



Forklift Operator Training Guide



Introduction

Forklifts use the laws of physics to give one person the power to move large loads with seemingly effortless precision. A well-trained and experienced forklift operator is a marvel of skill and competence that can safely stack pallets or pick a single item from a trailer or pipe rack.

Yet, each year more than 100 people are killed and over 95,000 injured in accidents involving forklifts. Why? The same laws of physics that allow forklifts to make great lifts also make them subject to great mishaps. They tip over, drop loads, trap people, and fall off ramps or trucks.

Because of the large number of workplace accidents, OSHA has issued regulations containing safety requirements relating to fire protection, design, maintenance, and use of fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors or internal combustion engines. These regulations are found in the Code of Federal Regulations at 29 CFR 1910.178.

OSHA, believing that proper training can reduce the number of forklift-related injuries and fatalities, has issued a training standard in the regulations that requires an employer to ensure that each powered industrial truck operator is competent to operate a powered industrial truck safely, as demonstrated by the successful completion of the training and evaluation requirements.

This guide will cover all the information necessary to help an employer understand OSHA's requirements and provide a study guide for employees working toward their Forklift Operator Certification.

Training Requirements

OSHA's training requirements consist of a combination of (1) formal instruction (e.g., lecture, discussion, interactive computer learning, video tape, written material), (2) practical training (demonstrations performed by the trainer and practical exercises performed by the trainee), and (3) evaluation of the operator's performance in the workplace.

Prior to permitting an employee to operate a powered industrial truck (except for training purposes), the employer shall ensure that each potential operator has successfully completed all the training requirements.

As your employer is conducting the practical training and driver observation components of the training, keep in mind that trainees may operate a powered industrial truck only under the direct supervision of persons who have the knowledge, training, and experience to train operators and evaluate their competence; and where such operation does not endanger the trainee or other employees.

At the successful completion of this training, the employee should be provided with a certificate that indicates that the employee has completed the training. The certification should include the name of the operator, the date of the training, the date of the evaluation, and the identity of the person(s) performing the training or evaluation.

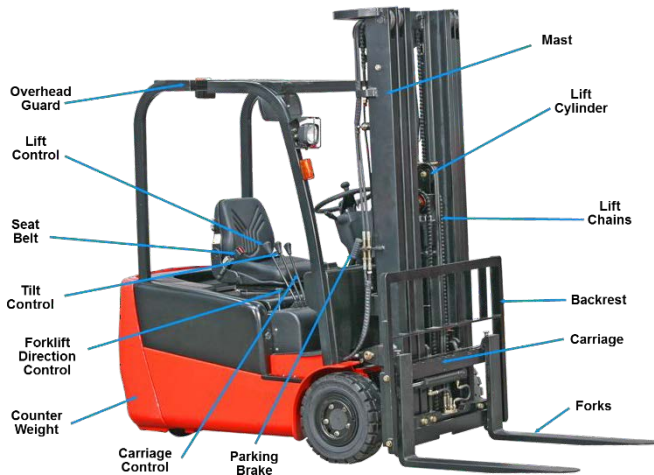
Refresher training, including an evaluation of the effectiveness of that training, shall be conducted **at least once every three years**.

Additionally, refresher training in relevant topics shall be provided to the operator when:

- The operator has been observed to operate the vehicle in an unsafe manner.
- The operator has been involved in an accident or near-miss incident.
- The operator has received an evaluation that reveals that the operator is not operating the truck safely.
- The operator is assigned to drive a different type of truck; or
- A condition in the workplace changes in a manner that could affect the safe operation of the truck.

Forklift Design

Forklifts come in a variety of sizes and designs and may operate on battery power, propane, gasoline, or diesel fuel. The picture at right shows the variety of designs that you may encounter in the workplace. Each forklift is designed to perform specific tasks in set situations. Using it in any other way is not only unprofessional – it is dangerous.



All forklifts have some things in common. They have forks that pick up the load, hold it during transit, and put it in place at the new location. Forks tilt forward or backward. The operator can adjust the space between forks to lift loads of varying widths. Some forks on forklifts can be replaced with special attachments for carrying oddly shaped loads, such as drums, or long loads, such as pipe. Some can be used with a man-basket for elevating people.

