The Forklift Workshop Operator's Handbook

Introduction

Forklifts—also called lift trucks, tow motors and powered industrial trucks—are among the most common pieces of equipment in the workplace. Yet these workhorse machines can also be dangerous—there are numerous forklift-related injuries each year, a number of them resulting in fatalities.

On one hand, forklifts have the power to lift and move the heaviest objects. On the other hand, all that power comes with the potential for serious damage. The more you know about how forklifts operate, the better equipped you'll be to stay safe and to keep those around you safe.

Regardless of whether you're a new operator or have years of experience, it's up to you to follow safety practices and a basic set of rules every time you use a forklift.

Starting with: Never operate a forklift unless you're trained and authorized to do so.

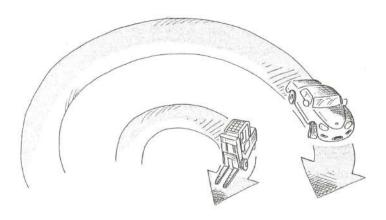
Forklift Basics

Types of forklifts

There are many classes and types of forklifts, from the common sit-down type to the narrow aisle stand-up type; and from order pickers to powered pallet jacks. They may be powered by electricity, LP gas, diesel fuel or gasoline. Some are approved for use in certain hazardous conditions. There's a forklift for just about any job you can imagine. In fact, forklifts can be grouped into the following classifications:

 Class 1—Electric motor, sit-down rider, counterbalanced trucks (solid or pneumatic tires)

- Class 2—Electric motor, narrow aisle trucks (solid tires)
- Class 3—Electric motor hand trucks or hand/rider trucks (solid tires)
- Class 4—Internal combustion engine trucks (solid tires)
- Class 5—Internal combustion engine trucks (pneumatic tires)
- Class 6—Electric and internal combustion engine tractors (solid or pneumatic tires)
- Class 7—Rough terrain trucks (pneumatic tires)



Forklifts vs. automobiles

Forklifts are not like automobiles. Some key differences:

- Forklifts steer with the rear wheels—the exact opposite of most other vehicles.
- Because they steer from the rear, forklifts can turn a much tighter circle than a car.
- Forklifts are not known for their maneuverability. Don't expect them to stop or swerve as easily as a car.
- Forklifts can also weigh two or three times more than a car. The reason is that forklifts carry heavy loads in the front so, to balance the load, they typically have a counterweight over the rear tires to prevent them from tipping forward.

Keeping a forklift balanced

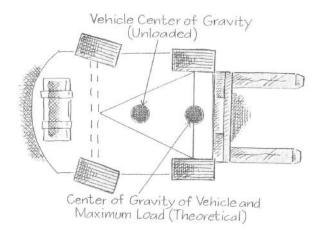
Every forklift operator needs to constantly think about keeping their unit from tipping. A forklift works on essentially the same principle as a teeter-totter—the weight of the load on the forks must be counterbalanced by the weight of the forklift body and counterweight.

The primary source for determining the load your forklift can handle is the forklift's nameplate (also known as the data plate, capacity plate, ID plate). The nameplate will state the capacity of the forklift, which is the manufacturer's guideline for how much weight the forklift can safely lift.

Important to note:

- Capacity data is calculated using a load with a specific load center (commonly 24 inches).
- Unless every load you lift has a load center that matches your truck's rating, the actual capacity will be reduced.
- Capacity data is calculated under ideal conditions. If a load is uneven, unbalanced or off-center on the forks, capacity may also be reduced.
- · Attachments typically reduce capacity.

When necessary, check with your supervisor to figure out the capacity of your unit to handle oversized or irregularly shaped loads.



Center of gravity and the stability triangle

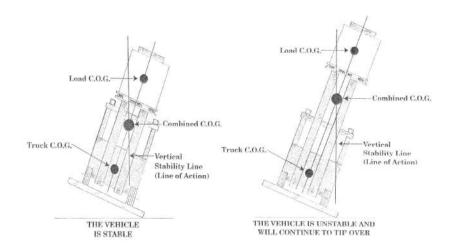
When it comes to balance, two other important concepts come into play: center of gravity and the stability triangle.

