

Fermilab



Forklift Operator Training

Student Booklet

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Forklift Safety Guide

Presented by
Robert J. Schneider
Sheffield Safety & Loss Control

Types of Forklifts



- **Whenever you see this symbol in the presentation, it means that failure to follow the instructions can result in serious injury or death.**

OSHA standard that regulate forklifts
Safety rules developed under the Occupational Safety and Health Act (OSHA) regulate safe use of forklifts and other "powered industrial trucks" in the workplace can be found in 29 CFR 1910.178. This standard is available at the OSHA web site:
<http://www.osha.gov>

Robert J Schneider CSP, ARM, CHCM

- Board Certified Safety Professional with the American Society of Safety Engineers
- Associate in Risk Management with the American Insurance Institute
- Certified Hazard Control Manager with the International Board of Safety Manager Certification
- Corporate Safety Manager, High Rise Construction 1980's
- Regional Manager Risk Control Services T&F, HRH, WillisNA
- Director for Industrial Safety Training Sheffield Safety & Loss Control

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Introduction

Introduction

- ◆ A forklift is a powerful tool that allows one person to precisely lift and place large heavy loads with little effort. Using a tool such as a forklift, cart or hand truck instead of lifting and carrying items by hand can reduce the risk that you will suffer a back injury.
- ◆ However, there is great risk of injury or death when a forklift operator:
 - has not been trained in the principles of physics that allows it to lift heavy loads,
 - is not familiar with how a particular forklift operates,
 - operates the forklift carelessly, or
 - uses a forklift that is not safe due to malfunctioning or missing parts.



Introduction

Every year nearly 100 workers are killed and 20,000 are seriously injured in forklift mishaps. According to the National Traumatic Occupational Fatalities (NTOF) Surveillance System 1530 workers died from forklift-related accidents between 1980 and 2001. At least 22% of these deaths were caused by forklift overturns and another 20% to workers on foot being struck by the forklift. With well over one million forklifts in operation today, emphasis must be placed on both worker and pedestrian safety.



What happened?????



Types of Forklifts



Types of Forklifts

■ A forklift is a type of "powered industrial truck" covered by OSHA standards. Like other powered industrial trucks, its purpose is to move, carry, push, pull, and lift a material load then stack it or place it in a storage rack (tier). Forklifts come in many sizes and capacities. They can be powered by batteries, propane, gasoline, or diesel fuel. Some are designed to be used in a hazardous location or atmosphere where an ordinary forklift might cause a fire or explosion.

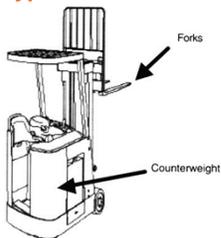


Types of Forklifts

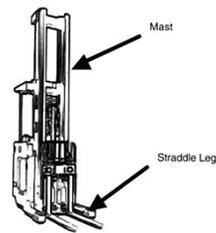
■ Powered industrial trucks are classified into seven types based on their characteristics. The next few slides are some illustrations of common forklifts that fit these classes.

- Class 1. Electric Motor, Rider, Counter-Balanced Trucks (Solid & 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 & Pneumatic Tires). There are no forklifts in this class
- Class 7. Rough Terrain Forklift Trucks (Pneumatic Tires)

Types of Forklifts



Stand Up Rider: Forklift has a counterbalance weight in the body. The rider stands inside the body of the forklift.
Example of:
Class 1. Electric Rider Counterbalanced Truck

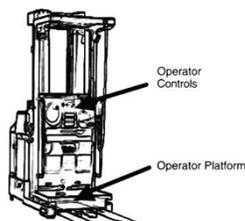


Stand Up Rider Narrow Aisle: The forklift has straddle legs on both sides of the forks to provide stability in the absence of a counterweight in the body.
Example of:
Class 2. Electric Narrow Aisle Truck

Types of Forklifts



Stand Up Reach Rider Narrow Aisle: Forks extend in and out as well up, down, and tilt.
Example of:
Class 2 Electric Narrow Aisle Truck

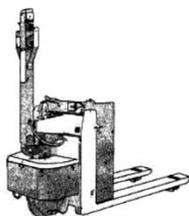


Stand Up Rider Order Picker: The operator stands on a platform in front and along with the controls is transported to the elevated location.
Example of:
Class 2 Electric Narrow Aisle Truck

Types of Forklifts

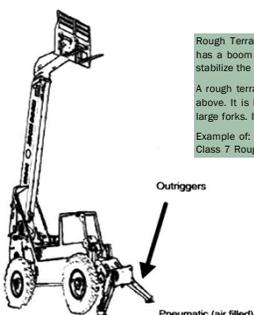


Sit Down Rider: The forklift has a counterbalance in the rear.
Example of:
Class 1 Truck if electric powered.
Class 4 Truck if internal combustion (gas, diesel or LP gas) powered with solid tires.
Class 5 Truck if internal combustion powered with pneumatic tires.



Motorized Hand Pallet Jack: A low lift (ground level) unit has forks or a platform. Some models allow the operator to stand on the back. Others, like this one are walked.
A high lift version has a mast and straddle legs.
Example of:
Class 3 Electric Motor Hand/Rider Truck

Types of Forklifts



Rough Terrain Reach Forklift: The forklift has large pneumatic tires. It has a boom which raises and extends. It has outriggers at the front to stabilize the forklift on soft or uneven ground.
A rough terrain forklift can also resemble a sit down rider as shown above. It is bigger with large pneumatic tires and a large mast with large forks. It is powered by an internal combustion engine.
Example of:
Class 7 Rough Terrain Forklift Truck

Types of Forklifts

◆ Sometimes special attachments are installed onto the forks to extend the reach, clamp a barrel, act as hoist, lift odd shaped items like a roll of carpet or even lift people.



Jib Crane Attachment



Hoist Attachment



Drum Grabber Attachment

Types of Forklifts



Carpet Lifting Attachment



Personnel Platform



- ◆ Using an unapproved attachment could alter the forklift's lifting and balance characteristics and lead to a forklift overturning.
- ◆ Whenever an attachment is used that could affect the capacity or safe operation of a forklift, its use must be approved by the forklift manufacturer. The employer must mark the forklift to show the new weight with attachment. The maximum capacity at the highest elevation must also be shown.

