

CHAPTER 11

AMMUNITION STORAGE AND HANDLING AFLOAT

The ammunition used by the U.S. Navy must be maintained in a state of readiness at all times. Improper, rough, or careless handling, storage, and shipping can result in malfunctioning ammunition and material damage or loss of life.

ORDNANCE CERTIFICATION

LEARNING OBJECTIVE: *Identify the purpose and use of the Explosives Handling Personnel Qualification and Certification Program, OPNAVINST 8023.2.*

The Explosives Handling Personnel Qualification and Certification Program (Qual/Cert) was established by the Chief of Naval Operations as a result of the catastrophic MK-24 parachute flare accident on USS ORISKANY in 1966 that led to significant loss of life and major ship damage. The Flag Board of Inquiry concluded the accident was attributed to a lack of training, direct supervision, and a method to determine personnel qualifications prior to being authorized to handle explosives. Qual/Cert, with proper oversight and management, can prevent similar accidents.

Although Qual/Cert has been in effect for over 30 years, improper handling, loading, processing or testing of explosive devices continues to result in death, injury and extensive high dollar damage to equipment. Research has shown personnel error due to inadequate training, lack of adequate supervision, lack of or inadequate Standard Operating Procedures (SOP), or just plain failure to follow the governing technical directives causes the majority of explosive mishaps.

Qual/Cert is intended to be the cornerstone for a ZERO DEFECT SAFETY PROGRAM. The Explosives Handling Personnel Qualification and Certification Program is governed by OPNAVINST 8023.2.

DEFINITIONS

Before you read about ordnance certification, you need to know the terminology that will be used in this

discussion. The following definitions will help when working with the Qual/Cert program and completing the Ordnance Certification Format (fig. 11-1).

Storage/Stowage. Physical act of stowing explosive/explosive devices in designated and approved magazines and ready service lockers. Demonstrated knowledge of afloat/ashore storage/stowage requirements per applicable instructions/directives.

Handling. Physical act of transporting or moving explosives/explosive devices afloat or ashore, with powered equipment, with nonpowered equipment, or manually.

Assembly/Disassembly. Physical act of mating/demating component to/from an All Up Round (AUR) configuration. This work task code is used when assembly/disassembly is authorized in applicable Weapons Assembly Manuals (WAM).

Load/Download. Physical act of mating an AUR with the bomb rack/launcher from which delivery/initiation is authorized. Includes all operations incidental to aircraft loading/downloading included in those portions of the NAVAIR Conventional Weapons Loading Checklists, shipboard loading/downloading of CIWS, and NATO Sea Sparrow systems as listed in applicable MRC's. Includes functions such as the installation of mechanical bomb fuzes, arming wires, electrical/mechanical connections, installing bands on LUU-2 flares, MK-58 MLM's and rack/launcher cartridges.

Arm/De-Arm. Applies to those procedures contained in the arm/ dearm section of the applicable NAVAIR loading manuals/checklist and NAVSEA MRC's which places an explosive/explosive device or system in an armed or safe condition. This does not include the installation of CADS/PADS in seats to place them in an armed condition. Arm/dearm as it pertains to Aircraft Egress Systems is covered in install/remove.

ORDNANCE CERTIFICATION FORMAT (REVISED 01-00)			SAMPLE ONE		
CERTIFICATION LEVELS			WORK TASK CODES		
TM-TEAM MEMBER I -INDIVIDUAL TL-TEAM LEADER QA-QUALITY ASSURANCE SO-SAFETY OBSERVER			1. STOWAGE/STORAGE 2. HANDLING 3. ASSEMBLY/DISASSEMBLY 4. LOAD/DOWNLOAD 5. ARM/DEARM 6. INSTALL/REMOVE		
EXPLOSIVE/ EXPLOSIVE DEVICE	CERT LEVEL /WORK TASK	INDIVIDUAL	BOARD MEMBER	BOARD CHAIRMAN	VALIDATION DATE
Bombs	TL 1 2 3				
PGM	QA/SO 1 2 3				
Cluster Bombs	TL 1 2				
Mines	QA/SO 1 2 3		INITIAL		
Practice Bombs	QA 1 2 3				
Expendable Countermeasures	TL 1 2 3				
Pyrotechnics	QA 1 2				
Grenades	QA 1 2				
Rockets	QA 1 2 3				
Containerized Explosives	QA/SO 1 2				
CERTIFICATIONS ABOVE HAVE BEEN REVIEWED AND RECERTIFIED PER SIGNATURES AND DATES INDICATED BELOW, EFFECTIVE FOR 1 YEAR. NOTE: ITEMS NOT REQUIRED FOR RECERTIFICATION SHALL BE LINED OUT, INITIALED AND DATED BY THE BOARD CHAIRMAN.					
INDIVIDUAL BEING RECERTIFIED SIGNATURE		BOARD MEMBER SIGNATURE		BOARD CHAIRMAN SIGNATURE	
NAME: ORDIE, BYRAN			RANK/RATE: AO1		
COMMAND: USS IWANASAIL (CVN-91)					

AOH101

Figure 11-1.—Ordnance Certification Format.

Install/Remove. Physical act of installing/removing all items listed in the family group Aircraft Egress Systems and aircraft cable cutters, aircraft fire extinguisher cartridges and non aircraft support cartridges/cartridge actuated devices.

Testing. Physical act of conducting a test on components. Built-in-Test (BIT), programming, reprogramming, and presetting are including in this work task code.

Explosive/Explosive Device. Applicable explosive/explosive device for which the person is being certified. May be listed by family group or specific device.

Individual Signature. Signature of person being certified. Signing acknowledges certification level and work task code for the explosive/ explosive device/family. Therefore, a signature is required for each line entry. Collective signatures are not authorized.

Certification Board Member Signature. Signature of the certification Board Member who either actually observed or verified that another board member observed the individual being certified performing the task under consideration. A signature is required for each line entry. Collective signatures are not authorized.

Board Chairman Signature. Signature of the CO/OIC, cognizant department head, Ordnance Handling Officer (0110), Carrier Air Group (CAG) Gunner or Naval Airborne Weapons Maintenance Unit One (NAWMU-1) Executive Officer (designator 636X) designated to act as Board Chairman. Signature and date may be collective, if desired.

Validation date. Date certification is effective. Date may be collective. Date will be in day/month/year format.

Recertification. After review of OJT, lectures, other documented training, and physical exams, recertification may be accomplished using the space provided. Once the individual, the board member, and the board chairman sign and date the form, recertification shall be valid for 1 year (365 days). Line items not requiring recertification shall be deleted by making a single line through the entire line entry. The

Board Chairman shall initial and date the deletion on the right hand border.

Corrections. Corrections shall be made with a single line through the entire line entry. The board chairman shall initial the deletion line in the right hand border of each line deleted. At this point, initiate an entire new corrected line.

Decertification. The Qual/Cert form requires a diagonal line made in red ink, and signed and dated by the individual and the Board Chairman, for revocation of certification for cause.

Delays. Newly assigned personnel should be certified within three months (90 days) of the demonstrated proficiency dates.

Family Groups. Family Groups are explosives/explosive devices with similar characteristics.

Certification Levels. Only list the highest certification level applicable (i.e. QA entry automatically covers TL, I, TM; TL entry covers I, TM; I entry covers TM).

EXPLOSIVES HANDLING PERSONNEL QUALIFICATION AND CERTIFICATION PROGRAM

The Explosives Handling Personnel Qualification and Certification Program sets guidelines for weapons certification. **This program is independent from all other maintenance programs.** The Explosives Handling Personnel Qualification and Certification Program is applicable to **all personnel** (both military and civilian, including contractors) in the Naval Establishment whose duties require evolutions or tasks involving explosive devices.

NOTE: All explosives, ammunition, weapon, and devices using conventional explosives, pyrotechnics, or incendiary material for their operation are included in the general term *explosive devices*.

All operators of power-operated handling equipment, such as hoists, winching cranes, or forklifts, that are used in handling explosive devices must be certified and licensed to handle the particular piece of equipment.

Personnel Who Require Individual Certification

If a person's duties (including explosive ordnance disposal [EOD] personnel involved in non-EOD duties) require him/her to individually inspect (including the duty of safety observer), prepare, adjust, arm, or dearm explosive devices, he/she must be qualified and certified for such tasks. Personnel who conduct magazine inspections, maintenance on aircraft safety and survival equipment, or perform any other function that involves explosive devices must be included in this program. The supervisor of explosive operations and members of the command-appointed certification board (except the chairman) must be individually certified for the evolution that they may supervise or observe.

Personnel Who Require Team Qualification and Certification

A person must be team certified and qualified or individually qualified to perform any of the following duties as a team member: packing, unpacking, assembling/disassembling, testing, fuzing, loading/downloading, or arming/dearming. When team operations are involved, the team leader must be designated and must be certified and qualified. Any change in team personnel must be kept to a minimum. Shipboard gun, missile crews, and air wing integrated arm/dearm crews are considered teams for the purpose of qualification and certification. Requalification or recertification of a team after any personnel change is at the discretion of the commanding officer. At times, contractor personnel perform functions within the scope of the Explosives Handling Personnel Qualification and Certification Program at naval activities. The contractor must provide the commanding officer or officer in charge with the documentation to prove that personnel are qualified and certified before performing any duties that come under the program. All contracts that deal with explosives and explosive operations come under the purview of OPNAVINST 8023.2.

Initial Board Member Certification

One major problem of the initial certification of personnel is to ensure that persons who perform qualification evaluations are themselves qualified. Occasionally, it is necessary to initially certify personnel to perform a particular explosive-related job if no certification board is currently established.

Commanders should ensure the intent of this program when they select certification board qualifying observers.

The department head (or equivalent supervisor) reviews personnel for initial certification by screening school records, previous certification, demonstrated ability, and a personal interview. Then he/she makes a recommendation to the commanding officer or officer in charge as to whether a person should or should not be certified. Certification is made at the discretion of the commanding officer or officer in charge. When sufficient personnel have been qualified, a minimum qualification, a certification board is established.

NOTE: The *Explosives Handling Personnel Qualification and Certification Program*, OPNAVINST 8023.2, is not applicable to the following personnel:

- Personnel, such as a security force, who are required to bear arms in the course of their duties.
- Aircrew personnel whose only contact with explosive devices is during logistic transport by aircraft.
- Lookouts, bridge watches, and man-overboard watches required to handle and launch man-overboard markers in emergency situations.
- Document destruction personnel and aircraft wheel watches should handle explosives only during emergencies.
- Personnel whose sole contact with explosive devices occurs when assigned to a working party for the purpose of replenishment, onloading, or offloading.
- Personnel, who conduct tests or inspections of magazine sprinkler systems, provided they have been qualified and certified by other means.

The personnel mentioned above must, however, be carefully instructed in the operation and in the safety precautions applicable to a particular device or explosive material.

Revocation of Certification

The commanding officer or officer in charge is responsible for revoking certification whenever such action is necessary in the interest of safety.

If culpability (responsibility) can be determined during a mishap investigation, a statement on the revocation of individual/team certification must be included in the mishap report.

If an explosive mishap is caused by a person's failure to follow authorized procedures, **revocation of certification is mandatory, and a page 13 entry is required.** If a person flagrantly (openly) disregards safety precautions, operates explosive device handling equipment recklessly, or shows incompetence or unreliability, **revocation of certification for cause is mandatory, and requires a page 13 entry.**

When the commanding officer or officer in charge considers retraining, recertification, and requalifying an appropriate action, the person may be retrained, recertified, and requalified. If, however, the person's behavior indicates that retraining will be ineffective, he/she is assigned to tasks that do not involve explosive devices.

