A handbook for workplaces

Safe use of tractors with attachments

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## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>1. Legal requirements</td>
<td>4</td>
</tr>
<tr>
<td>2. Common causes of injury</td>
<td>6</td>
</tr>
<tr>
<td>2.1. Tractor roll over</td>
<td>6</td>
</tr>
<tr>
<td>Roll Over Protective Structure (ROPS)</td>
<td>8</td>
</tr>
<tr>
<td>Seatbelts</td>
<td>8</td>
</tr>
<tr>
<td>2.2. Tractor run over</td>
<td>9</td>
</tr>
<tr>
<td>Operator access</td>
<td>10</td>
</tr>
<tr>
<td>2.3. Falling objects</td>
<td>11</td>
</tr>
<tr>
<td>Falling Object Protective Structure (FOPS)</td>
<td>12</td>
</tr>
<tr>
<td>Lifting and moving loads</td>
<td>13</td>
</tr>
<tr>
<td>2.4. Stability</td>
<td>14</td>
</tr>
<tr>
<td>Ballast and counterbalances</td>
<td>15</td>
</tr>
<tr>
<td>Axles and tyres</td>
<td>16</td>
</tr>
<tr>
<td>2.5. Maintenance and repair</td>
<td>17</td>
</tr>
<tr>
<td>Maintaining a safe tractor</td>
<td>19</td>
</tr>
<tr>
<td>Older tractors</td>
<td>20</td>
</tr>
<tr>
<td>2.6. Guarding - existing and retrofitted</td>
<td>21</td>
</tr>
<tr>
<td>Guarding requirements</td>
<td>22</td>
</tr>
<tr>
<td>Power Take Off (PTO) master guards and shaft guards</td>
<td>22</td>
</tr>
<tr>
<td>Guarding to protect bystanders</td>
<td>23</td>
</tr>
<tr>
<td>3. Traffic management and the home environment</td>
<td>24</td>
</tr>
<tr>
<td>3.1. Tractor travel</td>
<td>24</td>
</tr>
<tr>
<td>People working on attachments</td>
<td>25</td>
</tr>
<tr>
<td>Transporting inoperable machinery</td>
<td>26</td>
</tr>
<tr>
<td>3.2. The farm workplace and the home environment</td>
<td>26</td>
</tr>
<tr>
<td>Separating tractors and people</td>
<td>26</td>
</tr>
<tr>
<td>Supervising children</td>
<td>28</td>
</tr>
<tr>
<td>4. Operator competency</td>
<td>29</td>
</tr>
<tr>
<td>5. Operator health</td>
<td>30</td>
</tr>
<tr>
<td>Posture</td>
<td>30</td>
</tr>
<tr>
<td>Vibration</td>
<td>30</td>
</tr>
<tr>
<td>Operator controls</td>
<td>30</td>
</tr>
<tr>
<td>Noise</td>
<td>31</td>
</tr>
<tr>
<td>UV exposure</td>
<td>31</td>
</tr>
<tr>
<td>Fatigue and stress</td>
<td>32</td>
</tr>
<tr>
<td>Working alone - communication strategies</td>
<td>32</td>
</tr>
<tr>
<td>Risk of fire</td>
<td>33</td>
</tr>
<tr>
<td>6. Checklists</td>
<td>34</td>
</tr>
<tr>
<td>Tractor maintenance checklist</td>
<td>34</td>
</tr>
<tr>
<td>Sample routine tractor maintenance checklist</td>
<td>35</td>
</tr>
<tr>
<td>Pre-operation checklist</td>
<td>38</td>
</tr>
<tr>
<td>Sample tractor pre-operation checklist</td>
<td>38</td>
</tr>
<tr>
<td>Tractor purchase/review checklist</td>
<td>40</td>
</tr>
<tr>
<td>Sample tractor purchase/review checklist</td>
<td>40</td>
</tr>
<tr>
<td>Tractor attachment purchase/review checklist</td>
<td>43</td>
</tr>
<tr>
<td>Sample tractor attachment purchase/review checklist</td>
<td>43</td>
</tr>
<tr>
<td>Sample Front End Loader (FEL) pre-operation checklist</td>
<td>44</td>
</tr>
<tr>
<td>Sample Front End Loader (FEL) purchase/review checklist</td>
<td>45</td>
</tr>
<tr>
<td>7. Appendices</td>
<td>46</td>
</tr>
<tr>
<td>Appendix A: Example safe work method statement</td>
<td>46</td>
</tr>
<tr>
<td>Tractor and slasher</td>
<td>46</td>
</tr>
<tr>
<td>Appendix B: Example - Calculation of required counterbalance</td>
<td>48</td>
</tr>
<tr>
<td>8. Definitions and abbreviations</td>
<td>50</td>
</tr>
<tr>
<td>9. References and further information</td>
<td>51</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>52</td>
</tr>
</tbody>
</table>

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This publication is protected by copyright. WorkSafe encourages the free transfer, coping and printing of this publication if such activities support the purpose and intent for which this publication was developed.
This handbook has been developed by WorkSafe Victoria and the agricultural industry to encourage the safe use of tractors with attachments.

WorkSafe Victoria encourages all users of tractors, especially farmers, contractors and farm workers, to read this publication. The guidance will assist farmers to review their current farm machinery to ensure that the tractor and attachment is compatible and appropriate for specific farm jobs.

Led by the University of Ballarat’s Victorian Farm Safety Centre, a reference group of industry experts was convened to support the development of Safe use of tractors with attachments.

The purpose of this handbook is to outline the legal requirements and provide known industry solutions and strategies to ensure the safe operation of tractors with attached implements on farms.

There are many abbreviations throughout this handbook. Please refer to the definitions and abbreviations on page 50 for complete terms and explanations.

This industry safety standard has been reviewed and endorsed by: WorkSafe Western Australia. For specific occupational safety and health requirements refer to: Occupational Safety and Health Act 1984 and Occupational Safety and Health Regulations 1996.
Introduction

Who should read this handbook?
This handbook is for farmers, their family members, employees, contractors and farm machinery designers, manufacturer’s and suppliers. It provides advice for the safe use of tractors with attachments on farms; it does not cover industrial Front End Loaders (FEL), telehandlers or forklift trucks.

This document also applies to those using tractors for other activities, such as lifestyle farming, green keeping, boating and public land management.

Why should you read this handbook?
Tractors are, by far, the most dangerous piece of equipment on Australian farms. About 20 people are killed on Australian farms each year while using tractors – more than the number killed by farm utilities, motorbikes and quad bikes combined. Many more people are injured. This can happen on any size of farm and to anyone regardless of age or type of tractor.

Agricultural tractors include a broad range and variety of vehicles, from around half a tonne in weight to more than 25 tonnes. They may be rigid or articulated, tyre or tracked, two-wheel drive, front-wheel assist and four-wheel drive, single or multi-wheeled per axle.

Tractors handle a variety of attachments. Even if the tractor itself is well set up for safe use, a new attachment introduces a new set of hazards. Combinations of tractor and attachment require competence and experience to set up, operate and maintain.

Planning and selecting the right equipment for the job is a key step before you start. You should think through the tasks, consider the type of equipment necessary and the terrain to ensure you select the right tractor and attachments for the job. This will result in a reduced risk of injury or death. It also includes benefits such as better tractor efficiency, longer equipment life and lower repair costs.
What information does this handbook contain?

This handbook provides useful solutions for:

• preventing incidents in the first place – choosing the right tractor and attachments and setting them up correctly
• protecting the operator and others when things go wrong – through the use of safety guards, safe protective structures and personal protective equipment (PPE)
• considering the ongoing health and safety of the operator – including reducing or preventing fatigue, stress, ergonomics, noise, chemical and UV exposure.
1. Legal requirements

The Occupational Health and Safety Act (OHS Act) applies to all workplaces, including farms. As a farmer, you may be an employer, a self-employed person or a person who manages and controls the farm. As such, you have legal responsibilities under the OHS Act. You must ensure that, as far as is reasonably practicable, the farm workplace and means of entering and leaving the farm is safe and without risk to health. This extends to all people (including family members, employees, visitors, contractors or the public) to ensure they are not exposed to risks to their health and safety arising from farm activities. In certain circumstances, an independent contractor and their employees may be deemed employees of the employer.

When you are ensuring health and safety on the farm, you must do what is ‘reasonably practicable’ having regard for the following:

- the likelihood of hazard or risk eventuating
- the degree of harm that would result if the hazard or risk eventuated
- what the person concerned knows or ought reasonably to know about the hazard or risk and any ways of eliminating or reducing the hazard or risk
- availability and suitability of ways to eliminate or reduce the hazard or risk
- the cost of eliminating or reducing the hazard or risk.

A farmer, who may be an employer, self-employed person or a person who manages or has control of the workplace, also has specific employer responsibilities to consult with workers and provide adequate information, instruction, training and supervision concerning the safe use of the plant together with safe work procedures.

Employees must also take reasonable care for their own and others’ health and safety and cooperate with their employer in any actions taken to comply with the OHS Act and Occupational Health and Safety Regulations (OHS Regulations).
The OHS Regulations provide more information about how OHS legislation should be followed. For example, suppliers of machinery must provide adequate information to the purchaser at the time of supply, covering its safe use combined with any limitations concerning operating conditions. This includes the designer and manufacturer's specifications, the manufacturer's operator instruction manual on safe use, maintenance requirements, the designer and manufacturer's specifications for a safe workload and any compatible implements.

The OHS Act also places responsibility on farm machinery designers, manufacturer's and suppliers to ensure, as far as reasonably practicable, that the tractor and attachments are safe and without risk to health.

If farmers have modified machinery, the same responsibility may apply to them.

The following examples show how a farmer can be considered under the OHS Act to be a designer, manufacturer, or supplier of plant:

- As a designer of an alteration to a machine, the farmer assumes responsibility for any consequences that occur as a result of the alteration. The tractor should remain functional, stable and structurally sound and the farmer should consult with the machine manufacturer before altering plant.

- One example of poor practice on farms is welding extensions onto hay forks to stop additional bales from falling back onto the tractor or operator. This destroys the forks which will need to be replaced. Farmers should make enquiries with the tractor manufacturer or agent to determine whether extension slippers that fit over the existing forks are appropriate. The increased carrying-capacity could mean the tractor and other components are overloaded.

- A farmer makes up a carry-all platform for the three-point linkage of a tractor to carry tools and supplies. Ensure the carry-all equipment undergoes appropriate load testing and the load is within the rated capacity of the three-point linkage and tractor to ensure the tractor remains stable. If an employee is injured because a component on the carry-all fails, the farmer assumes responsibility for any consequences of the design and manufacture under the OHS Act as the designer and manufacturer.

