LOWLANDER MANURE SPREADER

INSTRUCTIONS AND SPARES MANUAL

HD MK2 & WIDEBODY RANGE
MODELS 150HD, 175HD, 180WB & 230WB

For spare parts please call:
Telephone: +44 (0)1362 860352
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E-mail: mail@gtbunning.co.uk
Website: www.gtbunning.co.uk

Version: 2020 V1.0

DEALERS STAMP

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.

Thank you for buying a Bunning spreader. For your 3-year Bunning guarantee please fill in the form below and return it to GT Bunning & Sons Ltd.

LOWLANDER WARRANTY REGISTRATION FORM	
Customer Name	
Company Name	
Address	
Post Code	
Telephone	
Fax	
Email	
Machine ID Number	*(Example: 9999)*
Machine Type	MSL ☐ TVA ☐HBD
Date of delivery	
Dealer	

Important Data Protection Information.
We or our business partners may contract you by mail, telephone, e-mail or other electronic messaging services with offers of goods and services or information that may be of interest to you.
By providing us with your telephone number or e-mail address you consent to being contacted by these methods.
If you do not wish to receive marketing information by these methods from GT Bunning or our business partners, please tick this box. ☐

GT Bunning & Sons Ltd
The Green
Gressenhall, Dereham
Norfolk
NR20 4DT ENGLAND

Bunning Lowlander HD MK2 & WIDEBODY

Pre-Delivery Inspection sheet

The purpose of this document is to ensure that the operator, hirer or owner is fully appraised of all safey guidelines and operating and maintenance methods before taking possession of the machine.

GENERAL		
1	Ensure the operator receives a copy of the instruction & spares manual.	
2	Draw attention to the safety decals located on the machine.	
3	Explain the functions of the machine.	
4	Locate, identify & explain spreader to towing vehicle air ,hydraulic and electric connectors.	
5	Check oil level of floor drive gearbox and auger drive gearbox.	
6	Explain how to cut the PTO guard to size and where to fit the safety chains.	

LIGHTING		
12	Check operation of lights	
13	Check condition of cabling & 7 pin connector.	

BRAKING		
7	Check operation of parking brake.	
8	Check operation of service brake.	

HYDRAULICS & PNUEMATICS		
14	Check hydraulic hose condition especially brake hoses & connectors.	
15	Check hydraulic cylinder for leaks and damage.	
16	Check air system hose condition and connectors. (Option).	

STRUCTURE		
9	Check condition of body, drawbar & augers	
10	Check condition of all cylinders & pins.	
11	Grease all points if necessary.(see manual).	

WHEELS & TYRES		
17	Check condition of tyres.	
18	Ensure tyre pressures are correct for speed & load.	
19	Check wheel nut torque. (Check daily for first week of use)	

DATE:	SIGNATURE	
I have received a copy of the instruction & spares manual and understand the method of operation, the safety requirements and the maintenance methods.		OPERATOR
I have given basic instruction in the method of operation, the position of safety stickers and methods of maintenance, and ensured that the owner/operator is in possession of the Manual.		DEALER

CHASSIS SERIAL NUMBER..... MSL.....

** THIS MANUAL IS THE ORIGINAL INSTRUCTIONS **

PREFACE

The instructions in the 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, operating instructions and maintenance.

The use of spare parts, accessories and additional equipment which is not originally manufactured checked and release by GT Bunning 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 and could invalidate warranty.

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

Technical specifications, dimensions and weights are given with the usual tolerances (+ or – 2%).

GT Bunning Ltd operates a policy of continual improvement as such some items in this manual may differ slightly from that of your machine. GT Bunning reserves the right to make changes to the machine or manual without notice. If in any doubt regarding any aspect of the design or operation of this machine, contact GT Bunning Ltd or your GT Bunning Ltd agent for clarification.

HOW TO USE THIS MANUAL

The manual contains sections that cover all of the following, Safety, Operating instructions, 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 should 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.

This manual should always stay with the machine/operator.

OPERATING ON PUBLIC ROADS (UK)

Before operating on public roads, the spreader must be correctly connected to the towing vehicle, the lights must be connected, and function of the lighting equipment must be checked. The braking system of the spreader must be correctly connected to the towing vehicle and checked for correct operation.

Remember:

- **Maximum gross combination weight is 31000kg and maximum gross spreader weight is 18290kg.**
- **If your spreader is not wider than 2.55m your maximum speed is 25 mph.**
- **If your spreader is wider than 2.55m and up to 3.5m your maximum speed is 25 mph.**
- **If your spreader is wider than 3.5m your maximum speed is 12 mph, and this includes having an attendant. Police dispensation is also required.**

INTRODUCTION

This manual provides information on the use, adjustment and servicing of the GT Bunning range of Lowlander spreader.

Following the advice on the correct maintenance and servicing procedures will ensure maximum performance and a long service life of 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 Lowlander spreader was originally designed.

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 oxyacetylene cutting equipment is to be used.

The wheels and tyres, hydraulic 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.

G.T.BUNNING & SONS LIMITED

MANURE SPREADERS

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EC MACHINERY DIRECTIVE
2006/42/EC
DECLARATION OF CONFORMITY

We hereby certify that the machinery stipulated below complies with all the relevant provisions of the EC Machinery Directive 2006/42/EC & regulations adopting the Directive.

Modifications to this machine without prior written approval from the undersigned will render the declaration null & void.

Machine Description: Unbalanced trailer for the carriage & application of manure

Machine Type: Agricultural manure spreader

Model: **Lowlander MSL TVA**
Lowlander MSL HBD

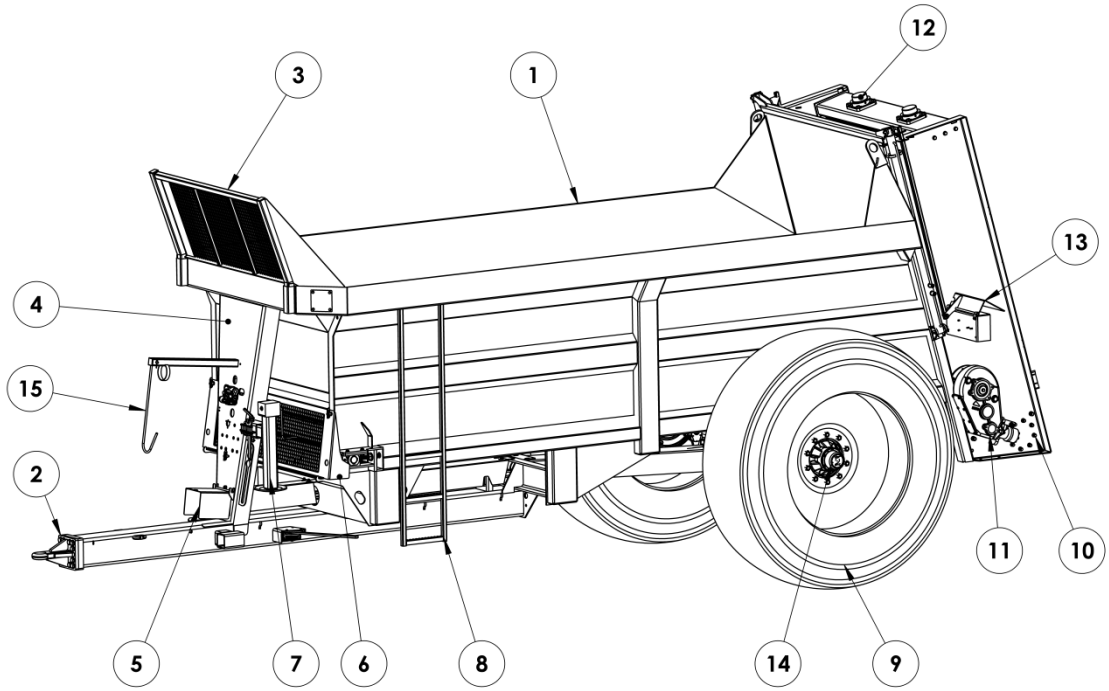
Serial Number: **Year:**

Standards used.
BS ISO 4251-1:2005+A1:2012, BS EN ISO 12100-1:2010, BS EN ISO 4254-1:2015, BS EN 690: 2013, BS EN 15811:2014, BS EN ISO 13857:2008, BS EN 349:1993+A1:2008, BS EN 12965:2003+A2:2009, BS EN 150 14120:2015, BS EN ISO 5674:2009, BS EN ISO 4413:2010, BS EN ISO 4414:2010

Signed: S M Day
Name: Sarah M. Day

Date :
Position: Managing Director

MACHINE OVERVIEW



KEY	QTY	DESCRIPTION
1	1	BODY
2	1	DRAWBAR
3	1	STONE GUARD
4	1	FRONT PILLAR
5	1	PTO DRIVE LINE
6	1	FINGER GUARD
7	1	SUPPORT LEG
8	1	LADDER
9	2	WHEEL & TYRE ASSEMBLY
10	1	AUGER GEARBOX
11	1	FLOOR DRIVE GEARBOX, MOTOR AND VALVE
12	2	AUGERS
13	2	AUTO LAMP ASSEMBLY
14	1	AXLE
15	1	PTO STOWAGE

1. OPERATING INSTRUCTIONS

The intended purpose of the vehicle is to tow and spread manure and other materials.

1.1 HITCHING TO TRACTOR

Attach spreader to pick-up hook or static hitch stub. Do not attach to swinging drawbar or pick-up hook in extended position.

Remove screwjack from drawbar (if fitted) and locate in the transport position provided at the front of spreader.

1.1.1 CUTTING PTO SHAFT TO SIZE

Turn off the tractor and remove key before fitting PTO.

1. Slide the tractor end of the PTO shaft out and fit to the tractor PTO.
2. Lay the two halves of the PTO shaft alongside one another and mark the required lengths, allowing for turning. Maximum pull out of 300mm (12 inches) of the 2 shafts.
3. Cut to size and clean the burrs at each end of the shaft

   KEEP SHAFT SLIDING SURFACES GREASED.

Attach chains fitted to PTO guard (to prevent the rotation of the guard) to suitable point on the tractor and the staple on the drawbar.

Ensure that the spring loaded pins in splined yokes are fully locked in position.

Always disengage the PTO when turning sharply to avoid damage to shafts universal joints. Where a wide Angle PTO is fitted, attach this end to the tractor.

1.2 COUPLING OF HYDRAULIC HOSES

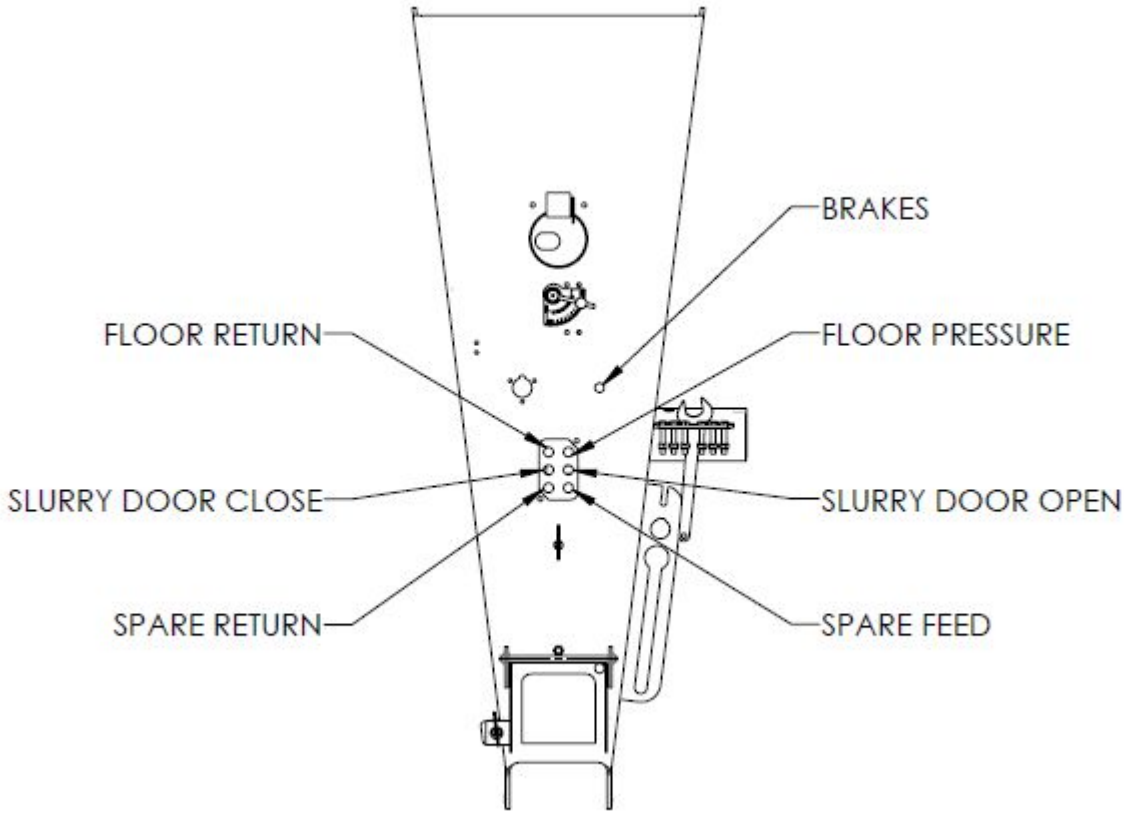
Fit the two hoses for the floor drive hydraulic motor (one to feed and one for return) to double spool valve on tractor. Choose position of spool lever for ease of control to obtain floor movement to rear. Reversing of floor is done by selecting the opposite position of the hydraulic control lever. Universal quick release probes are fitted as standard to hose ends. Mark hose as required to assist in the future coupling for correct position of feed and return.

NOTE: CHECK DIRECTION OF FLOOR BEFORE LOADING.
Do not run floor in reverse with full load. Speed of floor in reverse is at **MAXIMUM**.
Only reverse floor for a few seconds.

When a slurry door is fitted connect the hydraulic hoses to a double spool valve and select the hose positions to suit the operator to open and close the door.

Fit hydrualic brake hose to trailer brake valve on tractor (male fitting). A universal female brake coupling is fitted as standard to the hose end.

Ensure the braking system is connected and that it functions correctly before moving.



1.3 HANDBRAKE

The handbrake is a multi-stroke ratchet type. To apply the handbrake give the handle short pumps (a clicking of the ratchet will be heard) until resistance occurs and subsequent tightening of the cable. To release the handbrake give the handle one sharp movement in the opposite direction. This releases the ratchet mechanism.

1.4 BRAKE ADJUSTMENT

1.4.1 HYDRAULIC BRAKES

Brake adjustment is carried out at the hydraulic brake ram unit fitted to each wheel axle giving independent adjustment to each wheel. To adjust, jack up the spreader, slacken the locknut in the set screw and turn the set screw clockwise. (See Section 6.2 HYDRAULIC BRAKE SYSTEMS)

BEWARE NOT TO OVER ADJUST. Make sure the wheel can rotate freely.

1.4.2 AIR (PNEUMATIC) BRAKES

See Section 6.3 AIR (PNEUMATIC) BRAKE SYSTEMS.

1.5 FLOOR ADJUSTMENT

When adjusting floor chains ensure that the adjustment is carried out equally to both sides.

DO NOT ALLOW THE CHAINS TO BECOME TOO SLACK.
ADJUST CHAINS AFTER A FEW LOADS.
KEEP CHAINS ADJUSTED CORRECTLY AT ALL TIMES, A GUIDE IS TO BE ABLE TO SEE A WHOLE LINK BELOW FRONT BOTTOM EDGE OF SPREADER i.e. FROM CENTRE TO FRONT.

Reversing the floor
The floor should only be reversed for very short periods, to clear the augers.
Do not reverse if the floor chain is slack, tighten floor chain first.

1.6 METHOD OF OPERATION

1) Select speed of floor required on control valve.
2) Engage PTO to power the rear augers – tractor engine revs low.
3) Raise slurry door fitted.
4) Engage spool valve to power floor to rear.

1.7 SLURRY DOOR

As the load height reduces lower the slurry door to cover the augers. This will help prevent foreign objects being thrown forward.

1.8 INSTALLATION AND GENERAL USE OF DETACHABLE SPINNER DECK

1.8.1 GENERAL USE

The detachable spinner deck is designed purely for wider spread patterns and low application rates of between 1 and 3 tonnes per acre (2 ½ to 7 ½ tonnes per hectare). It must **NEVER** be used to spread long straw-based materials or heavy applications beyond 5 tonnes per acre.

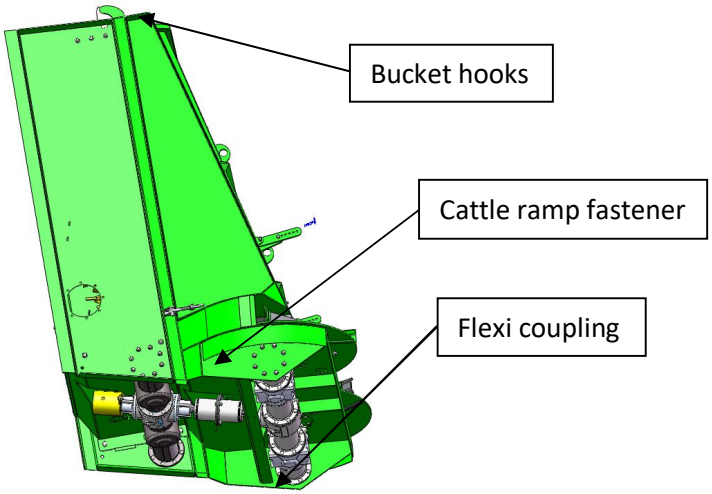
1.8.2 INSTALLATION

When fitting or removing the spinner deck assembly great care must be taken not to endanger an assistant in any way, especially when raising or lowering the unit. Persons must not be put at risk.

Before making any adjustments, fitting or removing attachments, the tractor that the spreader is attached to must be switched off and the key removed.

FITTING THE SPINNER DECK – See Section 8.8 (DETACHABLE SPINNER DECK) for parts list.

1. Remove guard from output spigots of the auger gearbox.
2. Slide one half of 'flexi coupling' onto the shaft, through shaft of spinner gearbox.
3. Slide other half of the 'flexi coupling' on the input spigot of the spinner gearbox.
4. Using approved lifting apparatus lift the complete spinner deck assembly using lower lifting eye on canopy (ensure bolt & nuts No. 20/20 and 16/18 are securely in place).
5. Offer the assembly to rear of the machine and lower into position. Firstly, locate the 'bucket hooks' of deck into clevises at the top rear corners of the spreader.
6. Hinge hook bolt No. 14 into anchors and tighten.
7. Fit and tighten 4 bolts to join the two halves of the flexi coupling.
8. The machine is now ready for use with the spinner deck.



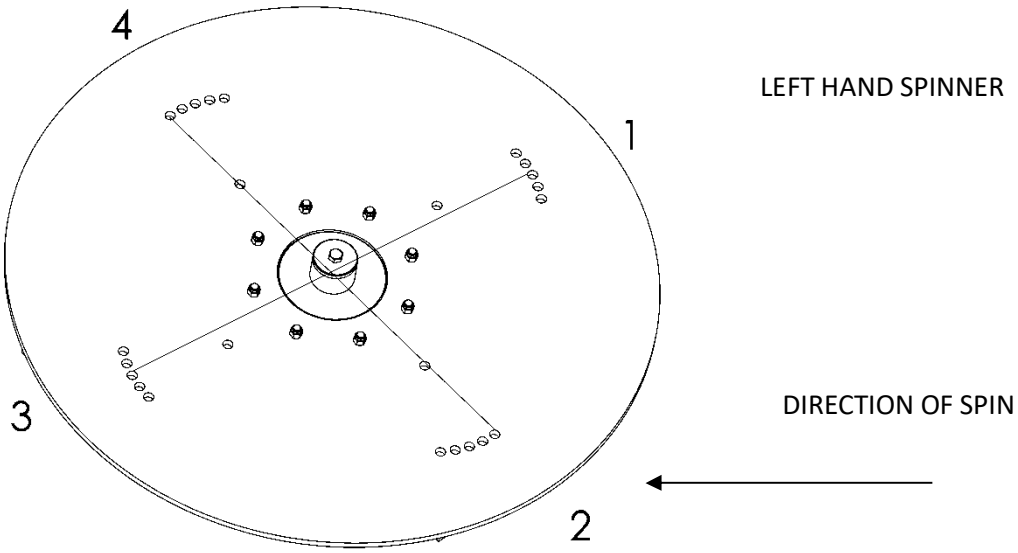
REMOVING THE SPINNER DECK

1 Clean all material from spinners and decks.
2 Remove 4 bolts from the flexi coupling.
3 Loosen hook bolts No. 14 and hinge back to clear anchors.
4 Using approved lifting apparatus lift from lower lifting eye on the canopy firstly pulling the bottom of the deck assembly away from rear of spreader to the clear auger blades.
5 Lift the assembly clear of the spreader and stand on level ground with the front of the assembly close to, or against a wall or stable object.
6 Fit the shaft cover to the output spigot of the spreader beater gearbox.
7 The machine is now ready for use without spinner deck.

ADJUSTMENT OF CANOPY & BLADES

<u>For the best results</u>

1 Fix the canopy on the inner positions for light materials i.e. Poultry manure.
2 For heavy material i.e. slurry or sludge adjust canopy out as far as possible so as not to deposit material beyond the deck into gaps between the discs.
3 To increase the width of the spread pattern adjust the angle of blades forward on the disc.
4 If the spread pattern is light immediately behind the machine adjust the angle of the blades back.
5 It is possible to achieve an even spread by adjusting blades as opposing pairs. i.e Blade 1 and 3 in position 3 and blade 2 and 4 in position 1.



1.9 OPERATING INSTRUCTIONS FOR HORIZONTAL BEATERS

1.9.1 GENERAL USE

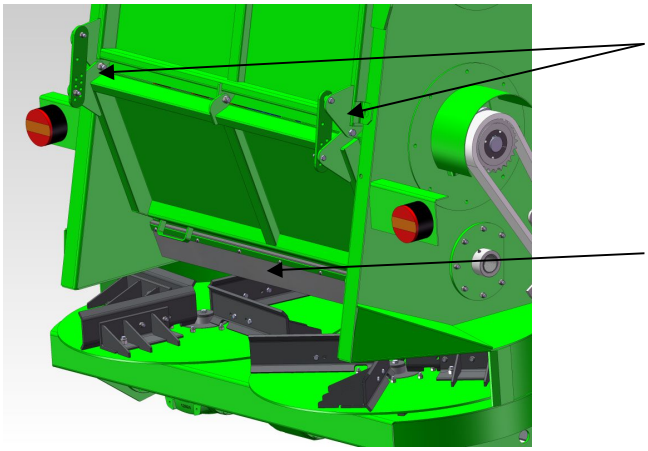
The horizontal beater with spinner discs is designed primarily for wider spread patterns and lower application rates for product such as chicken and turkey manure, however long straw based materials can be spread effectively. It must be expected that application rates maybe slower than a vertical auger spreader.

1.9.2 ADJUSTMENTS FOR SPREAD PATTERNS

The position of the lower section of rear canopy and the angle of the blades on the discs will affect the spread pattern and width.

Select a hole position that places the rubber strip over the middle of the discs for a lighter application rates and wider widths. Adjust the hole position to move the rubber strip rearwards for higher application rates e.g. for straw-based materials. Excessive rearward adjustment will cause the material to miss the discs and hit the ground without being spread.
Each spinning disc is supplied with 2 blades on and the others loose; it has been proven that many materials are spread more effectively with just 2 blades per disc.

1. To increase the width of the spread pattern, adjust the angle of blades forward on the disc.
2. If the spread pattern is light immediately behind the machine adjust the angle of the blades back.
3. It is possible to achieve an even spread by adjusting the blades, as opposing pairs. i.e. Blade 1 and 3 in position 3 and blade 2 and 4 in position 1.
4. When adjusting angle use the 2nd set of holes on the blade to keep the tip of the blade on the edge of the disc



1.10 WEIGH CELL SETUP GUIDE – ISOCAN & ISOBUS

1.10.1 BUNNING CUSTOM SETUP

This part of the setup is done at the factory and **MUST NOT** be changed at any time. If required, it must only be performed by an authorised Bunning personnel.

1.10.2 VALVE SETUP

It is highly recommended to update the valve calibration if you change tractors.

It is very important to firstly turn the tractor oil down to 50% in forward and reverse.

From the main spread screen, scroll to the **MAIN MENU:**

Then **FACTORY** icon and enter the PIN: **1234** **(OK)**

FACTORY MENU:

CHANNELS: (OK)

Then **FEEDBACK** **(OK)** This must be set to the required MACHINE GEARBOX combination. See the value on the following GEARBOX & MOTOR CONFIGURATION table.

Then **VALVE SETUP (OK)**

Then **VALVE AUTO CAL** **(OK)**

1. Lift slurry door to clear the floor slats
2. Set the engine to normal operating RPM then **(OK)** when you have set it
3. You should be on the **BELT VALVE AUTO:** screen
4. Click floor hydraulic spool into work
5. With the **MIN DUTY** highlighted, using the ↑ ↓ in the top right of the screen, increase the **PWM %** until you see the **LIVE FEEDBACK: RPM** showing a reading of **0.1 - 0.0 RPM** and you can just see the floor is just turning then press **(OK)**.
6. Select **MAX DUTY:**
7. Run the **PWM %** to 100% and press **(OK)**
8. The **MAX DUTY RPM** should match the approximate rpm of floor shaft on the GEARBOX & MOTOR CONFIGURATION table for the machine, gearbox and motor combinations. If not, then the tractor oil flow **MUST BE REDUCED** until it does.

   As the oil flow on the tractor is reduced in stages, press **(OK)** on the RDS screen to confirm and recalculate the **RPM**

   Once the required **MAX DUTY: RPM** has been achieved, then the valve calibration is complete.

GEARBOX & MOTOR CONFIGURATIONS															
GEARBOX TYPE	**RT350 /50**	**RT500/50**			**RT800/60**							**RT1000/70**			
BRAND VALVE (LTRS/MIN)	**57**	**57**	**76**	**114**	**57**	**76**	**114**	**57**	**76**	**114**	**114**	**76**	**114**	**76**	**114**
ADAN MOTOR SIZE (CC)	**200**	**200**	**200**	**200**	**200**	**200**	**2 x 200**	**250**	**250**	**250**	**2 x 250**	**200**	**200**	**250**	**250**
FLOOR SHAFT SPEED (RPM)	**9**	**6.5**	**8.7**	**13**	**9**	**12**	**9**	**7.2**	**9.6**	**14.4**	**7.2**	**9.8**	**14.7**	**7.9**	**11.8**
FEEDBACK PPR:	**1024**														

1.10.3 WEIGH CELL CALIBRATION

From the main spread screen, scroll to the **MAIN MENU:**

Then **FACTORY** icon and PIN: **1234** **(OK)**

FACTORY MENU:

LOADCELL INTERFACES: **(OK)**

Check that **FUNCTION:** is set at **CAN MODULE 1**

If not then select **FUNCTION** and use ← → to select it.

With the machine empty and on a LEVEL SURFACE select **ANGLE SENSOR** **(OK)**

Use the ↻ icon to rotate the junction box to the front of the spreader icon.

Press the **TARE** button to ZERO the **ANGLE SENSOR**

Press **ESC** The weigh cells can now be calibrated.

Select **LOADCELL CALIBRATION (OK)**

Follow the on-screen instructions. **IS THE SPREADER EMPTY? (YES)**

PRESS OK TO SET TO ZERO

CONFIRM-> 0kg press **(OK)**

Press **ESC** to return to **IS SPREADER EMPTY?**

Press **NO** and add your known weight

Select **ACTUAL WEIGHT (Kg) 0Kg** and enter the weight in kg and **(OK)**

Press **ESC** to go to main spread screen to check the weight in the machine

1.10.4 SET THE SHAFT SENSOR ALARMS

NOTE: HBD machine has 2 sensors: 1 mounted on the PTO shaft behind front bulkhead, and 1 mounted on the top horizontal beater

TVA machine has only 1 sensor mounted on the PTO shaft behind the front bulkhead.

From the main spread screen, scroll to the **MAIN MENU:**

In the middle right hand side select the **BELL/ALARM** icon

Select **RPM1 Lo:** **(OK)** and enter an RPM of **100** **(OK)**

HBD MACHINES ONLY:

Select **RPM2 Lo:** **(OK)** and enter an RPM of **100** **(OK)**

The alarms have been set, press **ESC** to go back to the main spread screen.

1.11 LOAD CELL DIAGNOSTICS

There are several things that can be checked to diagnose load cell issues.

1.11.1 INSTRUMENT DIAGNOSTICS

1.11.1.1 In "Diagnostics – Loadcell Interfaces" is there a voltage and weight reading?

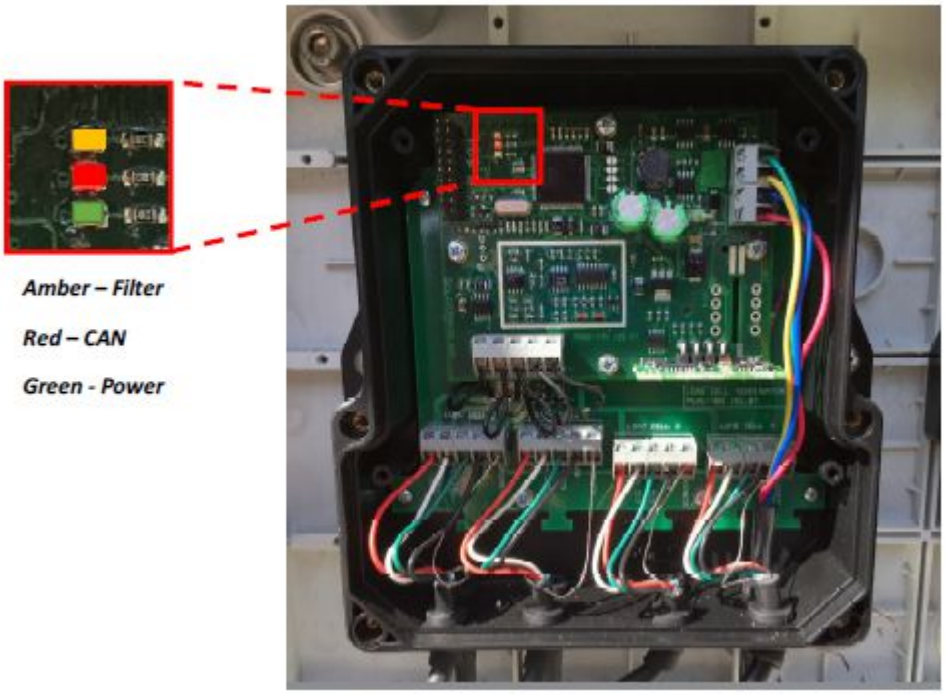
- YES & Wrong – It could be the angle sensor or loadcells – **1.11.1.2**
- NO – It could be an issue with the loadcells or the CAN communication - **1.11.1.2**

1.11.1.2 Is there an angle reading in "Diagnostics – Angle Sensor"?

- YES & Correct – It is likely to be a problem with the load cells – **1.11.3**
- YES & Wrong – Re-calibrate the angle sensor on level ground
- NO – It is likely there is a problem with the general CAN communication – **1.11.2**

1.11.2 CAN DIAGNOSTICS

1.11.2.1 Open the Loadcell Interface and check if there is a constant green power light.

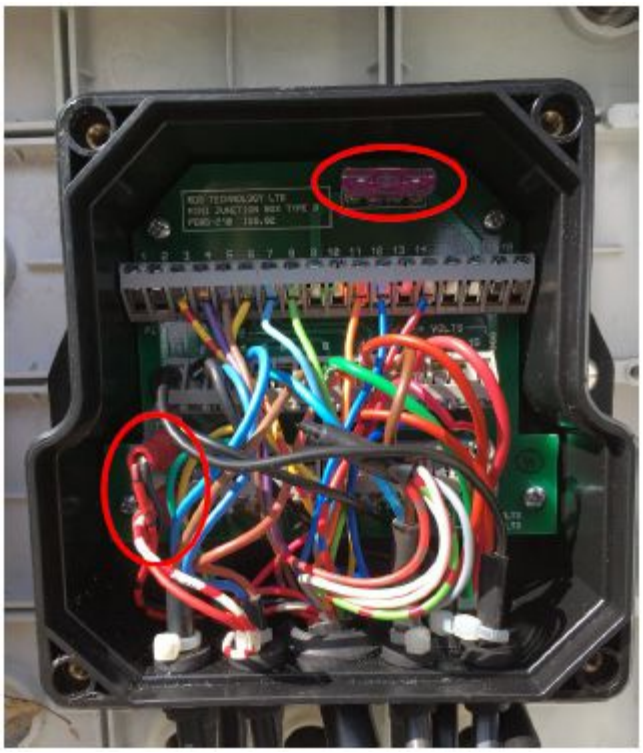


- YES – Power supply is correct – **1.11.2.2**
- NO – No Power – **1.11.2.3**

1.11.2.2 Check if the red CAN communication light is flashing (just above green power light)

- YES – It is likely to be a problem with the load cells – **1.11.3**
- NO – There is a problem with the CAN connection in the load cell interface or the head-unit. – **1.11.4**

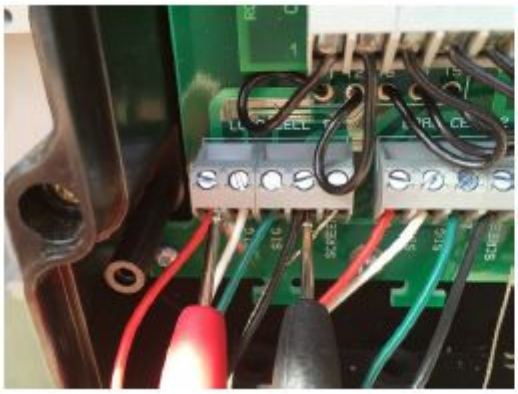
1.11.2.3 Open the Type-C junction box and check the input power (12v) and fuse is OK. If not, change fuse/check cabling and main power supply.



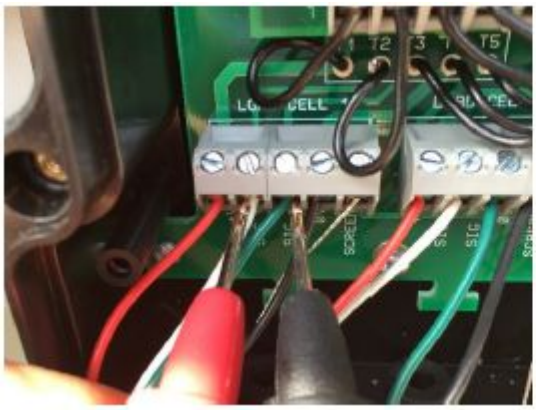
1.11.3 LOADCELL DIAGNOSTICS

A multi-meter will be needed for these tests, capable of reading in V and mV. 

1.11.3.1 Measure between the red (+v) and black (0v) wire on one of the loadcell inputs, it should be 5v. If not, then there is an issue with the power supply to the cells.

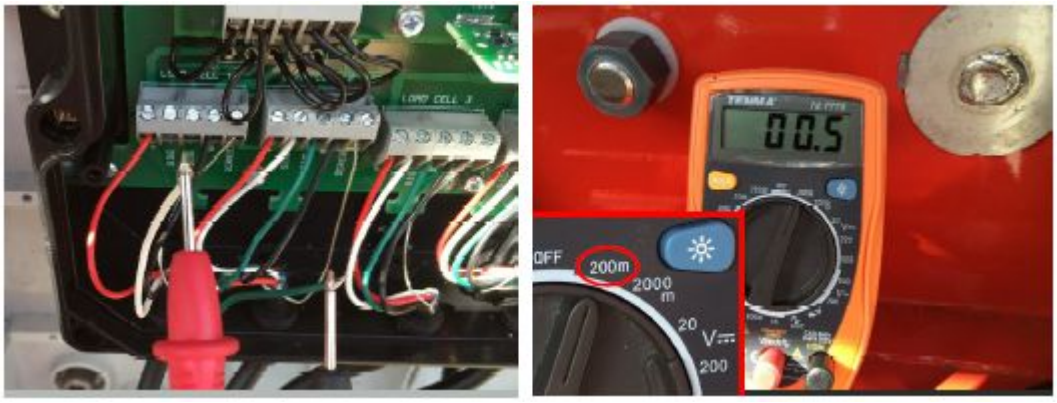


1.11.3.2 Measure between the white (Sig +) and green (Sig -) wires (any input can be used as they are all summed together on the board)



- Typical Reading – 0-10 mV (0.4mV was an empty 5m3, 5t spreader with 4 cells, this showed as 0.385 in the Loadcell Diagnostics)
- Anything around 30mV would be unusual
- Anything around 100mV would indicate a failure of a load cell
- 0v exactly would be strange because the cells should be loaded by the hopper even when empty
- Anything negative would also indicate a failure

1.11.3.3 If an unusual reading is measured, then each cell will need to be tested separately. Remove the white (Sig +) and green (Sig -) wires for one cell and measure the reading.



The same guidelines apply as in **1.11.3.2**. Measure each load cell one by one, in the same way, and check to see if any are giving a very different reading to the others.

1.11.3.4 To double check any cells that are suspected of being faulty, the impedance (resistance) can be measured in two places, Input and Output.

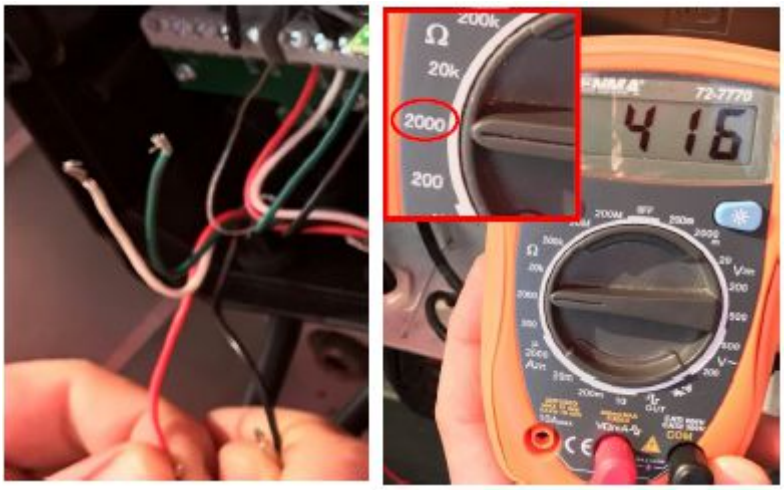
If they are functioning correctly the measured value (Ohms) should not fall outside of the specified ranges below, regardless of weight on the cells.

All four wires should be removed from the cell before the readings are taken as follows:

- **Input**: Red and Black wires
- **Output**: Green and White wires

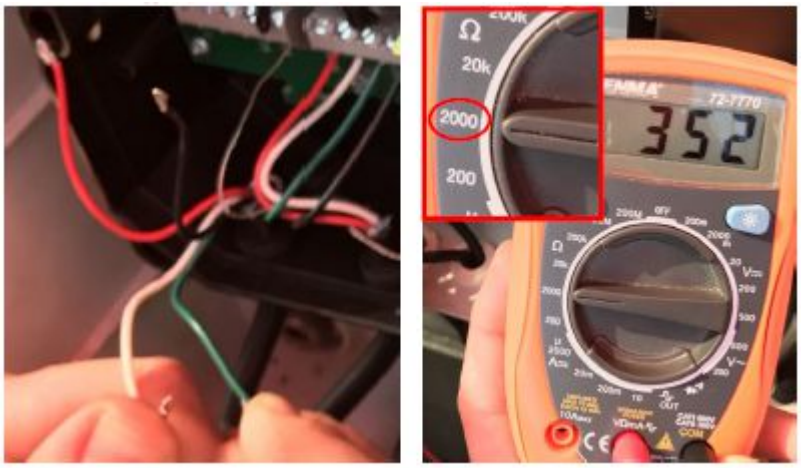
Input

- 20t Standard Output: 410783, 410784 = 410Ω +/- 25Ω
- 20t Low Output: 410785 = 726Ω +/- 25
- 13t Standard: 407312 (S/SR/500-2-089), 407498 (S/SR/500-2-090) = 410Ω +/- 25Ω
- 13t Low Output: 407376 (S/SR/500-2-093) = 726Ω +/- 25



Output

- 20t (all types): 410783, 410784, 410785 = 354Ω +/- 3Ω
- 13t (all types) 407312, 407498 and 407376 = 354Ω +/- 3Ω

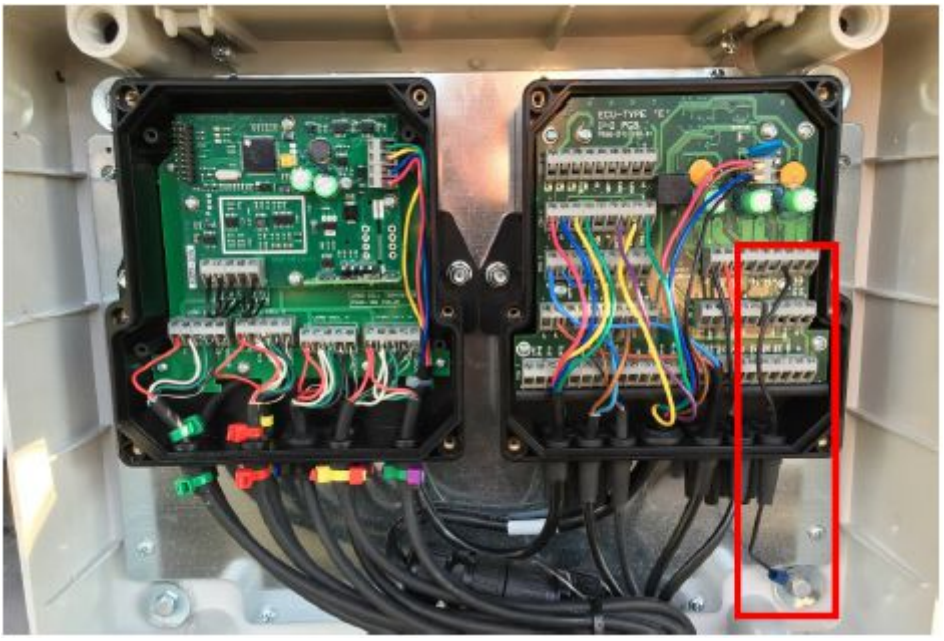


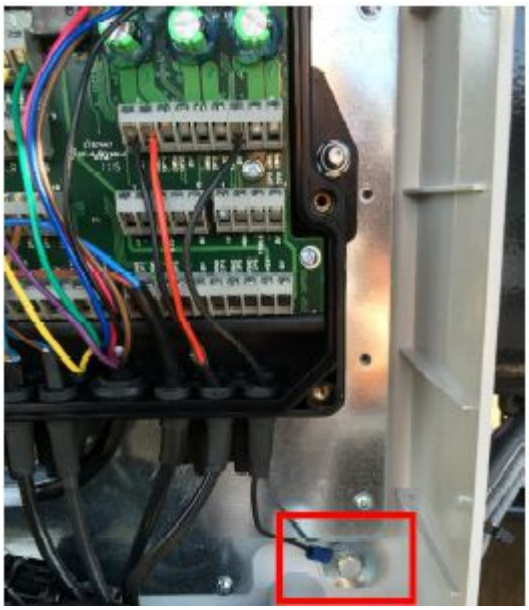
1.11.4 EARTH BONDING FOR JUNCTION BOX/ECU

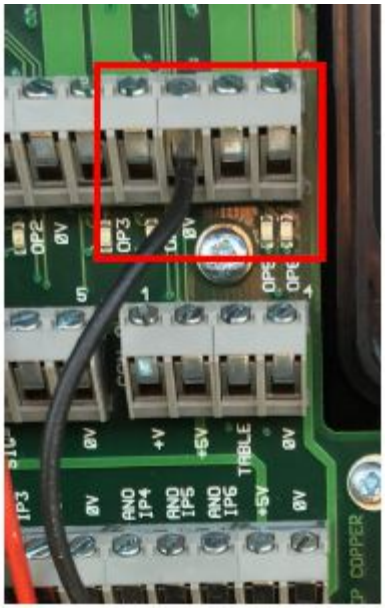
It is recommended that the “Type-C” junction box (PSi systems) or the “Type-E” ECU (Isocan/Isobus systems) be grounded to the chassis of the spreader. This is to ensure that any voltage spikes (caused by solenoids shutting down etc.) do not damage the equipment.