For military personnel, revocation of certification for cause requires a service record entry stating the specific reason(s). For civilian personnel, a letter revoking certification for cause is prepared and filed in his/her civilian personnel record. Revocation of certification means complete removal of an individual from the qualification/certification program. **Onetime decertification for the above infractions is not authorized. There are NO exceptions!**

PROGRAM INITIATION

Commanding officers or officers in charge initiate, monitor, and maintain the Explosives Handling Personnel Qualification and Certification Program.

Personnel

Personnel within the program should be sent to formal schools, if possible, and personnel qualification standards are required, where applicable. However, school attendance and personnel qualification standards do not necessarily qualify an individual for certification.

Certification board members are appointed by name and in writing by the commanding officer/officer in charge. The authority may not be delegated.

Certification must be documented by using the format shown in figure 11-1. The board chairman maintains the original. A copy is placed in the individual's training records. When the individual is transferred, the original (maintained by the board chairman) is placed on the left side of the individual's service record.

Certification of military personnel is transferable at the discretion of the receiving command. Receiving commands should validate the certification by placing the board chairman's signature in the recertification block. Certification, unless revoked, is valid for a period of 1 year.

Aviation Ordnance Family Types

Training record documentation is by specific explosive device and task. This training will be documented by using an Ordnance Certification Training Format (fig. 11-2). This documentation must support the level of certification listed on the individual's or teams' certification form and must reflect all the individual's or teams' training.

NOTE: Supplemental instruction of the Explosives Handling Personnel Qualification and Certification Program by subordinate commands is neither required nor desired.

CERTIFICATION BOARD

The commanding officer or officer in charge of each organization whose duties include handling explosive devices appoints (in writing) an explosives handling personnel qualification and certification board. The following personnel are the minimum personnel included on the board:

- A department head, designated as the board chairman
- No less than one individual, E-6 or above/civilian supervisor, who is certified to perform the function or tasks under consideration

If seniority requirements cannot be met from within the command, a waiver of personal seniority for the board may be requested from the TYCOM, via the chain of command.

ORDNANCE CERTIFICATION TRAINING FORMAT (NEW 01-00)				SAMPLE TWO	
CERTIFICATION LEVELS			WORK TASK CODES		
TM-TEAM MEMBER I -INDIVIDUAL TL-TEAM LEADER QA-QUALITY ASSURANCE SO-SAFETY OBSERVER			1. STOWAGE/STORAGE 2. HANDLING 3. ASSEMBLY/DISASSEMBLY 4. LOAD/DOWNLOAD 5. ARM/DEARM 6. INSTALL/REMOVE		
Explosive/ Explosive Device	Cert Level	Work Task	Instructor/ Observer	Date	Remarks/ Lecture/ Inert
MK-82/FMU-139/M904 BSU-86/E-148E1	TL	1 2 3	A01 JONES	10 MAY 90	
	TL	1 2 3	A01 JONES	22 JUN 90	
	QA/SO/IT	1 2 3	A01 JONES	10 JUL 90	
MK-83/ FMU-139/M904 BSU-85/E-148E1			AOC SMITH	15 JUL 90	LECTURE
	TL	1 2 3	A01 JONES	11 MAY 90	
	TL	1 2 3	A01 JONES	22 JUN 90	
	QA/SO/IT	1 2 3	A01 JONES	10 JUL 90	
MK-84/FMU-139/M904 Con Fin/E-148E1			AOC SMITH	15 JUL 90	
	TL	1 2 3	A01 JONES	10 MAY 90	
	TL	1 2 3	A01 JONES	17 MAY 90	
	QA/SO	1 2 3	A01 JONES	30 JUL 90	LECTURE
BDU-45/MK-89/ CXU-3/BSU-86			AOC SMITH	01 AUG 90	LECTURE
	TL	1 2 3	A01 JONES	21 JUN 90	
	TL	1 2 3	A01 JONES	21 JUN 90	
	QA/SO	1 2 3	A01 JONES	30 JUL 90	
BDU-45/MK-4/MK-89/ BSU-33			A01 JONES	01 AUG 90	LECTURE
	TL	1 2 3	A01 JONES	15 MAY 90	
	TL	1 2 3	A01 JONES	22 JUN 90	
	QA/SO	1 2 3	AOC SMITH	30 JUL 90	
BDU-45/BSU-86/ MK-89/CXU-3			A01 JONES	01 JUN 90	
	TL	1 2 3	A01 JONES	01 JUN 90	
	QA/SO/IT	1 2 3	A01 JONES	22 JUN 90	
	QA/SO	1 2 3	AOC SMITH	23 JUN 90	
			A01 JONES	03 AUG 90	LECTURE
NAME: SAILOR, THERMON			RANK/RATE : A01		
COMMAND: USS NEVERSAIL (CVN-90)					

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Figure 11-2.—Ordnance Certification Training Format.

The board chairman is not required to be certified. However, the board chairman certifies other board members. Because of the number of tasks and the number of explosives devices found in some commands, board augmentation with personnel from other commands is authorized and, in some instances, desirable.

CERTIFICATION BOARD RESPONSIBILITIES

Some of the responsibilities of the certification board are discussed below.

- The objective of the board is to ensure that applicable personnel are certified to perform those explosive devices work tasks required for accomplishment of the command mission.
- The board coordinates the unit personnel certification program. It ensures that administrative procedures are established to ensure the establishment and effectiveness of the program.
- The board observes and evaluates the proficiency of the personnel being nominated for certification and makes recommendations concerning certification nomination to the board chairman. If a person nominated for certification requires additional training and/or experience before certification can be made, that person's division officer or supervisor be notified.
- The board reviews proposed formal courses of instruction and makes appropriate recommendations.
- The board reviews safety infractions concerning explosive devices. It makes recommendations to unit commanders concerning corrective actions. If an explosive incident or accident is caused by a person's failure to use or to adhere to the authorized procedures, the person's certification is revoked. **IN SUCH A CASE, REVOCATION OF CERTIFICATION IS MANDATORY!**

If a person exhibits a flagrant disregard of safety precautions, a reckless operation of explosive devices handling equipment, or unreliability, that person's certification **must** be removed.

The certification levels and minimum qualifications are given in OPNAVINST 8023.2.

AMMUNITION STOWAGE

LEARNING OBJECTIVE: *Describe the types of ammunition stowage afloat. Identify the types of stowage spaces afloat to include types of magazines, magazine designations, ammunition stowage requirements, environmental control systems, sprinkler systems and auxiliary equipment, and magazine temperature requirements.*

Stowing ammunition aboard ship presents problems you won't find in other types of storage facilities. When ships are underway, they are subjected to random motion. Ammunition is fastened in place firmly and securely when it isn't being handled. Adequate ventilation is a problem. Most ammunition stowage spaces are located below the main deck. Normally, these areas require extensive piping and venting to maintain proper temperature control and to vent hazardous fumes.

Access to stowage spaces often requires specialized equipment for moving ammunition quickly and efficiently. Stowage spaces are located close to other working spaces, which presents hazards to others on the ship, especially if there were a fire or explosion.

AMMUNITION STOWAGE SPACES

NAVSEASYSKOM develops and approves the detailed specifications for construction of Navy ships and individual ship's blueprints. Ammunition stowage spaces (magazines) for various types and classes of ships are designated in these specifications. Aircraft or aircraft carriers' ammunition stowage magazines are also approved by NAVAIRSYSKOM.

Magazines are arranged so they are close to supply, have the best available protection, and the most favorable stowage conditions. Figure 11-3 shows the magazine locations of a typical CV/CVN (aircraft carrier). For safety reasons, various types of explosives and ammunition are stowed in separate magazines or lockers.

The type of stowage varies with the type of ship, the space available and the amounts of explosive involved. Label plates that designate the compartment and the types of ammunition stowed in them mark all magazines. Magazines are marked with warnings that apply to specific special hazardous conditions and operations. Additionally, paint-stenciled labels or painted signs are installed on the outside surfaces of ammunition stowage spaces (except where the outside

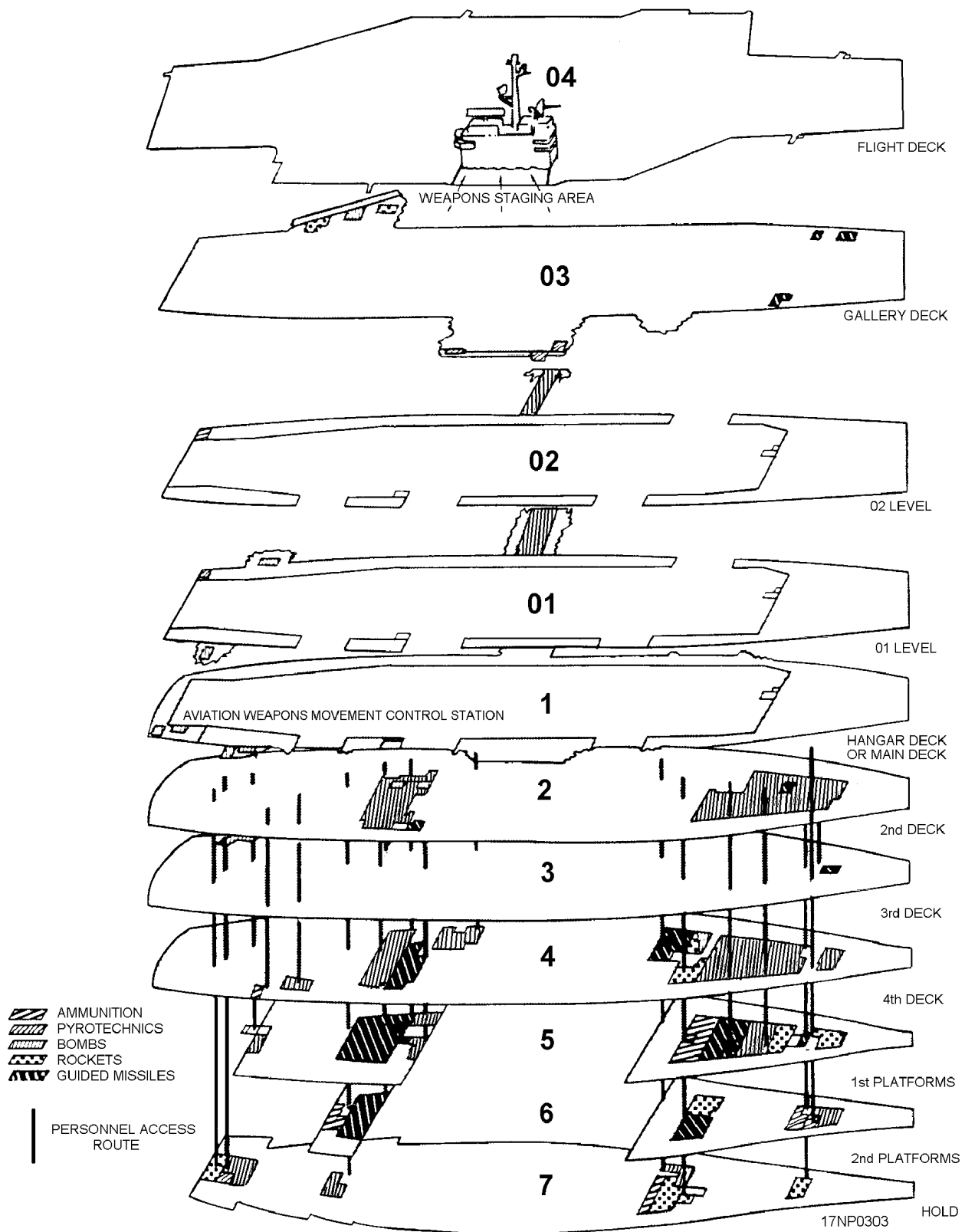


Figure 11-3.—Typical CV magazine locations.



