



working
across
borders

Front end loaders and their attachments on tractors

A guide on health and
safety standards

September 2010



Disclaimer

This publication may contain occupational health and safety and workers compensation information. It may include some of your obligations under the various legislations that WorkCover NSW administers. To ensure you comply with your legal obligations you must refer to the appropriate legislation.

Information on the latest laws can be checked by visiting the NSW legislation website (www.legislation.nsw.gov.au).

This publication does not represent a comprehensive statement of the law as it applies to particular problems or to individuals or as a substitute for legal advice. You should seek independent legal advice if you need assistance on the application of the law to your situation.

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1. INTRODUCTION

The Industry Solutions Program is a research and development initiative undertaken by WorkCover NSW, which has worked with industry to devise practical solutions to problematic issues in an industry. It recognises the need for assistance in some industry sectors to overcome particular difficulties or challenges in order to improve workplace safety.

Solutions to safety issues are developed in partnership with industry and released for industry-wide implementation. Within 12 months, an evaluation is conducted to determine the effectiveness and practicality of the solutions. If necessary, further refinements, including additional solutions, are included after the evaluation.

WorkCover is aiming to harmonise industry solutions in conjunction with other occupational health and safety (OHS) jurisdictions to develop a common approach to control hazards.

The Industry Solutions Program identified that front end loader attachments designed for use on a tractor can be hazardous to operate and that there is currently no practical guidance available in Australia for their design and use – hence this guide was developed.

Contributors to this guide include:

- Burder Group Australian
- Challenge Implements
- Howard Australia
- Farmsafe Australia
- John Deere
- Kentan Machinery (FIMDA)
- Kubota Tractor Australia
- Motor Traders Association NSW
- Nowra Truck and Tractor (FIMDA)
- NSW Farmers Industrial Association
- Online Safety Systems
- Tractor and Machinery Association of Australia
- Workplace Health and Safety Queensland, Department of Justice and Attorney-General
- WorkSafe Victoria
- WorkSafe Western Australia
- Workplace Standards Tasmania, Department of Justice.

This guide provides practical guidance for designers, manufacturers, suppliers and users of front end loader attachments on tractors. OHS legislation requires the control of risk to health and safety, and following this guide is a means to achieve such compliance.

2. SCOPE

This guide covers the design, manufacture, supply and safe use of a front end loader (FEL), and its ancillary attachments, on a tractor. It also covers used front end loaders, and their attachments for resale.

This guide excludes workboxes and associated slinging equipment.

3. DEFINITIONS

For the purpose of this guide, the following definitions apply:

Attachment	a bucket or other implement designed to be attached to the FEL.
Competent person	for any task means a person who has acquired, through training, qualifications or experience, or a combination of them, the knowledge and skills to carry out that task.
FEL	front end loader, a unit consisting of lifting arms and fastening devices, designed to be mounted on the front of an agricultural tractor and equipped for fitting of a bucket or other attachment.
Rated capacity	the maximum lift capacity (in kilograms) at maximum height for the FEL and standard bucket, determined in accordance with ASAE S301.
Rollback	losing control of the load, resulting in the load falling rearwards onto the tractor and/or operator.
ROL	rated operating load, the maximum load (in kilograms) that can be lifted to full height without exceeding the tractor specifications and still maintaining stability – ROL is determined for a specific tractor, FEL and attachment combination.

4. DESIGN

OHS legislation places obligations on designers to identify hazards and control the risks associated with the design, manufacture, supply and use of plant. The designer must, where reasonably practicable, design-out any risks associated with the use of the FEL and/or its attachments. Where the risks cannot be designed-out, a means to control the risks must be provided.

The designer must provide information to the manufacturer, which includes advice on:

- results of testing and examination conducted during the design phase
- purpose for which the FEL and its attachments are designed
- limitations on its use
- testing and inspections to be carried out on the FEL and its attachments
- installation and commissioning, operation, maintenance, transport, storage and dismantling
- systems of work necessary for the safe use of the FEL and its attachments
- knowledge, training and skills necessary for undertaking inspection and testing of the FEL and its attachments.

The following sections provide advice on specific hazards that are associated with FELs and their attachments, and should be addressed in the design.

4.1 ROLLBACK

Rollback of the load onto the operator is a cause of serious incidents when handling materials. Therefore, it is essential that all FELs incorporate a rollback elimination system.

The designer must eliminate the possibility of rollback when the tractor, FEL and attachment combination is used for its intended purpose on a level surface. They should also provide information on how to control rollback on sloping ground, including the load limitations for manufacturer-approved attachments.