The parts of a forklift include the mast, carriage, backrest, and overhead guard. Only the basic design is the same. In use, forklifts have different controls, weight capacities, and

restrictions on where they can be operated. That's why every forklift operator needs to learn all the operating requirements for the particular forklift that they use. OSHA requires that you are trained and certified for each type of forklift and each kind of work situation you encounter.

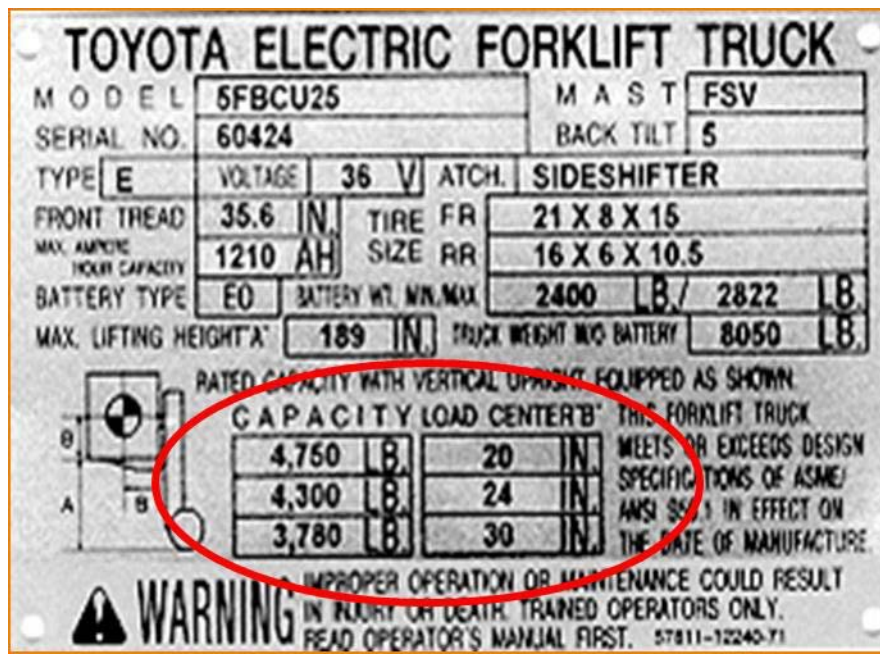
Is Driving a Forklift the Same as Driving a Car?

A forklift is not like a car. It steers in a very different way and has different controls. The forklift is less stable when turning because the front drive wheels support most of the load, and a forklift has just three points of stability - the front wheels and the center of the rear axle; while a car has four points of stability (four tires). You have less steering control when turning, especially when the forklift is loaded. The forklift's steering and drive mechanism also makes it difficult to stop quickly and dangerous to swerve. Remember that forklifts, even when unloaded, weigh two to three times more than an average car. Forklifts operate equally well in forward or reverse but steer differently in each direction. They also have blind spots, especially when loaded.

The Forklift Nameplate

OSHA requires a nameplate that is specific to the lift truck and any attachments that are used. The nameplate contains information including the weight of the forklift, tire size and pressure, fuel type, etc. However, the most important information to the operator is the capacity and load center (circled in red below).

So what is capacity and load center? Capacity is the maximum weight that can safely be lifted to the forklift's maximum lifting height, assuming the center of gravity of the load is within the rated load center. The load center is the distance between the vertical face of the carriage and the center of gravity of the load. These two pieces of data will help you prevent a tipover. More on that later...

