



Operate small plant and equipment

RIISAM204D

- In this unit you will learn how to:
 - Plan and prepare for work;
 - Conduct pre-operational checks;
 - Use small plant and equipment;
 - Carry out operator maintenance; and
 - Clean up after work.

- A vast range of plant and equipment is available for use in the civil construction industry.
 - Basic plant and equipment is the type of plant and equipment in general use on a construction site that does not require the operator to possess a specific licence to operate.
 - If you are to use a piece of plant or equipment for the first time, it is most important that you seek guidance in its safe and proper use.



- Using a single direction vibratory plate compactor.



- Using concrete vibrators.

- There are five (5) broad compliance requirements you need to know that apply to your work.
 - Government legislation or Acts and Regulations, as well as Codes of Practice.
 - Australian Standards.
 - Company policies and procedures.
 - Site management plans.
 - Engineer's specifications and project specific plans.

- You must make yourself aware of the site regulations before work commences.
 - Not doing so could halt work and incur penalties or additional costs.
 - Some worksites will have specific requirements relating to:
 - Start up times and hours of work;
 - Site disturbance and dust;
 - Service locations;
 - Site drainage;
 - Traffic control;
 - Hot work permits; and
 - Permission to dig permits.



- The task you have to carry out can be given to you in a number of ways.
 - A verbal direction given by a supervisor to carry out the work.
 - Being told what to do.
 - A company work order.
 - Written instructions.
 - A written instruction given to you by a supervisor, engineer or inspector.
 - A subcontract to perform the work.
 - Written specifications.
- You should always consult your worksite supervisor to confirm the instructions or determine the scope of the work.

- An important part of job planning is to locate the worksite and clearly establish the boundaries that will surround your working area.
 - The area should be checked for:
 - Potential hazards and the risks to the public, the environment and the workers; and
 - Types of materials and equipment required to carry out the work.
- The worksite and its boundaries may be identified from work orders and plans and specifications.



- How do you get work instructions in your company?
- What method do you prefer?
- Have you ever known work instructions to go wrong?
 - How can this be fixed?



- A worksite safety plan will have been developed for the site to ensure the safety of all workers prior to the commencement of work.
- The plan will cover matters relating to:
 - Site access;
 - Site emergency procedures;
 - Personal protective equipment (PPE);
 - Safe work procedures; and
 - Site rules.
- Safe Work Method Statements or SWMSs should be developed for each routine task involved with your project.



- Identify and become familiar with:
 - Worksite access – a planned area
 - Worksite emergencies – what to do
 - PPE – must wear
 - Hazards and risks – be aware of what they are
 - Mobile equipment
 - Utilities – underground and overhead
 - Records – accessible
 - Locating services on site – Dial Before You Dig
 - Underground services – potential to damage
 - Spotters – use in areas around services.



- Pipe and cable locating devices as shown should be used when working from old records and any inaccuracies in records should be notified to the relevant authority.

- Safety signage and barricades must be erected before work commences according to site procedures and the traffic management plan.
 - These may include:
 - Mandatory signs (blue and white)
 - Prohibitory signs (red, black and white)
 - Warning signs (black and yellow)
 - Danger signs (red, black and white)
 - Emergency information signs (green and white)
 - Fire related signs (red and white)
 - Hazchem signs
 - Hazard/barrier demarcation tape.



- Once you have identified the services that may be affected by civil construction work it is important to make sure others working on the site are aware of their location.
 - **Warning Barricades**
 - These barricades call your attention to a hazard but offer no physical protection.
 - They are usually barrier tape, mesh, stands or posts.
 - **Protective Barricades**
 - These barricades call your attention to a hazard and provide physical protection.
 - In all cases, signage must be erected on either side of the barrier stating the nature of the enclosed hazard.



- The design and job requirements must be taken into account when selecting plant, tools and equipment, to ensure that they meet the requirements of the job.

You may be required to use:

Power rammers or impact compactors	Pumps	Concrete mixers	Quick cut saws	Brushcutters
Tampers	Generator sets	Concrete vibrators	Jackhammers	Mowers
Vibratory plate compactors	Compressors	Concrete saws	Lifting equipment	
Drum rollers	Lighting sets	Brick or masonry saws	Wet and dry vacuum cleaners	



- Before you start work, carry out a pre-operational check on all of your tools and equipment.
- Tag defective equipment and report it to your supervisor.

