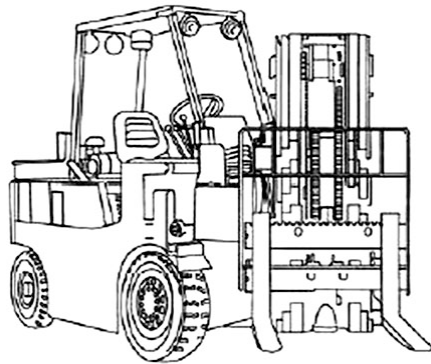


# **CDC 2W051B**

## **Munitions Systems Journeyman**

### **Volume 1. General Maintenance and Handling Equipment**



**Air Force Career Development Academy  
The Air University  
Air Education and Training Command (AETC)**

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CAREER DEVELOPMENT COURSE (CDC) 2W051B, *Munitions Systems Journeyman*, has three volumes. Volume 1, *General Maintenance and Handling Equipment*, contains information on the general tools you use to build munitions. It also covers the trailers, vehicles, and handling equipment used for munitions on the flight line and the munitions storage area. Volume 2, *Conventional Munitions*, discusses general munitions principles and aerospace and ground munitions. Volume 3, *Precision Guided Munitions*, covers guided bombs, air-to-ground missiles, and air-to-air missiles.

This first volume of CDC 2W051B pertains to general maintenance and support equipment. The subjects covered range from the use of power tools to procedures involving movement of nuclear weapons.

Unit 1 covers the use of power tools, specialized equipment, munitions handling vehicles, nonpowered, and powered handling equipment.

Unit 2 examines the use of ammunition loading systems and the munitions assembly conveyor.

Unit 3 contains information on the movement of munitions and requirements to configure, load, position, and tie down conventional munitions. Unit 3 also covers nuclear certified weapons handling equipment; as well as the principles for movement and loading of nuclear weapons.

A glossary is included for your use.

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**NOTE:**

In this volume, the subject matter is divided into self-contained units. A unit menu begins each unit, identifying the lesson headings and numbers. After reading the unit menu page and unit introduction, study the section, answer the self-test questions, and compare your answers with those given at the end of the unit. Then complete the unit review exercises.

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# Unit 1. General Maintenance and Support Equipment

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**H**OW MANY TIMES have you heard “use the right tool for the right job”? In other words, you do not use a screwdriver as a pry bar to open boxes. This also holds true for support equipment and handling vehicles. For instance, you should never use a forklift to tow a munitions trailer. The success of each combat mission lies in the ability of maintenance and munitions personnel to provide the aircrew with fully mission capable products. To accomplish this, not only does the end item need to be free of defects, but we must ensure that all ground and handling equipment delivered to the flightline is fully operational as well. Applying proper maintenance and operating procedures in an efficient and conscientious manner will help achieve this. In this unit, you will learn about different types of tools, munitions handling trailers, equipment, and vehicles necessary to complete your mission in a quality manner.

## 1-1. Tools and Lifting Equipment

Using and caring for power tools requires greater diligence than is needed for common hand tools. Power tools, as a general rule, are much more dangerous, complex, and expensive. Their use by inexperienced personnel could damage equipment and cause personal injury. Some of the power tools you must learn to use are drills, impact wrenches, and circular saws.

### 001. Electric tools

Whether you are working in the comfort of a maintenance facility or in the middle of a desert, it is much easier and faster to use electrically powered tools than to work by hand. Our main focus on job accomplishment is the quality of the end product and the length of time it takes to complete the task. In this lesson, we look at the most common electric tools you use in the munitions storage area.

## Drills

In the maintenance area, you use drills similar to the one shown in figure 1-1. These drills function in much the same manner as the hand drill, except that the power is furnished by electricity. Electric drills are designed to drill holes in wood, metal, plastics, and so forth.

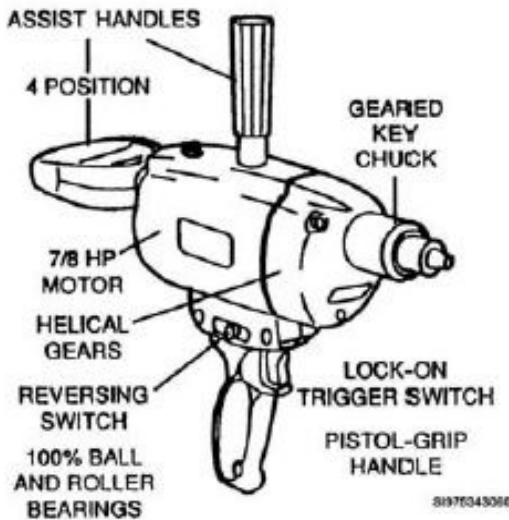


Figure 1-1. Typical electric drill.

Before using a drill, first make sure the diameter of the hole to be drilled is within the capacity of the drill you have selected. For example, you do not use a 1/4 inch electric drill to drill a 3-inch hole in a case section. Even if the drill bit would fit the drill, it would seriously overload the drill and cause it to stall out, possibly resulting in a damaged case section or a broken drill bit. After you select the proper size drill, make sure the power source is adequate and the ground connections are secure.

As a standard safety precaution, always disconnect the drill from the power source when installing or changing drill bits. With the power disconnected, insert the shank of the drill bit into the chuck of the drill. Secure the drill bit firmly by tightening the chuck using the chuck key. Many drills now have an automatic tightening chuck, which requires you to

simply hold the chuck by hand while applying light pressure on the drill trigger switch until the drill bit is secure. Do not make the mistake of holding the chuck of a drill that requires a chuck key or injury will result.

Before drilling in metal or other hard substances, use a center punch to mark the exact center of the hole you want to drill. This punch mark provides a start for the point of the drill bit. Place the drill bit with its point in the previously marked center. Depress the trigger switch and exert a light forward pressure to feed the drill bit into the work. Apply a few drops of oil to the drill bit frequently while drilling in metal. This minimizes the frictional heat developed during drilling. Lubricants are a necessity in many drilling operations. The use of cutting lubricant increases the drilling speed and the drill bit life.

Upon completion of the drilling operation, remove the drill from the work *without* stopping the drill. When the drill bit is clear of the work, stop the drill by releasing the trigger switch. Drills are primarily designed for drilling holes; however, the operational procedures just outlined are applicable when using them for reaming, counterboring, and so forth.

## Grinders

A typical bench grinder, found in the maintenance area, is used for such operations as sharpening chisels or screwdrivers, removing excess metal from work, or smoothing metal surfaces. A grinder may be fitted with both a medium-grain and a fine-grain abrasive wheel. The medium wheel is satisfactory for rough grinding; that is, grinding where you must remove a considerable amount of metal or grinding where a smooth finish is not important. If you are sharpening tools or are grinding to close specifications, use the fine wheel; it removes the metal slowly and gives the work a smooth finish. Additionally, it does not generate enough heat to temper the cutting edges of tools. The grinding wheels are removable, and most bench grinders are made so that wire brushes, polishing wheels, or buffing wheels can be substituted for them.

At a minimum, always use eye and face protection when using a grinder. Jobs involving certain materials and prolonged use will require additional personal protective equipment (PPE) such as shop aprons and/or gloves. A safety apparatus protects your eyes from flying chips of stone and metal. And in the



case of bench grinders equipped with wire wheels, the wires come loose and fly off as the wheel is used. In fact, it is not unusual to finish wire-wheeling something and find a couple of wires stuck in your clothing. Just imagine what they could do to your eyes or face without the proper safety protection.

### Electric Saws

A circular saw, like the one shown in figure 1-2, consists of a sturdy motor in a high-impact plastic or metal housing with a pistol-grip handle and a circular saw blade. The on-off switch is built into the handle. The saw illustrated has an angle adjustment (angle adjustment thumbscrew) to tilt the base of the saw for sawing at different angles. There are also both a depth adjustment knob and a ripping guard. The bottom plate of the base is flat and wide enough to support the saw on the lumber being cut. The circular saw blade is covered by a spring guard (telescoping blade guard) and has a blade guard control lever; the guard opens (telescopes) when sawing. This guard is usually designed to snap back automatically when the cut is finished to protect both the blade and the saw operator. Saw blades for the circular saw range from 4 inches to 14 inches in diameter, with the 8-inch blade being the most commonly found in the maintenance activity. These blades are held in place by a saw clamp screw and flange. The blades are also available with teeth specifically designed for crosscutting or ripping.

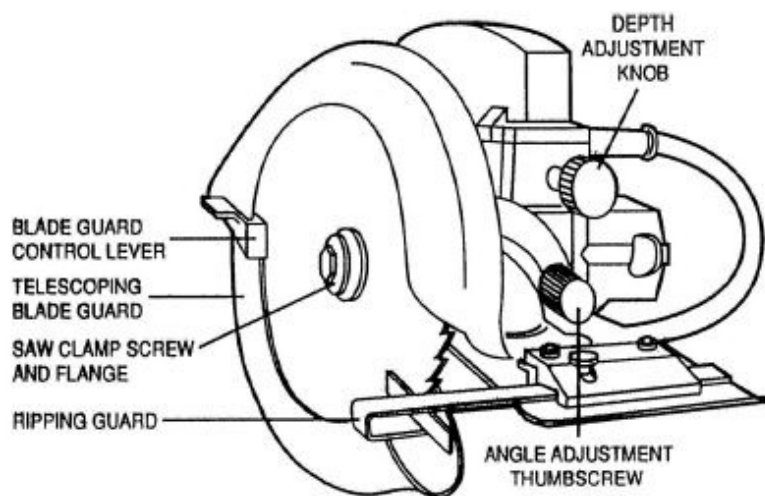


Figure 1-2. Typical electric circular saw.

Set the guide on the saw to the correct angle and depth of cut. Make sure the material is secured firmly and will not shift before cutting. Press the switch trigger in the handle to start the saw. The saw blade must be revolving at *full* speed before it contacts the material being cut. Keep your hands, legs, and other parts of your body away from underneath the work surface, since the guard on the portion of the blade under the work has been slid back to allow the saw to cut.

If the blade becomes dull or nicked, replace it with a new one. It is inefficient and dangerous to use a dull or nicked blade. When you replace a blade, make sure the teeth are in the proper cutting direction. The teeth should point upward and toward the front of the saw. Most blades have the instruction "THIS SIDE OUT" stamped on them. Use the correct blade for the material being cut. The wrong blade is as dangerous as a dull blade. You can burn up the saw by working it too hard and possibly destroy the material you are cutting.

### 002. Pneumatic tools

Portable pneumatic power tools look similar to electric power tools, but they use compressed air instead of electricity to operate. You may use pneumatic tools in missile maintenance, conventional munitions, or precision-guided munitions maintenance elements. These tools are also the primary source for building munitions on the munitions assembly conveyor (MAC) system. The air source for

the use of pneumatic tools comes from an internal facility source (built-in compressor) or a portable compressor like the MC-7. In this lesson, we discuss the safe use and maintenance of pneumatic tools and the most common pneumatic tool you use—the impact wrench.

### Safety

Take the following precautionary measures when working with pneumatic tools:

- Inspect the air hose for cracks or other defects. If you identify defects, make repairs or replace the hose before placing it into service.
- Before connecting the air hose to the air outlet fitting, open the control valve momentarily. Next, connect the hose to the fitting and open the valve again momentarily; this ensures the hose is clear of water and other foreign material.
- Stop the flow of air to a pneumatic tool by closing the control valve at the compressed air outlet before connecting, disconnecting, adjusting, replacing, or repairing a pneumatic tool.
- When using sockets, make sure they are designed specifically for pneumatic tools (impact sockets). Non-pneumatic accessories cannot withstand the stresses of pneumatic equipment and will result in damaged equipment and injury to personnel.

### Maintenance

Keep your tools ready for use at all times by regularly inspecting and repairing minor faults immediately. Follow these guidelines to keep your pneumatic tools serviceable:

- Keep pneumatic tools properly lubricated. (Refer to the specific tool technical order (TO) or instruction book for lubricating procedures.)
- Make sure that 90 pounds per square inch (psi) of clean, dry air is available at the tool end of the air hose to operate the tool safely and efficiently.
- Always use the proper size hose and fittings to avoid restricting and reducing airflow.

### Pneumatic impact wrench

The most common pneumatic tool you use is the impact wrench. This tool installs or removes nuts and bolts. The wrench comes in different sizes and is classified by the size of the square anvil on the drive end. The anvil has a socket lock, which is a spring-loaded ball bearing, used to keep the socket or attachments from flying off while in use. The wrench also has a built-in adjustable air valve regulator that adjusts the torque output of the wrench. The torque regulator reduces the possibility of shearing or damaging threads when installing nuts and bolts. When using an impact wrench, a variation in excess of  $\pm 5$  lbs. of pressure can be serious. Lower pressure causes a decrease in the driving speeds, while higher pressure causes the wrench to over-speed and places abnormal wear on the motor impact mechanism. Most wrenches have a trigger for starting and stopping. Also, located in close proximity to the trigger is a stem that controls the direction the anvil turns. The stem has letters stamped or engraved on it with *F* for forward, and *R* for reverse.

### 003. Lifting devices

Besides vehicular forklifts, the *most common* type of lifting device you will encounter is the overhead hoist. Many maintenance areas have an electric/hydraulic overhead hoist built into the building or a manual chain hoist like that on the A/E32K-3 Munitions Assembly Conveyor (MAC). Specific guidance on how to operate a particular crane/hoist depends on the make, model, and manufacturer. An operator's manual is normally provided with this type of equipment. Familiarity of the manual and equipment to be used are prerequisites of safe operation. Before using a lifting device, operators and maintenance personnel should read and be thoroughly familiar with the operator's manual and all publications supplied with the equipment. In this lesson, we discuss different safety precautions while using lifting devices and the use and inspection of the wire-rope sling.

## Safety precautions

While operating lifting devices, all personnel involved in a given project, including the operator, spotters, hand-line handlers, and supervisors must practice good safety habits to avoid accidents.

Consider the following safety precautions before you start any overhead lifting operation:

- Operators who must divert their attention while operating a hoist will stop the hoist.
- When an AF Form 979, *Danger* tag is attached to the power/starting controls the hoist operator will not apply power to the unit or start operations until the condition has been corrected.
- The operator must make certain all personnel are clear of the area before operation.
- The operator will be familiar with the equipment and its proper care.
- The rated capacity will not be exceeded except for properly authorized tests.
- The load will be attached to the hook, equipped with a safety latch, by means of slings or other devices designed specifically for the load being lifted.
- The load will not be moved or lifted more than a few inches until it is well balanced in a sling or lifting device and center of gravity is known.
- A hoist will not be used for hoisting personnel unless it has been specifically designed for that purpose and only if it is the safest means of available.
- The operator will not carry loads over personnel or leave a suspended load unattended.
- Excessive inching (rapid, repeated starts and stops) of hoist controls should be avoided. Premature wear or possible uncontrolled movement could occur.
- Protective helmets (hard hats) and safety-toed boots will be worn.
- Gloves will be worn by workers performing hooking, unhooking, loading, or unloading operations.

## Wire-rope slings

In your career, you will come across many different types of lifting slings. These slings are made of different types of material (steel chain, wire rope, metal mesh, synthetic webbing, etc.), each having its own peculiarities for use and safety. The most common sling you use is the wire rope, as shown in figure 1-3. Wire ropes can be used in handling all general-purpose (GP) bombs, cluster bomb units (CBU), and even missiles.

However, you do not use these slings by themselves. They must be used in conjunction with a forklift, jammer (bomb lift truck), over-head hoist, or crane. As with any piece of equipment, the first step before using a sling is to inspect it for serviceability. Use AFOSH Standard 91-46, *Materials Handling and Storage Equipment*, to inspect for serviceability; if any of the following conditions exist, do not use the sling until it is repaired or replaced:

- Ten broken wires in one rope lay, or five broken wires in one strand in one rope lay.
- Wear or scraping of one-third the original diameter of outside individual wires.
- Kinking, crushing, or any other damage resulting in distortion of the wire rope.
- Any evidence of heat/fire damage.
- End attachments that are cracked, deformed, or worn.
- Hooks that have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook. Hook inspection areas are shown in figure 1-4.

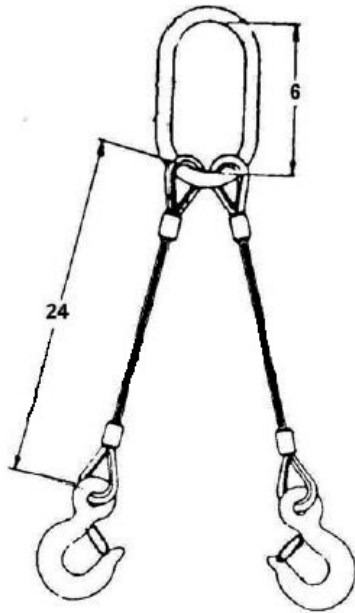


Figure 1-3. Bomb sling assembly.

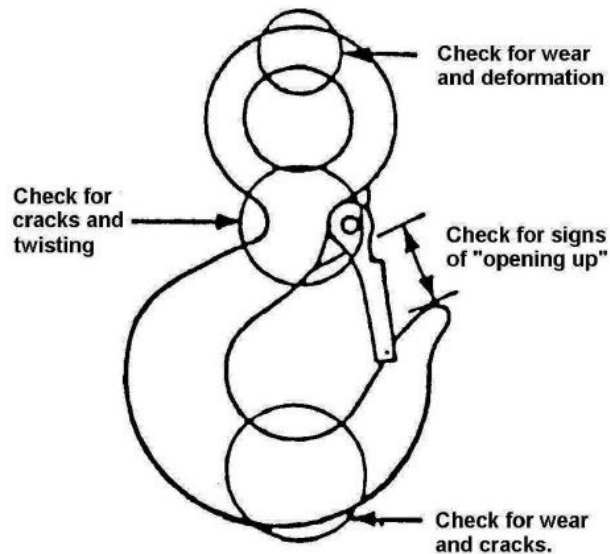


Figure 1-4. Hook inspection areas.

Before and during the hoisting operation, comply with the following safety practices to make sure a smooth and safe working environment exists:

- Do not inspect a sling by passing your bare hand over the body of the sling. Broken wires, if present, may puncture your hand.
- Determine the weight of the load and choose a sling with suitable capacity.
- Do not tighten a sling by knotting, by wire-rope clips, or by any other means.
- Pad or protect any sharp corners the sling comes into contact with.
- Center the load in the base (bowl) of the hook to prevent hook point loading.
- Keep your hands and fingers from in-between the sling and the load.
- Stand clear of the attached load, especially directly underneath it.

By following the inspection and safety practices just identified, you ensure that the lifting devices remain serviceable and add to the safety of the operation being performed. If all else fails, the use of good common sense will keep you out of danger in most instances. Although all the different types of lifting devices you will encounter are not listed or identified here, AFI 91-203, *Air Force Consolidated Occupational Safety Instruction* and/or the specific manual for the lifting devices used at your base will provide you with guidance and safe lifting procedures.

#### 004. Multimeters

A multimeter is used to make various electrical measurements, such as alternating current (AC) and direct current (DC) voltage, AC and DC current, and resistance. It is called a *multimeter* because it combines the functions of a voltmeter, ammeter, and ohmmeter. The multimeter is the most convenient and most used item of test equipment for measuring electrical current. Through the proper setting of controls, it has the ability to measure amps, ohms, and voltage in different amounts through the use of different scales on the face of the meter that correspond to the different settings of the function switch. There are many different types of multimeters, but we will focus on the Fluke 8025A and Fluke 8025B model multimeters which are used most often in the munitions career field.

### Fluke 8025-series digital multimeter description

The Fluke 8025-series is a rugged water- and chemical-resistant multimeter. It is versatile enough to use at any of our bases and can withstand water, dust, dirt, humidity, airborne particles, and even accidental dropping. A unique feature of this meter is that it can withstand a severe electrical overload without being damaged. The 8025-series multimeter combines the performance and accuracy of a digital meter with the dynamic capability of an analog meter. All controls and connectors are located on the front panel, beneath the display window, as shown in figure 1-5.

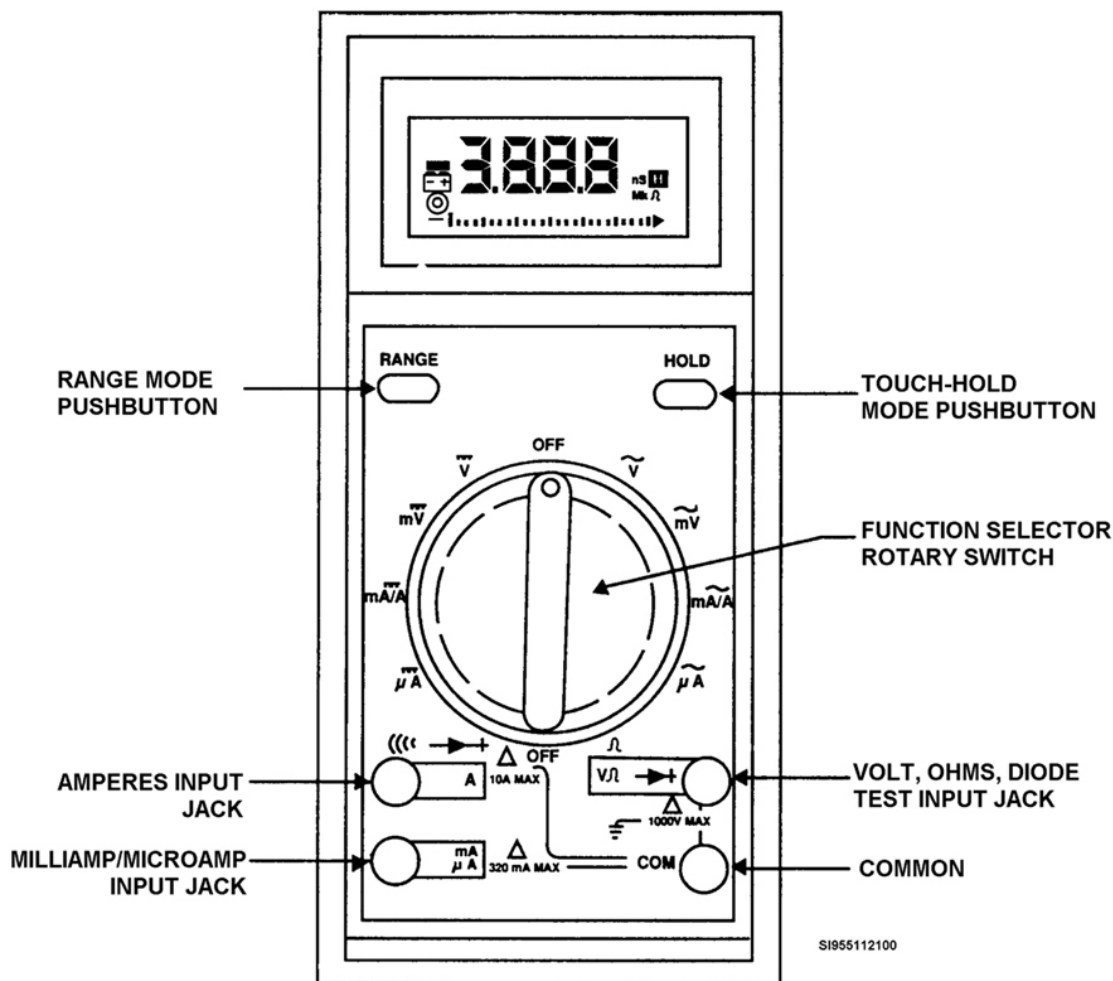


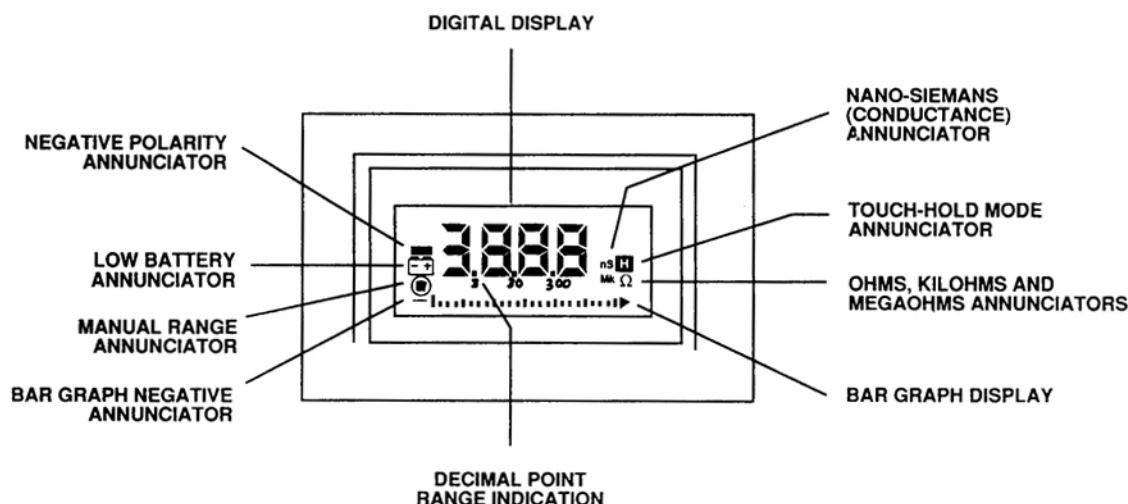
Figure 1-5. Multimeter 8025-series controls.

Display information consists of four functional categories (fig. 1-6):

1. Digital display.
2. Various annunciators.
3. Bar graph display.
4. Range indicator.

The annunciators are used to distinguish among ohms, kilohms, and megohms. Other annunciators are displayed when the meter is set to the “ohms” function. These annunciators display information about the polarity, the condition of the meter’s battery, whether you’re in manual or auto range, and negative annunciator for the bar graph. The analog bar graph is located just below the digital display. The range indicators are located between the analog bar graph and the digital display. A 3-, 30-, or 300-range indicator is displayed just below the decimal point in the digital display. The number

displayed indicates the range in use for each of the decimal point positions. No decimal point is displayed in the 1,000 V or 3,200 microamperes ( $\mu\text{A}$ ) range.



## DISPLAY

	WHEN FIRST DISPLAYED, IT INDICATES THAT REMAINING BATTERY LIFE IS AT LEAST 60 HOURS
Mk Ω	THE Ω IS DISPLAYED WHEN THE OHMS FUNCTION IS SELECTED. THE M AND k ANNUNCIATORS INDICATE THE MEGAOHM OR KILOHM RANGE.
nS	THE NANOSIEMENS (nS) ANNUNCIATOR IS DISPLAYED WHEN THE TOP RANGE OF THE RESISTANCE FUNCTION IS SELECTED USING MANUAL RANGING ONLY. MEGAOHMS EQUALS 1000 DIVIDED BY NANOSIEMENS. THE Ω IS NOT DISPLAYED WITH nS.
	INDICATES THAT THE MANUAL-RANGING MODE IS IN USE.
	INDICATES THAT THE TOUCH-HOLD MODE IS IN USE.

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## DISPLAY ANNUNCIATORS

Figure 1-6. Multimeter 8025-series digital display.

## Operation

Operation of the 8025-series multimeter is provided in two modes. You can actuate the two modes, RANGE and HOLD, with their respective push buttons.

### RANGE

Use the RANGE push button to initiate the manual range operating mode, change ranges while in the manual mode, and return to the auto range mode. You must press the RANGE push button for more than 1 second to exit the manual mode.

### HOLD

In the TOUCH-HOLD mode, you can make a measurement in a delicate, hazardous, or difficult-to-reach circuit without taking your eyes from the test leads. The multimeter's beeper indicates when a stable measurement is held in the display; then the operator can look at the measurement when convenient.



**Function selection**

In selecting the function, you use a single rotary switch to select all of the available functions. Listed below are the functions:

- Volts DC.
- Millivolts DC.
- Milliamps/amps DC.
- Microamps DC.
- Diode test.
- Volts AC.
- Millivolts AC.
- Milliamps/amps AC.
- Microamps AC.
- Ohms  $\Omega$ .

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**Self-Test Questions**

After you complete these questions, you may check your answers at the end of the unit.

**001. Electric tools**

1. What safety precaution must you take before installing or changing a drill bit of an electric drill?
2. What do you do before drilling in metal or other hard surfaces?
3. What minimum personal protective equipment shall be used for all jobs using a bench grinder?
4. How fast should an electric saw blade be spinning before it contacts the material to be cut?

**002. Pneumatic tools**

1. List four safety precautions when dealing with pneumatic tools?
2. How many psi are used for safe efficient operation of a pneumatic tool?
3. What ensures the socket or attachment does not fly off an impact wrench?
4. What does the torque regulator do for a pneumatic impact wrench?

**003. Lifting devices**

1. Familiarity of what two things are prerequisites for safe operation of lifting devices?
2. What will be worn if there is a potential for injury from falling objects or moving equipment?
3. What are four items that can be used in conjunction with wire-rope slings when lifting munitions?
4. Where can general guidance be found for safe operating procedures using lifting devices?

**004. Multimeters**

1. What information do the multimeter's annunciators display?
2. What are the two *modes* of operation for a Fluke 8025-series multimeter?
3. What *mode* of the Fluke 8025-series multimeter is most useful when taking measurements in a circuit where it may be necessary to keep your eyes on the test leads after they are positioned?

**1-2. Non-powered Support Equipment**

Munitions trailers are used in many situations on the flight line and in munitions storage areas. Some of the more common uses are temporary storage of various munitions, transporting general-purpose bombs or missiles between storage areas and aircraft loading sites, and transporting munitions-related equipment and bomb components. The Air Force uses a wide variety of equipment to help move munitions efficiently and easily from one point to another and load or unload aircraft. The types, models, and sizes of these trailers are so varied that we will not try to describe each one of them. We cover the most widely used trailers that move our munitions. Study them carefully; they can make your job easier and safer. Your unit vehicle trainer provides instruction on the proper operating and maintenance procedures for the equipment assigned to your base.

**005. MHU-141 trailers**

The munitions handling unit (MHU)-141 trailer is very versatile and can transport many different types of munitions and materials. This trailer is a four-wheeled automotive steering vehicle with a 5,500 lb. load capacity. It is basically a flat-deck unit with a hinged center section that can be lifted and opened to provide a hatchway across the width of the trailer. With the center section opened, several attachments can be configured for holding most out-of-container munitions (e.g., GP bombs, GBUs, CBUs, missiles). Figure 1-7 shows the MHU-141/M with the hinged deck panels closed. TO 35D3-2-27-1, *Trailer, Munitions Handling, Type MHU-141*, contains more information on the



MHU-141 trailer to include maintenance requirements. Let's take a closer look at a few of its features.

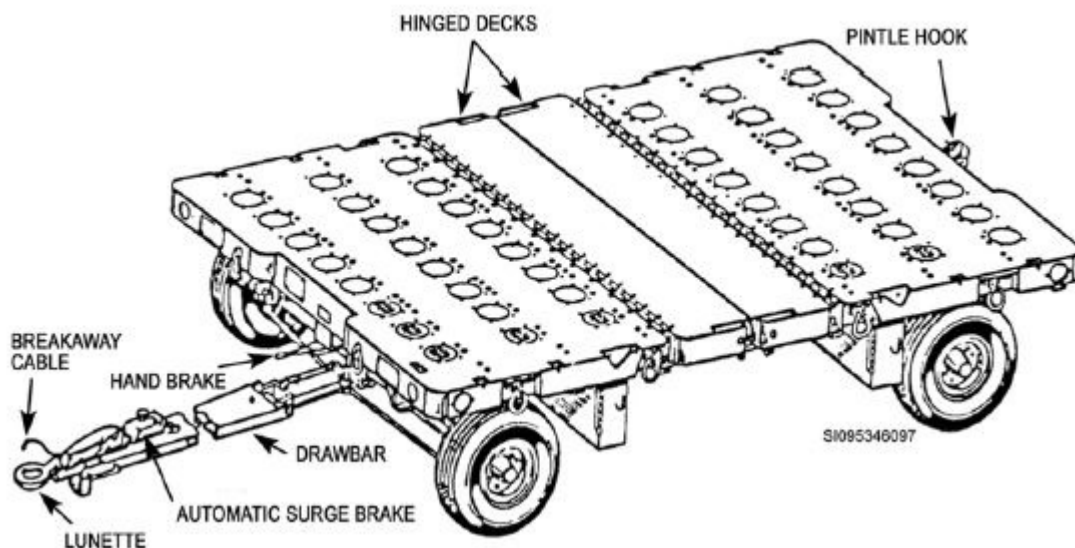


Figure 1-7. MHU-141/M munitions handling trailer.

### Steering system

The MHU-141 trailer is equipped with an automotive-type steering assembly. The front-wheel steering mechanism is controlled by means of the tie-rod assemblies attached to the center steering arm and spindle and knuckle subassemblies. The steering system has a turning radius of 200 inches, which equates to 40 degrees in either direction. Attempting to turn the trailer at a sharper angle than 40 degrees is the leading cause of cracked steering assemblies.

### Trailer deck

The trailer deck is composed of fore and aft sections, with tie-down devices used to secure a load. Metallic links on each side of each section serve as additional tie-down devices. The main beam provides the support for the two decks. A pintle hook assembly is mounted on the aft deck so that two of these trailers can be towed in tandem. When the trailer is loaded or towed with the hinged deck panels open, it is imperative that the two deck-panel supports are properly positioned and locked in place with the attached quick-release pins.

### Brake system

The automatic surge brake activates the hydraulic brake system. Hydraulic fluid used to operate the four brake cylinders (one on each wheel) is contained within the master cylinder (surge brake reservoir). Associated fittings, tubing, and hose assemblies interconnect the brake system components. The surge brake is mounted on the trailer drawbar and consists of a telescoping drawbar and a hydraulic master cylinder. The towbar is in line with the master cylinder piston and actuates the piston by means of a slide-mounted push rod. When the towing vehicle slows down, the forward pressure of inertia from the trailer pushes against the telescoping drawbar. This pressure compresses the drawbar and actuates the hydraulic master cylinder. A hydraulic line automatically transfers the correct amount of braking pressure to the wheel cylinders to slow down or stop the trailer.

Internal operation of the master cylinder is similar to that of an automotive hydraulic master cylinder, but it has a separate fluid accumulator chamber that absorbs impact loads and permits backing the trailer into position (for loading or unloading). As an added safety feature, a breakaway cable using a safety hook is connected between the trailer and the towing vehicle to stop the trailer in the event of an accidental breakaway. The parking brake is part of the trailer's brake system, but is separate from

the hydraulic system. The parking brake is a standard mechanical-type brake and consists of several linkages and connecting points. The hand-brake lever, located in the middle of the forward deck, operates the brakes in the two rear wheels.

### Accessories

Figure 1-8 shows accessories associated with the trailer when it is shipped or received. The figure also shows optional items available, depending on mission requirements. When not in use, all accessories are stored in the toolbox mounted under the deck at the rear of the trailer.

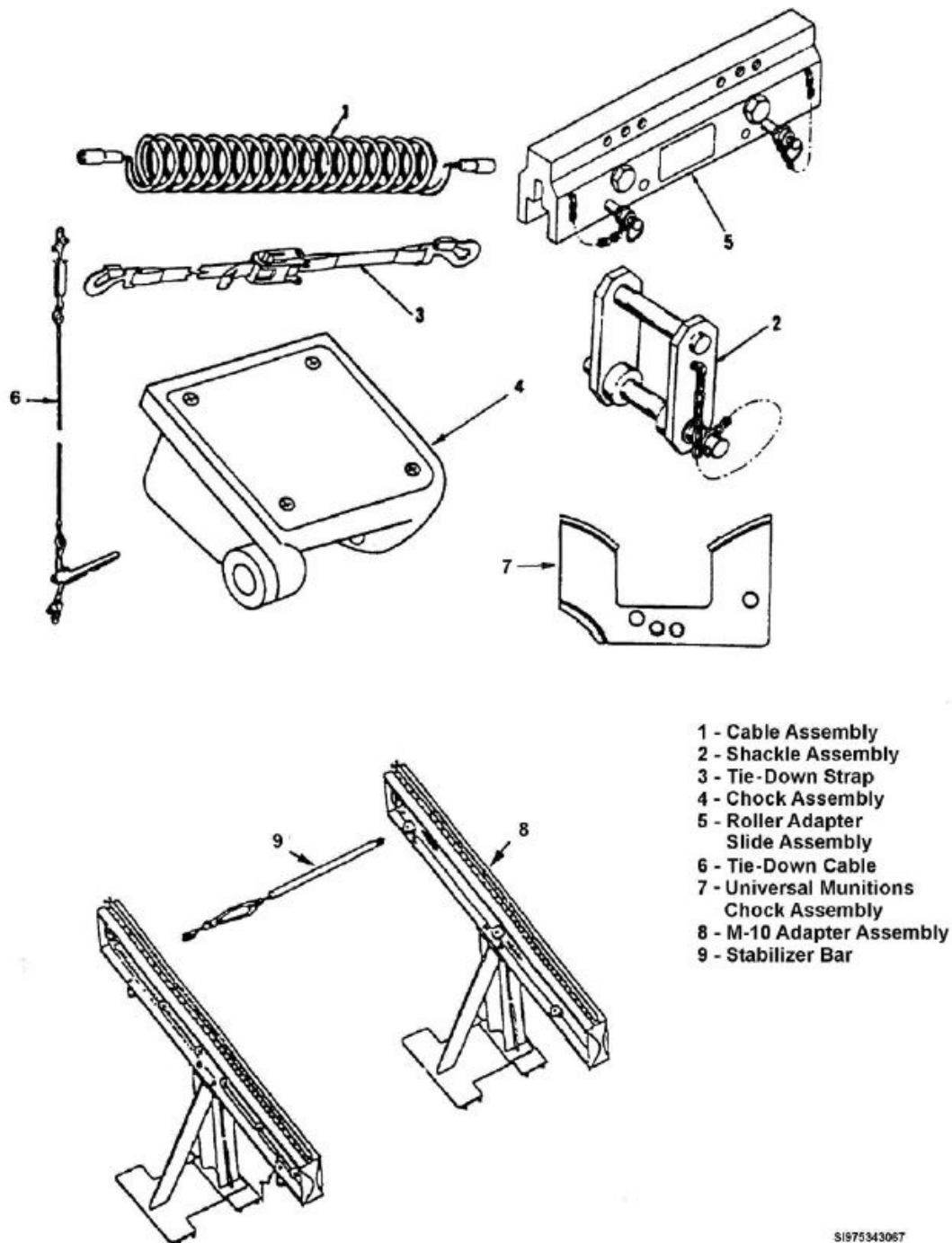


Figure 1-8. MHU-141 munitions trailer components.

