release V-ring.

does not cross the collar lobes of the flotation device. This could restrict inflation. The parachute should fit tightly, high on the back, and snugly in the seat. Before you tighten the chest straps (fig. 5-6), attach the leg straps as - shown in figure 5-7. Prior to

bailout, ensure the main sling is well under the buttocks before you tighten the leg straps. It should be lowered under your buttocks as shown in figure 5-8 and the leg straps tightened (fig. 5-9). At this point you will not be able to stand erect.

540'114

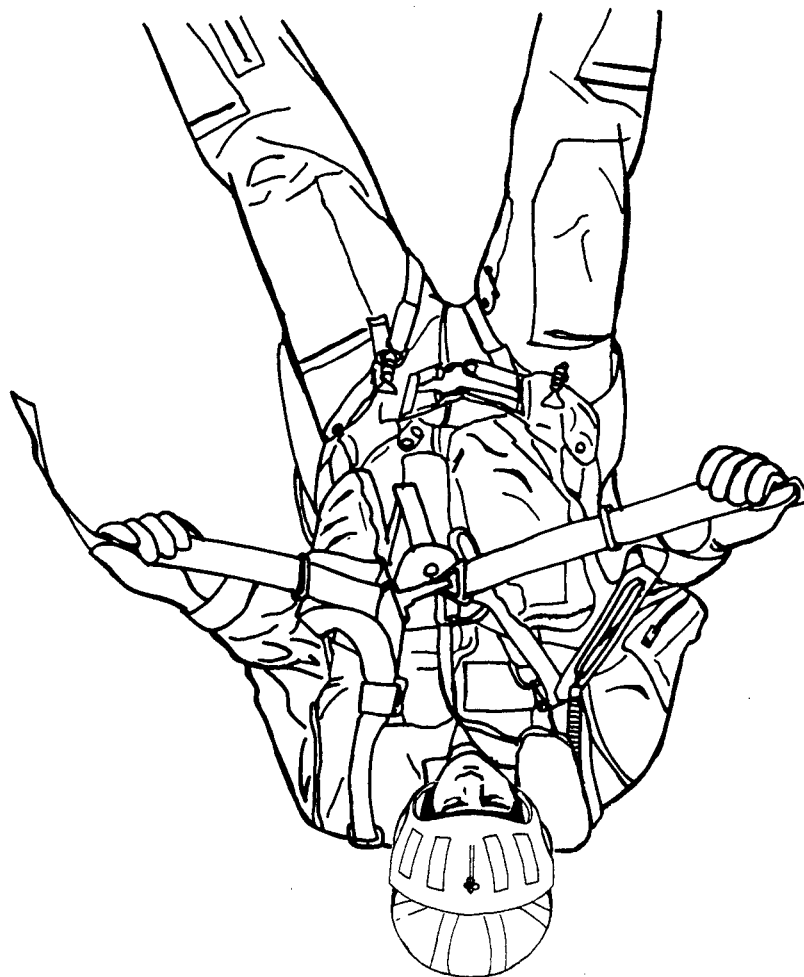


Figure 5-6.—Aircrewman tightening chest strap.

540'112



Figure 5-7.—Aircrewman attaching leg straps.

540'110



Figure 5-8.—Aircrewman lowering seat strap.

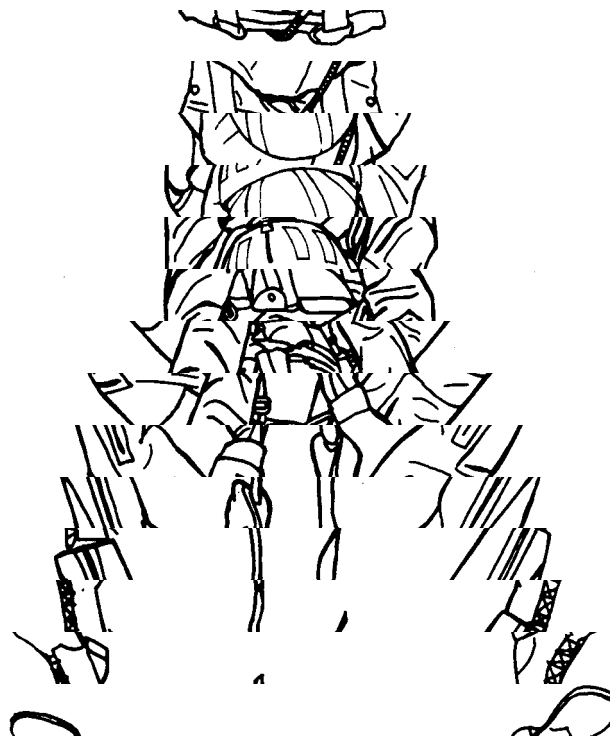


Figure 5-9.—Aircrewman tightening leg straps.

540'111



Figure 5-10.—Aircrewman preparing to exit aircraft.

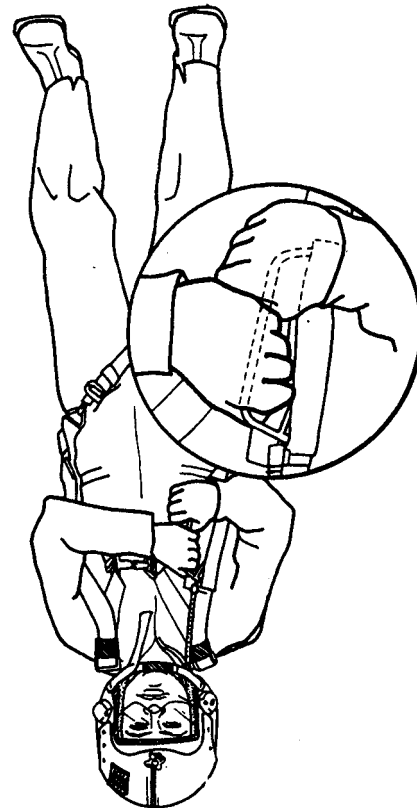


Figure 5-11.—Aircrewman gripping rip cord handle.

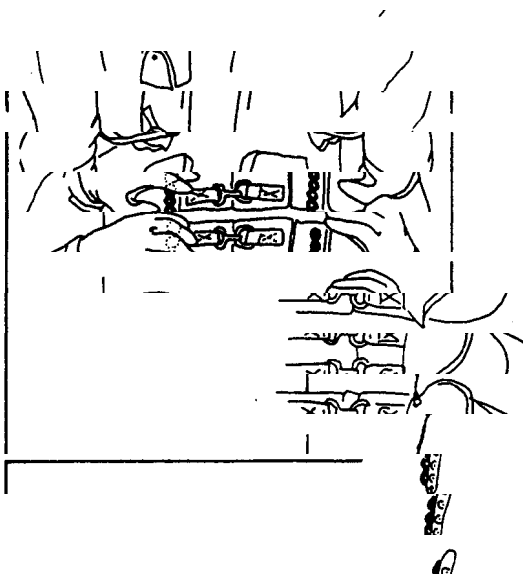


Figure 5-12.—LPA inflation.



Leaving Aircraft. — Grasp the door edges about waist high, and place your feet together over the edge of the hatch, as shown in figure 5-10. Pull your body forward and exit the aircraft.

The NB-8 parachute used in the P-3 aircraft does not have automatic opening features. Therefore, the aircrewman must manually pull the rip cord. Grip the rip cord handle as shown in figure 5-11 and pull it to the maximum length of travel. This allows for complete release of pins from the parachute pack.

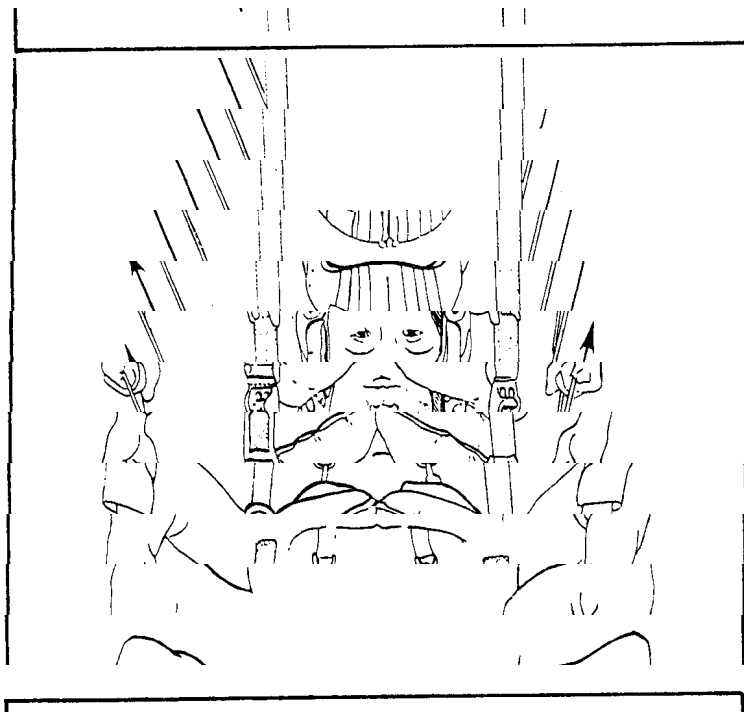
Parachute Descent. — Immediately following the opening shock of the parachute, check the condition of the parachute canopy. Assuming you

have a fully deployed canopy, locate the two beaded handles on the LPA; pull them down and straight out to inflate the life preserver (fig. 5-12). You may need to squeeze the waist lobes to release the hook-and-pile tapes on the collar lobes. Sometimes it is necessary to manually release the hook-and-pile tapes to allow full inflation of the collar lobes (fig. 5-13). At this point you should raise the visor on your helmet if you are over water and lower it if you are over land.

Four-Line Release. — Actuation of the four-line release system reduces oscillation and provides a method of maneuvering the parachute to an optimal landing site.



Figure 5-13.—Aircrewman releasing the hook-and-pile tapes on collar.



540'133

Figure 5-14.—Aircrewman pulling lanyard loops.

540'133

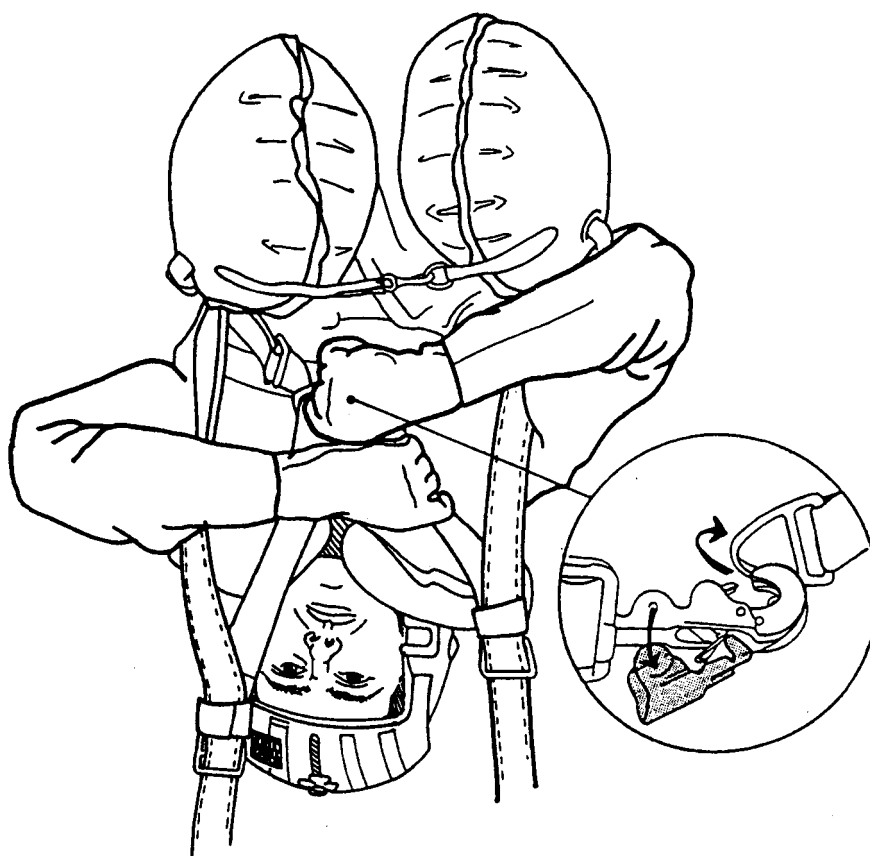


Figure 5-15.—Aircrewman grasping left main sling webbing with right hand.

WARNING

Carefully inspect the canopy and suspension lines prior to using the four-line release. If any parachute damage is evident or if there are broken suspension lines, do NOT use the four-line release system.

The four-line release system should not be used at night since parachute damage may be difficult to determine.

To operate the four-line release system, you locate the two lanyard pull loops. They are on the inside of the rear risers. Pull the lanyard pull loops sharply downward (fig 5-14). This takes approximately 20 pounds of pull force. This action frees the rear four suspension lines, which allows the canopy to form a lobe in the rear center and permits a steady escape of air, which reduces

oscillation and allows directional control. By pulling down on the right lanyard, you steer your canopy to the right. To steer your canopy to the left, you pull down on the left lanyard.

Parachuting. — Try to determine the wind direction at the surface by watching white caps or smoke from the aircraft wreckage or known surface winds in the vicinity. Winds at the surface may be quite different from those encountered at altitude. When nearing the water, maneuver the parachute so that you are facing into the wind. Begin preparing for water entry as soon as possible after your chute is opened, because judging your altitude over water is difficult in daylight and nearly impossible at night. Grasp the left main sling webbing with your right hand (fig. 5-15). With your left hand, release the chest strap and left leg strap quick-ejector snap (fig. 5-16). Now grasp the right main sling webbing with your left hand. With your right hand, locate the right leg strap quick-ejector snap and release it upon water entry (fig. 5-17). Your

540'132



Figure 5-16.—Aircrewman releasing left leg strap quick-ejector snap.



Figure 5-17.—Aircrewman releasing right leg strap quick-ejector snap.

buttocks must be well back into the harness seat at all times. After you have entered the water release your parachute harness and get out of it; in the water the parachute can quickly become your worst enemy. It can easily drag you under and cause you to drown; therefore, it is important for you to get out of your harness as quickly as possible.

To remove the harness, place your right hand between your body and the right main sling (fig. 5-18); turn 90 degrees to the left and roll out of the harness (fig. 5-19).

A fact that may not be obvious is that when you bail out of any aircraft equipped with multiplace life rafts, such as the P-3, you will

not have a life raft available when you reach the surface. Even if the life rafts are jettisoned before bailout, your chance of landing close to one is very remote; therefore, you will have to depend entirely on your life preserver for flotation.

Life Rafts

Naval aircraft are required to carry enough life rafts to meet the needs of the aircrewmembers in the event of a crash landing at sea. Some aircraft carry the LR-1, a one-man life raft designed to be carried in a soft pack or a seat survival kit (SKU and RSSK), and the helo backpack.



Figure 5-18.—Aircrewman placing right hand between body and right main sling.

5-12

The Navy maintains four sizes of multiplace life rafts—the LRU-12, 13, 14, and 15. These life rafts are installed in aircraft that have the capability of carrying a large crew or a large number of passengers. To select the proper life raft for an

aircraft, refer to the *Allowance List*, NAVAIR 00-35QH-2. There is also a listing by aircraft in the *Inflatable Survival Equipment Manual*, NAVAIR 13-1-6.1. The Navy also uses some aircraft that are civilian-contractor maintained,



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Figure 5-19.—Aircrewman turning 90 degrees.

such as the C-9, C-12, and C-44. These aircraft carry life rafts that vary in capacity from 7 to 25 persons.

Three basic designs of life rafts used in naval aircraft are shown in figures 5-20, 5-21, and 5-22.

LR-1 LIFE RAFT ASSEMBLY.— The LR-1 assembly (fig. 5-20) consists of a one-man life raft and an inflation assembly (CO₂ cylinder with inflation valve). The life raft has a single flotation tube with a noninflatable floor. It is 6 feet long when fully deployed. It is blue and features a weather shield, a sea anchor, a sea anchor pocket, and ballast bags with a retaining line and pocket.

- The weather shield is sea blue on the outside and fluorescent red on the inside. It is sewn to coated cloth tape, which is cemented around the periphery of the life raft. When the securing straps (which are manufactured from hook-and-pile tape) are properly positioned, the hooks interweave with the pile to hold the weather shield in a stowed condition.

- The sea anchor is attached to one end of the lanyard and is stowed in a pocket outboard

of the flotation tube. The other end of the lanyard is attached to a ring located at the bow end of the raft.

Inflation Procedures.— There are two inflation systems for the LR-1 life raft. The CO₂, a mechanical system, inflates the raft within 30 seconds and is normally used during parachute descent. If the mechanical system fails, the oral inflation system is used to inflate the raft. The oral inflation system consists of a length of rubber tubing; an oral inflation valve with a rubber mouth piece and a knurled, locking collar. The oral inflation valve may be used in topping or relieving pressure from the flotation tube; this may become necessary because of temperature changes from daytime to nighttime. The raft should not be inflated drum tight, as it will ride more comfortably in choppy seas if the pressure is slackened.

Righting Procedures.— The LR-1 life raft is equipped with boarding handles to assist the survivor in boarding the life raft. You can easily right the LR-1 life raft by grasping the boarding handles on the flotation tube and turning it over.

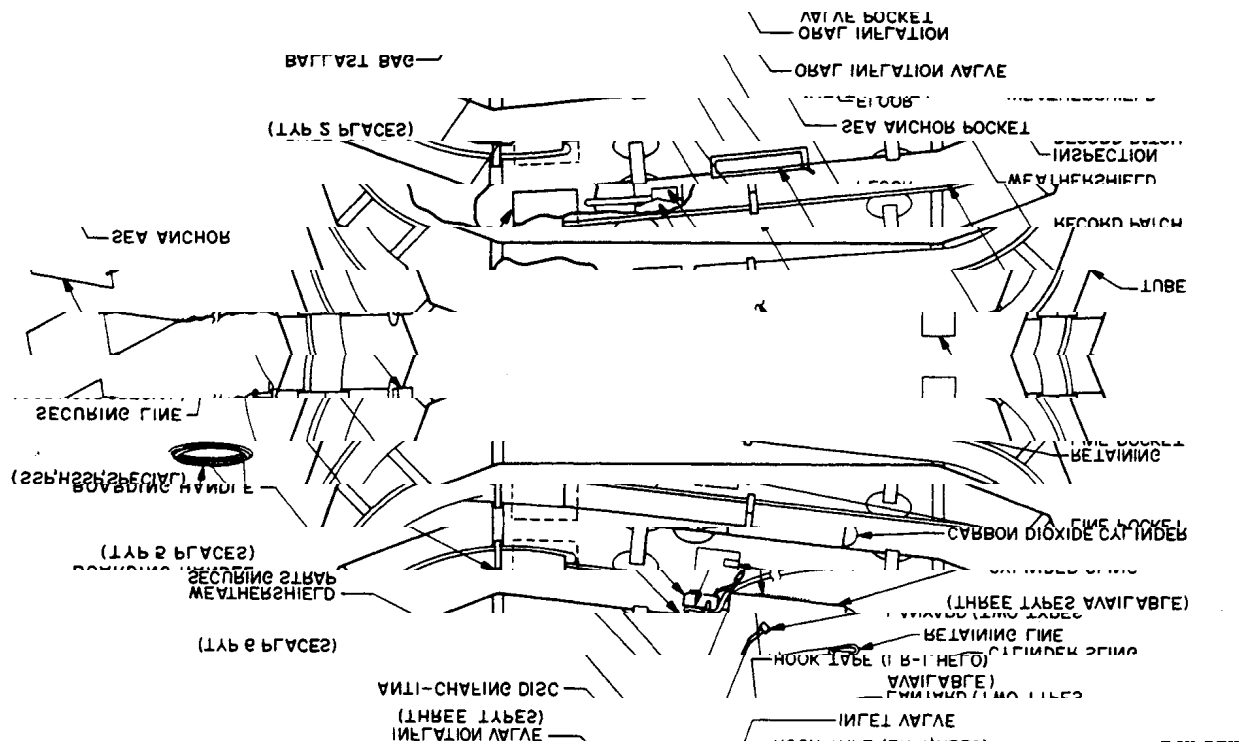


Figure 5-20.—LR-1 life raft assembly parts nomenclature.

Boarding Procedures.— The design of the LR-1 life raft makes it easy to board. Approach the life raft from the small end. One end is noticeably smaller than the other. Grasp the small end of the flotation tube with both hands. Locate the boarding handles and push the life raft down into the water. To board the raft, pull your body into the raft so that the upper body is completely inside. Once you are inside the raft, roll your body so that you are lying face up or in a sitting position. Now deploy the sea anchor. The sea anchor reduces drifting. Adjust the length of the sea anchor securing line so that the sea anchor

rests in the wave trough and causes the life raft to ride on the crest of the wave. Always remain attached to the raft; if it capsizes in rough water or during high winds, it will be lost if not securely fastened to you.

LRU-12/A LIFE RAFT ASSEMBLY.— The LRU-12/A, 13/A, and 14/A are very similar in design. The basic difference is size. The LRU-12/A carries 4 survivors, the LRU-13/A carries 7, and the LRU-14/A carries 12. Of the three, only the LRU-12/A life raft is discussed in this chapter.

