

**RICHARD WESTERN**



## **Operation and Maintenance Manual**

*Delilah Spreaders*

*FBS Manure Spreaders*

*SDS Manure Spreaders*

Make a Note of the Machine serial number in this box for future reference and when ordering replacement parts.

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Original Instructions

Please Read and follow all instructions  
before Operating the Machine

**It is the responsibility of the operator to read and understand the contents of this manual before operating the machine for the first time.**

**The Operators manual must accompany the machine at all times. If the machine is resold the Operators manual must be given with the machine to the new owners.**

## **Introduction**

Pages containing information about the Manufacturer, Agent, Use of the machine and its Disposal.

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# ***Introduction***

## **INTRODUCTION**

This manual provides information on the use, adjustment and servicing of the RICHARD WESTERN range of spreaders

Models covered are:-

Delilah Spreaders

FBS Manure Spreaders

SDS Manure Spreaders

Following the advice on the correct maintenance and servicing procedures will ensure maximum performance and a long service life for your machine.

Failure to carry out maintenance work correctly, or incorrect operation will result in poor machine efficiency and loss of valuable time.

By ensuring the correct operation, and by carrying out maintenance and service work with care, you will be able to make full use of the technical knowledge and the experience with which your trailer was originally designed.



# Introduction

*continued*

The Richard Western range of machines covered in this manual are trailed agricultural implements designed and constructed for the sole purpose of carrying and redistributing agricultural crops and associated materials.

## **This is their intended use.**

The machines may contain, additional equipment which may function under the direct control of the operator of a towing vehicle., or in certain circumstances automatically and autonomously.

Use of the machine in any other way is considered by the manufacturer to be contrary to the intended use. Consequently the manufacturer does not accept any liability for such use and the user therefore accepts all risks arising from such use.

Intended use also includes the observation of the service, maintenance and repair conditions and routines as prescribed by the manufacturer.

Within this manual is the information required by an operator to assemble and put the machines to work, operate and maintain them and lay them up for storage.

Additionally comprehensive information relating to the machines safe use and the responsibilities of the operator is also given.

### **WARNING**



*The Operator and User must read this manual fully before commencing work with or transporting the machine. If the Operator or User does not understand any part of this manual further help and advice is available from the manufacturer or from the manufacturers agent shown on the following pages of this manual.*

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## ***Manufacturer***

Manufacturers Name :

**Richard Western Ltd**

Manufacturers Address :

**D'Urbans,  
Framlingham,  
Suffolk,  
ENGLAND  
IP13 9RP**

# ***Agent***



**Agents Stamp :**



## ***Disposal***

Upon completion of the useful life of the machine, all parts can be disposed of at a suitable waste disposal facility.

Care must be taken if oxy-acetylene cutting equipment is to be used.

The wheels and tyres , hydraulic & pneumatic cylinders, valves and hoses must be removed before using cutting equipment.

Oil must be drained collected and disposed of in accordance with current legislation.

Electrical components must be disposed of in accordance with the relevant legislation.

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## ***Preface***

Note that the Richard Western Range of Trailers may also be referred to simply as the machine(s) in the following sections.

The instructions set forth in this manual must be read carefully and followed by all persons concerned with the operation, maintenance, repair or inspection of this machine in order to prevent accidents.

Read especially sections relating to Safety and Before Operation.

The use of spare parts, accessories and additional equipment which is not originally manufactured, checked and released by Richard Western Ltd can have a negative effect on specific design features of the machine and on its operability. This may impair its operating safety, as well as safety at work for the operator.

Richard Western Ltd will in no way be liable for damage or personal injury caused by the use of other than original Richard Western Ltd parts, accessories and additional equipment.

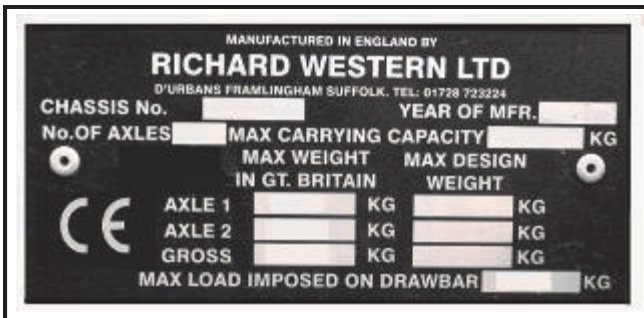
Technical specifications, dimensions and weights are given with the usual tolerances.

Front, rear, right and left refer to the direction of forward travel as viewed from the operators seat of the towing vehicle.

Fitment of Parts or accessories or modifications not approved in writing by Richard Western Ltd may compromise the effective and safe operation of the machines and could invalidate the warranty.

Richard Western Ltd operates a policy of continual improvement, as such some items in this manual may differ slightly from that of your machine. Richard Western Ltd reserve the right to make changes to the machine or this manual without notice.

If in any doubt regarding any aspect of the design or operation of this machine contact Richard Western Ltd or your Richard Western Ltd agent for clarification.



## IDENTIFICATION PLATE

The machine number (VIN) , the model are required with all orders for spare parts and technical enquiries. This is necessary in order to ensure correct delivery of spare parts.

The identification plate with the machine Number (VIN) is attached to the front right side of the machine frame (1) on all machines

Additionally an identification number is located on the forward crossbrace of the main chassis (2)



## ROAD TRANSPORT

Observe the applicable road regulations in your country.



### Information

*It is the duty of the operator to ensure that the machine is maintained and operated in accordance with all Local and National regulations.*

**Operating on public roads**

Before operating on public roads the trailer must be correctly connected to the towing vehicle, the lights must be connected and function of the lighting equipment must be checked.

The trailers are equipped with hydraulic and/or Pneumatic braking systems. These must be correctly connected to the Towing Vehicle and checked for correct operation.

If the trailer has an air brake system the brake lines and any breakaway rope (breakaway brake) must be connected.

**Number plate**

To 15 m.p.h. (25 km/h) : Trailers must be fitted with a number plate issued to the vehicle owner for one of his vehicles

Over 15 m.p.h. (25 km/h) : Trailers must be fitted with a duplicate of the number plate fitted to the Towing Vehicle.

## ***How to use this manual***

The manual contains sections that cover all of the following, Safety , before and during operation, Assembly, Using the machine, Maintenance, Specifications and Technical data. Refer to the contents pages for the relevant page number.

Before use of the machine familiarise yourself with the manual and its contents.

The machine may only be operated, serviced and repaired by persons who are familiar with the machine and who have read and understood this manual, and are informed of the risks.

Observation of the relevant accident prevention regulations and other generally acknowledged regulations regarding safety, and occupational health is critical, as is conformance with local and nationally enforced standards relevant to motor vehicles and road traffic law.

Modifications to the machine without the specific approval of the manufacturer, exclude the manufacturer from any liability or damage resulting from the modifications.

Failure to follow the procedures given in this manual could invalidate the warranty given.

## Safety Warnings

### Identification of Warnings and Danger

All parts of the manual to do with the safety of the operator, or the safe operation of the machine, are marked with the following symbols.

#### WARNING



#### **Warning**

*This symbol identifies that hazard exists. If proper precautions are not taken, it is highly probable that the operator (or others) could be killed or seriously injured*

#### CAUTION



#### **Caution**

*This symbol identifies a reminder of safety practices. Failure to observe these safety practices could result in injury to the operator (or others) and possible damage to the machine.*



#### **Information**

*This symbol identifies instructions that make it easier to use the machine effectively and economically*

# ***Warranty***

The Richard Western range of machines are supplied with a full One Year warranty.

There are some exclusions, namely :-

Wheels and Tyres

Damage caused by misuse and abuse

Damage caused by overloading

Damage to ground engaging or suspension parts

For full details refer to the manufacturers documentation.

If you have a claim under warranty contact the manufacturer or the manufacturers agent.

# ***Electrical Equipment***

Your machine may be supplied with electrical control equipment for some of its functions.

To ensure correct operation care should be taken to ensure that these controllers are correctly connected when in use.

Ensure any damage howsoever caused is repaired immediately.

When not in use the controllers should be removed from the machine and stored in a suitable dry container on the towing vehicle or alternatively in the workshop.

If the machine is to be unused for a prolonged period of time, the open connections should be covered and protected against water ingress and corrosion.

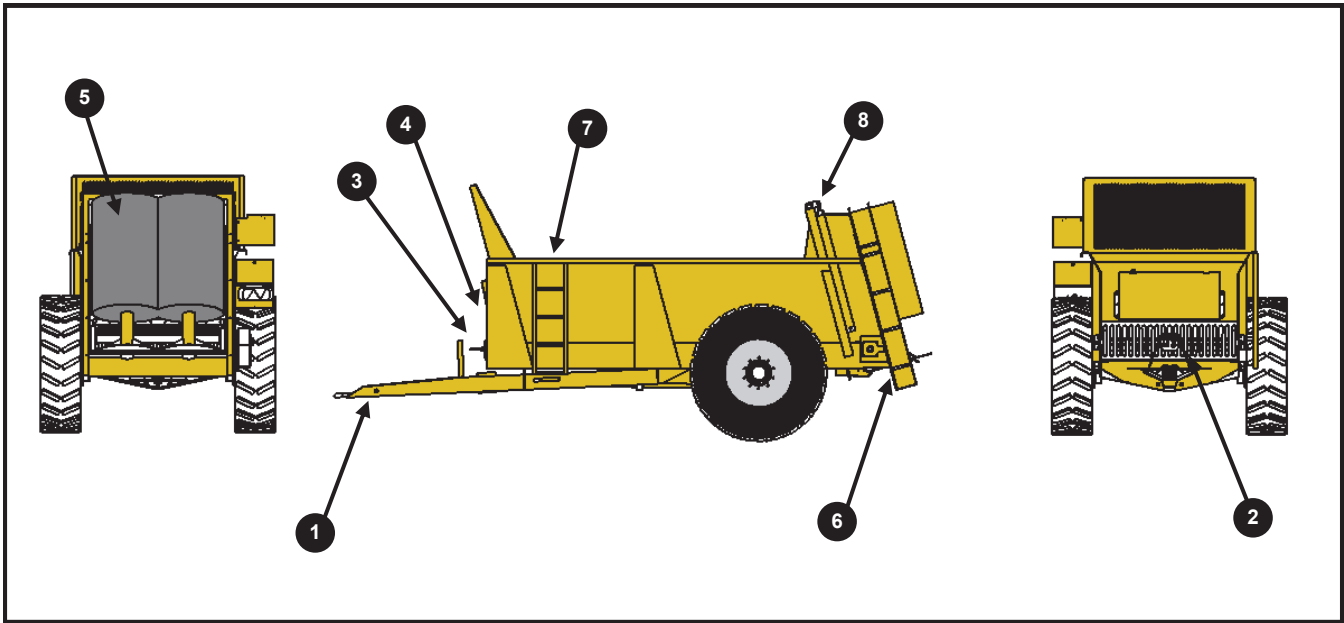
Controllers damaged by the ingress of water, water damage to electronic components or corrosion to electrical or electronic components will not be covered by the warranty agreement.



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The information contained within this section identifies the major assemblies and component parts within each machine model.

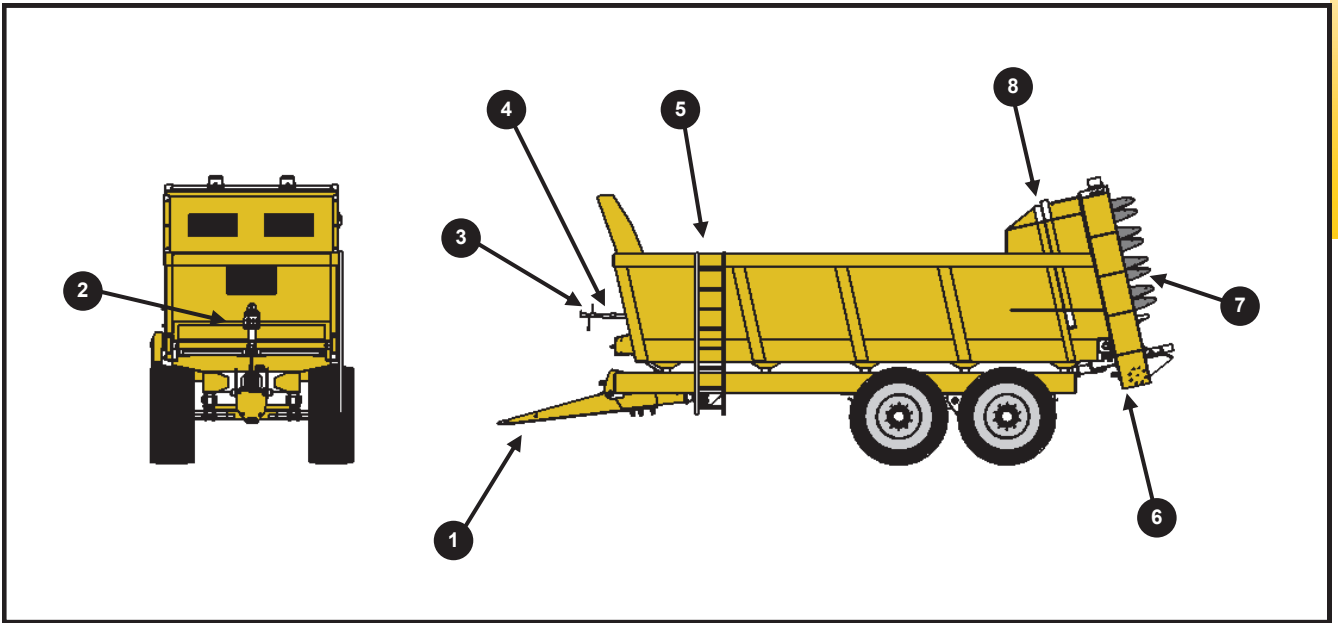
# Delilah Manure Spreaders



## Key

- 1 Drawbar
- 2 PTO
- 3 Hose Storage
- 4 Hydraulic & Brake Connectors
- 5 Discharge Rotors
- 6 Rotor Gearbox
- 7 Ladder
- 8 Slurry Gate

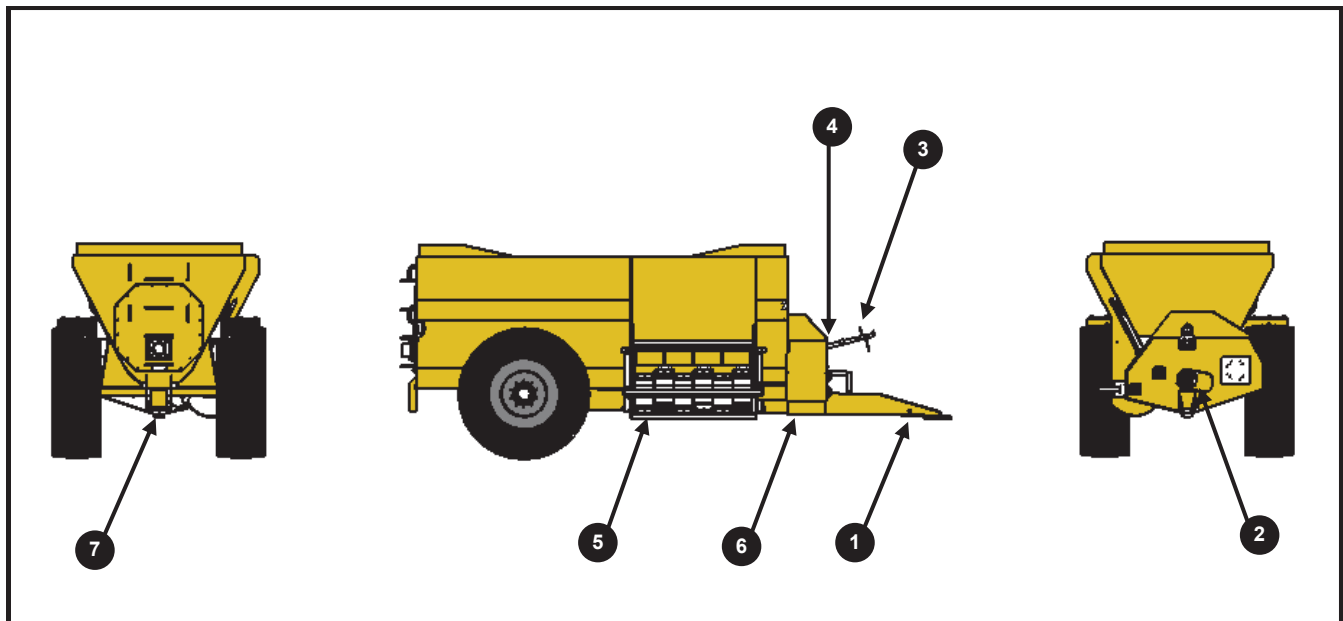
# FBS Manure Spreaders



## Key

- 1 Drawbar
- 2 PTO
- 3 Hose Storage
- 4 Hydraulic & Brake Connectors
- 5 Ladder
- 6 Rotor Gearbox
- 7 Rotor
- 8 Slurry Door

# SDS Manure Spreaders



## Key

- 1 Drawbar
- 2 PTO
- 3 Hose Storage
- 4 Hydraulic & Brake Connectors
- 5 Discharge Rotors
- 6 Rotor Gearbox
- 7 Rear Step

# **LOCATION OF SAFETY DECALS**

Safety decals & warning symbols are placed in danger areas of the machine to help identify risks of injury.

The decals fixed to a machine do not make the machine safe they are there as a guide and to direct appropriate behaviour when using the machine.

The operator is ultimately responsible for his own safety and that of other persons around the machine. Never permit anyone to ride on the trailer or to approach the trailer or any of its components whilst operating.

The information in these decals show how to avoid injury and accidents by appropriate behaviour.

The location of the decals on the machine and their wording is shown on the following pages.

Over time the manufacturer may change the type and quantity of decals. A machine may therefore contain a mixture of all of the decals shown.

The numbers against the explanation correspond to those showing the location on the illustrations

**CAUTION**

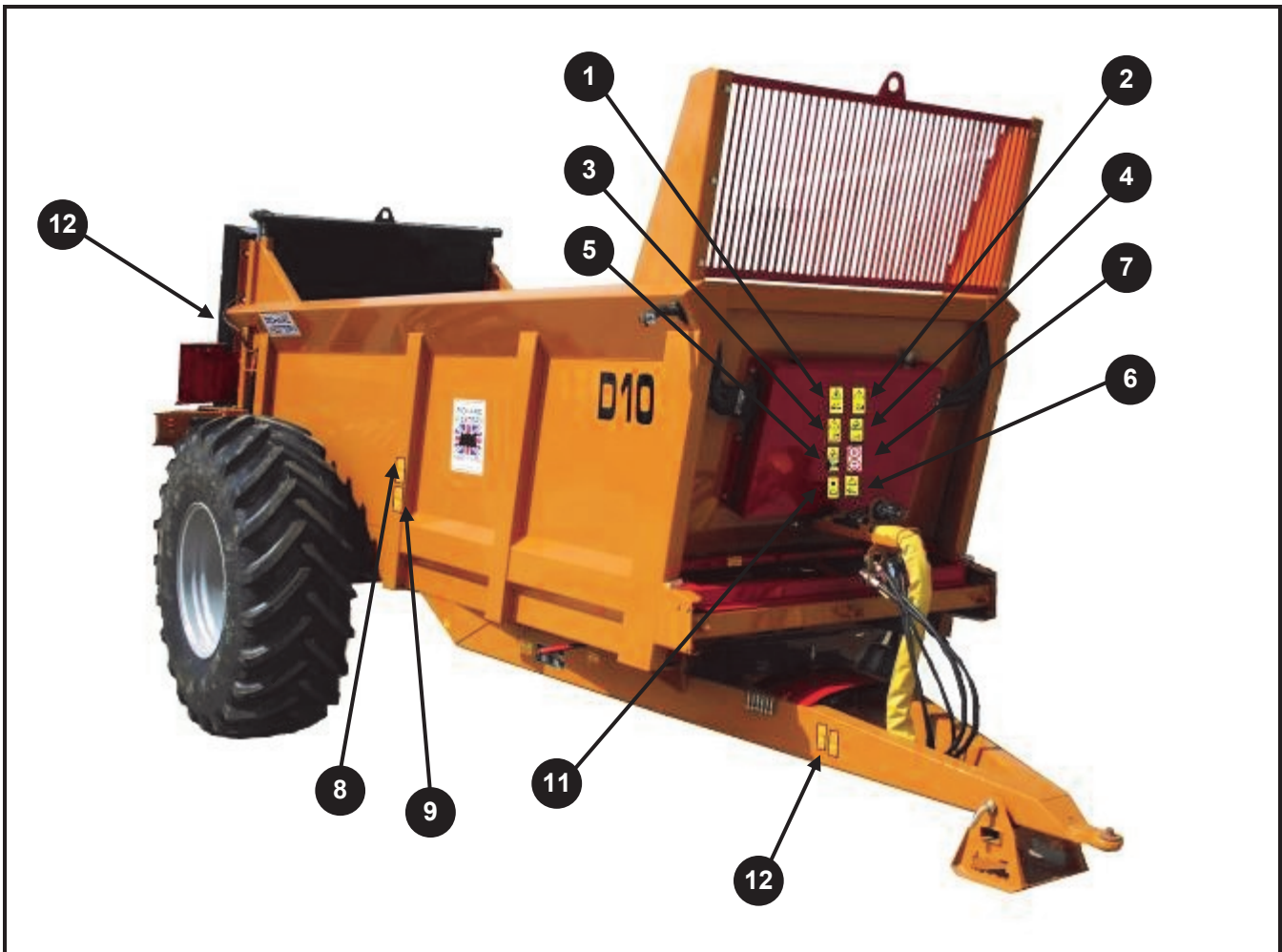


*Immediately replace damaged or illegible safety decals with new replacements.*

*When replacing parts with decals affixed to them, make sure you affix new decals again to the new parts.*

# Manure Spreaders

## Typical



### 1 Overhead Power Lines

Warns the operator not to raise the body or any lifting device in the proximity of Overhead Power lines or obstructions



### 2 Refer to Operators Manual

Reminds the operator to refer to the operators manual for Technical information and data



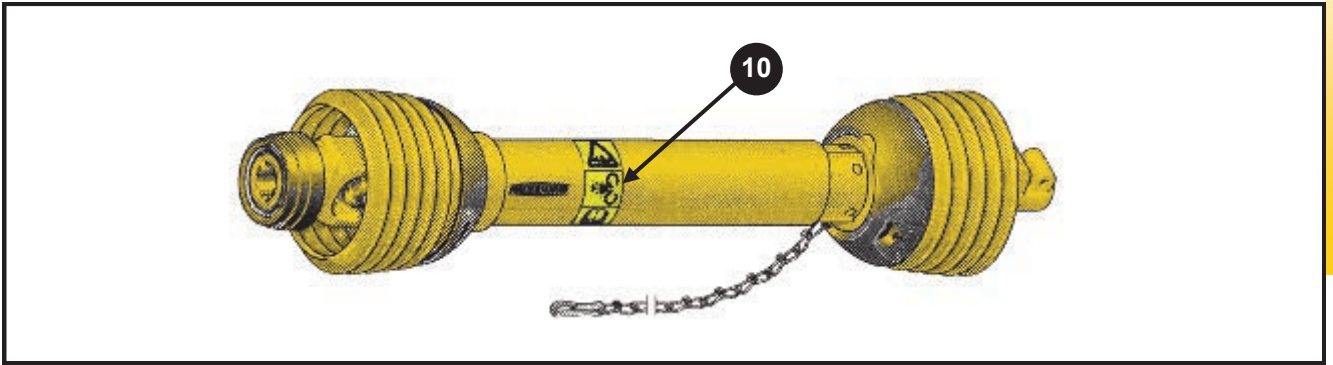
### 3 Refer to Operators Manual

Warns the operator to disable the Towing Vehicle and Isolate the trailer from any energy sources when undertaking maintenance



### 4 Hydraulic & Pneumatic Pressure

Warns the operator of the danger of trapped residual pressures when coupling and de-coupling the trailer



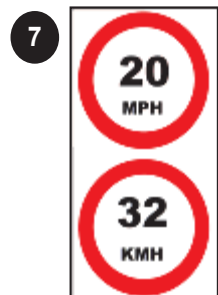
### Crush Prevention

Warns the operator of the potential for crushing injuries in the area between the Trailer and Towing vehicle



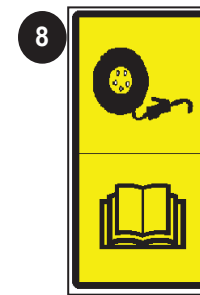
### Crush Prevention

Reminds the operator of the need to raise the slurry door before operating the floor chains



### Maximum Allowable Speed

Reminds the operator of the maximum permissible towing speed



### Service Checks

Reminds the operator to refer to the Operators Manual for information on Tyre Pressures



### Service Checks

Reminds the operator to refer to the Operators Manual for information on Wheel Nut Torques



### Rotating Shafts

Warns the operator to refer to the Operators Manual for information related to fitting and using the rotating driveshaft and its guards



### Power Take Off

Reminds the operator to refer to the Operators Manual for information on Power Take Off Connection and permissible rotation Speed



### Rotating Shafts

Warns the operator of the danger in this area due to rotating machinery

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## General Hazards

### Introduction

Warnings or Cautions for hazards that may be present when operating the machine, or during maintenance of the machine, are shown in the following sections

### Before Operation

### Operation

The following Warnings and Cautions are of a General nature and are not task specific. All personnel operating or maintaining this machine must be fully aware of these warnings.

### General

**WARNING**



Make sure the location of high voltage power lines and buried power cables are known. Serious injury or death, by electrocution, can occur if the machine contacts these hazards.

**WARNING**



Do not wear loose clothing or Jewellery, which can snag on the controls or machine structure, causing personal injury.

**WARNING**



Make sure that all protective guards and covers are secured in place on the machine. If guards and covers are removed, a hazard to personnel will exist.

**WARNING**



Make sure that all foreign objects and materials, such as oil, tools, debris and other items, are kept clear from equipment, walkways and steps on the machine. Failure to do this can cause personal injury.

**WARNING**

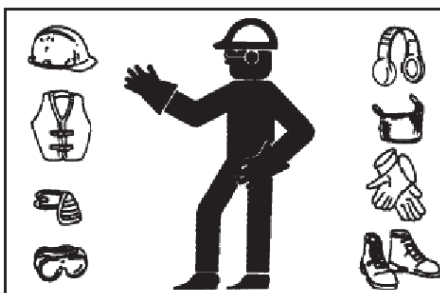


Make sure that all loose items, such as tools, lunch boxes and other items, which are not part of the equipment, are secured correctly before operating the machine. Failure to do this can cause personal injury.

**WARNING**



Always wear the correct protective equipment, including a hard hat and protective glasses, as required.



**CAUTION**



Machine operators must be aware of the correct hand signals and those personnel authorised to give them.

**CAUTION**



Operators must accept hand signals only from a single and authorised person.

**CAUTION**



Make sure that all fluids used during maintenance of the machine are stored in the correct containers.

**CAUTION**



Never store these fluids in other types, such as glass containers.

**CAUTION**



Make sure that all fluids are disposed of correctly and in accordance with Local Health and Safety Regulations.

**CAUTION**



Make sure that all cleaning fluids are used with care and that any necessary repairs are reported immediately.

**CAUTION**



Unauthorised personnel must **not** be permitted to operate or maintain this machine.

**CAUTION**



Make sure the size of the machine, including any load, is known. This will ensure a correct and safe clearance is maintained, when operating the machine in confined spaces or near obstacles.

## GENERAL HAZARDS

### Pressurised air and water

**WARNING**



If released, air or water in pressurised machine systems can cause debris or hot water to be ejected. This can cause personal injury. Care must be taken when working on pressurised machine systems.

**WARNING**



Operators using pressurized air or water for cleaning purposes must wear the correct protective equipment. This includes protective clothing, shoes/boots and goggles or face shield.

**WARNING**



Operators using pressurised air or water for cleaning purposes must not exceed the following maximum operating pressures:

Air - 205 kPa (30 psi)  
Water - 275 kPa (40 psi).

### Residual hydraulic pressure

**WARNING**



Refer to the Service Manual before releasing hydraulic pressure. Non-operating hydraulic systems can retain residual hydraulic pressure. If released, this residual pressure can cause:

Sudden movement of the machine or machine attachments.

Disconnected hoses to whip.

Hydraulic fluid to be sprayed, causing a personal hazard through direct contact or ingestion.

### Fluid penetration

**WARNING**



Residual hydraulic pressure must be released before any hydraulic maintenance, disconnection or component removal is done. Refer to the Service Manual before releasing hydraulic pressure. Non-operating hydraulic systems can retain residual hydraulic pressure. If not released correctly, personal injury can occur.

**WARNING**



Leaking fluid, even from a pin hole leak, can penetrate the skin, causing serious injury or death. Always use cardboard or a board to check fluid leaks. If fluid penetration of the skin occurs, you must seek medical help immediately, preferably from experienced medical staff.

### Fluid spillage

**WARNING**



Care must be taken to avoid fluid spillage during machine maintenance, testing, adjusting and repair. Before any possible fluid spillage can occur, a suitable container must be positioned to collect the fluid.

### Disposal of waste material

**WARNING**



The disposal of waste materials, including potentially harmful fluids, must be in accordance with local Health and Safety Regulations. Improper disposal procedures can be harmful to personnel and the environment. Always use the correct and leakproof type of container for the storage of waste fluids. Do not dispose of these fluids by pouring onto the ground, into water sources or into drains. Improper disposal procedures can be harmful to personnel and the environment.

### Asbestos hazards

**WARNING**



Contact with asbestos must be avoided, particularly inhalation of airborne dust, which can cause serious injury or death.

If it becomes necessary to come into contact with asbestos, you must use the guidelines that follow:

Avoid creating dust if handling debris or components that may contain asbestos, such as brake pads and bands, liner material, clutch plates and some gaskets. Never use compressed air for cleaning purposes.

Avoid machining or brushing materials that may contain asbestos.

Before disposal, use a wet, damping down method to concentrate material dust and debris.

If possible, a vacuum cleaner fitted with a high particle air filter (HEPA), should be used to collect debris and dust. Use exhaust ventilation on permanent machining work.

Wear an approved respirator if there is no other way to control any dust produced. Always comply with the applicable environmental regulations for the disposal of asbestos.

Stay away from areas that may contain airborne asbestos particles.

Always comply with the applicable rules and regulations for the work place.

Use genuine Richard Western equipment, components and parts, which are supplied asbestos free.



## GENERAL HAZARDS

### Crushing or cutting prevention

**WARNING**



Support equipment correctly before you do any work or maintenance from beneath that equipment.

**WARNING**



Unless instructed otherwise, never attempt to do adjustments whilst the machine is moving or the engine or other power source is running.

**WARNING**



Clearances in machine control linkages will change with control operation or machine movement. Always keep clear of controls or areas that may experience clearance changes.

**WARNING**



Always keep clear of rotating or moving parts of the machine. Always re-install any guard or cover that has temporarily removed.

**WARNING**



When handling cables, always wear protective gloves. Never use kinked or frayed cables.

**WARNING**



Striking any object can cause debris chips to fly off, causing personal injury. Always wear protective glasses/goggles before striking an object and make sure that the area is clear of other personnel.

**WARNING**



If a retaining pin is struck with force, it may be ejected and cause personal injury. Always wear protective glasses/goggles before striking a retaining pin and make sure that the area is clear of other personnel.

### Burn prevention

**WARNING**



Some components will get hot during operation, causing a potential burn hazard to personnel. Before you do any maintenance on these parts, you must:

**WARNING**



Always allow these parts to fully cool before you do any maintenance work.

**WARNING**



Always release residual pressure in the air, hydraulic and lubrication systems and associated pipe lines/hoses, before you do any maintenance work.

**WARNING**



Hot fluids and surfaces can cause personal injury. Avoid direct contact with hot fluid or surfaces.

### Fire and Explosion prevention

**WARNING**



If a Fire extinguisher is fitted, make sure it is available and in a fully charged and serviceable condition.

**CAUTION**



Make sure you are fully aware of the operating instructions for the fire extinguisher.

Inspect and service the fire extinguisher at regular intervals or in accordance with the manufacturers instructions.

**WARNING**



All fuels, most lubricants and some coolant mixtures are flammable and if leaking onto a hot surface or electrical components, can create a fire. Fire can cause severe personal injury or death.

**WARNING**



Do not operate the machine close a naked flame or heat source.

**WARNING**



Always clean pipes and thoroughly with a non-flammable solvent first.

**WARNING**



Examine all electrical wires daily and check and tighten all electrical connections. If necessary, repair loose or frayed wires before you operate the machine.

**WARNING**



Dust produced from repairs to Non-metallic components, such as hoods or fenders, can be flammable. Always repair such components in a well ventilated area, away from naked flame and heat sources.

**WARNING**



Leaking pipes and hoses can cause a fire. Examine all pipes, hoses and associated supports for wear, deterioration and damage and ensure hat pipe and hose clamps are secure. Make sure pipe and hose connections are correctly torqued.

**WARNING**



Remove all flammable materials such as fuel, oil and debris from the machine. Do not allow the accumulation of flammable materials on or around the machine.

**WARNING**



Always store fuels and lubricants in the correct and properly marked containers and away from unauthorised personnel.

