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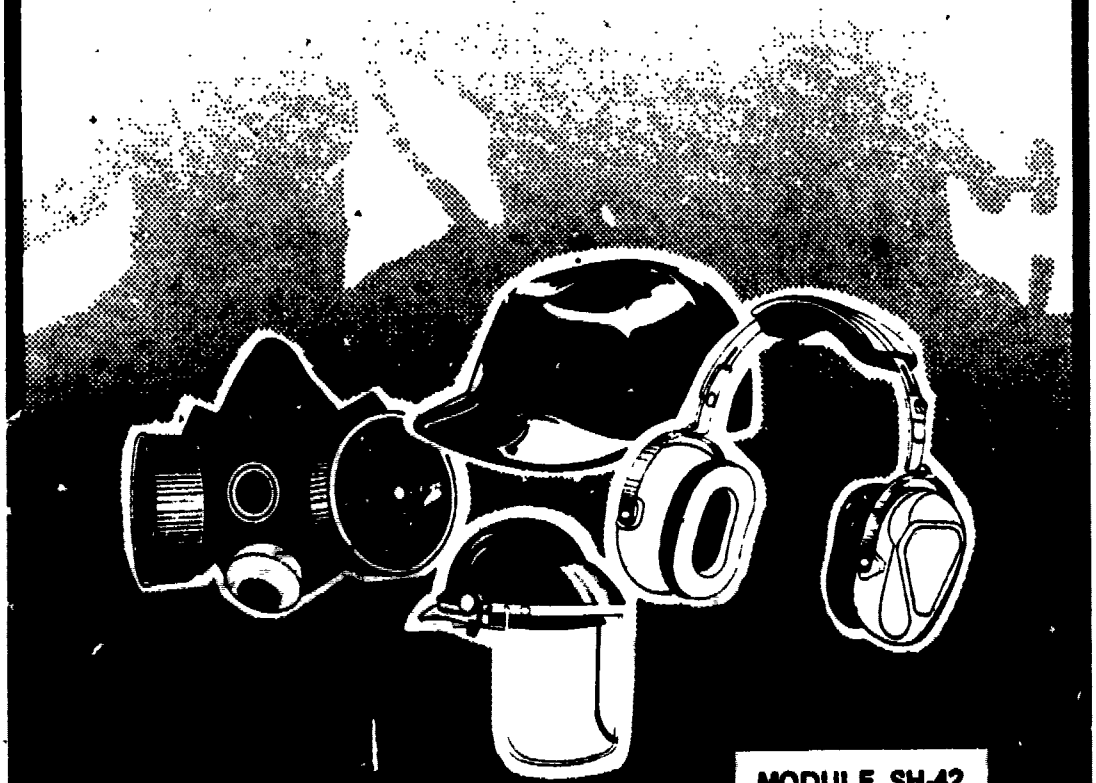
ABSTRACT

This student module on safe use of powered industrial trucks is one of 50 modules concerned with job safety and health. This module discusses safety issues relating to the operation of powered industrial trucks: controls, general loading practices, inspection, etc. Following the introduction, 12 objectives (each keyed to a page in the text) the student is expected to accomplish are listed (e.g., Describe the principle on which most powered lift trucks work). Then each objective is taught in detail, sometimes accompanied by illustrations. Learning activities are included. A list of references and answers to learning activities complete the module. (CT)

SAFETY AND HEALTH

SAFE USE OF POWERED INDUSTRIAL TRUCKS



MODULE SH-42

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INTRODUCTION

Powered industrial trucks are used in factories, warehouses, on docks and at railroad terminals to lift, carry, stack, and store material. The establishment of safe work practices for the operations, maintenance, and inspection of these vehicles is essential to preventing accidents where they are used.

Accidents involving powered industrial trucks can be both numerous and severe. The weight and design of these trucks, the differences in handling characteristics between these trucks and ordinary cars, and the size and weight of the loads carried contribute to the seriousness and frequency of accidents. Training is needed to educate the potential operator in the proper use of controls, general loading practices, maneuvering around obstacles, inspection, refueling or recharging, and working in hazardous areas or with hazardous materials. This module discusses these and other safety issues relating to the operation of powered industrial trucks.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. Describe the principle on which most powered lift trucks work. (Page 3)
2. List four types of rider-operated powered industrial trucks and explain their uses. (Page 4)
3. List three classifications of locations where powered industrial trucks may be used. (Page 9)
4. Identify special guards or safety devices required for each type of powered industrial truck. (Page 10)
5. Discuss formal training programs, licensing, and certification required by OSHA for operation of powered industrial trucks. (Page 12)
6. Identify the major differences between driving a powered industrial truck in a plant and driving an automobile. (Page 14)
7. Discuss general safe operating procedures for powered industrial trucks, including rules for intersections, doors, elevators, confined spaces, and traffic. (Page 16)
8. Discuss safe operating procedures for operating on grades, backing, and parking. (Page 19)

9. Explain safe procedures for loading and unloading, including special precautions necessary for trailers, highway trucks, and boxcars. (Page 20)
10. Discuss operating procedures for motorized hand trucks. (Page 24)
11. Describe daily inspection points on powered industrial trucks. (Page 26)
12. Discuss precautions that shculd be taken in the handling of hazardous materials. (Page 31)

OBJECTIVE 1: Describe the principle on which most powered lift trucks work.

The principles of the modern lift truck began with discoveries made by early humans. Among the first of these discoveries was the lever. The early experimenters found that when they put one end of a pole under a big rock and placed a smaller rock under the pole, they could push down on the other end of the pole, and easily move the big rock. The pole, which was being used as a lever, multiplied their muscle power.

Early man also learned that loads heavier than those that could be picked up by hand could be carried by placing the burden on a cradle between two poles. The end of the poles could be lifted up and pulled, while the load dragged behind, with most of the weight still on the ground. These two examples represent the first steps toward modern material handling.

Later, the discovery of wheels started progress rolling toward the lift truck. But first, improvements had to be made to the original inventions. When wheels were put under the previously "dragged load," the first wagon came into being. From this basic machine eventually developed the two-wheeled hand truck that could handle as much as 1,000 pounds. With this type of hand truck, the load is usually piled on the forks or platform, and the loaded truck is then wheeled to the desired spot and unloaded. Each time the load is moved, it is usually handled piece by piece.

During the unloading of some material, an early storekeeper may have piled it on top of a child's sled that was being stored in the back room. Later, all that had to be done to move the load was to pull the sled. This could have been the forerunner of today's pallet and unitized load.

In time, it became desirable to handle larger loads and to move them more quickly. It also became necessary to stack these loads three or four loads high. These needs brought about the development of the powered lift truck, and of modern material handling equipment and methods.

The powered lift truck was developed for moving a large or heavy load for short distances, using a pallet, and stacking the load or placing it

on a rack. The amount of weight the lift truck can safely carry is determined by the design of each component: axles, forks, chassis, wheels hoists, and so forth. Of equal importance to the safe operation of the truck is having properly selected, well trained, disciplined drivers.

The counterbalanced or cantilever type lift truck requires a heavy truck to balance the weight of the load. This type of lift truck uses the principle of the lever, and works in the same way as a child's seesaw. When the weight of two children is the same, they balance on the seesaw and little effort is needed for them to seesaw up and down. The counterbalanced lift truck works on the same principle. A heavy load is balanced by the counterweight, which makes steering and moving the load less difficult for the driver. If any more weight is added to the load, the rear wheels will come off the ground.