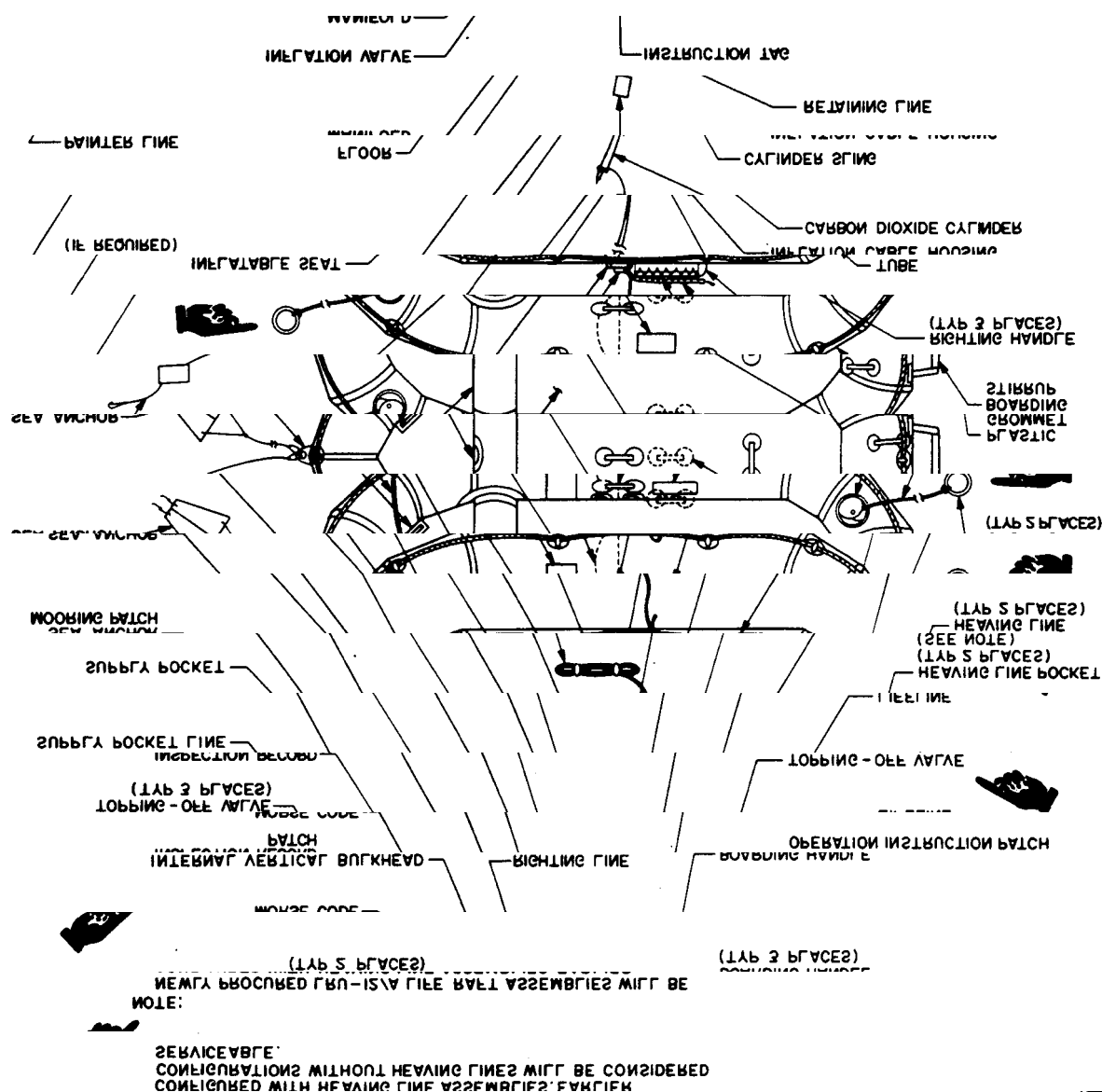


Figure 5-21.—LRU-12/A life raft assembly parts nomenclature.

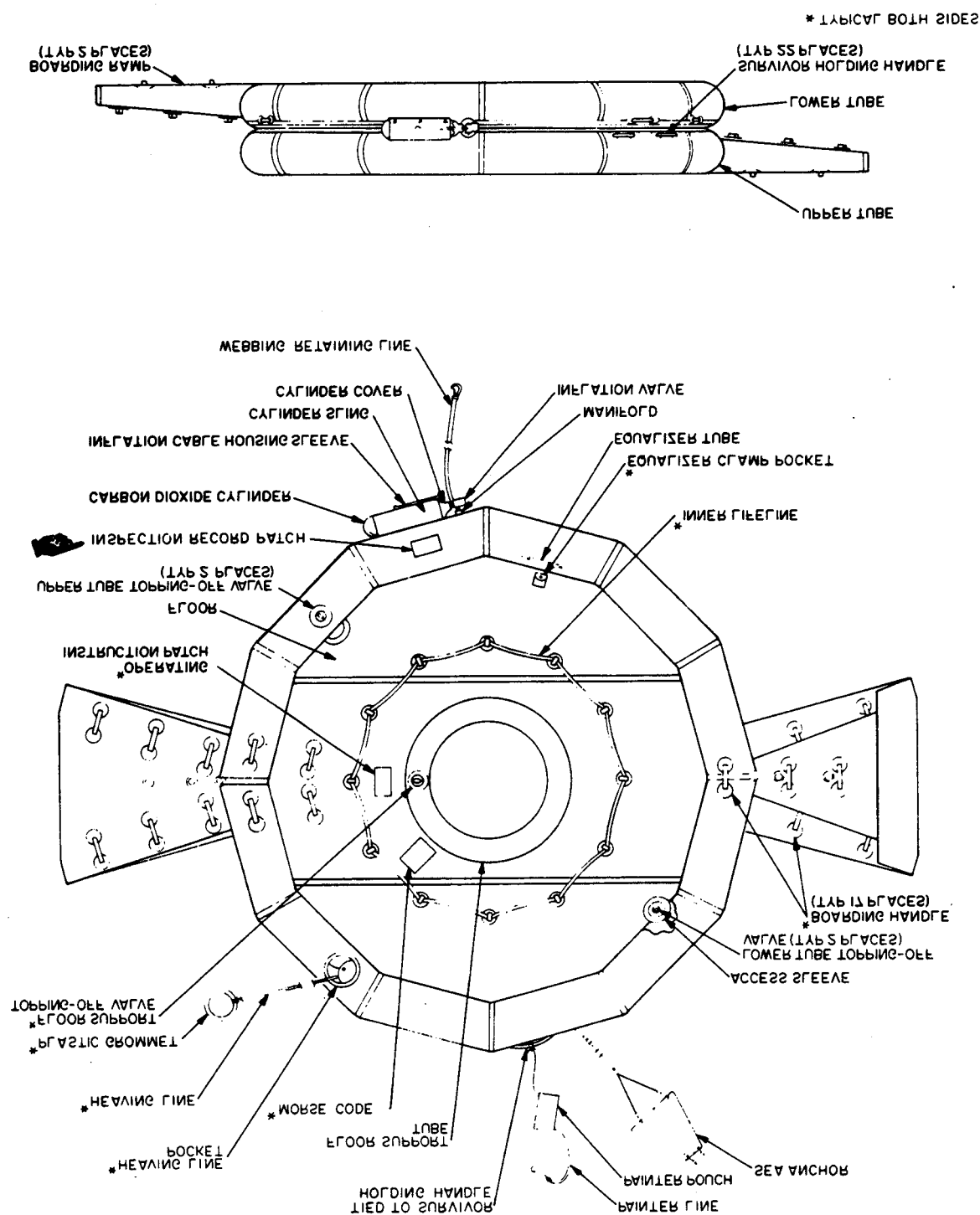


Figure 5-22.—LRU-15/A life raft assembly parts nomenclature.

The LRU-12/A life raft assembly (fig. 5-21) consists of a four-man inflatable life raft and an inflation assembly (a CO₂ cylinder with an inflation valve and a manifold). The life raft has an orange flotation tube that is divided into two separate compartments by two internal vertical bulkheads. These two compartments are called the bow and the stern. The raft has a noninflatable floor with an inflatable seat in the bow section. This seat is manually inflated through the topping-off valve using the hand pump. A lifeline encircles the flotation tube. A righting line and accessory-container securing line are attached to the lifeline. Survival equipment is stowed in the accessory container and a supply pocket attached to the flotation tube. A sea anchor is attached to the bow, a boarding stirrup is attached to the stern, and heaving lines equipped with rubber weights are attached at each end. Two topping-off valves and four boarding handles are located on the tube. Three righting handles are located on the underside of the life raft floor. Two boarding handles are located on the topside of the floor, one amidships in the center, the other athwartships towards the stern. The life raft CO₂ inflation

assembly and accessory container are contained in the LRU-12/A carrying case. When the life raft is fully inflated, it measures 9 1/4 feet long.

Inflation Procedures.— Like other flotation equipment, the LRU-12/A has a CO₂ type of inflation system. This system can be installed to operate automatically or manually, depending upon aircraft installation.

The LRU-12/A is also equipped with a hand pump for manually inflating the two-section flotation tube and/or the inflatable seat and is stowed in the accessory container. The pump-attaching fitting and the topping-off valve are designed to allow a positive connection. To use the hand pump, follow the steps listed below:

NOTE: In the absence of a CO₂ type of inflation system, manual inflation starts with the seat section. It fills quickly and provides flotation for the raft while the main flotation tubes are being inflated.

● Screw the inflation end of the assembly hose of the hand pump into the topping-off valve (fig. 5-23).

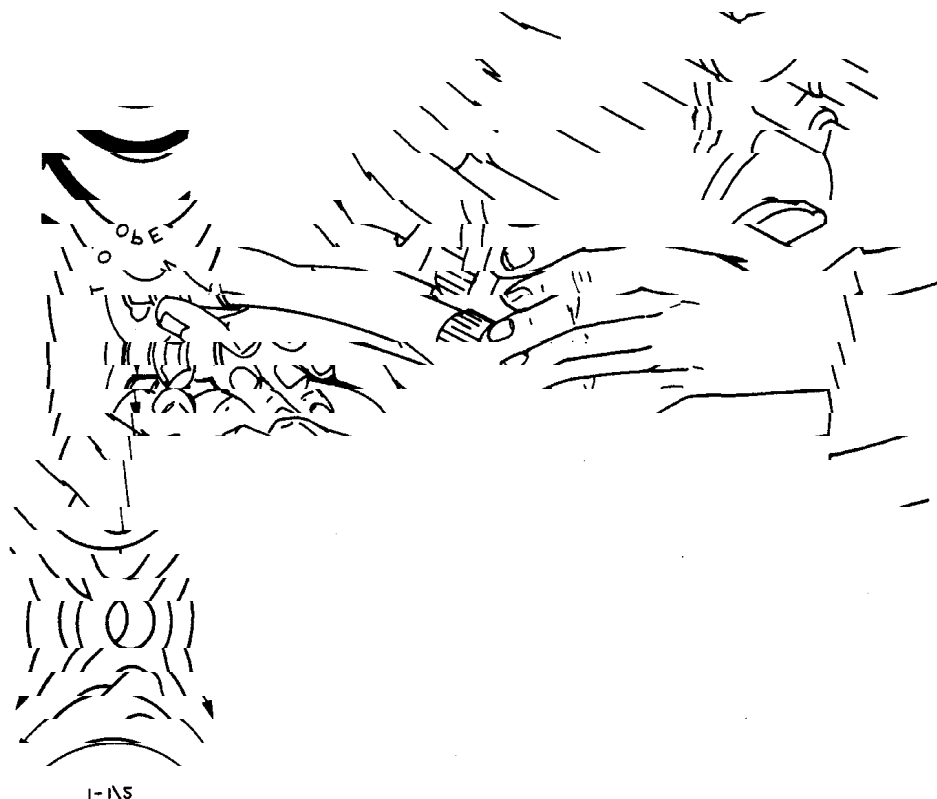


Figure 5-23.—Survivor holding the hand pump while attaching the assembly hose to the topping-off valve.

- Turn the topping-off valve cap 1 1/2 turns to the right when the assembly hose is attached.

- Pump the handle until desired inflation is achieved.

- Then turn the valve cap 1 1/2 turns to the left.

- Remove the hand pump and secure it in the accessory container.

NOTE: The main flotation tube is divided into two separate sections by an internal bulkhead. This design feature prevents the life raft from completely deflating if for some reason the tube is punctured.

Righting Procedures.— The LRU-12/A life raft may inflate upside down. To correct this problem proceed as follows:

1. Locate the righting line on the side of the raft opposite the CO₂ bottle.
2. Toss it over the life raft on the side where the CO₂ bottle is located.
3. Grasp the righting line and climb onto the bottom of the raft. Pull the righting line from the far side and at the same time stand up and push the near side of the life raft away with your feet. This will cause the life raft to flip over.

Boarding Procedures.— In most cases, there are four or more survivors in the water. Upon reaching the life raft, grasp the lifeline to keep the raft from drifting away until your turn to board. Use the boarding stirrup and the boarding handles at the stem to board the life raft; survivors should board one at a time.

The first survivor to board the life raft should assist the remaining survivors and ensure the life raft loading is balanced to protect against overturning.

LRU-15/A LIFE RAFT ASSEMBLY.— The LRU-15/A life raft assembly (fig. 5-23) consists of a 20-man life raft and an inflation assembly (CO₂ cylinder with an inflation valve). The raft is orange and has two single compartments, circular flotation tubes connected by an equalizer tube, a noninflatable floor suspended between the two flotation tubes, and two boarding ramps. One ramp is attached to each tube on opposite sides of the raft. The floor has an inflatable floor support. The life raft also features a sea anchor,

a lifeline, boarding handles, and topping-off valves located on each side of the flotation tubes and floor support. The life raft and accessory container are contained in the LRU-15/A carrying case. The life raft assembly is stowed either in an accessible area inside the fuselage (droppable type) or in a life raft compartment (wing or fuselage installation) of the aircraft.

Inflation Procedures.— The wing-installed LRU-15/A life raft assembly is automatically ejected and inflated from the life raft compartment of the aircraft when the compartment door is released. To inflate the droppable LRU-15/A life raft, you perform the following steps:

- Locate the inflation assembly actuating handle outside the end flap of the carrying case.

- Pull the actuating handle with sufficient force to actuate the inflation assembly. Ensure that adequate space is provided for the raft to inflate.

NOTE: This is a very large life raft and should never be inflated inside an aircraft.

Righting Procedures.— Because of the large size and cumbersome configuration of the LRU-15/A life raft, it is designed with identical components on each side so that the raft is always right side up.

Boarding Procedures.— Survivors should board the LRU-15/A using the boarding ramps on the lower flotation tube (boarding is possible over the ramp attached to the upper tube but is extremely difficult and therefore not recommended). As you board the life raft, grasp the handles provided and kick with your feet to pull yourself into the life raft. Boarding can be accomplished more easily and quickly if survivors are assisted by those who board first.

The first person in the life raft is responsible for installing the equalizer clamp. The clamp is in a pocket located next to the equalizer tube. The equalizer clamp is necessary to prevent the life raft from completely deflating in the event one side of the life raft has a tear or puncture.

RAFTSMANSHIP.— We assume that with all the advanced rescue equipment and technology available to the Navy, a rescue can be effected in a few hours. However, the possibility exists that you may spend days or even weeks at sea.

Common sense is the best survival tool you will have aboard the life raft. The following dos and don'ts will help you survive in a life raft at sea.

Dos.— The following are helpful things to do while you are trying to survive in a life raft at sea:

- Stow all sharp objects and equipment that might abrade or puncture the raft fabric.
- Ensure all survival equipment is tied to the life raft. This prevents loss if any item is dropped over the side.
- Secure yourself and other survivors to the raft, in case it capsizes. Rough water or a strong wind can easily separate a raft from a survivor.
- Ration all food and water. Rationing should be based on the minimum amount of food and water that will sustain life.
- Inventory all supplies daily.
- Take every precaution to prevent the life raft from turning over.
- Sit low in the life raft and distribute the weight to hold the weather side down.
- If there is more than one life raft, tie them together. When tying life rafts together, you should tie the first life raft at the stern and the second one to the bow. Since the LRU-15/A has no bow or stern, tie them together at any available point. If there are more than two LRU-15/A life rafts, the ties should be 180 degrees apart on the center raft.
- Allow approximately 25 feet of line between the life rafts; adjust the length of the line to correspond with the state of the sea.
- Adjust the sea anchor line so that the sea anchor will stay in the trough when the raft is at the crest of a wave.
- In very rough weather, keep a spare sea anchor rigged and ready for instant use in case the one that is deployed breaks loose. A spare sea anchor will have to be improvised as no spare is furnished; however, a paulin, casualty blanket, or signal panel can be used for this purpose.

● Be prepared to catch any rainfall, because water is essential to survival at sea.

Don'ts. — The following are some things that you should not do while trying to survive in a life raft at sea:

- Never eat any food unless an adequate amount of freshwater is available. The reason is that digestion depletes the body's fluid level. A person in relatively good physical condition can survive only about 6 days without water but can survive up to 40 days without food.
- Never drink seawater; it will cause nausea and vomiting, which further depletes the body's water level, and will eventually cause death. Seawater will not quench your thirst; it will increase your thirst.
- When fishing never tie your fishing line to the side of the life raft. A large fish can capsize your life raft.
- Never tie your fish catch to the life raft. You are inviting a larger fish to a meal.
- When you are using the Mk 13 day/night distress signal, never hold it near your life raft. The burning material will drip and can burn a hole in the flotation tube or the floor of the life raft.
- Avoid unnecessary moving around inside the life raft.

These are just a few dos and don'ts. By using common sense you will be able to add to this list.

Rafting Ashore. — Going ashore in a strong surf is dangerous. Take your time. Select the landing point carefully. Try not to land when the sun is low and straight in front of you. Try to land on the lee side of an island or on a point of land. Keep your eyes open for gaps in the surf line and head for them. Avoid coral reefs and rocky cliffs. Coral reefs do not occur near the mouths of freshwater streams. Avoid rip currents or strong tidal currents, which may carry you far out to sea. Either signal shore for help or sail around and look for a sloping beach where the surf is gentle.

If you must go through surf to reach shore, keep your clothes and shoes on to avoid severe cuts. Adjust and inflate your life vest. Trail

the sea anchor over the stern using all the available line. This will keep the life raft pointed toward the shore and prevent the sea from throwing the stern around and capsizing the life raft. Surf may be irregular and velocity may vary, so the procedure must be modified as conditions demand.

If you have a choice, do not land at night. If you have reason to believe that the shore is inhabited, lie away from the beach and signal; then wait for the inhabitants to come out and bring you in.

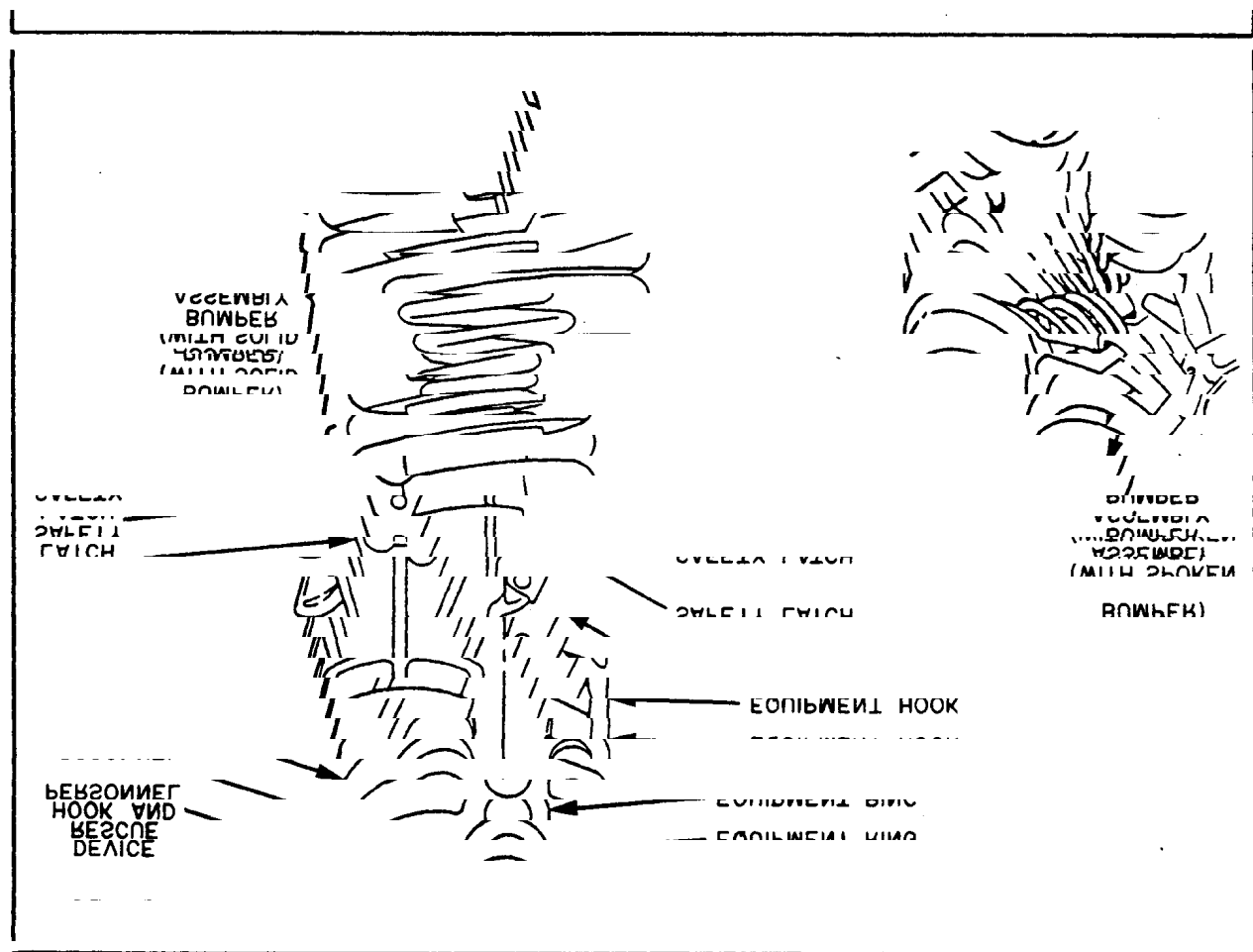
RESCUE DEVICES AND PROCEDURES

Rescue operations will normally be accomplished by helicopter and involve either maritime

(sea) or land conditions. In this chapter we will cover only maritime rescue.

Potential survivors should be aware that, in most cases, the helicopter will first mark the location of the survivor. The pilot will fly the helicopter directly over the survivor and then fly it away from the survivor's position. At this time one to three marine markers (flares) or electric sea marker lights will be dropped prior to the start of the rescue pattern. The survivors should take caution not to touch the markers, as they can be dangerous.

A naval helicopter assigned to operate as a rescue vehicle over water will have a rescue swimmer as a crewman. When the rescue swimmer is deployed, the survivor should remain



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Figure 5-24.—Rescue hook.

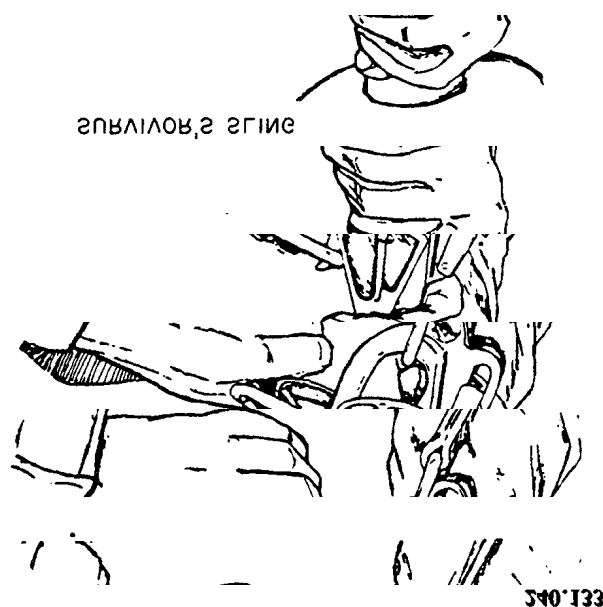


Figure 5-25.—Attaching the rescue hook to the gated D-ring.

in the life raft and await instruction from the swimmer.

The aviator and the aircrewman must be familiar with a number of rescue devices to ensure a successful rescue. These devices are covered in the *Aircrew Survival Equipmentman 3 & 2*, volume 1, NAVEDTRA 10328. In this chapter we will discuss the use of the various rescue devices.

