



Part 21 - Powered Industrial Trucks: What Every Trainer and Operator Must Know

**Student Materials
MTI Level Two Compliance Course
Consultation Education and Training Division
Michigan Occupational Safety and Health Administration
Michigan Department of Labor and Economic Opportunity
www.michigan.gov/miosha
517-284-7720**



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Part 21 – Powered Industrial Trucks: What Every Trainer & Operator Must Know

MIOSHA Training Institute (MTI) Level Two Compliance Course

Presented By:
Consultation Education and Training (CET) Division
Michigan Occupational Safety and Health Administration
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Objectives

- Discuss employer responsibilities related to powered industrial truck operations in the workplace.
- Identify the health hazards and control methods associated with fuel-fired and electric powered industrial trucks.
- Review employee responsibilities related to powered industrial truck operations in the workplace.

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Construction Standards

- **Part 12 Scaffolds and Scaffold Platforms**

- Rule 408.41243 Rough terrain forklift scaffolds

- **Part 13 Mobile Equipment**

- Rule 1926.602(C) Material Handling Equipment
- Rule 1910.178(I) Operator Training
- Appendix A Stability of Powered Industrial Trucks

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Scope

Rule 2101 - The purpose of this part is to provide, in or about places of employment, minimum safety rules for the care and use of powered industrial trucks and to provide for operator safety and specifications of equipment.

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Definitions

“Attachment” - A device, other than conventional forks or load backrest extension, mounted permanently or removed on the elevating mechanism of a truck for handling the load.



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Definitions

“Cantilever truck” - A self-loading counter-balanced or non-counterbalanced truck equipped with cantilever load engaging means.



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Definitions

“Capacity” - When referring to trucks, means the following:

(a) The capacity of a truck equipped with a load carriage and forks, or with attachments, is the maximum weight in pounds, at a specified load center which the truck, based on the strength of its various components and applicable stability, can lift to the maximum elevation of the load engaging means. Alternate capacities may be established at the same specified load center and at less than maximum elevation of the load engaging means.

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Definitions

(b) The capacity of a truck equipped with a platform is the maximum weight in pounds, at a specified load center which the truck, based on the strength of its various components, can lift to the maximum elevation of the load engaging means.



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Definitions

“Carriage” - A support structure for forks or attachment, generally roller mounted, traveling vertically within the mast of a cantilever truck.



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Definitions

“Counterbalanced truck” A truck equipped with load engaging means wherein all the load during normal transporting is external to the polygon formed by the wheel contacts.



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Definitions

“Electric truck” - A truck in which the principal energy is transmitted to motors in the form of electricity from a power source such as, but not limited to, a battery or motor generator.



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Definitions

“Fixed platform truck” - A truck equipped with a load platform which is non-elevating.



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Definitions

“Forks” - Horizontal tine-like projections, normally suspended from the carriage, for engaging and supporting loads.

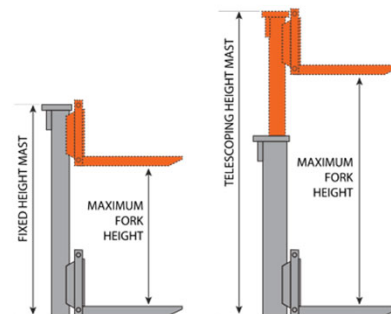


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Definitions

“Fork height” - The vertical distance from the floor to the load carrying surface adjacent to the heel of the forks with mast vertical, and in the case of a reach truck, with the forks extended.



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Definitions

“Fork-lift truck” - A light-lift self-loading truck equipped with load carriage and forks for transporting and tiering loads.



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Definitions

“High-lift platform truck” - A self-loading truck equipped with a load platform, intended primarily for transporting and tiering loaded skid platforms. (Appendix A, Figure 2.)



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Definitions

“Industrial crane truck” - A truck intended primarily for pick and carry use in warehousing, yarding, or industrial plant operation over improved or hard surfaced roads and yards, including maintenance within these areas.



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Definitions



“Industrial tractor” – Designed primarily to draw one or more nonpowered trucks, trailers or other mobile loads.

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Definitions

“Internal combustion engine truck” - A truck in which the power source is a gas, LP gas, gasoline, or diesel type engine.



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Definitions

“Issuing authority” - An employer or his or her designated representative who instructed and trained the operator.



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Definitions

“Liquefied petroleum gas (LP gas)” - A fuel which is composed predominantly of any of the following hydrocarbons, or mixtures of them: propane, propylene, butanes and butylenes.



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Definitions

“Load backrest extension” - A device extending vertically from the fork carriage frame.

Load backrest extension



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Definitions

“Mast” - A support member providing the guide ways permitting vertical movement of the carriage.

Reach truck with mast extended



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Definitions



“Motorized hand truck” - Designed to be controlled by a walking operator and used to lift, tow, carry, stock and tier materials.

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Definitions

“Narrow aisle truck” - A self-loading truck primarily intended for right angle stacking in aisles narrower than those normally required by counterbalanced trucks of the same capacity.



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Definitions

“Order picker truck, high-lift” - A high-lift truck controlled by the operator stationed on a **platform** movable with the load engaging means and intended for manual stock selection. The truck may be capable of self-loading or tiering or both.



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Definitions

“Overhead guard” - A framework fitted to a truck over the head of a riding operator.



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Definitions



“Pallet truck” - A self-loading low-lift truck equipped with wheeled forks of dimensions to go under a single faced pallet or between the top and bottom boards of a double-faced pallet....

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Definitions

“Parking brake” - A device to prevent the movement of a stationary truck.



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Definitions

“Powered industrial truck” or “truck”- A mobile, power-driven vehicle used to carry, push, pull, lift, stack, or tier material.



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Definitions

“Reach truck” - A self-loading truck, generally high-lift, having load engaging means mounted so the means can be extended forward under control to permit a load to be picked up and deposited in the extended position and transported in the retracted position.



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Definitions



“Rough terrain forklift truck” - A wheeled-type truck designed primarily as a fork truck with a vertical mast and/or pivoted boom, with variable fixed length reach and may be equipped with attachments and is intended for operation on unimproved natural terrain and the disturbed terrain of construction sites.

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Definitions



“Side loader” - A self-loading truck, generally high-lift, having load engaging means mounted so that the means can be extended laterally under control to permit a load to be picked up and deposited in the extended position and transported in the retracted position.

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Definitions

“Straddle truck” - A class of cantilever truck with horizontal structural wheel supported members extending forward from the main body of the truck, generally high-lift, for picking up and hauling loads between its outrigger arms.



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Definitions

“Tire” - A tire which may be standard solid, cushion solid, pneumatic or solid pneumatic style.