The center of gravity is the point within an object where all the weight is concentrated. It's in the center of a symmetrical load, but off-center in an irregular load.

When a forklift is not carrying a load, you only need to consider the forklift's own center of gravity, usually somewhere near the middle of the unit. But when you're lifting or carrying a load, you have to consider the combined center of gravity of the forklift and the load.

The forklift will be stable as long as the combined center of gravity stays within what is known as the stability triangle. The stability triangle is formed by the three-point suspension system that runs along an imaginary line between the two front tires and the center of the rear axle. Even though the vehicle has four wheels, it is only supported at these three points.

The combined center of gravity has to be within the stability triangle in order for a forklift to be stable.



Line of action

It might help to imagine a line running straight up and down through the combined center of gravity. To remain stable, the bottom of this "line of action" has to be inside the stability triangle.

Many factors can impact whether or not the combined center of gravity remains in the stability triangle, including:

- · Load size
- Load position
- · Weight distribution
- Moving
- Braking
- Cornering
- Lifting
- Tilting

It's up to you to know the load capacity of the unit you drive, as well as the weight and dimensions of any load you carry. Also be familiar with the rest of the information on the vehicle's nameplate, as well as the operator's manual and any warning labels, so you have all the facts you need to operate that particular unit safely.

Bottom line: Stay within the forklift's rated parameters, and the combined center of gravity will stay within the stability triangle, and the unit will be stable.

Forklift controls

Get a good feel for the controls before you operate a forklift for the first time. These include:

- · Forward and reverse directional controls
- · Lift controls
- · Accelerator and brake pedals
- · Parking brake

Inspecting Your Forklift

No matter how busy you are, you're required to inspect your vehicle for defects and safety hazards at least daily before placing it in service. If your vehicle operates around the clock, you must inspect it at the end of every shift. Given the heavy loads a forklift carries, even a seemingly small defect could lead to a serious crash.

Always follow inspection guidelines from the forklift manufacturer and your employer. Using a checklist helps ensure that you don't miss any critical steps and gives you peace of mind that your unit is ready to operate. Complete your inspection in two parts:

1. Pre-operation or walk-around inspection

- Tires: Examine tread and walls to see that they're in good condition.
- ✓ Cables, belts and hoses: Inspect for defects or signs of excessive wear, such as cracks, pinholes or leaks.

- ✓ Forks, backrest, mast and overhead guard: Look for irregularities like cracks, dents or broken welds.
- ✓ Fluid levels: Check for signs of leaks.
- Nameplate and warning labels: Make sure these are readable.



2. Operational inspection

- Mounting: Always face the unit and use three points of contact (typically both hands and one foot as you climb aboard).
- ✓ Seatbelt: Check the condition and fasten it securely. If the unit has a seatbelt or lap bar, you're required to use it.
- ✓ Horn: See that it's working.
- ✓ Safety equipment: Make sure it's in good working order.
- ✓ Ignition: Always start a forklift from a seated (or operator's) position.
- Gauges, battery or fuel levels: Check to see that all are working properly.

- Controls: Make sure they are clearly labeled and functioning appropriately. Check out the lift, lower and tilt controls.
- Lights: Check that all are working.
- Brake pedal: Engage pedal to see that it'll stop the vehicle smoothly and reliably.
- Parking brake: Test to see that it's functional.
- Steering: Inspect for free play or stiffness that can compromise control.
- ✓ Floor under unit: Move the unit and look for leaks that could indicate a problem with the hydraulics or create a slipping hazard.
- Exhaust: Check for sparks, flames or unusual noises.

If you found anything wrong during your inspection, note it according to your company's procedures, and don't operate the unit until it gets fixed by authorized personnel.