## 006. MHU-110 trailers

The MHU-110/M trailer (fig. 1-9) is a 10-wheel flatbed trailer capable of transporting conventional munitions up to 15,000 lbs. It is a flat-deck unit that can also be fitted with deck rails and bomb chocks to be used to transport all types of munitions except missiles and nuclear weapons. The MHU-110 is also the trailer typically used to transport the MAC.

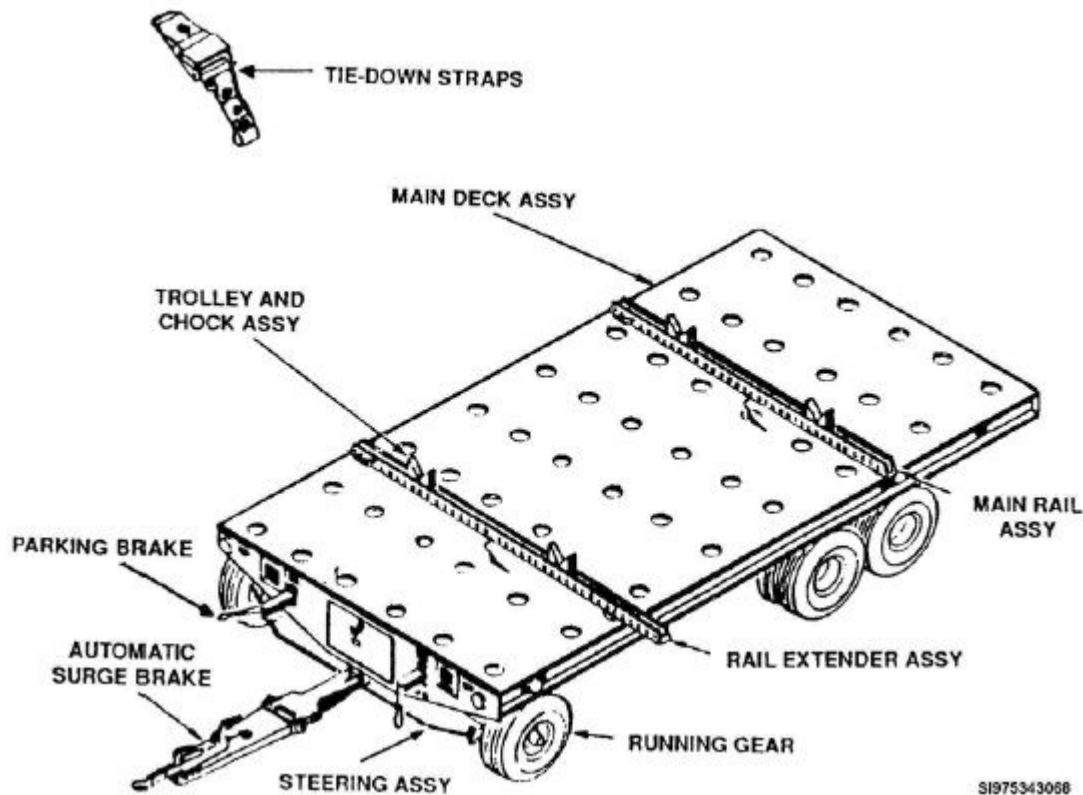


Figure 1-9. MHU-110/M munitions handling trailer.

### Main deck assembly

The main deck is made of welded aluminum and consists of several parts welded to the frame to support functional components such as the rear dual-wheel springs, front-wheel running gears, and toolboxes. Attached to the deck assembly are 48 recessed 10,000 lb. tie-down rings, eight 25,000 lb. ring eyebolts on the sides, various lights and reflectors, and a pintle hook. Connections for electrical facilities to other towed trailers are incorporated on the aft deck by means of receptacles. For more information on the MHU-110 trailer, reference TO 35D3-2-26-1, *Munitions Handling Trailer Type MHU-110*.

### Steering system

The towbar and steering mechanism are designed so that additional turning force cannot be applied to the steering mechanism after the maximum cramping angle has been reached. The front axle also incorporates a spring-loaded latch device to stow the towbar in a vertical position. You should be extremely careful when you store the towbar in the up position because it can cause serious personal injury.

### Brake system

The brake system on the MHU-110 trailer consists of surge brakes (hydraulic) and parking brakes (mechanical). The parking brake can be applied by either one of two hand levers located on each side of the front of the trailer. The parking brakes are applied to the four inboard rear wheels.

The brake system has six brake cylinders, one on each front wheel and one on each of the four inboard rear wheels. Hydraulic fluid for the primary braking system is contained in the master cylinder (surge brake reservoir). The automatic surge brake actuates the hydraulic system. Associated fittings, tubing, and hose assemblies interconnect the hydraulic brake system components. The surge brake and breakaway cable description for the MHU-141 trailer above are the same for the MHU-110.

### 007. MHU-226 trailers

The MHU-226 (fig. 1-10), a four-wheeled munitions trailer with double-Ackerman steering (four wheel coordinated), is air transportable and capable of transporting conventional loads up to 12,000 lbs. or 8,000 lbs. for nuclear. The MHU-226 has a welded aluminum frame/deck structure with three identical openings, each with hinged door panels. With the center panels open, long loads can be carried. With the center panels closed, and the fore and aft panels open, smaller loads can be carried. The trailer can function as a flat bed with all door panels closed. Two storage boxes at the front and three at the rear of the trailer provide storage for accessories. A stowage container is provided to stow the wheel chocks.

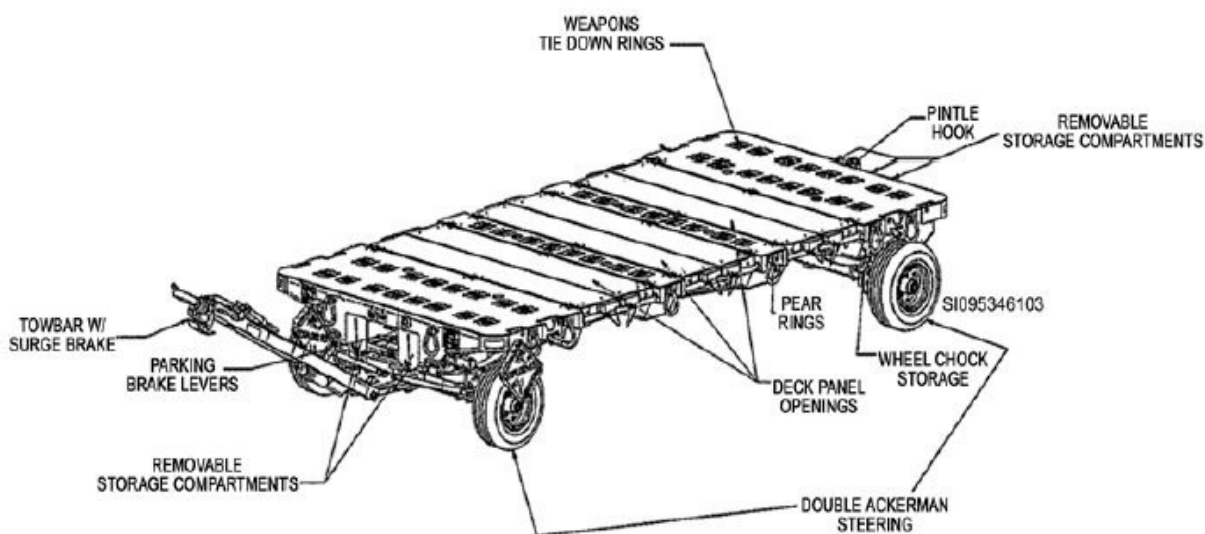


Figure 1-10. MHU-226 munitions handling trailer.

### Brakes and towbar

The brake system consists of disc brakes with a parking brake system on all four wheels and a breakaway braking system that includes a lanyard on the lightweight towbar for attachment to the vehicle. The towbar is not interchangeable with the MHU-141 and MHU-110.

### Tires

The tires used on the trailer are specially designed. They are special in respect to the size, shape, and load capacity. The tires support a gross maximum weight of trailer and payload at 15 miles per hour (mph) loaded and 30 mph empty.

### Steering

The trailer is equipped with four-wheel steering (double Ackerman) to aid in tighter steering radius. The towbar is rotated from side to side during towing which, in turn, pushes or pulls on the rear axle guiding arm flat causing it to transfer the turning direction to the rear wheels through the use of short rear tie-rods connected to the spindles.

## Lighting

Lighting on the trailer is supplied to the unit through the use of an intervehicular wire harness. The lights are mounted in the rear frame of the unit and use a sealed LED light assembly. The trailer is wired to ASE standard J560 enabling it to be compatible with all tow vehicles.

## Wheel chocks

Chocks are supplied and attached to the unit to use when accompanied with the front and rear parking brake.

## 008. 25- and 40-foot trailers

Three types of commercial trailers are used in the munitions storage area: vans (closed), flatbed (open), and rollerized 25-foot and 40-foot trailers, which come in a variety of styles and weight capacities and may be single or dual-axle. However, the trailer most commonly used during day-to-day operations is the flatbed. The weight capacities vary and may be as much as 27 tons. It is a good idea to know the trailers available at transportation.

A 40-foot flatbed trailer is actually 51 feet in length when you include the gooseneck of the trailer. It is approximately 8.5 feet in width and for use when moving a wide variety of items, such as palletized munitions and equipment or unpalletized bombs secured on a rail set. The weight capacities vary by manufacturer, so you must read the vehicle data plate to make sure you do not exceed the weight limits.

The rollerized trailer, shown in figure 1-11, is designed specifically to handle cargo loaded on 463L aluminum aircraft cargo pallets to place aboard either commercial or military aircraft. The rollerized trailer can be loaded and transported or used as a transfer platform for loading aircraft. To ensure the smooth movement of 463L pallets from the trailer to the aircraft/K-loader, the trailer is equipped with an adjustable ramp that can be raised or lowered by using the attached hydraulic hand pump. The roller sections are spaced across the width of the trailer to provide maximum load distribution. Each roller has a safe load capacity of 300 lbs. Height and spacing of the roller sections provide the capability to use a forklift for loading pallets on the back of the trailer without interference. After pallets are positioned on the trailer, they can be secured with either tie-down straps or MB-1 chain assemblies.

## Uses

Trailers are used for logistical or operational movement of conventional munitions and nuclear weapons. To clarify these terms, a logistical movement refers to moving munitions and weapons from one base to another, depot to base, base to depot. Operational movements are those to support on-base operations to or from the flightline.

Trailer preparation is the responsibility of the shipper. The trailer you select for transporting nuclear weapons must be nuclear certified, be clean, have sound floors, and be free from protruding nails or other projections. When selecting a trailer for a specific munitions item, make sure it meets the guidelines stated in the applicable directive. The trailer selected should ensure the maximum stability for the munitions to be placed on it.

Before any operation, perform a pre-use inspection. If the inspection reveals any unsatisfactory condition, the trailer is unacceptable for shipment of hazardous materials. Always remember that areas such as inspections, maintenance, and detection of deficiencies are the responsibilities of the using vehicle operator of the trailer before, during, and after use.



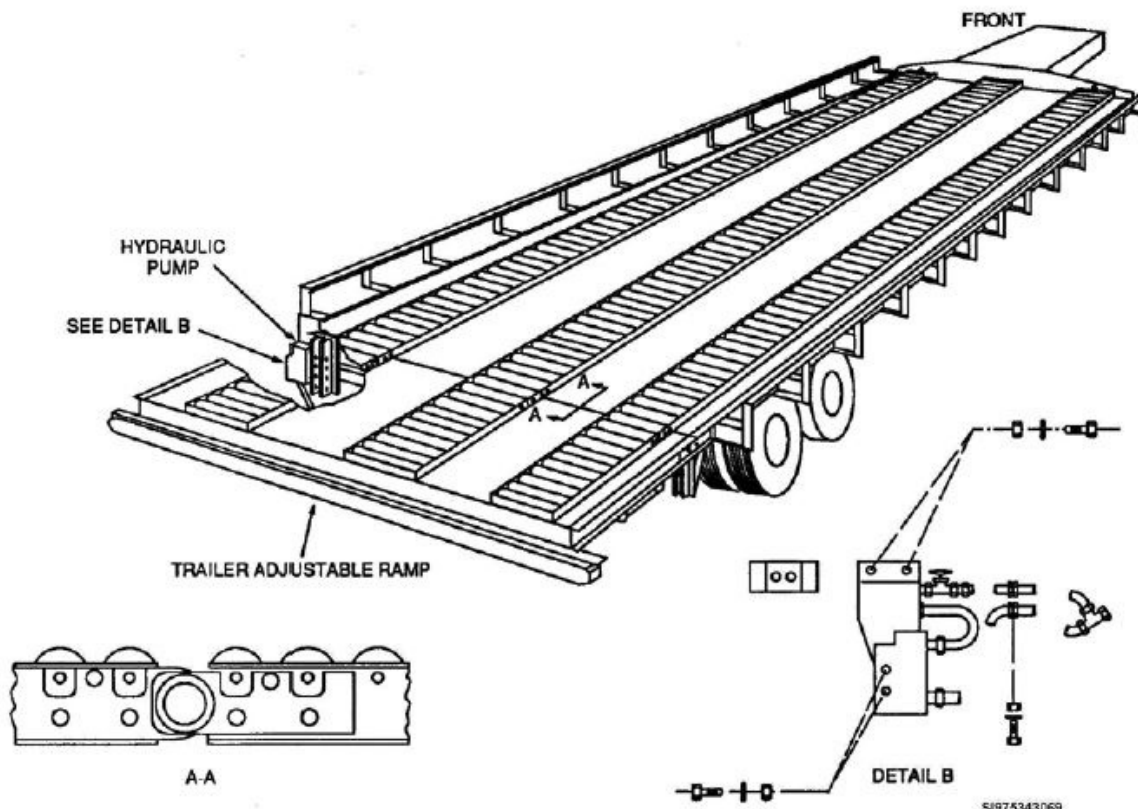


Figure 1-11. 463L trailer.

### 009. Transport modules

The munitions career field uses many types of transport modules (fig. 1-12) to safely transport a variety of munitions items between the munitions storage area and flight line. Essentially, a transport module is nothing more than a large container designed to secure atop of MHU-141 (fig. 1-13), MHU-226 or MHU-110 trailers for the transport of small built-up munitions. However, this does not include all small built-up munitions. For instance, 20 MM and 30 MM do not use transport modules, but are transported in their original containers or by ammunition loading systems. Munitions that can be loaded in transport modules include the BDU-33, rockets, chaff, or flare and the module is unique to the munition to be transported. Regardless of the module type, all have internal dividers to segregate each munition from the next; much like, an egg carton segregates and protects each egg. There are many types and capacities of transport modules you may encounter, since it would be redundant to cover them all, we will only discuss some of the more common modules.

#### Module types

The BDU-33/MK 106 practice bomb, transport module, transports BDU-33 and MK 106 practice bombs. It is manufactured in either a 40- or 80-round capacity module.

The 2.75-inch rocket, transport module, transports or stores up to 60 fully assembled 2.75-inch rockets configured in lengths of approximately 54 inches to 72 inches (rocket lengths vary based on rocket motor and warhead combinations).

The ALE-40 series chaff/flare, transport module, transports ALE-40 chaff and flare magazines. The maximum capacity per module is 40 magazines. It replaces all existing local manufactured transport modules.

The ALE-50 series decoy, transport module, transports ALE-50 decoy magazines. The maximum capacity per module is 30 magazines. It replaces all existing local manufactured transport modules.

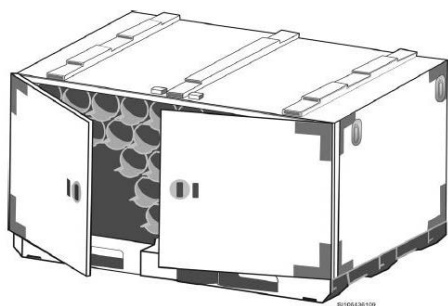


Figure 1-12. Transport module.

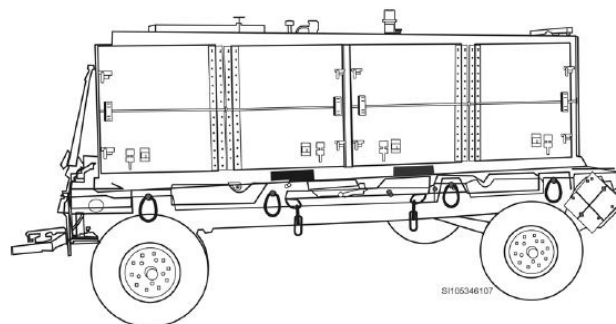


Figure 1-13. Transport Module on MHU-141.

### Module safety

When loading or unloading any transport module, carry only one munition at a time. It does not matter how small or light a munition may be, positive (two-hand) control is an absolute necessity. Of all safety concerns with transport modules, one has been above all others, the security of transport modules doors. This has been the cause of many past incidents; therefore, the security of module doors is paramount to prevent future incidents.

All modules have some type of door to prevent the munitions from falling out of their module. Rather these doors swing down, open from the sides, or slide open, all have some type of positive locking device. Typically, these locking devices are safety pins or latches. It is the failure to engage these locking devices and routinely checking them between stops that has led to past incidents. Munitions often shift during transport putting pressure on the doors, safety pins, and/or latches of transport modules. It is your job as a munitions specialist to verify these devices are engaged after loading, unloading, and to periodically check these devices between stops to prevent munitions from falling out.

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## Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

### 005. MHU-141 trailers

1. State the maximum load capacity of the MHU-141 trailer.
2. Which TO contains information on the MHU-141 trailer?
3. What is the turning radius of the MHU-141 trailer?
4. Explain the purpose of the breakaway cable on the MHU-141 trailer.

### 006. MHU-110 trailers

1. State the maximum load capacity of the MHU-110 trailer.

2. Which TO contains information on the MHU-110 trailer?
3. What allows you to stow the towbar of an MHU-110 trailer in a vertical position?
4. What is the primary brake system for the MHU-110 trailer?

**007. MHU-226 trailers**

1. What is the maximum load capacity of the MHU-226 trailer?
2. How many openings are on the deck of the MHU-226 trailer?
3. How many storage boxes are on the MHU-226 trailer?
4. What is the MHU-226 equipped with that aids in having a tighter steering radius?

**008. 25- and 40-foot trailers**

1. Name the three types of trailers you may encounter.
2. What is the actual length of a 40 foot trailer when you include the gooseneck?
3. The rollerized trailer is designed for what specific purpose?
4. Who has the responsibility to detect deficiencies on trailers?

**009 Transport modules**

1. What is a transport module and how is it used for the 2W0X1 career field?
2. What is the maximum transport capacity of the BDU-33/MK 106 transport module?



3. When loading or unloading any module, what common safety practice is an absolute necessity?
4. What should you do to ensure transport module doors remain closed to prevent munitions from falling out?

### 1-3. Powered Support Equipment

Support equipment in bomb buildup operations and other tasks within the munitions storage provide invaluable assistance. They allow for the rapid assembly of bombs, cluster bomb units, and other types of munitions, as well as provide a means to load different trailers or move the items to a different location. Although there are many different types of support equipment, the two most common are bomb-lift trucks and compressors. In this section, we discuss those two types of support equipment.

#### 010. Common lift trucks and components

Handling and loading lift trucks are the primary powered support equipment you use to install suspension equipment and load air munitions on munitions handling trailers. These lift trucks make it relatively easy to transport heavy stores and related suspension equipment from one location to another.

##### Lift trucks

Lift trucks have a wide variety of uses. Munitions and Weapons personnel typically use them to load/unload munitions and suspension equipment (e.g., pylons, heavy stores, beams, multiple ejector racks) onto or into fighter and bomber aircraft. In addition, you use them to load/unload munitions and equipment from trucks and trailers for transport to the flightline or within munitions storage areas.

Lift trucks are powered by diesel fuel or electricity. Here we only talk about the two most common series of lift trucks: the MJ-1 and the MHU-83. To begin, let's look at how the lift trucks are built.

The MHU-83 and MJ-1-series trucks are built on a low-slung, heavy-duty frame with their engines mounted to the rear. The MHU-83s have manually extendable wheelbases and hydraulically operated side frames width adjustments (outriggers). The powered lift trucks are rear-wheel drive vehicles and the rear wheels are also the steerable wheels. The power-assisted steering is controlled from a conventional steering wheel. All bomb-lift trucks have either cantilever lift boom assemblies (to lift and lower munitions) or suspension equipment. Attached to lift arms or boom assemblies is a cradle assembly. The cradle assembly adjustment features let you secure the munitions, pylon, and so forth, and make fine adjustments during installation removal from the aircraft.

##### *MJ-1-series bomb-lift truck*

This truck is on a low-slung, heavy-duty frame supported by four small, high-capacity wheels. It has a rear-wheel drive powered by a gasoline engine mounted on the extreme rear of the frame. The two rear wheels are steerable from a conventional steering wheel located in the midsection of the unit. The truck has an engine, cantilever lifting mechanism, bomb cradle (or table), hydraulic system, and mechanical traction components. The MJ-1B is basically identical to the MJ-1A except that it uses a diesel engine.

MJ-1 lift trucks have cantilever lift arms and have transport beams beneath the cantilever lift arm assembly. The transport beam is used to provide added support and to relieve hydraulic pressure from

the lift arms when carrying loads on long distances. Lift trucks with lift boom assemblies have a control valve that does the same thing.

The MJ-1 is used primarily to load externally carried munitions, weapons, ammunition cans, rockets, pylons, and fuel tanks on tactical fighter-type aircraft (fig. 1-14). It is used to lift, carry, and attach these different sized items weighing up to 3,000 lbs. It is also used in munitions storage areas to load trucks and trailers with munitions that are too heavy to handle by hand. The accessories include the bomb support rollers, the fork adapters, the extension lift arm, and the lug beam attachment that is used with the extension lift arm.

Using the accessories usually lowers the maximum lifting capacity. With the extension lift arm or the fork adapter, the maximum lifting capacity is 2,200 lbs. However, using the bomb rollers does not lower the capacity from the basic 3,000 lbs. The MJ-1 lift trucks have automatic transmissions and a forward and reverse gear. Their top speed is 18 mph, and they can climb a maximum grade of 20 percent. The steering operates through the rear wheels, which are capable of a 35 degree swivel in either direction or a total traverse of 70 degrees.

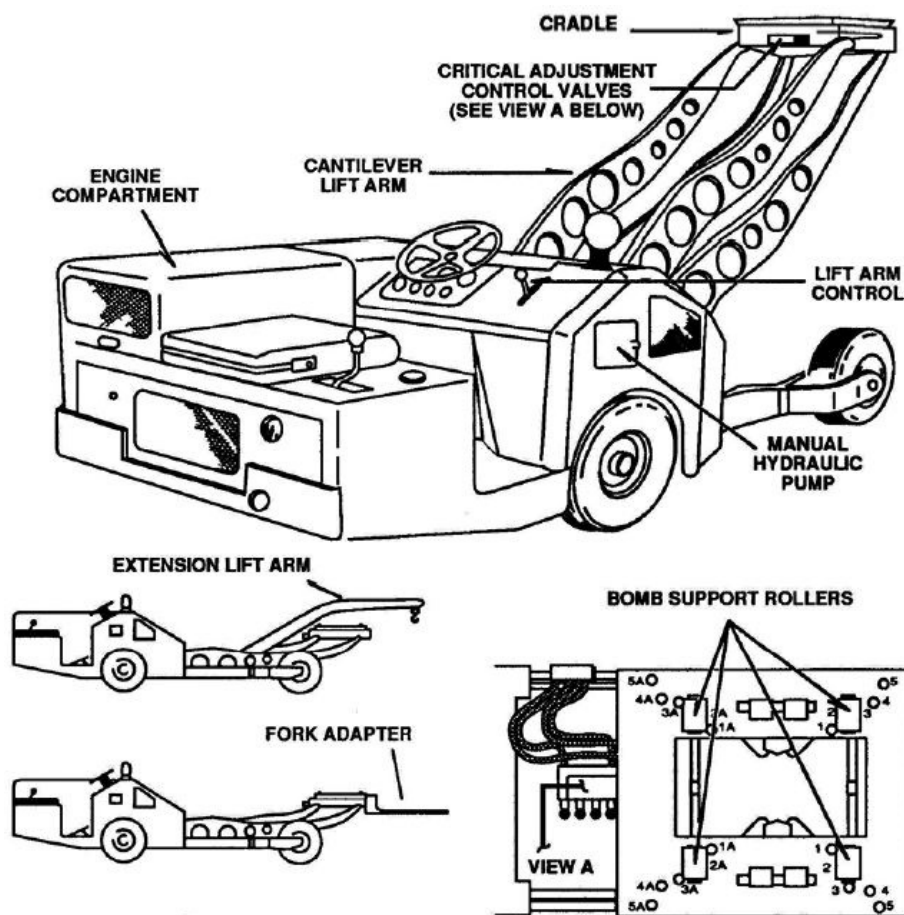


Figure 1-14. MJ-1 bomb-lift truck.

### *MHU-83-series bomb-lift trucks*

Although the MJ-1-series lift trucks have proved to be very effective pieces of equipment, their use is limited by the relatively small lifting capacity. To accommodate heavier stores, the Air Force has adopted the MHU-83-series bomb-lift trucks. The primary purpose of the MHU-83-series lift trucks is to load externally carried munitions, rocket launchers, pylons, and fuel tanks onto fighter aircraft. The lift truck is capable of handling prepackaged multiple and triple ejection racks. It is used to lift loads weighing up to 7,000 lbs. to the wing racks and centerline pylons of fighter aircraft.

The MHU-83-series lift trucks look somewhat like the MJ-1 (fig. 1-15). They are mounted on a low-slung, heavy-duty frame supported by six small, high-capacity wheels. The vehicle has rear-wheel drive powered by a diesel engine mounted on the extreme rear of the frame. The two rear wheels are steerable from a conventional steering wheel located in the midsection of the unit. The lift truck has five major components—the engine, lifting boom, bomb cradle, hydraulic system, and mechanical traction component.

Two accessories are provided as standard equipment—a hand crank for starting the engine if the battery is low or the starter is defective and a hand pump to manually operate the hydraulic system. Other accessories available are a fork adapter (which lowers the maximum lifting capacity to 6,000 lbs.) and a cargo hook adapter (which must be used with the fork adapter). Additional accessories can also be obtained if your unit is in the business of preloading multiple ejector racks (MER) and triple ejector racks (TER).

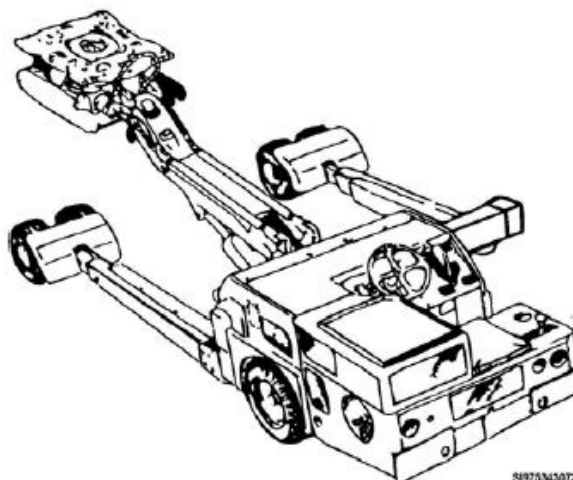


Figure 1-15. MHU-83-series bomb-lift truck.

## Systems

The lift trucks you work with have three very important systems: the hydrostatic drive, brake, and hydraulic systems.

### *Hydrostatic drive system*

Powered lift trucks have hydrostatic drive systems. These systems are nothing more than a hydraulic motor, pump, and control valves that work in conjunction to control the forward and aft movement of the lift trucks. They work like automatic transmissions, moving the lift truck forward and backward. The major difference in the drive systems is that an automatic transmission can roll while in gear, whereas a hydrostatic drive system will not move unless the operator actuates the necessary controls.

### *Brake system*

The brake systems on powered lift trucks are hydraulically actuated disk brakes on the front wheels and disk or drum brakes on the rear wheels actuated by a foot-brake pedal. The hydrostatic drive system also serves as a brake system in two ways. If you release the accelerator pedal to its center position, the unit coasts to a stop very quickly; if you reverse the accelerator pedal, the unit comes to an immediate stop. There's also a hydraulic emergency brake that's incorporated into the service braking system, which is also an emergency brake system. Throwing the emergency brake lever and then pumping the normal brake pedal sets it.

### *Hydraulic system*

The hydraulic system supplies fluid under pressure to operate various components of the bomb-lift trucks. The main hydraulic components you're concerned with are the hydraulic tank; hand pump; lift arm or lift boom cylinders; various hydraulic controls, valves, and connections; and the side frame (outriggers) adjustments (if applicable). The hydraulic tank, along the right side of the lift truck, stores the hydraulic fluid for the system. Never fill the tank above the screen that you can see by looking into the filler neck because thermal expansion might make the fluid overflow.

The hand pump (also on the right side of the bomb-lift truck) lets you operate the hydraulic system manually if the engine or the hydraulic pump fails. The primary drawback is that it's an extremely slow way to build hydraulic pressure for controlling lift truck components. The lift-arm or lift-boom

cylinders actuate the lift arms or boom assemblies. They actually do the work by converting hydraulic pressure into mechanical motion to lift or lower the lift arms or boom.

Hydraulic cylinders also operate the right- and left-side frames. These cylinders let you adjust the frame width from the fully retracted width of 70 inches between the inside front wheels to any width up to the fully extended width of 140 inches. The various hydraulic controls, valves, and connections concern us because they are our interface with the equipment; they let us use this equipment to do our job.

Your responsibilities concerning these components are to make sure the controls are in proper working order. Make sure the various valves and connections are secure when they're attached to adapters or fittings, and there are no hydraulic leaks (or that they're within acceptable limits). Remember, if these components do not function right, you will not be able to use the truck to lift, lower, or make fine adjustments during loading and unloading.

### Controls

The controls for all of the powered bomb-lift trucks are similar (ammeters, system pressure gauges, oil pressure gauges, lift-arm or boom controls, directional control levers, etc.). Differences depend on the model of the lift truck and how each model is equipped. The major difference between the different models is the locations of driver's position, cradle or boom, and remote control unit.

### Driver's position

At the driver's position of the MHU-83 series (fig. 1-16), are several controls and gauges needed for proper operation of the jammer. You will find controls to perform the following functions:

- Starting the engine.
- Controlling throttle.
- Braking.
- Monitor hydraulic, engine, and electrical system operation.
- Control forward and aft movement of the unit.
- Raise and lower lift arms of lift booms (Lift).
- Move the boom assembly to the left or right (Azimuth/Lateral).

### Cradle or boom position

The cradle or boom position controls (fig. 1-17) are on the rear end of the cradle assembly for the MJ-1 and on the forward end of the lift boom for the MHU-83. They let you make fine adjustments during cradle or boom operation. The control levers that actuate the cradle or boom functions at these positions are spring centered to the NEUTRAL position. In other words, once you release them, they automatically spring back to the NEUTRAL position and have no effect on the movement of the boom or cradle assemblies. The adjustments you can make (tilt, azimuth, and longitudinal) are discussed in the following table.

Position	Description
Tilt	This adjustment causes whatever is being loaded to slope, lean, or have a slight incline to either side. All bomb-lift truck tables have this capability.
Longitudinal	This adjustment provides the forward and aft table movement of all bomb-lift trucks.
Yaw	This adjustment rotates or swivels the table assembly either clockwise or counter clockwise. All bomb-lift truck tables have this capability; however it is done manually on the MJ-1.
Roll	This adjustment is much like <i>tilt</i> , but instead of tilting side-to-side the <i>roll</i> adjustment tilts either forward or backwards. Beneficial for aligning/locking the bomb rack hooks with the bomb's lugs. All bomb-lift truck tables have this capability.

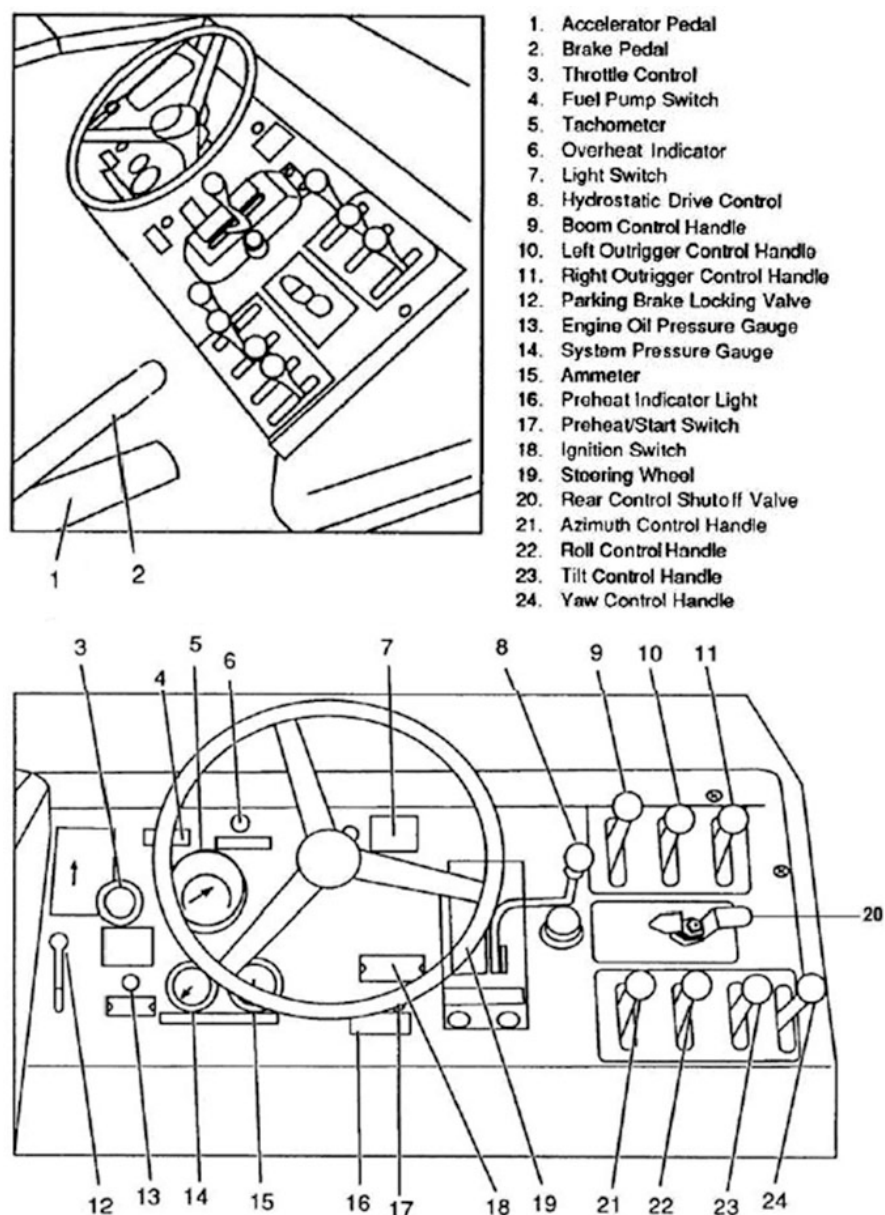


Figure 1-16. MHU-83-series control panel.