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Definitions

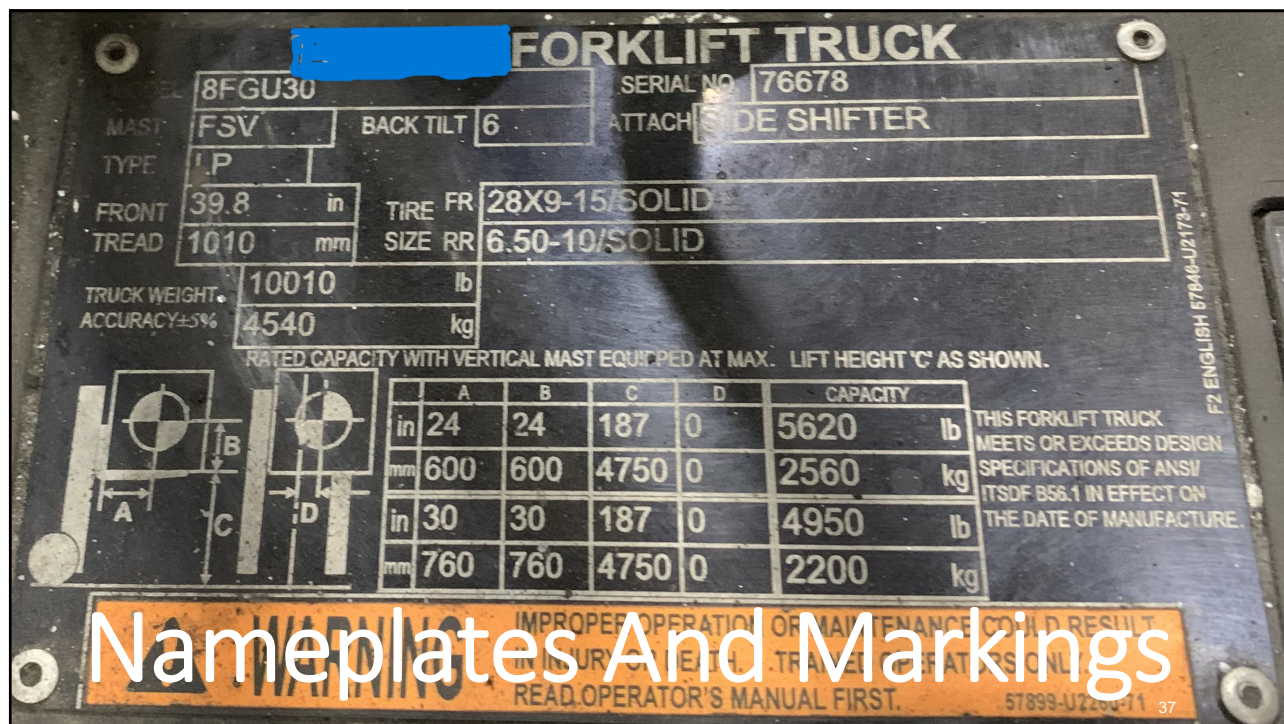
“Unattended truck” - One which is beyond the vision or more than 25 feet from the operator, whichever is less.



Elevated forks

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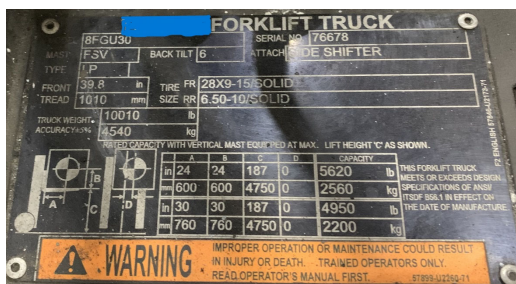


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Nameplates Rule 2122

(1) A powered industrial truck which has been accepted by an approved testing laboratory shall bear a label or marking indicating such acceptance.

(2) A nameplate, label or tag provided on such a truck shall be maintained in place and in legible condition.



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Designations on Nameplates

GAS POWERED

G = Gasoline

GS = G + additional safeguards to exhaust, fuel and electrical

LIQUEFIED PETROLEUM GAS (LPG)

LP = Similar to G, except for liquefied petroleum gas is the fuel

LPS = liquefied petroleum gas powered units that are provided with additional safeguards to the exhaust, fuel, and electrical system

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Designations on Nameplates

ELECTRIC POWERED

E = Electric (minimal protection against inherent fire hazards)

ES = E + prevents emission of hazardous sparks + limits surface temperatures

EE = ES + motors and all other electrical completely enclosed

EX = Electrical fittings and equipment designed, constructed and assembled for use in certain atmospheres containing flammable vapors or dusts

DIESEL POWERED

D = Diesel (minimal protection against fire and spark emission)

DS = D + additional safeguards to exhaust, fuel and electrical

DY = DS + no electrical + equipped with temperature limitation features

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Audible Device Rule 2131(1)

A truck, except a motorized hand truck, shall be equipped with an audible device to warn of approach.



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Modifications Rule 2132(1)



Employees acting as a counterweight

An employer shall not install an additional counterweight without written assurance from the manufacturer of the truck that the truck will meet the stability requirements of ANSI standard B56.1 "Safety Standard for Low Lift and High Lift Trucks" 1993 edition, as adopted in R 408.12111.

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Modifications Rule 2132(2)



An employer shall not make or install modifications affecting capacity or safety without written approval of the manufacturer or an engineer knowledgeable on the subject.



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Parking Brakes Rule 2134(1)

The parking brake on a sit-down rider truck shall be capable of holding the truck on the maximum grade which the truck can negotiate with rated load, or on a 15% grade, whichever is lesser.



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Operator Platforms Rule 2136(3)

All the following apply to an order picker truck, high-lift:

- (a) A removable operator platform with a device that attaches the platform to the lifting means.
- (b) The operator platform shall be equipped with side guard rails.
- (c) When the platform is elevated, the horizontal travel speed of the truck shall be reduced to a degree necessary to maintain stability under a maximum braking load and turning.



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Steering Controls Rule 2137(1)

The steering control shall be contained within the outlines of the planes of the truck or guarded to prevent injury to the operator during movement of the controls when passing an obstacle such as a wall, post, equipment, box, or another truck.



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Steering Controls Rule 2137(2)

An employer shall assure that on a motorized hand and motorized hand or rider truck, the steering handle is provided with a guard or device to protect the operator's hands from injury when passing an obstacle such as a wall, post, equipment, box, or another truck.



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Load Handling Controls Rule 2138



All of the following apply to a load handling control on a truck:

- (a) Preferably located for right hand operation.
- (b) Single lever used to perform more than one function. Push button or pre-selected controls shall be properly identified.
- (c) Clearly and durably identified to indicate function and direction of motion of load or equipment.
- (d) Self-centering.

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Load Handling Controls; Direction of Motion and Guards Rule 2139

(1) A lever or handle type control, including a toggle switch, shall be in accordance with Table 1 Direction of Motion in the Standard.

(2) Moving parts that represent a hazard from the operator's position shall be protected by suitable guards.



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Overhead Guard Rule 2143(1)

Except as provided in subrule (2) of this rule, a high-lift truck shall be fitted with an overhead guard. The overhead guard shall be capable of supporting a uniformly distributed static load in accordance with the following table. The overhead guard is not intended to withstand the impact of a falling capacity load.



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Overhead Guard Rule 2143(3)

An overhead guard may be omitted from a high-lift truck if the truck is never used to lift or raise material or objects more than 72 inches measured from the floor to the forks and if all the following are compiled:

- (a) The load is limited to a single rack or pallet.
- (b) The truck is not operated in an area where material or objects are stacked above the operator's head.



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Operator Selection

Rule 2151

An employer shall be able to demonstrate that an employee is trained and qualified to operate a powered industrial truck prior to authorizing the employee to operate a powered industrial truck.

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Training

Rule 2152(1)

An employer shall provide training to the employee before the employee's assignment as an operator of a powered industrial truck. Instruction shall include all of the following:

- (a) Capacities of the equipment and attachments.
- (b) Purpose, use, and limitations of controls.
- (c) How to make daily checks.
- (d) Practice and operating assigned vehicles through the mechanical functions necessary to perform the required job.

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Training

Rule 2152(1) (Continued)

(e) The requirements contained in R 408.12171 to R 408.12193 State safety standard Rules 2171 to 2193 of Part 21.