This can be done by connecting a wire (as thick as possible) from any 0v screw terminal in the junction box/ECU to a suitable point on the chassis.

Type-E ECU

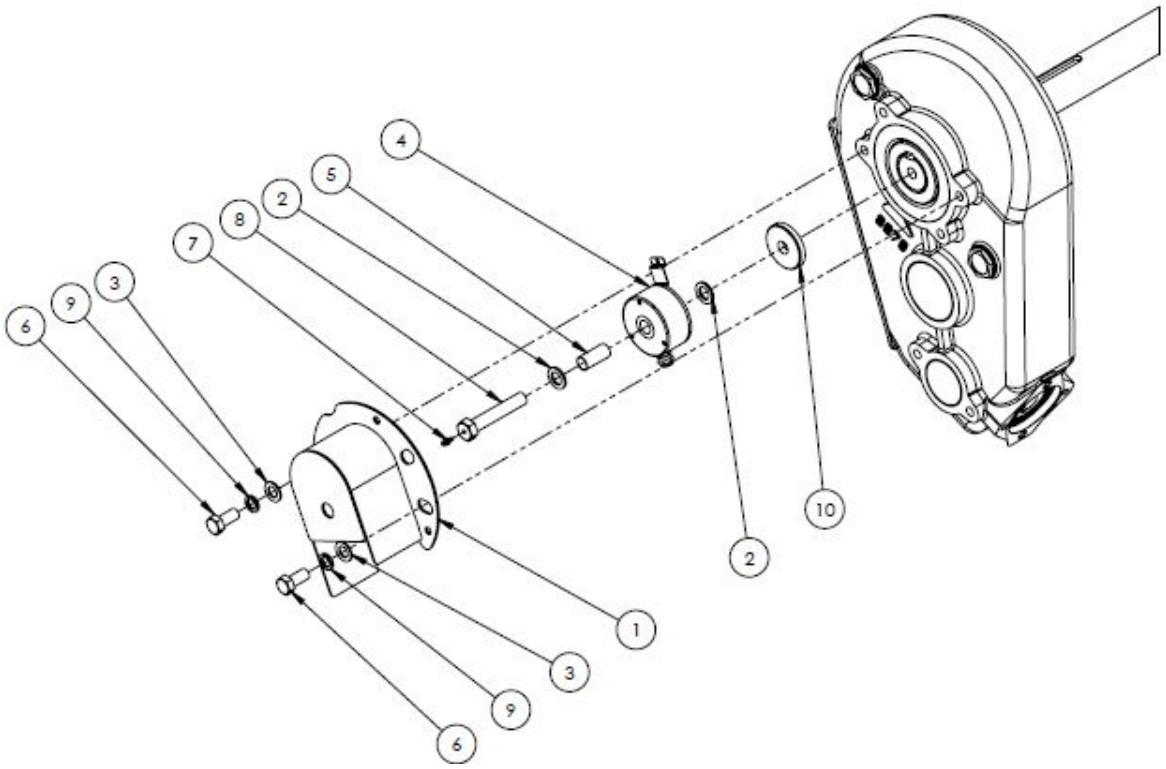






Type-C Junction Box

1.12 ENCODER FITTED TO REAR FLOOR SHAFT



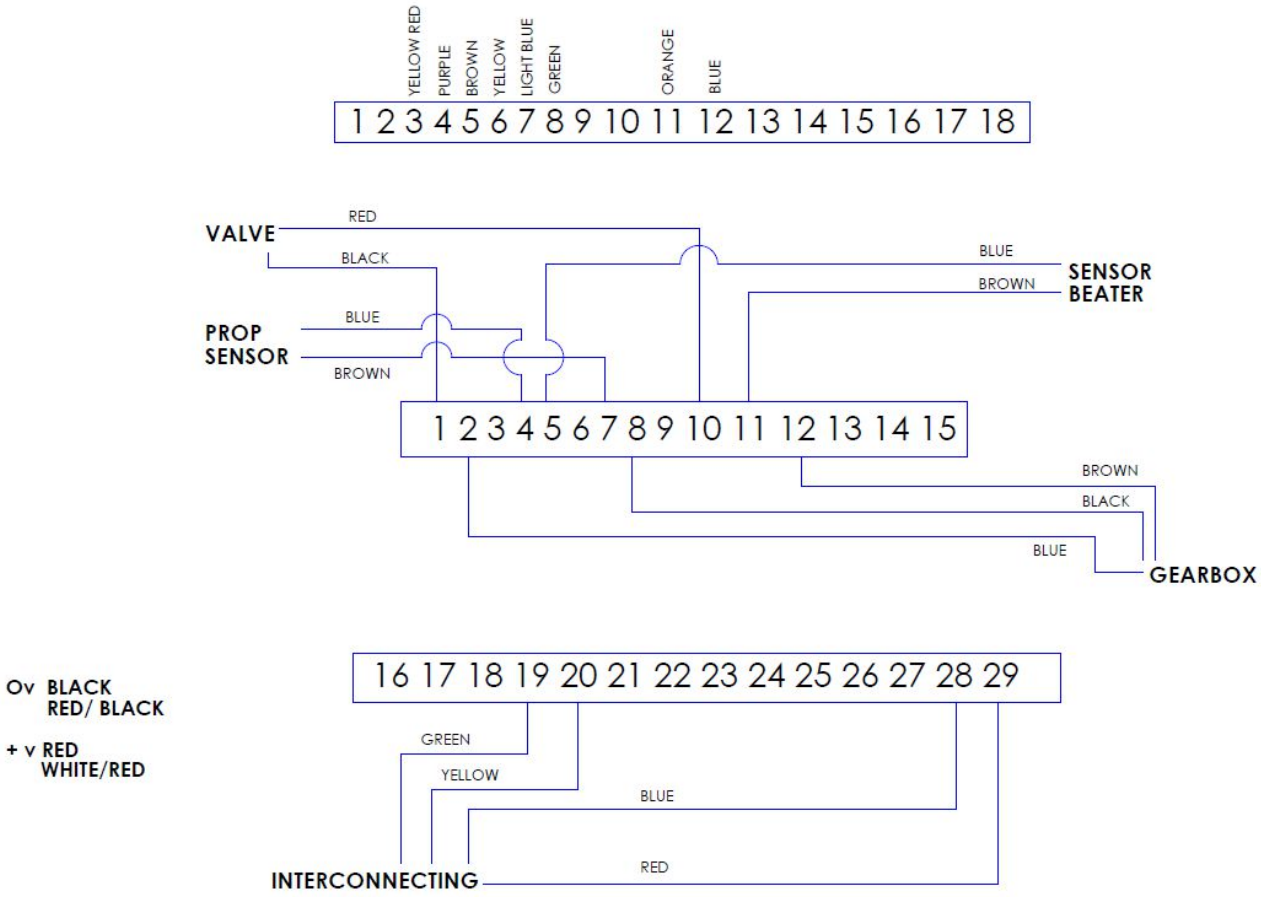
See Section 8.14 WEIGH CELLS SPARES for part numbers.

Gearbox Type	Gearbox Ratio	Brand Valve Type (Litres/min)	Adan Motor (cc size)	RDS Feedback (ppr)	Approx rpm of floor shaft
RT350/50	31.4:1	57	200	1024	9
RT500/50	43.6:1	57	200	1024	6.5
		76	200	1024	8.7
800/60	31.7:1	57	200	1024	9
		76	200	1024	12
		57	250	1024	7.2
		76	250	1024	9.6
		114	250	1024	14.4
		114	2x250	1024	7.2
		114	2x200	1024	9
1000/70	38.7:1	76	200	1024	9.8
		114	200	1024	14.7
		76	250	1024	7.9
		114	250	1024	11.8

1.13 RDS WEIGH CELL WIRING COLOUR CODE

ORANGE	=	GEARBOX SENSOR
BLUE	=	BEATER SHAFT SENSOR (HBD MACHINES)
GREEN	=	WEIGH CELL No. 1
N/A	=	WEIGH CELL No.2
RED	=	WEIGH CELL No. 3
YELLOW	=	WEIGH CELL No. 4
GREY	=	FLASHING BEACON FOR MAX LOAD WEIGHT

1.14 RDS WIRING DIAGRAM



2. MAINTENANCE

2.1 LUBRICATION OF SPREADER

DAILY GREASE Front and rear floor shaft
Overrun clutch to front of main auger or beater gearbox
Hitch eye

WEEKLY GREASE All sealed bearings – 1/2 pump of grease gun maximum.

TAKE CARE NOT TO DAMAGE GREASE SEAL BY OVERGREASING

Sliding tube of PTO shaft.
PTO universal joints – **Follow manufacturer's instructions.**
Screwjack top (when fitted)
Shearbolt bush

MONTHLY	Check gearbox oil levels
ANNUALLY	Change oil to all gearboxes
TYPE OF LUBRICATION GREASE	Multi purpose
TYPE OF GEARBOXES OIL	EP90

2.2 SERVICING INTERVALS

The period recommended is based on normal operating conditions. Severe or unusual conditions may require more frequent lubrication or oil changes.

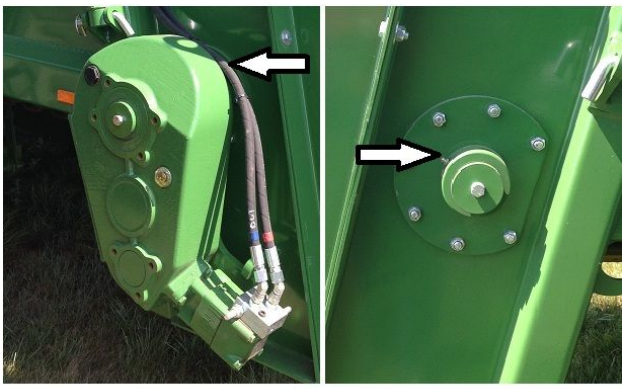
IMPORTANT: *ENSURE CV JOINT IS GREASED BEFORE FIRST USE!*
TAKE CARE NOT TO DAMAGE SEALS BY OVERGREASING.

DAILY (8 HRS)

1. Check for hydraulic fluid leaks and damaged hoses.
2. Grease Front and Rear floor chain shaft bearings.

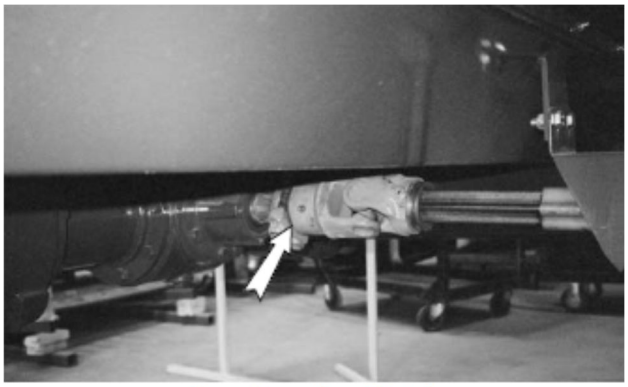
a. Front shaft.
- Remove front Finger Guard to access bearings.

b. Rear Shaft.
- Grease both left and right bearings.



LEFT BUSHING RIGHT BUSHING

3. Grease the Overrun Clutch to front of the auger gearbox.



Over-Running Clutch

WEEKLY (40 HRS)

1. Check wheel nuts. Re-torque as needed.
2. Grease all sealed bearings
   a. Driveline hanger bearings (2 or 3 depending on model).
   b. Top auger bearings (Grease nipples access provided on right turret).
3. Grease the telescoping section of the PTO shaft.
4. Grease PTO input drive system.
   a. Input shaft.
   b. Cross joint fittings.
   c. Guard bearings.
   d. Shear bolt housing.
   e. Over-running clutch (5 pumps).
5. Grease the implement jack top.

6. Check gearbox oil level

   a. Floor Chain Drive Gearbox

      - Oil should be level with the middle of the sight glass.

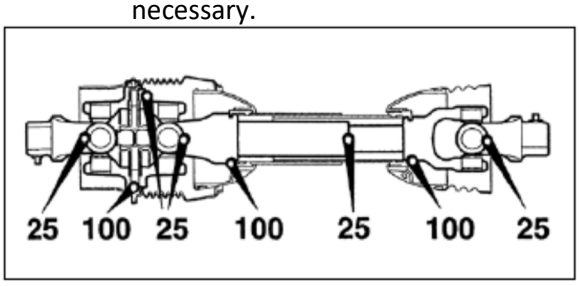
      - Add oil as required through the top plug.

   b. Auger Gearbox

      - Spreader must be unhooked from tractor and set on level ground to check oil. Oil should be level with the middle of the sight glass.

      - Add oil as required through the top plug.

      - Oil may take a while to distribute in casing, recheck level after 30 – 40 minutes and repeat if necessary.



MONTHLY

1. Apply grease or heavy oil to apron chain.

2. Grease telescoping section of PTO shaft.

3. Grease the CV Joint of PTO shaft (15 pumps)
4. Grease suspension system spring bushings on each side.
5. Grease brake pivot bushings (Tandem Suspension machines).

6. Grease parking brake leaver joint.

7. Check and adjust the apron chain tension. Refer to section 5.2.2 - page 50.

ANNUALLY

1. Change oil to all gearboxes.
2. Check the condition of the frame sealing flaps. Replace if not sealing the sides or bottom.

   a. Front.
   b. Rear Slurry Door Auger Deck.

3. Check brake setting.

   Brakes can be checked by depressing the brake petal with the engine running and the tractor in gear; release clutch to determine brake adjustment.

4. Check condition of rotor blades and paddles. Repair when there are loose bolts, cracked welds, chipped, bent or broken blades or paddles. Replace when any components are worn within 1 inch (25 mm) of flighting.

5. Clean machine.

6. Check general hardware/bolt tightness. Retighten if necessary.
   It is recommended to apply waste oil to the floor chains periodically when spreading dry material and particularly at the end of the spreading season. This assists in the smooth running of the machine and prolongs the working life of the components.

7. Check bearings in gearboxes.

8. Remove the floor drive gearbox from drive shaft, clean both, add copaslip to the drive shaft and gearbox and replace.

2.3 AMOUNT OF OIL REQUIRED TO FILL GEARBOX

Please use EP90 gear oil

GEARBOX	TVA		HBD		REFERENCE
	LITRES	GALLONS	LITRES	GALLONS	
RT800/60/32	10.5	2.8	12	3.2	FLOOR DRIVE
RT1000/70/32	12.7	3.4	14	3.7	FLOOR DRIVE
SRT 18	13.5	3.6			AUGER DRIVE
SRT 18 ALL-IN-ONE GEARBOX			20	5.3	BEATER DRIVE
SRT 20 ALL-IN-ONE GEARBOX			20	5.3	BEATER DRIVE

2.4 SERVICE RECORD

See Lubrication and Mainteneance sections for details of service. Copy this page to continue record.

ACTION CODE CK = CHECK CL = CLEAN G = GREASE

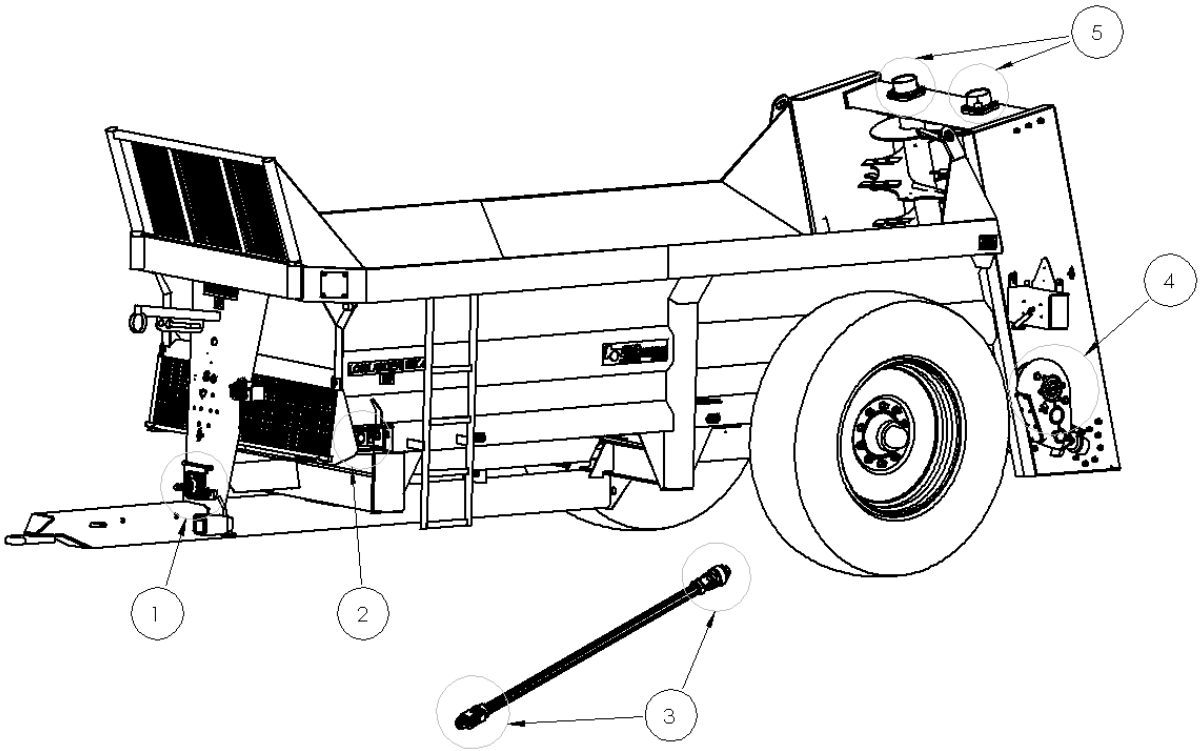
HOURS / SERVICED BY / MAINTENANCE																							
25 Hours or Monthly																							
G PTO Driveline																							
G Telescoping Section PTO																							
G PTO Input Drive System																							
G Hub Ratcheting Mech.																							
G Apron Chain Shaft Bearings																							
G Roller Bearings																							
CK Oil Levels in Gearboxes																							
G Apron Chain																							
100 Hours or 4 Months																							
G Telescoping Section PTO																							
G Spring Bushings																							
G Brake Pivot Bushings																							
G Tandem Pivot																							
CK Apron Chain Tension																							
Annually																							
CK Sealing Flaps																							
CK Brake Settings																							
CK Rotor Blades & Paddles																							
CL Machine																							
G FLOOR GEARBOX																							

2.5 SHEARBOLT PROTECTION

Only one shearbolt is fitted to the spreader. This is located on the spreader end of the PTO shaft. The bolt is M10 x 60 grade 6.8 mild steel.

ON NO ACCOUNT MUST A BOLT OF HIGHER GRADE THAN 6.8 TENSILE STRENGTH BE FITTED.

2.6 GREASING POINTS



KEY	GREASE POINT
1	ALL BEARINGS IN DRIVE LINE
2	FRONT SHAFT
3	PTO KNUCKLES
4	REAR SHAFT
5	BEARINGS TOP OF AUGERS

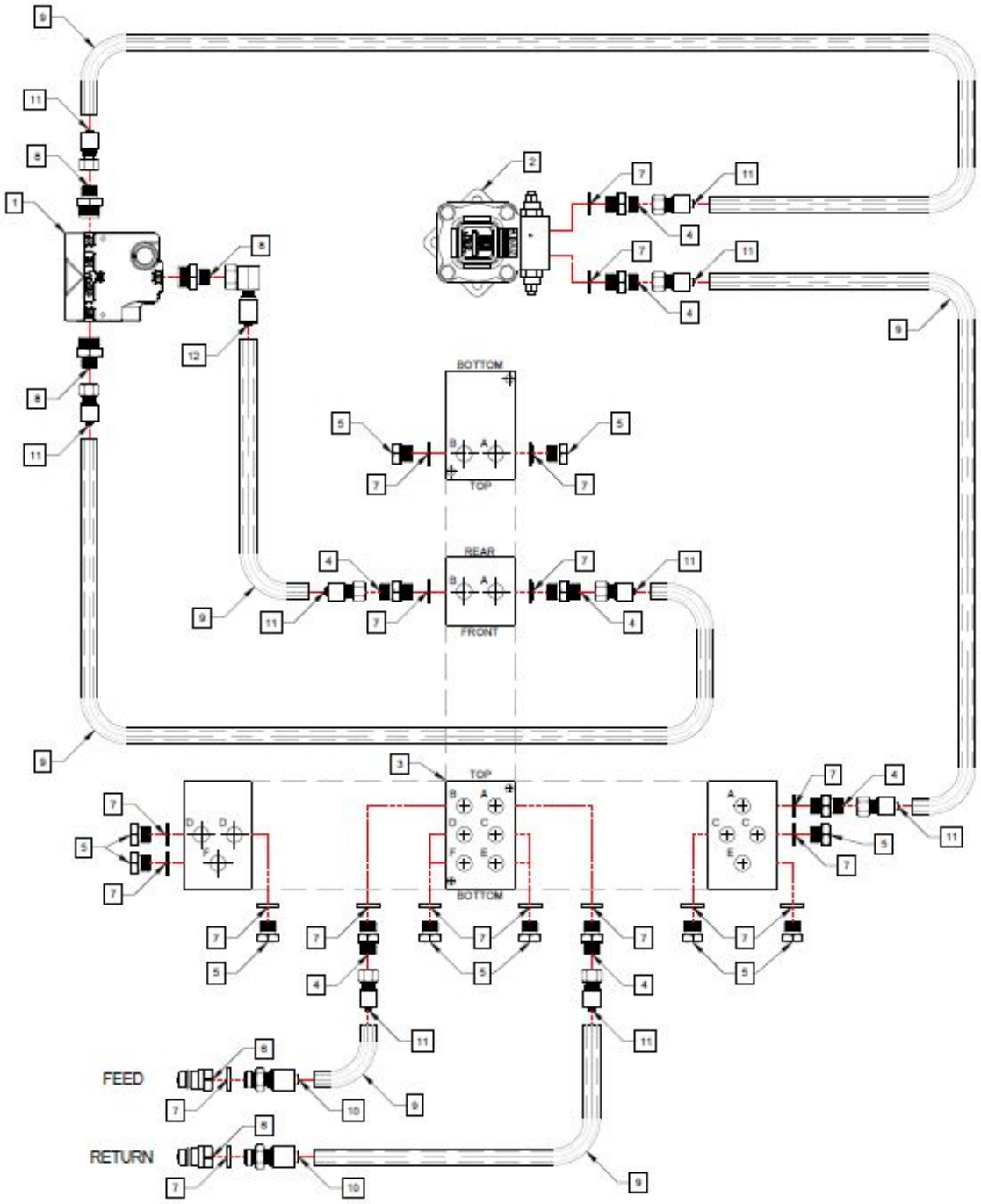
2.7 JACKING POINTS

Jack the spreader up on the axle or on the base of the auger turret pressings at the rear to replace a wheel.

3. FLOOR DRIVE

3.1 HYDRAULIC CIRCUIT FOR FLOOR DRIVE

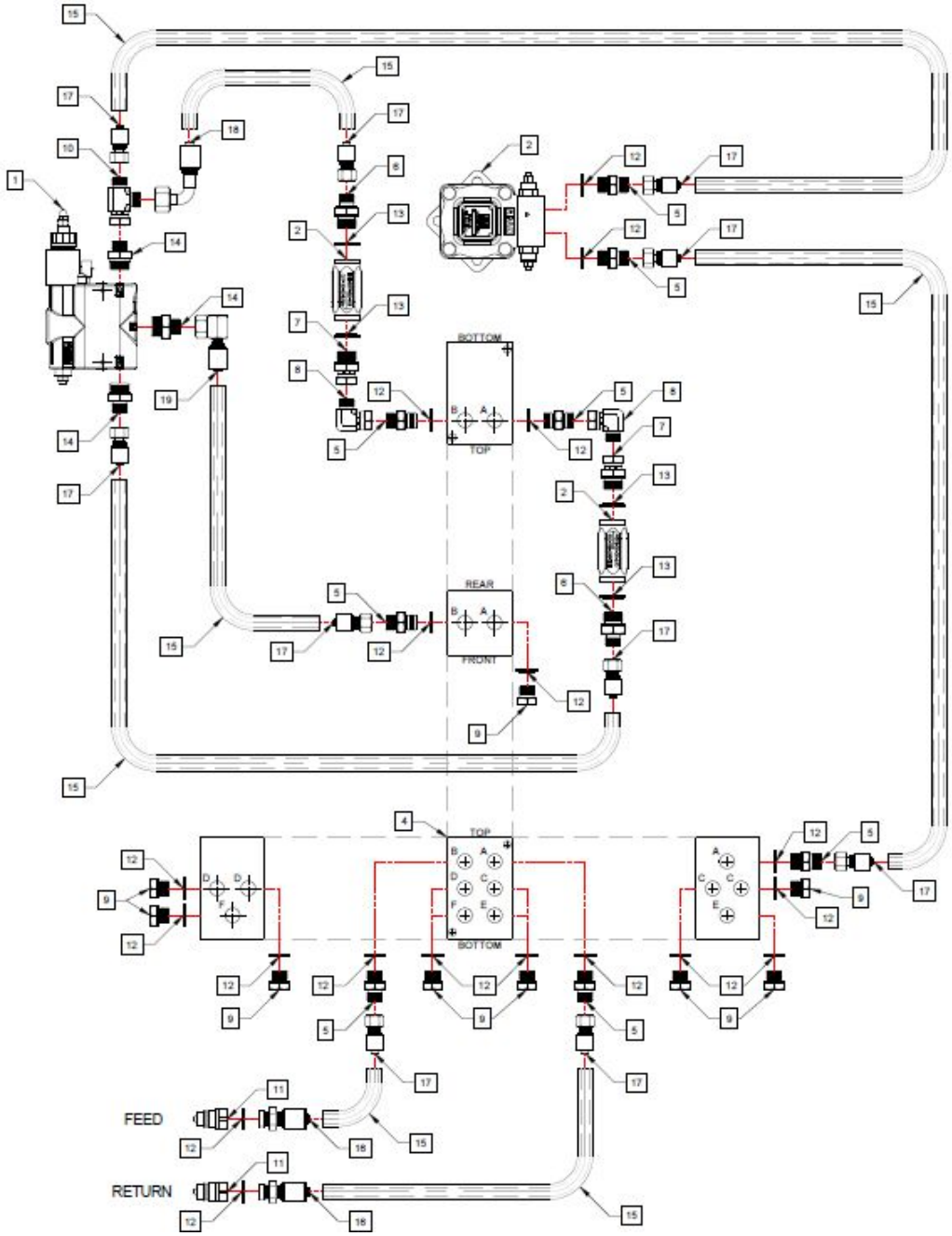
3.1.1 HYDRAULIC CIRCUIT SINGLE DRIVE 800/60 WITH MANUAL FLOW CONTROL



KEY	QTY	PART No.	DESCRIPTION
1	1	B3030/1	MANUAL VALVE 84LPM
	1	B3031	MANUAL VALVE 114LPM
2	1	B3052	HYD MOTOR 200CL
	1	B3054	HYD MOTOR 250CL
3	1	B4369	MANIFOLD BLOCK
4	7	51338	FITTING BSP M-M 1/2"
5	10	51440	PLUG BSP 1/2"

KEY	QTY	PART No.	DESCRIPTION
6	2	51576	QUICK RELEASE PROBE M 1/2"
7	19	51591	DOWTY SEAL BSP 1/2"
8	3	52602	FITTING BSP-UNF M-M 1/2"
9		52794	HOSE 1/2" (PER METER)
10	2	52841	HOSE CRIMP BSP M 1/2"
11	9	52843	HOSE CRIMP BSP F 1/2"
12	1	52847	HOSE CRIMP 90° BSP F 1/2"

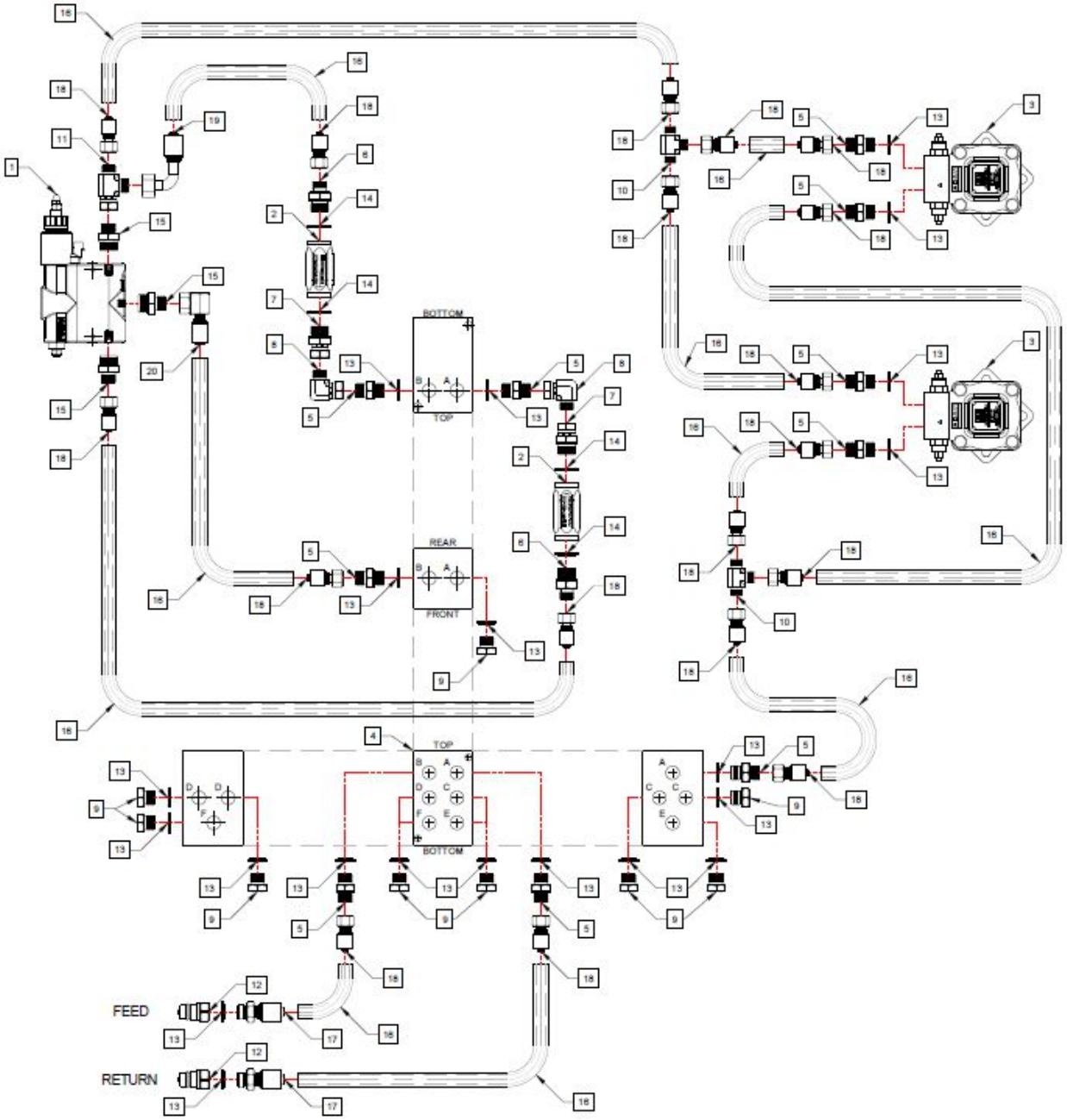
3.1.2 HYDRAULIC CIRCUIT SINGLE DRIVE 800/60 WITH ELECTRIC FLOW CONTROL



KEY	QTY	PART No.	DESCRIPTION
1	1	B3034	ELECTRIC VALVE 76LPM
	1	B3035	ELECTRIC VALVE 114LPM
2	2	B3038	CHECK VALVE F-F 3/4"
3	1	B3052	HYD MOTOR 200CL
	1	B3054	HYD MOTOR 250CL
4	1	B4369	MANIFOLD BLOCK
5	8	51338	FITTING BSP M-M 1/2"
6	2	51340	FITTING BSP M-M 1/2"-3/4"
7	2	51372	FITTING BSP M-F 3/4"-1/2"
8	2	51428	FITTING 90° BSP M-F 1/2"
9	9	51440	PLUG BSP 1/2"

KEY	QTY	PART No.	DESCRIPTION
10	1	51458/1	FITTING TEE BSP M-M-F 1/2"
11	2	51576	QUICK RELEASE PROBE M 1/2"
12	19	51591	DOWTY SEAL BSP 1/2"
13	4	51593	DOWTY SEAL BSP 3/4"
14	3	52602	FITTING BSP-UNF M-M 1/2"
15		52794	HOSE 1/2" (PER METER)
16	2	52841	HOSE CRIMP BSP M 1/2"
17	10	52843	HOSE CRIMP BSP F 1/2"
18	1	52845	HOSE CRIMP 90° BSP F 1/2"
19	1	52847	HOSE CRIMP 90° BSP F 1/2"

3.1.3 HYDRAULIC CIRCUIT DUAL DRIVE 800/60 WITH ELECTRIC FLOW CONTROL



KEY	QTY	PART No.	DESCRIPTION
1	1	B3034	ELECTRIC VALVE 76LPM
	1	B3035	ELECTRIC VALVE 114LPM
2	2	B3038	CHECK VALVE F-F 3/4"
3	2	B3052	HYD MOTOR 200CL
	2	B3054	HYD MOTOR 250CL
4	1	B4369	MANIFOLD BLOCK
5	10	51338	FITTING BSP M-M 1/2"
6	2	51340	FITTING BSP M-M 1/2"-3/4"
7	2	51372	FITTING BSP M-F 3/4"-1/2"
8	2	51428	FITTING 90° BSP M-F 1/2"
9	9	51440	PLUG BSP 1/2"

KEY	QTY	PART No.	DESCRIPTION
10	2	51448	FITTING TEE BSP M-M-M 1/2"
11	1	51458/1	FITTING TEE BSP M-M-F 1/2"
12	2	51576	QUICK RELEASE PROBE M 1/2"
13	21	51591	DOWTY SEAL BSP 1/2"
14	4	51593	DOWTY SEAL BSP 3/4"
15	3	52602	FITTING BSP-UNF M-M 1/2"
16		52794	HOSE 1/2" (PER METER)
17	2	52841	HOSE CRIMP BSP M 1/2"
18	18	52843	HOSE CRIMP BSP F 1/2"
19	1	52845	HOSE CRIMP 90° BSP F 1/2"
20	1	52847	HOSE CRIMP 90° BSP F 1/2"

3.2 FLOOR SPEED CONTROL UNIT

3.2.1 MANUAL FLOW CONTROL VALVES

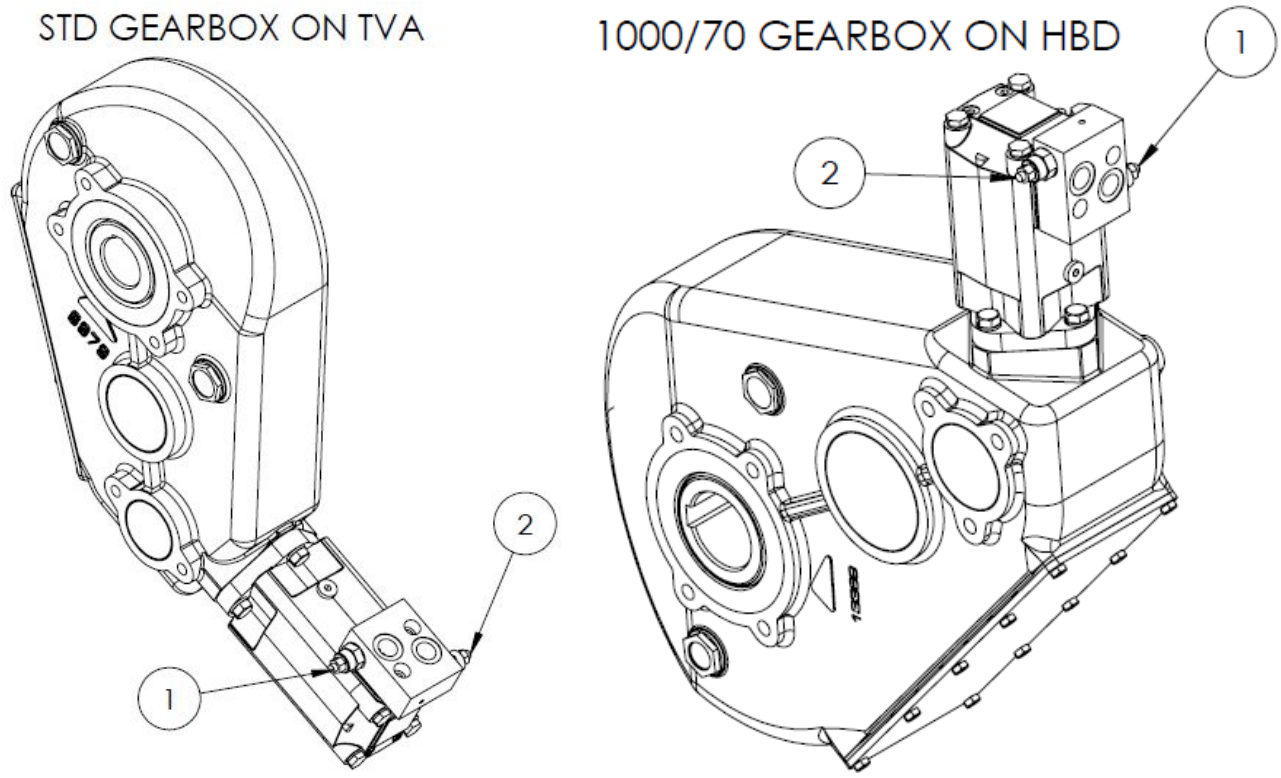
PART No.	DESCRIPTION	FLOW RATE (LPM)	REFERENCE
B3030/1	MANUAL VALVE	84	STANDARD
B3031	MANUAL VALVE	114	OPTION

3.2.2 ELECTRIC FLOW CONTROL VALVES

PART No.	DESCRIPTION	FLOW RATE (LPM)	MODEL REF.
B3034	ELECTRIC VALVE	76	OPTION
B3035	ELECTRIC VALVE	114	OPTION

***B3032 ELECTRIC CONTROL BOX IS USED FOR MODELS WITHOUT WEIGH CELLS**

3.3 FLOOR DRIVE RELIEF VALVES



This valve is cross line type and is fitted to the hydraulic motor on the floor drive gearbox. The pressure can be varied to suit the material being spread. To adjust, engage the oil flow via the spool valve on the tractor, insert the Allen key to prevent the screw from rotating whilst slacking off the lock nut. Using the Allen key, turn the screw clockwise to increase pressure until the floor starts to move. Use the Allen key to prevent rotation of screw and retighten the lock nut.

To decrease the pressure, reverse the procedure. When making this adjustment, the spreader pressure should be set lower than the tractor PRV (Pressure Relief Valve).

To adjust relief valve pressure

No.1
Cartridge contols movement of floor to rear. To increase pressure release locknut turn screw clockwise and retighten locknut.
To decrease pressure turn screw anticlockwise.

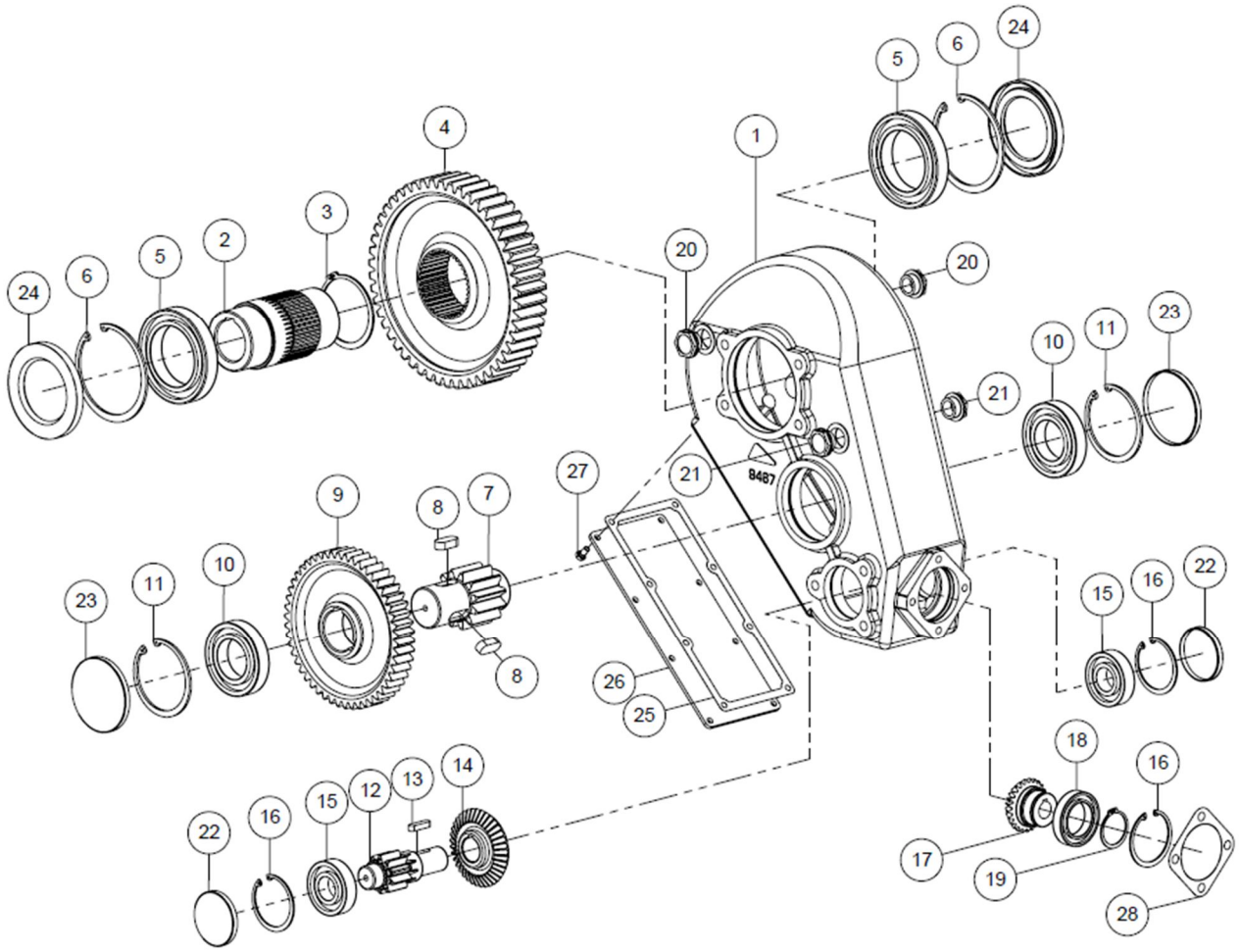
No.2
Cartridge controls movement of floor to front. To increase pressure release locknut turn screw clockwise and retighen locknut.
To decrease pressure turn screw anticlockwise.

NOTE
Maximum protection can be given to moving parts by keeping relief valve pressure set to a minimum.

The factory set pressure for the valve is 2000 PSI (138 bar).

DO NOT REVERSE THE MOVING FLOOR WHEN A PLASTIC FLOOR IS FITTED.

