

Forklift Safety Guide

Learning the safe way to operate a forklift and other powered industrial trucks may save your life



Division of Occupational Safety and Health
www.Lni.wa.gov/go/F417-031-000 | 1-800-423-7233



Washington State Department of
Labor & Industries

DISCLAIMER: This document discusses forklifts. Forklifts are a type of Powered Industrial Truck (PIT) and must meet the applicable standard requirements found in Chapter 296-863 WAC. Forklifts are not the ONLY type of PIT. Each piece of equipment must be evaluated to determine whether or not it meets the definition and is covered by the standard.

Contents

How This Book Can Help Prevent Forklift Accidents	1
Introduction	2
Types of Forklifts	3
Forklift Operators Must be Trained	6
How a Forklift Works	8
Safely Using a Forklift	15
Driving Indoors and In Other Enclosed Locations	23
Driving Indoors and In Other Enclosed Locations	24
Maintenance of Forklifts	27
Summary	28
Resources	30
Get 1-on-1 Assistance	31

How This Book Can Help Prevent Forklift Accidents

This book has general information about:

- The kinds of forklifts and powered industrial trucks commonly available.
- The principles that allow a forklift to lift and move heavy loads safely.
- Forklift operator training requirements.
- Basic operator safety rules.
- Hazardous locations where carbon monoxide is a problem or a special forklift is needed.
- Safety while servicing a forklift.

This book is not designed to substitute for operator training in the operation of specific forklifts and other powered industrial trucks used in your workplace.



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

L&I's Standards That Regulate Forklifts

Safety rules developed under the Washington Industrial Safety and Health Act (WISHA) regulate the safe use of powered industrial trucks in Washington workplaces. You can find these rules in:

- WAC 296-863:
Forklifts and other Powered Industrial Trucks
- WAC 296-155:
Construction Standard
- WAC 296-307-520:
Agriculture Standard
- WAC 296-56-60077:
Longshore, Stevedore and Related Waterfront Standard

You can get a copy of these rules on our website at www.Lni.wa.gov/Safety or by calling the L&I office nearest you.

Introduction

A forklift is a powerful tool that allows one person to precisely lift, move 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 of suffering 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 a forklift to lift heavy loads.
- Is not familiar with how a particular forklift operates.
- Operates the forklift carelessly, unsafely or without knowing the hazards
- Uses a forklift that is not safe due to malfunctioning, missing parts or unapproved alterations.

Approximately 35,000 serious injuries and 62,000 non-serious injuries involving forklifts occur in the United States every year. OSHA estimates 11% of all forklifts are involved in accidents every year.



A forklift operator was pinned and killed when the forklift the worker was operating overturned.

Fatal accident type	Percentage
Crushed by vehicle tipping over	42%
Crushed between vehicle and a surface	25%
Crushed between two vehicles	11%
Struck or run over by a forklift	10%
Struck by falling material	8%
Fall from platform on the forks	4%

Types of Forklifts

A forklift is a type of powered industrial truck (PIT) covered by safety standards. A PIT is a mobile, power-driven vehicle used to carry, push, pull, lift, stack or tier material.

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.

There are several different types of PITs that are used in different types of industries. Some of the types are shown below.

Electric Motor Counter-Balanced Trucks (solid and pneumatic tires)



Sit-Down Rider

The forklift has a counterbalance weight in the body.

Electric Motor Narrow Aisle Trucks (solid tires)



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.

Electric Motor Hand Trucks or Hand/Rider Trucks (solid 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 are walked. A high-lift version has a mast and straddle legs.

Types of Forklifts

Internal Combustion Engine Trucks (solid tires)



Sit-Down Rider
The forklift has a counterbalance in the rear.

Internal Combustion Engine Trucks (pneumatic tires)



Sit-Down Rider
The forklift has a counterbalance in the rear.

Electric and Internal Combustion Engine Tractors (solid and pneumatic tires)



Sit-Down Rider
The forklift has a draw bar that is capable of pulling heavy loads.

Rough Terrain Forklift Trucks (pneumatic tires)



Rough-Terrain Reach Forklift
The forklift has large pneumatic tires, and a boom which raises and extends. Outriggers at the front stabilize the forklift on soft or uneven ground.

A rough-terrain forklift might also resemble a sit-down rider as shown above. However, it is bigger with large pneumatic tires and a large mast with large forks. It is powered by an internal combustion engine.

