

CHAPTER 3

AVIATION SUPPORT EQUIPMENT

As naval aircraft have become more complex, the equipment used to support them has also become more complex. The Aviation Machinist's Mate (AD) uses many different types of support equipment (SE) to maintain aircraft in optimal condition. Some SE, such as tow tractors and power units, are common to many different aircraft. There is also a long list of SE that applies only to a specific type or model of aircraft. Using SE correctly is a challenging, sometimes dangerous, but never routine operation. The support equipment manuals or the maintenance instruction manuals (MIMs) cover the proper operating procedures and safety precautions for the use of SE. Read the manuals, learn to use the equipment, and become qualified on it before you are required to use it.

Over the years, safety procedures and precautions for operating SE have developed mainly from direct experience. Unfortunately, much of that experience was gained as a result of accidents. Each of us must be aware that accidents are always present. People cause accidents. We are all capable of having an accident for any number of reasons. Carelessness, complacency, haste, ignorance, shortcuts, fatigue, and stress are some of the reasons given for SE accidents. It is amazing, and a little scary, that the same type of SE accidents happens over and over again each year. Each year, the Navy spends millions of dollars to repair damaged SE and aircraft caused by the improper use of SE. Navy personnel are injured, maimed, or killed by improper use of SE because of failure to follow prescribed safety precautions. We must do something to eliminate these tragedies and costs.

This chapter discusses SE identification and the use of different types of SE. You will learn about the hazards, safety precautions, and proper procedures to follow when using both powered and non-powered SE. Finally, you will learn about the SE Training and Licensing Program, as discussed in Commander Naval Air Forces Instruction (COMNAVAIRFORINST) 4790.2(series).

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to do the following:

1. Recognize the different types of support equipment.
2. Identify the function of the Support Equipment Training and Licensing Program.
3. Discuss the purpose, operation, and safety precautions in using powered and non-powered support equipment.

IDENTIFICATION OF SE

In previous years, identifying SE has been somewhat difficult. You learned the designations and applications of the equipment by association. You knew that an A/S32A-45 was a tow tractor; so were an A/S32A-31A and an A/S32A-32. There were several more tow tractors, but nothing in their designations showed that they had anything in common. SE is now undergoing a change in designations to group them by application. Newly constructed and modified support equipment is now identified by Military Standard 875A (MIL-STD-875A). This designation system for aeronautical equipment and support equipment will be identical throughout the military services. Present SE with old designations remains the same until it undergoes an alteration or modification; then it is redesigned. *Table 3-1* contains all SE code indicators used in the Navy today.

Table 3-1— Equipment indicator code

INSTALLATION (1st Indicator)	TYPE OF EQUIPMENT (2nd Indicator)	PURPOSE (3rd Indicator)	MISCELLANEOUS IDENTIFICATION
A. Aircraft or Missile (Installed in or on vehicle, non-mission expendable)	22. Apparel 23. Chemical 24. Electrical 25. Explosive 26. Gaseous 27. Hydraulic	A. Aircraft or Missile B. Bombing or Fire Control or Both (Non- electronic) C. Air Conditioning D. Detection E. Destruction	T. Training V. Variable Configuration
B. Aircraft or Missile (Transported, but not installed in or on vehicle, mission expendable)	28. Materials. Pliable (Fabric, rubber, etc.) 29. Materials. Rigid (Metals, Wood, etc.) 32. Mechanical 33. Nuclear 34. Pneumatic 35. Optical	G. Flight Control or Navigation or Both (Non-electronic) H. Aircraft Loading and Cargo Handling J. Indicating K. Aerial Stores (Munitions)	
C. Combination (Ground and Airborne)	36. Opti-Mechanical 37. Electromechanical	L. Lubricating	
E. Ground, Not Fixed F. Ground, Fixed M. Ground, Self- Contained (Movable, includes vehicle but not self-propelled)	38. Invisible Light (Infrared) 39. Inertial 42. Electrohydraulic 43. Manual 44. Internal Combustion 45. Biological 46. Pneumatic-Hydraulic	M. Maintenance Aircraft P. Protection Q. Reconnaissance (Non- electronic) R. Fueling S. Personnel	
N. Aircraft or Missile (Transported, but not installed in or on vehicle, non-mission expendable vehicle) P. Personal Use (Held or worn by individual) S. Ground Self-Propelled (Include vehicle) U. Multi-Installation	47. Electro-Pneumatic 48. Hydro-mechanical 49. Gunnery 82. Mobile Deployment (Bare Base) – Miscellaneous 83. Mobile Deployment (Bare Base) - Medical Serving (Including kitchen, dining, etc.)	T. Testing U. Special. Not Otherwise Covered, or Combination of Purposes V. Maintenance Automotive W. Graphic Arts X. Identification Y. Dissemination	
W. Water	99. Miscellaneous		

TYPES OF SUPPORT EQUIPMENT

SE is all equipment required on the ground to make an aeronautical system, system command and control system, support system, subsystem, or end item of equipment operational in its intended environment. SE is primarily that equipment covered by the Aircraft Maintenance and Material Readiness List (AMMRL) Program. SE is categorized as common general purpose and peculiar special purpose. SE is normally identified as either powered or non-powered. SE types maybe further divided into the categories of avionic SE and non-avionic SE. Avionic SE common and peculiar includes all equipment of an electronics nature used for, but not limited to, the testing, troubleshooting, alignment, or calibration of aircraft systems or components. Avionic SE includes general-purpose electronic test equipment (GPETE) and automatic test equipment (ATE). Examples of this type of SE include multimeters, pressure testers, and fuel quantity indicator test sets. Non-avionic SE common and peculiar includes all equipment that is nonelectric in nature and may be powered or non-powered. Examples of powered equipment are mobile electric powerplants, aircraft tow tractors, and mobile air-conditioners. Examples of non-powered SE are engine stands and maintenance work stands. *Table 3-2* shows an example of AS32/A-45 tow tractor designation breakdown.

