حكومة دبي
GOVERNMENT OF DUBAI

هيئة الطرق والمواصلات
ROADS & TRANSPORT AUTHORITY
RTA

Shovel Operator's Handbook

A Guide to Safe Operation

LICENSING AGENCY

7th Edition January 2016

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Introduction

What This Handbook is About

This handbook is about the skills and knowledge required to safely operate a shovel. The handbook is for a shovel with an empty weight exceeding 7.5 tonnes.

Why Read This Handbook

This handbook tells you about some of the legal requirements for shovel operators in Dubai, along with important safety information, background material, technical information and current procedures.

The knowledge test that you must pass to get a shovel licence is based on the material in this handbook. You need to understand the information in this handbook to pass your test.

How To Use This Handbook

The Table of Contents will show you where to find each section. At the end of each section, there is a section called Test Yourself Questions to help you check if you have understood important issues.

How You Will Learn

Learning to operate a shovel is like any other complex task. If you break the task into small, manageable pieces and do not try to learn too many things at once, it is much easier. You will:

- develop the knowledge and skills needed to operate forklifts
- be shown how to drive and control forklifts safely
- practise and correct your driving techniques in an increasingly complex set of conditions, so that you are capable of successfully undertaking your licence test.

The length of each stage of learning depends on the amount of practice you have had. Be sure you are confident and competent before moving on to the next stage. Your Instructor will advise you when you are ready to move on.

How fast and how much you learn will depend on you. You should learn by:

- reading this handbook carefully
- attempting all the questions and activities in the handbook
- observing the operations being performed by your Instructor and on your work site
- asking questions
- practising the new skills included in this handbook
- undertaking the assessment tasks on completion of the training.

If there is anything in this handbook you do not understand or do not agree with, do not be afraid to ask your Instructor for assistance.

Symbols

Symbols used in the handbook.

Graphic symbols are used to guide your learning and identify types of information. The meaning of each symbol is as follows:

Caution You must follow instructions to avoid damage to products, a process or surroundings.

Safety You must follow safety procedures or wear protective clothing.

Test Yourself Questions Check that you have understood the information in this section by answering the questions at the end of each section.

Part 1: Licence to Operate a Shovel

Eligibility Criteria

The eligibility criteria for a licence to operate a shovel are set out below.

You may drive a shovel if you:

- are over 20 years of age
- have passed an eye test
- have undertaken shovel operator training until competency is shown
- have passed a practical test
- pay the agreed fees.

If you meet these criteria, you will be issued with a Heavy Tractor and Mechanical Equipment licence.

Learning to Operate a Shovel

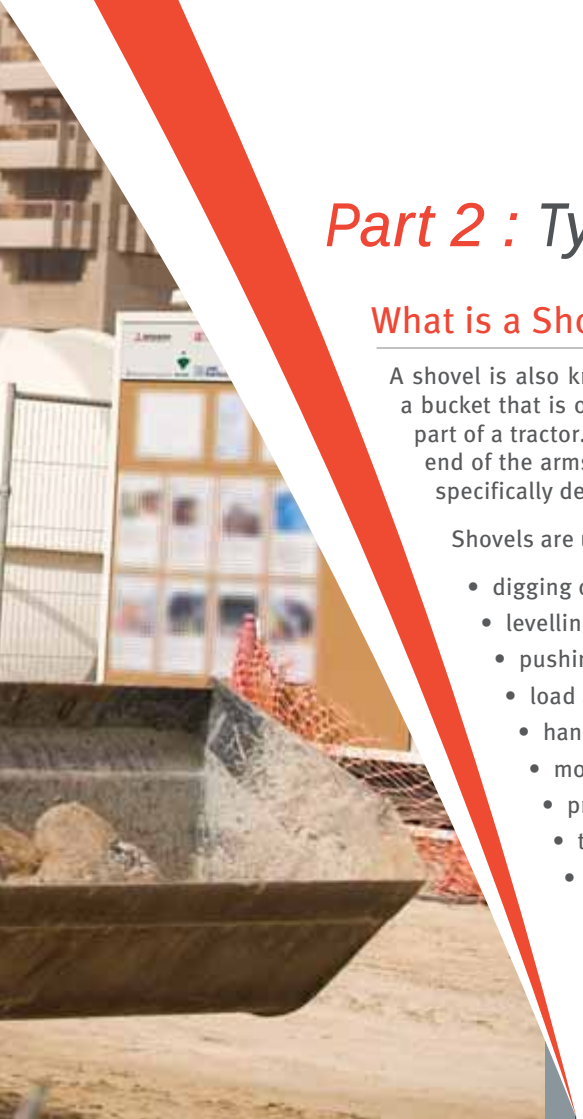
Until you get your shovel licence, you may only drive a shovel if you are under the supervision of an Instructor who holds a valid licence for the type of vehicle you are driving.

Test Yourself Questions

Q1 What age do you have to be to apply for your shovel licence?

Q2 What tests do you need to pass to obtain your shovel licence?

A1 You must be over 20 years of age
A2 Yes, a knowledge test and a practical test



Part 2 : Types and Components of Shovels

What is a Shovel?

A shovel is also known as a front-end loader, loader, a bucket loader or sometimes a scoop loader. It is a bucket that is on the end of movable arms. It tilts and is used to lift and move material. The shovel is part of a tractor. It is either a permanent-mounted version or a removable attachment. The bucket at the end of the arms can be replaced with other tools, such as forks for lifting pallets or bale tools that are specifically designed to handle bales of hay.

Shovels are used for:

- digging operations
- levelling operations
- pushing operations
- load and carry operations
- handling loads similar to crane
- mounting other equipment and acting as a tool carrier
- preparing and levelling stock storage pads
- towing loads and other equipment similar to a tractor
- general clean up of work areas.

Types of Shovels

There are many makes and models of shovels. You must locate the operator's manual for your shovel and study the operating and safety features. You will find that the position and operation of the controls vary considerably.

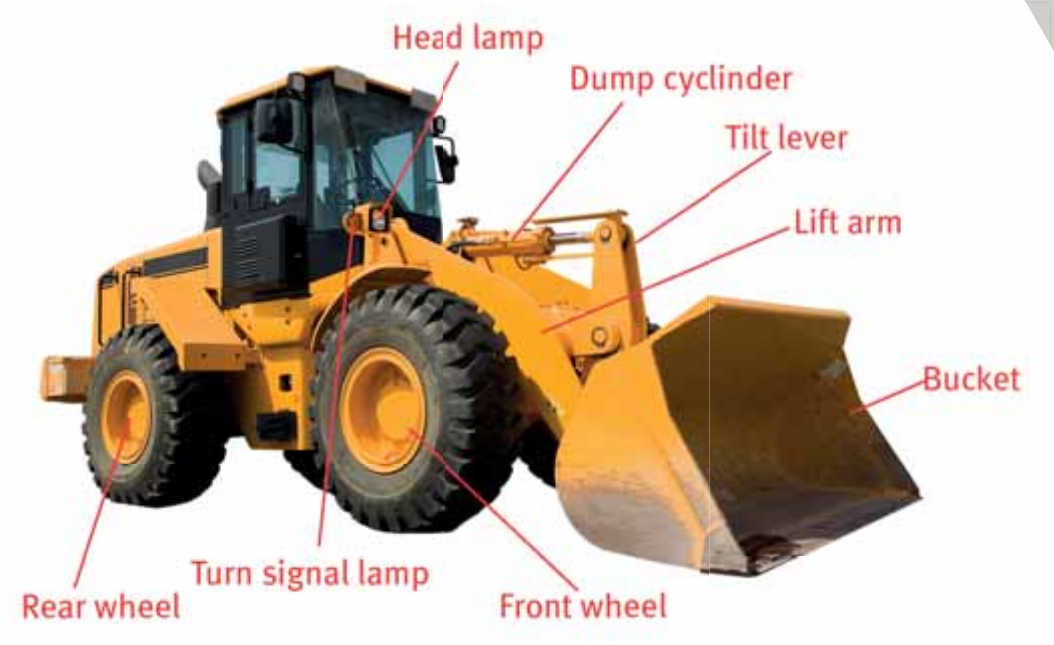
Before starting or operating your shovel:

- locate and identify each control and familiarise yourself with its function
- check the position and operation of park brakes and emergency devices
- know how to stop the engine.

