NONRESIDENT
TRAINING
COURSE

December 2001

Aviation Boatswain's Mate H

NAVEDTRA 14311

NOTICE

Page 8-20 must be printed on a COLOR printer.

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.

COURSE OVERVIEW: Provides information on tools and equipment, aircraft handling equipment, aircraft handling, aircraft firefighting, and crash and salvage.

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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Published by
NAVAL EDUCATION AND TRAINING
PROFESSIONAL DEVELOPMENT
AND TECHNOLOGY CENTER

NAVSUP Logistics Tracking Number
0504-LP-026-4040

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."

TABLE OF CONTENTS

ASSIGNMENT QUESTIONS follow the Index.

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) 452-1001, ext. 1779
DSN: 922-1001, ext. 1779
FAX: (850) 452-1370
(Do not fax answer sheets.)
Address: COMMANDING OFFICER
NETPDTC N315
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32509-5237

For enrollment, shipping, grading, or completion letter questions

E-mail: fleetservices@cnet.navy.mil
Phone: Toll Free: 877-264-8583
Comm: (850) 452-1511/1181/1859
DSN: 922-1511/1181/1859
FAX: (850) 452-1370
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NAVAL RESERVE RETIREMENT CREDIT

If you are a member of the Naval Reserve, you may earn retirement points for successfully completing this course, if authorized under current directives governing retirement of Naval Reserve personnel. For Naval Reserve retirement, this course is evaluated at 9 points. (Refer to *Administrative Procedures for Naval Reservists on Inactive Duty,* BUPERSINST 1001.39, for more information about retirement points.)

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Student Comments

Course Title: *Aviation Boatswain's Mate H* ____________________

NAVEDTRA: *14311* ____________________ **Date**: ____________________

We need some information about you:

Rate/Rank and Name: ____________________ SSN: __________ Command/Unit ____________________

Street Address: ____________________ City: __________ State/FPO: __________ Zip __________

Your comments, suggestions, etc.:

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.

NETPDTC 1550/41 (Rev 4-00)

CHAPTER 1

TOOLS AND EQUIPMENT

Routinely, as an ABH, you are assigned tasks involving the use of hand tools or power tools. Therefore, it is to your advantage that you become familiar with the tools you need to accomplish these tasks quickly and SAFELY. *Use and Care of Hand Tools and Measuring Tools*, NAVEDTRA 12085, should be read for more detailed information on the proper use of each particular hand tool. For example, using a screwdriver as a cold chisel is extremely dangerous and a mark of poor workmanship and judgment. "The right tool for the right job" is an old proverb, but it is a time proven one.

SAFETY is paramount when using any tool. Special care should be used with a wood or metal cutting tool. Safety glasses must be in place before cutting tools are used. An organized tool control program will also increase safety for personnel and equipment. Never use the crash tool roll kit for general maintenance, always use the tools designated for divisional use.

Power tools can be dangerous and should only be used by a person who has been fully familiarized and checked out in their use and proper operation by competent authority. Safety cannot be overemphasized in the use of hand tools or power tools. See OPNAVINST 5100.19 for safety precautions, as well as the manufacture's safety precautions.

Upon completion of this chapter, you will be able to select, use, and maintain tools required for maintenance of equipment; identify the uses for wire rope and various lines; and determine safe work load and breaking strength values of wire rope and various lines.

HAND TOOLS

OBJECTIVES: Identify the different types of hand tools. Describe the proper care of hand tools.

Tools are designed to make a job easier and enable you to work very efficiently. Tools are a craftsman's best friend. (A *craftsman* is skillful in any one of a number of trades, such as machinist, carpenter, plumber, builder, or steelworker). If the tools are not used properly or cared for, their advantages will be lost.

Regardless of the type of work you have to do, you must use the correct tools to do your work quickly, accurately, and safely. When you do not use the proper tool, you waste time, reduce your efficiency, and may injure yourself. This section explains the specific purposes, correct use, and proper care of hand tools. Figures 1-1 and 1-2 illustrate some of the hand tools you will use.

SCREWDRIVERS

Screwdrivers are frequently abused as a tool. They should only be used for driving and removing screws. They are not designed for scraping or mixing paint, cleaning padeyes, use as a pry bar or chisel, or testing an electrical circuit.

Standard Screwdriver

Three main parts make up the construction of the standard screwdriver: the handle, the shank, and the end. The end (called the blade) fits into the screw slot. When you are using a screwdriver, select the proper size blade for the job intended. A blade too large or too small causes the screwdriver blade and the screw head to become damaged. For a proper fit, the blade should fill at least 75 % of the slot. A standard screwdriver is shown in view A of figure 1-1.

Phillips Head Screwdriver

Phillips head screwdrivers, figure 1-1, view B, differ in construction from standard screwdrivers only in that the tip is shaped to fit the special cavity in the Phillips screw head. A standard screwdriver must never be used in a Phillips screw head, as damage will occur to the driver. For a proper fit, the blade should fill 100% of the cavity.

Reed and Prince Screwdriver

Reed and Prince screwdrivers look like, but are <u>not</u> interchangeable with, Phillips screwdrivers. Therefore, always use a Reed and Prince screwdriver with Reed and Prince screws and a Phillips screwdriver with Phillips screws, or a ruined tool or ruined screw head will result.

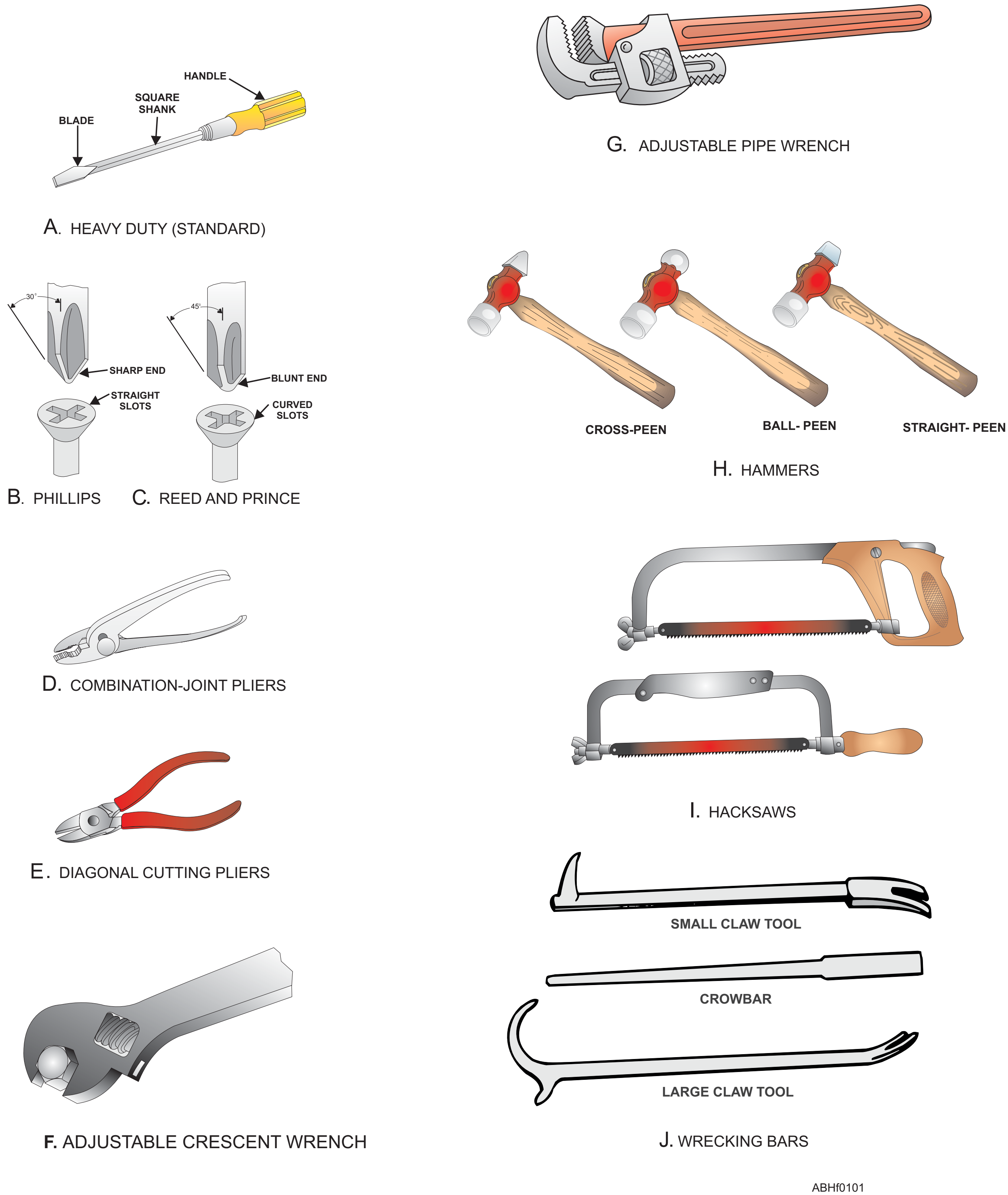


Figure 1-1.—Hand tools.

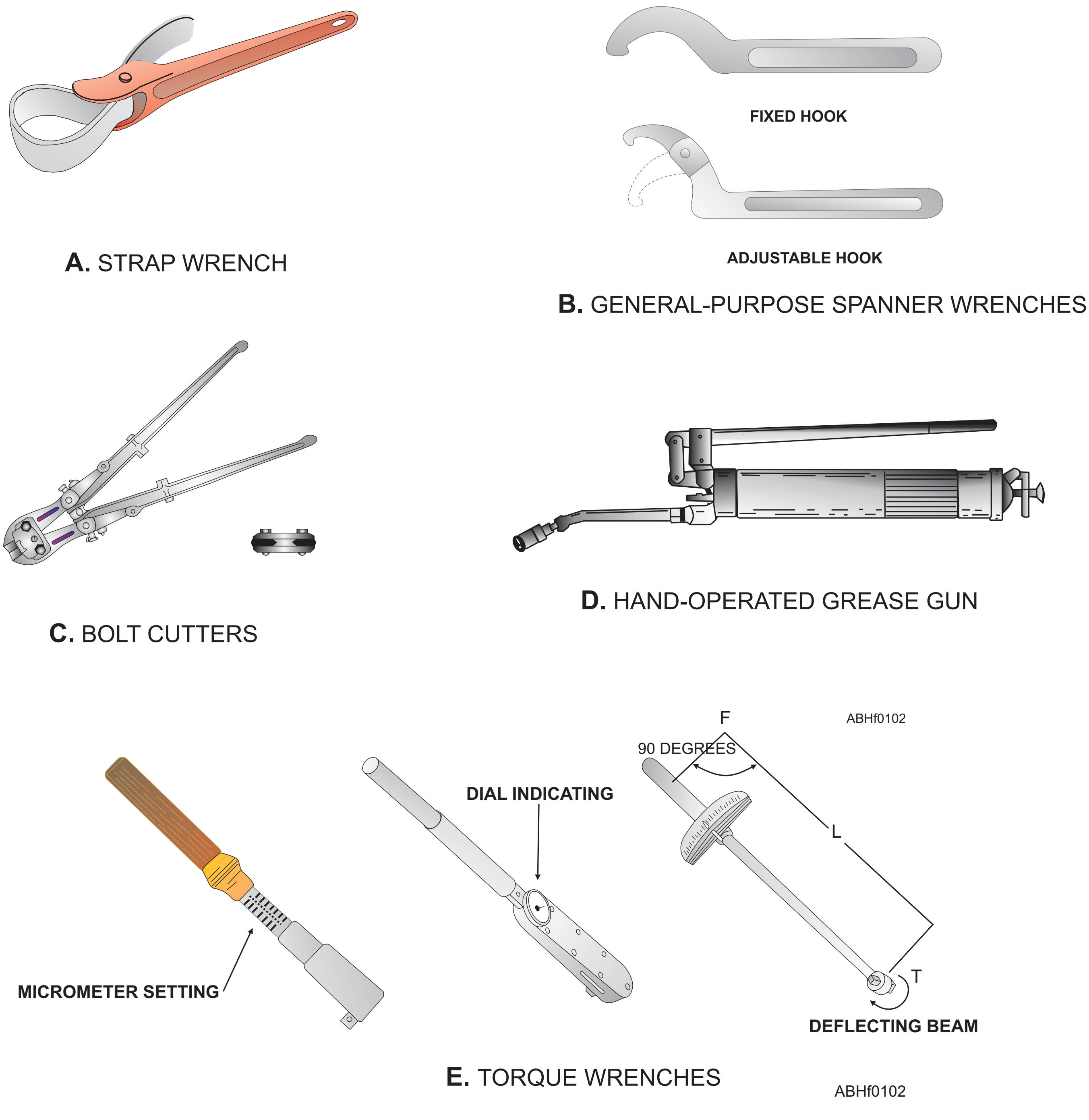


Figure 1-2.—Hand tools (continued).

How do you distinguish between these similar screwdrivers? See figure 1-1, view C. The Phillips screwdriver has about 30° flukes and a blunt end, while the Reed and Prince has 45° flukes and a sharper, pointed end. The Phillips screw has beveled walls between the slots; the Reed and Prince, straight pointed walls. In addition, the Phillips screw slot is not as deep as the Reed and Prince slot.

Additional ways to identify the right screwdriver are as follows:

1. If the screwdriver tends to stand up unassisted when the point is put in the head of a vertical screw, it is probably the proper one.

2. The outline of the end of a Reed and Prince screwdriver is approximately a right angle, as seen in the illustration.

3. In general, Reed and Prince screws are used for airframe structural applications, while Phillips screws are found most often in component assemblies.

COMBINATION JAW PLIERS

Combination jaw pliers, figure 1-1, view D, are manufactured with straight serrated jaws for gripping objects. The pivots with which the jaws are attached together are adjustable to fit different size objects. Pliers should not be used to grasp the shanks of screwdrivers to gain greater twisting force.

DIAGONAL PLIERS

Diagonal pliers, figure 1-1, view E, and are used only for cutting small material such as wire or cotter pins. They are designed specifically for cutting, and should not be used for grasping objects such as nuts and bolts.

CRESCENT ADJUSTABLE WRENCHES

Crescent adjustable wrenches are not intended to replace open-end wrenches, but they are useful in working in restricted areas. In addition, they can be adjusted to fit odd sized nuts or bolts. Figure 1-1, view F, shows one type of crescent adjustable wrench in use today. These wrenches are often referred to as "knuckle busters" because mechanics frequently suffer the consequences of improper usage of these tools.

To avoid accidents you should follow four simple steps. First, choose a wrench of the correct size; that is, do not pick a large 12-inch wrench and adjust the jaw for use on a 3/8-inch nut. This could result in a broken bolt and a bloody hand. Second, be sure the jaws of the correct size wrench are adjusted to fit snugly on the nut. Third, position the wrench around the nut until the nut is all the way into the throat of the jaws. If it is not used in this manner, the result is apt to be as bloody as before. Fourth, pull the handle TOWARD the side having the adjustable jaw. This will prevent the adjustable jaw from springing open and slipping off the nut. Should the location of the work not allow for all four steps to be followed when you are using an adjustable wrench, then select another type of wrench for the job.

ADJUSTABLE PIPE WRENCHES

Adjustable pipe wrenches, figure 1-1, view G, are primarily used for rotating round stock and/or various pipes and piping. The most common adjustable pipe wrench is the Stillson. It is equipped with two jaws that have serrated teeth to provide gripping ability. The largest jaw is a fixed jaw; the smallest jaw is adjustable and also the weakest of the two jaws. Whenever a Stillson wrench is used, it should be applied in such a manner that the fixed jaw provides the twisting force. These wrenches also come in varying lengths, which makes the jaw sizes vary. A Stillson wrench should never be used on soft metal such as brass or on chromium-plated or machined surfaces, as the teeth tend to mar or otherwise ruin the metal. The strap wrench (fig. 1-2, view A) should be used instead of a Stillson to eliminate damage to soft metals. The strap wrench employs a heavy nylon strap, one end of which is attached to the wrench handle and the other is free to pass around the object to be rotated, and finally back through the locking device provided on the wrench handle.

HAMMERS

The hammer (shown in fig. 1-1, view H) most used by the ABH is the ball peen. The ball peen hammer is used for working metals such as chiseling rivets and shearing metal.

HACKSAWS

The hacksaw is a portable metal cutting tool that can be used for cutting sheet metal, bolts, and pipe. Hacksaws cut on the push stroke only; the blade should be installed in the frame with the teeth facing away from the handle. Figure 1-1, view I, shows two types of hacksaws with the blade in the proper position.

Use and Care of Hand Tools and Measuring Tools, NAVEDTRA 12085, illustrates the proper way to hold and use the hand hacksaw and describes the method used in selecting the most suitable blade for different metals.

WRECKING BARS

Three types of wrecking bars are shown in figure 1-1, view J. Wrecking bars are designed for prying boards from crates, pulling spikes or heavy nails, and as a lever for moving heavy objects short distances. Longer and heavier bars, such as the Johnson bar, are available in the Navy for damage control functions as well as on crash trucks on shore stations. The wrecking bar is sometimes called the all-purpose tool.

STRAP WRENCH

The strap wrench, figure 1-2, view A, uses a heavy web strap to grip the work. This wrench is used for turning pipe or cylinders where you do not want to mar the surface of the work. To use this wrench, the webbed strap is placed around the cylinder and passed through the slot in the metal body of the wrench. The strap is then pulled up tight. As the mechanic turns the wrench in the desired direction, the webbed strap tightens further around the cylinder. This gripping action causes the cylinder to turn.

SPANNER WRENCH

Many special nuts are made with notches cut into their outer edge. For these nuts a hook spanner, figure 1-2, view B, is required. This wrench has a curved arm with a lug or hook on the end. This lug fits into one of the notches of the nut, and the handle turns to loosen or tighten the nut. This spanner may be made for just one particular size of notched nut, or it may have a hinged arm to adjust it to a range of sizes.

When you use a spanner wrench, you must ensure that the pins, lugs, or hooks make firm contact with the nut while the turning force is transferred from the wrench to the nut. If this is not done, damage will result to personnel, tools, or equipment.

BOLT CUTTERS

Bolt cutters, figure 1-2, view C, are giant shears with very short blades and long handles. The handles are hinged at one end. The cutters are at the ends of extensions, which are joined in such a way that the inside joint is forced outwards when the handles are closed, thus forcing the cutting edges together with great force.

Bolt cutters are made in lengths of 18 to 36 inches. The larger ones will cut mild steel bolts and rods up to one-half inch. The material to be cut should be kept as far back in the jaws as possible. Never attempt to cut spring wire or other tempered metal with bolt cutters; this causes the jaws to be sprung or nicked.

Adjusting screws near the middle hinges provide a means for ensuring that both jaws move the same amount when the handles are pressed together. Keep the adjusting screws just tight enough to ensure that the cutting edges meet along their entire length when the jaws are closed. The hinges should be kept well oiled at all times.

When you are using bolt cutters, make sure your fingers are clear of the jaws and hinges. Be careful that the bolt heads or piece of rod that is cut off does not fly and injure you or someone else. If the cutters are brought together rapidly, sometimes a bolt head or piece of rod being cut off will fly some distance.

Bolt cutters are fairly heavy. Make sure that they are stored in a safe place where they will not fall and injure someone.

HAND OPERATED GREASE GUN

To use a push type, hand operated grease gun (fig. 1-2, view D), you connect the nozzle of the gun to its corresponding fitting at the lubrication point and work the handle in and out. To connect the gun, align the nozzle and the fitting end-to-end and push on the gun handle so the nozzle slips over the hydraulic fitting or into the flush fitting. At the same time that the nozzle mates with the fitting, the handle moves inward to build pressure inside the gun to force grease out of the nozzle and into the fitting. Then, let up on the handle a moment. A spring in the gun will then force the handle out a little way and prepare the gun for another inward stroke of the handle.

When you connect the push type gun to a hydraulic fitting, the nozzle grips the fitting and is held firmly as long as the nozzle and fitting are aligned or until pulled free. In connecting the gun to a flush type fitting, however, you must keep a steady pressure on the fitting because the nozzle doesn't grip the fitting.

TORQUE WRENCHES

When a definite force must be applied to a nut or bolt head, a torque wrench must be used. For example, equal force must be applied to all the bolt heads of an engine head, otherwise, one bolt may bear the brunt of the force of internal combustion and ultimately cause engine failure.

The three most commonly used torque wrenches are the micrometer setting, dial indicating, and deflecting beam types (fig. 1-2, view E). When you are using the deflecting beam and the dial indicating torque wrenches, the torque is read visually on a dial or scale mounted on the handle of the wrench.

To use the micrometer setting wrench, unlock the grip and adjust the handle to the desired setting on the micrometer scale, then relock the grip. Install the required socket or adapter to the square drive of the handle. Place the wrench assembly on the nut or bolt and pull in a clockwise direction with a smooth, steady motion. A fast or jerky motion will result in an improper torque. When the torque applied reaches the torque value, which is indicated on the handle setting, a signal mechanism will automatically issue an audible click, and the handle will release or "break" and move freely for a short distance. The release and free travel is easily felt, so there is no doubt when the torque process is complete.

Manufacturers' and technical manuals generally specify the amount of torque to be applied. Use the wrench properly in accordance with the manufacturer's instructions.

You should use a torque wrench that reads about mid range for the amount of torque to be applied. BE SURE THAT THE TORQUE WRENCH HAS BEEN CALIBRATED BEFORE YOU USE IT. Remember that the accuracy of torque measuring is determined with how the threads are cut and the cleanliness of the threads. Make sure you inspect and clean the threads. If the manufacturer specifies a thread lubricant, it must be used to obtain the most accurate torque reading. When using the deflecting beam or dial indicating wrenches, you should hold the torque at the desired value until the reading is steady.

The torque wrench is a precision tool. It has a torque indicating handle and appropriate adapters or attachments (fig. 1-2, view E). It measures the amount of turning or twisting force applied to a nut or bolt in inch or foot-pounds. Certain aircraft hoisting slings require torque values applied to successfully hoist the aircraft. For specific instructions, you should refer to NAVWEPS 17-1-108.

CARE OF HAND TOOLS

Tools are expensive and vital equipment. When the need for their use arises, common sense plus a little preventive maintenance prolongs their usefulness. The following precautions for the care of tools should be observed:

1. Clean tools after each use. Oily, dirty, and greasy tools are slippery and dangerous to use.

2. NEVER hammer with a wrench.

3. NEVER leave tools scattered about. When they are not in use, stow them neatly on racks or in toolboxes.

4. Applying a light film of oil after cleaning can prevent rust on tools.

5. INVENTORY tools after use to prevent loss.

Q1. What pliers are designed for cutting?

Q2. When using bolt cutters, what two types of metals should you avoid cutting?

a.

b.

Q3. How can you prevent rust from building up on hand tools?

PORTABLE POWER TOOLS

LEARNING OBJECTIVES: Identify the different types of power tools. Describe the uses of different types of power tools.

ABH's have a frequent requirement for the use of portable power tools in the maintenance of assigned areas that are exposed to the weather. A power tool, when used properly and efficiently, is an enormous time saver, especially when a large painted or rusted surface requires scaling and preservation. Before using electric portable tools, you should be sure the proper voltage is supplied. This information can be found on the nameplate, which is permanently attached to the tool. Electric tools of all types used in the Navy are required to have an up to date electrical safety tag and proper ground capability. The tool should be provided with a ground lead that connects the tool casing to the ship's structure. If doubt exists that a good ground has been established, you should request the services of an Electrician's Mate to check it out before applying power to the tool. NEVER VARY the manufacturers recommended voltage. SAFETY IS PARAMOUNT. Proper use of common power tools is discussed in detail in chapter 52 of *Use and Care of Hand Tools and Measuring Tools*, NAVEDTRA 12085. Wearing appropriate EYE protection and HEARING protection equipment is mandatory for Navy personnel when operating portable power tools.

When pneumatic tools are used, the air supply pressure specified on the nameplate should always be maintained. Insufficient air pressure causes the tool to function improperly. Excessive air pressure results in damage to the tool, and the person operating the tool may not be able to control it properly.

REMEMBER that tools cut through rust, paint, metal, arms, and legs. Give your full attention while operating any power tool; never distract anyone who is using power equipment. Never attempt to change blades and bits or perform maintenance on any portable power tool without first disconnecting the tool from the power source.

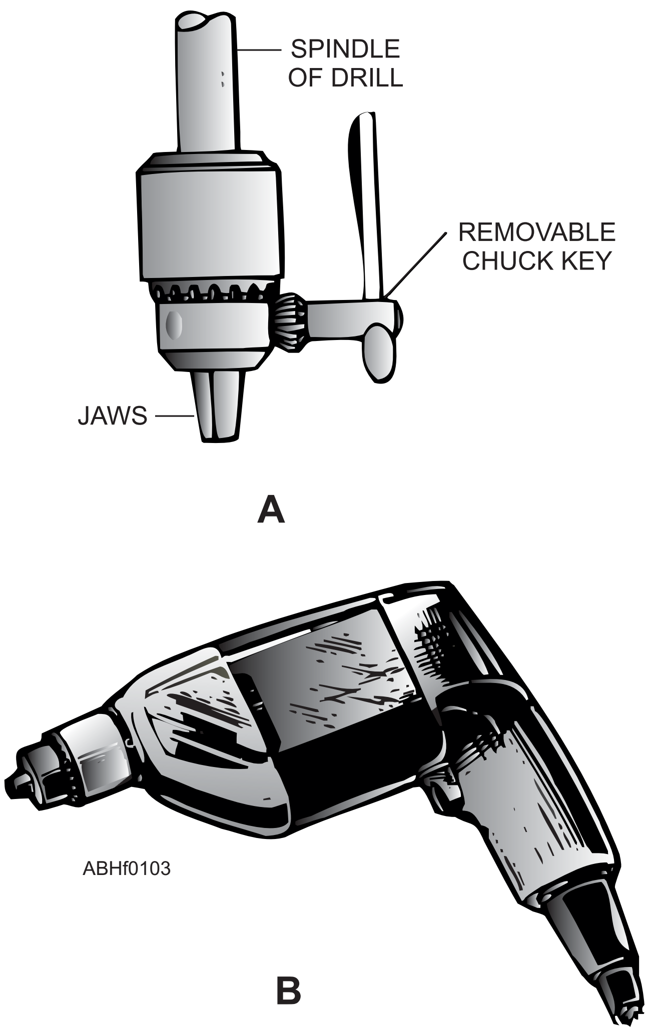


Figure 1-3.—Portable electric drill and a three-jaw chuck and chuck key.

PORTABLE ELECTRIC DRILL

The portable electric drill, figure 1-3, view B, is a versatile piece of equipment that is probably used more than any other portable electric tool. It can be used for drilling holes in wood or metals, mixing paint, and buffing small items with the proper attachments, as well as a variety of other uses.

The average size electric drill is equipped with a 1/4-inch capacity, three fingered chuck (fig. 1-3, view A), which is tightened by the use of a chuck key. The chuck key is usually secured to the electric cord about 18 inches from the drill itself to allow it to be used in the chuck without being removed from the cord. The capacity of the chuck is what determines the size of the drill. Heavier drills are larger in appearance and weight and are equipped with larger motors and chucks. In general, the larger the drill and motor, the slower the rpm. This provides the needed extra torque to twist large drill bits. Using a punch or an awl to make a small starting point on the object to be drilled will prevent the drill bit from bouncing or slipping away.

PORTABLE SANDER (ELECTRIC OR PNEUMATIC)

The power sander, figure 1-4, is one of the most desirable tools for the scaling of rust, removing paint, and smoothing flight decks prior to laying nonskid materials. The design of the portable power sander is much like that of the electric drill motor with the addition of the sanding disc attached at right angles. The average size disc sander used in the Navy is 7 or 9 inches. These tools produce sparks, so be sure to follow your command's established procedures.

PNEUMATIC SCALING TOOLS

Pneumatic scaling tools are discussed in the following text.

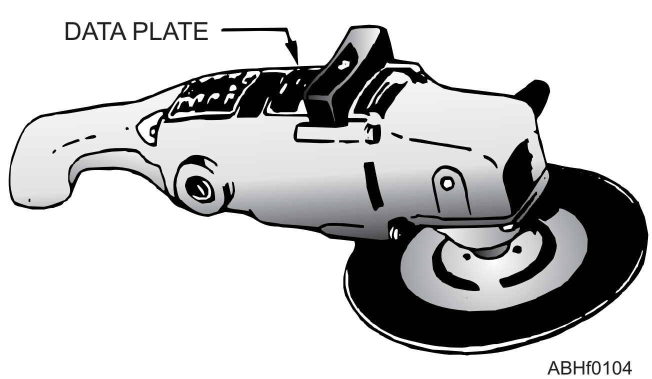


Figure 1-4.—Portable electric sander.

Pneumatic Chipping Hammer

The pneumatic chipping hammer, figure 1-5, is another tool useful to the ABH when for scaling large areas. Air pressure supply should be maintained to the manufacturer's recommended working pressure, which is found on the nameplate attached to the tool. Never point the pneumatic chipping hammer at another person or to you while tool is under pressure. Personal injury could occur if the chisel were expelled at high speed from the scaling hammer. Also, be aware of the type of metal to be worked. Softer metals, such as brass or aluminum, may become damaged.

Rotary Impact Scaler

The rotary impact scaler, figure 1-6, is a scaling and chipping tool, sometimes called a "jitterbug." It is electric or pneumatic powered, and has a bundle of cutters mounted on either side. In use, it is pushed along the surface to be scaled with the rotating chippers doing the work. Replacement bundles of cutters are available.

Needle Impact Scaler

The needle impact scaler, figure 1-7, has needle like attachments that fit into one end. This tool is used in conjunction with the rotary scaler, but is able to clean out (scale) corners not reached by the other tool. Caution should be used with this tool on soft metal and on piping.

Q4. What are the two types of portable sanders are used in the Navy?

a.

b.

Q5. What portable power tool should you use to scale out a corner?

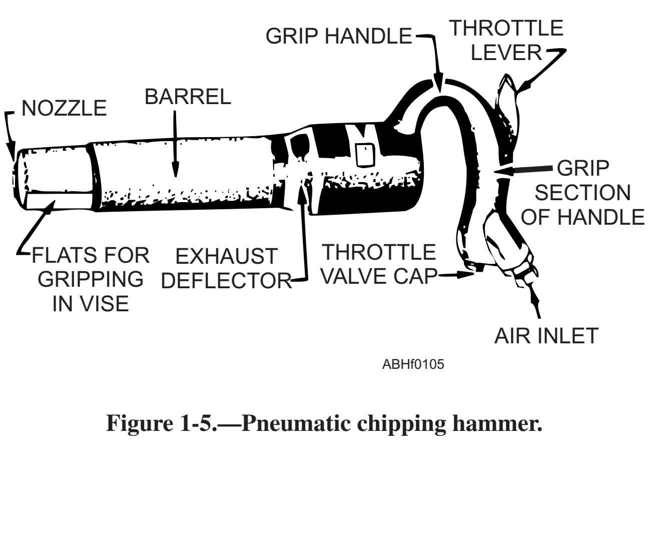


Figure 1-5.—Pneumatic chipping hammer.

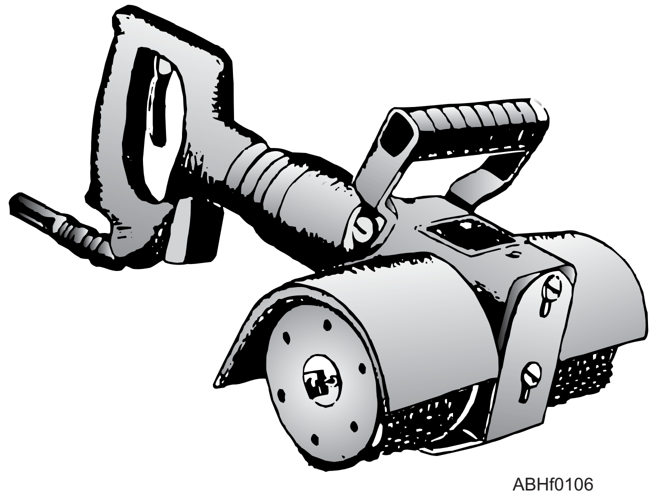


Figure 1-6.—Rotary impact scaler.

MEASURING TOOLS

LEARNING OBJECTIVE: Describe the use of rules and tapes. Describe the proper care of rules and tapes. Describe the purpose of dynamometers.

In performing many jobs during your Navy career, you will be required to take accurate measurements of materials and objects. It is common practice in the Navy to fabricate material for installation on a ship or in the field. For example, suppose you need a box of a certain size to fit a space in a compartment. You would have to take measurements of the space and send them to a shop where the box would be built. This example suggests that the measurements you took and those taken in the process of building the box must be accurate. However, the accuracy of the measurements will depend on the measuring tools used and your ability to use them correctly.

Measuring tools are also used for inspecting a finished product or partly finished product. Inspection operations include testing or checking a piece of work by comparing dimensions of the work piece to the required dimensions given on a drawing or sketch. Again, the measurements taken must be accurate. Accuracy depends on your ability to use measuring tools correctly!

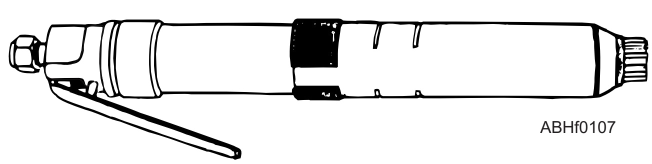


Figure 1-7.—Needle impact scaler.

You should be able to select the appropriate measuring tool to use in doing a job and be able to operate properly a variety of measuring instruments. Measuring tools and techniques are discussed in detail in various chapters of *Use and Care of Hand Tools and Measuring Tools*, NAVEDTRA 12085.

RULES AND TAPES

Many different types of measuring tools are in use in the Navy. Where exact measurements are required, a micrometer caliper is used. When properly used, this caliper gives measurements accurate to within 0.001 of an inch. Where accuracy is not critical, the common rule or tape will work well enough for most measurements.

Figure 1-8 shows some of the types of rules and tapes commonly used in the Navy. Of all measuring tools, the simplest and most common is the steel rule. It is usually 6 or 12 inches long, although other lengths are available. Steel rules may be flexible or rigid, but the thinner the rule, the easier it is to measure accurately, because the division marks are closer to the work.

Generally, a rule has four sets of graduations, one on each edge of each side. The longest lines represent the inch marks. On one edge, each inch is divided into eight equal spaces; so each space represents one-eighth of an inch. The other edge of this side is divided into sixteenths. The 1/4-inch and 1/2-inch marks are commonly made longer than the smaller division marks to facilitate counting, but the graduations are not, as a rule, numbered individually, as they are sufficiently far apart to be counted without difficulty. The opposite side is similarly divided into 32 and 64 spaces per inch. It is common practice to number every fourth division for easier reading.

There are many variations of the common rule. Sometimes the graduations are on one side only.

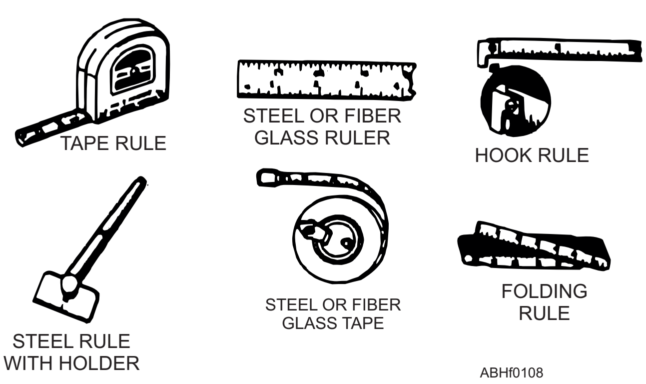


Figure 1-8.—Common types of rules.

Sometimes a set of graduations is added across one end for measuring in narrow spaces. Sometimes only the first inch is divided into sixty-fourths, with the remaining inches divided into thirty-seconds and sixteenths.

A metal or wood folding rule may be used for measuring purposes. These folding rules are usually 2 to 6 feet long. The folding rules cannot be relied on for extremely accurate measurements, because a certain amount of play develops at the joints after they have been used.

Steel tapes are made from 6 to 300 feet in length. The shorter lengths are frequently made with a curved cross section so that they are flexible enough to roll up, but remain rigid when extended. Long, flat tapes require support over their full length when measuring, or the natural sag will cause an error in reading.

The flexible-rigid tapes are usually contained in metal cases, into which they wind themselves when a button is pressed, or into which they can be easily pushed. A hook is provided at one end to hook over the object being measured so you can handle it without assistance. On some models, the outside of the case can be used as one end of the tape when measuring inside dimensions.

Steel or fiberglass tapes are generally used for making long measurements. Secure the hook end of the tape. Hold the tape reel in the hand and allow it to unwind while walking in the direction in which the measurement is to be taken. Stretch the tape with sufficient tension to overcome sagging. At the same time, make sure the tape is parallel to an edge of the surface being measured. Read the graduation on the tape by noting which line on the tape coincides with the measurement being taken.

CARE OF RULES AND TAPES

Rules and tapes should be handled carefully and kept lightly oiled to prevent rust. Never allow the edges of measuring devices to become nicked by striking them with hard objects. When not in use, they should preferably be kept in a wooden box.

To avoid kinking tapes, pull them straight out from their case and do not bend them backward. With the windup type, always turn the crank clockwise since turning it backward will kink or break the tape. With the spring wind type, guide the tape by hand. If it is allowed to snap back, it may become kinked, twisted, or otherwise damaged. Do not use the hook as a stop. Slow down as you reach the end.

DYNAMOMETER

A dynamometer is an apparatus for measuring force or energy. It commonly embodies a spring to be compressed, combined with an index scale to show the amount of tension obtained. Uses for this type of measuring tool may include determining the breaking strength of flight or hangar deck padeye fittings in conjunction with PMS. Make sure the dynamometer is calibrated before you use it. Figure 1-9 shows a common type of dynamometer.

Q6. What is the most common measuring tool?

Q7. When re-coiling a spring loaded tape measure, what action should you prevent against?

Q8. What is the purpose of a dynamometer?

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: List the safety precautions associated with portable electrical tools, extension cords, and pneumatic tools.

You are responsible for knowing and observing all safety precautions concerning your living and working spaces. Your continuous cooperation and vigilance are needed to see that the operating procedures and work methods are accomplished safely and without loss or damage to property.

As a petty officer, you are responsible for ensuring that your subordinates are instructed in and carry out applicable safety precautions.

PORTABLE ELECTRICAL TOOLS

When portable electric tools are used, you should use the following procedures:

1. Before portable electrical tools are used for the first time after procurement, they should be inspected and approved for shipboard use by the ship's electrical safety officer.

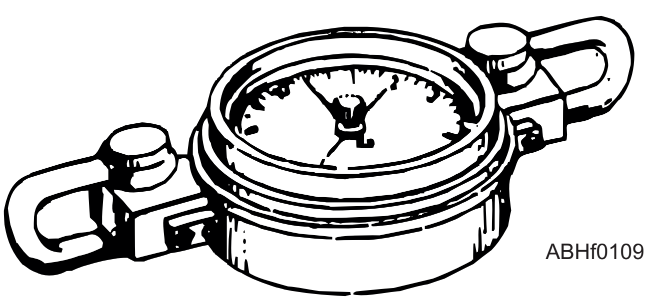


Figure 1-9.—Dynamometer.

2. Prior to the use of any portable electric tools, you should make sure the tools have a current ship's inspection mark. Additionally, visually examine the attached cable with the plug and any extension cords for cracks, breaks, or exposed conductors and damaged plugs. When any defects are noted, the tools should be turned in to the ship's electrical shop for repair before use. Before plugging in any tool, be sure the tool is turned off.

3. Personnel using portable electric tools are required to wear safety glasses/goggles.

4. Portable electric tools producing hazardous noise levels in excess of the limits set forth in OPNAVINST 6260.2 must have a warning tag. Personnel using tools designated as producing hazardous noise levels are required to wear proper ear protection, as issued by the medical department.

5. Only explosions proof (class I, group D, or better) portable electric tools should be used where flammable vapors, gases, liquids, or exposed explosives are present.

6. Hand held portable electric tools authorized for use onboard ship shall be equipped with ON/OFF switches, which must be manually held in the closed ON position to maintain operation.

7. Rubber gloves must be worn when you are using portable electric tools under hazardous conditions; for example, wet decks, bilge areas, working over the side, in boats, and so forth.

8. Leather glove shells should be worn over rubber gloves when the work being done, such as sheet metal work, could damage the rubber gloves.

EXTENSION CORDS

You should use the following procedures when using extension cords:

1. Only three wire extension cords that have three pronged plugs and three slot receptacles should be used.

2. Because a metal hull ship is a hazardous location, personnel who must use portable electric devices connected in extension cords should take the time to plug the device into the extension cord before the extension cord is inserted into a live bulkhead receptacle. Likewise, the extension cord should be

unplugged from the bulkhead receptacle before the device is unplugged from the extension cord.

3. Electrical cords shall be cared for as follows:

a. Cords should not be allowed to come in contact with sharp objects. They should not be allowed to kink nor should they be left where they might be damaged by vehicle/foot traffic. When it is necessary to run electrical leads through doors and hatches, the cords must be protected to guard against accidental closing of the doors/hatches.

b. Cords must not come in contact with oil, grease, hot surfaces, or chemicals.

c. Damaged cords must be replaced. They are not to be patched with tape.

d. Tools must be stored in a clean, dry place where the cords can be loosely coiled.

e. Cords extending through walkways should be elevated so they do not become a tripping hazard or interfere with safe passage.

f. Extension cords should be no longer than 25 feet in length, (except repair locker and CV/CVN flight deck cords, which are 100 feet long). No more than two such cords should be connected together for the operation of portable equipment.

PNEUMATIC TOOLS

When using pneumatic tools, you should use the following procedures:

1. You should wear and use necessary personnel protective devices. Pneumatic tools shall not be connected to, or driven by, air pressure in excess of that for which the tools are designed. Wearing appropriate eye protection equipment is mandatory for Navy personnel when operating pneumatic tools.

2. You should be authorized and trained to operate pneumatic tools. If you have arthritis, neuritis, or circulatory disease, DO NOT use vibrating tools such as hammers, chisels, tampers, riveters, or caulkers.

3. Pneumatic tools should be laid down in such a manner that no harm could be done if the switch is accidentally tripped. No idle tools should be left in a standing position.

4. Pneumatic tools should be kept in good operating condition. They should be thoroughly inspected at regular intervals with particular attention given to the ON/OFF control valve trigger guard (if installed), hose connections, guide clips on hammers, and the chucks of reamers and drills.

5. Pneumatic tools and air hoses may be fitted with quick disconnect fittings. These should incorporate an automatic shutoff valve. This valve automatically shuts off the air at the hose before charging grinding wheels, needles, chisels, or other cutting or drilling bits.

6. The air hose must be suitable to withstand the pressure required for the tool. Leaking or defective hose should be removed from service. The hose should not be laid over ladders, steps, scaffolds, or walkways in such a manner as to create a tripping hazard. Where the hose is run through doorways, the hose should be protected against damage by the door edges. The air hose should generally be elevated over walkways or working surfaces in a manner to permit clear passage and prevent damage to it.

7. A tool retainer shall be connected on each piece of equipment, which, without such a retainer, may eject the tool.

8. All portable pneumatic grinders and reciprocating saws must be equipped with a safety lock off device. A safety lock off device is any operating control that requires positive action by the operator before the tools can be turned on. The lock off device must automatically and positively lock the throttle in the OFF position when the throttle is released. Two consecutive operations by the same hand are required; first to disengage the lock off device and then to turn on the throttle. The lock off device should be an integrated component of the tool. It should not adversely affect the safety or operating characteristics of the tool, and it should not be easily removable. Devices, such as a "dead man control" or "quick disconnect," that do not automatically and positively lock the throttle in the OFF position when the throttle is released are not safety lock off devices.

For detailed information on safety precautions, see OPNAVINST 5100.19 (series), *Navy Safety Precautions for Forces Afloat*, or NAVAIR A1-NAOSH-SAF-000/P-5100-1, Technical manual *NAVAIROSH Requirements for the Shore Establishment*.

Q9. Before plugging in a tool, what action should you first take?

Q10. What safety feature is required on all portable grinders?

PERSONAL PROTECTIVE EQUIPMENT

LEARNING OBJECTIVE: Identify the types of personal protective equipment.

To protect you from danger, personal protective equipment (PPE) such as safety shoes, goggles, hard hats and gloves are issued. Using PPE is mandatory on certain jobs. Be sure to USE PPE on any job WHEN REQUIRED. The purpose of PPE is to protect you from harm.

PROTECTIVE CLOTHING AND SAFETY EQUIPMENT

The use of protective clothing and safety equipment is a must! The following requirements must be met.

1. Personnel involved in the operation of hazardous industrial tools or equipment shall wear protective clothing and safety equipment appropriate to the work being performed.
2. Loose or torn clothing, neckties, neck chains, unbuttoned long sleeve shirts, rings, beads, or bracelets must not be worn around rotating machinery. Should clothing become caught in a tool or machine, the power supply must be secured immediately.

FOOT PROTECTION

Hazardous foot operations are those that have a high incidence of foot injuries. The ratings generally associated with a high incidence of injuries are those employed in construction, materials handling, maintenance, transportation, ship repair, aircraft handling, servicing and repair, weapons servicing and handling, and all shipboard personnel.

All personnel exposed to foot hazards are provided with and required to wear appropriate special foot protection. Safety shoes are designed to limit damage to your toes from falling objects. Safety shoes, with a protective steel toe box, are required for use by personnel engaged in hazardous foot operations. Personnel assigned working stations on the flight or hangar decks must wear flight deck safety shoes.

EYE PROTECTION

Proper eye protection is of the utmost importance for all personnel. All personnel operating power tools, both fixed and portable must wear approved safety glasses with side shields, goggles, or face shields.

Personnel who wear corrective glasses while engaged in eye hazardous work must be protected by eye protection equipment of a type that can be worn over personal spectacles. Glasses with prescription ground safety lenses with side shields may be worn in lieu of cover goggles when such glasses provide suitable protection against the hazard involved.

In any operations such as chipping, caulking, drilling, riveting, grinding, and pouring babbitt metal, in which the eye hazard of flying particles, molten metal, or liquid chemical exists, personnel must be protected by suitable face shields or goggles.

Appropriate use of goggles limits eye hazards. Some goggles have plastic windows that resist shattering upon impact. Others are designed to limit harmful infrared and ultraviolet radiation from arcs or flames by appropriate filter lenses.

Remember that eye damage can be excruciatingly painful. PROTECT YOUR EYES.

HAND PROTECTION

When you are required to handle rough, scaly, or splintery objects, use gloves.

- When you are handling sharp materials, leather gloves must be worn except when the work involves rotating machinery.

- When you are working with caustic or toxic chemicals, specified gloves must be worn. Rubber gloves will protect against some chemicals. Gloves of a special plastic may be needed for protection against other chemicals.

- When it is necessary to work with portable electrical tools or equipment in damp locations or when it is necessary to work on live electrical circuits or equipment, electrical grade insulating rubber gloves must be worn.

- When rubber gloves could be subjected to cutting by sharp or abrasive objects, leather shell gloves must be worn over electrical grade rubber gloves.

- When it is necessary to handle hot work, insulated gloves must be worn, but only if tongs or other gripping/clamping tools are not available.

HEARING PROTECTION

Personnel working with tools and machinery that produce hazardous noise levels must wear proper ear protection. All equipment that produces hazardous noise levels should have a warning tag to alert the operator to the requirement for PPE.

Wearing hearing protection, such as insert earplugs, is frequently required. For more information on hearing conservation, refer to OPNAVINST 6260.2 (series) and local instructions. For detailed information on personnel protective clothing and safety equipment, refer to chapter 9, section 5, of OPNAVINST 5100.19 (series), *Navy Safety Precautions for Forces Afloat*; or NAVAIR A1-NAOSH-SAF-000/P-5100-1 technical manual, *NAVAIROSH Requirements for the Shore Establishment*.

HEAD PROTECTION

During the course of flight operations on your flight deck, head protection is offered to the ABH by means of the cranial. The cranial is an essential piece of personal protective equipment and its value has been time tested. The cranial saves lives and prevents injury. Often times though, you will be involved in work that is not related to flight operations, but the necessary precautions must still be undertaken.

Personnel should not use flight quarters clothing for routine maintenance, use a hard hat. During Periods of Maintenance for your ship, hard hats are essential, if not required, as prescribed safety equipment. Head protection is mandatory anytime you are working up on a ladder, raised up in the crash basket, working on scaffolding, or working in the vicinity of an aircraft elevator during a stores on-load.

Q11. What are five types of personal protective equipment?

a.

b.

c.

d.

e.

Q12. What type of personal protection is required when working with a portable cutting tool?

RIGGING EQUIPMENT

LEARNING OBJECTIVES: Describe the types and uses of rigging equipment.

Basic seamanship is essential to the aircraft handling crews and line handlers during hoisting operations, or in the preparation for hoisting operations.

Basic seamanship includes proper knot tying and splicing manila line. The basic skills can be obtained by reading *Seaman*, (NAVEDTRA 12016). Some of the basic knowledge should include the bowline, becket bend, half hitch, and square knot. Skills should also include the back splice, eye splice, and short and long splice.

The bowline is used to secure tag lines during aircraft hoisting operations and for securing components of the MK–1 life preserver. Eye splices and back splices are used in the fabrication of tag lines. Normally an eye splice retainer is a quick-disconnect hook for attaching to a securing device. The other end is back-spliced to prevent the line from unraveling. When a quick-disconnect hook is not used, a bowline is used to secure the tag line to the aircraft. The becket bend and half hitch are used to secure line to round stock or clevis hooks. Short and long splices are used to connect two pieces of line together. They could be used to add a length to tag lines and securing lines for yellow equipment.

In this section, you will learn the types and uses of wire rope, manila line, nylon rope, and the formulas for determining safe working loads and breaking strengths. Also covered are the various types of hoisting rigs and their uses. For detailed information on the use and types of wire and fiber rope and rigging, you should refer to Naval Sea Systems Command, *Naval Ships' Technical Manual* (NSTM) chapter 613.

BLOCKS AND TACKLE

As an ABH, you may be assigned to a detail that must load or move heavy parts by using a block and tackle or other hoisting rigs (for example, crash and salvage operations or to close/open the hangar deck elevator or divisional doors in an emergency). It is a good idea that you know a few terms and basic fundamentals of the block and tackle.

A block consists of one or more sheaves (or pulleys) fitted in a wood or metal frame (or shell) supported by a hook or shackle inserted in the strap of the block. The name and location of the principal parts of a block are shown in figure 1-10.

The sheave is a round, grooved wheel over which the rope runs. Ordinarily, blocks have one, two, three, or four sheaves. Blocks are available, of course, with more than four sheaves. The straps (one inner and one outer) are used to enclose the shell, hold the block together, and support the pin on which the sheaves rotate. The swallow of the block is the opening through which the rope passes. The breech is the bottom part of the block opposite the swallow.

The function of the block (or blocks) in a tackle assembly is to change the direction of pull or provide mechanical advantage, or both.

Construction of Blocks

Blocks are constructed for use with fiber line and wire rope. Wire rope blocks are heavily constructed and have a large sheave with a deep groove. Fiber line blocks are generally not as heavily constructed as wire rope blocks and have small sheaves with shallow, wide grooves.

Blocks fitted with one, two, three, or four sheaves are often referred to as single, double, treble, and quadruple blocks, respectively. Blocks are fitted with a varying number of attachments, depending on their particular use. Some of the most commonly used fittings are hooks, swivel or loose side, sister hooks, shackles, eyes, and rings.

All line used in rigging should be good grade manila or the equivalent, and all wire should be plow steel or the equivalent.

Use of Tackle

A tackle is an assembly of blocks and ropes used to gain a mechanical advantage in lifting or pulling. Figure 1-11 shows the name and location of various main parts of a tackle.

In working with tackle, it helps to understand the meaning of a few simple terms you hear used. The term *fall* means a rope, either manila or wire, reeved through a pair of blocks to form a tackle. The *hauling part* is the

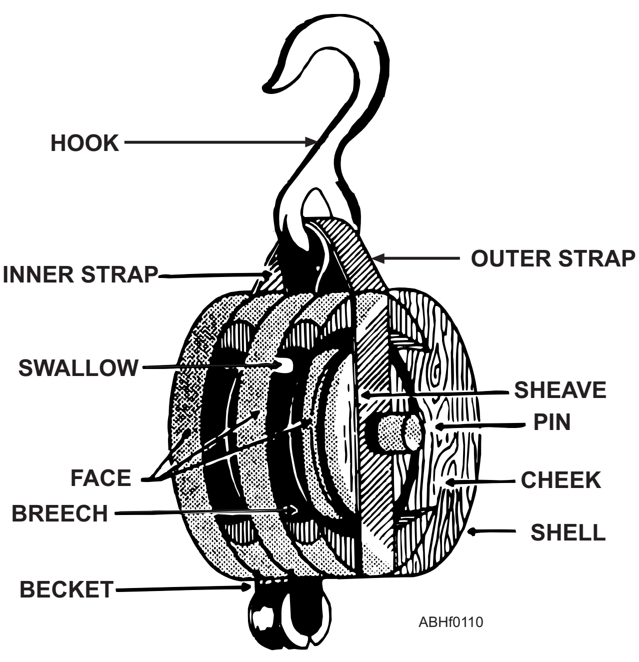


Figure 1-10.—Nomenclature of a block.

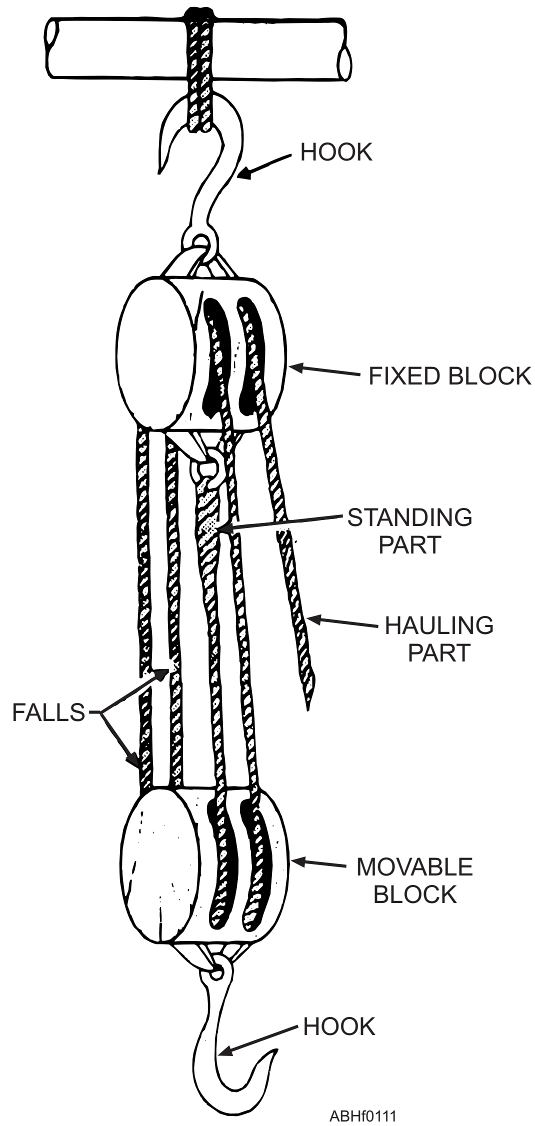


Figure 1-11.—Parts of a tackle.

part of the fall leading from one of the blocks upon which the power is exerted. The *standing part* is the end of the fall of the blocks. The *movable* (or running) *block* of a tackle is the block attached to the object to be moved. The *fixed* (or standing) *block* is the block attached to a fixed object or support. When a tackle is being used, the movable block moves up and down and the fixed block remains stationary.

Mechanical Advantage

The mechanical advantage of a tackle is the term applied to the relationship between the load being lifted and the power required to lift that load. In other words, if a load of 10 pounds requires 10 pounds of power to lift it, the mechanical advantage is 1. However, if a load of 50 pounds required only 10 pounds to lift it, then you have a mechanical advantage of 5 to 1, or 5 units of weight are lifted for each unit of power applied.

The easiest way to determine the mechanical advantage of a tackle is by counting the number of parts of the falls at the movable (or running) block. If there are two parts, the mechanical advantage is two times the power applied (less friction). A gun tackle, for instance, has a mechanical advantage of 2. Thus, to lift a 200-pound load with a gun tackle requires 100 pounds of power, disregarding friction.

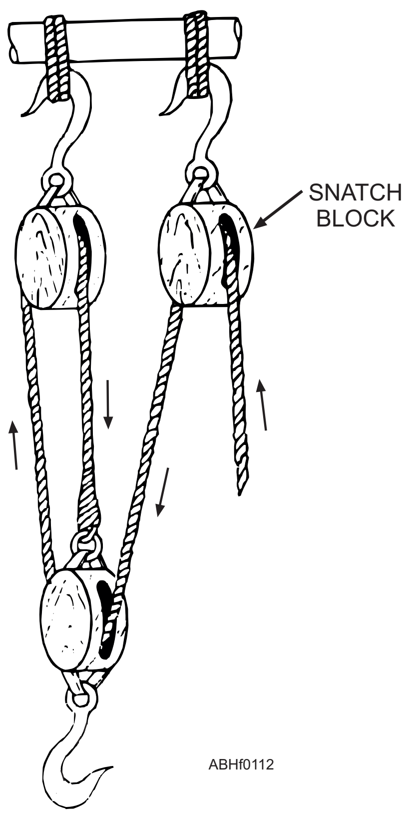


Figure 1-12.—Inverted gun tackle.

By inverting any tackle, a mechanical advantage of 1 is always gained because the number of parts at the movable block is increased. By inverting a gun tackle (fig. 1-12) a mechanical advantage of 3 is attained. When a tackle is inverted, the direction of pull is difficult. This can be easily overcome by adding a snatch block, which changes the direction of pull, but does not increase the mechanical advantage.

Types of Tackle

Among the various types of tackle in common use are the gun tackle, single luff tackle, and twofold purchase, each shown in figure 1-13.

In studying each type illustrated, note the direction in which the arrows are pointing for that particular tackle. The purpose of the arrows is to indicate the sequence and direction in which the standing part of the fall is led in reeving.

A gun tackle is made up of two single sheave blocks. This tackle got its name in the old days by being used to haul muzzle-loading guns back into battery after the guns had been fired and reloaded. As discussed earlier, a gun tackle has a mechanical advantage of 2. A single luff tackle consists of a double and a single block. This type has a mechanical advantage of 3. A twofold purchase consists of two double blocks, as illustrated in figure 1-13. In has a mechanical advantage of 4.

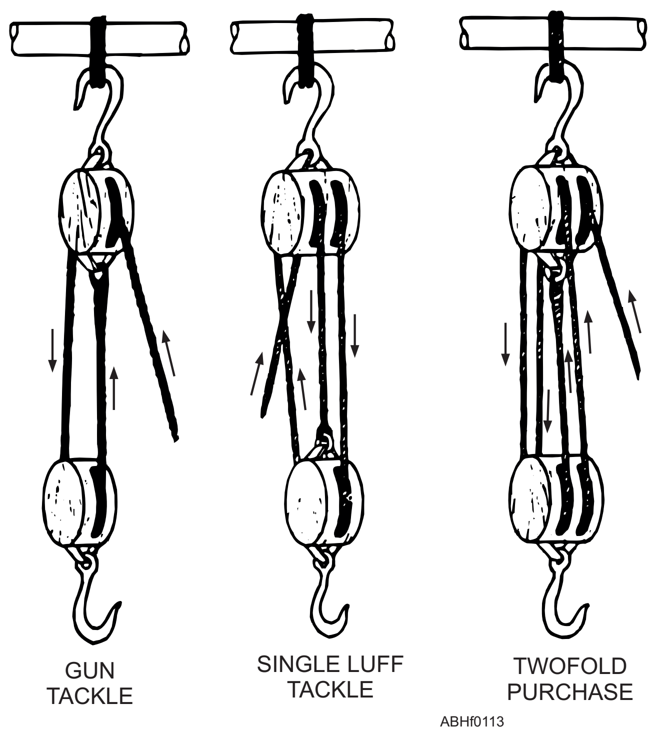


Figure 1-13.—Three common types of tackle.

Figure 1-14 shows the pattern for reeving a right-angle threefold tackle. When reeving falls in a right angle pattern, it facilitates the process to stand one block on its cheek and lay the other (usually the one with the becket) down.

CHAIN RATCHET (COME-ALONG)

One piece of equipment you should be familiar with is the chain ratchet. In more common terms, it is usually referred to as a *come-along* (see fig. 1-15).

Chain ratchets have an operating handle similar to a ratchet wrench. They are normally light in weight and come in a variety of sizes, depending on the job to be done. A chain ratchet has a friction brake incorporated in its mechanism to hold the load when the handle is released. Chain ratchets are reversible so that the load may be raised, inspected, and lowered back into place. Some of the common types of chain ratchets use either sprocket (bicycle) chain or link chain.

As an ABH working on chain type shore base arresting gear, you will probably use a 3-ton capacity chain hoist assembly. This assembly is used to provide the needed tension for the cross deck pendants.

Always lubricate a chain ratchet before stowing. Never apply more power than can be exerted by one man. Do not use extensions on the ratchet handle for additional leverage. Inspect chain ratchets regularly to ensure that the chain, hooks, and ratchet gears are in good condition. Never apply a strain greater than the safe working load.

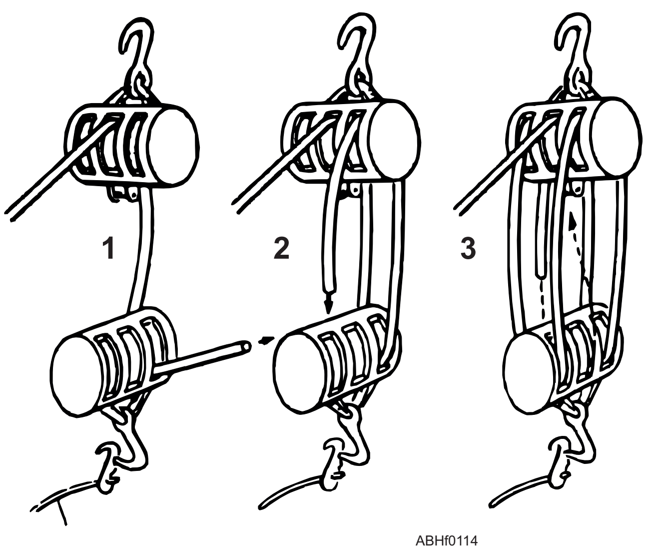


Figure 1-14.—Reeving a threefold purchase.

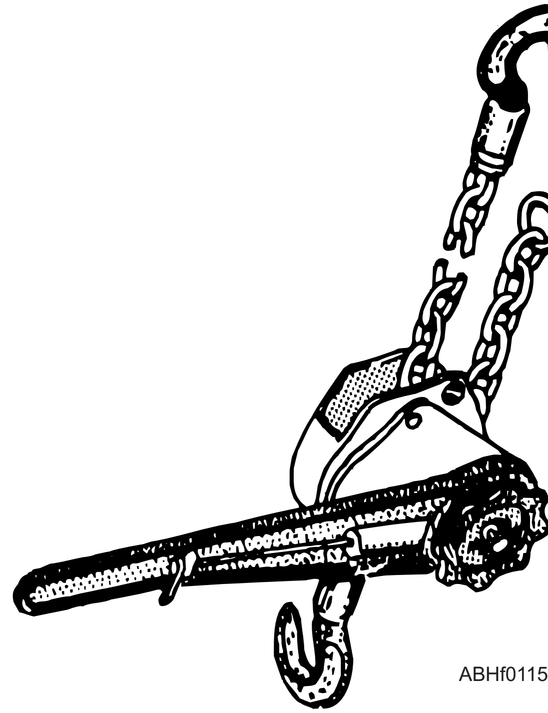


Figure 1-15.—Come-along.

LINE

Line used by the Navy is made from a variety of natural fibers like abaca, agave, sisal, hemp, jute, and cotton. It may also be made from various combinations of these fibers, depending upon its use.

In the manufacture of line, the fibers of the various plants are twisted together in one direction for the yarns. The yarns are twisted together in the opposite direction to form strands, and the strands are again twisted together in the opposite direction to form the line. Most of the line used is three-strand, although four-strand is sometimes used.

By far the greater part of the line now used is right laid, that is, the strands in the finished line spiral along in a right handed direction as one looks along the line. Right laid line must always be coiled down right-handed, or clockwise.

Nylon Rope

Nylon is a synthetic fiber and differs from natural fiber lines in that it will stretch under load and yet recover to its normal size when tension is removed. A stretch of one-third of its length is normal under safe working loads. A stretch of 40% of its length is the critical point, and it will part at 50% stretch. This elongation at times may be a disadvantage, but doubling the lines can halve it. Nylon rope can stand repeated stretching with no serious effect.

Nylon rope that has been under heavy strain may develop glazed areas. Paint or the fusing of fibers may cause this condition. In either case, the effect on the rope's strength is negligible.

Nylon rope will hold a load even though a considerable amount of the yarns have been abraded. Where such a condition is excessive but located in only one area, the chafed section may be cut away and the ends spliced together for satisfactory reuse.

Nylon is spliced in a manner similar to manila, employing tape instead of seizing stuff for whipping the strands and rope. Because of its smoothness and elastic properties, nylon requires at least one tuck more than manila. For heavy-load applications such as towing, a back tuck should be taken with each strand. When nylon lines become iced over in use, they should be carefully thawed at moderate temperatures and dried before being stowed.

Since nylon rope, on parting, is stretched to 50% of its length, it parts with a decided snapback. Keep yourself and your personnel out of the direct line of pull when heavy strains are applied.

Pulling the end through the eye of the coil does not open a coil of nylon rope, unlike fiber line. It should be unreeled in the same manner as wire rope.

Size and Types

Line 1–3/4 inches or larger in circumference is designated to size by its circumference in inches. Line is manufactured in sizes up to 16-inch hawsers. A hawser is any line larger than a 5-inch line, which is used for towing or mooring. As a general rule, a 10-inch line is about the largest line issued by the Navy for general shipboard use.

Line less than 1–3/4 inches in circumference is referred to generally as SMALL STUFF, and is designated to size by the number of yarns it contains, called threads in this case. To find the size of a piece of small stuff, a strand is opened out, the number of yarns it contains is counted, and the result multiplied by 3 for 3-strand stuff. The largest small stuff is 24-thread; it has 3 strands, each of which contains 8 yarns.

Certain small stuff used for special purposes is designated by name, with no reference to size. Marline is the most common stuff of this type. It is 2-strand, left laid stuff, rather roughly made up, tarred a dark brown, and not much larger than ordinary package wrapping cord. A serving (smooth finish on line or wire made of close wrapped turns) is normally made with marline. It is inexpensive, fairly strong, and well protected by its tarring against the weather.

Seizing stuff is small stuff laid up right handed by machine, like regular line, but not much larger than fishing line. It is used for servings when a fancier job than can be done with marline is desired.

Applications

Besides the uses that have already been mentioned, line is used as tiedown's on aircraft equipment and loose gear. Line is also used for guide and steadying lines in hoisting aircraft and equipment.

Working lines, as used in this manual, are categorized as follows and should be made up in the minimum quantities as follows:

1. <u>STABILIZING LINES</u>--4 each, 50-foot lengths. They are intended for attachment between an aircraft and a crane to prevent oscillations while the load is suspended and in transit from the salvage site.

2. <u>TAG LINES</u>--4 each, 100-foot lengths. These are hand held stabilizing lines.

3. <u>SECURING LINES</u>--Sufficient quantity and random lengths. These are used to secure equipment such as an aircraft to a dolly and a dolly to the flight deck during jettison operations.

4. <u>TENDING LINES</u>--4 each, 100-foot lengths. These are to be used primarily for personnel safety when a crewmember is operating in an area requiring the use of the safety harness.

Care

When line must be stowed wet, it should always be laid on gratings in long fakes (laid back over itself in single turns one set forward of the other). This is so that it may dry as quickly as possible. It should never be covered.

Deterioration of line may be through age, exposure, use, or abuse. Signs of deterioration through age or exposure are indicated by the gradual change in color of the inner parts of the strands. The bristling ends of broken or dislodged yards indicate deterioration from use or abuse. Where a line has been overstrained, it not only bristles, but also shows a decrease in diameter. Do not depend on it in any situation for more than a fraction of its normal working load.

WIRE ROPE

Wire rope is made up of single wires twisted together in one direction to form strands. These are, in turn, twisted together in the opposite direction to form the rope. The number of strands and the number of wires in the strand designate wire rope. For example, wire rope built up of 6 strands with 19 wires per strand is designated as 6×19. Wire rope size is determined by its diameter, which is measured from the high point of one strand to the high point on the strand on the opposite side. See figure 1-16.

Wire rope made from iron or cast steel is used occasionally in manufacturing, but is not strong enough for general use aboard ship. For wires in cranes, cargo gear, towing gear, and so forth, the Navy specifies a MINIMUM tensile strength of 220,000 pounds per square inch (psi). Extra strong crucible steel, monitor steel, and plow steel meet Navy specifications. Plow steel wire is the type most generally in use.

Some wire that is used for special purposes is PREFORMED. In preformed wire, each strand is shaped so that it lies in with the others the way a strand does in line. Preforming makes wire more flexible, it lasts longer in cranes, boat winches, and so forth. However, preformed wire is expensive, and most wire used in cargo gear, towing gear, mooring gear, and so forth, is nonpreformed. Nonpreformed wire is much stiffer than preformed. Its strands have a strong tendency to fly apart if they are not kept tightly whipped or seized.

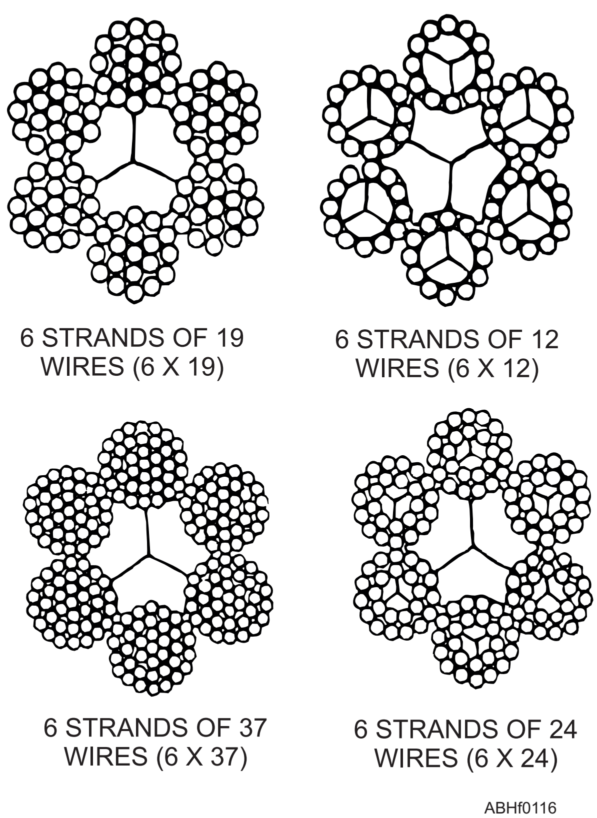


Figure 1-16.—Arrangement of strands of wire rope.

Flexible wire rope, called SPRING LAY, is often used for wires that require a good deal of handling, such as mooring wires. Each strand in spring lay is composed partly of wire and partly of fiber. This construction increases the flexibility, but reduces the strength of spring lay considerably compared to that of an all steel wire rope. If available, the manufacturer's data on the strength of wire rope should be used. If this information is not known, the information shown in table 1-1 should be used to estimate the safe working load.

Care of Wire Rope

All exposed wire must be periodically covered with surface coating for protection against the weather. For wire used in standing rigging, weather protection is the only consideration. However, wire rope used in running rigging (airplane cranes, winches, and so forth) must be slushed with a mixture that provides lubrication as well as protection against the weather. Graphite grease is normally used for this purpose. Wire that is kept well slushed deteriorates very little as a result of exposure. However, wire subject to long usage wears like any other metal item. The outer parts of the strands begin to flatten and the diameter of the wire decreases. As a consequence, individual wires begin to wear through and fishhooks appear. By this time the wire is definitely unsafe and must be replaced.

Wire rope that has been overstrained will show fishhooks, as well as a marked decrease in diameter where the strain occurred. The wire is extremely unsafe at this point, and it should be replaced.

Handling of Wire Rope

Persons handling wire rope must always wear gloves. Even new wire contains an occasional fishhook, which, if allowed to slide through the unprotected hand, may inflict a severe gash.

The handling of wire rope requires attention to detail. Wire rope must not be coiled or uncoiled like manila line. Wire direct from the manufacturer, whether on a reel or not, has always been wound into a coil and must be unwound, never picked up in bights. The outside end always goes off first, never the inside end, as with line.

Table 1-1.—Wire Rope Safe Working Loads

Wire Size-Inches		Safe Working Loads-Pounds		
Diameter	Circumference	New Safety Factor-4	Good Used Safety Factor-6	Frequently Used Safety Factor-8
1/4"	7/8"	1125	750	565
3/8"	1-3/16"	2530	1690	1265
1/2"	1-9/16"	4500	3000	2250
5/8"	2"	7020	4670	3510
3/4"	2-3/8"	10,100	6750	5050
1"	3-1/8"	18,000	12,000	9000
1-1/4"	4"	28,100	18,750	14,050
1-1/2"	4-3/4"	40,500	27,000	20,250
1-3/4"	5-1/2"	55,200	36,800	27,600
2"	6-1/4"	72,000	48,000	36,000

Some wire comes from the manufacturer in a plain coil, stopped together with wire stops. Some means must be found for unwinding the coil in such a manner that it will not kink. Rolling it along the deck is generally impracticable, because of the weight of the wire and the tendency of the coil to come apart.

The best way to unwind a new coil of wire is to set it on a capstan, if available; run the machinery at slow speed, and walk away with the outside end of the wire as the capstan turns. If a capstan is not available, the coil may be slung like a reel and unwound. Some ships and stations have constructed special reels on which to place coils of wire to facilitate unwinding. Simply slinging the reel up on a piece of pipe or a crowbar and walking away with the end can unwind wire on a reel.

FORMULAS

The manufacturer's data concerning the strength of a fiber line or wire rope should be used, if available. If you do not have that information, there are formulas or THUMB RULES that can be used to compute the breaking strength and the safe working load. These rules give results that only APPROXIMATE the figures in the manufacturer's tables, because they, of necessity, contain constants. In these thumb rules, constants are figures arbitrarily chosen as those that result in the most nearly accurate answers in the greatest number of circumstances. It is doubtful if results ever are completely accurate, but they are on the side of safety.

The thumb rules for the breaking strength (BS) and safe working load (SW) for manila line, nylon line, and wire rope all use the circumference C and are as follows:

FORMULA 1--BREAKING STRENGTH OF MANILA:

$$BS = C^2 \times 900 \text{ pounds.}$$

FORMULA 2--BREAKING STRENGTH OF NYLON:

$$BS = C^2 \times 2{,}400 \text{ pounds.}$$

FORMULA 3--BREAKING STRENGTH OF WIRE ROPE:

$$BS = C^2 \times 8{,}000 \text{ pounds.}$$

C^2 refers to the circumference of the line or wire in inches, multiplied by itself. If the circumference is not known, but the diameter is known (as is usually the case with wire), the circumference may be found by multiplying the diameter by 3.

It is necessary to establish limits within which line or wire can be used safely under specified circumstances or, in other words, to provide a margin for safety. Introducing into the problem elements called SAFETY FACTORS does this. In the case of rope, the safety factor used depends upon the rope's condition. To compute the safe working load, find the breaking strength and divide by one of the following safety factors:

FACTOR 1. New rope: 4.
FACTOR 2. Good used rope: 6.
FACTOR 3. Frequently used rope: 8.

EXAMPLE: The formula to find the safe working load for a new piece of 2-inch circumference manila line is as follows:

$$SW = BS/4$$

$$SW = \frac{C^2 \times 900}{4}$$

$$SW = \frac{4 \times 900}{4} = 900 \text{ pounds}$$

The safe working load of 2-inch manila equals 900 pounds.

The thumb rules for a safe working load is designed for easy remembering and hasty rough calculations only. However, they are well within the margin of safety for practically any line or wire rope used aboard ship. The exact safe working load of a line depends on the type of fiber used in its construction. A wire will be stronger or weaker depending on whether it is made of iron, cast steel, or plow steel. Manufacturers' tables are available for both line and wire and you should refer to them when possible.

Q13. What are the three common types of tackle?

a.
b.
c.

Q14. What is the mechanical advantage of a two-fold purchase?

STOWAGE OF EQUIPMENT

LEARNING OBJECTIVE: State the guiding principle of equipment stowage?

"A place for everything and everything in its place." This is the definition often given for the word *shipshape*. To the ABH, this phrase has a special significance. Since a great deal of the equipment used by the ABH is for use in emergencies (aircraft crash, rescue, salvage, and firefighting equipment), it is imperative that it be in its assigned area, ready for use when required. Time spent in searching for a piece of needed equipment is costly.

As an example, suppose that an aircraft has crashed, a personnel rescue must be made, and the equipment necessary to make the rescue is not in its assigned location. The delay caused by having to search for this vital equipment could very well mean the difference in whether or not a successful rescue is made.

Serious damage to aircraft and injury to personnel may be caused when equipment such as chocks, towbars, and tiedowns are left lying loose about the flight or hangar decks. Flight operations are often conducted at night when this loose gear is particularly difficult to spot. As an ABH, you must not only be especially alert for loose gear, but you must also train the assigned crew to always return all gear and equipment not actually in use to the designated area and stow it properly.

Everything movable that is not in use should be kept in bins or racks or lashed securely into place. Sudden hard turns, rough weather, or vibration at high speeds can tumble material or throw it across a compartment, ruining equipment and possibly causing serious personnel injuries. There is not always time to secure loose gear before a sudden turn.

Material and equipment should be stowed as close as possible to the place where it will be used. Careful planning allows use of space that otherwise might be wasted because of its size, shape, or its accessibility. If the items to be stowed are pilferable, locks should be placed on the access doors or on the racks holding the material in place. Emergency equipment should NOT be locked up.

Q15. What is the guiding principle of equipment stowage?

ANSWERS TO REVIEW QUESTIONS

A1. *Diagonal Pliers are pliers designed for cutting.*

A2. *When using bolt cutters, the two types of metals that you should avoid cutting are (a) spring wire and (b) tempered metal.*

A3. *By applying a light coat of oil, you can prevent rust from building on the tool.*

A4. *The two types of portable sanders used in the Navy are (a) electrical and (b) pneumatic.*

A5. *To scale out a corner, you should use a needle impact scaler.*

A6. *The most common measuring tool is the steel rule tape.*

A7. *When recoiling a spring loaded tape measure, you should prevent against tape snapback.*

A8. *The purpose of a dynamometer is to measure energy or force.*

A9. *Before plugging in a tool, you should make sure the tool is turned off.*

A10. *A safety lock-off device is required on all portable grinders.*

A11. *The five types of personal protective equipment are (a) Foot (b) Eye (c) Hand (d) Hearing and (e) Head.*

A12. *Eye protection is required when working with a portable cutting tool.*

A13. *The three common types of tackle are (a) Gun (b) Single Luff and (c) Two-Fold Purchase.*

A14. *The mechanical advantage of a two-fold purchase is four.*

A15. *The guiding principle of equipment stowage is "A place for everything and everything in its place."*

CHAPTER 2

AIRCRAFT HANDLING EQUIPMENT, NON-SKID, AND MARKINGS

As naval aircraft become more complex, so must support equipment. Many different types of support equipment are required to perform the various functions necessary to maintain aircraft in top condition. Most of today's equipment is used in the direct support of the aircraft itself. Aircraft squadrons and the air department aboard carriers and large deck amphibious ships are the principal users of support equipment. Within the air department, flight deck and hangar deck aircraft handling crews use aircraft handling equipment such as tow tractors, spotting dollies, aircraft tiedown chains, aircraft wheel chocks, and aircraft towbars.

As a user of the equipment, the ABH depends upon personnel of the Aviation Support Equipment Technician (AS) rating for their expertise in maintaining ground support equipment (GSE). However, even the best maintained GSE must have a surface that provides the best traction possible, if maximum effectiveness is to be achieved. As an ABH, you must be knowledgeable in all areas of nonskid preparation, application, and corrosion prevention. Properly applied, a nonskid coating will provide the appropriate surface coating on your flight deck or hangar deck, for safely handling naval aircraft.

Although a good quality non-slip deck surface is a proven asset to aircraft handlers, the pilots, aircrews, and deck crews rely on the special markings, known as Visual Landing Aids (VLA), for a wide range of information that leads to successful flight operations. VLA markings, in both the flight deck and hangar deck, are used in the launch and recovery evolutions, firefighting, first aid and emergency situations, and much more. As an ABH, you should be the resident expert for visual markings located on flight and hangar decks and bulkheads.

AIRCRAFT GROUND SUPPORT EQUIPMENT

LEARNING OBJECTIVES: Describe the various types of GSE. Identify the capabilities of various GSE. State the licensing procedures for GSE.

Ground support equipment is classified into four major types: common (general purpose), peculiar (special purpose), standard (has government approved specifications/drawings), and developmental (no government approved specifications/drawings). Figures 2-1 and 2-2 can be used to identify and determine the use of various types of GSE.

LIQUID-OXYGEN-SERVICING GSE

Liquid oxygen (LOX) systems are serviced from liquid oxygen trailers or storage tanks. The Closed-Loop, Low-Loss Liquid Oxygen Storage Tank Type TMU-70M is used aboard ship. The Liquid Oxygen Trailer, 50-gallon capacity, Type No. 4 is one type normally used ashore. Both are commonly called LOX carts.

TYPE TMU-70M LOX STORAGE TANK

The primary purpose of the TMU-70M (fig. 2-3) is to service aircraft LOX converters. The cart consists of three major components:

1. A 50-gallon (189-liter) storage tank

2. A 4-gallon (15-liter) transfer tank

3. A system of transfer lines and control valves, anyone of which, when broken off or damaged, could cause severe injury to personnel and damage to equipment.

The components are permanently mounted on a portable three-wheel trailer. The complete unit filled with LOX weighs 1,175 pounds. It is 3 feet high, 4 feet wide, and 7 feet 6 inches long. The front wheel is a free-swiveling caster type. A lunette eye is attached to the front of the frame for towing. A tubular bar attached to the frame and running up over the top is provided for manual handling. The parking brake handle is located in front, next to the handling bar. Parking brakes are mechanical drum/shoe-type. All three tires are pneumatic. Four tiedown and hoisting rings are provided on the frame. The rings permit hoisting of the unit fully loaded with LOX.

CHART 1 - Equipment Indicators			Miscellaneous Identification
INSTALLATION (1st Indicator)	TYPE OF EQUIPMENT (2nd Indicator)	PURPOSE (3rd Indicator)	
A - Aircraft or Missile (installed in or on vehicle, nonmission expendable) B - Aircraft or Missile (Transported, but not installed in or on vehicle, mission expendable) C - Combination (Ground and Air - borne) E - Ground, Not Fixed F - Ground, Fixed M - Ground, Self - con - tained (Movable, includes vehicle but not self - pro - pelled N - Aircraft or Missile (Transported, but not installed in or on vehicle, non - mission expendable) P - Personal Use (Held or worn by individual) S - Ground, Self - pro - pelled (Includes vehicle) U - Multi - installation W - Water (Surface or Submerged)	22 - Apparel 23 - Chemical 24 - Electrical 25 - Explosive 26 - Gaseous 27 - Hydraulic 28 - Materials, Pliable (fabric, rubber, etc.) 29 - Materials, Rigid (metals, wood, etc.) 32 - Mechanical 33 - Nuclear 34 - Pneumatic 35 - Optical 36 - Opti-mechanical 37 - Electromechanical 38 - Invisible Light (Infrared) 39 - Inertial 42 - Electrohydraulic 43 - Manual 44 - Internal Combustion 45 - Biological 46 - Pneumatic - Hydraulic 47 - Electropneumatic 48 - Hydromechanical 49 - Gunnery 82 - Mobile Deployment (Bare Base) - Miscel laneous 83 - Mobile Deployment (Bare Base) - Medical including dental, surgical, x-ray, etc. 84 - Mobile Deployment (Bare Base) - Billeting/ Administration 85 - Mobile Deployment (Bare Base) - Shop Facilities - all types except electronics 86 - Mobile Deployment (Bare Base) - Food Servicing including kitchen, dining, etc. 99 - Miscellaneous Note: Where more than one type number applies, use the one most applicable.	A - Aircraft or Missile Support B - Bombing or Fire Control or Both (Nonelectronic) C - Air Conditioning D - Detection E - Destruction G - Flight Control or Navigation or Both (Nonelectronic) H - Aircraft Loading and Cargo Handling J - Indicating K - Aerial Stores (Munitions) Handling L - Lubricating M - Maintenance, Aircraft P - Protection Q - Reconnaissance (Nonelectronic) R - Fueling S - Personnel Support T - Testing U - Special, Not Otherwise Covered, or Combination of Purposes V - Maintenance, Auto - motive W - Graphic Arts X - Identification Y - Dissemination	T - Training (See 5.3d) (V) - Variable Configuration (See 5.6h, 5.6l)

ABHf0201

Figure 2-1.—Equipment indicator codes.

Tow Tractor	A/	S	32	A	31
Item Name	Aero/ Support Equipment	Ground, Self Propelled	Mechanical	Aircraft or Missile Support	The 31st equipment in the 32A category to which a type designation has been assigned

ABHf0202

Figure 2-2.—Equipment type designation.

WARNING

Extreme caution must be used when moving aircraft around the LOX cart. Any damage to the structural container could result in an intense explosion.

TOW TRACTORS

The tow tractor is the primary means of moving most aircraft that are on the ground or deck and with engines not running. Features of most value to the ABH are the tow tractor's weight, maneuverability, and drawbar pull.

The maneuverability of the tractor depends on the tractor's dimensions and turning radius. The smaller the dimensions and turning radius, the more maneuverable the tractor. *Drawbar pull* is the amount of force that the tractor can exert. The drawbar pull of any tractor is dependent on the type and condition of the surface on which the tractor is being used. Dry concrete gives the most traction, hence the most drawbar pull for a given tractor. On a wet, fuel soaked flight deck the force may

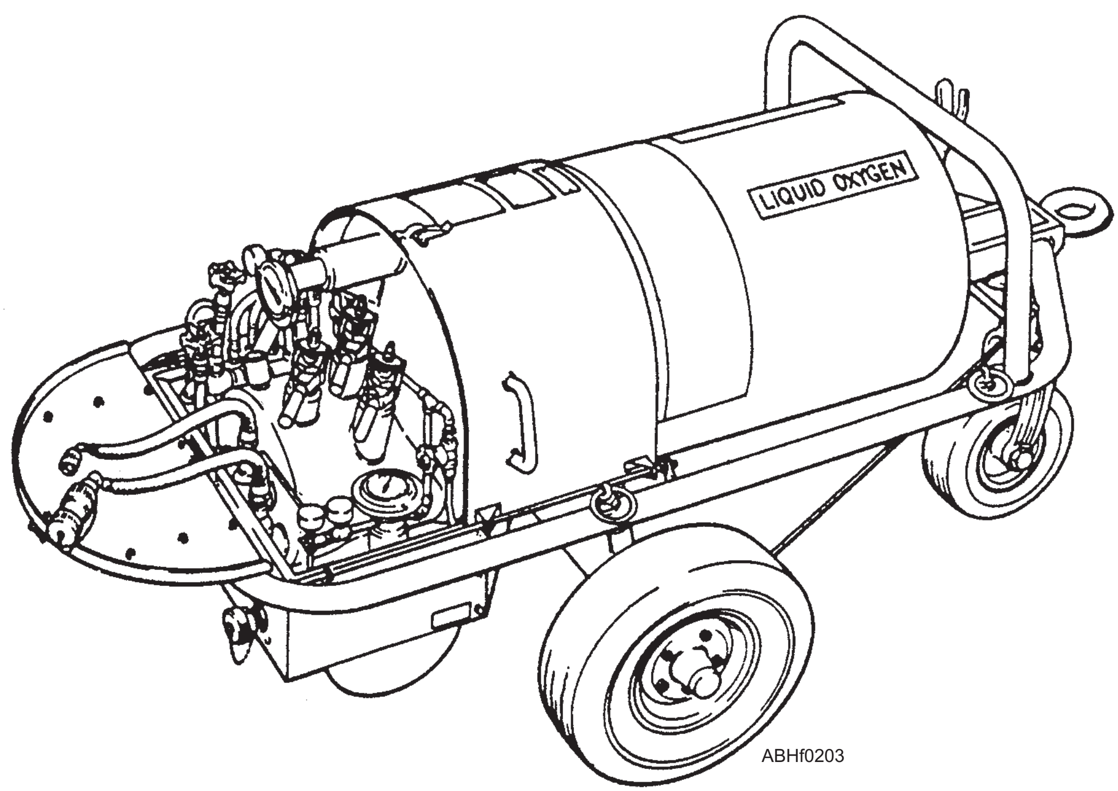


Figure 2-3.—Type TMU-70M LOX storage tank.

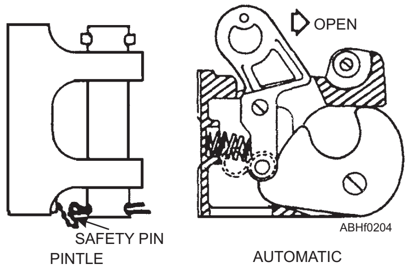


Figure 2-4.—Tow couplers.

be greatly reduced. Towing capacity is normally stated in drawbar pull. <u>The maximum aircraft weight that a tractor can safely handle is 10 times the drawbar pull</u>. In other words, a tractor with an 8,000-pound *drawbar pull* can tow aircraft weighing up to 80,000 pounds.

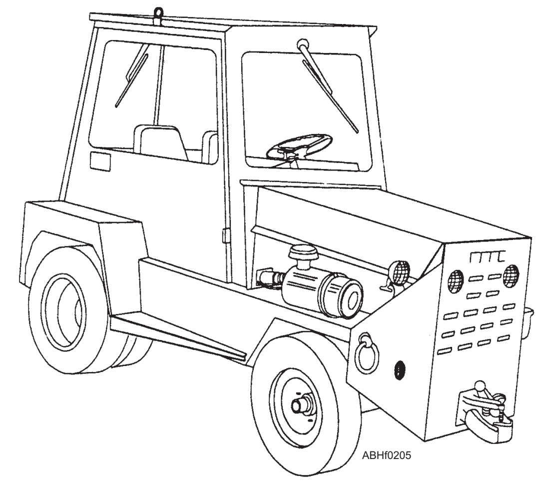


Figure 2-5.—A/S32A-30A (Support Equipment & Aircraft Tow Tractor).

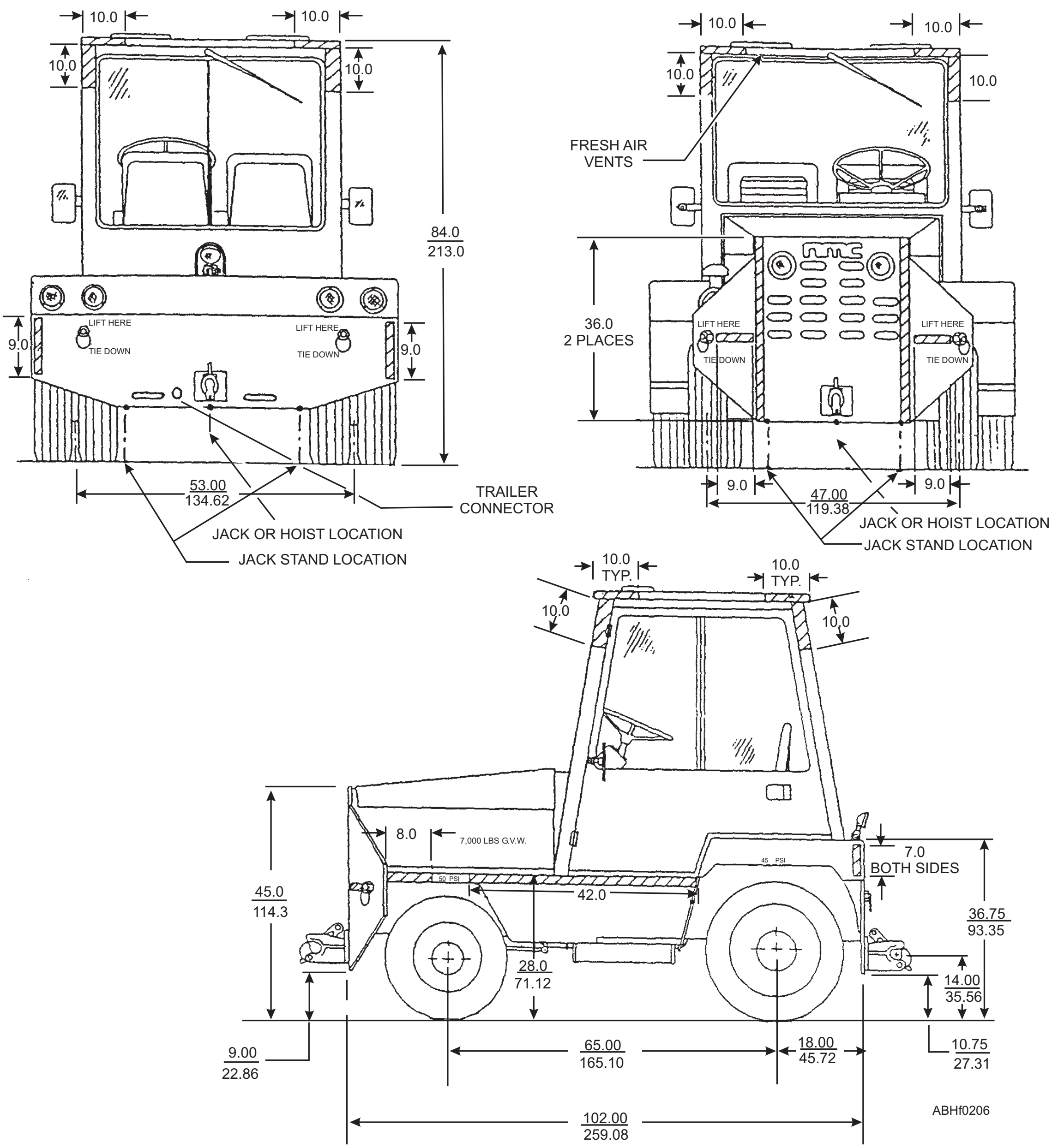


Figure 2-6.—A/S32A-30A Side/Front/Back views.

The engine and transmission types allow for easy maneuverability of the tractor and for installing aircraft starting and fire fighting equipment. The type of transmission may also contribute to ease in handling the tractor. Support equipment for supplying electric power and/or compressed air for aircraft engine starting or servicing and electric power for brake operation may be installed on some tractors.

You should know how to use the different pedals and levers in the operation of these vehicles. Certain daily functions such as checking the water, air, oil, and fuel are done before operation of this equipment. These items are on a checklist and are part of the standard procedures for use of motorized equipment throughout the Navy. All other maintenance is the responsibility of the AIMD (aircraft intermediate maintenance department) aboard carriers and at air stations.

Operating a tow tractor requires good judgment and general knowledge of motorized equipment. The driver must be licensed in accordance with OPNAVINST 4790.2 (series) before assuming control of the vehicle.

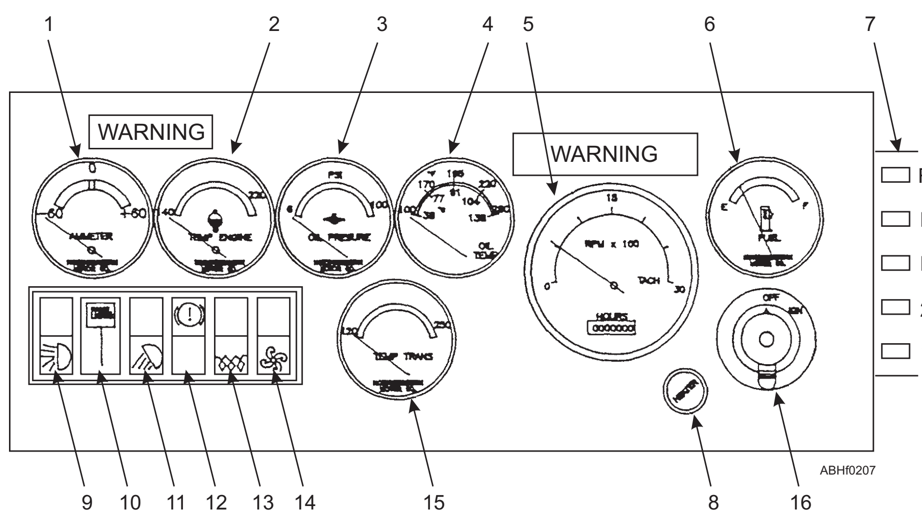
The tractors are equipped with either pintle or automatic tow couplers (fig. 2-4) both front and rear. Some tractors, if outfitted with support equipment on the rear end of the tractor, may not be equipped with a towing coupler.

TOW TRACTOR TYPES

Throughout this chapter, the following tow tractors will be discussed: A/S32A-30A (Support Equipment & Aircraft Towing Tractor); A/S32A-32 (Aircraft Towing Tractor); A/S32A-31A (Aircraft Towing Tractor); A/S32A-42 (Aircraft Mid-Range Tow Vehicle); A/S32A-37 (Aircraft Towing Tractor). These tow tractors represent the most common types of towing vehicles that an ABH would use both at-sea and ashore.

A/S 32A-30A (Support Equipment & Aircraft Tow Tractor)

This tractor was designed primarily for towing mobile support equipment such as starting units, mobile electric power plants (MEPP's), work stands, and other tractors. Commonly called the GSE tractor (figs. 2-5, 2-6, and 2-7), it can also be used to tow munitions trailers and, as a secondary mission, to tow light aircraft and helicopters. It is a shore based unit and routinely used around hangars and warehouses. The unit is powered by a 4-cycle diesel motor and is a dual-wheeled, rear drive tractor. For specific information



DASH CONTROLS AND INSTRUMENTS

1. AMMETER
2. ENGINE COOLANT TEMPERATURE GAUGE
3. ENGINE OIL PRESSURE GAUGE
4. ENGINE OIL TEMPERATURE GAUGE
5. TACHOMETER / HOURMETER
6. FUEL LEVEL GAUGE
7. TRANSMISSION SHIFTER PLATE
8. HEATER CONTROL KNOB
9. HEADLIGHT / TAILLIGHT SWITCH
10. INSTRUMENT PANEL LIGHT SWITCH
11. REAR WORK LIGHT SWITCH
12. BRAKE FAILURE WARNING LIGHT
13. GLOW PLUG SWITCH
14. HEATER FAN SWITCH
15. TRANSMISSION TEMPERATURE GAUGE
16. IGNITION SWITCH

Figure 2-7.—A/S32A-30A Dash Controls & Instruments.

Table 2-1.—Leading Particulars of the A/S32A-30A Tow Tractor

Gross vehicle weight	6,970 lbs.	Towing capacity	40,000 lbs.
Basic length	102 inches	Turning radius	142 inches
Height	84"	Width	70 inches
Fuel capacity	12 gallons	Electrical system	12 volt
Min. Oil Pressure	7 psi	Tire pressure	50 psi

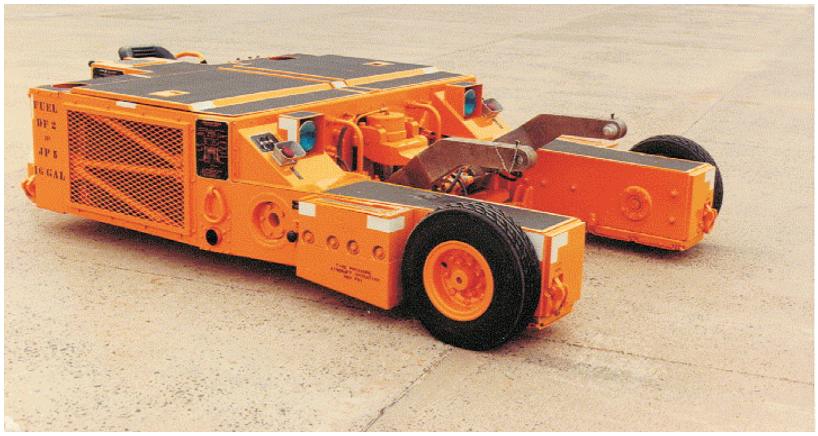


Figure 2-8.—Aircraft Tow Tractor model A/S32A-32 (*SD-2 Spotting Dolly*).

concerning this tractor, refer to NAVAIR 19-40-520. Leading particulars of the A/S32A-30A are noted in Table 2-1.

A/S 32A-32 (Aircraft Towing Tractor)

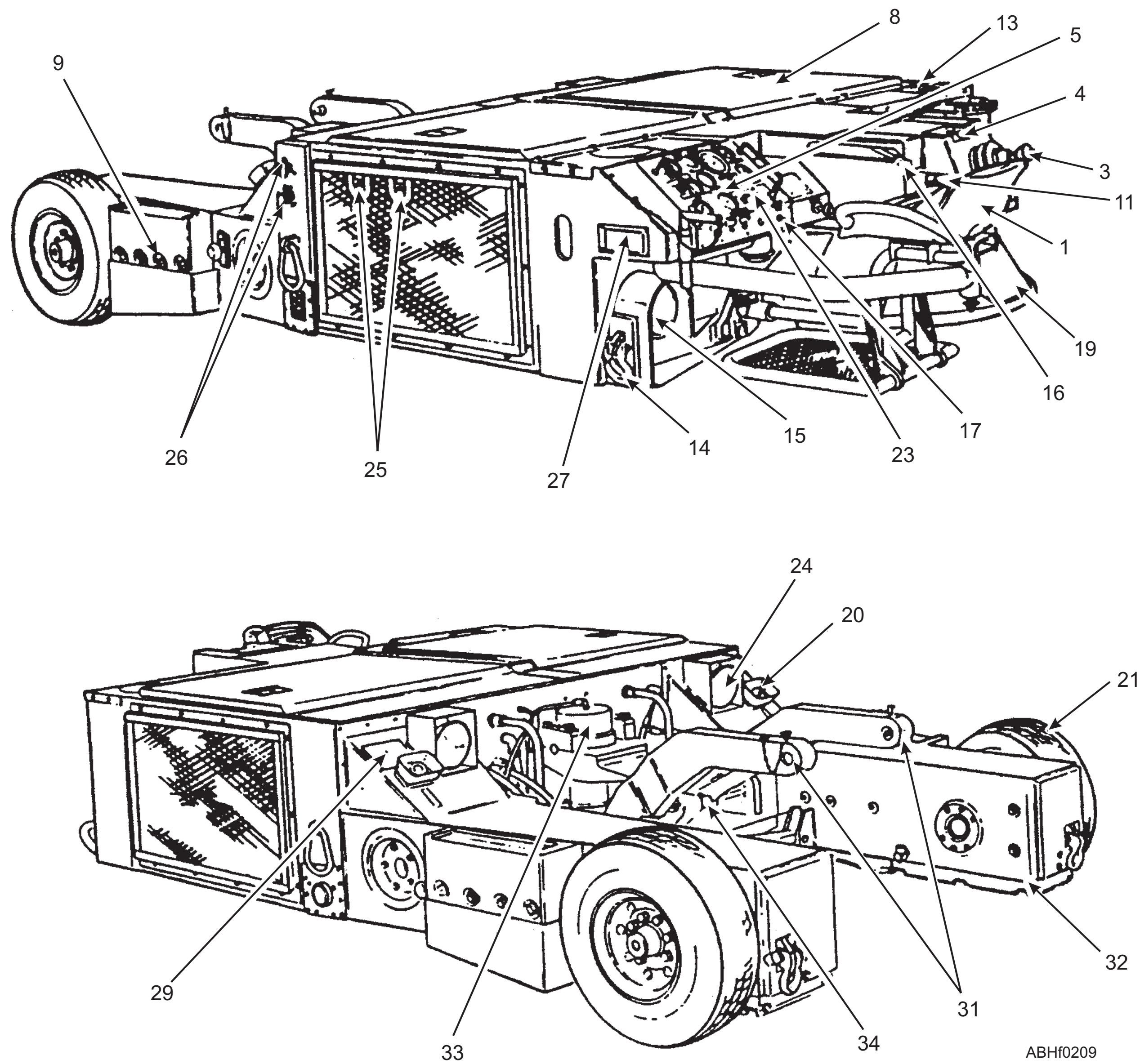
This vehicle is formally known as a towing tractor, however, it is commonly referred to as a *spotting dolly, SD-2* (fig. 2-8).

The movement of aircraft on the ground has historically been accomplished by means of towbars and tractors; but in crowded areas, that method becomes ineffective. The A/S32A-32 tow tractor (*spotting dolly*) (fig. 2-8) can provide maximum maneuverability, tow, turn, and spot several types of aircraft equally as effectively in congested areas as in the open. The s*potting dolly* can also be operated under most aircraft, since its heights is only 30 inches. See table 2-2.

Self propelled, the AS 32A-32 towing tractor (*SD-2 spotting dolly*) can move an aircraft by picking up the nosewheel and moving in any direction. The tractor requires no turning radius. The tractor can approach an aircraft head on, pick up the nosewheel, spin on its own axis, and then tow the aircraft out at any angle to the aircraft's original line of direction. It can turn an aircraft through 360 degrees while the center of the landing gears remains stationary. A hydraulic drive system permits one wheel of the tractor to be driven forward and the other in reverse. This allows the tractor to spin completely about without moving the aircraft's nosewheel. The AS 32A-32 towing tractor is a three-wheel vehicle; two of the wheels are driven, and the third is an independent caster. You can control the tractor by using a joystick handle on the end of the control console. See figures 2-9 and 2-10. Steering is accomplished by pushing the handle to the left or to the right. You can control direction (forward or reverse) by moving the handle away from you (forward) or toward you (reverse). The maximum speed when carrying a load is 2 miles per hour; unloaded, 5 miles per hour.

Table 2-2.—Leading Particulars of the A/S32A-32 Tow Tractor (*Spotting Dolly*)

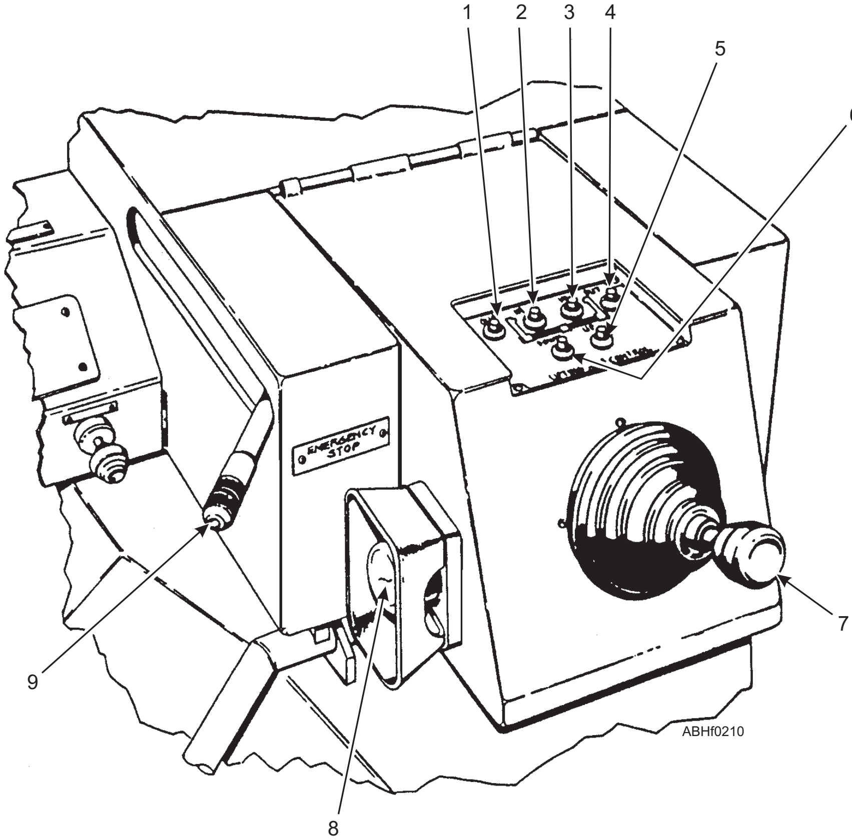
Overall length	148 inches
Overall width	81 inches
Overall height	30 inches
Gross vehicle weight	11,500 lbs.
Drawbar pull	14,000 lbs.
Maximum lifting capacity	16,000 lbs.
Maximum speed (loaded)	2 mph
Maximum speed (unloaded)	5 mph
Minimum turning radius	0 inches
Ground clearance	5 inches
Fuel	JP-5



1. **Seat**
2. **Blank**
3. **Control handle**
4. **Lifting arm control box**
5. **Instrument and engine control access panel**
6. **Hydraulic oil fill**
7. **Blank**
8. **Engine compartment access panel**
9. **Axle pin holder**
10. **Blank**
11. **Emergency stop switch**
12. **Blank**
13. **Fuel fill**
14. **Tie-down and lift ring**
15. **Headlight**
16. **Parking brake**
17. **Horn Button**
18. **Blank**
19. **Caster**
20. **Emergency stop switch**
21. **Main tires**
22. **Right-hand lifting arm control panel**
23. **Light switch**
24. **Spotlight**
25. **Emergency arm spread control buttons**
26. **Emergency arm control valves**
27. **Slave receptacle**
28. **Blank**
29. **Lifting arms control panel**
30. **Blank**
31. **Lifting arms**
32. **Chassis**
33. **Lifting hydraulic cylinder**
34. **Spread hydraulic cylinders**

Figure 2-9.—A/S32A-32 Aircraft Towing Tractor.

The usual manner of loading aircraft onto either of the tractors is to maneuver the *spotting dolly* into the loading position, in front of the braked aircraft, with the lifting arms spread to their maximum width. Slowly move the tractor toward the aircraft until the lifting arms are astride the nosewheel of the aircraft. Try to keep the tractor centered with the nosewheel of the aircraft. Make certain the correct axle pins in the lifting



1.	**Right-hand lifting arm out switch**	**4.**	**Left-hand lifting arm out switch**	**7.**	**Joystick control**
2.	**Right-hand lifting arm in switch**	**5.**	**Lifting arms up switch**	**8.**	**Emergency stop switch**
3.	**Left-hand lifting arm in switch**	**6.**	**Lifting arms down switch**	**9.**	**Parking brake handle**

Figure 2-10.—A/S32A-32 Control Console.

arms are installed. Adjust the lifting arms by using one of the control panels until the axle pins are in line with the nosewheel axle. Lock one axle pin at a time in the nosewheel. After the nosewheel has been securely engaged, raise the lifting arms upon the director's signal, and proceed as directed. Specific information concerning the A/S32A-32 can be found in NAVAIR 19-1-157.

A/S 32A-31A Tow Tractor

The A/S 32A-31A aircraft tow tractor (fig. 2-11) is designed for towing aircraft aboard ship. It is a conventional six-wheel vehicle equipped with dual rear drive and front wheel steering with a three speed automatic transmission. A 24-volt electrical system powers the starting, lights, and the engine protective devices. Provision is made for mounting a Jet Aircraft Starting Unit (JASU) on the rear of the tractor. Fuel for the starting unit comes from the tractor tank. The control panel for the starting unit is installed at the right side of the tractor operator. When the starting unit is not installed, counterweights are used to load the drive wheels and achieve the rated drawbar pull. Towing pintles are located at the front and the rear of the tractor. The rear pintle is not available when the starting unit is installed. A single seat for the operator is located on the left side.

The engine has a 3-cylinder, 2-cycle diesel with an automatic 4-speed transmission and one reverse gear. The tractor has mechanical steering, assisted with hydraulic power. If hydraulic pressure is lost, steering is maintained through the mechanical linkage from the steering wheel to the spindles. Brakes for the tractor are also hydraulically operated. They are a wet-disc type, and are located in the rear axle wheel ends. The brakes are NOT adjustable and brake squeal is quite normal with this type. For proper operation, the accumulator-charging valve is set to detect when the pressure drops below 1500 psi. The charging valve will then signal the pump to recharge the accumulator. When towing an aircraft with the A/S32A-31A, be sure that the transmission selector lever is in either the "1" or "R" position. Never shift the transmission through to "N" (neutral) while the tractor is in motion; damage may result to the transmission.

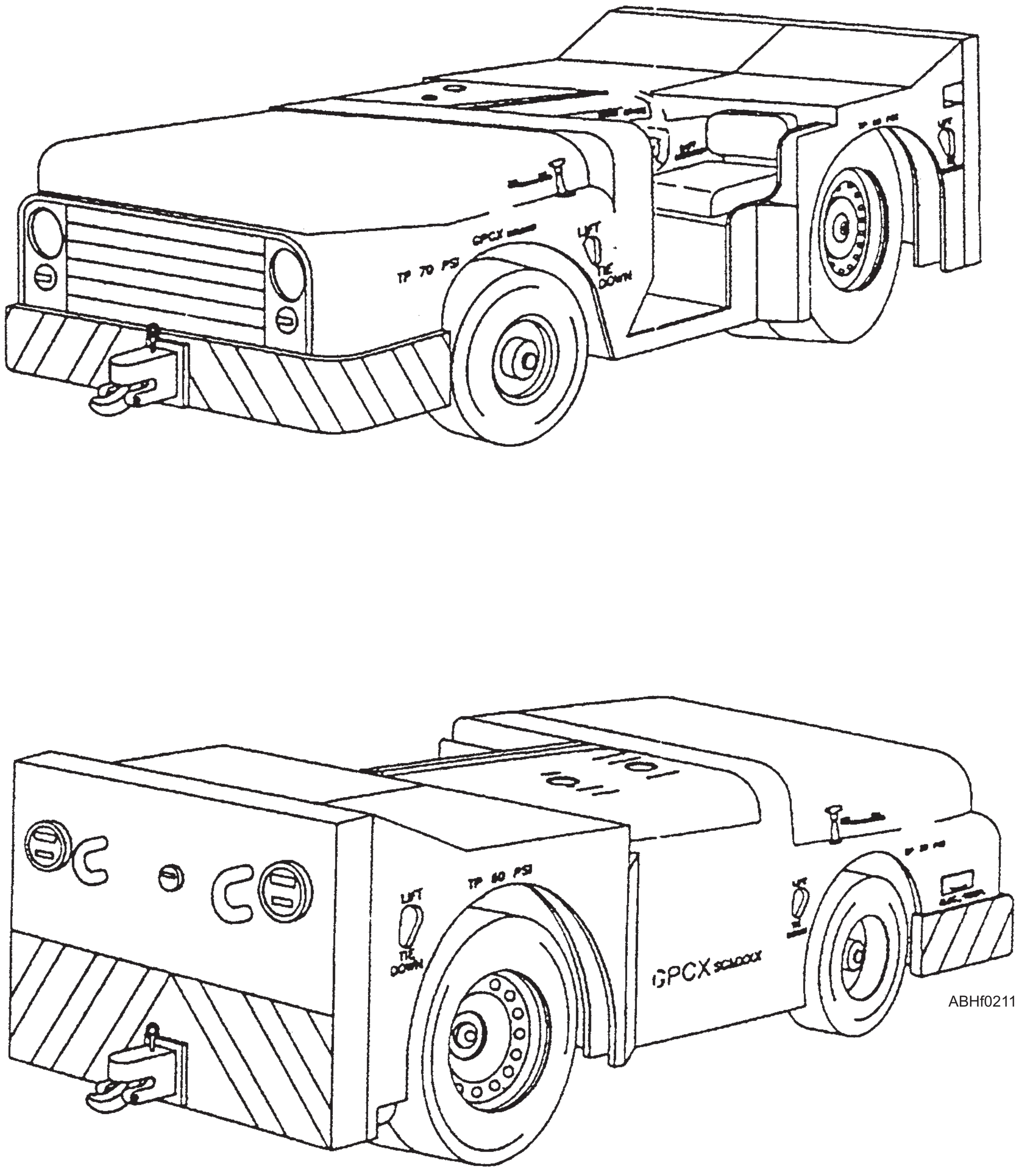
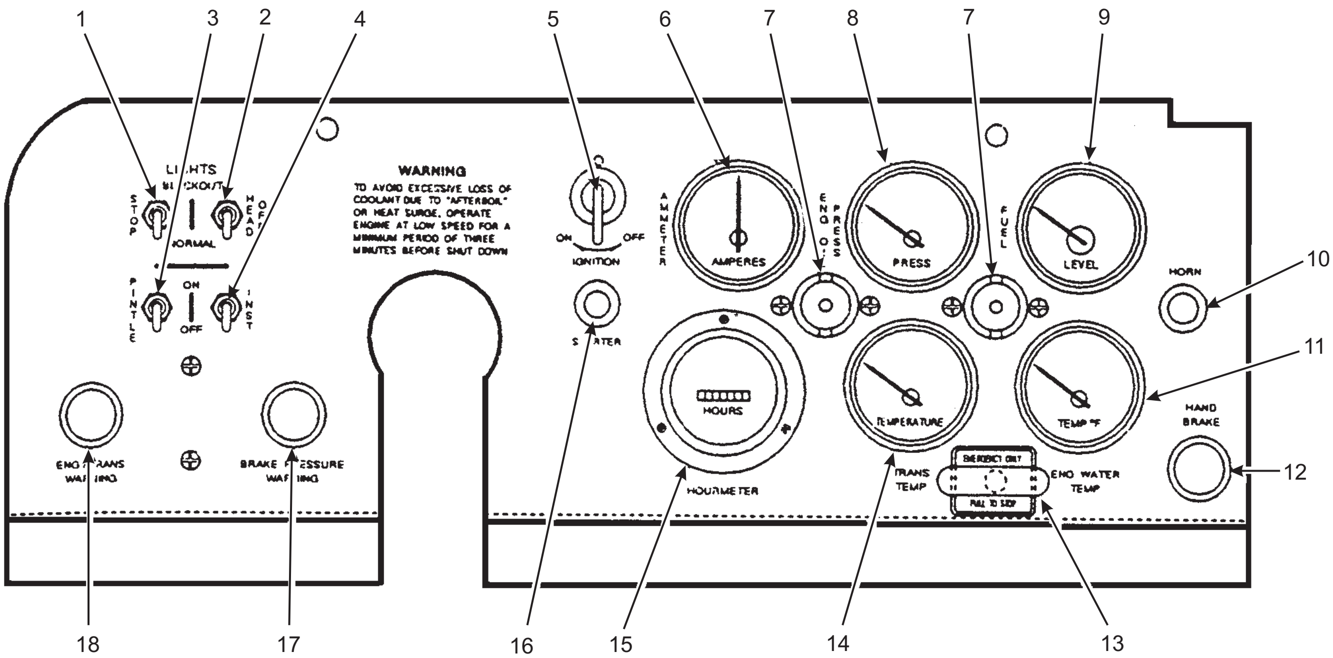


Figure 2-11.—A/S 32A-31A Aircraft tow tractor.

The A/S23A-31A has a brake warning light that will illuminate when the pressure in the accumulator falls below 1350 psi. The engine/transmission warning light will illuminate when the torque converter reaches temperatures above 300°F, engine temperatures go above 215°F, or engine oil pressure falls below 6 psi. You should always make sure that the engine water temperature never exceeds 196°F and the transmission



1	LIGHTS-STOP	11	ENG WATER TEMP
2	LIGHTS-HEAD	12	HAND BRAKE
3	PINTLE	13	EMERGENCY ONLY PULL TO STOP
4	INST	14	TRANS TEMP
5	IGNITION	15	HOUR METER
6	AMMETER	16	STARTER
7	LIGHT	17	BRAKE PRESSURE WARNING
8	ENG OIL PRESS	18	ENG/TRANS WARNING
9	FUEL		
10	HORN		

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Figure 2-12.—A/S32A-31A Control Panel.

Table 2-3.—Leading Particulars of the A/S32A-31A Aircraft Tow Tractor

Gross vehicle weight	12,400 lbs.	Drawbar pull	8,500 lbs.
Basic length	117 inches	Height	40 inches
Width	70 inches	Turning radius	132 inches
Ground clearance	7-1/2 inches	Fuel capacity	85 gallons
Front tire pressure	70 psig	Rear tire pressure	60 psig

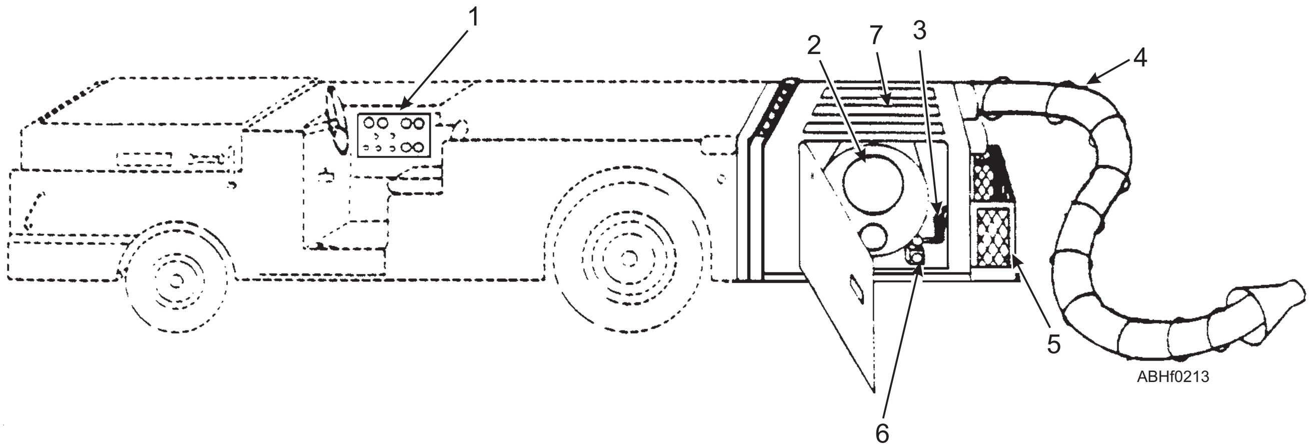
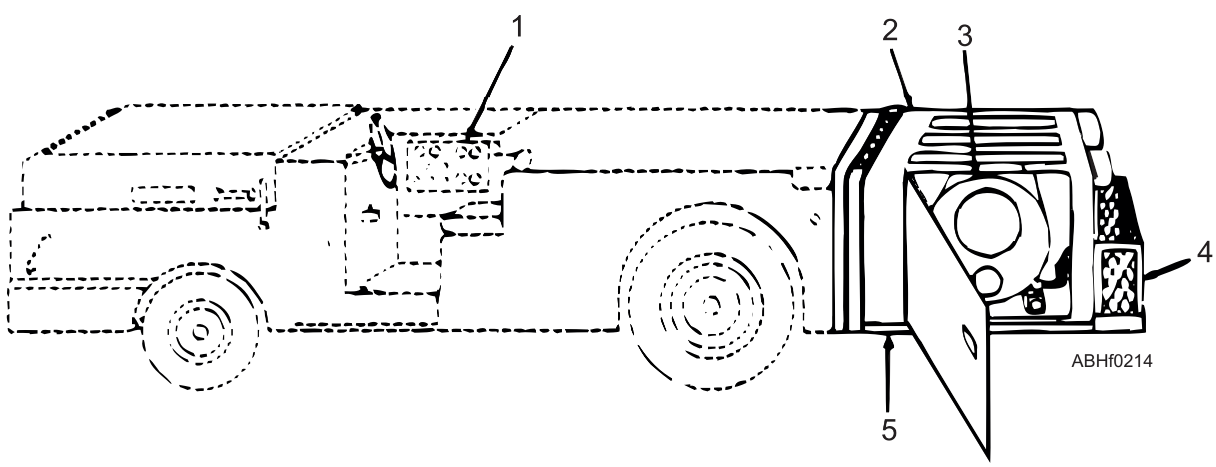


Figure 2-13.—A/S47A-1 GTE (GTCP-100) Tractor Mounted Enclosure.

temperature remains below 220°F. See figure 2–12 for gauge locations on the control console. Specific operating procedures for this tractor can be located in NAVAIR 19-40-521. The leading particulars for the A/S32A-31A tow tractor are listed in Table 2-3.

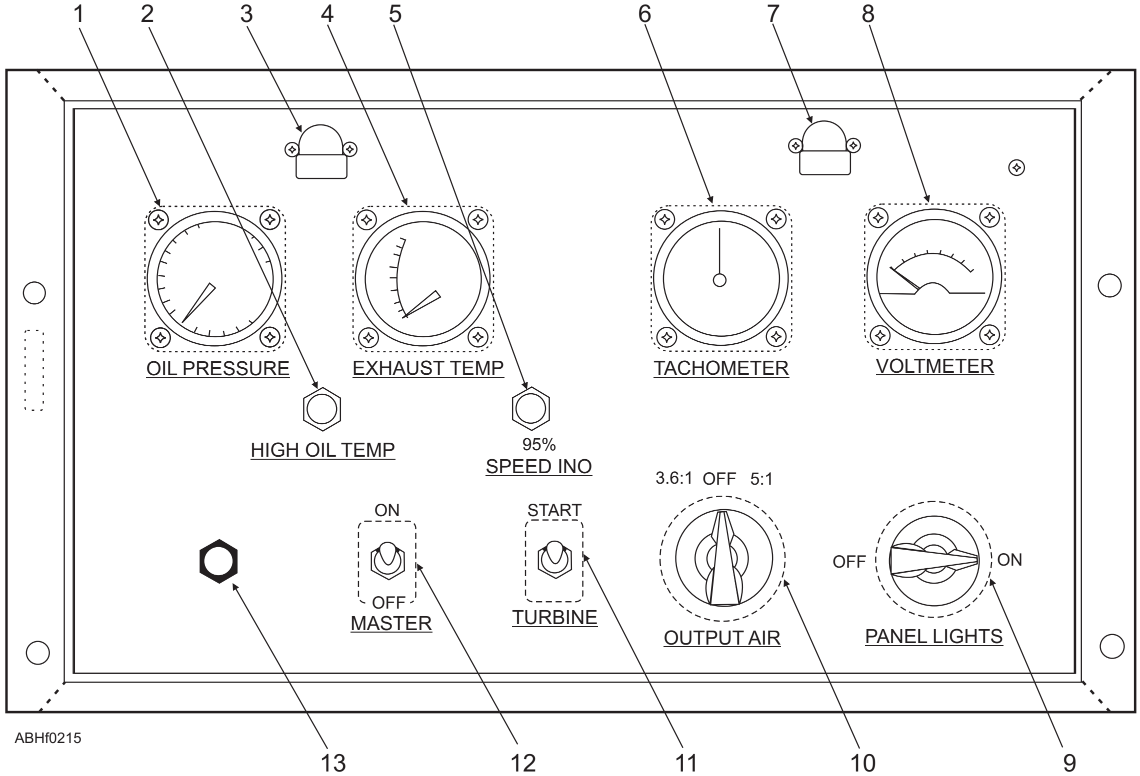
A/S47A-1 GTE (GTCP-100) Tractor Mounted Enclosure

This enclosure (fig. 2-13) is mounted on the back end of the A/S32A-31A Tow Tractor and provides handling crews with a portable aircraft turbine engine starting unit. The five main components of the starting unit are (1) the control panel, (2) the enclosure assembly, (3) the gas turbine engine, (4) the stowage rack, and (5) the mounting assembly (see fig. 2-14). The control panel (fig. 2-15) provides the single point of operation for the starting unit. On the control panel, the output switch controls the engine operation and air delivery function of the unit. The enclosure assembly houses the gas turbine engine and the lube oil, electrical, and pneumatic support systems for the Gas Turbine Enclosure (GTE). The GTE is capable of delivering compressed airflow for aircraft engine starts at two ratio settings: 3.6:1 or 5:1. The stowage rack is located on the back of the enclosure assembly and provides stowage space for the air duct hose, and the mounting assembly simply provides the entire enclosure to be mounted on the back of an A/S32A-31A Tow Tractor. Proper operation of the aircraft starting unit requires the operator to pay close attention to the aircraft director, the sound of the starter motor and engine compressor rotation, the engine rpm's, oil pressure, and exhaust temperature throughout the start and acceleration cycle. For specific information on the operating procedures of the A/S47A-1 GTE Tractor Mounted Enclosure, you should refer to NAVAIR 19-105B-60.



1. **Control Panel**
2. **Enclosure Assembly**
3. **Gas Turbine Engine**
4. **Stowage Rack**
5. **Mounting Assembly and Turbine Support**

Figure 2-14.—Tractor Mounted Enclosure Components.



1. **Oil Pressure Gauge**
2. **High Oil Temperature Indicator**
3. **Panel Light**
4. **Exhaust Gas Temperature Indiciator**
5. **95% Speed Indicator**
6. **Tachometer Indicator**
7. **Panel Light**
8. **Voltmeter**
9. **Panel Lights Switch**
10. **Output Air Selector Switch**
11. **Turbine Switch**
12. **Master Switch**
13. **Circuit Breaker**

Figure 2-15.—Control Panel.

