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**NSCI Safety
Awareness Series**

Safety in Warehouses & Logistics Industry

Campaign

Topic :

**Forklift Safety –
Ensuring safe Workplace**



**SAFE
OPERATION**



**WEAR
PPE**



**FOLLOW
SPEED LIMITS**



**PROPER
LOAD HANDLING**



**KEEP
PEDESTRIANS SAFE**



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Forklift Safety: Ensuring A Safe Workplace

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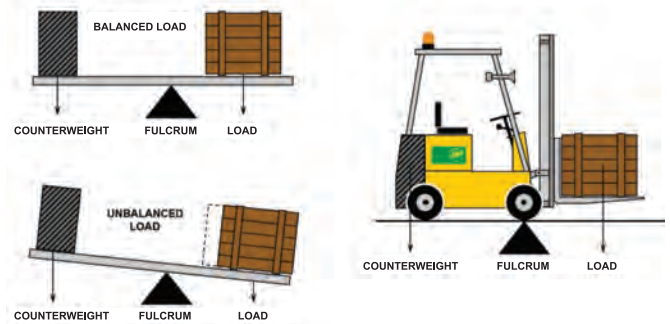


- Are more sensitive to shifts in centre of gravity

Forklift Operation Principle:

The basic principle of a forklift is based on an ordinary see-saw. The Forklift balances the load in the counter weight at the back. The front wheels acts as a fulcrum. The centre of Gravity moves upward when the fork are rest.

FORKLIFT STABILITY



Load Handling and Stability

Understanding Load Capacity:

Operators must know the forklift's load capacity and never exceed it. Overloading can cause the forklift to tip over.

Load Centre and Stability:

The load centre, or the point where the load's weight is concentrated, affects stability. Loads should be evenly distributed and placed as close to the mast as possible.

Using Attachments:

Attachments like clamps, rotators, or side shifters can alter the forklift's capacity and stability. Operators should be trained to use these attachments safely.

1. Introduction

Forklifts are indispensable tools in industries like warehousing, manufacturing, and construction. However, their operation presents significant risks to operators and nearby workers. Forklift-related accidents can result in severe injuries, fatalities, and costly damages. Therefore, understanding and implementing forklift safety protocols is crucial for any business that utilizes these machines.

Forklift mainly consists of following components:



Differences Between Forklifts and Automobiles

Forklifts:

- Often weigh more than a car
- Have reduced visibility
- Often use rear-wheel steering
- Operate in a more complex traffic environment
- Can ride less smoothly due to tire types

2. Importance of Forklift Safety

The Human Cost of Accidents:

Forklift accidents are a leading cause of workplace injuries and fatalities. According to the Occupational Safety and Health Administration (OSHA), approximately 85 forklift-related fatalities and 34,900 serious injuries occur each year in the United States alone. Many of these accidents are preventable with proper safety measures.

Financial Impact:

Beyond the human toll, forklift accidents can lead to substantial financial losses. These include direct costs like medical expenses and equipment repairs, and indirect costs such as lost productivity, legal fees, and increased insurance premiums.

Legal and Regulatory Compliance:

Businesses are legally required to provide a safe working environment under The Factories Act and State Rules. Failure to comply can result in significant fines, legal action, and damage to a company reputation.

3. Types of Forklifts and Their Uses

- **Forklifts are Classified into following 7 classes.**

Class I - Electric motor rider trucks

Class II - Electric motor narrow aisle trucks

- Class III** - Electric motor hand trucks or hand/rider trucks
- Class IV** - Internal combustion engine trucks (solid/cushion tires)
- Class V** - Internal combustion engine trucks (pneumatic tires)
- Class VI** - Electric and internal combustion engine tractors
- Class VII** - Rough terrain forklift trucks

Following are commonly used Forklifts

Counterbalance Forklifts:

Counterbalance forklifts are the most common type, featuring a weight at the back of the vehicle to counterbalance the load at the front. They are versatile and used in various settings, from warehouses to outdoor construction sites.

Reach Trucks:

Designed for use in narrow aisles, reach trucks have extended forks that can reach deep into racking. They are commonly used in warehouses where space is limited.

Rough Terrain Forklifts:

These forklifts are built for outdoor use on uneven ground, such as in construction sites. They have large, pneumatic tires and a powerful engine to handle rough conditions.

Pallet Jacks and Stackers:

These are smaller, more specialized forklifts used for moving pallets over short distances. They are often used in smaller warehouses or retail settings.