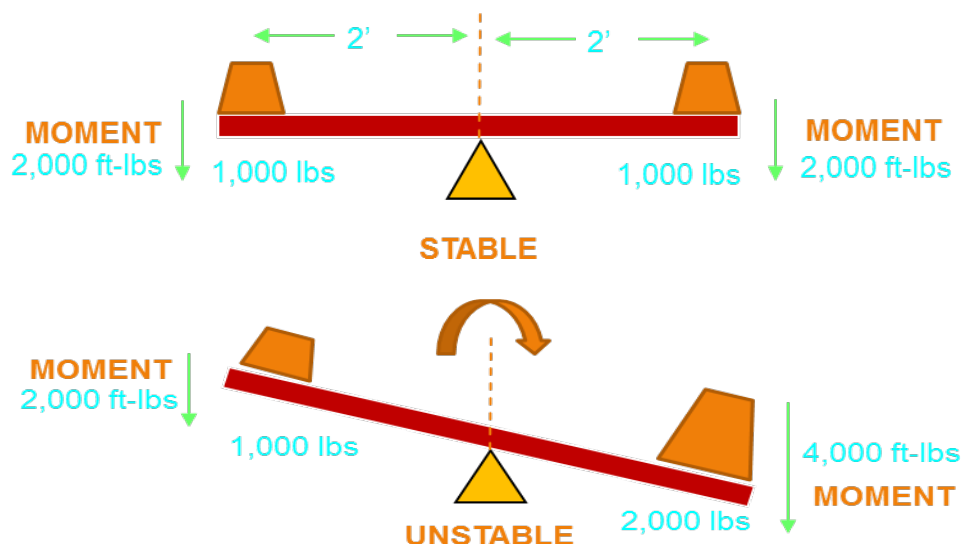


You should report and not operate any forklift that does not have the proper nameplate.

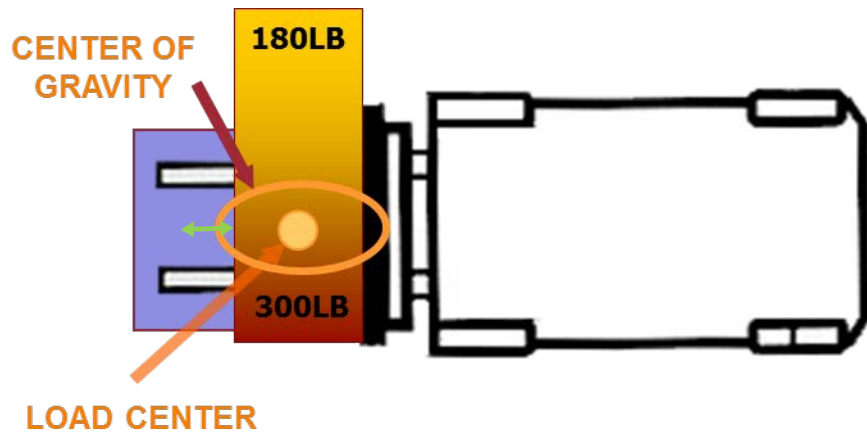
Forklift Stability

Knowledge of the forklift – things such as balance, stability, capacity and visibility - separates the good operator from the average operator. The professional knows that every load and every situation is different and that every lift and carry must be evaluated and planned.

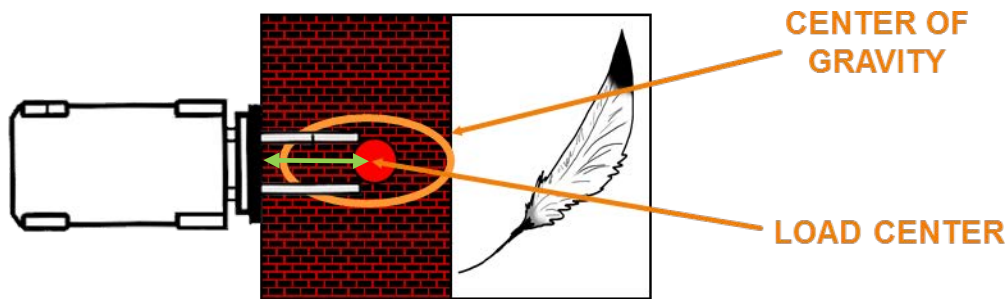
Let's talk a little physics again. A moment of force is the product of a force and its distance from an axis, which causes rotation about that axis. Whether an object is stable depends on the object's moment at one end being greater than, equal to, or less than the object's moment at the other end. This principle can be seen in the way a teeter-totter works: that is, if the product of the load's downward force and its distance from the axis (moment) is equal to the moment at the device's other end, the device is balanced. However, if there is a greater moment at one end of the device, the device will rotate downward at the end with the greater moment.