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Figure 11-4.—Example of AMMUNITION FAR SIDE sign or label.

surfaces are visible from the exterior of the ship). The stenciled markings must be located on the bulkheads, overheads, and decks 12 feet apart. The sign or label (fig. 11-4) is a yellow rectangle, 5 inches high by 9 inches wide. The sign has black slanted lines; 1/8-inch thick and 1 inch long, on 3/4-inch centers along the top and bottom edges, with lines slanting from top right to bottom left. The letters are 1/8-inch thick and 3/4-inch high, with the words AMMUNITION FAR SIDE arranged as shown in figure 11-4. Primary and missile magazines aboard CVs are designed to hold a ship's service allowance and the embarked air wing's service allowance of ammunition.

Ships have several different types of magazines. Each magazine is designed for a specific type of ammunition. The magazine types include primary, missile, ready-service, lockers, and chemical.

Primary Magazines

Primary magazines are stowage spaces that are usually located below deck and, if possible, below the waterline. They are adequately equipped with thermal insulation, temperature control, and ventilation. Primary magazines are equipped with adequate sprinkler systems, and they are closed and locked when unattended.

Missile Magazines

Because of the nature of guided missiles, requirements for their stowage aboard ship differ from those of conventional ammunition. Air-launched missile magazines in aircraft carriers are usually located below the waterline and within the armor box. Air-launched missile ready-service magazines may be located either above the waterline or within the armor box. Missile magazines contain electrical, hydraulic, and pneumatic power-operated handling equipment. A restraining gear prevents movement of an accidentally ignited motor. You must take special care of the ventilation system of missile magazines to ensure pressures don't build up to a dangerous level if a missile motor is ignited.

Ready-Service Magazines

Ready-service magazines (fig. 11-5) are designated spaces located near the weapon or area to be served.

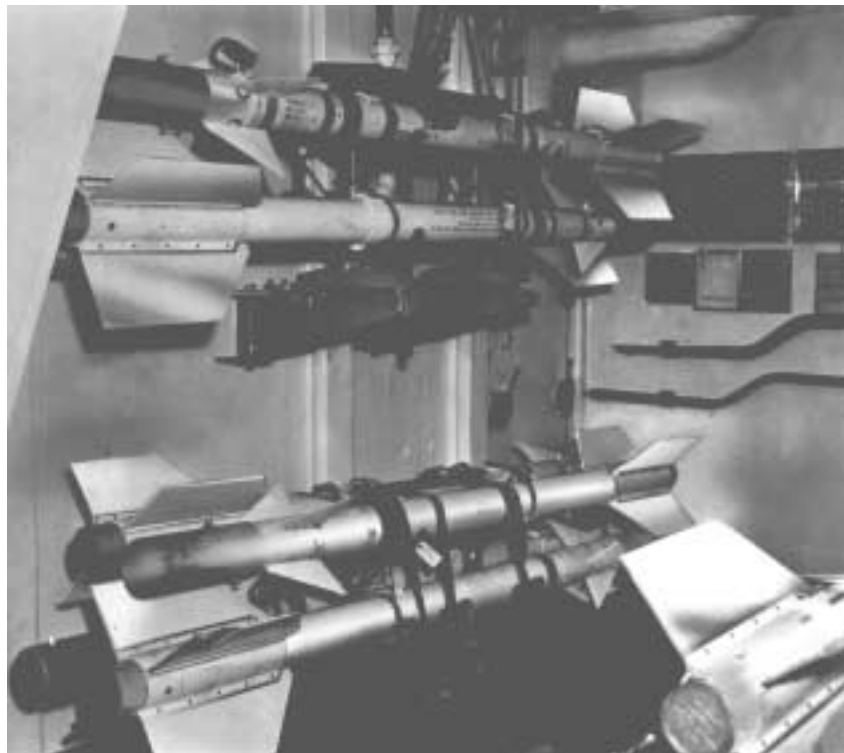


Figure 11-5.—Typical missile ready-service magazine.

Normally, they are equipped with thermal insulation, ventilation, and a sprinkling system. They are securely locked. Certain magazines located within the armor box of aircraft carriers and used for stowage of completely assembled rounds of weapons and deployable targets are also ready-service magazines.

Lockers

Certain compartments or lockers are used to stow special types of ammunition and ammunition components, such as detonators, pyrotechnics, and chemicals. They are frequently located on the weather deck. They are located as conveniently to the weapon or space to be served as possible. They may not be equipped with sprinklers, but they do have locking devices. Special flare ready-service lockers are located at outboard locations on aircraft carriers for short-term stowage of aircraft parachute flares. These flares have either been removed from the primary pyrotechnics magazines or prepared for launching or they have been returned intact after a mission. If necessary, these lockers are manually jettisoned. A label is installed on the locker identifying the type of explosives that are stowed within each locker. Where stowage for ammunition is provided by lockers, chests, or racks that are permanently secured to the ship's structure, don't change their location without prior approval of NAVSEASYSCOM.

Chemical Magazines

Chemical ammunition classified as lethal or incapacitating isn't carried aboard ships unless specifically authorized by NAVSEASYSCOM or higher authority. If authorized, specific stowage instructions are issued by NAVSEASYSCOM, and personnel involved in handling procedures must receive appropriate training. Specific spaces aboard ship may be designated as chemical magazines by NAVSEASYSCOM. The decks and bulkheads of a chemical magazine are coated with an impermeable material, and the magazine contains a provision for sampling its internal atmosphere from an adjacent compartment. Facilities for personnel and gross decontamination are located near the magazine.

IMPROVED REARMING RATE PROGRAM

Modern naval aircraft carriers incorporate a magazine stowage concept called "modular stowage." The modular stowage concept gives greater versatility in magazine stowage arrangement and minimizes

ammunition handling. It makes it easier to stow ammunition, such as bombs and missiles, as fleet issue loads. Also, it isn't necessary to depalletize or decan loads before they are stowed. The incorporation of modular stowage and the addition of larger weapons elevators to service these areas brought about the Improved Rearming Rate Program (IRRP).

The IRRP allows major handling time improvements in two areas—rearming and weapons assembly. Stowing ammunition as received on pallets lets handling crews rearm the ship's mission load in less time than the old system. In turn, handling time is minimized during weapons assembly.

DESIGNATION OF MAGAZINES

Magazines or ammunition spaces afloat are designated with particular reference to the purpose intended. Generally, magazines aboard ship are designated to hold a single type of ammunition.

Single-Purpose Magazine

Magazines are designated as single-purpose stowage magazines whenever practical. The following are single-purpose magazine designations: powder and rocket motor magazine; hypergolic rocket motor magazine; fixed ammunition magazine; small arms magazine; missile magazine; warhead locker or magazine; aircraft bomb magazine; projectile and rocket head magazine; fuze magazine; detonator locker; pyrotechnic magazine or locker; ready-service ammunition room, box, rack, or locker; and chemical magazine.

Multipurpose Magazine

While stowage of a single type of ammunition in an individual magazine is desirable, it isn't always possible. NAVSEASYSCOM authorizes certain mixed stowage in magazines that retain a single-purpose designation. Where stowage space is limited and the mission requires carrying various types of ammunition, stowage of more than one type of ammunition in a magazine is an acceptable hazard. Authorization for this type of stowage is at the discretion of the operational commander.

AMMUNITION STOWAGE REQUIREMENTS

Generally, there are magazines for each type of ammunition stowed aboard ship. Ammunition, explosives, and explosive components are stowed in

specifically designated stowage spaces. Ammunition stowage spaces aboard ships are limited, and in certain classes of ships, extremely limited. Therefore, ammunition stowed aboard ship should stay within authorized ammunition allowances. Its important for shipboard ammunition to be stowed so maximum effectiveness is achieved. For these reasons, strict compliance with ammunition stowage by compatibility groupings aboard ship, while desirable and observed when practical, may not be feasible. When mixed stowage is used, make sure that it conforms to the stowage tables listed in *Ammunition Afloat*, NAVSEA OP 4.

REVIEW NUMBER 1

- Q1. *What command develops and approves specifications for construction of Navy ships?*
- Q2. *A ship's primary magazines are usually located _____.*
- Q3. *What types of magazines are located close to the area to be served?*
- Q4. *What is the purpose of modular stowage?*
- Q5. *List the two areas that the IRRP created improved handling.*
- Q6. *Generally, magazines aboard ship are designated to hold _____.*
- Q7. *Authority for stowing mixed types of ammunition in a magazine rest with _____.*

ENVIRONMENTAL CONTROL SYSTEMS

Magazines are fitted with environmental control and safety features to protect ammunition from excessive temperatures and humidity. Most magazines have either mechanical cooling or ventilation systems. However, there are a few magazines that don't have either of these features. If a magazine without controls shows a heat gain in excess of 100°F, use portable ventilation systems to prevent overheating or condensation of moisture.

Supply and Exhaust Ventilation

Ventilation ducts and exhaust ventilation outlets to and from magazines provide forced-air ventilation. Air is forced through the ducts by electric fans installed within the ductwork. Standard covers maintain

watertightness and prevent the entrance of flames from hits on the ship during combat. Always close these covers during combat (general quarters) conditions, unless otherwise directed. If you inhale fumes from some types of ammunition, you might get slightly intoxicated. However, this should not appreciably reduce your work efficiency. Generally, there is sufficient air volume in large, sealed magazines and handling rooms to provide a safe working atmosphere for approximately 5 hours. Magazines that are continuously occupied by personnel are blown through or ventilated a minimum of once every 5 hours.

Magazine Vent Check Valves

Sometimes, it is necessary to operate the sprinkler system in magazines while the ventilation valves are secured. When this happens, the magazine must be vented by an air escape to ensure that the pressure within the magazine doesn't build up beyond the allowed pressure limits of its watertight boundaries. Magazine check valves allow air and water to escape from the magazine into one of the ventilation ducts or through an independent air escape.

REVIEW NUMBER 1 ANSWERS

- A1. *NAVSEASYS COM develops and approves specifications for construction of Navy ships.*
- A2. *A ship's primary magazines are usually located below the waterline.*
- A3. *Ready-service magazines are located close to the area to be served.*
- A4. *The purpose of modular stowage is to give the greatest versatility and to minimize ammunition handling.*
- A5. *The two areas that the IRRP created improved handling are rearming and weapons assembly.*
- A6. *Generally, magazines aboard ship are designated to hold a single type of ammunition.*
- A7. *Authority for stowing mixed types of ammunition in a magazine rest with NAVSEASYS COM.*

Exhaust Vents

Aboard ship, most magazines, particularly missile magazines, are vented to the atmosphere. When missile

motors burn, they rapidly produce large volumes of smoke and gas. To avoid spreading smoke and gas to other areas of the ship if a missile motor in a magazine accidentally ignites, the exhaust ducts are vented to the atmosphere. The area on the weather deck in the vicinity of an exhaust vent is potentially hazardous, and it is marked to warn personnel not to loiter (hang around) in this area.

SPRINKLER AND ALARM SYSTEMS

Primary and missile magazines, ammunition handling rooms and most ready-service magazines are fitted with sprinkler systems. Sprinkler systems consist of spray heads or sprinkler-head valves arranged to dash water directly on the munitions and completely cover the magazine's interior. Sprinkler systems for spaces located below the damage control deck (second deck on aircraft carriers) are arranged for local control at the valve and for remote control from the damage control deck. On aircraft carriers, the remote controls are normally divided into two groups—forward sprinkler control board and aft sprinkler control board. The forward magazine group and the aft magazine group sprinklers can be remotely activated from the two control boards. Sprinkler systems for spaces located on and above the damage control deck are arranged for local control only from a position outside the access entrance to the space.

