

OPERATE AND MAINTAIN MACHINERY AND EQUIPMENT

REGIONAL AUSTRALIAN WORKFORCE DEVELOPMENT
“DRIVEN BY LOCAL INDUSTRY & COMMUNITY”



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1. INTRODUCTION

HOW TO USE THESE MATERIALS

This workbook relates to skills required for small machinery operation and maintenance and is appropriate to people employed in a range of workplaces in the rural, regional and remote sectors of Australia. Skills and knowledge developed will ensure your work meets acceptable standards for your industry sector. Resources and activities provided are designed to develop your skills and provide formative assessments to monitor progress.

On completion of appropriate summative assessments provided by your Registered Training Organisation (RTO) will enable you to achieve competency in the unit applicable to your sector.

These student materials apply to the following industry sectors and units of competence.

Sector	Unit code	Book	Unit name
Retail/Agribusiness Services	AHCMOM304A	Book 1	Operate Machinery and Equipment
Local Government, Civil and Construction	LGAWORK205A	Book 1	Operate and Maintain Equipment
Resources/Infrastructure/Mining	RIISAM204A	Book 1	Operate Small Plant and Equipment

2. LEARNING MATERIALS

WHAT ARE THEY ABOUT?

This workbook supports the attainment of skills and knowledge required for competent workplace performance in a variety of rural and regional workplaces related to the operation of small machinery and equipment. It includes the planning and preparation for work, the conducting of pre-operational checks, the use of the plant and/or equipment, and carrying out operator maintenance and cleaning up.

This unit is appropriate for those working in operational, service and maintenance roles, at worksites within:

- Civil Construction
- Local Government
- Coal Mining
- Drilling
- Extractive Industries
- Metalliferous Mining
- Primary Industries

2.1 EMPLOYABILITY SKILLS

The learning materials provide opportunities to develop and apply employability skills that are learnt throughout work and life to your job. In completing the activities and summative assessments you must be able to demonstrate competent employability skills in the workplace.

Communication	<ul style="list-style-type: none"> • participate in discussions with others, which may involve: • listening, questioning and paraphrasing to confirm understanding • read and interpret a range of information relevant to job/role including plans, specifications, plant and equipment capabilities, manufacturer's recommendations • speak clearly and directly • listen carefully to instructions and information • read and interpret work instructions and safety signs • complete incident and maintenance reports
Teamwork	<ul style="list-style-type: none"> • ability to work cohesively within own work group and others • contribute to the planning and execution of operations • understanding the roles of team members and referring tasks to others where appropriate
Problem Solving	<ul style="list-style-type: none"> • measuring and calculating material quantities • participate in team solutions to safety issues • resolving work related problems
Initiative and Enterprise	<ul style="list-style-type: none"> • considering the effect of incidents to others before determining course of action • identify and assess risks in the workplace
Planning and Organising	<ul style="list-style-type: none"> • planning and preparing equipment, materials, resources, sites and surfaces • follow procedures and techniques relevant to the equipment and work being done • identifying and using correct personal protective equipment according to job/role requirements and workplace procedures • planning the use of resources, including time management
Self-Management	<ul style="list-style-type: none"> • conducting a self-assessment of own competencies against required job competencies
Learning	<ul style="list-style-type: none"> • attending relevant on and off the job training sessions • applying learning to technical issues (e.g. learning about products) and people issues (e.g. interpersonal and cultural aspects of work)
Technology	<ul style="list-style-type: none"> • adapting to the use of new technology as appropriate • having the OHS knowledge to apply technology • using technology relevant to the job/role such as environmental protector devices

3. PREPARE MACHINERY

AND EQUIPMENT FOR USE

Before starting any job pre-planning must take place to determine what machinery is required.

In selecting the appropriate machinery or equipment for a task you need to consider the following:

- What machine is most suited to perform the work?
- What will prevent the use of a particular machine e.g. the ground is wet and boggy, too steep or uneven?
- Does the machine require power or water to operate, and if so, are they available?
- Are there people close by that will be affected by the movement of the machine, noise or dust?
- Do you have access to the machine long enough to complete the job?
- Is hiring a more suited machine an option?
- Is a smaller machine a better option? – it may not be as fast but it may be more manoeuvrable and safer to operate in awkward locations.
- Can you access the site with your machine or are there some possible restrictions?

What other equipment / resources are required to do the job

You also need to consider the other equipment that is needed to do the job. This could include such things as:




- a suitable delivery vehicle to get the machine on site
- a tip truck and skid steer to possibly prepare the area first or clean up afterwards
- bollards, bunting and work area sign
- traffic management personnel



creative commons image

➔ ACTIVITY 1

The pictures below show 3 different types of soil compactors. Complete the table answering the questions about each machine.

Machine	Image	Advantages	Disadvantages
Vibrating plate 60kg			
Pedestrian roller 300 kg			
Combination roller 1.7 tonnes			

→ ACTIVITY 2

Now complete the table below. Think about a typical day at your workplace and list the machinery and equipment that you would use. In each case provide a brief description regarding why the equipment is correct for the job and what changes to circumstances may make it unsuitable.

[illegible]

Click on the You Tube video link below and watch the short video. The sound quality is not good but you can see clearly what has happened.



Click here view the video “Ditch Witch Stuck Again”

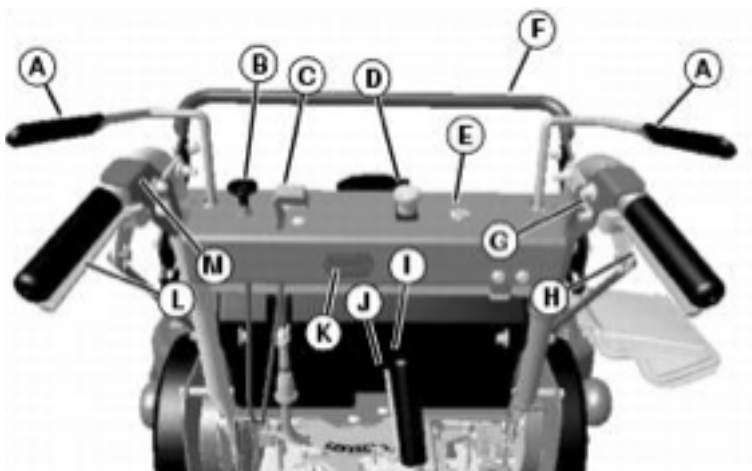
OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=NNgWQFrwxEc>

The operator in the video is well and truly stuck. What options would you consider to avoid this situation?

