

## CHAPTER 2

# MINE HANDLING AND STORAGE

### LEARNING OBJECTIVES

Upon completing this chapter, you should be able to do the following:

1. Recognize the proper handling and stowage of mines and explosive materials.
2. Determine the requirements, principles, and applications necessary for the quantity-distance requirements of an operating building and storage area.
3. Differentiate between the various types of handling gear and their uses in handling explosive-loaded mines.

Explosive devices, ranging from mines to initiating devices, are dangerous and are designed for specific purposes. When explosive devices are manufactured, every effort is made to ensure that they are as safe as possible when they are handled. But, even the least-sensitive explosives can detonate if they are subjected to careless or improper handling. Any negligence can result in equipment damage, personnel injuries, and/or loss of life.

The history of accidents involving ammunition and explosives illustrates that avoidable circumstances existed in practically every incident where the cause could be determined. Complete understanding and strict observance of prescribed safety regulations are necessary to eliminate unsafe acts and conditions that can cause preventable accidents. Tasks performed repeatedly, no matter how dangerous, are likely to become routine and lead to carelessness. Therefore, constant alertness on the part of all personnel and intelligent, close supervision by supervisors are required to help prevent accidents. The most important areas to consider are handling and storage of ammunition and explosives.

All ammunition and explosives must be maintained in a high state of readiness at all times. In addition to proper preparation, assembly, and maintenance, ammunition and explosives must be handled and stored with extreme caution. Strict compliance with all prescribed safety standards, regulations, and procedures must be observed and enforced. Safety is always the first priority in any operation involving handling and storing ammunition, explosives, and other hazardous materials.

This chapter discusses safety during mine handling and storage, quantity-distance requirements, and handling equipment.

### SAFETY DURING MINE HANDLING AND STORAGE

It is crucial that all personnel who handle or transport or are involved in the storage of explosives and other hazardous materials think, act, and live *safely* so that it becomes instinctive.

Accidents are usually the result of failure to follow regulations, failure to understand hazards, or failure to take necessary precautions. In each of these cases, failure indicates human error, carelessness, and/or poor judgment. All personnel must realize that when they do not follow safety regulations, they not only endanger their own lives but also the lives of their fellow workers. In the Navy, the responsibility for safety is an all-hands effort. This section addresses these responsibilities.

## GENERAL SAFETY RESPONSIBILITIES

All personnel engaged in operations involving the storage of ammunition and explosives must be trained in all phases of the work they will perform. In addition, you must make them aware of the proper methods for performing tasks within their work area. Included in their training must be instructions in the following areas:

- Recognizing magazine identification markings.
- Loading and unloading techniques within magazines and between magazines and conveyances.
- Selecting and properly using materials-handling equipment.
- Using protective equipment and protective clothing properly.
- Operating fire-fighting equipment properly, knowing its availability and use, and knowing the procedures for reporting fires.
- Knowing the procedures for detecting faulty ammunition and explosives.
- Identifying ammunition and explosives by container markings and color codings.
- Recognizing special hazardous characteristics of current inservice items as well as new items.
- Knowing the proper handling procedures and storage arrangements for the ammunition and explosives.

- Checking and observing placards or signs posted in the magazines.
- Enforcing procedures for magazine security.

## Commanding Officer Responsibilities

The commanding officer is solely responsible for the activity's safe handling, transportation, and storage of explosives, and must exert the same active, aggressive leadership in safety that is exerted in all aspects of the command. The commanding officer also must ensure that all personnel who perform or supervise explosive operations are qualified and certified to perform their jobs and that personnel from other agencies (civilian contractors or other armed services) manage their activities in accordance with established safety rules. The commanding officer is never excused for poor judgment, carelessness, and/or failure of subordinate personnel to follow safety regulations.

## Supervisor Responsibilities

Supervisors must be thoroughly familiar with the provisions of *Ammunition and Explosives Ashore Safety Regulations For Handling, Storing, Production, Renovation and Shipping*, NAVSEA OP 5, Volume 1, and other pertinent publications and directives concerning operations involving ammunition and explosives. As previously mentioned, safety is always the primary factor in any operation. You, as the supervisor, must be constantly alert for, and eliminate, potential hazards that may exist in your work area.

As a supervisor, you have no authority to waive or alter safety regulations; nor may you permit violations of these regulations by other personnel. When the words *shall*, *will*, and *must* are used with ordnance regulations or requirements, they mean *mandatory*, unless exempted by the Chief of Naval Operations (CNO) in accordance with the provisions in *Waivers of Exemption from Explosives Safety Requirements; Policies and Procedures for Requesting*, OPNAVISNT 8023.20. When the words *may* and *should* are used with ordnance regulations or requirements, they mean the requirements shall be followed unless exceptions are authorized by the commanding officer of the shore station.

In accordance with NAVSEA OP 5, a supervisor involved with ammunition and explosives is responsible for complying with all regulations. To accomplish this requirement, you, the supervisor, must take the following actions:

- Explain to all personnel under your immediate supervision the standard safety regulations, industrial hygiene safeguards, and precautions that must be followed; and enforce the observance of all safety regulations by each person. Furthermore, you must explain the characteristics of the ammunition, explosives, and other hazardous materials involved; the selection, use, and care of handling equipment—protective equipment as well as process equipment; and the hazards of fire, explosion, and other catastrophes that the safety regulations and industrial hygiene requirements are intended to eliminate or reduce.

- Instruct and train each person under your immediate supervision in the tasks that they are to perform. Instructions may be given directly or through experienced operators until you are satisfied that the person is capable of performing the work safely. Instructions must include information concerning magazine location, identification, location and use of shelters and bombproof, first-aid kits, fire-fighting apparatus, guards, personal protective equipment, showers, plunges, and neutralizing solutions.

- Ensure that all personnel are certified and qualified to perform the job assigned to them and that their certification is current. You must report promptly to your immediate supervisor all personnel who, in your opinion, are not qualified to perform their assigned tasks. This includes any person engaged in operations involving the storage of ammunition and explosives who is suspected or known to be colorblind.

- Investigate, or assist in the investigation of, all accidents involving operations, equipment, or personnel under your supervision and report, or assist in the preparation of the investigation results for submission to higher authority.

- Identify all persons entering or approaching the work area under your responsibility and determine their authority to enter and/or remain in the area. You must exercise your authority to eject any person whose

presence and/or actions, in your opinion, are detrimental to safety.

- Enforce orders relating to the maximum number of persons permitted in the area. When the total number of persons (including operators, supervisors, inspectors, and transients) exceeds the number permitted in the magazine, magazine area, or work area, you are required to cease operations and to inform the personnel not regularly employed in the area of the excess number. If such notice is not effective in reducing the number of persons to the number permitted, you must suspend operations and promptly notify the appropriate authority. You must also cease operations when the amount of explosives exceeds the permissible quantity until such time that the excess amount is removed.

- Permit the use of only authorized tools and handling equipment for the operations in the manner prescribed by standard operating procedures. As the supervisor, you must require that tools and handling equipment be properly stored in designated locations when not in use. When a tool is lost or misplaced in an operating area or magazine, you must stop operations until the tool is found.

- Maintain cleanliness in the operational area, building, magazine, or magazine area. You must maintain all safeguards and prevent blocking of safety exits, aisles, and access to fire-fighting equipment.

- Forbid major repairs or changes to any magazine, machines, or equipment in operating and magazine areas containing hazardous materials, except in accordance with specific instructions approved by the commanding officer. As the supervisor, you must enforce safety standards in magazines under repair in your area.

- Ascertain, before leaving at the close of work, that all conditions in the operating and magazine area under your control comply with orders relating to operation shutdown. When an operation is not relieved by an oncoming shift, you must make certain that windows and doors are closed and properly locked and that all master power and light switches outside buildings and magazines are turned off. When an oncoming shift relieves an operation or when a supervisor is relieved for any other reason, the off-going supervisor must make a complete report to the relief of any situation that

requires immediate attention or that should be kept under observation.

- Enforce observation of the safety regulations concerning personnel protective clothing and equipment. You must make sure that protective materials (such as goggles, gloves, gauntlets, respirators, aprons, helmets, safety uniforms, safety shoes, and other implements, accessories, and appliances required for the safe performance of the work) are inspected, maintained, and/or replaced, as necessary.

- Be constantly alert for areas where lights, guards, or safety appliances are needed or where repairs are required, and all areas where sprays, showers, shelters, and exits or passageways should be accessible.

- Report in writing to your commanding officer or officer-in-charge any requests, suggestions, or comments you may have about safety standards.

- Alert your immediate supervisor of the need for explosive ordnance disposal (EOD) personnel to remove defective or suspect ammunition from the work area.

### **Technician Responsibilities**

Technicians, or operating personnel, are responsible for reading, understanding, and strictly observing all safety standards, requirements, and precautions applicable to their work or duty. In accordance with NAVSEA OP 5, personnel in operations involving ammunition or explosives must comply with the following regulations:

- Immediately report to your supervisor any unsafe condition, personnel action, or equipment or material that you consider unsafe.

- Immediately warn other personnel when they are in danger by known hazards or by their failure to observe safety precautions.

- Always wear or use approved protective clothing or equipment when it is required.

- Immediately report to your supervisor any injury or evidence of impaired health either to yourself or to others occurring in the course of work or duty.

- Always be prepared, in the event of an unforeseen hazardous occurrence, to give an audible warning to other personnel and to exercise reasonable caution appropriate to the situation.

- Immediately report to your supervisor the presence of unauthorized personnel in the area.

### **GENERAL SAFETY REGULATIONS**

Throughout your Navy career, safety has always been an important part of the job to which you have been assigned. In any ordnance-related rating, safety becomes even more important in your daily activities. Since the number of regulations is too great to include in this chapter, only the general regulations will be discussed in this subsection.

For detailed information on safety regulations, refer to volume 1 of NAVSEA OP 5 and to *Navy Transportation Safety Handbook for Ammunition, Explosives, and Related Hazardous Materials*, NAVSEA OP 2165, Volume 1.

#### **Personnel Limit Regulations**

The maximum number of personnel permitted in a specific area during an operation or situation is known as the *personnel limit*. Supervisors are responsible for ensuring that established personnel limits are not exceeded. When such limits are exceeded, operations must be ceased immediately and the situation corrected.

The number of persons allowed in the vicinity of ammunition or explosives or a given job shall, as much as possible, be kept to the minimum required to properly perform the work safely and efficiently. However, no person shall be permitted to work alone in a location if assistance from another person is not available immediately in the event of an accident.

Commanding officers of ordnance activities determine personnel limits inside and/or in the vicinity of operating buildings, magazines, transfer points, and pier and wharf areas. Normally, the commanding officer of the host command determines the personnel limits for Mobile Mine Assembly Group (MOMAG) facilities. However, these limits may be established on the basis of recommendations by the MOMAG activity.

Some of the factors that must be considered in determining personnel limits are the

- type of building or area involved,
- nature of work involved, and
- degree of hazard present.

Established personnel limits must be strictly enforced to reduce the danger and extent of injury to personnel in case of an accident. In addition to personnel limits, the following requirements must be observed:

- Tasks that are not necessary in the accomplishment of a particular hazardous operation must be prohibited in the immediate vicinity of the hazard.
- Unnecessary personnel must be prohibited from visiting the area.
- The layout of concurrent operations in a building or an area must be subdivided into separate areas of operations or lesser operational hazards. These separate operations should be protected by substantial dividing walls, fire walls, operational shields, or other appropriate barricades.

Placards stating the maximum number of personnel (workers and transients) permitted in an area must be conspicuously posted. The placards must be kept current and must use lettering large enough to be read by persons with average vision as they enter the building, area, or room.

Three-inch minimum-height letters must be used on signs for operating building areas including, but not limited to, inert preparation rooms, assembly rooms, and paint spray rooms.

One-inch minimum-height letters must be used on signs in service magazines, fuzing or defuzing cells, or rooms of similar size used for similar functions.

Personnel limits do not need to be posted in storage magazines, magazine areas, transfer points, and pier and wharf areas.

## **Explosive Limit Regulations**

The maximum amount of ammunition or explosives permitted in a specific area is known as the *explosive limit*. Explosive limits may be expressed as the net weight of the explosives, the number of items, or the number of containers. The explosive limit of a building includes explosive items in vehicles or stored in the adjacent area outside the structure.