Table 3-2 — Equipment type designation

Tow Tractor	A	S	32	A	45
Item Name	Aero/Support Equipment	Ground, Self-Propelled	Mechanical	Aircraft or Missile Support	The 45th equipment in the category to which a type designation has been assigned

POWERED SUPPORT EQUIPMENT

The most common types of powered SE are tow tractors, mobile electric power plants (MEPPs), mobile air conditioners, air start units (MSUs), and portable hydraulic power supplies/hydraulic test stands.

A/S32A-45 Mid-Range Tow Tractor (MRTT)

The A/S32A-45 Mid-Range Tow Tractor is a land-based, four-cylinder, diesel-powered, three-speed automatic transmission, liquid-cooled, rear-wheel drive tractor designed for towing aircraft weighing up to 80,000 pounds. Standard disk brakes are provided on the front wheels, and integrated hydraulic brakes are provided on the rear wheels. It employs a 12-volt, 800 cold cranking ampere battery, which supplies power for lights, horn, starter motor, ignition, and instrumentation. The mid-range tow tractor is geared to travel at a maximum speed of 15 miles per hour (mph) forward and 7 mph in reverse (*Figure 3-1*).



Figure 3-1 — A/S32A-45 Mid-Range Tow Tractor (MRTT).

A/S32A-31A Shipboard Tow Tractor

The Shipboard Tow Tractor (STT) will be required to operate on nuclear powered aircraft carrier (CVNs) and L-class air-capable ships. The following information includes some of the requirements for the new STT. The diesel power plant is capable of towing aircraft weighing up to 74,500 pounds and be capable of 11,200-pound drawbar pull (the force with which the tractor pulls vehicles on the drawbar behind it) in forward and reverse directions. It shall engage the aircraft using a tow bar. The STT will transport and provide power and fuel to a mounted universal jet engine start unit (MSU). The STT is no larger than 70 inches wide, 40 inches high, 121 inches long, and has a minimum ground clearance of 7½ inches. It operates in ambient temperatures from -20 to 125 degrees F. It shall be transportable in military aircraft (C-130, C-17, and C-5). As required for any typical Navy SE, the STT is highly reliable, maintainable, supportable, and capable of meeting environmental, shipboard shock, and vibration standards (*Figure 3-2*).



Figure 3-2 — A/S32A-31A Shipboard Tow Tractor.

Engine Installation and Removal Vehicle (EIRV)

The purpose of the Engine Installation and Removal Vehicle (EIRV) is to satisfy the operational need of the Navy and Marine Corps by providing a commercial off the shelf (COTS), mobile, engine/propeller installation and removal system. This unit has the capability of safely installing and removing the T56 engine and/or T56 propeller on and from P-3, C-2, E-2, and C-130 aircraft. Installation and removal of the T56 engine and propeller onto the respective aircraft requires relatively fine lateral and horizontal adjustments in order to be executed properly. To accomplish this, the Navy is requiring a commercially available, mobile engine/propeller installation and removal system for procurement. This project is a valuable use of taxpayer funds because procurement of the system will reduce damage to the engine/propeller and the airframe, thereby decreasing downtime and increasing operational readiness. The EIRV was chosen to reduce damage to equipment, reduce injuries to workers, and increase efficiencies.

MOBILE ELECTRIC POWER PLANTS (MEPPS)

Mobile electric power plants (MEPPs) supply regulated electrical power for aircraft servicing, starting, maintenance, and testing. There are various types of motor generator assemblies. Some supply direct current (dc) power only, while others furnish both dc and alternating current (ac) power. The MEPPs used today are designed for operation on shore stations and aboard aircraft carriers. On aircraft carriers, these units are usually mobile with minimum vehicular dimensions and weight. They are designed for the utmost maneuverability and mobility. On shore stations, these units may be mobile or mounted on trailers that require towing. The type used depends upon the type of aircraft to requiring service. MEPPs, especially the self-propelled type, are high on the list of SE involved in ground accidents with aircraft. In addition to the hazards of driving or towing MEPPs with cables still plugged into the aircraft, there is also the possibility of damage to the aircraft's electrical or electronic systems due to improper electrical operation. High voltage is certainly a hazard that should be considered during the use of all MEPPs. Although insulation and covers provide protection, malfunctions or improper operation can create electrical shock hazards.

