



Oregon OSHA Powered Industrial Truck (Forklift) Safety

STUDENT WORKBOOK



Department of Consumer
and Business Services

Oregon OSHA Powered Industrial Truck (Forklift) Safety

Presented by Oregon OSHA Public Education — Our Mission:

We provide knowledge and tools to advance self-sufficiency in workplace safety and health.



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Introduction

Whether you call them forklifts, jitneys, HI LOs, or lift trucks, powered industrial trucks are as widely used as your debit card. (This workbook uses “forklifts”). It seems everywhere you look, forklifts are unloading trailers at department stores, tiering product in a warehouse, or loading material at a construction site.

With more than 850,000 forklifts operating in the United States, emphasis must be placed on worker and pedestrian safety. This workbook will help you understand Oregon OSHA's safety and health rules governing this equipment and help you develop training for your forklift operators and other affected employees.

Workbook objectives

1. Discuss the safe work practices for operating forklifts.
2. Review Oregon OSHA's general industry rules for forklifts: [29 CFR 1910.178](#), Powered Industrial Trucks; and [OAR 437-002-0227](#), Additional Oregon Rules for Powered Industrial Trucks.





What is a forklift?

A forklift is a mobile, power-driven vehicle used to carry, push, pull, lift, stack, or tier material. Vehicles not covered by [29 CFR 1910.178](#) include compressed air or nonflammable compressed gas-operated industrial trucks, farm vehicles, and vehicles intended primarily for earth moving such as skid steers, which can be very dangerous for lifting because they easily get top-heavy and can tip over.

General rules for forklifts [29 CFR 1910.178(a)]

- Design and construction of forklifts must comply with [ANSI/ITSDF B56.1: Safety standard for low, high lift trucks](#) (current standard), which can be downloaded at no cost from the [Industrial Truck Standards Development Foundation](#).
- If a forklift is approved by a nationally recognized testing laboratory, it should be marked with a label or some other identifying mark indicating it was approved by the testing laboratory. An “approved” forklift is one that has been listed or approved for fire safety purposes by a nationally recognized testing laboratory, using nationally recognized testing methods.
- Modifications and additions that affect forklift capacity and safe operation must not be performed by the customer or user without the manufacturer’s prior written approval. Capacity, operation and maintenance instruction plates, and tags or decals must be changed accordingly.
- Front-end attachments, other than those made by the manufacturer, must be marked to identify the attachment and list the approximate combined weight of the forklift

and the attachment at maximum elevation with a centered load.

All nameplates and markings must be _____ and readable.

Additional Oregon rules for forklifts [OAR 437-002-0227] Overhead guards

When a forklift operator is exposed to hoisted objects that might fall, or stacked objects that might be dislodged and fall, the forklift must be equipped with an overhead guard that can support impact loads. The guard must be of sufficient strength to support the impact load test specified in Table OR-N-1 of Oregon OSHA’s [Additional Oregon Rules for Powered Industrial Trucks](#).

Guards must be constructed in a manner that does not interfere with good visibility; openings in the top must not exceed 6 inches in one of the two dimensions, width or length. Guards must also be large enough to extend over the operator under all normal circumstances of operation, including forward tilt.

Load backrests

Forklifts that handle small objects or unbanded units must be equipped with a vertical-load backrest that:

- Has the height, width, and strength sufficient to prevent the load or any part of it from falling toward the operator.
- Must be constructed in a manner that does not interfere with good visibility.
- Has openings that do not exceed 6 inches in one dimension.

Shear-point guards

Shear points on forklift loaders and similar type vehicles must be guarded as necessary to protect operators from hazardous exposure (for example, a protective barrier must be provided between the worker and the mast if exposure to the chains and or shear points exists).