- Each State or Territory has their own environmental protection legislation which requires all personnel on the worksite to take all reasonable and practicable measures to prevent or minimise any environmental damage resulting from their work.
 - It is important that all possible sources of risk for the worksite are identified and procedures followed to:
 - Minimise the environmental impact;
 - Comply with the Act; and
 - Avoid prosecution for the workers and the company.



Personnel have a duty to notify of any activity that could cause environmental harm involving:

Land contamination	Sediment control	Waste	Vibration
Oil, fuel and chemical handling, storing or transport	Acid sulphate soils	Vegetation	Lighting
Water	Air	Noise	

- Operating small plant and equipment requires the work to be well planned and safely carried out according to site procedures and State or Territory legislative requirements.
- The correct selection and usage of plant and equipment will ensure work is carried out safely and to the specified quality and tolerances.
- Workers must at all times during operations be aware of their responsibilities for worker safety and to protect the environment.

1. Why is it important to make yourself aware of the site regulations before work commences?
2. If you notice any damage or a defect that would make a tool or piece of equipment unsafe to use you should:
 - a) Tag it and report it immediately to your supervisor
 - b) Return it to its storage area and report it to your supervisor at the end of the day
 - c) Return it to its storage area and report it immediately to your supervisor
 - d) Tag it and report it to your supervisor at the end of the day

- A typical manual provided by the manufacturer of small plant and equipment will include information that is required to operate the plant and equipment in a safe and professional manner, gain maximum output from the machine and maintain the machine in working order.
- Before commencing any operations, check to see if anyone has placed a Do Not Operate Tag on the machine.
- If there is a tag, contact the person who has placed it there for further instructions.



- Daily maintenance is a basic responsibility of all small plant and equipment operators.
 - The basics are:
 - Fluid levels;
 - Pre-operational inspection; and
 - Greasing.
 - Walk Around Inspection – Daily:
 - Critical to achieving the maximum service life of the small plant and equipment; and
 - Safety of the operator and other people on the job site.
- For these reasons the inspection is made before preparing to start the engine.



- Report any faults before commencing work.

Areas for inspection:

Engine compartment	Air intake system	Oil leaks	Structure	Safety signs	Lights / electrical
Radiator	Attachments	Tyres	Transmission	Stickers	Isolation switch
Hydraulic system	Covers and guards	Tracks	Fuel	Steps and handrails	Batteries



- There are three types of fuels used in construction equipment:

- Straight petrol (unleaded)

- Used on small four-stroke engines.

- Two stroke (mixture)

- Used on small two-stroke engines.

- Diesel

- Generally used on larger plant and equipment.

- It is imperative that you fully understand the difference.

- The cleanliness of fuel, lubricating oil and engine intake air are the controlling factors in engine wear.
 - The diesel engine fuel injection system is constructed to such fine tolerances that insignificant particles of foreign matter can cause irreparable damage to parts.



- Operators will be required to wear appropriate PPE when handling fuel including gloves.

- Before starting small plant and equipment, refer to the manufacturer's operator's manual as different small plant and equipment will vary on recommended start up procedures.
 - Levers and controls – check.
 - Throttle control – in the low idle position.
 - Starting the engine – move starter switch to start, allow the engine to warm up.
 - Gauges – in correct operation.
 - Safety check – check the correct operation of components and ensure the area is clear before moving.

- Select a safe place to park.
 - Site safety – comply with site rules.
- Transmission - place the transmission and forward reverse levers into the neutral position and apply any safety locks.
- All small plant and equipment should be idled down at approximately 1000 rpm for 3 to 5 minutes to allow the heat to dissipate evenly through the engine.



- For operator safety and maximum service life of small plant and equipment, it is important that the pre-start, start up, park and shut down procedures are carried out according to the manufacturers' operator's manual and company policy and procedures.
- Though the care and maintenance responsibilities of operators of small plant and equipment may vary from employer to employer, daily maintenance is a basic responsibility of all small plant and equipment operators.
- Daily inspections will also add to operator safety and productive use of the small plant and equipment.

