Rayonier matariki Forests

Repair and maintenance of mobile plant

Safe system of work

Document Control	
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Supplementary Information

Introduction

Scope

The principles in this document apply to all businesses operating mobile plant and heavy equipment in RMF operations.

This includes, but is not limited to:

Wheeled machinery used in forestry activities	Tracked machinery used in forestry activities
Yarders and Towers	Trucks used in forestry activities, including stage trucks
Ute's and LUV's	**Log Cartage** Applies if the repairs are undertaken in a RMF forest

For contractors directly supplying services to RMF our expectation is that any person performing, assisting or supervising repair and maintenance work will abide by the guidance laid out in this document.

Where contractors have developed their own general R&M guidance or procedures, those standards should meet the minimum requirements set out in this safe system of work. Manufacturer or supplier maintenance instructions should always be followed.

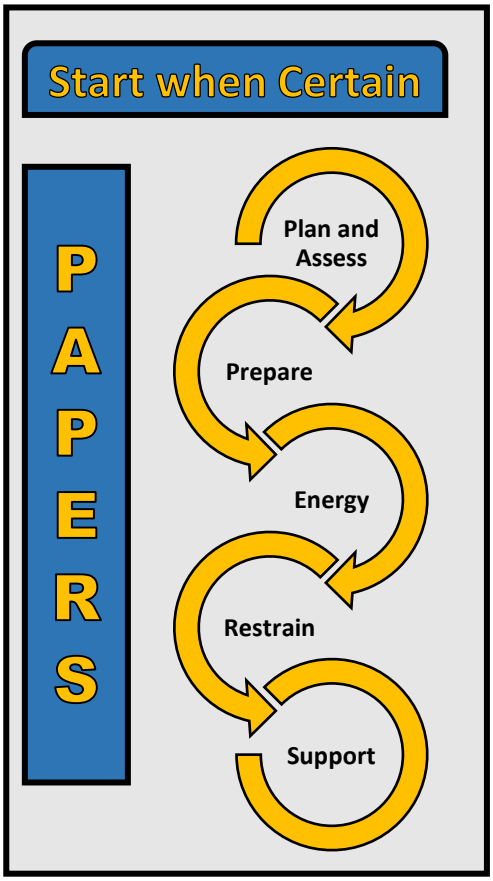
For specialist service providers, we recognize that they have specific training, knowledge and processes, but they should still abide by the principles described in this document.

Repair and Maintenance Safe System of Work

Section 1: Start when Certain

Industry experts have indicated that there are some key steps to working on mobile plant that must be followed for work to be performed safely. These steps include planning, risk assessment, dealing with stored energy and performing lockout procedures.

PAPERS is an acronym to remember when performing repair and maintenance work. The steps in this acronym follows the same processes discussed in our repair and maintenance videos.



P Plan **A** Assess	• What needs to be done? • Do we have the knowledge, skills, and tools to do it? • Are the weather conditions acceptable? • Are there any hazards at the selected site that need to be removed or controlled? • Who will be involved? • Who will be in charge? • Where will the work be done? • Is the planned site suitable to do the job safely? • Do we have a reliable communication system in place? • Do we need to call a specialist to do the work or to advise? • Should this be a two-man job?
P Prepare	**Before work starts:** • Prepare the site, move any obstacles that may make the job difficult • Get the right tools and PPE to where the work will be done • Demarcate the work area if necessary • Make sure that other machines or operations are aware of your location and that you have a safety buffer in place • If necessary, notify others that you are about to start the work
E Energy	Do we have a zero-energy state? **Before work starts:** • Turn the engine off and remove the keys • Power down the computer (where applicable) • Turn off the main isolation switch (where applicable) • Remove any residual energy out of the system (hydraulic, air, kinetic, electric) • Perform your lockout procedure. Install any lockout devices. • Chock the wheels if applicable
R Restrain	Have we restrained anything that can move or make the machine unstable? • Are all attachments grounded and secure? • Has only the necessary guarding been removed? • Can anything fall on a person?
S Support	Do we have proper support available for lifting the machine or parts of the machine? **Before work starts:** • Is the work surface solid enough to support the load and lifting equipment? • Do we have the right jacks, strops, or chains to do the lifting? • Do we have good solid wood or blocks to prop and support the load?
Do not rely on hydraulics only for support!	

Repair and Maintenance Safe System of Work

Section 2: Risk Assessment

Following on from the PAPERS concept, most large service suppliers have a pre-start assessment process to ensure that nothing is missed before work starts.

Some of our contractors would have similar processes in place. These are often called a job safety analysis (JSA) or a Take-5.

On the next page is an example of a similar process. These are most applicable to complex or critical repairs and not done during routine daily maintenance activities.

This is an example document that you may choose to use.

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R&M Pre-start risk assessment

Date		Employee name	
Location		Company Name	
Task			

	Assess the following	Yes	No	N/A
1	Can I be injured by being caught in, on or between anything?			
2	Can I fall onto, into or from anything?			
3	Can I be struck by a moving object?			
4	Can someone fall on to me or can I cause something to fall on someone else?			
5	Does anything need to be isolated or tested for dead?			
6	Do I know how to release stored energy on this machine?			
7	Do I know what lock out devices needs to be installed and how to install them?			
8	Can I come into contact with or be exposed to something that may harm me? (Electricity, heat, gas, hazardous substances or stored energy)			
9	Do I need a second person to assist me?			
10	Can I be injured by nearby activities, or can my activities injure others nearby?			
11	I'm working alone – Do I have a good emergency communication system in place?			
12	Can weather conditions, work environment or poor lighting affect job safety?			
13	Are there any other hazards present?			
14	Am I fit for work? (Fatigue, drugs, alcohol, medication, stress)			
15	Do I have the correct tools, training, equipment and PPE?			

If you have a TICK in any of the YELLOW boxes, please STOP and address the risk. Call someone for assistance or a second opinion if you are UNSURE.

Repair and Maintenance Safe System of Work

Section 3: Elevated Risk Situations

Some jobs are riskier than others. Below are a list of R&M situations that RMF have identified to be of an elevated risk. Also included are the minimum preventative controls that must be followed in all RMF operations.

R&M Situation	Preventative controls
1. Repair or maintenance work while working alone	**Minimum Requirements:** • No weekend work unless: ✓ an effective call-in process is in place and ✓ a robust emergency response process is in place and ✓ RMF is notified • For critical repair work use a second person to assist • Lone worker repairs must be performed in daylight. • If maintenance activities are performed in the dark, there must be adequate lighting available (i.e., early morning greasing and inspection) **Optional Best Practice**: Use a radio with man-down or lone worker functionality if out of sight of other workers
2. R&M work that requires operator in-cab assistance. Some examples could be: • fault testing • load lifting and positioning • fitting or refurbishment of OPS structures • electrical testing on processor heads	**Minimum Requirements:** • Only one person in charge (often the technician or mechanic) • Clear understanding of the work involved before it starts • Good visibility if hand signals are used **Optional Best Practice**: Use a hands-free voice activated radio communication system on a dedicated channel or direct Wi-Fi, between the machine operator and the technician or mechanic.
3. Working under a raised object Some examples could be: • Replacing wheels • Undercarriage repairs • Work on machinery attachments that need to be supported to prevent unexpected movement: o Hauler grapples o Front end loader bucket o Skidder blade	**Minimum Requirements:** • Mandatory use of all safety locking pins as specified by the manufacturer. This includes locking pins for articulated machinery and locking pins on processor heads. • Any support structures used to elevate a machine, a part of a machine, or an attachment must be able to support the weight of the work piece. The support structure must securely hold the attachment, machine or work piece in place and must limit any lateral or horizontal movement. • The support structure must be suited to the site in which it is used. • There should be a secondary support device or method to prevent a raised object from falling on a person if the primary support fails.