In each case when a Navy helicopter is the rescue vehicle, the Navy rescue swimmer will be employed to effect the rescue. Follow the swimmer's instructions and do not assist his efforts unless directed by him to do so. Because other SAR forces may not employ a rescue swimmer to assist survivors, this text will explain procedures for assisted and unassisted rescue using the following rescue devices.

Rescue Hook

The rescue hook is the primary rescue device (fig. 5-24). All other rescue devices can only be used with the double rescue hook. In accordance with *Aviation Crew Systems Rescue and Survival Equipment*, NAVAIR 13-1-6.5, the large hook, rated at 3000 pounds, shall be the only hook used to hoist personnel; the small hook, rated at 1000 pounds, is to be used only for lightweight items such as mail. The equipment ring, rated at 1000 pounds, can be used to hoist light equipment and mail.

Hoisting personnel by the equipment ring or small hook can lead to failure of the ring or hook and can result in injury or death of hoisted personnel.

When wet and cold, an individual may have difficulty handling the latch on the rescue hook. However, by pushing down on the latch with the gated D-ring, you will force the latch open on either the hook or the gated D-ring (fig. 5-25).

Rescue Swimmer's Harness

During swimmer-assisted rescues, the swimmer's harness may be used to attach the survivor to the hoist cable. When the rescue swimmer's harness is selected as the rescue lifting device, the rescue swimmer uses the following procedure:

1. He approaches the survivor from the rear and pulls the chest strap from the pocket of the rescue harness.

NOTE: When connecting to a survivor who has an SV-2 vest, he ensures that the chest strap on the survivor is loosened slightly to avoid injury. If the survivor is wearing an integrated torso harness, he uses extreme caution to ensure that the gated D-rings are not disconnected before hoisting.

2. Connects the gated D-ring of the rescue swimmer's harness to the survivor's lifting device. The connection of the survivor's lifting device to the rescue hook will negate the survivor's quick release feature of the swimmer's harness.

3. Signals the aircraft "ready for pickup." When the rescue hook is lowered in the water, connects the lifting V-ring of the rescue swimmer's harness to the large rescue hook.

4. Signals the aircraft "ready for hoist."

NOTE: If the survivor is wearing an integrated torso harness, the swimmer ensures that the gated D-rings are not disconnected before hoisting. Upon reaching the aircraft door opening and while bringing in the survivor, he ensures that the gated D-rings do not twist and inadvertently disconnect.

5. Upon clearing the water, he places his arms and legs around the survivor.

Rescue Strop (Unassisted Rescue)

The rescue strop (sometimes called the horse collar or rescue sling) (fig. 5-26) is lowered attached to the rescue hook. The following is a step-by-step procedure for the survivor to don the strop and attach the rescue hoist:

1. Stand by as the rescue device is lowered.

WARNING

Do not touch the rescue device until after the hook makes contact with the water. This prevents any electrical shock that may occur because of static electricity buildup in the rescue device.

2. Swim to the rescue device. Grasp the free end of the rescue strop with your right hand and rotate your body clockwise, as shown in figure

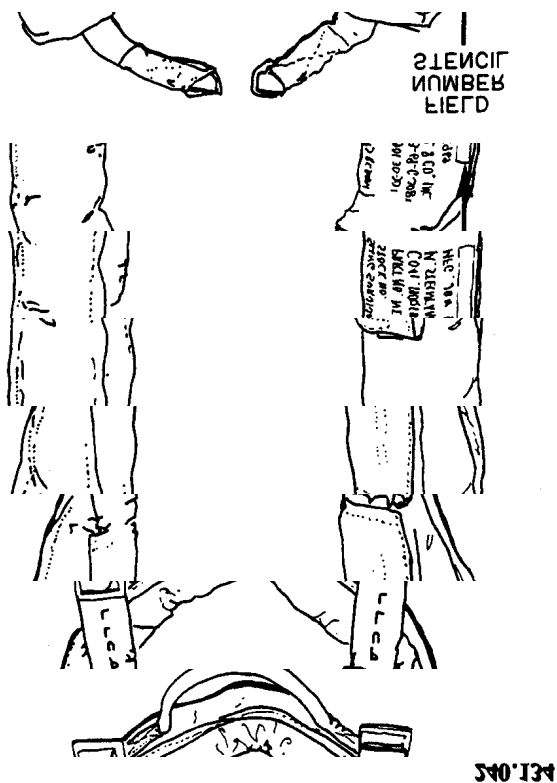


Figure 5-26.—Rescue strop (horse collar).

3. Attach the V-ring on the strop to the rescue hook, as shown in figure 5-28.

4. Grasp the two pull tabs of the retainer straps (fig. 5-29) and pull the straps out. Attach the quick-ejector snap hook to the V-ring and pull the strop tightly across your chest.

5. Ensure that the rescue strop is above the LPA/LPU waist lobes and high on your back. Give a thumbs-up signal to the hoist operator. Wrap your arms around the collar and keep your head down.

6. Upon clearing the water, cross your feet as shown in figure 5-30 and remain in this position until you are inside the helicopter.

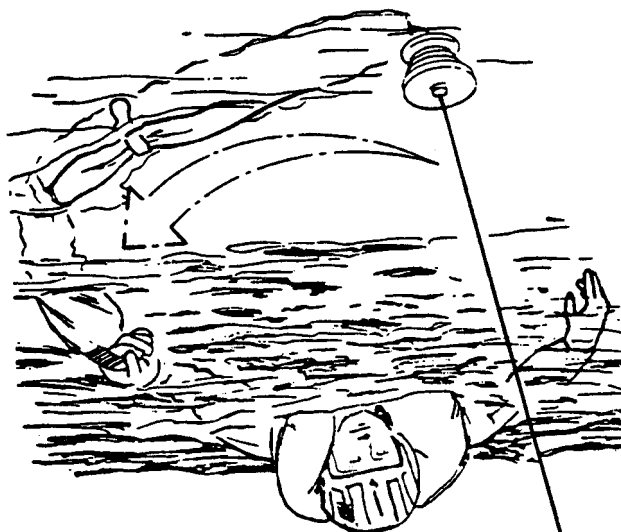


Figure 5-27.—Grasping the rescue strop.

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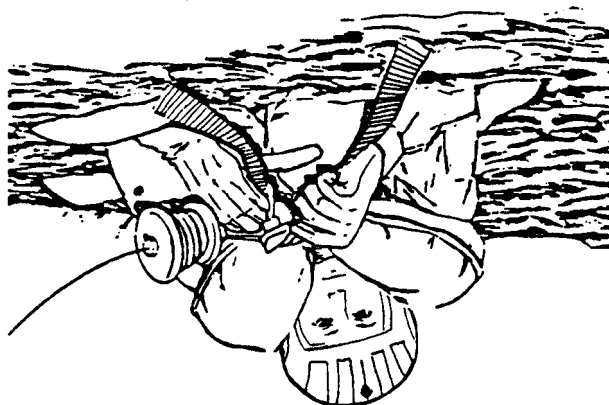


Figure 5-28.—Attaching the V-ring.

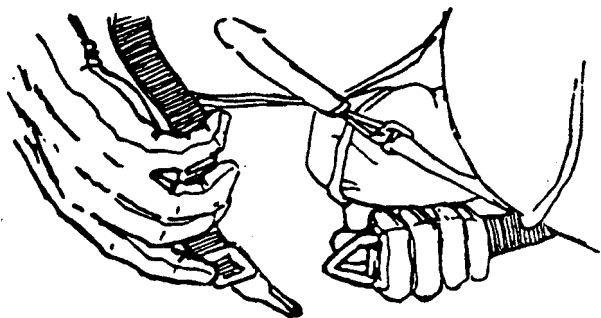


Figure 5-29.—Removing the pull tabs.

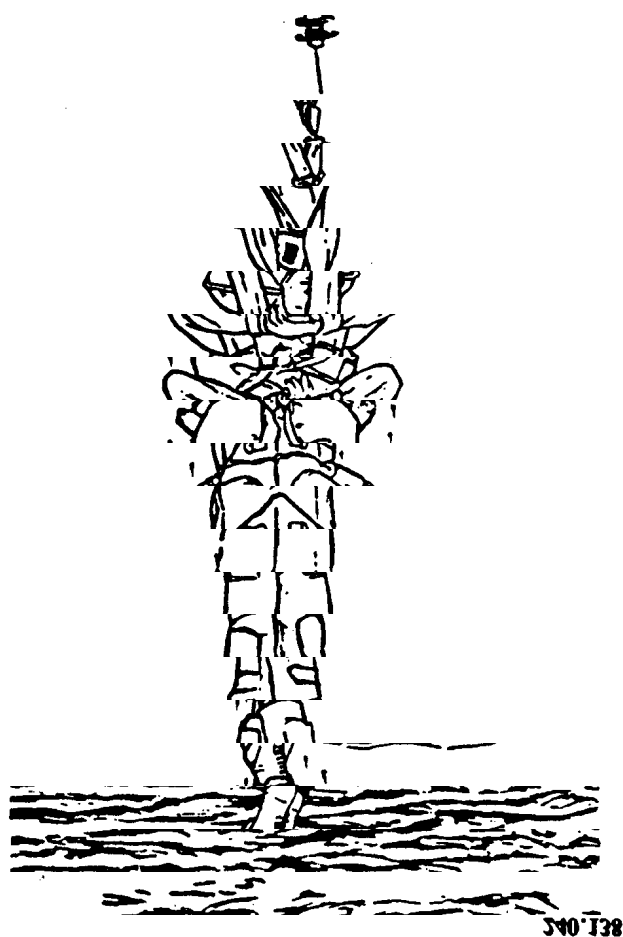


Figure 5-30.—Hoisting the survivor's sling.

NOTE: Do not, under any circumstances, attempt to assist with your entry into the helicopter.

RESCUE STROP (Horse Collar) (Swimmer-Assisted Rescue)

When the rescue strop (horse collar) is used during swimmer-assisted rescues, the rescue

swimmer uses the following procedure to attach the survivor to the hoist cable:

1. From the survivor's front, passes the free end of the rescue strop under one arm, around the back, and under the other arm.
2. Reconnects the V-ring to the rescue hook.
3. Pulls both retainer straps free and connects the quick ejector of one strap to the V-ring of the other strap and pulls them tight.

● If the survivor is wearing the Imperial dry suit, the retainer straps cannot be connected because of the bulky configuration of the dry suit and SV-2A survival vest with LPA.

4. Has the survivor fold his arms across the chest.
5. Signals the aircraft "ready for hoist."
6. The rescue swimmer and the survivor are hoisted up to the helicopter. After reaching the helicopter, the rescue swimmer assists the survivor into the helicopter.

Forest Penetrator

The forest penetrator, shown in figure 5-31, is used to assist rescue personnel in both land and

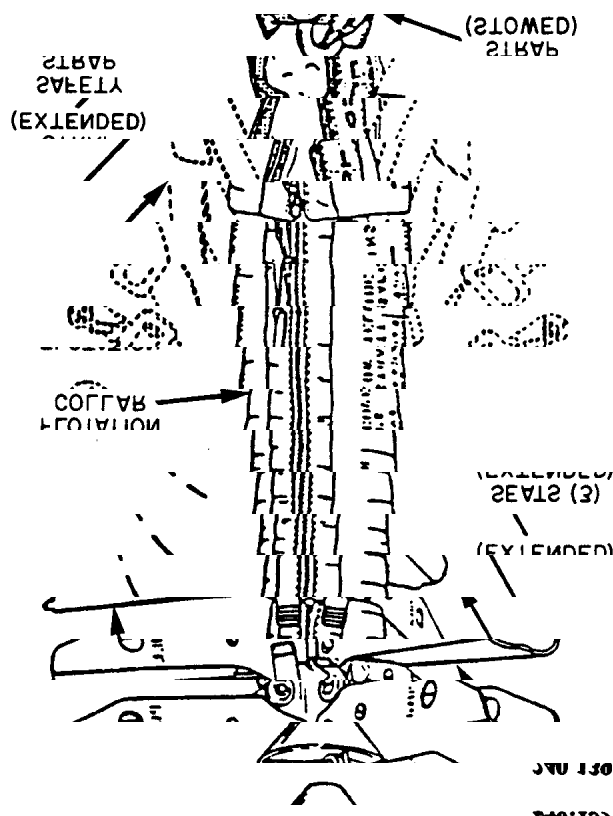


Figure 5-31.—Forest penetrator shown with flotation collar, seats, and safety straps extended.

sea rescue operations and is designed to accommodate one, two, or three survivors at a time; however, one at a time is best for entrance into the helicopter. During land rescue, the forest penetrator is lowered to the survivor with the three seats in the retracted position; during sea rescue, it is lowered with the flotation collar installed, a safety strap hanging free, and the three seats in the retracted position. In this configuration, the penetrator will float with its top 6 inches above the surface of the water.

The following is a step-by-step procedure for the survivor to safely use the forest penetrator:

1. Lower the visor on your helmet as you wait for the rescue device to enter the water.
2. Swim to the forest penetrator and lower one of the three seats. Sit on the lowered seat facing the flotation collar.
3. Grasp the free end of the safety strap and pass it around your body. Attach the adjustable quick-ejector snap to the forest penetrator and tighten the strap as shown in figure 5-32.
4. Give a thumbs-up signal to the hoist operator. As you are lifted from the water, put your arms around the penetrator and tuck your head down.

Forest Penetrator With Flotation Collar (Swimmer-Assisted Rescue)

During swimmer-assisted rescues using the forest penetrator with flotation collar, the



Figure 5-32.—Attaching the forest penetrator.

swimmer uses the following procedure to attach the survivor to the hoist cable:

1. After the penetrator is in the water, pulls down a seat for the survivor to sit on, facing the penetrator.
2. Disconnects a safety strap, passes it under the survivor's arm, around the back, and under the other arm. Reconnects the strap and tightens it.
3. Has the survivor wrap his arms around the penetrator.
4. Signals the aircraft "ready for hoist."
5. After the survivor is hoisted to the helicopter, the crewman assists the survivor into the helicopter.

Rescue Seat

The rescue seat can be used to lower and hoist personnel performing rescue operations from a helicopter over land or water. The rescue seat is designed to accommodate one survivor at a time. It is a buoyant aluminum device consisting of a hollow flotation chamber, a three-pronged seat, and a safety strap (fig. 5-33).

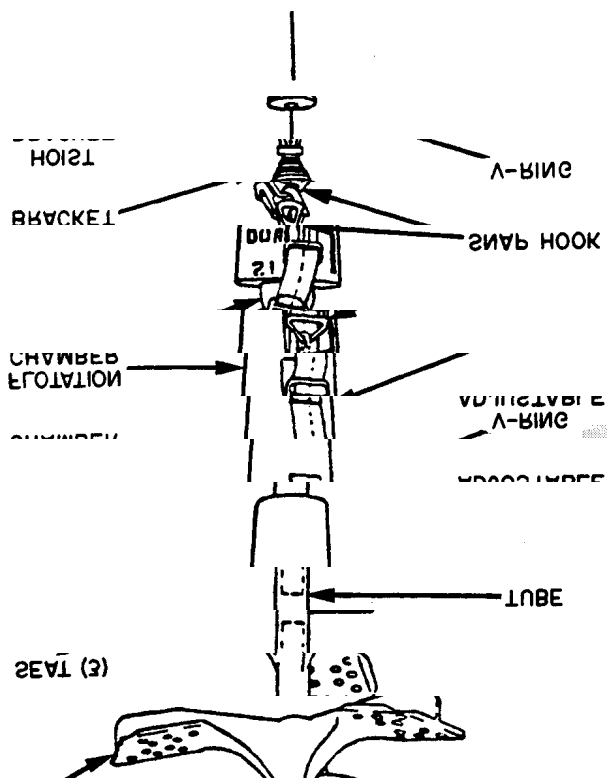


Figure 5-33.—Rescue seat.

The rescue seat is an optional rescue device and is not normally carried by all rescue-capable helicopters. However, it is a suitable substitute for the forest penetrator for some applications.

WARNING

Failure to assume proper position on rescue seat could result in serious injury if hard contact is made with aircraft during hoist operation.

ATTACHMENT PROCEDURE.—The following is an attachment sequence for the rescue seat:

1. Swim to the rescue seat. Draw it to you and position one of the three flukes of the seat between your legs.
2. Disconnect the snap hook of the safety strap from the V-ring, pull the safety strap free, pass it under your arm, around your back, and under the other arm; then reconnect the V-ring to the snap hook and tighten the strap.
3. Give a thumbs-up hand signal to the hoist operator, put your head down to the left, and wrap your arms around the rescue seat. Upon clearing the water, cross your legs as shown in figure 5-34.

RESCUE SEAT OPERATIONAL DIFFICULTIES.— Ensure that the safety strap is on and that you hold tightly to the flotation chamber. Do not lean back; it will cause the rescue seat to swing and tilt away from the rescue hook.

Rescue Seat (Swimmer-Assisted Rescue)

During swimmer-assisted rescues using the rescue seat, the swimmer uses the following procedures to attach the survivor to the hoist cable:

1. After the rescue seat is in the water, faces the flotation chamber and assists the survivor in sitting on the seat.
2. Disconnects the safety strap; passes it under one arm, around the back, under the other arm, and reconnects the V-ring to the rescue hook.
3. Tightens the strap.
4. Has the survivor wrap his arms around the flotation chamber.
5. Signals the aircraft “ready for hoist.”

WARNING

The survivor must not attempt to get off the rescue seat until directed by the crewman.

6. After the survivor is hoisted to the helicopter, the crewman assists the survivor into the helicopter.

Rescue Net

The rescue net is a simple and safe rescue device that can be used to hoist two survivors into a helicopter. It is designed for multiple rescue scenarios or for rescuing survivors who are unfamiliar with other rescue devices, such as the rescue strop or rescue seat. A lifting ring for hoisting is located at the top or upper portion of



Figure 5-34.—Rescue seat maritime rescue procedure.

the net, along with locking support rods. These rods incorporate sliding sleeves to prevent the net from collapsing while it is occupied. At the front of the net are two additional support rods that can be disconnected from the top section when it is stored. When in use, the rescue net tilts away from its open side. This design helps prevent survivors from falling out (fig. 5-35).

The following is a step-by-step procedure for the survivor to safely board the rescue net:

1. When the net enters the water, swim to the net and position the net with its opening directly in front of you. Grasp each of the lower support rib floats (fig. 5-36).
2. Pull yourself into the net and turn so you are facing the opening.
3. Move all the way to the back of the net with your back resting against the rear of the net and your arms and legs completely inside. Give a thumbs-up hand signal to the hoist operator and maintain a secure handhold during the hoist.

Rescue Net (Swimmer-Assisted, Single Rescue)

During swimmer-assisted rescues using the rescue net, the swimmer uses the following procedure to assist the survivor:

1. Places the rescue net opening directly in front of the survivor without disconnecting it from the rescue hook.
2. Places the survivor in a collar/equipment tow and swims into the rescue net backwards while positioning the survivor on either side of the net, facing out.
3. Ensures the survivor is completely inside the net.

WARNING

The survivor must not attempt to get out of the rescue net until directed by the crewman.

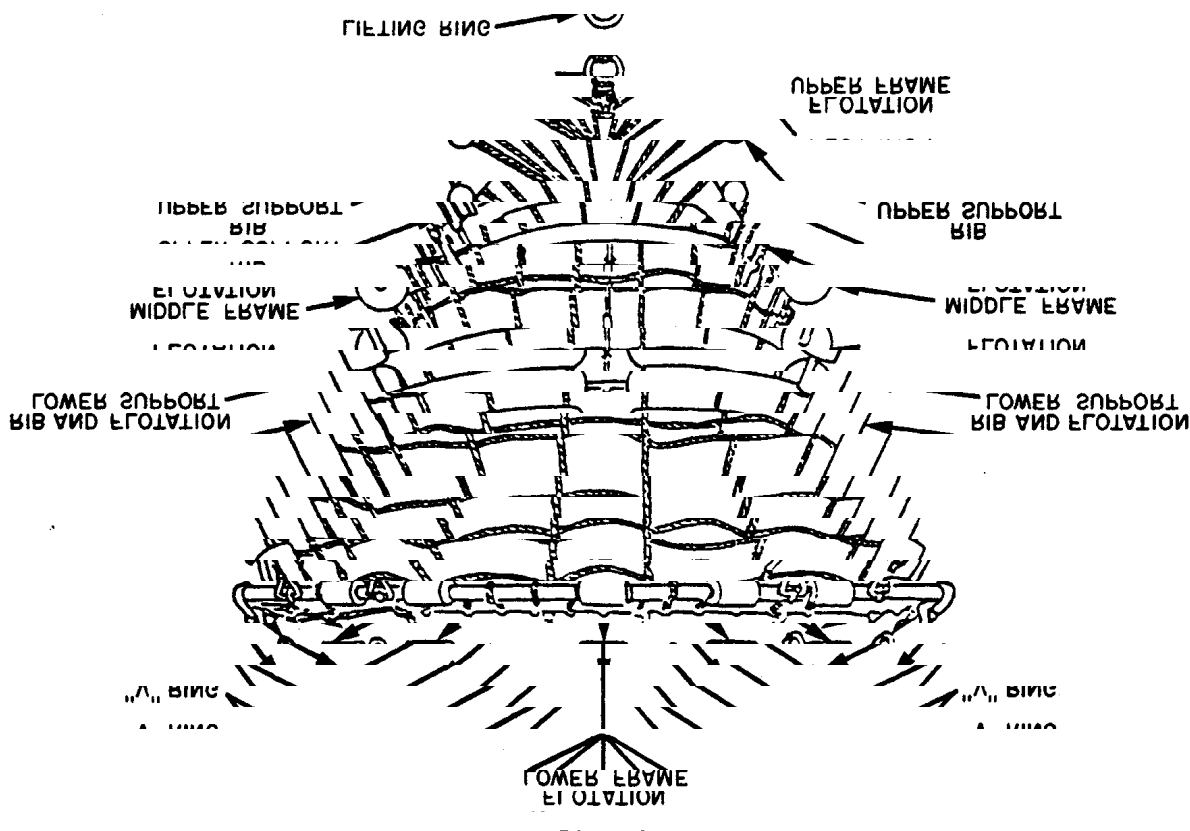


Figure 5-35.—Rescue net.

4. Places one arm across the net to ensure that the survivor cannot fall out and signals the aircraft when ready for hoisting. After reaching the helicopter, the crewman hooks up the safety strap from the rescue net to the decking of the helicopter. The crewman assists the survivor into the helicopter.

Rescue Net (Swimmer-Assisted, Multiple Rescue)

The following is a step-by-step procedure for the swimmer to-use when performing multiple rescues:

1. Places the rescue net opening directly in front of the survivors without disconnecting it from the rescue hook.
2. Has the survivors swim into the rescue net.

WARNING

The survivors must not attempt to get out of the rescue net until they are directed by the crewman.

3. Ensures that the survivors are completely in the rescue net with their legs inside. The survivors are hoisted to the helicopter. The crewman hooks up the safety strap from the rescue net to the decking of the helicopter. The crewman assists the survivors into the helicopter.