A/S32A-42 Aircraft Mid-Range Tow Vehicle

This shore-based tractor (fig. 2-16) is designed for towing aircraft weighing up to 100,000 lbs. The tractor operates much like any automobile, but the high gear ratio in the rear axle gives this tractor its towing ability. It has a drawbar pull of 10,000 lbs., and a maximum forward speed of 13 m.p.h. The four-cylinder diesel

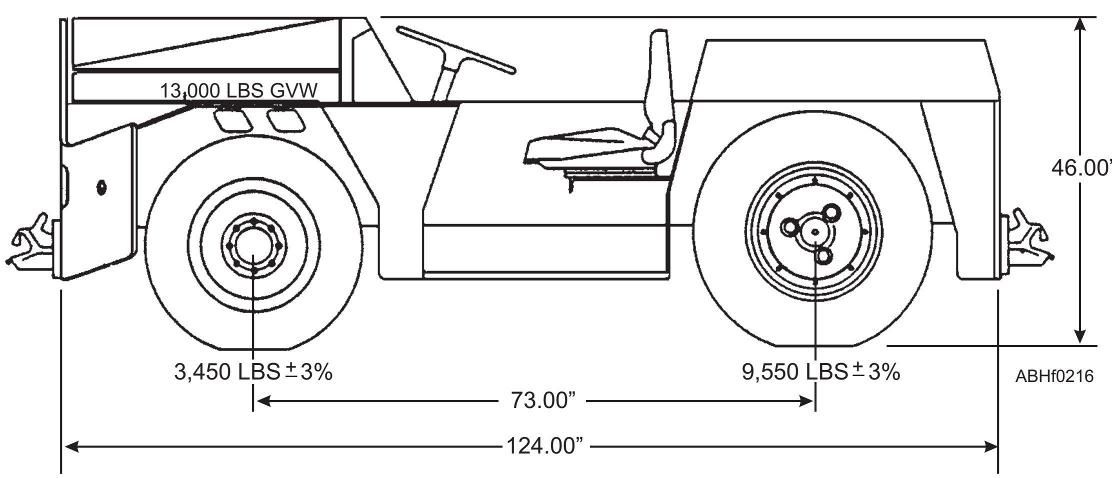
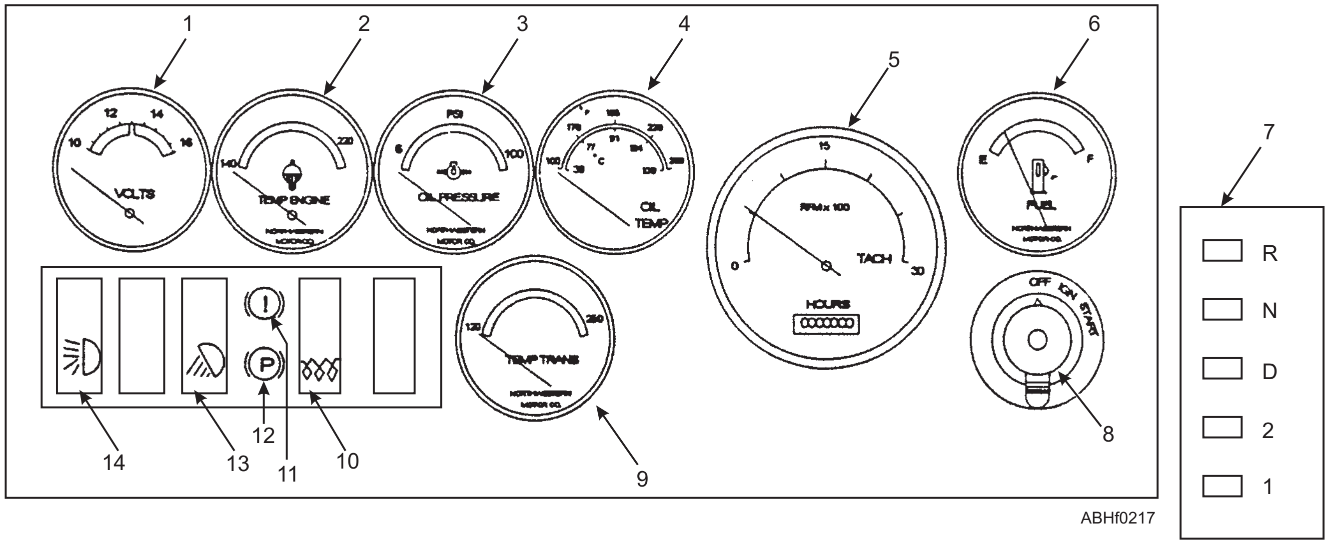


Figure 2-16.—A/S32A-42 Aircraft Mid-Range Tow Vehicle.



1. **Voltmeter**
2. **Engine coolant temperature gauge**
3. **Oil pressure gauge**
4. **Engine oil temperature gauge.**
5. **Tachometer/Hourmeter**
6. **Fuel gauge**
7. **Gear shift lever**
8. **Ignition switch**
9. **Transmission oil temperature gauge**
10. **Manifold preheat switch**
11. **Brake failure light**
12. **Park brake light**
13. **Rear work light switch**
14. **Head and tail light switch**

Figure 2-17.—A/S32A-42 Instrument Panel.

engine displaces 236 cubic inches and produces 80 horsepower at 2600 rpm's. Figure 2-17 shows the location of instrument panel components. Table 2-4 contains the leading particulars of the A/S32A-42 tow tractor.

Before starting the tractor when it has a cold engine, place the gear selector to N (neutral), turn the ignition switch to IGN, and push in the preheater switch for about 15 seconds. Then turn the ignition switch to start and crank the engine to start. Cranking should never exceed 15 seconds; if the engine has not started, try the preheater again for an additional 10 seconds before you attempt to crank start the engine again. The transmission is a three speed automatic with a torque converter enclosed within the same housing. A gear selection lever allows the operator to choose from five different gear positions. The transmission will automatically shift up as the vehicle gains speed, unless the transmission is placed in either 1 or R. Select the appropriate speed range based on the following: R-Reverse; D-No load or light load; 2-Medium load; 1-Heavy load. For specific information concerning operating instructions for the tow tractor, refer to NAVAIR 19-40-522.

Table 2-4.—Leading Particulars of the A/S32A-42 Mid-Range Tow Vehicle

Gross vehicle weight	13,000 lbs.	Drawbar pull	10,000 lbs.
Vehicle length	124 inches	Vehicle width	70 inches
Vehicle height	46 inches	Ground clearance	5-1/2 inches
Maximum speed	13 miles per hour	Turning radius	200 inches
Fuel capacity	20 gallons	Tire pressure	60 psig

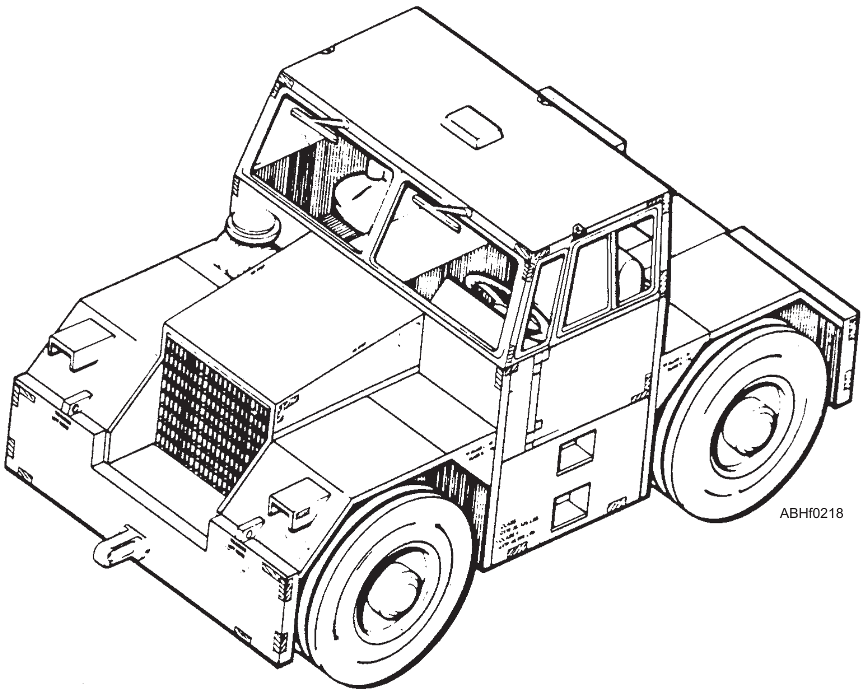
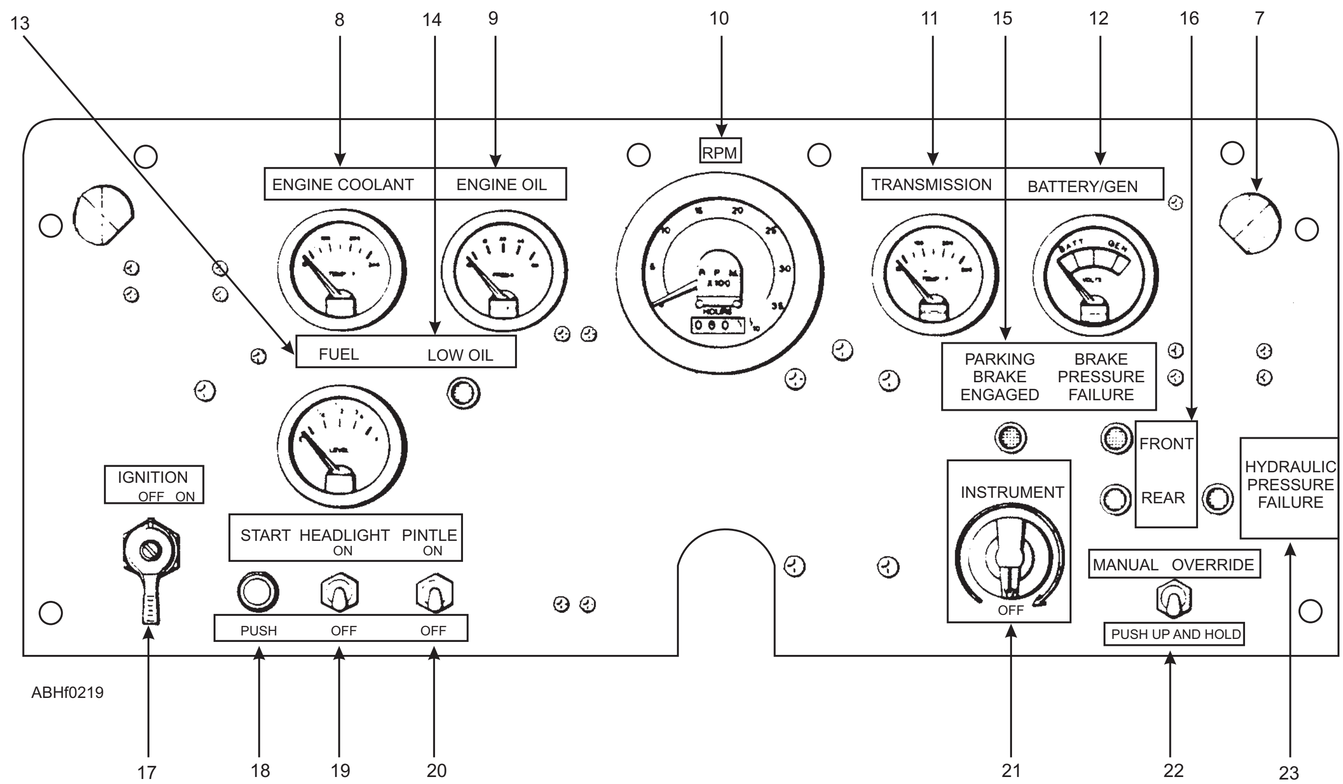


Figure 2-18.—A/S32A-37 Aircraft Towing Tractor.



1. **Steering Wheel/Horn Button**
2. **Transmission Control**
3. **Parking Brake Actuator**
4. **Throttle Actuator**
5. **Brake Actuator**
6. **Seat Adjusting Lever**
7. **Panel Lights**
8. **Engine Coolant Gauge**
9. **Engine Oil Gauge**
10. **RPM Gauge**
11. **Transmission Gauge**
12. **Battery/Gen Gauge**
13. **Fuel Gauge**
14. **Low Oil**
15. **Parking Brake Engaged**
16. **Brake Pressure Failure Front, Rear**
17. **Ignition Switch**
18. **Start Switch**
19. **Headlight Switch**
20. **Pintle Light Switch**
21. **Instrument Panel Light Switch**
22. **Manual Override**
23. **Hydraulic Pressure Failure**

Figure 2-19.—A/S32A-37 Aircraft Towing Tractor Control Panel.

Table 2-5.—Leading Particulars of the A/S32A Aircraft Towing Tractor

Class 1 GVW	30,525 lbs.	Class 2 GVW	48,600 lbs.
Class 1 Drawbar pull	20,000 lbs.	Class 2 Drawbar pull	35,000 lbs.
Class 1 Tire pressure	80 psi.	Class 2 Tire pressure	115 psi.
Vehicle length	198 inches	Vehicle width	98 inches
Vehicle height	102 inches	Ground clearance	13 inches
Turning radius	300 inches	Maximum rpm.	2800
Fuel capacity	30 gallons	Min. oil pressure	800 psi @ idle

A/S32A-37 Aircraft Towing Tractor

This shore-based tractor (figs. 2-18 and 2-19) is used to move large, heavy shore based aircraft. It comes in two different configurations, Class 1 and Class 2. There is no visible physical difference between the Class 1 and Class 2; the difference is that the Class 2 has a ballast kit installed. The Class 2 version is likely to be found at shore stations with poor weather conditions for aircraft towing.

The tractor operates on a liquid cooled, 6 cylinder, 4-cycle diesel engine. The transmission is automatic, with six forward speeds and three reverse speeds. Additionally, the A/S342A-37 has four-wheel drive, power steering, and four wheel power disc brakes. The electrical system is 24 Volt, DC. The engine's normal idle speed is 800 rpm, and should have a minimum oil pressure of 10 psi at idle. The Class 1 version has a maximum drawbar pull of 20,000 lbs., and the Class 2 has a maximum drawbar pull of 35,000 lbs. Table 2-5 lists the leading particulars of the A/S32A-37 tow tractor. Further information on this tow tractor can be found in NAVAIR 00-80T-113, *U.S. NAVY SUPPORT EQUIPMENT COMMON, BASIC HANDLING AND SAFETY MANUAL,* or in NAVAIR 19-40-519, *AIRCRAFT TOWING TRACTOR A/S32A-37.*

A/S37A-3 Shipboard Mobile Electric Power Plant (MEPP)

The A/S37A-3 (fig. 2-20) is the replacement for the NC-2A. This new unit is designed to provide 115 vac, 3

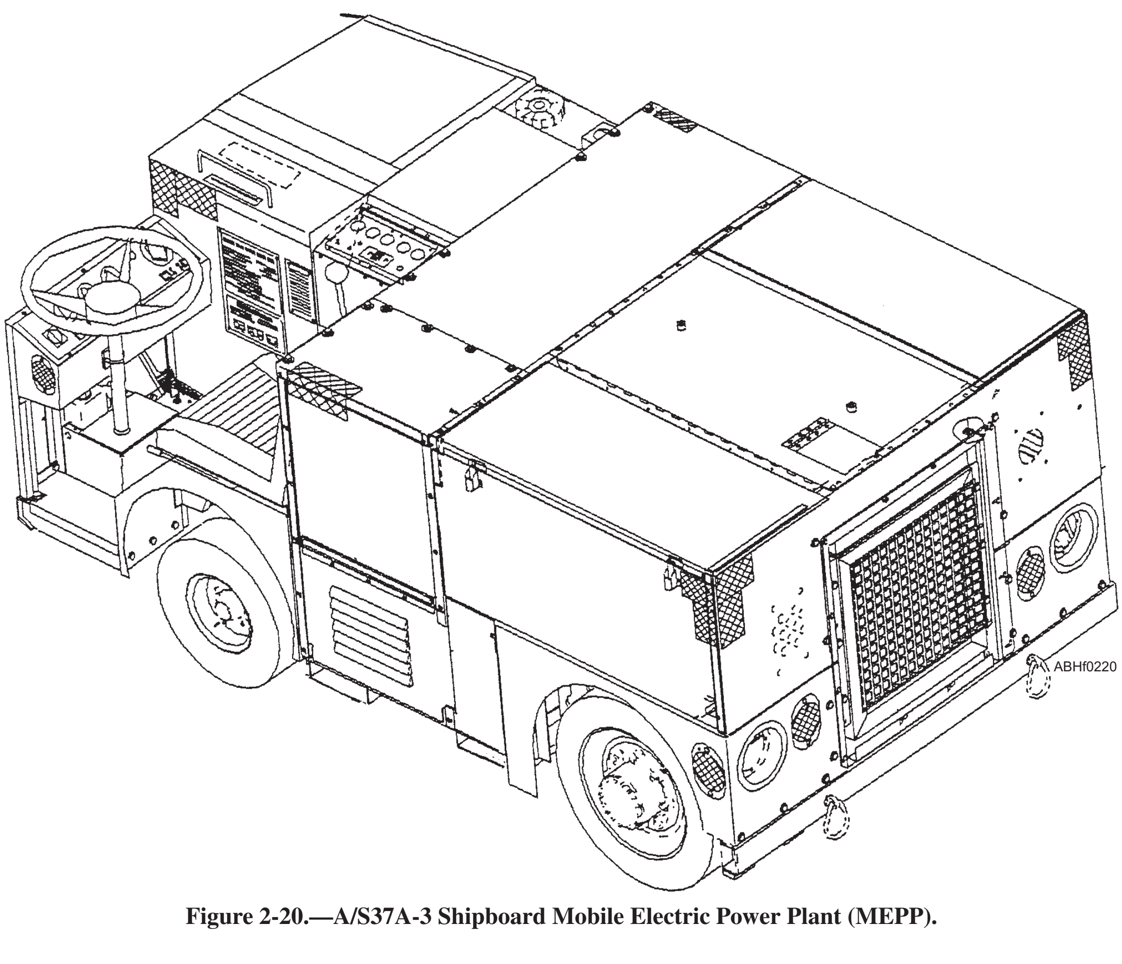


Figure 2-20.—A/S37A-3 Shipboard Mobile Electric Power Plant (MEPP).

phase, 400 Hz, or 28-vdc electrical power for aircraft aboard ships. The MEPP is propelled by a three-cylinder, two-stroke diesel engine. When the mode selector switch is placed in DRIVE or OUTPUT/POWER, the engine is electronically governed to run at its operating rpm (2000 rpm) and the idle rpm is set at 870 rpm. The hydraulic system powers the rear wheel drive, steering, and brakes. The new MEPP has front wheel steering, unlike the old NC-2A, which had rear wheel steering. The MEPP has an emergency stop system that can be engaged by pressing the EMERGENCY STOP button, or by several emergency conditions. Automatic shutdown will occur if the engine exceeds 2400 rpm, if the oil pressure drops to 10 psi, or if engine temperature rises to 220°F. Table 2-6 lists the leading particulars of the MEPP. You can obtain further information on the A/S37A-3 in NAVAIR 19-45-26.

Towing Operation

All drivers who perform towing operations must be fully qualified. No attempt should be made to train a beginning driver during an actual towing operation, no matter how simple it may seem. The training of drivers is an operation of its own. A training program must be used for this purpose in order for the beginner to be instructed in the proper techniques. Close supervision must be exercised until the trainee is thoroughly competent. An area should be laid out where traffic can be controlled and where the aircraft being towed is not likely to strike anything.

Speed limits with tow tractors must be a matter of common sense. Directives and instructions can give maximum speed limits; however, they cannot cover every situation that may be encountered. It is hard to imagine any situation that can justify exceeding the maximum speed limits. Stopping distances become greater on wet surfaces. You should always maintain a reasonable speed when towing an aircraft. At night the speed of the tractor should be such that it can be stopped in the distance that the driver can see. For example, if the driver can see only 15 feet, and the tractor can only be stopped in 20 feet, the driver cannot avoid hitting anything that may come into his path. Weather conditions, traffic congestion, and many other factors should be taken into consideration when determining safe speeds.

As a general rule, the tractor can safely tow an aircraft that weighs ten times the tractor's drawbar pull over level dry concrete. Weather conditions, deck conditions, and terrain can affect the weight that the tractor can safely tow.

Tow tractors are not "wreckers." They should not be used to push or pull any equipment other than that specified. You should check your local instructions and directives on this item and follow them closely.

Tractors should be operated in a gear that will allow the tractor engine to reach its full rpm. Any time the load on the tractor becomes such that the engine speed drops 10%, the transmission should be shifted to a lower gear. Lugging (that condition in which the engine is running at a low speed with the throttle fully open) should be avoided, as it can cause rapid wear or serious damage to the engine.

Tractors that are being used continuously or under heavy loads during hot weather are subject to overheating; in cold weather the reverse is encountered. Either condition can seriously affect the reliability of the engine. Operating temperatures for the engine are given in the technical manual for the tractor and should be closely followed.

The proper approach to an aircraft with the tow tractor must be a matter of sound judgment on the part of the driver and/or the aircraft director. Position additional safeties along the path of travel if there is going to be less than 5' of clearance from any obstacle.

WARNING

When attempting to hook the towbar to an aircraft with its engines running, you should be extremely careful. This practice should be avoided whenever possible.

Table 2-6.—Leading Particulars of the A/S37A-3 Mobile Electric Power Plant

Gross vehicle weight	5,060 lbs.	Vehicle length	102 inches
Turning radius	13 feet	Vehicle width	58 inches
Fuel capacity	18 gallons	Vehicle height	45-1/2 inches
Hyd. Drive pressure	1500 psi (2400 max)	Ground clearance	7 inches

The approach should be made so as to minimize the danger of hitting the aircraft. Tractor brakes have failed before. Never allow the tractor to pass under any part of the aircraft unless it is absolutely essential to the towing operation. When this is necessary, ensure that someone is stationed so that all clearances between the tractor and the aircraft can be observed. Be especially watchful for antennas, bomb racks, and so forth, as they always seem to be where least expected. When you are backing a tractor to hook onto a towbar already attached to an aircraft, stop the tractor a few feet ahead of the bar and ease the tractor backward to the correct position.

After the hookup is made and before any attempt is made to remove tiedowns or move the aircraft, the aircraft director must make sure the aircraft cockpit is manned by a qualified brake rider, who understands the operation to be performed. All tiedowns must be completely removed from the aircraft, and the chocks pulled before the tow is started.

Before any towing operation, make sure that the towbar is in the best condition and properly connected to both the tractor and the aircraft. Extreme care must be taken to avoid jackknifing the tractor into the towbar when backing a towed aircraft. Care must also be taken to avoid sharp turns while towing aircraft. A sharp turn may cause the towbar to strike the rear of the tractor, inflicting damage to the towbar and/or the tractor.

Tractors are not to be parked with their engines running, nor are they to be used for workstands.

Maintenance

General inspections and preventive maintenance that pertain to practically all tow tractors are as follows:

1. Preoperational inspection
2. Periodic inspection
3. Detailed maintenance inspection

Keeping your tractor ready for service requires that the inspection and preventive maintenance program be followed. Preventive maintenance is also a factor in accident prevention. With equipment, the failure of a single part may cause the loss of the entire assembly. Loss of that equipment may cause the loss of personnel, and may be the difference between the success and failure of an important mission. Good preventive maintenance keeps a piece of equipment safe and in working order for a long time. An enforced preventive maintenance program is the key to a successful operation.

Preoperational checklist cards have been completed for major items of aircraft handling equipment such as tow tractors and spotting dollies.

Maintaining and repairing support equipment is not a requirement of an ABH. That responsibility belongs to the AIMD or the activity having permanent custody of the equipment performs these tasks. However, to properly carry out your duties as a tractor driver, you must have some knowledge of the mechanical difficulties that may be encountered in its operation.

CAUTION

Never allow a defective tractor to be used.

Never use the tractor in a towing operation until preoperational checks have been made and the noted discrepancies are corrected. These checks, using the applicable NAVAIR preoperational checklist, must be made before the first operation of the day and/or before each use. In conjunction with the daily preoperational inspection, there is equipment servicing that must be carried out on the tractor periodically. There are fittings to be lubricated, oil to be checked or changed, filter elements to be changed, and a number of other components to be cleaned. Servicing these systems is to be done at prescribed intervals depending on the number of operating hours the tractor has. These periodic service and inspection intervals are in terms of engine operating time. Operating time (hours of operation) can be found in the operation, service, and repair instructions or the MRC's for the tractor concerned. The ABH supervising the equipment should ensure that the checks and servicing are accomplished by AIMD.

Any unusual gage indications are warnings of possible trouble. The operator should become familiar with the average operating points of the various instruments and report immediately any radical deviation from the normal. Major difficulties encountered should be reported and corrected as soon as possible. Minor difficulties should be noted and corrected, when possible, to avoid the development of major repairs. Any difficulty that affects the safety of operation is a major difficulty.

Safety Precautions

The importance of safety cannot be overstated. Safety *must* be the first considerations of any job. Investigation after a mishap almost invariably shows that the mishap could have been prevented by exercising a few simple precautions, which should then

From: ______________________________
(Division Officer)

To: SE Licensing Support Activity
Via: Assistant Maintenance Officer

Subj: SE OPERATOR TRAINING REQUEST

1. Request operator training for ______________________________ on the following SE:
Last Name, First, MI Rate/Rank

a. ____
b. ____
c. ____
d. ____
e. ____
(Single line item of SE per line, maximum of 5 lines)

2. The individual has been screened, physicals conducted and is considered a suitable nominee.

3. Date of Physical Examination (if applicable): ____________________

4. This training is for:

a. Initial qualification ______
b. Re-qualification ______

5. Currently possesses:

a. A USN Aviation Support Equipment Operator's License (OPNAV 4790/102)
Yes ____ No ____

b. A US Government Motor Vehicle Operator's Identification Card (OF-346)
Yes ____ No ____

6. State Driver's License Information (Figures 17-9 and 17-10)

a. License number ____________________
b. State ____________________
c. Expiration date ____________________
d. Auto extension Yes ______ No ______
e. Restrictions ____________________

______________________________ ____________
Division Officer Signature Date ABHf0221

Figure 2-21.—SE Operator Training Request.

be posted for future guidance. The process of exercising safety precautions before engaging in a job is known as *Operational Risk Management (ORM).* Safety precautions must always be observed.

One of the major causes of mishaps is the lack of attention to the job being done. The safety precautions necessary for the safe operation of each piece of equipment should be studied and discussed at length with personnel concerned before any operation is attempted.

The safety precautions are issued by individual commanding officers to suit particular needs of activities, ships, and operating schedules. All personnel concerned with tow tractor operation should be familiar with these instructions.

Only qualified drivers should be allowed to operate a tow tractor. To be a qualified tractor driver, you must have satisfactorily completed the Personnel Qualification Standards (PQS) for tow tractors particular to your duty assignment (carrier or amphibious, flight deck or hangar deck). Remember, being licensed does not automatically mean being qualified.

The GSE operator training and licensing program has two distinct parts: Phase 1 and Phase 2.

Phase 1 covers the GSE (ground support equipment), and Phase 2 covers the operation or use of the GSE on a specific type of aircraft. You'll get your Phase 1 training from expert AS ratings at the GSE school run by AIMD. Figure 2-21 is an example of a request for training, initiated by your division. At Phase 1 training, the instructors will introduce and familiarize you to the gear and will cover daily pre/postoperational inspections, safety, and operating procedures on each specific type of equipment. The training will normally satisfy the requirements of the 100/200 operator series of the Personnel Qualification Standards (PQS) program.

Your own division or unit will handle your Phase 2 training. This will be practical on the job training (OJT) relating what you learned in GSE School with actual aircraft handling, servicing, or maintenance. Normally, this training will satisfy the 300/400 operator series of the PQS. While you're in Phase 2 training, you'll be under the direct supervision of a fully qualified and licensed operator of the GSE you're using.

Upon completion of Phase 2 training you are eligible for an Aviation Support Equipment Operators Identification Card, OPNAV Form 4790.102, commonly known as a Yellow License. This license is required to check out certain types of support equipment (SE) and/or to operate the SE. For an example of *some* of the SE that requires a license to operate refer to table 2–7. This list does not include all the SE that requires a license to operate; it only represents a portion. In the case of self-propelled GSE, a valid SF 46 or a valid state driver's license is a prerequisite to the issuance of a GSE license.

When you complete Phase 1 of the operator's course, a certificate of completion similar to the one in figures 2–22 and 2–23 will be issued to your unit. It certifies completion of Phase 1 training <u>only</u> and <u>does not</u> authorize you to operate any given piece of GSE. When you complete Phase 2 training in your unit, you will be issued your Yellow License, signed by your commanding officer (or the AIMD officer if so authorized in writing by the commanding officer).

The certificate of completion shows that you have received training in the operation of towing equipment and that you have read and understand the operations section of the technical manual for the tractor you will operate. Also, it identifies that you know and understand the standard signals used for towing an aircraft. You are then issued a Yellow License, OPNAV Form 4790/102 (figs. 2-24 and 2-25). For more detailed information on licensing, you should read NAVAIR 00-80T-96, *U.S. Navy Support Equipment Common,*

Table 2-7.—List of Equipment Requiring a SE Operator's License

ACU-20/M Air compressor unit	A/M26U-4 Nitrogen cart
A/M27T-3 Hydraulic power supply	A/M32M-18A Trailer mounted CC cart
A/M48A-5 Steam Cleaner	A/M48M-4 Pressure washer
A/S32A-30 Aircraft tow tractor	A/S32A-31A Aircraft tow tractor
A/S32A-32 Aircraft tow tractor-spotting dolly	A/S32A-37 Aircraft tow tractor
A/S32A-35 Aircraft crash crane, (CVCC)	A/S32A-36 Aircraft crash crane, (AACC)
A/S32M-14 Aircraft maintenance crane	A/S32M-17 Aircraft maintenance crane

SE LICENSE CERTIFICATION

Last Name	First	MI	Rate/Rank	SSN	Activity	T/M/S Aircraft

State Driver's License				U.S. Government Motor Vehicle Operator's License	
State	License No.	Expiration Date	Auto Extend ☐Yes ☐No	License No.	Expiration Date

PHASE I SECTION

Training Activity		
Support Equipment	Course Number	Date Completed
Self Propelled Vehicle ☐ Yes ☐ No	Flight Line Training Date	Weight Handling Equipment Physical
SE DIVISION OFFICER		DATE:

PHASE II SECTION

☐ NEW (Parts A, B, C, D, and E required)
☐ RENEWAL (Parts C, D and E required)
☐ PROFICIENCY (Parts C and E required)

PART A. REQUIRED READING	Trainee Signature	Date Read
A. OPNAVINST 4790.2G, Volume V, Chapter 17		
B. NAVAIR 00-80T-96, Chapter____, Page___		
C. NAVAIR 00-80T-105 "Aircraft Emergency Procedures", Chapter___, Page__		
D.		
E.		

PART B. ON THE JOB TRAINING	Instructor's Signature	Date	Instructor's Signature	Date	Instructor's Signature	Date
1. Discuss ramp/flight line/hangar deck procedures.						
2. Discuss safety precautions.						
3. Discuss emergency procedures (Fuel spill, A/C or SE fire, etc.).						
4. Discuss personnel requirements and positioning.						
5. Discuss hand signals and other communication devices.						
6. Perform and document pre-operational inspection.						
7. Perform proper driving/towing procedures.						
8. Properly position and hookup SE.						
9. Perform maintenance/servicing tasks with the SE.						
10. Perform normal shutdown/disconnect procedures.						
11. Perform postoperational inspection.						

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Figure 2-22.—Sample certificate of completion of training (Front).

PART C. PRACTICAL EXAMINATION	SAT/ UNSAT	Examiner's Signature / Date:
1. Discuss ramp/flight line hangar deck procedures.		Remarks:
2. Discuss safety precautions.		
3. Discuss emergency procedures (Fuel spill, A/C or SE fire,etc).		
4. Discuss personnel requirements and positioning.		
5. Discuss hand signals and other communication devices.		
6. Perform and document preoperational inspection.		
7. Perform proper driving/towing procedures.		
8. Properly position and hookup SE.		
9. Perform maintenance/servicing tasks with the SE.		
10. Perform normal shutdown/disconnect procedures.		
11. Perform postoperational inspection.		

PART D. QUALITY ASSURANCE WRITTEN EXAMINATION			
QAR Examiner	Signature	Exam Score: (Min. Passing Score 85%)	Date

PART E: CERTIFICATION				
Work Center Supervisor	Signature	Recommended	☐ Yes	☐ No
Division Officer	Signature	Recommended	☐ Yes	☐ No
Support Equipment Officer (IMA only)	Signature	Recommended	☐ Yes	☐ No
AMO (OMA only)	Signature	Recommended	☐ Yes	☐ No
MO	Signature	Approved	☐ Yes	☐ No

From: Personnel Officer
To: Division Officer

Subj: SUPPORT EQUIPMENT LICENSE SERVICE RECORD ENTRY

1. Returned. Service record entry completed.

Signature Date

ABHf0223

Figure 2-23.—Sample certificate of completion of training (Back).

OPNAVINST 4790.2B

USN AVIATION SUPPORT EQUIPMENT OPERATOR'S LICENSE

1. NAME OF OPERATOR	2. RATE	3. DATE EXPIRES

4. U.S. GOVERNMENT/STATE MOTOR VEHICLE OPERATOR'S LICENSE

CARD NO.	ACTIVITY/STATE

LICENSEE IS QUALIFIED TO OPERATE AVIATION SUPPORT EQUIPMENT SPECIFIED ON THIS CARD SUBJECT TO STATED RESTRICTIONS.

5. NAME AND LOCATION OF ISSUING ACTIVITY

NOT TRANSFERABLE Card must be carried at all times when operating aviation support equipment.	6. SIGNATURE OF LICENSEE (Not Valid Unless Signed)
	7. ISSUED BY (Signature and Title)

OPNAV 4790/102 (REV. 10/82) S/N 0107-LF-047-9511

8A. TYPE EQUIPMENT(S) FOR WHICH QUALIFIED	B. EXPIRATION DATE	C. CERTIFIED BY (Initials)

ABHf0224

Figure 2-24.—Aviation Support Equipment Operators License (Front).

8A. TYPE EQUIPMENT(S) FOR WHICH QUALIFIED (continued)	B. EXPIRATION DATE	C. CERTIFIED BY (initials)
9. RESTRICTIONS		

OPNAV 4790/102 (REV 10-82) BACK

ABHf0225

Figure 2-25.—Aviation Support Equipment Operators License (Back).

Basic Handling and Safety Manual, or refer to OPNAVINST 4790.2G, VOL. 5.

The following precautions must be observed while aircraft are being towed:

1. Look in the intended direction of travel to be sure no personnel or obstructions are in the way. Sufficient clearances must exist on all sides of the tractor and load while both are moving as a unit.
2. Move slowly on wet or slippery surfaces and in congested areas.
3. Pull the load gradually and tow it at a steady rate, keeping in mind the type of surface being traveled. Tow in a gear range and at a speed that minimizes sudden speed changes; for example, operate in a speed range that allows full acceleration of the engine and allows ample turning space.

The tow tractor should be used only for those jobs for which it was designed or has been authorized. It should not be used to push-start other tractors or vehicles. Passengers should be carried only on those tractors that have seats installed for this purpose. Tractors should not be used as a truck to haul parts or other equipment.

The tractor must be operated so as to avoid any sudden stops or starts. Extreme care must be taken when towing an aircraft over rough ground and/or arresting gear pendants. Jerking, bumping, and bouncing can quickly disconnect the towbar from the aircraft or tractor, or cause damage to a strut.

When operating a tractor with an installed gas turbine compressor, you must observe additional safety precautions. The starting and operating procedures for the turbine are given on a plate fixed to the tractor instrument panel and must be followed. Before starting the unit, make sure that the area around the compressor inlet and exhaust outlet is clear of all loose gear. All personnel must stand clear of the compressor air inlet, the exhaust outlet, and the area adjacent to the plane of rotation of the high-speed compressor and turbine assembly. Personnel handling the flexible air ducts should wear gloves when connecting and disconnecting the duct to the aircraft and should stand well clear of the duct quick-disconnect fittings during starting operations.

WARNING

Hot exhaust from an aircraft-starting unit is a serious hazard when operating in close proximity to aircraft, aircraft components, fuel, weapons, equipment, and personnel.

The proceeding warning means that you must take extra precautions as to where a Gas Turbine Compressor (GTC) is positioned when the unit is started and operating. This is particularly true aboard ship, where aircraft are parked close together. You, as the operator, must know where the exhaust is pointed and make absolutely sure it's not directed at something the heat or velocity can damage, set on fire, or explode. When a GTC is operating under load conditions, the danger zone is normally considered to be a 10-foot semicircle from its exhaust to 90 degrees on either side.

For detailed information on positioning a tractor equipped with an enclosed GTC for aircraft starts, you should refer to the *Air Department Standard Operating Procedures (SOP)* COMNAVAIRPAC/ COMNAVAIRLANTINST 3100.4.

Q1. What tow tractor is most commonly found on the flight deck?

Q2. What tow tractor is most commonly found on the hangar deck?

Q3. What are the two ratio settings of the A/S47A-1 GTE Tractor Mounted Enclosure?

Q4. What OPNAV instruction outlines the SE licensing procedures?

AIRCRAFT HANDLING EQUIPMENT

LEARNING OBJECTIVES: Identify the various types of aircraft securing devices. Determine correct towbar for naval aircraft. State the functions of securing devices and aircraft towbars.

AIRCRAFT WHEEL CHOCKS

The Navy uses several types of aircraft wheel chocks for providing aircraft security both at-sea and ashore. New materials have greatly improved the performance of the wheel chock. Although simple, the operation of walking chocks should *never* be taken lightly. Far too many injuries and even fatalities have occurred during this operation. Attention to detail, direction, and procedures are essential ingredients for a safe and successful aircraft move.

WARNING

The proper position to walk chocks is abreast the main wheel, with the adjustable block towards the aft end of the aircraft. At no time will the chock walker place themselves in the direction of aircraft travel, either forward or aft of the main mount. The chock is walked on the opposite side of the brake/strut assembly. It must be installed on the side opposite the brake/strut assembly to avoid becoming jammed under the aircraft during fueling or in case of a flat tire.

The NWC-4 universal wheel chock (fig. 2-26) is approved for shipboard use for all aircraft (except H-2 series; the NWC-4A is the wheel chock designed to be used with this series aircraft). It is made out of polyurethane and must be cleaned and visually inspected at least monthly. The effectiveness of a wheel chock will be greatly reduced if dirt, grease, and oil are allowed to build up on its surface. When you inspect the wheel chock, look for excessive wear, frayed cable, and missing components. Never use a defective wheel chock, and report all discrepancies to AIMD.

The molded tread increases traction and also displaces liquids on the deck by a squeegee-type action. The polyurethane end blocks are sufficiently rigid to prevent crushing, but will still deform enough to permit the aircraft tire loads to be readily transferred through the end block to the flight deck.

The polyurethane end blocks not only provide vastly superior traction, but they require no painting, will not corrode, are self-extinguishing in fire, and are environmentally and chemically resistant to deterioration. This chock uses polyurethane extensively in a redesigned rack (bar running between the end blocks) and a latching mechanism that has far fewer parts. These features should further minimize the need for repairs and greatly improve reliability. The NWC-4 chock is adjustable to fit main landing gear wheels up to approximately 45 inches in diameter. To aid easy removal, the chock should be inserted with the adjustable block toward the after end of the aircraft.

Wheel chocks approved for shore base use are also manufactured from polyurethane and in some instances, wooden chocks can be authorized. Metal chocks are not authorized for use ashore. Since land based aircraft may be much larger than shipboard aircraft, the wheel chocks for shore stations are found in three different sizes. These chocks are available in the following sizes: 1). To chock tires up to 33 inches in diameter. 2). To chock tires over 33 inches in diameter. 3). To chock dual wheels. For further information on wheel chocks, refer to NAVAIR 17-1-537, *Aircraft Securing and Handling Procedures for Aircraft Restraint Devices and Related Components.*

TIEDOWN ASSEMBLIES

Various types of tiedown assemblies are described in the following text. As ABH's, you will develop speed and accuracy in securing aircraft, especially during shipboard flight operations or when tasked with securing an aircraft on a deck edge elevator during

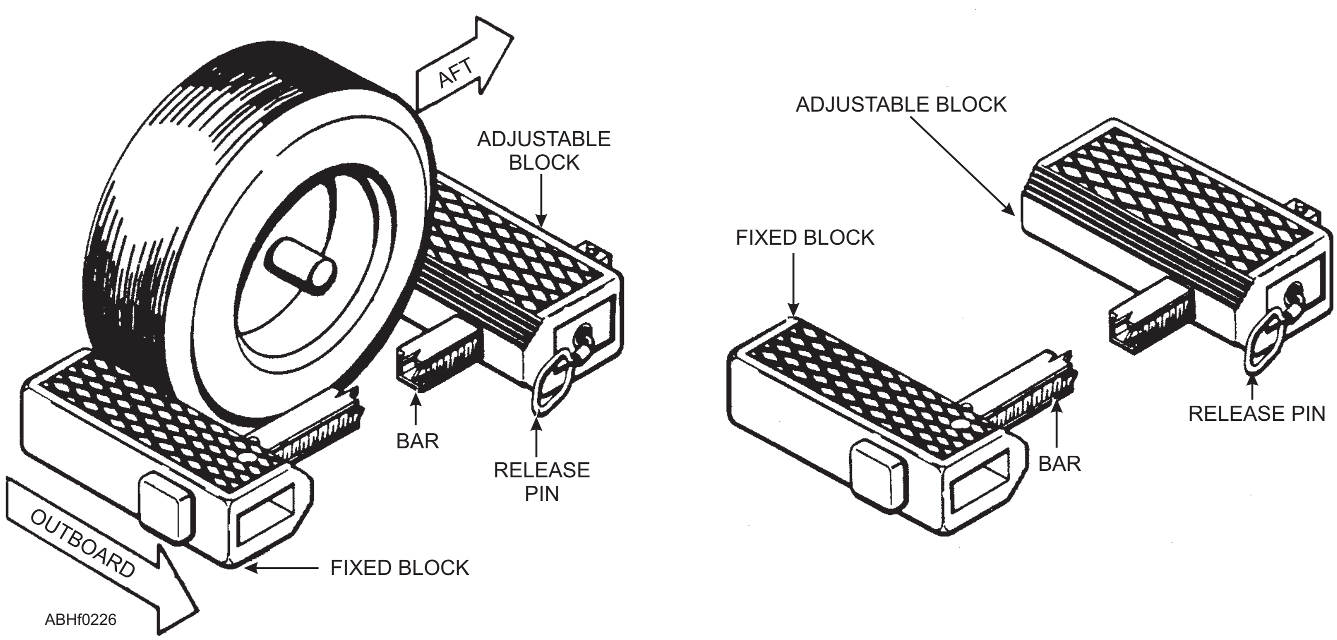

Figure 2-26.—NWC-4 Shipboard Aircraft Wheel Chock.

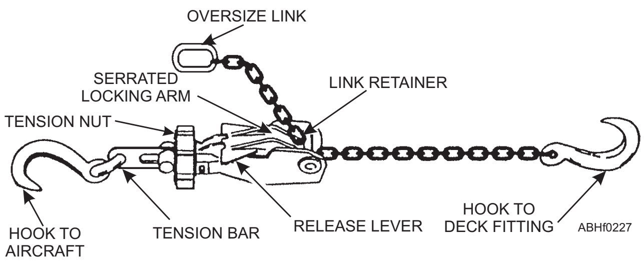

Figure 2-27.—TD-1A Aircraft Tiedown.

heavy seas. Aircraft tiedown chains are an essential piece of equipment for executing your job. Never throw a defective tiedown chain over the side (a new TD-1B can cost in *excess* of $200 *each*). Securing devices are repairable, and any defective unit should be turned in to AIMD.

TD-1A Quick-Release Aircraft Tiedown Chain Assembly

The TD-1A quick-release aircraft tiedown chain assembly has been used almost exclusively aboard ship and ashore for nearly 30 years. It has a safe working load of 10,000 pounds. See figure 2-27.

The single greatest difficulty with this chain tiedown is that the chain can be inserted in two positions in the tensioner assembly. The incorrect position reduces the tiedown's breaking strength to 6,000 pounds. See figure 2-28.

TD-1B Aircraft Tiedown Chain Assembly

To eliminate the problem of incorrect assembly of TD-1A tiedowns, the Naval Air Warfare Center and manufacturers' engineers have developed a new one-way chain. This chain (fig. 2-29) has two bumps or nodes formed by "staking" one end of each link. These nodes will not permit half of the link to be inserted in the chain pocket of the tensioner assembly. This new chain prevents improper installation and the breaking strength has been increased by several thousand pounds.

The new TD-1B tiedowns contain the following improvements:

- Better materials and heat treatment of tensioner assembly components for increased strength and reduced wear.
- The solid, riveted-in-place aluminum spacer has been replaced with a piece of heavy wall tubing and a bolt and nut. The old spacer was prone to failure, and the loose pieces were a potential FOD source.
- A clamp now secures the end of the chain to the tensioner assembly. It replaces the old safety lanyard described in NAVAIR 7-1-537.

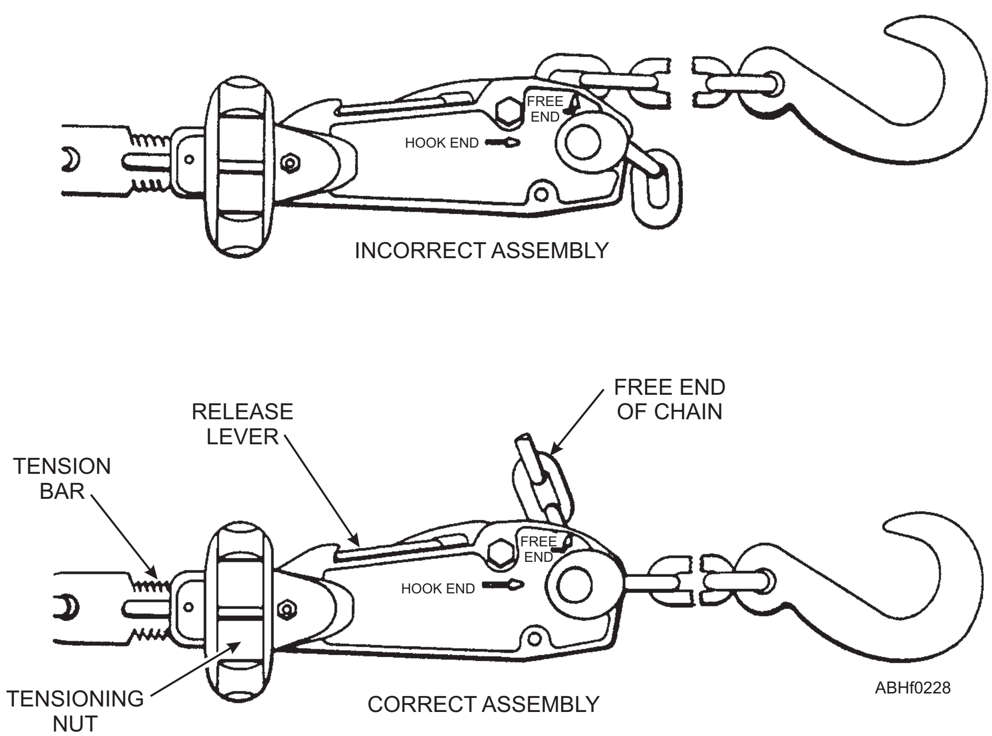

Figure 2-28.—TD-1A Correct and Incorrect Assemblies.

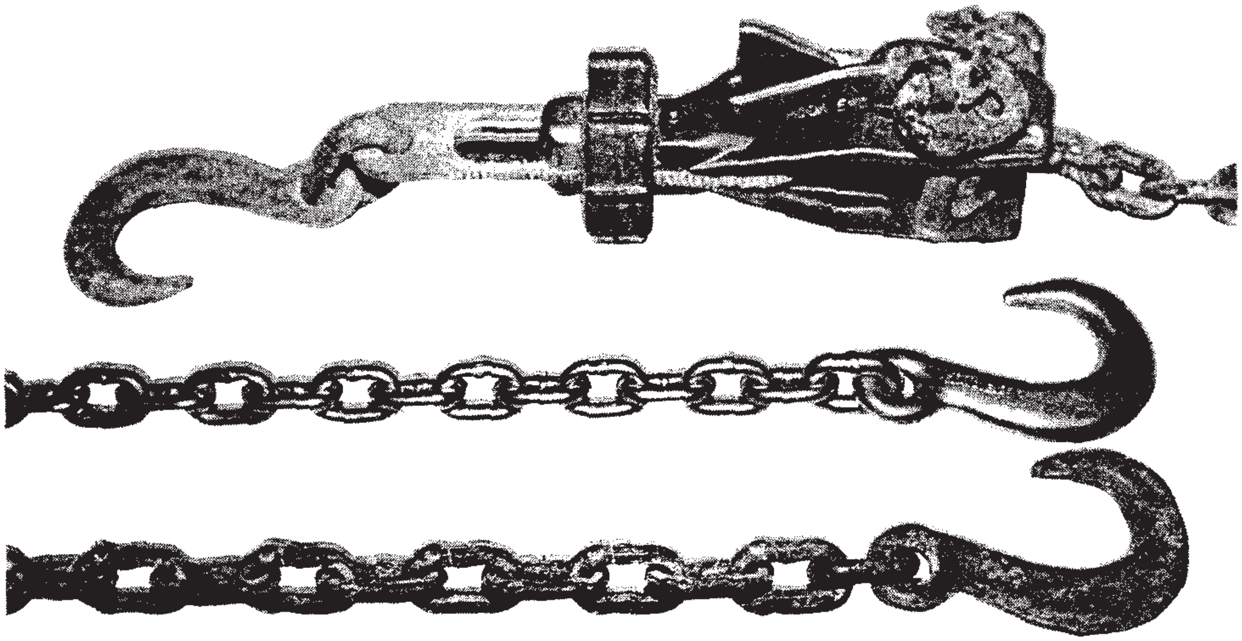
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Figure 2-29.—TD-1A/TD-1B Aircraft Tiedown Chains.

The Naval Air Warfare Center is also experimenting with several ways to add reflective markings to the tiedown and thus improve its visibility at night.

The new chain tiedown, designated the TD-1B, has a safe working load capacity of up to 10,000 pounds. Part numbers 1540AS100-1 (9-foot version) and 1540AS100-2 (14-foot version) identify each version.

The following precautions for use of the existing TD-1A tiedowns are offered:

- Make sure the chain is correctly positioned in the tensioner.

- Frequently inspect the tensioner assembly for broken or missing parts. Take particular notice of the aluminum spacer and its riveted heads. This spacer is subject to high-impact loads when the quick-release lever is actuated and there is heavy tension on the tiedown. Backing off the tensioner handwheel a couple of turns before operating the release lever will greatly reduce stress on the spacer.

You can adjust the length of the TD-1A from 1 foot 6 inches to 9 feet 10 inches. The TD-1A weighs about 12 pounds and has a safe working load of 10,000 pounds. Another version, used only on amphibious ships, has a 14-foot chain for high-point tiedowns. Otherwise, the two are identical.

High-Power Tiedown Assembly

There is another authorized tiedown you may be required to use called the Aero Full-Power Tiedown Assembly (fig. 2-30). It is commonly called the A/B tiedown (for afterburner). It has a deck attachment fitting, a safety lock retainer, a chain, and a coupler that fits the aircraft catapult holdback fitting. This assembly is not used for normal securing of aircraft. It is used as an added safety measure, which is installed when an aircraft must perform a full-power turn-up while secured to the deck for maintenance purposes.

The tiedown assembly has a working load of 30,000 pounds. It weighs about 102 pounds and has no adjustments to lengthen or shorten it. Joining two tiedowns together with a dummy link can modify the chain, when required.

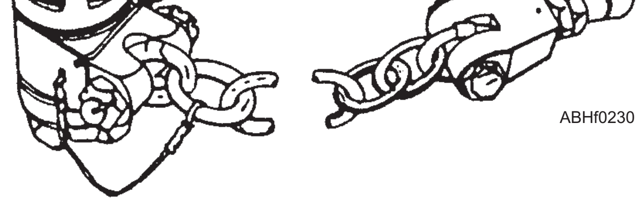
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Figure 2-30.—Aero Full-Power Tiedown Assembly.

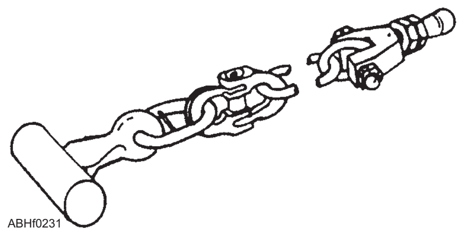


Figure 2-31.—Aircraft Restraint.

A newer version of the A/B tiedown, called an aircraft restraint, has a different deck attachment fitting (fig. 2-31). Otherwise, the two are identical.

Special high-strength deck fittings are installed aboard ships and at shore stations in designated engine run-up areas. Specific A/B tiedown instructions for each type of aircraft are contained in the MIM's.

You should have a good working knowledge of both nylon and manila line, as they are frequently used in securing of gear and equipment aboard ships. Handling of line and the thumb rule for safe working loads are covered in detail in chapter 1 of this TRAMAN. Further information concerning aircraft tiedown assemblies is located in NAVAIR 17-1-537.

AIRCRAFT TOWBARS

The ALBAR Universal Aircraft Towbar, (fig. 2-32), is the type most commonly used by the Navy today. It is designed to provide for the nose tow of aircraft and has four different sizes of nosewheel axle tow pins. The ALBAR is also designed for towing aircraft provided with fuselage and landing gear tow rings. The locking pins on the end of the tubes are also used to attach to the standard shipboard crash dollies to provide positive control while moving damaged aircraft supported with crash dollies.

The term *ALBAR* is a word form for "Adjustable Length Towbar." ALBAR's are presently designed in four lengths. They are the model 8 ALBAR (9 feet long), the 15 ALBAR (15 feet long), the 20 ALBAR (20 feet long), and the 24 ALBAR (25 feet long). These towbars are designated universal since one type of towbar can be used on carrier based aircraft.

When the CH-53E helicopter was being introduced into the fleet, the NAVAIRENGCEN was requested to design a lightweight, easily maintained, 20-foot-long towbar. Through use of simple bolt-on leg extensions to the existing towbars, the requirements for the CH-53E were met, and a simple design concept for adjusting the length of the towbar for other applications was born. The result is a towbar design called the ALBAR.

The 8 ALBAR is designed for shipboard movement and spotting of H-46 helicopters on LHA's, LHD'S, and LPD's. The 15 ALBAR is the standard towbar for moving most land-based and shipboard based aircraft weighing up to 90,000 pounds. Its configuration is virtually identical to the existing model ALBAR towbar, but it can be easily expanded to make the 20 and 24 ALBAR's. The 20 ALBAR was designed to handle the RH-53D and CH-53E helicopters when they are equipped with an in-flight refueling probe, the AV-8B, and the F/A-18 ashore. Because of the lower height of the shipboard A/S32A-31A tow tractors, the F/A-18 can be safely towed aboard CVs with the 15 ALBAR.

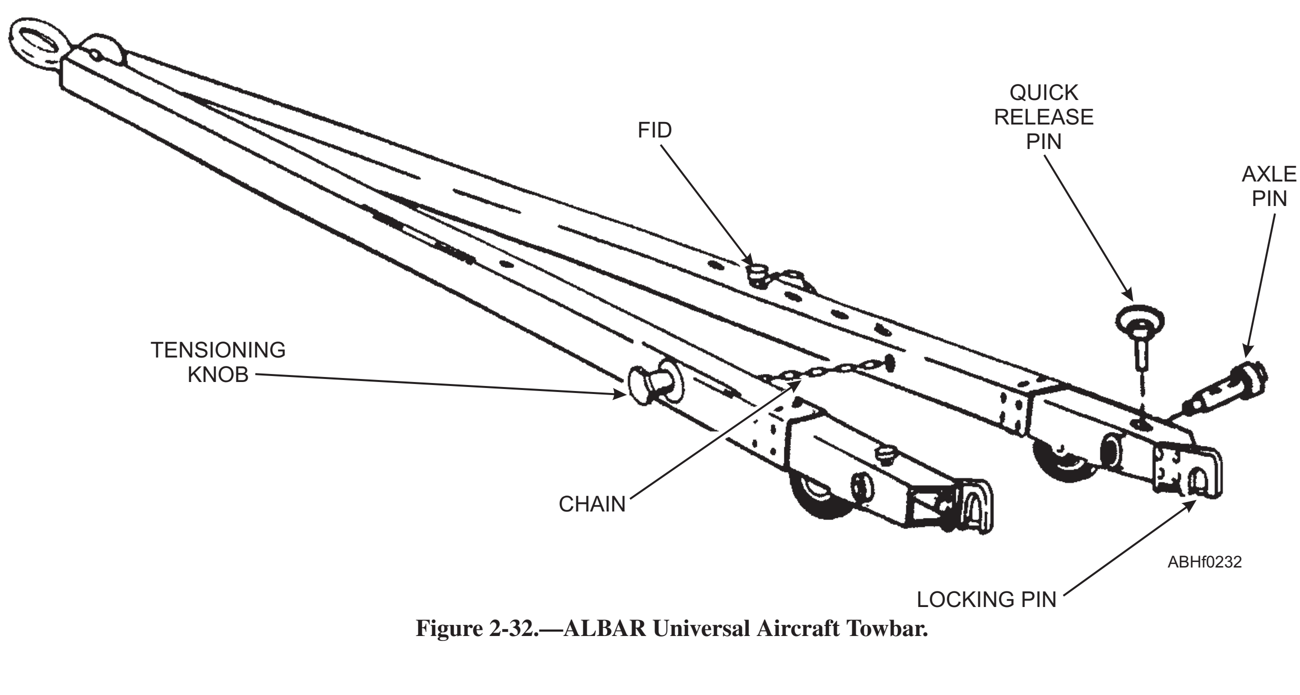


Figure 2-32.—ALBAR Universal Aircraft Towbar.

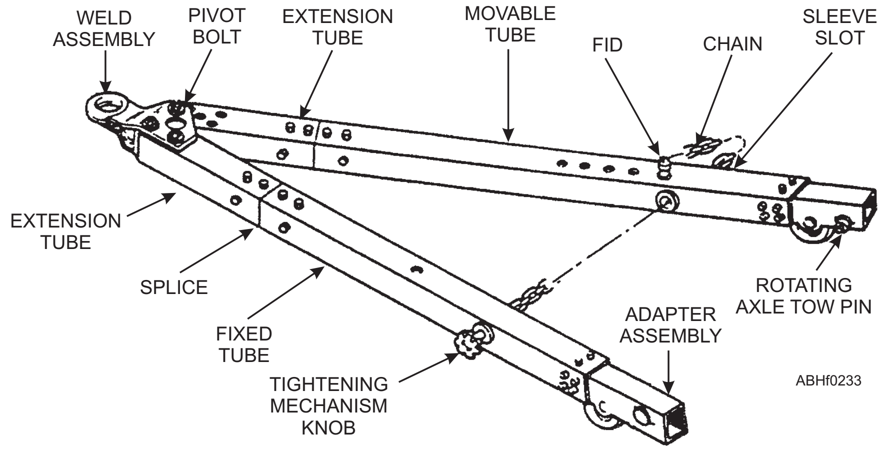


Figure 2-33.—Model 24 ALBAR.

The 24 ALBAR (fig. 2-33) was expressly designed to handle the SH-60B helicopter. This extra length is needed to reach into the tailwheel for towing this aircraft.

The ALBAR concept offers many advantages, including the following:

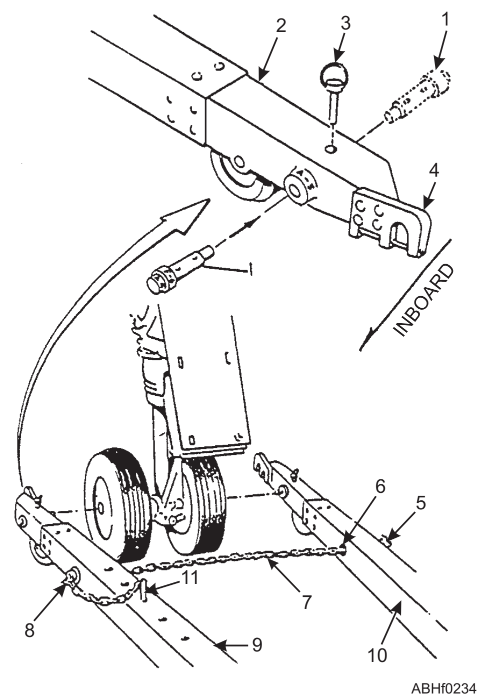
- Spare parts, except leg extensions, are identical.
- The 20 and 24 ALBAR's can be broken down for shipment in a standard 15-foot towbar container.
- Bent towbar tubes on the 20 and 24 ALBAR (caused by "jack-knifing" the tractor) can be easily repaired with replacement extensions, or the damaged extension can be removed, leaving a still usable 15 ALBAR.

The ALBAR's also possess other design improvements. These include a grease fitting in the movable leg pivot to facilitate lubrication. The tighter tolerances improve the fit of spare parts and there are tightened specifications for welding and painting. Improved fasteners for better service life (they remove easily and reduce corrosion) and; instead of the old riveted-on I.D. tag (which was easily lost or caused corrosion), the towbar is now impression-stamped with the needed identification data.

Most carrier aircraft have provision for towing from the nosewheel axle. Since these aircraft have been provided with four different sizes of holes, ranging from 3/4-inch diameter to 2 1/2-inch diameter, the tow pins have been sized to suit. Before attaching the towbar to the aircraft nosewheel, you must select the proper size pin.

A close-up of the method of installing axle tow pins in the towbar is shown in figure 2-34. The axle tow pin (1) has been metal-stamped on the appropriate axle tow pin diameter as shown.

When aircraft are being towed that have 3/4-inch-diameter axle tow facilities, the axle tow pin is turned around and installed in the manner shown by the phantom axle tow pin in the illustration. The detent pin is employed in a like manner for this installation.



1.	**Axle tow pin**	**7.**	**Tensioning chain**
2.	**Attachment fittings**	**8.**	**Sleeve**
3.	**Detent pin**	**9.**	**Tow bar tube**
4.	**Hook**	**10.**	**Tow bar tube**
5.	**Knob**	**11.**	**Fid**
6.	**Barrel**		

Figure 2-34.—Installation of axle tow pins.

Before installing the detent pins, you may have to rotate the axle pins to align the holes through the axle pins with the holes in the aircraft attachment fittings. With these holes aligned, install the detent pins by pushing them all the way down against the attachment fittings.

Referring to figure 2-34 spread tow bar tubes (9 and 10) to fit the aircraft to be towed. Lift the towbar and insert the axle tow pins into the towing holes on the aircraft. Slide chain (7) through sleeve (8) to take up the slack after turning knob (5) until barrel (6) protrudes as far as possible from towbar tube (10). Be sure that the axle pins are in the holes on the aircraft as far as they can go. Engage the nearest link of chain in the slot in the sleeve, rotating the chain if necessary. Stow fid (11) in one of the grommet holes in the towbar tube so that the chain does not drag on the ground. Turn the knob so that the barrel retracts into the towbar tube and causes tension to build up in the chain.

CAUTION

Before attempting to tow aircraft, be sure that the chain is under the maximum tension possible by turning the knob. Be sure that the barrel has not reached the end of its travel before the chain is under maximum tension. If the barrel bottoms before the chain is tight, loosen the chain and move it out through the sleeve as many links as possible. Re-engage the chain in the slot in the sleeve and then tighten, using the knob, to maximum tension possible by hand.

Information on the towbar(s) for any given aircraft can be found in the general information section of the Maintenance Instructions Manual for that aircraft.

There is one modification to the ALBAR towbar for towing H-1 series helicopters. The modification simply reverses the right and left tube ends, which contain the aircraft attachment fittings, so the hooks fit the helicopter skid pins. Maximum towing weight for the ALBAR 20 is 20,000 pounds. The usual stencil on the ALBAR towbar, "MAX CAPACITY 90,000 LBS AIRCRAFT GROSS WT" is deleted on the ALBAR and replaced by the stencil "ALBAR TOW BAR CONFIGURED FOR TOWING OF H-1 SERIES HELICOPTERS ONLY."

For technical information on the ALBAR, you should refer to NAVAIR 19-1-137, *Technical Manual Operation and Intermediate Maintenance Instructions with Illustrated Parts Breakdown, Towbar, Aircraft, Model ALBAR and Model ALBAR/ALBAR*.

The leading particulars for the towbars are contained in table 2-8.

NOTES:

1. Exchange aircraft attachment fittings, P/N 1479AS103-1 & 2 to mate hooks to helicopter skid rings. See paragraph 19, page 8, (WP-00300) NAVAIR 19-1-137.
2. For shipboard use when not equipped with in-flight refueling probe.
3. For land based use when not equipped with in-flight refueling probe.
4. For shipboard/land based use when equipped with in-flight refueling probe.
5. Use 15 ALBAR when gun pod is installed ashore/afloat, 8 ALBAR may be used otherwise.

For detailed information on support equipment, you should refer to the *U.S. Navy Support Equipment Common Basic Handling and Safety Manual*, NAVAIR 00-80T-96.

Q5. What is the standard shipboard wheel chock?

Q6. What are the two lengths of the TD-1B Aircraft Tiedown Chain?

Q7. What model ALBAR should you use when towing a shipboard AV-8?

AIRCRAFT ELEVATORS

LEARNING OBJECTIVES: Describe the functional operation of an aircraft elevator. State the various watchstations and personnel responsibilities associated with operating an aircraft elevator.

All aircraft carriers and large deck amphibious assault ships are equipped with aircraft deck edge elevators. The operating principles are basically the same for all elevators, although the size and capacity may vary.

Operation of the aircraft deck edge elevator is done under the cognizance of the aircraft handling officer. The flight deck and hangar deck officers are responsible for ensuring that all elevator operators and safeties are trained and qualified.

Table 2-8.—Leading Particulars and ALBAR Selection Table

Model Number	8 ALBAR	15 ALBAR	20 ALBAR	24 ALBAR
Part Number	1479AS100-1	1479AS200-1	1479AS300-1	1479AS400-1
Length	108 inches	180 inches	240 inches	300 inches
Width	14 inches	14 inches	14 inches	14 inches
Height	10 inches	10 inches	10 inches	10 inches
Weight	128 lbs.	170 lbs.	218 lbs.	255 lbs.

AIRCRAFT	8 ALBAR	15 ALBAR	20 ALBAR	24 ALBAR
AV-8		Shipboard	Land Based	
TAV-8			X	
C-2		X		
E-2, EA-6B		X		
F-14		X		
F/A-18		Shipboard	Land Based	
UH-1, AH-1		See Note 1		
H-2, H-3		X		
H-46	Shipboard	Land Based		
H-53, CH-53E	See Note 2	See Note 3	See Note 4	
SH-60				X
S-3		X		
T-2, T-34, T-44		X		
TH-57		See Note 1		
UC-12		X		
V-22	See Note 5	See Note 5		

Qualification and certification of elevator operators must be documented as prescribed in the aircraft elevator PQS; the *Air Department Standard Operating Procedures (SOP)*, COMNAVAIRPAC/COMNAVAIRLANTINST 3100.4; the *CV NATOPS Manual*, NAVAIR 00-80T-105; or the *LHA/LHD/LHD NATOPS Manual*, NAVAIR 00-80T-106, as appropriate.

Operation of the elevators is a joint responsibility of the V-1, V-3, and A division. V-1 and V-3 divisions may also have some maintenance requirements associated with upkeep of the elevator locks and safety stanchions. Overall maintenance and operational upkeep of the elevator machinery rooms and systems are responsibilities of A division.

The elevator platform is a welded structure of either steel or aluminum. The platform serves as a foundation for the guide rollers, the face rollers, and the safety shoes. Guide rails are securely bolted to the ship's structure, one located on the aft side and one on the forward side of the elevator platform, and serve as guides for the guide and face roller travel. There are two sets of double guide rollers and one face roller on the forward and aft sides of the platform.

When not in use, the elevator platform is locked at the flight deck level by horizontal locking bars, which slide into housings supported by the ship's structure, engaging the platform. These locking bars are independently operated by a double-acting air engine for normal operations.

On most ships, a manually operated gear system is also provided for each locking bar, in the event of a loss of air pressure. Each locking bar system includes a safety interlock. It prevents the locking bar from being extended when the platform is not at the flight deck level, or from being withdrawn when there is insufficient pressure in the hydraulic engine cylinder to force the platform against the flight deck stops.

For the protection of personnel, power operated safety stanchions are provided for each main deck and flight deck elevator opening. There are two sets at each flight deck opening and one set at each hangar deck opening. Each flight deck set can be raised automatically when the elevator's DOWN push button is pressed. The hangar deck set can be raised automatically when the elevator's UP push button is pressed. Although elevator stanchions can be raised or lowered automatically when the elevator's DOWN or UP button is pushed, this is never done, because of safety considerations.

Stanchion controls are always set on the manual and NOT the automatic mode. Stanchions should not be operated in the automatic mode.

After aircraft elevator safety stanchions have been raised or the warning given, no person is to attempt to board or leave the elevator.

All stanchions are lowered automatically by action of hydraulic engine-mounted limit switches. Handcrank operation for emergency lowering of each set of stanchions is also provided on some ships at the power unit. A limit switch is provided on the magnetic brake housing to de-energize the motor when the handcrank is inserted.

The platform is connected to the hydraulic engine by a series of cables. These cables are shackled to a cable hitch on each side of the platform. They then pass over the overhead sheaves to the end sheaves and around the plunger sheaves to the dead end hitch on the engine. A broken or slack cable switch assembly is designed so that the slacking or breaking of an individual hoist cable stops the elevator operation.

The platform is equipped with serrated safety shoes for wedging the platform between the guide rails to bring the platform to rest with a minimum of damage should all the hoist cables break on either side of the platform.

With all pumps in use and the elevator loaded to capacity, the duty cycle is about 60 seconds. This includes 15 seconds at the top and 15 seconds at the bottom stations for loading and unloading. When the elevator is operating on the cycle specified, should there be a loss of electric power at any point in the cycle, the residual capacity of the pressure tanks is sufficient to permit returning the loaded platform to the flight deck. It should also be possible to raise the loaded elevator at any time within 30 minutes of loss of power, in spite of normal system leakage. There are two control stations for each of the deck edge elevators. One control station is located on the hangar deck and one in the gallery walkway on the flight deck.

The control station is bolted to the hangar deck where the operator has an unobstructed view of the deck edge elevator opening on that deck. This station contains a master switch; horn button; horn cutout switch; power available light (white); control energized light (green); and on certain ships, a handwheel for manual operation; and a gearbox assembly.

The ABH at the gallery walkway station has semiautomatic control over the operation of the elevator platform. The control station consists of the following:

1. A three-unit, watertight, pushbutton station for elevator platform control
2. A single-unit, watertight, pushbutton station for horn operation
3. Two three-unit, watertight, pushbutton stations for flight deck automatic stanchion operation
4. An automatic stanchion watertight selector switch
5. A signal light selector switch
6. A watertight signal enclosure
7. A locking gear air operating valve
8. A bypass valve
9. A manual locking gear lever

For satisfactory aircraft elevator performance, operating personnel must carry out the instructions posted on instruction plates mounted at the hangar deck station and gallery walkway station. Sound-powered phones interconnect the stations. When putting the elevator into operation or during an emergency, the personnel at the gallery walkway and hangar deck control stations must wait for instructions from the machinery room before performing any operation.

The normal operating instructions for personnel at the hangar deck station are as follows:

1. Check with the machinery room to determine that the system is ready.
2. Check the power available light; it should be illuminated.
3. Turn the horn switch to ON.
4. When all is clear within the elevator platform area and upon signal from the yellow shirt, turn the master switch to ON. This switch must be *held* in the ON position.
5. Release the master switch at the end of the operation, or if an emergency arises, during the operation.

NOTE

The elevator machinery room must notify all stations immediately of an electric power failure or any other emergency. Communication from the machinery room to each station is relayed via an emergency call phone.

Should electric power fail when the platform is not locked at the flight deck, perform the following operations immediately:

1. Raise the platform to the flight deck. (During the emergency, keep in close contact with the elevator machinery room.) If the emergency is caused by failure of the high-pressure system, the platform is raised to the flight deck by the sump pumps.
2. Lock the platform at the flight deck until the power is restored. When the platform is locked at the flight deck, notify the machinery room.

The normal operating instructions for personnel at the gallery walkway station are as follows:

1. Check to make sure the white and green signal lights are on.
2. Withdraw the platform locks.
3. Sound the horn before operating the elevator.
4. Lock the platform at flight deck level only at the end of service or in case of power failure.
5. Use the STOP button to stop the elevator in emergencies. When the elevator is stopped within the slowdown zone, it is necessary to run the elevator out of the zone with the hand control before proceeding. Ensure that the removable coaming (if installed) is in the UP position.

All aircraft elevators have a safety net configuration to provide safety for the crews. These nets are located on the outboard side of the elevator platform. These nets are storable type nets; the V-1 and V-3 divisions are responsible for raising and lowering them. The elevator nets are lowered for the following purposes, though not limited to them:

1. To jettison aircraft
2. To accommodate conveyor belts in port

Q8. Which three divisions are primarily charged with safely operating an aircraft deck edge elevator?

Q9. What is the operating mode that elevator stanchions should be set in?

Q10. What is the color of the signal light that indicates Power Available?

SLIP RESISTANT DECK COVERING (NONSKID)

LEARNING OBJECTIVES: Describe the types of slip resistant deck coverings. Describe the application of slip resistant deck coverings. State the safety precautions associated with slip resistant deck coverings.

Slip resistant (nonskid) deck coverings are high performance textured organic materials that are applied to wood, primed steel, or aluminum aboard ship to provide safe footing for personnel and a slip resistant surface for vehicles and aircraft. With the exception of the carrier landing area, which has the special requirement that the slip resistant deck covering not abrade or otherwise damage the steel arresting cables, nonskid coverings are functionally the same.

NOTE

Prior to using nonskid compound, you should consult the appropriate directives and the *Naval Ships' Technical Manual* (NSTM) chapter 634, Naval Sea Systems Command (NAVSEA), S9086-VG-STM-010, entitled "Deck Coverings". This is the governing publications concerning nonskid.

Surface preparation and application procedures of nonskid compounds most routinely used by the ABH are discussed in the following paragraphs.

NONSKID SLIP RESISTANT SYSTEMS

The slip resistant systems covered include:

1. General-purpose exterior (includes the carrier flight and hangar deck, except for the landing and cable run-out areas).
2. Carrier landing area (contains an aggregate that is nonabrasive to the arresting cable).
3. Helicopter landing pads.

GENERAL PURPOSE USE OF NONSKID

A general purpose, abrasive type nonskid coating is normally satisfactory for most shipboard applications. The abrasive type nonskid coating uses a coarse aggregate of silicon carbide, furnace slag, or aluminum oxide to provide the nonskid texture. The nonabrasive type nonskid coating used on the carrier landing area uses an aggregate, typically aluminum metal, that is nonabrasive to the steel arresting cable. The special nonabrasive characteristic is not required for helicopter landing pads.

Nonskid materials in the federal supply system have a shelf life of 1-year (shelf life code F). Only materials that are less than 1 year old, as determined from the date of manufacture, should be used. The coatings are supplied as a two component kit, and the two components must be thoroughly mixed and blended to produce the coating. The two components are carefully matched to each other during manufacture, and should only be used only with each other. Components from different kits (manufacturers) are NOT interchangeable. Nonskid deck coatings are critical materials for aircraft safety and must meet the requirements set in MIL-PRF-24667.

Either improper application or a poorly prepared surface causes most nonskid coating failures; either will lead to premature failure. Table 2-9 outlines the recommended environmental conditions for the nonskid process. Application over a hot or cold surface will dramatically affect the cure time and workability of the nonskid material. When it is applied on a hot surface, the cure time will be significantly decreased; on a cold surface the cure time will be significantly increased. Ideally, the nonskid system should be applied over a white, or near white, abrasive blasted surface that is free from oil, grease, or other contaminants. It should be applied on a day when the relative humidity limits are not exceeded and the air temperature is within the designated range. Adhesion of nonskid materials, just as for other coatings, is dependent upon the degree of surface preparation and the environmental conditions under which they are applied.

Nonskid coatings have an abrasive or a nonabrasive coating applied over the proprietary primer specific to the particular application. The primer not only improves the adhesion of the nonskid coating but also prevents rapid failure or undermining of the nonskid topcoat should it become cut, pierced, or otherwise damaged.

Before removing old nonskid, precautions must be taken to protect all deck penetrations and equipment (for example, deck drains, washdown nozzles, tiedown cups, catapult tracks, zipper tracks) from contamination by dirt, grit, and nonskid material. Drop cloths and masking should be used to prevent damage from the abrasive material. Deck openings must be covered with strips of sponge rubber, adhesive plates/circles, or similar material. The covering should extend at least one-half inch past the opening onto the

Table 2-9.—Nonskid System Environmental Conditions

Environmental Condition	Minimum	Maximum
Long Term Storage Temperature	55°F	100°F
24-hours prior to mixing (nonskid/primer/color topping)	70°F	80°F
Ambient Air Temperature	55°F	100°F
Deck Temperature	55°F	100°F
Relative Humidity	N/A	85%
Dew Point	The deck temperature must be 5°F (minimum) above the dew point temperature.	

deck. NOTE: One tiedown crossbar near the refueling area should be cleaned to bare metal and masked prior to nonskid application. This clean crossbar will be used for grounding. After the nonskid coating has been applied and allowed to cure, all covering material and debris must be removed.

Nonskid deck coating systems meeting MILSPEC MIL-PRF-24667 are furnished in the following types:

Type I	High durability, rollable deck coating
Type II	Standard durability rollable or troweled deck coating
Type III	Standard durability, rollable resilient deck coating for use on exterior wooden decks, GRP, or metal decks where flexibility is required and where increased weight is not a factor
Type IV	Standard durability, sprayable deck coating

These four types of nonskid systems are subcategorized into two different compositions: Composition G and Composition L.

Composition G is for general use and has an abrasive coating. This composition is available in each system Type: I, II, III, and IV. Composition L is a limited use, non-abrasive coating, used on CV/CVN landing areas. This composition is found only in Types I and II systems. Service life limits for each nonskid system is as follows:

Type of Nonskid	Composition G (months)	Composition L (landings)
I	12	10,000
II	6	5,000
III	6	N/A
IV	6	N/A

Table 2-10 is a list of nonskid applications in accordance with NAVAL SHIP'S TECHNICAL MANUAL (NSTM), chapter 634.

DECK PREPARATION FOR NONSKID COATING ON METAL DECKS

Many cases of nonskid coating failures have been the result of improper surface preparation or application. The degree of adhesion of a nonskid coating is directly proportional to the degree of surface preparation and cleaning. Reduction in the degree of surface preparation is usually accompanied by a proportionate reduction in performance. Various degrees of surface preparation specifically relating to gradations in performance have not been established nor can they be assessed with any degree of confidence.

Table 2-10.—List of Nonskid Applications

Ship Type	Area	Type Nonskid
Carriers	Flight deck impact areas and catapult tracks (metal decks)	Type I or II, Comp L
Carriers	Hangar deck, flight deck traffic parking areas and aircraft elevators (metal decks)	Type I or II, Comp G
Air-capable	Hangar decks and helipads (excluding skid configured zones)	Type I or II, Comp G
Air-capable	Helipads (skid configured zones)	Type I, Comp G
Air-capable	Flight decks (metal decks) (excluding carriers)	Type I or II, Comp G
All Ships	All vertical replenishment areas, weather decks, exterior passageways, and interior decks (metal decks)	Type I or II, Comp G, or Type IV
All Ships	All exterior passageways and interior decks (wooden decks, GRP, and metal)	Type III

Also, there are other factors such as cost, time, abrasive equipment availability, grit disposal, and dust and machinery contamination, which must be considered. Therefore, every effort should be made to achieve or approach the optimum surface within the constraints encountered in each situation. Ideally, the nonskid coating system should be applied over a metal surface that is free of corrosion products and other contaminants, degreased, and coated with a NAVSEA approved metal primer.

SURFACE PREPARATION PROCEDURES (ABRASIVE BLAST)

Abrasive blasting is the process in which the nonskid coating is removed and a 3-4.5 mil profile is left in the deck metal. The most effective method of removing worn nonskid systems, scale, rust, and contamination is by centrifugal blasting. This method consists of steel shot being thrown at the coating by the use of a vaned wheel. Equipment for abrasive blasting is normally available at the depot and intermediate level maintenance facilities

Various abrasives are used for cleaning. For steel surfaces, chilled iron, steel abrasive, and aluminum oxide are used. Steel shot can be used to produce a profile of 3-4.5 mils. Steel shot, aluminum oxide, or garnet abrasive may be used on aluminum decks. However, extreme care must be taken to assure that <u>all</u> shot is removed before coating and that no shot is caught in joints, cracks near hangar doors, or wedged in crevices. Shot left in these areas will lead to rapid corrosion of aluminum decks.

Shot retention is important during the blasting operation, and there are a number of ways to retain shot. Deck drains and water washdown systems should be totally sealed from shot contamination to keep them free from obstructions and in good working order. Barriers erected around the blast area are suitable for containment of shot during the actual blasting operation. These barriers should be portable and should be made of a suitable material that will contain shot, preferably plywood sheets. You should also take care to prevent contamination by the blast media with removed rust particles.

After an abrasive blast, the surface profile is determined by using a replica tape system. This makes a replica of the surface profile, which is then measured by the use of a micrometer. Replica tape measurement readings of the surface profile are to be kept as part of a permanent record of a nonskid job.

You should exercise caution when abrasive blasting is used to provide only the profile depth recommended. Controlling the standard mil profile is dependent on the size of shot in relation to the speed of the blasting machine. Excessive depth of profile can cause problems with poor coating performance. For example, if the surface profile of a steel section is greater than 3 to 4.5 mils, the primer must be applied to totally cover the profile to prevent pinhead or flash rusting. The increase in application of primer as to wet film also increases the probability of solvent entrapment, which would cause blistering and early failure of the coating.

The blasting operation is done by making repeated passes until the surface condition meets the requirements of the coating to be applied. For application of the primer, a near white metal, blast cleaned surface is required. A near white metal blast cleaned surface is defined (SSPC-SP-10) as a surface with very light shadows, slight streaks, or discoloration's. At least 95% of each square inch of surface must be free of all visible residues. The surface must be completely free of all oil, dirt, mill scale, rust, paint, or other foreign matter. The primer should be applied within 1 hour after the metal is cleaned to lessen the possibility of rusting or other surface contamination. If primer is not applied within six hours of being abrasive blasted, the surface must be brush blasted to remove any superficial flash rust that may have accumulated. In any case, the surface must be free of any rust before painting can continue.

SURFACE PREPARATON (HYDROBLASTING)

Hydroblasting relies on the energy of fresh water striking a surface to remove the existing coating. This technique eliminates dust pollution and disposal requirements for spent abrasives. High Pressure (HP) hydroblasting operates at pressures between 680 to 1,700 bar (10,000 to 25,000 psi) and Ultra High Pressure (UHP) operates at pressures above 1,700 bar (25,000 psi). The primary advantages of hydroblasting include no dust pollution, significantly less waste to dispose, elimination of foreign object damage hazard (steel shots not used), and less disruption of other ship work in the vicinity of the non-skid work. The hydroblast facility shall comply with all local, state, and federal regulations regarding the proper storage, use, collection, and disposal of all abrasive materials. Compliance with the requirements of the Clean Air Act and Clean Water Act amendments are the responsibility of the hydroblast facility. Water from hydroblast operations shall meet Clean Water Act requirements before being disposed of into surface waters.

SURFACE PREPARATION (POWER TOOL CLEANING)

This procedure includes the use of several kinds of power driven equipment commonly available to ship's force, either as an onboard allowance item or on a loan basis from a depot, intermediate level maintenance activity, or fleet tool issue room. Wire brushes, sanding discs, grinders, chippers, scalers, needle guns, and rotary descalers are available. The tools are predominantly air-powered, although some electrically driven models may be found. Use of these tools is preferred over abrasive blasting in some applications. This is because there is less risk of contamination, no grit removal problem, less damage to the sound coating in the surrounding areas, and less environmental pollution hazard. Power tool cleaning removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. SSPC-SP-11-87T defines power tool cleaning.

The Tennant machine is a rotary descaler and deck peening apparatus. It is used to remove old paint and nonskid from steel or aluminum substrates. This machine does not afford the capabilities of proper profiling. While removing the old coating, it hammers or peens the profile flat. In most cases, the needle guns are needed to introduce a profile after the Tennant machine is used.

The Descobrader, much like the Tennant machine, is a rotary descaler and deck peening apparatus. The Descobrader, however, is unique because of its multipurpose uses. Through interchangeable heads, it is possible to remove old or worn coatings, profile the deck, and clean any residual contaminants that remain. Controlling the machine for removal of coatings and profiling is accomplished by a counterweight located on the top of the unit. Both the Tennant machine and Descobrader should be used for small nonskid repair areas.

The selection of the appropriate tool for the type of surface to be prepared is of primary importance. It is not possible to prescribe exact choices because the results obtained will vary with the type and thickness of the coating, the way the coating was originally applied, the surface hardness of the metal, and other factors. <u>As a general rule, select the fastest method of removal that will cause the least damage to the underlying metal surface</u>. The only sure way to determine this is by trial and error, starting with the least abrasive or lightest cutting action tool or attachment that will do the job.

SAFETY PRECAUTIONS

Each of the compounds in the discussion of slip resistant deck coverings contains volatile solvents. These solvents are flammable so adequate safety precautions must be observed during application.

1. Some individuals are more sensitive than others to the materials and may develop a skin rash. To prevent this possibility, gloves should be worn. If materials are spilled on the hands or other parts of the body, they should be wiped off and the skin washed with soap and water. In case of accidental contact with the eyes, flush the eyes immediately with clear water and contact a physician. Clothing and gloves contaminated with the uncured resins should not be worn again until they have been thoroughly cleaned. To prevent hazards due to solvent entrapment, adequate exhaust ventilation is necessary where these materials are used in closed spaces. When the proper precautions are taken to ensure cleanliness, ventilation, and protective clothing, no difficulty should be encountered during the use or handling of epoxy resins, hardeners, or solvents.

2. Where optimum slip resistance and heavy wear resistance is required, such as on carrier and helicopter flight decks, the nonskid materials should be applied by roller or trowel.

3. The following safety and health precautions apply in general to epoxy and polyurethane coatings. You should refer to the product's Material Safety Data Sheet (MSDS) for specific requirements and precautions.

a. Spray painters shall wear protective garments that fit snugly at their ankles, necks, and wrists. They shall wear gloves and approved filter type respirators while spraying, mixing dry colors, or using other finishing materials that create flammable vapors.

b. Personnel mixing these coatings should wear solvent resistant synthetic rubber gloves and an apron. Sleeves should be kept rolled down. NIOSH approved respiratory protection is required when air sampling data indicates solvent concentrations in excess of the threshold limit values, or when it is reasonable to assume that solvent vapor concentrations cannot be controlled by ventilation and are expected to exceed the threshold limit value for the solvent involved.

c. Solvents are flammable and toxic. They should be used only in well-ventilated areas. They should not be used near any source of flame or sparks such as a welding operation or disc sander usage. Prolonged contact with the skin must be avoided.

Small Area Nonskid Repair

Damage to the nonskid coating, which exposes either primer or metal substrate and is repairable by ship's force, must be repaired as follows:

1. Determine the failed area by scraping or hammering loose chips or sheets of nonskid from the deck.
2. Use power tool cleaning procedures, as described earlier in this TRAMAN, to remove damaged nonskid and extended repair area 6-10 inches in undamaged nonskid area.
3. Remove all loose debris by vacuum cleaning, and immediately follow with a solvent degreaser to clean the surface.
4. Tiedowns are of particular interest in small area repair since the coating is lost very quickly due to constant use, and the exposed steel is left to rust. Power tools may be used for removing the old coating in accessible areas; however, the bars that cover the dish area, especially their underside, should be wire brushed and primed.

Surface Priming

An anticorrosive primer is normally required over metal surfaces beneath the nonskid topcoat. Primer not only improves the adhesion of the nonskid topcoat, but also enhances the total performance of the nonskid system. Primer should be stored between 70°F and 80°F for 24-hours prior to mixing. Before mixing any components together, be sure the components are from the same manufacturer. <u>Never mix the components of epoxy primer from different manufacturers</u>.

1. The primer should be mixed per the manufacturer instructions to achieve a dry film thickness (DFT) between 2 to 4 mils. The surface to be primed should be clean and dry, and abrasive blasted to a white or near white finish. The primer should be applied as soon as practical (within 1 hour) after the metal is cleaned, to lessen the possibility of surface corrosion and contamination. Some primers may require an induction time (stand time), to allow the mixed components to remain in the pail, chemically reacting to each other, before application. Thinning primer is prohibited.
2. Primer can be applied by either rolling or spraying. If the primer is sprayed, be sure to consult the manufacturer's ASTM F-718 sheets for spray data. The sheets will have information on the required pressure, hose sizes, and nozzle sizes. When applying the primer by rolling, make sure that only rollers outfitted with a nap range between 3/4" to 1" are used. Hard to reach areas can be brushed.
3. Throughout the application process, wet film thickness (WFT) readings are to be taken to ensure that the desired DFT primer coverage is obtained. Refer to *NSTM CH. 634-3.35.5* to learn more about the tools used for determining the WFT.
4. Be sure to frequently inspect the area being primed for complete primer coverage. Bare spots (holidays) will allow corrosion to set in and risk degrading the process.
5. The cure time of primer will generally range between 6 to 12 hours depending on the weather. If the primer was applied during cool weather, the cure time will be increased. If the weather was warm, then the cure time will be faster. In either case, the primer should be allowed to cure until it is tack-free. ASTM D-1640 contains the procedures for determining when the primer coating is tack free.
6. To ensure correct primer coverage, the DFT readings must be taken once the primer has cured. The magnetic dial gauge (banana gauge), the single fixed probe magnetic gauge (PosiTector 2000 or 3000), and the dual fixed probe magnetic gauge (Elcometer) are all tools used for determining DFT. *NSTM CH. 634-3.35.6* can be referred to for more information concerning these gauges and the procedures for taking DFT measurements may be found in Appendix B.
7. For maximum performance between the primer coat and the nonskid, the nonskid should be applied within 36 hours from the application of the primer coat. It is extremely important for the primed surface to be inspected for traces of any contaminants, such as moisture, oil, grease, etc. Make certain that the surface is wiped down with lint free rags and an approved solvent cleaner. The timetable guidelines for nonskid application are as follows:

Time elapsed between coatings	**Surface preparation requirement**
Fewer than 36 hours	Inspect for contaminants; clean/dry as needed
Between 36-72 hours	Wipe surface with lint free rags and solvent
Between 3-7 days	Wipe surface with lint free rags and solvent; lightly sand surface; repeat wipe down; apply a primer tack coat (1-2 mils)
More than 7 days	Reblast area to a near white surface; reprime

Nonskid Coating

After the primer has cured, the nonskid is applied. The nonskid should normally be applied within 36 hours for optimum adhesion. Be sure to follow the manufacturer's instructions for pre-mixing storage temperatures, mixing times and procedures. Environmental conditions must be closely monitored and documented, and examples of the documentation sheets can be found in *COMNAVAIRLANT/ AIRPACINST 3100.4C Air Department Standard Operating Procedures (SOP)* Enclosure (3).

1. Nonskid is usually applied by the roller method. Trowel application is also authorized, but guidance from the Type Commander (TYCOM) must be obtained to determine the location and direction of the troweling. While some nonskid types may be applied by spraying, spraying of nonskid is not authorized on any flight deck. The roller should be a long handled, smooth surfaced hard-phenolic core roller (9") unless otherwise designated by the nonskid manufacturer.

2. Proper application of nonskid is extremely important to the ABH. Flight decks and hangar bays are the largest areas on any ship, so ABH must be alert and watchful during the curing phase of a nonskid job. The targeted surface profile of properly cured nonskid should be between 1/32" (minimum) to 1/16" (maximum). Some standard precautions you should be aware of to help better the chance of obtaining a good nonskid job are as follows:

- Do not apply nonskid coating over color toppings.
- Do not thin nonskid mixtures.
- Do not apply nonskid over already existing nonskid. (A small overlap to create a seam is acceptable).
- Do not apply nonskid within approximately 5" of the deck edge or deck edge coaming or within 2" of padeye deck fittings and deck protrusions.
- Cover or protect padeye deck fittings and deck protrusions, catapult and zipper tracks, deck drains, and flush deck nozzles prior to applying nonskid.

3. The quality of the ridge formation of fresh nonskid will depend on the curing process. During this curing phase, it is very important for the ABH to keep the area roped off with signs and watches posted. Your ship's announcing system should also be used to announce frequent reminders to keep clear of the new nonskid. The ambient temperature plays an important role on the curing process. The cooler the temperature, the slower the cure and vice-versa. The following timeline represents typical traffic allowed in relation to the curing process:

Foot traffic	24 hours after application
Vehicular traffic	48-72 hours after application
Fully cured	After 7 days

For the specific guidelines and detailed procedures for nonskid removal, deck preparation, priming equipment to be used, and new nonskid application and quality assurance checkpoints, you should refer to *Naval Ships Technical Manual* (NSTM), Chapter 634, S9086-VG-STM-010, "Deck Coverings."

Q11. What publication governs the nonskid process?

Q12. What is the service life limit of composition G nonskid?

Q13. By what method is nonskid normally applied?

Q14. Freshly applied nonskid typically cures fully after what number of days?

VISUAL LANDING AIDS (VLA)

LEARNING OBJECTIVE: Describe the ABH's responsibilities related to Visual Landing Aids.

On board aircraft carriers (CV/CVN) and amphibious aviation ships (LHA/LHD/MCS/LPD), V-1 division is responsible for the general upkeep of the flight deck. This includes the painting of specific markings on the flight deck and reporting lighting problems. Similarly, V-3 division is responsible for those markings located within the hangar bay.

FLIGHT DECK MARKINGS

Visual Landing Aids on the flight deck are not only used by the pilots of aircraft approaching the ship for a landing, but also by the ABH's as a quick reference for locating equipment, and identifying areas for safety concerns. For instance, wheel-stop coamings are marked with a 12" wide, color-coded stripe that goes up and over the wheel stop. These stripes are placed to correspond with locations of CO2 fire bottles, PKP fire bottles, and AFFF hose reel stations, just to list a few. On those areas of the flight deck where there is no wheel-stop coaming to correspond with equipment

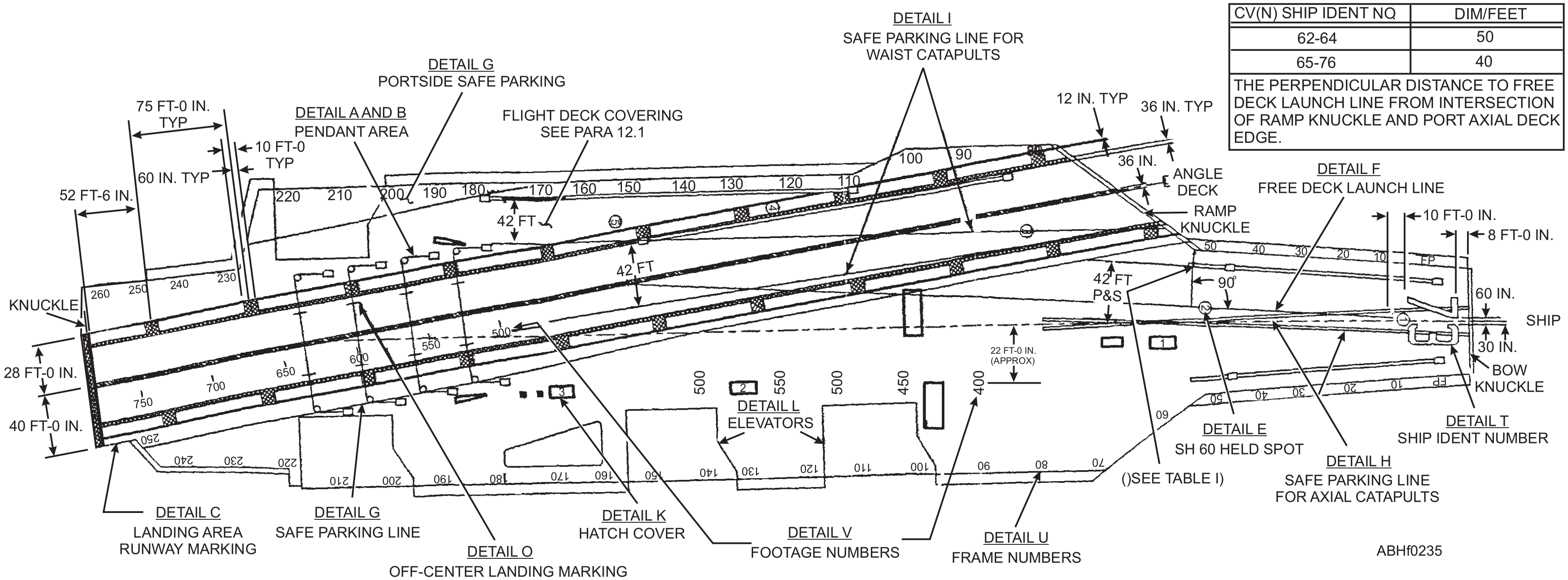


TABLE I

CV(N) SHIP IDENT NO	DIM/FEET
62-64	50
65-76	40

THE PERPENDICULAR DISTANCE TO FREE DECK LAUNCH LINE FROM INTERSECTION OF RAMP KNUCKLE AND PORT AXIAL DECK EDGE.

Figure 2-35.—CVN aircraft carrier flight deck markings.

location, the VLA is placed right on to the deck or on the bulkhead of the island structure.

HANGAR DECK MARKINGS

While flight deck markings offer a source of information to pilots, LSE's, and ABH's, the markings located in the hangar bay provide important information and safety warning to a large population of shipboard personnel. Once the ship deploys, the hangar deck turns into a crowded work center filled with aircraft. Bulkhead VLA markings are placed 14' up from the deck to direct personnel to Battle Dressing Stations, first aid boxes, eye wash stations, fire stations, aircraft power outlets, as well as a host of other items. The ships frame number markings are placed on both the starboard and port bulkheads, at 10 frame intervals, for easy location identification in an emergency.

The **Naval Air Warfare Center** *Visual Landing Aids General Service Bulletin, No. 8* (series), is the bulletin that establishes standard certification requirements and inspection procedures for the markings (called VLA systems) for aircraft carriers. For information on amphibious ships refer to *Amphibious Assault Ship Aviation Facilities Bulletin No. 1 (*series). NAEC-ENG-7576 (latest revision) is also an excellent source of information. Figure 2-35 is a print of the standard flight deck markings on CVN aircraft carrier. (For further information on class ships and multiple helicopter refer to figs. 2-36, 2-37, and 2-38.)

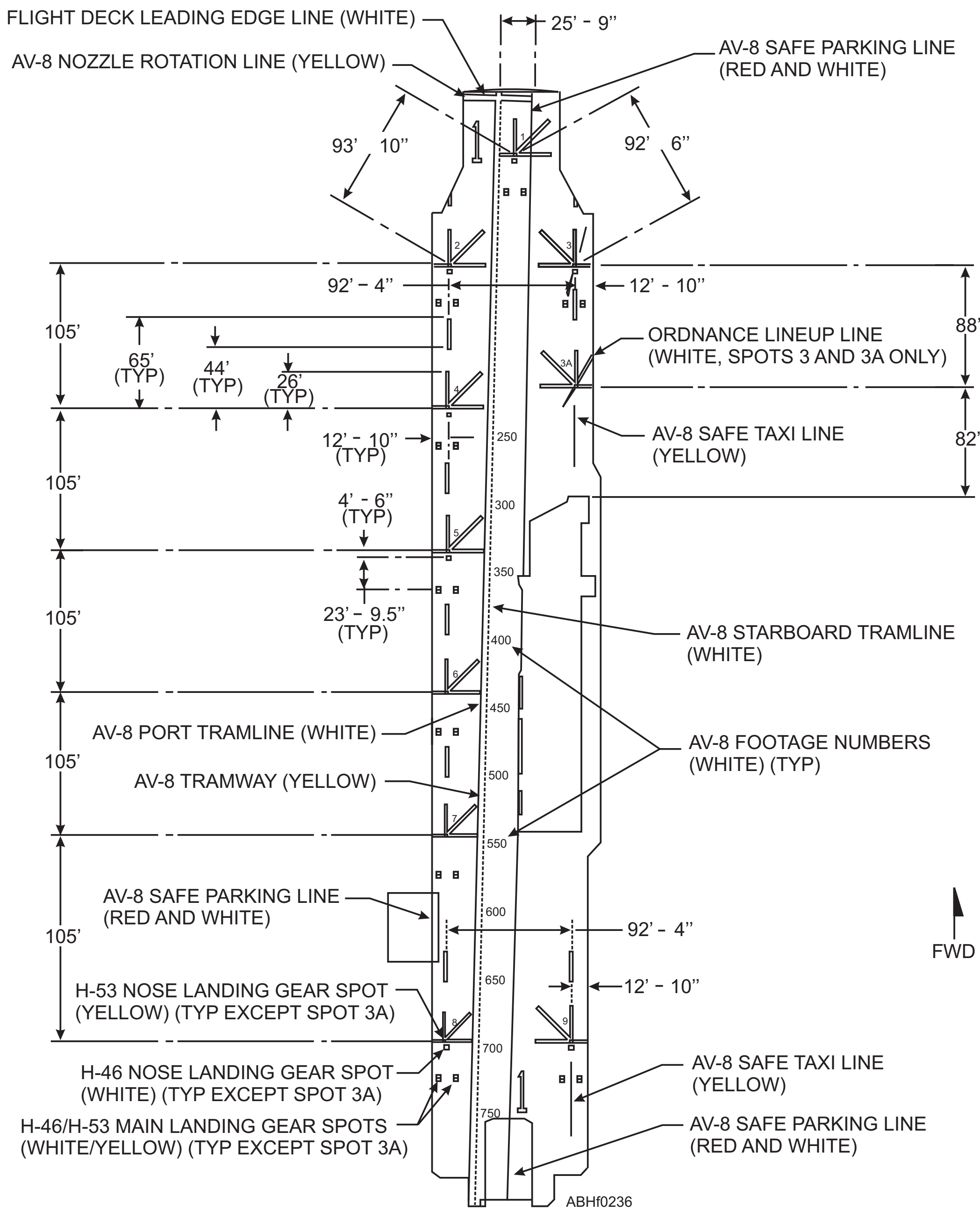


Figure 2-36.—Marking arrangement LHA-1 class ship.

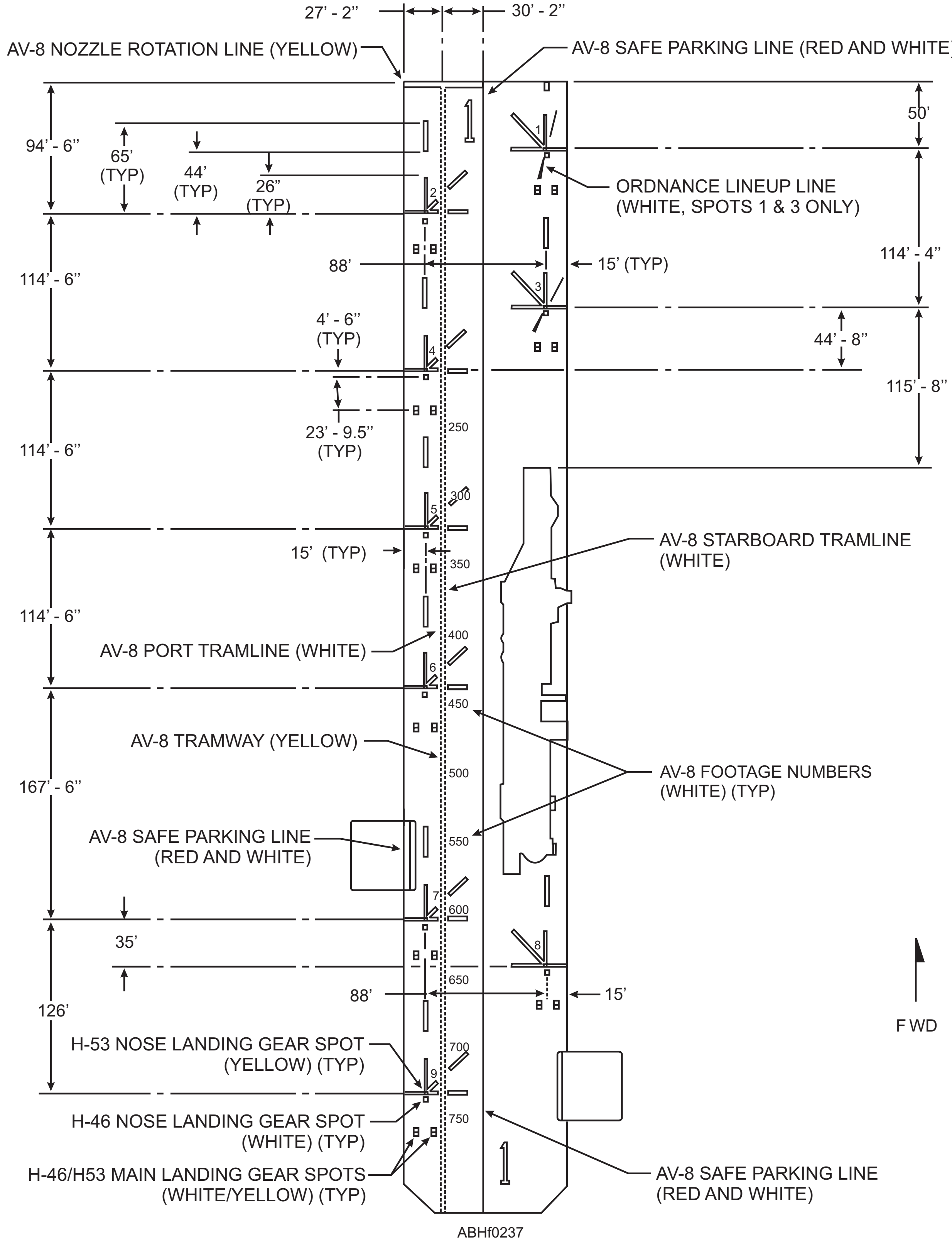
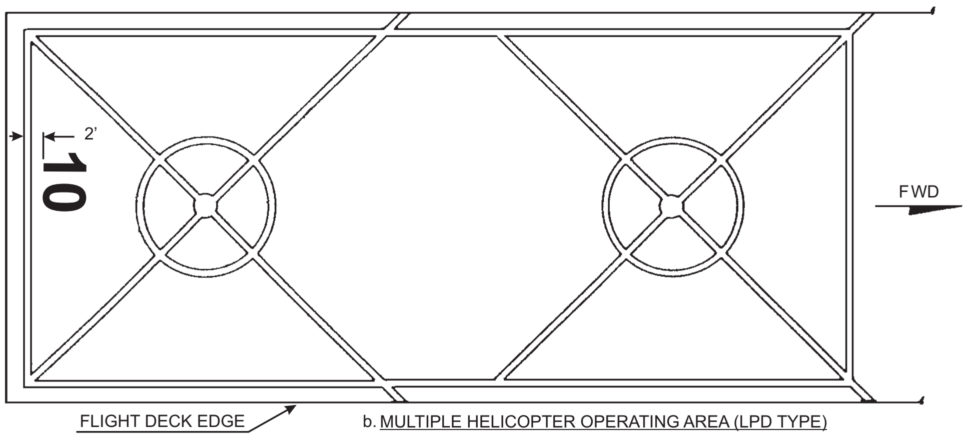
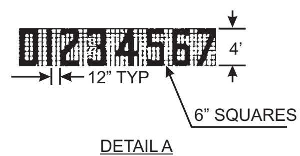


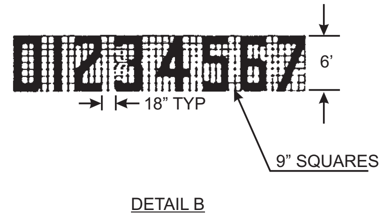
Figure 2-37.—Marking arrangement LHD-1 class ship.





NOTES:

1. MARKING OF HULL NUMBERS WITHIN A LANDING AREA, VERTREP/HOVER AREA OR COMBINATION LANDING-VERTREP/ HOVER AREA IS OPTIONAL.
2. LOCATION OF HULL NUMBERS SHALL BE AS SHOWN IN THIS FIGURE.
3. ON SINGLE HELICOPTER OPERATING AREAS THE SIZE AND SPACING OF NUMBERS SHALL BE AS SHOWN IN DETAILS A AND B. DETAIL A IS INTENDED FOR SHIPS WITH SMALL HELICOPTER AREAS, SUCH AS DESTROYERS.
4. ON MULTIPLE HELICOPTER OPERATING AREAS (LPD TYPE SHIPS) THE SIZE AND SPACING OF NUMBERS SHALL BE AS SHOWN IN DETAIL C.
5. HULL NUMBERS MUST NOT TOUCH OR INTERSECT LINE-UP LINES OR TOUCHDOWN CIRCLE.
6. NUMBERS MAY BE APPLIED WITH WHITE NON-SKID COMPOUND OR WHITE COLOR TOPPING.
7. NUMBER "8" SHALL BE A CLOSED "3". NUMBER "9" SHALL BE A INVERTED "6".



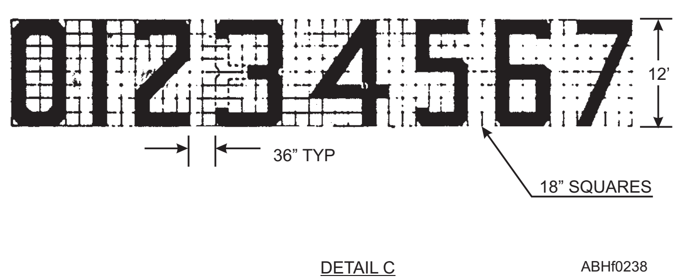


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Figure 2-38.—Multiple helicopter operating area (LPD type).

FLIGHT DECK LIGHTING

Other VLA components include lights, transformer relay boxes, control panels, and other devices used in the visual guidance of landing aircraft. You should always make sure you have the correct VLA bulletin for your ship.

Q15. VLA markings painted on wheel stop coamings should be painted what width?

Q16. At what height should hangar deck bulkhead VLA markings be placed?

Q17. What publication lists the VLA marking requirements for an aircraft carrier?

ANSWERS TO REVIEW QUESTIONS

A-1. The A/S32A-31A AIRCRAFT TOWING TRACTOR is most common tractor on the flight deck.

A-2. The A/S32A-32 AIRCRAFT TOWING TRACTOR, (Spotting Dolly).is the most common tractor on the hangar deck.

A-3. The two ratios setting of the A/S47A-1 GTE Tractor Mounted Enclosure are:

a). 3.6:1

b). 5:1

A-4. The SE Licensing procedures are outlined in OPNAVINST 4790.2G.

A-5. The NWC-4 is the standard shipboard wheel chock.

A-6. The two lengths of the TD-1B tiedown chain are:

a). 9 foot

b). 14 foot

A-7. The 15 ALBAR is used for towing a shipboard AV-8.

A-8. The three divisions involved with operating a deck edge elevator are:

a). V-1

b). V-3

c). A

A-9. Stanchions for a deck edge elevator should be set in the manual mode.

A-10. The signal light for Power Available is white.

A-11. The publication that governs the nonskid process is the NSTM-CHAPTER 634.

A-12. The service life of composition G nonskid is 12 months.

A-13. Nonskid is normally applied by the rolling method.

A-14. Freshly applied nonskid normally fully cures after 7 days.

A-15. VLA's painted on wheel stop coamings are 12 inches wide.

A-16. VLA's painted on hangar deck bulkheads are 14 feet high.

A-17. VLA General Service Bulletin NO. 8 lists the marking requirements for a CV/CVN.

CHAPTER 3

AIRCRAFT HANDLING: CV, CVN, AND SHORE STATIONS

This chapter deals with the routine handling of aircraft on the flight and hangar decks of aircraft carriers and on shore stations. It provides a general overview of aircraft handling signals, procedures, and publications. The task of handling aircraft, whether on ship or ashore, requires complete attention to detail, thorough knowledge of handling procedures, and documented qualifications. As an ABH, you are expected to handle aircraft in a confidant and responsible manner. Professionalism and pride in your work are minimum standards for success. Understanding the contents of this chapter will greatly assist you in the daily routine of aircraft handling.

GENERAL AIRCRAFT HANDLING SIGNALS

OBJECTIVES: Identify standard aircraft handling signals. Describe the various applications of hand signals.

The aircraft handling signals discussed in this section are used in identical form by all aviation branches of the United States Armed Forces. These signals are illustrated and defined in figure 3-1 (sheets 1 through 16). Personnel who wish to obtain in-depth information concerning aircraft signals should refer to NAVAIR 00-80T-113 *Aircraft Signals NATOPS Manual.*

NOTE

Signals 1 through 32 and 34 through 42 in figure 3-1 are NATO-approved. Signals 43 through 64 are for use in the U.S. Navy Department only.

CARRIER FLIGHT DECK HANDLING SIGNALS

The aircraft handling signals included in this section pertain to those used aboard aircraft carriers. Signals are included in individual *Naval Air Training and Operating Procedures Standardization (NATOPS)* flight manuals for those signals peculiar to each aircraft.

Launching Signals

See figure 3-2 (sheets 1 through 8, numbers 1 through 21) for launching signals that are being used.

Landing Signals

See figure 3-3 (sheets 1 through 3, numbers 1 through 8) for landing signals used. Signals numbered 3, 4, 7, and 8 are NATO-approved.

Handling Signals

See figure 3-4 (sheets 1 and 2, numbers 1 through 6) for the handling signals used. Signals 1 and 2 are approved by NATO.

Refueling Signals

See figure 3-5, numbers 1 through 10 for the refueling signals used.

Aircraft Elevator Signals

See figure 3-6, numbers 1 through 4 for the elevator operation signals used.

GENERAL COMMENTS

The beginner must first learn the signals thoroughly, then practice them to ensure precise execution. If the arm is to be dropped to indicate application of a brake on a turn, snap your arm out briskly. If your arms are to be stretched out in rendering a signal, open them wide. When possible, keep your hands well separated. It is better to exaggerate a signal than to make it in such a manner that it may be misinterpreted.

The emergency STOP signal is used more frequently aboard aircraft carriers than on shore stations. Remember, however, the emergency STOP is meant for emergencies only. It should not be used as a routine STOP signal.

It is sometimes necessary for an aircraft director to give **COME AHEAD SLOWLY** signal in close

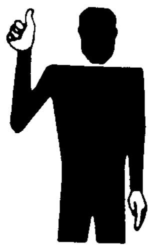
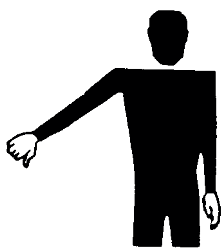
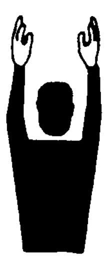
SIGNAL	DAY	NIGHT	REMARKS
1  AFFIRMATIVE (ALL CLEAR)	Hand raised, thumb up.	Same as day signal with addition of wands.	Conforms to ICAO signal.
2  NEGATIVE (NOT CLEAR)	Arm held out, hand below waist level, thumb turned downwards.	Same as day signal with addition of wands.	
3  PROCEED TO NEXT MARSHALER	Right or left arm Down, other arm moved across the body and extended to indicate direction to next marshal.	Same as day signal with addition of wands.	Conforms to ICAO signal.
4  THIS WAY	Arms above head in vertical position with palms facing inward.	Same as day signal with addition of wands.	Conforms to ICAO signal.

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Figure 3-1.—General aircraft handling signals (sheet 1; numbers 1 through 4).

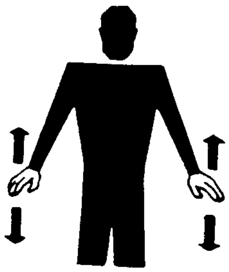
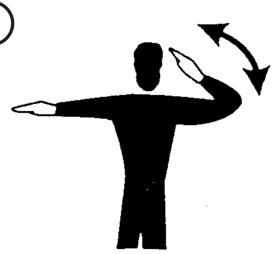
SIGNAL	DAY	NIGHT	REMARKS
5  SLOW DOWN	Arms down with palms towards ground, then moved up and down several times.	Same as day signal with addition of wands.	Conforms to ICAO signal.
6  TURN TO LEFT	Extend right arm horizontally, left arm is repeatedly moved upward. Speed of arm movement indicating rate of turn.	Same as day signal with addition of wands	1. Clench fist (day), or down-turned wand (night), means for pilot to lock indicated brake. 2. Also used for spot turns airborne aircraft. Conforms to ICAO signal.
7  TURN TO RIGHT	Extend left arm horizontally, right arm is repeatedly moved upward. Speed of arm movement indicating rate of turn.	Same as day signal with addition of wands	1. Clench fist (day), or down-turned wand (night), means for pilot to lock indicated brake. 2. Also used for spot turns airborne aircraft. Conforms to ICAO signal.
8  MOVE AHEAD	Arm extended from body and held horizontal to shoulders with hands up-raised and above eye level, palms facing backwards. Execute beckoning arm motion angled backward. Rapidity indicates speed desired of aircraft.	Same as day signal with addition of wands	

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Figure 3-1.—General aircraft handling signals (sheet 2; numbers 5 through 8).

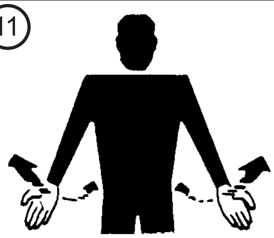
SIGNAL	DAY	NIGHT	REMARKS
9  STOP	Arms crossed above the head, palms facing forward.	Same as day signal with addition of wands.	
10  BRAKES	ON - Arms above head, open palms and fingers raised with palms toward aircraft, then fist closed. OFF - Reverse of above.	ON - Arms above head, then wands crossed. OFF - Crossed wands, then uncrossed.	
11  MOVE BACK (ALSO USED TO PULL BACK AIRCRAFT UTILIZING ARRESTING WIRE)	Arms by sides, palms facing forward, swept forward and upward repeatedly to shoulder height.	Same as day signal with addition of wands.	Conforms to ICAO signal.
12  TURNS WHILE BACKING (TAIL TO LEFT)	Point right arm down and left arm brought from overhead, vertical position to horizontal position repeating left arm movement.	Same as day signal with addition of wands	Conforms to ICAO signal.

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Figure 3-1.—General aircraft handling signals (sheet 3; numbers 9 through 12).

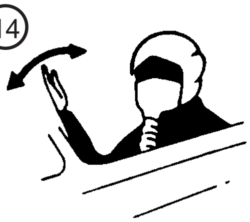
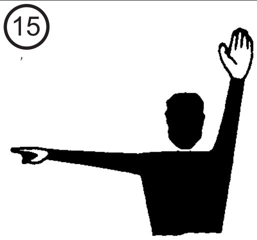
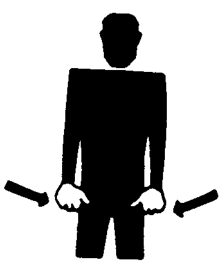
SIGNAL	DAY	NIGHT	REMARKS
13  TURNS WHILE BACKING (TAIL TO RIGHT)	Point left arm down and right arm brought from overhead, vertical position to horizontal forward position, repeating right arm movement.	Same as day signal with addition of wands.	Conforms to ICAO signal.
14  CLEARANCE FOR PERSONNEL TO APPROACH AIRCRAFT	A beckoning motion with right hand at eye level.		
15  PERSONNEL APPROACHING THE AIRCRAFT	Left hand raised vertically overhead, palm towards aircraft. The other hand indicates to personnel concerned and gestures towards aircraft.	Same as day signal with addition of wands.	
16  INSERT CHOCKS	Arms down, fists closed, thumbs extended inwards, swing arms from extended position inwards.	Same as day signal with addition of wands.	Conforms to ICAO signal.

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Figure 3-1.—General aircraft handling signals (sheet 4; numbers 13 through 16).

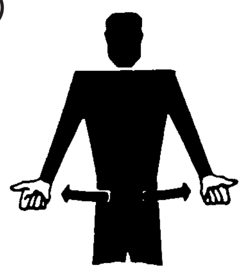
SIGNAL	DAY	NIGHT	REMARKS
17  REMOVE CHOCKS	Arms down, fists closed, thumbs extended outwards, swing arms outwards.	Same as day signal with addition of wands.	Conforms to ICAO signal.
18  INSTALL DOWN LOCKS/ UNDERCARRIAGE PINS	With arms above head, the right hand clasps left forearm and the left fist is clenched.	Similar to the day signal except the right wand is placed against left forearm. The wand in the left hand is held vertical.	
19  REMOVE DOWN LOCKS/ UNDERCARRIAGE PINS	With arms and hands in “install down locks” position, the right hand unclasps the left forearm.	Similar to the day signal except with the addition of wands.	
20  CONNECT GROUND ELECTRICAL POWER SUPPLY	Hands above head, left fist partially clenched, right hand moved in direction of left hand with first two fingers extended and inserted into circle made by fingers of the left hand.	Same as day signal with addition of wands.	Same signal for air start unit except using two fingers (day).

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Figure 3-1.—General aircraft handling signals (sheet 5; numbers 17 through 20).

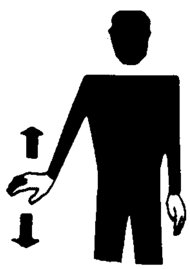
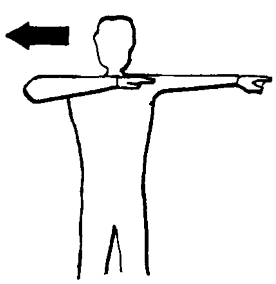
SIGNAL	DAY	NIGHT	REMARKS
21  DISCONNECT GROUND ELECTRIC POWER SUPPLY	Hands above head, left fist partially clenched, right hand moved away from the left hand, withdrawing first two fingers from circle made by fingers of the left hand.	Same as day signal with addition of wands.	Same signal for air start unit except using two fingers (day).
22  START ENGINE(S)	Left hand overhead with appropriate number of fingers extended, to indicate the number of the engine to be started, and circular motion of right hand at head level.	Similar to the day signal except that the wand in the left hand will be flashed to indicate the engine to be started.	Conforms to ICAO signal.
23  SLOW DOWN ENGINE(S) ON INDICATED SIDE	Arms down with palms toward ground, then either right or left arm waved up and down indicating that left or right side engines respectively should be slowed down.	Same as day signal with addition of wands.	Conforms to ICAO signal.
24  CUT ENGINE(S)	Either arm and hand level with shoulder, hand moving across the throat, palm down. Hand is moved sideways, arm remaining bent. Other arm pointing to engine.	Same as day signal with addition of wands.	

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Figure 3-1.—General aircraft handling signals (sheet 6; numbers 21 through 24).

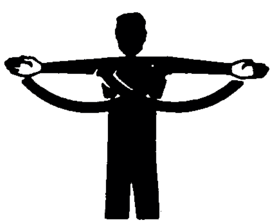
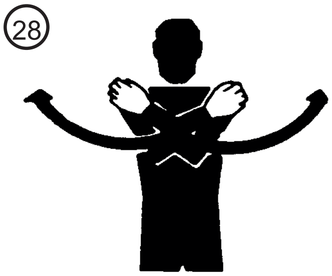
SIGNAL	DAY	NIGHT	REMARKS
25  LOCK TAILWHEEL	Hands together overhead, opened from the wrists in a V , then closed suddenly.	Same as day signal with addition of wands.	
26  UNLOCK TAILWHEEL	Hands overhead, palms together, then hands opened from the wrists to form a V, wrists remaining together.	Same as day signal with addition of wands.	
27  FOLD WINGS/ HELICOPTER BLADES	Arms straight out at sides, then swept forward and hugged around shoulders.	Same as day signal with addition of wands	
28  SPREAD WINGS/ HELICOPTER BLADES	Arms hugged around shoulders, the swept straight out to the sides.	Same as day signal with addition of wands	

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Figure 3-1.—General aircraft handling signals (sheet 7; numbers 25 through 28).

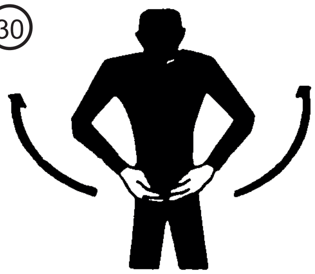
SIGNAL	DAY	NIGHT	REMARKS
29  LOCK WINGS/ HELICOPTER BLADES	Hit right elbow with palm of left hand.	Same as day signal with addition of wands.	
30  OPEN WEAPON BAY(S) DOOR(S)	Body bent forward at the waist, hands held with fingertips touching in front of body and elbows bent at approximately 45°, then arms swing downward and outward.	Same as day signal with addition of wands.	
31  CLOSE WEAPON BAY(S) DOOR(S)	Body bent forward at the waist and arms extended horizontally, then arms swing downward and in until fingertips touch in front of the body with elbows bent at approximately 45°.	Same as day signal with addition of wands	
32  TAKE OFF	Director conceals left hand and makes circular motion of right hand over head in horizontal plane ending in a throwing motion of arm towards direction of takeoff.	Same as day signal with addition of wands	

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Figure 3-1.—General aircraft handling signals (sheet 8; numbers 29 through 32).

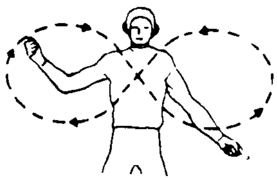
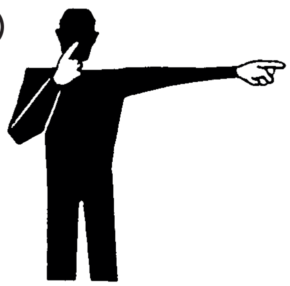
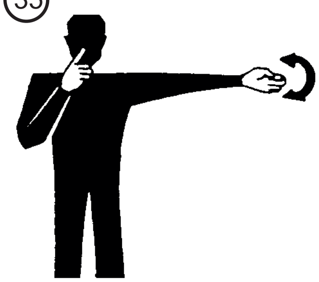
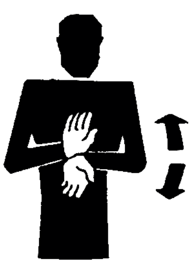
SIGNAL	DAY	NIGHT	REMARKS
33  FIRE	Describes large figure eight with one hand and point to the fire area with the other hand.	Same, except with wands.	Signal is meant for information only. Pilot should be given a cut engine or continuous turnup signal, as appropriate.
34  ENGAGE NOSEGEAR STEERING	Point to nose with index finger while indicating direction of turn with other index finger.	Same as day signal with addition of wands.	
35  DISENGAGE NOSEGEAR STEERING	Point to nose with index finger, lateral wave with open palm of other hand at shoulder height.	Same as day signal with addition of wands.	
36  LOWER WING FLAPS	Hands in front, palms together horizontally then opened from the wrist crocodile-mouth fashion.	Same as day signal with addition of wands.	

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Figure 3-1.—General aircraft handling signals (sheet 9; numbers 33 through 36).

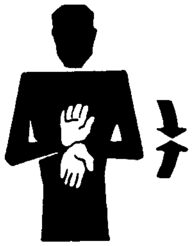
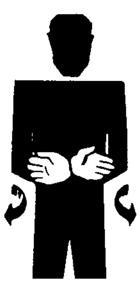
SIGNAL	DAY	NIGHT	REMARKS
37  RAISE WING FLAPS	Hands in front horizontally, with palms open from the wrists, then suddenly closed.	Same as day signal with addition of wands.	
38  DOWN HOOK	Right fist, thumb extended downward, lowered suddenly to meet horizontal palm of left hand.	Same as day signal with addition of wands.	
39  UP HOOK	Right fist, thumb extended upward, raised suddenly to meet horizontal palm of left hand.	Same as day signal with addition of wands.	
40  OPEN AIR BRAKES	Hands in front, palms together vertically. Then opened from the wrists crocodile-mouth fashion.	Same as day signal with addition of wands.	

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Figure 3-1.—General aircraft handling signals (sheet 10; numbers 37 through 40).

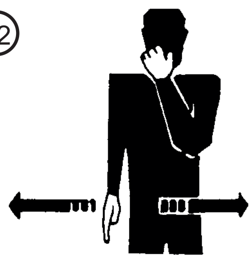
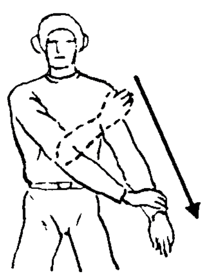
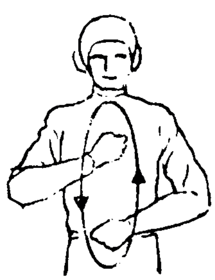
SIGNAL	DAY	NIGHT	REMARKS
41  CLOSE AIR BRAKES	Hands in front vertictally, with palms open from the wrists, then suddenly closed.	Same as day signal with addition of wands.	
42  TILLER BAR/STEERING ARM IN PLACE	Hold nose with left hand, right hand moving horizontally at waist level. a. Affirmative signal immediately following means: MAN IS TENDING BAR. b. A negative signal immediately following means: NO ONE TENDING BAR.	Same as day signal with addition of wands.	
43  REMOVE TIEDOWNS (director)	To tiedown crew: Makes wiping motion down left arm with right hand.	Same as day except with wands.	
44  INSTALL TIEDOWNS (director)	To tiedown crew: Rotates hands in a circle perpendicular to and in front of his body.	Same as day except with wands.	

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Figure 3-1.—General aircraft handling signals (sheet 11; numbers 41 through 44).

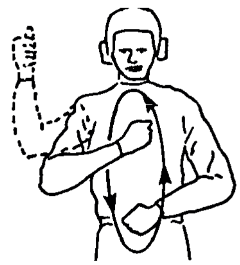
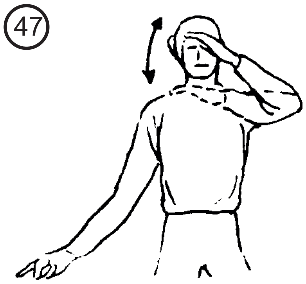
SIGNAL	DAY	NIGHT	REMARKS
45  TIEDOWNS IN PLACE (director)	Same signal as “install tiedown,” followed by thumbs up.	Same as day except with wands.	
46  ENGINE RUNUP (pilot)	Moves forefinger in a circular motion in view of director to indicate that he is ready to run up engines.	Makes circular motion with hand held light.	Director responds with same signal (wand at night) to indicate “clear to run up.”
47  HOT BRAKES	Makes rapid fanning motion with one hand in front of face and points to wheel with other hand.	Same as day except with wands.	
48 BRAKE FAILURE (tail-hook equipped aircraft) (pilot)	Pilot drops tailhook and turns on external lights as an emergency signal to the director and deck crew.	Same as day.	Pilot also informs tower via radio.

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Figure 3-1.—General aircraft handling signals (sheet 12; numbers 45 through 48).

SIGNAL	DAY	NIGHT	REMARKS
(49)  LIGHTS	Points to eyes with two fingers to signal "lights on."	Flashing wands.	When lights are already on, same signal is used to signal "lights off."
(50)  I HAVE COMMAND	Hold one hand open, motionless and high above head, with palm forward.	Same as day except with wand.	
(51)  OPEN COWL FLAPS	Hold hands against side of head; then open hands by moving thumbs forward and outward.	Same as day except with wands.	
(52) CONNECT/DISCONNECT AIR STARTING UNIT			Same as "connect/ disconnect ground electrical power supply," except using one finger (day). (See signals 20 and 21.)

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Figure 3-1.—General aircraft handling signals (sheet 13; numbers 49 through 52).