Each truck has a maximum load weight. Only by keeping within this recommended weight limit can the lift truck be operated safely and without costly breakdowns.

ACTIVITY 1:*

(Fill in the blank.)
The counterbalanced lift truck works on the same principle as a _____.

OBJECTIVE 2: List four types of rider-operated powered industrial trucks and explain their uses.

Powered industrial trucks may be classified by power source, operator position, and means of engaging the load. Electric motors energized by storage batteries; gasoline engines; liquid petroleum gas; diesel fuel; a combination of gas or diesel fuel; or a combination of gas or diesel and electrical power are the power sources.

*Answers to Activities appear on page.33.

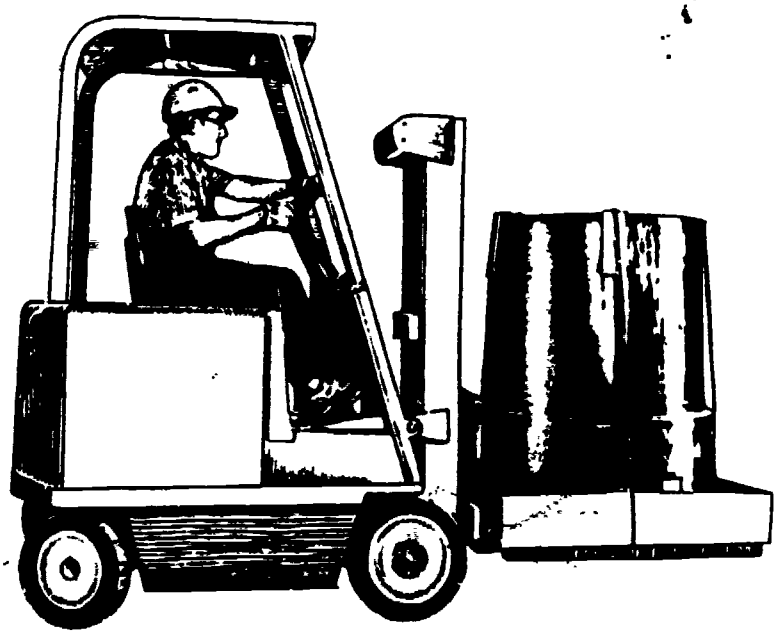
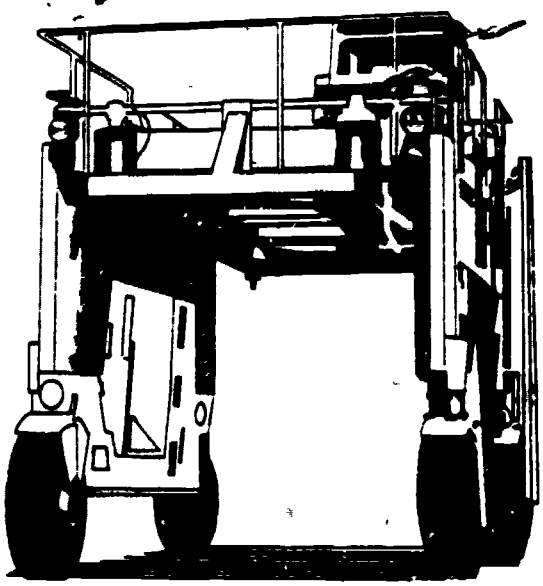


Figure 1. Lift truck.

Two types of powered industrial truck are designed to be controlled by a riding operator. The widely used lift truck (see Figure 1), with its cantilever load-engaging design, vertical uprights, and elevating mechanism is one example. A platform is used to engage the load on some other rider trucks. Both types may be either high-lift (having an elevating mechanism that permits the tiering of one load on another), or low-lift (having a mechanism that raises the load only enough to permit horizontal movement).

The development of attachments has increased the adaptability of the lift truck to perform other functions. Clamps, rotators, shifters, stabilizers, pushers, pullers, upenders, bottom dumpers, top lifters, rams, cranes, scoops, and other modifications have been developed to meet specific needs. Two or more motions have been built into some attachments: for example, clamp and rotate, or side-shift and push and pull. It is possible to interchange attachments so that one truck can be used for various types of loads. Thus lift trucks are the most common of powered industrial trucks, and probably the most versatile.

The vacuum handling truck utilizes a suction or vacuum system to hold and carry loads. This system is especially appropriate for loading and hauling sheets of smooth material. A safety consideration for this type of truck is a secondary vacuum system to take over if the primary system fails. On trucks that have an independent engine (mounted at the back of the truck) to provide a vacuum source, the truck engine is used as a secondary source of vacuum.



Figuire 2. Straddle truck.

The truck must have controls that automatically cut in the secondary vacuum system if it is needed.

Straddle trucks (see Figure 2) or carriers are designed to carry loads of pipe, lumber, or other long material under the truck body, which rides on four high legs. Special precautions must be taken to avoid striking pedestrians, since the angle of sight is reduced by the material being carried. Hazards increase when these trucks carry long loads. Red flags may be attached to the ends of the load or flagmen may be stationed in congested areas. Particular care must be taken if the truck is used after dark.

Crane trucks usually have four wheels, although some have three. In one model, the operator sits behind a small pillar-type job crane mounted on a chassis, while in another, the operator stands on a platform and operates a fully or partly rotating crane. Still another type has a fixed boom (which cannot be swung), and in order to make side motions the entire rig must be moved from one position to another. Crane trucks are equipped with a boom, cable, drum, and special lifting hooks, spreaders, and slings.

Every movable boom crane should have a capacity plate or sign plainly legible to the crane operator, signalman, and rigger, stating the safe loads at various radii from the center pin of the turntable. In addition, these guidelines should be followed:

- Industrial cranes should be operated only by qualified crane operators.
- Cranes carrying loads should be operated at the lowest possible speed with the load suspended as low as practicable.
- The operator should always have a helper to hook on the loads and act as signalman, and where necessary, control the load with a tag line.

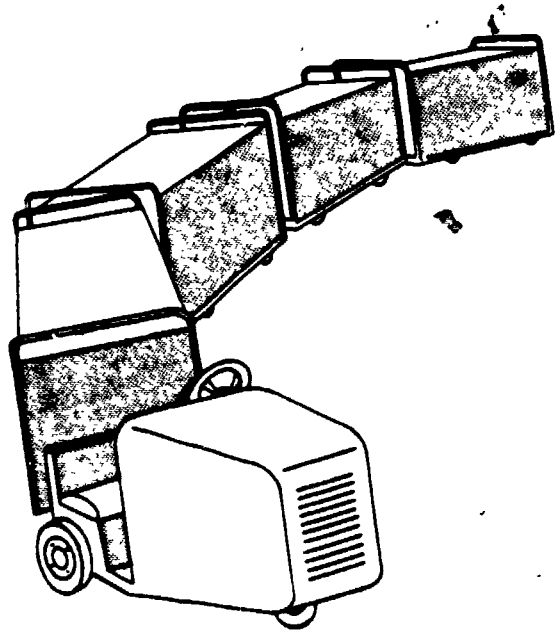


Figure 3. Tractor and draw trailer.