If the FEL and its attachments are not from the same designer, the person putting the two together must ensure they are compatible, and that rollback is eliminated.

Self-leveling systems must be designed so they cannot be overridden to create rollback. Figures 1b and 2b illustrate self-leveling as a control for rollback.

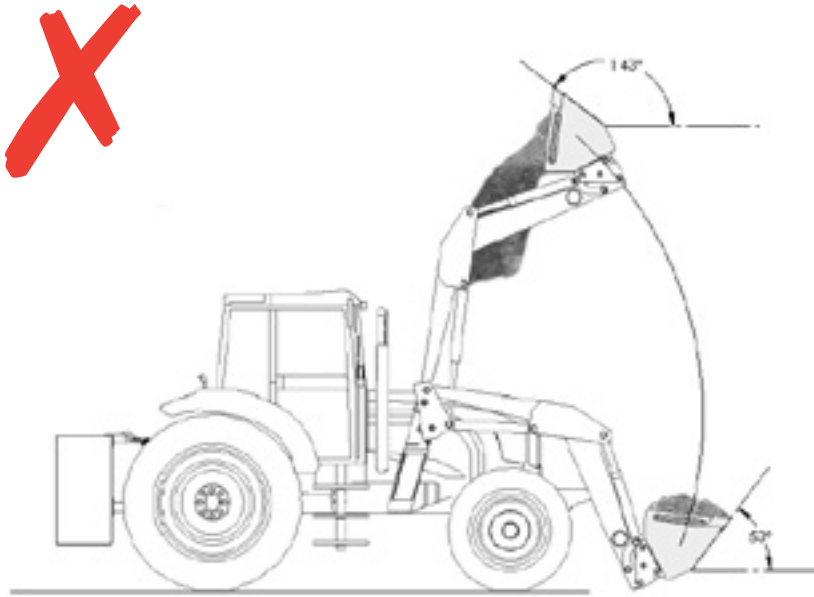


Figure: 1a

The angle of the earthmoving bucket attachment, relative to the ground, is greatly increased as the FEL is raised, which allows the load to rollback on to the tractor or operator.



Figure: 1b

With self-leveling anti-rollback device incorporated into the FEL and its attachments, the angle remains the same and ensures the risk of rollback is eliminated when operated correctly.

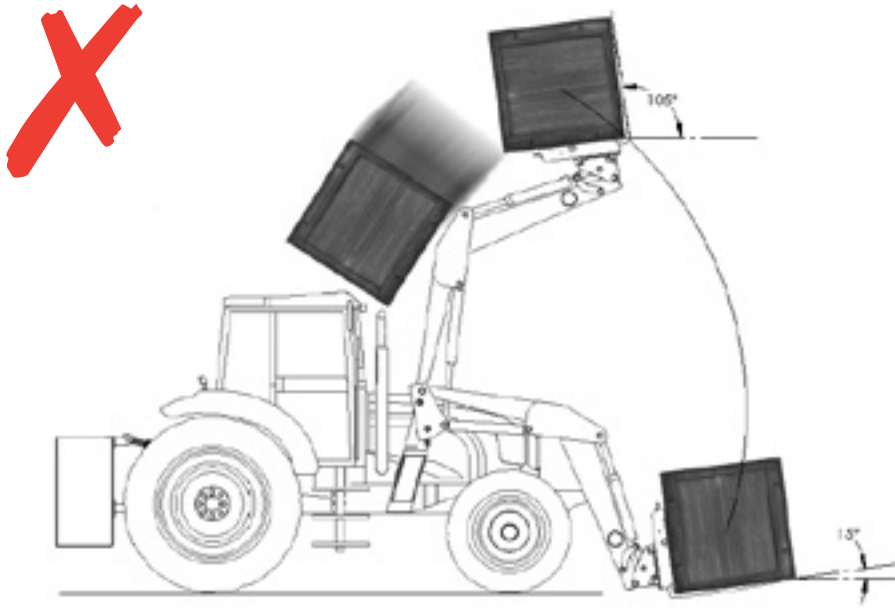


Figure: 2a

The angle of the pallet fork attachment, relative to the ground, is greatly increased as the FEL is raised, which allows the load to rollback on to the tractor or operator.

