National Construction College

Rough Terrain Fork-Lift

Study Notes

PL 007
ROUGH TERRAIN FORKLIFT

Regulations Applicable

- Health and Safety at Work Act 1974
- The Management of Health and Safety at Work Act 1992
- The Electricity at Work Regulations 1989
- The Control of Substances Hazardous to Health Regulations 1989
- Provision and Use of Work Equipment Regulations 1998
- Lifting Operations and Lifting Equipment Regulations 1998
- Supply of Machinery (Safety) Regulations 1992
- The Noise at Work Regulations 1989
- Road Traffic Act (UK)

& Guidance notes

- Avoidance of Danger from Electric Lines GS 6
- Safe Use of Cranes BS 7121 Parts 1&2
- Safe Use of Work Equipment L22
- Safe use of Lifting Equipment L113
- Rider Operated Lift Trucks – Operator Training CoP 26
- Working Platforms on Lift Trucks PM 28
- Diesel Engined Lift Trucks in Hazardous Areas PM 58
- Safety in Working with Lift Trucks HS(G) 6
- Lift Trucks in Hazardous Areas HS(G) 113

Further guidance on these regulations is given in the plant operator Safety Awareness training manual CSN 074, which accompanies this manual

Category of plant

- Rough terrain forklift
- 2-wheel and 4-wheel drive
While its operational concept is the same, the rough terrain forklift differs in many ways from its factory counterpart. In order to cope with the construction site environment it has taken on some of the features of an agricultural tractor:

a. a more rugged construction, designed around a purpose-built chassis

b. larger earth moving type wheels, with an increased wheel base, to improve ground clearance and overall stability

c. options of two- and/or four-wheel drive to improve traction

Some models have extra features such as:

a. articulated steering; in action the machine literally hinges in the middle

b. mast side tilt; enabling loads to be picked and deposited even though the chassis may be standing on uneven ground

c. side shift: forks can be moved to either side of the mast to facilitate loading and unloading

d. rotators: used to rotate forks or other attachments laterally

e. forward reach: movement of the forks forwards by extending scissors. (Some models are purpose built for forward reach)
A variety of attachments are available for use on the rough terrain forklift including:

1. **loading buckets** with which the forklift can load and carry material
2. **concrete skips** to lift, transport and discharge at a height
3. **jib/hook** to carry suspended loads
4. **clamps** designed for the palletless handling of concrete blocks and similar loads
5. **extension masts** enabling the machine to lift to greater heights
6. **fork extenders** to make the original forks longer and allow larger pallets to be lifted

It should be noted that the use and fitting of lifting attachments may alter the designation of the base machine and thus any legislation applying, and in addition, alter the lifting capacities or load centres, e.g. jib hook attachment and Lifting Regulations.
It is normal practice to reduce the capacity of the forklift by the weight of the attachment and also by any increase in the load centre.
The Power Unit

How does a diesel engine work?

The fuel used in modern high speed diesel engines, usually gas oil, is a liquid which does not vaporise at ordinary temperatures. It is injected into the cylinders of the engine in a very fine spray.

The air necessary for combustion is drawn into the combustion chamber and then compressed by the piston to a high pressure. The compression heats the air sufficiently to ignite the fuel spray spontaneously when the injection takes place.

This process is the characteristic feature of the diesel engine, or as it is otherwise called, the compression ignition engine.

Four-stroke cycle

It is quite simple mechanically. If we consider only the four-stroke engine (a complete movement of the piston, up OR down, is known as a stroke) the working cycle is as follows:

1. The piston moves down in the cylinder as the inlet valve opens, and a charge of clean air is drawn in. This is known as the Induction stroke. When the piston reaches the bottom of its travel, the inlet valve closes.

   ![Diagram of a diesel engine showing the induction stroke and compression stroke]
2 In the Compression stroke, both valves remain closed whilst the piston moves upwards; the charge of air is compressed and its temperature rises steeply. Just before the piston reaches the top of the compression stroke, fuel is injected into the top of the cylinder (combustion chamber) in a very fine spray.