As the supervisor, you will be responsible for knowing and enforcing the explosive limits in your working area. If the permissible limit is exceeded, all operations must cease immediately. Only after the excess explosive quantity is removed may the operations continue.

The determination of explosive limits depends on several factors. For magazines, the determining factors are the type of magazine, the hazards involved, and the quantity-distance relationship. For an operating building, the maximum explosive limit is determined by the operational directives that are subject to the applicable quantity-distance requirements in chapter 7 of NAVSEA OP 5.

Explosive limit placards must have lettering large enough to be read by persons with average vision as they enter the building.

Three-inch minimum-height letters must be used for signs in operating building areas including, but not limited to, inert preparation rooms, assembly rooms, finishing rooms, paint spray rooms, and rooms or confined areas of similar size used for similar functions.

One-inch minimum-height letters must be used for signs in service magazines, fuzing and defuzing cells, pyrotechnic mixing and pressing cells, and rooms of similar size used for similar functions.

## **Housekeeping Regulations**

Good housekeeping (cleanliness and orderliness) is necessary for maintaining effective accident and fire prevention programs. All buildings and adjacent areas must be kept clean and orderly at all times. This is especially important in areas involving ammunition, explosives, and other hazardous materials because a

potential danger is already present. As the supervisor, you will be responsible for ensuring that good housekeeping procedures are maintained constantly.

**SMOKING.**— Smoking is prohibited in any magazine, railcar, vehicle, or other conveyance that contains explosives, ammunition, or other hazardous material. Smoking is also prohibited where operations involving such material are in process. Smoking in vehicles that are passing through these areas of operations is not authorized. Designated smoking areas will be established by the commanding officer.

**AISLES AND SAFETY EXITS.**— The aisles in buildings that contain ammunition or explosives must be kept clear. Safety exits such as doors and their outside passageways, ramps, and stairways must not be blocked. All doors and locks must be kept in good working order. Doors must be fastened only with anti-panic catches or approved quick-acting devices during operating hours, when work is scheduled or underway.

**SAFETY EQUIPMENT.**— Access to safety equipment must not be blocked. Such safety equipment consists of fire alarm stations, fire hydrants, fire extinguishers or hoses, protective-clothing lockers, safety showers, building and equipment electrical switches, thermometers, local fire bills, first-aid kit locations, and similar safety equipment.

**TOOLS AND HANDLING EQUIPMENT.**— When not in use, tools must not be left on floors, decks, platforms, scaffolds, stairs, ladders, ledges, rafters, or moving parts of machines or equipment. After use, tools must be collected and returned to the locations designated for their storage. Handling equipment must be neatly arranged and restowed when not in use.

**CLOTHING LOCKERS.**— Clothing not worn during working hours must be kept only in approved clothing lockers in designated locations.

**FLOORS.**— Floors must be kept clean and free of stains such as those caused by exudation of explosives. They must be kept free of oil, grease, and other materials that tend to make them slippery. Floors must not have cracks or crevices where explosives might lodge. Such defects must be repaired as soon as possible after discovery.

## **FIRE PREVENTION AND CONTROL**

Fire is a great hazard to life and property, especially when ammunition and explosives are involved. Because explosives are very sensitive to heat and can react at temperatures lower than those that are required to ignite paper, wood, or fabrics, personnel involved in explosive operations must keep in mind that excessive heat must be prevented. It is the responsibility of all personnel concerned with ammunition and explosives to recognize and observe good practices for the prevention of fires and to thoroughly understand procedures for fighting and controlling fires that involve explosive materials. This subsection discusses fire prevention and control for mine shops and storage facilities.

### **Flame-Producing Devices**

Flame-producing devices, such as matches and cigarette lighters, are not allowed in explosive areas. All personnel involved in storage, handling, and production of ammunition and explosives are not allowed to carry matches or lighters on their person. Only installed electric lighters shall be allowed in smoking areas and these must be of a type that can be lighted only by a positive action such as closing a switch or pressing a button.

### **Motor Vehicles**

Motor vehicles and equipment that use internal combustion engines and that are used in the vicinity of explosives to transport ammunition, explosives, and other hazardous materials must be equipped with a spark- and flame-arresting device in the exhaust system.

### **Refueling**

Motor vehicles that contain ammunition or explosives must not be refueled within magazines or explosive areas. With this in mind, you should ensure that this equipment is fueled before any operation to keep refueling to a minimum. Refueling of gasoline- or diesel-powered materials-handling equipment (MHE) is extremely hazardous when working with explosives or other hazardous materials. If you are involved in sustained operations and the MHE requires refueling, some of the major points you must remember when refueling are as follows:

- Never refuel inside a building.
- Tow the equipment outside for refueling if the fuel supply is exhausted while in the building.
- Accomplish refueling at least 100 feet from the nearest explosives area and at least 20 feet from inert warehouses or buildings.
- Ensure that doors and windows of buildings through which vapors may enter are closed.
- Use the smallest size refueling unit available (500-gallon size or less).
- Ensure that a continuous grounding path is maintained from the tank being filled to the tank being emptied. The entire system must be electrically grounded.
- Ensure that the motors of both pieces of equipment are turned off unless the motor is required for pumping fuel.
- Run equipment motors for a sufficient time after refueling and recapping the tanks to ensure that a fire, which might result from fuel vapors on the equipment, occurs before the return to the operational area.
- Do not, in the event of a fuel spill, restart the motors of either piece of equipment until the fuel tank is capped and the spill is washed down with water or until the equipment is manually moved at least 50 feet from the spill.

**NOTE:** Never direct the contents of a CO<sub>2</sub> fire extinguisher at or into an open fuel tank in the event of a fire. High velocity streams of CO<sub>2</sub> when injected into the concentrated vapors of hydrocarbon fuels (such as JP, gasoline, diesel, etc.), can generate static electricity, despite a grounded fuel hose, and may ignite the fuel vapor and cause an explosion.

### Vegetation

Vegetation such as grass, leaves, undergrowth, and weeds can become a serious fire hazard to structures and facilities. Vegetation can be ignited by sparks from motor vehicles, by careless use of flame-

spark-producing devices, or by lightning. Therefore vegetation near explosive facilities must be controlled. This can be accomplished by chemical weed killers or by cutting, plowing, or burning as necessary or appropriate under the circumstances. Grass and/or brush within 50 feet of explosives operating buildings, magazines, or open storage sites must be kept to a height not to exceed 18 inches.

Gasoline-powered grass cutters may be used on top of earth-covered magazines, but they should be kept at least 5 feet from ventilators and a safe distance from the door. The remaining 5 feet around the ventilator should be cut by hand-powered equipment.

### Fire and Chemical Hazard Symbols

Fires that occur in explosives operating buildings and magazines pose various hazards to fire-fighting personnel. Some explosives detonate when exposed to heat or flames. Others may burn freely, produce poisonous fumes, or ignite when water is applied. To prevent a situation from becoming more hazardous than it might already be, understanding the fire and chemical hazard symbols associated with explosives or other hazardous materials is necessary.

**FIRE SYMBOLS.**— The fire symbols shown in figure 2-1, represent the four class-1 explosives divisions. The hazard decreases as the fire division symbol number increases. These symbols also designate those items that are hazardous to fire-fighting personnel and the burning or explosive characteristics of the stored material. Each of the four symbols has a distinctive shape, is colored orange, and has the class division number shown in the middle of the shape in black. The hazard and fire-fighting precautions for each symbol are summarized in table 4-1 of NAVSEA OP 5, volume 1.

**CHEMICAL HAZARD SYMBOLS.**— Chemical hazard symbols are used to identify operating buildings and storage facilities that contain pyrotechnics and chemical munitions or agents and other hazardous materials. They may be used by themselves or in conjunction with fire symbols, as appropriate. These symbols, shown in figure 2-2, are used specifically for fire-fighting situations and are not necessarily applicable to normal operating conditions. The hazard each symbol

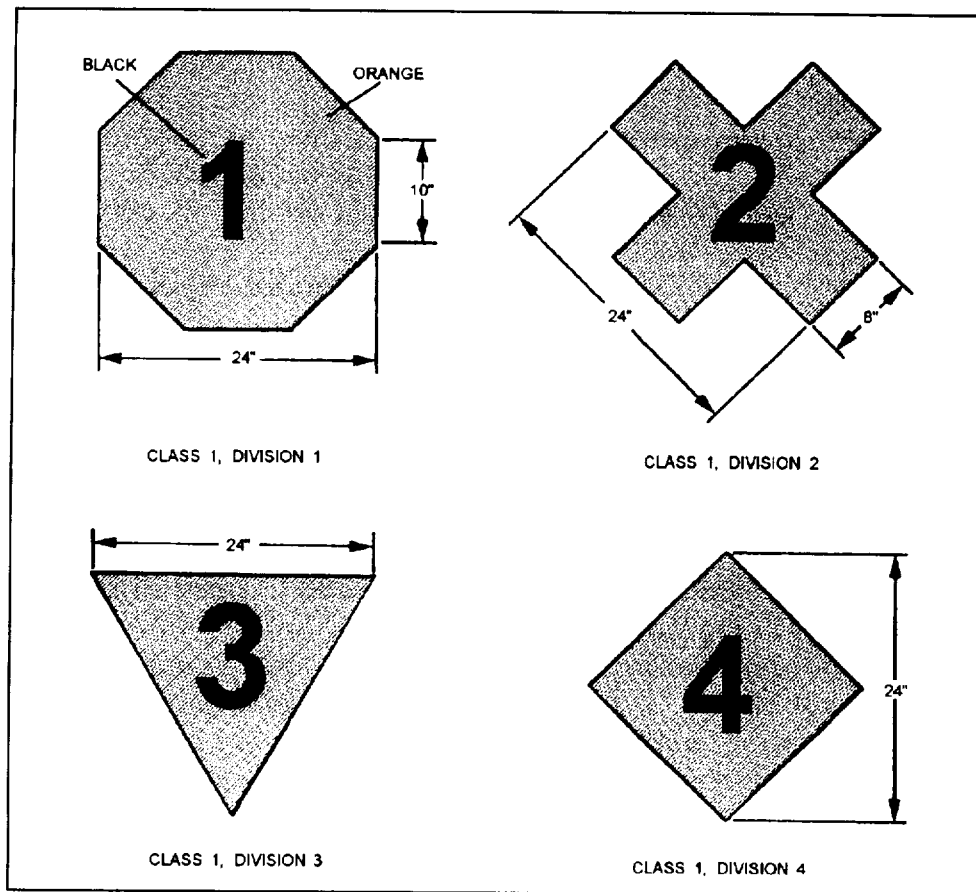


Figure 2-1.—Fire division symbols.

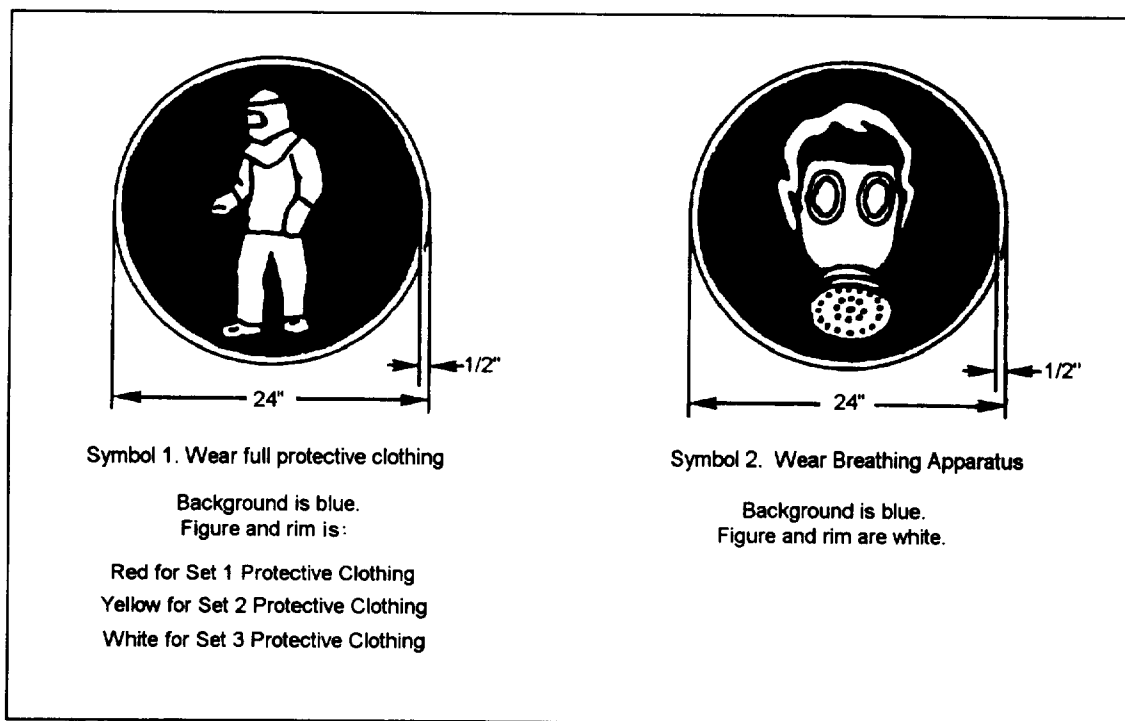


Figure 2-2.—Chemical hazard symbols.



represents and the fire-fighting precautions are summarized in table 4-2 of NAVSEA OP 5, volume 1.