3.4 FLOOR DRIVE GEARBOX 800/60/32 - B3122 TVA STD

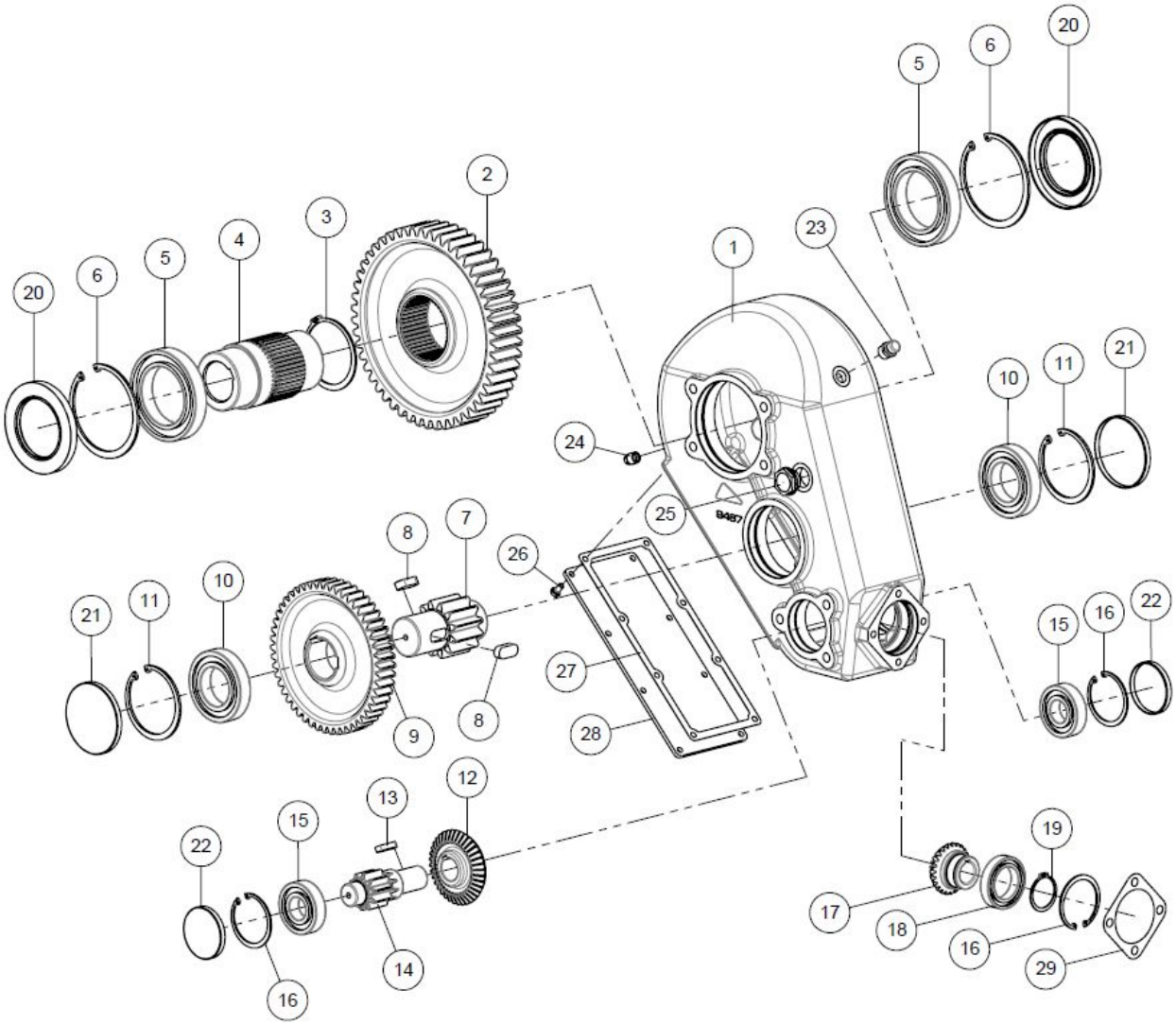


KEY	QTY	PART No.	DESCRIPTION
1	1	B3204	CASING
2	1	B3230	SLEEVE Ø60
3	1	B4030	CIRCLIP
4	1	B3236	GEAR
5	2	BR325	BEARING
6	2	B4016	CIRCLIP
7	1	B3240	PINION SHAFT
8	2	B2276	KEY
9	1	B3244	GEAR
10	2	BR365	BEARING
11	2	B4012	CIRCLIP
12	1	B3242	PINION SHAFT
13	1	B2270L	KEY
14	1	B3248	CROWN BEVEL

KEY	QTY	PART No.	DESCRIPTION
15	2	BR390	BEARING
16	3	B4006	CIRCLIP
17	1	B3254	PINION SHAFT
18	1	BR310	BEARING
19	1	B4019	CIRCLIP
20	2	B3997	BREATHER PLUG
21	2	B3995	SIGHT GAUGE
22	2	SL265	CAP SEAL
23	2	SL270	CAP SEAL
24	2	SL205	SEAL
25	1	B3224	GASKET
26	1	B3220	COVER PLATE
27	8	73030/1	BOLT
28	1	B3227	GASKET

Hydraulic Motor part no. **B3052** or **B3054** (not shown, see Sections 3.8, 3.9 and 3.12 REAR FLOOR SHAFT ASSEMBLY)

3.5 FLOOR DRIVE GEARBOX 800/60/32 - B3123 150HD & 175HD HBD STD

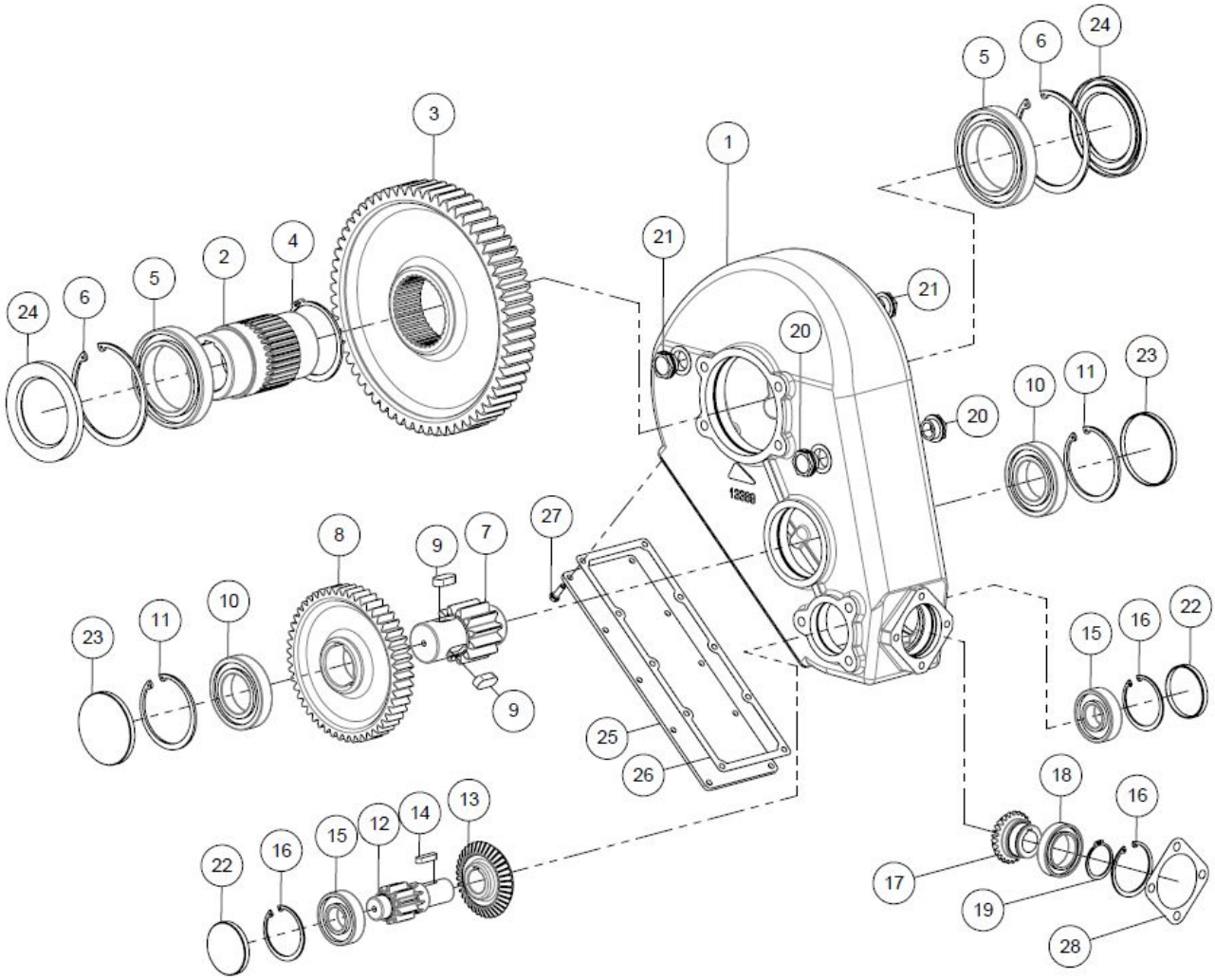


KEY	QTY	PART No.	DESCRIPTION
1	1	B3204/1	CASING
2	1	B3236	GEAR
3	1	B4030	CIRCLIP
4	1	B3230	SLEEVE Ø60
5	2	BR325	BEARING
6	2	B4016	CIRCLIP
7	1	B3240	PINION SHAFT
8	2	B2276	KEY
9	1	B3244	GEAR
10	2	BR365	BEARING
11	2	B4012	CIRCLIP
12	1	B3248	CROWN BEVEL
13	1	B2270L	KEY
14	1	B3242	PINION SHAFT
15	2	BR390	BEARING

KEY	QTY	PART No.	DESCRIPTION
16	3	B4006	CIRCLIP
17	1	B3254	PINION SHAFT
18	1	BR310	BEARING
19	1	B4019	CIRCLIP
20	2	SL205	SEAL
21	2	SL270	CAP SEAL
22	2	SL265	CAP SEAL
23	1	B3991	SPRING BREATHER PLUG
24	1	72062	DRAIN PLUG
25	1	B3995	SIGHT GAUGE
26	8	73030/1	BOLT
27	1	B3224	GASKET
28	1	B3220	COVER PLATE
29	1	B3227	GASKET

Hydraulic Motor part no. **B3052** or **B3054** (not shown, see Sections 3.8, 3.9 and 3.12 REAR FLOOR SHAFT ASSEMBLY)

3.6 FLOOR DRIVE GEARBOX 1000/70/32 - B3124 TVA OPTION

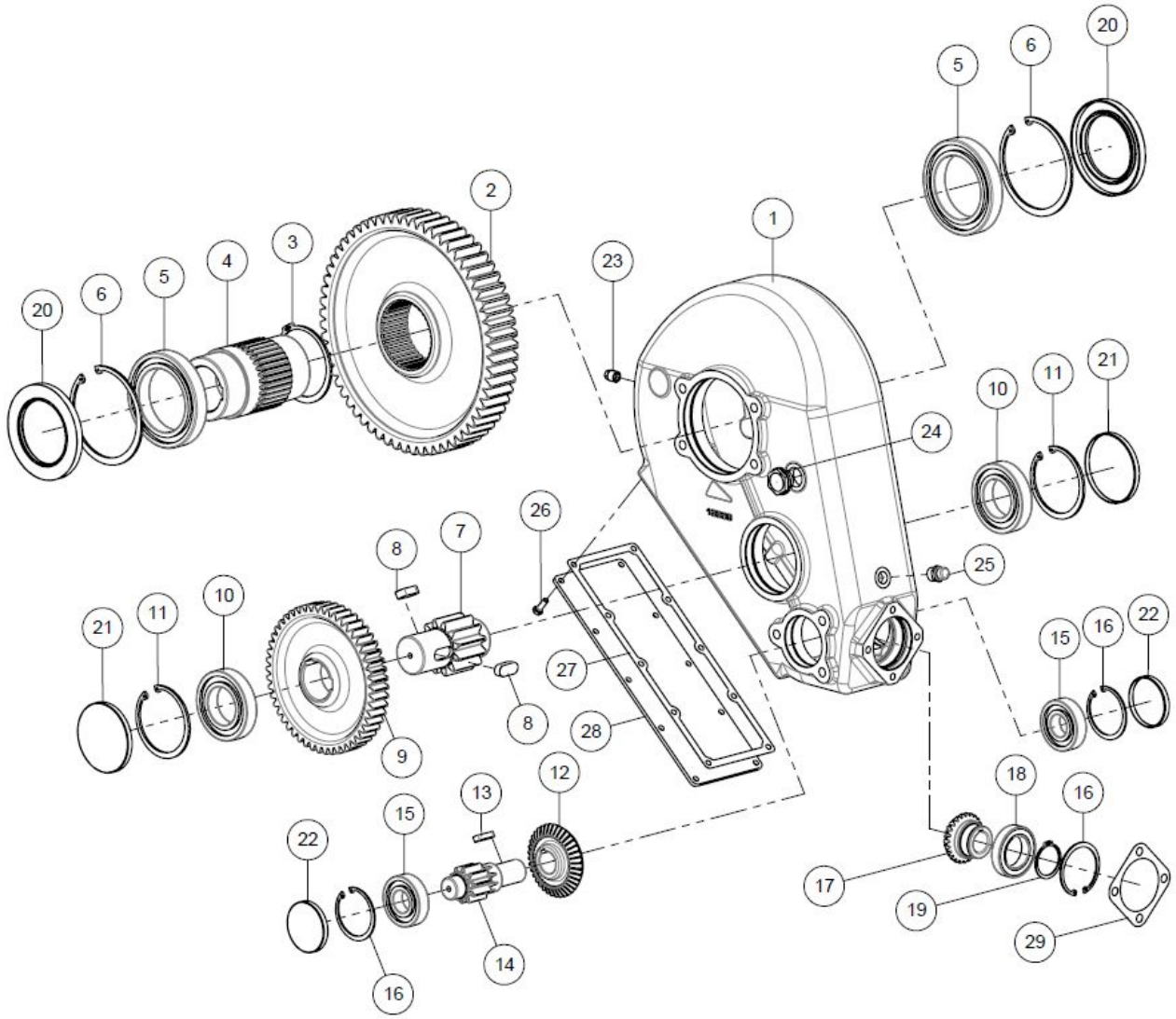


KEY	QTY	PART No.	DESCRIPTION
1	1	B3257	CASING
2	1	B3258	SLEEVE Ø70
3	1	B3259	GEAR
4	1	B3260	CIRCLIP
5	2	BR327	BEARING
6	2	B3261	CIRCLIP
7	1	B3240	PINION SHAFT
8	2	B3244	GEAR
9	2	B2276	KEY
10	2	BR365	BEARING
11	2	B4012	CIRCLIP
12	1	B3242	PINION SHAFT
13	1	B3248	CROWN BEVEL
14	1	B2270L	KEY

KEY	QTY	PART No.	DESCRIPTION
15	2	BR390	BEARING
16	3	B4006	CIRCLIP
17	1	B3254	PINION SHAFT
18	1	BR310	BEARING
19	1	B4019	CIRCLIP
20	2	B3995	SIGHT GAUGE
21	2	B3997	BREATHER PLUG
22	2	SL265	CAP SEAL
23	2	SL270	CAP SEAL
24	2	SL207	SEAL
25	1	B3262	COVER PLATE
26	1	B3263	GASKET
27	8	73030/1	BOLT
28	1	B3227	GASKET

Hydraulic Motor part no. **B3052** or **B3054** (not shown, see Section 3.10, 3.11 and 3.13 REAR FLOOR SHAFT ASSEMBLY)

3.7 FLOOR DRIVE GEARBOX 1000/70/32 - B3125 180 & 230 HBD

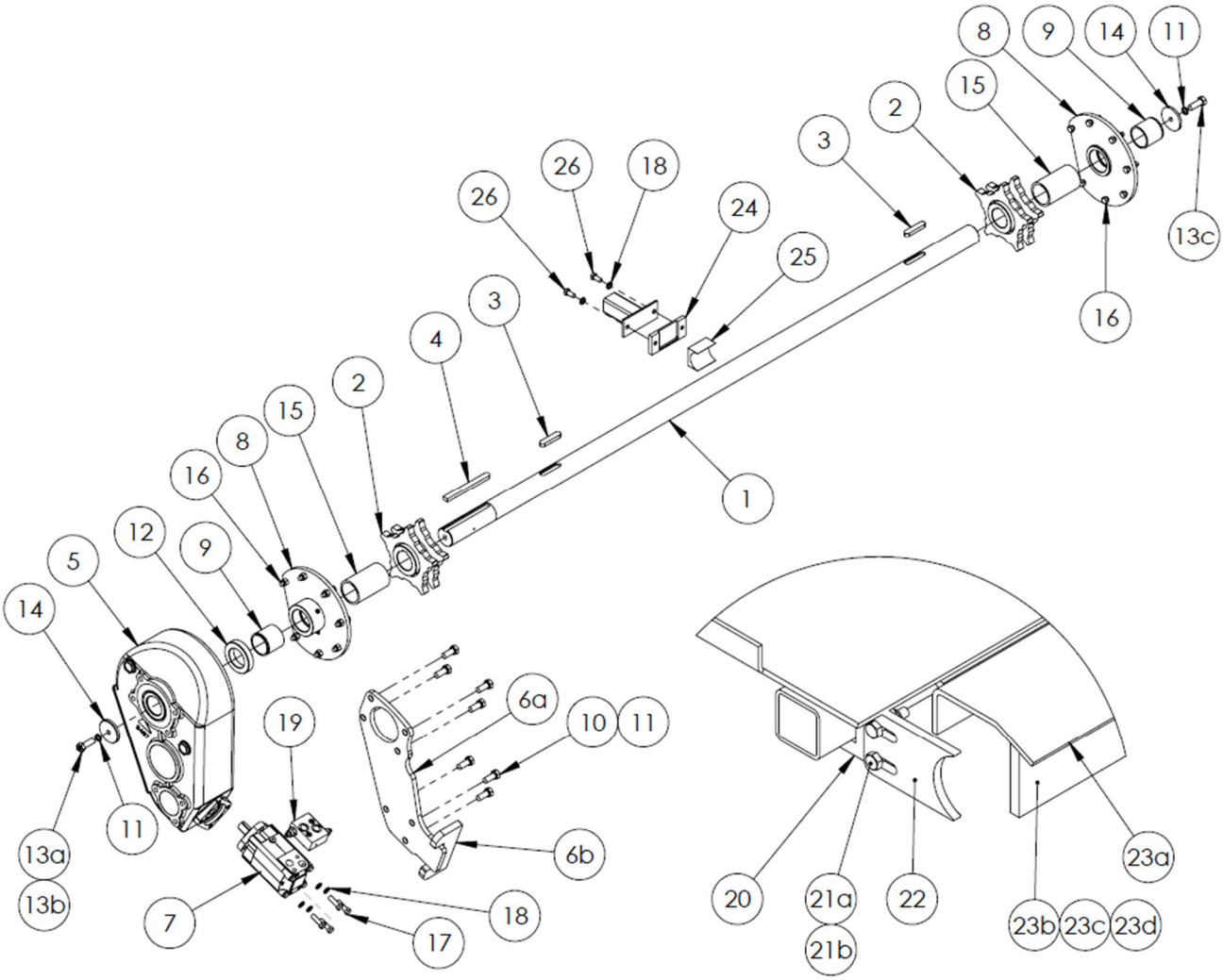


KEY	QTY	PART No.	DESCRIPTION
1	1	B3257/1	CASING
2	1	B3260	CIRCLIP
3	1	B3259	GEAR
4	1	B3258	SLEEVE Ø70
5	2	BR327	BEARING
6	2	B3261	CIRCLIP
7	1	B3240	PINION SHAFT
8	2	B2276	KEY
9	2	B3244	GEAR
10	2	BR365	BEARING
11	2	B4012	CIRCLIP
12	1	B3248	CROWN BEVEL
13	1	B3242	PINION SHAFT
14	1	B2270L	KEY
15	2	BR390	BEARING

KEY	QTY	PART No.	DESCRIPTION
16	3	B4006	CIRCLIP
17	1	B3254	PINION SHAFT
18	1	BR310	BEARING
19	1	B4019	CIRCLIP
20	2	SL207	SEAL
21	2	SL270	CAP SEAL
22	2	SL265	CAP SEAL
23	1	72062	DRAIN PLUG
24	1	B3995	SIGHT GAUGE
25	1	B3991	SPRING BREATHER PLUG
26	8	73030/1	BOLT
27	1	B3263	GASKET
28	1	B3262	COVER PLATE
29	1	B3227	GASKET

Hydraulic Motor part no. **B3052** or **B3054** (not shown, see Section 3.11 REAR FLOOR SHAFT ASSEMBLY)

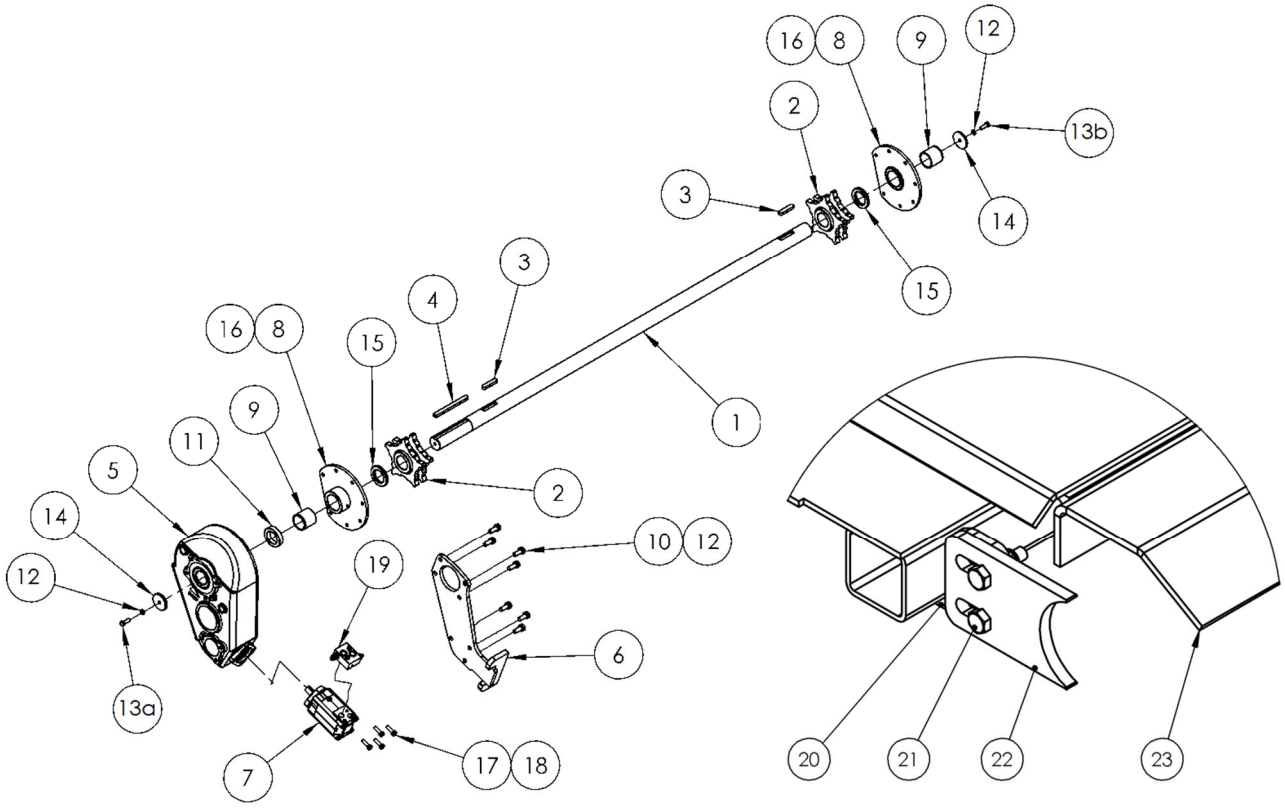
3.8 REAR FLOOR SHAFT ASSEMBLY 150HD & 175HD (800/60/32 GEARBOX)



KEY	QTY	PART No.	DESCRIPTION
1	1	B2260	REAR SHAFT Ø60
2	2	B2110	GYPSY WHEEL ASSY
3	2	B2275	KEY 18x11x80
4	1	B2278	KEY 18x11x190
5	1	B3122	GEARBOX RT800/60 TVA
	1	B3123	GEARBOX RT800/60 HBD
6a	1	B3214	GEARBOX MTG PLATE
6b	1	B3215	TORQUE PLATE (WELDED)
7	1	B3052	HYD MOTOR 200CL
8	2	B2306	BEARING FLANGE
9	2	B2322	ACM BUSH Ø60
10	7	73153	BOLT M16x40
11	9	74704	SPRING WASHER M16
12	1	B2348/1	SPACER 20mm THICK
13a	1	B2253	GREASER BOLT M16x45
13b	1	50726	GREASE NIPPLE
13c	1	73154	BOLT M16x45

KEY	QTY	PART No.	DESCRIPTION
14	2	B2282/1	END PLATE
15	2	B2343	SPACER 120mm THICK
16	14	73092	BOLT & NUT M12x40
17	4	73093	BOLT M12x40
18	6	74702	SPRING WASHER M12
19	1	B3078	RELIEF VALVE
20	2	B2124	SCRAPER MOUNT (WELDED)
21a	4	73064	BOLT M10x40
21b	4	73363	NYLOC NUT M10
22	2	B2122	REAR SCRAPER PLATE
23a	1	B2824*	DRIVE SHAFT COVER ASSY
23b	1	B4123	DOUBLE WIPE RUBBER
23c	1	B4188/1	CLAMP STRIP
23d	8	73034	BOLT & NUT M8x35
24	1	B2337	ACM BUSH SUPPORT PLATE
25	1	B2330/1	ACM SHAFT SUPPORT Ø60
26	2	73090	BOLT M12x25

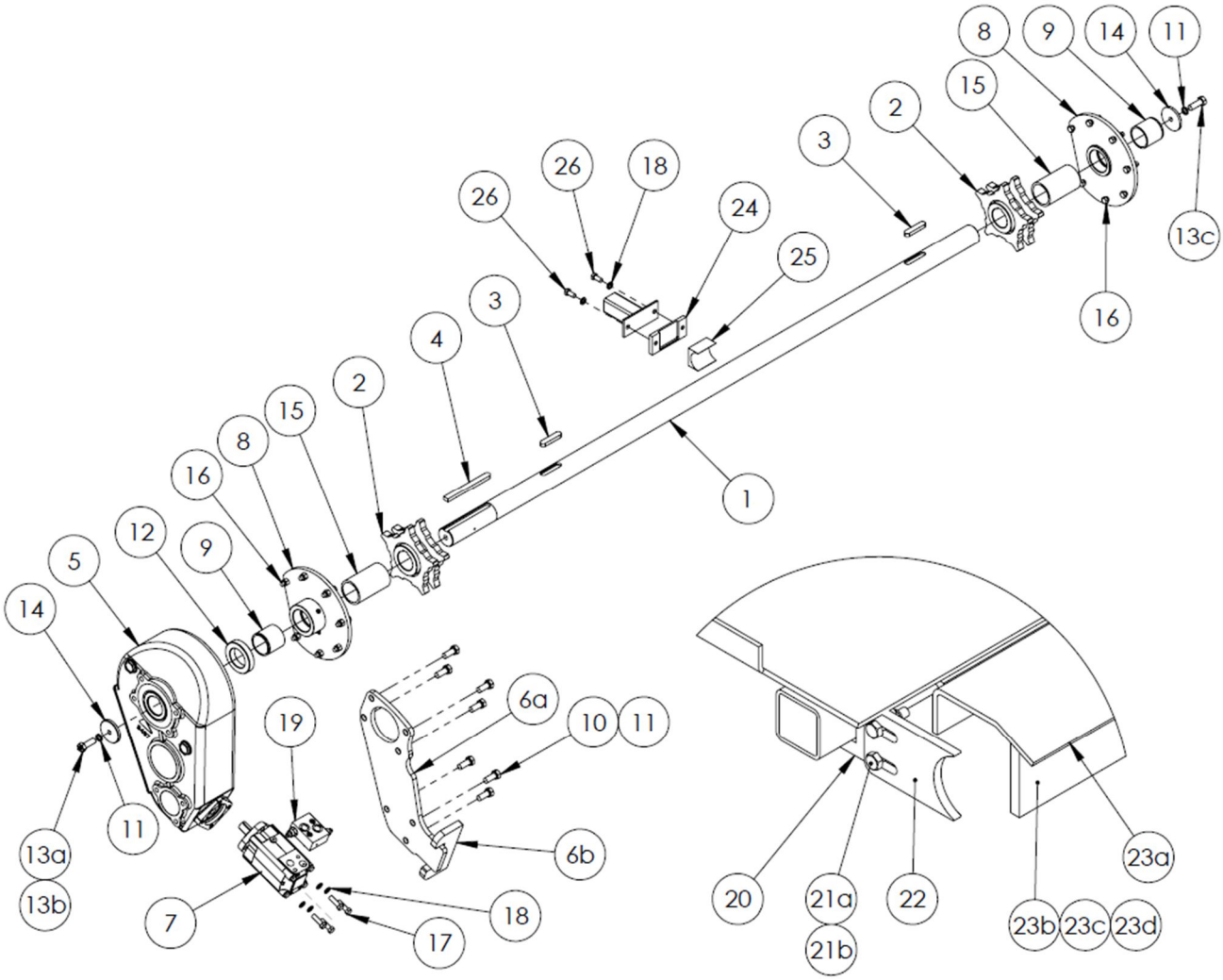
3.9 REAR SHAFT ASSEMBLY WIDEBODY 180 & 230 (800/60/32 GEARBOX)



KEY	QTY	PART No.	DESCRIPTION
1	1	B2270	REAR SHAFT Ø60
2	2	B2110	GYPSY WHEEL
3	2	B2275	KEY 18x11x80
4	1	B2278	KEY 18x11x190
5	1	B3122	GEARBOX RT800/60 TVA
	1	B3123	GEARBOX RT800/60 HBD
6a	1	B3214	GEARBOX MTNG PLATE
6b	1	B3215	TORQUE PLATE (WELDED)
7	1	B3054	HYD MOTOR 250CL
8	2	B2306	BEARING FLANGE + ACM BUSH
9	2	B2322	ACM BUSH Ø60
10	7	73153	BOLT M16x40
11	1	B2348/1	SPACER 20mm THICK

KEY	QTY	PART No.	DESCRIPTION
12	9	74704	SPRING WASHER M16
13a	1	B2253	GREASER BOLT M16
13b	1	73154	BOLT M16x45
14	2	B2282/1	END PLATE
15	2	B2348/2	SPACER 8mm THICK
16	14	73092	BOLT & NUT M12x35
17	4	73093	BOLT M12x40
18	4	74702	SPRING WASHER M12
19	1	B3078	RELIEF VALVE
20	2	B2124	SCRAPER ATTACHMENT (WELDED)
21	4	73064 + 73363	BOLT & NUT M10x40
22	2	B2122	PLATE REAR SCRAPER
23	1	B2824	DRIVE SHAFT COVER

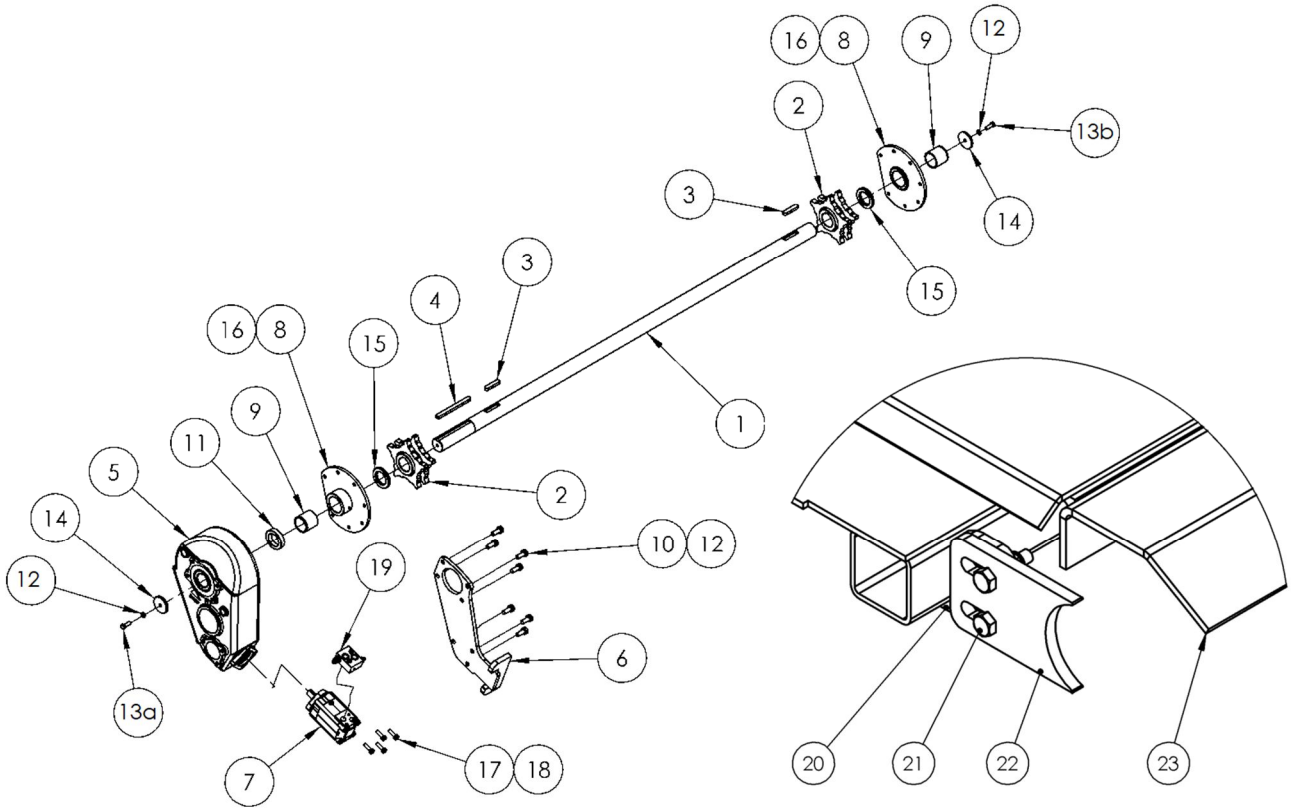
3.10 REAR FLOOR SHAFT ASSEMBLY 150HD & 175HD (1000/70/32 GEARBOX)



KEY	QTY	PART No.	DESCRIPTION
1	1	B2268/2	REAR SHAFT Ø70
2	2	B2112	GYPSY WHEEL ASSY
3	2	B2275/1	KEY 20x12x80
4	1	B2278/1	KEY 20x12x180
5	1	B3124	GEARBOX RT1000/70 TVA
	1	B3125	GEARBOX RT1000/70 HBD
6a	1	B3216	GEARBOX MTG PLATE
6b	1	B3215	TORQUE PLATE (WELDED)
7	1	B3052	HYD MOTOR 200CL
8	2	B2309	BEARING FLANGE ASSY
9	2	B2325	ACM BUSH Ø70
10	7	73153	BOLT M16x40
11	9	74704	SPRING WASHER M16
12	1	B2349	SPACER 20mm THICK
13a	1	B2253	GREASER BOLT M16x45
13b	1	50726	GREASE NIPPLE
13c	1	73154	BOLT M16x45

KEY	QTY	PART No.	DESCRIPTION
14	2	B2283/1	END PLATE
15	2	B2349/2	SPACER 120mm THICK
16	14	73092	BOLT & NUT M12x40
17	4	73093	BOLT M12x40
18	6	74702	SPRING WASHER M12
19	1	B3078	RELIEF VALVE
20	2	B2124	SCRAPER MOUNT (WELDED)
21a	4	73064	BOLT M10x40
21b	4	73363	NYLOC NUT M10
22	2	B2122	REAR SCRAPER PLATE
23a	1	B2824*	DRIVE SHAFT COVER ASSY
23b	1	B4123	DOUBLE WIPE RUBBER
23c	1	B4188/1	CLAMP STRIP
23d	8	73034	BOLT & NUT M8x35
24	1	B2337	ACM BUSH SUPPORT PLATE
25	1	B2330/2	ACM SHAFT SUPPORT Ø70
26	2	73090	BOLT M12x25

3.11 REAR SHAFT ASSEMBLY WIDEBODY 180 & 230 (1000/70/32 GEARBOX)

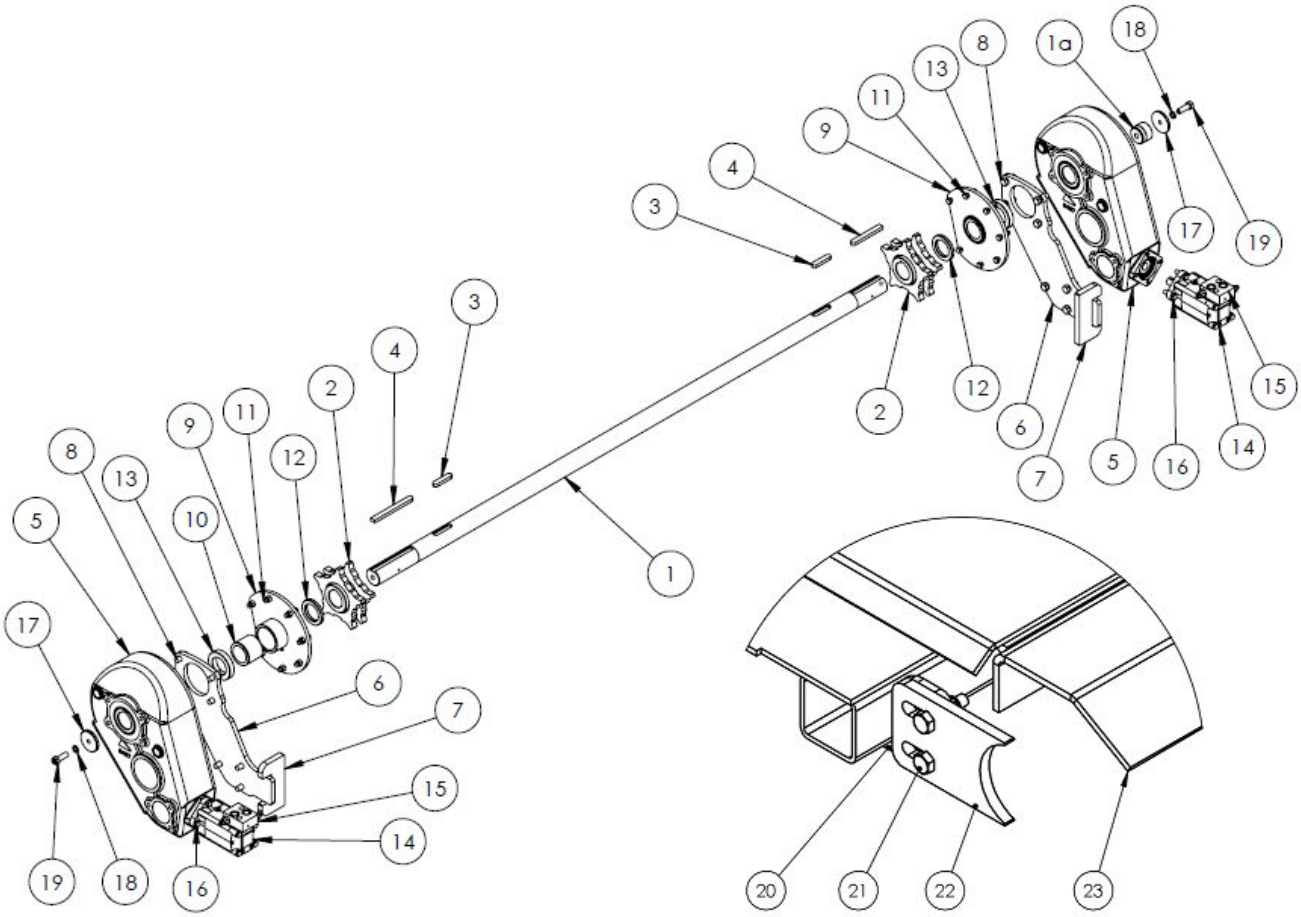


KEY	QTY	PART No.	DESCRIPTION
1	1	B2268/1	REAR SHAFT Ø70
2	2	B2112	GYPSY WHEEL
3	2	B2275/1	KEY 20x12x80
4	1	B2278/1	KEY 20x12x180
5	1	B3124	GEARBOX RT1000/70 TVA
	1	B3125	GEARBOX RT1000/70 HBD
6a	1	B3216	GEARBOX MTNG PLATE
6b	1	B3215	TORQUE PLATE (WELDED)
7	1	B3054	HYD MOTOR 250CL
8	2	B2309	BEARING FLANGE + ACM BUSH
9	2	B2325	ACM BUSH Ø70
10	7	73153	BOLT M16x40
11	1	B2349	SPACER 20mm THICK

KEY	QTY	PART No.	DESCRIPTION
12	9	74704	SPRING WASHER M16
13a	1	B2253	GREASER BOLT 16
13b	1	73154	BOLT M16x45
14	2	B2283/1*	END PLATE
15	2	B2349/1	SPACER 8mm THICK
16	14	73092	BOLT & NUT M12x35
17	4	73093	BOLT M12x40
18	4	74702	SPRING WASHER M12
19	1	B3078	RELIEF VALVE
20	2	B2124	SCRAPER ATTACHMENT (WELDED)
21	4	73064 + 73363	BOLT & NUT M10x40
22	2	B2122	PLATE REAR SCRAPER
23	1	B2824	DRIVE SHAFT COVER

*** DMS2870 CAM END PLATE FOR HBD ON OFFSIDE – OPERATES THE CHAIN OILER PUMP**

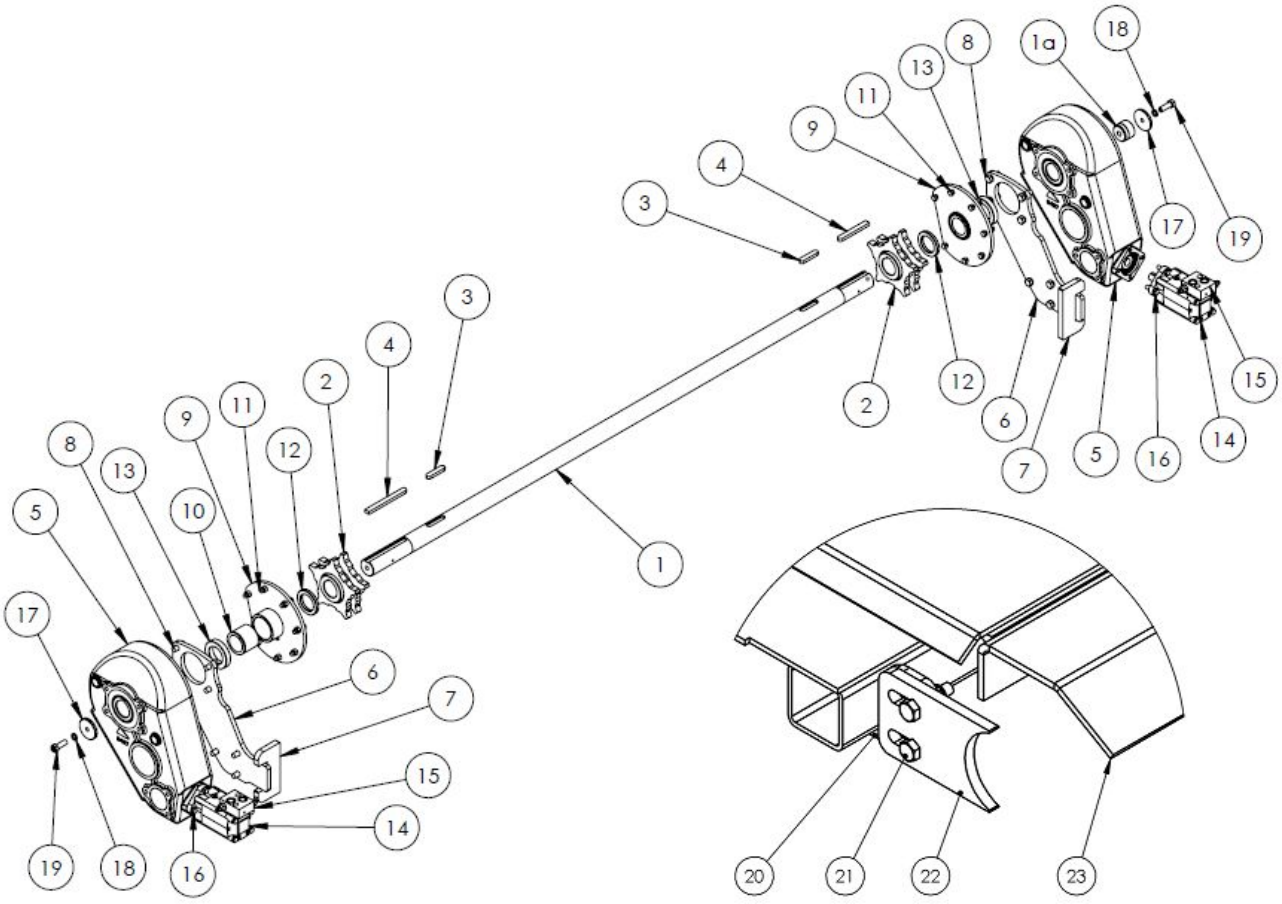
3.12 REAR SHAFT ASSEMBLY – DUAL DRIVE (800/60/32 GEARBOX) TVA STANDARD



KEY	QTY	PART No.	DESCRIPTION
1	1	B2267/1	REAR SHAFT Ø60mm (NON-OCEANIC EXPORT)
	1	B2268	REAR SHAFT Ø60mm INC STUB END (OCEANIC EXPORT)
1a	1	B2268/2	REAR SHAFT STUB END
2	2	B2110	GYPSY WHEEL
3	2	B2275	KEY 18x11x80
4	2	B2278	KEY 18x11x190
5	2	B3122	GEARBOX RT800/60/32
6	2	B3214	GEARBOX MOUNTING PLATE
7	2	B3215	TORQUE PLATE (WELDED)
8	14	73153 + 74704	BOLT & SPRING WASHER M16x40
9	2	B2306	BEARING FLANGE + STD ACM BUSH
	2	B2307	BEARING FLANGE + THICK ACM BUSH
10	2	B2322	ACM BUSH Ø60
	2	B2324	ACM BUSH Ø60 SPECIAL THICK WALL