Forklift stability [Appendix A to 29 CFR 1910.178]

Balancing both ends – the fulcrum point

Forklift stability is based on the principle of two weights balanced on opposite sides of a _____; the front wheels are the fulcrum point on a forklift. This is the same principle used for a teeter-totter. For this principle to work, the forklift's load must be balanced by the weight of the forklift. Note: A properly loaded forklift does not exceed the rated capacity listed on its data plate.

Balancing in all directions – the center of gravity

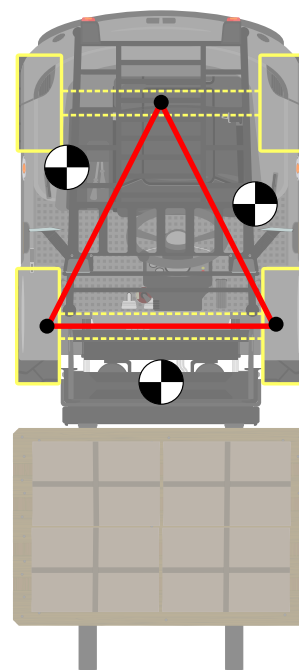
The _____ of any object is the point around which the object is balanced. Every object has a center of gravity. Because a forklift has moving parts, its center of gravity also moves: The center of gravity moves forward and back as the forklift's mast is tilted forward and back, and the center of gravity moves up and down as the upright moves up and down.

When a forklift picks up a load, the forklift and its load have a new *combined* center of gravity – the point where the center of gravity of the forklift and its load meet. The operator should constantly visualize this combined center of

gravity as a single point that is moving when operating and moving the forklift. Think of riding a tricycle around a corner. If you lean forward, you will turn over as you move your center of gravity to the narrowest portion of the tricycle. If you lean back, applying your center of gravity over the two rear wheels, you are less likely to tip because the center of gravity has moved to the widest portion of the tricycle.

The center of gravity and the 'stability triangle'

For the forklift to remain stable, the center of gravity must stay within an area represented by a triangle drawn between the drive wheels and the pivot of the steering axle. Think of this triangle as the _____. If the center of gravity moves in front of the drive axle, the forklift tends to tip forward. If the center of gravity moves outside of the stability triangle, the forklift tends to tip sideways. The operator must keep this combined center of gravity within the stability triangle.



What can cause a forklift to tip forward?

What can cause a forklift to tip sideways?

Understanding 'load center'

The horizontal distance from the load's edge (or the fork or other attachment's vertical face) to the line of action through the load's center of gravity is called the _____. The load center is determined by the location of the center of gravity of the load. Most forklifts are rated at a load center of 24 inches. When the load is carried at a greater distance than the load center, the maximum capacity of the forklift is _____. The maximum capacity is the maximum load the forklift can safely handle. The maximum capacity of the forklift at load center is shown on the forklift's data plate at a specified load height.

The use of special attachments instead of standard forks will also _____ the maximum capacity of a forklift.

The CG of a loaded forklift is affected by a number of factors, including:

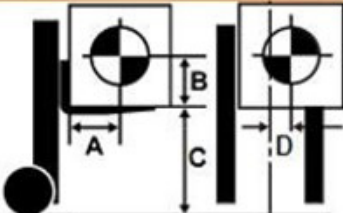
- Size, weight, shape, and position of the load
- The height to which the load is raised

- The amount of forward or backward tilt of the load
- Tire pressure
- Dynamic forces created when the forklift is moving, such as acceleration, braking, operating on uneven surfaces or inclines, and turning

Note: These factors must also be considered when traveling with an unloaded forklift, because an unloaded forklift can tip over easier than a loaded forklift with its load in a lowered position.

It's important to make sure that operators know how much capacity is lost when attachments and extensions are used on forklifts. Think of a forklift that handles a roll of carpet; the roll is handled parallel to the forklift. A 40-foot carpet roll has a load center of 20 feet; the carpet may not weigh much but a large capacity forklift must be used to accommodate for this additional leverage.