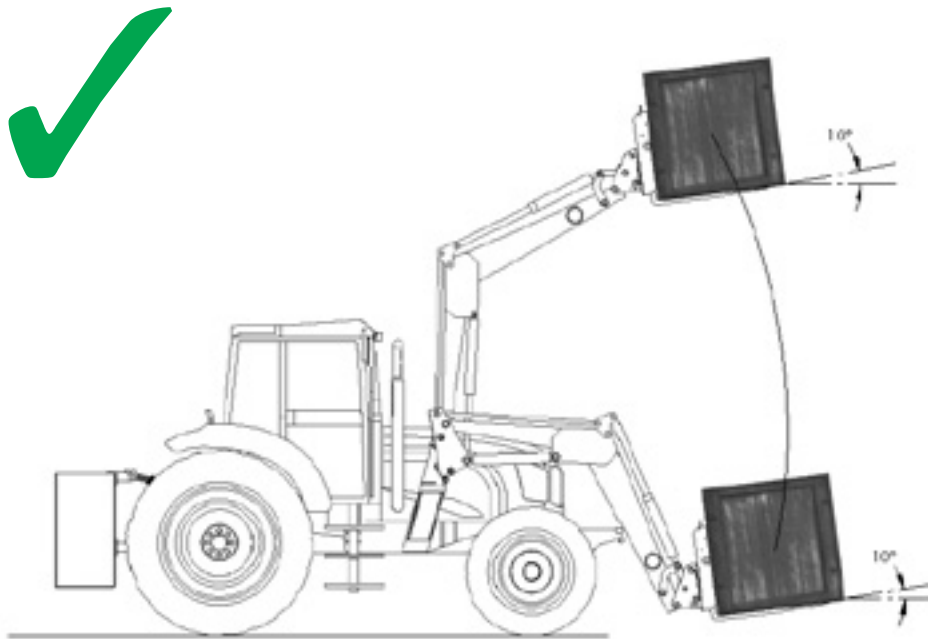


Figure: 2b

With self-leveling anti-rollback device incorporated into the FEL and its attachments, the angle remains the same and ensures the risk of rollback is eliminated when operated correctly.

4.2 HYDRAULIC SYSTEMS

New hydraulic hoses must have a safety factor of 4:1 – ie the minimum burst pressure of the hose must be four times greater than to the maximum working pressure. All hydraulic hoses must be in good condition and be serviceable.

Operator controls and hoses should be located, and/or guarded if reasonably practicable, to prevent oil injection, or burn injuries caused by contact with oil over 50 degrees celsius, in the event of a hose or coupling failure. Guarding can take the form of a hose sock or rigid guard.

It is not always reasonably practical to guard quick-disconnect couplers.

4.3 STABILITY AND RATED OPERATING LOAD (ROL)

The addition of the FEL attachment to a tractor will adversely affect its stability and axle loadings. Counterweights or ballasting may be required to improve stability.

The ROL of the FEL and its attachments, and associated ballast requirements, must be determined in accordance with:

- EN 12525 – *Agricultural machinery – Front loaders – Safety*
- *Code of practice for manufacture and supply of front end loaders for use on agricultural tractors in Australia* (Tractor Machinery Association of Australia)
- ASAE EP562 – *Procedure for determining recommended ballast and minimum rear wheel tread settings for agricultural tractors with agricultural front loaders.*

The designer must also ensure that the tractor specifications are not exceeded, whether the attachment is loaded or empty. Therefore, specifications must not be exceeded for:

- rear axle loads
- front axle loads
- allowable loadings for attachment points
- tyre ratings
- total allowable tractor mass.

4.4 SECURITY OF LOAD

The FEL and its attachments should be designed to retain the load, when used according to the designer's limitations.

4.5 CONTROLS

Operating controls of the FEL and its attachments should be of the hold-to-run (ie deadman) type, except for a float position on the FEL lowering control, which can be retained in position.

All controls for the FEL and its attachments must be clearly and permanently identified (wording must be in English) – see figure 3.

Controls should not result in any movement that is counter intuitive to the direction of control movement. The direction of the raise/lower lever or joystick controls must follow the direction of movement of the assigned function – eg lever forward to lower, lever back to raise.