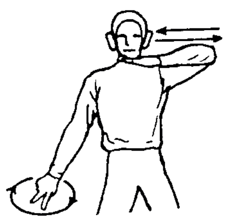
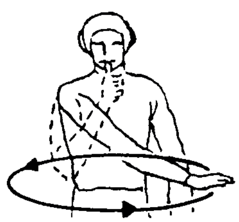
SIGNAL	DAY	NIGHT	REMARKS
53  START AIRCRAFT AUXILIARY POWER UNIT	Points to power unit exhaust with left hand index finger; moves right hand in horizontal circle, index and middle finger pointing downward.	Same as day except with wands.	
54  STOP AIRCRAFT AUXILIARY POWER UNIT	Makes “throat cutting” action with left hand; moves right hand in horizontal circle, index and middle fingers pointing downward.	Same as day except with wands.	
55  GROUND REFUELING ALL TANKS, NO EXTERNAL POWER (ground crewman)	Extends arm in front of body and makes a wide circular wiping motion; then brings thumb to mouth as if drinking from a glass.	Same except with wand held vertically.	Pilot extends air refueling probe and sets switches for fueling all tanks.
56  GROUND REFUELING, INTERNAL TANKS ONLY, NO EXTERNAL POWER (ground crewman)	Makes a circular motion as if rubbing stomach with palm of hand; then brings thumb to mouth as if drinking from a glass.	Same as day except with wand.	Pilot extends air refueling probe and sets switches for fueling internal tanks only.

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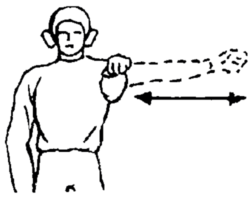
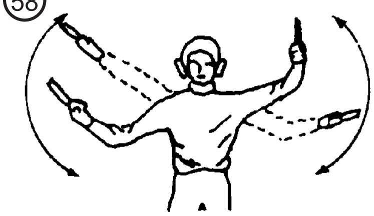
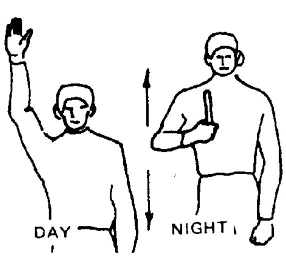
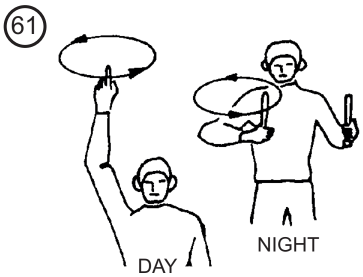
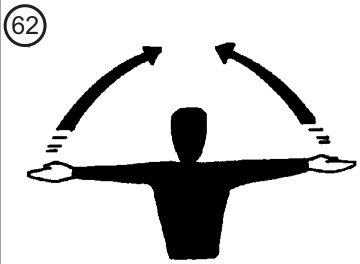
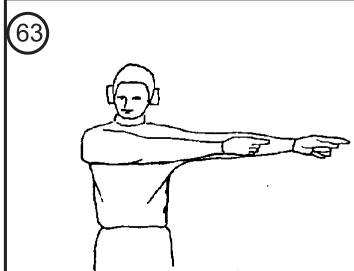
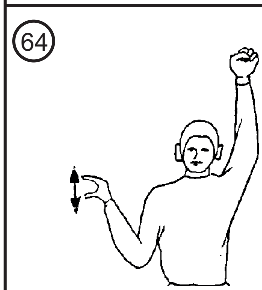
Figure 3-1.—General aircraft handling signals (sheet 14; numbers 53 through 56).

SIGNAL	DAY	NIGHT	REMARKS
57  EXTEND/RETRACT AIR REFUELING PROBE OR RAM AIR TURBINE	TO EXTEND: Extend arm straight ahead, fist clenched; swing arm 90° to side. Use left or right arm according to location of probe. TO RETRACT: Use the reverse of the EXTEND signal	Same as day except with wand.	Pilot actuates probe on signal.
58  NEED AIRCRAFT STARTING UNIT	Extend arms out from body (curved upwards) and rotate arms in a clockwise/counterclockwise motion.	Same as day except with wands.	
59  FUEL DISCHARGE DURING START	Left arm raised above shoulder with number of fingers extended to indicate affected engine; right hand describes a pendulum motion between waist and knees.	Similar to day signal except that wand in left hand will be flashed to indicate the number of the affected engine.	Signal is for information only; pilot should be given cut engine or continuous turnup signal, as appropriate.
60  AIR WATER INJECTION (AV-8)	Give FINAL TURNUP signal. Chapter 4 (No. 9). Wait 2 or 3 seconds while pilot turns up military rated thrust and checks instruments. Then, hold open hand toward pilot, fingers extended vertically.	Same except hold GREEN wand vertically and move up and down.	Day - Pilot acknowledges by salute. Night - Pilot acknowledges by turning on light to steady dim.

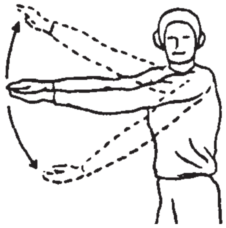
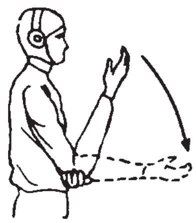
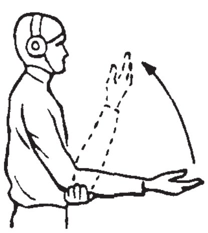
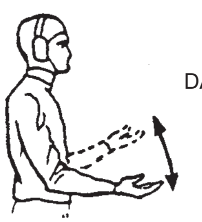
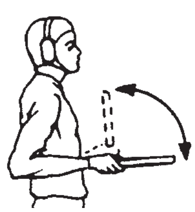
ABHf0301o

Figure 3-1.—General aircraft handling signals (sheet 15; numbers 57 through 60).

SIGNAL	DAY	NIGHT	REMARKS
 ENGINE THRUST CHECK (AV-8)	Extend arm overhead, forefinger pointing up. Hesitate, then rotate hand rapidly in a horizontal circle.	Hold RED and GREEN wands at chest level, rotating the green wand in a horizontal circle.	Signal is optional, given at request of pilot. Also can be used for deck launch.
 VTO (AV-8)	Arms extended horizontally sideways beckoning upwards, with palms turned up.	Same as day signal with addition of wands.	
 PASS CONTROL	With both arms shoulder height, point in direction of person receiving control.	Same as day except point amber wand.	Used by U.S. Navy personnel. Not a NATO signal.
 COD RAMP: OPEN/CLOSE	One hand held in hold, the other finger and thumb extended but not touching; then bring fingers and thumb together several times. Pilot will respond with same signal.	Two wands used in same manner.	Ramps shall not come down until deck crew acknowledges pilot signal.

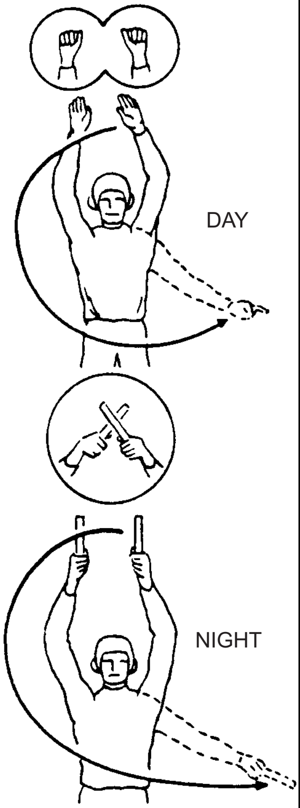
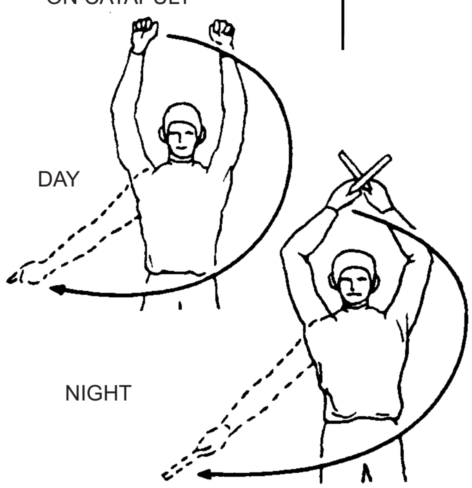
ABHf0301p

Figure 3-1.—General aircraft handling signals (sheet 16; numbers 61 through 64).

SIGNAL	FROM	TO	EXECUTION
1 EXTEND or LOWER STRUTS(S) 	Director	Pilot	Day: Extend arms to one side, palms together and horizontal. Then, open arms. Night: Same except hold wands horizontally. Note: For lowering strut, reverse the procedure for extending strut.
2 LOWER LAUNCH BAR/ TOW LINK 	Director	Deck crew, Pilot	Day: Rest right elbow in left palm at waist level. Bring right hand down to horizontal position. Night: Same except with wands.
3 RAISE LAUNCH BAR/ TOW LINK 	Director	Deck crew, Pilot	Day: Rest right elbow in left palm at waist level. With right forearm horizontal, bring right hand up to shoulder level. Night: Same as day except rest right elbow on wand.
4 ATTACH BRIDLE/ PENDANT  DAY  NIGHT	Launching officer	Director and Catapult crew	Day: Extend arms forward at waist level; make slight lifting motion with forearm. Night: Hold both wands close to waist, extending forward horizontally; rotate wands from horizontal to vertical position.

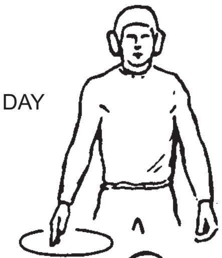
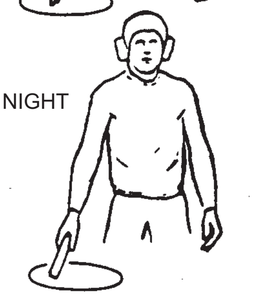
ABHf0302a

Figure 3-2.—Launching signals (sheet 1; numbers 1 through 4).

SIGNAL	FROM	TO	EXECUTION
(5) TENSION AIRCRAFT ON CATAPULT 	Director	Catapult crew, Pilot	Day: Extend arms overhead. Open clenched fists, palms forward to indicate pilot release brakes. Then sweep one hand across chest in direction of launch. Pilot will release brakes and apply appropriate power in accordance with aircraft NATOPS Manual. Night: Same using wands except indicate pilot release brakes by opening crossed wands above head.
(6) UNTENSION AIRCRAFT ON CATAPULT 	Launching officer	Catapult crew, Pilot	Day: Extend arms overhead, fists clenched to indicate pilot hold brakes. Then sweep one fist across chest and point in opposite direction of launch. Pilots will hold brakes. Night: Hold wands crossed overhead to indicate pilot hold brakes. Then sweep one wand across chest and point in opposite direction of launch. Pilot will hold brakes.

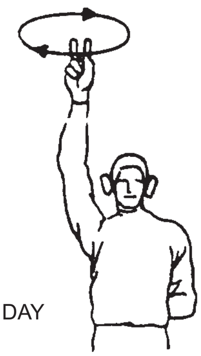
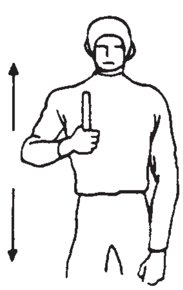
ABHf0302b

Figure 3-2.—Launching signals (sheet 2; numbers 5 and 6).

SIGNAL	FROM	TO	EXECUTION
7 TENSION BRIDLE ARRESTER LANYARD DAY  NIGHT 	Hookup petty officer	Catapult crew	Day: With hands down, make horizontal circular motion with one hand. Night: Same except use white stubby wand pointed down.
8 FIRST TURNUP  DAY  NIGHT	Launching officer	Pilot	Day: Extend arm overhead, forefinger pointing up. Hesitate, then rotate hand rapidly in a horizontal circle. Night: Hold RED and GREEN wands at chest level, rotating the green wand in a horizontal circle. Remarks: Signal is optional, given at request of pilot. Also can be used for deck launch.

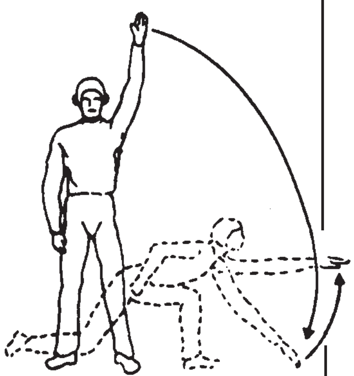
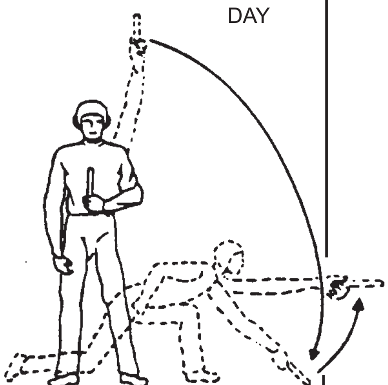
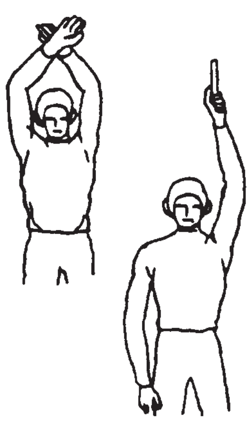
ABHf0302c

Figure 3-2.—Launching signals (sheet 3; numbers 7 and 8).

SIGNAL	FROM	TO	EXECUTION
9 FINAL TURNUP  DAY  NIGHT	Launching Officer	Pilot, Catapult crew	DAY: Extend arm overhead, index and middle finger pointing up. Hesitate then rotate hand rapidly in a horizontal circle. Night: Rotate GREEN wand in a horizontal circle at chest level. Hold RED wand behind back. Remarks: The pilot will apply or maintain full power, check instruments, get set and: 1. Day - turn head slightly toward Launching Officer, execute a hand salute, and position head against headrest. 2. Night - turn on only hsi running lights (STEADY), and keep them on until clear of ship.
10 AFTERBURNER  DAY  NIGHT	Launching officer	Pilot	DAY: Give "final turnup" signal (no. 9). Wait 2 or 3 seconds while pilot turns up to military rated thrust and checks instruments. Then, hold open hand toward pilot, fingers extended vertically. Night: Same except hold GREEN wand vertically and move up and down. Remarks: Pilot select afterburner, check instruments, and: 1. Day - Salute when ready for launch. 2. Night - turn on only his running lights (STEADY), and keep them on until clear of ship.

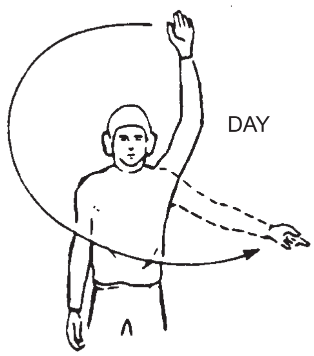
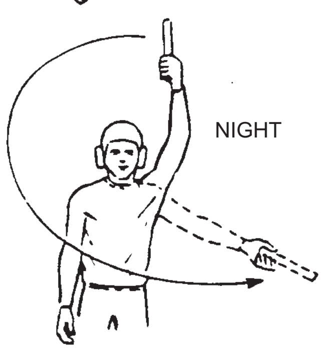
ABHf0302d

Figure 3-2.—Launching signals (sheet 4; numbers 9 and 10).

SIGNAL	FROM	TO	EXECUTION
(11) FIRE/LAUNCH  DAY  NIGHT	Launching officer	Catapult crew, Pilot	Day: Extend arm overhead. Ensure that pilot's head is against headrest and deck is clear forward. Sweep up-raised hand downward in the direction of launch, touching the deck and returning hand to the horizontal in the direction of launch. Night: Raise GREEN wand vertically overhead. Wait 2 or 3 seconds for pilot to position head against headrest. Ensure that deck is clear forward. Sweep wand in a wide arc, ending by pointing in the direction of launch, touching the deck and returning wand to the horizontal in the direction of launch. **WARNING** The launching officer shall remain in the crouched position with his hand/wand held horizontally in the direction of launch until the aircraft has passed his position or a suspend/hangfire situation is indicated. Note - Also used for free deck launches.
(12) SUSPEND  NIGHT	Launching officer	Catapult crew, Pilot	Day: Cross arms high overhead indicating the launch is off. Night: Hold RED wand high overhead indicating the launch is off. GREEN wand is turned off. Remarks: After this signal, pilot must remain ready for launch and not throttle back until after the "untension" and "throttle back" signals are given by the launching officer/catapult safety observer (ICCS). Note - Any flight deck or catapult personnel may signal a SUSPEND to the launching officers. The DAY signal is the same as the launchings officer's. The NIGHT signal is a horizontal movement of a wand or light.

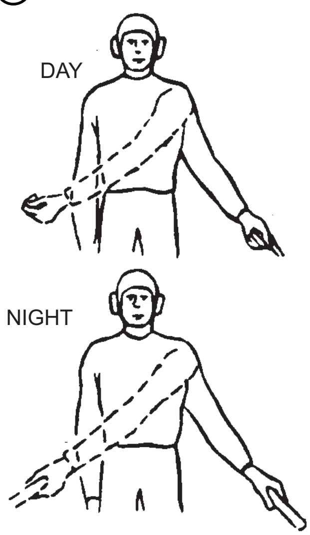
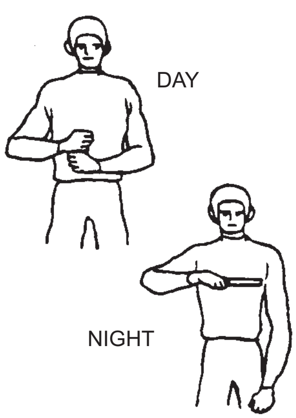
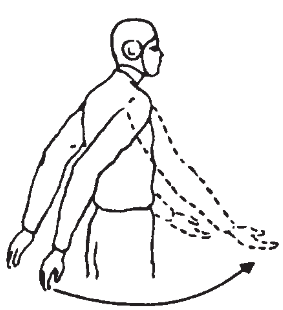
ABHf0302e

Figure 3-2.—Launching signals (sheet 5; numbers 11 and 12).

SIGNAL	FROM	TO	EXECUTION
(13) HANGFIRE  DAY  NIGHT	Launching officer/ Catapult Safety Observer (ICCS)	Catapult crew, Pilot	Day: Give "suspend" signal (no. 12). Then point index finger of one hand at palm of other hand. Night: Give "suspend' signal (no. 12). Then hold RED wand overhead in a horizontal position. GREEN wand remains off.
(14) UNTENSION AIRCRAFT ON CATAPULT (Following suspend or hangfire)  DAY  NIGHT	Launching officer Catapult Safety Observer (ICCS)	Catapult crew Launching officer (ICCS)	Day: With arms in "suspend" or "hangfire" position, sweep one hand from above head across chest and point in opposite direction to launch. Night: With RED wand in "suspend" or "hangfire" position, sweep it across chest and point in opposite direction of launch.

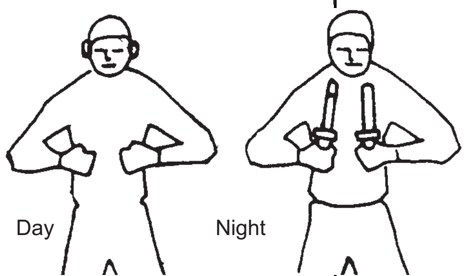
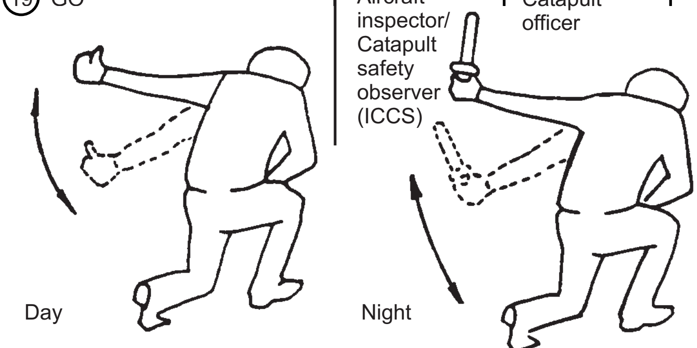
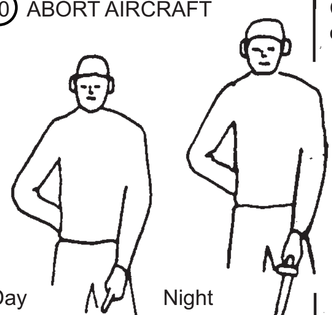
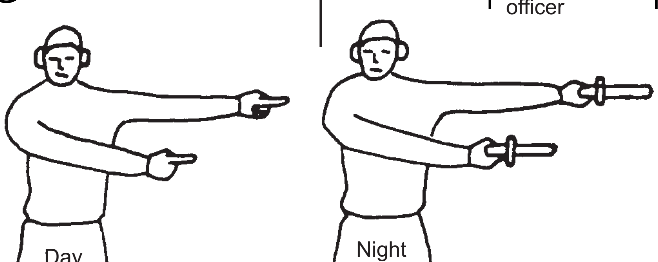
ABHf0302f

Figure 3-2.—Launching signals (sheet 6; numbers 13 and 14).

SIGNAL	FROM	TO	EXECUTION
(15) SHUTTLE FORWARD 	Launching officer/ Catapult crew Catapult safety observer (ICCS)	Catapult crew Launching officer (ICCS)	Day: Sweep one hand (pointed aft) in the forward direction. Night: Sweep RED wand (pointed aft) in the forward direction. GREEN wand is off.
(16) THROTTLE BACK 	Launching officer/ Catapult safety observer (ICCS)	Pilot	Day: Hold one fist at waist level, thumb extended up. Grasp thumb with other hand and rock as if adjusting throttle. Night: Hold RED wand horizontally across chest. Raise and lower horizontal wand. GREEN wand is off.
(17) PUSH/PULL BACK 	Director	Deck crew	Day: Make fore-to-aft sweeping motion with arms extended downward, palms forward. Night: Same except with wands.

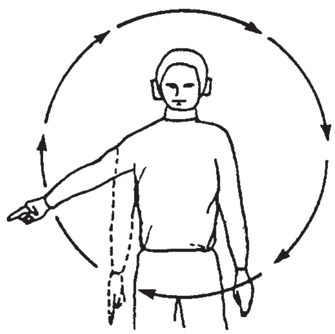
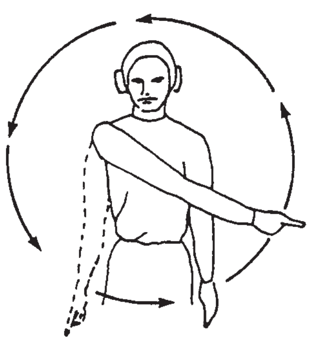
ABHf0302g

Figure 3-2.—Launching signals (sheet 7; numbers 15 through 17).

SIGNAL	FROM	TO	EXECUTION
(18) ACCEPT CONTROL 	Catapult officer	Director	Day: Hold both hands with fists clenched in front at waist height. Night: Hold wands vertically in front of body. Turns wands on.
(19) GO 	Aircraft inspector/ Catapult safety observer (ICCS)	Catapult officer	Day: Hold arm outstretched horizontally with fist clenched and thumb extended vertically. Move arm up and down. Night: Same as day signal except hookup petty officer uses white wand and catapult observer uses green wand.
(20) ABORT AIRCRAFT 	Catapult officer	Director	Day: Hold right hand behind back and point down with forefinger of left hand. Night: Place green wand behind back and point down with red wand.
(21) PASS CONTROL 	Director	Catapult officer	Day: With both arms at shoulder height, point in direction of person receiving control. Night: Same as day signal except point wands.

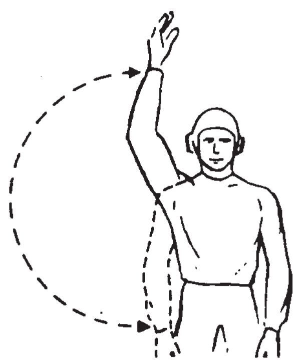
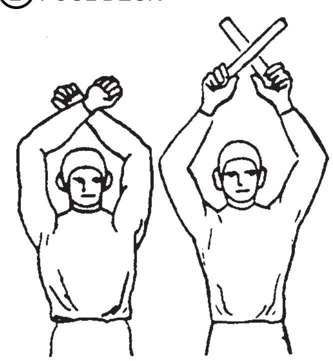
ABHf0302h

Figure 3-2.—Launching signals (sheet 8; numbers 18 through 21).

SIGNAL	FROM	TO	EXECUTION
22  RETRACT SHUTTLE	Catapult officer	Deckedge officer	Day: Finger pointing towards the bow at waist level. Sweep arm in a complete large circular motion. Stopping the sweeping motion with the finger pointed aft at waist level. Night: Same except use RED wand. Remarks: Deckedge Operator retract shuttle.
23  ADVANCE SHUTTLE	Catapult officer	Deckedge officer	Day: Finger pointing aft at waist level. Sweep arm in a complete large circular motion. Stopping the sweeping motion with the finger pointed towards the bow at waist level. Night: Same except use RED wand. Remarks: Deckedge Operator retract shuttle.

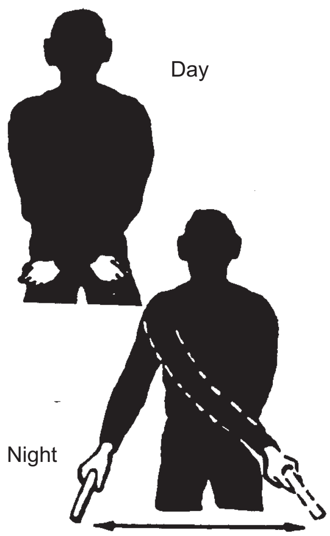
ABHf0302i

Figure 3-2.—Launching signals (sheet 8; numbers 22 through 23).

SIGNAL	FROM	TO	EXECUTION
1 CLEAR DECK 	Flight deck officer/ Director	Arresting gear officer	Day: Sweep arm from overhead position to side position and return. Night: Same as day except with AMBER wand.
2 FOUL DECK 	Flight deck officer/ Director	Arresting gear officer	Day: Cross arms overhead, fists clenched. Night: Crossed AMBER wands held overhead
3 PULLBACK 	Hook runner Director	Director Pilot Deck-edge operator	Day: Make fore-to-aft sweeping motion with arms extended downward, palms aft. Night: Same motion except with RED stubby wand. Day: Make fore-to-aft sweeping motion with arms extended downward, palms forward. Night: Same motion except with two AMBER wands.

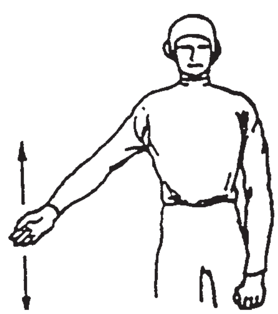
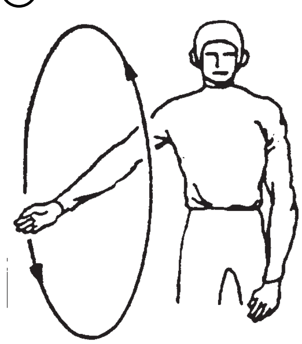
ABHf0303a

Figure 3-3.—Landing signals (sheet 1; numbers 1 through 3).

SIGNAL	FROM	TO	EXECUTION
4 CEASE PULL BACK 	Director Hook runner	Deck-edge operator Director	Day: Cross arms below waist. Night: Horizontal movements of wand below waist.
5 RAISE HOOK 	Director	Pilot	Day: Position left hand horizontally in front of body, palm down. Move right hand upward, bringing extended thumb into left palm. Night: Position left wand horizontally in front of body. Position right wand vertically to form a "T".

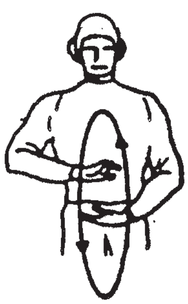
ABHf0303b

Figure 3-3.—Landing signals (sheet 2; numbers 4 and 5).

SIGNAL	FROM	TO	EXECUTION
6 LOWER HOOK  DAY  NIGHT	Director	Pilot	Day: Position left hand horizontally in front of body, palm up. Move right hand downward, bringing extended thumb into left palm. Night: Position left wand horizontally in front of body. Position right wand vertically to form an inverted "T".
7 WIRE CLEAR 	Hook runner	Director	Day: Make vertical motion with arm pointed at the taxi director. Night: Same, holding RED stubby wand.
8 WIRE RETRACT 	Hook runner	Deck-edge operator	Day: Make large circular motion with arm extended to one side. Night: Same, holding RED stubby wand.

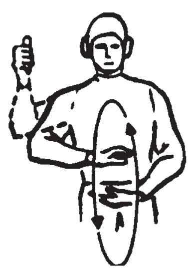
ABHf0303c

Figure 3-3.—Landing signals (sheet 3; numbers 6 through 8).

SIGNAL	FROM	TO	EXECUTION
(1) TILLER BAR IN PLACE OR ENGAGE NOSE-WHEEL STEERING 	Director	Pilot	Day: Touch end of nose with forefinger. Then, give thumbs up signal with same hand. Night: Touch end of nose with wand. Then give "up" signal with same wand.
(2) TILLER BAR REMOVED OR DISENGAGE NOSE-WHEEL STEERING 	Director	Pilot	Day: Touch end of nose with forefinger. Then, sweep arm downward in direction of aircraft movement.. Night: Touch end of nose with wand. Then sweep wand downward in direction of aircraft movement.
(3) WING RIDER 	Director	Deck crew, Pilot	Day: Position forearms flat against each other in front of and perpendicular to body. Night: Same, holding wands.
(4) INSTALL TIE-DOWNS 	Director	Pilot, Brake rider	Day: Rotate hands in a vertical circle in front of body Night: Same as day except with AMBER wands.

ABHf0304a

Figure 3-4.—Flight deck aircraft handling signals (sheet 1; numbers 1 through 4).

SIGNAL	FROM	TO	EXECUTION
5 TIE-DOWNS IN PLACE 	Director	Pilot Brake rider	Same as "install tie-downs," adding a thumbs up signal.
6 REVERSE THRUST TAXI 	Director	Pilot	Day: Palms facing aircraft at eye level with a push back motion. For turns, the director points in direction tail is to move. Night: Same, holding wands.

ABHf0304b

Figure 3-4.—Flight deck aircraft handling signals (sheet 2; numbers 5 and 6).

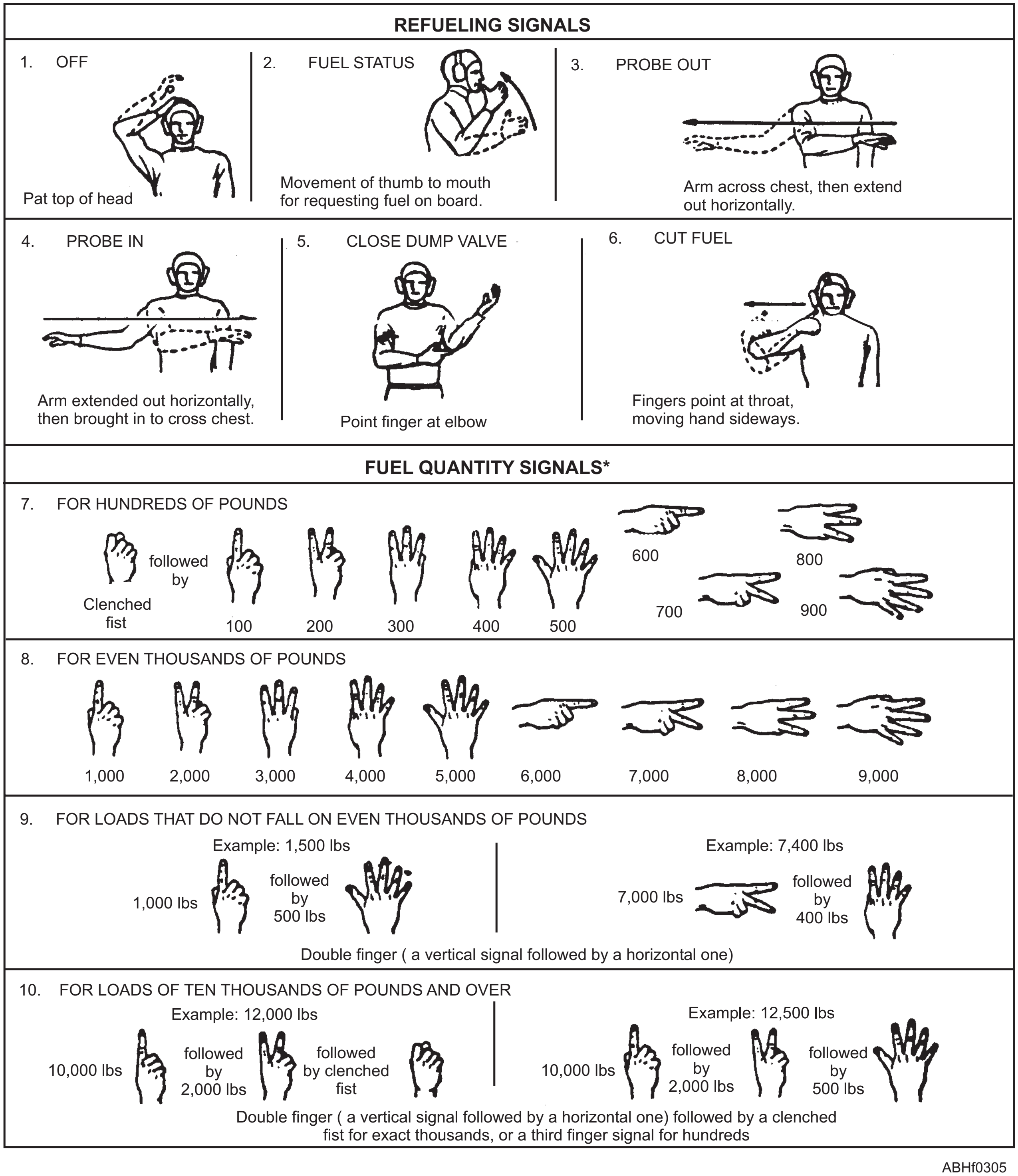
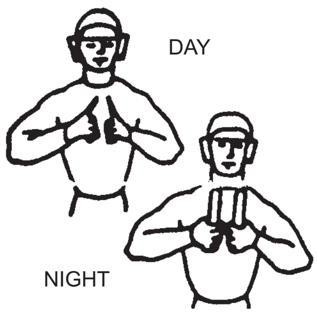
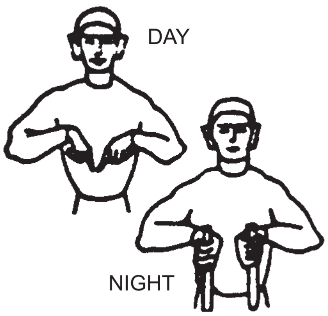
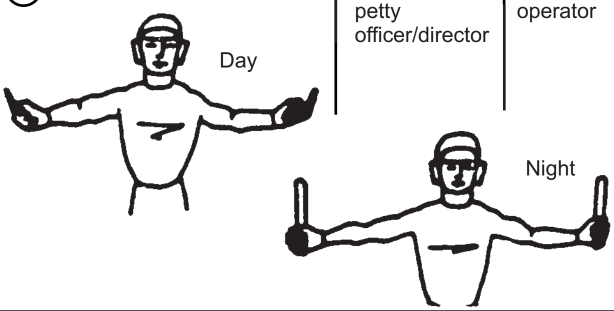
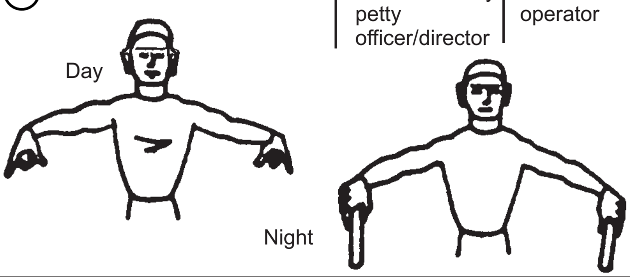


Figure 3-5.—Refueling hand signals (numbers 1 through 10).

SIGNAL	FROM	TO	EXECUTION
(1) RAISE SAFETY STANCHION 	Elevator safety petty officer/director	Elevator operator	Day: Raise both index fingers extended upward chest level, in close together, near body. Night: Raise both wands pointed upward at shoulder level, close together, and near body.
(2) LOWER SAFETY STANCHION 	Elevator safety petty officer/director	Elevator operator	Day: Lower both index fingers, extended downward, chest level, close together, and near body. Night: Lower both wands pointed downward at waist level, in close together, and near body.
(3) RAISE ELEVATOR 	Elevator safety petty officer/director	Elevator operator	Day: Fully extend both arms with index finger pointing upward. Night: Fully extend both arms with wands pointing upward.
(4) LOWER ELEVATOR 	Elevator safety petty officer/director	Elevator operator	Day: Fully extend both arms with index finger pointing downward. Night: Fully extend both arms with wands pointing downward.

ABHf0306

Figure 3-6.—Aircraft elevator signals (numbers 1 through 4).

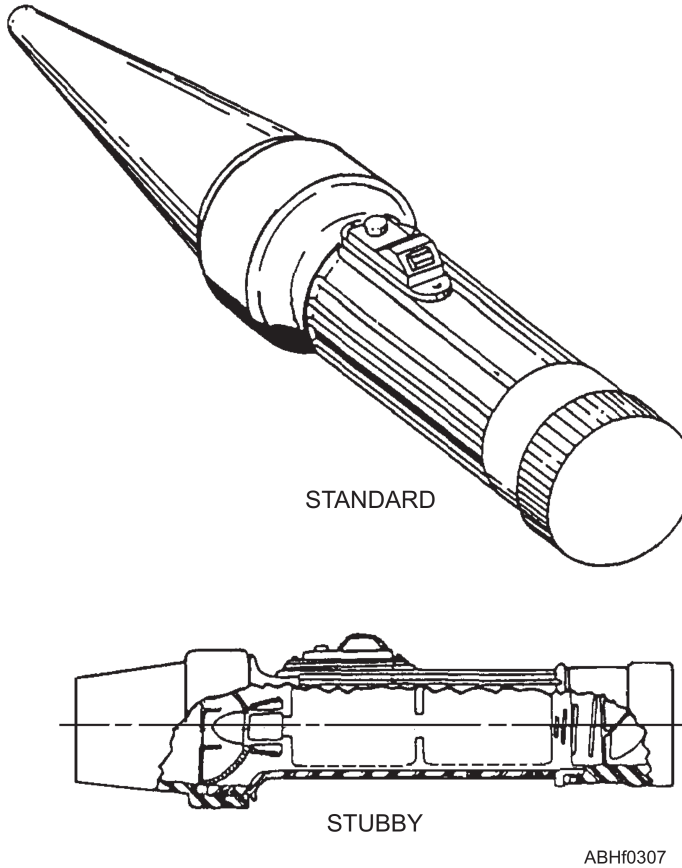


Figure 3-7.—Signal wand.

quarters. The plane director should execute this signal by alternately giving the standard **COME AHEAD** signal (with slow movement of the arms), followed by the **SLOW DOWN** signal, followed by the **STOP** signal, as necessary.

Q1. What NAVAIR manual provides in-depth information on aircraft signals?

Q2. Which aircraft handling signals are NATO approved?

SIGNAL WANDS

OBJECTIVE: Identify the correct application of signal wands.

During night operations, signal wands perform an important role in aircraft handling safety on the flight deck. Inappropriate use of signal wands on the flight deck will cause confusion and lead the way for a mishap. Standard signal wands (see figure 3-7) are used by a wide variety of personnel during night flight operations, and it is important that only those signal wands prescribed in table 3-1 be used.

To give visual direction to pilots and other deck personnel during night operations, the aircraft director will use two signal wands with amber colored filters. A signal wand comes with additional interchangeable colored filters (white, red, amber, green, and blue) for use by other deck personnel. A conical shaped diffuser screwed on the flashlight forms the lighted portion of the wand. A push button or slide switch provides momentary or continuous light control. Refer to figure 3-7 for the overall view.

Two signal wands are used by aircraft handling personnel to give visual direction to the aircraft pilot and other deck personnel during night operations. The wands are of different colors and/or shapes for the personnel designated to use them. The different colors and/or shapes of the cones on the wands are a safety factor. This is to prevent the pilots or other personnel working in or around where night flight operations are being conducted from misinterpreting a signal, which could cause damage to the aircraft or equipment or serious injury or death to personnel. Table 3-1 lists the personnel authorized to use wands during night operations, color of the wand(s), numbers of wands used, and type or shape.

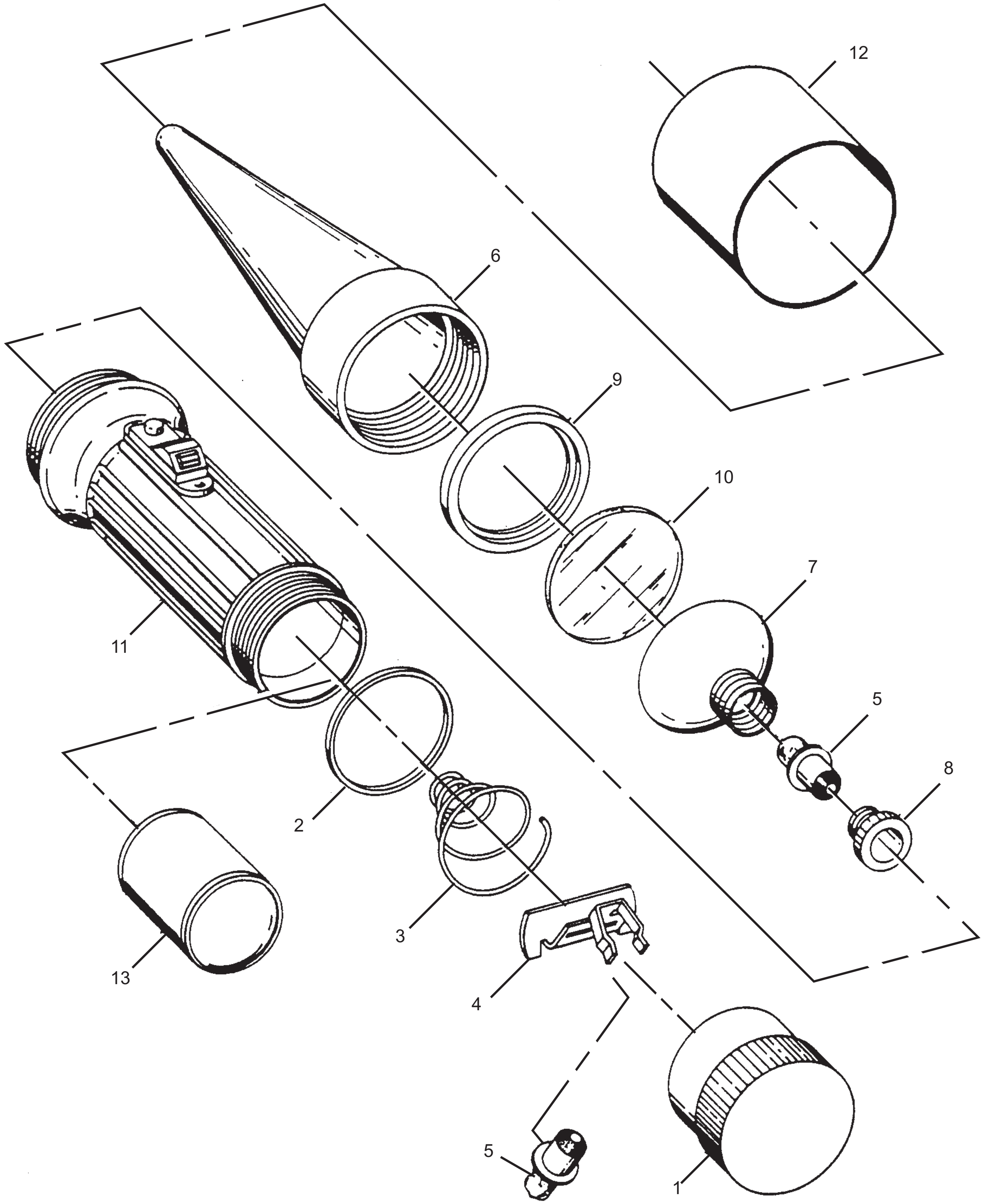
Table 3-1.—Standard Signal Wands

PERSONNEL	COLOR	NO	TYPE*
Aviation Fuels Checker/Repairman	Amber	1	Stubby
Bow Safety	Red	1	Standard
	Green	1	Standard
Catapult Hookup Petty Officer	White	1	Stubby
Catapult Safety Observer (ICCS)	Red	1	Standard
	Green	1	Standard
Center Deck Operator (Topside)	White	1	Stubby
Deck Edge (Arresting Gear)	Red	1	Standard
	Green	1	Stubby
Deck Edge (Catapults)	Red	1	Standard
	Green	1	Standard
Flight Deck Officer and Aircraft Directors	Amber	2	Standard
Hook Runner	Red	1	Stubby
JBD Safety	White	1	Stubby
Launching and Arresting Gear Officer/Helicopter LSE/LSO	Red	1	Standard
	Green	1	Standard
LSO Platform Talker (Arresting Gear)	Red	1	Standard
	Green	1	Standard
Ordnance Arming Crew	Red	1	Stubby Banded**
Ordnance Arming/Safety Supervisor	Red	2	Standard Banded***
Plane Captain	Blue	2	Standard
Squadron Aircraft Inspector	Blue	1	Stubby

* Standard and stubby denote cone shape. Standard denotes full length cones; stubby is a modified cone providing 3 inches of lighted cone. Any suitable battery and switch housing is authorized if cone is brightly lighted. All signal wands/flashlights shall be equipped with heat-strinkable sleeving to prevent possible cone separation.

** One 3/4-inch band on the cone (plastic electricians tape is recommended).

***Two 3/4-inch bands spaced equidistant on the cone (plastic electricians tape is recommended).



1. **Cap**
2. **Gasket**
3. **Spring**
4. **Spring retainer**
5. **Bulb**
6. **Diffuser**
7. **Reflector assembly**
8. **Insert**
9. **Gasket**
10. **Red filter, green filter, yellow filter**
11. **Case assembly**
12. **Heat shrinkinable sleeving, 2 21.D. (81349)**
13. **C size batteries**

Figure 3-8.—Wand assembly (408117-2).

Wands are used at night in the same manner as the hands are used in day signaling. Night signals that differ from day signals are shown in figures 3-1 through 3-6.

WAND MAINTENANCE

Maintenance of the signal wand generally consists of replacing the batteries and the bulb. Maintenance on the wands should be done well before the wands are required on deck. Don't wait until it is almost dark before checking on the signal wands. Refer to figure 3-8 for the exploded view of the wand. A spare bulb is provided on a spring retainer in the cap.

The exploded view shows each component of the wand. The component parts are listed in the order of disassembly.

Q3. What is the color and type of signal wand used by a plane captain?

Q4. What personnel on the flight deck have red wands with two 3/4" bands on the cone?

AIRCRAFT HANDLING PROCEDURES

OBJECTIVES: Identify the responsibilities of an aircraft director. Recognize aircraft handling safety procedures. Identify catapult nose gear launch procedures.

Aircraft handling is a general term that describes any movement of aircraft or associated equipment aboard a CV/CVN. All aircraft handling on the flight and hangar decks is controlled by the Aircraft Handling Officer (ACHO). The ACHO briefs the flight/hangar deck supervisory personnel before each evolution of planned aircraft movements. They, in turn, brief their crews. The crews are responsible, through their designated supervisors, for the safe and efficient accomplishment of each evolution. Table 3-2 outlines the flight quarters clothing requirements for aircraft handling crews as well as the other personnel associated with flight operations onboard an aircraft carrier.

Only designated and qualified aircraft directors may control the movement of an aircraft. Aircraft handling personnel are required to report to higher authority any observed unsafe practices or any conditions that may affect the safety of personnel or equipment. For detailed information on aircraft handling procedures and safety precautions, you should refer to the *CV NATOPS Manual*, NAVAIR 00-80T-105, and the *Air Department Standard Operating Procedures (SOP)*, COMNAVAIRPAC/COMNAVAIRLANTINST 3100.4.

MOVEMENT OF AIRCRAFT

The flight deck of an aircraft carrier is one of the busiest places in the Navy. Understanding the relationships and responsibilities of personnel who work on the flight deck will greatly increase the efficiency of handling aircraft. The most effective, efficient and successful air department's understand and practice the concept of teamwork and function together as a unit. The following text identifies some of the responsibilities of personnel assigned to work on the flight deck when moving aircraft.

A plane captain's (PC) paramount duty is to be with his aircraft at all times during Flight Quarters and other times as may be ordered. A qualified PC or brake rider shall be in the cockpit manning the brakes any time the aircraft is moved without a pilot. The PC shall ensure that the brakes are functioning properly and is positioned in such a manner to properly apply the brakes. The PC shall ensure that the cockpit is open, weather permitting, so that the director's whistle can be heard. The PC shall know all visual and oral signals used in aircraft handling and be alert to respond to them instantly. The PC is responsible for wearing proper flight deck gear as outlined in the CV NATOPS.

When a pilot is to man the aircraft, the plane captains will assist the pilot with cockpit strapping procedures. When completed, the plane captain will stand by the nose of the aircraft ready to start engines. This command shall be given by the Air Officer and at that time, and not before, the plane captain will signal the tractor driver, and pilot to start engines. Engines will not be started unless personnel are clear of intakes, tailpipes, propellers, etc.

Plane captains and chockwalkers will be responsible for removing tiedown chains when signaled by the director. Removing the chocks is a chockwalker responsibility. After the aircraft is ready to taxi out of its spot, the PC will proceed, with the required tiedowns, jury struts, etc., to a designated area and remain there until the aircraft has been launched. The PC should be prepared to return immediately to the aircraft should it not launch for any reason.

When an aircraft lands and is spotted forward, the PC shall meet the aircraft immediately and insert down locks/gear pins and/or jury struts, as required. The PC shall ensure that the aircraft has initial tiedowns installed before the pilot(s) exit(s) the aircraft.

Table 3-2.—Authorized Flight Quarters Clothing

PERSONNEL	HELMET	JERSEY/ FLOATATION VEST	SYMBOLS, FRONT AND BACK
Aircraft handling crew and chock men	Blue	Blue	Crew number
Aircraft handling officers and plane directors	Yellow (Note 1-5 as needed)	Yellow	Billet title — crew number
Arresting gear crew	Green	Green	A
Aviation fuel crew	Purple	Purple	F
Cargo handling personnel	White	Green	"Supply"/"POSTAL" as appropriate
Catapult and arresting gear officers	Green	Yellow	Billet title
Catapult crew	Green	Green	C
Catapult/AG QA	Green	White	ALRE QA
Catapult safety observer (ICCS)	Green	(Note 6)	Billet title
Crash and salvage crews	Red	Red	Crash/Salvage
Elevator operators	White	Blue	E
Explosive ordnance disposal	Red	Red	"EOD" in black
GSE troubleshooter	Green	Green	"GSE"
Helicopter LSE	Red	Green	H
Helicopter plane captain	Red	Brown	H
Hook runner	Green	Green	A
JBD safety observer	Green	Green/White	JBD safety
Landing signal officer	None	White	LSO
Leading petty officers:			
Line	Green	Brown	Squadron designator and "Line CPO"
Maintenance	Green	Green	Squadron designator plus "Maint. CPO"
Quality assurance	Brown	White	Squadron designator and "QA"
Squadron plane inspector	Green	White	Black and white checkerboard pattern and squadron designator
LOX crew	White	White	LOX
Maintenance crews	Green	Green	Black stripe and squadron designator
Medical	White	White	Red Cross
Ordnance	Red	Red	3-inch black stripe and squadron designator/ship's billet title
Ordnance QA	White	(Note 8)	Squadron designator and "ORDNANCE QA/SAFETY"
Photographers	Green	Green	P
Plane captains	Brown	Brown	Squadron designator
Safety	White	White	"SAFETY"
Supply VERTREP coordinator	White	Green	"SUPPLY COORDINATOR"
Tractor driver	Blue	Blue	Tractor
Tractor King	Blue	(Note 7)	TK
Transfer officer	White	White	"TRANSFER OFFICER"

Table 3-2.—Authorized Flight Quarters Clothing—Continued

Note
1. Only personnel charged with the actual control or direction of aircraft movements on the flight or hangar decks shall wear yellow jerseys. Personnel in charge of a detail, such as aviation fuels, ordnance, and maintenance, shall wear a helmet and jersey corresponding in color to that of their respective detail and with their billet title on the jersey and flotation vest.
2. Helmets for all personnel shall be marked with a 6-inch square (or equivalent) of white reflective tape on the back shell and a 3-inch by 6-inch (or equivalent) of white reflective tape on the front shell. Landing signal officers are not required to wear helmets or sound attenuators when engaged in aircraft control. Helmets shall have a 2-inch piece of velcro on the left side of the front shell and velcro on the survival light.
3. Three reflective international orange stripes, 1-inch wide, evenly spaced, running fore and aft on top of the white reflective tape. a. All air department officers b. Air department chief petty officers and leading petty officers c. EOD team members d. All ordnance officers and gunners e. Ordnance handling officer and gunner.
4. Helmets for all personnel who have not completed flight deck observer qualification shall be marked (front and rear) with a "T" using 1-inch wide blue reflective tape over the existing reflective tape (front minimum 2-inch tall, rear minimum 3-inch tall lettering).
5. Helmets for all aircraft directors under instruction shall be marked (front and rear) with a "U/I" using 1-inch wide blue reflective tape evenly spaced over the existing reflective tape (front minimum 2-inch tall, rear minimum 3-inch tall lettering).
6. New requirement for ICSS is green jersey and yellow vest.
7. Yellow jersey/blue flotation vest.
8. White jersey/red flotation vest.

Plane captains will assist fueling crews during all fueling operations of their aircraft. The PC shall check primary and secondary shutoff valves. Aircraft shall be fueled per the flight plan. Any change must have approval of the Air Operations Officer. Fuel spilled on the deck due to fuel venting or failure to close dump valves is the cleaning responsibility of the plane captain.

An aircraft director is charged with the safe and effective handling of aircraft. Whether towing or taxiing, inport or underway, flight deck or hangar bay, the responsibility for safety of the move crew and the aircraft rest with the aircraft director. Sound judgement, experience, skill, and adherence to established procedures will positively affect successful aircraft handling. An aircraft director should make sure of the following:

(1). The cockpit is manned by a qualified brake rider who has checked the aircraft braking system to ensure adequate pressure for safe movement. The director must also visually verify aircraft brake pressure, when applicable.

(2). Before having the chocks and tiedowns removed, the director shall call for "brakes" and receive visual or verbal confirmation from the person in the cockpit that the brakes are being held.

NOTE

When an aircraft with inoperative brakes must be respotted, the cockpit will not be manned and chockwalkers will remain in position to chock the main wheels instantly if ordered. Movement of no-brake aircraft must be with the approval of the ACHO.

(3). All personnel except those necessary for the move are well clear of the aircraft, and those personnel necessary for the move are properly positioned.

(4). Adequate clearance exists to permit safe movement.

(5). All chocks, tiedowns, power cables and other servicing/securing devices are removed prior to moving the aircraft. Tiedowns shall not be "hung" from the aircraft.

(6). If weapons loading/downloading is in progress, assurance is received from the ordnance crew leader that the aircraft is safe to move insofar as weapons are concerned.

(7). Directors and aircraft handling team shall be equipped with whistles which they will hold in their mouths while controlling aircraft movement. The whistles and hand signals will be used to signal for brakes and chocks.

(8). The controlling director shall ensure that they are plainly visible to the brake rider.

(9). Safety observers shall be stationed as necessary to ensure safe clearance any time an aircraft will pass in close proximity (five feet or less) to another aircraft, bulkhead or other obstruction. Anyone properly equipped with a whistle and familiar with deck signals and procedures may act as a safety observer. The safety observer and the director in control of the aircraft must either have each other in sight at all times or have a second safety observer stationed in position to relay signals. At least one safety observer is required for each aircraft movement on the hangar deck.

(10). Item (9) above shall not be construed to require any individual to place their personal safety in jeopardy. This is particularly applicable at night or during periods of heavy weather.

(11). During periods of high winds or when the deck is unsteady, chockwalkers shall closely tend each main wheel. Brake riders shall apply partial brakes as necessary to prevent excess speed from building up. Caution should be exercised to ensure brake pressure remains built up during the move. When these conditions prevail, aircraft shall not be moved by hand except in cases of extreme urgency.

(12). When the word is passed to stand by for a turn, exercise extreme caution in moving aircraft.

(13). Tractor drivers shall not move an aircraft except under the positive control of a director. If a director's signal is not completely understood, the driver shall stop and await further instructions.

(14). Sudden stops by tractors towing aircraft must be avoided except in an emergency.

(15). Personnel shall not ride on tractors except in the driver's seat.

(16). Movement shall be slow enough to permit a safe stop to be made within the clear space available, and in no case faster than the chockwalkers can walk.

(17). An aircraft's tailwheel shall be unlocked only on a signal from the director.

(18). When an aircraft towbar has to be repositioned to permit a better path of movement prior to aircraft reaching interim or final spot, the aircraft shall be chocked and initial tiedowns installed prior to disconnecting the towbar.

(19). As an aircraft nears its parking spot, it should be slowed to a speed that will permit an immediate stop. Directors and safety observers are responsible for maintaining safe clearance for the tractor when maneuvering in close quarters, since the tractor driver must watch the director and is often unable to check the clearance for himself.

(20). Prior to backing aircraft to deck edge spots, chockwalkers shall be positioned so as to enable them to chock the main wheels instantly.

WARNING

Proper position to walk chocks is abreast the main wheel with adjustable block towards the aft end of the aircraft. At no time will the chock walker place himself in the direction of the aircraft wheel's travel, either forward or aft of the mainmount. The chock shall be walked on the opposite side of the brake/strut assembly. It shall be installed on the side opposite the brake/strut assembly to avoid the chock becoming jammed under the aircraft during fueling or in case of a flat tire. At no time will chockwalker carry tiedown chains while walking chocks.

(21). When the signal for brakes is given, the pilot/ brake rider in the cockpit shall immediately apply full brakes. Care must be exercised to apply brakes simultaneously, particularly when the aircraft is being moved by hand. The brake signal is a sharp blast on the whistle, accompanied by the standard visual signal.

(22). The main wheels will be chocked as soon as the aircraft stops, and the director will remain with the aircraft until the handling crew has completed the initial tiedowns. The tractor will then be unhitched and the brake rider notified by the director that he could leave the cockpit. The plane captain will thereupon inspect attached tiedowns for proper installation and ensure intermediate tiedown security.

(23). When maintenance evolutions on the hangar deck require the tails or other parts of aircraft to protrude through or otherwise foul aircraft elevator door openings, a fully PQS qualified elevator door operator shall be assigned and remain in the immediate vicinity of the elevator door control panel. The door operator will remain stationed until the aircraft maintenance has been completed and the aircraft has been respotted clear of the elevator doors' path of travel. Aircraft maintenance conducted in these areas shall never be such that it will preclude movement to clear elevator doors in an emergency.

(24). When parking aircraft on the hangar deck, allow clearance for access to, and operation of, lightwater and salt water stations, as well as for the operation of hangar bay doors.

(25). Reverse tow of properly configured aircraft is authorized when using locally established procedures.

<u>CAUTION</u>

Special precautions are required when aircraft are parked over elevator/barricade stanchions, JBD's, elevators, catapult tracks, or with tail skag outboard of the deck edge. When aircraft are spotted adjacent to an elevator, tiedowns shall not be attached to the elevator. Tiedowns shall never be attached to catapult tracks, holdback fitting cleats, or bridle arrestor tracks.

ELEVATOR OPERATION

Operating an aircraft elevator for the purpose of aircraft movement must be a planned, well executed evolution by both flight deck and hangar deck handling crews. Inaccurate spotting of an aircraft by either crew or sloppy handling procedures can lead to disastrous results.

Elevator operation must be coordinated with the maneuvering of the ship. Only qualified and designated personnel must operate an aircraft elevator. A director/elevator safety petty officer must supervise operation of the elevator any time it is being raised or lowered. He or she must be plainly visible to the elevator operator at all times. When operating an elevator, the director must verify that any aircraft on the platform are properly secured and configured for the elevator movement.

CAUTION

If weapons loading/downloading is in progress, the director must receive assurance from the ordnance crew leader that it is safe to move the elevator insofar as weapons are concerned.

When the word is passed to standby for a turn, deck edge elevators on the side opposite the direction of turn, if not already at flight deck level, must be raised as soon as feasible.

Any delays must be reported immediately to the bridge. When aircraft are being parked on deck edge elevators, the ACHO must consider the sea state and wind velocity in determining the degree of security required.

WARNING

Extreme caution must be exercised when operating deck edge aircraft elevators during high winds and/or heavy seas.

When sending aircraft to the hangar deck, flight deck directors should position the aircraft on the elevator so that it can be towed directly into the hangar bay without repositioning.

Elevators and stanchions should not be operated in the automatic mode. Guardrail (stanchion) and elevator operations are two distinctly separate functions that require coordination. Before signaling the elevator to be raised or lowered, the director must check the stanchion for clearance, then signal for it to be raised or lowered. If obstructions prevent raising of stanchions to full height, the positions desired will be indicated before commencement of the evolution. The elevator operator will then sound the warning horn, check to ensure that all personnel are clear, and raise the stanchion. As soon as the stanchions are up, and after ensuring locks are retracted, the director will signal for the elevator to be raised or lowered. If the stanchions are inoperative, safety observers must be stationed near the elevator to warn approaching personnel, and a temporary safety line will be rigged as quickly as possible. The warning horn must be sounded three times before elevator movement, and continuously throughout the elevator cycle. On low-speed operations, warning horns will sound a 5 to 10 second blast every 20 to 30 seconds. After the stanchions have been raised or the warning given, no person is to board or leave the elevator.

WARNING

- Extreme caution is necessary when operating aircraft elevators when stanchions are inoperative.
- Elevators must NOT be operated without two-way communication, either verbal or visual, between operators.

Elevators will remain at hangar deck level for as short a time as possible. An elevator carrying an aircraft to the hangar deck must NOT be lowered until it has been determined that a crew is standing by to remove the aircraft from the elevator as soon as it arrives at hangar deck level.

Except during launch and recovery, when full flight deck gear must be worn, all personnel who ride an elevator between the flight deck and hangar deck when the ship is underway must wear flotation gear.

REPORT OF DAMAGE TO AIRCRAFT

Any damage to an aircraft, no matter how slight, must be immediately reported to the safety officers, ACHO, flight deck officer, or hangar deck officer, who will immediately report the incident to the air officer and inform the air wing maintenance liaison representative. The aircraft must NOT be flown until it has been inspected and declared to be in an "Up" status by authorized squadron personnel.

The flight deck officer and hangar deck officer maintain a record showing director's name, model aircraft, bureau number, and a brief summary of the aircraft damaged, regardless of the extent of damage. Reports of these occurrences must be made according to OPNAVINST 3750.6 and COMNAVAIRPAC/ COMNAVAIRLANTINST 3100.4.

TAXIING OF AIRCRAFT

CAUTION

You should never attempt to give signals to an aircraft that is not under your command.

In operations requiring taxiing of aircraft, directors are stationed at intervals of 50 to 100 feet along the flight deck. The director must be in a position to give the pilot an unobstructed view of the signals. The visual stance of an experienced director ready to take over control of an aircraft is with one arm high overhead and palm forward. (See figure 3-1, signal No. 52.) This not only aids the pilot in recognizing the director but also puts the director in a position to render practically any taxi signal with a minimum of movement. The director retains control of the aircraft only while it is in their area of control. The director then passes control to the next director in line on the deck by means of the turnover-of-command signal. See signal No. 3 of figure 3-1.

For more information on aircraft signals, you should refer to the *Aircraft Signals NATOPS Manual*, NAVAIR 00-80T-113, or the *CV NATOPS Manual*, NAVAIR 00-80T-105.

DIRECTING TAXIING AIRCRAFT

During flight operations, the speed with which aircraft can be launched or landed depends largely upon the efficiency of the plane directors. Aircraft must often be moved expeditiously, often within inches of the edge deck and within inches of other aircraft. Mistakes by directors under these conditions usually prove costly.

When launching, aircraft must be moved out of the spotting area and spotted on a catapult or in the takeoff spot. When an aircraft lands, it must be released from the arresting gear, moved forward, and spotted to make room for the next aircraft to land. Since time is an essential factor in these operations, aircraft are generally taxied to the desired location. Plane directors are charged with the responsibility of directing these taxiing aircraft to their proper spots.

Three of the most important rules for you to remember in directing taxiing aircraft are as follows:

1. Make sure the pilot can see the signals. The standard position for the director is slightly ahead of the

aircraft and in line with the left wing tip. On carriers, it is often necessary to direct aircraft from other positions. A foolproof test of whether or not signals are visible to the pilot is "if you can see the pilot's eyes, the pilot can see your signals."

2. The person being signaled must understand the signals, know them thoroughly, and use them in a precise manner. Indistinct signals or confused execution of signals will lead to casualties. Do not walk while taxiing an aircraft.

3. When jet aircraft are taxied, extreme caution should be used to prevent personnel from being caught in the jet blast exhaust and being severely burned or blown overboard. Other aircraft and/or support equipment could suffer a similar fate.

SPOTTING AIRCRAFT

All carriers have a basic spotting order. The aircraft are spotted for launching in approximately the same location each time. This spotting order varies from carrier to carrier to suit the flight deck layout. Certain aircraft must be spotted in a specific location to permit servicing, loading of ammunition, starting, maintenance, and so forth. The spotting of large aircraft should be such that the aircraft does not interfere with the movement of other aircraft or where they do not need to be moved during launching or recovery operations.

Before each launching operation, a briefing is held by the ACHO. All flight deck directors and spotters attend this briefing. During the brief, specific launch procedures and sequences are given. The disposition of aircraft that go down during the launch is determined, and directors and spotters are informed as to their specific part of the operation. Once the brief is completed, the Fly Petty Officers (Fly PO's) inform their crew of the launch details. When briefing for the first launch of the day, details of the recovery are also included. As soon as the last aircraft has left the deck, the previous launch must be recovered. The crews must also be aware that the need for a ready deck may arise at any time because of an emergency situation. While actual operational procedures will vary from ship to ship, the Fly PO typically is responsible for correctly spotting each aircraft within their respective Fly.

LAUNCHING AIRCRAFT

Using the flight schedule, the aircraft status board, and advice from the air group maintenance officer as to what aircraft may be ready, the ACHO assigns the aircraft by side number to the scheduled launch. After making the decision as to which aircraft to use, the ACHO, using the Ouija (wee-gee) board, determines the best location for the GO aircraft.

A typical aircraft carrier launch spot has aircraft spotted along the deck edge, island structure, on aircraft elevators, and in the six-pac. Some aircraft may be spotted on the catapults or in the "ready" position behind the catapults, clear of the JBD's.

When in a turn-up position, the engine exhaust should go outboard over the side of the deck whenever possible.

During a launch, some of the GO aircraft could be spotted on the hangar deck, brought up to the flight deck on the aircraft elevator during the launch, and started.

A launch spot sheet prepared by the ACHO is used to indicate the location of the aircraft, also up and down traffic for the aircraft elevators, as well as some special maintenance requirements such as a tail over deck (TOD), and a birdcage over deck (BCOD). A copy of the sheet is given to each director on the flight deck. This spot sheet may include specific notes for launching sequences.

Catapult Launching

The takeoff requirements of jet aircraft necessitate the use of the catapult for launching. With the use of modern catapults, the time interval between the last launch and the next launch depends more on the flight deck directors and catapult spotters than on the catapults. The most experienced directors are assigned as catapult spotters. There is no room for the smallest error by the spotter if a good launch interval is to be maintained.

Nose Gear Launch

The nose gear launch equipment is designed to assist in launching aircraft by means of attaching the nosewheel strut to the towing mechanism of the catapult. This means of launching aircraft permits a positive and automatic engagement of aircraft to the catapult and a smooth and rapid operation.

CATAPULT SPOTTING. The catapult spotter taxies the aircraft to the mouth of the approach ramp. The launch bar is then lowered to engage the aircraft to the approach ramp. This provides positive steering into the buffer assembly.

CAUTION

Taxi speeds into the nose gear launch assembly must NOT exceed 4 knots. This is approximately equal to a normal walking pace, and is considered the maximum taxi speed for any aircraft to engage the nose gear launch assembly.

AIRCRAFT HOOKUP. The aircraft engages the nose gear launch assembly (buffer) and is taxied forward until the launch bar is positioned in front of the shuttle spreader. Upon signal from the catapult hookup petty officer, the catapult spotter then gives the **TENSION AIRCRAFT** signal. The hookup petty officer will then closely observe the launch bar in relation to the shuttle spreader to ensure correct positioning of the launch bar. See figure 3-9.

When an aircraft is being spotted on the catapult in preparation for launch, the following procedures are used:

1. The catapult officer informs the director when to start bringing the aircraft on the catapult before the first launch.

2. As the aircraft is positioned on the catapult, the squadron's aircraft inspector inspects the aircraft to make sure that it is properly configured and ready for flight. They give a THUMBS UP signal (day) or display a blue wand held vertically (night) to indicate that the aircraft is ready for launch. The aircraft inspector continuously displays this signal at a position from which clearly visible to the launching officer. Should an aircraft inspector want to prevent the aircraft from being launched, they immediately gives a SUSPEND signal (day) or display a blue wand moved horizontally (night) to the director or launching officer who has control of the aircraft at the time the discrepancy is discovered.

WARNING

Aircraft must NOT have the launch bar over the shuttle spreader until the aircraft is armed and properly configured for flight.

3. In positioning an aircraft on the catapult, the director must be acutely aware of the activities of the catapult crewmembers. The director must control the aircraft's speed and movement in such a way that personnel safety will not be jeopardized. Pilots must guard against the tendency to add excessive power, which invariably results in roughness and poor control and jeopardizes launching accessories.

4. The aircraft is directed to the mouth of the approach track. See view A, figure 3-10. As soon as the aircraft's nosewheel reaches the aft end of the approach track, the director gives the pilot the **APPLY BRAKES** signal, (signal No. 10, fig. 3-1). The director then stops the aircraft at the entryway area of the guide track. The holdback man attaches the holdback bar if it is not previously attached.

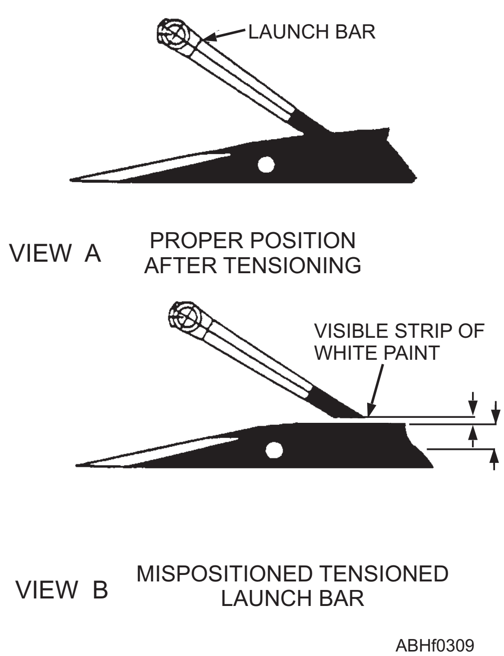


Figure 3-9.—Launch bar and shuttle spreader. A. Correct positioning. B. Incorrect positioning.

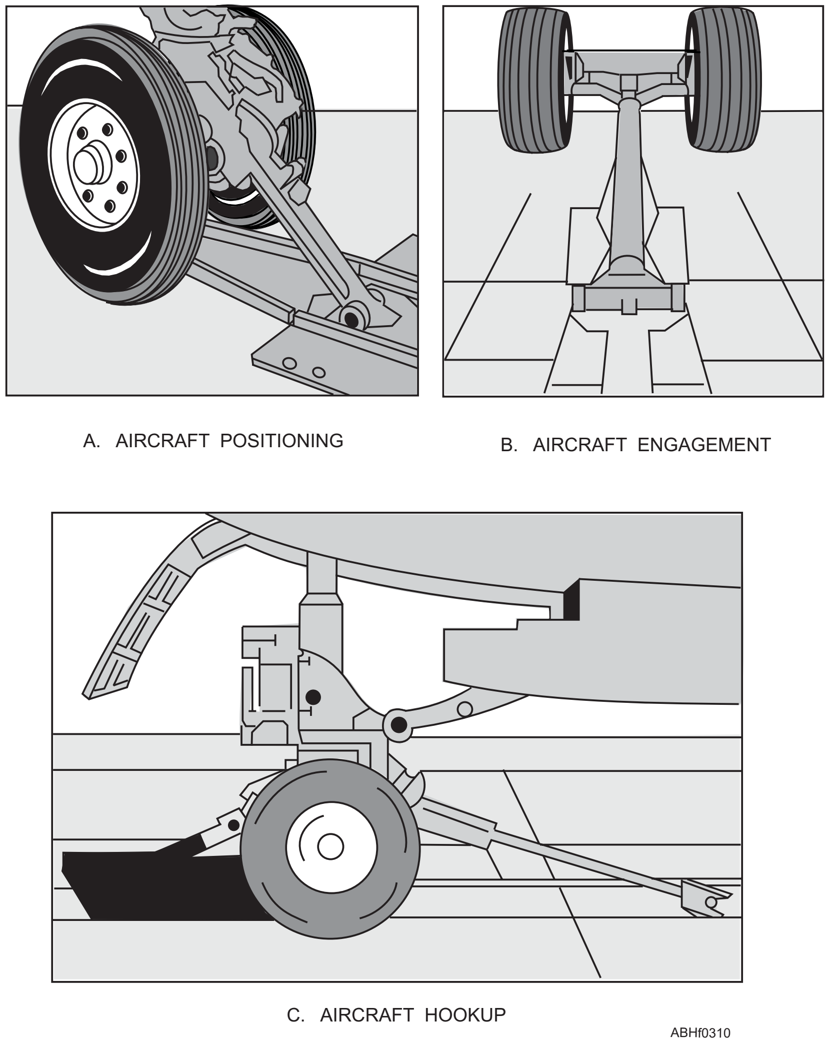


Figure 3-10.—Nose gear launch operation. A. Aircraft positioning; B. aircraft engagement; and C. aircraft hookup.

5. The director signals the pilot and hookup petty officer, where applicable, to lower the launch bar (signal No. 2 of fig. 3-2). The launch bar is then lowered.

6. The director makes sure the nose gear launch equipment is ready.

7. The director gives the pilot the **RELEASE BRAKES** signal (signal 10 of fig. 3-1) and the **TAXI FORWARD** signal (signal No. 8 of fig. 3-1).

NOTE

When ordnance is to be armed, the aircraft is stopped before full buffer penetration with the launch bar resting on top of the shuttle. All hookup personnel should clear the area until arming procedures are complete. When the area is cleared, the director signals the pilot forward to hookup position and the hookup petty officer to return under the aircraft.

WARNING

Squadron aircraft inspectors must **NOT** perform inspections while an aircraft is taxiing. To prevent injury, they must remain well clear of rolling tires at all times.

8. The aircraft taxies forward and the launch bar lugs slide into grooves in the guide track. The grooves in the guide track contain and align the launch bar, and the steering of the aircraft is thus controlled. As the aircraft continues forward, the launch bar contacts the buffer hook actuator, causing the buffer hook to be

raised above the deck level. The aircraft continues at the same velocity until the holdback bar engages the buffer hook (fig. 3-10, view B).

9. Aircraft hookup is achieved as the launch bar is seated in the throat of the spreader assembly during aircraft tensioning (fig. 3-10, view C.)

10. When the aircraft reaches the hookup position, the hookup petty officer visually checks that the launch bar has dropped into proper position in front of the shuttle spreader. Should the bar fail to drop, the hookup petty officer directs a catapult crewmember to manually depress it to ensure hookup.

WARNING

You should make sure that the launch bar is properly positioned so that it will engage the spreader cutout when tension is applied.

11. When the aircraft is ready for tensioning and upon signal from the hookup petty officer, the director gives the **TENSION AIRCRAFT** signal to the deck edge control-panel operator and/or the ICCS operator and the pilot. See signal No. 5 of figure 3-2.

12. Upon seeing the director's **TENSION** signal, the pilot increases engine thrust to the level authorized by the applicable NATOPS aircraft manual.

13. The deck edge control panel operator or the ICCS operator checks the panel to make sure no catapult suspend lights are on. He presses the bridle tension push button, and advises the main control console operator by sound powered phone, saying the words *taking tension*. Under normal conditions, this is the last word passed over the sound powered phones until the launch is complete and the next launch cycle begins.

WARNING

After tension is taken on an aircraft having a launch bar selector switch, the pilot must NOT place the switch in the **OFF**, **ABORT**, or **RETRACTED** position until he receives the **RAISE LAUNCH BAR** signal from the director. See signal No. 3 of figure 3-2.

14. After tension has been applied and all personnel have cleared the area, the hookup petty officer must positively determine that the aircraft launch bar is properly seated in the shuttle spreader and verify that tension has been applied. He or she then gives the **GO** signal (thumbs up) to the director and the catapult officer. See signal No. 19 of figure 3-2.

NOTE

When an aircraft has a launch bar selector switch, the director, upon receiving the **GO** signal (thumbs up) from the hookup petty officer, gives the **RAISE LAUNCH BAR** signal to the pilot. See signal No. 3 of figure 3-2. The pilot then places the launch bar selector switch in the appropriate position.

15. When the director is satisfied that the aircraft is ready for launching and the catapult area is clear, he or she passes control of the aircraft to the catapult officer by giving the **PASS CONTROL** signal. See signal No. 21 of figure 3-2.

WARNING

Should there be any doubt in the minds of the topside safety petty officer, director, squadron aircraft checker, or any other individual on the flight deck as to satisfactory hookup, aircraft configuration or proper catapult condition, they will so indicate to the catapult officer or for ICCS operations the catapult safety observer by initiating a crossed arm **SUSPEND** signal (day) or horizontal wand movement (night). See signal No. 12 of figure 3-2.

16. Any person who sees a situation that warrants a SUSPEND must immediately signal **SUSPEND** to the launching officer/catapult safety observer. Any person who observes the SUSPEND signal must immediately repeat the signal.

17. Any person who observes any unusual conditions during the launch, such as objects falling from or striking the aircraft, must immediately report the facts to responsible personnel.

For detailed information on nose gear launch procedures, you should refer to the following manuals:

- CV NATOPS Manual, NAVAIR 00-80T-105.
- Air Department Standard Operating Procedures (SOP), COMNAVAIRPAC/COMNAVAIRLANTINST 3100.4.
- Mk 2 Nose Gear Launch Equipment, NAVAIR 51-25-19 are available in the V-2 division maintenance office.

NOTE

All ICCS operations follow the procedures outlined in *CV NATOPS*.

RECOVERY

When the last aircraft has been launched, the remaining aircraft in the landing area of the deck must be moved. An alternating red and white striped line on the deck, known as the FOUL LINE or safe parking line, separates this area from the rest of the deck. No portion of any equipment or aircraft should be in this area. All personnel except those specifically authorized to enter the landing area must remain back of this line during landing operations.

A tow tractor is always kept in a ready condition during landing operations to tow aircraft that have blown tires or some other condition that prevents them from being taxied from the landing area.

A basic spot is used for recovered aircraft much in the same manner as in the launching spot. Experience with spotting the different aircraft assigned to the ship determines this spot. As an exact landing sequence cannot be determined in advance, the directors must take the aircraft as they come aboard and spot them in the most feasible location.

When it is possible to determine in advance which aircraft are going to be in a DOWN status upon landing, it may be possible to send them to the hangar deck.

EMERGENCY RECOVERY EQUIPMENT

Barricades are that part of the emergency recovery equipment used for the emergency arrestment of aircraft that, because of battle damage or tailhook or other mechanical failure, cannot make a normal (pendant) arrested landing. The makeup of barricades includes the following basic items or parts of concern to the ABH: barricade nylon webbing, port/starboard stanchions, and deck ramps. See figures 3-11 and 3-12.

The barricade has expendable webbing assemblies that are stretched across the flight deck between the port and starboard stanchions.

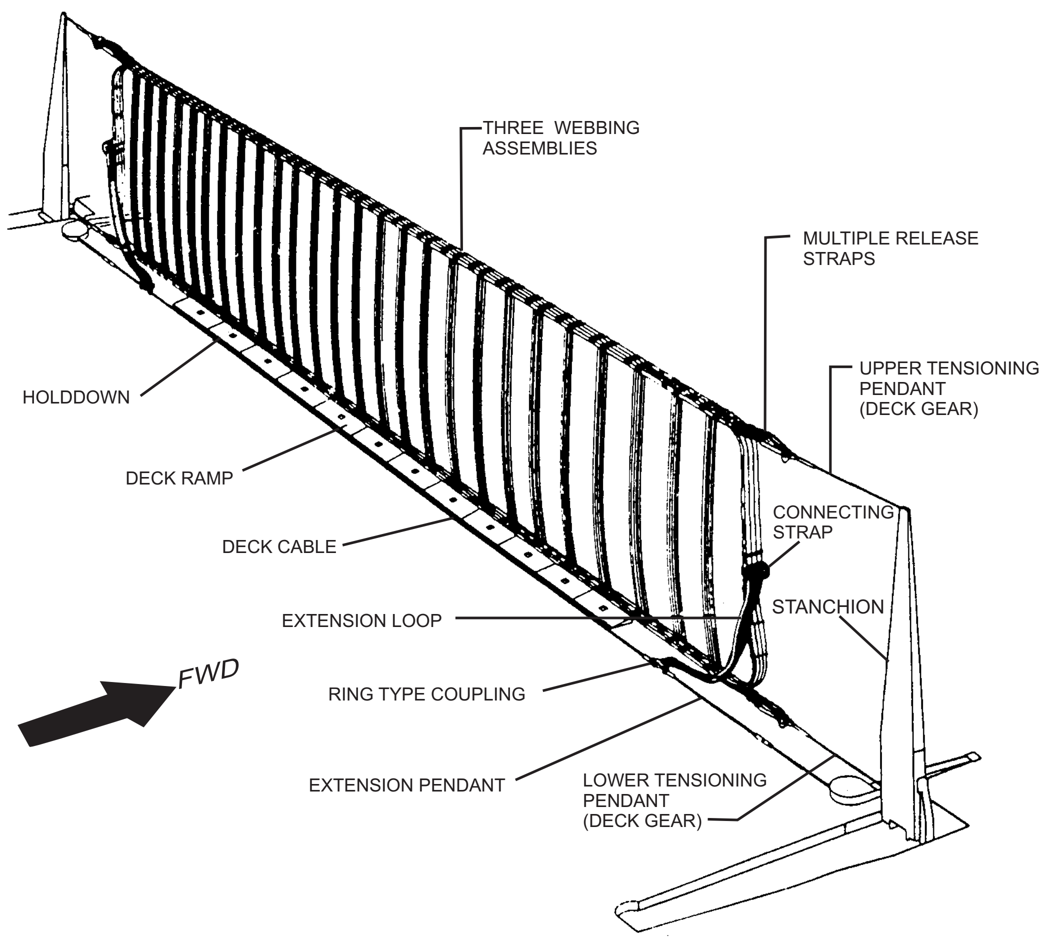


Figure 3-11.—Typical barricade in the ready position.

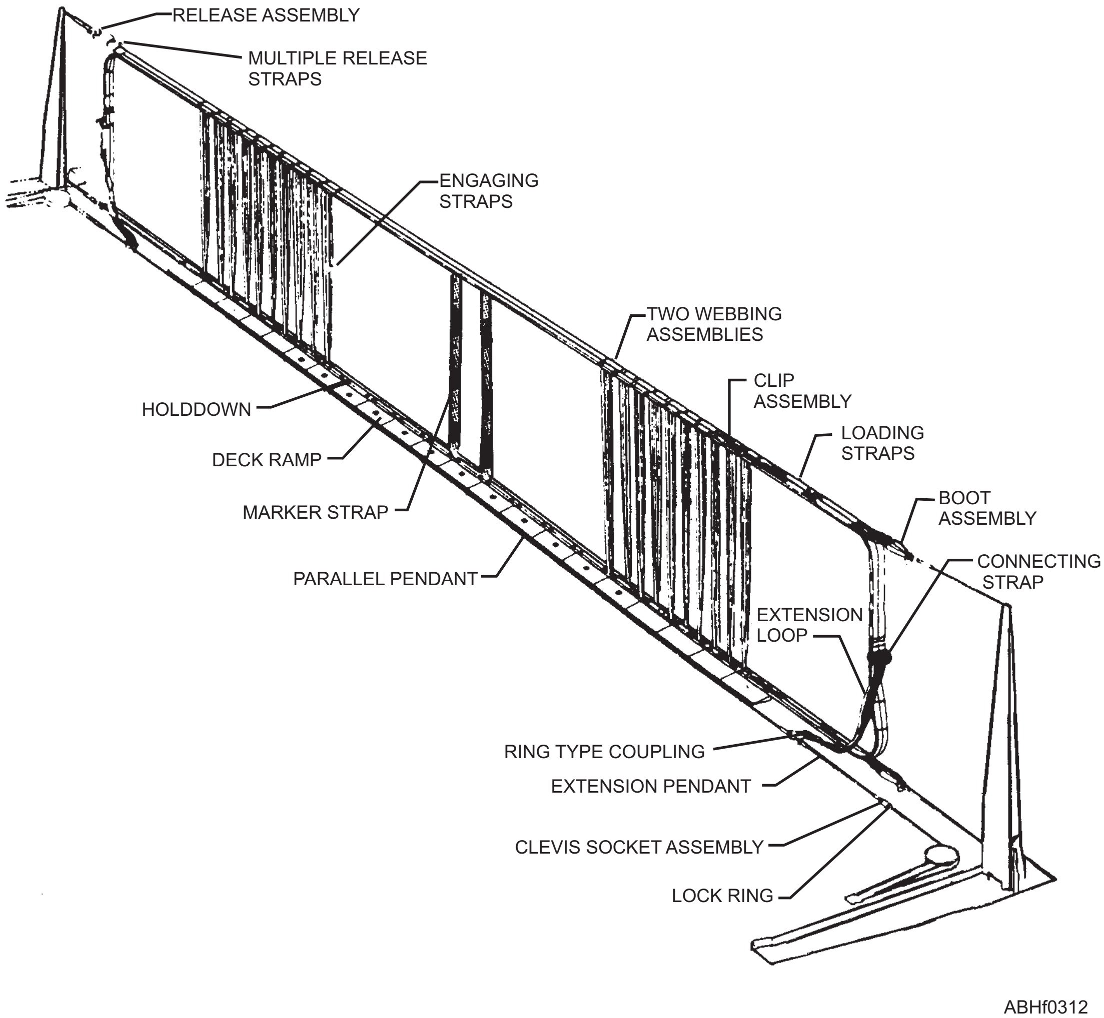


Figure 3-12.—E-2/C-2 aircraft barricade installation.

V-1 division personnel working in conjunction with V-2 division personnel assist in the initial preparations of the barricade; for example, securing the deck ramps, pulling out the webbing, and directing all flight deck personnel in this evolution.

The barricade is normally in a stored position below decks. The webbing and cross-deck pendant are removed from stowage by use of a tow tractor when a barricade is to be rigged. Then they are stretched across the flight deck between the stanchions and secured to the upper and lower tensioning pendants (fig. 3-11). The extension pendants are secured to the purchase cable couplings. The deck ramps are clamped into place on the flight deck, and the lower loading straps are tucked under the U-shaped hold-downs. There are 12 portable deck ramps. They should be numbered 1 through 12 from port to starboard. They should be large enough to facilitate easy identification and placement in corresponding positions on the flight deck.

The purpose of the deck ramps is to ensure that the aircraft landing gear does not become entangled with or damage the lower load straps during approach and engagement of the barricade.

The barricade stanchions (fig. 3-11) are then raised to a vertical position by the V-2 division arresting gear personnel at the deck edge station.

During the aircraft arrestment, the wings of the aircraft engage the barricade webbing, which transmits the arresting force to the barricade engine located below decks. Following a barricade arrestment, the webbing and deck cables are discarded.

A double barricade webbing assembly (fig. 3-12 has been specially designed for the E-2/C-2 turboprop type of aircraft only. This limits the amount of damage to the aircraft by allowing clearance for the aircraft propellers to pass through the center section of the webbing assembly. The red straps in the center of the

E-2/C-2 barricade webbing assembly are designed for the pilot to align his aircraft with the center of the barricade.

During training exercises and underway training, a practice barricade is used. The "ready" barricade is only rigged when required for actual aircraft barricade arrestment.

After all aircraft have landed, the flight deck is respotted by the handling crews for the next launch. Tractors are used to tow the aircraft aft. When the refueling and rearming are completed, the carrier is again ready to launch aircraft. The entire procedure from launch to landing and respotting takes less than 90 minutes. For precise instructions on the proper training and operating procedures for carrier (CV/CVN) flight operations, you should refer to the CV NATOPS Manual, NAVAIR 00-80T-105, and to the Air Department Standard Operating Procedures (SOP), COMNAVAIRPAC/COMNAVAIRLANTINST 3100.4. Should conflict exist between the training and operating procedures, the CV NATOPS Manual, NAVAIR 00-80T-105 will govern.

RESPOTTING AIRCRAFT

The respotting of aircraft on the flight deck becomes an exercise in cooperation with personnel of the refueling and rearming crews, squadron personnel, and the plane handlers. The servicing, maintenance, and re-arming of the aircraft start as soon as the first aircraft recovered is spotted, and continues through the recovery and respotting periods. Due to the various respot requirements of carrier aircraft, the plane director has basic control over the respot operation. The director must decide if the servicing or other operation on the aircraft is to be continued or halted. Servicing and maintenance must not be allowed to interfere with the orderly flow of aircraft during the respot; however, servicing and maintenance should not be stopped unnecessarily.

During the respot, "down" aircraft that would interfere with operations may be sent to the hangar deck. Aircraft in an "up" status that are needed for the next launch may be brought to the flight deck. Respotting of aircraft on the hangar deck for maintenance may be done at this time. It may be necessary to bring some of these aircraft to the flight deck temporarily to have room to respot the hangar deck. Aircraft undergoing an engine change or check require additional space for the work to be done. For some jet aircraft, this requires considerable space. No aircraft maintenance that prevents the aircraft from being moved is undertaken without the approval of the hangar deck officer and the ACHO, no matter how much or how little time is required for the work.

AIRCRAFT TOWING

When directing aircraft that are being towed, the director uses verbal orders, signals, and a whistle in directing the tow vehicle operator and the man in the cockpit. All directors, safetymen, and tow vehicle operators wear whistles on a lanyard. A blast on the whistle is equivalent to the **STOP TAXI** signal.

After the aircraft has been properly attached to the tow vehicle, the director makes sure that all persons involved in moving the aircraft are at their stations and that all other personnel are well clear of the aircraft. After ensuring that all tiedowns have been removed from the aircraft, the director then directs the chock walkers to remove the chocks; and the tow tractor driver, under the control of a director, tows the aircraft away.

When a director's signal is not completely understood, the driver should stop and await further instructions.

As an aircraft nears its parking spot, it should be slowed to a speed that will permit an immediate stop. Directors and safety observers are responsible for maintaining safe clearance for the tractor when maneuvering in close quarters. Since the tractor driver must watch the director, members of the move crew are responsible to check the clearance throughout the evolution. The aircraft director in control directs the movement of the aircraft into the final spot. Sudden stops by tractors towing aircraft must be avoided except in an emergency.

When an aircraft towbar has to be repositioned to permit a better path of movement before the aircraft reaches an interim or final spot, the aircraft must be chocked and initial tiedowns installed before the towbar is disconnected from the tow tractor.

When the signal for brakes is given, the brake rider in the cockpit must immediately apply full brakes. The brake signal is a sharp blast on the whistle accompanied by the standard visual signal.

The main wheels are chocked as soon as the aircraft stops, and the director remains with the aircraft until the handling crew has completed the initial four-point/six-point tiedown. The tractor is then unhitched, and the director will inform the brake rider that they may leave the cockpit. Where possible, the towbar should remain attached to the aircraft.

HANGAR DECK SPOTTING

The hangar deck officer is responsible for the movement of all aircraft from, onto, and on the hangar deck. The movement of any aircraft is coordinated through the ACHO.

There are two types of spotting that concern the hangar deck handling crews: operational spotting and maintenance spotting.

OPERATIONAL SPOTTING. Aircraft that are not needed for a launch are sent to the hangar deck to increase the amount of room for operations on the flight deck. These aircraft are normally needed for the next launch and must be readily available to be sent back to the flight deck. Care should be taken in choosing their spots so that this movement is not blocked.

Information as to the "up" or "down" status of the aircraft must be given to the hangar deck officer at or before the time that the aircraft is sent to the hangar deck. At times, it may be necessary to send some aircraft from the hangar deck to the flight deck and then return them to the hangar deck with the additional aircraft. This is to prevent burying "up" aircraft behind "down" aircraft.

Servicing of some aircraft is also required on the hangar deck. Spotters of the aircraft must take this into consideration. Care must be taken to prevent crunches while moving the aircraft. Care must also be taken in the spotting so that overlapping wing and tail surfaces are not forced together because of the increase in weight of the aircraft when fuel is put into the tanks of the aircraft. The reverse can happen when defueling an aircraft and its wing is on the bottom.

MAINTENANCE SPOTTING. The spotting of aircraft for maintenance on the hangar deck is the largest problem of the hangar deck crews. The condition of the aircraft undergoing a check or extensive maintenance or repair may prevent it from being moved. When the aircraft must be placed on jacks, only a certain area of the hangar deck is used because of the low overhead in most areas.

GENERAL SAFETY PRECAUTIONS

In naval aviation, approximately 10 persons are required to keep each aircraft in a flyable condition. Included among these personnel is the aircraft handler (ABH), whose job is equally as important as that of any of the other nine persons. This is especially true aboard carriers, where space is so limited and where many hazards are involved in the movement of aircraft.

Nearly all aircraft handling mishaps/incidents are the result of poor supervision, disinterest, and/or disregard of applicable handling instructions.

Some of the safety precautions to prevent dangerous and costly accidents during flight operations aboard carriers are listed below:

1. The most important safety precaution to remember is that personnel (yourself or those under your supervision) should never be allowed to operate any machinery or equipment before being thoroughly checked out (PQS qualified) on all safety and operating instructions for that machinery or equipment.

2. The deck is considered foul any time unauthorized personnel are in or around aircraft parked in the safe parking area aft of the island.

3. During flight operations, no personnel except those authorized and required are to be on the catwalks, on the flight deck, or in the catapult or arresting gear engine rooms or pilot landing aid television (PLAT)/fresnel lens optical landing system (lens) room without the express permission of the air officer.

4. Personnel should NEVER stand or otherwise block entrances to the island structure or exits leading off the catwalks.

5. PERSONNEL SHOULD NOT TURN THEIR BACKS ON AIRCRAFT LANDING OR TAXIING OUT OF THE ARRESTING GEAR.

6. While taxiing aircraft out of the arresting gear, directors must be aware of the activities of the hook runner.

7. While directing aircraft, the director must exercise care to remain in plain view of the pilot at all times. If the pilot loses sight of his director, he must STOP immediately.

8. Except to prevent a mishap, no director should give signals to a pilot who is being controlled by another director.

9. While working in or around where aircraft are being launched, recovered, taxied, or towed, never allow yourself to become complacent to the point of permitting unsafe conditions to exist. Complacency is one of the major causes of aircraft mishaps/incidents in handling aircraft.

10. Make sure that the brakes are manned before moving an aircraft.

NOTE

If an aircraft with inoperative brakes is to be respotted, the cockpit must NOT be manned, and the chock walkers must be in position to chock the main wheels instantly when ordered.

11. Use the proper towbar for the aircraft that is being moved.

12. Wing and tail walkers are used in all movements.

WARNING

The proper position to walk chocks is abreast the main wheel with adjustable block towards the aft end of the aircraft. At no time will the chock walker place himself in the direction of the aircraft travel, either forward or aft of the main mount. The chock is walked on the opposite side of the brake/strut assembly. It must be installed on the side opposite the brake/strut assembly to prevent the chock from becoming jammed under the aircraft during fueling or in case of a flat tire.

13. Chock walkers are used at all times in case the aircraft is to be stopped without brakes or in the instance where brakes fail. Chock walkers are used when backing an aircraft to the deck edge spots.

14. Never move an aircraft when there is doubt as to its clearance.

15. Watch for unexpected ship movement, which could affect the aircraft being moved.

16. When handling aircraft on and off elevators, you must be extremely cautious, because the aircraft are at the extreme edge of the deck and there is always the danger of losing one over the side.

17. Make sure the elevator is in the full up or down position before moving an aircraft on or off it.

18. Because of the small confines of the hangar deck, it is of the utmost importance that aircraft be moved with extreme caution. Make sure hydraulic brake fluid pressure is available and is sufficient to safely accomplish the handling operation required. The qualified brake rider signifies that he has checked the aircraft brakes, that adequate braking pressure is available, and that the brakes appear to be in proper working order.

19. The handling of other equipment around aircraft must always be performed with utmost care.

20. Before moving an aircraft that has a tail wheel, make sure that the tail wheel is unlocked.

21. Be particularly careful when moving a jet that has been started. Make sure that all personnel are clear of the jet engine exhaust blast and engine intakes.

22. Stay clear of the landing area unless you are part of that operation.

23. Be alert when you are working around aircraft; never daydream during the handling of aircraft.

24. Keep a constant vigilance for co-workers; many mishaps have been avoided in this manner.

25. When an aircraft is stationary, make sure that aircraft wheel chocks are always used.

26. For personal protection and to prevent damage to aircraft, you should always wear articles of flight deck clothing in the following manner:

- Helmets on and buckled, goggles down over eyes
- Flight deck jerseys on with sleeves rolled down
- Life vest on and fastened, and safety shoes

27. Be alert for slick deck areas that are often caused by the spillage of oil, hydraulic fluid, JP-5 or poor non-skid areas. Clean spillage from the deck as soon as possible.

CAUTION

Aircraft with wings folded are NOT to be spotted, towed, or taxied immediately behind a jet blast deflector when another aircraft is at high power (turn up) on the catapult.

For your information, the naval aviation safety review magazine *Approach* (NAVAIR 00-75-510) is published monthly and distributed on the basis of one copy for every 10 persons. It presents the most accurate information currently available on the subject of aviation mishap prevention.

Approach reports the results of mishap investigations. It points out those mishaps that are a result of carelessness on the part of personnel and describes what was done wrong and how it should have been done. It suggests corrective measures to prevent future mishaps due to these causes. In short, you as an ABH who reads and heeds the messages in *Approach* can benefit from other ABH's experiences.

Q5. When chocking a wheel, the adjustable end of the chock should be placed toward what end of the aircraft?

Q6. What is the name of the sheet that indicates aircraft status for respotting purpose?

Q7. What signal should be given to prevent a catapult launch?

SECURING AIRCRAFT ABOARD CARRIERS

OBJECTIVES: Identify the four types of tiedown configurations. Recognize basic securing requirements for support equipment.

The importance of properly securing and handling aircraft aboard carriers cannot be overstressed. The aircraft MUST be secured in a manner that prevents fore-and-aft and athwartship movement. The reasons for this are (1) the pitch and roll of the ship, caused by heavy seas; (2) the list of the ship, caused by maneuvering, particularly when making high-speed turns; and (3) aircraft are parked on the flight and hangar decks with a minimum of clearance between them.

Adjustable chock assemblies are used to block the main landing gear of all aircraft. The chocks should be in position at all times when the aircraft is not being moved. They should be removed only upon command from a plane director. Both ends of the chock should be positioned snugly against the wheel, with the adjustable end toward the rear of the plane. This assures easy removal when engines are turning up and the wheel is set hard against the forward end of the chock.

Pad eyes are provided on both the flight and hangar decks and on the aircraft elevators for securing aircraft.

TIEDOWN REQUIREMENTS

Tiedown assemblies are used to secure aircraft aboard aircraft carriers. These assemblies are equipped with hook attachments for pad eye fittings. The preferred method of installation is with the chain end hook in the deck fitting (pad eye) with the hook pointing up. When aircraft are being secured, four or more of the assemblies are used, depending upon scheduled operations and weather conditions. The TD-1A/B tiedown assemblies are used to secure aircraft aboard carriers and are discussed in chapter 2 of this RTM. When aircraft are being secured, the number of tiedowns required is directed by the ACHO, who uses the following table as a minimum guideline.

TIEDOWN REQUIREMENTS

Aircraft Type	Initial	Intermediate	Permanent	Heavy Weather
E-2*, C-2*, F-14*, EA-6, F-18, S-3	6	9	12/14*	18/20*
AV-8, H-3, H-46, H-53, H-60	4	6	12	16

* Requires more tiedown chains

Insert 3-1.—Tiedown requirements.

These tiedown requirements are provided as a *minimum* guide and may be increased as necessary for safe handling operations of shipboard aircraft. Tiedown procedures for specific aircraft are given in the applicable NATOPS, HMI, or MIM. Attachment points of most aircraft are included in the *Air Department Standard Operating Procedures (SOP)*, COMNAVAIRPAC/COMNAVAIRLANTINST 3100.4.

EQUIPMENT SECURITY

Mobile equipment should be parked fore and aft with one rear wheel chocked and the parking brake set (as applicable). Crash vehicle(s) should be parked as prescribed by the flight deck boatswain. They must have a minimum of two tiedowns (one forward and one aft) with the rear wheel chocked. The mobile cranes are parked as prescribed by the flight deck boatswain and are secured with a minimum of thirteen tiedowns. All rolling stock such as air conditioners and nitrogen carts must have their parking brakes set (as applicable) and a minimum of two tiedowns tending fore/aft or athwartship position to prevent movement.

When not at flight quarters, mobile equipment should be "packed" fore and aft and vehicles at each end secured with two tiedowns running toward the pack. All vehicles must have one rear wheel chocked and the parking brake set (as applicable). During heavy weather, these requirements will increase as directed by the ACHO.

All aircraft will be tied down as directed by the ACHO or his representative. Unless otherwise specified, chain tiedowns are used exclusively. Tiedowns must run from a proper tiedown fitting on the aircraft to a pad eye on the deck without pressing against oleo struts, hydraulic lines, tires, or any other portion of the aircraft. When an aircraft is spotted adjacent to an elevator, tiedowns must NOT be attached to the elevator. Tiedowns also must NEVER be attached to catapult tracks or holdback fitting cleats.

Tiedowns are removed only when an aircraft director signals such action. They are affixed to aircraft to prevent movement in any direction, which requires that they tend to oppose each other. They should be as equally distributed on the aircraft as possible.

For an aircraft carrier, tiedown requirements are divided into four categories as defined by the following:

Initial Tiedown. This condition of aircraft security exists immediately prior to aircraft movement from spot and immediately after aircraft is parked. "Initial tiedown" installation after recovery or respot is the responsibility of the plane handling crew. Prior to launch, intermediate tiedown requirement may be reduced to initial tiedown condition by the plane captain upon direction of a qualified aircraft director. As a minimum, initial tiedowns are required for all refueling operations.

Intermediate Tiedown. This condition of aircraft security shall exist during flight quarters when an aircraft can expect to be moved, when an aircraft is in an anticipated launch spot, or when an aircraft is unattended. Intermediate tiedown installation is the responsibility of the plane captain.

Permanent Tiedown. This condition of aircraft security is required when not at flight quarters or when the aircraft is not expected to be respotted.

Heavy Weather Tiedown. The plane captain will achieve this condition of aircraft security when directed. Determination of heavy weather tiedown security rests with the ACHO.

NORMAL WEATHER CONDITIONS

In general, the following procedures apply when aircraft are being secured under normal weather conditions:

- Plane captains of landing aircraft should stand by with tiedowns on the flight deck in a designated area and join their aircraft as they are being parked. If an aircraft is struck below, its plane captain should board the elevator with it if he can do so safely.

- Aircraft handling crews stand by in a designated area during recoveries and act as chock walkers while aircraft are being taxied and parked. They put on the initial tiedowns, assisted by the plane captain when possible.

- The plane captain connects the ground wire, installs the wing fold jury struts, installs the parking harness and batten boards, installs the engine and cockpit covers, and installs the tiedowns needed other than the initial tiedowns put on by the aircraft handling crews.

You can find detailed procedures for securing a specific aircraft in the *Maintenance Instructions Manual* for that aircraft and in the *Air Department Standard Operating Procedures (SOP)*, COMNAVAIRPAC/COMNAVAIRLANTINST 3100.4.

HEAVY WEATHER PROCEDURES

A precise definition of each heavy weather condition is listed in the individual ship's SORM, instructions, or in various chain of command instructions, and they must be referred to for specific guidelines. Operational commitments may require flight operations during heavy weather conditions, and such operations will be under the direction of the commanding officer.

The procedure for securing aircraft during heavy weather differs very little from that used in normal weather. The main difference is that more tiedowns are used, all control surfaces are secured with battens, and controls inside the aircraft are tied down. Figure 3-13 shows the heavy weather tiedown arrangement for an aircraft.

When a heavy weather spot requirement has been determined by the commanding officer the following procedures are recommended.

a. A maximum number of aircraft shall be spotted on the hangar deck in such a manner to permit access to fire stations at all times.

b. Space and time permitting, remaining aircraft should be spotted fore and aft on the flight deck, as far from deck edge and the fantail as possible and no further forward of the bow catapult JBD's than absolutely necessary. Consideration for desired trim of the ship must govern actual spotting location.

c. The bow catapult JBD's should be raised to assist in decreasing wind over deck (deck space permitting).

d. Chocks shall be secured to wheels with 21 thread (or greater) manila line to prevent them from working free.

e. Maximum tiedowns shall be applied and parking brakes (if applicable) shall be set.

f. Wingspreads may be desirable on some types of aircraft as space and other factors permit.

g. Deflating of struts and/or tires will be accomplished as directed.

h. Fuel load adjustments will be made as directed.

i. Security watches shall be doubled to function as 2-man teams (buddy system). Safety lines to join man-to-man and man-to-structure will be utilized as necessary. The watches shall be especially vigilant to detect loose tiedowns or chocks and for any contact between aircraft and/or equipment.

COLD WEATHER PROCEDURES

The handling of aircraft during cold weather operations is extremely difficult and is important to you

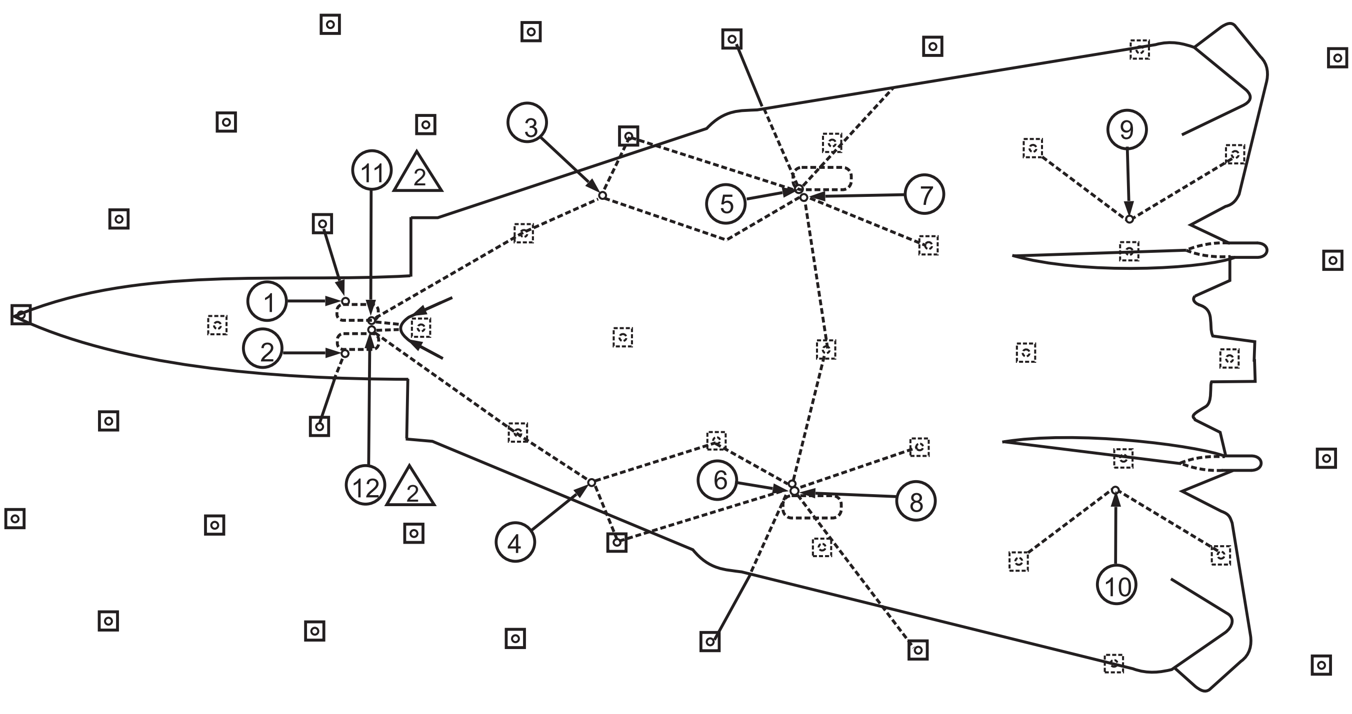


Figure 3-13.—Heavy weather aircraft tiedown.

as an ABH. It is advisable to keep as many aircraft on the hangar deck as possible during extremely cold weather, because the hangar deck is protected. Keeping the flight deck clear of ice and snow is one of the jobs for which you are responsible.

The following methods, gear, and equipment for snow and ice removal are often used:

1. Manually freeing the deck of ice is done by the use of conventional brooms, crowbars, shovels, wooden mallets, and scrapers. Compressed air is used for blowing snow from pockets. Fire main water at 100 psi and steam lances are used for undercutting ice. Flight-deck equipment such as wires, sheaves, arresting gear, elevators are cleared of ice with deck scrapers and auxiliary hot air heaters.

2. Normal deck procedures are used in cold weather, but considerably more time is required because of the excessive hazards involved. It is necessary to use battens on control surfaces, and the use of jury struts and cockpit covers is recommended. The controls inside the aircraft should be tied down to eliminate the chance of movement of outer control surfaces. The movement of aircraft on ice or snow should always be slow. When aircraft are being turned, the use of brakes should be avoided as much as possible.

CAUTION

When aircraft are parked in the landing area, their canopies should NOT be placed in the locked position. Canopies will freeze "closed" and will be unable to give the brake rider access to protection.

Q8. Who is responsible for setting the aircraft tiedown configuration requirement?

Q9. What are the four types of tiedown configurations?

Q10. What minimum number of tiedown chains is required by an H-60 for heavy weather?

AIR DEPARTMENT INTEGRITY WATCH

OBJECTIVES: Identify the basic organization of the Integrity Watch. Identify specific responsibilities of Integrity Watch personnel.

At all times when aircraft are embarked (except when the ship is at flight quarters or general quarters) the Air Department Integrity Watch shall be posted and conducted in accordance with COMNAVAIRLANT/COMNAVAIRPACINST 3100.4 (series) and current directives. When the ship is in an alert posture or conducting a special evolution (VERTREP, CONREP, helo operations, etc.), the Integrity Watch may be set as conditions dictate at the discretion of the Air Officer or his representative.

FUNCTION

The Air Department Integrity Watch shall be responsible to the Command Duty Officer (CDO)/Officer of the Deck (OOD) for the security of all aircraft and equipment of the flight and hangar decks, the catapults, arresting gear, the aviation fuels system, and for the observance of all safety precautions. In the absence of all Air Department Handling Officers, the Integrity Watch Officer (IWO) assumes responsibility for the entire deck evolution which is Air Department responsibility during flight quarters. The Integrity Watch shall also be responsible for maintaining red light conditions on all exposed decks and equipment when "darken ship" is prescribed. Additionally, the Integrity Watch shall implement all "heavy weather" conditions prescribed per current ship's instructions. The watch shall be a 4-hour continuous watch.

COMPOSITION

The Air Department Integrity Watch will normally be composed of qualified personnel from the air wing and the Air Department. Table 3-3 outlines the basic formation of the integrity watch team.

EQUIPMENT

While on watch, each roving security patrol shall wear a properly configured white flotation (life) vest. It shall be stenciled front and rear with large black letters "IW". Survival equipment (flotation vest, cranial, etc.) shall be provided for the IWO and the Integrity Watch Petty Officer (IWPO) to don in the course of their routine flight deck inspections. No member of the IW team shall routinely venture onto the flight deck without proper survival equipment.

The flight and hangar deck integrity watches, aviation fuels security patrols, and catapult security watches shall be equipped with a flashlight. Foul weather gear shall be provided for watches exposed to the elements during inclement weather.

An Integrity Watch Officer's Logbook, Pass Down (PDL) book, night order log, equipment accountability

Table 3-3.—Air Department Integrity Watch Composition

WATCH/DUTY	PERSONNEL REQUIRED	PROVIDED BY
Integrity Watch Officer (IWO)	1	Air Wing
Integrity Watch Petty Officer (IWPO)	1	Air Wing
Flight Deck Security Patrol	3	Air Wing
Hangar Deck Security Patrol	2/3*	Air Wing
Integrity Watch Messenger	1	V-1 Division
Catapult Security Watch	2	V-2 Division
Conflagration Watches	2/3*	V-3 Division
Aviation Fuels Security Watch	1	V-4 Division
Aviation Fuels Petty Officer of the Watch	1	V-4 Division
Pri-Fly Security Watch	1	Air Office
* One Watch Per Bay		

log, and instruction/reference binder and publications will be provided by the ACHO.

Integrity Watch gear will be provided and maintained as directed by the ACHO. Integrity Watch Officer's shall be responsible for ensuring the accountability of this gear with any discrepancies noted in the equipment accountability log.

TRAINING

Formal training of the Integrity watchstanders will be coordinated by the ACHO. All IW team members shall receive training/briefings prior to standing watches. This training shall be per current PQS directives, but is not limited to, the following items:

a. Watch organization and responsibility.

b. Chain of command required reports, inspections, logs, etc.

c. Aircraft and equipment security (tiedowns, chocks, configuration, etc.).

d. Deck cleanliness (leaks, spillage, washing, etc.).

e. Firefighting/damage control (steam smothering, AFFF and salt water hoses, mobile equipment, fixed firefighting system, etc.).

f. Heavy/adverse weather precautions/safeguards.

g. Aircraft maintenance support (turn-ups, configuration changes, moves, etc.).

h. Elevator operations.

i. Special evolutions (visiting, picnics, sporting events, etc.).

j. Communications equipment/methods.

k. Safety considerations.

l. Other (whip antennae, points of contact, etc.).

GUIDELINES

The following guidelines shall govern the conduct and functioning of Integrity Watchstanders.

a. All watchstanders must be familiar with tiedown requirements, turn-up requirements, and any other specific governing factors that deal with the situation at hand. All pertinent instructions and publications should be consulted before undertaking or approving a non-standard or unfamiliar evolution.

b. The usage, purpose, and functioning of all available communications equipment must be thoroughly understood by all members of the watch team. Specifics will be covered during the mandatory ACHO briefing given prior to qualification for watchstanding.

c. Maintenance and enforcement of superb deck cleanliness, FOD free environment, security of aircraft and equipment, and safety of all hands are primary responsibilities of Integrity Watches.

d. Watches shall be stood in a professional, military manner. Complete attention to the job at hand is required; therefore, no reading materials shall be permitted at the watch station during the course of the watch. Likewise, writing shall be minimized and not permitted to detract from ones attentiveness.

e. Reliefs will occur on station, face-to-face, under the cognizance of the IWPO or the IWO. All watch stations must remain manned throughout the duration of the period. Turnovers in flight deck control or other centralized locations are not permitted; however, watch teams should be thoroughly briefed prior to on-station relief.

f. Air Department briefings by the ACHO and/or representatives are mandatory for all IWO's/IWPO's prior to their being assigned a watch. Roving patrols will be briefed by the IWO/IWPO and squadron maintenance supervisors. Random questioning of Integrity Watchstanders will occur; failure to respond to such queries knowledgeably will be cause for immediate relief and replacement.

g. Appropriate logs shall be maintained in an accurate and traditional manner.

h. Chow relief's, where necessary, will normally be furnished by the division/squadron concerned. For IWO'S, the off going 1200-1600 watch will return to relieve the 1600-2000 watch unless previous arrangements, satisfactory to both parties, have been made.

i. The aircraft spotting board and associated templates shall not be moved. Accuracy of deck spot is critical for many evolutions.

j. Information passed to flight deck control such as air plan changes, changes to alert status, etc., will be entered in the PDL and the ACHO immediately notified (if deemed necessary).

k. Integrity Watchstanders are a crucial link in the ship's security network. Watches shall challenge all personnel in civilian clothes who are not recognized and have no visitor badge or are unescorted.

INTEGRITY WATCH OFFICER

The Integrity Watch Officer (IWO) shall be a fully qualified officer from embarked squadrons and will stand a 4-hour watch. The IWO will relieve the ACHO or designated representative upon secure from flight quarters. Subsequent watches will relieve in Flight Deck Control at thirty minutes prior to the hour. The IWO will be responsible for carrying out the following basic functions:

a. Supervise the mustering, instruction and posting of the Air Department Integrity Watch. Instruct the watch in the following:

(1) Use and location of all available firefighting equipment.

(2) Methods of turning in a fire alarm.

(3) The need for constant vigilance to ensure the security of embarked aircraft and to prevent unauthorized personnel from gaining access to aircraft and equipment.

b. Carry out the instructions of the Aircraft Handling Officer as published in the Integrity Watch Night Order Book.

c. Assume a station in flight deck control (or hangar deck control if applicable) from where frequent inspections of the flight deck, hangar deck and conflag stations, should be conducted to cover each watch at irregular intervals to ensure that the instructions and orders governing the watch are being carried out.

d. Make security reports on the hour to the Officer of the Deck (OOD) after assembly of reports from the following:

(1) Aviation Fuels Security Patrol (every two hours)

(2) Catapult Security Watch

(3) Flight and Hangar Deck Security Patrols

(4) Conflagration Station Watches

(5) Pri-Fly Security Watch

NOTE

Failure of watches to report as prescribed is cause for immediate investigation.

e. Be familiar with safety precautions that pertain to equipment and machinery on the flight and hangar decks, aviation fuels systems, and catapults, and ensure compliance with such precautions.

f. Ensure that squadrons and detachments concerned keep the area beneath their aircraft clear of trash, all combustibles, and all items of FOD potential, and ensure proper care and securing of power cables and air start hoses.

g. Be thoroughly familiar with all firefighting equipment on the flight deck, in the hangar bay, catapult spaces, and in the Conflagration Stations and the means of turning in a fire alarm.

h. Take immediate steps to control all fires on the flight deck, hangar bay, and catapult spaces until relieved by proper authority.

i. Permit aircraft to be moved only as specifically authorized by the Aircraft Handling Officer or Air Department Duty Officer (ADDO). **THE INTEGRITY WATCH OFFICER MAY AUTHORIZE THE MOVING OF AIRCRAFT ONLY IN EMERGENCIES.**

j. Permit an aircraft engine to be turned up only after ensuring that the following conditions are satisfied:

(1) The ACHO and the OOD approve the turn-up (at sea).

(2) Permission has been obtained from the ADDO and OOD (in port).

(3) Aircraft has been parked and secured to preclude damage to other aircraft, objects, or ship structure. **ENSURE THE REQUIREMENTS FOR TIEDOWNS ARE MET, A SQUADRON SAFETY REPRESENTATIVE IS STANDING BY**, and that all other precautions specified in section 1603 are observed.

k. Unless otherwise directed, ensure that all aircraft elevators remain at the flight deck level with the locks inserted when the ship is underway. Permit the aircraft elevators to be operated only as specified below:

(1) Only after obtaining permission from the ACHO and OOD when the ship is underway and not at flight quarters.

(2) Only after obtaining permission from the Air Department Duty Officer and OOD when the ship is in port.

(3) Only when satisfied all aircraft electrical leads have been disconnected from aircraft on elevators and elevators are otherwise clear.

l. Supervise any additional Security Patrol furnished by the ship as directed in ship's instructions.

m. Keep informed on the prospective state of the weather and take the necessary precautions as conditions warrant or as may be prescribed by ship instructions, the Officer of the Deck, Aircraft Handling Officer (at sea), or the Air Department Duty Officer (in port).

n. Keep the Officer of the Deck, the Air Department Duty Officer (in port), Aircraft Handling Officer (at sea), and the air wing and squadron duty officers informed of all matters requiring their action.

o. Maintain a PDL for entry of items of significance for succeeding IWO'S.

p. Enforce smoking regulations and other safety measures on the flight deck and catwalks or on the hangar deck as applicable.

q. Enforce "darken ship" regulations on the island structure, flight deck, and gallery walkways.

r. Supervise the keeping of the Integrity Watch Log and sign the log at the end of each watch.

INTEGRITY WATCH PETTY OFFICER

The Integrity Watch Petty Officer (IWPO) shall be a fully qualified first or second class petty officer of the embarked air wing. The IWPO will be responsible for the supervision of the Aircraft Integrity Watches and for carrying out the following duties and responsibilities:

a. Act as an assistant to the Integrity Watch Officer.

b. Under the direction of the Integrity Watch Officer, muster, instruct, post and supervise the Aircraft Integrity Watches.

c. Make periodic inspections of all watches posted to ensure alertness of the sentries and familiarity and compliance with the instructions contained herein.

d. Inspect for security of aircraft and aircraft fuel systems and for the presence of fire hazards. Inspect all power cables carefully and ensure they are properly secured after use. Take appropriate action if discrepancies are noted. Report such discrepancies and action taken to the Integrity Watch Officer.

e. Assemble and make required security reports to the Integrity Watch Officer.

f. Maintain and ensure custody of the equipment required by the Integrity Watch.

g. Perform such other duties as may be required.

FLIGHT AND HANGAR DECK SECURITY PATROLS

The Flight and Hangar Deck Security Patrol watches shall be stood by fully qualified personnel of the embarked air wing. These watches will be responsible for the physical security of all aircraft and equipment on the flight and hangar decks and for the following:

a. Ensure that all aircraft and support equipment are secured IAW current directives and instructions of the Integrity Watch Officer.

b. Inspect all aircraft in assigned area for loose tiedowns, jury struts, chocks, intake and exhaust covers installed, canopies closed, and gear/rack pins in place. Loose tiedown deficiencies shall be corrected on the spot.

c. Inspect assigned area for rags, hydraulic fluid, fuel, oil, and fire hazards. Report any discrepancies to the Integrity Watch Officer and stand by aircraft concerned with firefighting equipment.

d. Pick up all loose rags, rubbish, and missile hazards and place them in proper receptacles.

e. Ensure that all external power cables have been properly secured and de-energized when not connected to an aircraft and de-energized when maintenance personnel are required to be away from the aircraft temporarily.

f. Know the location and proper use of all firefighting equipment in assigned area.

g. IMMEDIATELY REPORT ALL FIRES to the Officer of the Deck, Damage Control Central, and the Integrity Watch Officer.

h. Report any suspicious actions or occurrences to the Integrity Watch Officer.

i. Allow no unauthorized personnel in assigned areas.

j. Perform such other duties as may be required.

k. Report the security of the assigned area of the flight or hangar deck 15 minutes before every hour per existing procedures.

INTEGRITY WATCH MESSENGER

The Integrity Watch Messenger shall be stood by fully qualified personnel of the V-1 Division. The messenger will carry out the following duties and responsibilities:

a. Be available to the Integrity Watch Officer to perform such duties as the watch officer may assign.

b. In the absence of the IWO and IWPO, remain in flight deck control to handle communications.

AVIATION FUELS SECURITY WATCH

The Aviation Fuels Security Watch shall be stood by V-4 Division personnel under the supervision of the Duty AVFUELS Petty Officer. All watchstanders shall have completed the AVFUELS (Afloat) PQS qualification section for this watch. Trainees may be assigned under the supervision of a qualified watchstander. Spark producing items such as matches, cigarette lighters, and ferrous metals shall not be worn or carried. The Aviation Fuels Security Watch shall perform the following duties:

a. Make rounds as directed in chapter 8 of the *Air Department SOP*.

b. Inspect each space or station on his post for the following:

(1) Security of valves

(2) Leakage of any kind

(3) Gear adrift

(4) Unauthorized personnel

(5) Proper ventilation

(6) Lighting

(7) Liquid in the bilge

(8) Unauthorized smoking, open flames or welding

c. The watch shall be a roving patrol.

d. Report the condition of the AVFUELS system at the completion of each round to the IWO (when air wing is embarked, and to OOD/Quarterdeck) when the air wing is not embarked).

e. Report any abnormalities to the Duty AVFUELS PO, IWO, OOD, AVFUELS LCPO, AVFUELS Maintenance Chief or Damage Control Central (DCC).

f. Know the location and proper use of all firefighting equipment in or adjacent to fuels spaces.

g. Ensure that all safety precautions pertaining to AVFUELS are strictly observed.

h. Perform such other duties as may be assigned.

CATAPULT SECURITY WATCH

This watch shall be stood by qualified personnel of the V-2 Division (one man for bow and one man for waist catapults) and shall be responsible to the IWO or OOD for the security of the catapults and associated equipment. The catapult security watch shall be supervised by the duty V-2 catapult petty officer. This watch shall relieve on station and shall be maintained in each catapult area whenever the respective machinery is pressurized. Specific duties and responsibilities are as follows.

a. Report completion of watch turnover or assumption of the watch to the IWO or OOD as appropriate.

b. Make hourly reports fifteen minutes prior to the hour to the IWO or OOD as appropriate per existing directives.

c. Maintain a roving patrol through all catapult machinery spaces with emphasis on security and safety.

d. Keep unauthorized personnel out of machinery spaces.

e. Be alert for fire hazards particularly in launch valve areas and cat troughs.

f. Immediately report all fires or abnormalities.

g. Know the location and proper usage of all firefighting equipment in or adjacent to catapult spaces.

h. Maintain logs as required of accumulator pressure, steam temperatures, cylinder elongation and any unusual incidents.

i. Be alert for and report air, steam or fluid leaks.

j. Perform such other duties as may be assigned.

CONFLAGRATION STATION WATCH

Each Conflagration Station Watch shall be stood by fully Conflag PQS qualified personnel of the V-3 Division who shall be responsible to the IWO or OOD, as appropriate, for the security of the hangar bay and for the proper operation of all remotely controlled firefighting apparatus on the hangar deck. It is a 4-hour watch requiring constant vigilance to detect and report the outbreak of fire or other hazardous conditions at the earliest possible moment. As a minimum, one conflagration station per bay (containing aircraft) will be manned during the watch period. Specific duties and responsibilities are as follows:

a. Report completion of watch turnover or assumption of the watch to the IWO or OOD, as appropriate.

b. Make hourly reports fifteen minutes prior to the hour to the IWO or OOD, as appropriate, per existing directives. Conflag reports should be consolidated so that only one conflag actually reports to the IWO/OOD (i.e., conflag one reports to conflag two who reports for both).

c. Permit no unauthorized personnel in the conflag.

d. Maintain a continuous visual watch with particular emphasis on security, safety, and fire/damage potential.

e. Be thoroughly familiar with the operation procedures pertaining to all controls, systems and circuits located within the conflag.

f. Be prepared to provide proper and timely use of firefighting equipment remote controls as needed.

g. Be prepared to provide proper and timely use of elevator and hangar divisional door remote controls as needed.

h. Operate hangar lighting and communications systems as directed.

i. Immediately report all fires, fire potential and any abnormalities per existing directives.

j. Perform other duties as may be prescribed.

PRI-FLY SECURITY WATCH

The Pri-fly Security Watch shall be stood by fully PQS qualified personnel from the air office who shall be responsible to the IWO or OOD as appropriate. The Pri-Fly watchstanders duties include:

a. Report completion of watch turnover or assumption of the watch to the IWO or OOD, as appropriate.

b. Make hourly reports fifteen minutes prior to the hour to the IWO or OOD as appropriate.

c. Permit no unauthorized personnel in Pri-fly.

d. Maintain a visual watch with particular emphasis on security, safety and fire potential.

e. Be thoroughly familiar with the operation procedures pertaining to all controls, systems and circuits located within Pri-fly.

f. Be prepared to provide proper and timely use of remotely controlled installed AFFF systems as needed.

g. Operate flight deck lighting and communication systems as directed.

OTHER RESPONSIBILITIES

The Aircraft Handling Officer is responsible to the Air Officer for the overall training and supervision of the Air Department Integrity Watch. The ACHO shall review the Integrity Watch Log daily and shall take action as required to correct any problem areas or discrepancies that are noted in the log. Also, the ACHO will assist in training the air wing personnel by providing qualified instructors in all areas of Integrity Watch procedures, responsibilities, and equipment.

Q11. The Aircraft Integrity Watch team is constructed of personnel from what groups?

Q12. A fully qualified Integrity Watch Petty Officer should be what minimum rank?

NAVAL AIR STATIONS

OBJECTIVES: Recognize aircraft handling requirements aboard an air station. Identify aircraft handling and securing equipment used at an air station. Recognize air terminal organization and procedures.

AIRCRAFT HANDLING

Air stations are usually provided paved spotting areas. The area where a particular group of aircraft is spotted is referred to as the LINE. Aircraft are spotted on the line for servicing, loading, and checking for operational readiness. It is the responsibility of the ABH assigned to the line crew on an air station to direct and spot aircraft on the line.

The line is spotted according to flight schedule instructions. Aircraft must be spotted in such a manner as to facilitate engine turnup, taxiing, or towing without materially endangering other aircraft on the line.

The methods and procedures used for handling carrier-type aircraft ashore are similar to those used on carriers.

In directing an aircraft that is taxiing from the line, the director should remain in control of the aircraft until it is clear of other aircraft or obstructions in the spotting area. Incoming aircraft should be met at the edge of the spotting area and directed to the appropriate spot.

Transient aircraft often require assistance in taxiing from the runway to the spotting area. This is accomplished by the use of a jeep or other appropriate vehicle that has the words FOLLOW ME displayed in large letters. The vehicle meets the aircraft at the end of the runway or an intersection of the runway and leads it to the spotting area.

MULTIENGINE AIRCRAFT

Since each type of multiengine aircraft requires slightly different handling procedures, this discussion is limited to general handling procedures. Specific handling procedures for particular aircraft are found in the General Information and Servicing section of the *Maintenance Instructions Manual* for that aircraft.

Many multiengine aircraft are provided with a means of steering the nosewheel from the cockpit. While this provides a more effective control when the aircraft is taxied, it also limits the radius of turns. When an aircraft equipped with cockpit steering is being directed, care must be taken to allow sufficient space as a turn is being made. If possible, the nosewheel steering system should be disengaged when an aircraft is towed by means of the nosewheel.

Special towing equipment is provided for each type of multiengine aircraft. This consists of a nosewheel towing and steering bar for forward towing and a main gear towbar or adapter for aft towing. The nosewheel bar is used to steer the aircraft when towing from aft.

Large aircraft should be towed slowly and carefully. Sudden starts, stops, and turns must be avoided. When an aircraft is towed, the brakes should be engaged only in an emergency. When a quick stop is necessary, the brakes of the tractor and aircraft should be applied at the same time. This is done when the tractor driver blows a whistle.

In addition to the above handling instructions, the following safety precautions should be observed:

- During towing operations, a qualified operator should be in the pilot's seat to operate the brakes when necessary and to make sure that there is sufficient hydraulic pressure for brake operation.

- When moving aircraft in close spaces, a taxi director and sufficient walkers should be placed to provide centralized control and to ensure clearance of obstructions.