NOTE: Some magazines are designed without sprinkler systems so water-activated ammunition can be stowed in them. For example, Mk 58 marine location markers cannot be stowed in magazines that can be flooded. Also, weather-deck lockers and 20-mm and 40-mm ready-service rooms do not require sprinkler systems.

Sprinkler Systems

Sprinkler systems are classified by the type or location of the control exercised over the valves that restrain the flow of water. These valves may be operated manually or by remote control (manually or automatically). There are three types of remote operation:

1. Manual, by operating gears
2. Hydraulic, by means of control cocks and water from the fire system or control cocks and oil pressure supplied by hand pumps

3. Automatic, by means of a *rate of rise* or combined *rate of rise* and fixed temperature thermopneumatic control system

The *rate of rise* is indicated in a magazine when the temperature increases rapidly (such as from a fire). The rapid temperature increase activates the sprinkler-alarm device (FH circuit), which, in turn, automatically activates the sprinkler system control valve.

Alarm Systems

There are three alarms that are commonly associated with all magazine sprinkler systems—a sprinkling (FH circuit) alarm, a flooding (FD circuit) alarm, and a high-temperature (F circuit) alarm.

- High-temperature alarm systems (F circuit) are installed in all of the following magazines or spaces:
- Ammunition and propellant stowage areas
- Ammunition handling spaces
- Ammunition assembly/disassembly/check-out areas
- Cargo ammunition holds to provide a means of determining high temperatures

Don't confuse the F circuit with the FH circuit. The F circuit detects a slow rise in temperature while the FH circuit detects a rapid rise in temperature.

Install a minimum of two thermostats in each space. Install a minimum of one thermostat for each 250 square feet of deck area, or fraction of a deck area. If high temperatures occur in any of the spaces containing thermostats, the high-temperature that occurrence is indicated on an alarm switchboard installed in an area continuously manned when the ship is underway. Usually, this is damage control central. Audible alarm systems are also installed in the pilothouse, officer-of-the-deck (OOD) area, secondary damage control station, and each interior communications room. The audible alarm systems work in conjunction with the F and FH circuits.

Tests and maintenance of the magazine sprinkler systems are performed periodically according to NAVSEA and applicable preventive maintenance system (PMS) instructions.

MAGAZINE INTERNAL ARRANGEMENT

The internal arrangement of each magazine may vary considerably. The arrangement depends on the

stowage space available and the type of ammunition stowed. Figure 11-5 shows a ready-service magazine configured for ready-service missiles. Notice some missiles are stowed in cradles attached to the bulkhead. Other missiles are loaded onto handling equipment and ready for immediate issue. In larger magazines, such as primary missile magazines, stanchions may be installed

in sockets provided in the deck and overhead. Cradles are attached to the stanchions to stow a large number of decanned, ready-service missiles. Straps are used to secure the missiles in the cradles.

Stanchions are also used to divide a large magazine area into smaller areas or bins (fig. 11-6) to hold various

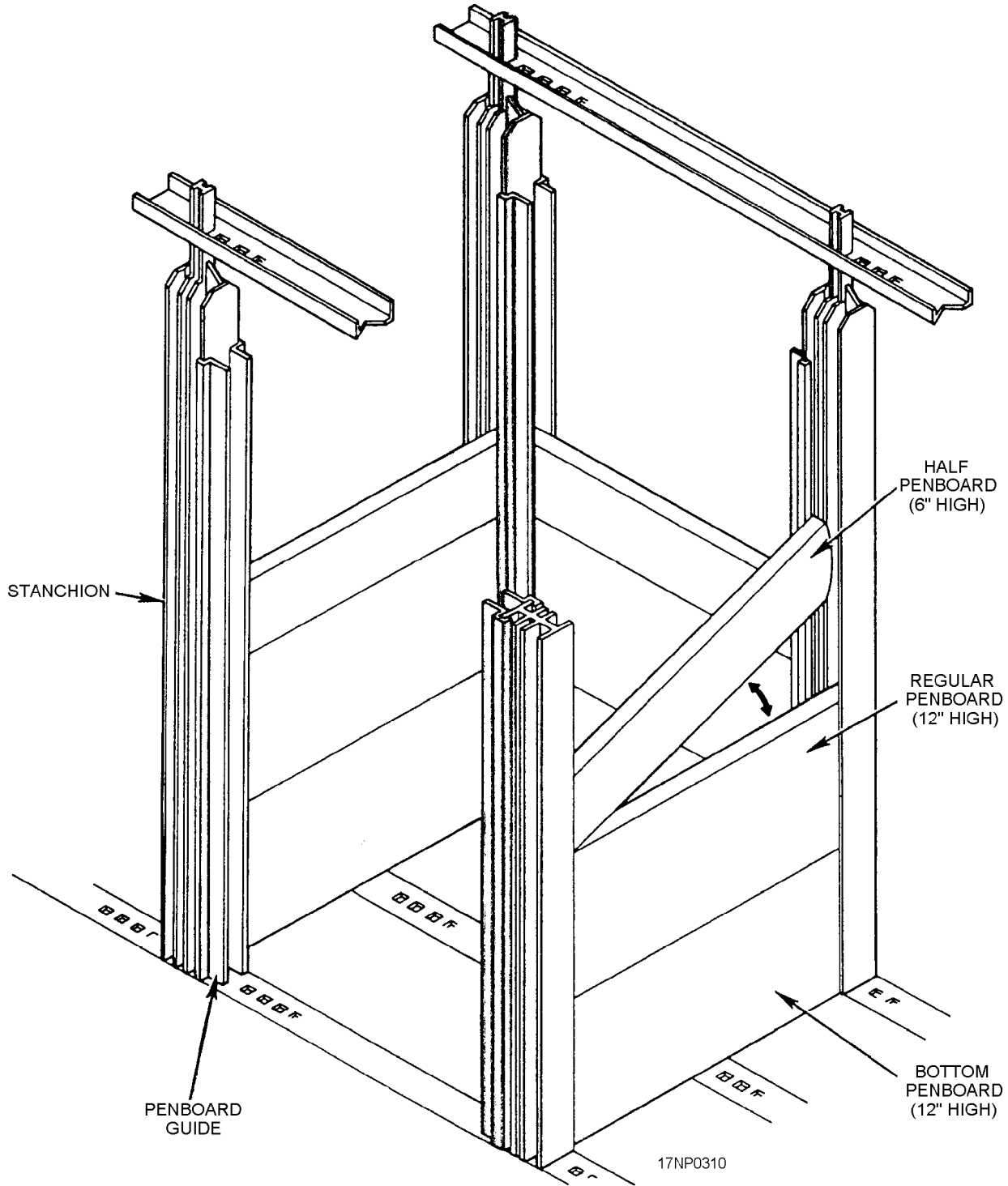


Figure 11-6.—Typical stanchions and bin configuration.

sizes of ammunition with a minimum loss of space. The stanchions are fitted with slots or have other means for receiving battens. The battens (which run horizontally) provide the walls that form the bin.

No matter which stowage method is used, arrange the stowage area so access to as much ammunition and as many containers as possible is provided, and provide adequate space for ventilation and handling operations. Stow ammunition and explosives on dunnage to provide an airspace so all parts of the magazine receive maximum ventilation and exposure to the sprinkler system. Mk 3 or Mk 12 metal pallets are used as dunnage aboard aircraft carriers. These have the correct space between the deck and stowed material. They also provide adequate grounding. Additionally, make sure that there is an air space of not less than 2 inches between any ammunition stowage stack and the surface of adjacent plating or sheathing. Stow the stacks of ammunition so sprinkler systems, circuit F sensors, or air escape lines aren't obstructed. When different lots and/or types of ammunition are stored in the same magazine, segregate the ammunition by lot, size, and type. Record this information on magazine cards and post them in the magazine.

Ships at sea move randomly; therefore, securely fasten all hazardous munitions and explosives in place, except when they are actually being handled. In some cases, stanchions and battens provide adequate security. Other types of ammunition stows, such as palletized bombs or missile containers, are secured by tie-down chains especially designed for this purpose. Connect the tie-down chains to the load and the deck tie-down points so even the slightest movement of the ammunition is prevented.

MAGAZINE INSPECTION AND VISUAL SURVEILLANCE OF AMMUNITION

The term's *magazine inspection* and *visual surveillance of ammunition* mean the same thing. They apply to the inspection of magazines and their contents. Aboard ship, these inspections are mandatory according to *The Ships' Maintenance and Material Management (3-M) Manual*, OPNAVINST 4790.4, other Navy regulations, and NAVSEASYS COM instructions. Magazine inspections are part of the ship's Preventive Maintenance System (PMS), and qualified personnel should only conduct them. These personnel use a check sheet (maintenance requirements card) to ensure that a hazard or abnormal condition is not overlooked.

DAILY VISUAL INSPECTION

Generally, the daily visual inspection of magazines consists of checking for the following:

- Improperly secured stowage
- Unsatisfactory protective packaging
- Unusual fumes or odors
- Magazine cleanliness
- Other abnormal conditions

Abnormal conditions in a ship's magazine or ammunition stowage space include evidence of tampering to gain access, evidence of theft, evidence of temperature or humidity fluctuations, and the presence of unauthorized materials. Abnormal conditions also include evidence of localized overheating from adjacent compartments on decks, bulkheads, and overheads; indications of leaks from sprinkler or flood pipes, nozzles, or control valves and regulators; and inoperable or damaged reach-rods, linkages, automatic fire alarm devices, and other similar equipment in the specific hazard stowage's. Record the results of all magazine inspections on the appropriate PMS schedule.

An important requirement of the daily magazine inspection is observing, recording, and reporting maximum and minimum temperature conditions in each stowage space. Magazines shall be fitted with thermometers and temperature record cards and holders, or temperature sensing devices. They must be capable of recording minimum and maximum temperatures.

Where no functional automated temperature indication system is present, at least one bimetallic thermometer shall be placed in each designated ammunition magazine or locker. The thermometer shall be located in a readily accessible area where maximum variations of temperature will normally occur. Where installation of the thermometer and bracket interferes with stowed material or equipment, the thermometer shall be mounted in a boss on the outside with the stem projecting inside the stowage space.

These thermometers shall be direct-reading, bimetallic thermometers with maximum and minimum index pointers and reset knob. They shall meet the specifications of MIL-I-17244. Thermometers shall have a temperature range of -40 to 180°F, a 3-inch, back-connected dial, and a 4-inch stem. For applications, which do not require recording of

MAGAZINE TEMPERATURE RECORD CARD			
COMIT <u>A-304M</u>		THERM. NO. <u>279</u>	
MONTH <u>APRIL</u>		19 <u>70</u>	
DATE	MAX.	MIN.	INITIAL
1	84°	64°	JCH
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
26			
27			
28			
29			
30			
31			
INDEX	ROUNDS		
INDEX	ROUNDS		
INDEX	ROUNDS		
INDEX	ROUNDS		

17NP0312

Figure 11-7.—Magazine Temperature Record Card.

minimum temperatures, a bimetallic thermometer with a maximum index pointer only is also acceptable.