4. Forklift Operation Training:

Qualification and training for Forklift Drivers

Qualification:

For an employee to be authorized to operate/ drive a Forklift he / she shall be required to fulfil following criteria:

- Attained the age of 18 years.
- Possess valid Forklift Truck Driving License issued by the State RTO authorities.
- Successfully complete "Specialized Forklift Truck Driving Training" imparted by authorised agency.
- Be medically fit (Eye test and medical fitness test to be conducted by certified medical team)
- Operator should possess knowledge about the Forklift he will be operating.
- The operator should be competent to operate a forklift in the environment in which they are required to work. Specific skills require additional training. For example, gaining your qualification is based on general forklift use with a standard mast, but where attachments are used further supervision and training are required.

Training:

The purpose of this Safety training is to make operators and technicians aware about safety culture and prevent unsafe acts and conditions happening while driving a forklift.

Imparting safety training for Forklift operator involves a structured approach to ensure comprehensive knowledge and adherence to safety protocols.

Schedule periodic training to ensure continuous

adherence to safety protocols and update knowledge on any new regulations or equipment.

Documentation and Record-Keeping: Keep detailed records of training sessions, attendance, assessments, and certifications for compliance purposes.

Continuous Reinforcement: Emphasize the importance of safety through posters, reminders, and regular safety meetings.



Certification Requirements:



5. Pre & Post-Operation Inspection Procedures

Pre-operational Safety Checks on Forklift

Following are the checks to be performed before driving a forklift.

Visual Checks:

- Check all around the forklift for leakages, hanging wires, missing nuts / bolts etc.
- Check for any cracks, damaged parts etc on Forklift, especially the load back rest, forks, and overhead guard of forklift.
- Check the tyre, rims, and nuts also inspect for any wear and tear of tyre.
- Check the lift chains for tension, loose of chain, condition, and lubrication, hydraulic cylinders. Also check for any missing fasteners, the anchor pins, and nuts.
- Check fork length, fork angle and fork pins.
- Check mast and chain condition.
- Check the counterweight bolts.
- Check the electrical components in driver cabin, warning light, flashlights, camera display etc.
- Check the data plate for information about the Forklift.

Checks for Fluid Level:

- Check the Fuel level.
- Check the Engine Oil level.
- Check the radiator water level and the radiator cap.

- Check the battery condition and tightness of the cables.

Functional Checks:

- Check the functioning of all gauges on instrument cluster.
- Check the Brakes and handbrakes.
- Check the Steering system.
- Check all the lights and the horn.
- Check for abnormal noise.
- Check functionality of all control levers.

Before Leaving the forklift

- Stop forklift.
- Fully lower the forks or any other attachment such as clamps, side shifter, etc.
- Place the directional control lever in neutral.
- Apply the parking brake.
- Stop the engine or turn off power.

Before maintenance work on forklift

Raise wheels free of floor and disconnect Power source.

- Use chocks or other positive truck positioning devices.
- Block load engaging means, inner mast, or chassis before working under them.
- Before working on engine fuel system be sure that the fuel supply is shut off by turning the ignition switch to "OFF" position.
- Operation to check performance of the truck or attachments should be conducted in an authorized and safe clearance area by trained authorized personnel only.

Before Starting to Operate the forklift

- Be in operating position.
- Place the directional control lever in neutral.
- Start Engine
- Release parking brake
- Whilst initially operating the truck, check functioning of lift and tilt systems, directional and speed controls, steering, warning light, brakes, and any attachment (if used).
- Avoid fire hazards and have fire extinguisher present inside operator's cabin.
- Forklift trucks or devices designed and approved for hazardous area operation should receive special attention to ensure that the original, approved safe operating features are always maintained.
- Brakes, steering mechanisms, control mechanisms, warning devices, lights, guards, and safety devices should be inspected regularly and maintained in a safe operating condition.
- All parts of lift and tilt mechanisms and frame members should be carefully and regularly inspected and maintained to the standards specified in the following sections.
- Fuel, oil, and water systems should be checked for leaks and conditions of parts. Action should be taken

to in case of leak, prevent the use of the vehicle until the leaks has been corrected.