Some shovels are tracked machines. The tracks allow them access to rougher working areas that would damage tyres.

Larger shovels have a steering feature known as articulated steering. They steer from a pivot point set between the front and rear axles. This allows the front axle to be solid and support more weight. The driver can steer the loaded bucket in a tight arch to reach a truck. There is danger of tipping over, because the weight is shifted away from the body of the shovel.

Components of Shovels



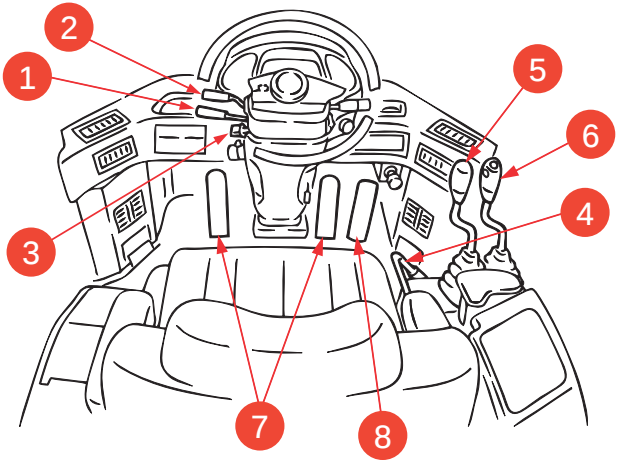
Shovel Controls

There are a number of pedals and levers to operate. Various combinations will be used at the same time, depending on what work you will be doing. Check the operator's manual for your shovel for details of position and operation.

Typical controls

1. Transmission gear selection lever
2. Forward and reverse shift lever
3. Park brake switch
4. Safety lock lever
5. Bucket control lever
6. Lift control lever with transmission kick down switch
7. Brake pedals
8. Accelerator.

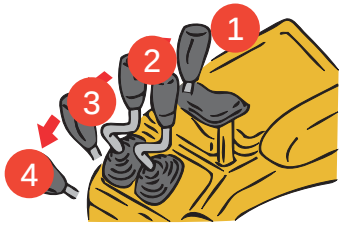
As well as the control levers and pedals, shovels have alarms and gauges to help you check the condition of the shovel. Alarms let you know when the shovel is not operating properly or when there is a danger.

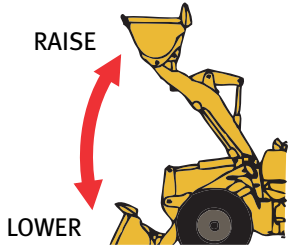


Never continue to use a shovel when an alarm is sounding and never disconnect or tamper with any warning system

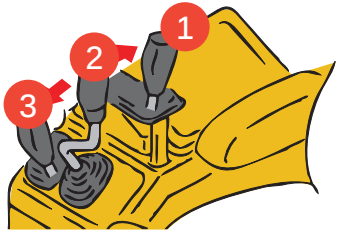
Bucket Controls

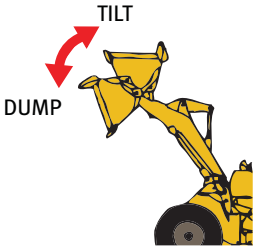
The controls to lift the bucket are: 1. Raise 2. Hold 3. Lower 4. Float





The controls to tip the bucket are: 1. Roll back, crowd or tilt 2. Hold 3. Tip or dump





Make sure you make the raised bucket safe by using chocks, blocks or safety bars before you inspect underneath it.

Pedals

Right pedal – service brake, normal braking operations when travelling.

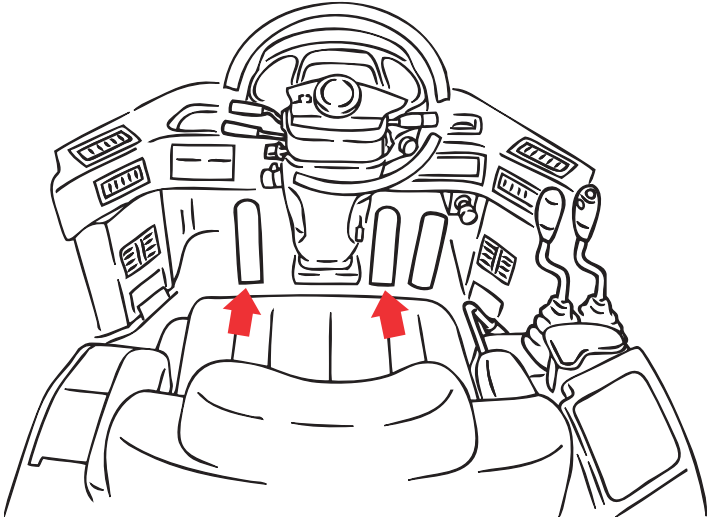
Left pedal – applies the brake and neutralises the transmission to allow the engine revs to be increased, which is used to increase the hydraulics speed.

Park Brake Operation

The park brake should be able to hold the tractor when fully loaded to the manufacturer's maximum permissible tractor weight, including any ballast, equipment and material load.

Headlights, Turning Indicators and Windscreen Wipers

You will need to look at the operator's manual for your shovel to locate the switches for operating the headlights, indicators and windscreen wipers.



When you understand the uses of a shovel, its parts and the alarms and controls, you are ready to proceed to the next section.

Test Yourself Questions

Q1 Name four typical controls on a shovel.

Q2 Name five operations shovels are used for.

Q3 What should you do before inspecting underneath a bucket?

Q4 What are alarms on a shovel used for?

Q5 Large shovels have special steering that lets the driver steer a loaded bucket in a tight arch to reach a truck. What is it called?

A Q1 Transmission gear selection lever, Forward and reverse shift lever, Park brake switch, Safety lock lever, Bucket control lever, Lift control lever with transmission kick down switch, Brake pedals

A Q2 Digging operations. Levelling operations. Pushing operations. Load and carry operations. Handling loads similar to crane. Mounting other equipment and acting as a tool carrier. Preparing and levelling stock storage pads. Towing loads and other equipment similar to a tractor. General clean up of work areas.

A Q3 Make sure you have made the raised bucket safe by using chocks, blocks or safety bars to secure it.

A Q4 To let you know when the shovel is not operating properly or when there is a danger.

A Q5 It is called articulated steering.

Part 3: Shovel Safety

Learning Operating and Handling Skills

Your Instructor will demonstrate a wide range of driving and handling skills and then get you to practice activities within the work area whilst he supervises from within the cabin. These activities will include:

- making sure that the worksite is safe
- locating and understanding the various controls and alarms within the cabin
- starting the shovel
- moving forward and reversing the shovel
- driving around obstacles
- loading, carrying and unloading the bucket
- unloading into a dump truck
- spreading a load and levelling operations
- stopping and shutting down the shovel.

While you are practising, your Instructor will provide helpful feedback.

Your safety and the safety of others depends upon your care and judgement in the operation of the shovel.

Work Site Safety

Follow all these safety rules, precautions and instructions when operating or performing maintenance on the shovel.

- Do not operate the shovel if you are not feeling well, or if you are taking medicine which will make you sleepy, or if you have been drinking alcohol.
- When working with another driver or with a person on work site traffic duty, be sure that all personnel understand all hand signals that are to be used.
- Always follow all work site rules related to safety.
- Be sure all guards and covers are in their proper position and have them repaired if damaged.
- Avoid loose clothing and jewellery, and loose, long hair. They can catch on controls or in moving parts and cause serious injury or death.
- Do not wear oily clothes, because they are flammable. Wear a hard hat, safety glasses, safety shoes, mask or gloves when operating or maintaining the shovel. In dusty or hazardous areas you may need to wear a mask or other breathing protection.
- Check that there is no one near the shovel before commencing operations.