1. Which document includes information that is required to operate small plant and equipment in a safe and professional manner, gain maximum output from the machine and maintain the machine in working order?
2. The Do Not Operate tag can be removed if an operator believes there is nothing wrong with the small plant and equipment and wants to get on with the job:
 - a) True
 - b) False
3. Name the three (3) types of fuels used in civil construction small plant and equipment.
4. Briefly explain why diesel fuel in particular must be kept clean.

It is the operator's responsibility to be on watch for people at all times. NEVER expect them to stay out of harm's way.

- The following precautions must be observed when operating small plant and equipment:
 - Ensure that the pre-start checks are undertaken prior to operation.
 - Assess the ground conditions.
 - Look for hazards which may pose a danger to the small plant and equipment operation.
 - Never operate small plant and equipment in unsuitable conditions.
 - Always operate with safety devices in place and in working order.
 - Stay alert at all times.
 - Equipment left unattended should be locked or made inoperable.
 - Be aware of the minimum safe operating distances from electrical cables.

- A vast range of plant and equipment is available for use on a civil construction site.
 - The following basic guidelines should help you understand the safe and proper use of the listed small plant and equipment including:
 - Compaction equipment;
 - Pumping equipment;
 - Power source equipment; and
 - Concreting equipment.



- The four basic compaction forces used in the compaction process are:
 - Static pressure
 - Kneading action (manipulation)
 - Impact
 - Vibration.
- Compactors use a combination or a single application of these four basic forces of compaction to achieve compaction of the material.
 - Compaction equipment in the small plant category includes:
 - Rammers;
 - Tampers;
 - Vibratory plate compactors; and
 - Rollers.



- Generally power driven, handheld rammers are used in small areas or confined spaces to compact cohesive soils and other mixed and granular soils.
- The shoe or rammer is usually about 250 mm in diameter and is intended for use in cohesive soil (that which tends to stick together).
 - Pneumatic rammers for similar compaction are also available.
- They are particularly useful for compacting trench bottoms and backfill footings or edges of enclosed areas where access is limited.

- Generally power driven, handheld tampers are used in small areas or confined spaces to compact less cohesive soils such as gravel or sand.

Operating a tamper:

1. Start the machine on level ground.	5. Adjust the tamping pressure by returning the throttle lever slightly.	9. If you want to advance more quickly, have the rear part of the foot in contact with the ground by pulling it towards you.
2. Allow the machine three minutes to warm up before operating.	6. The shoe must be parallel to the ground.	10. Stop the machine in the manner recommended by the manufacturer.
3. Move the throttle lever quickly to the full on position.	7. If you start losing control, quickly bring the throttle back to idle.	11. Close the fuel tap to the off position.
4. Guide the tamper with the handle by exerting a downward pressure.	8. The tamping frequency should be less for hard ground and more for soft.	



- Made up of a power unit, petrol, diesel or electric, driving a vibrating element mounted on a plate guided from a handle on which the controls are positioned.

Operating a vibratory plate compactor:

1. Start the machine on level ground.	4. Let the machine plane itself along and use the handles to steer it.	7. Compact the soil in layers of up to 100-150 mm.
2. Allow the compactor three minutes to warm up before operating.	5. Bring the vibratory plate compactor back to idle when stationary or when travelling over compacted or solid ground.	8. Stop the machine as recommended by the manufacturer.
3. Move the throttle quickly to the full on position.	6. Work progressively over the area to be compacted.	9. Close the fuel tap to the off position.



- Hand guided pedestrian vibratory rollers are self-propelled, the engine also providing power for vibration.
 - These rollers are suitable for small patch asphalt laying, trench backfilling, sub-bases, footpath and car park construction.
- Self-propelled tandem smooth drum rollers are equipped with two drums of the same size, one following in the track of the other.
 - They operate in both forward and reverse directions, vibrating or non-vibrating and are suitable for compaction of asphalt paving, granular materials and crushed rock in sub-base platform, road or car park construction.