Example data plate:

TOYOTA ELECTRIC FORKLIFT TRUCK																																							
MODEL	8FBE18U				SERIAL NO.																																		
MAST	FSV	BACK TILT	6.5		ATTACH	SIDE SHIFTER																																	
TYPE	E	VOLTAGE	48	V	BATTERY TYPE	E O	MAX AMPERE HOUR CAPACITY	660	AH																														
FRONT TREAD	34.5	in	TIRE FR 18X7X12-11/8/SOLID																																				
	875	mm	SIZE RR 15X5X11-1/4/SOLID																																				
TRUCK WEIGHT W/O BATTERY	5790	lb	BATTERY WEIGHT	1540	lb/	2270	lb																																
ACCURACY ±5%	2620	kg	MIN/MAX	700	kg/	1030	kg																																
 <table border="1"> <thead> <tr> <th></th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> <th>CAPACITY</th> </tr> </thead> <tbody> <tr> <td>in</td> <td>24</td> <td>24</td> <td>189</td> <td>0</td> <td>2900 lb</td> </tr> <tr> <td>mm</td> <td>600</td> <td>600</td> <td>4800</td> <td>0</td> <td>1310 kg</td> </tr> <tr> <td>in</td> <td>30</td> <td>30</td> <td>189</td> <td>0</td> <td>2510 lb</td> </tr> <tr> <td>mm</td> <td>760</td> <td>760</td> <td>4800</td> <td>0</td> <td>1130 kg</td> </tr> </tbody> </table>											A	B	C	D	CAPACITY	in	24	24	189	0	2900 lb	mm	600	600	4800	0	1310 kg	in	30	30	189	0	2510 lb	mm	760	760	4800	0	1130 kg
	A	B	C	D	CAPACITY																																		
in	24	24	189	0	2900 lb																																		
mm	600	600	4800	0	1310 kg																																		
in	30	30	189	0	2510 lb																																		
mm	760	760	4800	0	1130 kg																																		

THIS FORKLIFT TRUCK MEETS OR EXCEEDS DESIGN SPECIFICATIONS OF ANSI/ITSDF B56.1 IN EFFECT ON THE DATE OF MANUFACTURE

Seat belt safety

Seat belts or other operator restraint systems should be used when provided. Seat belts prevent the operator from being thrown from the seat during a tip over. Manufacturers' operating manuals also require operators to use seat belts. Operators must also be trained in the manual's instructions, warnings, and precautions.

Oregon OSHA's general industry rule for forklifts, [29 CFR 1910.178, Powered Industrial Trucks](#), does not specifically require the use of seat belts; however, employers are required to protect workers from serious and recognized hazards and to make full use of safety devices and [ASME/ITSDF B56.1](#) does contain provisions for operator-restraint use.

If a forklift has seat restraints installed, operators must use them when exposed to an overturn hazard, or when they are traveling in areas where they can be thrown from the operator's compartment. If your existing forklifts are not equipped with seat restraints and they are used in areas where overturning or being thrown from the forklift is possible, contact the manufacturer for an approved conversion kit and ensure it is installed to their recommendations and specifications.

Oregon OSHA can cite employers for not enforcing seat restraint use or for not using an approved retrofit kit when operators are exposed to potentially serious injuries in areas where overturning or being thrown from a forklift can occur. Operators should be able to recognize hazardous areas or conditions where an operator could be thrown from a forklift or the forklift could overturn.

When evaluating potential forklift hazards, consider:

- Speed
- Loading docks
- Ramps and inclines (including portable yard ramps and dockboards)
- Other vehicle traffic
- Defined traffic lanes
- Rough or uneven driving surface
- Tight areas
- Speed bumps
- Debris in roadway
- Tire pressure and condition
- Railroad tracks
- Potholes
- Slick surfaces
- Center of gravity outside of the stability triangle
- Condition of forklift to ensure safe operation

Operating a forklift safely [29 CFR 1910.178(m)]