KEY	QTY	PART No.	DESCRIPTION
11	14	73092	BOLT & NUT M12x35
12	2	B2348/2	SPACER 8mm THICK
13	2	B2348/1	SPACER 20mm THICK
14	2	B3054	HYDRAULIC MOTOR 250CL
15	2	B3078	RELIEF VALVE
16	8	73093 + 74702	BOLT & NUT M12x40
17	1	B2282/1	END PLATE LH
17	1	B2283/1	END PLATE RH
18	2	74704	SPRING WASHER M16
19	1	B2253	GREASER BOLT M16
20	2	B2124	SCRAPER ATTACHMENT
21	4	73064 + 73363	BOLT & NUT M10x40
22	2	B2122	REAR SCRAPER PLATE
23	1	B2824	DRIVE SHAFT COVER

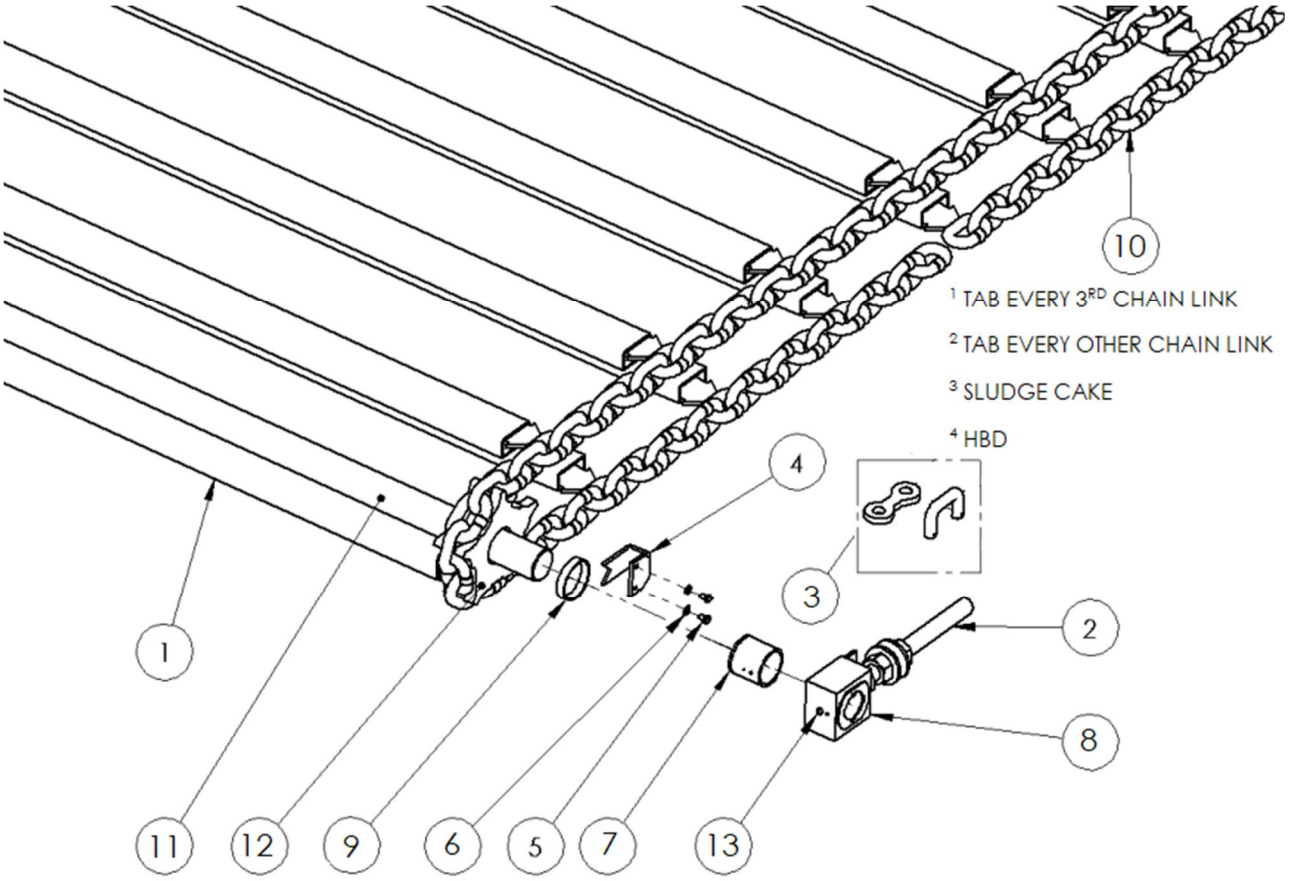
3.13 REAR SHAFT ASSEMBLY – DUAL DRIVE (1000/70/32 GEARBOX) TVA OPTION



KEY	QTY	PART No.	DESCRIPTION
1	1	B2267/1	REAR SHAFT Ø70mm (NON-OCEANIC EXPORT)
	1	B2258/1	REAR SHAFT Ø70mm INC STUB END (OCEANIC EXPORT)
1a	1	B2268/3	REAR SHAFT STUB END
2	2	B2112	GYPSY WHEEL
3	2	B2275/1	KEY 20x20x80
4	2	B2278/1	KEY 20x12x190
5	2	B3124	GEARBOX RT1000/70/32
6	2	B3216	GEARBOX MOUNTING PLATE
7	2	B3215	TORQUE PLATE (WELDED)
8	14	73153 + 74704	BOLT & SPRING WASHER M16x40
9	2	B2309	BEARING FLANGE ASSY INCL. ACM BUSH
10	2	B2325	ACM BUSH Ø70
11	14	73092	BOLT & NUT M12x35

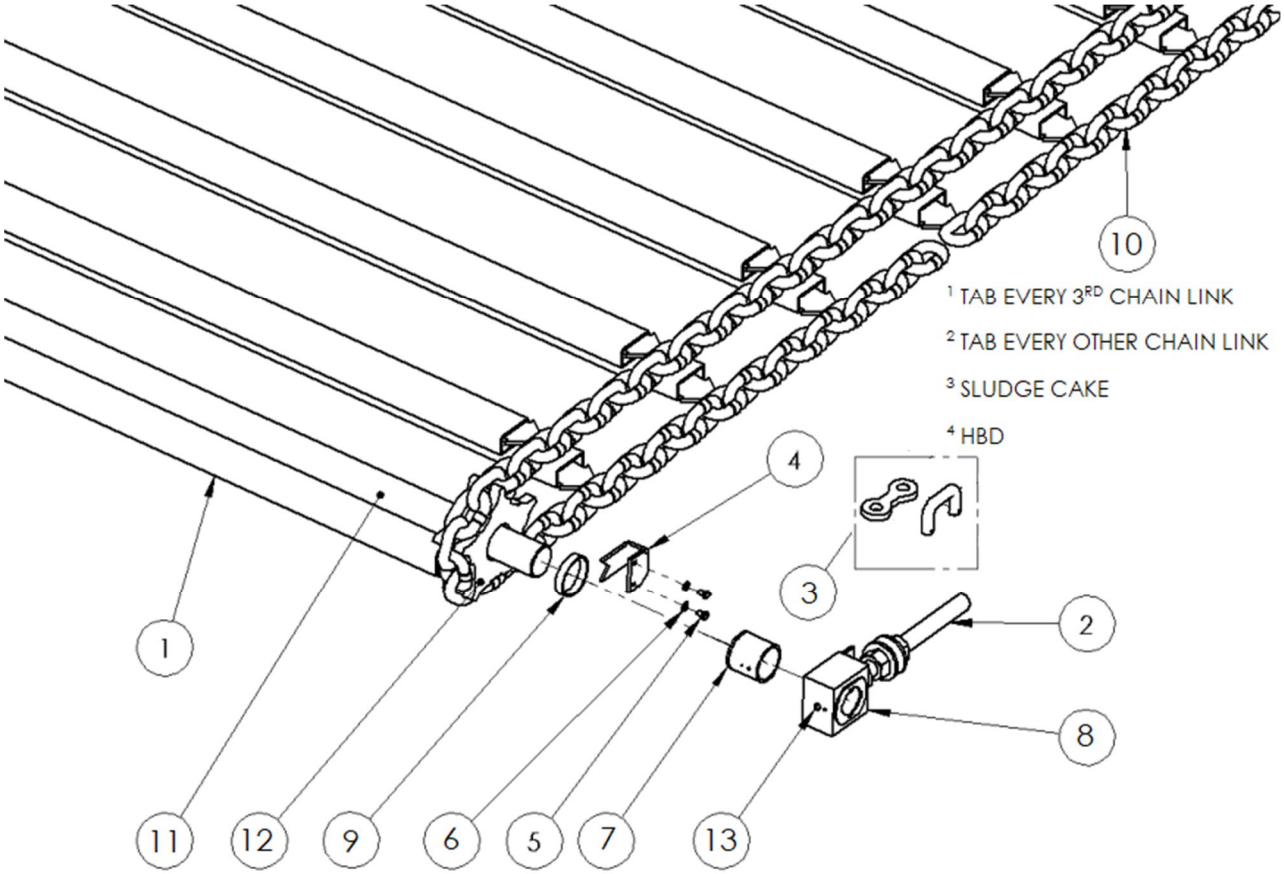
KEY	QTY	PART No.	DESCRIPTION
12	2	B2349/1	SPACER 10mm THICK
13	2	B2349	SPACER 20mm THICK
14	2	B3054	HYDRAULIC MOTOR 250CL
15	2	B3078	RELIEF VALVE
16	8	73093 + 74702	BOLT & NUT M12x40
17	1	B2283/1	END PLATE LH
17	1	B2281/1	END PLATE RH
18	2	74704	SPRING WASHER M16
19	1	B2253	GREASER BOLT M16
20	2	B2124	SCRAPER ATTACHMENT
21	4	73064 + 73363	BOLT & NUT M10x40
22	2	B2122	REAR SCRAPER PLATE
23	1	B2824	DRIVE SHAFT COVER

3.14 FRONT SHAFT AND CHAIN ASSEMBLY 150HD & 175HD MK2



KEY	QTY	PART No.	DESCRIPTION
1	35	B2041	FLOOR SLAT BOX TYPE (EVERY 3RD LINK)
	53	B2041	FLOOR SLAT BOX TYPE (EVERY OTHER LINK)
2	2	B2288	ADJUSTER M30
3	2	B2205	JOINER LINK ASSEMBLY
4	2	B2128	CLEANER FRONT GYPSY
5	4	73031	BOLT M8 x 12
6	4	74700	SPRING WASHER M8
7	2	B2322	ACM BUSH Ø60
8	2	B2294	BEARING BLOCK
9	2	B2346	SPACER
10	1PR	B2191	CHAIN TABBED 3RD FLAT LINK
	1PR		CHAIN TABBED 2ND FLAT LINK
11	1	B2230	FRONT SHAFT ASSEMBLY
12	4	B2218	PLATE WHEELS (WELDS ONTO SHAFT)
13	2	50726	GREASE NIPPLE

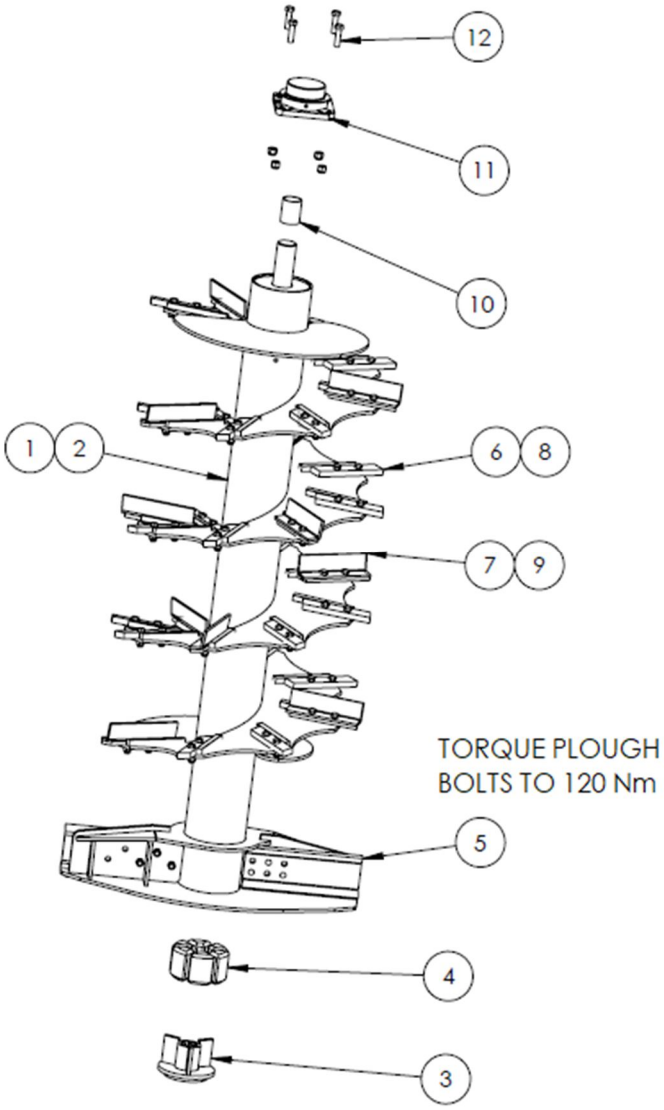
3.15 FRONT SHAFT AND CHAIN ASSEMBLY WIDEBODY 180 & 230



KEY	QTY	PART No.	DESCRIPTION
1	35	B2042	FLOOR SLAT BOX TYPE (EVERY 3RD LINK)
	53	B2042	FLOOR SLAT BOX TYPE (EVERY OTHER LINK)
2	2	B2288	ADJUSTER M30
3	2	B2205	JOINER LINK ASSEMBLY
4	2	B2128	CLEANER FOR FRONT GYPSY
5	4	73031	BOLT M8 x 12
6	4	74700	SPRING WASHER M8
7	2	B2322	ACM BUSH Ø60
8	2	B2294	BEARING BLOCK
9	2	B2346	SPACER
10	1PR	B2191	CHAIN TABBED 3RD FLAT LINK
	1PR		CHAIN TABBED 2ND FLAT LINK
11	1	B2240	FRONT SHAFT ASSEMBLY
12	4	B2218	PLATE WHEELS (WELDS ONTO SHAFT)
13	2	50726	GREASE NIPPLE

4 AUGERS, BEATERS AND DRIVES

4.1 TWIN VERTICAL SHREDDING AUGERS STANDARD

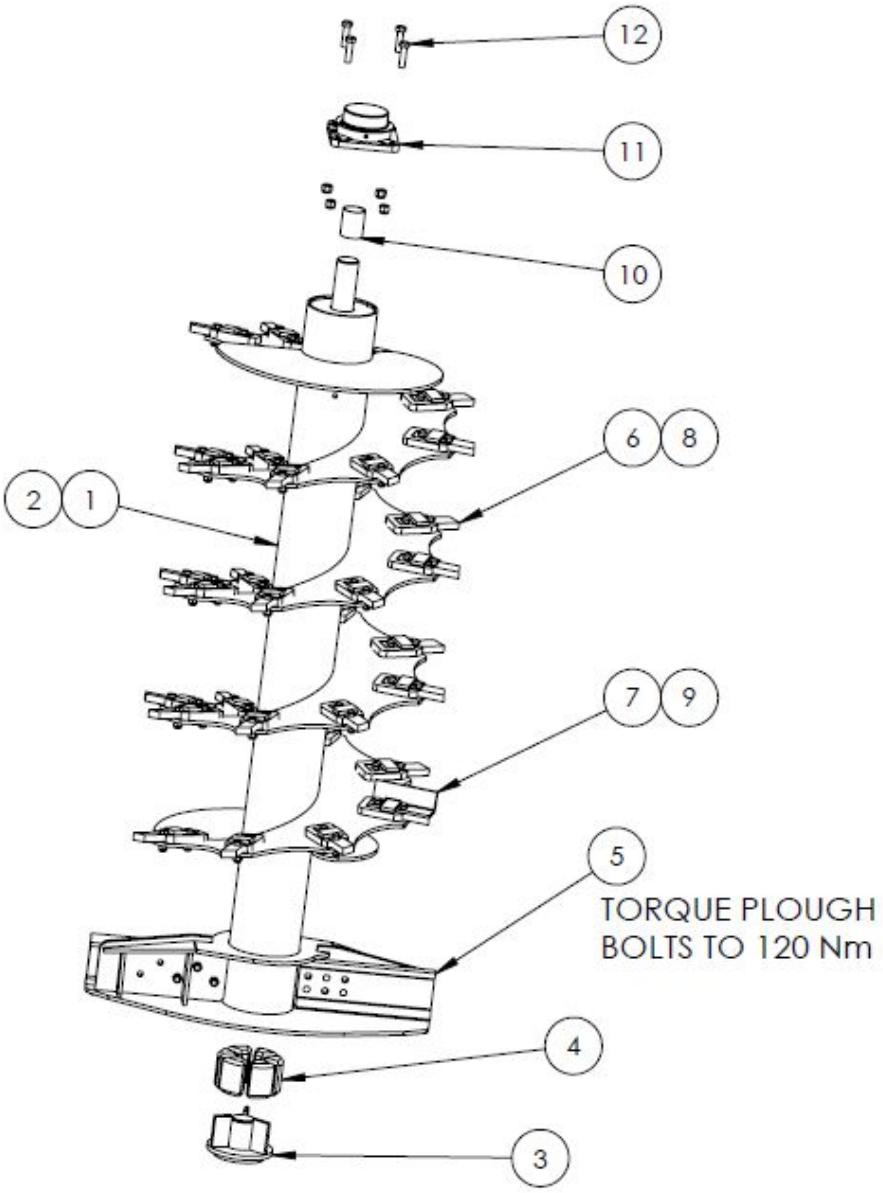


KEY	QTY	PART No.	DESCRIPTION
1	1	B1050	AUGER L.H
2	1	B1051	AUGER R.H
3	2	B1156	DRIVE FLANGE
4	12	B1146	RUBBER DRIVE BLOCK W.B
5	2	B1123/18	AUGER BLADE EACH AUGER INCL. BOLTS & NUTS
6	140	B1101/1	BOLT & LOCK NUT M14x50 FINE
7	22*	B1102	CUTTER STD POINT BORON 12mm FITTED WITH B1106
8	64	B1101	CUTTER POINT H.D BORON 20mm
9	22*	B1106	ANGLE THROWER OPTIONAL (FITTED EVERY 3RD)
10	2	B2352	SPACER
11	2	B1192	BEARING Ø60 C/W CAP
12	4	73154	BOLT & LOCK NUT M16x50

*** OPTIONAL FITMENT, FITTED EVERY 3RD CUTTER POINT.**

OPTION: B1046 & B1047 – AUGER ASSEMBLIES LH & RH WITH HORSESHOE KEEPS & NON-REVERSIBLE CUTTER POINTS

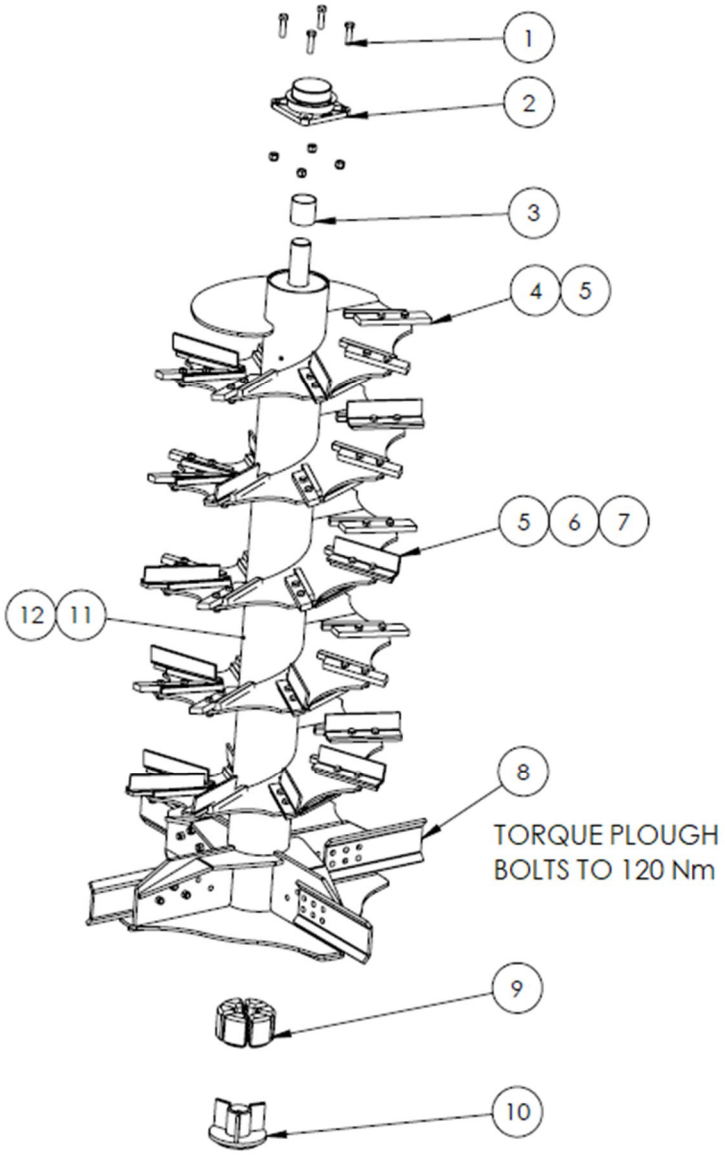
4.2 TWIN VERTICAL SHREDDING AUGERS – HORSESHOE KEEPS OPTION



KEY	QTY	PART No.	DESCRIPTION
1	1	B1046	AUGER L.H
2	1	B1047	AUGER R.H
3	2	B1156	DRIVE FLANGE
4	12	B1146	RUBBER DRIVE BLOCK W.B
5	2	B1123/18	AUGER BLADE EACH AUGER INCL. BOLTS & NUTS
6	140	B1101/1	BOLT & LOCK NUT M14x50 FINE
7	44*		BOLT & LOCK NUT M14x60 FINE
8	64	B1101A	CUTTER POINT H.D BORON 20mm NON-REVERSIBLE
9	22*	DMS4839	ANGLE THROWER OPTIONAL (FITTED EVERY 3RD)
10	2	B2352	SPACER
11	2	B1192	BEARING Ø60 C/W CAP
12	4	73154	BOLT & LOCK NUT M16x50

*** OPTIONAL FITMENT, FITTED EVERY 3RD CUTTER POINT.**

4.3 TWIN VERTICAL SHREDDING AUGERS SLUDGE CAKE

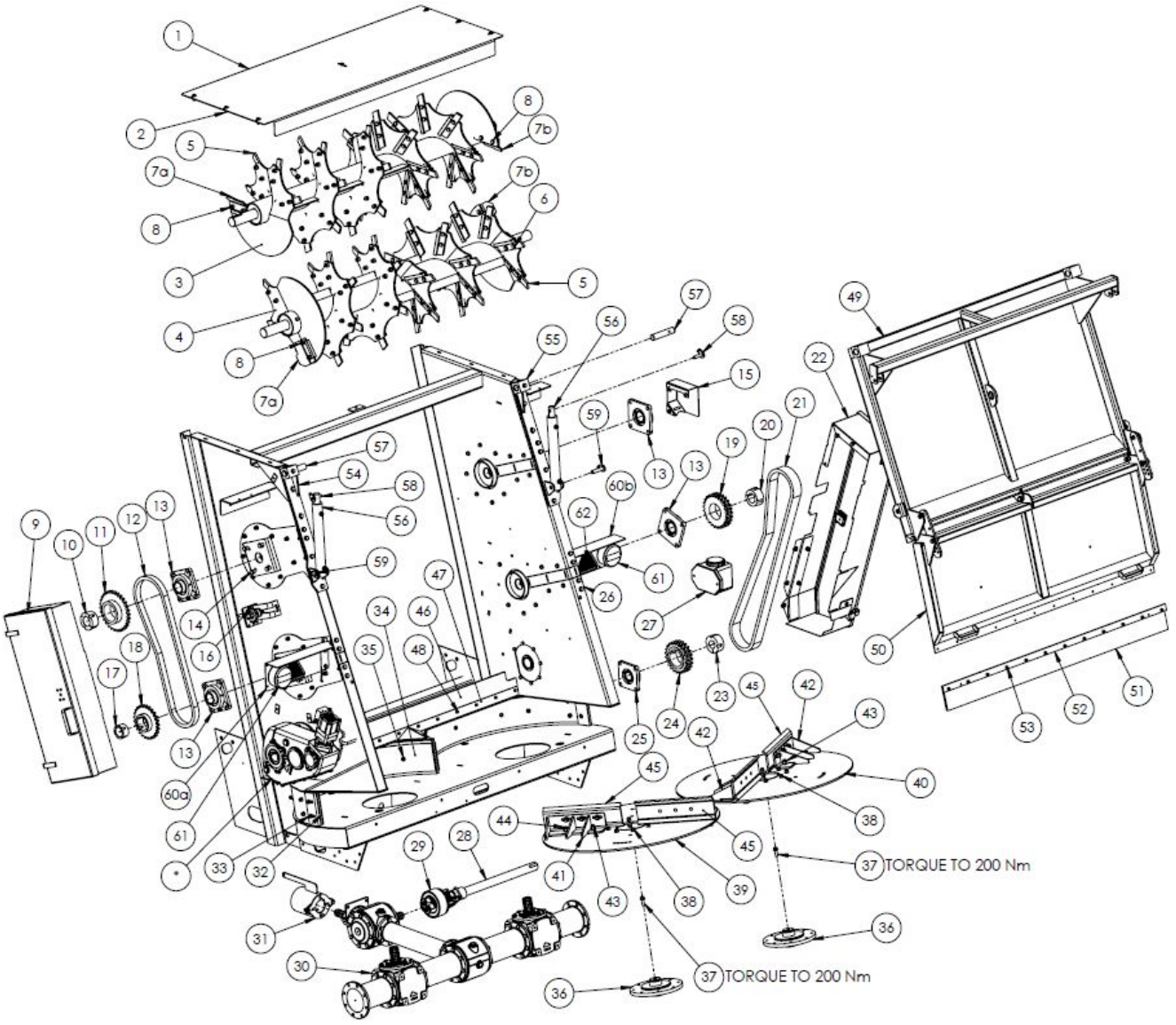


KEY	QTY	PART No.	DESCRIPTION
1	4	73154	BOLT & LOCK NUT M16x50
2	2	B1192	BEARING M60 C/W CAP
3	2	B2352	SPACER
4	44	B1101	CUTTER POINT H.D BORON 20mm
5	184	B1101/1	BOLT & LOCK NUT M14x50 FINE
6	36	B1102	CUTTER POINT STD BORON 12mm
7	36	B1106	ANGLE THROWER
8	4	B1123/18	AUGER BLADE EACH AUGER INCL. BOLTS & NUTS
9	12	B1146	RUBBER DRIVE BLOCK W.B
10	2	B1156	DRIVE FLANGE
11	1	B1048	SLUDGE AUGER ASSEMBLY LH
12	1	B1049	SLUDGE AUGER ASSEMBLY RH

NOTE:

ANGLE THROWERS FITTED ON THE BOTTOM AUGER SPIRAL AND THEN FITTED EVERY 3RD CUTTER POINT.

4.4 HORIZONTAL BEATER (x 2) WITH SPINNING DISCS (HBD)



KEY	QTY	PART No.	DESCRIPTION
1	1	DMS5029-3	CANOPY LID
2	1	73062 + 73363 + 74688	BOLT, NUT & WASHER M10x30
3	1	B8225	TOP BEATER ASSEMBLY
4	1	B8224	BOTTOM BEATER ASSEMBLY
5	64	B1102	CUTTER POINT
6	128	B1107	BOLT & NUT M14x40 FINE
7a	2	B5333	BEATER SCRAPER LHS
7b	2	B5334	BEATER SCRAPER RHS
8	8	B1107	BOLT & NUT M14x40 FINE
9	1	AMS4165	LHS CHAIN GUARD
10	1	BC445	TAPERLOCK BUSH 3020/60
11	1	BC258	SINGLE SPROCKET 30T 3020
12	1	BC120	SINGLE CHAIN 1"

KEY	QTY	PART No.	DESCRIPTION
13	4	B1180/1	BEARING UCFX13-60mm
14	32	73155 + 73375 + 74686	BOLT, NUT & WASHER M16x50 G8.8
15	1	DMS4307	SHAFT GUARD TOP RH
16	1	BC214	SINGLE TENSION SPROCKET C/W BEARING LHS
17	1	BC436	TAPERLOCK BUSH 2517/60
18	1	BC248	SINGLE SPROCKET 25T 2517
19	1	BC294	DUPLEX SPROCKET 25T 3020
	1	BC298	DUPLEX SPROCKET 30T 3020 (OPT)
20	1	BC445	TAPERLOCK BUSH 3020/60
21	1	BC140	DUPLEX CHAIN 1"
22	1	AMS4158	RHS CHAIN GUARD
23	1	BC442	TAPERLOCK BUSH 3020/50
	1	BC434	TAPERLOCK BUSH 2517/50 (OPT)

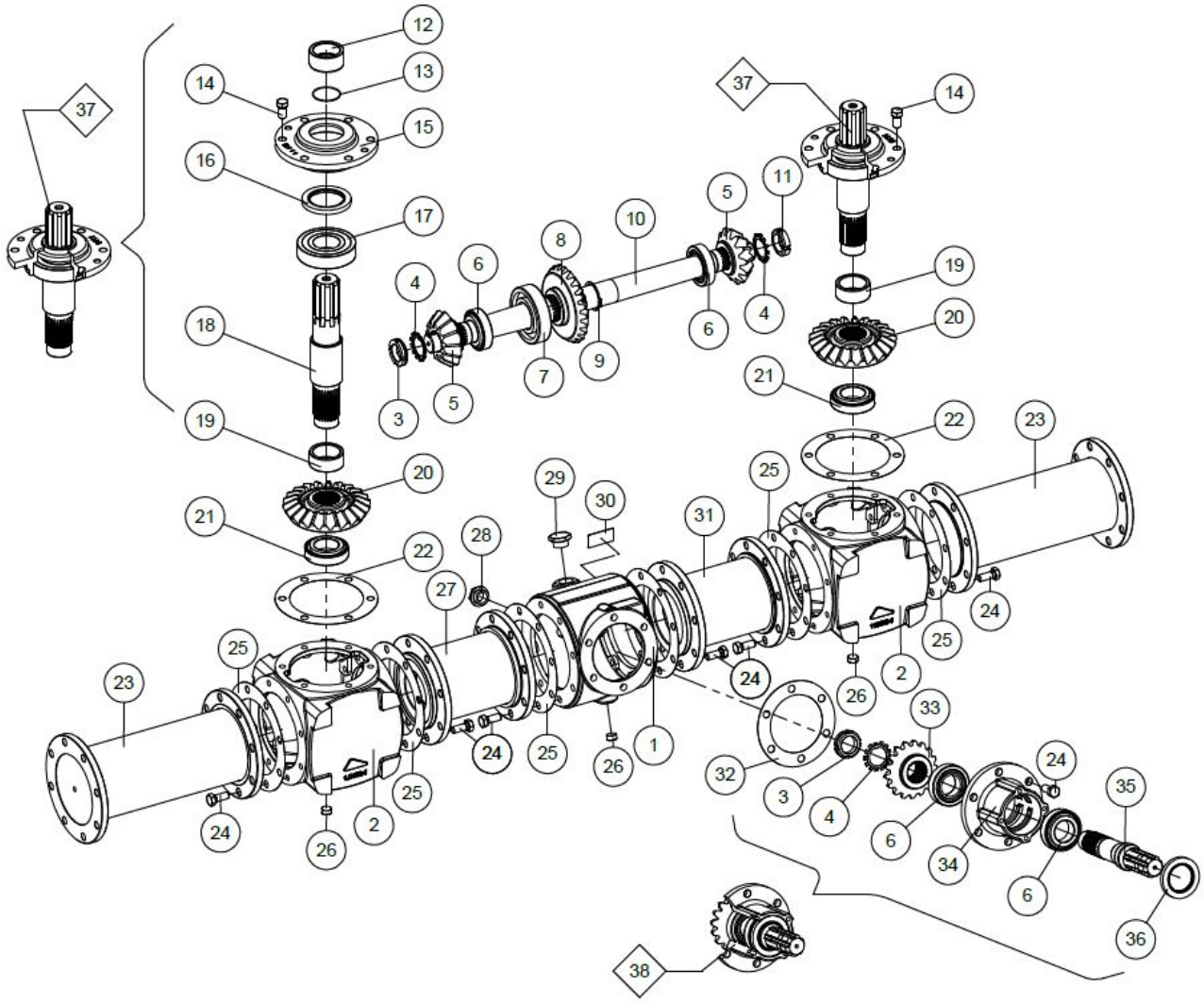
4.4 HORIZONTAL BEATER (x 2) WITH SPINNING DISCS (HBD) – CONTINUED

KEY	QTY	PART No.	DESCRIPTION
24	1	BC290	DUPLEX SPROCKET 23T 3020
	1	BC281/1	DUPLEX SPROCKET 16T 2517 (OPT)
25	1	B1178/1	BEARING UCFX10-50mm
26	1	BC222	DUPLEX TENSION SPROCKET C/W BEARING RHS
27	1	B8920	OIL TANK FOR OILER
28	1	DMS1328-17	DRIVE SHAFT SRT18 (STD)
	1	DMS1328-15	DRIVE SHAFT SRT20 (OPT)
29	1	42506	TORQUE LIMITER UNION ASSY 1-3/4" 6 SPLINE
30	1	B3183	HBD GEARBOX SRT18 (STD)
	1	B3188	HBD GEARBOX SRT20 (OPT)
31	1	B5364	PTO GEARBOX GUARD
32	2	B5326	WEAR END PLATE
33	2	73830 + 73367 + 74684	CSK BOLT, NUT & WASHER M12x50
34	2	B5325	HARDOX WEAR PAD WRAP
35	10	B5330 + 73367 + 74684	CSK BOLT, NUT & WASHER M12x40
36	2	B8338	MOUNTING FLANGE ASSY SRT18 (STD)
	2	B8338/1	MOUNTING FLANGE ASSY SRT20 (OPTION)
37	2	73128/1 + 74703	BOLT & SPRING WASHER M14x45 GR 10.9
38	16	73095	BOLT & NUT M12x50
39	1	B8370H	LHS SPINNING DISC ASSY
40	1	B8342H	RHS SPINNING DISC ASSY
41	2	B8356/18	BLADE HOLDER LHS
42	2	B8357/18	BLADE HOLDER RHS

KEY	QTY	PART No.	DESCRIPTION
43	4	73155/1 + 73375	BOLT & NUT M16x50 G12.9 (INNER)
44	4	73155 + 73375	BOLT & NUT M16x50 G8.8 (OUTER)
45	4	B1130/18	PADDLE INC NUTS & BOLTS
46	1	B4176/1	SPINNER DECK RUBBER WB
47	1	B4186/1	RUBBER CLAMP STRIP
48	12	73035 + 73359 + 74682	BOLT, NUT & WASHER M8x40
49	1	B8450	TOP DOOR
50	1	B8451	BOTTOM DOOR
51	1	B4125	CANOPY RUBBER
52	1	B4186/1	RUBBER CLAMP STRIP
53	12	73035 + 73359 + 74682	BOLT, NUT & WASHER M8x40
54	1	AMS1867-4	CANOPY DOOR HINGE ASSY
55	1	AMS1867-3	CANOPY DOOR HINGE ASSY
56	2	65093	RAM CANOPY DOOR
57	2	DMS2381	PIVOT PIN
58	2	DMS0940-1	TOP RAM PIN
59	2	DMS0940-2	BOTTOM RAM PIN
60a	1	AMS4253-3	LIGHT BRACKET LHS 500**
60b	1	AMS4252-3	LIGHT BRACKET RHS 500**
61	2	70009/3	LED REAR LAMP
62	2	70081	TRIANGLE REFLECTOR - RED
*	1	GEARBOX	SEE FLOOR DRIVE ASSY

** 600mm wide brackets available by request

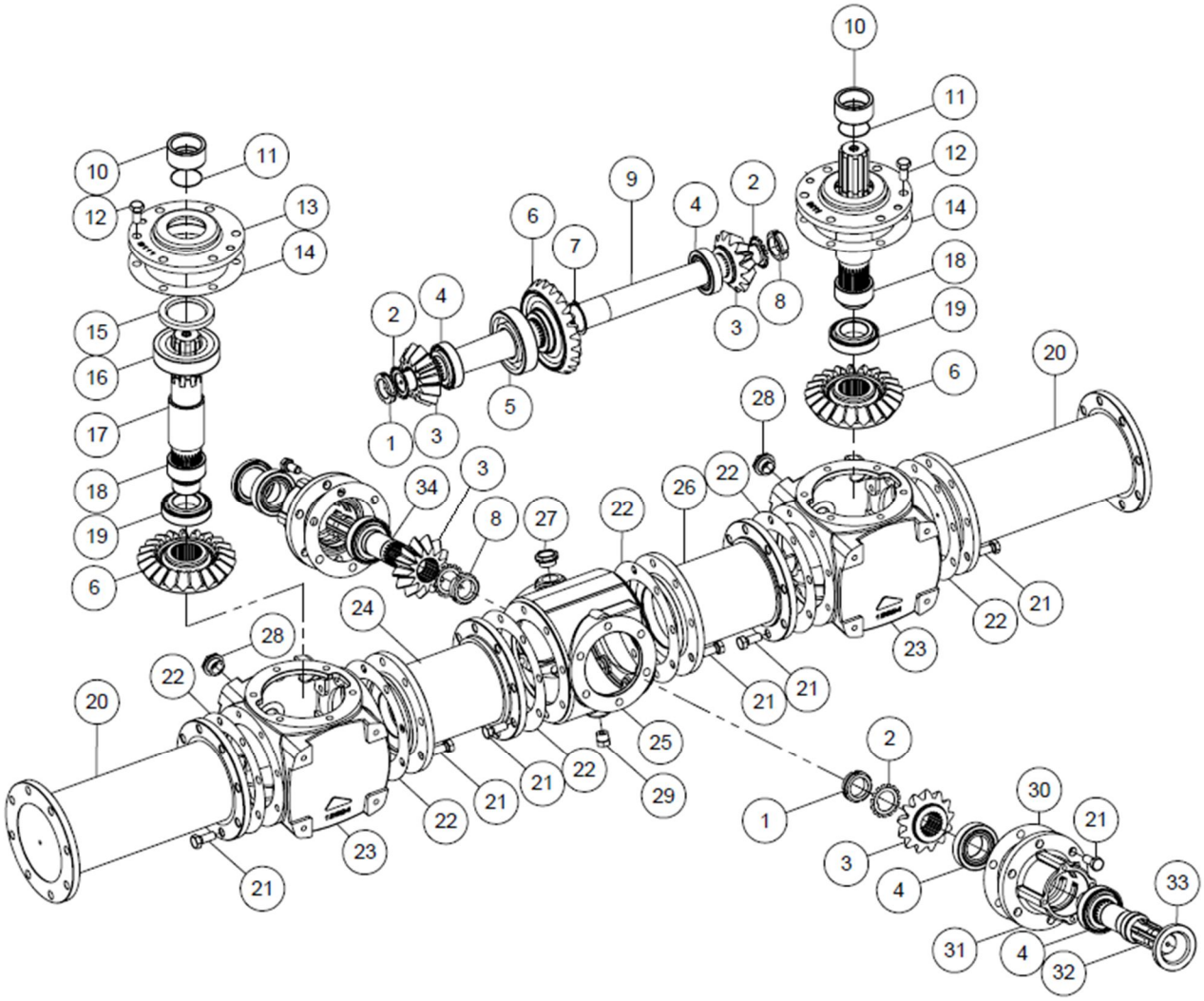
4.5 GEARBOX SRT18-1000/420 – B3182 TVA STD



KEY	QTY	PART No.	DESCRIPTION
1	1	B3401	CENTRE CASING
2	2	B3406	DRIVE CASING
3	2	B3510	LEFT THREADED RING
4	3	B3520	WASHER
5	2	B3460	BEVEL PINION
6	4	BR175	BEARING
7	1	BR410	BEARING
8	1	B3468	GEAR
9	1	B4020	CIRCLIP
10	1	B3448	SHAFT
11	1	B3512	RIGHT THREADED RING
12	2	B3482	SPACER
13	2	B3939	O RING
14	12	73124	BOLT M14x30
15	2	B3420	TOP PLATE
16	2	SL195	OIL SEAL
17	2	BR405	BEARING
18	2	B3444	SHAFT
19	2	B3480	SPACER

KEY	QTY	PART No.	DESCRIPTION
20	2	B3470	GEAR
21	2	BR180	BEARING
22	2	B3490	GASKET
23	2	B3412	SPACER
24	54	73125	BOLT M14x35
25	6	B3492	GASKET
26	3	B3993	OIL PLUG 1/2"
27	1	B3414	SPACER
28	1	B3996	SIGHT GLASS
29	1	B3998	BREATHER
30	1		IDENTIFICATION PLATE
31	1	B3417	SPACER
32	1	B3225	GASKET
33	1	B3458	BEVEL PINION
34	1	B3410	EXTENSION
35	1	B3440	SHAFT
36	1	SL165	OIL SEAL
37	2		TOP PLATE ASSEMBLY
38	1	B3409	HUB ASSEMBLY

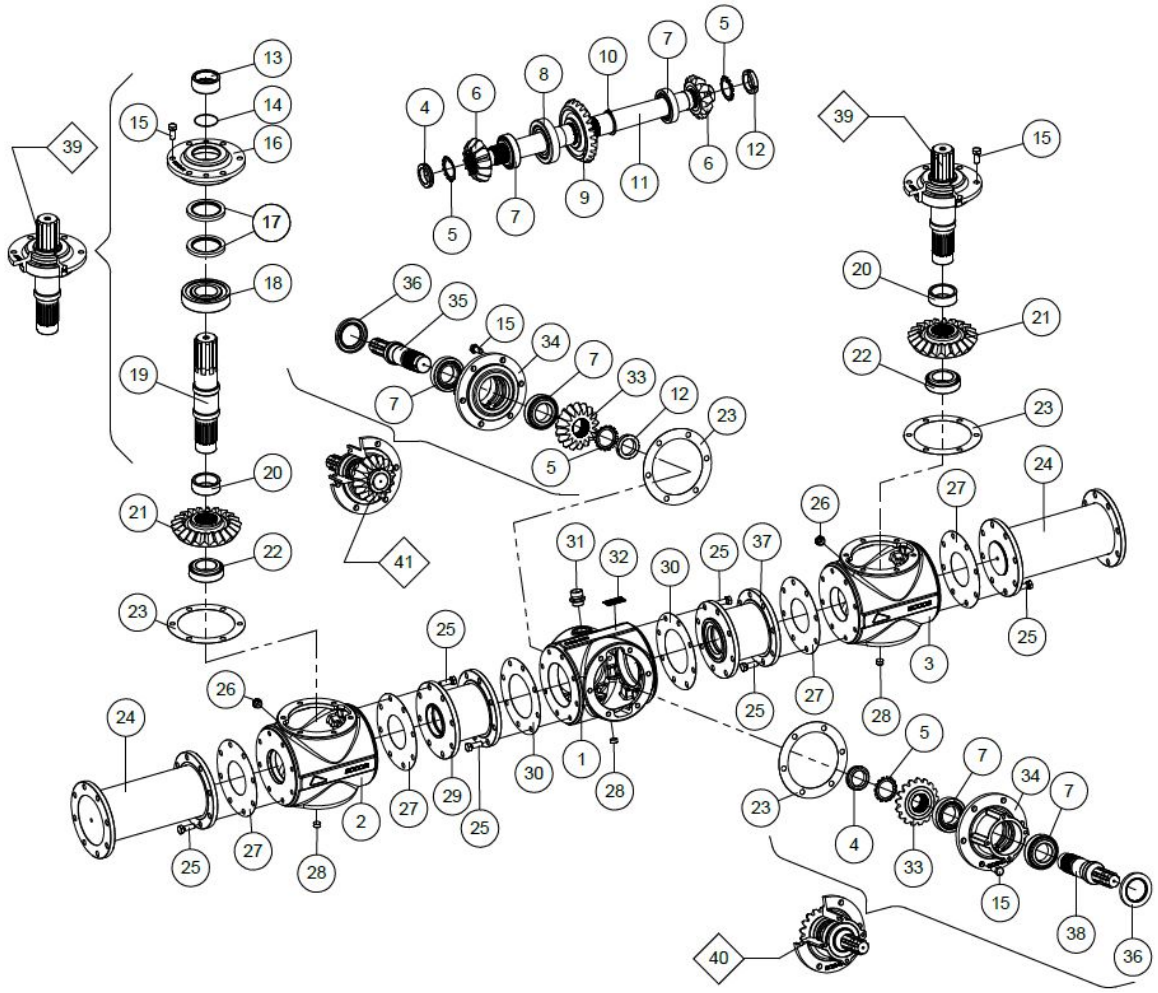
4.6 GEARBOX SRT18-1000/420 THRU – B3186 TVA SPINNER DECK READY