• Double drum vibratory roller

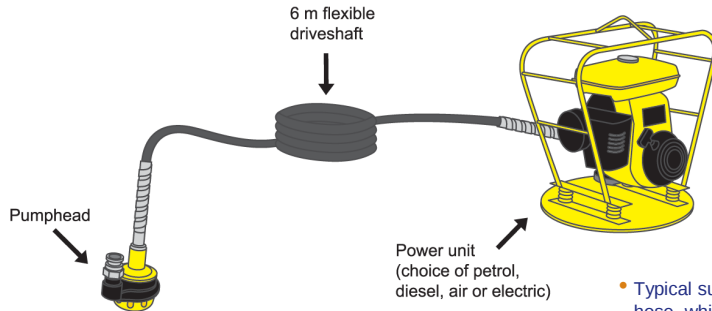
- Multipurpose compactors provide high utilisation and are especially suited for use on difficult to compact soils.
- Many of these machines have four-drum drive and steering which permits operating in confined areas such as trenches where turning would otherwise be difficult if not impossible.
- Compactors can be manually or remote controlled.

NOTE: Always make sure you choose the right equipment for the type of material being compacted and use it safely.

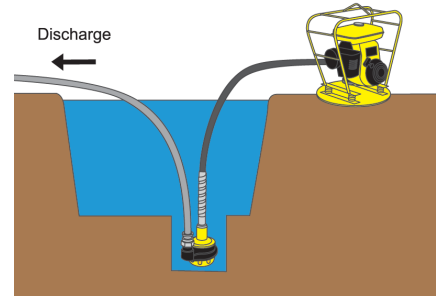


- A pump on a construction site is used to remove fluids from one level to another, around or over obstructions for the purpose of:
 - Keeping a site free from excess water, particularly the foundations or basement; and
 - Lowering the watertable or the natural water level in the ground during excavation work.
- When selecting a pump for a specific purpose, three (3) main things need to be considered:
 - The amount of water to be moved;
 - The vertical height and distance from the level of the liquid to a safe and suitable position of the pump; and
 - The height and distance from the pump to point of delivery.

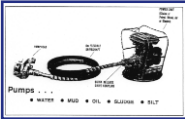
- A variety of pumps are available but the most commonly favoured on construction sites are:
 - Centrifugal pump;
 - Diaphragm pump; and
 - Submersible pump.



- Typical submersible pump, without the discharge hose, which fits on to the pumphead.



- How a sump hole should be dug and the pump positioned

Diaphragm Pump 	- Can be used for pumping large volumes of water and can cope with dirty muddy water with fairly large amounts of solids and silt mixed in with the water. - Usually powered by a petrol or diesel engine.
Centrifugal Pump 	- Light weight and easy maintenance. - Needs to be primed. - Can run dry and pump solids up to 20 mm in diameter.
Submersible Pump 	- Used in deep excavations and sumps. - Some are capable of moving large volumes of fluid containing granular particles of up to 20 mm diameter. - Either electric, compressed air or flex driven from a petrol or diesel motor.

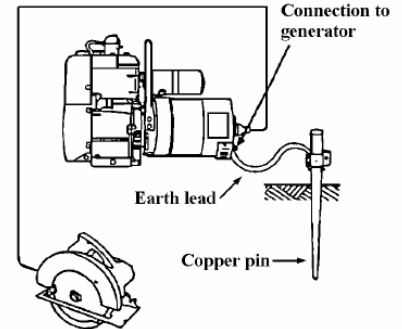
- Ensure pump is on level and stable ground.
- Connect suction hose to pump and immerse the strainer in the liquid to be pumped.
 - (Not applicable to submersibles).
- Connect delivery hose to pump and lay out, avoiding kinks and sharp bends, to desired discharge point.
- Fill pump suction end (prime) with water before starting.
 - (Not applicable to submersibles or self-priming pumps).

- Submersible pumps - completely submerge pumps in fluid to be moved.
- Start motor or pump.
- Pump should begin to pump fluid almost immediately.
- Do not attempt to refuel engine while pump is running
 - (If applicable).
- Do not run pump without water.
- On completion of job switch off pump as soon as last water has been extracted.
- Disconnect hoses and remove.
- Store hoses, pump and motors safely to avoid damage.