A/S37A-3 MEPP

The A/S37A-3 Shipboard MEPP is designed to provide 115-volt ac, three-phase, and 400-Hertz (Hz) or 28-volt dc electrical power for aircraft aboard ship (*Figure 3-3*). The MEPP is a four-wheeled, self-propelled vehicle powered by a three-cylinder diesel engine. The engine drives the electrical generator and hydraulic propulsion system. A 24-volt dc vehicle electrical system provides starting, lighting, and instrumentation. The variable displacement, axial piston pump provides hydraulic pressure to two gear pumps that drive the rear wheels. Power steering is provided to the front axle for ease of vehicle movement in congested areas on the flight deck or hangar bay. The ac/dc power cables are stored in the compartment near the driver.



Figure 3-3 — A/S374A-3 MEPP.

One of the primary hazards of this MEPP is the unusual driving characteristic. The rear-wheel steering puts the maneuvering part of the vehicle behind you. It takes a great deal of practice to become familiar with rear-wheel steering, and you should be familiar with the equipment before maneuvering close to aircraft on the flight line.

NC-10C MEPP

The NC-10C is designed for shore-based facilities (*Figure 3-4*). The unit will supply regulated electric power up to 90 kilo volt amp (kVA) at 0.08 power factor, 120/208-volt, three-phase, and 400 Hz ac for servicing, maintenance, and starting of helicopter and jet aircraft. The unit is powered by a Detroit diesel six-cylinder, two-cycle engine. A portion of the generated ac power is rectified to supply 28-volt dc at 750 amperes continuously. The unit is self-contained and requires no external electrical or mechanical sources of power. It may be towed at speeds up to 20 mph. The efficiency of the NC-10C is not affected on inclines up to 15 degrees maximum in any direction from horizontal. Climatic conditions of operation are from -18° to 120° degrees (F) or 22° to 50° degrees (C) and under relative humidity up to 100 percent. It will operate efficiently at altitudes from sea level to 8,000 feet. The general hazards of high voltage, hot cables, noise, noxious gases, and exhaust heat are all applicable to the NC-10C. Also the NC-10 does not have lockout circuit to prevent moving the unit with the cables still plugged into the aircraft.

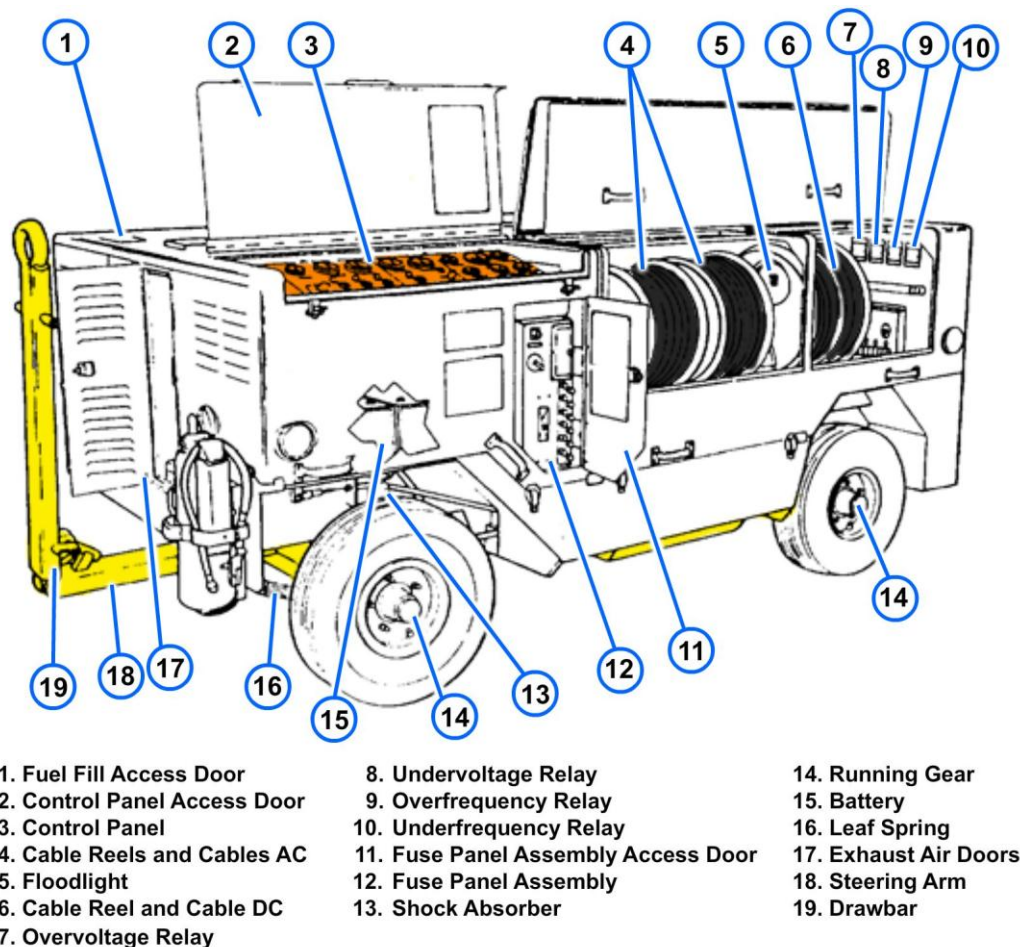


Figure 3-4 — NC-10 MEPP.