When picking up a load

- Ensure the load does not exceed the forklift's rated capacity
- Ensure forks are positioned properly
- Ensure the load is balanced and secure
- Ensure the bottom of the load is _____ to the proper traveling height
- Drive as far under the load as possible; be cautious when using extensions, which can protrude from the backside of the load
- Slightly tilt _____ and lift the load
- Back, stop, and lower load 2 to 6 inches from the floor
- Before backing up, check behind and on both sides for pedestrians or other traffic

When traveling with a load

- Operator and pedestrians must effectively _____
- No riders or other passengers are allowed
- Travel at a safe operating speed
- Follow all traffic regulations, including plant speed limits
- Maintain at least _____ forklift lengths
- Be aware of the traveling surface's condition
- Keep the load slightly above grade
- Avoid sudden braking
- Turn in a sweeping motion
- Keep the load slightly tilted back
- When approaching corners and blind areas, sound the _____
- Lift and lower the load only when stopped
- Keep a safe distance from the edge of ramps or platforms while on any elevated dock

When placing and stacking a load

- Completely stop before raising a load
- Never walk, stand, or allow anyone to pass under the elevated portion of any truck, whether loaded or empty. Move slowly after raising the load
- Tilt forward, level only when over a stack or rack
- Make sure forks have cleared the pallet when backing out & before turning or changing height
- Before backing up, check _____ and on both sides for pedestrians or other traffic
- Use additional caution when handling unusually shaped and/or off-center loads
- Stack the load square and straight
- Only handle loads within the forklift's rated capacity



- Forklifts equipped with _____ must be operated as partially loaded trucks even when unloaded
- Avoid running over loose objects
- Operate loaded and unloaded forklifts at a speed that will permit it to stop safely
- Never engage in horseplay or stunts
- Cross railroad tracks _____
- Never park closer than eight feet from tracks
- Give the right of way to emergency vehicles
- Keep your arms and legs from the mast and within the running lines of the forklift
- Never drive up to someone standing next to a fixed object
- Enter enclosed areas with the forklift's load-end forward
- Never pass another forklift traveling in the same direction at blind corners, intersections, or other dangerous areas
- Lower forks, neutralize controls, shut off, and set brakes (block if on an incline) if truck will be unattended

Operating forklifts around pedestrians

Most forklift-related incidents in Oregon involve pedestrians. Best practices for operating forklifts around pedestrians include:

1. Establish clear, separate pathways for pedestrians and forklifts. Employees should wear high-visibility apparel when they are walking outside of designated walkways.
2. Minimize blind spots and highlight intersections and restricted areas.
3. Restrict the use of forklifts near time clocks, break rooms, cafeterias, and main exits, particularly when the flow of workers on foot is at a peak (such as at the end of a shift or during breaks).
4. Install physical barriers where practical to ensure that workstations are isolated from aisles traveled by forklifts.
5. Use proximity detection lights on forklifts where ambient noise levels are high and to alert pedestrians when a forklift is moving or changing direction.



What safety instruction would you provide to the employees exposed to forklift traffic?

Lifting people on a work platform [OAR 437-002-0227(4)]

Unless prohibited by the forklift manufacturer, workers can be lifted on a work platform, without controls at the platform, under the following conditions [OAR 437-002-0227(4)]:

- The work platform must be equipped with guardrails or equivalent means to protect workers from fall to lower level hazards.
- The work platform must be firmly secured to the carriage or forks to prevent displacement.
- The forklift operator must stay with the forklift while workers are on the platform.
- The forklift must not travel from point to point with the work platform elevated at a height greater than 4 feet while workers are on the platform. When necessary at heights greater than 4 feet, inching may be permitted provided it is done at a very slow speed.
- The operator must be in the normal operating position when raising and lowering the platform.

- A protective barrier must be provided between the worker and the mast if exposure to the chains and/or shear points exists.
- The forklift's load capacity must not be exceeded.

Recommended: When feasible, use a mobile elevating work platform that is specifically designed to lift people instead of using a forklift.