SEARCH AND RESCUE (SAR) COMMUNICATION

During rescue operations, it is essential that you use standardized communication procedures. Voice, hand, and signal communications are important in aiding a rescue. The primary means of communication is the survival radio carried by the aircrewman or supplied with the survival equipment. Instructions for using the radio are embossed on the radio case, and all crewmen must be familiar with the radio operations.

Radios

Depending upon available stock levels, air commanders may direct a particular radio to be used. If no particular type of survival radio is

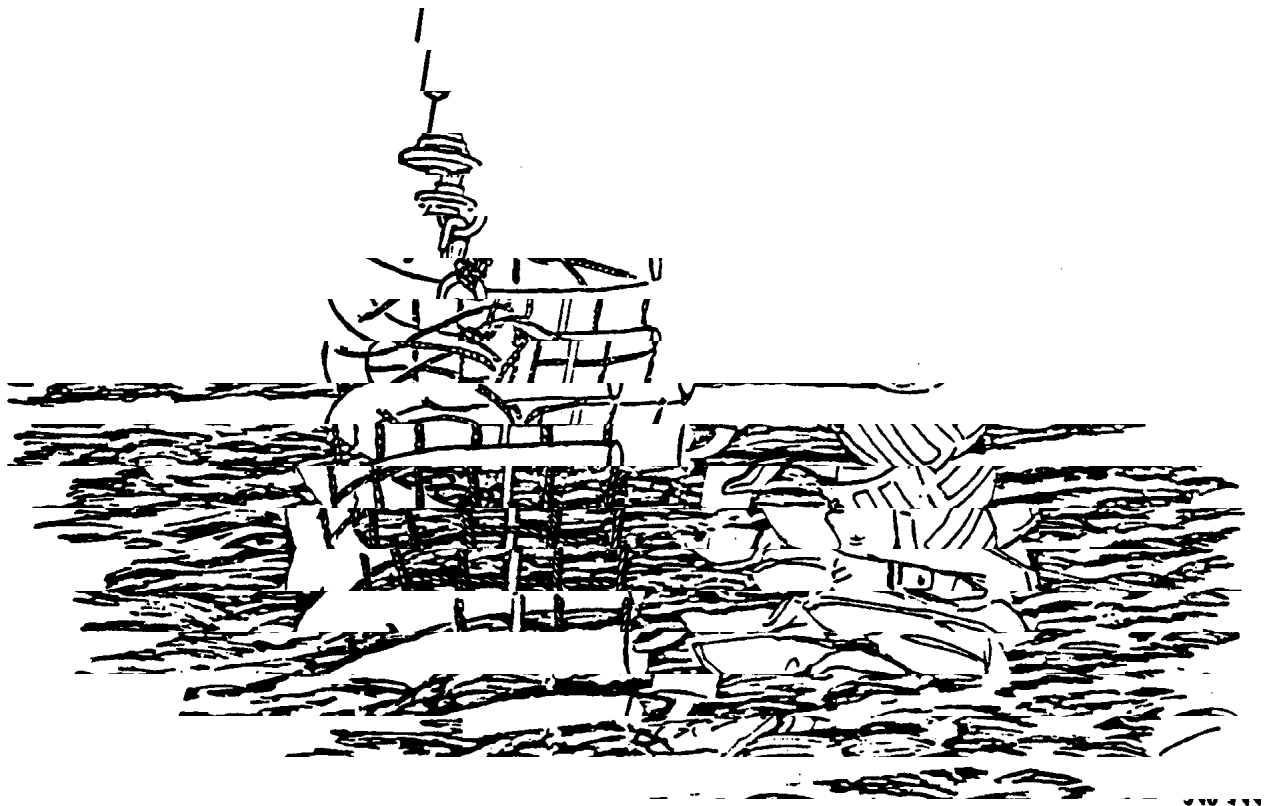


Figure 5-36.—Survivor entering the rescue net.

available, each life raft must have an AN/URT-33A beacon or AN/PRC-90 radio set. We will cover the AN/PRT-5, AN/URT-33A, and the AN/PRC-90 survival radios in this chapter.

In addition to the automatic direction finder (ADF) capability of SAR force aircraft, the United States government also uses satellites that monitor guard frequencies for emergency locator transmitter (ELT) broadcasts.

AN/PRT-5.— The AN/PRT-5 radio transmits a tone-modulated signal in both high- and ultrahigh-frequency ranges. The set has an inflatable collar assembly that allows it to float at sea or sit upright on land. The radio can operate continuously for 72 hours at 25°C (77°F). No provisions for voice or code communications or for receiving signals from search aircraft are available with this transmitter. The AN/PRT-5 radio operates on 243.0 and 8364 MHz. The assembly instructions and the directions for use are included with each set.

AN/URT-33A.— The AN/URT-33A beacon radio is a battery-operated radio that transmits a tone-modulated radio signal. The battery provides 72 hours of continuous operation. It must be pointed out that this beacon should not be used at the same time the AN/PRC-90 is being used, as the AN/URT-33 will interfere with the voice communication signal of the AN/PRC-90. When you are using the AN/URT-33, do not point the antenna directly toward the receiving aircraft because of the type of antenna employed; a conical area perpendicular to the antenna tip does not radiate a signal.

Do not attempt to use the telescoping antenna on the AN/URT-33A radio without first detaching the flexible antenna. Use of both antennae creates interference in the transmission patterns of both.

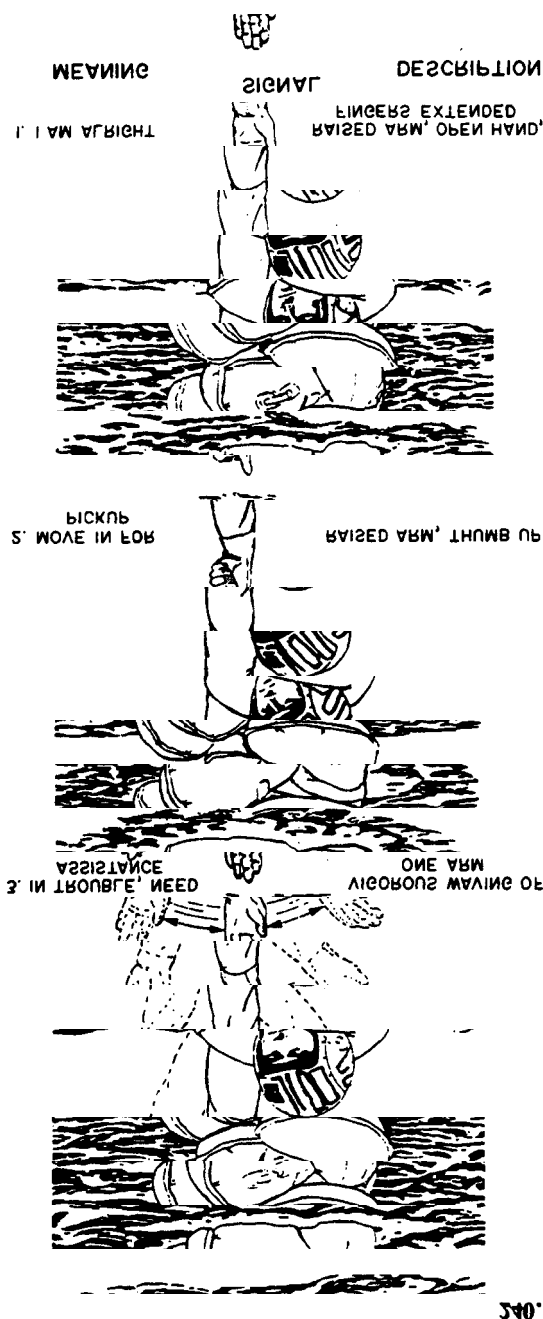
To turn the AN/URT-33A radio on, you must move the switch to a position where the word *ON* can be read. This may be confusing to the aircrewman, and the AN/URT-33A could be on when the aircrewman thinks it's OFF.

AN/PRC-90.— The AN/PRC-90 radio set is a dual-channel personal emergency rescue transceiver, used principally for two-way-voice or modulated-continuous-wave (MCW) communication between a downed aircrew member and a rescue aircraft. Provisions are included for

transmitting tone MCW and swept-frequency homing beacon signals to guide rescue efforts.

The AN/PRC-90 is battery powered and contains a flexible antenna, an interchangeable telescopic antenna, a function switch (knob and indicator), an MCW button for Morse code, a volume control dial, and an earphone.

When you are using the voice mode, the AN/PRC-90 is capable of transmitting up to 60 nautical miles (nmi) and up to 80 nmi on beacon or code. A rule of thumb is that this and other survival radios are limited to a line-of-sight



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Figure 5-37.—Rescue hand signals.

transmitting capability. Because of this line-of-sight imposition, you should try to transmit from the highest point in the area. All survival radios should be held at least 14 inches above the surface for best results. Signal range increases proportionally with the altitude of the search aircraft provided the line of sight is not obstructed. Degradation can be expected when the radio set is operated in bad weather and inside areas of rugged terrain. The radiated ranges given are obtained when

the half-wave antenna is used; the range is typically one-third less when the quarter-wave antenna is used.

Hand Signals

Hand signals are used by all helicopter crewmen. All aircrew members must be thoroughly familiar with the rescue hand signals to ensure the success of the rescue attempt. All aircrewmen must memorize the hand signals shown in figures 5-37, 5-38, and 5-39.

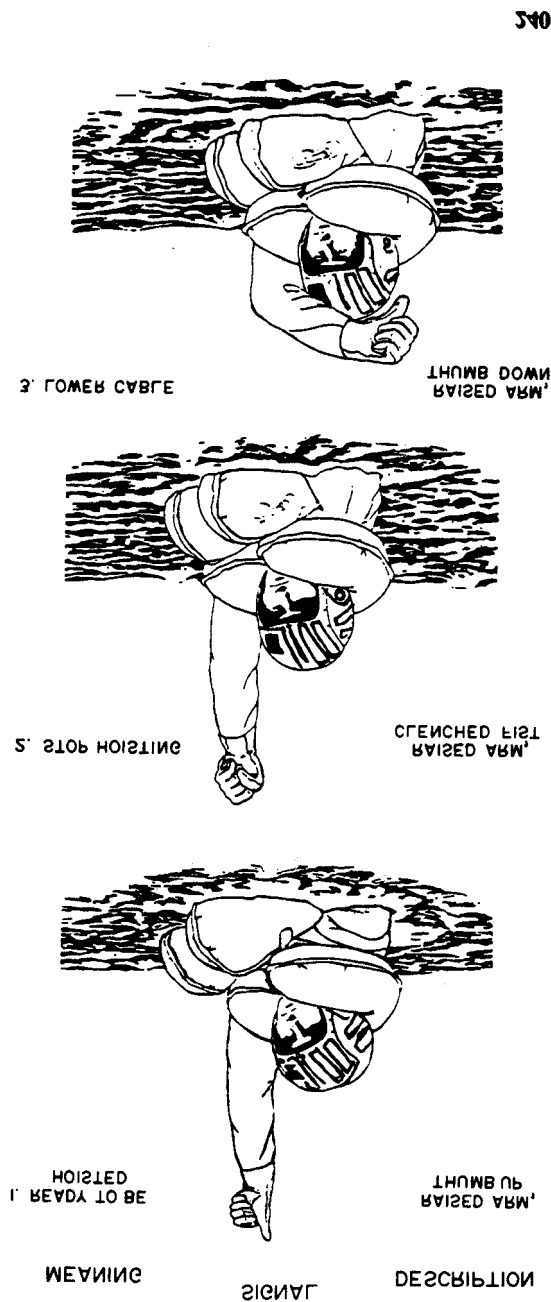


Figure 5-38.—Signals to the hoist operator after hookup to the rescue hook.

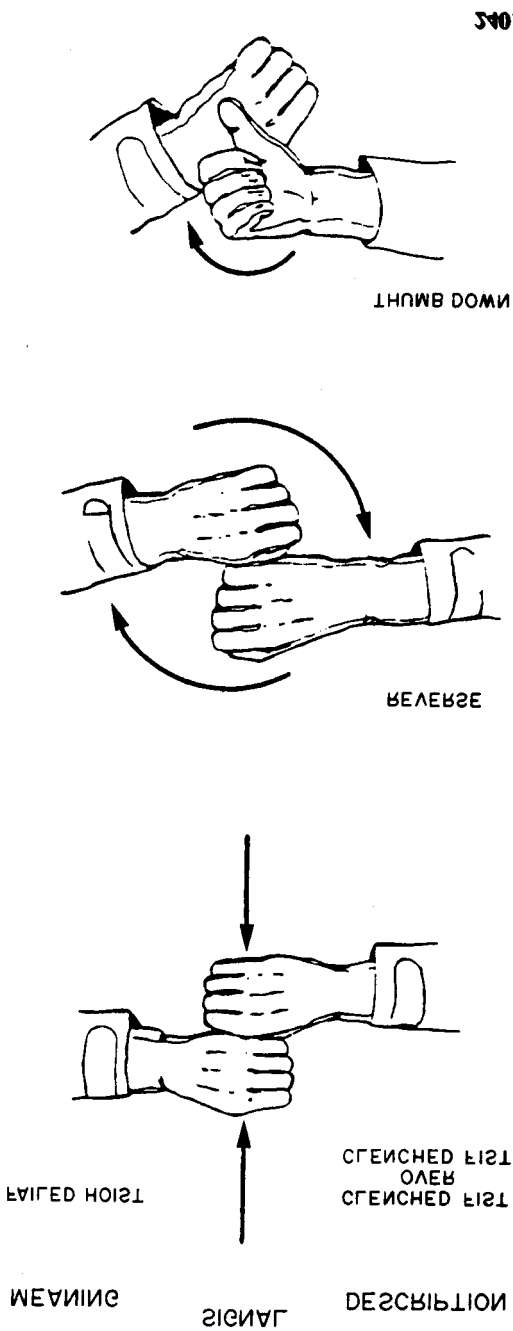


Figure 5-39.—Signals from the hoist operator after hookup to the rescue hook.

SURVIVAL

When an aircraft must be ditched or crash-landed, the sudden shifting of cargo or equipment may cause injury or loss of life. Therefore, it is important to secure any loose gear that may not be tied down and recheck cargo for security of tiedowns. Emergency gear, such as life rafts, water, food, and first-aid kits, should be placed in the aircraft where it can be easily removed in the event of a crash landing. Each type of aircraft has different ditching or crash-landing procedures. Therefore, you should refer to the NATOPS manual for ditching procedures of each specific aircraft.

LAND SURVIVAL

Once your aircraft has crash-landed, clear the aircraft as soon as possible. If you have time, remove the emergency supplies from the aircraft.

- Once the aircraft is cleared, stay a safe distance away until the engines have cooled and any spilled fuel has evaporated.

- Set up temporary shelter for protection from the wind and rain. If a fire is needed, start it at once.

- Get your emergency radio operating and have other signaling equipment, such as flares, ready for immediate use.

- Now relax and rest until you are over the shock of the crash. Leave extensive preparations and planning until later.

- After you rest, organize the camp. Appoint individuals to specific duties. Inventory all food and equipment. Look for a water supply. Prepare a shelter for protection from rain, hot sun, snow, wind, or cold. Collect all possible fuel for fires. Try to have at least a day's supply of fuel on hand. Look for food.

- Prepare signals that can be recognized from the air. Spread a parachute canopy out. This will be a good signaling aid for search aircraft.

If you have bailed out, try to make your way to the crashed aircraft. The rescuers can spot it from the air even when they cannot see a person.

Stay with the aircraft unless briefing instructions have been to the contrary. Do not leave the

aircraft crash area unless you know you are within easy walking distance of help. If you travel, leave a note giving planned route (except in hostile territory). Stick to your plan so rescuers can locate you.

You are the key man in the rescue. Help the search parties to find you and follow their instructions when they sight you.

ARCTIC SURVIVAL

Most people, when they think of arctic survival, think of trying to survive on an ice float at a temperature of -50° below zero without shelter or the possibility of getting food. This is not true.

Even on the ice pack, a person who is properly prepared can survive. Many of the arctic regions have abundant plant and animal life. The arctic regions are not too different from some regions of the United States.

Shelter

In the Arctic, as in any area, a shelter can be improvised from parts of the aircraft and emergency equipment or from natural materials in the vicinity.

The kind of shelter that is made depends on whether protection is needed from rain, cold, heat, sun, or insects, and also whether the camp is only for a night or for many days.

Choose the location for the camp carefully. Try to be near fuel and water—especially water.

ARCTIC WINTER.— Do not live in the aircraft—it will be too cold. Try to improvise a better insulated shelter outdoors.

Camp in an area of timber, if possible, to be near fuel. If you cannot find timber, choose a spot protected from wind and drifting snow. Do not camp at the bases of steep slopes or cliffs where snow may drift heavily or come down in avalanches or in areas where you run the risk of floods, rockfalls, or being battered by winds.

In timbered country, a good winter shelter is a lean-to. Lay the covering boughs shingle fashion, starting from the bottom. If you have a piece of parachute nylon, use it for the roof. Close the ends with fabric or boughs.

Keep the front openings of all shelters crosswind. A windbreak of snow or ice blocks set close to the shelter is helpful.

In making shelters, remember that snow is a good insulator. In timberless country, make a

simple snow cave or burrow by digging into the side of a snowdrift and lining the hole with grass or brush. Snow caves must be ventilated. If the snow is not deep enough to support a roof, dig a trench in a drift and roof it with snow blocks or other materials.

In wooded country, make a tree-pit shelter if snow is deep enough. Enlarge the natural pit around a tree trunk and roof it with any available covering.

Prevent carbon monoxide poisoning by providing good ventilation in closed shelters in which a fire is burning.

Do not sleep directly on the snow. Put insulation under your sleeping bag or body. Lay a thick bough bed shingle fashion; or use seat cushions, a parachute canopy, or even an inverted and inflated life raft if available.

ARCTIC SUMMER.— If you stay with the aircraft, use it for shelter. Cover openings with netting or parachute cloth to keep insects out. Do your cooking outside to avoid carbon monoxide poisoning. Make your fire at a safe distance from the aircraft.

Make a simple outdoor shelter by hanging a parachute over the wing of the aircraft; anchor the ends to the ground by weighting them down with stones. You can quickly improvise a tent by placing a rope or pole between two trees or stakes and draping a parachute over it; make the corners fast with stones or pegs.

Shelter against rain and insects will be needed. Choose a campsite near water but on high, dry ground if possible. Stay away from thick woods, as mosquitoes and flies will make your life miserable. A good campsite is a ridgetop, the shore of a cold lake, or a spot that gets an onshore breeze.

A fine shelter for drizzly weather and protection against insects is a tepee made from the parachute. In it you can cook, eat, sleep, dress, and make signals—all without going outdoors. Use 6 panels of parachute for a two-man shelter and 12 to 14 panels for a three-man paratepee. This shelter is worth building if you decide to stay in one spot for some time.

Avoid sleeping on the bare ground. Provide some sort of insulation under yourself; soft boughs or an inflated life raft provides excellent insulation. Pick a bed site on level, well-drained ground free from rocks and roots. If you have to sleep on bare ground, dig depressions for your hips and shoulders and try out the site before you set up your shelter or spread your bedding.

Signaling

Build your fire on a platform so that it will not sink in the snow. A standing spruce tree near a timberline burns readily even when green. Build a “bird nest” of quickly flammable material in the branches to ensure a quick start. Tramp out signals in the snow. Fill them in with boughs, sod, moss, or water colored with fluorescent dye.

In brush country, cut conspicuous patterns in vegetation. In tundra, dig trenches; turn sod upside down at the side of the trench to widen your signal. A parachute tepee stands out in the forest or on the tundra in summer, especially at night with a fire inside.

Remember, sound does not carry well through snow. If the entire party is in a snow cave or igloo, you may not hear rescue aircraft. Keep someone on guard as a spotter. Build the spotter a windbreak but do not roof it.

Signal with smoke by day and bright flame by night. Add engine oil, rags soaked in oil, or pieces of rubber (matting or electrical insulation) to the fire to make black smoke; add green leaves, moss, or a little water to send up billows of white smoke. Keep plenty of spare fuel on hand.

Signaling aids, such as flares and smoke grenades, must be kept dry. Use them only when friendly aircraft are sighted or heard.

Signal with a flashlight or, if the aircraft landing lights are intact and you can get the engine to run, remove the lights and extend them for signaling; but do not waste the battery—save it for the radio.

Arrange your ground signals in big geometric patterns rather than at random—they will attract more attention that way.

Use the fluorescent dye available in the life raft or life preserver kit for signaling on water or snow. Use it carefully; a little goes a long way. Use it only downwind because the fine dye will penetrate clothing or food. On rivers, throw it out into the current for a quick spread.

Water Problems

Water is not a serious problem in the Arctic. An abundant supply of pure water is available from streams, lakes, ponds, snow, and ice. Pollution should not be a problem. The Arctic is an area that is usually too cold for bacterial growth. Therefore, in the Arctic almost any source of water can be used.

During the winter, melt snow or ice for drinking water. Do not eat unmelted snow or

ice; this lowers your body temperature and thus reduces endurance. One way you can melt snow or ice for drinking water is to put ice or snow in a plastic water bag and place it between the outer layers of your clothing.

If your fuel supply permits, it is better to drink hot water in cold climates. Hot liquids are a rapid and effective source of internal warmth.

DESERT SURVIVAL

There are more than 50 named deserts in the World. Deserts cover nearly one-fifth of the earth's land surface. Therefore, the aircrewman must have a good knowledge of desert survival.

Deserts have extreme temperatures; hot days and cool nights are common. You may think of a desert as always being hot and dry. However, in winter months, the desert can become a freezing nightmare.

Hazards

Lack of water and exposure to sun and heat are the big hazards to health in the desert. One to five percent dehydration will make you lose your appetite, become sleepy and nauseated, and begin to vomit. As dehydration goes up to 10 percent, dizziness results. You will have headaches, difficulty in breathing, tingling of the legs and arms caused by poor circulation, indistinct speech, and, finally, an inability to walk. Still, 10 percent dehydration generally causes no permanent ill effects. When dehydration exceeds 10 percent, you will become delirious, spastic, almost deaf, and barely able to see. The skin shrivels and becomes numb. At temperatures

above 90°F, dehydration over 15 percent is generally fatal. At 85° and less, the body can stand up to 25 percent dehydration. Dehydration is quickly cured by water—in fact, only water can cure it.

When you are dehydrated, you don't have to worry about how much water you drink or how quickly you drink it if the water is warm or cool. Cold water, though, will upset the stomach.