A/M24M-5 Static Frequency Converter

The Static Frequency Converter (SFC) is a four-wheeled, non-self-propelled vehicle that must be towed. It is equipped with tie-down rings, pneumatic tires, a mechanical hand brake, and a tow bar for towing and steering. It is designed for flight deck conditions as well as land-based theaters. The SFC consists of two major assemblies: the trailer assembly and the converter assembly. Input power is provided from shipboard and shore-based receptacles that supply an external power source of 440/220 voltage alternating current (VAC), three-phase, 60/50 Hz, ungrounded. The SFC converter assembly automatically senses either 440 VAC or 220 VAC input. The input phase rotation is insensitive and will operate normally when rotation is in either direction. The SFC converts the input power and provides converted power via four 30-foot cables, providing 115 VAC three-phase, 400 Hz, 270 voltage direct current (VDC) and 28 VDC, providing electrical power to aircraft/equipment aboard ship or shore.



R-22 is nonflammable, nontoxic, non-explosive, and odorless. However, it can still be dangerous. It can cause serious "burns" in its liquid state. R-22 vapors displace oxygen in the air, and if enough is inhaled, it can cause asphyxiation.

A/M32C-23 Mobile Air Conditioner

The A/M32C-23 Large Land-Based Air Conditioner (LBAC) is a mobile, four-wheeled, trailer-mounted, self-contained, six-cylinder diesel-powered unit. This unit contains three 15-ton scroll-type compressors that provide air-conditioned, dehumidified, or vented ambient air through a standard 8-inch ring, collapsible air ducting hose to the aircraft's electronic equipment or cockpit/cabin areas during ground maintenance. The LBAC consists of a Generator Engine Set (GENSET) rated at 211 kilowatts (Kw), 480 VAC, and 60 Hz at 1,800 revolutions per minute (RPM) with operating controls for air conditioning and heating systems. The amount of air conditioning can be adjusted at the control panel. In low speed (30 Hz), a single compressor can output as little as 5 tons of air conditioning. At high speed (90 Hz), each compressor can output 15 tons for a total of 45 tons of air conditioning at a discharge temperature between 40 and 65 degrees (F). The tertiary compressor (COMP-3) is activated first. If additional cooling is required, the secondary compressor (COMP-2) is activated, followed by the primary compressor (COMP-1). Each compressor is activated in turn as the demands for additional cooling increase. The chassis has towing and Ackerman-type steering and manually operated parking brake. The LBAC is designed for air transport and is provided with tie-down/lifting rings and forklift channels. Some of the hazards for air conditioning units are the same as other diesel or electrical support equipment. These hazards include noise, high voltage, high-pressure fluids, and exhaust fumes. In addition, air conditioners have large, whirling fans and blowers and refrigerant 22 (R-22) in both the liquid and gaseous state. (Figure 3-5).



Figure 3-5 — A/M32C-23 Mobile Air-Conditioner.

A/M27T-15 Diesel Hydraulic Power Supply (DHPS)

The A/M27T-15 Diesel Hydraulic Power Supply (DHPS) is powered by a four-cylinder, four-cycle turbocharged diesel engine. During normal operation, the diesel engine operates at 2,100 RPM. The engine is directly coupled to the main hydraulic pump assembly. The electrical system consists of two 12-volt maintenance-free batteries to power the 24 VDC electrical systems. During initial startup of the DHPS, battery current energizes the starter motor to crank the diesel engine. During normal operation, the alternator current is used to power the various lights, controls, cooling fans, and indicators on the DHPS control panel and keep the batteries fully charged. A warning alarm alerts to a fault condition before damage to the unit occurs. The DHPS is a four-wheeled vehicle that is not self-propelled and must be towed or moved manually. It is equipped with tie-down rings, pneumatic tires, a mechanical hand brake, and a tow bar for towing and steering as shown in Figure 3-6.

MSU-200NAV

The air start unit is designed to provide compressed air for main engine start (MES) and to supply on-board environmental control system (ECS) with compressed air. The MSU delivers sufficient bleed air to start the main engines of all aircraft whose requirements are within the performance range of the unit. The MSU comes in two variations. The MSU-200NAV Air Start Unit will provide a source of compressed air for powering Air Turbine Starters (ATS) and Constant Speed Drive Systems (CSDS) for aircraft engine starting and motoring. The MSU-200NAV can be configured on the Shipboard Tow Tractor (STT) for shipboard use and mounted to an A/M32U-16 trailer for shore-based use and shipboard test cell support (*Figure 3-7*).



Figure 3-6 — T-15 Diesel Hydraulic Power Supply (DHPS).

NON-POWERED SUPPORT EQUIPMENT

So far we have discussed only powered SE. This portion of the text will discuss non-powered SE. Non-powered SE is all the equipment that has no engine or motor installed to supply power for equipment operation.

Maintenance Platforms

Maintenance stands, platforms, or work stands (the names are commonly interchangeable) give us a means to reach parts of the aircraft we cannot safely reach or work on from the ground. A large variety of types and models are available. Some of the stands are common SE used on almost any type of aircraft; others are very large stands used only at shore activities or on one specific type of aircraft.