## Fire and Explosion prevention (contd)

**WARNING**



*Always store soiled oily rags and other flammable materials in protective containers.*

**WARNING**



*Do not smoke in areas that are used for the storage of flammable materials.*

**WARNING**



*Do not operate the machine close to naked flames.*

**WARNING**



*Make sure that heat shields, installed to prevent fluids or fluid spray from igniting, are fitted correctly.*

**WARNING**



*Do not weld or flame cut any pipes or tanks that contain flammable fluids or gases. Always clean such pipes and tanks thoroughly with a non-flammable solvent first.*

## Pipes, tubes and hoses

**WARNING**



*Leaks from loose or damaged pipes, tubes or hoses can cause a system failure or a fire. Examine pipes, tubes and hoses regularly, particularly for signs of damage, leaks or being loose.*

**WARNING**



*Never use bare hands to check for leaks from pipes, tubes or hoses. Always use cardboard or a board and if necessary, torque connections to the recommended value.*

**CAUTION**



*Do not bend or strike high pressure pipes or install a bent or damaged high pressure pipe.*

**CAUTION**



*You must replace any pipe, tube or hose if:*  
*End fittings are damaged or leaking.*  
*Outer coverings are chafed or cut.*  
*Wires are exposed.*  
*Outer covering is blistered or ballooning.*  
*Flexible portion of a hose is kinked.*  
*Outer covers have embedded armouring.*  
*End fittings are damaged or displaced.*

**CAUTION**



*Clamps, guards and heat shields are installed to prevent vibration, contact between components and excessive heat. Make sure that all clamps, guards and heat shields are installed correctly.*

## Tyre hazards

**WARNING**



*An air inflated tyre can expand and explode if excessive heat is applied through welding, heating rim components, external fire or excessive use of the brakes. An exploding tyre can eject axle and wheel debris 500 m (1500 ft) or more from the vehicle, causing damage and possibly personal injury or death. All personnel must be aware of the hazards of overheating tyres.*

**WARNING**



*An over-inflated tyre can blow out or cause a rim failure. This can cause damage or personal injury. Inflation of tyres must only be done by trained personnel.*

**WARNING**



*When you inflate a tyre, you must stand behind the tyre tread and use a self-attaching inflator.*

**WARNING**



*Do not approach a warm or hot tyre. Keep the minimum distances away from the tyre and stay outside the shaded areas (refer to illustration above).*

**WARNING**



*Maintenance on tyres and rims can be hazardous. The use of incorrect procedures can result in a tyre exploding. An exploding tyre can eject axle and wheel debris 500 m (1500 ft) or more from the vehicle, causing damage and possibly personal injury or death. Maintenance on tyres and rims must be done only by trained personnel, using the correct tools and procedures. The tyre dealer or manufacturers instructions must be followed.*

## GENERAL HAZARDS

### Mounting and dismounting

**WARNING**



You must never attempt to mount, dismount or jump from a machine that is moving.

**WARNING**



Always mount or dismount the machine at the recognised locations, which have steps and/or hand holds. Make sure the steps and/or hand hold are clean and examined regularly. Make any necessary repairs.

**CAUTION**

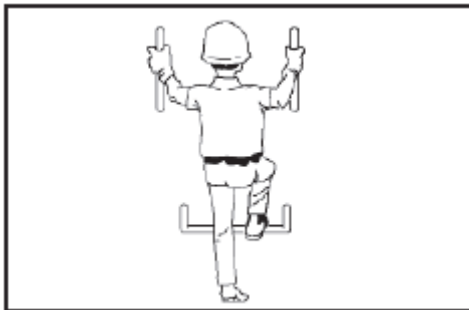


When you mount or dismount the machine, always keep a three -point contact with the steps and hand holds. Three-point contact can be two feet/one hand or two hands/one foot.

**CAUTION**



When you mount or dismount the machine, always face the machine and never attempt to carry tools or supplies. Tools and supplies should be raised or lowered from the machine using a hand line or other suitable method.



### Before operating the machine

**CAUTION**



This machine must be operated only by correctly trained and authorised personnel. Certain local operating conditions may require the machine operator to obtain an operators licence or a certificate.

**CAUTION**



The machine operator must be fully aware of the machines capabilities and limitations. The operator must also be familiar with the local working area or site and in particular:

**CAUTION**



Check the area for vertical and horizontal clearances. Check for overhead obstructions. Check for electrical power lines and make sure the machine keeps at least 8 m (25 ft) away.

**CAUTION**



Check the work area or site for changes in the stability of the ground surface, back filled trenches and structural integrity of buildings, roofs etc.

**CAUTION**



Make sure that all protective guards and covers are correctly installed on the vehicle.

**CAUTION**



Make sure that if the machine is equipped with a fully working lighting system that is adequate for the working conditions, and is compliant with local or national road traffic regulations

**CAUTION**



Make sure that the machine reverse alarm and other warning devices are in full working order.

**CAUTION**



Make sure that all obstacles are cleared from the intended path or route of the machine.

**CAUTION**



Make sure that before the machine is moved, there are no personnel on, under or near the machine.

## GENERAL HAZARDS

**WARNING**



*Collision of high speed road traffic and slow moving machines can cause personal injury or death. When on a public road, use a flashing beacon and other lights according to local laws. Use a Slow Moving Vehicle (SMV) emblem displayed at the rear of the machine where this is a national requirement. Pull over to let faster traffic pass. Signal and slow down before turning off the road.*

**WARNING**



*Use warning devices (flags, SMV emblem, lights, etc.) which are approved for use by your local government agencies, when using equipment on public roads. Keep these devices clean and in good working order.*



## GENERAL SAFETY INSTRUCTIONS

Check that the machine is roadworthy and safe to operate every time it is put into operation!

1. Observe the current regulations regarding safety and accident prevention as well as the information in the operator's manual.
2. When using public roads observe all traffic regulations.
3. Make yourself familiar with all equipment and controls and their functions before starting work as it will be too late once you have set off.
4. Make sure that there is no one in close proximity to the machine before putting it into operation (Be especially aware of children!).

Check that visibility is good, particularly when reversing (have someone direct you if necessary).

5. Clothing worn by the operator must be close-fitting. Avoid wearing loose fitting clothing when operating or maintaining the machine
6. Keep the machine clean to prevent fire.
7. If it is necessary to access the machine, the Engine of the towing vehicle must be switched off. The ignition key of the towing vehicle must be removed.
9. Any safety guards must be checked regularly for wear and replaced if necessary.
10. Any safety decals that are missing must be replaced immediately.

### General

1. Use only the recommended fastenings on the machine!
2. Do not exceed the maximum load on the trailer drawbar
3. Use extreme caution when coupling and uncoupling the machine from the towing vehicle to avoid risk of injury.
4. During maintenance or after use prevent the machine from rolling away by use of the parking brake or wheel chocks.

5. A risk of injury due to crushing exists in the vicinity of the Towing vehicle 3-point linkage!
6. Couple and uncouple the machine to the towing vehicle only as specified in the instructions.
7. The performance of the towing vehicle can be influenced by the machine, ensure the towing vehicle has sufficient steering and braking capacity..
8. Make sure no one is between the machine and the towing vehicle unless both are secured and prevented from moving.
9. The travel speed must always be matched to the under wheel conditions. Avoid sudden turns and braking when driving up or down hill or across a slope.
10. Observe the maximum permissible axle loads and total weights!
11. Operate the machine only when all guards are fitted and in the correct position!
12. Ensure that the machine is stable when parked.
13. Ensure all equipment is placed in the transport position before driving on the road.
14. Always switch off the engine of the towing vehicle before carrying out troubleshooting, and for repair, maintenance and cleaning work. Remove the towing vehicle ignition key.
15. When working under raised covers ensure that they are sufficiently supported.
16. When handling sharp-edged parts, wear appropriate protection (gloves, shoes etc.).
17. Do not stand near hinged covers.



## **GENERAL SAFETY INSTRUCTIONS contd**

### **BRAKES**

1. Check the brakes before every journey.
2. Check the brake system thoroughly at regular intervals.
3. If the brake system malfunctions, do not use the machine, stop the towing vehicle immediately. Repair faults immediately.
4. Any adjustments and repairs to the brake System must be carried out by your Richard Western agent or approved specialist work shop.
5. Engage a lower gear before going downhill.
6. Engage the parking brake before coupling or uncoupling the towing vehicle
7. The brakes must always be correctly adjusted. No liability can be accepted for normal wear or unauthorised modifications.

### **HYDRAULIC SYSTEM**

1. The hydraulic system is under high pressure!
2. When connecting the hydraulic hoses to the towing vehicle hydraulics, make sure that the hydraulic systems are depressurised on the tractor side and on the machine side.
4. The female and male couplings between the tractor and the machine should be labelled to prevent incorrect connections. If connections are reversed (e.g. lifting/lowering), there is a risk of accident.
5. Keep the hydraulic plugs clean.
6. Check hydraulic lines at regular intervals, and replace them if they are damaged
7. Any replaced hydraulic lines must meet the technical requirements of the manufacturer!
10. The towing vehicle engine must be switched off and the system depressurised before starting work on the hydraulic system.
11. Repair work on the hydraulic system must be carried out by approved specialised work shops only.

### **WHEELS AND TYRES**

1. Repair work to the tyres must be carried out by qualified technicians using suitable tools.
2. When working on the wheels make sure that the trailer is secured and that wheels are chocked to prevent it from moving.
3. Tighten the wheel nuts after the first trip with a load.
4. After replacing the wheels retighten the wheel nuts or bolts after the first 10 operating hours, then check them every 50 hours.
5. Make sure that the jack used has sufficient load capacity.
6. Avoid excessive inflation pressure.
7. The specified tyre pressure must be maintained.
8. Stand clear of the tyre when inflating.
9. Check the pressure regularly.
10. Regularly check nuts and screws for tightness and retighten them, if necessary.
11. All mounting bolts and nuts must be tightened to the torque specified by the manufacturer.

### **MAINTENANCE**

1. Always switch off the towing vehicle engine before carrying out any troubleshooting, and before all repair, maintenance and cleaning work. Remove the ignition key!
2. Use suitable tools and wear safety gloves when replacing working parts!
3. Always disconnect the power supply before working on the electrical system!
4. Protection devices that are subjected to wear must be checked at regular intervals and replaced as necessary.



# Specifications

## INTRODUCTION

This section contains tables covering the general specification of the machine , dimensions , weights and capacities.

All information given is subject to alteration without notice and is subject to manufacturing tolerances.

If in doubt contact the manufacturer or the manufacturers agent for further information or advice.

### CAUTION

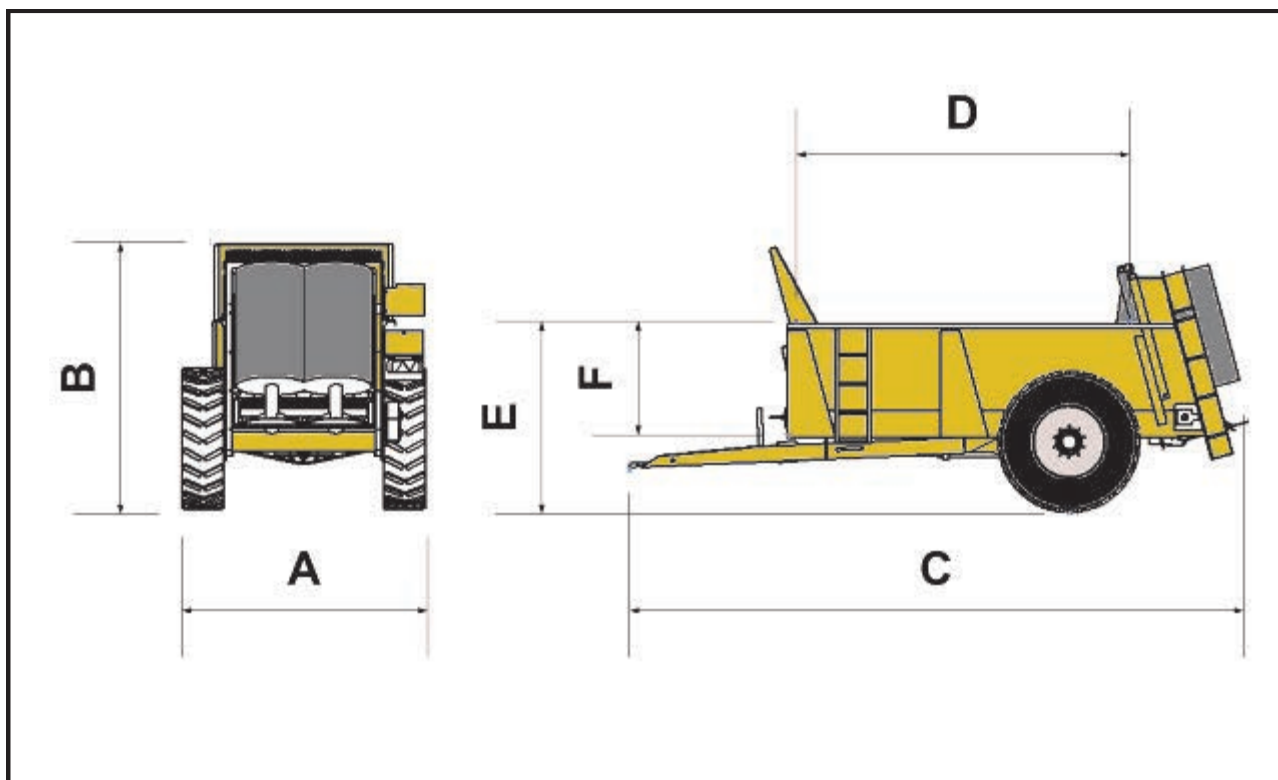


*A number of factors may cause the overall dimensions to change EG Tyre pressures ,etc  
Always check actual dimensions before entering confined areas buildings and vehicles.*

# General Specification

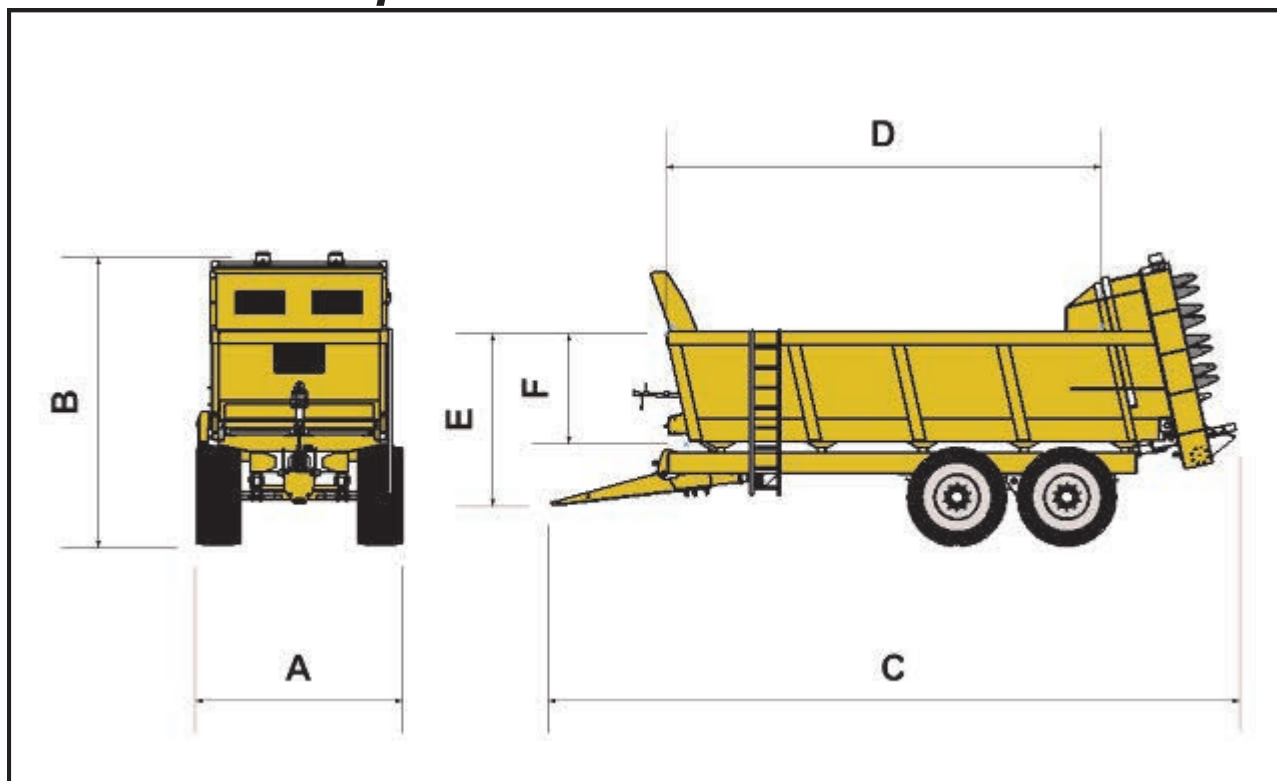
Model			Delilah	FBS	SDS
<b>Electric System</b>					
Voltage		<b>V</b>	12 V DC	12 V DC	12 V DC
Current (cont)		<b>A</b>	10 A	10 A	10 A
Current (max)		<b>A</b>	15 A	15 A	15 A
<b>Braking System</b>					
Standard			Single line hydraulic brakes		
Option	1		<b>Eurosafe</b> <sup>(TM)</sup> Hydraulic Failsafe with Load Sensing & ABS options		
	2		Dual line airbrakes		
<b>Speed</b>					
Standard braking system		<b>kmh</b>	32	32	32
Option	1	<b>kmh</b>	32	32	32
	2	<b>kmh</b>	Max towing vehicle speed	Max towing vehicle speed	Max towing vehicle speed
<b>Hydraulic System</b>					
Supply			As towing vehicle	As towing vehicle	As towing vehicle
Hyd working pressure		<b>bar</b>	As towing vehicle	As towing vehicle	As towing vehicle
Max hydraulic pressure		<b>bar</b>	200	200	200
Max hydraulic flowrate		<b>l/min</b>	75	75	75
<b>Noise</b>					
		<b>dB(A)</b>	< 70	< 70	< 70

**Delilah**



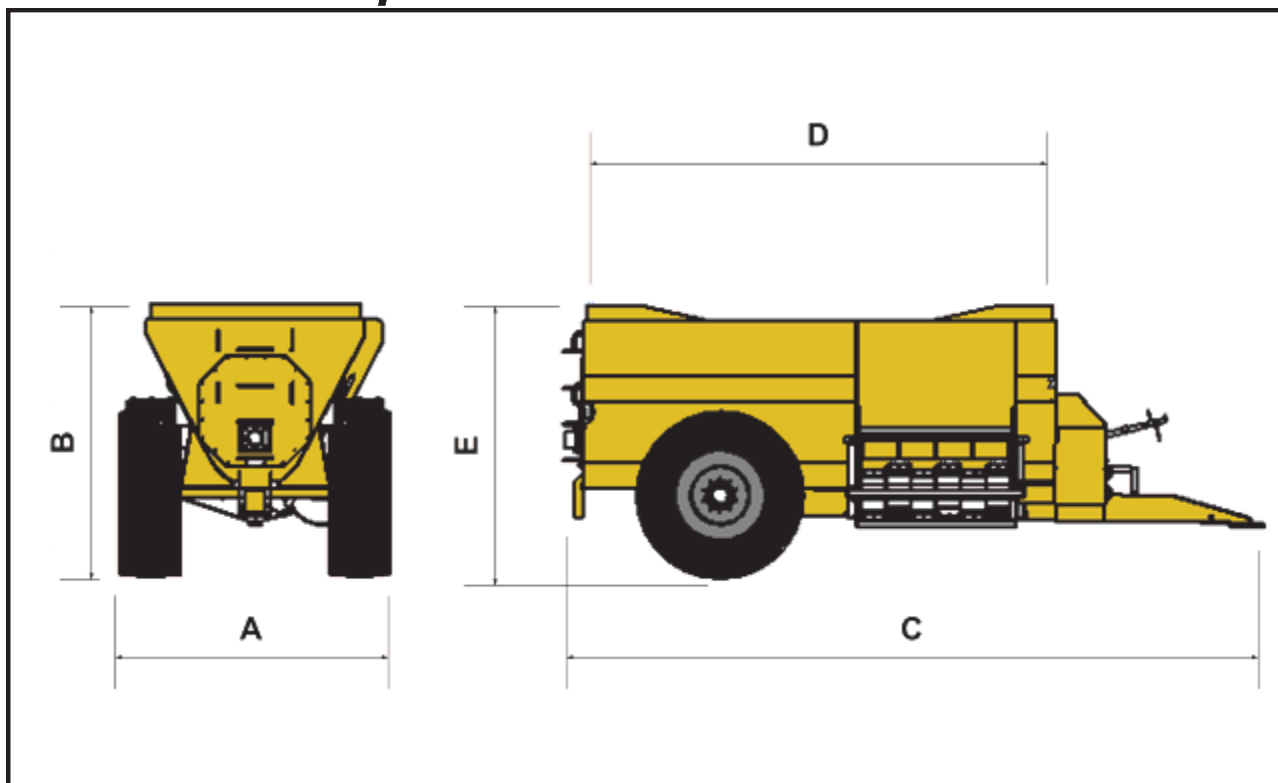
Model			D7c	D8	D10	D12	D18T
<b>Dimensions</b>							
Width (Overall)	A	m	2.53	2.76	2.87	2.87	3.10
Height (Overall)	B	m	2.73	2.91	2.99	2.99	3.30
Length (Overall)	C	m	6.31	6.28	7.28	8.28	9.50
Body Length	D	m	3.41	3.61	4.61	5.61	7.07
Loading Height	E	m	1.97	2.30	2.40	2.40	2.96
Body Depth	F	m	0.90	1.24	1.24	1.24	1.24
Body Width		m	1.49	1.50	1.50	1.50	1.50
<b>Capacities</b>							
Capacity		m <sup>3</sup>	4.80	7.15	9.18	11.22	18.30
<b>Weights</b>							
Unladen Weight		kg		4895	5530	5825	6250
<b>Misc</b>							
Floor Chains		mm	2 X 16	4 X 14	4 X 14	4 X 14	4 X 16
PTO Speed		r/min	1000	1000	1000	1000	1000
Rotor Speed		r/min	420	420	420	420	420
Rotor Tips			24 X 2	30 X 2	30 X 2	30 X 2	30 X 2
Number of Axles			1	1	1	1	1

## FBS Manure Spreaders



Model			FBS12	FBS16	FBS20
<b>Dimensions</b>					
Width (Overall)	A	m	2.50	2.50	2.50
Height (Overall)	B	m	3.52	3.52	3.52
Length (Overall)	C	m	7.64	8.45	10.59
Body Length	D	m	4.68	5.49	7.63
Loading Height	E	m	2.59	2.59	2.59
Body Depth	F	m	1.20	1.20	2.00
Body Width		m	2.00	2.00	1.50
<b>Capacities</b>					
Capacity		m <sup>3</sup>	12.00	14.00	19.00
<b>Weights</b>					
Unladen Weight		kg	6250	6750	7250
<b>Misc</b>					
Floor Chains			4 X 14	4 X 14	4 X 16
PTO Speed		r/min	1000	1000	1000
Rotor Speed		r/min	420	420	420
Rotor Tips			24 X 2	24 X 2	24 X 2
Number of Axles			2	2	3

## SDS Manure Spreaders



Model			SDS 1600	SDS 2000	SDS 2400	SDS 24T
<b>Dimensions</b>						
Width (Overall)	A	m	2.39	2.68	2.68	2.39
Height (Overall)	B	m	2.57	2.87	2.87	2.75
Length (Overall)	C	m	5.30	6.12	7.26	7.26
Body Length	D	m	3.72	4.54	5.68	5.68
Loading Height	E	m	2.42	2.71	2.71	2.60
Body Width		m	2.12	2.12	2.12	2.12
<b>Capacities</b>						
Capacity		l	7264	9080	10896	10896
<b>Weights</b>						
Unladen Weight		kg	4500	5125	5750	6000
<b>Misc</b>						
PTO Speed		r/min	540	540	540	540
Number of Axles			1	1	1	2

# Axles & Tyres

Delilah			D7c	D8	D10	D12	D18T
<b>Axles</b>							
Axle Beam		mm	100	127	127	150	150
Axle Studs			10	10	10	10	10
<b>Brakes</b>							
Brake Drum		mm	400X80	420X180			
<b>Tyres &amp;Rims</b>							
Tyre Size			16.9X34	18.4X34	650/75 X 32		650/75 X32+B20

FBS			FBS 12	FBS 16	FBS 20
<b>Axles</b>					
Axle Beam		mm	100	127	127
Axle Studs			10	10	10
<b>Brakes</b>					
Brake Drum		mm	400X80	420X180	420X180
<b>Tyres &amp;Rims</b>					
Tyre Size			20.5 X 22.5	560/60 X 22.5	

SDS			SDS 1600	SDS 2000	SDS 2400	SDS 24T
<b>Axles</b>						
Axle Beam		mm	127	127	127	100
Axle Studs			10	10	10	10
<b>Brakes</b>						
Brake Drum		mm	420X180	420X180	420X180	400X80
<b>Tyres &amp;Rims</b>						
Tyre Size			23.1X26	600/65X23		560/60X22.5

## ***Transportation & Handling***

Richard Western Trailers are generally delivered ready for use.

However in some circumstances it is necessary to remove certain components for shipment and/or storage, these will need to be fitted before use.

General instructions for the fitting of these components are given in the following pages, for further information refer to your Richard Western agent.

**WARNING**



*Assembling the machine should only be undertaken by a competent person. If in doubt about any procedure refer to the manufacturer or the manufacturers agent for further information.*

**WARNING**



*When working on the machine always ensure that the Towing vehicle engine is turned off and the Key removed.*

## **PTO Driveshaft**

The PTO Driveshaft is supplied loose with the machine. Ensure it is removed before use.



## Before Operation

### WARNING



When working on the machine always ensure that the Towing vehicle engine is turned off and the Key removed.

### CAUTION



Dirty Quick release couplings can cause increased wear in Hydraulic pumps and Air Compressors. Incorrectly connected couplings can cause failure within the system. Always clean the couplings before connecting them

### BEFORE OPERATION CHECK THE FOLLOWING

- 1 The towing vehicle must be equipped for operation hydraulically with at least one feed and one free flow return.

- 2 Trailer Braking System

The machines can be fitted with one of the two different types of brake systems (this may differ and be dependant on locally or nationally enforced traffic regulations

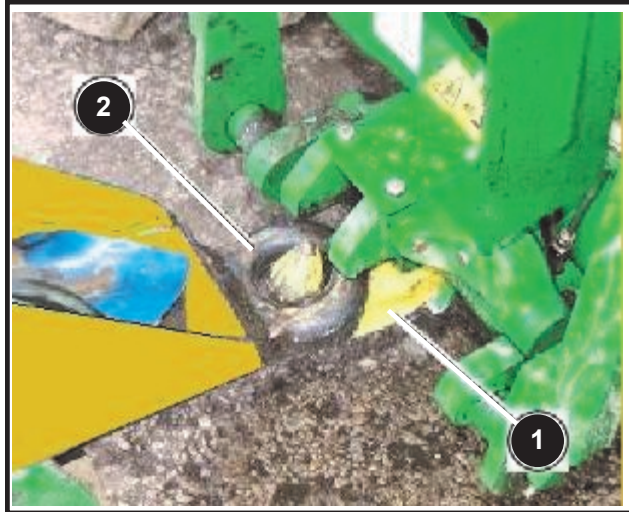
- Air brake system (dual-circuit system)
- Hydraulically operated brake system.

The towing vehicle brake system must be the same as that of the machine

Machines to be towed at speeds above 32 km/h (20 mph) are to be equipped with an ABS air brake system.

- 3 Check the brakes before every journey.
- 4 Check safety equipment for function and correct position.
- 5 Thoroughly lubricate the machine before operation.
- 6 Check all Bolts and Nuts are tight.
- 7 Couple the towing vehicle to the trailer at idle speed only.
- 8 Before connecting Air and Hydraulic lines turn off the engine of the towing vehicle and ensure the connections are clean.

- 9 Check the wheel nuts for tightness  
(see Specification section)
- 10 Check tyres for correct inflation pressures.  
Correct if necessary  
(see Specification section)
- 11 If a wheel is changed check the wheel nut  
torques after 10 hrs of operation, and every  
10 hours until the torque is maintained.  
(see Specification section)
- 12 Wheels must be changed using a jack with  
sufficient lifting capacity for the weight of the  
machine.
- 13 Make sure that there are no loose parts on  
the machine and the towing vehicle before  
moving off. Secure or cover parts which  
could fall off during travel.
- 14 Make sure no persons are in the danger  
areas before moving off or raising the body.  
If any person approaches the danger areas  
turn off the Towing vehicles engine  
immediately and make safe.
- 15 When connecting the Air, Electric and  
hydraulic lines to the Towing vehicle, ensure  
they are fixed in a way which allows their full  
articulation as the machine steers.
- 16 Ensure the Air, Electric and hydraulic lines  
cannot be trapped or chafed by moving  
parts during operation.



## Coupling to the Towing Vehicle - Hitch

Reverse the towing vehicle until the tow hitch (1) is located beneath the Eye (2)

Raise the tow hitch (1) and lock into the raised position.

## Uncoupling from the Towing Vehicle - Hitch

Ensure the tipping body is lowered fully.

Ensure the drawbar is in the tow position.

Lower the trailer onto the drawbar foot or Skid

Decouple all hoses and electrical connections.

Apply the parking brake.

Unhitch the trailer.

### WARNING



*Ensure all personnel are outside of the danger area between the Towing Vehicle and Trailer before reversing*

### WARNING



*Check that the trailer is properly and securely attached to the Towing Vehicle before moving off*

### CAUTION

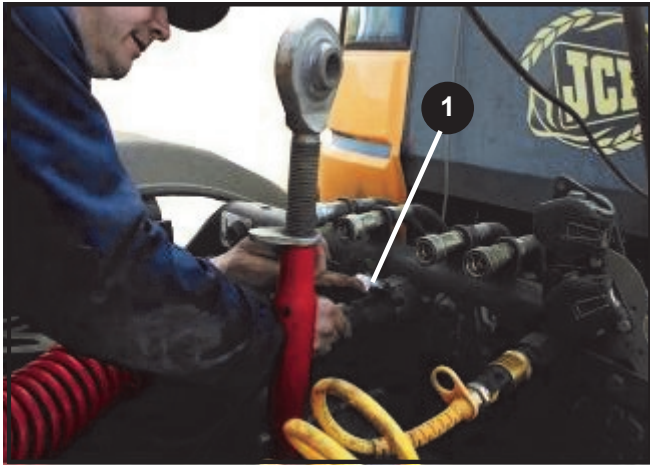


*Always park the trailer on firm level ground*

### CAUTION



*Check the Eye periodically for signs of damage or wear. Replace as required*



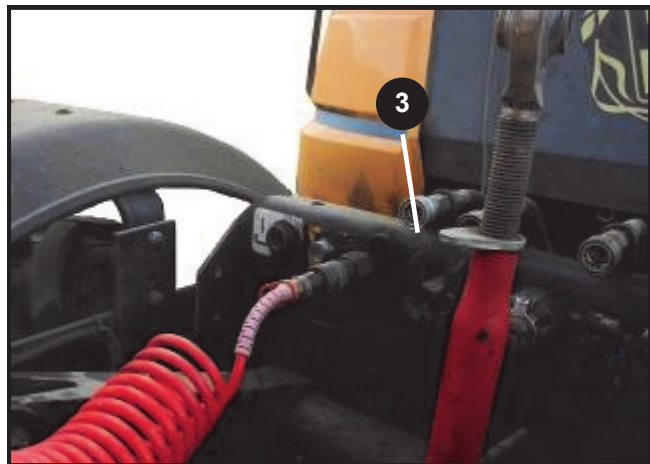
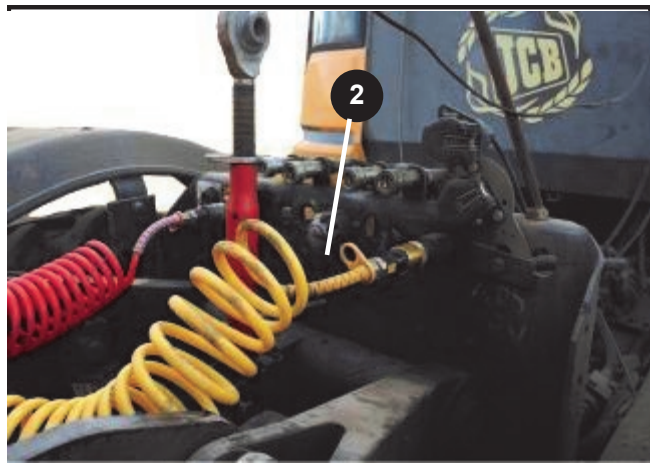
## Coupling to the Towing Vehicle Air Braking Connections

Connect Seven Pin Trailer Electric connector (1) to towing vehicle trailer lighting socket.

Connect Yellow Control Line Braking Connector (2) to the relevant connection on the Towing Vehicle

Connect Red Air Service Line Braking Connector (3) to the relevant connection on the Towing Vehicle

**Always connect the Yellow line first when coupling and Disconnect the Red line first when uncoupling.**



Note! The trailer will also be equipped with the standard hydraulic brake connections, it is not necessary to connect these when the Air service is used.

### WARNING



*When working in the danger area between the trailer and the Towing Vehicle always ensure that the Towing vehicle engine is turned off and the Key removed.*

### WARNING



*When working in the danger area between the trailer and the Towing Vehicle always ensure that the hydraulic and Pneumatic controls are in Neutral.*

### CAUTION



*Release residual Pneumatic & Hydraulic pressure before connecting or disconnecting Air & Hydraulic lines.*

### WARNING



*Ensure all personnel are outside of the danger area between the Towing Vehicle and Trailer before reversing.*

### WARNING



*Check that the trailer is properly and securely attached to the Towing Vehicle before moving off.*

### CAUTION



*Check the Ring Hitch periodically for signs of damage or wear. Replace as required.*

### CAUTION

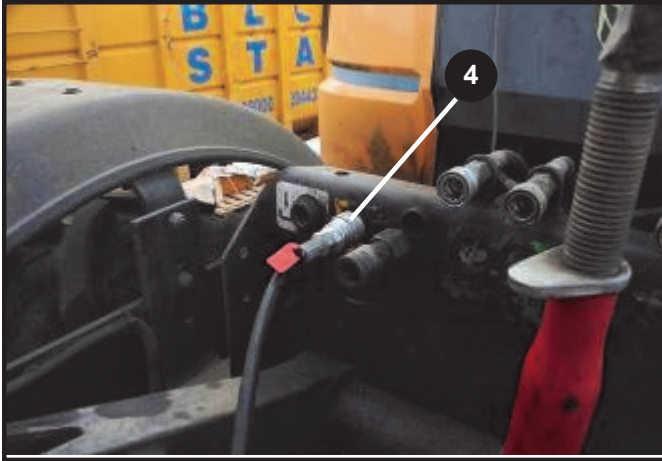


*Dirty Quick release couplings can cause increased wear in Hydraulic pumps and Air Compressors. Incorrectly connected couplings can cause failure within the system. Always clean the couplings before connecting them.*

### WARNING



*When coupling to a tractor connect the Yellow line first when connecting and remove the Red line first when disconnecting.*



## Coupling to the Towing Vehicle Hydraulic Braking Connections

For trailers that are equipped with Hydraulic Brakes connect the Hydraulic Service Line (4) to the correct connection on the Towing vehicle.