**FIRE-FIGHTING DIRECTION SYMBOL.**— Where pyrotechnics are involved, there are times when the use of water can intensify the fire, the hazard of explosion, and/or the spreading of the fire. The “apply no water” symbol, shown in figure 2-3, is intended to inform fire-fighting personnel of the danger involved in containing the fire.

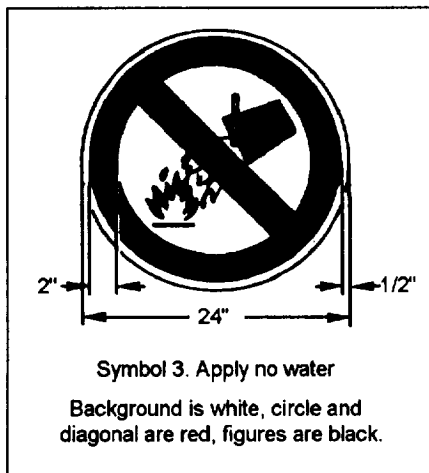


Figure 2-3.—Fire direction symbol.

### Posting Symbols

The symbol(s) that represent the most hazardous material present must be posted outside hazardous materials storage sites and operating buildings unless security considerations make it undesirable to identify the materials present at the location. In those cases, the posting of fire-fighting symbols on chemical sites will be at the discretion of the commanding officer.

A posted symbol must be situated so it is visible during daylight from a distance of at least 500 feet. If visibility is obstructed by vegetation curves in the road, etc., the symbol must be placed on the roadway at a distance of at least 500 feet.

One symbol posted on or near the door end of an igloo magazine or on the head wall of a box-type magazine is normally adequate. One or more symbols may be required on other buildings.

Where all material within a storage area is covered by one fire symbol, the symbol may be posted at the entry control point or the access roadway. Where different classes or divisions of explosives are stored in individual multi-cubicle bays or module cells, they may further be identified by posting the proper symbol on each bay or cell.

Placement of symbols must be coordinated with the fire department. Backing material for symbols should be the shape of the symbol decal and should be noncombustible.

### Magazine Designator

All buildings and magazines of all types, including open storage sites, containing ammunition, explosives, or chemical or inert components normally associated with them, must be marked to provide rapid and positive identification of the facility.

The minimum identification consists of the building number; it must be at least 6 inches high. This number must be displayed on the facility or at the entrance of an open site.

Previously mandatory, but now optional, the magazine designator system consists of a three-group symbol made up of numbers and letters. This system is better described in appendix C of NAVSEA OP 5, volume 1. Stations may elect to continue using the optional facilities identification system if they so desire.

### ELECTRICAL SAFEGUARDS

When personnel are working with explosives or other hazardous materials, consideration must be given to electrical safeguards. Primary, secondary, and static grounding systems are used to protect equipment and personnel from accidental ignition or combustion. This subsection discusses the grounding requirements for a MOMAG activity.

### Power Ground System

The power ground system is used to keep hazardous electrical potentials from developing between equipments. The power ground prevents electrical shock to

personnel and arcing between separate items, and it protects equipment from overvoltage.

### **Instrumentation Ground System**

The instrumentation ground system is used to provide error-free operation of sensitive electronic equipment. It minimizes spurious signals from entering the equipment from electrical distribution systems, lighting, motors, and other instrumentation that might be in the area. This system is normally connected to the secondary ground girdle.

### **Lightning Ground System**

The lightning ground system is used to keep the entire activity at the same potential to prevent arcing between metal objects and to provide a low resistance path to a ground for lightning strikes.

### **Static Ground System**

The static ground system eliminates electric discharges due to static buildup. It conducts the charges to the ground as fast as they are generated. Segments of static ground systems are conductive floors, ground grab bars, and conductive table tops. A static ground system may be connected to water pipes or rods driven into the earth, but it must be interconnected to the secondary ground system.

### **Ordnance Ground System**

The ordnance ground system is used to ensure that electric current does not flow between ordnance components when they come in contact or are mated. The ordnance ground system must be electrically separated from other ground systems and must be connected to the secondary ground girdle at a single point. The use of an ordnance buss connected to a single point is acceptable when several weapons are connected to the ground. Ordnance ground busses, static ground busses, and electrical ground busses must be clearly marked to keep personnel from misidentifying them.

### **Ground System Inspections**

Ordnance ground systems must be visually inspected at least every 6 months to ensure that connections are

secure and free from paint, corrosion, or foreign materials that may impair the efficiency of the system.

### **Ground System Test**

The ordnance ground system must be tested for electrical resistance and continuity upon installation and at least every 24 months thereafter. The results of these tests must be maintained on file for at least five inspection cycles. It is recommended that test records be maintained for longer periods to provide a better database for trend analysis.

## **STORAGE OF AMMUNITION AND EXPLOSIVES**

The proper storage of ammunition and explosives is essential in maintaining them in a ready-for-issue (RFI) condition. Magazines and inert facilities must be inspected and maintained to ensure that they are safe and clean and that they afford the protection necessary to the assets kept by your activity. This section discusses the storage regulations for ordnance and inert material.

### **MAGAZINE REGULATIONS**

Ammunition and explosives must be stored only in magazines or other approved areas designed, designated, and isolated for the particular material. The type and amount of material stored in a magazine or an area are dependent upon quantity-distance (Q-D) and compatibility requirements.

All permanent magazine assignments must be approved by the Naval Sea Systems Command (NAVSEASYS COM). Occasionally, under emergency situations, it may be necessary to temporarily store ammunition or explosives in a structure not constructed as a magazine. Under these situations, the structure should, in all respects, provide adequate protection for the contents and adjacent areas. The structure must also provide adequate protection against moisture and dampness, have adequate ventilation comply with Q-D requirements, and be equipped with approved lightning protection if required. All applicable conditions of magazine storage and security requirements commensurate with the contents of the magazine must be met.

## **MAGAZINE OPERATIONS**

Operations involving ammunition and explosives in magazines and magazine areas are limited to specific types of work. There are permitted and prohibited operations. You must be familiar with the operation and type of work you can perform in the magazine before you start the job. The following subsections are excerpts from volume 1 of NAVSEA OP 5 and are not all inclusive.

### **Permitted Operations**

The following operations are permitted in and around magazines:

- Palletizing for storage or shipment. Not more than four people and two pallet loads may be involved.
- Opening containerized units for visual inspection without removing items from containers.
- Replacing damaged or loose strapping on boxed ammunition.
- Removing bomb nose and tail plugs by hand for visual inspection of cavities and liners.
- Removing minor rust and corrosion, touching up paint, and stenciling non-mass detonating items, but only on loading docks, empty railcars, or motor vehicles outside magazines and away from magazine doors.

### **Prohibited Operations**

The following operations are prohibited inside magazines:

- Fuzing or unfuzing operations.
- Boostering or deboostering bombs.
- Soldering or other heat-producing operations.
- Painting, repainting, stenciling, or restenciling.

- Performing electrical checks or tests on weapons.

## **MAGAZINE EXITS**

At least one door must be open when one or more people are working in a magazine. The exit route must not be blocked. Magazines with self-closing latches must be secured so that they will not swing shut and trap personnel inside.

## **MOTOR VEHICLES AND RAILCARS**

When motor vehicles or railcars are used to transport ammunition or explosives to and from the magazines, they must be unloaded as quickly as practicable.

## **RED FLAG**

A red (Bravo) flag must be prominently displayed at the entrance to each magazine area where personnel are working. At the discretion of the commanding officer, a Bravo flag may also be displayed on each magazine where personnel are working.

## **EXPLOSIVES OPERATING AND ASSEMBLY BUILDINGS**

Hazardous materials should not be allowed to accumulate within an operating or assembly building except for the minimum quantities necessary to maintain operations. However, ammunition and explosives that are part of the work in process within the building may stored overnight in operating and assembly buildings provided the following requirements are strictly observed:

- Approved explosive limits are not exceeded.
- Compatibility requirements are met.
- Explosives, mines, all-up rounds, etc., are not exposed. Containers of bulk explosives or propellants must be properly and securely covered.
- The building must be equipped with an automatic sprinkler system. However, a waiver to this requirement may be obtained from the CNO.

- The building must be specifically included in the security patrol's schedule.
- The fire department must be made aware of the building's content.
- A red (Bravo) flag must be displayed to indicate the presence of ammunition or explosives.

If the operation in a building is to be inactive for a period in excess of 108 hours, all ammunition and explosives must be removed to magazines. Normally, supplies exceeding approximately an 8-hour work requirement must be kept in a ready-service magazine located at an intraline distance from the operating building.

### **MAGAZINE, MAGAZINE AREA, AND STORAGE INSPECTIONS**

All areas used for long- or short-term storage or holding ammunition explosives and/or other hazardous materials must be periodically inspected. At a minimum, magazines must be inspected before initial use, before reuse after being empty, and periodically while in use to ensure that the facilities are capable of safely storing ammunition, explosives, and/or other hazardous materials. The inspection must include an examination of the facility or location, the surrounding area, and the material being stored. The inspection must address, but not be limited to, the following factors:

1. Housekeeping
2. Fire hazards
3. Content compatibility
4. Net explosive weight
5. Grounding system and lightning protection
6. Security systems
7. Physical condition and suitability of the facility, including roads, rail service, and power lines
8. Firebreaks and fire protective equipment
9. Environmental control

10. Content identification, arrangement, segregation, and condition
11. Posting of fire, chemical hazard and safety information, and explosive limits
12. First-aid equipment
13. Alarm systems
14. Unnecessary combustible material
15. Abnormal odors, thermometer condition, and log (if installed)
16. Evidence of tampering, forced entry, or sabotage
17. Current magazine standard operating procedure (SOP)

A log must be maintained to document all deficiencies and corrective actions taken. Mandatory log entries include the date of inspection, the inspection SOP used, the deficiencies detected, and the deficiencies corrected. All entries must be signed.

### **QUANTITY-DISTANCE REQUIREMENTS**

The relationship between the quantity of hazardous material allowed in an area and the separation (safety) distance between such areas is known as *quantity-distance* (QD). Q-D requirements are designated to protect personnel from serious injury or death and all adjacent property from destruction by fires or explosions.

As a Mineman, you normally will not determine the Q-D requirements for an operating building or a storage area. However, you must be aware of the necessity for such requirements and their principles and applications.

### **BASIC Q-D PRINCIPLES**

The principle considerations that form the basis for Q-D requirements are the amount and type of material involved, the segregation of material, the separation

(safety) distance, and the material hazard classification. Volume 1 of NAVSEA OP 5 provides applicable Q-D tables.

### **Quantity of Material**

The potential hazard area surrounding the accumulation of explosives increases as the quantity of explosives increases. Therefore, it is desirable to minimize the quantities of explosives at anyone location. Limits have been established in most cases for the maximum amount of explosives permitted in any one pile and in any one magazine, and the distances that such piles or magazines are to be separated. Whenever practicable, the specified distances should be exceeded to afford greater safety.

### **Type of Material**

The potential dangers involved in the storage of ammunition and explosives are not measured solely by the quantity of explosives stored, but also by the kind of explosives. Ammunition and explosives used by the Navy are classified into certain broad subdivisions, or groups, for storage purposes. The materials within each group present the same general type of hazard and are, therefore, stored in the same general manner.