3 The fuel is ignited instantly by the heat of the compressed air, and the piston is driven downwards by the rapid expansion of the burning fuel gases. This is known as the Power stroke.

4 Following the power stroke, the exhaust valve opens as the piston moves upwards, and the waste gases are expelled. This is known as the Exhaust stroke.

When the piston reaches the top of its stroke the exhaust valve closes, and this completes one cycle (four strokes).

The cycle repeats itself as long as the engine is supplied with air and fuel.

3 – Power stroke

4 – Exhaust stroke

Air Induction System

An air cleaner filters the air before it enters the combustion chamber, protecting the engine from dust, water and other foreign matter.

There are two types of air cleaner in general use, the dry filter type and oilbath type. Both types are usually fitted with a pre-cleaner. The pre-cleaner comprises either a cap or bowl shaped so as to create a swirling action which causes the heavier particles of dirt to fly outwards and be deposited either within the casing of the pre-cleaner, or ejected through vents to the atmosphere.
### Dry type air filter

This type uses a paper filter element. Air is drawn through the pre-cleaner into the filter housing, then passes through the paper filter and into the engine. Foreign particles are retained by the filter, or else ejected through a rubber clack valve.

Servicing usually consists of gently blowing away the accumulated dust with a LOW pressure air line or, when necessary, renewing the filter.

![Dry type air filter diagram](image)

### Oilbath type air filter

Air is drawn through the pre-cleaner down the inlet tube; then passes through the oil bath, and via a series of wire mesh screens into the engine.

Foreign particles are retained by the oil in the oilbath or collect on the oil-soaked wire mesh screen.

1. Both types of filter should be serviced at intervals recommended by the manufacturer. **UNLESS THE CONDITIONS OF WORK ARE IN RAIN OR DUST!** In these bad conditions the filters require more frequent servicing.

2. Some dry type filters incorporate a visual indicator which shows when the element requires cleaning or changing.

![Oilbath type air filter diagram](image)
Some engines have a turbocharger fitted. Exhaust gases from the engine drive a turbine at very high speed. The turbine is connected to an impeller which forces air under pressure into the induction manifold. The pressurised air increases the efficiency of the engine.

The engine should be run at a high idle speed for one minute before stopping. If this procedure is not complied with, the turbocharger can continue to run for a considerable time after the engine has stopped. As the turbocharger is lubricated from the engine lubrication system, it may then suffer loss of lubrication and seize up.

**Note:** Turbocharger speeds of 65,000 rpm are common. Special precautions must be taken when stopping a turbocharged engine.
Fuel systems are designed and adapted by manufacturers to suit their particular requirements. Basically, they consist of standard components.

A supply of fuel is contained in the fuel tank. From there it is delivered via the primary fuel filter, which filters out coarse grit and foreign matter, and through the fuel lift pump to the main fuel filter which removes the finer particles. Next it goes to the injection pump which measures, pressurises and delivers the fuel to the engine’s injectors by way of high pressure pipes, at the correct time. Excess fuel is delivered back to the fuel tank.

Diesel fuel is injected either into the cylinders by direct injection, or by injection into a pre-combustion chamber.

Direct injection takes place through several small atomising orifices, directly into the cylinder, where it is ignited. Multiple orifices, particularly of small size, increase the risk of clogging.

Pre-combustion designs inject through one large orifice into a pre-chamber where the fuel is atomised, and burning begins. The mixture then passes into the cylinder where complete combustion occurs.
Bleeding the fuel system

If air has entered the system, through lack of fuel, loose connections, fractured pipe etc. the engine will either stop or badly misfire. After the cause of the entry of air has been rectified, the system must be 'bled' as follows:

**Note:** This procedure should be carried out by a trained and competent person.

**In-line fuel pump**

1. Check adequate supply of fuel in the tank.
2. Check that the fuel cap air vent is clear.
3. Open the air bleed screws on the filters and prime by operating the lift pump until fuel flows free of air. Continue pumping whilst tightening the vent screws.
4. Carry out procedure (3) at the injection pump and restart the engine.