Repair and Maintenance Safe System of Work
Section 3: Elevated Risk Situations

R&M Situation	Preventative controls
4. Working under a suspended load	Always prohibited (not allowed)
5. Working at heights	**Minimum Requirements:** • The use of ladders should be a last resort. It's best to perform work from a stable platform like the back of a service vehicle, natural terrain features like a high bank or the roof of a container (providing the container has a safe access ladder, a non-slip surface and removable guard rails to prevent a person from falling off the container) • Where hauler service access ladders are used ensure that workers are trained and certified to use fall arrest harnesses when accessing service ladders on yarders. Ensure that the harness is in good working order and inspected regularly. • Ensure that effective handrails and guards are in place on yarders where there is a risk of falling to the ground or falling on machine structures and components • Never wear spiked boots when walking on metal surfaces or operating machinery. **Optional Best Practice**: Consider modifications that eliminate the need to access service ladders for maintenance purposes
6. Working on slopes – where a winch assisted machine experience a breakdown. Includes, but not limited to winch-assisted: • falling machines • forwarders and skidders and • backline machines	**Minimum Requirements:** • All winch assisted falling or extraction operations must perform a risk assessment for repair work involving assisted machinery on slopes. • From the risk assessment a repair procedure must be developed that includes robust preventative controls and it must be specific to the situation

Repair and Maintenance Safe System of Work

Section 4: Common causes of harm

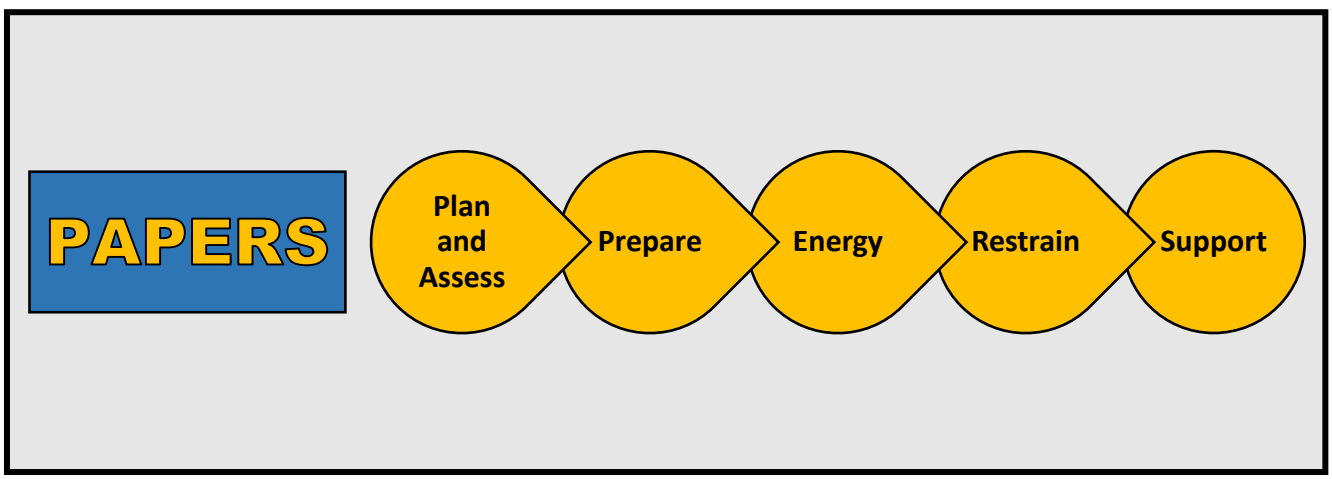
1 Upset Conditions

Upset conditions while performing repair and maintenance work can add unintended pressure to the work being performed and can contribute to poor decision making which in turn may create a hazard. Examples of these could include, realizing that you have the wrong parts, the wrong tools or the wrong oils. Realizing that you cannot fix the problem without getting an expert involved, or that you cannot move the machine and therefore must undertake the work in an unsuitable location. All these examples can create frustration and result in the job taking longer.	**Best Control Measures**
	Understand what supplies, tools and parts are required for the repair or maintenance work. This comes back to being suitably skilled. If in doubt, get an experienced technician to do the work.
	Start only when certain – Stop and review when something changes
	Ensure that there is proper planning and communication between everyone involved in the work. Where two or more people are selected to perform a task, make sure that they have a good relationship with each other in the first instance.
	Don't rush, It's not an emergency, there are no lives at stake but poor decision making due to self created pressure can lead to instances where people can be harmed while performing repairs or maintenance work. Take timeout when you feel frustrated. Have a cup of tea then come back to it. Ensure that there is enough time left in the day when performing maintenance work or attempting repairs. Fatigue and time pressure late in the day can lead to poor decisions. It's best to postpone challenging repair or maintenance work to the next day.

2 Poor or lack of communication

Poor instructions or a lack of instruction is a leading cause of incidents in the forestry industry. Nothing on the job site can be achieved effectively and safely without communication of some sort.	**Best Control Measures**
	Any work that requires ground staff to communicate with a machine operator should be done by **one-on-one direct radio** conversation. This would apply to situations like for example fault finding, diagnostics and testing or when lifting or loading components.
	Assumptions contribute in a major way to workplace miscommunication. Assumptions are taken as fact when there is no proof. They are often preconceived misconceptions about a situation, person or task . Some examples of how assumptions can lead to miscommunication: • Assuming someone understands the instruction or the plan • Assuming when a job needs to be completed • Assuming someone is upset with you because of their body language • Assuming everyone interpreted the safe working procedures the same • Assuming someone can do a specific task **Instead of assuming, ASK for clarification**.

3	Lack of skills or competence
The danger with a lack of skills or competence is that people may be tempted to undertake work because they "think it will be all right" or they want to do a good job and get the machine fixed. Sometimes it's pride, sometimes it's arrogance that catches people out. A lack of skills or competence can be the most dangerous risk on the job when undertaking repair or maintenance work involving machinery.	**Best Control Measures**
	Follow the **PAPERS** process when starting a challenging or unfamiliar task. Call for assistance if you are unsure.
	To be deemed competent an individual should have: • specific knowledge of the tasks to be undertaken and the risks which the work will entail and • appropriate experience and ability to carry out their duties in relation to the work; to recognise their limitations and take appropriate action in order to prevent harm to themselves or those affected by the work.
	When given a task, there is a duty on the worker to indicate if they have a lack of suitable knowledge or experience for the task assigned
	Don't let pride, arrogance or your sense of duty dictate your level of competency. Assess each repair or maintenance job on its own merits. It's not business as usual, often each job is unique and needs a cool head to apply their skills and knowledge to problem solve and formulate an effective strategy for the work to be safely performed.
	Don't assume people have the required level of competence.



4 Entanglement

Entanglement is when a worker's body part or loose items worn by them get caught in moving machine parts. An example of this would be an exposed PTO drive shaft catching on loose clothing or clothing caught in the drum while fleeting ropes.

Best Control Measures

Install effective and appropriate machine guarding to secure moving machine parts. Types of guarding options may include:

- Fixed guards (should require special tools to remove which are not commonly found on forestry sites)
- Fixed limited access guards. They provide limited access to an adjustment screw as an example
- Interlock guards. These guards make certain that the machine cannot be started until the guard screen is in the closed position and conversely the guard cannot be removed until the working parts have been stopped. Mechanical, electrical, hydraulic or pneumatic systems are used to activate the guard.

Where possible, only work on machines when the engine is shut off .

5 Crushing

A crushing hazard is where a worker can be caught between two objects. Where either one or both parts may be moving, and cause injury or death by physical crushing, pulling you in or suffocation. An example of this would be performing repair work under a supported load.

Best Control Measures

Take the machine off-site to a workshop where skilled technicians can perform the work.

Always use two forms of support when working under a raised object or between a raised object and a stationary object. For example, when changing a wheel on a skidder or replacing a hydraulic hose on a lift ram. Using two forms of support ensures that there is a backup option in the event of failure.

De-energize the machine - Apply hydraulic lockouts and remove any stored residual energy out of the system. Lock out the master switch. De-energization also includes using restraint devices like slings, chains or lockout pins provided by the machine manufacturer.

Chock (place a barrier under the wheels) all wheeled equipment to ensure that they are unable to move unexpectedly when performing repairs.

Ensure that the machine is on **stable ground** and that there is no risk of a rollover or sudden machine movement. This includes any machine attachments.