- A farmer sells a tractor with modifications to another farmer for use on a farm. If the tractor is subsequently involved in an incident and someone is injured as a result of the modification's failure, the farmer who sold the tractor has duties under the OHS Act as a supplier and may be held accountable.
2. Common causes of injury

Farmers need to plan and make informed choices to ensure they select the safest and most appropriate machinery and equipment for the tasks on their farms and ensure safe use.

The following are some industry known controls that reduce the risk of injury or death associated with tractor operation.

2.1 Tractor roll over

Tractor roll over was until recently the single most significant cause of farmer fatality throughout Australia. The gradual introduction of Roll Over Protective Structures (ROPS) has helped to reduce the number of farmer roll over fatalities.

Tractor with a four-post ROPS. (Refer to page 8 for examples of two-post ROPS and fold down ROPS)
## Common causes of injury

### Recommended solutions

<table>
<thead>
<tr>
<th>Activity</th>
<th>Problem</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>All tractor operating conditions</td>
<td>Roll over and backflip</td>
<td>• Ensure tractors (over 560 kg) have a compliant ROPS or ROPS-compliant cabin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensure the ROPS complies with AS 1636:1996 <em>Tractors - Roll over protective structure - criteria and tests</em> and the compliance plate is attached to the structure.</td>
</tr>
<tr>
<td>Tractor travel</td>
<td>Operating on uneven ground along a road or where there is a risk of the operator being ejected from the seat</td>
<td>• Wear a seatbelt where there is a risk of being ejected from the tractor. If the tractor does not have a seatbelt it should be retrofitted, where reasonably practicable, to tractors that have been fitted with a ROPS.</td>
</tr>
<tr>
<td>Using tractor for vehicle recovery or pulling stumps</td>
<td>Tractor backflips</td>
<td>• Never attach a towing chain to the top link pin of the three-point linkage. Attach the towing chain as low as possible to the ground.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If it is not possible to attach very low to the ground on a particular tractor, it should not be used.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Do not attempt to move the impossible. Even if an attachment point is very low to the ground, a tractor with sufficient torque and traction can still backflip.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensure tractors are fitted with a ROPS.</td>
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<tr>
<td></td>
<td></td>
<td>• Ensure the chain is in good condition and has a rated capacity sufficient for the task. Be aware that if the chain or cable breaks, it may recoil along its length, potentially injuring operators and others.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establish a safe work zone and exclude bystanders from the work area.</td>
</tr>
<tr>
<td>Using tractor near buildings</td>
<td>Tractor ROPS contacting building structure</td>
<td>• Only use a tractor with a fold down ROPS if you are working near buildings or overhead structures, including trees.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fitting a long plastic (non-conductive) flexible pole to the front of the tractor is a simple solution to warn the operator of unnoticed overhead hazards.</td>
</tr>
</tbody>
</table>
2. Common causes of injury

Roll Over Protective Structure (ROPS)
Tractors must have a compliant ROPS fitted\(^1\). This requirement may not apply in limited circumstances. Since the early 1980s, all new tractors in Australia must be ROPS-compliant.

- Check all tractors to make sure the cabin or structure is ROPS compliant and not simply there for weather protection.
- A ROPS must be fitted to the tractor by a competent person and the means of attachment must be as strong as the ROPS itself.
- Some tractors with a cast iron rear axle might not be strong enough to fit a two-post ROPS. A four-post ROPS will better distribute the load when fitted to both the rear axle and the chassis forward of the operator. Tractor manufacturer's and suppliers should be consulted about the most suitable ROPS design.
- Where overhead hazards limit the use of a standard ROPS, a fold down ROPS should be fitted.
- To ensure the operator is not ejected from the tractor, it is recommended that a seatbelt is fitted at the same time as fitting the ROPS.

Ensure the fitted ROPS meet Australian Standard, AS 1636:1996 Tractors - Roll over protective structure - criteria and tests including a verification plate from the manufacturer. It is critical the ROPS is not structurally modified (welded or drilled) because it could undermine its structural integrity. It is acceptable to strap or clamp lightweight objects to the ROPS frame, for example, using U-bolts to attach a work light and a strap for the electric cable. The ROPS frame should be checked at least every two years for damage and yearly to ensure all bolts are securely fastened.

Seatbelts
Tractors are often used in terrain where rocks, stumps, holes, ditches, embankments, depressions and crumbling or slippery banks exist, increasing the risk to the operator of being ejected from the tractor.

Seatbelts on tractors can save lives by preventing operators being ejected from the tractor seat. Where there is a risk of roll over, the seatbelt keeps the operator within the protected ROPS area and prevents the operator from being thrown in front of the wheel or implements. Where there is a risk of the operator being ejected, a seatbelt must be worn. If the tractor does not have a seatbelt, it is recommended that a seatbelt is fitted where reasonably practicable.

Many older tractors are not fitted with seatbelts or may not have provision to fit a seatbelt. There are commercial products available for older tractors that provide for the installation of seatbelts. In many cases, this involves replacing the seat and seat mount. Ensure the retrofit uses compliant equipment and is attached to suitable points on the tractor by a competent person. It is critical that the seatbelt is connected to components that are at least as strong and durable as the seatbelt itself and are anchored to the tractor in a way that allows the seatbelt to be effective for all seat adjustments.

\(^1\) See Part 4, Div 4 of the OHS Regulations for the limited circumstances.
2. Common causes of injury

Case study

An Australian farmer was travelling in top gear when the tractor became unstable on rough terrain. He was thrown in front of the front wheel and crushed, suffering serious injuries. A seatbelt would have kept him on the tractor.

2.2 Tractor run over

A large number of tractor-related deaths and injuries involve tractor run over. These are often a result of poor practices, including starting the tractor from the ground, jumping off a moving tractor and getting off a tractor without engaging the handbrake or park.

Recommended solutions

<table>
<thead>
<tr>
<th>Activity</th>
<th>Problem</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>People riding on attachments</td>
<td>Run over and other fall injuries</td>
<td>• Never ride on attachments, including carry-alls unless the attachment is specifically designed for people and this will not over-load the attachment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If the attachment is specifically designed to carry people as part of the operation (e.g. planting or vegetable harvesting), the attachment should provide protection from all hazards and in particular, the risk of falls, ejection and entanglement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A Front End Loader (FEL) bucket or attachment connected to the FEL linkages should not be used to lift people.</td>
</tr>
<tr>
<td>Getting on or off a moving tractor</td>
<td>Tractor runs over the operator</td>
<td>• Never get on or off a moving tractor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Never start or operate a tractor from the ground.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Turn off the engine before dismounting. Even when dismounting to close or open a gate there is a risk of knocking the tractor into gear.</td>
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<td></td>
<td></td>
<td>• Ensure the handbrake is always applied or park mode engaged.</td>
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<td></td>
<td></td>
<td>• Maintain brakes to ensure they are effective for all terrain and strong enough to restrain the movement of the tractor should the tractor be knocked into gear.</td>
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<tr>
<td></td>
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<td>• Steps, rails and guarding should ensure the operator steps off outside of the rear wheel track.</td>
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<tr>
<td></td>
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<td>• When dismounting do not jump off the tractor. Always use the steps and handrails with three points of body contact.</td>
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</tbody>
</table>
2. Common causes of injury

Operator access

Good cabin access can prevent slips and falls when getting on and off a tractor (particularly for less-agile operators). Many older tractors (and some newer tractors) can benefit from some simple modifications to improve safe access. When replacing an old tractor or purchasing a new tractor look for the following:

- stair design access is preferable to ladder (vertical) access
- the steps should have adequate grip in all conditions and be made of materials such as wide grill mesh so that mud does not easily accumulate
- step design – AS 1657-1992 Fixed platforms, walkways, stairways and ladders - Design, construction and installation recommends the steps be approximately 150–200 mm
- when accessing the tractor, the operator should face the tractor when getting on and off, maintaining three points of hand and feet contact with the handrails and steps. There should also be a guard between the steps and the rear tractor tyre. This is effectively a wide mud guard on the side of the vehicle
- to maintain sufficient ground clearance, the bottom step can be fold-up or spring loaded.

Case study

An Australian farmer was thrown from the tractor seat when travelling over rough terrain. He fell in front of the rear wheel and was crushed. He was not wearing a seatbelt and there was no cabin or guarding to stop him falling under the rear wheel.

If a tractor needs to be modified to improve access, the added components should not affect its structural integrity. Modifications should be undertaken by a competent person in consultation with the tractor manufacturer.

Consider using long-handled tools at ground level to avoid the need to climb to clean windows and roof. Unless specifically identified for the task by the manufacturer, components such as mudguards or bonnets should not be used as access platforms. Consider using adjacent platforms and secure ladders when servicing the engine bay.
2. Common causes of injury

2.3 Falling objects

Many farmers have been killed and injured by falling objects. Examples include: objects falling from Front End Loader (FEL) attachments, hay bales falling from a haystack or overhead branches falling from trees. A safe system for lifting includes both the appropriate lifting attachment for the material being handled and a suitable Falling Object Protective Structure (FOPS) on the tractor.

Recommended solutions

<table>
<thead>
<tr>
<th>Activity</th>
<th>Problem</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handling hay and wrapped silage</td>
<td>Fodder can roll back or fall from a stack onto the tractor operator</td>
<td>• Select the right attachment for the job. The tractor should have a hay spike for hay or a grab for wrapped silage. This decreases the risk of fodder rolling back onto the tractor operator. Flat forks or buckets are not appropriate. • Tractors should have a suitable FOPS or a FOPS-compliant cabin. • Select the appropriate FEL for the task. It should be self-leveling with hydraulic load-limiting valves to avoid overloading.</td>
</tr>
<tr>
<td>Using a tractor without a cabin with a FEL and a rear mounted two-post Roll Over Protective Structure (ROPS) but no FOPS</td>
<td>The operator has no protection from fodder or other items that may fall from the FEL or a nearby stack or trees where there is a risk of falling branches</td>
<td>• Fit a suitable FOPS and select self-leveling forks or attachment that's fitted with a rear frame to prevent load from rolling back onto operator. • Retire tractors that are not suited to the task and use tractors that incorporate a ROPS and FOPS. • A mid-mounted two-post ROPS does not fulfill the requirement of acting as a FOPS, especially around trees and haystacks.</td>
</tr>
<tr>
<td>Farmer uses a FEL to lift a generator from the back of a vehicle.</td>
<td>Components could fail, destabilising the tractor, or the operator to be struck by broken components</td>
<td>• Check that the tractor has rated lifting locations specified on the FEL. Consult farm machinery supplier and manufacturer's specifications for lifting advice including lift ratings and locations. • Check the tractor’s lift capacity. Determine whether a counterbalance is necessary to achieve the required capacity. • Find out the weight of the generator (this may be on the specification plate). Use components such as chain and shackles that have an identified rated capacity that is appropriate for the lift. • Lift the generator from the specified lifting points.</td>
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</table>
Common causes of injury

Falling Object Protective Structure (FOPS)

If there is a risk that the tractor operator can be harmed by falling objects, an appropriate, suitably located means of protection must be installed. For example, tractors with a Front End Loader (FEL) must be fitted with attachments that are designed to contain the load and provide appropriate overhead protection for operators.