- When the aircraft is equipped with a tail wheel, unlock the tail wheel before moving the aircraft.

- Make sure that the landing gear safety lockpins or down locks are installed before towing aircraft.

- Do not turn the nosewheel beyond the nosewheel turn limits, as structural damage will result.

SECURING AIRCRAFT

The parking areas on air stations are usually equipped with tiedown pad eyes that are sunk into the surface of concrete aprons. Securing lines or assemblies are used in securing the aircraft to the pad eyes.

The staking of aircraft out in the open, away from the air station, may present problems. Chocks, which are normally available at air stations, may have to be improvised by using logs or other objects or by digging holes in the ground, in which the wheels may be placed. Stakes are used as anchors for the tiedown lines. Corkscrew-type stakes provide the greatest security. Plain metal or wooden stakes are used if other types are not available.

The fundamental rules for securing aircraft ashore are as follows:

- Locate a protected spot.

- Head the aircraft into the wind.

- Place chocks both in front of and behind each wheel.

- Ground the aircraft.

- Place all controls in the neutral position, and lock or secure with a parking harness.

- Tie the aircraft down.

CAUTION

Do not install engine covers when the engine is hot.

- Install cockpit, engine, and pilot covers.

When there is a threat of high winds, lines and anchorages should be doubled and control surfaces secured with battens.

Fittings are provided on most aircraft for attaching tiedown lines. On carrier-type aircraft, these fittings are usually located on each of the landing gear struts. In most circumstances, two lines are attached to each of these points when the aircraft is being secured. Figure 3-14 shows an aircraft properly secured on the line.

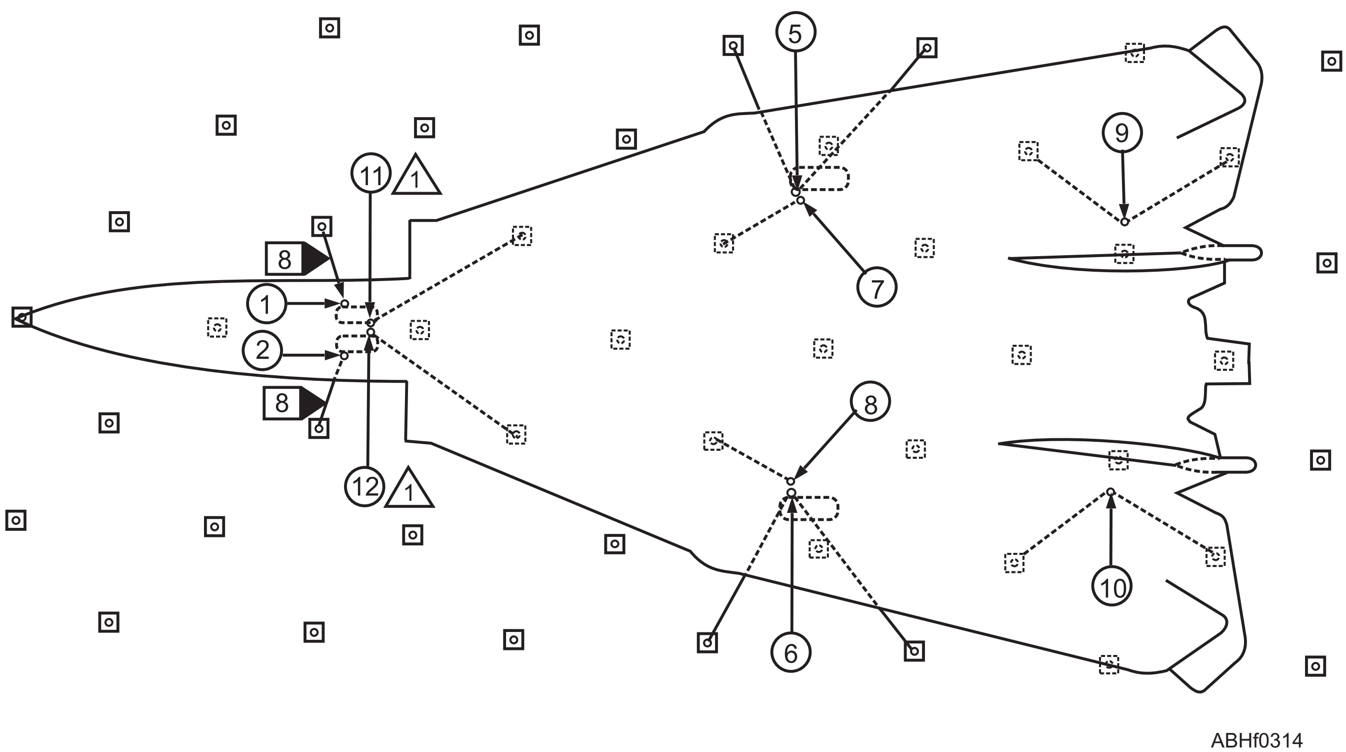


Figure 3-14.—Aircraft properly secured on the line.

CAUTION

When securing aircraft with manila line, leave sufficient slack for shrinkage that occurs when the line becomes wet.

Multiengine aircraft are tied down at six points. These points are the landing gear, the tail, and each wing. Detailed information concerning securing a particular aircraft may be found in the *Maintenance Instructions Manual* for the aircraft.

HANDLING EQUIPMENT

The type and the amount of aircraft and servicing equipment on the line vary with the type and number of aircraft that may be assigned to the naval air station. The tractors may be one or more of the types discussed in chapter 2 of this RTM. The standard towbars, chocks, tiedowns, and related equipment are also covered in chapter 2 of this RTM.

All handling and servicing equipment used around aircraft have standard colors and markings. This is necessary so that the equipment and markings can be easily seen by pilots taking off, landing, or taxiing in aircraft, or by tower operators. Also, they can be readily identified as being authorized for use around aircraft on parking ramps, taxiways, and runways. This equipment is painted chrome yellow with the front and rear bumpers having alternate black and chrome yellow stripes at 45-degree angles.

All vehicles should have their serial numbers painted in black. Motorized refuelers and aviation lube oil service trucks should have the type of fuel or oil they carry painted in black on their sides. At times, it is necessary, around aircraft, to use vehicles that are not painted standard colors. These vehicles must display an identifying flag above the highest part of the vehicle so that it can be seen from all directions. This flag is 3 feet square with 1-foot square blocks, alternating white and international orange in color. See figure 3-15. In addition to the identifying color flag, all vehicles carrying explosives of any nature must also display a BRAVO (red) flag in the same way as stated above.

The operators of all self-propelled vehicles must have a valid state driver's license and a yellow license for that equipment. They must have attended a formal course of instruction in support equipment (SE). They should be aware of all safety precautions and vehicle operating instructions issued by the commanding officer of the naval air station and higher authority.

Vehicles operated in the vicinity of aircraft (50 feet) must limit their speed to 5 mph. Elsewhere the speed limit on runways, taxiways, parking ramps, work areas, and beaching areas is 10 mph. In addition to the operator of the vehicle, there should be only the number of passengers for which the vehicle is designed. Riding on fenders or hoods, running boards, or any place not intended for passengers is prohibited. All vehicles entering or crossing runways must get radio or visual clearance from the control tower. The procedure generally used is to stop the vehicle 100 feet from the landing area and obtain clearance. Should radio communication not be possible, the following visual signals flashed by a hand-held Aldis lamp are used:

- Green light — proceed
- Red light — stop or remain where you are
- White flashing light — report to Operations/return to point of departure

AIR TERMINALS

Air terminals are located at many naval air activities. Their functions include handling of mail, air cargo, and the transportation of passengers.

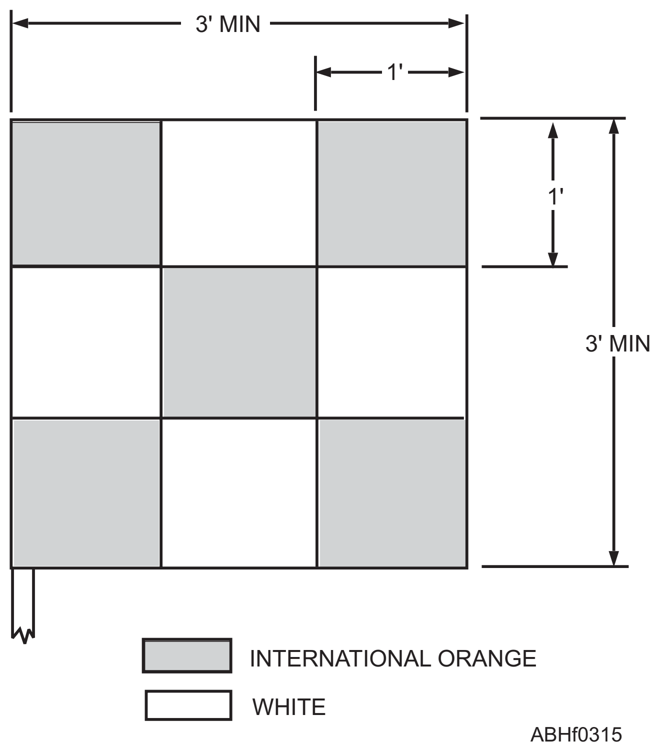


Figure 3-15.—Authorized-vehicle identification flag.

OPNAVINST 4660.3 establishes Department of the Navy (DON) procedural guidance and standards for operation of DON shore facilities and vessels providing air terminal services. These services are provided to support airlift scheduled under OPNAVINST 4631.2B (NOTAL), *Management of Department of the Navy Airlift, and Non-tactical Carrier/Vertical Onboard Delivery (COD/VOD) Operations*.

A definition of an air terminal is given in OPNAVINST 4630.13D (NOTAL), *Aerial Ports of Embarkation*. It states that an *air terminal* is a facility on an airfield that functions as an air transportation hub. It accommodates the loading and unloading of airlift aircraft and provides processing of transit cargo, mail, passengers and baggage.

Also defined is a "Uni-Service Air Terminal," which handles traffic moved primarily by organic airlift of a single military service. DON air terminals are established under this premise and include loading/unloading support provided by vessels to nontactical COD/VOD operations.

Commanding officers/officers in charge of facilities/vessels providing collateral air terminal services, as discussed here, use enclosure (1) to OPNAVINST 4660.3 as the basic source of reference.

An air terminal officer is designated to manage air terminal functions. Assignment may be as a primary or collateral duty to an officer, enlisted, or civilian, consistent with the anticipated volume of traffic and appropriateness to the location or mission of the command.

OPNAVINST 4660.3 gives basic guidance to operate Navy air terminal facilities to support air logistics movements scheduled and flown. This also follows OPNAVINST 4632.2, *Management of DON Airlift*, to support nontactical airlift operations to a vessel.

Each Navy air terminal, according to local capabilities, should include at least the following:

1. Designated space to process anticipated passenger loads, including a waiting area, scales, and a secured area for inspected passengers and baggage.

2. Designated secure area sufficient for expected cargo.

3. Ground support equipment for anticipated aircraft loads, including cargo/baggage carts and passenger ramps.

4. Passenger inspection device; this is not required for shipboard operations.

5. Schedule board to show flight number, aircraft type, destination, origins, arrival/departure times, load, space available, and other pertinent information.

6. Local facility information board showing local transportation schedules; location/hours of operation for exchange, mess, recreation, and medical facilities; and other pertinent information for passenger comfort. (This is not required for shipboard operations.)

AIR TERMINAL OFFICER

The duties and responsibilities of the Air Terminal Officer will vary according to the size of the air terminal and the terminal's capabilities. In some cases, the duties may be primary or collateral, depending on the level of operations. Typical responsibilities include the following:

a. Complying with applicable instructions and regulations

b. Implementing aircraft movements and load priorities following OPNAVINST 4630.13, *Aerial Ports of Embarkation*

c. Arranging for servicing, maintenance, meals and supplies for transiting aircraft

d. Arranging crewmember ground transportation, billeting and messing

e. Arranging for security and custody of cargo, mail, classified material, small arms and guard mail

f. Using procedures for handling very important persons (VIP)

g. Maintaining a secure area and procedures for lost/found baggage and astray cargo

h. Training terminal personnel

i. Arranging for cargo, baggage, passenger loading under the supervision of the aircraft commander or a designated representative

j. Arranging for aircraft security for remote parking areas

k. Handling health, agriculture, and customs clearance

l. Maintaining a current reference library

m. Notifying consignor/consignee on status of shipment (shipped, arrived, lost, etc.).

REFERENCE LIBRARY

The air terminal library must be maintained and contain current pertinent local instructions and references listed below that are readily accessible to air terminal personnel.

REFERENCE LIBRARY

OPNAVINST 3710.2, *Foreign Clearance Procedures for U.S. Naval Aircraft*

OPNAVINST 4630.9, *Worldwide Aeromedical Evacuation*

OPNAVINST 4630.13, *Air Terminal and Aerial Ports*

OPNAVINST 4630.16, *Revenue Traffic Transported on Department of Defense Aircraft other than Airlift Service; Industrial Fund (MAC)*

OPNAVINST 4630.25, *Air Transportation Eligibility*

OPNAVINST 463l.2, *Management of Department of Navy Airlift Assets.*

OPNAVINST 4660.3, *Department of the Navy Air Terminal Procedures*

OPNAVINST 5840.3, *Customs Inspection*

NAVSUPINST 4061.9, *Sale of Meal and Surcharge Rates and Ration Credit Conversion Factors*

NAVSUPINST 4610.33, *Reporting of Transportation Discrepancies in Shipments*

NAVSUP P-505, *Preparing Hazardous Materials for Military Air Shipments; Packaging and Materials Handling*

SWOP 50-1, *Nuclear Ordnance General Information*

DOD Regulation 4500.32-R, *Military Standard Transportation and Movement Procedures (MILSTAMP) Vol. I, 15 May 1987*

NAVMEDCOMINST 5360.1, *Decedent Affairs Manual*

BUMEDINST 6210.3, *Etiological Agents/ Biomedical Materials; Handling of.*

RATING RESPONSIBILITIES

Personnel of the ABH rating are assigned to duty at air terminals. When you, as an ABH, are assigned to air terminal duty, you must be well trained and have a thorough knowledge of the following subjects:

- Terminal security procedures
- Passenger handling, manifesting, loading/ unloading, and inspection policy
- Baggage check-in, inspection, loading, and unloading procedures
- Baggage weight and size restriction
- Baggage loss and damage claims, lost baggage, and prohibited articles policy
- Cargo acceptance, documentation, and records policy
- Cargo loading/offloading, manifesting, and unaccompanied baggage procedures
- Lost and damaged cargo procedures
- Mail priorities, mail handling, guard mail, lost/ damaged mail, and prohibitions policy
- Procedures for handling, processing, documenting, and transporting patients and human remains.

HAZARDOUS CARGO

NAVSUP P-505, *Preparing Hazardous Materials for Military Air Shipments; Packaging and Materials Handling*, should be checked whenever dangerous cargo is to be airlifted. It is also invaluable as text material for instructing newly assigned personnel as cargo handlers. Improper handling and labeling of acid containers could result in damage to the aircraft as well as fatal injuries to personnel. Therefore, it is vital to you and other personnel to be thoroughly aware of the contents of NAVSUP P-505 when handling materials to be transported in military aircraft.

WEIGHT LIMITATIONS

To properly load an aircraft, you, as an ABH, must know the weight limitations of the aircraft, the weight of the cargo and mail, its priority and destination, and the number of passengers for the flight. You are required to properly manifest all passengers. Along with this information, you then select mail, cargo, and passengers according to priority, plan the load distribution within the limits of the aircraft, and supervise the loading crew to make sure that proper loading and load securing procedures are followed under the direction of the aircraft loadmaster.

SECURING CARGO

The cargo must be secured properly in the aircraft according to type (explosive, sharp pointed, etc.). Should the cargo and mail be destined for more than one place, both categories must be loaded in a manner to allow unloading at each stop without unloading the entire aircraft. With cargo and mail loaded and secured in the aircraft, passenger seats are then installed.

After the aircraft reaches its destination and the passengers have departed the aircraft, the seats are removed or moved out of the working area to facilitate unloading.

Extreme caution must be exercised in both loading and unloading operations. In addition to the personal injury risk, a carelessly handled piece of equipment or cargo can cause thousands of dollars in aircraft damage; for example, consider what could happen to a multimillion dollar aircraft being loaded with cargo by inexperienced, improperly trained, and careless personnel. A carelessly operated forklift can pierce an aircraft's pressure bulkhead. This will limit the altitude at which the aircraft can fly. Considerable damage may also result to the aircraft by improperly secured cargo that becomes loosened and is cast about during flight. Not only could the aircraft be damaged in such circumstances, but also the cargo could, and usually does, become damaged.

Some of the equipment used in air cargo loading and unloading operations are listed below:

1. Forklift
2. Block and tackle
3. Baggage cart
4. Come-along
5. Nylon straps
6. Wire slings of various lengths and diameters
7. Baggage conveyor belts
8. Aircraft stairs truck
9. Aircraft passenger ramp stairs
10. Cargo pallets and dollies

For detailed information on the DON air terminals operational procedures, established practices, and knowledge of the air transportation capabilities and requirements, a single comprehensive source is OPNAVINST 4660.3, *Department of the Navy Air Terminal Procedures*.

Q13. At a Naval Air Station, what is the area where a particular group of aircraft is typically spotted referred to?

Q14. What OPNAVINST provides guidance to air terminal personnel for dealing with customs inspections?

ANSWERS TO REVIEW QUESTIONS

A-1. The Aircraft Signals NATOPS Manual provides in-depth information on aircraft signals.

A-2. Signals 1 through 32 and 34 through 42 in figure 3-1 are NATO approved.

A-3. A plane captain uses a blue colored, standard signal wand.

A-4. Ordnance Arming/Safety Supervisors have two red standard wands that are banded with two 3/4" wide bands.

A-5. To properly chock an aircraft wheel, the adjustable end should be placed toward the aft end of the aircraft.

A-6. The spot sheet is prepared by the Aircraft Handling Officer and indicates the status of an aircraft for respotting purposes.

A-7. The SUSPEND signal can be given by any member of the flight deck or catapult crew in order to prevent a launch.

A-8. The Aircraft Handling Officer is responsible for setting the aircraft tiedown requirements.

A-9. The four types of tiedown configurations used aboard aircraft carriers are Initial, Intermediate, Permanent, and Heavy Weather.

A-10. An H-60 requires a minimum of 16 tiedowns for Heavy Weather configuration.

A-11. At a Naval Air Station, the Line is the area where particular groups of aircraft are typically spotted.

A-12. OPNAVINST 5840.3 provides guidance to air terminal personnel on matters dealing with customs inspections.

A-13. At a Naval Air Station, the area where a particular group of aircraft is typically spotted is referred to as the line.

A-14. OPNAVINST 5840.3, Customs Inspections, provides guidance to air terminal person in dealing with customs inspections.

CHAPTER 4

AIRCRAFT HANDLING ABOARD AMPHIBIOUS SHIPS

The LHA (General Purpose Amphibious Assault Ship), LHD (Amphibious Assault Ship, Multipurpose), and LPD (Amphibious Transport Dock) ships play an important role in amphibious operations. They transport and land troops and essential equipment and supplies, using embarked transport helicopters, landing craft, and amphibious vehicles. The MCS (Mine Countermeasures Support Ship) has the mission of providing a dedicated command, control, and support service platform to the Mine Countermeasures Commander.

The LHA class is a general-purpose amphibious assault ship. The ship has the general profile of an aircraft carrier with its superstructure to starboard, flight deck, a deck-edge aircraft elevator to port and an aircraft elevator aft stem centerline and a well deck for landing craft. These ships often operate with one Newport class landing ship tank (LST) and one amphibious transport dock (LPD). This combination of ships can land a marine battalion landing team with all equipment, using advanced automation. An LHA can carry AV-8B Harrier V/STOL aircraft as well as the usual helicopters.

The LHD is the Navy's newest multipurpose Amphibious Assault Ship. It also has the general profile of an aircraft carrier with its superstructure to starboard, flight deck, and aircraft deck-edge elevators to port and starboard. It also has a well deck for landing craft. The LHD can transport and operate AV-8B V/STOL aircraft as well as helicopters.

The LPD is capable of launching or landing two helicopters at the same time. The newer LPD's have retractable hangars that can accommodate one helicopter. When air transportation of the ship's combat troops and equipment to the beach landing area is desired, the LPD usually teams up with and uses the helicopters from the larger deck amphibious ships.

The MCS (USS Inchon, MCS 12) is a former LPH that has been converted and modified for its role in mine warfare. This ship has both a flight deck and hangar deck for embarked aircraft and associated minesweeping equipment. Aircraft elevators are found on both the port and starboard side of the ship. This type of ship does not have a well deck.

When serving on an LHA, LHD, or MCS, as an ABH, you are generally assigned to the V-1 (flight deck) or the V-3 (hangar deck) division. When serving on an LPD, air department has only one V division and usually all aviation ratings are assigned to this division.

Your duties aboard LHA, LHD, LPD, or MCS ships can include helicopter and V/STOL operations, supporting mine countermeasures, and operation of related shipboard ground handling and firefighting equipment.

AIRCRAFT HANDLING PROCEDURES

OBJECTIVES: Identify the requirements and procedures for aircraft handling aboard amphibious ships. Describe the procedures for securing aircraft aboard amphibious ships. Demonstrate the standard helicopter handling signals used aboard amphibious ships.

Aircraft handling is a general terin that describes any movement of aircraft or associated equipment aboard the ship. All aircraft handling on the flight and hangar decks must be controlled by the Aircraft Handling Officer (ACHO).

When NOT at flight quarters, personnel at sea who are designated by the ACHO may authorize the movement of aircraft. In port, the air department duty officer may authorize the movement of aircraft.

The direction of aircraft movement on the flight and hangar decks of an aircraft carrier is a hazardous job requiring physical stamina, experience, and attention to duty, skill, and proper judgment.

To be an effective aircraft director, you must have pride in your work and confidence in your ability. You must be thoroughly trained in all procedures involving aircraft movement and security. You must know the proper signals, when to give them, how to allow for delayed reaction on the part of the plane captain and tractor drivers, and you must be a good judge of distance. Good eyesight and depth perception are required. You must have a good sense of timing. As an aircraft director, you must understand that once qualified, your seniors will rely on you to safely and efficiently direct the movement of aircraft. The lives of your shipmates may also be at stake. An aircraft director cannot afford to gamble or take chances on inattention to duty and inefficiency. Prior to being designated as an aircraft director, you must pass a written examination administered by the V-1 or V-3 division officer. The ABH Personnel Qualification Standard (PQS) is used in conjunction with other applicable instructions. When you become an aircraft director, the air officer will designate you in writing for that position.

Personnel who are assigned to handling crews are responsible for the handling of aircraft on the flight and hangar decks. Handling crews (blue shirts) must pass a written examination administered by the V-l/V-3 division officer. This examination covers, as a minimum, applicable sections of the LHA/LHD/MCS NATOPS Manual, and in conjunction with the ABH PQS for amphibious ships.

GENERAL REQUIREMENTS

Designated aircraft directors control all aircraft movement on the flight and hangar deck. Aircraft can only be moved with the express authority of the ACHO, flight deck officer, hangar deck officer, or personnel designated by the ACHO. As an ABH, you should report to higher authority any observed unsafe practices or any condition that may affect the safety of personnel or equipment. Safety on the flight deck and hangar deck is a key responsibility of all ABH's.

When the ship is at flight quarters, the Officer of the Deck (OOD) ensures that all anticipated turns are passed to Primary Flight Control (PRIFLY) so they may be announced over the flight deck (5MC) and hangar deck (3MC) announcing systems.

It is the responsibility of the ACHO to begin a respot early enough to avoid unnecessary haste. However, when aircraft are airborne, the desirability of maintaining a ready deck as long as possible should be kept in mind. The tempo of a respot should be governed by the time available, deck stability, and prevailing wind and weather conditions. Primary consideration must be given to the safety of personnel and equipment.

MOVEMENT OF AIRCRAFT

Briefing

Prior to any major respot, the ACHO briefs the flight deck officer, hangar deck officer, and other key aircraft handling personnel. This briefing includes expected wind and deck conditions, information pertinent to handling crews and aircraft safety, and contingencies for emergencies.

Procedures

The minimum deck crew, for towing an aircraft on the flight deck or hangar deck, one qualified aircraft director, at least one safety observer, a qualified tractor driver, two chock walkers/tiedown personnel, and, in the case of H- I helicopters, one handler on the tail skid. A pilot, plane captain, or qualified brake rider mans the cockpit of aircraft with wheel brakes. Since skid configured aircraft don't require chocks, the two chock walkers should continuously monitor the brake actuating handle on the ground handling wheels. Duties and safety rules for movement of aircraft on flight decks and hangar decks are as follows:

WARNING

When heavy weather conditions are forecast, as many aircraft as possible should be moved to the hangar deck, and all aircraft must be secured.

1. In preparing to move an aircraft (taxi, tow, or by hand), the director ensures the following:

a. A qualified brake rider mans the cockpit.

b. Unauthorized personnel are removed from the aircraft.

c. Only qualified personnel pump up the ground handling wheels for skid aircraft. Skid aircraft are aircraft with skids instead of permanently attached wheels for ground-handling purposes.

d. The towbar is securely attached to the aircraft and to the tractor, or, if the aircraft is to be moved by hand, another director or specifically designated towbar man should properly tend the towbar.

WARNING

Towing of AV-8 aircraft with the engine running is prohibited. Towing of helicopters with the rotors engaged is prohibited.

On AV-8 aircraft, the nosewheel steering accumulator must be depressurized before attaching the towbar. The nosewheel is then free to caster ±179º.

When the flight deck is slick with moisture, hand pushing should NOT be attempted if the ship's pitch exceeds 10º and roll exceeds 5º.

CAUTION

Movement of aircraft by hand pushing is inherently less safe than towing by a vehicle. Pushing should only be used as a last resort or because of operational necessity. As rolling and pitching of the ship increases, so does the danger of hand pushing.

NOTE

AV-8 aircraft can be chocked without danger to personnel with the engine at idle and nozzles aft.

e. All chocks, tiedowns, power cables, and other servicing/securing devices are removed before moving the aircraft.

CAUTION

Tiedowns and chocks shall NOT be removed before attachment of the towbar to the tractor.

When aircraft are moved by hand, chocks and tiedowns must NOT be removed until all positions are manned, brakes are checked firm, and the deck pitch has been determined safe.

NOTE

Consideration should be given to starting the auxiliary power plant (APP) before moving H-53 helicopters. Pressurizing the utility hydraulic system with the APP will provide more positive braking action. Maximum continuous APP run time is 30 minutes in any 1-1/2 hour period.

f Adequate clearance exists to penult safe movement of aircraft.

g. Safetymen are posted, as required, to ensure clearance if in close proximity to other aircraft, bulkheads, or obstructions.

h. The qualified brake rider signifies he has, checked the aircraft brakes and that adequate braking pressure is available, and they appear to be in working order.

WARNING

On AV-8 aircraft, the brake accumulator must be pressurized to a minimum of 2,000-psi using the hand pump before pushing or towing the aircraft.

i. All personnel except those necessary for the move are well clear of the aircraft.

WARNING

Working or passing beneath a moving aircraft is extremely hazardous and is strictly prohibited.

2. Before having chocks and tiedowns removed, the director calls for "brakes" and receives visual or verbal confirmation from the man in the cockpit that the brakes are being held. The aircraft's tail wheel/ nosewheel is unlocked only on signal from the director. When aircraft are being moved, the following procedures will be followed:

a. Movement should be slow enough to permit a safe stop to be made within the clear space available, and in no case faster than the chock walkers can walk.

b. The director ensures that he or another director is always visible to the brake rider in the cockpit.

c. Safety observers are stationed as necessary to ensure safety clearance any time an aircraft will pass in close proximity to another aircraft, bulkhead, or other obstruction. Only directors or personnel specifically designated by the flight deck officer or hangar deck officer can act as safety observers. The safety observer and the director in control of the aircraft will either have each other in sight at all times or have a second safety observer stationed in a position to relay signals.

CAUTION

The movement of aircraft shall not be attempted if sea state or maneuvering of the ship produces excessive motion. Should a maneuver that would result in excessive deck motion be necessary while an aircraft is being moved, an announcement of the impending turn shall be made over the IMC, 3MC, or 5MC system. This announcement should be made in time to permit the application of chocks and tiedowns before the turn will commence.

NOTE

Nothing herein should be construed to require any individual to place his personal safety in jeopardy. This is particularly applicable at night or during periods of heavy weather.

d. During periods of high winds or when the deck is unsteady, chock walkers should closely tend each main wheel. The brake rider should apply partial brakes as necessary to prevent excess speed from building up. When these conditions prevail, aircraft must NOT be moved by hand except in the case of extreme urgency.

e. Aircraft should only be moved using aircraft handling equipment unless deck space does not allow for safe maneuvering of the equipment and the aircraft. When aircraft must be moved by hand, the movement should be against the motion of the deck. This requires that the aircraft always be pushed rather than allowing it to roll with the movement of the ship.

WARNING

Pushers shall NOT position themselves in front of aircraft wheels.

f. Tractor drivers should not move an aircraft except under the control of a director. If a director's signal is not completely understood, the driver should stop and await further instructions.

g. Sudden stops by tractors towing aircraft should be avoided except in an emergency.

h. Directors shall be equipped with whistles, which they should hold in their mouths while controlling aircraft movement. The whistles are used to signal for brakes and chocks.

i. When an aircraft with inoperative brakes must be respotted, the cockpit is not manned; however, chock walkers should remain in position to chock the main wheels instantly if ordered. In addition, deck crewmen should be immediately available with tiedowns ready. Only the ACHO can authorize movement of aircraft with inoperative brakes.

j. As an aircraft nears its parking spot, it should be slowed to a speed that will permit an immediate stop. Directors and safety observers are responsible for maintaining safe clearance for the tractor when maneuvering in close quarters, since the tractor driver must watch the director and is often unable to personally check the clearance.

k. Prior to backing aircraft to deck edge spots, chock walkers should be positioned so as to enable them to chock the main wheels instantly.

l. When an aircraft towbar has to be repositioned to permit a better path of movement prior to the aircraft reaching the interim or final spot, the aircraft should be chocked, and initial tie downs installed prior to disconnecting the towbar.

m. When moving skid configured aircraft, the aircraft handlers (blue shirts) should continuously monitor the brake-actuating handle on the ground handling wheels.

n. When the signal for brakes is given, the brake rider should immediately apply full brakes. Care must be exercised to apply brakes simultaneously, particularly when the aircraft is being moved by hand. The brake signal is a sharp blast on the whistle accompanied by the standard visual signal.

o. The main wheels are chocked as soon as the aircraft stops. The director remains with the aircraft until the handling crew has completed the initial four-point tiedown. The tractor should then be unhitched, and the brake rider notified by the director that he could leave the cockpit. Where practicable, the towbar should remain attached to the aircraft. The crew chief/plane captain inspects attached tiedowns for the required number and proper installation.

p. When parking aircraft on the hangar deck, you should allow clearance for access to and operation of AFFF stations and fireplugs, as well as for the operation of hangar bay doors.

q. Personnel are not allowed to ride on tractors except in the driver's seat.

r. Chock walkers should only serve as chock walkers when moving and aircraft. They are responsible for removing and installing wheel chocks and should never be used as safety observers.

Safety observers shall be stationed as necessary to ensure the safety clearance of aircraft and should never be used as chock walkers.

WARNING

When the word is passed to stand by for a turn, you should exercise extreme caution while moving aircraft. Embarked aviation units provide qualified personnel to the flight deck officer to ensure the expeditious folding/spreading of rotor blades, initial breakdown, and final position of tiedowns, rotor blade security, and other similar functions.

All tractors, towbars, chocks, and other equipment used in handling aircraft on the flight and hangar deck must be in satisfactory condition and used properly. Only equipment that has been signed out to V-1/V-3 divisions should be used to move aircraft. A preoperational check (dailies) on assigned equipment is mandatory.

Chocks and tiedowns should be applied after landing upon signal from the aircraft commander and should remain attached until ready for launch. Short duration on-deck times (when troops or material are loaded quickly) require only that the aircraft be chocked.

Because of the increased possibility of the helicopter entering ground resonance, high-point tiedowns must not be installed while rotors are engaged or turning. Whenever tiedowns are applied, the pilot should be notified of the number used. After tiedowns are removed for takeoff, the chock/tiedown personnel show them to the pilot.

NOTE

Ground resonance is a condition of geometric imbalance on helicopters. This is caused by offsetting dynamic forces when the helicopter makes improper contact with the flight deck. If allowed to continue, destruction of the helicopter is imminent. Improper tiedowns aggravate the onset of ground resonance.

AIRCRAFT TOWING

During aircraft towing operations, the general procedure and safety precautions to be observed are as follows:

1. Ensure that all access panels and doors are closed to prevent damage to the aircraft.

2. Remove all loose objects that could fall from the helicopter during towing.

3. Ensure that a qualified person is in the cockpit to operate the brakes. The pilot or plane captain manning the cockpit must remove their flight helmet or sound attenuators.

NOTE

If brakes are inoperative, station a person with a wheel chock at each main landing gear. The chocks should be used only if an emergency stop is necessary.

4. Station one person at each side of the helicopter just outboard of the rotor blade tip path to ensure that adequate clearance exists between the rotor blades and any object in the towing path.

5. Connect the towbar to the helicopter, unlock the nose/tall wheel, and connect the towbar to the tow vehicle.

6. Remove all tiedowns and chocks.

7. Release the parking brake and proceed to tow.

8. Tow the helicopter smoothly, and do not use the helicopter brakes for steering.

For detailed towing instructions for a specific helicopter, always consult the applicable *NAVAIR Maintenance Instructions Manual* (General Information Section) for the type of helicopter to be towed.

For detailed operating procedures aboard LHA, LHD, LPD, and ships, you should always consult the *LHA/LHD/MCS NATOPS Manual,* NAVAIR 00-80T-106; *Naval Warfare Publication Shipboard VISTOL Aircraft Operating Procedures,* NWP-63-1; and the *Shipboard Helicopter Operating Procedures,* NWP 3-04.1

ASSIGNED EQUIPMENT

The flight deck officer ensures that all tractors, mobile fire fighting vehicles, towbars, chocks, and other equipment used in the handling of aircraft on the flight deck are in satisfactory condition and are properly used. The hangar deck officer has a similar responsibility with regard to the equipment used on the hangar deck. All aviation support equipment operators must be licensed in accordance with current directives. Tractor drivers shall under NO circumstances operate a tractor with defective brakes or steering. Discrepancies should be reported immediately to competent authority. Defective towbars, chocks, wheels, and tiedowns should be taken out of service and turned in for repair. Towbars, chocks, and tiedowns not in use are stowed in designated spaces.

NOTE

Crash and salvage crews should NOT be used as tow tractor operators during aircraft start, launch, recovery, and respot operations.

Specific requirements for crash and salvage crews and equipment operator requirements can be found in the U.S. *Navy Aircraft Firefighting and Rescue Manual* (NAVAIR 00-80R-14).

Helicopter ground handling equipment such as tow tractors, towbars, chocks, and tie downs are similar to those used with fixed wing aircraft discussed in chapter 2 of this NRTC.

AIRCRAFT ELEVATORS

Elevator operation is coordinated with the maneuvering of the ship. Only qualified and designated personnel should operate aircraft elevators. A director is required to supervise the elevator any time it is being raised or lowered. The director must be plainly visible to the elevator operator at all times. Elevators should NOT be operated without two-way communication, either verbal or visual, between directors and operators.

Directors should position the aircraft on the elevator so that it can be towed directly off without repositioning.

Tiedowns and chocks should be set prior to elevator movement. Before signaling for the elevator to be raised or lowered, the director checks the safety stanchions for proper clearance, then signals for the stanchions to be raised. The elevator operator then sounds the warning horn, checks to ensure that all personnel, aircraft, and equipment are clear, and raises the safety stanchions. As soon as the stanchions are up, the director signals for the elevator to be raised or lowered. Only under conditions of operational necessity should an elevator be lowered when the safety stanchions are inoperative. Under these circumstances, directors should be stationed near the elevator to warn approaching personnel. If the safety stanchions on the hangar deck should fail, a temporary lifeline should be rigged as quickly as possible. After the safety stanchions have been raised or the warning given, no person should attempt to board or leave the elevator.

Elevators should remain at hangar deck level for as short a time as possible. An elevator carrying an aircraft to the hangar deck should NOT be lowered until it has been determined that a crew is standing by to remove the aircraft from the elevator as soon as it arrives at hangar deck level.

WARNING

Extreme caution should be exercised when operating deck edge aircraft elevators during periods of high winds and/or heavy seas.

AIRCRAFT DAMAGE REPORTS

Any damage to an aircraft, no matter how slight, should be immediately reported to the ACHO, flight deck officer, or hangar deck officer, who immediately reports the incident to the air officer and informs the squadron maintenance liaison representative. The aircraft can NOT be flown until it has been inspected and declared to be in an "up" status by authorized squadron personnel.

The flight deck officer and hangar deck officer should maintain a record showing the director's name, model aircraft, bureau number, and a brief summary of circumstances for occurrences in which aircraft are damaged, regardless of the extent of damage. Reports of these occurrences are made in accordance with OPNAVINST 3750.6.

Ql. *Who is responsible for designating an aircraft director?*

Q2. *What does the term Ground Resonance indicate?*

Q3. *What is the minimum number of personnel required when towing an aircraft?*

FLIGHT DECK SAFETY

OBJECTIVES: Identify safety precautions associated with helicopter and V/STOL operations. Determine safety hazards associated with aircraft refueling and arming/dearming evolutions.

The ship's commanding officer is responsible at all times for the safety of embarked aircraft and personnel. The commanding officer/officer in charge of the aircraft squadron/detachment and the pilots of individual aircraft are directly responsible for the safety of assigned aircraft and personnel.

OPERATIONAL SAFETY PRECAUTIONS

Safety at the deckplate level cannot be understated. As an ABH, you are in a position of front-line defense in maintaining a safe workplace. Your knowledge of standard operating procedures in conjunction with aircraft handling and flight operations is essential. Personnel associated with flight deck operations must observe the following safety precautions:

1. While aircraft are being recovered, no personnel other than those required should be in the catwalks, on the flight deck, or on the elevators without the express permission of the air officer.

2. Personnel should NOT stand in or otherwise block entrances to the island structure or exits off the catwalks.

3. Personnel should NOT sleep or lounge on the flight deck, catwalks, galleries, or guntubs during flight quarters.

4. Personnel should remain clear of all cargo elevator hatches and weapons mounts outlined by danger lines.

5. Personnel should NOT turn their backs to landing aircraft.

6. No director should give signals to a pilot who is being controlled by another director except in an attempt to avert an accident.

7. During night operations, only the flight deck supervisor or launch officer should use green and red wands.

8. Taking flash pictures during flight operations is prohibited.

9. To minimize the possibility of an aircraft landing on a foul deck, landing spot/deck edge lights are NEVER turned on without the express permission of the air officer.

HELICOPTER SAFETY PRECAUTIONS

Helicopter operations bring on their own special precautions and safety considerations. Whenever you are involved in helicopter operations, the following safety precautions will be observed:

1. Personnel should NOT approach or depart a helicopter while rotors are being engaged or disengaged.

2. Helicopters should NOT be taxied on the flight deck.

3. Helicopters should NOT be towed or pushed while rotors are engaged.

4. Helicopters should NOT be launched or recovered and rotors should NOT be engaged or disengaged while the ship is in a turn.

5. A helicopter should NOT be flown over another aircraft on launch.

6. Only spots that afford visual reference to the deck should be used for night helicopter launches.

7. Personnel required to be in the area of operating helicopters should exercise extreme caution and observe the signals/directions of the landing signal enlisted (LSE) or the combat cargo representative as appropriate.

8. Dual-engine helicopters should NOT be intentionally hovered with just one engine over a deck spot. If topping checks cannot be performed in contact with the deck. They must be performed in flight at an appropriate altitude.

VERTICAL/SHORT TAKEOFF AND LANDING (V/STOL) AIRCRAFT SAFETY PRECAUTIONS

The V/STOL aircraft engines are extremely susceptible to foreign object damage (FOD). The engine can ingest any debris in the vicinity of the aircraft. Ingestion may cause the loss of an engine and possibly result in loss of the aircraft. Foreign objects that are propelled by aircraft jet blast can blind personnel.

Exhaust gases from V/STOL aircraft have tremendous speed and impact force. Special precautions should be taken to remove or thoroughly secure all loose items, such as missile/gun director covers, deck drain covers, life raft covers, or padeye covers, which are near the landing area or the approach path.

Taxiing sharp turns under heavy gross weights coupled with a rolling deck could pinch the outrigger tire to the point of deflation. Pumping the brakes and momentarily straightening the turn to ease the strain on the outrigger and tire can solve this problem.

NOTE

Figure 4-1 shows the danger areas for flight deck personnel from AV-8B jet efflux for start and idle, STO, and VTO.

Except in emergencies, the aircraft nozzles should NOT be rotated downward unless the taxi director or the launch officer directs the pilot.

WARNING

During vertical takeoff and landing (VTOL) operations, a large volume of high-velocity gas is emitted downward from the exhaust nozzles. This downwash strikes the flight deck and flows horizontally above the deck and creates dangerous conditions for the flight deck crew. Personnel movement in this high-velocity blanket is impeded and is similar to walking in a swift stream of knee-deep water. However, should a flight deck crewman fall, there is a high risk of being blown overboard.

The jet efflux produced during vertical operations will exceed 200ºF (93ºC) at a distance of 25 feet from the center of the landing spot when the AV-8 is below 10 feet. Flight deck personnel should remain clear of this area during takeoff and landings. Additionally, flight deck personnel should remain clear of the wing tips, nose, and tall area because of the jet blast danger from the reaction control ducts (there is no blast from the reaction control ducts with nozzles aft). The reaction control ducts also present a hazard with the engine off, in that they have sharp edges and retain heat after the aircraft is shut down.

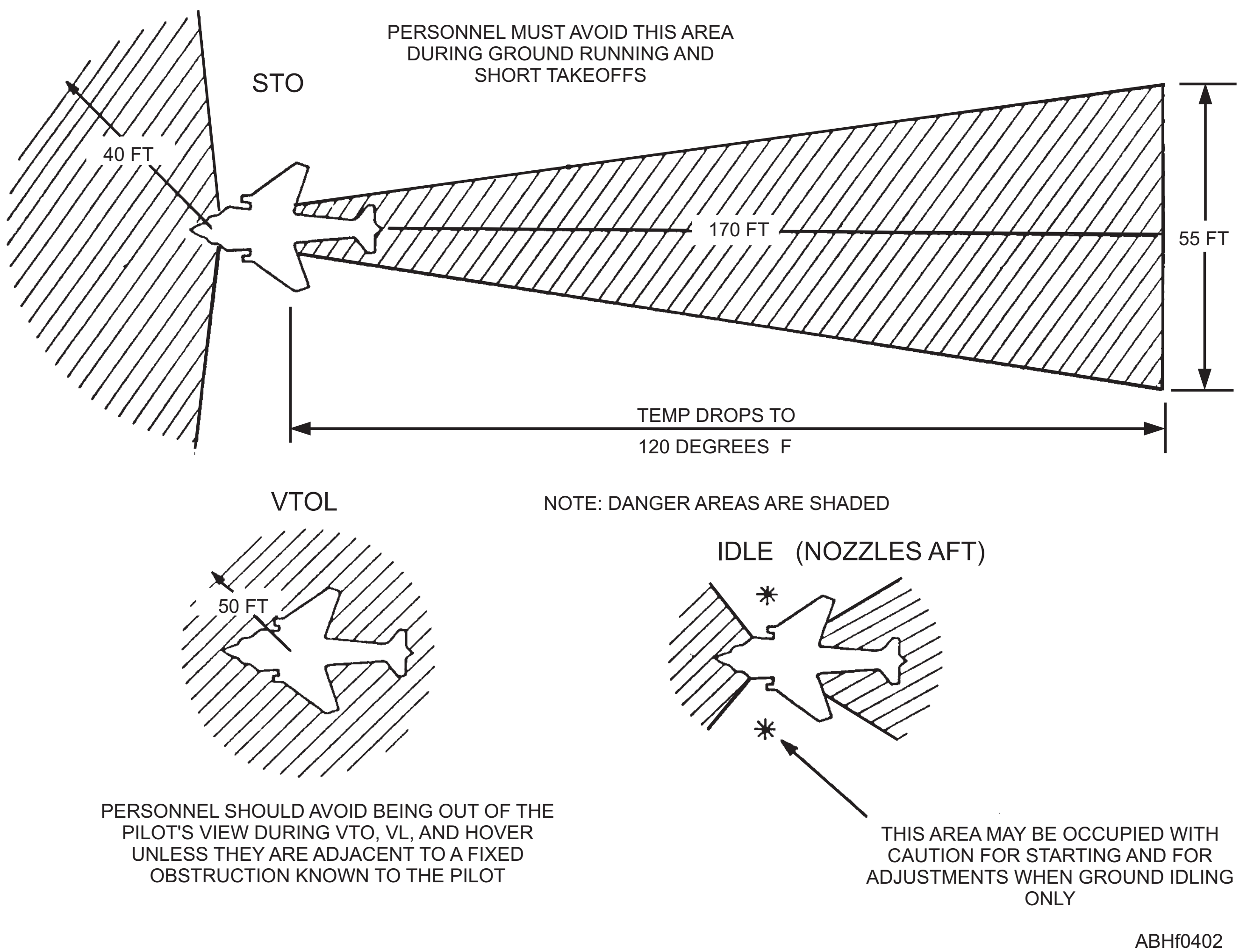


Figure 4-1.—Danger areas to flight deck personnel from the AV-8B.

The blast patterns of the AV-8 create a hazard not only to men and equipment on the deck but also to the aircraft itself. Any items that may cause foreign object damage (FOD) to an aircraft engine must be cleared from the flight deck and from all pad eyes and catwalks prior to AV-8 operations. All equipment such as warning signs, hoses, hatches, and so forth, must be securely fastened down.

The exhausts and ducts of the AV-8 aircraft are a potential bum hazard to personnel. The deck and other objects around the aircraft become extremely hot after only brief exposure to exhaust gases. Flight deck personnel should be thoroughly briefed on these hazards and on how to avoid them.

WARNING

Launch officers should wear gloves during all STO launches to prevent padeye bums to their hands.

AIRCRAFT ARMING/DEARMING

Weapons arming should be conducted in a designated arming area.

When forward firing weapons are involved, the area ahead of the aircraft must be clear and maintained clear until completion of the launch. Arming is conducted only while the aircraft is at a complete stop and when control of the aircraft has been turned over to an arming crew supervisor. All arming signals must be in accordance with the *Aircraft Signals NATOPS Manual,* NAVAIR 00-80T-113, and appendix B of the *LHA/LHD/MCS NATOPS, Manual,* NAVAIR 00-80T-106.

WARNING

Arming of helicopters is conducted after the pilot has signified he is ready for takeoff and after removing the tiedown chains. Arming of V/STOL aircraft is conducted after the launch officer's initial walk around inspection and prior to commencing launch procedures.

A designated aircraft dearming supervisor is positioned on the flight deck during recovery operations to ensure coordination between the landing signal enlisted (LSE), the aircraft director, and the dearming crew. This supervisor indicates to the LSE/director those aircraft that require safing before being moved or shut down.

All V/STOL aircraft landing with hung weapons and/or forward firing weapons are safed as soon as practicable after landing. Helicopters must be dearmed before installing chain tiedowns.

WARNING

During aircraft arming and dearming, the area ahead of and immediately behind the aircraft must be kept clear.

The aircraft safing signals are in accordance with the *Aircraft Signals NATOPS Manual,* NAVAIR 00-80T-113, and appendix B of the *LHA/LHD/MCS NATOPS Manual,* NAVAIR 00-80T-106.

AIRCRAFT REFUELING

Pressure refueling with aircraft shutdown is the normal procedure. The aircraft is completely shut down and only the plane captain, refueling party, and fire party need to remain on station. Additional information on pressure refueling can be found in the applicable aircraft NATOPS flight manual.

Aircraft equipped for pressure refueling may be hot refueled during training, operational, and combat situations. Hot refueling is NOT to be used on aircraft that require gravity refueling. During hot refueling, the LSE/director should ensure the following:

1. The LSE/director can see the pilots, fueling station operator, and nozzlemen.

2. The procedures for hot refueling of helicopters are in accordance with the NAVSHIPS technical manual and the applicable aircraft NATOPS Right manuals. The aircraft should be chocked and the initial tiedown applied. Tiedown crews must remain clear of the rotor arc, but in the vicinity of the helicopter in case of an emergency.

3. All personnel movements from one side of the aircraft to the other should be via the nose. Under no circumstances should personnel work in close proximity to a tail rotor.

4. Any passengers on board the aircraft should be debarked prior to commencement of hot refueling.

5. All refueling personnel, equipment, chocks, and tiedowns should be clear before giving the taxi/launch signal to the pilot.

PERSONNEL	HELMET*	JERSEY	JERSEY/FLOAT COAT SYMBOLS
Aircraft Handling Crew and Chockmen	Blue	Blue	Crew Number
Aircraft Handling Officers, CPO, LPO	Yellow	Yellow	Billet Title
Elevator Operators	White	Blue	E
LSE (Crew Directors)	Yellow	Yellow	Crew Number
Squadron Maintenance Crews	Green	Green	Black Stripe and Squadron Designator
Medical	White	White	Red Cross
Messengers and Telephone Talkers	White	Blue	T
Ordnance	Red	Red	Black Stripe and Squadron Designator/ ship's billet title
Photographers	Green	Green	P
Plane Captains	Brown	Brown	Squadron Designator
Crash and Salvage Crews	Red	Red	Crash/Salvage
Tractor Driver	Blue	Blue	Tractor
AIMD Maintenance Crews	Green	Green	Black Stripe broken by abbreviation of specialty (that is, P/P (Power Plants))
Aviation Fuel Crew	Purple	Purple	F
Aviation Fuel Officer	Purple	Purple	Fuel Officer
Combat Cargo	White	White	Combat Cargo
Safety Observer	White	White	Green Cross

*Combination cranial. **N6/98**

Notes:

1. The life preserver, vest type, U.S. Navy, Mk 1, is designed for prolonged wear while engaged in flight deck activity and is available in colors identical to those listed above.

2. Helmets for all personnel shall be marked with a 6-inch square (or equivalent) of white reflective tape on the back shell and a 3-inch by 6-inch piece, (or equivalent) on the front shell.

3. Combination cranial helmets for the following personnel shall be marked with three vertical reflective international orange stripes, 1-inch wide, evenly spaced, placed on top of white reflective tape:

   a. All officers
   b. Flight and hangar deck chief petty officer and leading petty officer
   c. Crash and salvage chief petty officer and leading petty officer
   d. EOD team members
   e. Squadron's ordnance officer
   f. Ship's air gunner

4. The ordnance arming/safety supervisor at night shall have two red standard wands banded with two 3/4-inch bands equally spaced on the cones.

Figure 4-2.—Flight deck clothing.

WARNING

> The presence of high winds, high noise levels, fire hazards, flying objects, turning rotors, taxiing aircraft intake suction, and jet blast make safety consciousness imperative.

During flight operations, only essential personnel are allowed on the flight deck. All others should remain clear of the flight deck, catwalks, and guntub areas. Personnel may view flight operations only from an area designated by the commanding officer.

Personnel engaged in flight operations should wear appropriate safety helmets, sound suppressors, safety goggles, flight deck safety shoes, long-sleeve shirts/jerseys, and life vests. Flight quarters clothing should conform to the colors and symbols prescribed in figure 4-2.

While flight operations are being conducted, personnel on exposed decks and catwalks should remove all loose items of clothing and equipment, including hats, except for approved, and properly fastened safety helmets.

Personnel on the flight deck should be trained to take cover immediately on command of the flight deck officer, air officer, or launch officer.

Personnel working near an aircraft should observe the aircraft carefully for any signs of malfunction, such as smoke, oil, hydraulic leaks, and so forth, and immediately report such malfunctions to the flight deck officer or air officer.

Crewmembers, passengers, and troops returning from flights should expeditiously clear the flight deck and the vicinity of the island structure exposed to flight operations. Qualified personnel must escort all passengers and troops to and from aircraft.

Dawn, dusk, and night operations increase the hazards to personnel on the flight decks, and greater vigilance is required during these periods.

WARNING

> Smoking is NEVER permitted on the flight deck, hangar deck, catwalks, elevators, or weather decks. Matches and cigarette lighters must NEVER be used in compartments where fuel fumes may be present.

When aircraft are serviced, especially at night, extreme care must be taken to prevent overfilling of fuel tanks and spilling of oil or hydraulic fluid. Any oil, grease, hydraulic fluid, and spilled fuel should be removed from the flight deck immediately.

Care should be used in approaching elevator openings, particularly on the windward side. No person should attempt to get on or off an elevator once the elevator operator has raised the elevator stanchions. No one should lean on the elevator stanchions or stanchion cables at any time. Safety chains/lines/gates must be connected across cargo elevator openings at all times when main hatches are open and cargo is not being moved into or out of the elevator.

Crash crew and/or organized fire parties are responsible for responding to aircraft crashes and fires. All other personnel should remain clear of the area in which the fire or crash has occurred, unless specifically requested to assist in combating the fire or clearing the deck. In case of fire, designated squadron personnel should aid in handling hoses and personnel casualties.

Q4. What color are the flight deck supervisor's signal wands?

Q5. When should an aircraft carrying forward firing ordnance be armed?

Q6. What are six items of personal protective equipment that must be worn during flight operations?

AIRCRAFT INTEGRITY WATCH

OBJECTIVES: State the composition and organization of the integrity watch team. Identify the equipment requirements of the integrity watch team.

The embarked unit provides personnel to stand the air department integrity watch. This watch is set both underway and in port whenever there are aircraft aboard and the ship is not at general quarters or flight quarters. The watch has one officer and as many enlisted personnel as may be required to ensure complete aircraft integrity. Integrity watch personnel are indoctrinated in equipment and procedures for flight deck/hangar deck fire fighting. The air officer is overall responsible for the integrity watch aboard the ship.

INTEGRITY WATCH COMPOSITION

The air department integrity watch is composed of qualified personnel from the air wing and the air department as follows (these requirements may be modified by the air officer/ACHO as required):

WATCH or DUTY	PERS. REQ.	PROVIDED BY
Integrity watch officer (IWO)	1	Air wing
Integrity watch noncommissioned Officer (NCO)	3	Air wing
Flight deck security patrol	3	Air wing
Hangar deck security patrol	2/3	Air wing
Integrity watch messenger	1	V-1 division
Conflagration watches	2/3	V-3 division*
AV fuels security watch	1/2	V-4/Air Dept.

* One watch per day

INTEGRITY WATCH EQUIPMENT

The following equipment is used:

1. While on watch, each roving security patrol wears a properly configured white flotation (life) vest. It is stenciled on the front and rear with large black letters "IW." Survival equipment (flotation vest, cranial, and so forth) is provided for the integrity watch officer (IWO) and integrity watch noncommissioned officer (NCO) to don in the course of their routine flight deck inspections. No member of the integrity watch (IW) team should routinely venture onto the flight deck without proper survival equipment.
2. The aviation fuels patrol wears a duty belt. The flight and hangar deck integrity watch, aviation fuels security patrols, and catapult security watches are equipped with a flashlight during hours of darkness. Foul weather gear is also provided for watches exposed to the elements during inclement weather.
3. An integrity watch officer's logbook, pass down (PDL) book, night order log, equipment accountability log, and instruction/reference binder and publications are provided by the ACHO.
4. Integrity watch gear is provided and maintained as directed by the ACHO. The integrity watch officer (IWO) is responsible for ensuring the accountability of this gear with any discrepancies noted in the equipment accountability log.

INTEGRITY WATCH OFFICER

The integrity watch officer (IWO) is a fully PQS qualified officer from embarked squadrons. The IWO stands a 4-hour watch, and relieves the ACHO or the ACHO's representative upon being secured from flight quarters.

INTEGRITY WATCH NONCOMMISSIONED OFFICER (NCO)

The integrity watch NCO is a fully qualified NCO of the embarked air wing. The integrity watch NCO is responsible for the supervising the aircraft integrity watches and for carrying out the duties and responsibilities of the watch under the direction of the integrity watch officer.

FLIGHT AND HANGAR DECK SECURITY PATROLS

PQS qualified personnel of the embarked air wing stand the flight and hangar deck security patrol watches. These watches are responsible for the physical security of all aircraft and equipment on the flight and hangar decks.

INTEGRITY WATCH MESSENGERS

Assigned personnel from V-1 division stand the integrity watch messengers. They carry out the following duties and responsibilities:

- Are available to the IWO to perform such duties as the watch officer may assign.
- In the absence of the IWO and MNCO, they handle communications.

AVIATION FUELS SECURITY WATCH

V-4 division personnel under the supervision of the duty aviation fuels (AVFUELS) petty officer stand the aviation fuels security watch. All watchstanders must have completed the AVFUELS (Afloat) personnel qualification standards (PQS) qualification card for this watch. Trainees may be assigned under the supervision of a qualified watchstander. Aviation fuels security watchstanders report the security of the AVFUELS system to the IWO (or OOD as appropriate), according to existing procedures.

CONFLAGRATION STATION WATCH

Each conflagration (conflag) station watch is stood by fully PQS qualified personnel of the V-3 division, who are responsible to the IWO or OOD, as appropriate.

TRAINING

The ACHO is responsible to the air officer for the overall training and supervision of the air department integrity watch. He reviews the integrity watch log daily and takes action, as required, to resolve problem areas or discrepancies noted therein.

Q7. Who has overall responsibility for the Aircraft Integrity Watch?

Q8. The Integrity Watch messengers are assigned from what division?

AIRCRAFT SECURING PROCEDURES

OBJECTIVE: State the three categories of aircraft tiedown conditions.

Aircraft are tied down as directed by the ACHO or his representative. Unless otherwise specified, chain tiedowns should be used exclusively. Tiedowns should run from a proper tiedown fitting on the aircraft to a pad eye on the deck without pressing against oleo struts, hydraulic lines, tires, or any other portion of the aircraft. When an aircraft is spotted adjacent to an elevator, tiedowns should NOT be attached to the elevator or across the safety stanchions.

Tiedowns are removed only when signaled by an aircraft director. They are affixed to aircraft to preclude movement in any direction. This requires that they oppose each other. They should be as equally distributed on the aircraft as possible.

Tiedown requirements are divided into three categories, which are discussed in the following text.

INITIAL (FOUR-POINT) TIEDOWN

This configuration is required for all aircraft prior to launch, upon recovery immediately after an aircraft is parked or immediately preceding movement of an aircraft.

PERMANENT (EIGHT-POINT) TIEDOWN

This is required when not at flight quarters or when the aircraft is not expected to be moved for respot. The crew chief/plane captain applies permanent tiedowns.

HEAVY WEATHER (TWELVE-POINT) TIEDOWNS

This is required when an increase in aircraft security is required during high winds/sea state, ship's maneuvers, or for prolonged periods of heavy maintenance.

NOTE

The ACHO may adjust the number of tiedowns required in each of the above categories when such action is indicated due to the aircraft model. He should order an increase in the number of tiedowns required when such action is indicated due to expected wind, sea state, or ship's maneuvers.

AV-8 TIEDOWN

The presently configured AV-8 aircraft have four tiedown points, two on each outrigger (one inboard and one outboard). To secure the nose gear, the nosewheel must be positioned on the aircraft centerline. The standard TD-lB tiedown is inverted, the chains crossed to form an X, and the deck end of the tiedown attached to the aircraft (and vice versa). Tie downs attached to AV-8 outriggers can be removed after engine start and attached before engine shutdown without danger to personnel. An example of an AV-8 tiedown configuration is shown in figure 4-3.

NOTE

A permanent tiedown requires 10 tiedown chains for the AV-8.

With the exception of the main rotor blade tiedowns, helicopter tiedown and securing procedures are similar to those given for fixed-wing aircraft in chapter 3 of this TRAMAN.

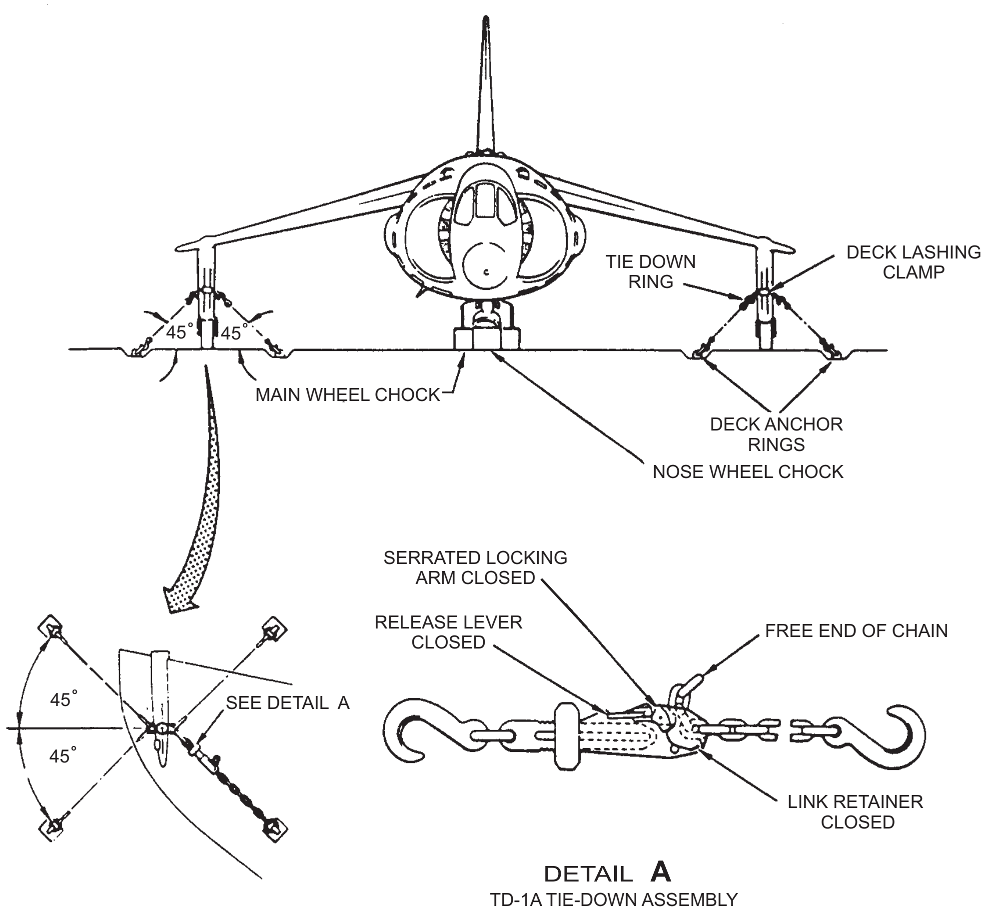
Tiedowns for the main rotor blades are used to prevent damage that might be caused by gusty and turbulent wind conditions when the blades are in a spread position. This type of tiedown usually has a canvas boot with an attached length of manila line.

The canvas boot is placed over the tip of the rotor blade and the boot line is then secured either to a deck fitting or to a fitting on the helicopter itself

NOTE

The boot lines should be taut enough to hold the blades without applying excessive bending force. The lines must be checked for shrinkage when wet, and the lines must be re-adjusted when shrinkage occurs.

An example of a helicopter tiedown configuration is given in figure 4-4. You should always consult the applicable NA VAIR *Maintenance Instructions Manual* (General Information section) for detailed securing instructions for a special type of helicopter.



1. RAPID TIE-DOWN OF SHIPBOARD AIRCRAFT.
2. PROCEDURE

NOTE

THIS PROCEDURE IS SAFE FOR WIND SPEEDS UP TO 40 KNOTS FROM ANY DIRECTION

a. APPLY WHEEL BRAKES, SET PARKING BRAKE AND LOCK RUDDER BAR.
b. CHOCK NOSE AND MAIN WHEELS FORWARD AND AFT.
c. INSERT CHAIN HOOKS (POINT UP) IN DECK ANCHOR RINGS AND LOCK HOUSING HOOKS IN OUTRIGGER OUTBOARD TIE-DOWN RING. SECURE CHAIN IN LOCK HOUSING AND APPLY TENSION BY HAND AS DESCRIBED IN NAVAIR 17-1-537, SECTION 11.
d. THE PROCEDURE FOR THE OUTRIGGER INBOARD TIE-DOWN IS THE SAME AS THE OUTRIGGER OUTBOARD TIE-DOWN.

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Figure 4-3.—Tiedown configuration (AV-8).

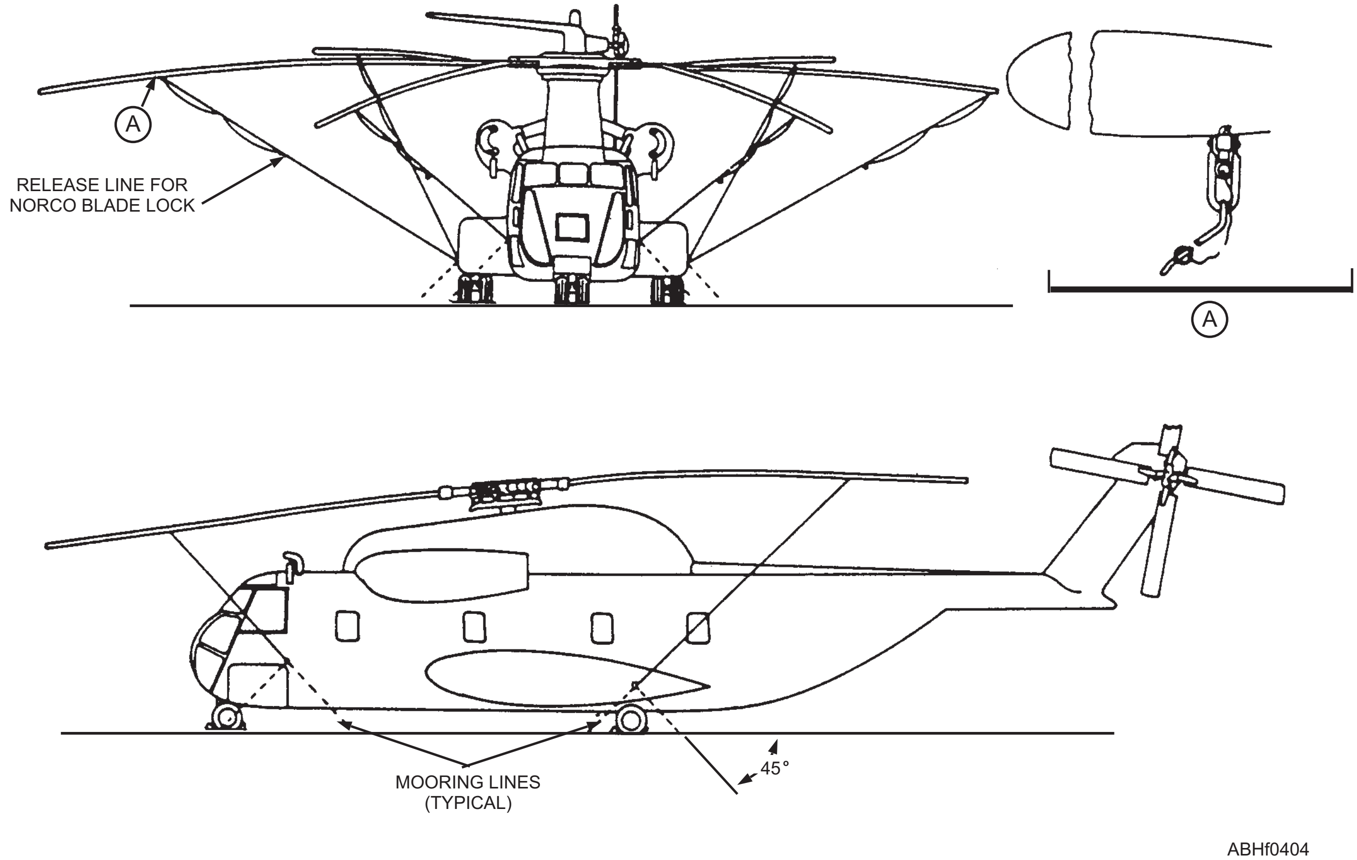


Figure 4-4.—Tiedown configuration (CH-53).

Q9. What are the three categories of aircraft tiedown security?

HELICOPTER HANDLING SIGNALS

OBJECTIVE: Demonstrate the correct use of helicopter handling signals.

Figure 4-5 (sheets I through 12) illustrate helicopter-handling signals. Both day signals and night signals are explained. The signals that are used in U.S. Navy operations and when ships are operating with NATO forces are also shown in figure 4-5.

MANDATORY HELICOPTER SIGNALS

All signals given by the LSE to the pilot are advisory in nature, with the exception of WAVE-OFF and HOLD POSITION, which are mandatory.

Q10. What hand signal is being given when a director/LSE hold both fist clenched at eye level?

AIRCRAFT FLIGHT OPERATION PROCEDURES

OBJECTIVES: Identify flight quarters preparation requirements. Interpret the deck status beacon signals. Demonstrate familiarization with launch and recovery operations.

The air officer is responsible to the ship's commanding officer for activities in support of flight operations on the flight and hangar decks. The air officer or a qualified assistant is in primary fly control (Pri-Fly) during flight quarters to control all evolutions involving aircraft.

Pri-Fly has control for flight deck lighting, landing spot lighting, flight deck floodlights, the stabilized glide slope indicator (SGSI), and the flight deck rotary beacon light.

When flight quarters are sounded, the air officer ensures the following:

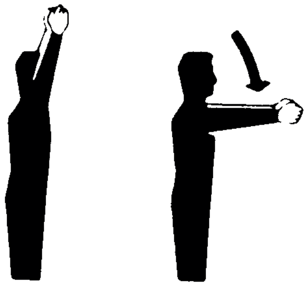
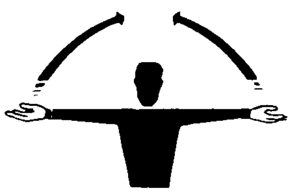
SIGNAL	DAY	NIGHT	REMARKS
1  LANDING DIRECTION	Marshaler stands with arms raised vertically above head and facing toward the point where the aircraft is to land. The arms are lowered repeatedly from a vertical to a horizontal position, stopping finally in the horizontal position.	Same as day signal with addition of wands.	
2  MOVE UPWARD	Arms extended horizontally sideways beckoning upwards, with palms turned up. Speed of movement indicates rate of ascent.	Same as day signal with addition of wands.	Conforms to ICAO signal.
3  HOVER	Arms extended horizontally sideways, palms downward.	Same as day signal with addition of wands.	Conforms to ICAO signal.
4  MOVE DOWNWARD	Arms extended horizontally sideways beckoning downwards, with palms turned down. Speed of movement indicates rate of descent.	Same as day signal with addition of wands.	Conforms to ICAO signal.

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Figure 4-5.—Helicopter handling signals (sheet 1).

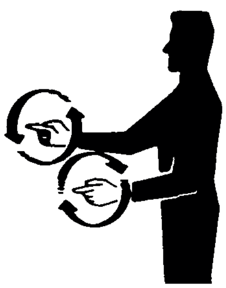
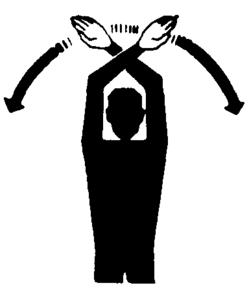
SIGNAL	DAY	NIGHT	REMARKS
5  MOVE TO LEFT	Right arm extended horizontally sideways in direction of movement and other arm swung over the head in same direction, in a repeating movement.	Same as day signal with addition of wands.	
6  MOVE TO RIGHT	Left arm extended horizontally sideways in direction of movement and other arm swung over the head in the same direction, in a repeating movement.	Same as day signal with addition of wands.	
7  LOWER WHEELS	When aircraft approaches director with landing gear retracted, marshaler gives signal by side view of a cranking circular motion of the hands.	Same as day signal with addition of wands.	
8  WAVE OFF	Waving of arms over the head.	Same as day signal with addition of wands.	Signal is mandatory.

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Figure 4-5.—Helicopter handling signals (sheet 2).

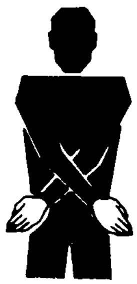
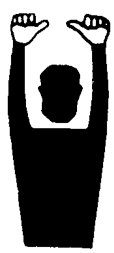
SIGNAL	DAY	NIGHT	REMARKS
9  LAND	Arms crossed and extended downwards in front of the body.	Same as day signal with addition of wands.	Conforms to ICAO signal.
10  DROOP STOPS OUT	When rotor starts to “run down” marshaler stands with both hands raised above head, fists closed, thumbs pointing out.	Same as day signal with addition of wands.	
11  DROOP STOPS IN	When droop stops go in, marshaler turns thumbs inwards.	Same as day signal with addition of wands.	
12  REMOVE BLADE TIEDOWNS	Left hand above head, right hand pointing to individual boots for removal.	Same as day signal with addition of wands.	

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Figure 4-5.—Helicopter handling signals (sheet 3).

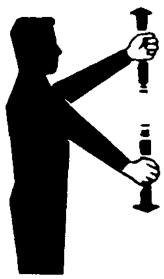
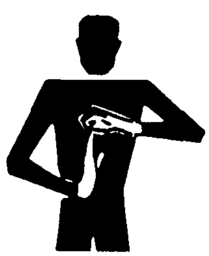
SIGNAL	DAY	NIGHT	REMARKS
(13)  ENGAGE ROTOR(S)	Circular motion in horizontal plane with right hand above head.	Same as day signal with addition of wands.	
(14)  HOOK UP LOAD	Rope climbing motion with hands.	Same as day signal with addition of wands.	
(15)  RELEASE LOAD	Left arm extended forward horizontally, fist clenched, with hand making vertical pendulum movement with fist clenched.	Same as day signal with addition of wands.	
(16)  LOAD HAS NOT BEEN RELEASED	Bend left arm horizontally across chest with fist clenched, palm downward; open right hand pointed up vertically to center of left fist.	Same as day signal with addition of wands.	

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Figure 4-5.—Helicopter handling signals (sheet 4).

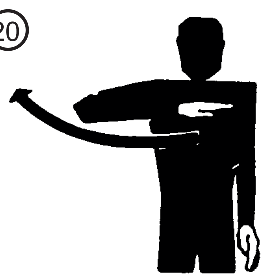
SIGNAL	DAY	NIGHT	REMARKS
17  WINCH UP	Left arm horizontal in front of body, fist clenched, right hand with palm turned upwards making upward motion.	Same as day signal with addition of wands.	
18  WINCH DOWN	Left arm horizontal in front of body, fist clenched, right hand with palm turned downwards making downnward motion.	Same as day signal with addition of wands.	
19  CUT CABLE	Right arm extended forward horizontally, fist clenched, left arm making horizontal slicing movements below the right fist, palm downward.	Same as day signal with addition of wands.	
20  SPREAD PYLON	Bend elbow across chest, palm downward. Extend arm outward to horizontal position, keeping palm open and facing down.	Same as day signal with addition of wands.	

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Figure 4-5.—Helicopter handling signals (sheet 5).

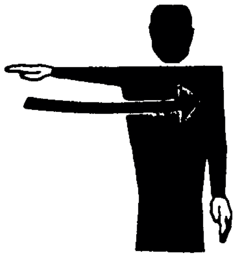
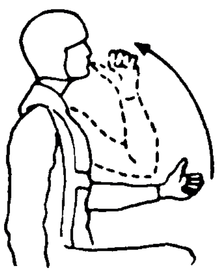
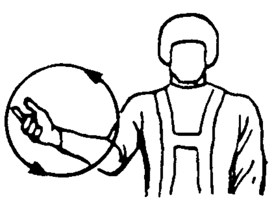
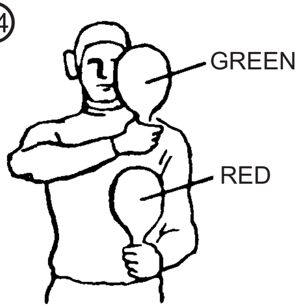
SIGNAL	DAY	NIGHT	REMARKS
21  FOLD PYLON	Extend right arm horizontally, palm downward. Bend arm keeping palm down.	Same as day signal with addition of wands.	
22  I DESIRE HIFR/FUEL	Helicopter crewmember brings thumb to mouth as if drinking from glass.	Same except use red lens flashlight.	
23  COMMENCE FUELING	Helicopter crewmember makes circular motion with right hand.	Helicopter crewmember makes circular motion with red lens flashlight.	
24  AM PUMP FUELING	Ship's fuel crewmember holds green device vertically over red device.	Ship's fuel crewmember holds green wand vertically over red wand.	

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Figure 4-5.—Helicopter handling signals (sheet 6).

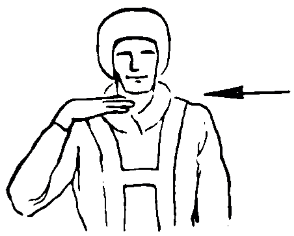
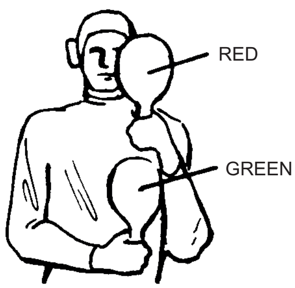
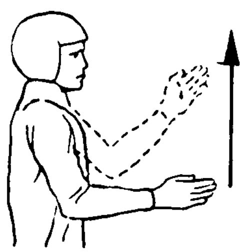
SIGNAL	DAY	NIGHT	REMARKS
25  CEASE FUELING	Helicopter crewmember makes horizontal cutting motion of right hand across throat.	Helicopter crewmember makes horizontal motion of red lens flashlight.	
26  HAVE CEASED PUMPING FUEL	Ship's fuel crewmember holds red device over green device.	Ship's fuel crewmember holds red wand vertically over green wand.	
27  DESIRE TO MOVE OVER DECK AND RETURN HOSE	Helicopter crewmember makes vertical motion of hand.	Helicopter crewmember makes vertical motion of red lens flashlight.	
28  EXECUTE EMERGENCY BREAKAWAY	LSE/director makes waveoff signal.	LSE/director makes waveoff signal with wands.	Signal is mandatory.

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Figure 4-5.—Helicopter handling signals (sheet 7).

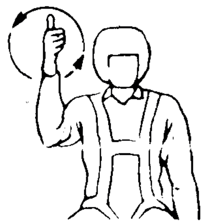
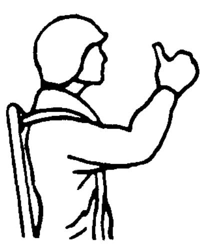
SIGNAL	DAY	NIGHT	REMARKS
29  READY TO START ENGINE (pilot)	Move hand in a circle perpendicular to the deck; follows with a thumbs up signal. Signify by number of fingers, engine to be started	Turns on flashlight or moveable light and moves it in a circle perpendicular to the deck.	
30  READY TO ENGAGE ROTORS (pilot)	Moves hand in horizontal circle at eye level, index finger extended. Aircraft lights FLASHING BRIGHT.	Same as day except holds red light in hand. Aircraft lights FLASHING DIM.	At night, aircraft lights should be on FLASHING DIM until aircraft is declared up and ready for takeoff by the pilot.
31  READY TO ENGAGE ROTORS (LSE)	FACES FLY CONTROL: Holds left fist above head; gives circular motion of right hand above head, index finger extended.	Rotates one wand at chest level; holds other wand above head.	The air officer shall signal authority to engage rotors by illuminating a yellow rotating beacon.
32  READY FOR TAKEOFF (pilot)	Gives thumbs up signal at eye level. Aircraft lights STEADY BRIGHT.	Places running and formation lights on STEADY DIM. May give thumbs up signal by turning on flashlight or other moveable lights and moving it up and down.	

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Figure 4-5.—Helicopter handling signals (sheet 8).

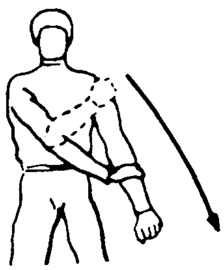
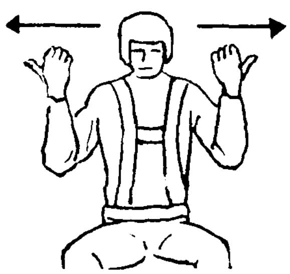
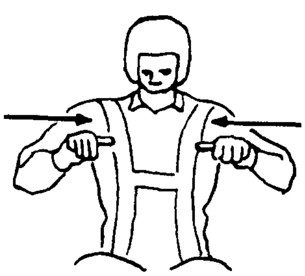
SIGNAL	DAY	NIGHT	REMARKS
33  READY FOR TAKEOFF (LSE)	FACES FLY CONTROL. Holds right thumb up at eye level; holds left fist at eye level.	Signal not required. Pilot's STEADY DIM indicates readiness to Fly Control.	The air officer shall signal authority for launch of helicopters by illuminating a green rotating beacon in addition to the rotating yellow beacon.
34  REMOVE TIEDOWNS (LSE)	To tiedown crew: Makes wiping motion down left arm with right hand.	Same as day except with addition of wands.	
35  REMOVE CHOCKS AND TIEDOWNS(pilot)	Swings arms apart, thumbs extended outwards.	Using hand held light or flashlight, gives on/off signals at 1-second intervals.	
36  INSERT CHOCKS AND TIEDOWNS (pilot)	Swings arms together, thumbs extended inwards. In single piloted aircraft, pilot may swing one arm alternately from each side, thumb extended inwards.	Moves hand held light or flashlight at eye level in a horizontal plane alternately inwards from each side.	

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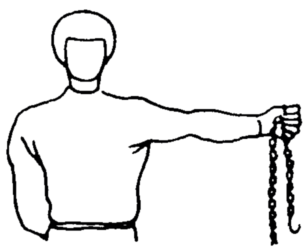
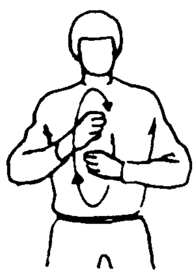
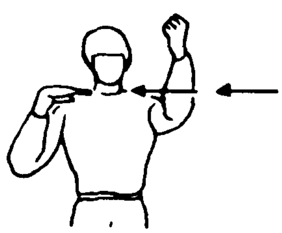
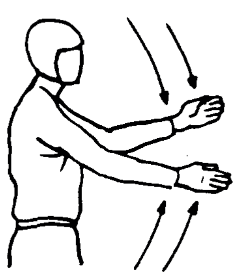
Figure 4-5.—Helicopter handling signals (sheet 9).

SIGNAL	DAY	NIGHT	REMARKS
37  TIEDOWNS REMOVED (deck crew)	Stands in full view of pilot and LSE and holds tiedown and chocks extended to side.	Same as day except illuminates tiedown with amber flashlight.	
38  INSTALL TIEDOWNS (LSE)	To tiedown crew: Rotates hands in circle perpendicular to and in front of his body.	Same as day except with amber wands.	Give “hold” signal as soon as first tiedown is attached.
39  DISENGAGE ROTORS (LSE)	Holds left fist above head; makes throat cutting action with right hand.	Same as day except with amber wands.	Give “hold” signal as soon as first tiedown is attached.
40  HOOK NOT DOWN/UP	Arms extended, make short up and down chopping action, alternating hands.	Same as day except with amber wands.	

ABHf0405j

Figure 4-5.—Helicopter handling signals (sheet 10).

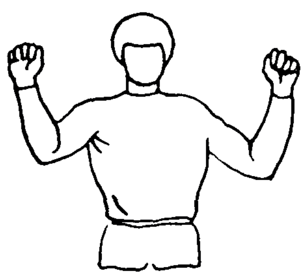
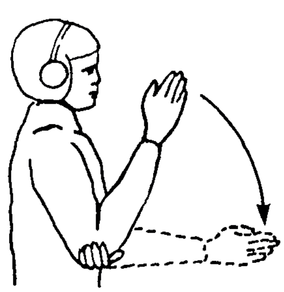
SIGNAL	DAY	NIGHT	REMARKS
41  SWING TAIL LEFT	Use standard fixed-wing turn signal, pointing with hand to wheel to be pivoted and giving "come-on " with other hand.	Same as day except with amber wands.	
42  SWING TAIL RIGHT	Use standard fixed-wing turn signal, pointing with hand to wheel to be pivoted and giving "come-on " with other hand.	Same as day except with amber wands.	
43  HOLD POSITION	Makes clenched fists at eye level.	Hold crossed wands (any color) overhead.	Signal is mandatory.
44  ANTENNA IN DOWN POSITION	Rest elbow in left palm at waist level. Bring right hand down to horizontal position.	Same except with wands.	

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Figure 4-5.—Helicopter handling signals (sheet 11).

1. Procedures prescribed in applicable bulletins and instructions for inspection and preparation for operation of the optical landing aids, elevators, aviation fuels system, and crash and firefighting equipment are followed.

2. A FOD walkdown is conducted prior to flight operations; and

3. Communications equipment is tested.

The flight deck is marked with the number of spots for the particular ship. The landing areas are controlled separately by rotary beacon lights or flags from Pri-Fly. Figure 4-6 is a typical helicopter landing spot diagram.

Figures 4-7 and 4-8 explain the flight deck rotating beacon/deck status lights signals for helicopters and the light signals that a helicopter uses to communicate information to the LSE/director. For a detailed description of flight decks, you should refer to *LHA/LHD/MCS NATOPS Manual,* NAVAIR 00-80T-106.

FLIGHT QUARTERS STATIONS

Flight quarters stations are manned when directed and as prescribed in the ship's watch quarter and station bill. Squadron personnel man aircraft as appropriate. Some evolutions may not require that all flight quarters stations be manned. On such occasions, specific instructions are issued at the time flight quarters are set (for example, "Flight quarters for respot").

All personnel assigned to working stations on the flight or hangar decks, aviation fuels, and ordnance spaces should wear flight deck safety shoes or flight boots. Those personnel assigned flight quarters stations on or above the hangar decks should wear jerseys, as required in figure 4-2. Flight deck personnel should wear cranial impact helmet or its equivalent. In addition, all personnel that work on the flight deck should wear goggles, sound attenuators, flotation gear, dye markers, and adequately secured whistles and survival lights. All personnel working on the hangar deck on deck-edge elevators should wear flotation gear, dye markers, and adequately secured whistles and survival lights. During night flight operations, LSE/directors should use signal wands. All other personnel should use flashlights. Under red flight deck lighting conditions, white flashlights are NOT used.

During flight quarters, individuals wearing improper clothing are NOT permitted on the flight deck without the express consent of the air officer.

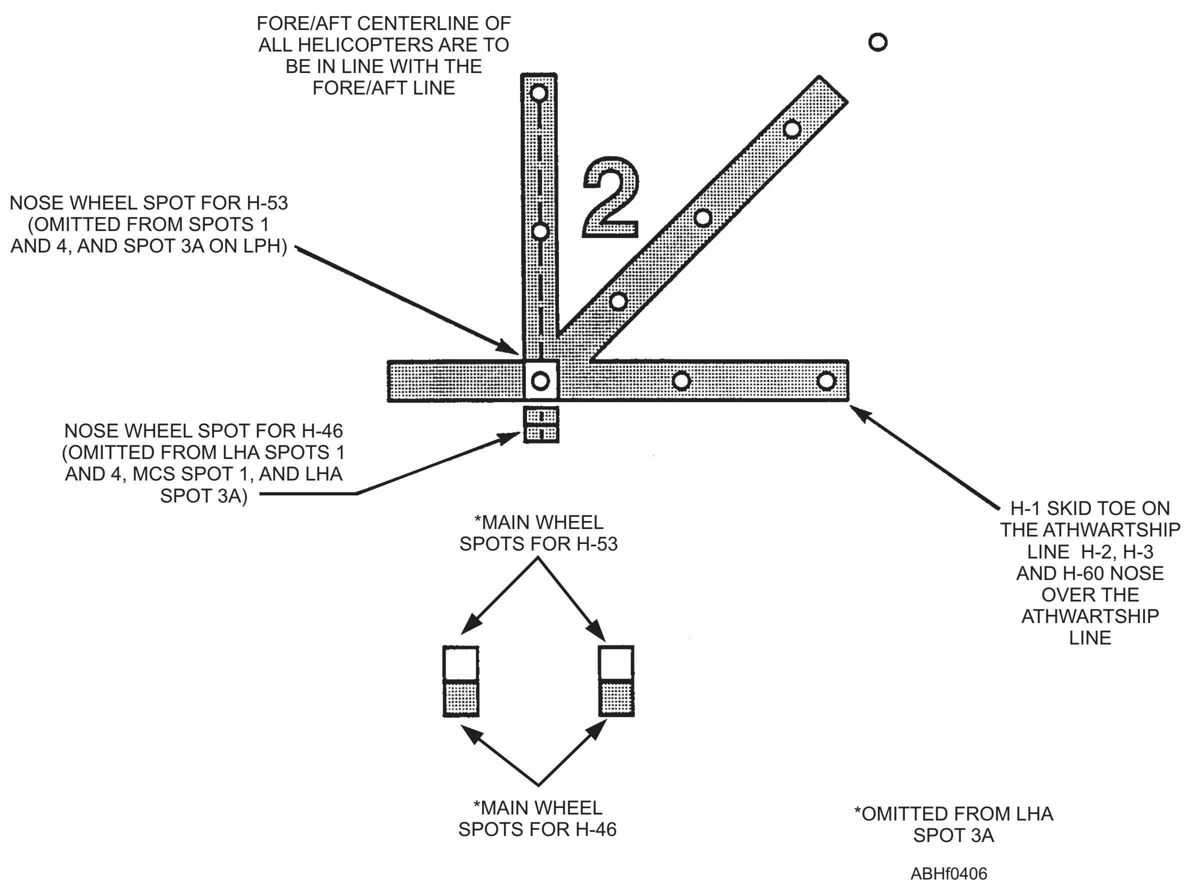

Figure 4-6.—Helicopter landing spot diagram (typical).

EVOLUTION	COMMAND	DISPLAY	MEANING (HELO)	MEANING (AV-8)
1. Prepare to start engines	Check chocks, chains, tiedowns, fire bottles, and all loose gear about the flight deck. Helmets buckled, goggles down, start APP/GTS on LSE/director signal.	Red signal in flight deck area	Verify starting wind limitations chocks and tiedowns in place. Boots removed and stowed. Secure all loose gear. Man fire extinguishers.	Intake blanks clear GTS wind limits met, chocks, tiedowns in place, loose gear secured. Man fire extinguishers.
2. Start engines	Start engines	Red signal in flight deck area	Authority for responsible flight deck personnel to signal for starting engines. Ship not ready for flight operations	
3. Engage/disengage rotors	Stand clear of rotors (20-second pause)-engage/disengag e rotors	Amber signal in flight deck area	Ship is ready for the pilot to engage rotors. Authority for responsible flight deck personnel to signal for engaging rotors when the immediate area is cleared. Ship not ready for flight operations.	Squadron personnel conduct poststart checks (i.e., controls) clear exhaust areas.
4. Removal of tiedowns	Remove all tiedowns	Not applicable Note: Emcon (Red, Green, Red)	Remove tiedowns from aircraft and show to pilot. LSE points to tiedowns and shows one finger to the pilot for each tiedown removed.	
5. Aircraft arm/dearm	Arm/dearm aircraft	Amber/Green	LSE turns aircraft over to arm/dearm supervisor.	
6. Launch	Launch aircraft	Green signal in flight deck area	Ship is ready in all respects for flight operation. Authority for responsible flight deck personnel to launch aircraft when pilot is ready and tiedowns and chocks have been removed.	
7. Aircraft approaching	Standby to recover aircraft, spot ______.	Red signal in flight deck area	Prepare designated landing area to land aircraft. Ship not ready to recover aircraft.	
8. Recover	Land aircraft	Green signal in flight deck area	Ship is ready in all respects to land aircraft.	
NOTE: Flight deck rotating beacon signals are for Pri-Fly control of flight deck operations only. These lights are not be interpreted by pilots as clearance/denial for any evolution.				

Figure 4-7.—Deck status lights/rotating beacon signals for helicopter operations.

HELICOPTER SIGNAL	HELICOPTER LIGHTS
Ready to start APP	Red cockpit dome light on or red lens flashlight.
Ready to start engines	External navigation lights on STEADY DIM.
Ready to engage rotors	External navigation lights on FLASHING DIM.
Ready for takeoff	Anticollision lights on, navigation lights on STEADY BRIGHT.
After takeoff	Anticollision lights on, navigation lights on STEADY BRIGHT.
180º abeam position/right seat landing	Navigation lights on STEADY BRIGHT. Anticollision lights on.
180º abeam position/left seat landing	Navigation lights on FLASHING BRIGHT. Anticollision lights on.
After final landing, or when on deck for extended period	Anticollision lights off. Navigation lights on FLASHING DIM.
Ready for disengage rotor	Red dome light on or red flashlight. Navigation lights on FLASHING DIM.
Note: May be modified by Pri-Fly to accommodate weather conditions and aircraft characteristics. Use day hand signals during NVD operations.	

Figure 4-8.—Helicopter Night Lighting Procedures.

FOREIGN OBJECT DAMAGE (FOD) WALKDOWN

All deck areas and particularly the flight deck, should be inspected before, and monitored throughout, flight operations. This is to ensure that they are free of foreign objects, such as rags, pieces of paper, line, caps, nuts, bolts, and so forth, which can be caught by air currents and later cause damage to aircraft or injure personnel.

WARNING

The dumping of trash during flight operations creates a serious FOD hazard. Therefore, the dumping of trash should be secured before flight operations and NOT resumed until flight operations are completed.

Gas turbine engines power the V/STOL aircraft. The high turbine speed makes these engines extremely susceptible to FOD. The engine can ingest any debris in the vicinity of the aircraft. Ingestion may cause the loss of an engine and result in crash of the aircraft.

Foreign objects propelled by aircraft jet blast have blinded personnel.

WARNING

Due to the hazard from flying objects, all personnel on the flight deck must wear protective goggles during flight operations.

Exhaust gases from V/STOL aircraft have tremendous speed and impact force. Special precautions must be taken to remove or thoroughly secure all loose items such as missile/gun director covers, deck drain covers, life raft covers, or pad-eye covers, which are near the landing area or the approach path.

LANDING SIGNAL OFFICER (LSO, V/STOL)

The V/STOL LSO's primary responsibility is the safe and expeditious launch and recovery of V/STOL aircraft aboard ship. The employment of high performance aircraft and the necessity for all-weather operations have placed ever-increasing demands on the LSO's skill and judgment. Through training and experience, the LSO correlates factors of wind, weather, aircraft capabilities, ship configuration, pilot experience, and so forth, to provide optimum control and assistance in aircraft shipboard operations. The

LSO is also directly responsible for training pilots in shipboard launch and landing techniques. In this regard, he constantly monitors pilot performance, schedules and conducts necessary ground training, counsels and debriefs individual pilots, maintains trend sheets to track each pilot's performance, and certifies their shipboard readiness and qualification. The pilot and LSO are a professional and disciplined team, both ashore and afloat. The LSO develops the pilot's confidence, judgment, maximum effort, technical proficiency, and personal interest. The pilot relies on the LSO's experience and ability to prepare for optimum effectiveness as a shipboard pilot.

Additionally, the V/STOL LSO is responsible for computing all launch data, supervising all takeoffs, controlling all landings, providing launch officer training and qualification, and interfacing with the ship's air officer during launch and recovery operations.

When embarked, the V/STOL LSO is responsible to the ship's captain for the safe and efficient launch and recovery of V/STOL aircraft. The LSO informs the captain, through the air officer, of any conditions that might interfere with launch and recovery, such as malfunctions of equipment, improper deck configurations, or adverse weather, wind, or sea conditions. It is the V/STOL LSO's responsibility to make appropriate recommendations based on his evaluation of the operating environment.

LANDING SIGNAL ENLISTED (LSE)

The LSE, under the supervision of the air officer, is responsible for visually signaling to the helicopter, thus assisting the pilot in making a safe takeoff and/or approach and landing on the ship. He or she is responsible for directing the pilot to the desired deck spot and for ensuring general safety conditions of the flight deck area, to include control of the flight deck crew. The LSE ensures that on signal, helicopters are safely started, engaged, launched, recovered, and shutdown and that all tiedowns are removed before liftoff and properly secured after landing. These signals are advisory in nature, with the exception of WAVEOFF and HOLD, which are mandatory.

LAUNCH OFFICER

The launch officer is an officer or enlisted who has been trained by the aircraft squadron or qualified ship's personnel. He or she is designated in writing by the ship's commanding officer. The launch officer reports directly to the air officer for the performance of launch officer duties. He or she is thoroughly familiar with the prelaunch checks and launch procedures of the NATOPS flight manual and/or shipboard operating bulletin for the specific type of aircraft. He or she is able to recognize proper and improper aircraft functioning Just before launch, and is able to time a short takeoff (STO) launch so that the aircraft reaches the bow on a rising deck.

WARNING

When the deck is pitching, an STO-launched aircraft will be placed in a hazardous flight condition if the bow is below the horizon or on its way down as the aircraft crosses the bow.

HELICOPTER FLIGHT OPERATIONS

Flight deck operations with rotors engaged are particularly hazardous to personnel. The tail rotor of some helicopters revolves in a vertical plane fairly close to the deck. In addition, the possibility always exists that the main rotor may strike the deck, hurling pieces of the blade outward from the helicopter with great velocity and endangering all exposed personnel. Because of this hazard, the number of flight deck personnel should be kept to the minimum needed for operations.

The LSE aboard an LHA, LHD, LPD, or ship is normally stationed on a 45' bearing to the port or starboard side of the helicopter. He or she will stand to the port side if the pilot in control is in the left seat and to the starboard side if the pilot in control is in the right seat. Just before launching, the LSE moves farther to left or right to remain in full view of the pilot.

When you are acting as LSE, you should position yourself upwind of the area in which the helicopter is to be launched and in a position similar to that for launch for a landing.

LAUNCH AND RECOVERY OPERATIONS

The following text describes the normal sequence of action during launch and recovery operations:

When aircraft are still in the pack awaiting deck spotting, preflight inspection is completed to the maximum extent possible. All preflights are completed 30 minutes before launch time, and pilots are strapped in the aircraft, with the prestart checklist completed as far as possible.

WARNING

> Performing maintenance or preflighting any portion of an aircraft that extends beyond the ship's deck edge is prohibited.

Completion of preflight on aircraft areas that are inaccessible (for example, over deck edge) is accomplished after the aircraft is spotted.

Launch Responsibilities

The OOD sets flight quarters in time for all personnel to man stations and complete preparations before flight.

NOTE

> Starting, engagement, launch, and recovery wind envelopes are available for use by the OOD and the air officer during flight operations.

The OOD ensures that the rescue boat is fully prepared and that the boat crew is detailed and available for launch.

The air officer ensures that obstructions such as weapons, antennas, cranes, flagstaffs, and lifelines are lowered, trained clear, or unrigged.

WARNING

> Antennas must be de-energized before lowering or unrigging.

The air officer clears the flight deck of all unnecessary personnel and requires all flight deck personnel to use appropriate flight deck clothing and equipment.

Before starting of engines, the ACHO makes sure a complete FOD walkdown is conducted of the flight deck and the adjacent topside area.

The flight deck officer ensures that the mobile crash and firefighting equipment is manned and ready.

The OOD maneuvers the ship to obtain favorable wind conditions. This is intended to mean within the established wind limitations. Wherever environmental conditions or the ship's motion dictates, these wind limitations are reduced to provide safe engine start, engagement/disengagement, and launch and recovery winds. Squadron/detachment commanding officers/officers in charge must ensure that limitations more restrictive than those established by NATOPS are discussed and agreed upon with the ship's commanding officer.

Launch Preparation

When spotting an aircraft for launch, the LSE/director/crew chief/plane captain ensures that the parking brakes are set, wheels are chocked, tail or nose gear locked (as applicable), and safe rotor/wing clearance exists. Special instructions for tiedowns are found in appendix D of the *LHA/LHD/MCS NATOPS Manual,* NAVAIR 00-80T-106. When specific guidance is not contained in appendix D, chains attached to fuselage-mounted mooring rings or mooring rings mounted above landing gear shock struts must have sufficient slack to preclude ground resonance. Those chains attached to landing gear axle-mounted mooring rings must be without slack.

CAUTION

> Engine gas turbine system auxiliary power plant (GTS/APP) starts, blade spread, and rotor engagement must not be accomplished in wind conditions exceeding individual aircraft NATOPS limitations.

NOTE

> When helicopters are being positioned for launch, ensure that they are moved without any undue delay in order that APP run time limitations are not exceeding during start and runup.

Whenever possible, aircraft spotting for night amphibious operations should be from bow to stem in event sequence as indicated in the air plan.

The LSE receives clearance from the air officer prior to starting engines or engaging rotors.

When aircraft are spotted on the flight deck, pilots proceed with the prestart procedures and signal the LSE when ready to start the APP.

The LSE requests clearance for the APP start from the air officer in Pri-Fly via the Right deck officer. Pri-Fly displays a red rotating beacon and announces the following over the 5MC: "Check chocks, tiedowns, fire bottles, and all loose gear about the flight deck, helmets buckled, goggles down, sleeves rolled down, start APP on LSE signal."

The LSE relays the clearance to the pilot before the APP start can be initiated.

Rotor Blade Spreading

All blade spreads are done under the supervision of the LSE. The pilot requests and must be granted clearance before blade spread can be attempted. Blades must not be spread while the aircraft is under tow or while being pushed. Pri-Fly ensures that relative winds are within aircraft limitations prior to blade spread.

Engine Starting

When ready to start the engines, the pilot will request clearance from the LSE/director by raising a hand and displaying one or two fingers to indicate which engine is to be started first. The LSE/director requests clearance from Pri-Fly via the flight deck officer. Pri-Fly ensures that winds are within limits for start/engagements, displays a red rotating beacon (amber for skid configured helicopters), and then announces clearance for engine start over the 5MC circuit. Upon signal from the LSE/director, the pilot starts engines.

WARNING

A rotor brake failure must be recognized as an emergency. Prior to disengagement with a known or suspected rotor brake failure, the ship provides optimum winds for shutdown and the resulting windmilling stop of the rotor system.

NOTE

The mechanical latching of weapons on aircraft racks/launcher is completed before the engine(s) on that aircraft is/are started for launch.

Engaging Rotors

When rotors are ready to be engaged, the pilots give the LSE the ready-to-engage signal. The LSE relays this request to the flight deck officer, who, in turn, signals Pri-Fly when spotted aircraft have indicated their readiness to engage.

Helicopters should not engage rotors while the ship is in a turn. The ship's commanding officer must grant permission for engagement while in a turn. Anticipated wind parameters and the ship's heel must be communicated to the helicopter aircraft commander prior to execution of the turn.

The air officer ensures that proper wind conditions exist for engagement. If high winds exist, rotor engagements should commence with the downwind aircraft and work upwind.

WARNING

Reported winds as displayed in Pri-Fly may vary greatly with existing winds over the deck.

Extreme care must be exercised when engaging/disengaging rotors if other aircraft are launching or recovering.

Rotor engagement must not be attempted unless the tiedown configuration is as stated in the aircraft NATOPS flight manuals. Ground resonance could cause destruction of the helicopter.

When engagement is ready, the amber beacon light is displayed to direct the flight deck officer and LSE's to give the engage signal to the pilots.

Relative winds are provided to the pilots of all aircraft either by radio, 5MC, or hand and arm signal indicating both direction and velocity of the wind. The pilot of each aircraft acknowledges clearance prior to attempting engagement.

WARNING

Personnel must not walk under rotor blades until the blades have stopped or come up to full speed. Clearance must be received from the LSE before passing under rotor blades.

Personnel must not pass under the tail boom or tail rotor of a single rotor helicopter.

Internal cargo normally moves to the flight deck staging areas via cargo elevators near the island, fixed vehicle ramps (LHA), or aircraft elevators. The Combat Cargo Officer directs loading. Internal loading varies according to the type aircraft, type of cargo, and deck load. The combat cargo officer ensures that pilots are given notification of any changes to prebriefed cargo loads.

Troops are escorted by combat cargo personnel to the flight deck via the designated troop debark stations/shelters, as directed by the combat cargo officer (CCO). Clearance must be requested from the LSE prior to loading/unloading troops while aircraft are turning.

Disposition of downed aircraft is made according to the prelaunch briefing. Except in case of emergency, downed aircraft are shut down only on signal from the LSE/director. Pilots remain in downed aircraft until the crew chief/plane captain is on hand and ready to man the cockpit. This does not apply to skid-configured helicopters.

A downed aircraft on deck must be shut down expeditiously upon signal from the LSE/director. The maintenance officer or his or her representative inforrns the flight deck officer of the nature of the trouble and also gives an estimate of the time needed for repair. When the maintenance required is for a long duration, the aircraft will non-nally be put into the pack or taken below to the hangar deck. When repairs can be accomplished on deck, and succeeding launches will not be delayed, the aircraft is launched to rejoin the flight when placed in an "UP" status by the maintenance officer.

Launching

When all prelaunch checks are completed and the pilot is ready for launch, the pilot gives the LSE/launch officer a thumbs-up signal and transmits his status to Pri-Fly. The LSE/director signals the flight deck officer, and the flight deck officer then notifies Pri-Fly that all aircraft are ready for launch. Pri-Fly requests a green deck from the bridge. When the ship is on a steady course, the OOD orders the HOTEL/FOXTROT flag close-up, and gives Pri-Fly a green deck signal.

Launching helicopters while the ship is in a turn should be attempted only when authorized by the ship's commanding officer or his designated representative. Anticipated wind parameters and the ship's heel are communicated to the helicopter aircraft commander before execution of the turn.

The air officer directs the flight deck officer to have chocks and tiedowns removed. The flight deck officer directs the LSE/director to remove tiedowns and chocks. On signal from the LSE/director, each blue shirt removes all tiedowns and chocks from his side of the aircraft, and then proceeds to the LSE/director and faces the pilot.

Tiedowns should be carried so that they are within the view of the pilot, and shown to and acknowledged by the pilot. The LSE/director points to the chocks and the tiedowns that were removed followed by the showing of one finger for each tiedown removed to the pilot. The pilot acknowledges by indicating the number of tiedowns and chocks seen and then replies with a "thumbs-up" signal when ready to launch.

WARNING

When removing tiedowns from helicopters, the tail/nose tiedowns are removed first. The mainmount tiedowns are then removed simultaneously.

When Pri-Fly is satisfied that all conditions are ready for a safe launch, the deck condition light(s) is/are set to green and the launch begun.

When the green deck signal is given, the LSE rechecks that the aircraft is clear of all tiedowns and the area surrounding the aircraft is clear of equipment and personnel. The LSE also checks that all airborne aircraft are clear of the launch area, and only then gives the takeoff signal to the helicopter. The pilot does not commence takeoff until he receives this signal from the LSE and the winds for launch are received from Pri-Fly.

Recovery

When the word is passed to stand by to land helicopters, the LSE takes a position clearly visible to the pilot. Pri-Fly obtains a gear down report from the pilot before issuing final landing clearance. As the helicopter approaches, you, as an LSE, ensure the following:

1. The landing gear is down.

2. The flight deck condition light, which controls your area of the flight deck, is green.

3. The landing area is clear of personnel, equipment, and loose gear.

Except for the **WAVEOFF** and **HOLD** signals, your signals as the LSE are accepted as advisory; the pilot has full responsibility for the proper and safe operation of the aircraft. At night, when two or more helicopters are landing, all external lights are left on until the succeeding helicopter has landed. After landing and before shutdown, chocks are placed on the main wheels and the deck crew attaches initial tiedowns. A hold signal is given by the LSE while tiedowns are being attached to indicate that an unsafe takeoff condition exists. Helicopters are disengaged and shut down only on signal from the LSE.

For detailed information on training and operating procedures for helicopters, you should refer to *LHA/LHD/MCS NATOPS Manual,* NAVAIR

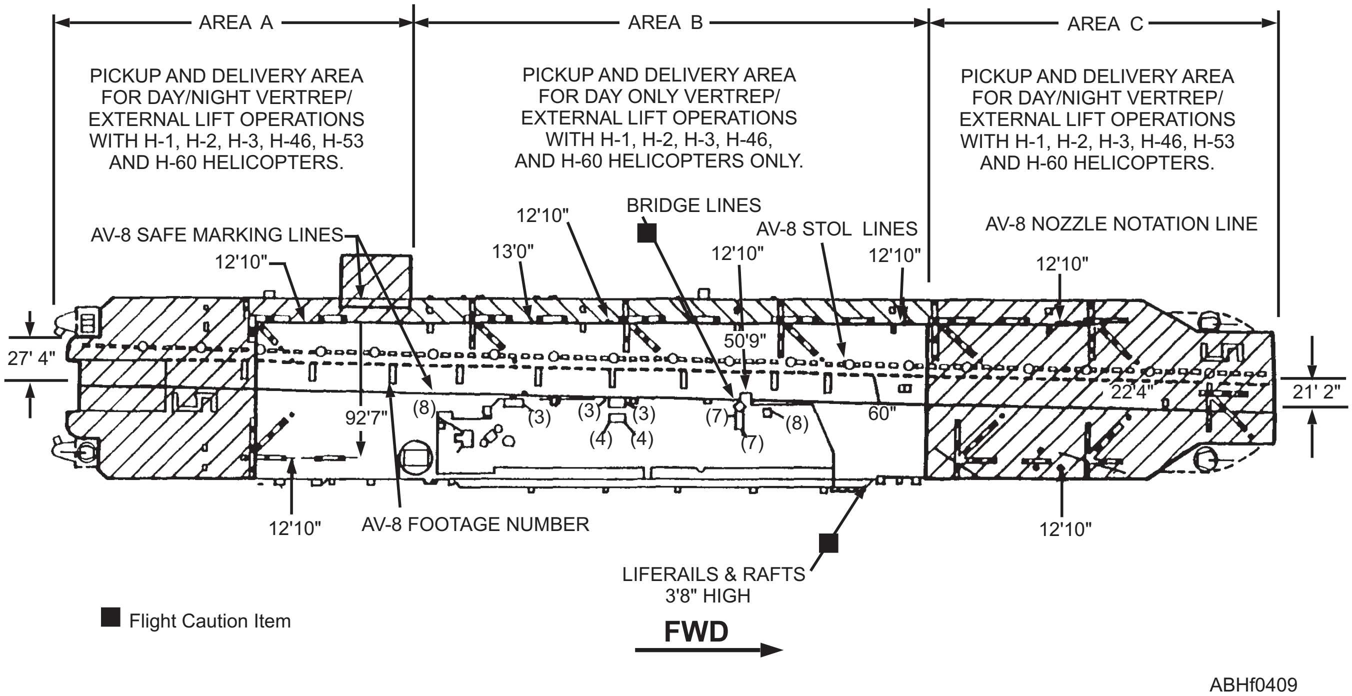

Figure 4-9.—LHA Day/Night External Lift Operating Areas.

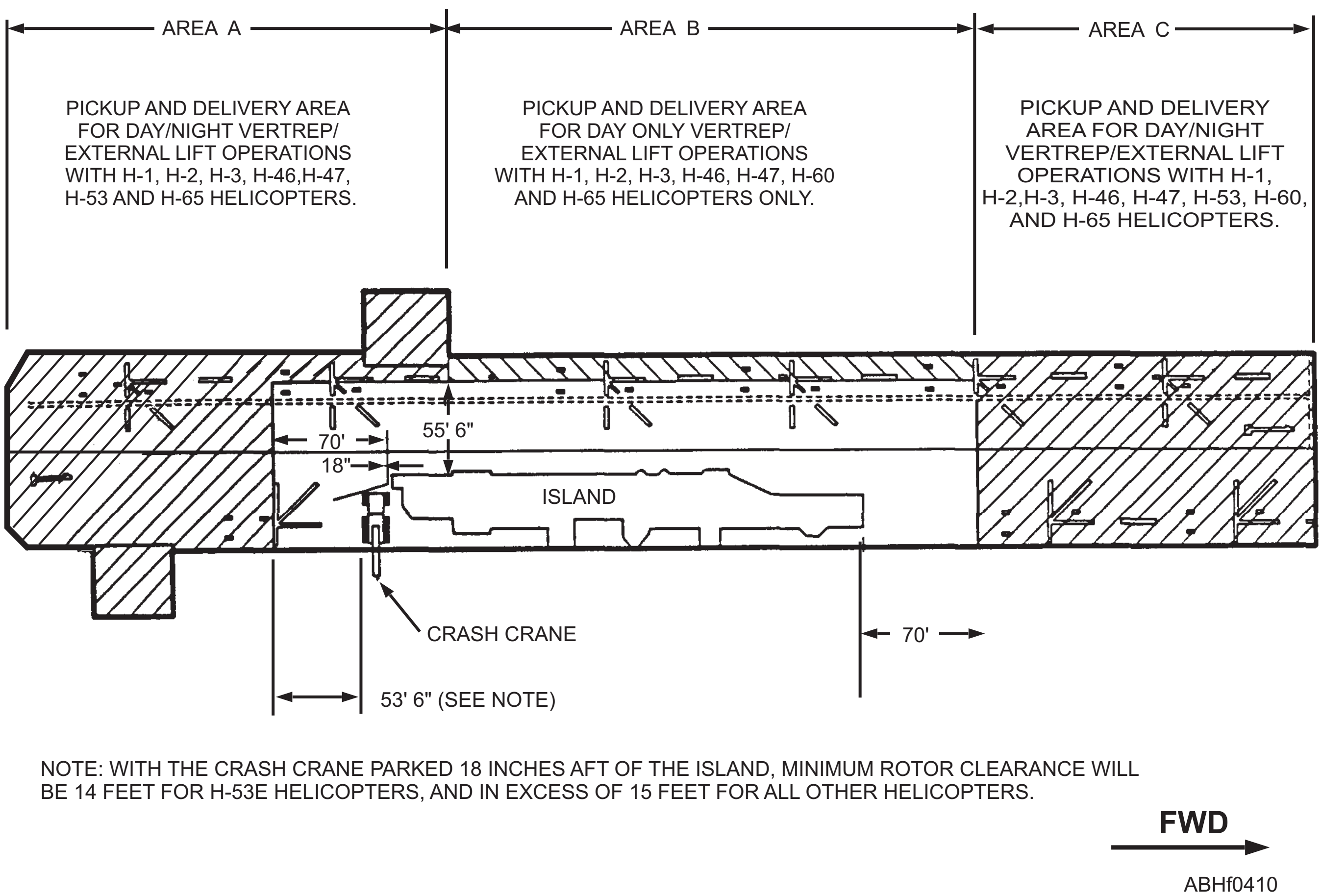

Figure 4-10.—LHD Day/Night External Lift Operating Areas.

00-80T-106, and NWP 3-04.1, latest revision, for LPD ships.

For detailed information on shipboard V/STOL aircraft operating procedures, you should refer to the *Naval Warfare Publication Shipboard VISTOL Aircraft Operating Procedures* (NWP-63-1), the *LHA/LHD/MCS NATOPS Manual,* (NAVAIR 00-80T-106), and the *Shipboard Helicopter Operating Procedures* (NWP 3-04.1, latest revision).

VERTICAL REPLENISHMENT

Vertical replenishment (VERTREP) gives a ship the capability to replenish supplies while underway. As an ABH, you will have a direct hand in a successful, smooth VERTREP evolution, primarily serving as an LSE. The Combat Cargo Officer (CCO) is the liaison between the embarked aviation unit and the ship's personnel, and the CCO will supervise the hookup team throughout the VERTREP evolution. You should refer to NWP 4.01.4 in order to obtain further specific information concerning VERTREP organization and specific responsibilities.

To provide sufficient clearance from shipboard obstructions, helicopter VERTREP operations on LHA/LHD/MCS ships should only be conducted in the areas outlined in figures 4-9, 4-10, and 4-11.

Q11. Flight deck lighting, landing spot lighting, flight deck floodlights, the stabilized glide slope indicator (SGSI), and the flight deck rotary beacon light are all controlled from which area?

Q12. What is the primary reason for keeping the number of personnel on the flight deck at a minimum during flight operations?

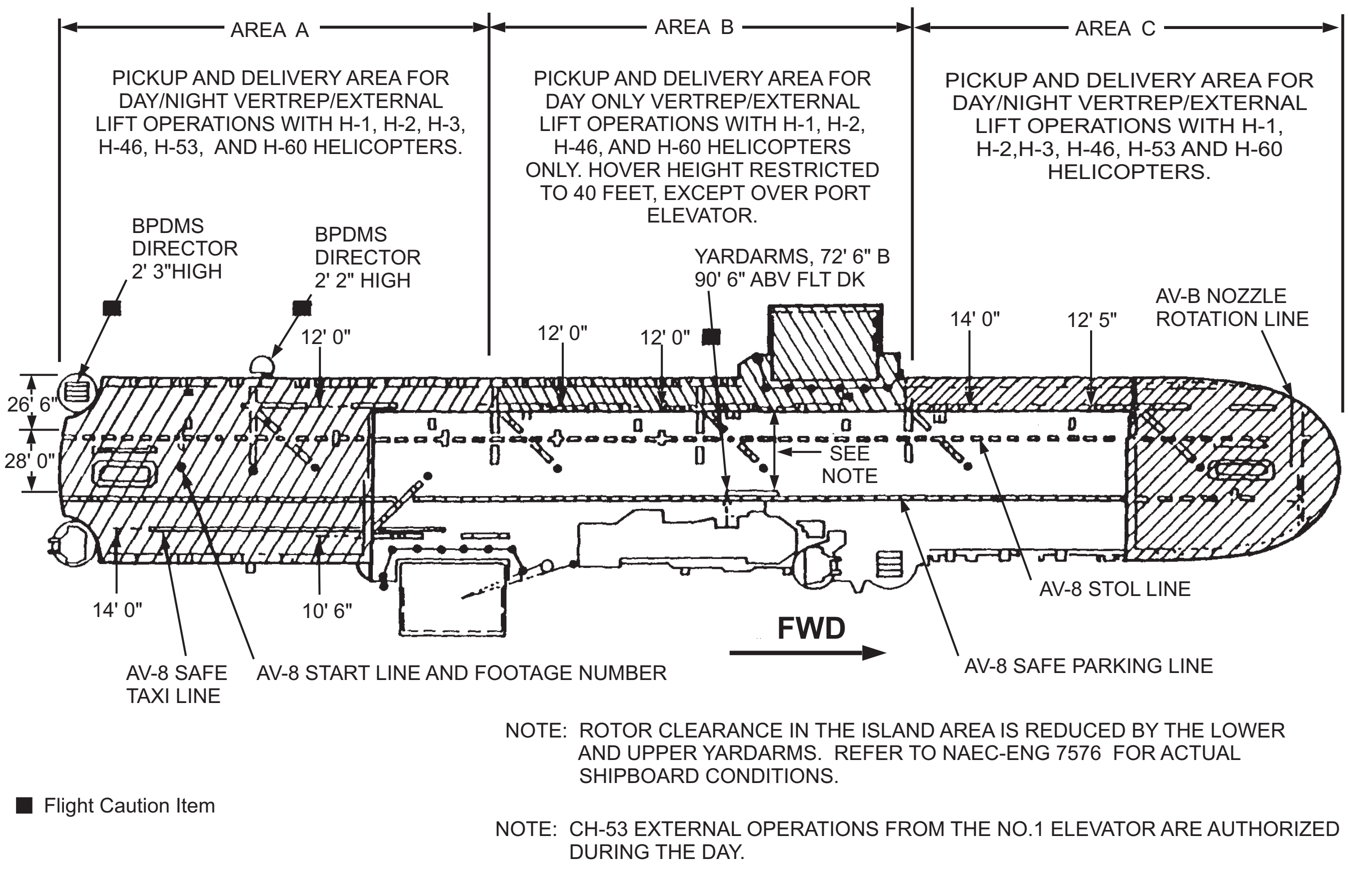

Figure 4-11.—MCS Day/Night External Lift Operating Areas.

ANSWERS TO REVIEW QUESTIONS

A-1. The Air Officer is responsible for designating personnel in writing as aircraft directors.

A-2. The term Ground Resonance indicates a condition of geometric imbalance on helicopters caused by offsetting dynamic forces.

A-3. The minimum number of personnel required to tow an aircraft is six.

A-4. The flight deck supervisor's wands are red and green.

A-5. A V/STOL aircraft should be armed only after the launch officer's initial walk around and prior to commencing launch operations.

A-6. Six items of personal protective equipment that must be worn during flight operations are:

1.) Cranial 2.) Sound suppressors

3.) Safety goggles 4.) Flight deck safety boots

5.) Flight jersey 6.) Float coat

A-7. The Air Officer has overall responsibility for the Aircraft Integrity Watch.

A-8. Integrity Watch messengers are assigned from V-1 division.

A-9. The three categories of aircraft tiedown security are:

a). Initial tiedown

b). Permanent tiedown

c). Heavy Weather tiedown

A-10. When a director/LSE hold both fist clenched at eye level, the HOLD signal is being given.

A-11. Flight deck lighting, landing spot lighting, flight deck floodlights, the stabilized glide slope indicator (SGSI), and the flight deck rotary beacon light are all controlled from Primary Flight Control.

A-12. Safety is the primary reason for keeping the number of personnel on the flight deck at a minimum during flight operations.

CHAPTER 5

AIRCRAFT FIREFIGHTING (CV/CVN)

Firefighting is a highly technical profession and firefighting, when associated with crashed aircraft, is a highly specialized field. The prerequisites for assignment to this duty include alertness, courage, dedication, agility, physical strength, and the ability to be an exacting team worker.

The primary duty of the firefighter is saving life. Proficiency and expertise can be achieved with frequent drills, training sessions, formal schooling, and practice. You must actually use all equipment, extinguishing agents, and tools in order to learn their capabilities and limitations.

FIRE CHEMISTRY

OBJECTIVES: Identify the different elements of fire. Identify the various classes of fire.

For many years, fire was considered to be the product of a combination of three elements: fuel, oxygen, and temperature. Research in the past 30 years has indicated the presence of a fourth critical element. It is the *chemical chain reaction* that takes place in a fire and allows the fire to both sustain itself and grow. For example, in a fuel fire, as the fire burns, fuel molecules are reduced within the flame to simpler molecules. As the combustion process continues, the increase in temperature causes additional oxygen to be drawn into the flame area. Then, more fuel molecules break down, enter into the chain reaction, reach their ignition point, begin to burn, cause a temperature increase, draw additional oxygen, and continue the chain reaction. As long as there are fuel and oxygen and as long as the temperature is sustained, the chain reaction will cause the fire to grow.

CLASSIFICATION AND DESCRIPTIONS OF FIRES

Fires are classified into four classes, depending on the fuel sources involved and methods of extinguishing.

Class A Fires

Class A fires (burning wood and wood products, cloth, textiles, and fibrous materials; paper and paper products) are extinguished with water in a straight or fog pattern. If fire is deep seated, aqueous film-forming foam (AFFF) can be used as a wetting agent.

Class B Fires

Class B fires (gasoline, jet fuels, oil, and other volatile liquids) are extinguished with AFFF, Halon 1211, Purple-K-Powder (PKP), and carbon dioxide (CO_2).

Class C Fires

WARNING

Water in any form, particularly salt water, is dangerous when used on electrical equipment.

Class C fires (electrical fires) are extinguished by de-energizing the electrical equipment and applying CO_2 or Halon 1211.

Class D Fires

Class D fires (combustible metals such as magnesium and titanium) are extinguished with water in large quantities, such as high-velocity fog. When water is applied to burning class D material, there may be small explosions. The fire fighter should apply water from a safe distance or from behind a shelter.

FLAMMABLE, HAZARDOUS, AND FIRE-ACCELERATING MATERIALS

Fire-accelerating materials carried on aircraft are of major concern to the aircraft firefighting and rescue crews. They include the following:

- Jet fuel
- Oils
- Oxygen
- Anti-icing fluid
- Class A combustible
- Ordnance
- Overheated batteries
- Flare dispensers

- Lithium
- Hydrazine

Fires may occur at any time during flight operations or servicing of aircraft, but fires are especially critical following a crash. This type of fire spreads rapidly, and because of the unusual fuel dispersion and flame intensity, is a severe hazard to those inside the aircraft.

Success or failure in aircraft-crash firefighting may depend upon the fire fighter's knowledge of the basic characteristics of aviation fuels. Knowledge of their properties and hazards is essential to skillful operations in aircraft crash Firefighting.

IGNITION OF AIRCRAFT FUELS

To better understand the readily ignitable property of aircraft fuels, consider the accepted definitions of the physical characteristics of flammable liquids.

The *flash point* of a liquid is the temperature at which sufficient vapors are emitted to form an ignitable mixture with the air near the surface of the liquid. An *ignitable mixture* is a mixture within the explosive range that when ignited, is capable of spreading the flame away from the source of ignition.

Another term used in discussing the ignition properties of aviation fuels is *Autogenous Ignition Temperature* (AIT). AIT is the temperature just hot enough to cause spontaneous ignition of a liquid petroleum product in air when tested in a prescribed laboratory test apparatus. The AIT varies with the nature of the container, the concentration of the vapor in the air, and other test conditions. This temperature <u>might</u> be useful in <u>theoretically</u> indicating the order in which fuels would tend to ignite following accidental spillage on a hot surface.

When mixed with air, aircraft fuels (like most flammable liquids) can burn only within a certain concentration range. Thus, there is a minimum concentration of vapor, or too lean a mixture, below which spreading of flames does not occur on contact with an ignition source. Likewise, there is a maximum ratio of vapor to air, or too rich a mixture, above which similar flame propagation (spreading) cannot occur. These limiting mixtures of fuel vapor with air are known as the "lower and upper explosive or flammable limits" of fuel. At these two points, the mixture only spreads flame. Ignition and subsequent burning can occur in the range between these two limits. The low flash point of all modern aircraft fuels renders them easy to ignite and burn or explode. The low minimum explosive or flammable limits of these fuels add to the hazard.

Appropriate safety precautions must be used around flammable liquids such as aircraft fuels, whose ignition temperature (140°F) is low enough to readily explode with a simple spark. However, a spark is not required for the fuel to explode should a source of heat bring the fuel to ignition temperature.

The temperature produced by the burning of vaporized aircraft fuel and air is intense (approximately 1,500°F). Heavier oils may have greater heat retention properties, but are much more difficult to ignite than aircraft fuels. When heavier lubricating oil is combined with gasoline, as frequently occurs in aircraft fires, the aircraft fuel serves to provide ignition. It raises the temperature of the oil to the flash point, producing additional flammable vapors.

AIRCRAFT FUEL VAPORS

Aircraft fuel vapors are heavier than air and, consequently, pass slowly downward to ground level or any lower surface. They spread out and follow the surface to low points, flowing in the same manner as a liquid.

Accumulations of vapor may spread over a flat surface, flow down ladderways, or drop through openings in structures or crevices in decks. These vapors gradually mix with the air; but if not affected by drafts, they may remain in low spots for a considerable time. The bulk of the vapors in such low spots or flowing along the deck may be too rich to burn when first released. However, there will always be, on the outer regions of the rich mixture, a part of the vapor that has mixed with sufficient air to be within combustible or explosive limits. Should ignition occur at this time, the richer vapors may slowly diffuse with the air until a flammable mixture exists over a considerable increased area. This increases the possibility of ignition resulting in burning or explosion. The larger the quantity of diffused mixture within the flammable limits, the larger the resultant fire or explosion will be if the mixture is ignited.

A flame has been reported to travel 162 feet along the path of fuel vapors before reaching the fuel source and igniting it. For this reason, spills or discharges from fuel tanks must be regarded as potential hazards. Steps must be taken to prevent their spread, accumulation in low areas, and ignition.

JET FUELS

Jet fuels constitute the principal problems in aircraft firefighting. The Navy uses the following aircraft fuels:

1. Jet fuel JP-4
2. Jet fuel JP-5
3. Jet fuel JP-8

JP-4

Grade JP-4 jet fuel is a blend of gasoline and kerosene and has a flashpoint beginning at low as -10°F. The rate of flame spread is calculated to be between 700 to 800 feet per minute. JP-4, because of the range of its vapor pressure (2 to 3 psi at 100°F), requires additional precautions in handling. JP-4 forms explosive vapors from -10°F to 80°F, which are normal storage and handling temperatures. This means that the space above the liquid almost always contains an explosive mixture.

JP-5

Grade JP-5 has a flash point (lowest temperature at which vapors burst into flame) of 140°F (minimum for shipboard use) and is a kerosene type of fuel. It has a vapor pressure close to 0 psi. Since it does not have a tendency to vaporize, the vapor-air mixture above its liquid surface in tanks or containers is usually too lean to be ignited until the liquid surface reaches a temperature of about 140°F. The rate of flame spread is calculated to be 100 feet per minute. **JP-5 is the only fuel that can be used for turbine engine aircraft aboard ships and is used widely at USN and USMC air stations.**

JP-8

Grade JP-8 is a kerosene grade with a flashpoint of 100°F and a flame spread rate of 100 feet per minute. Since the lowest flashpoint considered safe for use aboard ships is 140°F, extra caution must be exercised whenever JP-8 has been mixed in with JP-5. As little as a 2.5% mixture of JP-8 in JP-5 can lower the flashpoint below the acceptable 140°F.

The Fundamentals of Petroleum, NAVEDTRA 10883-C, (Chapter 10) is helpful when studied with this chapter.

Crash Fire Hazards

The aircraft crash fire hazards of JP-4 and JP-5 approximate those of gasoline. Crash impacts have been known to split fuel tanks open. When this happens, the fuel comes out under high pressure in the form of mist or vapor. This vapor could be hurled as far as 60 feet or more and is extremely dangerous. Because of the oxygen in the air, the vapor or mist ignites readily. Any spark could cause a violent explosion.

For more information on the fire hazard properties of fire accelerating materials and aviation fuels, you should refer to chapter 8 of this TRAMAN and the *U.S. Navy Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14, chapter 2 and appendix B.

Q1. What are the four elements of fire?

Q2. An electrical fire has what classification?

FIREFIGHTING AGENTS AND EQUIPMENT

OBJECTIVES: Recognize the various extinguishing agents used aboard aircraft carriers. Identify flight deck and hangar deck firefighting equipment.

FIREFIGHTING AGENTS

Aqueous Film-Forming Foam (AFFF)

AFFF liquid concentrates consist primarily of synthetic fluorocarbon surfactant materials, which are noncorrosive and have an unlimited shelf life when stored in a protected area where the temperatures range from 32°F (0°C) to 120°F (48°C).

NOTE

Failure to follow the manufacturer's storage procedures may cause the AFFF to break down and separate, degrading its ability to form a vapor seal.

These concentrates must meet current military specifications (MIL-F-24385).