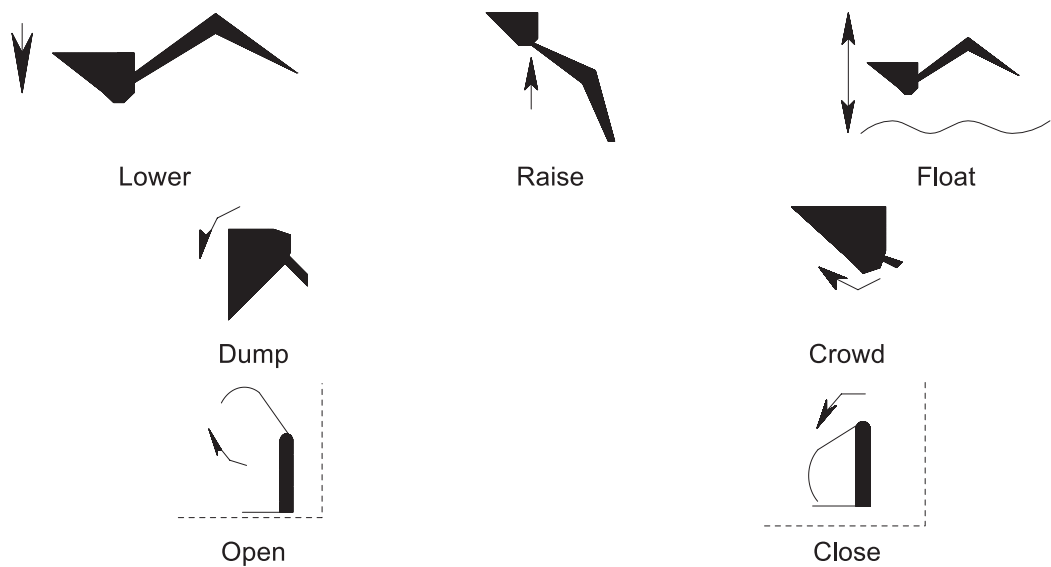


Figure 3: Typical operating control identification

4.6 CRUSH AND SHEAR HAZARDS

Shear hazards between the moving arm and stationary structure of the tractor must be identified and eliminated, where practicable. Where a hazard cannot be eliminated, information and instructions must be provided in the manufacturer's instructions that identify the potential hazards and recommended controls.

The FEL should be removable, to allow unobstructed access for tractor maintenance and inspection. It should be stable when disconnected from the tractor.

If it is impracticable to disconnect the FEL, such as in field service, a safe system of work must prevent inadvertent lowering of the raised lift arms when there is hydraulic pressure loss of the FEL. A mechanical or hydraulic safety device must be provided as part of the design. Where a mechanical safety device is provided, it must be located on the FEL or the tractor, and readily available for use.

Where a hydraulic safety device is provided, there must be no possibility of the raised arm lowering in the event of a single or multiple hydraulic leak or failure in the system – eg hose failure, ram seal damage, valve leakage.

4.7 SAFETY SIGNS AND DECALS

The FEL and its attachments should prominently display pictorial and/or written signs that warn against serious safety risks. Examples (see appendix A) of these signs include:

- Do not exceed ROL
- Crush zone
- Use of mechanical devices during maintenance.

Symbols should conform to AS 1319 *Safety signs for the occupational environment*, all words must be in English and units in metric.

5. MANUFACTURERS

5.1 MANUFACTURER'S RESPONSIBILITIES

OHS legislation places obligations on manufacturers to identify hazards and control the risks associated with the manufacture, supply and use of plant. The manufacturer must ensure all relevant advice provided by the designer is incorporated into the manufacture of the FEL and its attachment.

The manufacturer must ensure that the FEL and its attachments conform to this guide, or provide an equivalent or higher level of safety.

A manufacturer must provide those who have responsibilities under the legislation with all available information about the FEL and its attachments that enables them to fulfil their responsibilities with respect to identifying hazards and controlling the risks associated with the manufacture, supply and use of the FEL and its attachments. This includes advice on the:

- purpose for which the FEL and its attachments were designed
- limitations on its use
- suitable tractors, their counterweight requirements and ROL
- testing and inspections to be carried out on the FEL and its attachments
- installation, commissioning and dismantling
- operation, maintenance, transport and storage
- systems of work that are necessary for the safe use of the FEL and its attachments
- knowledge, training and skills that are necessary for undertaking inspection and testing of the FEL and its attachments.

The manufacturer should affix a compliance decal or plate to the FEL's sub frame or arm – it should be accessible, and clearly and permanently marked. It should indicate:

- tractor model*
- FEL model
- identification or serial number
- manufacturer's identification
- counterweight requirements*
- ROL*

- warning not to exceed ROL
- year of manufacture (or date of supply*).

* These may be stamped by the supplier, or provided on a separate decal or plate, so that the FEL can be fitted to different tractor models, as per the manufacturer's instructions.

