

Best Practice Guidelines for Mobile Plant

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These Best Practice Guidelines are to be used as a guide to the operation of mobile plant. They do not supersede legislation in any jurisdiction or the recommendations of equipment manufacturers.

FITEC believes that the information in the guideline is accurate and reliable; however, FITEC notes that conditions vary greatly from one geographical area to another; that a greater variety of equipment and techniques are currently in use; and other (or additional) measures may be appropriate in a given situation.

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Mobile plant basics

Types of mobile plant

The main types of mobile plant used in the forest industry are:

- Wheeled skidders
- Excavator-based machines
- Forwarders
- Bell loaders
- Power-operated work platforms
- Tracked skidders
- Mechanised harvesters
- Wheeled loaders
- All terrain vehicles

The following sections describe the features of each of these.

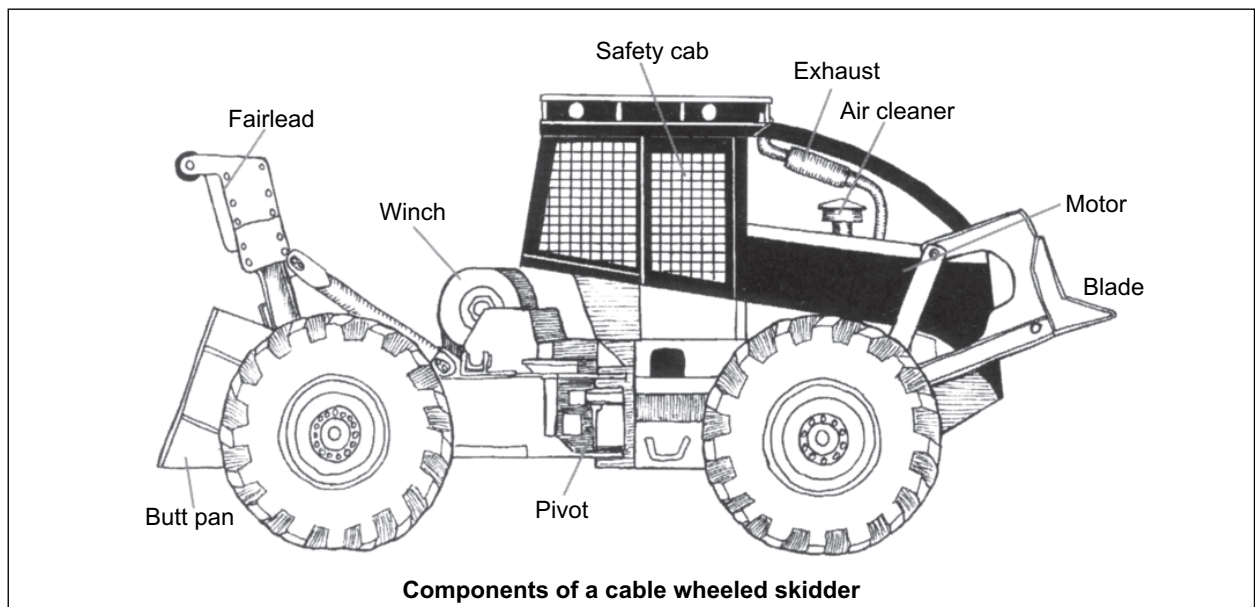
Wheeled skidders

Description

- Wheeled skidders are articulated four-wheel drive machines. Their main use is for wood extraction, from the felling site to the landing. They are used widely in production thinning (tree size 0.2 to 0.5 tonnes) and clearfell (tree size 1.2 to 2.5 tonnes) operations. In clearfell operations, load sizes can average 5 to 7 tonnes.
- Wheeled skidders may be fitted with wider types of dual rear wheels to reduce ground pressure and increase stability.
- The Approved Code of Practice for Safety and Health in Forest Operations states that as a guide, wheeled skidders should not operate on slopes exceeding 18° (30%) unless otherwise specified by the manufacturer. Where weather or ground conditions affect machine stability, the maximum operating slope will be actually less than this.
- Skidders are classed as either cable or grapple machines.
- Cable skidders employ a winch, wire rope (generally 25 to 30 m long), and stops to attach and move felled trees.

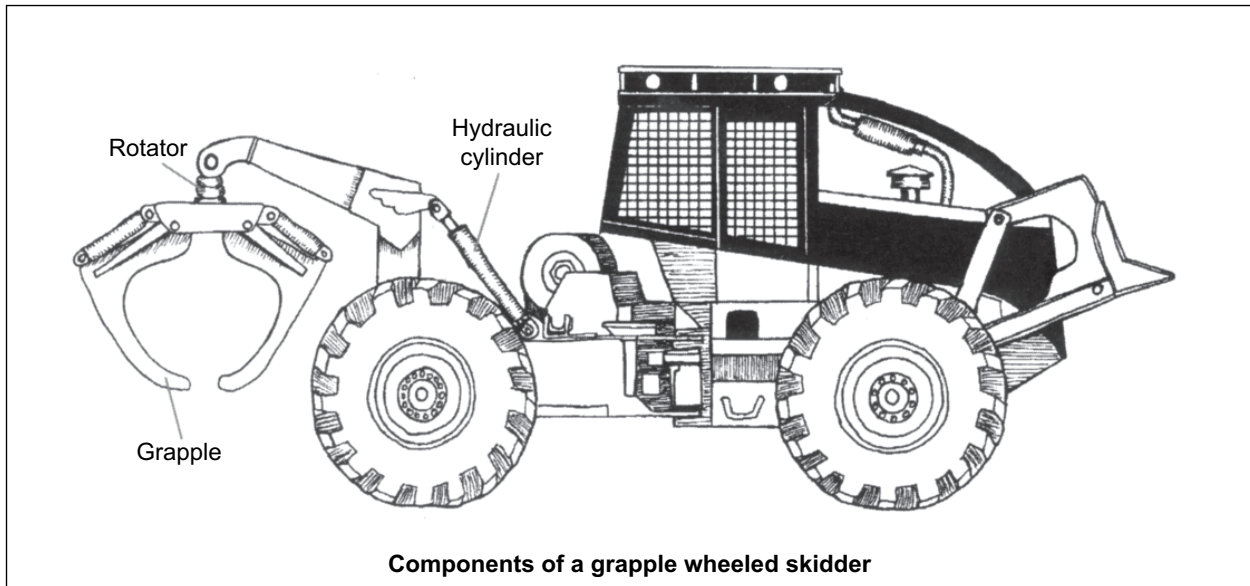


A wheeled skidder with 109 cm tyres for operation on wet sites



Components of a cable wheeled skidder

- Grapple skidders use a large hanging grapple (conventional or swing-boom) to grab the felled trees.



- There is a range of wheeled skidder sizes. They are classified by the output of the engine.

Skidder size	Engine power output (kW)	Examples	Optimum load size (tonnes, level terrain)
Small	76-105	John Deere 540G Ranger F65 Timberjack 360	3-5
Medium	106-135	Caterpillar 525C Timberjack 460 Ranger H67 John Deere 640G	5-7
Large	136+	Caterpillar 545 John Deere 748G Timberjack 560	7-8

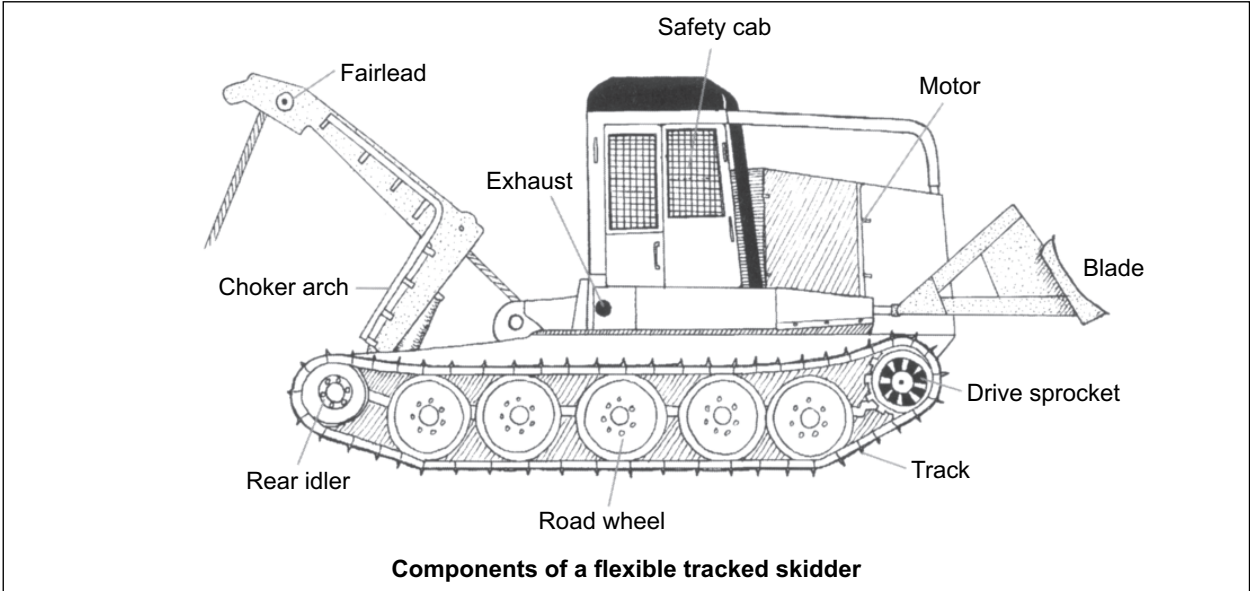
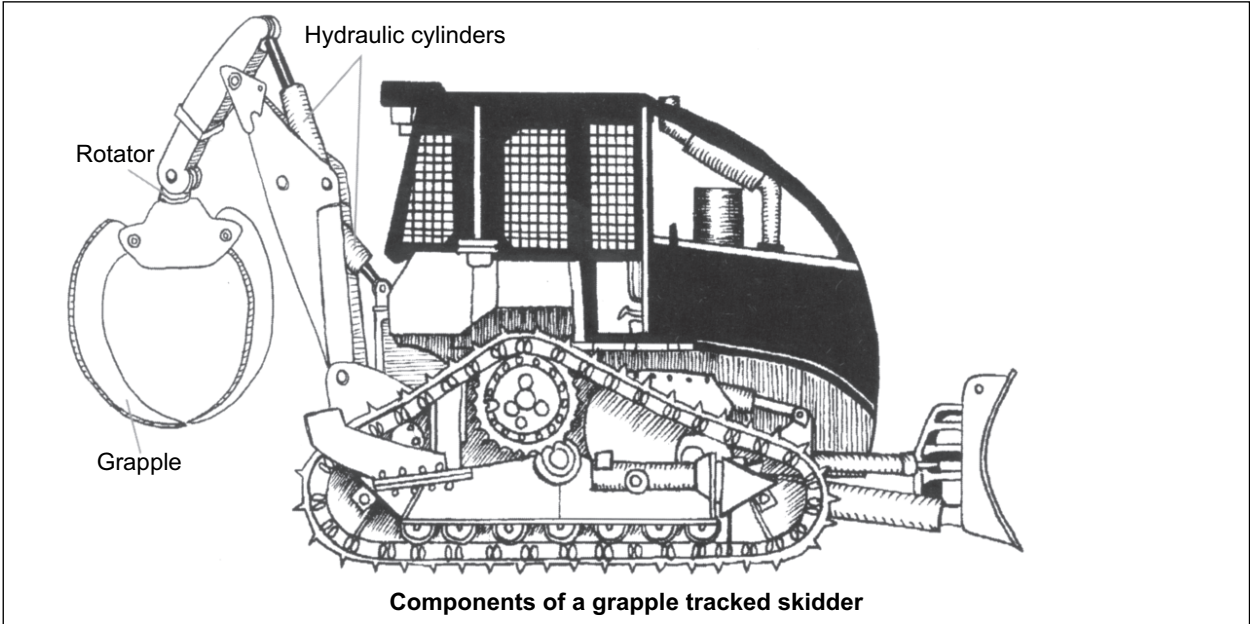
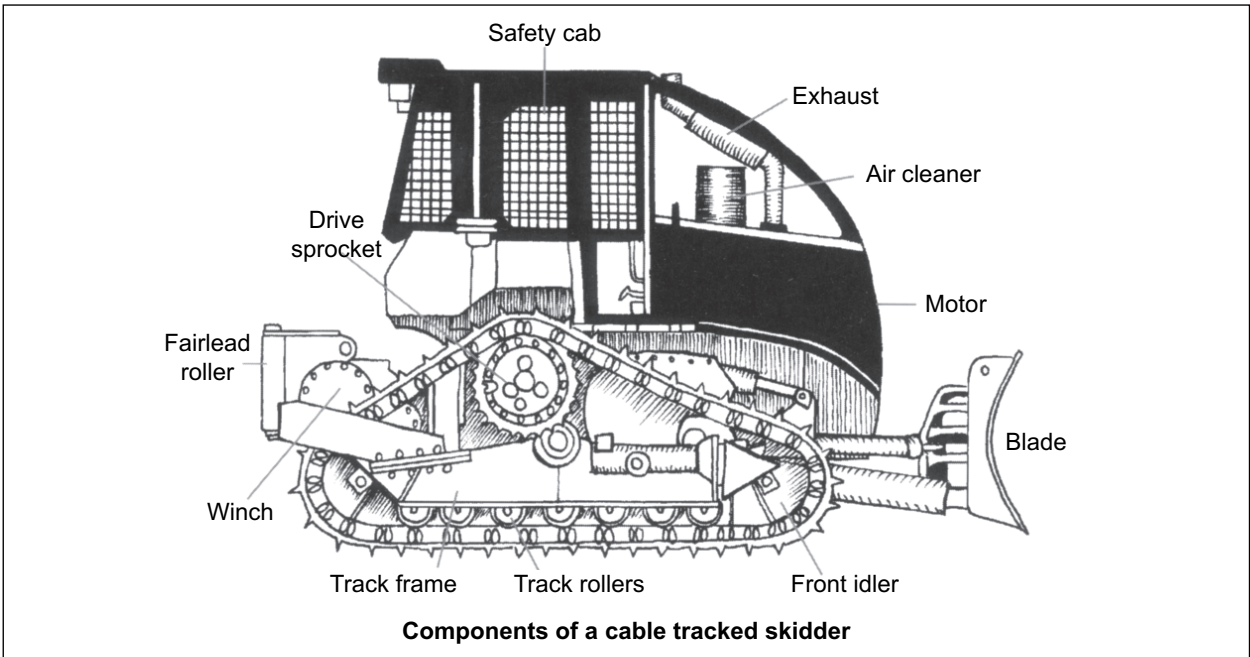
Safety features

- Wheeled skidders shall have a certified Falling Object Protection Structure (FOPS), an Operator Protection Structure (OPS), and a Roll Over Protection Structure (ROPS).
- A seat belt shall be fitted and worn when the machine is being operated.