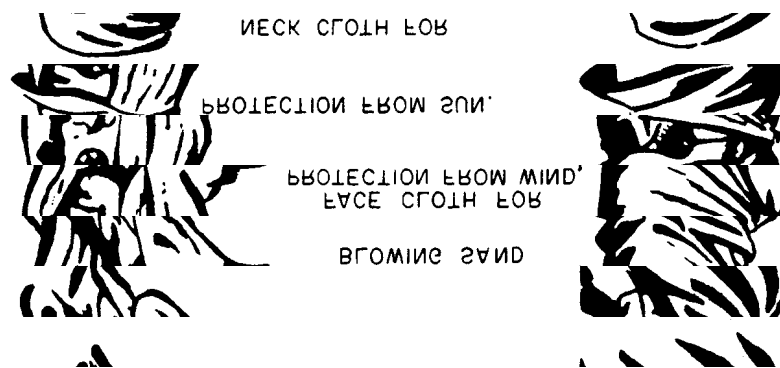
Table 5-1 shows the number of days you can normally expect to survive on a given amount of water, according to temperature and whether you rest or walk at night until you are exhausted.

Aside from a lack of water, exposure to the sun is the foremost desert ailment. Stay under cover as much as possible. If you must be out in the sun, keep as much of your body covered as possible. Roll down your sleeves, button your collar and turn it up around your neck, keep your head covered, and, if possible, cover your face also. Tuck the legs of your pants into your socks and keep your shoes on. On any area of your body that is not covered with clothing, use a sunburn ointment. It is better to use it as a preventive than as a cure. Wear a cloth neckpiece to cover the back of your neck from the sun. If you have no hat, make a headpiece like that worn by the Arabs, as shown in figure 5-40. You can also adapt your pilot chute as a parasol for use in the desert.

Exposure to desert heat is dangerous. It may cause three different types of heat collapse—heat stroke, heat exhaustion, and heat cramps. Another desert danger is sun glare. Glare is extremely painful. You can avoid it easily by taking the proper precautions. Keep your eyes protected from the glare of the sun by darkening the bridge of the nose and the area beneath the

Table 5-1.—Survival Potential as Determined by the Amount of Water, Temperature, and Activity

	TEMPERATURE	NO	1	5	9	10	30
DEGREE OF DEHYDRATION	WATER	REST	REST	REST	REST	REST	REST
100%	100°	1 DGL	3 DGL	3 DGL	3 1/2 DGL	3 DGL	1 1/2 DGL
75%		3 DGL	3 DGL	3 1/2 DGL	4 DGL	2 DGL	1 DGL
50%	100°	3 DGL	3 1/2 DGL	3 1/2 DGL	4 1/2 DGL	2 1/2 DGL	13 1/2 DGL
25%		2 1/2 DGL	2 1/2 DGL	2 1/2 DGL	1 DGL	1 1/2 DGL	
0%	90°	2 1/2 DGL	2 1/2 DGL	2 1/2 DGL	2 1/2 DGL	8 DGL	14 1/2 DGL
0%		2 1/2 DGL	2 1/2 DGL	2 1/2 DGL	2 1/2 DGL	8 DGL	



540-140

Figure 5-40.—Face and neck protection.

eyes; use sunglasses or improvise a mask for your eyes.

Clothing

Clothing is your protection against sunburn, heat, sand, and insects. Clothing also helps you get along with less water. Keep your body and head covered. During dust storms, cover your mouth and nose as shown in figure 5-40—parachute cloth will do.

Keeping your clothing loose and flapping will help you stay cooler. Light-colored or white clothing is best because it reflects heat and light, whereas black or dark-colored clothing absorbs it. Wear your clothing at all times even though you imagine it will be cooler to strip it all off. It won't. Stripping off your clothing will cause your perspiration to evaporate too rapidly, and you will lose its cooling effects. Besides, the rapid evaporation of perspiration speeds up the process of dehydration.

Shelter

Shelter in the desert is important not only to protect you from the sun and heat but also to protect you from the cool of the night and occasional rain. Use whatever materials are available to improvise a suitable desert shelter. Your parachute can be used effectively to make a good shade and serve as a signaling aid at the same time. Several layers spaced apart provide good insulation from the sun. Use your inflated life raft turned upside down to elevate your bed off the desert floor. By using the parachute for shade and the life raft for insulation, you will be 20°F to 40°F cooler than you would be in the outside temperature.

You will need fire in the desert, not only for cooking and signaling but also for heat at night. In some deserts fuel is extremely rare. Wherever you find plant growth; save all twigs, leaves, stems, and underground roots for burning. Dry animal dung often found along travel routes provides a very hot flame.

Food

Eat sparingly unless you have plenty of water. Of course, dehydration will help you out on that score—it will decrease your appetite. Whatever food you do get, eat it immediately; food spoils rapidly in the heat. Don't try to preserve food by drying it. Dehydrated food is of little value if you don't have enough water.

In most deserts animals are scarce. Look for them at water holes; in grassy canyons or low-lying areas; dry riverbed areas, in which there is greater chance of moisture; or under rocks and in bushes. They are most likely to be seen at dusk or early morning. The most common animals are the small rodents (rabbits, prairie dogs, rats) and reptiles (snakes and lizards). They are your best and most reliable source of food.

Travel

Don't travel in the desert unless you are absolutely sure you can reach your destination on the water supply available. When the days are hot, travel only at night. Stay in the shade during the day and rest. Follow the easiest route possible—avoid soft sand and rough terrain. In the sand-dune areas follow the hard-floor valleys between the dunes or travel on the ridge of the dunes. Follow trails if at all possible.

Beware of flash floods when you are traveling along dry watercourses, particularly in the vicinity of mountains. You should never make camp in a stream bed; while rain in the desert is scarce, storms can and do produce flash flooding very quickly.

TROPIC SURVIVAL

When used with reference to survival, the term *tropics* refers primarily to jungles, for those are the parts of the tropics that present survival problems distinctly different from those in other parts of the world.

Hazards

Most stories about the animals, snakes, spiders, and nameless terrors of the jungle are pure bunk. You are probably safer from sudden death in the jungle than in most big cities. You will probably never see a poisonous snake or a large animal. What may scare you most are the howls, screams, and crashing sounds made by noisy monkeys, birds, and insects.

The real dangers of the tropics are the insects, many of which pass on diseases. Probably the worst disease is malaria, which is transmitted by the mosquito. That is why the survival kit provides a mosquito headnet. Wear this net regularly, especially at dawn and dusk when mosquitoes are the thickest; use insect repellent, wear gloves, and take Atabrine pills too. A smudge fire also helps keep mosquitoes away, especially at dawn and dusk.

There are many other insects and pests in the jungle—ticks, leeches, scorpions, centipedes, and spiders, to name just a few. Stings or bites from these insects can create infection and cause illness. Frequently check your body and your clothing for insects and get rid of them. Beware of scratches also. In the jungle even the slightest scratch can cause serious infection within hours.

Clothing

As with the Arctic and the desert, clothing in the tropics serves as a protection against exposure, insects, and plant life. You should keep your sleeves rolled down and buttoned. Tuck the legs of your pants into your socks and keep your shoes on. This may help keep out unwanted insects such as ticks, leeches, and ants. Always wear full clothing in the tropics. By wearing your clothing loosely, your body will be cooler. Change your

clothing as often as it is practical. Remember dirty clothes may lead to a skin infection; therefore, they should be washed daily, especially your socks.

Food and Water

Food and water are plentiful in the jungle. It is a proven fact that a person can survive in the jungle and actually like it, if provided with a basic knowledge of how to use the animals and other food found in the jungle. When you are selecting food in the jungle, watch the monkeys. Almost everything a monkey eats is eatable by humans. There are fish in all jungle streams. Eat only fish that have scales and look typically like a fish. Fish that have slimy skin and unusually shaped bodies are to be avoided.

Shelter

Night in the jungle comes very fast. So prepare for bed early. In the jungle you need more sleep than usual to keep up your energy and strength and to maintain resistance against disease.

Try to pick a campsite on a knoll or high spot in an open place well away from swamps. You will be bothered less by mosquitoes, the ground will be dryer, and there will be more chances of a breeze. Don't build a shelter under large trees or trees with dead limbs. They may fall and wreck your camp or cause injury. Don't sleep or build a shelter under coconut trees.

In the wet jungle forest, you will need shelter from the dampness. If you stay with the plane, use it for shelter. Try to make it mosquitoproof by covering the openings with netting or parachute cloth.

In mountainous jungle, the nights are cold. Get out of the wind. Make a fire a few feet from a cliff or against a log or rock pile, and build your shelter so that you get reflected heat. Arrange the reflector so that the fire doesn't blow toward you.

FIRE MAKING

You may need fire for warmth, for keeping dry, for signaling, for cooking, and for purifying water. Do not build a big fire. Small fires require less fuel, are easier to control, and their heat can be concentrated. In cold weather small fires arranged in a circle are much more effective than one large fire.

Preparing a Fireplace

Prepare the location of the fire carefully. Clear away leaves, twigs, moss, and dry grass so that you do not start a grass or forest fire. If the surrounding vegetation is dry, scrape the fire location down to the bare dirt. If the fire must be built on wet ground, build a platform of logs or flat stones.

To get the most warmth and to protect the fire from wind, build it against a rock or wall of logs that will serve as a reflector to direct the heat into your shelter. Cooking fires should be walled in by logs or stones, not only to concentrate the heat but also to provide a platform for the cooking pot.

Kindling and Fuel

Some fuels cannot be ignited directly from a match. You will need some easily flammable kindling to start a fire. Good natural kindling materials are thin sticks of dry wood; dry bark; wood shavings; palm leaves; twigs; loose, ground-lying lichens; dead, upright grass straw; or ferns. If sticks are used for kindling, split them and cut long thin shavings, leaving the shavings attached (shave stick). Store kindling in a shelter to keep it dry. A little JP-5 poured on the fuel before it is ignited will help it start burning. Do not pour petroleum fuel on a fire already started even if it is only smoldering.

For fuel, use dry, standing, dead wood and dry, dead branches. Dead wood is easy to split and break-pound it on a rock. The inside of fallen tree trunks and large branches may be dry even if the outside is wet; use the heart of the wood. Green wood that will burn, especially if freely split, can be found almost everywhere. In treeless areas, you will look for other natural fuels, such as dry grass that can be twisted into bunches, dried animal dung, and animal fats; sometimes you can even find coal, oil shale, or oily sand lying on the surface. If no natural fuels are available and you are with the aircraft, burn aircraft fuel and lubricating oil or a mixture of each. Hydraulic fluid is specifically designed and manufactured not to burn; therefore, it should not be used.

Fire Making With Matches and Lighter

Prepare a fireplace. Get all materials together before trying to start the fire. Make sure that matches, kindling, and fuel are dry. Have enough

fuel on hand to keep the fire burning. Arrange a small amount of kindling in a low pyramid. Arrange the kindling close enough together to permit flames to lick from one piece to another. Leave a small opening for lighting.

Save matches by using a candle (if available) to light the fire. If you have no candle, use a shave stick or make a faggot of thin, dry twigs, tied loosely. Shield the match from the wind as you light the candle or faggot. Apply the lighted candle or faggot to the lower windward side of the kindling, shielding it from the wind.

Small pieces of wood or other fuel can be placed gently on the kindling before lighting or can be added after the kindling begins to burn. Lay on smaller pieces first, adding larger pieces of fuel as the fire catches. Do not smother the fire by crushing the kindling with heavy wood. Do not make the fire too big. Do not waste fuel.

Fire Making With Special Equipment

A flare can be used to start a fire; however, it should be used only as a last resort. Some emergency kits contain small fire starters, wind-proof matches, and other aids.

Fire Making Without Matches

First, find or prepare one of the following kinds of tinder: very dry, powdered wood; finely shredded, dry bark; the shredded pith of a dead palm frond; lint from unraveled cloth, cotton, twine, or rope; first-aid gauze bandage; fuzzy or woolly material scraped from plants; fine bird feathers or birds' nests; field-mouse nests; or fine wood dust produced by insects, often found under bark of dead trees. Tinder must be bone dry. Tinder will burn more easily if you add a few drops of aircraft fuel or mix it with powder taken from a cartridge. Once tinder is prepared, put some in a waterproof container for future use.

Once you have the tinder, light it in a place sheltered from the wind. Several additional methods of starting a fire are described in the following paragraphs.

Flint and Steel

Striking sparks with flint and steel is the easiest and most reliable way of starting a fire without matches. Use the flint fastened to the bottom of the waterproof match case. If you have no flint, look for a piece of hard rock from which you can strike sparks. If it breaks or scars when struck

with steel, throw it away and find another. Hold your hands close over the dry tinder; strike the flint with a knife blade or other small piece of steel with a sharp, scraping, downward motion so that the sparks fall in the center of the tinder. Adding a few drops of JP-5 to the tinder before you strike the flint will make the tinder flame up—for safety, keep your head to one side. When the tinder begins to smolder, fan it gently into a flame. Then transfer the blazing tinder to the kindling pile or add kindling gradually to the tinder. The wrist compass furnished in the individual survival kit (SRU-31/P) can be used to locate/identify iron-base lodestone.

Burning Glass

Any convex lens can be used in bright sunlight to concentrate the sun's rays on the tinder and start it burning.

Friction

There are many methods of making fire by friction (bow and drill, fire plough, fire thong, etc.), but all require practice. If you are proficient in one of these methods, use it; but remember that flint and steel will give the same results with less work.

Electric Spark

If you are with the aircraft and have a live storage battery, direct a spark onto the tinder by scratching the ends of wires together to produce an arc.

Burning Aircraft Fuel

If you are with the aircraft, you can improvise a stove to burn jet fuel, lubricating oil, or a mixture of them. Place 1 to 2 inches of sand or fine gravel in the bottom of a can or other container and add fuel. Be careful when lighting; the fuel may burst into flames at first. Make slots at the top of the can to let flame and smoke out, and punch holes just above the level of the sand to provide a draft. To make a fire burn longer, mix fuel with oil. If there is no container, simply dig a hole in the ground, fill it with loose dirt, pour on fuel, and light; take care to protect your face and hands. Always ensure that you handle fuel carefully to prevent spilling it on your clothing.

You can use lubricating oil with a wick arrangement for fuel. Make the wick of string, rope, rag, or even a cigarette, and rest it on the edge of a receptacle filled with oil. Also, soak rags, paper, wood, or other fuel in oil, and throw them on the fire.

You can also make a stove out of any empty waxed ration carton by cutting off one end and punching a hole in each side near the unopened end. Stand the carton on the closed end; stuff an empty sack loosely inside the carton, leaving an end hanging over the top; light this end—the stove will burn from the top down and will boil more than a pint of water.

Useful Hints

Do not waste matches by trying to start a poorly prepared fire. Do not use matches for lighting cigarettes; get alight from the fire or use a burning lens. Do not build unnecessary fires; save your fuel. Practice primitive methods of making fires before all the matches are gone.

Carry some dry tinder with you in a waterproof container. Expose it to the sun on dry days. Adding a little powdered charcoal will improve it and allow the tinder to stay dry, as the charcoal will absorb small quantities of water vapor from the humidity. Collect good tinder wherever it can be found.

Collect kindling along the trail before making camp. Keep firewood dry under shelter. Dry damp wood near the fire so that it can be used later. Save some of the best kindling and fuel for quick fire making in the morning.

To split logs, whittle hardwood wedges and drive them into cracks in the log with a rock or club; split wood burns more easily.

To make a fire last overnight, place large logs over it so that the fire will burn into the heart of the logs. When a good bed of coals has been formed, cover it lightly with ashes and then dry earth. In the morning the fire will still be smoldering.

Fire can be carried from one place to another in the form of a lighted punk, smoldering coconut husk, or slow-burning coals. When you want a new fire, fan the smoldering material into flame.

Do not waste fire-making materials. Use only what is necessary to start a fire and to keep it going for the purpose needed. Put out the fire upon leaving the campsite.

ARCTIC.— Do not build a fire under a snow-covered tree—snow may fall and put out the fire.

Low, dead, needle-bearing branches of standing spruce trees are good fuel. On the tundra, wood is scarce. Look for any woody bush or shrub; burn roots as well as stems. Look for dry twigs in willow thickets or for dry grasses. On the coasts, look for driftwood.

Animal fat and bones can be used as fuel. Put chunks of fat on a stick or bone framework or on top of a perforated can with a wick of greasy cloth or sphagnum moss underneath, and light the wick. Congealed oil can be burned in the same way.

A candle burning in a tin can makes a simple heater for the shelter.

In cold weather, drain oil from the aircraft and store it for fuel. If the temperature is not low enough to solidify the oil, leave it in the aircraft and drain it off when needed.

TROPICS.— In the tropics, wood is plentiful. Even if it is wet outside, the heart of dead wood will be dry enough to burn. Dry wood can also be found hanging in the network of vines or lying on bushes.

In palm country, good tinder can be obtained from the fibers at the bases of palm leaves. The insides of dry termite nests make good kindling.

Keep spare wood dry by stowing it under the shelter. Dry out wet kindling and fuel near the fire for future use.

SURVIVAL SELF-TREATMENT FIRST AID

During a survival situation the one thing that can jeopardize the aircrewman's ability to survive is a medical problem. Injuries incurred during ejection, parachute descent, and/or parachute landing can reduce survival expectancy as well as compromise the ability to evade the enemy.

Military personnel must be able to treat their injuries and sicknesses in a survival situation. The treatments described in this chapter are suitable for application by nonmedical personnel.

Some of the first-aid procedures described may be substandard compared with present medical standards within U.S. medical facilities. However, in a survival situation, they will increase your survival expectancy.

Health and Hygiene

In a survival situation, cleanliness is more than a virtue. It is essential if infection is to be prevented. Since skin is the first line of defense

for your body, you must give particular attention to the washing of your face, hands, armpits, groin, and feet to minimize the chance of small scratches and abrasions becoming infected. Keeping the hands clean is especially important because most germs are introduced to the body by the hands. Keep fingernails short to prevent scratches; scratches as well as cuts and insect bites can cause serious infections, especially in the tropics. If an antiseptic is available use it on even the smallest of scratches or insect bites. Remember, an infection may hurt your chances of survival.

Clean clothes help to prevent infections and chafing, especially fungal infections that are common in the tropics. If washing clothes is not possible, at least shake and air clothing in the sun.

Soap is not essential to keeping clean. A substitute of ashes, sand, loamy soil, or other expedients may be used in cleaning the body and the utensils used in cooking and eating.

Intestinal Illnesses

Contaminated water or spoiled food, fatigue, overeating in hot weather, or using dirty utensils may cause diarrhea and other intestinal illnesses. Cook or wash food carefully before eating. When possible, purify water by boiling for 10 minutes; this will leave no doubt as to water purity at any altitude. If diarrhea does occur, the following field treatments may be used:

- Rest and fast, except for drinking water, for the first 24 hours; then take only liquid foods, and avoid starches.

- Eat several small meals instead of one or two large ones. Drink tannic tea or eat clay, chalk, or charcoal. Once the diarrhea has stopped, do not worry about lack of bowel movement. This will take care of itself in a few days provided you have an ample daily supply of water.

Foot Care

If traveling afoot in a survival situation, you should take particular care of your feet. Remove clots of material from socks to eliminate possible sources of friction and ensure that shoes fit properly. If possible, air your shoes and socks at night by putting them on small stakes. This keeps the insides dry and eliminates the danger of insects crawling inside. Watch for blisters and apply adhesive tape smoothly to your skin

wherever shoes rub. If you have blisters and they burst, leave the skin in place and apply a clean dressing. Carrying an extra pair of socks in your survival vest is suggested. At least once per day, clean, dry, and massage your feet to ensure adequate circulation. Remember, trench foot is caused by prolonged exposure to wet, usually cold, conditions; but it may be developed in the tropics. If symptoms of trench foot appear—that is, tingling, numbness, swelling, blisters, or sores—pay extra attention to your feet and give them proper care.

Control of Bleeding

The control of heavy bleeding is extremely important under all conditions, but it is of even greater importance in a survival situation since transfusions are not possible. When breathing ceases in conjunction with heavy bleeding, you must first take action to initiate breathing, then to stop the bleeding.

NOTE: Never apply a tourniquet unless that is the only way to stop bleeding from an extremity.

Restoration of Breathing

When breathing signs are absent, the most common cause is blockage of the airway. If normal first-aid procedures fail to clear the airway and restore breathing, you have one alternate procedure. This procedure is called a cricothyroidotomy and can be performed successfully by unskilled nonmedical personnel. To perform a cricothyroidotomy, proceed as follows:

1. Locate the thyroid cartilage (Adam's apple), which is the largest bony protrusion in the center line of the neck.
2. Locate the cricoid cartilage (the first circular ridge below the Adam's apple). The point of incision is the depression immediately above the cricoid cartilage.
3. Using a sterile surgical razor blade, if available, or any other cutting instrument in an emergency, make a lateral incision one-fourth to one-half of an inch wide and approximately one-fourth of an inch deep into the trachea.
4. Insert the lower half of a ball-point pen barrel or any similar rigid tube into the incision one-half to three-fourths of an inch or until movement of air is felt or heard.
5. Secure the tube with tape if it is to be left in place for an extended period of time or if the victim is to be transported.

Control of Pain

Control of pain accompanying disease or injury is extremely difficult because pain cannot be measured. The severity of pain accompanying any disease or injury is relative to the individual's ability to withstand or cope with that pain. Although some individuals can tolerate a great deal of pain, others cannot. Psychological injury may alter an individual's pain threshold. Regardless of this difficulty, every effort should be made to control or eliminate pain, not only because of its adverse effect on morale, but also because it contributes to shock and makes a survivor less capable of performing other essential tasks. The ideal method for pain reduction is to eliminate its cause. Since this is not always possible, the following methods are recommended:

- Reduce movement of the painful area. Immobilize the wounded area in a position that provides maximum comfort and ease of maintenance. Use splints and bandages.
- Apply a clean dressing that will protect the wound from the air and from painful contacts with objects in the environment.
- Apply hot or cold compresses. Try both hot and cold compresses to determine which offers the most relief.
- A common injury sustained by downed aircrew members is broken teeth. This results in extreme pain because the nerves are exposed to air. To ease the pain, take the following steps:
 - Cover broken teeth with pine or other tree saps or any waxy substance.
 - Drink tea made from the boiled inner bark of a willow tree. The bark contains an active substance called salicylate, which is an aspirin substitute. Aspirin will prevent blood from clotting. Pain-relieving drugs should be given sparingly, and then only to relieve true pain, not to soothe the victim's apprehension. The only ready-made pain reliever available to aircrew members is the aspirin located in the SRU-31/P Medical Packet #1.

Control of Shock

Shock is frequently the most serious consequence of an injury. You should become familiar

with the signs and symptoms of shock so that the condition may be anticipated, recognized, and dealt with effectively. The best approach to shock treatment is to treat all survivors suffering from moderate and severe injuries for shock. Act! Don't wait! Anticipate shock and take care of it along with treatment of the specific injury.

- Giving a survivor fluids by mouth in the treatment of shock is normally not recommended. However, in survival situations, recovery may often depend on adequate hydration. In an early shock incident, giving the survivor small amounts of fluid by mouth maybe beneficial, provided he is conscious, can swallow, and has no internal injuries. Burn victims particularly need large amounts of water to replace their loss of fluids.