External Vehicle Pre-operational Checks

Carry out the following checks before starting the engine at the beginning of the day's work. Failure to carry out these checks may lead to serious injury or damage.

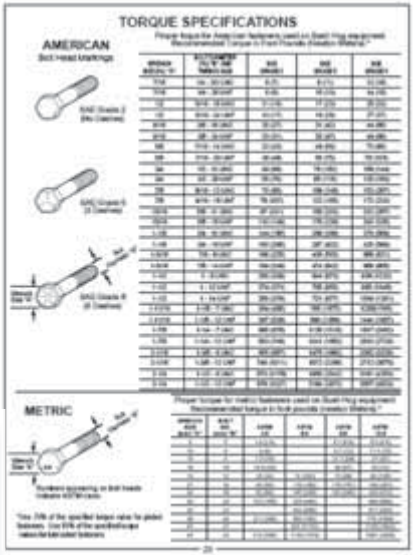
Safety decals and shovel specifications

Safety decals are signs that are used to indicate:

- general safety rules
- potentially hazardous situations
- immediate hazards which could cause death or serious injury.

Check that you have read all safety decals and specification plates. You will need to refer to these to check and operate equipment.

Specifications are used to indicate levels of operation. For example, a bolt that has been tightened beyond recommended torque specifications can easily break in use and can also cause danger to the operator. Tyre pressure specifications will show the maximum pressure for a tyre.


TORQUE SPECIFICATIONS

AMERICAN

METRIC

Tyres and Wheels

Tyres are very expensive items in shovel operations and are often overlooked during daily checks. Tyre pressure should be checked regularly while the tyres are cold. When adding air to the tyre, it is a good safety idea to stand to one side of the wheel. Tyres have been known to fly off the rim.

Check that tyre pressures are within specifications and of equal pressure. Adjust as necessary. When checking the air pressure of water filled tyres, make sure the valve is at the top of the wheel.

Uneven tyre pressure will cause the load to transfer to the side with the lower pressure and may cause an overturn.

Check that all wheel nuts are tight – that there is no looseness and tighten if required.

Visually check the tyre case for cuts and gouges, stones, wire or metal embedded in the rubber. Report any damage to your supervisor.

Wheel Changing

Depending on your company policy, it may be necessary to remove and replace a wheel on your shovel.

- Ensure that the shovel is in a safe position for jacking. Before positioning the jack, check that the shovel braking systems are engaged.
- Always block the wheels on the opposite side of the shovel.
- Position the jack on a base plate and in a safe lifting position.
- Loosen the wheel nuts before lifting the shovel.
- Lift the shovel so that the wheel is clear of the ground.
- Support the shovel on a suitable stand or wooden blocks to prevent it from falling from the jack.
- Remove the wheel nuts, then the wheel.

A shovel wheel with ballast will weigh many kilograms. It may take two people to manually remove the wheel or the use of a mechanical lifting device.

Removing the tyre and tube from the rim is a specialist job. There are several types of rims in use on shovels. You must check the operator's manual for your shovel for the recommended method of removing tyres from rims for your shovel.

Newly fitted tyres and tubes with a demountable split rim should be inflated in a special safety cage, because the rim can fly off if you are not careful.

Replace the wheel using the reverse procedure.

Take care when lowering the shovel that it does not slip off the jack. When the shovel is fully lowered, tighten the wheel nuts.

Lubrication and Hydraulic Systems

Check for leaks and have any leaks repaired. Check around the engine, all hydraulic cylinders and hoses, under the shovel engine, transmission and oil cooler. Adjust levels to manufacturer's specifications, if needed. Check the operator's manual for your shovel for details of lubrication that is required before each use.

Fuel System

Fuel levels may be checked by fuel gauge, dip stick, sight gauge or mobile warning device.

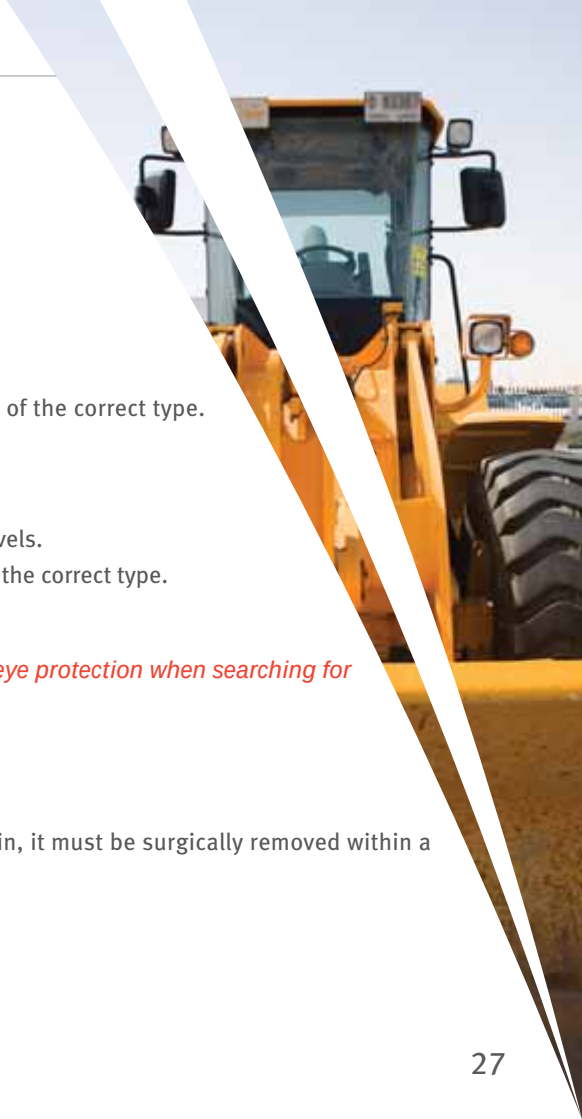
Before removing the fuel cap, clean dirt and dust from around the filler to prevent contamination.

Add fuel through an acceptable fuel filter to the required level. Replace the filler cap when finished.

Equipment should be refuelled after use to cool the remaining fuel and minimise the intake of moisture from atmosphere overnight.

Check the breather on the fuel tank. A blocked breather may cause a vacuum in the fuel tank and reduce or stop fuel flow. Clean the breather at regular intervals.

Do not fuel the shovel near any fire or flame.



Oil Levels - Engine Sump

Ensure that the shovel is on level ground and allow engine to cool.

- Remove the dipstick and wipe clean with a cloth.
- Replace the dipstick fully into the hole.
- Remove the dipstick and check the oil level.
- Add oil to the correct level if found to be insufficient. Make sure that the oil is of the correct type.

Hydraulic Oil Level Reservoir

- Oil level may be checked by dipstick or sight gauge.
- If checking by dipstick, use the same method as checking for engine sump oil levels.
- Add oil to the correct level if found to be insufficient. Make sure that the oil is of the correct type.

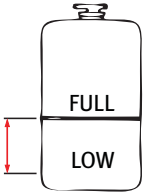
Use a piece of cardboard or wood, rather than hands, and wear eye protection when searching for hydraulic leaks.

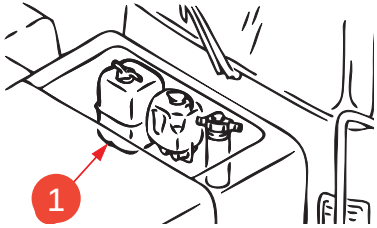
Escaping hydraulic oil under pressure can penetrate skin. If oil is injected into skin, it must be surgically removed within a few hours by a doctor or gangrene may result.

Engine Coolant Level

If the engine has been running, remove the radiator cap with caution to avoid serious burns.

Modern engines use recovery cooling systems. This system has a small external container or bottle attached to the radiator overflow tube which stores coolant. This is forced out during operation due to expansion. Some of the contents of the recovery bottle are drawn back into the radiator as the engine cools after shut-down.