So far in the workbook you have considered what equipment or machine is the correct one for a particular task and the operating conditions. You have selected your machine/equipment. It is now important that you read and understand any compliance documentation, work instructions or safety requirements applicable to the operation of the machine or equipment.

Pictured below is the operator controls for a self-propelled walk behind mower. Before using this machine, you should know what all the controls are and the functions they perform. Can you honestly say that you know the functions of all of the controls on machines/equipment you use in your workplace? You need to make sure that you do understand all of the functions. They are there for a reason and you need to be familiar with all controls if you are to operate machinery and equipment safely.



Operator Station Controls

- A – Operator Presence Lever
- B – Choke
- C – Throttle Lever
- D – PTO Switch Knob
- E – Key Switch
- F – Reverse Assist Tube
- G – Right Brake Lock
- H – Right Brake Lever
- I – Speed Selector Lever
- J – Reverse Lockout Lever
- K – Hour Meter (Optional)
- L – Left Brake Lever
- M – Left Brake Lock

➔ ACTIVITY 3

Select one of the most commonly used pieces of machinery/equipment in your workplace.

The machine or equipment selected is:

What is the task that you will use the machine/equipment for:

For any task you must be sure that you clearly understand the work instruction whether it is written or verbal. Quite often the person giving the instruction has a clear picture of what is required in their mind but their verbal instruction does not give all the information. If possible, in your own words, repeat what you are required to do to the person providing instruction. This helps to confirm that you fully understand what is required.

Complete the table below related to the machine/equipment you have selected.

Question	Your answer	What additional information, training, equipment should be provided to safely and competently operate the machine/equipment?
Is a licence required to operate the machine/equipment?		
Have you read and understood the operators hand book?		
Have you undertaken training on this machine/equipment?		
Are there any local restrictions that would prevent the use of this machine/equipment?		
What are the OHS requirements that apply to operating this machine/equipment?		
What Personal Protective Equipment is required to be used during operation?		
What are the work instructions applicable to your use of this machine/equipment?		

You will definitely have been given work instructions that stress the importance of pre-operational checks. The operator's manual for any machine/equipment will also give clear instructions regarding an appropriate pre-operational check. With any tool or machine we use, it is a good safety practice to check it out first before starting work. We need to know that the machine is not going to harm us or anyone else, that it is going to perform the job as it was designed to do and that it will work reliably.

The list of items that need to be checked can vary enormously. It can be as simple as a visual inspection or quite involved requiring the use of basic tools to perform checks and lubrication. In all cases, the operator's handbook should be read, this will identify all the items you need to check as well as identifying any safety hazards you may encounter while performing the checks.

If you have more than one type of a particular machine you should still consult the operator's hand book for each individual machine. The machines may all look the same but sometimes manufacturers make changes that are not obvious. You may have two machines that are the same type but different brands, they will probably have different service requirements.

A good place to start with pre-operational checks, is a visual inspection before the machine is moved. Imagine yourself as a crime scene investigator looking for evidence, you are looking for anything that may be a clue to warn of a possible failure.

In some cases if a problem is fixed immediately it prevents more serious damage and a more costly repair bill. You will need to look closely for any leaks or fluid loss, perhaps any marks on the ground where fluids may have leaked overnight. You will also need to be looking for loose or missing bolts, loose covers, possible cracks or an unusual build-up of dirt where there has been a slow oil leak and dust and dirt has started to stick to it.

One item that is often overlooked on pre-operational checks but must always be considered is vandalism. Some forms are external and quite visual like graffiti or broken windows. Some vandals will interfere with the internal components to try and cause mechanical failure. When you do your pre-operational checks, look out for any unusual signs of possible interference, particularly around fill and inspection points of the engine, radiator, brake fluid, fuel and hydraulic tanks.



TRUE STORY

An operator of a large front end loader on a council work gang was performing his usual pre-operational checks when he noticed a small amount of sand around the oil fill point on the top of an engine. Concerned about the sand he didn't start the engine and called a mechanic. They found sand had been tipped in the oil fill point on the top of the engine. They were able to clean all the sand out and avoid costly damage. If the operator hadn't noticed the sand when he started the motor, the engine oil would have carried the sand through the motor and caused substantial damage.

Lets take some time now to look at the most likely pre-operational checks required on most machinery.

Tyres

Look for any cracks or damage to either the walls of the tyre or the tread area as well as the general condition of the tyre. The inside wall of the tyre can sometimes get damaged and may not be visible from just walking around the machine, you may have to get down on your hands and knees and look under the machine to check. The tyre pressure needs to be checked as well, this may be visual and then check with a gauge once a week.

Fuel, Oil and Brake Fluid

The fuels and oils will need to be checked. If topping up is required cleanliness is important, as any small dirt particles that enter the system will cause early failure. There are a wide range of oils available and many of them are quite different in their properties. If you have to add oil, you must consult the operators handbook for the correct oil type.

Coolant

The coolant level must only be checked with the engine cold and if topping up is required, the correct coolant must be used. Dust and grass build up around the radiator core can cause an engine to overheat and needs to be blown out. A visual inspection of the radiator hoses is also required. Cracks or swelling indicate the hose is about to fail.

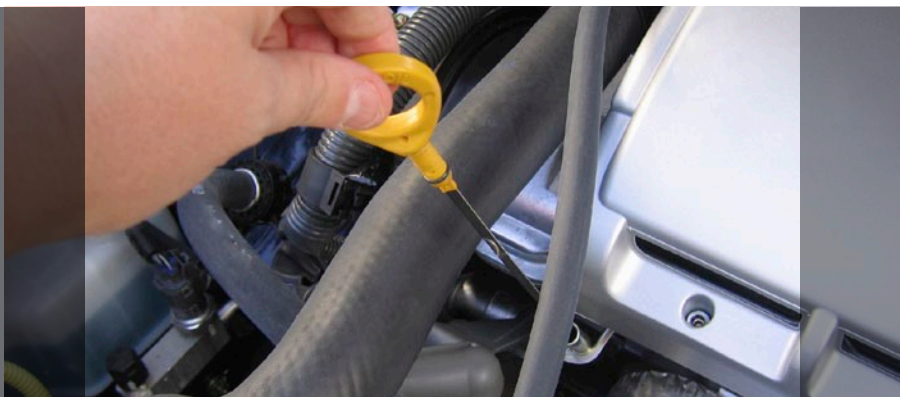
Battery

Most modern batteries are maintenance free, however if there is corrosion around the terminals, you will need to get them attended too. The battery must be secured in place with a clamp to reduce the risk of a short circuit and possible fire.