Training

Fermlab ES&H Policy

OBJECTIVE

Fermlab has developed a Powered Industrial Truck (PIT) Program to minimize the risk of employee injury and property damage loss from the use of Powered Industrial Trucks. It is Fermi Lab's intent to communicate and monitor appropriate standards of conduct in the performance of routine forklift operations.

APPLICABILITY/SCOPE

It is the responsibility of the management and the supervisor of Fermlab to ensure that all employees that operate PIT's are certified.

Fermlab ES&H Policy

- Truck-related training topics:
 - Operating instructions, warnings, and precautions for the types of truck the operator will be authorized to operate.
 - Differences between the truck and the automobile.
 - Truck controls and instrumentation: where they are located, what they do, and how they work.
 - Engine or motor operation.
 - Steering and maneuvering.
 - Visibility (including restrictions due to loading).
 - Fork and attachment adaptation, operation, and use limitations.
 - Vehicle capacity.
 - Vehicle stability.
 - Any vehicle inspection and maintenance that the operator will be required to perform.
 - Refueling and/or charging and recharging the batteries.

Fermlab ES&H Policy

- Workplace –Related Topics:
 - Surface conditions where the vehicle will be operated.
 - Composition of loads to be carried and load stability.
 - Load manipulation, stacking, and un-stacking.
 - Pedestrian traffic in areas where the vehicle will be operated.
 - Narrow aisles and other restricted places where the vehicle will be operated.
 - Hazardous (classified) locations where the vehicle will be operated.
 - Ramps and other sloped surfaces that could affect the vehicle's stability.
 - Closed environments and other areas where insufficient ventilation or poor vehicle maintenance could cause a buildup of carbon monoxide or diesel exhaust.
 - Other unique or potentially hazardous environmental conditions in the workplace that could affect safe operation.

Fermilab ES&H Policy

- Operating Procedures
- General Rules
- Lift trucks shall not be driven up to anyone standing in front of a bench or other fixed object.
- All body parts (hands, arms, head, feet, legs, etc.) are prohibited outside the operator compartment of the truck, between the uprights of the mast or within the reach mechanism or other attachments of the truck.
- Passengers are not allowed to ride on powered industrial trucks.
- Operators shall not block access to fire or emergency exits, stairways, fire equipment or electrical panels.
- Under all travel conditions; operate the truck at a speed that will permit it to be brought to a stop in a safe manner.



Fermilab ES&H Policy

- Stunt driving and horseplay shall be prohibited.
- The operator must slow down for wet and slippery floors.
- Running over loose objects on the floor is prohibited.
- The operator is responsible for cleaning up all fluid leaks (oil, hydraulic fluid, etc.) from the floor.
- Operators are required to report all lift truck accidents involving personnel, building structures and equipment to shift leaders and department managers.
- The operator shall handle loads only within the capacity rating of the truck.
- Lift trucks shall not be used for any purpose other than what they were designed.



Forklift Operators Must Be Trained



- **An untrained operator of a forklift can be as dangerous as an unlicensed operator of a motor vehicle.**
- OSHA standards require that the employer ensure that a forklift operator is competent to operate the forklift he or she is assigned to use. The employer must document operator training and an evaluation of the operator's performance while using the forklift.
- Refresher training must be given if the operator is observed operating the truck in an unsafe manner, is involved in an accident, near miss, or is assigned a different type of truck.



Forklift operators must be trained in the operating instructions, warnings and precautions for the types of forklifts they will be authorized to use.



Fermilab ES&H Policy

- Refresher Training
- Refresher training, including an evaluation of the effectiveness of that training shall be conducted when needed to ensure that the operator has the knowledge and skills needed to operate the powered industrial truck safely. 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.
 - A condition in the workplace changes in a manner that could affect safe operation of the truck.



Fermilab ES&H Policy

- No person shall be allowed to stand or pass under the elevated portion of any truck whether empty or loaded.
- Lift trucks shall not be started or any of its functions or attachments operated from any position other than from the designated operator's position.
- The operator shall look 360 degrees traveling with a lift truck, especially when backing up.
- The operator shall observe all traffic regulations and under normal traffic conditions, keep to the right.
- A safe distance of no less than three truck lengths shall be maintained when following another lift truck and additional truck length per adverse condition and the operator shall keep his/her truck under control at all times and additional truck lengths per adverse conditions.
- The operator shall not pass another truck traveling in the same direction.



Fermilab ES&H Policy

- Operators shall slow down and sound the horn at cross aisles and other locations where vision is obstructed.
- The operator must keep a clear view of the path of travel and observe for other traffic, personnel and safe clearances. If the load being carried obstructs forward view, travel with the load trailing (except when ascending a ramp or entering a trailer).
- When the forks are empty, the operator shall travel with the forks at a negative pitch as low to the floor as practical. The operator is responsible for adjusting the height of the forks to a safe level when the operating terrain warrants.
- When traveling with a load on the forks, the operator shall travel with the load as low to the floor as practical with the load tilted slightly for improved stability.
- At no time shall a powered industrial lift truck be parked on inclines, ramps or dock plates.



Fermilab ES&H Policy

- A powered industrial truck is considered to be ATTENDED when the operator is less than 25 feet from the truck, which remains in his view. Before leaving the operator's position, the operator shall:
 - Bring truck to a complete Stop.
 - Place directional controls in neutral.
 - Apply the parking brake.
 - Lower the forks or attachments fully until resting completely flat on the floor. When lowering unloaded forks, the forks shall be tilted forward first and then lowered to the ground until the tips of the forks come in contact with the floor.
- A powered industrial truck is considered to be UNATTENDED when the operator is more than 25 feet from the truck which remains in his view. Or whenever the operator leaves the truck and it is not in view regardless of distance from the truck. Before leaving the operator's position in the instance, the operator shall:
 - Follow the procedures in item above
 - Stop the engine or turn off the controls

Fermilab ES&H Policy

- If the lift truck is not put on a charge during off shifts or weekends, the operator shall disconnect the battery plug from the truck plug. NOTE: During normal production operation, the lift truck may remain plugged into the battery when left unattended.
- To change an LP gas tank, the operator shall:
 - Put on leather work gloves and goggles.
 - Disconnect lift truck valve from the employ LP cylinder.
 - Replace with full cylinder.
 - NOTE: The pin on the lift truck must fit into the cut hole(s) provided on the gas cylinder. THIS IS REQUIRED BY LAW.
 - Strap in the cylinder and reconnect the truck valve securely to the cylinder in outlet.
- Open cylinder valve and listen for leaks.
- If leaking, close cylinder valve and slowly uncouple the fuel valve. Try to reconnect. If still leaking, try a different cylinder and notify shift leader or department management of faulty cylinder.
- If no leaks are present, lift truck may be utilized.
- Lift trucks shall not be operated with a leak in the fuel system until the leak has been corrected.