Have an effective **tag out** system in place to ensure that the machine is not accidently started

6 Cutting, Stabbing and Puncturing

A cutting, stabbing or puncturing hazard occurs when a part of the workers body is exposed to a cutting edge or sharp machine parts. An example of this would be the delimbing knives and the saw on a processor head.

Best Control Measures

Install effective and appropriate machine guarding to secure moving machine parts. Types of guarding options may include:
- Fixed guards (should require special tools to remove which are not commonly found on forestry sites)
- Fixed limited access guards. They provide limited access to an adjustment screw as an example

Provide supports for larger work pieces that require cutting with oxy acetylene torches, grinders or cut of saws. Ensure that these supports can securely grab and hold a work piece.

Do not remove the manufacturer's guarding on portable cutting tools. Inspect cutting discs before use, replace worn discs or discs showing signs of cracking before use.

Place material with sharp exposed edges or sharp points in a safe location where there is no risk of someone slipping or tripping on to the material. Maintain a minimum safe distance of 5m from anyone using portable power tools while performing cutting work.

7 Striking

Striking hazards are caused by objects that strike the body, but do not enter it. An example of this would be a metal fragment striking a person or a machine part falling from a hauler striking a worker below.

Best Control Measures

Install effective and appropriate machine guarding to secure moving machine parts. Where practical, install toeboards or screens to prevent tools and components from falling from an elevated work area.

When potentially hazardous equipment is not in use make sure that it is secured. Lower blades and lock moving parts on bulldozers, skidders, loaders, excavators, graders and similar machines when they are being repaired or not in use.

Secure tools and components to prevent them from falling on people below. Stack and secure materials to prevent sliding, falling or collapse. Keep walking areas clear of clutter.

When lifting heavy components with a sling ensure that:
- Slings, chains and rigging components are in a good condition and of an appropriate safe working load limit
- Securing the load is done by a competent person
- There is clear communication and an agreed plan between the machine operator and ground staff
- Use a lead rope to maneuver the load instead of using hands and getting your body into the strike zone

8 Shearing

A shearing hazard exists where nip point or pinch point exists between moving and fixed parts of a machine. This pinch point can trap a part of the body (hand or fingers) or trap clothing

Best Control Measures

Install effective and appropriate machine guarding to secure moving machine parts.

- Use **fixed guards** to prevent access to shear points that are not 'safe by position'. Fixed guards must require the use of a tool to open or remove and their fixings should generally remain attached to either the guard or machine when removed.
- If access is needed that precludes the use of fixed guards, use **interlocking guards**.
- If it is not practicable to use interlocking guards, use **fixed distance guards** and **barriers** secured in position.
- If guarding is not practical, fit safety devices such as trip bars that will detect the presence of a person and stop the machine
- Provide a means of immobilising the drive mechanism such as a flywheel brake or locking system

Turn off machines and wait for any rotating parts to come to a complete stop before beginning any type of maintenance.

9 High Pressure Fluid

Fluid release from a hydraulic system can be injected under the skin and lead to injury which may need amputation or major surgery. Even pinprick punctures can cause major injury.

Best Control Measures

De-energize the machine - **Apply hydraulic lockouts and remove any stored residual energy out of the system**. **Lock out the master switch**. Ensure that all residual energy is released from the air and hydraulic lines prior to work commencing.

De-energization also includes using restraint devices like slings, chains or lockout pins provided by the machine manufacturer **to prevent the uncontrolled movement** of machine attachments.

When releasing stored energy on wheeled equipment, **chock** the wheels and perform the work on a level surface.

Let oil cool down before starting any work. Hot oil can burn you. Hot hydraulic oil can re-energize itself and cause pressure to rebuilt.

When removing certain parts off plant i.e., rams etc. you should have all lines plugged and capped before taken the part off as they have the potential to move and release stored fluid resulting in injury.

When checking for hydraulic oil leaks on machines, keep your body and hands clear. Wear protective glasses and leather gloves. Use a piece of cardboard to locate suspected pinhole leaks.

10 Electrical

Electrical hazards have the potential to cause injury through electric shock and as a result of fire caused by electrical malfunction. Injuries can also result from unintended mechanical outcomes due to electrical circuits malfunctioning or while performing testing and inspection.

Best Control Measures

Overhead power lines. Perform repair and maintenance work on machinery **at least 4m** from any overhead powerline. Consider the length of machine booms and cranes and adjust the safe working distance accordingly to avoid accidental contact with a powerline. Notify the power company if a close approach consent is required.

- Engage a **heavy equipment electrician** to perform any electrical repairs or fault-finding work
- When performing machine inspections make sure to check for damaged leads and exposed wires and for bulging or warpage on batteries.
- Avoid bringing metal into contact with batteries. As metal conducts electricity, anyone touching a metal object as it comes into contact with the battery terminals runs the risk of electrocution.
- Starter motors can cause burns, ensure that battery or isolation switches are off prior to starting.
- Ensure that portable power tools and generators is safe and maintained in a safe condition.

11 Falling from height

This hazard exists with certain mobile plant used in forestry. Maintenance work on haulers and large excavators have inherent potential for falling from heights due to their size. Examples of this includes greasing sheaves and blocks on haulers and cleaning the windows on large excavators.

Best Control Measures

Avoid working at height completely. Where possible, repair or maintain equipment at ground level rather than a elevated. If it is not possible to lower the work piece to the ground, then work from an stable elevated platform. Some options include the back of a service vehicle, natural terrain features like a high bank, or the roof of a container (providing the container has a safe access ladder, a non-slip surface and removable guard rails to prevent a person from falling off the container)

Use extendable brushes to clean machine windows. Consider **engineering modifications** that removes the need to work at height. For example, grease points lower down on the machine for components that are difficult to reach.

Install **suitable and effective guard rails and work platforms** to prevent falls were working at height is unavoidable.

Wear appropriate footwear – laced up boots with nonslip soles, steel spiked boots are not to be worn when accessing mobile plant. Maintain **3 points of contact** when getting on or off work areas.

12 Explosion

Some machinery components and portable electrical equipment contain pressurized gasses, springs and fluids that may explode when not correctly handled or when unskilled persons attempt to dismantle them when undertaking repair and maintenance work. Some examples include batteries (jump starting a 12V battery with a 24V battery, high pressure stored energy in maxi brake spring packs, air compressors, vehicle tires exploding due to pyrolysis.

Best Control Measures
When dealing with components that have stored energy, pressurized gasses or pressurized fluids, it's **best to get experts** to perform the repair work.
Inspect and test Oxygen and Acetylene gas cylinders, regulators, check valves and flashback arrestors annually. Inspect before use and store cylinders appropriately. **Train workers in the correct use to avoid flashbacks**. Keep acetylene and oxygen separate until the torch is ignited. When starting a torch, the acetylene valve should be opened first. Next, the torch should be ignited, and then oxygen can be introduced. Note that opening both gas valves prior to ignition can cause gas backflow into either gas hose, leaving the system vulnerable to flashback.
Remove ignition sources when refueling. Ensure that there are no ignition sources where fuels are stored. Ensure that adequate ventilation is present where fuels are stored.
Springs may retain **potentially dangerous stored energy**. Always exercise caution when servicing springs. Before dismantling equipment, release any tension on the spring (if possible). Position yourself away from the direction of spring travel if the spring is compressed in any manner.

13 Slipping/Tripping

Slipping and tripping are among the most common hazards when working around machinery. Examples of these include, objects left in the walkway, slippery surfaces, confined areas, poor or no guard rails and handrails and inappropriate footwear.

Best Control Measures
Ensure that guard rails are fitted and functional on machinery
On machines, install adhesive and abrasive anti slip material or anti-skid paint on walking surfaces to reduce the risk of slipping.
Wear proper lace up boots. Spiked boots are not permitted when walking on the steel surfaces of mobile plant.
In poor light conditions ensure that adequate portable lighting is supplied and used.

Repair and Maintenance Safe System of Work
Section 5: Training and Competence Assessments

RMF recognizes the need for appropriate training of machine operators. The following NZQA unit standards are strongly recommended for all machine operators working in RMF operations.