(f) Hazards associated with exhaust gases produced by fossil fuel powered industrial trucks and hazards associated with the handling of electrolyte chemicals used for battery operated trucks shall be provided.

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Training

Rule 2152(2)

Training shall consist of a combination of formal instruction such as lecture, discussion, interactive computer learning, videotape, written material, practical training, and testing of the operator's performance in the workplace as required in R 408.12153.

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Training - Workplace Specific

- Surface conditions
- Composition and stability of loads
- Load manipulation, stacking, un-stacking
- Pedestrian traffic
- Narrow aisles and restricted areas
- Employee responsibilities

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Refresher Training Rule 2152(3)

Refresher training in relevant topics shall be provided to an operator under any of the following conditions:

- (a) An operator has been observed to operate the vehicle in an unsafe manner.
- (b) An operator has been involved in an accident or a near-miss incident.

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Refresher Training

Rule 2152(3) (continued)

- (c) An operator has received an evaluation that reveals that the operator is not operating the truck safely.
- (d) An operator is assigned to a different type of truck.
- (e) A condition in the workplace changes that could affect safe operation of the truck.

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Refresher Training

Rule 2152(4)

An evaluation of each operator's performance shall be conducted before renewal of a truck operator permit.

An individual who is authorized by the employer and who has the knowledge, training, and experience to train and evaluate the competence of the operator shall provide training and evaluation.

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Testing Rule 2153(1)

An employer shall test an employee before authorizing the employee to operate a powered industrial truck.

- (a) Operating ability
- (b) Knowledge of the equipment
- (c) Knowledge of requirements in Part 21 rules 2171 to 2193
- (d) Knowledge of daily checks

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Testing Rule 2153(2)

A performance test shall be given to determine whether the employee can operate the assigned powered industrial truck through the functions necessary to perform the required work.

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Testing Rule 2153(3)

An employee who has a valid permit to operate a powered industrial truck issued by another employer may be tested as prescribed in this rule without meeting the training requirements of R 408.12152.

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Permits Rule 2154

(1) An employer shall provide the employee with a permit to operate a powered industrial truck only after meeting the requirements prescribed in R 408.12151, R 408.12152, and R 408.12153. A permit is optional for operators of motorized hand low lift trucks.

(2) An employee being trained is exempt from the permit requirement for a period of not more than 30 days, provided the employee is under the supervision of an individual who is authorized by the employer and who has the knowledge, training, and experience to train operators and to evaluate their competence, and that the training period does not endanger the trainee or other employees.

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Permits

Rule 2154 (Continued)

(3) A permit shall be carried by the operator or be available upon request by a department representative at all times during working hours.

(4) A permit shall indicate the type of truck an operator has been trained on and is qualified to operate.

(5) A permit to operate a powered industrial truck shall be valid only with the employer who issued the permit, and the permit shall be issued for a period of not more than 3 years and shall be consistent with subrule (2) of R 408.12151.

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Permits

Rule 2154 (Continued)

(6) A permit shall contain all of the following information.

(a) Firm name.

(b) Operator's name.

(c) Operator I.D. number, if any.

(d) Name of issuing authority.

(e) Type of truck authorized to operate.

(f) Operator restrictions, if any.

The permit shall state the nature of the restriction.

(g) Date issued.

(h) Date expiring.

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Mechanical Condition/Maintenance Rule 2161(1)

**FORK TRUCK
PRE-OPERATION INSPECTION CHECKLIST**

Complete the pre-operation checklist with one of the following responses after each item.

- If working properly, enter an X in the "O.K." column.
- If not working properly, enter an X in the "Needs Repair" column and explain the condition.

Turn the checklist in to the appropriate person.

Truck No. _____ Operator _____

Date ____/____/____ Type of Truck _____

Shift 1 2 3 Department _____

Checklist	O.K.	Needs Repair
Accessory Control		
Battery Indicator		
Brakes		
Fluid Levels		
Forks, Mast, Chains, Stops, Backrest		
Horn		
Hydraulic Cylinders		
Hydraulic Hoses and Fittings		
Lift Control		
Lights		
Limit Switches		
LP Leaks		
Overhead Guard		
Steering		
Tilt Control		
Tires and Wheels		

A powered industrial truck shall not be used if:

- (a) The service and parking brakes do not perform their intended function.
- (b) The fuel system leaks.
- (c) A lift cylinder of a load engaging means allows a downward drift of the load engaging means loaded or unloaded in excess of five inches in five minutes.

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Mechanical Condition/Maintenance Rule 2161(1) (Continued)

- (d) A tilt cylinder of a mast allows a forward drift of the mast in excess of two degrees in five minutes with the mast in a vertical position and a capacity load on the fork or load engaging means.
- (e) The steering mechanism allows free play of the steering wheel of more than 1/4 turn on trucks capable of speeds up to 8 miles per hour and more than 1/8 turn on trucks capable of speeds over eight miles per hour.
- (f) A hydraulic system leaks and creates a hazard for an employee and equipment in the area.

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Mechanical Condition/Maintenance Rule 2161(3)

Repairs to the truck electrical system shall be made only after the battery has been disconnected.



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Blocks & Safety Stands For Maintenance Rule 2162(1)

An employer shall provide the following:

- (a) Chock blocks, support blocks, or jack stands for the maintenance department's use when repairing powered industrial trucks or their components.
- (b) Blocks or safety stands as a means of support for powered industrial trucks elevated from the floor by a hoist or chain fall.

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Fuel Rules 2163

- (1) An employer shall provide safety fuel cans where trucks are refueled with gasoline at other than a gas pump area
- (2) An employer shall provide a special area for refueling that is not less than 25 feet from a source of open flame or spark and the area shall be posted to this effect.



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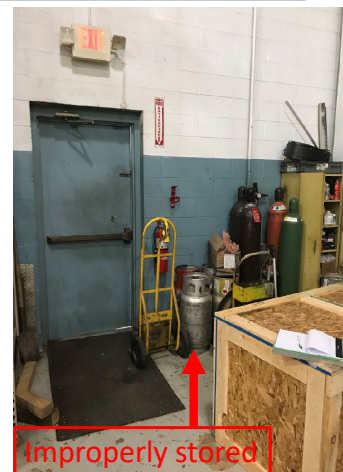
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Fuel Rules 2163 (continued)

- (3) Use and storage of LP gas shall be as specified by General Industry Safety Standard Part 56 "Storage and Handling of Liquefied Petroleum Gases," as referenced in R 408.12111.

PART 56, STORAGE AND HANDLING OF LIQUEFIED PETROLEUM GASES

1910.110(f)(2)(ii) Containers when stored inside shall not be located near exits, stairways, or in areas normally used or intended for the safe exit of people.



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Electric Trucks Rule 2164

(1) An employer shall provide a designated area for battery changing, charging, or both, which shall be performed by a trained and authorized employee.

(2) Provisions shall be made in a battery charging area where batteries are removed from the truck for flushing and neutralization of spillage, for fire protection, and for air movement sufficient to disperse fumes from gassing batteries.



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Electric Trucks Rule 2164 (Continued)

(3) Smoking and other sources of ignition is prohibited in areas.

(4) An employer shall assure that an employee shall be trained to position the truck and apply the brake before changing or charging a battery and to position and secure a reinstalled battery before releasing the truck for use.

(5) Material handling equipment, such as, but not limited to, a conveyor or overhead hoist, shall be used for removing and replacing a battery.