Oil Level - Transmission and Differential Case

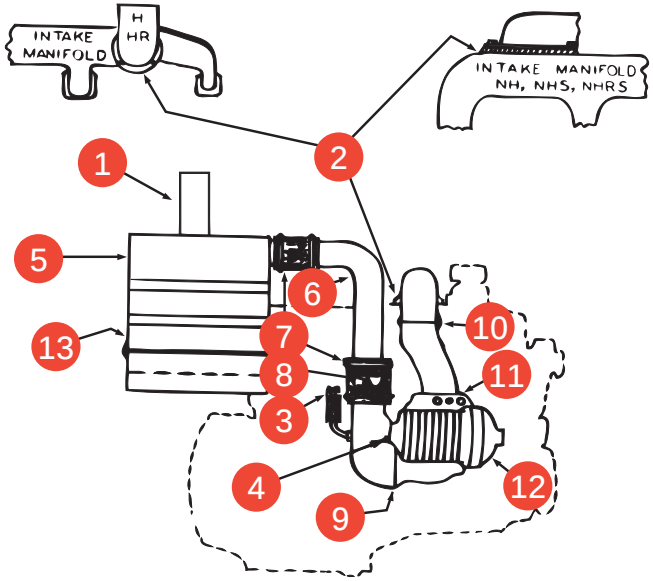
- Transmission and differential case oil levels are best checked when the shovel is parked and it has cooled down.
- The cases may have a dipstick, sight glass, level plug or filler plug requiring removal to indicate the oil level.
- Add the correct oil through the filler plug to the required level.

Wipe up any excess oil, fuel or other flammable fluids. Return all fuel containers to their proper place.

Air Filters and Air Intake

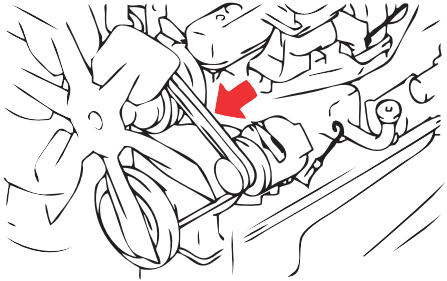
Air cleaner systems also need regular maintenance. The most common sign that the air cleaner system needs attention is that the indicator will change colour or the gauge will show into the red, or an alarm could sound, depending on the system. Check for clogging of the air cleaner. Check all tubing, hoses and clamps for security and sealing. Check your operator manual for the air cleaner warning system on your shovel. Some air cleaner elements can be cleaned and reused and some will need replacing.

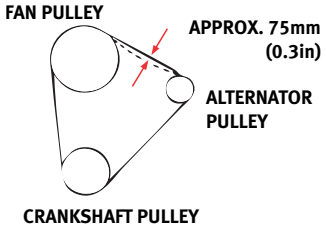
1. Raw air intake area
2. Intake manifold pressure seal
3. Air cleaner restriction indicator
4. Low pressure (super charger) manifold
5. Air cleaner
6. Clean air tube
7. Hump hose clamps
8. Hump hoses
9. Supercharger intake seal
10. Trunking support bracket
11. High pressure air seal
12. Super charger



Fan Belts

You will need to check the tension of the belt by depressing between the fan and the alternator pulleys.





Electrical wiring

Check for damage to the electric wiring. Use the operator's manual for your shovel to locate the wiring layout for the shovel you are using. You should check for frayed or broken wires, and that lights and horn are working.

Battery Condition

Checking the battery regularly is an important task. Most shovel starting problems are the result of poor battery maintenance. Check the battery for:

- Correct electrolyte level; low level can cause the battery to over-heat and fail prematurely; high levels can overflow when being recharged, causing corrosion.
- Tight terminals ensure a good connection during starting operations.
- Loose terminals can cause a spark, which in turn can cause an explosion.
- Residue build-up on the terminals can cause charge leakage, the terminals to become corroded and the area around the battery to be damaged. Clean off by flushing with water and then coat the clean terminals with a commercial anti-corrosion paste or heavy grease.
- The battery is securely restrained. Working over rough ground may cause the battery to jump around and be damaged.

Mirrors, Handrails and Steps

Remove any dirt from the mirrors, handrails, and steps. Check handrails and steps for:

- grease
- oil
- mud
- any other slippery substance.

Adjust the side mirror to a position which gives the best view from the operator's seat.

Clean the surface of the mirror. (If the mirror glass is damaged, replace with a new part.)

Operator's Seat

Adjust the operator's seat to a position where it is easy to carry out operations. Check for wear or damage to the seat belt and seat belt mounting equipment.

Gauges

Check that the gauges work properly.

Levers

Check that the control levers are at the PARKING position.

Worksite Emergency Procedures

You need to know Emergency Safety Procedures for your worksite. Remember that you will be able to deal more safely with an emergency if YOU DO NOT PANIC.

Worksite emergency procedures should inform you of the following:

- the action to be taken in an emergency
- who to report to and where
- emergency phone numbers
- position of emergency stop buttons
- fire extinguishers
- showers
- breathing apparatus
- safe assembly areas and emergency exits
- meaning of horns, sirens, lights and flags, hand signals
- warning signs
- what to do in the event of a fire.

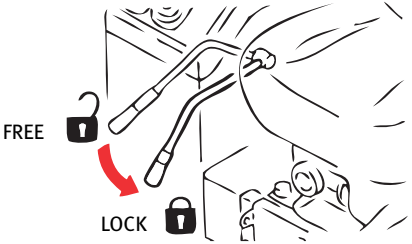
Internal Pre-operational Checks

You will need to know the following internal pre-operation checks.

Correct Entry and Exit Procedure

When getting on or off the shovel, always face the shovel and maintain three-point contact (both feet and one hand, or both hands and one foot) with the handrails and steps to ensure that you support yourself.

Never hold any control levers when getting on or off the shovel.



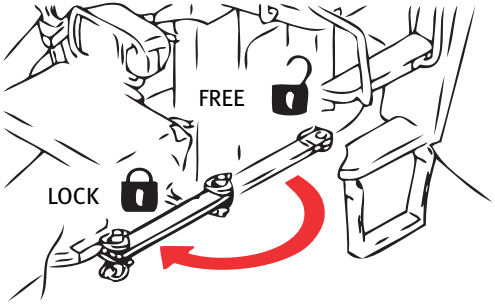
Always apply the safety lock (if fitted) before leaving the operators seat. When standing up from the operator's seat, always place the safety lock lever to the LOCK position and parking brake switch to the ON position securely. If you accidentally touch the travel or swing lever when they are not locked, the shovel may suddenly move and cause serious injury or damage.

When leaving the shovel, lower the work equipment completely to the ground, set the safety lock lever to the LOCK position and the parking brake switch to the ON position, then stop the engine and use the key to lock all the equipment. Always take the key with you.

It is very important to use the articulation lock when entering the chassis area between the wheels on an articulated shovel.

An articulation lock is used for locking the pivot connection between the front and rear frames of an

articulated vehicle for operations such as maintenance and transporting. The articulation lock has a number of locking positions. A removable locking pin is stored next to the operator's seat.



Start-up and Shut-down Procedures

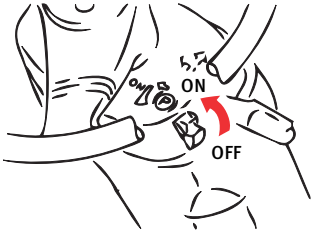
You will need to check the shovel Operator's Manual for the correct procedure for starting up and stopping your shovel.

Before starting the engine:

- Walk around your shovel again just before mounting it and check for people and objects that might be in the way.
- Know where to obtain warning tags.
- Never start the engine if a warning tag has been attached to a control lever or any other part of the shovel.

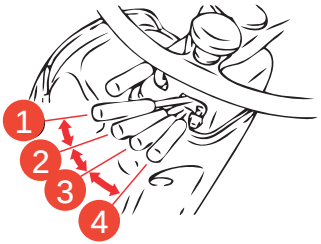
Prior to starting the engine, sound the horn as an alert. Start and operate the shovel only while seated.