Unit 27964	Demonstrate knowledge of forest industry machines
Unit 27965	Operate a forest industry machine
Unit 24568	Demonstrate knowledge of, and undertake, basic repairs and maintenance on a forestry industry machine

To support operator training and awareness, RMF have produced two videos that can be used as reference material by all our suppliers. These videos can be accessed through the following links:

Part One	**Repair and Maintenance Safety for Mechanised Log Processors**
	https://www.youtube.com/watch?v=Pm_GilfKw-U
Part Two	**Repair and Maintenance Safety for General Mobile Plant**
	https://www.youtube.com/watch?v=DBKzcM5Bf6Q

The other part to training is verification systems to make sure that work is performed as prescribed and/or imagined. The following pages include a repair and maintenance safe behavioral audit and a template for repair and maintenance training exercises.

If your business already have these audits in place, please ensure that the contents in the supplied templates are covered. Alternatively, please use the templates provided.

The frequencies for these contractor audits are:

Audit	Purpose	Frequency	Who
Form A : R&M SBO **Form B:** R&M Training Exercise	To verify that work is conducted safely and in alignment with expectations. To identify any gaps in existing processes.	**Minimum Requirements** • One SBO per crew every 3 months • One R&M training exercise per crew every 6 months	Principal, in-house mechanic or a designated person

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Form A: Repair and Maintenance SBO

Stop any unsafe practices observed immediately. Work can only resume if robust controls are implemented, if this is not possible, expert opinion will be required.

Location		Date		Supplier and/or Service Agents	

Type of work and machines involved:

	SAFE WORK AREA	Yes	No	N/A
1	Is the work zone free of falling object hazards? i.e. standing trees, unstable road batters, unstable rock faces, root balls	☐	☐	☐
2	Is the machine free of trip, slip, fall hazards? (Hydraulic fluid, diesel and oil leakage)	☐	☐	☐
3	Are risks from other machines, vehicle or people entering the work zone being managed? (i.e., Area taped off)	☐	☐	☐
4	Are environmental conditions acceptable for the work to proceed (good light, visibility and fog, rain, dust or heat not adding to safety risks)?	☐	☐	☐
	PLANNING AND COMMUNICATION	**Yes**	**No**	**N/A**
5	If more than one person is involved in the task is ONLY one person in charge? Do assistants know what is expected of them?	☐	☐	☐
6	Where the work requires in-cab operator assistance, is there a radio communication process in place to allow ground staff to speak directly to the operator? (Preferably a one-on-one voice activated system)	☐	☐	☐
7	If multiple workers are assisting, is every worker crystal clear about their role in the diagnostics / live check? (Question them)	☐	☐	☐
	MACHINE LOCKOUT	**Yes**	**No**	**N/A**
8	Can the person doing the job describe / demonstrate the machine's lock-out / disable features?	☐	☐	☐
9	Can the person doing the job describe how stored energy has been released before starting the job (mechanical energy or fluid pressure)?	☐	☐	☐
10	Have hydraulic lockouts been applied and all residual energy removed as far as possible?	☐	☐	☐
11	Has the lock-out switch been turned off (electrical circuit)?	☐	☐	☐
12	Has the computer been turned off?	☐	☐	☐
13	Are restraining devices being used i.e., slings, chains, locking pins or cylinder supports	☐	☐	☐
14	Are raised objects appropriately supported / managed? Are backup support options used in case the main support fails?	☐	☐	☐
15	Is the work being performed on stable ground that will prevent sudden unexpected movement?	☐	☐	☐
16	Is wheeled equipment chocked to prevent sudden movement?	☐	☐	☐
17	Has the machine been tagged-out – key removed and clearly marked that work is being performed and the machine is not to be used?	☐	☐	☐

MECHANICAL HAZARDS		Yes	No	N/A
18	Can anyone be crushed due to uncontrolled or unexpected movement of the machine or attachments?	☐	☐	☐
19	Can anyone be crushed due to the machine tipping or rolling over?	☐	☐	☐
20	Can anyone be crushed due to being trapped between the machine and materials or fixed structures?	☐	☐	☐
21	Can anyone be crushed due to coming into contact with moving parts of the machine during testing, inspection, operation, maintenance, cleaning or repair?	☐	☐	☐
22	Can anyone be injured due to sharp or flying objects?	☐	☐	☐
23	Can anyone be injured due to unexpected start-up or a malfunction during testing and diagnostics?	☐	☐	☐
24	Where machine guarding features have been removed to perform repairs, is this putting anybody at risk while the work is being performed?	☐	☐	☐
25	Is there a risk of anyone falling from height while performing the work?	☐	☐	☐
26	When testing a repair or fault finding, are body parts clear of nip / crush points?	☐	☐	☐
TIME PRESSURE		**Yes**	**No**	**N/A**
27	If downtime is likely to have a production impact, has the foreman been advised?	☐	☐	☐
28	If temporary manual processes have been put in place while the machine is out of service, have risks been assessed (tailgate records) and has supervision been organised (if necessary)?	☐	☐	☐
SKILLS & COMPETENCY + TOOLS & RESOURCES		**Yes**	**No**	**N/A**
29	Does the worker have the skill set and experience to do this job correctly and safely?	☐	☐	☐
30	Does the worker have the correct tools, operator manuals and PPE to do the job?	☐	☐	☐
31	Is there a suitably experienced person available to assist (if required)?	☐	☐	☐
32	Have external service providers received site access instructions and been provided with a site induction?	☐	☐	☐
WORKING ALONE		**Yes**	**No**	**N/A**
33	If the worker is working alone is an effective call-in arrangement in place?	☐	☐	☐
ARE THERE ANY OTHER CONCERNS OR OBSERVATIONS?		**Yes**	**No**	**N/A**
34		☐	☐	☐

Auditor:	Names of people involved:	Is the work safe and allowed to continue?	
		☐Yes ☐No ☐Unsure	**If "No" or "Unsure" stop the work and seek expert opinion**

Question Number	Corrective Action Required	Who	When

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Form B: R&M Training Exercise

Use this document as a practice or training tool for new or existing machine operators, mechanics or others that may assist with repair and maintenance work

Location		Date		Supplier	
Type of work and machines involved:					
Describe the training scenario:					

	MACHINE LOCKOUT, DE-ENERGISING, RESTRAIN AND SUPPORT	Yes	No	Needs training
1	Can the person doing the job describe and demonstrate how to they will lockout this machine before performing work? Electrical and mechanical lockout (Consider the given scenario)	☐	☐	☐
2	Did they consider turning off the lock-out switch (electrical circuit)? Where applicable	☐	☐	☐
3	Did they consider turning the computer off? Where applicable	☐	☐	☐
4	Did the person doing the job consider restraining devices to secure moving parts or attachments? (Slings, chains, locking pins or cylinder supports). Have they given an adequate description of the process and considerations involved?	☐	☐	☐
5	Can the person explain how they would support raised objects? Have they considered back-up support devices in the event that the main support fails? And is it adequate?	☐	☐	☐
6	Can the person doing the job describe and demonstrate how stored energy will be released before starting the job (mechanical energy or fluid pressure)?	☐	☐	☐
7	Where wheeled equipment is involved, did they describe how they would ensure that there is no unexpected movement? (i.e. placing chocks behind wheels)	☐	☐	☐
8	Can the person describe how they would ensure that the machine will not be accidently started while work is being performed? (Tag out system)	☐	☐	☐
9	Can the person involved identify and describe potential crush zones when the work is done? Can they describe how they would prevent this from happening?	☐	☐	☐
10	Can the person involved identify and describe potential crush zones when the work is done? Can they describe how they would prevent this from happening?	☐	☐	☐
11	Can the person involved identify any machine guarding that will need to be removed to do the job and do they know how to remove it?	☐	☐	☐
12	Are they identifying unnecessary guarding removal that may create a hazard for them when performing the work?	☐	☐	☐

ARE THERE ANY OTHER CONCERNS OR OBSERVATIONS?		Yes	No	N/A
13		☐	☐	☐

Question Number	Corrective Action Required	Who	When

Auditor:	Names of people involved:	Person assessed is competent to perform the work described in this training scenario
		☐ Yes ☐ No ☐ Training needed ☐ Not allowed to perform this work until trained and assessed

Repair and Maintenance Safe System of Work

Section 6: New Machine Induction

Another part to a safe system of work is to ensure that new hazards are not introduced to operations. This is particularly important when purchasing or leasing used machines but could also apply to new machines.