**DPA fuel injection pump**

On DPA pumps open the air bleed screws on the main filters, pump body and governor housing. Operate the priming lever and close the bleed screws in the following order: fuel filters, pump body and then governor housing. Also slacken and bleed at pump inlet union.

**Note:** If the engine still misfires, reopen, bleed and close each screw in turn working from the fuel tank towards engine.

Set throttle in RUN position and bleed two of the injectors using the engine starter motor. Start engine and check for misfire. If misfire persists repeat process with remaining injectors.

Always take care to observe regulations concerning avoidance of fuel spillage onto site surface causing pollution.
Fuel tank

Only clean fuel must enter the tank, through a filter in the filler. Fuel tanks may ‘sweat’ inside during the night due to condensation and, to prevent this, they should be filled at the end of each day.

Avoid topping up with fuel from the bottom of a storage drum that may be contaminated with dirt or water.

Filters

These must be cleaned at intervals recommended and, where replaceable types are employed, new elements and gaskets fitted. If the presence of dirt or water is suspected then the whole system should be cleaned.

Fuel lift pump filter

This, with the sediment bowl, if fitted, must be cleaned regularly. Care must be taken in refitting so as not to damage the filter and gasket(s).

Fuel injection pump governor

Normally lubricated from its own sump, it must be checked regularly for correct oil level. Drain and refill in accordance with the maker’s instructions. No attempt should be made to tamper with or adjust the governor.

Starting Aids

Ignition of fuel in diesel engines depends upon high temperature of the inducted and compressed air. It is sometimes necessary during cold weather to assist the ignition of the fuel. Two types of device are in general use, an excess fuel device and a glow plug device.

Excess fuel device

This allows delivery of an excess amount of fuel to the combustion chambers. It is normally operated by a control button on the fuel injector pump housing. The throttle must be open before setting the button. The device disengages automatically when the engine starts.
Glow plug device

An electric element fitted in the induction manifold (or in some cases, in each pre-combustion chamber) is operated by a control switch. When the starter is engaged, the inducted air flows over the element and is warmed to assist ignition.

Note: A variation, known as the THERMOSTART, injects fuel into the induction manifold where it is ignited by the glow plug to produce a flame to assist ignition.
Lubricating system

Without oil between the moving parts, wear through friction would be excessive and power would be lost. The heat generated would cause expansion and seizure of the parts.

Oil reaches the main and big-end bearings, camshaft bearings and rocker shaft under pressure. It bleeds out of the rocker shaft bearings and returns to the sump by gravity. The oil is heated by its contact with the moving parts, so this heat is removed by either an oil cooler fitted in the system, or by the movement of air past the surface of the sump. Foreign matter washed from the moving parts and passageways of the engine by the oil, either falls to the sump or is held in suspension by detergent oil and then removed by the filter.

The oil level in the sump should be checked before starting the engine. Remove the engine oil level dipstick, wipe clean and replace in the engine. Remove dipstick again and check the oil level against marks. If the level is low add clean oil until the correct level is obtained. **Do not overfill.**

Immediately after the engine is started, the oil pressure gauge should be checked for the correct pressure reading. A warning light is usually fitted to warn of low oil pressure. This warning light or gauge should be checked occasionally throughout the day for correct reading.

Any excessive oil consumption, unusual noises or vibrations should be noted and reported.

Typical lubricating system
Cooling System

Liquid cooling

The cooling system is designed to dissipate excessive heat. The engine cylinder block and head contain passages to allow circulation of the coolant (water). The system includes a radiator which provides a large cooling area and acts as a reservoir, a fan to increase the cooling air flow and a thermostat to restrict the flow of water to the radiator until correct working temperature is reached.