KEY	QTY	PART No.	DESCRIPTION
1	2	B3510	NUT LH THREAD
2	2	B3520	WASHER
3	4	B3458	PINION GEAR
4	6	BR175	BEARING
5	1	BR410	BEARING
6	3	B3468	CROWN GEAR
7	1	B4020	CIRCLIP
8	2	B3512	NUT RH THREAD
9	1	B3448	CROSS SHAFT
10	2	B3482	SPACER SLEEVE
11	2	B3939	O RING
12	12	73125	BOLT M14x35
13	2	B3420	TOP PLATE
14	2	B3490	GASKET
15	2	SL195	SEAL
16	2	BR405	BEARING
17	2	B3444	OUTPUT SHAFT
18	2	B3480	SPACER SLEEVE

KEY	QTY	PART No.	DESCRIPTION
19	2	BR180	BEARING
20	2	B3412	OUTER CASE SECTION
21	60	73128	BOLT M14x45
22	6	B3492	GASKET
23	2	B3418	DRIVE CASING
24	1	B3415	INNER CASING SECTION RH
25	1	B3404	CENTRE CASING
26	1	B3416	INNER CASING SECTION LH
27	1	B3998	BREATHER PLUG
	1	B3989	BREATHER RECOIL PLUG
28	2	B3996	SIGHT GLASS
29	1	B3990	DRAIN PLUG
30	2	B3494	GASKET (EXTENSION)
31	2	B3410	EXTENSION
32	1	B3440	INPUT SHAFT
33	2	SL165	SEAL
34	1	B3442/1	OUTPUT SHAFT - THRU

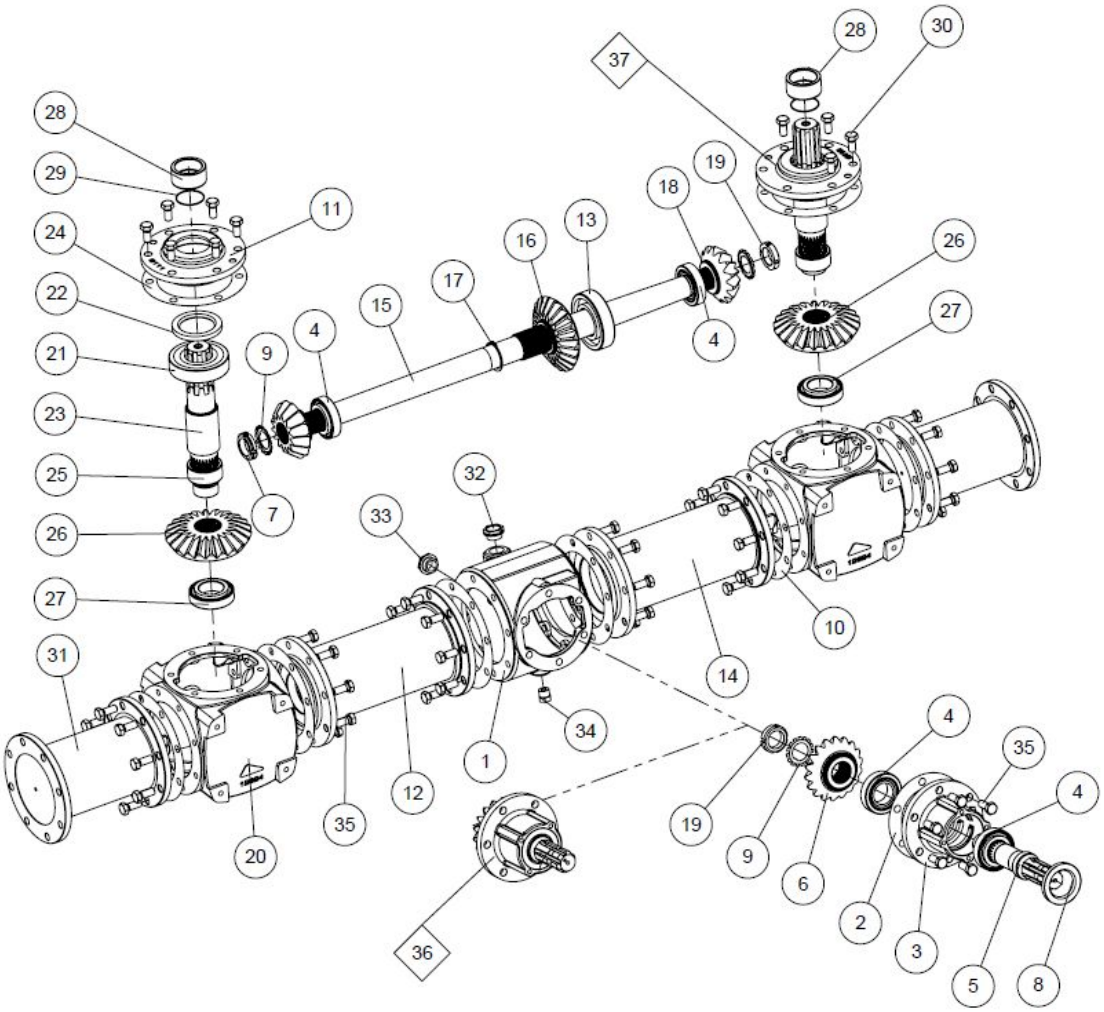
4.7 GEARBOX SRT20-1000/420 THRU – B3196 TVA SPINNER DECK READY



KEY	QTY	PART No.	DESCRIPTION
1	1	B3701	CENTRE CASING
2	1	B3736	RIGHT DRIVE CASING
3	1	B3738	LEFT DRIVE CASING
4	2	B3704	NUT LH THREAD
5	4	B3705	WASHER
6	2	B3706	PINION GEAR
7	6	BR185	BEARING
8	1	BR156	BEARING
9	1	B3451	CROWN GEAR
10	1	B4021	CIRCLIP
11	1	B3708	CROSS SHAFT
12	2	B3709	NUT RH THREAD
13	2	B3710	SPACER SLEEVE
14	2	B3937	O RING
15	24	73125	BOLT M14x35
16	2	B3711	TOP PLATE
17	4	SL198	SEAL
18	2	BR415	BEARING
19	2	B3712	OUTPUT SHAFT
20	2	B3713	SPACER SLEEVE
21	2	B3707	CROWN GEAR

KEY	QTY	PART No.	DESCRIPTION
22	2	BR232	BEARING
23	4	B3714	GASKET
24	2	B3715	OUTER CASE SECTION
25	48	73127	BOLT M14x40
26	2	B3994	SIGHT GLASS Ø1/2"
27	4	B3716	GASKET
28	3	B3993	DRAIN PLUG Ø1/2"
29	1	B3717	INNER CASING SECTION RH
30	2	B3718	GASKET
31	1	B3998	BREATHER PLUG Ø1"
	1	B3989	BREATHER RECOIL PLUG Ø1"
32	1		IDENTIFCATION PLATE
33	2	B3455	PINION GEAR
34	2	B3719	HUB
35	1	B3720	OUTPUT SHAFT - THRU
36	2	SL190	SEAL
37	1	B3721	INNER CASING SECTION LH
38	1	B3722	INPUT SHAFT
39	2	B3723	COMPLETE DRIVE
40	1	B3421	COMPLETE HUB INPUT
41	1	B3422	COMPLETE HUB OUTPUT

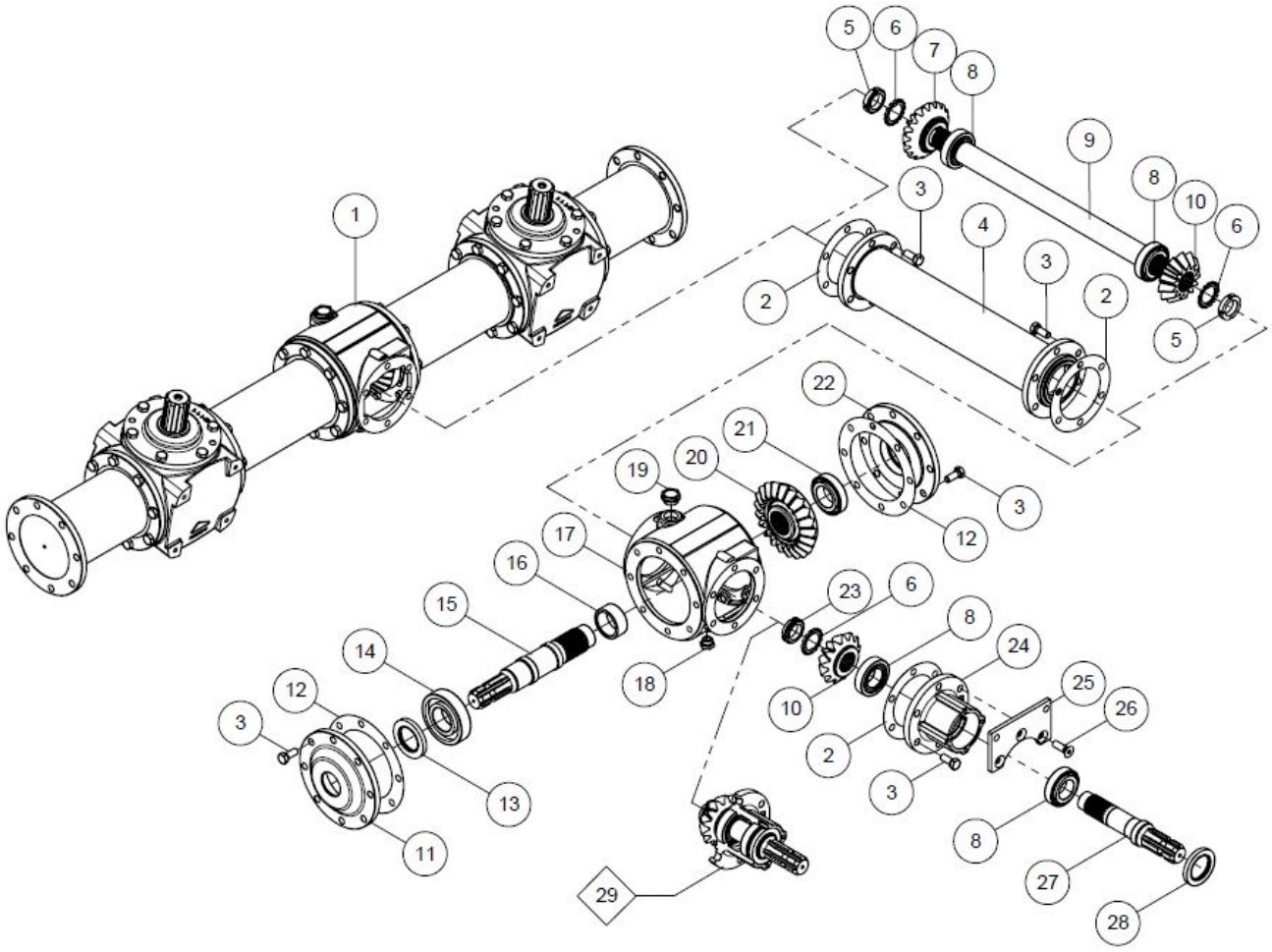
4.8 GEARBOX SRT18-1000/520 – B3190 WB TVA DETACHABLE SPINNER DECK



KEY	QTY	PART No.	DESCRIPTION
1	1	B3405	CASING
2	1	B3494	GASKET
3	1	B3410	EXTENSION
4	4	BR175	BEARING
5	1	B3440	SHAFT
6	1	B3454	PINION GEAR
7	1	B3510	NUT LH THREAD
8	1	SL165	SEAL
9	3	B3520	WASHER
10	6	B3492	GASKET
11	2	B3420	TOP PLATE
12	1	B3415R	INNER CASE SECTION
13	1	BR410	BEARING
14	1	B3416R	INNER CASE SECTION
15	1	B3449R	CROSS SHAFT
16	1	B3464	PINION GEAR
17	1	B4020	CIRCLIP
18	2	B3459	PINION GEAR
19	2	B3512	NUT

KEY	QTY	PART No.	DESCRIPTION
20	2	B3418	AUGER GEAR CASE
21	2	BR405	BEARING
22	2	SL195	SEAL
23	2	B3444	OUTPUT SHAFT
24	2	B3490	GASKET
25	2	B3480	SPACER
26	2	B3469	CROWN GEAR
27	2	BR180	BEARING
28	2	B3482	SLEEVE
29	2	B3939	O RING
30	12	73124	BOLT M14x30
31	2	B3413	OUTER CASE SECTION
32	1	B3998	BREATHER PLUG Ø1"
	1	B3989	BREATHER RECOIL PLUG Ø1"
33	1	B3996	SIGHT GLASS Ø1"
34	1	B3990	DRAIN BUNG Ø1/2"
35	54	73125	BOLT M14x35
36	1	B3408/1	NOSE CONE ASSEMBLY
37	2	B3420	DRIVE ASSEMBLY

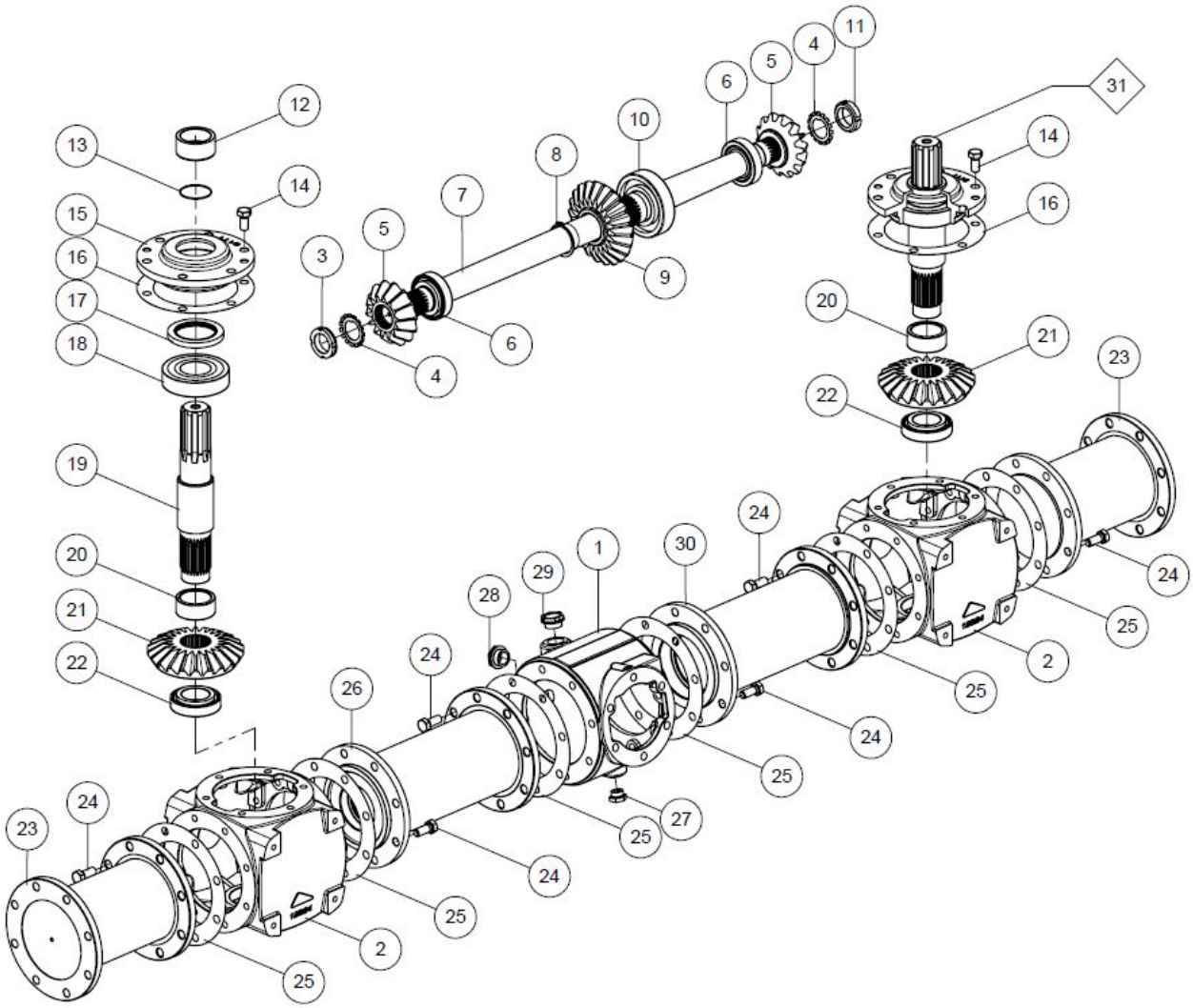
4.9 GEARBOX SRT18-1000/590/520 – B3183 ALL HORIZONTAL BEATERS & DISCS MACHINES



KEY	QTY	PART No	DESCRIPTION
1	1	B3511	BACK GEARBOX (SEE Pg 58)
2	3	B3494	GASKET
3	31	73125	BOLT M14x35
4	1	B3514	SPACER L = 573.5
5	2	B3512	THREADED RING
6	3	B3520	WASHER
7	1	B3454	BEVEL PINION
8	4	BR175	BEARING
9	1	B3515	SHAFT
10	2	B3460	BEVEL PINION
11	1	B3516	FLANGE
12	2	B3492	GASKET
13	1	SL178	OIL SEAL DL
14	1	BR410	BEARING
15	1	B3517	OUTPUT SHAFT

KEY	QTY	PART No	DESCRIPTION
16	1	B3480	SPACER
17	1	B3405	HOUSING
18	1	B3990	OIL PLUG Ø1/2"
19	1	B3998	OIL BREATHER PLUG Ø1"
20	1	B3470	GEAR
21	1	BR180	BEARING
22	1	B3518	BLIND FLANGE
23	1	B3510	THREADED RING
24	1	B3410	HUB
25	1	B3519	SUPPORT PLATE
26	3	73128	BOLT M14x45
27	1	B3440	SHAFT
28	1	SL165	OIL SEAL DL
29	1	B3408	COMPLETE HUB

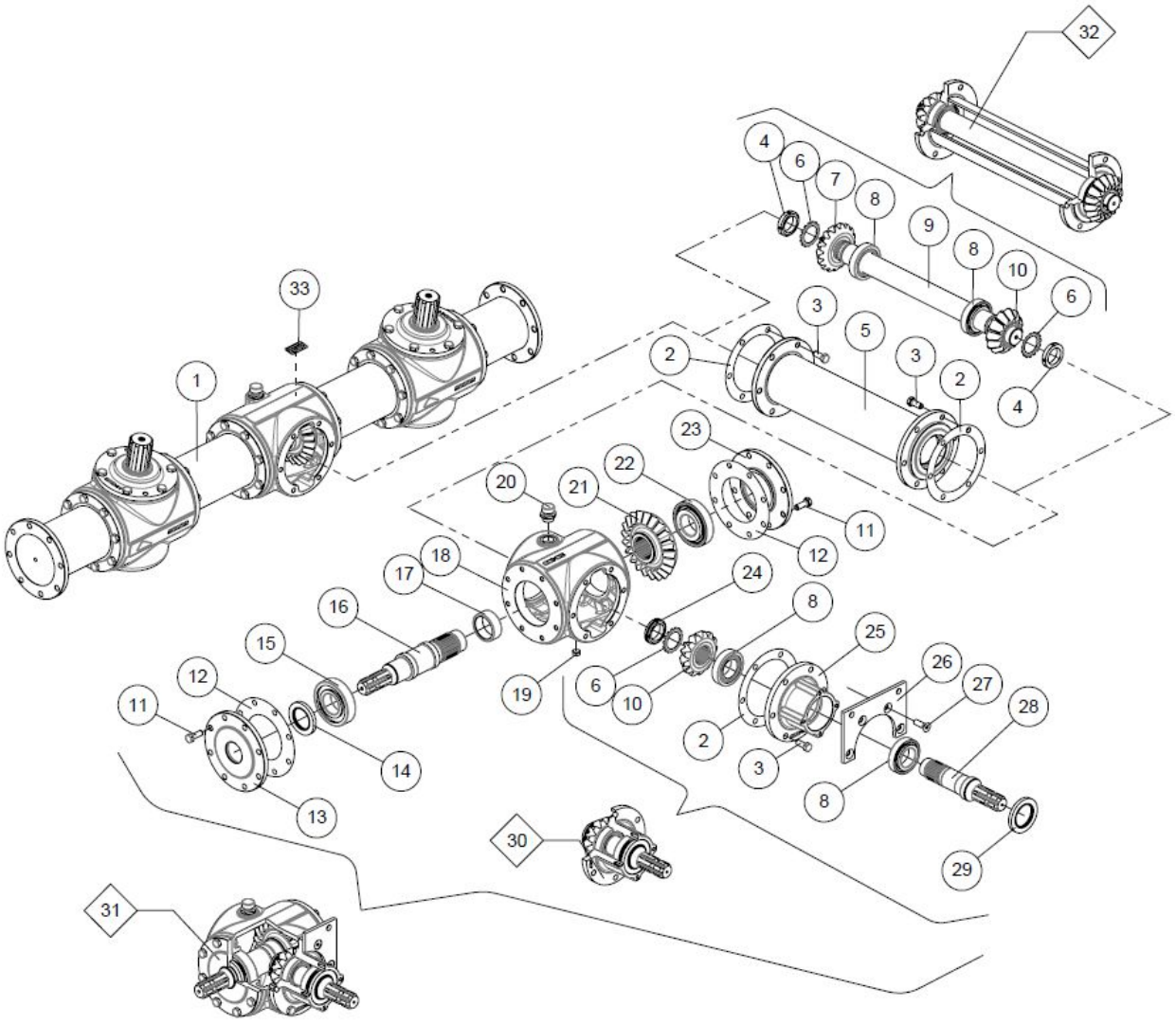
4.10 GEARBOX SRT18-1000/590/520 BACK GEARBOX – B3511 ALL HBD MACHINES



KEY	QTY	PART No.	DESCRIPTION
1	1	B3401	CASING
2	2	B3418	AUGER GEAR CASE
3	1	B3510	NUT LH THREAD
4	2	B3520	WASHER
5	2	B3459	PINION GEAR
6	2	BR175	BEARING
7	1	B3449R	CROSS SHAFT
8	1	B4020	CIRCLIP
9	1	B3464	PINION GEAR
10	1	BR410	BEARING
11	1	B3512	NUT
12	2	B3482	SLEEVE
13	2	B3939	O RING
14	12	73124	BOLT M14x30
15	2	B3420	TOP PLATE

KEY	QTY	PART No.	DESCRIPTION
16	2	B3490	GASKET
17	2	SL195	SEAL
18	2	BR405	BEARING
19	2	B3444	SHAFT
20	2	B3480	SPACER
21	2	B3469	CROWN GEAR
22	2	BR180	BEARING
23	2	B3413	OUTER CASE SECTION
24	48	73125	BOLT M14x35
25	6	B3492	GASKET
26	1	B3415R	INNER CASE SECTION
27	1	B3990	DRAIN BUNG Ø1/2"
28	1	B3996	SIGHT GLASS
29	1	B3998	BREATHER PLUG Ø1"
30	1	B3416R	INNER CASE SECTION

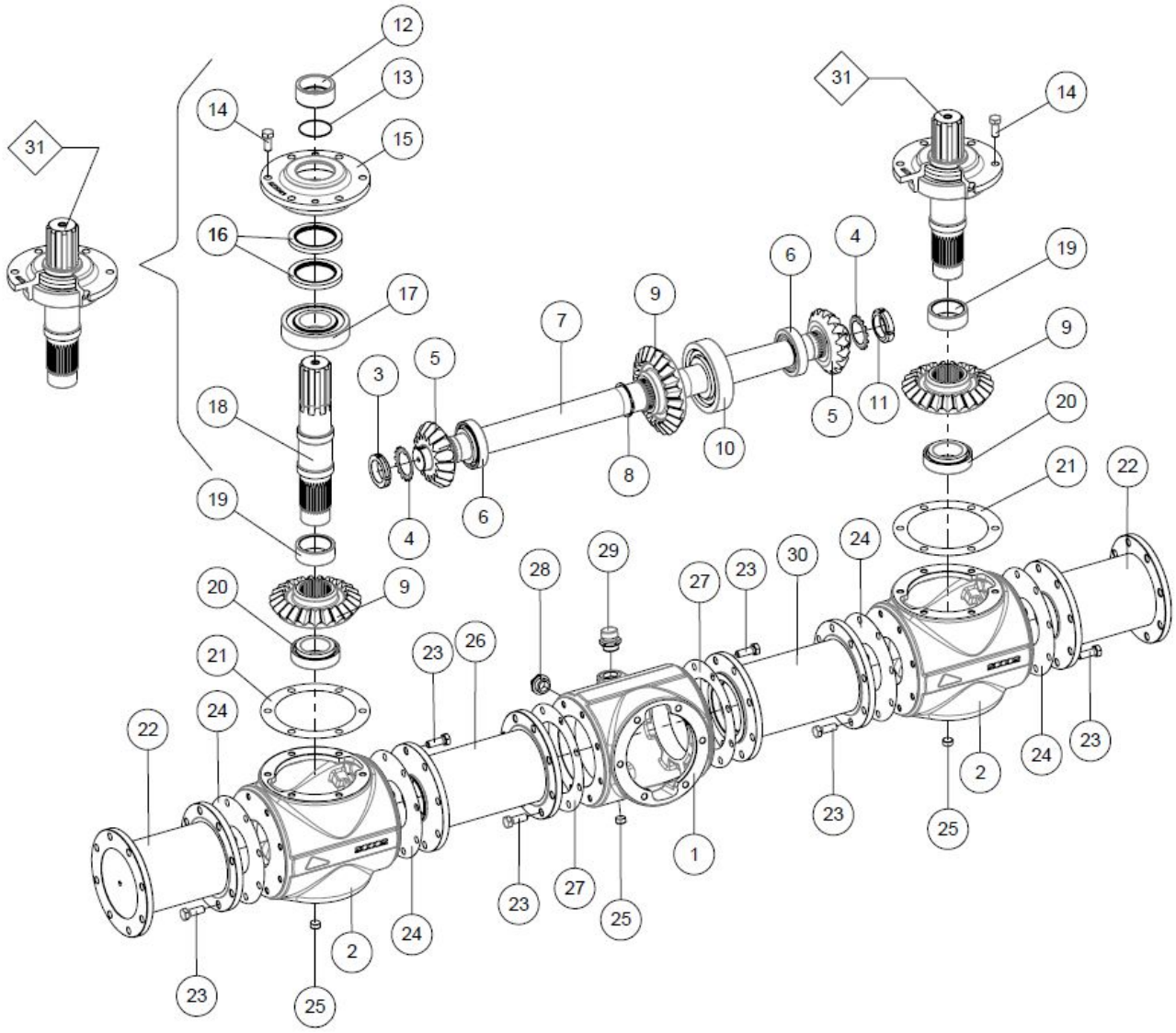
4.11 GEARBOX SRT20-1000/590/520 – B3188 WB HBD MACHINES OPTION



KEY	QTY	PART No	DESCRIPTION
1	1	B3189	BACK GEARBOX (SEE Pg 60)
2	3	B3714	GASKET
3	14	73125	BOLT M14x35
4	2	B3709	RIGHT THREADED RING
5	1	B3729	SPACER L = 570
6	3	B3705	WASHER
7	1	B3472	BEVEL PINION
8	4	BR185	BEARING
9	1	B3447	SHAFT
10	2	B3706	BEVEL PINION
11	16	73127	BOLT, HEX-HD M14x40
12	2	B3718	GASKET
13	1	B3730	FLANGE
14	1	SL180	OIL SEAL DL
15	1	BR412	BEARING
16	1	B3731	OUTPUT SHAFT
17	1	B3713	SPACER

KEY	QTY	PART No	DESCRIPTION
18	1	B3701	CENTRAL HOUSING
19	1	B3993	OIL PLUG Ø1/2"
20	1	B3989	OIL BREATHER PLUG Ø1"
21	1	B3707	GEAR
22	1	BR156	BEARING
23	1	B3732	BLIND FLANGE
24	1	B3704	LEFT THREADED RING
25	1	B3719	HUB
26	1	B3733	SUPPORT PLATE
27	4	73128	BOLT M14x45
28	1	B3722	INPUT SHAFT
29	1	SL190	OIL SEAL DL
30	1	B3725	COMPLETE HUB
31	1	B3734	COMPLETE GEARBOX
32	1	B3735	COMPLETE SPACER
33	1		IDENTIFICATION PLATE

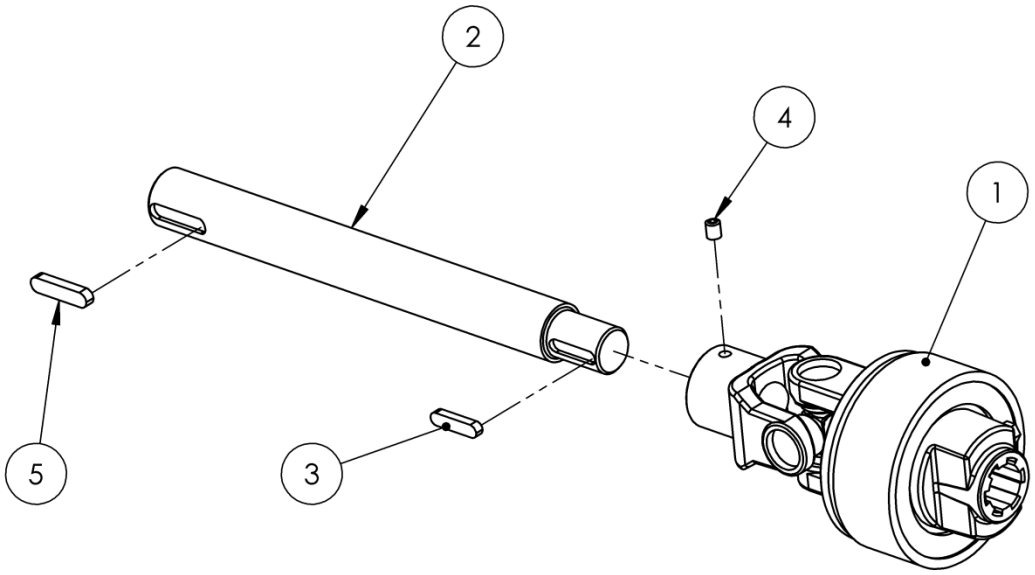
4.12 GEARBOX SRT20-1000/590/520 BACK GEARBOX – B3189 WB HBD MACHINES OPTION



KEY	QTY	PART No.	DESCRIPTION
1	1	B3425	CENTRAL CASING
2	2	B3426	LATERAL CASING
3	1	B3704	NUT LH THREAD
4	2	B3705	WASHER
5	2	B3472	PINION GEAR
6	2	BR185	BEARING
7	1	B3443	CROSS SHAFT L=1011
8	1	B4021	CIRCLIP
9	3	B3473	CROWN GEAR
10	1	BR418	BEARING
11	1	B3709	NUT RH THREAD
12	2	B3710	SPACER SLEEVE
13	2	B3937	O RING
14	12	73125	BOLT M14x35
15	2	B3711	TOP PLATE
16	4	SL198	SEAL DL

KEY	QTY	PART No.	DESCRIPTION
17	2	BR415	BEARING
18	2	B3712	SHAFT
19	2	B3713	SPACER
20	2	BR232	BEARING
21	2	B3714	GASKET
22	2	B3726	OUTER CASE SECTION
23	48	73127	BOLT M14x40
24	4	B3716	GASKET
25	3	B3993	DRAIN BUNG Ø1/2"
26	1	B3727	INNER CASE SECTION RH
27	2	B3493	GASKET
28	1	B3996	SIGHT GLASS Ø1"
29	1	B3989	BREATHER PLUG Ø1"
30	1	B3728	INNER CASE SECTION LH
31	2	B3723	COMPLETE OUTPUT

4.13 TRANSVERSE DRIVE ASSEMBLY HORIZONTAL BEATERS CAM CLUTCH

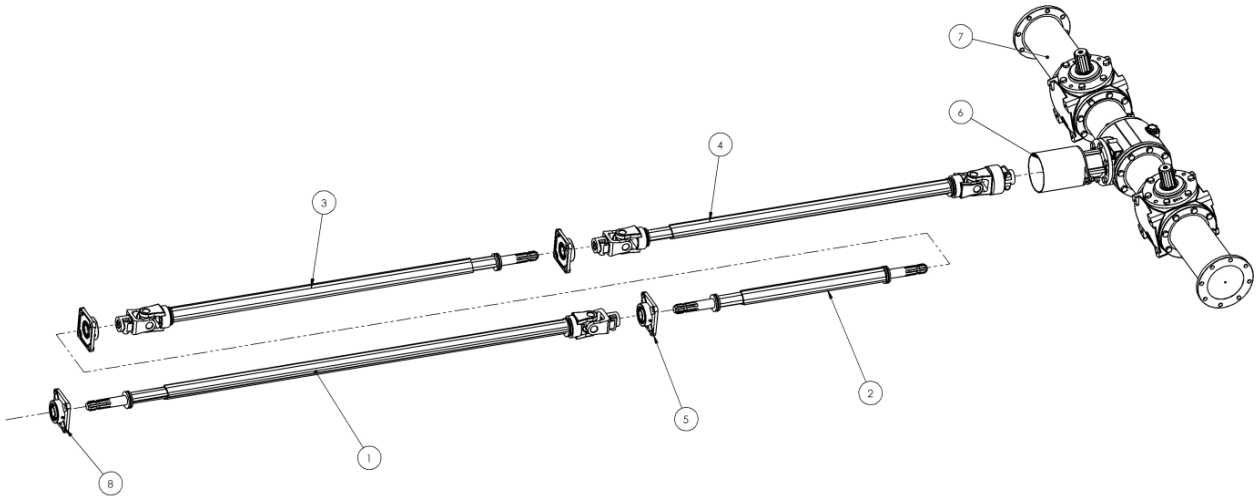


KEY	QTY	PART No.	DESCRIPTION
1	1	42506	TORQUE LIMITER ASSEMBLY 1-3/4" TO 6 SPLINE
2	1	DMS1328-17	DRIVE SHAFT WIDEBODY SRT18
2	1	DMS1328-15	DRIVE SHAFT WIDEBODY SRT20
3	1	DMS0263-03	KEY 12x8
4	1	73898	GRUB SCREW M12 x 16LG
5	1	DMS0326	KEY 14x9

Factory set Torque limit at 2900 Nm (138 bar)

5. PTO AND TRANSMISSION

5.1 TRANSMISSION MK2 150HD & 175HD AND WIDEBODY 180 & 230 TVA



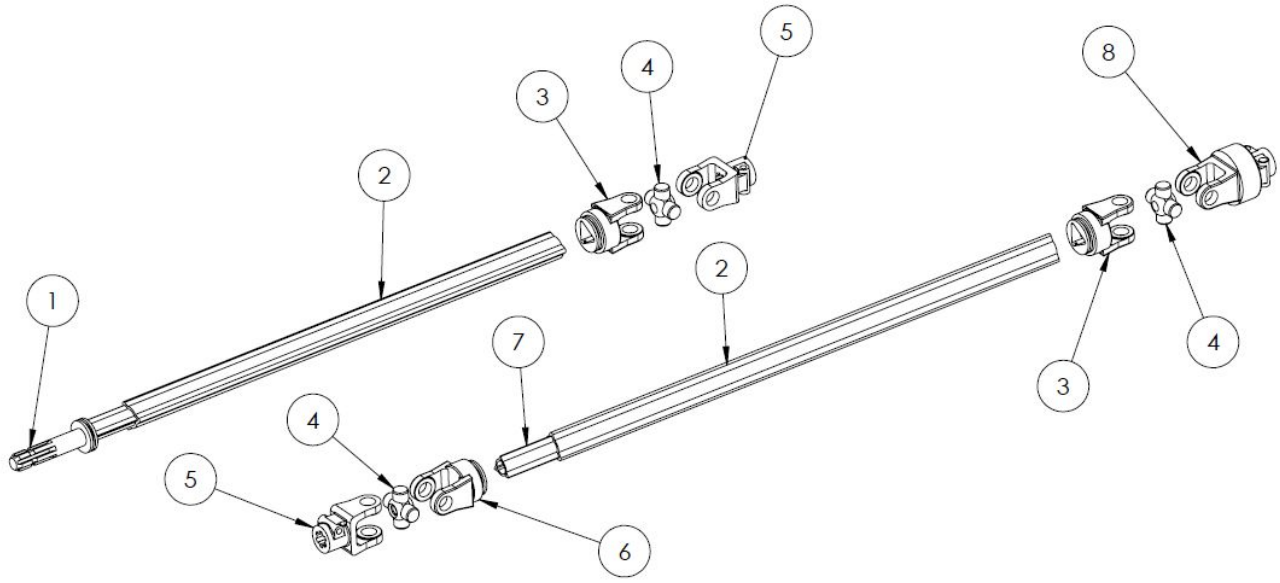
T80 SHAFTS ON ALL MODELS

KEY	QTY	PART No.	DESCRIPTION
1	1	42360	PTO SHAFT F/M
2	1	42311	PTO SHAFT M/M
3	1	42355	PTO SHAFT F/M
4	1	42310	PTO SHAFT F/F
5	3	B1176	BEARING MSF 45mm
6	1	AMS1524	GUARD
7	1	B3180	GEARBOX
8	1	B1177	BEARING MSF 45mm - FRONT ONLY

5.2 TRANSMISSION MK2 150HD & 175HD AND WIDEBODY 180 & 230 HBD

MODEL	FRONT	MIDDLE	REAR
150HD/175HD	42360	42350 x 2	42380
180/230	42360	42350 x 2	42380

5.3 TRANSMISSION DRIVELINE PARTS

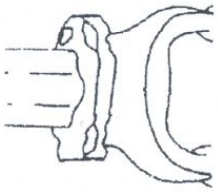
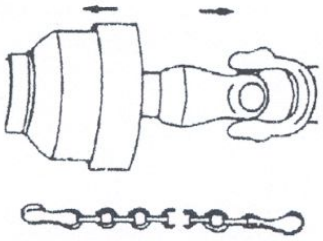


KEY	PART No.	DESCRIPTION
1	42045	SHAFT 1-3/4" 6 SPLINE + INNER T80 TUBE ASSY
2	42106	OUTER T80 TUBE 3m *
3	42102	YOKE TO OUTER T60 TUBE
4	42100	JOURNAL

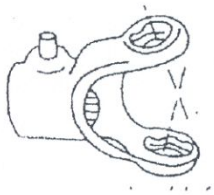
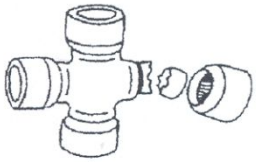
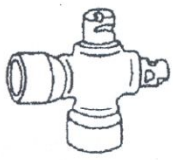
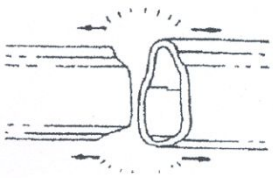
KEY	PART No.	DESCRIPTION
5	42108	YOKE TO 1-3/4" 6 SPLINE
6	42101	YOKE TO INNER T80 TUBE
7	42105	INNER T80 TUBE 3m *
8	42766	YOKE TO OVER-RUN CLUTCH 1-3/4" 6 SPLINE

***Tubes supplied in 3 meter lengths (cut to length).**

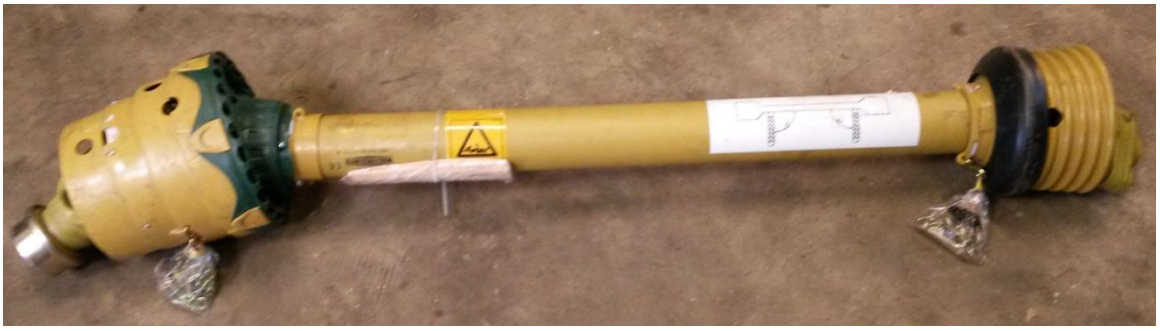
5.4 PROBLEMS AND POSSIBLE SOLUTIONS

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
 Torsion of telescopic tubes	Excessive twisting of shafts	Fit an appropriate safety device onto the drive
		Upgrade the drive
 Rapid wear on tubes	Excessive slipping under load of drive	Use drive polyamide coated tubes. (Rilsan coated)
	Drive too short so tubes are not coupled well	Replace drive with one of an adequate length
	Poor lubrication	Lubricate as prescribed
 Rapid wear on shielding ring nuts	Poor lubrication	Lubricate as prescribed
 Shielding coming out of its seat and chain giving way	Bad chain connection	Position chain properly so that even at the maximum drive angle the chain is not under tension

5.4 PROBLEMS AND POSSIBLE SOLUTIONS

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
 Yoke eyes opening / deforming	Excessive twisting of shafts	Fit an appropriate safety device onto the drive
	Drive too long	Upgrade the drive
 Wear on yoke arms	Excessive working angle of worn joint	Use a constant velocity joint or disengage the P.T.O. on tight bends
 Cross pins break	Excessive twisting movement	Fit an appropriate safety device onto the drive
		Upgrade the drive
 Rapid wear on cross pins	Excessive continuous load or excessive working angle	Check that the choice of working conditions and type are appropriate
	Lubrication intervals not respected	Respect the prescribed lubrication intervals
 Telescopic tubes disengaging during work or manoeuvring	Drive too short	Replace drive with a longer one

5.5 WALTERSCHIED WIDE ANGLE PTO SHAFT – SHEAR BOLT



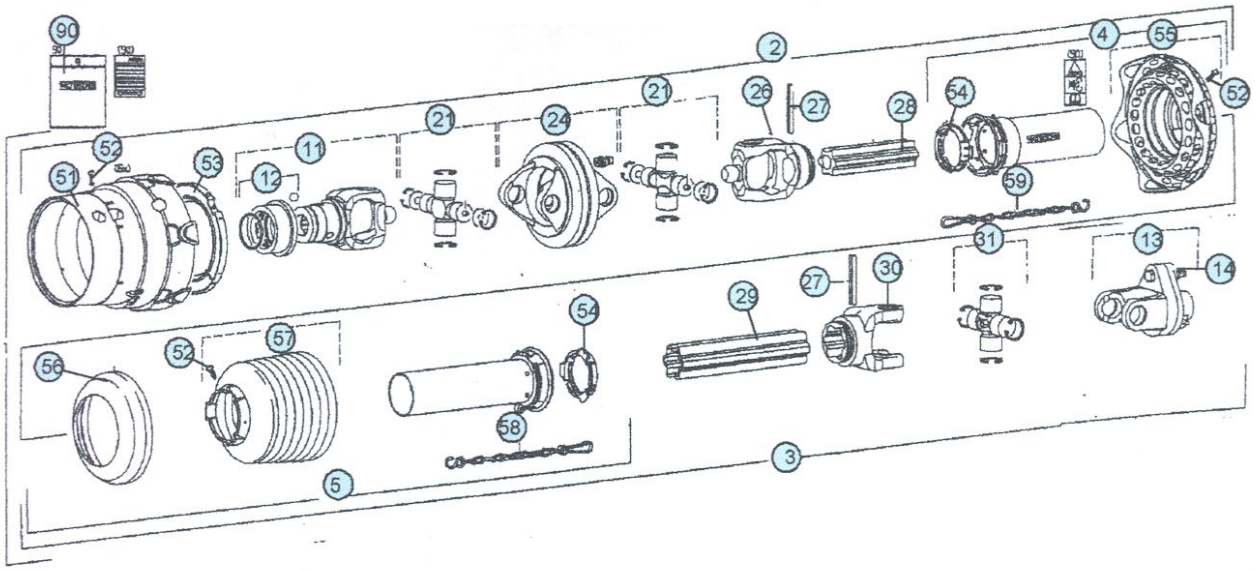
PART No.	TRACTOR END	SPREADER END	LENGTH	REF
43004	1 3/8" 6 SPLINE	1 3/4" 6 SPLINE	1210mm	
43004/1	1 3/4" 20 SPLINE	1 3/4" 6 SPLINE	1210mm	
43004/2	1 3/8" 21 SPLINE	1 3/4" 6 SPLINE	1210mm	
43005L	1 3/8" 21 SPLINE	1 3/8" 6 SPLINE	1510mm	AUSTRALIA ONLY
43006L	1 3/8" 6 SPLINE	1 3/8" 6 SPLINE	1510mm	AUSTRALIA ONLY
43007L	1 3/4" 20 SPLINE	1 3/8" 6 SPLINE	1510mm	AUSTRALIA ONLY

NOTE: All PTO shafts meant for Australia and used on the T80 driveline will have the spreader end updated to 1 ¾" 6 spline.