5.2 MANUFACTURER'S INSTRUCTIONS

The manufacturer must provide documented operator instructions in English. These instructions must clearly specify all information outlined in section 5.1.

As a minimum, the instructions should include information about:

- tractor requirements
- FEL and attachment capabilities
- inspection and maintenance requirements
- method to attach and detach the FEL and its attachments
- storage
- operation.

The manufacturer should consider providing more practical means for communicating their instructions, such as an instructional DVD or web based information, in addition to the documented operator instructions.

6. SUPPLIERS

6.1 SUPPLIER'S RESPONSIBILITIES

The supplier includes anyone involved in the supply, sale, transfer, lease or hire of plant that is used in a workplace.

OHS legislation places obligations on suppliers to identify hazards and control the risks associated with the supply and use of a FEL and its attachments. They must ensure that any FEL and its attachments, manufactured after the commencement of this guide, conforms to the requirements outlined herein, particularly if imported from abroad, or from another State or Territory, as the manufacturer may not be aware of these requirements – see sections 5.1 and 5.2.

Suppliers who:

- provide advice on the suitability of a FEL
- provide a FEL for a known tractor
- fit a FEL to a tractor, or
- provide a FEL/tractor combination

must ensure that the FEL and its attachments are compatible with the tractor, and any ancillary attachments that the purchaser has advised will be used.

The checklist in appendix B assists the supplier to check whether they are complying with this guide. This guide can be used to assist you in complying with those requirements.

Note: FELs first manufactured prior to the commencement of this guide may not comply with the requirements herein. However, this guide should still be used to assist you in meeting the risk control obligations in the OHS legislation. Where compliance with the requirements in this guide is not reasonably practicable other measures should be implemented to control the identified risks.

6.2 USED EQUIPMENT

Regulatory jurisdictions have different requirements for the sale and transfer of used plant. Ask your workplace regulator for information on the sale or transfer of used plant in your State or Territory. This guide can be used to assist you in complying with those requirements.

6.3 PROVISION OF INFORMATION

The manufacturer's instructions and all other information relevant to the safe use of the FEL and its attachments must be provided at the point of supply.

Prior to sale, the supplier should obtain information from the purchaser and compare this with the specifications provided by the manufacturer, to ensure the FEL and its attachments are fit for the described purpose (when used according to the manufacturer's instructions). The supplier should get information about the type of tractor to be used, the loads to be handled, and the type of terrain on which the FEL will be used.

6.4 PRACTICAL SAFETY INFORMATION

The supplier should establish a means to instruct, at the point of supply, those who purchase a FEL and its attachment on its safe use. This may include a DVD, an instructional session, or an explanation of the manufacturer's instructions.

6.5 RETENTION OF INSTRUCTIONS

The FELs operating instructions must be provided at the point of sale and a copy must be stored in a permanent weatherproof receptacle in the tractor, or on the FEL.

6.6 MODIFICATIONS

Anyone who modifies the FEL or its attachments assumes the role and responsibilities of the designer and manufacturer. As a general rule, modifications should not be done and, if they are, they must be done by a competent person and based on a risk assessment. Before any modifications are done, contact the manufacturer or supplier.

When modifications are carried out, review the safety instructions and revise them where necessary.

7. USE

7.1 EMPLOYER/CONTROLLER RESPONSIBILITIES

OHS legislation places obligations on the employer, or person in control of the plant, including FELs and their attachments, to identify hazards and control the risks associated with their use in the workplace.

When purchasing a FEL or attachments:

- ensure the manufacturer's instructions are provided at the point of purchase
- ensure the FEL and the attachments conform to this guide
- discuss your needs with the supplier to ensure the FEL and the attachments are compatible with your tractor and appropriate for the type of work to be undertaken
- seek practical advice and instruction from the supplier on the use and limitations of the FEL and the attachments.

If you are hiring, leasing or borrowing a FEL or an attachment on a temporary basis, get safe use instructions from the person supplying it.

7.2 ROLL-OVER PROTECTIVE STRUCTURES (ROPS)

ROPS must be manufactured and maintained according to AS1636 (series) *Tractors – Roll-over protective structures – Criteria and tests*. A plate or decal confirming compliance should be attached to the ROPS' frame, or inside the tractor cabin.

Note: A falling object protective structure (FOPS) is not normally required for agricultural tractors but you should assess whether the change of activity relating to the FEL and its attachments introduces a falling risk. If so, you may need to consider installing a FOPS.