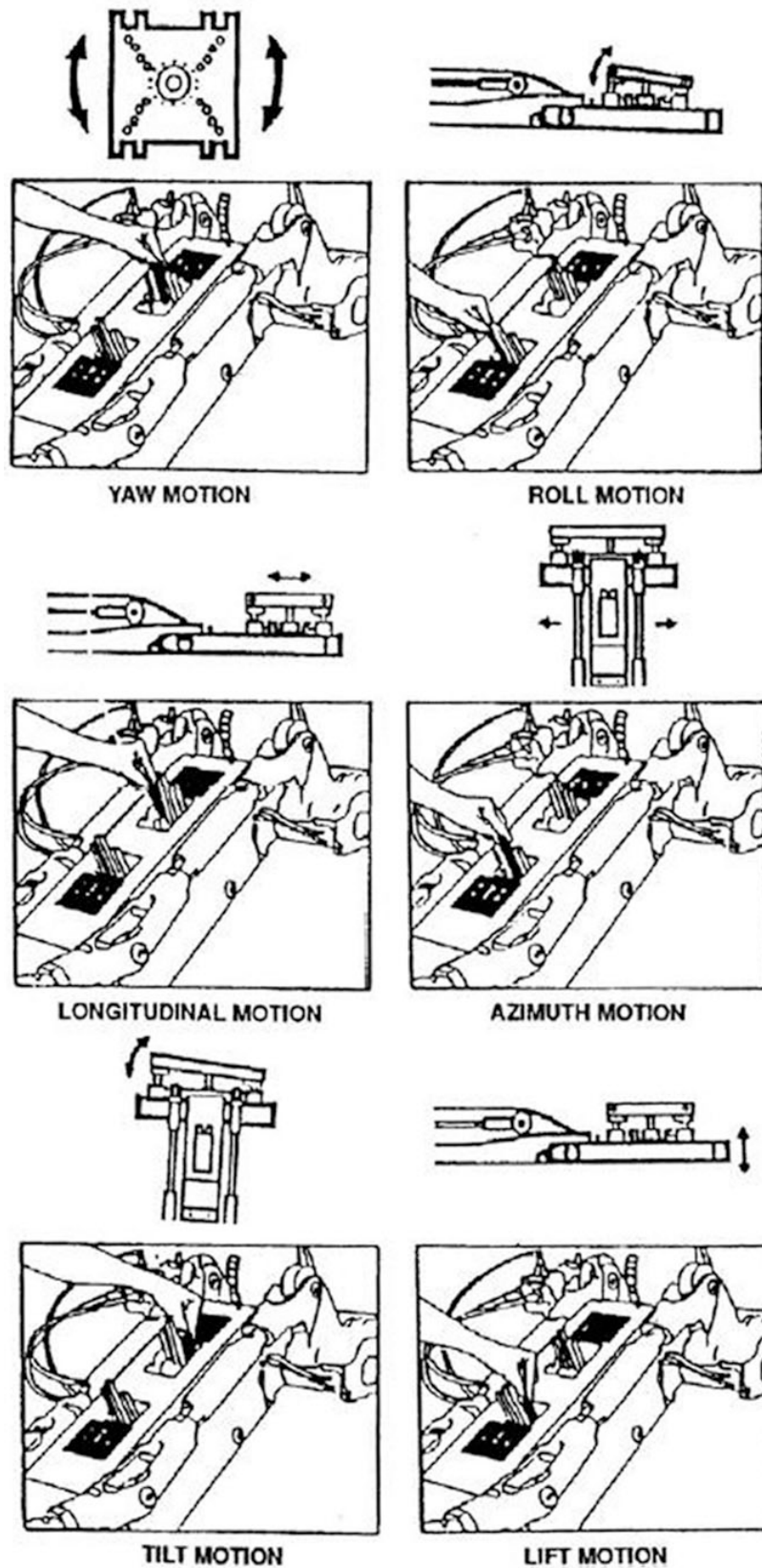


Figure 1-17. Boom-mounted controls and boom operations.



## Lift truck accessories

There are many different accessories to use in lifting, moving, and loading munitions available for use with bomb-lift trucks, let's take a close look at them.

### Rollers

Bomb support rollers are used with all bomb-lift trucks. Install them on the lift truck tables, ram assemblies, and various other adapters. Rollers provide rotation of stores (munitions) during loading. They differ, not by their purpose, but by design and individual uses. Figure 1-18 shows where the different types of rollers can be installed on the tables of bomb-lift trucks. Rollers are used in sets of four, and their weight capacities vary with their construction and the lift trucks they are installed on. Aluminum rollers installed on the MJ-1 or MHU-83 have a capacity of 3,000 and 7,000 pounds, respectively. The extra-long roller assembly is made of hardened rubber and is used to handle soft-shelled stores such as rocket launchers or special weapons/bombs. Its weight capacity is 2,000 pounds.

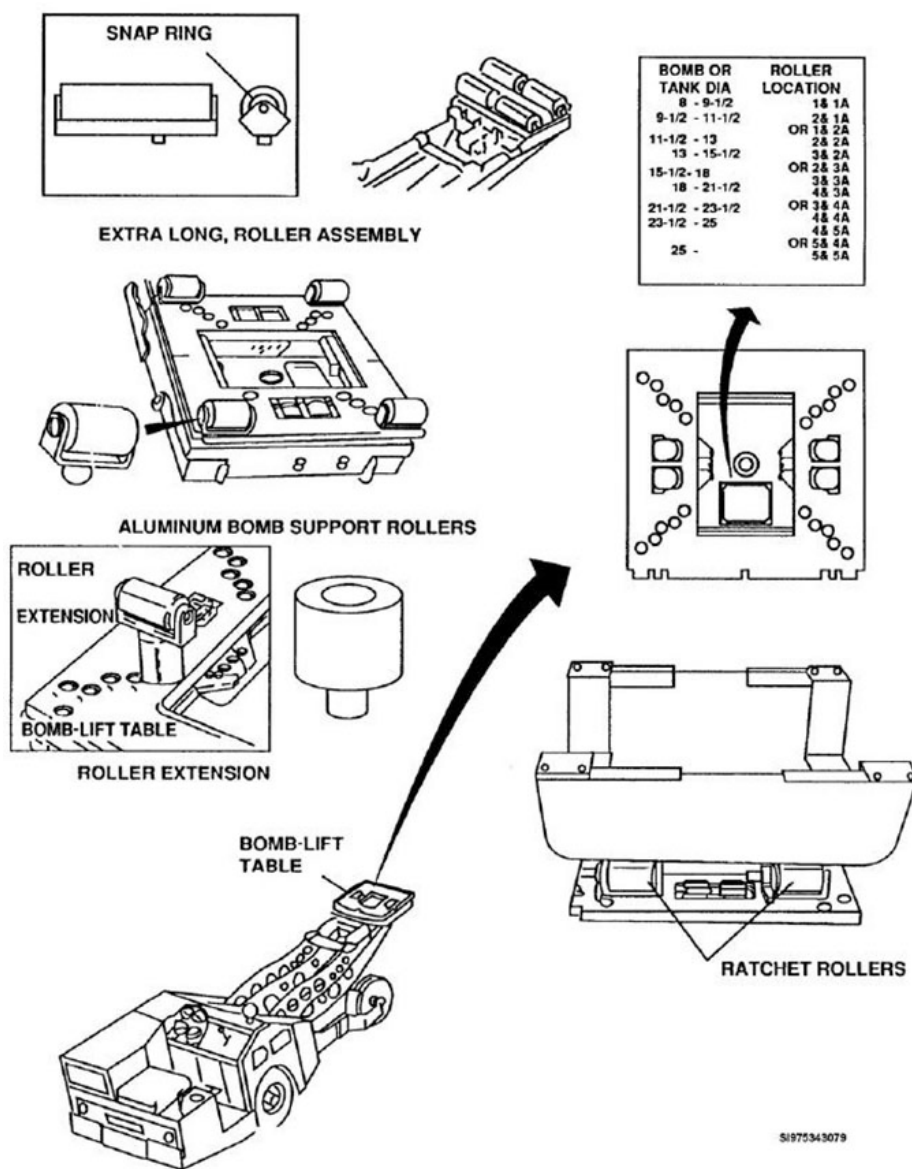


Figure 1-18. MJ-1 boom table rollers.

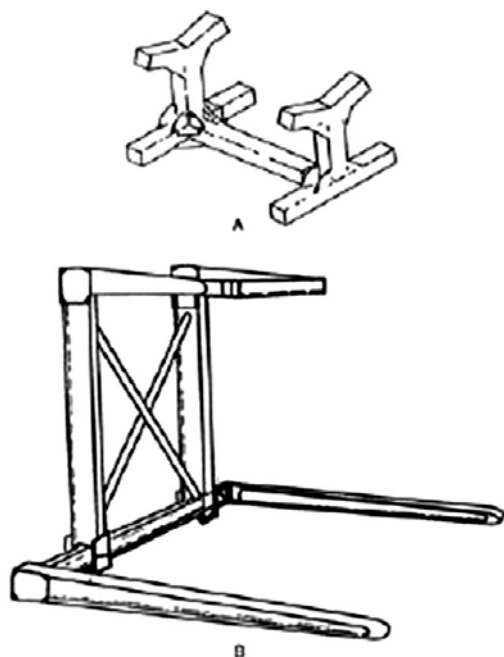


Figure 1-19. Munitions support stands.

### Straps

Load binder assemblies (tie-down straps) are used to secure a single item to the lift table or to load adapters of bomb-lift trucks during transport, loading, or unloading. Only one tie-down strap is required per item when using the MJ-1, but you need two per item when you're using the MHU-83-series bomb-lift trucks.

### Stands

Bomb stands, also known as *Y-stands*, (fig. 1-19a) are used to temporarily support munitions. They are found in aircraft loading or munitions storage areas. These stands save considerable loading time by supporting munitions that have been removed from handling trailers. Another type of stand you may use at some time is a preload stand, also known as a *gantry* (fig. 1-19b). This type of stand is used to support multiple ejector racks (MER) to load and store for future use. Once the MER is loaded and stored, they are considered preloaded. These preloads can be picked up with lift trucks at any time and loaded directly on an aircraft.

### Beams

All types of beams are classed together and serve the same basic purpose—to support or lift some type of munitions. Use them with bombs, missiles, dispensers, or anything with suspension lugs. They accommodate items equipped with suspension, bail, or T-lugs spaced 14 inches or 30 inches apart. The beams vary in their individual design depending on which munitions or dispenser is used. Each individual beam has a particular capacity rating that matches the store it is used with. The bomb support beam is equipped with a nylon load binder attached to it for securing munitions that are transported over long distances.

### Chains and slings

Chains and slings (fig. 1-20) are used together or separately depending on the task. They attach to the cradle or table assembly of bomb-lift trucks, forklift adapters, or lift arm extensions to get the configuration you need for a particular task. Use them for lifting bombs or other munitions from the ground, bomb stands, crates, trailers, and so forth. The lift capacity of the chains presently in use ranges from 2,000 to 7,000 pounds. The sling assembly has a lift capacity of 4,600 pounds.

### Adapters

Adapters used with bomb-lift trucks come in many different sizes, shapes, and configurations. Here we cover some of the more common adapters that are used to move, load, or unload munitions and to install or remove suspension equipment.

### Extension lift arms

Use the extension lift arms only with MJ-1 lift trucks. Lift single munitions from the ground, trailers, dollies, and so forth, and position them onto bomb stands for subsequent pickup. You can also use them to position munitions onto a lift truck table immediately before transportation or aircraft loading. This accessory reduces the lifting capacity of the MJ-1 from 3,000 pounds to a maximum of 2,200 pounds.

Other accessories such as the utility chain, cargo hook sling, and lug beam are used in conjunction with the extension lift arms by attaching them to the hook located on the end of the arms. The extension lift arms are installed on the MJ-1 by inserting the end of the arms into slots on the inside



of the MJ-1 lift arms. Make sure the extension lift arms are fully seated in the slots to prevent equipment damage and possible personnel injury.

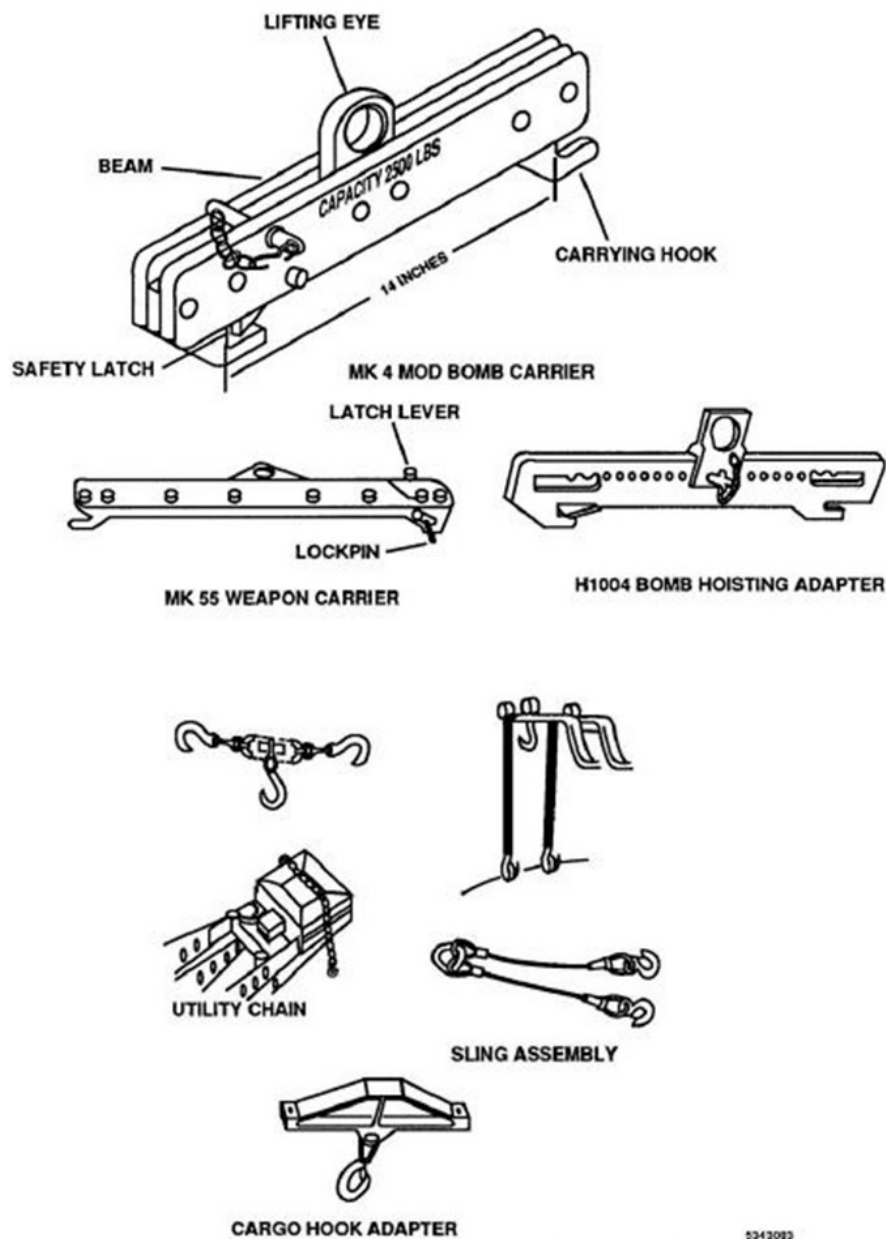


Figure 1-20. Bomb/weapon carriers and hoists.

#### *Forklift adapter assemblies*

Forklift adapter assemblies for the MJ-1- and MHU-83-series bomb-lift trucks are quite different in design, but they serve basically the same purpose. The MJ-1 forklift adapter is used for loading where there's not enough clearance between components to use the bomb-lift truck table. A typical example of this is when loading a single munitions item with a diameter that won't let you align the suspension lugs with the bomb rack hooks properly, even with the bomb-lift truck arms positioned as low as possible. In the above example, the forklift adapter will allow you to align and mate the munitions suspension hooks and the bomb rack. The MHU-83 fork adapter assembly limits the weight capacity to 6,000 pounds.

Load binder adapters must also be used when forklift adapters are installed on the lift trucks. They are used as connection points for tie-down straps when a store is being carried on the adapter. They are readily attached to the fork adapter by inserting two locating pins through the roller adapter holes on the forks. The load binder adapter is held in place by the secured load binder.

The adapter assembly consists of the fork adapter, a short or long bar, and a set of forks. The short bar facilitates one set of forks and provides fork centerline spacing from 4 to 32-inch increments. The long bar facilitates two sets of forks and provides centerline spacing from 4 to 124-inch increments. The forks are attached to the bars by quick-release pins. Each fork has 11 holes for weapon support rollers to facilitate handling munitions of various sizes. Since the standard forks sometimes are not long enough, fork extensions provide extra length for unusual situations.

### **Bomb-lift truck safety precautions**

As a driver, *you* are responsible for the proper and safe operation of your vehicle or equipment. *You* are responsible for performing pre-, during-, and post-use inspections, as well as providing routine service and repairs on your vehicles. *You* are the most important single factor in preventive maintenance. Preventive maintenance is the systematic care of a vehicle including daily cleaning, servicing, and inspecting for maintenance discrepancies. Your job is to maintain serviceability at reduced cost. Detecting and correcting defects in their early stages before they develop into major defects results in lower maintenance costs and less vehicle out-of-commission time. Safety is an inherent part of our lives. Even though you've driven lift trucks, transported or loaded and unloaded munitions, there are still safety precautions that you probably are not aware of concerning the use of these trucks. Here is a list of precautions to keep in mind:

- The MJ-1A/1B unit's travel bar must be in the up position before shutdown. This prevents damage to the lift arms, cradle assembly, and associated hydraulic lines due to the lift arms resting on the ground. It also keeps excessive hydraulic pressure from building up in the lift arm cylinders after the unit is shut down.
- All lift trucks equipped with the hydrostatic drive system must be brought to a complete stop before changing from forward to reverse or reverse to forward.
- Any time a lift truck is parked on a slope for an extended period of time, the wheels must be chocked. When a unit is parked in this position, brake fluid can bleed past the master cylinder and cause brake system failure.
- In loading or unloading munitions or suspension items with the bomb-lift truck stationary, you must position the directional control lever to the NEUTRAL position and set the parking brake to make sure the lift truck does not inadvertently move.
- You must raise the boom or extend the wheels (MHU-83 B/E and C/E) to ensure clearance between the table and inner wheels before driving these units. If not, damage to the inner wheels can result.

### **011. MC-7 air compressor**

The Air Force uses many types of air compressors varying in shape, size, and pressure output. They are classified in two categories—*low pressure*, zero to 200 psi, and *high pressure*, over 200 psi.

Some of the normal everyday uses of air compressors include the following:

- To power pneumatic tools.
- To provide compressed air used in cleaning and drying equipment components.
- To provide compressed air to run vacu-blast operations.

### **Characteristics**

An air compressor that you will likely use is the MC-7. MC-7 compressors come in two versions—gas and diesel. Each version of the MC-7 has its own TO. The gas powered MC-7 model GR125 is

governed by TO 34Y1-134-1, *Gasoline Engine Driven Portable Rotary, Air Compressor, Type MC-7, 100 PSI Gage, 125 CFM, Model GR125* and will be the first compressor that we will discuss.

The MC-7 model GR125 air compressor is capable of continuous operation at a rated capacity of 125 cubic feet of free air per minute at a discharge pressure of 100 psi. It is a source of air for general maintenance and operates with its side doors open.

The MC-7 (fig. 1-21) is fully road transportable, and is installed on a leaf-spring-mounted chassis. After draining the compressed air system and compressor oil and performing other servicing procedures according to TO 34Y1-134-1, the MC-7 can also be flown to wherever it is needed.

The diesel model of the MC-7 is maintained in accordance with TO 34Y1-244-1, *Compressor, Air, Rotary, Diesel Engine Driven, 2-Wheel, Trailer-Mounted, 125 CFM, 100 PSI, Type MC-7 Model 11M125POQ*. This model of the MC-7 compressor operates with its side doors closed to meet Occupational Safety and Health Administration (OSHA) standards. Operating the compressor with the doors open can cause hearing damage. There is an extensive list of safety precautions in the safety summary, and they should be reviewed before operating the compressor.

The diesel model of the MC-7 is also capable of continuous operation at a capacity of 125 cubic feet of air per minute at a discharge pressure of 100 psi. It is capable of operating for up to eight hours at a time without refueling. This compressor is designed for general construction work and use with pneumatic tools.

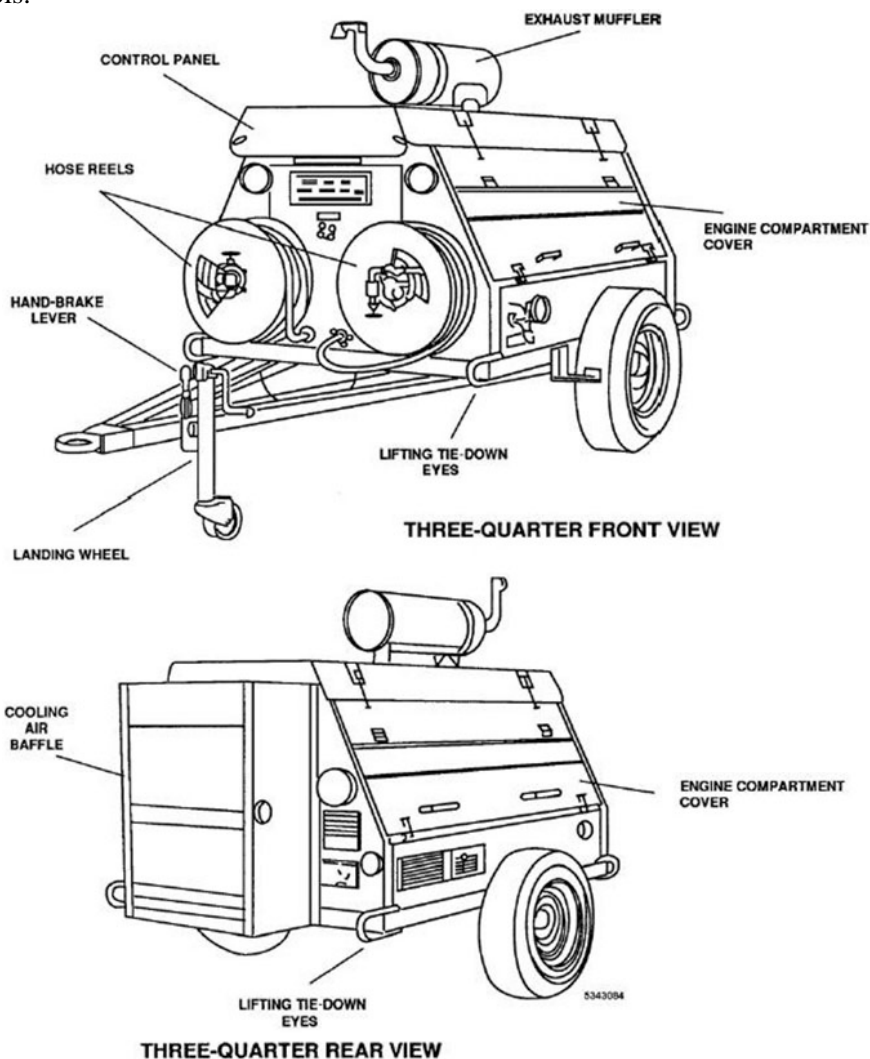


Figure 1-21. MC-7 air compressor.

**Safety considerations**

Serious injury can be caused by compressed air pressure as low as 10 to 15 psi. Besides breaking the skin and allowing air to enter the bloodstream, compressed air can blow small objects (dust or pebbles) into a person's eyes or ears. Compressed air must be handled with extreme care.

Serious injuries have been caused by using compressed air to blow dirt or dust from work clothes or to clean up filings, chips, and shavings from repair jobs. Any air pressure strong enough to clean dust or dirt is also strong enough to injure a person's eyes and ears or to penetrate the body. Compressed air greater than 30 psi must not be used for cleaning purposes. Protective equipment must be used. This protective equipment is identified in AFI 91-203, *Air Force Consolidated Occupational Safety Instruction*.

There are various safety precautions that you should be aware of when working with or around air compressors. Air compressors should be used in a location with adequate ventilation. Using these units in an enclosed area can result in asphyxiation or death. Never attempt to fill a fuel tank on one of these units while the engine is operating. A spark could cause a fire or explosion. Make certain the air hoses of these units are not frayed, cracked, kinked, or deteriorated in any way and all air fittings used on the units are serviceable. A broken airline with 3,500 psi can quickly become a lethal weapon instead of a timesaving piece of equipment. Never connect or disconnect a high-pressure service hose to any system without first making sure that there is no pressure in the system. If you do this by accident, the amount of pressure coming out of the hose could cut your skin and push air into your bloodstream. Also, never connect high-pressure air to a low-pressure air system. Normally, noninterchangeable chucks and connections are installed on high- and low-pressure equipment to prevent servicing low-pressure systems with high-pressure equipment.

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**Self-Test Questions**

After you complete these questions, you may check your answers at the end of the unit.

**010. Common lift trucks and components**

1. What types of items will personnel usually load and unload onto fighter or bomber aircraft using lift trucks?
2. Which wheels on the lift truck are steerable?
3. What is the standard lifting capacity of the MJ-1 lift truck?
4. Explain the major difference between the hydrostatic drive system and the automatic transmission.
5. What allows you to operate the hydraulic system of a MHU-83 if the engine or hydraulic pump fails?

6. What particular fine adjustment would cause whatever is loaded to slope or lean using the boom position controls of an MHU-83?
7. What is the maximum capacity of an MHU-83 lift truck using the fork adapter assembly?
8. When loading or unloading with a bomb-lift truck, the directional control lever should be in what position and why?

#### **011. MC-7 air compressor**

1. List three normal uses of the MC-7 air compressor.
2. Why should the diesel-powered MC-7 only be operated with the cover doors closed?
3. Compressed air has caused injuries at what minimum amount of air pressure?
4. What publication governs the use of protective equipment for an air compressor operator?

### **1-4. Munitions Handling Vehicles**

Most operations involving the movement from the munitions storage area to the flight line are done with the munitions handling trailers, you studied earlier. This section covers tow vehicles, cargo trucks, and tractor trailers you'll use to move those trailers.

#### **012. Bobtail truck**

There is a variety of different makes and models, each with its own unique set of operating procedures. Your unit vehicle trainer will help you with specifics on those bobtails (fig. 1-22) used at your base. However, there are common characteristics in which we describe below.

##### **Characteristics**

The bobtail is, basically, a pickup truck modified for use as a primary tow vehicle for moving munitions trailers to and from the flight line. From the back edge of the cab to the front bumper, the bobtail is a pickup truck, but this is where the similarity ends. The back end has been shortened by about one-half, thus the name "Bobtail." The front wheelbase is the same as a pickup. The rear wheel base is considerably shorter to accommodate a dual-wheel setup. The distance between the front and back dual wheels is shorter than a standard pickup. A toolbox is mounted behind the cab for storing chocks, tie-downs, light cables, and so forth. A reinforced bumper on the rear has pintle hooks and electrical outlets for trailer towing.

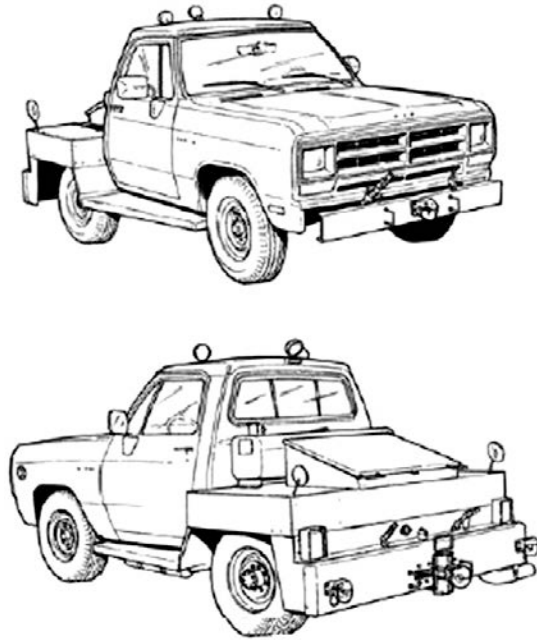


Figure 1-22. The bobtail.

### Safety considerations

The center pintle hook on this truck has a unique and very handy feature—it can be unpinned and moved in, out, or sideways to make coupling up to a trailer easier. Once the trailer lunette is secured inside the pintle hook, simply back the truck up until the pintle locks itself back in place. This is better than maneuvering the truck several extra times in order to make a connection. Once the bobtail is in motion, driving it is just like driving a pickup truck with a few exceptions. Here are some things to watch for:

- The turning radius of the bobtail is 18-22 feet depending on the model. It can turn a very sharp corner, a lot sharper than the trailer you are towing can safely negotiate. Keep this point in mind when towing a trailer to avoid damaging the trailer steering assembly.
- Keep in mind, that the bobtail is *not* designed for long-distance, over-the-road transport. It is a towing vehicle and should *not* be driven at high speeds. High-speed driving could easily damage the vehicle.
- The maximum towing capacity of the bobtail ranges from 40,000-70,000 lbs. depending on the model. The maximum speed on paved roads is 35 mph. However, this is not the maximum speed for towing. When pulling equipment, the maximum towing speed is 15 mph unless conditions or local requirements reduce speed further. Always verify the correct towing speed at your assigned location.
- The operator must recognize the effect that local weather conditions can have on the bobtail. To ensure maximum use and minimum downtime, operating procedures, inspections, and maintenance must be adjusted to local conditions. In other words, get the proper training and follow that guidance.

### 013. 1/2-ton and 2 1/2-ton cargo trucks

The trucks in a munitions organization range from the 1/2-ton pickup up to the 2 1/2-ton cargo truck. They are used for transporting munitions, trash, personnel, and so forth.

### Characteristics

Like any vehicle, powered or nonpowered, you must perform a pre-use inspection to determine the serviceability of the truck before you use it. For cargo trucks, use AF Form 1800, Operator's Inspection Guide and Trouble Report, as a guide and means to document defects you find. Report defects immediately so repair actions can be started. In addition to pre-use inspections, you perform organizational maintenance, commonly known as operator maintenance, on all assigned vehicles. Operator maintenance is the systematic care of a vehicle, including daily cleaning, servicing, and inspecting for maintenance discrepancies. Its purpose is to maintain vehicle serviceability at reduced cost.

### Brake systems

On the pickup trucks, you will find the usual automotive hydraulic brake system. Usually, the parking brake is a manually operated mechanical type, which requires you to set a hand lever. However, the larger trucks have an air-over-hydraulic brake system. In most cases, this system requires 60 psi air pressure in order to operate. A gauge on the dashboard indicates the air pressure. The air pressure system has a warning system buzzer, light, or both associated with the air pressure system to alert you when the air pressure drops below the required operating level. When the warning device gives its signal, you must stop and try to find the reason for losing air pressure.

### Drive systems

The cargo trucks used by the Air Force may be two-, four-, or six-wheel drive. Two-wheel drive systems are generally found in pickup trucks, although some  $\frac{3}{4}$ -ton pickups may be of the four-wheel-drive configuration. A vehicle with a four-wheel-drive capability is designated a "4 × 4 vehicle". The first "4" designates the number of drive wheels, and the second "4" designates the total number of wheels on the vehicle. Even if a four-wheel-drive vehicle has dual wheels on the rear (six tires total), it is still considered a four-wheel vehicle. Each dual wheel is considered one wheel.

The transmission can be three-, four-, or five-speed, meaning that you have three, four, or five forward gear ratios to select from. In conjunction with the transmission, some of your trucks will have another lever for selecting a high or low range. High range is used for normal driving but when you are in mud, sand, or snow or are transporting a heavy load, you can put the transmission into low range (which lowers the overall gear ratios of your transmission) and get the power you need. If the truck is so equipped, you also have the option of placing the truck into four- or six-wheel drive. This also helps you move through mud, sand, or snow and can be used in conjunction with a high- or low-range section of your transmission. When driving, you decide which range and whether you need four- or six-wheel drive, depending on the load and the terrain or road conditions over which you are driving.

## 014. MB-4-series aircraft towing tractor

It's hard to imagine a vehicle powerful enough to move an aircraft with little or no effort. This vehicle can also move mountains of snow if equipped properly. What vehicle is it? It must be a tug.

### Characteristics

The USAF MB-4 aircraft towing tractor (fig. 1-23) is a full-time, four-wheel drive, four-wheel steering tractor designed primarily to tow and push aircraft weighing up to 140,000 lbs. gross weight. However, munitions people find it very useful for pulling trailers loaded with munitions. All controls and indicators required for tractor operation are located in the cab. Power is transmitted to steerable front and rear driving axles through a four-speed automatic transmission and a transfer case. The tractor has a radio-suppressed 12-volt electrical system.

### Safety considerations

The MB-4 is a very expensive piece of equipment that is difficult to maintain and expensive to repair. It weighs almost 11,000 lbs. and has 1-inch thick cast steel bumpers. If you hit something, you may



scratch the paint on the bumper; however, whatever you hit will probably be destroyed. Therefore, you must pay close attention when operating this vehicle. Once the engine is running properly and warmed up, you can drive the tractor. There are two different procedures for driving, depending on whether the roads are dry or slippery. Please take note of the following to prevent damage to equipment.

- Use first gear when towing and second, third, or drive under other conditions.
- Severe damage to the tractor drive train can result if the differential shift lever is in the **LOCKED** position when the tractor is operated on dry road surfaces. The differential shift lever engages the all-wheel-drive feature of the MB-4. Unlike the limited-slip, four-wheel drive in most pickup trucks and jeeps, the MB-4 has a no-slip drive system. This means that every wheel will turn exactly the same amount as any other wheel. With this no-slip feature, the MB-4 can experience serious damage if it is driven on dry pavement with the differential lock engaged.

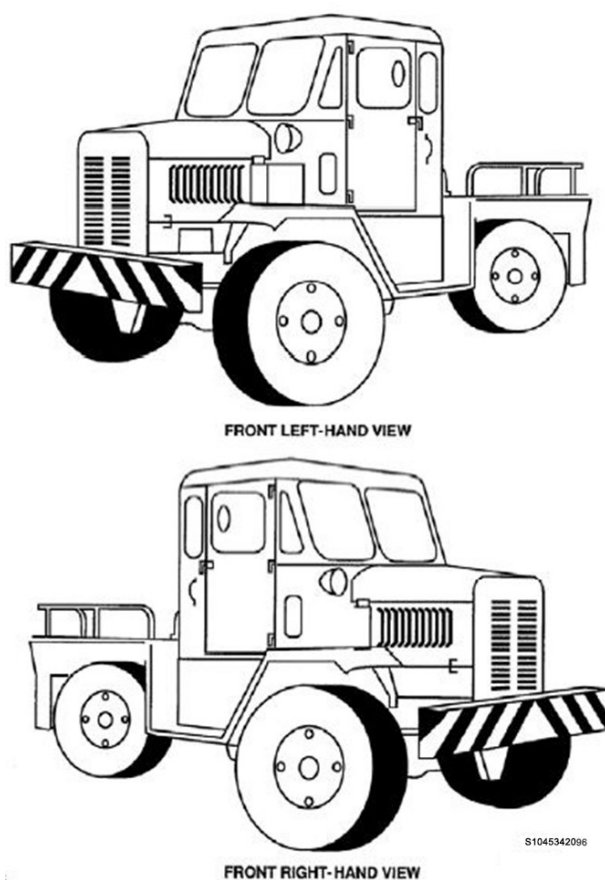


Figure 1-23. MB-4 aircraft towing tractor.

### 015. Pintle hooks

Towing equipment, whether it is munitions material handling equipment or aerospace ground equipment (AGE) requires good safety practices to ensure safe transport. The majority of equipment and/or munitions towed by an ammo troop will have a pintle hook assembly (fig. 1-24) connecting the tow vehicle to the towed item.

#### Components

A pintle assembly consists of essentially two components: a lunette ring and pintle hook. The lunette ring is a type of gooseneck/hitch connection on the item to be towed that works in combination with a



pintle hook assembly on the tow vehicle. It is nothing more than the attach point (a ring) permanently affixed to the piece of equipment to be towed. A pintle hook and lunette ring has a more secure coupling than a ball-type trailer hitch that we are accustomed to seeing on personally owned vehicles. The focus of this lesson is to stress the importance of properly connecting/locking the pintle hook for safe towing operations.

Although this is not an all-inclusive list, most issues can be avoided by following this list of safety requirements during operations with use of a pintle assembly.

- The vehicle operator is responsible to make sure all connections/couplings are secure before moving equipment. After inserting the lunette into the pintle hook, make sure the upper jaw is fully closed.
- Pintle hook towing assemblies will be secured with safety locking pins (typically a large cotter pin). The safety locking pin is attached to the towing vehicle's pintle assembly with a chain, or cable to prevent an unsecured pin from coming out and getting lost.
- Some pintle hook assemblies may have a quick release type safety pin. In this case make sure the ball locks on the pin are present and not excessively worn. Other pins use a cotter type pin with wrap-around clamps to prevent the pin from coming out.
- If any discrepancies are discovered, DO NOT use the vehicle to tow any equipment. Report the discrepancy to the unit Vehicle Control Officer/Munitions Control and turn-in the vehicle to Motor Pool.

**NOTE:** After the safety pin is installed, pull up on the latch (manual unlock device) to ensure the upper jaw will not open and the pintle assembly is locked (beware of the equipment with spring loaded towbars). If the manual locking device is not properly secured, spring loaded towbars or towbars under pressure can come out of the pintle hook and cause injury and/or damage.

- When the pintle is not in use (not connected to a lunette) the safety locking pin must be inserted. This prevents the safety locking pin from getting caught or torn off and becoming foreign object damage (FOD). Make sure this safety pin stays inserted in the pintle at all times.

## 016. 5- to 15-ton trucks

To move munitions on 25 foot or 40 foot trailers you'll need a tractor, or otherwise known as a heavy duty transport truck. The Air Force uses many different types of tractors for this purpose. This includes M-series (military type) and several makes/models of commercial tractors (e.g., International, Ford, GMC).