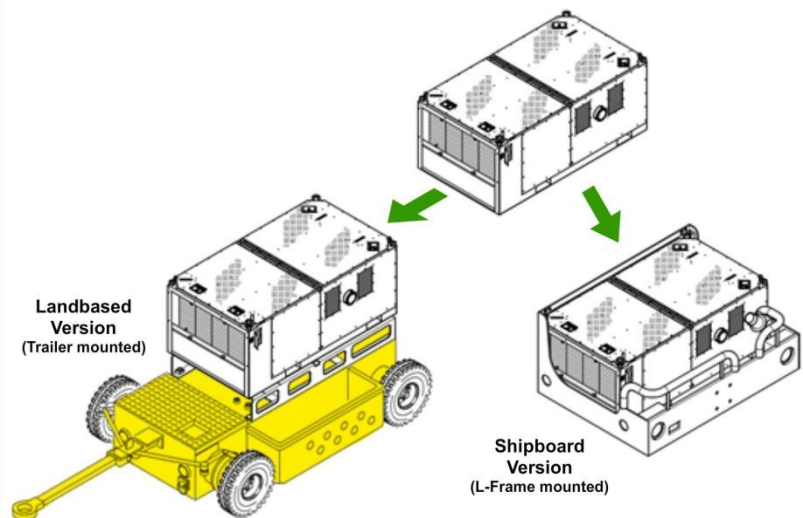


Figure 3-7 — Air Start Units (MSU's).

Most adjustable aircraft maintenance platforms are hydraulically operated. A platform and ladder assembly is mounted on a caster-equipped base, which enables maintenance personnel to safely work at heights from 3 feet to a maximum of 20 feet, depending on the stand selected. Because the design, use, safety precautions, and procedures are generally very similar, we will cover only a few of the more common stands. Most maintenance work stands become defective through abuse and lack of care. Most small stands are designed to hold 500 pounds safely. Overloading the stand can cause some part of the platform structure to bend, causing the lift structure or steps to bind, which in turn

puts abnormal pressure on the hydraulic cylinder, pump, and lines. Eventually the stand will fail, either by jamming or collapsing.

B-2 Work Stand

The B-2 Work Stand (*Figure 3-8*) consists basically of a fixed-height (10-foot) lower structure, a variable-height upper structure, and a manual pump-actuated hydraulic system for raising and lowering the upper structure. The upper structure includes a work platform with guardrails and steps with handrails. The platform and steps, because of parallelogram linkage, stay horizontal throughout their upward or downward travel. The lower structure includes fixed steps and handrails, a tow bar, and four free-swivel caster wheels for mobility. Each caster is equipped with a safety locking device containing a spring-loaded pin, which snaps into notches on the caster pivot axle to lock the caster swivel. The lower structure also includes four immobilizing jacks with baseplates. The jack plates press against the ground and act as brakes. You may find some B-2 stands with the foot-lever brakes (similar to the B-4A and B-5A) instead of the jackscrews. The height range for the B-2 work platform is from 13 feet to 20 feet. Overall height, including the 3½-foot guardrails, is 16½ feet lowered and 23½ feet raised. The base structure is 10 feet wide and 14 feet long; however, the upper work platform extends the length of the whole work stand to 21 feet when it is in the lowered position. The work platform space is 4 feet by 4 feet square. The complete work stand weighs 1,900 pounds. The hydraulic system on the B-2 includes a hand pump, hydraulic lines, a reservoir, and a hydraulic lift cylinder with a safety lock. The pump is located on the left-hand angle iron of the platform. Hydraulic lines lead from the pump to the lift cylinder reservoir, which attaches to the scissor section and platform structure. The work stand is raised and lowered by using the pump and the release valve the same as a jack. When the B-2 work platform is raised, the inner barrel of the hydraulic cylinder is exposed. This inner barrel has spaced grooves around it to hold a safety barrel lock. Most of the models have a barrel lock consisting of a ring with four spring grips, which rides out on the piston. When the ring is rotated, cams force the grips out free of the barrel. When the ring is rotated farther, the cams allow the grips to press against the barrel and snap into one of the grooves. The lock then prevents the cylinder piston from collapsing in the event of hydraulic failure. You may run across some models that have a U-shaped bolt attached to the piston by a chain. This U-lock is inserted into a barrel groove to lock the piston up.



Figure 3-8 — B-2 Maintenance Platform.

B-4A and B-5A Platforms

The two most common maintenance platforms are the B-4A and the B-5A (*Figures 3-9 and 3-10*). Both work stands are movable, hydraulically operated, adjustable platforms with ladders. They are mounted on free-swivel caster wheel assemblies. Each wheel has a foot-lever actuated mechanical brake and a swivel lock assembly. The steel-grated platforms are equipped with safety rails on three sides, and there are handrails on the ladder. Both stands are equipped with locking pins that, when inserted through the top of the platform frame, lock the scissors. Locking prevents the platform from collapsing in the event of hydraulic failure. Both stands are raised by using a hydraulic pump, which is located on the platform to the left of the ladder. The stands are lowered by using the hydraulic release valve on the pump. The major difference between the B-4A and the B-5A stands is their size and height range. The B-4A extends for a working height between 3 and 7 feet. The B-5A extends for a working height between 7 and 12 feet. Both stands have a capacity of 500 pounds. The B-4A is 8 feet long, 3 feet wide, and weighs 460 pounds. The B-5A is 8 feet 4 inches long, 8 feet wide at the base, and weighs 860 pounds.