- Check lubrication oil level of the engine. If necessary, fill up to "Full" mark on the dipstick. Do not overfill.
- Check engine-cooling system. Make sure that the radiator cap and the water drain in the cylinder block are closed. Check the radiator coolant level. Fill the radiator with the clean water up to proper level, if necessary. If operation is in cold weather, use a suitable anti-freeze solution.
- Batteries, starter, generator, switches, protective and safety devices, electrical conductors, and connections should be inspected and maintained in conformance with good practice.
- Trucks should be kept in a clean condition to minimize fire hazards and facilitate detection of loose or defective parts.

Start of Forklift: -

- Do not engage the starter longer than 6 seconds at a time. Allow a minute or so interval between trials.
- If all the necessary equipment is in correct working order, the engine will start.
- After engine has started, check instrument panel making certain the engine oil pressure is correct. The oil pressure should not fall below 2.1 kg/cm² (30 psi) at working temperature and normal working speed. The temperature gauge should register 79° C to 90° C after the first ten or fifteen minutes of operation.
- Run the engine a few minutes to warm oil before putting the fork truck to work, especially in cold operating conditions.

Post operational Safety Checks on Forklift

- The fuel and oil box should be checked for leaks.
- All hydraulic systems should be regularly inspected and maintained in conformance with good practice. Tilt and lift hydraulic cylinders, valves and other similar parts should be checked to assure that the "drift" has not developed to the extent that it would create a hazard.
- Capacity, operation and maintenance data plate or tags should be always maintained in legible condition.
- Batteries, starter, switches, electrical conductors, and connections should be inspected and maintained in good practice.
- Modifications and additions which affect capacity and safe operation should not be performed by the customer or user without the manufacturer's prior written approval.
- Tyres with split wheels should be inflated only in a safety cage when not properly installed on the vehicle. However, in any either case, make sure that all nuts and bolts are properly installed and torqued according to specifications.
- Always use Genuine parts procured from the supplier or from any Authorised Dealers only.

Documentation:

It's crucial to document all inspections. Any issues found should be reported immediately and addressed before the forklift is used.

6. Safe Forklift Operation Practices:

Forklift operators should wear a seat belt

- You might not know this, but overturning and tipping over is one of the biggest risks for forklift operators. In worst cases, it has led to the death of the workers.
- When you are wearing a seat belt, it ensures you are attached to the machine and are not falling off it.
- You cannot jump out of the cabin when involved in an accident whether it is the forklift tipping over or overturning.



This is good because when our **fear of fight or flight response** is activated, we want to get out of the situation as quickly as possible (in this case from Forklift).

Therefore, reducing the chances of you getting crushed over by the machine

Starting and Stopping:

- Starting: Ensure the forklift is in neutral, apply the parking brake, and check the surroundings before starting.
- Stopping: Always lower the forks to the ground, set the parking brake, and turn off the engine when the forklift is not in use.

Speed Control:

Operators should always adhere to the speed limits set within the facility. High speeds can lead to tipping and loss of control, especially when turning.

Safe Turning:

Turning should be done slowly and cautiously. Forklifts have a high center of gravity and are prone to tipping if turns are made too quickly.

- Load Positioning: Ensure the load is centered and stable before lifting.
- Lifting: Lift loads slowly and steadily. Avoid sudden movements.
- Traveling with a Load: Keep the load as low as possible to maintain stability and improve visibility.
- Maintain 360° Visibility : Keep forks low to the ground to provide clear forward visibility. If the load restricts your visibility, operate the equipment in reverse. Always ensure you have a good view of the rack when you are positioning the load.
- Additional safe practices are:
 - Always make eye contact with pedestrians and other workers.
 - Always look in the direction of travel
 - Use rear-view mirrors to boost visibility
 - Use headlights if working at night, outdoors, or in areas where additional lighting is needed

Do's & Don'ts:



Additional Safety Practices:

- Operators should follow operator's manuals, which are supplied by all equipment manufacturers and describe the safe operation and maintenance of forklifts.
- Separate forklift traffic and other workers where possible.
- Limit some aisles to workers on foot only or forklifts only.
- Restrict the use of forklifts near time clocks, break rooms, cafeterias, and main exits, particularly when the flow of workers on foot is at a peak (such as at the end of a shift or during breaks).
- Install physical barriers where practical to ensure that workstations are isolated from aisles travelled by forklifts. Do not store bins, racks, or other materials at corners, intersections, or other locations that obstruct the view of forklift operators.
- Evaluate intersections and other blind corners to determine whether overhead dome mirrors could improve the visibility of forklift operators or workers on foot. The person who conducts the inspections should have the authority to implement prompt corrective measures.
- Enforce safe driving practices such as obeying speed limits, stopping at stop signs, and slowing down and blowing the horn at intersections.
- Repair and maintain cracks, crumbling edges, and other defects on loading docks, aisles, and other operating surfaces.
- Have a thorough planned maintenance program in place for each of your forklifts based upon usage and type of duty operation.