Fermilab ES&H Policy

- The operator shall use the following back up procedure and sequence:
 - Pivot at the waist and inspect the area of operation in the rear of the fork truck. Watching for obstructions and pedestrians.
 - Blow the horn to alert any pedestrians that may or may not be visible.
 - Engage the directional lever to the reverse position.
 - Concentrate on the removal of the forks from the load to avoid any load disturbance, as you back the fork truck out of the load.
 - Stop the fork truck 18" to 24" away from the loads resting location and lower the forks to the proper travel height and angle.

Fermilab ES&H Policy

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- At no time shall a powered industrial lift truck be parked on inclines, ramps or dock plates.



Fermilab ES&H Policy

- During load placement, the operator shall:
 - Square the fork truck with the load resting location.
 - Stop the fork truck 18" to 24" away from the load resting location.
 - Raise the load to proper entry height.
 - Drive forward with the load and position the load over its resting location.
 - Lower the load to a height of 4" if possible.
 - Tilt the load forward to a level position.
 - Lower the load to its resting position.
 - Back up the unit using proper back up procedures and sequence.



Fermilab ES&H Policy

- During load retrieving, the operator shall:
 - Square the fork truck with the load resting location.
 - Stop the fork truck 18" to 24" away from the load resting location.
 - Raise the forks to the proper entry height.
 - Enter the load and maintain the clearance around the forks to avoid load disturbance.
 - Raise the load so it is completely suspended from its resting platform.
 - Tilt the load back.
 - Visually inspect the rear area of the fork truck to ensure no pedestrians are behind or around the unit.
 - Back up the unit using proper back up procedures and sequence.
 - Back up the fork truck 18" to 24" and stop.
 - Lower the load to the proper travel height.



How a Forklift Works

How a Forklift Works

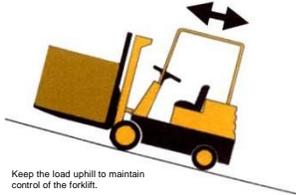
- Driving a forklift is different than driving a car
- In a car or truck, the front wheels steer the vehicle. A forklift has the steering wheels in the rear. The rear end of the forklift swings in a circle around the front wheels that support most of the load. The operator must check that there is room for the rear end to swing when making turns. This clearance can be maintained in your workplace by permanently marking aisles with painted lines or arranging storage racks in a way that creates obvious aisles for travel. However, these marked aisles will only be effective if you keep them clear of stored materials, which can gradually encroach as space is needed.
- A forklift is not as responsive as a car when turning the steering wheel. Rear steering makes it difficult to stop a forklift quickly or swerve and still maintain control. It is important, then not to drive a forklift fast or round corners quickly.



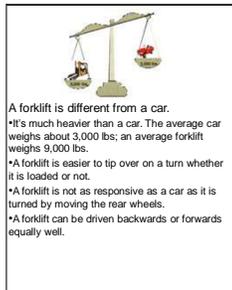
Mark aisles to help keep adequate clearance for forklifts.

Types of Forklifts

-  Driving with the load downhill can result in loss of the load and control of the forklift.



Keep the load uphill to maintain control of the forklift.



A forklift is different from a car.

- It's much heavier than a car. The average car weighs about 3,000 lbs; an average forklift weighs 9,000 lbs.
- A forklift is easier to tip over on a turn whether it is loaded or not.
- A forklift is not as responsive as a car as it is turned by moving the rear wheels.
- A forklift can be driven backwards or forwards equally well.

If you drive a forklift on an incline, you must keep the load on the uphill side. Otherwise, you may have no weight on the wheels that steer and can lose control! The load could also fall off or cause the forklift to tip.

Forklift Safety Features

Often a large forklift load obstructs the driver's view in one direction. It may be necessary to travel long distances with the load to the rear (in reverse for most forklifts).



A backrest extension keeps the load from falling rearward.

A backrest extension on the forks prevents part of the load from falling rearward toward the operator. This is required when loads are lifted high and the type of load would allow all or part of it to fall to the rear under conditions such as acceleration, sudden stops or driving on an uneven surface.

- Required when handling small objects or unbanded units
- Openings cannot be wider than 6 inches
- Load cannot obstruct your vision
- Must be capable in size and strength to prevent the load, or any part of the load from falling toward the operator.

Forklift Safety Features

An overhead guard prevents an object on the forks or on a high rack from falling onto the operator while picking or placing a load at elevation. Most vertical mast forklifts are equipped with the falling object protective structure; other forklifts, such as rough terrain, are equipped with roll over protective structures. The guard is not designed to withstand the impact from a full load. It can be effective in deflecting small packages. It is required on all forklifts that can lift a load above the operator unless conditions such as clearances would not allow the forklift to be used.



An overhead guard can deflect objects falling from above.

- Must be large enough to extend over the operator under normal circumstances
- Must not interfere with your vision
- Guard openings cannot be larger than 6 inches in one of the two dimensions.

Forklift Safety Features

Operator restraints will hold you in the seat if you strike an object or if the forklift overturns. The powered industrial truck standard does not specifically require the use of seat belts, but other OSHA standards state employers must:



Wear a seat belt to keep you inside if your forklift overturns.