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DockBoards And Plates Rule 2165

- (1) Carrying capacity shall be marked on a dockboard or plate.
- (2) Fork loops, pockets or lugs shall be provided for safe handling.
- (3) A dockboard or plate shall have a slip-resistant surface designed to reduce the possibility of slipping by an employee or truck.

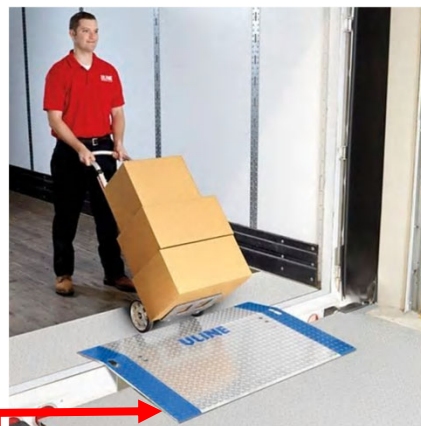


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DockBoards And Plates Rule 2165 (Continued)

- (3) A dockboard or plate shall have a slip-resistant surface, but not limited to tread plate, designed to reduce possibility of slipping.
- (4) For dockboards, see General Industry Safety Standard Part 2 – Walking-Working – Surfaces see section 1910.26.



Must secure plate
between dock and trailer

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Forklift Truck Platforms Rule 2167

(1) An employee shall not be lifted or transported except when a platform is attached to the forks by enclosed sleeves, a safety chain or a mechanical device in such a manner that the platform cannot tip or slip.



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Forklift Truck Platforms Rule 2167 (Continued)

(2) A platform shall be equipped with a railing not less than 36 inches or more than 42 inches high and a toeboard. The railing shall consist of 1 of the following materials: wood, steel or aluminum pipes.

(3) The intermediate rail may be omitted from 1 side.

(4) A toe board shall be made of not less than 1 inch x 4 inches nominal wood stock or a material of equal strength



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Spinner Knobs Rule 2169

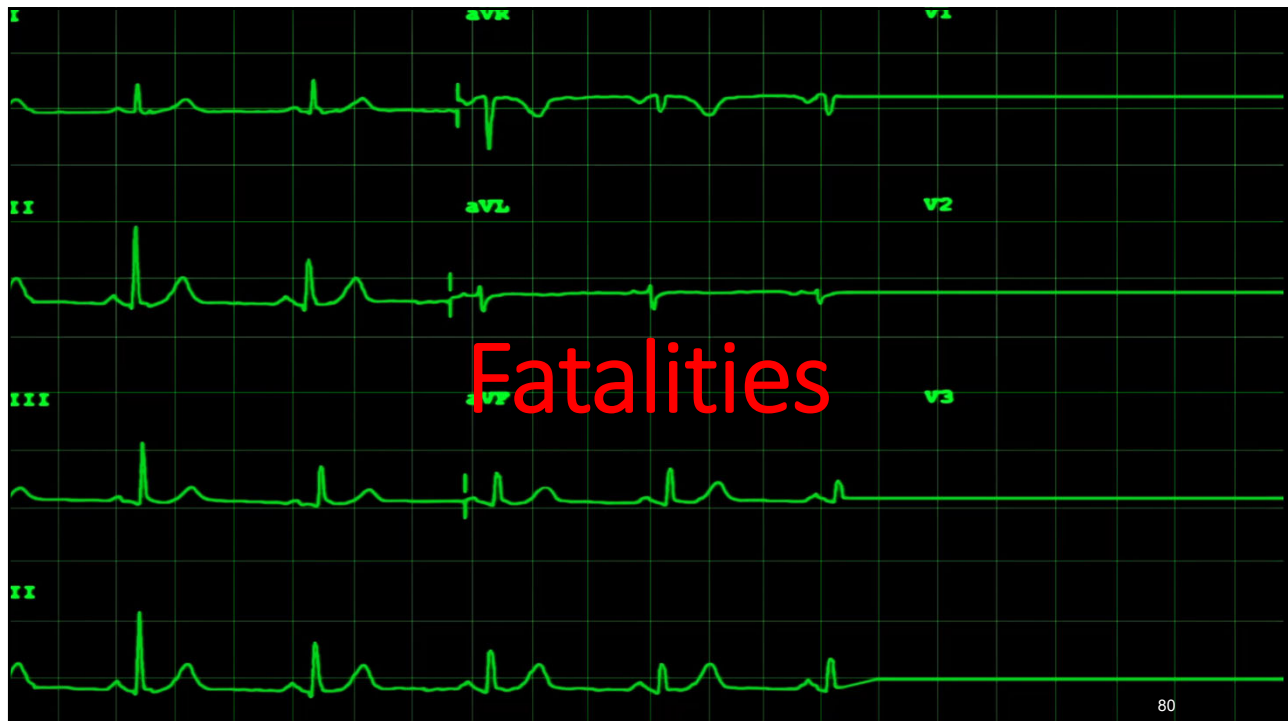
A spinner knob shall not be attached to a steering hand-wheel of a truck unless originally equipped with such; the truck is equipped with power steering; or the truck is equipped with an anti-kickback device on the steering mechanism. The knob shall be installed within the periphery of the handwheel.



Spinner Knob

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July 28, 2020, Struck By Fatal – Livingston County 49-Year-Old Maintenance Worker

Employee was putting a lift chain on a PIT mast during a repair. The employee moved the mast backwards and the mast crushed him between the mast and the overhead guard.



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July 28, 2020, Struck By Fatal – Livingston County 49-Year-Old Maintenance Worker

A worker was moving steel I-beams to a scrap pile behind the facility using a modified forklift and became trapped between a cement bunker and the forklift.



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Background

Why include this in the PIT training???

Carbon monoxide (CO) can be produced by lift trucks or any other devices that are powered by internal combustion (IC) engines.

CO is a **common industrial air contaminant hazard** resulting from the incomplete burning (or combustion) of material containing carbon such as natural gas, gasoline, kerosene, oil, propane, coal, or wood.

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Carbon Monoxide (CO)

A gas with NO warning properties

- **Colorless**
- **Odorless**
- **Tasteless**



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Carbon Monoxide (CO)

As stated previously, CO is produced from the incomplete combustion of solids, liquid, or gaseous organic materials.

Engines which burn gasoline, diesel fuel, liquid propane (LPG), or compressed natural gas (CNG) have the potential to release CO into the workers environment.



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MIOSHA Exposure Limit Acronyms

- Time-Weighted Average – TWA
- Permissible Exposure Limit – PEL (8 Hr. TWA)
- Maximum Allowable Concentration - MAC
- Short Term Exposure Limit – STEL (15 Min.)
- Ceiling Limit – C
- Immediately Dangerous to Life or Health – IDLH

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Exposure Limits Reference Part 301 Carbon Monoxide (General Industry)

Limit	OSHA	MIOSHA	ACGIH	NIOSH
TWA	50 ppm	35 ppm	25 ppm	35 ppm
STEL	NA	NA	NA	NA
Ceiling	NA	200 ppm	NA	200 ppm
IDLH	NA	NA	NA	1200 ppm

NA = not available

ACGIH = American Conference of Governmental Industrial Hygienists

NIOSH= National Institute of Occupational Safety and Health

IDLH= Immediately dangerous to life and health.