The coolant is circulated by a water pump and by the fact that heated water rises to the top of the radiator through convection.

Most liquid cooling systems are pressurised, using a special radiator cap, to allow higher working temperatures. Exercise extreme caution to avoid being scalded when removing the pressure cap from a hot radiator.

Air cooling

Another method of cooling is to provide each cylinder with finning over which cooling air is blown by a fan (blower). Ducting around the cylinders contains and guides the air down one side of the engine, around the cylinders, and then exhausts to atmosphere.

Maintenance of Cooling System

The system should be checked daily for:

- sufficient and correct type of coolant
- correct fan belt tension and condition
- cleanliness of air passages

During cold weather always be aware of the operating temperature of the engine of the machine. A temperature gauge or warning light is generally fitted for this purpose.
**Electrical System**

To start the engine, the crankshaft must be revolved. Diesel engines employ an electric starter motor powered from the battery to perform this function. The motor is mounted on the engine and, when the starter switch or button is engaged, the motor turns a small sliding pinion which meshes with a gear ring around the flywheel. The starter motor pinion gear disengages automatically when the engine starts.

The starter motor mounting bolts and connections require occasional checking for security.

The battery, (or more than one battery) is maintained in a charged condition by a *dynamo* or an *alternator*. The batteries also supply electrical current for the lights, horn, windscreen wipers etc.

**Batteries**

Electrolyte (the acid liquid in batteries) should be checked regularly to ensure that it covers the plates. *Distilled water only* should be used to top it up.

In addition to checking the level of the electrolyte the following regular checks should be made.

- Battery posts clean and free from corrosion.
- Terminals secure and clean.
- Batteries secure in their mountings.
- Filler caps in position with the air vents kept clear.

**Note:** Due to the presence of flammable gas given off in use, naked lights must not be allowed near batteries.

**Ammeter**

This is a gauge mounted on the instrument panel. It indicates the amount of charge current the batteries are receiving from the dynamo/alternator, or if a discharge (negative) situation applies. Whilst the engine is running the ammeter will normally indicate a positive charge.
**Dynamo or Alternator**

The purpose of the dynamo or alternator is to keep the batteries fully charged to enable all electrical circuits, including lights, and to keep them fully operational.

The mountings should be checked at regular intervals for security and, in addition, the end bearings lubricated in accordance with manufacturer's recommendations.

No engine should be run with the batteries disconnected as this may damage the dynamo/alternator internal components.

**Note:** When a power unit is fitted with an alternator:

It is essential that the alternator is disconnected, to avoid damage to internal components, before any electric arc welding is carried out on either the machine or its attachments.

The ignition switch *must* be in the ON position when the engine is running, and OFF when the engine is *stopped*, or the batteries disconnected.

**Belt drives**

Cooling fan, dynamo, alternator, exhauster, water pump and compressor are generally driven from the engine crankshaft pulley by means of one or more belt drives.

These belts require regular attention to ensure serviceability and correct drive tension. Usually adjustment is made by moving one pulley closer to, or further away from, another pulley; or by employing a spring-loaded jockey wheel riding on the belt to limit the amount of slack.

Always refer to the maker's handbook for the correct belt adjustment.

Multi-belts must always be replaced as a *complete set*. If more than one belt runs on the same set of pulleys, all must be replaced if any fail.
Types – Fixed Mast and Forward Reach

Fixed mast

With fixed mast machines the basic fork movement is confined to raising and lowering the forks and tilting the mast forward approximately 3 degrees and backwards approximately 10 degrees.

The stability of the forklift truck can be impaired if the use of the tilt is abused. Tilting the mast forward allows for ease of fork entry into and exit from the pallet. On a loaded machine this facility should only be used when the load is about to be lowered onto its final resting place.