Because of the many different types of tractors in use, we don't discuss specific types. Instead, our discussion centers on those elements common to all types, such as transmission, brakes, and airlines, with special emphasis on safety. Your unit vehicle trainer will give you specific training on inspecting and operating the tractors common at your duty station.

### Transmission types

The tractors you will encounter will have either an automatic or manual transmission. Let's take a look at both types.

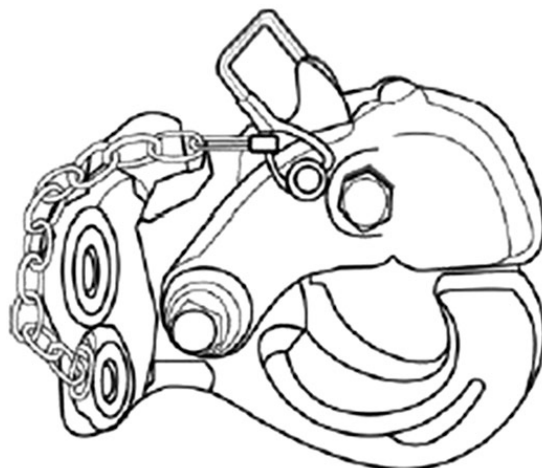


Figure 1-24. Pintle hook.

### ***Automatic transmissions***

Most USAF tractors have automatic transmissions. Automatic transmission tractors do not have clutches or stick shifts, but you can usually still select a low gear range to get greater engine braking when going down hills. The lower ranges prevent the transmission from shifting up beyond the selected gear and assists with braking. It is very important to use this braking effect when going down steep grades.

### ***Manual transmissions***

The USAF still owns trucks/tractors with manual transmissions that require clutching to change gears. This is a skill that is quite different than shifting with a personally owned vehicle (POV) with a manual transmission. The newer manual transmissions are operated based on the engines' revolutions per minute (rpm) and speed for shifting. The different gears will not engage properly, and will grind when trying to force the tractor into a higher or lower gear without traveling at the right speed. The clutch is not designed to be used every time you want to shift gears. Basically, if shifting gears correctly, the clutch should only be used for starting and stopping. Once at the right speed, you momentarily pass the stick shift through neutral and slide it into the next gear. It is important to not lose your patience when learning or training on these vehicles. Shifting gears with large trucks/tractors requires practice—even for the more experienced drivers.

### ***Brake systems***

There are a few brake components in a tractor that will be unfamiliar to the newly introduced driver. We will go over the most common brake components to all tractors and the purpose of their function.

#### ***Trailer hand valve***

The trailer hand valve (also called the trolley valve or Johnson bar) works the trailer brakes. The trailer hand valve should be used *only* to test the trailer brakes. Do *not* use it to slow the trailer while driving because of the danger of making the trailer skid. The foot brake sends air to all of the brakes on the vehicle including the trailer. There is much less danger of causing a skid or jackknife when using just the foot brake. Jackknifing is the act of your tractor and trailer meeting in the middle of a skid. Never use the hand valve for parking because all the air might leak out unlocking the brakes (in trailers that don't have parking brakes). Always use the parking brakes when parking. If the trailer does not have parking brakes, use wheel chocks to keep the trailer from moving.

#### ***Tractor protection valve***

The tractor protection valve keeps air in the tractor brake system should the trailer break away or develop a leak. The tractor protection valve is controlled by the "trailer air supply" control valve in the cab. The control valve allows you to open and shut the tractor protection valve. The tractor protection valve will close automatically if air pressure is low (in the range of 20 to 45 psi). When the tractor protection valve closes, it stops any air from going out of the tractor. It also lets the air out of the trailer emergency line. This causes the trailer emergency brakes to come on, with possible loss of control.

#### ***Trailer air supply control***

The trailer air supply control on modern tractors is a red eight-sided knob (fig. 1-24), which you use to control the tractor protection valve. You push it in to supply the trailer with air, and pull it out to shut the air off and put on the trailer emergency brakes. The valve will pop out (thus closing the tractor protection valve) when the air pressure drops into the range of 20 to 45 psi. Tractor protection valve controls or "emergency" valves on older tractors may not operate automatically. There may be a lever rather than a knob. The "normal" position is used for pulling a trailer. The "emergency" position is used to shut the air off and put on the trailer emergency brakes.

### *Trailer service, parking, and emergency brakes*

Newer trailers have parking brakes just like standard vehicles. However, trailers built before 1975 are not required to have parking brakes. Those that do not have parking brakes have emergency brakes, which work from the air stored in the trailer air tank. The emergency brakes come on whenever air pressure in the emergency line is lost.

The emergency brakes come on whenever the air supply knob is pulled out (fig. 1-25) or the trailer is disconnected. A major leak in the emergency line will cause the tractor protection valve to close and the trailer emergency brakes to come on. But the brakes will hold only as long as there is air pressure in the trailer air tank. Eventually, the air will leak away and then there will be no brakes. Therefore, it is very important for safety that you use wheel chocks when you park trailers. You may not notice a major leak in the service line until you try to put the brakes on. Then, the air loss from the leak will lower the air tank pressure quickly. If it goes low enough, the trailer emergency brakes will come on.

### **Airlines**

Every tractor has two airlines: the service line and the emergency line. They run between the tractor to the trailer.

## **TRACTOR PROTECTION VALVE & EMERGENCY TRAILER BRAKE OPERATION**

### **Tractor protection valve**

- Provides air supply
- Closes automatically if air supply drops when driving

The parking brakes, when applied, close the tractor protection valve and set the spring brakes at the same time.

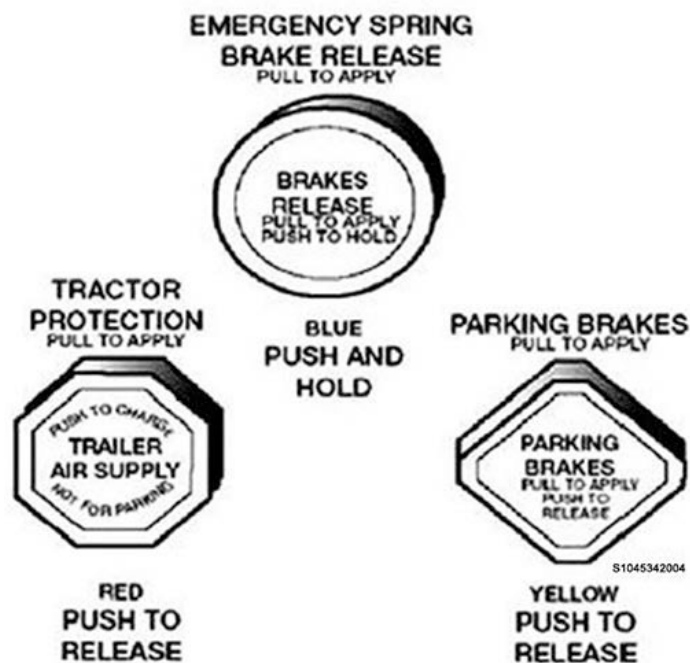


Figure 1-25. Tractor protection valves.

### Service airline

The service line carries air, which is controlled by the foot brake or the trailer handbrake. Depending on how hard you press the foot brake or hand valve, the pressure in the service line will similarly change. The service line is connected to relay valves. These valves allow the trailer brakes to be applied more quickly than would, otherwise, be possible.

### Emergency airline

The emergency airline has two purposes: it supplies air to the trailer air tanks, and it controls the emergency brakes on your trailer. Loss of air pressure in the emergency line causes the trailer emergency brakes to come on. An example of pressure loss could come from a trailer breaking loose, thus tearing apart the emergency air hose. When the emergency line loses pressure, it also causes the tractor protection valve to close (the air supply knob will pop out). Emergency lines are often coded with the color red (red hose, red couplers, or other parts) to keep from getting them mixed up with the blue service line.

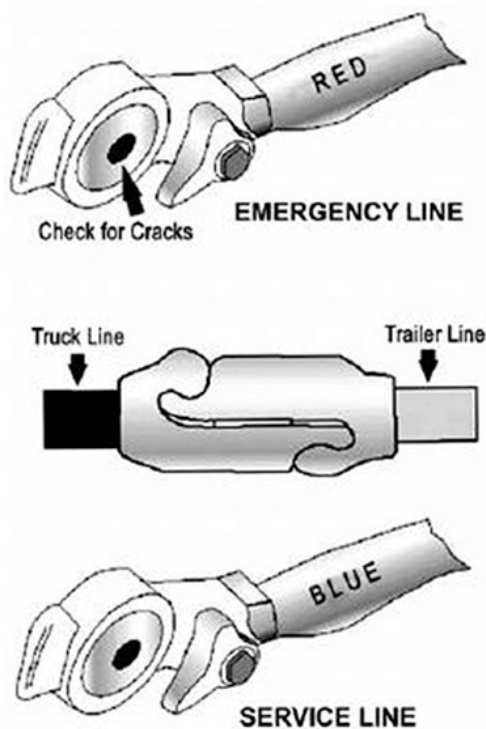


Figure 1-26. Hose couplers (glad hands).

### Hose couplers (glad hands)

Glad hands are coupling devices used to connect the service and emergency airlines from the truck or tractor to the trailer (fig. 1-26). The couplers have a rubber seal, which prevents air from escaping. When connecting the glad hands, press the two seals together with the couplers at a 90 degree angle to each other. A turn of the glad hand attached to the hose will join and lock the couplers. When coupling, make sure to couple the proper glad hands together. To help avoid mistakes, colors are used on modern tractors. Blue is used for the service lines and red for the emergency (supply) lines. Sometimes, metal tags are attached to the lines with the words “service” and “emergency” stamped on them. If you do cross the airlines, supply air will be sent to the service line instead of going to charge the trailer air tanks. Air will not be available to release the trailer parking brakes. If the parking brakes do not release when you push the trailer air supply control, check the airline connections.

Some vehicles have dummy couplers to which the hoses may be attached when they are not in use. This will prevent water and dirt from getting into the coupler and the airlines. Use the dummy couplers when the airlines are not connected to a trailer. If there are no dummy

couplers, the glad hands can sometimes be locked together (depending on the couplings). It is very important to keep the air supply clean.

### Safety considerations

As long as you are moving forward on a straight road, driving is relatively easy. Unfortunately, roads turn and sometimes you must back up. Because you cannot see everything behind your vehicle, backing up is always dangerous. Although the majority of vehicle training is accomplished with hands-on training, below are more crucial safety considerations.

### *Tractor/trailer coupling*

Safety considerations for the tractor trailer coupling include the following steps:

1. **Inspect fifth wheel.** Check for damaged/missing parts and that fifth wheel is in proper position for coupling. The fifth wheel should be tilted down toward rear of tractor with the jaws open. If you have a sliding fifth wheel, make sure it is locked.
2. **Inspect area and chock wheels.** Make sure area around the vehicle is clear and trailer wheels are chocked.
3. **Back slowly.** Back until the fifth wheel just touches the trailer.
4. **Secure tractor.** Put on the parking brake and place transmission in neutral.
5. **Connect airlines to the trailer.** Connect the tractor emergency airline and service airline to the corresponding trailer glad handles.
6. **Supply air to the trailer.** From the cab, push in the “air supply” knobs to supply air to the trailer brake system. Wait until the air pressure is normal and in the operational range.
7. **Back under the trailer.** The trailer should be low enough that it is raised slightly by the tractor’s fifth wheel when it is backed under it. Back the tractor slowly under the trailer to avoid hitting the kingpin too hard. Stop when the kingpin is locked into the fifth wheel.
8. **Check connection for security.** Raise the trailer landing gear slightly off the ground and pull the tractor gently forward while the trailer brakes are still locked to check that the trailer is locked onto the tractor.
9. **Secure vehicle.** Put the transmission in neutral and put the parking brakes on. Take the key with you so someone else does not unknowingly move the truck while you are under it.
10. **Inspect coupling.** Make sure there is no space/gap between the fifth wheel and trailer coupling. If there is space, something is wrong. Make sure the fifth wheel jaws have closed around the shank of the kingpin and is in the “LOCK” position.
11. **Connect the electrical cord and check the airlines.** Plug the electrical cord securely into the trailer and check both airlines and electrical line for signs of damage.
12. **Raise the front trailer supports (landing gear).** Raise the landing gear all the way up or far enough to prevent it from catching on railroad tracks or other elevated obstacles in the road.

### *Tractor/trailer combination backing*

Avoid backing whenever you can. When you park, try to park so you will be able to pull forward when you leave. When you must back up, here are a few simple safety rules.

- **Start in the proper position.** Put the vehicle in the best position to allow you to back safely. If possible, turn toward the driver’s side for better visibility. To prevent “jack knifing” of the tractor/trailer, try to avoid sharp angles when backing.
- **Use mirrors on both sides.** Check the outside mirrors on both sides frequently. Get out of the tractor/trailer and check your path if you are unsure.
- **Back slowly and use a spotter.** Always back as slowly as possible and rely on your spotter to identify blind spots you cannot see. The spotter should stand near the back of your vehicle where you can both see one another.

### *Wide turns*

When a vehicle goes around a corner, the rear wheels follow a different path than the front wheels. This is called “off-tracking” or “cheating”. Longer vehicles will off-track more. The rear wheels of the tractor will off-track some, and the rear wheels of the trailer will off-track even more. To counter this, steer the front end wide enough around a corner (called button hook) so the rear end does not run over the curb, pedestrians, and so forth. Keep the rear of your vehicle close to the curb to prevent eager drivers from passing you on the right and getting in your blind spot. If you cannot complete your turn without entering another traffic lane, turn wide as you complete the turn. This is better than



swinging wide to the left (called jug handle) before starting the turn because other drivers may be tempted to pass you in the right lane if you move to the left lane to make a right turn (fig. 1-27).

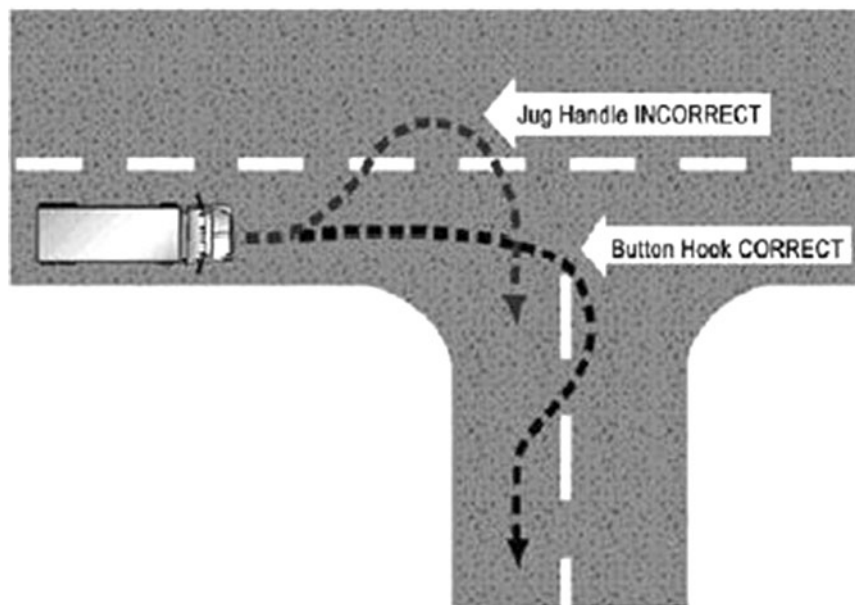


Figure 1-27. Proper turning with tractor/trailer combination.

### 017. Forklifts

Handling equipment you use includes forklifts, bomb-lift trucks (jammers), cargo trucks, and various tow vehicles. Today, most of these vehicles are commercial vehicles purchased by the military; however, there are some designed especially for the military like the rough-terrain (RT) forklift and M-series trucks. Using commercial vehicles saves the military time and money in the development and maintenance of its equipment. The first vehicles we look at here are commercial (non-tactical) forklifts in the 4,000 to 15,000 lb. capacity range.

In munitions handling, you use a variety of forklifts, depending on where you are assigned. These forklifts are divided into two categories, based on their capabilities: non-tactical and tactical terrain. Let's look at these in more detail.

#### Nontactical forklifts

The most common forklifts you are most likely to encounter in your career are nontactical forklifts. They are rated by their safe lifting capacities and are generally found in 4,000; 6,000; 10,000; and 15,000 lb. rated models. Appearances differ depending on the manufacturer and year produced. You will find that the 4,000 lb. through 6,000 lb. nontactical models are most effective on hard surfaces in and around storage warehouses. They are highly maneuverable and capable of handling most jobs associated with lifting and transporting (for short trips) pallets of munitions; however are suspect to getting stuck if driven off of unpaved surfaces. An example of a nontactical 6,000 lb. rated forklift can be seen in figure 1-28 below.

Nontactical forklifts are equipped with power rear-wheel steering, front-wheel drive, front-wheel brakes, and, usually, a one-speed torque-converter transmission. Two-speed transmissions can be found among the 10,000 and 15,000 lb. machines because they are usually driven to the job site as opposed to trailering the smaller models.

## Tactical forklifts

Although not as common, you may encounter a tactical forklift and be required to use it. Two types are used in the Air Force—the rough-terrain (RT) and the adverse-terrain (AT) forklifts; which are both diesel powered.

### *Rough-terrain forklift*

The rough-terrain forklift, commonly referred to as the “RT,” is one of the most useful and versatile pieces of munitions-handling equipment developed. Originally designed for use by the Marine Corps, the forklift is available in two models—one with a 6,000 lb. lifting capacity and another with a 15,000 lb. capacity. Since both models are similar in design, appearance, and operation, we can select one—the 6,000 lb. lift—as a representative type.

As shown in figure 1-29, the RT is a diesel-powered, self-contained, rider-type piece of equipment designed for RT handling, transporting, and warehousing of materials. It is capable of lifting loads of 6,000 lbs. to a maximum height of 144 inches. It can be used to transport loads from one area to another, indoors and outdoors, as well as in water to a maximum depth of 5 feet. The hydraulic-operated forklift mechanism mounted on the front of the vehicle provides the means of lifting, reaching, tilting, and sliding loads during the handling operation. To stop the engine, release the load and, at the same time, decrease the engine speed. Allow the engine to run at half speed or slower with no load for four or five minutes before closing the throttle and stopping the engine. When the engine stops, place the ignition switch in the OFF position.



Figure 1-28. Nontactical 6K forklift.

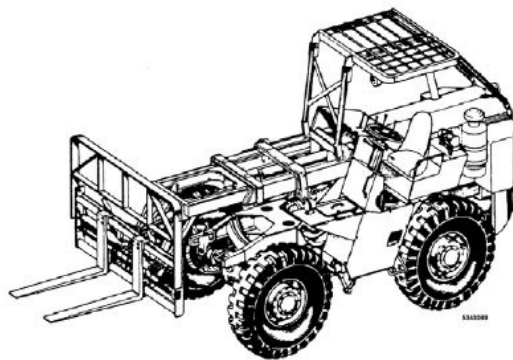


Figure 1-29. Rough-terrain forklift.

### *Adverse-terrain forklift*

The 10,000 lb. adverse-terrain (AT) forklift is diesel powered with a planetary-gear-type hydraulically actuated transmission that has two forward speeds and two reverse speeds (fig. 1-30). The closed AT cab is equipped with a heater, windshield wipers (front and rear), and two defroster fans. If desired, you can remove the upper half of the cab after disconnecting air and electrical connections for the windshield wipers and defroster fans. You can operate the AT in either two- or four-wheel drive. The front wheels provide the drive in two-wheel-only drive. The hydraulic power steering system controls the forward section of the AT.

The front axle of the adverse terrain forklift is solid, and turning the steering wheel causes the front section of the forklift to pivot around a pivot pin. This pivot point is also one of the most dangerous features of this machine. The machinery on the inside of the turn closes together with very little clearance. If the vehicle should pivot when someone is climbing in or out, severe injury could result. One way for this to happen is to use the steering wheel as a handhold to climb in or out. Remember, we said that the AT has hydraulic steering; however, that hydraulic system has a large accumulator or hydraulic pressure reservoir. If the system isn't properly bled when the machine is shut down, a



potential disaster is waiting to happen. To protect yourself, don't touch the steering wheel unless you intend to steer the forklift.



Figure 1-30. Adverse-terrain forklift.

### Special-purpose forklifts

Because of the environment where you work, a forklift with special characteristics is sometimes required. The two special-purpose forklifts currently in use are the variable reach and swingmast forklifts. Additional vehicle training will be required before adding these forklifts to your license as they have unique features and controls.

#### *Swingmast forklift*

Depending on the model, the swingmast forklift has a lifting capacity of 3,000 to 12,000 lbs. and is powered with either electric, gas, or diesel sources. The mast assembly can rotate 90 degrees from the main body which allows you to maximize available storage space and move large all-up-round containers anywhere in the storage area with ease. Since these forklifts are designed to be used indoors in tight spaces, most models you will see are electric-powered.

#### *Variable-reach forklift*

The variable reach is a RT, 6,000 lb. capacity, diesel-powered forklift (fig. 1-31). The safety and operator maintenance requirements for this forklift are the same as mentioned for other types of forklifts. A pilot-operated hydraulic joystick controls the boom hoisting and extension. The main feature, the telescopic three-stage boom, gives you the capability to reach and pick up pallets at a distance of 22 feet when the fork is level. The reach of the boom is cut to 15 feet with the fork elevated to 45 degree. This vehicle gives you the ability to download panel vans, large shipping containers, and trailers in no time at all. The forklift's size does not allow you to use it for operations in aboveground munitions igloos very often. This forklift is air transportable, has tie-downs for lifting, a pintle hook for towing, and an enclosed cab with a heater and defroster.

### 50K forklifts

The 50K forklift, also referred to as the "superstacker" or "sideloader," is used to load, stack, and transport ISO containers, or other heavy/bulky items. ISO containers have largely replaced breakbulk as a means of shipment for munitions, because these containers save massive amounts of crossload/handling time and storage space.

The 50K forklift is an impressive piece of equipment. As the name implies, this forklift can lift up to 50,000 lbs. Usually, the 50K lifts ISO containers from the top with the aid of a special adapter, but may also use forks (once the adapter is removed). Be very careful *not* to stand underneath a container

when it is suspended in the air by the superstacker. Also, if the container has two sets of openings for forklift tines, always use the outer set of openings for better load stability.

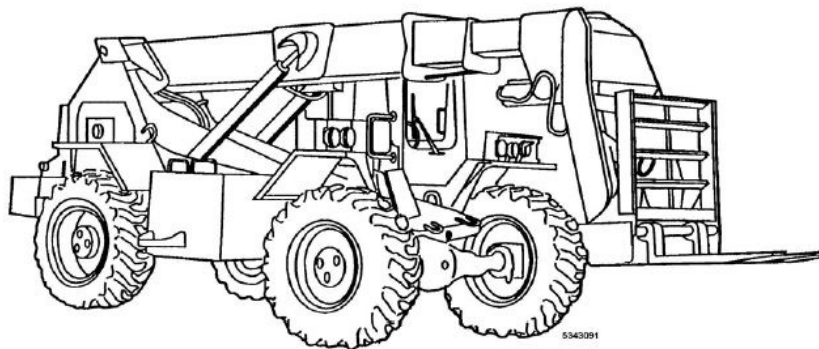


Figure 1-31. Variable-reach forklift.

### **Forklift safety**

Forklift safety is extremely important because of the hazards of the munitions you handle. The following paragraphs cover the safe operating standards for forklifts. Each operator must be thoroughly familiar with these provisions and comply with them during everyday operation.

Only trained and authorized operators are permitted to operate forklifts. The same standards apply to forklift drivers that apply to motor vehicle operators. Before you are considered fully qualified, you must be thoroughly trained in the operating rules discussed below.

### **Fork height while traveling**

Forklift tines shall be tilted back on all grades while a load is moved and raised only as far as necessary to clear the road's surface. Uneven ground and small steps due to door frames are common obstacles in a bomb dump. Additional precautions are identified in Air Force Manual (AFMAN) 24-306, *Manual for the Wheeled Vehicle Operator* and unit lesson plans. The following precautions should be used as a guide for safe and efficient operations:

- Do not raise or lower load while traveling.
- Do not descend ramps with load in front. Back down slowly.
- Do not exceed 5 mph around aircraft.
- Proceed slowly and cautiously around corners.
- For better vision, drive backwards with bulky loads.

### **Forklift parking**

You must park only in specified areas and out of the aisles of a warehouse. Perform the following when parking a forklift:

- Place the forks flat on the floor or ground.
- Place transmission in NEUTRAL.
- Turn off ignition and/or battery switch (certain models require you to pull the choke to kill the engine as well).
- Set the hand brake and chock the non-steering wheels as applicable.

### **Driver's orientation**

You can operate the forklift either forward or backward. Forklifts are usually driven in the forward gear for regular transportation purposes. Which direction (forward or backward) you travel can depend on several factors (e.g., distance being traveled/overheated engine, load is obstructing your view, going up/down steep inclines). The safest method is usually the right one, but your vehicle

control officer (VCO) or the vehicle operations office at your base can provide additional guidance on local requirements.

### ***Unattended forklifts***

Never leave a forklift unattended with the motor running. In a confined storage structure, a continuously running engine only adds to the amount of toxic carbon monoxide in the air. Also, do *not* park the forklift with a load on the tines. If the machine fails to start, performing maintenance and/or forklift removal will be easier. Never park the forklift with munitions on it.

### ***Driver's attention***

Pay attention to narrow entry ways/aisles and low-hanging objects. Usually, this type of accident occurs when you are backing up and *not* looking to the rear. A common object hit by forklifts is the arched ceiling in igloos. You get so busy looking at what you want to move that you forget about the top of the machine. *Always* keep your hands and legs inside the safety cage. It is easy to pinch yourself between the forklift and a stack of munitions or a building.

### ***Passengers***

Do *not* permit any person to ride on the forks or any other part of your vehicle. Forklifts are not built to carry passengers. This is a huge safety violation.

### ***Forklift refueling***

When possible, fuel forklifts at designated refueling points. When a mobile fuel truck is used, ensure a fire extinguisher is nearby and the refueling area is at least 100 feet from sites containing explosives. Shut off the motor before beginning to refuel. If fuel spills while refueling, delay restarting the forklift until the spilled fuel evaporates and fumes disappear.

### ***Intended purpose of forklifts***

Only use a forklift for its intended purpose. Never use the forks of a lift truck to push or lift another vehicle. Do *not* use a forklift to tow trailers or other equipment. Lifting unstable loads that are not designed/intended to be lifted by a forklift, and/or lifting items beyond the forklift's rated capacity are huge risks to personal safety.

### ***Forklift storage***

A separate building or parking facility is preferred for handling equipment. However, you can store serviceable equipment (without dangerous defects such as hot brakes or leaking electrolyte) in magazines or a warehouse containing inert material.

Park the forklift at least 10 feet from combustible material and keep all aisles clear at all times. To prevent fire from spreading from one equipment piece to another, space them far enough apart. Do not store gas or diesel powered equipment in a building containing explosives. However, for buildings with multiple bays, the equipment can be stored in an area that is suitable and completely separated (by fire walls and closed doors) from the bays, rooms, or cubicles that do contain explosives.

## Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

### **012. Bobtail truck**

1. For what purpose does a munitions systems specialist use a bobtail vehicle for?
2. Explain the unique feature of the pintle hook.
3. What is the turning radius of a bobtail tow vehicle?
4. What is the maximum towing capacity of the bobtail?

### **013. 1/2-ton and 2 1/2-ton cargo trucks**

1. Explain the term “operator maintenance.”
2. For what type of driving are the high-range gears of a cargo truck used?

### **014. MB-4-series aircraft towing tractor**

1. What is the primary purpose of the MB-4 tug?
2. Moving the differential shift lever into the locked position does what for the MB-4 tug?

### **015. Pintle hooks**

1. What are the two main components of the pintle assembly?
2. What are pintle towing assemblies secured with to prevent the pintle hook from opening?

### **016. 5- to 15-ton trucks**

1. When correctly operating a commercial tractor with a manual transmission, at what time(s) would you utilize the clutch?

2. What are the two purposes of the emergency airline?
3. Name three safety rules to follow when backing up a tractor/trailer combination.
4. Describe what the term “off-tracking” means in regards to tractor/trailer operations.

### **017. Forklifts**

1. Where are smaller nontactical forklifts most effective?
2. What are the two types of tactical forklifts?
3. Explain the shutdown procedures of a rough-terrain forklift.
4. Name the two special-purpose forklifts.
5. What is the weight capacity of the forklift referred to as the *superstacker* or *sideloader*?
6. What are the forklift tire height requirements while traveling with a load?
7. Why should you drive backwards with bulky loads?
8. How far from combustible material must a forklift be parked?

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## **Answers to Self-Test Questions**

### **001**

1. Remove or disconnect the drill from the power source.
2. Use a center punch to mark the exact center of the hole to be drilled.
3. Eye and face protection.
4. At full speed.

**002**

1. (1) Inspect the air hose for cracks or other defects. If you identify defects, make repairs, or replace the hose before using.  
(2) Before connecting the air hose to the air outlet fitting, open the control valve momentarily. Then connect the hose to the fitting and open the valve again momentarily—this ensures the hose is clear of water and other foreign material.  
(3) Stop the flow of air to a pneumatic tool by closing the control valve at the compressed air outlet before connecting, disconnecting, adjusting, replacing, or repairing a pneumatic tool.  
(4) When using sockets, make sure they are designed specifically for pneumatic tools (impact sockets). Non-pneumatic accessories cannot withstand the stresses of pneumatic equipment and can result in damaged equipment and injury to personnel.
2. 90 psi.
3. Spring-loaded ball bearing or socket lock.
4. Reduces the possibility of shearing or damaging threads when installing nuts and bolts.

**003**

1. The manual and equipment to be used.
2. Protective helmets and safety-toed boots.
3. (1) Forklift.  
(2) Jammer (bomb lift truck).  
(3) Over-head hoist.  
(4) Crane.
4. AFI 91-203 and/or the specific manual for the lifting device.

**004**

1. The polarity, the condition of the meter's battery, whether you are in manual or auto-range, and negative annunciator for the bar graph.
2. RANGE and HOLD.
3. HOLD mode.

**005**

1. 5,500 lbs.
2. TO 35D3-2-27-1.
3. 200 inches or 40 degrees in either direction.
4. It's an added safety feature to stop the trailer in the event of an accidental breakaway.

**006**

1. 15,000 lbs.
2. TO 35D3-2-26-1.
3. A spring-loaded latch device on the front axle.
4. Hydraulic/surge brake.

**007**

1. 12,000 lbs for conventional loads and 8,000 lbs for nuclear loads.
2. Three.
3. Five.
4. Four-wheel steering (double Ackerman).

**008**

1. (1) Vans (closed).  
(2) Flatbed (open).

- (3) Rollerized.
2. 51 feet.
3. To handle cargo loaded on 463L aluminum aircraft pallets.
4. The using vehicle operator.

**009**

1. Essentially, a large container, designed to secure atop the MHU-141, MHU-226 or MHU-110 munitions trailer for the transport of small built-up munitions.
2. 40 or 80 rounds.
3. Positive, two-hand control of munition.
4. Ensure the safety pins and/or latches are engaged after loading, unloading, and periodically check these devices between stops.

**010**

1. Munitions and suspension equipment (e.g., pylons, heavy stores, beams, multiple ejector racks).
2. The two rear wheels.
3. 3,000 lbs.
4. The automatic transmission can roll in gear, whereas the hydrostatic drive system will not move unless the operator actuates the necessary controls.
5. Using the hand pump.
6. Tilt.
7. 6,000 lbs.
8. Neutral with the parking brake set; to ensure the lift truck does not inadvertently move.

**011**

1. (1) To power pneumatic tools.  
(2) To provide compressed air used in cleaning and drying equipment components.  
(3) To provide compressed air to run vacu-blast operations.
2. Operation with the doors open can cause damage to the hearing of operating personnel.
3. 10 to 15 psi.
4. AFI 91-203.

**012**

1. Used primary as a tow vehicle for moving munitions trailers to and from the flight line.
2. It can be unpinning and moved in, out, or sideways to make coupling up a trailer easier.
3. 18-22 feet depending on model.
4. 40,000-70,000 lbs. depending on the model.

**013**

1. The systematic care of a vehicle, including daily cleaning, servicing, and inspecting for maintenance discrepancies.
2. Normal driving.

**014**

1. To tow or push aircraft weighing up to 140,000 lbs. gross weight.
2. Engages the all-wheel-drive feature.

**015**

1. A lunette ring and a pintle hook.
2. A safety locking pin.



**016**

1. Should only be used for starting and stopping.
2. It supplies air to the trailer air tanks and controls the emergency brakes on your trailer.
3.
  - (1) Start in the proper position.
  - (2) Use mirrors on both sides.
  - (3) Backup slowly and use a spotter.
4. Off-tracking is the path trailer or rear wheels follow as they go around a corner. The rear wheels follow a different path than the front wheels.

**017**

1. On hard surfaces in and around storage warehouses.
2. Rough terrain and adverse terrain.
3. To stop the engine, release the load and, at the same time, decrease the engine speed. Allow the engine to run at half speed or slower with no load for four or five minutes before closing the throttle and stopping the engine. When the engine stops, place the ignition switch in the OFF position.
4. Variable-reach forklift and swingmast forklift.
5. 50,000 lbs.
6. Raised only as far as necessary to clear the road surface.
7. Better vision.
8. 10 feet.

**Complete the unit review exercises before going to the next unit.**

## Unit Review Exercises

**Note to Student:** Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field-Scoring Answer Sheet.

**Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).**

1. (001) Before using an electric drill, what is the *first* thing you should do?
  - a. Make sure the diameter of the hole to be drilled is within the capacity of the drill.
  - b. Connect the drill to the power source.
  - c. Ask a coworker for assistance.
  - d. Insert the chuck key.
2. (001) The purpose of cutting lubricant in most drilling operations is to increase the
  - a. life of the drill only.
  - b. speed of drilling only.
  - c. frictional heat during drilling.
  - d. drilling speed and the drill bit life.
3. (001) Which *minimum* articles of safety gear must be worn when using a bench grinder?
  - a. Apron and gloves.
  - b. Eye and face protection.
  - c. Gloves and steel-toed boots.
  - d. Safety glasses and long sleeved shirt.
4. (001) An electric saw blade must be operating at what speed before it contacts the material being cut?
  - a. Full.
  - b. Low.
  - c. Moderate.
  - d. Accelerated.
5. (002) How many pounds per square inch (psi) of clean, dry air is required at the tool end of the air hose to ensure the tool is operating safely and efficiently?
  - a. 60.
  - b. 90.
  - c. 110.
  - d. 125.
6. (003) What condition would prevent an operator from applying power to a hoist or other powered lifting device?
  - a. An AF Form 979 is attached to the unit.
  - b. Potential for lightning within 15 miles of the area.
  - c. Procedures are not covered in detail in the owner's manual.
  - d. The unit is tagged with a DD Form 1574-1, condition code A.
7. (003) What should be worn anytime there is a potential for injury from overhead objects during a lifting operation?
  - a. Kevlar.
  - b. Safety goggles.
  - c. Leather gloves.
  - d. Protective helmets.

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8. (003) What is the *most common* type of lifting sling used in the munitions career field?
    - a. Chain assembly.
    - b. Web strapping.
    - c. Metal mesh.
    - d. Wire rope.
  9. (003) The following are all good safety practices to follow when using a lifting sling *except*
    - a. standing clear of the attached load.
    - b. padding any sharp corners the sling may come in contact with.
    - c. keeping your hands and fingers from between the sling and the load.
    - d. inspecting the sling by passing your bare hand over the body of the sling.
  10. (004) The annunciators displayed on the Fluke 8025-series multimeter are used to distinguish among
    - a. ohms, milliohms, and kilohms.
    - b. ohms, kilohms, and megohms.
    - c. amps, ohms, and millivolts.
    - d. ohms, volts, and amps.
  11. (004) What are the two operational modes of the Fluke 8025-series multimeter?
    - a. Alternating current and direct current.
    - b. Range and hold.
    - c. Auto and manual.
    - d. Continuous and momentary.
  12. (005) The steering system on the MHU-141/M trailer has a turning radius of how many inches?
    - a. 90.
    - b. 200.
    - c. 400.
    - d. 600.
  13. (005) When the MHU-141 trailer is loaded or towed with the hinged deck panels open, what must be done?
    - a. The deck-panel supports must be properly positioned and locked in place with quick-release pins.
    - b. The deck-panel supports must be properly positioned and held in place with a tie-down strap.
    - c. Bomb chocks must be positioned to the deck-panels and locked in place with cotter pins.
    - d. Close and lock the two deck panels; the trailer cannot be towed in this configuration.
  14. (006) What is the *maximum* load capacity of the MHU-110/M trailer?
    - a. 5,000 pounds.
    - b. 5,500 pounds.
    - c. 15,000 pounds.
    - d. 20,000 pounds.
  15. (006) The parking brake on the MHU-110/M is applied by
    - a. pulling either one of two hand levers located on each side of the front of trailer.
    - b. pulling either one of two hand levers located on each side of the rear of trailer.
    - c. pulling the center hand lever located in the front of trailer.
    - d. pulling the surge brake located on the tongue of trailer.