Tractors and trailers (see Figure 3) should incorporate the necessary safety features in the couplings used to make up the tractor-trailer train. The type of coupling used depends on the construction of the trailer, the loads carried, and whether or not the route traveled includes sharp curves, ramps, or inclines. The coupling must be one that will not come unhitched on grades nor permit the trailer to whip or cut in on curves.

A unique powered industrial truck is an electronically controlled vehicle without an operator. It travels a prearranged route, outlined on or under the floor, and is controlled by a light beam or by induction tape. This type of truck should be equipped with a light-weight, flexible bumper that shuts off power and applies the brakes immediately upon contact with an obstacle. The bumper must be attached to the front of the truck in such a way that the truck can come to a complete stop without jamming into anything in its path. This prevents injury to workers who inadvertently step into the path of the truck.

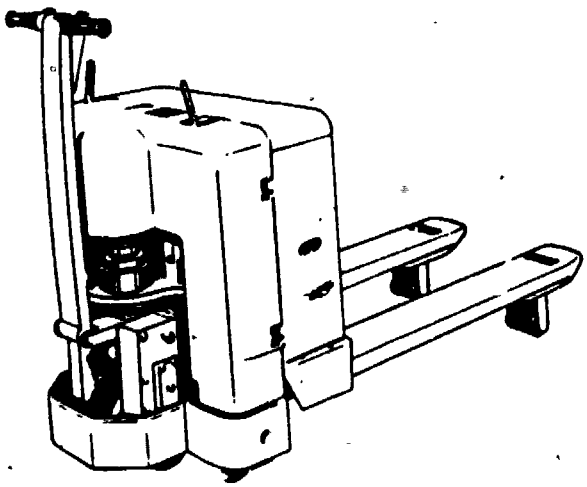


Figure 4. Motorized hand truck.

The use of such "robot" trucks requires that aisles where the truck operates be clearly marked and free of obstacles. No one should ever ride, or jump on or off these trucks. No attempt should be made to load or unload a remote control truck that is in motion.

The motorized hand truck (see Figure 4) is used throughout industry to carry all types of material in

tote boxes, on racks, skids, pallets, and so on. All powered hand truck operators should be trained, and only trained personnel should be authorized to operate this equipment. A powered hand truck should be equipped so that its brakes will be applied when the handle is in either the fully raised or the fully lowered position.

The principal hazards in the operation of a motorized hand truck include the operator's getting pinned between the truck and a fixed object, and the truck's running over the operator's heels. Operators should walk ahead of the truck, leading it from either side of the handle and facing the direction of travel.

Most powered hand trucks fall into three basic types (shown in Figure 5):

- Platform.
- Platform stacker.
- Fork stacker.

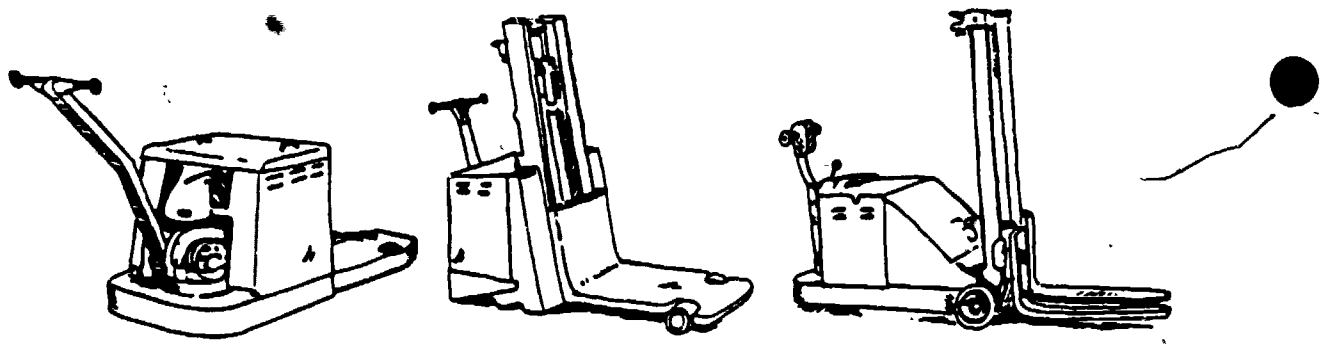


Figure 5. Three types of motorized hand trucks.

The platform type is used for handling tote boxes and other items that can be moved by placing them on the platform. It is used primarily for working in aisles.

The platform stacker differs from the fork type stacker in that it has no tilt mechanism. It is used for transporting, stacking, or unstacking tote boxes, racks, or pallets.

As its name implies, the fork stacker is equipped with forks and is used for moving, stacking, or unstacking tote boxes or pallets in storage areas. It is equipped with a mechanism for tilting to prevent the load from tipping.

ACTIVITY 2:

(Fill in the blank.)

1. A _____ _____ is generally used to carry loads of lumber, pipe, or other long material.
2. A _____ truck is used to pick up heavy loads and is equipped with a boom, cable, drum, and special lifting hooks.
3. A _____ and _____ are generally used in making a train that sometimes is electronically controlled to travel a prearranged route.
4. A _____ truck permits the tiering of one load on another.
5. Electronically controlled trucks must have a sensitive _____ that, when contacted, shuts off all power.

OBJECTIVE 3: List three classifications of locations where industrial trucks may be used.

There are four classes of locations where powered trucks can be used, and 11 different designations of trucks. The use of each designation is determined by the class of the location and the potential exposure to fire or explosion hazards.

An unclassified location is one that has no known usual fire or explosion hazard. Any industrial truck, diesel electric, gasoline, or liquid propane powered may be used in an unclassified location.

The designations of trucks to be used in classified or unclassified areas include: Diesel — D, DS, DY; Electric — E, ES, EE, EX; Gasoline — G and GS; and Liquid Propane — LP and LPS.

A Class I location is one in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Only an electric turck designated EX should be used in these areas.

A Class II location is one that is hazardous because of the presence of combustible dust. Only an electric truck designated EX should be used in a Class II location.

A Class III location is one where easily ignitable fibers or flyings (loose, airborne fibers) are present in quantities sufficient to produce ignitable mixtures. Only an electric truck designated EX or EE, or a diesel truck designated DY should be used.

ACTIVITY 3:

1. Match the classification of powered industrial truck locations to its definition.

___ Unclassified	a. Ignitable fibers or flyings are present
___ Class I	b. Combustible dust present.
___ Class II	c. Flammable gases or vapors present in hazardous quantities.
___ Class III	d. No known fire or explosion hazard.

2. Which designation of trucks should be used in the following classes?

   a. Unclassified location with no known usual fire or explosion hazard. _____

   b. Class I location where flammable gases or vapors that could be ignited or cause an explosion may be present. _____

   c. Class II location where combustible dust is present. _____

   d. Class II location containing ignitable fibers or flyings in quantities to produce ignitable mixtures. _____

OBJECTIVE 4: Identify special guards or safety devices required for each type of powered industrial truck.

Four general types of safety devices are required on powered industrial trucks: an overhead guard, a backrest extension, tire guards, and a name plate.

The overhead guard is designed to protect the operator from a falling load or part of a load. The backrest extension offers protection for the operator and the load where loads are being stacked high. The backrest extension prevents the load from sliding off the back of the forklift (Figure 6).