7. Hazard Awareness and Mitigation

♦ Common Workplace Hazards:

- Uneven Surfaces: Potholes, debris, and ramps can destabilize a forklift.
- Obstructions: Ensure pathways are clear of obstacles.

- Pedestrian Traffic: Be aware of pedestrians in the area and use warning signals when approaching.
- ♦ **Hazard Mitigation Strategies:**
 - Signage and Markings: Clearly mark forklift pathways and pedestrian zones.
 - Lighting: Ensure adequate lighting in all areas where forklifts operate.
 - Communication: Use signals and alarms to alert others to forklift movement.
 - Fitment of advance safety controls on forklifts.

8. Safe Driving and Manoeuvring



Visibility:

Always ensure clear visibility when driving. If the load obstructs the view, drive in reverse or use a spotter.

All the people on the floor should know

"That the forklift operators may not be able to see or notice them, while they are operating the forklift trucks."

There can be many reasons for that, but here are some of them:

- **Noise** - makes it harder to notice people and other moving objects
- **Poor lighting** in some areas or throughout the Warehouse or Distribution Centre (DC)
- **Blind Spots** in areas such as corners, exits, staging area, big loads, narrow aisles etc - all these things affect the vision of the operator
- If the operator is **driving backwards** because of carrying two pallets or driving through a slope
- When a load is **raised OR being lowered**
- Is **putting a pallet** into a location OR **picking one**
- An operator is taking a **load out of a container / truck**

Traveling on Inclines:

When ascending or descending inclines, keep the load facing uphill to prevent tipping. Avoid turning on slopes.

Avoiding Sudden Movements:

- Sudden stops, starts, or turns can lead to loss of control. Smooth, controlled movements are essential for safety.

No one should touch the forklift, while it is in operation:

- Most people are unaware of the true power a forklift truck has.
- They are very powerful machines and can cause serious damage to people, property, and other types of machinery if treated in the wrong manner.

No one should walk under a Forklift OR stand too close to it while it is in operation:

- If you've worked in warehousing operations, you might have seen people taking shortcuts to save themselves a few seconds. They take a risk by either walking under a forklift or standing too close to it while it is in operation.
- They forget to realise that only the truck is very powerful but also the load they are carrying can crush them in a matter of seconds.
- Nothing is more important than one's safety.

To ensure everyone's safety:

- Stand a few feet away
- Maintain a distance of **2 - 3 pallets** between you and the forklift

- Never walk under a forklift while it is in operation, no matter how urgent the task maybe
- If an operator gets too close, alert them of your presence either via hand gesture or a voice

All employees should be aware of safety procedures around forklifts

- The management team needs to put a system in place that helps in educating and training employees around forklift safety.
- This is to ensure they have a clear understanding of the safety guidelines and help reduce workplace accidents that occur in this industry.



- Having proper signage, markings, and safety notices/boards in place throughout the warehouse or a distribution centre, showing clear instructions on what to do and what not to do.
 - ♦ Make it easy for them to understand. Don't use jargon, that will confuse them. Simplicity is the way to go!
- Use simple plain language so that everyone can understand the message.
 - ♦ Have visual signs and illustrations, so even those who are not literate can understand what the sign means.
 - ♦ Spend more time with these people and help them understand safety in a way that makes sense to them.
- Taking employees on a visual walk and explaining different aspects of safety around forklifts. Answering any questions, they may have during these safety walks.
- Doing refresher training at least once a year.
 - ♦ More for new employees to ensure they understand the concepts and procedures correctly.

Operators should beep the horn when they're in critical areas

- Horns are such a useful tool on a forklift truck.
- It allows the operator to inform other workers of their presence and communicate through sound where they are operating.
- Pickers, packers, and other workers can get distracted and might not see forklifts around them.
- This is why operators must be trained on where and how to use horns to communicate their presence to others.