Picking up a Load

To help prevent your forklift from tipping while picking up a load, take these safety precautions:

- Wear any required personal protective equipment (PPE).
- Mount and dismount using three points of contact.
- Fasten your seatbelt or use the lap bar.
- Be sure you know exactly what you'll be lifting. Is it within the capacity limits for the forklift? Is it balanced? Will it be secure?
- If there's any possibility that the load might fall backwards, make sure there's a load backrest extension in place.
- If the load has an uneven shape, be aware of any special stacking requirements before you pick it up.
- Check for overhead obstructions—are there any lights, pipes or wires in the way? Plan ahead to avoid them.

Safety Alert:

If you drive a sit-down unit, never attempt to jump off while it's tipping over—you could be pinned by the unit or the load. Instead, hang on to the steering wheel and lean *away* from the direction you're falling. This will help keep you, and all your limbs, safely inside the cage.

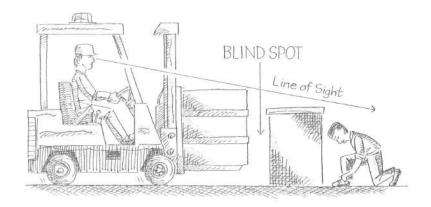
To lift the load:

- Set the width of the forks as far apart as possible under the load to evenly distribute the weight.
- Drop the forks and slowly position them under the load, driving forward until the load is resting against the backrest.
- Only raise or lower the forks when the lift truck is stopped.
- Help stabilize the load by tilting it back so it stays tight against the backrest.
- If you're lifting from a rack, back out slowly until you've cleared the rack and any other obstacles.
- Slowly lower the load to prepare it to move.

Traveling with a Load

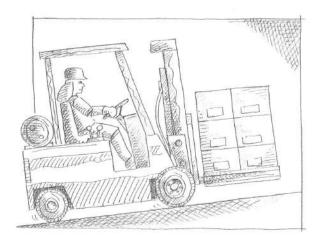
When operating a forklift, always pay close attention to what's going on around you, especially when you're traveling. Some general rules for moving and maneuvering safely:

- Load height: The lower the load, the more stable it is.
 Always travel with the forks and the load at the lowest safe height. That's usually about two to four inches off the ground, though you may have to raise them slightly to travel over bumps or seams.
- Raising and lowering loads: Never raise or lower the load while you're in motion. Your combined center of gravity will become a moving target, and one you may not be able to control.



- Line of sight: Always look in the direction of travel, and keep a clear view of your path. Even without a load, visibility is somewhat restricted by the forklift apparatus. Once you add a load, your line of sight can be severely impaired.
 - If you can, split stacked or large loads to move them.
 - If you can't split the load and it blocks your view, travel in reverse and use a spotter if necessary.
 - Spotters must be able to quickly notify you of hazards. You and the spotter must be on the same page when it comes to hand signals.
- Cornering: Your forklift has rear steering, so its rear end
 will swing wide when cornering. The opposite is true when
 you're backing a forklift. When backing around a corner,
 the front of the load will swing. Make sure there's plenty of
 clearance.
- Traveling speed: Safe speed for a forklift depends on what you're moving, available space and other traffic. Bumps, depressions or debris may also come into play. It's not easy to stop or swerve in a heavy forklift. Even an empty forklift can tip over if you swerve or corner too fast. Always go slow enough to maneuver and stop safely at any time.

 Surface hazards: Watch for wet, oily or icy surfaces along your route—avoid these hazards when you can, and get someone to clean them up as soon as possible.



- Ramps or inclines: Ramps or inclines are hazardous and require special attention.
 - o If you drive with a load on a ramp or incline, keep the load on the uphill side. Otherwise, the unit's weight may shift forward and off the rear "steer" wheels, compromising your control. It could also shift your load forward, causing the load to fall off or the forklift to tip.
 - When traveling on a ramp or incline without a load, the forks should point downgrade, regardless of direction of travel.
 - Avoid surfaces that would cause the truck to tilt sideways—it's a very short distance from a tilt to a tip-over.
 - Never turn on a ramp or incline.
- Docks and platforms: Keep a safe distance from the edge of ramps or dock platforms.
- Railroad tracks: Approach the tracks at a 45 degree angle to avoid getting stuck or losing balance.