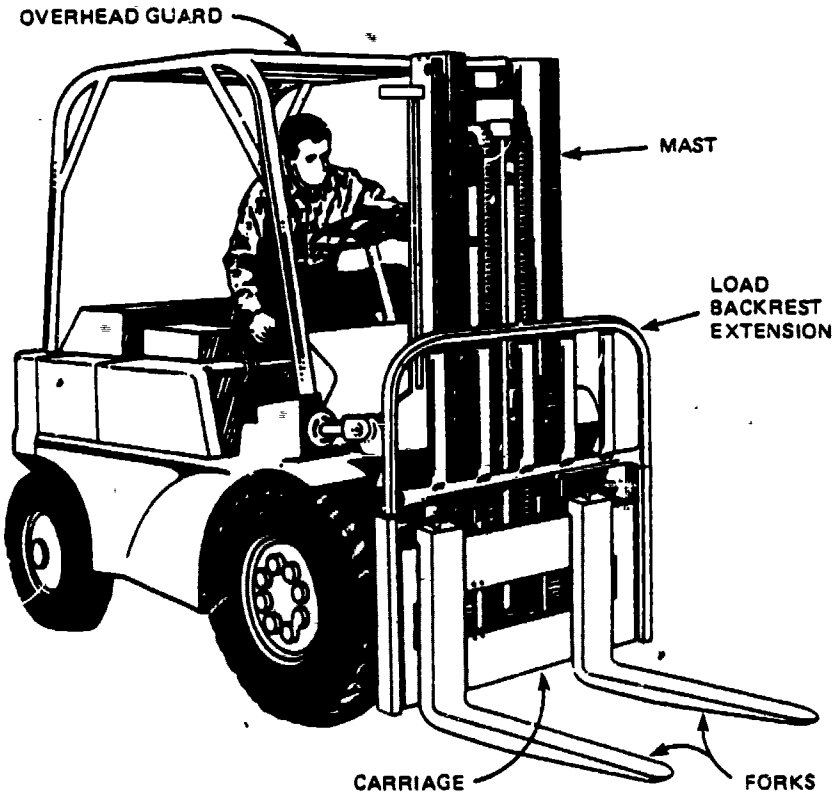


Figure 6. Backrest extension for lift truck.

Guards that will stop materials such as gravel or sand from being thrown at the operator should be on all exposed tires.

A name plate must be attached to every lift truck by the manufacturer. Pertinent identification and reference information must include the weight of the truck, its rated capacity, model, and serial numbers as specified in The American National Standards Institute's ANSI B 56.1, "Safety Standard for Powered Industrial Trucks."

While not specifically required on fork lifts, a fire extinguisher is a good addition to the safety equipment on the lift truck. Not only do fire extinguishers protect the driver and truck, they enable the driver to put out any small fires that might be encountered. A dry powder ABC rated fire extinguisher is the most versatile. (Note: The driver should be trained in its use and it must be inspected at regular intervals.)

Each powered industrial truck should be equipped with several warning devices. The most important of these is the horn. It should be used at every intersection or wherever pedestrians are in close proximity. The next most important warning device is a convex mirror that can alert the driver to hard-to-see hazards around corners. Other warning devices include flashing or rotating lights and a backup alarm or horn.

ACTIVITY 4:

(Fill in the blank.)

1. The most important warning device is the _____.
2. The _____ _____ is designed to protect the operator from falling loads.
3. Rated load capacity can be found on the _____ of a powered industrial truck.

OBJECTIVE 5: Discuss formal training programs, licensing, and certification required by OSHA for operators of powered industrial trucks.

Powered industrial trucks are powerful enough to cause serious injury and property damage if they are not used correctly. While OSHA (Occupational Safety and Health Administration) does not provide licensing or certification, it does examine evidence of formal training programs for the operators who maneuver these trucks. The essentials of a good training program are —

- Physical qualification.
- Aptitude selection.
- Classroom instruction and testing.
- Laboratory or field instruction and testing.

Potential operators for powered equipment should be given a preplacement physical exam, and re-examination on at least an annual basis. Physical qualities that are particularly important to safe operations, such as visual acuity, reaction time, hearing coordination, heart condition, and susceptibility to fainting should be identified through medical screening activities. In addition to the medical screening, preselection tests that determine knowlege, learning ability, and attitudes can be helpful in determining potentially safe operations. A thorough check of previous employment and driving records is also desirable.

Students should be instructed in all operating procedures including starting and stopping; forward, reverse and turning movements; hoisting, lowering and tilting forks; loading and unloading; maneuvering around obstacles; and operating under adverse conditions. Inspection and maintenance practices should also be taught, to ensure that the operator will be able to recognize and/or prevent vehicle malfunctions. Safe refueling and recharging practices should also be provided. Where it is relevant to the work to be performed, the student should be informed about hazardous material handling, including any necessary personal protective equipment. Some types of protective gear, such as hard hats and safety shoes, are necessary for all powered industrial truck operations.

The instructional approach should be threefold, including classroom training, demonstration of skills and techniques, and practice sessions. The student should be given written and performance tests at the end of the course. Performance tests should include the trainee's ability to negotiate an obstacle course of pallets that have been set up to simulate aisles, materials, boxcars, and other obstructions.

ACTIVITY 5:

1. Name three physical characteristics that are relevant to the operator's ability to safely handle powered industrial trucks.

   a. _____

   b. _____

   c. _____

2. Name six procedures that should be covered in the training of powered industrial truck operators.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

OBJECTIVE 6: Identify the major differences between driving a powered industrial truck in a plant and driving an automobile.

Considerable differences exist between driving a powered industrial truck in a plant and driving an ordinary car on the road. Many of these differences result from the unique features of the industrial vehicle.

Powered industrial trucks move more slowly and most of those used in plants are smaller than cars. However, in terms of the hazards they present, their greater weight makes up for their slower speed and smaller size.

Because most trucks are not designed to use shock absorbers or springs, road shocks (from ruts, dips, debris, rough spots, and so on) can more readily spill the load. When traveling over rough surfaces is unavoidable, speed must be reduced considerably.

A truck is more easily tipped over than a car because of the location of the load, the truck's higher center of gravity, and narrow track width (distance between wheels on an axle), so it must be operated more smoothly than a car in order to maintain adequate stability.

Drive wheels must be in front for powered industrial trucks to get adequate traction while using small tires. Their manueverability in tight quarters is also enhanced by rear steering. Both ends of a counterbalanced truck (load and counterweight) swing during a turn, due to rear wheel steering. Extra room must be allowed when turning to clear stationary objects, other moving trucks, and pedestrians. These trucks steer more easily with a

load (but not with an overload) due to decreased weight on the steering (rear) wheels, while a car steers most easily when unloaded. Overloading a counterbalanced truck causes loss of steering (rear wheels lose traction necessary for steering).

One way that cars and trucks do not differ is that speed must be slow in order to make a sharp turn, especially when the vehicle is loaded. This is because the higher the turning speed and load weight, the more the steering wheels creep (increasing the turning radius).

Powered trucks, especially battery-electric models, can be considerably quieter than a car, and pedestrians and other truck operators may not hear them approaching, especially in noisy areas. Also, all cars are equipped with headlights, while operating lights on trucks are often optional. Changes in plant lighting or storage arrangements may require that nonlighted trucks be equipped with lights, or that lighted trucks be used to ensure adequate light levels for safe operation.