Similarly, any tractors near objects that could fall on the operator should be fitted with a suitable structure for protection. The Australian Standard for FOPS is AS 2294.1:1997 Earth-moving machinery - Protective structures. There are two levels of FOPS protection in this Standard. For most agricultural applications, the applicable protection is level two. A four-post ROPS may afford the operator some protection.

Not all tractor cabins have been designed to meet FOPS standards. Insist on checking for compliance when planning the job and selecting a tractor with an attachment suitable to undertake this type of work.

A common tractor configuration is a smaller tractor with a FEL, a two-post ROPS, but no FOPS. Anyone supplying and using these tractors should ensure that adequate protection from nearby falling objects is included. Where the tractor with FEL configuration is not fitted with FOPS, the FEL use should be restricted to free flowing material only – such as sand, gravel, and grains.

The frames or cabins on many older tractors are not ROPS-compliant; they were only designed to keep out the weather. These structures are not strong enough to protect the operator from being struck by a falling object or as a result of a tractor roll over.

Case study

An experienced farm worker was lucky to survive when several large square hay bales were dislodged by the FEL from a haystack falling onto the roof of the tractor. Fortunately, the tractor was fitted with a FOPS-compliant cabin, which saved his life.

Case study

A farmer was killed when a round hay bale rolled back and crushed him. The hay was incorrectly being lifted using forklift-style tynes rather than a hay spike. The tractor had not been fitted with a compliant FOPS.
2. Common causes of injury

Lifting and moving loads

The farmer or contractor, in consultation with operators, should plan the job and consider whether the selected tractor and attachment with lifting components are suitable for the load being moved.

Tractor operators should only lift using components that are specifically designed and have a rated capacity. Operators should not use unrated components or components rated for other purposes, such as towing. Only use rated lifting components and only attach to specifically designed, rated and identified lift points on the tractor.

Load ratings for the three-point linkage and the FEL on a tractor are determined under ideal conditions, such as being on solid, level ground and stationary. To ensure stable operation and to avoid damage to components, operators should never exceed the rated load limits and should consider the ground being travelled over and speed of travel.

When assessing the load being lifted by either the three-point linkage or the FEL, consider the following:

- dead load – the rated capacity generally includes the weight of the attachment itself
- density of load – a denser load will weigh more than a less dense load for the same bucket cubic capacity
- load centre – as the distance between the centre of the load and the tractor increases, the lifting capacity decreases (below the identified rated load capacity)
- components – various components involved in load lifting will have different ratings. Select lifting components that have the manufacturer’s marked rated capacity (e.g., the tractor, the FEL, the FEL attachment and any lifting gear, such as hooks, shackles, chains or slings). The lowest rating of all of these components indicates their maximum lifting load
- ground speed – depends on the terrain and load. A tractor carrying a load is less stable when it is moving. The safe lifting capacity will be less than the identified rated capacity if the tractor is moving
- terrain – rough, undulating terrain, hilly gradients and hidden objects such as holes and rocks can reduce the rated capacity of the tractor and make it unstable
- counterbalance – to achieve the maximum rated capacity, and not overload the tractor, a counterbalance is required at the front or rear of the tractor to offset any added weight.

It is good practice to retrofit a hydraulic valve that limits the maximum force applied through the hydraulics to less than the rated capacity. This protects the equipment and ensures the rated capacity of the tractor’s components cannot be exceeded.
2.4 Stability

The safety and structural integrity of a tractor is adversely affected if it is loaded, counterbalanced or ballasted incorrectly.

Recommended solutions

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<tr>
<th>Activity</th>
<th>Problem</th>
<th>Solutions</th>
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<tr>
<td>Overloading tractor three-point linkage</td>
<td>Tractor can be unstable, leading to loss of control or component failure</td>
<td>• Keep load within all rated capacities, including any requirement for counterbalance weights at the front of the tractor.</td>
</tr>
<tr>
<td>Tractor has mounted tank for spraying or liquid transport</td>
<td>Tractor instability due to liquid movement or high centre of gravity</td>
<td>• Fitting baffles in tanks reduces liquid movement. • Stabiliser bars or chains on three-point linkage will prevent sideways movement of the tank. • Ballast will lower the centre of gravity.</td>
</tr>
<tr>
<td>Loading Front End Loader (FEL)</td>
<td>Tractor has two load ratings for a FEL. Which is applicable?</td>
<td>• If there are two load ratings for a FEL, confirm with the manufacturer or the operator’s manual, what is the specific tractor configuration for each load rating. • The hydraulics should have load-limiting valves to avoid overloading the components.</td>
</tr>
<tr>
<td>Tractor driven on road at speed</td>
<td>The tractor tyres are unevenly inflated</td>
<td>• Tyre pressures should be even and set for road travel according to the manufacturer’s specifications. • Your speed should be appropriate for road conditions.</td>
</tr>
</tbody>
</table>
Ballast and counterbalances

Ballast refers to weight that is added to the tractor’s axles. For newer tractors with radial tyres, this is added by attaching weights to the axle (in the past, water has been used in tyres as ballast, however, tyre manufacturer’s recommend against adding water ballast to radial tyres).

Ballast ensures the weight distribution across the axles is optimum for a given task — increasing the stability, protecting the driveline, reducing fuel consumption and giving better handling.

Counterbalance weights are added to offset the weight of a load or attachment, ensuring that the axles are not overloaded. They act like a see-saw, pivoting about the closest axle to decrease the load from the furthest axle (unlike ballast, which simply increases load at the axle to which it is attached).

For best performance, the ballast and counterbalances should be changed whenever there is a change in the weight distribution, such as when fitting an attachment.

If ballast and counterbalance configurations for various operations are not identified in the tractor’s operator manual, seek the manufacturer or supplier’s recommendations. Where there’s a recommendation against ballasting or counterweighting the tractor, it should not be done.
Axles and tyres

Tractor tyres must not be loaded beyond their rated limit for the work they are doing (e.g. when lifting large loads using a FEL without a counterbalancing weight in place on the three-point linkage).

Identify the axle and the tyre limits of the tractor, then adjust the load distribution to make sure everything is within specifications.

- Tyre load limits depend on the type of tyre and the tyre pressures required (tyres are the weakest point and most limiting factor).
- Tyre ratings can be found on the tyre sidewall.
- Tyre load limits depend on inflation, speed and terrain (consult the operator’s manual for more guidance).
- Tractor axles and tyres must not be under-loaded. A reasonable amount of load is required for safe steering and traction (under-loading can occur when lifting large loads using the three-point linkage without a counterbalancing weight on the front of the tractor).
- Regularly check tyres for correct pressure, uniform wear and damage.
2. Common causes of injury

2.5 Maintenance and repair

Many injuries and fatalities occur due to a lack of tractor and attachment maintenance or while undertaking maintenance. All the maintenance requirements referenced below should be undertaken in accordance with the tractor manufacturer’s operation and maintenance manuals.

**Recommended solutions**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Problem</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braking of tractor</td>
<td>Uncontrolled or inadequate braking</td>
<td>• Routine maintenance and adjustment of brakes and brake controls.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Interlocking of brake pedals for travel.</td>
</tr>
<tr>
<td>Use of hydraulic attachments</td>
<td>Uncontrolled lowering of the load</td>
<td>• Ensure loads are lifted within rated capacities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Routine checking and maintenance of hydraulic couplings and hoses.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fitting of hydraulic load holding (hose burst protection) devices.</td>
</tr>
<tr>
<td>Tractor operated beyond scheduled</td>
<td>Hydraulic failure</td>
<td>• Scheduled maintenance carried out by a competent person in accordance</td>
</tr>
<tr>
<td>maintenance interval</td>
<td></td>
<td>with the operator’s manual or at least annually and prior to seasonal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All hydraulic hoses, filters and oils checked and changed as recommended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in the operator’s manual.</td>
</tr>
<tr>
<td>Tractor in constant use with FEL</td>
<td>Front-wheel wheel bearing and/or centre pivot pin failure</td>
<td>• Scheduled inspection and maintenance intervals should be shortened and tailored to allow for known high-load use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regular checks of tyres for damage and correct pressure.</td>
</tr>
</tbody>
</table>
## 2. Common causes of injury

### Recommended solutions (cont.)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Problem</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| Working under raised attachments  | Hydraulics could fail, crushing people underneath | • Mechanical lock-out devices for hydraulics such as sleeves must be used.  
• The use of rated Safe Work Load stands on raised attachments, such as when maintaining tillage equipment.  
• Hydraulic lock-out devices are desirable, but should never be relied upon on their own. |
| Jump starting a tractor in the paddock | Battery exploding              | • Jump-starting or battery boosting is dangerous and should be avoided.  
• Where possible remove the battery and charge with a battery charger or replace with a healthy battery of the same size for example 12V 100Ah (ampere hour). |
| Charging battery                  | Battery exploding                | Batteries being charged generate and release hydrogen gas which is flammable and can ignite.  
• Ensure there are no naked flames, welding or cutting that may create an ignition source.  
• Prohibit cigarette smoking.  
• Wear protective face and eye protection and follow safe procedures.  
If there is no alternative take the following precautions:  
• Read the manufacturer’s recommendations and follow all safety procedures and wear a face shield.  
• Ensure the tractor is out of gear, park brake on and always attempt to start from the operator seat.  
• Always use the same voltage booster battery, be extremely careful of series connected systems, ie two x 6 volt batteries in series = 12 volts or 2 x 12 volt batteries connected in series = 24 volts.  
• Ensure jumper leads have suitable current carrying capacity (the bigger the battery, the heavier the jumper leads required).  
• Double check polarity connection, always positive (\textcolor{red}{+	ext{ red}}) to positive and negative (\textcolor{black}{- black}) to negative.  
• Make sure there is a firm positive connection to all terminals.  
• On a negative earth system always connect the negative connection first.  
• Always connect the jumper leads to the dead battery first. |
2. Common causes of injury

Maintaining a safe tractor

Maintenance should be scheduled and planned. Always refer to the tractor manufacturer's operation and maintenance manual for advice on the inspection and maintenance specification routine. It is essential to keep all service and maintenance records for the life of the tractor so that this information can be passed on to the purchaser when the tractor is sold.