### **Segregation of Material**

Some explosives are more hazardous than others, and some are potentially more hazardous when stored with others. Therefore, the segregation of certain types of ammunition and explosives is imperative. Magazines of different sizes and designs are used, depending on the characteristic of the material to be stored.

### **Separation Distance**

The distance separating the location of one explosives location from another explosives location, and from inhabited buildings or facilities, determines the permissible amount of explosives at any location. Separation distances are measured along a straight line from the outside of the nearest wall of the structure containing explosives, or the nearest wall of the controlling subdivision when the structure is subdivided. Subdivisions are used within a structure to prevent mass detonation of material within the structure.

## **Hazard Classification**

The hazard classification system is based on a system established for international use by the United Nations Organization (UNO). The UNO system consists of nine classes of dangerous material. The nine classes and the types of hazardous materials involved are shown in table 7-1 of NAVSEA OP 5, volume 1.

You will deal primarily with hazard class-1 material (ammunition and explosives, Department of Transportation (DOT) classes A, B, and C; blasting agents). The ammunition and explosives hazard class 1 is further subdivided into six divisions. These divisions are based on the characteristics and predominance of the associated hazards and on the potential for causing personnel casualties or property damage. The divisions and types of hazards expected are as follows:

1. Division Designator 1—Mass detonating
2. Division Designator 2—Non-mass detonating, fragment producing
3. Division Designator 3—Mass fire
4. Division Designator 4—Moderate fire, no blast
5. Division Designator 5—Very insensitive
6. Division Designator 6—Extremely insensitive

## **STORAGE COMPATIBILITY**

The assignment of class-1 ammunition and explosives into six divisions does not necessarily mean that the different items in a division may be stored or transported together. Compatibility groups determine storage and transportation compatibility for rail and motor modes, while the class and division designators determine segregation requirements for carriage by vessels. Explosive articles that differ in minor respects maybe assigned to different divisions if their predominate hazards differ.

### **Storage Compatibility Groups**

A compatibility group accompanies the hazard class to complete the hazard classification designation.

Ammunition and explosives are assigned to a compatibility group when they can be stored and transported together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident. Ammunition and explosives are assigned to 1 of 13 compatibility groups; mines and their explosive-loaded components fall into 6 of these groups.

### **Storage Compatibility Tables**

All ammunition, explosives, and related hazardous materials must be stored by compatibility group. Different types of ammunition and explosives, by item and division, may be mixed in storage if they are compatible and, as required, are authorized for mixed storage by the NAVSEASYS COM. Criteria for permissible storage of different kinds of explosives is given in NAVSEA OP 5, volume 1. Mixing of compatibility groups in storage is permitted in accordance with *Transportation and Storage Data for Ammunition, Explosives and Related Hazardous Materials*, NAVSEA SW020-AC-SAF-010, providing the material is in its proper packaging configuration.

### **EXEMPTIONS AND WAIVERS**

Exemptions and waivers are written authorizations that allow specific deviations from mandatory requirements. The difference between the two is the time period for which the deviation is granted. Normally, an exemption is granted for a period of 5 years or less, whereas a waiver is granted for a period of 2 years or less.

The procedures for requesting exemptions and waivers concerning ammunition and explosive requirements are contained in OPNAVINST 8023.20. All such requests are submitted to the CNO, via the chain of command and the Commander, Naval Sea Systems Command (COMNAVSEASYS COM).

Activities granted exemptions and waivers must periodically review the necessity for the deviations. Existing exemptions and waivers must be revalidated every 5 and 2 years, respectively, in accordance with OPNAVINST 8023.20 and NAVSEA OP 5, volume 1. If an existing exemption or waiver is no longer

required, the CNO must be informed so the exemption or waiver can be canceled.

## **HANDLING EQUIPMENT**

Accidents that occur during the handling of hazardous material can cause destruction of essential material, injuries, and sometimes death. Many accidents are caused by lack of knowledge, by not using the proper equipment for the job, and by careless operations. You must ensure that when you are involved in handling ammunition and explosives, you have a thorough understanding of the operation and of the hazards involved in the use of the equipment. This section discusses industrial materials-handling equipment, ordnance-handling equipment, and dollies.

### **INDUSTRIAL MATERIALS-HANDLING EQUIPMENT**

Industrial materials-handling equipment (MHE) for use in ammunition- and explosives-handling operations includes forklift trucks, pallet trucks, platform trucks, crane trucks, warehouse tractors, and warehouse trailers. This equipment is classified by types based on their use. The following subsections discuss the types, selection and use, operation and maintenance, and repair of MHE.

#### **Equipment Types**

Industrial MHE approved for specific uses is assigned a standard alphabetical type designation that identifies its fire and explosion safety features and its power source. These designators appear on the sides and the rear of each piece of MHE. The type designations are as follows:

- Type D—diesel powered; minimum acceptable safeguards against fire hazards.
- Type DS—diesel powered; additional safeguards to exhaust, fuel, and electrical systems.
- Type EE—electrically powered; safeguards against igniting fire or explosion; electric motor and all other electrical equipment are completely enclosed. Generally referred to as *spark enclosed*.

- Type EX for Class I—electrically powered; all electrical fixtures and equipment constructed and assembled so that the truck may be used in certain atmospheres that contain flammable vapors. Generally referred to as *explosion proof*.

- Type EX for Class II—electrically powered; all electrical fixtures and equipment constructed and assembled so that the truck may be used in atmospheres containing combustible dust. Generally referred to as *ignition proof*.

- Type G—gasoline powered; minimum acceptable safeguards against igniting fire or explosion.

- Type GS—gasoline powered; additional safeguards to exhaust, fuel, and electrical systems over type G.

- Type H—hand powered.

- Type HS—hand powered; electrically conductive nonsparking wheels or ground strap.

Always select the proper equipment for the operation. Generally, the EE- and EX-type equipments are used in operations that involve handling ammunition and explosives inside buildings. The DS- and GS-type equipments are normally used in open areas or areas with adequate forced ventilation.

### Equipment Markings

MHE that is used for handling ammunition and explosives is painted solid yellow, with the exception of explosion-proof trucks and tractors. These are painted yellow with 6-inch blue diagonal stripes at 45 degrees across each side and on the rear. Also the designation (EE, DS, etc.) is painted in 4-inch black block letters on both sides and at the rear of all equipment. The equipment's safe working load (SW), weight test date, and vehicle weight must be clearly printed on an appropriate space that is in view of the operator.

### Operator Safety

Personnel who operate MHE must observe the following safety precautions:

- Check the condition of the MHE before starting periodically during use, and after securing for the day.
- Only qualified personnel who are properly trained and licensed are to operate MHE.
- When the engine is shut off, set the brake, and lower the forks to the deck when leaving the equipment unattended.
- Do not allow anyone to stand or walk under any elevated portion of the equipment.
- Keep arms and legs inside the running lines of the equipment.
- Do not put arms or legs between the uprights of the mast.
- Do not use MHE for opening or closing doors.
- Do not remove overhead guards without permission of the safety officer.
- Always ensure that the load is balanced and secured and does not exceed the capacity of the forklift.

**NOTE:** This is not a complete listing of safety regulations. Ensure that you are familiar with the contents of volume 1 of NAVSEA OP 5, and *Handling Ammunition, Explosives, and Hazardous Materials with Industrial Handling Equipment (MHE)*, NAVSEA OP 4098.

### Equipment Testing

Periodic testing and frequent inspections of MHE is essential if equipment reliability and safety are to be maintained. Frequency of tests for shore activities must not exceed 500 operational hours of use or 12 months, whichever occurs first. These tests must also be performed before placing the equipment into service or whenever components are changed or repaired. A log must be maintained by the testing activity for each piece of equipment tested, indicating date, place, by whom, and disposition of each deficiency. This log must remain

with the equipment if it is assigned to another activity. For further information on testing of MHE, refer to NAVSEA OP 4098.

### Explosives Drivers

Personnel involved in transporting hazardous materials must meet certain qualifications to be certified as an explosives driver. These qualifications are as follows:

- The driver must be at least 18 years of age for on-station movement, and 21 years of age for off-station movement.
- The driver must have a valid state driver's license. It need not necessarily have been issued by the state where the activity is located.
- The driver must have a physical every 2 years and have a medical examiner's certificate.
- The driver must have an explosives driver identification card (Standard Form 46), which must be noted with *Explosives Driver*.
- All explosives drivers must receive at least 12 hours of instruction and training in driving trucks and tractors, handling and transporting hazardous materials, regulations and procedures pertaining to transporting hazardous materials, properly using fire extinguishers, and completing and filing required reports.

### ORDNANCE-HANDLING EQUIPMENT

The handling of ammunition, explosives, and other hazardous materials should be kept to a minimum. However, when handling is necessary, use properly tested and tagged equipment designed for the task.

Except as otherwise indicated, portable ordnance-handling equipment used ashore must be tested annually at 40 percent of the equipment's design load. This testing schedule must be followed for all ordnance-lifting equipment, unless specifically exempted by higher authority.

Equipment that has satisfactorily passed the periodic load test requirements must have the name of the testing facility, the date tested, and the safe working load (SWL) stenciled in legible, contrasting colored paint on a conspicuous surface, or this information may be stamped or etched on a tag that is securely attached to the equipment. See figure 2-4. New ordnance-handling equipment received in original packaging if an inspection shows that the equipment is free of defects, may have the test date changed to the current date without retest. A record of each periodic test must be maintained by the facility performing the periodic test,

For further information regarding the testing of ordnance-handling equipment, refer to *Periodic Testing Arrangements for Ordnance Handling Equipment*, NAVSEA SG420-AP-MMA-010.

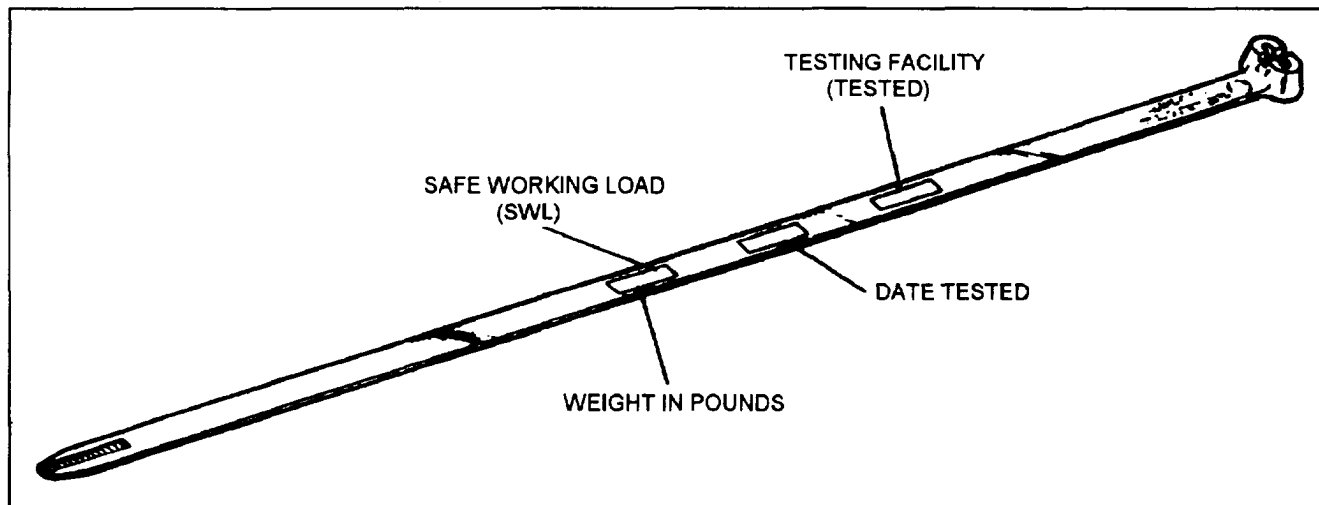


Figure 2-4.—Weight test inspection tag.