- Protect workers from serious and recognized hazards
 - Require all employees to make full use of safety devices.
 - Adhere to equipment manufacturer recommendations
- Since 1992, forklift manufacturers have been required to equip new forklifts with operator restraints such as seat belts. Many forklift manufacturers offer retrofit kits for older forklifts.
- Femilab ES&H Policy requires seat belt use where present.

Forklift Safety Features

If your forklift begins to overturn, you are safest when you stay in the seat, hold on firmly, and lean in the opposite direction of the fall rather than trying to jump. Many fatal accidents happened when the operator tried to jump. As the forklift begins to tip, it will move slowly tricking the operator into believing there is time to jump. Once the center of gravity is past the wheel line, the forklift will rapidly fall. The forklift's overhead guard will quickly pin or crush a jumping operator.

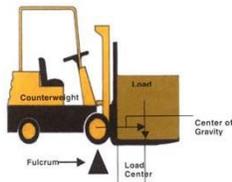


Failure to wear a seat belt can result in the operator being thrown outside the protective cage in the event of overturn. If your forklift has a restraint such as a seat belt or lap bar, you must use it.



A forklift operator was struck and killed by the overhead guard when he attempted to jump as the forklift overturned.

How Forklifts Safely Carry and Lift Heavy Loads



A forklift is counterbalanced and operates on a teeter-totter principle. A load on a beam (the forks) supported by a fulcrum (the front wheels) is counterbalanced by a weight on the other end of the beam (the forklift body and counterweight built into it).

Forklifts are designed and manufactured deliberately unbalanced! The load of the forks must be balanced by the weight of the lift truck in order for this principle to work. We need a proper load to balance our "teeter-totter." You balance at both ends! A properly loaded lift truck does not exceed the rated capacity of the truck as listed on the trucks data plate.

How Forklifts Safely Carry and Lift Heavy Loads

Whether a forklift will safely carry a load or will tip forward can be determined by comparing the "moment" (a tendency to produce motion) of both the load and the forklift. Moment equals the distance from the fulcrum to the center of gravity (the point where all the weight is concentrated) times the weight.

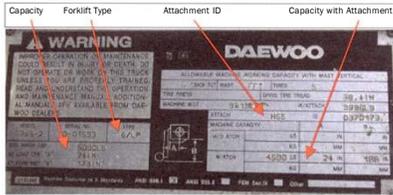
Moment (tendency to produce motion) expressed in "inch-pounds" = Distance from fulcrum to center of gravity (load center) x weight of the load

- Moment is the distance measured from the point at which the truck will tip over to the objects line of action.
- Example: an evenly distributed 36" wide load on the forks has a center of gravity that is 18" from the face of the forks.¹ If the load weighs 4000 lbs. then the load moment will be (18" x 4000 lbs.) = 72,000 inch-pounds.
- If the "moment" of the forklift is greater than or equal to the 72,000 inch pounds of the load then the forklift will safely carry the load.

¹ The fulcrum point is actually at the center of the wheel. Forklift load charts, however, are adjusted to allow measuring from the face of the forks.

How Forklifts Safely Carry and Lift Heavy Loads

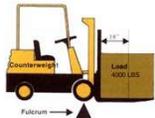
- Forklifts have a capacity plate to tell the user what loads are safe to lift. If the plate says the capacity is 30,000 lbs. or less then the capacity is rated for a load with a center of gravity 24" from the face of the forks. If the forklift capacity is greater than 30,000 lbs. then the label will rate the load at a 36" or 48" center of gravity since larger forklifts usually lift physically larger loads.



This LP Gas forklift can safely lift 5000 lbs. 173" high with a center of gravity 24" from the face of the forks. With an attachment labeled "HSS," the safe load drops to 4500 lbs.

How Forklifts Safely Carry and Lift Heavy Loads

- Using the example and capacity plate on the previous slide, a forklift rated at 5000 lbs would safely lift a load with a moment of up to (24" x 5000 lbs.) = 120,000 inch-pounds. In this case the load would be safe to lift.

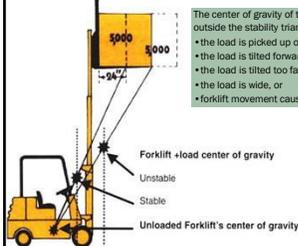


Forklift Moment = (24" x 5000 lbs.) = 120,000 inch-pounds
 Load Moment = (18" x 4000 lbs.) = 72,000 inch-pounds
 The load is safe to lift because the load moment is less than forklift moment.

- However, if the 4000 lb. load was 66" wide, the load moment would be (33" x 4000 lb.) = 132,000 inch-pounds which would be greater than the moment of the forklift. The forklift would tip forward.
- As the load is raised, it becomes possible for the forklift to fall to the side as well as tip forward. The operator must consider the center of gravity of the forklift and load together. This combined center of gravity moves as the load is moved and as the forklift travels over surfaces that are rough or inclined.

How Forklifts Safely Carry and Lift Heavy Loads

- Forklifts have a "stability triangle." The sides of the triangle as shown in the illustration are formed by the center of each front wheel and the center of the rear wheel or at the center of the axle if there are two rear wheels. A vertical line extending from the center of gravity of the vehicle-load combination must be inside of the stability triangle to prevent the forklift from tipping forward, falling sideways or dropping its load.



The center of gravity of the forklift-load combination can move outside the stability triangle if:

- the load is picked up on the tip of the forks,
- the load is tilted forward,
- the load is tilted too far back when raised,
- the load is wide, or
- forklift movement causes the center of gravity to shift.