For the reasons previously mentioned, the machine tends to be in its most unstable condition with the mast tilted forward.

Forward reach

In addition to the raising and lowering of the forks and the forward and backward tilt of the mast, the forward reach forklift has the ability to move the forks forward and backwards without using the machine travel motion.

In its simplest form this movement is achieved by a scissor action type load extender, fitted between the fork carriage and the mast.

Forward reach

It must be remembered that forklift forward reach systems can alter considerably the machine load capability. The driver should be aware of load limitations before lifting a load.

When travelling with a forward reach machine, the forks should always be retracted. Forward reach capability involves more sophistication than other types and it follows that the skill required for safe operation is that much greater. Designers use great expertise in giving such machines stability, but it is
necessary for the user to respect the equipment and to use it within its rated capability.

Scissors forward reach attachment

**Load Centres**

All forklifts have their lifting capabilities shown on a duties plate attached to the machine. These show the load in kilograms (or pounds) which can be lifted when the centre of gravity of the loads situated at a given distance from the 'heel' of the forks. If the load centre is lengthened the load carrying capacity is reduced, but it does not follow that a shortening of the minimum rated load centre permits an increase in the maximum rated load weight. **This must never be exceeded**, an increased load would place more strain on the lifting chains, hydraulics or gears, and could result in mechanical failure and accidents.
**Balance**

*Weight X Distance = Force*

This simple and well known principle is used by the forklift designers to ensure that, used correctly, the machine will remain stable in use.

An easy way to remember this principal is to consider the operation of a children’s see-saw.

The four figures below show how distance is just as important as weight.

If two equal weights are placed at an equal distance from the pivot point the see-saw remains in balance:

\[
5t \times 2 \text{ m} = 10 \text{ mt}
\]

![Diagram](image1.png)

If we calculate the force each side of the pivot point, \((5t \times 2 \text{ m} = 10 \text{ mt})\) we can see that the see-saw will balance.

If the weight one side of the pivot is increased, the calculation will change and the see-saw will tip towards the end with most force:

\[
8t \times 2 \text{ m} = 16 \text{ mt}
\]

![Diagram](image2.png)

If both weights are identical, but one is moved a greater distance from the pivot, the see-saw will again move to accommodate the greatest force:

\[
5t \times 3 \text{ m} = 15 \text{ mt}
\]

![Diagram](image3.png)
Having understood the basic principals of balance in a see-saw we can now apply them directly to a forklift. The diagram below shows a balance between the counterweight on the left and the load on the right. If we should increase the load weight, or move it away from the pivot the machine will become out of balance, and under certain conditions could lose stability. Of course the forklift driver can only affect the balance by either lifting a load that is too heavy or positioned at too great a load centre.

\[
\begin{align*}
1.5t \times 2 \text{ m} &= 3 \text{ mt} \\
1.5t &\quad \text{Pivot} \\
3t \times 1 \text{ m} &= 3 \text{ mt}
\end{align*}
\]

### Induced Forces

These are forces which act upon a forklift, or its load, due to sudden changes in speed or direction, such as stopping, turning and starting. The greater the travelling speed of the machine when such incidents occur the greater will be the effect of the induced forces. Induced forces could cause a machine to overturn sideways or to tip forwards. Travelling with a load raised unnecessarily high will greatly increase the effect of induced forces.

[Image of forklift braking or hitting an obstruction when travelling forward]
**Lateral and Longitudinal Stability**

Anything which causes the forklift to move away from a level condition will affect the stability of the machine.