Tracked skidders

Description

- There are two types of tracked skidder:
 - Conventional tracked skidders (earthmoving or modified bulldozers) that have a rigid track frame.
 - Flexible track skidders with suspension to allow the track to conform to the shape of the ground. These are specialist machines, designed to operate on wet and/or weak soils.
- Conventional tracked skidders are used widely in production thinning and clearfell operations. In clearfell operations, load sizes can average 6 to 9 tonnes.
- They can have a lengthened track frame or wider tracks to reduce ground pressure and increase stability.



Tracked skidders cont...

- The Approved Code of Practice for Safety and Health in Forest Operations states that tracked skidders should not operate on slopes that exceed 22° (40%) unless otherwise specified by the manufacturer. Where weather or ground conditions adversely affect machine stability, the maximum slope will be actually less than this.
- Tracked skidders are equipped with winches, ropes and strops, or a grapple (similar to wheeled skidders).
- Tracked skidders manoeuvre by altering the speed or direction of the two tracks. This allows them to turn within their own length.
- A conventional tractor may tow a two-wheeled arch to provide lift for the front of the load and reduce load friction. This enables larger loads to be carried.
- Tracked skidders can be classified into four classes according to engine power output.

Tractor size	Engine power output (kW)	Examples	Estimates of optimum load size (tonnes, level terrain, no arch)
Small	50-74	John Deere 450G Komatsu D37E-5 Caterpillar D3C	3-4
Small-medium	75-100	Caterpillar D5M Komatsu D53A-7	4-6
Medium	101-130	John Deere 750C Caterpillar D6M Caterpillar 527	6-8
Large	131+	Caterpillar D7R Komatsu D65EX-12 Komatsu D85E-21 KMC 2400 CA	7-9

Safety features

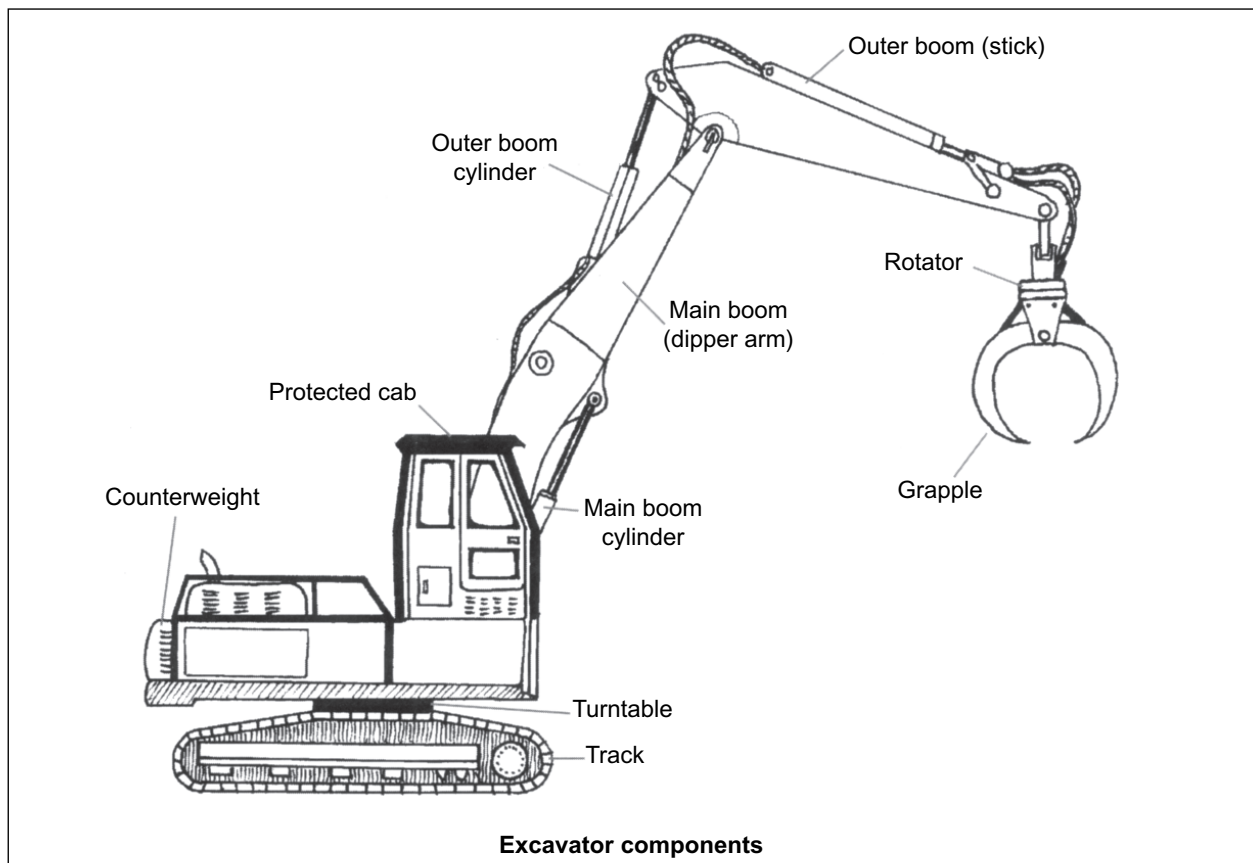
- Tracked skidders shall have a certified FOPS, OPS, ROPS.
- A seat belt shall be fitted and worn when the machine is being operated.

Excavator-based machines

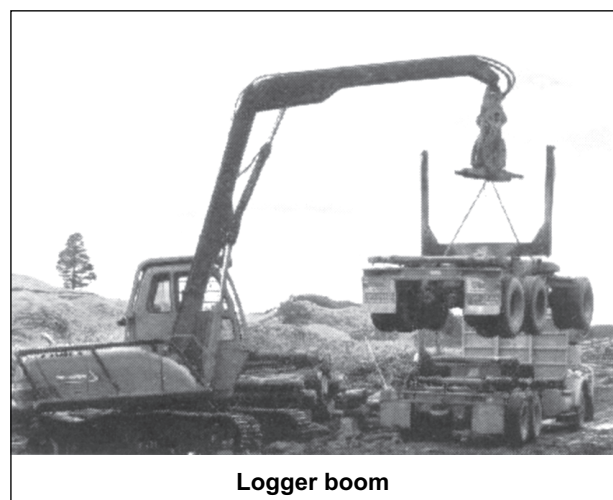
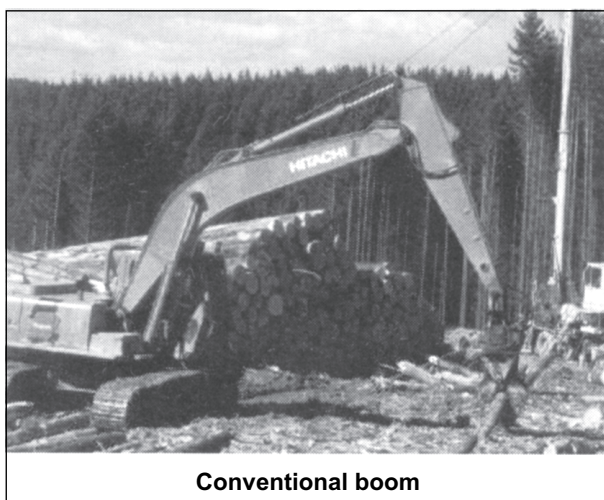
Description

- An excavator comprises a tracked undercarriage and a continuous rotating upper body with a hydraulically operated boom.
- Excavators can be fitted with a range of boom attachments according to the activity being undertaken.

Activity	Attachment
Earthworks	Bucket, ripping tine
Land preparation	Rake, bucket, ripper-moulder, mulcher, cultivator, winch set
Mechanical felling	Felling/processing head
Bunching or extraction	Grapple
Processing	Grapple, felling/processing head
Sorting, fleeting, and loading	Grapple



- Two boom configurations are available.
 On the conventional boom, the stick is operated by a hydraulic ram fixed to the top side of the dipper arm. This configuration is designed for pulling a bucket (or similar) towards the excavator during digging.
 The logging boom is designed for lifting heavy weights. The hydraulic ram operating the stick is fixed to the bottom side of the dipper arm.
- Excavators may have a lengthened track frame or wider tracks to reduce ground pressure and increase stability.
- The Approved Code of Practice for Safety and Health in Forest Operations states that as a guide, excavators should not operate on slopes that exceed 22° (40%) unless otherwise specified by the manufacturer. Where weather or ground conditions adversely affect machine stability, the maximum slope will be actually less than this.



- Excavator-based machines can be divided into four classes (often the base weight of the machine will be increased considerably with the addition of guarding, strengthening, and an attachment such as a harvesting head): See table.

Excavator size	Gross weight (tonnes)	Examples
Small	<20	Hitachi EX120 Komatsu PC150
Small-medium	20-25	Caterpillar 320 or 322 Hyundai 210 Komatsu PC220
Medium	25-30	Daewoo 290 Hitachi EX270 Caterpillar 325 Komatsu PC300
Large	>30	Caterpillar 330 Komatsu PC400 Hyundai 290 Kato HD1880

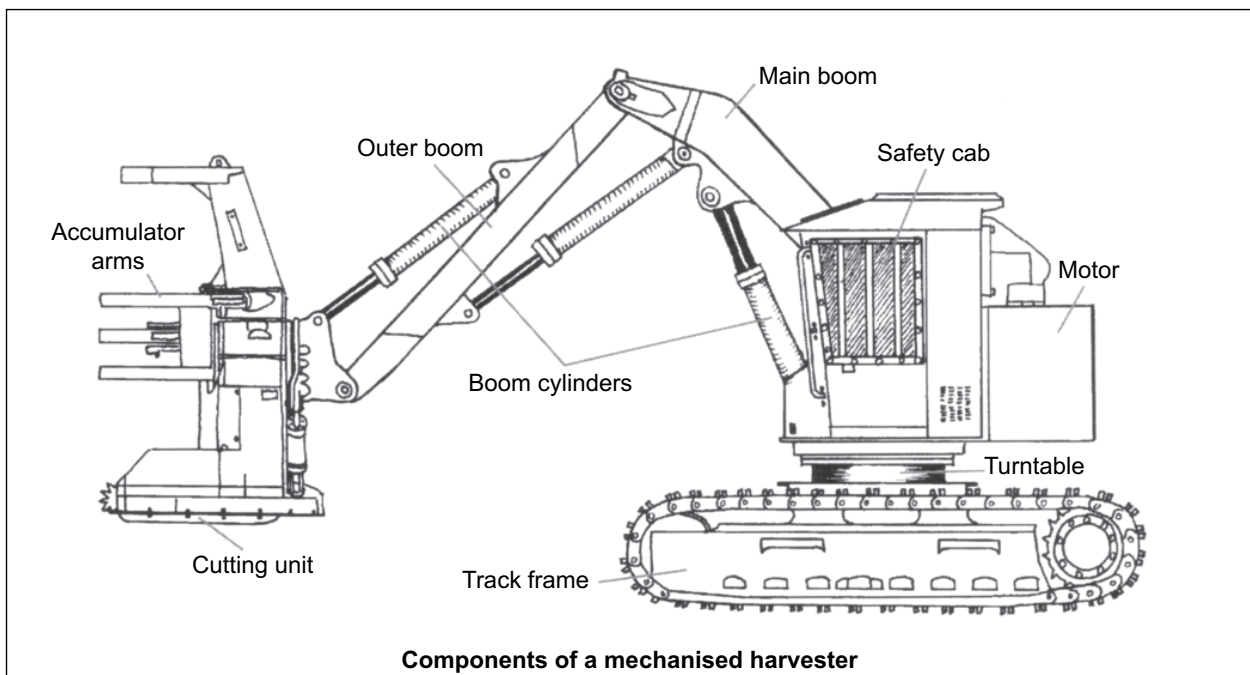
Safety features

- Excavators used in forestry operations shall be fitted with FOPS and OPS.
- If operating on terrain where stability cannot be assured, the excavator shall be fitted with a certified Cabin Operator Protection Structure (COPS) to a minimum of Grade 3.
- A seat belt shall be fitted and worn when the machine is being operated.
- Disabling levers or switches (to be used when leaving the cab).

Mechanised harvesters

Description

- Mechanised harvesters are either excavators, or custom-built (usually tracked) machines fitted with a harvester head.
- The Approved Code of Practice for Safety and Health in Forest Operations states that as a guide, mechanised harvesters should not operate on slopes that exceed 22° (40%) unless otherwise specified by the manufacturer. Where weather or ground conditions adversely affect machine stability, the maximum slope will be actually less than this.