Note! The trailer will also be equipped with the standard hydraulic brake connections, it is not necessary to connect these when the Air service is used.



Note! The trailer will also be equipped with the Optional Air brake connections, it is not necessary to connect these when the Hydraulic service is used.



## ABS Brake Connections

Some trailers are fitted with ABS braking, if applicable connect the ABS system plug to the relevant socket on the towing vehicle.

For connection information see page 5:7

## Coupling to the Towing Vehicle Steering Axle Connections

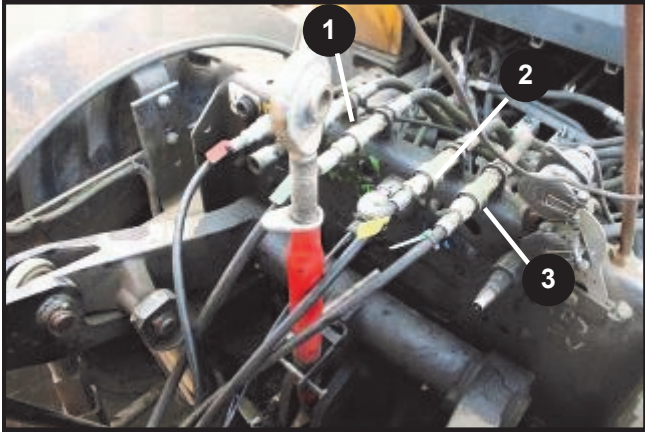
Some trailers are fitted with a self steering axle, this allows easier turning with less damage to tyres and to the road surface.

A Dual hydraulic connection from the towing vehicle is used for this.

When travelling forwards the spool valve should be moved to Power Cylinders this allows the pressure in the cylinders to be released, and the steering axle will follow the lead axle.

When reversing the trailer the spool position must be moved to extend the cylinders. The trailer wheels will then stay in line.

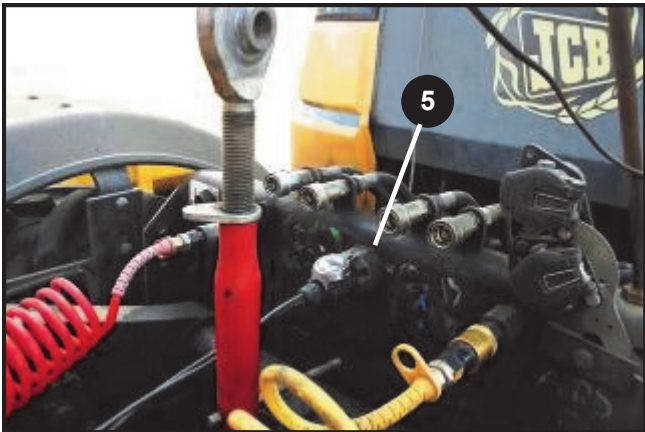




### Coupling to the Towing Vehicle Hydraulic Connections

Connect the Hydraulic floor drive (Delilah & FBS models) service lines **(1)** and **(2)** to a spool valve connection on the towing vehicle

Connect Hydraulic slurry gate (Optional ) service lines **(3)** and **(4)** to double acting spool valve connections on the towing vehicle



### Coupling to the Towing Vehicle Lighting Connections

Connect the electrical seven pin connector **(5)** to the vehicle lighting socket

#### WARNING



*When working in the danger area between the trailer and the Towing Vehicle always ensure that the Towing vehicle engine is turned off and the Key removed.*

#### WARNING



*When working in the danger area between the trailer and the Towing Vehicle always ensure that the hydraulic and Pneumatic controls are in Neutral and that the Control Panel switch is off*

#### CAUTION



*Release residual Pneumatic & Hydraulic pressure before connecting or disconnecting Air & Hydraulic lines.*



## Coupling the Drive shaft to the Towing Vehicle

Ensure the Tractor and Trailer PTO shafts are clean and suitably greased.

Ensure the driveshaft is of the correct length (Refer to the driveshaft manufacturers documentation for further information)

Ensure the correct orientation of the driveshaft (IE The tractor symbol on the guard indicates the Tractor end connection).

Slide back the guard sleeve and slide the shaft onto the trailer PTO , then repeat and fit to the Towing vehicle PTO.

Fit safety chains where applicable

When not in use remove the driveshaft from the machine.

For normal operation the skid should be moved to its stowed position at the rear of the drawbar.

The correct skid must always be used when parking the machine.

## Adjusting Sprung Drawbar Height

The trailer chassis should run level when connected to the towing vehicle.

Remove any load from the trailer, lower the body apply the parking brake and disconnect from the Towing Vehicle.

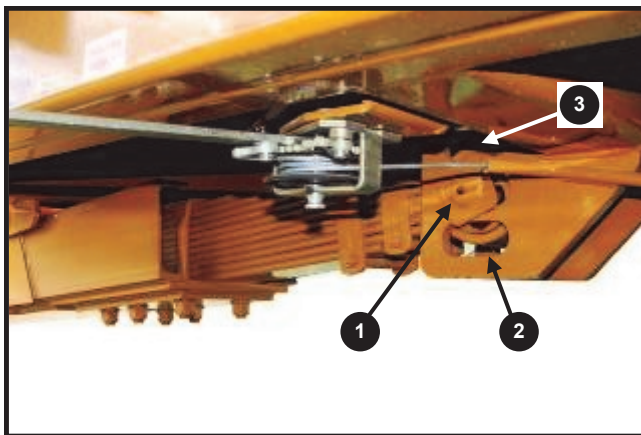
Support the front of the trailer chassis on suitable supports and remove all weight from the drawbar.

Using a suitable jack under the front of the drawbar , take the load and remove the Pin (1).

Using the jack raise or lower the drawbar to the required height.

Insert the Pin (1) in the Lower hole (2) to increase the drawbar height , or in the Upper hole (3) to reduce it.

Remove jack and supports and check operation.



### WARNING



*Never work beneath any unsupported vehicle*

## Adjustments before Towing the Trailer



Adjust the drawbar and/or the hitch of the towing vehicle so that when towing the Spreader body is parallel to the road surface.



Hitching too high will cause unnecessary wear to the suspension and brake components of the rear axle, and reduce the braking efficiency. It can also cause stability problems for the Spreader and towing vehicle



Hitching too low will cause unnecessary wear to the suspension and brake components of the front axle, and reduce the braking efficiency. It can also cause additional loading to be placed on the towing vehicle, possibly causing damage to rear axle and brake components.



## **Operation**

**WARNING**

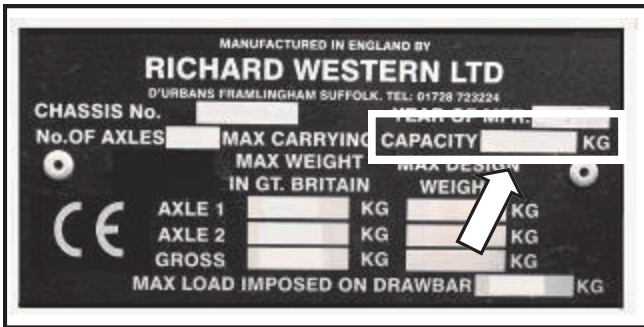


*Never exceed the trailers maximum permitted capacity as stated on the manufacturers plate*

**CAUTION**



*Dirty Quick release couplings can cause increased wear in Hydraulic pumps and Air Compressors. Incorrectly connected couplings can cause failure within the system. Always clean the couplings before connecting them*

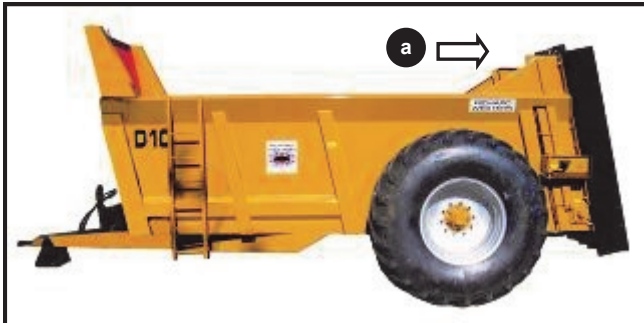


### Loading the Trailer

The capacity of the trailer is shown on the Manufacturers plate on the chassis.

Do not overload the trailer

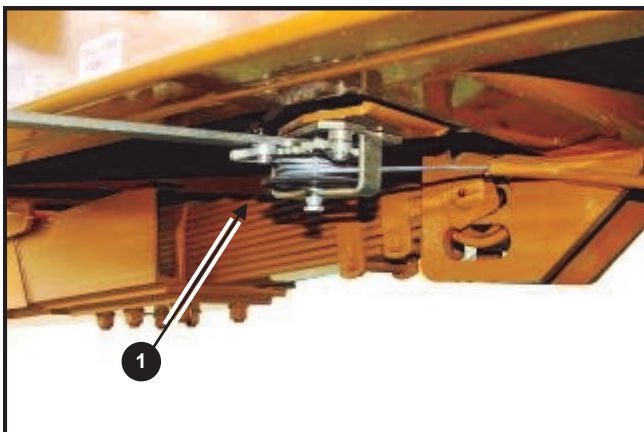
Always load by weight not volume.



### Loading Method

Commence loading the Spreader from the rear of the machine and progress towards the front..

Avoid packing the material down into the body with the loader bucket., this will minimise the start up power requirements  
For Deliliah and FBS models do not load higher than the beaters. (a)



### Moving Off

Ensure all Hydraulic connections are made and that services are functioning correctly

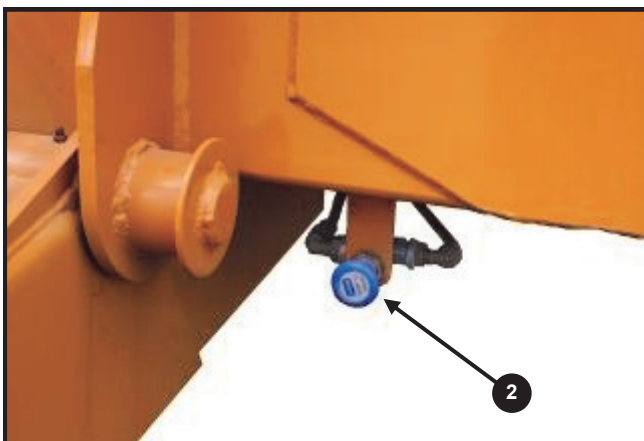
Ensure all Air connections are made and that the brakes are functioning correctly

Ensure all electrical connections are made and that all lighting systems and the Eurosafe braking (option) are functioning correctly.

When the Air Braking system is fitted allow air pressure from the towing vehicle to build to the required level.

Release the manual Parking brake lever (1).

If only using the hydraulic brakes or when shunting the trailer push the Air release valve (2) before moving off.



**CAUTION**



*Check all around the trailer before moving away, especially in confined areas and when reversing.*

**CAUTION**



*Be especially careful when reversing, use a banksman if visibility is limited.*



## Spreading (Delilah & FBS Models)

The Beaters are driven directly by the towing vehicles Power Take Off.

The maximum spreading width is approximately 4 Meters (dependant on material density), this will be achieved with an appropriately powered Towing vehicle driving the PTO at 1000 rev/min.

Allow the beaters to reach full operating speed before engaging the floor drive.

The floor drive is operated by an appropriately configured double acting spool on the Towing Vehicle.

### CAUTION



*Ensure the spool valve is connected so the floor moves towards the beaters before spreading . Failure to do this will result in severe damage to the machine.*

The floor drive speed should be adjusted by the in line spool valve to provide a suitable flow of material to the beaters. Overfeeding the beaters may lead to premature damage of the floor and beaters, aswell as increasing fuel consumption.

## Spread Density

Variation of spreading density is controlled by varying the floor speed of the spreader and varying the forward speed of the towing vehicle.

Experience with the machine and different loads will ensure an equal spread pattern can be achieved.

Operators should take account of varying ground and weather conditions and for example work with the wind when spreading rather than against it.

## Slurry Gate

A gate controlled by a double acting spool on the Towing Vehicle can be supplied as option. The purpose of the gate is to hold semi solid material in the hopper and to limit the flow of material to the beaters.

This is essential when the material being spread is a semi solid slurry and light material such as poultry litter.

Using the gate will allow the fine control of material flow so that the a very fine spread can be achieved, however the gate should be fully opened spreading heavier materials.

### CAUTION



*Ensure the Slurry gate is raised to the required height before engaging the floor drive.. Failure to do this will result in severe damage to the machine*





### **Spreading (SDS Models)**

The Auger and side discharge rotors are driven mechanically from the Towing vehicle PTO

The maximum spreading pattern is approximately 16 Meters (dependant on material density), this will be achieved with an appropriately powered Towing vehicle driving the PTO at 540 rev/min.

When commencing spreading the Slurry door should be opened as the PTO is engaged. The PTO should not be engaged whilst the door is closed.

After use and when turning on the headland the door should be closed and the PTO disengaged.

Leaving the door open and the PTO disengaged may lead to blocking of the spreading rotor.

When restarting this will place additional loads on the rotor and may lead to breakage of the shear bolts.



### **Spread Density**

Variation of spreading density is best controlled by varying the forward speed of the towing vehicle.

Experience with the machine and different loads will ensure an equal spread pattern can be achieved.

Operators should take account of varying ground and weather conditions and for example work with the wind when spreading rather than against it.

### **Slurry Gate**

A gate controlled by a double acting spool on the Towing Vehicle Seals the Hopper and can be used to meter light material to the rotors.

This is essential when the material being spread is a semi solid slurry and light material such as poultry litter.

Using the gate will allow the fine control of material flow so that the a very fine spread can be achieved.

The gate should be fully opened when spreading heavy material.



## Unblocking the spreader (Delilah & FBS Models)

In the event of a blockage the floor direction can be reversed momentarily by using the appropriate double acting spool of the towing vehicle.

Never attempt spread whilst in this configuration, as serious damage will occur.

Return the floor direction to the correct direction when the blockage has been cleared.

## Unblocking the spreader (SDS Models)

In the event of a blockage the auger direction can be reversed

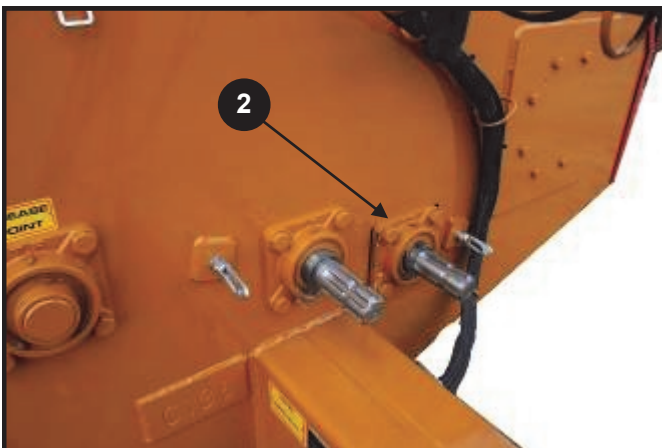
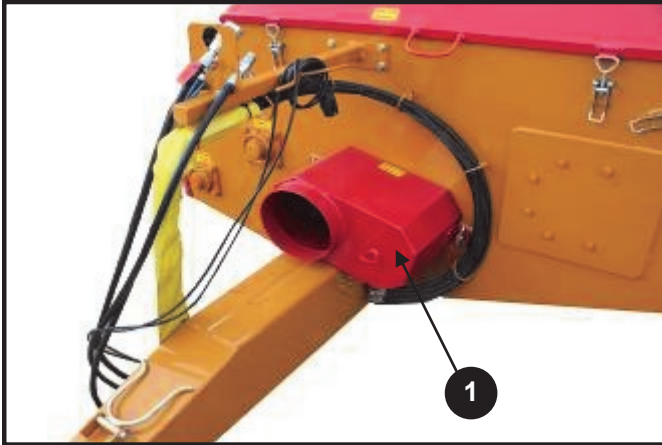
Stop the towing vehicle and turn off the engine.

Remove the PTO drive shaft from the Spreader.

Remove the Guard **(1)** and turn it to expose the offset drive input. **(2)**

Replace the PTO Driveshaft

Start the machine and run the spreader, the auger will now turn in reverse to clear the blockage.



### CAUTION



*Only run the auger in reverse for a short period of time as it could result in damage to the machine.*

### WARNING



Never operate the machine whilst stood in the vicinity of rotating shafts or with the guards removed.

If the above procedure does not remove the blockage it may be necessary to intervene manually.

Fully open the Slurry gate and block in the raised position.

Stop the machine and turn off the engine.

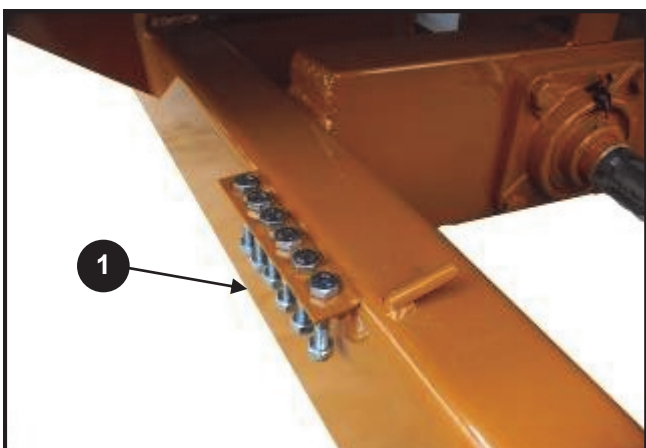
Open the Hydraulic Stone trap to allow access to the blockage .

The stone trap is fitted to the Left side of the machine and is designed to catch larger stones and solids.

During use this should be opened at least twice a day to allow any accumulation to clear.

# Troubleshooting

Problem	Possible Cause
Towing Vehicle Stalls	Excessive material packed into body
	Foreign Body jamming Auger / Beaters
	Shear Bolts broken
	Insufficient power from Towing vehicle PTO
Auger / Beaters Fail to Start	Excessive material packed into body
	Foreign Body jamming Auger / Beaters
	Shear Bolts broken
	Incorrect PTO speed
	PTO Clutch incorrectly adjusted
Material Not Shredded properly	Floor advance too fast
	PTO speed too low
	Insufficient power from Towing vehicle PTO
Floor Fails to move	Spool Valve incorrectly adjusted
	Hydraulic Hoses incorrectly fitted to rear of Towing Vehicle



## Driveshaft Shear Bolts

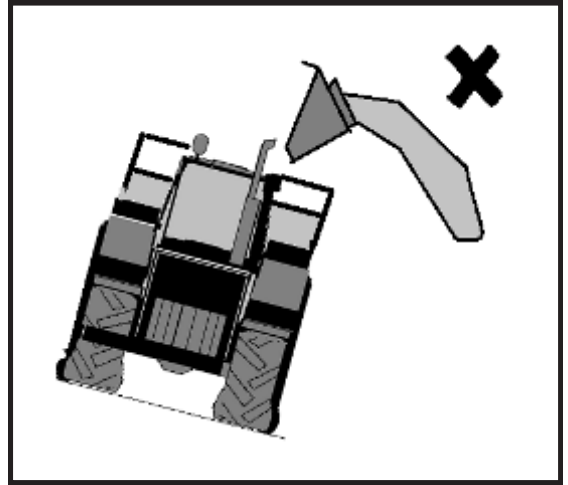
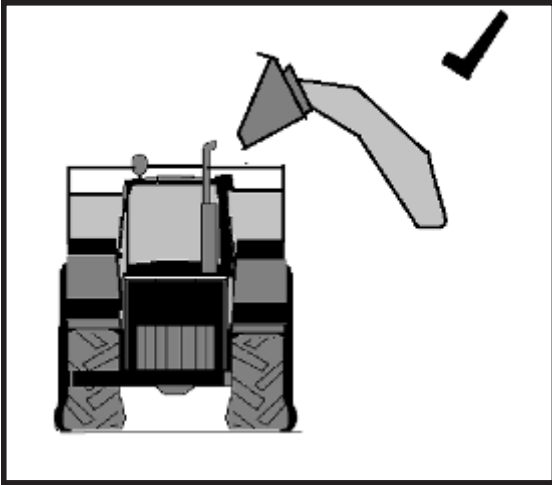
The PTO Driveshafts are equipped with shear bolts which will fail and cut the drive in the event of a severe blockage, and therefore prevent mechanical damage.

Spare Shear bolts (1) are provided, conveniently located adjacent to the Drive input.

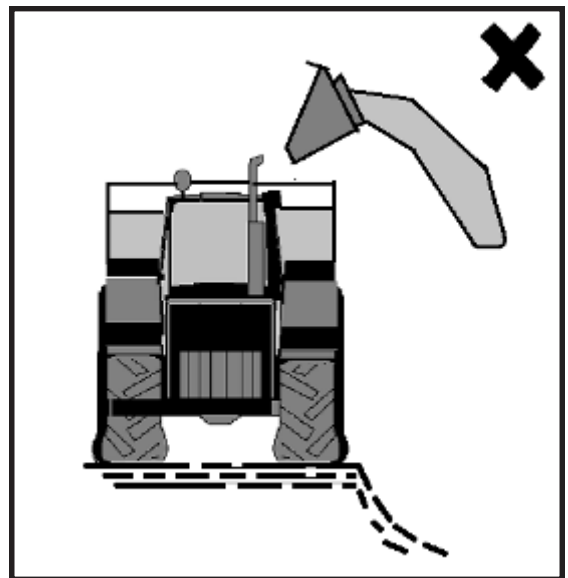
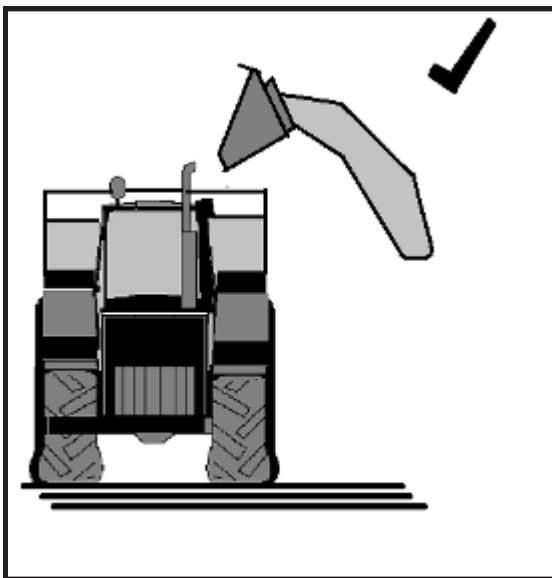
Always replace shear bolts after use.

On SDS machines additional shear bolts are located under the front cover.

All Shear bolts are Grade 8.8. Higher grade bolts must not be used if severe damage to the machine is to be prevented.



Load and travel on Level Ground as far as practical. Avoid Traversing slopes



Always load on firm Ground, avoid trenches and submerged services

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# Maintenance & Service Schedules

The service and maintenance schedule must be adhered to ensure the optimum availability and efficiency of the machine is maintained.

Failure to adhere to these schedules may cause damage to the machine and possibly endanger the operator and others.

The warranty given for the machine will become void if the maintenance schedule is not followed.

WARNING



*Ensure all personnel are outside of the danger area between the Towing Vehicle and Trailer before use.*

WARNING



*When working in the danger area between the trailer and the Towing Vehicle always ensure that the Towing vehicle engine is turned off and the Key removed.*

WARNING



*When working in the danger area between the trailer and the Towing Vehicle always ensure that the hydraulic and Pneumatic controls are in Neutral and that the Control Panel switch is off.*

WARNING



*Ensure the control panel or Joystick power is in the off position before maintaining the machine.*

WARNING



*Ensure the Cylinder locks are installed before working under the raised bed.*

WARNING



*Wear the correct personal protective clothing. The brake linings may contain asbestos, a respirator should be worn whilst handling brake components.*

WARNING



*Ensure tyre pressures are correct. Incorrect tyre pressures can cause stability and handling problems for the trailer and Towing vehicle*

CAUTION



*Release residual Pneumatic & Hydraulic pressure before connecting or disconnecting Air & Hydraulic lines.*

CAUTION



*Ensure that decals are clearly visible. Replace damaged or missing decals immediately.*

CAUTION



*Carry out all maintenance at the correct intervals and in accordance with the instructions in this manual.*

# Service Schedule

	Delilah Manure Spreaders	FBS Manure Spreaders	SDS Manure Spreaders
<input checked="" type="checkbox"/> Perform task			
<input type="checkbox"/> Check			
Maintenance Task			
<b>Daily</b>			
Inspect for damage due to the load or loading machine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check Brake operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check Park brake operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drain Water from Air reservoir (if fitted)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Grease Rocking Beam Pivots (if fitted)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Grease Floor chain Tensioner Bearings	<input checked="" type="checkbox"/>		
Grease Drive Shaft support bearings	<input checked="" type="checkbox"/>		
Grease Floor drive shaft bearings	<input checked="" type="checkbox"/>		
Grease Rotor Top Bearings	<input checked="" type="checkbox"/>		
Check Floor Drive Gearbox Oil level	<input checked="" type="checkbox"/>		
Check Rotor gearbox Oil level	<input checked="" type="checkbox"/>		
Grease PTO Shaft	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Grease Rotor PTO Shaft			<input checked="" type="checkbox"/>
Grease Main Rotor Bearings			<input checked="" type="checkbox"/>
Grease Chain Drives			<input checked="" type="checkbox"/>
Grease Rear Thrust bearing			<input checked="" type="checkbox"/>
Grease All Support Bearings			<input checked="" type="checkbox"/>

	Delilah Manure Spreaders	FBS Manure Spreaders	SDS Manure Spreaders
<b>Weekly</b>			
Check Lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check Wheel nut torque	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check for Oil leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check Hydraulic hose condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check air line condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check connections to Towing Vehicle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check Towing Eye condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check Tyre Pressures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check Tyre condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grease all nipples on running gear	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Inspect the machine for loose Nuts and Bolts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adjust Floor Chain Tension	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>Every Month</b>			
Lubricate PTO			
<b>Every 3 Months</b>			
Check Brake clearance & wear	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Adjust Brakes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

# Service Schedule *contd*

	Delliah Manure Spreaders	FBS Manure Spreaders	SDS Manure Spreaders
<b>Every 6 Months</b>			
Check the Axle Hubcaps	■	■	■
Check Wheel bearing wear	■	■	■
Tighten All Suspension U-Bolts	■	■	■
Tighten All Spring Drawbar U-Bolts	■	■	■
<b>Every Year</b>			
Check Suspension	■	■	■
<b>Every 2 Years</b>			
Lubricate Wheel Bearings	■	■	■
<b>Laying Up Protection</b>			
Protect all Electrical Connections	■	■	■
Clean down machine	■	■	■
Repaint any areas where paint has been removed	■	■	■
Replace worn or damaged parts	■	■	■
Replace missing or damaged decals	■	■	■
Grease all bright parts	■	■	■
Cover ends of all Quick release connectors	■	■	■

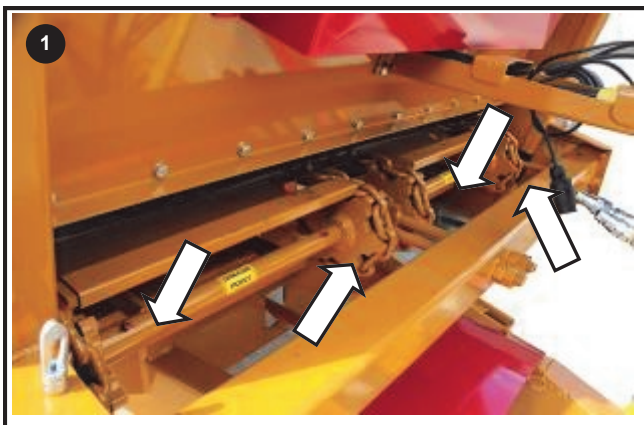
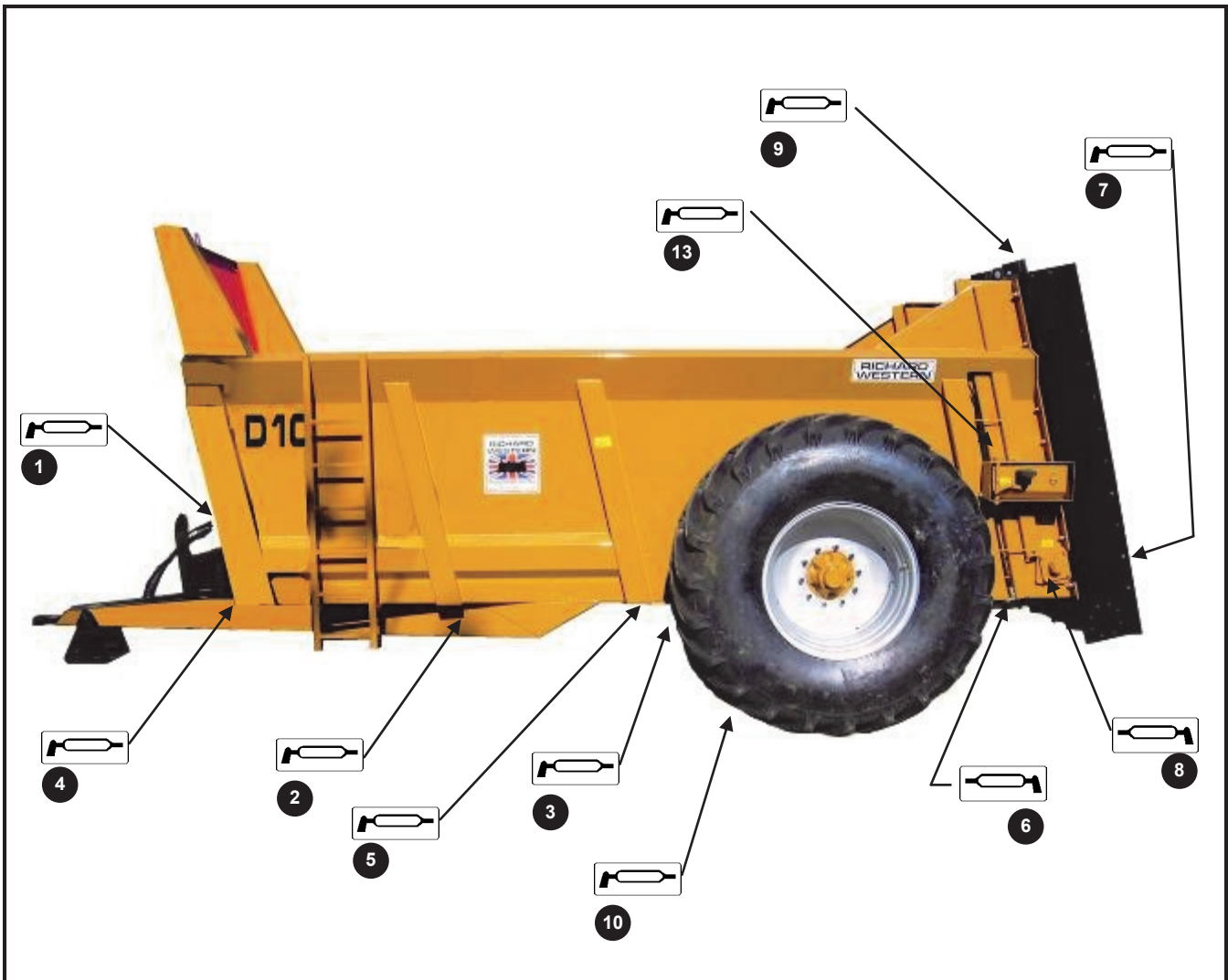
# ABS Brakes *additional requirements*

	Delliah Manure Spreaders	FBS Manure Spreaders	SDS Manure Spreaders
<b>Every 3 Months</b>			
Check all system components for signs of damage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Test whole system for air leakage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Every Year</b>			
Check Electrical wiring for damage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check piping for damage & security)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check Sensor for Wear & Readjust as required	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Every 2 Years</b>			
Replace Modulator & Solenoid	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>When Hubs removed</b>			
Check and readjust Exciter & Sensor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

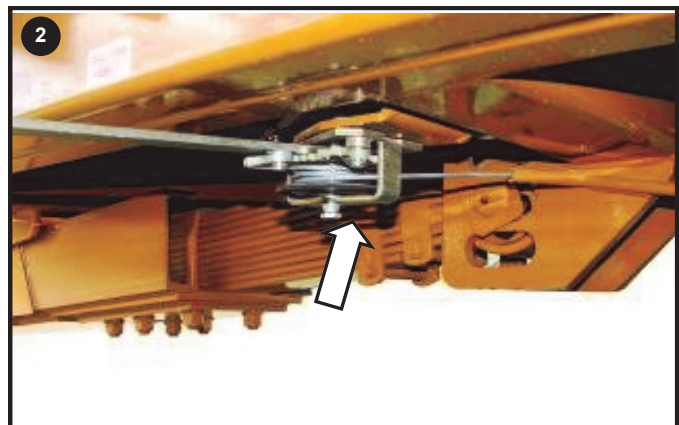
# Lubrication Points

(Delilah & FBS Types)