Plant and sidewalk pedestrians are different, too. The plant pedestrian walks and works under unique conditions, quite unlike the usual sidewalk situation. The pedestrian on the sidewalk has a special walkway free from motorized traffic; plant and yard pedestrians share the "road."

The auto operator can often see pedestrians intering the roadway, and sidewalk pedestrians often have traffic signals to protect them; in many plants, blind intersections are common and signals uncommon. In addition, pedestrians in plant aisles do not always take the precautions they would in the street; they may not be watching for truck traffic. On-the-road vehicles rarely carry loads that are unsecured or overwide, and so could strike a pedestrian by their size or instability; trucks may do so frequently. One way that plant and sidewalk pedestrians do not differ is that neither stands a chance in a collision with a 3,000 pound car, a 10,000 pound lift truck, or a 6,000 pound load.

Particular hazards exist for operators who drive trucks in the yard of a plant or warehouse. These include slow moving trains, backing semi-trailers, and temporary blind corners (created by freight cars or trucks). Drivers should avoid parking within eight feet of the railroad tracks. Also, the driver must yield the right-of-way to any emergency vehicle in the yard and elsewhere.

ACTIVITY 6:

(Choose the best answer.)

1. Driving a powered industrial truck differs from driving a car in all except which of the following ways:
   a. Trucks are less equipped to travel smoothly over bumpy or uneven surfaces.
   b. Trucks tip more easily than cars.
   c. Trucks must make sharp turns slowly.
   d. Trucks are not so likely to be heard approaching as cars.
   e. Trucks steer more easily with a load.
2. Plant and sidewalk pedestrians differ in all except which of the following ways:
   a. Plant pedestrians are unequally "matched" against powered industrial trucks.
   b. Plant pedestrians are subject to sliding or overwide loads.
   c. Plant pedestrians do not have crosswalks.
   d. Blind intersections are common in plants.

OBJECTIVE 7: Discuss general safe operating procedures for powered industrial trucks, including rules for intersections, doors, elevators, confined spaces, and traffic.

Certain rules for driving powered industrial trucks are standard at intersections, doors, elevators, and confined spaces. Operators may not pass vehicles moving in the same direction at intersections, blind spots, or other dangerous locations. At intersections and other locations where vision is obstructed, the operator must slow down and sound the horn. Fixed convex mirrors are provided at many intersections (identify these "blind spots" in your workplace) to aid the driver in checking for cross-traffic. Drivers should slow down and honk the horn before going through crash doors, especially where windows are small.

Trucks entering elevators should abide by these rules:

1. Approach slowly.

2. Check to see that the rated elevator capacity is sufficient for the combined weight of the truck and the load.
3. After entering the elevator, shut off the power, set the brakes and put the controls in neutral.
4. Never tamper with the limit switches on the mast that cut down on the speed in proportion to platform height.
5. The warning flasher or rotating light should be activated on the fixed portion of the truck when an employee is elevated.

Loading or unloading in limited access areas presents unique hazards. These confined spaces include areas such as barges, a ship's hold, a freight car, or even a semi-trailer. Electric or battery-powered trucks should be used in such areas to avoid the possibility of carbon monoxide poisoning. Overexposure to this odorless, tasteless gas produces symptoms of headache, nausea, and fatigue. If uncertain as to the conditions in the area, operators should check with supervisory personnel for any necessary respiratory protection. This applies in other areas as well, if the load being handled is potentially toxic.

Escape routes must always be kept open. The truck should be driven in or the motorized hand truck wheeled in so that the operator is between the load and the exit. When entering, the operator should look first, then sound the horn and proceed slowly (so that someone else's escape route is not blocked). There should be at least two inches' mast clearance at all exits. Another important rule when working in confined spaces is to avoid working alone; a "buddy" system should be used in case an emergency should arise.

Whether in a confined area or in an open part of a plant, established traffic rules should always be followed. Speed limits are usually established, with 5 mph being a common maximum. When working close to pedestrians or when floors are slippery or uneven, speed should be reduced to 3 mph or less.

In addition, all specific plant traffic rules about when to sound the horn and when to yield the right-of-way should be followed.

Emergency stops take a greater distance to accomplish than often anticipated. At 1 mph, it takes 1.3 feet to stop, at 10 mph it takes 22 feet and at 18 mph it takes 55 feet. A safe following distance (about three truck lengths) should be maintained at all times.

Drivers should avoid going over loose materials. Loss of control of the truck, spillage of the load, tipping of the truck, and back pain for the driver can result from attempts to drive over even low-lying obstacles. Oil slicks should be reported or corrected.

Dockboards or bridge plates must be secured before use by the truck, and travel on these ramps should be very slow. A safe distance should be maintained from edges of all platforms, ramps, and docks. The operator should be especially careful not to allow the rear of the truck to swing over the edge. Adequate clearance should be maintained between the top of the truck and lights, pipes, doorways, and other overhead fixtures, also.

Stunt driving and horseplay with powered trucks are strictly prohibited, and no riders are allowed other than the operator. An additional rider can easily be pinned against materials or walls when the rear end of the truck swings during steering. A passenger could also fall if the truck were to stop abruptly, or a rider's hands could be caught in the lift mechanism.

Some trucks are designed to lift an employee (stock pickers, order pickers, sideloaders.) These provide controls on the elevated platform, and are required to have a shutoff switch on the platform so that the elevated employee can cut the power. If for any reason a truck not designed for lifting employees should be pressed into service for this purpose, the following precautions should be observed:

1. The elevating platform must be at least two foot square and be securely attached to the lifting member. The employee cannot simply ride on the fork or pallet.
2. A second employee should stay at the controls while the person is elevated.
3. The driver and the person lifted should maintain eye and voice contact. The driver should never manipulate any of the truck's controls until the lifted person is made aware of what is to happen and is prepared for it.
4. A standard guardrail on exposed sides of the platform, or a safety belt or harness (with lanyard that limits free fall to four feet) should be used.

These rules apply for all trucks used to lift employees:

1. Where head injuries could result from falling objects, head protection is required for the platform rider.
2. There should be no travel while a person is elevated except minor movements to position the platform or with high-lift order picker trucks; the parking brake should be kept on at all other times.
3. The mast should not be tilted when an employee is elevated.

ACTIVITY 7:

(Fill in the blank.)

1. A safe following distance for powered trucks is about _____ _____ _____.
2. Around pedestrians, or on a slippery or uneven surface, a _____ miles per hour speed limit should be maintained.
3. Oil slicks should be _____ or _____.
4. Adequate _____ should be maintained between the truck and ceiling fixtures (at the top) and edges of platforms, ramps, and docks (on the ground).
5. At blind intersections, _____ _____ are often provided to aid the driver in checking cross-traffic.
6. Trucks in confined spaces may create a _____ _____ poisoning problem.

OBJECTIVE 8: Discuss safe procedures for operating on grades, backing, and parking.

Drivers must exercise special care when operating trucks on grades. Travel should be slow and angles or turns should be avoided. In addition, these guidelines apply:

- Loaded rider trucks operated on an incline greater than 10% must be driven with the load upgrade.
- Empty rider trucks should be driven on grades with the lift section downgrade.
- Backing is required when vision is obstructed by the load or other obstacles. In all cases, backing should be done with extra care.