1. Some causes of lateral instability.
   a. Driving or working along a slope
   b. Turning at speed, (instability increases as the radius of the turn decreases)
   c. Centre of gravity of the load not over the centre of the wheel base
   d. Uneven tyre pressures
   e. Carrying a load too high
   f. Travelling too fast
   g. Ground conditions
2 Some causes of longitudinal instability.
   a Driving up or down a slope incorrectly
   b Overloading the machine
   c Placing a rated load too far forward on the forks
   d Violent braking and starting
   e Erratic forward movement
   f Uneven tyre pressures
   g Operating hoist controls violently
   h Driving or working up and down a slope
   i Travelling too fast
   j Ground conditions

Site Conditions

Although forklifts used on site should have rough terrain capabilities, the best possible ground conditions should be provided. Sites should be tidied up and levelled off to create the desirable conditions for forklift movement and materials placing in the working area. Forklift routes should be planned to utilise site roads as far as possible, and running on irregular ground restricted to the absolute minimum. Forklift stability will then be maintained to the maximum extent possible.

Where a site is hilly, or has local steep gradients, forklift routes should be designed to minimise the effect of such gradients. If steep slopes are unavoidable, the forklift driver must be fully briefed as to the correct method of travelling with a load in such circumstances.

The first consideration when negotiating a slope with a forklift has to be, is the gradient within the machines capabilities? Forklifts of this type are usually designed to operate on gradients of up to 25°. For further details you must refer to the forklift handbook.

Where the forklift is carrying a full load or is empty, its heaviest end should face uphill at all times. Lowest gear and speed should be used and, if fitted, 4 wheel drive should be engaged if it is judged necessary, i.e. if the slope is slippery.
Load stability and machine traction can be improved whilst negotiating slopes, by tilting forward just enough to maintain the loads vertical/horizontal position when the forklift itself is of horizontal. Never “freewheel” down a slope.

At all times, forklift routes should be kept in the best possible condition, and local pot holes etc. filled as soon as they occur.

Obstructions from odd items left lying about the site, can be avoided by systematic and planned stacking of materials. Equally dangerous obstructions on or just above the ground may arise as part of the permanent or ground works. Routing of forklift runs should be arranged to avoid them.

### Tyres

Rough terrain forklift tyres are designed to cope with uneven ground and arduous conditions, and the tyres’ ability to cope with them is vital.

It is essential that tyre pressures are maintained by the forklift driver as recommended by the manufacturers, and checked daily before commencing work. Failure to maintain the correct pressures will result in a short life, overheating and, most important, in the machine being out of level, which, in turn, will affect the load and machine stability. The tyre condition should also be checked by the driver with consideration to wear and damage. Cuts, particularly in the side walls can prove to be dangerous.

Some machines use water ballast in their tyres as an aid to stability, where this is so, the ballast must always be maintained in accordance with the Manufacturer’s instructions. Air pressure in this type of tyre should always be checked with the valve at the topmost position unless a proper water gauge is fitted.
Correct travel position

c The forks should be leading when travelling loaded up an incline and trailing when travelling loaded down an incline. (The reverse applies when the machine has no load, i.e. the counterweight facing up the slope.)

d It may be necessary on occasions to travel with the load elevated because of the nature of the load, or that it might foul obstructions. In such circumstances, the load should be well heeled and secured to the forks, and the travel speed kept as slow as possible.

e The driver should always try to face the direction of travel and, if the load, or obstructions, impair his view, be under guidance from a Banksman.

Loading a tower

Loading towers are coming into increasing use due, primarily, to brick and block manufacturers producing unit loads in excess of those acceptable on normal scaffolds. Such towers have many safety advantages:

a They are independent of the main scaffold so that excess loading of the scaffold cannot take place.

b Shock loading is not transmitted to the building.

c They are designed with a known load capacity.

d Resulting from (c) they provide a safe reservoir of materials.

At the platform level of loading towers guard-rails and toe-boards are necessary to comply with statutory regulations. These should not be removed to allow material to be stacked onto the tower.
Loading tower

Approach the tower squarely with the load in the correct carry position. Manoeuvre the truck so it is in the straight ahead position and stop at the face of the tower. Apply the handbrake.
Raise the load to the required height. Release handbrake and with the mast tilted back drive forwards slowly until the base of the mast is just clear of the tower then reapply the handbrake. Take care not to foul the loading tower with the lift arms, forks or load.
Tilt forward to vertical then lower the load ensuring it is safe and secure, further lower the forks until they are free within the pallet. Look to the rear to ensure it is clear, release the handbrake and reverse slowly ensuring the forks do not foul.