Every 8 hrs or daily unless specified



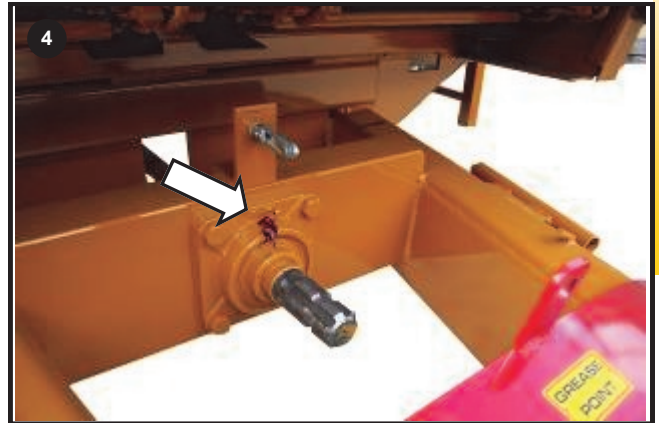
Remove Cover and grease Chain Tensioner Pivots and Jockey wheel bearings (4 Off)



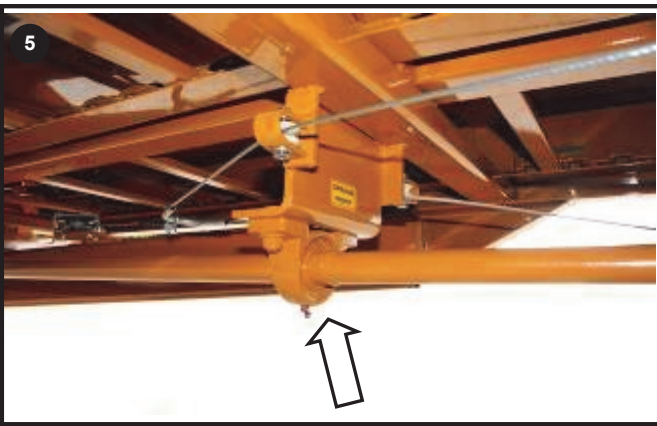
Grease Parking Brake Mechanism



Grease Suspension & Rocking Beam Pivots  
(Tandem Axle Machines)



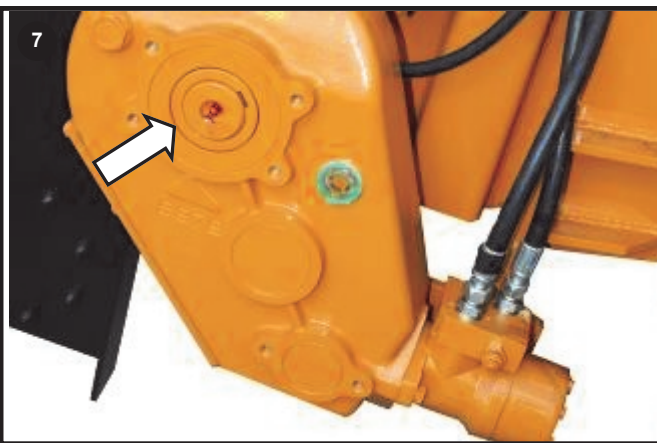
Grease Drive shaft Support Bearings



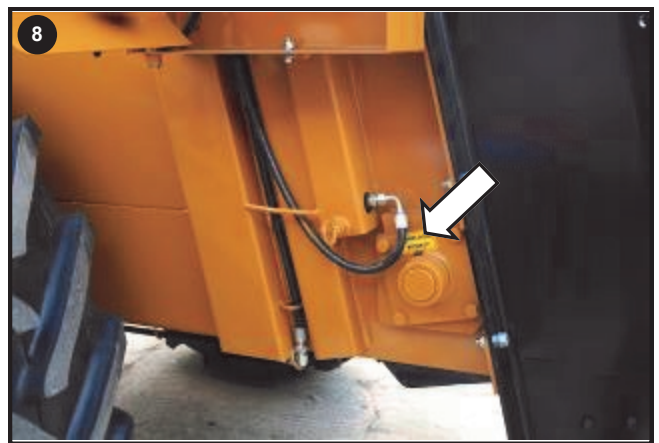
Grease Drive shaft Support Bearings



Grease Drive shaft Support Bearings

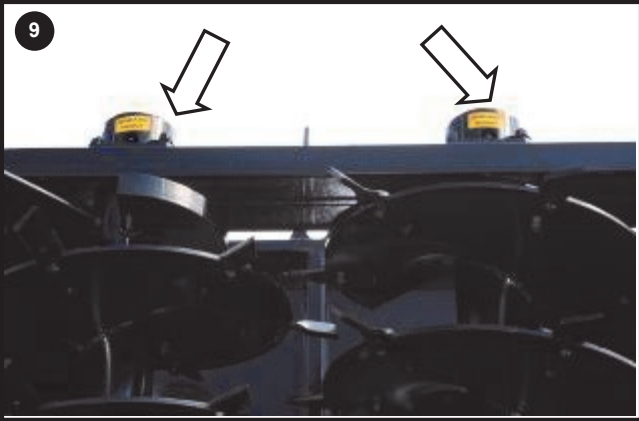


Grease Floor Drive Gearbox Centre Shaft



Grease Floor Drive Shaft bearings (2 off)

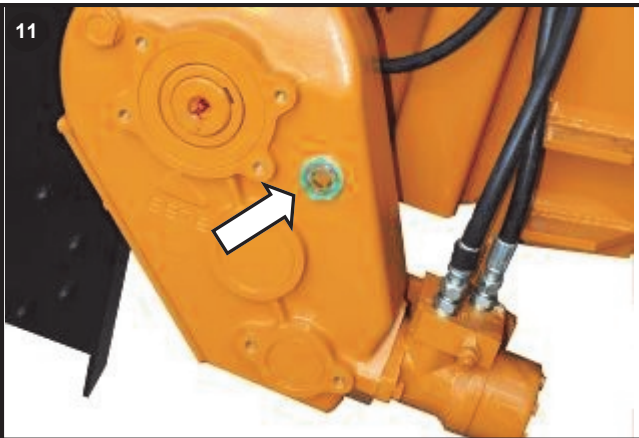




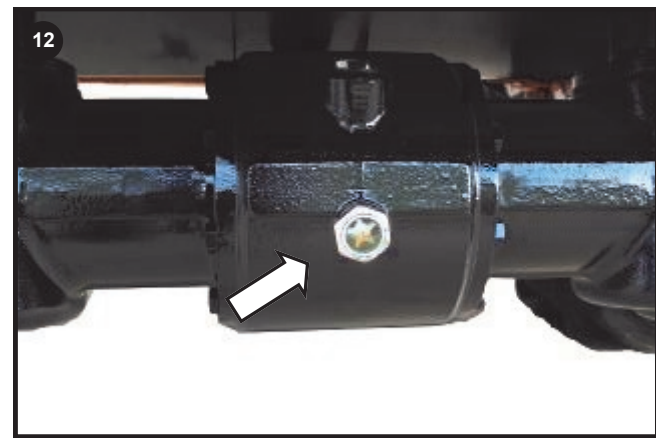
Grease Rotor Top Nipples (2 off)



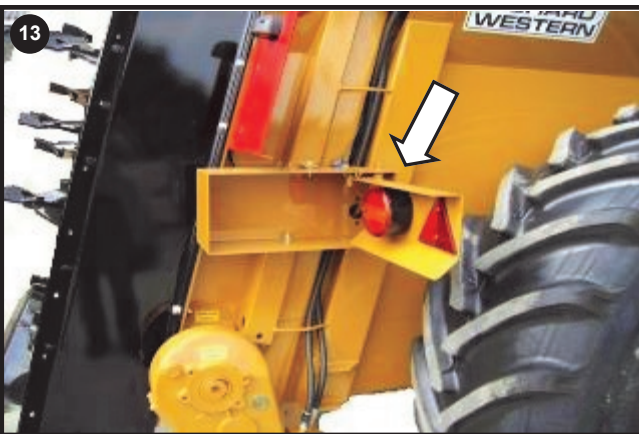
Grease Brake Actuators (Weekly)



Check Floor Drive Gearbox oil level & top up as required



Check Rotor Drive Gearbox oil level & top up as required



Grease Light cluster pivots



## ***Power Take Off***

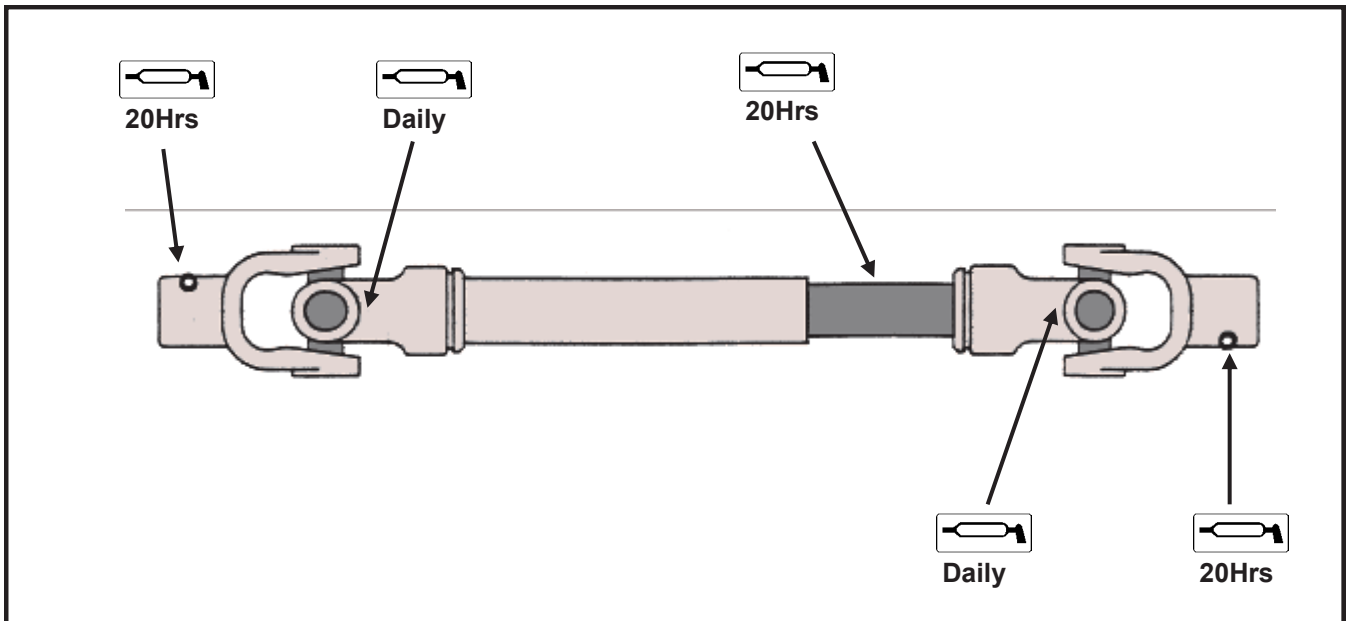
Ensure the tubes are well greased and free from debris before coupling

Regularly lubricate and check the movement of the spring couplings at both ends of the shaft

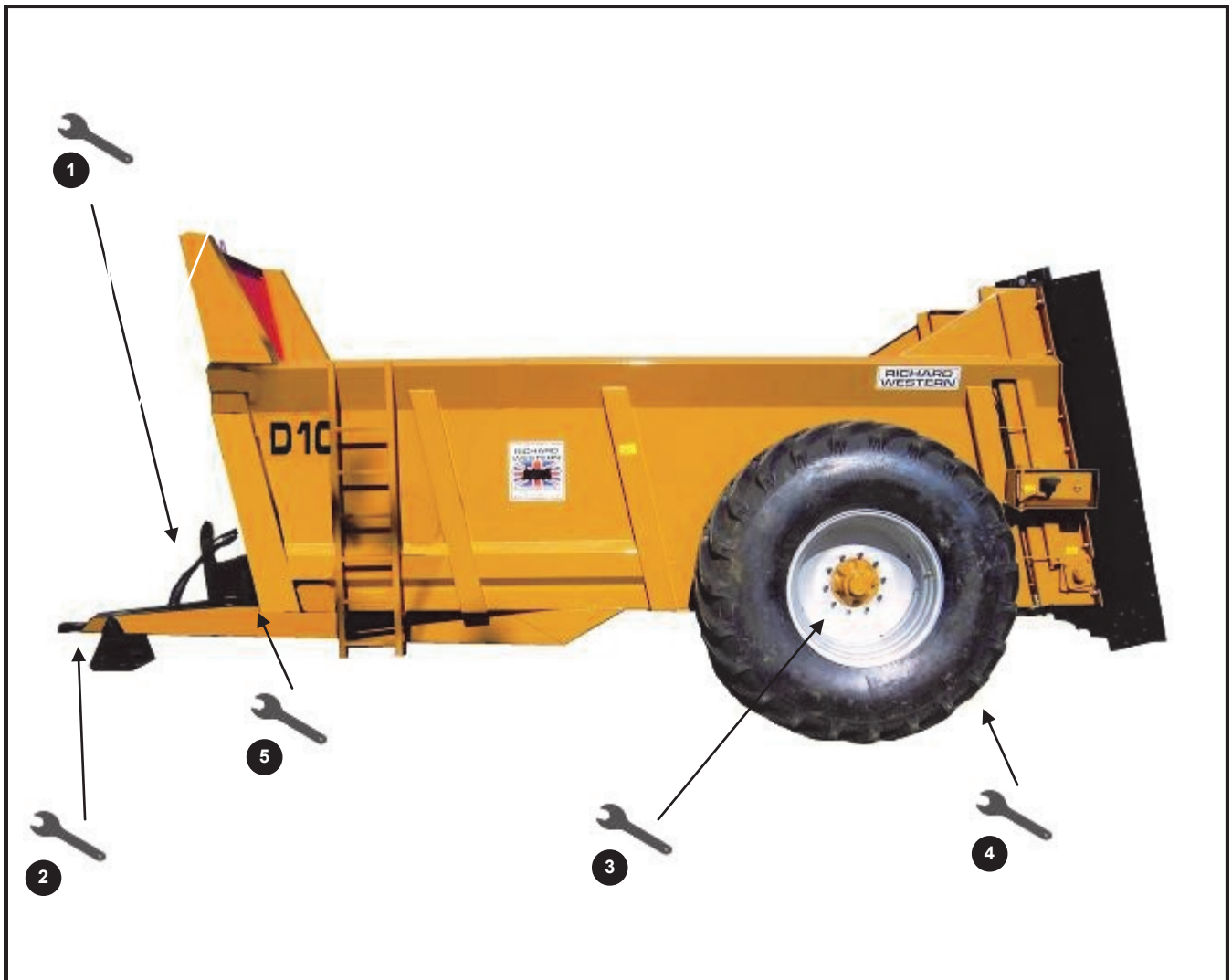
Grease the Joints daily and before laying up the machine for extended periods

Clean the guards and grease the bearings regularly especially in arduous conditions

Avoid use at extreme angles, declutch on turning.



# Service Checks



Check All Air and Hydraulic Lines for signs of Damage  
Check Connections to Towing Vehicle



Check the condition of the Towing eye for signs of wear or damage



Check Wheel Nut Torque



Check Tyre Pressure & Tyre condition

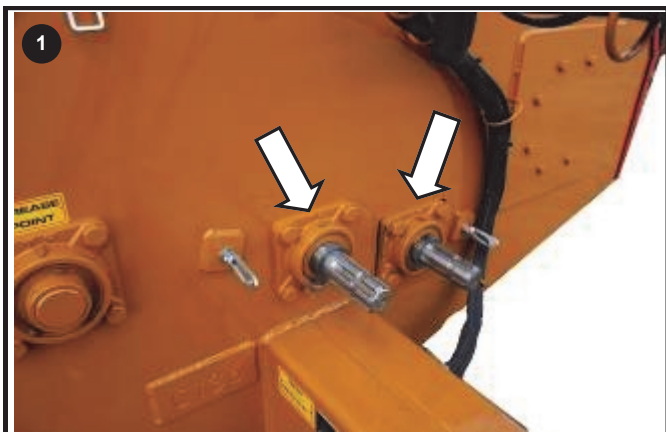
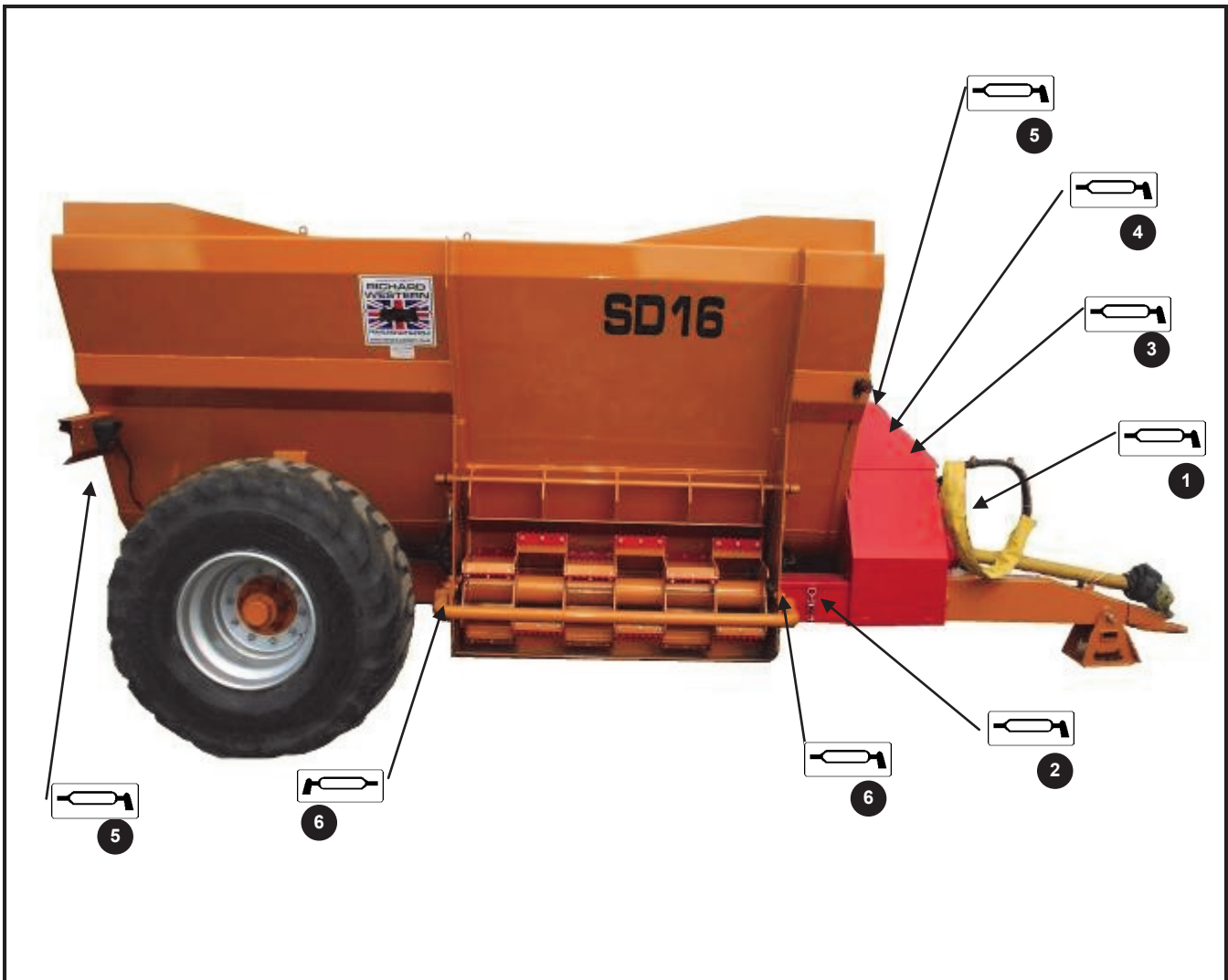


Adjust Floor chains. To give equal tension on each chain.  
When lifted in the centre of the body there should be approx. 100mm free play.

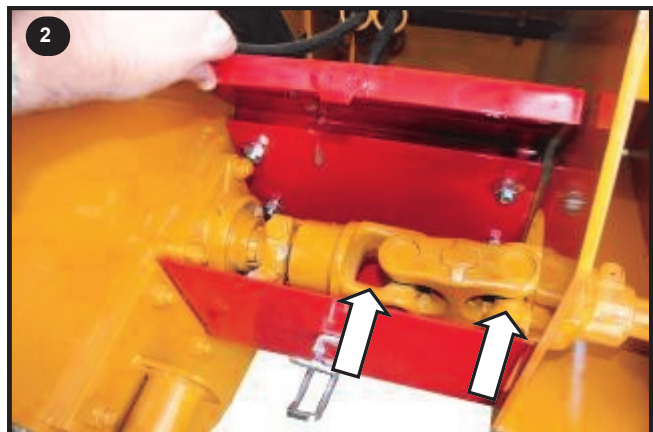
# Lubrication Points

(SDS Types)

Every 8 hrs or daily unless specified

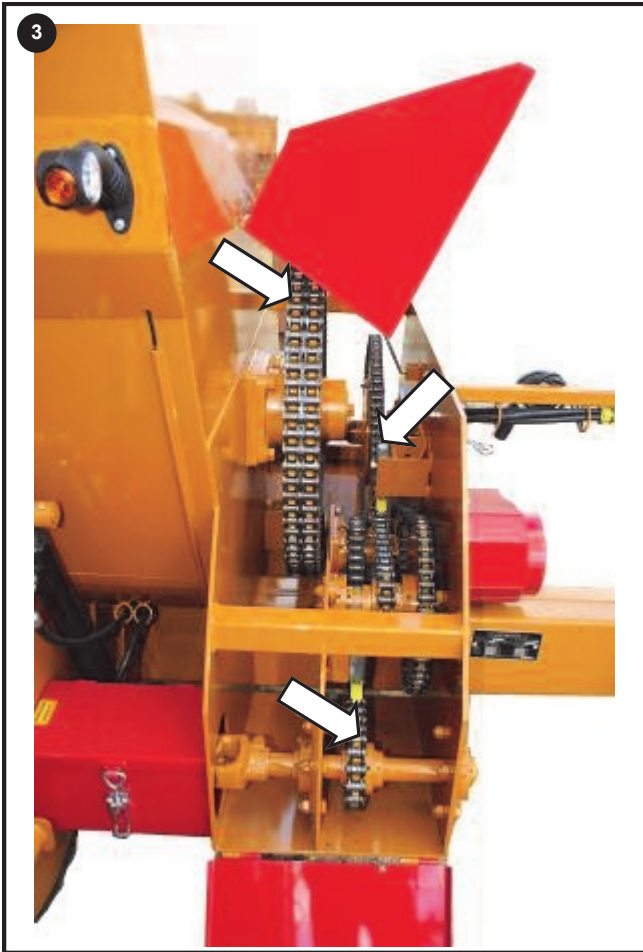


Grease PTO Support Bearings

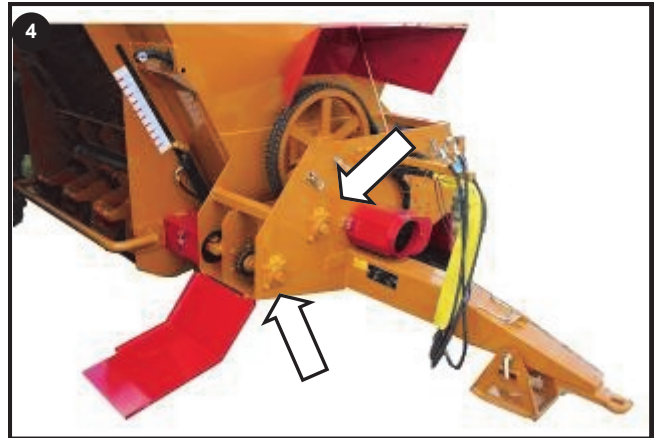


Grease Rotor PTO shaft

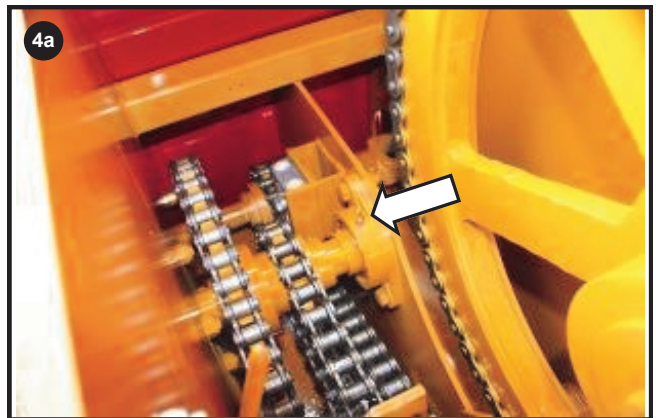




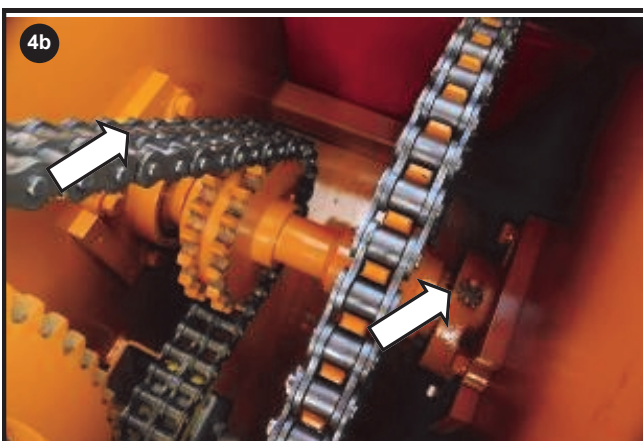
Grease Chain Drives



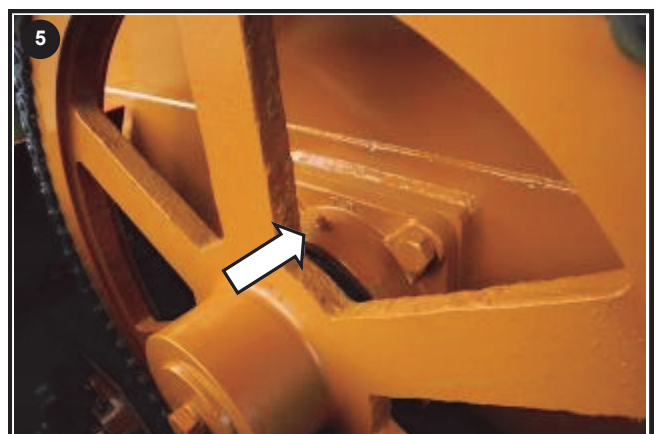
Grease All support bearings



Grease All support bearings



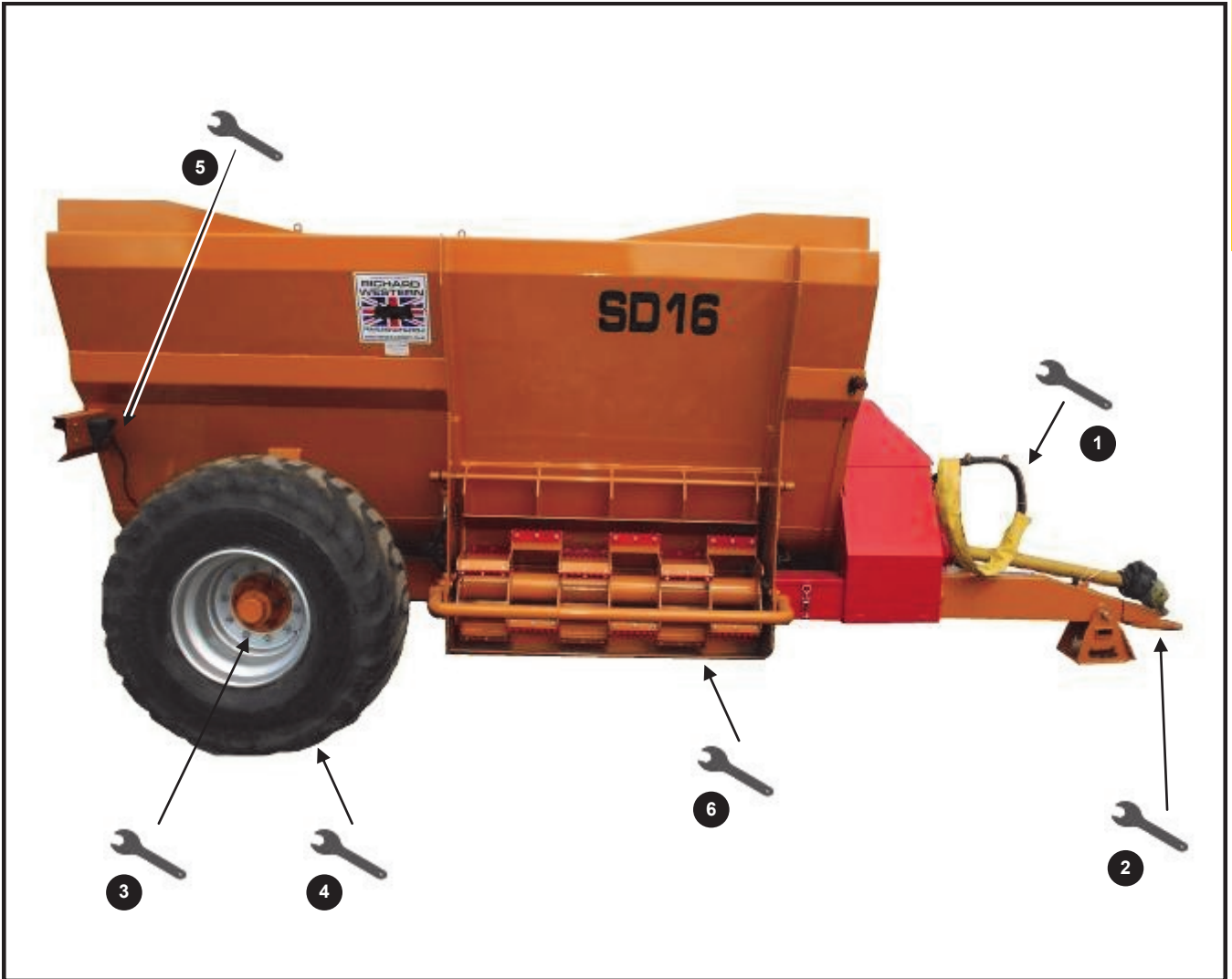
Grease All support bearings



Grease Mainshaft support bearings Front and Rear

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# Service Checks



Check All Air and Hydraulic Lines for signs of Damage  
Check Connections to Towing Vehicle



Check the condition of the Towing eye for signs of wear or damage





Check Wheel Nut Torque



Check Tyre Pressure & Tyre condition



Check Lights & Reflectors for Correct operation & Damage



Replace the rotor blades when they become worn to prevent damage to auger See procedure below.

### Rotor Blade Replacement

Remove all of the old blades from the machine.

It is important to maintain the rotors balance and clearance when replacing blades.

Start from the bottom of the flighting and work upwards.

All blades should be placed on top of the flighting.

Note the leading edge of the flight is plain and the trailing edge is chamfered.

If using mixed flails (IE Straight and Twisted), like flails should be fitted opposing each other on the rotor to maintain balance.

Always use new nuts and bolts



## Axles Brakes & Suspension

This section contains information that must be followed to ensure the correct functioning of the axles and wheel brakes.

If in doubt contact the manufacturer or the manufacturers agent for further information or advice.

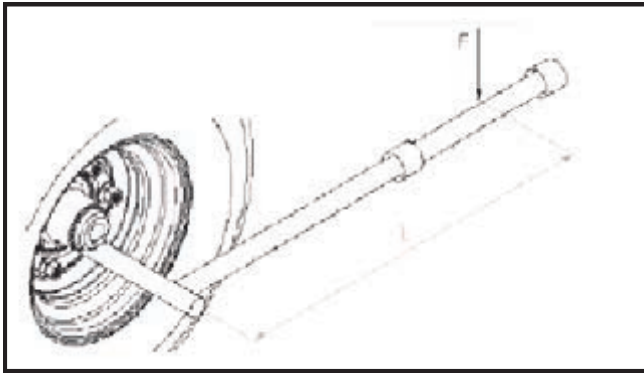
**CAUTION**



*Failure to adhere to these instructions may affect the performance of the brakes and axles and could therefore lead to injury*



*For additional information refer to the manufacturers documentation*



## TIGHTENING WHEEL NUTS

Before Use  
After Refitting  
Every 6 Months

On wheels that have been replaced or refitted, the nuts can loosen after short periods of operation.

It is therefore necessary to check the tightness of the nuts after the first loaded run, after refitting and again after approx 1000 km (620 Miles)

To tighten the nuts, to use a suitable wheel brace, and tighten the progressively and diagonally. Check the torque using a Torque Wrench, or if not available use a suitable spring balance and refer to the table above.

**CAUTION**



Do not use Impact Tools to tighten the Wheel Nuts

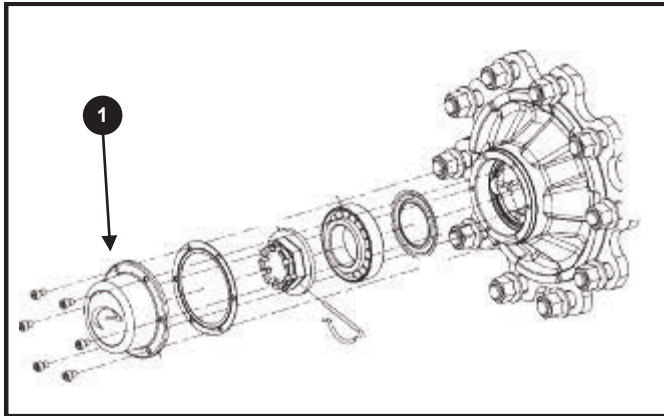
**CAUTION**



Various Wheel Nut and Stud combinations may be used. Always select the correct Nut Type from the table before checking Wheel Nut Tightness.