Other Maintenance Platforms

There are many more types of work stands available to you from both Navy and commercial sources, from foot-high work stools to step stools, stepladders, and phase platforms. These work stands are generally designed for the specific jobs for which they are used and incorporate the strength, ruggedness, and features required for safety. If used properly and with care, they are safe. What is not safe is anything that was not designed as a ladder or work stand, such as folding steel chairs, swivel (or even solid) chairs, boxes, card tables, cans, barrels, drums, tractor hoods, or the top of any other SE. There are a hundred other things that people try to use every day instead of proper work stands. These substitutes are usually available and convenient, although they are NOT safe. They are dangerous and cause a tremendous number of falls and disabling injuries.

ENGINE TRAILERS AND WORK STANDS

Since the days of the early axial flow turbojet engines, the Navy has moved toward universal engine installation, and removal, transportation trailers and work stands. These basic trailers and engine work stands are a matched rail ground-handling system that can be modified to handle different types of engines, installations, and aircraft by the use of various peculiar support equipment (PSE) adapters and, in

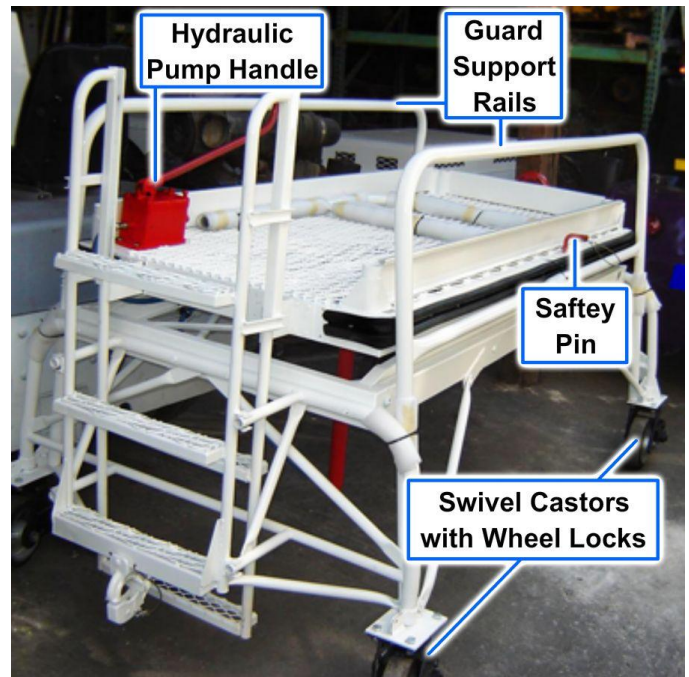


Figure 3-9 — B-4A Maintenance Platform.



Figure 3-10 — B-5A Maintenance Platform.

some cases, hoisting equipment. The equipment in common use today is the engine removal and positioning trailer, models 4000A and 4000B, and the engine transportation trailer, model 3000B. The removal and positioning (or installation/removal) trailer, as the name shows, is used to remove and install engines and move them for short distances. The transportation trailer is used to transport engines over longer distances and to transfer engines from other trailers or stands using the matched rail ground-handling system. Actual work on the engine is normally performed after it is transferred to the engine work stand. The work stand is usually in a fixed location in the hangar or shop.

3000B Trailer

Figure 3-11 shows the 3000B trailer. The unit is a four-wheeled trailer incorporating a detachable, telescopic tow bar at the front and a tow coupling at the rear. The twin parallel rails are equipped with male and female quick-disconnect couplings and spring-loaded roller adapter stops on both ends of each rail. The rails can be mated to the model 4000A or 4000B engine removal stand or the model 3110 engine work stand. The main purpose of the 3000B trailer is to move or transport engines for short or long distances, such as from hangar to hangar or from squadron to the Aircraft Intermediate Maintenance Department (AIMD) afloat and Fleet Readiness Centers (FRCs) ashore. The trailer is one part of the universal matched rail ground-handling system. The trailer weighs 600 pounds and has a load-carrying capacity of 8,000 pounds. It is equipped with pneumatic tires inflated to 30 pounds per square inch (psi). The rails are 12 feet 8 inches long. The overall trailer is 2 feet 10 inches high and 6 feet wide.



Figure 3-11 — 3000B Engine Transportation Trailer.

4000A and 4000B Trailers

4000A and 4000B engine removal and installation trailer models are very similar (*Figure 3-12*). It is a four-wheeled, mobile, hydraulically controlled, self-supporting unit. The trailer consists of a main frame supported by four wheels, a lift linkage system, an upper frame holding two cradle assemblies, and a tube and rail assembly. A detachable, telescopic tow bar provides a means of manually steering or towing the trailer. Some trailers may be equipped with a tow coupling on the rear.