When clear of tower apply handbrake, tilt mast back and lower forks.
Adjust the forks to the correct carry position and, ensuring the way is clear, reverse away from the stack.

Removing the load is the reverse of the loading procedure.

When forming a stack with unit load elements adequate precautions are necessary to ensure the stability of the whole. Such stability depends on:

- **a**  the quality of the stacking area, and its ability to support the loads.
- **b**  ability of the unit loads including the pallets to support the loads above them.
- **c**  height/base ratio of the stack (it is recommended that the height should not exceed three times the minimum base dimension of the package).
- **d**  box or post pallets – for the containerisation of loose materials, should never be stacked unless of the interlocking type.
- **e**  unit loads which do not require pallets, e.g. timber and plasterboard, require separators or packing pieces. always place separators one above the other.
- **f**  when stacking concrete prestressed elements, ensure that the separators are placed in the specified positions.
Guidance Notes for Drivers

Offloading and loading vehicles

Any vehicle being unloaded/loaded should be in a prepared area or an adjacent road. If possible it should be unloaded and loaded in such a manner that the platform remains level.

The following general points should be observed:

**DO**

1. Ensure your machine is serviceable and correctly maintained at all times.
2. Understand the limits of your machine (unloaded and loaded) with load in any position.
3. Check that weights to be lifted are within the safe capacity of the forklift, particularly if using forward reach.
4. Be aware of other personnel and plant in your working vicinity.
5. Remove loose objects from your forklift routes.
6. Use a banksman for awkward and bulky loads that restrict vision.
7. Travel with load at lowest level and tilted back.
8. Remember and apply the safety rules, for travelling and working on slopes.
9. Ensure forks are at correct spacing for the load.
10. Ensure forks are completely under the load.
11. Lift with mast vertical or slightly back.
12. Drive carefully, avoiding sudden stops and changes of direction.
13. Give warnings on the horn at corners, crossings, etc.
14. Ensure that there is sufficient overhead clearance for the mast.
15. Raise load just clear of the lorry bed, ensure it is within safe working capacity and check the stability before travelling.
16. Unload from the rear first and load from the front first or alternatively to the directions of the lorry driver.
17. The lorry driver should be out of his cab acting as banksman.
18. Ensure that the forks do not project beyond the far side of the load and interfere with adjacent loads.
19. Ensure that attendant labour never stands under elevated forks.
20. Park your forklift with the forks flat on the ground, controls in neutral, brakes on, engine stopped and the starter key removed.
21. Avoid parking on slopes.
DON'T

1 Use the forks as a working platform unless proper safeguards are taken as to the safe use and all relevant safety requirements are adhered to.

2 Add unauthorised counterweights to the forklift.

3 Put your arms, legs or head between mast uprights or outside the limits of the truck frame.

4 Load scaffolds beyond their regulation capacity.

5 Subject scaffolds to unnecessary 'shock' loads.

6 Raise load excessively high whilst travelling.

7 Travel with load elevated and mast vertical.

8 Raise a load on uneven ground and the mast out of vertical.

9 Carry passengers.

10 Attempt to discharge a load off the forks by using inertia force i.e. stopping the machine quickly.
MODULE SEVEN – TRANSPORTATION

Transporters will normally be in one of the following categories:

- Articulated low-loader
- Semi low-loader
- Towed trailer

Whichever type is used, it must be adequately capable of carrying the size and weight of the machine.

All loading and unloading operations must be carried out on firm level ground and under the direction of the lorry driver.