16. (007) How many openings (hinged door panels) are on the deck of the MHU-226 trailer?
  - a. One.
  - b. Two.
  - c. Three.
  - d. Four.
17. (007) What type of steering aids the MHU-226 in a tighter steering radius?
  - a. Rack and pinion.
  - b. Power recirculating ball.
  - c. Front-wheel automotive type.
  - d. Four-wheel double Ackerman.
18. (008) After 463L pallets are positioned on a rollerized trailer, what can you use to secure the pallets to the trailer?
  - a. Steel chains only.
  - b. Wire ropes and slack adjusters.
  - c. Wood bracing and tie-down straps.
  - d. MB-1 chain assemblies and/or tie-down straps.
19. (008) What kind of movement supports on-base activities to or from the flightline?
  - a. Hazardous cargo.
  - b. Operational.
  - c. Logistical.
  - d. Intrabase.
20. (009) What munitions item is *not* loaded into transport modules by munitions personnel?
  - a. BDU-33.
  - b. MK 106.
  - c. ALE-50.
  - d. 20 MM.
21. (009) What transport module used for decoy munitions has a *maximum* capacity of 30 magazines?
  - a. BDU-33.
  - b. ALE-40.
  - c. ALE-50.
  - d. 20 MM.
22. (009) How often should the positive locking devices on the doors of munitions transport modules be checked?
  - a. At the beginning and ending of each shift.
  - b. During initial pre-check of the trailer only.
  - c. After loading, unloading, and periodically between stops.
  - d. After loading, unloading, and every 10 minutes when transporting.
23. (010) The purpose of the transport beam beneath the lift arm assemblies on the MJ-1-series lift truck is to
  - a. provide added stability and to decrease hydraulic pressure from the lift boom when carrying maximum capacity loads over long distances.
  - b. provide added support and to relieve hydraulic pressure from the lift arms when carrying loads for long distances.
  - c. relieve excess pneumatic pressure from the lift boom when the lift truck is parked.
  - d. relieve excess hydraulic pressure from the lift boom when the lift truck is parked.

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24. (010) What is the lifting capacity of the MJ-1 series lift truck?
- a. 3,000 pounds.
  - b. 3,500 pounds.
  - c. 6,000 pounds.
  - d. 6,500 pounds.
25. (010) What is the lifting capacity of the MHU-83-series lift truck?
- a. 3,000 pounds.
  - b. 3,500 pounds.
  - c. 6,000 pounds.
  - d. 7,000 pounds.
26. (010) When using the MHU-83-series lift truck with fork adapters, you immediately
- a. reduce its lifting capacity by 800 pounds.
  - b. increase its lifting capacity by 800 pounds.
  - c. reduce its lifting capability by 1,000 pounds.
  - d. increase its lifting capability by 1,000 pounds.
27. (010) What happens when you release the accelerator pedal on a vehicle driven with a hydrostatic transmission?
- a. The lift truck stops immediately.
  - b. The unit rolls until its inertia is spent.
  - c. The unit coasts to a stop very quickly.
  - d. The transmission automatically drops to a lower gear.
28. (010) What is the *primary* drawback to using the hydraulic hand pump to build hydraulic pressure on the MHU-83-series lift truck?
- a. Very labor intensive.
  - b. Difficult to make fine adjustment to the table.
  - c. Extremely slow way to build hydraulic pressure.
  - d. Possible to damage hydraulic system due to over pressurization.
29. (010) How is the yaw positioning from the cradle or boom controls of an MJ-1 lift truck adjusted?
- a. Pneumatically.
  - b. Hydraulically.
  - c. Electrically.
  - d. Manually.
30. (011) What category or categories are Air Force air compressors classified?
- a. By application.
  - b. High or low pressure.
  - c. Self-propelled or towed.
  - d. Powered or non-powered support equipment.
31. (012) The *primary* difference between a bobtail and a pickup truck is the
- a. bobtail provides a smoother ride.
  - b. bobtail is designed for long-distance towing.
  - c. bobtail's back end is shortened by about one-half.
  - d. bobtail's front wheel base is smaller for better turning radius.
32. (013) What is the purpose behind good operator maintenance of all assigned vehicles?
- a. Mission readiness.
  - b. Reduce maintenance costs.
  - c. Maintain vehicle serviceability at reduced cost.
  - d. Make sure vehicles are serviceable and in good condition.

33. (014) What is the maximum amount of pounds the MB-4 aircraft towing tractor can tow and push?
- a. 120,000.
  - b. 130,000.
  - c. 140,000.
  - d. 150,000.
34. (015) Pintle safety locking pins must remain attached to the pintle assembly
- a. to prevent an unsecure pin from coming out and getting lost.
  - b. to ensure it is available if needed.
  - c. by a nonconductive material.
  - d. by a bungee cord.
35. (016) What gear range should be selected in a tractor with an automatic transmission while going downhill?
- a. Neutral.
  - b. Low range.
  - c. High range.
  - d. Any range is acceptable.
36. (016) What is the purpose of the trailer hand valve (Johnson bar)?
- a. Test the trailer brakes.
  - b. Slow the tractor on wet pavement.
  - c. Slow the tractor to prevent skidding.
  - d. To drift the trailer into the right trajectory when you make a turn too sharp.
37. (016) What are hose couplers (glad hands) used for on tractor/trailer combinations?
- a. To connect the service and emergency brake airlines from the tractor to the trailer.
  - b. To connect the service brake airline with the emergency brake airline.
  - c. To secure the airlines to the tractor to avoid them from dragging.
  - d. To join sections of service brake airlines on the trailer.
38. (016) Which procedure is *not* a consideration for backing a tractor/trailer combination?
- a. Use a spotter.
  - b. Use mirrors on both sides.
  - c. Turn toward the driver's side.
  - d. Turn toward the passenger's side.
39. (017) What is the *maximum* depth of water you may drive a rough-terrain forklift through?
- a. Three feet.
  - b. Five feet.
  - c. Seven feet.
  - d. Eight feet.
40. (017) What is the *most* beneficial attribute of using the swingmast forklift?
- a. Operates inside due to its quiet running engine.
  - b. Allows you to maximize the available storage space.
  - c. Moves bigger assets quickly due to its increased weight limitation.
  - d. Empties International Shipping Organization (ISO) containers quickly.
41. (017) With the forks level, what is the *maximum* reach of the variable-reach forklift?
- a. 15 feet.
  - b. 16 feet.
  - c. 20 feet.
  - d. 22 feet.

## **Student Notes**

**Please read the unit menu for unit 2 and continue ➡**



## Student Notes

## Unit 2. Munitions Handling Equipment

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**I**N THE EARLY DAYS of the military, loading aircraft gun systems was a very slow process. Many of the operations were done by hand. In today's Air Force, the need for quick response and turnaround time requires fast loading of our aircraft. In this unit, you will study 20 millimeter (mm) and 30 mm handling equipment and the procedures for rapid assembly of munitions using the MAC. Understanding and using these equipment items better prepares us for any contingency required.

### 2-1. Ammunition Loading Systems

As long as the need exists to expediently load aircraft gun systems with 20 mm and 30 mm ammunitions, then loading and linking equipment will still be required. Ammunition loading systems (ALS) allow us to transport large amounts of ammunition between the munitions storage area and the flight line and load aircraft much quicker than would, otherwise, be possible. This special kind of munitions support equipment is designed around a specific aircraft with a specific job to do. There are three models of 20 mm ammunition loading systems in use. The linkless ammunition loading system (LALS), the universal ammunition loading system (UALS), and the ALS are the three systems in service today.

#### 018. Linkless ammunition loading system

The LALS, as seen in figure 2-1, is the newest loading system in our equipment inventory. The LALS is used to transport 20 mm ammunition to and from the aircraft and transfer 20 mm ammunition into an aircraft gun system. While uploading ammunition into the M61A1, 20 mm gun system, the loader assembly simultaneously downloads all the cleared rounds and/or spent cases. The LALS is used exclusively for the loading and downloading of F-15, F-16, and F-22 aircraft. The LALS holds a maximum load of 1,800 rounds of 20 mm ammunition.

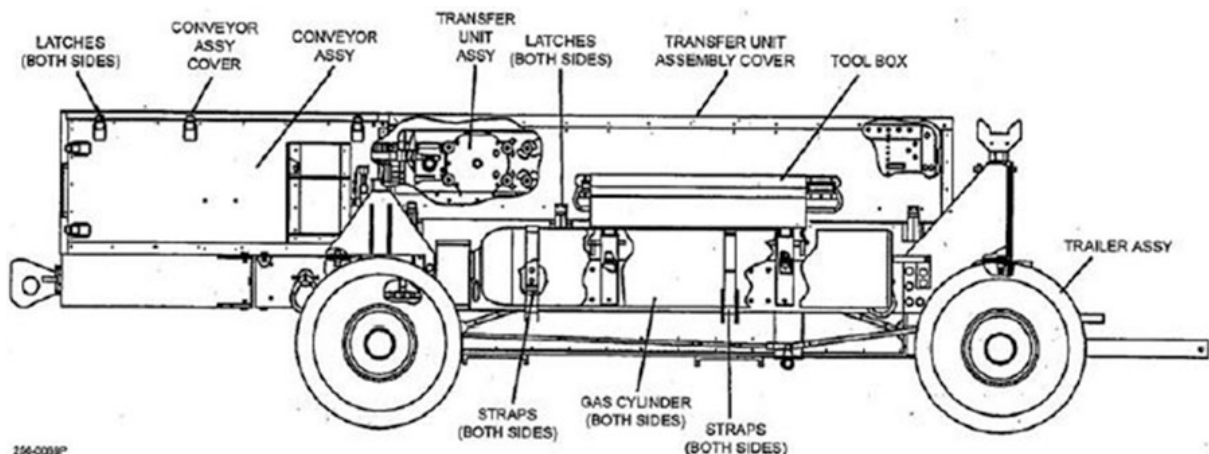


Figure 2-1. LALS.

## Characteristics

The LALS is divided into four modes: the replenishment mode, aircraft servicing mode, transport mode, and stowage mode. The replenishment mode is used to load and download ammunition into the LALS in preparation to service aircraft. The replenishment mode has the capability to separate and collect spent cases, unfired rounds, and cardboard tubes stripped off tube-packed ammunition. The LALS consists of five weapons replaceable assemblies which include the storage container assembly, transfer unit assembly, conveyor assembly, trailer chassis assembly, and the pneumatic system assembly. We will discuss the purpose of the weapons replaceable assemblies in the following paragraphs.

### *Storage container assembly*

Housed within the support frame, the storage container assembly stores 20 mm ammunition and spent casings. The storage container assembly is a box-like structure that has no moving parts. It is constructed of lightweight aluminum panels. The storage container assembly can store up to 1,800 rounds of 20 mm ammunition inside of its three bays.

### *Transfer unit assembly*

This assembly (fig. 2-2) interfaces with and is mounted on top of the storage container assembly. The transfer unit receives ammunition from the three bays of the container assembly and merges them into a single stream of ammunition to be handed off to the conveyor assembly. Likewise, when downloading aircraft, the transfer unit assembly distributes the ammunition from the single stream into the three bays within the storage container assembly.

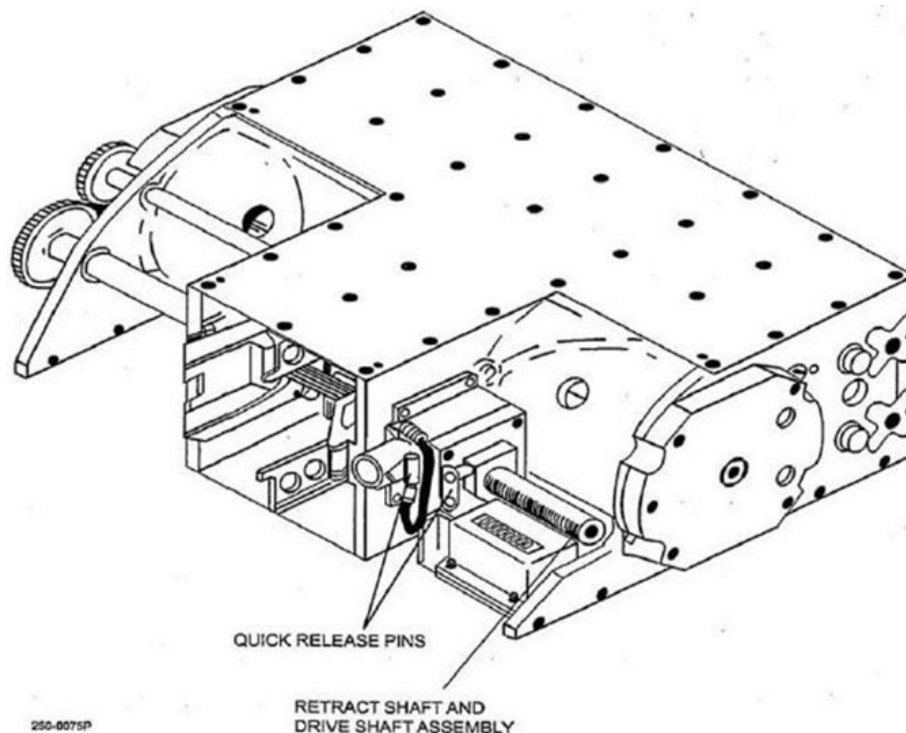


Figure 2-2. Transfer unit assembly.

### *Conveyor assembly*

The conveyor assembly consists of the universal aircraft interface unit, interchange unit, flex-drive shaft, conveyor belt, and conveyor chute (fig. 2-3). The conveyor assembly is connected to and receives rounds from the transfer unit assembly. The rounds are then transported via the conveyor belt elements within the conveyor chute to the universal aircraft interface unit. The universal aircraft interface unit transfers the rounds directly into the aircraft gun feed system while simultaneously

downloading spent cases and unfired rounds. The conveyor assembly transports the spent cases and unfired rounds in the conveyor chute to the transfer unit assembly. The transfer unit assembly then transfers the stream of unfired rounds and spent cases into the three bays of the storage container assembly.

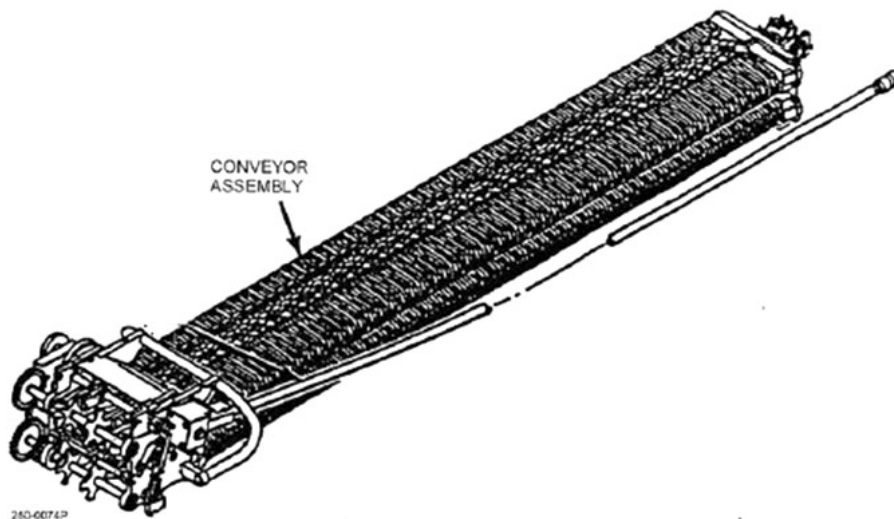


Figure 2-3. Conveyor assembly.

#### *Trailer chassis assembly*

The trailer chassis is a four-wheel trailer with a handbrake and is used to transport the loader behind a tow vehicle to an aircraft or to a location for replenishing operations.

#### *Pneumatic system assembly*

The pneumatic system is mounted on both sides of the loader assembly. The system consists of two gas cylinders and is used to power the loading/downloading or replenishing operations.

### **019. Universal ammunition loading system**

The UALS is the most common loader used in the field. Of the three models of 20 mm ammunition loading systems in use, the ALS and UALS are visually and operationally similar; therefore, we will only discuss the UALS.

#### **Characteristics**

The UALS is used to transfer 20 mm, M-50 series ammunition into an aircraft gun system on the flight line. While performing this loading function, the loader assembly simultaneously downloads cleared rounds and/or spent cases from the gun system. The UALS ammunition drum holds a maximum of 2,100 rounds. The UALS should only be towed 15 mph with a bobtail or other authorized vehicle equipped with a pintle hook.

#### **Subassemblies**

Before any operation, you must make sure the loader is serviceable; therefore, you must be familiar with the different subassemblies that make up the UALS. These subassemblies are identified in figure 2-4. We will look at a few of the major subassemblies now. If you require more information on the other subassemblies, refer to TO 35D30-4-15-1, *20 MM Ammunition Loading System Loader Assembly*.

#### *Outer drum*

The outer drum subassembly serves as a storage container for ammunition (or spent cartridges) and provides housing for the inner drum. The number of rounds remaining in the outer drum can be visually checked through a rounds remaining indicator window. This window provides the means of

visually determining the approximate number of rounds in the drum. Rounds stored in the outer drum are held in place by partitions within the drum that hold the rounds in place.

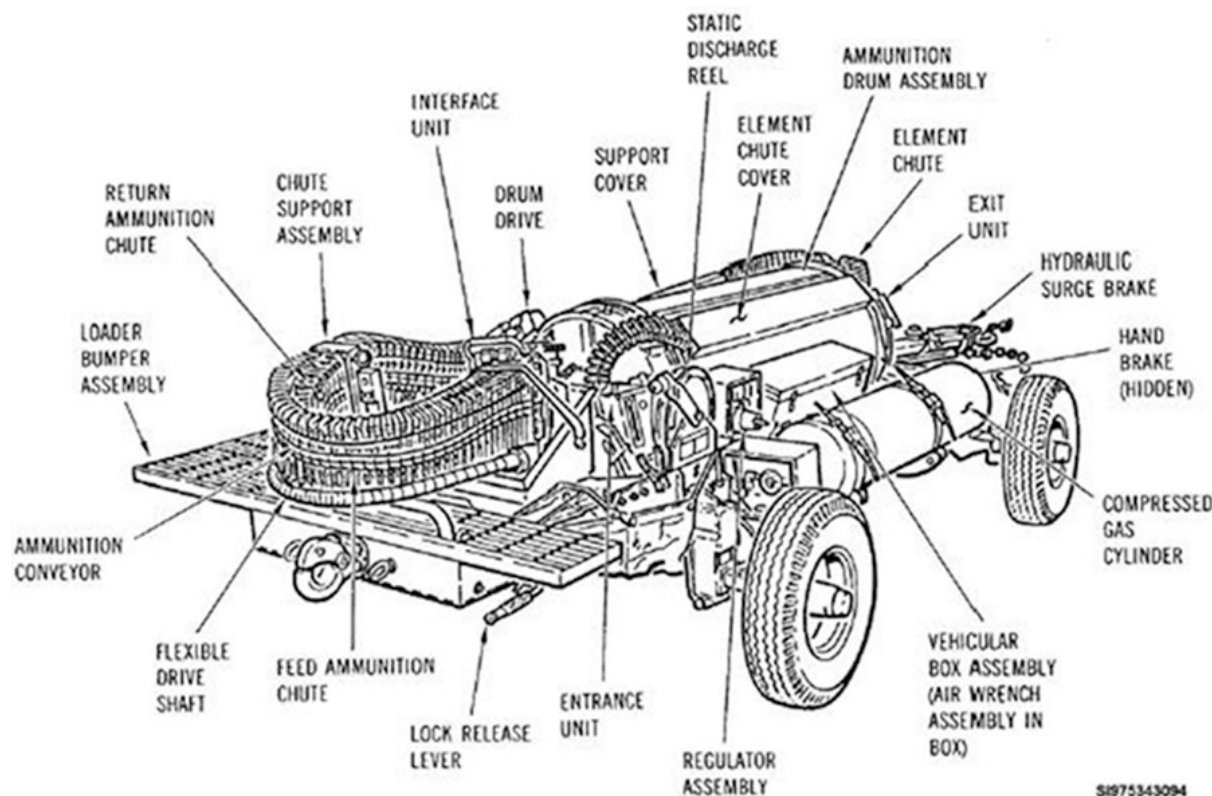


Figure 2-4. UALS subassemblies.

### *Inner drum*

The inner drum, when rotated, moves rounds and cases along the outer drum partitions from the entrance end to the exit end of the drum assembly. A scoop disk is mounted on each end of the inner drum to transfer rounds and cases from the entrance cover assembly to the outer drum partitions and from the outer drum partitions to the exit cover assemblies.

### *Ammunition conveyor and chuting*

The ammunition conveyor consists of 220 conveyor elements assembled to form an endless conveyor for live rounds and spent cases. During loading/downloading by the replenisher, live rounds are loaded into the interface unit conveyor elements by the access unit and carried to the ammunition drum by an ammunition chute, while cleared rounds and/or spent cases are removed from the ammunition drum, placed in conveyor elements, and carried through chuting back to the interface unit to the access unit of the replenisher.

### *Interface unit*

The interface unit drives a flexible drive shaft coupled to the drum assembly and loads live rounds into the aircraft gun system while simultaneously downloading spent cases and cleared rounds from the gun system. Within the loader, live rounds are carried to the interface unit by an ammunition conveyor that picks up the rounds at the exit unit on the ammunition drum assembly. From there the conveyor carries the rounds through an ammunition chute to the interface unit. If the interface unit is set in the load position, ammunition will be fed into the aircraft.

**SAFETY NOTE:** A very important safety factor to remember is that the interface unit has an exposed three-gear cluster that turns when mated to the aircraft access/transfer unit or the replenisher

assembly presenting a working situation that requires caution. Keep your hands, feet, and loose clothing clear from exposed gears.

Three counters on the interface unit record load/download operations as follows: live rounds loaded, spent cases and cleared rounds downloaded, and just cleared rounds downloaded. Each counter is reset to zero at the beginning of the load/download operation.

### ***Pneumatic regulator system***

The pneumatic regulator system is mounted on the rear of the loader assembly. The system includes two gas cylinders and a pneumatic regulating system, which provide air that cycles the rounds through the system.

### **Operation**

Before operating the loader, the interface unit of the loader is mated to either the replenisher access unit or the aircraft access transfer unit, depending on whether the loader is to be loaded or downloaded by the replenisher or the aircraft is to be loaded or downloaded by the loader. In either case, a half-inch speed wrench or a pneumatic drive assembly is inserted into the drive receptacle of the access unit on the replenisher or aircraft, and cranking is initiated.

The ammunition loader has two modes of operation: bypass and load/download. In the *bypass* mode, the loader is first mated to the aircraft and the loader interface unit is set to bypass. This will allow the gun to cycle without loading or downloading ammunition or links. This is necessary to enable the loader to shift to the load/download mode after mating with the aircraft and to shift back before demating.

In the load/download mode, cycling the system will transfer rounds to and from the gun system from the loader access unit and remove spent cartridges from the gun. When the loading/downloading procedure is completed, the loader is again shifted to the bypass mode.

## **020. 20 mm ammunition loading system replenisher assembly**

The 20 mm ammunition loading system replenisher assembly as shown in figure 2-5 is used to transfer 20 mm ammunition from storage containers into the ALS, UALS, or the LALS for transportation to the flight line. While performing this function, it simultaneously and independently receives spent cases and/or unfired ammunition from the loader assembly. The replenisher functions when supplied with either bulk (loose) or linked ammunition. It may be manually or pneumatically operated. When the pneumatic drive assembly is used, an external compressed air source is required.

### **Subassemblies**

To determine the extent of preventative maintenance or repair necessary, you should inspect the replenisher assembly every 30 days when in use and every 365 days when in storage. To perform the inspections and to use the replenisher, you should be familiar with the replenisher assembly and subassemblies. We will discuss a few major components here. A more detailed description can be found in TO 35D30-4-11-1, *Replenisher, Assembly, 20 MM Ammunition Loading System*.

### ***Table assembly***

The table assembly provides a mobile chassis for mounting the other components and is mounted on four wheels, each of which has its own brake.

### ***Access unit***

This unit provides the mechanical gating and switching functions that move ammunition to and from the interface unit of the loader. During operation, the access unit is mated and geared to the interface unit of the loader assembly. Power is applied to the access unit and it drives the replenisher.



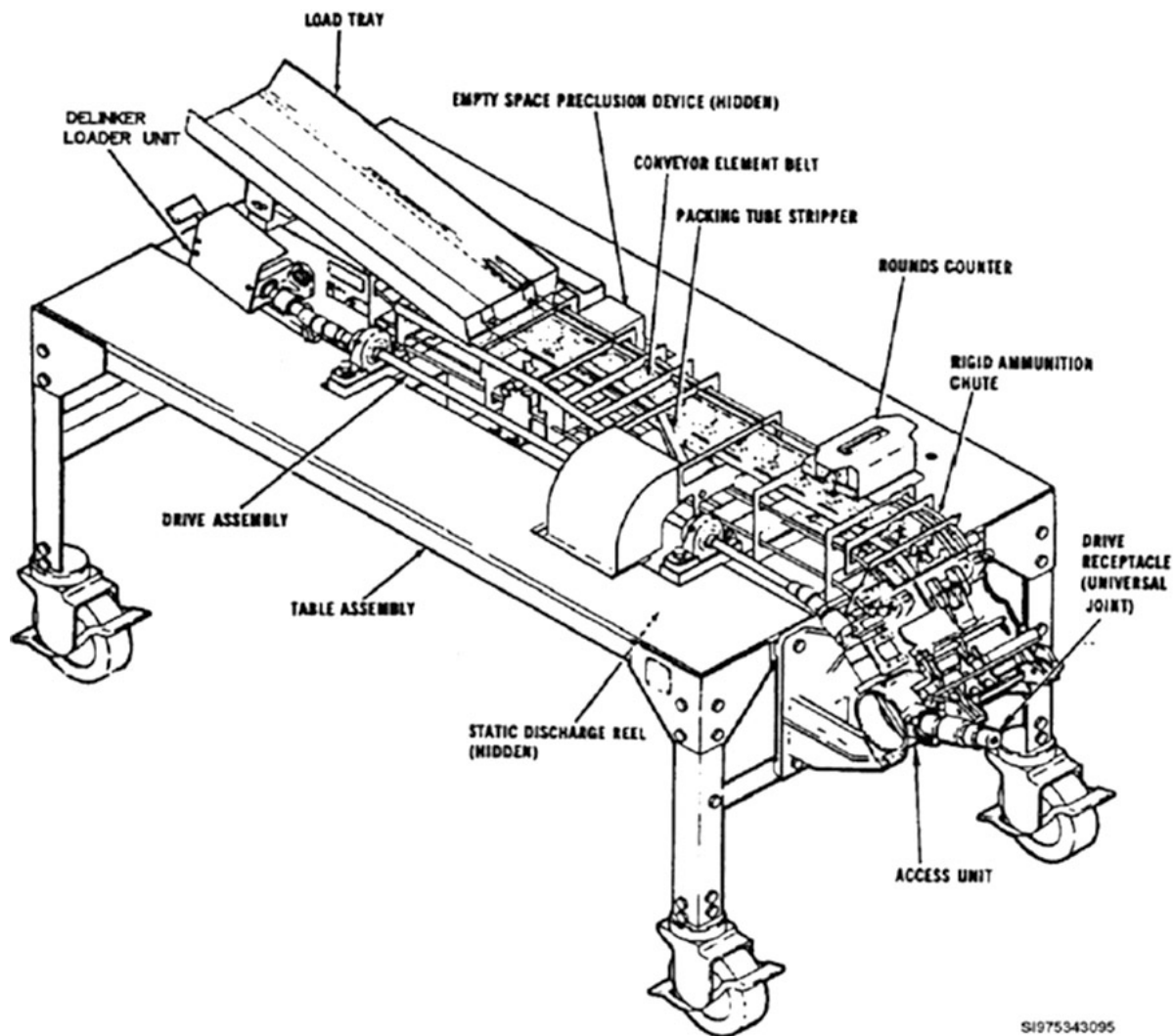


Figure 2-5. Replenisher major components.

### *Conveyor element*

The conveyor element is used to support and transport ammunition from the delinker loader unit or the ammunition tray, to the access unit. It also supports and transports spent cases and unfired rounds from the access unit to the separate downloading gates. The conveyor can also cycle the unfired rounds in a closed loop through the delinker loader unit back into the access unit.

### *Rigid ammunition chute assembly*

The rigid ammunition chute assembly contains two pathways: one to move ammunition from the replenisher to the loader and the other to return spent brass and unfired rounds from the loader to the replenisher. The chute assembly is secured to the table assembly and the access unit. It contains one download station to remove spent brass from the system. The packing tube stripper is also part of the chute assembly.

### *Rounds counter*

The rounds counter is mounted on the rigid ammunition chute assembly and as its name implies, it counts the rounds cycled into the access unit.



### *Delinker loader unit*

This unit strips M14 or M22 links from the ammunition, and then feeds the rounds into the replenisher conveyor. The delinker loader unit automatically downloads any unfired rounds returning from the ammunition loader, unless manually released to recycle them.

### *Drive assembly*

The drive assembly consists of a rigid drive shaft, two drive shaft supports, and two universal joints. The drive assembly is connected between the gearbox of the delinker loader unit and the output shaft of the access unit and is the means by which operating torque is transmitted from the access unit to the delinker loader unit.

### *Load tray*

The load tray is positioned on top of the replenisher and is used to load linked or bulk ammunition into the conveyor element belt.

### *Empty space preclusion device*

This device prevents accidentally loading a blank space or a spent cartridge into the loader assembly. When the empty space preclusion device senses a spent cartridge or an empty space (no round present), it automatically trips the last round switch, which stops the machine.

### *Static discharge reel*

The static discharge reel provides a means for electrically grounding the replenisher assembly before connecting the loader interface to it. It consists of a 75 foot cable and a spring-loaded reel with brake and latch mechanisms.

## **Operation**

Before operating the replenisher, it must be mated to the replenisher access unit. Bulk 20 mm ammunition, with or without the packing tubes installed, is placed in the load tray. Using a standard 1/2-inch speed wrench, apply clockwise manual cranking power to the drive receptacle on the access unit to initiate cycling.

As the ammunition is fed from the load tray into the loader interface by the conveyor, the packing tubes are removed, if installed. Simultaneously with the stripping and loading procedures, the replenisher receives spent brass and unfired rounds from the loader. The replenisher separates the brass from the live rounds. It can then pass the live rounds back to the load tray for reloading or drop them through a gate in the bottom of the replenisher. The spent brass is dropped through a gate in the bottom of the replenisher into a container (fig. 2-6).

Linked belts of ammunition can also be processed through the replenisher. When belted munitions are processed, the links are stripped from the rounds before they are fed into the access unit. When this procedure is used, unfired rounds returning from the loader are automatically downloaded through the second gate in the bottom of the replenisher.

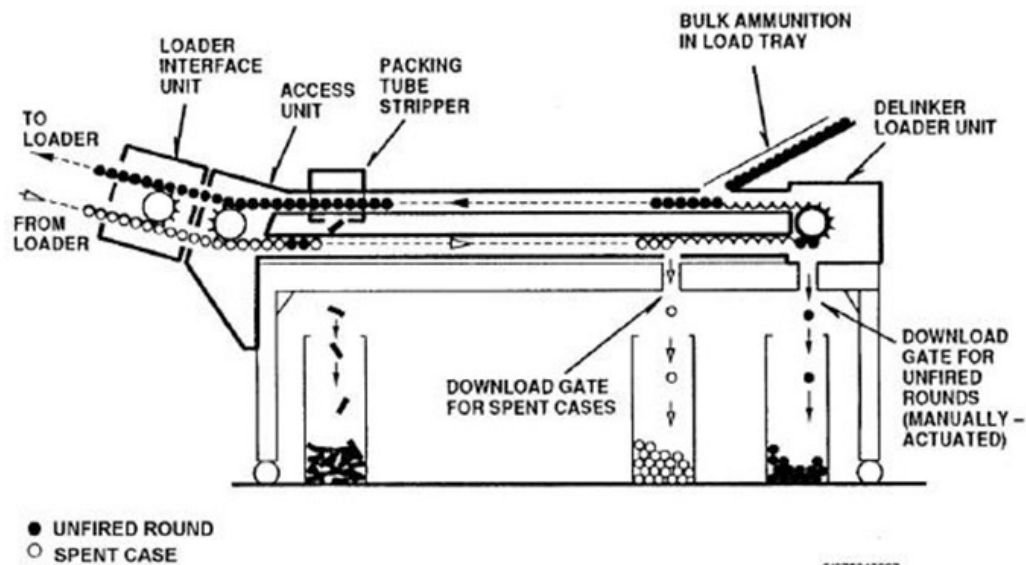


Figure 2-6. Replenisher operation—loading ammo.

## 021. 30 mm ammunition loading systems

There are two 30 mm ammunition loading systems now used by the Air Force—the GFU-7/E and the GFU-10/E. Although different in design, they both have the same basic functions used for processing 30 mm rounds. One system strictly loads and unloads the GAU-8/A, 30 mm cannon (internally mounted in the A-10 aircraft), and the other loads and unloads the GPU-5/A, 30 mm gun pod.

### A-10 ammunition loading system

When the GAU-8/A gun came into use, loading the gun system was slow. A table loader was designed to load ammunition into the gun system, but it was a slow process. The A-10 needed a faster system, so we built the GFU-7/E, commonly called the ammunition loader assembly (ALA), capable of loading up to 300 rounds of ammunition per minute. To make a complete ALS, we need a GFU-7/E ALA, a GFU-8/E auxiliary drive assembly, and a CNU-309/E ammunition container and link tube carrier (LTC) (fig. 2-7).

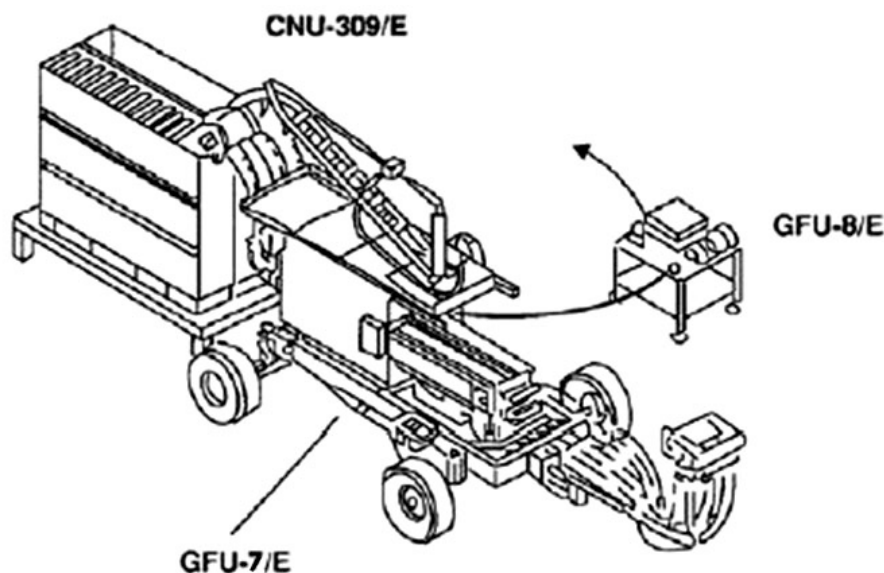


Figure 2-7. A-10 ALS.

The ALA uses a conveyor mechanism consisting of a series of plastic tubes linked together with knitted fiber straps packed into CNU-309/E ammunition containers. The link tube carrier (fig. 2-8) provides both a packaging and handling medium for the individual rounds of 30 mm ammunition. The ammunition containers are initially positioned at the rear of the ALA. The pre-linked ammunition is pulled into the ALA, separated from the LTC, and loaded into the gun system. The spent ammunition is passed out of the gun system and into the ALA, where it is packed into the LTC. The spent rounds in the LTC are then fed into empty ammunition containers.

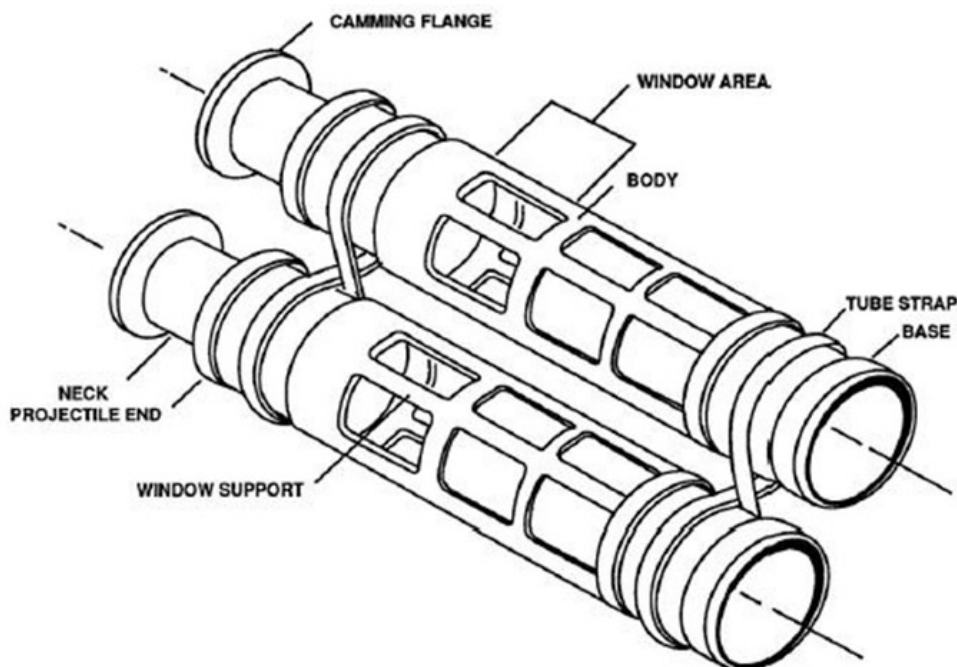


Figure 2-8. Link tube carrier.