Other requirements should be considered if a truck is left unattended. A truck is considered "unattended" if the operator is not in view of it, or is in view of it but is more than 25 feet away. When the truck is unattended, the lifting member must be fully lowered, controls put in neutral, power shut off, brakes set, and (if on a slope) wheel chocks in place. When the truck is

attended, but the operator leaves the controls, the lifting member must be fully lowered, the controls put in neutral, and the brake set.

Trucks may only be parked in approved locations. For example, a liquid propane (LP) truck must never be parked near a furnace or any other significant source of heat (gas will expand and trigger the relief valve). No truck may be parked blocking an aisle or exit.

ACTIVITY 8:

1. Why are angling and turning to be avoided on grades?

   _____

2. Why must liquid propane trucks be kept away from heat sources? _____

OBJECTIVE 9: Explain safe procedures for loading and unloading, including special precautions necessary for trailers, highway trucks, and boxcars.

Loading and unloading of trucks should be done in an orderly manner. The maneuvering of heavy loads can involve a number of falling, tipping, tripping, and crushing accidents unless precautions are observed.

When unstable loads are encountered, they should not be picked up until corrected. It may be necessary to discard broken pallets, or to restack, band, tape, or shrink-wrap any unstable load. The proper attachment should always be used when loading; improvising is unsafe. Remember that bystanders may be injured by unstable loads falling off the truck, and that overhead protection is not designed to be effective against a capacity load falling. In addition, if the load is particularly deep, fork extentions should be used.

In attempting to pick up a palletized load, the forks should be fully and squarely seated in the pallet, an equal distance from the center stringers and well out toward the sides, but always directly under the load. Forks to be inserted in a pallet should be level, not tilted forward or back. If the forks are placed close together, the pallet tends to drop at the sides and

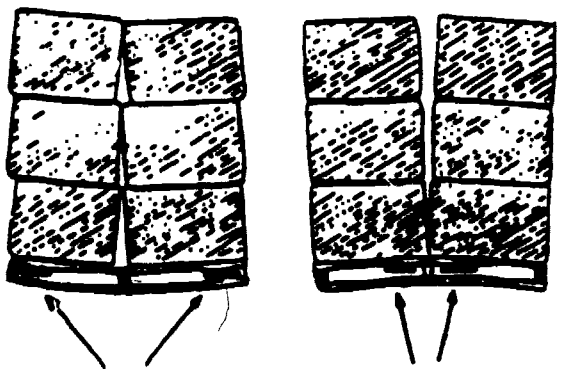


Figure 7. Placing of forks affects stability of the load.

seesaw, causing strain and instability. The effect of placing the forks too close is shown in Figure 7a. With the forks spread wide (see Figure 7b), the load is well distributed and tends to bind itself together.

Caution is required in handling off-center loads that cannot be centered. The load should be strapped to the mast with chain, or with a nylon sling if the load could be unstable during travel. Curves and corners must be taken more slowly than when one is handling balanced loads. Raising, lowering and tilting should be done with a steady even movement.

The stability of a loaded truck is increased as the center of gravity of the load is brought closer to the front axle. Steering is easier when the load is as close to the mast as possible. (See mast in Figure 8.) The center of gravity may be safely shifted by tilting the mast gently backward (but not excessively, particularly when the load is elevated). If these precautions are not taken, the truck may tip forward or the load may spill backwards when the driver is braking, driving over a rough spot, or turning.

When loading or lifting unpalletized loads, extra care must be exercised to avoid an unstable or unbalanced load. It may be necessary to use wedges to brace or block the load and/or secure the load to the truck with nylon webbing, chains, or cables. All of this, in addition to the procedures listed above, should be considered.

It is extremely important that no loads heavier than the rated capacity should be lifted and transported. Truck capacity is marked on the nameplate. Excess counterweighting (such as by persons standing or sitting on the counterweight) is prohibited. The load should be reduced or a larger capacity truck obtained. A load backrest extension or fork extensions will increase the size of the load that can be handled, but will not increase the maximum weight that can be handled.

Figure 8. Mast is tilted back slightly to shift the center of gravity.

The danger with overweight loads is that counterbalanced trucks may tip over. There is also a risk of losing part or all of the steering control because of inadequate weight on the steer axle, if the load is overweight. Sidewalks, floors, or platforms may be weakened or may collapse with overloads. A vertical load backrest extension must be used for high loads to provide overhead protection for operators, and to help prevent parts of a load from falling on other persons.

When unloading heavy equipment, using wedges helps to get the equipment raised a enough off broken skids to get the forks under. Using a spotter can help in placing heavy equipment on skids.

When a load is being set down, assistants and other pedestrians should be kept out of the area where the load could fall. The truck must have ceased traveling before the load is raised or lowered. A load must never be placed in an aisle, or where it could block a stairway, fire equipment, or a fire aisle.

A spotter, a fork-height positioner, or some other compensating method may be required when working in close racks with high-reach forklifts. Caution is necessary to avoid hitting heaters, electric cables, steam pipes, chainfalls, sprinkler heads, and conveyors with an elevated load. Overhead clearance must constantly be checked.

The load must not be tilted forward until the operator has it on the floor or on top of the stack, and a load must not be backed out of while the forks or attachments are being lowered. Backing out must be done carefully. The operator should stop, and then lower the lift section.

Special precautions are necessary for loading and unloading boxcars and highway trucks:

1. Wheel stops, chocks, or other positive movement-preventing devices must be used when working in railroad cars.
2. Highway trucks must have brakes set, and chocks must be used on both sides to ensure against highway truck movement; otherwise, the highway truck can roll away from the edge of the dock, allowing the lift truck to drop or tip.
3. Fixed jacks should be used to prevent an uncoupled semi-trailer from upending when a truck enters (particularly when unloading the last sections of cargo from the far end of a trailer).
4. Dockboards or bridge plates must be used to provide a smooth, gapless riding surface between highway truck and dock, and must be properly secured.
5. An operator should check highway truck, trailer, or rail car floor for breaks, weaknesses, or slippery spots before driving on it. A weak floor may collapse; the weight of even an unloaded truck is substantial.
6. A truck should not be used to move a rail car or to open and close rail car doors; truck attachments specifically designed for opening or closing rail car doors can be used if hazards are not created. Attachments must be properly designed so the operator must not be endangered if a door should fall. The attachment must be operated so that force is applied parallel to the door. Pedestrians must be cleared from the area. The operator's view of the door must be unobstructed, and the operator must be specifically trained to perform this task.

ACTIVITY 9:

(Mark these statements true or false.)

___ 1. Forks spread wide tend to increase the stability of the load.

___ 2. The stability of a loaded truck is decreased as the center of gravity of the load is brought closer to the front axle.

___ 3. The mast can be tilted back as far as necessary to shift the center of gravity.

___ 4. A load backrest extension will increase the size of the load that can be handled.

___ 5. Excess counterweighting is always a bad idea.

___ 6. Loading should be completed before the lift section is raised.

___ 7. The weight of an unloaded truck is practically insignificant in term of floor load.

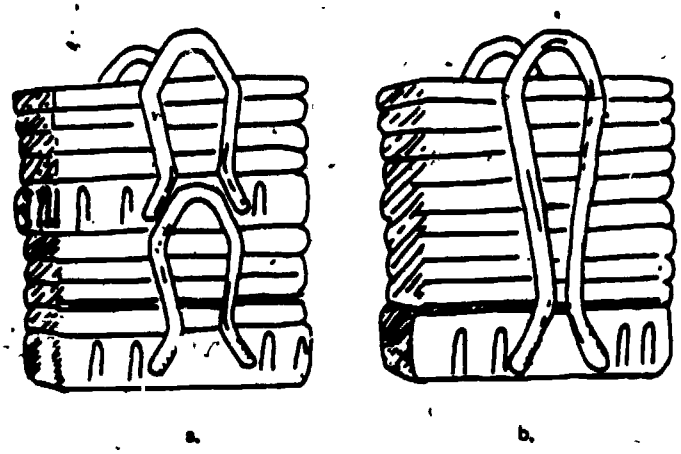
___ 8. Overhead protection is designed to protect the operation against the falling of a full capacity load.