- On civil construction sites where mains supplied electricity is not available, portable generators are used to supply power to drive portable power tools and supply lighting if necessary.
- Another commonly used source of power for driving a wide range of portable power tools, pneumatic hammers and pumps is compressed air which is generated by portable compressors.



- It is important to determine whether the generator must be earthed to ensure the safe operation of single-insulated tools.
- Earthing will consist of heavy wire cable from the metal casing of the generator to a metal stake driven well into the ground.
 - The power required to operate portable power tools is stamped on a plate attached to them.
 - The minimum generator capacity required is equal to the total Watts or amperes of all tools that may be used at the one time.



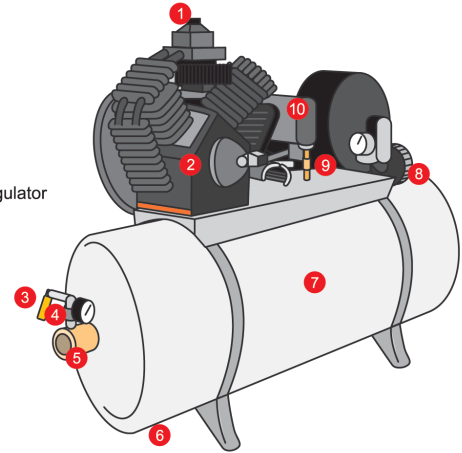
- Earthing a generator

- When using a single phase generator the following safe operation procedures should be followed:
 - Ensure you have been properly instructed.
 - Keep the generator on level ground.
 - Never use double male plug extension leads.
 - Operate in a well ventilated area.
 - Select correct size unit for your job.
 - Do not refuel while the engine is running.
 - Do not operate in damp areas or rain.
 - Keep extension leads as short as possible.
 - Switch off all loads before starting.
 - Ensure cable connectors are firmly plugged in and not standing in wet or moist conditions.
 - Switch on power load progressively.
 - Do not disconnect power leads until the engine is completely stopped.

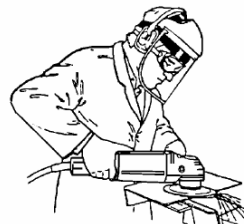


- Mobile or portable air compressors consist of a compressor driven by diesel, petrol or electric motor that is mounted on or adjacent to an air storage tank.

- 1 Air filter
- 2 Compressor
- 3 Air release cock
- 4 Safety valve
- 5 Pressure gauge
- 6 Drain valve
- 7 Storage tank
- 8 Motor
- 9 Check valve
- 10 Automatic pressure regulator



- The following are some specific safety procedures that must be adhered to when using compressed air.
 - Check the condition of air hoses and connections.
 - The compressed air pressure must be adjusted (by altering the regulator) to suit the tool being used.
 - Before making any adjustments or routine maintenance to any compressed air tool, ensure that the air is turned off or disconnect the hose from the tool.
 - You must wear the appropriate PPE.
 - Prevent air hoses from becoming tangled and getting caught up as you are using or unwinding them.



DO NOT blow anything off anyone's body or skin using compressed air. Death can result from air getting into the bloodstream, even through a small scratch on the skin.

- Basic concreting equipment used on civil construction sites includes:
 - Concrete mixers;
 - Concrete vibrators; and
 - Wheelbarrows.
- A concrete mixer consists of a mixing bowl, mounted on a sturdy frame, driven by an electric, petrol or diesel motor.
- It can be towed behind a vehicle or carried on the back of a light truck or trailer.



- Using a concrete mixer. For safe operation ensure the following procedures are followed:
 - Locate concrete mixer on firm level ground.
 - Always place water in the bowl prior to cement.
 - Do not splash water on the electric motor.
 - Do not place shovel in the mixing bowl.
 - No loose clothing is to be worn near the mixing bowl.
 - Keep the motor and belts guarded.
 - Always clean, wash down and oil after daily use.