### DO NOT OVERTIGHTEN

NUT TYPE	Spanner	Wheel stud	Tightening torque	Leverage (*L)	Force (*F)
	mm	mm	Nm	mm	Kg
DIN	17	M12x1.5	90	300	30
	19	M14x1.5	130	300	40
	24	M18x1.5	270	450	60
Plain nut + washer	24	M18x1.5	270	450	60
	27	M20x1.5	380	600	60
	30	M22x1.5	510	800	60
"Twin"	24	M18x1.5	270	450	60
	27	M20x1.5	380	600	60
	30	M22x1.5	510	800	60
"M"	-	-	-	-	-
	27	M20x1.5	450	800	55
"Bec"	32	M22x1.5	650	1000	65
	28	M18x1.5	270	450	60
	30	M20x1.5	380	600	60
	32	M22x1.5	510	800	60



## CHECKING THE HUBCAPS

### Every 6 Months

Missing or damaged hubcaps must be replaced immediately to avoid dirt penetrating into the hub which might result in damage to the bearings.

Check that the hub caps (1) are in place and in perfect condition.

For press fit hubcaps, check visually that they are fully home.

For hubcaps attached using screws, fit a new gasket if necessary when the hubcap is removed and retighten the screws regularly

## CHECKING THE WHEEL BEARING PLAY

### Every 6 Months

Wheel bearings are subject to wear: their lifetime depends on the operating conditions, the load, the speed, the adjustment and lubrication, etc.

To check the wheel bearings:

- Use a suitable Jack and lift the wheel off the ground.
- Turn the wheel in both directions slowly to check for any rough points or friction.
- Turn the wheel at high speed to check for unusual noises, such as grating or knocking.

**If the bearing is damaged or worn, the bearing and seals should all be replaced**

**CAUTION**



*It is advisable to Check Hub Caps and Wheel bearing play after the first 1000km (620 miles)*

## LUBRICATING THE WHEEL BEARINGS

### Every 2 Years

In normal operating conditions, lubricate the bearings every 2 years or every 50,000 km and when the brake shoes are replaced.

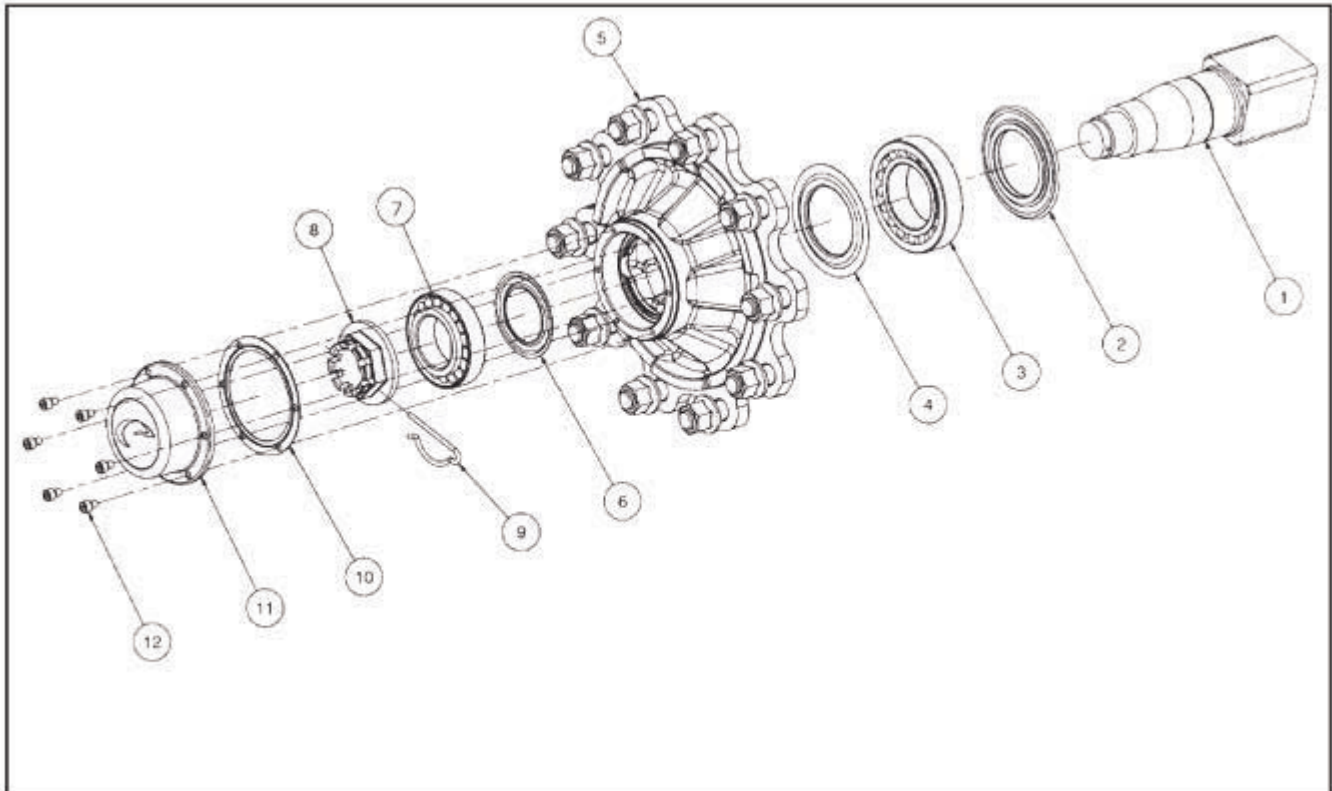
In harsh conditions the bearings should be lubricated more frequently.

Use a general purpose EP grease formulated for lubricating plain, ball and roller bearings, subject to heavy loads and impacts typical of HGV, agricultural vehicle hubs, etc.

**All parts (hub, spindle, bearings, seals, castle nuts, hubcap, cotter pin) should be degreased and Perfectly clean before reassembly.**

The work should be carried out in a clean environment with appropriate tools as the slightest bit of dirt can Damage the bearings or even the spindle.

When carrying out maintenance on the bearings, check the brake linings, drum and return springs, clean the brakes, clean and lubricate the brake cam shaft.



- 1 Spindle
- 2 Oil seal
- 3 Inner bearing
- 4 Grease retaining plate, inner bearing
- 5 Hub
- 6 Grease retaining plate, outer bearing
- 7 Outer bearing
- 8 Castle nut
- 9 Split pin or Split cotter pin
- 10 Hubcap gasket
- 11 Hubcap
- 12 Hubcap screw

## METHOD - DISASSEMBLY

Slacken the wheel nuts.(12) Lift the axle until the wheel is off the ground, and remove the wheel

Ensure the trailer cannot move by chocking the remaining wheels or suitably supporting the trailer.

Release the brakes

Remove the hubcap (11) and Gasket (10). Remove the split pin or pin (9) from the spindle and remove the castle nut.(8)

Remove the drum/hub assembly.(5) using a hub puller if necessary: the outer ring, the grease retaining plates inside the hub (depending on the model), the small bearing cone and cage come away with the hub.

The bearing cups and grease retaining plates can be left inside the hub for cleaning.

Remove the large bearing cage and cone (3) from the spindle (1) using a bearing puller if necessary.

Check the oil seal (2) between the spindle and the large bearing (or the wheel bearing seal depending on the model), and replace these parts if necessary. A puller may be required to remove the wheel bearing seal.

Note the orientation of the oil seal for reassembly.

Check the contact surfaces on the spindle for the bearing and seal and the threaded end of the spindle and remove any bumps or scratches.

Check the hub surfaces and the bearing face of the castle nut in the same way.

**Clean and degrease all parts with a suitable cleaning fluid.**

## REASSEMBLY & LUBRICATION

Grease the spindle lightly.

Refit the oil seal or wheel bearing seal (2) ensure that the seal is the right way round), use a tube of the correct size to fit the wheel bearing seal to avoid damaging the seal.

Apply a generous coating of grease to the large bearing cage and rollers (3), making sure that the grease penetrates all round the rollers and under the cage. Fit Bearing Cone of the large bearing onto the spindle (1), take care not to damage the cage of the bearing, use a tube of the correct size to tap the bearing onto the spindle.

Apply a 15 - 20 mm layer of grease all around the large and small bearing cups that are still in the hub (5).

If the hub does not have grease retaining plates (2 & 6), put a large amount of grease in the centre of the hub to act as a reservoir.

Slide the hub/drum (5) assembly over the spindle and the brake shoes keeping the hub perfectly straight and aligned until it is in contact with the oil seal at the back of the spindle.

Apply a generous layer of grease to the small bearing cage and rollers (7) and fit the assembly to the spindle.

Tighten the castle nut (8) (right-hand thread) to take up the internal play (the roller bearings should then be firmly held between the hub seatings). Rotate the hub whilst tapping it gently with a mallet

Slacken the castle nut until there is no longer any friction between the castle nut and the outer bearing and the hole for the pin is aligned with a notch in the castle nut. Check that the hub rotates freely.

Lock the castle nut with a new split cotter pin as appropriate.

For hubs without grease retaining plates, fill the hubcap with grease, then refit the Hubcap (12) and Gasket (11)

## BRAKE MAINTENANCE & ADJUSTMENT

### Initial checks

The brakes should be tested before using for the first time and after the first laden journey:

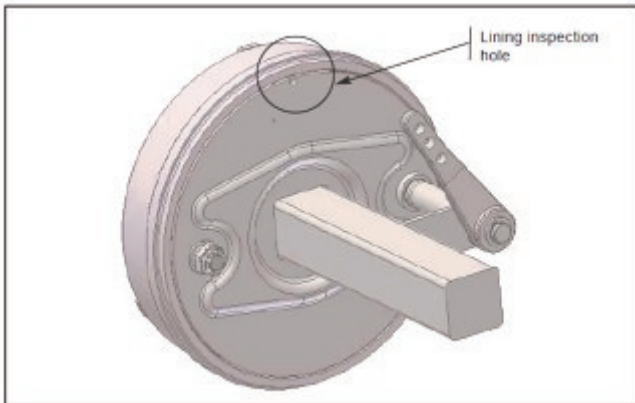
Check the actuator and return spring mountings, check the actuator stroke and return travel and check that the road and parking brakes operate and release correctly.

Tighten the screws and nuts (covers, fulcrum, etc), check the cotter pins, pins, circlips, etc.

Check for hydraulic fluid and air leaks.

### Checking brake clearance and wear

#### Every 3 Months



as the minimum lining thickness is reached.

Check and test the brakes before intensive use and every 3 months:

Check the brake wear and the clearance between the brake linings and the drum visually.

It is probable that the linings are worn when the actuator travel has increased significantly.

Check the thickness of the brake linings (See table opposite)

**The brake shoes should be replaced as soon**

Check that the brakes are clean and clean them if necessary.

MINIMUM LINING THICKNESS		
BRAKE TYPE	DIMENSIONS (Drum internal diameter and lining width)	Minimum lining THICKNESS
A25	250 x 60	2
A30	300 x 60	2
309E	300 x 90	2
310E	300 x 100	5
314C	300 x 135	5
316	300 x 160	5
A320	350 x 60	2
A410	355 x 80	2
A61	400 x 80	2
408E	400 x 80	2
314S	300 x 135	5
A910	406 x 120	5
A040	408 x 140	5
412S	408 x 120	5
414S	406 x 140	5



## ADJUSTING BRAKES (WITH FIXED LEVERS)

### Every 3 Months

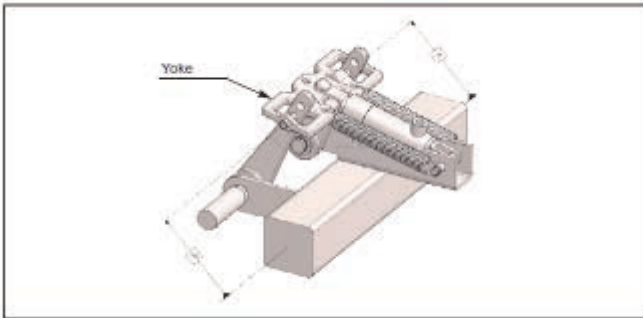
Take up the slack when the actuator stroke reaches about two thirds of the maximum travel.

To adjust, turn the lever by one or more splines, ensuring that the brakes are not touching when released (to prevent overheating the brakes).

**CAUTION**



*Never change the linkage position for the actuator on the lever. Always use the original hole*

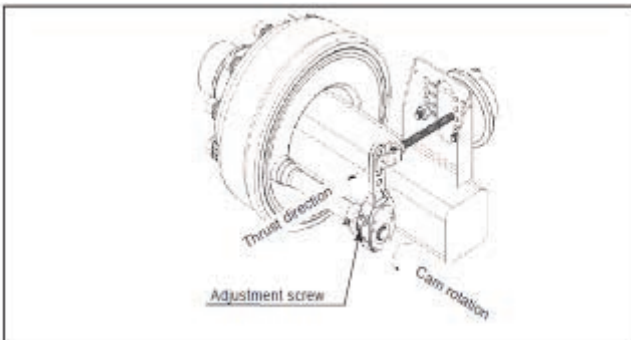


For braking systems which use a yoke, the yoke must remain parallel with the axle especially when the brakes are fully applied. This means that the stroke of the levers on the brakes at each side must be identical. Otherwise, the brake slack must be adjusted.

## ADJUSTING BRAKES (WITH ADJUSTABLE LEVERS)

### Every 3 Months

Take up the slack when the actuator stroke reaches about two thirds of the maximum stroke



To take up the slack, turn the adjustment screw on the lever to adjust the relative position of the cam and the lever

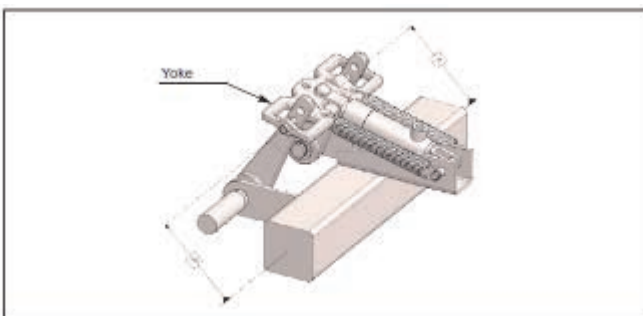
**NB. The actuator brakes by pushing the lever to turn it in a particular direction. The screw must be adjusted so that the cam moves in this direction to take up the slack. The direction in which the screw must be turned depends on the configuration of the axle.**

**CAUTION**



*Never change the linkage position for the actuator on the lever. Always use the original hole*

Ensure that the brakes are not touching when released (to prevent overheating the brakes).



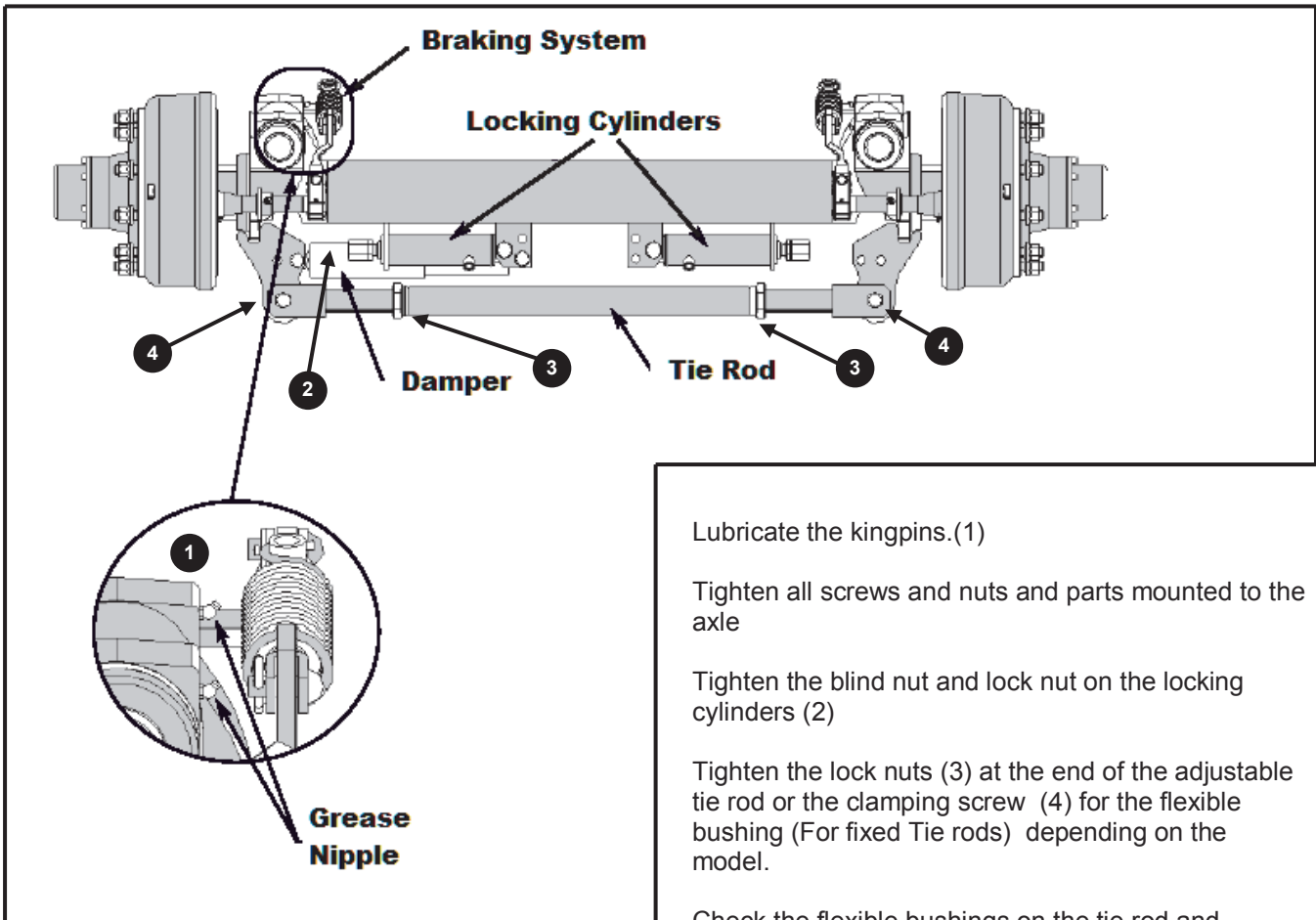
For braking systems which use a yoke, the yoke must remain parallel with the axle especially when the brakes are fully applied. This means that the stroke of the levers on the brakes at each side must be identical. Otherwise, the brake slack must be adjusted.



## ADJUSTMENTS FOR STEERING AXLES

### Every 3 Months

Steering axles should be maintained in the same way as standard axles. The following additional maintenance is required for steering axles



Lubricate the kingpins.(1)

Tighten all screws and nuts and parts mounted to the axle

Tighten the blind nut and lock nut on the locking cylinders (2)

Tighten the lock nuts (3) at the end of the adjustable tie rod or the clamping screw (4) for the flexible bushing (For fixed Tie rods) depending on the model.

Check the flexible bushings on the tie rod and damper and change them if necessary.

Check that the tie rod has not been accidentally bent as this adversely affects the steer axle, in particular the wheel alignment.

#### CAUTION



*When maintaining hydraulic components  
Always release trapped hydraulic  
pressure*



*For further Information and detailed  
servicing instructions refer to the  
manufacturers documentation or  
to your dealer.*

## BASIC TANDEM SUSPENSION

### Every 6 Months

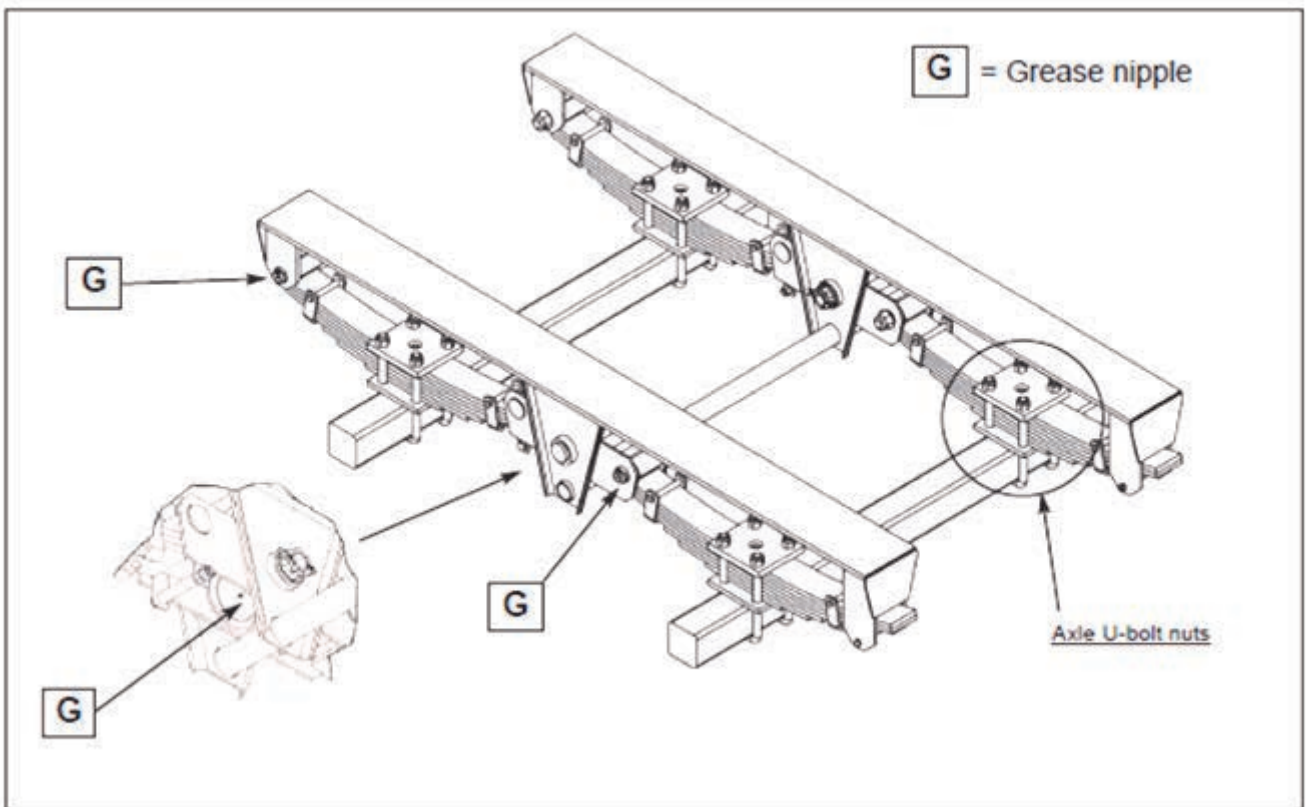
After the first laden journey, before intensive use.

Tighten all the centre clamping bolts and axle U-bolts to the recommended torque. (See Table Below)

Tighten the nuts diagonally

Retighten all the nuts and screws on the suspension (spring shackles, rocker, equaliser bearings, spring bolts, springs)

Lubricate the rocker bearings and the spring bolts.



U-bolt	Torque
mm	mKg
Ø18	23
Ø22	45
Ø24	50
Ø27	60

## Every year

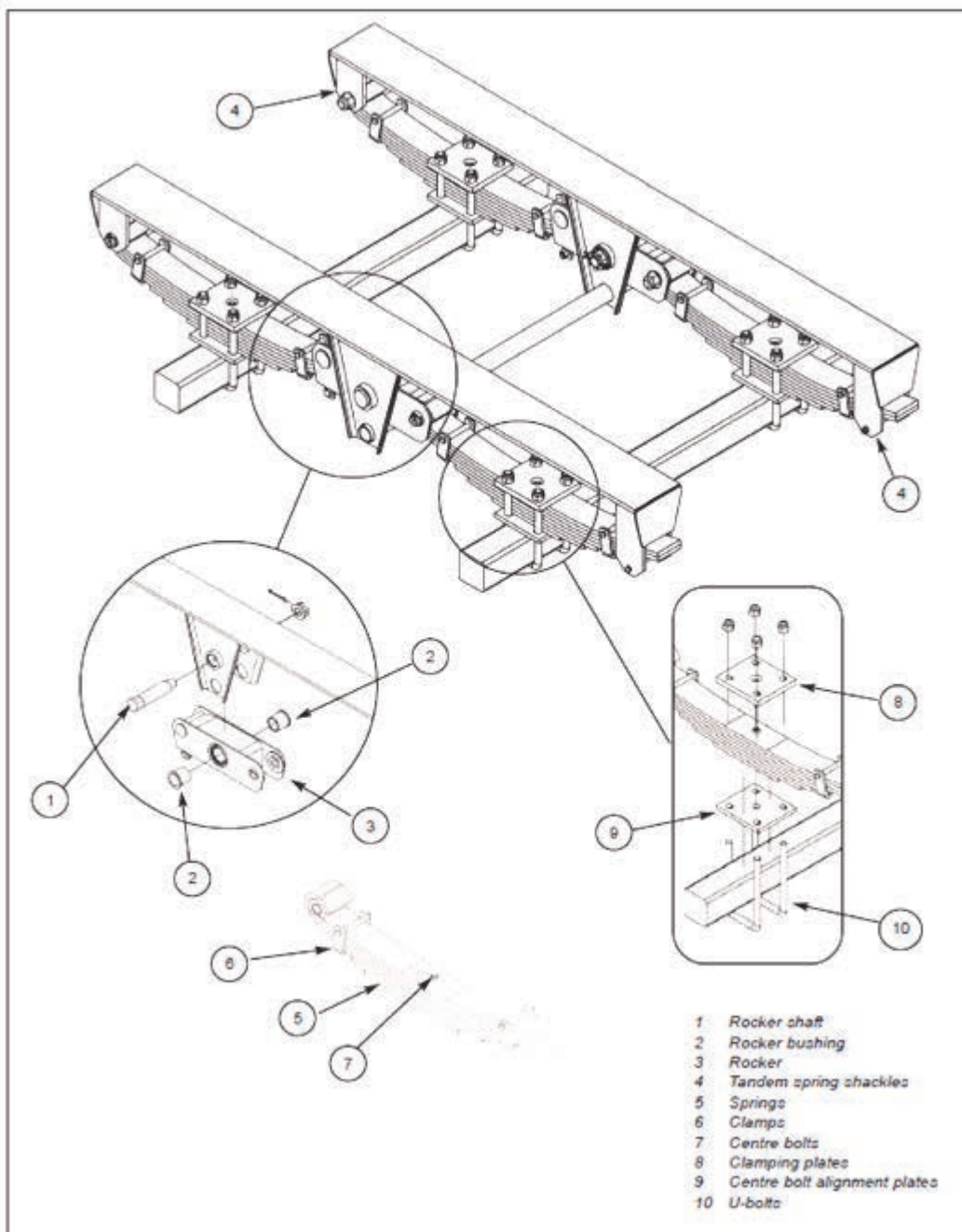
Check the play between the bushings (2) and the rocker shafts (1) and, if there is excessive play, replace the worn parts.

Check the rocker (3) and the spring shackles (4) for wear (spring bearing surface) and replace these parts if they are very worn.

Check the general condition of the springs (5), clean them thoroughly and brush the sides of the springs to check for cracks.

If there is any play between the springs and the axles, check the whole of the clamping system: clamping plates (8), spring alignment (9), bridges (10)

Maintenance of half-tandem suspensions without rocker bars is the same as for simple tandem suspensions with rocker.



## SPRING DRAWBAR

### Every 6 Months

After the first laden journey, and before intensive use.

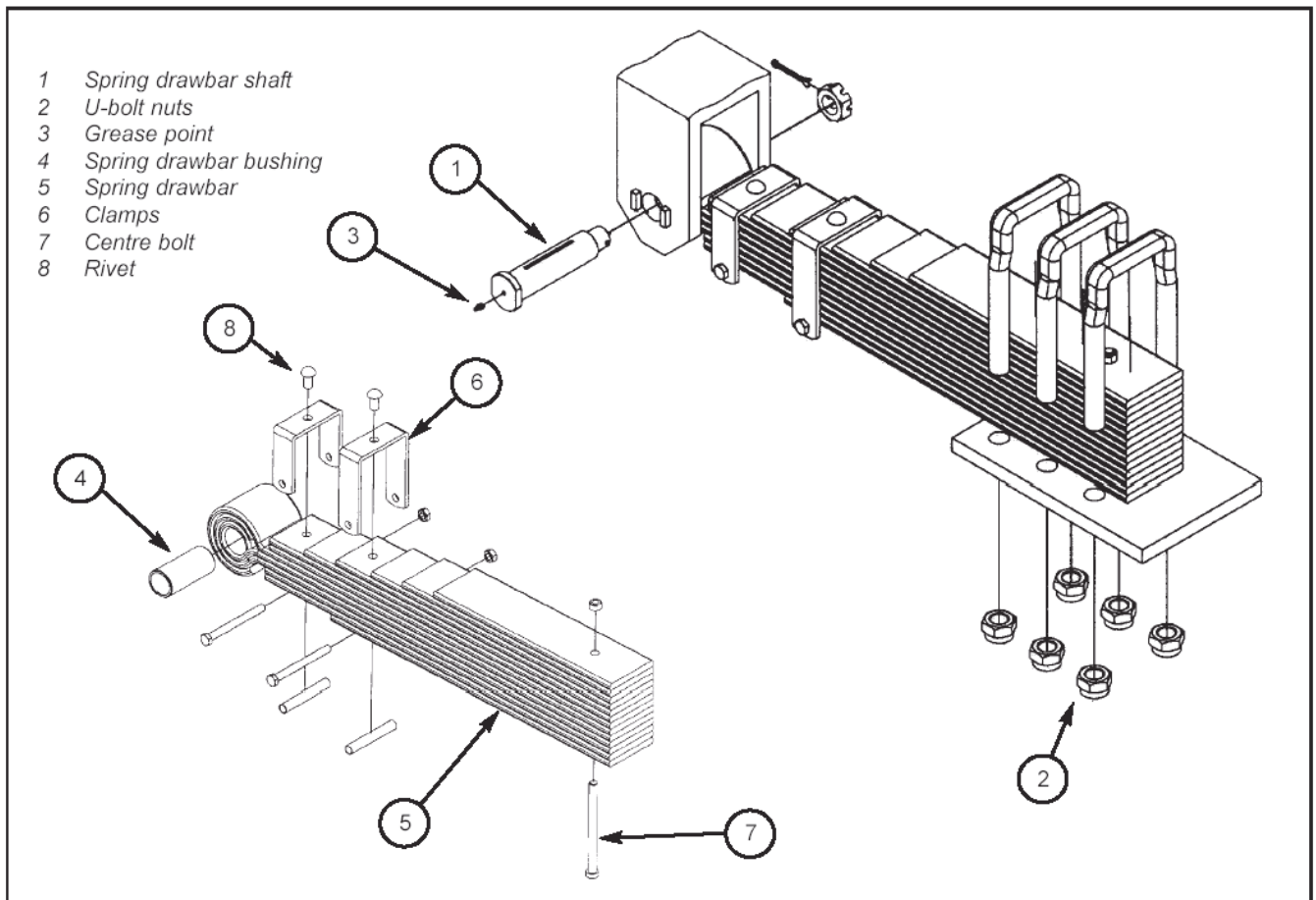
Retighten all the mounting U-bolt nuts **(2)** to the recommended torque

Lubricate the attachment shaft **(3)**

**CAUTION**



*Under harsh or intensive operating conditions, maintenance should be carried out more frequently.*



### Every year

Check the play between the bushing **(4)** and the spring drawbar shaft **(1)** and, if there is excessive play, replace the worn parts.

Check the general condition of the spring **(5)** clean it thoroughly and brush the sides of the springs to check for cracks.

Check the condition of the clamps **(6)**.

# ***Tyre Pressures***

Tyre Size	Pressure In Bar	
	Bar	PSI
12.5/80 X 15 PR14	5.75	83.4
15 X 22.5 X 18 PR Rem	5.5	79.8
385 / 65 R 22.5	5.5	79.8
20.5 X 22.5 Rem	4.5	65.3
560 / 60 X 22.5 Cross Ply	4.5	65.3
560 / 60 X 22.5 FP	4.0	58.0
560 / 45 X 22.5 FP	4.0	58.0
650 / 50 X 22.5 FP	4.0	58.0
650 / 75 X 32	2.5	36.3
710 / 50 X 26.5 FP	4.0	58.0
800 / 45 X 26.5	4.0	58.0
23.1 X 26	2.4	34.8
16.9 X 34	2.5	36.3
18.4 X 34	2.5	36.3

# Recommended Lubricants

							
Grease	Energrease LS / LS2	Marfak All Purpose 2 Multifak EP2	Agricastrol Multi Use Spheerol AP2 Castrol LM	Esso MultiPurpos e Beacon 2	Mobilux 2 Mobigrease MP	Farm Grease Universal Retinax A	Multifak EP2 Totalfarm Multis 2
Oil Floor Drive Gearbox	Energear Hypoid 80w-90		EPX 80w - 90		Mobilube 1 SHC 75W-90	Spirax A 80w-90	Geartex EP-C 80w-90
Oil Rotor Drive Gearbox	Energear Hypoid 80w-90		EPX 80w - 90		Mobilube 1 SHC 75W-90	Spirax A 80w-90	Geartex EP-C 80w-90

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## Brake system

This section contains information that must be followed to ensure the correct functioning of the ABS wheel brakes.

If in doubt contact the manufacturer or the manufacturers agent for further information or advice.