· Other forklifts:

- When traveling among other forklifts, keep a distance of at least three forklift lengths in front of and behind you.
- Don't pass another forklift traveling in the same direction if you're at an intersection, a blind spot or any other dangerous location. In fact, it's safer just to avoid passing all together.
- Stunt driving: Stunt driving or horseplay is never acceptable.
- Protective frame: Never travel with any part of your body outside of the protective frame—a hand or foot could easily get pinched or crushed.
- · Pedestrians: Pedestrians always have the right-of-way.
 - Be on constant alert for pedestrians.
 - Use the convex mirrors if your workplace has them.
 - Sound the horn and proceed with care at intersections.
 - Never approach someone head-on who's standing in front of a bench, wall or other fixed object. Your forklift could lurch forward and pin or crush them. Instead, approach parallel to the person and the fixed object.
 - Don't let anyone walk under your raised forks (even if you're not carrying a load).
 - Never give anyone a ride on your forklift unless it's designed for passengers.

Placing a Load

Common sense should rule when placing a load. Your goal is to ensure that your load is safe and stable.

Before placing the load:

 Make sure the surface where the load is to be placed is flat and sturdy so the load won't tilt.

- If the load is going in a rack or storage loft, be sure the load will be safely supported.
- Check the rack frame and decking. If it's damaged, wait until it's been repaired before placing the load.
- Before stacking, see that the bottom pallets are in good condition and able to support the additional weight.
- Never place heavy loads on top of light loads.



To place a load:

- Stop in front of your destination.
- Look for overhead obstructions and, if there aren't any, slowly raise the load to the height required.
- Stay on the forklift and at the controls whenever you raise a load.
- · Position the load and drive slowly forward.
- · Lower the load. Place it square and straight.
- Once the load settles, look for pedestrians or obstacles in your path, then back up slowly.

- Don't turn the forklift or change the fork height until you're sure the forks are clear of the pallet.
- Lower the forks before you turn or drive away.

Parking a Forklift

When parking a forklift, be a safe and courteous co-worker. Never park in front of walkways, stairways or fire exits, and lower the forks to the ground so they don't become a tripping hazard. If you're parked on an incline, chock the wheels.

There are rules every operator must follow when leaving a fork-lift:

- If you'll be staying within 25 feet of the forklift
 - Lower the forks
 - Set the controls to neutral
 - Set the parking brake
- If you'll be more than 25 feet away, or the forklift will be out of your line of sight
 - Lower the forks
 - Set the controls to neutral
 - Set the parking brake
 - Turn the unit off
- Follow your company's policy for managing the keys.

Working in a Truck, Trailer or Railcar

When loading or unloading a truck, trailer or railroad car, follow these rules to help avoid surprises:

- Interior Inspection: Walk in and inspect the interior. It should be well lit so you can see what you're doing.
 - Check the floor for trash, loose objects or obstructions.

- Look for holes or weak floors—heavy forklifts have been known to drop right through a faulty trailer floor.
- Check overhead clearance.
- If anything looks unsafe, don't drive in until the situation is corrected.
- Dock plates: You may need a dock plate to bridge the gap between the dock and a trailer.
 - Check to see that the dock plate is designed for the combined weight of the load, the lifting device and you.
 - Inspect the dock plate—look for cracks, bends or other signs of damage.
 - O Portable dock plates should allow at least 8 inches of overlap on each end. See that it's stable and secure before you drive over it. Most dock plates have a vertical divider to hold them in place between the trailer and the dock.
- Stabilizing the truck, trailer or railcar: Make sure the unit you're loading or unloading is stable and properly secured, and the engine is shut off, before you begin.
 - Options you may encounter:
 - A system mounted to the dock that clamps on to the trailer's rear impact guard. It indicates when the system is engaged so truck drivers know whether it's safe to move the vehicle or not.
 - A restraint that latches on to the rear wheels of the truck or trailer. These are useful when the trailer doesn't have an impact guard.
 - o If you don't have a restraining system with indicator lights, post signs clearly warning not to move the vehicle, and place wheel chocks in front of the rear wheels.
 - Downward-sloping pavement is not a substitute for wheel chocks or other restraint systems.