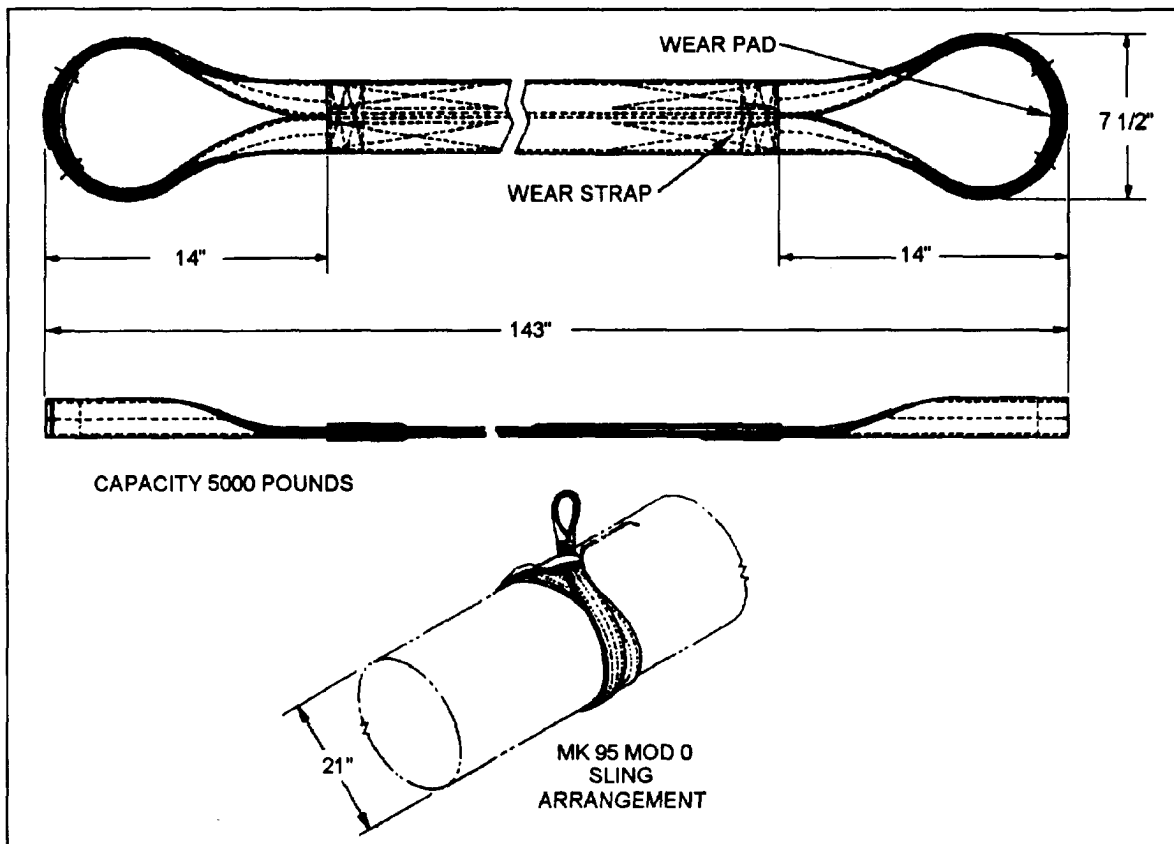


Figure 2-5.—Mk 95 Mod 0 torpedo sling.

Lifting equipment used for handling ammunition and explosives, specifically mines, includes adapters, booms, hoists, lifting attachments, and slings. The following subsections discuss various types of handling equipment and their uses.

### Slings

In the assembly areas, slings are used mainly for crating, uncrating, and marrying various sections of the mines. They are used for shipboard loading and off-loading of mines at dockside and for transferring the mines between ships at sea. Slings can be classified into the following two groups:

1. Nonmetallic nylon slings form a choker hitch around the body of the mine or the mine component.
2. Multiple-leg, wire-rope slings are shackled or safety-hooked to lugs, rings, eyebolts, or lifting eyes. They are either an integral part of the load or are attached temporarily during handling.

Before you use any ordnance-handling equipment, you should verify that it has been tested and that the test date is current. Inspect the equipment for evidence of wear, such as frayed threads, broken stitches, cuts, damaged cables, loose fasteners, missing safety keepers, bent hooks, etc. If any such damage is noted, remove the equipment from service.

**MK 95 MOD 0 TORPEDO SLING.**— Although its nomenclature indicates it is used with torpedoes, this sling is also used with other cylindrically shaped weapons that are 21 inches in diameter and within its rated lifting capacity of 5,000 pounds. Fabricated of nylon webbing with a loop that is reinforced with a leather pad at each end, the sling is used for loading the Mk 67 mine aboard submarines. As shown in figure 2-5, the sling is wound twice around the mine with one loop inserted through the other to form a double-wrap choker hitch. The loops are reinforced with leather wear pads, and both sides of the body have nylon wear straps so that either side may bear directly against the mine without chafing.

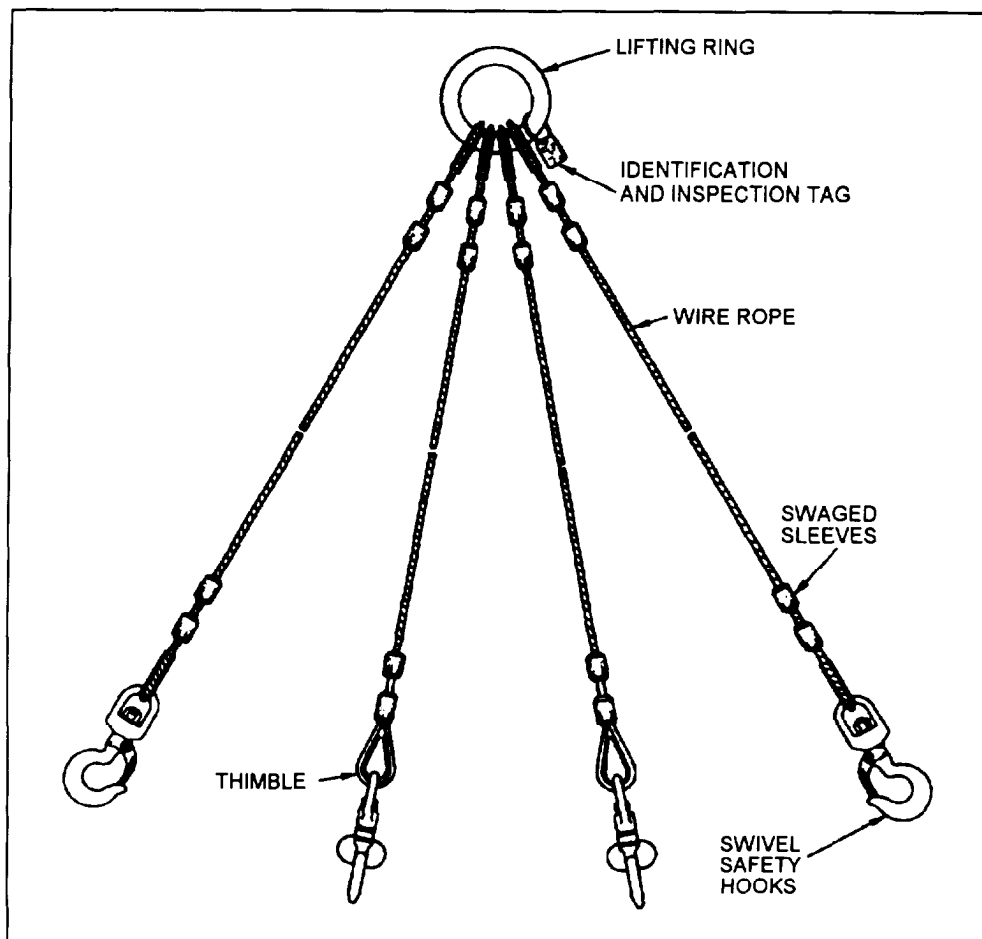


Figure 2-6.—Mk 99 Mod 0 weapons-handling sling.

**MK 99 MOD 0 WEAPONS-HANDLING SLING.**— The Mk 99 Mod 0 weapons-handling sling is used at dockside and aboard ammunition ships for loading combatant ships with crated mines and palletized unit loads of mines. This sling, shown in figure 2-6, consists of four swiveled safety hooks, each attached to a flexible, galvanized 1/2-inch, wire-rope leg. The four legs are joined to a 5 1/2-inch lifting ring that is compatible with standard cargo lifting gear used at dockside or aboard ammunition ships. Its rated lifting capacity is 6,000 pounds. The sling is used for lifting one crated Mk 56 mine or two Mk 55 mines in parallel by the suspension lugs.

**MK 101 MOD 0 MINE SLING.**— Except for its shorter length, the Mk 101 Mod 0 mine sling, shown in figure 2-7, is similar to the Mk 95 Mod 0 torpedo sling.

It is used for lifting the Mk 56 mine in and out of its shipping crate and for hoisting operations when marrying or disassembling sections of the Mk 56 mine. The sling is made of nylon webbing and has a loop at each end. One loop is reinforced with a leather wear pad and should always interface with the hoisting equipment. The sling is wrapped once around the body of the mine to form a single-wrap choker hitch so that the reinforced loop is positioned to engage the hoisting equipment. This sling's lifting capacity is 5,000 pounds.

**MK 111 MOD 0 SLING.**— The Mk 111 Mod 0 sling is constructed in the same manner and of the same materials as the Mk 95 and Mk 101 slings. As shown in figure 2-8, it is a single-wrap sling used for hoisting operations when marrying or disassembling sections of the Mk 67 mine. The sling's lifting capacity is 5,000 pounds.

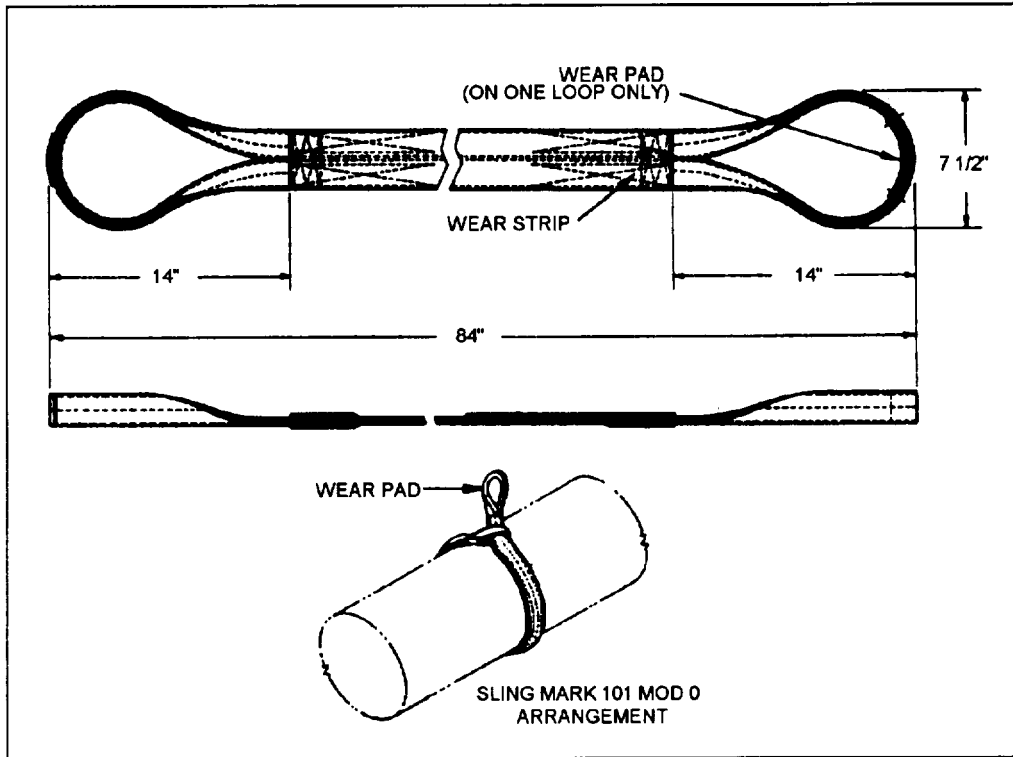


Figure 2-7.—Mk 101 Mod 0 mine sling.