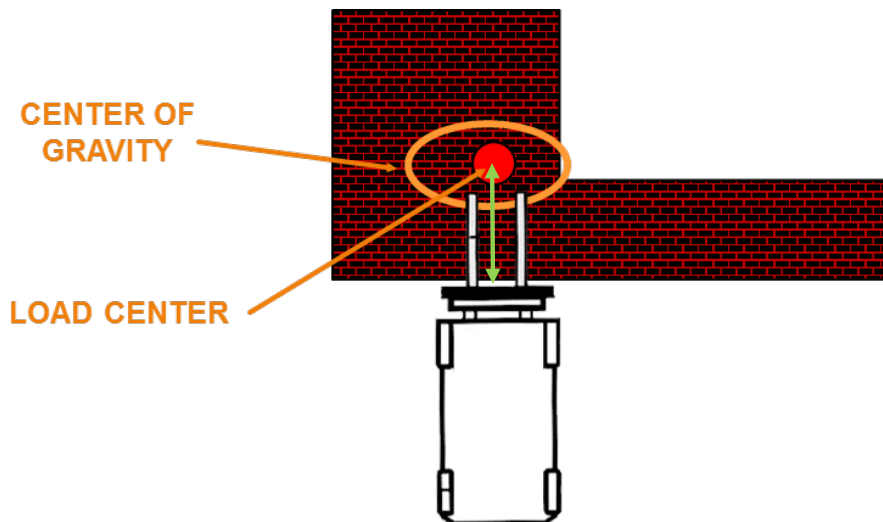
From that bit of knowledge, let's define a couple of more terms that will help us determine the stability of a forklift. Earlier, we mentioned the center of gravity and load center. The center of gravity is the average location of the weight of an object. The load center is the distance from the carriage, or vertical face of the forks, to the center of gravity of the load.



If a load contains materials with different weights or densities, the center of gravity will be on the side containing the heavy material. For example, if a pallet contains bricks on one side and feathers on the other, the center of gravity will be closer to the side of the pallet containing the bricks.



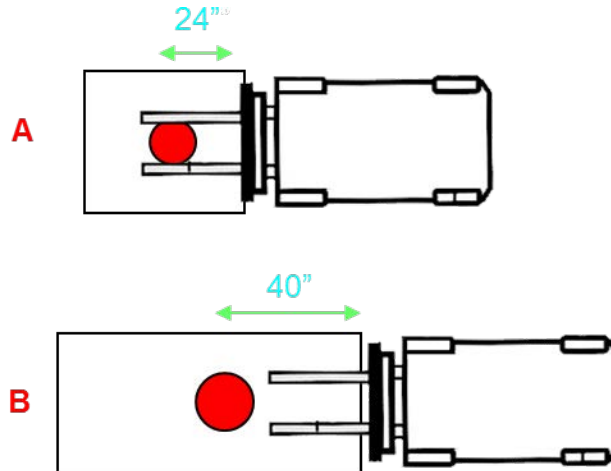
Similarly, the center of gravity for odd-shaped loads of similar materials will be near the side with the most mass.



The load center is the distance from the carriage, or vertical face of the forks, to the center of gravity of the load. In the examples below, the load centers are:

A: Load center = 24"

B: Load center = 40"



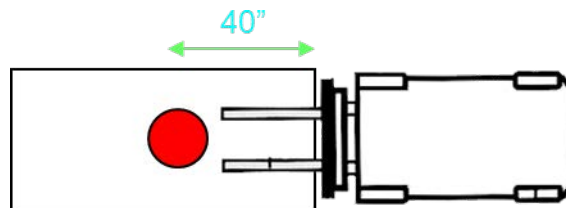
So understanding the center of gravity and load center helps the operator to determine how to pick up a load and maintain stability (pick up the load on the side closest to the center of gravity). In example B above, the load should be picked up from the side, not the end, as shown.

Load Center and Capacity

The load center is also related to the capacity of the forklift. Trucks with a capacity of 30,000 pounds or less are normally rated based on a 24-inch load center. Trucks with a capacity greater than 30,000 pounds are normally rated based on a 36- or 48-inch load center. The operator should always check the nameplate to determine the maximum allowable weight at the rated load center.

If your forklift is rated for 5,000 pounds at 24 inches, it can safely lift a 5,000-pound load as long as the load center is 24 inches or less from the front face of the forks. If the load center is greater than 24 inches, it will reduce the lift truck's capacity. Each forklift is different; however, it is safe to assume that for every additional inch beyond 24 inches, the capacity will be reduced by 100 pounds.