OBJECTIVE 10: Discuss operating procedures for motorized hand trucks.

Operators of motorized hand trucks must adhere to a different set of guidelines from those governing rider-operated trucks. Primarily, operators should walk ahead of the truck, leading it from either side. If the truck must be driven close to a wall or other obstruction, down an incline or into an elevator, the operator should put the truck in reverse and walk behind it facing the direction of travel. Hands should be kept inside handle guards. In addition, these rules should be noted:

- Never drive a hand truck up to anyone standing in front of a bench or other fixed object.
- No riders are allowed (including operator).
- Avoid sudden starts and stops.
- Do not rock the hand truck sideways.
- Be careful of fellow workers.
- Always cross industrial railroad tracks at an angle.

- Stop the hand truck before reversing direction.
- Avoid running over any hot or sharp object.



a. b.

Figure 9. Two-half-sized totes (a) and one full-sized tote (b).

Figure 10. Never use the hand truck as a ram.

As with lift trucks the importance of observing the rated load capacity of motorized hand trucks cannot be overemphasized. The hand truck should never be overloaded.

Stacked totes should never be moved with a hand truck. Transporting limits are one full-size tote or rack, or two half-sized tote boxes, as shown in Figure 9. Any deviation from these limits must be authorized by the supervisor.

Lift platform or forks must be all the way under the load, unless a special long bed model is being used. A hand truck must never be used as a ram (see Figure 10). Whenever possible, lift platform or forks should be placed under tubs when the truck is being parked.

ACTIVITY 10:

1. (Mark true or false.)

   ____ The maximum passenger capacity of a motorized hand truck is two.

2. (Select one answer.)

   When going up or down an incline, the operator of a loaded or unloaded motorized hand truck, should stay (in front of/behind) the vehicle.

OBJECTIVE 11: Describe daily inspection points on powered industrial trucks.

Powered industrial trucks must be inspected on a regular basis by maintenance workers, and a complete overhaul should be carried out periodically. Operators should make daily inspections of controls, brakes, tires, and other moving parts. This inspection, briefer than the maintenance personnel inspection, should be done at the start of each shift for multishift operations. Checklists (see Tables 1 and 2) should be used to record conditions requiring correction.

When any problem is found, it should be noted and reported. If any defect is found that would affect safe operation, the vehicle must be taken out of service and repaired. Manufacturer's Recommendations on maintenance should be followed, and a record of all maintenance kept for each vehicle. Defective brakes, controls, tires, lights, power supply, load-engaging mechanisms, lift system, steering mechanism, and signal equipment should be repaired before trucks are allowed to go back into service. Operators should be prohibited from making repairs to trucks. The operating mechanism should be locked "off" before repairs are made to any part of a powered industrial truck.

Refueling and recharging is part of maintaining a working truck. In most cases, it is not simply a matter of "fill it up." Some general safety practices should be understood and followed.

TABLE 1. INSPECTION AND DAILY MAINTENANCE CHECK LIST FOR INDUSTRIAL TRUCKS.

DATE _____

(Use a check mark unless the item affects safe operation; then use an "x"; under "Needs Maintenance" list items below with any necessary explanation).

Withdraw from use and tag the truck if any safety defects are found.

OK	NEEDS MAINTENANCE		
____	____	1.	Tires (for cuts, gouges, imbedded objects; air pressure, if pneumatic). Air added to _____ psi.
____	____	2.	Steering.
____	____	3.	Foot or other service brake; parking brake.
____	____	4.	Hydraulic system for leaks or frayed hose, etc.
____	____	5.	Controls.
____	____	6.	Horn.
____	____	7.	Chains and limit switches.
____	____	8.	Mast, carriage, and attachment (for damaged, loose, or missing bolts; unusual wear on chain guides or insides of mast channels).
____	____	9.	Condition of slides for adjusting fork width — when properly lubricated, forks slide smoothly; latches secure and in good condition.
____	____	10.	Nameplate and markings (load limits, etc.).
		If applicable, also inspect:	
____	____	11.	Operating lights; flashing or rotating lights.
____	____	12.	Clutch or creeper control.
____	____	13.	Overhead guard; load backrest extension.
____	____	14.	Battery connectors & battery water level. Water was added _____
____	____	15.	Fuel line (for leaks or damage).
____	____	16.	Exhaust system (for sparks, flame, or leaks).
____	____	17.	Water muffler water level.
____	____	18.	Directional signals.
____	____	19.	Backup alarm.
____	____	20.	Seat-actuated dead man brake.
____	____	21.	Coolant level; added _____ pts.
____	____	22.	Engine oil level; added _____ qts.
____	____	23.	Seat belt or lap bar.
____	____	24.	Catalytic converter.
____	____	25.	Shift linkage.

Tagged out due to defective items: _____

_____

OPERATOR _____

TABLE 2. HANDTRUCK OPERATOR DAILY CHECK LIST.

Make it a habit to run through the check list before you leave the parking area.

If you find a problem, have it fixed before beginning your shift.

OK	NEEDS MAINTENANCE	ALL TYPES
____	____	Steering
____	____	Brakes
____	____	Battery
____	____	Drive control
____	____	Horn
		STACKER TYPES
____	____	Hoist-tilt control
____	____	Lifting-lowering speeds
____	____	Drift

The truck should be unloaded, forks or attachment lowered to the floor, and the parking brake set before refueling or recharging is attempted. The engine must be shut off when refueling takes place; the driver should leave the vehicle. No smoking should be permitted during refueling.

Gasoline and diesel trucks should have fuel tanks filled at designated locations, in the open air or in a well-ventilated area. Gasoline should be handled in accordance with the National Fire Prevention Association Standard No. 30, Flammable and Combustible Liquids Code. The filling hose and equipment should be grounded and bonded properly to prevent fire or explosion in case of static electricity. Safety cans used for handling the fuel must be tested and approved by Factory Mutual or listed by Underwriter's Laboratories.

Liquefied petroleum is used increasingly by industry in powered industrial trucks. The chief hazard associated with its use is fire. Fittings or connections improperly tightened may fail and release combustible gas into the air. Use the following guidelines in handling liquefied petroleum gas:

1. Do not refuel or store LPG tanks near sources of heat, or near underground entrances, elevator shafts, or other depressions where leaking gas could accumulate.
2. Check tank to see that there are no dents or gouges that could weaken the structure.
3. Do not throw, drag, drop, or roll LPG containers.
4. Check fuel lines for rubbing, chafing, or exposure to manifold heat.
5. Check for damage to the liquid level gage.
6. Inspect quick-disconnect couplings for damage, deterioration, and for damaged or missing flexible seals.
7. Make sure threads on fittings are in good condition.
8. Check to see that the relief valve points in the direction specified by the manufacturer.
9. Make sure hand wheels, relief valves, and valve caps are in place.
10. Make sure locating pin is intact and that it properly engages the tank.
11. Do not jam the valve in the open position (when opening valve, open fully, then turn toward closed position 1/4 to 1/2 turn — this prevents jamming and enables quick shutoff in an emergency).
12. Wear gloves when changing LPG tanks, as escaping gas is painfully cold to the skin.
13. After installing a new cylinder, check fittings for leaks with a soap solution (never with a match or other flame, or with the bare hand).
14. If LPG tank is kept on a truck overnight or longer, close the service valve.