MAGAZINE TEMPERATURE LOG

A Magazine Temperature Record Card (fig. 11-7) is located in each magazine. It is posted near the thermometer for recording daily magazine temperatures. These cards are replaced on the first day of each month. The completed cards are removed from the magazine, and the temperatures for each month are posted in a permanent log. The Magazine Temperature Record Cards are retained on file for a period of 1 year. When recording magazine temperatures in the permanent log, record temperatures in excess of 100°F so they stand out (use red ink). If the temperature exceeds 110°F in smokeless powder, rocket motor, and JATO magazines, check the temperature hourly and record it in a separate notebook. Transfer these recorded temperatures to the permanent log on a daily basis. Any magazine with a temperature consistently above 100°F is reported to NAVSEASYSKOM.

MAGAZINE SECURITY

Unless work is actually being performed within the space, all ammunition stowage spaces containing ammunition or explosives are secured and locked. Current directives and instructions require this action. Properly securing an ammunition stowage space includes the following actions:

- Properly set all environmental controls.
- Close all hatches, doors, or accesses.
- Properly set all dogs on watertight closures.
- Lock the space with an adequate locking device.

Some ammunition and explosive items, such as small arms ammunition, small arms, and pyrotechnics, are highly pilferable. Stow them in high-security stowage spaces. These spaces are equipped with an unauthorized entry alarm system and a specially designed, high-security, locking device (fig. 11-8).

The ship's gunner maintains and controls the magazine keys, including the high-security keys. The keys are logged out to authorized personnel only. During emergencies, such as fire and flooding, the ship's gunner provides access, as necessary, to locked ammunition spaces. If the ship's gunner is absent, the weapons department duty officer performs this function.

REVIEW NUMBER 2

- Q1. *Missile magazines are vented to _____.*
- Q2. *What item shouldn't be stowed in magazines that are equipped with sprinklers?*
- Q3. *In a shipboard magazine, what alarm circuit indicates a rapid rise in temperature?*
- Q4. *What types of pallets are used as magazine stowage dunnage aboard ship?*
- Q5. *NAVAIRSYSCOM should be notified if the temperature in any magazine is consistently above _____.*
- Q6. *What person controls all magazine keys aboard ship?*

AMMUNITION HANDLING

LEARNING OBJECTIVE: *Identify ammunition handling equipment used aboard ship and recognize its purpose and use. Identify the purpose and use of weapons elevators.*

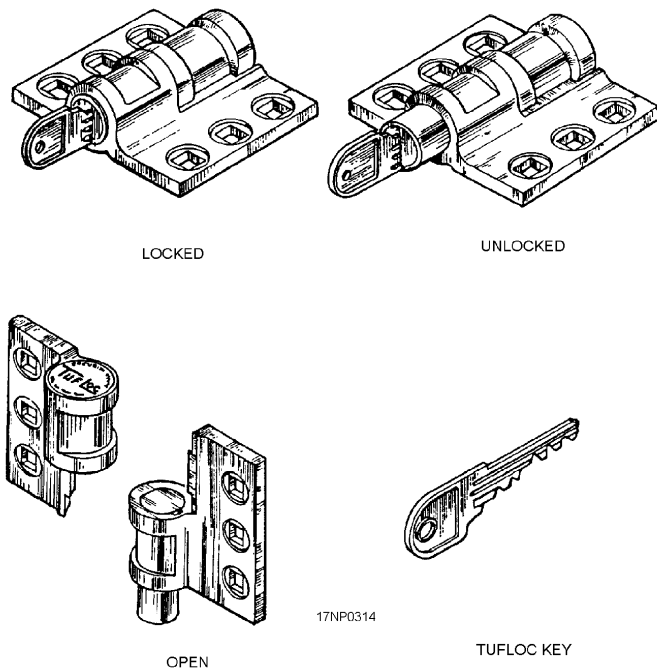


Figure 11-8.—High-security locking devices.

Handling ammunition requires detailed planning, precise execution of details, and strict compliance with safety regulations. When handling ammunition aboard a ship, these requirements can't be overemphasized. The working space is limited, and there are a large number of personnel contained within the ship. All personnel (both military and civilian) who handle ammunition must be qualified and certified in their areas of responsibility.

INSTALLED HANDLING EQUIPMENT

Aboard ship, weapons elevator service most large magazine and weapons assembly areas. These areas have provisions for the use of hoists. A brief description of handling equipment and its purpose is discussed in the following text.

Hoists

You use hoists in magazine stowage areas to stack or relocate ammunition within the magazine. You also use them to decan weapons. Hoists are used during weapons assembly to lift a weapon from the handling equipment or pallets to the assembly stands and from the assembly stand to the handling equipment.

There are three basic types of hoists—manually powered, electrically powered, and pneumatically powered (fig. 11-9). A hoist may be attached to the overhead by a stationary fitting, or it may be mounted onto an overhead monorail to move the load laterally.

You must use the correct sling, hoisting beam, and bomb carrier when connecting the hoisting cable to the load. Hoists have an established safe working load (SWL) that you must consider when selecting a hoist for a particular job. Also, consider the SWL of the interfacing equipment (bomb carrier, sling, etc.). For example, you have selected a hoist with an SWL of 4,000 pounds and a bomb carrier with an SWL of 2,000 pounds. The maximum weight this configuration can safely lift is 2,000 pounds.

Inspect hoists before you use them. Hoist must be periodically load tested. Equipment that has satisfactorily passed periodic load tests is marked to indicate its SWL. As a minimum, the marking includes the following information:

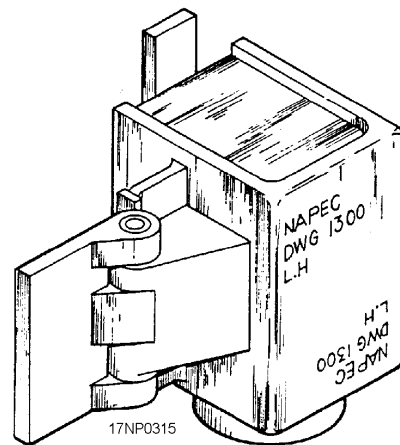
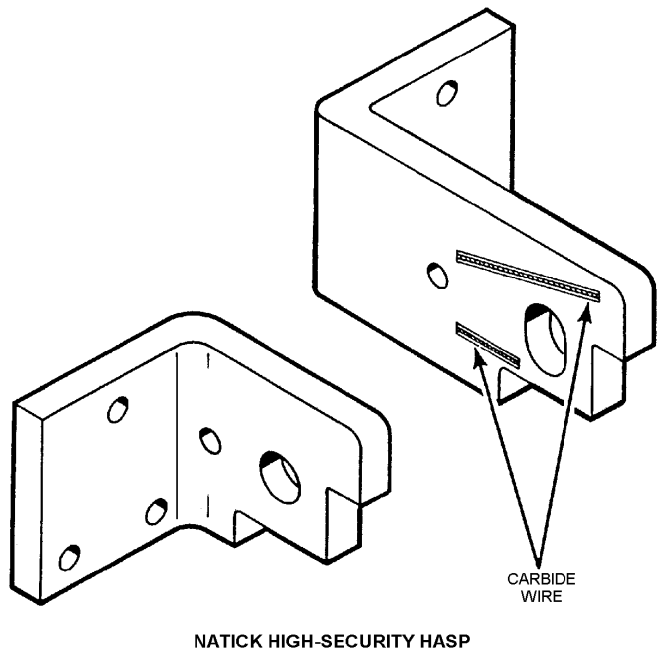
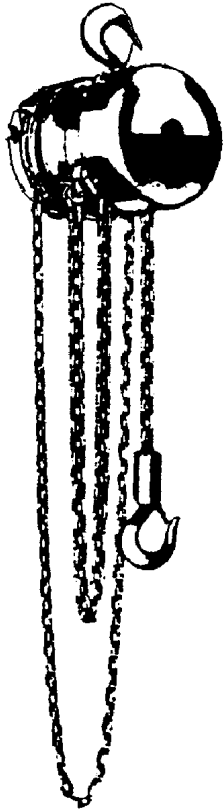
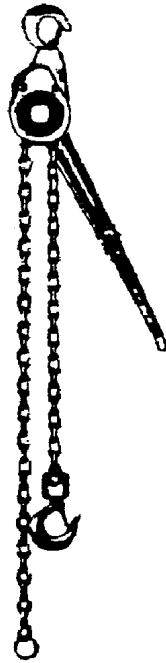


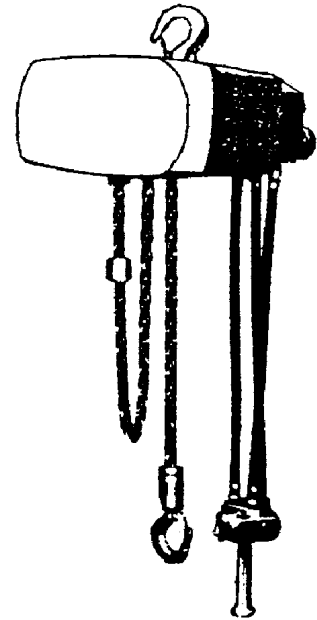
Figure 11-8.—High-security locking devices—Continued.



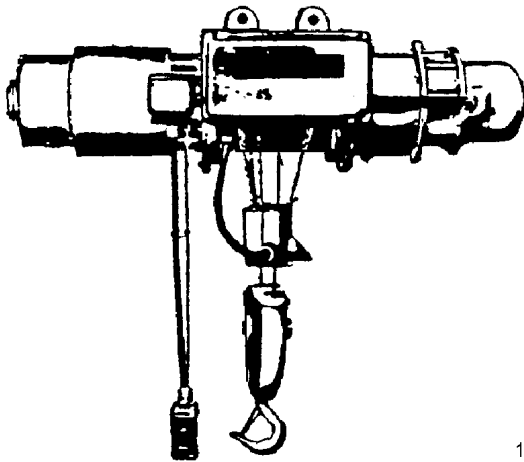
HOOK CHAIN HOIST
MANUALLY OPERATED



HOOK CHAIN HOIST
MANUALLY OPERATED
LEVER TYPE
(COME-A-LONG)

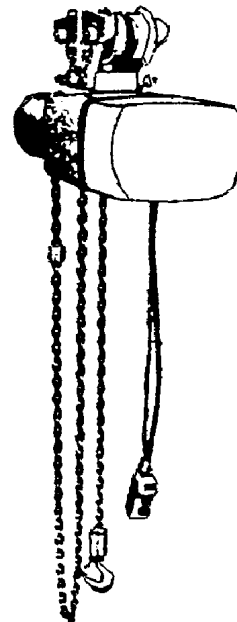


CHAIN HOIST
PNEUMATICALLY
OPERATED



WIRE ROPE HOIST
ELECTRICALLY OPERATED

17NP0316



CHAIN HOIST
ELECTRICALLY
OPERATED

Figure 11-9.—Typical ammunition handling hoists.

- The name of the testing activity and the name of the person performing the test.
- The date the test was performed.
- The date of the next required inspection may be included, if desired.

If the test period has expired or if documentation is not available to verify the latest load test status, the equipment is tested before it is used. If the equipment fails the load test specifications, the equipment is destroyed or, if economically feasible, repaired.

REVIEW NUMBER 2 ANSWERS

- A1. *Missile magazines are vented to the atmosphere.*
- A2. *Mk 58 marine location markers shouldn't be stowed in magazines that are equipped with sprinklers.*
- A3. *In a shipboard magazine, the FH circuit indicates a rapid rise in temperature.*
- A4. *Mk 3 or Mk 12 metal pallets are used as magazine stowage dunnage aboard ship.*
- A5. *NAVSEASYSKOM should be notified if the temperature in any magazine is consistently above 100°F.*
- A6. *The ship's gunner controls all magazine keys aboard ship.*

Weapons Elevators

There are currently more than 150 weapons elevators, involving over 55 different designs, installed on aircraft carriers. The size, type, and location of these weapons elevators will vary among the different classes of aircraft carriers.