AFFF concentrations of 3% and 6%, by volume, are approved for Navy uses. Optimum performance for a 3% concentration is realized when the AFFF is proportioned at 3 parts concentrate to 97 parts water. For a 6% concentration, optimum performance is achieved when the AFFF is proportioned at 6 parts concentrate to 94 parts water. Current shipboard firefighting equipment requires a 6% concentration; and because of equipment and demand variations, foam may be produced in an acceptable concentration range of 3.5% to 40%. AFFF concentrate itself is noncorrosive. When the concentrate is mixed with water, however, the AFFF mixture becomes corrosive, because the AFFF-induced low surface tension of the mixture allows the corrosive properties of the water (particularly salt water) to seep through small cracks, and so forth. Either freshwater or seawater may be used in proportioning systems. However, only freshwater should be used to reduce corrosion activity of the premixed solution. The mandatory procedures that must be followed whenever an aircraft is sprayed with AFFF solution are contained in OPNAVINST 4790.2.

The unique extinguishing and securing action of AFFF on flammable liquid fires results from a combination of rapid foam blanketing and vapor sealing when applied properly. During fire extinguishment, the AFFF foam blanket rapidly yields a very thin layer of AFFF solution that also extinguishes the fire and forms a vapor seal, restricting further emission of flammable vapors. AFFF is compatible with Halon 1211 and PKP (dry-chemical) firefighting agents.

Water

Water is *not* generally considered to be a suitable agent for use in combating large aircraft fuel fires without the addition of either foam agents or surfactants. This is particularly true when the fire involved is in deep pools or pits.

Many procedures for applying water in aircraft firefighting have been explored. The most successful applications have been obtained by using fog and narrow angle spray streams. It is generally recognized that within certain limits, the higher the nozzle pressure, the smaller the water particles and the more effective the spray stream. The successful use of water may be attributed to (1) correct methods of application, (2) the ability of a water stream to move the burning fuel to an area sufficiently remote from the aircraft, and (3) its ability, when properly applied, to cool the aircraft fuselage and provide a heat shield for personnel.

Water is also an effective agent for cooling ordnance or batteries and for extinguishing class A fires incidental to an aircraft fire.

WARNING

Extreme caution must be exercised to preclude disruption of an AFFF blanket with water. Re-ignition or spread of the fire can result.

Carbon Dioxide

Carbon Dioxide (CO_2) is a dry, non-corrosive inert gas, and is considered a smothering agent. CO_2 extinguishes a fire by diluting and displacing its oxygen supply. When CO2 is directed into a fire so that sufficient oxygen to support combustion is no longer available, the flames will die out. It is approximately 1.5 times heavier than air and will tend to settle and blanket a fire. Since CO_2 is a non-conductor of electricity in both the gaseous state and the finely divided solid (snow) state, it can be safely used in fighting electrical fires, when correctly applied. CO_2 not an effective extinguishing agent for use on fires that produce their own oxygen supply, such as parachute flares. Fires involving reactive metals such as magnesium, lithium or titanium cannot be extinguished with CO_2 because the high temperatures of these metal fires will decompose the CO_2 and continue to burn.

Halon 1211

Halon 1211 is a colorless gas with a faintly sweet smell. It is a non-conductor of electricity, leaves no residue, and is non-corrosive. Halon 1211 extinguishes the fire by chemically inhibiting combustion, breaking the fire chain. Halon 1211 decomposes once it comes in contact with flames or hot surfaces above 900°F. The byproducts of decomposed Halon 1211 will result in a sharp, irritating odor, even at low concentrates. Because of this, firefighters should wear breathing apparatuses when using Halon 1211 in unvented or confined spaces. Halon 1211 is primarily used for class "B" and "C" fires, and is also effective in class "A" fires. But, because Halon 1211 is easily dissipated and has no vapor sealing property, AFFF should be used in conjunction with Halon 1211 when fighting fuel fires.

Dry Chemical, Purple-K-Powder (PKP) (Potassium Bicarbonate)

PKP is a dry chemical primarily used as an extinguishing agent for liquid fires. When applied to a fire, PKP breaks the chain reaction of the fire. Discharging PKP into the flames prevents reactive particles from coming together and continuing the combustion chain reaction. PKP does not have vapor sealing or cooling capacities. PKP is non-toxic, but it does contain corrosive and abrasive properties, and its use on electrical or electronic equipment should be avoided. Additionally, PKP is not effective on combustible metals and may cause a violent reaction if applied.

PORTABLE FIRE EXTINGUISHER

The best application technique varies with the type of extinguishing agent and associated hardware. Some fire extinguishers deliver their entire quantity of extinguishing agent within 10 seconds; others are designed to be operated for 30 seconds or longer. The agent must be applied correctly at the outset, since there is seldom time to experiment. Using a portable extinguisher at too close a range may scatter the fire. Using it at a distance beyond the effective range will simply waste the extinguishing agent.

WARNING

- Fire fighters must use caution in fighting fuel fires and be prepared to back out well before the extinguisher contents are exhausted.
- Halon, PKP, and CO_2 are all rapidly dissipated and no vapor sealing property is developed, so the fuel is always subject to re-ignition. Discharge should be continued for a short time after the flames are extinguished, to prevent possible reflash and to cool any ignition sources in or near the fire.
- Portable Halon, PKP, and CO_2 extinguishers must be discharged in an upright position. If the extinguisher is on its side or inverted the siphon tube will not reach the agent, and an unsatisfactory discharge will result.

Halon 1211

The Halon 1211 (figure 5-1) portable extinguisher contains 20 pounds of liquid Halon 1211 and is pressurized with nitrogen gas for expulsion. Although the agent is retained under pressure in a liquid state and is self-expelling, a booster charge of nitrogen is added to ensure proper operation. Upon actuation, the vapor pressure causes the agent to expand so that the discharge stream consists of a mixture of liquid droplets and vapor. Halon 1211 extinguishers are marked with a reflective 6-inch silver band around the tanks. There is a pressure gauge, discharge hose, and nozzle attached and mounted on the valve assembly. The portable Halon 1211 extinguisher has an effective range of approximately 10 to 30 feet and its discharge time is approximately 15 to 40 seconds. Its primary use is for class "B" and "C" fires, and is effective on class "A" fires as well. It is not effective on class "D" fires. Additional training restraints regarding use of Halon 1211 may be found in chapter 5 of NAVAIR 00-80R-14.

WARNING

Do NOT use Halon 1211 on class D fires. It has no blanketing effect, and if it reaches a class D

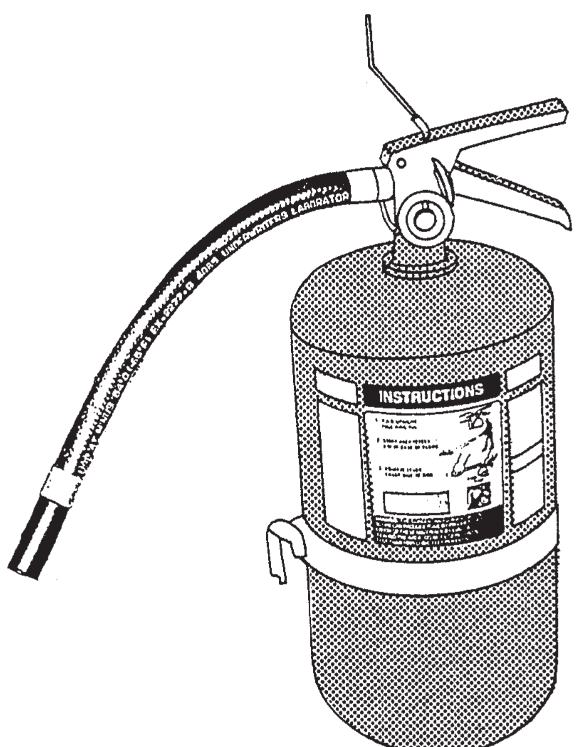

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Figure 5-1.—Halon 1211 portable fire extinguisher.

fire in the liquid state, an explosion might result.

Carbon Dioxide (CO_2)

The portable CO_2 extinguishing equipment available consists of 15-pound-capacity CO_2 extinguishers. See figure 5-2. These extinguishers, mounted for quick and easy access, are located along the gallery walkways and on the flight deck around the base of the island structure. Additional extinguishers are stored in the repair stations.

Some types of aircraft carry portable CO_2 extinguishers, usually 2 to 5 pound capacity. Should aircraft carrying these portable extinguishers be parked on the flight deck, these extinguishers may also be used in an emergency.

CO_2 is effective in fighting both class B and C fires. Portable CO_2 extinguishers are used mainly for extinguishing electrical fires. They are also effective on small fires, including burning oil, gasoline, paint, and trashcans. The CO_2 is heavier than air, and fire suppression is accomplished by the displacement of oxygen in the atmosphere to a level below the percent that is required to support combustion. The maximum range of the extinguisher is 4 to 6 feet from the outer end of the horn. These extinguishers are marked with a 6" yellow reflective band around the tanks.

Agent application should commence at the upwind edge of the fire and be directed at the base of the fire in a side-to-side sweeping motion, gradually moving toward the back of the fire.

Purple-K-Powder (PKP) Extinguishers

The PKP (dry-chemical) extinguishers are intended primarily for use on class B fires. See figure 5-3. Potassium bicarbonate powder is the principal base chemical used in the production of PKP (dry-chemical agent). Various additives are mixed with the base material to improve its stowage, flow, and water repellency characteristics. A small CO_2 cartridge supplies the propellant force to discharge the dry chemical powder onto the fire. The ingredients used in PKP are nontoxic. However, the discharge of large quantities of ingredients may cause temporary breathing difficulty, seriously interfere with visibility, and cause disorientation. The dry-chemical agent does not produce a lasting inert atmosphere above the surface of flammable liquid. Consequently, its use will

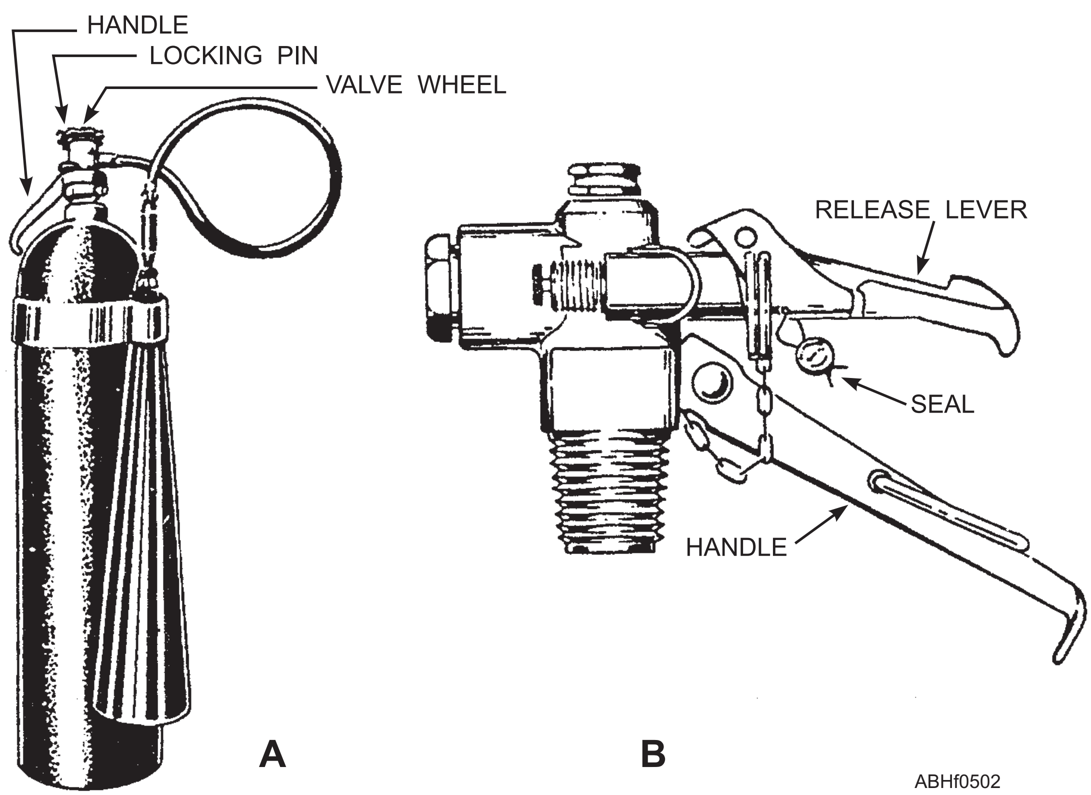

Figure 5-2.—(A) Portable CO_2 extinguisher with disk-type release valve; (B) squeeze-grip type release valve.

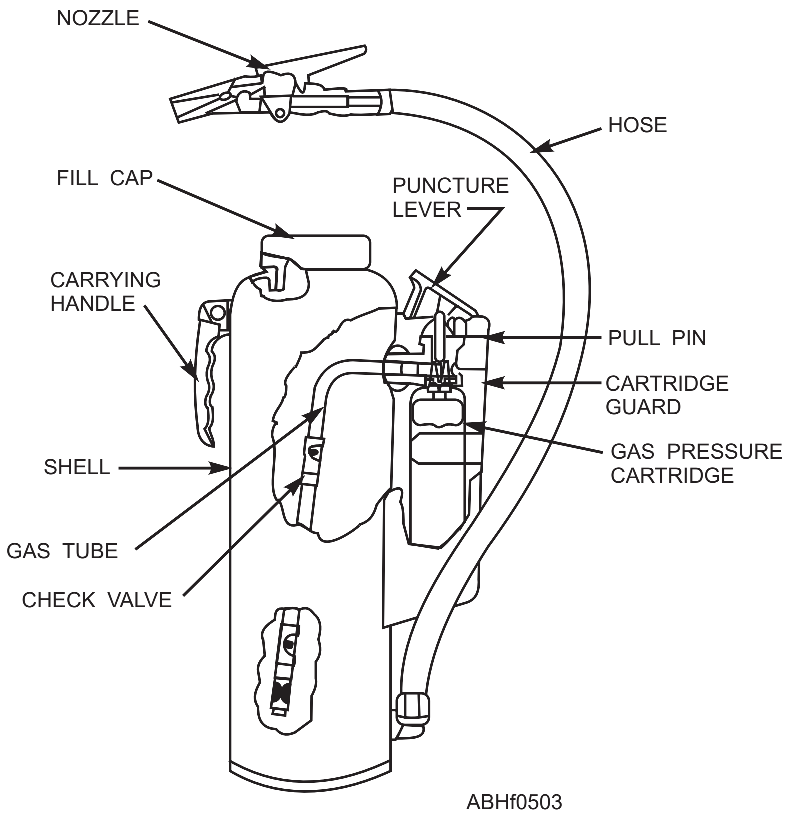

Figure 5-3.—PKP (dry-chemical) extinguisher.

not result in permanent extinguishment if re-ignition sources are present. PKP extinguishers are marked with a 6" purple band around the tanks.

CAUTION

- Dry-chemical agents may harden after being exposed to moisture. It is, therefore, important to avoid exposing them to any moisture during stowage, handling, and recharging evolutions.
- When PKP is used as the fire suppression agent on an aircraft fire and the agent is directed at or ingested into an engine or accessory section, the air boatswain, personnel using the extinguisher, or on-scene leader should notify the maintenance officer of the unit involved or, in the case of a transient aircraft, the supporting facility. PKP injected into a jet engine cannot be completely removed without disassembly of the engine to remove deposits that penalize engine performance and restrict internal cooling air passages.

These extinguishers are available in two sizes: 18-lb. and 27-lb. The 18-lb. extinguisher has an effective discharge range of approximately 19 feet and a minimum discharge time of 10 seconds. The 27-lb. extinguisher has an effective discharge range of approximately 21 feet and a minimum discharge time of 11 seconds. When PKP is used on flammable liquid fires, the stream should be directed at the base of the flame and gradually moved toward the back of the fire while the nozzle is rapidly swept from side to side.

PROTECTIVE CLOTHING

Aircraft firefighting/rescue protective clothing is a prime safety consideration for personnel engaged in firefighting and rescue work. Aluminized protective clothing offers a means of providing protection to fire fighters because of its high percentage of reflectivity to radiant heat. Aluminized proximity fabrics have been adopted for use in the Navy mishap/rescue program. It is important to point out that these garments are not classified as entry suits, but are known as *proximity* clothing to be worn with fire fighter's knee-length boots that have safety toes and soles. Firefighters assigned to aircraft rescue and firefighting duties shall be provided with a complete set of protective clothing that meet appropriate National Fire Protection Association (NFPA) standards. A complete set of protective clothing consists of trousers, coat, gloves, aviator summer flight gloves, flash hood (sock), and proximity helmet or hood, and boots. See figure 5-4.

Care and Maintenance

The heat-reflective ability of aluminized clothing items is reduced when they are stained or otherwise soiled. It is imperative that careful attention be given to the following care and maintenance instructions:

1. Storage should be on hangers, with suitable hanging space to prevent aluminized fabrics from creasing or cracking. If the garment is folded, the folds should be loose. Do not sit on a folded garment.

2. Dirt and soot should be sponged off with mild soap and water, and the aluminum surface dried with a clean cloth. Rub gently to avoid removal of the aluminum.

Figure 5-4.—Proximity suit.

3. Grease stains may be removed by using dry-cleaning solvents, but isopropanol or perchloroethylene will react with the metal in proximity suits and may etch the aluminum surface. Clean the clothing with water and wipe dry. Allow the garment to hang in a ventilated location at room temperature.

4. AFFF may be removed by sponging the clothing clean with mild soap and water. Hang the garment to dry in the open or in a place with good circulation. It is realized that during firefighting operations it is not always possible to prevent agents from getting onto protective clothing. However, aluminized protective clothing that has been covered or spotted with agent will have less heat-reflecting ability than the suit normally would provide.

5. Corrosive chemicals will react with the aluminum surface and may etch the metal. Clean the clothing with water and wipe it dry. Allow it to hang in a ventilated location at room temperature.

6. Garments should be replaced when the aluminum wears off or when the fabric cracks or tears. Spraying worn clothing with aluminum serves no useful purpose and is a dangerous practice.

Care of Facepiece

The gold-coated facepiece is a heat-reflective shield. The facepiece is NOT a sun shield. This item should be kept in excellent condition to maintain the radiant-heat-reflective efficiency. In particular, when the gold surface of the facepiece becomes worn, scratched, or marred, 90% of the heat protection is lost, and the facepiece should be replaced immediately. Other precautions are as follows:

1. Keep the protective cover in place when you are carrying or storing the hood, to minimize damage to the gold-coated surface. Remove it when using the hood.

2. For adequate protection, replace a worn gold-coated facepiece. When wearing the facepiece, make sure the gold surface is on the outside as marked on the edge.

3. Avoid touching or wiping the gold surface as much as possible.

4. Clean the facepiece, without removing it from the hood, using a clean soft cloth with mild soapy water; rinse and pat dry.

LIFE SUPPORT DEVICES

Life support devices are designed to allow the wearers to breathe, and thereby, to continue work, assist in saving the ship and crewmembers, and to escape when necessary. You will need to know what equipment is available, how to operate it, and how to maintain it in top operating condition. The equipment is listed below:

- Oxygen breathing apparatus (OBA)
- Emergency escape breathing device (EEBD)
- Air-line mask

The above listed equipment is described in detail in *Damage Controlman 3&2*, NAVEDTRA 10572, chapter 6, and *Basic Military Requirements*, NAVEDTRA 10054-E1, chapter 11, and will not be covered further.

The protective mask is the most single important piece of protection against CBR attack. The Chemical-Biological Mask, type MCU-2/P is now in use in the U.S. Navy. This mask is described in detail in NAVSEA S-6470-AB-MMO-010, and it will not be covered further.

For detailed information on aircraft firefighting and personnel rescue procedures, refer to *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual* (NAVAIR 00-80R-14).

Detailed information on aircraft entry, engine shutdown procedures, ejection seat safety, and personnel removal may be found in the *U.S. Navy Aircraft Emergency Rescue Information Manual* (NAVAIR 00-80R-14-1).

The *U.S. Navy Aircraft Crash and Salvage Operations Manual* (Afloat) (NAVAIR 00-80R-19) gives standardized procedures for shipboard aircraft salvage operations.

AFFF HOSE REELS AND RELATED EQUIPMENT

The AFFF single hose reel (fig. 5-5) performs the function of storing the hose. The hose reels provide a rotatable connection to the piping. This permits the hose to be unwound from the reels while still connected to the piping. A gearing system is incorporated in the reels to facilitate rewinding of the hoses. A manually operated friction brake is attached to the reel pinion shaft. The brake is used to lock the hose reel in place and prevent it from turning. The brake should always be slightly engaged when the reel is in ready condition, so the hose will not unreel itself because of vibration. See figure 5-6.

The single hose reel also has controls. Refer to figure 5-6. A crank is furnished to drive the pinion shaft and rotate the hose reel to rewind the hose onto the reel.

The hose reel drum is supported at one side by a bearing assembly and at the other by a swing joint. The swing joint and bearing assembly allow the drum to be

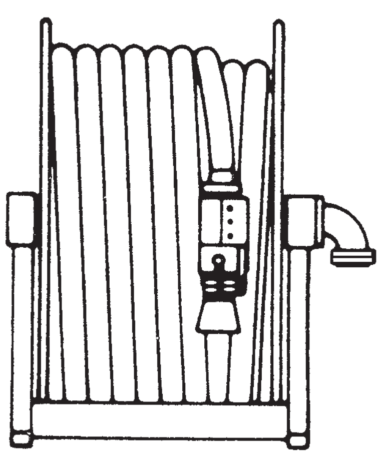

Figure 5-5.—AFFF hose reel.

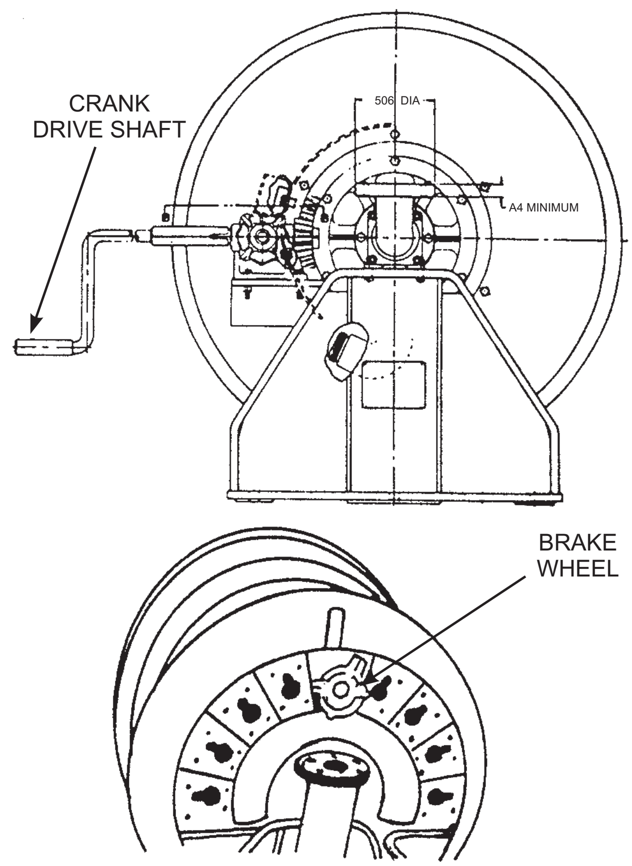

Figure 5-6.—AFFF hose reel controls.

rotated. Both are mounted on the frame assembly, which supports the entire reel assembly.

A ring gear is attached to the side of the drum so that it meshes with the drive pinion. The drive pinion is supported by a bearing housing, which is also mounted on the frame assembly. A hand crank is provided to turn the drive pinion and rewind the hose onto the drum.

AFFF enters the hose reel through the swing joint and flows into the swing joint elbow located inside the drum. From the swing joint elbow, the AFFF flows through the outlet elbow, which protrudes from an opening in the drum. The hose is connected to the outlet elbow and then wound around the reel drum for storage.

Approved variable-stream-type nozzles are fully effective for use with AFFF. Examples of nozzles meeting MIL-N-24408 requirements are shown in figure 5-7. The 1-1/2" and 2-1/2" variable nozzles must have settings of 125 gpm and 250 gpm, respectively.

SALTWATER SERVICE FIREPLUGS

The saltwater service fireplugs are also located at strategic points about the flight deck, gallery walkways, and hangar deck bulkheads. Each station is provided with adequate hose, spanner wrenches, and variable stream nozzles.

The number of AFFF outlets and service fireplugs installed on a particular aircraft carrier is dependent upon the size and type of the carrier.

FLIGHT DECK AFFF SPRINKLER SYSTEM

Aircraft carrier flight decks are equipped with an AFFF sprinkling system consisting of flush deck, flush deck cannon-type, and deck edge nozzles installed in conjunction with the saltwater washdown system. AFFF from a concentrate tank is injected into the saltwater (injection point is on the 03 level just downstream of the saltwater control valve) via a positive displacement pump, usually 60 gpm. This injection pump serves the flush deck and cannon-type nozzles. Deck edge nozzles may be served by the AFFF two speed pump system or single speed injection pump system.

Controls for the flight deck fixed fire extinguishing system are located in both Pri Fly and on the navigation bridge. The controls allow for selection of saltwater, AFFF, or system shutdown. On CVN 72 and newer carriers, the countermeasure water washdown system is controlled only from the navigation bridge.

On the flight deck, the weapons staging area is protected by an AFFF sprinkler system consisting of deck edge and flush deck nozzles. The number and location of the deck edge nozzles are designed so that adequate coverage will exist regardless of the placement of bomb skids and carts. The system is used to rapidly extinguish an aviation fuel spill fire prior to heat buildup sufficient to initiate weapons cookoff conditions. In the event of a bomb farm/weapons

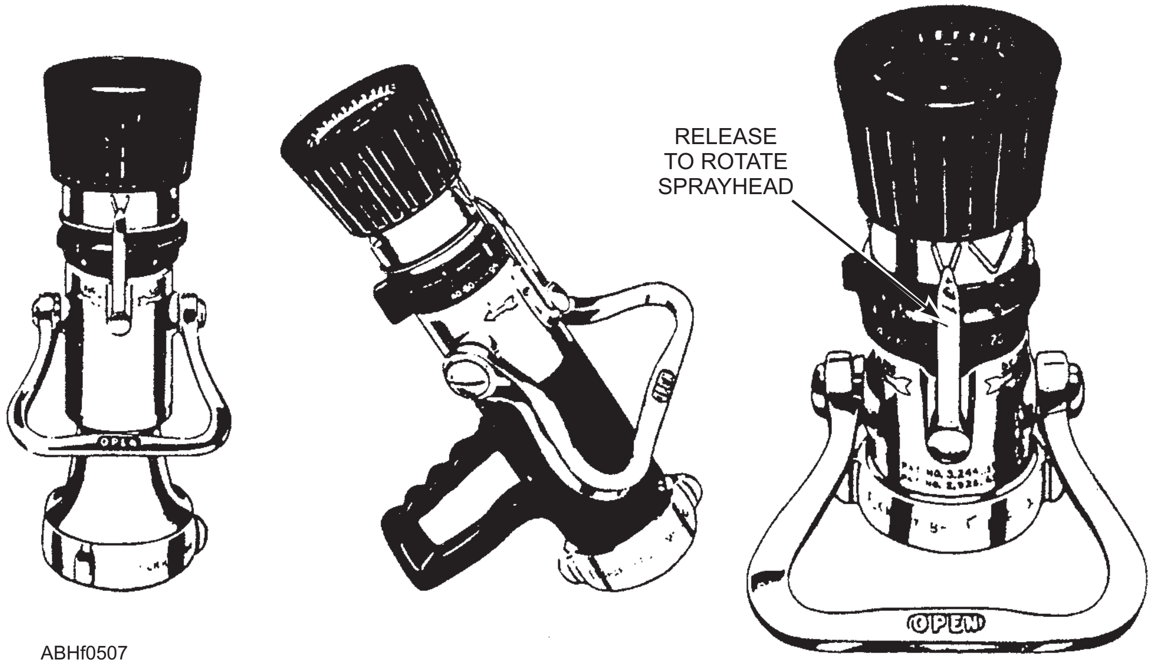

Figure 5-7.—Examples of variable-stream fog nozzles.

staging area conflagration, or upon activation of the weapons staging area sprinkler system, immediate employment AFFF.

HANGAR DECK AFFF SPRINKLER SYSTEM

The AFFF sprinkler systems are installed in the overhead of the hangar deck. The sprinkler system is divided into groups that can be individually actuated. Each group is supplied from two risers: one from a port AFFF injection station, and one from a starboard AFFF injection station. Controls to open and close individual sprinkler groups are located in the conflagration (CONFLAG) stations and along each side of the hangar deck near the related sprinkler group. CONFLAG stations located nearest the division doors will include controls for all AFFF sprinkler groups on each side of the door.

High-Capacity AFFF System

On a CV/CVN an AFFF station consists of a 600-gallon AFFF concentrate tank, a single-speed injection pump or a two-speed AFFF pump, electrical controllers, valves, and necessary piping. Saltwater and AFFF flow is controlled by hydraulically operated valves, which are actuated by solenoid-operated pilot valves (SOPV's). Electrical switches at user locations (Pri-Fly, NAVBRIDGE, hose stations, and CONFLAG stations) activate the SOPV's.

The injection pump system supplies the flush deck nozzles on the flight deck, and the deck edge nozzles on CVN's and some CV's.

The two-speed pump operates at 27 or 65 gpm, depending upon the demand. The low-rate output will supply handlines and small sprinkler systems. High-demand systems such as hangar bay sprinklers are served by the high-speed output. On selected CVs, the two-speed pump supplies the deck edge nozzles. See figure 5-8.

Detailed information on the arrangement and operation of the AFFF system and hangar-deck sprinkler systems are contained in chapter 555, *Naval Ships' Technical Manual* (NSTM), NAVSEA S9086-S3-STM-010, "Firefighting - Ship"; and NAVSEA S9555-AS-MMO-01A/CV66 Technical Manual, *High Capacity Fog Foam System (AFFF), Description, Operation, and Maintenance.*

AFFF Hose Outlets

Hangar bay AFFF hose outlets are located port and starboard near the AFFF injection stations from which they are supplied. A push-button control is located adjacent to each AFFF hose station. The station has a 1-1/2" hose reel and one 2-1/2" hose outlet.

Flight deck AFFF hose outlets are located in catwalks and near the island. The station has one reel of 1-1/2" hose and/or one 2-1/2" hose outlet or two 2-1/2" hose outlets with hose and nozzle connected to each outlet. A push-button control, X50J phone circuit box and E call button are located adjacent to each AFFF hose station. Emergency lighting is provided at each hose reel station; controls are located in Pri-Fly and on the NAVBRIDGE.

Hoses must be of sufficient length to permit reaching all areas on the flight deck and adjacent weather decks from at least two outlets.

SHIPBOARD TWIN AGENT UNIT (TAU)

The TAU series of fire extinguishers are dual-agent apparatuses. These are designed primarily for extinguishing class B fires, and are normally used aboard ship and at hot-refueling sites as mobile TAU's. The TAU is a self-contained unit having a framework with two *agent* tanks, one containing an AFFF premixed solution and the other containing PKP. The TAU uses a noncollapsable dual-hose line encased in cotton and normally stowed in a basket. The fire-extinguishing agents are propelled by nitrogen from a cylinder mounted on the framework of the TAU. Agents are applied in a sweeping motion, with PKP used first. This is followed by application of AFFF to blanket the combustible liquid and preclude re-ignition. The configurations discussed in this chapter are the units used aboard ship.

The TAU-2 and the TAU-2A are frame-mounted units designed for shipboard use. The TAU is mounted on the rear of a tow tractor for flight deck use and on a suitable cart or trailer for hangar deck use. (The use of bomb/missile skids for mounting the TAU units is not authorized.)

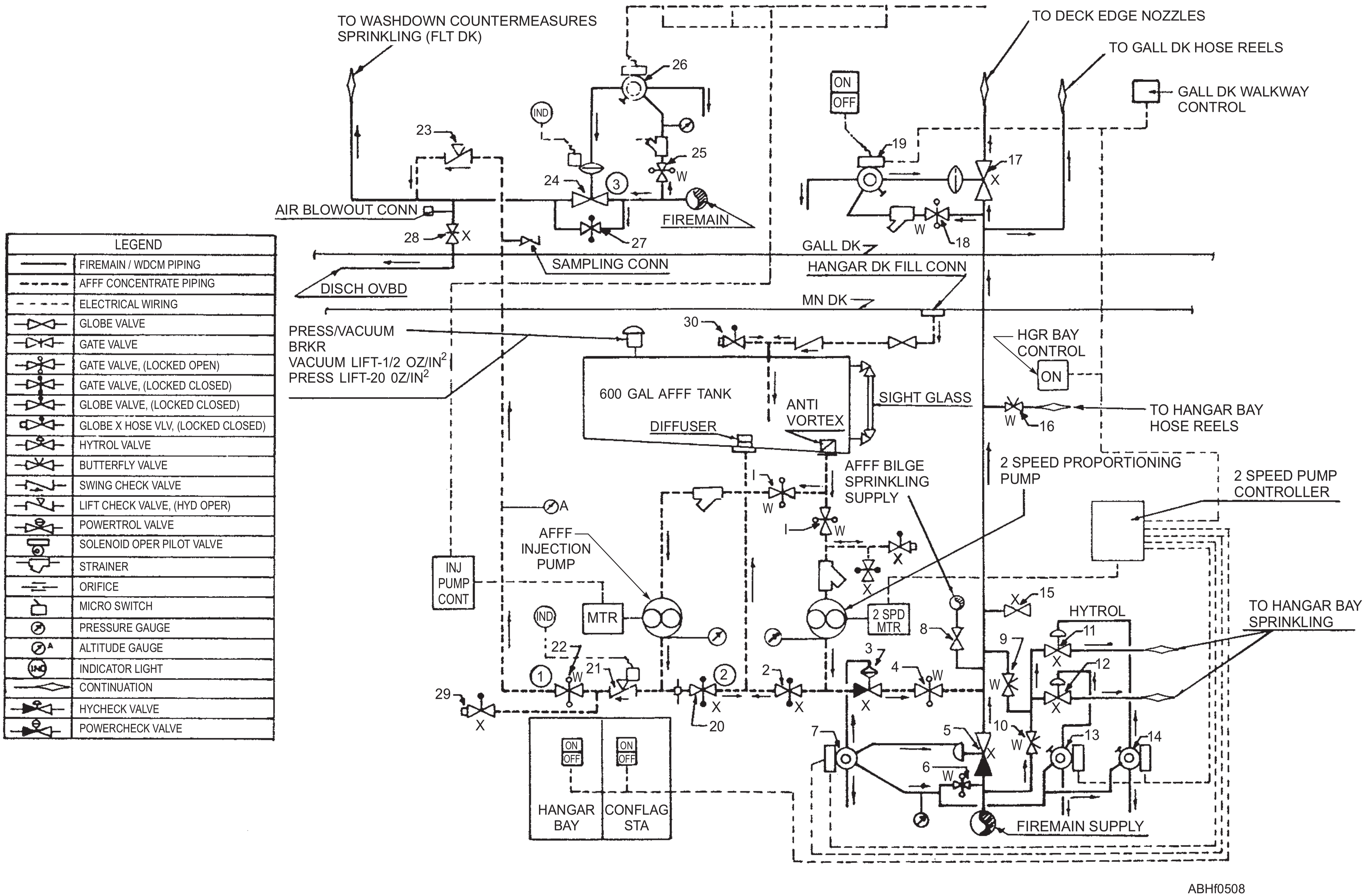

Figure 5-8.—AFFF system injection station, 600-gallon.

The TAU-2 contains 80 gallons of AFFF premixed solution and 200 pounds of PKP. The hose line is stored in a basket. See figure 5-9.

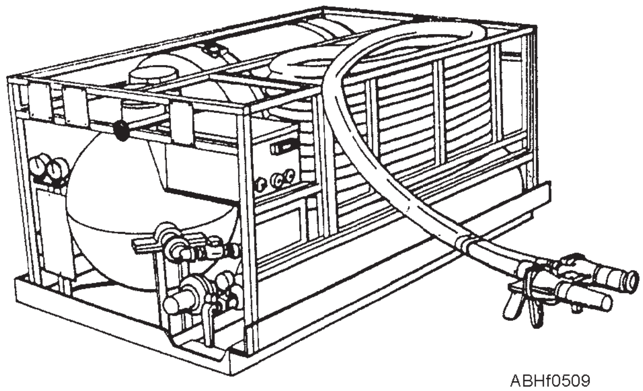

Figure 5-9.—Fire extinguisher TAU-2.

The TAU-2A has 86 gallons of AFFF premixed solution and 200 pounds of PKP.

Components, Arrangement, and Function

The leading particulars for the TAU-2 are contained in table 5-1. A diagram of the TAU-2 is shown in figure 5-9.

Table 5-1.—Fire Extinguisher TAU-2 Leading Particulars

Length	66 inches
Width	42 inches
Height	30 3/8 inches
Weight Dry	1390 pounds
Weight Operation	2280 pounds
AFFF Mixture	80 gallons
PKP	200 pounds
Nitrogen Press	1700 PSI minimum
Operating Press	230 PSI

The TAU-2 fire extinguisher is a skid-mounted dual agent unit employing an AFFF firefighting agent and a dry-chemical agent. It is designed to rapidly extinguish and prevent re-ignition of hydrocarbon fuels. The unit can be used in a corrosive salt environment. A heating system is incorporated in the AFFF manifold for use under adverse weather conditions. The AFFF concentrate is premixed with water, at 6% concentrate and 94% water. The mixture is expelled with nitrogen gas through one line of the twin handline. PKP is contained in a separate tank and is expelled with nitrogen gas through the other line of the twin handline. The system permits use of the firefighting agents either separately or simultaneously.

Dry-Chemical Tank.—The dry-chemical tank is a round, steel tank with a 200-pound capacity. Nitrogen gas enters the tank through a gas dispersion line. The gas/PKP mixture is discharged through pick-up tubes to the dual handline.

AFFF Tank.—The AFFF tank is a cylindrical stainless steel tank. The tank has an 80-gallon capacity and is equipped with a liquid-level dipstick gauge for refilling. Nitrogen gas enters through the top and AFFF is expelled from the bottom.

Tank Caps.—Each tank has a 4-inch-diameter fill opening with a screw-type self-venting pressure cap. Caps are installed with neoprene gaskets to ensure sealing. Four 1/8-inch-diameter holes are drilled for venting.

Nitrogen Cylinder.—The 400-cubic-foot shatter-proof gas cylinder is charged to a minimum of 1,700 pounds per square inch. An integral pressure gage is installed to permit visual reading of the gas pressure at all times. Nitrogen is released from the cylinder through a lever-operated valve. The single-stage pressure-reducing regulator reduces the pressure from the nitrogen cylinder to the chemical tank, with a working pressure of 230 psi.

Vent Valves.—A manually operated quarter-turn ball-type vent valve is installed in each tank.

Pressure Relief Valves.—A spring-operated pressure-relief valve is provided at the inlet of each tank. The valves are set to relieve at 250 psi.

Check Valves.—Six check valves are installed in the system to allow for flushing the twin handline hose without charging the chemical tanks and to prevent backflow of chemical agents into the nitrogen system.

Discharge Hoses.—A dual-type line is used to discharge the firefighting agents. The line consists of two neoprene-lined and covered hoses with a polyester outer jacket. A 3/4 diameter hose is used for PKP, and a 1" diameter hose is used for the AFFF. Hoses are fitted with reusable swivel couplings. The hose is stored in a compartment on the side of the fire extinguisher.

Nozzles.—The twinned nozzles on the handline expel the firefighting agents. Each nozzle has a pistol grip handle and a trigger-operated shutoff valve. The nozzles are fastened together by a tie bar to make up the dual assembly. The PKP nozzle is equipped with a low-reaction discharge tip. The nominal flow rate of the

PKP nozzle is 4 to 5 pounds per second. The AFFF nozzle is equipped with an aspirating-type tip, which is directed outward from the parallel planes of the nozzle handle. The AFFF nominal flow rate is 60 gallons per minute. See figure 5-10 for the PKP and AFFF nozzles.

Pressure Gages.—Pressure gages are provided to indicate pressure in each tank while the system is operating. The gages should indicate 0 psi when the fire extinguisher is in the ready/standby condition and 230/235-psi when in the firefighting condition.

Temperature Relief Valve.—A fusible-plug type relief valve mounted on the AFFF tank relieves pressure at 212°F (100°C). When the relieving temperature is reached, the plug material melts, allowing pressure to escape.

NOTE

The temperature relief valve is not reusable and must be replaced after an overpressure temperature is reached.

HEATING ELEMENT.—An immersion-type heating unit is mounted in the AFFF manifold for use during adverse weather conditions.

NOTE

The heater system should be activated when the ambient temperature is expected to fall below 40°F (4.4°C).

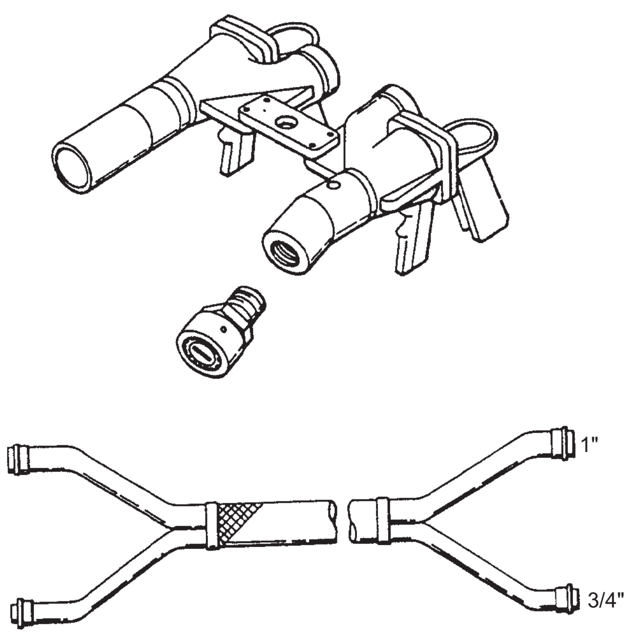

Figure 5-10.—TAU-2 AFFF and PKP nozzles, AFFF nozzle tip, and twin-hose assembly swivel coupling.

Transformers.—A single-phase transformer is provided to reduce the ship's 440-volt power to 220 volts for use by the heater.

Thermoswitch.—A cartridge-type screw-plug thermoswitch installed in the AFFF discharge manifold is preset at 60 ±2°F (18.3 ±1°C). Constant temperature control is maintained by the slow make and break contacts.

Principles of Operation

When the lever valve on the nitrogen cylinder is opened, nitrogen gas at 1,700 psi flows to the pressure regulator, where it is reduced to 230 psi. The gas then flows through the selector valves into the AFFF and PKP tanks. A pressure gage is installed at the inlet of each tank to indicate the operating pressure. As gas flows into the AFFF tank, AFFF is forced from the tank, through the handline, to the nozzle. Gas flowing into the dry-chemical tank aerates and pressurizes the PKP agent. As gas leaves the tank, the PKP agent is suspended in the gas stream and is carried along by the velocity of the moving gas. The mixture of gas and PKP is carried through the handline to the nozzle. To discharge the chemicals, open the trigger-operated shutoff valves. Nitrogen is provided to flush the residue from the twinned handline and nozzles after use. A flow diagram is shown in figure 5-11.

Two pressure relief valves, set to release pressure at 250 psi, are installed to provide protection from excessive pressure. The valves are installed on each tank's inlet piping. A temperature relief valve, relieving at 212°F (100°C), is located on AFFF tank piping.

The AFFF solution is protected from freezing in temperatures as low as -25°F (-31°C) by the electrical heating unit. The heater system has a control box attached to the frame, an immersion-type heating element, and a thermoswitch installed in the AFFF manifold. The indicator lamps on the control box show when the power is on and when the heating element is energized.

Operating and Maintenance Instructions

You should conduct a preoperational inspection according to NAVAIR 19-600-120-6-1.

WARNING

The dry-chemical ingredients are classified as nontoxic. However, discharge of large quantities may cause you to have temporary

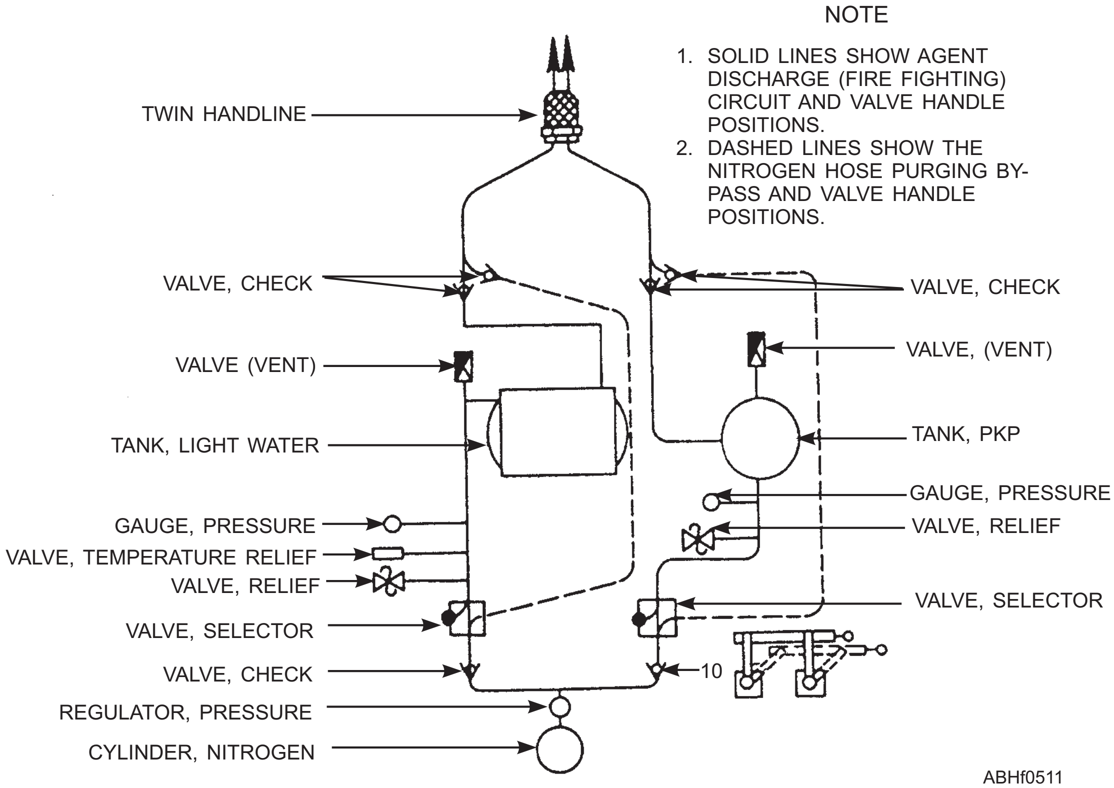

Figure 5-11.—TAU-2 flow diagram.

breathing difficulty during and immediately after the discharge, and it may seriously interfere with your visibility. If your eyes become irritated rinse with cool, clean water.

NOTE

When testing and operating fire extinguishers, you should comply with anti-pollution regulations. Fire extinguishers should be discharged only when your ship is outside the 12-mile limit, or when the ship is making at least 10 knots. In other cases, either retain foam in a tank or discharge it into a barge. Exception to this requires the permission of local pollution control authorities.

Use the following procedures when testing and operating fire extinguishers:

1. Make sure the selector valve is in the firefighting position (handle in).

2. Make sure the vent valves are closed.

3. Open the nitrogen cylinder by pulling the valve handle forward.

4. Remove the desired length of hose from the hose rack.

5. Uncoil the hose to the desired length.

6. Operate the nozzles by actuating the trigger-operated shutoff valves.

NOTE

When approaching the fire, you should open the dry-chemical nozzle first. When headway on the fire is gained, open the AFFF nozzle to cover the extinguished fuel with foam. Proceed slowly until the fire is out. Should an area need reworking, go back with the AFFF nozzle off, and then proceed with both nozzles open. The effective discharge time period for the PKP is 40 seconds, and for the AFFF, 80 seconds.

NOTE

Upon returning to the ready, standby, and service status, service the fire extinguisher after each use, regardless of the discharge time. Proper servicing/purging procedures ensure that an operational unit is available upon demand.

Use the following procedures when servicing fire extinguishers:

1. Close the nitrogen cylinder valve.

2. Open the vent valves to vent the tanks.

3. Place the selector valve in the purge position (handle out).

4. Open the nitrogen cylinder valve.

5. Open the nozzles and purge the hoses. Direct the residue into the drain, scupper, or a suitable tank.

6. Close the nitrogen cylinder valve and leave the nozzles open until the hoses have vented.

7. Place the selector valve in the FIREFIGHTING position (handle in).

8. With the vent valves open, slowly remove the PKP tank cap, and make sure the cap vent holes are open.

9. Fill the PKP tank to 1 inch from the neck.

10. Inspect the gasket for cuts and tears.

11. Install the gasket and the fill cap.

NOTE

Do not expose PKP to the atmosphere longer than necessary. Dampness causes the powder to bond, causing lumps.

12. Remove the AFFF tank cap.

13. Fill the AFFF tank as follows:

a. If the tank is NOT empty, measure the liquid level with a dipstick. The dipstick is marked in 3-inch increments. See table 5-2 for the quantity of AFFF concentrate to be added.

Table 5-2.—AFFF Refill Chart for the TAU-2

Mixture Level From Top (Inches)	AFFF Concentrate (Add Qt/Gal)
3	2 qt
6	1 gal
9	1 gal, 3 qt
12	2 gal, 2 qt
15	3 gal, 1 qt
18	4 gal
21	4 gal, 3 qt
Empty	5 gal

CAUTION

Do not fill the tank to overflowing or agitate the AFFF, as this causes foaming.

(1) Add the AFFF concentrate as required.

(2) Insert the freshwater hose in the tank with the discharge end at the bottom of the tank; slowly fill the tank to 1 inch from the top.

b. If the tank is empty, fill with freshwater to 9" from the top of the dipstick.

(1) Add 5 gallons of AFFF concentrate.

(2) Insert the freshwater hose into the tank with the discharge end at the bottom of the tank. Slowly fill the tank to 1" from the top.

14. Inspect the gasket for cuts and tears.

15. Install the gasket and the fill cap.

16. Change or charge the nitrogen cylinder when the pressure is below 1,700 psi.

17. Shut the AFFF and PKP tank vent valves.

18. Stow the hose and nozzle assembly in the hose compartment.

19. When the ambient temperature is below 40°F (4.4°C), actuate the heater unit.

a. Plug the transformer into the ship's power and heater unit.

b. Turn the circuit breaker switch to ON.

All the scheduled maintenance must be made according to the maintenance requirement cards (MRC's), NAVAIR 19-600-120-6-2.

Due to the corrosive effects of firefighting agents and the severe environment in which the fire extinguisher is operated, a strict corrosion control program is mandatory. Corrosion control must be accomplished according to *Ground Support Equipment Cleaning and Corrosion Control*, NAVAIR 17-1-125.

When filling or inspecting the fire extinguisher, you should examine the fill-cap gaskets for cuts, tears, deformation, and elasticity.

For detailed information on the TAU-2, you should refer to NAVAIR 19-45-17 Technical Manual, *Operation and Intermediate Maintenance Instructions with Illustrated Parts Breakdown, Fire Extinguisher (TAU-2)*.

For detailed information on the TAU-2A, you should refer to NAVAIR 19-45-18 Technical Manual, *Operation, Maintenance and Overhaul Instructions with Illustrated Parts Breakdown, TAU-2A Twinned Agent Firefighting System*.

A/S32P-16A FIREFIGHTING VEHICLE (P-16/A)

The P-16/A shipboard firefighting vehicle (fig. 5-12) is powered by a two-cycle, four-cylinder, liquid-cooled diesel engine, and contains a hydrostatic drive system with front-wheel power steering. In addition, the vehicle has two storage tanks. They are designed to carry 375 gallons of aqueous film-forming foam (AFFF) solution (also known as light water), and 400 pounds of Halon 1211. The vehicle is equipped with an 80-foot twinned-hose handline, a single-hose 100-foot handline, and a driver-operated turret

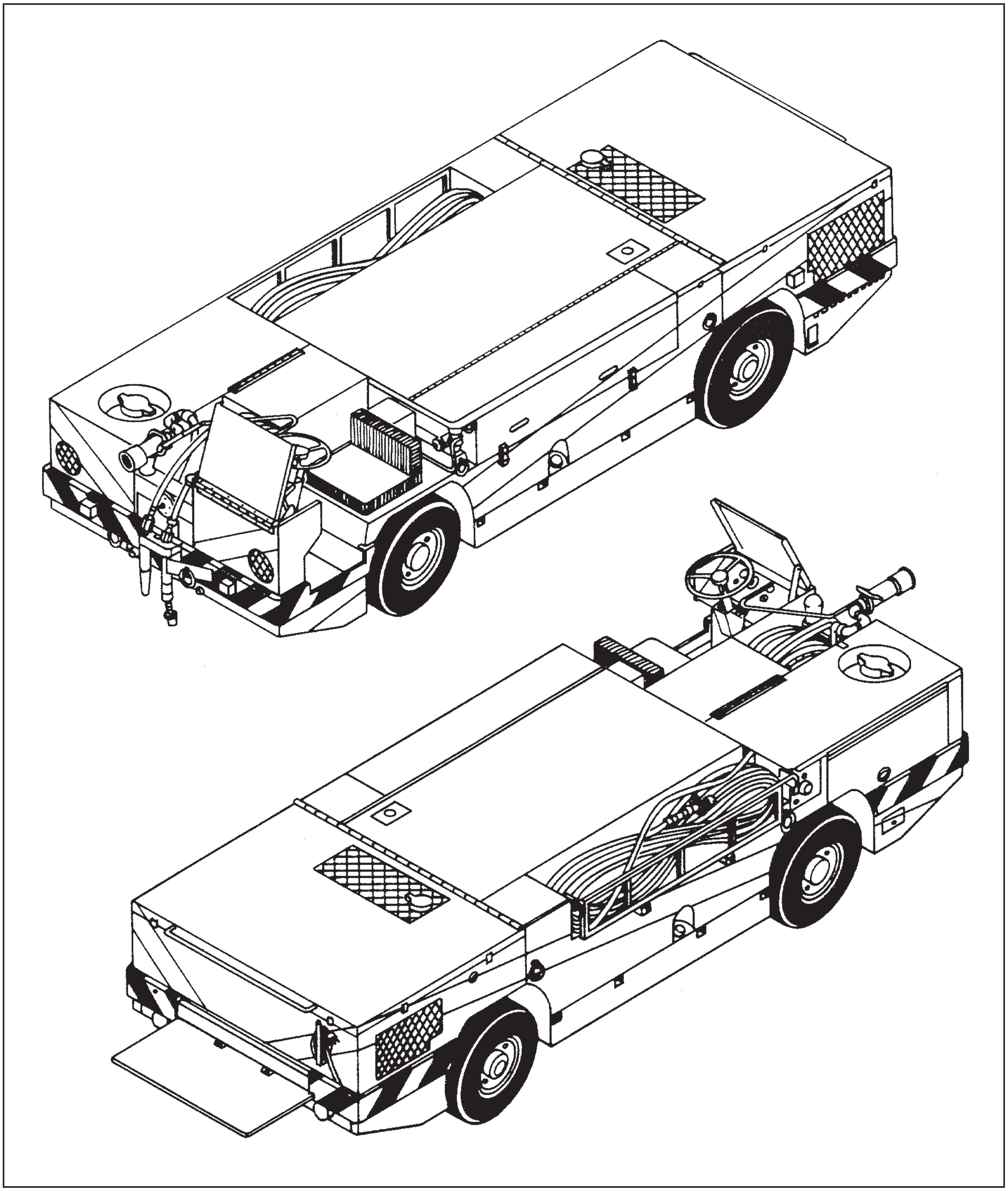
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Figure 5-12.—Shipboard firefighting and rescue vehicle, P-16/A

(fig. 5-13). The AFFF solution can be delivered through the left-hand nozzle of the twinned-hose handline, the single handline, and the driver-operated turret. Halon 1211 can only be delivered through the right-hand nozzle of the twinned-hose handline. See table 5-3 for the leading particulars.

A three-man crew mans the vehicle. The driver compartment is located at the left forward end of the vehicle and contains all controls for activating the firefighting systems. Two handline operators are stationed on a platform at the rear of the vehicle.

A selector lever is located in the driver's compartment for forward, neutral, or reverse when the neutral interlock button is pushed in. The selector lever becomes a throttle when the neutral interlock button is pulled out. The engine is started with the lever in neutral. A speed control foot pedal is mounted in the driver's compartment. The farther the foot pedal is depressed the greater the output flow from the drive pump. There is no flow from the pump to the drive motor when operating in neutral or when the foot pedal is not depressed. Switching to forward or reverse and depressing the pedal causes the truck to be driven in the selected direction.

Fire Fighting Vehicle, A/S32P-25 (P-25)

The P-25 (see figures 5-13, 5-14, 5-15, 5-16, and table 5-4) is a self-propelled firefighting vehicle for use on aircraft carriers and amphibious assault ships. It is powered by a Detroit Diesel (6V-53TA, 237-bhp) engine. The vehicle's hydrostatic drive system provides power to the rear wheels and to the dynamic braking system. Parking and service brake modules (one each) are mounted on the rear drive wheels. The P-25 has front wheel steering, controlled by a single hydraulic cylinder and tie rod. There are four wheel and tire assemblies on the P-25, each a 12" diameter three-piece rim and a tube-type tire. The tire is factory inflated with *permafoam* to an equivalent of 150 psi. The manufacturing process of the tire/wheel assembly render it a one-piece non-repairable item. The tires can be used until tread wear exposes the tire carcass cord; however, replacement should take place when the tire center rib tread depth is worn to 0.120 inch. Tire/wheel

Figure 5-13.—Fire Fighting Vehicle, A/S32P-25 (P-25)

Table 5-3.—Firefighting Vehicle, P-16/A Leading Particulars

Dimensions:		
Height (Less Driver)	41	inches
Height (Average Driver)	68	inches
Width	65	inches
Length	175	inches
Wheel Base	91	inches
Tread Width	54	inches
Ground Clearance	8	inches
Turn Radius (Outside Wheel Tread)	168	inches
Turn Radius (Outside Corners)	196.5	inches
Weights:		
Front (Fully Loaded)	5,050	pounds
Rear (Fully Loaded)	6,950	pounds
Total Gross Weight	12,000	pounds
Front (Empty)	3,150	pounds
Rear (Empty)	5,350	pounds
Total Weight	8,500	pounds
Capacities:		
Diesel Fuel	27	gallons
Engine Oil	12	quarts
Light Water Solution	357	gallons
Halon 1211	400	pounds
Nitrogen	400	cu ft bottle
Hydraulic Reservoir	10	gallons
Fire Fighting System:		
Agueous Film Forming Foam (AFFF) Pump Output	240	gpm at 200 psi foot
Dry Chemical	30	range, expels 4 to 5 pounds per second

assemblies should be replaced in pairs to avoid imbalanced side-to-side loading.

Firefighting System

A water tank within the vehicle carries 750 gallons and the AFFF tank carries 60 gallons of foam concentrate. There are three HALON 1211 (20-lb) portable fire extinguishers mounted on the right side of the unit. The nursing system consists of two National Fire Hose Thread Fittings, one on each side of the vehicle above the rear wheels. These fitting allow the P-25 to be nursed from the ship's AFFF system directly to the turret via the water pump by either a 1-1/2" or

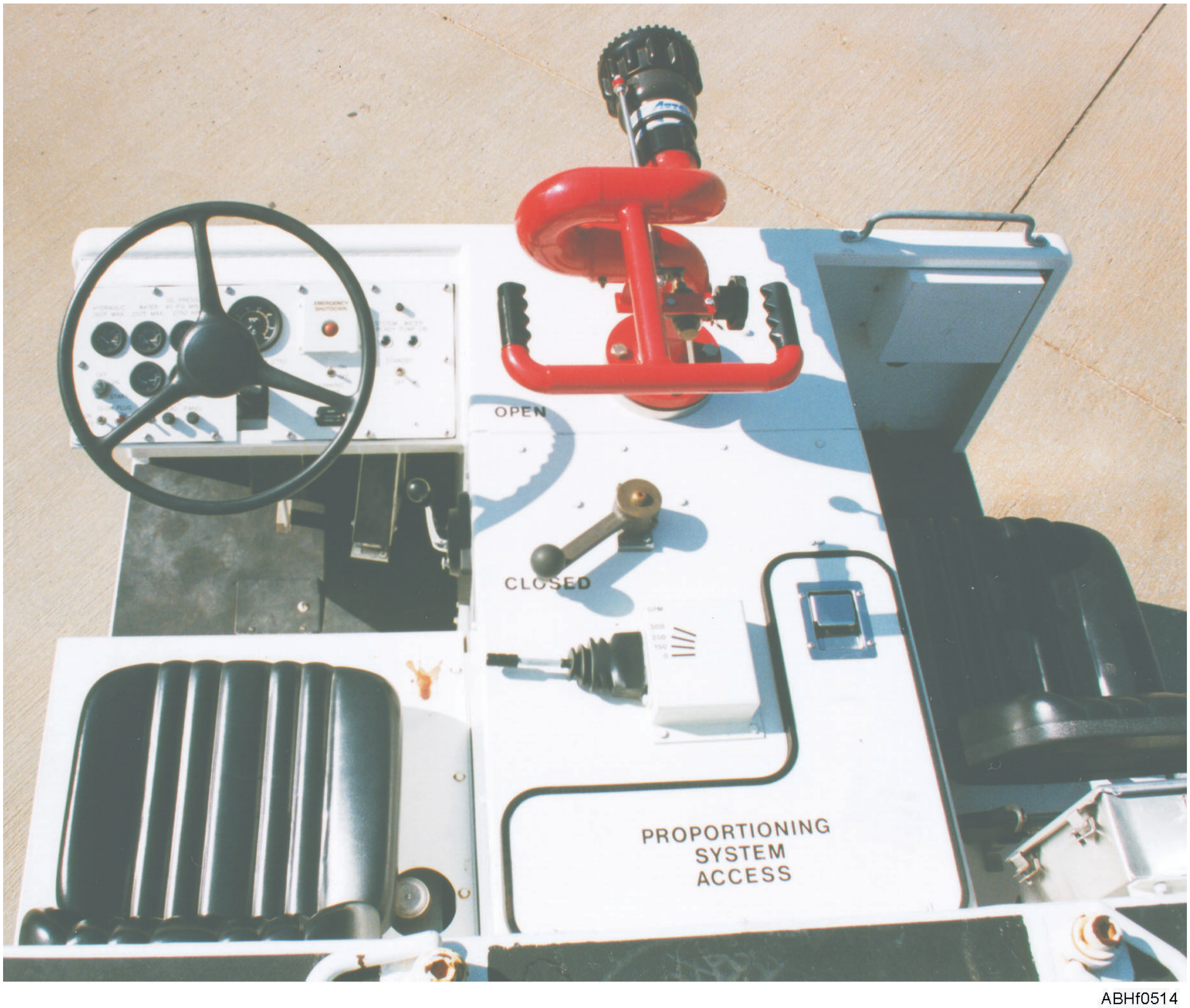


Figure 5-14.—Fire Fighting Vehicle, A/S32P-25 (P-25) Driver's Station

2-1/2" hose. The P-25 can produce flow rates from 0 to 500 gpm, depending on the selection made by the operator. Flow rate option settings are 0, 150, 250, and 500 gallons per minute. AFFF can be sprayed from both the turret nozzle and from a handline hose nozzle. Both nozzles operate independently and can be operated at the same time. Maximum flow rate for the turret is 500 gpm, and for the handline it is 95 gpm. The AFFF handline is a 1-1/2" hose that is 100 feet long with a nozzle. This handline is stowed on the right hand side of the P-25 on a hose reel.

Preoperational Checkout

Before you start or operate the P-25 firefight -ing vehicle, you must perform a preoperational checkout of the vehicle in accordance with Preopera- tional Checklist, NAVAIR 19-600-6-1. The leading

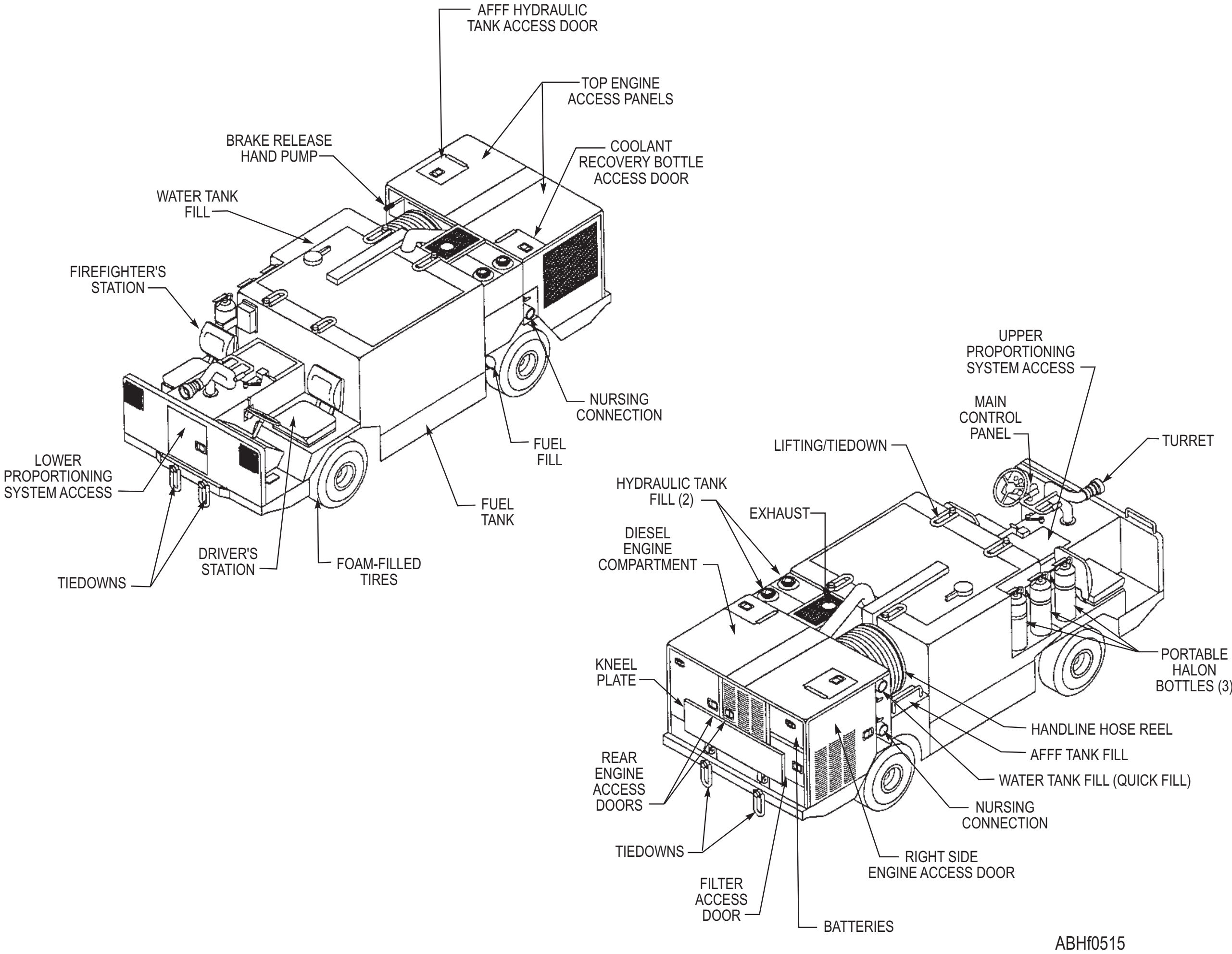


Figure 5-15.—Fire Fighting Vehicle, A/S32P-25 (P-25) General Layout

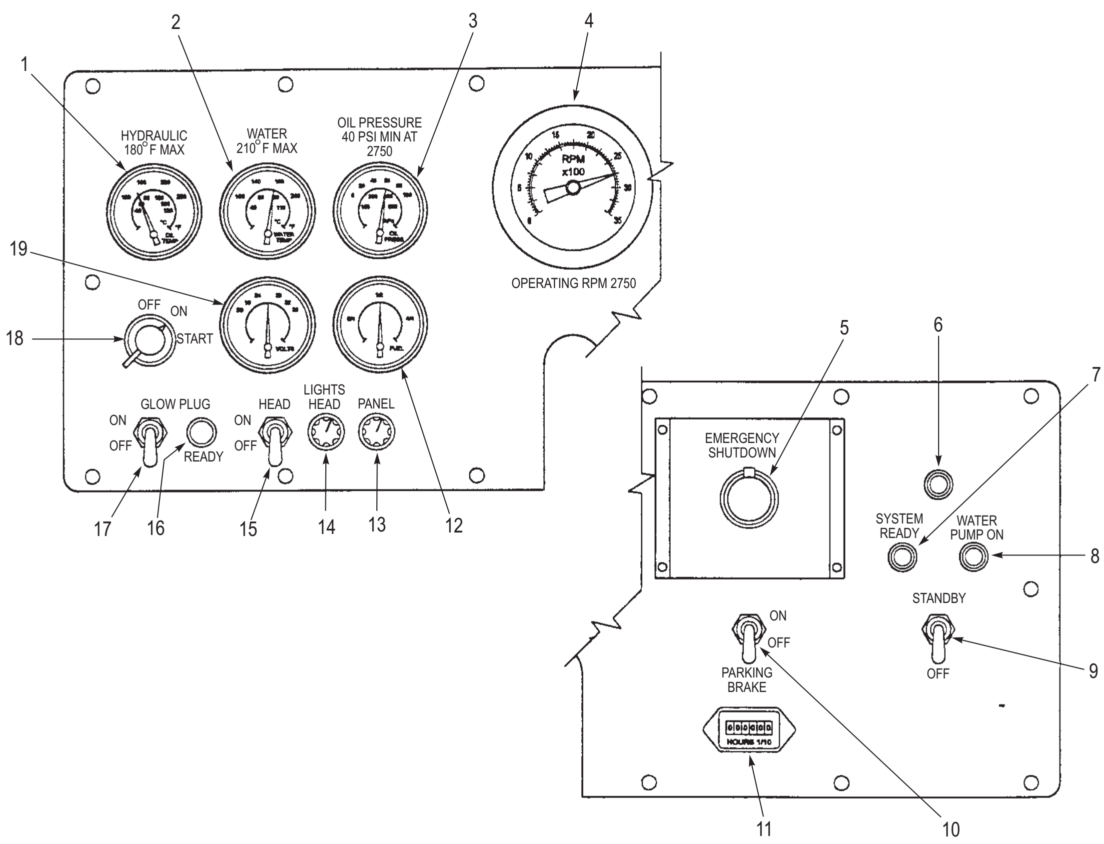


Figure 5-16—Fire Fighting Vehicle, A/S32P-25 (P-25) Main Control Panel

Table 5-4.—P-25 Main Control Panel, Controls and Indicators

(Figure 1) Index No.	Control/Indicator	Function
1	OIL TEMP Gage	Indicates temperature of hydraulic fluid. Maximum operating hydraulic oil temperature indication is 160ºF.
2	WATER TEMP Gage	Indicates engine coolant temperature. Normal indication is 160 to 185ºF. Maximum engine coolant temperature is 210ºF.
3	OIL PRESS Gage	Indicates engine oil pressure. Normal indication is 40 psi minimum at 2750 rpm.
4	RPM Tachometer	Indicates engine revolutions per minute (rpm). Normal idle speed is 800 rpm. Normal operating speed is 2750 rpm.
5	EMERGENCY SHUTDOWN Pushbutton	When depressed, intake air to diesel engine is shutoff via solenoid operated butterfly valve.
6	Panel Light	Illuminates dash panel.
7	SYSTEM READY Indicator Light	When light is lit, indicates water pump suction inlet is flooded and ready to pump.
8	WATER PUMP ON Indicator Light	When light is lit, indicates water pump is operating.
9	STANDBY/OFF Switch	STANDBY - Opens water pump isolation valve to flood pump suction inlet with water.
		OFF - Closes water pump isolation valve insolating water pump suction inlet from water supply.
10	PARKING BRAKE ON/OFF Switch	ON - Sets parking brake.
		OFF - Releases parking brake when diesel engine is running.
11	HOURS Indicator	Indicates total hours of diesel engine operation.
12	FUEL Gage	Indicates amount of fuel in fuel tank.
13	PANEL Lights Dimmer Switch	Full counterclockwise position is off. Rotate knob clockwise to increase intensity of panel light and all control panel indicator lamps.
14	LIGHTS - HEAD Dimmer Switch	Rotate knob clockwise to increase intensity of head lights and rear marker lights.
15	HEADLIGHTS ON/OFF Switch	ON - Turns on headlamps and rear marker lights.
		OFF - Turns off lights.
16	GLOW PLUG READY Indicator Light	When lit, indicates that glow plug circuit is active.
		When flashing on and off, indicates that diesel engine is ready to start.
17	GLOW PLUG ON/OFF Momentary Toggle Switch	ON - Turns on diesel engine glow plugs for cold weather starting. When held in ON position, switch overrides glow plug controller to energize glow plugs.
		OFF - De-energizes glow plug control circuit.
18	OFF/ON/START Switch	OFF - De-energizes 24 VDC control system.
		ON - Activates 24 VDC electrical control system.
		START - Applies 24 VDC power to engine starting motor.
19	VOLTS Indicator	Indicates battery charging. Normal indication is from 26 to 28 VDC.

particulars of the P-25 firefighting vehicle are listed in Table 5-5.

Q3. How many pounds of liquid Halon 1211 are carried in the portable Halon extinguisher?

Q4. PKP portable fire extinguishers are primarily used for extinguishing what type of fire?

Q5. How long is the twin agent handline on the P-16/A?

ORGANIZATION AND PROCEDURES

OBJECTIVES: Identify the air department's aircraft firefighting organization. Explain the duties and responsibilities of the aircraft firefighting team members. Identify aircraft firefighting procedures.

DEPARTMENTAL ORGANIZATION

Air Department Repair Teams

Within the aircraft carrier's basic damage control organization are three repair teams in the air department:

1. Aviation fuels repair team
2. Aircraft crash, salvage, and rescue team
3. Hangar firefighting and rescue team

Air Officer (Air Boss)

The air boss is responsible for aircraft firefighting, salvage, jettison, personnel rescue, and aviation fuels repair occurring on the flight/hangar deck. The air officer is also responsible for coordination with damage control central.

Aircraft Handling Officer

The aircraft handling officer is responsible for the direction and coordination of aircraft movement on the flight/hangar decks as required during aircraft crash and fire evolutions. This person acts on and relays communications from the scene leader to primary flight (Pri-Fly) control.

Aircraft Crash, Salvage, and Rescue Officer (Air Boatswain)

The air boatswain is responsible for organizing, supervising, and training the aircraft crash, salvage, and rescue team (both flight and hangar deck). The air boatswain is also responsible for material maintenance, readiness, and operation of assigned equipment on the flight deck. Additional duties for the air boatswain are included within this chapter.

Table 5-5.—A/S32P-25, P-25 Firefighting Vehicle Leading Particulars

Height	64 inches
Width	70-3/4 inches
Length	197 inches
Wheel base	95 inches
Ground clearance	8 inches
Minimum weight (empty)	12,050 lbs.
Maximum weight (full)	18,850 lbs.
AFFF tank capacity	60 gallons
Water tank capacity	750 gallons
Hydraulic fluid reservoir capacity	15 gallons
Diesel fuel capacity	28 gallons
Engine water temperature	160°-185°F (normal range)
Oil pressure	18 psi (minimum), 40-65 psi (normal range)
Engine RPM range	800 rpm (idle), 2100-2500 rpm (normal range)
Hydraulic fluid temperature	160°F (maximum)

Hangar Deck officer

The hangar deck officer is responsible for organizing, training, and supervising the hangar deck firefighting and rescue team and maintaining and operating assigned equipment.

Aircraft Integrity Watch Officer

The IWO assumes the duties of the aircraft handling officer when the air integrity watch is set. The integrity watch officer's duties apply to initial emergency response only and do NOT include authority to set flight quarters or have aircraft moved in other than emergency conditions.

Aviation Fuels Officer

The aviation fuels officer is responsible for the organization, training, and operation of the aviation fuels repair team.

AIRCRAFT FIREFIGHTING TEAM ORGANIZATION

The organization of the aircraft firefighting team and duties essential to meet training and procedural requirements are contained in the following paragraphs.

Scene Leader

The scene leader is an individual in the vicinity of the incident who is trained, understands the requirements of the emergency, and can get the rest of the crew to respond to directions. This person is responsible for the direction and use of all available firefighting assets at the scene.

Mobile Firefighting Vehicles (MFFV) Driver and Operator

The driver and operator of the MFFV provide for immediate response and initial firefighting actions.

Hose Team Leader

The hose team leader is responsible, under the supervision of the scene leader, for the direction of one hose team.

Hose Teams

The AFFF hoses must be deployed to the scene using maximum personnel participation. When in place, a hose team must have one AFFF hose with a minimum of five personnel (maximum seven) on each 2-1/2" hose, and a minimum of three personnel (maximum five) on each 1-1/2" hose.

NOTE

All personnel on the hose team shall be positioned on the outside of the hose to aid in mobility and to decrease interference between the hose team members.

Messengers

Messengers are responsible for relaying information from the scene leader to flight deck control/hangar deck control.

Rescue Personnel

Rescue personnel must be available and properly attired in firefighting proximity clothing (hotsuits). They should always work in pairs as directed by the scene leader.

NOTE

On the hangar deck, proximity suits must be immediately available for a minimum of 2 hotsuitmen and self contained breathing apparatuses (SCBA's) for each hangar bay.

AFFF Hose Station Operator (Plug Person)

The plug person operates the station at the direction of the hose team. This person also maintains direct communications with the injection station operator.

Background Assistance Leader

The background assistance leader organized and dispatches background assistance personnel in support of the scene leader. All flight or hangar deck personnel, as well as embarked squadron personnel not actively involved in other critical duties shall muster with the background assistance leader.

Medical Personnel

Medical personnel are to muster with the background assistance leader for assignment.

EOD/Weapons Personnel

Properly equipped EOD/weapons personnel are stationed in flight deck control to provide technical assistance and weapons disposal. The air gunner/air wing ordnance officer maintains a status board that confirms type, quantity, and location of all weapons on the flight/hangar deck and/or aircraft. This information is provided to the scene leader and the ACHO.

Aviation Fuels Repair Personnel

The aviation fuels repair personnel shall report to the background assistance detail and be available provide technical assistance and fuels systems repair. Additional V-4 personnel should be dispatched to isolate affected stations of the fuel system and then notify flight deck control.

Aviation Squadron Personnel

Aircraft squadrons provide a senior maintenance representative for technical assistance. The squadron representative should be included in the background assistance leader's detail. Additionally, all air wing personnel provide immediate assistance in all firefighting or training evolutions.

AIRCRAFT FIREFIGHTING PROCEDURES

Notification. Reporting of a mishap should be accomplished by the most expeditious method in accordance with the ship's operating instructions. In the event of a pending emergency, the air officer notifies flight and hangar deck personnel by use of the 3MC and 5MC announcing systems and flight warning alarm. The accident alarm is sounded to notify flight deck personnel of an actual on-deck aircraft mishap.

NOTE

When fire occurs on the flight and/or hangar deck, word must be passed on the 1MC announcing system. At this time, designated personnel must man assigned AFFF injection stations. Immediate communications should be established, on the X50J sound powered circuit, with the AFFF injection station.

Minimum Initial Response. All preplanning and training should be directed toward providing the following minimum initial response to an actual mishap or drill:

1. MFFV(s)/TAU(s)
2. Scene leader
3. Hose team leaders
4. Four AFFF hoses

NOTE

When MFFV equipment is nursed at the scene, it can be considered the equivalent of one AFFF hose team.

5. Two rescue persons (hot suit personnel)
6. Two stretchers/two first-aid kits
7. Two spare hose rolls
8. Forcible entry equipment
9. Messengers/phone talkers
10. Two portable extinguishers (Halon 1211, PKP, or CO_2)
11. AFFF hose(s) for weapons staging area(s) (bomb farm) protection, properly manned

NOTE

Personnel must be assigned to monitor charged fire hose(s) restrained with hose control device(s). These personnel must ensure prompt response to conditions that affect the fire stream, such as wind change and/or other disruptions.

12. Two spare 1-1/2" and two spare 2-1/2" hose control devices with the appropriate Vari-Nozzle attached.

It is emphasized that nothing herein is intended to discourage immediate firefighting action by individuals while awaiting the arrival of organized teams. On the contrary, the 1-1/2" AFFF hose reels and variable pattern nozzles were specifically designed and installed for rapid deployment by one person , if necessary. Local command and formal training provided to all air department and embarked aviation personnel (Shipboard Aircraft Firefighting, J-495-0413) covers basic procedures and firefighting techniques for emergency operation of 1-1/2" hose reels by the first person on the scene.

The individual actions that should occur on initial response are an essential component in the success of the team's efforts. The scene leader must assume command and direct available firefighting assets and equipment in firefighting, ordnance cooling, and personnel rescue.

WARNING

Personnel must use extreme caution when approaching an aircraft prior to engine shut-down.

The scene leader should immediately make an appraisal as to the presence of hazardous ordnance and request confirmation from flight deck control. He or she must direct firefighting teams in weapons cooling as specified below.

Ordnance. Naval aircraft carry a wide variety of ordnance in support of their assigned mission. TP-75-22, entitled "Fast Cook-Off Characteristics of Air-Launch In-Service Weapons," provides a single source reference for fast cook-off characteristics and summarizes the current available data for inservice naval air-launched weapons. Summarized are weapons descriptions, explosive type, cook-off time, reaction, typical fast cook-off results, hazards, and cook-off test data. Summary cook-off times for these ordnance items are contained in figures 8-15, 8-16, 8-17, 8-18, and 8-19 in chapter 8 of this TRAMAN. TP-75-22 shall become a part of the ready reference library of crash and rescue crews ashore and afloat.

The Ordnance Handling Officer (OHO) must keep the crash and salvage officer/crash chief continually updated as to type/quantity of ordnance being used in the day to day operations.

WARNING

- All air-launch weapons exposed to a fire can cook off either during or after the fire is extinguished. The fire duration and the type/location of the weapons will determine the reaction severity likely to occur.
- In the event of an aircraft fire, the OHO/air gunner must confirm the type, quantity, and location of all weapons on the aircraft involved and immediately provides this information to the scene leader. The scene leader must ensure that AFFF is continuously applied to all weapons exposed to fire.

WARNING

A *post-fire* weapons cooling time of **15 minutes** is considered the <u>minimum acceptable</u> cooling time for all weapons. Personnel safety and the time weapons are exposed to fire must be considered when expediting post-fire evolutions to satisfy operational commitments.

Water hose lines should not be used for ordnance cooling until *after* the fire is extinguished. The use of water hose lines for ordnance cooling may delay extinguishment, because of the tendency of water to dilute or wash away the AFFF blanket. Post-fire ordnance cooling (AFFF or water) must be continued for a minimum of 15 minutes to allow the weapon cases to return to safe ambient temperatures.

NOTE

The scene leader should evaluate the fire and make recommendations to Pri-Fly for maneuvering the ship to provide favorable wind conditions.

Designated driver/operators must immediately position the vehicle at the scene of a fire in a location that will afford the most efficient control of the fire, cool ordnance, and provide protection for personnel rescue. All attempts should be made to position the vehicle upwind of the fire.

The air officer assesses the fire situation, advises the commanding officer, and requests appropriate assistance, depending on the gravity of the incident.

AFFF Hose Teams, each guided by a hose team leader, attack the fire and/or cool personnel and ordnance

Rescue Personnel. These persons position themselves near the scene leader.

Messengers. The messengers position themselves directly behind the scene leader.

Background Assistance Leader

The duties and responsibilities of the background assistance leader are as follows:

1. Assembles additional personnel not required at scene.

2. Ensures immediate assignment of personnel to provide nursing/replenishment hose to the initial-response MFFV at the scene.

3. Ensures adequate flow of messengers to the scene leader.

4. Assembles two backup AFFF hoses properly manned.

WARNING

The decision to use saltwater hoses for further weapons cooling shall not be made until all residual fire/smoke has ceased.

5. Effects the removal of aircraft adjacent to the scene.

6. Provides stretcher-bearers for personnel casualty removal.

7. Provides personnel to other areas if additional fires occur.

8. Dispatches support personnel as required by the scene leader.

9. Coordinates manning of appropriate elevators, as necessary.

10. Makes sure fuels repair, medical, electrician, and maintenance representatives are available, as necessary.

11. Makes sure electrical power to aircraft involved is secured.

12. Makes sure one person (plug person) is stationed at each saltwater outlet and each AFFF control box. The AFFF plug person also maintains direct communication with the injection station operator.

The fire extinguishment procedure is as follows:

1. Approach and extinguish the fire from the upwind position.

2. Extinguish the fire as quickly as possible.

3. If afloat, request the ship be maneuvered to direct smoke and debris away from parked aircraft, the island structure, and the ventilation inlets.

WARNING

Airborne fibers from any composite material may be a respiratory hazard to personnel.

4. Respiratory protection must be selected based upon the quantity of composite materials present at the site, as well as the potential duration of personnel exposure. Where possible, the local cognizant industrial hygienist or medical department representative should be consulted for specific guidance. For situations in the earlier stages of clean-up/investigation when airborne composite material levels are unknown and may be accompanied by vapors released from smoldering debris, the use of a full-face high-efficiency particulate air/organic vapor combination respirator is appropriate. For later stages of clean-up/investigation when much of the debris has been contained and vapors are no longer being released, the use of a dust-fume-mist filter respirator may be appropriate. Firefighting and rescue personnel should wear positive-pressure SCBA's during initial response.

NOTE

Filter or mask must be properly disposed of and replaced immediately after use.

Interim Containment

Provide interim containment of aircraft debris by spraying AFFF until the debris is cool, more permanent containment is specified, or disposition is directed.

Cleanup (Afloat)

Pending establishment of local command policy, it is anticipated that cleanup will be under the direction of the air officer. For details refer to the *NATOPS, U.S. Navy Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14.

Training

All preplanning and training should be directed toward a "worst case" scenario. Shipboard fire drills should include the requirement to practice nursing/replenishment of mobile vehicles.

RESCUE PROCEDURES

After an adequate rescue path has been created, the scene leader directs the rescue of personnel. He or she reports the beginning and completion of the rescue and the number of casualties.

WARNING

Adequate fire protection must be maintained for rescue personnel during rescue evolutions.

NOTE

Rescue and firefighting evolutions should be conducted simultaneously once a rescue path is provided.

Rescue Personnel

Rescue persons effect the rescue of aircrew and passengers. Information on aircraft entry, engine shutdown procedures, ejection seat safing, and personnel removal may be found in NAVAIR 00-80R-14-1.

Rescue persons investigate the surrounding area (catwalks, gun tubs, and so forth) for additional casualties.

Background Personnel

The background assistance personnel provide immediate first aid to casualties and evacuate them as necessary.

Completion of Rescue

Upon completion of rescue, the scene leader continues to direct the fire teams until the fire is extinguished, and then reports "under control" and "out".

Weapons Cooling

Hose teams cool weapons involved in the fire for a minimum of 15 minutes or until the ordnance is reported to be at a safe ambient temperature by EOD/weapons personnel.

RESIDUAL FIRE OVERHAUL/REFLASH WATCH

The scene leader directs two personnel attired in complete proximity suits, one with a portable fire extinguisher and one with a Halligan tool/crash axe, to make sure no residual fire exists. When that is done, he or she sets the reflash watch.

Background Assistance Detail

The background assistance detail assembles to commence FOD walkdown, restore gear, and provide personnel to the crash, salvage, and rescue officer.

Scene Leader

The scene leader gives estimated ready deck time to Pri-Fly if salvage operations are not required, or turns command of the scene over to the crash, salvage, and rescue officer to effect removal of aircraft.

Crash Salvage, and Rescue Officer

The crash salvage, and rescue officer estimates time to ready deck and reports to Pri-Fly, updating the estimate, as necessary.

NOTE

In the event of a fire on either the flight or hangar deck, sufficient stand-by personnel from the unaffected area, with equipment, must remain ready to assist in fire containment and casualty control. The decision to commit these assets will normally be made by the air officer.

Multi-Aircraft CONFLAGRATION

In the event of multi-aircraft CONFLAG on the flight or hangar deck, many additional requirements must be considered in establishing procedures for safety of life, damage control, and fire suppression.

NOTE

As a result of a multi-aircraft CONFLAG, mass-casualty reactions may be required.

Response to the Scene

The initial response to the scene must include equipment and personnel as stipulated in NAVAIR 00-80R-14, paragraphs 7.7.2 and 7.7.3, together with all available stretcher-bearers, stretchers, and first-aid kits. A constant resupply and augmentation of portable extinguishers, hoses, and AFFF for MFFV's should be made available, contingent upon the on-scene leader's requirements.

Additional Actions to Cover Mass-Casualty Scene

The actions outlined previously are required at a mass-casualty scene, with the following additions.

Air Officer.—The air officer directs the fire-fighting effort on the flight deck as soon as fire progresses beyond the capability of a single scene leader. The air officer energizes appropriate zones of the AFFF flight-deck fire extinguishing system. In addition to activation of the zone in which the fire is located, at least one upwind zone should be activated. Approximately 15 knots relative wind speed provides optimum distribution of AFFF from the flight-deck fire extinguishing system.

Aircraft-Handling Officer.—The ACHO establishes the area for collection and disposition of personnel casualties and designates the aircraft/bomb elevator to be used for movement of casualties.

Hangar Deck Officer.—The hangar deck officer mans the applicable CONFLAG control station as soon as fire progresses beyond the capability of a single scene leader, and directs the firefighting evolutions.

Medical Officer.—The medical officer processes personnel casualties.

Damage Control Assistant.—The damage control assistant directs the damage control effort and provides for replenishment of AFFF stowage tanks.

Air Wing Commander.—The air wing commander provides personnel to assist the air department in firefighting, casualty evacuation, and damage assessment and repair.

HANGAR DECK

Responsibilities and procedures for dealing with fires in the hangar bay have recently been updated. A hangar bay fire is an all hands responsibility and cannot be treated as solely an aircraft fire or general shipboard fire. Hangar deck firefighting requires a combination of both aircraft and general shipboard firefighting techniques. The following list represents some responsibilities specific to hangar deck firefighting:

On-Scene Leader (OSL)

The initial OSL must organize an initial attack team (rapid response) consisting of:

— On Scene Leader

— 4 AFFF hose teams manned with minimum personnel

— Messengers, until communications are established

Once the initial attack team is formed and organized, the OSL is responsible for directing the hose teams and attacking the fire and making recommendations for aircraft movement. The OSL must ensure initial response equipment is on the scene. Communications must be established with CONFLAG stations, Hangar Deck Control, Damage Control Central, Primary, Flight Deck Control, and the Background Scene Leader. Uninterrupted communications is paramount between the OSL and the receiving stations. The OSL must direct remaining personnel to an unaffected hangar bay and muster with the background scene leader for further tasking.

Background Scene Leader

The Background Scene Leader is responsible for establishing the background scene in an unaffected hangar bay. Some specific responsibilities include:

— Ensure the CONFLAG station makes appropriate 3MC announcement and report of the fire to Damage Control Central.

— Ensure effected hangar bay fuel systems are mechanically and electrically isolated, and the OSL is notified.

— Return aircraft elevators to the flight deck level.

— Close the division and elevator doors.

— Ensure hangar deck lighting remains on.

— Ensure all weapons elevator doors and hatches are closed.

— Ensure all doors and hatches from the hangar deck to the ships interior spaces are closed.

— Assemble immediate response equipment at the background assistance scene consisting of:

Two portable extinguishers (Halon 1211, PKP or CO_2).

Two spare hoses

Crash/fire axes

Halligan tool

Two flashlights (2-cell safety type)

Battery powered megaphone

Tool roll kit

Two SCBA's (minimum) with 4 spare cylinders

— Establish communications with CONFLAG, OSL, Hangar Deck Control, Damage Control Central, and Fire Marshall.

— Assign personnel to provide for a background response team (dressed out in OBA/SCBA's).

— Effect the removal of aircraft adjacent to the scene.

— Assemble two AFFF hose teams for backup/cooling.

— Provide a relief for the OSL.

— Provide immediate relief of the initial attack team (members are to fitted with OBA/SCBA's).

— Ensure plugmen, messenger/phone talker, two rescue personnel, and two overhaul personnel are dispatched to the scene.

— Assemble additional personnel not immediately required at the scene (fuels repair, squadron representative, weapons, EOD, medical, etc.).

— Assign an OBA/SCBA time management coordinator.

— Assemble stretcher-bearers (fitted with OBA/SCBA's).

— Setup an OBA/SCBA change out area and a firefighter recovery area.

— Set smoke boundaries throughout the hangar bay.

— Coordinate with the Fire Marshall and the At Sea Fire party On-Scene leader. Provide tasking as required.

Sequence of events

The scene leader must maintain visual contact for hand signal and voice communications with the hose team leaders and overhaul personnel. The following list is a guideline that outlines the basic sequence of events for a hangar deck fire.

— Initial response equipment on the scene

— Identify hose teams

— Nozzles on/Move in

— Fire under control

— **NOTE: If weapons are in the laydown area, begin cooling with additional hose teams.**

— Effect rescue/casualties

— Fire out

— Nozzles off/back out

— EOD to scene/weapons safe (if applicable).

— Overhaul residual fire, remove liquid oxygen converter (if required), batteries

— Set reflash watch

— De-smoke

— Conduct atmospheric test

— Restow damage control equipment

— Commence FOD walkdown

— Estimated time of repair

CONFLAGRATION STATION (CONFLAGS)

Watches. Each Conflagration Station Watch must be stood by fully Conflag PQS qualified personnel of the V-3 Division. They are responsible to the Integrity Watch Officer (IWO) or OOD, as appropriate, for the security of the hangar bay and for the proper operation of all remotely controlled firefighting apparatus on the hangar deck. This is a 4-hour watch requiring constant vigilance to detect and report the outbreak of fire or other hazardous conditions at the earliest possible moment. At the minimum, one conflagration station per bay (containing aircraft) will be manned during the watch period. Specified duties and responsibilities of this watch are as follows:

1. Report completion of watch turnover or assumption of the watch to the IWO or OOD, as appropriate.

2. Make hourly reports 15 minutes prior to the hour to the IWO or OOD, as appropriate, in accordance with existing directives. Conflag reports should be consolidated so that only one conflag actually reports to the IWO/OOD (for example, conflag one reports to conflag two, who reports for both).

3. Permit no unauthorized personnel in the conflag.

4. Maintain a continuous visual watch with particular emphasis on security, safety, and fire/damage potential.

5. Be thoroughly familiar with the operation procedures pertaining to all controls, systems and circuits located within the conflag.

6. Be prepared to provide proper and timely use of firefighting equipment remote controls as needed.

7. Be prepared to provide proper and timely use of the elevator and hangar division door remote controls as needed.

8. Operate hangar lighting and communications systems as directed.

9. Immediately report all fires, fire potential, and any abnormalities according to existing directives.

10. Perform other duties, as required.

All persons standing this conflag watch must be PQS-qualified. The V-3 division officer certifies them as fully qualified to stand the watch.

Reports. Hourly reports are made to Hangar Deck Control at flight quarters and to the IWO when not at flight quarters.

Firefighting Procedures. When there is an actual fire in the hangar bay, the Conflag operator is responsible for the following actions:

1. Reporting the fire or mishap by the most expeditious method in accordance with the ship's operating instructions

2. Actuating the high-temperature alarm, thereby alerting damage control central

3. Closing the elevator and divisional ballistic doors when necessary

4. Activating firefighting facilities immediately, when:

a. Fire is detected and an inadequate number of personnel are available for immediate fire containment

b. Ordnance is in the immediate area of the fire

c. Directed by competent authority

d. Multi-aircraft are involved and the catastrophe is so large that it cannot be rapidly brought under control

e. Establishing communications to AFFF stations in use

The conflag stations are inspected daily by the air department duty officer in port, and the duty section leader for cleanliness and overall condition of the equipment. At sea when the watch is posted, the IWO is required to inspect the conflag stations at irregular intervals to ensure that the instructions and orders governing the watch are carried out.

Equipment Controls. The equipment controls located in the conflag station include the following: ballistic doors, aircraft elevator doors, AFFF sprinkler groups, weapons elevator AFFF sprinklers, and hangar deck lighting.

Communications Equipment. The communications equipment includes 11 items, listed and defined as follows:

3MC control box. Allows for one-way communication to personnel in the hangar deck via the loud speaker system.

1MC speaker. A loudspeaker facility for one-way communication to the entire ship

X50J sound-power circuit. Communication between AFFF hose stations, AFFF injection stations, and conflag stations.

3JE sound-power circuit. Communication between ready rooms and the conflag station.

3JZ sound-power circuit. Communication between the conflag and main deck repair.

5JZ sound-power circuit. Communication between the conflag and the forward repair locker.

2JZ sound-power circuit. Communication between damage control/stability and the conflag station.

X2JZ sound-power circuit. Secondary communication between the conflag and damage control.

1JG sound-power circuit. Communication between the conflag and primary, flight deck/hangar deck control, and elevator stations.

Ship's telephone system. Communication for the entire ship

E call system. A bell-activated sound powered telephone system used for alerting the AFFF pumproom operator or conflag watchstander of station status (up, down, light off, and secure).

Fire Doors (Ballistic)

Ballistic doors are large metal doors athwartship that are used to divide the hangar deck into sections or bays. This compartmentalization of the hangar deck aids isolation of hangar deck fires and CBR contamination. It also limits ballistic damage on the hangar deck. The doors can be completely opened or closed in 28 seconds. A control at either side of the doors and a control at conflag stations control the doors. The bay doors operate on overhead and deck tracks. To open or close the bays, the doors are moved inboard or outboard on their tracks. The doors may be moved either electrically or manually.

Deck-Edge Elevator Doors

The deck-edge elevator doors are used to open and close the hangar deck openings through which aircraft are moved onto the deck-edge elevators. These doors can be opened or closed by a control at either side of the door and a control at conflag stations. The doors open fore and aft and operate in the same manner as the hangar bay doors.

Normal opening of either a deck-edge elevator door (or ballistic doors) is accomplished by momentarily pressing any of the OPEN push buttons. This energizes an alarm bell, de-energizes the hangar deck white lighting, and energizes the red lighting when the hangar deck lighting control is placed on automatic. This also energizes the red indicating light in each door panel.

The motor then operates at high speed to rotate the wire rope drums to move the door to the open position. At nearly full open position, the movement of the door actuates (by a cam) an OPEN SLOW switch, causing the motor to run at low speed. As the door reaches fully open, the cam trips an OPEN STOP switch. This causes the motor to stop, the brake to set, the door to stop, and the alarm bell to stop ringing.

The closing operation is similar to the opening and originates by pressing any CLOSE push button. CLOSE SLOW and CLOSE STOP switches operate the same as the OPEN SLOW and OPEN STOP switches. The door travel may be stopped at any time by pressing any STOP button.

The doors may be opened or closed in an emergency by the use of a block and tackle arrangement. A set of tackle consisting of two 14-inch wooden treble blocks and 4-1/2" manila line should be used.

Recessed pad eyes are built into each door. One block of the tackle is secured to one of the pad eyes; the other block is secured to a pad eye located on the ship's outboard longitudinal bulkhead. The 4-1/2" line is then fed through a snatch block, and the doors are opened or closed by securing the bitter end of the line to a tractor, capstan, or by the use of human energy.

Q6. Within the air department's aircraft firefighting organization, what is the Air Bosn responsible for?

Q7. What is the minimum number of personnel required for manning a 2-1/2" fire hose?

Q8. What person is responsible for assigning personnel to nurse the MFFV?

ANSWERS TO REVIEW QUESTIONS

A-1. The four elements of fire are fuel, oxygen, temperature, and chemical chain reaction.

A-2. An electrical fire is classified as a CHARLIE fire.

A-3. The portable Halon 1211 extinguisher contains 20-lbs. of liquid Halon 1211.

A-4. PKP portable fire extinguishers are primarily used for extinguishing fuel fires.

A-5. The twin agent handline on the P-16/A is 80 feet in length.

A-6. Within the air department's aircraft firefighting organization, the Air Bosn is responsible for organizing, supervising, and training the aircraft crash, salvage, and rescue teams, and for readiness and operation of firefighting equipment.

A-7. The minimum number of personnel required for manning a 2-1/2" fire hose is five.

A-8. The background assistance leader is responsible for assigning personnel to nurse the MFFV.

CHAPTER 6

AIRCRAFT FIREFIGHTING, AMPHIBIOUS AVIATION SHIPS (LHA/LHD/MCS/LPD)

Although helicopters are the primary aircraft operating from amphibious aviation ships, fixed-wing, vertical/short takeoff or landing (V/STOL) aircraft are operated at times. Because of the helicopter's ability to land and take off vertically, a crashed helicopter on the flight deck may not cause the entire flight deck to be disabled and, subsequently, stop flight operations until the flight deck is cleared. For amphibious aviation ships (LHA/LHD/MCS/LPD), the training requirements, the equipment, and the procedures remain the same as those previously discussed in the Aircraft Firefighting (CV/CVN) chapter. This chapter discusses only the subjects that are different.

AIR DEPARTMENT ORGANIZATION AND OPERATIONS

OBJECTIVES. Recognize the air department's crash, fire, and rescue organization aboard amphibious ships. Identify the duties and responsibilities of assigned personnel.

Within the ship's damage control organization on LHA, LHD, and MCS types of ships are two repair teams and one repair party in the air department. They are known as the

1. aviation fuels repair team;
2. crash, salvage, and rescue team
3. hangar deck firefighting and rescue team

The organization and responsibilities of the officers are the same as for the officers of CV/CVN's except for the aircraft crash, salvage, and rescue officer. There is normally no air boatswain assigned as the aircraft crash, salvage, and rescue officer. However, the flight deck officer or an ABHC or ABH1, is assigned this responsibility.

LPD Organization and Operations

The organization and operations of the air department of LPD-type ships are discussed in the following text.

Air officer (LPD)/Helicopter Control Officer or Flight Deck Officer

In an LPD, the air officer directs all aircraft firefighting, weapons cooling, salvage, jettison, and personnel rescue operations occurring on the flight/hangar decks. The air officer is responsible for the direction and coordination of aircraft movement on the flight deck/landing platform as required during aircraft crash and fire evolutions. He acts on and relays communications from the scene leader to the bridge and damage control central.

Aircraft Crash, Salvage, and Rescue Officer (LPD)

The aircraft crash, salvage, and rescue officer is responsible for the organization and training of flight deck/landing platform firefighting and rescue teams and for aircraft salvage and jettison operations. He is also responsible for the material maintenance readiness and operation of assigned equipment.

Aircraft Crash, Salvage, and Rescue Team Organization (LHA/LHD/MCS)

The aircraft crash, salvage, and rescue team organization aboard LHA/LHD/MCS is similar to the organization for CV/CVN, as discussed in chapter 5 of this TRAMAN. However, the following exceptions exist for team organization during normal flight operations. Figure 6-1 is a guideline only and should be adapted to meet individual ship's requirements. The crash and salvage officer may be the flight deck officer, chief, or first class petty officer. Some responsibilities may seem vague to a casual observer. However, a well-trained, well-organized crash and salvage team will have no doubt as to individual responsibilities in a given situation.

NOTE

Additional personnel shall be assigned AS NECESSARY to support extended flight operations and to provide fire protection during periods when the ship is not at flight quarters.

NAME	RATE	FUEL SPILL	A/C FIRE	A/C CRASH (SALVAGE)	A/C IN CATWALK	A/C JETTISON	HELO IN WATER
	ABHC	SCN LDR	SCN LDR	SCN LDR	SCN LDR	SCN LDR	SCN LDR
	ABHC/1	SPRVSR	SPRVSR	SPRVSR	SPRVSR	SPRVSR	SPRVSR
	ABH-2	S/W NZL	CRANE	CRANE	CRANE	CRANE	HELO KIT
	ABH-2	---	FRKLFT	FRKLFT	FRKLFT	FRKLFT	HELO KIT
	ABH-3	MFFV	MFFV	SLING	SLING	SAFETY	EQUIP
	ABH-3	MFFV	MFFV	SLING	SLING	SAFETY	EQUIP
	ABHAN	MFFV	MFFV	SLING	SLING	SAFETY	EQUIP
	ABHAN	MFFV	MFFV	DOLLY	DOLLY	AS RQD	AS RQD
	AN	S/W	EQUIP	EQUIP	EQUIP	AS RQD	AS RQD
	AN	S/W	EQUIP	EQUIP	EQUIP	AS RQD	AS RQD
	AA	S/W	EQUIP	EQUIP	EQUIP	AS RQD	AS RQD
	AA	S/W	EQUIP	EQUIP	EQUIP	AS RQD	AS RQD

NOTE After providing required equipment, all personnel perform duties as directed by the supervisor.

ABHf0601

Figure 6-1.—Crash, salvage, and rescue team organization during normal flight operations.

The following aircraft firefighting team members are essential to meet the training and procedural requirements:

1. One scene leader.

2. One MFFV driver and an operator for each unit.

3. One hose team leader for each hose team.

NOTE

When in place, a hose team consists of one AFFF hose with a minimum of five persons (maximum seven persons) on each 2-1/2 inch hose and a minimum of three persons (maximum five) on each 1-1/2 inch hose.

4. Sufficient number of messengers.

5. Two rescue persons per team. They must always work in pairs, be available for rescue emergencies, and be properly attired in firefighting proximity clothing.

6. One saltwater or AFFF station operator (plug person) for each station manned.

7. One background assistance leader.

8. Sufficient medical personnel.

9. Sufficient EOD/weapons personnel.

10. Sufficient aviation fuels persons.

11. All air wing personnel on the flight deck.

NOTE

Proximity suits must be immediately available for rescue persons in the hangar.

Aircraft Crash, Salvage, and Rescue Team Organization (LPD)

The crash, salvage, and rescue team is the flight deck/landing platform repair party. From its station, it effects the rescue of personnel from damaged aircraft on the flight deck, contains the wreckage, cools weapons, and fights fires on the flight deck.

Team Organization during Flight Operations

The following crash, rescue, and salvage team organization is considered minimal for effective firefighting and rescue functions during flight operations. These duties and responsibilities are primary in nature and are manned for all evolutions including the following:

1. Launch
2. Recovery
3. Respot (LPD only)
4. Fuel
5. Defuel
6. Maintenance turn-up
7. Vertical replenishment (VERTREP) operations
8. Helicopter in-flight refueling (HIFR) operations

For flight operations, a primary flight quarters crash and rescue party is manned when an aircraft is over the deck.

The LPD minimum personnel requirements are as follows:

1. Aircraft crash, salvage, and rescue officer.
2. MFFV with driver and operator.
3. Two rescue persons (hot suitmen).
4. Hospital corpsman.
5. Additionally, sufficient personnel are maintained on deck to man two complete hose teams and stations.

The minimum initial response personnel and equipment are discussed later in this chapter.

Aircraft Firefighting Team Organization and Duties

The following aircraft firefighting team organization and duties are considered essential to meet the training and procedural requirements and are as follows:

Scene Leader.—The scene leader is a trained individual who is present in the vicinity of the incident, who understands the requirements of the emergency, and who can get the rest of the crew to respond to directions. This person is responsible for the direction and use of all available firefighting assets at the scene.

LPD MFFV Crew.—This crew is used for immediate response and initial firefighting actions.

CAUTION

MFFV's are not used to tow aircraft under any circumstances.

Background Assistance Leader.—This person supports the scene leader as required. The background assistance leader will be positioned so that he has a view of the entire flight deck or crash scene. The background assistance leader must be able to anticipate the needs of the scene leader and he must know the location of all the required equipment. Additional responsibilities of the background assistance leader may be found in chapter 9 of NAVAIR 00-80R-14, NATOPS *Aircraft Firefighting and Rescue Manual*.

Hose Team/Deployment.—AFFF hoses are deployed to the scene using maximum personnel participation. When in place, a hose team consists of the AFFF hose with a minimum of five persons (maximum seven) on each 2-1/2 inch hose, and a minimum of three persons (maximum five) on each 1-1/2 inch hose.

NOTE

All personnel in the hose team are positioned on the outside of the hose to aid in mobility and decrease interference between hose team members.

Hose Team Leader.—The hose team leader is positioned directly behind the nozzlemen and is responsible under the direction of the scene leader for the hose team.

NOTE

The hose team leader shall not man the hose. He shall remain in close proximity to the hose team to provide direction.

Messengers.—Messengers are responsible for relaying information between the scene leader and appropriate control centers.

Rescue Persons.—The rescue persons are available and properly attired in Firefighting proximity clothing (hot suits). Rescue persons always work in pairs as directed by the scene leader.

AFFF Hose/Station Operator.—This person operates the station and maintains direct communications with the injection station operator (as required).

Medical Personnel.—These personnel are positioned with the background assistance detail near the background assistance leader to provide medical assistance as required.

EOD/Weapons Personnel.—Properly equipped EOD/weapons personnel shall be available to respond to the scene to provide technical assistance, weapons cooling temperature checks, and weapons disposal as required.

Aviation Fuels Persons.—These individuals shall respond to the background assistance detail and be available to provide technical assistance and fuel systems repair.

Aviation Squadrons/Helicopter Detachments (Ships with Aircraft Embarked).—The squadrons/detachments provide a senior maintenance representative for technical assistance. Additionally, all squadron personnel provide immediate assistance in all FIREFIGHTING or training evolutions.

Q1. On an LPD, who is responsible for directing all aircraft firefighting efforts?

Q2. Who is responsible for directing the use of all available firefighting assets at the scene?

CRASH AND SALVAGE EQUIPMENT

OBJECTIVES: Identify crash and salvage equipment used aboard amphibious ships. Recognize the capabilities, limitations, and requirements of crash and salvage equipment.

Crash Forklift

The crash forklift is used to partially lift aircraft in certain situations. It is highly maneuverable and most useful in those salvage situations that involve damage or collapse of one landing gear. Most are diesel-powered and equipped with pneumatic tires. Amphibious aviation ships have a wide variety of forklifts. Each model has a maximum safe weight lifting capacity that should never be exceeded. This essential piece of equipment should be used only for the work for which it was intended. Generally, the crash forklift should have a 20,000-lb. capacity, although a 15,000-lb. capacity forklift may be used at times. Qualified personnel are required to operate forklifts.

Amphibious Assault Ship Crash Crane, (AACC), A/S32A-36A

Crash cranes are used for lifting and removing crashed helicopters from flight decks. These cranes are self-propelled with individually driven wheels for high maneuverability. The crane does not directly attach to the helicopter. It uses either the manufacturer's aircraft sling for the particular helicopter or a universal aircraft fabric-hoisting sling. The A/S32A-36A crash crane is used on amphibious aviation ships. They are equipped with outriggers to provide a more stable base, which allows lifting the rated weight at a greater boom reach. The A/S32A-36A crash cranes can also rotate (slew) the boom through 360 degrees. These cranes have limited carrying capacity. The recommended method of moving an aircraft is to extend the outriggers, hoist, then slew the boom. When carrying the load is necessary, the boom should be aligned with the fore-and-aft axis of the crane. Qualified operators and signal persons are required for use of this equipment. The A/S32A-36A crash crane is shown in figure 6-2.

The AACC is a self-propelled, four-wheel drive diesel electric powered vehicle mounted on pneumatic rubber tires. It has a minimum lift capacity of 50,000 pounds at a clear outreach of 20 feet, and a hook lifting height of 25 feet minimum. The AACC is capable of lifting 70,000 pounds at a clear outreach of 13.7 feet, with a hook lifting height of 33 feet. The maximum gross vehicle unloaded operating weight of the AACC is 90,000 pounds. The crane must lift crashed and damaged aircraft from various locations and attitudes and move them on a rolling and pitching deck, to a safe parking zone. The crane, designed for stowage on the flight deck, can be operated aboard ship in inclement weather.

The crane is a six-wheel, diesel electric powered vehicle constructed of a steel frame. It is 25'H × 15'W × 30'L (less boom). Rear and mid DC drive motors provide power for crane travel. Each motor receives power from the AC generator that is coupled directly to the diesel engine. Steering is hydraulically controlled and performed via the front and rear wheels. Six-wheel self-adjusting air/hydraulic brakes accomplish vehicle braking. A DC motor provides power for the main hoist control or boom luff control. A tag line system powered by an AC electric motor provides for load stability.

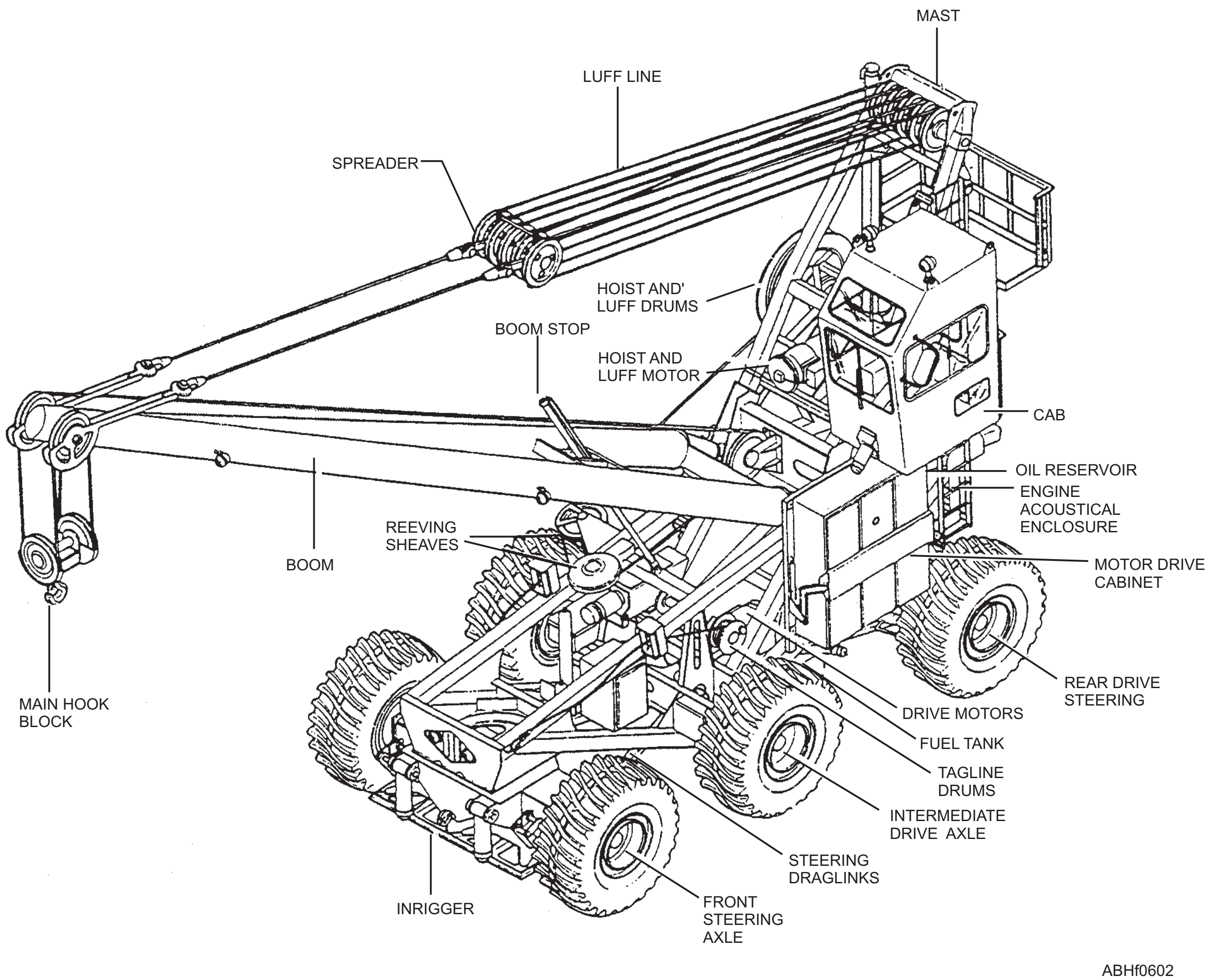


Figure 6-2.—A/S32A-36A Amphibious Assault Ship Crash Crane, (AACC).

The engine is a two-cycle, six-cylinder, liquid-cooled, turbo-charged Detroit Diesel. It has a displacement of 92 cubic inches per cylinder, for a total displacement of 552 cubic inches. The engine idles at 900 rpm and operates at 1800 rpm in the run setting.

A radiator and fan engine cooling system is used in the crane. A gear driven centrifugal type water pump circulates engine coolant through the engine and radiator. The engine coolant is a 50-50 mixture of ethylene glycol and water. The system thermostat maintains a normal operating temperature of 164°F.

The fuel tank is located between the rear and mid axles, and holds 60-gallons of JP-5. The filter opening is readily accessible on the top of the tank. A replaceable, full flow, spin on paper element type fuel filter removes contaminants from the fuel. During engine operation, the fuel pump bleeds air form the fuel lines.

The wheels of the AACC are 29-inch, multi-piece flange type. The tires are 29.5 by 29-inch 28-ply bias, tubeless pneumatic, and are rated at 38 psi. At proper inflation, each tire has a load capacity of 21,000 pounds at 10 miles per hour, and 35,000 pounds at 3 miles per hour.

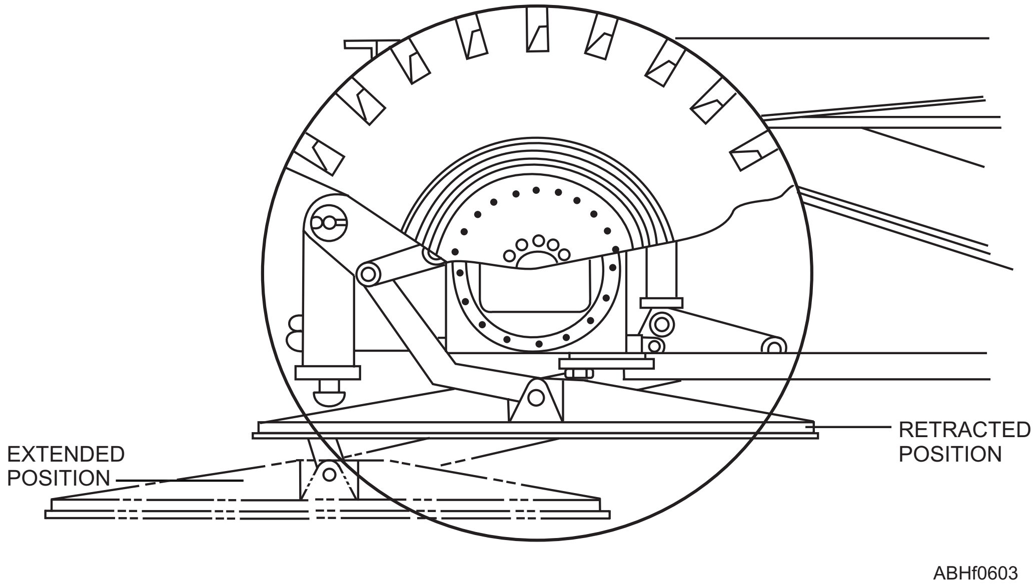


Figure 6-3.—Retractable Inrigger.

A retracting inrigger (fig. 6-3) is mounted between the two front wheels. It is a weight redistribution tool that, when deployed before crane lifting operations, provides additional load support in the front end of the crane. A hydraulic accumulator allows the inrigger to adjust extension height automatically when heavy loads are lifted. This process distributes more weight to the tires and avoids damage to the deck. Maximum load capability for the inrigger is 110,000 pounds.

A 24V DC electrical system supplies power to the lights, heater, defroster, windshield wipers, and starting system. The primary source of DC electric power is two

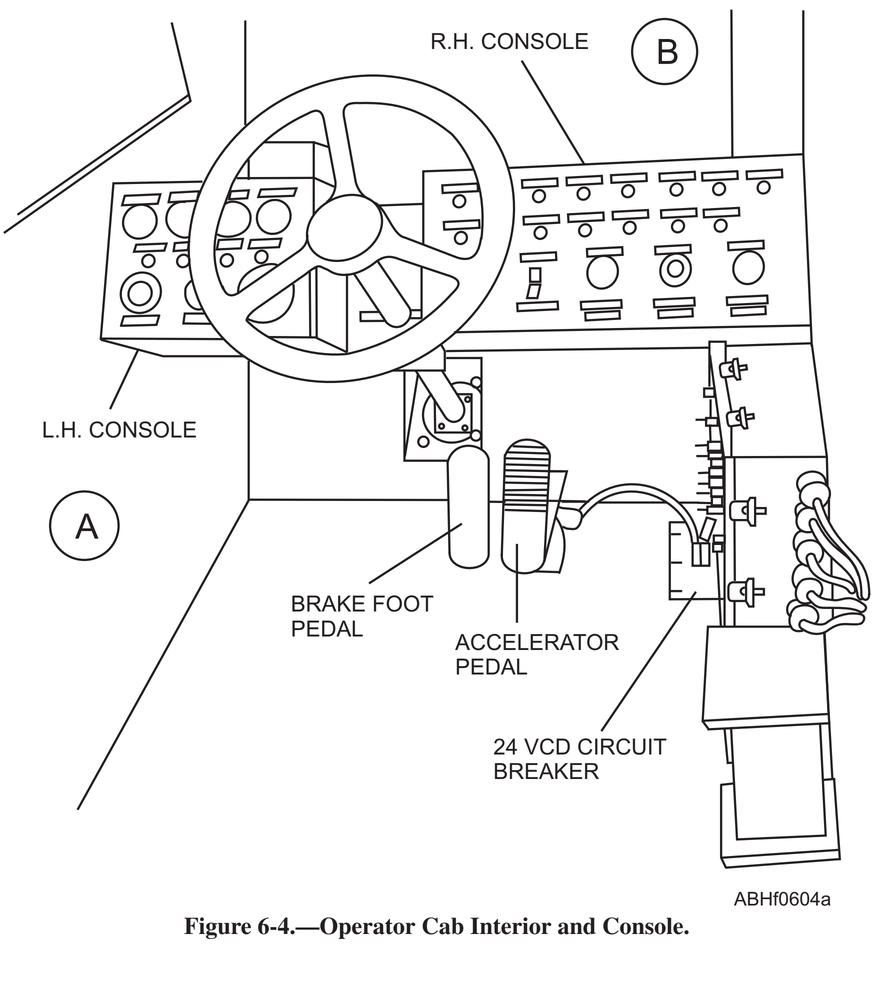


Figure 6-4.—Operator Cab Interior and Console.

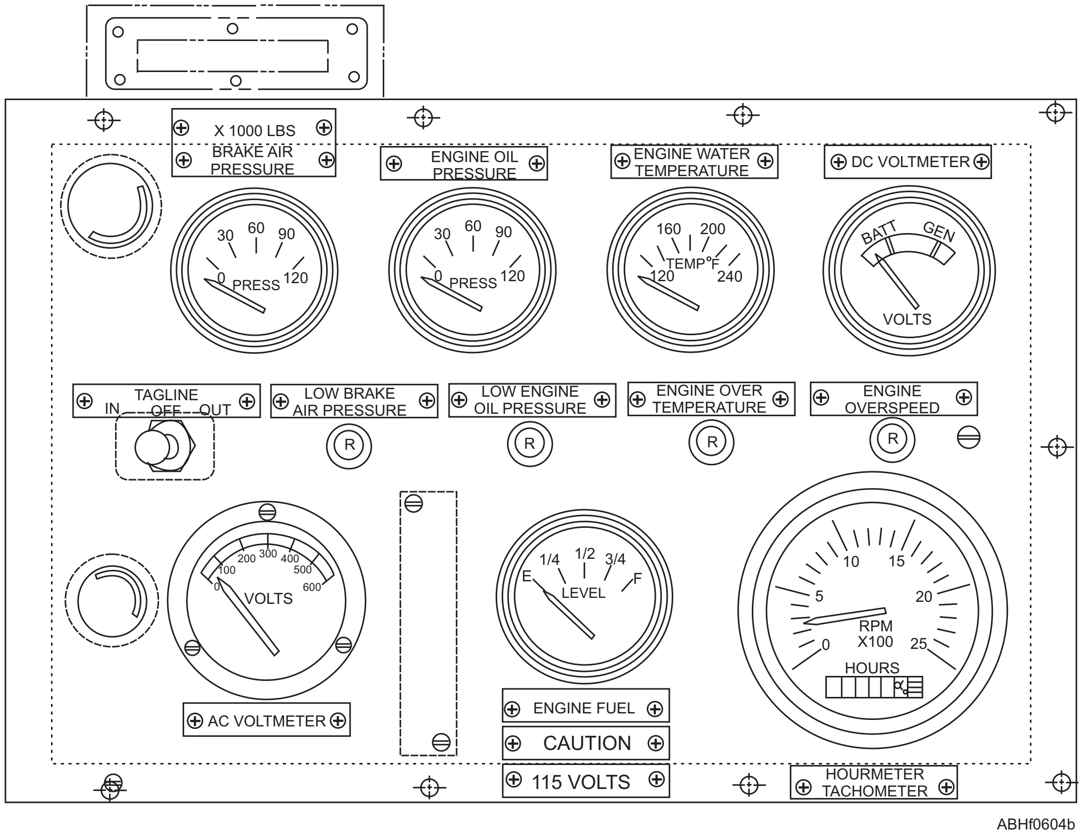


Figure 6-4.—Operator Cab Interior and Console—Continued.

12V lead acid batteries connected in series. A second set of 12V batteries provides back up. In operation, a 28V belt driven alternator charges the batteries. A transistorized voltage regulator controls the alternator output voltage. A gauge on the control panel shows the charge voltage.

The AACC may be operated from the cab (fig. 6-4) or by the pendant control (fig. 6-5). The cab houses the

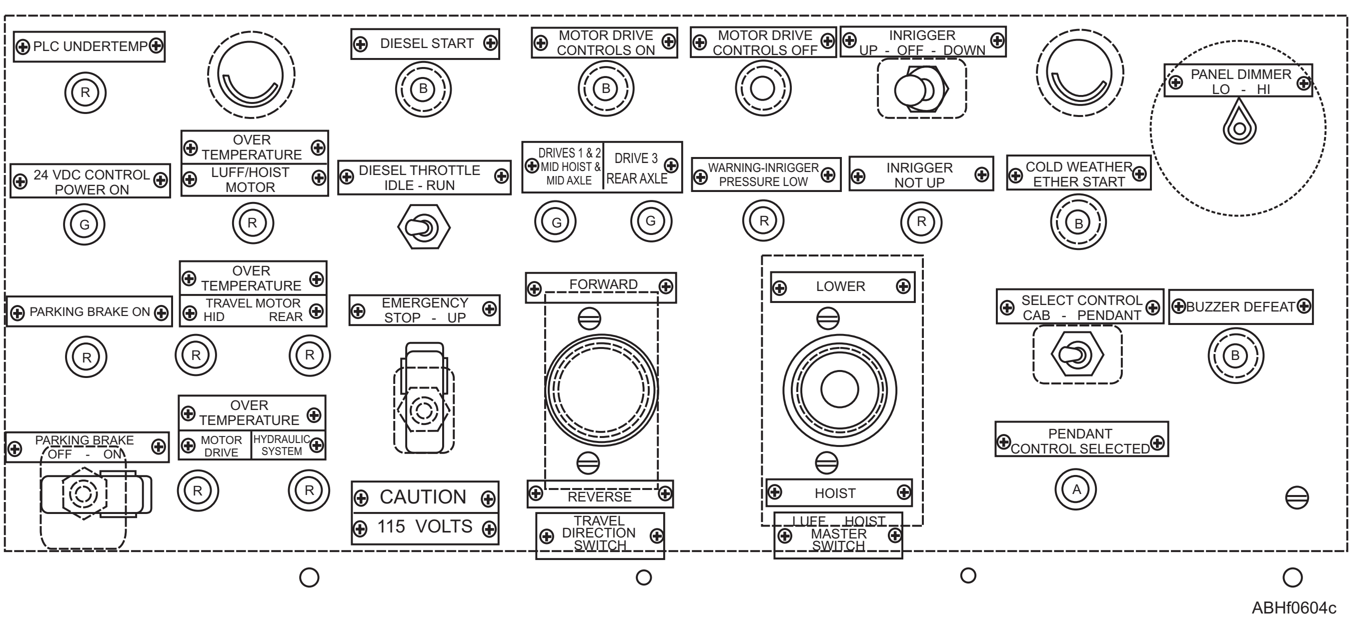


Figure 6-4.—Operator Cab Interior and Console—Continued.

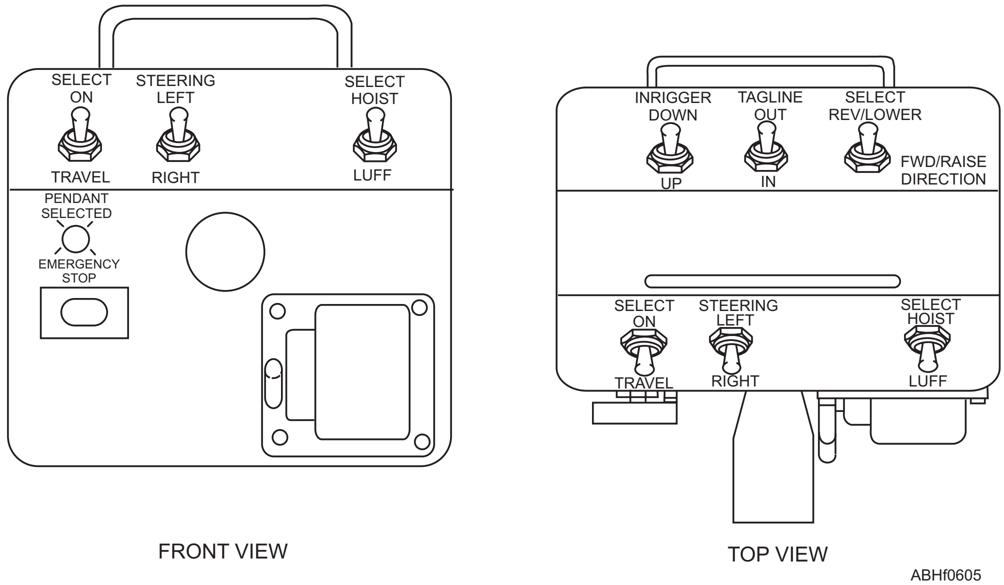


Figure 6-5.—Pendant Control.

following items used to operate the crane; control panel, indicator panel, 440V ac power disconnect switch, accelerator pedal, brake pedal, and circuit breaker panel.