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Exposure Limits Reference Part 601 Carbon Monoxide (Construction Industry)

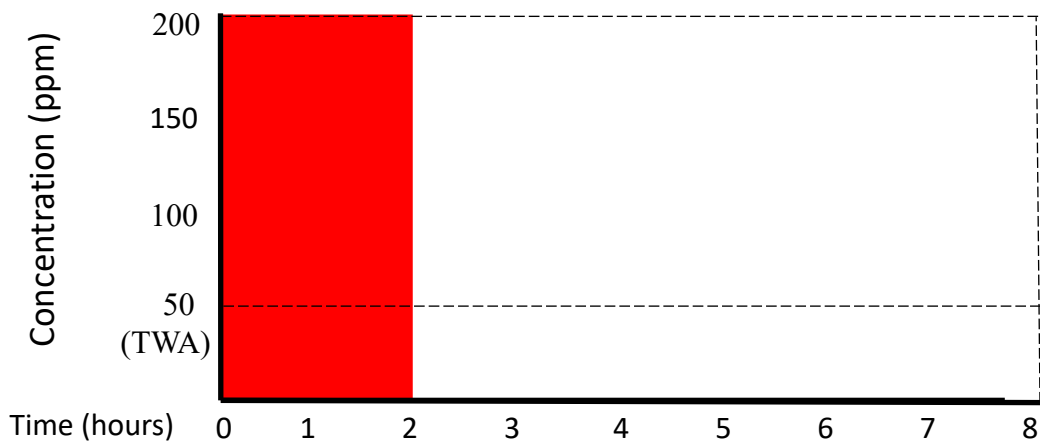
Limit	OSHA	MIOSHA	ACGIH	NIOSH
TWA	50 ppm	50 ppm	25 ppm	35 ppm
STEL	NA	NA	NA	NA
Ceiling	NA	NA	NA	200 ppm
IDLH	NA	NA	NA	1200 ppm

NA = not available

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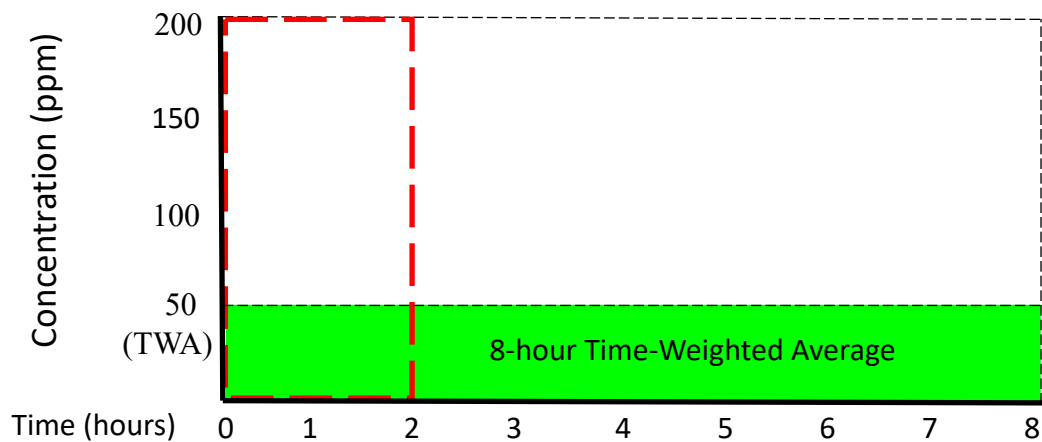
Time-Weighted Average (TWA)



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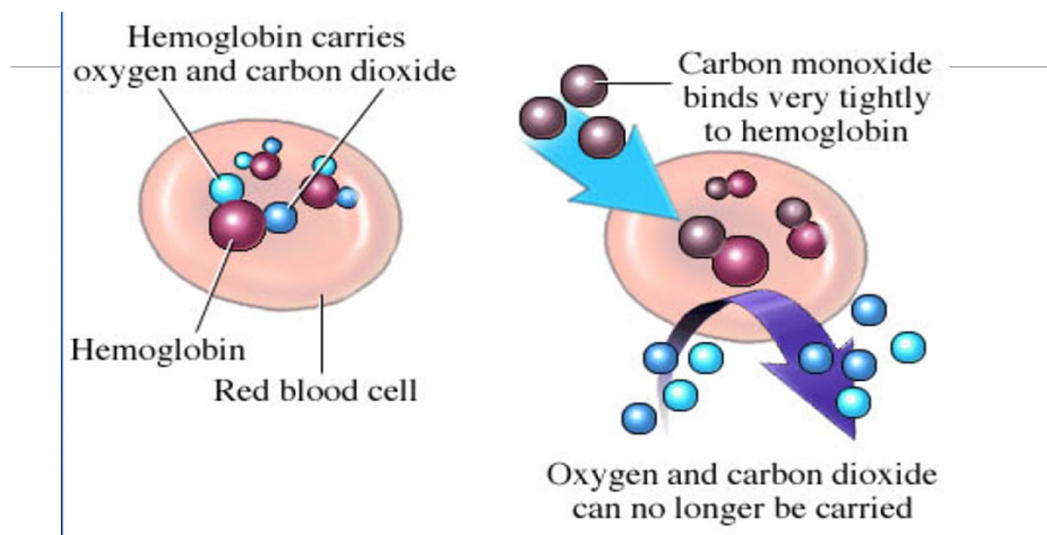
Time-Weighted Average (TWA)



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Hemoglobin



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Effects of Carbon Monoxide Exposure

<u>COHb%</u>	<u>CO PPM</u>	<u>Time</u>	<u>Symptoms</u>
Est. 5%	35	8 hours	None expected - MIOSHA PEL
5-10%	200	2-3 hours	Mild headache, fatigue, nausea, and dizziness. MIOSHA Ceiling limit
10-25%	400	1-2 hours	Serious headache – other symptoms intensify. Life threatening after 3 hours.
25-50%	800	45 minutes	Dizziness, nausea, and convulsions. Unconscious within 2 hours. Death within 2-3 hours.
≥50%	≥1600	≤20 minutes	Headache, dizziness, and nausea, and/or death.

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Treatment for Excessive CO Exposure

- Move exposed person to fresh air
- Loosen any tight clothing
- Contact 911/physician/healthcare professional
- Physician determined treatment may also include use of:
 - Oxygen
 - Hyperbaric Chamber

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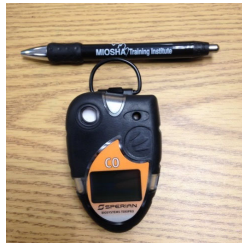
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CO Monitoring

Direct reading instrument

Colorimetric detector

CO specific dosimeter



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Sources of Assistance for Air Monitoring

- MIOSHA Consultative Services
- Company/corporate safety and health team
- Insurance carriers
- Private consultants
- Private organizations/associations

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Hierarchy of Controls

To achieve compliance with the provisions of the air contaminant standards, engineering and administrative controls must first be determined and implemented when feasible.

This is required if employees are overexposed above MIOSHA exposure limits.

Employees need to be protected from overexposure to airborne contaminants including emissions from powered industrial trucks.

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Controlling Exposures

- Elimination: Use electric lift trucks
- No carbon monoxide if no combustion
- Substituting propane for gas or diesel
- Liquid propane gas (LPG) is a cleaner burning fuel
- Reduces engine wear
- Gasoline requires more ventilation for indoor use
- Diesel produces soot and other air contaminants



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Engineering Controls – General Industrial Ventilation

- General exhaust or dilution ventilation is the dilution of contaminated air with uncontaminated air.
- The air volume shall be sufficient to dilute the airborne contaminants to levels not exceeding permissible exposure limits.
- Part 520. Ventilation Control, provides requirements for both local exhaust and general ventilation system.