Performing a machine induction supports the start when certain concept in that it allows you to identify hazards before the machine is used.

The following page shows one example of a machine hazard inspection. This is not something that you are expected to do daily or weekly. It's good practice to perform this inspection when **new or used** plant is introduced into your operation.

Form C: Machine Hazard Inspection

For the induction of new machines

Machine description		**Machine location**	
Machine Function		**Inspection date**	

"Yes" to any of the following indicates the need to implement control measures		
Entanglement	**YES**	**NO**
Can a person's hair, clothing or gloves become entangled with moving parts of the machine?	☐	☐
Crushing	**YES**	**NO**
Can anyone be crushed due to: • material falling off the machine? • uncontrolled or unexpected movement of the machine? • lack of capacity for the machine to be slowed, stopped or immobilised? • the machine tipping or rolling over? • parts of the machine collapsing? • coming into contact with moving parts of the machine during testing, inspection, operation, maintenance, cleaning or repair? • being thrown off or under the machine? • being trapped between the machine and materials or fixed structures? • other factors not mentioned?	☐	☐
Cutting, Stabbing or Puncturing	**YES**	**NO**
Can anyone be stabbed or punctured due to: • coming in contact with sharp or flying objects? • coming in contact with moving parts during testing, inspection, operation, maintenance, cleaning or repair? • parts of the machine or work pieces disintegrating? • work pieces being ejected? • the mobility of the machine? • uncontrolled or unexpected movement of the machine? • other factors not mentioned?	☐	☐
Shearing	**YES**	**NO**
Can anyone's body parts be sheared between two parts of the machine, or between a part of the machine and a work piece or structure?	☐	☐
Striking	**YES**	**NO**
Can anyone be struck by moving objects due to: • uncontrolled or unexpected movement of the machine or material handled by the machine? • parts of the machine or work pieces disintegrating? • work pieces being ejected? • mobility of the machine? • other factors not mentioned?	☐	☐
High Pressure Fluid	**YES**	**NO**
Can anyone come into contact with fluids under high pressure, due to component failure or misuse of the machine?	☐	☐
Electrical	**YES**	**NO**
Can anyone be injured by electrical shock or burnt due to: • the machine contacting live electrical conductors? • the machine working in close proximity to electrical conductors? • overload of electrical circuits? • damaged or poorly maintained electrical leads and cables? • damaged electrical switches? • water near electrical equipment? • lack of isolation procedures? • other factors not mentioned?	☐	☐
Explosion	**YES**	**NO**
Can anyone be injured by explosion of gases, vapours, liquids, dusts or other substances, triggered by the operation of the machine or by material handled by the machine?	☐	☐

Slipping, Tripping and Falling	YES	NO
Can anyone accessing or egressing the machine or performing repair and maintenance work, slip, trip or fall due to: • uneven or slippery work surfaces? • poor housekeeping, for example offcuts, cables, hoses obstructing walkways, spills not cleaned up? • obstacles being placed in the vicinity of the machine? • other factors not mentioned?	☐	☐

Work at height	YES	NO
Can anyone fall from a height due to: • lack of a proper work platform? • lack of proper access stairs, steps or ladders? • lack of guardrails or other suitable edge protection? • unprotected holes, penetrations or gaps? • poor floor or walking surfaces, for example the lack of a slip-resistant surface? • steep walking surfaces? • collapse of the supporting structure? • other factors not mentioned?	☐	☐

Ergonomic	YES	NO
Can anyone be injured due to: • poorly designed seating? • poorly designed operator controls? • high forces? • repetitive movements? • awkward body posture or the need for excessive effort? • vibration? • other factors not mentioned?	☐	☐

Hazard combination	YES	NO
Can anyone be injured due to the unexpected start-up, unexpected over-run/over-speed or similar malfunction from: • failure/disorder of the control system, for example a hydraulic system? • restoring energy supply after an interruption? • external influences on electrical equipment? • other environmental factors, for example gravity and wind? • errors in the software? • errors made by the operator?	☐	☐

Operator Protection	YES	NO
Are the following operator protection features suitable for the work that the machine will be performing: • Operator restraints – lap belt or 4 point-harness fitted correctly, functioning correctly and in good order? • OPS structure has a current certification and meets RMF requirements? • FOPS structure has a current certification and meets RMF requirements? • ROPS has a current certification and meets RMF requirements? • COPS fabrication has a current certification and meets RMF requirements? • Fire extinguishers are installed and meet RMF guidelines? • Fire suppression system is installed and meets RMF guidelines? • Emergency exits are functional and not hindered by protective structures? • The machine has adequate lighting for the function that it is expected to perform?	☐	☐

Control Measures Required	Who	When

Repair and Maintenance Safe System of Work
Section 7: Mobile Plant Recovery

When a machine cannot be fixed and needs to be recovered, the following aspects should be considered. Remember that every situation is unique, and the assessment of the situation must be done without assumption or prejudgment. For complex recovery it is best to involve experts, both from a safety and insurance point of view

Considerations	Good Practice
1. Assessment	1. Do an accurate assessment of the site. Take pictures of the location, machine position, terrain challenges, terrain obstacles and other relevant information required to formulate the recovery plan. 2. Identify the most logical extraction path and inspect the ground stability along the entire extraction path. 3. Calculate the minimum recovery capacity (The pulling effort to extract the machine) and the safe working load required . 4. Identify the hazards involved in the recovery process 5. Identify what's different, difficult or dangerous 6. Identify who will be involved and who will oversee the recovery
2. Plan	1. Determine if you need an expert recovery company to do the work 2. Determine if you have the right resources (machine power and rigging) to do the job safely 3. Ensure that you have emergency procedures in place specific to the recovery. 4. Ensure that you have a robust communication system in place, ideally radio communication between all involved.
3. Execute	1. Start only when certain that you can get it done safely the first time 2. If you need to stop and reset, or the plan must change, ensure that everyone involved understands the changes 3. Reassess the hazards and safety controls if you must stop and reset or change the plan

If there are any doubts around your capability to extract the machine STOP and get specialist assistance to advice or to perform the machine recovery

Calculation for minimum pulling force required and safe working load parameters

W+ARR+AGR= Minimum pulling force required	
W	This is the total weight of the machine including attachments, ropes, fuel
ARR	This is the surface in which the machine is stuck. Take the total weight of the machine, select the surface in the image below to and use that selected multiplier to calculate "ARR". 
AGR	This is the degree of slope that the extraction will take place on. The steeper the slope the greater the multiplier used. Take the total weight of the machine, select the slope (degrees) in the image below and use that selected multiplier to calculate "AGR". 

Example calculation: A John Deere 648 grapple skidder needs to be recovered. The surface is mud and it's on a slope of 30 degrees.

W	**ARR**	**AGR**	**Minimum pulling force required**
19,000 kg (19 Ton)	Wheel deep in clay (Wx2) = **38,000 kg (38 Ton)**	30-degree slope (W x .5)= **9,500 kg (9.5 Ton)**	**W+ARR+AGR=(19t + 38t + 9.5t)** **66,500 kg (66.5 Ton)**

You will need a pulling force of 66.5 tonnes to extract this machine in this example. For guidance on utilising smaller blocks in a double purchase configuration please consult expert advise.