How Forklifts Safely Carry and Lift Heavy Loads

These actions will have the following affects:

Action	Center of gravity moves:
Tilting the load forward	Toward the front axle
Raising the load while tilted forward	
Driving on an incline with the load downhill	
Stopping forward travel or accelerating backward	
Tilting the load back	Toward the rear axle
Raising the load while tilted back	
Driving on an incline with the load uphill	
Accelerating forward or stopping backward travel	
Driving across an inclined surface	Toward the downhill side of the triangle
Driving across a rough or uneven surface	Toward the rut or low side of the triangle
Turning	Toward the side now facing the original direction of travel

How Forklifts Safely Carry and Lift Heavy Loads



This list represents operator procedures that reduce the risk of overturn, collision or loss of the load.
To prevent your forklift from tipping over, falling sideways or dropping its load:

- Make sure the load is stable and safely arranged on the forks.
- Do not tilt the forks forward except with picking up or depositing a load.
- Tilt the load backward only enough to stabilize the load.
- Keep the load low just above the pavement with forks tilted back when traveling.
- Cross railroad tracks diagonally when possible.
- Enter elevators squarely.
- Keep the load uphill when going up or down an incline.
- Drive at a speed that will allow you to stop safely within the stability triangle.
- Slow down on wet or slippery surfaces.
- Slow down to make turns.
- Avoid driving over loose objects or on surfaces with ruts and holes.



Safely Using a Forklift

Pre-use Inspection



- Failure to check that the forklift is operating properly can lead to an accident as the description below demonstrates.

A Defective Forklift Can Kill
September 1996

A 43-year old president of an advertising sign company was killed while using a forklift to unload steel tubing from a flatbed trailer. He was driving about 5 miles per hour beside the trailer on a concrete driveway with a 3% grade. The victim turned the forklift behind the trailer. The forklift began to turn over on its side. The victim jumped from the seat toward the driveway. The victim's head and neck were pinned to the driveway by the forklift's overhead guard. An inspection of the forklift revealed that the right-side rear axle stop was damaged before the accident and was not restricting forklift lateral sway as it turned. Also, slack in the steering mechanism required the operator to turn the steering wheel slightly more than half a revolution before the wheels started to turn. The forklift was not equipped with a seat belt.

From NIOSH Alert 2000-112

Pre-use Inspection

- The forklift must be checked for defects daily—usually by the operator before beginning shift. Even if you operate a forklift safely, a defect can cause or contribute to a serious accident. Some things to look for are:
 - Is the horn working? Sound the horn at intersections and wherever vision is obstructed.
 - Are there hydraulic leaks in the mast or elsewhere? These could cause slipping hazards or lead to hydraulic failure.
 - Are fuel connections tight and battery terminals covered? Dropping a piece of metal across battery terminals can cause an explosion.
 - Is there a lot of lint, grease, oil or other material on the forklift that could catch on fire?
 - Do sparks or flames come out from the exhaust system?
 - Does the engine show signs of overheating?
 - Are tires at proper pressure and free of damage? A tire with low pressure or a tire failure can cause a forklift to tip or fall when a load is high.

Pre-use Inspection

- Do all controls such as lift, lower, and tilt work smoothly? Are they labeled?
- Is there any deformation or cracks in the forks, mast, overhead guard, or backrest?
- Are lights operating if used at night or in dark locations?
- Is steering responsive? A lot of play or hard steering will reduce your control.
- Do brakes stop smoothly and reliably? Sudden stops can cause tipping.
- Does the parking brake hold the forklift on an incline?
- Are seat belts (if equipped) working and accessible?
- Is the load capacity plate readable?
- Trucks must be removed from service when found to be in need of repair, defective, or otherwise unsafe. Any defects that would affect safety must be corrected before the forklift is returned to service. A sample operator pre-use inspection checklist is located on the next 2 slides.

Traveling

- ▶ The basic rule for traveling is that you maintain control of your forklift at all times. Other rules include:
 - Operate a forklift only while in the seat or operator's station. Never start it or operate the controls while standing beside the forklift.
 - Never allow passengers unless the forklift was designed for a passenger.
 - Do not put any part of your body between the uprights of the mast or when traveling, outside of the forklift frame.
 - Always look in the direction of travel and keep a clear view of the travel path. Travel in reverse if the load blocks your view.
 - Always observe posted speed limits at your workplace. A forklift should not be driven faster than a quick walking pace.

Traveling

- Keep a distance of at least three forklift lengths between you any forklift traveling in front of you.
- Do not pass a forklift traveling in the same direction if it is at a blind spot, intersection or other dangerous location.
- Never drive a forklift up to anyone in front of a bench or other fixed object.
- Never allow anyone to walk or stand under the elevated forks—even if the forks are not carrying a load.
- Check that there is adequate clearance under beams, lights, sprinklers, and pipes for the forklift and load to pass.
- Never engage in stunt driving or horseplay.

Workers on Foot

- ▶ Make every effort to alert workers when the forklift is nearby. Use horns, audible backup alarms and flashing lights to warn workers and other forklift operators in the area. Flashing lights are especially important in areas where the ambient noise level is high.
 - Separate forklift traffic and other workers when possible.
 - Limit some aisles to workers on foot only or forklifts only.
 - Restrict the use of forklifts near time clocks, break rooms, cafeterias, and main exits. This is particularly important when the flow of workers on foot is at a peak (such as at the end of a shift or during breaks).
 - Install physical barriers where practical to ensure that workstations are isolated from aisles traveled by forklifts.
 - Evaluate intersections and other blind corners to determine whether overhead dome mirrors could improve visibility of forklift operators or workers on foot.

Driving Onto Trucks, Trailers, and Railroad Cars

Forklifts are often driven into trucks, trailers, or railroad cars over a dock board (also known as a bridge plate) at loading docks. If the truck, trailer or car is not secured to the dock or otherwise chocked, it can move over time. The dock board can then fall between the trailer and the dock as the forklift crosses it.



Chock the rear wheels of trucks and trailers to prevent movement away from the dock. Notice the sign tells drivers to chock the wheels.



Failure to secure the truck or trailer with blocks can cause the trailer to move resulting in the forklift falling between the trailer and the dock.

Driving Onto Trucks, Trailers, and Railroad Cars

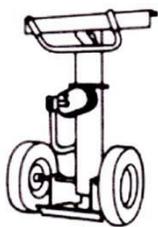


Dock mounted vehicle restraint clamps to a bar under the truck.

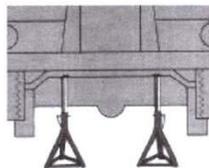
- You can secure wheel chocks with chain at each loading dock bay and tell truck drivers that they must place them in front of the rear wheels. Another way of securing the trailer is to use a vehicle restraint system mounted to the dock that clamps onto a bar below the trailer as it backs into place. This system will signal when the restraint is engaged or if there is a problem.
- The pavement at some loading docks slopes down hill toward the loading dock. This is not a substitute for chocking wheels.