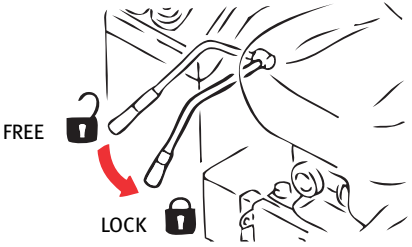
An additional worker should only ride in the shovel when sitting in the passenger seat. Do not allow anyone to ride on the shovel body.

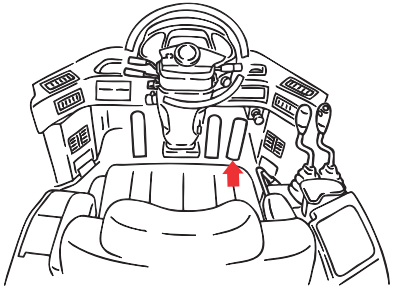


Follow this sequence of operations to start the shovel:

- Check that the park brake is set to the engaged position.
- Check that the gear selector is in neutral.
- Check that the forward and reverse lever is in neutral and locked (if fitted).
- Check that the accelerator pedal is pushed far enough down (past the detent or normal position) to work in with the brake, so that a parking mode is engaged for the shovel while in a stationary position.
- Check that the lift control levers are in the hold position and the control lock is activated (if fitted).
- Before turning the ignition key, sound the horn to let other personnel know that you are about to start the engine.







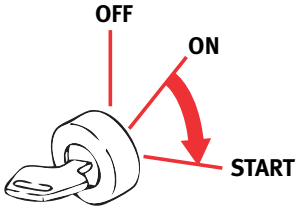
- Turn the key to the start position and hold for a maximum of 10 seconds or until the engine starts.

- When the engine has started, return the key to the ON position.
- Check the fuel and oil pressure gauges to ensure that they are working.

Warning:

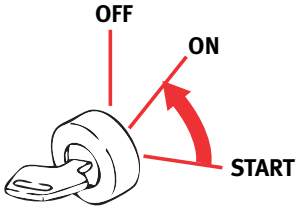
If the oil pressure gauge does not come up to the recommended operating pressure, shut the engine down immediately and have it checked before restarting.

If the engine does not start after approximately ten seconds, allow the starter to cool down and try again. If it still will not run, refer to the Operator's Manual and look under heating devices for the engine (glow plugs).



Once the engine has started, let it warm to operating temperature before it is put under load.

If a turbo charger is fitted, warm up the engine at half the rated revs per minute (RPM) to allow the oil to be supplied to the turbo charger bearings.



Shut-down Procedure

Shut-down procedures will vary depending upon specific makes and models of shovel. Check the Operator's Manual for your shovel.

You will need to follow these steps to shut down the shovel:

- Park on level ground and ensure that the shovel does not obstruct any traffic or access points to private property.
- Lower all ground engaging implements.
- Place the transmission and the forward-reverse levers into neutral (and put locks on).
- Place bucket control levers into the neutral position.
- Apply the park brake.

Idle down the shovel for three to five minutes, especially for turbo charge shovels. This procedure allows the components to remain lubricated while the turbine shaft slows down and to allow other components to cool down.

Before leaving the cab, shut down the engine, remove the keys and relieve pressure in the hydraulic lines by moving the bucket control levers through all positions.

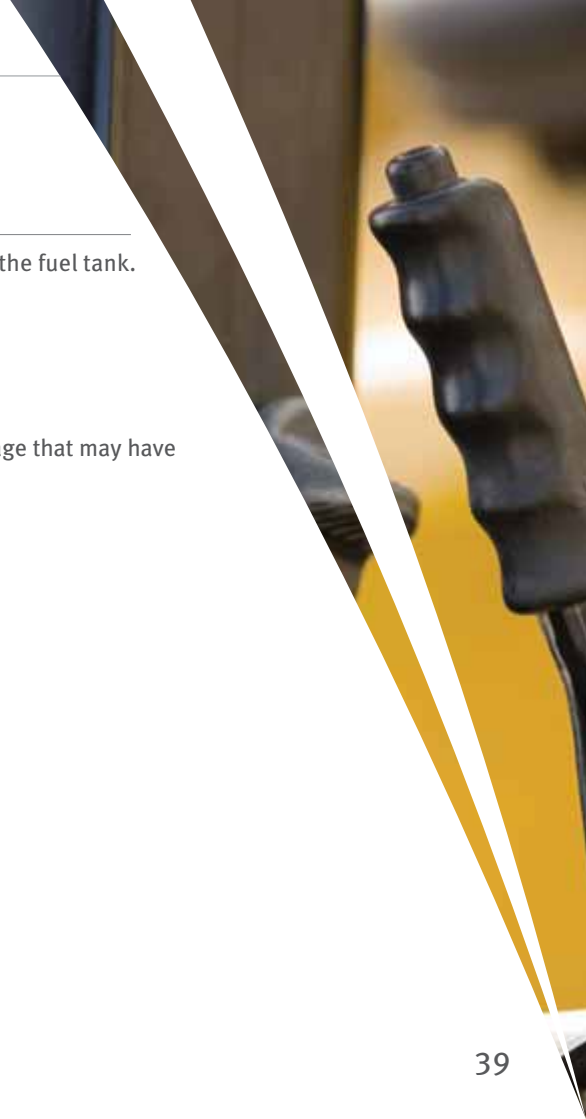
Before leaving the shovel, walk around it and look for any oil leaks or any damage that may have occurred during operation. Report any leaks.

If necessary, place a barricade around the shovel to make it safe.

Refuelling

Refuelling at the end of the day will help to reduce the amount of condensation in the fuel tank. Before refuelling:

- Shut down the engine.
- Make sure there are no naked flames in the area to reduce the risk of fire.
- Remove the key, lock the cab and turn off the isolator switch (if fitted).
- Before leaving the shovel, walk around it and look for any oil leaks, or any damage that may have occurred during the day's activities. Report any problems.
- Check all oil levels so that the shovel is ready for the next day's activities.

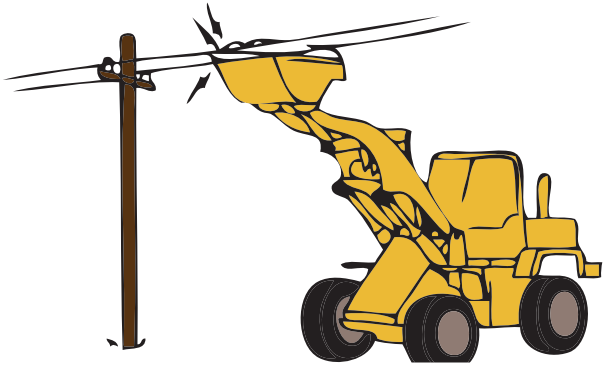


Shovel Emergency Procedures

The following is a series of possible emergency situations. The procedure listed is only a guide and may vary with each individual situation as it develops.

Shovel Begins to Side Slip on a Grade

- Immediately dispose of the load.
- Turn the shovel downhill.
- Place the bucket on the ground to act as a brake.



Shovel Catches On Fire

- Stop the shovel.
- If possible raise the alarm using the radio.
- Turn the shovel off.
- Get out if possible.
- Use fire extinguishers if possible.

Shovel Contacts Live Power Lines

- Do not panic.
- Remain inside the cabin.
- Warn all other personnel to keep clear from the shovel and not to touch any part of the machine.
- Try unaided, and without anyone approaching the shovel, to move the shovel until it is clear of the power lines.
- If the shovel cannot be moved, remain inside the cabin. If possible, have someone inform the power supply authority and have the power disconnected. Take no action until it has been confirmed by the authority that conditions are safe.

- If you must leave the shovel's cabin because of fire or other reasons, take the following action:
  - Jump clear as far as possible from the shovel.
  - Do not at any time make contact with the shovel and the ground at the same time.
  - When moving away from the shovel, the operator should shuffle or hop slowly away from the shovel across the ground area that is energised with live power.
  - Avoid large steps because one foot could be in a high voltage area and the other foot in a low voltage area. Under some circumstances, the difference between the two could be fatal.