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.



Using an unapproved attachment could alter the forklift's lifting and balance characteristics and cause the forklift to overturn.

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.

Hoist Attachment



Personnel Platform



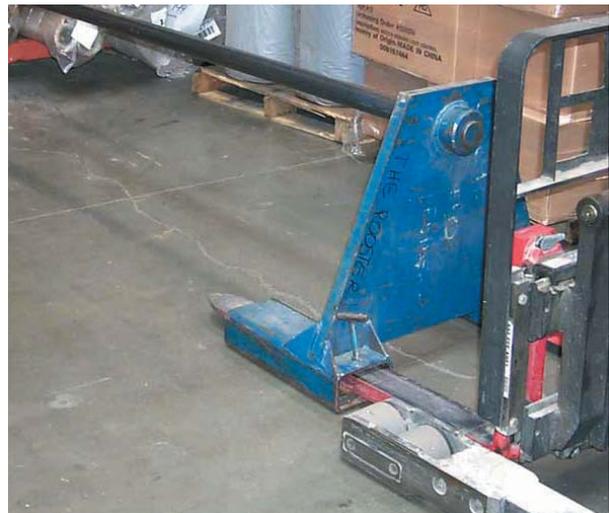
Jib Crane Attachment



Drum Grabber Attachment



Carpet Lifting Attachment



Forklift Operators Must be Trained

An untrained forklift operator can be as dangerous as an unlicensed driver of a motor vehicle.



State regulations require the employer to 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.

The topics listed below must be covered when training a forklift operator. However, if a specific topic does not apply to the forklift in the employer's workplace, covering it is optional.



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

Topics related to forklifts

- Operating instructions
- Warnings and precautions for the types of forklift the operator will be authorized to operate
- Differences between a forklift and automobile
- 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
- Forklift capacity
- Forklift stability
- Any inspection and maintenance that the operator will be required to perform
- Refueling
- Charging and recharging of batteries
- Operating limitations
- Any other operating instructions, warnings or precautions listed in the operator's manual for the types of forklift that the employee is being trained to operate

Topics related to your workplace

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

Forklift Operators Must be Trained

- Pedestrian traffic in areas where the forklift will be operated
- Narrow aisles and other restricted places where the forklift will be operated
- Use of door opening and closing devices
- Hazardous (classified) locations where the forklift will be operated
- Ramps and other sloped surfaces that could affect the forklift's stability
- Closed environments and other areas where insufficient ventilation or poor 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

Qualified Trainers: The employer or any other person the employer chooses who has the knowledge, training and experience to train and evaluate forklift operators can do this training and evaluation. The trainee can operate the forklift only when directly supervised by such a person and when this would not endanger anyone.

Documenting Training: If the operator had previous forklift training, the employer must document that the training covered the required topics described above. The operator must have been evaluated in the current workplace within the last three years.

Training and Evaluation Records: The employer must keep a record that shows that each forklift operator has been trained. The record must include the name of the operator, date of training, date of evaluation and the name of the person(s) giving the training and evaluation.

Refresher training must be given if the operator has been involved in an accident, a near miss or unsafe operations. Also, if an operator is assigned to a new type of forklift or if workplace conditions change and an evaluation shows they are not operating it safely, then refresher training is required.



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 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.



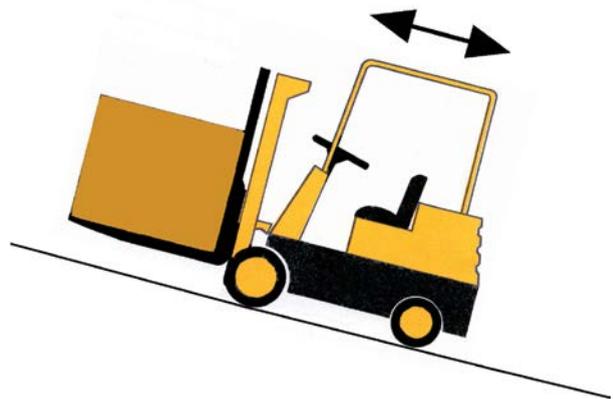
Driving with the load downhill can result in loss of the load and control of the forklift.

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.

Often a large 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). Use extra caution when traveling in reverse.



Mark aisles to help keep adequate clearance for forklifts.