- The body of the harvester may be non-levelling (similar to an excavator) or levelling up to 27° forward and 20° sideways. The levelling body allows the cab and boom to be horizontal when operating on a slope.
- The non-levelling body is capable of continuous rotation. The levelling body is generally restricted to 540° of rotation.
- The harvester head may be able to perform a range of tasks. These include:
 - Fell Delimb
 - Process stems into logs Bunch or shovel stems or logs
- The head is a hydraulically powered attachment which may be equipped with drive rollers, delimiting grapple-type knives, and integral chainsaw, rotary saw or shears. There may be provision for a computerised measuring and log cutting (bucking) system.
- Harvester heads come in different sizes: from thinning heads (mounted on 20 to 25 tonne base machines) to 4 tonne clearfell heads (mounted on 30 to 40 tonne base machines).

Head size	Fell diameter/delimb diameter limits (cm)	Examples	Likely application
Small	55/41 60/45	Waratah HTH 20 Lako 60	Production thinning
Medium	64/14-46 69/3-50	Waratah HTH 22 Super Logmax GM650	Production thinning/ Small clearfell
Large	76/20-66 75/10-75	Waratah HTH26 AFM Magnum	Clearfell

Safety features

- All mechanised harvesters shall be equipped with certified FOPS, COPS and OPS.
- A seat belt shall be fitted and worn when the machine is being operated.
- Immobilising levers and switches will be fitted and used to avoid accidental start-up of the machine during maintenance or repair.

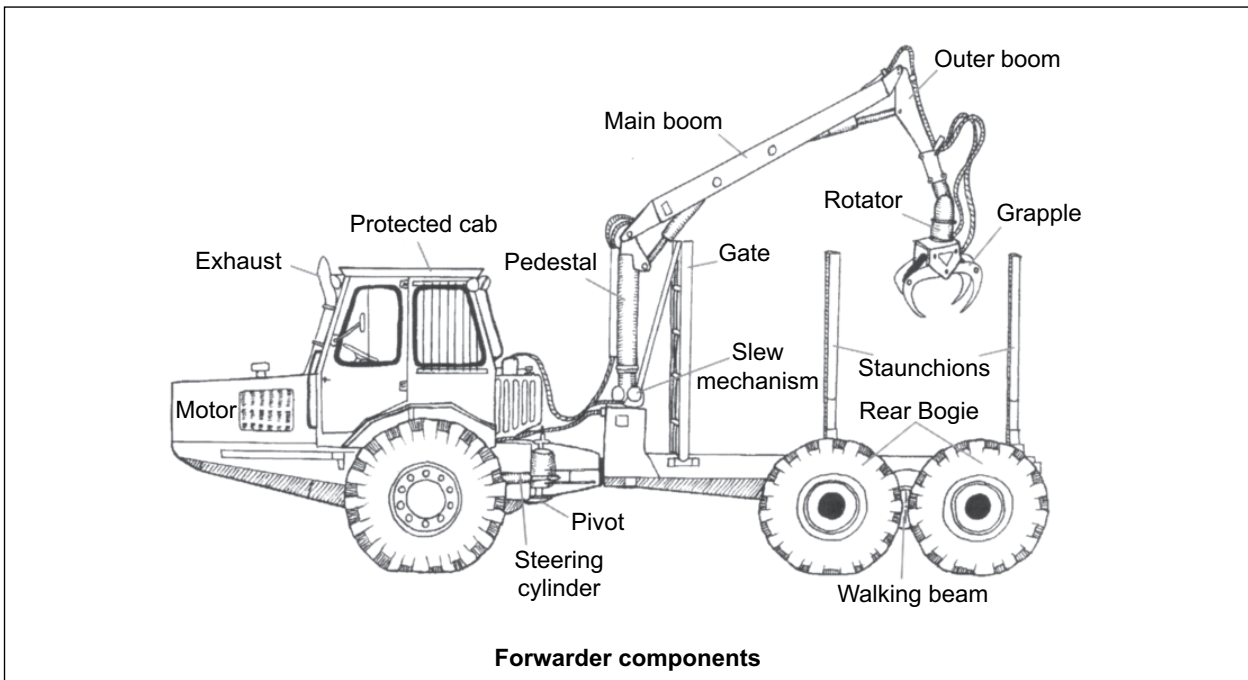
Forwarders

Description

- Forwarders are articulated four, six or eight wheel drive machines with a knuckle-boom crane designed primarily for the transport or extraction of logs 3 to 6 m in length.
- They range from the more basic converted skidder designs to sophisticated purpose-built machines.
- Forwarders can be fitted with wider tyres or band tracks to reduce ground pressures and increase stability.
- The Approved Code of Practice for Safety and Health in Forest Operations states that as a guide forwarders should not operate on slopes that exceed 18° (30%) unless otherwise specified by the manufacturer. Where weather or ground conditions adversely affect machine stability, the maximum slope will be actually less than this.
- Forwarder load size typically ranges from 14 to 18 tonnes.



A forwarder with band tracks fitted to the rear bogies



Forwarder size	Optimum load size (tonnes)	Examples
Medium	14	Timberjack 1410 Valmet 860
Large	18	Timberjack 1710 Valmet 890

Safety features

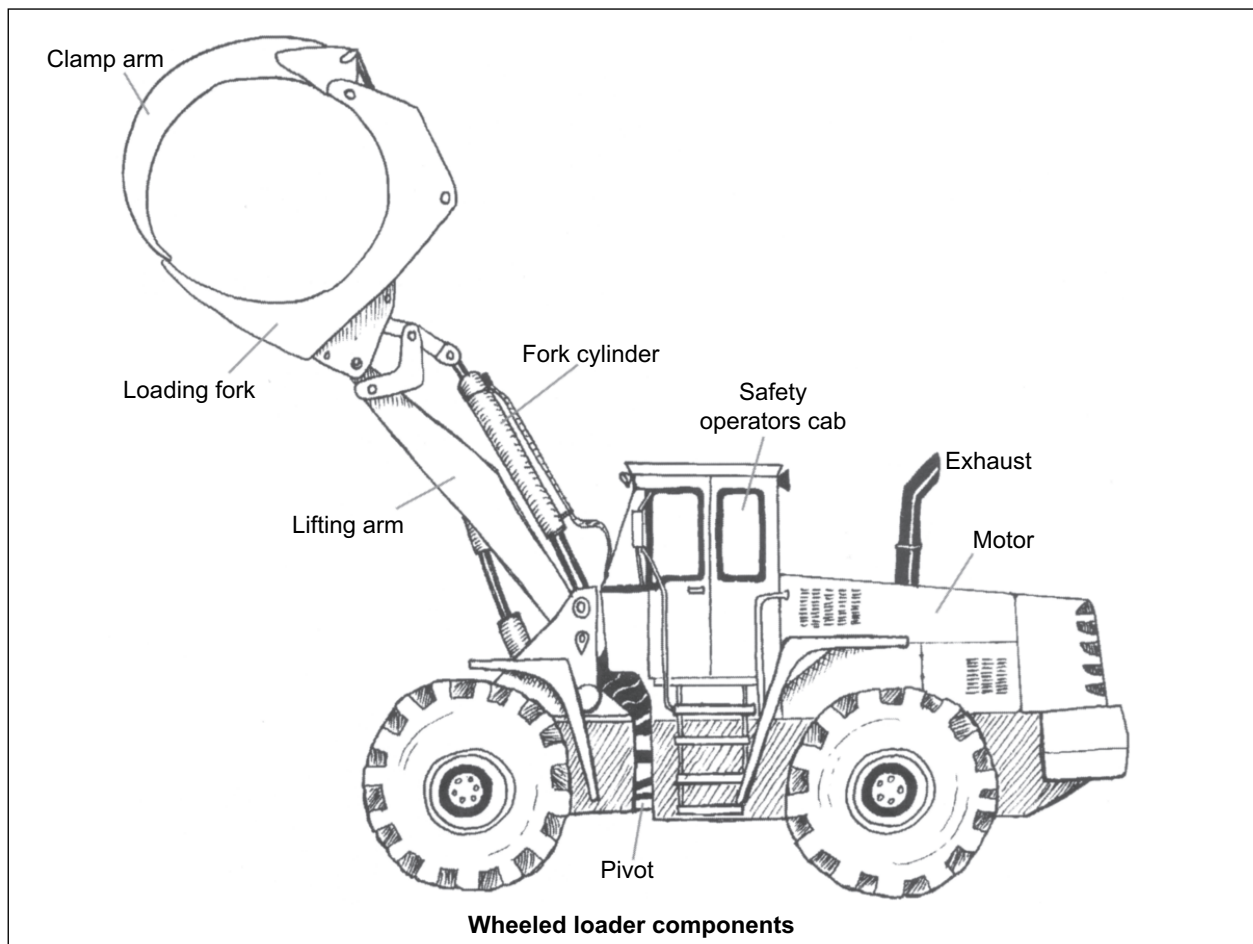
- Forwarders shall have a certified FOPS, OPS, and ROPS.
- A seat belt shall be fitted and worn when the machine is being operated.

Wheeled loaders

Description

- Wheeled loaders used in forestry are articulated four-wheel drive machines fitted with loading forks (or a bucket for earthworks).
- They are designed to handle stems and logs during sorting, fleeting, loading and unloading operations.
- Wheeled loaders are designed to operate on formed roads, landings, log yards and wharves. In these situations, operating slopes are minimal.
- Wheeled loaders are classified according to engine power output.

Loader size	Gross engine power output (kW)	Examples	Application
Light	66-100	Cat 914, Volvo L70 Cat 928, Komatsu WA180	Thinning and small clearfell operations
Medium	101-120	Cat 938, Komatsu WA320 Volvo L90	Small to medium clearfell operations
Heavy	121-200	Cat 950, Volvo L120 Komatsu WA380	Larger clearfell, some log yard use



Safety features

- Wheeled loaders normally operate on level ground. Although legally exempt, forest owner policy may require a certified ROPS be fitted. A seatbelt shall be fitted and worn while the machine is operated.
- Wheeled loaders shall be equipped with a certified FOPS and OPS.
- Notwithstanding the legal requirement for a seat belt with ROPS, it is best practice to ensure that a seat belt is fitted and worn.

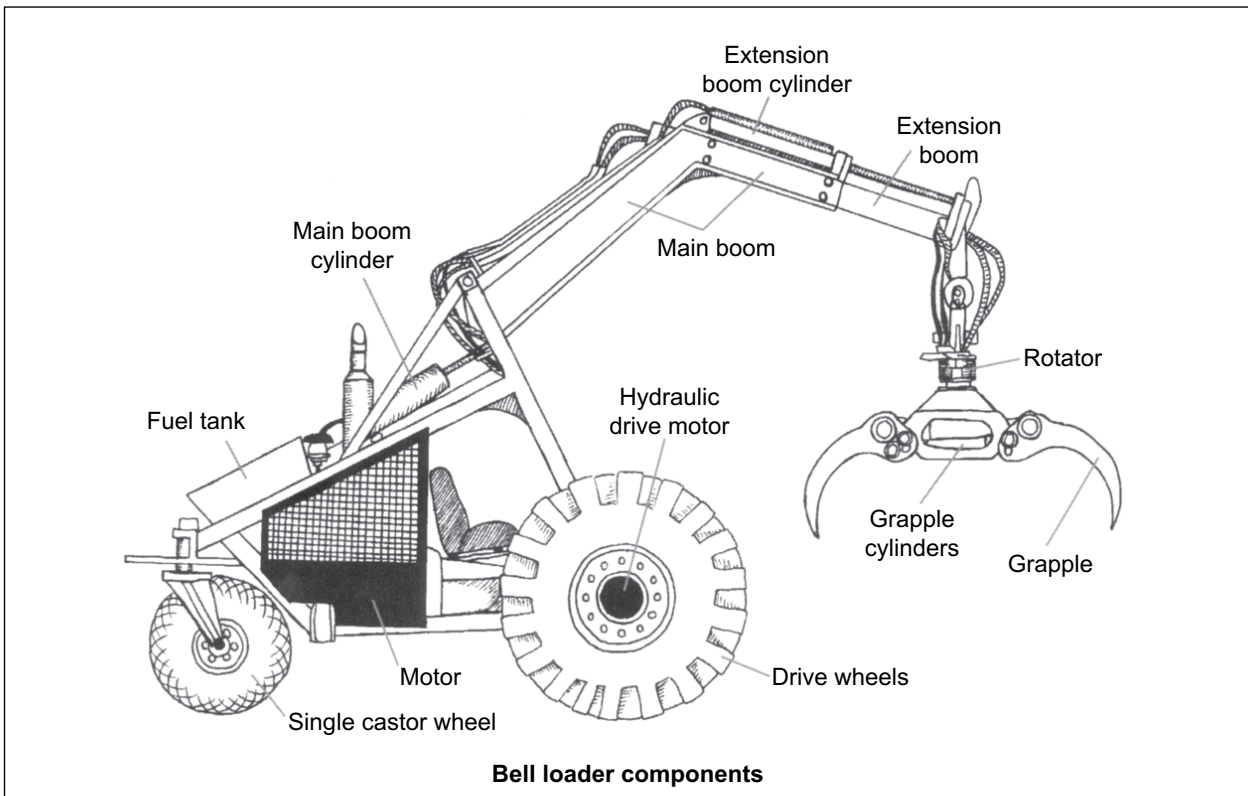
Bell loaders

Description

- Bell loaders are small (<6 tonne) 3-wheeled machines equipped with an extending boom and rotating grapple.
- They are steered by two differentially-driven wheels at the front and a non-steered castor or jockey wheel at the rear of the machine.
- They are highly manoeuvrable (much work is carried out in reverse gear) and are suited to sorting and bunching of small logs. They can also be used to load trucks if required. They are less suited to fletting of logs because of slow travel speeds and small load sizes.
- Bell loaders can be used to pull full-stems through a static delimber. In some small clearfell cable operations, chute clearance is combined with delimiting using a static delimber.