The control panel has controls for crane travel, hoisting, inrigging, tag line, and fault indicators for 24V DC power ground fault and motor drive controls. The indicator panel has gauges for brake air pressure, engine coolant temperature, dc voltmeter, ac voltmeter, engine fuel level, and engine RPM. In addition, the panel contains fault indicators for brake air pressure, engine oil pressure, engine over-temperature and engine overspeed. The circuit breaker panel provides ON-OFF switches for all 24V dc crane accessories. The 440V AC power-disconnect switch provides overload protection form the ac generator. The operator may

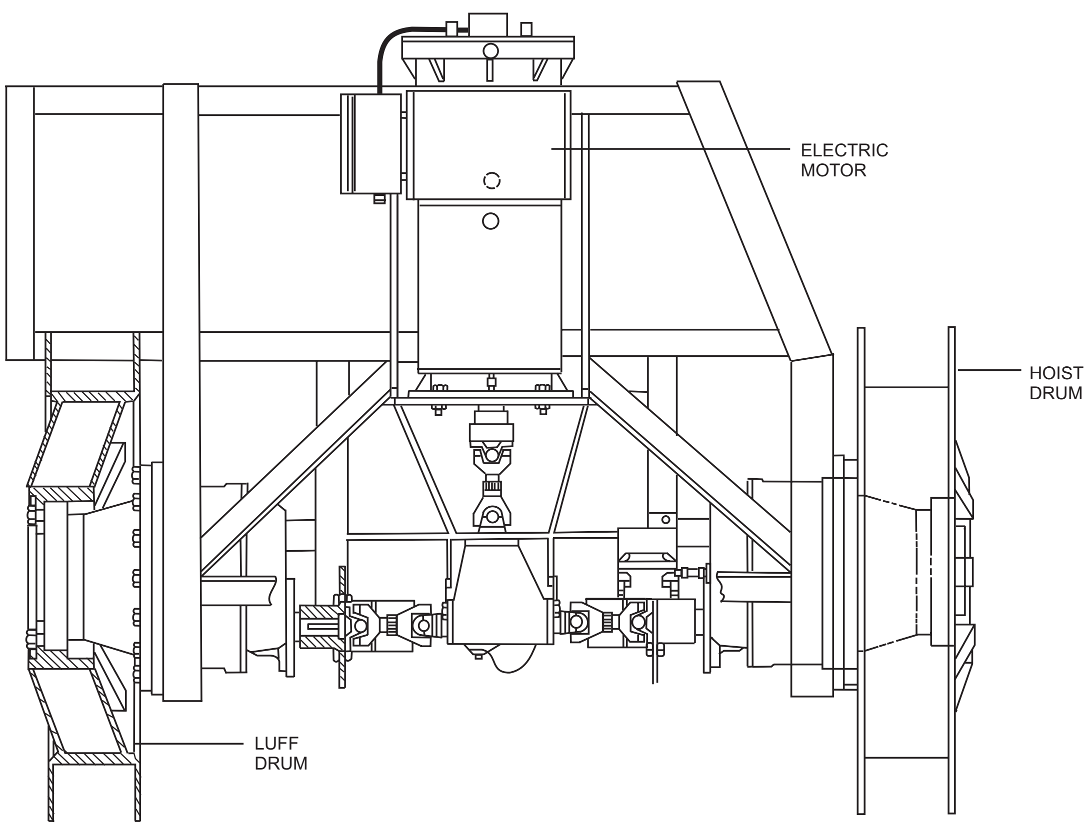


Figure 6-6.—Luff and Hoist Unit.

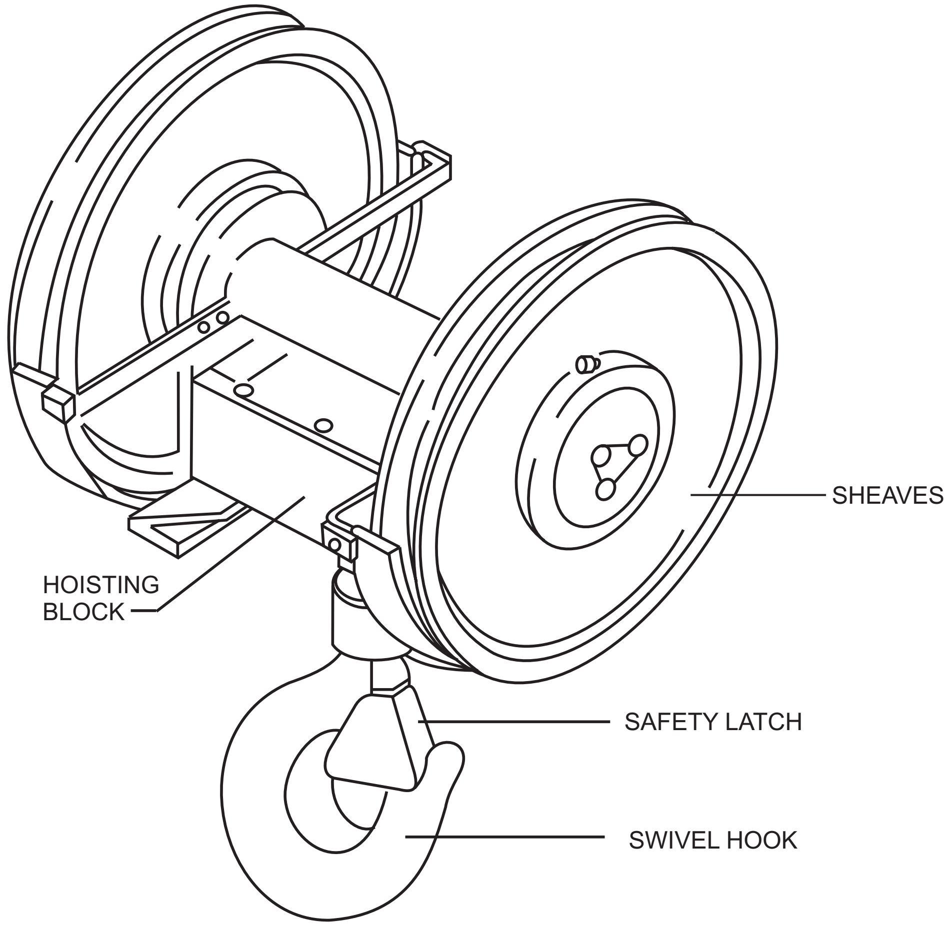


Figure 6-7.—Main Hoist System.

select travel controls, inrigger control, and hoisting controls from the pendant.

Because the operator cannot control the brakes from the pendant, crane speed is limited to 1 mph during pendant use. Electric brakes on the two drive motors stop crane motion when the pendant is in use. The brakes are regenerative when the pendant control travel switch returns to the neutral position.

The AACC has a 46-foot steel boom. The boom pivots on foot pins attached to the main frame of the crane. You can boom up or down by using the luffing control. The luff hoist rope is reeved from the luff drum (fig. 6-6) through a mast head sheave to the luffing sheave and back to a dead-end link on the masthead. A luff boom link rope connects the luffing pendant to the boom head.

A single dc electric drive motor (fig. 6-6) provides power for the luffing control as selected by the operator. This 60-hp motor receives power from the ac generator. The motor has a dc electric brake that is spring set when power is interrupted or lost. This provides a safety feature in case of malfunction during lifting operations. The brake releases electrically when power is returned.

The AACC main hoist system (fig. 6-7) has a maximum capacity of 70,000 pounds, with a boom outreach of 13.5 feet, and the hook 33 feet off the deck. The main hook is a swivel type and can rotate 360°.

The crane is equipped with a tag line system that provides load stability (fig. 6-8). A 6-hp ac motor provides winching power to both the right and left side drums via a fluid coupling and gear assembly. Each rope drum is keyed to the end of an output shaft from a non-overhauling worm gear. This arrangement prevents large forces, due to the ship's motion, from overloading the drive components. Table 6-1 is provided to list the leading particulars of the A/S32A-36A crash crane. You can obtain further information by referencing the *Aircraft Crash Handling and Salvage Crane,* A/S32A-36A *Technical Manual* AG-310DO-OMM-000.

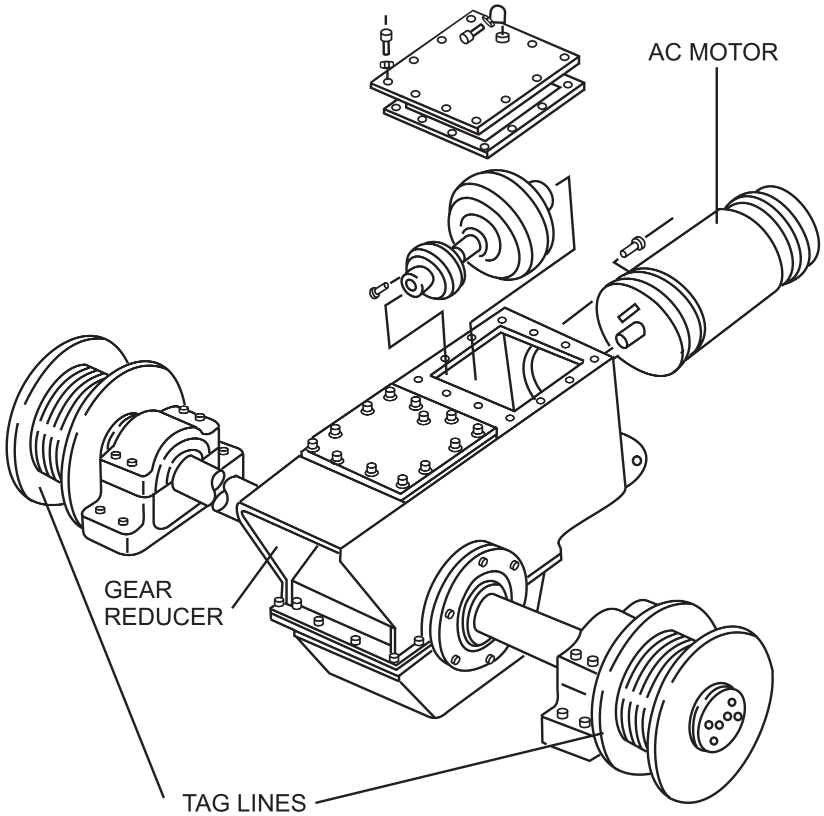


Figure 6-8.—Tag Line Assembly.

Table 6-1.—Leading Particulars of the AACC.

Height (boom down)	25 feet
Width	16 feet
Length (less boom)	30 feet
Boom length	46 feet
Ground clearance	12 inches
Turning radius	30 feet
Weight	91,500 lbs.
Max. lift capacity	70,000 lbs
Max. travel speed (Unloaded)	5 mph
Max. travel speed (Loaded)	3 mph
Travel motors	60 hp
Main hoist motor	60 hp
Tagline motor	5 hp
Engine	445 hp Detroit diesel
Fuel capacity	60 gal

ABHt0601

Universal Aircraft Fabric Hoisting Slings (Bellybands)

Crash and salvage units are required to have four pairs of adequate length fabric hoisting slings. When it is not feasible to install the manufactures hoisting sling, fabric slings may be required to safely remove crashed aircraft from the landing area. The required lengths of bellybands are two 20-foot slings, two 30-foot slings, two 40-foot slings, and two 50-foot slings, and each sling must be labeled with the length, load capacity, and strike date of the sling. The lifting eye, made of 5/16" steel plate, should be locally manufactured in accordance with NAVAIR drawing 1359AS700. Slings must be replaced if they are 6 years old and were manufactured with *new* arresting gear tape, or if they are 3 years old if they were made with *used* tape. Cuts or tears more than 1/4" or fraying to the point that broken threads are visible will also require the slings to be replaced. More information is available in NAVAIR 00-80R-19, *NATOPS U.S. Navy Aircraft Crash & Salvage Operations Manual (Afloat).*

Q3. What is the maximum lift capacity of the A/S32A-36A crash crane?

Q4. What is the length of the boom on the A/A32A-36A crash crane?

FIREFIGHTING EQUIPMENT (LHA/LHD/MCS/LPD)

OBJECTIVES: Identify aircraft firefighting equipment used aboard amphibious ships. Recognize equipment inventory, operating procedures, and capabilities of firefighting equipment used aboard amphibious ships.

The following firefighting equipment is installed or readily available on board amphibious aviation ships (LHA/LHD/MCS/LPD).

Portable Fire Extinguishers

Halon 1211, CO_2, and dry-chemical extinguishers are provided according to paragraphs 8.3.1.1 and 8.3.1.2 of the *NATOPS U.S. Navy Aircraft Fire Fighting and Rescue Manual*, NAVAIR 00-80R-14. As a minimum, the sizes of these extinguishers are 20, 15, and 18 pounds, respectively.

Flight Deck Extinguishers

Two Halon 1211 extinguishers or one CO_2 and one PKP extinguisher are mounted at each AFFF hose station on the flight deck and gallery walkway areas and must be readily available to all flight deck areas. Seven Halon 1211 or CO_2 extinguishers on MCS and nine Halon or CO_2 extinguishers on LHAs are permanently fitted with insulated extension pipes approximately 5 to 7 feet long. Extinguishers on the flight and weather decks do not have tags or labels. Tags or labels could come loose and be caught by air currents, thus presenting an FOD hazard to aircraft and personnel.

Hangar Extinguishers

One Halon 1211, or one CO_2, and one PKP extinguisher are mounted near each AFFF hose station for ready availability to all hangar areas.

High-Capacity AFFF Systems

An AFFF injection station aboard amphibious-aviation-type ships consists of an AFFF concentrate tank (capacity as follows: LHA, 1,000 gallons; LHD, 2,000 gallons; MCS, 600 gallons, and LPD, 300 gallons); an AFFF pump/proportioning unit; electrical controllers; valves and necessary piping. Saltwater and AFFF flow is controlled by hydraulically operated valves that are actuated by solenoid-operated pilot valves (SOPV's). Electrical switches at user locations (Pri Fly, NAVBRIDGE, and hose stations) activate the SOPV's. The following are the types of AFFF proportioning systems aboard amphibious aviation ships.

Balanced-Pressure Proportioners

Balanced-pressure proportioners are installed on LHD's and LHA's. The balanced-pressure proportioner mixes AFFF concentrate with salt water at a nominal 6 percent over a wide range of flows. Excess AFFF concentrate from the pump is diverted back to the AFFF concentrate tank, as necessary, to maintain a nominal 6 percent solution of AFFF. Balanced-pressure proportioners supply a foam-piping loop that serves all AFFF systems (AFFF flight deck, hangar deck, well deck, vehicle stowage, JP-5 pump room, and machinery space systems).

Single- and Two-Speed Pumps

Proportioners aboard the MCS operate with single- and two-speed electric pumps. The two-speed pump injects AFFF concentrate into the saltwater supply line at one of two rates (27 or 65 gpm), depending on the demand. The low-rate output will serve the AFFF handlines and small sprinkler system demands. The hangar bay sprinkler system and other large systems will be served by the high-speed output. The single-speed pumps supply the flush deck nozzles on the flight deck.

AFFF Hose Outlets

Hangar bay AFFF hose outlets are located port and starboard in the general vicinity of the AFFF stations from which they are supplied. A push-button start switch is located adjacent to each AFFF hose outlet.

Flight deck AFFF hose outlets are located in catwalks and in the vicinity of the island. A push-button control is located adjacent to each AFFF hose station. Emergency lighting is provided at each hose reel station; controls are located in Pri Fly and on the NAVBRIDGE.

Hose Outlets

Hoses must be of sufficient length to permit reaching all areas on the flight deck and adjacent weather decks from at least four outlets.

Equipment for AFFF Saltwater Hose Outlets

The following equipment is located at each saltwater hose outlet:

1. Hose outlet valves
2. Hoses
3. Vari-nozzles
4. Spanner wrenches (two)
5. One Halon 1211, or one CO_2 and one PKP extinguisher (AFFF outlet only).

NOTE

Helicopter operations require two additional carbon dioxide (CO_2) 16-pound portable units with 7-foot extensions.

Equipment for AFFF Hose Outlets (Hangar Deck and Flight Deck)

The following equipment is located at each AFFF hose outlet:

1. Hose valve.
2. Vari-nozzles are used on all AFFF hose lines. Flow rates are 125 gpm for installed 1-1/2 inch hose reels on flight and hangar decks, and 250 gpm for 2-1/2 inch hose lines. Portable 1-1/2 inch AFFF in-line eductors have been provided to ship repair lockers. These must be matched with a 95-gpm nozzle and no more than 150 feet of hose beyond the eductor for proper operation.
3. Hose.
4. Wrench, spanner (two).

Hose Control Devices

Hose control devices shall be preconnected on designated 1-1/2 inch AFFF hose outlets to afford protection forward and aft of the island structure. Alternate stations should be designated in the event of inoperative AFFF services.

AFFF Flight Deck Fire-Extinguishing System

Flush deck nozzles are installed to provide AFFF coverage on the flight deck. On LHA's and LHD's, the nozzles are supplied from the foam loop. On MCS's, a high-capacity foam station is piped direct to specific flight deck sprinkler groups. Controls to start and secure the flight deck systems are located in Pri Fly and on the NAVBRIDGE. The flush deck nozzles can also be operated to flow saltwater only as part of the wash down counter measures (WDCM) system.

Hangar Deck AFFF Sprinkler System

AFFF sprinkler systems are installed in the overhead of the hangar deck. The sprinkler system is divided into groups, which can be individually actuated. Each group is supplied from two risers, one from a port AFFF injection station and one from a starboard AFFF injection station. The individual AFFF sprinkler groups are actuated by controls located in the CONFLAG stations and around the hangar bay in the vicinity of each sprinkler group. The controls open the hydraulically operated control to the AFFF proportioning unit and the control valve for the individual group. A control is also installed that closes the control valve only to the individual group.

Crash and Rescue Tool Kit

A minimum of one tool kit (see figure 6-9) is maintained by the crash, salvage, and rescue team. It is essential that tools be inventoried before each flight quarters. Each tool should be engraved with the ship's hull number, at a minimum. Crash and rescue locker tools must be dedicated to aircraft firefighting. Each division should maintain a separate tool inventory for general maintenance purposes. The kit contains the tools listed below (at the minimum).

1. Fire Axe
2. Halligan tool
3. Cable cutter (14-inch)
4. Flashlight, safety, two-cell
5. Hacksaw (with six blades)
6. Knife, rescue, V-blade (with 6 sets of blades)
7. Pliers, lineman
8. Pliers, rib joint, (channel lock)
9. Quick release fastener tool
10. Saw, metal cutting
11. Screwdriver, common (4-inch)
12. Screwdriver, common (8-inch)
13. Screwdriver, Phillips (4-inch)

Figure 6-9.—Tools in rescue kit.

14. Screwdriver, Phillips (8-inch)
15. Tool roll, canvas
16. Wrench, adjustable (12-inch)

NOTE

A typical tool roll/kit contains pockets or straps to maintain the tools in an orderly manner. The tool roll/kit may be of local design and manufacture.

Crash Locker

A crash locker containing the firefighting/rescue tools and equipment listed in chapter 7 of this TRAMAN must be maintained for use in emergencies. All equipment must be inspected daily before commencement of flight operation. The requirements for salvage equipment can be found in NAVAIR 00-80R-19 *NATOPS Aircraft Salvage Manual (Afloat)*.

Firefighting Equipment, LPD's

A general description of firefighting agents and equipment is contained in *Naval Ships' Technical Manual*, chapter 555, "Firefighting-Ship."

AFFF Injection Stations

A typical station has a 300-gallon or 600-gallon AFFF concentrate tank (some ships have 50-gallon tanks with 5-gallon cans stowed at the station), a proportioning unit, and ancillary piping and controls.

Balanced Pressure Proportioners

The balanced pressure proportioner operates by maintaining AFFF concentrate and saltwater to the entrance of the proportioner at the same pressure. There is a mechanism in the proportioner that allows a pressure drop in the water supply inlet so that AFFF can be injected into the proportioner discharge. With pressures balanced, AFFF is proportioned with seawater at a nominal 6 percent over a wide range of flows. A balance line and balancing valve is installed between the AFFF concentrate supply and seawater supply. The valve responds to pressure changes resulting from different demands placed on the AFFF system. The valve throttles AFFF into the seawater or diverts it back to the AFFF concentrate tank, as necessary, to maintain a nominal 6 percent AFFF.

Two-Speed Pump

The two-speed pump injects AFFF concentrate into the saltwater supply line at one of two rates (27 or 65 gpm), depending on the demand. The low-rate output serves the AFFF handlines and sprinkler systems demanding 250 gpm or less. The hangar bay sprinkler system and other sprinkler systems greater than 250 gpm are served by the high-speed output.

AFFF Hose Outlets

Helicopter landing platform AFFF outlets are located port and starboard adjacent to the landing area. The station normally consists of one 1-1/2 inch hose (reel/station) or one 2-1/2 inch hose outlet. A push-button control is located adjacent to each AFFF hose station. Some ships are equipped with helicopter hangars. AFFF hose outlets are located within these hangar areas. For initial response, the AFFF hose station can be activated and firefighting efforts initiated by one person until help arrives. Emergency lighting is provided at each hose reel station; controls are located in Pri Fly and on the NAVBRIDGE.

Hose Outlets

Hose outlets must be of quantity and location to permit reaching all areas, on the weather deck and below, from at least two outlets.

The routing of fire hoses through hatches and scuttles is not permitted. The routing of fire hoses through doorways is permitted where there is a positive mechanical means of securing the door in the open position. Also the helicopter operations bill specifies that, when required, the door must be secured in the open position to permit the hose to pass through.

NOTE

Exceptions to the above requirements are permitted where, by ship's design, hose reels serving the flight deck must be routed through hatches.

Minimum Equipment for Each AFFF Hose Outlet Per Operating Area

The minimum equipment required is as follows:

ITEM	QUANTITY
1. Appropriate connection to source	
2. Hose assembly as required (see hose outlets above)	
3. Spanner wrench	2
4. Vari-nozzles	1
5. Two Halon 1211 or one CO_2 and one PKP extinguisher.	

Equipment for Saltwater Hose Outlets

The equipment required is as follows:

ITEM	QUANTITY
1. Hose valve	1
2. Strainer	1
3. Hose assembly as required (see hose outlets above)	
4. Vari-nozzle	1
5. Spanner wrench	2

Vari-nozzles are used on all AFFF hose lines. Flow rates are 125 gpm for installed 1-1/2 inch hose reels on flight and hangar decks, and 250 gpm for 2-1/2 inch hose lines. Portable 1-1/2 inch AFFF in-line eductors have been provided to ship repair lockers. These must be matched with a 95-gpm nozzle and not more than 150 feet of hose beyond the eductor for proper operation.

AFFF Flight Deck Fire Extinguishing System

Some LPD's have an AFFF firefighting system with flush-deck nozzles installed in combination with the saltwater washdown system. In some installations, AFFF from the concentrate tank is injected into the salt water via a positive displacement pump, usually 60 gpm. This injection pump serves the flush-deck nozzles. Deck-edge nozzles may be served by the FP 1000, two-speed pump, or balanced pressure-proportioning unit.

The controls (push buttons) for the flight deck fixed fire-extinguishing system are located in both the helicopter control and the Navigation Bridge. A manual switch for injection start-stop is located near each injection pump. The push buttons allow for selection of salt water, AFFF, or system shutdown.

Hangar Deck AFFF Sprinkler System

AFFF sprinkler systems are installed in the overhead of the helicopter hangars in LPD's that have helicopter hangars for embarked helicopters. In some ships, the overhead AFFF sprinkling system is part of the same system providing services to AFFF hose stations.

Tool Roll

A crash and rescue tool kit must be immediately available for use by the crash, salvage, and rescue team. The tool roll must be inspected daily (before flight quarters) for completeness and to ensure that tools are usable. The requirements for the tool roll are the same for LHA/LHD/LPD/MCS type ships listed in this chapter. See figure 6-9.

Firefighting Clothing Requirements

The aluminized fire-protection suits required are as follows:

1. LPD—four complete sets
2. LHA/LHD/MCS—six complete sets

Q5. What is the established flow rate for a 1-1/2" vari-nozzle installed on an AFFF hose reel station?

Q6. What is the maximum capacity of an LHD HICAP station AFFF concentrate tank?

FIREFIGHTING PROCEDURES

OBJECTIVES: Recognize standard firefighting procedures for amphibious air operations. Identify personnel training requirements related to aircraft firefighting, crash and rescue personnel. Identify the duties and responsibilities of the scene leader and associated key personnel at a fire scene.

Mobile Firefighting Equipment

The following positioning of the mobile firefighting vehicle (MFFV) during flight quarters must be accomplished.

CAUTION

MFFV's (P-25, P-16 or TAU-2) must NOT be used to tow aircraft under any circumstances.

Launch.—The MFFV must be manned and positioned at a location to provide the best view of the launch area.

Recovery.—The MFFV must be positioned so that an unobstructed approach can be made to a maximum number of the landing spots in use.

Operations.—The MFFV must be manned and running from the commencement of the launch and/or recovery until the evolution is complete.

Respot.—During the respot, the MFFV must be manned and positioned so that it may readily respond anywhere on the flight deck.

Hangar Deck.—During flight quarters, a minimum of one TAU must be available and centrally located to afford immediate response.

Fueling.—The MFFV when manned, positioned, and operating as described above must be considered to fulfill the requirements for portable fire extinguishers during aircraft refueling operations on the flight deck.

Limited Flight Operations.—During limited flight operations, such as single aircraft launch or recovery, a minimum of one MFFV must be manned and positioned in the immediate vicinity of the area from which the flight operations will occur.

Extended Flight Operations.—The equipment must be manned, running, and positioned according to the requirements for limited flight operations.

Maintenance Turnups.—One MFFV must be positioned in the immediate vicinity of the aircraft for maintenance turnups, helicopter engine auxiliary power plant starts, or any time rotors are to be engaged.

Ordnance Handling Evolutions UNREP.—One MFFV must be manned in the vicinity for each concentrated weapons loading/off-loading evolution.

Mobile Firefighting Equipment (LPD's)

The following manning and positioning of the MFFV on LPD's during flight quarters must be accomplished.

CAUTION

MFFV's must NOT be used to tow aircraft under any circumstances.

Launch.—An MFFV must be manned and positioned at a location to provide the best view of the launch area.

Recovery.—The MFFV must be manned and positioned so that an unobstructed approach can be made to a maximum number of the landing spots in use.

Operations.—The MFFV must be manned and running from the commencement of the launch and/or recovery until the evolution is complete.

Respot.—During the respot, the MFFV must be manned and positioned so that it may readily respond anywhere on the flight deck.

Fueling.—The MFFV when manned, positioned, and operating as described above must be considered to fulfill the requirements for portable fire extinguishers during aircraft refueling operations on the flight deck.

Limited Flight Operations.—During limited flight operations, such as single aircraft launch or recovery, a minimum of one MFFV must be manned and positioned in the immediate vicinity of the area from which the flight operations will occur.

Extended Flight Operations.—During extended flight operations (over 1 hour), continuous engine operation of the MFFV is not desired. The equipment must be manned and ready with engines checked periodically and positioned according to the requirements for limited flight operations.

Maintenance Turnups.—One MFFV must be manned in the immediate vicinity of the aircraft for maintenance turnups, helicopter engine auxiliary power plant starts, or any time rotors are to be engaged. When not at flight quarters, a minimum of one MFFV must be manned and centrally located on the flight deck during maintenance turnups.

Ordnance Handling Evolutions (UNREP).—One MFFV must be manned in the vicinity of each concentrated weapons loading/off-loading evolution.

Training Requirements (LHA/LHD/LPD/MCS)

All personnel assigned duties incidental to flight operations must attend a formal aviation firefighting school as required by OPNAVINST 3541.1. The required training is discussed in the following text.

Embarked on-the-job (OJT) Training Requirements (LHA/LHD/MCS)

The air officer ensures that all personnel assigned duties incidental to flight operations (including embarked aviation activities) receive continuous training in the following areas:

1. Organization and leadership of the crash, fire, and rescue team
2. Fire reporting procedures
3. Communications
4. First aid and self-aid
5. General Firefighting
6. Hazardous ordnance/weapon cooling
7. AFFF and saltwater station operation on flight deck and hangar deck
8. Portable CO_2, PKP, and Halon 1211 extinguishers (operation and location)
9. Appropriate firefighting actions to perform until assistance arrives
10. Basic handling of composite materials and hazardous materials produced after a crash or fire.

Crash, Salvage, and Rescue Crewmember Training (LHA/LHD/MCS)

Personnel assigned as crash, salvage, and rescue crewmembers must receive additional (in-depth) training to include the following:

1. Aircraft familiarization
2. Personnel rescue procedures

3. Mobile crash-handling vehicles (when assigned)

4. Crash dollies (when assigned)

5. Aircraft salvage procedures

6. Aircraft jettison procedures

7. Maintenance of mobile equipment (when assigned)

8. At least one team member shall receive formal training/certification in basic oxygen, acetylene, and ARC welding.

9. Aircraft entry (normal, forcible, and emergency)

10. Crew member release (normal, forcible, and emergency)

Hazardous Material Training

Commanding Officers should require that all personnel assigned to the crash fire rescue organization receive training on hazardous materials to ensure they are capable of handling hazardous materials produced after a crash or fire.

Drills

Drills are conducted with sufficient frequency to maintain the level of proficiency in the fundamentals of aircraft firefighting and salvage operations as specified in FXP 4.

NOTE

Crash, salvage, and rescue personnel are cross-trained to meet the requirements listed herein.

NOTE

At the direction of the air officer, a qualified person can initiate aircraft fire drills on the flight or hangar deck.

When drills are being conducted, the necessary information is provided to the scene leader by the exercise observer.

For training, the scene leader uses the following checklist when fighting a fire (simulated) on the flight or hangar deck. The sequence should be followed to the maximum practical extent in combating actual fires. The quotes indicate the report to be made.

1. Initial response equipment at scene (MFFV and AFFF hose teams)

2. Nozzle on, move in

3. "Nursing commenced" (if applicable)

NOTE

Nursing/replenishment of MFFV is highly recommended for multi-aircraft mishaps and a single aircraft mishap that spreads to one or more aircraft with or without weapons involvement.

4. "Fire under control"/"weapons cooling in progress" (if required)

NOTE

Hose control devices shall be deployed on all drills involving weapons.

5. Effect "rescue"/"casualties"/"safe seats" (if required)

6. "Fire out"/"weapons cooling continuing"

NOTE

The decision to commit saltwater hoses for further weapons cooling must not be made until all residual fire/smoke has ceased.

7. "Nozzle off, back out"

8. "EOD to scene"/"weapons safed"

9. "Overhaul" of residual fire, remove liquid oxygen converter (if applicable), batteries

10. "Set reflash watch"

11. De-smoke (hangar bay)

12. Conduct atmospheric test (hangar bay)

13 With squadron maintenance personnel present, turn the scene over to the crash team leader, commence salvage operations, and defuel (if required)

14. "Estimated time to ready deck"

15. Conduct FOD walkdown; hazardous material shall be brought to the attention of the background assistance detail leader, who will delegate its removal to cognizant personnel, as required.

14. "Ready deck"

15. Debrief

NOTE

The drill sequence of events for fuel station fires may be found in chapter 7 of this NRTC.

Embarked on-the-job (OJT) Training Requirements (LPD)

The air officer in an LPD is responsible for conducting a continuous training program for all personnel (including embarked aviation activities personnel). All preplanning and training should be directed toward a "worst case" scenario. As a minimum, the training includes the following:

1. Organization and leadership of crash, fire, and rescue team

2. Fire reporting procedures

3. Communications

4. First aid and self-aid

5. General fire fighting

6. Hazardous ordnance/weapons cooling

7. Saltwater and AFFF station operation on the flight deck and hangar (hangar if applicable)

8. Portable CO_2, PKP, and Halon 1211 extinguishers (operation and location)

9. Aircraft entry (normal, manual, and emergency)

10. Crew member release (normal, manual, and emergency)

11. Appropriate firefighting actions to perform until assistance arrives

Crash, Salvage, and Rescue Crewmember Training

Personnel assigned as crash, salvage, and rescue crewmembers must receive additional in-depth training to include the following:

1. Aircraft familiarization

2. Hazardous ordnance/weapons cooling

3. Aircraft entry (normal, manual, and emergency)

4. Personnel rescue procedures

5. Mobile crash handling vehicles (when assigned)

6. Crash dollies (when assigned)

7. Aircraft salvage procedures

8. Aircraft jettison procedures

9. Maintenance of mobile equipment (when assigned)

10. A minimum of two personnel shall receive formal training/certification in basic oxygen, acetylene, and ARC welding.

Hazardous Material Training

Commanding Officers should require that all personnel assigned to the crash fire rescue organization receive training on hazardous materials to ensure they are capable of handling hazardous materials produced after a crash or fire.

Flight Quarters Preparation

The aircraft crash, salvage, and rescue officer and the hangar deck officer ensure inspection of their respective areas when flight quarters is sounded. This is done to evaluate the readiness and availability of firefighting equipment and to report the results of the inspection to the aircraft-handling officer. As soon as they are detected, discrepancies are reported to the commanding officer via the air officer. When discrepancies exist in firefighting equipment, a decision to conduct flight operations is made only by the commanding officer.

Firefighting Procedures (LHA/LHD/MCS)

The reporting of a mishap should be accomplished by the most expeditious method according to the ship's operating instructions. In the event of a pending emergency, the air officer notifies the flight deck personnel by using the 3 and 5-MC announcing system and the flight warning alarm. The crash alarm must be sounded to notify flight deck personnel of an actual on-deck aircraft mishap.

NOTE

When fire occurs on the flight and/or hangar deck, word is passed over the 1-MC announcing system via the bridge. At this time, designated personnel are assigned to AFFF injection stations. Immediate communication is established on the X50J sound-powered circuit with the AFFF injection station.

Minimum Initial Response

All preplanning and training must be directed toward providing the following minimum initial response to an actual mishap or drill:

1. MFFV(s)/TAU(s)
2. Scene leader
3. Hose team leaders
4. Four AFFF hoses

NOTE

When MFFV equipment is nursed at the scene, it is considered to be the equivalent of one AFFF hose team.

5. Two rescue persons (hot suitmen)
6. Two stretchers and two first-aid kits
7. Two spare lengths of hose
8. Forcible entry equipment
9. Messengers/phone talkers
10. Two portable extinguishers (Halon 1211, PKP, or CO_2)
11. Two spare 1-1/2 inch hose control devices (these devices must have the appropriate Vari-nozzle attached).

NOTE

Personnel shall be assigned to monitor charged fire hose(s) restrained with hose control device(s). These personnel shall ensure prompt response to conditions that affect the fire stream, such as wind change, ruptured hose, pressure change and/or other disruptions.

12. AFFF hose(s) for weapons staging area(s) (bomb farm) protection, properly manned

NOTE

It is emphasized that nothing herein is intended to discourage immediate firefighting action by individuals while awaiting the arrival of organized teams. On the contrary, 1-1/2 inch AFFF hose reels and variable pattern nozzles were specifically designed and installed for rapid deployment by one person, if necessary. Accordingly, the training provided to all air department and embarked aviation personnel should cover activation procedures and firefighting techniques for emergency operation of 1-1/2 inch hose reels by the first person on the scene.

The individual actions occurring on initial response are as follows:

Air Officer/Helicopter Control officer.—This air officer assesses the fire situation, advises the commanding officer, and requests assistance commensurate with the severity of the incident.

Scene Leader.—The scene leader assumes command and directs available personnel and equipment in Firefighting procedures and tactics, ordnance cooling, and personnel rescue as the situation requires.

WARNING

- Personnel must exercise extreme caution when approaching an aircraft before engine shutdown.
- The scene leader must make an immediate appraisal regarding the presence of hazardous ordnance and request confirmation from flight deck control. Firefighting teams are directed in weapons cooling as specified in chapter 2, paragraph 2.5.4., of the *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual* (NAVAIR 00-80R-14).

NOTE

The scene leader evaluates the fire and makes recommendations to Pri-Fly for maneuvering the ship to provide favorable wind conditions.

MFFV driver/Operators.—Designated MFFV driver/operators must immediately position the vehicle in a location to afford the most efficient control of the fire, cool ordnance, and provide protection for personnel rescue. All attempts should be made to position the vehicle upwind of the fire.

Air Officer.—The air officer assesses the fire situation, advises the commanding officer, and requests assistance commensurate with the severity of the incident.

AFFF Hose Teams.—These teams extinguish the fire and/or cool personnel and ordnance as directed by the hose team leaders.

Messengers.—The messengers position themselves directly behind the scene leader.

Background Assistance Leader.—This person does the following:

1. Ensures adequate flow of messengers to the scene leader.

2. Effects the removal of aircraft adjacent to the scene.

3. Provides stretcher-bearers for personnel casualty removal.

4. Provides one manned AFFF hose.

NOTE

The decision to commit saltwater hoses for further weapons cooling must not be made until all residual fire and smoke has ceased.

5. Provides personnel to other areas if additional fires occur.

6. Dispatches support personnel as required by the scene leader.

7. Ensures fuels repair, medical, and maintenance representatives are available, as necessary.

8. Ensures that one AFFF plug person is stationed at each saltwater outlet and that each AFFF control box is in use. That AFFF plug person also maintains direct communication with the injection station operator.

9. Assembles additional personnel not required at the scene.

10. Ensures electrical power is secured to the aircraft involved.

11. Coordinates the manning of appropriate elevators as necessary (applies to only LHA/LHD/MCS).

Weapons Staging Area (Bomb Farm) Fire Response AFFF Hose Teams. If there is a fuel spill or fire on the flight deck when ordnance is stowed in a weapons staging area, properly manned AFFF hose team(s) shall be deployed forward and/or aft of the weapons staging area to conduct rapid fire extinguishment or provide weapons cooling protection. On ships with flush/deck edge AFFF sprinkler systems or improved weapons staging (bomb farm) AFFF sprinkler system, the scene leader should evaluate the threat and recommend activation of adjacent sprinkler systems, as appropriate. This requirement is waived aboard ships where the improved weapons staging area (bomb farm) AFFF sprinkler system is installed and operative.

Rescue Path. When an adequate rescue path is provided, the scene leader directs the rescue of personnel. Reports are made at the commencement and completion of the rescue and on the number of casualties.

WARNING

Adequate fire protection must be maintained for rescue persons during rescue evolutions.

NOTE

Rescue, firefighting, and ordnance cooling evolutions should be conducted simultaneously once a rescue path is provided.

Rescue Persons.—Each team of rescue persons must maintain a two-man buddy system throughout the rescue effort. Each rescue effort must be directed toward evacuating one incapacitated person at a time. These rescue persons position themselves in close proximity to the scene leader.

Rescue persons effect the rescue of aircrew and passengers. Information on aircraft entry, engine shutdown procedures, ejection seat safing, and personnel removal are in NAVAIR 00-80R-14-1.

Investigation is made of the surrounding area (catwalks, gun tubs, and so forth) for additional casualties.

Background Personnel.—The background personnel provide immediate first aid to casualties and evacuate them, as necessary.

Completion of Rescue.—Upon completion of rescue, the scene leader continues to direct the fire teams until the fire is extinguished, and then reports the fire is out.

Weapons Cooling.—The cooling of fire-exposed weapons shall continue for 15 minutes after all residual fire/smoke has ceased or until EOD/weapons personnel have determined that weapons have reached safe ambient temperatures.

Residual Fire Overhaul/Reflash Watch

The duties of the members of this group are as follows:

Scene Leader.—The scene leader directs two persons, attired in complete proximity suits, one with a portable CO_2/Halon fire extinguisher and one with a

Halligan tool/crash axe, to ensure no residual fire exists. When completed, he sets the reflash watch.

Background Assistance Detail.—This detail assembles to commence FOD walkdown, restore gear, and take personnel to the aircraft crash, salvage, and rescue officer.

Estimated Ready Deck/Salvage

Personnel perform this function as follows:

Scene Leader.—The scene leader gives the estimated ready deck time to Pri-Fly if salvage operations are not required or turns command of the scene over to the aircraft crash, salvage and rescue supervisor to effect the disposition of aircraft.

Aircraft Crash, Salvage, and Rescue Officer.—This supervisor estimates the time to ready deck and reports to Pri-Fly updating the estimate, as necessary.

NOTE

In the event of a fire on either the flight or hangar deck, sufficient personnel from the unaffected area must stand by to provide personnel and equipment augmentation, as necessary, for fire containment and casualty control. The decision to commit these assets is made by the air officer.

Welder.—Crash and salvage teams on LHA/LHD/MCS/ must have a designated welder assigned and welding equipment available.

Hangar Deck.—The following additional procedures for aircraft fires on the hangar deck must be followed:

1. Return elevators to the flight deck level.
2. Close aircraft elevator doors immediately.
3. Leave all hangar deck lights on.
4. Close all weapons elevator doors/hatches.
5. Close all doors and hatches from hangar to interior of ship.

Mass Casualty/Conflagration (CONFLAG)

In the event of mass casualties or a CONFLAG on the flight or hangar deck, many additional requirements must be considered in establishing procedures for life safety, damage control, and extinguishment of fire.

NOTE

As a result of a multiaircraft CONFLAG, mass casualty reactions could be required.

Response to the Scene

The initial response to the scene must include the equipment and personnel stipulated earlier in this chapter, under "Minimum Initial Response," together with all available stretcher-bearers, stretchers, and first aid kits. A constant resupply and augmentation of portable extinguishers, hoses, and AFFF for MFFV's should be made available, contingent upon the on-scene leader's requirements. The hangar deck officer will maintain a minimum of two positive pressure self-contained breathing apparatus with two spare bottles.

RESCUE PROCEDURES

The function of the rescue teams is to rescue personnel from burning and crashed aircraft. This duty is primary in nature; no other duties are assigned these teams during flight operations.

Approaching Crashed Aircraft

Should the aircraft be on fire, ordnance/weapons type, quantity, and location must be identified so that AFFF cooling hoses are immediately and continuously applied to all weapons exposed to the fire. A rescue path must be made by the fire fighters before approaching the aircraft. At the direction of the crash officer or on-scene leader, the rescue team(s), with at least two people per team, moves into the aircraft to effect the rescue.

Jettison

It is conceivable that a situation may arise that requires the jettison of an aircraft. Specific procedures for jettison are included in the ship's operating instructions based upon assigned equipment and according to the *U.S. Navy Aircraft Crash and Salvage Manual (Afloat)* (NAVAIR-00-80R-19).

Air Officer

The air officer directs the firefighting effort on the flight deck. As soon as fire progresses beyond the capability of a single scene leader, the air officer energizes appropriate zones of the AFFF flight deck fire-extinguishing system. In addition to activation of the zone in which the fire is located, at least one upwind zone should be activated. Approximately 15 knots relative wind speed provides optimum distribution of AFFF from the flight deck extinguishing system.

Aircraft Handling Officer

This officer informs the scene leader as to the type of ordnance carried on the disabled aircraft, establishes the area for collection, and disposition of personnel casualties, and designates the aircraft/bomb elevator to be used for movement of casualties.

Hangar Deck Officer

This officer mans the applicable CONFLAG control station. The hangar deck officer then directs all Firefighting evolutions on the hangar deck.

For further detailed information on the standardized aircraft firefighting and personnel rescue procedures, you should refer to the *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual* (NAVAIR 00-80R-14).

FIREFIGHTING PROCEDURES (LPD)

The following firefighting procedures are used on LPD's.

Approaching and entering a Burning Helicopter

The on-scene leader assesses the severity of the helicopter fire and directs the fire parties to approach the fire as rapidly as possible with the wind to their backs. The objectives are to cool ordnance (if ordnance is involved), rescue the occupants, and to extinguish the fire. The hose team opens a path through the flames for the rescue persons to approach the helicopter.

When directed by the on-scene leader, the rescue persons work (as a team) to evacuate the aircrew and passengers. Each team maintains a two-man buddy system throughout the rescue and salvage evolution. In multiple casualty rescues, the team concentrates on evacuating one person at a time. Following removal of the occupants, the on-scene leader continues to direct extinguishment of the fire.

WARNING

If rescue persons become wet during entry, hose teams shall continuously cool rescue persons to prevent scalding.

The fire-extinguishing nozzle is directed from waist level. The initial application of AFFF is made from a distance that allows the agent to fall or descend on the fire area, moving the nozzle from side to side for maximum distribution. You should move forward as the fire line recedes. A fog pattern of AFFF should be used on burning fuel.

Additional information concerning aviation fuels is in chapter 2 and appendix B of the *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual* (NAVAIR 00-80R-14).

Minimum Initial Response

All preplanning and training must be directed toward providing the following minimum initial response personnel and equipment to an actual mishap or drill:

1. Scene leader
2. Background team leader
3. Two AFFF hose teams
4. Two rescue persons
5. Medical corpsman
6. Messengers/phone talkers
7. AFFF proportioner station operator
8. (LPD) MFFV
9. Two spare hoses
10. Crash and rescue tool kit (tool roll)
11. Two portable extinguishers (Halon 1211, PKP, or CO_2)

The individual actions that should occur on initial response are as follows:

Scene Leader.—The scene leader assumes command and directs available firefighting assets with guidance from the air officer or HCO.

WARNING

You should exercise extreme caution when approaching an aircraft mishap before engine shutdown.

NOTE

The scene leader evaluates the fire and makes recommendations to the bridge via

Pri-Fly for maneuvering the ship to provide favorable wind conditions.

(LPD) MFFV.—The MFFV operator immediately positions the vehicle in a location at the scene of the fire to afford the most efficient control of the fire while providing protection for personnel rescue. Attempts should be made to maintain the vehicle's position upwind of the fire during subsequent ship maneuvers without jeopardizing hose teams or associated equipment.

Air Officer/Helicopter Control Officer.—This officer assesses the fire situation, advises the commanding officer, and requests assistance commensurate with the severity of the incident.

Messengers/Phone Talkers.—These individuals position themselves directly behind the scene leader or as directed.

Rescue Path.—When adequate fire protection is provided, the scene leader directs the rescue of personnel. Reports are made at commencement and completion of the rescue and the number of casualties.

WARNING

Adequate fire protection must be maintained during rescue evolutions.

NOTE

Rescue and firefighting evolutions should be conducted simultaneously if fire protection is provided.

Rescue Persons.—Rescue persons effect rescue of aircrew and passengers. These rescue persons position themselves in close proximity to the scene leader for directions. Information on aircraft entry, engine shutdown procedures, ejection seat safing, and personnel removal are in the *NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1.

Background Personnel.—The background personnel provide immediate first aid to casualties and evacuate them. They also investigate the surrounding area (catwalks, gun tubs, and so forth) for additional casualties, as necessary.

Completion of Rescue.—When the fire is under control and weapons cooling is in progress (if required), the scene leader directs rescue persons to effect the rescue of aircrew or passengers from the helicopter. The scene leader continues to direct the fire teams until the fire is extinguished (out). Weapons cooling shall continue, if required. The scene leader then reports the "fire is out" to primary flight control.

Residual Fire Overhaul/Reflash Watch

The following functions describe the established required procedures and personnel involved in the fire overhaul and setting the reflash watch and fire overhaul.

Scene Leader.—The scene leader directs two persons to ensure that no residual fire exists. These persons are attired in complete proximity gear and are equipped with a portable fire extinguisher and a Halligan tool. After receiving their report, the scene leader sets the reflash watch.

Salvage Operations.—The aircraft crash, salvage, and rescue officer/scene leader proceeds with the restoration of equipment and area based on the condition at the scene and operational requirements. Hull Maintenance Technician (HT) rating personnel on LPD's have a designated welder assigned and welding/cutting equipment available.

Mass Casualty/Conflagration (CONFLAG).—In the event of mass casualties or a CONFLAG on the flight deck, many additional requirements must be considered in establishing procedures for life safety, damage control, and extinguishment of fire. The decision to commit these assets is made by the commanding officer via the air officer/helicopter control officer/damage control assistant.

Jettison

In the event that a helicopter fire becomes uncontrollable, thus endangering the ship, jettison of the helicopter may be required. There is no established procedure for jettison of a helicopter under these circumstances. Methods that can be considered are as follows:

1. The ship uses a high-speed, full-rudder turn to create centrifugal forces of sufficient magnitude to roll the helicopter over the side of the ship.

2. A forklift, where available.

3. A 3/4-inch cable around three sides of the periphery of the deck with the bitter end secured at one corner of the deck and the other end attached to a capstan. Taking up the cable pulls the helicopter to the side of the ship and overboard.

Local procedures for jettison are included in the ship's operating instructions based upon assigned equipment and according to the *U.S. Navy Aircraft Crash and Salvage Operations Manual*, NAVAIR 00-80R-19.

Q7. During launch operations on an LPD, what is the requirement of the MFFV?

Q8. What type of nozzle pattern should you use to fight a burning fuel fire?

ANSWERS TO REVIEW QUESTIONS

A-1. On an LPD, the Air Officer is responsible for directing all aircraft firefighting efforts.

A-2. The scene leader is responsible for directing the use of all available assets at the scene.

A-3. The maximum lift capacity of the A/S32A-36A crash crane is 70,000 lbs.

A-4. The length of the boom on the A/S32A-36A crash crane is 46 feet.

A-5. The flow rate for a 1-1/2" vari-nozzle installed on an AFFF hose reel station is 125 gpm.

A-6. The maximum capacity of an LHD HICAP station AFFF concentrate tank is 2,000 gallons.

A-7. During launch operations on an LPD, the MFFV must be manned and positioned at a location to provide the best view of the launch area.

A-8. When fighting a burning fuel fire, you should use AFFF in a fog pattern.

CHAPTER 7

CRASH AND SALVAGE, CV/CVN

Aircraft crashes usually occur suddenly and without advance warning. They permit no extensive on-the-scene preparation. Prompt and exacting actions by trained personnel with a minimum waste of motion are essential. This chapter introduces you to aircraft crashes aboard carriers; water crashes; salvage operations; and crash and salvage equipment, along with its purpose. You will become more familiar with these subjects as you participate in the emergency drills on board your ship.

AIR DEPARTMENT ORGANIZATION AND OPERATIONS

OBJECTIVES: Identify the organization of the air department in relation to crash and salvage operations. Determine responsibilities of air department personnel during aircraft fire fighting, salvage, and rescue operations.

Each crash situation dictates the immediate availability of specific equipment and highly trained personnel. Fire fighting, rescue, and salvage problems can vary with every crash; there are still many procedures that are common to crashes of the same general category. For the crash crewmember to perform in the safest, most efficient and expeditious manner possible, a detailed plan of action is developed and implemented. Each member's duties and responsibilities are clearly defined. See table 7-1.

A continuous on-the-job training program develops the theoretical and practical skills that the crash/salvage

Table 7-1.—Typical crash, salvage, and rescue team organization during normal flight operations

NAME	RATE	FUEL SPILL	A/C FIRE	A/C CRASH (SALVAGE)	A/C IN CATWALK	A/C JETTISON	HELO IN WATER
	ABHC	SCN LDR	SCN LDR	SCN LDR	SCN LDR	SCN LDR	SCN LDR
	ABH-1	---	SPRVSR	SPRVSR	SPRVSR	SPRVSR	SPRVSR
	ABH-2/3	S/W NZL	CRANE	CRANE	CRANE	CRANE	HELO KIT
	ABH-2/3	---	FRKLFT	FRKLFT	FRKLFT	FRKLFT	HELO KIT
	ABH-3	MFFV	MFFV	SLING	SLING	SAFETY	EQUIP
	ABH-3	MFFV*	MFFV	SLING	SLING	SAFETY	EQUIP
	ABH-3	MFFV*	MFFV	EQUIP	EQUIP	SAFETY	EQUIP
	ABHAN	MFFV	MFFV	SLING	SLING	AS RQD	AS RQD
	ABHAN	MFFV*	MFFV	SLING	SLING	AS RQD	AS RQD
	AN	MFFV*	MFFV	DOLLY	DOLLY	AS RQD	AS RQD
	AN	---	EQUIP	DOLLY	DOLLY	AS RQD	AS RQD
	AN	---	EQUIP	DOLLY	DOLLY	AS RQD	AS RQD
	AN	S/W	EQUIP	EQUIP	EQUIP	AS RQD	AS RQD
	AN	S/W	EQUIP	EQUIP	EQUIP	COMBING**	AS RQD
	AN	S/W	EQUIP	EQUIP	EQUIP	COMBING**	AS RQD
	AA	S/W	EQUIP	EQUIP	EQUIP	COMBING**	AS RQD
	AA	---	EQUIP	EQUIP	EQUIP	COMBING**	AS RQD
	RMNDR	AS RQD	EQUIP	EQUIP	EQUIP	NETS**	AS RQD

Note

Figure 5-1 is a guideline only and should be adapted to meet local requirements. Some responsibilities may seem vague to a casual observer. However, a well-trained, well-organized crash and salvage team will have no doubt as to individual responsibilities in a given situation.

*Normally one MFFV will respond to fuel spill while the other two cover flight ops.

**Applicable to jettison stations with portable combing and safety nets with lowering capability.

crew need to achieve operational readiness. All crash and salvage crewmembers attend a formal aircraft firefighting school. In addition, a comprehensive team-training program is locally established.

Aircraft fire fighting, rescue, and salvage problems vary with every crash situation. There is no single step-by-step procedure that can be given that would apply in every case. Frequent practicing of the general firefighting/rescue procedures and salvage functions increases the ability of the team to solve many of the problems that could be encountered in extraordinary situations.

Assignments to duties are made according to the Personnel Qualification Standards (PQS), which provide an accurate and continuing display of the level of training of the team. These qualifications should be certified by the cognizant officer or designated supervisor, and an appropriate entry should be made in the team member's service or training record. Periodically changing the task assignments increases the skill levels of the individual members and prepares them for greater versatility. Cross training protects the unit, in the event of unplanned personnel shortages or transfers.

In the case of shipboard crashes, the safety of the ship and its crew is of prime importance. Next on the priority list comes the safety and rescue of flight crew personnel. These considerations take on added significance in crashes involving high explosives and nuclear weapons. For the most part, the material in this chapter refers specifically to crashes other than these. Because of the many variables involved, each crash situation differs from all others. The exact procedure used depends on the ship and the crash situation with which it is confronted. General procedures that apply to a particular ship are used by the aircraft crash and salvage officer and his assistants in training crash crew personnel.

AIR OFFICER

The air officer has overall responsibility for aircraft fire fighting, salvage, jettisoning, personnel rescue, and aviation fuels repair occurring on the flight/hangar decks, and for coordination with damage control central.

AIRCRAFT HANDLING OFFICER

The aircraft handling officer (ACHO) is responsible for the direction and coordination of aircraft movement on the flight/hangar decks as required during aircraft crash and fire evolutions. The ACHO acts on and relays communications from the scene leader to primary flight (Pri-Fly) control.

FLIGHT DECK OFFICER

The flight deck officer is responsible to the air officer for flight deck operations to include supervising clearing the flight deck of aircraft crashes and for extinguishing flight deck fires.

AIRCRAFT CRASH, SALVAGE, AND RESCUE OFFICER (AIR BOATSWAIN)

The aircraft crash, salvage, and rescue officer is responsible to the flight deck officer for the organization, supervision, and training of the crash, salvage, and rescue team. The air boatswain is also responsible for the material maintenance readiness and operation of assigned equipment.

AIRCRAFT CRASH, SALVAGE, AND RESCUE TEAM

From its station in the island structure, the crash, salvage, and rescue team is the flight deck repair team.

The functions of the team are to rescue personnel from crashed, damaged, and/or burning aircraft on the flight deck; fight fires; clear away wreckage from any area that would interfere with flight operations; and make minor emergency repairs to the flight deck and associated equipment.

The crash crew should consist of experienced and highly trained personnel. Ideally, each member should be trained and qualified to perform the functions of every other member of the unit. As a prerequisite for assignment to the crash crew, each member should have qualifications in other areas of responsibility on the flight deck, such as aircraft handling crewman, tractor driver. Figure 7-1 is a suggested organization for a CV/CVN crash and salvage team.

TEAM ORGANIZATION

The following crash, salvage, and rescue team organization is for normal flight operations. Table 7-1 is a guideline only and should be adapted to meet local requirements. Some responsibilities may seem vague to a casual observer. However, a well-trained, well-organized crash and salvage team will have no doubt as to individual responsibilities in a given situation.

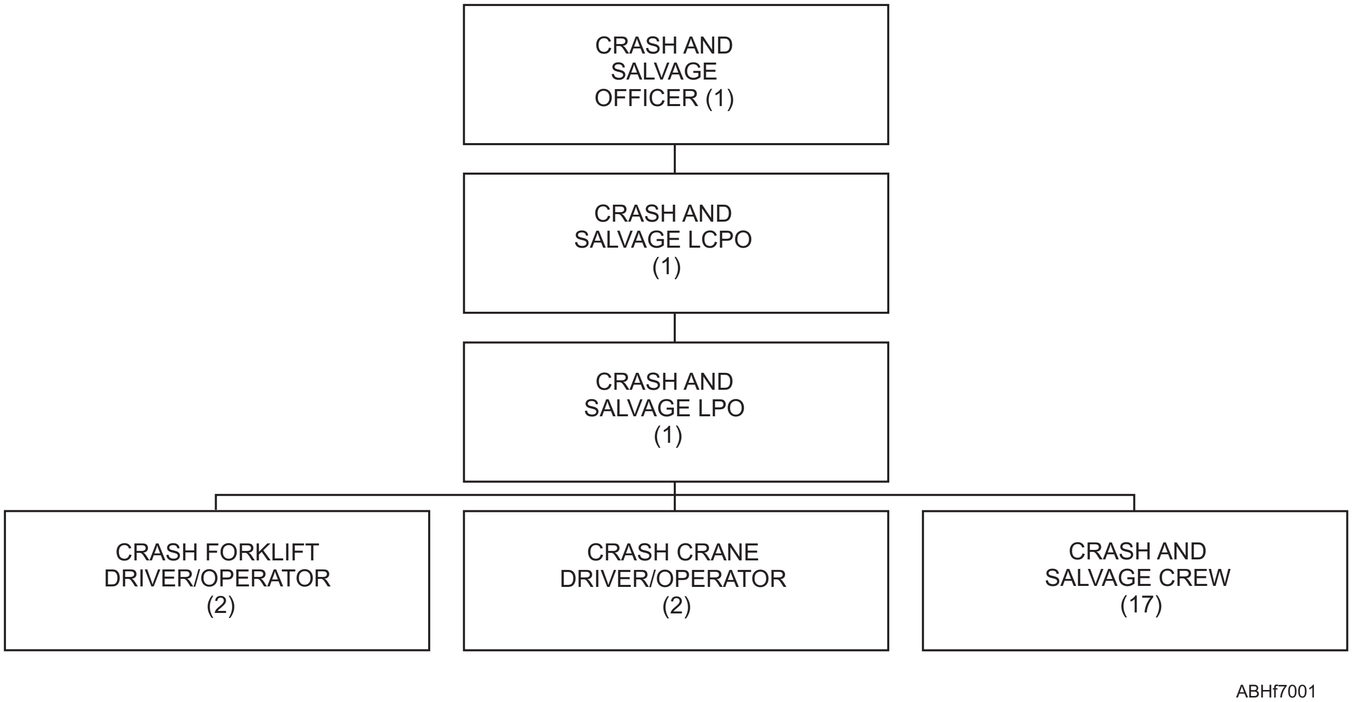


Figure 7-1.—Typical organization of a crash, salvage and rescue team.

NOTE

Additional personnel should be assigned AS NECESSARY to support extended flight operations and to provide fire protection during periods when the ship is not at flight quarters.

Air Boatswain

The Air Boatswain is responsible to the Flight Deck Officer for the overall direction of the crash crew in the handling of aircraft emergencies. He ensures readiness of assigned personnel and equipment. The Air Boatswain is responsible for directing the training of crash and salvage personnel in wreckage removal, aircraft familiarization, and equipment operation. He conducts salvage drills, and ensures all assigned crash equipment is properly maintained, inventoried, and stowed ready for use.

Crash and Salvage Leading Chief Petty Officer

The crash and salvage LCPO acts as assistant to the Air Boatswain and his duties include coordinating activities for salvage for each type of aircraft on board, aircraft jettison operations, equipment maintenance requirements, and water related salvage operations. He also coordinates the on/off loading of aircraft aboard the ship.

Crash and Salvage Leading Petty Officer

The crash and salvage LPO assists the LCPO and his specific duties include supervising installation of aircraft hoisting equipment for each type of aircraft on board, supervising crash crane operations, crash dolly placement and securing, hoisting operations utilizing the boat and aircraft (B & A) crane, and jettison operations. He is also responsible for supervising/operating the crash crane in case of locked brakes or when a limit switch is inoperative. The crash and salvage LPO should ensure that all required salvage tools are immediately available.

Crash Forklift Driver

The crash forklift driver is responsible for the preoperational checks, safety of operations, and postoperational shutdown and securing of the crash forklift. He must be fully aware of aircraft weights at specific lifting points related to crash forklift operations, and be fully aware of forklift capacities and the capacities of equipment used in conjunction with the forklift, such as the boom adapter and salvage platform. The LPO must also be aware of forklift positioning as related to aircraft jettison operations.

Crash Crane Driver

The crash crane driver is responsible for the preoperational checks, starting and safety of operations within weight and operating surface limitations, and postoperational shutdown and securing of the crash crane. He is also responsible for positioning the crane and hoisting all types of aircraft carried on board. The crash crane driver must also be knowledgeable of crane positioning as related to aircraft jettison operations and the shipboard on/off loading of aircraft using the crash crane.

Crash and Salvage Crewmembers

The crash and salvage crewman is responsible for knowing the principles of operation of all available tools and equipment. The crewman shall be trained to safely perform all installation and rigging functions of equipment for each type of aircraft that is carried on board the ship. The crewman must know how to install aircraft ground safety locks and wheel chocks, tiedowns for salvage operations, securing crash dollies for salvage removal, and attaching the ALBAR to the crash dolly and aircraft. All crewmen must be familiar with installing both the manufacturers' hoisting sling and the universal aircraft fabric-hoisting sling for each type of aircraft carried on board, and attaching stabilizing lines for aircraft and equipment.

Q1. Within the air department organization, who is responsible for material maintenance readiness and operation of assigned crash and salvage equipment?

Q2. Within the crash and salvage team organization, what person is responsible for supervising the installation of aircraft hoisting equipment?

CRASH AND SALVAGE EQUIPMENT

Objectives: Identify crash and salvage equipment used aboard aircraft carriers. Determine the capabilities, quantity requirements, and application of crash and salvage equipment.

MOBILE AIRCRAFT CRASH CRANE

Crash cranes are used for lifting, maneuvering, and removing crashed planes from carrier flight decks.

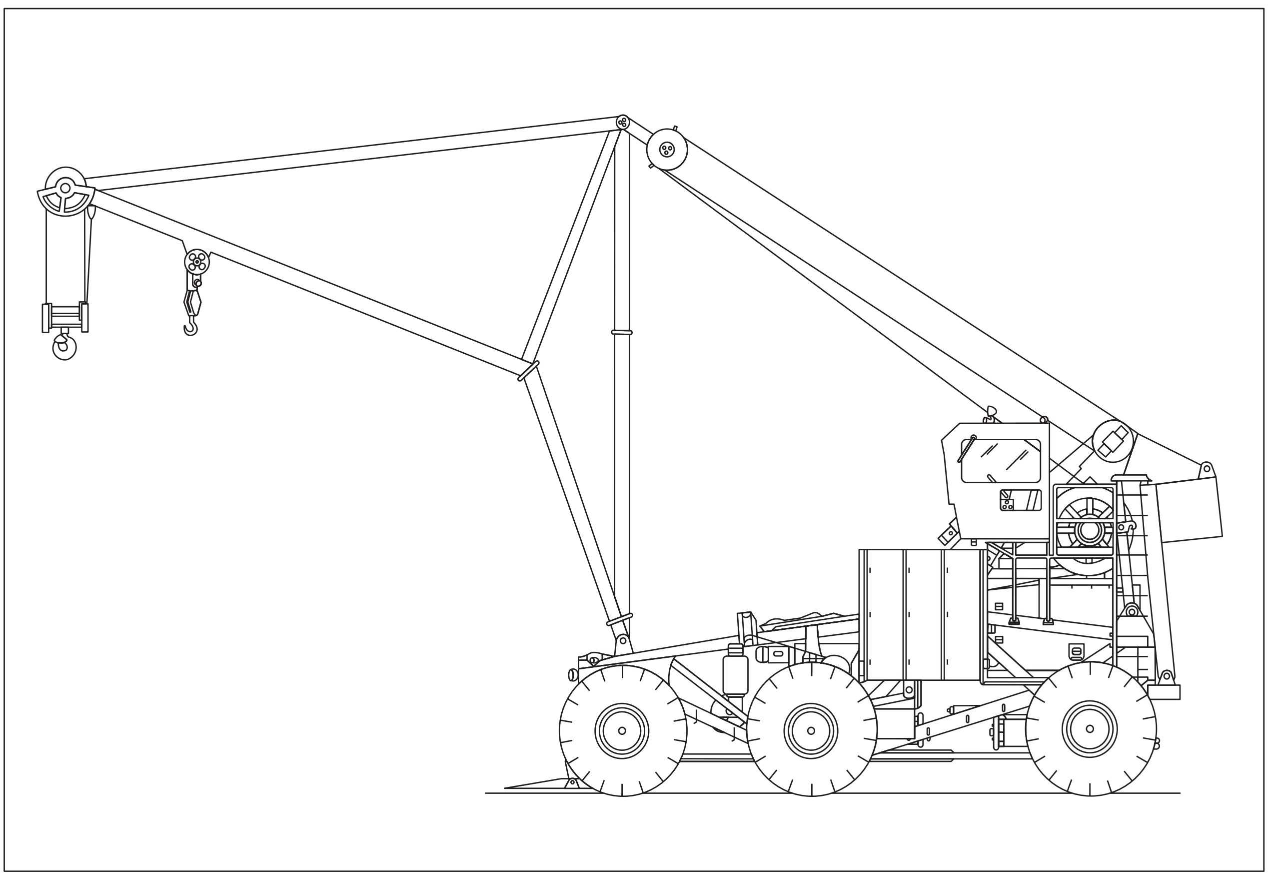


Figure 7-2.—Carrier Vessel Crash Crane (CVCC).

These cranes are self-propelled vehicles mounted on four electrically powered wheels using electric motors and gear reduction units. The main power unit is a diesel engine driving a generator, which supplies current for the electric motors operating the four wheels, boom, hook, and steering apparatus. In most cases, these cranes do not directly attach to the aircraft when lifting, but use hoisting slings.

Before the aircraft recovery phase of flight operations, the crane should be started; it should remain in ready condition until the last aircraft has landed.

CARRIER VESSEL CRASH CRANE (CVCC) (A/S32A-35A)

A new generation of the mobile crash crane for use aboard CV/CVN aircraft carriers is the CVCC (Fig. 7-2). It is the primary vehicle for removing damaged or disabled aircraft aboard aircraft carriers, utilizing its lift and roll capability.

FUNCTIONAL DESCRIPTION AND MAJOR COMPONENTS OF THE CVCC

The CVCC is a self-propelled, four-wheel drive, diesel-electric powered vehicle mounted on pneumatic rubber tires. The crane is capable of operating aboard ship in inclement weather. It is required to lift crashed/damaged aircraft from various locations and attitudes and move with the load on a pitching and rolling deck to a designated area within a safe parking zone. The CVCC is capable of operating without loss of capabilities during moderate sea conditions. Refer to table 7-2 for the leading particulars of the A/S32A-35A.

The CVCC has a main hoist lifting speed of 0 to 60 feet per minute (unloaded) and 0 to 20 feet per minute (maximum load). The maximum travel speed is 5 mph (unloaded) and 3 mph (with a load). All NAVAIR crane operators must have a valid stated drivers license, complete phase one operating procedures (40 hours), phase two (10 hours) of OJT under a qualified operator, maintain a current annual physical, and have a support equipment license.

To check for proper operation of the CVCC once the engine is started, make sure of the following operating ranges:

- ENGINE IDLE: 900-1,000 RPM
- ENGINE WATER TEMPERATURE: 160°-185°
- ENGINE OIL PRESSURE: 50-70 PSI
- DC VOLTMETER: Reads in the green range
- BRAKE PRESSURE: 65-90 PSI

Once the throttle is switched to RUN, the engine operating speed should be between 1,800-2,100 rpm's and the AC voltmeter should read 460 VAC. For specific information concerning the CVCC, you should refer to NAVAIR 19-25G-19, *Technical Manual, Aircraft Crash Handling and Salvage Crane*, A/S32A-35A.

Table 7-2.—Leading Particulars of the A/S32A-35A Crash Crane (CVCC)

Boom height (at 17.5' rated outreach)	33.5 feet
Width	16 feet
Length (minus boom)	34 feet
Boom length	28.5 feet
Turning radius	35 feet
Ground clearance	9 inches
Basic weight	133,500 pounds
Auxiliary hoist maximum lifting capacity	10,000 pounds
Main hoist maximum lifting capacity	75,000 pounds
Fuel capacity	60 gallons (diesel/JP-5)
Tire pressure	38 PSI (Nitrogen)

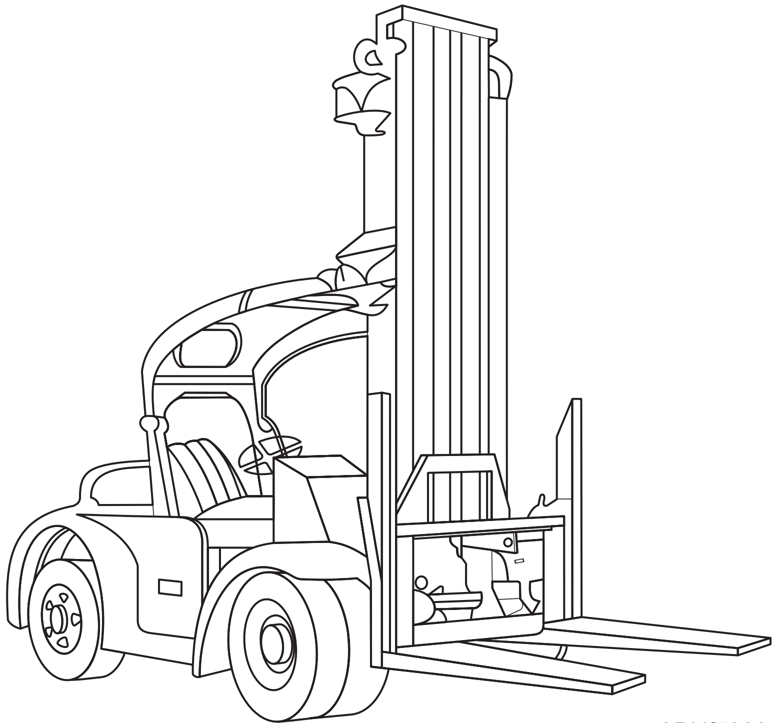


Figure 7-3.—Crash forklift (20-K).

CRASH FORKLIFT (20-K)

The crash forklift normally used for CV salvage operations (fig. 7-3) has a maximum safe lifting capacity of 20,000 pounds at 24-inch load centers. Occasionally a 15,000-pound-capacity forklift may be used on CVs or amphibious aviation ships. The driver/operator must be aware of equipment limitations as well as appropriate lifting points for aircraft.

The crash forklift is used to partially lift aircraft in certain situations. It is highly maneuverable and most useful in those salvage operations that involve the damage or collapse of one landing gear. Forklifts are rated to a maximum safe weight lifting capacity. The easy maneuverability of the forklift makes it most useful when it is necessary to speedily lift only a portion of the aircraft at one time.

This essential piece of salvage equipment should be used only for the work it was designed for, and at all times, only by qualified operators.

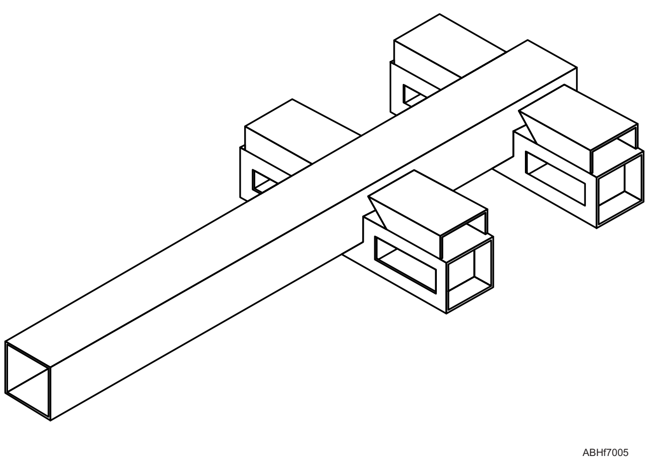


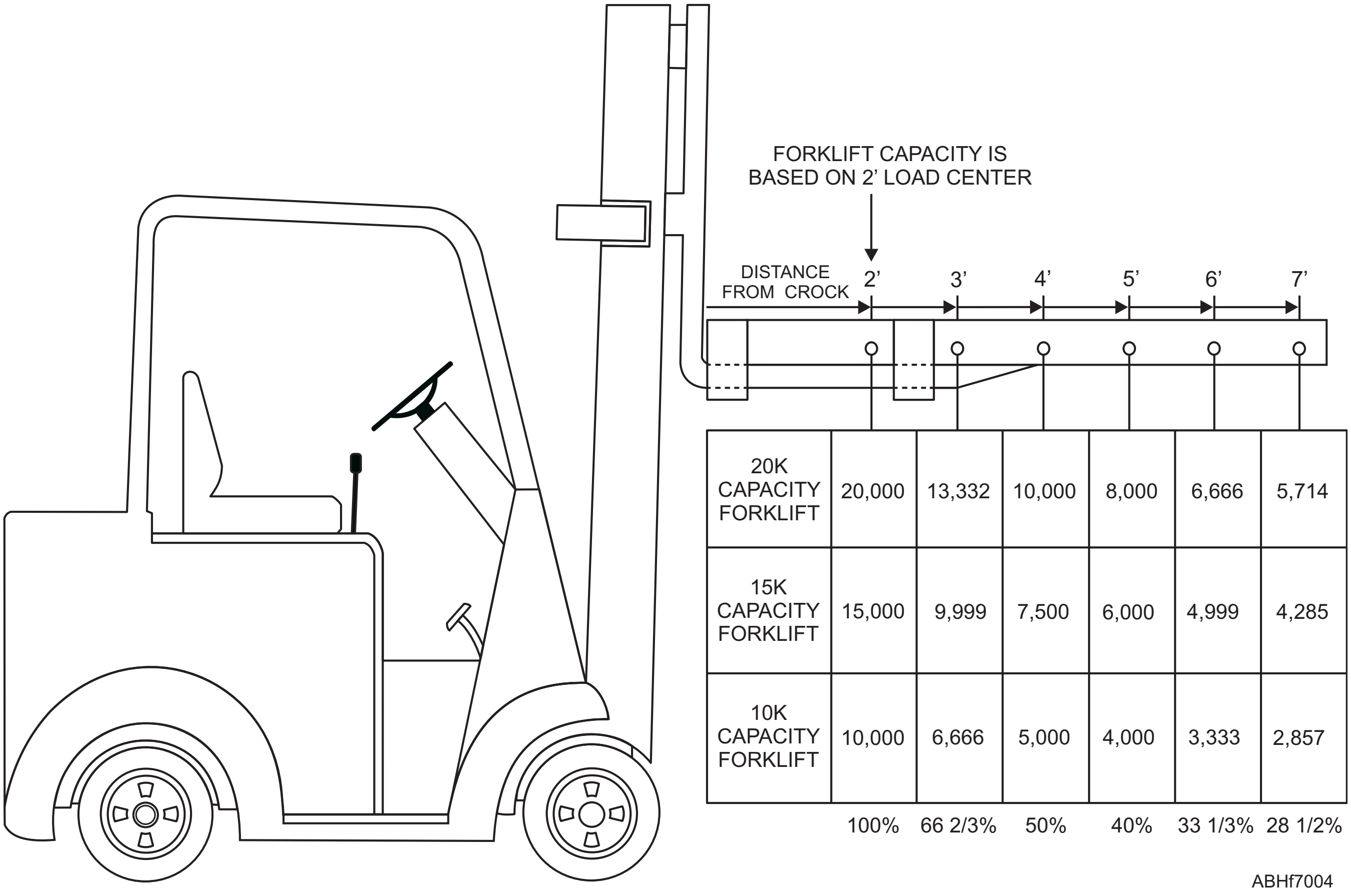
Figure 7-4.—Forklift boom adapter.

HANGAR DECK SALVAGE FORKLIFT

A 15,000-pound lift capacity forklift shall be maintained on the hangar deck.

FORKLIFT BOOM ADAPTER

A forklift boom adapter (fig. 7-4) is designed to add extension to the length of the forklift's tine when partial lift of the aircraft is required. The rated capacity of the boom adapter will vary depending on the location of load center on the boom (fig. 7-5). The boom adapter is used with a crash forklift to prevent further structural damage to the crashed aircraft during lifting operations. You should refer to NAVAIR 00-80R-19, *NATOPS U.S. NAVY Aircraft Crash & Salvage Operations Manual (Afloat)* for further information concerning fabrication,



	2'	3'	4'	5'	6'	7'
20K CAPACITY FORKLIFT	20,000	13,332	10,000	8,000	6,666	5,714
15K CAPACITY FORKLIFT	15,000	9,999	7,500	6,000	4,999	4,285
10K CAPACITY FORKLIFT	10,000	6,666	5,000	4,000	3,333	2,857
	100%	66 2/3%	50%	40%	33 1/3%	28 1/2%

Figure 7-5.—Forklift weight capacity chart.

inspection, and testing the adapter. The forklift boom adapter must be load tested annually.

The forklift boom adapter can be inserted under ordnance pylon stations, jack points, or other structurally strong aircraft members. See figure 7-6. Care should be taken to place the fingerboom under a section of the aircraft that can sustain the weight without damage.

AIRCRAFT CRASH DOLLIES

Aircraft carriers are provided with a total of four aircraft crash dollies, which are used in moving crashed

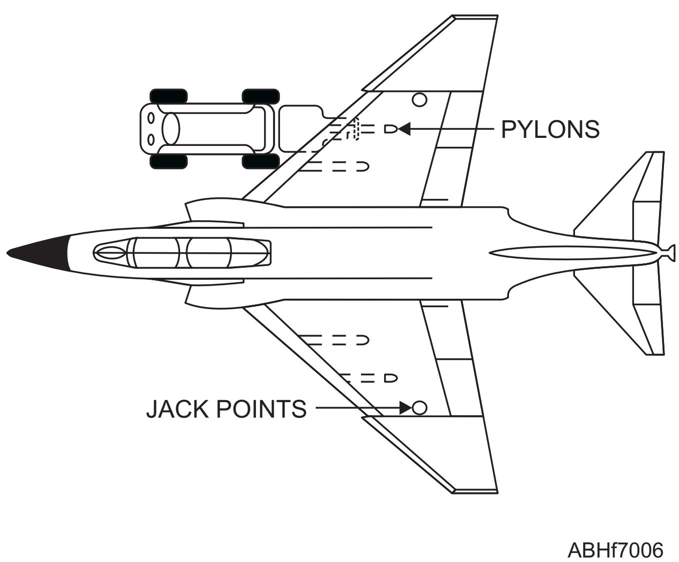


Figure 7-6.—Forklift position.

or immobile aircraft or heavy components (fig. 7-7). The dollies are capable of supporting a 32,000-pound load. Each carrier also has two adapters to be used in conjunction with the crash dollies. One adapter features a concave centerpiece and the other adapter is flat, allowing for a variety of options when support is needed on the fuselage or wing surface. A crash dolly can be configured many different ways to meet the demands of each salvage operation. An assortment of metal pallets, padding, and banding material is maintained to build different height variations for numerous types of salvage operations. Aircraft must be secured to the aircraft crash dolly with appropriate length nylon straps and securing lines. See figure 7-8.

AIRCRAFT TAILHOOK DOLLY

The tail hook dolly enables handling and salvage crews to expeditiously move an aircraft suffering from a malfunctioning tailhook mechanism. A standard tail hook dolly has been developed with a rated capacity of 400 pounds (see figure 7-9). To ensure proper fabrication of the tail hook dolly, order Tail Hook Dolly drawing 1359AS500 and all associated drawings from the Naval Air Warfare Center, Lakehurst, NJ.

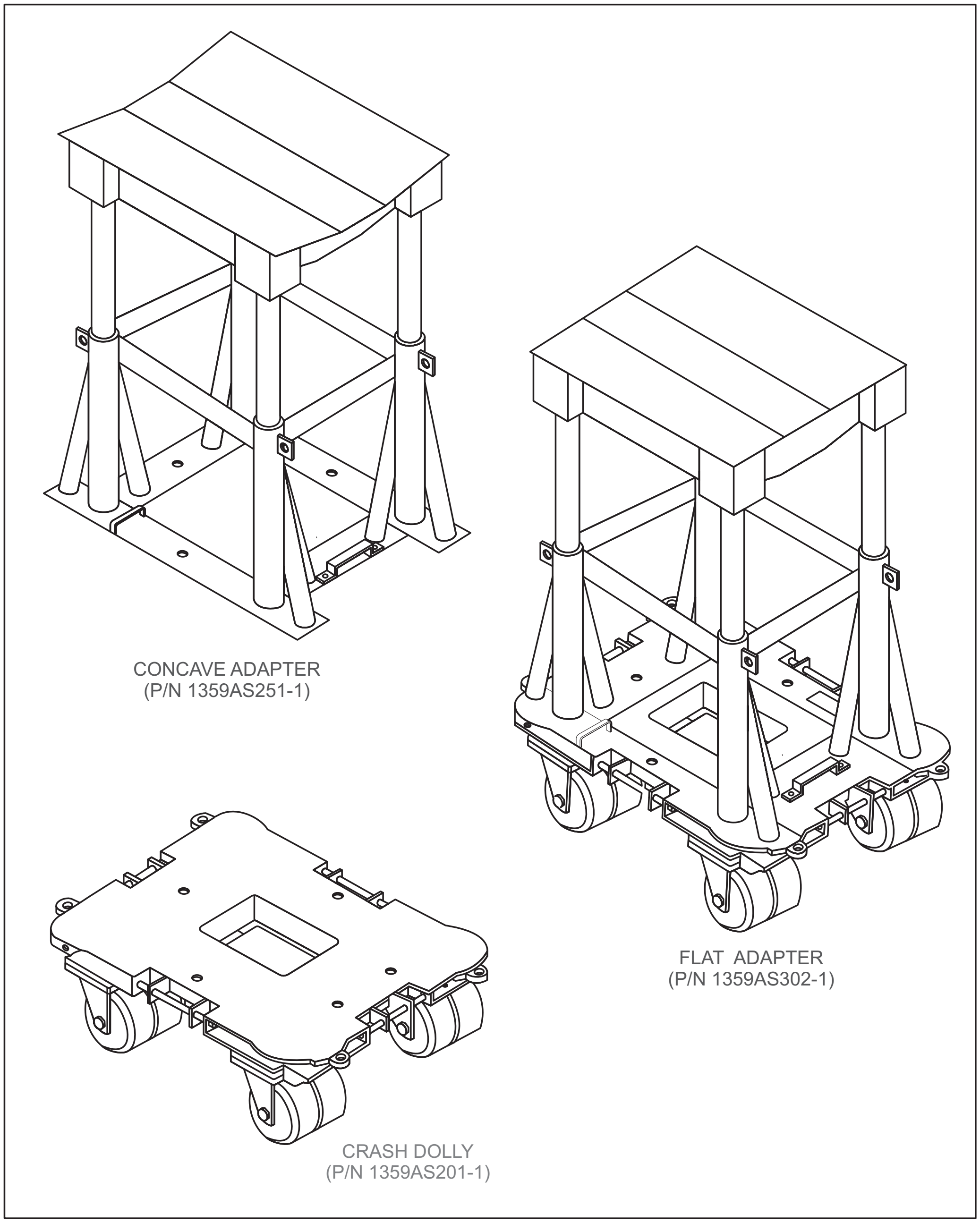


Figure 7-7.—Aircraft crash dolly.

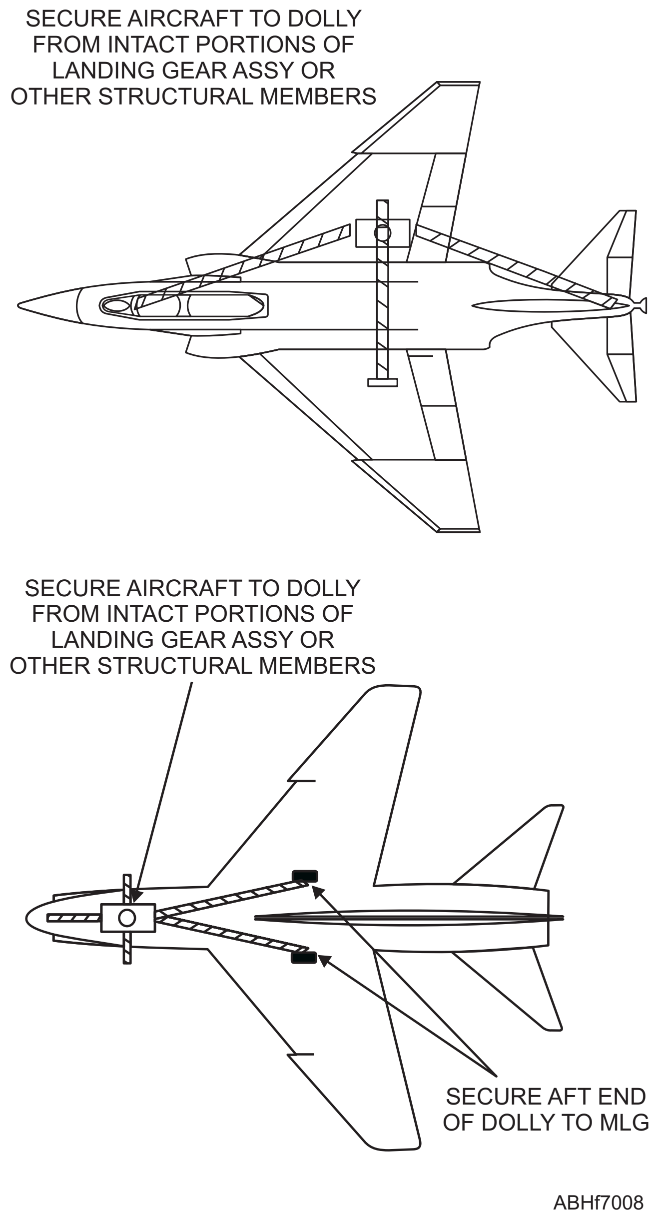


Figure 7-8.—Positions for securing crash dolly.

ADDITIONAL EQUIPMENT USED FOR HANDLING CRASHED AIRCRAFT

Other equipment used in the handling of crashed aircraft on the flight decks of carriers include the following:

- Automotive-type jacks and skid plates
- Tractors
- Blocks and tackle, wire straps, 24-thread manila line, and safety line
- Emergency cutting and forcible-entry tools
- Hoisting slings and improvised slings

EQUIPMENT AND TOOLS USED IN AIRCRAFT SALVAGE OPERATIONS

The equipment described in this section is typically available to the crash crew. Included are items furnished through initial outfitting lists, items available through the supply system, and some items that are designed and manufactured locally.

It is not intended that this section represent an all-inclusive allowance list, but rather that it provide the crash and salvage team a consolidated listing of the equipment and tools that could be used in the salvage operations addressed in this NRTC.

Provisioning of crash and salvage equipment is a responsibility shared by the individual ship and the Naval Air Systems Command. Information regarding the acquisition and/or logistics of this equipment may be found in the *U.S. Navy Aircraft Crash and Salvage Operations Manual (Afloat)*, NAVAIR 00-80R-19.

Universal Crash Handling Slings (Bellybands)

Universal aircraft fabric hoisting slings are required for salvage operations when it is not feasible to safely install a standard aircraft-hoisting sling. Crash and salvage units are required to manufacture eight fabric-hoisting slings. *U.S. Navy Aircraft Crash and Salvage Operations Manual (Afloat)*, NAVAIR 00-80R-19, explains how to make up your own slings. The required lengths of the bellybands are two 20-foot slings, two 30-foot slings, two 40-foot slings, and two 50-foot slings. Color coating the end hardware pieces of the bellybands can prove to be an effective way of easily identifying the length of a particular sling. The E-28 shore base arresting gear tapes is used in the

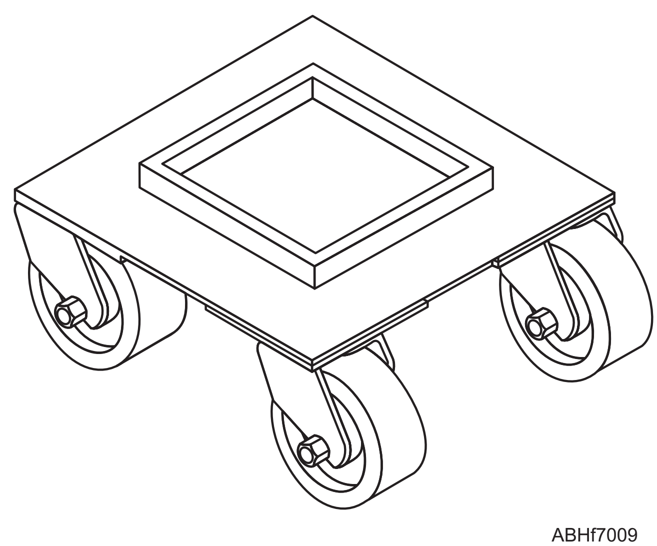


Figure 7-9.—Tail hook dolly.

manufacture of the hoisting slings (fig. 7-10). Used, but serviceable E-28 nylon tape may be obtained through Navy salvage yards, or new nylon tape may be purchased through the Navy supply system. The lifting eye is locally manufactured of five-sixteenths of an inch steel plate, type 4130.

NOTE

Used nylon tape should be inspected to ensure its condition is satisfactory for service. There is no published load test data for used nylon tape. Breaking strength of new E-28 tape is 150,000 pounds. Exposure to weather causes an estimated 20 percent reduction in strength. A working load limit of 50 percent of the breaking strength of new tapes or 50 percent of the estimated breaking strength of used tapes is suggested. The use of E-28 tapes is recommended.

Fabric hoisting slings manufactured from E-28 nylon tapes should be *replaced* as follows:

1. New nylon tapes must be replaced after 6 years, even if no wear or damage is apparent.
2. Used nylon tapes must be replaced after 3 years' service as a bellyband.
3. Nylon tape that is cut or torn 1/4" or greater at any location, or webbing that is frayed or abraded where the broken threads (not merely fuzzy) are visible.

Each sling should be marked with the following minimum items of identification:

1. Maximum load capacity.
2. Strike date (latest date the item must be removed from service).
3. Local serial number (for accountability).

Spreader Bars

Spreader bar(s), as depicted in figure 7-11, suspended from the crane hook and to which slings can be attached may serve to prevent additional damage to the aircraft. Any of the three spreader bar installations may be used, depending upon the aircraft configuration and the distance between fore and aft structural bulkheads. The decision should be based on which will incur least damage to aircraft and provide best stability.

Torque Wrench

The torque is a precision tool consisting of a torque-indicating handle and appropriate adapters or attachments. It measures the amount of turning or twisting force applied to a nut or bolt, in inch- or foot-pounds. Certain aircraft hoisting slings require torque values applied to hook-up points. The torque values must be accurately applied to successfully hoist the aircraft. Refer to NAVWEPS 17-1-108 for specific instructions.

For more detailed information on torque wrenches, you should refer to chapter 1 of this NRTC.

Aircraft Jacks

Figure 7-12 shows the different types of hydraulic jacks that are provided for maintenance support of carrier-based aircraft. The type and capacity of the

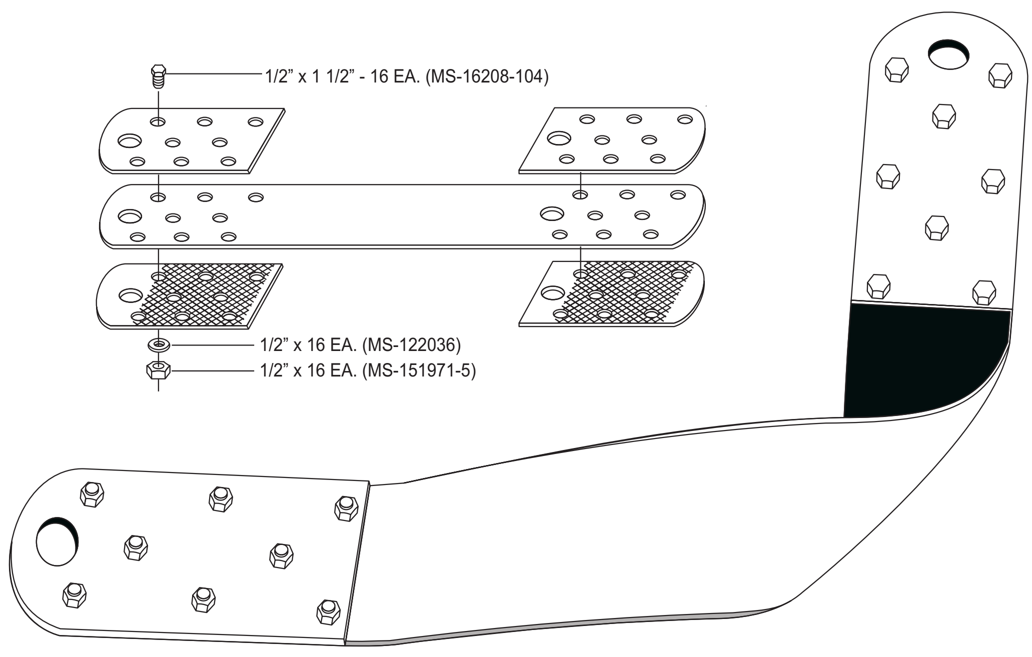
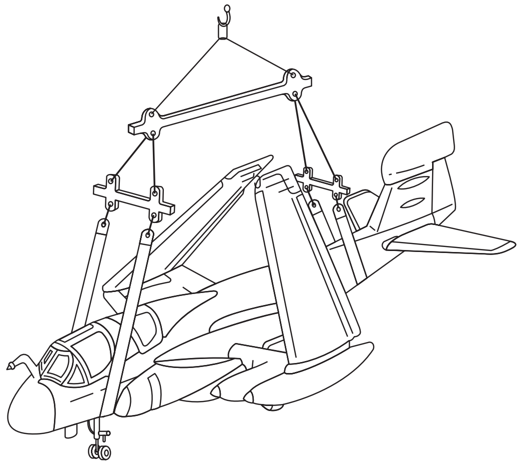
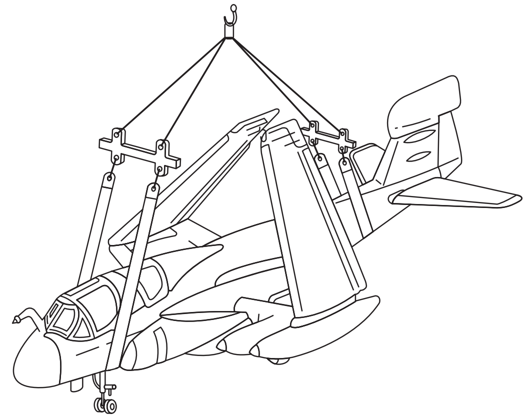


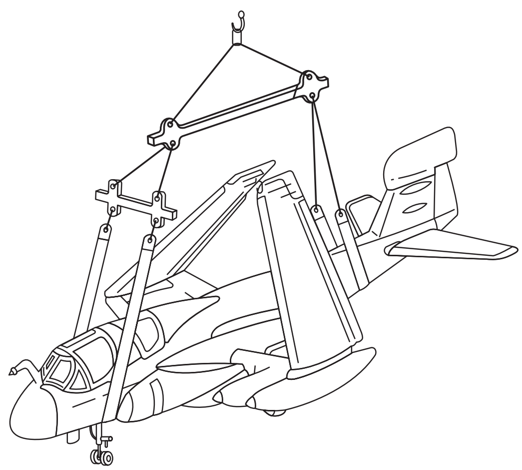
Figure 7-10.—Universal aircraft fabric hoisting slings (bellybands).



LONGITUDINAL AND ATHWART SHIP SPREADERS
(Maximum cradling effect with minimum damage potential)



ATHWART SHIP SPREADERS WITH BELLYBANDS
(Reduces compression of fuselage)



LONGITUDINAL SPREADER WITH BELLYBANDS
(Keeps bellybands in position and away from flaps, etc.)

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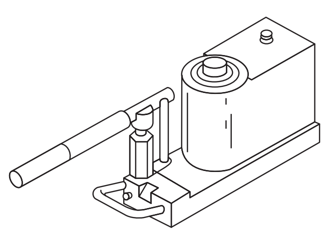
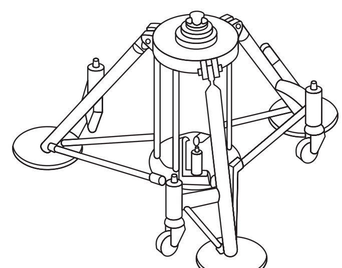
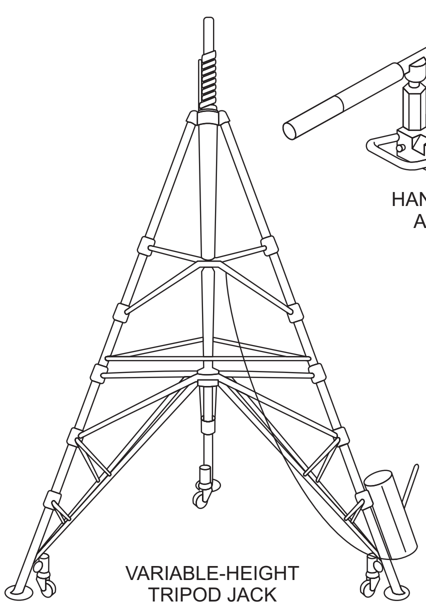
Figure 7-11.—Spreader bars; longitudinal and athwartship spreaders.



HAND-CARRIED
AXLE JACK



FIXED-HEIGHT
TRIPOD JACK



VARIABLE-HEIGHT
TRIPOD JACK

TYPE	CAPACITY
VARIABLE-HEIGHT TRIPOD JACK	5-TON 10-TON 12-TON 20-TON 30-TON
FIXED HEIGHT TRIPOD JACK	10-TON
HAND-CARRIED AXLE JACK	5-TON 10-TON 15-TON 17-TON

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Figure 7-12.—Aircraft jacks.

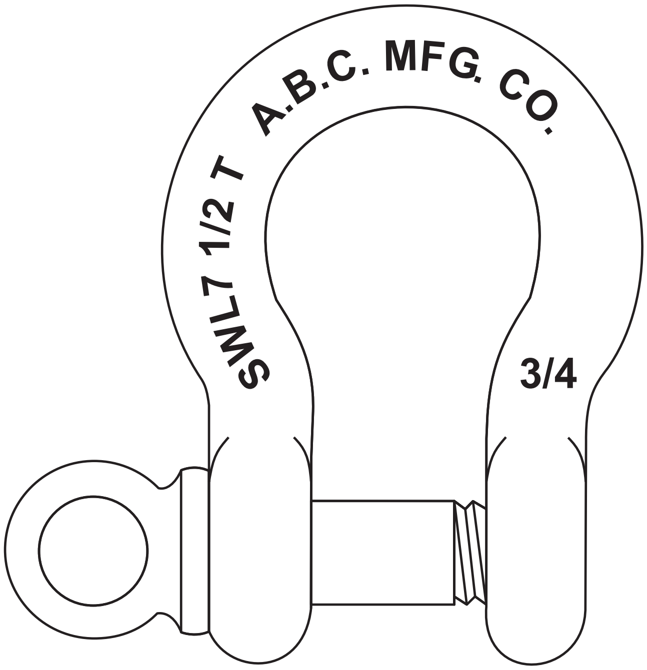


Figure 7-13.—Screw pin anchor shackle.

jacks furnished for a given carrier depend upon the type of aircraft assigned. Not all of the jacks shown in figure 7-12 are necessarily furnished on each carrier. You should refer to NAVAIR 19-70-46 for the complete index.

Screw Pin Anchor Shackle

The screw pin anchor shackle is used by personnel of the ABH rating in various sizes for crash and salvage and other uses. See figure 7-13.

Each shackle body are permanently and legibly marked, in raised or stamped letters on the side of the shackle bow, with an identifying manufacturer's name or trademark, the shackle size, and the recommended safe working load. Grade regular-strength shackle pins and bolts are unmarked, and are *not* authorized for crash and salvage use. Grade B high-strength shackle pins is marked with the raised or stamped letters "HS" on the head.

WARNING

There have been repeated cases of the use of screw pin shackles with the pin welded to the shackle bail. Shackles are forged steel, and welding to forged steel can reduce the strength of the shackles by 30 percent. Never weld anything on a shackle.

For more information on the screw pin anchor shackle, refer to the *U.S. Navy Aircraft Crash and Salvage Operations Manual (Afloat)*, NAVAIR 00-80R-19.

Wire Ropes

Wire ropes that are required for salvage operations are fabricated in a variety of lengths and sizes. You should refer to chapter 1 of this NRTC and to *U.S. Navy Aircraft Crash and Salvage Operations Manual (Afloat)*, NAVAIR 00-80R-19, for more details. Additionally, valuable information concerning proper handling and safety, care and preservation, and terminology of wire rope is found in Naval Ships' Technical Manual, Chapter 613, *Wire and Fiber Rope and Rigging.*

Forcible Entry Saw (Gasoline)

The forcible entry saw (gasoline), equipped with metal cutting blades, is capable of cutting catwalks, life jacket lockers, and other metal obstructions that interfere with aircraft salvage operations (fig. 7-14). These forcible entry gasoline-powered handsaws are air-cooled, 4 1/2 or 6 1/2 horsepower, single-cylinder, two-cycle engines that provide consistent, dependable power. Adequate fire prevention measures must be taken, and standby fire protection should always be at hand when the forcible entry saw is operated. Qualified operating personnel are required to operate this piece of salvage equipment. Three types of blades are available: abrasive, diamond, and carbide tip. Additionally, ten spare saw blades for each portable saw should be maintained to support crash and salvage operations.

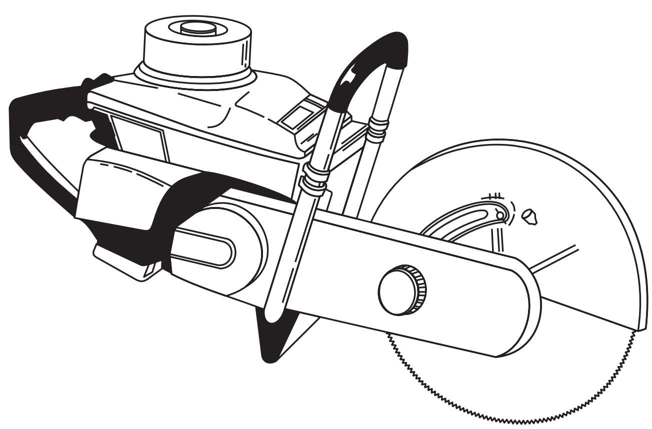


Figure 7-14.—Forcible entry gasoline saw.

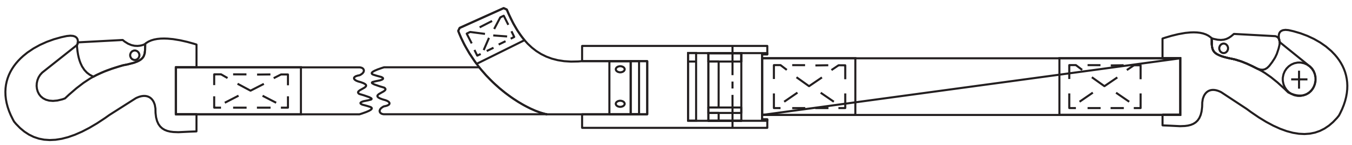


Figure 7-15.—Crash handling tiedown.

When flight quarters is sounded, crash and salvage team personnel ensure that crash fire fighting, rescue, and salvage equipment and materials are ready for instant use. Each person checks and mans certain items of this equipment.

When a crash occurs, the overall supervision and direction of salvage operations is the responsibility of the crash and salvage officer (Air Boatswain). This person is further responsible for the safety of all personnel involved in salvage operations.

During prelaunch starts, checkouts, and launches on ships with two mobile firefighting vehicles (MFFVs) operational, one MFFV is positioned at a location that provides the best view of the FLY 2 area and the bow catapults. The second MFFV is positioned at a location that provides the best view of the FLY 3 area and the waist catapults.

During prelaunch starts, checkouts, and launches on ships with one MFFV operational, the MFFV is positioned at a location that provides a view of the largest number of aircraft.

These units are positioned, manned, and running from the time "start engines" is announced until the launch is completed.

Crash Handling Tiedown (P/N 1359AS195-1)

Crash handling tiedowns can be used with crash dollies and other crash equipment (fig. 7-15). During crash and salvage operations, when an aircraft must be moved with a crash dolly, crash handling tiedowns are used to secure the dolly to the aircraft. Each tiedown has a 10,000-lb. capacity and is constructed of webbing material. These tiedowns have a ratchet-type tightening mechanism with an end fitting and are adjustable from 10 to 30 feet.

Universal Salvage Harness (P/N 1359AS600-1)

The universal salvage harness (fig. 7-16) can be used in particular salvage situations, such as partially lifting a fixed-wing aircraft by the nose or wing tip areas. The harnesses are constructed of woven polyester and are approximately 9 feet long and 5

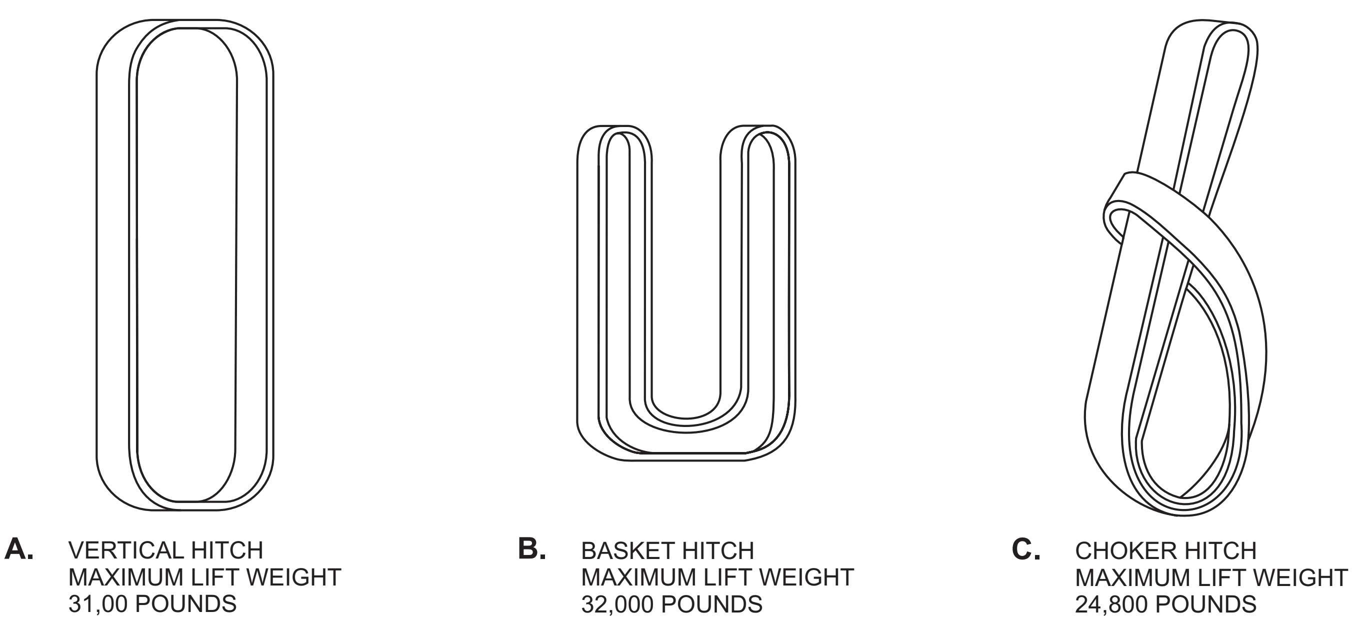


Figure 7-16.—Universal salvage harness.

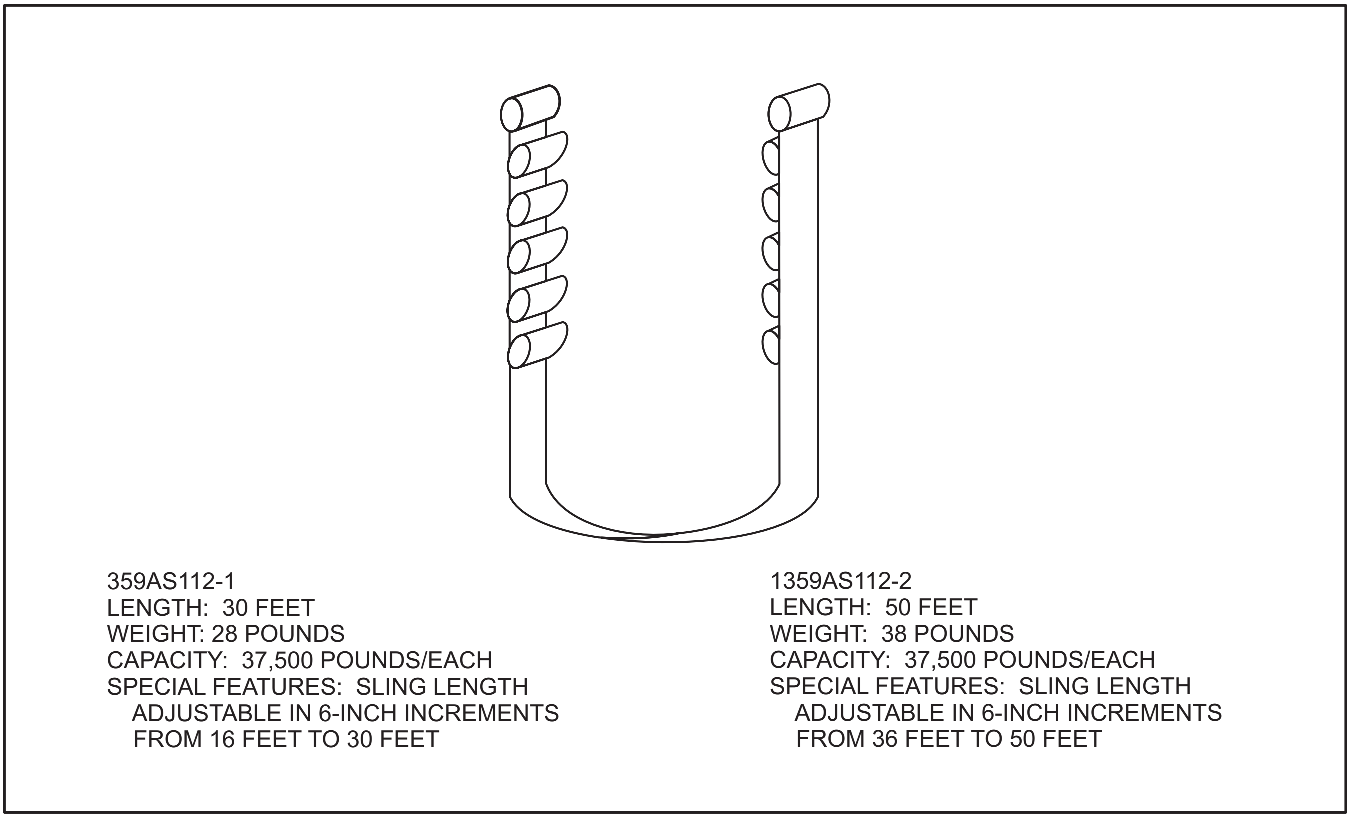


Figure 7-17.—Webbing sling.

inches wide. A universal salvage harness consists of a set of five endless-loop grommets.

Webbing Slings

The webbing slings are used in pairs when a manufacturer's sling cannot be used (fig. 7-17). These slings have 14 loops that can be adjusted in order to achieve a desired length. The webbing slings come in two standard lengths, 30-foot (P/N 1359AS112-1) and 50-foot (P/N 1359AS112-2). The maximum lifting capacity of each webbing sling is 37,000 pounds.

Universal Aircraft Wheel Ramp (P/N 1359AS800)

The universal aircraft wheel ramp (fig. 7-18) can be used to raise the height of aircraft jacking points in situations when a main landing gear tire is deflated. The wheel ramp should be manufactured in accordance with the appropriate NAVAIR drawing package. The maximum weight capacity of the wheel ramp is 32,000-lbs. (based on the load of one mainmount).

Crash Lockers and Crash Inventory

Each CV/CVN aircraft carrier has a crash locker and crash inventory. They contain the firefighting/ rescue tools and equipment required to be used in emergencies. These tools and equipment are inspected daily before flight operations. They are as follows:

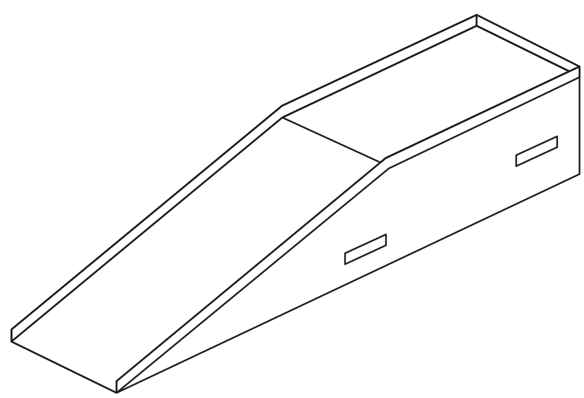


Figure 7-18.—Universal aircraft wheel ramp.

1. Aluminized fire-protection suits (12 complete sets). A backup ready stock of four aluminized fire protection suits shall be maintained.
2. Four Halon 1211, CO_2, or PKP and three fresh water portable extinguishers.
3. Special tools required for hoist panel removal. Two each 3/8-inch speed handles with various Reed and Prince, Phillips, and high-torque screw adapters and other tools unique to the type of aircraft embarked.
4. A crash and rescue tool inventory containing the following equipment. Table 7-3 refers to the remaining tool inventory requirement for crash crews:

   One pair of cable cutters (14-inch).

   One side-cutting pliers (10-inch).

   One 10K port-a-power jack.

Table 7-3.—Crash and Salvage Tool Requirements

ITEM	QTY
Ball Peen Hammer (1-1/2 lb.)	1
Bolt Cutters	1
Prybar (36-inch)	1
Prybar (60-inch)	1
Drift Punch	1
Fire Axes	2
Flashlights, Safety	2
Grapple Hooks with Chain, 4-lb.	1
Group Locks for Each Type Aircraft Assigned	1 Set
Halligan Tool	1
Hack Saws	2
Hack Saw Blades (Spares)	12
Megaphone, Battery Powered	1
Pinch Bar (26-inch)	1
Pliers (6-inch)	1
Pliers (10-inch)	1
Portable Oxygen Acetylene Cutting Kit	1
Saw. Portable Forcible Entry with Spare Blades	1
Screwdriver (8-inch) Reed and Prince	1
Screwdriver (12-inch) Reed and Prince	1
Speed Handles (3/8-inch with various Reed and Prince, Phillips and high torque screw adapters)	2
Socket Set, 1/2-inch drive	1
Torque Wrench (150-190 lb. ft.)	1
V-Blade Rescue Knives	2
V-Blade Knife Blades	12
Wire Cutter (14-inch)	1
Welding Kit, Portable	1

   Minimum of six safety harnesses.

   Minimum of six positive-pressure self-contained breathing apparatus with six spare air bottles.

   Minimum of six kapok-filled life jackets.

Q3. What is the A/S32A-35A?

Q4. How many aircraft fabric-hoisting slings are crash and salvage units required to maintain?

Q5. What is the working capacity of the crash handling tiedown strap?

PERSONNEL RESCUE

OBJECTIVES: Identify proper procedures for conducting a rescue. Recognize the standard equipment used for crash rescue.

RESCUE

The rescue of occupants from a crashed or disabled aircraft is a highly technical profession. Working in and around crashed or burning aircraft is a highly specialized task. The prerequisites for assignment to duties as a rescue person include alertness, courage, dedication, agility, physical strength, and the ability to be a meticulous team worker. *Rescue teams shall consist of at least two persons per team.*

The primary duty of a rescue team is to save the lives of the aircrew and passengers of disabled aircraft, as directed by the crash officer or scene leader. Until it is established that there is no further hazard to or potential for loss of life, such as ordnance cook-off, rescue shall be accomplished concurrent with other on-scene emergency functions.

Training and preplanning for emergencies is extremely important. However, each aircraft incident presents its own particular problems. The crash and salvage officer, the scene leader, and rescue personnel will each make decisions on the scene based on training and experience.

Because of the hazards to life, ordnance cooling is the very first priority of the aircraft firefighting and rescue crews.

WARNING

- All air-launch weapons exposed to a fire can cook off either during the fire or after it is extinguished. The fire duration and the type/location of the weapons determine the reaction severity that may occur.

- In an aircraft fire, the ordnance handling officer/air gunner confirms the type, quantity, and location of all weapons on the aircraft involved and immediately provides this information to the scene leader. The scene leader must ensure that AFFF is continuously applied to all weapons exposed to fire. Water hose lines should not be used for ordnance cooling until after the fire is extinguished. The use of water hose lines for ordnance cooling may delay extinguishment, because of the tendency of water to dilute or wash away the AFFF blanket. Post-fire ordnance cooling (AFFF or water) must continue for a minimum of 15 minutes to allow the weapon cases to return to safe ambient temperatures.

When the aircraft is on fire, a rescue path must be made by the fire fighters prior to approaching the aircraft. Since the rescue of personnel in a crash is normally the first objective of the rescue crew, AFFF nozzles must be trained on the cockpit area and other crew stations to protect the plane crew until a rescue can be accomplished. Upon the direction of the crash officer or scene leader, the rescue team moves into the aircraft to accomplish the rescue. Aluminized suits protect the rescue personnel. Rescuemen should approach the aircraft with regard for danger areas. If the aircraft is actually on fire, these personnel must be protected with AFFF from the fire.

WARNING

You should NEVER spray personnel who are wearing firefighting suits while they are working on a fire or when they come out of one. Spraying will generate steam; therefore, personnel might be scalded.

Whenever possible, access by means of door openings or hatches should be used when you are rescuing flight crew personnel from crashed aircraft. These door openings and hatches may be opened from both inside and outside the aircraft. Emergency escape exits are also provided. Cockpit canopies and emergency escape hatches are equipped with normal and emergency entry and release mechanisms. These release mechanisms may be operated from both inside and outside the aircraft.

If conditions permit, enter the aircraft through the normal accesses, for example, doors, hatches, and canopies. This provides the most effective and expeditious entrance into the aircraft.

If, because of structural or other damage, normal accesses cannot be made, emergency entry methods may be used. All canopies, escape doors, and hatches are equipped with emergency jettison or release mechanisms. The locations and means of opening accesses for specific aircraft are included in the appropriate crash crew information diagrams (CCIDs), Appendix A through F, in the *U.S. Navy, Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1.

Portable, explosion proof, electric power saws are provided as part of the crash equipment. They are used in cutting emergency accesses in the aircraft's fuselage. Cuts should be made between major structural members. Points at which to cut are sometimes marked and labeled on the fuselage of the aircraft.

The presence of oxygen in aircraft is a serious fire hazard. Every precaution must be taken to protect the equipment from damage during forcible entry. If possible, it should be protected from exposure to heat. You, as a crash crewmember, should be familiar with the location and operation of oxygen master control valves. If possible, shut these valves off during rescue and firefighting operations.

The release of free oxygen during a fire results in extreme acceleration of burning and great intensity of heat. Liberation of oxygen during crash fires also results in the rapid spread of fire and resistance to extinguishing agents.

A part of every crash crewmember's fund of general information should include the size of the aircrew likely to be found on the various types and classes of aircraft as well as their probable flight stations. Some types of fighter and attack aircraft carry only the pilot. Others, including certain utility aircraft, may carry two, three, or four flight-crew members.

WARNING

- When you are removing personnel from the cockpit of a propeller-driven aircraft, you, as a rescue person, FACE the direction of the spinning propellers.
- When you are removing personnel from the cockpit of jet aircraft, you, as a rescue person, FACE AFT to lessen the chance of firing the ejection seat or being injured if the seat inadvertently fires.

When you are accomplishing a rescue, follow these basic procedures:

1. Secure the seat ejection system by using the "head knocker" or inserting a safety pin.
2. Remove the pilot's oxygen mask to prevent suffocation when the oxygen hose is disconnected. See figure 7-19.
3. Place the oxygen switch in the OFF position. You should study the CCIDs of the appropriate aircraft as to cockpit arrangement and emergency situation procedures.

For general ejection seat information, you should refer to the *NATOPS, U.S. Navy, Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1.

Upon gaining access to the cockpit, you must make certain to shutdown the aircraft engines. Rescue personnel must be familiar with engine shutdown procedures. This will prevent further injury to personnel or damage to equipment.

As soon as the crewmembers are reached, open their pressure suit helmet faceplates or unlock their oxygen masks, depending upon the type of flight gear they are wearing. This eliminates any possibility of the crewmembers suffocating from the lack of oxygen because of damaged oxygen systems or disconnected hoses. See figure 7-19.

NOTE

Pressure in the facemask will start movement when the wings are compressed.

Specific instructions for each aircraft on the release of personnel from seat restraint devices are contained in the NATOPS, *U.S. Navy, Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1 and the *NATOPS, U.S. Navy, Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14.

Stretcher-bearers should be readily available with their stretchers for the removal of personnel injured in crashes. These personnel are moved from the crash scene under the supervision of the medical officer and his assistants. All personnel involved in aircraft crashes must be examined by the medical officer. For detailed information on emergency aircraft entry and standardized rescue procedures, you should study the *NATOPS, U.S. Navy, Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1.

WARNING

DO NOT DISCONNECT OXYGEN HOSE OR SET OXYGEN SWITCH TO "OFF" BEFORE REMOVING CREW MEMBER'S FACE MASK

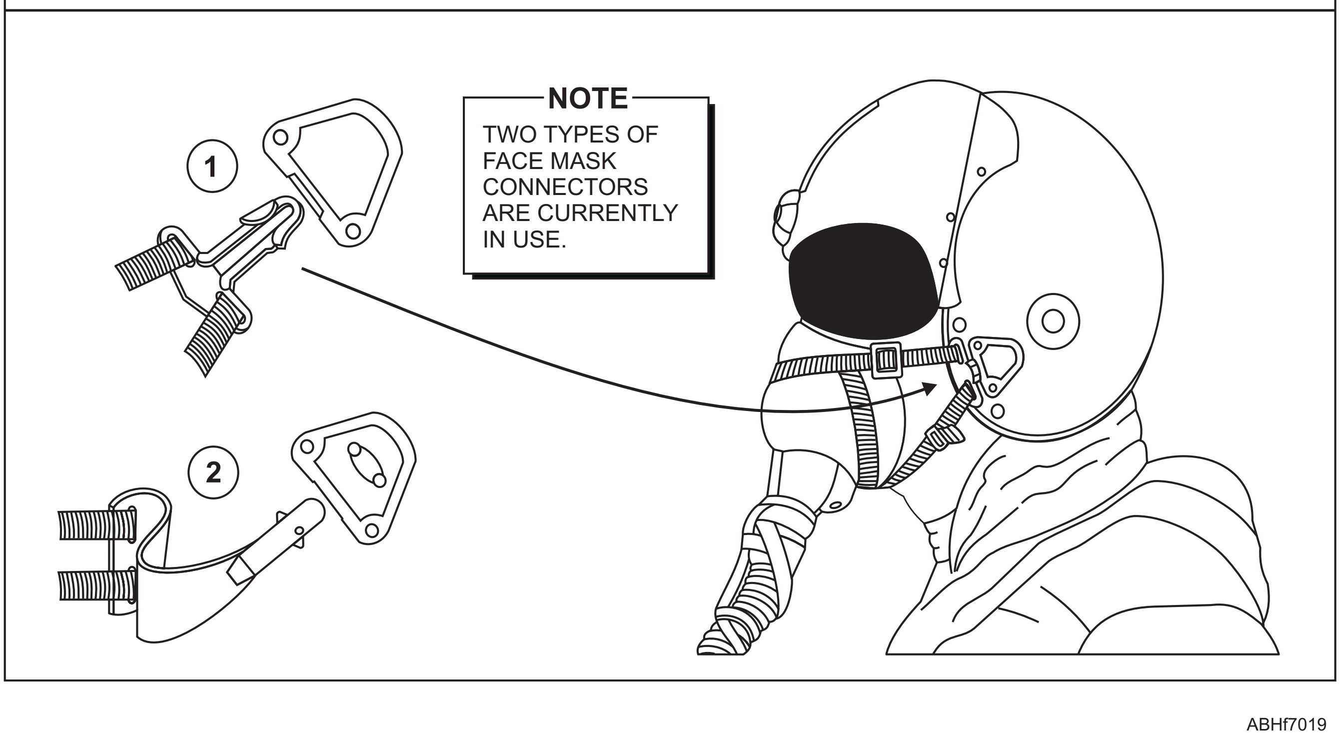


Figure 7-19.—Facemask connectors.

AIRCRAFT RECOVERY

On ships with two MFFVs operational, one MFFV is positioned so that a downwind approach can be made to the landing area. The other is positioned in the FLY 1 area, remaining upwind of the most forward positioned aircraft, during refueling or rearming evolutions.

On ships with one MFFV operational, the MFFV is positioned in the FLY 2 area, with a clear approach available to the landing area.

The forklift, as well as the mobile crane, should be manned and started at the aircraft recovery phase of flight operations, and remain in a ready condition throughout this period.

These units are manned and running from commencement of recovery until recovery is complete.

The primary fly control officer (air officer or his assistant) sounds the crash alarm and announces "crash on the flight deck" over the 5MC announcing system.

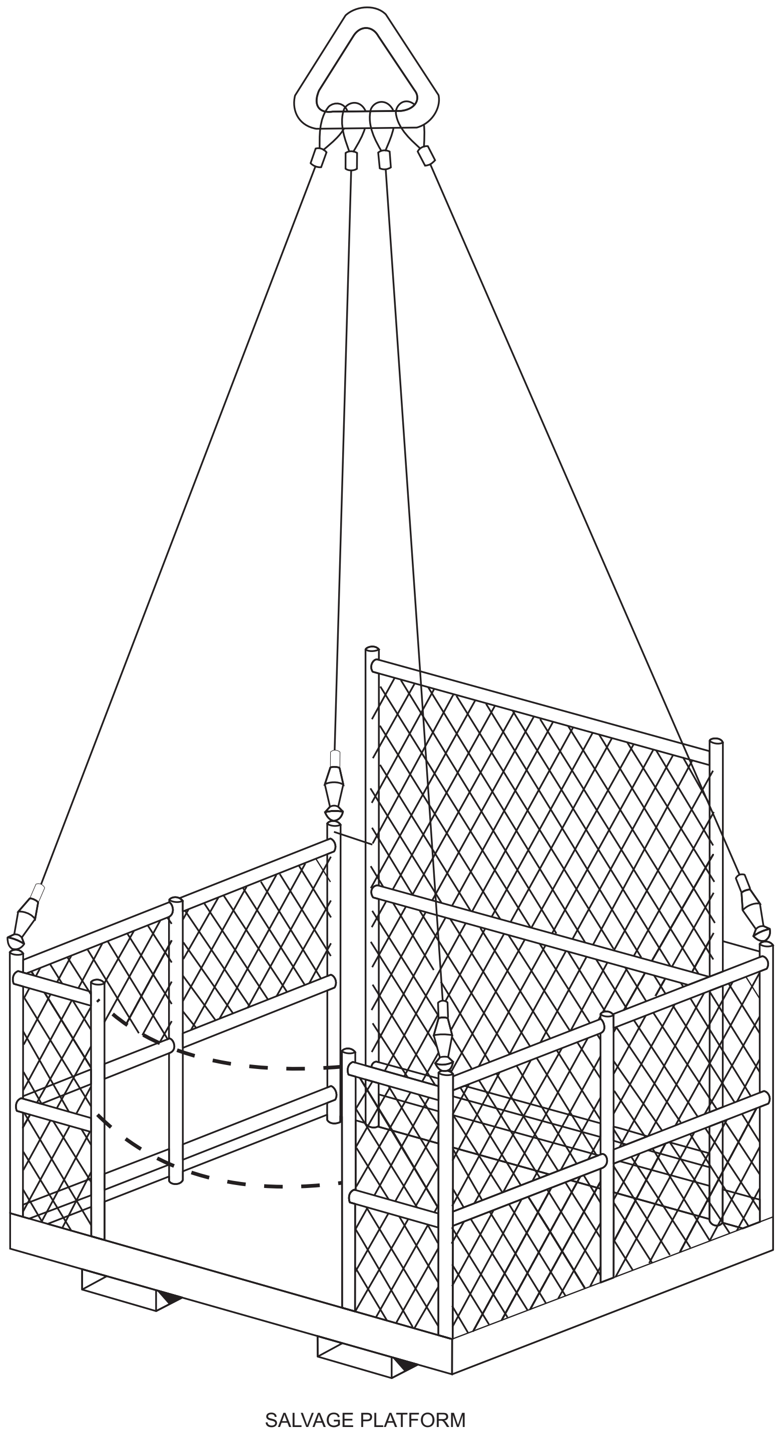


Figure 7-20.—Salvage platform with sling.

Whenever a crash occurs or when, in his opinion, a crash is imminent, the crash and rescue team personnel must carry out the following functions:

1. Provide expeditious removal of the crew from the crash.
2. Provide an adequate amount of firefighting equipment ready for immediate use until the danger of fire has passed.
3. Isolate the crash to minimize the danger of fire spreading to other aircraft. Only for reasons of operational necessity is the wreckage ever jettisoned.
4. Extinguish all fires.
5. Clear the flight deck of wreckage. The wreckage may have to be jettisoned because of the existing tactical situation, shortage of fuel in other planes in the air, or threatening low visibility conditions. When possible, assistance should be rendered in collecting debris for use by the aircraft-reporting custodian in making investigations and reports.
6. Make minimum necessary repairs to the flight deck so that flight operations may be continued.

Availability and Use of Equipment

Primary and ancillary crash equipment must be available at all times during flight operations. The crash and salvage leading petty officer ensures that all necessary tools and equipment are immediately available at the crash scene.

As a general rule, landing area crashes involving the damage or collapse of one landing gear will be salvaged by use of the forklift. Crashes involving more than one landing gear and those situations involving aircraft in the catwalk are handled with a crane and sling. Equipment positioning for salvage operations varies with each situation and aircraft model, and should be accomplished in accordance with locally developed procedures. In every instance, the salvage officer or his designated representative supervises the positioning and/or attaching of salvage equipment. Extreme care must be exercised to preclude additional damage occurring to the aircraft during salvage operations. Particular attention must be given to the merit of retracting extended slats, droops, speed brakes, or other control surfaces.