The following text contains a brief description of the two major classifications (lower-stage and upper-stage) of weapons elevators. Regardless of the type of installation, a weapons elevator provides a safe and efficient means for you to handle weapons and weapons components among the magazines and the various assemblies, staging, and arming areas within the ship.

LOWER-STAGE WEAPONS ELEVATORS (5,500 POUNDS).—The 5,500-pound, lower-stage, weapons elevator (fig. 11-10) services magazines and ammunition handling areas from the 7th-deck level up to and including the 2nd-deck level. The components of

the elevator include an electrically powered, multiple-drum winch, an elevator platform, and an enclosed, watertight, vertical trunk with doors located at the levels and stations serviced, and a semiautomatic control system.

Ramps are used to bridge the gaps in the door opening between the elevator platform and the deck. These allow you to load or unload the elevator platform by using forklift trucks or wheeled skids.

Each lower-stage elevator is equipped with a broken-rope safety device, an over speed governor device, and slack cable-sensing devices. The broken-rope safety device is mounted on the elevator platform assembly. If any one of the platform suspensions ropes break, a roller-wedging mechanism automatically operates to lock the platform to the guide rails.

A counterweight-type governor device for limiting speed of elevator down travel is located in the upper end of the elevator trunk. The governor is operated by a wire rope connected to a lever of the broken-rope safety device on the elevator platform. Then, the rope is passed over the governor sheave and attached to the governor spooling drum on the hoisting winch. Excessive down speeds causes the governor limits

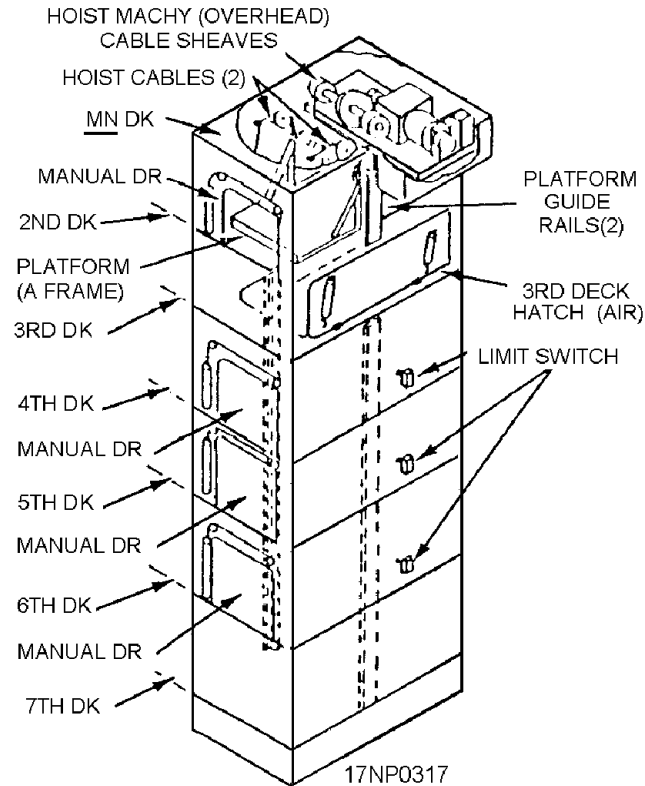


Figure 11-10.—Typical 5,000-pound, lower-stage, weapons elevator.

switch to shutoff the power to the hoist motor and electric brake. Loss of electric power causes the brake to automatically stop the elevator. If the brake fails to stop the elevator, the governor sheave grips the governor rope, causing the broken-rope safety device to stop the elevator.

A slack, cable sensing, safety device is provided for each suspension rope and the governor rope. Located in the area between the winch drums and the overhead sheaves, these devices function by applying a spring-loaded follower roller to the wire rope. Rope slack causes a proximity switch to shutoff electrical power to the hoisting winch motor and brake, which stops the elevator.

If the elevator over travels upward beyond the maximum up stop position, an over travel limit switch is actuated. This stops the elevator by shutting off power to the hoisting winch motor and brake.

If the elevator over travels downward beyond the hold deck loading station level, spring bumpers in the bottom of the elevator trunk stop the platform. The slack-cable switches are actuated to cut off power to the hoisting winch motor and brake.

An operator-attended control panel is located next to all elevator doors. All operator control panels have a display of selector switches, push buttons, and indicator lamps suited for the control functions required at the station served. All control panels have an emergency stop-run switch from which all operations of the elevator can be stopped.

The main operator control panel and electrical power switch are located at the 2nd deck-level station. An elevator can be dispatched to another level from any operator control panel. The lower-stage elevator control system can dispatch the elevator to another level. However, it can't retrieve the elevator from another level.

IMPROVED WEAPONS HANDLING SYSTEM (IWHS) LOWER-STAGE WEAPONS ELEVATORS.—The IWHS lower-stage weapons elevator (fig. 11-11) services magazines and ammunition handling areas from the 7th deck level up to and including the main deck (hangar deck). The IWHS is a highly sophisticated system controlled by a PDP-14 programmable controller that continually tracks the location of the platform to within one-twelfth of an inch. Because of the complexity of the IWHS, elevator operators and maintenance personnel are extensively trained in hydraulics, electricity, and electronics.

Four cables attached at the corners lift the platform. The platform machinery is located at the 3rd deck level. The hatches are opened hydraulically. They are designed to automatically undog-open-latch and unlatch-close-dog. The elevator doors are also operated hydraulically.

The IWHS incorporates the following safety features:

- An over speed governor slack-cable device
- An over speed governor device
- A hydraulic interlock to prevent two hatches from being opened at the same time
- A hydraulic interlock to prevent hatches from closing when dogs are in the dogged position
- An electrical interlock to prevent opening a magazine door unless the platform is at that level
- An electrical interlock to prevent opening more than one magazine door at a time
- A pressure switch to prevent operation of the elevator when the hydraulic pressure is below 1,200 psi

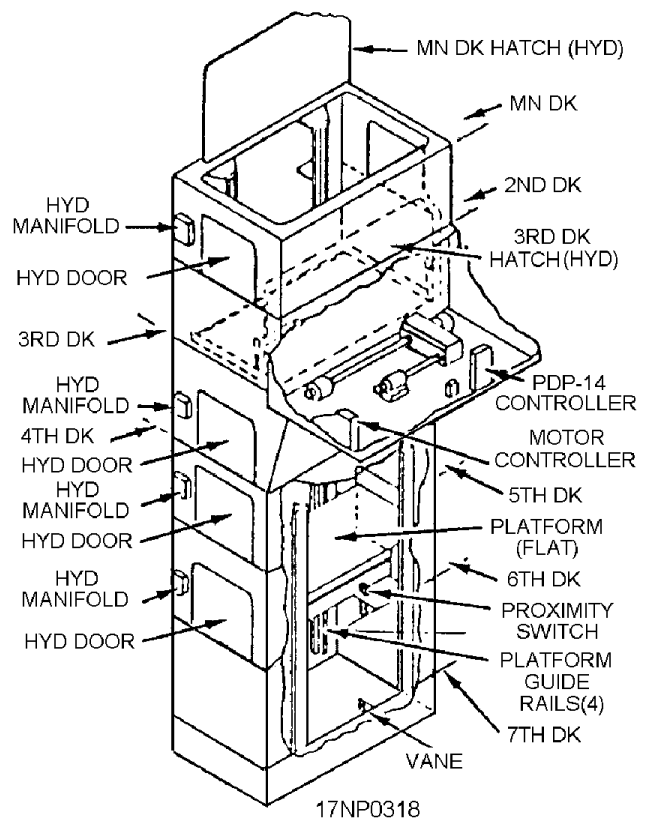


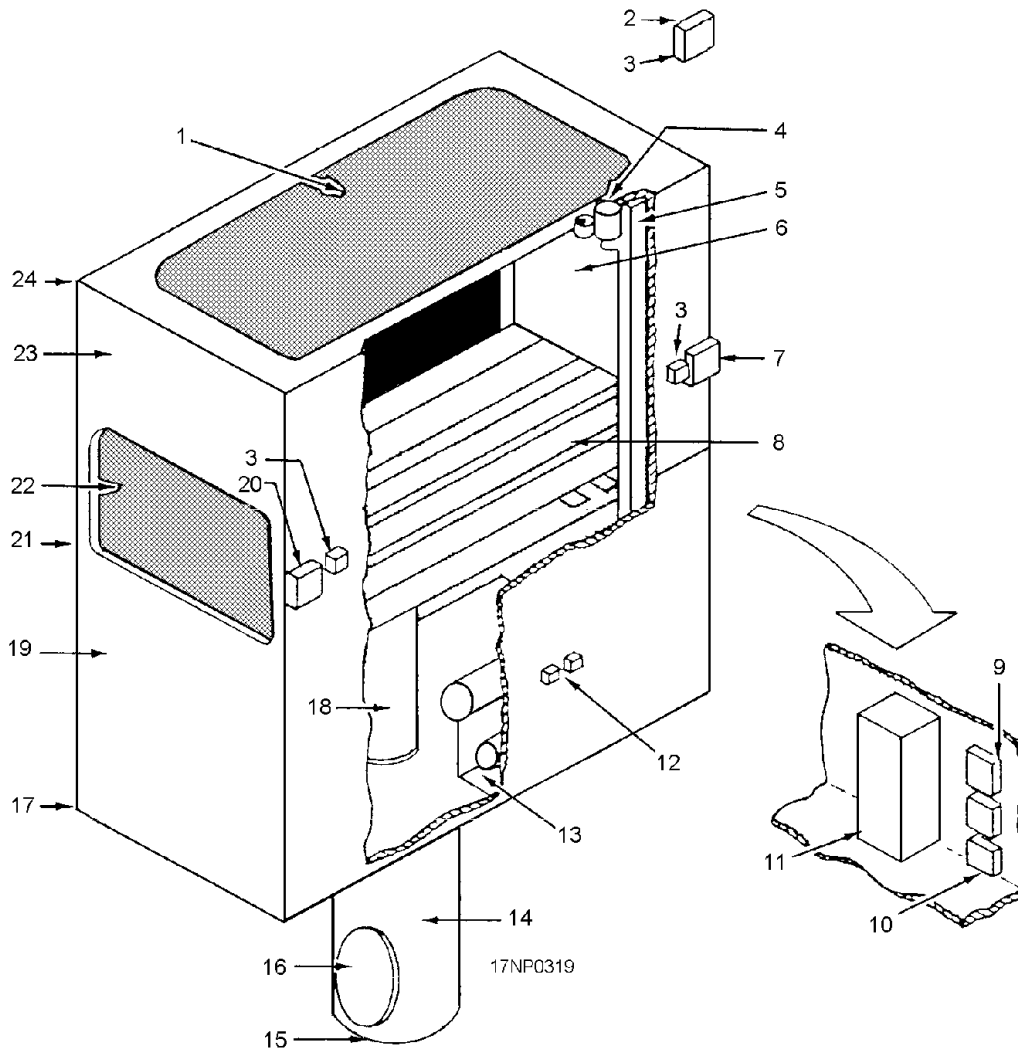
Figure 11-11.—Typical IWHS lower-stage, weapons elevator.