Incidents can occur when tractor maintenance is delayed beyond the manufacturer's specifications and maintenance schedule, creating a higher risk to the safety and health of the operator and incurring greater costs through the need to replace parts and components. This can include the following:

- a poorly maintained tractor may not operate properly, (e.g. faulty brakes) and can mean that you have to interrupt your normal tasks to conduct running maintenance (e.g. adding lubricant)
- you may need to perform repairs in the field which in turn can present a new set of hazards that need to be managed. Ensure safe working procedures and safety equipment are used
- when removing guarding or where other protective devices need to be removed for inspection and maintenance, ensure they are also inspected and replaced or repaired if damaged or worn. It is good practice to hinge or lanyard guards so they are not misplaced
- ensure the tractor and its attachments cannot be started during maintenance; for example, disable the battery connections
- ensure the wheels are chocked and the park brake is applied
- remove the key and leave it with the person performing the maintenance
- ensure hydraulic equipment is lowered to the ground
- if a tractor is being worked on and not to be used, it should be tagged out by removing the key and placing a tag on the tractor (e.g. on the steering wheel) stating that the tractor has been tagged out for maintenance.

Case study

A farmer was seriously injured when he operated his brakes while travelling down a gravel road in top gear. One rear drum brake came on more than the other, causing the tractor to career out of control.

Case study

A farmer lost most of his eyesight when a battery exploded while he was attempting to jump start one tractor using another.

Consult the tractor maintenance checklists (page 34) for additional guidance. Also refer to the manufacturer's maintenance instruction manual.
Older tractors

Research shows that for each year of the farm machine's age the risk of injury when using it increases by about four per cent, highlighting the need to regularly inspect and maintain machinery to ensure it is safe to use. Older machinery may need to have improvements retrofitted to meet new technology and industry standards of safety, for example:

- improved guarding
- steps for easier and safer access
- better ergonomic seating, with a seatbelt
- Roll Over Protective Structure (ROPS)
- Falling Object Protective Structure (FOPS)
- improved exhaust system, position, direction and guarding
- spark arrestor
- more efficient cabin air-conditioning and chemical spray filters
- warning and advisory signs for tractor operators
- reversing alarm and flashing lights
- fire extinguisher/knapsack.

All modifications should be conducted by a competent person.

Case study

A farmer undertaking maintenance lost part of a finger when it was crushed between components while attempting to remove the kingpin in an articulated tractor.
2.6 Guarding – existing and retrofitted

Many farmers have been killed or injured after becoming entangled in unguarded or poorly guarded hazardous parts of a tractor. It is critical that moving parts are guarded as far as is reasonably practicable to provide the highest level of protection to workers. Plant operators must also be instructed and trained on safe work maintenance procedures which may also include a person exclusion zone for the work area.

Recommended solutions

<table>
<thead>
<tr>
<th>Activity</th>
<th>Problem</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| Operating hydraulics with remote control located outside cabin tractor | Operator entangled when loose clothing is caught on the rotating Power Take Off (PTO) shaft | • PTO must be disengaged until guarded.  
• Guards must be designed and installed to prevent entanglement.  
• External hydraulic controls should be located outside the back wheel track of the tractor. If the controls are within the back wheel track, they should be relocated to a position where their operation doesn't involve a risk of entanglement.  
• No loose clothing or jewelry should be worn.  
• Ensure no dangling cords on clothing.  
• Long hair should be tied back. |
| Checking the engine while it's running | Tractor operator is caught in unguarded pulley or radiator fan | • Turn off the tractor engine before checking.  
• Guard all moving parts or hot components in the engine bay. |
| Use of PTO driven attachments | Entanglement in PTO | • PTO master guards and shaft guards must be fitted and fixed, including covering universal joints and clutches. Damaged or inadequate guarding must be replaced.  
• PTO must be disengaged when working near the PTO. |
2. Common causes of injury

Guarding requirements

Moving parts and other hazards must be guarded on tractors and attachments. Guarding design should ensure operators are separated from the hazard. Guards should fully enclose the hazard and prevent any part of the body or clothing from accessing the moving parts. The Australian Standard, AS 4024:2006 Safety of machinery for machinery guarding advises that guards be fixed or if they need to be removed for cleaning, inspection or maintenance, the guard remains attached to the machine by a hinge or lanyard to ensure the guard cannot be misplaced.

It is common for guards to be removed for cleaning and servicing. Ensure guards are inspected for damage, repaired and replaced when the maintenance is complete.

Power Take Off (PTO) master guards and shaft guards

AS 1121.4-2007 Agricultural tractor power take-offs - Guards for power take-off (PTO) drive-shafts - Strength and wear tests and acceptance criteria provides the specifications for a PTO output stub and shaft guard. Guarding must be fitted to agricultural tractors even though at the time of manufacture the tractor PTO and shaft was not guarded. The PTO, shaft and its universals should be regularly inspected for wear and all guards maintained and replaced when they are damaged or worn.

Agricultural PTOs rotate at more than nine revolutions per second (540 rpm) – far too fast for a person to pull clear from an entanglement.

People should not work close to an operating PTO, even when there are compliant guards in place.

Case study

An Australian farmer was seriously injured when his weatherproof coat was caught up in an inadequately guarded PTO.
Guarding to protect bystanders

Tractor attachments such as slashers can throw out rocks and other debris that could injure operators and bystanders. In most cases, effective skirt guarding can be fitted that will contain the debris. If machinery cannot be completely guarded, an exclusion zone should be established around the work area. Other examples of attachments that may put workers at risk include post hole diggers, post rammers, chemical applicators, harvesters, bench saws and any raised implement.

The person in control must provide a safe system of work to ensure workers and other people are not put at risk. Safe work procedures should take into account the safety of the machine operator, assistant ground workers and anyone in the vicinity of the work area, including road users, pedestrians, cyclists and motorcyclists passing operating machinery.

These safe working procedures should include an encroachment zone where the operator ceases operations if someone breaches this zone.

An example of a Safe Work Method Statement (SWMS) for slasher operation is provided in Appendix A.
Farmers are responsible under law for the safe welfare of themselves, employees, contractors, visitors to the farm, the farm family and the public. It is important that the home and workplace are set up to ensure exposure to the many farm hazards are controlled. This also includes controls that separate farm traffic and pedestrians.

3.1 Tractor travel

A tractor travelling on public roads is required under the state road laws to be registered and in a roadworthy condition. Check current road regulations, including size limits, licensing, required signage, speed and route restrictions.

If tractor operator training is taking place on the farm, the trainer should be in a suitable second seat with a seatbelt that affords the same degree of protection as that of the trainee. Where the ROPS does not afford the same level of protection to the person in the training seat, the tractor should not be used.

While most tractors have modest top speeds, some tractors are capable of up to 80 km/h, increasing the risk of an accident or injury. Choose a safe speed based on:

- load configuration
- attachments
- towed load
- terrain
- visibility
- the relevant experience of the operator
- the practicalities of travelling on public roads
- speed limits on public roads.

Be aware of the tractor and implements when working anywhere near power lines.
### Recommended solutions

<table>
<thead>
<tr>
<th>Activity</th>
<th>Problem</th>
<th>Solution</th>
</tr>
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</table>
| Tractor operating near power lines | Tractor attachment contacts power lines the operator may be electrocuted | • Observe ‘No Go Zone’ guidelines for overhead power lines.  
• Property manager should ensure all workers and contractors know where both overhead and underground power lines are located (e.g. by providing induction and a farm map showing the location of the power lines).  
• Use the ‘Dial before you dig’ free service (Dial 1100 or dialbeforeyoudig.com.au) to identify the location of underground power lines and other services. |
| Passengers on tractors             | Passenger falls from tractor or injured during roll over                | • Passengers must not be carried on tractors.  
• If a second seat is provided on the tractor, it must provide the same level of protection as the tractor’s ROPS for the operator and includes a seatbelt. |
| Reversing close to an effluent pond, or dam | Tractor could fall into the pond or dam, and the operator could drown | • Pumps and agitators should be set up so that tractors do not need to go near steep sides.  
• Pond design should include moderate slopes for safe access.  
• Install a solid wheel stop barrier. The barrier should be large and strong enough to prevent the tractor from entering the dam.  
• Ensure tractor brakes are well maintained and effective. |

### People working on attachments

Agricultural workers are required to undertake harvesting and planting tasks while sitting or standing on a harvester or tractor attachments that are engaged and in motion. Tractor start-up procedures that consider the safety of ground workers should be established. The procedures should include everyone being clear and in the driver’s line of sight before machinery and attachments are started up. If it’s not possible to have everyone in the driver’s line of sight, other methods should be employed (e.g. video cameras supported by verification of workers location and communication system).

These workers are exposed to a number of hazards which are controlled by a combination of safety measures such as safe work platforms with handrails and guarding. A safe system of work incorporates safe work platforms with handrails, guarding including emergency shut-off switches and an effective communication system between operators.

All operators must be instructed and supervised on the safe operating procedures and system of work.

Never travel on FEL attachments on tractors. Farm workers should not travel on tractor carry-all attachments unless specifically designed to carry people.
3. Traffic management and the home environment

**Transporting inoperable machinery**

If an inoperable tractor requires maintenance, avoid towing the tractor along a public road. Arrange for a mobile mechanic to visit the site or transport the tractor to the workshop.

If this is not practicable:

- research local road laws regarding towing on public roads
- tow the tractor at a low speed that allows full control, including steering and the ability to brake safely and stop
- ensure tyres, mirrors, lights, brakes and other tractor parts are functional and roadworthy on both vehicles
- to prevent decoupling, ensure coupling components are compliant with heavy vehicle regulations including the correct use of safety chains and safety chain attachments.

A tractor with hydraulic steering requires the engine to be running for the steering to operate.

**Case study**

An Australian farm worker was killed while operating a tractor that was under tow on a public road. The tractor was being towed at a speed beyond the capacity of the tractor's brakes to be effective using a long tow chain. These two factors contributed to a loss of control.