Crash and Salvage Rescue Platform

When the cockpit area of a crashed aircraft is a considerable height from the deck, the crash and salvage forklift combined with a rescue platform (P/N 3056AS100) (fig. 7-20) inserted over the forks may be used to lift the rescuemen to a more advantageous point. This will permit a more rapid and safer rescue operation. The salvage platform can also be fitted with a sling (P/N 3056AS200-1), permitting use with the crash crane when lifting rescue personnel to higher or lower elevations is required. The salvage platform has a working capacity load of 1,000-lbs. and should be load tested annually. The sling shall have four leg pennants with a minimum length of 8 feet per leg and must be certified safe to 10,000-lbs. The appropriate drawings for the salvage platform and sling may be obtained from the Naval Air Warfare Center, Aircraft Division.

Crash Ax

Because of mechanical or structural damage, regular and emergency releases to aircraft accesses may fail to function. In crashes involving such failures, access must be gained through forcible entry. The crash ax (fig. 7-21) or a fire ax of the type normally found in damage control repair lockers is provided as standard crash equipment for this purpose.

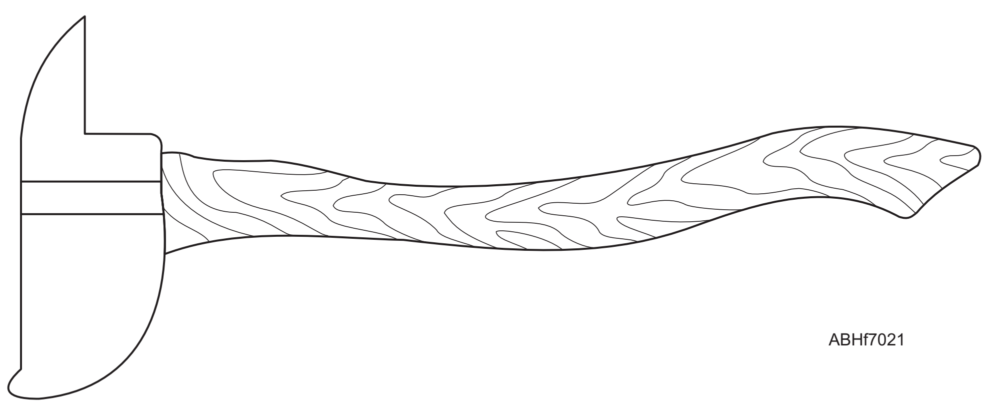


Figure 7-21.—Crash ax.

Minimum Initial Response

All preplanning and training must be directed toward providing the following minimum initial response to an actual mishap or drill:

1. MFFV(s)/TAU(s)
2. Scene leader
3. Hose team leaders
4. Four AFFF hoses

NOTE

When MFFV equipment is nursing at the scene, it is to be considered the equivalent of one AFFF hose team.

5. Two rescue persons (hot suitmen)
6. Two stretchers and two first-aid kits
7. Two spare 50-foot lengths of fire fighting hose
8. Forcible entry equipment
9. Messengers/phone talkers
10. Two portable extinguishers (Halon 1211, PKP, or CO_2)
11. AFFF hose(s) for weapons staging area(s) (bomb farm) protection properly manned.

NOTE

Personnel must be assigned to monitor charged fire hose(s) restrained with hose control device(s). These personnel must ensure prompt response to conditions that affect the fire stream, such as wind change and/or other disruptions.

12. Two spare 1 1/2-inch and two spare 2 1/2-inch hose control devices (with appropriate vari-nozzle attached).

NOTE

It is emphasized that nothing herein is intended to discourage immediate firefighting action by individuals while awaiting the arrival of organized teams. On the contrary, 1 1/2-inch AFFF hose reels and variable pattern nozzles were specifically designed and installed for rapid deployment by one person, if necessary. Accordingly, the training provided to all air department and embarked aviation personnel should cover activation procedures and fire-fighting techniques for emergency operation of the 1 1/2-inch hose reels by the first person on the scene.

The individual actions which should occur on initial response are outlined in *NATOPS, U.S. Navy Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14.

CRASH FIRE FIGHTING

After rescuing personnel from crashed aircraft, the rescue person should ensure that the master electrical switches, battery switches, and manual control valves for the oxygen system are turned OFF. The throttles on jet aircraft and the throttles and mixture controls on aircraft having reciprocating engines should be CLOSED. Should time permit, the battery cables of crashed aircraft should be disconnected at the battery by the quickest means available.

WARNING

Before removing the "quick disconnect" from the battery, you should make sure the battery switch in the cockpit is in the OFF position. Failure to conduct this procedure may initiate a fire or explosion if battery gases are present.

The location of the batteries, master switches, and fuel and oxygen controls for a particular aircraft are found in the *NATOPS, U.S. Navy, Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1. Crash rescue persons should know the location and operation of these controls for each aircraft that is likely to land on the carrier.

Alkaline or nickel-cadmium batteries may experience an overheated condition resulting from internal shorting or thermal runaway. The overheated battery presents a hazardous condition to both aircraft and personnel. When an overheated battery is detected, the crash crew should open the battery compartment, check for the following conditions, and take the action indicated.

WARNING

Halon 1211 or CO_2 is an acceptable fire-extinguishing agent once a fire has developed. However, CO_2 must NOT be directed into a battery compartment to effect cooling or to displace explosive gases. Static electricity generated by the discharge of the extinguisher could explode hydrogen/oxygen gases trapped in the battery compartment.

1. If flame is present, use available extinguishing agent, Halon 1211, or CO_2.
2. If no flame or fire exists but smoke, fumes, or electrolyte is being emitted from the battery or vent, use water fog to lower the battery temperature.
3. Following the visual check and the action indicated above, the "quick disconnect" should be removed from the battery and the battery removed from the aircraft. Additional cooling may be accomplished with water fog.

WARNING

When approaching a battery that is in a thermal runaway condition, crash crew personnel must be attired in full protective clothing, with an extinguishing agent available for instant use.

Since ample firefighting equipment is provided aboard carriers, crash fire fighting and rescue operations are normally carried out simultaneously.

WARNING

CO_2 in high concentration can produce asphyxiation. Avoid discharging it on personnel.

Small fires may be successfully extinguished with portable CO_2 or Halon 1211 extinguishers. The CO_2 should be discharged at the base of the fire. You should ensure that the source of the fire is adequately cooled to prevent a flashback.

WARNING

Post-fire weapons cooling time of 15 minutes only provides an interim time element for weapons cooling and is considered the minimum acceptable cooling time for all weapons. Personnel safety and fire exposure time of weapons must be considered when expediting post-fire evolutions to satisfy operational commitments.

Large crash fires require the use of two or more AFFF lines. While one or more of the nozzles are being used to keep fuel tanks and armor cooled, men handling the other nozzles should proceed to isolate the crashed aircraft from other aircraft and to prevent the fire from spreading to other parts of the flight deck and ship. Crash fire fighters should know the location of fuel tanks and armor for each carrier aircraft. The scene leader must ensure that AFFF is continuously applied to all weapons exposed to fire. After the fire has been extinguished, one or more hoses must be kept ready for immediate use, since a flashback may occur.

Q6. What is the primary purpose of the rescue team?

Q7. What NATOPS publication contains specific instructions for releasing personnel from seat restraint devices for each type of aircraft?

SALVAGING AIRCRAFT

OBJECTIVES: Identify the procedures and precautions associated with aircraft salvage, aircraft jettison, or aircraft in the water.

As in the combating of crash fires, the specific action to be taken in clearing the flight deck can only be determined after an on-the-spot analysis of the crash situation. The time element is a very important factor. <u>Crashes that interfere with flight operations must be cleared by the most expeditious means available</u>.

On-deck crashes that render the landing gear inoperable may be removed by supporting the aircraft on one or more dollies. Automotive-type jacks or mobile cranes may be used to lift the aircraft so that these dollies can be placed under the aircraft. The dollies must then be secured to the aircraft by means of lines or straps. The aircraft can then be towed or pushed clear of the landing area.

Catwalk crashes and over-the-side suspensions present many and varied problems. Depending upon the situation, various items of crash equipment are used (sometimes all the equipment available is used).

A safety line should be passed to plane personnel, and they should be assisted from the plane as soon as possible. Precautions against fire should be taken as required. Tie-down chains should be secured from the propeller shaft, landing gear, fuselage, and wings (as required) to deck fixtures. These chains should be of sufficient number to prevent loss of the aircraft in the event the salvage gear subsequently fails.

The steps in recovering a crashed aircraft from this point vary considerably, depending upon the situation. Basically, they consist of righting the aircraft so that it can be hoisted or mulehauled (bodily dragged) up on deck.

Hoisting slings should be used with care when lifting an aircraft in other than the three-point attitude relative to the flight deck.

The use of fabric slings in place of the manufacturer's hoisting sling is often a judgmental decision. Consideration must be given to the roll and pitch attitude angle of the aircraft to be hoisted. Each model aircraft has specific attitude limitations beyond which it is unsafe to use the manufacturer's hoisting sling. Appendix C of the *NATOPS, U.S. Navy, Aircraft Crash and Salvage Operations Manual (Afloat)*, NAVAIR 00-80R-19, provides the most current information available on these limitations. Because of the roll or pitch attitude angle of the aircraft, the manufacturer's sling may not be easily attached. In those instances, while the attitude may be within the hoisting limits of the manufacturer's sling, use of the fabric sling may provide the best option in hoisting equipment. The weight and bulk of the manufacturer's hoisting sling, the accessibility of hoisting attachment points, the approach path and positioning of the crane, the structural bulkhead locations, and the safety of personnel and equipment all combine with the clock in determining the most advantageous method of salvage.

The procedures recommended in NAVAIR 00-80R-19 are intended to apply to the general or most common situations. It is recommended that the manufacturer's hoisting sling be used for flight deck and catwalk crashes where pitch/roll angles do not exceed the design limitation. The fabric sling is recommended for all other situations. A well-trained crew could, in ideal conditions, substitute one type of sling for the other and achieve a successful result. Common sense, training, and safety are paramount.

Loads in the hoisting sling fitting must be increased if a departure is made from this attitude. Instances of failure have been reported in which attempts were made to raise crashed aircraft that had become lodged in abnormal positions. In such cases, it is considered safer to improvise a sling than to use the aircraft's usual hoisting sling. Improvised slings should be safeguarded with heavy tie-down lines.

Improvised slings may be attached to such members as the main landing gear, catapult hooks, or by lines encircling the fuselage or wings at points of maximum strength, such as bulkheads and ribs. Provisions to prevent chafing of surfaces must be provided if salvage operations are intended. Reinforced canvas straps with hook-on provisions are usually provided in the crash locker for this purpose.

The existing tactical situation may require jettisoning the wreckage. Extreme caution must be exercised in this operation, as personnel and equipment may be accidentally dragged over the side.

Personnel engaged in clearing the flight deck of wreckage and in aircraft salvage must know and understand their jobs. They must be able to perform their duties quickly and with minimum directions and supervision.

JETTISONING AN AIRCRAFT

The location, attitude, and condition of the aircraft to be jettisoned, time available to perform the jettisoning operation, and the equipment on hand with which to work may present some of the problems confronted by you when jettisoning an aircraft.

The aircraft to be jettisoned may be in an inverted position on the flight deck, have one wheel in the catwalk, two wheels in the catwalk, or it may have the landing gear completely sheared off.

The situation and problems vary with each aircraft. No single step-by-step procedure can be given that would apply in every case where an aircraft is to be jettisoned. Common sense and resourcefulness are important assets in such an operation.

AIRCRAFT JETTISON PROCEDURES

The jettisoning of aircraft from the flight deck may become necessary in various situations (for example, to eliminate fire/weapons hazards during a major disaster or to dispose of damaged/destroyed aircraft because of operational necessity.)

NOTE

Only the commanding officer may authorize the jettisoning of aircraft.

If firefighting is in progress, turning the ship may not be advisable if it causes a change in relative wind direction, which might endanger firefighters or worsen the fire. Depending upon the gravity of the situation (in many cases after the fire is extinguished), aircraft may have to be jettisoned from virtually any area of the deck and by whatever means are available at the time. The proper jettisoning procedure should be left to the discretion of the on-scene crash and salvage officer/supervisor, with the commanding officer's approval. They must take into consideration the safety of personnel, the immediacy of the requirement, and minimum damage to the equipment and the ship. Aircraft will normally be jettisoned from an aft elevator to protect the ship's screws.

The following are general guidelines, which may be adapted to meet situational requirements:

1. Rollable Aircraft
   a. Swing down the outboard safety nets for the selected deckedge elevator.
   b. Drop/remove the wheel stops in line with aircraft's main landing gear.
   c. Spot aircraft athwartship (nose inboard) on the elevator and secure it with tie-downs.
   d. Attach the single-wire-rope pendant (or equivalent) from the nose gear to the crane pintle, or tractors, using a Raymond releasing hook or similar quick-release mechanism, and take a slight strain.
   e. Request the officer of the deck to commence a gradual turn to cause the ship to heel to the jettisoning side.
   f. As soon as the danger of aircraft rolling inboard is past, remove the tie-downs.
   g. Immediately after the tie-downs are removed and ALL PERSONNEL ARE CLEAR, request the officer of the deck to increase the turn and increase the heel.
   h. When heel is sufficient, activate the Raymond releasing hook by pulling the attached lanyard.
   i. When the aircraft is clear, reconfigure the elevator and restore all gear as soon as possible.
2. Non-Rollable (on deck)

NOTE

The procedure may vary, depending upon aircraft damage and location.

   a. Move the aircraft by whatever means available to an aircraft elevator agreed to by the commanding officer.
   b. Swing down the outboard safety nets of the elevator.
   c. Drop/remove the wheel stops.

WARNING

Do not permit any part of the forklift or other equipment to puncture the aircraft or in any way attach itself to the aircraft being jettisoned.

   a. In coordination with the bridge, use a crane, forklifts, or tractors to push and raise aircraft to a point where its momentum will carry it over the side.
   b. When the aircraft is clear, reconfigure the elevator and restore all gear as soon as possible.
3. Non-Rollable (catwalk)

WARNING

Maneuvering of the ship may be required to protect the screws. Strict coordination with the bridge is essential.

NOTE

The procedure may vary, depending upon aircraft damage and location.

   a. Clear the area around the aircraft. Remove antennas, speakers, and so forth, if time permits, to prevent further damage.

WARNING

Do not permit any part of the forklift or other equipment to puncture the aircraft or in any way attach itself to the aircraft being jettisoned.

   b. Using a crane, forklifts, or tractors, raise and push the aircraft, preferably at a structurally sound point of the aircraft.
   c. Use minimum force required, using the aircraft's momentum to carry it over the side.
   d. Make any repairs to catwalks or damaged equipment as required for resuming normal operations.

WATER CRASH (UNDERWAY)

When an aircraft crashes into the sea in the vicinity of the ship while it is underway, the crash alarm is sounded from primary flight (Pri Fly control. This is followed by "crash in the water, (port/starboard) side," passed from Pri Fly control over the 5MC announcing circuit.

Whenever flight operations are being conducted, the landing signal officer (LSO) must ensure that the following distress equipment is available at the LSO platform:

1. Battery-powered marker
2. Life preserver ring
3. Very pistol
4. Search and rescue sonobuoy

Lookout's man stations as assigned by the OOD and perform duties in accordance with the ship's lookout doctrine.

The life buoy/after lookout watch is located at the designated station aft.

The life-buoy watch is a special watch assigned to lookouts and carries the responsibility for detecting and reporting man overboard incidents, providing a life ring to the person in the water, and marking the spot where the incident occurred. The number of persons assigned to this watch and the location of their stations will vary with different ship types.

These persons are instructed to drop a life ring with a small light buoy, without further orders, into the water if a crash occurs in the water on their side of the ship. The equipment should be thrown overboard regardless of whether the person is seen. In no case should the equipment be dropped so close to the aircraft or personnel in the water that there is any danger that it will strike them.

Since it is not normally practical for a carrier to interrupt air operations to effect a rescue, the ship's helicopter or vessel in company nearest the scene of the crash must take appropriate action. If the helicopter or vessel has not observed the crash, they should be notified by the carrier to proceed with rescue operations.

The helicopter is normally airborne and on station as the plane guard during landing and launching operations. If it is not airborne when a crash occurs, it will be launched as soon as practical.

Additionally, the officer of the deck (OOD) usually orders the crash boat called away. "Away crash boat" is passed by the Boatswain's Mate of the watch over the ship's general announcing system.

The OOD then maneuvers the ship as necessary to lower the crash boat (lifeboat). Lookouts are alerted to keep the crash and personnel in sight.

The crash boat (lifeboat) normally is a designated motor whaleboat. This boat is manned as follows:

- The relief officer of the deck <u>or</u> junior officer of the deck
- Hospital corpsman
- Two qualified swimmers, in-boat shark watch
- One signalman-lifeboat crew
- Boat crew-coxswain, bowhook, and engineer

The lifeboat crew ensures that all personnel are free of the crashed aircraft. If the aircraft is still afloat and personnel are trapped in it, immediate steps are taken to effect the rescue of these personnel. The rescue of all personnel is the first objective of the lifeboat crew.

Crashed helicopters may sometimes be kept afloat for a while by use of the emergency flotation gear carried by the crash boat for this purpose. The gear must be passed under the helicopter, secured in place, and inflated. Personnel that have been unable to escape from the helicopter must then be removed by the most expeditious means available.

Q8. Information concerning a particular aircraft's acceptable hoisting attitude is found in what NAVAIR publication?

Q9. Who must authorize the jettisoning of any aircraft?

ANSWERS TO REVIEW QUESTIONS

A1. The Crash and Salvage Officer (Air Boatswain) is responsible for material maintenance readiness and operation of assigned crash and salvage equipment.

A2. The Crash and Salvage Leading Petty Officer (LPO) is responsible for supervising the installation of aircraft hoisting equipment for each type of aircraft on board.

A.3. The A/S32A-35A is the carrier vessel crash crane (CVCC).

A.4. Crash and salvage units are required to maintain eight fabric hoisting slings: two 20-footers, two 30-footers, two 40-footers, and two 50-footers.

A.5. The crash handling tiedown strap has a maximum capacity of 10,000-lbs.

A.6. The primary purpose of the rescue team is to save the lives of the aircrew and passengers.

A.7. NAVAIR 00-80R-14-1 NATOPS publication contains specific instructions for releasing personnel from seat restraint devices for each type of aircraft.

A.8. NAVAIR 00-80R-19 contains information concerning a particular aircraft's acceptable hoisting attitude.

A.9. The commanding officer must authorize the jettisoning of any aircraft.

CHAPTER 8

SHORE BASE CRASH AND SALVAGE

On every naval air station, the two types of fires encountered are the aircraft fire and the structural fire. Each type requires different fire fighting materials and procedures to effect rapid extinguishment. To help crash crew personnel meet these responsibilities, the Navy is placing at their disposal the finest equipment available and the latest developments in fire fighting. Airport fire fighters should study and practice this specialized fire fighting so that they can perform their responsibilities with maximum speed and efficiency.

CREW ORGANIZATION

LEARNING OBJECTIVES: Recognize the factors to consider when evaluating a crash situation; the methods for extinguishing the fire; and the procedures for saving the crew, passengers, and aircraft.

Fighting fires in and around grounded or crashed aircraft is a highly specialized field of fire fighting that demands skill, courage, teamwork, physical agility, and mental alertness. The crash crew personnel must be intimately familiar with the crashed aircraft. They must understand its fuselage, for possible entry points; the electrical, oxygen, and fuel systems; the armament carried; engines; and the firewall locations.

All personnel concerned with aircraft fire fighting and rescue operations are listed in the air station's aircraft fire fighting and rescue procedures. This procedure outlines the responsibilities, requirements, and general procedures to meet local situations and missions.

ABH's are a source rating for shore based airport firefighters and perform these duties at Naval Air Stations, Naval Air Facilities, and outlying fields.

AIR STATIONS

Each air station within the continental United States employs a civilian fire chief, who is responsible for the technical administration of both the crash fire crew and the structural fire crew. Each platoon (section) in the crash crew is under the supervision of a civilian crash captain. A qualified military or civilian driver-operator is in charge of each crash truck in operation. Other personnel may be either military or civilian.

Each section is further divided into equipment crews under the driver-operator of each vehicle. The driver-operator is responsible for the vehicle and its crew.

FIRE PROTECTION ORGANIZATION

The two principal fire-protection functions at aviation shore activities are aircraft fire and rescue protection and structural fire protection. These services are organized and consolidated by direction of the commanding officer.

The station fire chief/crash fire rescue and firefighting (ARFF) officer is responsible for the operational readiness, performance, technical training, and management of the fire protection organization. The fire chief/ARFF officer or his or her designated representative has control and direct supervision of all fire fighting and rescue operations at the immediate scene of an aircraft emergency and is so designated in writing. The air operations officer, or in his or her absence a designated assistant, exercises overall control of the airfield other than at the immediate scene of an accident.

The combined fire functions require that civilian and military personnel assigned to the fire protection organization be appropriately trained in both structural and aircraft fire fighting and rescue procedures. Civilian firefighter position descriptions contain all the duties and responsibilities associated with aircraft and structural fire fighting. The position title is "Fire fighter," rather than "Fire fighter, Structural" or "Firefighter, Airfield."

Where the combined fire protection organization is located in common quarters or the structural fire station is so located to permit response within the time prescribed for standby alert response, one aircraft fire fighting and rescue vehicle is cross-manned by personnel normally assigned to structural fire fighting duties. One structural fire pumper is maintained in a fully manned condition at all times to permit ready response to structural fire emergencies.

Because of the broad range of fire protection facilities (personnel, equipment) required at some aviation shore activities, deviation from the standard fire protection organization may be advantageous.

Figure 8-1 contains the minimum response requirements (categories 1 through 5) necessary to adequately perform the aircraft crash, fire, and rescue functions predicated on the aircraft gross weight assigned at an activity. For those activities that do not have aircraft assigned, minimum response is determined by the type/gross weight of the aircraft normally supported.

NOTE

When the water requirement for minimum response cannot be provided by the combination of immediate response and standby alert, the commanding officer concerned must curtail or reduce flight operations to meet minimum response requirements. This require- ment does not apply to OLFs (outlying fields) where a TAU is the only assigned ARFF vehicle.

AIRCRAFT FIRE AND RESCUE NETWORK

To ensure an effective airfield fire and rescue effort, a dedicated emergency fire and rescue radio network is provided. Such a network requires the following equipment:

- Fixed-base stations must be installed in the air traffic control tower, aircraft fire and rescue alarm room, and the structural fire station.
- All aircraft fire and rescue vehicles and support vehicles must have mobile transceivers. In the case of the fire chief's vehicle, a dual installation must include the aircraft fire and rescue network and the internal security network.
- Portable transceivers must be available for use in helicopters, boats, weapons convoys, and by principal fire fighting supervisors and foot parties, as required. One portable transceiver must be assigned to the duty search and rescue (SAR) helicopter.
- A Computer Aided Dispatch (CAD) system is recommended for all shore-based fire departments. This system provides for rapid dispatch of appropriate vehicles to any emergency incident via a predetermined response (PDR) program. It also, via a terminal/printer, prints out all relative information on either aircraft or structure; for example, location of building, hydrants, and occupancy. When installed, alarm rooms should be

Gross Weight Category	Aircraft Maximum Gross Takeoff Weight in Pounds	Truck Capacity/Flow	
		Water	GPM*
1	Up to 10,000	TAU**	N/A
2	10,000 to 200,000	2,000	1,000
3	200,000 to 500,000	4,000	1,500
4	500,000 and above	7,000	2,500

Note

A minimum requirement for gross weight categories 2 and 3 above shall consist of a minimum of two major ARFF fehicles and category 4 shall consist of a minimum of three ARFF vehicles.

*GPM delivery rate based on firefighting and rescue truck on board water/ARFF supply delivered by the roof and bumper turrets.

** Or as directed

Fig 8-1

Figure 8-1.—Minimum response requirements.

equipped with logging recorders to record all emergency communications from either AM or FM radio or telephonic equipment.

- Mobile or portable transceivers on the mutual assistance frequency should be installed in all vehicles designated to respond to emergency calls under an established mutual assistance agreement.

Primary Aircraft Emergency Alarm Intercommunication System

In addition to the authorized radio equipment previously discussed, a direct wire intercommunication system must be installed at the following locations:

- Air traffic control tower (initiating agency)
- Aircraft fire fighting and rescue alarm room
- Structural (fire organization and centralized dispatch)
- Air operations duty office
- Station hospital and/or dispensary
- Search and rescue (SAR) organization (if applicable)

Secondary Aircraft Emergency Alarm Intercommunication System

The secondary aircraft emergency alarm system may operate through the regular telephone switchboard. The initiating instrument is generally located at the operations control tower. This system is used for the simultaneous notification of essential support and administrative personnel. The following stations are recommended for connection:

Aircraft fire and rescue alarm room

Structural fire organization

Hospital or dispensary

Photographic laboratory

Aircraft maintenance department

EOD personnel

Aircraft rescue boat house (if applicable)

Security office

Airfield operations office, which, in turn, notify by regular telephone, or other means, the aviation safety officer and the senior member of the aircraft mishap board

Station duty officer, who notifies by regular telephone those personnel previously designated by the commanding officer

Notification of an On-Station Mishap

The station or person observing an aircraft mishap activates the primary crash alarm network or notifies the air operations duty officer by the fastest means available. If available, the following information must be provided:

1. Location
2. Type of aircraft
3. Nature of the emergency
4. Fuel state
5. Number of personnel aboard
6. Ordnance stores or other hazardous cargo
7. Landing runway and estimated time of arrival (ETA)
8. Any other pertinent information

Notification of an Off-Station Mishap

When notification of an off-station mishap is received from an outside source, the following information must be obtained:

1. Location of the mishap and directions to the scene
2. Type of aircraft and whether fire is present
3. Reporting person's name and telephone numbers and a request that the person remain at a designated location and act as guide, as necessary

Emergency Communications System for Designated Outlying Landing Fields (OLF) Category 1 Outlying Fields with No Facilities

Outlying fields in this category must have VHF FM radio transceivers for the primary emergency communications system. When installed in mobile fire fighting and rescue vehicles, these units should have an effective range for communications with the home station, air traffic control tower, and the aircraft fire and rescue center.

The home station fire and rescue alarm center and station air traffic control tower should maintain constant communications with each outlying field mobile stations.

Outlying fields lacking an air traffic control tower should be provided with a mobile ground-to-air radio and a backup radio. Outlying fields must be provided with telephone communications for secondary communications.

Crash Grid Map System

A comprehensive survey of the area, on and off station, should be made to facilitate rapid location of, and immediate access to, potential mishap sites. This survey should result in the development of two-detailed grid maps. The on-station grid map should identify planned rendezvous points, staging areas, water supplies, airfield boundaries, and so forth. The off-station grid map should identify the same rendezvous points shown in the on-station grid map, major and secondary roads, access routes, locations of residential areas, industrial complexes, medical facilities, and any significant landmark or terrain feature that may be pertinent to a salvage operation.

Each fire department and ARFF unit should maintain two identical alphanumeric grid systems maps. The grid maps are superimposed on an aerial photograph or local base area map, and are used for the following functions:

1. To provide uniform response to those crash areas not visible from the tower
2. To coordinate fire department support to the weapons areas
3. To ensure police and security forces adequately support fire suppression operations

Naval air activities with operating air traffic control towers are required by NAVAIR 00-80T-114 to have such a grid system. To make sure the grid system is effective, the area fire marshall/inspector general personnel should examine the grid for currency and condition. In addition, individual fire fighters are required to demonstrate a working knowledge of the grid system. The grid system is readily available on board all ARFF vehicles and at all activities on the primary or secondary communications systems. Where practicable, all fire departments should develop an additional grid system based on compass azimuth and mileage out to 15 nautical miles from the airfield. See figure 8-2.

Aircraft Firefighting and Rescue Daily Journal

A daily journal must be maintained by each aircraft fire fighting and rescue organization. This journal should be a chronological listing of all pertinent events. It should be retained for a minimum of 3 years after the journal is completed.

Q1. For those activities that do not have aircraft permanently assigned, what factor determines the capacity of the minimum response vehicle?

Q2. When notification of an off-station mishap is received from an outside source, what information must be obtained?

MAJOR AIRCRAFT FIRE FIGHTING AND RESCUE VEHICLES

LEARNING OBJECTIVES: Recognize aircraft firefighting and rescue vehicles typically used at shore stations. Understand minimum response requirements to support fixed and rotary wing aircraft.

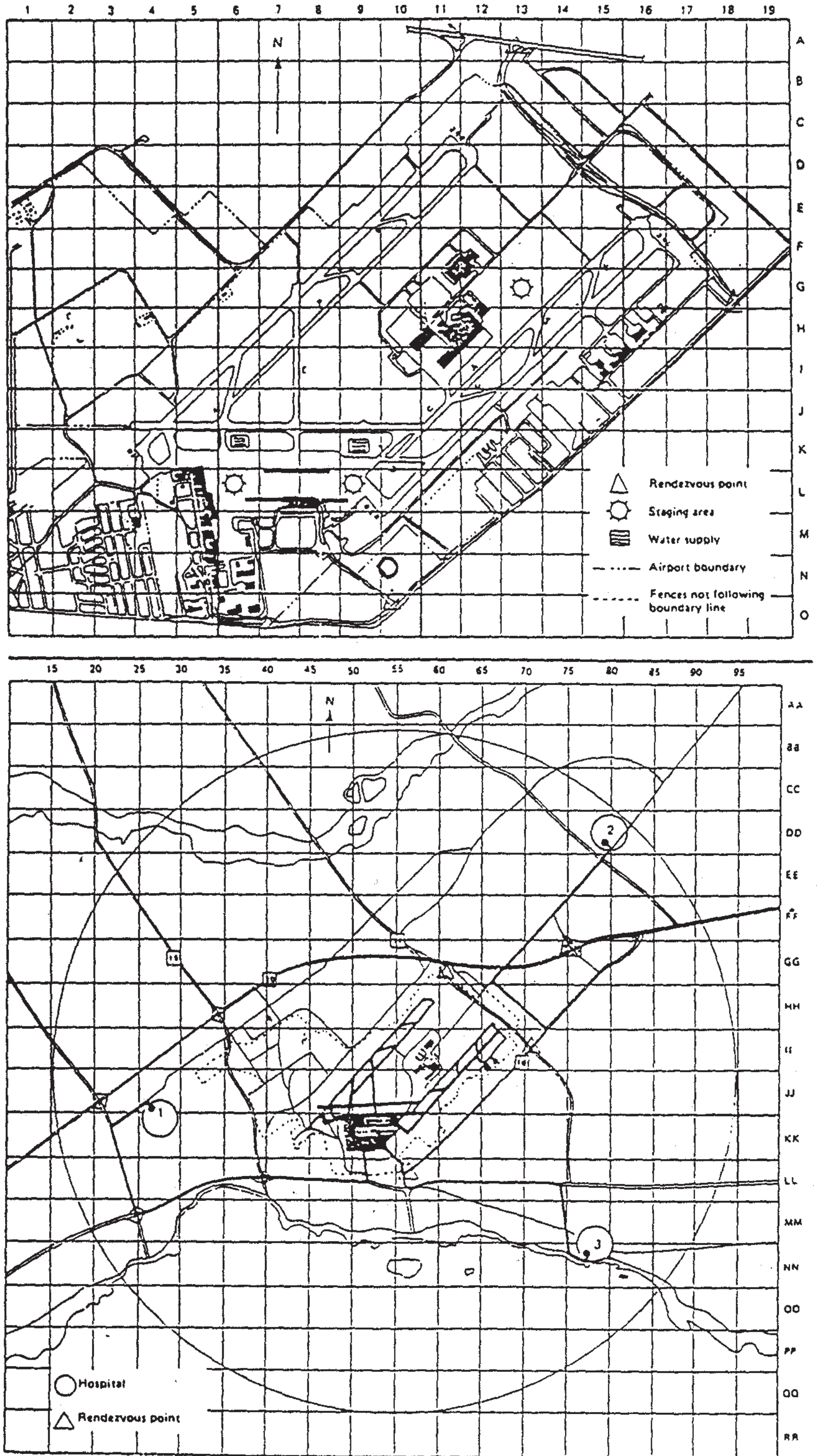
The M-1000, P-15, P-19 and P-19A, Amertek CFL 1000, and Oshkosh T/A 3000 vehicles are basic designated major fire fighting and rescue apparatus. The type and quantity of aircraft fire fighting and rescue vehicles assigned vary with the operational status of the air activities. The minimum response requirements are based on the gross weight of the aircraft assigned at the activity. For those activities that do not have aircraft assigned, minimum response must be determined by the type/gross weight of the aircraft normally supported. Additional equipment over and above the minimum response is provided to allow for repair and maintenance or for exceptionally hazardous or intense flight operation.

AUXILIARY AIRCRAFT FIRE FIGHTING AND RESCUE VEHICLES

Auxiliary fire fighting and rescue trucks are small lightweight vehicles, multidrive type, equipped with assorted power- and hand-operated forcible entry tools and field lighting equipment. An M1008, M998, or M1038 should be used as the auxiliary vehicle loaded with rescue equipment and serve as the rescue vehicle. A truck-mounted TAU with the above equipment meets this requirement.

TANK VEHICLES

Tanks trucks (M50) are used to resupply primary fire fighting and rescue vehicles (major or combined agent vehicles) with liquid agents for extended periods of operation. The 5,000-gallon capacity combination



Hospital (1) 55 beds
Capable of handling all emergency medical cases

Hospital (2) 70 beds
Capable of handling most emergency medical cases except special cases such as extensive burns

Hospital (3) 40 beds
Capable of handling common emergency medical cases such as simple wounds or fractures

Figure 8-2.—Example of typical grid maps.

fire and resupply unit must be maintained as part of standby alert and manned in accordance with minimum response requirements for those air stations designated "Special Category." It is desirable that pumps have sufficient capacity to replenish the firefighting vehicle having the largest rate of discharge when the vehicle is operating at maximum capacity.

STRUCTURAL FIRE PUMPERS AND BRUSH FIRE TRUCKS

Structural fire pumpers and brush fire trucks are used to back up aircraft fire fighting and rescue trucks and should be equipped with AFFF.

FIRE FIGHTING AND RESCUE VEHICLES

The aircraft firefighting and rescue vehicles described are those presently in use at shore-based activity use by both the Navy and Marine Corps. The following descriptions of the equipment are brief. Detailed operating, maintenance, and repair instructions are contained in technical manuals provided with the vehicles.

P-15

The P-15 (fig. 8-3) is a twin-diesel-powered fire fighting truck that has a limited off-road capability. The truck body is mounted on an 8 × 8 all-wheel-drive chassis. The truck and pumping system is powered by two 8-cylinder diesel engines, one forward and one rear mounted. The transmission connected to the front engine driveline powers the front tandem axles, and the transmission connected to the rear engine powers the rear tandem axles. By means of controls at the output of each transfer case, the driver may operate the truck on both engines together or either engine separately. Normally both engines power the truck, and both tandem axles will be engaged. The truck provides discharge of foam/water agent through the twin turrets or by a hose reel handline. Each turret has a dual discharge rate of 600 or 1,250 gpm. The handline discharge rate is 100 gpm. The turrets are hydraulically operated, with provisions for manual override. The insulated water tank has a 6,200-gallon capacity, and the foam tank holds 515 gallons.

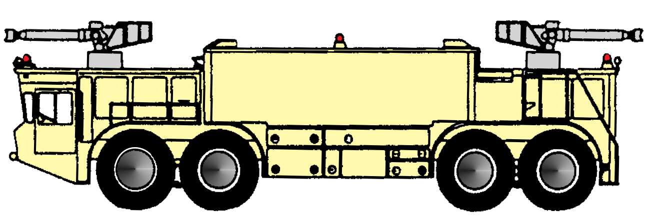


Figure 8-3.—P-15 aircraft fire fighting and rescue vehicle.

M-1000

The M-1000 (fig. 8-4) is an aircraft firefighting vehicle used by some U.S. Navy air activities. The vehicle is equipped with a single centerline roof turret, accessible through a hatch in the top of the driver's compartment. Two diesel engines power the unit. One provides all-wheel drive; the other (rear-mounted) engine drives the fire pump system. Handlines are provided for water or water-foam mixture capability. The M-1000 has an off-road capability and will climb an 18-inch wall or ascend or descend a 60-percent grade. The vehicle can reach a top speed of 60 mph and can accelerate from 0 to 50 mph in 35 seconds. The vehicle's proportioning system is a balanced pressure-type, adjustable to obtain from 2 to 10 percent foam concentrations.

P-19

The P-19 (fig. 8-5) has a diesel-engine-powered, 4 × 4 all-wheel-drive chassis. A single diesel engine powers the truck drive train and water pump. The fire fighting systems of the truck is self-sufficient. No outside source for extinguishing agents is needed. The truck contains its own pressure pumps and fire fighting equipment. Water, foam, and Halon 1211 are carried in tanks built into the truck body. The truck body is insulated, preventing heat loss from the truck's interior during cold weather. The insulation also provides protection from fire heat.

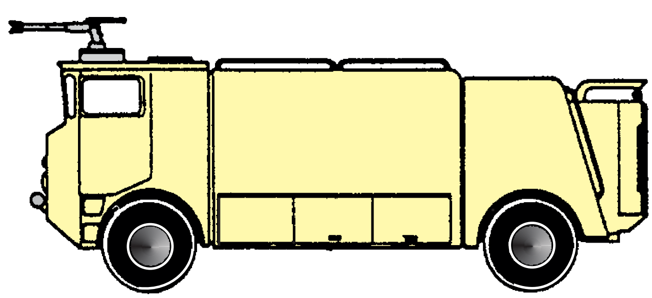


Figure 8-4.—M-1000 aircraft fire fighting and rescue vehicle.

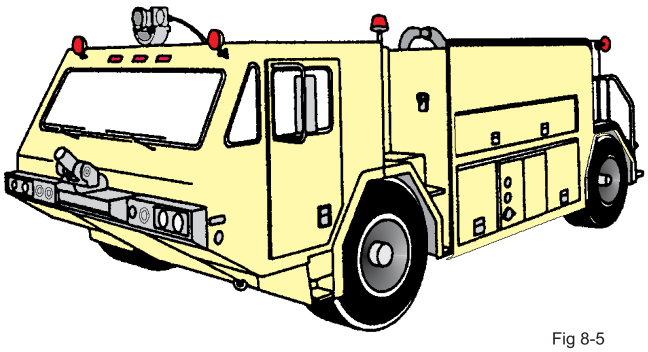


Figure 8-5.—P-19 aircraft fire fighting and rescue vehicle.

Water or a combination of water and foam can be used to put out a fire. Agents are delivered through the cab-mounted roof turret, the bumper turret, or the handline. These can be used alone or at the same time. The truck can be filled either by a 2 1/2" intake located on the left side, mid-vehicle or through the water tank fill hatch located on top of the vehicle. The Halon system uses its own handline. The chassis design allows the truck to operate in all kinds of weather and on off-road terrain.

The P-19 has a water capacity of 1,000 gallons, and the foam tank holds 130 gallons. The single-roof turret has a discharge capacity of 500 gpm, and the bumper turret discharges agent at 250 gpm.

AFFF can be applied by using a 100-foot, 1-inch-diameter (60-gpm), reel-mounted handline. Five hundred pounds of Halon 1211 is also available on another 100-foot-long, 1-inch-diameter, reel-mounted handline.

P-10 RESCUE VEHICLE

The P-10 (fig. 8-6) is a gasoline-engine-driven, four-wheel drive, crew cab vehicle designed to contain various items of fire fighting and rescue equipment. It is equipped with emergency lighting mounted atop the cab, in the grille, and at the rear of the body. A speaker is mounted on the cab light bar. The speaker is connected to an electronic siren/public address control console mounted in the cab. Controls for emergency warning equipment are located in the cab with easy accessibility by the driver. The vehicle is equipped with cab-operated, front adjustable spotlights, two rear floodlights, and two telescoping quartz floodlights. An 8,000-pound power winch is installed on the front of the vehicle. Fire fighting and rescue equipment is stowed in the utility body.

AMERTEK CF 4000L

The Amertek CF 4000L (fig. 8-7) is a diesel-powered, four-wheel-drive truck with a 5-speed automatic transmission. The brake system is air-drum. The electrical system is 12-volt negative ground with automatic thermal reset breakers. The water tank capacity is 1050 gallons with the AFFF tank holding 156 gallons. The roof turret is non-aspirating, variable pattern with a range (solid stream) in excess of 175 feet. The discharge rate is 500 gpm. The bumper turret discharges at 250 gpm with a range (solid stream) in excess of 150 feet. Water/AFFF can also be applied from the 100 foot, 1-inch, reel-mounted handline. Five hundred pounds of Halon 1211 are also available on another 100 foot, 1-inch handline.

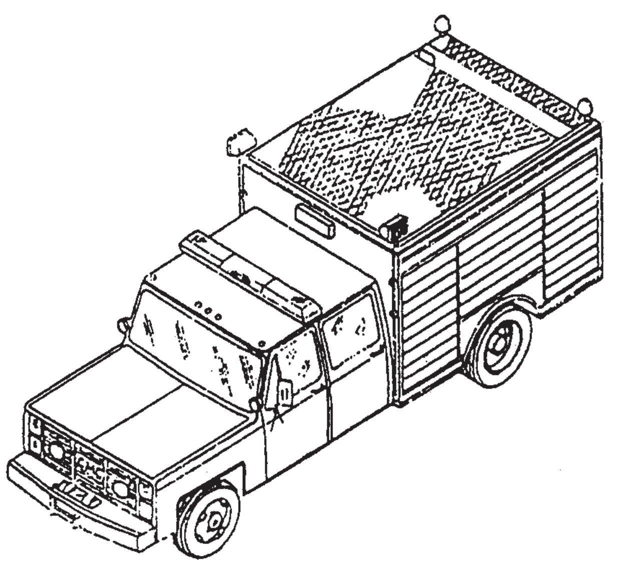


Figure 8-6.—P-10 rescue vehicle.

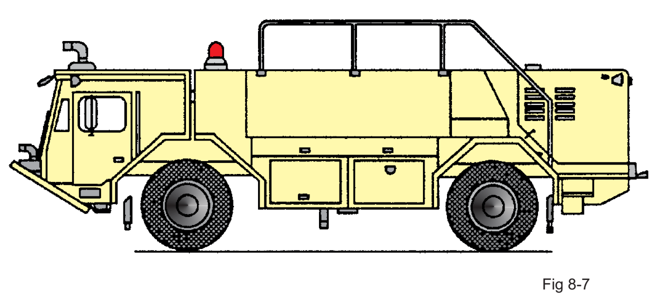


Figure 8-7.—Amertek CF 4000L.

T-3000 OSHKOSH

The T-3000 (fig. 8-8) is a diesel-powered, six-wheel-drive truck with an automatic transmission. The operator controls consist of power-assisted steering, air/mechanical brakes, transmission range selector, and in-cab controls for operating the fire fighting system. The water storage tank has a capacity of 3000 gallons and the AFFF concentrate tank holds 420 gallons. The water pump is single stage centrifugal with an around-the-pump proportioning system, preset to either 3% or 6% solution. The roof turret is a non-aspirating type, remote electric power assist with manual override controls. The roof turret has a discharge rate of 600-1200 gpm and a variable pattern from straight stream to fully dispersed. The bumper turret is electric joystick controlled with auto-oscillation. The discharge rate is 300 gpm and it is also variable pattern. Two 150 feet, 1-3/4 inch preconnected handlines are provided, one per side. They have a discharge rate of 95 gpm and have a pistol grip with variable pattern.

TWIN AGENT UNITS (TAU)

The TAU series of fire extinguishers are dual-agent apparatus that are designed primarily for extinguishing class B fires and are normally employed aboard ship, at hot refueling sites, or as a truck-mounted TAU. The TAU is a self-contained unit with a framework with two agent tanks, one containing an AFFF premixed solution and the other containing either PKP or Halon 1211. The TAU employs a noncollapsable dual hose line encased in a cotton jacket. The hose line is normally mounted on a reel. The fire-extinguishing agents are propelled by nitrogen supplied from two pressurized cylinders, which are mounted on the framework. Extinguishment is obtained by applying agents in a sweeping motion, using the chemical agent (PKP or Halon) to gain initial extinguishment, followed by application of AFFF to blanket the combustible liquid and preclude re-ignition. TAUs are available in the various configurations described below. A description of shore-base TAUs follows.

Mobile TAU

The mobile TAU (fig. 8-9) is designed specifically to be mounted on the bed of a lightweight, all-wheel-drive truck (equipment code 7102 or CUCV M1028FF TAM control No. D1082). The standard agent capacity is 80 gallons of AFFF premixed solution and 100 pounds of chemical agent.

Skid-Mounted TAU-1

The skid-mounted TAU-1 contains 100 gallons of AFFF premixed solution and 200 pounds of chemical agent. It is designed as a stationary fire fighting apparatus for use at hot refueling sites.

AMBULANCE

An ambulance is a properly equipped vehicle for casualty transport, according to current directives.

U.S. NAVY AIRFIELD CRASH CRANE REQUIREMENTS

The following listings are the categories for the minimum response requirements for heavy-lift crane support to clear runways and/or to assist in salvage operations.

Category I—Airfield Crash Crane

Minimum response requirement: Personnel and equipment must arrive at the scene of an aircraft mishap on the airfield within 15 minutes after notification, by a senior aircraft salvage supervisor, of the intent to lift/salvage a mishap aircraft. Figure 5-3 in the *NATOPS U.S. Navy, Aircraft Fire Fighting and Rescue Manual* (NAVAIR 00-80R-14) lists the approved categories I, II, and IIA airfields.

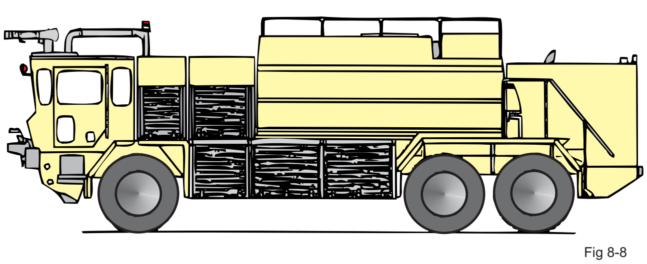


Figure 8-8.—T-3000 Oshkosh.

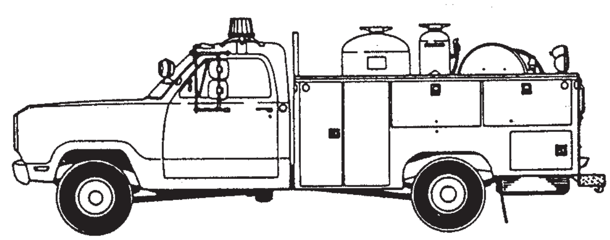


Figure 8-9.—Truck-mounted TAU.

Crane lift capacity: The crane must be capable of lifting the heaviest tactical/training aircraft assigned.

<u>Category II—Public Works Crane</u>

Minimum response requirement: Personnel and equipment must arrive at the scene of an aircraft mishap on the airfield within 45 minutes after notification, by a senior aircraft salvage supervisor, with the intent to lift or salvage a mishap aircraft.

Crane lift capacity: The crane must be capable of lifting the heaviest tactical/training aircraft assigned.

<u>Category IIA—Public Works Crane</u>

To provide for aircraft salvage operations, the commanding officer of the cognizant field activity (CFA) establishes the minimum response requirements for the appropriate public works salvage crane, salvage equipment, and personnel. Category IIA activities are identified as all auxiliary and/or OLFs.

Crash Crane Category Changes: Requests for changes in the approved crash crane category are initiated and fully justified at the activity level. These change recommendations are forwarded to the Chief of Naval Operations via the major claimant, Naval Facilities Engineering Command, and Naval Air Systems Command for technical review and approval.

Q3. On the P-15, what are the maximum capacities of the water tank and foam tank?

Q4. On the AMERTEK CF4000L, how much Halon 1211 is available on the 100 foot, 1-inch handline?

PERSONNEL REQUIREMENTS AND ORGANIZATION

LEARNING OBJECTIVES: Identify personnel manning level requirements for various shore base installation categories. State the personnel training requirements for an airport firefighter.

TRAINING REQUIREMENTS

Standard and continuous training must be provided and documented for all personnel through an on-the-job training program.

NOTE

Care should be exercised in using trainees in duty assignments in which they may unnecessarily impede rescue operations or endanger themselves, aircraft occupants, and other fire fighters.

Every person, military or civilian employee, who is assigned the duty of operating vehicles and equipment on all naval activities, afloat and ashore, including ships, must be qualified and properly licensed according to current directives.

Driver/operators of major emergency aircraft fire fighting and rescue equipment must be properly licensed in accordance with NAVFAC P-300, NAVSAFECENINST 11240.5.

These assignments should be for a 2-year period with a well-planned program for replacements in order to preclude sudden transfers of large numbers of experienced personnel. At least one-half of the on-duty personnel should have a minimum of 8 months' experience in the assignment.

Formal School

All military and civilian personnel assigned duties incidental to aircraft fire fighting and rescue should attend a formal fire fighting and rescue school. Department of Defense Instruction 6056.6 defines the requirements of the Fire and Emergency Service Program, which impacts all Navy shore base installations. For ABH personnel assigned as airport firefighters, the Fire Protection Apprentice (Shore-Based) course, taught at Goodfellow Air Force Base, San Angelo Texas provides the graduate with the NEC 7012. Successful completion of this course (CIN X3ABR3E731-006) certifies you as an airport firefighter.

Training Program Subjects

An aircraft firefighter training program must include the following subjects and should be conducted at the frequency indicated:

1. Hot drills simulating aircraft fire emergencies—bimonthly
2. Firefighting operations and tactics—monthly
3. Rescue and first aid procedures—monthly
4. Emergency equipment operation—monthly
5. Crash locator maps and on-station/off-station familiarization—monthly
6. Aircraft familiarization—twice quarterly

7. Preparation of administrative reports—twice quarterly

8. Review and discussion of past mishaps—quarterly

9. Basic structural firefighting—quarterly (International Fire Service Training Association (IFSTA) manuals should be used)

10. Firefighting and rescue organization—semiannually

11. Airfield emergency communication procedures—semiannually

12. Fundamentals of combustion, fire control, and extinguishment—semiannually

13. Aircraft fire hazards, fuel, ordnance, lubricants, and composite materials—semiannually

Sufficient personnel must be assigned to perform necessary fire, rescue, support, and administrative functions. Physical conditioning, capability, and agility should be considered when personnel are assigned to fire and rescue duties.

1. The minimum on-duty requirements to operate the major aircraft fire fighting and rescue vehicles necessary to meet the minimum response for U.S. Navy activities are three personnel.

2. The crew requirements to operate auxiliary fire fighting equipment are as follows:

Vehicle	Number of Persons
CUCV M1028FF (with TAU)	2
Rescue vehicle	2
Tank vehicle	2
530-C	3
M1028FF	2

When the primary mission of the aviation facility involves extra-hazardous flight operations, the type commander can increase the minimum manning, as appropriate, for each fire fighting and rescue vehicle.

3. The requirements for support operations are as follows:

- Aircraft maintenance personnel
- Public works transportation division
- Locally designated crane operators
- Security personnel
- Photographic personnel
- EOD personnel
- Medical personnel

4. Administrative support required at a mishap site is as follows:

- Mishap board members (aviation safety officer)
- Such other personnel as the commanding officer may designate

ALERT REQUIREMENTS

When directed by appropriate authority, certain conditions of readiness must be maintained. They are discussed in the following text.

IMMEDIATE-RESPONSE ALERT (FIXED-WING AIRCRAFT)

An immediate-response alert is maintained at all times while landings and takeoffs are being conducted. The purpose of this alert is to provide immediate response to observed unanticipated emergencies and to control any fires until the standby alert team can effect rescue and fire extinguishment. The immediate-response alert crew and equipment are strategically located on the airfield to observe all landings and takeoffs and to respond immediately to an emergency. An immediate response alert team consists of a major aircraft fire fighting and rescue vehicle manned to provide initial fire control capabilities.

Minimum Immediate Response Alert Manning

Vehicle	Number of Persons
M-1000	2
P-10	3
P-15	3
P-19	2
P-19A	3
Amertek CFL 4000	2
Oshkosh T/A 3000	3

NOTE 1: When the immediate response alert is manned at the above level, the additional crewman assigned responds with the standby alert.

NOTE 2: P-15 vehicles will not be used as immediate response alert vehicles unless absolutely necessary.

The commanding officer of the air facility may increase the manning of immediate response alert to the minimum onboard manning. No one person is allowed to perform immediate response alert duty for more than 8 hours in any 24-hour period.

NOTE

A truck-mounted TAU with a crew of three persons may be used where aircraft gross takeoff weight is 10,000 pounds or less (gross weight category 1) as the immediate response alert in lieu of a major emergency fire fighting and rescue vehicle.

STANDBY ALERT

At all times during flight operations, a standby alert must be maintained. Such an alert consists of the remaining complement of manned major aircraft fire fighting and rescue vehicles to meet minimum response requirements of the airfield category. The alert is maintained to permit arrival at the scene of an emergency within 3 minutes. Upon notification of an anticipated emergency landing, the standby alert assumes the condition of readiness of immediate response alert at predesignated strategic positions on the airfield.

BACKUP STANDBY ALERT

During flight operations, a backup standby-alert crew consisting of other medical/ambulance personnel, EOD personnel, and the structural fire companies is maintained in a condition of readiness that permits prompt response from normal working areas to standby alert position. Upon notification of an emergency, these forces assume the standby alert condition of readiness and await instructions from the senior fire officer at the scene of the emergency.

NOTE

So that optimum operational readiness is maintained according to current technical manuals, a daily preoperational inspection must be performed on all aircraft fire fighting and rescue vehicles and associated equipment.

Q5. What is the purpose for an immediate-response alert, which is maintained whenever landings and takeoffs are being conducted?

Q6. When can a truck mounted TAU with a crew of three be used as an immediate alert vehicle?

EMERGENCY RESCUE EQUIPMENT AND REQUIREMENTS

LEARNING OBJECTIVES: Identify rescue equipment that should be maintained at a shore station crash, fire, and rescue organization.

AIR BAG RESCUE AND LIFTING SYSTEM

An air bag rescue and lifting system must consist of bags sufficient in size and quantity to lift normally supported aircraft. This system must be supplied with accompanying pressure regulators, hoses, valves, and an air supply. The system is used for expeditious rescue of pinned victims, lifting heavy debris, and other various needs if entry at the immediate mishap scene is inaccessible to heavy equipment (cranes or mechanical lifting devices). Complete operating instructions must be provided with, and accompany, each system.

There are three different basic types of lifting bags: high, medium, and low-pressure bags. When the bags are deflated, they are approximately 1" thick and can easily be inserted into areas with very little clearance. Once inflated, some bags are capable of reaching 6 ft. in height. The low and medium pressure bags have a greater lifting distance than a high-pressure bag.

Whenever you are using an air bag lifting system, be sure to place the bags on a solid surface before inflating, and always inflate slowly. Watch for shifting loads during inflation. Once inflated, additional support for the lifted load will be required, such as cribbing, before personnel begin work. Never work under a lift supported only by an air bag.

EMERGENCY RESCUE EQUIPMENT

The following rescue equipment should be maintained within the crash, fire, and rescue organization:

1. "Jaws of Life" or equivalent
2. Power cutting saw
3. Hydraulic Port-A-Power
4. Exhaust fans/smoke ejector
5. Air chisel

6. Fire blankets

7. Portable generator system with floodlights

8. Chain saws

9. Ground locks (for each type of aircraft assigned)

10. Air bag rescue and lifting system

11. Ejection seat safety pins (aircraft normally supported)

This equipment is maintained by the crash, fire, and rescue organization and should be assigned to either major fire fighting vehicles or support equipment as designated by the local commander.

The following items of equipment should be placed on all major fire fighting vehicles, as well as on other vehicles as required:

1. Stretcher/backboard
2. Siren/incaptor system
3. Metal ladder (10 to 24 feet)
4. Pike pole
5. Spanner wrench
6. Pick head axe
7. Round point shovel
8. Crash and rescue tool kit
9. Hydrant wrench
10. Positive-pressure self-contained breathing apparatus
11. First-aid kit
12. 50 feet of 2 1/2- or 3-inch fire hose
13. 20-pound Halon 1211 extinguisher
14. 18 or 27-pound PKP extinguisher
15. Two 15-pound CO_2 portable fire extinguishers.

RESCUE TOOLS FOR REMOTE OUTLYING FIELDS

The rescue equipment listed below should be maintained and carried on crash fire apparatus in use at remote outlying landing fields.

1. Emergency rescue equipment.

a. Power cutting saw

b. Chain saw

c. Hydraulic porta-power

d. Air lifting bags (fixed-wing aircraft airfields only)

e. Air chisel

f. Chain or cable come-a-long

g. Pick head axe

h. Crash axe

i. Sledge hammer

j. Pry bar/Halligan tool

k. Round-point shovel (1 ea.)

l. Square-blade shovel (1 ea.)

m. Fire beaters (2 ea.)

n. 50' section line with grappling hook (1 ea.)

o. 50' section lines with eye splice and back splice (2 ea.)

p. Goggles (3 pr)

q. Sound attenuators (4 pr)

r. First aid kit

s. Fire blankets (2 ea.)

2. Canvas Tool Roll.

a. Forcible entry tool (design for prying, ramming, cutting, and chopping)

b. Metal cutting saw (hand)

c. Hacksaw (6 spare blades)

d. V-blade rescue knife

e. Wrench, vise grip (6")

f. Wrench, vise grip (duck bill 6")

g. Water pump pliers

h. Lineman pliers

i. Adjustable wrench, (6")

j. Adjustable wrench, (12")

k. T-handle socket, 7/16" (battery removal on some helicopters)

l. Screwdriver, common (4")

m. Screwdriver, common (8")

n. Screwdriver, Phillips (4")

o. Screwdriver, Phillips (8")

p. Duct tape (2 rolls, 2" wide)

q. Tapered plugs (6 ea.) (Designed for tenant aircraft)

3. Cribbing.

a. 2 × 4 (12 ea.)

b. 4 × 4 (4 ea.)

c. 6 × 6 (4 ea.)

4. Portable fire extinguishers.

a. Halon 15 LB (2 ea.)

b. AFFF 2.5 gal (1 ea.)

SELF-CONTAINED BREATHING APPARATUS

Positive pressure self-contained breathing apparatus (fig. 8-10) must be made available to all fire fighters required at the immediate scene of an aircraft mishap ashore. The unit's four main components are the backpack and harness assembly, the air cylinder assembly, the regulator assembly, and the facepiece assembly. Since there are several manufacturers of SCBAs, ensure you become familiar with the particular specifications of SCBAs assigned to your crash locker. Cylinder capacity range from 30 minute to 60 minute, but actual air supply duration will be influenced by many factors. Some of these factors include, but are not limited to physical fitness, cardio-vascular fitness, temperature, experience, external conditions, as well as the activity being performed. Training with the SCBA is essential in order to gain familiarity and optimum performance.

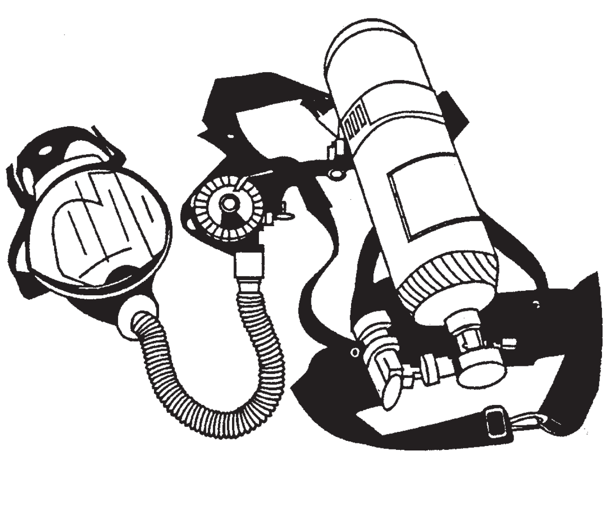


Figure 8-10.—Self-contained Breathing Apparatus (SCBA).

RESPIRATORY PROTECTION PROGRAM

Each activity must establish and maintain a respiratory protection program; per OPNAVINST 5100.19 series. Each activity's program must be in writing and should include procedures governing the selection, issue, care, maintenance, repair, and use of respirator in use by the individual unit. A respiratory protection program should be established for all personnel. The program should include written standard operating procedures, the training and medical monitoring of personnel, and cleaning, maintenance, and storage of respirators.

FILTER BREATHING MASKS

Provisions should be made to ensure a sufficient number of filter-type breathing masks are available as prescribed for composite materials which are likely to be encountered at the crash site. All personnel involved in mop-up, salvage, or standby operations at the crash site are required to wear this mask.

TIRES

Worn or defective tires on all major ARFF apparatus must NOT be replaced with recaps or retreads. Replacement tires must be of the appropriate type of tread suitable for the local terrain and weather conditions.

Q7. At a shore station, what lifting system should be deployed if entry to a mishap scene is inaccessible to heavy equipment?

Q8. Tools that are used to pry, ram, cut, and chop are known as what type of tools?

AIRFIELD FIRE PROTECTION REQUIREMENTS

LEARNING REQUIREMENTS: Understand the operation of portable fire extinguishers, wheeled units, skid-mounted twin-agent units, and any installed fire-suppression systems typically associated with airport firefighting duties.

Fire protection is essential during aircraft service and maintenance operations, with the degree of fire protection based on the hazard potential involved. Personnel involved in service and maintenance operations must be trained in the operation of portable fire extinguishers, wheeled units, skid-mounted twin-agent units, and any installed fire-suppression system(s). Should a fire or fuel spill occur, on-site personnel are the first line of defense in protecting naval assets when fire department (ARFF) personnel are not on standby at the incident site. On-site personnel must immediately notify the fire department/ARFF unit and use available fire extinguishers or other fire-suppression systems until assistance arrives on the scene.

U.S. NAVY FIRE EXTINGUISHING AGENT SUPPLY REQUIREMENTS

Each crash and fire fighting organization must maintain in reserve stock a total of two agent tank loads of AFFF and one load of Halon 1211 and PKP for each manned apparatus. The minimum reserve stock must exclude the initial load of agent in the tank and agent necessary to satisfy fire fighting training requirements.

NOTE

Outlying fields using Halon 1211 as a primary agent must maintain a minimum of two loads of Halon 1211 for each manned apparatus.

Supply departments for air activities should maintain an equal amount of agent.

PRIMARY AIRFIELD EXTINGUISHERS

The primary flight line extinguishers are 150-pound, wheeled, Halon 1211 fire extinguishers (fig. 8-11). Each activity is authorized an additional 10 percent of the total activity requirements, shown in table 8-1, to meet transient aircraft requirements and to provide spares.

PORTABLE EXTINGUISHER TRAINING REQUIREMENTS

All personnel engaged in aircraft-related operations will be trained annually by the fire department in operating all airfield fire extinguishers. Annual training includes at least one demonstration of the use of a fire extinguisher on an actual fire. Supervisors must ensure that all personnel in their areas of responsibility are familiar with the operation and location of portable fire extinguishers.

INSPECTION

Extinguishers must be inspected daily by the using activity in accordance with local fire department instructions. Personnel conducting the inspections must make sure the extinguishers are in their designated locations, confirm that they have not been actuated or tampered with, and identify any obvious physical damage, corrosion, or other impairments. Extinguishers with defects must be turned in for inspection and test according to the procedures in NFPA Fire Codes, Standard No. 10.

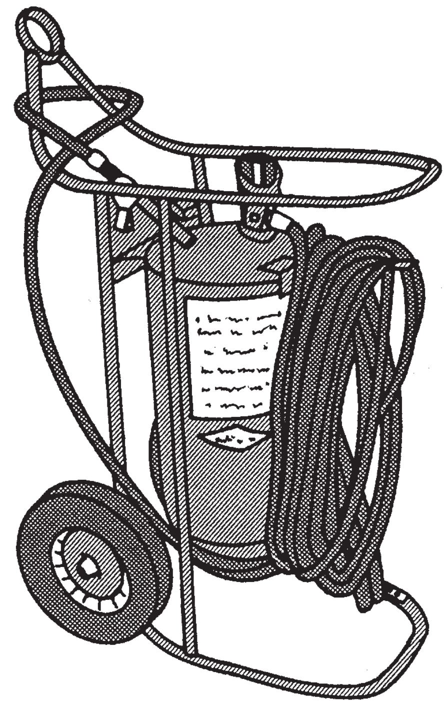


Figure 8-11.—One hundred fifty pound Halon 1211 fire extinguisher.

MAINTENANCE

Extinguishers must be thoroughly examined and recharged or replaced at least once each year according to the manufacturer's guidelines to ensure their operability and safety.

1. An equivalent spare extinguisher must replace an extinguisher that is removed from its assigned location to be recharged during the period of removal. Personnel turning in an extinguisher for recharge or maintenance must be issued an equivalent replacement extinguisher.

2. Records of required extinguisher maintenance must be kept on file for a minimum of 1 year. NAVFAC Form 11320/3 is used for this purpose.

HYDROSTATIC TESTS

When an extinguisher shows evidence of corrosion or mechanical damage, it must be subjected to a

Table 8-1.—Airfield fire protection requirements per NAVAIR 00-80R-14.

TYPE OF OPERATION	FIRE PROTECTION REQUIREMENT
NOTE All references to Halon 1211 extinguishers are for the 150-pound wheeled unit. Current in-service CO_2 and PKP extinguishers are acceptable until Halon units can be placed in service.	
FLIGHT LINE PARKING AREA	
A. SMALL OR MEDIUM TYPE AIRCRAFT C-12, T-34, T-38, T-44, OV-10 AV-8, F-5, F-14, F-18, T-39, S-3, E-2, C-1, C-2, UH-1, AH-1, H-3, H-57, H-46, H-60	1 Halon 1211 Extinguisher Per 3 Aircraft.
B. LARGE TYPE AIRCRAFT P-3, C-9, DC-10, C-130, C-131, C-141, KC-135, 707, 747, L-1011, KC-10, H-53	1 Halon 1211 Extinguisher Per 2 Aircraft.
NOTE • Two Halon 1211 extinguishers are required for each C-5 aircraft • If any substitutions are required, the substituted unit should be approved by the fire department or ARFF unit. As a general rule, any substitute portable extinguishing unit should have the same extinguishing capability as the Halon unit replaced.	
C. HOT REFUELING - Transfer of fuel into aircraft tanks with one or more aircraft engines operating.	1 Twin-agent (AFFF/PKP) or (AFFF/HALON) skid-mounted extinguisher shall be positioned at each fueling lane. When such equipment is not available, the minimum fire protection shall be two 150-pound PKP or two 150-pound Halon 1211 wheeled units positioned at each lane.
NOTE A crash fire vehicle (TAU) shall be on standby alert during multiple aircraft hot refueling operations. The location and response criteria will be determined by the Fire Chief ARFF officer.	
D. CONCURRENT FUELING AND SERVICING OF AIRCRAFT WITHOUT PASSENGERS	1 Halon 1211 extinguisher. Additionally, one major crash fire vehicle as specified in chapter 5 shall be capable of responding to the scene within 3 minutes.
E. FUELING OF AIRCRAFT WITH PASSENGERS	1 Halon 1211 extinguisher. Additionally, a TAU or major crash fire vehicle as specified in chapter 5 shall be positioned at the aircraft.
NOTE Fire department/ARFF unit shall be alerted at least 15 minutes prior to commencement of fueling operations. The number of passengers on board the aircraft shall be included in the notification.	
F. FUELING OR SERVICING OF MEDICAL EVACUATION FLIGHTS WITH PASSENGERS/PATIENTS ONBOARD	1 150-pound Halon 1211 wheeled extinguisher. Additionally, one major ARFF vehicle shall be positioned at the aircraft for optimum response. Turrets shall be manned and agent pumping equipment/systems ready for instant activation.
NOTE Fire department/ARFF unit shall be notified at least 15 minutes prior to commencement of concurrent servicing operations. The number of passengers/patients on board the aircraft shall be included in the notification.	
G. HIGH POWER AND NEW ENGINE TURN-UP	2 Halon 1211 extinguishers located in immediate vicinity. One major ARFF vehicle shall be capable of responding to the site within 3 minutes.
NOTE Fire department/ARFF unit shall be notified at least 15 minutes prior to commencement of new engine turn-up.	
H. COMBAT AIRCRAFT ORDNANCE LOADING AREA	1 Halon 1211 extinguisher Per 2 aircraft.
NOTE Fire department/ARFF unit shall be notified of daily ordnance loading/unloading schedule.	

hydrostatic pressure test according to the NFPA Fire Codes, Standard No. 10.

EXTINGUISHER TYPES, AGENTS, AND METHODS OF APPLICATION

The best application technique varies with the type of extinguishing agent and associated hardware being used. Fire extinguishers deliver their entire quantity of extinguishing agent within 10 to 30 seconds, depending on the unit. The agent must be applied correctly at the outset, since there is seldom time to experiment. Using a portable extinguisher at too close a range may scatter the fire. Using it at a distance beyond the effective range will simply waste the extinguishing agent.

WARNING

- Fire fighters must use caution in fighting fuel fires and be prepared to back out well before the extinguisher contents are exhausted.
- Halon, PKP, and CO_2 are all rapidly dissipated, and no vapor sealing property is developed; therefore, the fuel is always subject to re-ignition. Discharge should be continued for a short time after the flames are extinguished, to prevent possible reflash and to cool any ignition sources in or near the fire.
- Portable and wheeled Halon, PKP, and CO_2 extinguishers must be discharged in an upright position. When the extinguisher is on its side or inverted the siphon tube will not reach the agent, and an unsatisfactory discharge will result.

HALON 1211 (BROMOCHLORODIFLUOROMETHANE) PORTABLE EXTINGUISHERS AND WHEELED UNITS

Although Halon 12ll extinguishers are intended primarily for use on class B and C fires, Halon 1211 is also effective on class A fires. Halon 1211 is a colorless, faintly sweet smelling, electrically nonconductive gas that leaves no residue to clean up. Halon 1211 extinguishers are marked with a reflective 6-inch silver band around the tank. Halon, which uses fluorine, bromine or iodine based hydrocarbons to interfere with the combustion process, has been identified as an ozone-depleting agent.

WARNING

- Do NOT use Halon 1211 on class D fires. It has no blanketing effect, and should it reach a class D fire in the liquid state, it might explode.
- The discharge of Halon 1211 to extinguish a fire may create a hazard to personnel (such as dizziness and impaired coordination and asphyxiation) from the natural Halon 1211 product and from the products of decomposition that result through exposure of the agent to the fire. Exposure to the agent is of less concern than exposure to the products of decomposition. In using extinguishers of this type in unventilated spaces or confined areas, operators and others should use positive-pressure self-contained breathing apparatus.
- The inhalation of Halon 1211 can be fatal.

The initial application must start close to the fire. On all fires, the discharge should be directed at the base of the flames. Sweep the agent stream back and forth across the leading edge of the fire, overshooting on both sides, and continue to push the leading edge of the fire back until the fire is extinguished. These units have an effective discharge range of 10 to 30 feet, depending on ambient conditions. They have a discharge time of 15 to 40 seconds, depending on the extinguisher size and application rate.

CARBON DIOXIDE (CO_2) 15-POUND PORTABLE UNITS AND 50-POUND WHEELED EXTINGUISHER UNITS

Carbon dioxide (CO_2) units are intended primarily for use on class B and C fires. CO_2 is a colorless, odorless gas that is approximately one and one-half times heavier than air. It is stored in rechargeable containers designed to hold pressurized carbon dioxide in liquid form at atmospheric temperatures. These extinguishers are marked with a 6-inch yellow reflective band around the tank. Fire suppression is accomplished by the displacement of oxygen in the atmosphere to a level below the percent that is required to support combustion.

WARNING

- Exposure to CO_2 in high concentrations for extended periods of time can be fatal.

- The use of portable CO_2 extinguishers to render flammable atmospheres inert is prohibited. When a portable CO_2 extinguisher is discharged, the liquid CO_2, as it expands through the nozzle and cone, becomes solid (commonly called "snow"). This "snow" contacting and separating from the extinguisher cone becomes electrically charged, as does the extinguisher itself. If the charged "snow" contacts an insulated metal object, it will cause the object to become charged. Tests indicate that voltages greater than 15 kilovolts can be developed on insulated metal objects from a 1- to 2-second application of CO_2 from an extinguisher. This voltage is sufficient to cause a spark.

Agent application should commence at the upwind edge and be directed slowly in a side-to-side sweeping motion, gradually moving toward the back of the fire. These extinguishers have a limited discharge range of 3 to 8 feet and a discharge time of 8 to 44 seconds, depending on the extinguisher size and application rate.

PURPLE-K-POWDER (PKP) DRY CHEMICAL POWDER 30/150-POUND EXTINGUISHERS

Purple-K-Powder (PKP) extinguishers are intended primarily for use on class B fires. The principal base chemical used in the production of PKP (dry-chemical agent) is potassium bicarbonate.

The ingredients used in PKP are nontoxic. However, the discharge of large quantities may cause temporary breathing difficulty, may seriously interfere with visibility, and may cause disorientation. PKP extinguishers are marked with a 6-inch purple band around the tank.

CAUTION

- Dry-chemical agents will harden after being exposed to moisture. Therefore, it is important to avoid exposing them to any moisture during stowage, handling, and recharging evolutions.

- When PKP is used as the fire-suppression agent on an aircraft fire and the agent is directed at or ingested into an engine or accessory section, the fire chief, on-site personnel using the extinguisher, or senior fire official must notify the maintenance officer of the unit involved or, in the case of a transient aircraft, the supporting facility. PKP injected into a jet engine cannot be completely removed without disassembly of the engine, to remove deposits that penalize engine performance and restrict internal cooling air passages.

Depending on their size, PKP extinguishers have a discharge range of approximately 10 to 40 feet. The discharge times vary from 8 to 60 seconds. When these extinguishers are used on flammable liquid fires, the stream should be directed at the base of the flame and gradually moved toward the back of the fire while the nozzle is swept rapidly from side to side.

DEPLOYMENT OF PORTABLE FIRE EXTINGUISHERS FOR AIRFIELD OPERATIONS

Fire extinguishers are designed to be carried or rolled on wheels to the fire. The units must be operated according to the instructions printed on the extinguishers.

Agent application is started at the upwind edge of flammable liquid fires and directed at the base of the flame in a side-to-side sweeping motion. Fires must be extinguished as quickly as possible.

Extinguishers are kept filled with the specified weight of the proper agent at all times. In the case of cartridge-operated extinguishers, cartridges are kept fully charged at all times. Reweighing is the primary method of determining whether or not the cartridge is fully charged. In the case of pressurized extinguishers, proper expelling pressure must be maintained. Examination of the pressure gage indicates whether or not the extinguisher is properly pressurized. Extinguishers are refilled immediately after use, even though only partly discharged.

The inspection, maintenance, and recharging of portable fire extinguishers are of prime importance to ensure proper operation. Station fire chiefs are responsible for placement, timely inspection, maintenance, recharging of all fire extinguishers, and the training of flight line personnel in the use of portable fire extinguishers.

Fire protection equipment provided for airfield operations should consist of the equipment listed in table 8-1.

PROTECTIVE CLOTHING

Aircraft fire fighting and rescue protective clothing is a prime safety consideration for personnel engaged in fire fighting and rescue work. Aluminized protective clothing provides protection to fire fighters because of its high reflectivity to radiant heat. Aluminized proximity fabrics have been adopted for use in the Navy mishap and rescue program. These garments are not classified as entry suits, but are known as proximity clothing, to be worn with fire fighter's knee-length boots, which have safety toes and soles.

Fire department and ARFF units that have a dual crash and structural mission must provide protective clothing of the aluminized proximity type or NFPA-approved structural protective clothing, as determined by the fire chief or ARFF officer. A complete set of proximity protective clothing includes trousers, coat, gloves, aviators' summer flight gloves, flash hood (sock), and helmet or hood.

Fire departments and ARFF units should maintain a backup ready stock of protective clothing of approximately 30 percent of total unit requirements.

NOTE 1

Only protective clothing that conforms to or exceeds current military specifications must be used.

NOTE 2

NAVSUPINST 4440.120 must be complied with should protective clothing fail in its intended purpose or have an unreasonably short service life. A completed copy of an SF 368 form and the defective material must be forwarded to the Commanding Officer, Navy Fleet Material Support Office (Code 91423), Mechanicsburg, Pa., 17055.

Care and Maintenance

The heat-reflective ability of aluminized clothing items is reduced when they are stained or otherwise soiled. Careful attention must be given to the following care and maintenance instructions:

1. Aluminized clothing should be stored on hangers with suitable hanging space to prevent the aluminized fabric from creasing or cracking. If the garments are folded, the folds should be loose. Do not sit on a folded garment.

2. Dirt and soot should be sponged off with mild soap and water, and the aluminum surface dried with a clean cloth. Rub it gently to avoid removal of the aluminum.

3. Although grease stains can be removed by using dry-cleaning solvents, isopropanol or perchloroethylene will react with the metal in proximity suits and may etch the aluminum surface. Clean the clothing with water and wipe it dry. Allow the garment to hang in a ventilated location at room temperature.

4. AFFF may be removed by sponging the garment clean with mild soap and water. Hang it to dry in the open or in a place with good ventilation. During fire fighting operations, it is not always possible to prevent agents from getting onto protective clothing. However, aluminized protective clothing that has been covered or spotted with agent will provide less heat reflection than the suit normally would provide.

5. Corrosive chemicals react with the aluminum surface and may etch the metal. Clean the clothing with water and wipe it dry. Allow the clothing to hang in a ventilated location at room temperature.

6. Garments should be replaced when the metal wears off or when the fabric has cracks or tears. Not only does spraying worn clothing with aluminum serve no useful purpose, but it is a dangerous practice.

Care of the Facepiece

The gold-coated facepiece is a reflective heat shield. The facepiece is not a sun shield. This item should be kept in excellent condition to maintain its radiant-heat-reflective efficiency. In particular, when the facepiece's gold surface becomes worn, scratched, or marred, 90 % of the heat protection is lost, and the facepiece should be replaced immediately. Other precautions are as follows:

CAUTION

An old facepiece must not be used as a cover to protect a new facepiece.

1. Keep the protective cover in place when you are carrying or storing the hood, to minimize damage to the gold-coated surface. Remove the protection cover when using the hood.

2. To ensure adequate protection, replace a worn gold-coated facepiece. Make sure the gold surface is on the outside as marked on the edge.

3. Avoid touching or wiping the gold surface as much as possible.

4. Clean the facepiece without removing it from the hood by using a clean soft cloth with mild soapy water, then rinse and pat dry.

Q9. What are the primary flight line fire extinguishers?

Q10. What is the proper method of deploying portable flight line fire extinguisher?

AIRCRAFT CONSTRUCTION AND HAZARDOUS MATERIALS

LEARNING OBJECTIVES: Recognize various hazards associated with aircraft construction components, internal systems, and armament.

Materials currently used in aircraft construction are classified as either metallic or nonmetallic. These materials are primarily metals and plastics. You should consult the NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual, NAVAIR 00-80R-14-1, for the types of materials used in each particular aircraft.

METALS USED IN AIRCRAFT CONSTRUCTION

Aluminum is one of the most widely used metals in modern aircraft construction.

Aluminum alloy is approximately one-half as heavy as steel and almost as hard. It is light gray and has a silvery surface when polished. It is used as sheets for skin surface, as channels for framework, and as plates and castings for bulkheads and fittings. Forcible entry into fuselages through skin surfaces of aluminum alloy may sometimes be accomplished with special axes or metal cutting saws, but the thickness of the metal may make this impossible. This is especially true on the newer jet transports and supersonic military aircraft. This metal will not contribute to a fire to any significant degree. It will not withstand heat or flame exposure, because it melts under the conditions found in aircraft fires. For this reason, it is essential to keep fuselage skin surfaces cool where this metal is used until rescue operations are completed. Otherwise, the occupants will be subjected to the direct fire exposure.

Magnesium alloys are used for landing gear and wheels, engine mountings, brackets, crankcase sections, coverplates, and other engine parts. These alloys are silvery white or grayish in color, about two-thirds the weight of aluminum, and are used on most large commercial-type aircraft for the framework and flooring. Some military fighter-type aircraft are also largely constructed of magnesium. This metal introduces a serious additional problem in fire extinguishment when it becomes involved in an aircraft fire. It is not easily ignited. The ease of ignition depends on its mass (thickness and shape). However, it burns violently and cannot be extinguished readily, which presents a constant re-ignition threat where flammable vapors are present.

Steel is used in engine parts, around engine nacelles to increase the fire resistance of the nacelle, for engine "firewalls," and for tubing and structural framing on fabric aircraft. It presents no fire hazard, nor does it contribute to a fire. In most forms used in aircraft, steel can be cut with metal saws, but it is likely to be a time-consuming operation. Stainless steel may be found on skin surfaces of jet aircraft.

Titanium is used in engine parts, nacelles, and for engine "firewalls." This metal is a combustible metal, but in the forms used in aircraft, it has a high degree of heat- and fire-resistance. The principle hazard presented by this metal is its friction-spark hazard in cases where the metal is exposed to contact with a paved surface. If flammable vapors are present (as might be in the case of an accident); this spark hazard is serious.

AIRCRAFT PLUMBING AND ELECTRICAL WIRING

Throughout most aircraft there is extensive plumbing to carry fuel, hydraulic and lubricating oils, oxygen, and so forth, and a great deal of electrical wiring. Under adverse circumstances these lines may break, fail, and be the source of a fire. While failure of these lines is not of the same magnitude as a fuel tank failure, many aircraft have been destroyed because of difficulty with these plumbing lines or electrical systems. Color banding is used to identify the various plumbing systems, to aid in the installation and maintenance of aircraft. Knowing this color-coding scheme permits fire fighters to use proper caution when they are confronted with such plumbing while making entry into a damaged aircraft. Figure 8-12 shows the various color codes and symbols used.

CONSTRUCTION HAZARDS

In aircraft construction, there are many hazards that could occur. Some of these are discussed in the following text.

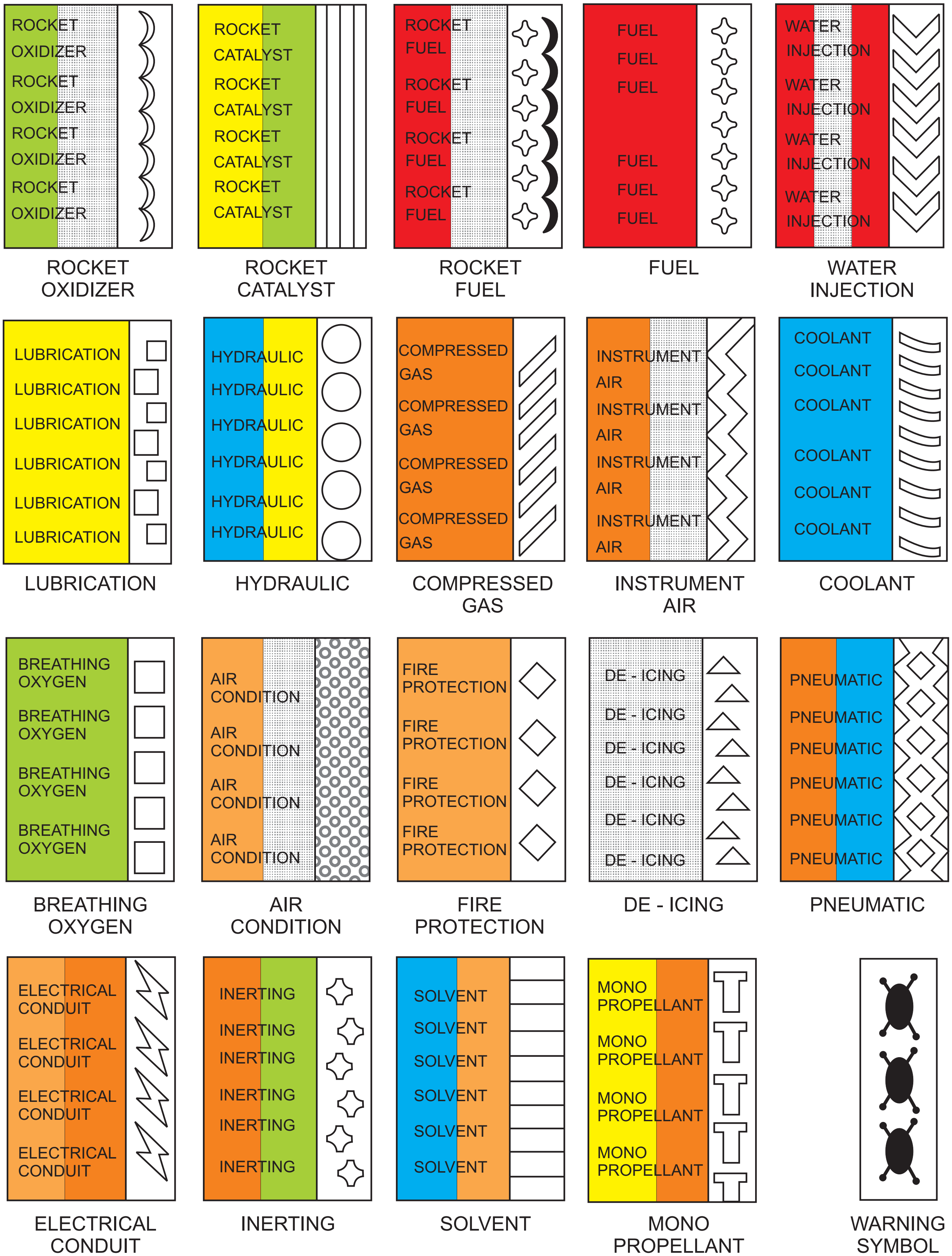


Figure 8-12.—Color-code designations for piping for aircraft systems.

Wing to Fuselage Mountings

In some aircraft where the wing joins the fuselage, there is no substantial firewall to provide for the desired segregation. As all aircraft have wing tanks, many without separate metal tanks or bladder tanks within the wing cavities, the existence or absence of this fire-resistant division is very important. Some aircraft also have fuel in the center wing section, which, in effect, places fuel storage within the fuselage. Thus, it is possible for fuel from damaged tanks to leak into the fuselage in vapor or liquid form. Such leakage increases the danger of ignition within the aircraft and increases the hazard to the aircrew and passengers.

Fuel Tanks and Lines

When an aircraft crashes, the impact usually is such that the fuel lines and fuel tanks become ruptured. Ordinarily, all the fuel is not liberated at once. There is a source of fuel that is supplying the fire either from the rupture in the tank or from the loosened and ruptured fuel lines in the accessory section of the engine. The accessory section should be given due concern because the fuel lines are the weaker points for such loosening or rupturing. The control of the fire around the fuselage section under these conditions presents a very complex problem. From the study of the wing tank construction of the aircraft, it is obvious in which direction the force will be relieved in case of an expansion rupture or an explosion. The top portion of the tank is more void of liquid than any other section of the tank. Because of the restraining cushion of the liquid itself, the explosive force will be directed upward, instead of downward or on a horizontal plane.

Fuel loads can vary from 30 gallons in small aircraft to approximately 50,000 gallons in large jet aircraft. Fuel tanks are installed in a variety of places within the aircraft structural framework or as a built-in part of the wing. Fuel tanks are often carried under the floor area in the fuselage of helicopters. You should refer to *NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1, for the exact location of fuel tanks on a particular aircraft. Upon severe impact, the tanks generally rupture and result in fire. Many naval aircraft are provided with external auxiliary fuel tanks located under the wings and fuselages.

A number of tests were conducted on external aircraft fuels tanks in which they were exposed to an enveloping fuel fire. These studies show that there were no deflagrations. The tanks did melt or rupture, releasing fuel onto the decks. The time to fuel tank failure (release of fuel) was dependent on the percent of fuel in the tank and ranged from 28 seconds for a 10 percent load to 3 1/2 minutes for a 100 percent load.

Although there are differences in the properties of the different fuels now in use, it is emphasized that under aircraft crash-impact conditions where fuel mists (fuel-air mixture) are created, all of the fuels are easily and readily ignitable.

There is so little difference in the heat of combustion of the various aircraft hydrocarbon fuels that the severity after ignition would be of no significance from the view of fire safety. The fire fighting and control measures are the same for the entire group of aviation hydrocarbon fuels.

Fire Hazard of Hydraulic Fluid

The fire hazard from the small quantities of flammable liquids used as hydraulic fluid is nominal compared to the quantities of fuel usually present. The fact that important aircraft parts are hydraulically controlled is, however, of importance to firefighters. For example, the burning out of some hydraulic lines may release the brakes and result in unanticipated and dangerous movement of the aircraft. Hydraulic tubing should not be cut carelessly; but where such tubing obstructs rescue operations, firemen should feel no hesitancy in cutting it. However, care should be exercised in cutting tubing, as the pressure of the fluid may be as high as 3,000 pounds per square inch and may discharge with violence when the tubing is severed. This pressure may be reduced by operating bomb bay doors or wing flaps until the pressure is 0 pound per square inch (psi).

Electrical System

The electrical system on aircraft supplies current for lights, radio, interphone system, booster pumps, hydraulic pumps, propeller pitch gears, heaters, turret operation, gunfiring by remote control, and numerous electrically actuated devices. An extensive wiring system is involved, and the principal fire hazard is the danger of a short circuit or arcing of this system.

Oxygen Systems

Oxygen systems on aircraft can present hazardous conditions to fire fighters during an emergency. Liquid oxygen is a light blue liquid that flows like water and is extremely cold. It boils into gaseous oxygen at -297°F

(-147°C) and has an expansion rate of approximately 860 to 1. Liquid oxygen is a strong oxidizer and though in itself is nonflammable it vigorously supports combustion.

Class A Combustibles

Class A combustibles in aircraft fires are best extinguished with AFFF. (See the section on AFFF for full explanation of the uses and efficiency of AFFF.) When aircraft cockpit and interior finish materials are burned or charred, they produce toxic gases. These gases include carbon monoxide, hydrogen chloride, and hydrogen cyanide. Therefore, it is necessary that fire fighting and rescue personnel who enter an aircraft during a fire sequence be equipped with a self-contained breathing apparatus.

ARMAMENT HAZARDS

Naval aircraft carry a wide variety of ordnance in support of their assigned mission. TP-75-22, entitled *Fast Cook-Off Characteristics of Air-Launch In-Service Weapons*, provides a single source for fast cook-off characteristics and summarizes the current available data for in-service naval air-launched weapons. Summarized are weapons descriptions, explosive type, cook-off times, reaction, typical fast cook-off results, hazards, and cook-off test data. Summary cook-off times for these ordnance items are contained in figures 8-13 through 8-17. TP-75-22 must be a part of the ready reference library of crash and rescue crews ashore and afloat.

WARNING

- All air-launch weapons exposed to a fire can cook off either during a fire or after it is extinguished. The fire duration and the type/location of the weapons determine the reaction severity that may occur.
- When an aircraft fire occurs, the ordnance handling officer/air gunner confirms the type, quantity, and location of all weapons on the aircraft involved and immediately provides this information to the scene leader. The scene leader ensures that AFFF is continuously applied to all weapons exposed to fire. Water hose lines should not be used for ordnance cooling until after the fire is extinguished. The use of water hose lines for ordnance cooling may delay extinguishment, because of the tendency of water to dilute or wash away the AFFF blanket. Postfire ordnance cooling must continue for a minimum of 15 minutes to allow the weapon cases to return to safe ambient temperatures.

WARNING

Postfire weapons cooling time of 15 minutes only provides an interim time element for weapons cooling, and is the minimum acceptable cooling time for all weapons. Personnel safety and fire exposure time of weapons must be considered when expediting postfire evolutions to satisfy operational commitments.

The ordnance-handling officer must keep the crash and salvage officer/crash chief continually updated as to the type/quantity of ordnance being used.

The training program for your crash crew informs you of the hazards of the guns, bombs, and missiles carried by the aircraft assigned to the air station. Rockets and pyrotechnics are discussed here because of their extreme danger during aircraft fires.

Hypergolic Mixtures

Hypergolic mixtures are used as propellants for rockets and missiles. Hypergolic fuels ignite on contact with certain chemical oxidizers and do <u>not</u> require a source of ignition. Examples of hypergolic combinations used in missile and rocket propulsion systems are found in *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual* NAVAIR 00-80R-14.

WARNING

The health hazards of hypergolic materials include chemical burns, poisoning, and frostbite. In accidents involving these materials, personnel must use full respiratory protection and protective clothing. Fires involving these materials can best be handled by diluting the fuel and oxidizer with large quantities of water.

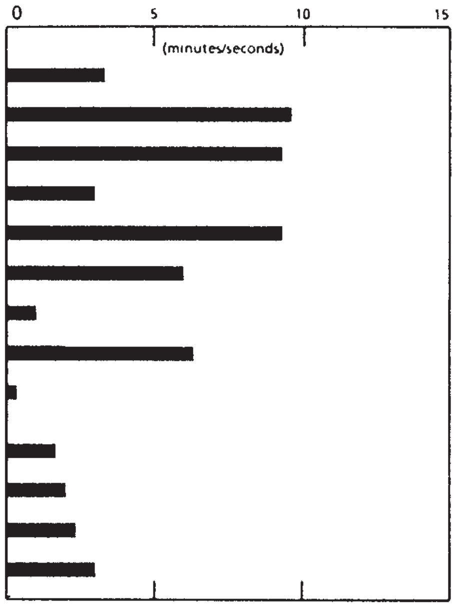
Hydrazine

The following information is provided on the makeup, use, and characteristics of hydrazine and the safety precautions to be used with hydrazine.

1. Hydrazine is a clear, oily, water-like liquid with an odor similar to that of ammonia. Hydrazine will

BOMB COOKOFF TIME SUMMARY

MINIMUM FAST COOKOFF TIME



BOMBS	REMARKS: TIME	REACTION	FIREFIGHTING HAZARD
MK 82 MOD 1 THERMALLY PROTECTED	3:33	DEFLAG/EXPL/DET	MAJOR AFTER 4:00 MIN
MK 82 MOD 2 THERMALLY PROTECTED	8:52	DEFLAG/EXPL/DET	MAJOR AFTER 10:00 MIN
MK 83 MOD 5 THERMALLY PROTECTED	8:49	DEFLAG/DET	MAJOR AFTER 9:00 MIN
BLU-110/B	3:00	BURN/DEFLAG	MAJOR AFTER 3:00 MIN
MK 84 MOD 3 THERMALLY PROTECTED	8:45	DEFLAG/DET	MAJOR AFTER 9:00 MIN
ROCKEYE MK 20 MOD 6 THERMALLY PROTECTED	6:15	DEFLAG/EXPL/DET	MAJOR AFTER 6:00 MIN
ROCKEYE MK 20 MOD 3	1:13	DEFLAG/EXPL/DET	MAJOR AFTER 1:00 MIN
GATOR CBU-78 B	6:32	BURN/DEFLAG	MAJOR AFTER 6:00 MIN
MK 77 FIRE BOMB	0:30	BURN/DEFLAG/ EXPL/DET	MAJOR AFTER 5:00 MIN
MK 81 MOD 1	1:50	DEFLAG/EXPL	MAJOR AFTER 2:00 MIN
MK 82 MOD 1	2:04	DEFLAG/EXPL/DET	MAJOR AFTER 2:00 MIN
MK 83 MOD 4	2:32	DEFLAG/DET	MAJOR AFTER 2:00 MIN
MK 84 MOD 2	3:02	DEFLAG/DET	MAJOR AFTER 2:00 MIN

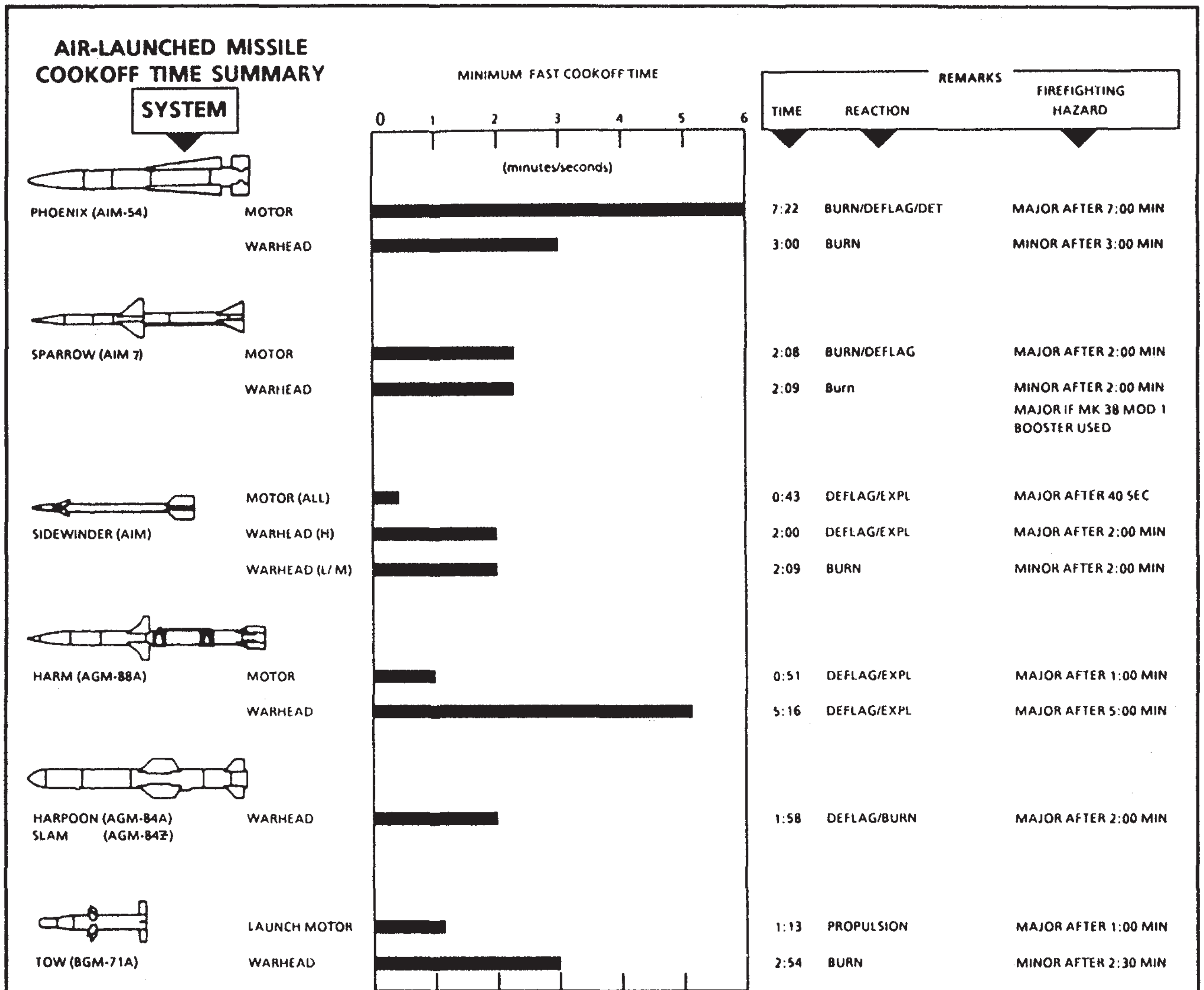
WARNING

ENSURE THAT AFFF IS CONTINUOUSLY APPLIED TO ALL WEAPONS EXPOSED TO FIRE. WATER HOSE LINES SHOULD NOT BE USED FOR ORDNANCE COOLING UNTIL AFTER THE FIRE IS EXTINGUISHED. THE USE OF WATER FOR ORDNANCE COOLING MAY DELAY EXTINGUISHMENT BY DILUTING OR WASHING AWAY THE AFFF BLANKET. POSTFIRE ORDNANCE COOLING (AFFF OR WATER) SHALL CONTINUE FOR A MINIMUM OF 15 MINUTES TO ALLOW THE WEAPONS CASES TO RETURN TO SAFE AMBIENT TEMPERATURES. POST AIRCRAFT FIRE OVERHAUL/SALVAGE EVENTS SHALL NOT BEGIN UNTIL ALL WEAPONS HAVE BEEN DETERMINED SAFE OR REMOVED BY EXPLOSIVE ORDNANCE DISPOSAL (EOD) PERSONNEL.

WARNING

WEAPONS WITH SUBMUNITIONS (I.E., ROCKEYE, GATOR, TOMAHAWK BGM-109D, AND APAM), WHEN EXPOSED TO FIRE, DISBURSE UNREACTED BOMBLETS/MINES TO DISTANCES GREATER THAN 1/4 MILE. LOOSE BOMBLETS/MINES MAY BE ARMED AND ARE EXTREMELY DANGEROUS AND SHOULD BE DISPOSED OF BY EOD PERSONNEL ONLY.

Figure 8-13.—Bomb cook-off time summary.



WARNING

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WARNING

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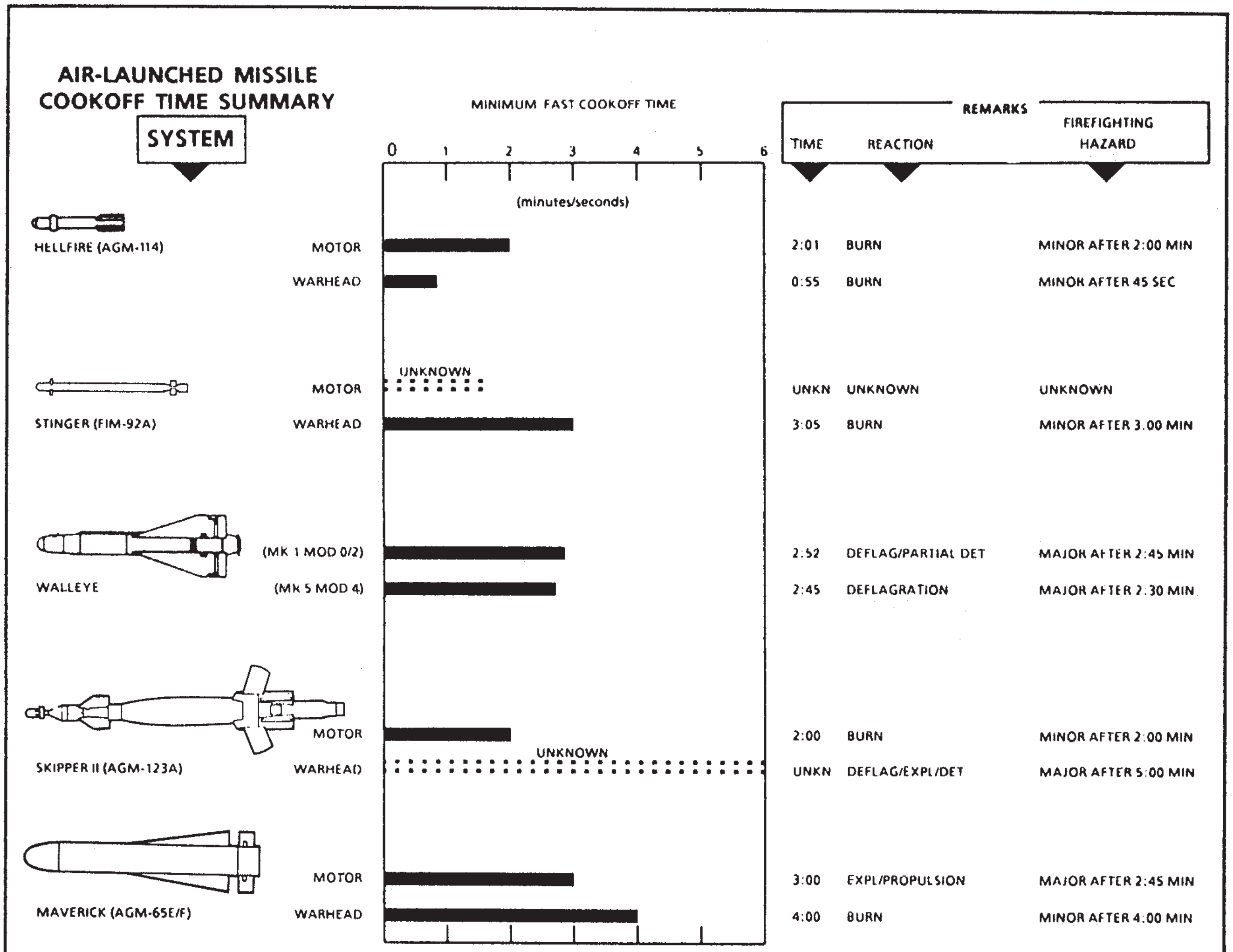
Figure 8-14.—Air-launched missile cook-off time summary (sheet 1 of 2).



WARNING

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Figure 8-14.—Air-launched missile cook-off time summary (sheet 2 of 2).

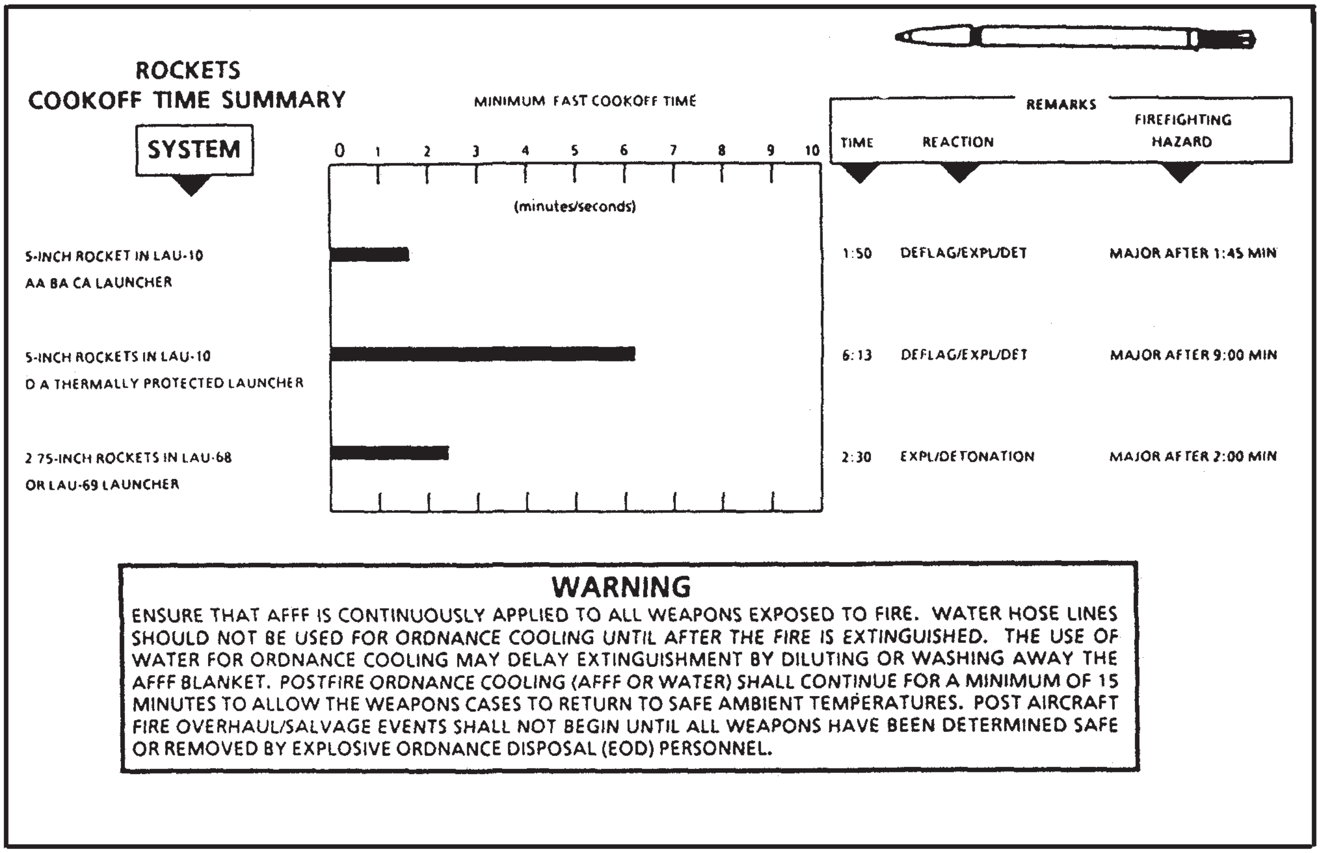


Figure 8-15.—Rocket cook-off time summary.

readily ignite when exposed to heat, flame, or oxidizing agents. The flash point is 126°F (52°C). As opposed to liquid form, hydrazine vapors are much more sensitive to electrical sparks, embers, flame, and so forth.

2. Hydrazine fuel (H-70) is a blend of 70 % hydrazine and 30 % water and is used to power the emergency power unit (EPU) on F-16 series aircraft. EPU operation results in noise similar to the rapid firing of a rifle. Exhaust gases exiting the EPU turbine are approximately 1,600°F (871°C) and basically consist of 40 % ammonia, 17 % nitrogen, 15 % hydrogen and 28 % water.

3. The following Warnings and Cautions pertain to all aspects of fire fighting and cleanup information concerning hydrazine.

WARNING

- Aircraft crash or emergency landing may result in hydrazine spill or vapor release. Personnel who may be exposed must wear positive-pressure self-contained breathing apparatus and protective garments. At the minimum, spilled hydrazine should be diluted with equal amounts of water spray to render it nonflammable.
- Hydrazine is toxic and if the vapors are inhaled, irritation of the respiratory tract will occur.
- If liquid hydrazine is splashed in the eyes or on the skin, flood with water for 15 minutes at the minimum, and seek medical care. Immediately remove contaminated clothing. If odor of ammonia is present, remove personnel to fresh air area, at least 100 feet upwind of the aircraft.

WARNING

- If EPU is operating in the hydrazine mode, personnel in the immediate vicinity of the aircraft must wear positive-pressure self-contained breathing apparatus. The EPU exhaust gases may cause irritation of the eyes, nose, and throat.

M61A1 AIRCRAFT GUN/MK 4 GUN POD COOKOFF TIME SUMMARY

EXPLOSIVE-M56A3
20 mm Ammunition
Aluminized A-4

M61A1 GUN SYSTEM

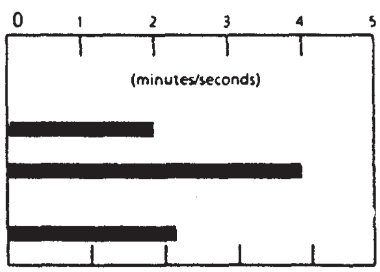
THE M61A1 GUN SYSTEM IS INSTALLED IN THE A-7, F-14, AND F-18 AIRCRAFT. THE GUN SYSTEM CONSISTS OF THE GUN FEED CHUTE AND AMMUNITION MAGAZINE. THE MAGAZINE AND FEED CHUTE CONTAIN UP TO 1,000 ROUNDS OF 20 mm HIGH EXPLOSIVE (M56A3) OR TARGET PRACTICE (M58A1) AMMUNITION.

EXPLOSIVE - MK 104
20 mm Ammunition
Tetryl

MK 4 GUN POD

THE MK 4 GUN POD IS A SELF-CONTAINED AND SELF-POWERED 20 mm AIRCRAFT GUN SYSTEM. THE ALUMINUM POD CONTAINS THE MK 11 GUN FEED MECHANISM AND A MAGAZINE OF 750 ROUNDS. A PNEUMATIC RESERVOIR CHARGED TO 2500 PSI OPERATES THE SYSTEM. THE MK 4 GUN POD IS INSTALLED IN THE F-4 AIRCRAFT.

MINIMUM FAST COOKOFF TIME



	REMARKS TIME	REACTION	FIREFIGHTING HAZARD
M61A1 GUN SYSTEM			
FEED CHUTE	2:00	DEFLAGRATION	MINOR AFTER 2:00 MIN
MAGAZINE	4:40	DEFLAGRATION	MINOR AFTER 2:00 MIN
MK 4 GUN POD			
GUN POD	2:20	CARTRIDGE INITIATION	SEE REMARKS

REMARKS

HAZARD OF M61A1 AND MK 4 GUN POD IS LESS THAN OTHER AIR-LAUNCHED WEAPONS BECAUSE OF THE SMALLER AMOUNTS OF EXPLOSIVE REACTING IN EACH ROUND.

WARNING

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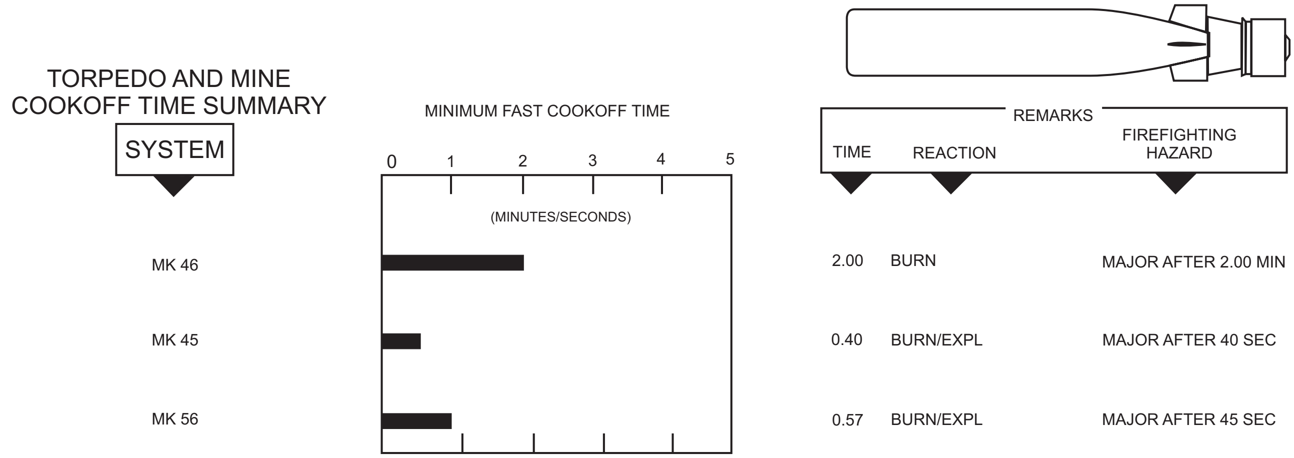
Figure 8-16.—M61A1 aircraft gun/Mk 4 gun pod cook-off time summary.



WARNING

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WARNING

MK 46, MK 55, AND MK 56 TORPEDOES CONTAIN OTTO FUEL II. THIS BRIGHT RED, ONLY LIQUID IS TOXIC. DIRECT CONTACT WITH SKIN AND INHALATION OF VAPOR OR INHHALATION OF SMOKE FROM BURNING OTTO FUEL MUST BE AVOIDED

Figure 8-17.—Torpedo and mine Cook-off Time Summary.

- Contact of H-70 with body tissues can produce local damage resembling an alkali burn. Ingestion or absorption of hydrazine through the skin can produce nausea, dizziness, headaches and convulsions. Medical examinations of personnel exposed to H-70 should be done as soon as possible.

4. Emergency limits for exposure to hydrazine vapor are in concentrations of 30 parts per million (ppm) for 10 minutes, 20 ppm for 30 minutes, and 10 ppm for 60 minutes. Irreversible health effects occur at 80 ppm for 30 minutes. Such high concentrations only occur in enclosed areas, such as a hangar, and could not occur in open air.

5. Specific hydrazine cleanup and fire fighting instructions are contained in USAF technical orders T.O. 42B1-1-18, *General Procedures Handling of H-70 Hydrazine-Water* and T.O. 1F-16C-2-49GS-00-1, *H-70 Fuel Spill Management and Neutralization.*

Rockets

Rockets still on their launchers are extremely dangerous. Every precaution should be taken to stand clear both fore and aft of rocket installations. A fire in or around the area of a rocket pod makes assessing whether the rockets in the pod will ignite difficult. A considerable period of time would be required to heat the propellant to autoignition temperature (approximately 300°C). This would also be true of the warhead, which is enclosed in a case to a sufficient degree. Consequently, even with direct exposure to a fuel fire (approximately 1,500°F), the rocket requires a very definite time period (estimated to be approximately 5 minutes) to heat to autoignition temperature.

The effect of explosion depends on whether the warhead or the rocket propellant exploded. When the explosion takes place in the propellant, the results are relatively minor. In a propellant explosion, the usual result is a split motor tube. The propellant is usually consumed very rapidly in this circumstance, and exhaust flame is ejected from the motor tube through the nozzles and the split. In this event the tubes in the rocket pod would be severely damaged; also, it would probably be impossible to remove the warheads from the package since the exhaust gases from the burning propellant are very hot (approximately 4,000°F)

It is unlikely that ignition of the propellant would fire the rocket in a normal manner. However, if that were to occur the rockets would follow a normal path and would be armed when they came to rest. In such a circumstance, great care must be taken in handling these rounds.

The warheads of the rockets might ignite, which could be expected in the event of long exposure of the rockets to the fire. The primer of the warhead would be the source of ignition because of its greater sensitivity to high temperature (as compared to the warhead explosive). Explosion of the warheads would be major in effect and would probably destroy the aircraft structure. One warhead's going off would set off the remaining rocket propellant.

Missiles

Guided missiles are defined as self-propelled objects that, after being launched into the air, automatically alter their direction of flight in response to signals received from outside sources. They usually carry high-explosive charges and are equipped with a means to explode them at or near a target. The majority of guided missiles used in the Navy are essentially rockets that can maneuver while in flight.

The majority of air-launched guided missiles used by the Navy use the solid propellant rocket motor. They include the double base and multi-base smokeless powder propellants, as well as the composite mixtures. Grain configurations vary with the different missiles. Power characteristics and temperature limitations of the individual rocket motors also vary.

The areas immediately in front of and behind rockets and missiles are danger areas. Rocket/missile flash, which occurs upon ignition, is fatal at short ranges behind the rockets and missiles.

For fire fighting, you should ensure that AFFF is continuously applied to the rockets/missile package exposed to the fire.

Water should NOT be used for ordnance cooling until after the fire is extinguished. The use of water for ordnance cooling may delay fire extinguishment, by diluting or washing away the AFFF blanket.

Postfire ordnance cooling with AFFF or water must continue for at LEAST 15 minutes. This is to allow the weapons cases to return to a safe ambient temperature.

Postfire aircraft overhaul salvage events must not begin until all weapons have been determined safe or removed by explosive ordnance disposal (EOD) personnel.

Pyrotechnics

Pyrotechnics are fireworks designed for signals, warnings, lighting for photography, bombing or landing, or other special purposes. They consist of various types of flares, signal lights, smoke grenades, and so forth.

Pyrotechnics usually are rapid-burning powder, magnesium, or other flammables that are readily discharged or set on fire. Since they may contain small exploding charges to spread the signals, when ignited in an aircraft fire, they will generally spread the fire quickly throughout the fuselage.

They may be located anywhere on the aircraft. In single-place aircraft, hand-launched pyrotechnics are located conveniently for the pilot. In other types of aircraft, they may be in any part of the aircraft. Parachute flares are released by remote controls located in the pilot's compartment. The flares are normally carried in special compartments in the side of the fuselage or in chutes for discharge.

Whenever possible, pyrotechnics should be promptly removed from a crashed aircraft. Failure to do so may result in the discharge of these flares and signals, with great increase in the intensity of an existing fire or with the ignition of a fire that otherwise might not have occurred.

Additional information on armament hazards may be found in the *NATOPS U.S. Navy Aircraft Fire Fighting and Rescue Manual,* NAVAIR 00-80R-14 and *NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual,* NAVAIR 00-80R-14-1. Similar information on high explosives, nuclear weapons, and/or hazardous cargo applicable to shore stations may be found in publications such as NAVORD OP-5, Volume 1 chapter 40, and NAVAIRINST 11320.4.

Flare Dispensers

The SUU-44/SUU-25 flare dispensers carry eight Mk 45/LUU-2 paraflares. When the flares are ejected from the dispenser and the tray separates, they are considered fully armed. Once the tray separates from the flare, it ignites a fuze on the Mk 45 flare, which fires within 5 to 30 seconds. The LUU-2 flare uses a simple mechanical timer instead of an explosive fuze.

WARNING

- Upon fuze function, the Mk 45-flare casing is explosively separated and can travel up to 150 feet. Personnel must remain clear of the longitudinal axis (trajectory path) of the casing. The LUU-2 flare timer functions mechanically and falls off the flare. The timer is not explosively ejected.
- When a flare is accidentally ejected on the ground or deck, a wind force of 35 knots may cause the drogue chute to remove the deployment bag from the main parachute and open the main parachute. The parachute must, if possible, be kept from opening, and all shroud lines should be cut. When it is not possible to keep the main chute from opening, no effort should be made to hold the candle tube against the pull of the parachute, because a 50-pound pull on the shroud lines may actuate the candle igniter. The parachute will drag an unrestrained candle tube without causing ignition. HOLD THE PARACHUTE, NOT THE CANDLE.

When ignited, the Mk 45 or LUU-2 candle should be extinguished by inserting a water applicator tip into the burning end of the candle and applying low velocity fog. The flare normally extinguishes in less than 30 seconds. When a fog applicator is not readily available, an alternate method is to have someone who is fully outfitted with a hotsuit to cut the shroud lines, pick up the flare by the cold end, and jettision it over the side or remove it to a clear area if it is ashore.

WARNING

Paraflares burn with an intense light. Personnel must wear protective eye covering.

Overheated Batteries

Alkaline or nickel-cadmium batteries may get hot from internal shorting or thermal runaway. The overheated battery is hazardous to both aircraft and personnel. When an overheated battery is detected, the crash crew should open the battery compartment, check for the following conditions, and take the action indicated:

1. When flame is present, use available extinguishing agent, such as Halon 1211 or CO_2.

WARNING

Halon 1211 or CO_2 is an acceptable fire-extinguishing agent once a fire has developed. CO_2 must not be directed into a battery compartment to effect cooling or to displace explosive gases. Static electricity generated by the discharge of the extinguisher could explode hydrogen or oxygen gases trapped in the battery compartment.

2. When the battery is emitting smoke, fumes, or electrolyte in the absence of flame or fire, make sure the battery switch in the cockpit is in the OFF position. Remove the quick disconnect from the battery and, if possible, move the battery clear of the aircraft. Use water fog to lower the battery temperature.

WARNING

When approaching a battery that is in a thermal runaway condition, ARFF personnel must work in teams of two and must be attired in full protective clothing, with extinguishing agent available for instant use.

Sonobuoys with Lithium Batteries

Some sonobuoys contain lithium batteries, which, if damaged, could vent highly toxic and irritating sulfur dioxide gas (SO_2). SO_2 turns to a colorless liquid at temperatures below 14°F. It is noncombustible and will retard fire. Positive-pressure self-contained breathing apparatus and eye protection should be worn.

WARNING

- If the pungent odor and rusty metallic taste of SO_2 fumes are detected, execute smoke and fume elimination procedures and launch/remove the venting buoy. If unable to determine which buoy is venting, jettison/remove all buoys to natural ventilation.
- Burning lithium emits a toxic and caustic particulate cloud. Do not breathe or expose yourself to the particulate cloud. Breathing of the particulate may cause damage to respiratory systems. Exposure to the particulate cloud may cause burning and damage to the eyes. Molten lithium will burn the skin.
- The white light emitted by burning lithium can cause eye burns. Avoid looking directly at the lithium.
- Application of Halon, PKP or CO_2 is NOT effective against burning lithium and will result in an explosion. Direct application of Halon, PKP, or CO_2 to burning lithium should be avoided.
- The application of water of AFFF on a lithium fire results in a decomposition of water into hydrogen and oxygen. Liberated hydrogen may violently ignite if confined and allowed to reach its lower explosive limit. This hydrogen ignition may produce a pressure wave of burning lithium, scattering out to a distance of approximately 50 feet.
- Proper protective clothing with gloves, flash hoods, and breathing gear should be worn when attacking a lithium fire and during investigation/clean-up operations.

COMPOSITE MATERIALS

Information regarding the advantages and disadvantages of using composite materials in aircraft construction follows.

WARNING

Inhalation of composite fibers resulting from aircraft fires and/or aircraft material damage may be harmful to personnel. Respiratory protection must be worn when personnel are exposed to these potential hazards.

Composite Materials Reinforced With Carbon/Graphite Fibers

Composite materials that are reinforced with carbon/graphite fibers provide superior stiffness, a high strength-to-weight ratio, and ease of fabrication. As a result, this material is being used extensively in advanced aircraft, such as the AV-8B, to replace heavier metal components. Unfortunately, carbon or graphite fibers can be released into the atmosphere if their epoxy binder burns. Once free, these small lightweight fibers can be transported up to several miles by air currents and, because of their high electrical conductivity, can damage unprotected electrical/electronic equipment. Temperatures of approximately 752°F (400°C) causes epoxy binder to ignite or decompose. Similarly, mechanical agitation, especially an explosion, can fragment the fibers and cause them to become airborne. Until such time as more information is known, aircraft crash and fire fighting units must attempt to extinguish fires involving carbon-fiber-reinforced composites as quickly as possible and to provide maximum containment of the aircraft debris. The containment and cleanup function is extremely important and must be treated as a special hazard prevention measure. Accordingly, the practices for extinguishment, containment, and cleanup, as stated in paragraph 6.7 of *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14, should be observed when an aircraft crash/fire incident occurs that involves any aircraft that contain carbon-graphite fiber composites. Any aircraft incident involving fire on these types of aircraft must be considered to have potential contamination hazards until positively identified to the contrary.

Composite Materials Reinforced with Boron/Tungsten Fibers

Composite materials reinforced with boron fibers also provide superior stiffness, a high strength-to-weight ratio, and ease of fabrication; this material is being used in advanced aircraft such as the F-14, F-15, and F-16 to replace heavier metal components. Unfortunately, boron fibers can be released if their epoxy binder burns. Boron fibers pose less of a problem to unprotected electrical equipment than carbon or graphite fibers, because boron fibers are much heavier and are less likely to become airborne. Also, boron fibers are much less electrically conductive. However, loose boron fibers are stiff and sharp, and thus pose handling problems. The extinguishment, containment, and cleanup practices for boron fibers are the same as those previously outlined for carbon or graphite fibers.

Special hazards

Polyethylene packaging materials (bubble packs, and so forth) present a special hazard, since they cannot be extinguished by water only. AFFF must be used on these materials to preclude a continued reflash.

FLUOROELASTOMER (VITON)

Fluoroelastomer (Viton) is a vulcanizing compound, which may be found in small quantities throughout aircraft. In small quantities, it poses no significant threat to fire fighting or salvage personnel. However, aircraft such as the F/A-18 and F-14D do contain substantial amounts of Viton.

This rubber like compound is applied to the aircraft engine exterior and various other areas throughout the aircraft. Highly toxic products of combustion, including hydrogen fluoride, carbonyl fluoride, carbon monoxide, and low-molecular-weight fluorocarbon fragments, can be generated in a fire involving Viton. Personnel fighting such a fire should wear a positive-pressure self-contained breathing apparatus.

Anyone exposed to fumes from the fire should be moved to fresh air at once and checked by a physician.

NOTE

Viton is halogen-based and will self-extinguish if the ignition source is removed.

Personnel handling residues of Viton that have been involved in a fire must wear neoprene gloves to avoid skin contact with these possibly highly corrosive residues, which likely include hydrogen fluoride.

Clean up procedures for small pieces of Viton must include wrapping and packaging for transportation to an authorized hazardous-material disposal site. Entire engine sections must be processed in accordance with current directives.

CAUTION

Do not attempt to wash away pieces of Viton with water or AFFF, as it could increase the danger of corrosive residues.

PERSONNEL HAZARDS/PROTECTION

Radiological. Inhalation of alpha particles is considered the most significant radiological hazard associated with a mishap involving nuclear weapons containing plutonium. A properly sized and fitted protective mask and standard fire fighter's clothing will protect personnel against levels of radiation expected at a mishap site.

Non-radiological Metals/Compounds. The following materials are often associated with nuclear weapon mishaps and may present the following health hazards:

1. Beryllium. Beryllium is a light, gray-white non-radioactive, hard and brittle metal that resembles magnesium. Because beryllium oxidizes easily, any fire or explosion involving beryllium will release toxic fumes and smoke. Positive-pressure self-contained breathing apparatus are required whenever beryllium fumes or smoke are present.

WARNING

- Lithium can react directly with water in body tissue, causing severe chemical burns. Lithium hydroxide is also a caustic agent and effects the body, especially the eyes, in the same manner as lye.

2. Lithium. Lithium and its compounds, normally lithium hydroxide, may be present at a nuclear weapon mishap. Upon exposure to water or halogenated agents, a violent chemical reaction occurs, producing heat, hydrogen, oxygen, and lithium hydroxide. The heat causes the hydrogen to burn explosively, producing a great deal of damage.

- Halon fire extinguishers must not be used to extinguish burning lithium fires, otherwise a violent reaction may occur.
- Positive-pressure self-contained breathing apparatus and fire fighter's clothing must be worn when combating fires and during investigation/clean-up operations when lithium has been exposed to fire.

3. Lead. Pure lead and most of its compounds are toxic. Lead enters the body through inhalation, ingestion, or skin absorption. Inhalation of lead compounds presents a very serious hazard. Skin absorption is usually negligible. Positive-pressure self-contained breathing apparatus and fire fighter's

clothing are required to protect personnel from lead compounds.

4. Plastics. All plastics involved in a fire present varying degrees of toxic hazards because of the gases, fumes and/or minute particles produced. Any fire involving plastics should be approached on the assumption that toxic fumes and particles are present. This includes all fires involving nuclear weapons. See NAVAIR 00-80R-14-1 for aircraft containing composite material.

FIXED AND PORTABLE FIRE PROTECTION ON AIRCRAFT

Fire protection equipment installed on aircraft consists of one or more portable fire extinguishers. On the larger aircraft, this protection may be supplemented by a built-in fire-extinguishing system. Firemen should have knowledge of this equipment for their own use in emergencies.

Portable Fire Extinguishers

Multiplace aircraft are usually provided with hand-held/hand-operated fire extinguishers. On the larger aircraft several units may be supplied for emergencies. These units range in size from a 2-pound to a 5-pound capacity. They are mounted for quick access, and are usually located within the fuselage at or near aircrew flight positions or adjacent to specific equipment hazards.

Extinguishers may be mounted outboard in compartments with access covers flush with the outer skin surface of the aircraft. In this case, stenciling on the adjacent skin surface indicates extinguisher locations. The location of internal-mounted fire extinguishers is likewise indicated by stenciling on the external skin surface, directly outside the points at which the extinguishers are mounted on the inside of the fuselage.

Extinguishers may be mounted so they may be reached either directly from within the fuselage or through a door from the outside. Outside-mounted extinguishers may sometimes be reached from the inside by cutting through the protective mat lining of the fuselage.

Fixed Fire-Extinguishing Systems

As a general rule, fire-extinguishing systems are incorporated only in multiengine aircraft. These systems are designed primarily for extinguishing engine fires; however, on some aircraft, provision is made for protecting the aircraft heater (or heaters), as well as the engines.

The extinguishing agent is stored in cylinders mounted at various places within the fuselage, wings, nacelles, or landing gear wells, and is directed to the area of fire through a system of tubing and various control valves. At the pilot or flight engineer's station, a switch or pull handle is used in releasing the extinguishing agent when a fire occurs.