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PIT Engineering Controls – Dilution Ventilation



Sit Down Rider - Gas-Pneumatic Tires



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Dilution Ventilation Rate (VR) Recommendations

Type of Truck or Location	Volume of Air (cfm) per Truck
	ACGIH Ventilation Rate Recommendations
Gasoline Powered	16,000 CFM
Propane Powered	10,000 CFM
Loading Docks	2 cfm per square foot of dock space

Source: American Conference of Governmental Industrial Hygienists (ACGIH), *Industrial Ventilation: A Manual of Recommended Practice for Design*, 29 Ed, page 13-176

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Dilution Ventilation Rates (ACGIH, Industrial Ventilation Manual)

Stipulation	Ideal Condition	Change for Non-ideal
Maintenance Program	Propane 1% CO or less; Gasoline 2% CO or less	Vent Rate (VR) x 3
Operation Period	Limit to <50% of working day	VR x (% of day/50%)
Good Air Distribution	Refer to Figure 4-1, ACGIH® Ind. Vent. Manual, 28 th edition	Not Recommended
Volume of Space	150,000 cubic feet per lift truck	75,000 – VR x 1.5 30,000 – VR x 2 <25,000 – NR
Lift Truck Power	Limit engine power to < 60 HP	VR x (actual HP/60)

102

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Engine Maintenance

- Carburetor
- Air cleaner
- Ignition timing
- Fuel system adjustment
- Oxygen sensor
- Catalytic converter
- Utilize proper diagnostic equipment



103

103

Are electrical
trucks safer?



104

104

Powered Industrial Trucks Part 21, Rule 2164 (9)

Where there is potential for employee exposure to injurious corrosive electrolyte solutions associated with battery powered industrial trucks, the employer shall provide...

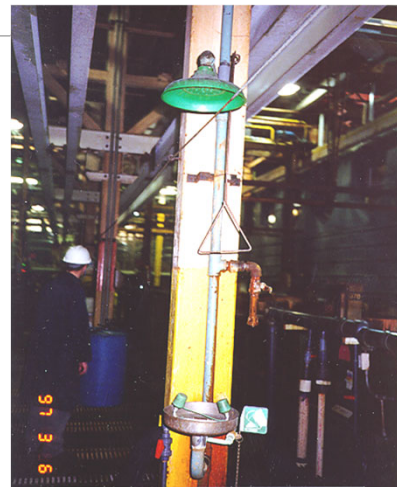


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Medical Services and First Aid Part 21, Rule 2164 (9)

Suitable facilities for quick drenching or flushing of the eyes and body within the work area for immediate emergency use.



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Area of Corrosive Exposure

Battery charging station:

- Replacement
- Changing
- Mixing electrolyte
- Charging



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Eyewashes and Showers

- Ten second travel time (approximately 55 feet)
- Consult Label and SDS pictograms and hazard statements (examples):
 - "Severe skin burns and eye damage"
 - "Serious eye damage"
 - "Serious eye irritation"
 - $\text{pH} \geq 11.5$
 - $\text{pH} \leq 2.0$
- Shall be easily accessible
- Should be well lit and marked



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Powered Industrial Trucks Part 21, Rule 2164 (9)

Personal protective equipment shall be provided in accordance with:

- Occupational Health Standard Part 433, R 325.60001 et seq.,
“Personal Protection Equipment”
- General Industry Safety Standard Part 33, R 408.13301 et seq.,
“Personal Protective Equipment”

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Adequate Personal Protective Equipment (PPE)

- Eye and face:
 - Splash goggles
 - Face shield
- Hands and arms: Gloves - long
- Body: Apron

PPE needs to be acid-resistant
(rubber or neoprene)



110

110

Noise

- Part 380. Occupational noise exposure would apply if employee time-weighted average (TWA) noise exposures exceed the Action Level of 85 dBA.
- Sources could include general workplace noise, metal forks on the trucks handling metal totes and loading into trailers, back up alarms.
- PIT Operators who work in noisy areas should be monitored to determine their noise exposure in the workplace.

111

111

Train Employees

- Recognize effects of CO exposure
- Sources of CO
- Exposure monitoring program
- Measures to protect themselves
- Treatment for excessive exposure
- Adequate PPE during battery maintenance
- Adequate PPE during LPG changes
- Location and use of eyewash and shower
- Hearing protection if necessary

112

112

Module Review

Identify the health hazards and control methods associated with fuel-fired and electric powered industrial trucks.

113

113



114

Daily Checks

Rule 2171

- (1) At the start of each shift, the operator of powered industrial truck or qualified employee shall perform daily checks of the equipment.
- (2) An employer shall ensure that any defects that would affect the safe operation of the equipment are repaired before use.
- (3) An operator shall promptly report any defect on the powered industrial truck to the employer.

115

115

Other Warning and Safety Devices

- Back-up alarm
- Brake lights
- Directional signals
- Fire extinguishers
- Mirrors
- Seatbelts



116

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Other Warning and Safety Devices



The Blue Spot LED light projects typically 16 to 24 feet in advance of PIT to alert others.

117

117

Daily Checks Rule 2171



(1) At the start of each shift, the operator of a powered industrial truck or a qualified employee shall

perform daily checks of the equipment as required by the employer.

(2) An employer shall ensure that any defects that would affect the safe operation of the equipment are repaired before use.

(3) An operator shall promptly report any defect on the powered industrial truck to the employer.

118

118

General Operating Rules Rule 2172(1)

An operator shall safeguard other employees at all times.



Safeguard other employees

119

119

General Operating Rules Rule 2172(2)

An operator shall not drive a truck up to anyone who is standing in front of a fixed object.



120

120

General Operating Rules

Rule 2172(3)



An operator shall not allow anyone to stand or pass under the elevated portion of any powered industrial truck, whether loaded or empty

121

121

General Operating Rules

Rule 2172(4)



No employee except the operator, shall ride on a powered industrial truck unless the truck is provided with a passenger seat. Passenger seats on a forklift truck shall be under the overhead guard.

122

122

Position of Arms and Legs Rule 2173



An employee shall not place his or her arms or legs in either of the following positions:

- (a) Between the uprights of the mast.
- (b) Outside the running lines of a moving truck.

123

123

Parking Rule 2174

- (1) When a powered industrial truck is left unattended, load engaging means shall be fully lowered, controls shall be neutralized, power shall be shut off, and brakes set.
- (2) Whenever it is necessary to leave a truck on an incline, the truck wheels shall be blocked, and the steering wheels turned toward the curbing, wall or railing.

124

124

Towing And Pushing Rule 2175

A truck shall not be used to tow or push railroad cars, unless it is specifically designed for that purpose.



General Provisions. R 408.10026(1)



Attachment for moving railcars

125

125

Towing And Pushing Rule 2175 (Continued)

Freight car doors shall not be opened or closed by using a powered industrial truck, unless it is equipped with attachments designed for that purpose.



Device designed to attach to forks of PIT and open/ close freight car doors.

126

126

Loading Trucks, Trailers, Railcars Rule 2176(1)



An employer shall ensure that a highway truck and trailer are not boarded by a powered industrial truck before the highway truck and trailer has its brakes set and not less than 2 wheels blocked or be restrained by other mechanical means installed in a manner that will hold the trailer from movement.