Belts, Hoses, Chains and Cables

Fan belts and drive belts do wear out. Belts should be replaced if there are any signs of cracking. They should also be checked to ensure they are not loose as this will lead to an engine overheating and early failure.

Hoses, chains and cables need to be inspected for damage or wear marks. All hoses and cables should be secured and not hanging loosely where they can get caught on something or drag on the ground.



Air Filter

The air filter is normally serviced during routine maintenance, however in very dusty conditions the operator may be required to clean the filter. If you are to service the air filter, you will need to be shown how to do it because an incorrectly fitted filter in dusty conditions will lead to engine failure very quickly.

Blades and Cutting Edges

Blades and cutting edges on a machine are usually the areas that require regular inspection and routine maintenance. The operators hand book must be consulted to determine what components will wear and what the acceptable wear limits are. Items that are worn past their acceptable limit can dislodge and cause personal injury or not cut correctly and severely reduce the efficiency of a machine.

Below is a picture of a mower blade being sharpened. If the blades are left blunt the mower will not cut the grass well, the engine will also have to work a lot harder and use more fuel.

Adjustments or Calibration. **NOTE – adjustments should never be performed with the engine running.**

With any machine that has operating adjustments, they need to be checked before you start to use the machine e.g.

A mower cutting height may have been set very low by the previous operator using it on a smooth grass pitch. You need to use the mower to clean up around trees on the golf course. The height will need to be lifted or you may throw rocks and dirt everywhere.

A sprayer can be set at different operating pressures for different applications and conditions. If you start using it without checking the settings you may end up not applying enough spray or possibly apply too much spray.

At all times consult the operators hand book to ensure the machine is not operated outside the operational range it was designed for.



Below is an example of instructions you will find in an operators hand book related to adjusting a mower cutting deck height.

The mower deck height adjustment consists of seven different cutting heights. The seven cutting heights range from 38–114mm (1-1/2 – 4-1/2 in.) when front caster wheel (A) is located in lower mounting hole in the yoke (B), as shown.

The cutting height label (C) indicates the proper hole placement.



CAUTION: Avoid injury! Rotating parts can catch fingers, loose clothing, or long hair. Wait for engine and all moving parts to stop before leaving operator's station to adjust or service machine.

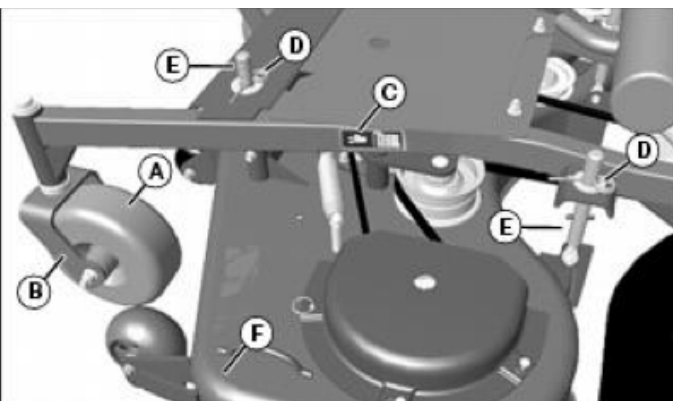
To change mower deck cutting height:

- Park machine safely. (See Parking Safely in the SAFETY section.)
- Pull out height adjustment locking pins (D) from both suspension pins (E).
- Lift or lower mower deck using handle (F) to the desired mower deck height as shown on the decal. A handle is located on each side of the mower deck.
- Replace locking pins into appropriate holes in deck suspension pins.
- Repeat procedure for other side of deck.
- To maintain a level mower deck, both sides, front, and rear of the deck must be adjusted equally.

➔ ACTIVITY 4

What is the purpose of item "F" in the picture below?

Is there any reason why the operator couldn't put their hand under the edge of the mower and lift rather than use item "F" ?



→ ACTIVITY 5

Select a machine that requires adjustment or calibration that you routinely use in your workplace. Using the operators manual as a guide summarise the specific adjustment or calibration process for that machine to ensure it is correctly set up for your work task.

Adjustment or Calibration			
The machine is:			
Make:		Machine:	
The work task is:			

[illegible]

After adjustments or calibration you should always take the time to run through the machines functions. Using the operators manual, have a look to see if there are any special start up or shut down procedures.

When you start the machine you are looking to identify any hard starting problems, unusual or excessive noises and that all your gauges and warning lights are working as they should.

Carefully try the brakes, clutch, transmission and steering for correct operation.

You should then try all the functions of the machine, checking that they are working as they should and there are no unusual noises or vibrations.

Below is an example of a checking process for the safety cut out systems on a specific self-propelled walk behind mower. Each machine will be different, you will need to check the operator's hand book for your particular machine. The safety systems are there to protect you from harm so you need to check that they are functioning correctly.

Testing PTO Switch

1. Start engine.
2. Release operator presence levers.
3. Pull PTO switch knob up to engage PTO.

Result: The engine must stop.

Testing Neutral Switch (Start)

1. Lock park brake.
2. Push PTO switch knob down to disengage.
3. Set speed selector in any gear except Neutral "N".
4. Pull starter handle to try and start engine.

Result: The engine must not start.

Testing Neutral Switch (Run)

1. Lock park brake.
2. Start engine.
3. Push PTO switch knob down to disengage.
4. Release operator presence levers.
5. Set speed selector in any gear except Neutral "N".

Result: The engine must stop.

Testing Operator Presence Switches

1. Start engine.
2. Push throttle to the 1/2 position.
3. Engage an operator presence lever.
4. Pull PTO switch knob up to engage PTO.
5. Release operator presence lever.

Result: The engine must stop when an operator presence lever is not engaged with the PTO engaged.

Testing Park Brake

1. Inflate tyres to correct pressures.
2. Stop machine on a 17° slope (30% grade). Stop engine and lock park brake by engaging thumb locks.

Result: Park brake must hold the machine stationary. Machine should move no more than 61 cm (24 in.) in one hour.

If machine moves more than that, brake needs to be adjusted. (See Adjusting Park Brake).

→ ACTIVITY 6

Select a machine that you regularly operate in your workplace. Read the operators manual and summarise the safety cut out systems for that specific machine.

Regularly Operated Machine			
Machine type:			
Make:		Model:	

[illegible]

Covers and Guards are in place on a machine for a reason!