7.3 SECURITY OF LOAD

FEL attachments are designed for specific applications and must be used only for the purpose for which they are designed – eg large round hay bales cannot be lifted safely using a bucket.

7.4 TRACTOR STABILITY

The addition of FEL will raise the tractor's centre of gravity, making the tractor/FEL combination less stable than the tractor on its own. Having a raised load in the attachment further raises the centre of gravity. This effect is demonstrated in figure 4.

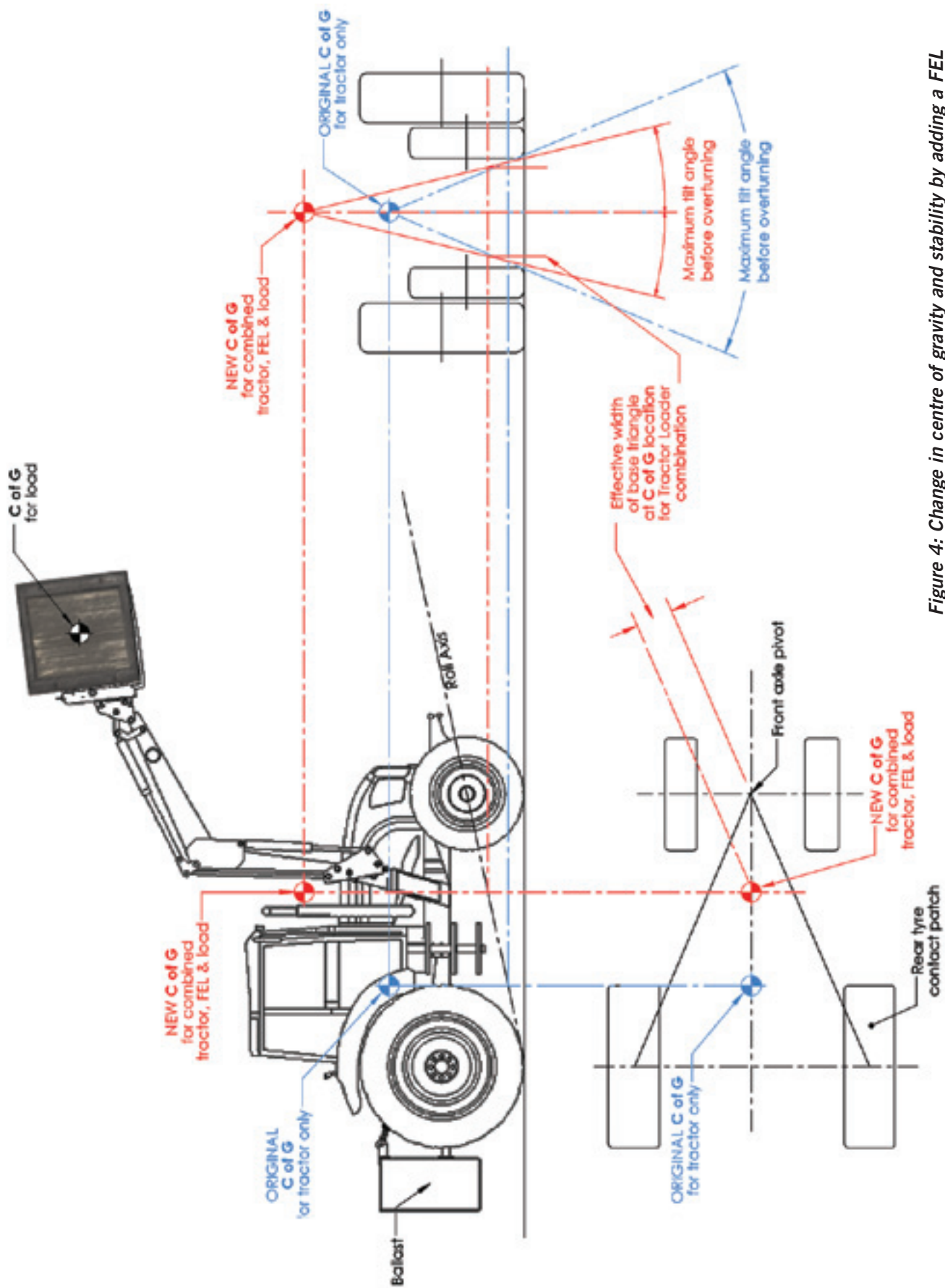


Figure 4: Change in centre of gravity and stability by adding a FEL

7.5 SAFETY INSTRUCTIONS

The employer must provide safety instructions to all those involved in using a FEL and its attachments. A copy of the safety instructions must be kept in good condition with the FEL and its attachments, or with the tractor.