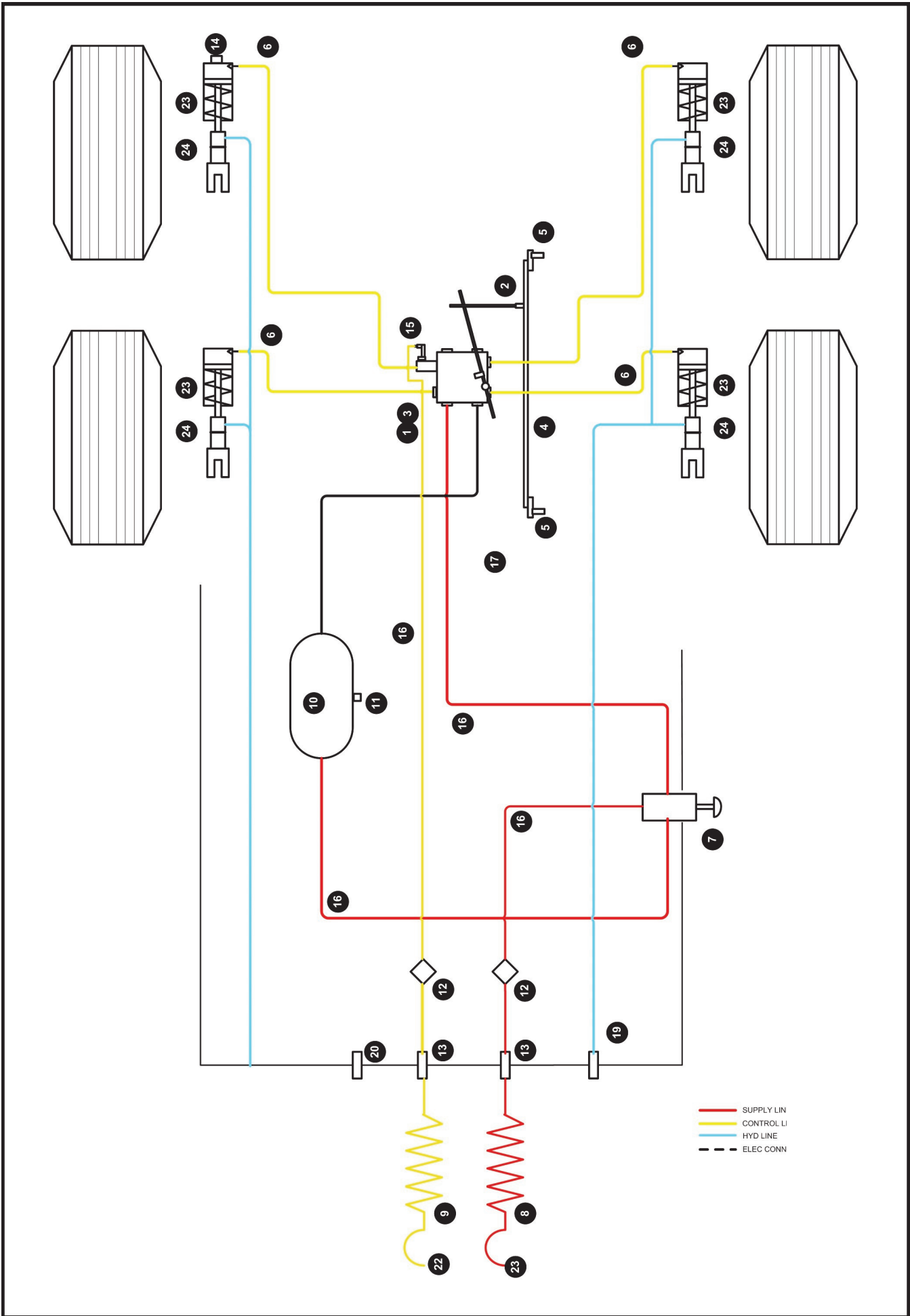
**CAUTION**



*Failure to adhere to these instructions may affect the performance of the brakes and axles and could therefore lead to injury*



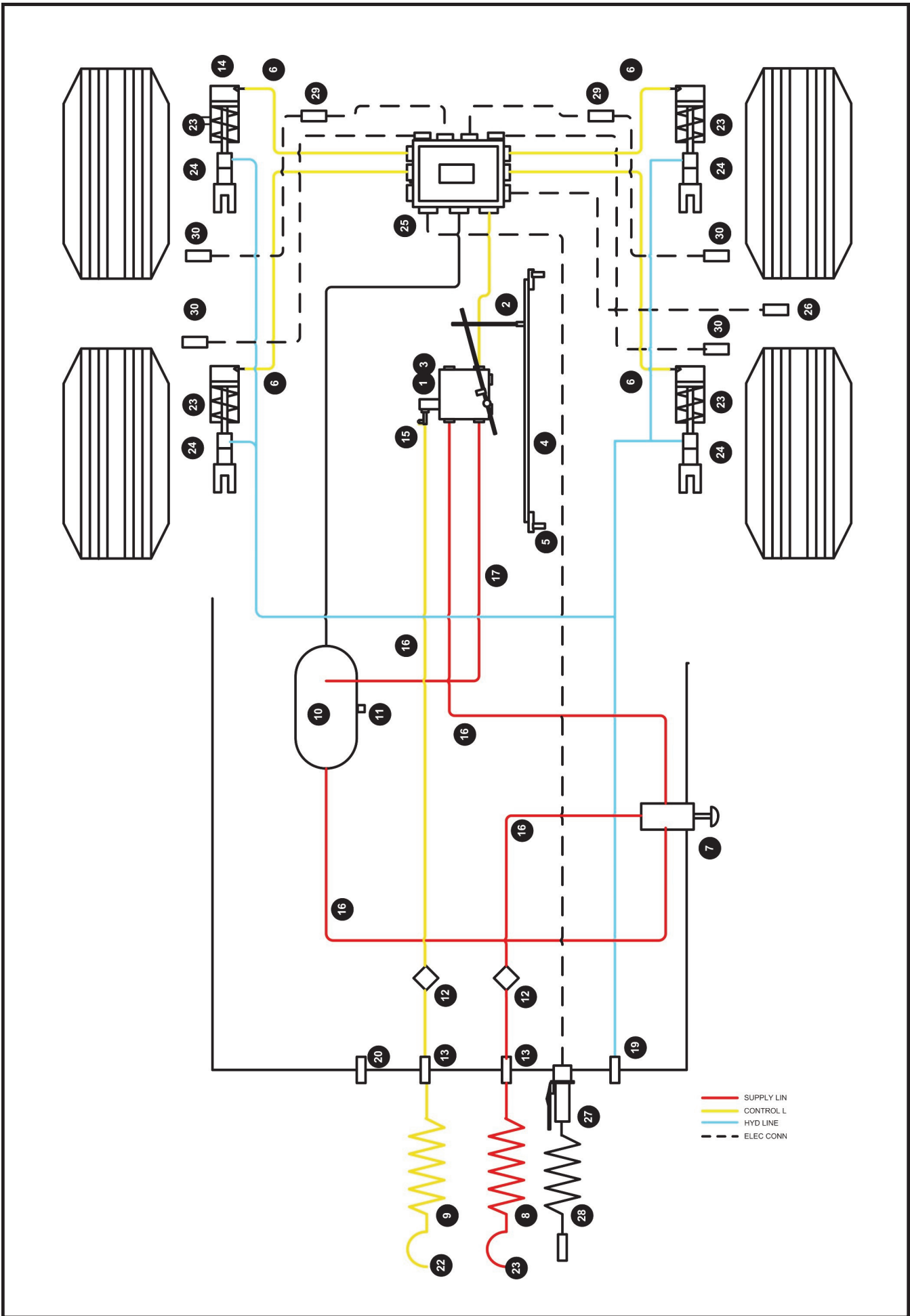
*For additional information refer to the manufacturers documentation*



# Brake system

Two Line Air / Hydraulic with Mechanical Load Sensing Valve

	Component Description	Notes
1	Load Sensing Emergency Relay Valve (Mech Suspension)	
2	Load Sensing Valve Linkage	
3	Load Sensing Valve Fixing Bracket	
4	Telescopic Rod	
5	Rubber Isolation Mount	
6	Hose	
7	Shunt Valve	
8	Red Connection Coiled Hose	
9	Yellow Connection Coiled Hose	
10	Reservoir	
11	Drain Valve	
12	Inline Filters	
13	Bulkhead Connectors	
14	Test Point (Brake Chamber)	
15	Test Point Tee (Load Sensing Valve)	
16	Tube	
17	Tube	
18	Connector	
19	Coupling	
20	Coupling	
21	Coupling	
22	Coupling	
23	Air Brake Actuators	
24	Air Hydraulic Brake Actuators	



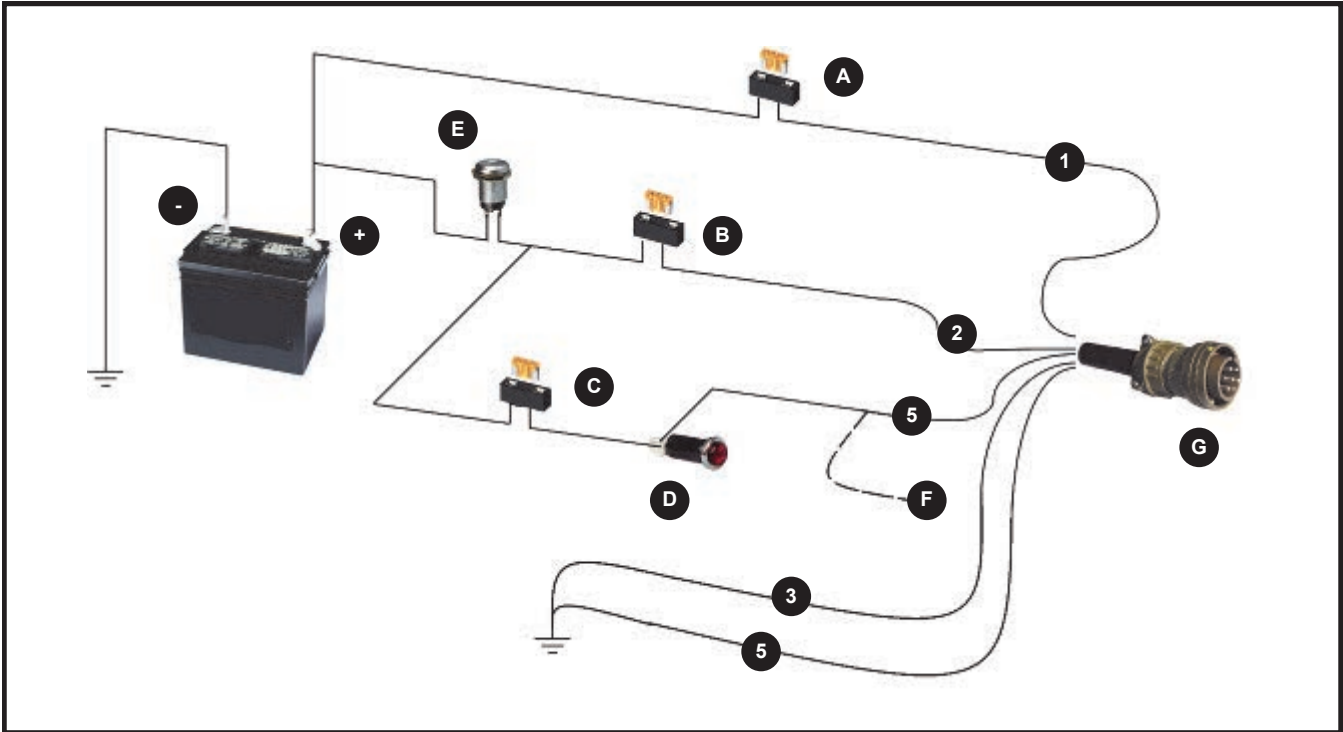
# Brake system

Two Line Air or Air / Hydraulic with Mechanical Load Sensing Valve & ABS

Component Description	
1	Load Sensing Emergency Relay Valve (Mech Suspension)
2	Load Sensing Valve Linkage
3	Load Sensing Valve Fixing Bracket
4	Telescopic Rod
5	Rubber Isolation Mount
6	Hose
7	Shunt Valve
8	Red Connection Coiled Hose
9	Yellow Connection Coiled Hose
10	Reservoir
11	Drain Valve
12	Inline Filters
13	Bulkhead Connectors
14	Test Point (Brake Chamber)
15	Test Point Tee (Load Sensing Valve)
16	Tube
17	Tube
18	Connector
19	Coupling
20	Coupling
21	Coupling
22	Coupling
23	Air Brake Actuators
24	Air Hydraulic Brake Actuators
25	ABS Modulating Valve 12V 2 Sensor
26	Diagnostic cable & Socket
27	ABS Socket DIN 7638
28	ABS Flexible Connection
29	Sensor Cable
30	Wheel Sensor

# Brake system

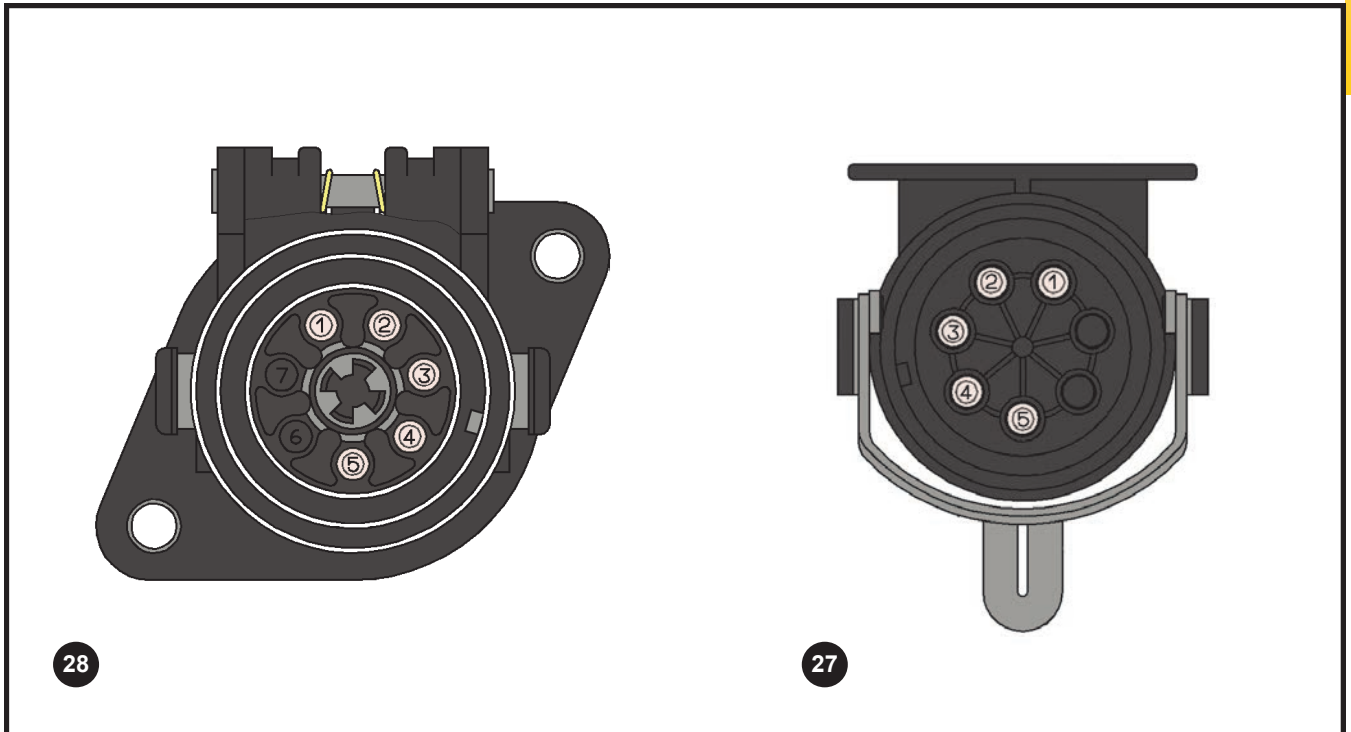
For Tractors not fitted with an ABS Connection the following diagram shows what is required.



	Component Description	Notes
1	Red Cable to Battery Positive	
2	Red / White to Ignition Switch	
3	Brown / Blue return to Battery Negative (Ground)	1.5mm <sup>2</sup> Cable
4	Brown return to Battery Negative (Ground)	6mm <sup>2</sup> Cable
5	Blue / Yellow ABS Warning Lamp	
A	Fuse 25 Amp	6mm <sup>2</sup> Cable
B	Fuse 5 Amp	1.5mm <sup>2</sup> Cable
C	Fuse 5 Amp	1.5mm <sup>2</sup> Cable
D	Warning Lamp	2W rating
E	Ignition Switch	
F	Optional Connection to 24S Socket Pin 2	1.5mm <sup>2</sup> Cable
G	ISO 7638 Connector	

# ISO 7638

The following Diagram shows the correct cable connections for the ISO 7638 ABS Socket



Pin	Component Description	Notes
1	Battery Positive	
2	Switched Ignition Live	
3	Battery Negative (Ground)	1.5mm <sup>2</sup> Cable
4	Battery Negative (Ground)	6mm <sup>2</sup> Cable
5	Warning Lamp	
6	Not Used	
7	Not Used	6mm <sup>2</sup> Cable



## Two-line trailer air braking systems

### General description

The two-line trailer braking system is based on the commercial trailer braking systems which are designed to meet the criteria set by European Council Directive 71/320/EEC.

These systems use one Red air line (known as a supply or emergency line) which, when coupled to the tractor is permanently pressurised, and one Yellow line (known as the service or control line) which has a variable pressure.

This variable pressure is controlled by the driver, and is determined by how quickly the driver wishes to slow down, or whether the tractor's parking brake is applied.

It is commonplace for this line to be fully pressurised when the tractor's ignition is switched OFF.

The schematic diagram on page 5:2 is a typical layout of a tandem-axle trailer, with a Relay Emergency Load Sensing Valve (RELSV) (1), whilst the circuit shown on 5:4 shows the combined RELSV (1) and Advanced Brake System (ABS) controller (25).

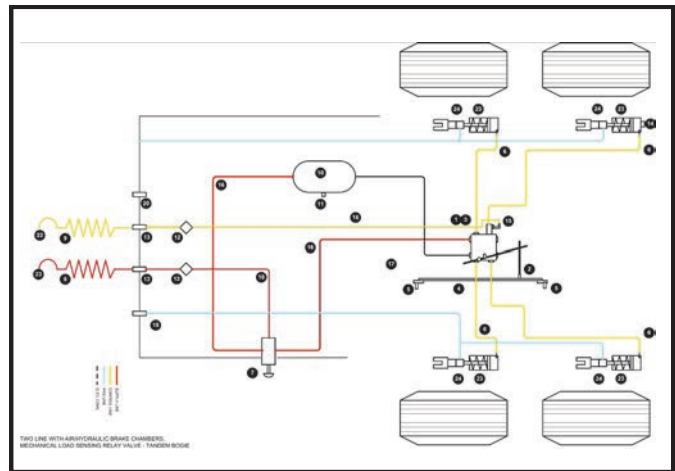
The RELSV (1) is mounted between the axles, and connects to either a telescopic pole or an angle iron (4) which fits between them, the angle iron system is sometimes supported by rubber isolation mounts (5).

For a two sensor ABS system the front axle is ABS sensed (30), the layout also shows extra (optional) ABS sensors connected to the rear axle. These extra ABS sensors should ensure that the rear axle does not lock.

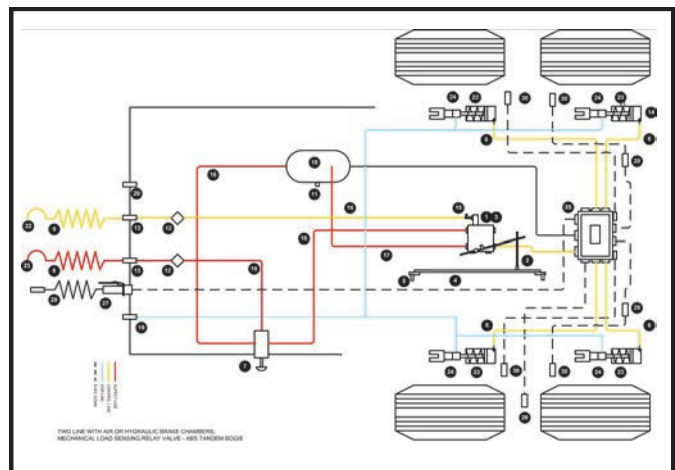
Where no ABS system is fitted, then the RELSV (1) delivers the air directly to the brake chambers (23) from each of its delivery ports. (The brake chambers are also fitted with hydraulic cylinders (24), which are fed directly from the tractor's hydraulic brakes, when the tractor does not provide trailer air braking.)

For tri-axle trailers with ABS, then the centre axle is normally ABS sensed, when using a two ABS sensor system. With a four ABS sensor system, the extra two sensors are fitted on the front or rear axle, dependent upon trailer design and weight distribution.

With a tri-axle trailer the RELSV (1) is generally fitted above the centre axle and connected directly to it.



Non ABS refer to page 5:2



ABS refer to page 5:4

**Two-line Pneumatic trailer braking systems**

**Operation**

Refer to diagrams on 5:2 & 5:4

The air enters the trailer via the Red flexible connection line (8), and passes through a filter (12). The filter is designed to trap particles of dirt, and to stop them entering the sytem, it is not designed to stop water entering the trailers system.

Water separation is a function of the tractors pneumatic braking system as they should be fitted with an air dryer. Filters should be dismantled and cleaned from time to time to remove any debris.

The air then passes through a shunt valve (7), which is mounted on the side of the trailer, the air pressure pushes out its button. This button can be pushed in to release the trailers brakes, when a tractor with air braking is not available. The button can be pulled out again, to re-apply the brakes, or it will automatically be reset after the Red flexible connection line (8), is re-connected to a tractor with air braking.

The air travels into the combined RELSV (1) at port 1, before exiting at port 1-2 to feed the air reservoir (10).

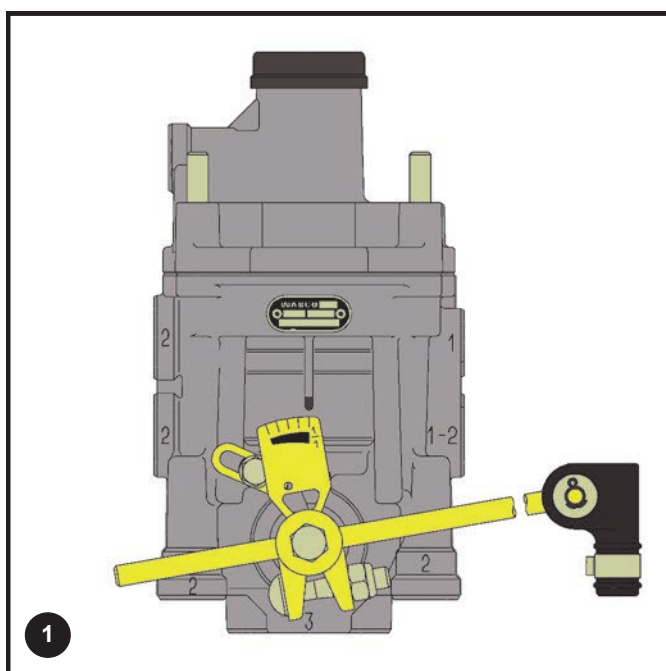
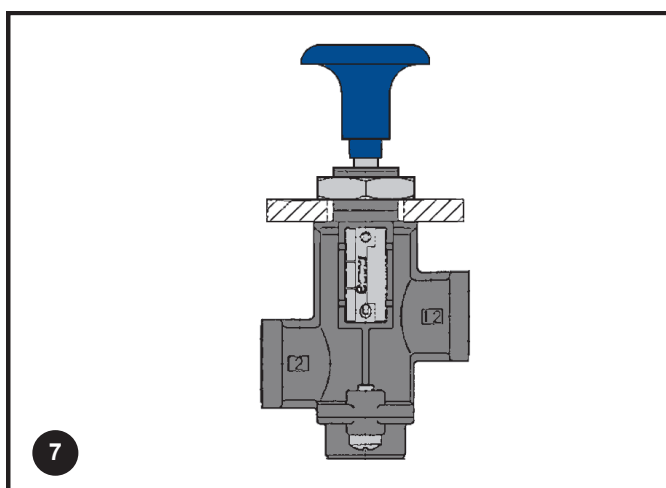
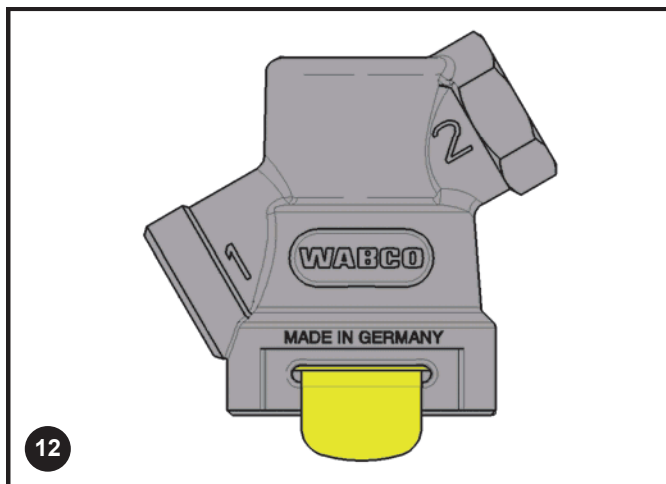
The reservoir is linked back to the shunt valve (7), air in this line signals the RELSV (1) simulating that the Red flexible connection line (8), has been re-connected, after the shunt button is pushed in.

The reservoir (10) is then charged with air until it reaches the system pressure set by the tractor.

This is normally between 6.5 bar and 8.5 bar, and this pressure is also present at port 1 of the ABS modulator valve (25).

Note: Pipes shown as Red on pages 5:2 & 5:4 (and the Black pipe between the tank and ABS module (25) in 5:4) will be pressurised when ever the tractor is connected, and charged up.

None of these pipes should be removed, for diagnostic or repair purposes, until the tractor has been disconnected from the trailer and all of the air drained from the trailers reservoirs.



## Operation contd.

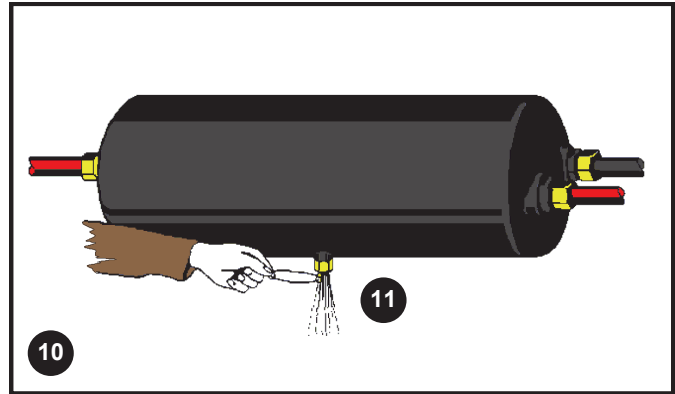
### Reservoir Draining

Draining should be undertaken periodically to remove any water that has condensed in the air reservoirs.

A drain valve which is fitted at the bottom of each air reservoir.

Failure to drain the reservoirs will lead to a reduction in the available air capacity, affecting the brake performance.

This water may also freeze in the winter, causing other problems.



### Brake Application

During braking, a control pressure is sent to the trailer through the Yellow flexible connection (9).

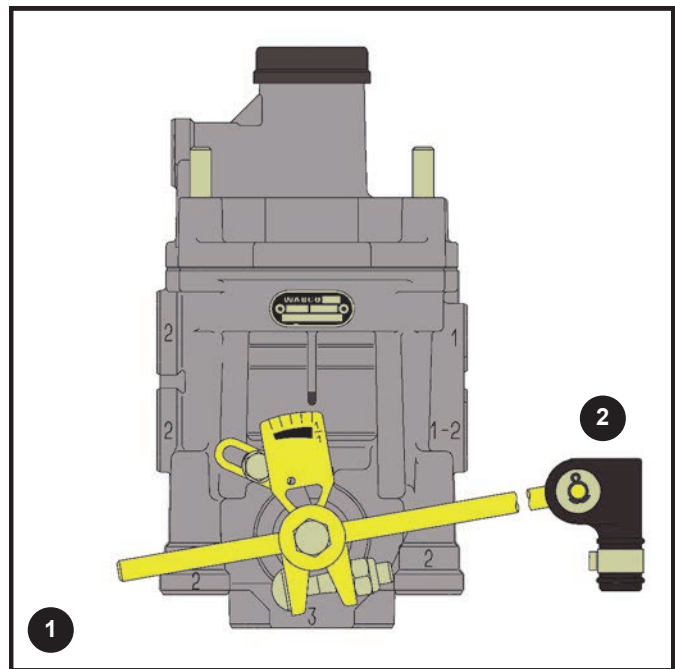
This pressure in this line is determined by how hard the driver presses the brake pedal, and the pressure may be anything up to the maximum pressure in the tractor's system.

However, under normal braking (known as check braking) this control pressure is often around 2 bar.

The control pressure enters the trailer and passes through the yellow line filter (12), before reaching the RELSV (1) at port 4.

The RELSV (1) has several functions, one of which is load sensing.

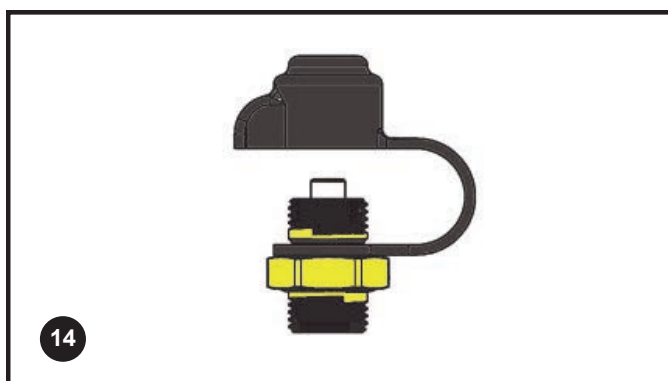
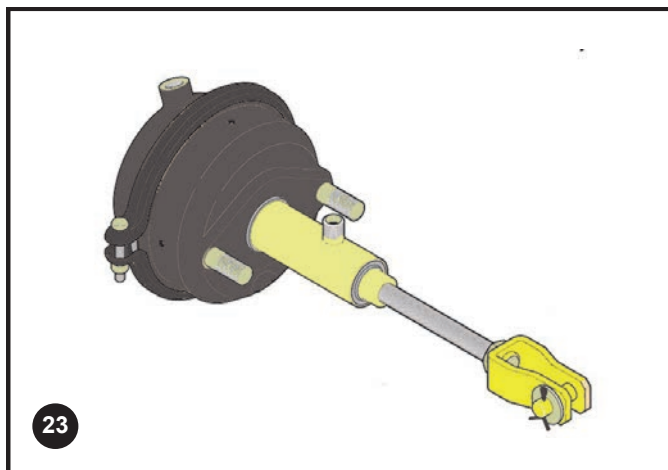
The RELSV (1) is connected to the suspension via a vertical linkage rod (2) and its operating arm. With tandem axled trailers it is common to be connected between the two axles by either telescopic pole or an angle iron (4), in order to give the RELSV (1) an average spring deflection.



The service pressure may be modified by the RELSV (1) based upon the physical load sensed by the valve, as weight is removed from the trailer its chassis rises, causing the RELSV (1) operating arm to lower (rotate clockwise).

This has the effect of increasing the ratio between input and output pressures, thus reducing the braking pressures.

This new, modified pressure exits the RELSV (1) at port 2, and signals the ABS modulator valve (25) at port 4 (just below where the ABS sensors plug in). The ABS modulator then delivers this same pressure to all of the brake chambers, unless "wheel locking" is detected.



**Operation contd.**

**Air / Hydraulic Actuators**

The brakes are applied in a controlled manner, as the pressure builds up behind a rubber diaphragm housed inside the brake chambers (23), and the output forces act on the slack adjusters (or levers) increasing the torque entering the foundation brakes via the camshafts.

As the driver releases the brakes, the control pressure drops. This results in the air within the brake chambers returning back up to the ABS modulator (25), where it exhausts to atmosphere.

No pressure should be evident at the brake chambers whilst the service brakes are not being applied.

This can be checked using the test points (14), one of which is fitted to a spare port in each of the brake chambers.

The RELSV (1) of a two-line air braking system also fulfils an “emergency” function, which is designed to apply full tank pressure into the brake chambers (irrespective of load condition) should the Red flexible connection be removed, or become ruptured.

A comparison of the pressure in the Red line and that in the reservoir (10) is made in the RELSV (1) Should the Red line pressure fall below 2.5 bar the remaining pressure in the reservoir is supplied directly to the Air / Hydraulic actuators (23).

This happens automatically when the trailer’s Red flexible connection is removed during uncoupling.

This emergency function is not be used as a substitute for the trailer’s mechanical parking brake, as any air leak will cause the brakes to release, and the trailer would be left without any effective parking brake.

## Basic checks

### Before Operation

Some basic but functional air checks can be undertaken by the operator as and when required.

Two calibrated air pressure gauges are required, along with suitably long connecting hoses, it is useful to have long test hoses so that two gauges can be positioned close together and viewed simultaneously.

### Test 1 (Charging Test)

Disconnect the Red flexible connection from the tractor, and drain all of the air from the trailers reservoirs.

Attach one gauge to a test point on one tank (fit test point if necessary – normally M22x1.5 threaded).

Fit a second gauge in the Red line, push in the shunt valve button (7) and reconnect the Red flexible connection.

The button should pop out as the Red flexible connection is connected.

Read the two gauges side-by-side and monitor each gauge as the system charges up. The reservoir pressure should rise in line with the pressure in the Red line (it may be slightly behind), until the tank is fully charged and the tractor compressor unloads

If the tank pressure is much lower than the red line pressure when the tractor unloads, then this indicates an internal problem with the RELSV (1), or the pipe work leading to port 1.

This pipe can be tested by disconnecting the Red flexible connection, and temporarily removing the pipe from port 1 of the RELSV (1), and replacing it with a new one.

This new pipe can then be connected to the tractor's red coupling, and the test repeated.

If the pressures now rises correctly, then examine any filters for blockages, and the original pipe work for kinks.

If the pressures still fail to equalize, then the RELSV has an internal fault. Repair or replace as necessary.

### Test 2 (Red Line/Leak Test)

Fully charge the trailer and disconnect the Red Flexible Connection.

A "chuff" of air should be heard as the air exits the open Red line.

Observe the gauge connected to the trailer's air reservoir, the pressure should drop momentarily, then stabilize.

If the reservoir pressure continues to drop, then check the open Red line for the presence of air pressure (A new thin rubber glove is ideal for this, as it can be attached to the open Red flexible connection, and sealed with tape/cable tie and left. If it inflates quickly, this indicates a leaking RELSV).