- O Constant loading and unloading activity may loosen the wheel chocks. Even with chocks in place, a trailer may still slowly creep or "walk away" from the dock. Make regular checks to be sure there's no movement.
- Trailer creep is even more of a problem on trailers left at the dock without a tractor. It's especially important to use a restraining device here, if possible.
- of If there's no tractor attached, don't rely on the trailer's landing gear alone to keep the trailer stable. Use trailer jacks to prevent the trailer from upending or collapsing when you drive the forklift to the front of the trailer.
- See your supervisor for securing rail cars.
- Hazardous emissions: Carbon monoxide or other hazardous emissions may build up in enclosed spaces during loading or unloading. This is a potentially deadly situation you need to avoid.
 - Don't operate forklifts inside vehicles or other enclosed spaces for long periods without proper ventilation.
 - If you experience headaches, nausea or dizziness, they may be signs of overexposure. Seek medical attention immediately.
 - o If you aren't sure whether an area has enough ventilation, check with your supervisor.

Think of trucks, trailers and railcars as an extension of your facility, and take the necessary steps to make sure they're safe.

Charging and Refueling

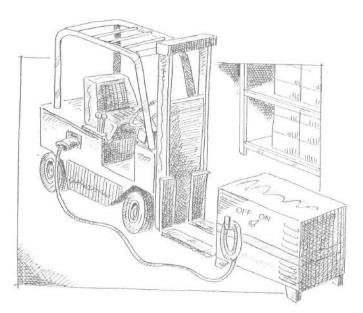
Depending on how your unit is powered, you may need to refuel, charge or change a battery or cylinder during your shift. This should only be done in designated areas, and only by someone who has been properly trained. Some precautions to keep in mind:

Smoking: Never smoke in this area.

- PPE: Use PPE. This may include eye and face protection, gloves and an apron.
- Emergency Equipment: Know where the eyewash station is, as well as the shower and other emergency equipment, like spill clean-up supplies.

Changing the battery on an electric forklift:

- Position the forklift in the changing area, turn off the engine and set the brake.
- Make sure the battery is securely attached to the hoist before lifting.
- Stand clear as the battery is moved in and out of position.



Charging the battery on an electric forklift:

- · Be sure the ventilation system is working properly.
- If the battery is being charged on the forklift, uncover the battery compartment to prevent heat or hydrogen gas buildup.
- Make sure the vent caps aren't plugged.

- Turn off the battery charger before connecting it to the battery.
- Make certain no metal objects contact the battery terminals.
- If you're diluting concentrated sulphuric acid with water, always add acid to the water, not water to the acid. Adding water to acid could cause a violent reaction or explosion. If you need to add water to top off a battery you can do it safely (with the proper precautions) because the acid in a forklift battery is already diluted.
- Wear safety goggles and a face shield, plus gloves and an apron, to protect against electrolyte splash or spray.

Changing cylinders on liquid petroleum gas (LPG)-powered forklifts:

- Wear protective gloves and eye protection to avoid freeze burn from contact with LPG.
- Before you start, close the fuel line valve on the cylinder, then run the engine until it stops to empty the connection hose.
- Shut off the ignition, disconnect the hose and the holding straps and remove the empty cylinder.
- Never use metal tools to change a cylinder. One small spark could ignite a fire or explosion.
- Replace the empty cylinder with a full one in the proper position.
- The locating pin should engage the hole in the cylinder handle so the relief valve is straight up in the 12 o'clock position.
- Connect the holding straps, tighten the connecting nut and check the hose to make sure it's tight.
- Slowly open the valve on the cylinder part way and check for leaks. Smell, listen and look for leaks. You can also use a solution of soap and water to test the seal. Never use matches or a flame.