The inspection and maintenance of aircraft fire-extinguishing systems is one of the important responsibilities of the Aviation Structural Mechanic, Safety Equipment (AME).

TRIFLUOROBROMOMETHANE (CF_3Br)

CF_3Br (the chemical symbol for trifluoro-bromomethane), the most common extinguishing agent used in aircraft fire-extinguishing systems, is a fluorinated hydrocarbon. It is more efficient than CO_2. Under normal atmospheric pressure and temperature, it is a colorless, odorless, and tasteless gas. It exists as a liquid only when contained under pressure. CF_3Br is noncorrosive. It leaves no residue, does not deteriorate with age, is an electrical insulator, and goes farther than CO_2.

Trifluorobromomethane (CF_3Br) System

In the CF_3Br system there are four containers, four bonnet assemblies, one double-check tee valve, one wing selector (directional) valve, and four engine-selector valves. The controls for this system have four engine-selector switches, a discharge selector switch, and a time delay relay. The time-delay relay allows approximately a 2-second delay between the operation of the directional valves and the release of liquid CF_3Br.

Trifluorobromomethane (CF_3Br) System Operation

Should a fire occur in engine number 1, a light in the cockpit will light. At this time, the pilot should place the No. 1 engine selector switch to the ON position. This operates the wing selector valve. Now the pilot has the option of discharging either bank of cylinders. If bank 2 is chosen, both cylinders in bank 2 will discharge. If the fire fails to extinguish from the discharge of bank 2, bank 1 can also be discharged to disperse the fire.

In most cases, the CF_3Br supplied by two cylinders is sufficient to extinguish an engine fire. This would leave two cylinders available should another fire occur or should the original fire flare up again.

Q11. What is the principle hazard presented by titanium during an aircraft crash situation?

Q12. What is the principle hazard presented by hydraulic fluid during an aircraft fire?

AIRPORT FIREFIGHTING TACTICS AND RESCUE PROCEDURES

LEARNING OBJECTIVES: Determine the appropriate response route for firefighting vehicles responding to an aircraft fire. Explain the procedures for combating aircraft fires.

TACTICS FOR APPROACHING AN AIRCRAFT

When an aircraft crash fire occurs, personnel should use the approach methods discussed in the following text. Fire fighting and rescue tactics employed at an accident scene are dependent upon many factors, including the following:

- Terrain and obstacles
- Wind direction
- Type of aircraft
- Crew stations and passenger locations within the aircraft
- Fire location on aircraft or the degree of fire involvement
- Presence of ordnance

WARNING

Because of possibility that ordnance may be aboard military aircraft, ARFF crews should exercise extreme caution at all military aircraft mishap sites.

Response Routes and Vehicle Speed

After an alarm has been received, drivers/operators should use the most direct route with the best travel conditions. When emergency vehicles from more than one location respond, they should use different routes, if possible. Vehicles should respond to an emergency as quickly as possible consistent with maneuverability and safety.

ARFF personnel must be familiar with field response routes and off-station areas where an aircraft incident might be expected to occur during landing approach or takeoff.

WARNING

To prevent injury to person(s) inadvertently thrown or ejected from an aircraft, driver/operators should exercise extreme caution during the final part of their approach to an aircraft mishap site.

Basic Approach

Few, if any, aircraft incidents involving fire and rescue procedures are identical. The basic vehicular approach is that which affords the most efficient control of the fire in the area or location where rescue of personnel is to be performed. Normally, the first aircraft fire fighting and rescue vehicle to arrive at the scene of an aircraft accident will be the immediate response alert vehicle. All other aircraft fire fighting vehicles take positions complementing the first vehicle to arrive, enlarging on the pattern for rescue and total fire extinguishment.

All personnel directly assigned to fire fighting vehicles other than the driver must wear full protective clothing. The driver's protective clothing should be carried in the vehicle.

Basic Vehicle Spotting Procedures

The following paragraphs outline points of consideration in vehicle spotting, but such considerations are not to be interpreted as being in their sequence of importance.

The basic aircraft fire fighting vehicle position is at the nose or tail of the involved aircraft. This position affords the most advantageous location to provide coverage in the control area along both sides of the fuselage. See figure 8-18.

Use the Wind

Unless conditions dictate otherwise, position vehicles to attack from upwind. This position affords several advantages: it is easier to identify the seat of the fire; personnel are subjected to less heat and smoke; and fuel vapors, ignited or not, will drift away in the wind. See figure 8-19.

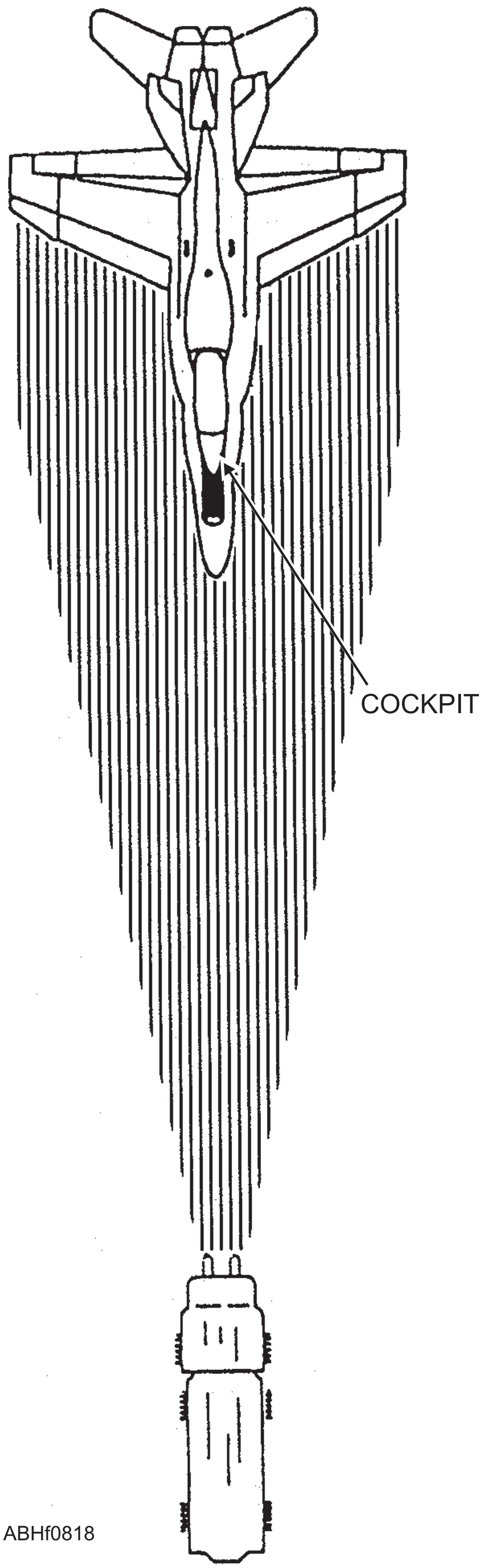

Figure 8-18.—Fire control area.

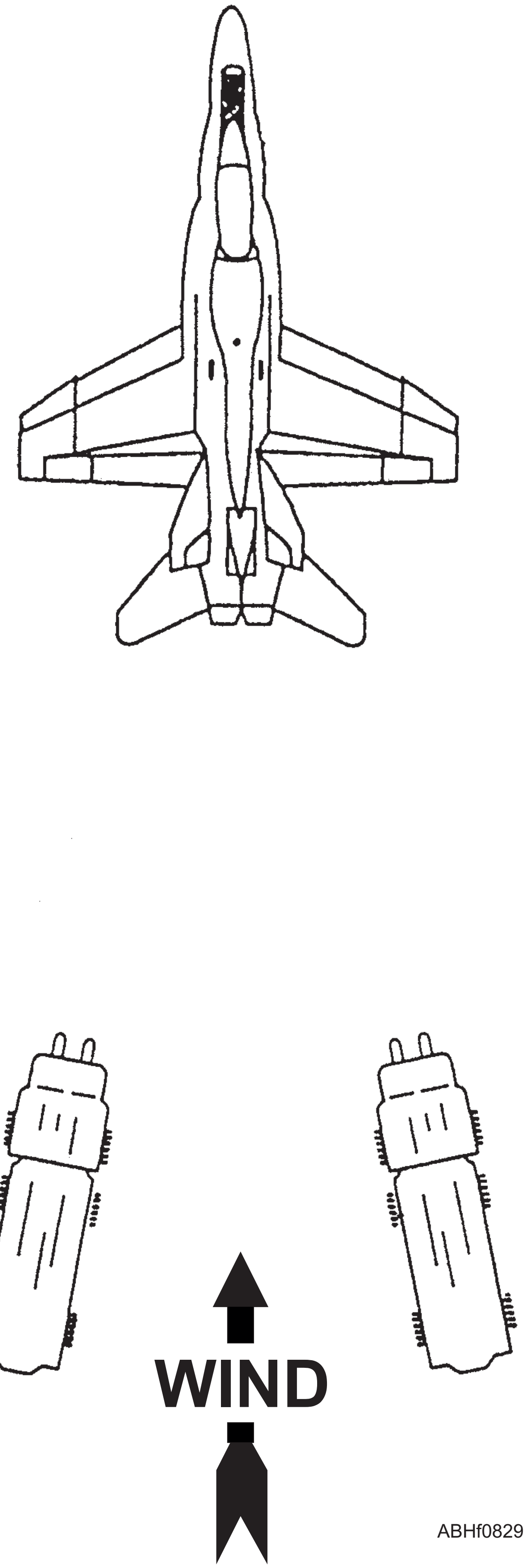

Figure 8-19.—Attack from tail, using wind.

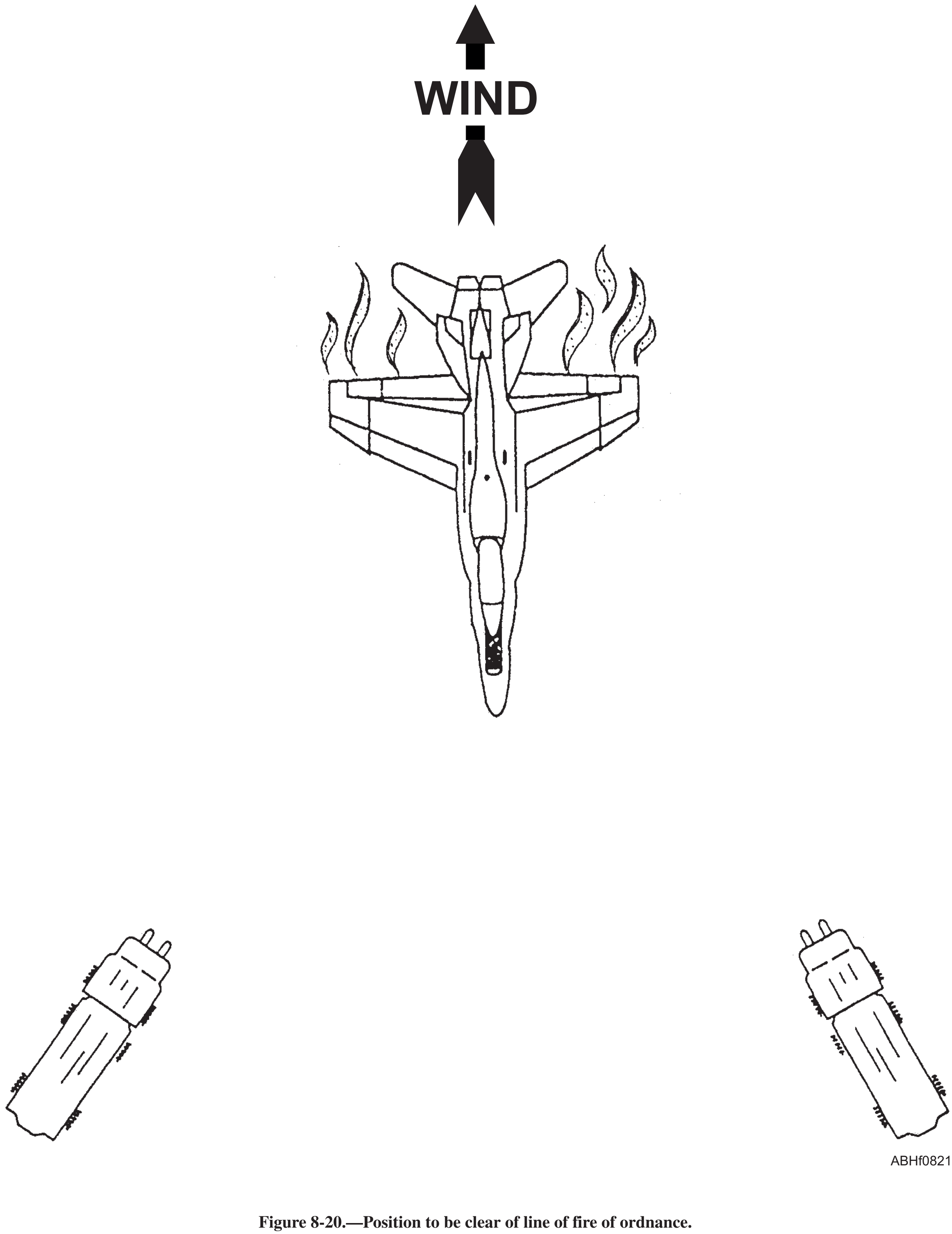

Figure 8-20.—Position to be clear of line of fire of ordnance.

Ordnance Stores

On aircraft carrying air-launch weapons, the basic vehicle spotting position should be adjusted to keep vehicles from being in the line of fire or the exhaust blast areas. In this case, the attack would be from the quarters, with attention directed at expanding the control area to apply agent to cool the air-launch weapons. See figure 8-20.

Attack From Uphill

Whenever possible, attack and fire from uphill. Liquid fuels or their flammable vapors flow to lower elevations. See figure 8-21.

Initial Attack

The initial attack begins during the approach of fire fighting vehicles, using the roof turret(s) and bumper turret nozzles as soon as the vehicles are within range of the fuel spill and/or aircraft. Turret operator(s) adjust the turret from a straight stream to a dispersed pattern, depending on the reach required. A dispersed pattern that reaches the seat of the fire covers a larger area in a shorter period of time. Sweeping the turret from side to side also contributes to quickly covering a larger area of fire.

Handline(s)

Handline(s) is/are provided on all aircraft fire fighting and rescue vehicles. Handline(s) is/are used to control and extinguish fires in shadow areas in and around the fuselage that are not extinguished by the turret. Handline(s) is/are also used to extinguish interior cabin fires and for cooling fuselage and ordnance.

Using Vehicle-Mounted Twin-Agent Unit

The vehicle approaches from upwind and is positioned to aid in pulling the nozzles and hoses from the rear. The nozzle person advances toward the fire, directing chemical agent (Halon 1211 or PKP, as available) at the base and then coating the area with AFFF to prevent reflash. When headway on the fire is gained, the nozzle person advances, making a rescue path by sweeping from side-to-side using chemical agent and AFFF. The fast action of the chemical agent (Halon 1211 or PKP) and the excellent holding qualities of AFFF allow the nozzle persons to advance. After the rescue path has been opened, the nozzle persons continue to extinguish the fire that may hinder rescue or, if rescue has been accomplished, continue toward total extinguishment.

ACCESSORY SECTION, COMPRESSOR COMPARTMENT, OR ENGINE COMPARTMENT OF JET FIXED-WING AND ROTARY-WING AIRCRAFT

CAUTION

When AFFF is used as the fire suppression agent on an aircraft fire and the agent is directed at or ingested into the engine or accessory sections, the fire chief or senior fire official must notify the maintenance officer of the unit involved or, in the case of a transient aircraft, the supporting facility.

Fires in the accessory section, compressor compartment, or engine compartment of jet aircraft result from fuel being introduced into the area between the engine and fuselage or between the engine and nacelle on engines carried in pods, and coming into contact with the heat generated by the engine. Knowledge of accessibility to these areas for

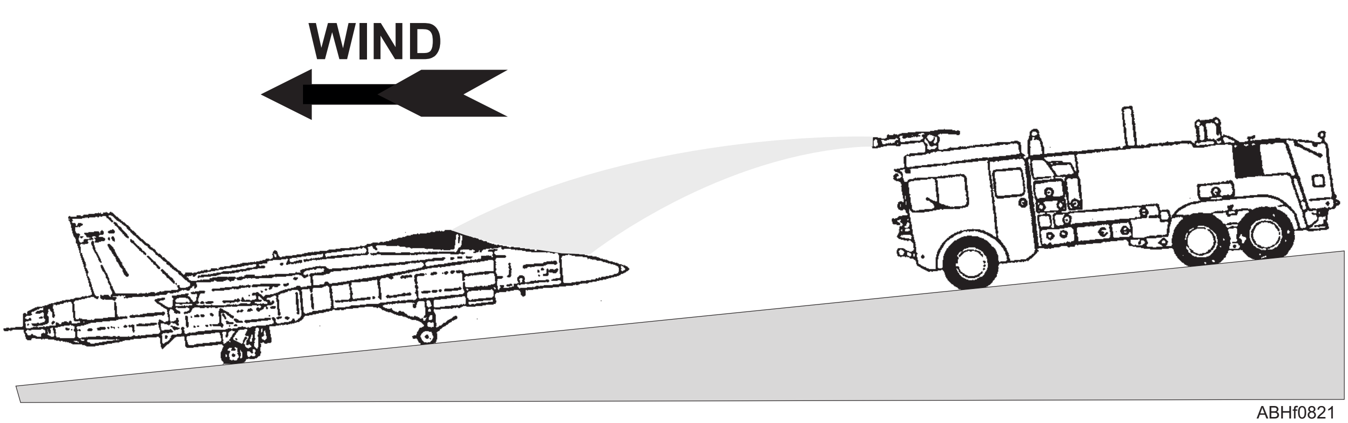

Figure 8-21.—Attack fire from uphill.

application of the extinguishing agent must be gained by aircraft familiarization. (See *NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1.)

Halon 1211 or CO_2 are the extinguishing agents used on these fires. However, when a fire in an aircraft cannot be extinguished with Halon 1211 or CO_2, the use of AFFF to prevent further damage outweighs the disadvantages.

INTERNAL ENGINE FIRES

Internal engine fires usually result when residual fuel is dumped into the engine on shutdown. When starting equipment and qualified starting personnel are immediately available, these fires may be controlled by windmilling the engine. If this procedure fails or if the equipment and personnel are not available, an extinguishing agent must be directed into the engine. Halon 1211 or CO_2 is the primary agent for internal fires. Application of Halon 1211 or CO_2 must be accomplished at a distance so that the Halon 1211 or CO_2 enters the fire area in gaseous form.

CAUTION

- When CO_2 or Halon 1211 is expelled directly into an engine, thermal shock may result, causing engine damage.
- High bypass turbofan engines require unique techniques to extinguish engine core fires.

S-3A, S3-B, ES-3A AND US-3A AIRCRAFT ENGINE FIRES

The following procedures are directed for extinguishing fires in high bypass turbofan engines (TF-34).

1. Engine accessory section fire.
   a. Halon 1211 or CO_2 may be introduced into the engine accessory section through the oil access door.
   b. When the fire is under control, one fire fighter in full protective clothing (hot suit) will open the engine cowling. An AFFF handline should be used to provide fire protection to the fire fighter.

NOTE

A screwdriver may be required to open the engine cowling due to the restrictions of proximity gloves.

2. Engine fire turbine section engine core. When the engine is shutdown, apply Halon 1211 or CO_2, and if required AFFF, into the aircraft exhaust section only until the fire is extinguished.

3. Engine fire in compressor section engine core.

CAUTION

The source of this fire will probably be burning titanium, and can be identified by the sparking effect of this material when it's burning. This fire is potentially destructive and may possibly burn through the engine casing if immediate fire suppression measures are not taken.

   a. Follow the fire fighting procedures prescribed in subparagraph 1 above.
   b. When the engine cowling is open, apply AFFF to both sides of the engine casing to complete extinguishment and provide additional cooling.

ELECTRICAL AND ELECTRONIC EQUIPMENT FIRES

In combating electrical fires, you must secure the source of electrical power. For combating class C fires, Halon 1211 or CO_2 is the primary agent and has no adverse effect on electrical or electronic components.

WARNING

- Halon 1211 may be used in a small electronics compartment to make the atmosphere inert, provided fire fighters do not enter the compartment, or enter it with a self-contained breathing apparatus.
- Do NOT use CO_2 to make the atmosphere in an electronics compartment inert, as it may produce a spark.

TAILPIPE FIRES

When a fire occurs in the tailpipe of an aircraft during start or shutdown, the aircraft engine should be started by authorized personnel in order to attempt extinguishment through exhaust pressures. If this operation does not extinguish the fire, the crash crew should perform the following:

1. Direct Halon 1211 or CO_2 into the tailpipe.

2. If fire is not extinguished by the above methods, direct the stream of extinguisher agent into the intake duct.

WARNING

Do not stand directly in front of the intake duct.

HOT BRAKES

During a normal or an emergency landing, the landing gear is an item of considerable concern. With the added weight and landing speeds of modern aircraft, and because of the extreme braking required on shorter runways, overheated brakes and wheels are becoming a common occurrence. You as a fire fighter must have a thorough understanding of the hazards created by overheated brakes, as well as the techniques and equipment developed for coping with this type of emergency.

The heating of aircraft wheels and tires presents a potential explosion hazard involving built-up air pressure in the tires, which will be greatly increased when fire is present. To avoid endangering the crews needlessly, you must NOT mistake hot brakes for brake fires. Hot brakes will normally cool by themselves, without the use of an extinguishing agent. Most aircraft operating manuals for propeller-driven aircraft recommend that flight crews keep the propeller turning fast enough to provide an ample cooling airflow. Some aircraft now have fusible plugs incorporated in the wheel rims. These fusible plugs are designed to automatically deflate the tires when a temperature of approximately 400°F (204°C) is reached. (Failure of fusible plugs to function properly has occurred.) Releasing the tire pressure reduces the pressure on the wheel, and thus eliminates the possibility of explosion.

One emergency cooling measure that may be used by the responding fire forces in the event of hot brakes is the use of the smoke ejector.

WARNING

- Placing a smoke ejector close enough to a hot brake to make it effective endangers the fire fighter. The decision to use such devices is up to the fire chief/ARFF officer and should be made on a case by case basis, depending upon safety and operational necessity.
- When responding to a wheel fire/hot brakes as a member of the emergency crews, you should approach the wheel with extreme caution in a fore or aft direction, never from the side, in line with the axle. Peak temperatures may not be reached until 15 to 20 minutes *after* the aircraft has come to a complete stop. See figure 8-22.

WHEEL ASSEMBLY FIRES

The following types of fires and hazards may occur around an aircraft wheel assembly:

1. The heating of aircraft wheels and tires presents a potential explosion hazard, which is greatly increased when fire is present. The combination of increased stress on the brake wheel assembly, additional tire pressure, and the deterioration of components by heat may cause an explosion. This explosion is likely to propel pieces of the tire and/or metal through the air at high speeds.

2. Materials that may contribute to wheel assembly fires are grease, hydraulic fluid, bearing lubricants, and tire rubber.

a. Grease and bearing lubricant fires. When ignited, wheel grease fires can be identified by long flames around the wheel brake/axle assembly. These fires are usually small and should be extinguished quickly with Halon 1211 or water fog.

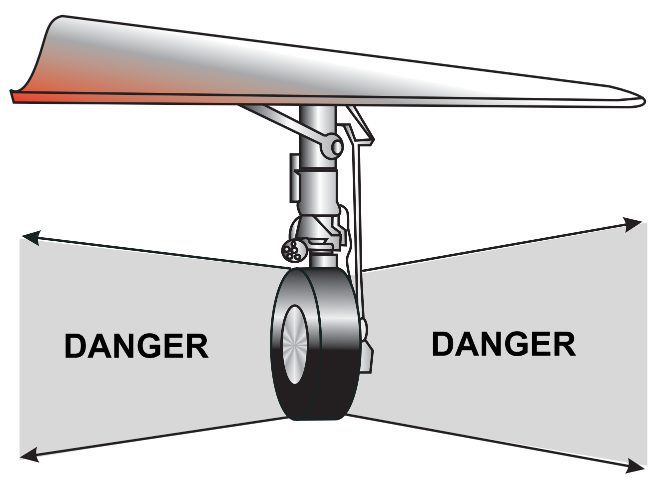

Figure 8-22.—Danger zones and attack zones in combating wheel fires. (Attack the fire from fore and aft--Do not attack from the side).

b. Rubber tires. Rubber from the tires may ignite at temperatures from 500°F (260°C) to 600°F (315°C) and can develop an extremely hot and destructive fire. Halon 1211 or water fog should be used as early as possible to extinguish the fire. Re-ignition may occur if the rubber sustains its autoignition temperature or if the rubber is abraded and the fire is deep-seated.

c. The following information is furnished on hydraulic fluids:

(1) A broken hydraulic line may result in the misting of petroleum-based fluids onto a damaged or hot wheel assembly. Upon ignition, misting fluid will accelerate a fire, resulting in rapid-fire growth and excessive damage to the aircraft if not extinguished rapidly.

WARNING

- A broken hydraulic line that causes misting of petroleum-based fluids around an over-heated brake assembly can cause a potentially dangerous and destructive fire. Intermittent application of water fog should be used to extinguish this type of wheel assembly fire. Rapid cooling of a hot inflated aircraft tire/wheel assembly presents an explosive hazard. Therefore, good judgment and care must be exercised to prevent injury to fire fighting personnel.
- The vaporized products of hydraulic fluid decomposition will cause severe irritation to the eyes and respiratory tract.

(2) Navy C-9, C-20, E-6A aircraft and most commercial aircraft incorporate hydraulic systems that contain hydraulic fluid that decomposes when exposed to high temperatures resulting from fire

The following Warnings, Cautions, and Note pertain to all aspects of wheel assembly fire fighting operations:

WARNING

- Rapid cooling may cause an explosive failure of a wheel assembly.
- When water fog is used on a wheel assembly fire, an intermittent application of short bursts (5-10 seconds) every 30 seconds should be used.
- The effectiveness of Halon 1211 may be severely reduced under extremely windy conditions; that is, if the Halon cannot be maintained on the fire source.
- Protective measures must be taken to prevent hydraulic fluid from coming into contact with the eyes. Seek medical attention immediately, should the fluid come in contact with the eyes.
- Positive-pressure self-contained breathing apparatus must be worn in fighting fires associated with hydraulic systems.
- In a fire, F-14, S-3 and C-5 aircraft with beryllium brakes may produce irritating or poisonous gases. These gases are toxic, and are respiratory and eye irritants.

CAUTION

Although Halon 1211 may extinguish hydraulic fluid fires, re-ignition may occur, since this agent lacks an adequate cooling effect.

NOTE

Since heat is transferred from the brake to the wheel, agent application should be concentrated on the brake area. The primary objective is to prevent the fire from spreading upward into wheel wells, wing, and fuselage areas.

COMPOSITE MATERIAL REINFORCED WITH CARBON/GRAPHITE OR BORON/TUNGSTEN FIBERS

Carbon/graphite and boron/tungsten fibers can become airborne as a result of (1) fires involving these composite materials or (2) a crash/explosion, which may fragment sections of aircraft composites.

In the event of a fire without high impact or explosion, release of carbon/graphite or boron/tungsten fibers from composite materials by exposure to the fire is more probable. The event occurs because the epoxy will burn readily in a fuel spill fire, and exposed fibers can be broken and carried into the atmosphere via air currents of the smoke. The aircraft debris in this case will be well charred and the fibers exposed, with the reduced volume assumed to have been released into the atmosphere.

In the event of a fire followed by an explosion, release of carbon/graphite or boron tungsten fibers from composite materials into the atmosphere is a virtual certainty. Immediate action is required to prevent damage to electrical or electronic equipment and facilities downwind.

The normal sequence of an aircraft crash/fire incident is high impact, fuel spill, ignition, and fire. Accordingly, during this sequence the release of carbon/graphite or boron/tungsten fibers into the atmosphere is very likely dispensed by smoke and air currents. The degree of contamination (fibers released into the atmosphere) is assumed to vary directly with the degree of fire destruction (burning time).

WARNING

In aircraft mishaps where carbon/graphite or boron/tungsten fibers are suspected, helicopters should never be used to control the fire or allowed to fly or hover over the site at altitudes of less than 500 feet. The rotor wash will only serve to spread the fibers. Injection of fibers into the helicopter electrical system could cause aircraft failure, resulting in a serious mishap.

EXTINGUISHMENT

You should approach and extinguish fire from the upwind position, and extinguish the fire as quickly as possible.

WARNING

Airborne fibers from any composite system may constitute a potential respiratory hazard to personnel. Respiratory protection must be selected based upon the quantity of composite materials present at the site, as well as the duration of potential personnel exposure. Where possible, the local industrial hygienist or medical department representative should be consulted for specific guidance. For situations in the earlier stages of clean-up/investigation when airborne composite material levels are unknown and may be accompanied by vapors released from smoldering debris, the use of a full-face high-efficiency particulate air/organic vapor combination respirator is appropriate. For later stages of clean-up/investigation, when much of the debris has been contained and vapors are no longer being released from smoldering debris, the use of a dust-fume-mist filter respirator may be appropriate. Fire fighting and rescue personnel should wear positive-pressure self-contained breathing apparatus during initial response.

Interim Containment Ashore

You should provide interim containment of aircraft debris with the spray pattern of light water until the debris is cool, more permanent containment is specified, or disposition is directed.

Cleanup Ashore

Cleanup should be under the direction of the safety officer or air operations officer unless local command policy makes it a function of the crash and fire department. In any case, the following procedure is necessary.

WARNING

Keep handling of the fibers at a minimum; handlers must wear gloves.

1. If the aircraft cannot be removed immediately, a more permanent containment than that provided by light water may be provided by use of polyurethane primer, spray lacquer, or light oil to achieve bonding.

2. Aircraft or facilities or equipment that has been "dosed" with debris from the aircraft fire must be vacuumed and/or washed down.

CAUTION

Do not put power to or start up dosed aircraft or electrical or electronic equipment until decontamination by vacuuming and/or washdown is completed.

3. Decontamination of the immediate area of the aircraft wreckage may require vacuuming, washing down, and/or other methods dictated by current base regulations. Use a sealed industrial vacuum when vacuuming. Store debris collected in sealed plastic garbage bags and dispose or store in accordance with proper directives. If the debris is needed for an accident investigation, store the debris in a designated location.

4. If wrapping and secure taping of the aircraft wreckage is not possible, transporting the wreckage must be planned to bypass highly populated and industrial areas. If this is not possible, aircraft parked along the planned route must have their canopies and access doors closed and engine inlet and exhaust covered. In addition, the doors and windows of surrounding buildings should be closed to minimize the probability of having wind-blown fibers enter areas with electrical or electronic equipment.

5. Disposable coveralls and shoe covers may be necessary for many operations involving mishap investigation/cleanup. A full-face respirator should be worn in areas significantly contaminated with airborne fibers/debris. Safety glasses with side shields must be worn when full-face respirators are not in use and eye contact with fibers/debris is of concern. Showers and change room facilities should be available after particularly "dirty" investigation/clean-up operations.

6. Gloves (leather palm preferred) should be worn, to prevent injury, when personnel are handling any type of composite debris.

7. Polyethylene sheeting and tape should be used as a means of containing debris present on larger composite components, where the use of chemical binders may not be warranted or feasible.

8. Use of a high-efficiency vacuum cleaner is recommended whenever possible for cleanup of debris. Following the vacuuming process, a thorough detergent/water washdown should be performed to remove any remaining residual material.

9. Local authorities of solid waste disposal should be consulted for approved burial sites/techniques for composites or composite contaminated materials. In addition, the local industrial hygienist or medical department representative should be consulted for detailed health hazard control guidance, based upon extent of exposure.

AIRCRAFT SEATS AND ASSOCIATED EQUIPMENT

Ejection seats are manufactured by a number of companies in the United States and abroad. Each of these companies has designed and developed ejection seats to meet the requirements of a variety of aircraft configurations and military applications. For ARFF operations, the most noticeable difference in the various types of ejection seats is the location and method of employing ejection safetying equipment. Because of equipment design differences, there are a number of methods used to perform the ejection seat safetying procedures. Some seats require only one step to render the seat safe, while others may require several steps to ensure that the seat is safe for removal of a disabled crewmember.

WARNING

Inadvertent firing of an ejection seat during rescue operations would, in all probability, be fatal for the crewmember and the rescue personnel. Safetying procedures for all Navy ejection seats currently in service are provided in NAVAIR 00-80R-14-1.

As a member of a crash rescue team, you must be able to use the correct procedures when working in the ejection seat area and rendering the seat SAFE.

For further details of the following topics, refer to *NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1.

1. Seat restraint equipment
2. Torso harness suit
3. Personal services connections
4. Arm and leg retention devices

EMERGENCY ENTRY AREAS

Federal Aviation Agency (FAA) regulations require that exterior surfaces of aircraft be marked to identify clearly all required emergency exits. When such exits are operable from the outside, markings must consist of, or include, information indicating the method of opening.

Doors

Depending upon the type of aircraft, doors may be located on either side of the fuselage or in the rear of the fuselage. Doors may open to the side, up or down, and from the interior or exterior of the aircraft. In many cases, an emergency release is provided in the interior at the hinge side of the door. The release location is normally indicated, and the pull handle is painted red. Pulling the handle will withdraw the pins from the hinges. This arrangement, if the latch or frame is jammed, will allow the door assembly to be pushed out of position from the hinge side. If conditions permit, you should enter the aircraft through the normal access doors. This provides the most effective and expeditious entry into the aircraft for rescue of personnel. You should check NAVAIR 00-80R-14-1 for specific aircraft information.

Hatches

Hatch locations vary according to the type of aircraft and may be located on the sides, bottom, or top of the fuselage. Hatches designed for normal personnel access are hinged and may be opened internally or externally. Hatches designed for emergency escape from the interior of the aircraft are generally secured internally with quick-opening compression devices around the circumference. When released from the inside or outside of the aircraft, the complete hatch is removed. Hatch locations for specific aircraft and the means of opening them can be found in NAVAIR 00-80R-14-1.

Canopies

Canopies include a metal framework with a transparent material covering provided to enclose the cockpit and afford protection and visibility to the pilot or aircrew. The canopy system includes the canopy, plus all of the components used in opening and closing for normal entrance and exit, as well as those used in jettisoning the canopy during an emergency. Three types of canopies are commonly used on naval aircraft. They are the clamshell, the hinge type, and the sliding type. See figure 8-23. The clamshell canopy is hinged aft and opens upward at the forward end. The hinged type is hinged at the top or side and opens from the side, upward. The sliding canopy rests on tracks on the fuselage and opens and closes by a sliding motion. The sliding type of canopy offers the greatest ease in rescue of personnel, as the rescue person is not restricted in the removal of crewmembers. Emphasis must be placed on having drills for the removal of personnel from aircraft by using clamshell and hinged canopies. These drills will help to assure that rescue persons are thoroughly familiar with emergency removal techniques and restrictions of these canopies.

Normal Canopy Opening

Aircraft manufacturers use various methods of actuating the canopy. Normal opening and closing may be accomplished pneumatically (compressed air), electrically, manually, or hydraulically. When a malfunction or mechanical damage occurs to the electrical, pneumatic, or hydraulic systems, a secondary method may be employed by opening the canopy manually. Normally, when the clamshell canopy is opened manually, it must be physically held or propped open. The clamshell canopies on some aircraft can be locked open with a canopy lock. This lock prevents the canopy from being closed by accidental actuation of the canopy closing controls. On other aircraft, opening the canopy is accomplished by a handle provided on the exterior of the aircraft. This permits you as a rescue person to jettison the canopy. Jettisoning of a canopy by fire fighters should be accomplished only when the canopy cannot be opened by the normal or manual systems.

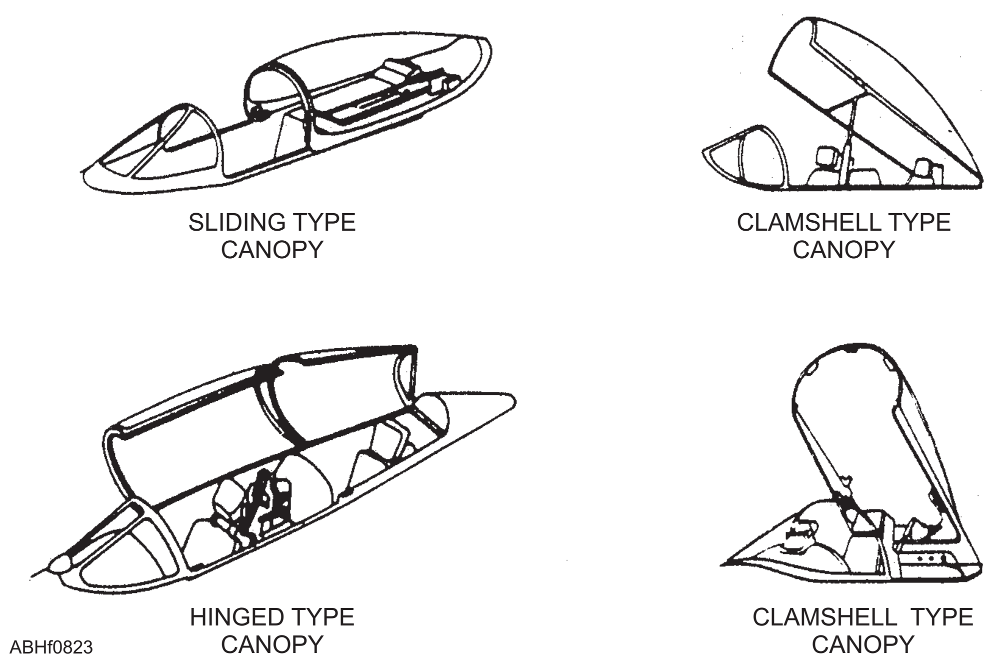

Figure 8-23.—Types of canopies.

WARNING

- Do NOT jettison the canopy with fuel in the cockpit area, because a fire or explosion may result.
- Keep clear of the canopy during jettisoning and be familiar with its trajectory.

Normal, manual, and forcible entry procedures on canopies are contained in the individual aircraft sections of NAVAIR 00-80R-14-1.

FORCIBLE ENTRY INTO TRANSPARENT ACRYLIC PLASTIC FUSELAGE OPENINGS

WARNING

Extreme caution must be exercised when cutting through the canopy, to avoid crew injury or striking the ejection seat firing mechanism.

When emergency entry into the cockpit area cannot be made by normal or manual means or by jettisoning of the canopy, it will be necessary to gain entry into the acrylic-plastic-covered areas by forcible means. If the aircraft configuration contains large acrylic plastic areas suitable for entry and rescue, forcible entry should be conducted through these areas. Under normal conditions, acrylic plastic, when struck with an instrument, will shatter and may be chopped or knocked out. Application of carbon dioxide (CO_2) on the surface will make the plastic brittle and permit easier breakage. The contour blade hand axe, carried in the crash rescue tool kit, is the most satisfactory tool for cutting acrylic plastic. Approved methods include chopping along the canopy frame with a serrated axe or cutting with a portable power saw. See figures 8-24 and 8-25.

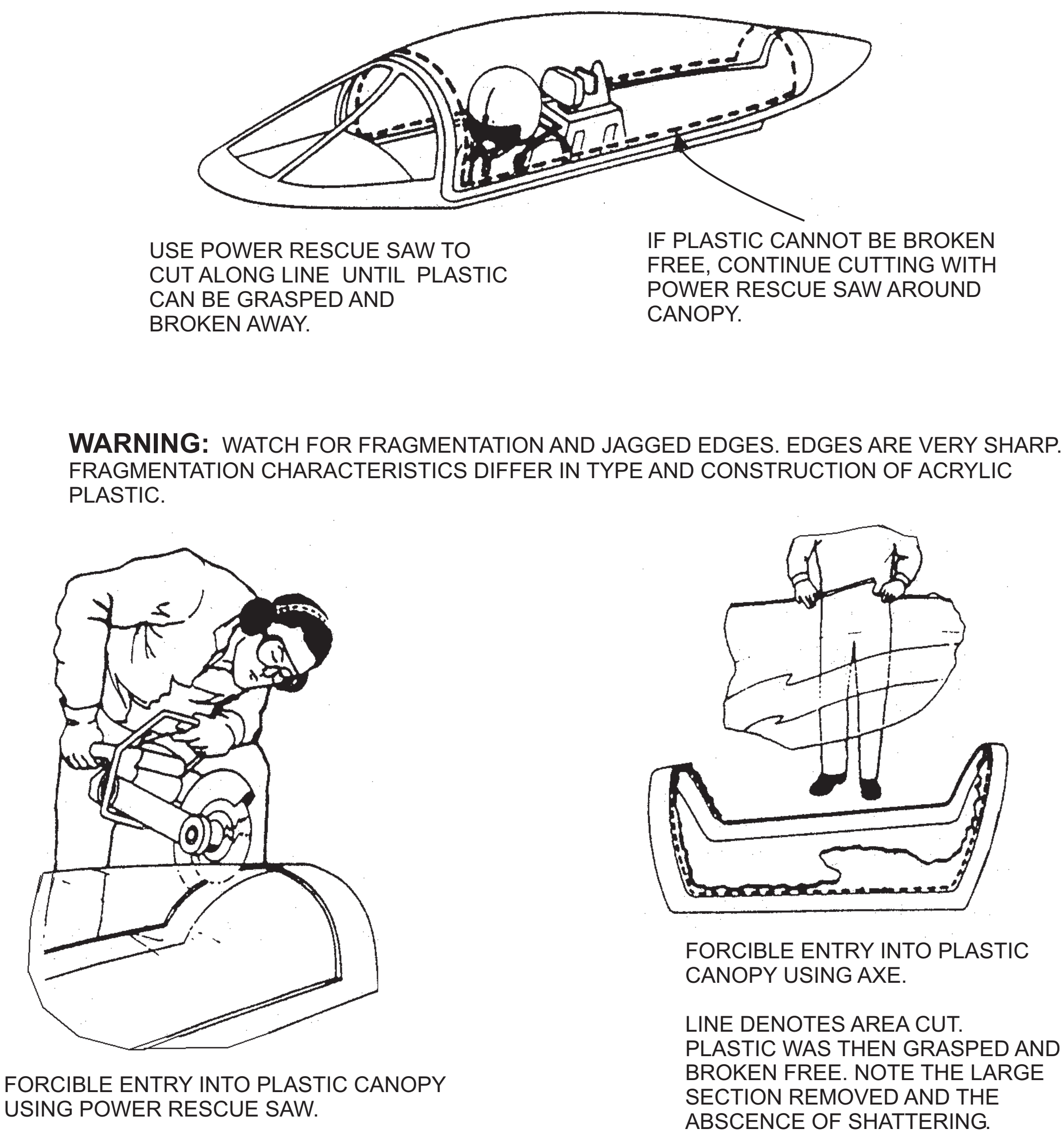

Figure 8-24.—Forcible entry into fuselage (axe and power rescue saw).

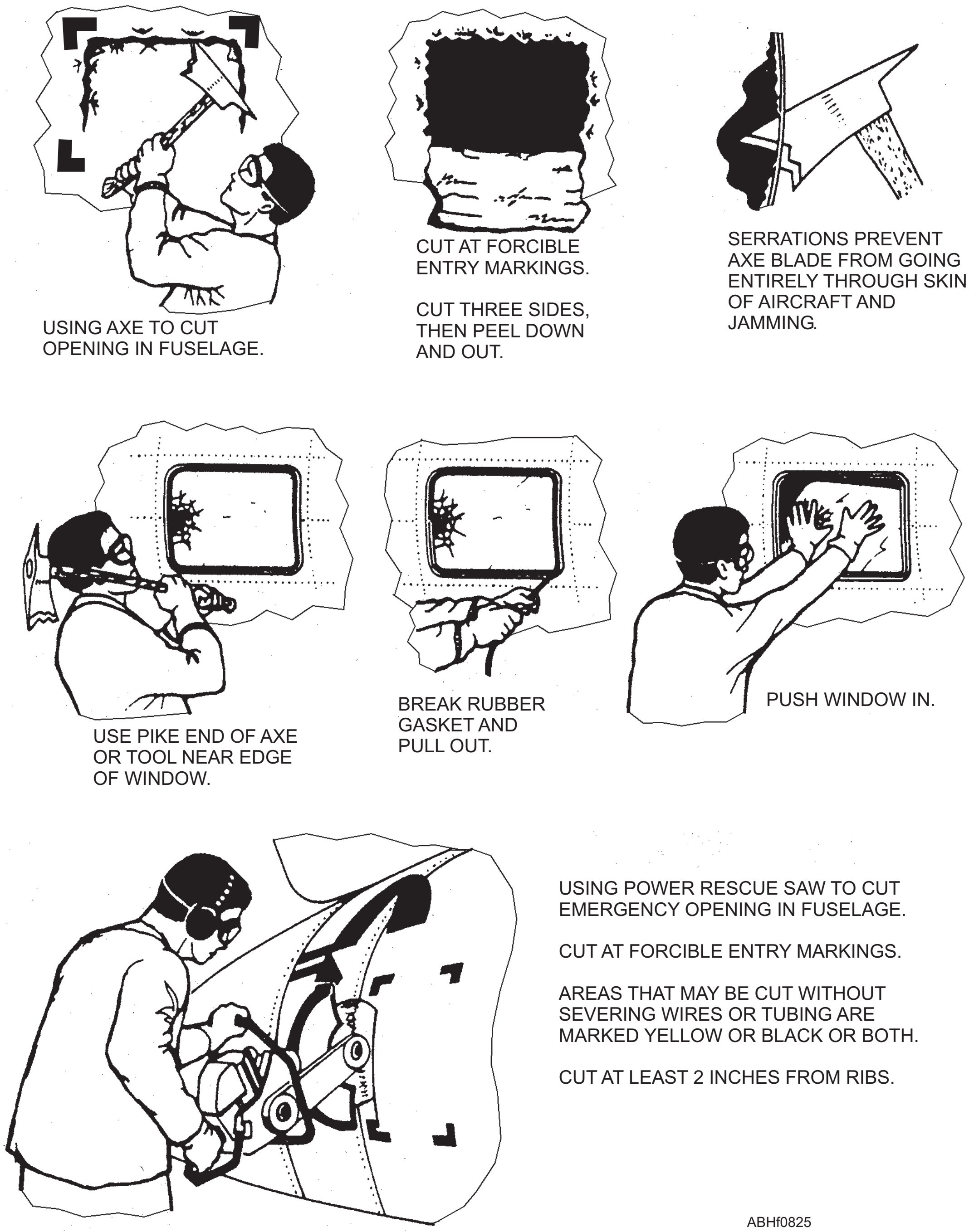

Figure 8-25.—Forcible entry into plastic canopies (axe and power rescue saw).

FORCIBLE ENTRY INTO FUSELAGE AREAS

WARNING

Flammable vapors may be present where the portable power saw is to be used to cut away any part of the aircraft. Therefore, the entire area must be covered with AFFF prior to the cutting operations.

Entry through the fuselage presents the most difficult problem in making a forcible entry into an aircraft. ARFF personnel conducting forcible entry must have a thorough knowledge of the interior of the aircraft. They should be very familiar with bulkhead locations, fuel tank locations, equipment inside the aircraft, and the areas where forcible entry will present the least obstacle to cutting and gaining entry. ARFF personnel must not be dependent upon aircraft markings, as they could be eliminated during an incident. During aircraft familiarization, ARFF personnel must study these areas and become familiar with their locations for all types of aircraft. When forcible entry is initiated, the plan is to gain the largest opening as quickly as possible. On large aircraft an outline of cutting areas is stenciled on the fuselage. The power saw equipped with metal-cutting blades is a most satisfactory tool for forcible entry. Figure 8-25 shows the portable power saw being used to cut through a fuselage. If the aircraft is relatively thin skinned, three cuts may be made, and then the area cut may be bent down and outward from the aircraft. If the aircraft fuselage is of thicker material, four sides must be cut. When ARFF personnel are cutting through an aircraft, particularly when using the power saw, there is the danger that sparks from the cutting operation will ignite fuel vapors. Adequate fire prevention measures must be taken, and standby protection should always be at hand.

ARFF personnel should be familiar with forcible entry points for all aircraft as specified in NAVAIR 00-80R-14-1.

TRAINING OF ARFF PERSONNEL

Variance in design and operation of ejection seats is accompanied by differences in methods and procedures for rendering the ejection apparatus safe. Therefore, a comprehensive training program is required to maintain the proficiency and experience level of ARFF personnel. The program should be revised on a continuing basis to reflect current ejection seat designs, as well as modifications to existing installations, or procedural changes. Instruction should be designed to provide the trainee with accurate background knowledge and hands-on practical application to perform ejection seat safetying procedures for the safe extraction of disabled crewmembers. Training programs should include, but not be limited to, the following:

1. Aircraft familiarization classes
2. Lectures from squadron safety and maintenance personnel
3. NAVAIR 00-80R-14-1
4. Maintenance instruction manuals (MIMs)
5. Air Force technical orders (TOs)
6. Aircraft training films

Procedures for aircrew rescue discussed in the proceeding paragraphs are illustrated in a number of training films. These films, along with NAVAIR 00-80R-14-1, should be used as part of the training program.

There is no better way to combat emergencies at any time than preplanning such emergencies. Knowing pertinent facts about different types of aircraft may reduce the loss of life and permit control of the fire to effect rescue operations.

Visual training aids for aircraft fire fighting and rescue instruction are standard equipment on all naval air activities. They should be used with the instructor's guide manuals. While visual aids are a valuable asset in teaching aircraft fire fighting and rescue, they cannot replace actual practice and experience on the fire practice area. They are training tools to assist understanding of the many phases of fire fighting. Mastery of these phases is necessary for saving human life and government property. As an ABH, you should train to instruct in the following subjects:

1. Fire fighting equipment
2. Aircraft structures
3. Canopy and ejection seats
4. Forcible entry
5. Fire fighting and rescue techniques
6. Aircraft identification
7. Driver-operator

The current *NATOPS, U.S. Navy Aircraft Fire fighting and Rescue Manual*, NAVAIR 00-80R-14, and the *NATOPS, U.S. Navy Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1, are invaluable sources of detailed information that can be used for text material in training a potential rescue personnel.

Q13. Normally, what will be the first aircraft fire fighting and rescue vehicle to arrive at the scene of an aircraft accident?

Q14. When responding to a wheel fire/hot brakes as a member of the emergency crews, how should you make your approach?

ANSWERS TO REVIEW QUESTIONS

A1. *For those activities that do not have aircraft permanently assigned, the minimum response vehicle requirement is determined by the type/gross weight of the aircraft normally supported.*

A2. *When notification of an off-station mishap is received from an outside source, the following information must be obtained:*

1. Location of the mishap and directions to the scene

2. Type of aircraft and whether fire is present

3. Reporting person's name and telephone number (request that the person remain at a designated location and act as guide, as necessary)

A3. *On the P-15, the water tank holds 6,200-gallons and the foam tank holds 515 gallons.*

A4. *On the AMERTEK CF400L, five hundred pounds of Halon 1211 is available on the 100 foot, 1-inch handline*

A5. *The purpose of this alert is to provide immediate response to observed unanticipated emergencies and to control any fires until the standby alert team can effect rescue and fire extinguishment.*

A6. *A truck mounted TAU with a crew of three may be used as the immediate response alert vehicle when the aircraft gross takeoff weight is 10,000 pounds or less (gross weight category 1).*

A7. *At a shore station, an air bag rescue and lifting system should be deployed when entry to a mishap scene is inaccessible to heavy equipment.*

A8. *Tools that are used to pry, ram, cut, and chop are known as Forcible Entry Tools.*

A9. *The primary flight line extinguishers are 150-pound, wheeled, Halon 1211 fire extinguishers.*

A10. *The proper method of deploying a portable flight line fire extinguisher is to start at the upwind edge of the fires and directed at the base of the flame in a side-to-side sweeping motion.*

A11. *The principle hazard presented by titanium is friction/spark hazard when the metal is exposed to contact with a paved surface.*

A12. *The principle hazard presented by hydraulic fluid during an aircraft fire is that important aircraft parts are hydraulically controlled and damaged hydraulic lines may release brakes, struts, or other components causing unanticipated and dangerous movement of the aircraft.*

A13. *Normally, the first aircraft fire fighting and rescue vehicle to arrive at the scene of an aircraft accident will be the immediate response alert vehicle.*

A14. *When responding to a wheel fire or hot brakes as a member of the emergency crews, you should approach the wheel with extreme caution in a fore or aft direction, never from the side, in line with the axle.*

APPENDIX I

GLOSSARY

AFFF—Aqueous film-forming foam.

AIRBORNE STORES—Items intended for carriage internally or externally by aircraft, including racks, launchers, adapters, and detachable pylons. These are items not normally separated from the aircraft in flight, such as tanks, pods, guns, nonexpendable training weapons, and targets.

AIRBORNE WEAPONS—Items intended for carriage internally or externally by aircraft. These are items normally separated from the aircraft in flight, such as missiles, rockets, bombs, mines, torpedos, pyrotechnics, and ammunition.

AIR CAPABLE SHIP—All ships other than a CV/CVN or an LHA/LHD/MCS from which aircraft can take off, be recovered, or routinely receive and transfer logistic support.

AIR OPERATIONS—A section of the operations department that is responsible for coordinating all matters pertaining to flight operations, including the proper functioning of the ATCC or AOCC/HDC.

AIR OPERATIONS CONTROL CENTER/HELICOPTER DIRECTION CENTER (AOCC/HDC)—A centralized air control agency responsible for the status keeping and tactical control of all aircraft not assigned to CIC/TACC. Also it is responsible for aircraft approach and departure control. It becomes the helicopter direction center for tactical control of the helicopters during an amphibious operation.

AIR TAXI—Jetborne or hovering flight at very low speed between two points.

AMPHIBIOUS ASSAULT AVIATION SHIP—An LHA, LHD, or MCS.

ARFF—Aircraft rescue and fire fighting.

ARMING—An operation in which a weapon is changed from a safe condition to a state of readiness for initiation.

ARMING AREA—That area where ordnance is changed from a safe condition to a state of readiness. All arming evolutions that are required to be accomplished in the arming area by the aircraft stores loading manual/checklist must be performed in this area. Before arming commences and prior to aircraft launch, the area in front of or behind and/or surrounding the aircraft must remain clear.

AVIATION ORDNANCE EVOLUTION—A shipboard ordnance evolution requiring the breakout, buildup, and staging of ordnance and the loading, arming, launching, recovering, and dearming of ordnance-carrying aircraft.

AVIATION SHIP—A CV or CVN.

BINGO—An order to an aircraft to proceed immediately to a divert field. Bearing, distance, and destination must be provided.

BUNKER GEAR—The aluminized protective clothing and boots worn by crash/rescue fire fighters when they respond to alarms.

CARRIER AIR TRAFFIC CONTROL CENTER (CATCC)—The centralized agency responsible for the status keeping of all carrier air operations and control of all airborne aircraft under the operations officer's cognizance except those being controlled by the combat information center (CIC).

CCA—Carrier controlled approach.

DEARMING (SAFING)—An operation in which a weapon is changed from a state of readiness for initiation to a safe condition.

DEARMING AREA—That area where ordnance is changed from a state of readiness to a safe condition. All dearming evolutions are to be conducted in the dearming area by using the individual stores loading manual/checklist. The area ahead of or behind and/or surrounding the aircraft must be kept clear until all weapons/ordnance are completely safe. When aircraft are being taxied from the landing area to the dearming area, care must be taken to minimize exposure of the armed ordnance to personnel and equipment.

DECK STATUS LIGHT—A three-colored light (red, amber, and green) controlled from the Pri-Fly. The light displays the status of the ship to support flight operations. A description follows:

1. Red deck status—The ship does not meet the requirements to conduct flight operations. This generally means an unsafe deck condition exists.

2. Amber deck status—A condition during which helicopter transition is taking place (for example, engage/disengage rotors).

3. Green deck status—The ship meets the requirements to conduct aircraft operations.

DIVERT—An order for an aircraft to proceed and land at the field specified. This is a non-emergency situation.

DOWNLOADING—An operation that removes airborne weapons/stores from an aircraft.

EOD—Explosive ordnance disposal.

ETA—Estimated time of arrival.

FIRE CHIEF, FIRE DEPARTMENT—Used in this manual as generic terms to indicate the head of the fire-fighting organization itself. It is meant to include Marine fire departments, Marine crash, fire, and rescue (CFR) units, Navy fire brigades, and Navy civilian fire departments.

FIRE WALL—A bulkhead separating two compartments of an aircraft.

FOAM APPLICATION RATE—A measure of the quantity of foam applied per unit of time on a fire.

FOAM BLANKETS—A dense layer of foam applied to a burning or susceptible surface to smother flames or prevent ignition.

FOD—Foreign object damage.

FOULED RUNWAY—Runway is not ready for operations.

GROUND RESONANCE—A condition of geometric imbalance in helicopters caused by offset dynamic forces when the helicopter makes improper contact with the deck. If allowed to continue, destruction of the helicopter is imminent. Improper tie-downs aggravate the onset of ground resonance.

HELICOPTER DIRECTION CENTER (HDC)—*See* AIR OPERATIONS CONTROL CENTER/HELICOPTER DIRECTION CENTER (AOCC/HDC).

HOVER—A condition of flight in which all relative or all forward movement has ceased.

HUNG WEAPON—An airborne weapon that cannot be fired or dropped, because of a malfunction of the weapon, the rack, or an aircraft circuit.

LANDING GEAR—The understructure that supports the weight of an aircraft when it is in contact with land. The understructure usually contains a mechanism for reducing the shock of landing; it is also called an undercarriage. A description of other landing gear follows:

1. Retractable landing gear—A type of landing gear that can be withdrawn into the body or wings of an airplane while it is in flight in order to reduce the drag.

2. Tricycle landing gear—Most multiengine aircraft are equipped with a tricycle landing gear. The main wheels are usually located at mid-wing (a short distance behind the center of gravity). The nosewheel is placed well forward and under the fuselage of the aircraft.

LIFT OFF—To take off or leave the deck in a controlled condition of flight.

LIGHT WATER—Trade name for aqueous film forming foam. It can be used simultaneously with dry chemicals to smother flammable liquid fires.

LOADING—Operations that install airborne weapons and stores on or in an aircraft and may include fusing bombs and stray voltage checks.

LOADING AREA—That area in which replenishment of airborne weapons or stores and other armament items on or in an aircraft is conducted. When weapons are being handled in this area, all fuses and initiators must remain safe and all gun chambers clear.

LSE—Landing signal enlisted.

LSO—Landing signal officer.

MEDEVAC—Medical evacuation.

MFFV—Mobile firefighting vehicle.

OVERHAUL—The final phase of firefighting, during which all of the fire is searched out and extinguished.

PASSENGER/MAIL/CARGO (PMC)—An administrative/logistics flight scheduled for transfer of personnel and/or material to or from the ship. PMC does not include lifts of combat troops for actual or training vertical assaults or withdrawals.

PILOTS LANDING AID TELEVISION (PLAT)—A closed-circuit TV presentation of air operations on a flight deck.

PRIMARY FLIGHT CONTROL (PRI-FLY)—The controlling agency on aviation ships that is responsible for air traffic control around the ship.

RAMP TIME (READY DECK)—Anticipated time specified by Pri-Fly that the deck will be ready to recover aircraft, and the first aircraft of a case III recovery is expected to be at the ramp.

RDO—Runway duty officer.

READY DECK—When recovery personnel are clear of the runway, the arresting gear engines are in the battery position, and the proper throttle (valve) settings are set on the arresting engines for the type of aircraft to be arrested.

REARMING AREA—That area where an operation is conducted that replenishes prescribed airborne weapons in or on an aircraft or where final dearming is accomplished following recovery and engine shutdown or following ground abort. Only loading, downloading, arming and dearming evolutions are authorized to be conducted in the rearming area. All weapons handled or loaded in the rearming area must be safed and remain safed.

RESPONSE TIME—The time elapsed between the initial notification of an accident/incident and the time of the first discharge of the extinguishing agent at the accident/incident site.

SCBA—Self-contained breathing apparatus.

STO—Short takeoff (V/STOL).

TURNOUT GEAR—The protective clothing (helmet, coat, trousers, boots and gloves) worn by structural fire fighters.

TURRET—A manually or hydraulically operated cannon mounted on a fire truck that can be used to dispense water or AFFF.

UNEXPENDED WEAPONS—Airborne weapons that have not been subjected to attempts to fire or drop. They are presumed to be in normal operating condition and can be fired, or jettisoned if necessary.

VERTREP—Vertical replenishment.

VLA—Visual landing aid. As used in this NRTC, *visual landing aids* are the specific deck marking, ship lights, and lighting arrays provided to aid the pilot in shipboard taxiing, launch, and recovery.

V/STOL—Vertical/short takeoff and landing.

V/STOL AIRCRAFT—An aircraft other than a helicopter, whose characteristics of flight enable it to make vertical or short takeoffs and landings.

WASHING DOWN—Descriptions are as follows:

1. Wetting down or dampening of burned material to ensure complete extinguishment.
2. Fire fighting, with heavy streams and large quantities of water, where it is not possible to enter a burning structure.
3. Flushing away any spilled material with water.

WAVE-OFF—An action to abort a landing, initiated by primary flight control, the LSO or LSE, or the pilot at his discretion. The response to a wave-off signal is mandatory.

WOD—Wind over deck.

APPENDIX II

REFERENCES USED TO DEVELOP THE NRTC

NOTE: Although the following references were current when this NRTC was published, their continued currency cannot be assured. Therefore, you need to be sure that you are studying the latest revision.

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INDEX

Assignment Questions

Information: The text pages that you are to study are provided at the beginning of the assignment questions.

ASSIGNMENT 1

1-1. You are guilty of misusing a screwdriver if you use it for which of the following purposes?

1. Prying
2. Chiseling
3. Testing an electrical circuit
4. Each of the above

1-2. Which parts of a standard screwdriver may be damaged if its blade does not fill 75 percent of the screw slot?

1. The blade
2. The shank
3. Both 1 and 2 above
4. The handle

1-3. Which of the following statements best describes a Phillips screwdriver?

1. It has a straight, flat blade
2. Its flukes are angled at 60 degrees and it has a pointed end
3. Its flukes are angled at 30 degrees and it has a blunt end
4. It has only two flukes that are angled at 45 degrees

1-4. Reed and Prince screws are generally used in what structural application?

1. Ship building
2. Simple component assembly
3. Automotive
4. Airframe

1-5. A Phillips screwdriver should fill what percent of the cavity of a Phillips screwhead?

1. 25%
2. 50%
3. 75%
4. 100%

IN ANSWERING QUESTIONS 1-6 AND 1-7, SELECT FROM COLUMN B THE FUNCTION FOR WHICH EACH TYPE OF PLIERS IN COLUMN A IS DESIGNED.

A. TYPES OF PLIERS		B. FUNCTIONS
1-6.	Slip joint	1. Cutting
1-7.	Diagonal	2. Crimping
		3. Gripping

1-8. What type of wrench is sometimes referred to as a "knuckle buster" because of the consequences mechanics frequently suffer from its improper use?

1. Strap
2. Stillson
3. Open-end
4. Adjustable

1-9. When using a Stillson wrench to rotate a pipe, you should apply the wrench so the twisting force will be provided by its fixed jaw.

1. True
2. False

1-10. Which type of wrench should you use on a chromium-plated pipe?

1. Adjustable
2. Open-end
3. Strap
4. Pipe

1-11. Which type of torque wrench emits an audible click when you reach your desired torque value?

1. Deflecting beam
2. Dial indicating
3. Automatic adjustable
4. Micrometer

1-12. Which of the following statements relative to hacksaw use is valid?

1. Since a hacksaw cuts on the pull stroke only, the blade should be installed with its teeth facing toward the handle
2. Since a hacksaw cuts on the push stroke only, the blade should be installed with its teeth facing away from the handle
3. Since a hacksaw cuts on the push stroke only, the blade should be installed with its teeth facing toward the handle
4. Since a hacksaw cuts on the pull stroke only, the blade should be installed with its teeth facing away from the handle

1-13. Which of the following is a correct use of a wrecking bar?

1. Moving heavy objects a short distance
2. Pulling spikes or heavy nails
3. Prying boards from a crate
4. Each of the above

1-14. Before you plug any power tool into its power source, you should make sure the power outlet is the same voltage as that specified for the tool, and that the tool is properly grounded.

1. True
2. False

1-15. A portable electric drill may be used for which of the following jobs?

1. Mixing paint
2. Drilling holes in metal or wood
3. Buffing small items
4. Each of the above

1-16. Which of the following statements best describes the comparison of speed and cutting power of the 1/2-inch drill as compared to the 1/4-inch drill?

1. The 1/2-inch drill has less power and fewer rpm
2. The 1/2-inch drill has more power and a larger number of rpm
3. The 1/2-inch drill has more power and fewer rpm
4. The 1/2-inch drill has less power and a larger number of rpm

1-17. The ABHs use portable power sanders, either electrically or pneumatically driven, for doing which of the following jobs?

1. Smoothing flight decks prior to laying nonskid materials
2. Removing paint
3. Scaling rust
4. Each of the above

1-18. What authority determines the recommended air supply pressure when a pneumatic tool is being used?

1. Manufacturer
2. Safety center
3. Engineering officer
4. Division chief

1-19. When referring to a "jitterbug," you are using which of the following tools?

1. Rotary impact scaler
2. Needle impact scaler
3. Chipping hammer
4. Pneumatic chipping hammer

1-20. Which of the following is an advantage when you are using a needle impact scaler to chip a deck?

1. It can remove nonskid at a rate of 250 to 500 feet per hour
2. It is gas, electric, or pneumatic powered
3. It can scale (chip) corners

1-21. A dynamometer is an apparatus for measuring what value?

1. Distance or time
2. Force or energy
3. Depth or diameter
4. Weight

1-22. Because tools are expensive and vital equipment, which of the following precautions should be observed?

1. Inventory all tools after each use
2. Apply a light film of oil on tools after cleaning
3. Clean all tools after each use
4. Each of the above

1-23. There are many variations of the common rule and steel tape. Which of the following statements concerning the care of rules and tapes is NOT valid?

1. Metal tapes and rules should be kept lightly oiled
2. When not in use, tapes and rules should be kept in a wooden box
3. When using the windup type of tape, you should always turn the crank clockwise
4. When using the windup type of tape, you should always use the hook as a stop

1-24. Eye goggles must be placed over your eyes before operating cutting tools.

1. True
2. False

1-25. Electric extension cords used with portable power tools should, in general, be no longer than

1. 100 feet, with two cords connected together
2. 75 feet
3. 25 feet, with no more than two cords connected together

1-26. For information on hearing conservation, you should refer to which of the following instructions?

1. COMNAVAIRPAC/LANTINST 3100.4
2. OPNAVINST 3120.32
3. OPNAVINST 6260.2
4. NAVAIRINST 10340.3

IN ANSWERING QUESTIONS 1-27 THROUGH 1-29, SELECT FROM COLUMN B THE DEFINITION THAT MATCHES THE BLOCK PART IN COLUMN A. NOT ALL RESPONSES IN COLUMN B ARE USED.

A. BLOCK PARTS		B. DEFINITIONS
1-27.	Sheave	1. The opening through which the rope passes
1-28.	Swallow	2. The framework that holds the block together and supports the pin on which the sheave rotates
1-29.	Strap	3. The shackle that supports the block
		4. The wheel over which the rope runs

1-30. What is the rope called in a block and tackle?

1. Line
2. Runner
3. Fall
4. Sheave

IN ANSWERING QUESTIONS 1-31 THROUGH 1-33, SELECT FROM COLUMN B THE DEFINITION THAT MATCHES THE TACKLE COMPONENT LISTED IN COLUMN A. NOT ALL RESPONSES IN COLUMN B ARE USED.

A. COMPONENTS		B. DEFINITIONS
1-31.	Hauling part	1. The end of the fall that is attached to one of the blocks
1-32.	Standing part	2. The block that is attached to a fixed object or support
1-33.	Running block	3. The part of the fall leading from one of the blocks upon which the power is exerted
		4. The block that is attached to the object to be moved

1-34. What is the mechanical advantage of the tackle illustrated in figure 1-11 of your textbook?

1. 16
2. 2
3. 8
4. 4

1-35. A twofold purchase tackle is illustrated in figure 1-13. What would the mechanical advantage be if the figure were inverted?

1. Eight
2. Two
3. Five
4. Four

1-36. A gun tackle is made up of which of the following combinations?

1. One single-sheave and two double-sheave blocks
2. Two single-sheave blocks
3. Three single-sheave blocks
4. Two double-sheave blocks

1-37. Which of the following groups lists the components of a line in increasing order of size?

1. Fibers, strands, and yarns
2. Fibers, yarns, and strands
3. Strands, yarns, and fibers
4. Yarns, fibers, and strands

1-38. Right-laid line must be coiled down in a clockwise direction.

1. True
2. False

1-39. What is a line called that is 6 inches in circumference and is used for towing or mooring?

1. Cable
2. Hawser
3. Halyard
4. Houseline

IN ANSWERING QUESTIONS 1-40 THROUGH 1-42, SELECT FROM COLUMN B THE DEFINITION THAT MATCHES THE TYPE OF LINE LISTED IN COLUMN A. NOT ALL RESPONSES IN COLUMN B ARE USED.

A. TYPES OF LINE		B. DEFINITIONS
1-40.	Marline	1. A line made smooth by close-wrapped turns or smaller line
1-41.	Seizing stuff	2. Lines less than 1 3/4 inches in circumference
1-42.	Small stuff	3. Two-strand left-laid stuff, roughly made up, and tarred a dark brown
		4. Small stuff laid up right-handed by machine

1-43. The size of small stuff is designated by the number of yarns it contains multiplied by the number of threads in each yarn.

1. True
2. False

1-44. How should a line be stowed when it is wet?

1. Tight coils
2. Loose coils
3. Short fakes
4. Long fakes

1-45. An indication that a line has deteriorated due to age is when the inner parts of the strands have changed color.

1. True
2. False

1-46. Which of the following conditions indicates that a line has deteriorated as a result of overstrain?

1. Gray-colored surface
2. Brown-colored surface
3. Decreased diameter
4. Smooth surface

1-47. How does a 6×37 wire rope differ from 6×19 wire rope?

1. The 6×37 is left-laid
2. The 6×37 has longer wires in each strand
3. The 6×37 has more wires in each strand
4. The 6×37 has more strands

1-48. Aboard ship, wire rope is unsuitable for general use when it is made from which of the following types of steel?

1. Cast steel
2. Plow steel
3. Monitor steel
4. Extra strong crucible steel

1-49. When you compare the flexibility and tendency to untwist of nonpreformed wire rope with preformed wire rope, what statement best describes nonpreformed wire rope?

1. It is flexible and less likely to untwist
2. It is rigid and more likely to untwist
3. It is rigid and less likely to untwist
4. It is flexible and more likely to untwist

1-50. How does spring lay compare with all-steel wire of corresponding size?

1. It is stronger and more flexible
2. It is stronger but less flexible
3. It is weaker but more flexible
4. It is weaker and less flexible

1-51. What lubricant is recommended for use on wire rope used for exposed running rigging?

1. Motor oil
2. Tallow and lead
3. Petroleum jelly
4. Graphite grease

1-52. When you handle wire rope you should always wear a pair of gloves as a protection against which of the following conditions?

1. Jamming
2. Kinking
3. Slipping
4. Fishhooks

1-53. What is the best way to uncoil a new coil of wire rope?

1. Unwind it in the same way as a coil of line
2. Unwind it by rotating the entire coil
3. Fake it out along the deck
4. Pick it up in bights by hand

1-54. The critical length to which a 200-foot nylon line can be stretched is how many feet?

1. 220
2. 240
3. 280
4. 310

1-55. The elasticity of nylon line requires that a back tuck be taken in each strand when it is to be spliced for use as a towing line.

1. True
2. False

1-56. How should you uncoil new nylon rope?

1. Pull off the top end in bights by hand
2. Unreel it like wire rope
3. Pull the end up through the eye of the coil
4. Walk away with the bottom end

1-57. What is the rule of thumb for the breaking strength of 1-inch diameter nylon line?

1. 800 lb
2. 2,300 lb
3. 7,200 lb
4. 21,600 lb

1-58. Based on rule of thumb calculations, what is the safe working load of new wire rope 4 inches in circumference?

1. 134,000 lb
2. 128,000 lb
3. 64,000 lb
4. 32,000 lb

1-59. Providing a place for your equipment and seeing that it is placed there when it is not in use enables you to do which of the following tasks?

1. Perform rescue operations more efficiently
2. Obtain longer service life from equipment
3. Lessen the chances of injury to personnel
4. All of the above

1-60. What is a dynamometer most commonly used to measure?

1. Volumetric output of hydroelectric dynamos
2. Dynamic impact forces of the aircraft tail hook on the deck pendant
3. Tension
4. Magnetism

1-61. Which of the following characteristics applies to chain ratchets?

1. Can be used to raise and lower loads
2. Have a maximum safe working load
3. Are obtainable in more than one size
4. Each of the above

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ASSIGNMENT 2

2-1. Before using any nonskid compound, you should consult which chapter of the Naval Ships' Technical Manual (NSTM), NAVSEA S9086-VG-STM-010, concerning deck coverings?

1. 631
2. 632
3. 633
4. 634

2-2. Nonskid materials in the federal supply system are assigned a nonextendable shelf life of how many months?

1. 6
2. 9
3. 3
4. 12

2-3. At what range, in degrees Fahrenheit, should nonskid coatings be stored until used?

1. 30 to 90
2. 50 to 90
3. 55 to 100
4. 65 to 110

2-4. Prior to deck preparation and nonskid application, which of the following precautions must be taken to protect all deck penetrations and equipment?

1. Drop cloths and masking must be used to prevent damage from the abrasive material
2. Deck openings must be covered with strips of sponge rubber, adhesive plates/circles, or similar material
3. One tie-down crossbar near the refueling area should be cleaned to bare metal and masked prior to nonskid application
4. Each of the above

2-5. What causes the majority of nonskid coating failures?

1. Applying the coating compound over a cold deck
2. Improper application or application over a poorly prepared deck
3. Use of compounds that have an expired shelf life
4. Mixing of components from different compound kits

2-6. Composition G nonskid is used in the arresting gear wire runout area.

1. True
2. False

2-7. A slip-resistant surface is required for the flight and hangar deck on a carrier (except beneath the arresting cables and run-out areas). Which of the following nonskid systems is intended for this use?

1. Type I or II, composition G
2. Type I or II, composition L
3. Type III, composition G
4. Type IV, composition L

2-8. Which of the following is an indication that a nonskid surface should be resurfaced?

1. The nonskid surface shows signs of rust through or corrosive undercutting
2. Patches of the nonskid surface are easily removed by chipping or scraping
3. The nonskid surface is worn smooth, but retains good adhesion with no bare areas
4. Twelve months have elapsed since the initial coating

2-9. What is the best method of applying nonskid to heavy wear areas, such as carrier flight decks?

1. Brushing
2. Spraying
3. Rolling or troweling
4. Using a broom

2-10. What is the general cure time range of surface primer?

1. 6 to 12 hours
2. 12 to 18 hours
3. 18 to 24 hours
4. 24 to 30 hours

2-11. When you use the solvent degreasing method to prepare a steel deck for priming, which of the following conditions should exist before laying nonskid?

1. The deck surface should retain a film
2. The deck surface should be absolutely clean
3. Only loosely adhering paint should remain
4. Only the most compacted soil and grease should require scraping

2-12. What is the only authorized nonskid coating to be used in aircraft carrier landing and arresting gear cable run-out areas?

1. Type I or II, composition L
2. Type I or II, composition G
3. Type III or IV, composition L
4. Type III of IV, composition G

2-13. Nonskid epoxy primers may be applied by which of the following methods?

1. Brushing
2. Roller coating
3. Spraying
4. Each of the above

2-14. As an ABH, the keys to your maximum performance is the ability to safely use and give proper maintenance to which of the following equipment?

1. Tie-downs and chains
2. Tractors
3. Chocks and tow bars
4. All of the above

2-15. Maneuverability and ease of handling of a tractor are directly dependent on which of the following characteristics?

1. Its dimensions
2. Its turning radius
3. Its type of transmission
4. All of the above

2-16. Which of the following factors determines the amount of force a tractor can exert?

1. Its dimensions and turning radius
2. The type and condition of the surface on which it is being used
3. Its turning radius and support equipment
4. Its support equipment and dimensions

2-17. What tractor has the greatest drawbar pull capacity?

1. A/S32A-37, Class 1
2. A/S32A-37, Class 2
3. A/S32A-30A
4. A/S32A-31A

2-18. The maximum aircraft weight a tow tractor can safely handle can be calculated by multiplying its drawbar pull by what number?

1. 10
2. 2
3. 5
4. 4

2-19. What is the primary function of the A/S 32A-30A tow tractor?

1. To tow aircraft with gross weights of less than 50,000 pounds
2. To tow mobile GSE
3. To be used as a GSE mobile workstand
4. To tow heavy aircraft and helicopters

2-20. A/S32A-37 tow tractor was designed for which of the following operations?

1. Towing aircraft at high speeds on beaching ramps
2. Towing and spotting large shore based aircraft
3. Spotting small aircraft on carrier flight decks
4. Positioning arresting gear chain on air station runways

2-21. Which of the following devices is/are used to assist in starting an A/S32A-31A tow tractor when the ambient temperature is below 40ºF?

1. Glow plugs
2. Electric heater
3. Gas turbine
4. All of the above

2-22. When you are driving a tractor at night, which of the following rules is best to follow?

1. Always have another person present with a lighted wand
2. Always be able to stop within the distance in which you have clear visibility
3. Always maintain a speed as close to the posted speed as possible
4. Always maintain a speed within 10 percent of the posted speed

2-23. What is the maximum lifting capacity of the SD-2 towing tractor?

1. 6,000 lb
2. 10,000 lb
3. 12,000 lb
4. 16,000 lb

2-24. You can seriously damage a tractor's engine by placing the throttle in its wide-open position while the engine is lugging at a low speed.

1. True
2. False

2-25. While you are operating a tractor that has an automatic transmission, the horn starts to blow. What should you do?

1. Stop the tractor and shut off the engine
2. Momentarily reduce throttle and then proceed
3. Shift to a lower range gear and reduce engine speed
4. Shift to a higher range gear and increase engine speed

2-26. When preparing to tow an aircraft, the tractor driver must never hook the tractor to the tow bar if the tow bar is already attached to the aircraft.

1. True
2. False

2-27. Before towing an aircraft, you must ensure which of the following requirements has been accomplished?

1. A fully qualified brake rider is in the cockpit
2. All tie-downs are removed and all chocks are pulled
3. The tow bar is properly connected to both the aircraft and the tractor
4. Each of the above

2-28. Which of the following general inspections and preventive maintenance pertain to practically all tow tractors?

1. Preoperational inspections
2. Periodic inspections
3. Detailed maintenance inspections
4. All of the above

2-29. The ABH is not required to repair or maintain tractors. However, it is imperative that he has some knowledge of the mechanical difficulties that may be encountered during tractor operation.

1. True
2. False

2-30. Prior to the use of tow tractors each day, the operator should verify that which of the following actions has been taken?

1. Periodical servicing
2. Daily inspection and preoperational checks
3. Discrepancies corrected
4. Both 2 and 3 above

2-31. Which of the following statements most accurately describes the ABH who is to be assigned the responsibility of driving a tractor?

1. The ABH knows and understands the standard signals used to direct aircraft towing
2. The ABH has been instructed and has a satisfactory understanding of the operation of the towing equipment
3. The ABH has mastered the operations section of the technical manual for the tractor he is to operate
4. The ABH is qualified in all of the above areas

2-32. The maximum speed an aircraft may be towed is how many miles per hour?

1. 5
2. 11
3. 14
4. 22

2-33. Aircraft towing tractors (spotting dollies) are of particular benefit for moving aircraft in which of the following situations?

1. On the flight deck only
2. On amphibious ships only
3. In congested areas
4. During emergency respots

2-34. Spotting dollies have what wheel configuration?

1. One driven wheel and two free-wheeling caster-type wheels
2. Two driven wheels and two free-wheeling caster-type wheels
3. Two driven wheels and one free-wheeling caster-type wheel
4. Four individually motor-driven wheels

2-35. What must you do to the joystick handle on the end of the control console to control the forward or backward movement of the spotting dollies?

1. Twist it
2. Depress it or raise it
3. Push it to the right or to the left
4. Push it forward or pull it backward

2-36. The NWC-2 universal wheel chock and the NWC-4 chock used aboard aircraft carriers are adjustable to what maximum wheel size?

1. 45 in.
2. 40 in.
3. 36 in.
4. 32 in.

2-37. For easiest removal, the NWC-2 universal wheel chock and the NWC-4 chock should be positioned with the adjustable block in what position?

1. Forward
2. Aft
3. Inboard
4. Outboard

2-38. Which of the following characteristics is NOT a feature of the NWC-4/5 aircraft wheel chock?

1. Endblock tread design increases traction
2. Made entirely of corrosion resistant steel
3. The latching mechanism has fewer parts
4. Resists chemical deterioration

2-39. What is the safe working load, in pounds, of the TD-1A and TD-1B tie-downs?

1. 10,000
2. 12,000
3. 36,000
4. 90,000

2-40. The ALBAR type tow bar is designated "universal" because it can be used for towing which of the following aircraft?

1. All aircraft equipped with nosewheel or tailwheel axle tow holes
2. All shipboard and shore base aircraft
3. Most aircraft equipped with nosewheel axle tow holes and fuselage and landing gear tow rings
4. All carrier aircraft currently in use

2-41. When hooking up a tow bar to an F-14 aircraft, what is the last step you must take prior to towing the aircraft?

1. Engage the nearest link of chain in the sleeve slot
2. Make sure there is maximum tension on the chain
3. Be sure the axle pins are in the holes as far as they can go
4. Release chain tension sufficiently to permit tow bar vertical action

2-42. If the TD-1A tie-down chain is incorrectly positioned in the tensioner assembly, its breaking strength is reduced by how many pounds?

1. 4,000
2. 6,000
3. 8,000
4. 10,000

2-43. What feature prevents the chain of the TD-1B tie-down from being incorrectly positioned in the tensioner assembly?

1. Nodes on each chain link
2. Wider hook design
3. Shorter tensioning bar
4. Safety lanyard

2-44. How long is the model 24 ALBAR?

1. 25 ft
2. 20 ft
3. 15 ft
4. 9 ft

2-45. Operation of aircraft elevators is a responsibility of which of the following carrier divisions?

1. V-1 only
2. V-2 only
3. V-1 and V-3, jointly
4. A and V-1, jointly

2-46. Each aircraft elevator is locked at the flight deck level by two independently actuated locking bars. What provision is made to ensure that these locking bars do not extend or retract at the wrong time?

1. The locking bars are manually operated from the gallery deck and do not depend on automatic actuation
2. The safety interlock prevents premature extension or retraction
3. The safety interlock prevents premature retraction, and a hand-operated locking mechanism prevents premature extension
4. The safety interlock prevents premature extension, and a hand-operated locking mechanism prevents premature retraction

2-47. The electric power that operates an aircraft elevator's power plant fails after the fully loaded elevator has been raised only 3 feet from the hangar deck. What will happen?

1. The elevator will slowly return to the hangar deck level
2. The elevator will continue to the flight deck level
3. The elevator will lock in position 3 feet above the hangar deck level
4. The elevator will remain in position 3 feet above the hangar deck level for 30 minutes and then continue to the flight deck level

2-48. What action must the aircraft elevator operating personnel take prior to operating any elevators?

1. Obtain instructions from the machinery room
2. Obtain permission from the OOD
3. Ensure all weekly maintenance has been completed
4. Obtain permission from the Air Boss

2-49. The high-pressure system fails during operation of an aircraft elevator. The elevator is raised to the flight deck level by which of the following means?

1. Electrical motors
2. Hand cranks only
3. Sump pumps only
4. The combined action of hand cranks and sump pumps

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ASSIGNMENT 3

- REFER TO FIGURE 3-1 IN YOUR

TEXTBOOK AND FIGURE 3A IN THIS COURSE WHEN YOU ARE ANSWERING ITEMS 3-1 THROUGH 3-6.

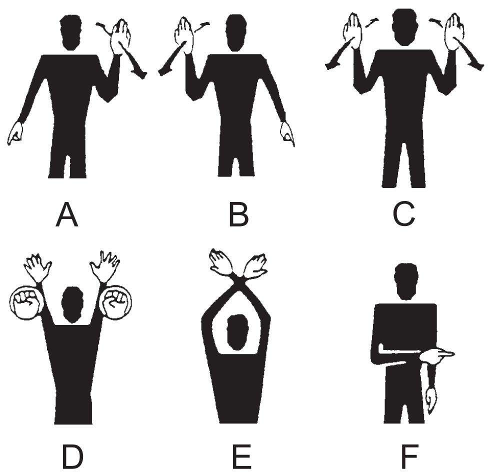

Figure 3A

3-1. You have just taken over control as taxi director of a F-14 moving rapidly out of the arresting gear and heading directly toward an EA-6B parked ahead of the island. To stop the aircraft, you should give its pilot what signal?

1. A
2. C
3. E
4. F

3-2. After the F-14 has come to a safe stop, you must direct the pilot to taxi to the left of the EA-6B. What signal should you use to direct the pilot in his turn?

1. A
2. B
3. D
4. F

3-3. When you turn over control of the F-14 to another director, what signal should you use to inform the pilot of the change?

1. A
2. D
3. E
4. F

3-4. At night, what signal is replaced by two wands crossed over the head?

1. A
2. D
3. E
4. F

3-5. Which of the following signals should a director give only when he can see the pilot's eyes?

1. A and D
2. B and E
3. C and F
4. Each of the above

3-6. A blast on the plane director's whistle is equivalent to what signal?

1. A
2. B
3. C
4. E

3-7. What colors of light are displayed by taxi guidance wands held by the launching and arresting gear officers?

1. Red and green
2. White and blue
3. Blue and green
4. Amber and white

3-8. At night, an aircraft has landed and disengaged from the arresting pendant. What color signal wands will the pilot look for to receive taxi instruction?

1. Red
2. Green
3. Amber
4. White

3-9. Normally the same plane director will control an aircraft until which of the following events occurs?

1. Aircraft comes to a full stop
2. Aircraft moves from a specified area of the deck
3. Pilot indicates a director is no longer necessary
4. Pilot can no longer see the eyes of the director

3-10. Information concerning aircraft handling procedures and safety precautions can be found in which of the following publications?

1. CV NATOPS Manual
2. Air Department Standard Operating Procedures
3. Both 1 and 2 above
4. NAEC Bulletin 91131

3-11. Aircraft damage reports should be prepared according to which of the following instructions?

1. OPNAVINST 3120.32
2. OPNAVINST 3750.6
3. OPNAVINST 5100.19
4. OPNAVINST 00-35QH2

3-12. During launching and recovery operations, the movement of aircraft about the narrow confines of a carrier's flight deck is characterized by the need for speed and care.

1. True
2. False

3-13. Who is responsible for spotting an aircraft on the flight deck?

1. The pilot
2. The plane captain
3. The plane director
4. The ABH designated to ride in the cockpit

3-14. In planning the spots for the various types of aircraft aboard, you must bear in mind that some types must be spotted in a specific location each time for which of the following reasons?

1. Servicing
2. Maintenance or starting
3. Loading ammunition and preventing interference with the movement of other aircraft
4. All of the above

3-15. Before each launching operation, the aircraft handling officer briefs all flight-deck directors and spotters on which of the following information?

1. The disposition to be made of aircraft that might go down during the launch
2. The details for recovery of the launched aircraft
3. The specific launch procedures and sequence to be followed
4. All of the above

3-16. Since the time interval between catapult launches depends more on the flight deck directors and catapult spotters than on the catapult, only the most experienced directors should be assigned as catapult spotters.

1. True
2. False

3-17. What purpose does the "foul line" serve on a carrier's flight deck?

1. It separates the landing area from the rest of the deck
2. It marks off an area for parking tow tractors and handling equipment
3. It marks off an area to be used only for spotting aircraft that are damaged in landing
4. It is a line marking the center of the landing area

3-18. During the recovery phase of flight operations, what equipment is kept in a ready condition to remove nontaxiable aircraft from the landing area?

1. Two spotting dollies
2. Two crash forklifts
3. Both 1 and 2 above
4. Tow tractors

3-19. Who is responsible for determining if servicing and maintenance on an aircraft should be interrupted in the interest of flight operations aboard a carrier?

1. Flight deck officer
2. Plane director
3. Flight deck LPO
4. Flight deck CPO

3-20. Maintenance that prevents an aircraft from being moved from its spot must be approved by which of the following officers?

1. Hangar deck officer and aircraft handling officer
2. Aircraft maintenance officer only
3. Flight deck officer and hangar deck officer
4. Flight deck officer and crash and salvage officer

3-21. Who is/are responsible for maintaining safe clearance when moving an aircraft into spot in close quarters?

1. The tractor driver only
2. The aircraft brake rider only
3. The plane director and safety observers
4. The tractor driver and aircraft brake rider

3-22. Spotting aircraft on the hangar deck is the greatest problem for the handling crews when the aircraft are in which of the following categories?

1. Aircraft needing maintenance
2. Aircraft needing servicing
3. Aircraft not needed for a particular launch
4. Aircraft to be launched when there is not enough room on the flight deck until other aircraft are launched

3-23. Almost all of the accidents that occur during the handling of aircraft can be attributed to which of the following reasons?

1. Disregard of handling instructions
2. Poor supervision
3. Disinterest
4. All of the above

3-24. During flight operations, what is the most important safety precaution to remember?

1. Never turn your back on an aircraft taxiing out of the arresting gear
2. Never operate or allow personnel under your supervision to operate machinery or equipment when they are not thoroughly checked out on all safety and operating procedures
3. Keep unauthorized personnel clear of the catwalks, flight deck, and catapult or arresting gear engine rooms
4. Always wear articles of flight clothing in the prescribed manner

3-25. Which of the following statements pertaining to safety on the flight deck is NOT valid?

1. Make sure an elevator is in the full up or down position before moving an aircraft on or off
2. When you must tow an aircraft behind a jet blast deflector when another aircraft is at high power turnup, be sure the wings are folded
3. Ensure that wheel chocks are used whenever an aircraft is not being moved
4. Watch for unexpected ship movement that may alter the direction of aircraft movement

3-26. What determines the number of tie-down chains required to secure an aircraft after it is in spot?

1. Number of chocks blocking the main landing gear
2. Discretion of the plane director
3. Scheduled operations and weather conditions
4. Total number of tie-down attachment points on the aircraft

3-27. An ABH wants to obtain the most accurate information on accident prevention that is currently available and also wants to benefit from the experiences of other ABHs. The ABH should read which of the following publications?

1. Approach
2. Naval Aviation News
3. The applicable Crossfeeds
4. Either 2 or 3 above

3-28. Under normal conditions, where should the chocks be positioned to secure an aircraft having tricycle landing gear?

1. Around all three wheels
2. All wheels except the nose wheel
3. Nose wheel only

3-29. The method used to secure aircraft on both the flight and hangar decks depends upon which of the following factors?

1. Expected operations of the aircraft
2. Weather conditions
3. Types of aircraft
4. All of the above

3-30. What extra precautions are taken to secure aircraft for heavy weather conditions?

1. Canvas covers are secured to all intake and exhaust openings
2. Extra tie-downs are used and controls and control surfaces are secured
3. Stronger tie-downs, wire tie-downs, and extra chocks are used
4. Wire rope is used in place of tie-downs

3-31. Why are aircraft generally spotted on the line?

1. For loading
2. For servicing
3. For checking for operational readiness
4. All of the above

3-32. When directing an aircraft from its spot on the line, you must remain in control of it until which of the following procedures is complete?

1. It is clear of other aircraft and obstructions
2. It is taxied to the edge of the runway
3. The tower has passed control to the pilot
4. The aircraft has reached the center of the runway and is ready for takeoff

3-33. An ABH striker billeted at a naval air station is likely be assigned to which of the following duties?

1. Flight crewman
2. Fueling crewman
3. Line crewman

3-34. What braking procedures should be used to make an emergency stop when a multiengine aircraft is being towed with a tractor?

1. Aircraft and tractor brakes should be applied simultaneously when the aircraft director blows a whistle
2. Tractor brakes only should be used
3. Aircraft brakes should be applied after tractor brakes have been applied
4. Aircraft brakes only should be used

3-35. Prior to moving an aircraft, you should check to ensure which of the following conditions exists?

1. The tailwheel is unlocked
2. Landing gear lockpins are installed
3. A qualified operator is in the pilot's seat
4. All of the above

3-36. For securing an aircraft on a remote airstrip, corkscrew type stakes provide the greatest security.

1. True
2. False

3-37. What standard colors and markings are used on aircraft handling and servicing vehicles?

1. Chrome yellow with solid black front and rear bumpers
2. Black with chrome yellow front and rear bumpers
3. Black with the front and rear bumpers having alternate black and chrome
4. Chrome yellow with the front and rear bumpers having alternate black and chrome yellow stripes at a 45-degree angle

3-38. Your duties as an ABH assigned to the terminal at a naval air station will probably require you to become knowledgeable in which of the following areas?

1. Aircraft cargo limitations
2. Aircraft cargo loading and unloading
3. Packaging and handling dangerous materials for shipment by military aircraft
4. All of the above

3-39. Basic guidance for the operation of naval air terminal facilities can be found in which of the following OPNAVINST?

1. 4790.4
2. 4660.3
3. 3120.3
4. 3100.4

3-40. A maximum of how many helicopters can be simultaneously launched or landed aboard an LPD?

1. Five
2. Two
3. Three
4. Four

3-41. You are assigned a billet aboard an LHA/LHD or LPD. Your duties will include which of the following work?

1. Operating shipboard ground handling and fire-fighting equipment
2. Launching helicopters
3. Recovering helicopters
4. All of the above

3-42. Which of the following statements concerning aircraft handling procedures is NOT valid?

1. When preparing to move an aircraft, the director ensures that a pilot or a qualified plane captain mans the cockpit
2. The time available, deck stability, prevailing wind and weather conditions and the safety of personnel and equipment should determine the tempo of respotting aircraft
3. A designated aircraft director controls all aircraft movements
4. High point tie-downs must be installed while rotors are turning

3-43. Which of the following statements regarding the tie-down and securing of helicopters is NOT valid?

1. Helicopters are secured in the same manner as fixed-wing aircraft with the exception that rotor blades are tied down
2. The applicable NAVAIR maintenance instructions manual provides the detailed procedures for tying down and securing helicopters
3. The rotor blades should not be tied down during gusty or turbulent wind conditions if a helicopter is spotted on the flight deck
4. The rotor blades of a helicopter can be secured by using blade tip boots that are attached to the deck with manila lines

3-44. If manila boot lines get wet, you should check them for shrinkage and readjust the force being exerted on the rotor blades.

1. True
2. False

3-45. How does the LSE signal the pilot to LOCK TAIL WHEELS?

1. He rotates his hands in a circle perpendicular to and in front of his body
2. He places his hands together overhead opened from the wrists in a "V", then closes them suddenly
3. He makes clinched fists at eye level and holds a flag of any color in his left hand
4. He moves his arms from a wide-apart position at shoulder height to a "bear hug" position

3-46. What is an LSE directing the pilot of an airborne helicopter to do when he holds his arms extended horizontally sideways, palms downward?

1. LAND
2. INCREASE ALTITUDE
3. HOVER
4. LOWER WHEELS

3-47. How does an LSE signal the pilot of an airborne helicopter to REDUCE ALTITUDE?

1. He makes fore and aft movements with his arms down
2. He holds a green flag in his right hand and waves his arms overhead
3. He extends his arms sideways horizontally beckoning downward with his palms turned down
4. He positions his arms in front of his shoulders with his palms forming an inverted "V"

3-48. During night operations, how does a pilot signal the LSE that he is READY TO START ENGINES?

1. Rotating an amber wand at chest level
2. Rotating a movable light in a circle perpendicular to the deck
3. Holding up one hand and rotating it
4. Turning external lights on flashing dim

3-49. What information does the pilot provide the LSE when he gives the "thumbs up" signal at eye level?

1. READY FOR TAKEOFF
2. READY TO START ENGINE (S)
3. READY TO ENGAGE ROTORS
4. REMOVE CHOCKS AND/OR TIE-DOWNS

3-50. What is the LSE directing the pilot to do by holding crossed wands over his head?

1. START ENGINES
2. TAKE OFF
3. HOLD POSITION
4. ENGAGE ROTORS

3-51. What is an LSE signaling to the pilot of an engaged helicopter when he holds his left fist above his head and makes a throat cutting action with his right hand?

1. WAVE OFF
2. INSERT CHOCKS
3. DISENGAGE ROTORS
4. PROCEED UNDER THE GUIDANCE OF ANOTHER DIRECTOR

3-52. What is the LSE signaling to the pilot when he leans over with his arms hanging as if they were around a barrel and then closes them?

1. OPEN CARGO DOORS
2. CLOSE CARGO DOORS
3. HOOK UP EXTERNAL LOAD
4. RELEASE EXTERNAL LOAD

3-53. Why should the number of personnel on the flight deck of an LHA/LHD be kept to a minimum during launch and recovery operations?

1. The main rotor may strike the deck
2. Some tail rotors revolve in a vertical plane close to the deck
3. Both 1 and 2 above
4. Training is not conducted during launch and recovery operations

3-54. All tie-down chains attached to the fuselage mounted mooring rings or above the landing gear shock struts must be loosened (have sufficient slack) before engaging or disengaging rotors because of which of the following reasons?

1. The helicopter is prevented from going into ground resonance that could destroy it
2. The rotors will cut the tie-downs and sling pieces of chain in all directions
3. Personnel are not allowed under the rotors while they are turning
4. All of the above

3-55. When will the pilot of a helicopter commence takeoff?

1. After flight quarters personnel clear the flight deck
2. After receiving the launch signal from the LSE
3. After receiving the green light from Pri-Fly
4. After the four-point tie-downs are removed

3-56. Which of the following LSE signals must be obeyed by the pilot?

1. TAKE OFF AND HOVER
2. DISENGAGE ROTORS AND LOCK TAIL WHEEL
3. WAVE OFF AND HOLD
4. All of the above

3-57. When should a helicopter be armed?

1. Before the pilot signals ready for takeoff and before the tiedowns/chocks are removed
2. Before the pilot signals ready for takeoff and after the tiedowns/chocks are removed
3. After the pilot signals ready for takeoff and before the tiedowns/chocks are removed
4. After the pilot signals ready for takeoff and after the tiedowns/chocks are removed

3-58. Which officer is overall responsible for the aircraft integrity watch onboard ship?

1. The aircraft handling officer
2. The air wing safety officer
3. The aircraft integrity watch officer
4. The air officer

3-59. What color flotation vest is worn by the aircraft integrity watch roving patrols?

1. Brown
2. Blue
3. Red
4. White

3-60. On an LHA/LHD, at least how many chains are needed to secure a helicopter in permanent tiedown configuration?

1. 6
2. 8
3. 10
4. 12

3-61. To an ABH, what are caps, nuts, and bolts found on the flight or hangar deck classified as?

1. Hardware
2. IMRL
3. Repair Parts
4. FOD

3-62. As an LSE, what is your position relative to approaching helicopters?

1. 30°
2. 45°
3. 90°
4. 180°

3-63. What fixed-wing aircraft operate from amphibious aviation ships?

1. V/STOL
2. F-14s
3. A-3s
4. C-130s

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ASSIGNMENT 4

4-1. Who is responsible for the deployment and use of all fire-fighting personnel and equipment at the scene of a fire?

1. Scene leader
2. Background leader
3. Crash and salvage officer
4. Crash and salvage supervisor

4-2. What is the flow rate of a vari-nozzle installed on a 2 1/2-inch AFFF hose line?

1. 95 gpm
2. 125 gpm
3. 150 gpm
4. 250 gpm

4-3. A general description of fire-fighting agents and fire-fighting equipment can be found in which chapter of the Naval Ships' Technical Manual?

1. Chapter 555
2. Chapter 631
3. Chapter 843
4. Chapter 9114

4-4. To most effectively fight a flight deck fire while affording maximum protection to fire-fighting personnel, where should you position mobile fire-fighting equipment in relation to the fire?

1. Downwind
2. Upwind
3. Abreast
4. Behind

4-5. Ordnance that has been involved in a fire must be cooled by a hose team for a minimum of how many minutes after the fire is extinguished?

1. 45
2. 30
3. 15
4. 5

4-6. An aircraft that is not carrying high explosives or nuclear weapons crashes and catches on fire. What is the first function of the ARFF team?

1. To extinguish the fire
2. To isolate the crash to minimize the danger of fire spreading to other aircraft
3. To clear the flight deck of wreckage
4. To remove the flight crew

4-7. During prelaunch starts on CVs/CVNs that have two mobile fire-fighting vehicles, one is positioned at a location that provides the best view of FLY 3 and the waist catapults. Where will the other one be positioned?

1. To view FLY 2 and the bow catapults
2. On the bow, to view the entire flight deck
3. Aft of the island in standby
4. On the point, where aircraft are being armed

4-8. A rescuemen wearing a fire fighting suit is working in a fire. What is most likely to happen should he be sprayed with AFFF or water?

1. The fireproof material of the suit may wash off
2. Steam will be generated and he may be scalded
3. Liquids running over the faceplate will impair his vision
4. It is normal practice and nothing adverse will happen

4-9. What direction should rescuemen always face when rescuing personnel from the cockpit of a jet aircraft?

1. Aft
2. Toward the cockpit
3. Away from the cockpit
4. Forward

4-10. You are removing a pilot from a crashed aircraft. What must you remove before disconnecting the oxygen hose?

1. The safety pin from the face curtain
2. The dust cap from the seat pan coupling
3. The oxygen mask
4. The anti-G suit hose disconnect

4-11. Which of the following pieces of equipment is NOT part of the emergency distress equipment maintained at the LSO platform?

1. Battery-powered marker
2. Search and rescue sonobuoy
3. Multicolored beacon
4. Life preserver ring

4-12. Who is required to examine all crash victims?

1. The on-scene leader
2. The first hospital corpsman on the scene
3. The duty medical assistant
4. The medical doctor

4-13. What symptom will result from high concentrations of CO_2 discharged on personnel in a confined space?

1. Asphyxiation
2. Chills
3. Fever
4. Vomiting

4-14. What directly determines success or failure in containing a fuel fire?

1. The firefighter's knowledge or ignorance
2. The accurate prediction of the prevailing winds
3. The response time of the below-decks pump rooms
4. The response time of the OOD turning the ship out of the wind

4-15. What is the primary jet fuel used aboard ship?

1. JP-4
2. JP-5
3. AvGas
4. MoGas

4-16. Fires are especially critical following a crash because of which of the following reasons?

1. They present a severe hazard to the pilot
2. They present a severe hazard to the crash truck driver
3. They present a hazard to the on-the-scene leader
4. All of the above

4-17. What is the term for the lowest point at which a combustible vapor is formed in aviation fuels?

1. Autogenous ignition temperature
2. Volatility index
3. Flash point
4. Combustion point

4-18. The kerosene type fuel (JP-5) has a flash point of how many degrees Fahrenheit?

1. 60
2. 100
3. 140
4. 180

4-19. What is the term for the heat level necessary to cause aviation fuel to ignite spontaneously?

1. Flash point
2. Volatility index
3. Autogenous ignition temperature
4. Combustion point

4-20. Which of the following would NOT be a safety concern when handling modern aviation fuels?

1. Low flash point
2. Spontaneous explosion
3. Static electricity
4. Water content

4-21. In aircraft fires, the intense heat of burning fuel may provide a source of ignition for which of the following material?

1. Oil
2. Plastics
3. Magnesium
4. All of the above

4-22. Who mans the hangar deck conflagration stations during flight quarters?

1. ABH strikers from the V-1 and V-3 divisions
2. ABH2s and ABH3s from the V-1 division
3. Senior ABHs from the V-1 division
4. Junior ABHs and ABH strikers from the V-3 division

4-23. Conflag station watchstanders are certified as to their competence and qualifications to stand the watch by which of the following officers?

1. Integrity watch officer
2. Air department duty officer
3. V-3 division officer
4. Any of the above officers, depending upon the circumstances

4-24. The light-water container and the dry-chemical container on the TAU-2 are fully charged. The capacities of the light-water container and the dry-chemical container are (a) how many gallons, if any, of AFFF and (b) how many pounds, if any, of PKP?

1. (a) 200 (b) 80
2. (a) 80 (b) 200
3. (a) 230 (b) none
4. (a) None (b) 230

4-25. A fusible-plug temperature relief valve is mounted on the AFFF tank. At what temperature will the plug material melt, allowing pressure to escape?

1. 200°F (96°C)
2. 212°F (100°C)
3. 220°F (104°C)
4. 230°F (108°C)

4-26. What are the sizes of the twinned neoprene lined hose and the neoprene covered hose?

1. The dry-chemical hose is 3/4 inch and the light-water hose is 1 inch
2. The dry-chemical hose is 1 inch and the light-water hose is 3/4 inch
3. Both hoses are 1 inch
4. Both hoses are 3/4 inch

4-27. Which of the following statements is correct concerning the simultaneous use of PKP and light water on a fire?

1. A mixture of nitrogen and PKP is discharged through the dry-chemical nozzle
2. Only light water is forced out of the light-water nozzle until the solution is exhausted
3. Both 1 and 2 above
4. Nitrogen, PKP, and light water are discharged from the same nozzle by use of a manifold

4-28. Which of the following components is/are protected by a 250-psig pressure relief valve in the inlet side?

1. The pressure regulator
2. The light-water tank
3. The dry-chemical tank
4. Both 2 and 3 above

4-29. After approaching a fire from upwind, what procedure should you use to knock down the flames?

1. Use light water on the base of the flames
2. Use PKP on the base of the flames
3. Use a mixture of PKP and light water on the base of the flames
4. Use a mixture of PKP and light water around the perimeter

4-30. When full of water and concentrate mixture, the light-water container actually contains how many gallons of light-water concentrate, MIL-F-24385?

1. 80
2. 75
3. 15
4. 5

4-31. You must replace or charge the nitrogen cylinder when the pressure falls below what specific psi?

1. 1200
2. 1300
3. 1500
4. 1700

4-32. What amounts of water and AFFF are carried by the P-25 shipboard fire-fighting and rescue vehicle?

1. 650 gallons of water and 45 gallons of AFFF
2. 750 gallons of water and 60 gallons of AFFF
3. 800 gallons of water and 65 gallons of AFFF
4. 850 gallons of water and 75 gallons of AFFF

4-33. The P-25 crew consists of which of the following personnel?

1. Crewman in forward left quarter
2. Driver in forward left quarter
3. Two handline operators on the rear of the vehicle
4. Both 2 and 3 above

4-34. What is the maximum turret flow rate on the P-25?

1. 125 gpm
2. 250 gpm
3. 400 gpm
4. 500 gpm

4-35. What is the maximum handline flow rate on the P-25?

1. 75 gpm
2. 85 gpm
3. 95 gpm
4. 125 gpm

4-36. What is the length of the AFFF handline on the P-25?

1. 50 feet
2. 75 feet
3. 100 feet
4. 125 feet

4-37. How much does a fully loaded P-225?

1. 15,850 lbs
2. 16,850 lbs
3. 17,850 lbs
4. 18,850 lbs

4-38. How many portable firefighting extinguishers does the P-25 carry?

1. 3
2. 4
3. 5
4. 6

4-39. Which of the following statements correctly describes the driver-operated turret?

1. It can be operated with the single line hose reel
2. The turret has an effective range of 65 feet
3. The turret has a 125 gpm rating
4. Each of the above

4-40. The duties and responsibilities of personnel assigned to aircraft fire-fighting and rescue teams are outlined in which of the following manuals?

1. NAVAIR 00-80R-14
2. NAVAIR 00-23-100
3. NAVAIR 19-1-137
4. NAVAIR 51-5-31

4-41. Who exercises direct supervision over the aircraft crash and salvage repair team?

1. The air officer
2. The crash, salvage, and rescue officer
3. The flight deck officer
4. The hangar deck officer

4-42. For ready-use storage, six-percent concentrate AFFF, MIL-F-24385 is mixed with which of the following chemicals or liquids?

1. Fresh water
2. Seawater
3. Both 1 and 2 above
4. Dry-chemical extinguishing agents

4-43. Why is AFFF an effective agent in combating aircraft fires?

1. It smothers fires
2. It is easy to apply
3. To cools the aircraft
4. It will not stick to the aircraft

4-44. Which fire extinguishing agent has the greatest sealing capacity?

1. Light water
2. Protein type foam
3. CO_2
4. Salt water

4-45. What is the main disadvantage in using dry chemical powder for class B flammable liquid fuel fires?

1. It is difficult to apply
2. It cannot be used with foam
3. In some instances the fire may reflash
4. It will not extinguish small fuel fires

4-46. Which of the following is NOT generally considered to be a primary fire-fighting agent when combating large aircraft fuel fires?

1. AFFF
2. Halon 1211
3. PKP
4. Water

4-47. Halon 1211 is a colorless, faintly sweet-smelling, electrically nonconductive gas extinguishing agent used primarily to fight what class(es) of fire?

1. Class B fires only
2. Class B and C fires
3. Class A and D fires
4. Class A fires only

4-48. What is the effective range of the discharge from the dry chemical extinguisher?

1. 5 to 20 feet
2. 10 to 40 feet
3. 15 to 50 feet
4. 20 to 60 feet

ASSIGNMENT 5

5-1. On an LPD, who is responsible for overall direction of aircraft firefighting efforts, weapons cooling, salvage operations, and personnel rescue efforts on the flight deck?

1. The aircraft salvage officer
2. The fire marshall
3. The air officer
4. The damage control officer

5-2. When properly manned for flight operations on an LPD, what minimum number of complete hose teams will the crash, salvage, and rescue team be able to man?

1. One
2. Two
3. Three
4. Four

5-3. Which of the following traits should the scene leader posses?

1. A scene leader should be a trained individual
2. A scene leader must understand the requirements of the emergency
3. A scene leader can get the rest of the crew to respond to direction
4. All of the above

5-4. Where should background assistance be located for a flight deck crash?

1. Upwind of the crash
2. Downwind of the crash
3. Next to the island structure
4. Positioned to view the crash scene

5-5. During an aircraft fire, what group of personnel are required to work in groups of two?

1. Rescue personnel
2. AFFF station operators
3. Medical personnel
4. Messengers

5-6. Where should aviation fuels personnel report to during an aircraft fire on the flight deck?

1. Flight deck control
2. The scene leader
3. The background assistance leader
4. DC central

5-7. An amphibious assault ship's crash forklift should have what maximum capacity?

1. 10,000 lbs.
2. 15,000 lbs.
3. 20,000 lbs.
4. 25,000 lbs.

5-8. What vehicle is used for lifting and removing crashed helicopters from amphibious assault ships flight decks?

1. A/S32A-35A
2. A/S32A-36A
3. A/S32A-37A
4. A/S32A-38A

5-9. How does the Amphibious Assault Ship Crash Crane (AACC) connect to a crashed helicopter?

1. The AACC is connected directly to a crashed helicopter for lifting
2. The AACC uses a manufacturer's hoisting sling for lifting a crashed helicopter
3. The AACC uses fabric-hoisting slings for lifting a crashed helicopter
4. Either number 2 or 3

5-10. Concerning crash cranes, what does the term *slew* refer to?

1. Slow forward movement of the crane
2. Slow reverse movement of the crane
3. Rotation of the boom
4. Lifting/lowering of the boom

5-11. What is the function of outriggers on a crash crane?

1. They provide balance during motion
2. They serve as counterweights while hoisting
3. They increase the lift and carry capacity of the crane
4. They provide a stable base for lifting rated weights at a greater boom reach

5-12. When carrying a load with the AACC, how should the boom be aligned?

1. The boom should be aligned with the fore and aft axis of the load
2. The boom should be aligned with the fore and aft axis of the crane
3. The boom should be perpendicular to the fore and aft axis of the load
4. The boom should be perpendicular to the fore and aft axis of the crane

5-13. What is the maximum gross vehicle (unloaded) weight of the AACC?

1. 80,000
2. 85,000
3. 90,000
4. 95,000

5-14. What is the normal engine operating temperature of the AACC?

1. 134°
2. 144°
3. 154°
4. 164°

5-15. What is AACCs normal engine operating rpm at (a) idle and (b) run setting?

1. (a) 600 (b) 1500
2. (a) 700 (b) 1600
3. (a) 800 (b) 1700
4. (a) 900 (b) 1800

5-16. What is the maximum load rate for the inriggers?

1. 100,000 lbs
2. 105,000 lbs
3. 110,000 lbs
4. 115,000 lbs

5-17. Which of the following AACC functions can be operated from the remote pendant control?

1. Travel control
2. Inrigger control
3. Hoisting control
4. Each of the above

5-18. On the AACC, what function do the luffing controls regulate?

1. Boom up or boom down
2. Slewing
3. Extending and retracting inriggers
4. Braking

5-19. How many pairs of fabric hoisting slings are amphibious crash and salvage units are required to have?

1. Five pairs
2. Two pairs
3. Three pairs
4. Four pairs

5-20. At a minimum, what information is required to be labeled on a fabric hoisting sling?

1. The length of the sling
2. The load capacity of the sling
3. The strike date of the sling
4. Each of the above

5-21. You are approaching a burning aircraft and you are responsible for removing the pyrotechnics. Where may they be stowed?

1. Near the co-pilot
2. Near the crew chief
3. In the "pyro" locker
4. Anywhere on the airplane

5-22. If hoisting slings were manufactured with new arresting gear tape, what is the maximum service of the slings?

1. 3 years
2. 6 years
3. 9 years
4. 12 years

5-23. If hoisting slings were manufactured with used arresting gear tape, what is the maximum service of the slings?

1. 3 years
2. 6 years
3. 9 years
4. 12 years

5-24. Where are the controls for the flight deck fixed fire-extinguishing system located on LPDs equipped with the combination AFFF fire-fighting/ saltwater washdown system?

1. Flight deck control and the navigation bridge
2. The navigation bridge and primary control
3. Primary control and flight deck control
4. All deckedge fire-fighting stations

5-25. When a portable in-line eductor (1-1/2") is rigged for operation, what capacity vari-nozzle should be utilized?

1. 95 gpm
2. 100 gpm
3. 110 gpm
4. 125 gpm

5-26. In order to combat a fire in the hangar bay, which of the following procedures should be followed?

1. Return all aircraft elevators to the flight deck level
2. Close all aircraft elevator doors
3. Leave all hangar deck lights on
4. Each of the above

5-27. During flight operations, crash and salvage crewmen assigned as rescuemen should be assigned to what additional duties?

1. Phone talkers
2. Tractor drivers
3. Firefighters
4. None of the above

5-28. As a scene leader, what information is provided to you via the aircraft handling officer?

1. The type of ordnance carried by the aircraft
2. The designated area for collecting personnel casualties
3. The designated aircraft/bomb elevator to be used for casualty transportation
4. Each of the above

5-29. Who is responsible for energizing the appropriate zones of the fixed AFFF flight deck fire fighting system in order to combat a large scale fire?

1. The air officer
2. The aircraft handling officer
3. The crash and salvage officer
4. The scene leader

5-30. Rescue teams should be trained in which of the following duties?

1. Aircraft entry procedures
2. Engine shutdown procedures
3. Rotor blade folding procedures
4. Both 1 and 2

5-31. During a salvage operation, what officer is responsible for the positioning and/or attaching of salvage equipment?

1. Crash and salvage officer
2. Aircraft handling officer
3. Air officer
4. Squadron aircraft maintenance officer

5-32. What is the maximum safe lifting capacity, in pounds, of the crash forklift normally used for CVs/CVN's?

1. 10,000
2. 15,000
3. 20,000
4. 30,000

5-33. At what distance from the heel of the forks should the center of a load be placed to use a forklift's maximum capacity?

1. 1 ft
2. 2 ft
3. 3 ft
4. 4 ft

5-34. Relative to the fingerboom and lifting operations, the fingerboom can be inserted under which of the following locations?

1. Ordnance pylon stations
2. Jack points
3. Structurally strong aircraft members
4. Each of the above

5-35. CV/CVN crash and salvage units are required to manufacture how many fabric hoisting slings?

1. 10
2. 8
3. 6
4. 4

5-36. What are the required four lengths, in feet, of the bellybands?

1. 20, 30, 40, and 50
2. 20, 30, 35, and 45
3. 20, 40, 50, and 60
4. 40, 50, 60, and 80

5-37. What is the required number of spare 12-inch blades required for each forcible entry gasoline saw?

1. 8
2. 10
3. 12
4. 15

5-38. The method of salvaging an aircraft is dependent on which of the following criteria?

1. Accessibility of hoisting attachment points
2. Approach path and positioning of the crane
3. The safety of personnel and equipment
4. All of the above

5-39. Who is the only person that may authorize the jettisoning of aircraft?

1. The crash boatswain
2. The aircraft handling officer
3. The air officer
4. The commanding officer

5-40. When a water crash (underway) occurs, who orders the launching of the crash boat (lifeboat)?

1. The air officer
2. The officer of the deck
3. The repair 8 officer
4. The air boatswain

5-41. What is the likely outcome of a crash crew that practices cross training?

1. The members of the crew who are the newest will experience increased confusion
2. The crew will be less receptive to change
3. The crew will be protected in the event of unforeseen personnel losses
4. The crew will never reach their maximum potential

5-42. Which of the following prerequisites must a carrier vessel crash crane (CVCC) operator possess?

1. A valid state drivers license
2. An adequate number of OJT hours in phase I and phase II training
3. A current annual physical
4. Each of the above

5-43. Lifting a maximum load, what is the maximum hoisting speed of the CVCC?

1. 10 feet per minute
2. 20 feet per minute
3. 30 feet per minute
4. 40 feet per minute

5-44. A forklift boom adapter should NOT be positioned for a lift at which of the following locations?

1. Flight control surface
2. Ordnance pylon
3. Structurally reinforced bulkhead
4. Jack point

5-45. How many aircraft crash dollies are assigned to crash crews?

1. 6
2. 2
3. 8
4. 4

5-46. What markings identify a screw-pin anchor shackle as being strong enough for use in crash and salvage operations?

1. The shackle should be stamped "Grade A"
2. The shackle should be stamped "Grade B"
3. The shackle should be stamped "H"
4. The shackle should be stamped "HS"

5-47. During a salvage situation when a crash dolly must be used to move an aircraft, what device should be used to secure the dolly to the aircraft?

1. Aircraft handling tiedowns
2. Crash handling tiedowns
3. Three strand manila line
4. Nylon line

5-48. What are the two standard lengths of crash webbing slings?

1. 30 foot and 50 foot
2. 40 foot and 60 foot
3. 50 foot and 70 foot
4. 60 foot and 80 foot

5-49. Before attempting to rescue the occupants of a crashed fighter jet, what must firefighting and rescue teams first establish?

1. The number of personnel on board
2. That ordnance/weapons cooling is in effect
3. That medical personnel are on station
4. That the fire is out

5-50. What is the primary danger associated with the release of oxygen when fighting an aircraft fire?

1. Reduced visibility
2. Asphyxiation
3. Accelerating fire
4. Missile hazard

5-51. What is the working capacity of the crash and salvage rescue platform?

1. 500 lbs.
2. 750 lbs.
3. 1000 lbs.
4. 1150 lbs.

5-52. Before removing the quick disconnect fitting from an aircraft battery, what step must a crash and salvage crewmember accomplish?

1. Verify that there are no explosive gasses trapped in the battery compartment
2. Cool the battery with CO_2
3. Place the battery switch in the cockpit to the off position
4. Both 1 and 2

5-53. What agent should you use to combat an aircraft battery fire?

1. PKP
2. CO_2
3. Halon 1211
4. Both 2 and 3

5-54. When deciding to use fabric slings or manufacturers slings to hoist a disabled aircraft, what is the primary factor?

1. The time available to accomplish the lift
2. The pitch attitude angle of the aircraft
3. The roll attitude angle of the aircraft
4. Both 2 and 3

5-55. As a rescuman performing a rescue, what task should you accomplish first?

1. Turn the master oxygen switch off
2. Remove the pilot's facemask
3. Safety the ejection seats
4. Turn off the engines

5-56. What source of reference provides crash crewmembers with the location and means of opening accesses for specific aircraft?

1. Crash crew information diagrams (CCIDs)
2. Crash crew information sheets (CCIFs)
3. Crash crew technical diagrams (CCTD's)
4. All of the above

5-57. What publication do crash and salvage crewmen use to obtain general knowledge about ejection seat familiarization?

1. NAVAIR 00-80R-14-1
2. NAVAIR 00-80R-19
3. NAVAIR 00-80R-20
4 All the above

5-58. What publication do crash and salvage crewmen use to determine the acceptable pitch and roll attitude of a particular aircraft?

1. NAVAIR 00-80R-14-1
2. NAVAIR 00-80R-19
3. NAVAIR 00-80R-20
4 Either 2 or 3

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ASSIGNMENT 6

6-1. Crash crewmen at a naval air station have which of the following responsibilities relative to an aircraft crash?

1. Instantly evaluate the situation
2. Rescue the crew and passengers and save the aircraft
3. Extinguish the fire that might result
4. All of the above

6-2. Who is responsible for the technical administration of the crash fire crew at a naval air station?

1. The crash captain
2. The senior fire marshal
3. The civilian fire chief
4. The damage control officer

6-3. What person is individually responsible for the safety of the crew and equipment aboard the fire-fighting truck at all times?

1. The safety monitor
2. The driver-operator
3. The crash captain
4. The crash fire chief

6-4. What kind of communication systems are normally used for the (a) primary and (b) secondary alarms?

1. (a) Regular telephone switchboard
   (b) Radio
2. (a) Direct wire
   (b) Secondary regular telephone switchboard
3. (a) Radio
   (b) Direct wire
4. (a) Radio
   (b) Radio

6-5. A daily journal shall be maintained by each aircraft fire-fighting and rescue organization. After the journal is completed, it should be maintained for a minimum of how many years?

1. 1
2. 2
3. 3
4. 4

6-6. Uniform alphanumeric grid systems superimposed on aerial photographs or local base area maps are maintained by each fire department. How many of these locator grid maps are required for each fire department?

1. One
2. Two
3. Three
4. Four

6-7. To maintain constant communication with the home station control tower, what primary communication system is used at an outlying air field?

1. Ground-to-air radio transceivers
2. Telephone
3. VHF FM radio transceivers
4. Messengers

6-8. When fixed-wing flight operations are being conducted, a condition of readiness must be maintained by which of the following organizations?

1. Immediate-response alert
2. Standby alert
3. Backup standby alert
4. All of the above

6-9. What is the discharge rate of the bumper turret on the T-3000 Oshkosh fire-fighting vehicle?

1. 250 gpm
2. 300 gpm
3. 400 gpm
4. 600 gpm

6-10. The T-3000 Oshkosh has a capacity for how many gallons of (a) water and (b) AFFF concentrate?

1. (a) 800 (b) 250
2. (a) 1,000 (b) 350
3. (a) 1,500 (b) 375
4. (a) 3,000 (b) 420

6-11. The handline is provided with a soft hose consisting of (a) how many feet and (b) what diameter?

1. (a) 150 (b) 1 1/4 in.
2. (a) 100 (b) 1 3/4 in.
3. (a) 150 (b) 2 in.
4. (a) 150 (b) 2 1/2 in.

IN ANSWERING QUESTIONS 6-12 THROUGH 6-15, SELECT FROM COLUMN B THE EQUIPMENT THAT MATCHES THE DESCRIPTION IN COLUMN A.

	A. DESCRIPTION	B. EQUIPMENT
6-12.	Has a discharge capacity of 75-100 gpm	1. Roof turret
6-13.	Powered rewind	2. Air motor
6-14.	Can deplete its total self-contained capacity in 1 1/2 min	3. Handline
		4. Roof turret and bumper turret
6-15.	Has a rated capacity of 750 gpm	

6-16. What is the maximum discharge flow rate from the handline on a P-15 fire-fighting vehicle?

1. 100 gpm
2. 200 gpm
3. 300 gpm
4. 400 gpm

6-17. In addition to AFFF, the CF 4000L is equipped to fight a fire with which of the following agents?

1. CO_2
2. Water
3. Halon 1211
4. Both 2 and 3 above

6-18. How does the TAU fire extinguisher affect a fire?

1. The light water and PKP combine to act as an extinguishing agent
2. The light water and PKP combine and act as a vapor-securing agent
3 The PKP acts as an extinguishing agent and the light water acts as a vapor-securing agent
4. The PKP acts as a vapor-securing agent and the light water acts as an extinguishing agent

6-19. Concerning the CF 4000L fire-fighting vehicle, what is the effective range, in feet, of the (a) roof turret and (b) bumper turret?

1. (a) 125 (b) 100
2. (a) 135 (b) 110
3. (a) 175 (b) 150
4. (a) 200 (b) 185

6-20. Concerning the CF 4000L fire-fighting vehicle, what are the (a) water and (b) tank capacities in gallons?

1. (a) 400 (b) 130
2. (a) 200 (b) 400
3. (a) 1,000 (b) 100
4. (a) 1,050 (b) 156

6-21. What is the discharge flow rate of AFFF or water from the roof turret on a CF 4000L fire-fighting vehicle?

1. 350 gpm
2. 450 gpm
3. 500 gpm
4. 550 gpm

6-22. Worn or defective tires on all major ARFF equipment shall NOT be replaced with recaps or retreads.

1. True
2. False

6-23. The assignment as driver/operator of major emergency aircraft fire-fighting and rescue equipment should be a made for what length of time?

1. 12 mo
2. 18 mo
3. 24 mo
4. 36 mo

6-24. What official document governs the licensing of drivers/operators of major emergency aircraft fire-fighting and rescue equipment?

1. NAVFAC P-300
2. NAVPERS 10624-A
3. BUMED Record (DD Form 722)
4. NAVEDTRA 10305-C

6-25. Which of the following aircraft hardware will likely cause difficulty by melting during a fire?

1. Steel brackets
2. Magnesium hinges
3. Aluminum alloy latches
4. Titanium alloy landing gear struts

6-26. What is the probable effect of prolonged exposure to high temperatures on magnesium aircraft structures?

1. Intense burning
2. Fracturing
3. Slow burning
4. Melting

6-27. What symbol is used on aircraft plumbing that carries coolant?

1. Circle
2. Crescent
3. Horizontal S
4. Staggered triangles

6-28. What component is identified by a rectangular symbol on aircraft plumbing?

1. Compressed gas
2. Breathing oxygen
3. Hydraulic fluid
4. Electrical wires

6-29. What surface(s) of a partially filled wing fuel tank will most likely rupture if the tank explodes during a fire?

1. Top
2. Bottom
3. Fore and aft
4. Inboard and outboard

6-30. Which of the following liquids does NOT contribute significantly to the fire hazard in aircraft crashes?

1. JP-4
2. JP-5
3. Hydraulic fluid
4. AvGas

6-31. Which of the following identifications are used extensively in all aircraft to reduce the hazard to persons working on different systems?

1. Color bands to indicate the contents of different systems
2. Longer runs for dangerous materials
3. Larger label plates for dangerous systems
4. Different sizes of piping for different systems

6-32. What is the symbol for rocket fuel?

1. Green/gray crescent upside down
2. Red/gray crescent with a four-pointed star inside
3. Orange/blue continuous X-form lattice
4. Yellow/green vertical stripes

6-33. What is the color of the fuel symbol used for JP-5?

1. Red
2. Orange
3. Black
4. Green

6-34. What system is identified by a continuous zigzag line, orange and gray in color?

1. Coolant
2. Solvent
3. Air instruments
4. Air conditioning

6-35. You are preparing to cut a line on an F-14 and there is a symbol with a large "T". What is contained in that line?

1. Hydraulics
2. Water injection
3. Deicing
4. Mono-propellant

6-36. The newest and more sophisticated aircraft are built with a substantial "firewall" to provide for the desired segregation.

1. True
2. False

6-37. Regarding aircraft crashes, which of the following areas are weakest, and therefore most dangerous?

1. Fuel tanks
2. Fuel lines
3. Hydraulic lines
4. Oxygen cylinders

6-38. Why is the hydraulic fluid system of such great importance to the crash crew?

1. The lines may rupture
2. The brakes could release
3. The high pressure contained in some may harm crewmembers when cut
4. All of the above

6-39. Liquid oxygen is extremely dangerous because it boils into gaseous oxygen at how many degrees (a) Fahrenheit and (b) Celsius?

1. (a) 187 (b) 43
2. (a) 192 (b) 87
3. (a) 246 (b) 113
4. (a) -297 (b) -147

6-40. When an aircraft crashes, what is the chief hazard of its electrical system?

1. The interphone system may not operate
2. The hydraulic pumps may not operate
3. It may short circuit and causes an arc
4. The radio may not operate

6-41. What information is provided in "Fast Cook-Off" Characteristics of Air Launch in Service Weapons, TP-75-22?

1. A single source reference for fast cook-off and a summary of the current available data for in-service air-launched weapons
2. An entire catalog for all military air-launched weapons and a method of rapid egress from the area of danger
3. The amount of time required repairing and installing new components to safety the weapon
4. Both 2 and 3 above

6-42. Who should provide you with the most information about the hazards of armament carried by the aircraft at your particular station?

1. The ordnance handling officer
2. The operations officer
3. The safety officer
4. Instructors in the training program for the crash crew

6-43. Rockets are extremely dangerous when they are in which of the following situations?

1. Still on their launchers
2. Being downloaded
3. Being assembled
4. On moving and carrying dollies

6-44. What is a health hazard to personnel exposed to hypergolic mixtures?

1. Chemical burns
2. Poisoning
3. Frostbite
4. Each of the above

6-45. You are approaching a burning aircraft and you are responsible for removing the pyrotechnics. Where may they be stowed?

1. Near the co-pilot
2. Near the crew chief
3. In the "pyro" locker
4. Anywhere on the airplane

- IN ANSWERING QUESTIONS 6-46 AND 6-47, ASSUME THAT A PURSUIT JET AIRCRAFT CRASHES WITH THE WING ROCKETS STILL ATTACHED. THE PORT WING FUEL TANK BURSTS AND THERE IS AN INTENSE FIRE AROUND THE ROCKETS ON THE PORT SIDE. THE FIRE BLAZES FOR 2 MINUTES BEFORE THE CRASH TRUCK ARRIVES AT THE SCENE. THE FIRST ACTION OF THE CRASH CREW IS TO REMOVE THE PILOT BY WAY OF THE STARBOARD SIDE OF THE AIRCRAFT.

6-46. The rockets will probably fire unless they are cooled within a maximum period of how many minutes after they are exposed to the fire?

1. 1
2. 5
3. 6
4. 7

6-47. Which agent should be used to cool the rockets?

1. CO_2
2. AFFF
3. Water spray
4. Dry chemicals