The hydraulic system consists of the following:

- Four hydraulic frame lift rams that raise and lower the upper frame assembly (rails)
- Four (two on some models) wheel lift rams that raise and lower the main frame
- Two hand pumps with release valves that operate either the lift rams or the wheel rams
- A two-position selector valve labeled LIFT CYLINDER and WHEEL CYLINDER
- A hydraulic fluid reservoir (two on some models)
- Connecting lines and fittings

Foot-lever actuated drum/shoe types of parking brakes are located on the two rear wheels. Large foot assemblies, which can be manually lowered, are provided to give the stand maximum stability and support when required. The tie rods that hold the rear wheels fore and aft and those that control tow bar steering of the front wheels are configured so that they can easily be disconnected, which permits all four wheels to be manually positioned for maximum maneuverability in close quarters.

All four wheels are attached to the main frame by hydraulically controlled wheel support arms, operated by wheel lift rams. A ratchet and pawl system is provided on the rams to safely lock the rams, mechanically and automatically, as they extend. Pawl handles on each wheel lift cylinder must be actuated and held to permit the rams to retract.



Figure 3-12 — 4000A Engine Removal/Installation Trailer.

The wheel lift rams permit raising or lowering the main (lower) trailer frame. The main frame can be lowered right to the deck, provided the four manual foot assemblies are all the way up. The main frame full up position gives maximum ground clearance and is used when towing or moving the trailer, particularly when loaded. The forward hydraulic pump and release valve raise and lower the front end of the main frame. The aft pump and release valve raise and lower the rear end of the main frame. Operated together, the pumps or release valves raise and lower the whole main frame at once. The lift linkage consists of four upper and four lower links centrally hinged in a jackknife

position. The linkage system is raised and lowered by four frame lift rams. These lift rams are also equipped with a ratchet and pawl system to provide a safe mechanical lock in case of a hydraulic system leak or failure. Pawl knobs located on all four upper links must be actuated and held to permit the rams to retract. The upper frame is attached to the lift linkage system and holds a cradle assembly at each end. Inside each cradle are two rollers upon which the semicircular support tubes, holding the two parallel rails, can roll (rock from side to side). A rotation adjustment knob, located on the left side of the forward support tube, permits ± 10 degrees of roll adjustment of the rails. Two traverse adjustment knobs, located on the left side of each cradle assembly, permit ± 3 inches of horizontal lateral (side) movement of the rails. Yaw adjustments up to ± 2.25 degrees left or right of the center line of the rails can be made using just one of the traverse adjustment knobs, or both in different directions. The 4000A and 4000B trailers should never be used to transport engines, even for short distances.

3110 Work Stand

The model 3110 Work Stand is a 49-gauge matching rail-type unit designed to mate with rail-type trailers for the roll transfer of the engine. Model 3110, usually located in the hangar or power plant work center, allows for the horizontal maintenance and storage of aircraft engines. These stands can be used on any hard surface and are easily erected and maintained (*Figure 3-13*).



Figure 3-13 — Model 3110 Work Stand Platform.

SPECIAL-PURPOSE SUPPORT EQUIPMENT

The Aviation Machinist's Mate has a requirement to use special support equipment to accomplish tasks such as engine removal and corrosion control activities. The aero-bomb hoist and the jet engine corrosion control cart are examples of this special-purpose gear.

Hangar Engine Hoists

Hangar engine hoists are used in conjunction with the air logistic trailer for aircraft engine removal and installation in some aircraft (*Figure 3-14*). Prior to using the engine hoist, a preoperational inspection, which includes checking the cable for frayed or broken strands, must be conducted. Always be sure that the hoist load test date is current and that the cable is not damaged.



Figure 3-14 — Hangar Engine Hoist.



Never leave an engine unattended while it is being supported by hoists. Never work or get under an engine while it is being supported by hoists. When lowering or raising an engine, do it slowly. Constantly check the engine clearance with the aircraft nacelle and controls to prevent damage or binding.

Jet Engine Corrosion Control Cart

The corrosion control cart provides freshwater rinsing or the application of preservation compound to the compressor section of an engine through a low-pressure spray (*Figure 3-15*). The primary components of the unit are a large solution tank, two air cylinders, a work platform with guardrail, four spray applicator wand assemblies, and the trailer. The 33-gallon solution tank is separated into two separate compartments. The forward section is a 7-gallon preservative tank. The rear section is a 26-gallon freshwater tank. Each tank has its own filler neck and cap. There is a 4-inch opening for water and a 2-inch opening for the preservative tank. Each tank has a pipe plug at the bottom for draining. The freshwater and preservative fluid systems each have a shutoff valve, a quick-acting lever valve, and an applicator wand on/off valve. Two 500-cubic-inches, 3,000 psi air cylinders mount on the left side of the unit to supply air pressure in order to pump freshwater or preservative from the storage tanks. Four applicator wands are stored on the right side of the unit. Each wand is about 6 feet long and attaches to the two 10-foot supply hoses off the storage tanks. A Steel grated work platform on top of the unit provides a work platform to help operators reach the intakes of helicopter engines.