Keep the load uphill to maintain control of the forklift.

How a Forklift Works

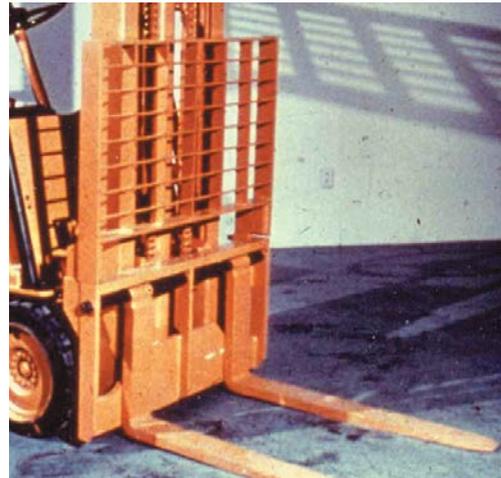
Forklift Safety Features

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.

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. 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.

Operator restraints will hold you in the seat if you strike an object or if the forklift overturns. Many forklift manufacturers offer restraint systems that can be retrofitted on older forklifts.

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 an operator who jumps.



A backrest extension keeps the load from falling rearward.



An overhead guard can deflect objects falling from above.

How a Forklift Works



Failure to wear a seat belt can result in the operator being thrown outside the protective cage in the event of an overturn.

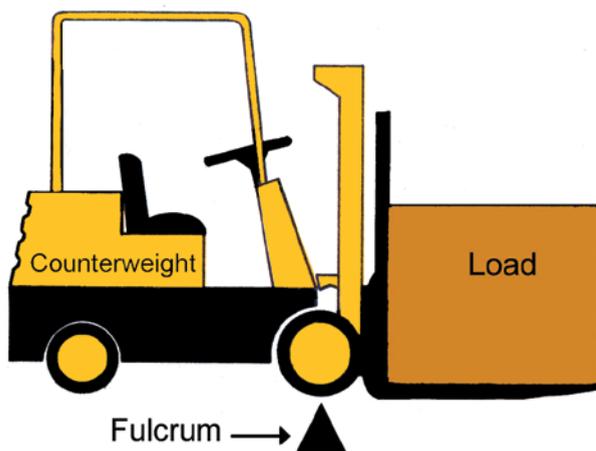
If your forklift has a restraint such as a seat belt or a lap bar, you must use it.

How Forklifts Safely Carry and Lift Heavy Loads

A forklift works on the principle of a cantilever. 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).

Whether a forklift will safely carry a load or will tip forward can be determined by comparing the “moment” of each.

Moment equals the distance from the fulcrum to the center of gravity (the point where all the weight is concentrated) times the weight.



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

Example: An evenly distributed 36-inch-wide load on the forks has a center of gravity that is 18 inches from the face of the forks.¹ If the load weighs 4,000 pounds, then the load moment will be 72,000 inch-pounds (18 inches x 4,000 pounds).

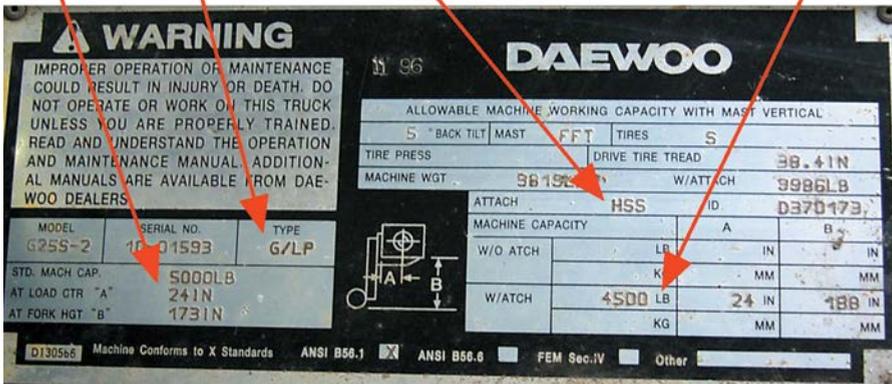
If the “moment” of the forklift is greater than or equal to the 72,000 inch-pounds of the load, then the forklift will safely carry the load.