If a safety cover or guard has been removed, the machine should not be used. It is a legal requirement for all Power Take-Off Shafts to be fitted with an external cover. The cover must be in good condition and held in place with chains so that it does not spin when the Power Take-Off Shaft is turning.



Power take-off shaft fitted with cover and safety chains – the chains stop the outer cover from spinning while the internal shaft is turning.

Hitches, Towing Points and Secure Loads

This is a full subject in itself and detailed information can be obtained from the National Transport Commission web site <http://www.ntc.gov.au/viewpage.aspx?documentid=00862>

Any equipment that is attached to or loaded onto a machine, truck or trailer must be secured correctly. Anything not secured properly may dislodge and cause personal injury or damage to the machine. In addition an unsecured or dangerous load may result in an accident, in which case you can be certain of prosecution. You can also be stopped by authorities and fined if your load is not properly restrained.

The driver, the person who loaded the vehicle, the supervisor, contractors and the business owner can all be fined or face prosecution. As the driver of a vehicle, you are ultimately responsible because you are in control of the vehicle. If you have not been trained in load restraint and are not certain of your responsibilities, then you should not drive the vehicle. The employer has a number of responsibilities, and one is to ensure that employees and contractors are trained in load restraint.

EXAMPLE Did you know that in some cases if the floor of the truck is slippery and the surface of the load sitting on the truck is slippery, that you will require four 50mm web straps (rated at 2 tonne each) to secure a half tonne load.

Reference: National Transport Commission – Load Restraint Guide 2004, pg 9.

As a driver you are also responsible for not overloading a vehicle or trailer. For example a 6 x 4 single axle trailer without brakes is only allowed to carry ½ tonne, even though most 6 x 4 trailers can hold a lot more. If you hire a machine you will need to know the weight of that machine if you are transporting it. Some hire places provide a trailer with a machine. The towing vehicle you may use will also have towing capacities and this information is in the operators hand book. The tow hitch will also be load rated and will have a plate attached to the tow bar stating the maximum capacity.

Knowing the weight of the machine you are using is also important. For example if you have to drive across a paved area to access a work area, you can cause considerable damage if the pavers are only meant for pedestrian traffic.

The *National Transport Commission – Load Restraint Guide* also provides advice on how to correctly secure vehicles and equipment for transport. You can access the Load Restraint Guide via the following link.

<http://www.ntc.gov.au/viewpage.aspx?documentid=00862>

Turbo-Charged Engines

This type of engine is increasingly common especially in farming. A turbocharger improves the efficiency and increases the power of an engine. When working the turbocharger spins very fast and is exposed to very high exhaust temperatures. Shutdown requirements vary between manufacturers so check the operators hand book. As a general rule, if an engine has been working, before you switch it off the turbocharger needs to slow down and normalise in temperature. To do this you will need to let the engine idle for 5 minutes before switching it off.

Tag Out

It is of utmost importance that if a machine is identified as faulty, needing repair or a safety guard has been removed, that it is not put back in the shed for someone else to inadvertently pick up and use. The piece of equipment needs to be clearly tagged as not to be used. The tag should identify:

- the reason why it is not to be used
- the name of the person who identified the fault

If you tag out a piece of machinery or equipment, you should report it to your supervisor who will arrange for the situation to be rectified.

Below are some samples of different types of warning tags that can be attached to a machine that is faulty.

Cleanliness

Any machine that performs work will eventually wear and require maintenance or replacement. How often depends on the type of machine, the sort of work it does, the environment it works in and the way the operator uses it. As an operator you are responsible to ensure that any machine is kept in good condition.

Keeping the machine clean enables you to accurately inspect wear components, identify loose or missing bolts, damaged hoses and wiring or structure cracks.

Another important reason for cleanliness is to stop spread of disease or weeds. For example there is a potato cyst nematode that is easily spread as vehicles and machinery move from paddock to paddock and other properties. Vehicle and personal hygiene is critical to stop the spread. Mowers used by council can spread noxious weeds as they move from one site to another. Cleaning the mowing deck after each job will help stop the transfer of weeds.

Refuelling

When refuelling a machine, cleanliness is important, particularly for equipment that works in a dusty and dirty environment. Before removing the fuel cap, use a rag to wipe away any build-up of dirt from around the filling point. When using a funnel wipe it clean just before you use it and if possible use a funnel that has a gauze filter. When filling from a fuel container, never tip the last dregs of fuel from the bottom of the container, they will most likely contain dirt and moisture particles that have settled in the bottom.

Always make absolutely certain that you are using the correct fuel.

- Diesel in a petrol motor – can be a costly inconvenience.
- Petrol in a diesel motor – is a costly inconvenience and in some cases can cause considerable damage to the fuel components.
- Two stroke motors if run with straight petrol can be totally destroyed within a few minutes. Different manufacturers run different mixes of oil and fuel, some may run 25:1 some 50:1. Running the incorrect ratio will lead to maintenance issues. Always check the operators hand book for the correct fuel / oil mix. Two stroke fuel containers should be clearly marked with the fuel / oil ratio.



➔ ACTIVITY 7

In the picture below what would you do to improve the fuel storage at this workplace?



→ ACTIVITY 8

List at least 7 different types of machines you regularly use in your workplace. For each machine list the correct fuel type/ ratio of mix. What would happen to this machine if incorrect fuel is used?

[illegible]

4. OPERATE MACHINERY

AND EQUIPMENT

In the previous sections of this workbook you have looked at pre-operational checks, safety and cleanliness. Now we progress to the actual operation of a machine or piece of equipment. As a number 1 rule :

All machinery and equipment must always be operated in accordance with manufacturer's specifications, work procedures and statutory requirements.

→ ACTIVITY 9

Click on the You Tube video link below and watch the short video.



Click here view the video "Ditch Witch Trencher Safety "

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=MjvHml03t9Y>

The narrator says that you work hard and are bombarded with priorities, what are these 4 priorities?

1.

2.

3.

4.

When operating a pedestrian trench digger and you are working on a slope, what precautions should you take to prevent a roll over?

1.

2.

List the 6 things that you the equipment operator have responsibility for:

1.

2.

3.

4.

5.

6.

➔ ACTIVITY 9 CONTINUED

This video is an American production and it tells you as part of your preparation you should call “one call service” to have existing underground lines and services located.

In Australia we have a similar service, what is that service called?

The service can be contacted by ringing 1100 or at www.1100.com.au

What can this service provide to you as an operator of a machine?