3.2 The farm workplace and the home environment

The farm usually includes both the home and the work environment. Children, relatives and visitors are exposed to hazards on the farm and that exposure needs to be controlled.

**Separating tractors and people**

A tractor operator cannot always see people that are nearby. Traffic infrastructure including bollards, fences and signs can be used to separate farm traffic from people. There should be clear procedures to ensure farm workers, contractors and others are kept separate from a moving or idling tractor and other equipment, including hazardous areas, such as in front of wheels or between wheels, under raised equipment or near the operating PTO.

Tractor traffic hazard control and recommended practices include:

- keeping farm traffic separate from pedestrian pathways and houses
- establishing low speed limits in and around buildings
- removing the keys from a stationary tractor and lower all attached implements
- installing convex mirrors on blind corners
- using highly visible permanent objects such as bollards, posts or large rocks to separate hazardous areas and people
- ensuring contractors or other visitors are instructed on directional signage, contact details such as a mobile number or UHF channel, a site map with location of power or gas utilities and onsite reporting instructions
### Traffic management and the home environment

- organising traffic to avoid hazards such as ditches, holes and overhead power lines (it may be necessary to relocate power lines underground in high risk areas, such as around buildings or silos where vehicle access cannot be altered)
- when unloading trucks or operating in an area with continued activity, the area could be temporarily isolated with posts and chain or tape with relevant ‘No access’ signage
- installing a reverse beeper and a rotating beacon to each tractor
- establishing a means of communication between the operator and others in the area
- everyone should wear high-visibility clothing or vests when near working areas.

### Recommended solutions

<table>
<thead>
<tr>
<th>Activity</th>
<th>Problem</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| Storage of tractor                    | Unauthorised access to the tractor                                      | • Park the tractor in a lockable shed.  
• Reverse park the tractor into the shed enabling the operator full vision on exit.  
• Apply handbrake and engage park.  
• Lower all attachments and hydraulics to the ground.  
• Remove the key and lock the tractor cabin and shed. |
| Storage of attachments                | Children, farmers or employees are crushed when attachments collapse or fall over | • Store attachments in a lockable shed and in an area away from people, especially children.  
• Support and secure attachments to prevent collapse or tipping over; a stable footplate may be required to prevent stands from sinking.  
• Store attachments at ground level without the need for support stands, when possible.  
• Store attachments in a manner that provides stability and allows easy reattachment without lifting. |
| Reconnecting attachments             | People assisting with the attachments can be run over                   | • Never stand between the tractor and attachment when manoeuvring to attach it.  
• Use alternative methods of connecting equipment, such as using a quick hitch or adjustable coupling.  
• If a second person is needed with attachment, they must stand outside of the wheel tracks and be visible to the operator.  
• A reversing camera or mirror can help the tractor operator to align a coupling pin. |
| Continual loading or unloading using a FEL | Person can be struck by moving machinery or falling objects          | • Establish a visible exclusion zone for loading and unloading.  
• Retrofit a reverse beeper and a rotating beacon.  
• Establish a means of communication between the operator and others to avoid the need for others to approach the operating area. |
Supervising children

Around one third of all fatalities on Australian farms are children under the age of five. Many of these children drown, are run over or are caught in machinery. Children on farms should be supervised at all times.

The farm is not a playground for children. Young children should only leave the protection of a designated and appropriately fenced (such as a ‘pool fence’ with child-proof gates) area when supervised by an adult.

Case study

A farmer was operating a tractor for spraying. A toddler wandered over to the tractor unnoticed, standing between the front and rear wheels and was run over and killed by the rear wheel.
Any machine, including a tractor, is dangerous if used by someone not properly trained or experienced. Ensure only authorised people operate tractors.

Those in charge of the farm should ensure all workers operating tractors and farm machinery are provided with information, training and instruction on the safe use of specific machinery for particular tasks and the hazards associated with the machinery, the terrain and safe operating conditions. The operator should also be instructed and understand the correct procedure for setting up the tractor, including attachments, ballast, and counterweights.

Ongoing training is necessary for anyone who operates tractors, including the self-employed farmer. This is especially true for changing technologies and increased machinery capacity.

Ensure records of induction and training are kept.

**Training should include:**

- on-farm training – may be done by experienced co-workers. Ensure sufficient supervision when training anyone in how to use and maintain machinery for the first time.
- induction for all workers and contractors – should include information and instruction to ensure an awareness of operational hazards, understanding of control measures, farm rules and policy, safe work procedures, as well as training the person in safe work practices on how to use a particular machine. Direct supervision should be provided for operators who are inexperienced with particular tasks, until an appropriate level of competency has been reached.
- formal training and accreditation – provides independent, up-to-date knowledge and best practice for the operation and maintenance of tractors with attachments. This is best organised through an agricultural registered training organisation.

**Example of the value of training:**

A tractor is pulling another tractor out of a bog and there is a risk of backflip. Experience and competency driving tractors is just one aspect of managing the day-to-day risks.

- The operator’s skill is important in setting up the tractor for the task. It is important the tow point is below the rear axle when towing while driving forward. When towing in reverse, use the designated tow point at the front of the tractor.
- If a tractor starts to backflip, it is impossible for an operator to engage the clutch quickly enough to stop the backflip, or to jump off the tractor. ROPS on tractors are critical.
5. Operator health

Short and long-term health effects associated with tractor operation can include a bad back, skin cancer, fatigue and hearing loss. Simple precautions can significantly improve tractor operator health, longevity and quality of life.

**Posture**

Seats that can swivel will reduce neck strain when turning to check attachments, and adjustable suspension will reduce the body impact when driving over rough terrain.

The seat on the tractor should be adjusted to support the natural inward curve of the lower back, maintaining an upright and comfortable posture. Nevertheless, maintaining a sustained posture is not healthy. Getting out every half an hour or so, doing neck exercises, extension stretches (stretch gently backwards with fists in the lower back) and walking about will improve circulation.

**Vibration**

Controlling vibration reduces operator fatigue.

Exposure to vibration when riding on an old tractor, experienced either through the whole body or the arms and legs, can lead to symptoms including distraction, diminished vision and concentration, fatigue, numbness with pain in the extremities (toes and fingers).

Long-term exposure to vibration can result in physical conditions such as ‘vibration white finger’ which consists of chronic numbness and pain.

A tractor seat with good suspension, solid work boots, a pair of leather, padded or gel-filled gloves will help to reduce the effects of vibration on the body.

If, after taking all steps to control vibration in an older tractor and there is still a problem, it is wise to consider limiting the use of that tractor.

**Operator controls**

Operator comfort and safety can be enhanced by ergonomically-designed operator control levers.

Ensure the following solutions:

- operator control levers should move freely and be within a comfortable reach so the operator isn’t straining the back or using an awkward posture
- the tractor seat should also be adjustable forward and backward to enable comfortable access to foot controls
5. **Operator health**

- Machine operating control levers must be clearly labelled to indicate their nature and function and conveniently located. The operator controls must be able to be locked into the off position to disconnect power, and be guarded to prevent unintentional activation.

- Maintain or replace safety decals (warning stickers and signs).

**Noise**

Sustained exposure to high noise levels leads to permanent hearing loss. The following show the duration for maximum exposure before risking hearing loss for the average person:

- Eight hours at 85 decibels (dB) (A)
- Four hours at 88 dB (A)
- One hour at 94 dB (A)

As an example, older tractors and some newer ones (even with cabins) have noise levels above 85 dB(A) decibels and therefore require hearing protection when the tractor is used.

Hearing loss also occurs with the ageing process and it is important to limit the rate of further hearing loss.

Following are some noise control measures:

- Select the lowest noise emission level when purchasing a new machine.
- Select an exhaust system with the lowest noise emission.
- Ensure well-maintained machinery to reduce noise levels.
- Maintain seals around the cabin doors and windows.
- Replace all noise insulation removed for maintenance.
- If the worker is still exposed to noise that exceeds the exposure standard, select hearing protection that meets AS/NZS 1270:2002 Acoustics - Hearing protectors, such as ear muffs or ear plugs.
- Monitor the noise level using a simple and inexpensive sound-level tester.
- Ensure regular hearing tests every two years for workers that use hearing protection to control noise exposure (records of these tests must be kept).

**UV exposure**

UV exposure increases the risk of skin cancer.

The Cancer Council of Australia recommends protection from UV rays during peak times (between 11am and 3pm) and limiting unprotected direct sunlight to only a few minutes a day during summer and 20–30 minutes a day during winter.

Sun protection when working in open tractors or outdoors includes full length clothing, a broad-rimmed hat and select sunglasses that meets AS/NZS 1067:2003 Sunglasses and fashion spectacles. Where practical, work in the shade or behind UV-rated windows. Open tractors can have a shade cloth clamped to the ROPS.
5. Operator health

Fatigue and stress

There is no substitute for a good quality sleep at night. Fatigue is an acute and ongoing state of tiredness that leads to mental or physical exhaustion and prevents people from functioning within normal boundaries.

Research has shown that being awake for 17 hours straight can impair driving performance to the same level as having a blood alcohol concentration (BAC) of 0.05. This may vary across individuals but importantly, as with alcohol, impairment commences before this 17-hour threshold.

Fatigue and stress as well as long and irregular hours are often a reality in farming, particularly during busy times such as harvest and cropping. Every effort should be made to manage fatigue. An exhausted or tired operator is more likely to make mistakes as fatigue affects judgment and decision making – which may lead to an accident.

The internal body clock has a natural low rhythm between 2pm and 4pm and at night between 2am and 6am. It is advisable to limit work activity that requires critical judgement or concentration during the low natural body clock period.

Poor working conditions including poor visibility, dehydration, lack of nutrition, vibration, extreme temperature, noise, dust, discomfort and a lack of mental stimulation can all contribute to fatigue.

There is increased risk of incident, injury or harm if workers are impaired by fatigue (eg operating certain machines such as tractors that involves making critical decisions where there may be significant consequences if judgement errors occur).

Establish good work practices for all employees on the farm to limit the occurrence of fatigue and its consequences. Schedule operator work arrangements to allow for uninterrupted night sleep. Take regular, short breaks during the work shift at least every two hours and walk about, stretch and rest.

Working alone – communication strategies

Planning and effective communication reduces risk.