A Bell loader pulling a stem through a static delimber



Safety features

- Bell loaders shall be fitted with a certified OPS. Where doors are supplied as an integral part of the OPS, they must be fitted and closed while the machine is being operated.
- If used where there is a risk of falling objects, a certified FOPS shall be fitted.
- Bell loaders normally operate on level ground. Although legally exempt, forest owner policy may require a certified ROPS be fitted. A seat belt shall be fitted and worn when the machine is being operated.
- Notwithstanding the legal requirement for a seatbelt with ROPS, it is best practice to ensure that a seat belt is fitted and worn.



Four-wheel ATV

All terrain vehicles (ATV)

Description

- All terrain vehicles or ATVs are 4 wheel drive vehicles derived from motorcycle technology.
- They are commonly used for on-farm transport in the agricultural sector.
- In logging operations, ATVs are useful for moving individual workers and equipment around a network of landings or other adjacent locations to perform quality control or supervision.
- In silvicultural operations, they can be fitted with trailers and used for moving seedlings or equipment in planting or spot-spraying operations.
- ATVs are classed as a vehicle in terms of the Transport (Vehicle and Driver Registration and Licensing) Act 1986. This means that the vehicle must be registered, and display a current Warrant of Fitness.

- Operators of ATVs must either be competent (hold NZQA Units 19056, 19058, 19059, 19060 as required), or be under the instruction of a competent person.
- Operators should wear the appropriate personal protective equipment (helmet, gloves, work boots, long-sleeved shirt or jacket, trousers, and goggles or face shield).
- Passengers shall only be carried if specified by the ATV manufacturer.

Safety features

The Approved Code of Practice for Safety and Health in Forest Operations states that because ATVs weigh less than 700kg they are not required to be fitted with ROPS.

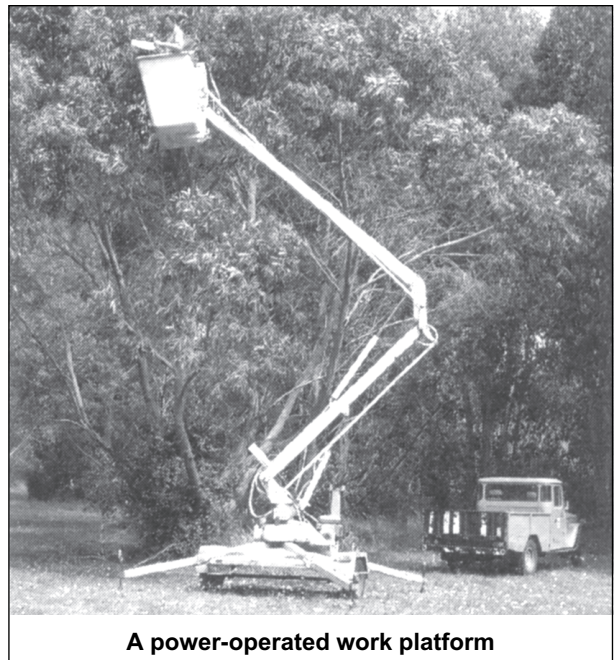
Power-operated work platforms

Description

- Power-operated work platforms are trailer mounted, and petrol-powered.
- They use an articulated hydraulic boom to raise a work platform to heights of up to 8 m.
- In forestry, these machines are used for accessing trees in seed orchards or collecting tissue for cloning propagation or tree-breeding purposes.
- The work platform shall be operated in accordance with the manufacturer's instructions and the **Code of Practice for Power-operated Elevating Work Platforms**.

Safety features

- A full body harness should be worn by an operator working from the basket.
- Control valve configuration (boom/leg) operation.
- Basket/boom lowering on engine failure.



A power-operated work platform

Safety requirements

Protective structures

There are four main protective structures relevant to mobile plant used in forestry:

- | | |
|---|---|
| • Rollover Protection (ROPS) | • Falling object protection (FOPS) |
| • Operator protection on steep or unstable terrain (COPS) | • Operator protection from objects entering the cab (OPS) |

Details of these structures are provided in the **Approved Code of Practice for Operator Protective Structures on Self-propelled Mobile Mechanical Plant**. The manufacturer or their agent must approve alterations to protective structures outside the manufacturer's specifications.

Rollover protection (ROPS)

Mobile plant (except excavators and tracked, rotating mechanised harvesters) that is not operated on level ground must be fitted with a roll over protective structure complying with *ISO 8082:1994 Self-propelled machinery for forestry, Roll over protective structures, Laboratory tests and performance requirements* or another standard with the same or more stringent criteria.

Included in the rule is all mobile plant used in forestry work such as;

- Wheeled skidders
- Tracked skidders
- Graders
- Loaders

Excluded from this rule is mobile plant that is designed to be and is operated on level ground, and;

- Machinery weighing less than 700kg
- Log haulers
- Buses
- Trucks
- Vans
- Cars
- Telescopic mast forklifts
- Power-operated work platforms

Operator protection on steep or unstable terrain (excavators) (COPS)

Hydraulic excavators and tracked, rotating mechanised harvesters operating on terrain where stability cannot be assured must be fitted with a Cabin Operator Protective Structure (COPS).

Falling object protection (FOPS)

Mobile plant working in standing trees (or where there is danger from falling material) must be fitted with a Falling Object Protective Structure (FOPS) complying with either *ISO 8083:1989 Machinery for forestry, Falling Object Protective Structures, Laboratory tests and performance requirements* or any other standard embodying the same or more stringent criteria.

Operator protection from objects entering the cab (OPS)

Mobile plant required to work where there is a danger of objects entering the cab must be fitted with a Operator Protective Structure (OPS) complying with either *ISO 8083:1989 Machinery for forestry, Operator Protective Structures, Laboratory tests and performance requirements* or any other standard embodying the same or more stringent criteria.

Where the machine is provided with a door (or doors) that are part of the OPS, they must be fitted and closed at all times when the machine is being operated.

Operator and plant certification

Mobile plant must have a valid warrant or certificate of fitness, and operators must hold a licence where applicable.

Other safety features

Different classes of mobile plant, or makes of machine, may have safety features that ensure the operator does not come to harm in the course of his/her duties.

The manufacturer's operator safety manual, or relevant parts of the operation and maintenance manual should be read and understood by anyone intending to use the machine.

Safety features present, which will require a daily check (or before starting a shift), may include:

- Seat belt
- Side, front and rear screens or doors
- Warning lights or devices
- Guards
- Lights
- Safety signs
- Horn
- Reversing or travel alarm
- Mirrors
- Windshield wipers and washers
- Fire extinguisher
- Fire suppression system
- First aid kit.

Seat belts

Mobile plant with ROPS or COPS must have a seat belt or safety restraint complying with AS 2664:1983 *Earthmoving machinery - seat belts and seat belt anchorages* or similar standard fitted and worn while the machine is being operated.

Night work

Machines required to work at night must be fitted with lights to light up the work area.

High structures

Machines with a long boom, tall structure, or tower that may come into contact with overhead power lines must have a warning sign displayed.

Brakes

Machines must be equipped with brakes capable of holding the machine and its load on any slope that it is working on.

Other parts of machine

Pulleys, shafts, belts and fan belts must be securely guarded.

Noise

If operating noise levels might cause hearing damage, a warning sign must be displayed. Operators must wear suitable hearing protection.

Ergonomic issues

To work efficiently and safely the machine should be matched to the individual characteristics of the operator(s). There is a range of machine features that impact on the operator's ability to perform a task. This includes:

- Working position
- Cab size and design
- Operators seat
- Information (machine/process feedback)
- Noise
- Climate control
- Lighting
- Cab access
- Visibility
- Controls
- Operating procedures
- Vibration
- Gases and particulate material

Many of these issues are design-related and cannot be managed without modifying the machine or cab environment. However, two issues that can be managed by the machine operator are work position and comfort. This can be achieved by:

- Adjusting the operator seat and hand control positions (forward, back, height, tilt, lumbar support, and arm rest position).
- Getting off the machine regularly to stretch your muscles.
- Regularly relaxing your body to avoid tension.

A suitable work posture is one where the foot and hand controls can be operated without muscle tension while sitting with your back against the seat.

If the set-up of the seat and controls is not matched to your body size, you find yourself reaching forward or carrying unnecessary muscle tension to operate the controls. If not attended to early, this can lead to Occupational Overuse Syndrome (OOS) that may impact on your ability to continue work.

Training and supervision

The operation of mobile plant involves a wide range of tasks and situations. Operators need to be skilled or under training in the particular tasks they are doing.

In addition, the Approved Code of Practice for Safety and Health in Forest Operations requires that a competent person supervise new workers to the operation or task. Regardless of their training status, new workers should not be allowed to work unsupervised until they have demonstrated that they are unlikely to harm themselves or anyone else.

All operators must be under a documented training program and should be aiming to pass the relevant NZQA Units.

Knowledge of hazards

As part of the supervision and training programme, operators need to be **shown** the hazards they will face on the job and the controls to avoid being harmed by those hazards.

Before starting any new block all operators must be involved in identifying any significant hazards **on the site** and the way those hazards will be controlled. There must be documented evidence on site listing the hazards and controls and showing that all operators have had them explained.

The two main hazard categories are **Health hazards** and **Operational hazards**.

Health hazards

Operation of mobile plant can be a physically and mentally demanding job. To maintain performance levels and prevent accidents through fatigue, operators must take special care of themselves.

Ensure that you:

- Take adequate rest breaks
- Maintain an adequate level of hydration and diet
- Get adequate sleep.
- Keep physically fit
- Do not let drugs or alcohol impair your judgement

Health hazards

Hazard	Control
Fatigue (mental and physical)	<ul style="list-style-type: none">• Build short frequent rest breaks into your work routine.• Take at least two evenly spaced 30-minute rest breaks during the working day.
Lack of sleep, tiredness	<ul style="list-style-type: none">• Ensure that you have at least 5 hours continuous sleep every night.• Use power-naps (short sleeps of 20-30 minutes duration).
Early starts	<ul style="list-style-type: none">• Learn to go to bed earlier to replace the sleep you lose in the morning.• Your body needs time to adjust to changes in sleep patterns. When first beginning early starts in spring/summer or after the Christmas holidays, recognise that you may remain tired until your body adjusts.• Also, allow time for your body to adjust once you go back to late starts.
Alcohol abuse	<ul style="list-style-type: none">• Avoid drinking alcohol for at least 24 hours before carrying out any hard physical work.
Poor nutrition (most accidents occur between 9 and 11am when you are tired and running low on energy so stop and have a smoko break)	<ul style="list-style-type: none">• Start each day with a high carbohydrate breakfast like porridge, cereal, toast, bananas, pasta, or potatoes.• Eat high protein foods like lean meat, chicken, eggs, milk, and cheese at night.• Eat at the start of a break and rest to allow digestion.• Always eat a high-carbohydrate snack straight after work.
Exposure to sun	<ul style="list-style-type: none">• Wear sun block (SP30+).• Wear a light shirt rather than a singlet on hot days.• Install a neck flap on your helmet.• Wear tinted UV protective eyewear.• Carry out regular health checks of moles, freckles etc.
Drugs	<ul style="list-style-type: none">• Avoid all non-prescription drugs as they seriously affect both your mental and physical ability to work.• Inform the boss if you are on any medication that may affect your work. Stay home if necessary.• Before receiving any medication, tell your doctor what you do for a living.• If you are on long-term medication inform your boss about your condition in case you are involved in an emergency at work.
Occupational Overuse Syndrome (OOS)	<ul style="list-style-type: none">• Use the correct techniques when operating a machine or other equipment.

Health hazards (cont...)

Hazard	Control
Occupational Overuse Syndrome (OOS) (cont...)	<ul style="list-style-type: none">• Be aware of muscle tension as you work. If you experience discomfort, take a break and let your muscles relax.• Have regular medical examinations if you suspect a problem.• Use stretching techniques both on and off the machine throughout the day.• Perform other tasks, off the machine, that will exercise different muscle groups.• Use micro-pauses (short breaks every 5 minutes or so). Take your hands off the controls and let your arms and hands totally relax for 5-10 seconds.
Hypothermia/chills	<ul style="list-style-type: none">• Polypropylene clothing (thermal underwear) is excellent for cold, wet weather.• If necessary also wear a warm hat or balaclava.• Put a hat and warm clothes on when you stop for a break.• Have wet weather clothing handy for working on maintenance or repair outside the cab.
Lack of hygiene/infection	<ul style="list-style-type: none">• Clean and dress any cuts or scratches received on the job as soon as possible and keep them covered.• Make sure the first aid kit is kept fully stocked.• Carry water and soap on the job to wash hands before smokes.• Bath or shower every night.• Eat a balanced diet to keep your body healthy.• Wear clean clothes against the skin every day.
Dehydration/heat exhaustion	<ul style="list-style-type: none">• Regularly drink fluids at a rate of 0.5 litres per hour and up to 1 litre per hour in hot conditions.• Drink before you feel thirsty.• Do not drink fluids like soft drinks and cordials that have more than 8% carbohydrate content.• Drink high carbohydrate drinks after work to replace energy levels.• Drink plenty of water at night to recharge the body.• Drink a couple of glasses of water before leaving for work.

Operational hazards

Operational hazards have been divided into operating and maintenance hazards.