5.6 WALTERSCHIED WIDE ANGLE PTO SHAFT – TORQUE LIMITER

PART No.	TRACTOR END	SPREADER END	LENGTH	REF
43004/2TL	1 3/8" 21 SPLINE	1 3/4" 6 SPLINE	1210mm	2 CAM
43008	1 3/4" 20 SPLINE	1 3/4" 6 SPLINE	1510mm	4 CAM

5.7 WALTERSCHEID WIDE ANGLE PTO SHAFT PARTS



KEY	QTY	PART No.	DESCRIPTION
1	1	43005	W/A P.T.O SHAFT COMPLETE 21 SPLINE
	1	43006	W/A P.T.O SHAFT COMPLETE 6 SPLINE
	1	43007	W/A P.T.O SHAFT COMPLETE 20 SPLINE
11	1	43360	W/A YOKE TO 21 SPLINE
	1	43361	W/A YOKE TO 6 SPLINE
	11	43362	W/A YOKE TO 20 SPLINE
12	1	43322	AS - LOCK SIZE C (AG118)
13	1	43374	SHEAR-BOLT CLUTCH TO YOKE
14	1	B1311	SHEAR-BOLT GRADE 6.8
21	2	43367	W/A JOURNAL KIT
24	1	43365	W/A CENTRE BODY
26	1	43366	W/A YOKE TO S4 INNER TUBE
27	2	42030	ROLL PIN
28	1	43301/1	INNER TUBE S4GA PROFILE

KEY	QTY	PART No.	DESCRIPTION
29	1	43302	OUTER TUBE S5 PROFILE
30	1	43315	YOKE TO S5 OUTER TUBE
31	1	43340	JOURNAL KIT
51	1	43474	W/A GUARD CONE
52	10	43490	SCREW
53	1	43475	W/A BEARING RING
54	1	43450	INNER TUBE BEARING RING
55	1	43476	W/A FLEXIBLE GUARD
56	1	43452	REINFORCING COLLAR
57	1	43451	CONE FOR INNER TUBE
58	1	43448	SAFETY CHAIN 400
59	1	43449	SAFETY CHAIN 600
90	1	43002	W/S INSTRUCTION MANUAL
	1	43469	GUARD COMPLETE

5.8 PTO GUARD SAFETY CHAIN FIXING

Care should be taken when fixing the PTO safety chains, by following the guidelines below you can help avoid unnecessary and possibly expensive damage to the PTO guard and its component parts.

The purpose of the safety chain is to stop the guarding from rotating during its normal operation thus preventing foreign objects becoming entangled in it including you!, the safety chains must be fixed in a position that limits the risk of damage to both operator and shaft guarding.

Because each application varies there is no one perfect way of fitting, as we are all aware tractors vary as do machines, some come with ideal fixing points others don't.
The chains are supplied at a set length, this is not the length they have to be used at, more so the length exists to ensure attachment can be achieved should a suitable anchor point be some distance from the guard.

In the case where a chain can be shortened it should be, not so much as to then cause damage by pulling on the guard but enough to stop the whole chain wrapping around the guard cuffs as the shaft starts to work. This is especially true when fixing wide angle constant velocity joints, by its nature the shaft will be moving to the left and right as the tractor turns, in this case we have to leave enough slack on the chain to allow this movement but at the same time ensuring that the chain does not wrap around the wide angle cover or pull across its surface causing damage, in an ideal world the chain would be fixed at 90 degrees to the guard, in effect the only point of contact between guard and chain would be where the chain is fixed to the guard, getting the anchor point as close to 90 degrees to the shaft will certainly help prevent damage.

Sometimes with the wide angle shafts it is possible to fix one chain to the other, at the same time shortening the length of chain as it is done, this can be achieved by taking the main tube guard chain that is at the wide angle end of the drive shaft and clipping it to the chain running from the wide angle guard which in turn is anchored as close to 90 degrees from the shaft as is possible, again providing there is some slack left in the chain, the length of chain can be reduced thus avoiding damage casued by excess chain wrap around and crossover.

The following pointers should help keep your guard serviceable for many hours.

1) Don't leave the chains too long allowing them to wrap around the guard it will damage the guard.
2) Don't leave the chains so short they pull on the guard.
3) Always try and avoid contact between chain and guard, keep contact to a minimum.
4) Anchor the chains as close to 90 degrees from the shaft as possible.
5) If needed attach one chain to the other, to avoid cross over and chain wrap around.
6) Always ensure there is enough slack to allow for exaggerated movement especially when using a wide angle shaft.
7) Always maintain the shaft as instructed by the manual supplied with it.
8) Grease your shaft and guard bearings regularly.
9) Always replace worn chains and guarding, damaged guards are potentially lethal.
10) Always stop the tractor engine, wait for the machine to stop turning and remove the ignition key before attempting to work on or around your driveshaft.
11) If in doubt, refer to PTO manual.

Safety chain fixing positions

5.9 PTO SHAFT STOWAGE

When the spreader is not in use stow PTO shaft as shown to prevent damage.

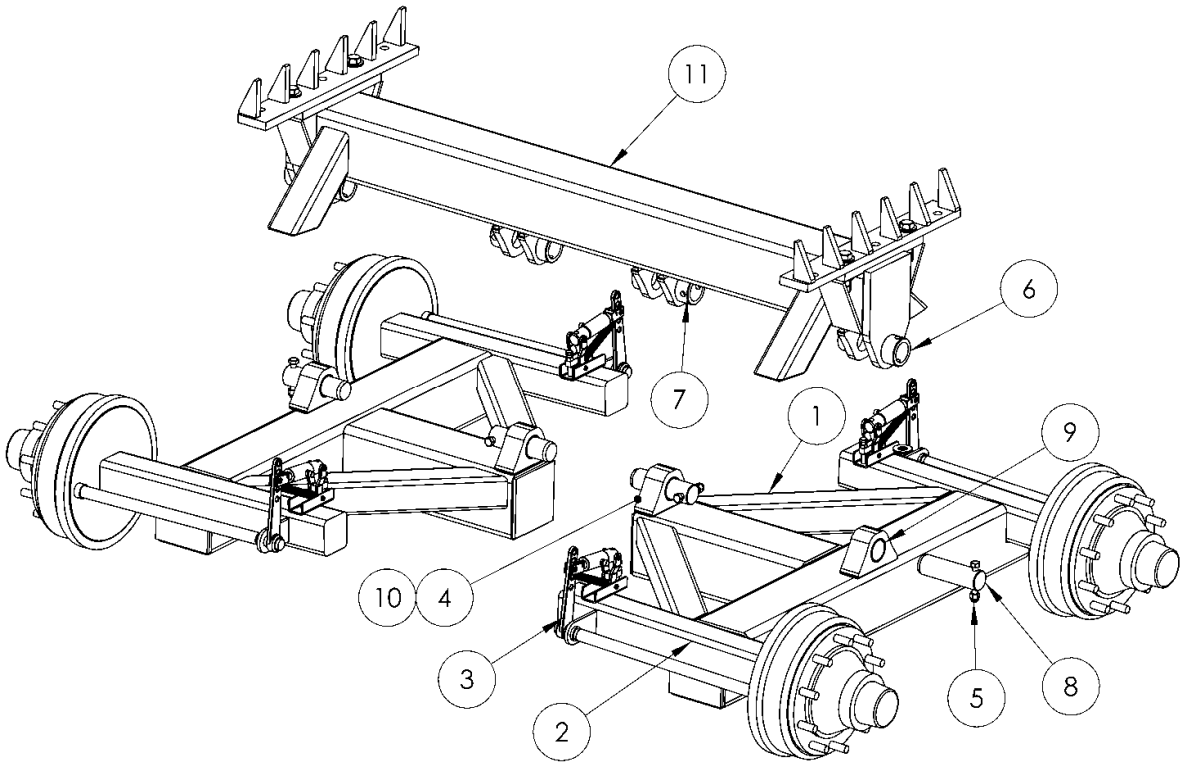
Please check the condition of the PTO shaft guard regularly, if damaged replace as soon as possible.

6. AXLES AND BRAKES

6.1 AXLES & BRAKES ARRANGEMENTS

For all brake and axle parts please contact your local dealer or GT Bunning.

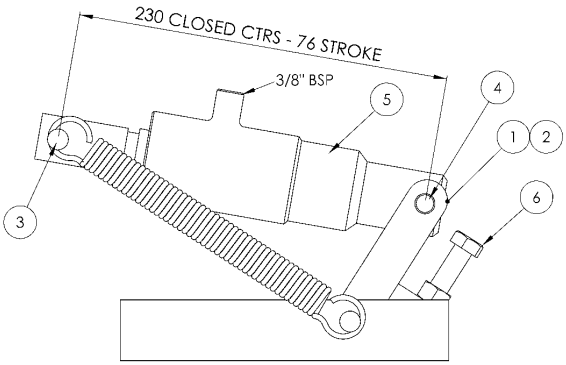
6.1.1 ROCKING-BEAM TANDEM SUSPENSION, 26 TONNE 230 WIDEBODY



KEY	QTY	PART No.	DESCRIPTION
1	1 PR	B5026	ROCKING BEAM ASSEMBLY
2	4		STUB AXLE 130 BEAM
3	4	F00620	BRAKE LEVER
4	4	B5130	PIVOT BLOCK M60
5	4	73164	BOLT & NUT
6	4	B5115	RETAINING COLLAR
7	4	B5117	COLLAR
8	4	B5110	PIVOT PIN BUSH M60
9	4	B2322	BUSH M60
10	4	50726	GREASE NIPPLE
11	1	B5050	CROSS BEAM

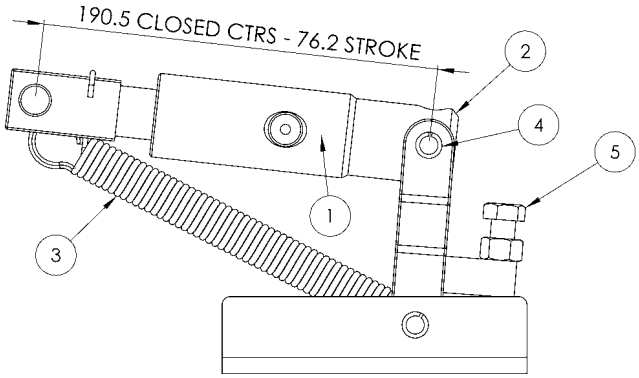
6.2 HYDRAULIC BRAKE SYSTEMS

6.2.1 HYDRAULIC BRAKE RAM ASSEMBLY – Widebody 150HD, 175HD & 180 35mm BORE – 70830.3



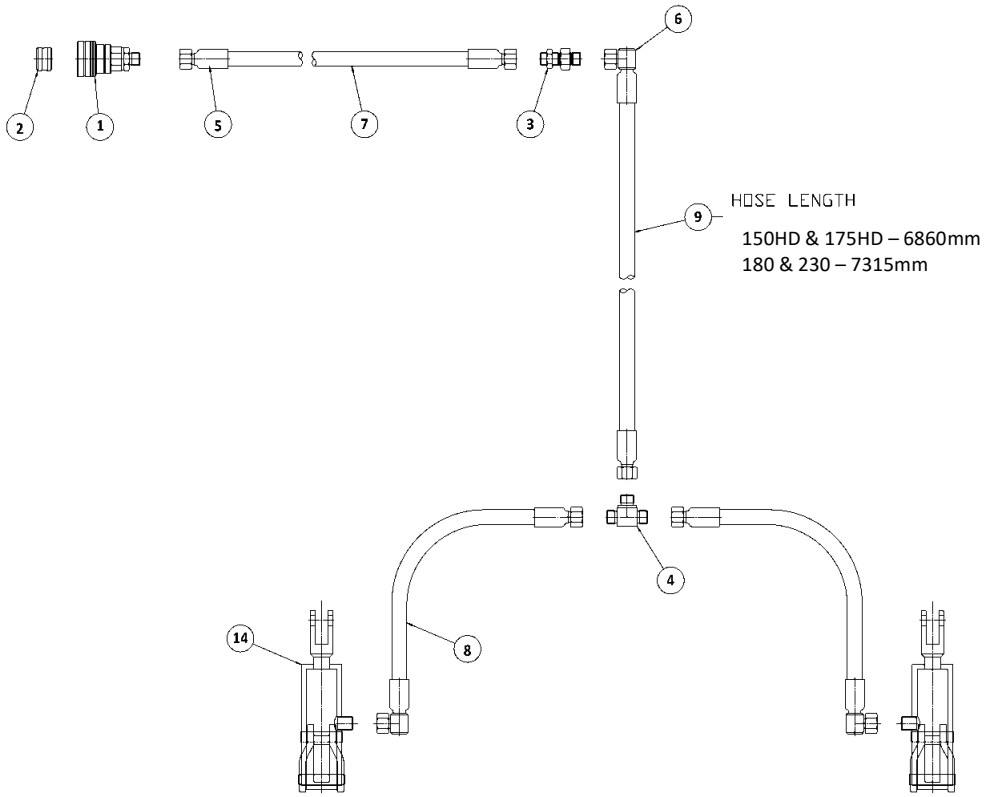
KEY	QTY	PART No.	DESCRIPTION
1	2	70830/3	RAM ASSEMBLY
2	2	70831/3	SEAL KIT
3	2	70830/4	SPRING & PIN KIT
4	2	70836	SELLOCK PIN
5	2	70835/3	CYLINDER
6	2	70834	ADJUSTER

6.2.2 HYDRAULIC BRAKE RAM ASSEMBLY – Widebody 230 30mm PART No. 70830/2



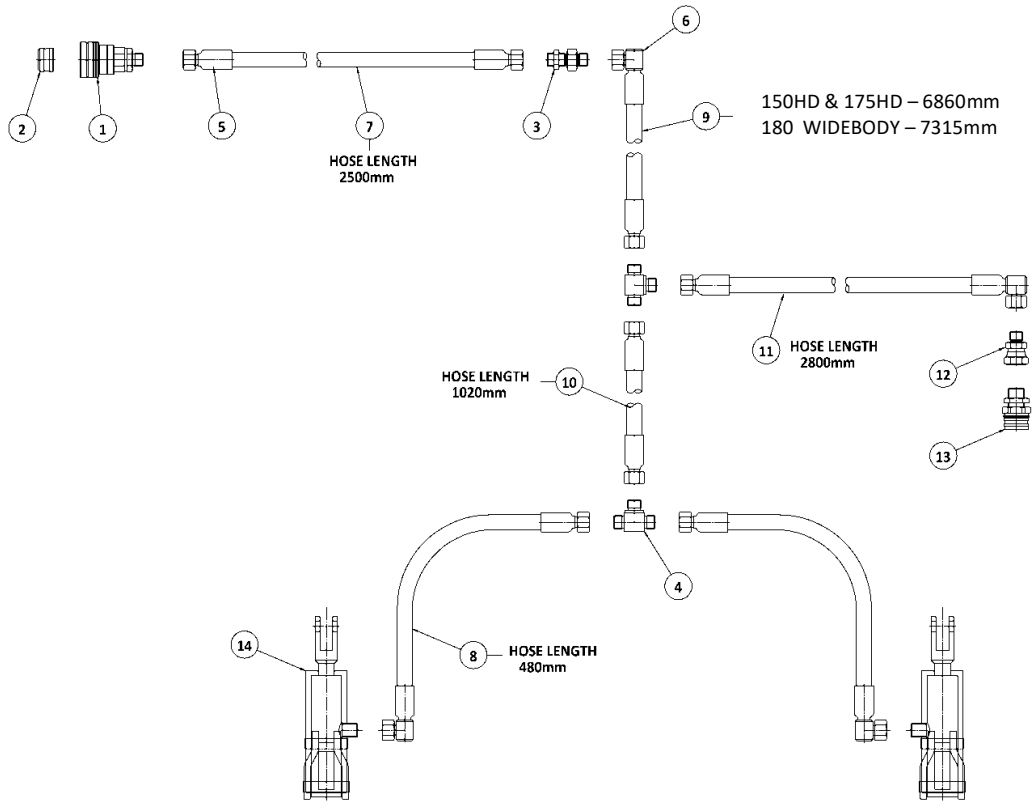
KEY	QTY	PART No.	DESCRIPTION
1	1	70835/1	RAM ASSEMBLY
2	1	70831	SEAL KIT
3	1	70832	SPRING & PIN KIT
4	2	70836	SELLOCK PIN
5	1	70834	ADJUSTER

6.2.3 HYDRAULIC BRAKE CIRCUIT SINGLE AXLE



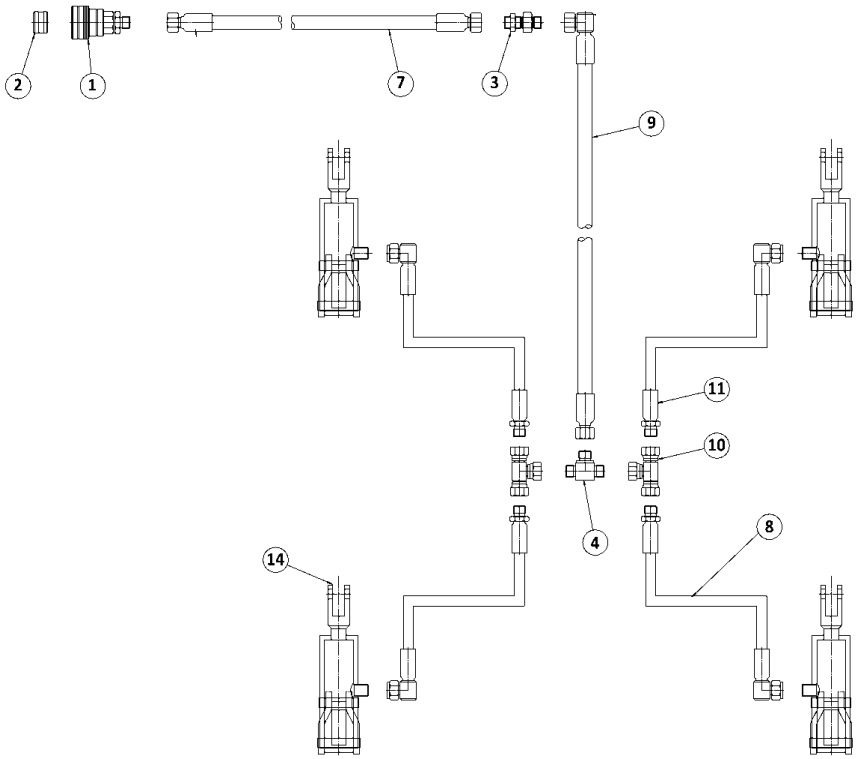
KEY	QTY	PART No.	DESCRIPTION
1	1	51568	COUPLING 3/8 FEMALE SELF SEAL
2	1	51583-1	DUMMY 3/8 MALE
3	1	51463	3/8"-3/8" NPT BULKHEAD
4	2	51447	3/8"-3/8"-3/8" NPT MALE TEE
7	1	B4462	INTER-CONNECTING HOSE
8	2	B4454	AXLE HOSE
9	1	B4458	LONG HOSE
14	REF		BRAKE ACTUATOR HYDRAULIC

6.2.4 HYDRAULIC BRAKE CIRCUIT & CLEVIS DRAWBAR



KEY	QTY	PART No.	DESCRIPTION
1	1	51568	COUPLING 3/8 FEMALE SELF SEAL
2	1	51583-1	DUMMY 3/8 MALE
3	1	51463	3/8"-3/8" NPT BULHKHEAD
4	2	51447	3/8"-3/8"-3/8" NPT MALE TEE
5	8	51037	HOSE END DIA3/8"-3/8" BSP FEMALE
6	4	51111	HOSE END DIA3/8"-3/8" NPT 90 DEG FEM
7	1	B4462	INTER-CONNECTING HOSE
8	2	B4454	AXLE HOSE
9	1	B4458	LONG HOSE
10	1		HOSE DIA3/8" BORE 2 WIRE x 1020
11	1		HOSE DIA3/8" BORE 2 WIRE x 2800
12	1	51644	ADAPTOR 3/8" MALE-M20x1.5 FEM
13	1	51569	COUPLING 3/8 MALE SELF SEAL
14	REF		BRAKE ACTUATOR HYDRAULIC

6.2.5 HYDRAULIC BRAKE CIRCUIT TANDEM AXLE 230 WIDEBODY



KEY	QTY	PART No.	DESCRIPTION
1	1	51568	COUPLING 3/8 FEMALE SELF SEAL
2	1	51583-1	DUMMY 3/8 MALE
3	1	51463	3/8"-3/8" NPT BULHKHEAD
4	2	51447	3/8"-3/8"-3/8" NPT MALE TEE
7	1	B4462	INTER-CONNECTING HOSE
8	4	B4454	AXLE HOSE
9	1	B4458	LONG HOSE
10	2	51457	TEE 3/8 NPT FEMALE
11	4	52310	HOSE END DIA3/8-3/8 NTP MALE
14	REF		BRAKE ACTUATOR HYDRAULIC

6.3 AIR (PNEUMATIC) BRAKE SYSTEMS

6.3.1 INTRODUCTION & SAFETY

Since 1986 trailers used for the sole purpose of Agriculture, Horticulture or Forestry, and travelling below 20mph have been allowed to have a braking performance of just 25%. This means that a tandem axled agricultural trailer with 16 tonnes of weight imposed on the road, by its tyres, would need to generate a minimum braking force of 1000 kg per wheel.

However, the same trailer travelling above 20mph, or not being used for Agriculture, Horticulture or Forestry would be required to have twice the braking capacity, and generate a minimum of 2000 kg braking per wheel.

Trailers travelling at above 20mph are required to have a two-line air braking system, and meet the prevailing standards for HGV trailers. The tractors will also need to meet the higher braking performances, and other design criteria.

NOTE: Agricultural tractor and trailer combinations are prohibited from travelling at speeds above 20mph (32 km/h) in the UK.

IMPORTANT!

Before working on braking systems and components always observe the following precautions:

a. Stop the engine before working under a vehicle.
b. Always chock the trailer wheels, because depleting the system pressure may cause the vehicle to roll.
c. Keep hands away from actuators and brake levers as they may move as the system pressure changes.
d. Never connect or disconnect an air line containing pressure, it may whip as the air is released.
e. Never remove a component or plug unless you are certain all system pressure has been released.
f. Never exceed maximum working pressures.
g. Never attempt to dismantle a component until you have fully read and understood the recommended procedures.
h. Use only the correct tools and observe all safety precautions pertaining to use of these tools.

IF ALL INSTRUCTIONS ARE FOLLOWED CORRECTLY THE TWO-LINE AIR BRAKING SYSTEM WILL PROVIDE YEARS OF TROUBLE-FREE SERVICE.

WARNING!

Thoroughly read and understand this manual before attempting any remedial work, or adjustments to this braking system.

6.3.2 MAINTENANCE

Generally speaking, the trailer two-line air braking system requires little specific maintenance. However, the whole system should be drained regularly to remove any water from the tanks.

Regular inspections should be undertaken, where all the pipes are visually inspected to ensure that none have become kinked or worn, and all mechanical linkages should be checked, and lubricated as necessary.

The air filters can be checked for contaminants (after disconnecting both of the air susies), and these can be cleaned/replaced as necessary.

In order to maintain a safe level of braking, the foundation brakes need to be serviced to the same levels as HGV trailers. Any reduction in the performance of the trailer's foundation brakes can adversely affect the life of the tractor's brakes, and possibly invalidate any warranty claims.

A brake troubleshooting page is included (see Section 6.3.9 TROUBLESHOOTING – PNEUMATICS), as well as extra technical detail concerning the RELSV. Help should be sought if any doubt exists about safety critical items.

6.3.3 TWO-LINE TRAILER AIR BRAKING SYSTEMS

The two-line trailer braking system is based on HGV trailer braking systems which were designed to meet the European Council Directive 71/320/EEC. These systems use one red air line (known as a supply or emergency line) which is permanently pressurized by the tractor when coupled to the trailer, 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 handbrake is applied. Also, this is often fully pressurized when the tractor's ignition is switched OFF.

Figure 1 is a typical layout of a tandem-axle trailer, with a combined RELSV and ABS. The RELSV is mounted between the axles and connects to either a telescopic pole or an angle iron which fits between them. The angle iron system is sometimes supported by rubber bobbings.

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

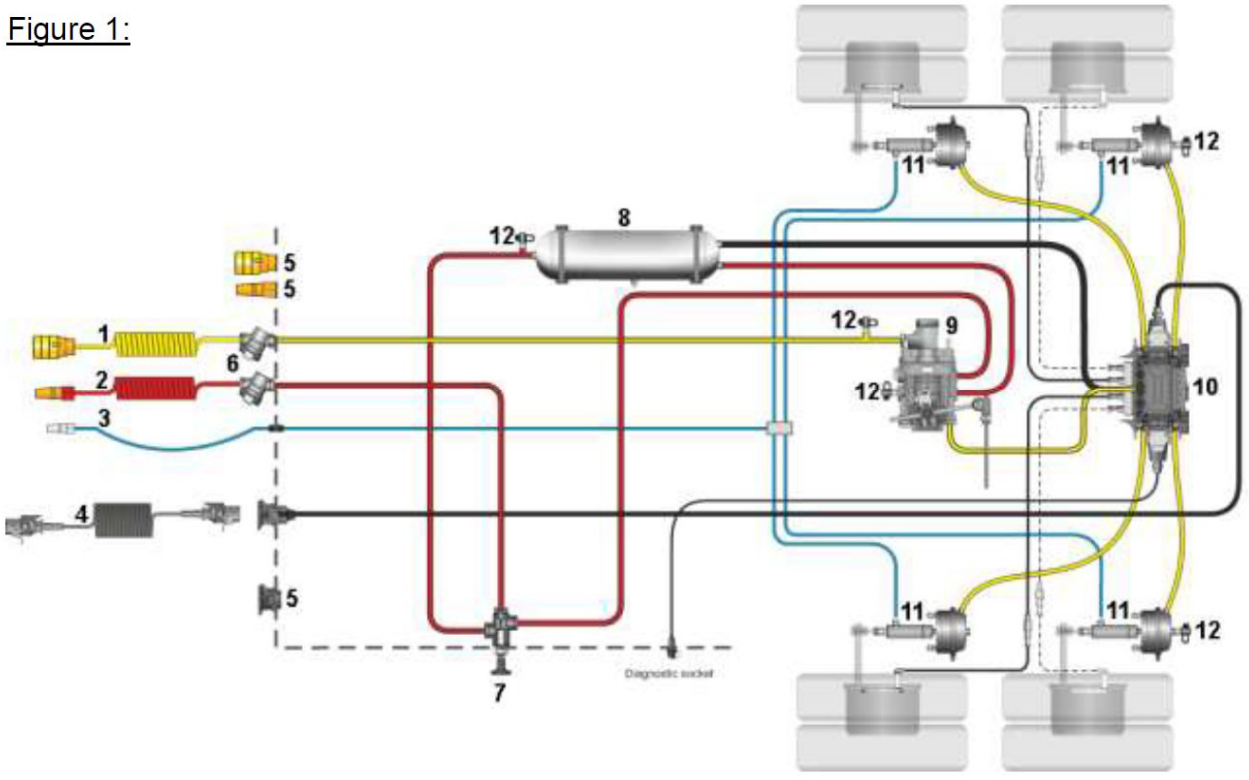
Where no ABS system is fitted, **which is the case for all our spreaders**, then the RELSV delivers the air directly to the brake chambers from each of its delivery ports. (The brake chambers shown on the diagram are also fitted with hydraulic brakes **[dual air & hydraulic brakes]**, to suit the tractors that do not provide trailer air braking.)

WHEN THE TRACTOR AND THE TRAILER BOTH HAVE AIR AND HYDRAULIC BRAKE CONNECTIONS, DO NOT CONNECT BOTH OF THEM – ONLY ONE BRAKE SYSTEM CAN BE CONNECTED AND USED AT A TIME.

With a tri-axle trailer the RELSV is generally fitted above the centre axle and connected directly to it, so no telescopic pole, angle iron or bobbings are required.

For a single axle trailer, with no moving point to connect the automatic RELSV, a manually controlled 3-position load sensing valve is fitted to meet the 2015/68 EU directive. The valve compasses the Manual LP Valve and the Relay Emergency Valve with the following positions: UNLADEDN, HALF LADEN and FULL LADEN.

Figure 1:



KEY	DESCRIPTION	KEY	DESCRIPTION
1	YELLOW LINE SUSIE	7	SHUNT VALVE
2	RED LINE SUSIE	8	AIR TANK
3	HYDRAULIC BRAKE HOSE	9	RELSV
4	ABS POWER SUSIE (5 CORE)	10	ABS MODULATOR VALVE + CABLES
5	DUMMY COUPLINGS	11	AIR + HYDRAULIC BRAKE CHAMBERS
6	FILTERS	12	PNEUMATIC TEST POINTS

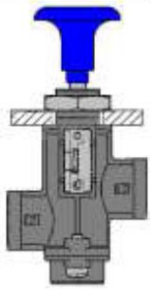
6.3.4 TWO-LINE SYSTEM – OPERATION

The air enters the trailer via the red susie (2) and passes through a filter (6). The filter is designed to trap particles of dirt, to stop them entering other valves further down the line. It is not designed to stop water entering the trailer's system, as this function is part of the tractor's braking system when fitted with an air dryer. From time to time it is worthwhile dismantling each filter and cleaning out any debris that has been caught.

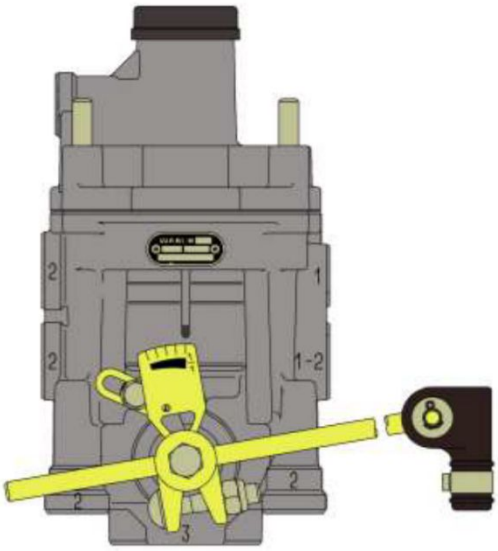
Filter (6):

The air then passes through a shunt valve (7), which is mounted on the side of the trailer, and the air pressure pushes out its button. This button can be pushed in to release the trailer's 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 susie is reconnected to a tractor with air braking.

Shunt Valve (7):



RELSV (9):



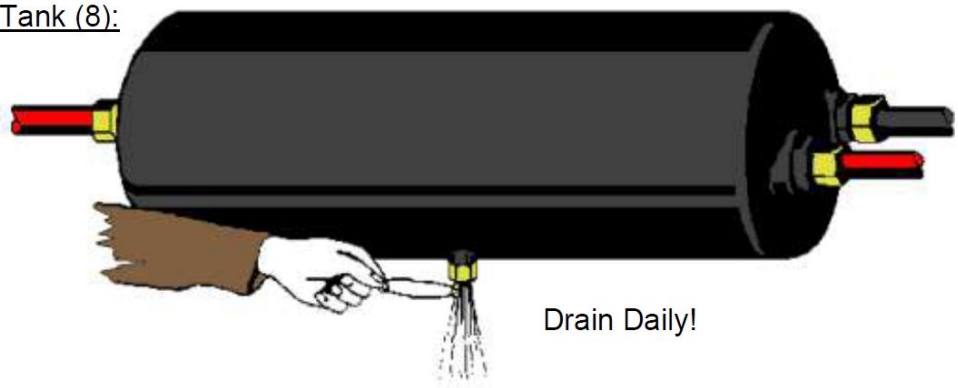
The air travels into the combined RELSV (9) at port 1, before exiting at port 1-2 to feed the air tank (8). The tank is linked back to the shunt valve, and this link is used to "fool" the RELSV into thinking the red susie has been reconnected, after the shunt button is pushed in.

The tank then charges up 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 (10).

NOTE: Any pipe shown as red in Figure 1 (and the black pipe between the tank and ABS) will be pressurized all of the time 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 the air drained from the trailer's air tanks.

Draining is achieved using a drain valve which is found at the bottom of each air tank. Draining should be done periodically to remove any water that has condensed in the air tanks. Failure to drain the tanks will lead to a reduction in the available air capacity of the tanks, affecting the brake performance, and this water may also freeze in the winter, causing other problems.

Air Tank (8):

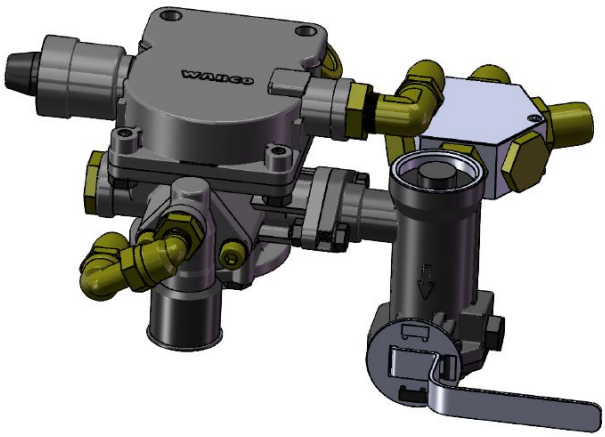


During service braking, a control pressure is sent to the trailer down the yellow susie (1). This pressure is determined by how hard the driver presses the brake pedal, and the pressure may be anything up to the maximum pressure in the tractor's system. However, under normal braking (known as check braking) this control pressure is often around 2 bar. The control pressure enters the trailer and passes through the yellow line filter, before reaching the RELSV at port 4.

The RELSV has several functions, one of which is load sensing. The service pressure may be modified by the RELSV based upon the weight sensed by the valve, as the RELSV is connected to the suspension via a vertical linkage (rod) 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, in order to give the RELSV an average spring deflection. The angle iron is usually mounted using rubber bobbings which absorb the movement between the axles. (With tri-axled trailers there is no need for an angle iron, as the RESLV is generally connected directly to the centre axle.)

As weight is removed from the trailer its chassis raises, causing the RELSV's 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 at port 2, and signals the ABS modulator valve at its 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 a "wheel locking tendency" is detected. (A full description of ABS function won't be given as all our machines do not have ABS installed).



For the machines that the design does not allow for the automatic weight sensing relay emergency valve (REV) and the manual load proportion (LP) valve are used in place of the RELSV to modify the service pressure based upon the 3 distinct set weight points of UNLADEN, HALF-LADEN and FULLY-LADEN. These pressure points are set up by the manufacturer.

The load positions, which have corresponding pictorial on the LP valve, must be manually selected, before driving off, using the lever to match the trailer loading scenario.

Air + Hydraulic Brake Chamber (11):

The brakes are applied in a controlled manner, as the pressure builds up behind a rubber diaphragm housed inside the brake chambers (11), 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, where it exhausts to atmosphere. Therefore, 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 (12), one of which should be found in one of the spare ports in the brake chambers. (A test procedure is given later).

Test Point (12):

Test points can be added to any spare ports, and they come in two standard port sizes being M16x1.5 and M22x1.5. They can also be used to drain the air tanks, should no drain valve be fitted.

The two-line air braking system contains an "emergency" function, which is designed to apply full tank pressure into the brake chambers (irrespective of load condition) should the red susie be removed or become ruptured.

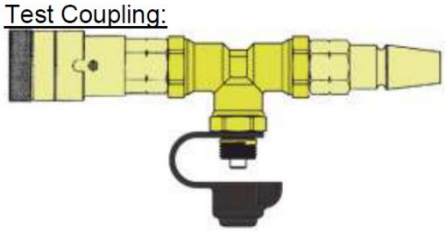
This function is part of the RELSV, where the pressure in the red line and tank are "compared", and tank pressure is delivered into the brake chambers, via the ABS modulator, should the red line pressure fall below 2.5 bar. This happens automatically when the trailer's red susie is removed during uncoupling.

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

6.3.5 BASIC PNEUMATIC CHECKS

In order to perform some basic air checks, at least two good quality, calibrated air gauges are required, along with their connecting hoses, and often a few extra assorted test points. The trailer should have test points positioned around the system, so that tests can easily be carried out. All test points have the same size connecting thread (M16x1.5) where the test hoses attach, and it is useful to have long test hoses so that two gauges can be positioned close together and viewed simultaneously.

Test Coupling:



If there are no test points in the yellow line leading up to port 4 of the RELSV (port in the top section), then a good alternative is to make up a test coupling complete with a test point to fit between the tractor and the trailer's susie. These can have a male C-Coupling at one end, and a female at the other, or suitable Palm Couplings if these are fitted.

These test couplings are useful to test the pressures coming from the tractor, whilst still connected to the trailer.

Test 1 (Charging Test)

Disconnect the red susie from the tractor and drain all of the air from the trailer's air tank(s) and attach one gauge to a test point on one tank (fit test point if necessary – normally M22x1.5 threaded).

Fit a second air gauge in the red line (using male/female test coupling as described above), push in the shunt valve button and reconnect the red susie. The button should pop out as the red susie is connected.

Have the two gauges side-by-side and monitor each gauge as the system charges up. You have to see the tank pressure rise in line with the red line (it may be slightly behind), until the tank is fully charged and the tractor unloads (blows off).

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, or the pipe work leading to port 1 of it.

This pipe can be tested by disconnecting the red susie, and temporarily removing the pipe from port 1 of the RELSV 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 rise 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 susie. A "chuff" of air should be heard as the air exits the open red line. Observe the air gauge connected to the trailer's air tank, and the pressure should drop momentarily, then stabilize. If the tank 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 susie 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 susie, 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.

Attach the other gauge to a test point on any brake chamber. If none are available, then an M16x1.5 threaded one can be added to a brake chamber, as most brake chambers have an extra port which has been blanked.

Fully charge the trailer and keep the red susie connected.

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 we are not yet testing the settings of the RELSV.) If the pressure in the yellow line is "jerky", then so will be the pressure in the brake chamber. 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 jerky 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, as it must be giving out a jerky pressure, even though it is signalled with a smooth one.

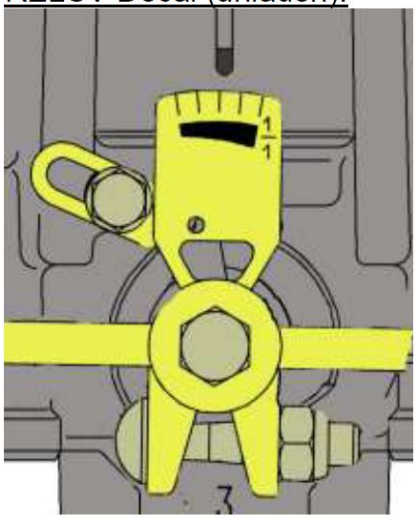
The same tests can be repeated for looking for residual pressure problems, should both gauges not show zero pressure when the service brakes are released.

Test 4 (Output of the RELSV)

The RELSV 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. This linkage, along with any other components (angle iron, cotton reels 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 susie 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.

RELSV Decal (unladen):



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.

Full RELSV setting instructions are given on the next two pages.

6.3.6 RELSV SETTING INSTRUCTIONS

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" passed the tractor. Also, too much pressure causes premature and expensive trailer tyre wear.

Periodically 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!

Step 1
Have the trailer completely laden (the maximum weight allowed) and stand it on level ground whilst still connected to the tractor. 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).

Step 2
Remove the load completely 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 was **25mm**.

Step 3
Find out the recommended unladen LSV setting pressure for your trailer. This may be on a data plate, or available from GT Bunning, or J H Milnes, the air kits supplier.

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.

Step 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**

Step 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.

Figure 2 Example:

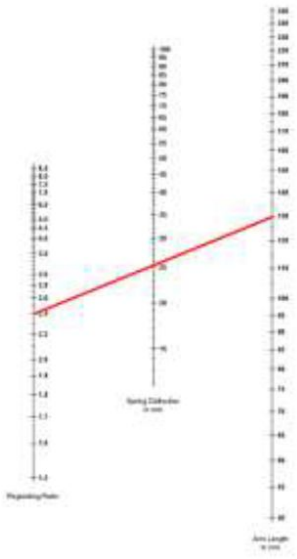
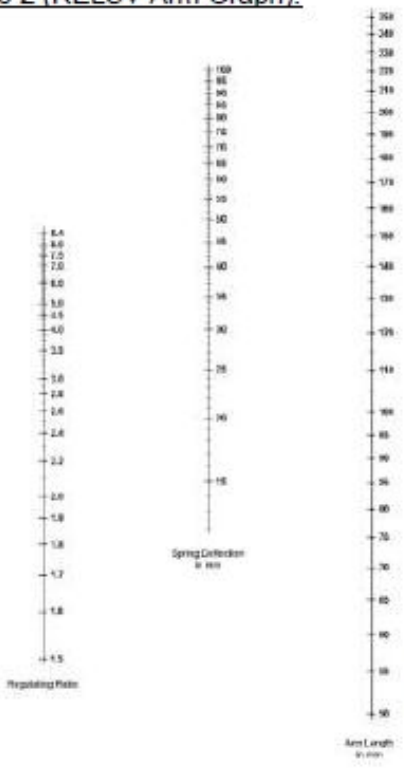
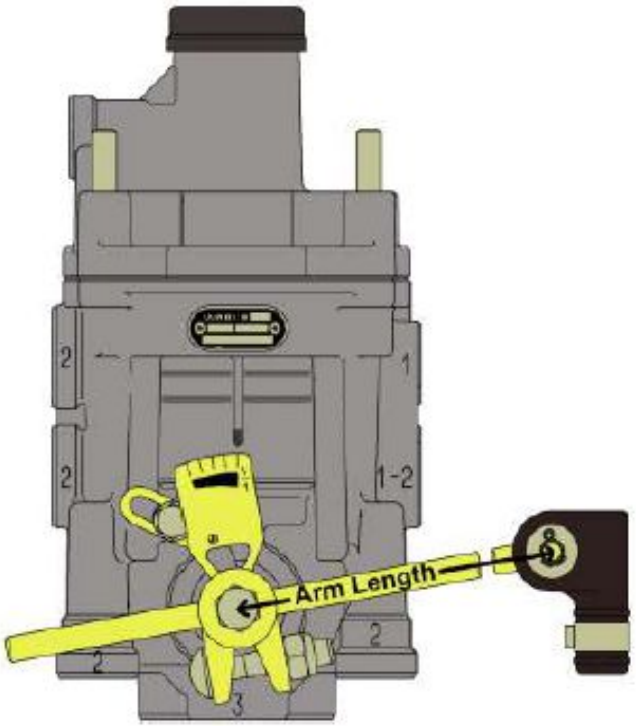


Figure 2 (RELSV Arm Graph):



RELSV (Arm length and laden decal shown):



Step 6

Check the unladen setting by applying the test pressure down 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.