During in-shop maintenance, ALA power comes from the GFU-8/E through the ALA's flexible drive shaft. The auxiliary drive assembly can cycle the ALA in forward and reverse directions while varying the speed at which rounds are traveling through the unit. This is done by connecting the ALA drive shaft to a 3/4-horsepower electric motor. Power to run the auxiliary drive assembly is derived from any 115 volts alternating current (VAC), 50/60-cycle, single-phase power source.

The GFU-7/E ALA interfaces directly with the A-10 (fig. 2-9) to load ammunition from storage containers into the gun system within a specific time and to simultaneously unload and deposit spent and/or live rounds of ammunition from the aircraft gun system into empty ammunition shipping and storage containers. During normal loading and unloading, the aircraft's hydraulic system provides ALA operating power.

### Operation

The A-10 ALS cycle of operation is shown in figure 2-10. The linked ammunition is pulled from the ammunition storage container by the container interface unit (CIU). The linked ammunition passes through the chuting to the rear interface assembly and onto the drum assembly. As the linked ammunition is conveyed over the top of the drum, the linked tubes are separated from the rounds. The rounds are then conveyed to the front interface assembly, where they are handed off onto the element conveyor chain. The chain and ammunition are conveyed through the upload chuting to the loadhead, where the rounds are handed off to the gun system.

Simultaneously, spent cases are off loaded by passing from the loadhead through the download chuting on the conveyor chain, through the inspection table, to the front interface assembly and onto the drum assembly, where they are cammed into empty tubes of the LTC. The LTC, with downloaded

rounds, passes through the rear interface assembly, where it is conveyed to the CIU through the tube chuting. The CIU completes the final phase of packaging by unloading the LTC into ammunition containers positioned at the rear of the ALA. A container interface tool is provided with each ALA to properly guide and layer the LTC in the containers.

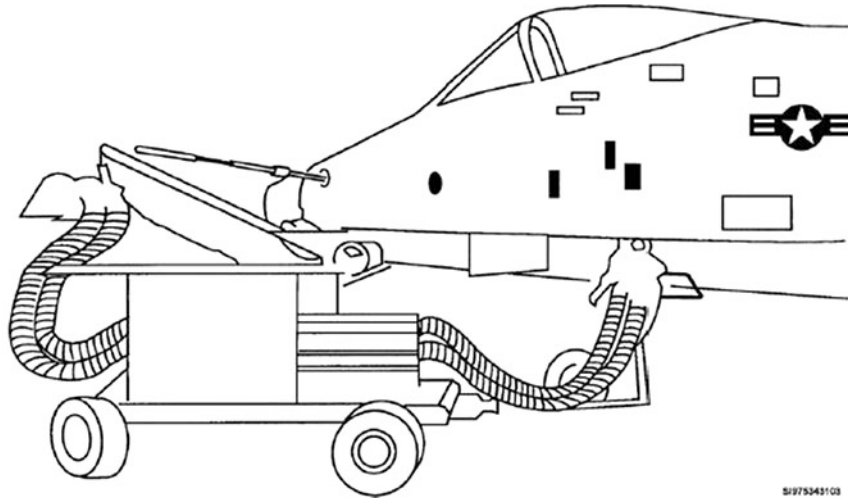


Figure 2-9. GFU-7/E with A-10 aircraft.

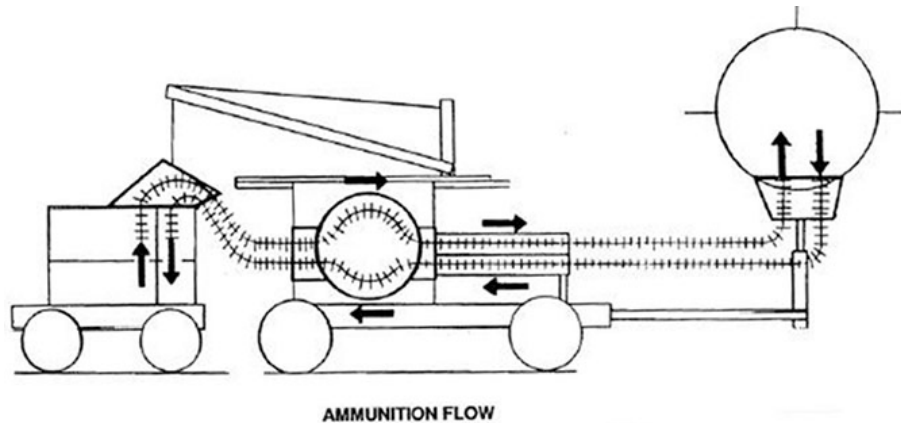


Figure 2-10. A-10 ALS cycle operation.

### 30mm UALS

The 30 mm UALS, GFU-10/E ALS, is universal in the sense that it is used to load and unload the GPU-5/A 30 mm gun pod on any aircraft that is capable of carrying the gun pod. It is not compatible with the gun system of the A-10 aircraft. The basic design of this unit was fashioned in some of the same ways as the A-10 ALS.

This ALS uses a conveyor mechanism and LTC such as that of the A-10 ALA, which, we already know, provides a packaging and handling medium for individual rounds of 30 mm ammunition. This unit works in conjunction with the equipment listed below to comprise the complete ALS:

- Replenisher assembly.
- Transporter assemblies.
- Loader assembly.
- Pod interface unit (PIU).
- Rounds return unit.

This ALS uses a systems approach to munitions, beginning with the ammunition packaging by the manufacturers and ending with the recycling of spent cases. The ALS serves as a mechanical conveyor, taking packaged LTC ammunition from the shipping and storage container and conveying it through the replenisher assembly into an empty transporter assembly. The transporter assembly is then moved to the aircraft with the loader assembly and PIU.

Once the unit is attached to the gun pod and power is applied to the unit, the loader starts transferring rounds into the PIU. The ammunition being handed off to the PIU is conveyed to the load-head assembly and handed off to the access unit of the gun pod system for storage until it is fired or downloaded.

The ALS conveyor mechanism also unloads ammunition or spent cases from the gun pod, either simultaneously or sequentially. During downloading, ammunition leaves the gun pod through the load-head assembly and is conveyed through the PIU to the loader assembly. There it is handed off onto the loader drum, where an empty LTC is cammed over the rounds. The LTC is then fed into the transporter assembly and awaits transfer back into the storage container.

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### Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

#### **018. Linkless ammunition loading system**

1. Which aircraft will the LALS service?
2. The LALS is divided into what four modes?
3. What are the five weapons replaceable assemblies on the LALS?
4. What weapons replaceable assembly is mounted on the top of the storage container assembly and merges the ammunition into a single stream to be handed off to the conveyor assembly?

#### **019. Universal ammunition loading system**

1. What is the UALS used for?
2. What maximum speed should you drive a Bobtail truck when towing an UALS?
3. What is the purpose of the scoop disk of the inner drum?
4. What is an important safety precaution to remember about the interface unit?

5. How is the cranking initiated on the UALS?

#### **020. 20 mm ammunition loading system replenisher assembly**

1. How is the 20 mm ammunition loading system replenisher operated?
2. Which TO gives a full description of the replenisher?
3. Which subassembly of the replenisher supports and transports spent cases and unfired rounds from the loader to the separate downloading gates?
4. Explain the function of the delinker loader.

#### **021. 30 mm ammunition loading systems**

1. Name the two 30 mm ammunition loading systems currently being used in the Air Force.
2. Which container is used to house the 30 mm ammunition in link tube carriers?
3. What does the container interface tool provide?
4. The GFU-10/E universal ammunition loading system can load and unload 30 mm on any aircraft that is capable of carrying what gun pod?

## **2-2. Munitions Assembly Conveyor**

The assembly line has been around for some time; however, many of us know it was made famous when instituted by the Ford Motor Company in the early 1900s. As a result of this method, Ford automobiles came off the line in three minute intervals. This was a much faster process than the methods used before the introduction of the assembly line, increasing production by eight to one while using less manpower.

The same concept holds true for assembling munitions. Without a rapid assembly of munitions capability; munitions assembly personnel would have to build bombs, cluster bomb units (CBU), and so forth, one at a time in a less than desirable time frame. With this capability, you can produce a sufficient quantity of built-up munitions in a minimum time to support almost any aircraft generation



requirement. The MAC involves a gantry system designed to build up conventional munitions. The assembled munitions are loaded on trailers for transport to the flight line for loading onto aircraft.

## 022. Characteristics of the munitions assembly conveyor

The MAC is designed for the rapid assembly of many conventional munitions. The two versions in use are the A/E32K-3, MAC which is governed by TO 35D2-17-1, *Conveyor Munitions Assembly Conveyor II A/E32K-9* and the A/E32K-9, MAC II which is governed by TO 35D2-17-11, *Munitions Assembly Conveyor II A/E32K-9*. Although the MAC is made up of several large components, it is generally packaged, transported, and shipped on either an MHU-110 or an MHU-226 munitions trailer.

### Components

The MAC must be assembled (fig. 2-11) before you begin the operation. Without going into complete step-by-step procedures that are thoroughly outlined in the item's TO; let's take a look at the major components that make up the MAC.

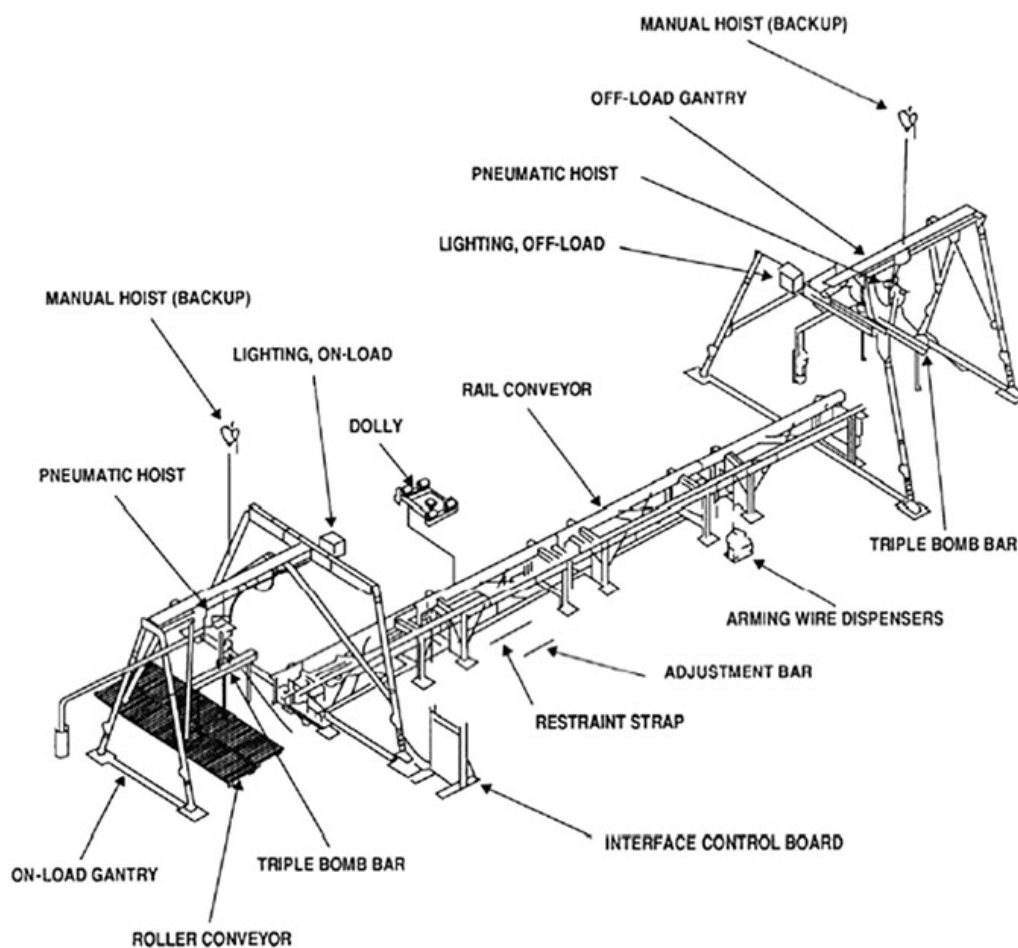


Figure 2-11. MAC A/E32K-3.

### Interface control board

The interface control board (ICB) routes electrical and pneumatic power to the MAC. The electrical portion has the safety switch and receptacle for lighting. An electric generator, NF-2, TF-1, or equivalent, is connected as the source of 115 VAC power. The electrical receptacles are for the lights on the gantries. The ICB has two air regulators, one for the pneumatic hoists and the other for pneumatic tools. Hoses are connected to accommodate the hoists and the tool outlets (located on the

rail conveyor). The air supply portion allows an air compressor, MC-7 or equivalent, to be connected. An air filter, pressure regulators, and oil lubricators are included. Air pressure is used for the pneumatic hoists and along the rail conveyor for use by air-driven tools. Pneumatic power is provided by an MC-7 (or equivalent) air compressor. The ICB also aids in setting up the system. It is used as a forklift adapter to raise the gantry to full height.

### *Gantries, pneumatic hoists, and lights*

Two A-frame-type gantries (fig. 2-12) are used with each system. One gantry is placed to allow lifting bulk munitions from the incoming pallets. The other is placed for removing built-up munitions from the rail conveyor and for loading the munitions transport vehicle or trailer. The gantry has an I-beam held upright by two A-frames at each end of the I-beam. The A-frames have footpads that can be bolted or pinned to various surfaces.

The A/E32K-3 version MAC has a 4,000 lbs. capacity pneumatic hoist, whereas the A/E32K-9 version MAC II has a 6,000 lbs. capacity pneumatic hoist. The hoists are attached to each gantry I-beam (one at each end) for a total of two hoists per MAC. Each hoist will attach to the I-beam with a hoist trolley. The trolley allows the hoist to move along the length of the beam. One spare manual hoist is provided with each system. The manual hoist allows for continued use should the pneumatic system fail.

One light assembly is mounted on each gantry to illuminate the area. The light for the on-load gantry has a 20-foot electrical cord. The light for the off-load gantry has a 70-foot electrical cord. Each light has a sodium vapor bulb.

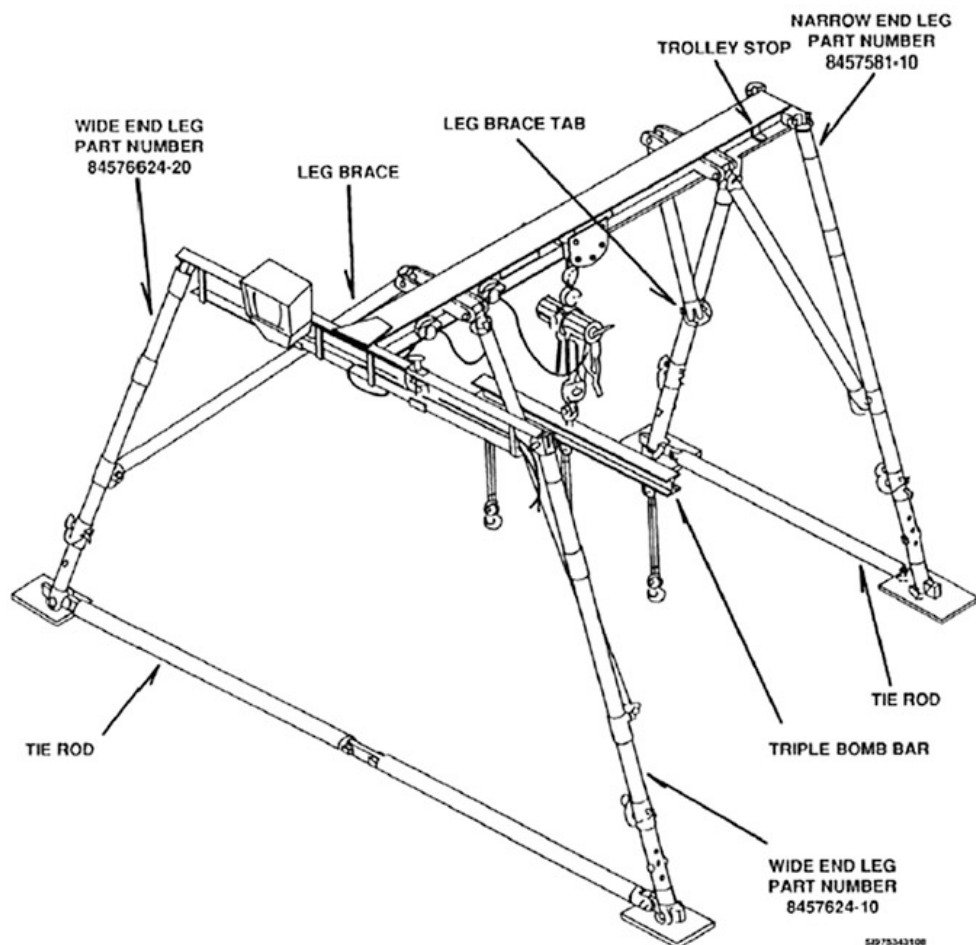


Figure 2-12. Gantry.



### **Rail conveyors**

The rail conveyor consists of four 12-foot sections. When assembled, it has a 48-foot long base for dolly travel. The dollies consist of a frame with roller bearings. The top of each dolly has four rollers to support and rotate the munitions during buildup. The rollers can be placed at different points on the top of the dolly. This allows different sizes of munitions to be built up. The system has twenty-five dollies. The dollies travel the length of the rail conveyor with the munitions. Empty dollies return to the starting point on a return rail located in the bottom of the rail conveyor. Collapsible legs are positioned, grounds connected, and interlocks secured to make complete conveyor section that fits between each gantry. An adjustment bar (fig. 2-13) is used to level the gantries once they are assembled. If the gantries become unlevel, the adjustment bar is used to raise or lower the legs. The bar draws the sections together for assembly and forces the sections apart during disassembly. Use the adjustment bar to position and adjust each section. The rollers are placed at different points on the top of the dolly. This allows different sizes of munitions to be built up. The dollies travel the length of the rail conveyor with the munition. Empty dollies return to the starting point on a return rail in the bottom of the rail conveyor.

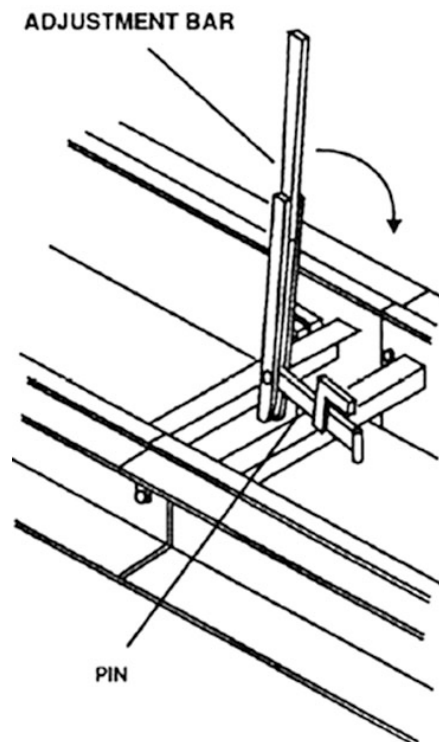


Figure 2-13. Adjustment bar.

If required for use, there are four 10-foot roller conveyor sections for the MAC. When connected together they provide a doublewide conveyor assembly that can move munitions pallets or containers under the gantry for breakout.

### **Triple bomb bar**

The triple bomb bar is a lightweight lift bar fitted with three sets of bomb slings. The bomb bar is used with each hoist to provide for lifting up to three 500 lb. munitions at a time or two 2,000 lb. munitions items. The bomb-lug hooks on the slings have safety latches.

### **Arming wire dispenser**

The MAC comes with its own arming wire dispenser. Arming wire is installed as part of the assembly process before the bombs are delivered to the flight line. As much as possible, munitions organizations remove arming wire installation from the flight line to reduce FOD.

### **Restraint strap**

One strap is provided for all guided bomb unit (GBU) buildups. Use the strap at a workstation to prevent the bomb body from turning while torque is applied.

## **023. Preparation for use of the munitions assembly conveyor**

You can find breakout and assembly instructions to rapidly assemble munitions items in TO 11A-1-63, *Munitions Assembly Procedures Inspection and Assembly of Conventional Munitions*. When a pallet of bombs or munitions containers is brought into the assembly area, they are off-loaded from the trailer. The forklift operator then places the pallet or container on the roller assembly. When the pallet or container is positioned under the on-load gantry/hoist, up to three munitions can be raised, moved, and lowered onto dollies. Once the munition is on the dolly, you can begin assembly.

At various points along the rail conveyor, the munition is boosted, finned, fuzzed, and arming wire is installed as applicable. The assembled munition is then positioned under the off-load gantry/hoist, placed on a munitions trailer, and, when fully loaded, transported to a holding area or the flight line for loading. The empty dolly is placed on the return rail for reuse. Now that you are familiar with the MAC components, let's look at the entire operation for assembling GP bombs. As stated earlier, TO 11A-1-63 contains the procedures for assembling GP bombs.

### **Site selection**

You can assemble the system on a concrete, asphalt, or earthen surface. A flat surface area that is approximately 50 × 100 feet is the minimum requirement for the A/E32K-3, MAC. A flat surface area of 50 × 150 feet is the minimum space requirement for the A/E32K-9, MAC II. In addition to the minimum assembly area requirement, you must consider space for vehicle operations, munitions storage, trash/packaging material, empty containers, and empty/loaded trailers. With these considerations, your optimum size for your pad is recommended at 250 x 250 feet. Figure 2-14 shows a typical layout for the system.

### **Unpacking**

The MAC is generally transported on a single MHU-110 trailer or a single MHU-226 trailer. Place the trailer near the site selected for system operation, allowing clearance for forklift operations. When you unpack the components, always check the packing list for missing items. Additionally, inspect all items for damage and keep the containers for repackaging.

### **Preparation for assembly**

First, check to see that your equipment is properly positioned. For example, is there sufficient room for the transport trucks to maneuver and then drive through the gantry at both ends of the roller conveyor? Next, verify that the munitions components (fuzes, fins, boosters, etc.) are the ones the mission specifies. Check this upon delivery of the munitions before unloading and unpackaging the components. This extra step can help avoid installing FMU-139s when the mission demands M-904 and/or M-905 fuzes.

During high-explosive bomb buildup, the supervisor must monitor net explosive weight (NEW) very closely. Even in wartime, the intermagazine and intraline distances as outlined in Air Force Manual (AFMAN) 91-201, *Explosives Safety Standards*, apply. If your NEW is over the authorized limit, a very dangerous situation is at hand. Remember that intermagazine and intraline distances are designed to prevent propagation of an explosion from one location to another. If you are over your NEW, an accident could destroy more than just your operation.

### **Bomb inspection and preparation**

Inspect the bombs for cleanliness and damage either at the assembly site or in the storage area before they are transported to the assembly site. First, make sure that the bomb lugs are flush with the bomb case and properly aligned. If the lugs bottom out before they are flush with the case, back them off only enough to align them. In either case, make sure that the lugs are free to turn so that the loaders can adjust them as needed. Using a triple bomb bar, remove the bombs from the transport trailer or bomb pallet and deposit them on the conveyor next to the gantry. Place the bombs on the roller dollies. Be careful not to overload the hoist.

### **Bomb assembly**

The boosters, fuzes, fins, and so forth, are installed on the bomb body as it moves down the conveyor. Keep a working stock of pre-inspected components near the assembly station for each component and the main stockpile somewhere else outside of the immediate work area. This helps to prevent congestion in the work area. You must also make plans for trash/packaging material removal. Work space can quickly diminish in large-scale bomb build operations.

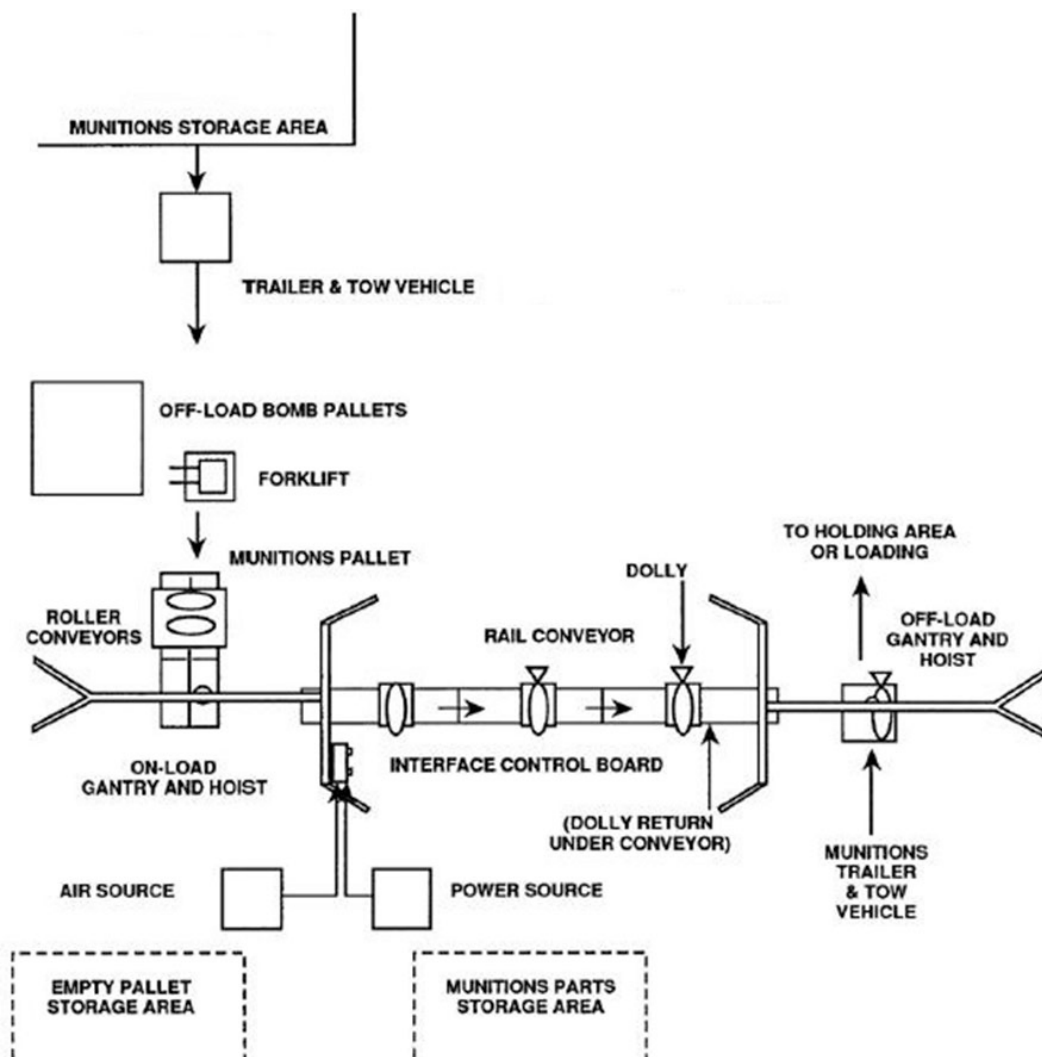


Figure 2-14. Typical MAC layout.

### Preparation for disassembly

Before packing components for storage or shipment, several initial actions must be done. To keep foreign materials from damaging the air hoses, caps must be installed on the ends. Other items must be cleaned and dry before packing. Finally, to ensure safe transport, place the parts of the MAC back in their original containers or suitable substitutes. The importance of the conveyor system cannot be overemphasized because of its role in mobility/contingency missions. Your unit could get tasked short-notice to pack, ship, and set up the MAC at a deployed location.

### Disassembly

There are a few more preliminaries to carry out before you disassemble the conveyor. Locate the trailer, crates, and packing material near the MAC. Turn off and disconnect all pneumatic and electrical power and disconnect all ground straps.

To disassemble the conveyor follow the procedures laid out in the item TO; which basically reverse the steps used to assemble it. The first component to be disconnected is the ICB. Disconnect and pack all air hoses. The electrical cord is stored inside the ICB with the cover latched. The dollies are packed in their containers after removing the rollers. Remove the four locking clips and pull the stop from the roller conveyor. The rail conveyors are then disassembled using the adjustment bar to separate the sections. Collapse and fold the legs, remove the return rails, and tighten all hand nuts.

The gantries are to be disassembled last. The gantry is lifted using a forklift and the ICB so that the legs and braces can be removed. Then, after lowering the main beam, remove the light and hoist. The final steps are to package all materials and load them onto the MHU-110 or MHU-226 trailer.

### **Inspecting and performing preventive maintenance on the MAC**

The inspection and preventive maintenance requirements in TO 35D2-17-1 or TO 35D2-17-11 (depending on which MAC version used) are minimum requirements to keep the system in a safe, operable condition. Any defects you find during an inspection that affects the operation or safety of personnel must be corrected before using the system. Troubleshooting the MAC is accomplished using detailed trouble-cause-solution tables found in the above mentioned technical orders.

---

## **Self-Test Questions**

**After you complete these questions, you may check your answers at the end of the unit.**

### **022. Characteristics of the munitions assembly conveyor**

1. Which TO contain specific information on the two munitions assembly conveyors in use by the 2W0 career field?
2. Which munitions trailers are generally used to efficiently transport a packaged MAC?
3. What is used to *route* electrical and pneumatic power to the MAC?
4. What piece of powered equipment can *supply* pneumatic power to the MAC?
5. What is used to level the gantries once the MAC is assembled?
6. Explain the purpose of the restraint strap used on the MAC.

### **023. Preparation for the use of the munitions assembly conveyor**

1. How many munitions items can be raised, moved, and lowered onto dollies from the on-load gantry/hoist?
2. Explain what happens to the dollies once they become empty.
3. What is the minimum space requirement (in feet) for the A/E32K-9, MAC II?

4. What should be the first thing you disconnect during disassembly of the MAC?

---

## Answers to Self-Test Questions

### 018

1. F-15, F-16, and F-22 aircraft.
2. (1) Replenishment mode.  
(2) Aircraft servicing mode.  
(3) Transport mode.  
(4) Stowage mode.
3. (1) Storage container assembly.  
(2) Transfer unit assembly.  
(3) Conveyor assembly.  
(4) Trailer chassis assembly.  
(5) Pneumatic system assembly.
4. The transfer unit assembly.

### 019

1. To transfer 20 mm M-50-series ammunition into an aircraft gun system.
2. 15 mph.
3. Transfers rounds and cases from the entrance cover assembly to the outer drum partitions and from the outer drum partitions to the exit cover assemblies.
4. The interface unit has an exposed three-gear cluster that turns when mated to the aircraft access/transfer unit or the replenisher assembly.
5. Either a half-inch speed wrench or a pneumatic drive assembly inserted into the drive receptacle.

### 020

1. Manually or pneumatically.
2. TO 35D30-4-11-1.
3. Conveyor element.
4. Strips M14 or M22 links from the ammunition, and then feeds the rounds into the replenisher conveyor. The delinker unit automatically downloads any unfired rounds returning from the ammunition loader, unless manually released to recycle them.

### 021

1. GFU-7/E and the GFU-10/E.
2. CNU-309/E.
3. Properly guides and layers the LTC in the containers.
4. GPU-5A.

### 022

1. TO 35D2-17-1 and TO 35D2-17-11.
2. The MHU-110 or the MHU-226.
3. ICB.
4. MC-7 air compressor.
5. An adjustment bar.
6. The strap is used at a workstation to prevent the bomb body from turning while torque is applied.

**023**

1. Up to three at a time.
2. They are placed on the return rail for reuse.
3. 50 x 150 feet.
4. The interface control board.

**Complete the unit review exercises before going to the next unit.**

## Unit Review Exercises

**Note to Student:** Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field-Scoring Answer Sheet.

**Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).**

42. (018) What USAF gun system is loaded and unloaded by the Linkless Ammunition Loading System (LALS)?
- a. The GAU-2B/A, 7.62 mm machine gun.
  - b. The M197, 20 mm gatling gun.
  - c. The GAU-8A, 30 mm cannon.
  - d. The M61A1, 20 mm cannon.
43. (018) Which weapons replaceable *assembly* of the Linkless Ammunition Loading System (LALS) has no moving parts?
- a. Conveyor.
  - b. Transfer unit.
  - c. Trailer chassis.
  - d. Storage container.
44. (019) Which subassembly of the universal ammunition loading system (UALS) houses a remaining indicator window that provides the means to visually determine the approximate number of rounds in the unit?
- a. Inner drum.
  - b. Outer drum.
  - c. Middle drum.
  - d. Interface unit.
45. (019) Which subassembly of the universal ammunition loading system (UALS) provides the means to load live rounds into the aircraft gun system?
- a. Inner drum.
  - b. Outer drum.
  - c. Interface unit.
  - d. Ammunition conveyor.
46. (019) Which subassembly of the universal ammunition loading system (UALS) provides the power that cycles the rounds through the system?
- a. Inner drum.
  - b. Outer drum.
  - c. Interface unit.
  - d. Pneumatic regulator.
47. (020) How often should universal ammunition loading system (UALS) replenisher assemblies be inspected?
- a. Every 30 days when in use and annually when in storage.
  - b. Every 45 days when in use and annually when in storage.
  - c. Every 60 days when in use and annually when in storage.
  - d. Every 90 days when in use and annually when in storage.



48. (020) Which subassembly on the universal ammunition loading system (UALS) replenisher assembly prevents accidentally loading a spent cartridge into the loader assembly?
- a. Drive assembly.
  - b. Delinker loader unit.
  - c. Empty space preclusion device.
  - d. Rigid ammunition chute assembly.
49. (020) Which tool can initiate cycling ammunition through the universal ammunition loading system (UALS) replenisher manually?
- a. 1/4-inch speed wrench.
  - b. 1/2-inch speed wrench.
  - c. 1/4-inch ratchet and socket.
  - d. 1/2-inch ratchet and socket.
50. (020) What happens to the unfired rounds returning from the loader when the linked ammunition is being processed?
- a. Manually separated and counted for the next upload.
  - b. Automatically counted and then uploaded back into the loader.
  - c. Manually downloaded through the second gate in the bottom of the replenisher.
  - d. Automatically downloaded through the second gate in the bottom of the replenisher.
51. (021) Which 30 millimeter (mm) cannon is internally mounted in the A-10 aircraft?
- a. M39.
  - b. M61.
  - c. GAU-8/A.
  - d. GPU-5/A.
52. (021) Which 30 mm ammunition loading system is used to service the GPU-5/A gun pod?
- a. GFU-7/E.
  - b. GFU-8/E.
  - c. GFU-10/E.
  - d. GFU-11/E.
53. (022) Which component of the munitions assembly conveyor (MAC) can be used as a forklift adapter to raise the gantry to full height?
- a. Gantry.
  - b. Rail conveyor.
  - c. Pneumatic hoist.
  - d. Interface control board (ICB).
54. (022) What is the weight capacity of the pneumatic hoists that are attached to the gantry's I-beam of the munitions assembly conveyor (both versions)?
- a. 4,000 lbs.(A/E32K-3, MAC); 4,000 lbs. (A/E32K-9, MAC II).
  - b. 4,000 lbs.(A/E32K-3, MAC); 6,000 lbs. (A/E32K-9, MAC II).
  - c. 6,000 lbs.(A/E32K-3, MAC); 6,000 lbs. (A/E32K-9, MAC II).
  - d. 6,000 lbs.(A/E32K-3, MAC); 10,000 lbs. (A/E32K-9, MAC II).
55. (022) The triple bomb bar is fitted with bomb slings and is used with each hoist to provide for lifting
- a. three 500-pound munitions at a time or two 2,000-pound munitions items.
  - b. three 500-pound munitions at a time or one 2,000-pound munitions item.
  - c. two 500-pound munitions at a time or two 2,000-pound munitions items.
  - d. two 500-pound munitions at a time or one 2,000-pound munitions item.

56. (023) Which technical order (TO) covers the rapid-assembly and inspection procedures of nonnuclear munitions?
- a. 11A-1-42.
  - b. 11A-1-46.
  - c. 11A-1-60.
  - d. 11A-1-63.
57. (023) What is the *minimum* number of feet required to assemble the A/E32K-3, munitions assembly conveyor?
- a.  $50 \times 100$ .
  - b.  $100 \times 200$ .
  - c.  $150 \times 200$ .
  - d.  $200 \times 500$ .
58. (023) Why is it important to monitor net explosive weight (NEW) during a bomb buildup operation?
- a. Excessive NEW at your location usually means a shortage at other sites.
  - b. Excessive NEW at your location will limit the operating space needed for bomb building.
  - c. If ignited, excessive NEW may cause the intermagazine and intraline distances to increase.
  - d. If ignited, excessive NEW may cause propagation of an explosive from one location to another.
59. (023) When packing up the munitions assembly conveyor (MAC) it is important to cap the ends of the air hoses to keep
- a. corrosion from setting in.
  - b. pressurized air from escaping.
  - c. the hose ends from being crushed.
  - d. foreign materials from damaging them.