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

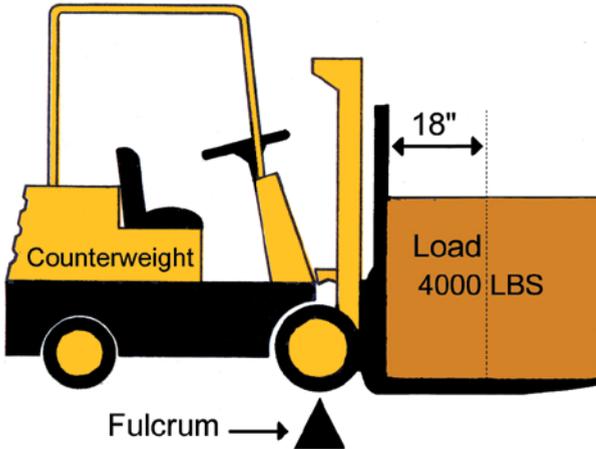
1. The fulcrum point is actually at the center of the wheel. Forklift load charts, however, are adjusted to allow measuring from the face of the forks.

How a Forklift Works

Capacity Forklift Type Attachment ID Capacity with Attachment



This LP Gas Forklift can safely lift 5,000 pounds 173 inches high with a center of gravity 24 inches from the face of the forks. With an attachment labeled "HSS," the safe load drops to 4,500 pounds.



Forklift Moment: 24" x 5,000 lbs. = 120,000 inch-pounds

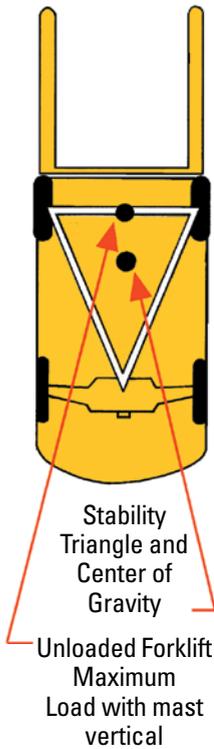
Load Moment: 18" x 4,000 lbs. = 72,000 inch-pounds

The load is safe to lift because load moment is less than forklift moment.

However, if the 4,000-pound load was 66 inches wide, the load moment would be 132,000 inch-pounds (33" x 4,000 lbs.), 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 a Forklift Works

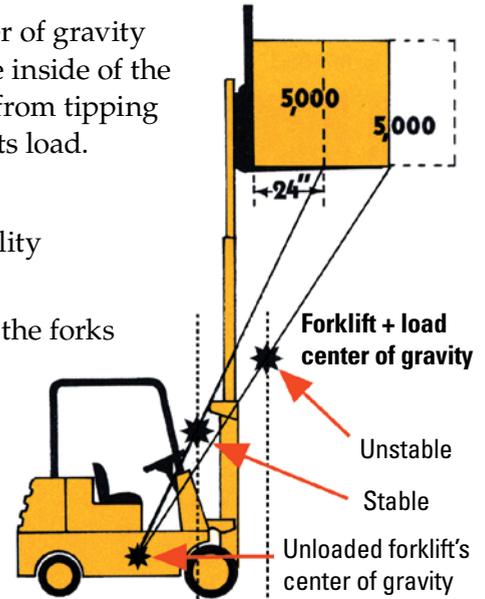


Forklifts have a “stability triangle.” The sides of the triangle as shown in the illustration are formed by the center of each front wheel and the center of the rear wheel, or at the center of the axle if there are two rear wheels.

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
- Forklift movement causes the center of gravity to shift.



These actions will have the following effects:

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	Toward the downhill side of the triangle
Driving across an inclined surface	
Driving across a rough or uneven surface	
Turning	Toward the side now facing the original direction of travel

How a Forklift Works



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 secured on the forks.
- Do not tilt the forks forward except when picking up or depositing a load.
- Tilt the load backward only enough to stabilize the load.
- Keep the load low 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, and honk if there is traffic.
- Avoid driving over loose objects or on surfaces with ruts and holes.
- Do not allow unauthorized people to ride on forklifts.
- Do not allow stunt driving or horseplay.



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

A Defective Forklift Can Kill

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 five 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.

How a Forklift Works

Pre-use Inspection Checklist

The forklift must be checked for defects daily – usually by the operator or a designated person prior to beginning and after a 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.
- 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.
- Are seat belts (if equipped) working and accessible?
- Is the load capacity plate readable?