To reduce the likelihood of accidents and safety incidents, forklift operators should use **(beep)** their **horns** and slow their speed when they are in the following areas:

- Entering aisles
- Exiting aisles
- At intersection
- High pedestrian activity
- Blind spots in the warehouse / Shopfloor/Office area
- When around other types of machinery
- Reversing
- Travelling in the backward direction due to stop or load type
- If they see something unsafe and warn them of their action
- If a load is falling from an aisle or something similar

If the load exceeds the capacity

- Operators should be trained properly on how to check the capacity rating of a forklift.
- They should not lift or carry the load unless they get the right kind of forklift that is fit for the job.
- It may not seem like a big deal but carrying loads that are over capacity can lead to accidents.
- Which can potentially harm the property, racking, materials, and even people if they are too close to it.

It is therefore essential that the management have procedures in place to deal with this kind of situation.

Never risk the SAFETY of people and property JUST to get the job done.

Keys should be removed after the operation is complete

- It is a good practice to have the keys removed from forklift trucks after the end of the shift.
- This helps in avoiding unauthorised access.
- Although modern technologies such as logging in via pass help with authorisation access.
- There are still a lot of forklifts that simply don't have this technology.

If that is the case, have a system in place where:

- Operators need to put their keys in a designated location
- Sign off on a sheet with their name and forklift number
- Write down the time it was used (start and finish time)
- Doing the above helps you manage access and track down the usage of forklifts.

Note: Managers and Supervisors need to train their team members on how to do the "above activities" correctly to ensure they understand and comply.

Driving Forklifts in Reverse Direction

There are situations where operators have to drive in reverse.

- **Usually, it is in these situations:**
 - ◆ When travelling down the slope
 - ◆ Moving down a ramp
 - ◆ When your front/forward view is obstructed

When driving in reverse, forklift operators should follow these safety guidelines to protect people, machines, and property around them:

- ◆ Look behind and drive with extra caution
- ◆ Beep to make others aware of their presence
- ◆ Use flashing/warning lights if the machine has it
- ◆ Use your rear-view mirrors
- ◆ Use a spotter if there is one

Using the above aids will help increase the **visibility** of **forklift trucks** to people around them.

Knowing The Safe Working limitations

- ◆ Every forklift truck has its limitation in terms of how much load can it carry and lift.
- ◆ They have different capacity ratings depending on their size and shape and what they are being used for.

To ensure safety in the workplace

Management should put a system in place where:

- ◆ **Operators** should be trained on how to read and interpret the data on rated capacity
- ◆ **Technologies** such as digital readers/sensors should be used, which alerts the operator if they exceed the safety limit
- ◆ **Machines** won't operate when they pass the safety threshold. This could be achieved by using access software that comes with certain forklifts such as Crown

Avoiding uneven ground where possible

One of the biggest risks for forklift and its driver is driving on uneven ground.

- **The risks become worse when the floor surface has the following issues:**
 - ◆ Rough
 - ◆ Inclined
 - ◆ Broken pieces here and there
 - ◆ Slippery

Ideally, the warehouse/distribution centre floors should be

as flat as possible and free from the obstacles listed above.

This not only reduces potential safety incidents but also helps streamline operations, which in turn results in increased productivity.

Do not travel with the load raised

One of the ways to prevent safety accidents from happening is by training forklift operators on proper ways of lifting and carrying loads in the warehouse or distribution centres (DC).

- **Few things to be consider:**

- ◆ A load should be first lowered to a safe height
- ◆ It should be close to the ground (floor) but a few cms raised so that it does not get caught up with the items on the floor such as plastic, broken pallet pieces etc
- ◆ When the load is lowered, the tip of the forks should be tilted a little backward to prevent the load from falling/slipping forward
- ◆ After completing the above steps, then proceed to your target location

Although doing this way takes a couple more seconds, but it is essential for the safety of your team members and work area.

It will also help to protect valuable resources, assets, reduce incidents, improve the overall operations and warehouse safety.

Follow these guidelines

- Looking up ahead and being aware of what's around you
- Being mindful of your blind spots and check them as often as you can
- Slowing down at intersections, exit and entry points, rough surfaces, slopes and ramps, and near high pedestrian activities zone
- Maintaining a safe distance from other machines, people and forklifts
- Avoiding distractions and being focused on
 - ◆ Where you are going
 - ◆ How you are going to get there
- Using case studies, simulations, videos, presentation slides and hypothetical situations and then teaching the drivers on how they should handle such situations.
- Doing training and inductions periodically to help them build their knowledge and keep it fresh.
- They are mentally ready to take appropriate actions, minimising the potential damage of an incident.