Conversely, 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 ± 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.

6.3.7 SAFE COUPLING AND UNCOUPLING OF TRACTOR/TRAILERS WITH TWO-LINE AIR BRAKING

The safe operation of the two-line air system relies on the driver correctly connecting the two air lines between the tractor and trailer, as well as any ABS power cable.

When coupling an air braked trailer to a tractor never have just the red line connected. (That is to say, connect the yellow line first when coupling, and remove the red line first when uncoupling.)

Follow all other Health & Safety rules and remember it is always good practice to not walk/climb between the tractor and trailer during coupling and uncoupling.

6.3.8 SPRING PARKING BRAKES

6.3.8.1 INTRODUCTION

Spring brakes are designed to work when you are parking your trailer or in an emergency when your service brakes fail. This chapter explains the operation and function of the spring brakes subsystem.

6.3.8.2 SPRING BRAKES FOR EMERGENCY BRAKING AND PARKING

All vehicles and trailers with air brakes must have a way of stopping if the service brake system fails. Using spring brakes combines this emergency braking system with a parking-brake system.

Spring brakes are not air applied like service brakes. They apply when air pressure leaves the brake chamber and release when air pressure builds up in the chamber.

Spring brakes use a different type of brake chamber from service brakes. A brake chamber that includes both service brake and spring brake sections is called a spring brake chamber. Spring brake chambers apply the brakes by means of a large coil spring that provides enough force to hold the brakes in the applied position, instead of using air to apply the brakes.

Spring brake chambers are different in appearance from service brake chambers. To accommodate the large coil spring, a section must be added to the service brake chamber that is clearly visible and adds significantly to its size. The spring brake section is “piggy-backed” onto the service brake section and these two sections function as two separate chambers. The portion nearest the pushrod end is the service brake section and it works in the same manner as a separately mounted service brake chamber.

To release the spring brakes, normally about 414 kPa (60 psi) of air pressure must be supplied to the spring brake chamber to compress or “cage” the spring (See Diagram 4-1). If system pressure is below 414 kPa (60 psi), the spring brakes start applying because there is no longer enough pressure to keep them released (See Diagram 4-2).

Some trailers can still be pulled away even with the spring brakes applied because they do not have the braking power of the full service brake application. Before pulling away the trailer, it is important to ensure that the air brake system has enough air pressure (normally 414 kPa (60 psi)) to keep the spring brakes from applying. Due to the way most spring brakes chambers are currently constructed, it is very difficult to unintentionally release the spring.

The large coil spring used in the spring brake chamber is compressed under very high tension. Tampering, damage or corrosion can cause the spring to release, resulting in sudden violent motion of parts of the air brake chamber. Since this can be hazardous, never attempt to service or repair any air brake chamber.

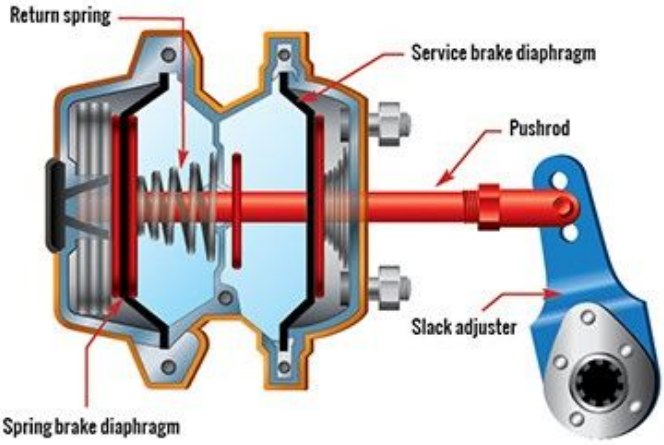


Diagram 4-1: Spring brake chamber - Brake not applied

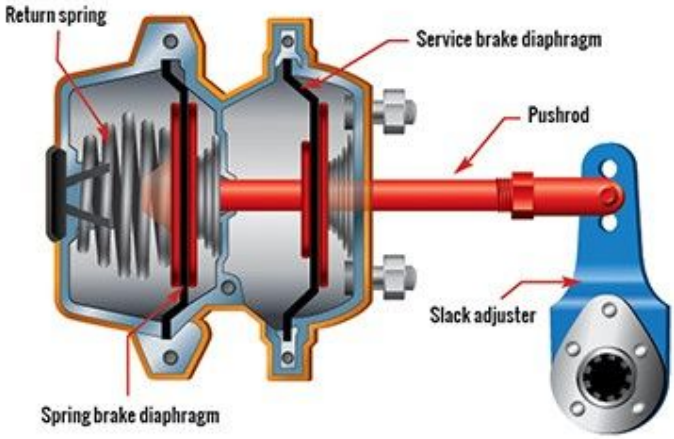


Diagram 4-2: Spring brake chamber - Brake applied

6.3.8.3 DISABLING THE SPRING BRAKE CHAMBER

Using a "caging bolt" or other mechanism, a technician can manually compress or "cage" the spring in a spring brake chamber. This may be necessary to move a trailer in an emergency. When a spring brake chamber fails, a technician may use the manual caging method to temporarily disable it. A spring brake chamber that has been disabled by this method looks different and the parking and emergency brake will not apply. Disabled or caged spring brakes chambers can be recognized by the protrusion of the caging bolt or other similar mechanism. Drivers encountering a disabled spring brake chamber should have the trailer inspected and repaired immediately.

6.3.8.4 SPRING BRAKE (PARKING AND EMERGENCY) CONTROL VALVES

A spring brakes control valve is normally a push/pull type valve fitted with a round red button/knob located on the right-hand side of the trailer (See diagram 4-3). The spring parking brakes control valve is pushed to supply air and release the spring brakes, then pulled to exhaust air and apply the spring parking brakes. Drivers must be familiar with the type of control valves used in their tractor and on their trailer.

The round black button/knob of the shunt valve must be pushed in to release the trailer's brakes, when a tractor with air braking is not available.

Spring brakes control valves are designed to respond to air brake system pressure dropping below a certain level (normally 414 kPa or 60 psi) by exhausting the remaining air that is holding the spring brakes in the released position. This causes sudden automatic application of the spring brakes and an uncontrolled vehicle stop. The control valve button/knob will pop out when this occurs.

Important: If air brake system pressure drops below its normal operating range (normally 414 kPa or 60 psi), the spring brakes will automatically begin to apply.

In an emergency when the service brakes fail, the spring brakes can be applied by using the spring brakes control valve.

The effectiveness of a vehicle's spring brakes depends on the condition of the brakes and proper brake adjustment. If brakes are out of adjustment, the spring brakes may not stop or hold a vehicle stationary.

Remember: Poor brake adjustment reduces the ability of service brakes to stop a vehicle and reduces the ability of spring brakes to stop or hold a vehicle.

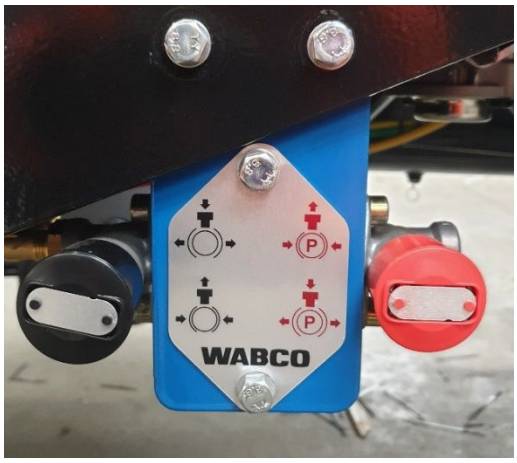


Diagram 4-3: Spring parking brakes control valve

Key points to remember

- The brake pedal in the tractor is used to apply the service brakes.
- Spring brakes chambers include both service brake and spring brake sections.
- The large coil spring inside a spring brake chamber is under high tension and can be hazardous.
- When the spring in a spring brake chamber is compressed or "caged", it looks different and the spring brakes will not apply.
- A spring brakes control valve is a push/pull type valve fitted with a round red button/knob located on the side of the trailer.
- When the air brake system pressure falls below its normal operating range (normally 414 kPa or 60 psi), the spring brakes will begin to apply automatically.
- If brakes are out of adjustment, the spring brakes may not stop or hold a vehicle or trailer.

6.3.8.5 FITTING THE SPRING PARKING BRAKES

With the spring parking brakes please do the following to help you remove the internal threaded rod;

- Fit the spring brakes to the Trailer/ tanker as normal connecting the service pipe to port 11 (normal brakes) and the spring brake pipe to port number 12.
- Connect the red and yellow lines to a tractor, to fill with air.
- Push the red button/knob in (the park button on the park and shunt valve), this will loosen the threaded bar at the back of the spring brakes, you can now twist this out easily and store them in the storage place on the side of the actuator. Finally put the plug in this hole.

To test the spring brakes just do the following;

- Making sure that there is no brake or handbrake applied (if connected to a tractor), just pull the red park button/knob and you will see the spring brakes apply, at the same time you will hear quite a lot of air exhaust.

Fastening

Fastening the Tristop® cylinder requires the use of nuts M 16x1.5 – strength class 8 – DIN EN 28673, ISO 8673 (in accessories pack, WABCO No. 423 903 532 2).

– Thread on both nuts by hand until the Tristop® cylinder makes full contact.
– Tighten the nuts to approximately 120 Nm (e.g. with an impact wrench).
– Tighten the nuts to 210 Nm (tolerance -30 Nm) using a torque wrench.
  Increase the tightening torque appropriately when using self-locking nuts.
– Check the tightening torque of 210 Nm in accordance with the maintenance intervals of the axle manufacturer.

Steering axle specifics
When installing Tristop® cylinders on steering axles, ask the axle manufacturer about the respective installation situation.

Spare
When replacing a brake chamber, check the bracket for any damage and replace according to the axle manufacturer's recommendations if necessary.

Installing a larger cylinder than type 30/30
Types 36/36 and 36/30 are not to be mounted using horizontally positioned fastening bolts. In this case, a vertical position with a deviation of ±30° is permitted.

General
WABCO Tristop® cylinders are delivered with the springs under tension. Release the springs before commissioning the vehicle.
With the TSL types, fasten the release screw in the hole provided on the side. Close the hole, on the cover with the cap attached to the device.

6.3.9 TROUBLESHOOTING - PNEUMATICS

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 TANK	CHECK THAT AIR FLOWS UNRESTRICTED FROM PORT 1-2 OF RELSV, WHEN THE RED SUSIE IS CONNECTED AND PRESSURIZED
INSUFFICIENT PRESSURE IN TRAILER'S AIR TANK	POOR AIR FLOW TO TRAILER'S AIR TANK	CHECK FOR KINKED OR BLOCKED PIPES
		CHECK THAT AIR FLOWS UNRESTRICTED FROM PORT 1-2 OF RELSV, WHEN THE RED SUSIE IS CONNECTED AND PRESSURIZED
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 (SEE INSTRUCTIONS ON SECTION 6.3.6 RELSV SETTING INSTRUCTIONS)
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
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

6.4 AXLES & DRAWBAR SPRINGS MAINTENANCE

6.4.1 SAFETY NOTICE

NB: Excerpt from the COLAERT ESSIEUX SYSTEM Manual.

The authors and publisher are not liable for any physical damage or personal injury resulting from errors or omissions in this manual.

This manual does not replace the manual provided by the vehicle manufacturer.

Maintenance must be carried out by suitably qualified personnel using appropriate tools.

This manual describes everyday maintenance operations and does not cover major repairs.

We recommend that maintenance should be carried out by a specialised workshop.

Carrying out repairs and maintenance work may be dangerous. This safety notice describes only some of the potential hazards and is intended to make users aware of the risks and encourage them to take care.

Personal protection:
Wear appropriate personal protection equipment: goggles, mask, gloves, helmet, safety shoes, overalls, etc.
Work in the presence of another person.

Unstable vehicles:
Never work underneath or near a vehicle that has been raised using only a jack.
When working underneath or near a vehicle that has been jacked up, always make sure that the jack is used in conjunction with stands or other effective supports and that the jack and stands used can bear the weight.
Check that the vehicle is perfectly stable and that the forces applied to the vehicle while carrying out maintenance will not cause it to shift. Also check that the ground is firm.

Hot parts:
Some parts, such as brake drums, for example, may become extremely hot in use.

Pressurised hydraulic or pneumatic systems:
NB: Before carrying out maintenance on hydraulic or pneumatic systems, which may be pressurised, take all necessary precautions to avoid accidental pressure release. (See Section 1.2)

Risk of fire, risks from fumes, toxic gases and irritant substances:
All fuel is highly flammable and petroleum vapour is explosive.
For cleaning and degreasing parts, use only appropriate, recognised cleaning fluids and follow the instructions on the packaging.
Avoid contact with the skin and avoid inhaling vapour, fumes or toxic gases.
Do not smoke, use a naked flame or create sparks, etc. if there is a risk of explosion or fire owing to the presence of flammable vapours, fuel, oil, paint, solvents, dust, straw, etc.
A fire extinguisher appropriate for the type of risk should always be at hand.

Asbestos:
The brake linings of our axles no longer contain asbestos. We used asbestos-free linings well before EU regulations prohibited its use.
If there is any doubt about the presence of asbestos (for example, when carrying out maintenance on old axles), the brakes and linings should be handled as if they contained asbestos, as asbestos dust is a major health hazard.

Environment:
We have carefully studied the harmful effects of our products on the environment.
Respect the environment and do not dump oil, grease and used chemical products. They should be disposed of in accordance with the regulations at a waste collection point, waste disposal centre or recycling centre.

6.4.2 GENERAL INFORMATION

The specifications of our axles and suspensions can be found in the general COLAERT ESSIEUX catalogue.
The catalogue provides the following information.

Axles

- The axle cross-section.
- The axle type.
- The axle loads and maximum admissible offset at speeds of 25, 40 and 60 km/h with zero offset wheels, with single, tandem or tridem axles.
- The number and size of studs and the bolt circle.
- The centre hole diameter.
- The brake dimensions (drum internal diameter and lining width).
- The braking characteristics certified by CEMAGREF and TUV.

The general catalogue also gives the admissible load on the axle assembly for different load offsets.
Exceeding these values may cause excessive bending of the axle and possibly permanent damage.

Stabiliser jacks bearing on the axles, weight transfer devices or lifting axles do not increase the maximum load on the axles or suspensions.

Suspension

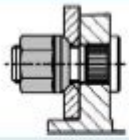
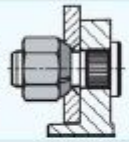
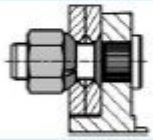
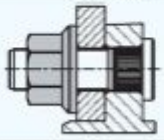
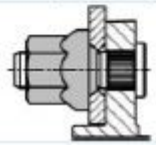
- The maximum load for the suspension.
- The wheel-base.
- The type of spring, the number of leaves and the number of fixed leaves.
- The height of the axle assembly unladen and laden, for different axle cross-sections.

6.4.3 AXLE MAINTENANCE AND ADJUSTMENT

6.4.3.1 ASSEMBLY AND FIXING OF THE WHEELS

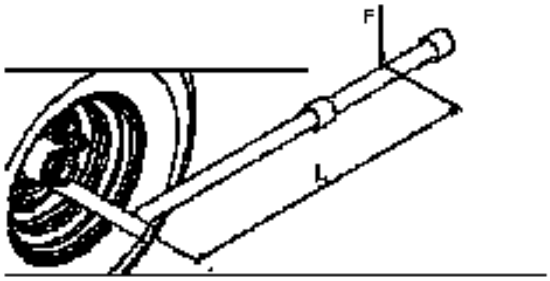
Above all to check that the type of wheel used is compatible with the nut of the wheel stud, for all the cases of fixing of the wheel with centering on the wheel stud, i.e. all those of table below except the nuts of the type M, to check that the holes of the rim have a conical part in order to receive the spherical part as of nuts DIN, the spherical washer of the plain nuts or the conical part of the nuts with “Bec “.

In the case of twin tires, in order to ensure a good centering, it is necessary to insert a spherical washer between the flask of the hub and the rim except assembly nuts M.

NUT TYP	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
	32	M22x1,5	650	1000	65
"Bec" 	28	M18x1,5	270	450	60
	30	M20x1,5	380	600	60
	32	M22x1,5	510	800	60

TIGHTENING OF THE NUTS OF WHEEL

On lately assembled wheels, the nuts can, at the beginning, to loosen up in consequence of a compressing. It is thus necessary to check the tightening of the nuts after the first course in load. One will proceed in the same way later on after each disassembling of wheels. To tighten the nuts, use the adapted special wrench. If one uses the machines bolt wrench for the nuts of wheel, be sure to regulate the tightening torque well, if not the threading and the metal of the stud and nuts of wheel will undergo an overload.



(*) The 2 last columns of the table are useful as reference for those which do not have a torque spanner or of pneumatic screwdriver (see the figure at side).

It is allowed to use an impact wrench for disassembling, but it is absolutely necessary to avoid the tightening of the nuts with this type of wrench, because the exerted torque is unverifiable.

6.4.3.2 TIGHTENING AND RETIGHTENING WHEEL NUTS (SUMMARY):

Never use impact wrenches to tighten the wheel nuts as the impact torque may be excessive.

Wheel nuts should be tightened diagonally using a torque wrench.

If power tools are used (for example, pneumatic torque wrench) they must be carefully set to the required torque for tightening. Otherwise, the studs and wheel nuts may be over tightened which may damage or break them.

Retighten the wheel nuts after:
- The first time of use.
- The first laden journey.
- The first 1,000 km.
- Every 6 months or 25,000 km.

Repeat every time the wheels are changed or removed.

6.4.3.3 CHECKING THE HUBCAPS

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 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 (every 6 months).

6.4.3.4 CHECKING THE WHEEL BEARING PLAY

- After the first 1,000 km.
- Before intensive use, every 6 months or 25,000 km.

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:
- Lift the wheel off the ground.
- Turn in both directions slowly to check for any rough points or friction.
- Turn it 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 (see Section 6.4.3.7 REPLACING THE WHEEL BEARINGS).

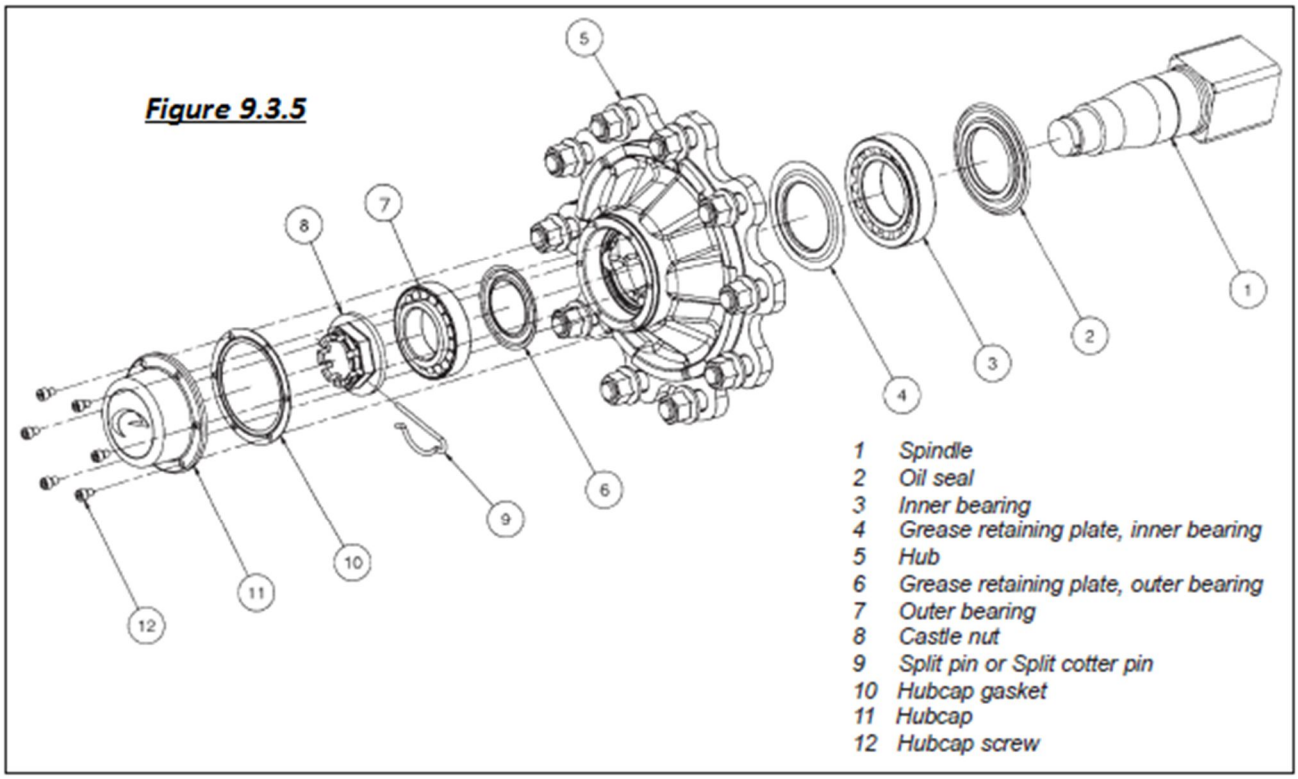
1. To check the wheel bearing play, raise the axle until the wheel is no longer resting on the ground ***(ensure that the vehicle cannot move)***.
2. Release the brake, grip the wheel at the top and the bottom and check the play by trying to tilt it. The play can also be detected by using a lever between the wheel and the ground.

If you can feel any play, adjust the wheel bearing (see paragraph 6.4.3.5 ADJUSTING THE WHEEL BEARINGS).

Make sure that the play does not come from the suspension or a steering axle kingpin.

6.4.3.5 ADJUSTING THE WHEEL BEARINGS

Lift the axle until the wheel is no longer resting on the ground.
Large wheels should be removed so that the play is easier to feel and to make it easier to adjust the bearings.



- Remove the hubcap.
- Remove the cotter pin or hair-pin clip from the spindle.
- Tighten the castle nut (right-hand thread) to take up the internal play (the conical roller bearings should then be firmly held between the hub seatings, the pressure ring, the spindle and castle nut).
  The rotation of the hub or wheel feels to be slightly stiff.
- 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.
- Tap the hub gently using a mallet to shake down the assembly.
- Check that the hub rotates more freely.
- Always err on the side of too free rather than too tight.
- When the hub has been adjusted, fit a new split cotter pin or re-fit the hair-pin clip.
- Refit the hubcap.
- Refit the wheel following the instructions in Sections 6.4.3.1 (FITTING WHEELS) and 6.4.3.2 (TIGHTENING AND RETIGHTENING WHEEL NUTS).

When the wheel has been refitted, turn it slightly. It should come to rest with a slow rocking movement due to the imbalance.

6.4.3.6 LUBRICATING THE WHEEL BEARINGS

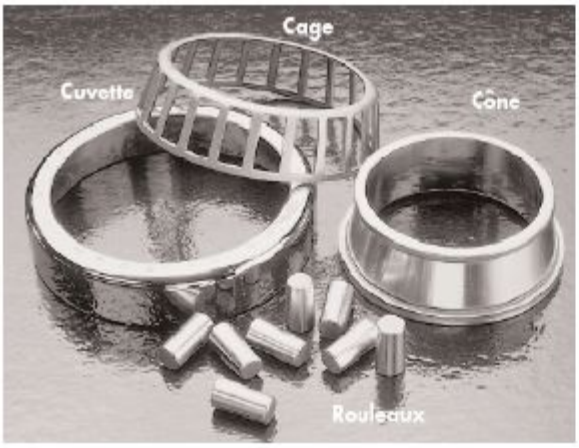
In normal operating conditions, lubricate the bearings every 2 years or every 50,000 km and when the brake shoes are replaced.
In harsh conditions the bearings should be lubricated more frequently.

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, and 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.



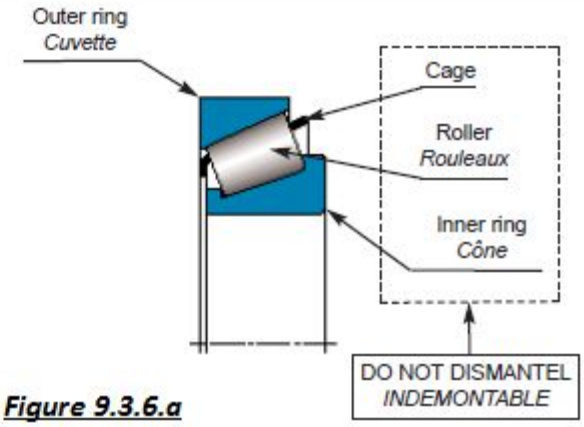


Figure 9.3.6.a

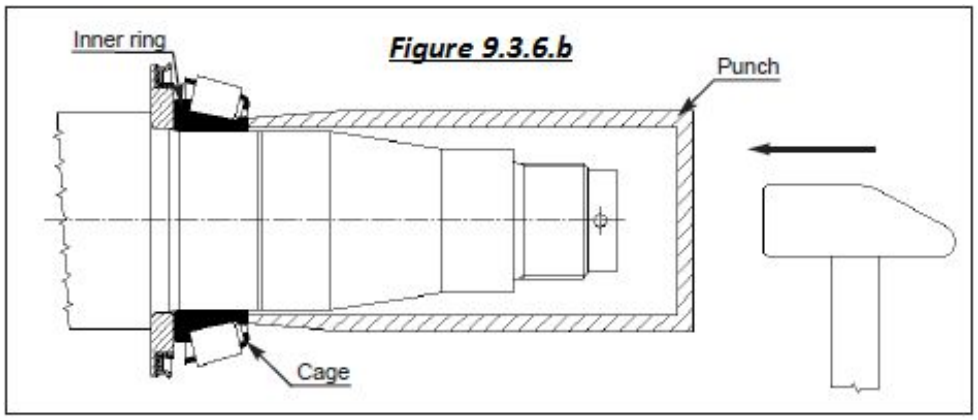
DISASSEMBLY: (See figures **9.3.5** and **9.3.6.a**)

- Slacken the wheel nuts.
- Lift the axle until the wheel is off the ground.
- Remove the wheel.
- Release the brakes (make sure that the vehicle cannot move).
- Remove the hubcap.
- Remove the split pin or pin from the spindle.
- Remove the castle nut.
- Remove the drum/hub assembly, 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 with the hub.
  Check these parts: The bearing cups and grease retaining plates can be left inside the hub for cleaning.
- Remove the large bearing cage and cone from the spindle using a bearing puller if necessary.
- Check the oil seal 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 asperities.
- Check the hub surfaces in the same way.
- Check the bearing face of the castle nut.

Clean and degrease all parts with a suitable cleaning fluid.

REASSEMBLY:

- Grease the spindle lightly.
- Refit the oil seal or wheel bearing seal (ensure that the seal is the right way around), a punch makes it easier to fit the wheel bearing seal and avoids damaging the seal.
- Apply a generous coating of grease to the large bearing cage and the rollers, making sure that the grease penetrates all around the rollers and under the cage.
- Fit at bottom the interior ring (cone) of the large bearing on the rocket, it is important to take care not to damage the cage of the bearing, to go up the cone unit, rollers and cage (figure **9.3.6.a**) on fixed to use if necessary tools as shown in the figure **9.3.6.b**, the effort to push must apply only to the cone, in no case on the cage or the rollers what involves a deterioration of the bearing.
- Apply a 15 mm (5/8 inch) (small axles) or 20 mm (3/4 inch) (large axles) layer of grease all around and right across the large and small bearing cups that are still in the hub.
- If the hub does not have grease retaining plates, put a large amount of grease in the centre of the hub to act as a reservoir.
- Slide the hub/drum 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 and fit the assembly to the spindle.
- Fit the castle nut and adjust it as described above (See section 6.4.3.5 ADJUSTING THE WHEEL BEARINGS).
- Lock the castle nut with a hair-pin clip or new split cotter pin as appropriate.
- For hubs without grease retaining plates, fill the hubcap with grease.
- Refit the hubcap.



6.4.3.7 REPLACING THE WHEEL BEARING

New grease retaining plates should be fitted to hubs with grease retaining plates (See figure 9.3.5), as the plates will be damaged while removing the bearing cups.

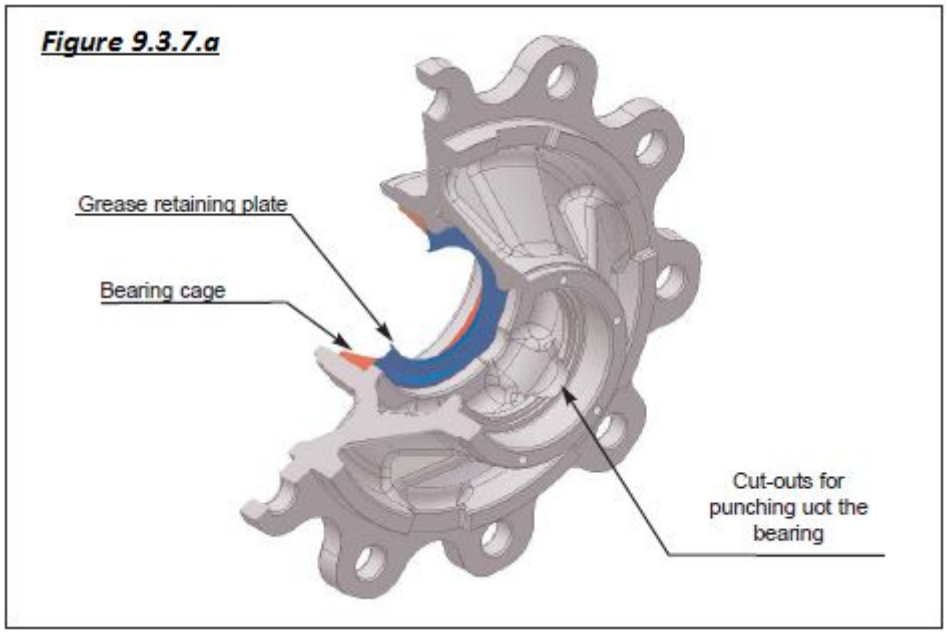
Unpack the bearings at the last moment and never mix them up.

To replace the wheel bearings, follow the instructions for removing the hub (see section 6.4.3.6 LUBRICATING THE WHEEL BEARINGS) and remove the bearing cups from the hub as follows.

REMOVING THE BEARING CUPS FROM THE HUB

Note the orientation of the bearing cups and grease retaining plates for reassembly.

- The bearing cups are an interference fit and must be punched out using a hammer and a mild steel punch (See figure **9.3.7.a**).
- If the hub has grease retaining plates, these will be punched out at the same time as the bearing cups and will, therefore, be damaged.



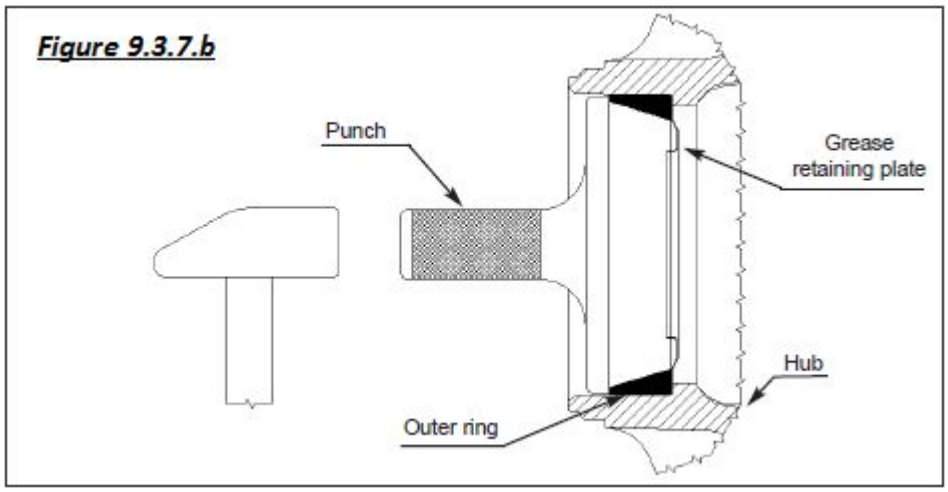
FITTING NEW BEARING CUPS INTO THE HUB:

Make sure that the bearing cups and grease retaining plates are the right way around.

NB: Never fit the bearing cup with the bearing cone and rollers in place

- If the hub has grease retaining plates, first put the grease retaining plate in its seating (the right way around) and ensure that it remains well centred and in place while the bearing cup is being fitted. Re-check when the operation is complete.
- Fit the bearing cups and punch into place using a mild steel punch as shown in figure 9.3.7.b.

Take care that the bearing cups are straight and that they are firmly against the seating in the hub.



6.4.4 BRAKE MAINTENANCE AND ADJUSTMENT

6.4.4.1 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.

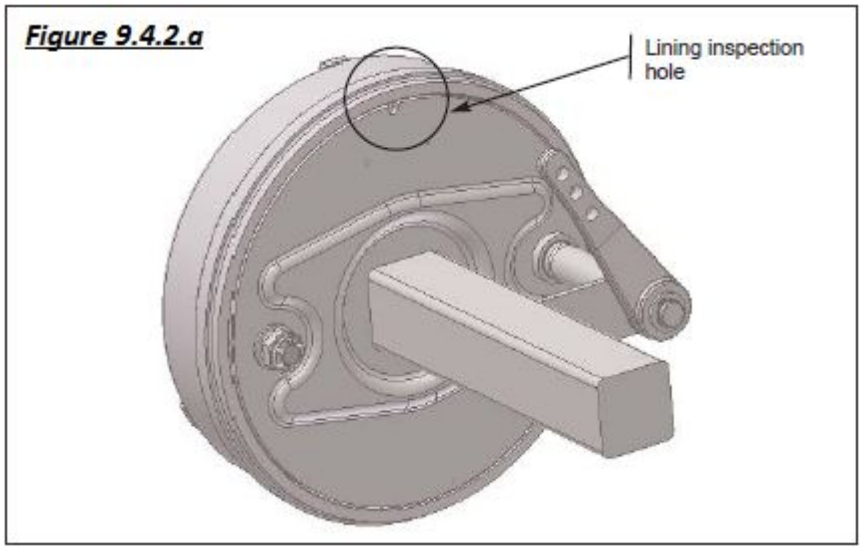
6.4.4.2 CHECKING BRAKE CLEARANCE AND WEAR

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 (See figure **9.4.2.a**). It is probable that the linings are worn when the actuator travel has increased significantly.
- Check the thickness of the brake linings (See table section 6.4.4.5 REPLACING THE BRAKE SHOES FOR THE MINIMUM THICKNESS).

The brake shoes should be replaced as soon as the minimum lining thickness is reached.

- Check that the brakes are clean and clean them if necessary.
- Lubricate brake cam shaft bearings with grease nipples lightly to avoid grease deposits on the brake linings and drums.
- Carry out the initial checks described above (See section 6.4.4.1 INITIAL CHECKS).



6.4.4.3 ADJUSTING BRAKES WITH FIXED LEVERS

Take up the slack when the actuator stroke reaches about two thirds of the maximum travel (See figure **9.4.3.a**).

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

Never change the linkage position for the actuator on the lever without authorisation from the vehicle manufacturer as the vehicle will have been tested with the actuator at this position (the brake operating levers have several holes, always use the original hole).

For braking systems with a yoke, the yoke must remain parallel with the axle especially when the brakes are fully applied (See figure 9.4.3.b). This means that the stroke of the levers on the brakes at each side must be identical. Otherwise, the brake slack must be adjusted.

Figure 9.4.3.a

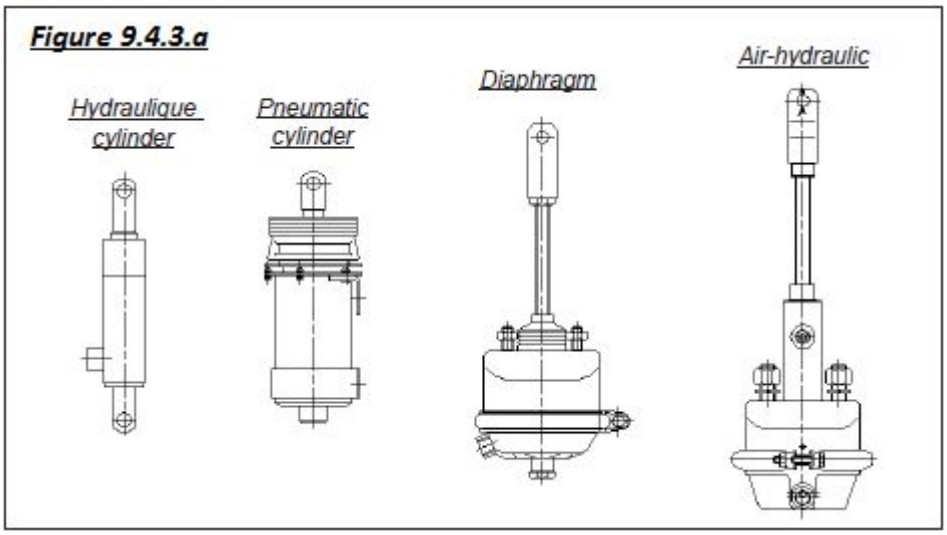
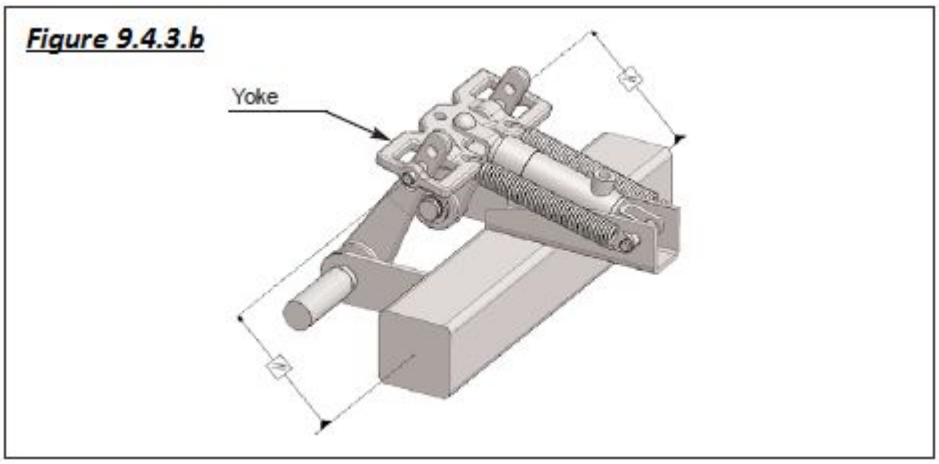


Figure 9.4.3.b



6.4.4.4 ADJUSTING BRAKES WITH ADJUSTABLE LEVERS

Take up the slack when the actuator stroke reaches about two thirds of the maximum stroke (See also section 6.4.4.3 Adjusting brakes with fixed levers).

To take up the slack, turn the adjustment screw on the lever to adjust the relative position of the cam and the lever (See figure **9.4.4**).

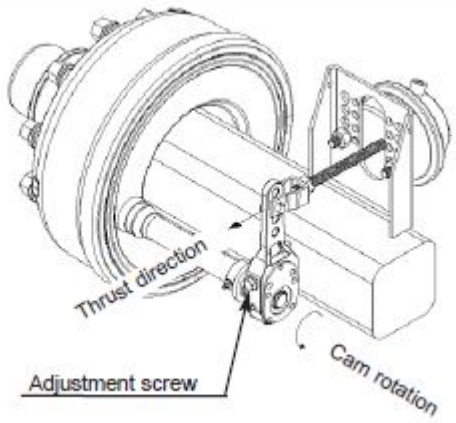
NOTE: Adjust the actuator brakes by pushing the lever to turn it in a particular direction. The screw must be adjusted so that the cam moves in this direction to take up the slack. The direction in which the screw must be turned depends on the configuration.

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

Never change the linkage position for the actuator on the lever without authorisation from the vehicle manufacturer as the vehicle will have been tested with the actuator at this position (the brake operating levers have several holes, always use the original hole)

For braking systems with a tandem yoke, the yoke must remain parallel with the axle especially when the brakes are fully applied (See figure **9.4.3.b**). This means that the stroke of the levers on the brakes at each side must be identical. Otherwise, the brake slack must be adjusted.

Figure 9.4.4



6.4.4.5 REPLACING THE BRAKE SHOES

The brake shoes should be replaced as soon as the minimum lining thickness is reached.
When replacing the brake shoes, repack the wheel bearings with grease (See section 6.4.3.6 LUBRICATING THE WHEEL BEARINGS).

Minimum lining thickness		
Brake type	Dimensions (Drum internal diameter and lining width)	Minimum lining thickness (mm)
A25	250 x 60	2
A30	300 x 60	2
309E	300 x 90	2
310E	300 x 100	5
314E	300 x 135	5
316	300 x 160	5
3020S	300 x 200	5
356E	350 x 60	2
359E	350 x 90	2
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
A940	406 x 140	5
412S	406 x 120	5
412E	406 x 120	5
414S	406 x 140	5
414E	406 x 140	5
4218S	420 x 180	5
4218E	420 x 180	5
4220S	420 x 200	5
4220E	420 x 200	5
5218E	520 x 180	5

See sections 6.4.3.5 ADJUSTING THE WHEEL BEARINGS and 6.4.3.6 LUBRICATING THE WHEEL BEARINGS for hub disassembly and reassembly and wheel bearing lubrication and adjustment.

When replacing the brake linings, check all the brake components.

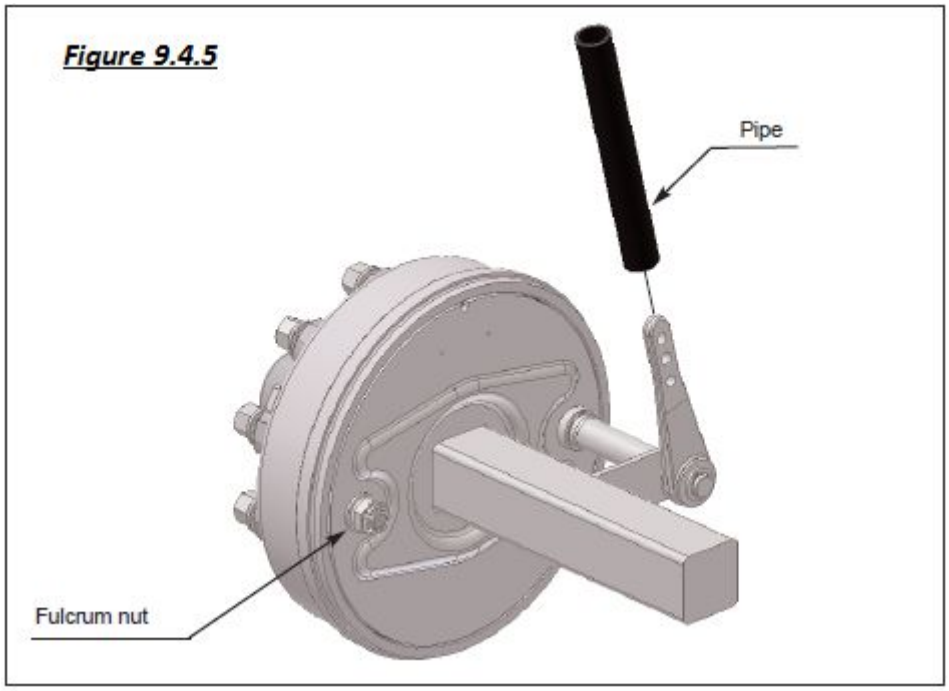
- Condition of the drums.
- Condition of the cam shafts and levers, in particular check the play in the splines.
- Wear on the bushings.
- Condition of the bellows (depending on the model).
- Condition of the shoe return springs.
- Condition the fulcrums and their mountings (depending on the model).
- Check the rotation of the brake shoe rollers (if fitted) and lightly lubricate before reassembly.

Always replace any worn or damaged parts.

When reassembling, apply a thin coat of grease to all contact surfaces (cams, fulcrums, bushings, etc.) being careful to avoid getting any grease on the drums and shoe linings.