Rear End Loading

1. The transporter must be in a straight line with the brakes applied, and with a low-loader it will be necessary to remove the rear wheels.
2. On a semi low-loader, place packing underneath the rear.
3. Fix the ramps in position, making sure that they are firm and secure.
4. Line up the machine with the ramps and drive up slowly.
5. Travel the machine on to the transporter, and position it according to the loader driver's instructions.
6. Lower all attachments, place the gears in neutral, lock on the brakes and stop the engine.
7. The loader driver will secure the machine to the loader.

NOTE: In some cases the assistance of a winch will be safer and even necessary, as when loading an unserviceable machine.

Unloading

This is basically the reverse of loading. Particular care should be taken to drive squarely down the ramps.

Signals

The driver will normally guide the operator on or off the transporter, and he will stand in a prominent position and use signals that are clearly understood.
MODULE EIGHT – SAFETY

Before Operation
- Always ensure machine is serviceable and safe to use
- Carry out the daily prescribed checks
- Always face the machine and use the hand and foot holds provided when climbing on.
- Check the location of underground services and overhead lines
- Clean all windows, mirrors, lights
- Check the function of brakes, steering and all controls
- Lock cab doors open or keep them shut. Never let them swing loose

During Operation
- Always wear a seat belt if fitted
- Periodically check the instruments and gauges
- Never carry passengers
- Be aware of persons entering the working area of the machine
- Keep cab clean and free of loose items
- Lower all attachments to the ground whenever you leave the machine
- Use all safety devices fitted
- Travel at speeds consistent with site conditions
- Never remove guards with engine running
- Always look to the rear before reversing
- Never overload the machine

After Operation
- Always park on firm, level ground in a safe secure location
- Lower all equipment to the ground and (when engine has stopped) release pressures
- Apply handbrake and all safety locks
- Stop the engine, remove key and lock the doors
- Climb down from the machine using hand and foot holds. Never jump
- Fill fuel tank if possible to reduce in-tank condensation
MODULE NINE – MAINTENANCE

Maintenance Programme

All machines are expensive. If owners are to obtain a profitable return on plant investment, it is essential that the machine is maintained fully and economically.

An efficient maintenance programme makes use of all available resources. These include the operator, the site mechanic, depot mechanic and various workshop facilities.

The objective will be to:

- maintain maximum output from the machines
- obtain maximum working life between overhauls
- as far as possible prevent breakdowns on site

Generally, maintenance can be divided into two categories:

- planned
- preventative

An effective maintenance programme should be a combination of the two.

Planned maintenance

This is an overall plan designed to ensure that the machines are fully maintained with the minimum number of staff. Aim for an even work load on the maintenance department.

The plan will take into consideration:

- company policy
- length of time the machine will be retained
- type of machine
- type of work for which it will be used
- expected hours the machine will work by day, week, month, etc.
Previous experience, and knowledge obtained from records or other sources, can assist greatly in the formulation of such a plan. Regular technical inspections are necessary to allow amendments to the plan as needs arise, also to ensure that operator maintenance is being carried out efficiently. The reports from these technical inspections should indicate:

- the location of the plant
- the lubrication and cleanliness state of the machine
- the mechanical state of the machine. Show repairs that require immediate action; repairs that should be effected in the very near future; and those that can safely be carried forward to a more convenient date
- the total machine hours

Records of field servicing, adjustments and running repairs will assist in amending and updating the overall maintenance plan. The plan must be sufficiently flexible to allow for unforeseen circumstances, such as machine damaged in transit, etc.

**Preventative maintenance**

This is a series of checks and inspections performed at regular intervals. They are designed to extend the working life of the machine, and prevent premature and unexpected failure of components.

The operator’s contribution to preventative maintenance is of prime importance. It is essential that adequate time and facilities are given. Supplies of materials (oils, greases, etc.) should be always to hand, with suitable provision for storing them.

All maintenance should be carried out in accordance with the machine manufacturer's schedule or as dictated by company policy.