The danger when dismounting is that you may make contact with the "live" truck and the earth at the same time, causing the power to earth through you resulting in death or injury.

- Have the shovel checked by a competent person for damage prior to further use.

Shovel Ruptures a Gas Line

- Stop the shovel.
- Turn off the machine.
- Leave the shovel.
- Notify the appropriate authorities.
- Keep the area clear of any personnel.

Shovel Stalls on Steep Ramp or Road

- Stay inside the cabin.
- Apply foot brake or emergency brake.
- Bring shovel to a stop.
- Lower all equipment.
- Attempt to re-start the engine.
- Chock the wheels.
- Report the problem and place an out of service tag on the shovel, if required.

Shovel Has a Steering Failure

- Stay inside the cabin.
- Apply the foot brake or emergency brake.
- Bring the shovel to a stop.
- Lower all equipment.
- Chock the wheels.
- Place an out of service tag on the shovel.
- Report the problem.

Shovel Has Brake Failure on Steep Ramp or Road

- Drop the bucket and use it as a brake, if necessary.
- Bring the shovel to a stop.
- Stay inside the cabin.
- Apply the emergency brake.
- Chock the wheels.

- Place an out of service tag on the shovel.
- Report the problem.

Shovel Becomes Hung-up On Edge of Stockpile

- Stay inside the cabin.
- Apply the park brake or emergency brake.
- Call for assistance.

Shovel Rolls Over or Partially Rolls on a Slope

- Stay inside the cabin until the shovel stops.
- Call for assistance.

Shovel Slips into a Cone or Hole When Pushing Up a Stockpile

- Stay inside the cabin.
- Switch off the motor.
- Call for assistance.
- Give your exact location when calling for assistance.

Shovel Rolls Over the Edge of a Stockpile

- Stay inside the cabin until the shovel stops.
- Wait for assistance.

Part 4: Shovel Operation

Planning to Work

It is important to have a good knowledge of the work site before commencing operations.

The type of work and material to be handled will need to be considered when preparing the shovel for work. Part of your planning operations will include carrying out any safe operating procedures required at the site.

Think about the following points:

- Where is the material to be moved to?
- Is it to be moved only with the shovel?
- Will it be loaded onto a haul truck?
- Is it to be stock piled?
- Are you digging it direct from the face or from a stockpile?

Safety considerations should include:

- observations of site speed limits
- safe working around overhead power cables
- underground power, water, gas, telephone lines
- overhead conveyors and equipment
- working safely around other shovels and people
- site traffic rules, for example. loaded vehicles, water trucks, etc.

- underground services such as power, telephone, gas, water, sewer, drainage, fibre-optic cable lines
- overhead dangers such as power and telephone lines or other obstructions
- overturning dangers such as sloping ground, hidden holes and drop-off's.

Filling the Bucket

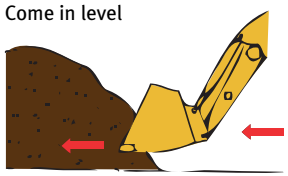
You will need to know the following important facts:

- Smooth shovel operations, rather than jerky movements, enables more efficient and speedy use of the shovel. This results in less wear and tear on the shovel and less operator fatigue.
- The design of the control valves on the shovel permit the operator to combine functions and control speed, that is raise and crowd the bucket at the same time.
- The operator can 'feather' the controls for slow, easy movement, thus avoiding erratic, jerky movements which can cause substantial wear on the shovel.
- Most shovels are designed so that more than one movement can be achieved with the use of one hand, while the other hand is used for the steerage of the shovel.
- To fill the bucket to capacity at every attempt requires practice and good hand to eye coordination.
- A new operator may need several attempts to fully load the bucket; with practice the skill will be mastered.
- Do not be impatient! Take your time! Get out of the cab the first few times and look at the bucket position, if you are having difficulty.

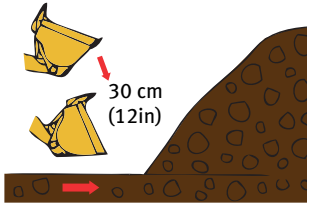
Filling the Bucket from a Stockpile

You will need to know how to fill the bucket using the following process:

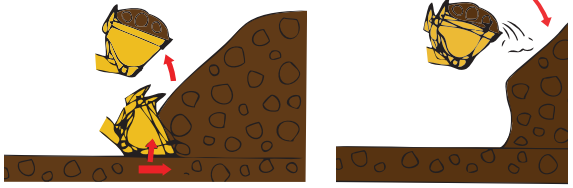
- Set the shovel facing directly to the front when carrying out digging or scooping operations, never carry out these operations with the shovel articulated.



- Drive the shovel forward and lower the bucket about 30cm from the ground, then lower it slowly to the ground. Shift down to the required gear, depress the accelerator pedal and thrust the bucket into the load.
- At the same time as thrusting the bucket into the material, raise the lift arm to prevent the bucket from going in too far and to increase the penetrating force.



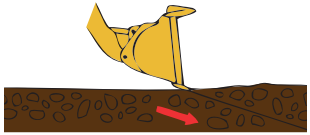
- Check that there is enough material loaded into the bucket, and then operate the bucket control lever to tilt the bucket and load it fully.
- If there is too much material loaded in the bucket, dump and tilt the bucket quickly to remove the extra load. This prevents spillage of the load during hauling and assists in keeping the work area floor clean.



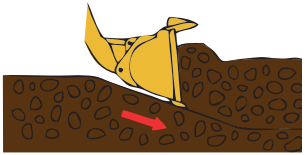
To Fill a Bucket When Digging and Loading on Level Ground

This operation should be carried out in 1st gear.

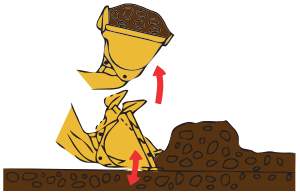
- Set the edge of the bucket facing slightly down.



- Drive the shovel forward and operate the lift arm control lever forward to cut a thin layer of the surface each time when excavating the soil.



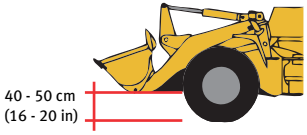
- Operate the lift arm control lever slightly up and down to reduce the resistance when driving the shovel forward. When digging with the bucket, avoid imposing the digging force onto only one side of the bucket.



Transporting with a Full Bucket

The following technique is for travelling with a loaded bucket.

- Carry the loaded bucket as low as possible, at all times, for best visibility and stability.
- Only raise the bucket just prior to discharge of the load. This will keep the loader's centre of gravity low and help to avoid instability if making a sudden stop.
- It is important to avoid sudden starts, stops or changes in direction. Operate the shovel controls as smoothly as possible.
- You need to take care when lifting and transporting loads, such as large boulders, as these could tip out of the bucket as it is raised and cause injury or damage.