Before operating a machine or carrying out maintenance, you should read the relevant manufacturer or operator's manuals. Methods or practices described in the manuals should be used, in the first instance, in any activity involving the machine to which they apply.

Operational hazards

Operating hazard	Control
Vibration from machine	<ul style="list-style-type: none"> • Avoid sudden impacts while operating the machine. • Reduce the time your back is exposed to vibration by getting off the machine at least once every hour. • Work smarter - move larger loads at slower speeds. • Make sure your seat is adjusted properly. • Do exercises while seated to even out pressure on spinal discs. • Control your breathing and relax muscles. • Keep a good posture. • Keep fit - strengthen abdominal muscles.
Noise - Typical noise levels: Car 70dB, Skidder 85-95dB, Chainsaw 100-105dB, Gunshot 180dB	<ul style="list-style-type: none"> • Use hearing protection inside the cab if noise level is above 85dB. • Reduce noise exposure by keeping doors and windows shut while working.
Solvents	<ul style="list-style-type: none"> • Read the safety information regarding the solvents used. • Avoid dangerous substances on your skin. • Wash your hands before eating food. • Avoid breathing in solvent fumes by ensuring there is plenty of ventilation in the work area.
Diesel fuel or hydraulic fluid under pressure (skin penetration, eye injury)	<ul style="list-style-type: none"> • Install cylinder rod support struts, or block the cylinders and equipment before working on the hydraulic system. • Cycle all hydraulic steering and other controls after shutdown to relieve system pressure. Follow the manufacturer's instructions. • When venting or filling the hydraulic system, loosen the filler cap slowly and remove it gradually. • Use a piece of cardboard or wood when looking for leaks. • Wear a face shield or goggles for eye protection.
Footing	<ul style="list-style-type: none"> • Move slowly while moving over the machine. • Use hand rails and steps if present. • Avoid jumping from the machine. • Boots must provide good ankle support and good grip. • Do not wear spiked boots while operating mobile plant.
Climbing into or out of cab	<ul style="list-style-type: none"> • Maintain 3 points of contact while climbing. • Face the machine when climbing or dismounting. • Be aware of the state of the ladder (e.g., ice, mud, water, oil, etc) and clean if necessary. • Do not jump from a machine. • Do not use either the steering wheel or any control lever when entering or leaving the cab. • Do not climb off a moving machine.

Operational hazards (cont...)

Operating hazard	Control
Climbing into or out of cab (cont...)	<ul style="list-style-type: none"> The cab should be aligned with the undercarriage centreline when entering or leaving the cab.
Fire and explosion	<ul style="list-style-type: none"> Never fill the fuel tank with the engine running, while smoking, or near a naked flame. Ground the fuel funnel or nozzle against the filler neck to prevent sparking. Do not cut or weld fuel lines, tanks or containers. Remove rubbish and debris from the cab of the machine. Make sure that oily rags and other flammable material is removed from the machine. Check for and repair fuel, oil and hydraulic leaks before operating the machine. Use non-flammable solvents for cleaning parts. Store all flammable fluids and materials away from the work area. Check the readiness of fire extinguishers or suppression systems.
Other vehicles on roads during relocation (if mobile plant is to be driven or transported on the road)	<ul style="list-style-type: none"> Make sure all flags, lights and warning signs are in place and visible. Use hazard warning lights. Use an escort vehicle if required. Secure all accessory equipment or attachments.
Machine instability	<ul style="list-style-type: none"> Do not work on slopes beyond the capability of the machine. Move up and down slopes, not across them. Ensure that the angle of break-out is directly behind the machine. Do not plan for or winch across a side-slope. If stems are caught on a stump or an obstacle, the extra tension on the rope could make the machine unstable. If moving on a track, keep as close to the inside (batter slope) and avoid driving on less stable fill.
Overhead hazards (power lines, trees)	<ul style="list-style-type: none"> Check logging plan for hazards. Stay alert and observant when operating. Keep machinery at least 4 m away from the overhead hazard (refer to the Approved Code of Practice for Tree Work: Part Two Maintenance of trees around Power Lines).
Exhaust fumes	<ul style="list-style-type: none"> If it is necessary to run the engine or operate the machine in an enclosed area, be sure there is enough ventilation.

Operational hazards (cont...)

Maintenance hazard	Control
Working on the machine	<ul style="list-style-type: none">• Remove the key if the machine is not to be started.• Start the engine only from the operator's seat.• Check the workspace has adequate clearances, light and ventilation.• Wear protective clothing, overalls, gloves and eye protection.• Keep clear of rotating components (e.g., fan blades and couplings).• Keep pockets free of objects that could fall into machinery.• Move the machine onto a level surface.• For tracked machines, block the tracks before releasing service brakes.• Stop the engine and release all hydraulic pressure.• Do not work on a running engine unless specified in the operators' manual.• Attach cylinder support struts, or block hydraulically operated attachments.• Place controls in neutral.• If doing maintenance on a running engine, use two people; one to sit in the operator's seat to switch off the machine if needed, the other to carry out the maintenance).• Do not leave guards off or access doors open when the machine is unattended.• If servicing the air conditioning system, avoid freon gas contact.• Do not work beneath raised equipment; use jacks, wood blocks, or jack stands as stable supports.• Understand all control levers and functions. Note safety devices and insure they work correctly.• Do not modify, move or remove harvester safety devices.• Lower all equipment to the ground so the machine is resting on level blocking. Stop the engine and remove the key.• Turn off the power to the relay box and isolate.• Hang a "Do not use" sign on the door.
Electrical shock	<ul style="list-style-type: none">• Disconnect the battery before working on the electrical system.• Remove the ground cable first, connect this cable last.• When checking coolant, stop the engine and let the system cool first before removing the filler cap (if this is necessary).• Keep arcs, sparks and naked flames away from lead-acid batteries.• Do not charge a battery or jump-start the engine if the battery is frozen.
Hydraulic oil	<ul style="list-style-type: none">• Do not work on live or pressurised hydraulic systems without full protective equipment.

Operational hazards (cont...)

Maintenance hazard

Control

Asbestos - some older machines may have components containing asbestos in friction (brake linings) and gasket materials

- Never use compressed air for cleaning.
- Avoid brushing or grinding.
- Use “wet” method for cleaning up.
- Wear an approved respirator.
- Avoid areas where particles may be in the air.
- Shower after contact.
- Store food, drink and personal belongings away from the work area.
- Never eat, drink or smoke where asbestos is in the area.

Tyre hazards

- Follow the supplier’s recommendations.
- Do not exceed correct tyre pressures.
- Inspect tyres and wheels daily.
- Do not operate with low pressures, cuts, bubbles, damaged rims or missing lug bolts or nuts.
- When adjusting the tyre pressure, use a long hose with a self-adjusting chuck. Always stand behind the tread when doing this. Ensure the area to the side of the tyre is clear of other people.

Track hazards

- Wear gloves if handling recently used pins and bushings from a dry joint - they may be hot.
- Never hit track tension springs (they could shatter explosively if under compression).

Chainsaw chain maintenance

- A boom-mounted head should be lowered to the ground in a stable upright position, the carrier engine turned off and the key removed. The controls should be disabled to prevent accidental start-up of head functions. The operator’s manual will describe specific methods for the particular machine.
- Wear all required protective equipment, and ensure that it is in good condition.
- Use the correct stance and work techniques.

Saw chain

- The chain can break or fly off the bar, stay clear at least 70 m when machine is operating.

Personal protective equipment (PPE)

The Approved Code of Practice for Safety and Health in Forest Operations specifies the following minimum PPE for operators of mobile plant.

- Hi-vis helmet (machine operators must wear a helmet when they are outside of their machine).
- Protective eyewear, unless it creates a greater hazard.
- Hi-vis shirt, vest or jacket
- Hearing protection if noise levels exceed or are likely to exceed 85dB.
- Safety footwear providing ankle support (machine operators should not wear spiked footwear).
- A means of communication in the event of an emergency (such as radio, cell phone).

Other useful equipment:

- Gloves (leather or thick cotton)
- Small first aid kit
- Water bottle

For further details on PPE read the **Best Practice Guidelines for Personal Protective Equipment**.

Mobile plant procedures

Before using mobile plant

Mobile plant will be supplied with an operator's manual when delivered new. This manual should accompany the machine if on-sold.

Anyone intending to use a machine in any way, including maintenance, should read and understand the relevant parts of the operator's manual or handbook for that machine.

It is the employer's duty to ensure that the operator is aware of hazards connected with machine operation. Likewise, it is the operator's duty to ensure that he/she performs the assigned task in a safe manner, not causing harm to themselves or others.

Make sure you have all the necessary safety protective equipment you need for the task and that it is in good working condition.

Wheeled skidders

Start-up and shut-down procedures

These procedures offer a general guide to some of the precautions and approaches taken with different types of wheeled skidder.

The reader should be aware that different makes, types or models of machine have their own specific procedures. Those procedures, as detailed in operator's manuals, should be followed in preference to any methods described in these guidelines.

Before start-up

Inspect the machine (walk-around) looking for loose bolts, trash build-up, oil or coolant leaks and broken or worn parts.

Inspect the condition of implements or attachments, especially hydraulic components.

As a guide, check the the following before start-up:

- (1) Fuel and hydraulic system: oil, coolant and fuel levels.
- (2) Broken, missing or damaged parts. Make necessary repairs.
- (3) Clean out rubbish build-up, especially in the engine compartment, the underside of the machine, and around rotating components.
- (4) The engine pre-cleaner screen for dirt build-up. Remove dirt or debris.
- (5) Tyres for cuts, bulges and correct pressure.
- (6) Steering frame lock link (if fitted) - in unlocked position.
- (7) The operator's compartment for tidiness, remove rubbish, and secure loose tools.
- (8) The seat belt mounting hardware. Tighten loose or replace missing components.
- (9) Adjust the seat so that the pedals are allowed full travel when you are correctly positioned.
- (10) Service and parking brakes for proper operation.
- (11) Fire extinguisher - filled and in working order.
- (12) Fasten your seat belt before starting the engine
- (13) Lights are working (if conditions require them).
- (14) No one is working on, underneath or close to the machine.
- (15) No one is in the immediate vicinity of the machine.

Start up

- (1) Start the machine only when you are seated in the operator's seat, with the seat belt fastened, and in full control of all the machine's functions.
- (2) Move hydraulic controls to the **hold** position before starting the engine.
- (3) Press the transmission neutral lock switch to shift the transmission into **neutral**.
- (4) Move the transmission direction control switch to **neutral**.
- (5) Engage the parking brake.
- (6) Turn the engine start switch key to **on**.

After starting the machine

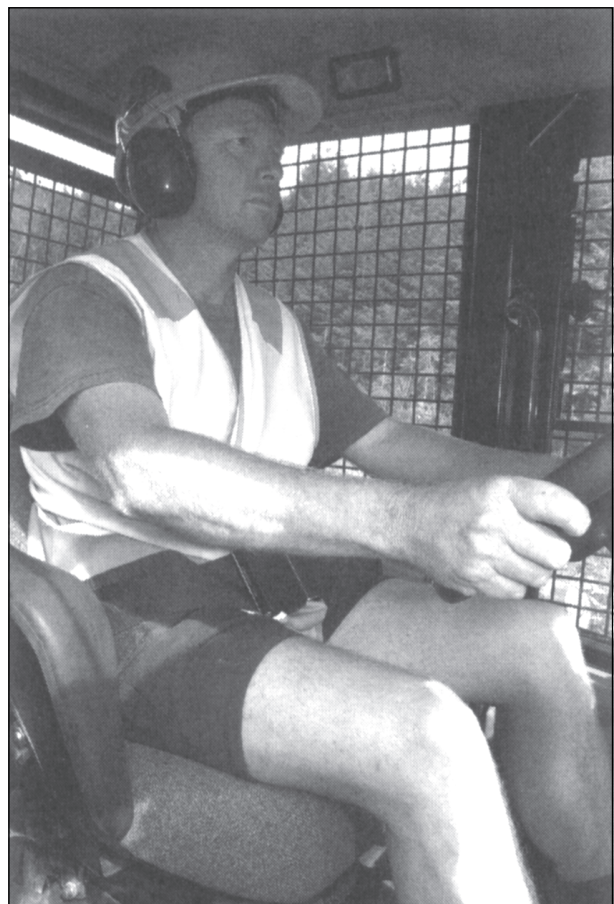
- (1) Keep the engine speed low until the engine oil pressure indicator goes out. If it does not go out within 10 seconds, stop the engine and find the cause before starting again.
- (2) Allow the engine time to warm up at **low idle** for **at least 5 minutes**. Engage and disengage implement or attachment controls to help speed warm up of hydraulic components. In temperatures above 0°C, warm up requires approximately 15 minutes. In temperatures below 0°C, warm up time requires approximately 30 minutes.
- (3) Cycle all controls to allow warm oil to circulate through all cylinders and lines.
- (4) Observe gauges and indicators frequently during operation.

Before operating the machine

- (1) Clear all personnel from the machine and the area
- (2) Clear all obstacles from the path of the machine.
- (3) Ensure windows are clean. Secure doors and windows. If they form an integral part of a protective structure, they should be closed.
- (4) Adjust rear view mirror (if equipped).
- (5) Ensure the horn, reverse alarm (if equipped) and all other warning devices are working properly.
- (6) Fasten your seat belt securely.



Use appropriate hand rails and steps



Fasten your seat belt



Lower attachments to the ground

Machine operation

- Operate the wheeled skidder only while seated with your seat belt fastened.
- Operate the controls only with the engine running.
- Check for proper operation of all controls and protective devices while moving slowly in an open area.
- No one should get on or off a moving machine.
- No one should ride on a machine unless it is provided with proper seating.
- No one should ride on a load carried or towed by a machine.