Generally, the safety instructions should be the manufacturer's instructions. Any variations from the manufacturer's instructions must be based on a risk assessment, and must not remove any of the safety features nor expose anyone to risks.

7.6 SUPERVISION, INSTRUCTION AND TRAINING

The employer must provide safe systems of work, adequate supervision, instruction and training to all those involved in using a FEL. They must be instructed in the safe operation of the FEL and its attachments, including hazards specific to the workplace, including the terrain, stability of the tractor, working environment and the like. The employer should ensure that everyone achieves a level of understanding that enables them to safely and competently operate the FEL and its attachments.

Regulatory jurisdictions have different licensing requirements for operation of a front end loader. Ask your workplace regulator for information on the licensing requirements in your State or Territory.

7.7 OPERATION

Prior to use, the FEL and its attachments should be inspected. All safety features must be included in this inspection. If any safety feature is not working correctly, the FEL and its attachments must not be used. The FEL and its attachments must be operated according to the manufacturer's instructions.

There are number of issues that need to be considered prior to operation, such as:

- overhead powerlines and obstructions
- underground services
- terrain
- people within vicinity of operation
- load, mass, dimensions, security
- ROL
- travel speed
- counterweights.

Regulatory jurisdictions have different approach (or separation) distances for work that is done in close proximity to overhead powerlines. Check with your OHS or electrical regulator for the relevant distances in your jurisdiction.

A load should be transported in its lowest practical position, at a safe speed, not exceeding 10 km/h. Consider the terrain and ensure the tractor remains stable during travel and use. A tractor's stability, and the ability of the FEL and its attachments to prevent roll back, are reduced when operating on a slope.

7.8 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Prior to use, a risk assessment must be undertaken to determine the appropriate PPE required. Any identified PPE must be provided by the employer and must be used by those involved in the operation and maintenance of the FEL and its attachments. Examples of PPE are appropriate footwear, hearing protection and eye protection.

7.9 STORAGE

When not in use, the FEL and its attachments should be stored according to the manufacturer's instructions. FELs attached to tractors are safest when rested on the ground. If detached from the tractor, ensure it is stable and poses no risk of falling.

7.10 INSPECTION, MAINTENANCE AND REPAIR

- The FEL and its attachments must be inspected according to the manufacturer's instructions, prior to use.
- All problems identified must be rectified, prior to use.
- The FEL and its attachments must be maintained according to the manufacturer's instructions.
- Replacement parts must be to the original manufacturer's specifications, or their equivalent.
- For replacement hydraulic hoses, the safety factor of 4:1 applies.
- Safety signs and decals should be legible, maintained and, where necessary, replaced.
- Repairs should be carried out by a competent person.

When servicing the tractor, remove the FEL to provide unobstructed access. If this is not practicable – eg for field repairs – use the mechanical or hydraulic safety device provided, to prevent unplanned lowering of the FEL and its attachment.

7.11 MODIFICATIONS

The FEL and its attachments should not be modified or altered. However, if it is necessary to make modifications, they must be done by a competent person and based on a risk assessment. All modifications must comply with this guide. Before any modifications are done, contact the manufacturer or supplier.

The instructions relating to the FEL and its attachments may need to be revised following a modification.

APPENDIX A – SAFETY SIGNS/DECALS

The FEL must clearly display pictorial and written signs warning against the serious safety risks. FEL attachments may also require pictorial and written signs warning against their specific serious safety risks. The following are examples of safety signs that may be used.



APPENDIX B – PRE-PURCHASE CHECKLIST

Use this checklist to purchase a FEL or an attachment, to ensure it complies with the safety features outlined in this guide.

FELs first manufactured prior to the commencement of this guide may not comply with the requirements herein. However, this guide should still be used to assist you in meeting the risk control obligations in the OHS legislation. Where compliance with the requirements in this guide is not reasonably practicable other measures should be implemented to control the identified risks.

Tick **YES** or **NO** against each item. If all **YES** answers, your FEL and attachment should enable you to meet your legal safety obligations. If **NO** to any question, you will need to address the issue to ensure that you comply with those obligations.