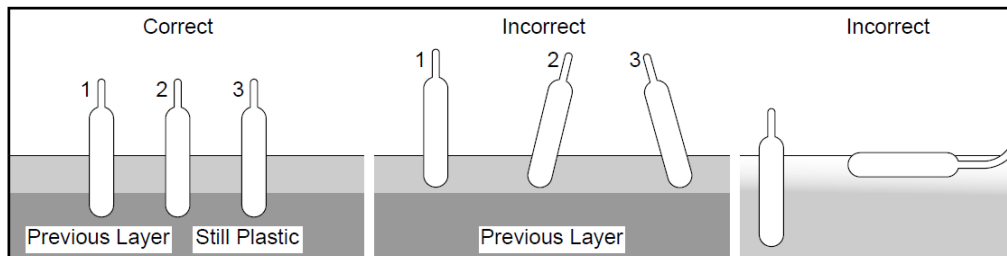


• Petrol mixer

- The purpose of a vibrator is to move the air to the surface of the concrete.
 - A direct vibrator is the most commonly used type as it works directly within the concrete and can be moved around easily.
 - The two piece direct vibrator comprises a motor and the shaft.
 - The one piece vibrator can be powered by a small petrol or electric motor.



- Vibrators used incorrectly or to insufficient depth will result in variable compaction and poor structural quality.
- Prolonged vibration in localised areas will cause segregation and bleeding.
- Therefore the vibrator should be held vertically at regular spaced intervals and inserted sufficiently to penetrate previously placed concrete.



- Using the correct small plant and equipment means that you can carry out your civil construction tasks as effectively as possible to meet the job specifications.
- Follow all safety precautions prior to operating equipment.
 - As a plant and equipment operator you must be aware of your own safety and use machinery according to company guidelines, manufacturer's operating manuals and design specifications.
- Small plant and equipment must be regularly inspected.
 - If any defects are detected the equipment must be immediately removed from use and repaired. Plant and equipment when not in use should be stacked and stored neatly to prevent unnecessary wear and damage.

1.	Name the four (4) basic compaction forces.
2.	When should a small vibratory plate compactor be used?
3.	Diaphragm pumps can cope with muddy water that has large amounts of solids and silt mixed in with the water. a) True b) False
4.	What two (2) things must be checked prior to using a mobile or portable generator?
5.	The most widely used type of concrete vibrator is the: a) Shaft vibrator b) Beam vibrator c) Indirect vibrator d) Immersion vibrator

- The best way to learn the specific details of maintenance is to study the operator's manual.
 - Small plant and equipment must be kept in a serviceable and productive condition which requires regular servicing.
 - Servicing usually includes:
 - Checking oil compartments;
 - Greasing linkages and pivot points;
 - Cleaning air filters; and
 - General inspections.
 - Other periodical services are carried out at designated intervals. These may be:
 - Hourly;
 - Monthly;
 - Half yearly; and
 - Yearly.



- Minor adjustments and replacing of worn parts may include:
 - Alternator adjustment;
 - Changing the radiator coolant;
 - Filters;
 - Air filters;
 - Fuel filters; and
 - Oil filters.



NOTE: If the coolant is contaminated, the cooling system requires flushing.

- You will need to report on your inspection and fault finding activities.
- You can do this by following your company's reporting procedure.
- Complete the documentation and submit it as required.

Civil Contractors Federation



Plant Daily Inspection – Fault Report

Company Name: Week commencing:
 Project: Site/Location:
 Plant Type: Plant No: Reg No:

Plant Operator Daily Safety Checklist

Operators are required to check the following items before commencing work. These records form the basis of a plant maintenance procedure and will be subject to random inspection. Keep the record with you at all times.

Please mark: ☐ OK ☐ Fault Identified ☐ Item not Applicable
 the boxes No obvious defect (Use Fault/Defect Report below) to this Plant

Before commencing operations check –	Mon	Tue	Wed	Thur	Fri	Sat	Sun
Record Plant Hours/Kilometre Reading							
1. Brakes, steering, gauges, lights, warning devices							
2. Visibility – windscreen, wipers, washer, demister, mirrors, windows							
3. Cabin – access/egress, seating, seatbelts, loose objects, control levers							
4. Wheels, tyres, nuts, damage, wear, pressure (visual)							
5. Guards – in place, secure, warning signs - lights, alarms							
6. Hydraulics – rams, hoses, leaks, wear							
7. Excessive wear – hooks, chains, pins, pivots, tracks, ground engagement tools							
8. Oil and Coolant Levels							
9. Misc. electrical, fire extinguisher, communications							
10. Operator's Names (Please print)							
Operator's Signatures							
Supervisor's Signature – Random Check							

Plant Fault/Defect Report

To be used to report any fault or defect identified during daily plant safety checks or during work operations.