There have been a number of farm machinery fatalities that could have been prevented, if help had arrived sooner. Recent research into serious farm machinery injuries shows that a number of the seriously injured farmers would have died had it not been for the timely help of a workmate, family member or neighbour.
If working in isolation it is critical to establish a communication strategy for a farm. Include the following in your strategy:

- a mobile phone or UHF radio. Make sure any isolated workers have a fully charged phone battery, telecommunication coverage and let others know the UHF band frequency to be used
- ensure others know where workers are located, the nature of work, and the expected time for completion. Leave a note or use a white board to show the paddock location where workers are operating on the farm
- ensure procedures require regular contact with another person such as every two hours by UHF radio or mobile phone
- ensure information and advice is provided to the contact person if timeframes or plans change
- if regular contact is not made, establish the practice that someone checks and confirms contact with the worker
- dial 000 in the event of an emergency
- all mobile phones have a free emergency number that works even if the keypad is locked and on any available network. Dial 112 for emergency assist – ensure everyone is familiar with this service
- everyone on the farm should be familiar with both the communications system and the emergency response plan.

An emergency response plan should consider:

- type and severity of injuries that may occur
- the period of time that the emergency service will arrive
- emergency services contact details and services required
- critical information required by emergency services
- exact farm location information to advise emergency services (GPS coordinates, state, region and nearest road intersection, fire map reference. It may be necessary to meet the emergency service at an agreed location)
- location and type of first aid kits
- training of people in first aid
- availability and location of fire extinguishers
- chemical controls.

**Risk of fire**

Tractors are often driven through or near flammable vegetation, and tractors start fires every year. The following practices can reduce the risk of fire:

- during extreme fire danger days, consider the risk before driving a tractor through or near dry grass and crops
- monitor and observe alerts for not operating machinery on high fire risk days in the area
- observe Fire Authority requirements for fire-fighting equipment and spark arresters
- carry a regularly maintained fire extinguisher at all times
- take regular breaks to check items such as straw or grass build-up on the tractor, exhaust, and attachments checking for hot points including bearings and moving parts
- regularly check to ensure a fire has not inadvertently started
- do not leave tractors unattended in long grass or crops.
6. Checklists

Tractor maintenance checklist

Routine maintenance involves cleaning, inspecting, lubricating, adjusting, and replacing parts. Before commencing any maintenance, ensure you know the acceptance/rejection criteria. This may not be adequately covered in the manufacturer’s instructions if they use subjective statements rather than values.

Ensure that a competent person carries out any maintenance tasks and a suitably qualified repairer carries out repairs.

Maintain completed forms to provide a record of the completed inspection and/or training.

Before undertaking any maintenance ensure:

• reference is made to the manufacturer’s instructions in the tractor and attachment manual
• the tractor (and attachments) are in a clear area away from other people and obstacles
• all hydraulic equipment is lowered to the ground (note: where maintenance requires the hydraulic equipment to be raised, ensure the equipment is properly positioned on stable support stands)
• the tractor is switched off, key removed and in park with the handbrake on. Preferably the wheels should also be chocked
• the tractor (and attachments) are clean and free from contamination, particularly if they have been used for chemical spraying. Where there is still doubt about contamination after cleaning, the equipment should be re-cleaned or personal protective equipment should be worn
• rated support stands and hydraulic lock-out devices are in place if there is a need to work under raised equipment
• isolation devices are in place, including lock-out key removal, battery is disconnected or a method of disabling the engine so the tractor cannot be started or attachments engaged when maintenance is taking place.
Sample routine tractor maintenance checklist

As a minimum, maintain your tractor and attachments in accordance with the maintenance schedule in the operator’s manual. The manual will recommend how and when routine maintenance should be conducted.

<table>
<thead>
<tr>
<th>Tractor manufacturer:</th>
<th>Model:</th>
<th>Serial number:</th>
<th>Odometer/hrs reading:</th>
</tr>
</thead>
</table>

**Guarding**
- Tractor safety guards are in place and are in good condition.
- Power Take Off (PTO) guards are in place and are functional and undamaged.
- PTO shaft guard is fixed to prevent rotation.
- Check PTO attachments for loose, missing or broken pins, bolts, lynch pins, R-clips, and replace if necessary.

**Steering – articulated tractors**
- Centre pivot area is barricaded off to restrict access to authorised personnel only and is free of foreign objects when maintenance is being carried out.
- Clean all steering hoses and inspect for scuff marks and leaks.
- Check steering by starting tractor and rotating through full lock. Continue steering the tractor until the hydraulic oil is at operating temperature. Switch off tractor and inspect each steering hose for rub or scuff marks and recheck for leaks.
- Check steering mechanical components for damage, tightness and any free play in the steering wheel.

**Wheels**
- Quick adjustable wheel setting devices are correctly tensioned as per the manufacturer’s operator manual.
- Wheel nuts are tensioned in accordance with the manufacturer’s maintenance manual.

**Brakes**
- Mechanical linkage brakes (turning brakes) - rotation dual pedals are separated.
- Both pedals travel the same distance when each pedal is depressed (check operator’s manual for specifications).
- Dual pedals are re-connected after being checked.

**Tyres**
- The tyres to be checked are cold and valves are at the 12 o’clock position before taking reading (note: if liquid ballast has been added to the tyre any pressure reading taken with the valve away from the 12 o’clock position will be affected).
- Tyre pressure as per operator’s manual (check with a good quality gauge).
- Tyres are roadworthy, and have adequate tread depth in accordance with the tyre manufacturer’s specifications.

**Fluid levels**
- **Note:** Check all levels as per the manufacturer’s specifications:
  - All fluid levels (tractor and any attachment) as recommended in the operator’s manual.
  - Transmission fluid.
  - Engine oil.
  - Battery fluid.
  - Brake fluid.
  - Fuel tank filled.
  - Hydraulic oil level on three-point linkage or Front End Loader (FEL) (refer to operator’s manual for ram/cylinder position).
  - Oil reservoir level on loader (if supply is separate from tractor).
## Sample routine tractor maintenance checklist (cont.)

<table>
<thead>
<tr>
<th>Exhaust</th>
<th>Signals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Check the condition of the exhaust:</strong></td>
<td><strong>Check and replace all non-functional elements:</strong></td>
</tr>
<tr>
<td>□ Holes and corrosion – Note: any holes in the exhaust should cause the exhaust to be replaced.</td>
<td>□ Lights (field, head and tail, external warning lights).</td>
</tr>
<tr>
<td>□ Excessive noise.</td>
<td>□ Horn.</td>
</tr>
<tr>
<td>□ Looseness.</td>
<td>□ Indicators.</td>
</tr>
<tr>
<td>□ Spark-arrestor fitted.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clutch (if fitted) – this test should be conducted with the wheels chocked</th>
<th>Battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ When park brake is applied and clutch pedal depressed there is some easy clutch pedal travel before resistance is felt (check operator’s manual for specifications and method of adjustment).</td>
<td>□ Battery terminals – for corrosion and tightness.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lever controls</th>
<th>Air filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Check the operator lever controls are clearly identified and marked to indicate their nature and function.</td>
<td>□ In accordance with the manufacturer’s specifications check, clean and replace regularly.</td>
</tr>
<tr>
<td>□ Check for any damage to knobs or levers and repair before plant use.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Roll Over Protective Structure (ROPS), Falling Object Protective Structure (FOPS) (if cabin provided, check if compliant)</th>
<th>Front End Loader (FEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Tractor is fitted with ROPS/FOPS that conforms with AS 1636:1996 Tractors - Roll over protective structure - criteria and tests for roll over and AS 2294.1:1997 Earth-moving machinery - Protective structures for falling objects, and has a confirming specification plate.</td>
<td>□ Falling Object Protection (FOPS) is provided and is in good condition.</td>
</tr>
<tr>
<td>□ ROPS/FOPS is in good condition and is undamaged (no holes drilled etc) and all bolts are securely fastened.</td>
<td><strong>In accordance with the manufacturer’s specifications:</strong></td>
</tr>
<tr>
<td>□ No loose, worn, corroded or missing bolts.</td>
<td>□ No damaged, worn or missing pins.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hydraulic hoses</th>
<th>Attachment controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Hoses are not leaking or worn.</td>
<td>□ Test for correct operation of all controls for three-point linkage and FEL attachment.</td>
</tr>
<tr>
<td>□ Check tractor is switched off then wipe all hose and fitting surfaces with a clean rag. Wear eye protection, gloves, and close fitted clothing.</td>
<td>□ In accordance with the manufacturer’s specifications check for excessive hydraulic creep by starting the tractor and lifting the bucket or attachment to its full height. Turn off the engine and observe how quickly the raised equipment drops. Refer to manufacturer’s operator manual or equipment specifications for drop rates.</td>
</tr>
<tr>
<td>□ Restart tractor and cycle all the hydraulics until the oil reaches operating temperature.</td>
<td>Ensure no personnel enters this area during this inspection.</td>
</tr>
<tr>
<td>□ Lower attachments to the ground then turn engine off and check that all cleaned areas show no signs of dampness (DO NOT place hands around hoses or connections when the system is under pressure).</td>
<td></td>
</tr>
</tbody>
</table>

---
### Sample routine tractor maintenance checklist (cont.)

#### Other
- Operator’s cabin is free of mud and oil.
- Platform access, steps and handrails are secure, clean and enable three points of contact for operator.
- All gauges and lights in the cabin operate correctly when the tractor is running (refer to operator’s manual).
- Vehicle registration plates (if applicable) are current and clean.
- Seatbelt is provided and is in good working order.
- Seat is in good condition and is able to be adjusted for individual needs.
- A first aid kit, working fire extinguisher and other personal protective equipment are on the tractor.
- Safe Work Load (SWL), axle loads and counterbalance requirements are known for all attachments.

#### Additional routine maintenance checks required for your tractor/attachments:

#### Notes:

---

On the back of this sheet list:
1. Maintenance actions required.
2. Items that require attention from a suitably qualified repair person.

<table>
<thead>
<tr>
<th>Maintenance check performed by:</th>
<th>Date:</th>
<th>Next service Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pre-operation checklist

Ensure your tractor and attachments are in proper working order before use to minimise the risk of personal injury and damage to your machinery. It is particularly important to do a pre-operational check if the tractor or attachments have not been used for some time or if you were not the last person to use them.

The machinery manufacturer's operator manual lists specific items to be checked to ensure the tractor is safe to operate and that damage is avoided. Always follow the procedures and specifications in the manual.

The following sample pre-operation checklist provides prompts to ensure the machinery is fit for safe use and can be adapted for your use. Always refer to your manufacturer's manual for maintenance specifications and if in doubt tag machine 'not for use' until the maintenance issue is remedied.