Please read the unit menu for unit 3 and continue ➔

## **Student Notes**

## Unit 3. Handling and Delivery

<b>3-1. General Handling Procedures .....</b>	<b>3-1</b>
024. Transportation of munitions .....	3-1
025. Placarding munitions-laden vehicles .....	3-3
026. Positioning and tie-down procedures for nonnuclear munitions.....	3-4
<b>3-3. Nuclear Weapons.....</b>	<b>3-11</b>
027. Nuclear-certified equipment .....	3-11
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029. Movements .....	3-17

**T**HERE WOULD BE no need for munitions systems specialists if all the munitions needed to support the mission were always available at the aircraft in a complete round configuration. Because of safety considerations; however, the munitions supporting the mission are stored and built within the safety of a separate operating location. In this unit, you'll study the methods and procedures for the safe transport of munitions in combat-ready (complete round) configurations. Additionally, you'll see what it takes to transport munitions within the boundaries of your installation as well as between installations and storage sites. You will also learn your responsibilities as they pertain to nuclear weapons.

### 3-1. General Handling Procedures

You must consciously practice safety during all phases of transport while carrying explosives. Since most of the responsibility falls on the driver of the vehicle, you must be fully qualified to operate the vehicle you are driving. Normally, you will not transport explosives for any long distance off base; however, instances could occur making it necessary to drive further. Some of the safe operating requirements pertain strictly to off-base transportation, while others are general in nature and apply at all times.

#### 024. Transportation of munitions

Title 49, *Transportation*, of the Code of Federal Regulation (CFR) regulates commercial shipments of hazardous material, including explosives by rail, motor vehicle, cargo aircraft, and ship within the United States. For transporting munitions and explosives on a military installation, refer to the criteria in AFMAN 91-201, *Explosive Safety Standards*. Quantity distance criteria *does not* apply to munitions and explosives in the transportation mode. As always, you must take precautions to ensure minimum exposure of people and property during all phases of transportation. The time munitions and explosives are in the transportation mode must be limited to the absolute minimum necessary to complete the task.

Title 49 of the CFR, along with other CFRs can be accessed at <http://www.ecfr.gov/>.

#### General munitions handling procedures

Some things you must keep in mind while handling munitions are as follows:

- Only trained personnel under the supervision of an individual who understands the hazards and risks involved in the operation will handle explosives.
- Keep electro-explosive devices (EED), such as detonators, initiators, squibs, and other such electrically or mechanically initiated devices in their protective containers during storage, transportation, and inspection. Use containers designed to prevent item-to-item contact. Mark the containers to identify the contents.
- Do not use nails to secure covers or make repairs on explosives containers unless there is no hazard to the explosive item or danger of penetrating protective coverings. Exercise special care when using pneumatic- or cartridge-activated nail guns.

- Do not tumble, drag, drop, throw, or roll munitions. Containers designed with skids may be pushed or pulled for positioning.
- Do not roll un-palletized conventional high-explosive bombs or other explosives unless authorized by the item TO. If authorized by the item TO, the lugs or other projections must be removed. Munitions protected by dunnage rails may be rolled.
- Interlock and support sections of roller conveyors used to move explosives. Do not use boxes containing explosives or munitions to support conveyors.
- Restraining devices designed for use with vehicle and handling equipment will be used according to applicable TOs.

### **Tie-down and load stability**

Do not operate vehicles containing explosives until the cargo has been checked to ensure safe transportation. Here are some things to remember for securing munitions:

- Fasten safety chains between towing vehicles and trailers carrying explosives when lunette and pintle fastenings are used. Safety chains are not required when using specifically designed breakaway control safety features, prescribed by the pertinent TO.
- Munitions may be carried on forklift tines when the weapon body is long enough to be firmly supported on both tines and strong enough to prevent damage.
- Make sure explosives/munitions loaded on vehicles and handling equipment are stable and secure before moving. Load stability is required for all transportation, to include movements conducted between one or more storage magazines, storage pads or other operating locations. "Secure" means the load is protected by an effective restraining system. A few authorized restraining devices include chains/binders, cargo nets, and tie-down straps.
- To the maximum extent possible, position munitions cargo vehicles to permit loading and unloading from either side of the cargo bed. Not only for obvious safety reasons, but to help avoid damage to materiel handling vehicles and trailers.

### **Handling equipment**

Only use government owned, specially designed equipment for transporting explosives and specific weapons where possible or required by directives. Cargo type trucks and tractor trailer combinations are preferred for long distance general transportation of explosives. Do not use other types of vehicles unless the items involved make handling by cargo vehicles or tractor trailer combinations impractical. Here are some things to remember while transporting munitions:

- Use Department of Transportation (DOT) placards as outlined in Title 49 and AFMAN 91-201. This generally applies on or off base when transporting explosive items over the roadways. The appropriate hazardous placard must be clearly visible from all four sides.
- *Always* make sure fire extinguishers are available and in good working order.
- *Always* chock explosive loaded vehicles when parked and driver is not behind the wheel.
- *Never* transport explosives in POV under any circumstance.
- Except in rare circumstances outlined in AFMAN 91-201, do not transport explosives in vehicle passenger compartments/inside vehicle's cab.
- Vehicles with plastic bed liners may be used to transport EEDs *only* if they are in their original sealed outer package, box, or container. Metal ammo-type containers may be used to transport EEDs in vehicles with plastic bed liners if the containers provide the protection to prevent item-to-item contact and are bonded to the metal body of the vehicle.
- Except as required in the event of an electrical storm, do not leave explosives laden vehicles unattended unless they are parked in a properly designated area, such as the weapons storage area, holding yard, or flight line munitions holding area.
- As needed, always refuel vehicles *before* loading explosive items.

### Explosives movement routes

Designate the safest possible primary and alternate explosives movement routes to cover all phases of movement. Identify routes and any limitations on explosives quantities by hazard class/division in base publications. Avoid built-up areas and key, mission-oriented facilities and equipment to the maximum extent possible. Movements of munitions within a munitions storage area or to and from licensed storage locations are not restricted to designated routes.

### Compatibility of explosives during transportation

Explosives transported on a public highway by Air Force motor vehicles, operated by Air Force personnel, will be separated and segregated using the rules in Title 49 CFR. When an item containing explosives is assigned to other than hazard class one because of the predominant hazard, a compatibility group is still assigned.

### 025. Placarding munitions-laden vehicles

While driving, or as a passenger, you may have seen signs posted on a fuel truck or another specialized vehicle carrying hazardous material aboard. Part of safely transporting hazardous materials is to make sure that those items can be quickly identified in case of an accident. There are many rules and regulations you must follow in order to identify your vehicle as one carrying munitions. Let's look at a few of those requirements.

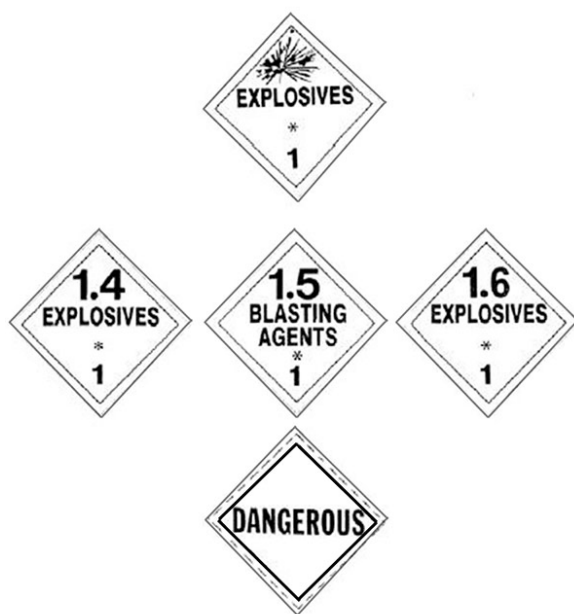


Figure 3-1. Explosives and dangerous placards.

### Types of placards

DOT placards provide a general warning to all personnel of hazardous cargo and furnish specific guidance for emergency response forces in case the vehicle is involved in an accident, fire, spill, or other serious incident. These placards also have been adopted for use on base and in areas outside DOT jurisdiction in order to give a standard identification method for nonnuclear explosives-laden vehicles of all types.

The Joint Hazard Classification System (JHCS) Web site is the source of information to check to ensure you have the proper hazard class and division. Also, Title 49 CFR can provide additional information and other placards that might be applicable. Figure 3-1 shows the different placards to use for vehicles transporting explosives. The asterisk (\*) is replaced by the appropriate division number and, when required, appropriate compatibility group letter.

### General placarding requirements

Below are general placarding rules and guidelines:

- Use DOT placards as outlined in Title 49 CFR. When transporting munitions off the installation in a foreign country, comply with host nation requirements.
- Commanders may omit placards on base where necessary to avoid attention of hostile forces. All personnel should be instructed on proper emergency actions.
- Where tow vehicle and trailer combinations are used on base, placard the lead vehicle on the front and the last vehicle on the rear. Placard loaded vehicles in between on each side.
- Placards may be omitted for transporting HD 1.4 material on base.

- Placard materiel handling equipment only when used in the same manner as a transport vehicle or trailer.
- Compatibility group letters may be omitted from the placard if the vehicle remains on the installation.
- Placards are not required when transporting nuclear weapons or on any explosives loaded vehicle in a nuclear weapons storage area.
- Vehicles transporting Military Working Dog Explosives Search Training kits must be properly placarded.

## 026. Positioning and tie-down procedures for nonnuclear munitions

Before we study specific trailer configurations and loads, let's take a brief look at TO 11-1-38, *Positioning and Tie-down Procedures Nonnuclear Munitions*. This TO provides information on the correct positioning of munitions and tie-down procedures. It also provides a list of the trailer accessories need for various munitions configurations.

As with all TOs, if you go straight to chapter 1 and begin reading, you will miss a lot of vital information. For best results, you need to start with the front cover. Ask yourself, "Do I have the current up-to-date TO 11-1-38?" Then check the A-page and ask yourself, "Is my TO complete?" The table of contents allows you to quickly find the chapter and load matrix card number you need for the task at hand. You should become well versed with the introduction section and the table of contents of this TO. By doing so, you will be able to quickly navigate this TO and accurately find the correct load matrix card for your intended load.

### Introduction

The introduction section of TO 11-1-38 contains information on the purpose, scope, concept, and the general policy of the TO, and information necessary for the correct use of this TO. You must have an understanding of all the information presented in the introduction section to correctly load your trailer. Our intent here is not to reiterate the contents of this TO but to stress some of the critical information within this section. Below, we've included some of the information from the introduction. This is not an all-inclusive list.

- Tables in each chapter represent the trailer decks and/or rails with the top of the page being the front of the trailer and the bottom being the rear of the trailer.
- The illustrations contained in TO 11-1-38 are for reference only. If there are any conflicts between the illustrations and written procedures, the written procedures shall take precedence.
- The procedures contained in TO 11-1-38 are used for standard maximum loads. Maximum load procedures serve as standardized guidelines for less than maximum load and combined loads with no additional written procedures required.
- The munitions flight chief is the lowest level in the chain of command authorized to interpret the TO in making decisions for less than maximum and combined loads. Positioning chocks, rails, tie-down straps, and so forth, may differ from written procedures when transporting less than maximum loads.
- All forward firing munitions will face the rear of the trailer when loaded, unless otherwise noted within the TO. All other munitions can face forward, aft or alternate, unless otherwise noted.

### Safety and accident prevention

This section contains procedures in the area of safety; however, using the information in this section alone is not always enough. You may need to use AFMAN 91-201, *Explosives Safety Standards*, and the specific item TO for additional safety concerns. Make sure you use the on-base explosives movement routes and use common sense when towing explosives. This section also provides guidance on emergency actions. You must remember, however, that no technical order or regulation



can anticipate every possible situation. TOs and regulations are provided as guidance. Always exercise common sense and good judgment when you are working with munitions.

### ***Munitions support equipment***

To meet aircraft generation requirements it may be necessary to tandem tow trailers. Tandem towing of intermixed MHU-141, MHU-110, and MHU-226 trailers is permissible when you meet the following requirements, unless otherwise stated in TO 11-1-38 for certain configurations:

- Always connect the trailer with the greatest gross vehicle weight (GVW) to tow vehicle.
- The lowest minimum turning radius (of the two trailers) must be maintained.
- Rear trailer will be off-loaded first.
- Maximum towing speed of loaded trailers shall be 10 miles per hour (mph) and 15 mph for unloaded trailers.
- Specific item technical order requirement for tandem towing shall apply.

### **Trailer preparation, configuration, and tie-down**

Before starting any trailer loading and unloading operation, you must position, chock, and set the brake on the trailer. Gather all required equipment and visually inspect for serviceability and foreign objects.

### ***Trailer load matrix cards***

TO 11-1-38 Chapter 1-5 provides the bulk of the information required to configure the MHU-141, MHU-110, MHU-226, and flatbed general-purpose trailers to accept different munitions. This information is presented in the form of load matrix cards. Once you understand how to read one load matrix card, you will have no trouble understanding all others. Before turning to your intended load matrix card, read the general notes starting on the first card of each trailer and weapon-type section. The general notes provide the WARNINGS, CAUTIONS, and NOTES pertaining to each trailer and weapon. You are required to review all information in this area before proceeding to the load matrix card to avoid missing critical steps.

For each configuration, the load matrix card lists the equipment and quantity required for each trailer. The load matrix card also illustrates the correct rail number and hole position to install the required equipment. Let's walk through the load matrix card for loading MK-82 general purpose bombs on a MHU-141 trailer. Using figure 3-2 below, you will notice this configuration requires 12 universal munitions chocks in the horizontal position, 4 shackles, and two tie-down straps as listed in the "REQUIRED EQUIPMENT" row of the load matrix card. The equipment designators "UH", "S", and "TS" are explained in table 1 of the TO. The title of the work card tells you a standard maximum load of 6 MK-82s can be loaded. The main body of the load matrix card illustrates the correct position to install your equipment, in this case a universal munitions chock will be installed on rail 2 and 3, pinned in hole position 4, 12, and 18. Shackles for your tie-down straps will be installed on rail 2 and 3, pinned in hole position 8.

By now you may have noticed that this load matrix card only illustrates six universal munitions chocks installed out of the 12 required. This is a correct observation; however, this load matrix card only represents half of the MHU-141 trailer deck. Actual rail hole positions on a MHU-141 trailer start in the center of the trailer deck (starting with hole position 1 in the center of the rail) and precede out to both the right and left ending with hole position 19 on both sides on a MHU-141 trailer rail. This load matrix card only represents half of the trailer; therefore, the steps on this card must be applied to both the right and left sides to configure the complete trailer. This is the type of information provided in the general section of each chapter that is required to be read.

The bottom of the work card provides specific procedures, in this case there are two notes pertaining to further requirements. When properly configured and loaded, your trailer will take on the appearance of figure 3-3. As you can see, work cards are a straight forward, visual process to

configure the trailer. If you are loading general purpose bombs or missiles, the general steps to loading are the same.

MK-82GBU-38GBU-54 with UMCs (Max Load6)																	
RAIL NO. AND HOLES	19	18A	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4
1																	
2			UH						UH				\$			UH	
3			UH						UH				\$			UH	
4																	
REQUIRED EQUIPMENT																	
DESIGNATOR	UH	\$	TS														
QUANTITY	12	4	2														
PROCEDURES																	
Read all applicable WARNINGS, CAUTIONS, and NOTES at the front of this section prior to starting an operation.																	
1. Bombs with BSU-49 fins should be alternated for fuze access.																	
2. Bomb Tie-Down: Attach fixed end of tie-down straps to deck rings 5RL and 6RL; route tie-down strap over bombs, through shackles, and attach ratchet end to deck rings 5RL and 6RL.																	

Figure 3-2. Sample TO 11-1-38 load matrix card.

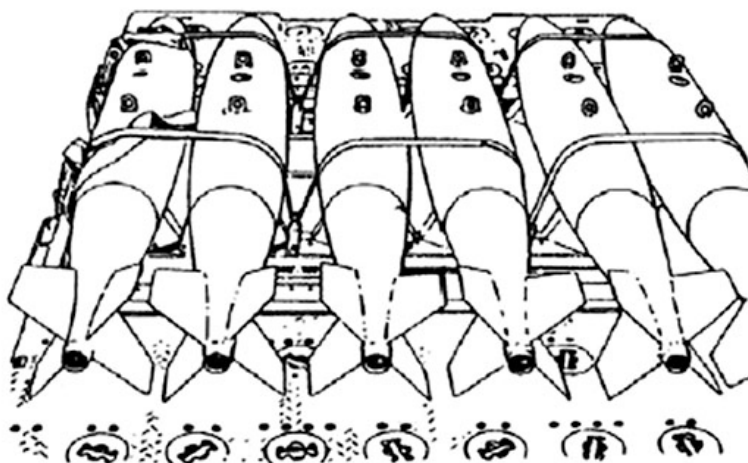


Figure 3-3. Positioning & tie-down of six MK-82s on MHU-141.

### Trailer tie-down

The CGU-1/B web-strap tie-down assembly (fig. 3-4) is used to tie-down munitions to trailers. It is made of nylon webbing and has a rated working load of 5,000 lbs. Since the tie-down strap assembly is made of webbing, it is more susceptible to damage or abuse. Thoroughly, examine the webbing for tears, punctures, frayed edges, or excessive wear before each use. Inspect the adjusting mechanism, tensioning mechanism, and the adjusting mechanism release for defects. Make sure the strap assembly opens and closes without binding. Reject all unserviceable assemblies.

When attaching the strap, use the tie-down points specified in TO 11-1-38. The CGU-1/B tie-down strap has two distinct ends: one with a ratchet and one with a fixed end. To provide even tension, place the ratchet handle ends with one on the left side and one on the right side of the trailer unless otherwise noted in the TO. Tighten the ratchets evenly, while working any slack out of the tie-down strap. When the straps are tight, lock the ratchets and secure any leftover strap so it won't drag when the trailer is moved.

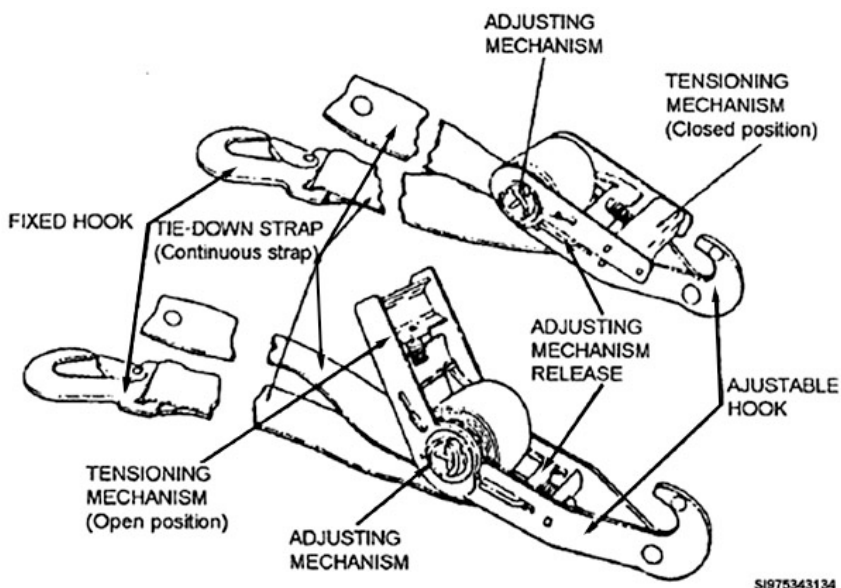


Figure 3-4. CGU-1/B web-strap tie-down assembly.

There are a few configurations where the load matrix card will call for load binders (fig. 3-5). The load binder uses two different types of chains. One type is the MB-1 chain that has a hook on one end only and the other type is a chain with hooks on both ends. These configurations are mainly for 25-40' and MHU-110 railed loads. Load binders should be located on the driver's side of the trailer for safety, driver visibility, and fin clearance unless otherwise noted in the TO. Tighten load binders ensuring equal pull is being applied to the chains; readjust load binder if necessary. If you cannot close the handle of the binder by hand, adjust the load-binder hooks on the chain. Do not use an extension (cheater bar) to close the handle. Using a cheater bar can place too much pressure on the load and trailer tie-down points. Once the handle is closed, secure it in place by wrapping the excess chain around the load binder. If there is not enough chain, use pressure-sensitive tape or any other suitable material to keep the handle closed.

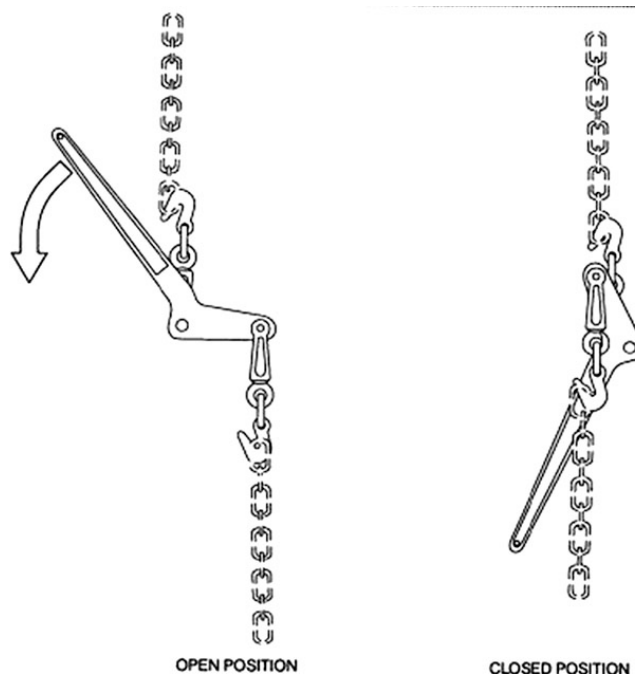


Figure 3-5. Load binder with chain.

### MHU-141/M munitions trailer

The MHU-141/M is probably the most widely used trailer in the munitions community. The MHU-141 has 4 rail positions for a variety of configurations. When it comes to the transport of air to air munitions the MHU-141 is the workhorse of the fleet. Configured with either the M9 or M10 adapters this trailer will transport the majority of our air to air munitions. Chapter 1 of TO 11-1-38 covers the loading of various munitions types on the MHU-141 trailer. Now that you have a basic knowledge of using the load matrix cards, there is no need to reiterate every munitions load for the MHU-141. You should be able to easily navigate chapter 1 of TO 11-1-38, find the load matrix card for your munitions type, and configure your trailer according to the load matrix. When loading is complete, stow excess trailer equipment in the storage compartments and make sure all quick-release pins are locked in place. Before handling or transportation, make sure all munitions are secured to the trailer, safety/protective devices are installed, and the trailer is placarded.

The following table shows the maximum load of munitions and containers on the MHU-141 trailer.

Munitions	Max Load	Munitions	Max Load	Munitions	Max Load
MK82	6	GBU-12	4	GBU-54	6
MK84	2	GBU-31	2	AIM-9	10
BLU-109	2	GBU-32	4	AIM-120	10
CBU	4	GBU-38	6	AGM-88	4
M129	4	GBU-39	6	SUU-25	4
GBU-10/24/27	2	GBU-51	4	CNU-300 series (30 MM)	5

### MHU-110/M munitions trailer

Another trailer option we have is the MHU-110/M trailer. It can hold more munitions than the MHU-141 so it might be the better choice, depending on the quantity requirements or time restraints of a specific mission. Chapter 2 of TO 11-1-38 list the load matrix cards for the MHU-110. The load matrix cards for the MHU-110 are essentially the same as the load matrix card for the MHU-141 with some minor differences. All the load matrix cards for the MHU-110 reflect the entire trailer deck. You will find the MHU-110 load matrix cards simple to use for configuring your trailer.

Always remember to load the front of the trailer first and unload it last. For loads less than maximum, make sure the load is secured toward the front of the trailer. Rail extenders may be used for ease of loading. Make sure rail extenders are securely installed before use or dropped munitions could result. For heavy loads, the MHU-110 stabilizer jack must be used with the rail extenders or the trailer will become unstable. Again, this information can be found in the general notes starting on the first card of each trailer/weapon-type section and is required to be reviewed before proceeding to the load matrix card.

The following table shows the maximum load of munitions and containers on the MHU-110 trailer.

Munitions	Max Load	Munitions	Max Load	Munitions	Max Load
MK82	12	GBU-28	2	AIM-120 Containerized	4
MK82 (w/ rail adapter)	18	GBU-31	4	AGM-65 Containerized	8
MK84	4	GBU-32	8	AGM-158 Containerized	2
CBU	10	GBU-38	18	BLU-109	4
M129	10	GBU-39	10	ADM-160	6
GBU-10/24/27	4	GBU-51	9	SUU-25	10
GBU-12	18	GBU-54	9	CNU-300 Series (30 MM)	11

### MHU-226 munitions trailer

The MHU-226 is the newest munitions trailer in the Air Force inventory. Destined to replace the MHU-110, the MHU-226 has borrowed some of the transport qualities from the MHU-110 and MHU-141 munitions trailer. With its large flat deck, it can transport containerized and heavy munitions similar to the MHU-110. Configured with missile adapters; it can carry an array of missiles similar to the MHU-141. Chapter 3 of TO 11-1-38 provides the load matrix cards for all configurations of the MHU-226.

The following table shows the maximum load of munitions and containers on the MHU-226 trailer.

Munitions	Max Load	Munitions	Max Load	Munitions	Max Load
MK82	12	GBU-28 (only certain models)	2	AGM-65 Containerized	8
MK84	4	GBU-31	4	AGM-158 Containerized	2
BLU-109	4	GBU-32	4	ADM-160	8
CBU / M129	10	GBU-38	12	AIM-9	10
GBU-10/24/27	4	GBU-39	12	AIM-120	10
GBU-12	8	AGM-88	4	CNU-300 Series (30 MM)	9

### Aluminum Rail Set

The Aluminum Rail Set (ARS) is primarily used on 40-foot trailers to allow for more munitions to be loaded onto one trailer and brought out to the flight line to be loaded. The aluminum rail sets are easier to use than wooden rails and come readily assembled. The benefit of wooden rail sets however, the lower cost and the ability to custom make them to fit MHU-110 and 25-foot trailers as well.

As in most trailer loading operations, always load the trailer from front to back and unload the trailer back to front. For loads less than maximum capacity, move all bombs toward the front of trailer. When using an ARS, ensure rail extenders are properly installed and secured with quick-release pins prior to use. Configurations/load matrix cards can be found in TO 11-1-38.

### 25- and 40-foot trailers

To help facilitate the efficient movement of a large number of bombs, we use a large 25-foot and 40-foot flatbed trailers. For delivery of rounded munitions, wooden rails sets or aluminum rail sets can be installed on the trailer deck. The following table shows the maximum load of munitions and containers on the 25-foot and 40-foot trailers.

Munitions on 25' Trailer	Max Load	Munitions on 40' Trailer	Max Load
MK82	26	MK82/GBU-38	42
M117/M129	15	M117/M129	27
SUU-64/65/66	16	SUU-64/65/66	26
AGM-158 Containerized	2	AGM-158 Containerized	4

## Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

### 024. Transportation of munitions

1. What regulation lists criteria for transporting explosives specifically for Air Force installations?
2. How are munitions and explosives affected by quantity distance criteria while in the transportation mode?

3. When is it acceptable to push or pull munitions containers?
4. When, *if ever*, is it acceptable to roll un-palletized conventional high explosive bombs or other explosives?
5. When possible, how should you position an explosive laden vehicle at a loading/unloading operation site?
6. When, *if ever*, is it acceptable to leave explosives laden vehicles unattended?

**025. Placarding munitions-laden vehicles**

1. What is the purpose of DOT placards?
2. What website provides information on which hazard class/division placard to use?
3. When would you placard materiel handling equipment such as forklifts?
4. When may compatibility group letters be omitted from a placard?

**026. Positioning and tie-down procedures for nonnuclear munitions**

1. What information does TO 11-1-38 provide?
2. If there is a conflict between the illustrations in TO 11-1-38 and the written directions, which takes precedence?
3. What requirements must be met to tandem tow trailers?
4. What information is required to be reviewed prior to proceeding to the load matrix cards?
5. Explain the characteristics of the CGU-1/B tie-down assembly.

6. Which chapter of TO 11-1-38 covers loading of various munitions on a MHU-141 trailer?
7. Which chapter of TO 11-1-38 includes all load matrix cards for a MHU-110 trailer?
8. What chapter of TO 11-1-38 provides configuration procedures for the MHU-226 trailer?

### 3-3. Nuclear Weapons

This section deals with some important aspects of your responsibilities concerning nuclear weapons. You are increasingly becoming more involved in handling, loading, and transporting nuclear weapons each day. These weapons require special protection because of their political and military repercussions, destructive power, and the consequences if one was lost or stolen. Because of this “world impact” associated with nuclear weapons, very specific rules are in force to ensure the safety and security of these resources.

#### 027. Nuclear-certified equipment

The Air Force nuclear safety certification program evaluates hardware, software, and procedures against specific nuclear safety criteria before use with nuclear weapons. The program’s goal is to prevent nuclear weapons accidents and incidents. Headquarters Air Force Safety Center is the approval authority for safety design certification. The Nuclear Weapons Directorate is responsible for listing certified items and usage restrictions on the Internet-based master nuclear certification list (MNCL). Much analysis and testing goes into the design and development of nuclear certified equipment to meet nuclear surety requirements. Make sure you are using authorized equipment before you perform operations with nuclear weapons. Use the MNCL to verify your equipment is nuclear certified. The MNCL is the sole authority for determining certification status.

#### Master nuclear certification list

The MNCL provides an itemized list of all Air Force equipment, hardware, and software that is nuclear design safety certified and authorized for use with nuclear weapons. Nuclear design safety certified or approved items can be added to the MNCL only by HQ Air Force Safety Center/Weapons, Space, and Nuclear Surety Division (HQ AFSC/SEW), through Nuclear Weapons Directorate. Changes to the MNCL are accomplished only after evaluation by the proper engineering command according to Air Force Instruction (AFI) 91-103, *Air Force Nuclear Safety Design Certification Program*. Deficiencies discovered on items listed are reported in accordance with AFI 91-204, *Safety Investigations and Reports*.

The Web-based MNCL is an excellent tool that provides users with rapid updates and changes. Since the MNCL can change almost on a daily basis, we must check it far more frequently than the old hard copy TO. The MNCL has an automatic search function, which allows you to enter nomenclature or national stock number (NSN) to find equipment. It also has a function to allow you to just search for recent changes.

The general guidance section of the Web site gives general and specific requirements concerning nuclear certified equipment. It also defines common terms, and lists certain items that do and do not require certification. Review this section on the Web site before using the MNCL.


#### Positive identification

Before you use any test and handling equipment with nuclear weapons, first verify it using the MNCL. If the piece of equipment is not listed, do *not* use this equipment with nuclear weapons. Make



positive identification by a nameplate, label, appropriate markings, or by official documents. If a discrepancy (e.g., characters do not match) exists with any element of the item identification in the MNCL, the item is considered not certified until the discrepancy can be resolved. However, the absence of a data element on the nameplate or label, when all other identifying elements are correct, does not constitute a discrepancy. The MNCL is the sole authority for determining certification status; therefore, no certified item is stamped, etched, painted, or similarly marked on the item structure or data plate to show that it is nuclear certified. Nuclear load restrictions may be marked where appropriate, but you cannot use the marking to verify certification status.

Refer to figure 3-6 to see how to locate an MHU-196, munitions handling trailer, on the MNCL. You can verify that the item is certified for use with nuclear weapons in one of two ways. First, take the NSN from the nameplate (1190-1-189-7381CM) and use the MNCL to locate the trailer by NSN. When verifying the certification of any equipment, use only the NIIN (last nine digits of the NSN). Do not use any suffixes following the NSN, such as “CM” for identification purposes; disregard them. The second way is by using the item nomenclature on the nameplate and using the MNCL to alphabetically locate the item. Check the manufacturer, model number, and part number. Pay special attention to any restrictions that may be listed for the item. In figure 3-6, note that both MHU-196/M trailers have maximum loaded speed restrictions on turns and around obstacles.



**USAF Master Nuclear Certification List**

Home | Hardware | Software | System Printer Friendly | Maintenance | Exit

Weapon System: B-52

WEAPON SYSTEM #1	NOMENCLATURE	HARDWARE TYPE	CERT TYPE	MODEL NUMBER	STOCK NUMBER	PART NUMBER	CRITICAL	LAST UPDATED
B-52	TESTER, WEAPONS PRELOAD	TEST EQUIPMENT	NUCLEAR	AVE24T-149	01-085-7927	6675-79002-1	NO	01 Apr 2003
REMARKS: USED WITH WEAPONS PRELOAD TESTER (WPT) OR PYLON LAUNCHER MISSILE SIMULATOR (PLMS) TESTER NSN 01-308-0444, P/N F400-40046-501 AND AUTHORIZED CABLE SETS.								
B-52	TRAILER, MUNITIONS HANDLING	MUNITIONS HANDLING EQUIPMENT	NUCLEAR	MHU-196/M	01-189-7380	60244-40001-10	NO	01 Apr 2003
RESTRICTIONS: MAXIMUM LOADED SPEED 10 MPH, 5 MPH ON TURN & AROUND OBSTACLES.								
B-52	TRAILER, MUNITIONS HANDLING	MUNITIONS HANDLING EQUIPMENT	NUCLEAR	MHU-196/M	01-189-7381	60244-4000	NO	01 Apr 2003
RESTRICTIONS: MAXIMUM LOADED SPEED 10 MPH, 5 MPH ON TURN & AROUND OBSTACLES.								
B-52	WEAPON CONTROL PANEL (WCP)	SUB COMPONENT	NUCLEAR	NONE	NONE	675-11495-604	NO	01 Apr 2003

51035566004

Figure 3-6. MNCL.

### Modifications

Modifications include all physical and/or functional configuration changes or new uses to existing nuclear design certified items. Air Force policy requires all modifications to certified items be identified to the Air Logistics Center item manager. Minor modifications to nonspecialized equipment (e.g., trucks, semi-tractors, trailers, hoists, and cranes) may not require formal certification, providing the equipment is still used for its original purpose and the changes are approved by the operational major command (MAJCOM). Do not perform any modifications to nuclear-certified equipment without proper approval.

### Delivery vehicles and components

All Air Force combat delivery vehicles (that is, bomber and fighter aircraft) and noncombat delivery vehicles (that is, logistics aircraft, tow vehicles, and trailers) require nuclear certification. All components and assemblies that are considered a part of nuclear weapons systems (such as reentry

vehicles, payload sections, and aircraft monitor and control devices) do not require individual nuclear certification, but are considered as part of the system's nuclear certification.

### **Tow vehicles**

Original equipment pintle hook assemblies are authorized. Replacements are authorized if procured and installed per appropriate TOs. Off-center rear of vehicle pintle hooks shall not be used for nuclear operations. Front mounted pintle hooks are only authorized for local positioning tasks, such as inner warehousing or around storage and maintenance structures when use of the rear pintle hook would degrade safety. Any questions dealing with identifying pintle hook assemblies should be referred to the item manager.

### **Semi-trailers used for transporting nuclear weapons**

Non-specialized semi-trailers (fixed axle, fixed bed, 2003 model year or newer) are considered nuclear certified when they are in original unmodified condition and meet applicable industry standards. Nuclear cargo tie-down must be according to TO 11N-45-51B, *Transportation of Nuclear Weapons, Materiel, General Shipping, and Limited Life Components (LLC) Data*.

The addition of a certified rollerized conveyer or other like item to an uncertified trailer does not certify that trailer, even if the stock number changes to a certified number. To have a certified unit, both the trailer and the modification kit are required to be separately certified.

Semi-trailers equipped with aluminum rail sets part number 20025477, NIIN 01-480-0226 or wood rail set assembly, Air Force code identification 18894, drawing X200334030-10 are not authorized unless rail sets are removed.

Individual semi-trailers will only be listed in the MNCL if nuclear certification was obtained before 2003, a remark is stated, or a restriction is imposed. Therefore, individual identification information for all semi-trailers must be checked in the MNCL to properly determine if any remarks or restrictions are applicable.

### **Equipment, software, and tools**

The following Air Force equipment and items require nuclear certification:

- Equipment used to lift, hoist, mate, support, store, restrain, tow, transport, or otherwise handle complete nuclear bombs or warheads, or warheads with attached or integrated assemblies (such as reentry vehicle payload sections, bomb ballistic cases, and boosters).
- Test equipment used to test and verify the proper functioning of critical circuits, assemblies, and devices associated with nuclear bombs and warheads in all nuclear weapons systems.
- Tie-down adjusters, straps, and shackles used for airlift.
- Software used to command and control critical functions and perform status reporting.
- Test software used to verify the proper functioning of the authorization, prearm, arm, unlock, release, or launch circuits of a combat delivery vehicle or that directly interfaces with weapons/operationally certified critical components.
- Components or software designated *critical* by HQ AFSA/SEW.
- Special test or certification equipment used to operationally certify a critical component.

The following Air Force equipment and items *do not* require nuclear certification:

- Equipment used to lift, hoist, mate, support, store, restrain, tow, transport, or handle unattached or unassociated assemblies intended for use with nuclear bombs or warheads (such as reentry vehicle shells and spacers, payload section shells, and bomb ballistic cases).
- Individual bomb roller assemblies.
- Tie-down adjusters, straps, and shackles used for ground transportation.
- Bridge plates, shoring, ramps, and similar items.