Any defects that would affect safety must be corrected before the forklift is returned to service.

Appendix A is a sample operator pre-use inspection checklist.

Safely Using a Forklift

Surface Condition

The surface a forklift operates on can cause serious safety problems. Loose objects, bumps, or depressions can cause you to lose control of steering, bring you to a sudden unplanned stop or cause you to drop your load. A soft dirt surface can cause a wheel to sink and destabilize an elevated load and the forklift.



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.
- Keep a distance of at least three forklift lengths between you and 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.

Safely Using a Forklift

Driving onto Trucks, Trailers and Railroad Cars



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.

Forklifts are often driven onto 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, blocked or secured, it can suddenly move over time or with the right amount of force. The dock board can also fall between the trailer and the dock as the forklift crosses it.

You can secure wheel chocks with a 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 downhill toward the loading dock. This is not a substitute for chocking wheels.

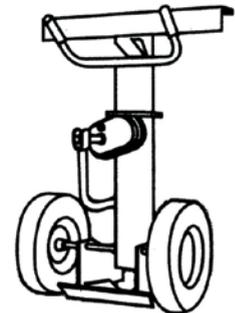
Sometimes a trailer is left at a loading dock without the tractor attached. Use trailer jacks to prevent the trailer from up-ending when a forklift drives to the front of the trailer to load or unload.



Trucks or trailers must be chocked or blocked at the wheels, or with a mechanical device that secures the truck or trailer to the loading dock. Notice the sign tells drivers to chock the wheels.



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



Trailer jack.

Safely Using a Forklift



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 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 crushed fingers and make for safe handling, a portable dock board must also have handholds, lugs or an equally effective means that allow the forklift to pick it up.

Keep a safe distance from the edge of a loading dock or a ramp. To help operators keep a safe distance, the edge of a dock could be painted 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. In a maritime setting, bull rails help prevent wheels from slipping off the sides of ramps or edges of the dock where a forklift would not have to cross to enter a trailer.

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.



Safely Using a Forklift

Loading and Unloading the Forklift

Check the load before you pick it up:

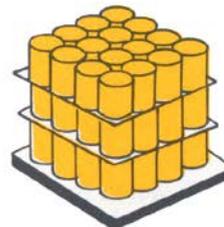
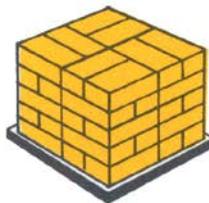
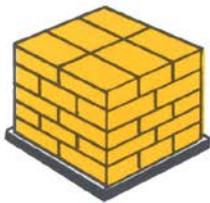
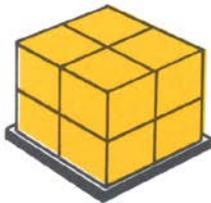
- Is it stable or will parts slide or fall during transit? Secure it as necessary. The illustrations below show some common pallet stacking patterns.
- Do the dimensions and weight of the load fall within the capacity rating of the forklift at the highest elevation and extension you will handle the load?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

When you pick up the load:

- 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.
- Tilt the mast backward slightly to stabilize the load and lift.

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?
- 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.



Block

The most common. The upper level may be unstable if not encircled with wire or strapping.

Brick

Containers are interlocked by turning each level 90 degrees.

Pinwheel

Used where brick pattern is unstable.

Irregular Stacking Patterns

Wood strips, plywood or heavy cardboard between layers can help stabilize castings, bags and other irregular shapes.

Safely Using a Forklift

- 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?
- Are racks secured to the floor or other adjacent structures?

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.

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 feet 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 feet, you must at least lower the forks to the ground, set the controls to neutral and set the brakes.



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.



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



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

Safely Using a Forklift

Lifting and Lowering People

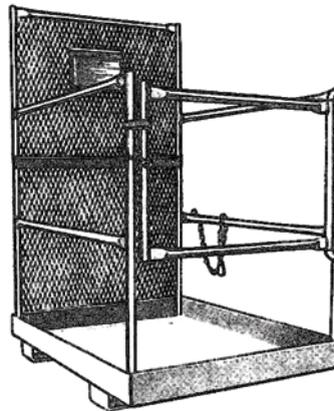
Never allow anyone to be lifted while standing on the forks or on a pallet lifted by the forks! If you want to use a forklift to raise an employee to an elevated position, use a platform or structure specifically built for this purpose that meets these conditions:

The platform must be approved by the manufacturer and have standard guardrails which include a top rail 39 to 45 inches above the midrail and toeboard. It must also prevent contact with chains and shear points on the mast. See the illustration below for an example.