If the truck uses storage batteries for a power supply, several other potential hazards exist including acid burns, electric shock, and hazardous fumes. The following rules should be observed during recharging of electric trucks:

1. Mechanical lifting aid plus a battery lifting sling is required for battery handling.
2. Charging area must have a working emergency eyewash fountain — know where it is and how to use it (how to hold eyelids open, need for 15-minute flush).
3. Battery charging must be limited to designated areas.

4. Ventilation must be adequate to disperse hydrogen gas produced by batteries during charging.

5. Open flames should not be used as a light source to check levels of electrolyte in batteries.

6. Always add battery acid to water (not the reverse), except when adding water to replace water lost during charging.

7. Bulk electrolyte must be handled by use of a carboy tilter or siphon. Never start a siphon with your month.

8. No smoking in the charging area (note: charging area must be posted with "No Smoking" signs).

9. Eliminate sparks, electric arcs, and open flames in battery charging areas.

10. Keep metal tools and items away from the top of uncovered batteries to prevent arcing.

11. The brake must be applied when charging or changing batteries.

12. Vent caps must be inspected to ensure that they are not plugged, and they must be placed in position before battery is charged to avoid electrolyte spray.

13. The battery cover or compartment cover must be left open during charging to dissipate heat.

14. Only pull the battery connector in an emergency, or when recharging (otherwise, wear on the terminals causes arcing).

15. Wear impervious gauntlet gloves and eye or face protection when filling battery cells.

16. Properly position and secure batteries reinstalled in trucks; to prevent shifting of an undersized battery, and excess space in the battery tray should be filled with a wood or similar spacer (dummy) — note that the use of an undersized battery reduces the load capacity of the truck, where the battery is part of the counterweighting.

ACTIVITY 11:

1. Name at least four checkpoints on all industrial trucks.

   a. _____

   b. _____

   c. _____

   d. _____

2. Name the chief hazard associated with liquefied petroleum gas. _____

3. Name two hazards associated with electric truck battery handling.

a. _____

b. _____

OBJECTIVE 12: Discuss precautions that should be taken in the handling of hazardous materials.

Material handling is the function of powered industrial trucks, and the nature of the material being handled on any given job should be of concern to the truck operator. Operators should identify and know the hazards of the material with which they are working. Labels usually indicate shock sensitivity, flammability, emergency spill or leak procedures, and necessary protective measures.

Operators should wear specified protective clothing when handling hazardous chemicals (e.g., impervious gauntlet gloves), and use an appropriate air supply respirator where air is oxygen-deficient or contaminated.

Fire, breathing, and eye contact hazards exist with the use of some organic solvents, and long-term breathing can be affected by chlorinated solvents (especially chloroform, carbon tetrachloride, trichloroethylene, and perchlorethylene) and certain unchlorinated organic solvents (e.g., gasoline, benzene, and carbon disulfide).

Skin and eye contact hazards exist with many pesticides, acids, caustic materials, and certain other industrial chemicals. Workers who handle these should know how to use and where to find emergency eyewash fountains and showers, what protective clothing to wear, (including gloves and eye protection), how to inspect gloves for leaks, and the dangers of wearing contact lenses (both hard and soft type). Hazards may result from noxious gases produced by trucks that are powered by diesel fuel, LP gas, or gasoline (oxides of nitrogen and hydrocarbon pollutants, as well as carbon monoxide) especially when operated in confined spaces.

Only an "approved" truck can be used in locations where fire hazards exist ("approval" is based only on fire considerations). Employees should

understand which particular areas of the workplace, if any, are classified because of their fire hazards as Class I (gases and vapors) Class II (dusts), or Class III (fibers or flyings) locations for purposes of truck selection.

Employees who drive powered industrial trucks may encounter a great many hazardous situations. Safety can be maintained if the operator remains aware and cautious with regard to the vehicle and the materials.

Employees should protect themselves, their fellow workers, and their employers by reporting the following hazards to a supervisor:

- Leaking or otherwise defective containers.
- Untrained operators.
- Unsafe trucks.
- Careless or excessively fast-paced activities.

ACTIVITY 12:

1. Name four potential hazards of materials of which truck operators should be aware.
   a. _____
   b. _____
   c. _____
   d. _____
2. List five unsafe practices that operators should avoid.
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____

REFERENCES

Bowman, Daniel. Lift Trucks - A Practical Guide for Buyers and Users. Boston, MA: Cahners Books, 1972.

National Safety Council. Accident Prevention Manual. Chicago, IL: 1979.

U.S. Department of Health and Human Resources. National Institute for Occupational Safety and Health. Outline for Training Powered Industrial Truck Operators. October 1978.

ANSWERS TO ACTIVITIES

ACTIVITY 1

Seesaw.

ACTIVITY 2

1. Straddle carrier.
2. Crane.
3. Tractor and trailer.
4. High-lift.
5. Bumper.

ACTIVITY 3

1. a. III.
   b. II.
   c. I.
   d. Unclassified.
2. a. Any.
   b. EX.
   c. EX.
   d. EX, EE, DY.

ACTIVITY 4

1. Horn.
2. Overhead guard.
3. Nameplate.

ACTIVITY 5

(Any three.)

1. a. Vision.
   b. Hearing.
   c. Reaction time.

d. Heart condition.

e. Susceptibility to fainting.

2. (Any six.)

a. Starting and stopping.

b. Forward, reverse, and turning.

c. Hoisting, lowering, and tilting of forks.

d. Loading and unloading.

e. Maneuvering around obstacles.

f. Operating under adverse conditions.

g. Inspection.

h. Maintenance.

i. Refueling and recharging.

ACTIVITY 6

1. c.
2. a.

ACTIVITY 7

1. Three truck lengths.
2. Three.
3. Reported or corrected.
4. Clearance.
5. Convex mirrors.
6. Carbon monoxide.

ACTIVITY 8

1. To avoid tipping hazard.
2. To avoid danger of explosion.

ACTIVITY 9

1. True.
2. False.
3. False.
4. True.
5. True.
6. True.
7. False.
8. False.

ACTIVITY 10

1. False.
2. Behind.

ACTIVITY 11

(Any four)

1. a. Brakes.
   b. Horn.
   c. Controls.
   d. Nameplate.
   e. Steering.
   d. Tires.
2. Fire.
3. a. Acid burns.
   b. Electrical shock.

ACTIVITY 12

1. a. Fire hazard.
   b. Breathing hazard.
   c. Skin contact hazard.
   d. Eye contact hazard.
2. a. Transporting leaking or defective containers.
   b. Using a truck when not trained to use it.
   c. Working with an unsafe truck.
   d. Handling an unsafe load.
   e. Working faster than safety allows.