Repair and Maintenance Safe System of Work

Appendix A: Processing Heads

This section contains specific repair and maintenance advice based on manufacturer recommendations and best practice guidelines

Before doing any repair or maintenance work on processing and harvesting heads, the following steps must be followed

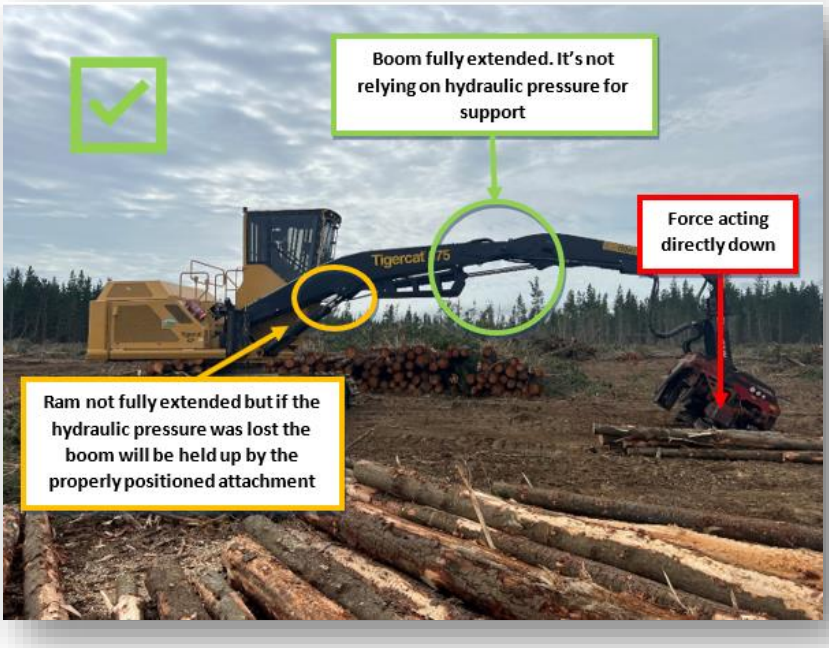
STEP 1 Turn the base machine off and ensure that it cannot be accidentally started while the work is underway	This is the most important step and is mandatory for any repair or maintenance work.
STEP 2 Turn the computer off inside the cab	This is especially important for heads that have hydraulic accumulators which can store harmful residual energy. This step is mandatory for any repair or maintenance work.
STEP 3 Install the manufacturer supplied locking pin on the head before performing any* work	This step will prevent lateral and horizontal movement of the head while repair and maintenance work is being performed. *There is one exception to this, when a main supply hose on a waratah head fails, it cannot be accessed with the locking pin in place. In this situation, the head needs to be placed in an energy neutral position where it is as safe as possible to prevent unexpected movement.

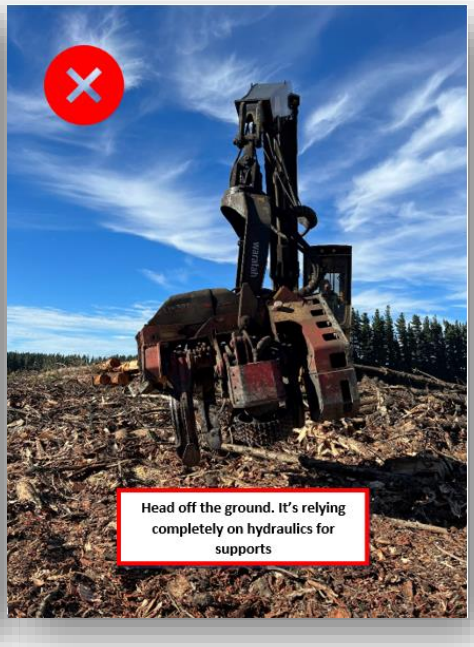
Repair and Maintenance Safe System of Work

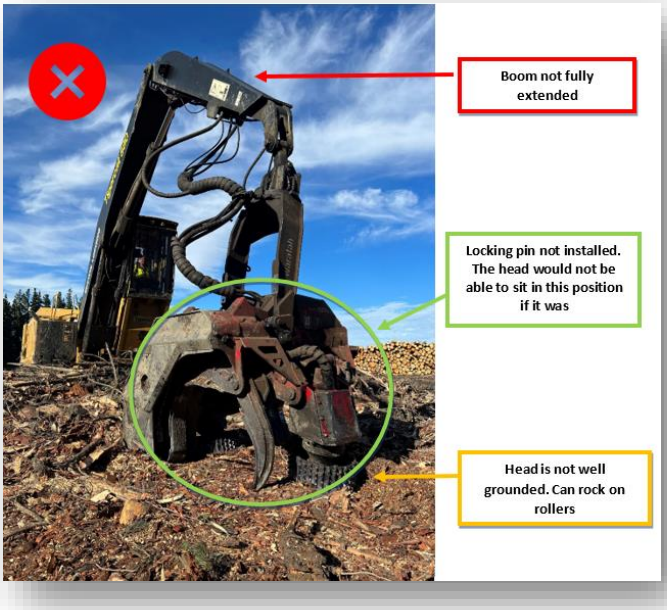
Appendix B: Machine Lockout and Safe Positioning

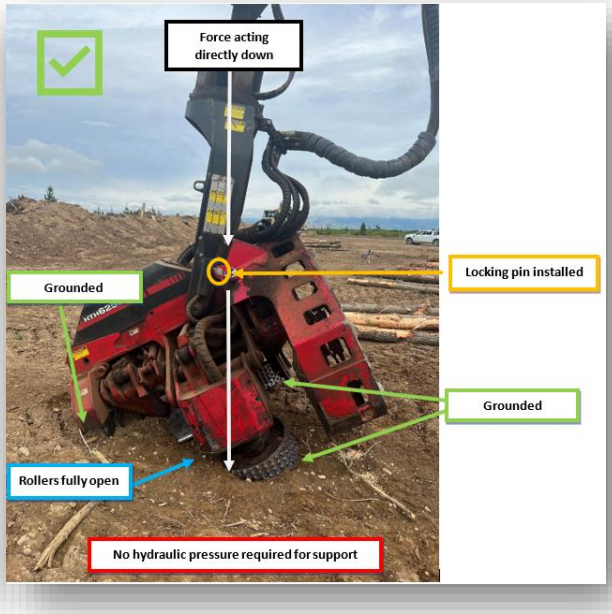
This section contains specific examples of safe machine setup for repair and maintenance work

Safe positioning of a log processor







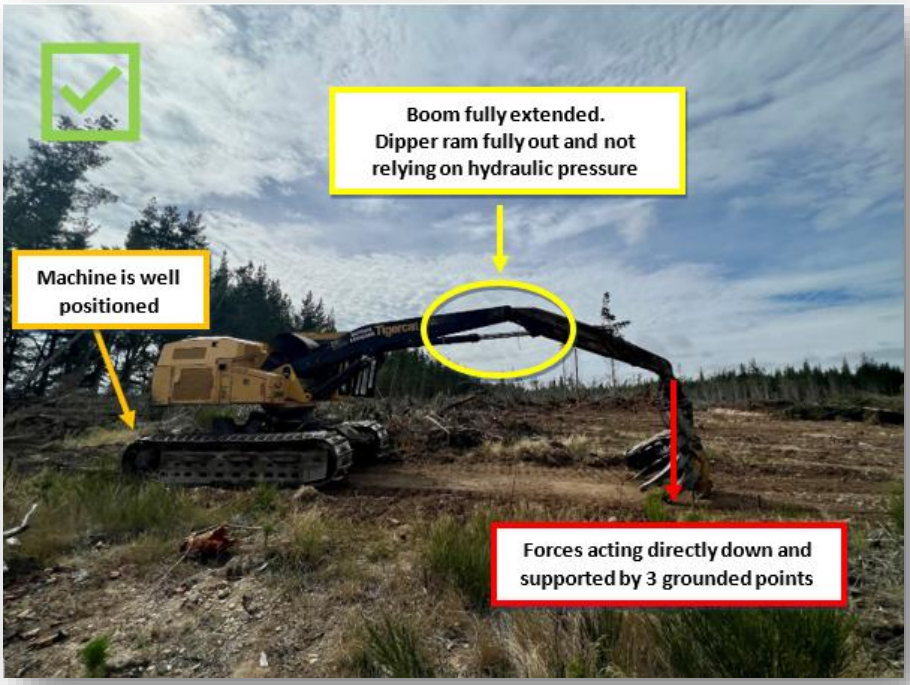


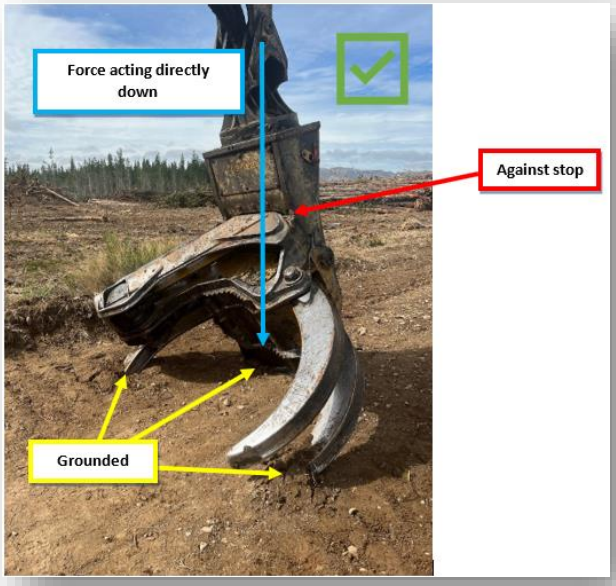
Repair and Maintenance Safe System of Work