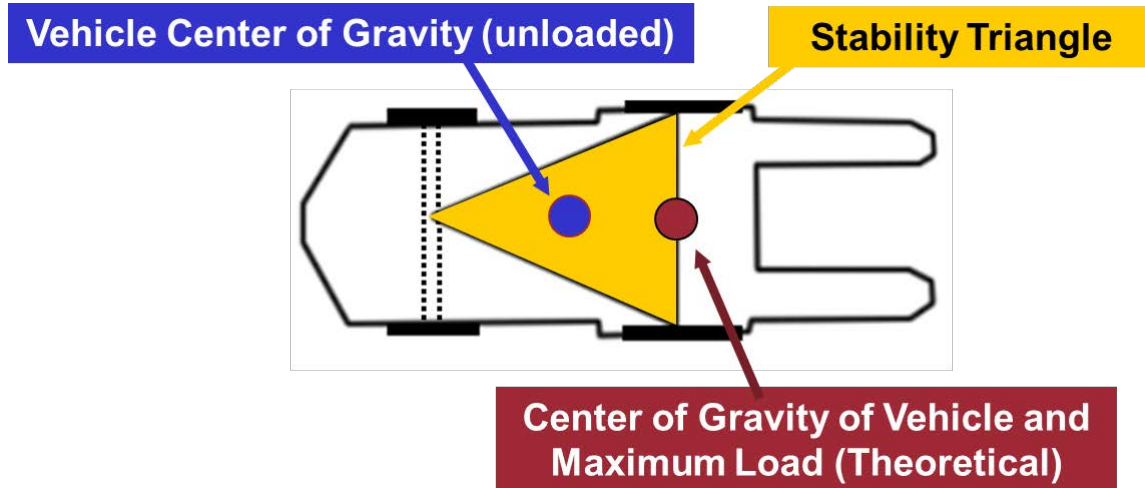
So, in the example below, you are going to try to lift a load that is 80 inches long with the forklift just described. The load center is 40 inches, or 16 inches greater than the rated load center of 24 inches. If 100 pounds capacity is lost per inch of extra load center, then the capacity of the lift truck is reduced by 1,600 pounds to 3,400 pounds.



Remember that the nameplate on the forklift identifies the capacity of the lift truck at various load centers.

The Stability Triangle

The design of the forklift is based on a stability triangle. The front axle, with its drive wheels, acts as the base of the triangle and supports the weight of the load. The sides of the stability triangle meet at the point where the forklift steers in the middle of the steering axle.



Keeping the downward force of the load (center of gravity) within the stability triangle keeps the forklift stable and keeps the load from crashing to the ground. Allowing the load to move outside the stability triangle makes both the forklift and the load less stable and subject to tipping, rolling, or dropping.

When Does the Load Become Less Stable?

- Whenever the load is raised
- When you are turning
- On slopes, either front-to-back or side-to-side
- On rough roads or uneven surfaces

On every move, you need to decide if your stability will be affected by:

- The load – its weight and/or shape
- The route and its condition along the way
- The destination and maneuvers needed to set down the load

Know the rated load capacity of your forklift and never exceed it. The load capacity information should be located on a plate inside the forklift. This information and your understanding of stability help make you a safe forklift operator.

How Do Attachments Affect Forklift Capacity?

All attachments, such as carton clamps, drum clamps, paper roll clamps, rotators, and push-pull attachments, affect your lift truck's capacity in two ways:

- Adding an attachment is like permanently carrying a load. If the attachment weighs 1,000 pounds, your lift truck's capacity is automatically reduced by 1,000 pounds;
- Attachments typically move the load further away from the lift truck, which increases your load center. If the attachment moves the load 8 inches away, it will reduce the capacity by approximately 800 pounds (@100 pounds per inch).

What Should You Do If You Tip Over?

If the forklift operators drive safely and consider the combined actions that might cause them to tip over, they should never tip over in the first place. But, if there is a tip-over, it is important that they know what to do and what NOT to do.

- Do not jump! You should be wearing the seat belt, so that should not be an option. Many operators who thought they could jump clear of a tip-over have been crushed by the overhead guard or the mast of the forklift.
- Seat belts must always be worn. Many fatalities have occurred when an un-seatbelted operator was thrown clear of the forklift and struck his or her head on a solid object.
- Brace yourself by holding firmly to the steering wheel and planting your feet.
- Lean away from the fall.

What Does the Pre-use Inspection Include?

According to OSHA studies, 6 percent of lift truck-related accidents are caused by improper maintenance. A thorough pre-operation inspection will catch almost any maintenance issue before it results in an accident. The pre-use inspection takes only a few minutes, and must be done at least daily or at the beginning of each tour. You may have a checklist to use – be sure to fill it out and turn it in every time. We have included a **Forklift Inspection Checklist** in the Appendix.