Sample tractor pre-operation checklist

<table>
<thead>
<tr>
<th>Tractor manufacturer:</th>
<th>Model:</th>
<th>Serial number:</th>
<th>Odometer/hrs reading:</th>
</tr>
</thead>
</table>

**Visually inspect**
- For missing, loose or damaged parts or guards.
- For fuel or oil leaks and other fluid leakage, particularly around hose joints.
- Tractor handrails, steps, platforms and cabin floor are clean and free of mud and oil.
- Tractor and attachments are free of any build-up of straw, grass or other flammable materials.

**Wheels and tyres**
- Check tyres for any cuts, bulging of the walls or other deterioration as specified by the tyre manufacturer.
- Ensure tyre pressure is correct – refer to the tyre manufacturer's specification.
- Check wheel nuts – tighten.

**Brakes**
- Check brakes are operating as per manufacturer's specification.

**Air cleaner**
- Engine air cleaner (if fitted) – check for dirt in the cleaner bowl. Blow or brush off any chaff or dirt trapped in the pre-cleaner entry grid.
- Dry type air cleaner – check the air cleaner indicator (if fitted) for correct operation. The air cleaner must be serviced when this indicator is activated. If no indicator is fitted, check and service the air cleaner daily or as per the operator's manual.
- Wet type air cleaners – check and remove the oil bath component and clean as per the operator's manual (Never use a solvent, petrol or diesel to clean the oil bath or cleaner).

**Lights, switches, gauges, signals**
- Check that lights, switches, gauges, horn and indicators work. Repair if not functioning.
Steering
☐ Check the steering moves freely, but without undue play in the steering wheel.

Fluid levels
☐ Check engine oil level. If milky-white contact your service outlet immediately. When topping-up ensure the correct oil specification is used.
☐ Check fuel for contamination. If there are signs of contamination in the fuel inspection bowls, drain, remove and clean.
☐ Check fuel tank level. (Tip: Topping up the fuel tank at the end of the day will prevent the fuel being contaminated by condensation as the tractor cools overnight. Do not fill from recently filled bulk storage tank. Allow the bulk tank to settle, preferably overnight, before refueling tractor).
☐ Check the coolant level is on the hot or cold mark in the expansion tank (if fitted) and that it corresponds with engine temperature. Use only the coolant recommended in the operator’s manual to top up the system. (Do not top up a hot engine with cold coolant).
☐ Check radiator level (if there is no header tank) when the engine is cool. Using leather gloves, carefully turn the radiator cap to the first stop. This will allow the release of any coolant pressure in a safe manner. Remove the radiator cap and check that the coolant is above the radiator core.
☐ Air-cooled engines – check cooling fins and shrouds as per the operator’s manual.

Drive belts
☐ Check condition and tension in accordance with the manufacturer’s specifications.

Greasing points, nipples
☐ Locate greasing points and lubricate as recommended by the operator’s manual. Clean grease nipples before greasing to prevent the entry of dirt. Do not over-grease universal joints or sealed bearings as it will damage the seals and allow dirt into the joint.

Airconditioning and cabin filters (if fitted)
☐ Filters are serviced as per the operator’s manual.
☐ Replacement filters meet the standards listed in the operator’s manual, including charcoal filters for chemical application.
☐ Charcoal filters are replaced as per their indicators (charcoal filters used for spraying should be removed after spraying is completed and stored in a sealed container).
☐ Tractor cabin seals to ensure that spray cannot enter.

Maintenance actions required:
1.
2.
3.
For safe operation, defects identified must be fixed before the tractor is put into operation.

Maintenance completion date:
1.
2.
3.

Checked by:

Date:
Tractor purchase/review checklist

The following checklist will be useful when purchasing a new or used tractor or for reviewing a tractor you already own.

If purchasing a tractor, choose a tractor that meets your needs (considerations include horsepower and rated lifting capacity to ensure compatible attachments are used).

Consider:

• has the tractor got the capacity to safely do the tasks that you intend to use it for?
• do you have a compliant ROPS (if tractor has a cabin, check that it is ROPS compliant and not just a sun canopy)?
• have you checked your tractor’s compatibility with attachments/FEL and is it a suitable combination for the tractor and attachment rated capacity for safe load?
• do you need a fold down ROPS if the tractor will be operated in constricted areas such as buildings and near trees?
• have you selected the right attachment such as a spike configuration that incorporates a back plate to lift and secure the round or large rectangular hay bale from falling back onto the operator?
• do you have provision of FOPS if you have selected a tractor with a FEL combination to move hay bales or other materials etc?
• is the tractor stability-rated for work on hilly ground?

Sample tractor purchase/review checklist

<table>
<thead>
<tr>
<th>Paperwork</th>
<th>Yes</th>
<th>No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Manufacturer specifications.</td>
<td>□</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>• Operator manual/Safety instructions.</td>
<td>□</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>• Maintenance manual.</td>
<td>□</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>• Operator qualifications or skills necessary to operate machinery.</td>
<td>□</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>• Warning signs and decals fitted.</td>
<td>□</td>
<td>□</td>
<td></td>
</tr>
</tbody>
</table>

Additional requirements for used tractors

• Independent assessment of identified hazards and mechanical condition or safety checks by supplier/previous owner with defects fixed. | □   | □  |       |
• Written advice if used tractor is sold for scrap material. | □   | □  |       |
• Written advice if used tractor is sold without information concerning the purpose for which it was designed, manufactured and supplied including any conditions for safe use. The tractor should not be used without this information. | □   | □  |       |
### Sample tractor purchase/review checklist (cont.)

<table>
<thead>
<tr>
<th>Additional requirements for used tractors (cont)</th>
<th>Yes</th>
<th>No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Service and repair records available.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Engineering certificate or equivalent provided for structural repairs and after-manufacture alterations.</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ergonomics</th>
<th>Yes</th>
<th>No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Service items such as battery, fuel, and air filter are easily accessible.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Good mounting/dismounting access provided (handrails and non-slip treads with steps facing away from rear wheel).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Steps and handrails are in good condition and are securely mounted.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• All glass is in good condition and is laminated safety glass (check for manufacturer's markings to ensure that glass provides protection from projectiles and UV exposure).</td>
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</tr>
<tr>
<td>• Controls do not get in the way when getting in and out of tractor.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Controls are clearly identified, easily accessible, and are logical in their operation (eg push to lower, pull to lift and includes symbol instruction on direction).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Exhaust has an approved spark arrester, is in good condition, is effective in reducing noise and directs fumes away from the operator and the air intake of the cabin.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>• Exhaust is provided with a heat shield or is located so as to prevent unintended contact.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cabin doors and windows seal to control noise and dust entry.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Airconditioner operable and air filters fitted.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Seat is in good condition and provides good lumbar support.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Seat has adjustable suspension and is able to be adjusted backwards, forwards up and down.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Checklists

#### Sample tractor purchase/review checklist (cont.)

<table>
<thead>
<tr>
<th>Operator protection</th>
<th>Yes</th>
<th>No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Approved ROPS or ROPS-compliant cabin fitted (check for Australian or international compliance plate).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• ROPS/cabin shows no sign of damage from roll over and the structural integrity of the ROPS has not been altered by drilling or welding etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Approved FOPS or FOPS-compliant cabin is fitted if there is a risk of falling objects (eg working near stacked hay bales or with a FEL attachment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Approved FOPS or FOPS-compliant cabin is fitted if FEL will be used.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cabin is completely sealed and air filters are able to be replaced with charcoal filters if chemical spraying will take place.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• PTO stub shaft master shield is provided (not just a cup stub cover).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cab doors open towards front wheel, that is, with the pivot closer to the front wheel.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Seatbelt is fitted and is in good condition.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Moving parts, including fan belts and hot parts, are guarded.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Structural integrity and roadworthiness

<table>
<thead>
<tr>
<th>Structural integrity and roadworthiness</th>
<th>Yes</th>
<th>No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Tyres, hydraulics (including hoses), brakes, parking brake, and steering are in good working condition.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Independent brake-locking mechanism operates correctly.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Roadworthiness – requirements include rear vision mirrors, lights (including rear lights and rotating warning safety beacon) fitted and operational, adequate brakes, tyres, and controls.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tractor attachment purchase/review checklist

When purchasing attachments that people will be required to work on, for example vegetable pickers, consider the following when making your decision:

### Sample tractor attachment purchase/review checklist

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="true" alt="Yes" /></td>
<td><img src="false" alt="No" /></td>
<td><img src="---" alt="Notes" /></td>
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<tr>
<td><img src="true" alt="Yes" /></td>
<td><img src="false" alt="No" /></td>
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<td><img src="true" alt="Yes" /></td>
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<tr>
<td><img src="true" alt="Yes" /></td>
<td><img src="false" alt="No" /></td>
<td><img src="---" alt="Notes" /></td>
</tr>
</tbody>
</table>
6. Checklists

---

**Front End Loader (FEL) pre-operation checklist**

**Sample Front End Loader (FEL) pre-operation checklist**

<table>
<thead>
<tr>
<th><strong>Pivot pins</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Check each pivot pin for wear by lowering FEL to the ground and placing in float position. Place a pry-bar between the frame and pivoted component and lever taking note of any play in the pin (excessive play may mean the replacement of the pin and bushing). Refer to the manufacturer's specifications.</td>
<td></td>
</tr>
<tr>
<td>☐ Pins are regularly rotated by gripping one end and turning to check for internal breaks in the pin or shearing of the pin head (refer to operator's manual).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Lock out mechanisms</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ No sign of wear or damage.</td>
<td></td>
</tr>
<tr>
<td>☐ All lock-out mechanisms operate freely.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Mounting bolts</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Loader to tractor frame mounting bolts are tight and undamaged.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Front wheel bearings on 2WD tractors</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Check front wheel bearings on 2WD tractors by jacking and blocking the front axle of the tractor until the front wheels are just clear of the ground. Grasp each front wheel and rock it to check for wheel bearing play (any movement indicates a wheel bearing problem. Contact your service dealer).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Loader attachment</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Clean both pins and bushes of dirt or grease.</td>
<td></td>
</tr>
<tr>
<td>☐ Check both pins and bushes for signs of damage.</td>
<td></td>
</tr>
<tr>
<td>☐ Carefully align the tractor to the loader.</td>
<td></td>
</tr>
<tr>
<td>☐ Lubricate all pins and refit ensuring they are retained correctly.</td>
<td></td>
</tr>
<tr>
<td>☐ Wipe all hydraulic connections clean and refit.</td>
<td></td>
</tr>
<tr>
<td>☐ Once the loader is connected operate it and the bucket through a complete cycle.</td>
<td></td>
</tr>
<tr>
<td>☐ Lower the loader to the ground, switch off and inspect all hydraulic components for leaks.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Disconnection of loader and storage</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Ensure the FEL is lowered onto a level surface, the hydraulic pressure is released and the detached FEL is left well supported. Ensure that access under the loader arms is prevented. This should be conducted in accordance with the manufacturer's recommendations.</td>
<td></td>
</tr>
<tr>
<td>☐ Grease pivot pins.</td>
<td></td>
</tr>
<tr>
<td>☐ Seal hydraulic connections.</td>
<td></td>
</tr>
</tbody>
</table>

**Maintenance actions required:**

1. 
2. 
3. 