Driving Onto Trucks, Trailers, and Railroad Cars

Sometimes a trailer is left at a loading dock without the tractor attached. Use trailer jacks to prevent the trailer from up-ending when a forklift drives to the front of the trailer to load or unload.



Trailer Jack



Jack stands placed under vehicle after lifted by a jack

Driving Onto Trucks, Trailers, and Railroad Cars



A projection below the surface prevents the dock board from shifting off its support.



An unsecured dock plate can move over time resulting in a sudden stop of the forklift and loss of the load as the wheels lodge in the space between the dock and the truck bed.



A bull rail at an unused edge of a dock reduces the risk of a forklift wheel slipping off.

Driving Onto Trucks, Trailers, and Railroad Cars

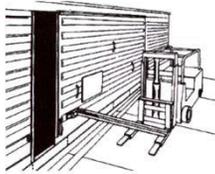
- A portable dock board must be secured in place to prevent it from moving. Some boards have pins that are inserted into the sides and project below the board. This prevents the board from moving toward the dock or toward the trailer. To prevent crushing fingers and make for safe handling, a portable dock board must also have handholds or lugs that allow the forklift to pick it up.
- Keep a safe distance from the edge of a loading dock or a ramp. Paint the edge yellow or with alternating yellow and black diagonal stripes to warn of both the fall hazard and the potential to be crushed by a trailer backing into the dock. Some loading docks have a bull rail that prevents a wheel from slipping off the sides of ramps or edges of the dock where a forklift would not have to cross to enter a trailer.
- Any part of the dock edge that is 4 ft. or more above the adjacent surface must have a standard guardrail. Removable rails (such as chain rails) and posts can be used at the place where trucks or trailers will be loaded.

Driving Onto Trucks, Trailers, and Railroad Cars

- Use rail mounted chocks to secure a railroad car. Also, prevent anyone from moving the rail car while the forklift is working. A blue sign with the word "STOP" attached to the track is one way of signaling that the car must not be moved. A special attachment must be used if a forklift is used to open a rail car door.



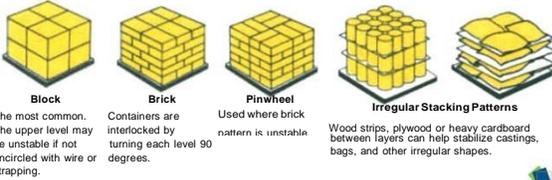
A railroad car wheel chock with a sign prevents car movement and warns that the wheel is chocked.



Forklift attachment used to open railroad car doors.

Loading and Unloading the Forklift

- ▶ Check the load before you pick it up.
 - Is it stable or will parts slide or fall during transit? Secure it as necessary. The illustrations below show some common pallet stacking patterns.
 - Do the dimensions and weight of the load fall within the capacity rating of the forklift at the highest elevation and extension you will handle the load? If not, can you break the load into smaller parts?



Loading and Unloading the Forklift



Rack leg is reinforced against forklift damage

- ▶ When you pick up the load:
 - Ensure the load does not exceed the forklift's capacity.
 - Move squarely into position in front of the load.
 - Position the forks wide apart to keep the load balanced.
 - Drive the forks fully under the load.
 - Ensure bottom of the load is raised to the proper traveling height.
 - Tilt the mast backward slightly to stabilize the load and lift.
 - Before backing up, check behind and on both sides for pedestrians or other traffic.

Loading and Unloading the Forklift

- ▶ Check the destination before you place the load.
 - Is the destination flat and stable—or, will the load rock, tilt or lean?
 - Never place heavy loads on top of light loads.
 - Observe maximum stacking quantities and orientation if printed on cartons.
 - Do you know the load bearing capacity of your rack or storage loft destination?

Loading and Unloading the Forklift

- Are rack legs or support members bent or disconnected? The load bearing capacity of a damaged rack is unknown! Wait until the damaged component has been replaced before loading.
- Are racks arranged back-to-back with a stock behind where you will place the load? Someone may need to be in the next aisle to control access while you place the load.
- Are wooden stringers or decking laid between front and rear rack beams in good condition?
- If you are stacking, are other pallets in the stack in good condition and capable of supporting the load in addition to what they are already supporting?



Check that wood stringers or decking in racks are in good condition. They may support the load if the pallet is not properly placed on both front and rear rails.

Loading and Unloading the Forklift

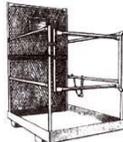


Never stand on the forks or a pallet to work at an elevated level.

- When you place the load at its destination:
 - Move squarely into position in front of the rack or stack where the load will be placed.
 - When ready to place the load, tilt the mast to level. Only tilt forward when the load is over the spot where it will be placed.
 - Lower the forks and back away.
 - Visually verify that the load is stable.
 - Never walk, stand, or allow anyone to pass under a raised load.
 - Before backing up, check behind and on both sides for pedestrians or other traffic.

Lifting and Lowering People

- Never allow anyone to be lifted while standing on the forks or on a pallet lifted by the forks! If you want to use a forklift to raise an employee to an elevated position, use a platform or structure specifically built for this purpose that meets these conditions:
 - The platform must have standard guardrails which include a top rail 36" to 42" above the platform (39" to 45" on a construction site), midrail and toeboard. It must also prevent contact with chains and shear points on the mast.
 - The platform must be securely attached to the forks such as by a clamp or chain.
 - Check with the forklift manufacturer to verify that the hydraulic system will not allow the lift mechanism to drop faster than 135 ft. per minute in the event of a system failure. Identify the forklift as approved for use with the platform.



Forklift work platform has standard guardrails and a screen to prevent contact with moving parts of the mast. A chain secures the platform to the mast.

Leaving a Forklift Unattended

- A forklift is considered to be unattended when it is not in view of the operator or if it is in view, the operator is 25 ft. or more away. If you leave a forklift unattended, lower the forks to the ground. Set the controls to neutral, turn off the power, and set the brakes. If the forklift is on an incline, block the wheels.
- If you dismount a forklift and stay within 25 ft., you must at least lower the forks to the ground, set the controls to neutral and set the brakes.