To begin a pre-operation inspection, you will need to do a “walk around.” Before you start, be sure the forklift has been properly disengaged; the engine should be turned off, the parking brake set, the forks down, and the gear in neutral. Walk to either side of the forklift. Check the tires, be sure there is no debris around the axle or behind the mast, and make sure the overhead guard is solid. Next, look at the front of the truck; check that the forks and hoses are in good condition, fork pins are in place, the backrest is solid, and the mast and chains are greased. Last, walk to the rear. Check that the counterbalance bolt is tight and the radiator is clear of debris. Look for oil or water leaks on the floor.

Next, lift the hood so that the engine can be inspected. Check the engine oil, transmission oil, coolant level, brake fluid, and hydraulic fluid; make sure the fan belt is tight and the fan is clear of debris, and check to be sure that the radiator is also clear of debris.

- On LPG (propane) powered lift trucks, inspect the propane tank and hose attachment for good condition. Does the propane tank clamp work effectively? Any signs of a propane leak?
- On electric lift trucks, inspect the battery to ensure that it is in good condition.
- On diesel-powered forklifts, check for fuel tank damage or leaks and make sure that all valves and nozzles are secure.

Next, hop into the seat of the forklift for some non-moving checks:

- Check the parking brake, be sure it is set;
- Put on the seat belt before starting the engine/turning the key to the “on” position;
- After starting the forklift, check all gauges, indicators, headlights and warning lights;
- Test the Horn;
- Operate the tilt & lift mechanism
 - When checking the tilt, listen for unusual sounds;
 - When checking the lift mechanism, inspect the hoses and chains, and listen for unusual sounds, look for leaks;
- Put the gear in reverse to test the backup alarm.

Finally, the moving checks:

- Check the parking brake by putting the forklift in gear (both forward and reverse) and stepping on the accelerator. The forklift should not move.
- Check the running brakes by moving forward and backward at speed and slamming on the brakes. The lift trucks should quickly stop.
- Inspect the steering by doing full turns to the right and left; listen for unusual sounds.

If anything is not right about the forklift, turn it off and secure it. Report the problem to your supervisor. You should never operate a forklift that has failed any of the pre-use checks.

Forklift Operation – Rules for Operators

To operate a forklift safely, operators should follow these rules:

- Only trained, authorized persons should operate a forklift
- Immediately report accidents
- Seat belts must always be worn
- Forklifts should never be driven up to anyone standing in front of a fixed object.
- Do not allow anyone to stand or pass under the elevated portion of any forklift, whether loaded or empty.
- Forklift controls should only be operated from the driver's seat
- Never block exits or emergency equipment
- Smoking is not permitted while driving, fueling, or charging
- Never eat or drink while driving
- No stunt driving or horseplay
- When a forklift is left unattended, the load shall be fully lowered, controls shall be neutralized, power shall be shut off, and parking brakes shall be set. A forklift is unattended when the operator is 25 ft. or more away from the vehicle, which remains in view, or whenever the operator leaves the vehicle and it is not in view.

Forklift Operation – Rules for Equipment

The following rules should be followed relative to forklift equipment:

- Never place weight (sandbags, metal weights, etc.) on the back of a lift truck to prevent it from tipping over. Adding weight to the back of the lift truck does not increase the capacity of the mast, hydraulic system, chains, tilt cylinders, etc., and may cause a failure in these systems when lifting loads over the designed capacity of the lift truck.
- Towing should only be done from the rear towing pin designed for such purpose.
- Never make modifications to your forklift (drill a hole in the forks, weld on hooks, etc.). This can degrade the integrity of the forklift. OSHA requires that only forklift manufacturers can make such modifications.
- Only use attachments designed for use with your forklift. Be sure to adjust the capacity and load center when using attachments.

What are Some of the Questions that You Should Ask Yourself?

As a forklift operator, you should ask yourself the following questions to help you plan for lifting/moving a load:

- What is the rated load capacity of the forklift?
- Is this load well within the capacity limits?
- Will the shape of this load affect my stability?
- Will the load affect my visibility?
- Do I need to split up the load?
- Do I need to drive in reverse?
- Do I need a spotter?
- What hazards are along the route?
- What turns will I have to negotiate?
- Are there ramps, slopes, rough ground, or obstacles?
- What about the destination?
- Can I get close enough?
- Can I pull in straight?
- Is the area free of overhead hazards like power lines, pipes, or beams?