- If the valve leaks:
 - o Tighten the nut and continue.
 - If it still leaks, change the cylinder.
 - o If it still leaks after that, have the hose changed or repaired.
- Once there are no leaks, slowly open the valve all the way, secure the cylinder and start the engine.

Fueling gasoline or diesel forklifts:

- Make sure you have the proper fuel.
- Turn the engine off and set the parking brake.
- Don't over-fill the tank.
- Replace the fuel cap and clean up any spilled fuel before starting the engine.

Any time you're charging a battery, changing a battery or LPG cylinder, or refueling a forklift, be absolutely certain you know the safest way to do it. If you have any doubts or questions, don't take the risk—ask your supervisor.

Maintenance and Modifications

In addition to the daily inspections you conduct on your forklift, your company will have authorized personnel perform routine checks and maintenance tasks to keep the forklift in safe operating condition. *Do your part*: Pay attention to how your unit operates, and report any problems.

Any modifications that affect the safe operation or capacity of a forklift—like non-factory-installed lifting attachments—must be approved in writing by the equipment manufacturer. Those changes must be printed on the unit's nameplate and in the operating instructions, so you know how the changes affect the units' load capacity.

These measures are taken so you can be certain that your forklift is capable of doing the job you need it to do.

Specialized Units and Attachments

While sit-down, counterbalanced forklifts are perhaps the most common type, you may encounter other industrial trucks in your workplace. These include stand-up rider trucks, order pickers or powered hand trucks. You may also find specialized attachments for handling things like drums or slip-sheeted loads.

Each of these units has its own purpose and set of safety considerations, and all are covered under the OSHA standard. That means you must be trained and authorized to use any one of them—even a powered pallet jack.

Stand-up rider trucks

There are several types of stand-up units, including:

- Counterbalanced rider type used for standard loads
- Narrow aisle types used in tight spaces, such as racking aisles
- Pallet or platform pallet trucks intended primarily for horizontal movement

Follow the general principles of safe forklift operation for each of these units, which includes reviewing the instructions, warnings and precautions in the operator's manual.

It's critical to know that stand-up forklifts pose a unique type of hazard—operators may be crushed if the unit underrides warehouse shelving. It happens when operators back toward a storage rack, crossbar or similar obstruction. If the operator drives too far, the forklift can pass beneath the horizontal crossbar, causing it to enter the operator's compartment. The unit may have special attachments, like rear post guards, as an added safety precaution.

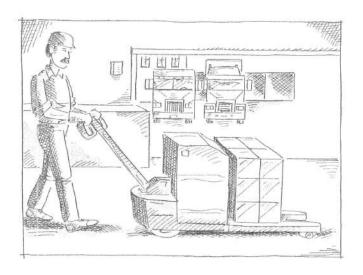
Safety Alert:

Standup forklifts differ from the sit-down type when it comes to tip-overs. While you never want to attempt to jump off a sit-down forklift, you should get clear of a stand-up unit during a tip-over to avoid injury.

High-lift order pickers

Typically used to "pick" less-than-pallet-load quantities off tall racking, these unique machines require extra precautions because the operator is actually being lifted into the air.

First and foremost, always use proper fall protection equipment with order pickers. Also keep in mind that the cab may become unstable if raised to the maximum height.



Powered hand trucks

Powered hand trucks move loads controlled by a walking operator. These include pallet jacks, pallet trucks and hand trucks.

Powered hand trucks are designed for handling low loads on hard, level surfaces. The steering handle on these units regulates the lift and lower functions, speed, direction, steering and braking. The controls should return to neutral when you remove your hands.

Additional guidelines:

- Never operate faster than a normal walking pace and, when you stop, the unit should stop. Never let it move on its own.
- When traveling down an incline or entering a confined area, keep the unit directly in front of you as you walk forward.
- In special circumstances where you have to travel down an incline with the load end up grade, walk to the side of the tongue.
- Always keep your hands in a safe position on the control handle, as recommended by the manufacturer. Pay attention to the position of the load, particularly when it's trailing.