MICO Brakes. This level locking brake application devices is not a substitute for the mechanical parking brake. This is a supplemental brake only! They can be used in addition to the primary mechanical parking brake. These devices lock the brake fluid in the system. The holding power can be reduced by declining ambient temperatures as well as very small amounts of internal fluid leakage or actual external leakage.

Lifting and Lowering People

- Lock or secure the tilt control to prevent the boom from tilting.
- A forklift operator must be at the normal operating position when lifting and lowering the platform. The operator must be near the forklift while a worker is elevated.
- Except to inch or maneuver at lower speeds, do not move the forklift between two points when a worker is on the platform.

Fall From Forklift
September 6, 1995

A 47 yr-old male assistant warehouse manager was fatally injured while working with a forklift operator to pull tires from a storage rack. The two workers placed a wooden pallet on the forks of the forklift and the victim stood on the pallet. The operator raised the forks and victim 16 ft above a concrete floor. The victim had placed a few tires on the pallet when the operator noticed that the pallet was becoming unstable. The victim lost his balance and fell, striking his head on the floor.

From NIOSH Alert 2000-112

Lowering and Lifting People

-  Lifting or lowering a person on forks or a pallet can result in a fall injury or fingers caught in moving parts of the mast.
- Order picker forklifts are designed to allow the operator to be lifted along with the controls to an elevated location. However, if the operator station does not have standard guardrails on all open sides, then the operator must wear a full body harness with lanyard attached to a manufacturer approved anchor.



The operator of an order picker type forklift must wear a safety harness to protect against the fall hazard at an elevated location.

Lowering and Lifting People



- These practices are designed to prevent explosion of flammable vapors due to spark or collision with unprotected fuel tanks.

Fueling/charging

When refueling or charging batteries, observe the following precautions:

- Do not smoke or allow any open flames or spark/arc generating equipment in the refueling/charging area.
- Make sure there is adequate ventilation to disburse fumes.
- When charging and fueling, set brakes and chock wheels.
- Wear personal protective equipment.
- Make sure there is a fire extinguisher nearby.
- Mark sure there is a barrier that protects the pump or charger against vehicle damage.



Propane tank used to refill the forklift LPG tank is protected against vehicle damage by heavy posts.

Lowering and Lifting People

- Liquid Petroleum Gas (LPG) forklifts
 - LPG gas is very cold. Wear gloves when changing LPG tanks. Check for leaks before operating.
- Gasoline or diesel forklifts
 - Turn the engine "OFF" and apply the hand brake before gasoline or diesel refueling.
 - Clean up any spilled fuel before restarting the engine.
- Battery operated forklifts
 - When charging batteries, keep the battery vent caps in place to prevent electrolyte spray. (Check that the vent caps are not plugged).
 - Keep the battery compartment open to dissipate heat.

Lowering and Lifting People

- Keep tools and other metal objects away from the top of the battery to prevent an arc or explosion due to short circuited terminals.
- When adding fluid to the battery, wear safety glasses and a face shield for protection against electrolyte splash or spray.
- Battery charging areas must have a way to flush and neutralize spilled electrolyte.
- Do not attempt to remove a battery from the forklift unless you have been trained and the charging station is equipped with a hoist designed for this purpose.
- If you do any service to a battery beyond routine charging the employer must supply an eyewash that can be reached within 10 seconds and that is capable of providing 4 gallons of water per minute for 15 minutes.



An eyewash or eyewash with shower must be available when doing battery service beyond routine charging.

Driving Indoors and in Other Hazardous Locations



Hazardous Locations



- Carbon monoxide hazard. Internal combustion engines produce carbon monoxide. This gas can rapidly build up in any indoor area. People can be overcome without even realizing they are being exposed. Confusion, headache, dizziness, fatigue, and weakness may set in too quickly for victims to save themselves. Carbon monoxide poisoning can cause permanent brain damage, including changes in personality and memory. Once inhaled, carbon monoxide decreases the ability of the blood to carry oxygen to the brain and other vital organs. Even low levels of carbon monoxide can set off chest pains and heart attacks in people with coronary artery disease.
- OSHA standards set the maximum allowable exposure to carbon monoxide. Gasoline powered forklifts should not be used indoors. Propane forklifts must be regularly inspected and maintained. If you are concerned about the exposure level in an enclosed area where a forklift operates, contact a qualified industrial hygienist to make measurements and recommendations to improve ventilation.

Internal combustion engine forklifts can cause carbon monoxide poisoning when used indoors if the engine is not kept tuned and the area well ventilated.



Forklift Designations and Hazardous Locations

- All forklifts have a hazard designation assigned to them that tells whether they are suitable for use in certain kinds of hazardous atmospheres. You can find the designation on the forklift's load capacity plate. The table below explains the designations.

Type	Built-in Safeguards Against Fire Hazards
D (Diesel forklift)	Minimum
DS	D + additional for fuel, exhaust and electrical systems
DY	DS+ all electrical equipment enclosed
E (Electric forklift)	Minimum
ES	E + prevents sparks and limits surface temperatures
EE	ES + all electric motors and equipment completely enclosed
EX	Can be used in flammable vapor or dust atmospheres
G (Gasoline forklift)	Minimum
GS	G + additional for fuel, exhaust and electrical systems
LP (Liquid Petroleum)	G + minimum safeguards for liquid petroleum gas
LPS	LP + additional for fuel, exhaust and electrical systems



Maintenance of Forklifts

Maintenance of Forklifts



“Out of Service” and Required Check Intervals

- OSHA standards require that a forklift be checked for defects the first time it is placed in service and every day that the forklift is used. If the forklift is used continuously, then it must be checked at the end of each shift.
- A sample operator’s “Daily Forklift Safety Checklist” can be attached to the forklift as a reminder to the operator to do this check. Some employers keep records of these daily checks.
- If a forklift is found unsafe then it must be removed from service until repaired by an authorized person.