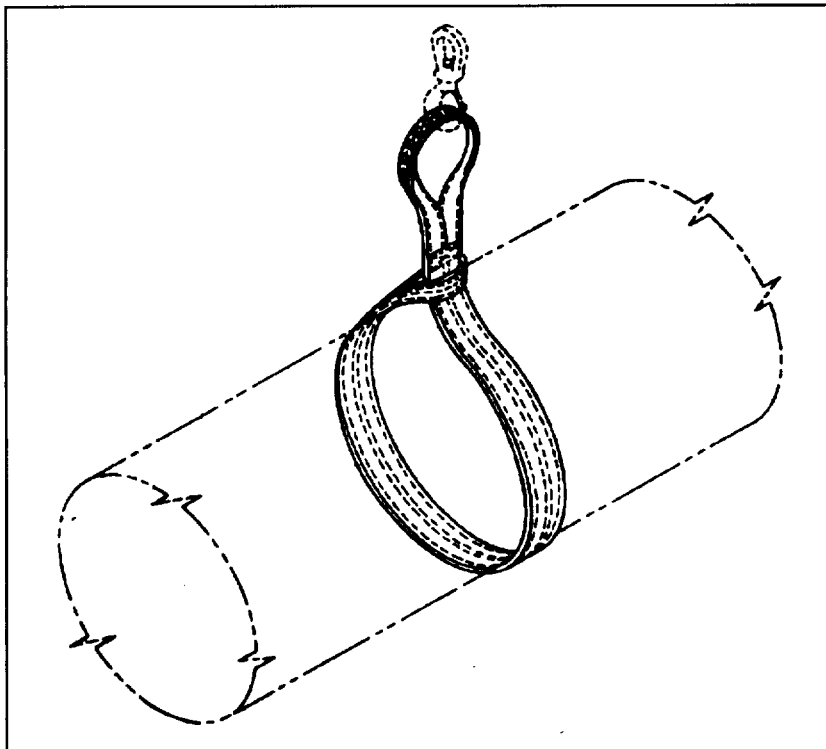


Figure 2-8.—Mk 111 Mod 0 sling.

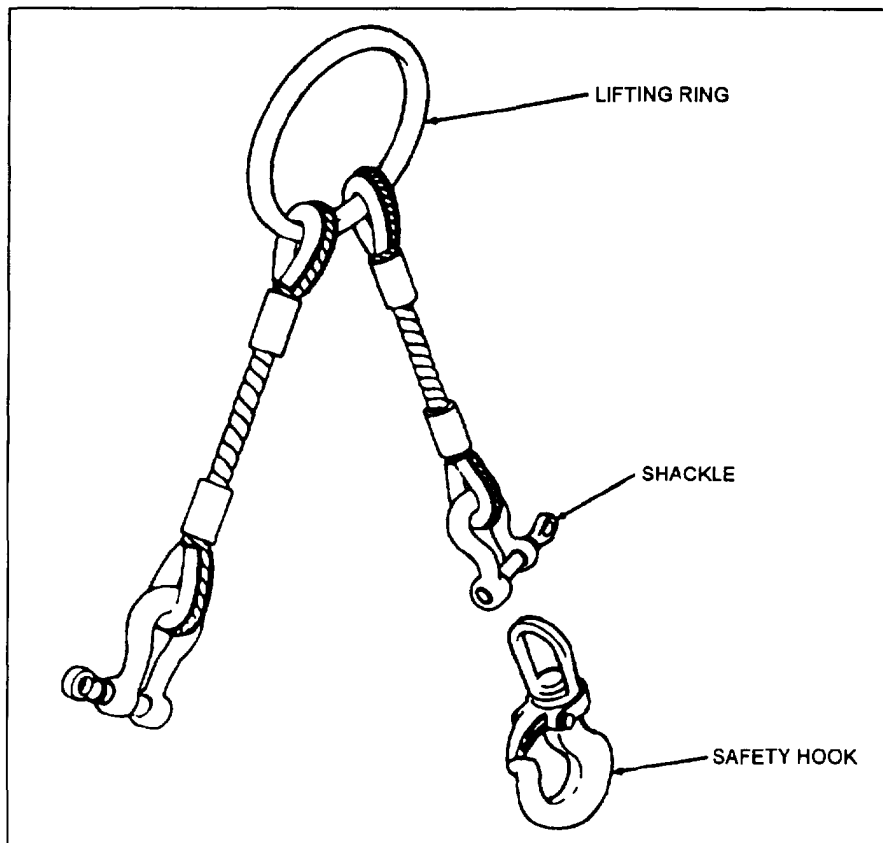


Figure 2-9.—Mk 115 Mod 0 weapons-handling sling.

**MK 115 MOD 0 WEAPONS-HANDLING SLING.**— The Mk 115 Mod 0 weapons-handling sling consists of two 1/2-inch wire ropes, 18 inches long, joined at one end by a 5 1/2-inch steel lifting ring. The other ends of the legs are terminated with shackles. Safety hooks are supplied with the sling. The Mk 115 Mod 0 sling shown in figure 2-9, is used for the general handling of the Mk 56 mine anchor and for hoisting operations when marrying or disassembling the anchor section and the mechanism section of the Mk 56 mine. The sling's lifting capacity is 2,500 pounds.

### Lifting Devices

In conjunction with hoists, lifting devices are used for handling mines and mine components in shop areas and magazines, both ashore and on board ship. Some examples of devices that make up this group of mine-handling equipment are carriers, lifting plates, lifting rings, and eyebolts.

**MK 49 MOD 1 WEAPON CARRIER.**— The Mk 49 Mod 1 weapon carrier is used as a lifting attachment for hoisting mines with suspension lugs spaced 14 inches apart. The steel-plated carrier, shown in figure 2-10, has a lifting capacity of 2,500 pounds and has four hoisting points and two attaching studs. A fixed stud is at one end of the strongback, and a pivoting stud is at the other end. They are locked in place on the mine by a quick-release pin.

**MK 55 MOD 1 WEAPON CARRIER.**— The Mk 55 Mod 1 weapon carrier is used to handle mines with suspension lugs spaced 30 inches apart. The carrier, shown in figure 2-11, has a lifting capacity of 3,000 pounds. It consists of two aluminum side plates and two stationary steel hooks; one hook has a spring-loaded steel safety latch. A quick-release pin secures the latch in the locked position. A lifting eye is centered on the top of the carrier.

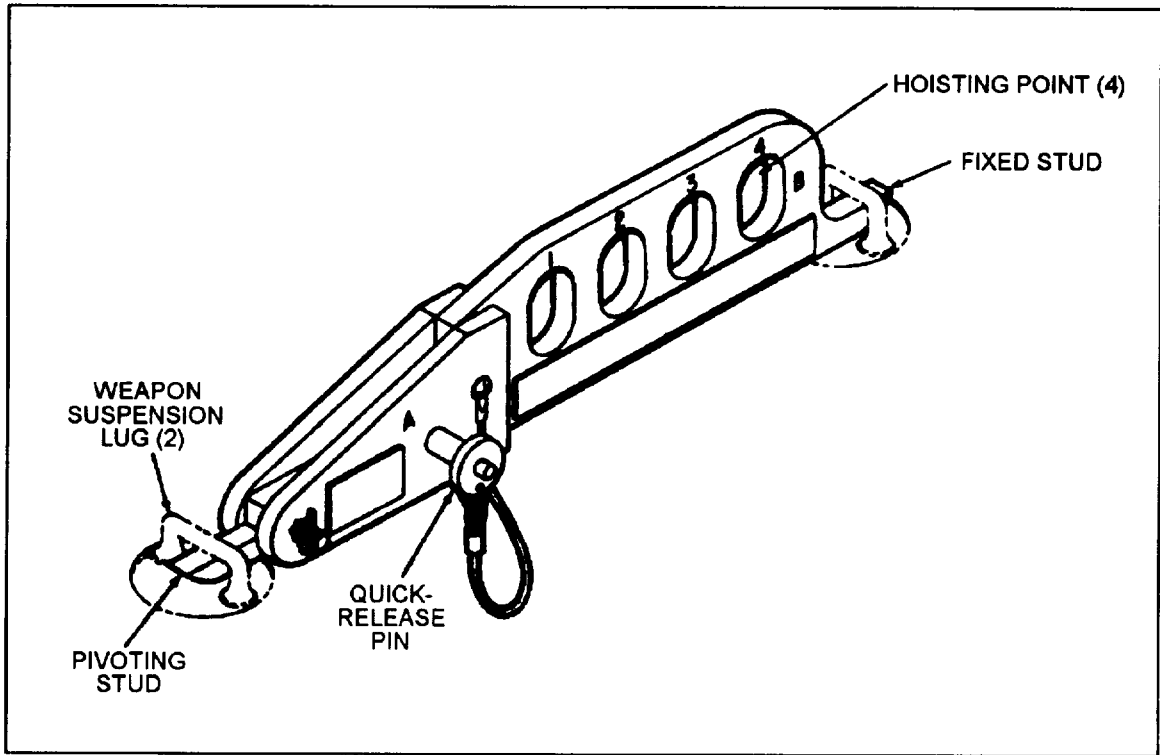


Figure 2-10.—Mk 49 Mod 1 weapon carrier.

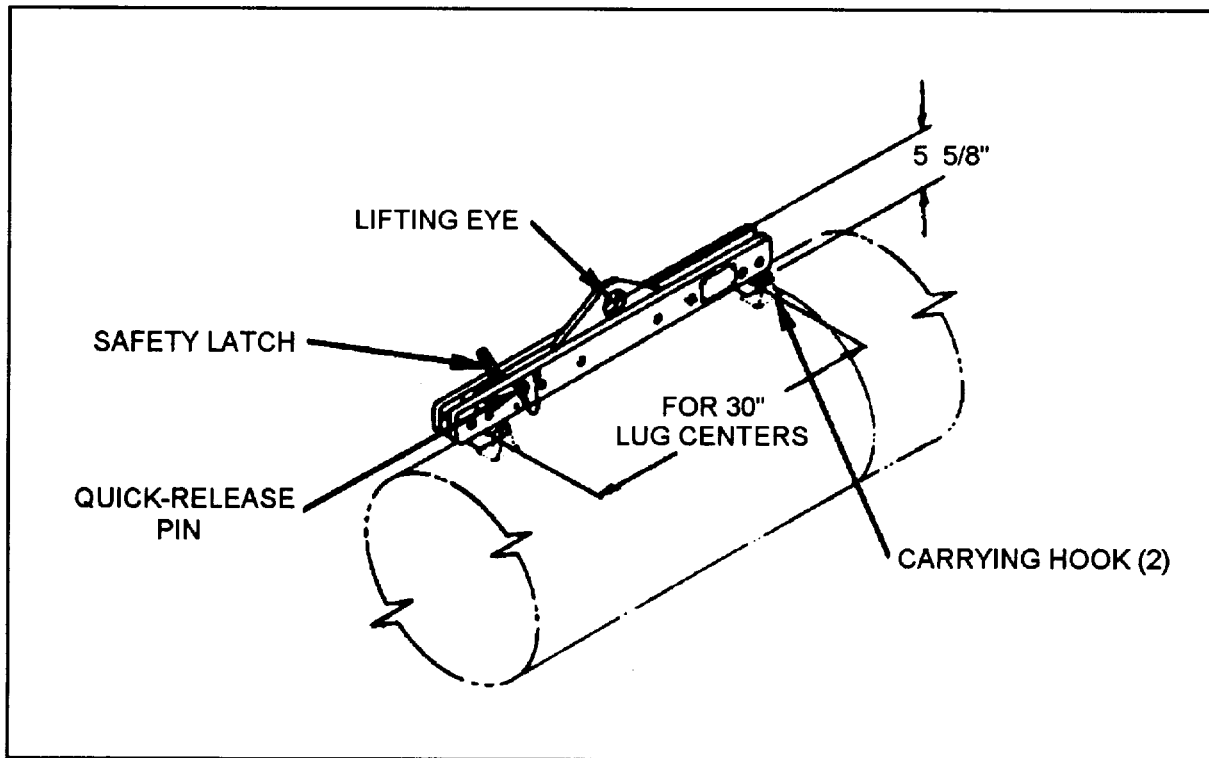


Figure 2-11.—Mk 55 Mod 1 weapon carrier.