Just like any other mechanical lifting device, a powered hand truck can tip over or lose its load or strike a pedestrian.

Specialized attachments

If you're moving something other than pallets, there's probably a specialized attachment to handle the job.

Slipsheet handlers, barrel clamps, roll handlers, container handlers and personnel platforms are all commonly used in industrial settings. If your forklift has any of these attachments, you need to know how they affect the unit's capacity rating and stability. For attachments that allow personnel to be lifted, there are very strict safety measures that must be in place.

If it isn't required or offered by your company, ask your supervisor for training on how to properly use any attachments. *Remember*: Just because you're trained on one type

of powered industrial truck doesn't mean you're qualified to operate another.

Hazardous Locations

Where chemicals or other hazardous substances are or can be present, special precautions must be taken to select the correct type of forklift.

To make the correct selection, you must know the type of location (known as Class), the specific chemical or substance, as well as the likelihood for the hazard to exist (Division). You also need to understand the Type Designation for forklifts.

Classes

- Class I location—may or does contain flammable gases or vapors.
- Class II location—may contain combustible dust.
- Class III location—may contain easily ignited fibers.
- Unclassified—Doesn't contain hazard conditions described in Class I, II, or III.

Within the Classes, there are Divisions providing an indication of the potential for the hazard.

Types/Designations

The OSHA standard specifies 11 designations of powered industrial trucks:

- Type D—Diesel powered; few safeguards against fire hazards.
- Type DS—Diesel powered; more safeguards than Type D, such as exhaust, fuel and electrical safety features.

- Type DY—Diesel powered; more safeguards than Type DS and has completely enclosed electrical equipment, and includes a temperature limitation feature.
- Type E—Electric powered; few safeguards against fire and electrical shock hazards.
- Type ES—Electric powered; more safeguards than Type E, such as spark-arresting features and suppression of surface sparks.
- Type EE—Electric powered; more safeguards than Type ES, by enclosing all electrical equipment.
- Type EX—Electric powered; constructed for use around certain flammable vapors, dusts and fibers (check with your supervisor for specifics).
- Type G—Gasoline powered; few safeguards against fire hazards.
- Type GS—Gasoline powered; more safeguards than Type G, such as fuel, exhaust and electrical system safety features.
- Type LP—LP gas powered; few safeguards against fire hazards.
- Type LPS—LP gas powered; more safeguards than Type LP, such as fuel, exhaust and electrical system safety features.

For guidance selecting the correct forklift for a given location, talk with your supervisor. Your employer will select forklifts based on the OSHA standard, fire codes, as well as guidance from the equipment manufacturer.

Lifting Employees

Only certain types of equipment, such as order pickers, are specifically designed to lift personnel.

If you want to lift personnel using a standard forklift, you should check with your supervisor. This practice must only be

done using a personnel platform/cage specifically designed for this purpose.

(NOTE: OSHA requires that employers obtain the manufacturer's written approval before making any modifications or additions that affect capacity and safe operation.)

Personnel platforms must have proper fall protection systems in place (e.g., railings or harness/lanyard), and they must be securely attached to the forks (e.g., by chain or clamp). In addition, strict safety and operating procedures must be observed.

Conclusion

Forklifts are powerful tools that do the heavy lifting needed to keep companies like yours moving. They're also dangerous machines unless they're operated by skilled, responsible operators. It's up to you to know—and follow—the rules of safe forklift operation to avoid any problems that might endanger your safety, or the safety of your co-workers.

That also means never operating a forklift unless you've gotten formal training and periodic evaluations as required by OSHA.

Remember:

- Treat forklifts with the respect they deserve.
- Know the capacity of your forklift and the weight of your load.
- · Be vigilant about what's going on around you.
- Follow the rules each and every time you use a forklift.

The awesome power of the forklift is in your hands. Use it wisely.