Training forklift operators [29 CFR 1910.178(I)]

Training for forklift operators must include a combination of:

- Formal training, such as classroom lectures and discussions
- Practical training: hands-on and site-specific training
- Evaluation(s) to determine the operator's competency

Someone other than the operator's employer can do the training and the evaluation; however, training outside of the workplace must be supplemented with on-site training that covers site-specific hazards and tasks the operator will be performing.

The operator's employer must also _____ that the operator has been properly trained and evaluated.

Evaluating the operator's competency

The evaluation of each forklift operator's competency must be conducted at least once every three years by the operator's employer.

The evaluation must include:

- Loading
- Ramps and inclines
- Stacking
- Traveling
- Fueling or charging
- Using attachments
- Inspecting
- Tiering
- Pedestrians
- Visibility
- Parking
- Shutting down
- Lifting and lowering
- Maneuvering
- Docks
- Horn
- Floor surfaces
- Driving in reverse
- Getting in and out of the forklift

Who must evaluate the operator?

Certifying operators

The employer must certify that each operator has been trained and evaluated to safely operate a forklift. The certification verifies that an operator has been trained and evaluated. The certification document must include the operator's name, the trainer's name, training and evaluation dates.

What does "certify" mean?



Refresher training for operators – when is it necessary?

Operators must receive refresher training when:

- They are observed operating a forklift in an _____ manner.
- They have received an _____ that shows they operated a forklift in an unsafe manner.
- They are involved in a forklift **accident** or _____ incident.
- They are assigned to operate a _____ forklift than the one they were trained on or use a new attachment.
- A _____ in the workplace changes that could affect the safe operation of the forklift.

What qualifications do forklift trainers need?

Trainers must have the knowledge, training, and experience necessary to train and evaluate forklift operators. Their experience should include the practical skills and the judgment necessary to operate forklifts safely.

What topics must the training for operators include?

Operators must receive initial training in the following topics – unless they do not apply to the operator's workplace.

Forklift-related topics

- Operating instructions, warnings, and precautions for the types of truck the operator will be authorized to operate

- Differences between a forklift and an automobile
- Forklift controls and instrumentation, including 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 or charging and recharging of batteries
- Operating limitations
- Any other operating instructions, warnings, or precautions listed in the operator's manual for the type of vehicle that the employee is being trained to operate

Workplace-related topics

- Surface conditions where the vehicle will be operated
- Composition of loads to be carried and load stability
- Load manipulation, stacking, and unstacking
- 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

What if an operator has previously been trained on these topics?

If an operator has previously received training in one of the topics above and the training is appropriate for the forklift and work environment, then additional training in that topic is not necessary. However, all operators must still be evaluated and found competent to operate the forklift safely.

Quiz

1. **Forklift stability is based on the principle of two weights balanced on opposite sides of a fulcrum point.**

True False
2. **Which of the following can cause a forklift to tip forward? (More than one may be correct.)**
a) Forks striking an obstruction
b) Traveling down ramps with load forward
c) Low air pressure in a rear tire
d) Accelerating too quickly
e) Traveling forward up a steep incline
3. **Which of the following can cause a forklift to tip sideways? (More than one may be correct.)**
a) Tight turns
b) Traveling up a steep incline
c) Accelerating too quickly
d) Turning sideways on ramps
e) Braking too quickly
4. **The distance from the front vertical face of the forks (or the load face of an attachment) to the center of the load is called the load center.**

True False
5. **The use of special attachments instead of forks will increase the maximum capacity of a forklift.**