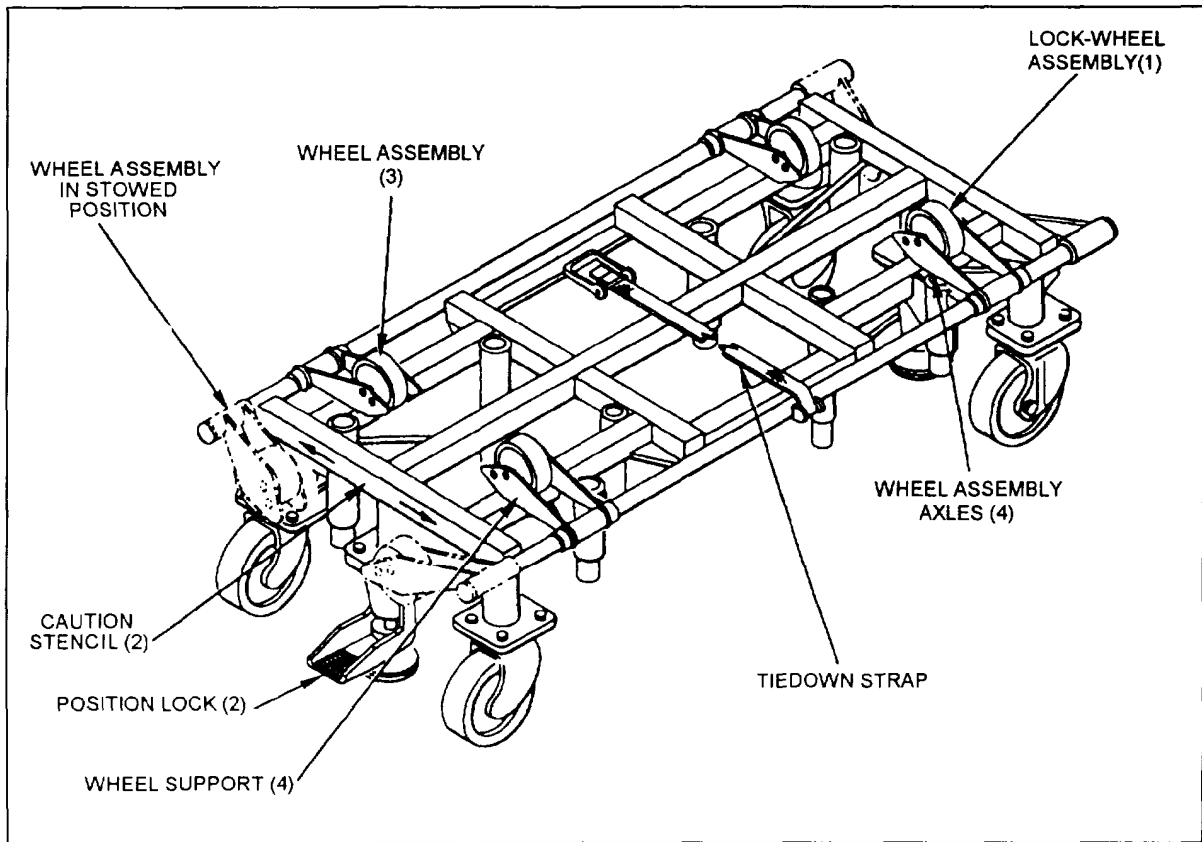


Figure 2-12.—Mk 11 Mod 1 weapons dolly.

## DOLLIES

Dollies are used for moving mines and mine components (either crated or uncrated) for short distances in the mine shop assembly areas. They are also used as stands or stationary fixtures during assembly, test, inspection, repair, or replacement of parts. For example, the placement of a mine section directly under a hoist hook for subsequent marriage to other sections, or the positioning of mine sections for installation of smaller components, is usually accomplished with dollies. In certain instances, dollies are also used for marrying major mine components.

### Mk 11 Weapons Dolly

The Mk 11 weapons dolly is used for moving major mine sections to the hoists in the shop where marriage to other sections is accomplished. It is also used for the assembly, handling, maintenance, and testing of Mk 56,

Mk 60, and Mk 65 service mines and most exercise and training assets.

The dolly, shown in figure 2-12, is constructed of welded tubular steel and has a 3,000-pound capacity. Its caster wheels allow it to be maneuvered in any direction. Adjustable wheel assemblies provide bearing surfaces for cylindrical weapons from 9 to 22 1/2 inches in diameter. When unlocked, the wheel assemblies permit rotation of the loads to positions convenient for installing smaller components. Load rotation is restricted by locking one of the wheel assemblies (lock-wheel assembly) with a locking screw that seats in any one of the index holes in the associated wheel support.

The improved Mk 11 Mod 1 weapons dolly has a welded gusset on each wheel support to prevent spreading. It also has support beams that run the entire length of the dolly. This eliminates the tool tray found on the Mk 11 Mod 0 dolly, but gives better wheel support

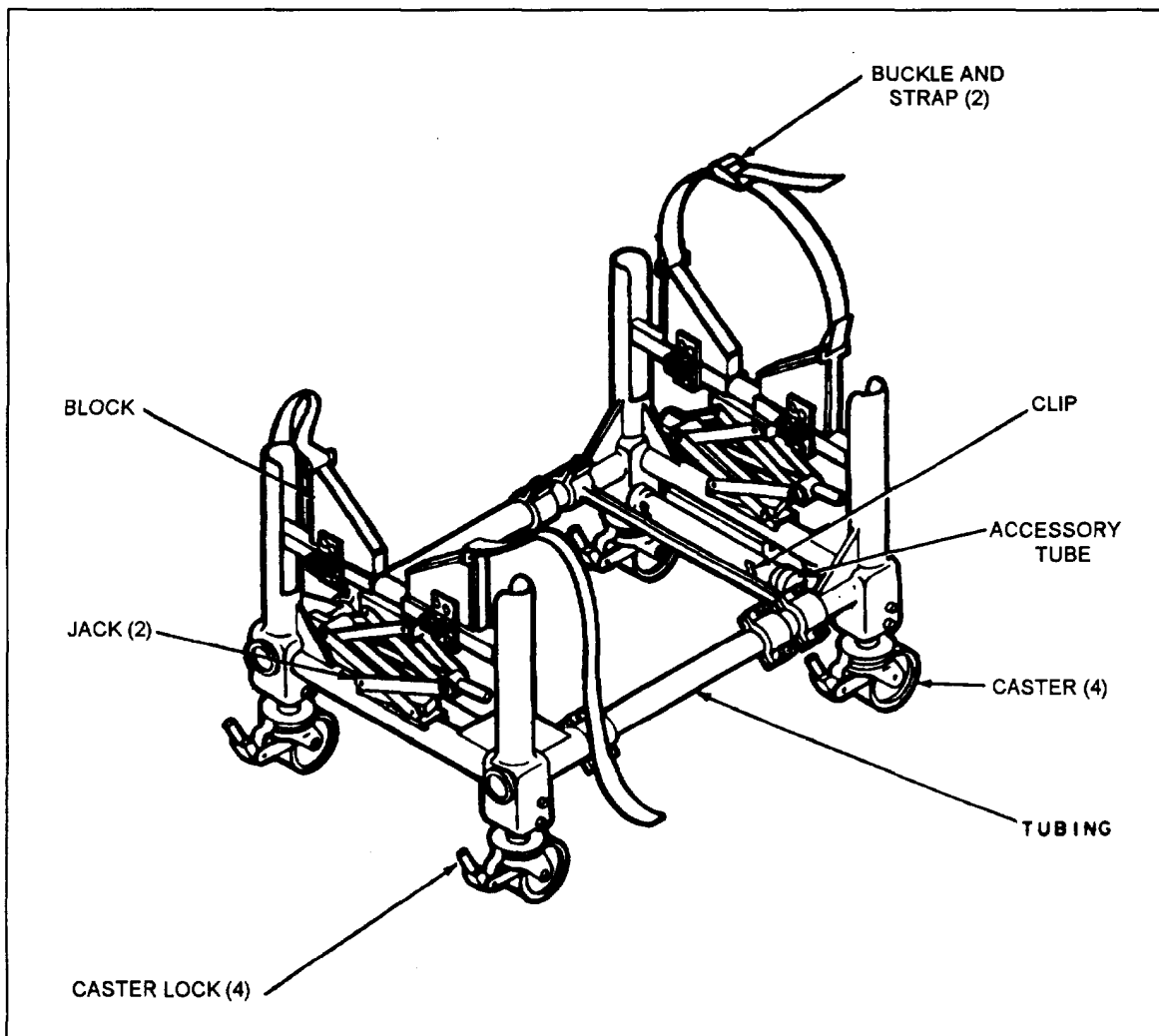


Figure 2-13.—Mk 21 Mod 0 dolly.

for the full length of the dolly. The Mk 11 Mod 0 dolly is obsolescent.

The Mk 11 weapons dolly has an instruction plate that shows the proper wheel axle positions for various diameter mines. Position locks under each end of the dolly anchor it to the deck and permit it to be used as a stationary work platform. A tiedown strap secures the load. When handling crated mines, stow the wheel assemblies below the bed at each end of the dolly.

#### Mk 21 Mod 0 Dolly

The Mk21 Mod 0 dolly (formerly called the universal dolly) is ideal for handling cylindrical mine sections of various lengths and diameters. It is used for the general

handling of explosive sections of Mk 56 and Mk 67 mines, as well as the various other sections of the Mk 67 mine. Its height is adjustable, between 18 1/2 inches and 28 inches, and its length can also be adjusted, between 10 1/2 inches and 46 1/2 inches, depending on the section supported. The Mk 21 dolly, shown in figure 2-13, is constructed of tubular aluminum and has a capacity of 1,600 pounds. It is equipped with lockable casters and clips that hold the accessory extension tubes when they are not in use.

#### AERO 51B MUNITIONS TRAILER

The Aero 51B munitions trailer is a flat-bed trailer used for intrabase transportation of small quantities of

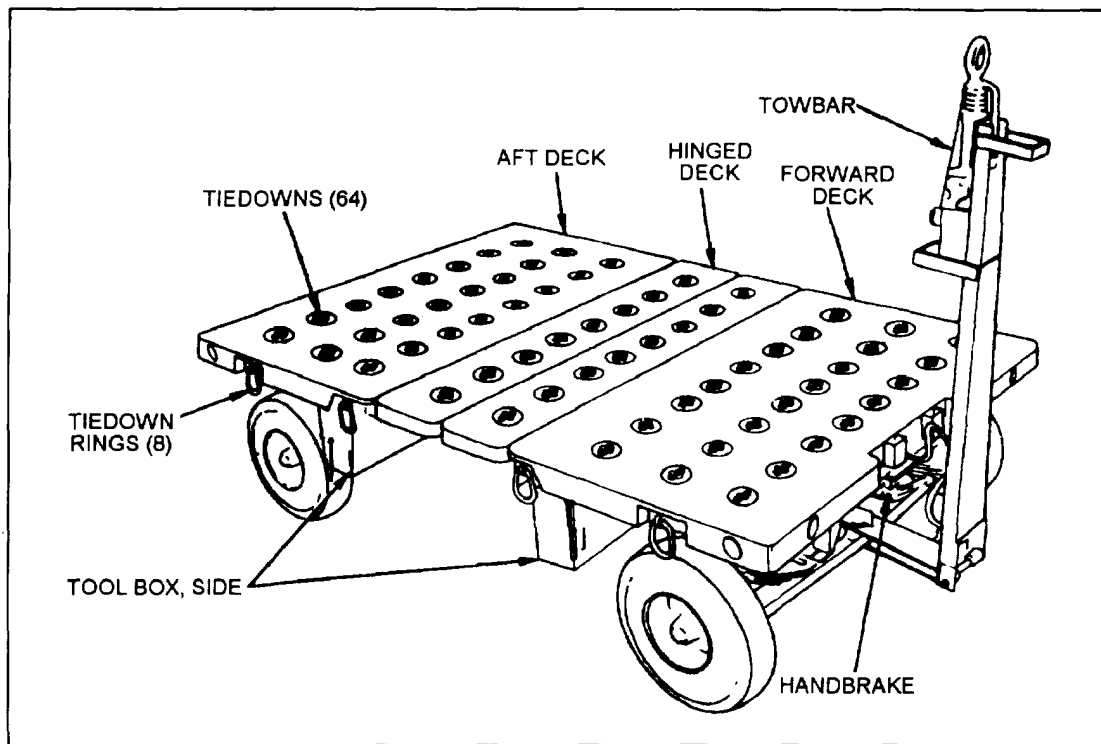


Figure 2-14.—Aero 51B munitions trailer.

mines and destructors between magazines, assembly shops, staging areas, airfields, and dockside locations, depending on the distance. The trailer, shown in figure 2-14, has an automotive-type chassis with two axles and four single wheels. It is equipped with hydraulic-surge brakes as well as mechanical parking brakes. A tow bar and a cable harness are provided for connection to any of a variety of tractors and trucks. Accessory items (such as chocks, tiedown straps, and an interconnecting electrical harness) are stored in toolboxes mounted underneath the forward and aft sections of the bed. The center section of the bed is hinged and can be opened to provide a hatchway across the full width of the trailer. Hinged bed panels have double rails with holes at intervals to provide a mounting base for chocks and roller adapters.