- No loose objects should be carried in the cab of a machine.
- Report any needed repairs noted during operation.
- Work up and down slopes rather than across them whenever possible.
- If a machine begins to side-slip on a slope, the load should be dropped (if possible) and the machine turned downhill.
- Keep the machine under control and work within its capacity.
- Know the maximum height and reach of the machine.

Shut down

- (1) Park the machine on level ground.
- (2) Apply the service brake to stop the machine.
- (3) Press the transmission neutral lock switch.
- (4) Move the transmission direction control switch to **neutral**.
- (5) Engage the parking brake.
- (6) Lower all attachments to the ground.
- (7) With the machine stopped, run the engine for 5 minutes at **low idle**. Stopping the engine immediately after it has been working under load can result in overheating and accelerated wear of engine components.
- (8) Turn the engine start switch key to **off** and remove.
- (9) If an electrical disconnect switch is fitted, turn and remove the key.

Tracked skidders

Start-up and shut-down procedures

These procedures offer a general guide to some of the precautions and approaches taken with different types of tracked skidder.

The reader should be aware that different makes, types or models of machine have their own specific procedures. Those procedures, as detailed in operator's manuals, should be followed in preference to any methods described in these guidelines.

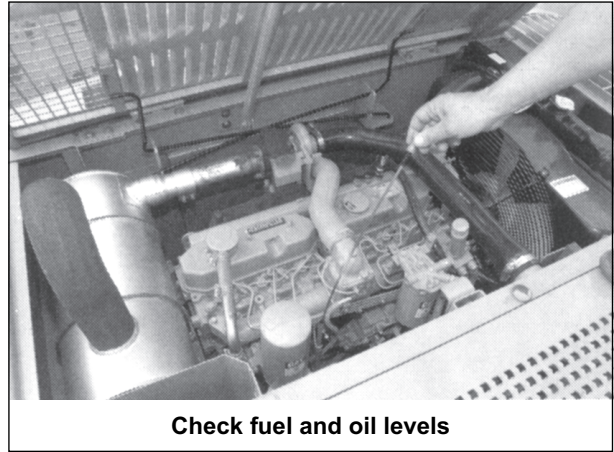
Before start-up

Inspect the machine (walk-around) looking for loose bolts, trash build-up, oil or coolant leaks, and broken or worn parts.

Inspect the condition of implements or attachments, especially hydraulic components.

As a guide, check the the following before start-up:

- (1) Fuel and hydraulic system: oil, coolant and fuel levels.
- (2) Broken, missing or damaged loose parts. Make necessary repairs.
- (3) Remove trash build-up, in and around the engine, and under the floor plate. Also remove any dirt build-up on top of the crankcase guard.
- (4) The engine pre-cleaner screen for dirt build-up. Remove dirt or debris.
- (5) Tracks for wear and/or damage, tighten loose bolts, replace missing ones.
- (6) The operator's compartment for tidiness, remove rubbish, and secure loose tools.
- (7) The seat belt mounting hardware. Tighten loose or replace missing components.
- (8) Adjust the seat so that the pedals are allowed full travel when you are correctly positioned.
- (9) Service and parking brakes for proper operation.
- (10) Fire extinguisher - filled and in working order.
- (11) Fasten your seat belt before starting the engine
- (12) Lights are working (if conditions require them).
- (13) No one is working on, underneath or close to the machine.
- (14) No one is in the immediate vicinity of the machine.



Start up

- (1) Start the machine only when you are seated, with the seat belt fastened, and in full control of all the machine's functions.
- (2) Move the transmission directional control into **neutral**.
- (3) Engage the parking brake.
- (4) Move the implement control levers to the **hold** position.
- (5) Pull the governor control lever back through the stop engine detent. Then return it to the **low idle** position.
- (6) Turn the start switch key to the **on** position.
- (7) Turn the start switch key to the **start**. Release the switch key when the engine starts. The clutch must be fully depressed to start direct drive machines.

After starting the machine

- (1) Keep the engine speed low until the engine oil pressure indicator goes out. If it does not go out within 10 seconds, stop the engine and find the cause before starting again.
- (2) Allow the engine time to warm up at **low idle** for **at least 5 minutes**. Engage and disengage implement or attachment controls to help speed warm up of hydraulic components. In temperatures above 0°C, warm up requires approximately 15 minutes. In temperatures below 0°C, warm up time requires approximately 30 minutes.
- (3) Cycle all controls to allow warm oil to circulate through all cylinders and lines.
- (4) Observe gauges and indicators frequently during operation.

Before operating the machine

- (1) Clear all personnel from the machine, and the area.
- (2) Clear all obstacles from the path of the machine.
- (3) Ensure windows are clean. Secure doors and windows in either the open or shut position.
- (4) Adjust rear view mirror (if equipped).
- (5) Ensure the horn, reverse alarm (if equipped) and all other warning devices are working properly.
- (6) Fasten your seat belt securely.

Machine operation

- Operate the machine only while seated with your seat belt fastened.
- Operate the controls only with the engine running.
- Check for proper operation of all controls and protective devices while moving slowly in an open area.
- No one should get on or off a moving machine.
- No one should ride on a machine unless it is provided with proper seating.
- No one should ride on a load carried or towed by a machine.
- No loose objects should be carried in the cab of a machine.
- Report any needed repairs noted during operation.
- Carry any implements (e.g., blade) close to the ground (about 40 cm above ground level).
- No one should be allowed between the machine and the trailing equipment (e.g., an arch) when the machine is manoeuvring to connect them.
- Work up and down slopes rather than across them whenever possible.
- If a machine begins to side-slip on a slope, the load should be dropped (if possible) and the machine turned downhill.
- Keep the machine under control and work within its capacity.
- Know the maximum height and reach of the machine.

Shut down

- (1) Park the machine on level ground.
- (2) Push the governor control forward slightly to reduce the engine speed.
- (3) Move the power shift transmission control lever to **neutral**.
- or** Move the direct drive directional control lever to **neutral**.
- (4) Engage the parking brake.
- (5) Lower all attachments to the ground. Apply a slight pressure.
- (6) Before stopping the engine, operate at **low idle** for 5 minutes . This allows hot areas in the engine to cool gradually.
- (7) Push the governor control lever past detent (all the way forward) to stop the engine.
- (8) Turn the engine start switch key to **off** and remove.

Excavator-based machines

Start-up and shut-down procedures

These procedures offer a general guide to some of the precautions and approaches taken with different types of excavator.

The reader should be aware that different makes, types or models of machine have their own specific procedures. Those procedures, as detailed in operator's manuals, should be followed in preference to any methods described in these guidelines.

Before start-up

Inspect the machine (walk-around) looking for loose bolts, trash build-up, oil or coolant leaks, and broken or worn parts.

Inspect the condition of implements or attachments, especially hydraulic components.

As a guide, check the the following before start-up:

- (1) Fuel and hydraulic system: oil, coolant and fuel levels.
- (2) Broken, missing or damaged loose parts. Make necessary repairs.
- (3) Remove trash build-up, in and around the engine, and under the floor plate. Also, remove any dirt build-up on top of the crankcase guard.
- (4) The engine pre-cleaner screen for dirt build-up. Remove dirt or debris.
- (5) Tracks for wear and/or damage, tighten loose bolts, replace missing ones.
- (6) The operator's compartment for tidiness, remove rubbish, and secure loose tools.
- (7) The seat belt mounting hardware. Tighten loose or replace missing components.
- (8) Adjust the seat so that the pedals are allowed full travel when the operator is seated against the seat back.
- (9) Service and parking brakes for proper operation.
- (10) Fire extinguisher - filled and in working order.
- (11) Fasten your seat belt before starting the engine
- (12) Lights are working (if conditions require them).
- (13) No one is working on, underneath or close to the machine.
- (14) No one is in the immediate vicinity of the machine.

Start up

- (1) Start the machine only when you are seated, with the seat belt fastened, and in full control of all the machine's functions.
- (2) Insert the key into the disconnect switch and turn the switch to the **on** position.
- (3) If the machine is equipped with an engine neutral start system, move the hydraulic activation control lever to the **locked** position.
- (4) Move the implement control levers to the **hold** position.
- (5) Turn engine speed control to low.
- (6) Turn the start switch key to the **start**. Release the switch key when the engine starts.

After starting the machine

- (1) Keep the engine speed low until the engine oil pressure indicator goes out. If it does not go out within 10 seconds, stop the engine and find the cause before starting again.
- (2) Allow the engine time to warm up at **low idle** for **at least** 5 minutes. Engage and disengage implement or attachment controls to help speed warm up of hydraulic components. In temperatures above 0°C, warm up requires approximately 15 minutes. In temperatures below 0°C, warm up time requires approximately 30 minutes.
- (3) Cycle all controls to allow warm oil to circulate through all cylinders and lines.
- (4) Observe gauges and indicators frequently during operation.

Before operating the machine

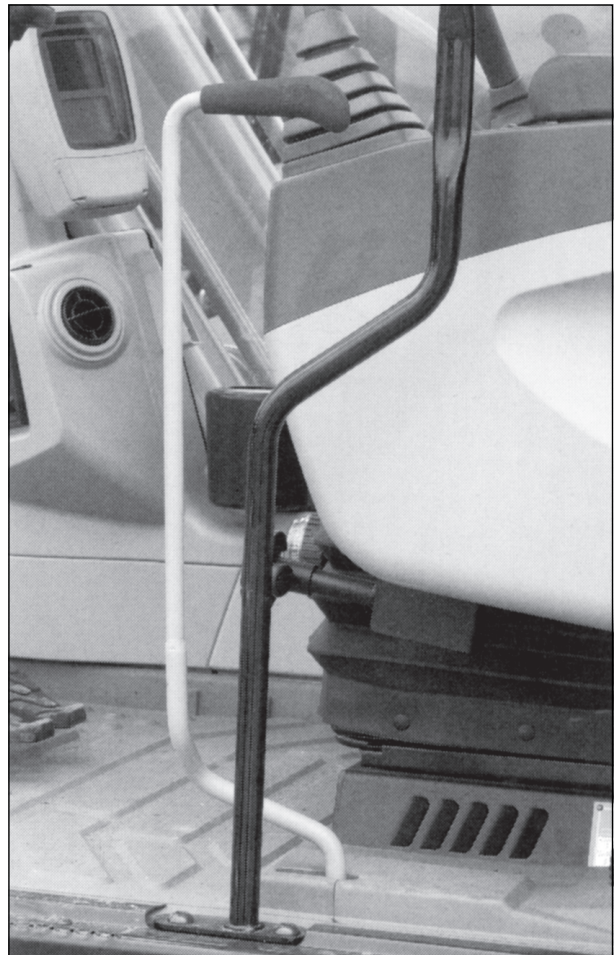
- (1) Clear all personnel from the machine, and the area.
- (2) Clear all obstacles from the path of the machine.
- (3) Ensure windows are clean. Secure doors and windows. If they are an integral part of a protective structure, they should be closed.
- (4) Adjust rear view mirror (if equipped).
- (5) Ensure the horn, reverse alarm (if equipped) and all other warning devices are working properly.
- (6) Before moving the machine, check the position of the undercarriage. The normal travel position is with the idler wheels to the front under the cab and the drive sprockets to the rear.
- (7) Fasten your seat belt securely.

Machine operation

- Operate the machine only while seated with your seat belt fastened.
- Operate the controls only with the engine running, to prevent uncontrolled movement of implements or attachments.
- Check for proper operation of all controls and protective devices while moving slowly in an open area.
- Watch for boom clearances when moving the machine. Uneven ground can cause the boom to move from side to side or up and down.
- No one should get on or off a moving machine.
- No one should ride on a machine unless it is provided with proper seating.
- No one should ride on a load carried by a machine.
- No loose objects should be carried in the cab of a machine.
- Report any needed repairs noted during operation.
- Work up and down slopes rather than across them whenever possible.
- If a machine begins to side-slip on a slope, the load should be dropped (if possible) and the machine turned downhill.
- Keep the machine under control and work within its capacity.
- Bring the load close to the machine before travelling or swinging the load.
- Lifting capacity decreases the further the load is from the machine.
- The swing lock pin should not be engaged while the swing frame is rotating.
- Know the maximum height and reach of the machine.
- Keep eye contact with the load at all times.

Shut down

- (1) Park the machine on level ground (if it is necessary to park on a slope, block the tracks securely).
- (2) Reduce engine speed.
- (3) Release the travel levers/pedals to stop the machine.
- (4) Lower the implement or attachment to the ground and apply slight down pressure.
- (5) Move the hydraulic activation control lever to the **locked** position.
- (6) With the machine stopped, run the engine for 5 minutes at **low idle**. Stopping the engine immediately after it has been working under load can result in overheating, and accelerated wear of engine components.
- (7) Turn the engine start switch key to **off**. Remove the key.



Hydraulic activation control lever should be locked to disable systems

Mechanised harvesters

Start-up and shut-down procedures

These procedures offer a general guide to some of the precautions and approaches taken with different types of mechanised harvester.

The reader should be aware that different makes, types or models of machine have their own specific procedures. Those procedures, as detailed in operator's manuals, should be followed in preference to any methods described in these guidelines.

Before start-up

Inspect the machine (walk-around) looking for loose bolts, trash build-up, oil or coolant leaks, and broken or worn parts.

Inspect the condition of implements or attachments, especially hydraulic components.

As a guide, check the the following before start-up:

- (1) Fuel and hydraulic system: oil, coolant and fuel levels.
- (2) Broken, missing or damaged loose parts. Make necessary repairs.
- (3) Remove trash build-up, in and around the engine, and under the floor plate. Also, remove any dirt build-up on top of the crankcase guard.
- (4) The engine pre-cleaner screen for dirt build-up. Remove dirt or debris.