For safe operation, defects identified must be fixed before the tractor is put into operation.

**Maintenance completion date:**

1. 
2. 
3. 

**Checked by:** 
**Date:**
### Sample Front End Loader (FEL) purchase/review checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Yes</th>
<th>No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>• FEL manufacturer's specifications are provided.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2.</td>
<td>• FEL manufacturer's specifications match the capabilities of the tractor you are purchasing or own.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3.</td>
<td>• Safe Working Load (SWL) is known and marked for the loader tractor combination (it must indicate the required counterbalance mass and position).</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4.</td>
<td>• Engine power and hydraulic system are capable of enabling satisfactory operation of the FEL.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5.</td>
<td>• Centre pivot pin on the front axle is not worn.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6.</td>
<td>• All pins and linkages are in good condition.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7.</td>
<td>• In accordance with manufacturer's specifications, check the condition of front wheel bearings (particularly on two-wheel drive tractors).</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8.</td>
<td>• Check the condition, suitability and load rating of front tyres for the capabilities of the FEL.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9.</td>
<td>• If intending to lift with slings and chains, ensure the FEL has identified and rated hitching points.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10.</td>
<td>• FOPS is fitted that will prevent a raised load from falling or rolling back on operator.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>11.</td>
<td>• Level lift system, lift height-limiting device and back plate guards fitted to implements that prevent loads from falling back towards the operator's position.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>12.</td>
<td>• Anti-drop or controlled lowering devices are fitted to prevent lowering in the event of hydraulic failure.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>13.</td>
<td>• Check ease of attaching loader arms and quick-release couplings on hydraulic hoses.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>14.</td>
<td>• FEL attachment coupling systems enable connection or disconnection without the need for a second person and the coupling system has a positive and secure retention system under all working conditions.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>15.</td>
<td>• FEL is fitted with hydro-ride damper to absorb shock.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>16.</td>
<td>• FEL is fitted with load-limiting hydraulic valve to ensure that the components cannot be overloaded.</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Appendix A:

Example safe work method statement - tractor and slasher

<table>
<thead>
<tr>
<th>Steps</th>
<th>Potential hazards</th>
<th>Control measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reverse tractor and attach the slasher</td>
<td>Slasher falling from stand</td>
<td>• Ensure slasher is safely supported on level ground or on solid chocks or stands, not stones, bricks or rotting timber.</td>
</tr>
<tr>
<td></td>
<td>People in the vicinity</td>
<td>• Exclude all other people from area.</td>
</tr>
<tr>
<td></td>
<td>Crushing between tractor and slasher</td>
<td>• Use 3PL quick-hitch system for attaching equipment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reverse tractor into position, shut engine down and apply handbrake before getting off tractor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Attach slasher.</td>
</tr>
<tr>
<td></td>
<td>Trapping fingers</td>
<td>• Do not use fingers to line up holes on linkage arms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ensure lynch-pins are correct size and in good condition.</td>
</tr>
<tr>
<td></td>
<td>Exposed PTO and drive shaft</td>
<td>• Do not connect or disconnect with tractor running. Ensure that PTO master shield is in place on tractor. Ensure slasher PTO shaft cover and universal joint and slasher clutch bell covers are in place and in good condition. PTO cover should not rotate with shaft and PTO chains should be fitted at both ends.</td>
</tr>
<tr>
<td></td>
<td>PTO hitting draw bar</td>
<td>• Remove or offset draw bar and ensure stabiliser bars/chains are fitted and correctly adjusted.</td>
</tr>
<tr>
<td></td>
<td>Unstable raised slasher, leading to light steering</td>
<td>• Fit counterbalance weights to improve weight distribution. Seek technical advice for correct fitment if required.</td>
</tr>
</tbody>
</table>
### Example safe work method statement - tractor and slasher (cont.)

<table>
<thead>
<tr>
<th>Steps</th>
<th>Potential hazards</th>
<th>Control measures</th>
</tr>
</thead>
</table>
| 2. Operating slasher   | Debris thrown out from slasher blades                  | • Before operation, inspect the condition of blades, bolts, gear box, shaft and rotor while it is supported on all four corners by vehicle stands or solid chocks.  
• Where practical, pick up stones and rubbish before starting to slash.  
• If there is no cabin, the operator should wear safety glasses and other personal protective equipment, including hearing protection.  
• Ensure the front and rear of the slasher is covered by a guard, chains or similar device to prevent debris flying out from all directions from the slasher.  
• Ensure area is clear of other people.  
• Stop if people or vehicles approach.  
Contact with objects, eg posts, trees when turning and fire danger | • Be aware of the extra width required for turning.  
• Be aware of the potential of slasher blades striking rocks, etc. and starting a fire, especially during the fire danger period. |
| 3. Slashing on slopes  | Roll over                                              | • Ensure tractor and cabin are fitted with approved ROPS and a seat belt is worn.  
• Set wheels on tractor to maximum width.  
Environmental hazards | • Identify and avoid rocks, humps, ditches, gullies, washouts, dams, waterways, embankments and depressions.  
Operating on slopes | • Engage clutch gently when going forward uphill.  
• Keep tractor in low gear when descending, enabling engine compression to act as brake; do not engage clutch. If stability is uncertain, turn down hill.  
• Keep slasher as low as possible to avoid weight transfer when making downhill turns.  
• Avoid steep slopes; do not park tractor on steep slopes.  
• Back up slope if practical; abort if wheel slip or spin occurs. |
| 4. Service slasher     | Rotating slasher blades                                | • Lower the slasher to the ground before leaving the tractor seat.  
• Do not service unless tractor is switched off and the shaft and rotor have stopped moving (in future, slashers will have a frame extension to reduce foot contact with slasher blades).  
Working under a slasher | • Never carry out any service work under a raised slasher unless it is supported on all four corners by vehicle stands or solid chocks. |
Appendix B: Example - Calculation of required counterbalance

It is possible to calculate loads by simply measuring axle loads and distances. A standard tractor, with measured or calculated axle tare masses (unloaded but including tyre and/or axle ballast) and masses added at three common points. The three-point linkage, front ballast position and the FEL (as shown).

- **T** = Three point linkage counterbalance.
- **r** = Tare rear axle load, including water and/or axle ballast.
- **f** = Tare front axle load, including water and/or axle ballast.
- **B** = Counterbalance at the front of the tractor.
- **L** = FEL load.
- **a, b, c, d** = distances between axles and the centre of mass of the various other loads as shown.

**What is centre of mass?**

Any object has a ‘centre of mass’, which is simply the spot that works out to be equivalent to the ‘middle’ of its mass. For symmetrical objects, this is in the middle. Where there is more mass down low (such as a racing car) the centre of mass is lower to the ground, which means it’s less likely to roll around corners. After we know (or have an educated guess) at where the centre of mass is, we can think of all of the mass of the object sitting in this spot with regard to stability. Like with the racing car example, the lower the centre of gravity, the more stable.

**Load calculation diagram**

![Load calculation diagram](image-url)
Any new loads can be calculated by assuming that the new rear axle load, R, or new front axle load, F, is a result of the loads ‘see-sawing’ about the opposite axle.

Following are simple formulae that provide an axle load by allowing for all of the added masses in the load calculation and axle load diagrams:

**Front axle load:**
\[ F = f + \frac{[L(b+d)+B(b+c)-T(a)]}{b} \]

**Rear axle load:**
\[ R = r + \frac{[T(a+b)-L(d)-B(c)]}{b} \]

**Front axle load with counterbalance:**
\[ F = 1000 + \frac{600(3+2)+0(3+1)-800(1.5)}{3} \]
\[ F = 1600 \text{ kg} \]

**Front axle load without counterbalance:**
\[ F = 1000 + \frac{600(3+2)+0-0}{3} \]
\[ F = 2000 \text{ kg} \]

Once the axle load is known, the farmer then checks the manufacturer’s axle rating. Complex loads or unknown centres of mass may require trial and error by measuring the effect of the counterbalance on the axle loads on suitable heavy duty scales.
8. Definitions and abbreviations

- **ROPS**: Roll Over Protective Structure to protect the operator of a tractor against injury as a result of the tractor rolling over in any direction.
- **FOPS**: Falling Object Protective Structure to protect the operator from the impact of falling objects (e.g., a hay bale or tree branches).
- **FEL**: Front End Loader.
- **PTO**: Power Take Off (external shaft on the rear of the tractor providing rotational power to implements).
- **Tonne**: One Metric Tonne (1000 kg).
- **Ton**: One Imperial Ton (907 kg; also called a ‘short ton’).
- **kN**: Force of 1000 Newtons (10 kN = 1019 kg).

**Rated capacity**

The rated capacity of a component for a specific task (formerly defined as: Safe Working Load (SWL), Working Load Limit (WLL) – the maximum gross load which may be applied while in a particular working configuration and under a particular condition of use. It is important to note the purpose of the rating as this will have a different rating depending on the application or configuration. Note: For lifting applications, the rated capacity of the slings or chains should never be exceeded (even when using the slings or chains for non-lifting applications).

- **SWL**: Safe Working Load.
- **WLL**: Working Load Limit.
9. References and further information

**Australian Standards**
- AS 1636:1996 Tractor. Roll-over protective structures – criteria and tests
- AS 2294.1:1997 Earth moving machinery – Protective structures
- AS 1121.4:2007 Agricultural tractor power take-offs – Guards for power take-off (PTO) drive-shafts - Strength and wear tests and acceptance criteria
- AS 4024:2006 Safety of machinery

**Industry Code of Practice**
- Front End Loader Code of Practice, Australian Tractor and Machinery Association

**Further information**
- Jenkins, R, Safe use of tractors, Safetyline Institute, WA WorkSafe, 2009
- Safe Work Australia website: ascc.gov.au
- Agricultural workbook & checklist WorkSafe WA
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FarmSafe Victoria
Country Fire Authority

A handbook for workplaces: Safe use of tractors with attachment

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