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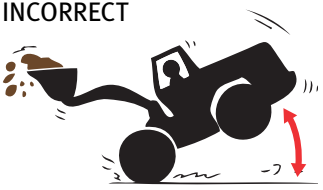
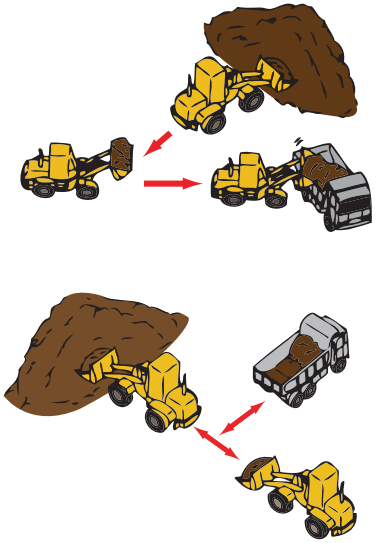


Loading a Truck

The correct process for loading a truck is as follows:

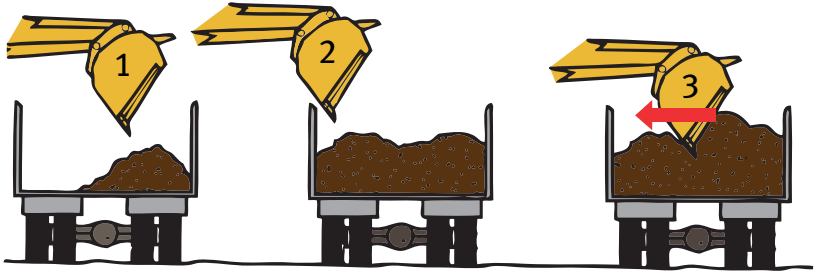
- Always approach the stockpile and the truck at a 90 degree angle.
- Align the bucket with the centre line of the truck, raise the bucket to clear the truck body and commence dumping the material. If necessary, shake the bucket to dislodge any stuck material.
- Spread the material as you go instead of just dumping on top. Work from the cabin to the tailgate. By dumping through the pile you can spread and dump at the same time. To do this, lower the bucket in a way that ensures that as it is dumped, it smooths the previous load (back blades it), thereby spreading the load towards the shovel.

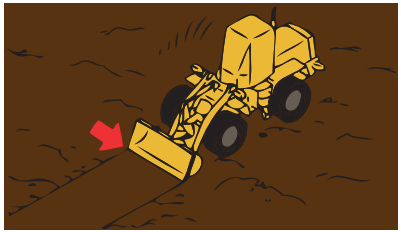


Levelling and Pushing Operations

The correct procedure for levelling should always be done with the shovel in reverse. (If it is necessary to travel forward when carrying out levelling, the bucket dumping angle should not be set to more than 20 degrees from level.)

- Scoop soil into the bucket. Move the shovel backward while spreading soil from the bucket little by little.
- Go over the spread soil with the bucket teeth touching the ground and level the ground by back dragging.
- Scoop some more soil into the bucket, put the lift arm in float, level the bucket at ground level and smooth the ground by moving backward.
- When carrying out pushing operations, set the bottom of the bucket parallel to the ground surface.
- Never set the bucket to the DUMP position when carrying out pushing operations.





Travelling on Sloping Ground

You will need to be very careful when travelling on sloping ground. You should:

- Work from a level surface wherever possible. If not possible, then make sure you have a flat area for safe turning, loading and unloading.
- Always have a loaded bucket uphill of the machine when travelling up or down inclines.
- When travelling empty on an incline, always have the rear end of the machine pointed uphill. Always “BACKUP” and “DRIVE DOWN” inclines.
- Select a low gear when travelling down inclines to maximise engine braking and minimise the need for brake operation. NEVER coast or freewheel down grade in neutral.
- Avoid making any turns or travelling across inclines. If unavoidable, make sure the centre of gravity of the machine is as low as possible and take care not to make any sudden changes in speed or direction.
- Check soil conditions when working on banks - slides and caving are a real hazard. Shore and brace as required.
- Watch for loose material while working on inclines, as the machine may slide and be placed in a dangerous position.
- When working near ditches or trenches on slopes, extra care must be taken to avoid the weight of the equipment causing a slide or caving.

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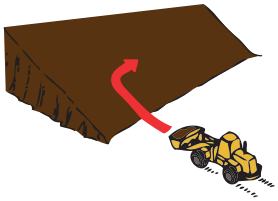

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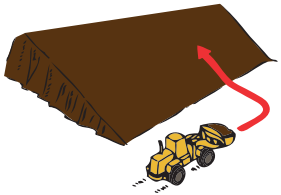


You will now have an understanding of the correct way in which to operate a shovel.

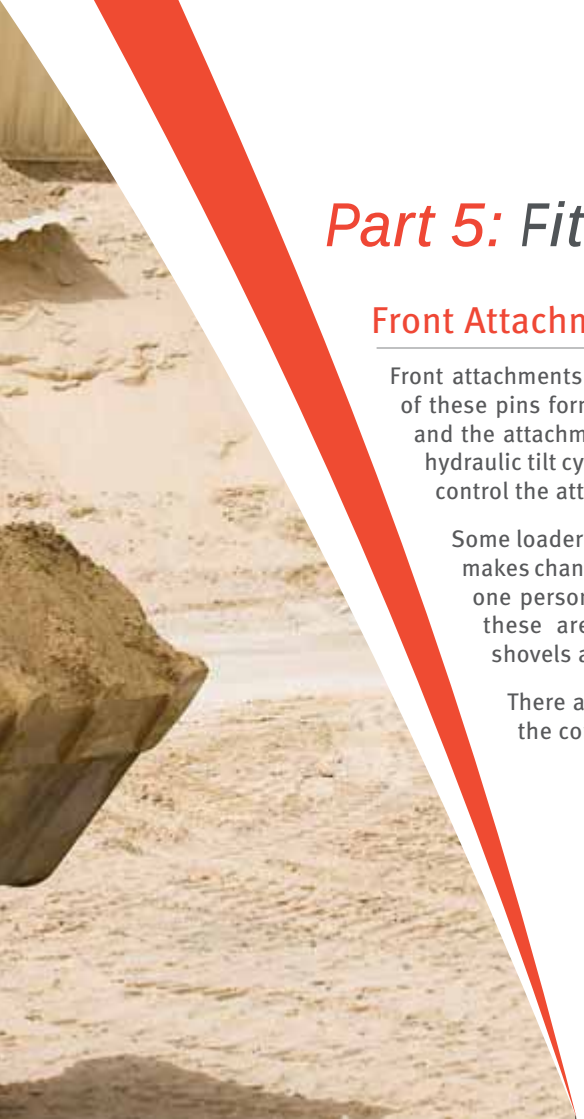
Test Yourself Questions

Q1 **Why is it important that the front tyres are of equal pressure on your shovel?**

Q2 **Name 3 faults to look for in the hydraulic system.**

Q3 **What gear should you use when travelling on a sloping surface?**

A1 Uneven tyre pressure will cause the load to transfer to the side with the lower pressure and may cause the shovel to tip over.
A2 Leaks form seals. Split or broken hoses. Bent or damaged rams.
A3 The lowest possible gear.



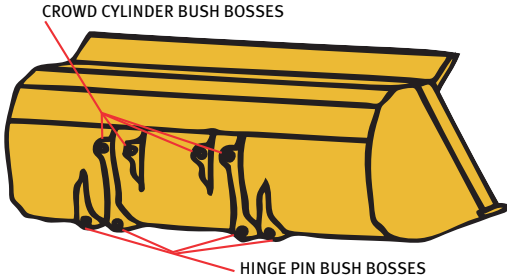
Part 5: Fitting and Removal of Attachments

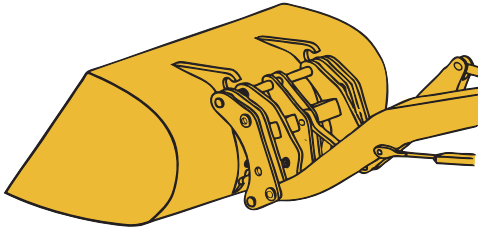
Front Attachments

Front attachments are usually fitted by three pins. Two of these pins form the hinge between the loader arms and the attachment and the third is connected to the hydraulic tilt cylinder/s or tilt mechanism and used to control the attachment's angle or plane.

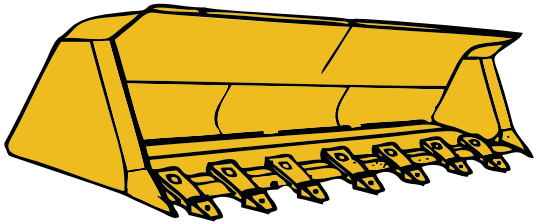
Some loaders have a quick hitch mechanism which makes changing attachments a simple and speedy one person operation, but because of strength, these are usually limited to moderate sized shovels and will not be covered in this course.

There are three main types of buckets used in the construction industry.