- (5) Tracks for wear and/or damage, tighten loose bolts, replace missing ones.
- (6) Check the cutting unit is sharpened, tensioned, and in good condition.
- (7) The operator's compartment for tidiness, remove rubbish, and secure loose tools.
- (8) The seat belt mounting hardware. Tighten loose or replace missing components.
- (9) Adjust the seat so that the pedals are allowed full travel when you are correctly positioned.
- (10) Service and parking brakes for proper operation.
- (11) Fire extinguisher - filled and in working order.
- (12) Fasten your seat belt before starting the engine
- (13) Lights are working (if conditions require them).
- (14) No one is working on, underneath or close to the machine.
- (15) No one is in the immediate vicinity of the machine.

Start up

- (1) Start the machine only when you are seated, with the seat belt fastened, and in full control of all the machine's functions.
- (2) Insert the key into the disconnect switch and turn the switch to the **on** position.
- (3) If the machine is equipped with an engine neutral start system, move the hydraulic activation control lever to the **locked** position.
- (4) Move the implement control levers to the **hold** position.
- (5) Turn engine speed control to low (1).
- (6) Turn the engine start switch key to **start**. Release the switch key when the engine starts.

After starting the machine

- (1) Keep the engine speed low until the engine oil pressure indicator goes out. If it does not go out within 10 seconds, stop the engine and find the cause before starting again.
- (2) Allow the engine time to warm up at **low idle** for **at least** 5 minutes. Engage and disengage implement or attachment controls to help speed warm up of hydraulic components. In temperatures above 0°C, warm up requires approximately 15 minutes. In temperatures below 0°C, warm up time requires approximately 30 minutes.
- (3) All harvester head functions should be activated in order to warm up the hydraulic components. Hot oil under pressure could damage them through thermal shock effects. Cycle all controls to allow warm oil to circulate through all cylinders and lines.
- (4) Observe gauges and indicators frequently during operation.

Before operating the machine

- (1) Clear all personnel from the machine, and the area.
- (2) Clear all obstacles from the path of the machine.
- (3) Ensure windows are clean. Secure doors and windows. If they form part of a protective structure, they should be closed.
- (4) Adjust rear view mirror (if equipped).
- (5) Ensure the horn, reverse alarm (if equipped) and all other warning devices are working properly.
- (6) Before moving the machine, check the position of the undercarriage. The normal travel position is with the idler wheels to the front under the cab and the drive sprockets to the rear.
- (7) Fasten your seat belt securely.

- (8) The machine should have the automatic idle facility turned off - This may idle the machine down when the chainsaw on the harvester head is being used.

Machine operation

- Operate the machine only while seated with your seat belt fastened.
- Operate the controls only with the engine running, to prevent uncontrolled movement of implements or attachments.
- Check for proper operation of all controls and protective devices while moving slowly in an open area.
- Watch for boom clearances when moving the machine. Uneven ground can cause the boom to move from side to side or up and down.
- No one should get on or off a moving machine.
- No one should ride on a machine unless it is provided with proper seating.
- No one should ride on a load carried by a machine.
- No one should be allowed within a harvester's safety zone (70 m).
- No loose objects should be carried in the cab of a machine.
- Report any needed repairs noted during operation.
- When the operation has stopped, lower the boom so that the felling head or attachment rests on the ground.
- Work up and down slopes rather than across them whenever possible.
- When operating near power lines, check first with local authorities regarding minimum distances for safety. At least 4 m should be allowed between the line and the nearest point of contact.
- When working in a restricted area, check for interference to cylinder rods, hydraulic hoses, electrical cables etc.
- When processing or delimiting, allow enough space between the stem and the carrier cab.
- When freeing a stem from a stack, avoid making sudden moves or giving a sharp rap with the harvester head. The head could be damaged or personnel could be put at risk.

Shut down

- (1) Park the machine on level ground (if it is necessary to park on a grade, block the tracks securely).
- (2) Reduce engine speed.
- (3) Release the travel levers/pedals to stop the machine.
- (4) Lower the head to the ground and apply slight down pressure. If leaving the head unattended, it should be left in the upright position, pointing away from the cab, with the boom stretched out. The head and link mechanism should not be laid down in such a way that the rotator comes into contact with the arm as damage may result.
- (5) Move the hydraulic activation control lever to the **locked** position.
- (6) With the machine stopped, run the engine for 5 minutes at **low idle**. Stopping the engine immediately after it has been working under load can result in overheating, and accelerated wear of engine components.
- (7) Turn the engine start switch key to **off**. Remove the key.

Forwarders

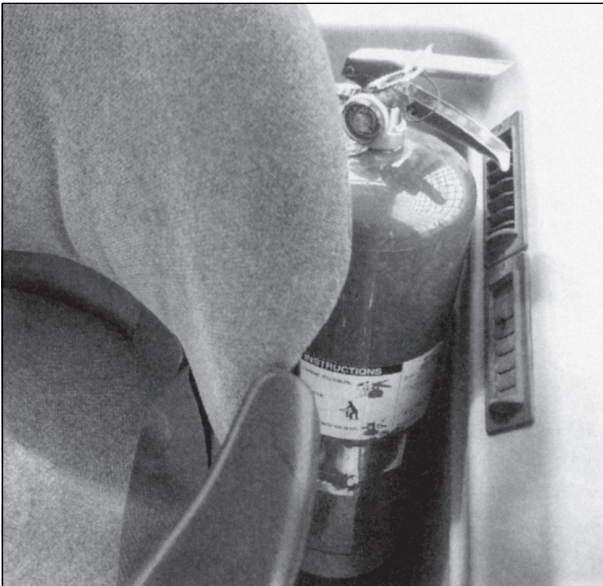
Start-up and shut-down procedures

These procedures offer a general guide to some of the precautions and approaches taken with different types of forwarder.

The reader should be aware that different makes, types or models of machine have their own specific procedures. Those procedures, as detailed in operator's manuals, should be followed in preference to any methods described in these guidelines.



Check and clean debris from the engine compartment



Check the fire extinguisher is present

Before start-up

Inspect the machine (walk-around) looking for loose bolts, trash build-up, oil or coolant leaks, and broken or worn parts.

Inspect the condition of implements or attachments, especially hydraulic components.

As a guide, check the the following before start-up:

- (1) Fuel and hydraulic system: oil, coolant and fuel levels.
- (2) Broken, missing or damaged loose parts. Make necessary repairs.
- (3) Clean out rubbish build-up, especially in the engine compartment, the underside of the machine, and around rotating components.
- (4) The engine pre-cleaner screen for dirt build-up. Remove dirt or debris.
- (5) Tyres for cuts, bulge's and correct pressure.
- (6) Steering frame lock link (if fitted) - in unlocked position.
- (7) The operator's compartment for tidiness, remove rubbish, and secure loose tools.
- (8) The seat belt mounting hardware. Tighten loose or replace missing components.
- (9) Adjust the seat so that the pedals are allowed full travel when you are correctly positioned.
- (10) Service and parking brakes for proper operation.
- (11) Fire extinguisher - filled and in working order.
- (12) The fire extinguishing system.
- (13) For machines with emergency exits: the lock pin of the emergency exit is removed.
- (14) Fasten your seat belt before starting the engine.
- (15) Lights are working (if conditions require them).
- (16) If the machine has been idle for more than 2 weeks, specific starting instructions may apply. The operator's manual should be consulted.
- (17) No one is working on, underneath or close to the machine.
- (18) No one is in the immediate vicinity of the machine.

Start up

- (1) Ensure there is no one within the danger zone around the forwarder.
- (2) Start the machine only when you are seated, with the seat belt fastened, and in full control of all the machine's functions.
- (3) Engage the parking brake (some machines will start only if the parking brake is on).

- (4) Check that the driving direction switch is in the middle position (and emergency stop switch is in the upper position).
- (5) Insert the key into the disconnect switch and turn the switch to the first position (warning lights should be working).
- (6) The pedal should be in the **idle** position.
- (7) Turn the engine start switch key to **start**. Release the switch key when the engine starts.
- (8) If the engine is cold, and outside temperatures are below 0°C, press the accelerator to full throttle for starting, then release immediately the engine fires.
- (9) Ensure the oil pressure warning light goes off after 10 seconds.
- (10) If the engine fails to fire within 15 seconds, discontinue starting. Allow the starter motor to cool for 1 minute, and try to restart. If the engine fails to fire after 3 tries, investigate the cause.
- (11) Turn engine speed control to low.

After starting the machine

- (1) Keep the engine speed low until the engine oil pressure indicator goes out. If it does not go out within 10 seconds, stop the engine and find the cause before starting again.
- (2) Allow the engine time to warm up at **low idle** (approximately 1000 rpm) for **at least** 5 minutes. Engage and disengage implement or attachment controls to help speed warm up of hydraulic components. In temperatures above 0°C, warm up requires approximately 15 minutes. In temperatures below 0°C, warm up time requires approximately 30 minutes.
- (3) Cycle all controls to allow warm oil to circulate through all cylinders and lines.
- (4) Observe gauges and indicators frequently during operation.

Shut down

- (1) Park the machine on level ground .
- (2) Make sure that the loader will not move freely once the engine has been turned off.
- (3) The loader grapple must be supported on the load carrier frame or on top of the load.
- (4) Let the engine idle for about 30 seconds to even out the temperature in the turbocharger. If only a short time has passed since operating at full load, the engine should be allowed to idle for 2 to 4 minutes before switching off. Stopping the engine immediately after it has been working under load can result in overheating, and accelerated wear of the engine components.
- (5) Turn the engine start switch key to the **stop** position. Remove the key.

Wheeled loaders

Start-up and shut-down procedures

These procedures offer a general guide to some of the precautions and approaches taken with different types of wheeled loader.

The reader should be aware that different makes, types, or models of machine have their own specific procedures. Those procedures, as detailed in operator's manuals, should be followed in preference to any methods described in these guidelines.

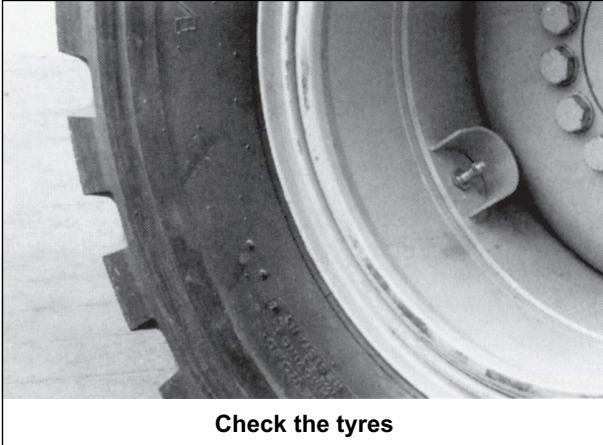
Before start-up

Inspect the machine (walk-around) looking for loose bolts, trash build-up, oil or coolant leaks, and broken or worn parts.

Inspect the condition of implements or attachments, especially hydraulic components.

As a guide, check the the following before start-up:

- (1) Fuel and hydraulic system: oil, coolant and fuel levels.
- (2) Broken, missing or damaged loose parts. Make necessary repairs.
- (3) Clean out rubbish build-up, especially in the engine compartment, the underside of the machine, and around rotating components
- (4) Tyres for cuts, bulges and correct pressure.
- (5) Steering frame lock link (if fitted) - in unlocked position.
- (6) The operator's compartment for tidiness, remove rubbish, and secure loose tools.



- (7) The seat belt mounting hardware. Tighten loose or replace missing components.
- (8) Adjust the seat so that the pedals are allowed full travel when you are correctly positioned.
- (9) Service and parking brakes for proper operation.
- (10) Fire extinguisher - filled and in working order.
- (11) Fasten your seat belt before starting the engine.
- (12) Lights are working (if conditions require them).
- (13) No one is working on, underneath or close to the machine.
- (14) No one is in the immediate vicinity of the machine.

Start up

- (1) Start the machine only when you are seated, with the seat belt fastened, and in full control of all the machine's functions.
- (2) Move the transmission direction control switch to **neutral**.
- (3) Engage the transmission neutral lock lever.
- (4) Engage the parking/secondary brake.
- (5) Move the control levers to the **hold** position.
- (6) Press the transmission neutral lock switch to shift the transmission into **neutral**.
- (7) Turn the engine start switch key to start the engine. Release the key switch when the engine starts.
- (8) Do not crank the engine for more than 30 seconds.
- (9) Allow the starter to cool for 2 minutes before cranking again.

After starting the machine

- (1) Keep the engine speed low until the engine oil pressure indicator goes out. If it does not go out within 10 seconds, stop the engine and find the cause before starting again.
- (2) Allow the engine time to warm up at **low idle** for **at least** 5 minutes. Engage and disengage implement or attachment controls to help speed warm up of hydraulic components. In temperatures above 0°C, warm up requires approximately 15 minutes. In temperatures below 0°C, warm up time requires approximately 30 minutes.
- (3) Cycle all controls to allow warm oil to circulate through all cylinders and lines.
- (4) Observe gauges and indicators frequently during operation.

Shut down

- (1) Park the machine on level ground .
- (2) Apply the service brakes to stop the machine.
- (3) Move the transmission direction control switch to **neutral**.
- (4) Engage the parking/secondary brake.
- (5) Lower all attachments to the ground and apply slight down pressure.
- (6) With the machine stopped, run the engine for 5 minutes at **low idle**. Stopping the engine immediately after it has been working under load can result in overheating, and accelerated wear of engine components.
- (7) Turn the engine start switch key to **off** and remove it.
- (8) If an electrical disconnect switch is fitted, turn and remove the key.