127

127

How a Dock lock works

<https://www.youtube.com/watch?v=ccMpzxk67eg>

128

128

Loading Trucks, Trailers, Railcars Rule 2176(1) (Continued)

WHEEL CHOCK



DOCK LOCKS



129

129

Loading Trucks, Trailers, Railcars Rule 2176(1) (Continued)



Wheel chock and dock lock light system in use

130

130

Loading Trucks, Trailers, Railcars Rule 2176(2)

An employer shall ensure that wheel stops, hand brakes, or other approved positive protection to prevent railroad cars from moving during loading or unloading operations are provided, and before and while dockboards or bridge-plates are in position.



Photos Courtesy of Aldon

131

131

Loading Trucks, Trailers, Railcars Rule 2176(4)

An employer shall ensure that the landing gear of all semi-trailers are visually inspected immediately before the trailer is uncoupled from the tractor to assure ability of the landing gear to support the imposed load.

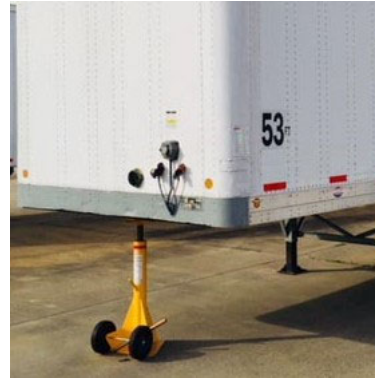


132

132

Loading Trucks, Trailers, Railcars Rule 2176(5)

A semitrailer less than 30 feet in length, when not coupled to a tractor and being loaded or unladed with a powered industrial truck shall be provided a support capable of sustaining a load at the front.

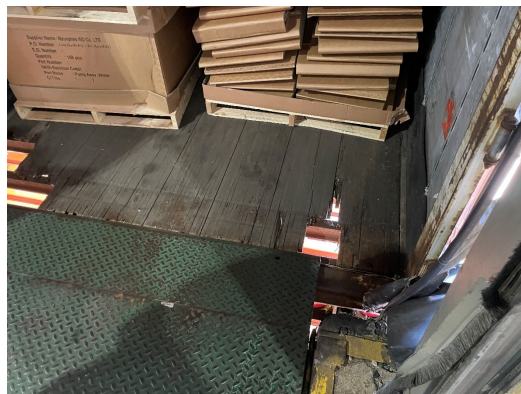


133

133

Loading Trucks, Trailers, Railcars Rule 2176(6)

An employer shall ensure that the flooring of trucks, trailers, and railroad cars are checked for breaks and weakness before they are driven onto.



134

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Surveying Path of Travel Rule 2177



Avoid obstacles and edge of platforms or ramps

135

135

Operations In Hazardous Areas Rule 2178

When operating a powered industrial truck in a hazardous area, only a truck specifically equipped for such operation shall be used. See R 408.12155.

Flame-proof forklift



Photo Courtesy of Chess Engineering

136

136

Other Hazardous Operations



GI Part 44 FOUNDRIES

Rule 4498. Where a powered industrial truck is used for loading a furnace, an operator, exposed to splash or splatter, shall be protected by a shield.

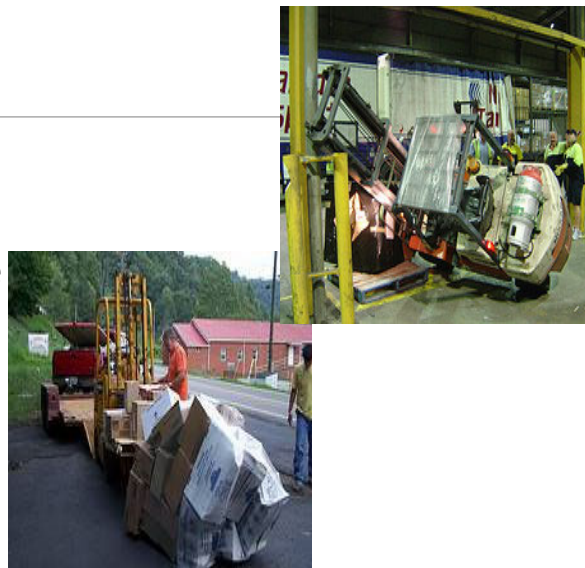
*If a PIT operator is exposed this rule would be cited out of Part 44, the vertical standard

137

137

Reporting Accidents Rule 2179

A powered industrial operator shall report all injuries involving injury to an employee or damage to buildings and equipment to the employer.



138

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139

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Clear Access Rule 2180

An operator shall maintain clear access of fire aisles, to stairways and fire equipment when depositing loads.



140

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Making Repairs Rule 2181

Operators shall not make any repairs or adjustments unless specifically authorized to do so.



141

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Flammables Rule 2182

A fuel tank shall not be filled while the engine is running. Spilled fuel shall be carefully washed away or completely evaporated, and the fuel tank cap replaced before restarting the engine.



142

142



143

Stability

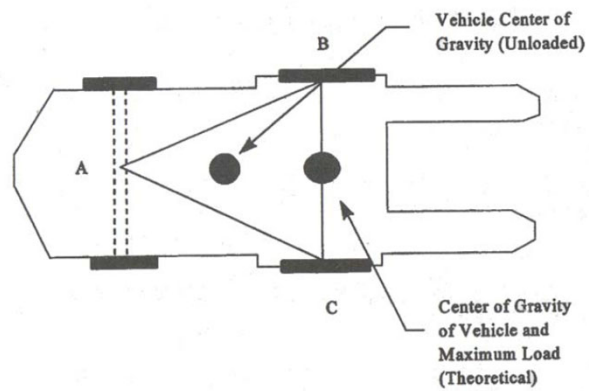
“Stability Triangle” Almost all counterbalanced powered industrial trucks have a three-point suspension system, that is, the vehicle is supported at three points. This is true even if the vehicle has four wheels. The truck's steer axle is attached to the truck by a pivot pin in the axle's center. When the points are connected with imaginary lines, this three-point support forms a triangle called the stability triangle.

144

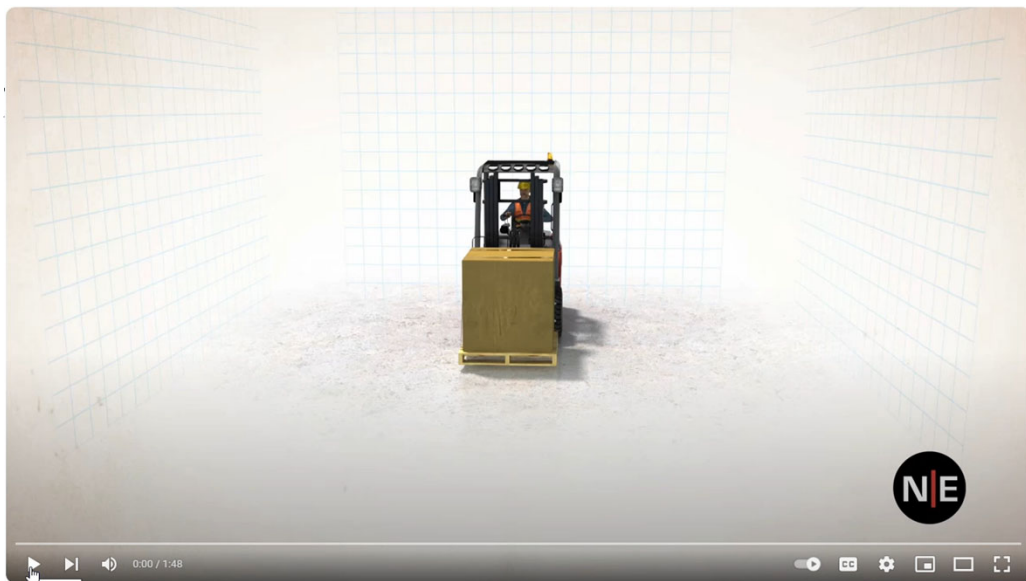
144

Stability (Continued)

FIGURE 1



145



146

Stability Related Terms

“Counterweight” is the weight that is built into the truck's basic structure and is used to offset the load's weight and to maximize the vehicle's resistance to tipping over.