- An electrical interlock to prevent platform high-speed travel beyond the sequence-level slowdown switch
- An electrical interlock to prevent platform travel beyond the sequence level until the main deck hatch is opened and latched
- An electrical interlock to prevent movement of the platform until the lock bars are fully retracted

In addition to the operator controllers located at each access door and the 2nd deck main controller, a

portable main controller may be used at the main deck level. Normally, there is one IWHS installed forward to service the forward-magazine group and one installed aft to service the aft-magazine group. These elevators support the Improved Rearming Rate Program (IRRP).

UPPER-STAGE HYDRAULIC ELEVATORS.—Upper-stage hydraulic elevators (fig. 11-12) are used to transport weapons between the second deck and the main deck only. The major components of each elevator are an enclosed, watertight, vertical trunk, an elevator platform assembly, a hydraulic power plant system, and a semiautomatic elevator control system.



- | | | |
|----------------------------|--|--------------------------------|
| 1. Main deck hatch | 9. HYD plant motor magnetic controller | 17. 3rd deck |
| 2. Main deck control panel | 10. PLATF CONVR motor MAG controller | 18. Hoisting cylinder assembly |
| 3. Call signal station | 11. Static control panel | 19. Machinery space |
| 4. Shock absorbers | 12. HYD plant motor master switch | 20. Remote control panel |
| 5. Guide rail | 13. HYD power unit assembly | 21. 2nd deck |
| 6. FWD elevator door | 14. Hoisting cylinder enclosure | 22. Aft elevator door |
| 7. Master elevator door | 15. 4th deck | 23. Elevator trunk |
| 8. Platform conveyor | 16. Hatch | 24. Main deck |

Figure 11-12.—Typical upper-stage, hydraulic, weapons elevator.

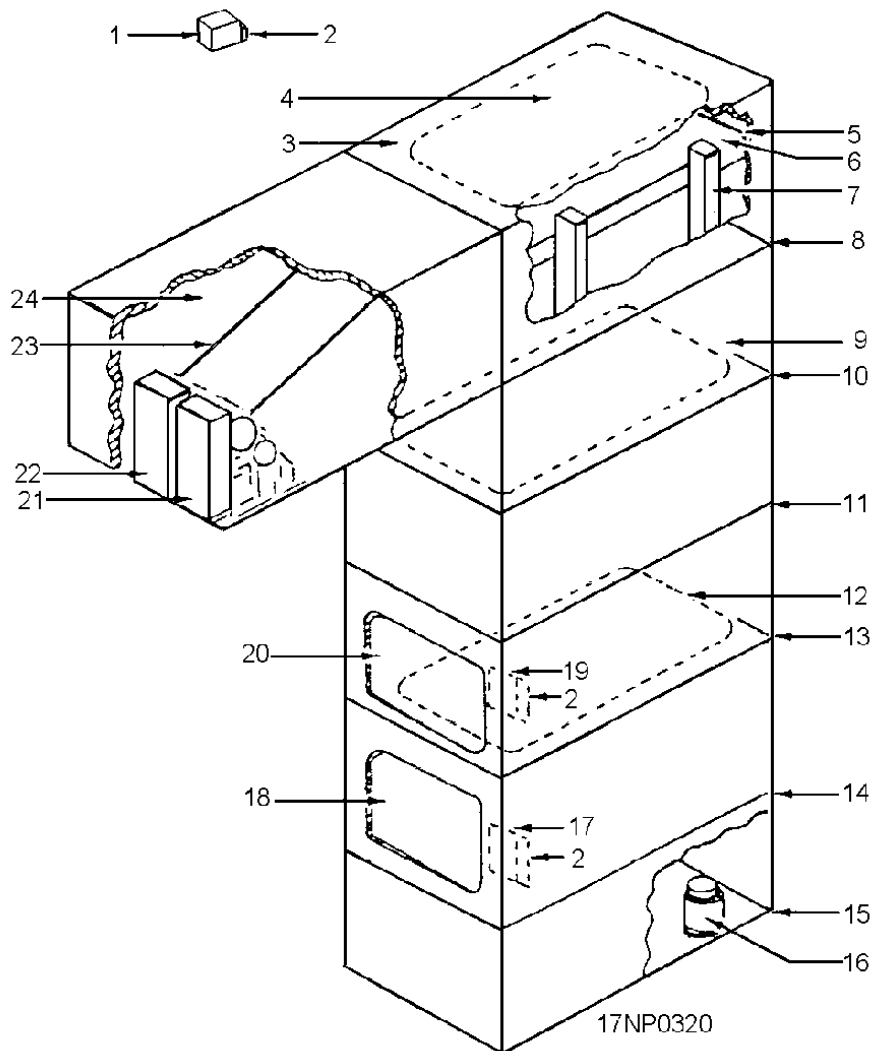
If an excessive elevator down speed occurs, an over speed valve closes and stops the elevator. The over speed valve is mounted on the lower end of the lifting ram hydraulic cylinder assembly.

UPPER-STAGE WIRE-ROPE ELEVATORS.—The upper-stage, wire-ropes elevators (fig. 11-13) are the only weapons elevators in the system that provide weapons transportation to the flight deck. The 2nd deck is the lowest level served by the upper-stage elevators. The equipment of upper-stage, wire-ropes elevators are either similar or identical to those of lower-stage, wire-ropes elevators. The following

discussion describes the difference between upper- and lower-stage, wire-ropes elevators.

The elevator trunk enclosure extends from the 3rd deck to the underside of the flight deck. Power-operated ballistic hatches in the main deck, 02 level, and flight deck allow passage of the elevator platform, and they maintain ballistic integrity within the trunk. There are power-operated doors in the trunk for elevator loading and unloading.

So the elevator platform can be raised flush with the flight deck, the wire-rope attachment points are on extensions of the platform structure, placing them



- | | | |
|---|---------------------|--|
| 1. FLT DK control panel (gallery walkway) | 9. 02 level | 17. 2nd deck control panel |
| 2. Call signal station | 10. 02 level | 18. 2nd deck aft elevator door |
| 3. Elevator trunk | 11. 01 level | 19. Main deck aft control panel |
| 4. FLT DK hatch | 12. Main deck hatch | 20. Main deck aft elevator door |
| 5. Flight deck | 13. Main deck | 21. Elevator hoist motor magnetic controller |
| 6. Elevator platform | 14. 2nd deck | 22. Elevator static control panel |
| 7. Guide rail | 15. 3rd deck | 23. Hoisting machine assembly |
| 8. 03 level | 16. Shock absorber | 24. Machine space |

Figure 11-13.—Typical upper-stage, wire-rope, weapons elevator.

below the main hoisting sheaves. An arrangement of hoisting and idler sheaves in the upper end of the elevator trunk allows the platform to be raised flush with the flight deck. Safety devices of upper-stage elevators are essentially identical to those for lower-stage elevators.

Control equipment for upper-stage elevators are essentially identical to those for lower-stage elevators. Operator control panels are located at each station served.

Weapons Elevator Maintenance and Safety

The weapons department is responsible for maintaining all weapons elevators aboard aircraft carriers. As an AO, you will perform preventive maintenance and repair elevator systems. The IWHS elevators are located close to the 5,500-pound elevators. Consequently, the same personnel are required to operate, maintain, and troubleshoot both types of elevators, even though they differ significantly in design and level of sophistication.

Although the primary responsibility of elevator maintenance rests with the AO, some maintenance procedures require the assistance of personnel within other ratings, such as Machinist Mate (MM) and Electricians Mate (EM). When this requirement exists, it is noted on the PMS card.

All electrical power requirements for the weapons handling system come from the ship's service 440-volt, three-phase, 60-hertz power supplied throughout the system. Ship's service power is converted to other ac and dc voltages by either the controllers or control panels to meet system equipment requirements.

For the safety of maintenance personnel, the tag-out and tag-in system has been established. The steps within this system are standardized throughout the Navy. You should comply with your ship's tag-out procedures to ensure safety.

Ship's service sound-powered telephones are located at each operator control station. They are used to supplement weapons handling system control indicators and coordinate operations between various deck levels. An elevator must not be dispatched from one deck to another until communications between the sending operator and receiving operator have been established.

In addition to OJT, most commands require that all personnel operating elevators possess a valid operator's license. The license should reflect the type(s) of

elevator(s) the individual is authorized to operate. For example, an operator may be authorized to operate all elevator systems at any control station, or an individual with less training may only be authorized to operate the 5,500-pound elevator systems at any station except the 2nd deck main control station.

REVIEW NUMBER 3

- Q1. What decks are serviced by lower-stage elevators?*
- Q2. What device is used to bridge the gap in the door opening between an elevator platform and the deck?*
- Q3. If an elevator suspension rope breaks, what mechanism automatically operates to lock the platform to the guide rails?*
- Q4. If an elevator over travels upward beyond the maximum up-stage position, what device actuates, stopping the elevator and shutting off power to the hoisting winch?*
- Q5. Upper-stage elevators are used _____.*
- Q6. What decks are serviced by IWHS lower-stage elevators?*
- Q7. The platform machinery for an IWHS lower-stage elevator is located on the _____ deck.*
- Q8. The only weapons elevators that provide access to the flight deck are the _____.*
- Q9. The primary responsibility for maintaining weapons elevators belongs to the _____ rate.*
- Q10. What electrical power is required to operate the weapons elevators?*

WEAPONS MOVEMENT

The movement of ammunition consists of routine operations such as intramagazine movement and movement of weapons and components in support of flight operations. It may also consist of major evolutions, such as ship rearmament or major loading and off-loading operations. Regardless of the size of the operation, anytime weapons or explosives are removed from their proper stowage environment, the opportunity for the occurrence of an ordnance mishap is much greater. Therefore, one of the most important

factors of any ordnance evolution is preplanning. Additionally, a safety-first attitude must be paramount.

Weapons Movement in Support of Flight Operations

To enable squadron personnel to meet the short turnaround time of the flight schedule requirements, weapons must be preassembled and located in staging areas on the hangar deck with sufficient lead-time.

The area of the hangar deck that is to be used as a weapons staging area must be coordinated with the hangar-deck officer. The weapons can't interfere with the movement of aircraft or obstruct fire lanes, but they must be positioned so they are protected by the hangar-bay sprinkler system. This area should be located as close as possible to the aircraft elevator doors to provide a means for jettisoning the weapons overboard in the event of an emergency. Anytime live ordnance is staged on the hangar deck, a security watch must be posted to restrict the area to authorized personnel only and to initiate movement of the weapons in case of an emergency.

The weapons staging area on the flight deck is located outboard of the island structure and inboard of the catwalk or deck edge for aircraft carriers and behind the island on LHA and LND amphibious class ships. This area is commonly called the "bomb farm." Anytime live ordnance is present, this area is manned by the bomb-farm watch. Bomb-farm watch personnel maintain direct communication with the aviation ordnance control station (AOCS). In addition to security of the ordnance, the bomb-farm watch issues ordnance to squadron personnel according to the ship's ordnance load plan.

The bomb-farm staging area also incorporates an emergency jettison ramp. The emergency jettison ramp, when in the rigged position (down), forms a ramp from the flight deck edge to an opening in the outboard bulkhead of the catwalk. This provides a path for jettisoning weapons overboard during an emergency. Additionally, jettison ramps are located fore and aft on the port and starboard sides of the flight deck so aircraft loading crews during an emergency can jettison weapons. Be careful when the emergency jettison ramps are rigged; they bypass the catwalk and safety net. When the ramps are in the stowed (raised) position, they form part of the catwalk structure.

The bomb farm is routinely replenished with weapons from the hangar deck staging area between the launch and recovery of aircraft. The weapons are

transported from the hangar deck to the flight deck by the upper-stage weapons elevators or deck-edge aircraft elevators.