True False

6. When picking up a load ensure that: (More than one item may be correct.)
- a) The load does not exceed the forklift's rated capacity
 - b) The load is not rectangular
 - c) The load does not contain anything that could break
 - d) The forks are positioned properly
 - e) The load is at least 2 feet high
7. The operator's employer must certify that the operator has been properly trained and evaluated.
- True False
8. Operators must receive refresher training when: (More than one item may be correct.)
- a) They are observed operating a forklift in an unsafe manner
 - b) When a condition in the workplace changes that could affect the safe operation of the forklift
 - c) They sleep less than six hours
 - d) They take a vacation longer than two weeks
 - e) They sleep less than four hours
9. The stability triangle is:
- a) Only visible in four-dimensional space
 - b) Unstable
 - c) An imaginary triangle connecting a forklift's drive wheels and the pivot of the steering axle
 - d) An invention created by Leonardo da Vinci
 - e) Also known as the Devil's Triangle
10. Forklifts that handle small objects or unbanded units must be equipped with a vertical-load backrest that:
- a) Has the height, width, and strength sufficient to prevent the load or any part of it from falling toward the operator
 - b) Is easy to remove in an emergency
 - c) Can correct poor back posture
 - d) Must be visible at night
 - e) Is approved by OSHA

Oregon OSHA services

Oregon OSHA offers a wide variety of safety and health services to employers and employees:

Appeals

► **503-378-3272**

- Discusses Oregon OSHA's requirements and clarifies workplace safety or health violations.
- Discusses abatement dates and negotiates settlement agreements to resolve disputed citations.

Conferences

► **503-378-3272; oregon.conferences@dcbs.oregon.gov**

- Hosts, co-hosts, and coordinates conferences throughout Oregon that enable employees and employers to learn and share ideas with local and nationally recognized safety and health professionals.

Consultations and Evaluations

► **503-378-3272; 800-922-2689; consult.web@dcbs.oregon.gov**

- Offers no-cost, on-site safety and health assistance to help Oregon employers recognize and correct workplace safety and health problems.
- Provides consultations in the areas of safety, industrial hygiene, ergonomics, occupational safety and health programs, assistance to new businesses, the Safety and Health Achievement Recognition Program (SHARP), and the Voluntary Protection Program (VPP).

Enforcement Information

► **503-378-3272; 800-922-2689; enforce.web@dcbs.oregon.gov**

- Offers pre-job conferences for mobile employers in industries such as logging and construction.
- Inspects places of employment for occupational safety and health hazards and investigates workplace complaints and accidents.
- Provides abatement assistance to employers.

Public Education and Training

► **503-947-7443; 888-292-5247, Option 2; ed.web@dcbs.oregon.gov**

- Provides workshops and materials covering management of basic safety and health programs, safety committees, accident investigation, technical topics, and job safety analysis.

Standards and Technical Resources

► 503-378-3272; 800-922-2689; tech.web@dcbs.oregon.gov

- Develops, interprets, and gives technical advice on Oregon OSHA's safety and health rules.
- Publishes safe-practices guides, pamphlets, and other materials for employers and employees.
- Manages the Oregon OSHA Resource Center, which offers safety videos, books, periodicals, and research assistance for employers and employees.

Need more information? Call your nearest Oregon OSHA office.

Salem Central Office

350 Winter St. NE
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Phone: 503-378-3272

Toll-free: 800-922-2689

Fax: 503-947-7461

en Español: 800-843-8086

Website: osha.oregon.gov

Medford

1840 Barnett Road, Suite D
Medford, OR 97504-8293
541-776-6030

Consultation: 541-776-6016

Pendleton

750 SE Emigrant Ave., Suite. 131
Pendleton, OR 97801
541-276-9175

Consultation: 541-276-2353

Bend

Red Oaks Square
1230 NE Third St., Suite A-115
Bend, OR 97701-4374
541-388-6066

Consultation: 541-388-6068

Portland

Durham Plaza
16760 SW Upper Boones
Ferry Road, Suite 200
Tigard, OR 97224-7696
503-229-5910

Consultation: 503-229-6193

Eugene

1500 Valley River Drive, Suite 150
Eugene, OR 97401-4643
541-686-7562

Consultation: 541-686-7913

Salem

1340 Tandem Ave. NE, Suite 160
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503-378-3274

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