General purpose excavating buckets



General purpose excavating buckets are used for universal excavating, loading, backfilling and levelling. These buckets can be used in just about any situation.

The bucket has a straight base edge, rounded corners and straight side bars, all of which are normally welded to the bucket assembly.

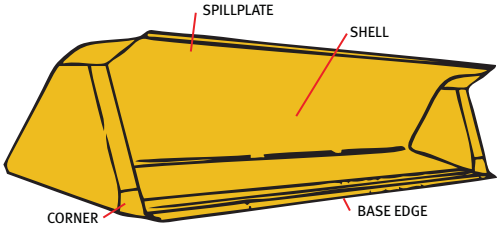
There is generally a spill plate or rock guard fitted to the top of the shell.

General purpose penetration bucket

General purpose penetration buckets are used for excavation work in material that requires moderate break out and impact forces.

General purpose penetration buckets have flush-mounted teeth and curved side bars to improve the penetration, and a straight base edge to improve the work surface.

They generally have a reinforced bucket shell and a full width back drag edge. The buckets have weld on adaptors and long tips.

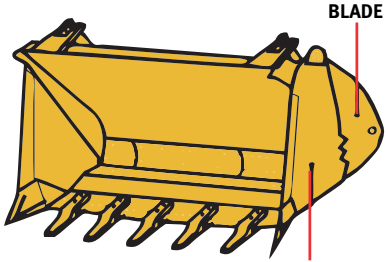


Multipurpose bucket

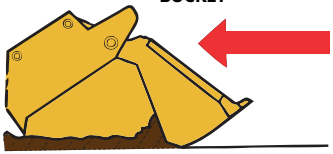
The multipurpose bucket is a combination bucket that has four positions; each of these positions can be selected from the operator's seat.

The four positions are known as:

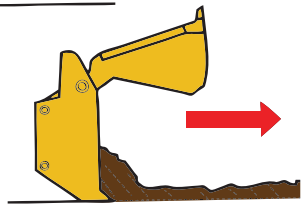
Bucket: Used as a normal bucket to handle material.



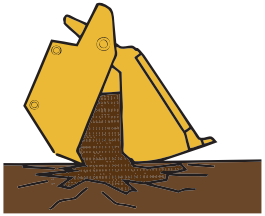
Blade: Used for general pushing, spreading and grading.



Scraper: Used for scraping actions such as spreading soft materials and/or finish levelling and removing thin layers of material when set properly; very effective when moving forward.



Clam shell: The clam operation of the bucket is used to allow the operator to pick up objects or grab and hold.

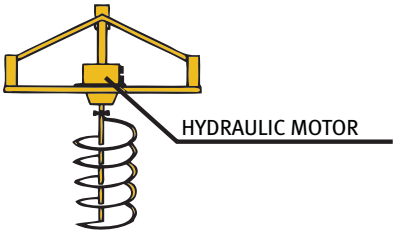


Rear Attachments

There are various types of rear attachments that can be used:

Augers

Augers are generally used during fence construction or when sinking piers during slab construction.



Grabs

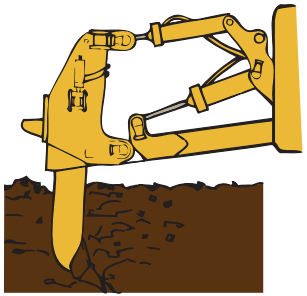
Grabs are mechanical hands used to pick up and place objects where required. Grabs vary in opening depending on the job. Materials may include drums, pipes of various size, timber logs and large objects etcetera.

Rippers

Rippers are used on hard ground to prepare it for removal.

These vary in size and number depending on the size of the shovel. Generally rippers come in one, two and three type arrangements.

You will need to check the shovel or attachment supplier handbook because fitting arrangements will vary.

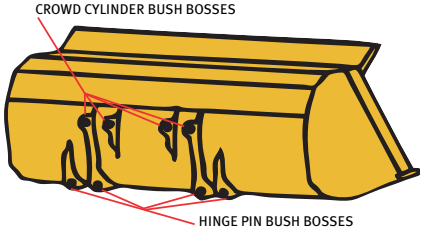


How to Fit, Operate and Remove Common Attachments

The operation of all attachments, whether front or rear, should always be according to the relevant manufacturer's specifications and safety information.

Front Attachments

Attachments used on a shovel all connect to the same place on the shovel. This is a typical attachment and connection:



- Buckets and attachments are usually fitted to the boom using pivot pins that fit neatly into greaseable bushed bosses, as shown in the following diagram.
- The pins are generally held in place with circlips (snap pins) or are locked by locking bolts and self locking nuts to prevent the attachment pins from falling out.
- In most cases washers will be used on the pins to take up any excess clearance between the attachment and the boom arms and/or crowd cylinder. It is necessary that these parts are maintained in good condition and replaced or repaired if damaged or worn. It is preferable to have a set of washers for each attachment as this enables the correct spacing of each attachment. Note that the washers should always be placed in their original positions to reduce wear and binding of the attachments.

You should always observe the following when changing attachments:

- Stop the shovel on a firm, flat surface and make safe.
- When performing work on the joints and linkages with someone else, it is vitally important that:
  - all signals are made clearly to each other; and
  - both the operators are fully aware of the procedure that will be used to complete the changeover.

Fitting an Attachment

This is the procedure to mount a bucket or attachment:

1. Place the attachment or bucket in the normal mounting position.
2. Clean all pins and bushes thoroughly.
3. Apply grease to all pivot points according to the manufacturer's specifications.
4. Start shovel and idle up to the attachment.
5. Align the boom with their respective bosses in the attachment.
6. Insert the boom pins. Make sure the washers are in place. This procedure often needs the help of a small pry bar or guide pin to align the boom and boss.
7. Guide the crowd cylinder to its boss. This operation is much simpler with two people.
8. Insert the crowd cylinder pin. Make sure the shims are in place.
9. Shut down the shovel.
10. Fit the snap ring, circlip or bolt to each of the pins.
11. Apply grease to each pin to the manufacturer's specifications.
12. If the attachment has hydraulic connections, these should now be connected. Store the bungs and caps for later use.
13. Start the shovel.
14. Operate the attachment, checking for any binding or undue movement.
15. Check for hydraulic leaks as appropriate.

Removing an Attachment

This is the procedure to remove the shovel bucket or attachment:

1. Select a flat surface and stabilise the bucket or attachment on the ground.
2. Stop the engine.
3. If the attachment has hydraulic connections, these should be disconnected. Fit bungs and caps to all hydraulic lines.
4. Remove the snap rings, circlips or lock bolts for each pin.
5. Remove the crowding cylinder pin. Watch for movement of the crowding cylinder as the pin is removed. This can cause a crush injury.
6. Remove the boom pins from the bucket. Watch for movement of the bucket as the pins are removed. This can cause a crush injury.
7. Start the shovel, reverse away from the bucket slowly and lift the boom as the shovel is reversed.
8. After removing the pins, make sure that they do not become contaminated with sand or grit. Place plugs or clean rag into the bush bosses of the attachment or bucket to stop the ingress of sand or grit into the bushes.

Rear Attachments and Connections

As the fitting arrangements for rear attachments vary widely, you will need to consult the shovel or attachment operator's manual for the correct procedure for the shovel and rear attachment.

Test Yourself Questions

Q1 What would you look for on the attachment pins to make sure they do not fall out?

Q2 During the routine check, you may find excessive wear in the power arms and connections that will make the loader dangerous to operate?

Q3 What faults would you look for when doing the external check on the bucket of a front-end loader?

A1 Make sure that the safety pins and keepers are in place.
A2 Tag the equipment. Tell the supervisor. Do not use the equipment until repairs have been carried out.
A3 Look for worn or missing teeth. Look for a worn cutting edge and other damage to the bucket. Check bucket pivot pins and keeper plates.

Note :

Roads and Transport Authority has the right to modify any item/s on this handbook at any time, according to new legislation, regulations and policies.

For Comments and/or Suggestions please call 800-9090 or email: crmadmin@rta.ae

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