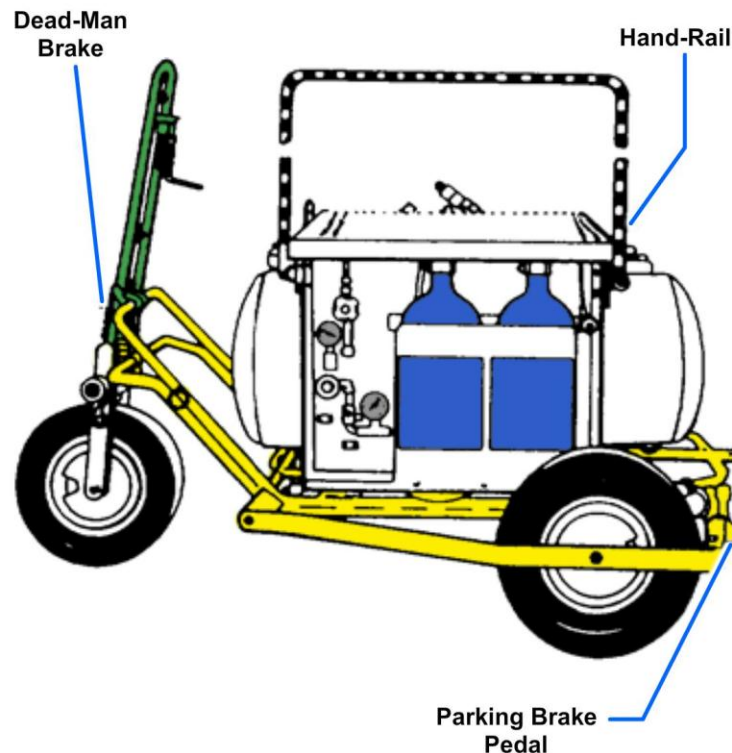


Figure 3-15 — Corrosion Control Cart.

⚠ WARNING ⚠

A drawbar at the front of the trailer provides towing and steering capabilities. It also incorporates a spring-loaded “dead-man” brake. If the drawbar is released from the horizontal towing position, it returns to the vertical position with considerable force. If a person is unaware of this feature when disengaging the tow bar from a tractor, there is the possibility of personnel injury.

SE Training and Licensing Program

The purpose of the SE Training and Licensing Program is to make sure you receive effective training in the safe and efficient operation of SE on specific types of aircraft. The improper use of SE has resulted in excessive ground accidents and repair and replacement costs amounting to millions of dollars each year. It also results in reduced operational readiness. The major reasons for improper use of SE are lack of effective training and lack of effective supervision. Proper licensing of SE operators takes the coordinated effort of both the FRC SE division and the user activity. COMNAVAIRFORINST 4790.2(series) lists the procedures and responsibilities required for the training and licensing of support equipment operators. The SE Training and Licensing Program contains two distinct parts. Part one, taught by the supporting FRC, covers the proper operation or use of the SE. Part two, taught by the user activity, consists of on-the-job training (OJT), practical exams, and written tests to operate the SE on a specific type/model/series of aircraft. Once this training is accomplished and documented, the division officer initiates an SE operator's license and forwards it for approval.

End of Chapter 3

Aviation Support Equipment

Review Questions

- 3-1. What standard is used to designate new or newly reconditioned support equipment (SE)?
- A. MIL-STD-875A
 - B. MIL-STD-650
 - C. MIL-STD-550
 - D. MIL-STD-4790.2
- 3-2. Support equipment (SE) is divided into what category or categories
- A. Working/Broken
 - B. Air/Ground
 - C. Common general purpose/Peculiar special purpose
 - D. Gravity
- 3-3. Which of the following designator is considered a mid-range tow tractor (MRTT)?
- A. A/S32A-45
 - B. A/S374A-3
 - C. A/S38-3
 - D. A/S44B-4
- 3-4. What is the towing weight, in pounds, limitation for the A/S32A-31A Shipboard Tow Tractor (STT)?
- A. 64,500
 - B. 74,500
 - C. 88,000
 - D. 100,000
- 3-5. Which type of assistance does the A/M27T-15 provide?
- A. Lifting
 - B. Towing
 - C. Hydraulic power
 - D. Personal transportation
- 3-6. Which of the following pieces of support equipment (SE) is considered non-self-propelled?
- A. A/M24M-5
 - B. A/S32A-45
 - C. A/S383-45
 - D. A/S399-45

- 3-7. What is the height range, in feet, for a B-2 work platform?
- A. 1 to 2
 - B. 5 to 8
 - C. 8 to 10
 - D. 13 to 20
- 3-8. Which of the following services does a MSU-200NAV provide?
- A. Fuel
 - B. Main engine start (MES)
 - C. Engine water wash
 - D. Oil
- 3-9. What is the purpose of a 3000B trailer?
- A. Engine installation
 - B. Aircraft towing
 - C. Engine repair
 - D. Moving or transporting engines for short or long distances
- 3-10. What is the purpose of a 4000A/4000B trailer?
- A. Moving or transporting engines for short or long distances
 - B. Engine repair
 - C. Engine installation/removal
 - D. Aircraft towing
- 3-11. Which of the following types of support equipment (SE) is considered special-purpose?
- A. Tow tractor
 - B. Hangar engine hoist
 - C. Torque wrench
 - D. Mobile electric power plant (MEPP)
- 3-12. What is the main purpose of the SE Training and Licensing Program?
- A. make sure you receive effective training in the safe and efficient operation of SE
 - B. support equipment repair training
 - C. support equipment inspection training
 - D. provide aircraft repair licensing

RATE TRAINING MANUAL – USER UPDATE

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