“Out of Service” and Required Check Intervals



Storing Cylinders

- > Always return empty cylinders to storage area
- > Don’t store near stairs or exits
- > Never store more than 300 pounds of propane in one area
- > If stored horizontally, make sure relief valve points straight up
- > Be sure service valve is in “off” position
- > Store a minimum 18-pound dry chemical fire extinguisher within 50 feet of the storage location

- > Keep gloves at cylinder storage site
- > Don’t store cylinders near pits, low areas or around air vents and heating equipment
- > Keep cylinders at least five feet from electrical equipment or other sources of ignition
- > Take defective cylinders out of service immediately

Storing Cylinders



“Out of Service” and Required Check Intervals

- In addition, the forklift owner’s manual will have routine checks and preventive maintenance tasks that must be done by a skilled maintenance person to keep the forklift in safe operating condition. Keep a record of this maintenance as well as any repairs that are made. An OSHA compliance officer assigned to investigate an accident involving a forklift will ask to see maintenance and repair records. If you do not have them, then you will have a hard time proving that you did any maintenance at all.
- When you replace parts, make sure they are equivalent to the original manufactured part.

“Out of Service” and Required Check Intervals

- All modifications and additions which affect the safe operation and capacity must be approved by the manufacturer. Data labels must be changed accordingly. The approval must be in writing. If using front-end attachments, the truck must be marked identifying the attachment and listing the approximate combined weight of the truck and attachment at maximum elevation with a centered load. Make sure all nameplates and markings are in place, legible and readable!



Do not alter or eliminate any forklift parts or add any accessories such as additional counterweights or lifting attachments unless approved by the manufacturer in writing. Make any necessary changes to the load capacity plate and operating instructions.



A winch welded on the boom of this telescoping truck without prior manufacturer’s approval.

Safety in the Maintenance Area

- To prevent injury or illness when doing maintenance on a forklift:
 - Do not do repairs in an area with a potentially flammable or combustible atmosphere (Class I, II, or III as described previously).
 - Make sure there is adequate ventilation to prevent accumulation of exhaust or gas fumes.
 - Do not use flammable solvent to clean a forklift. Use a non-combustible (flash point above 100° F) solvent.
 - Never get under a forklift supported only by a jack or under any part supported only by hydraulic pressure! Install jack stands or a secure block support.
 - To prevent the forklift from accidentally being started, remove and keep control of the key or disconnect the battery while making repairs. If the electrical system will be serviced, you must disconnect the battery before starting repairs. AND, chock the wheels.

Tire that Killed....why?



Excess Flow Valve

■ If engine doesn't accelerate or loses power, the excess flow valve may have closed.

- ✓ Shut off engine and close service valve.
- ✓ Wait 30 seconds
- ✓ reopen valve handle slowly.

- ✓ If you continue to have problems, alert your supervisor.

Refueling Safety



Propane

- Gas that is turned into a liquid when stored UNDER PRESSURE.
- Temperature affects pressure
 - As the ambient temperature rises, the liquid fuel inside the tank expands which INCREASES the pressure in the tank.
 - As ambient temperature drops, the liquid fuel decreases in pressure.
 - ✓ A tank is NEVER EMPTY.

Compressed Gas Cylinder Explosion



Propane

- 80% maximum fill to prevent a Bleve catastrophe
 - Weigh the tank and match the weight to the limits marked on the cylinder.
 - Re-certify each tank every 12 years
- During cold storage or winter, if there were to be a heat source, the expanding liquified gas could either:
 - Torch out of the relief valve creating a fire ignition source
 - Bleve: create a bomb like explosion rupturing the tank
 - OR BOTH
- Propane liquid released from the valve will burn skin (freeze) on contact

Compressed Gas Energy is Explosive



Cylinder Handling

- > Wear protective gloves that will not absorb propane
- > work in a well ventilated area
- > Use eye protection and avoid breathing vapors

- > Use proper lifting techniques when transporting to and from storage area, keep cylinders secure in an upright position

- > Always lock down cylinders with both latches tight.

- > NEVER: Drop, Throw, Roll or drag a cylinder

- > DO NOT:
 - > Use leaking or defective cylinders
 - > Tamper with or try to repair leaking or defective cylinders
 - > Fail to call Vendor when cylinders need repair

Connecting Cylinders check

- > Pressure Relief Valve - relieves excess pressure in the container. Though this happens infrequently, you should keep hands and head away from valve. Valve must be kept clean by using protective cap. Valve should always remain in vapor space, normally at 12 o'clock position, when container is mounted horizontally
- > Both seals must be inspected before connecting the cylinder to the forklift. Any indication of cuts, gouges or signs or work-hardening is cause for seal replacement.
- > Leak detector solution
 - > spray all connections, valves and fittings to determine if any leaks are present
 - > observe any bubbling or sound
 - > if so, remove and inspect for cross threading
 - > replace and recheck

Table Discussion & Team Reports

Battery Recharging

- ACID MSD
 - PPE Assessment is based on the MSD review
 - Neutralizing Solution must be present
 - Do Not Over Fill chambers
- PPE
 - All exposed clothing and skin must be protected
 - ✓ Eye Protection
 - ✓ Face Shield
 - ✓ Gauntlet gloves
 - ✓ Apron
 - ✓ Protective Work boots
- FIRE Prevention
 - No smoking or
 - Bonding and Grounding (no spark)
 - Fire Extinguisher and / or Fire Supresion System

Good Neighbor Policy



Summary

- ❖ A forklift is a powerful tool when used by a well trained operator. It helps to move materials and can reduce the risk of back injury by eliminating the need to lift and carry items by hand.
- ❖ However, the deaths of nearly 100 workers and 20,000 serious injuries that occur each year show that a forklift can be dangerous.
- ❖ To prevent your workplace from adding to these statistics:
 - Use the appropriate forklift and attachments based on the driving location, size of load, and potential for hazardous atmosphere.
 - Make sure that forklift operators are given formal instruction, hands-on training and periodic evaluation as required by OSHA standards.
 - Observe forklift operators in their daily work and take prompt corrective action to correct careless or unsafe operations.
 - Maintain forklifts in safe condition free of defective or missing parts through daily visual checks and regular preventative maintenance.



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Use Uncommon Sense