- The platform must be securely attached to the forks, such as by a clamp or chain.
- Must have nameplate and label attached to the forklift.
- Check with the forklift manufacturer to verify that the hydraulic system will not allow the lift mechanism to drop faster than 135 feet per minute in the event of a system failure. Identify the forklift as approved for use with the platform.
- 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 within 25 feet of the forklift while a worker is elevated.
- Do not move the forklift between two points when a worker is on the platform.

Fall from Forklift

A 47-year-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 then stood on the pallet. The operator raised the forks and victim 16 feet 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.



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.

Safely Using a Forklift

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 following 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.
- Make sure there is a fire extinguisher nearby.
- Make sure there is a barrier that protects the pump or charger against vehicle damage.

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.



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



Propane tank used to refill the forklift LPG tank is protected against vehicle damage by heavy posts and must be well ventilated and not near any ignition sources.

Safely Using a Forklift

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.
- 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 station 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 Enclosed 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.

State standards (WAC 296-841) set the maximum allowable exposure to carbon monoxide. Gasoline or diesel-powered forklifts should not be used indoors unless space is well ventilated. Propane forklifts also produce carbon monoxide and 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.

Operating a forklift in an environment where chemicals or other substances are present can be hazardous. Use only forklifts that are designed for operations under those conditions!

To select the appropriate forklift, you must know the type of location (Class), the name of the chemical or substance and how likely

it is that the hazardous condition would be present (Division).



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

Terms

- Class I locations are areas that contain flammable gases or vapors or where they may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.
- Class II locations are areas where the presence of combustible dust could be sufficient to produce explosions.
- Class III locations are areas where the presence of easily ignitable fibers are suspended in the air but are not in large enough quantities to produce ignitable mixtures.
- An unclassified location is an area that is not designated as a Class I, II or III location.

Driving Indoors and In Other Enclosed Locations

Use the table below to select a safe forklift.

- Look in the first column of the table for the hazard class of the material.
- Find the row that has the chemical or substance handled.
- Choose the second or third column based on the division that represents the exposure condition.
- To interpret the hazard designations listed in the second or third column, refer to the table at right.

Explosion/Combustion Hazards

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.

Hazard Designation Descriptions

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	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	G + minimum safeguards for liquid petroleum gas
LPS	LP + additional for fuel, exhaust and electrical systems

If you work in an area where this hazard classification is present:	Then use this type of forklift. (See hazard designation descriptions above.)	
Class I Flammable gases or vapors are or may be present in quantities sufficient for explosion or ignition.	Division I Condition exists continuously, intermittently, or periodically under normal operating conditions.	Division II Condition may occur accidentally e.g., puncture of a storage drum.
Acetylene, acetaldehyde, butadiene, cyclopropane, diethyl ether, ethylene, ethylene oxide, isoprene, propylene oxide, hydrogen (or gases or vapors equivalent in hazard to hydrogen, such as manufactured gas), unsymmetrical dimethyl hydrazine (UDMH).	Forklift use prohibited.	DY, EE, EX (also DS, ES, GS, LPS) if the only exposure is sealed containers or liquefied or compressed gases in containers.
Acetone, acrylonitrile, alcohol, ammonia, benzene, benzol, butane, ethylene dichloride, gasoline, hexane, lacquer solvent, natural gas, naphtha, propane, propylene, styrene, xylenes, vinyl acetate, vinyl chloride.	EX	DY, EE, EX (also DS, ES, GS, LPS) if the only exposure is sealed containers or liquefied or compressed gases in containers.
Class II Combustible dust is present.	Division I Explosive or conductive mixture may be present under normal conditions or where equipment failure can lead to both this condition and arcing or sparking.	Division II Explosive mixture not normally present but where deposits of dust may cause heat rise in electrical equipment.
Aluminum, magnesium, and their commercial alloys; other metals of similarly hazardous characteristics.	Forklift use prohibited.	Forklift with electrical enclosures manufacturer approved where magnesium, aluminum or aluminum bronze may be present.
Carbon black, coal or coke dust.	EX	Forklift manufacturer approved for this location.
Other combustible dusts.	EX	DY, EE, EX