If no air is seen leaking from the open Red flexible connection, this indicates that the leak is downstream of the RELSV, and this is best identified using a soap-water mixture.

Pay particular attention to pipe fittings, and note that these do not require to be tightened too much, as their seals will often become damaged by over-tightening.

Finally, if the tank pressures drop very slowly over an extended period, then this is acceptable as long as the leaking is not audible. This is known as "permissible leakage".

### Test 3 (Smooth Operation/No Residual Pressure)

Swap the test coupling to the Yellow line, or attach the gauge and test hose to any test point in the Yellow line leading up to port 4 of the RELSV (1).

Attach the other gauge to a test point on any brake chamber.

Fully charge the trailer, and keep the Red flexible connection.

Place the two gauges close together, and monitor them both as the service brakes are slowly and repeatedly applied on and off.

Both pressures should be seen to rise and fall smoothly, with both showing zero bar when the tractor's brakes are released. (Do not worry if the pressure at the brake chamber is lower than that of the Yellow line, as the settings of the RELSV are not yet being tested.)

If the pressure in the Yellow line is unstable then the brake chamber pressure will be as well.

This would indicate a problem with the tractor's brakes, in particular with its trailer control valve.



If the Yellow line pressure is smooth, but unstable at the brake chamber, then the problem is trailer related, and this is found by moving the gauge from the brake chamber to the output of the RELSV (port 2).

The test can be repeated, and if the pressure still is not smooth then this indicates a faulty RELSV. If it was smooth, then the problem is inside the ABS modulator (25), as it must be creating an unstable pressure, even though it is signalled with a stable one.

The same tests can be repeated for residual pressure problems, should both gauges not show zero pressure when the service brakes are released.

### Test 3 (Output of the RELSV)

The RELSV (1) is connected between the chassis and axles, and senses the way the springs deflect, as increasing weight causes them to flatten. This movement is transferred to the RELSV operating arm via a vertical linkage (2). This linkage, along with any other components (angle iron, flexible mounts etc) should be periodically checked for signs of damage, or becoming loose.

In order to check that the RELSV is functioning correctly, the linkage can be removed from the operating arm, and the service brakes applied.

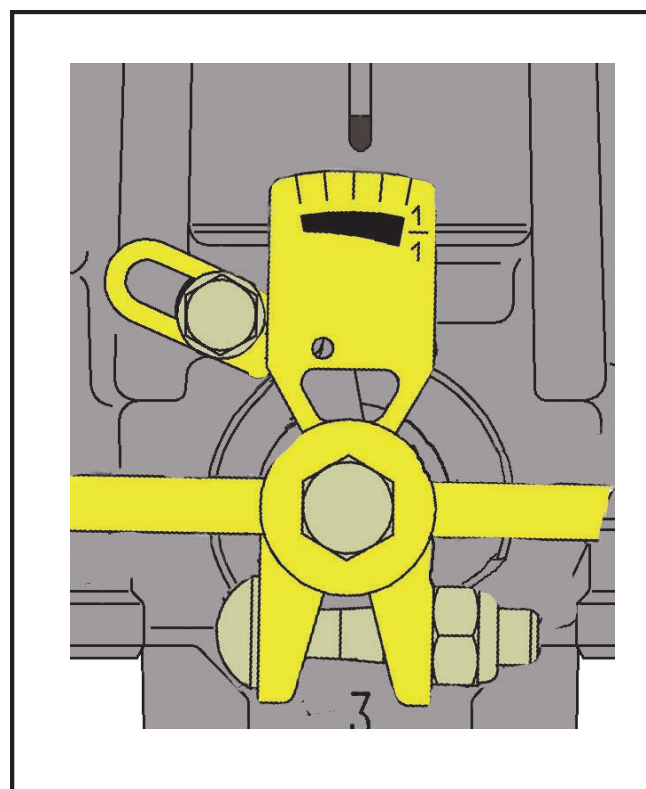
The Red Flexible connection needs to be connected for this test. An air gauge in the brake chamber will show the output pressure, and this gauge can be observed whilst the operating arm is rotated. As the operating arm is raised the brake chamber pressure should increase until it matches the service line pressure, and decrease as the arm is lowered. This demonstrates that the load sensing function of the RELSV is working.

When the vertical linkage is reattached to the operating arm, it is important that the arm is at the correct angle to give the proper braking pressure for the weight being carried.

A decal is fitted to the arm, which rotates with the arm passing a pointer on the RELSV's casting. This decal shows the approximate setting for the RELSV, but the valve is best set when the trailer is empty, and the linkage adjusted until the correct unladen pressure is given, when a known "test pressure" is used.

A typical unladen decal position is shown to the left, but this is only shown for a guide.

The trailer builder should be able to provide this information, if it does not appear on a LSV data plate attached to the chassis.



## RELSV Setting procedure

### Before Operation

The RELSV is probably the most important part of the trailer's braking system, whether ABS is fitted or not.

A poorly set up RELSV can be both dangerous and expensive.

Too little output pressure leads to under braking, and this could result in a jack-knife.

Too much pressure can cause the trailer to lock, and "swing" past the tractor.

Additionally, too much pressure causes premature and expensive trailer tyre wear.

Periodically, and when connecting to a different tractor it is worthwhile checking the RELSV output pressures, and making sure they match the suspension correctly.

To do this properly you will require two gauges, a tape measure, calculator and a little patience!

- 1 With the trailer standing on firm level and connected to the tractor, load it to the maximum weight allowed.

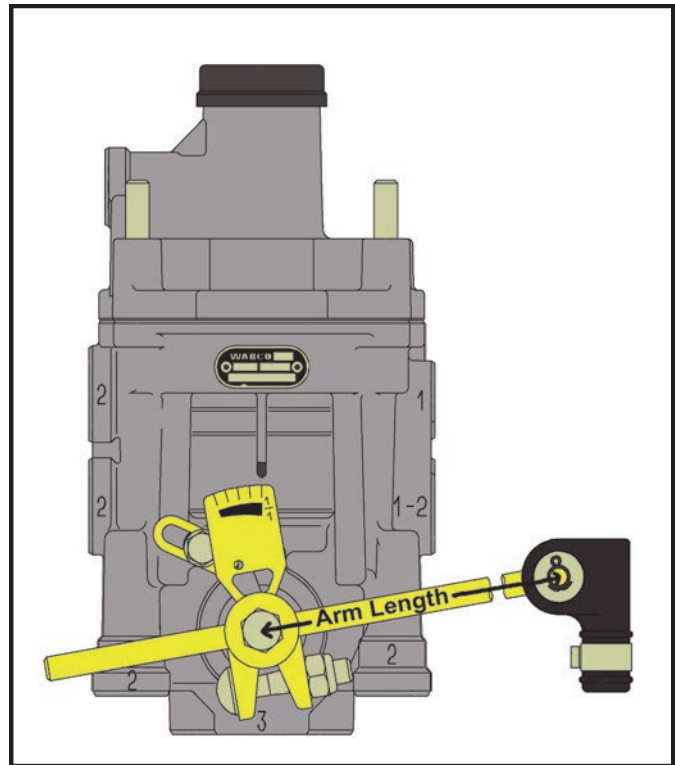
If the RELSV is connected to one axle, then measure the distance between the top of this axle and the underside of the chassis (If the trailer is fitted with a bar between the axles, then you can measure the distance above each axle and halve the total).

Record this measurement in mm

- 2 Remove the load and repeat the same measurements as taken above.

The difference between these two measurements is the "unladen to laden spring deflection".  
For this example we shall assume it is 25mm.

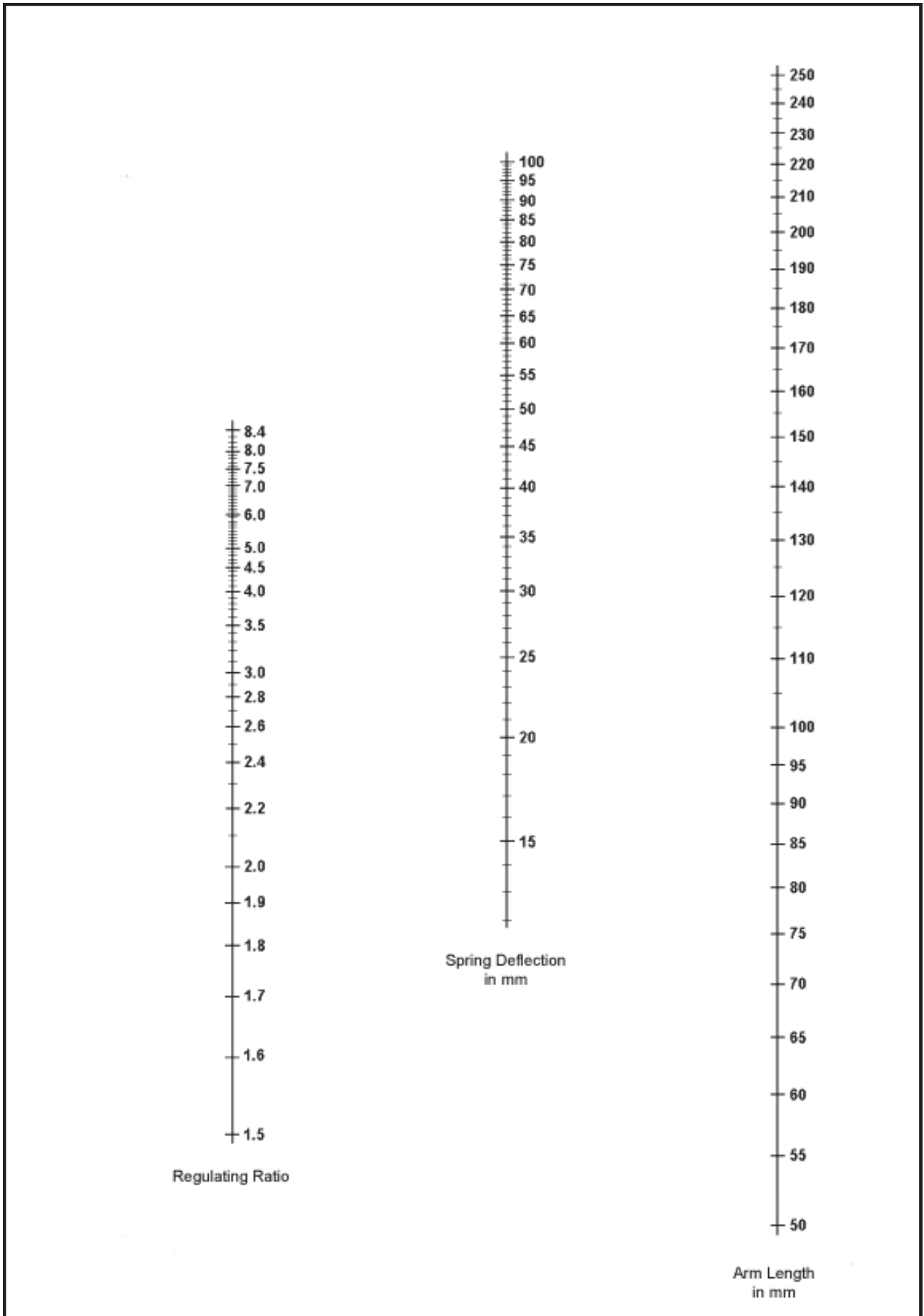
- 3 Find out the recommended unladen LSV setting pressure for your trailer. This may be on a data plate, or available from the trailer manufacturer.  
This is not the pressure present in the trailer's brakes during normal unladen braking, but is a pressure used for setting up the RELSV!  
Along with this unladen pressure you should also get its associated "test pressure", as well as the laden brake pressure.



Typically these could be 6.0 bar (Test) 2.5 bar (Unladen) and 6.0 bar (Laden). If you cannot get access to the actual test pressures for your trailer, then the above figures may be close enough.

- 4 Calculate the "regulating ratio".  
An acceptable way of doing this is by dividing the test pressure by the unladen pressure. Using the example above, this would be 6.0 divided by 2.5 = 2.4
- 5 Look at the graph (Figure 2 below), and find the point on the left hand column which relates to the regulating----- ratio (2.4) which you have just calculated. Mark that point.  
In the central column find the point which relates to your unladen to laden spring deflection, which you measured in Step 2 (25mm). Mark that point.  
Draw a straight line from the point you marked in the left column, through the point in the second column, and extend this line until it crosses the right hand column.  
Where it crosses this column read off the measurement, as this is the correct RELSV arm length for this trailer. This length is measured from where the arm connects to the RELSV (centre of the securing bolt head) and the point where the rubber linkage fits on the other end. Adjust the arm length on the valve accordingly, and tighten the securing bolt.





## RELSV Setting procedure contd

- 6 Check the unladen setting by applying the test pressure to the Yellow line (6.0 bar used in this example), and measure the RELSV output pressure.

This can be measured directly at any unused port 2, or on a brake chamber.

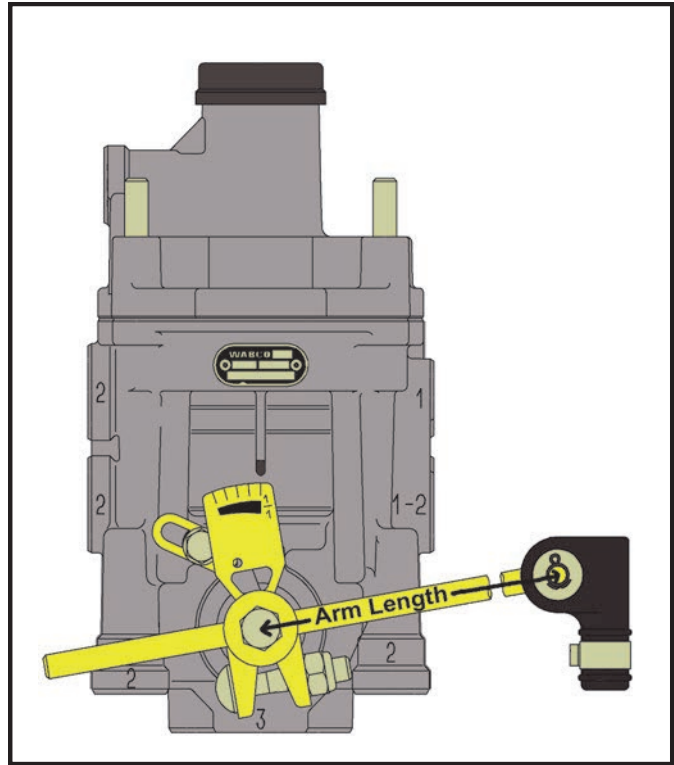
If the pressure is correct (2.5 bar in this example), then the valve is now set up.

If the pressure is too low (2.0 bar for example), then the vertical linkage between the RELSV arm and the axle (or bar) is too short.

If the output pressure is too high, then the vertical linkage is too long.

Amend the length until the unladen output pressure is correct (tolerance  $\pm 0.2$  bar).

Having set the RELSV at its correct unladen setting, and adjusted the arm length to match the true unladen/laden spring deflections, the valve should now automatically adjust to the correct brake pressure settings.



## Brake system

### ABS

#### General Description

The ABS system is designed to stop the wheels from locking, when the trailer is braked and the road surface is slippery.

Under normal braking operation the ABS does not affect the braking performance, but merely monitors the changing wheel speeds. By doing this it compares the differing wheel speeds and determines if there is a tendency for one or more wheels to lock.

The ABS system consists of an Electronic Control Unit (ECU) and a modulator valve (25) which is hard wired directly onto the ECU.

The ECU and modulator are internally split into two halves, so that one half of the ECU controls one half of the modulator, which in turn controls the braking system for one side of the trailer.

The braking system for the other side of the trailer is controlled by the other half of the ECU and modulator.

Two ABS sensors (30) are mounted in the brake assemblies on at least one axle, and these are in close proximity to toothed "polewheels", which pass by the ABS sensors, as the wheels rotate.

These ABS sensors are connected to the ECU by extension cables, and they are connected so that the nearside sensor controls the braking for the nearside wheels.

#### Operation

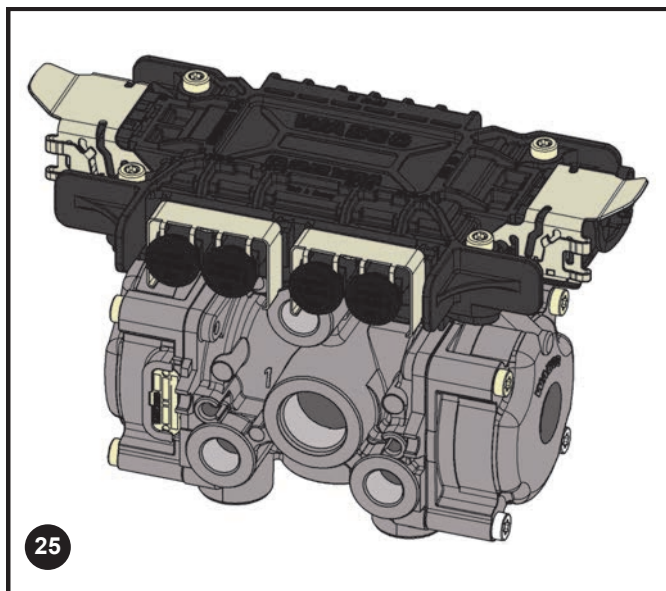
The ABS system when correctly operated is automatic and requires no inputs from the operator.

ABS systems are available in either 12 Vdc or 24Vdc variants. A 24Vdc version cannot be towed by a 12Vdc tractor and vice versa.

The main connection to the tractor is via the dedicated supply socket (ISO 7638 see page 5:7)

When connected to tractor as the tractor is started the ECU "exercises" the Modulator valve (25), this will be heard as a series of clicks, and if the service brake is applied some rapid exhaust sounds.

During initial power up, a cab mounted trailer ABS warning lamp should illuminate briefly, before going out. This warning lamp will indicate any ABS related failure to the driver.



**Note !** A trailer may have four wheels but just Two ABS sensors, the unsensed wheels still receive ABS modulated braking. However, unsensed wheels may still lock, as the ECU cannot detect this locking tendency, unless sensors are fitted to all wheels.

**Note !** Failure of the ABS lamp to illuminate will not cause a failure of the brakes to apply. However, the ABS functions may be impaired to a greater or lesser extent, so wheel locking may be evident which could lead to a loss of stability, and an accident.

**WARNING**



*If the ABS warning lamp illuminates whilst driving, proceed with caution until it is safe to stop. Check the system for faults before proceeding.*

**WARNING**



*Braking systems and brake related equipment must only be serviced by competent persons using the correct maintenance equipment*

## Operation contd

The ABS ECU (25) monitors, processes and compares the wheel speeds detected at the wheel sensors (30) , and only acts on this information if it determines that one, or more of the sensed wheels are about to lock.

At that point the ECU transmits a signal to the half of the modulator valve which is connected to that wheel, and this closes the inlet port, stopping further pressure building up in the brake cylinders.

If the locking tendency persists, a further signal is also transmitted to the exhaust port, resulting in air being relieved from the respective brake chambers. The wheels speeds are controlled in this way until the ECU is determines that the lock-up condition has been averted, and then normal braking is resumed.

## Basic Checks

The cab-mounted warning lamp should illuminate and extinguish once the tractor's ignition has been switched on. If this happens, then no checks are necessary.

Should the warning lamp stay on until the vehicle is moving, then this is also OK, and no further checks are required.

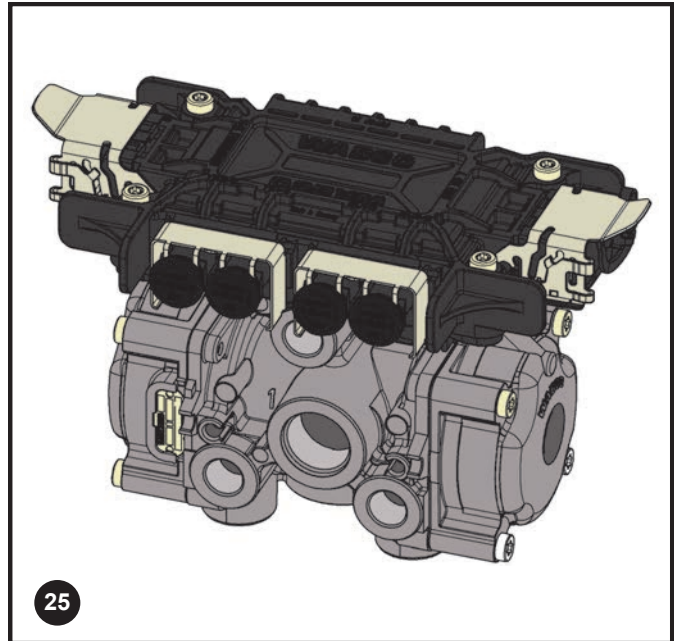
However, should the warning lamp fail to illuminate upon ignition, or fail to extinguish when pulling away, or come on again during driving, then a few basic checks may help find the cause.

General faults may be caused by poor electrical connections or damage to the cables .

These are best done with the ignition ON, following the warning lamp going out.

Trace the cable gently moving them and their connectors, check to see if the cab warning lamp illuminates, or flickers, or whether the ABS is heard to exercise again. If the ABS exercises, then you know that it switched OFF momentarily whilst the cable was moved, this could indicate a break in the power feed.

Testing the ABS sensor extension cables, where they connect to the ECU in this way, is also worthwhile, ensure any loose connections or pins are tightened and ensure correct operation. Always make sure that they are correctly reconnected following any removal.



Power and warning lamp checks are best performed using two wires attached to a 21watt bulb, with the voltage to match the ABS system, rather than an LED tester or multimeter.

These checks can be performed in stages, initially at the tractor's ISO 7638 socket, then into an attached ABS flexible connection cable, and finally in the ISO 7638 power cable after removing it from the ABS ECU. In this way the various segments of the cabling are checked in turn, which will pinpoint any cable problems.

All of the power and ABS warning lamp tests on the following pages are conducted within the ISO 7638 power supply (28).

# Brake system

## ABS

### Testing

#### Test 1 (Exercise check)

When the tractor ignition is switched ON, the trailer will exercise the Modulator valve (25) (This is often four sharp clicks, or click chuff click chuff, if the service brakes are applied.)

If these four noises are heard, then the ABS is being powered correctly.

If OK ignore Test 3 (ABS Power Test).

#### Test 2 (ABS warning lamp check)

With the ABS flexible connection between the tractor and trailer disconnected (ignition ON) the ABS warning lamp should be OFF.

(If the ABS warning lamp is ON, the tractor has a wiring problem.)

At the tractor socket (28) using a multimeter or test lamp, connect one terminal to pin 5, and the other to pin 4 (see 5:7 for pin functions). The ABS warning lamp should illuminate, but not the test bulb (If the test bulb illuminates brightly, the tractor has a wiring fault).

If the warning lamp fails to switch ON and OFF as the test lamp is connected and disconnected, then the ABS warning lamp fault is within the tractor wiring.

If the warning lamp operates correctly, repeat the tests into the plug on the ABS flexible connection between the tractor and trailer (27), having firstly reconnected it to the tractor, and disconnected it from the trailer's ABS socket .

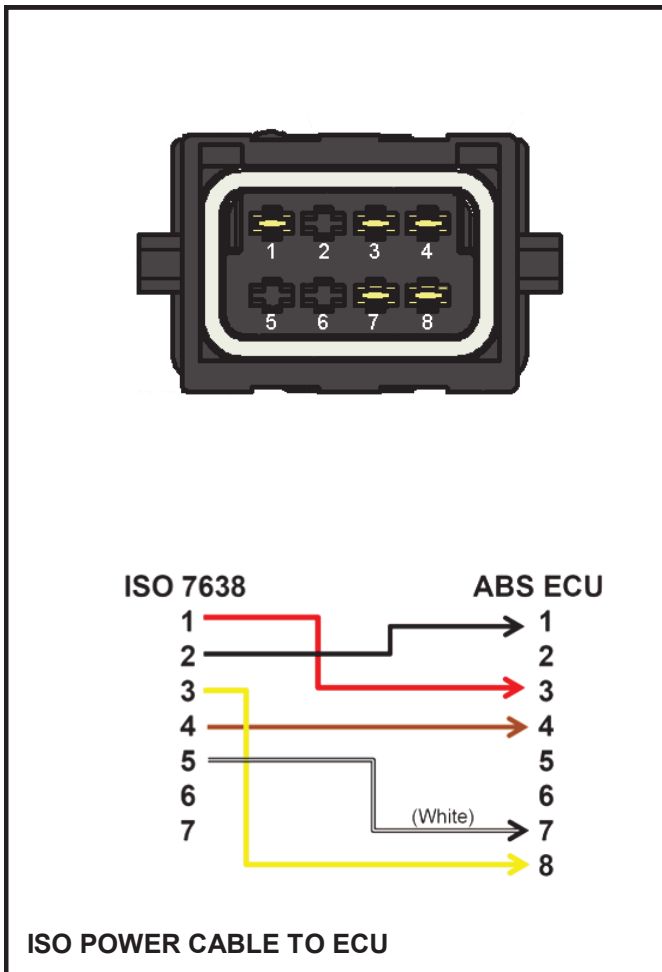
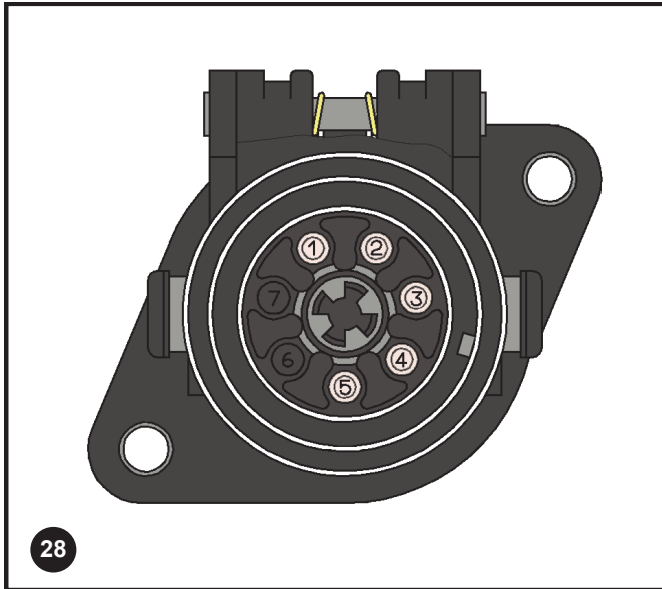
If the lamp is still working correctly, repeat the test into the ISO Power cable where the cable connects to the ABS ECU (25), this time using pins 4 and 7.

If the warning lamp is functioning correctly, then all of the ABS warning lamp wiring is correct.

Should the ABS warning lamp fails to illuminate after reconnecting all of the cables, and switching the ignition ON, then the fault must be inside the ABS ECU. (25)

However, if the ABS warning lamp stays on, then further tests are required.

By cycling the ignition ON (2 seconds) OFF (2 seconds) and ON again, a request is sent to the trailer's ABS ECU to give out a "blink code". If the ABS warning lamp starts flashing, this indicates that the ECU is functioning correctly, make a note of the number of flashes, as these can be used to identify the source of the problem.



## Testing contd

### Test 3 (ABS Power Test)

Using a multimeter or a 21 Watt test lamp, and with the ignition switched ON, check that it illuminates brightly when connected across pins 2 and 3 of the tractor's socket (28).

If it fails to illuminate then check the tractor fuse (often 5 Amp). Refer to the tractor's operation & maintenance manual for details of the electrical system.

Check that it switches ON/OFF with the ignition ON/OFF.

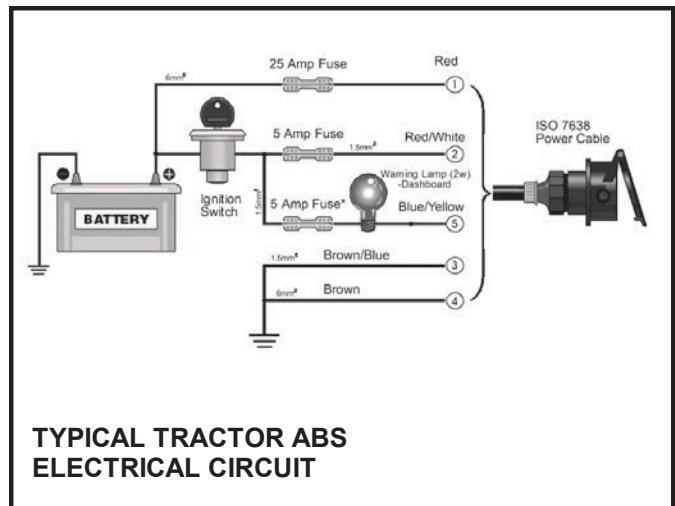
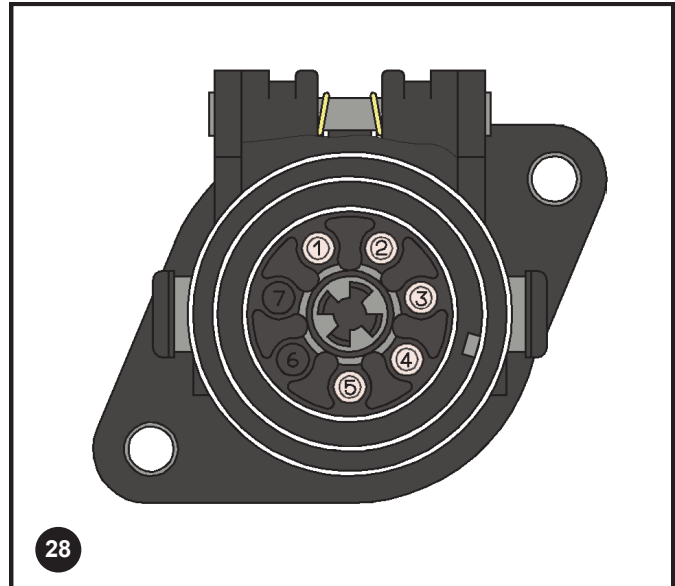
Repeat the test with the test lamp across pins 1 and 4.

If the lamp fails to illuminate then check the fuse (often 25 Amp). With the test lamp across pins 1 and 4, the lamp may stay illuminated, even after the ignition is switched OFF, and if it does then this is OK.

Connect the test lamp across pins 4 and 5. The lamp must not illuminate, but the cab warning lamp should come on.

All of the above tests can be repeated the ABS ISO7638 flexible connection between the tractor and trailer (27) having firstly disconnected it from the trailer's socket, in order to check the connection for damage.

Finally the remainder of the ISO 7638 cable can be checked by repeating the tests at the ABS ECU (25), remembering that the pin numbers are different, so refer to ISO Power cable to ECU wiring diagram shown on the previous page.





# Brake system

## ABS

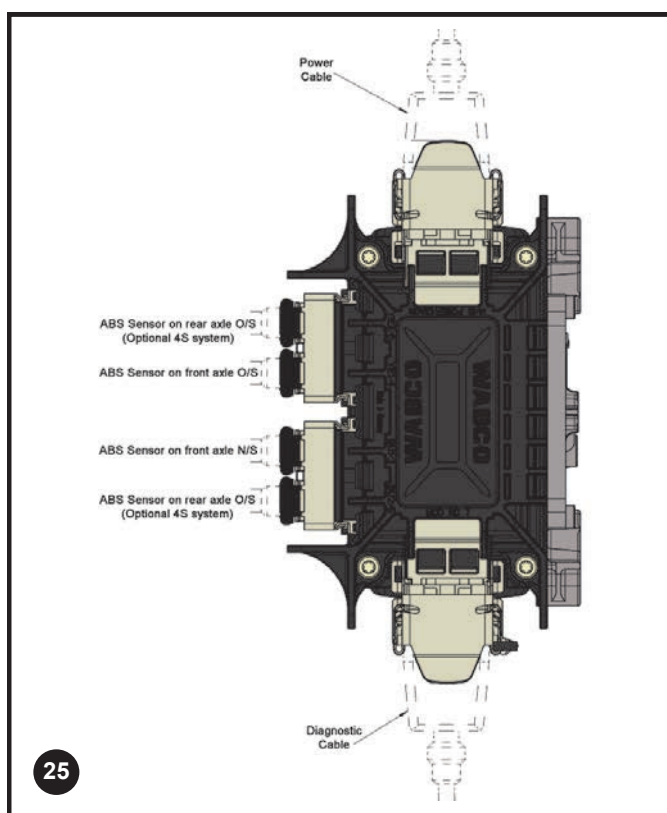
### Testing contd

Basic blink code errors

By starting the blink code routine (see page 5:19), any current ABS wiring fault error codes are shown by the ABS warning lamp, located in the tractor. The error codes are repeated three times.

FAULT CODE	COMPONENT	COMMENTS
3	ABS Sensor BU1 c	Broken wire – normally nearside of trailer
4	ABS Sensor YE1 d	Broken wire – normally offside of trailer
5	ABS Sensor BU2 e	Broken wire – normally nearside with 4 sensor system
6	ABS Sensor YE2 f	Broken wire – normally offside with 4 sensor system
7	Extra Modulator	Broken wire/solenoid – only on 4S/3M systems
9	Internal Modulator	Broken wire – new ABS assembly required
10	Internal Modulator	Broken wire – new ABS assembly required
11	Internal Modulator	Broken wire – new ABS assembly required
14	Power Supply	Check for over/under voltage
15	Internal ECU fault	Replace ABS assembly

**Note!** Fault codes 3,4,5,6,7,14 & 15, correspond to numbers cast into the ABS ECU valve body (25), allowing the faults to be traced to a specific connection.



### Component Testing

The ABS system consists of three basic components (ECU (25), Cables (29) and ABS Sensors (30)) the most effective method of fault diagnosis may be by substitution.

This is ideal for checking cabling/ABS Sensor wiring problems, when no specialist diagnostic tools are available.

When removing any cable it is vital that the cable is marked, so it can be returned to its original position. It is also imperative to ensure that no unused electrical connections are left open, as water will enter the electronics and cause premature failure.