Safe parking procedures

After you're done with your forklift whether you are going for a break or signing off from the shift, it is important to park the truck correctly.

- **Follow these simple guidelines:**

- After stopping in the designated parking slot, put the truck in neutral
- Engage the parking brake
- Lower your forks, until they touch the ground (flat), see attached photo

- Forks should not extend into aisles or walkways
- Switch off the machine
- Remove the keys and put them into a designated register

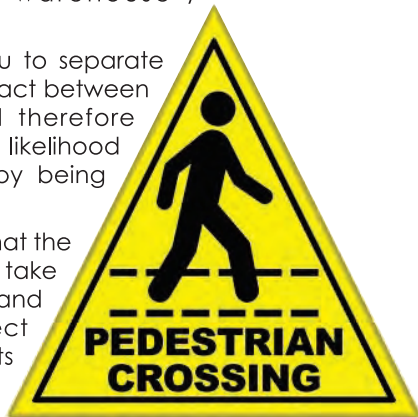
9. Pedestrian Safety

Separation of Forklift and Pedestrian Traffic:

- **Walkways should be created and designed in such a way that it separates the pedestrian from the forklifts.**

A simple way to reduce accidents and harm by designing good traffic routes both for **pedestrians** and **machines** throughout your warehouse / Shopfloor

- This allows you to separate points of contact between the two and therefore reducing the likelihood of incidents by being nearby.
- It is essential that the Management take this seriously and involve subject matter experts to do this effectively.
- A good option would be to bring experts who specialise in warehouse design and workplace safety. The two goes hand in hand.
- By utilising the knowledge of these people, you ensure you are investing to improve workplace safety and give assurance to your employees to feel safe when on site.



Remember: Employees will be more **productive** and **happier** when they **feel safe** working for you.

Where possible, separate forklift and pedestrian traffic using barriers or designated pathways. This reduces the risk of collisions.

Pedestrian Awareness:

- Operators must be constantly aware of pedestrians in the area. Use the horn and lights to signal your presence.

Communication:

- Establish clear communication between operators and pedestrians. Hand signals or radios can be used in noisy environments.

Minimising presence near high pedestrian activity!

- One of the things that forklift operators can do to make a workplace safe is by:
 - ♦ minimising or
 - ♦ avoiding altogether their presence where pedestrian activity is high
- Using a different aisle to get to a target location

10. Maintenance and Repairs

Maintenance of Forklift involves several safety precautions to ensure the well-being of workers, site, and efficient operation of the equipment. Below are some general safety precautions to consider:

- When servicing or adjusting the drive motor, hydraulic system, or truck drive module, accidentally starting the drive motor or a hydraulic function can fatally injure people standing in front, beside or behind the truck. Lower the forks and retract the mast reach. Jack up the truck so that the drive wheel is clear of the ground.
- Before performing any maintenance work the truck must be allowed to thaw out for at least 2 hours. This will ensure all truck parts are equally warmed up.
- Do not work underneath a suspended load Fatal injuries could result if the truck is suddenly lowered.
- Only qualified and authorised personnel may carry out work on the truck.
- Always keep fire extinguishers in good working condition. Do not approach fluid levels or leaks with a naked flame.
- To clean, use a non-flammable, non-combustible cleaning solution which is groundwater neutral. Only carry out cleaning with an oil separator. Protect the electrical system from dampness.
- Keep the service area clean, dry, and well-ventilated.
- Do not allow oil to penetrate the ground or enter the draining system. Used oil must be recycled. Oil filters and desiccants must be treated as special waste products. Relevant applicable regulations must be followed.
- Neutralise and thoroughly rinse any spilled battery fluid immediately.
- Keep the truck clean. This will facilitate the location of loose or faulty components.
- Do not eat, drink, smoke, or handle naked flames while carrying out assembly and maintenance work.
- Care should be taken to assure that all replacement parts are interchangeable with the original parts and of quality equal to that provided in the original equipment.
- Tyres with split wheels should be inflated in a safety cage when not properly installed on the vehicle. However, in either case, make sure all nuts and bolts are properly installed and torqued accordingly to specification.
- Brake and inching pedal should be checked for free travel.
- Only qualified and authorized personnel should be permitted to maintain, repair, adjust and inspect Forklift.
- If at any time a Forklift is found to need repair, or in unsafe condition, the Forklift shall be taken out of service until it has been restored to safe operating condition.
- No operator or employees shall be allowed to stand or pass under the elevated portion of any Forklift during maintenance.