If you work in an area where this hazard classification is present:	Then use this type of forklift. (See hazard designation descriptions above.)	
Class III Easily ignitable fibers or flyings are present but not likely to be in suspension in quantities sufficient to ignite.	Division I Locations in which these materials are handled, manufactured or used.	Division II Locations in which these materials are stored or handled (other than manufacture).
Baled waste, cocoa fiber, cotton, excelsior, hemp, istle, jute, kapok, oakum, sisal, Spanish moss, synthetic fibers, tow.	DY, EE, EX	DS, DY, ES, EE, GS, LPS (Type E may continue to be used if used previously at this location.)
Unclassified Locations Piers and wharves inside and outside general storage, general industrial or commercial properties.	D, E, G, LP (more protective designations may also be used)	

Maintenance of Forklifts

“Out of Service” and Required Check Intervals

State regulations 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.

Appendix A is a sample operator’s “Daily Forklift Safety Checklist” that 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.

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. A safety compliance officer assigned to investigate an accident involving a forklift will ask to see maintenance and repair records. If you do not have records, it will be impossible for you to prove any maintenance was done and may result in a citation.

When you replace parts, make sure they are equivalent to the original manufactured part. If the forklift was designed to operate in a hazardous (classified) location, ensure that any repairs meet UL or other testing laboratory requirements.

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.

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.

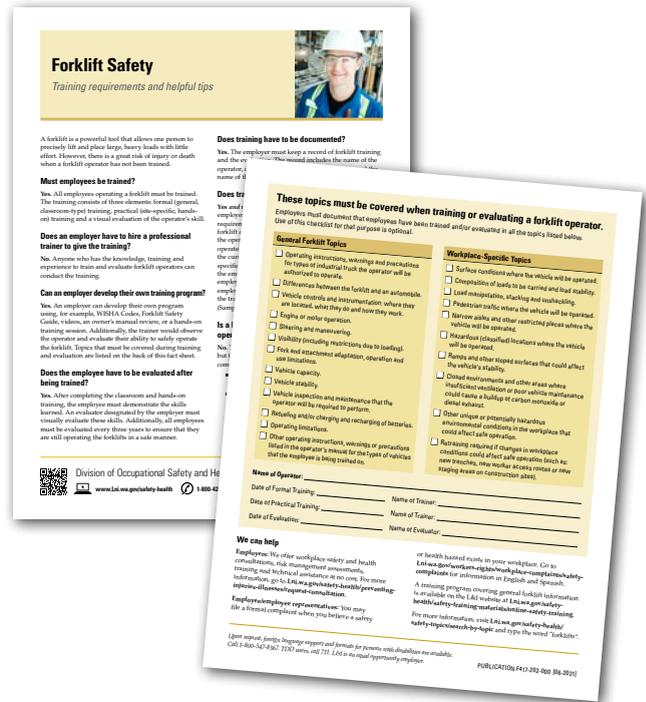
Summary

A forklift is a powerful tool when used by a well-trained operator. It allows workers to move and organize heavy materials.

However, it can expose workers to serious hazards which can result in injuries and in some cases even death.

To prevent or eliminate worker exposure to these hazards:

- 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 state regulations.
- 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 preventive maintenance.



To view or print a summary guide to forklift safety, visit

www.lni.wa.gov/go/F417-202-000

Operator's Daily Checklist: Gas or LPG Forklift

Check each item before the shift starts. Put a check in the box if the item is OK. Explain any unchecked items at the bottom and report them to a supervisor. Do not use an unsafe forklift! Your safety is at risk.