- Emotional shock frequently follows an emergency. This type of shock originates in the mind and may occur even without injury. Resistance to and the impact of this type of shock varies widely. It depends on your physical makeup and is related to the amount of training you have previously received. Comfort and reassurance coupled with rest and relaxation after you are clear of immediate dangers is very effective in management of the survivor suffering from emotional shock.

Symptoms of Shock

A person suffering from shock shows symptoms that are directly or indirectly related to the poor circulation of the blood. The pulse is weak and rapid. Breathing is likely to be shallow, rapid, and irregular, because the poor circulation of the blood affects the breathing center in the brain. The temperature near the surface of the body is lowered because of the poor blood flow; therefore, the face, arms, and legs feel cold to the touch. Sweating is likely to be very noticeable. A person in shock is usually very pale, but in some cases there may be a bluish or reddish color to the skin. The pupils of the eyes are usually dilated (enlarged).

If the victim is conscious, he may complain of thirst. He may have a feeling of weakness, faintness, or dizziness. He may feel nauseous. Also, the person may be very restless and feel frightened and anxious. As shock deepens, these signs gradually disappear and the victim becomes less and less responsive to what is going on around him. Even pain may not arouse him. Finally, the victim may become unconscious.

It is unlikely that you will see all these symptoms of shock in any one case. Some of them appear only in the late stages of shock when the disturbance of the blood flow has become so great that the victim's life is in serious danger. Sometimes the signs of shock maybe disguised by other signs of injury. It is important to know what symptoms indicate the presence of shock, but do not ever wait for symptoms to develop before beginning the treatment for shock. Remember, EVERY SERIOUSLY INJURED PERSON IS LIKELY TO DEVELOP SERIOUS SHOCK.

Treatment of Shock

In many emergency situations, the most helpful thing you can do for an injured person is to begin treatment for shock. If shock has not yet developed, the treatment may actually prevent its occurrence; if it has developed, you may be able to keep it from reaching a critical point. As we have seen, shock creates a vicious cycle—that is, the worse it is, the worse it becomes. It is extremely important that you begin treatment at the earliest opportunity.

It is important to keep the victim as calm as possible because excitement and fright will affect his condition and may even bring on shock. Try to prevent the victim from seeing his injuries, and reassure him that he will be properly cared for. Keep all unnecessary persons away, as their conversation regarding the victim's injuries may increase his agitation.

A person in shock is often thirsty. No particular harm will be done if you allow the victim to moisten his mouth and lips with cool water, if it will make him more comfortable. But in general, there is no need to give him anything to drink unless you are in a position where medical assistance will not be available for an excessively long period of time.

If medical care will not be available, you should give the victim SMALL AMOUNTS of warm water, preferably mixed with 1 teaspoon of salt and 1/2 teaspoon of baking soda per quart or liter. This should be done if he is conscious, able to swallow, and has not suffered internal injuries.

In the case of burns, an exception must be made to the rule of not giving liquids. A seriously burned person has an overwhelming need for fluids. It is, therefore, a permissible and even desirable part of first-aid treatment for burns to give water or other liquids. Sweet tea, fruit

juices, or sugar water maybe given if the casualty is conscious and able to swallow, if he has no internal injuries, and if vomiting is no problem.

One final precaution must be given concerning the use of liquids: **NEVER GIVE ALCOHOL TO A PERSON IN SHOCK OR WHO MAY GO INTO SHOCK.** Alcohol increases the blood supply to surface vessels and so diminishes the blood supply to the brain and other vital organs.

Heat is important in the treatment of shock to the extent that the injured person's body heat must be conserved. Exposure to cold, with resulting loss of body heat, can cause shock to develop or to become worse. You will have to judge the amount of covering to use by considering the weather and the general circumstances of the accident. Often alight covering will be enough to keep the casualty comfortable. Wet clothing should be removed and dry covering provided, even on a hot day. Use blankets or any dry material to conserve body heat. Artificial means of warming (for example, hot-water bottles, heated bricks, or heated sand) should not be ordinarily used. Artificial heat may cause the loss of body fluids (by sweating), and it brings the blood closer to the surface, thus defeating the body's own efforts to supply blood to the vital organs and to the brain. Also, the warming agent may burn the victim. **KEEP AN INJURED PERSON WARM ENOUGH FOR COMFORT, BUT DO NOT OVERHEAT HIM.**

The best position to use for the prevention or treatment of shock is one that encourages the flow of blood to the brain. If it is possible to place the injured person on his back on a bed, cot, or stretcher, you can raise the lower end of the support about 12 inches so that his feet will be higher than his head. If the circumstances of the accident make it impossible to do this, it might still be possible for you to raise his feet and legs enough to help the blood flow to the brain. Sometimes it is possible to take advantage of a natural slope of ground and place the casualty so that his head is lower than his feet.

In every case, of course, you will have to consider what type of injury is present before you can decide on the best position. For example, a person with a chest wound may have so much trouble breathing that you will have to raise his head slightly. If the face is flushed rather than pale, or if you have any reason to suspect head injury, do not raise the feet. Rather, you should keep the head level with or slightly higher than the feet. If the person has broken bones, you will have to judge what position would be best both

for the fractures and for shock. A fractured spine must be immobilized before the victim is moved at all, if further injuries are to be avoided. If you have any doubts about the correct position to use, have the victim lie flat on his back. **THE BASIC POSITION FOR TREATING SHOCK IS ONE IN WHICH THE HEAD IS LOWER THAN THE FEET.** Do the best you can, under the particular circumstances, to get the injured person into this position. In any case, never let a seriously injured person sit, stand, or walk around.

Distinguishing Characteristics of Poisonous Snakes

The first step to treating a snakebite is to determine whether the snake is poisonous. Many harmless snakes bite in self-defense. Distinguishing characteristics that help to determine if the snake is poisonous follow:

VIPERS.— The viper has two long, folding fangs at the front of the upper jaw. A pit viper also has a small, deep pit between the eyes and the nostrils, slit-like pupils of the eyes, and a flat, triangular head; the scales behind the anus are in one piece. Rattlesnakes, copperheads, and moccasins are pit vipers; all vipers are poisonous.

CORALS.— The coral snake has a black nose and brightly colored bands of either red, black, and yellow or red, black, and white. On coral snakes the black and red are separated by yellow or white; on the nonpoisonous (false coral) snake, the yellow and red are separated by black. It has short, grooved fangs and must chew into its victim before the poison can be injected. The coral snake is related to the cobra and the krait.

COBRAS.— The combat attitude of the cobra is with the forepart of the body raised vertically and the head tilted sharply forward. Usually the neck is flattened to form a hood. These snakes are very poisonous and should be avoided. Adders are related to the cobra and can be found throughout the continental United States.

TREATMENT OF SNAKEBITES.— Prompt action to reduce the effects of poisonous snakebites is essential. The following is a step-by-step treatment for snakebites:

1. Avoid undue exertion. If circumstances allow it, lie down and remain quiet. A snug

tourniquet (tight enough to impede the venous return of blood to the trunk, yet loose enough to allow arterial supply to the extremity) will further delay systematic absorption of the poison. Place a tourniquet between the bite and the heart, about 2 inches above the bite. A tourniquet should only be used if competent medical help is reasonably expected to take over management of a snakebite victim.

2. Clean a knife or razor blade and the fang marks by daubing with antiseptic, if available.

3. Make a small cut over each fang mark (deep enough, one-fourth of an inch or more, to penetrate the skin). Orient each cut parallel to vital structures (generally parallel to the long axis of the limb).

4. Apply suction. Suction can best be applied by mouth, but not if there are open oral lesions present. In this case, some other means of applying suction must be found. After 30 minutes, suction is of little benefit.

CARE OF WOUNDS.— Open wounds are a serious hazard in a survival situation, not only because of the tissue damage and blood loss, but also because of the increased possibility of infection. Little can be done to prevent wound contamination at the time of the injury. Proper wound care can minimize further contamination and promote healing and preservation of function in the injured part.

● Clothing should be cut or torn away from a wound; drawing clothes over the wound may introduce bacteria into the wound.

● Whenever possible, avoid touching the wound with fingers or any unsterile object. All water and instruments used in wound care should be sterilized by boiling. Washing your hands before you treat any wound is very important in keeping down infection.

● Clean all wounds as soon after occurrence as possible. Only antiseptics especially designed to use in open wounds should be used directly in the wound.

NOTE: Common antiseptics such as Merthiolate, iodine, and Mercurochrome should never be applied directly to a wound. These solutions destroy only part of the bacteria and actually damage the exposed tissues.

● When cleansing solutions for wounds are not available, a suitable substitute may be a poultice made of fern root. To prepare a poultice, you boil finely chopped roots in water until syrupy. Allow the poultice to cool and apply directly to the wound.

● The “open treatment” method is the safest way to manage wounds in a survival situation. No attempt should be made to close a wound by stitching. The wound should be left open to permit drainage of pus from infection. As long as a wound can drain, it generally will not become life threatening. If a wound is gaping, the edges can be brought together with adhesive tape cut in the form of a butterfly or dumbbell. When a butterfly bandage is applied properly, only a small portion of the adhesive is in contact with the wound; but a large surface of the tape is in contact with the skin on either side of the wound, providing traction that pulls the edges of the wound together. The narrow center permits some free drainage from the wound, and the strips can be removed easily if the wound has to be opened should infection develop.

Exposure

In certain climates, you will be exposed to excessive heat or cold and must safeguard yourself from its effects. Proper procedure is the key to prevention of all cases of heat or cold exposure.

HEAT.— Increased sweating requires more fluid intake. The duration of physical activity should be less during the first days of heat exposure and increased gradually as you become acclimatized. Alternate work and rest periods should be established. Avoid working in direct sun or on extremely hot days. Wear lighter clothing in hot environments.

COLD.— The most important aspect of prevention of cold-related injury is awareness of existing weather conditions and the likelihood of weather change. Adequate clothing to protect as much exposed skin as possible must be worn. Rain gear should be donned before you become wet; wool clothes and wind-protective garments should be donned before you start to shiver. Improvised clothing may be made from parachute material. Obtain shelter that provides protection from the wind, precipitation, and surface water as well as insulation from ground, snow, or ice. Improvised shelters, described in *Survival Training*

Manual, NAVAIR 00-80T-101, will be useful in combating exposure.

SNOW BLINDNESS.— Exposure to reflected sunlight from snow, ice, or water, even on grey overcast days, can result in sunburn of the tissues comprising the surface of the eye, as well as the retina, producing snow blindness.

Symptoms.— Symptoms may not be apparent until up to 12 hours after exposure. The eyes initially feel irritated and dry; then, as time passes, eyes feel as though they are full of sand. Blinking and moving the eyes may be extremely painful. The eyelids are usually red, swollen, and difficult to open.

Remedial Action.— A mild case will heal spontaneously in a few days, but you can obtain some relief by applying cold compresses and a lightproof bandage. An ophthalmic ointment can be applied hourly to relieve pain and lessen the inflammatory reaction.

W A R N I N G

Do not rub your eyes.

Prevention. — Snow blindness can be prevented by constant use of sunglasses or a tinted helmet visor. If the glasses or helmet are lost, an emergency set of goggles can be made from a thin piece of leather, cardboard, or other lightproof material. Cut the material the width of the face with horizontal slits over the eyes. These improvised goggles can be held in place with string or cord from the parachute shroud lines attached to the sides and tied at the back of the head.

As a first class or chief petty officer, you must assume more responsibility for yourself and those around you. You will be the resident expert in matters of survival equipment. You will be expected to teach your subordinate maintenance personnel and your unit's aircrewmen as well. This means that you must continue to educate yourself by studying everything available related to survival equipment. You are a key factor in the survival of those entrusted to your care.

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Assignment Questions

Information: The text pages that you are to study are provided at the beginning of the assignment questions.

Assignment 1

Textbook Assignment: "Liquid Oxygen Converter Test Stand 59A120". Pages 1-1 through 1-11.

<hr/> <p>Learning Objective: Recognize the operating characteristics and identify the maintenance requirements of the 59A120 liquid oxygen converter test stand.</p> <hr/>	
1-1. What rating level has the responsibility for maintaining liquid oxygen (LOX) converter test stands?	1-5. Weekly inspections are performed on the 59A120 test stand. These inspections may be broken down into operating hours. what total number of operating hours is considered a week?
<ol style="list-style-type: none"> 1. E-3 and 4 2. E-4 and 5 3. E-5 and 6 4. E-6 and 7 	<ol style="list-style-type: none"> 1. 100 hr 2. 50 hr 3. 35 hr 4. 40 hr
1-2. Which of the following is NOT a part of the 59A120 test stand?	1-6. Which of the following inspections requires you to zero the test pressure gage?
<ol style="list-style-type: none"> 1. Differential pressure gage 2. Linear flow element 3. Bell jar 4. Vacuum pump 	<ol style="list-style-type: none"> 1. Daily 2. Weekly 3. Monthly 4. Bimonthly
1-3. How many linear flow elements can be found on the 59A120 test stand?	1-7. At what Inspection interval is the relief valve set?
<ol style="list-style-type: none"> 1. Six 2. Five 3. Three 4. Four 	<ol style="list-style-type: none"> 1. Daily 2. Weekly 3. Monthly 4. Every 6 months
1-4. When preparing the 59A120 test stand for use is divided into five separate tasks, which of the following tasks is NOT accomplished by the PR?	1-8. What is the calibration requirement time interval on the 59A120 test stand?
<ol style="list-style-type: none"> 1. Installation 2. Visual inspection 3. Correction and preparation 4. Leakage testing 	<ol style="list-style-type: none"> 1. Weekly 2. Monthly 3. Every 6 months 4. Yearly
	1-9. Which of the following cleaning agents is used to clean external parts of the 59A120 test stand?
	<ol style="list-style-type: none"> 1. MIL-C-81302, Type 1 2. MIL-C-6903A, Type 1 3. MIL-C-8939 4. MIL-C-2613

- 1-10. Where are the test adapters stored for the 59A120 test stand?
1. In the storage compartment under the stand
 2. In the accessory tray
 3. Hung on the side of the test stand
 4. Inside the accessory toolbox
- 1-11. To remove dust and any foreign matter from the surfaces of the gage tester after removing the front panel on the 59A120 test stand, what maximum air pressure should you use?
1. 10 psig
 2. 15 psig
 3. 25 psig
 4. 50 psig
- 1-12. When you are using air pressure for cleaning, all interconnecting pipes, hoses, and fittings must be cleaned with what maximum air pressure?
1. 50 psi
 2. 160 psi
 3. 400 psi
 4. 500 psi
- 1-13. Which of the following chemicals is used to clean the terminals, of the Liquid Oxygen Quantity Gage Tester, on the 59A120 test stand?
1. Type I Freon
 2. Type II Freon
 3. Type I dry cleaning solvent
 4. Type II dry cleaning solvent
- 1-14. Who is responsible for calibrating the 59A120 test stand?
1. PRs, E-6 or above
 2. Personnel assigned to depot level maintenance
 3. On-site meteorology calibration team
- 1-15. What should you use to clean the O-ring that is installed in the bell jar?
1. Distilled water
 2. Denatured alcohol
 3. Natured alcohol
 4. Mild soap and water
- 1-16. After you clean the O-ring on the bell jar, it should be lubricated with which of the following?
1. MIL G 2489
 2. MIL G 27617
 3. MIL G 6903
 4. MIL G 2873
- 1-17. With of the following manuals gives information on the procedures for correction card preparation and calibration?
1. NAVAIR 13-1-6.4
 2. NAVAIR 13-1-6.5
 3. NAVAIR 17-15BC-2
 4. NAVAIR 17-17CAL-2
- 1-18. Which of the following components does NOT require a correction card?
1. PG-1
 2. PG-2
 3. FLM-1
 4. FLM-2
- 1-19. To prepare the correction cards, you must convert the actual liter-per-minute to
1. indicated millimeters
 2. psig
 3. inches of water
 4. inches of mercury
- 1-20. After converting the actual liter-per-minute, at what time will you enter the indicated flows?
1. When performing the leakage test
 2. When performing the daily test
 3. When calibrating the test stand
 4. Simultaneously
- 1-21. How many graphs are supplied with the calibration kit for the 59A120 test stand?
1. One
 2. Two
 3. Three
 4. Four
- 1-22. How can you be sure that you have the right graphs for the test stand you are going to calibrate?
1. The graphs will have the same serial numbers as the test stand
 2. The graphs are color coded
 3. All graphs are the same

- 1-23. When preparing the differential pressure gage correction card, you must connect the precision 0 to 100 in. H₂O low-pressure gage to which of the following components?
1. Pressure gage calibration kit
 2. Relief valve
 3. Flowmeter 125-250 mm
 4. Bell jar bottom coupling
- 1-24. When you are preparing the differential pressure gage correction card, what initial pressure is used to compare the readings on the 0 to 100 in. H₂O low-pressure gage and the differential pressure gage?
1. 25 in. H₂O
 2. 50 in. H₂O
 3. 100 in. H₂O
- 1-25. To complete the differential pressure gage correction card after making the correction for 100 in. H₂O, you must drop the pressure in what increments?
1. 10 in. H₂O
 2. 20 in. H₂O
 3. 25 in. H₂O
- 1-26. To prepare the test pressure gage correction card, you must connect the bell jar bottom coupling to which of the following precision gages?
1. 0 to 100 psig
 2. 0 to 200 psig
 3. 0 to 500 psig
 4. Differential pressure gage
- 1-27. The pointer of the low-pressure test gage can be adjusted by which of the following methods?
1. Turning the adjustment screw on the back of the gage
 2. Turning the adjustment screw on the front of the gage
 3. Opening the oxygen supply valve
 4. Closing the oxygen supply valve
- 1-28. When preparing the correction card for the low-pressure test gage, you must use the bleed valve to reduce the pressure indicated on the precision-0-to-200-psig pressure test gage. What maximum increments are used to reduce the indicated pressure?
1. 2 psig
 2. 5 psig
 3. 25 psig
 4. 50 psig
- 1-29. When preparing the correction card for the low-pressure gage, you make your first correction reading at 14 psig. How many other readings are required?
1. Five
 2. Two
 3. Six
 4. Four
- 1-30. When preparing the linear flow element correction cards, you should start with which of the following lpm flow elements?
1. 0 to 50
 2. 0 to 100
 3. 0 to 150
 4. 0 to 200
- 1-31. By setting the oxygen supply valve V-6 to 150 lpm on the 500- to 750-mm calibration kit flow element, the flow, in. H₂O, will be displayed on which of the following flowmeter indicators?
1. PG-1
 2. PG-2
 3. PG-3
 4. PG-4
- 1-32. Upon completion of any maintenance action on the 59A120 test stand, you must complete which of the following forms?
1. Ground Support Equipment Subcustody and Periodic Maintenance Record (OPNAV 4790/50)
 2. Ground Support Equipment Custody and Maintenance Record (OPNAV 4790/51)
 3. both 1 and 2 above
 4. VIDS/MAF
- 1-33. Which of the following manuals contains information on the 59A120 test stand?
1. NAVAIR 17-15BC-20
 2. NAVAIR 17-18BC-30
 3. NAVAIR 13-5-501
 4. OPNAV 4790.2A
- 1-34. Who has the responsibility to repair a defective flow element that consistently reads low?
1. Only personnel of the PR rate
 2. Only E-6 and above personnel of the PR rate
 3. Local AIMD personnel assisted by the calibration team

- 1-35. Which, if any, of the following gages, reads pressure applied to the item under test on the 59A120 test stand?
1. DF-1, 0 to 100 H₂O
 2. PG-1, 0 to 160 psig
 3. PG-4, 0 to 15 psig
 4. None of the above
- 1-36. When you are testing the accessories section for leakage, a leak will be indicated on which of the following gages?
1. PG-1
 2. PG-2
 3. PG-3
- 1-37. When you test the accessories section on the 59A120 test stand, what is the allowable leakage?
1. 2 psig in 10 min
 2. 5 psig in 10 min
 3. 2 psig in 15 min
 4. 5 psig in 15 min
- 1-38. The relief valve V-11 shall relieve at no more than how many psig?
1. 50
 2. 90
 3. 110
 4. 120
- 1-39. The relief valve V-11 shall be leak tight at what minimum psig?
1. 50
 2. 90
 3. 100
 4. 110
- 1-40. In order to bleed the accessory section of the 59A120, which of the following valves is used?
1. V-11
 2. V-6
 3. V-5
 4. V-1
- 1-41. Any time the 0 to 160 psig pressure gage pegs, it is caused by which of the following parts?
1. Supply cylinder
 2. Supply pressure gage DF-1
 3. Pressure regulator R-2
 4. Pressure regulator R-1
- 1-42. With 1800 psi supply pressure applied, the pressure regulator R-1 is set to maintain what maximum pressure?
1. 110 psig
 2. 120 psig
 3. 140 psig
 4. 160 psig
- 1-43. When operating valves V-2, V-5, V-6, V-7, and V-10 on the 59A120 test stand, you should be cautious when closing them because they are manufactured from soft aluminum.
1. True
 2. False
- 1-44. Before attempting to set the pressure on the R-1 regulator, you must first loosen which of the following parts?
1. Needle valve on the top of the regulator
 2. Needle valve on the left side of the regulator
 3. Needle valve on the right side of the regulator
 4. Hex nut on the front of the regulator
- 1-45. What is the pressure range of the low-pressure test gage (PG-4) on the 59A120?
1. 0 to 15 psig
 2. 0 to 50 psig
 3. 0 to 100 psig
 4. 0 to 500 psig
- 1-46. What type of a gage is the 0-100-in. H₂O differential pressure gage?
1. An aneroid operated
 2. A bellows operated
 3. A spring operated
 4. A gravity operated
- 1-47. The purpose of the low-pressure test gage is to read
1. pressure from the bell jar
 2. extremely low pressure from the item under test
 3. the relief valve pressure
 4. leakage of the relief valve

1-48. The low-pressure test gage is protected by a gage guard set at what pressure range?

1. 5 to 11 psig
2. 5 to 15 psig
3. 11 to 14 psig
4. 10 to 15 psig

1-49. If you have a 59A120 test stand that the differential pressure gage (DF-1) indicates low readings, your problem would most likely be located in which of the following areas?

1. Shut off differential pressure valve (V-8)
2. Low-pressure shut off valve
3. 0 to 160 psig oxygen pressure regulator (PG-4)
4. Differential pressure bleed valve (V-7)

1-50. The relief valve located in the bell jar has a range of













1. 3 to 5 psig
2. 5 to 7 psig
3. 5 to 15 psig
4. 110 to 120 psig

1-51. When you replace tubing on a 59A120 test stand, what is the minimum wall thickness for tubing used on high-pressure tubing?

1. .025
2. .032
3. .049
4. .052

Assignment 2

Textbook Assignment: "Oxygen Component Test Stand (1172AS100)." Pages 2-1 through 2-16.