11. Technological Advancement in Forklift Safety

Warehousing and industrial operations have seen a lot of changes over the past few years, with a rapid increase in the innovations that go into handling the logistics of e-

commerce businesses, construction, and storage. With the rise of consumer demand, the equipment used for running these facilities has undergone modifications and improvements too. In the industries several incidents are related to Forklift operations during material handling

Forklifts, while indispensable for optimal operations, pose inherent risks in the workplace, especially when they are not used correctly. Incidents, collisions, and injuries are challenges that businesses aim to mitigate through innovative safety solutions which are greatly aided by evolutions in technology. The integration of new safety inventions not only enhances safety but also contributes to increased efficiency in warehousing and logistics.

Some of the potential hazards due to incorrectly or careless operation of forklift may cause

- ◆ Tip Over
- ◆ Fall of Load
- ◆ Collision with other vehicle, equipment or person
- ◆ Injury to forklift operator, especially if he jumps out from the tipping forklift or place his arms or legs outside the forklift.
- ◆ Hit to nearby structure by forklift while reversing

As technology continues to evolve, so does the focus on enhancing forklift safety. The latest innovations shaping the forklift industry, from smart sensors to automated warning systems and advanced operator training simulators continue to become more advanced. With more staff and more stock in warehousing now more than ever, it's meant that there has had to be a shift in the way

of thinking about safety in forklift operation

i) Smart sensors and collision, other incidents avoidance

One of the groundbreaking innovations in forklift safety that has proven to be a game-changer in the industry is the implementation of smart sensors. These sensors are designed to detect obstacles, pedestrians, and other forklifts in the vicinity. Using a combination of ultrasonic, infrared, and radar tech, or a combination of all three, smart sensors provide real-time data to the forklift operator, alerting them to potential hazards and obstacles. This proactive approach significantly reduces the risk of collisions and improves overall workplace safety.

How smart sensors work

Smart Sensor utilizes advanced algorithms to interpret data from their surroundings. When an obstacle is detected within the predefined range, the system triggers an alert, either through visual indicators or audible alarms. Some more sophisticated systems can even initiate

automatic braking or speed reduction on behalf of the operator to prevent accidents. This is especially useful in mitigating Incidents caused simply by human error.

Using the smart sensing devices, many solutions are available in the market like

- i Forklift – Pedestrian collision avoidance system
- ii Forklift – Forklift collision avoidance system
- iii Forklift – AGV / Machine collision avoidance system
- iv Zone based speed control system



ii) Automated warning systems: enhancing visibility and awareness

Automated warning systems work hand-in-hand with smart sensors by providing enhanced visibility and awareness to forklift operators. These systems often include features such as 360-degree cameras, proximity alarms, and assistance in detecting blind spots. By drawing the operator's attention to blind spots and enhancing their visibility, technology offers a comprehensive view of the surroundings. Systems like these assist operators in making informed decisions, reducing the likelihood of incidents.

Benefits of Automated Warning Systems



Automated warning systems have several benefits for operators and warehouse managers. Some of these include:

360-Degree Visibility: Cameras positioned strategically on the forklift provide a complete view of the surroundings, minimizing blind spots.

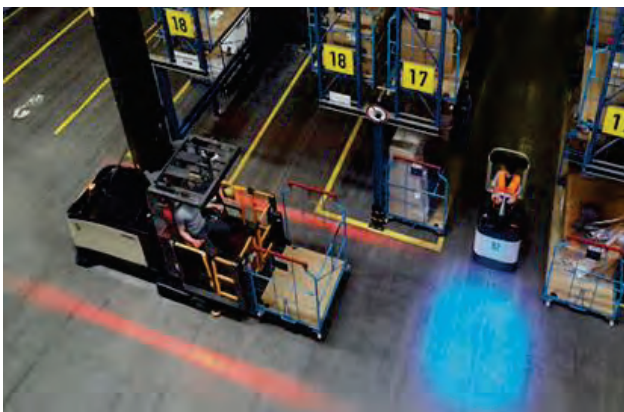
Proximity Alarms: Audible alarms notify both the forklift operator and nearby pedestrians and obstacles of the forklift's presence, preventing incidental collisions.