- Test equipment used only to test, troubleshoot, and calibrate critical test equipment.
- Common multipurpose, electrical/electronic test equipment that falls in the category of nonspecialized equipment (such as the AN/PSM-6 or the AN/PSM-37 multimeters).
- General-purpose hand tools such as manually operated hydraulic pallet jacks, pliers, wrenches, vacuum cleaners, screwdrivers, measuring tools, magnifiers, and pry bars.
- Equipment designed and used for proficiency training (such as practice delivery bombs, practice loading bombs and warheads, and training reentry vehicles and payload sections).

## **028. Weapons tie-down and transport**

Now that you're familiar with your role in the verification of nuclear-certified equipment, it's time to look at some of the different types of equipment and trailers used in the movement of nuclear weapons.

### **MB-1 tie-down device/chain assembly**

Two common items of loading equipment you will use are the MB-1 tie-down device/chain assembly and the load binder. Of the two, the MB-1 is the most versatile and is authorized for use in most weapon-to-trailer tie-down operations. MB-1 devices and chain assemblies can be used for securing nuclear weapons, so they all must be nuclear certified and inspected. The MB-1 consists of an adjuster and chain. You use it with tie-down procedures for bolstered weapons and containers put onto flatbed trucks and trailers, safe-secure trailers (SST), munitions handling trailers, and in aircraft. In addition, you can use it to secure weapons to pallets during routine logistic and emergency evacuation movements. Because these MB-1 tie-down devices and chains must be capable of withstanding extreme tension and pressure, ensure to inspect these items for any damage that may affect their function. Replace the tie-down devices and/or chains when you find any cracks, bent/worn parts, excessive corrosion, or any other obvious damage.

#### ***Preparation***

To prepare the tie-down device for installation, open the chain recess and extend the hook, until three threads are showing. The tie-down device has a take-up wheel that extends or retracts the hook depending on the direction you turn the wheel. You must hold the locking lever open to extend the hook. However, when retracting or tightening, the locking lever will slip (ratchet). To open the chain recess, unlatch the quick-release lever and rotate the chain recess. Then, lock the quick-release lever back into place.

#### ***Installation***

To install the chain assembly, first attach the tie-down device hook and chain to the specified tie-down points. When you are using an MB-1 chain (fig. 3-7), run the chain hook through the applicable tie-down ring, shackle, or link and secure the hook to the chain. There is a precaution to observe when using the MB-1. When you install the chain links into the chain recess, the loaded end of the chain must rest in the bottom of the chain recess slot; the locking mechanism can be broken or the take-up assembly can be pulled apart. Pull the chain as tightly as possible by hand, and place the link of the chain into the chain recess in the tie-down device. Close the chain recess and ensure that the locking latch is secure. (To open the chain recess, release the locking latch and pull the recess open).

#### ***Tightening***

To tighten the chain assemblies, tighten the take-up wheels on the tie-down device clockwise by hand. Do not tighten one chain to the extent that the tension is great enough to dislocate the container before the remaining assemblies are tightened. Tighten all the remaining chain assemblies around the container. After the initial tightening of the wheels on each chain, grasp the chain firmly in the center between tie points and push/pull strongly to take up the chain slack. Then retighten the take-up wheels a second time by hand. Repeat these procedures until the take-up wheels cannot be tightened

further by hand or until you cannot deflect the chain more than 3/4- inch from its pull direction with nominal hand pressure sideways on the chain.

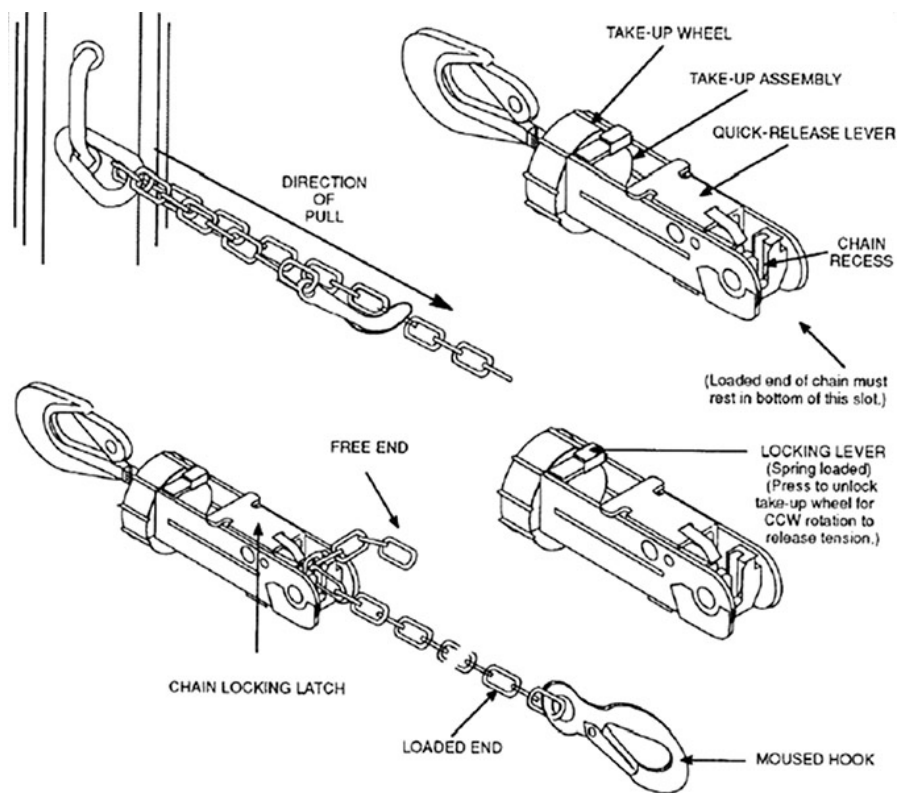


Figure 3-7. MB-1 tie-down device and chain.

To prevent damage during shipping, secure the loose lengths of chain to some convenient location with suitable material like electrical bundle ties or adhesive tape. You can loop or coil the excess chain, but *do not* wrap the loose ends of the chain or secure to the MB-1 tie-down device itself. Keep the ratcheting device and quick-release lever unobstructed in case you need to make final adjustments.

### Removal

One last note about using the MB-1—when removing it from a container, the chain is under tension. Before releasing the quick-release lever, remove the tension from the assembly by depressing the locking lever and turning the take-up wheel counterclockwise. If you are unable to release the tension this way, safely pull the chain inward toward the MB-1 tie-down device to release some tension, and pull out the MB-1 quick-release lever.

### Load binders

Load binders come in two varieties:

1. Chain type.
2. Cable type.

The chain type is used with tie-down operations associated with TO 11N-45-51, *Transportation of Nuclear Weapons Material*. The cable type is used with tie-down operations, according to TO 11N-B1004-1, *Weapon Loading and Tie-down Procedures for Nuclear Weapons, (FOUO)*. Always refer to the applicable TO for typical tie-down locations, patterns, and any restrictions concerning weapon/container tie-down procedures.

### Chain type

This type of load binder has already been introduced for the tie-down of nonnuclear munitions so we will not readdress its characteristics here. To use a load binder, first attach one end of the chain to the container and the other end to the trailer or flatbed. With the handle open, attach the top hook of the load binder to the chain about halfway between the tie-down points. With the handle still open, attach the bottom load-binder hook to the chain so the excess chain is located between the load-binder hooks. Then close and secure the handle. As stated earlier, if you cannot close the handle by hand, adjust the load-binder hooks on the chain. Do not use an extension (cheater bar) to close the handle. Using a cheater bar can place too much pressure on the container and trailer tie-down points. Once the handle is closed, secure it in place by wrapping the excess chain around the load binder. If there is not enough chain, use pressure-sensitive tape or any other suitable material to keep the handle closed.

### Cable type

You can use this load binder on MHU-141 trailers to secure unbolstered weapons. In figure 3-8, you notice there is a clevis at each end instead of hooks. Also, there is a turnbuckle at one end of the cable. Use the clevises to attach the ends to the tie-down points and the turnbuckle to remove excess slack from the cable.

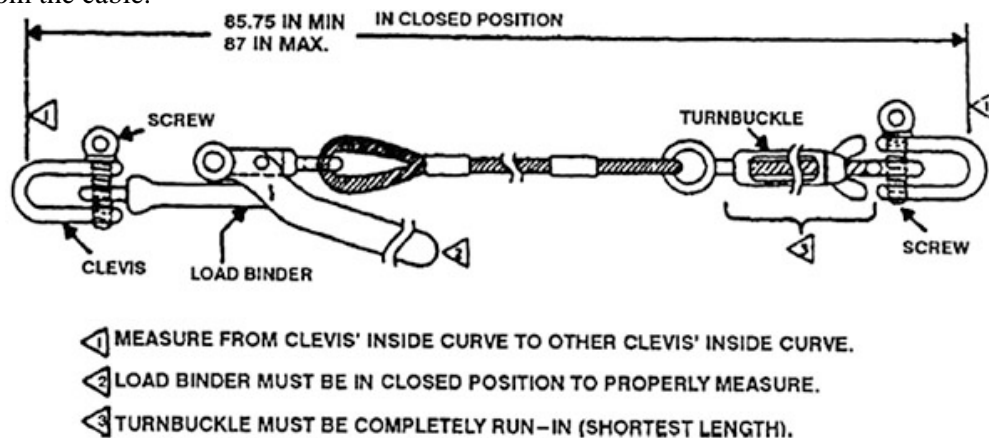


Figure 3-8. Load binder with cable.

Since the cable-type load binder is for a specific trailer, it must be a specific length. Part of the serviceability inspection includes verifying that the length is within tolerance. To measure the length of the assembly, first close the load binder and turnbuckle to its shortest length. Make your measurement from the inside curves of the clevises. Use only cables with lengths varying between 85.75-inch minimum to 87-inch maximum. If the length is not within these tolerances, replace the cable. To install the assembly, extend the turnbuckle and open the handle. Next, loop the cable over the weapon. Remove the screw from each clevis and insert the clevises through the tie-down attachment points. Reattach the clevises to the load binder and turnbuckle, and close the load-binder handle. It is not necessary to center the clevis on the tie-down point. Adjust the final tension with the handle closed. This prevents damage to the tie-down cables or the trailer. To remove cable slack, rotate the turnbuckle in the proper direction. Once you remove the slack, verify that threads (more than one) are exposed inside the turnbuckle. Finally, tighten the wing nut securely against the turnbuckle.

### CGU-1/B web-strap tie-down assembly

The CGU-1/B, or commonly referred to as a *tie-down strap*, has already been introduced for the tie-down of nonnuclear munitions, so we will not go into too much detail here. However, it is worth mentioning that TO 11N-45-51C, *Transportation of Nuclear Weapons Materiel, Military Criteria for Shipment, FOUO*, instructs the use of two CGU-1/B straps for one MB-1 tie-down assembly anywhere the MB-1 is specified.



When attaching the strap, use existing tie-down or lifting points on the cargo, if possible. If you are securing a cylindrical container without tie-down attaching points, make a complete wrap around the container rather than merely passing the strap over the top. Try to protect the strap from being cut by sharp corners, edges, and highly abrasive surfaces. Always focus on protecting your load. Use common sense and do not place tie-down straps over sensitive/fragile items. Also, avoid positioning the metal parts of the strap assembly from direct contact with the load to avoid damage.

## 029. Movements

One of your main responsibilities related to nuclear weapons is transporting them. Considering the constant threat of terrorist attack against our nuclear assets, this job is a complex and demanding one. Be constantly on your guard and prepared for any event or action taken against weapons in movement, since it is during this time they are most vulnerable.

This lesson covers general requirements for transporting nuclear weapons in support of logistic movements and operational movements.

### Logistic movements

A logistic movement is the transport of nuclear weapons in connection with supply or maintenance operations and involves moving weapons from one base to another, depot to base, or base to depot. Normally, the Department of Energy (DOE) ships by truck and the Department of Defense (DOD) transports nuclear weapons by truck or air. The trucks used are the SST, and the safeguards transporter (SGT). If *air* is the mode of transport, a C-17 or C-130 aircraft will be used. Your role in logistic movements could involve providing security, operating a vehicle, or helping the load crew maneuver weapons into the aircraft.

### SST/SGT

The SST/SGT is the primary method used for transporting nuclear weapons within the continental United States. The SST/SGT is a modified standard 40-foot, dry-freight, and cargo-type semitrailer. It includes an inner armored container (cargo space), cargo tie-down tracks, access denial walls, and items necessary for the immobilizing system. The SST/SGT includes heating and cooling units that maintain the cargo space temperature. These units ensure the access denial system operates properly and fulfills certain shipment temperature requirements. The trailer also includes a temperature-monitoring system and a fire alarm system.

### Aircraft

When moving a weapon into an aircraft, use the bolster to maneuver the weapon. Do not push or pull on any part of the weapon. It requires four people to move bolstered weapons across a bridge plate to maintain stability. To maintain directional control during the crossing, unlock only one of the front casters. When applicable, the weapon nose will face the rear of the aircraft. Once the weapon is in its approximate location in the aircraft, a wheeled pry bar may be used to position cargo and to elevate wheeled carriers to rotate casters. Make sure a prior-to-use inspection on the pry bar has been completed before use.

### Factors that affect logistic movements

The key factors during nuclear weapons movements are safety and security. Movement planning during peacetime plays a critical role in logistical movements and is given higher priority than operational requirements in determining transportation modes and routes. Now, let's discuss planning and other factors to consider when preparing for a logistic movement.

### Planning

Each movement of nuclear weapons is planned and coordinated in advance to reduce the possibility of an incident during transit. This planning includes the actions to take and the people to notify if there is an incident. The plan also includes other routes and methods of transportation. Everyone involved in the movement is briefed in advance on all phases of the movement.

Consider the following when planning a nuclear weapons movement:

- Current intelligence estimates of general and local threats associated with the point of origin, routes, enroute stops, and destination.
- The type of weapons and method of shipment.
- The availability of security forces and resources.

### *Delay or accident*

In the event of a delay or accident involving a shipment of nuclear weapons, the responsible individual at the scene must immediately notify the shipping and receiving commanders. This notification must be made by the fastest means available. Off base, the secured area thus created will be designated as a “National Defense Area” as prescribed in AFI 31-101, *The Air Force Installation Security Program, FOUO*. This established area can also serve as a “Close-in Security Area” consistent with AFI 31-101. If a fire or explosion hazard exists, security personnel must take safe positions that concurrently permits continued security and surveillance.

### *Couriers*

Another very important player during logistic moves is the DOE personnel who deliver and transport our weapons. These people are called *couriers* and they must be certified at least annually. DOE Transportation Safeguards Division provides their names and pertinent personal information to us. Couriers receive an FBI background investigation, are capable of handling all firearms and vehicles necessary for transporting nuclear weapons, and meet rigorous fitness standards.

Before each shipment, a list of the couriers is sent to your base. When the shipment arrives, the munitions accountability systems officer (MASO) or his or her appointed alternate meets with the shipment convoy commander to verify identity and authorization. Once this is completed, the truck or trucks with the chase vehicles enter the weapons storage area (WSA). After the vehicles are positioned, custody transfer begins. Custody transfer requires verification of the items in the shipment. Once this is done, download begins.

### *Safe Haven*

Safe Haven is the code name for a situation where a DOE convoy seeks sanctuary at a military base as a result of a hostile or emergency situation. The DOE and DOD have a formal agreement authorizing the temporary storage of nuclear or other classified DOE shipments at DOD facilities (such as your base) in an emergency. Other emergency circumstances include, but are not limited to, civil disorder, natural disaster, adverse-weather conditions, or vehicle breakdown. Any of these situations may require your organization to help set up a Safe Haven area. During a Safe Haven, DOD’s responsibilities are to provide security, fire-fighting equipment, communications, and logistic support. Logistic support includes lodging, dining, medical, vehicle maintenance, and petroleum supplies.

### **Operational movements**

There are two types of operational movements: intra-area and outside WSA. These movements support your local maintenance requirements. The procedures vary *not only* from one command to the next but also from base to base within a command. You may be moving individual weapons loaded on an MHU-141 trailer or a fully loaded launcher or pylon on an MHU-196 trailer. Each has its own requirements; however, even with the variations, there are certain required procedures and typical practices.

### *Intra-area movement*

An intra-area movement happens inside the WSA and involves transporting a weapon in any configuration from storage to the maintenance facility or from the maintenance facility to storage.



### *Outside WSA movement*

An outside WSA movement is more involved since you're leaving the security of the WSA. This type of movement requires more coordination and planning to ensure the safety and security of the weapon are not compromised. Generally, outside WSA movements transport weapons to and from the following:

- Hot cargo pad for a special-assignment airlift mission.
- Flight line for alert aircraft uploads.

### *Custody transfer*

Custody transfer is taking control of a weapon from another individual or relinquishing control of the weapon to another person. This procedure requires strict control of weapons while they are out of the normal storage environment. Verify identity/authorization of all parties involved, and use the appropriate custody transfer documents (i.e., AF Form 504, Weapons Custody Transfer Document) whenever accepting or releasing responsibility of any nuclear weapons and/or materials.

### *Convoy*

Whether it's a weapon movement inside or outside the WSA, the ground transportation procedure is commonly called a convoy. Convoys are always used when moving a weapon. During the convoy, there are several requirements and procedures to follow. Inside a WSA, these movements normally require conformance with prescribed procedures. In other words, weapons are secured for the method of transport; the two-person policy is used, and so forth. Convoys outside the WSA are a little more involved.

### *Breakout*

The term *breakout* is used to describe the action of removing weapons from a structure. You are issued keys and sent to the storage structures to break out the weapons. Before you leave the maintenance shop, be sure you have everything you need, such as checklists, fire extinguishers, code for the day, and so forth.

Before loading or departing, all vehicles must be checked out to make sure all equipment—including tires, brakes, lights, and communications equipment—are in proper and safe operating condition. Further, you need to search the vehicle for unauthorized devices. Make sure that the vehicle has a full or almost full tank of fuel.

After clearing your entrance with the security forces, open the structures. Perform a safety check on weapons and trailer(s), using your checklist. As you hook up the trailers to the tow vehicles, verify that each vehicle's pintle hook is closed and locked, with the safety pins inserted. If applicable, make sure that pneumatic, electrical, and other connections between the trailer and tow vehicle are correctly and securely connected. Throughout the breakout procedures, you must observe the two-person concept. Before towing the trailer, make sure you perform a brake check. Remove the chocks and drive forward a little; then apply the vehicle brakes to make sure they function properly. Now you're ready to convoy.

### *Convoy procedures*

When moving a nuclear weapon from the storage area, you must take steps to notify security forces in advance to allow time to establish the route and convoy security. All agencies involved with this movement must restrict any information to *only* those directly involved in the task.

Vehicle operators must be fully qualified to operate the particular vehicle, have in their possession a valid operator's license, and be certified to transport weapons. While enroute, drivers may be required to keep headlights and four-way flasher lights turned on to meet local requirements. Before leaving the WSA, convoy personnel will be given the exact route to take. It will be either the normal primary route or an alternate one. Figure 3-9 shows a primary route marked with a solid line and the alternate as a dashed line. When assigned to drive a tow vehicle during a weapons convoy, you need to be on

your guard at all times. Pay close attention to the convoy speed limit. Be alert for any instructions that come over the two-way radio (unless silent convoy procedures are in effect), and remain fully aware of your cargo or load. You will be armed with a rifle or shotgun. Be sure to handle it carefully. Bad weather conditions pose increased hazards, particularly when roads are icy or snow packed or when visibility is reduced.

Whether the convoy is made up of one, two, or several vehicles, at least two security guards will precede and follow. Each escorting vehicle must have a two-way radio. The most difficult job for escort guards is to keep other vehicles from entering the convoy, whether it's an on-base or off-base movement. When available, helicopter escort with armed security forces aboard is used during off-base weapons movement. Communications between the helicopter, communications control center, and the individual in charge of the movement are maintained throughout the movement.

Safe corridor guards, check points, and convoy security vehicles, as applicable, make communications checks with the maintenance operations center (MOC), munitions control, central security control (CSC), or the location from which additional security support is available; that is, immediately before, during, and upon arrival of the convoy at its destination. Any combination of communications checks is permissible; so long as, CSC is kept aware of convoy progress. A secure duress code word or signal will be incorporated during a communications check in the event of duress. Intraconvoy voice radio communications are established between all vehicles on the convoy, and between the convoy and CSC.

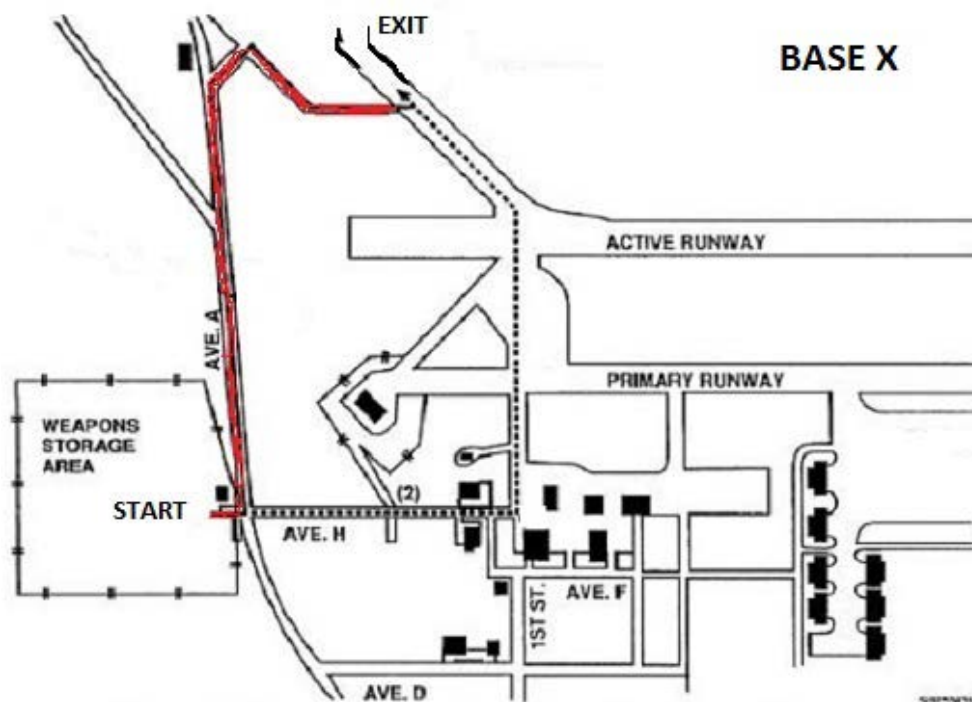


Figure 3-9. Example of typical primary & alternate convoy routes.

If an event occurs that halts or immobilizes a nuclear weapon(s) ground movement, convoy personnel will take positions that ensure that security is maintained and that access to the weapon(s) is restricted. If an emergency results in breaking up the convoy into separate elements, each element will be provided the same degree of security as the original convoy. When planning security actions, it is important to remember this well-recognized principle of law—a military commander has *not only* the right, but also an obligation, to use reasonable force to protect government property in his or her custody. In keeping with this broad philosophy, commanders should make sure that personnel responsible for emergency security actions consult the local base staff judge advocate concerning the extent of military jurisdiction in such operations off base.

## Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

### 027. Nuclear-certified equipment

1. What methods are used to positively identify nuclear certified equipment?
2. Explain two ways to locate a piece of equipment in the MNCL.
3. What test equipment requires nuclear certification?
4. List five examples of general-purpose hand tools that do *not* require certification.

### 028. Weapons tie-down and transport

1. Explain what damage to the MB-1 tie-down/chain assembly warrants replacing the assembly.
2. What preparation is required for MB-1 tie-down device installation?
3. Why is it important to evenly tighten the chain assemblies around the container and not completely tightening one at a time?
4. If you are unable to remove the tension on the MB-1 chain assembly by using the locking lever and reverse spinning the take-up wheel, what should you do?
5. Why are you not allowed to use an extension (cheater) to close the load-binder handle?
6. Which technical order instructs you to use two CGU-1/B straps for one MB-1 tie-down assembly?

### 029. Movements

1. How does the DOD normally transport nuclear weapons?

2. What types of aircraft are normally used for DOD nuclear weapons shipments?
3. List three things to consider when planning a nuclear weapons movement.
4. Who is notified in the event of an accident or delay involving a shipment of nuclear weapons?
5. How often are DOE couriers certified?
6. Why would a DOE convoy seek sanctuary (Safe Haven) at a military base?
7. What type of operational movement happens inside the WSA?
8. List two examples of outside WSA weapon movements.
9. What must a military member possess to be a vehicle operator in a convoy?
10. What communication check is used in the event of duress during a convoy?

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### Answers to Self-Test Questions

#### 024

1. AFMAN 91-201.
2. Quantity distance criteria *does not* apply to munitions and explosives in the transportation mode.
3. Containers designed with skids may be pushed or pulled for positioning.
4. Do not roll un-palletized conventional high-explosive bombs or other explosives unless authorized by the item TO. If authorized by the item TO, the lugs or other projections must be removed. Munitions protected by dunnage rails may be rolled.
5. Position munitions cargo vehicles to permit loading and unloading from either side of the cargo bed.
6. Except as required in the event of an electrical storm, do not leave explosives laden vehicles unattended unless they are parked in a properly designated area, such as the weapons storage area, holding yard, or flight line munitions holding area.

#### 025

1. To provide a general warning to all personnel of hazardous cargo and furnish specific guidance for emergency response forces in case the vehicle is involved in an accident, fire, spill, or other serious incident.

2. The JHCS is the source of information to check to make sure you have the proper hazard class and division. Once you know the hazard class and division, you can then check Title 49 CFR to determine the correct placard to use.
3. Placard materials handling equipment only when used in the same manner as a transport vehicle or trailer.
4. When used on base only.

**026**

1. TO 11-1-38 provides information on the correct positioning of munitions, provides tie-down procedures, and lists the equipment you need for each trailer and its various configurations.
2. Written procedures.
3. (1) Always connect the trailer with the greatest GVW to tow vehicle.  
(2) The lowest minimum turning radius (of the two trailers) must be maintained.  
(3) Rear trailer will be off-loaded first.  
(4) Maximum towing speed of loaded trailers shall be 10 mph and 15 mph for unloaded trailers.  
(5) Specific item technical order requirement for tandem towing shall apply.
4. All information in the general notes starting on the first card of each trailer and weapon-type section.
5. The CGU-1/B web-strap tie-down assembly is made of nylon webbing and has a rated load of 5,000 lbs.
6. Chapter 1.
7. Chapter 2.
8. Chapter 3.

**027**

1. Make positive identification by a nameplate, label, appropriate markings, or by official documents for the item and verify the item is located in MNCL.
2. Locate the national stock number or the item nomenclature on the nameplate. Use either the MNCL to locate the trailer by the NIIN (last nine digits of the NSN), or by using the item nomenclature on the nameplate and using the MNCL to alphabetically locate the item.
3. Equipment used to test and verify the proper functioning of critical circuits, assemblies, and devices associated with nuclear bombs and warheads in all nuclear systems. Also, special test or certification equipment used to operationally certify a critical component.
4. Any five of the following:
  - (1) Manually operated hydraulic pallet jacks.
  - (2) Pliers.
  - (3) Wrenches.
  - (4) Vacuum cleaners.
  - (5) Screwdrivers.
  - (6) Magnifiers.
  - (7) Pry bars.

**028**

1. Replace the tie-down device if it has any cracks or bent/worn parts. Replace the chain if you find any deformed, cracked, or damaged links.
2. To prepare the tie-down device for installation, fully extend the hook and open the chain recess.
3. The tension on one chain may be great enough to dislocate the container before the remaining assemblies are tightened.
4. Safely pull the chain inward toward the MB-1 tie-down device to release some tension, and pull out the MB-1 quick-release lever.
5. Using a cheater bar can place too much pressure on the container and trailer tie-down points.
6. TO 11N-45-51C.

**029**

1. By truck or air.

2. C-17 or C-130 aircraft.
3.
  - (1) Current intelligence estimates of general and local threats associated with the point of origin, routes, enroute stops, and destination.
  - (2) The type of weapons and method of shipment.
  - (3) The availability of security forces and resources.
4. The shipping and receiving commanders.
5. At least annually.
6. As a result of a hostile or emergency situation.
7. An intra-area movement.
8.
  - (1) Hot cargo pad for a special-assignment airlift mission.
  - (2) Flight line for alert aircraft uploads.
9. Vehicle operators must be fully qualified in the operation of the particular vehicle, have in their possession a valid operator's license, and be certified to transport weapons.
10. A secure duress code word or signal.

## Unit Review Exercises

**Note to Student:** Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field-Scoring Answer Sheet.

**Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).**

60. (024) What does Title 49 of the code of federal regulations (CFR) regulate?
  - a. Contingency operations.
  - b. Special access required for classified cargo.
  - c. Shipments of hazardous material, including explosives within the United States.
  - d. All shipments of explosives and munitions within the United States and overseas.
61. (024) Which approved restraining devices can be used for securing munitions on USAF vehicles/trailers?
  - a. Steel banding and steel chains.
  - b. Tie-down straps and bungee cords.
  - c. Chains/binders, cargo nets, and tie-down straps.
  - d. Chains/ratchets, heavy tarps, and tie-down straps.
62. (024) When is it permissible to transport explosives in privately owned vehicles (POV)?
  - a. Never.
  - b. During contingency operations only.
  - c. When given approval from the squadron commander.
  - d. Only for movements beginning and ending within the munitions storage area.
63. (024) What is the *primary* focus when designating primary and alternate explosives movement routes?
  - a. Use the most covert possible routes.
  - b. Use the securest possible routes.
  - c. Use the fastest possible routes.
  - d. Use the safest possible routes.
64. (025) What source is *best* used to determine the explosive hazard class/division of a specific munitions item?
  - a. TO 11A-1-46.
  - b. TO 11A-1-63.
  - c. AFMAN 91-201.
  - d. Joint Hazard Classification System (JHCS).
65. (026) What should you do if a conflict is discovered while using TO 11-1-38 between the illustrations and the written procedures?
  - a. Follow the illustrations.
  - b. Follow the written procedures.
  - c. Make a command decision and choose one.
  - d. Put the operation on hold until a TO change is received.
66. (026) Even though TO 11-1-38 has its own safety section, what other publication should you reference for safely transporting explosive items on base?
  - a. TO 11A-1-1.
  - b. TO 11A-1-10.
  - c. TO 11A-1-63.
  - d. AFMAN 91-201.



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67. (026) What type of information is given in the general notes on the first card of each trailer and weapon-type section in TO 11-1-38 and is required to be reviewed?
- a. Illustrations for each trailer configuration.
  - b. Equipment and quantity required for each trailer.
  - c. Equipment and quantity required for each trailer and weapon.
  - d. WARNINGS, CAUTIONS, and NOTES pertaining to each trailer and weapon.
68. (026) If you cannot fully close the load-binder handle by hand,
- a. use a forklift to close the handle.
  - b. use a cheater bar to close the handle.
  - c. adjust the load-binder hooks on the chain.
  - d. replace the load binder with a newer one that's not rusted.
69. (026) What chapter of TO 11-1-38 covers configuration of the MHU-141 munitions trailer?
- a. One.
  - b. Two.
  - c. Three.
  - d. Four.
70. (026) What piece of equipment must be used with the MHU-110 to prevent the trailer from becoming unstable while using the rail extenders for loading or unloading heavy munitions?
- a. Longitudinal trolley.
  - b. Cradle assembly.
  - c. Stabilizer jack.
  - d. M10 adapter.
71. (026) What can be constructed and attached to the bed of a 40-foot trailer to facilitate support of rounded munitions?
- a. Universal chock assembly.
  - b. Wooden rail sets.
  - c. Iron rail sets.
  - d. Bomb rack.
72. (027) What provides an itemized list of all equipment authorized for use with nuclear weapons?
- a. Master nuclear certification list.
  - b. Unit committed munitions list.
  - c. TO 11A-1-63.
  - d. TO 11-1-38.
73. (027) Once verified that an item is nuclear certified, how is it identified as such?
- a. Positive identification by a stamp, stencil, or etching.
  - b. Item will be stamped "NUCLEAR CERTIFIED" in black ink.
  - c. Item will be stenciled "NUCLEAR CERTIFIED" in black paint.
  - d. Positive identification by a nameplate, label, appropriate markings, or by official documents.
74. (027) Which statement about pintle hooks and their use in operations with nuclear weapons is correct?
- a. Original equipment pintle hook assemblies are authorized.
  - b. Front mounted pintle hooks are only authorized for towing on the flight line.
  - c. Off-center rear of vehicle pintle hooks can be used as long as both sides are used.
  - d. Replacement pintle hooks can be procured and installed per local operating instructions.

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75. (027) Which items *do not* require nuclear safety certification for use in operations with nuclear weapons?
- a. Combat delivery vehicles.
  - b. General-purpose hand tools.
  - c. Noncombat delivery vehicles.
  - d. Equipment used to transport nuclear weapons.
76. (028) When should you replace a nuclear certified MB-1 tie-down/chain assembly item?
- a. Every 10 years.
  - b. Every 25 years.
  - c. Only when the item no longer functions.
  - d. After finding any cracks, bent/worn parts, or excessive corrosion.
77. (028) Which action is *not* an authorized method for securing loose lengths of chain when using the MB-1 tie-down device/chain assembly?
- a. Loop the excess chain around the chain itself; secure with durable adhesive tape.
  - b. Loop the excess chain around the chain itself; secure with an electrical bundle tie.
  - c. Wrap the loose ends around the tie-down device and secure to the quick-release lever.
  - d. Wrap the loose ends around a container tie-down point; secure with an electrical bundle tie.
78. (028) When using a load binder for securing a load, what is the main reason for *not using* a cheater bar or extension tool to fully close the handle?
- a. It would place too much pressure on the load and/or tie-down points.
  - b. Fingers could get pinched between the tool and the load binder.
  - c. There is no written guidance for this procedure.
  - d. Not an authorized tool.
79. (028) When specifically authorized for transporting nuclear weapons and materiel, how many CGU-1/B tie-down straps need to be used as a substitute for every one MB-1 tie-down assembly?
- a. 1.
  - b. 2.
  - c. 3.
  - d. 4.
80. (029) What are the *key* factors to consider during a nuclear weapons movement?
- a. Time and money.
  - b. Safety and security.
  - c. People and equipment.
  - d. People and the mode of transportation.
81. (029) Which *area* is designated as a location used temporarily during a delay of an off-base movement involving nuclear weapons?
- a. No-lone zone.
  - b. High Security.
  - c. Close-in security.
  - d. National defense.
82. (029) What code word is used when a Department of Energy (DOE) convoy seeks sanctuary during an emergency?
- a. Bent Spear.
  - b. Safe Haven.
  - c. Empty Quiver.
  - d. Covered Wagon.

83. (029) In regards to ground transportation, when are nuclear weapons moved by convoy?
- a. When on base or within the confines of a military installation only.
  - b. When off base and traveling over state highways only.
  - c. Only when more than one weapon is being moved.
  - d. Every time weapons are moved.
84. (029) What is the *most* difficult job for escort guards during a convoy?
- a. Keeping other vehicles from entering the convoy.
  - b. Maintaining the proper speed required in a convoy.
  - c. Keeping the proper distance from the security forces.
  - d. Identifying the correct checkpoints along the convoy route.

## Glossary of Abbreviations and Acronyms

<b>AC</b>	alternating current
<b>AFI</b>	Air Force instruction
<b>AFMAN</b>	Air Force manual
<b>AFOSH</b>	Air Force safety and health
<b>AGE</b>	aerospace ground equipment
<b>ALA</b>	ammunition loader assembly
<b>ALS</b>	ammunition loading system
<b>ARS</b>	aluminum rail set
<b>AT</b>	adverse terrain
<b>CBU</b>	cluster bomb unit
<b>CFR</b>	Code of Federal Regulations
<b>CIU</b>	container interface unit
<b>CSC</b>	central security control
<b>DC</b>	direct current
<b>DOD</b>	Department of Defense
<b>DOE</b>	Department of Energy
<b>DOT</b>	Department of Transportation
<b>EED</b>	electro-explosive devices
<b>FOD</b>	foreign object damage
<b>FOUO</b>	for official use only
<b>GBU</b>	guided bomb unit
<b>GP</b>	general-purpose
<b>GVW</b>	gross vehicle weight
<b>ICB</b>	interface control board
<b>ISO</b>	international shipping organization
<b>JHCS</b>	Joint Hazard Classification System
<b>LALS</b>	linkless ammunition loading system
<b>LTC</b>	link tube carrier
<b>MAC</b>	munitions assembly conveyor
<b>MAJCOM</b>	major command
<b>MASO</b>	munitions accountability officer
<b>MER</b>	multiple ejector rack

<b>MHU</b>	munitions handling unit
<b>mm</b>	millimeter
<b>MNCL</b>	master nuclear certification list
<b>MOC</b>	maintenance operations center
<b>MPH</b>	miles per hour
<b>NEW</b>	net explosive weight
<b>NSN</b>	national stock number
<b>OSHA</b>	Occupational Safety and Health Administration
<b>PIU</b>	pod interface unit
<b>POV</b>	privately owned vehicle
<b>psi</b>	pounds per square inch
<b>rpm</b>	revolutions per minute
<b>RT</b>	rough terrain
<b>SGT</b>	safeguards transporter
<b>SST</b>	safe-secure trailers
<b>TER</b>	triple ejector rack
<b>TO</b>	technical order
<b>UALS</b>	universal ammunition loading system
<b>VAC</b>	volts alternating current
<b>VCO</b>	vehicle control officer
<b>WSA</b>	weapons storage area
<b>Ω</b>	ohms

## **Student Notes**

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