<p>Learning Objective: Recognize the capabilities, operational characteristics and leakage within systems, and associated maintenance procedures for the 1172 AS 100 oxygen system component test stand.</p>	<p>2-5. Which of the following symbols identifies a one-way check valve?</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <p>1. </p> <p>2. </p> </div> <div style="width: 50%;"> <p>3. </p> <p>4. </p> </div> </div>
<p>2-1. Who has the responsibility for maintaining the 1172 AS 100 test stand?</p> <ol style="list-style-type: none"> 1. Senior PR 2. Ground support personnel 3. Calibration lab team 	<p>2-6. Which of the following symbols identifies a line trap?</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <p>1. </p> <p>2. </p> </div> <div style="width: 50%;"> <p>3. </p> <p>4. </p> </div> </div>
<p>2-2. Which of the following test stands is used to test oxygen regulators?</p> <ol style="list-style-type: none"> 1. OTS 59A 120 2. OTS 31-15 3. 1172 AS 100 4. 135562A 	<p>2-7. Which of the following symbols identifies a Vol-O-Flow element?</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <p>1. </p> <p>2. </p> </div> <div style="width: 50%;"> <p>3. </p> <p>4. </p> </div> </div>
<p>2-3. Detailed instructions for periodic inspections for the 1172 AS 100 can be found in which of the following manuals?</p> <ol style="list-style-type: none"> 1. Aircrew Survival Equipmentman 3&2 Vol 2 2. NAVAIR 13-1-6.4 3. Both 1 and 2 above 4. NAVAIR 13-1-6.5 	<p>2-8. Before attempting to operate the 1172 AS 100 test stand, which of the following actions must you perform?</p> <ol style="list-style-type: none"> 1. Secure all the valves before opening the supply cylinder 2. Position the high-pressure regulator to LOAD then turn to VENT 3. Ensure the low-pressure regulator is hacked out 4. All of the above
<p>2-4. How many different systems are incorporated within the 1172 AS 100 test stand?</p> <ol style="list-style-type: none"> 1. 5 2. 7 3. 9 4. 12 	

- 2-9. During which leakage test is supply nitrogen pressure tested for leakage?
1. Inward leakage
 2. Outward leakage
 3. Rotameter leakage
 4. Differential leakage
- 2-10. How often do you perform the outward leakage test?
1. Daily
 2. Biweekly
 3. Weekly
 4. Monthly
- 2-11. To test for leakage on the supply pressure gage, you should pressurize the gage and wait 2 minutes. How much leakage, if any, is allowed?
1. 5 psi
 2. 10 psi
 3. 15 psi
 4. None
- 2-12. What is the minimum pressure range of the regulated high-pressure system?
1. 0 psig
 2. 100 psig
 3. 250 psig
 4. 500 psig
- 2-13. The gage guard that protects the low-range and high-range leakage rotameters is set to relieve at what maximum pressure?
1. 50 ± 5 psig
 2. 170 ± 5 psig
 3. 180 ± 5 psig
 4. 250 ± 10 psig
- 2-14. Which of the following gages indicates the gage guard pressure that protects the low-range and high-range rotameters?
1. Regulated low-pressure gage
 2. Regulated high-pressure gage
 3. Supply gage
 4. Differential pressure gage

- 2-15. When testing the regulated high-pressure system, you determine that there is a leak in one of your ON/OFF valves. The leak will be indicated on which of the following gages?
1. N_2 inlet pressure gage
 2. N_2 outlet pressure gage
 3. Differential pressure gage
- 2-16. To bleed the regulated high-pressure system, you should use which of the following valves or regulators?
1. High-pressure regulator only
 2. System bleed valve only
 3. Both 1 and 2 above
 4. Inlet bleed valve
- 2-17. To check the regulated high-pressure system for leaks, you should turn the supply cylinder ON. This pressure can be read on which of the following gages?
1. Low-pressure gage
 2. High-pressure gage
 3. Both 1 and 2 above
 4. Differential pressure gage
- 2-18. When testing the high pressure system for leaks, what period of time must you wait before reading and rereading the high-pressure gage?
1. 1 min
 2. 2 min
 3. 3 min
 4. 5 min
- 2-19. What is the minimum pressure range of the regulated low-pressure nitrogen system?
1. 0 to 180 psig
 2. 0 to 250 psig
 3. 0 to 500 psig
 4. 0 to 1800 psig

Learning Objective: Identify the test stand used to test LOX converters, test stand inspections, internal parts, and general maintenance.

- 2-20. The purpose of the regulated low-pressure nitrogen system is to supply nitrogen to which of the following components?
1. N₂ input connection
 2. In-system leakage rotameters
 3. Both 1 and 2 above
 4. N₂ output connection
- 2-21. When you are testing the regulated low-pressure system for leaks, what action determines a leak is present?
1. The low-pressure gage drops
 2. The low-pressure gage rises
 3. The ball in the high-range leakage rotameter rises
 4. The ball in the low-range leakage rotameter rises
- 2-22. When the low-pressure regulator indicates 160 psig, what should the N₂ input pressure gage be reading?
1. 70 psig
 2. 120 + 5 psig
 3. 145 ± 5 psig
 4. 160 psig
- 2-23. When making bleed adjustments to a 20004 miniature regulator, You should use which of the following systems?
1. Input
 2. Rotameter
 3. output
 4. Regulated low-pressure
- 2-24. How many rotameters are incorporated in the rotameter system?
1. One
 2. Two
 3. Three
 4. Four
- 2-25. Which of the following types of leakage tests requires you to connect the low-pressure connection (19) and the 200 ccm leakage connection (20) together by using the line with two bayonet fittings?
1. Leakage between the low-pressure and rotameter system
 2. Leakage between the high-pressure and rotameter system
 3. Leakage through the leakage control valve (E)
 4. Leakage through the supply shut off valve
- 2-26. Which of the following connections is NOT located inside the pressure chamber?
1. Low-pressure connection
 2. 200-ccm leakage connection
 3. Reference tap connection
 4. Differential pressure connection
- 2-27. To pressurize the differential pressure system for a leakage test, you open the leakage control valve until it reaches how many inches of water on the pressure/suction manometer?
1. 5 in.
 2. 9 in.
 3. 12 in.
 4. 18 in.
- 2-28. Leakage in the differential pressure system will be indicated on which of the following gages?
1. Pressure/auction rotameter
 2. High-range leakage rotameter
 3. Low-pressure leakage rotameter
 4. All of the above
- 2-29. The differential pressure indicating system is used to perform which of the following tests?
1. Safety-pressure
 2. Pressure breathing
 3. Flow suction
 4. All of the above
- 2-30. How many manometers are used on the test stand to indicate differential pressure?
1. One
 2. Two
 3. Three
 4. Four
- 2-31. Which of the following valves or connections affect(s) readings on the pressure suction manometer?
1. Helmet reference tap
 2. Suit simulator reference tap
 3. Pressure equalizer valve
 4. All of the above

- 2-32. 1.0 psig is equal to how many inches of H₂O?
1. 8.5
 2. 9.0
 3. 20.0
 4. 27.7
- 2-33. 1.0 psig is equal to how many inches of HG?
1. 5 in.
 2. 2 in.
 3. 3 in.
 4. 4 in.
- 2-34. To test the differential pressure indicating system, you must apply how many inches of H₂O to the system?
1. 16 in.
 2. 18 in.
 3. 20 in.
 4. 24 in.
- 2-35. Pressure applied to the differential pressure system can be read on which of the following component?
1. Pressure/suction manometer
 2. High-pressure gage
 3. Low-pressure gage
 4. Inclined flowmeter
- 2-36. Leakage in the differential pressure system will be indicated on which of the following components?
1. High-range flowmeter
 2. Low-range flowmeter
 3. Both 1 and 2 above
 4. Pressure/suction manometer
- 2-37. How should you bleed the differential pressure system?
1. Back out on the low-pressure regulator and open the bleed valve
 2. Back out on the high-pressure regulator and open the bleed valve
 3. Turn in on the low-pressure regulator and open the bleed valve
 4. Turn in on the high-pressure regulator and open the bleed valve
- 2-38. Which of the following systems is considered the heart of the test stand?
1. Vacuum system
 2. Differential system
 3. Rotameter system
 4. Nitrogen system
- 2-39. Which of the following valves allows a direct evacuation of the chamber?
1. Output valve
 2. Vacuum control valve
 3. Bypass valve
- 2-40. Which of the following valves draws a flow through the item under test?
1. Output valve
 2. Vacuum valve
 3. Input valve
- 2-41. The vacuum system is checked at which of the following altitudes?
1. 5,000 feet
 2. 10,000 feet
 3. 20,000 feet
 4. 50,000 feet
- 2-42. Atmosphere, as a unit of pressure, is equal to what total number of pounds per square inch?
1. 6.9
 2. 12.5
 3. 14.69
 4. 27.0
- 2-43. At what altitude do you perform the leakage test of the altitude sensing system?
1. 10,000 feet
 2. 20,000 feet
 3. 50,000 feet
 4. 150,000 feet
- 2-44. To indicate a leak is present when testing the chamber bleed system for leaks, you will receive a drop in
1. supply pressure
 2. regulated low pressure
 3. regulated high pressure
 4. altitude

- 2-45. Which of the following systems is the largest and most important system in the operation of the 1172 AS 100 test stand?
1. Vacuum
 2. System bleed
 3. Flow measuring
 4. Differential pressure
- 2-46. Where does the output flow system originate?
1. Prizometer
 2. Flow selector valve
 3. Vol-O-Flow element
- 2-47. Output flow systems can be used only with the chamber at altitude.
1. True
 2. False
- 2-48. The input flow system originates at the
1. prizometer
 2. flow selector valve
 3. suit simulator
 4. air intake
- 2-49. Which of the following systems originates at either the vent ambient valve or the vent pressure valve?
1. Vent flow
 2. Differential pressure
 3. Vol-O-Flow
 4. Bleed
- 2-50. To use the flow measuring system, you must convert liters-per-minute to which of the following measurements?
1. In. H₂O
 2. Psig
 3. In. Hg
- 2-51. At what altitude & you perform the leak test for the flow measuring system?
1. Sea level
 2. 5,000 feet
 3. 10,000 feet
 4. 15,000 feet

Assignment 3

Textbook Assignment: "Carbon Dioxide Transfer Equipment." Pages 3-1 through 3-13.

<hr/> <p>Learning Objective: Relative to CO₂ transfer equipment, recognize their components, construction and operating features, and servicing and maintenance procedures, including the replacement of packings and safety disc.</p> <hr/>		
3-1.	Which of the following companies manufacture(s) CO ₂ transfer pumps?	<p>3-5. How many pounds of CO₂ are there in a standard supply cylinder?</p> <ol style="list-style-type: none"> 1. 38 lb 2. 40 lb 3. 50 lb 4. 100 lb
	<ol style="list-style-type: none"> 1. C-O-Two Fire Equipment 2. Walter Kidde 3. Both 1 and 2 above 4. Bendix Engineering 	<p>3-6. The SC-5 pump has a flangeable safety disc that is designed to release pressure in the pump at what maximum pressure range?</p> <ol style="list-style-type: none"> 1. 2050 to 2100 psig 2. 2250 to 2300 psig 3. 2500 to 3000 psig 4. 2650 to 3000 psig
3-2.	Which of the following methods is used to take up any slack in the drive belt on a SC-5 CO ₂ transfer unit?	<p>3-7. What prevents any recoil in the event the safety disc ruptures?</p> <ol style="list-style-type: none"> 1. Recoil valve 2. Safety valve 3. Safety disc nut 4. Defuser
	<ol style="list-style-type: none"> 1. Adjust the adapter on the drive pulley 2. Slide the motor on the adjustable base 3. Replace the drive belt 4. Adjust the drive shaft 	<p>3-8. The SC-5 CO₂ pump requires which of the following types of oil?</p> <ol style="list-style-type: none"> 1. 10 W 40 2. 10 W 30 3. SAE 20 4. SAE 30
3-3.	The SC-5 CO ₂ pump is designed to work with a pressure of how many pounds per square inch?	<p>3-9. Which of the following motors is standard equipment on the SC-5 transfer unit?</p> <ol style="list-style-type: none"> 1. 1/2 horsepower 2. 1 horsepower 3. 1 1/2 horsepower 4. 2 horsepower
	<ol style="list-style-type: none"> 1. 2000 2. 2750 3. 3000 4. 3500 	
3-4.	The SC-5 CO ₂ Transfer pump will transfer approximately how many pounds of CO ₂ out of a full supply cylinder?	
	<ol style="list-style-type: none"> 1. 38 lb 2. 50 lb 3. 80 lb 4. 100 lb 	

- 3-10. When adding oil to the SC-5 CO₂ transfer pump that does not have a dip stick, you should fill the crankcase with oil to what level?
1. One-eighth of an inch from the top of the cup
 2. One-fourth of an inch from the top of the cup
 3. To the fourth thread
 4. To the first thread
- 3-11. Other than the crankcase, how many different lubrication points are required on the SC-5 transfer unit?
1. One
 2. Two
 3. Three
 4. Four
- 3-12. When lubricating the idler gear and the puny shaft, you should use what type of lubricant?
1. SAE 20 oil
 2. SAE 30 oil
 3. Vaseline
 4. Light cup grease
- 3-13. Motor bearings contain enough grease to keep the bearings lubricated for approximately how long?
1. 1 year
 2. 2 years
 3. 30 days
 4. 6 months
- 3-14. If it is necessary to wire the SC-5 CO₂ pump for 220 power, where can you find information on the wiring diagram?
1. In NAVAIR 13-1-6.1
 2. In NAVAIR 13-1-6.2
 3. In OPNAV 5510.1E
 4. On the pump's nameplate
- 3-15. If you are required to change the electrical plug on a SC-5 CO₂ unit, the ground wire is which of the following colors?
1. Red
 2. Green
 3. White
- 3-16. Carbon dioxide is stored under (a) what pressure and (b) at what temperature?
1. (a) 850 psig (b) 70°F
 2. (a) 1800 psig (b) 70°F
 3. (a) 2900 psig (b) 60°F
 4. (a) 3000 psig (b) 60°F
- 3-17. What is the purpose for running-in a new pump or one that has been idle for a long time?
1. To check for lubrication
 2. To check for leaks of CO₂
 3. To loosen the bearing packings
 4. To tighten the bearing packings
- 3-18. Which of the following wrenches is used to tighten fittings and connections on the C-O-Two unit?
1. A 10-inch wrench
 2. A 12-inch wrench
 3. A pipe wrench (13 inches)
 4. A crescent wrench (13 inches)
- 3-19. Which of the following statements concerning a supply cylinder is NOT true?
1. A supply cylinder weighs 50 pounds
 2. The maximum capacity of a supply cylinder is 50 pounds
 3. 10 pounds of the contents may be gaseous
 4. 40 pounds of the contents may be liquid
- 3-20. A cool supply cylinder will transfer its contents more efficiently than a warm one.
1. True
 2. False
- 3-21. The time required to charge an empty cylinder increases with increased temperature of the cylinder.
1. True
 2. False
- 3-22. A large cylinder will recharge faster if it is placed in an upright position.
1. True
 2. False
- 3-23. To prevent expansion of CO₂ in the supply hose, the valve should have an opening of at least
1. 1/8 inch
 2. 1/4 inch
 3. 3/4 inch
 4. 1 inch

- 3-24. How often is the idler shaft lubricated?
1. Every 30 days
 2. Every 6 months
 3. Every year
 4. Every 2 years
- 3-25. Gear teeth should be lubricated with
1. a thin coating of light cup grease
 2. a thick coating of light cup grease
 3. SAE 30 motor oil
 4. a thin coating of Vaseline
- 3-26. The piston rod should be lubricated every 6 months with a light coating of
1. light cup grease
 2. Vaseline
 3. gear grease
 4. SAE 30 motor oil
- 3-27. What should you use to clean the motor commutator on the Sc-5 CO₂ transfer unit?
1. A dry piece of lint-free cloth
 2. A piece of cloth dipped in dry cleaning solvent
 3. Freon Type II
 4. Freon Type I
- 3-28. How often should you change the oil in the crankcase of the Sc-5 CO₂ transfer pump?
1. Every 10 days
 2. Every 21 days
 3. Annually
 4. Every 2 years or biannually
- 3-29. What procedure must you use to lubricate the bearing housing on the electric motor?
1. Use a grease gun
 2. Disassemble the complete unit
 3. Disassemble the bearing housing
- 3-30. The electric motor bearings should be lubricated every 2 years. Before lubricating the bearings, you should clean them with
1. carbon tetrachloride
 2. toluene
 3. Stoddard solvent
 4. dry cleaning agent
- 3-31. How much grease should you apply to each bearing?
1. 1 or 2 shots of light cup grease
 2. Add grease until it flows freely from grease cups
 3. One-half ounce of grease
 4. 1 ounce of grease
- 3-32. When should you replace the piston rod packing on the SC-5 transfer pump?
1. Every 250 operating hours
 2. Every 500 operating hours
 3. Yearly
 4. Every 2 years
- 3-33. What is the purpose of the flanged-type packing nut?
1. It serves only to hold the pecking in place
 2. It is used to reduce leaks in the packing
 3. It is used as an adjustment for proper CO₂ pressure
- 3-34. The Walter Kidde transfer unit comes with which of the following motors?
1. One-fourth horsepower
 2. One-half horsepower
 3. Three-fourths horsepower
 4. 1 horsepower
- 3-35. The safety disc used in the Walter Kidde pumps has a range of
1. 2500 to 2750 psi
 2. 2650 to 3000 psi
 3. 2750 to 3000 psi
 4. 2900 to 3000 psi
- 3-36. The motor for the Walter Kidde transfer unit operates at
1. 550 rpm
 2. 1500 rpm
 3. 1750 rpm
 4. 2000 rpm
- 3-37. The multibreaker on the Walter Kidde unit is designed to protect the unit. It operates on what total number of amperes?
1. 5 amp
 2. 15 amp
 3. 20 amp
 4. 30 amp

- 3-38. How is the multibreaker reset on a Walter Kidde unit?
1. By replacing the blown fuse
 2. By resetting the breaker box
 3. By turning the ON/OFF switch to OFF then to ON
- 3-39. Which motor oil is used in the crankcase of the Walter Kidde unit?
1. SAE 10 W 40
 2. SAE 10
 3. SAE 20
 4. SAE 30
- 3-40. Which of the following directive take precedence over the procedures outlined in the manufacturer manual?
1. OPNAV
 2. NAVAIRSYSCOM
 3. 4790.2B
- 3-41. What size wrench is recommended by Walter Kidde to tighten connecting joints?
1. 6 in.
 2. 8 in.
 3. 10 in.
 4. 12 in.
- 3-42. How often should you change the oil in the Walter Kidde crankcase?
1. After 150 hours of operation
 2. After 500 hours of operation
 3. Every year
 4. Every 2 years
- 3-43. How much oil does the Walter Kidde crankcase hold?
1. 1 pint
 2. 2 pints
 3. 1 quart
 4. 2 quarts
- 3-44. If a leak should develop at the lower end of the plunger on the Walter Kidde unit, what type of tool should you use to correct the problem?
1. A special rod approximately 3/8 inch x 6 inches
 2. A special rod approximately 1/2 inch x 6 inches
 3. A one-half inch box end wrench
 4. A three-eighths inch box end wrench
- 3-45. The ICC requirement for testing a CO₂ cylinder requires that the cylinder be tested at what pressure?
1. Twice the working pressure
 2. Three times the working pressure
 3. Five-thirds the working pressure
- 3-46. How often should a cylinder be hydrostatically tested?
1. Every 5 years
 2. Every 2 years
 3. Every 3 years
 4. Every 7 years
- 3-47. Winterized extinguishers can be identified by
1. yellow dots three-fourths of an inch on opposite sides of each other
 2. one three-fourths of an inch yellow dot on the shoulder of the cylinder
 3. two black dots
 4. a 1-inch yellow band
- 3-48. How much nitrogen is required to winterize a CO₂ cylinder?
1. 100 psi
 2. 200 psi
 3. 300 psi
 4. 400 psi
- 3-49. What maximum temperature can a winterized cylinder be subjected to without rupturing the safety disc?
1. 80°F
 2. 110°F
 3. 150°F
 4. 160°F
- 3-50. To replace a safety disc on F/U-6/P cylinder, you need a torque wrench, a five-sixteenth inch socket and a
1. piece of hex stock 5/16 x 2 inches
 2. 3/8 x 6 inches rod
 3. 1/2 x 6 inches rod

Assignment 4

Textbook Assignment: "Sewing Machine Repair." Pages 4-1 through 4-37.