Reported by: Reported to:

Position: Position:

Date:

Method of reporting: Telephone ☐ In person ☐ Radio ☐

Details of fault/defect:

Does fault constitute a safety hazard? Yes/No

Does machine require immediate repair? Yes/No

If **YES** to either, **PARK MACHINE UP**, contact the Plant Manager or Supervisor.

Machine **SHALL NOT BE USED** until Plant Manager or his delegate gives clearance for use.

If **NO**, indicate when machine requires attention and send this form in with daily report.

Requires attention in next few days. Yes/No

Requires attention at next service. Yes/No

Signature: Date:

- Small plant and equipment must be kept in a serviceable and productive condition which requires that they must be serviced regularly.
 - It is the operator's responsibility to keep the machine in a serviceable and well maintained condition.
 - Plant should be serviced on a regular basis which is detailed in the manufacturers' manual.
 - This usually includes:
 - Checking oil compartments;
 - Greasing linkages and pivot points;
 - Cleaning air filters; and
 - General inspections.



- | | |
|----|--|
| 1. | The best way to learn the specific details of maintenance is to study the _____. |
| 2. | Small plant and equipment must be kept in a serviceable and productive condition which requires regular servicing. Name two (2) tasks which may be carried out during servicing. |
| 3. | If the coolant is dirty or is contaminated with sludge or scale, then the cooling system requires:
a) Sudsing
b) Washing
c) Injecting
d) Flushing |
| 4. | The operator's manual provides maintenance schedules that are broken down into specific timeframes.
a) True
b) False |
| 5. | Parts must be replaced according to the manufacturer's instructions.
a) True
b) False |

- Remove all waste products from site and store unused and reusable materials.
- The final operation at the worksite is restoration of:
 - Road surfaces;
 - Utilities;
 - Contaminated areas;
 - Drainage and watercourses;
 - Sodding, grassing, and trees; and
 - Private property.



- According to project environmental management plan, clean up also involves removal of:
 - Machinery and amenities sheds;
 - Temporary sediment controls;
 - Traffic control; and
 - Barricading.
- Roadway clean up involves using a vacuum street cleaner, broom and shovel to remove excess dirt and dust.

- On completion of the operation, tools and equipment must be thoroughly checked, cleaned, and oiled and greased if required before packing and storing.
- Regular care and maintenance will enhance the life of the equipment and maintain its accuracy.
- Damaged or worn equipment must be reported and the necessary servicing or repairs carried out to ensure safe equipment is available for the next operation.



- It's the end of the job, the end of the project, let's get on with the next one.
- Understandable, but discuss as a group why it is important to clear up a worksite and clean up plant and equipment.
- Come up with 5 good reasons.



- Conducting the clean-up operation of the site is the last stage of the construction schedule.
- It is important to ensure that all rubbish is removed and equipment and consumables are accounted for and correctly stored for removal and future use.
 - The clean up is an important part of finishing operations as it ensures:
 - Tools and equipment are made ready for the next operation; and
 - The site is environmentally safe and acceptable for use by others.

- Tools and equipment must be thoroughly checked and cleaned before storing in readiness for the next job.
- Damaged or worn equipment must be reported and the necessary servicing or repairs carried out to ensure safe equipment on the worksite.
 - Worksite restoration ensures that:
 - All unnecessary materials, signage, environmental controls are removed;
 - The worksite is returned for use; and
 - The worksite meets all environmental requirements and standards.

- | | |
|----|--|
| 1. | What should you do with materials that do not meet specification or you have had trouble using. |
| 2. | Utilities uncovered on the worksite should be restored on completion of the job.
a) True
b) False |
| 3. | Why is it important to ensure plant, tools and equipment are maintained in good order? |
| 4. | Any soil, dirt or dust left on the roadway can be removed by hosing it down the drainage system to make the road safer.
a) True
b) False |