Forklift Operation – Loading and Unloading

Before raising a load, you should know:

- The approximate (or better yet, the exact) weight of the load, and
- The location of the load's center of gravity (to determine load center and capacity) Only loads within the rated capacity of the truck should be handled.

Inspect the load for stability, projections, and damaged pallets before lifting. Restack unstable loads.

The brakes of highway trucks shall be set and wheel chocks placed under the rear wheels to prevent them from rolling while they are boarded with powered industrial trucks.

Fixed jacks may be necessary to support a semitrailer and prevent upending during the loading or unloading when the trailer is not coupled to a tractor.

Wheel stops or other recognized positive protection shall be provided to prevent railroad cars from moving during loading or unloading operations or while dock boards or bridge plates are in position.

Off-center loads should be cross-tied to the forks before lifting or traveling. Some loads require securing (tying, banding, or strapping down) before transport.

Compressed gas cylinders should be supported in an approved rack for transport by forklift. Laying the cylinders horizontally across the forks for transport should not be permitted.

When loading/unloading trailers using a dock with a lift truck, you should make a habit of these four practices:

- Check the dock plate for cracks or signs of wear, and be sure it is properly secured. Don't exceed the rated capacity of the dock board.
- Inspect the trailer floor before entering it with a lift truck. Look for holes or weak spots in the deck that the tire of a forklift could fall into, causing a tip-over.
- Chock the trailer wheels to prevent trailer creep.
- Support the nose of the trailer with the tractor or a fixed jack.

Forklift Operation – Safe Driving Practices

- Always look in the direction of travel. If the load blocks your forward vision, you should drive in reverse.
- Remember to always look behind you before backing up.
- Keep your body inside the cage of the forklift.
- When moving, the mast should be as low as possible.
- Avoid turning the truck when its load is raised more than a few inches (6" –12") above the ground.
- Sound the horn before moving and at corners, crossing aisles, near doorways, etc.
- All traffic regulations should be observed, including authorized speed limits.
- Operate at safe speeds - A safe speed is a speed at which you can quickly and easily stop if a pedestrian steps out in front of you. This isn't always the speed limit!
- Slow down on wet and slippery floors.
- Do not move the lift truck while raising or lowering a load. This can cause an unstable situation and a possible tip-over.
- Remember, the forklift steers from the rear, so be careful when turning as the rear end swings wide.
- Watch for overhead obstructions when lifting your load.
- Avoid driving on loose objects or into holes.
- Never carry passengers.
- Always be aware of pedestrians in the area where you are working.
- Pedestrians always have the right of way.
- Keep a safe distance from the edge of ramps or docks.
- Keep a safe distance (approximately three forklift lengths) from the vehicle ahead.
- Always keep the forklift under control.
- Yield the right of way to ambulances, fire trucks, or other vehicles in emergency situations.
- Don't pass other forklifts traveling in the same direction at intersections, blind spots, or other dangerous locations.
- If your view is obstructed, you should not move the truck until you have a spotter (second person) working with you.
- There should be only one spotter per driver and only one driver per spotter. (If a spotter is needed)
- Ascended or descended grades slowly.

- Don't attempt to turn while ascending or descending grades.
- When ascending or descending grades in excess of 5 percent, loaded forklifts should be driven with the load upgrade.
- Dock boards or bridge plates shall be driven over carefully and slowly.
- Pay attention to caution signs in the facility marking hazards that must be avoided, such as ammonia system lines and evaporators.

Operating Hazards

It is important to be aware of all the potential hazards of the area in which you will be operating the lift truck. Hazards include:

- Workplace Conditions: look out for and avoid ammonia system lines and evaporators
- Moving Loads
- Pedestrians

Operating Hazards – Workplace Conditions

Some examples of workplace conditions/hazards include:

- Combustible fuel-operated forklift in poorly ventilated area
- Ammonia system lines and evaporators
- Traveling on ramps
- Crossing railroad tracks
- Slippery floors
- Operating on dirt or gravel
- Poor lighting
- Congested/tight workspaces

Operating Hazards – Moving Loads

Some hazards associated with moving loads include:

- Working around loading docks
- Ammonia system lines and evaporators
- Loads that block the forward vision
- Stacking and unstacking on racks
- Large or bulky loads
- Uneven weight distribution
- Broken pallets
- Poorly stacked loads, unwrapped loads

Operating Hazards – Pedestrians

In most workplaces, there is a lot of activity with other workers or visitors coming and going from the areas where you may be operating a lift truck. You must always be aware of pedestrians, where they are or might be. You should always yield the right-of-way to pedestrians. You should also take charge of your work area by communicating with the pedestrians, letting them know you are working in the area, and directing them to safe areas before you resume operation. Some conditions that may cause accidents with pedestrians include:

- Obstructed views
- Turning
- Speeding
- Pedestrian unaware forklift is present
- Carrying passengers
- Horseplay

Forklift Maintenance – OSHA Requirements

Preventative maintenance should be completed on a routine basis per manufacturer recommendations. OSHA has specific requirements related to the maintenance of lift trucks. These requirements include:

- All power-operated industrial trucks are to be examined before placing into service (at least daily, usually every shift). Any truck not in safe operating condition shall be removed from service and immediately reported. All repairs shall be made by authorized personnel.
- Modifications and additions that affect capacity and safe operation shall not be performed by the customer or user without the manufacturer's prior written approval. Capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly. Additional counterweighting of fork trucks (such as using sandbags, extra weights, etc.) shall not be done unless approved by the truck manufacturer.
- No repairs shall be made in Class I, II, and III locations.
- Repairs to the fuel and ignition systems of industrial trucks which involve fire hazards shall be conducted only in locations designated for such repairs.
- Trucks in need of repairs to the electrical system shall have the battery disconnected prior to such repairs.
- All parts of any such industrial truck requiring replacement shall be replaced only by parts equivalent as to safety with those used in the original design.
- Water mufflers shall be filled daily or as frequently as is necessary to prevent depletion of the supply of water below 75 percent of the filled capacity. Vehicles with mufflers having screens or other parts that may become clogged shall not be operated while such screens or parts are clogged. Any vehicle that emits hazardous sparks or flames from the exhaust system shall immediately be removed from service, and not returned to service until the cause for the emission of such sparks and flames has been eliminated.
- When the temperature of any part of any truck is found to be in excess of its normal operating temperature, thus creating a hazardous condition, the vehicle shall be removed from service and not returned to service until the cause for such overheating has been eliminated.

- Industrial trucks shall be kept in a clean condition, free of lint, excess oil, and grease. Noncombustible agents should be used for cleaning trucks. Low flash point (below 100 deg. F.) solvents shall not be used. High flash point (at or above 100 deg. F.) solvents may be used. Precautions regarding toxicity, ventilation, and fire hazards shall be consonant with the agent or solvent used.
- Industrial trucks originally approved for the use of gasoline for fuel may be converted to liquefied petroleum gas fuel, provided the complete conversion results in a truck that embodies the features specified for LP or LPS-designated trucks.

Forklift Maintenance – Pre-Refueling Safety

Before refueling any forklift, the operator should observe and carry out the following safety precautions:

- Never refuel while the engine is running (the engine has the potential to ignite the fuel).
- Ensure you follow safe parking procedures.
- Open flame, smoke, and any potential source of ignition are prohibited within 10 meters of any truck being refueled or recharged.

Forklift Maintenance – Battery Charging

- Facilities shall be provided for charging batteries and should include equipment for handling batteries, flushing, and neutralizing spilled electrolyte, for fire protection, for protecting charging apparatus from damage by trucks, and for adequate ventilation for dispersal of fumes from gassing batteries.
- Always wear PPE when working with batteries. PPE includes a face mask, acid-resistant gloves, and an apron.
- Trucks shall be properly positioned, and brakes applied before attempting to change or charge batteries.
- Ensure that vent caps are functioning. The battery compartment cover shall be open to dissipate heat.
- Inspect battery connectors for damage.
- Hydrogen gas is released during the recharging process, so smoking in the charging area is prohibited.
- Never remove battery caps except to add water or take hydrometer readings.
- When charging batteries, acid shall be poured into water; water shall not be poured into acid.
- Immediately clean up electrolyte spills. Clean up electrolyte spills with baking soda (acid neutralizer) and water.
- Reinstalled batteries shall be properly positioned and secured in the truck.