➔ ACTIVITY 10

Click on the You Tube video link below and watch the short video.



Click here view the video “Operating a Self Propelled Trencher”

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=FTKQjMFh2X0>

When you are using a walk behind machine which way do you travel when digging?

What hazards could you encounter when travelling in the direction you answered in the previous question?

➔ ACTIVITY 11

Click on the You Tube video link below and watch the short video.



Click here view the video "Steve on the Trencher"

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=V0puo8qYTcc>

What problems does Steve appear to be having as he drives the machine?

If Steve was to use this machine a lot and the ground was uneven and sloping, what injury could he possibly sustain?

➔ ACTIVITY 12

Click on the You Tube video link below and watch the short video.



Click here view the video "Pro Split Firewood Log Splitters"

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=s8ylaL-L02Q>

What safety equipment is the operator wearing?

➔ ACTIVITY 13

Click on the You Tube video link below and watch the short video.



Click here view the video "Ramsplitter Log Splitter Electric"

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=cbQPITx7wxM>

What do you notice at the feet of the operator as he walks in?

What safety equipment is the operator wearing?

When he splits the wood and drops it on the ground, what is it falling on?

What are your thoughts on the location of the stop switch, particularly in an emergency or if the operator is accidentally injured by the machine?

After watching all of the You Tubes in the above activity:

list 5 major points that are important related to small machinery operation.

1.	
2.	
3.	
4.	
5.	

There are many types of equipment that are used in work places across rural, regional and remote Australia. The following section discusses some of the most commonly used small machines/equipment.

Stationary engines

A stationary motor is a powerful tool we can use to perform work for us, however if it is not looked after it can become unreliable, expensive or possibly cause personal injury. Cleanliness is critical when refuelling or topping up engine oil, particles of dirt or water can quickly cause failure.

Using a stationary motor in excessively dusty conditions requires more frequent maintenance and the operators handbook should be consulted for service requirements in severe conditions.

Spraying equipment

Using spraying equipment is not simply a matter of putting some chemicals in the tank and going to kill a few weeds or pests.

Spraying equipment must be set up, calibrated and operated correctly. Applying chemicals too strongly will give excess application rates, increased cost, possible harm to plants that are not supposed to be affected, environmental contamination, and undue operator exposure. Applying chemicals at a low application may result in ineffective treatment and possible resistance build up particularly in pest organisms.

You must not operate the equipment without being trained and for most chemicals you will need to complete a chemical handling course first.

In your training you will cover things like; Duty of care, personal protective equipment, chemical poisoning, legislative requirements, chemical storage and handling, cleaning of equipment to prevent cross contamination, where and how to clean equipment, weather considerations, impact on other exposures like humans, animals, other plants, waterways etc.

Hydraulic equipment

A hydraulic system enables us to perform all sorts of tasks. With the simple movement of a lever you are able to exert considerable force. This means hydraulic equipment needs to be operated carefully and treated with considerable respect. Before using a machine in a location that requires accuracy, you should train with the machine in a large area where there is room for error.

Once you are competent with a machine you can then work in areas that require precision and accuracy.



➔ ACTIVITY 14

Click on the You Tube video link below and watch the short video.



Click here view the video "Adelaide Arborists "

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=jaV3WoVf0Y0>

How easily did the stump cutter grind the stump away ?

There are other things the operator would have to consider apart from using the machine to grind the stump. If you were the operator what would you do if some people came to watch the machine work?

What is the operator looking at as he drives the machine up the bank?

What problems would the operator encounter in wet conditions?

→ ACTIVITY 15

Click on the You Tube video link below and watch the short video.



Click here view the video "Bandit Model 65xp hand fed chippers"

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=himCc89qPZE>

List the possible issues that you need to be aware of when using this chipper ?

Click on the You Tube video link below and watch the short video.



Click here view the video "Worker pulled through woodchipper"

OR if you are using the printed resource, enter the address below into your web browser.

http://www.youtube.com/watch?v=ji_-m_ylq10

After watching this video by WorkSafeBC what additional things should you have added to the list you completed in the previous question?






Three point linkage equipment





The operators hand book should be consulted particularly if the machine has never been used on a particular tractor before. This is most important with anything that is driven by a power takeoff (PTO) shaft. Because of variations in tractor design they may require a different length PTO shaft. The PTO extends and collapses in length as the equipment is raised and lowered. If the shaft is too long, as the machine is lowered it will not be able to collapse to the length required and it will result in damage to the equipment drive, a bent shaft and possibly tractor damage as well.

The operators hand book will also need to be consulted to determine the correct operating speed. Too slow and it will not do the job properly and too fast will result in premature wear and failure of the machine.

Listed below are just a few pieces of machinery/equipment you may encounter in your work place:

Farming	Local Council	Horticulture	Construction	Mining/Infrastructure
Powered hand tools	Powered hand tools	Powered hand tools	Powered hand tools	Powered hand tools
Compressors	Compressors	Compressors	Compressors	Compressors
Concrete mixers	Concrete mixers	Generator sets	Concrete mixers	Quick cut saws
Generator sets	Pedestrian rollers	Steam cleaners	Pedestrian rollers	Generator sets
Steam cleaners	Concrete saws	Concrete mixers	Quick cut saws	Lighting sets
Spray units	Generator sets	Spray units	Concrete saws	Steam cleaners
Water pumps	Lighting sets	Water pumps	Generator sets	Water carts / pumps
Slashers	Steam cleaners	Rotary hoe	Concrete vibrators	Rock drills
Augers	Brush-cutters	Fertilizer spreader	Water pumps	Laser levellers
Post hole borers	Spray units	Fire pumps	Brick/masonry saws	Drilling rigs
Fire pumps	Brick/masonry saws	Refuelling trailers	Jack hammers	Core sampling rigs
Refuelling trailers	Mowers	Bird netting applicators	Post hole borers	Refuelling trailers
Motor bike	Refuelling trailers	Cultivators	Laser levellers	Crushers
Bailer	Mulchers	Harvesting equipment	Refuelling trailers	Water transfer pumps

Tool	Image	Typical Job
Jack Hammer		Breaking up concrete and rock.
Grain Auger		Transferring grain from storage silo to truck.
Ride on mower (zero turn)		Mowing large parks that have trees and other obstacles to mow around.
Brush cutter		Mowing around trees and shrubs and in uneven or rough terrain that cannot be cut with a conventional mower.
Hedge trimmer		Trimming hedges and shrubs.
Quick cut saw		Cutting concrete and brick walls.
Generator		Operating drills, grinders, welders, lighting etc. where there is no mains power.