Water can also enter the electronics via “repaired cables”, where water migrates up the inside of the repaired cable, and corrodes the inside of the ECU.

The cable connections to the ECU (25) are shown opposite, only the two central ABS cables are used for a two ABS Sensor system.

If in doubt contact your dealer or a specialist ABS repairer!



## Troubleshooting Guide

Problem	Cause	Solution
TRACTOR (TRAILER CIRCUIT) LOW PRESSURE WARNING BUZZER ON ALL OF THE TIME	AIR LEAK IN SYSTEM	DISCONNECT TRAILER TO ASCERTAIN WHETHER LEAK IS IN THE TRACTOR, OR TRAILER
	COMPRESSOR OR UNLOADER/AIR DRYER PROBLEM	CHECK IF COMPRESSOR IS BLOWING-OFF AT UNLOADER, OR AIR DRYER.
	LOW PRESSURE SWITCH PROBLEM	CHECK CONNECTIONS - REPAIR AS NECESSARY CHECK LP SWITCH PRESSURES AGAINST THOSE IN THE AIR TANK (TRAILER CIRCUIT)
TRAILER BRAKES DO NOT RELEASE WHEN SYSTEM FULLY CHARGED, AND THE TRACTOR'S HAND BRAKE IS RELEASED	INSUFFICIENT RED LINE "FLOW"	CHECK SELF-SEAL VALVE TO ENSURE IT IS LIFTING SUFFICIENTLY TO ALLOW A HIGH FLOW OF AIR TO THE TRAILER
	INSUFFICIENT RED LINE PRESSURE	CHECK PRESSURE AT THE TRACTOR'S RED COUPLING USING CALIBRATED AIR GAUGE. PRESSURE SHOULD BE BETWEEN 6.5 BAR AND 8.5 BAR
	PRESSURE STILL IN YELLOW LINE	CHECK TRACTOR'S IGNITION IS SWITCHED ON CHECK CABLE LINKAGE (IF FITTED) TO TRACTOR'S TRAILER CONTROL VALVE, AND ADJUST/REPAIR AS NECESSARY
	RELSV EXHAUST PORT BLOCKED	ENSURE RELSV EXHAUST IS OPEN
TRAILER BRAKES DO NOT APPLY DURING TRACTOR BRAKING	INSUFFICIENT YELLOW LINE "FLOW"	CHECK LIFTER VALVE PRESENT IN TRAILER'S YELLOW SUSIE
		CHECK SELF-SEAL VALVE IN TRACTOR'S YELLOW COUPLING
		CHECK TRAILER'S YELLOW AIR LINES FOR KINKS OR BLOCKAGES
INSUFFICIENT PRESSURE IN TRAILER'S AIR RESERVOIR	CHECK THAT AIR FLOWS UNRESTRICTED FROM PORT 1-2 OF RELSV, WHEN THE RED SUSIE IS CONNECTED AND PRESSURISED	
INSUFFICIENT PRESSURE IN TRAILER'S AIR RESERVOIR	POOR AIR FLOW TO TRAILER'S AIR RESERVOIR	CHECK FOR KINKED OR BLOCKED PIPES
		CHECK THAT AIR FLOWS UNRESTRICTED FROM PORT 1-2 OF RELSV, WHEN THE RED SUSIE IS CONNECTED AND PRESSURISED
TRAILER'S BRAKES "SNATCHING"	RELSV NOT WORKING SMOOTHLY - INPUT AND OUTPUT PRESSURES JERKY WHEN COMPARED USING AIR GAUGES	REPAIR/REPLACE RELSV AND ENSURE THAT ANY REPLACEMENT IS SET UP CORRECTLY
TRAILER BRAKING TOO HARD, OR TOO WEAK	INCORRECT LSV SETTING	CHECK SETTINGS AGAINST RECOMMENDATION
	INCORRECT SLACK-ADJUSTER LENGTH	CHECK LENGTH AGAINST RECOMMENDATION
	INCORRECT BRAKE CHAMBER SIZE	CHECK SIZE AGAINST RECOMMENDATION
	LSV LINKAGE DAMAGED	CHECK LINKAGE AND ANGLE IRON
TRAILER BRAKES GETTING TOO HOT	HAND BRAKE PARTIALLY APPLIED	CHECK HANDBRAKE CABLES/ ADJUSTMENT
	RESIDUAL PRESSURE IN BRAKES	ENSURE NO AIR TRAPPED IN YELLOW LINE
	HYDRAULIC LINE ALSO CONNECTED	DISCONNECT HYDRAULIC BRAKE LINE

# Brake system

Problem	Cause	Solution
TRAILER BRAKES NOT GOING INTO "EMERGENCY", AFTER RED LINE REMOVED	KINKED PIPE IN LINE TO RELSV	CHECK ALL PIPES TO PORT 1 OF RELSV
	INCORRECT RED SUSIE COUPLING	CHECK COUPLING HAS NO SELF-SEAL VALVE
	RELSV EXHAUST PORT BLOCKED	ENSURE RELSV EXHAUST IS OPEN
ABS WARNING LAMP IN TRACTOR CAB ILLUMINATED WHEN NO ABS TRAILER CONNECTED	EARTH PROBLEM WITHIN TRACTOR'S ISO 7638 WIRING	CHECK ABS SOCKET FOR TOUCHING, LOOSE WIRES
		CHECK WIRING FROM ABS SOCKET TO CAB ABS WARNING LAMP.
ABS WARNING LAMP IN TRACTOR CAB DOES NOT ILLUMINATE WHEN TRACTOR CONNECTED TO TRAILER WITH ABS FITTED	ABS WARNING LAMP BULB BLOWN	REPLACE BULB
	ABS WARNING LAMP FUSE BLOWN	REPLACE FUSE (OFTEN 5 AMP)
	NO ABS SUSIE CONNECTED	CONNECT ABS SUSIE TO TRACTOR'S SOCKET
	FAULTY ABS SOCKET	IS PIN 5 PUSHED BACK INTO ABS SOCKET?
	FAULTY ABS SUSIE	REPLACE ABS SUSIE
	FAULTY ABS POWER CABLE	CHECK/REPLACE (SEE TEST INFORMATION)
	FAULTY ABS ECU	REPLACE ABS UNIT
ABS WARNING LAMP IN TRACTOR CAB DOES NOT EXTINGUISH AFTER CIRCA 2 SECONDS, WHEN CONNECTED TO TRAILER WITH ABS FITTED	POWER FAULT	CHECK FOR 12 VOLTS ACROSS PINS 1 & 4 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 2 & 3 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 1 & 8 OF ABS POWER CABLE, AT ABS ECU END
		CHECK FOR 12 VOLTS ACROSS PINS 3 & 4 OF ABS POWER CABLE, AT ABS ECU END
	ABS SENSOR SHORT/OPEN CIRCUIT	CHECK BLINKCODE FOR SENSOR FAULT LOCATION (SEE LIST)
	ECU PROBLEM	CHECK BLINKCODE FOR 12 FLASHES - REPLACE IF NECESSARY
	ABS POWERED FOR EXTENDED TIME	TOW TRAILER AND CHECK THAT LAMP GOES OUT AFTER CIRCA 7 KM/H
ABS WARNING LAMP IN CAB GOES OUT AFTER CIRCA 2 SECONDS, BUT ILLUMINATES AGAIN WHILST DRIVING	ABS SENSOR AIR GAP	CHECK ABS SENSOR INSTALLATION, AND PUSH SENSOR UP TO ABS POLEWHEEL
	POLEWHEEL WOBBLE	CHECK ABS SENSOR AND POLEWHEEL INSTALLATION, AS WELL AS WHEEL BEARING
SYSTEM DOES NOT "EXERCISE" AFTER POWERING UP (NO CLICKING/CHUFFING AUDIBLE)	POWER FAULT	CHECK FOR 12 VOLTS ACROSS PINS 1 & 4 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 2 & 3 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 1 & 8 OF ABS POWER CABLE, AT ABS ECU END
		CHECK FOR 12 VOLTS ACROSS PINS 3 & 4 OF ABS POWER CABLE, AT ABS ECU END
	FAULTY ABS ECU	REPLACE ABS UNIT

## Troubleshooting Guide

Problem	Cause	Solution
WHEELS LOCK DURING BRAKING - NO ABS WARNING LAMP ILLUMINATED	TOO MUCH BRAKE PRESSURE	CHECK RELSV SETTINGS
	NO ABS SENSORS FITTED TO LOCKING WHEELS	ADD EXTRA ABS SENSORS TO LOCKING AXLE TO CONVERT TO A 4S/2M SYSTEM
WHEELS LOCK DURING BRAKING - ABS WARNING LAMP ILLUMINATED	POWER FAULT	CHECK FOR 12 VOLTS ACROSS PINS 1 & 4 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 2 & 3 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 1 & 8 OF ABS POWER CABLE, AT ABS ECU END
		CHECK FOR 12 VOLTS ACROSS PINS 3 & 4 OF ABS POWER CABLE, AT ABS ECU END
	ABS SENSOR AIR GAP	CHECK ABS SENSOR INSTALLATION, AND PUSH SENSOR UP TO ABS POLEWHEEL
POLEWHEEL WOBBLE	CHECK ABS SENSOR AND POLEWHEEL INSTALLATION, AS WELL AS WHEEL BEARING	

## Brake system Euro-Safe<sup>™</sup> Hydraulic System

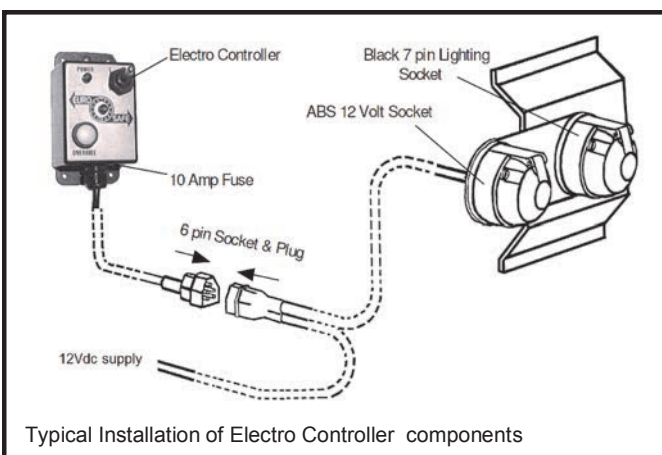
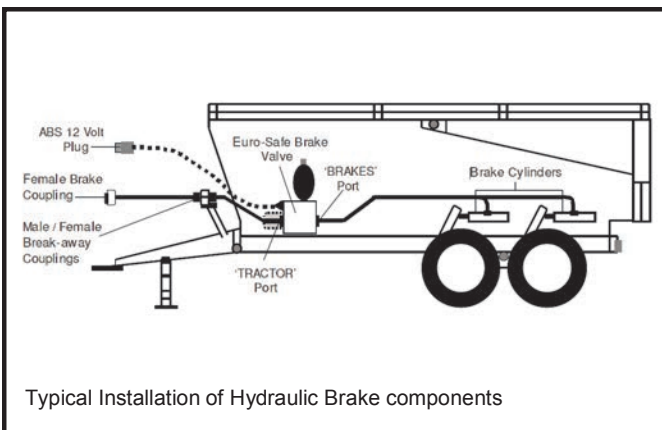
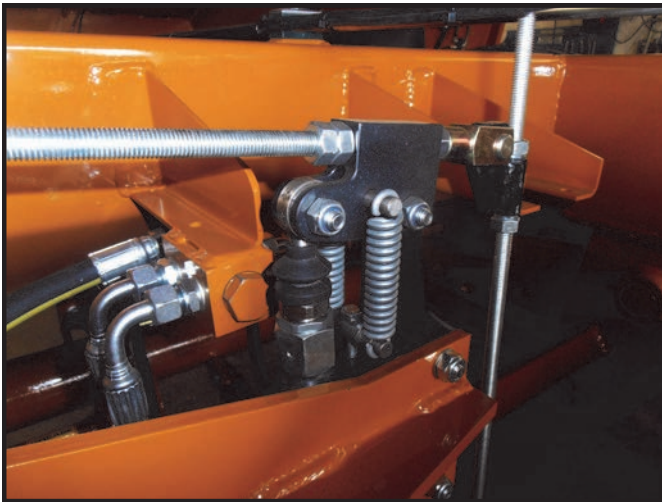
### General Description

The 'Euro-Safe' Automatic Fail-Safe/Emergency braking system is a dual line system, the service line is Hydraulic and the emergency line electric. It has been designed to fully comply with the revised EU Braking Regulations for towed trailers and implements travelling faster than 25 KPH.

The system provides automatic application of the trailer brakes in the event of the trailer becoming detached from the towing vehicle as well as a temporary parking brake.

The Euro-Safe brake valve is controlled by an Electro Controller located inside the cab of the towing vehicle. The use of the Electro Controller allows the operator, to fully control the trailers brakes, applying-releasing and overriding them without leaving his seat.

When applied the Euro-Safe brake valve delivers a brake pressure of 90-100Bar, which is essential when parking heavy trailers as the tractors parking brake is only designed to hold the weight of the tractor. A built in Safety Feature ensures that the trailer brakes do not release until the system has been fully recharged. An integrated high-pressure filter ensures no debris enters the system, which may cause malfunction or brake failure.



## Initial Setup

Operating the Euro Safe valve for the First time or after a major Service

Connect the trailer to the tractor.

Connect the hydraulic brake coupling and ABS brake plug to the tractor.

Unscrew all the brake pipes from the brake cylinders.

Place containers beneath each cylinder to recover any waste oil and debris exhausted from the cylinders.

With the Electro Controller switched 'OFF', start up the tractor, depress the tractors brake pedal for 10 seconds, this will flush the brake lines free of any debris that has entered the system.

Retighten the connectors and then bleed each brake cylinder individually making sure the system is air free.

Check tightness of all connectors and check for signs of any leakage.

Switch 'ON' the Electro Controller – the Red power light will illuminate and low-pressure warning buzzer will sound.

Allow the accumulator to charge by depressing the tractors brake pedal for 25-35 seconds (depending on oil temperature), until the trailer brakes release, the low-pressure warning buzzer stops and green light illuminates.

Keep brake pedal depressed for a further 10 seconds, the system is now ready for use.

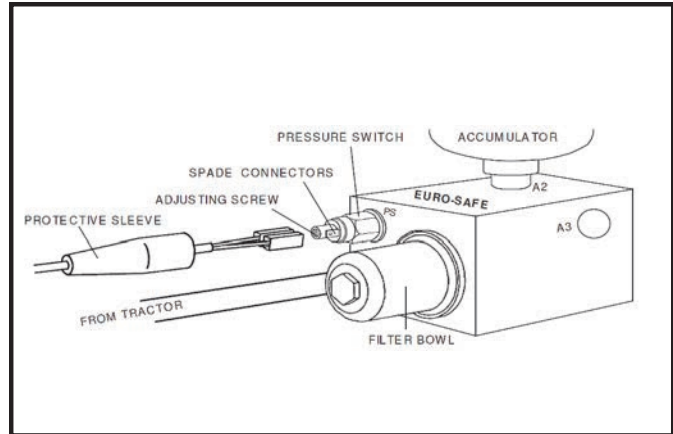
### Re-setting the Pressure switch

IF LOW PRESSURE WARNING BUZZER CONTINUES TO SOUND!

Check the tractors trailer-braking valve maximum pressure, if the maximum braking pressure is lower than 120 Bar, the valve needs repairing or replacing.

□

Reset the pressure switch to suit the tractors maximum trailer braking pressure.



**Note! The pressure switch is factory set and sealed. If seal is broken warranty for the unit becomes void.**

Pull back the protective sleeve from the pressure switch.

Switch 'ON' the Electro Controller in the cab.

Recharge the accumulator by depressing the tractor brake pedal for 30-40 seconds depending on oil temperature.

If low-pressure buzzer continues to sound slowly turn the adjusting screw anti-clockwise, until the trailer brake's release, buzzer stops and green light illuminates.

Turn the adjusting screw a further eighth of a turn anticlockwise ( $45^{\circ}$ ).

Switch 'OFF' the Electro Controller then repeat the above steps ensure the correct adjustment has been made.

Push the protective sleeve back over the pressure switch.

Test the trailer brakes: - Switch 'OFF' the Electro Controller – this applies the trailer brakes, slowly drive the towing vehicle forward, if trailer brakes are locked 'ON' – the system is working, If not: Check that the trailer brakes are fully adjusted replace worn parts if necessary.

If in doubt contact the manufacturer or your dealer.

## Brake system

### Euro-Safe <sup>(TM)</sup> Hydraulic System

#### Operation

When operating the tractor/trailer brakes under normal driving conditions oil from the tractors trailer brake circuit passes through the EURO-SAFE brake valve, applying the trailer brakes, in the usual way.

Oil stored in the accumulator is used for temporary parking and emergency braking only.

Operating the EURO-SAFE fail-safe/emergency brake valve: -

Connect trailer, hydraulic brake coupling and electrical brake ABS plug to the tractor.

Switch 'ON' the Electro Controller the red power light will illuminate.

If low-pressure buzzer sounds, recharge the accumulator by depressing the tractor brake pedal for 20 -30 seconds, until trailer brakes release, the buzzer stops, and the Green light illuminates.

**Note!** Keep brake pedal depressed for a further 10 seconds after green light illuminates this ensures that the accumulators are charged to maximum tractor pressure.

THE TRAILER BRAKES WILL APPLY WHEN: -

- a) The Electro Controller is switched 'OFF'
- b) The ABS plug is disconnected or the electrical power is lost or interrupted.

THE ACCUMULATOR PRESSURE AND THE BRAKES CAN BE RELEASED AT ANY TIME BY: -

- a) Switching the Electro Controller '**OFF**' - this will apply the trailer brakes.
- b) Push and hold the override button the Electro Controller, Red power light will illuminate

Alternatively twist and hold the Manual Override button mounted on the brake valve for 10 seconds. This will discharge the accumulator and release the trailer brakes.

**IMPORTANT!** Whilst driving if the green light goes out and the buzzer sounds . Push and hold the red override button until you can safely stop. □

If all electric supply to the tractor is lost the trailer brakes can be released by twisting the Manual Override button.

## Parking the Trailer

To park trailer with brakes applied.

The Trailer brakes will apply when the Electro Controller is switched 'OFF' or the electrical supply is interrupted or ABS plug removed.

To park trailer with brakes released

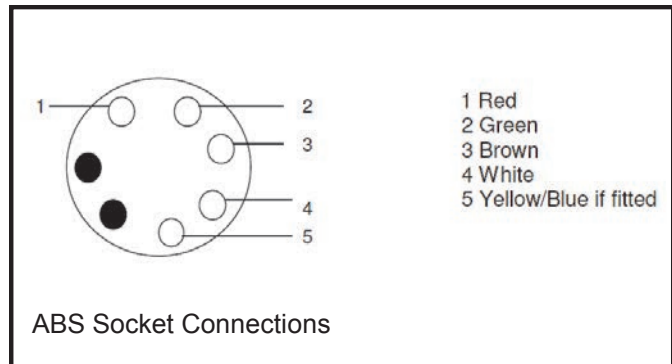
Switch the Electro Controller to 'OFF' - this will apply the trailer brakes.

Push and hold the override button the Electro Controller, the Red power light will illuminate. Alternatively twist and hold the Manual Override button mounted on the brake valve for 10 seconds, this will discharge the accumulator and release the trailer brakes.

**WARNING**



It is still legal requirement to have a mechanical parking brake fitted and working on agricultural trailers and implements, and should be used when parking the trailer up for long periods.

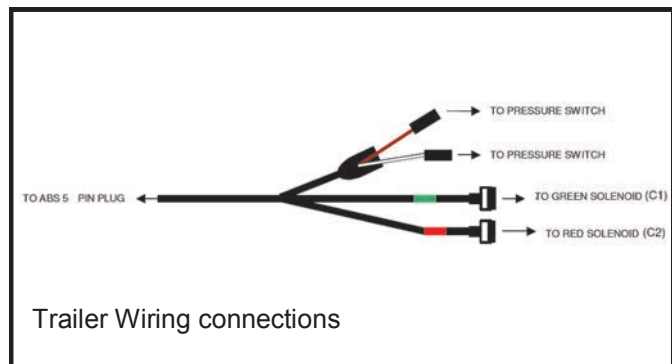


**ATTENTION!** it is still legal requirement to have a mechanical parking brake fitted to agricultural trailers and implements, and should be used when parking the trailer up for very long periods.

Or chock up the wheels securely, then release the mechanical parking brake or Euro-Safe brake valve. (This prevents the brake shoes sticking to the drum) **IMPORTANT! WHEN THE EURO-SAFE BRAKE VALVE IS FITTED TO A TRAILER THE BRAKES CAN ONLY BE OPERATED IF THE TRACTOR IS FITTED WITH THE ELECTRO CONTROLLER.**

It is **IMPORTANT** that the Male-Female breakaway couplings provided are fitted into the trailers brake line, which connects from the Euro-Safe brake valve to the Female brake coupling. (See diagram above) This ensures that if the trailer breaks away from the tractor accidentally the couplings automatically disconnect making sure no hoses are damaged and also preventing any oil spillage on to the highway. If trailer brakes are operated via the tractor spool valve: - Activate the spool valve until the system is fully charged, buzzer stops, green light illuminates and trailer brakes release.

Ensure that the spool valve pressure does not exceed 150 Bar or damage may occur to the trailer brakes.





# Brake system

## Euro-Safe (TM) Hydraulic System

### Adjusting the Minimum braking pressure

Unscrew Locknut B

Turn the Valve head A clockwise to increase the brake pressure or Counter clockwise to decrease.

Check the minimum pressure setting.

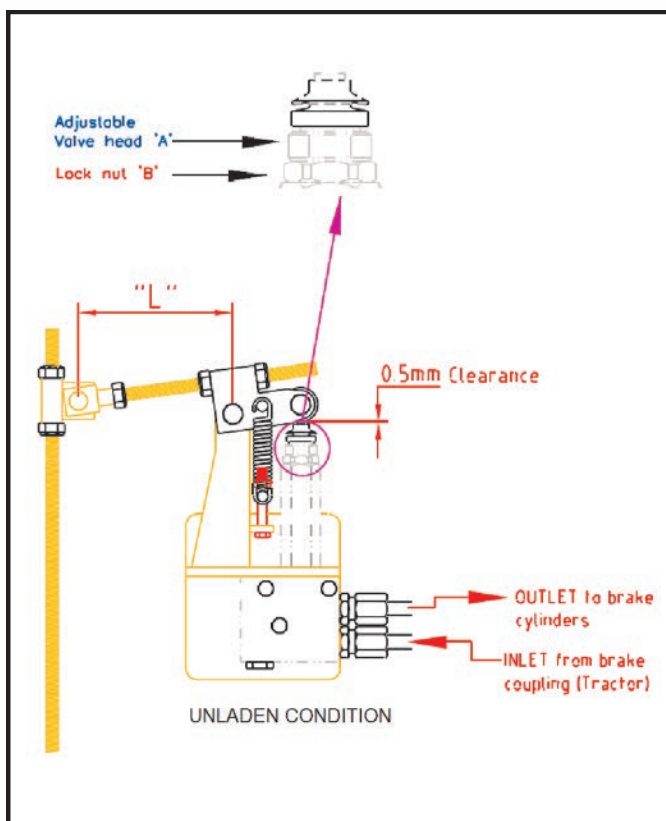
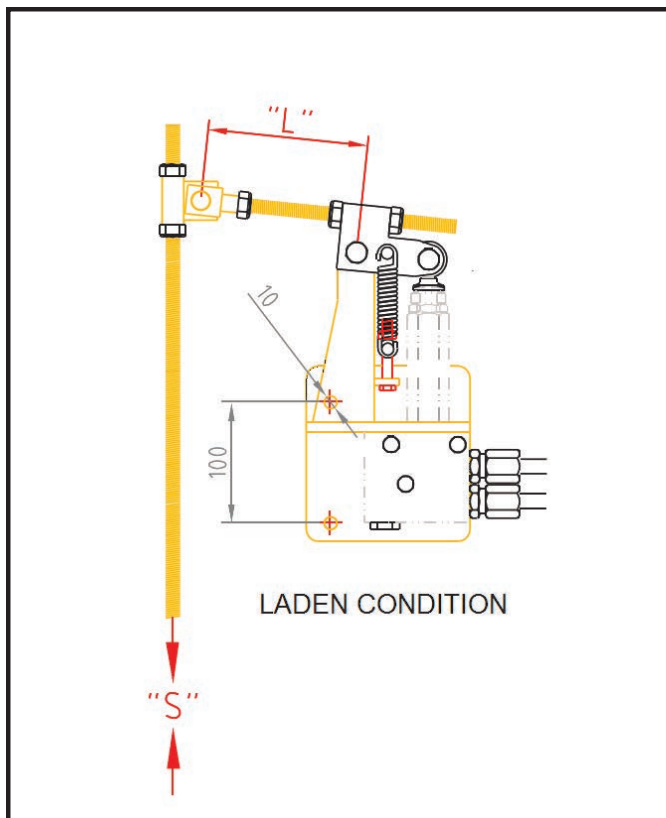
If satisfactory, retighten lock nut B

The same principles apply to the hydraulic system as earlier described for the Pneumatic system..

The load sensing valve should be set with the trailer sitting level. It should be checked when the trailer is first attached and re-checked whenever the trailer is connected to a different towing vehicle.

This is because any variation of the drawbar height will change the setting of the valve.

Note! For trailers fitted with the Heavy Duty (50mm thickness) spring the Distance L should be 70mm and for those fitted with the Light Duty (40mm thickness) the distance L should be 120mm.



## Troubleshooting Guide

Problem	Cause	Solution
LOW PRESSURE WARNING BUZZER ON ALL THE TIME: – TRAILER BRAKES WILL NOT RELEASE	PRESSURE SWITCH SET TOO HIGH	RESET PRESSURE SWITCH
	TRACTOR -TRAILER BRAKE VALVE NOT DELIVERING THE CORRECT PRESSURE	CHECK THE PRESSURE- IF THE MAX PRESSURE IS BELOW 120BAR REPAIR OR REPLACE TRACTOR-TRAILER BRAKE VALVE
	LOOSE CONNECTION, WIRING LOOM DAMAGED	CHECK CONNECTIONS - REPLACE WIRING LOOM
	<b>JOHN DEERE TRACTORS</b> TRAILER BRAKING PRESSURE TOO LOW <b>NEW HOLLAND, CASE , MF CLAAS TRACTORS</b> AIR IN THE TRACTOR BRAKE LINE CAUSING TRAILER BRAKE VALVE TO MALFUNCTION	ADJUST TRACTOR-TRAILER BRAKE VALVE PRESSURE TO 150 BAR MAX (REFER TO DEALER)  BLEED THE TRACTOR BRAKES, FIRST RIGHT SIDE THEN LEFT. TEST TRAILER BRAKING PRESSURE. IF LOWER THAN 120BAR CONSULT DEALER
LOW PRESSURE WARNING BUZZER SOUNDS WHILST DRIVING. <b>PRESS &amp; HOLD OVERRIDE BUTTON UNTIL YOU CAN SAFELY STOP</b>	PLUG & SOCKET TERMINALS CORRODED	CLEAN TERMINALS AND SPRAY WITH ANTI CORROSION COMPOUND
	PRESSURE SWITCH SET TOO HIGH	PRESS OVERRIDE BUTTON UNTIL YOU CAN SAFELY STOP THEN ADJUST PRESSURE SWITCH 1/4 TO 1/2 TURN ANTICLOCKWISE
	DEBRIS WITHIN SYSTEM CAUSING VALVES TO MALFUNCTION	REPLACE HIGH PRESSURE FILTER ELEMENT TAKE OUT VALVE C1 CLEAN THOROUGHLY AND FLUSH SYSTEM
TRAILER BRAKES WILL NOT RELEASE WITH SYSTEM CHARGED	RETURN FILTER BLOCKED WITHIN THE TRACTOR-TRAILER BRAKING VALVE	<b>JOHN DEERE TRACTORS</b> CLEAN OUT RETURN FILTER WITHIN TRACTOR TRAILER BRAKING VALVE
	TRAILER BRAKE COUPLINGS WORN RESTRICTING FLOW	REPLACE WITH NEW
	HIGH PRESSURE FILTER BLOCKED	REPLACE ELEMENT
	DEBRIS WITHIN SYSTEM CAUSING C2 VALVE TO JAM	REMOVE VALVE C2 CLEAN THOROUGHLY AND FLUSH SYSTEM
	TRACTOR - TRAILER WIRING LOOM OR PLUG & SOCKET DAMAGED	REPAIR OR REPLACE
NO POWER TO ELECTRO CONTROLLER	LOOSE CONNECTION OR WIRING LOOM DAMAGED	CHECK CONNECTIONS, REPAIR OR REPLACE LOOM
	BLOWN FUSE	REPLACE FUSE
ELECTRO CONTROLLER NOT FUNCTIONING CORRECTLY	WATER HAS ENTERED CONTROLLER	REPLACE CONTROLLER
TRAILER BRAKES DO NOT APPLY WHEN ELECTRO CONTROLLER IS SWITCHED OFF	PRESSURE SWITCH SET TOO LOW	RESET PRESSURE SWITCH
	TRACTOR - TRAILER VALVE NOT DELIVERING THE CORRECT PRESSURE	TEST TRAILER BRAKING PRESSURE. IF LOWER THAN 120BAR REPAIR OR REPLACE TRACTOR - TRAILER BRAKE VALVE . CONSULT DEALER
	TRAILER BRAKES NEED ADJUSTING	ADJUST,CHECK AND REPLACE WORN PARTS AS REQUIRED
	ACCUMULATOR PRE-CHARGE PRESSURE DEPLETED	REPLACE ACCUMULATOR

# Brake system

Problem	Cause	Solution
TRAILER BRAKES NOT GOING INTO "EMERGENCY", AFTER RED LINE REMOVED	KINKED PIPE IN LINE TO RELSV	CHECK ALL PIPES TO PORT 1 OF RELSV
	INCORRECT RED SUSIE COUPLING	CHECK COUPLING HAS NO SELF-SEAL VALVE
	RELSV EXHAUST PORT BLOCKED	ENSURE RELSV EXHAUST IS OPEN
ABS WARNING LAMP IN TRACTOR CAB ILLUMINATED WHEN NO ABS TRAILER CONNECTED	EARTH PROBLEM WITHIN TRACTOR'S ISO 7638 WIRING	CHECK ABS SOCKET FOR TOUCHING, LOOSE WIRES
		CHECK WIRING FROM ABS SOCKET TO CAB ABS WARNING LAMP.
ABS WARNING LAMP IN TRACTOR CAB DOES NOT ILLUMINATE WHEN TRACTOR CONNECTED TO TRAILER WITH ABS FITTED	ABS WARNING LAMP BULB BLOWN	REPLACE BULB
	ABS WARNING LAMP FUSE BLOWN	REPLACE FUSE (OFTEN 5 AMP)
	NO ABS SUSIE CONNECTED	CONNECT ABS SUSIE TO TRACTOR'S SOCKET
	FAULTY ABS SOCKET	IS PIN 5 PUSHED BACK INTO ABS SOCKET?
	FAULTY ABS SUSIE	REPLACE ABS SUSIE
	FAULTY ABS POWER CABLE	CHECK/REPLACE (SEE TEST INFORMATION)
	FAULTY ABS ECU	REPLACE ABS UNIT
ABS WARNING LAMP IN TRACTOR CAB DOES NOT EXTINGUISH AFTER CIRCA 2 SECONDS, WHEN CONNECTED TO TRAILER WITH ABS FITTED	POWER FAULT	CHECK FOR 12 VOLTS ACROSS PINS 1 & 4 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 2 & 3 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 1 & 8 OF ABS POWER CABLE, AT ABS ECU END
		CHECK FOR 12 VOLTS ACROSS PINS 3 & 4 OF ABS POWER CABLE, AT ABS ECU END
	ABS SENSOR SHORT/OPEN CIRCUIT	CHECK BLINKCODE FOR SENSOR FAULT LOCATION (SEE LIST)
	ECU PROBLEM	CHECK BLINKCODE FOR 12 FLASHES - REPLACE IF NECESSARY
	ABS POWERED FOR EXTENDED TIME	TOW TRAILER AND CHECK THAT LAMP GOES OUT AFTER CIRCA 7 KM/H
ABS WARNING LAMP IN CAB GOES OUT AFTER CIRCA 2 SECONDS, BUT ILLUMINATES AGAIN WHILST DRIVING	ABS SENSOR AIR GAP	CHECK ABS SENSOR INSTALLATION, AND PUSH SENSOR UP TO ABS POLEWHEEL
	POLEWHEEL WOBBLE	CHECK ABS SENSOR AND POLEWHEEL INSTALLATION, AS WELL AS WHEEL BEARING
SYSTEM DOES NOT "EXERCISE" AFTER POWERING UP (NO CLICKING/CHUFFING AUDIBLE)	POWER FAULT	CHECK FOR 12 VOLTS ACROSS PINS 1 & 4 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 2 & 3 OF ABS SOCKET
		CHECK FOR 12 VOLTS ACROSS PINS 1 & 8 OF ABS POWER CABLE, AT ABS ECU END
		CHECK FOR 12 VOLTS ACROSS PINS 3 & 4 OF ABS POWER CABLE, AT ABS ECU END
	FAULTY ABS ECU	REPLACE ABS UNIT

Problem	Cause	Solution
FEMALE BRAKE COUPLING WILL NOT CONNECT TO TRACTOR. EXCESS RESIDUAL PRESSURE IN BRAKE LINE	DISCONNECTED THE HYDRAULIC LINE BEFORE THE ELECTRICAL LINE	DISCONNECT THE ELECTRICAL LINE BEFORE THE HYDRAULIC LINE
	BACK PRESSURE IN TRAILER BRAKE LINE	RELEASE PRESSURE, DISCONNECT BREAKAWAY COUPLING AND RECONNECT.
	DEBRIS CAUSING VALVE MALFUNCTION	REMOVE VALVE C2 CLEAN THOROUGHLY AND FLUSH SYSTEM



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