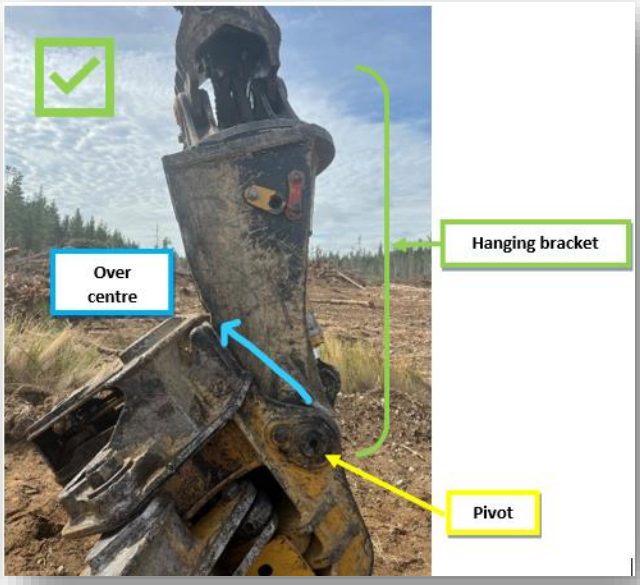
Appendix C: Machine Lockout and Safe Positioning

This section contains specific examples of safe machine setup for repair and maintenance work

Safe positioning of felling machine





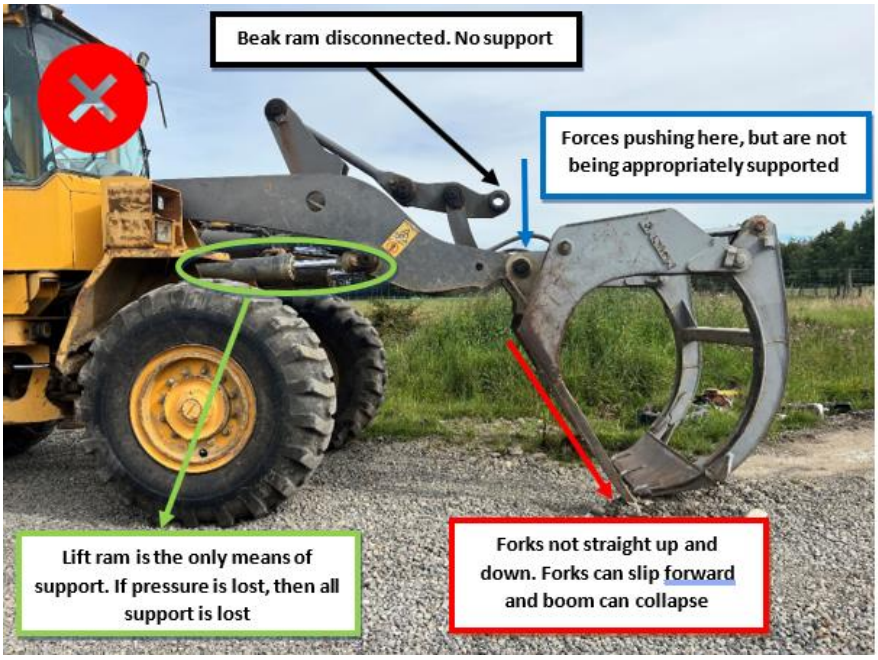


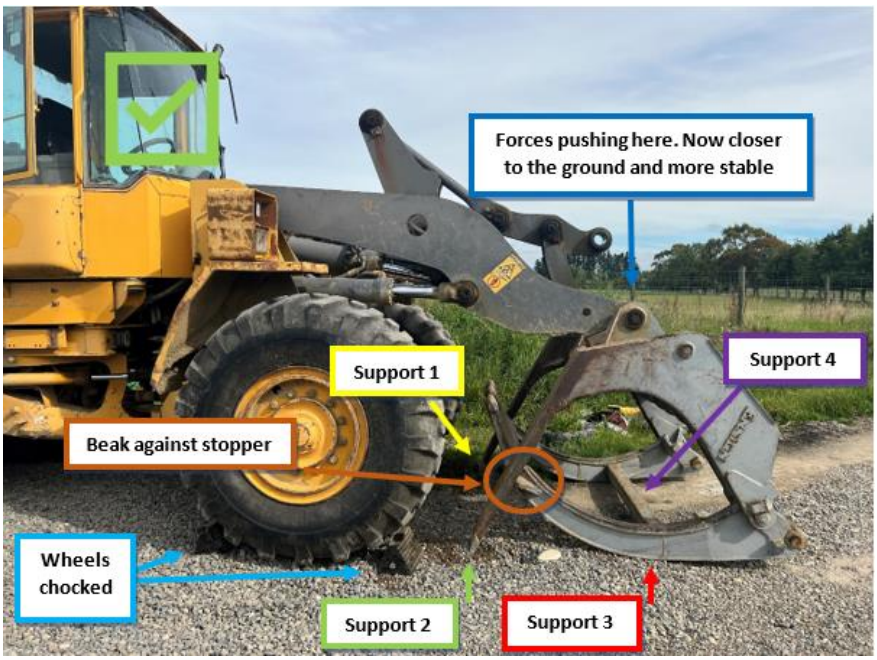
Repair and Maintenance Safe System of Work

Appendix D: Machine Lockout and Safe Positioning

This section contains specific examples of safe machine setup for repair and maintenance work

Safe positioning of wheeled loader



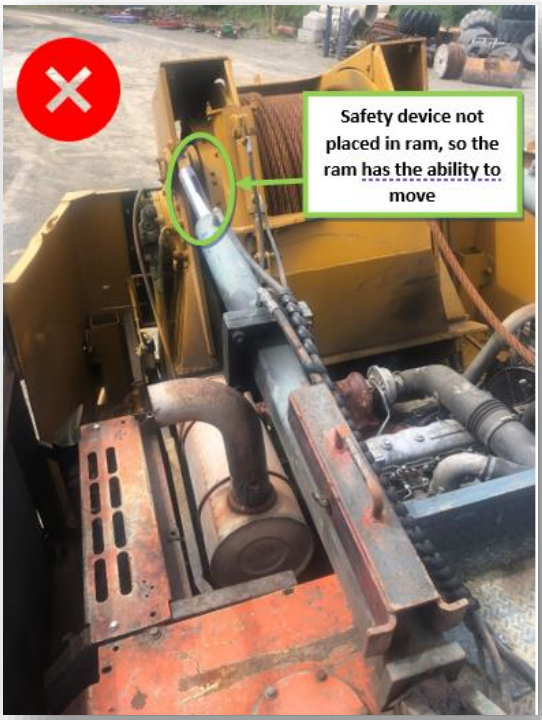


Repair and Maintenance Safe System of Work

Appendix E: Machine Lockout and Safe Positioning

This section contains specific examples of safe machine setup for repair and maintenance work