“Center of gravity” is the point on an object at which all of the object's weight is concentrated. For symmetrical loads, the center of gravity is at the middle of the load.

147

147

Stability Related Terms (Continued)

“Fulcrum” is the truck's axis of rotation when it tips over.

“Grade” is the slope of a surface, which is usually measured as the number of feet of rise or fall over a hundred-foot horizontal distance (the slope is expressed as a percent).

“Lateral stability” is a truck's resistance to overturning sideways.

148

148

Stability Related Terms (Continued)

“Line of action is” an imaginary vertical line through an object's center of gravity. Load center is the horizontal distance from the load's edge (or the fork's or other attachment's vertical face) to the line of action through the load's center of gravity.

“Longitudinal stability” is the truck's resistance to overturning forward or rearward.

149

149

Stability Related Terms (Continued)

“Moment” is the product of the object's weight times the distance from a fixed point (usually the fulcrum). In the case of a powered industrial truck, the distance is measured from the point at which the truck will tip over to the object's line of action. The distance is always measured perpendicular to the line of action.

“Track” is the distance between the wheels on the same axle of the truck. Wheelbase is the distance between the centerline of the vehicle's front and rear wheels.

150

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Operation Rule 2183

- (1) Operate according to this part and local traffic rules when on public roads.
- (2) Maintain a safe distance (approximately 3 truck lengths) from vehicle ahead and keep vehicle under control.
- (3) Give right of way to emergency vehicles.
- (4) Do not pass a PIT traveling in the same direction at intersections, blind spots, or other dangerous locations.
- (5) Cross RR tracks diagonally, do not park closer than 8 ½ ft from center of tracks.

151

151

Crossings And Obstructions Rule 2184

An operator shall slow down and sound the warning device at cross aisles and other locations where the operator's vision is obstructed by fixed objects.



152

152

Clear View Rule 2185

An operator shall look in the direction of and keep a clear view of the direction of travel. When moving loads blocking the forward visibility, for safe handling an operator shall drive the truck with the load trailing.



153

153

Ascending and Descending Grades Rule 2186

- (1) Not more than 2mph when descending grades of 10% or more.
- (2) If grade exceeds the back-tilt of the mast-load shall face upgrade.
- (3) Unloaded trucks load engaging means downgrade, tilted back and raised only as far as necessary to clear the floor or road surface.



154

154

Traveling Rule 2187

In level areas an operator shall travel with the load engaging means elevated only sufficiently to clear obstacles on floor or roadway.

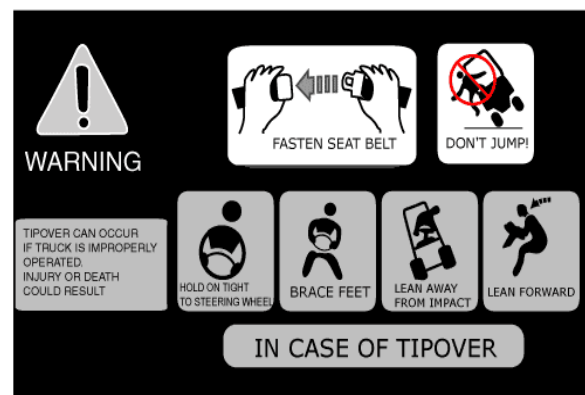


155

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Starts, Stops and Turns Rule 2188

Starts, stops, and turns shall be made in a manner which will prevent a load from shifting or overturning the truck.



156

156

Horseplay Rule 2189

Stunt driving and horseplay shall not be permitted.



157

157

Wet Floors, Dockboards and Bridgeplates Rule 2190

- (1) An operator shall drive at a slow speed over wet or slippery floors.
- (2) Before driving over a dockboard or bridgeplate, an operator shall observe that the dockboard or bridgeplate is secured.



Dock board

Wet Floor

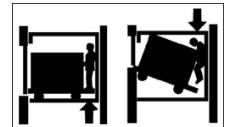


158

158

Entering Elevators Rule 2191

- (1) An operator shall drive onto elevators only when authorized to do so.
- (2) An elevator shall be entered squarely after it is leveled to the floor. Once on the elevator an operator shall neutralize the controls, set the brakes and shut off the power.
- (3) Motorized hand trucks shall enter an elevator and other confined areas with the load end forward.
- (4) A truck shall not enter an elevator if the combined weight of the load and truck exceeds the capacity of the elevator.



159

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Running Over Loose Objects Rule 2192



Get off the forklift and remove the obstruction

160

160



161

Operator's Loading Rule 2193

An operator shall:

- (a) Operate a truck equipped with attachments as a partially loaded truck when not transporting a load.
- (b) When loading a forklift truck, place the load engaging means under the load as far as possible and tilt the mast backwards to cradle the load.
- (c) Exercise caution when tilting loads especially when they are segmented.

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162

Operator's Loading Rule 2193 (Continued)

- (d) Lift or transport only a load that is within the rated capacity of the truck.
- (e) Lift or transport only a load that cannot fall out of a basket or container, or off the load engaging means during the normal movements of the truck.
- (f) Tilt an elevated load forward only when in a deposit position over a rack or stack.

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Course Review

164

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Assessment

The purpose of this assessment is to validate the knowledge learned in class.

Passing score of 70% correct is required.

Class reference materials/books are not allowed to be used during the assessment.

Collaboration/discussion with others is not allowed during the assessment.

Answers will be reviewed after everyone completes and submits their assessment.

165

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Online Transcript

www.macomb.edu/webadvisor

If you need help call 586-498-4106 or email mti@macomb.edu

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Thank you for attending this presentation.

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Consultation Education and Training Division
530 W. Allegan Street, P.O. Box 30643
Lansing, Michigan 48909-8143
**For further information or to request consultation, education
and training services, call (517) 284-7720
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167

Thank you.

Don't Forget to Take the Survey



168

Part 21. Powered Industrial Trucks

Student Resources

MIOSHA Standards:

[Part 21. Powered Industrial Trucks](#)

[Part 33. Personal Protective Equipment](#)

[Part 301. Air Contaminants for General Industry](#)

[Part 433. Personal Protective Equipment](#)

[Part 472. Medical Services & First Aid](#)

[Part 601. Air Contaminants for Construction](#)

MIOSHA Fact Sheets:

[Eyewashes & Safety Showers](#)

MIOSHA Publications:

[Powered Industrial Truck Manual](#)

[Powered Industrial Truck Sample Test](#)

[Powered Industrial Truck Sample Test Answer Sheet](#)

[Operator Permit For Equipment](#)

[Powered Industrial Truck Checklist / Do Not Start Cards](#)

[Chock 'em Poster](#)

[Carbon Monoxide \(CO\)](#)

[Carbon Monoxide Hazards from Internal Combustion Engines](#)

[Diesel Exhaust Gases](#)

[Eyewash/Shower Equipment](#)

Other Resource:

[Powered Industrial Trucks \(Forklifts\) OSHA eTool](#)

MIOSHA Training Institute (MTI) Resources:

www.michigan.gov/mti

MIOSHA Training Calendar:

www.michigan.gov/mioshatraining

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