Petrol driven pump		Transferring water, irrigating, fire fighting.
Terrazzo surfacer		Grind, edge, buff or restore terrazzo, granite, marble or stone.
Steam cleaner		Cleaning equipment using high pressure hot water.
Petrol powered cement mixer		Mixing up small quantities of cement in locations where there is no power.
Ride on trench digger		Digging trenches for services such as power, water, irrigation, gas, etc. however this machine has a number of attachment options, the trench digger disconnects and items such as bucket, blade and post hole borer can be quickly fitted.
Walk behind rotary hoe		Cultivating smaller areas such as in nurseries, small flower beds or cultivating between row crops.

➔ ACTIVITY 16

Think about everything you have completed in the work book so far. Remember that you have looked at pre-operational checks, safety, operating conditions, unsafe equipment and different types of equipment. Complete the table below specifically considering your workplace and 3 types of machinery/equipment you operate regularly. Make sure you consult the operator's manual to answer the questions correctly.

Type of machine/equipment	Pre-operational checks	PPE & safety mechanisms	Training required	What are the risks/hazards in operating this machine/equipment

Work Quality Requirements

Once you are trained and are familiar with a machine then you will need to use the machine in the workplace. The expectation is that you will use that machine to:

- perform the work it was designed to do
- complete the job to specifications

It may be that using a trench digger, you have to dig a straight trench 100 meters long, no less than 300 mm deep and no more than 500 mm deep.

To perform this task you will need to know your machine and what it is capable of. It will not be acceptable to go and dig a trench and after finishing telling your supervisor that the machine you used was only capable of digging down 200 mm when the trench had to be 300–500 mm deep.

➔ ACTIVITY 17

With specific reference to your workplace, describe 2 situations where you are required to operate machinery/equipment to precise specifications.

My workplace is:

Situation 1 requiring machinery operation to precise specifications is:

How do you ensure you meet the precise specifications of the job:

Situation 2 requiring machinery operation to precise specifications is:

How do you ensure you meet the precise specifications of the job:

5. MACHINERY

AND EQUIPMENT IS OPERATED IN A SAFE AND CONTROLLED MANNER

Machinery and equipment need to be considered as a source of energy we use to perform work for us. The machinery or equipment helps us to:

- make our job easier
- perform tasks more quickly
- complete tasks safely with a reduced chance of injury to ourselves

Unfortunately, if machinery and equipment is not operated in a safe and controlled manner, that same source of energy that should be working for us can be turned around and cause us serious harm.

Think about the following examples:

Ride on Mower – Your foot goes under the cutting deck of a ride on mower while the blades are still spinning.

Small Trench Digger – You are using a trench digger across the side of a hill on uneven ground, the wheel falls in a hole and the machine tips, you try to stop it tipping and the machine falls on you.

Post Hole Borer – A loose shirt sleeve gets caught in the rotating auger and pulls your arm in.

→ ACTIVITY 18

Think of 2 situations where the energy of a machine or piece of equipment that you use in your workplace could cause injury instead of performing the work it was supposed to do. Think of all the reasons why you think an injury could happen?

Type of machine	What are the potential injuries?	What can go wrong to cause these injuries?	What should you do to minimise the chance of these injuries occurring?

JSA's or Safe Work Method Statement

A JSA (job safety analysis) or a Safe Work Method Statement is a document that is prepared for a task that has the potential to cause injury or harm. It is prepared before a job is started and it identifies any hazards that may be associated with the work to be performed. It then outlines how the job should be carried out to minimise the risk to yourself, others, property or the environment.

If there is a JSA for a particular task, as an operator of a machine, you have the responsibility to be familiar with that JSA. You will then need to think about the task and work out how you will apply that information to the work you are about to perform. If in your assessment you identify a hazard that has been missed or possibly a hazard that may be created as you are working, then you must tell your supervisor before you start work. Then together you will need to determine the most suitable way to reduce the hazard and minimise the risk.

Not all work places will use JSA's but there is nothing stopping you from carrying out your own JSA before you start work, no matter how small the task. Before you unload your machine and start work, have a quick walk around looking for hazards or problems that may eventuate. If a problem is identified early it may prevent personal injury, damage to the machine or loss of valuable work time.

➔ ACTIVITY 19

Click on the You Tube video link below and watch the short video.



Click here view the video "John Deere tractor stuck in garbage dump "

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=WIPYVhKzq08>

Why did the operator of this machine get into trouble?

What would have been a better option?

While using a machine can save us a lot of work and save considerable time it can also cost a lot of time and money when things go wrong. You need to know and understand the capabilities of the machine you are using and have assessed the job before you start work. The slope, ground surface and weather conditions can change a simple job into one that is too dangerous to perform. The rule of thumb should be: if you are uncertain, do not proceed without checking with your supervisor.



Remember that while a machine is designed to save us work every piece of equipment has limitations. It is critical that you clearly understand those limitations and do not operate a machine over a stated limit. There are 2 particularly dangerous issues that can occur during machinery operation where a machine is operated outside its stated limits. These are:

- Overloading equipment – When a machine is made it is designed to carry a specific load, by overloading a machine it will cause premature wear, possible breakage, collapse or instability resulting in roll over.
- Towing, pulling or lifting with a machine that is not designed for that task or is incorrectly hitched can be an extremely dangerous practice. When towing anything, the connection point must be below the centreline of the rear axle and as close to the ground as possible.

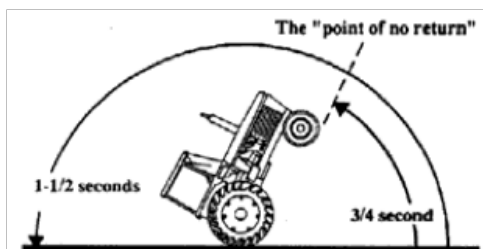


Figure 3. The "point of no return" during a rear turnover may be reached in 3/4 of a second.
(Source: Agricultural Safety, Deere and Company, Inc.)

→ ACTIVITY 20

Click on the You Tube video link below and watch the short video.



Click here view the video "Tractor Fail Flip Over Crash!"

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=73Ytlmsm9Zs>

What went wrong?