Example lockout devices

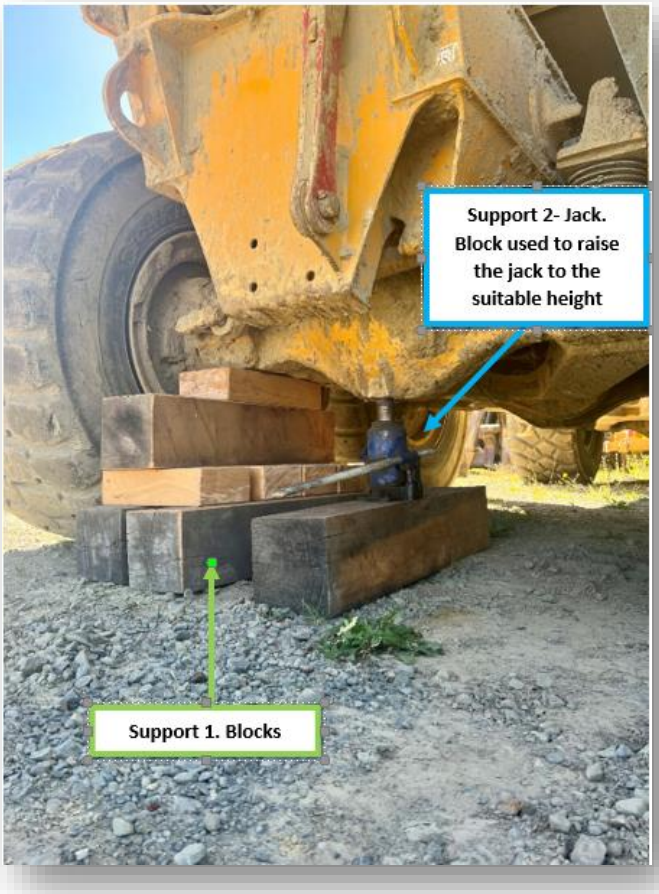


Repair and Maintenance Safe System of Work

Appendix F: Machine Lockout and Safe Positioning

This section contains specific examples of safe machine setup for repair and maintenance work

Using blocks / logs to elevate and support a load



- Ensure any blocks that you use are a suitable size and width to hold the capacity of the load
- Make sure that the ends are cut square and cut to fit
- Take the time to shape timber supports so that they are fit for purpose.
- Use sound timber. No cracks, decay, rot or damage.
- Cut to the right length and suitable size
- Ensure the blocks are on suitably level ground and well secured. Use a spade to level the ground if needed.
- Use a secondary support, in this example it's a jack of adequate size and lifting capacity

Repair and Maintenance Safe System of Work

Appendix G: Machine Lockout and Safe Positioning

This section contains specific examples of safe machine setup for repair and maintenance work

Using stands to elevate and support a load

Hauler being worked on in the workshop. The cab maintenance/transport support is the primary support. Support 2 is the stand resting on the top of the cab.

Wheel loader being worked on in the workshop. 2 support systems in place.

Stands may not be ideal in field conditions due to undulating ground, surface condition, rock , soft ground and mud. If a stand is our only way of providing a secondary support, then you may need to use an appropriate base plate.

<u>CRITICAL NOTE:</u> Extreme care must be taken so you are not putting yourself in danger when placing theses stands under the raised objects

If you are using the hydraulics as your secondary support, extreme care should be taken with regards to what you are repairing. Ensure that no maintenance or repair is being done to any component of the hydraulic system. A mistake may cause the hydraulics to collapse and your support system to fail.

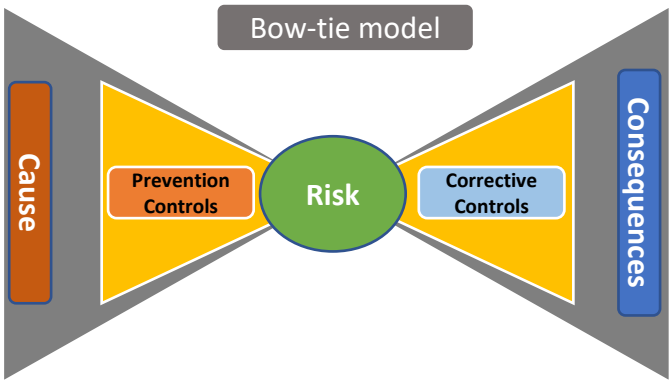
Supplementary Guidance
Risk Assessment Process

RMF's risk assessment process is focused on critical risk areas. In other words, hazardous activities that have significant risks associated with them. In the process of developing this guidance we followed a risk assessment process.

One method of performing a risk assessment is called the bow-tie process. It's called a bow-tie process because of the way it looks once the assessment is completed. The start of any bow-tie assessment is the risk focal point or event (the harm event that you imagine for the purpose of the assessment i.e., a crush injury due to unexpected machine movement).

The process steps are as follows:

Step 1 Identify the risk focal point or event	What event are you doing the risk assessment on?
Step 2 Identify the causes	What causes your event to happen?
Step 3 Identify the consequences	What are the consequences if your event happens?
Step 4 Identify the prevention controls	What prevention controls can you put in place to prevent the event from happening ?
Step 5 Identify the corrective controls	What corrective controls can you put in place if the event happens?



For an easy-to-understand explanation of the bow-tie process scan this QR-code

Working example of bowtie risk assessment

Below is an example of a completed bowtie assessment on a high-risk machine repair in the forest.

High Risk Activity – Onsite repair of a broken lifting ram

Causes	Preventative controls		Corrective controls	Consequences
Unsafe work area • Congestion • Poor visibility • Uneven ground	• Move machine to a flat stable area away from other operations • Repairs in daylight hours only		• Emergency response plan activated • Provide necessary assistance	**Person trapped with other workers around him**
Machine in unsafe state • Slippery due to oil • Broken guarding	• Install non-slip surface in high traffic areas • Inspect guarding daily • Engage machine lockout features • Remove all remaining energy sources (de-energise) • Perform preventative inspection and maintenance		• Man-down radio issued by crew to service provider or in-house mechanic when on site. • Initiate emergency response plan if lone worker alarm activates and no call in follows	**Lone worker trapped and unable to call for help**
Raised object not secure or stable	• Engage machine lockout features • Remove all remaining energy sources (de-energise) • No working directly under raised objects unless supported by fail safe (mechanical or stationary)	**Crush injury as a result of residual energy causing unexpected machine movement**	• Emergency response plan activated if required • Authorities and forest manager notified • Accident site frozen • Investigation commences	**Notifiable event – Worksafe request site inspection**
Lack of skills to do the job	• Operators to be familiar with operator's manual • Work that must be outsourced identified and operators understand not to attempt repair		• Internal investigation commences using appropriate resources • Seek specialist advice where required	**Prosecution, Fine or other Liability**
Miscommunication	• All involved discuss and formulate plan, one person in charge • If operator in-cab assistance is required, there must be handsfree voice activated radio communication between repair person and operator in the seat		• Emergency response plan activated if required • Report incident to forest owner • Ensure that the machine remains isolated • Investigate incident and act on corrective actions	**High Potential Non-Notifiable Accident or Injury**

Supplementary Guidance
Hierarchy of Controls

Always try to eliminate a hazard, that is the best way to avoid an accident. If you cannot eliminate a hazard, then look at minimizing the possibility of an accident.

Eliminate		
1	**Eliminate the hazard** completely remove it from the workplace	**Example** Prefabrication of components off-site at a workshop instead of unfavorable forest site Installing grip tape on metal surfaces where people walk on machines Handrails where there is a risk of falling Moving a machine or attachment off-site to a workshop for repairs
Minimise		
2	**Substitute the hazard** with a safer alternative	Replace a defective machine with a leased machine in a safer condition while the defective machine is off-site being repaired
3	**Isolate the hazard** as much as possible away from workers	Installing machine guarding for exposed components Using effective de-energizing procedures Using a fail-safe machine lock-out process
4	**Use engineering controls** adapt tools or equipment to reduce the risk	Modifying tools or machinery to reduce risk
5	**Use administrative controls** change work practices and procedures	Doing a hazard assessment before staring the job or a written safe procedure for the task
6	**Use PPE** this is the last resort after you have considered all other options	Using safety glasses, steel toe-cap boots and gloves. Wearing a hardhat with chin strap when working in a hauler's engine bay

For more guidance about effective control measures, have a look at these QR-Codes

Access to documents

Scan this QR code which will take you to our RMF public site. You will be able to download or view the audits and other guidelines contained in this document. You would also be able to get copies of this document if you need to.