Blind-Spot Detection: Sensors detect objects or individuals in blind spots and areas of low visibility, providing timely warnings to the operator who can react in time to prevent an accident.

iii) Advance Warning Light systems

Nowadays, advance warning lights are available in the market, which serve as very good administrative control in preventing potential injuries. Some examples of advance warning lights are as below:

- **Front and rear forklift mounted safety light** to keep pedestrians at safe distance from any approaching forklift, especially from ninety-degree



corners. It projects a focused beam of coloured light which forms a bright disc of that light on the floor, to show pedestrians where they are not allowed. The focus of the beam can be adjusted to the distance of your choice between two and five feet from the forklift.

- b) **Forklift sides Red – Danger zone warning lights** – The Red Zone puts a bright red line on the floor on both sides of the forklift to show the pedestrian demarcating a boundary line of safe distance from the forklift. This zone can be adjusted to the distance between one to three feet from the forklift based on the forklift working environment.

c) Advantages of Red Zone Warning Light

- i. The Red Zone helps prevent foot injuries and collisions from rear end swing & shows NO GO ZONE around the forklift.
- ii. The Red Zone lights are mounted to the sides of the forklift and can also be mounted on the rear and/or front.
- iii. They come with a tool-free bracket so that you can quickly and easily mount them to the forklift's overhead guard.
- iv. The Red Zone lights are to be kept "ON" at all the times that the forklift is on, even when it is stopped, or in motion.

iv) Operator Training Advanced Simulators:



Virtual Reality (VR) for Real-World Skills - Operator's Training is a fundamental aspect of forklift safety. Advanced training simulators leverage virtual reality (VR) technology to create realistic, immersive scenarios for operators. These simulators allow trainees to navigate a virtual warehouse, handle loads, and respond to various challenges in a controlled environment. The hands-on experience gained through VR simulations enhances operator skills, reaction times, and decision-making, helping to ensure safer and more advanced forklift operations.

Key features of operator training simulators (VR Based Trainings)

A typical forklift simulator will have the following key features:

Realistic Scenarios: Simulators recreate realistic warehouse scenarios, including potential hazards and challenges.

Hands-On Training: Trainees practice operating a forklift in a virtual environment, honing their skills without the risks associated with real-world operations.



Performance Analytics: Simulators provide detailed performance analytics, allowing trainers to assess and address specific areas for improvement.

v) Access control to prevent unauthorized operation of forklift

It comes with a fingerprint optical sensor with a multiple fingerprint algorithm, for speed and accuracy. The device comes with fast and accurate fingerprint identification and verification giving you fingerprint access control to the entire workforce. These devices work on both fingerprints as well as on RF-IDs. Usage of Bio metric access control in the forklifts has been very crucial in preventing unauthorized operation.



vi) Future trends in forklift safety

The innovations discussed provide insights into the current state of innovations in forklift safety, but the industry continues to evolve. Looking ahead, several trends are expected to shape the future of forklift safety technology.

vii) Artificial intelligence integration

The integration of artificial intelligence (AI) is anticipated to enhance forklift safety further. AI algorithms can analyse large amounts of data from sensors and cameras in real time, enabling predictive analytics for potential safety hazards and providing insights into areas for improvement. AI-driven systems can learn from past incidents, continuously improving their ability to prevent accidents and adapting to individual cases and set ups.

12. Conclusion:

The forklift is a great workhorse. Forklifts save time and money by allowing workers to move large, heavy loads quickly. They do also help workers stay safe by doing the heavy lifting and reducing the risk of injuries associated with manual labour. Anyone who works on or around forklifts needs to be aware of the potential dangers that these trucks present. The design of a forklift allows it to do the necessary tasks, but it also requires operators to follow proper procedures. Anyone who uses these machines needs to be trained properly according to standards. The training should be refreshed often so that procedures continue to be followed no matter how comfortable or experienced an operator is with the equipment. Safety training is also necessary for employees who work around these machines. Employees should learn to be respectful of forklifts and know what a forklift operator can and cannot do to avoid collisions.

While it may seem like a lot of work to develop traffic patterns and traffic signs, do maintenance checks, and provide constant training, it will be worth all of the effort. An operator with a good driving record has the potential to make a great deal of money. Likewise, a company that has a good safety record and procedures will save loads of money over time. Employees are any company's asset, so train them properly to keep them with your company for a long time.