<hr/> <p>Learning Objective: Recognize maintenance responsibilities in troubleshooting, repairing, and replacing parts of the Class 111 sewing machine.</p> <hr/>	
4-1. The single needle, rotary axis 111 W 155 sewing machine makes which of the following federal standard stitches?	4-5. The 111 W 155 sewing machine may be operated to what maximum number of stitches per minute (SPM)?
<ol style="list-style-type: none"> 1. 103 2. 200 3. 301 4. 400 	<ol style="list-style-type: none"> 1. 2200 2. 2800 3. 3500 4. 4000
4-2. Which of the following sewing machines is NOT suited for sewing medium-heavy fabrics?	4-6. The 111 W 155 sewing machine has a stitch per inch (SPI) range of
<ol style="list-style-type: none"> 1. Singer 111 W 155 2. Juki LU-562 3. Consew 225 4. Singer 31-15 	<ol style="list-style-type: none"> 1. 3 1/2 to 30 2. 5 to 32 3. 3 1/2 to 32 4. 5 to 30
4-3. The 111 W 155 sewing machine features a <u>rotary axis</u> ; to what component does this term apply?	4-7. What component holds the material as the needle is raised and moves forward for another bight?
<ol style="list-style-type: none"> 1. Safety clutch 2. Arm shaft 3. Sewing hook 4. Feed eccentric 	<ol style="list-style-type: none"> 1. Feed dogs 2. Vibrating presser 3. Feed eccentric 4. Lifting presser
4-4. The feeding action of the 111 W 155 sewing machine allows which components to move in unison?	4-8. In which direction will the 111 W 155 sewing machine move the fabric being sewed?
<ol style="list-style-type: none"> 1. The lifting presser foot, the pinion gear, and the feed dogs 2. The vibrating presser, the needle, and the feed dogs 3. The lifting presser, the needlebar, and the feed dogs 4. The vibrating presser, the lifting presser, the needle, and the feed dogs 	<ol style="list-style-type: none"> 1. Toward the operator 2. Away from the operator 3. Either toward or away from the operator, depending on the setting of the feed drive eccentric
	4-9. The 111 W 151 sewing machine has a stitch per inch (SPI) range of
	<ol style="list-style-type: none"> 1. 3 1/2 to 30 2. 5 to 32 3. 3 1/2 to 32 4. 5 to 30

- 4-10. What is the maximum presser foot lift for the 111 W 155 sewing machine?
1. One-half in.
 2. One-eighth in.
 3. Three-fourths in.
 4. Three-sixteenths in.
- 4-11. What is the maximum presser foot lift for the 111 W 151 sewing machine?
1. One-half in.
 2. Three-eighths in.
 3. Three-fourths in.
 4. Three-sixteenths in.
- 4-12. The 111 W 155 and 111 W 151 are similar in most features EXCEPT that the 111 W 151 has only one
1. feed drive eccentric
 2. presser foot
 3. oiling point
 4. feed dog
- 4-13. An accumulation of dust and lint will cause the same sluggish operation problem as a loose puny belt.
1. True
 2. False
- 4-14. New sewing machines should be cleaned to remove corrosion preventive substances that were applied at the factory. What substance is used to remove corrosion preventive substances?
1. Stoddard solvent
 2. Freon 113
 3. Diesel fuel
 4. JP-5
- 4-15. After using a sewing machine, you should clean and oil it.
1. True
 2. False
- 4-16. Compressed air should never be used to clean a sewing machine.
1. True
 2. False
- 4-17. An excessive amount of oil on the working parts of any sewing machine will probably result in which of the following conditions?
1. The oil will dry out and cause grease to form on friction surfaces
 2. The oil will drip on materials being sewn and soil the project
 3. The oil will accumulate in the drip pan and overflow on the drive motor
 4. The oil will cause condensation that will drip into the drive motor
- 4-18. Hard to reach places on the sewing machine may be cleaned with
1. a medium soft bristle brush only
 2. low pressure air only
 3. a medium soft bristle brush and low pressure air
- 4-19. At what minimum interval should sewing machines be given a through cleaning and oiling?
1. Every 3 mo
 2. Every 6 mo
 3. Every 12 mo
 4. Every 18 mo
- 4-20. A clean dust cloth should be used to clean all sewing machine parts EXCEPT the
1. head
 2. oil pan
 3. motor casing
 4. arm shaft
- 4-21. If unable to obtain the recommended types of oil required by the manufacturer, you may use which of the following oils as a substitute?
1. Cod oil
 2. Turbine oil
 3. Mineral oil
 4. STP oil treatment
- 4-22. Continual malfunction of a sewing machine is most likely caused by which of the following conditions?
1. Electrical lead unplugged
 2. Out of timing sequence
 3. Lack of lubrication
 4. Drive motor wired backwards

- 4-23. Complete disassembly of the 111 W 155 sewing machine is necessary to properly set the timing sequence.
1. True
 2. False
- 4-24. When the arm shaft is timed with the hook drive shaft, it is necessary to turn the balance wheel toward the operator until which of the following components reaches its highest position?
1. Bell crank
 2. Needlebar
 3. Thread take-up lever
 4. Drive belt
- 4-25. In timing the arm shaft with the hook drive shaft, you must align the timing mark on the timing plate with the timing mark on which of the following components?
1. Hook drive shaft
 2. Arm shaft
 3. Feed drive shaft
 4. Pinion gear
- 4-26. After timing the arm shaft with the hook drive shaft, you should perform which of the following actions?
1. Set the hook to the needle
 2. Install the connection belt pulley
 3. Set the feed dogs
 4. Install the motor drive belt
- 4-27. Centering the feeding action on the 111 W 155 sewing machine is accomplished by ensuring that the feed dogs do NOT strike the throat plate.
1. True
 2. False
- 4-28. Which of the following actions prevent(s) the needle from wandering from side to side?
1. Ensuring the needlebar rock frame hinge stud is tight
 2. Ensuring the needlebar rock frame guide bracket is tight
 3. Both 1 and 2 above
 4. Ensuring the needlebar is properly timed and tight
- 4-29. To set the 111 W class sewing machine to its maximum stitch length, which of the following actions is required?
1. Depress the plunger and turn the balance wheel toward the operator
 2. Depress the plunger and turn the balance wheel away from the operator
 3. Push the stitch regulator lever all the way down
 4. Push the stitch regulator lever all the way up
- 4-30. Which of the following actions allows you to adjust the movement of the feed dogs?
1. Loosen the feed dog fork
 2. Loosen the feed driving crank pinch screw
 3. Remove the throat plate
 4. Remove the feed driving cam
- 4-31. To time the sewing hook and the needlebar on the sewing machine, you should remove which of the following parts?
1. Throat plate
 2. Feed dogs
 3. Presser foot
 4. All of the above
- 4-32. Which of the following methods should you use to adjust the hook guard?
1. Loosen the two screws and move the hook guard left or right
 2. Move the adjusting screw clockwise
 3. Bend the hook guard washer
- 4-33. Which of the following parts prevents the needle from striking the sewing hook ?
1. Safety clutch
 2. Hook gib
 3. Hook guard
 4. Hook pinion gear
- 4-34. Which of the following parts controls the feeding motion provided by the alternating pressers?
1. Feed driving cam
 2. Feed driving rock shaft
 3. Pressure lifting cam
 4. Pressure lifting eccentric

- 4-35. When timing the pressure lifting eccentric, you should set the sewing machine at
1. 3 1/2 SPI
 2. 5 SPI
 3. 8 SPI
 4. 32 SPI
- 4-36. What is the purpose of the thread controller spring?
1. It prevents the bobbin thread from breaking
 2. It prevents the upper thread from breaking
 3. It prevents the sewing hook from piercing the thread
 4. It prevents the needle from piercing the thread
- 4-37. Which of the following statements concerning the thread controller spring is correct?
1. It rests on the thread controller spring stop as the point of the needle enters the material
 2. It rests on the thread controller spring stop as the needle reaches its highest point
 3. It prevents the bobbin thread from jamming under the throat plate
- 4-38. When adjusting the thread tension and you cannot properly adjust it with the upper thread tension disc, what action should you take?
1. Change the size of thread
 2. Change the needle size
 3. Adjust the bobbin tension
 4. Adjust the presser foot tension
- 4-39. If your machine is hard to turn after you time and adjust it, which of the following actions must be performed first?
1. Check the feeding action
 2. Remove the arm shaft connection belt
 3. Remove the throat plate and set the stitches to zero

Learning Objective: Identify the functions, adjustments, timing and general maintenance applicable to the 31-15 sewing machine.

- 4-40. Which of the following is an oscillating type sewing machine?
1. 31-15
 2. 331K1
 3. Consew C-30
 4. Each of the above
- 4-41. The 31-15 sewing machine will sew canvas up to
1. 4 oz
 2. 6 oz
 3. 8 oz
 4. 10 oz
- 4-42. What is the stitch range on the Consew C-30?
1. 5 to 30 SPI
 2. 7 to 32 SPI
 3. 5 to 27 SPI
 4. 7 to 27 SPI
- 4-43. What is the clearance between the presser foot and the throat plate at the 31-15 sewing machine?
1. One-fourth in.
 2. One-eighth in.
 3. Seven-sixteenths in.
 4. Five-sixteenths in.
- 4-44. Which of the following is the main timing point on a 31-15 sewing machine?
1. Hook drive gear
 2. Hook pinion gear
 3. Needlebar
 4. Balance wheel
- 4-45. When you set the needlebar and it starts its upstroke, what is the distance of the hook in relation to the eye of the needle?
1. One-sixteenth inch above
 2. One-sixteenth inch below
 3. One-eighth inch above
 4. One-eighth inch below
- 4-46. To set the feeding action on a 31-15 sewing machine, you must loosen which of the following screws?
1. Feed dogs setscrew
 2. Feed dog cam fork setscrew
 3. Feed-driving rock shaft crank pinch screw
 4. Feed-driving rock shaft connection pinch screw

Learning Objective: Recognize the procedures for disassembling and assembling the 111 W 155 sewing machine.

- 4-47. You may have to grind off the case hardening surface on a sewing machine screw before you can remove it with an easyout.
1. True
 2. False
- 4-48. Which of the following screws has a left-hand thread?
1. Balance wheels retaining screw
 2. Arm shaft connection setscrew
 3. Feed eccentric adjusting screw
 4. Thread take-up lever retaining screw
- 4-49. Which of the following screws is loosened a quarter of an inch and is NOT to be removed when you disassemble the 111 W 155 sewing machine?
1. Presser bar spring setscrew
 2. Presser bar spring support screw
 3. Vibrating presser bar connecting screw
 4. Presser lifting link crank pinch screw
- 4-50. If binding should occur while removing the presser bar, what action should you take?
1. Apply a light oil coating
 2. Turn the presser bar slowly with a back and forth motion
 3. Both 1 and 2 above
 4. Insert a screw driver into the lower slot of the presser bar while applying an upward motion on the presser
- 4-51. When you remove the presser bar, which of the following parts will fall off?
1. Presserbar spring bracket
 2. Releasing bracket
 3. Guide lever
 4. All of the above
- 4-52. Which of the following parts prevents side to side movement of the needlebar rock frame?
1. The needlebar support bracket
 2. The needlebar hinge bracket
 3. The needlebar rock frame position bracket
 4. The needlebar rock frame hinge bracket
- 4-53. Which of the following parts eliminates end play in the balance wheel and arm shaft?
1. Balance wheel adjusting screw
 2. Arm shaft shim
 3. Balance wheel shim
 4. Arm shaft bushing
- 4-54. Which of the following parts transfers the motion from the arm shaft to the needlebar?
1. The needlebar rock stand
 2. The needlebar driving shaft
 3. The needlebar rock shaft
 4. The needlebar driving stud
- 4-55. What is used to remove the needlebar crank friction washer from the sewing machine after you remove the arm shaft?
1. Allen wrench
 2. Needle nose pliers
 3. Index finger
 4. Spanner wrench
- 4-56. Which of the following parts controls the feeding mechanism of the sewing machine?
1. Feed driving eccentric
 2. Safety clutch
 3. Feed lifting eccentric
 4. Feed drive gear
- 4-57. Which of the following parts converts the longitudinal motion of the hook driving shaft to the horizontal motion of the sewing hook?
1. Hook saddle assembly
 2. Hook pinion gear
 3. Hook driving gear
 4. Hook drive eccentric
- 4-58. What part allows the thread to pass between the bobbin case and the throat plate?
1. The bobbin case opener
 2. The thread take-up lever
 3. The thread controller spring
 4. The bobbin case gib

- 4-59. Before reassembling a sewing machine, what do you use to smooth rusty parts?
1. Sand paper
 2. Rubbing compound
 3. Emery paper
 4. Grinding compound
- 4-60. When reassembling a sewing machine, what part should you install first?
1. Arm shaft
 2. Hook drive shaft
 3. Bobbin case opener
 4. Hook saddle assembly
- 4-61. When the bobbin case opener is properly installed, it is in what position?
1. The curved end points toward the bobbin case
 2. The curved end points away from the bobbin case
 3. The blunt end points toward the bobbin case
 4. The blunt end points away from the bobbin case
- 4-62. What total number of spline grooves are on a hook driving shaft?
1. Five
 2. Six
 3. Seven
 4. Eight
- 4-63. On the hook driving shaft, the end with a spline is installed first into the right hook driving shaft bearing.
1. True
 2. False
- 4-64. When you are replacing the feed-driving eccentric, which of the following statements is true?
1. The oiling felt faces down and the crank toward the operator
 2. The oiling felt faces up and the crank toward the operator
 3. The oiling felt faces up and the crank away from the operator
 4. The oiling felt faces down and the crank away from the operator
- 4-65. When you are installing the hook driving shaft lock ratchet, the flange and setscrews face the left of the machine.
1. True
 2. False
- 4-66. Before you insert the needlebar rock frame assembly, the needlebar connecting link must be at its lowest position.
1. True
 2. False
- 4-67. When installing the presser bar into the machine head, you should insert it through the upper bushing about
1. 1 inch
 2. 2 inches
 3. 3 inches
 4. 3 1/2 inches

Assignment 5

Textbook Assignment: "Aircrew Survival Equipment Training." Pages 5-1 through 5-42.

<hr/> <p>Learning Objective: Relative to sea survival, recognize the proper survival equipment, use of life preservers and life rafts, and bailout procedures over water using four-line release.</p> <hr/>	
5-1. During the Southeast Asian conflict, what was the average rescue time for a downed aircrewman?	5-6. As a PR, one of your jobs is to teach swimming to aircrewmembers. 1. True 2. False
1. 6 hours 2. 8 hours 3. 24 hours 4. 48 hours	5-7. During a survival situation, panic will be your worst enemy. 1. True 2. False
5-2. What is the most important factor in bringing downed aircrewmembers home alive?	5-8. The anti-g suit is an excellent flotation device. 1. True 2. False
1. New survival equipment 2. The will of the aircrewman to live 3. Air support for search and rescue (SAR)	5-9. The primary flotation device for an aircrewman flying in a VA type aircraft is which of the following? 1. LPU 2. LPP 3. Mk-2 4. Mk-3C
5-3. Which of the following manuals covers search and rescue (SAR)?	5-10. Which of the following life preservers is used by maintenance personnel?
1. NAVAIR 13-5-501 2. NAVAIR 13-1-6.2 3. NWP 19-1 4. NWP 13-1	1. LPU 2. LPP 3. Mk-1 4. Mk-3
5-4. Which of the following manuals covers survival techniques?	5-11. Which of the following preserver may be used as a substitute for the LPP life preserver?
1. NAVAIR 00-80T-101 2. NAVAIR 00-80T-201 3. NAVAIR 00-80T-501 4. NAVAIR 00-80T-601	1. LPU-30/P 2. Mk-3 3. LPU
5-5. General information about aircrew personnel protection equipment and training can be found in which of the following manuals?	5-12. Which of the following life preserver is worn by personnel flying ejection-seat-equipped aircraft?
1. OPNAV 4790.2B 2. OPNAV 4790.2C 3. OPNAV 3710.7 4. OPNAV 5100	1. LPA-2A 2. LPU-21B/P 3. LPU-24A/P 4. LPP

- 5-13. The FLU-8A/P is installed on which of the following life preservers?
1. LPU-21B/D
 2. LPU-23A/P
 3. LPU-24A/P
 4. Both 2 and 3 above
- 5-14. After life preservers are activated they inflate to their designed shape within what total number of seconds?
1. 10
 2. 20
 3. 30
 4. 60
- 5-15. The LPP life preserver provides the user with a buoyance of how many pounds?
1. 22
 2. 29
 3. 35
 4. 65
- 5-16. The FLU-8A/P will work only in sea water.
1. True
 2. False
- 5-17. The FLU-8A/P system is used as a backup system for the manual release.
1. True
 2. False
- 5-18. Partial inflation of the collar lobe on the LPA and LPU has been a reported problem.
1. True
 2. False
- 5-19. The NB-8 parachute harness is worn over the LPA life preserver.
1. True
 2. False
- 5-20. The four-line release system is designed to reduce oscillation.
1. True
 2. False
- 5-21. The four-line release should NOT be used if your canopy has any evident damage after opening.
1. True
 2. False
- 5-22. It takes approximately how much force to activate the four-line release?
1. 10 pounds
 2. 20 pounds
 3. 30 pounds
 4. 60 pounds
- 5-23. To select the proper life raft for an aircraft, which of the following allowance lists should you use?
1. NAVSUP 101
 2. NAVSUP 2002
 3. NAVAIR 00-35-QA-1
 4. NAVAIR 00-35-QH2
- 5-24. What is the length of an LPI life raft when it is fully deployed?
1. 4 feet
 2. 5 feet
 3. 6 feet
 4. 7 feet
- 5-25. What should you use to right an overturned LR1 life raft?
1. The righting handles on the sides of the raft
 2. The righting lanyard attached to the CO₂ bottle
 3. The boarding handles on the flotation tube
- 5-26. If the life raft is on the crest of a wave, a properly adjusted sea anchor will be in what position?
1. In the trough of the wave
 2. Resting in the wave
 3. 10 feet from the life raft
 4. 12 feet from the life raft
- 5-27. Which of the following life rafts is designed to carry four survivors?
1. LRU-12/A
 2. LRU-13/A
 3. LRU-14/A
 4. LRU-15/A
- 5-28. An LR-12/A life raft has how many separate inflatable compartments?
1. One
 2. Two
 3. Three
 4. Four

- 5-29. Which of the following flotation compartments is/are inflated by CO₂?
1. Bow
 2. Stern
 3. Both 1 and 2 above
 4. Seat
- 5-30. When using the hand pump to top off the pressure on an LRU-12/A life raft, how far should you open the topping-off valve?
1. 1 turn
 2. 1 1/2 turns
 3. 2 turns
 4. Fully open
- 5-31. If there is a tear in the bow section of an LRU-12/A life raft, what, if anything, would prevent it from sinking?
1. Quick patch kit supplied with the raft
 2. Double lined flotation walls
 3. The internal bulkheads
 4. Nothing
- 5-32. To board the LRU-12/A, which of the following procedures is most correct?
1. Board it from the bow using the boarding line
 2. Board it from the sides using the boarding handles
 3. Board it from the stern using the stirrup
- 5-33. Which of the following life rafts has a circular flotation tube?
1. LRU-12/A
 2. LRU-13/A
 3. LRU-14/A
 4. LRU-15/A
- 5-34. Who has the responsibility for installing the equalizer clamp?
1. First person aboard
 2. Last person aboard
 3. Senior man aboard
- 5-35. What is the purpose of the equalizer clamp?
1. To prevent CO₂ from escaping
 2. To prevent the raft from deflating in the event a hole is present
 3. To prevent overpressurization of flotation tubes
- 5-36. When you are tying three or more LRU-15/A life rafts together, which of the following statements is true?
1. Tie the rafts 180° apart from the pivot raft
 2. Tie all the rafts' bows to the stern
 3. Tie the rafts 50 feet apart
- 5-37. What is the recommended distance between life rafts that are tied together?
1. 8 feet
 2. 25 feet
 3. 50 feet
 4. 100 feet
- 5-38. Never eat any food unless an adequate amount of water is available.
1. True
 2. False
- 5-39. Never tie fish to the side of your raft.
1. True
 2. False
- 5-40. Always secure yourself to your life raft.
1. True
 2. False
- 5-41. In rough seas it is permissible to make a sea anchor out of a signaling panel.
1. True
 2. False
- 5-42. A person can survive without water for what period of time?
1. 12 days
 2. 14 days
 3. 3 days
 4. 6 days
- 5-43. A person can go without food for what period of time?
1. 14 days
 2. 21 days
 3. 30 days
 4. 40 days
- 5-44. When you are rafting ashore in heavy surf, which of the following is a true statement?
1. Tie the sea anchor to the bow
 2. Trail the sea anchor from the stern
 3. Make your landing stern first

Learning Objective: Identify rescue devices used by aircrewmembers and helicopter rescue. Identify search and rescue (SAR) communication modes.

- 5-45. Which of the following is the primary rescue device?
1. Rescue hook
 2. Rescue sling
 3. Gated D-ring
- 5-46. At what maximum number of pounds is the smaller hook on the double rescue hook rated?
1. 500 pounds
 2. 1000 pounds
 3. 1500 pounds
 4. 2000 pounds
- 5-47. Which of the following statements concerning the double rescue hook is most correct?
1. Use only the large hook to hoist personnel
 2. Use only the smaller hook to hoist personnel
 3. You can hoist personnel with either hook
- 5-48. As a survivor, why must you never touch any rescue device being lowered from a helicopter until it has touched the water?
1. To prevent electrical shock from static electricity
 2. To prevent development of cramps
 3. To prevent your raft from capsizing
- 5-49. Horse collar is another name for the rescue strop.
1. True
 2. False
- 5-50. A crewman being rescued by a helicopter should assist the helo crew by swinging into the helo feet first.
1. True
 2. False
- 5-51. The forest penetrator top will float only 6 inches out of the water with a flotation collar attached.
1. True
 2. False
- 5-52. To safely use the forest penetrator, the survivor should lower his helmet visor.
1. True
 2. False
- 5-53. If not used properly, which of the following rescue devices is considered the most dangerous?
1. Horse collar
 2. Rescue strop
 3. Forest penetrator
 4. Rescue seat
- 5-54. At 77°F the AN/PRT-5 can operate continuously for how many hours?
1. 24
 2. 36
 3. 48
 4. 72
- 5-55. Which of the following radios is equipped with a flotation device?
1. AN/PRC-90
 2. AN/URT-33
 3. AN/PRT-5
 4. AN/PRC-49
- 5-56. Which of the following radios must you place the ON/OFF switch to read ON to operate the radio?
1. AN/URT-33
 2. AN/PRT-5
 3. AN/PRC-49
- 5-57. The AN/PRC-90 is capable of transmitting up to what total number of nautical miles?
1. 10
 2. 20
 3. 50
 4. 60

Learning Objective: Relative to land survival, recognize the proper techniques for arctic, desert, and tropical survival.

- 5-58. During the winter months, which of the following is NOT considered a good shelter in the arctic?
1. Crashed aircraft
 2. Snow cave
 3. Lean-to
- 5-59. What percent of the earth's land surface is desert?
1. One-fifth
 2. One-fourth
 3. One-third
 4. One-half
- 5-60. When your body starts to dehydrate, what is/are the symptom(s)?
1. Lose of appetite
 2. Sleepiness
 3. Nausea
 4. All of the above
- 5-61. At what point of dehydration will you become delirious?
1. 5%
 2. 8%
 3. 10%
 4. In excess of 10%
- 5-62. At what temperature will 15 percent dehydration cause death?
1. 60°F
 2. 70°F
 3. 80°F
 4. 90°F
- 5-63. When you are dehydrated, which of the following is NOT recommended?
1. Drinking plenty of water
 2. Drinking cool water
 3. Drinking warm water
 4. Drinking cold water
- 5-64. When selecting food in a jungle environment, which of the following foods should you avoid?
1. Food that monkeys eat
 2. Slimy skin fish
 3. Fish with scales
- 5-65. Which of the following is a good substitute for soap in a survival situation?
1. Ashes
 2. Sand
 3. Loamy soil
 4. Each of the above
- 5-66. When should you apply a tourniquet?
1. Only when the bleeding is located on an arm
 2. Only when the bleeding is located on a leg
 3. Either 1 or 2 above, depending upon the flow of blood
 4. When it is the only way to stop the bleeding of an extremity
- 5-67. To ease the pain from broken teeth in a survival situation, which of the following remedies should you use?
1. Pull the broken tooth
 2. Apply pine sap to broken teeth
 3. Apply cold compresses
- 5-68. A substitute for aspirin can be made from which of the following?
1. Boiling sassafras tea roots
 2. Boiling oak bark
 3. Boiling willow bark
- 5-69. Which of the following snakes are considered pit vipers?
1. Rattlesnake
 2. Copperheads
 3. Water moccasins
 4. All of the above
- 5-70. Coral snakes can be identified by the colored bands around their body. Which of the following color sequences identify a coral snake?
1. Red, yellow, and black
 2. Red, black, and yellow
 3. Black, yellow, and red
 4. Yellow, red, and black

Learning Objective: Identify substitute first-aid items and treatment of snake bites?

- 5-71. When applying a tourniquet to a snake bite, which of the following methods should you use?
1. Apply it half way between the bite and the heart
 2. Apply it 6 inches above the bite
 3. Apply it between the bite and the heart, about 2 inches above the bite

- 5-72. Applying a suction to a snake bite is of little benefit after what maximum period of time?
1. 10 minutes
 2. 20 minutes
 3. 30 minutes
 4. 15 minutes