ITEM	YES	NO	COMMENT
Is the FEL and attachments suitable for use with your tractor? – eg stability and capacity (See section 4.3)			
Is the FEL and attachments appropriate for your needs? – eg security of load and terrain (See section 4.3)			
Does the FEL and attachments prevent rollback? (See section 4.1)			
Do hydraulic hoses have a safety factor of 4:1? (See section 4.2)			
Are counterweights or ballasting, if required, provided for use with the FEL? (See section 4.3)			
Are the controls clearly and permanently identified? (See section 4.5)			
Are the controls (other than the float control) hold-to-run? (See section 4.5)			
Is a mechanical or hydraulic safety device provided? (See section 4.6)			
Are safety signs/decals in place? (See section 4.7 and appendix A)			
Are the manufacturer's instructions provided in English? (See section 5.2)			
Is there a manufacturer's compliance decal or plate located on the subframe of the FEL? (See section 5.1 and 5.2)			
Is information provided on safe storage of the FEL when disconnected from the tractor? (See section 5.1)			
Is maintenance information provided with the FEL? (See section 7.10)			
Is there practical safety information provided by the supplier? (See section 6.4)			

APPENDIX C – FOR FURTHER INFORMATION

WorkCover NSW

- **Visit** www.workcover.nsw.gov.au
- **Call** the WorkCover Assistance Service on **13 10 50**
- **Call** the WorkCover Publications Hotline on **1300 799 003**
- **Visit** your nearest WorkCover office
- For technical specifications for FELs and attachments, contact your local supplier.

SafeWork South Australia

GPO Box 465
Adelaide SA 5001
Help Centre: 1300 365 255
Website: www.safework.sa.gov.au

Workplace Health and Safety Queensland, Department of Justice and Attorney-General

GPO Box 69
Brisbane QLD 4001
Workplace Health and Safety Infoline: 1300 369 915
Electrical Safety Infoline: 1300 650 622
Website: www.worksafe.qld.gov.au

Workplace Standards Tasmania, Department of Justice

PO Box 56
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Website: www.wst.tas.gov.au

WorkSafe Victoria

Advisory Service
222 Exhibition Street
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Telephone: 03 9641 1444
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Email: info@worksafe.vic.gov.au
Website: www.worksafe.vic.gov.au

WorkSafe Western Australia

1260 Hay Street
West Perth WA 6005
Telephone: 08 9327 8777
Toll Free: 1300 307 877
Email: safety@commerce.wa.gov.au
Website: www.worksafe.wa.gov.au

STATE OHS LEGISLATION

For specific OHS State requirements, refer to:

New South Wales

- *Occupational Health and Safety Act 2000*
- *Occupational Health and Safety Regulation 2001*

Queensland

- *Workplace Health and Safety Act 1995*
- *Workplace Health and Safety Regulation 2008*

South Australia

- *Occupational Health, Safety and Welfare Act 1986*
- *Occupational Health, Safety and Welfare Regulations 1995*
- *Workers Rehabilitation and Compensation Act 1986*
- *Workers Rehabilitation and Compensation (General) Regulations 1999*

Tasmania

- *Workplace Health and Safety Act 1995*
- *Workplace Health and Safety Regulations 1998*

Victoria

- *Occupational Health and Safety Act 2004*
- *Occupational Health and Safety Regulations 2007*

Western Australia

- *Occupational Safety and Health Act 1984*
- *Occupational Safety and Health Regulations 1986*

INDUSTRY CODE OF PRACTICE

Tractor Machinery Association of Australia

Manufacture and supply of front end loaders for use on agricultural tractors in Australia.

AUSTRALIAN STANDARDS

Australian Standards can be purchased from SAI Global by contacting the Customer Service Centre on **13 12 42**, or online at **www.saiglobal.com/shop**

Check if any updates or additions to the Australian Standards have been made.

AS 4100	<i>Steel structures</i>
AS 3990	<i>Mechanical equipment – Steelwork</i>
AS 1636	<i>Tractors – Roll-over protective structures – Criteria and tests – Conventional tractors.</i>

INTERNATIONAL STANDARDS

ASAE S301	<i>Front-End Agricultural Loader Ratings</i>
EN 12525	<i>Agricultural machinery – Front loaders – Safety</i>
ASAE EP562	<i>Procedure for Determining Recommended Ballast and Minimum Rear Wheel Tread Settings for Agricultural Tractors with Agricultural Front Loaders.</i>
ASAE S441	<i>Safety Signs</i>
ASAE S304	<i>Graphical control symbols</i>
ISO 3600	<i>Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Operator's manuals – Content and presentation</i>



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