In addition to operating the machine or equipment within the stated limits of the machine there is also the expectation that the operator observes all personal Occupational Health and Safety requirements. These are likely to include:

- Don't operate machinery under the influence of alcohol, drugs or prescription medication
- Don't operate the machinery without training
- Use all correct Personal Protective Equipment

ALCOHOL and DRUGS (including prescription drugs)

Alcohol and drugs can affect your ability to exercise judgement, coordination, motor control, concentration and alertness and it can result in injury to yourself or someone else. If you are affected by alcohol or drugs, you should not operate machinery or equipment.

➔ ACTIVITY 21

Click on the You Tube video link below and watch the short video.



Click here view the video “A Deadly Silence”

OR if you are using the printed resource, enter the address below into your web browser.

<http://www.youtube.com/watch?v=lUDlIhfBi8A>

TRAINING

There are two areas of training you will require to operate a machine:

1. The machine features, how it works, what it can and can't do, what are the hazards and safety features, and how to operate and maintain it.
2. How to use the machine in a working situation and in different environments.

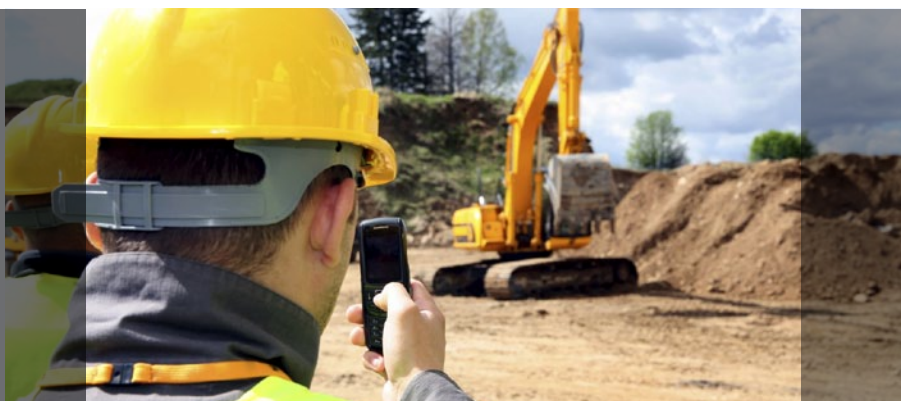
On the site below you can view an excellent training video on using a Stihl cut-off machine.

<http://www.stihldealer.net/videolibrary/OnePlayer.aspx?v=14&vt=14&vb=1&id=14>

PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE does just what the name suggests, it provides you with some form of protection and is worn for a very good reason. However, if it is not used correctly and looked after it is of no benefit. For example:

- If ear plugs are not used correctly your hearing may still suffer. Not looking after your ear muffs by letting them sit in the sun or bounce around in your tool box may cause the pads to become hard or distorted and they will not mould to the shape of your head and no longer give you adequate protection.
- If you leave your safety vest loose and flapping, it could get caught in a moving part and cause injury.
- High visibility clothing that is not kept clean is nowhere near as effective.
- Passengers must only be carried where there is a seat provided by manufacturers.



In addition to ensuring you are operating machinery and equipment with correct PPE, you should also consider the safety of any other person who may be in proximity to the machine. Examples of safety hazards to yourself or other people that can be caused by the machine operator include:

- EXCAVATIONS – any excavation must be barricaded off and sign posted to keep people away.
- COMPRESSED AIR – can easily dislodge loose material and propel it through the air and cause injury. Skin can easily be torn away when air is directed at it.
- NOISE – exposure to loud noise can cause permanent hearing loss. When we cut ourselves we feel the pain and see blood, unfortunately in most cases people are completely unaware they are damaging their hearing until it is too late and the damage is done. Once you damage hearing, it never recovers.
- VIBRATION – when using a vibrating plate or vibrating roller, noise and vibration may transmit along the ground and cause considerable discomfort to people close by. If this is the case, it may be that you will need to operate the machine at a time that will affect the least amount of people.
- DUST – can cause minor irritation or can lead to respiratory problems depending on the amount of dust and what is in the dust. Wearing a dust mask may not be comfortable but it stops the dust particles from entering your lungs.
- NON-MECHANICAL HAZARDS – there are a vast array of hazards we may also encounter in the workplace that are as a result of using machinery and equipment including:
 - Harmful emissions such as exhaust gas when used in confined spaces.
 - Gas under pressure exploding.
 - Chemicals and chemical by products such as sprays or cleaning solvents causing poisoning.
 - Hydraulic oil under very high pressure and usually high temperature causing injury.
 - Steam from engine radiators or steam cleaner causing burns.
 - Batteries spilling sulphuric acid, hydrogen gas causing injury.
 - Fuels that are flammable or carcinogenic causing injury.
 - Uneven, unstable and steep terrain – potholes, ditches, gullies, creeks, drains, embankments causing difficult operating conditions may result in an accident and injury.
 - Electricity – overhead or faulty power tools and cords resulting in injury.
 - Extreme weather conditions – lightening, heat, UV rays, cold, wind, rain, hail, snow.

→ ACTIVITY 22

List all of the PPE and why it is used for machinery and equipment in your workplace.

[illegible]

Safe Operating Procedures:

Each workplace should have safe operating procedures, particularly where a hazard exists.

For some hazards there are procedures in place that are law – like purchasing, handling and storage of some chemicals. Your workplace will have specific work instructions related to safe operating procedures for issues that apply to that workplace. Some detailed examples include:

- Underground services

If you are digging a trench, or excavation you need to know what services are below, there could be power, water, gas, sewer, telecommunications, stormwater, etc. Each of these items have specified distances that they are located underground, and at the time of installation they were probably correct. Over the years however soil is sometimes added or taken away and it is not uncommon to locate some services just below the surface. Within each state there are authorities who can come out and identify any underground services. If these authorities are not consulted, you risk personal harm and possibly huge expense if you damage a service.

- Overhead services

Overhead power lines are a hazard that is easily forgotten about. If you operate a machine that can go anywhere near a power line, then you need to know the recommended safe working distance. The recommended safe working distance varies from state to state, so you should check with your state OHS authority.

A workplace should also have safe operating instructions applicable to machinery and equipment operation where:

- multiple machines are operating simultaneously
- chemicals are transported, handled and used
- traffic control is required
- operators are working at heights
- operators are working in proximity to others
- machinery is operated around visitors and general public

→ ACTIVITY 23

Select one activity involving the use of machinery or equipment in your workplace where other people are in close proximity during operation. Describe the operating procedures that are expected to ensure every persons' safety.