Weapons Onload/Offload

There are three situations in which weapons onload or offload operations are normally conducted—pier side, offshore at anchorage, or at sea. The location of the ship during onloads or offloads operations affects manpower, equipment, time, and the degree of safety requirements.

PIER SIDE.—Handling large quantities of explosive munitions at piers is limited to those designated by NAVSEASYSKOM as "explosive piers." The pier area is restricted during ammunition and explosive loading and offloading operations. Nonessential personnel (visitors) aren't permitted access to the ship or pier area. All privately owned vehicles, ship's vehicles, and assigned government transportation are prohibited on a pier where ammunition is being handled. Before loading or offloading operations, the OOD is notified. The OOD makes sure that a red flag is prominently displayed to indicate that an ordnance evolution is in progress.

Pier-side ammunition handling operations are restricted to daylight hours, except in an emergency. Emergency operations can only be carried out at an adequately lighted pier. An emergency may be dictated by the ship's sailing schedule or by NAVSEASYSKOM. Therefore, ammunition isn't staged on the pier in large quantities. Close coordination is established between the ship's weapons department and the station's weapons department to ensure that the rate of delivery at the pier doesn't exceed the handling rate of the ship's ordnancemen.

REVIEW NUMBER 3 ANSWERS

- A1. *Lower-stage elevators service the 2nd through 7th decks.*
- A2. *A movable ramp is used to bridge the gap in the door opening between an elevator platform and the deck.*
- A3. *If an elevator suspension rope breaks, a broken-rope safety device automatically operates to lock the platform to the guide rails.*
- A4. *If an elevator over travels upward beyond the maximum up-stage position, an over travel*

limit switch actuates, stopping the elevator and shutting off power to the hoisting winch.

- A5. *Upper-stage elevators are used to transport weapons between the 2nd and main decks.*
- A6. *IWHS lower-stage elevators service the 7th through the main decks.*
- A7. *The platform machinery for an IWHS lower-stage elevator is located on the 3rd deck.*
- A8. *The only weapons elevators that provide access to the flight deck are the upper-stage, wire-rope elevators.*
- A9. *The primary responsibility for maintaining weapons elevators belongs to the AO rate.*
- A10. *The electrical power required to operate the weapons elevators is 440-volt, three-phase, 60-Hz power.*

EXPLOSIVE ANCHORAGE.—At times, loading or offloading large quantities of ammunition and explosives at the pier is not practical or feasible. For example, a ship may be located at a pier that has a restricted explosive load limit due to the geographical location of other ships or occupied structures. It could also be due to the geographical location of shore-based, ammunition handling facilities. For example, an aircraft carrier may be docked in Norfolk, Virginia, and the activity receiving or issuing the ammunition may be located in Charleston, South Carolina. In this situation, the most practical method would be to locate the aircraft carrier at a designated explosive anchorage (commonly called whiskey anchorage) and transport the ordnance by lighters and/or barges. The transfer of ammunition between the ship and the lighters/barges is normally accomplished by the use of a floating crane.

Even though a ship is located at an explosive anchorage, transferring ammunition is restricted to daylight hours. Normally, the ship remains at anchorage until the entire evolution is completed, which may vary from 1 to 5 days.

TRANSFER OF AMMUNITION AT SEA.—The transfer of ammunition at sea (underway) presents problems not met by pier-side or anchorage operations. Normally, replenishment at sea involves the transfer of fuel, supplies, stores, and ammunition simultaneously. Obviously, available deck space, available handling equipment, and manpower are used to the maximum efficiency. Every detail of the entire operation is preplanned and coordinated between the departments

involved within the ship and the individuals within the departments.

Conventional replenishment (CONREP) and/or vertical replenishment (VERTREP) methods at sea accomplish the transfer of ammunition. The CONREP method consists basically of a steel cable rigged between the supply ship and the receiving ship at the hangar-deck level. These points of contact are called "conning stations," and there may be more than one conning station in operation at the same time. Cargo is attached to the cable by using approved handling equipment and conveyed from one ship to the other. The AO is only responsible for ammunition items. You position each ammunition load at the conning station for transfer. As the ammunition loads are received at the conning station, you move the load to a designated staging area until it is struck below. The ship's deck department normally performs the operation of conning equipment.

In the VERTREP method, helicopters using slings and/or cargo nets transfer the ammunition to or from the supply ship. VERTREP operations are conducted on the flight deck. Aviation Ordnancemen are responsible for handling all ammunition and preparing and positioning empty slings and ammunition details for transfer to the supply ship. Ammunition is transferred from the flight deck to the hangar deck by a designated aircraft elevator. This elevator is normally on the port side when CONREP and VERTREP operations are being conducted simultaneously.

REVIEW NUMBER 4

- Q1. *The weapons staging area on the flight deck, located between the island and the starboard catwalks, is known as the _____.*
- Q2. *Under what conditions is a pier-side weapons movement of ammunition loaded onto an aircraft carrier?*
- Q3. *List the methods used to transfer ammunition at sea.*
- Q4. *When VERTREP is being used to transfer ammunition between ships, transfer is accomplished by _____.*

HAZARDS OF ELECTROMAGNETIC RADIATION TO ORDNANCE (HERO)

LEARNING OBJECTIVE: *Recognize HERO classification standards. Identify HERO*

hazards. Identify the uses of the emission control (EMCON) bill.

The functional characteristics of electrically initiated ordnance cause hazards of electromagnetic radiation to ordnance (HERO). Ordnance that presents a HERO problem includes cartridges, cartridge-actuated devices, and 20-mm ammunition. The ordnance electroexplosive devices (EEDs) may be accidentally initiated or their performance degraded by exposure to radio frequency (RF) environments. Ordnance is more susceptible to RF environments during assembly, disassembly, handling, loading, and unloading operations.

The term *RADHAZ* (radiation hazards) applies to radio frequency (RF) electromagnetic fields of sufficient intensity to

- produce harmful biological effects in humans, and/or
- cause spark ignition of volatile combustibles or actuate electroexplosive devices.

Although the effects of RADHAZ are important, this chapter limits discussion to HERO hazards.

HERO ORDNANCE CLASSIFICATIONS

A testing program sponsored by the Naval Sea Systems Command (NAVSEASYS COM) determines the susceptibility of ordnance to RF environments. Tests are conducted in the maximum RF environment the ammunition or ordnance systems may be subjected to in its stockpile-to-launch sequence. This data is the basis for the three HERO classifications assigned to ordnance—HERO-safe ordnance, HERO-susceptible ordnance, and HERO-unsafe ordnance.

HERO-Safe Ordnance

An ordnance item is classified as **HERO safe** if it meets the following criteria:

- Percussion initiated.
- Sufficiently shield protected so all EEDs contained by the item are immune to adverse effects (safe and/or reliable) when the item is used in its expected RF environments.
- General HERO requirements are observed.

HERO-Susceptible Ordnance

An ordnance item is classified as HERO susceptible if proved (by tests) to contain EEDs. HERO-susceptible ordnance can be adversely affected by RF energy. The safety and/or reliability of the system is in jeopardy when the system is used in its expected RF environments.

HERO-Unsafe Ordnance

An ordnance item is classified as **HERO unsafe** if it meets the following criteria:

- Its internal wiring is physically exposed.
- Tests are being conducted on the item that result in additional electrical connections to the item.
- EEDs that have exposed wire leads are handled or loaded.
- The item is being assembled or disassembled.
- It is disassembled.

REVIEW NUMBER 4 ANSWERS

- A1. *The weapons staging area on the flight deck located between the island and the starboard catwalks is known as the bomb farm.*
- A2. *A pier-side weapons movement of ammunition loaded onto an aircraft carrier is authorized in emergency situations when authorized by NAVSEASYS COM or to conform to the ship's sailing schedule.*
- A3. *Conventional replenishment (CONREP) and vertical replenishment (VERTREP) are used to transfer ammunition at sea.*
- A4. *When VERTREP is being used to transfer ammunition between ships, helicopters using slings or cargo nets accomplish transfer.*

HERO EMISSION CONTROL (EMCON) BILL

Ordnance items classified as **HERO unsafe** are protected from electromagnetic radiation by putting them in a completely enclosed all-metal container.

NOTE: Ordnance in a wooden or plastic container or on a metal pallet is as exposed as if the container or pallet were not there.

HERO-unsafe ordnance should NEVER be exposed to a RF environment. However, the requirement for assembly, disassembly, handling, loading, and unloading exposes ordnance to some degree. If exposure cannot be avoided, ordnance should be exposed only in essentially RF-free designated regions, such as below deck or in RF-shielded buildings.

The commanding officer is responsible for making sure that **HERO-unsafe** ordnance is not handled in RF environments. Sometimes operational commitments require **HERO-unsafe** ordnance to be exposed to RF environments, such as the flight deck, hangar deck, or weather decks. A degree of relief from HERO RF restrictions is obtained by following the command HERO EMCON bill.

The HERO EMCON bill depends upon two factors—(1) the amount and type of ordnance that is involved, and (2) a knowledge of the RF environment at locations where presence, handling, and loading occur.

The HERO EMCON bill contains a list of all **HERO-susceptible** and **HERO-unsafe** ordnance items on board and their allowable RF environmental levels. It also includes a list of all transmitter-antenna combinations on board and their output power. Reducing or securing certain transmitter-antenna combinations can maintain allowable RF environmental levels.

Normally, to ensure that proper conditions are met in a given ordnance-handling situation, two actions are taken:

1. All onboard transmitters are listed.
2. The action each operator is to take when a given HERO EMCON condition is set.

For example, in HERO condition 1, a transmitter operator may switch the transmitter to STANDBY. In HERO condition 2, the same operator may restrict transmission to 100 watts, or perhaps there is no transmission restriction at all.

The AO is the most important factor in avoiding a **HERO-unsafe** situation. You determine if an ordnance item is **HERO safe**, **HERO susceptible**, or **HERO unsafe**. Before moving a **HERO-unsafe** item from a RF-free environment, you must request, through strike operations or ordnance control, the proper HERO condition. You make sure that the ordnance item remains in a RF-free environment until the word has

been passed that the proper HERO condition has been set.

For detailed information concerning all aspects of electromagnetic radiation hazards, refer to *Electromagnetic Radiation Hazards*, NAVSEA OP 3565/NAVAIR 16-1-529, volumes I and II.

REVIEW NUMBER 5

- Q1. *List the three HERO ordnance classifications.*
- Q2. *Ordnance is HERO safe if it meets what criteria?*
- Q3. *Name the environment to which HERO-susceptible and HERO-unsafe ordnance should not be exposed.*
- Q4. *What is the HERO EMCON bill?*
- Q5. *What information can you find in the local HERO EMCON bill?*

SAFETY PRECAUTIONS

LEARNING OBJECTIVE: *Recognize the importance of safety precautions when working with ordnance.*

Preplanning, ordnance training, and carefully handling ordnance prevent accidents caused by explosives. The phrase "The life you save may be your own" is a good one, especially when you handle ordnance. It is your responsibility to make sure those safe, approved practices and procedures are used when you handle ordnance.

REVIEW NUMBER 5 ANSWERS

- A1. *The three HERO ordnance classifications are HERO safe, HERO susceptible, and HERO unsafe.*
- A2. *HERO-safe ordnance must be percussion initiated and shielded enough so that EDDs are safe when used in RF environments.*
- A3. *HERO-susceptible and HERO-unsafe ordnance should not be exposed to RF environments.*
- A4. *The HERO EMCON Bill contains a degree of relief from HERO RF restrictions.*
- A5. *The HERO EMCON Bill contains a list of all HERO-susceptible and HERO-unsafe ordnance items on board the command.*