Forklift Serial Number: _____

Operator: _____

Hour Meter Reading:	Date:	Visual Check
<input checked="" type="checkbox"/>		Tires are inflated and free of excessive wear or damage. Nuts are tight.
		Forks and mast are not bent, worn, or cracked.
		Load back rest extension is in place and not bent, cracked or loose.
		Overhead guard is in place and not bent, cracked or loose.
		Attachments (if equipped) operate OK and are not damaged.
		Forklift body is free of excessive lint, grease or oil.
		Engine oil is full and free of leaks.
		Hydraulic oil is full and free of leaks.
		Radiator is full and free of leaks.
		Fuel level is OK and free of leaks.
		Battery connections are tight.
		Covers over battery and other hazardous parts are in place and secure.
		Load-rating plate is present and readable.
		Warning decals and operators' manual are present and readable.
		Seat belt or restraint is accessible and not damaged, oily or dirty.
		Engine runs smooth and quiet without leaks or sparks from the exhaust.
		Horn works.
		Turn signal (if equipped) operates smoothly.
		Lights (head, tail, and warning) work and are aimed correctly.
		Gauges and instruments are working.
		Lift and lower operates smoothly without excess drift.
		Tilt operates smoothly without excessive drift or "chatter."
		Control levers are labeled, not loose or binding and freely return to neutral.
		Steering is smooth and responsive, free of excessive play.
		Brakes work and function smoothly without grabbing. No fluid leaks.
		Parking brake will hold the forklift on an incline.
		Backup alarm (if equipped) works.

Operator's Daily Checklist: Electric Forklift

Check each item before the shift starts. Put a check in the box if the item is OK. Explain any unchecked items at the bottom and report them to a supervisor. Do not use an unsafe forklift! Your safety is at risk.

Forklift Serial Number: _____

Operator: _____

Hour Meter Reading:	Date:	Visual Check
<input checked="" type="checkbox"/>		Tires are inflated and free of excessive wear or damage. Nuts are tight.
		Forks and mast are not bent, worn, or cracked.
		Load back rest extension is in place and not bent, cracked, or loose.
		Overhead guard is in place and not bent, cracked, or loose.
		Attachments (if equipped) operate OK and are not damaged.
		Forklift body is free of excessive lint, grease, or oil.
		Hydraulic oil is full and free of leaks.
		Battery connections are tight.
		Covers over battery and other hazardous parts are in place and secure.
		Load rating plate is present and readable.
		Warning decals and operators' manual are present and readable.
		Seat belt or restraint is accessible and not damaged, oily, or dirty.
		Motor runs smooth without sudden acceleration.
		Horn works.
		Turn signal (if equipped) operates smoothly.
		Lights (head, tail, and warning) work and are aimed correctly.
		Gauges and instruments are working.
		Lift and lower operates smoothly without excess drift.
		Tilt operates smoothly without excessive drift or "chatter".
		Control levers are labeled, not loose or binding and freely return to neutral.
		Battery charge level is OK while holding full forward tilt.
		Steering is smooth and responsive, free of excessive play.
		Brakes work and function smoothly without grabbing. No fluid leaks.
		Parking brake will hold the forklift on an incline.
		Backup alarm (if equipped) works.

Resources

Come to the Source!

Visit www.Lni.wa.gov/Safety for information on safety and health standards, ergonomics, WISHA guidelines, hazard alerts, training workshops, hospitalization and fatalities, proposed rule changes and safety and health videos.

Forklift Resources

Find forklift rules, policies, training materials, videos, hazard alerts and more online at www.Lni.wa.gov/SafetyTopics. Search for Forklifts.



Get 1-on-1 Assistance

When you need professional help, we're here (and we're free)

As a Washington State business owner, plant manager or safety officer, you're entitled to no-cost consultation services from L&I.

L&I's Division of Occupational Safety and Health includes safety professionals, industrial hygienists, ergonomists and risk management specialists who want to help you protect your employees and manage your costs.

- We'll work with you to develop a plan that meets the specific needs of your business.
- Consultants do not issue citations — they help you identify and solve problems.
- Visit www.Lni.wa.gov/RiskConsultation to learn more about the benefits of a consultation and request any or all that could benefit your company.
 - Workplace safety and health
 - Preventing sprains and strains
 - Risk management

Invest in your business and your employees

Benefits of a safe and healthy workplace and risk management include:

- Fewer injuries, lower costs
- Less risk of citations during compliance inspections
- Opportunities to lower employee turnover and improve morale
- Peace of mind knowing you have done your part
- Quality of life for employees
- Everyone goes home to their loved ones at the end of the workday.

Schedule your free consultation

Business location	Call
Northwest Washington	425-290-1369
King County	206-835-1065
Pierce County/ Olympic Peninsula	253-596-3917
Southwest Washington	360-575-6951
Central Washington	509-886-6570
Eastern Washington	509-886-6570

Upon request, foreign language support and formats for persons with disabilities are available. Call 1-800-547-8367. TDD users, call 711. L&I is an equal opportunity employer.

PUBLICATION F417-031-000 [07-2021]