6. CHECK & COMPLETE

MACHINERY AND EQUIPMENT OPERATION

Once you have finished using a machine you will need to complete post operational checks to ensure it is ready for the next job. Exactly what you do and when you do it will vary depending on:

- What sort of machine it is?
- How often it is used?
- Are you the only employee who uses this machine or is this machine operated by a number of employees?

Typically you would expect that as a minimum, the post operation tasks would be to check the machine over for any damage or safety issues and refuel it so that it is ready to go the next day. However if a machine is used infrequently, it should be cleaned thoroughly before being put away otherwise dirt and grass will harden and become difficult to remove. The residue will also become a moisture trap and cause corrosion. Thorough cleaning also enables you to clearly see any cracks starting to appear, loose or missing bolts or worn parts. By identifying and fixing faults early, you will minimise the repair bill and reduce the chances of machine failure while it is in use.

Some employers prefer the employees to do a basic check at the end of the day, let the machine cool, then first thing in the morning carry out the routine maintenance before starting work.

When you finish with a machine, make sure that it is parked in a suitable location, that you haven't blocked vehicle or person access and that you are not restricting access to emergency exits or fire extinguishing equipment. Where ever possible park on flat ground, lower all equipment, apply the hand brake, switch the engine off and remove the keys.

If the machine is parked and left in a public area you will probably be required to position warning signs, safety triangles or witches hats or possibly safety barricades. You may also be required to fit lockable covers to minimise damage by vandals.

➔ ACTIVITY 24

Look at the operator manual and also consult your supervisor. For at least 4 types of machinery or equipment used in your workplace, list the post operational checks that are required.

Type of machinery/equipment	Post operational checks	What potential problems are identified or prevented by completing these checks?

7. MONITOR

EQUIPMENT AND MAINTAIN RECORDS

In this workbook so far we have talked about pre-operational checks, safety, operating the machinery or equipment and post-operational checks. As an employee operating machinery or equipment it is your responsibility – under Occupational Health and Safety - to be familiar with that machine, to be trained in its use and to operate it correctly.

The operators hand book identifies areas that require maintenance and inspection and how often it should be carried out. There are aspects of routine maintenance that you will not perform, however you may need to know what is required so that you can arrange for that work to be carried out by suitably qualified personnel.

Some workplaces may have a recording system where you record the amount of hours the machine has worked, possibly what maintenance you have performed, the amount of fuel used and any items that you have identified that will require maintenance by trained personnel. Usually this information is passed on to a supervisor for follow up.

Communication with your supervisor and possibly your maintenance provider is essential if you are operating equipment and machinery. If you have a problem with a machine you may need professional advice to determine if it is ok to continue, or it may be that you have to stop to avoid further damage.

For routine repairs and maintenance you will need to pre-plan to determine the most suitable time for the machine to be off line. It may be that you will need to obtain a replacement machine or rearrange work activities.

You must also consider that in the process of operation and maintenance, you are likely to accumulate materials that must be correctly disposed of or recycled.

Environmental implications associated with the operation of machinery and equipment may include:

- negative environmental impacts which may result from
 - excessive noise and exhaust emissions
 - the incorrect use and disposal of maintenance debris, e.g. oils, containers, chemical residues
 - hazardous substances, e.g. fuel, fertiliser
- impacts may also include run-off flows of water and cleaning agents from servicing, maintenance and cleaning activities, soil disturbance and dust problems from high speed and frequent traffic (including irrigation equipment).

➔ ACTIVITY 25

This is the final activity for this workbook. Complete the table answering the questions specifically related to 3 types of machinery or equipment used in your workplace.

Machinery/ equipment type	What maintenance records are kept?	Who uses the maintenance records and why?	What environmental issues may be created by the use or maintenance of the machine?	How are the environmental issues managed?

8. BEING CONFIDENT

ABOUT YOUR SKILL LEVELS IN THE WORKPLACE

After finishing all of the activities in this workbook you should be able to competently complete final summative assessments. Do you feel that you are confident about your skill levels in the workplace related to machinery operation and maintenance?

Use the table below to help you check your skills. Before commencing your final assessments it is important to review any sections in which you feel unsure.

Remember: it is always OK to ask your supervisor or your assessor questions.

In the table below, read the list of skills and knowledge you should have after completing this workbook.

1. Put a tick in the column if you can do this now and a brief comment re why you believe you have this skill.
2. Put a tick in the next column if you feel you need more practice and a brief comment as to why.
3. If you require further training, complete the third column listing what training is needed. Show this list to your supervisor or assessor and ask for more time or training before completing the summative assessments.

Skills/knowledge you should have			Comment on why	What additional training do I need
	Yes	Need practice		
Collecting analysing and organising information with regard to machinery and equipment, safety procedures and their application.				
Planning and organising activities involving maintenance and repairs to machinery and equipment are planned and coordinated around work schedules or sequenced as required.				
Working with others and in teams. May be applied in methods and procedures to complete maintenance and job functions to achieve work plan requirements.				
Using mathematical ideas and techniques. May be applied in the calculation and measurement of load weights, distance, consumption and oil and fuel requirements.				
Solving problems may relate to machinery and equipment breakdown, faults or malfunctions.				
Using technology to communicate, measure and record information with regard to maintenance, usage and performance of machinery and equipment.				

9. ASSESSMENT

You have now reached the end of this workbook. All of the information and activities you have covered apply to the skills related to small machinery operation and maintenance in your workplace. In particular, assessment must confirm the ability to:

- operate machinery and equipment to industry standards
- read and interpret manufacturers specifications, work and maintenance plans, and Material Safety Data Sheets
- interpret and apply instructions, communicate with work team and supervisor, record and report equipment faults, workplace hazards, and accidents
- select and utilise various features and controls of a range of machinery and equipment to carry out tasks
- carry out work and maintenance plans
- determine appropriate operating methods
- carry out routine maintenance and basic repairs
- maintain records
- demonstrate safe workplace and environmentally responsible practices
- transfer the skills and knowledge required to operate machinery and equipment to a different work environment, e.g. this could include different machinery and equipment, workplaces and conditions of use

Please ask your assessor for the final assessment/s for this workbook

➔ FEEDBACK

This workbook has been developed to guide users to access current information related to gaining skills appropriate to their workplace. Please complete the following table notifying us of any errors or suggested improvements.

Subject Name	
Book Number	

Page	What is the error	Suggested improvement
10	You tube video is not accurate	Better websites / You Tube example

Is there a link to your suggested improvement

Additional comments



Click here to email your completed workbook to your assessor.

10. BIBLIOGRAPHY

AND SOURCES FOR CONTENT IN MATERIALS

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