The Aero 51B trailer has a capacity of 8,500 pounds and can be towed in trains of not more than three. Maximum towing speed of one trailer is 20 miles per hour (mph); however, if more than one trailer is being towed, the maximum speed is 10 mph.

#### GANTRY A-FRAME

The gantry A-frame is used for suspending one portion of a mine when moving to another. It has two trolleys and two air or chain hoists suspended from a 15-foot I-beam supported at each end by a steel A-frame. The working height of the gantry is adjustable between approximate heights from 10 to 17 feet by the operation of four independent spring-loaded bolts and jacks attached to the A-frame legs. The spring-loaded bolts seat into located holes in the telescoping legs of the A-frame.

Adjusting the height of the A-frame requires first that each jack be wound tautly to assure support of each leg. Then the four spring-loaded bolts are pulled out of their respective locating holes and held tensioned by the insertion of ball-lock pins. The jacks are operated simultaneously to maintain the necessary length of the legs of the A-frame at any given time, thereby ensuring maximum gantry stability. When the A-frame is within approximately 4 inches of its desired height, the ball-lock pins are removed, allowing the spring-loaded bolts to



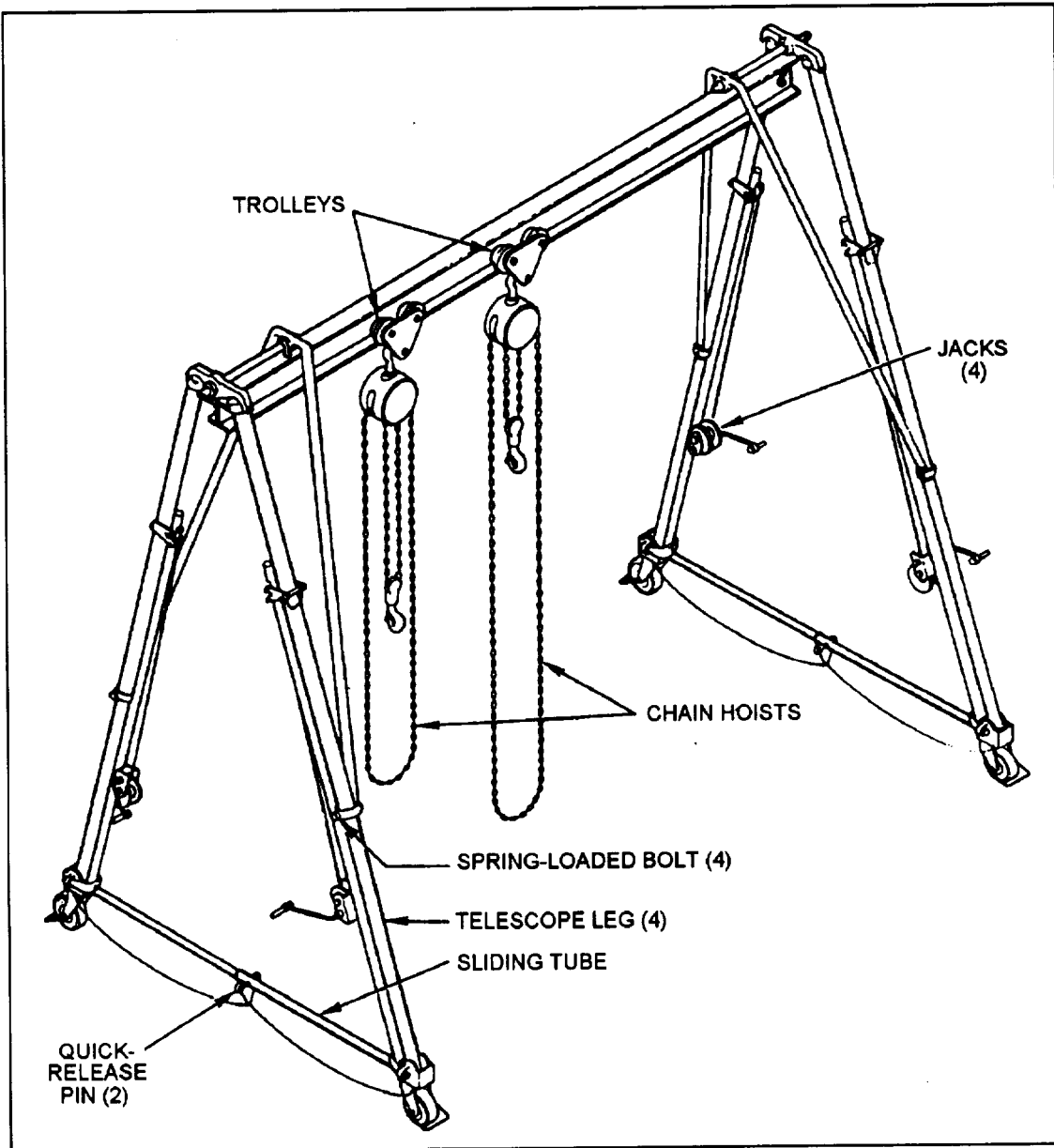


Figure 2-15.—Gantry A-frame.

press against the telescoping legs. The spring-loaded bolts snap into their respective locating holes when the desired height is reached.

Removal of a quick-release pin from the sliding tube that forms the base of the A-frame permits the frame to be spread to any one of four positions. Reinsertion of the quick-release pin maintains the tube in a fixed position. The four 8-inch casters permit easy

maneuvering of the entire structure either indoors or outdoors. The hoists can be positioned anywhere along the I-beam. The trolley wheels travel on its bottom flange.

The safe working load of the gantry A-frame, shown in figure 2-15, is either 3,000 or 4,000 pounds, depending on the hoists used. However, the 4,000-pound capacity must NEVER be exceeded.

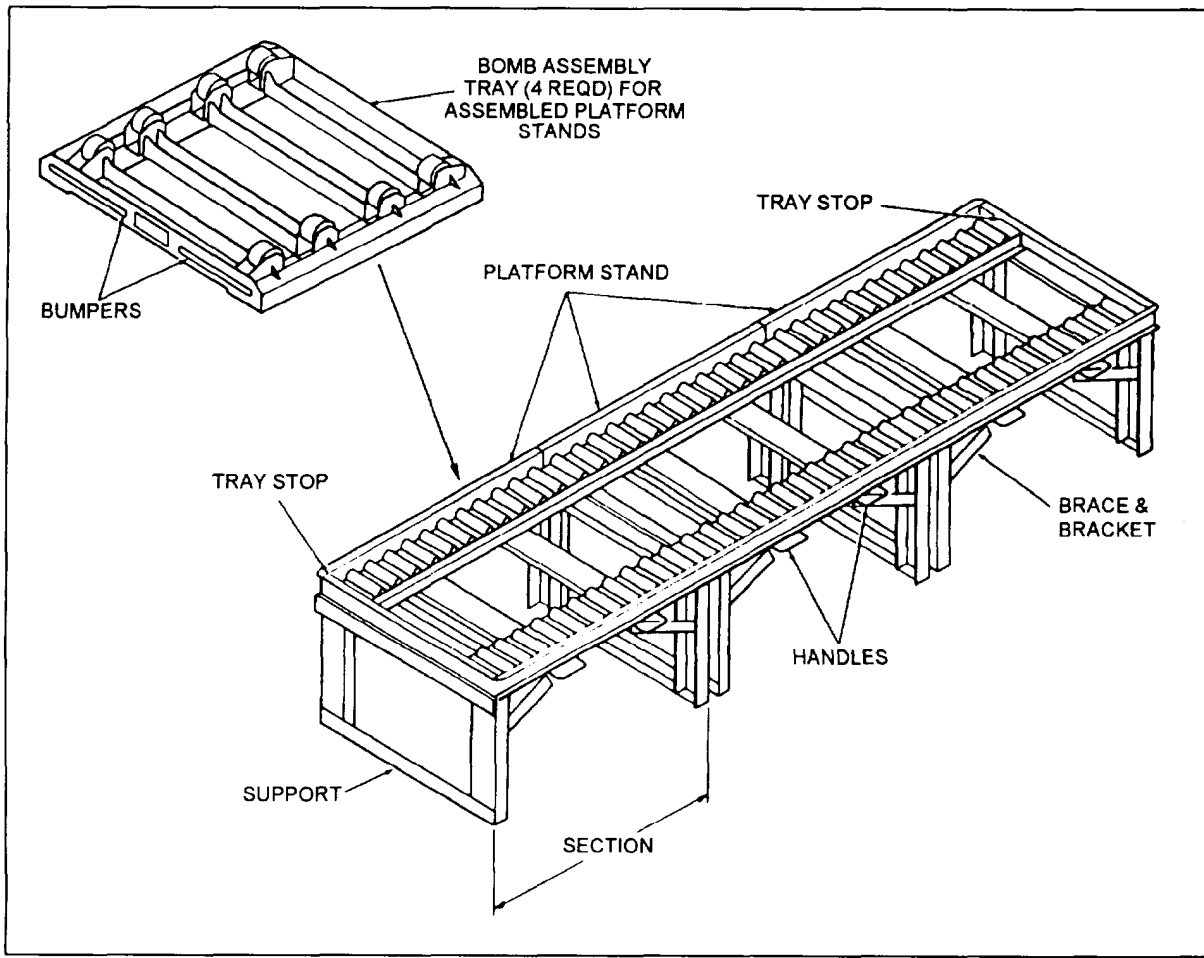


Figure 2-16.—Bomb assembly stand.

### BOMB ASSEMBLY STAND

The bomb assembly stand provides a working height platform in magazine or bomb assembly areas upon which bombs of various weights and sizes can be assembled. The stand, shown in figure 2-16, consists of three table assemblies and four tray assemblies. The table assemblies are structured frame weldments with folding leg weldments at each end that, after erection, are secured together with the center table assembly to form one complete table assembly. The top of the table assembly has two rows of industrial-type rollers and stops at the ends of the completely assembled table. The trays are also structural frame weldments with rollers on top that support and permit a 360-degree rotation of any bomb being assembled.

Maintenance and testing of the stand must be in accordance with *Periodic Maintenance Requirements Manual*, NAVSEA AG-220BO-MRC-010. In addition to these requirements, the stand must be tested anytime it is reassembled.

### RECOMMENDED READING LIST

**NOTE:** Although the following references were current when this TRAMAN was published, their continued currency cannot be assured. Therefore, you need to be sure that you are studying the latest revision.

*Ammunition and Explosives Ashore, Safety Regulations for Handling, Storing, Production, Renovation, and*

*Shipping*, NAVSEA OP 5, Volume 1, Naval Sea Systems Command, Washington, D.C., 1990.

*Bomb Assembly Platform Stand, A/F32K-1A Part Number 551AS100-1 and Small Bomb Assembly Platform Stand A/F32K-10 Part Number 551AS200-1*, NAVAIR 19-15-27, Naval Air Systems Command, Washington, D.C., 1989.

*Handling Ammunition, Explosives, and Hazardous Materials with Industrial Materials Handling Equipment*, NAVSEA OP 4098, Naval Sea Systems Command, Washington, D.C., 1976.

*Handling, Packaging, Storing, and Transportation of Underwater Mines and Destroyers for Shore-Based/Shipboard Operations*, NAVSEA

SW023-AB-WHS-010, Naval Sea Systems Command, Washington, D.C., 1990.

*Mine Components A through C; Description and Class-B Criteria*, NAVSEA SW550-AA-MMI-010, Naval Sea Systems Command, Washington, D.C., 1988.

*Motor Vehicle Driver's Handbook, Ammunition, Explosives, and Hazardous Materials*, NAVSEA OP 2239, Naval Sea Systems Command, Washington D.C., 1980.

*Periodic Testing Arrangements for Ordnance Handling Equipment*, NAVSEASG420-AP-MMA-010, Naval Sea Systems Command, Washington, D.C., 1990.