Bell loaders

Start-up and shut-down procedures

These procedures offer a general guide to some of the precautions and approaches taken with different models of Bell loader.

The reader should be aware that different makes, types or models of machine have their own specific procedures. Those procedures, as detailed in operator's manuals, should be followed in preference to any methods described in these guidelines.

Before start-up

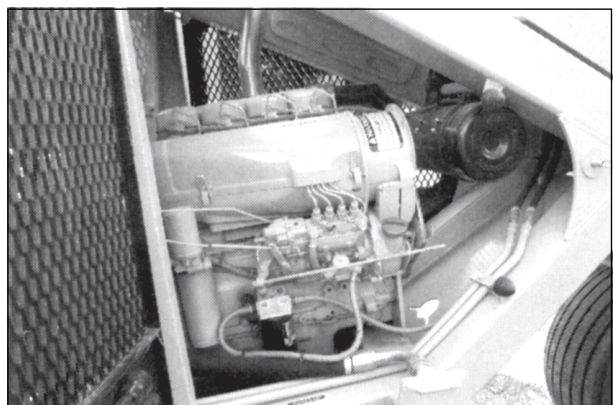
Note that Bell equipment recommend that a Bell supplied "Warning , do not operate" sign be placed over the cab master switch when carrying out maintenance on the machine.

Inspect the machine (walk-around) looking for loose bolts, trash build-up, oil or coolant leaks, and broken or worn parts.

Inspect the condition of implements or attachments, especially hydraulic components.

As a guide, check the the following before start-up:

- (1) Fuel and hydraulic system: oil, coolant and fuel levels.
- (2) Broken, missing or damaged loose parts. Make necessary repairs.
- (3) Clean out rubbish build-up, especially in the engine compartment, the underside of the machine, and around rotating components
- (4) Tyres for cuts, bulges and correct pressure.
- (5) The operator's compartment for tidiness, remove rubbish, and secure loose tools.
- (6) The seat belt mounting hardware. Tighten loose or replace missing components.
- (7) Adjust the seat so that the pedals are allowed full travel when you are correctly positioned. Your boots should be clean of grease and mud.
- (8) Service and parking brakes for proper operation.
- (9) Fire extinguisher - filled and in working order.
- (10) Fasten your seat belt before starting the engine.
- (11) Lights are working (if conditions require them).
- (12) No one is working on, underneath or close to the machine.
- (13) No one is in the immediate vicinity of the machine.



Check and clean engine compartment

Start up

- (1) Start the machine only when you are seated, with the seat belt fastened, wearing head and hearing protection, and in full control of all the machine's functions.
- (2) The key switch should be turned to **start**.
- (3) The shut down control lever should be in the **start** position.
- (4) The park brake switch is in the **applied** position.
- (5) The pedals are in **neutral**.
- (6) Press and hold the start switch until the engine has started.
- (7) If the engine fails to start do not crank the engine for more than 17 seconds.
- (8) Allow the starter to cool for 1 minute before cranking again.
- (9) If the engine will not start after 2 attempts, investigate the cause.



Ensure that doors are closed as these form part of the OPS

After starting the machine

- (1) Keep the engine speed low until the engine oil pressure indicator goes out. If it does not go out within 10 seconds, stop the engine and find the cause before starting again.
- (2) Allow the engine time to warm up at **low idle** for **at least** 5 minutes. Engage and disengage implement or attachment controls to help speed warm up of hydraulic components. Cycle all controls to allow warm oil to circulate through all cylinders and lines.
- (3) Observe gauges and indicators frequently during operation.
- (4) Ensure the doors are closed as these form part of the OPS.

Shut down

- (1) Park the machine on level ground .
- (2) Apply the service brakes to stop the machine.
- (3) Lower the grapple before stopping the engine.
- (4) With the machine stopped, run the engine for 1 minute at **low idle**. Stopping the engine immediately after it has been working under load can result in overheating, and accelerated wear of engine components.
- (5) Stop the engine by pushing the control lever all the way into the control box and hold until the engine shuts down.
- (6) Engage the parking/secondary brake.
- (7) Turn the engine start switch key to **off** and remove.
- (8) If an electrical disconnect switch is fitted, turn and remove the key.

Power operated work platforms (POWP)

Start-up and shut-down procedures

Before start-up

Inspect the machine (walk-around) looking for loose bolts, trash build-up, oil or coolant leaks, and broken or worn parts.

As a guide, check the the following before start-up:

- (1) Fuel and hydraulic system: oil, coolant and fuel levels.
- (2) Broken, missing or damaged loose parts. Make any necessary repairs.

Parking

- (1) The towing vehicle should be positioned so that it is possible to work on the uphill side of the unit (i.e., with the vehicle facing downhill). If it is necessary to work on the downhill side - load and horizontal extension must be reduced.
- (2) The unit should be parked in a position to give the best access to the object being worked on.
- (3) The ground beneath the unit should be firm. If the wheels and/or stabilisers sink, the unit could overturn.
- (4) If parked on a hill, the unit should face directly up and down the slope.
- (5) The parking brake on the unit should be locked, and wheel blocks used if necessary.

Start up

- (1) Before starting the engine, ensure that the basket stop is disengaged.
- (2) Activate the leg selector on the trailer. Front stabilisers must be activated first.
- (3) Lower the stabilisers, selecting the order in which the jacks are to be lowered using the 4-bank selector valve mounted on the trailer.
- (4) Fully extend all the jacks until firmly on the ground. If the ground is uneven, level up the unit on jacks using the levelling bubbles.
- (5) Ensure the jack footplates are in full contact with the ground. If the ground is soft, thick steel plates (300 mm square by 6 mm thick) can be placed under the feet.
- (6) If a tail light bracket is fitted to the basket remove it, along with any other securing straps. The ground/ basket switch on the column should be switched to "ground" to allow boom operation.
- (7) The leg/boom selector switch should be switched to "boom".

Machine operation

- Operate the lower boom lever to up position to allow entry to the basket (i.e., basket on the ground).
- Switch the ground/basket control to "basket".
- Safety harnesses must be worn.
- The lower boom should be operated before the upper boom.
- Controls should be moved slowly, to avoid jerking motions.
- In case of engine failure, use the emergency lowering valve (if fitted), to lower the upper boom to ground level. If and when the engine is restarted, the upper cylinder must be refilled with oil by raising the upper boom to its maximum height. The lower boom should not be operated until the upper cylinder has refilled.

Shut down or stowing

- (1) Dismount from the basket.
- (2) Before lowering the lower boom into the cradle, remove the entire load, and any loose objects from the basket and the levelling system.
- (3) The booms are returned to the rest position by first lowering the upper boom, then the lower boom into the boom rest. If a fly boom is fitted, that is then lowered next into its rest position.
- (4) Turn the engine off, if no more boom movement is planned.
- (5) Ensure that the boom rest pin is placed into position to lock the booms.
- (6) The fly boom (if fitted) may be secured by a strap.

Maintenance

Note that all maintenance should be carried out in accordance with the manufacturer's guidelines.

All maintenance should be carried out with the engine turned off.

Pre-start and maintenance (every day, or before each shift)

Typical check may include:

- Walk around the machine and check for damage, loose hardware, and worn components, including hydraulic leaks.
- Inspect implement cylinders and linkages for damage or excessive wear. Repair if damaged.
- Inspect and repair any final drive leaks.
- Ensure covers and guards are firmly in place. Inspect for damage or for loose and missing bolts.
- Check the oil level(s).
- Check the power train system oil level.
- Check the hydraulic implement oil level.
- Check the engine coolant level.
- Check fuel level.
- Drain moisture and sediment from the fuel tank.
- Check the air filter.
- Check seat position, mirror, and seat belt adjustments.

Daily maintenance and check (8hr)

Typical check may include:

- Check engine crankcase oil level.
- Check engine coolant level.
- Check power train hydraulic oil level.
- Clean outside of folded core radiator.
- Check hydraulic system oil.
- Inspect tracks for proper adjustment.
- Drain moisture and sediment from the fuel tank.
- Do a walk-around inspection.
- Clean windows
- Test indicator gauges and lights.
- Inspect seat belt for damage.
- Check the oil level in the winch (if fitted).
- Lubricate all items described in the manufacturer's operator's manual.

Periodic maintenance (e.g. 50hr)

Typical checks may include:

- Check pivot shaft for oil level and leaks.
- Inspect tracks.
- Lubricate ripper linkage and cylinder bearings (if fitted).

Storage, handling and filling procedures for fuels and oils

- Fuels and oils should be stored away from the main work area.
- At least two hand-held fire extinguishers suitable for fighting class B fires should be immediately available.
- Fuel and oils should be handled carefully, ensuring that minimal amount is spilt either on the ground or on a person.
- Water and detergents for removing fuel/oil contamination should be available.
- Protective eyewear and clothing should be worn.
- Refuelling should take place following the daily maintenance checks.

Glossary of terms

All terrain vehicle (ATV)	All terrain vehicles or ATV's are 4-wheel-drive vehicles derived from motorcycle technology.
Bell loader	A 3-wheeled loading and sorting machine. It has two differentially-driven steering and traction wheels and a third non-steerable jockey wheel. The Bell loader has a short boom and rotating grapple.
Breaking out	The activity of hooking on, winching, and dislodging the drag from other felled trees prior to extraction.
Cable skidder	An articulated, four-wheel drive machine for towing felled trees. The towing and attachment of the trees is by winch and strops (chokers).
Chute	An area used for depositing stems or trees. In cable logging, the area in front of the hauler, where the drags are landed.
Clearfell	A term describing the non-selective harvesting of all standing trees.
COPS	Cabin Operator Protective Structure. A self-contained protective capsule designed to protect operators working in excavators on steep terrain.
Cutover	A term for an area that has been clearfelled.
Dehydration	Insufficient water for normal body function.
Excavator	A tracked, turntable-mounted boom-equipped machine primarily designed for digging and transferring soil or rock. Configured as a log or stem loader (using a grapple) for harvesting operations, or as a base or carrier for felling or harvester heads.
Fairlead	A cluster of free-spinning rollers that guide a winch rope on/off the winch drum.
Feller-buncher	A general term for a felling machine. The machine is usually tracked, and equipped with any type of felling or harvesting head.
Feller-director	A term used to describe a kind of felling head. The head uses a hydraulically operated chainsaw to fell the tree while being held by the head's grapple. Felling direction is influenced by the movement of the boom in the opposite direction.
Fleeting	The process of moving sorted logs to a stack.
Flexible tracked skidder	A specialist logging tractor, equipped with torsion-bar mounted road wheels rather than track rollers giving the tracks flexibility. Made by Kootenay Manufacturing Company (KMC).
FOPS	Falling Object Protective Structure designed to prevent injury to the operator from falling objects when working in standing trees.
Forwarder	A wheeled, articulated, self-loading carrier for logs. Often used in conjunction with a harvester.
Grapple skidder	An articulated, four-wheel drive machine for towing felled trees. The towing and attachment of the trees is by a hydraulically operated grapple.
Harvester	A machine, usually tracked, equipped with a harvester head. The harvester may function as a full-time feller-delimber-buncher, a processor, or a full harvester.
Harvester head	A head attachment for a boom, with felling, delimiting and bucking functions. Trees are cut with a hydraulically operated chainsaw, delimited by grapple/knives and driven through the knives by toothed rollers. Most harvester heads are fitted with a computerised length and diameter measurement system.
Harvester-processor	A harvester operating as a processor. That is, it may or may not delimit, but it will cut the stem into logs.
Health hazard	An occurrence, condition or situation, often arising off-site, that could adversely affect the general health of a worker.

Glossary of terms (cont...)

Knuckle-boom	A hydraulically articulated boom with a terminal attachment, often a loading grapple capable of 360° rotation.
Log grade	A classification of logs for purposes of sale. A grade differs from other grades on the basis of length, small-end diameter, large-end diameter, allowable defects, and other characteristics.
Logging operations	The forestry processes and activities of felling, extraction, processing and loading.
Occupational Overuse Syndrome (OOS)	Describes work-related disorders of the musculo-skeletal system.
Operational hazard	An occurrence, condition or situation arising on-site that could adversely affect the health of a worker through physical injury.
OPS	Operator Protection Structure designed to prevent objects entering the cab and injuring the operator.
Power-operated work platform	A trailer mounted hydraulically operated boom and platform. Also known as a "cheery-picker".
ROPS	Roll Over Protective Structure. To be fitted to any mobile plant operated anywhere except on level ground. Excavators are exempted but require COPS.
Shovel logging	An extraction system using an excavator-loader. Stems are successively swung and deposited in rows or bunches - from the felling site, to a destination, usually a road. A single swing movement can be termed bunching, usually for grapple skidder extraction.
Silvicultural operations	The forestry processes and activities of establishment, pruning and thin-to-waste.
Site preparation	The process of preparing cutover for planting (e.g., windthrowing, ripping and mounding, spraying, and chemical releasing).
Solvents	Liquid chemicals such as mineral turpentine used for cleaning tools, or branding templates that have been used with oil-based paints.
Sorting	The process of accumulating logs of the same grade.
Static delimber	A delimber consisting of a hydraulically operated knife-set through which trees are pulled. The pulling machine may be a Bell loader, or an excavator loader. The knife-set may be mounted on a trailer, or on skids.
Thinning	The selective harvesting of a proportion of standing trees. Poorer specimens are taken, usually according to spacing criteria.
Towed arch	A towed two-wheeled structure of "A" frame configuration, fitted with a fairlead. For use with tractors without an integral arch and fairlead.
Wheeled loader	A four-wheeled, articulated machine equipped with loading forks.
Wheeled skidder	An articulated, four-wheel drive machine for towing felled trees.