For brakes with an adjustable fulcrum, centre the brake shoes before clamping the fulcrum:
When the hub/brake assembly has been reassembled, slacken the fulcrum nut slightly, and operate the brake lever in the correct direction (direction of the actuator thrust) by pulling on the lever by hand. (It is easier if a pipe is placed over the lever as shown in figure 9.4.5) to press the shoes against the drum.
Clamp the fulcrum while pressing on the lever.
If the nut is locked using a split cotter pin, always use a new cotter pin.

Figure 9.4.5



6.4.5 STEERING AXLES

6.4.5.1 GENERAL INFORMATION

Steering axles have a suspended traverse with two spindles that can swivel about a kingpin. This can considerably reduce tyre wear, improve the manoeuvrability of trucks and trailers and significantly reduce parasitic forces on the chassis and wheels.
They are particularly useful for large vehicles with several axles.
The wheel alignment is finely controlled by a tie rod which is adjusted by turning the tie rod that has a left-hand thread at one end and a right-hand thread at the other or by turning a flexible eccentric bushing, depending on the model.
There is a damper to reduce oscillations and stabilise the mechanism.
The two locking rams are used to straighten the wheels just ***BEFORE*** reversing. They can also be used on steep cambers or on particularly rough surfaces (bumps, potholes, etc.).

6.4.5.2 STEERING AXLE MAINTENANCE AND ADJUSTMENT

6.4.5.2.1 NORMAL MAINTENANCE

Steering axles should be maintained as for standard axles (See sections 9.2.2 AXLE MAINTENANCE AND ADJUSTMENT and 9.2.3 BRAKE MAINTENANCE AND ADJUSTMENT) as well as carrying out the maintenance and adjustments required for steer axles described below.

Before intensive use and every 3 months:
(See figure **9.3.2.1**)

- Lubricate the kingpins.
- Tighten the screws and nuts and all parts mounted on the axle (chambers, cylinders and mountings, locking cylinders, damper, tie rod, etc.).
- Tighten the blind nut and lock nut on the locking cylinders (see section 6.4.5.2.3 LOCKING CYLINDER MAINTENANCE AND ADJUSTMENT).
- Tighten the lock nuts at the end of the tie rod (See section 6.4.5.2.2.1 STEER AXLE WITH ADJUSTABLE LENGTH TIE ROD) or the clamping screw for the flexible bushing (See section 6.4.5.2.2.2 STEER AXLE WITH ECCENTRIC FLEXIBLE BUSHINGS) 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.
- Check the full-lock angle limit screws on the axle, if appropriate.
- If the steer axle oscillates, check the damper. Oil traces do not indicate that the damper is unserviceable but a major oil loss will result in its failing. Uncouple it at one end and push it in and out by hand for the whole travel. If there is little resistance, replace the damper. Also replace the damper if it is badly dented.
- Ensure that the damper is mounted the right way around. A new damper should have the ***label at the top*** as shown in figure **9.3.2.1**
- Look for and correct any leaks of air or hydraulic fluid from the chambers, cylinders and damper.

NOTE: Before carrying out any work on hydraulic or pneumatic systems, take all necessary precautions to ensure that the hydraulic fluid or air is not under pressure.

For steering axles with conical kingpins: check and adjust the clearance (See Section 6.4.5.2.4 ADJUSTING THE CLEARANCE, STEER AXLES WITH CONICAL PINS ONLY).

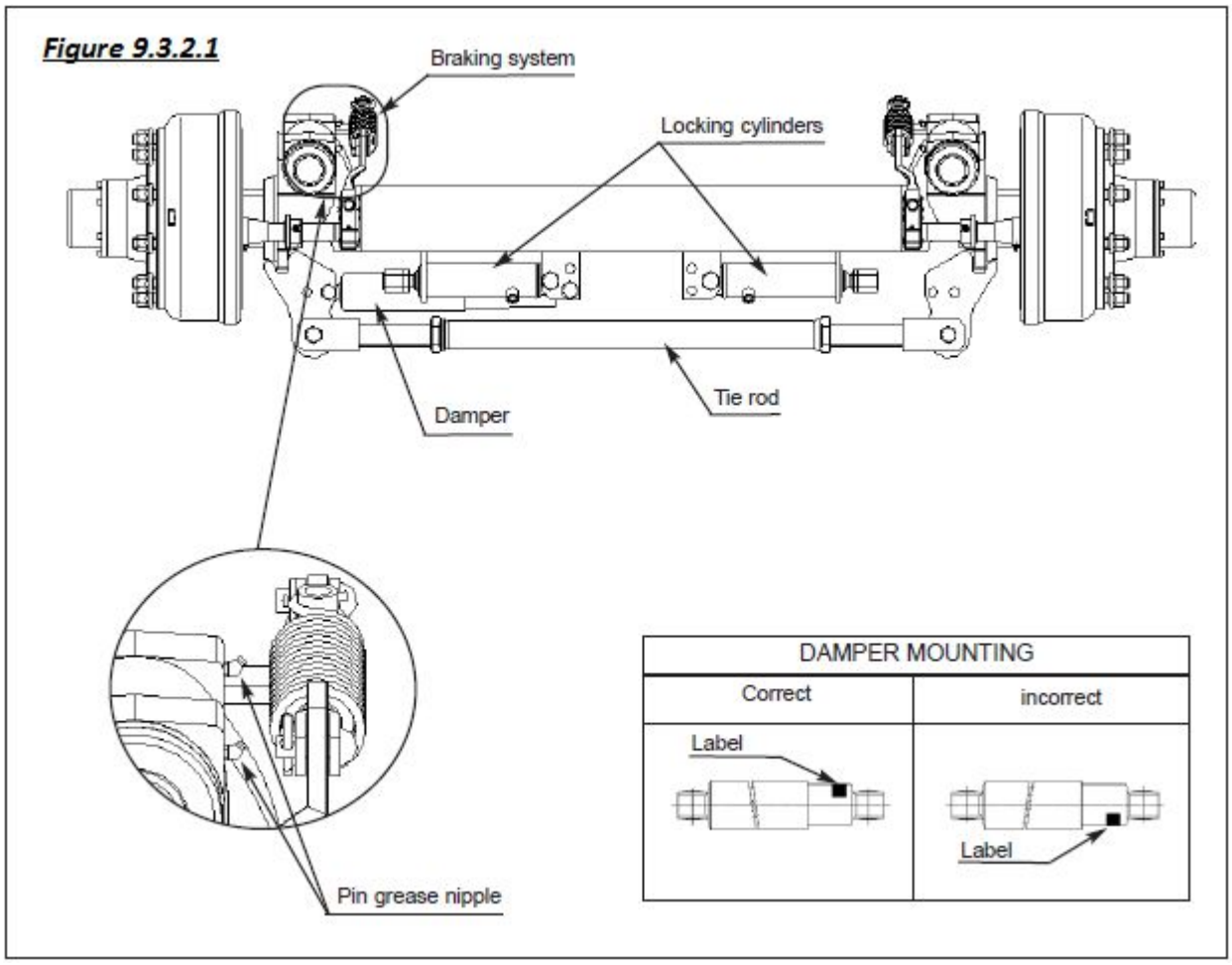


Figure 9.3.2.1
Braking system
Locking cylinders
Damper
Tie rod
Pin grease nipple
DAMPER MOUNTING
Correct
incorrect
Label
Label

6.4.5.2.2 CHECKING AND ADJUSTING THE WHEEL ALIGNMENT

6.4.5.2.2.1 STEERING AXLE WITH ADJUSTABLE LENGTH TIE ROD (see figure 9.3.2.2.1)

Before adjusting the wheel alignment, check that the flexible bushings at the ends of the tie rod are in good condition and replace them if necessary.

Align the wheels with the vehicle on a smooth, level surface.

The wheel alignment must be adjusted with the locking cylinder pistons retracted.

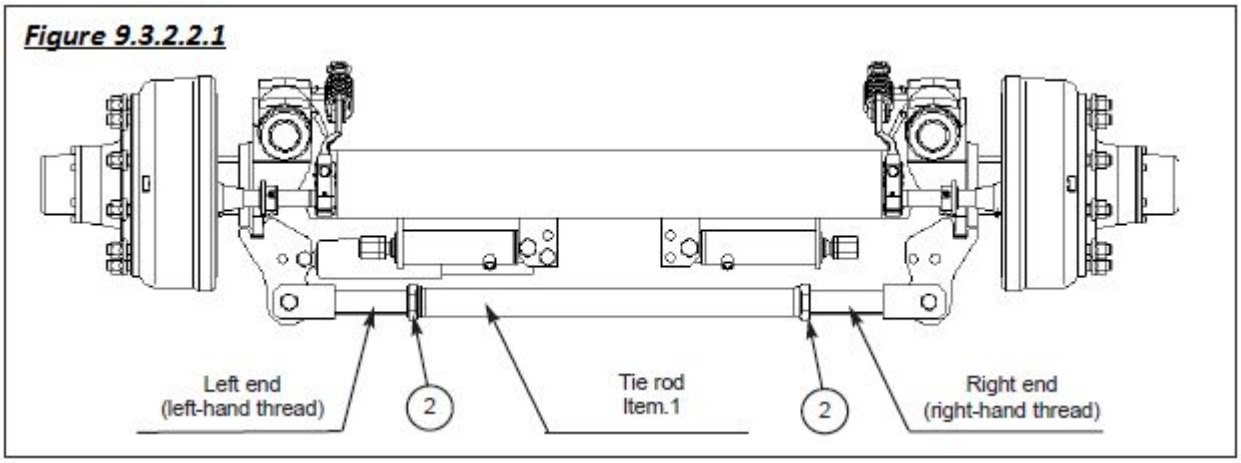
- Measure the distance between the rim at the front of the wheels and at the back of the wheels: the distance should be the same.
- Move the vehicle forward to turn the wheels through 180° and repeat the check to allow for bent wheels.

If the wheel alignment is not perfect, adjust it as follows;

With the locking cylinder pistons still retracted

- Slacken the 2 lock nuts Item 2 on the end of the tie rod Item 1.
- Turn the tie rod to pull or push the wheels until the distances are the same. The wheels may be set to have a slight toe in (distance at the front less than the distance behind) of no more than about 4 mm but never adjust with toe out.
- Lock the lock nuts Item 2 when the tie rod has been adjusted and then adjust the locking cylinders (See section 6.4.5.2.3 LOCKING CYLINDER MAINTENANCE AND ADJUSTMENT).

Figure 9.3.2.2.1

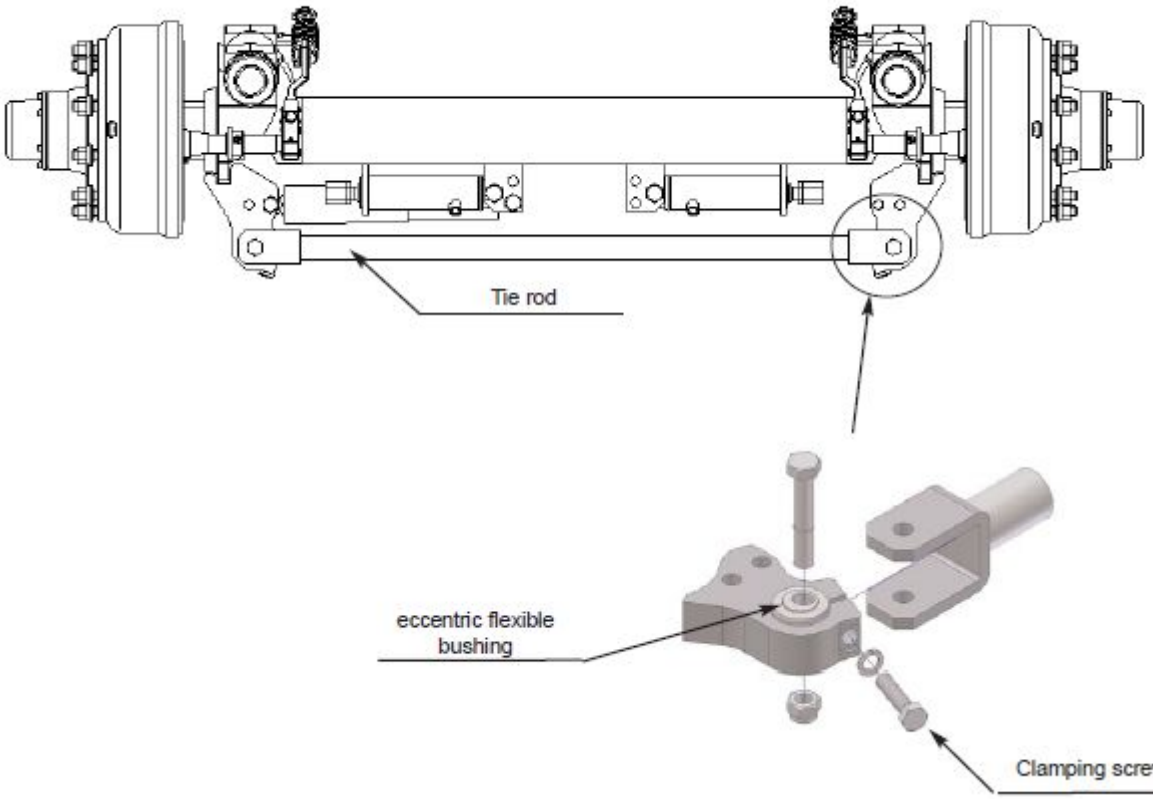


6.4.5.2.2.2 STEERING AXLES WITH ECCENTRIC FLEXIBLE BUSHINGS (see figure 9.3.2.2.2)

In this case the length of the tie rod is fixed and the wheel alignment is adjusted using the flexible bushings at the ends of the tie rod. The mounting hole in the flexible bushing is eccentric. The wheels are aligned by slackening the screw clamping the flexible bushing and then turning the flexible bushing in its housing. Follow the instructions in section 6.4.5.2.2.1 (STEER AXLE WITH ADJUSTABLE LENGTH TIE ROD).

Retighten the clamping screw after adjustment.

Figure 9.3.2.2.2



6.4.5.2.3 LOCKING RAM MAINTENANCE AND SERVICING

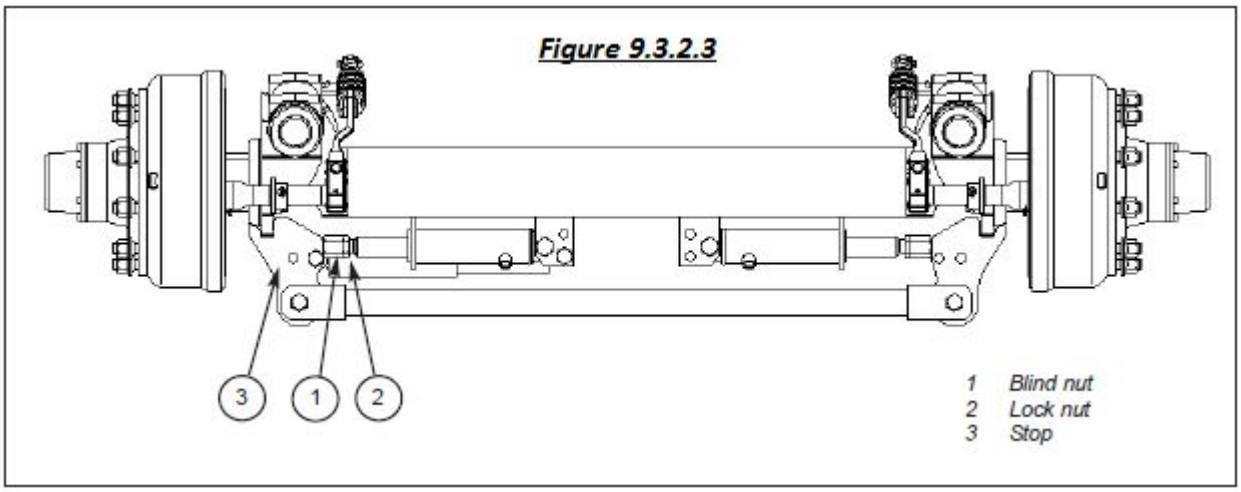
The locking rams straighten the wheels and hold them straight.

Tighten the lock nut Item 2 against the blind nut Item 1 regularly (figure 9.3.2.3).

Adjust the locking rams after aligning the wheel (See section 6.4.5.2.2 Checking and adjusting the wheel alignment).

Procedure: (See figure 9.3.2.3)

Figure 9.3.2.3



- Move the lock nuts Item 2 and the blind nuts Item 1 as close as possible to the body of the ram.
- Without operating the locking rams, align the steer axle and the vehicle on a smooth, level surface.
- Pressurise the rams and maintain the pressure.
- Screw the blind nuts Item 1 to contact the stops Item 3 without forcing
- Screw the lock nuts Item 2 to contact the blind nuts Item 1
- Tighten the lock nuts Item 2 firmly
- Check that the wheels are still aligned.

The only maintenance required for the locking rams is to keep them perfectly clean, in particular the surface of the ram rod.
If the seals are leaking, they can be replaced (contact the vehicle manufacturer).

NB: Before carrying out any work on hydraulic or pneumatic systems, take all necessary precautions to ensure that the hydraulic fluid or air is not under pressure.

6.4.5.2.4 ADJUSTING THE CLEARANCE, STEERING AXLES WITH CONICAL PINS ONLY

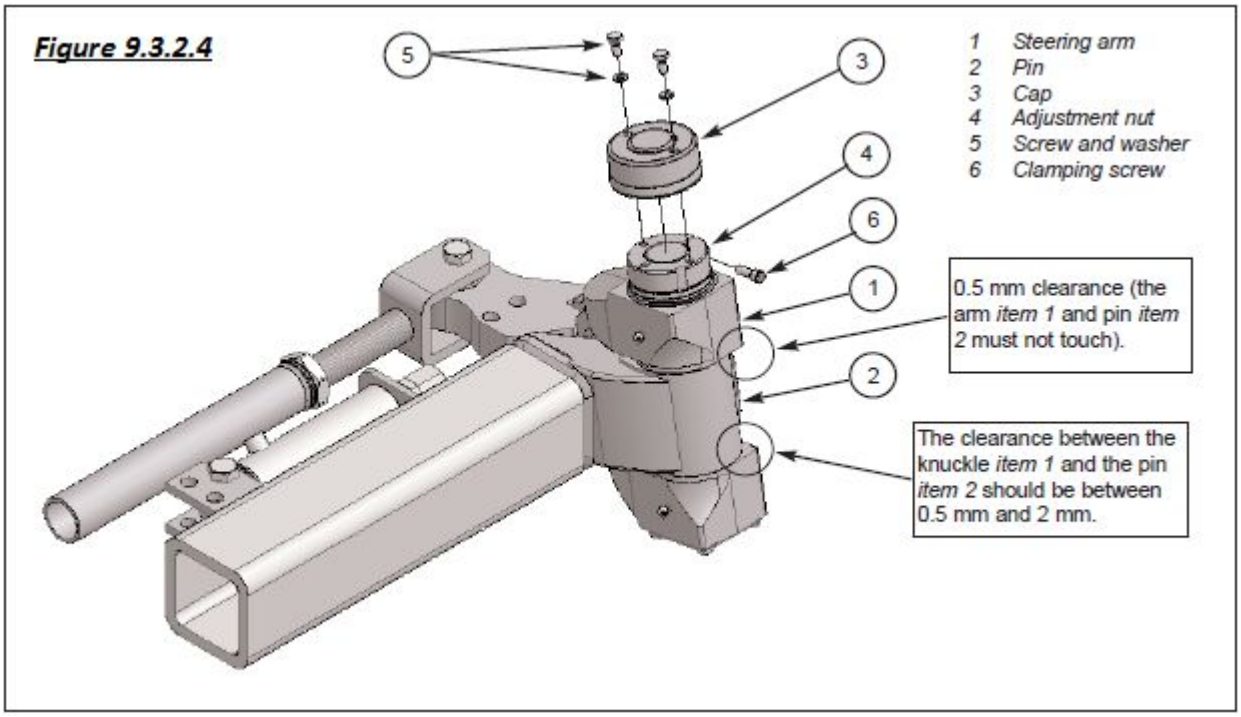
Before intensive use and every year:

- For steer axles with conical kingpins (this type of axle has pressed steel caps *Item 3* over the adjustment nuts *Item 4*).
- Check and, if necessary, adjust the clearance. It should be between 0.5mm and 2mm (***see figure 3.2.4***). The clearance should be adjusted before it falls below 0.5mm.

(See figure 9.3.2.4)

- Remove the 2 screws and washers *Item 5* and the cap *Item 3*
- Slacken the clamping screw *Item 6* on the adjustment nut *Item 4*
- Adjust the clearance using the adjustment nut *Item 4*
- Tighten the screw I*tem 6* and refit the cap *Item 3*

Figure 9.3.2.4

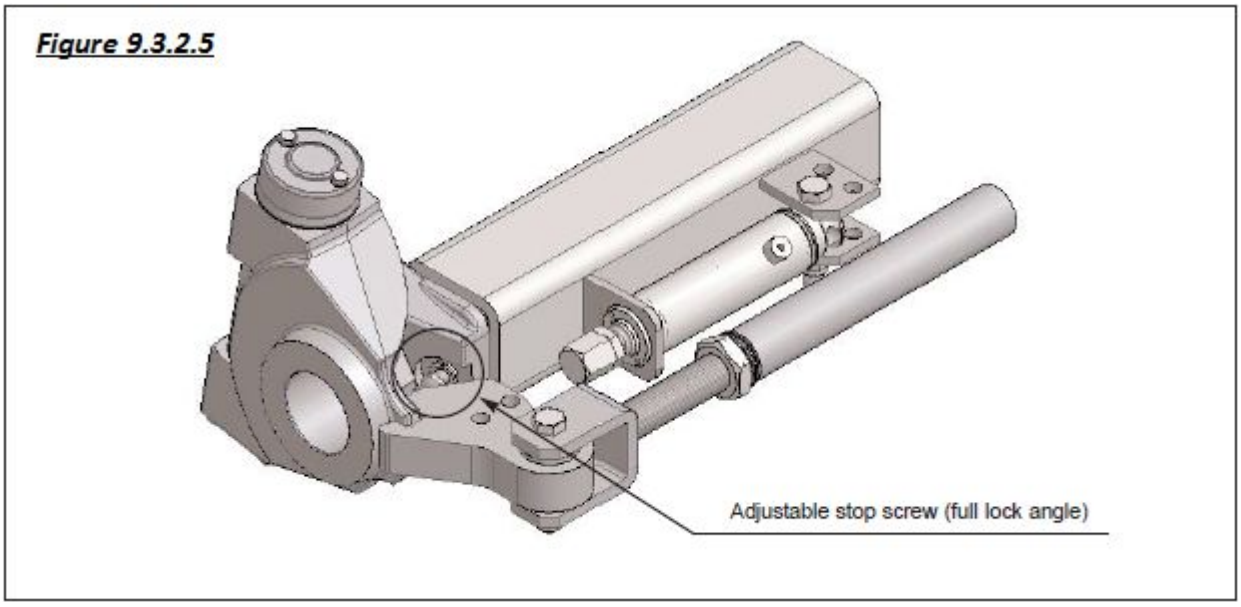


6.4.5.2.5 ADJUSTING THE FULL-LOCK ANGLE (DEPENDING ON THE MODEL)

Adjust the full-lock stop screws to limit the axle full-lock angle when fitting wide tyres.

Check the full-lock angle regularly by turning fully to the right and to the left and checking that the tyres do not touch the trailer or suspension as this might wear or damage the tyres.
Adjust the full-lock stop screws, if appropriate.
Tighten the lock nuts.

Figure 9.3.2.5



6.4.5.3 DRIVEN STEERING AXLES

To align a steered axle, bleed the hydraulic circuit or carry out any other maintenance on the hydraulic system, see the vehicle manufacturer's manual.

NOTE: Before carrying out any work on hydraulic or pneumatic systems, take all necessary precautions to ensure that the hydraulic fluid or air is not under pressure.

6.4.6 BASIC TANDEM AND BASIC HALF-TANDEM SUSPENSIONS

After the first laden journey, before intensive use or every 6 months (***See Figure 9.4.1***):

- Tighten all the centre clamping bolts and axle U-bolts to the recommended torque. Tighten the nuts diagonally (See Section 6.4.8 U-BOLT TIGHTENING TORQUE).
- 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.

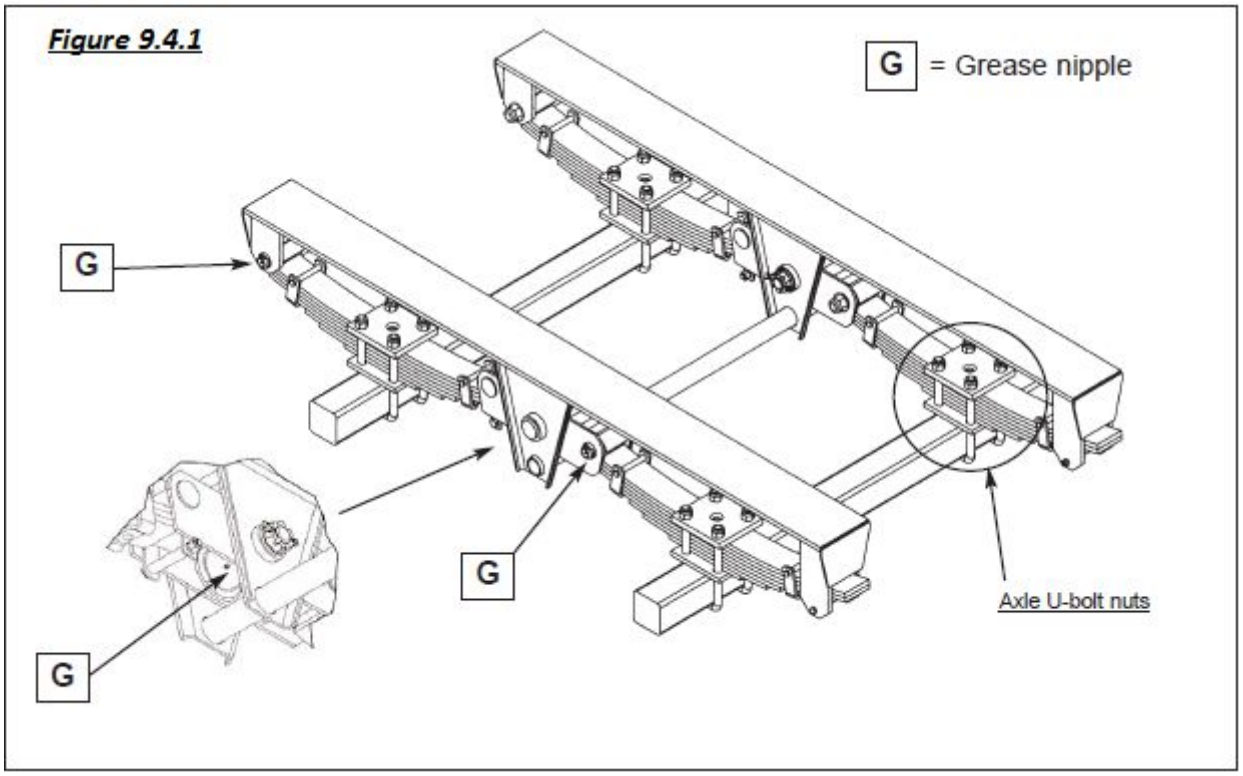
Under harsh or intensive operating conditions, maintenance should be carried out more frequently.

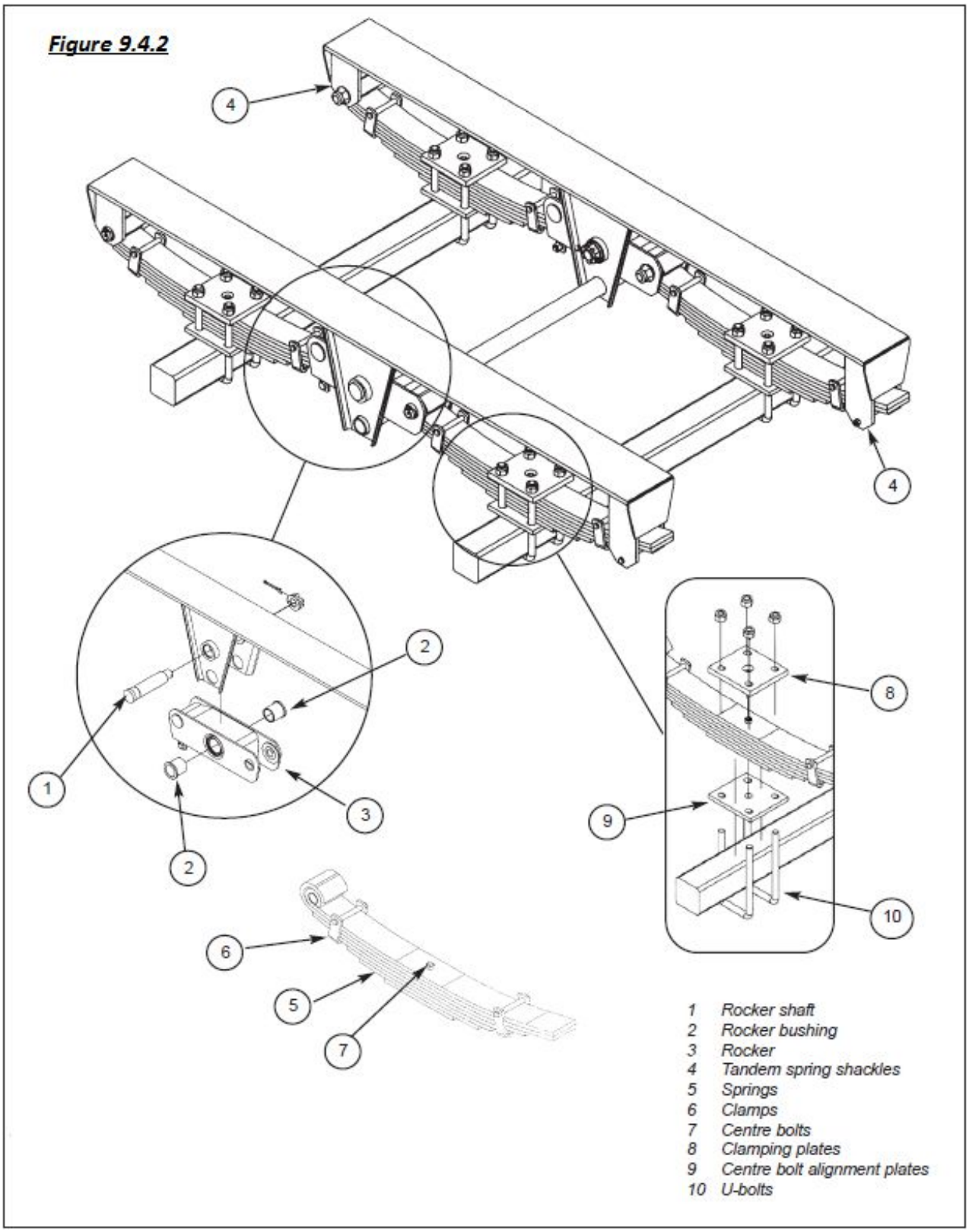
Every year (***See Figure 9.4.2***):

- Check the play between the bushings Item 2 and the rocker shafts Item 1 and, if there is excessive play, replace the worn parts.
- Check the rocker Item 3 and the spring shackles Item 4 for wear (spring bearing surface) and replace these parts if they are very worn.
- Check the general condition of the springs Item 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 Item 8, spring alignment Item 9, brides Item 10.

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

Figure 9.4.1





6.4.7 ROD HALF-TANDEM SUSPENSION, TANDEM AND TRIDEM

After the first laden journey, before intensive use or every 6 months ***(See figure 9.5.a)***:

- Tighten all the axle U-bolt nuts to the recommended torque. Tighten the nuts diagonally (See Section 6.4.8 U-BOLT TIGHTENING TORQUE).
- Retighten all the nuts and screws on the suspension (spring shackles, rocker, fixed and adjustable trailing arms, and springs).

- Retighten the adjustable trailing arms ***(See figure 9.5.b)***: if the bolts were loose, the length of the trailing arms may be incorrect. Check that the axles are correctly aligned after tightening (central section with left and right-hand threads).
- Retighten the fixed and adjustable trailing arm flexible bushing mountings:

NOTE: The clamping washers Item 1 should not touch the bracket Item 2. If they do, the conical rubber bushings, Item 3, should be replaced *(See figure 9.5.c)*.

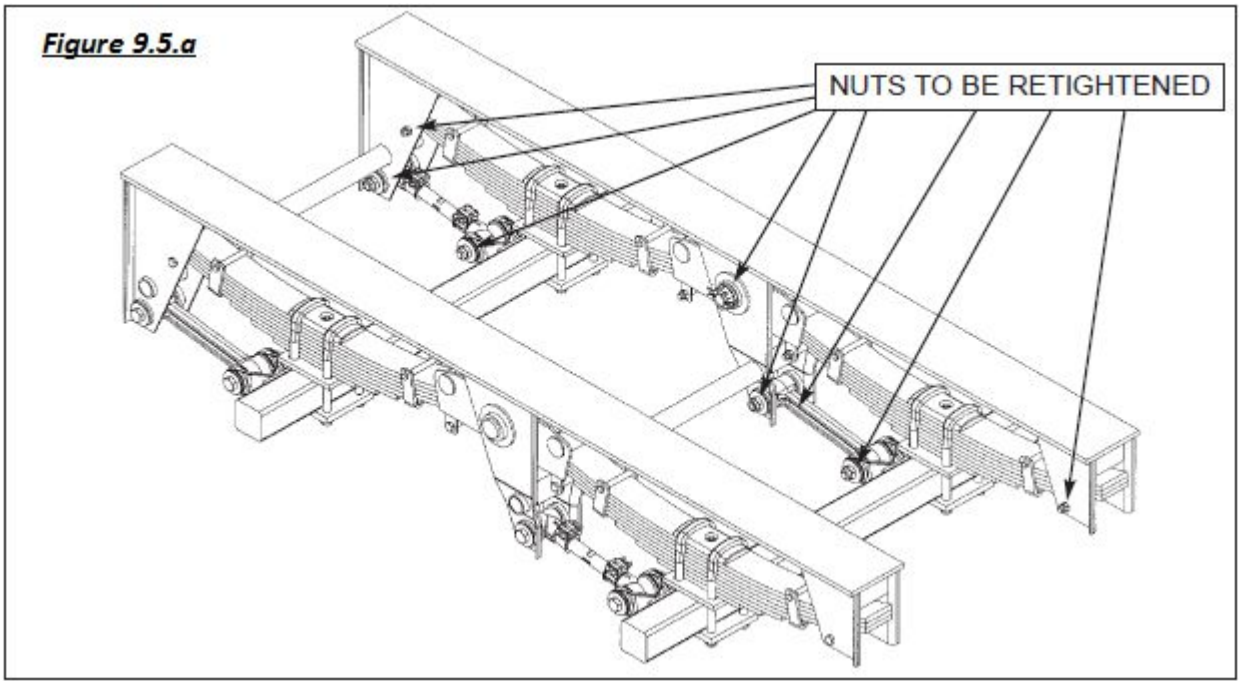
- Check the condition of the clamping bolts.
- Lubricate the rocker shafts.

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

Every year ***(See figure 9.5.d)***

- Check the play between the bushings Item 1 and the rocker shaft *Item 2*, and, if there is excessive play, replace the worn parts.
- Check the rocker *Item 3* and the spring shackles *Item 4* for wear (spring bearing surface) and replace these parts if they are badly worn.
- Check the general condition of the springs *Item 5*, clean them thoroughly and brush the sides of the springs to check for cracks.
- If there is any play between the springs *Item 5* and the axles, check the whole of the clamping system: clamping plates *Item 8*, spring bolt alignment plate *Item 9*, U-bolts *Item 10*.

Figure 9.5.a



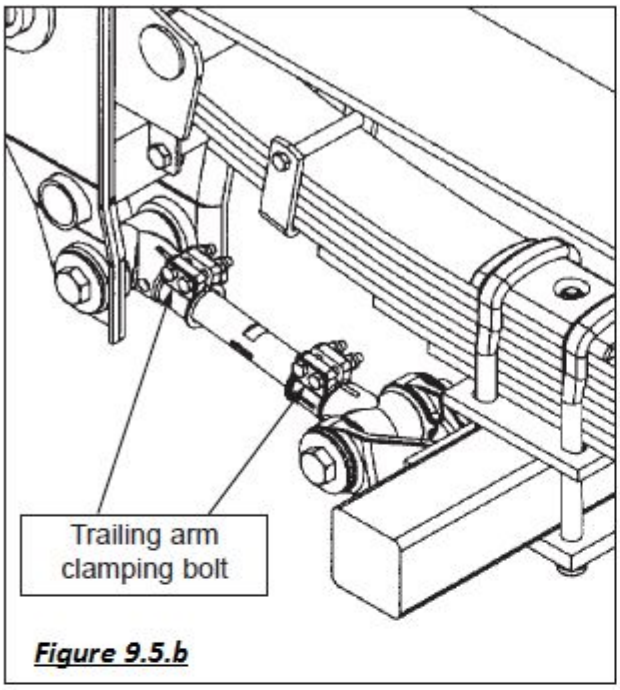


Figure 9.5.b

Figure 9.5.c

1 Clamping washer
2 Bracket
3 Conical rubber bushing

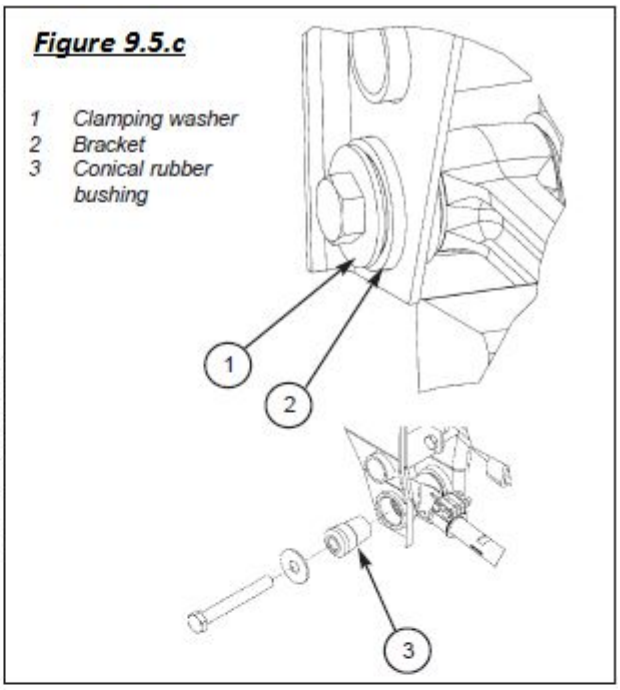
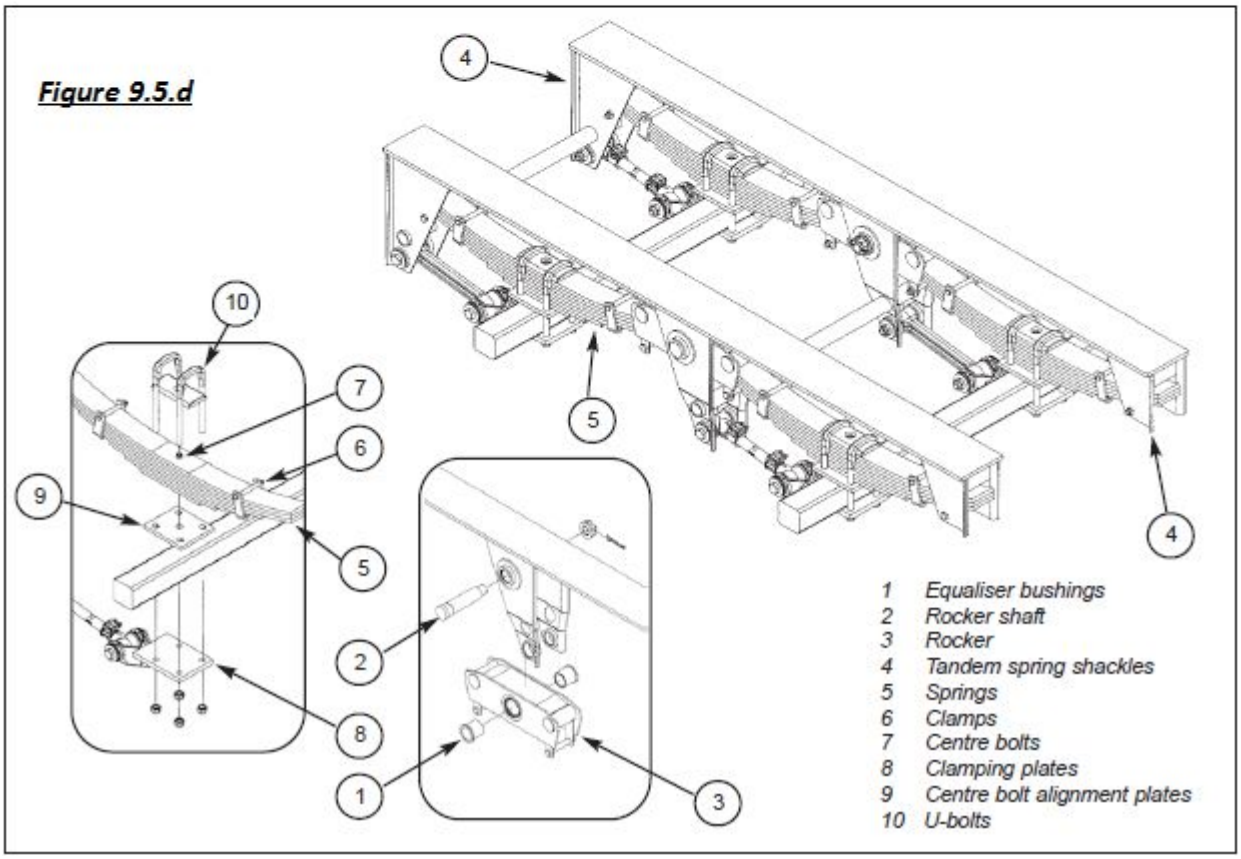
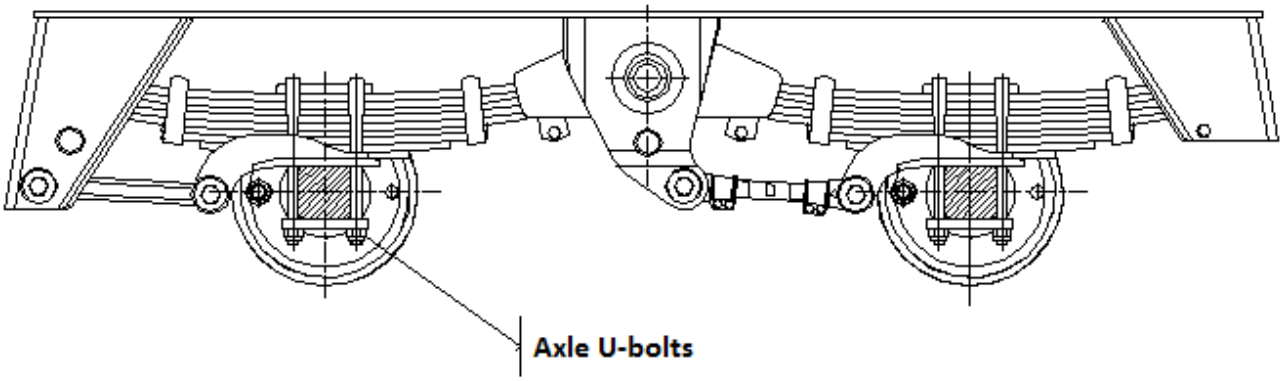


Figure 9.5.d



1 Equaliser bushings
2 Rocker shaft
3 Rocker
4 Tandem spring shackles
5 Springs
6 Clamps
7 Centre bolts
8 Clamping plates
9 Centre bolt alignment plates
10 U-bolts

6.4.8 U-BOLT TIGHTENING TORQUE



U-BOLT, ∅		WRENCH	MIN TIGHTENING TORQUE			MAX TIGHTENING TORQUE		
mm	inch	mm	Kg.m	N.m	ft.lb	Kg.m	N.m	ft.lb
18	0.709	27	23	230	166	27	270	195
22	0.866	34	45	450	325	54	540	391
24	0.0945	36	50	500	362	60	600	434
27	1.063	41	60	600	434	72	720	521
30	1.181	46	90	900	650	100	1000	723

6.4.9 DRAWBAR SPRINGS

After the first laden journey, before intensive use or every 6 months ***(See figure 9.7)***

- Retighten all the mounting U-bolt nuts to the recommended torque *Item 2*.
- Lubricate the attachment shaft *Item 3*.

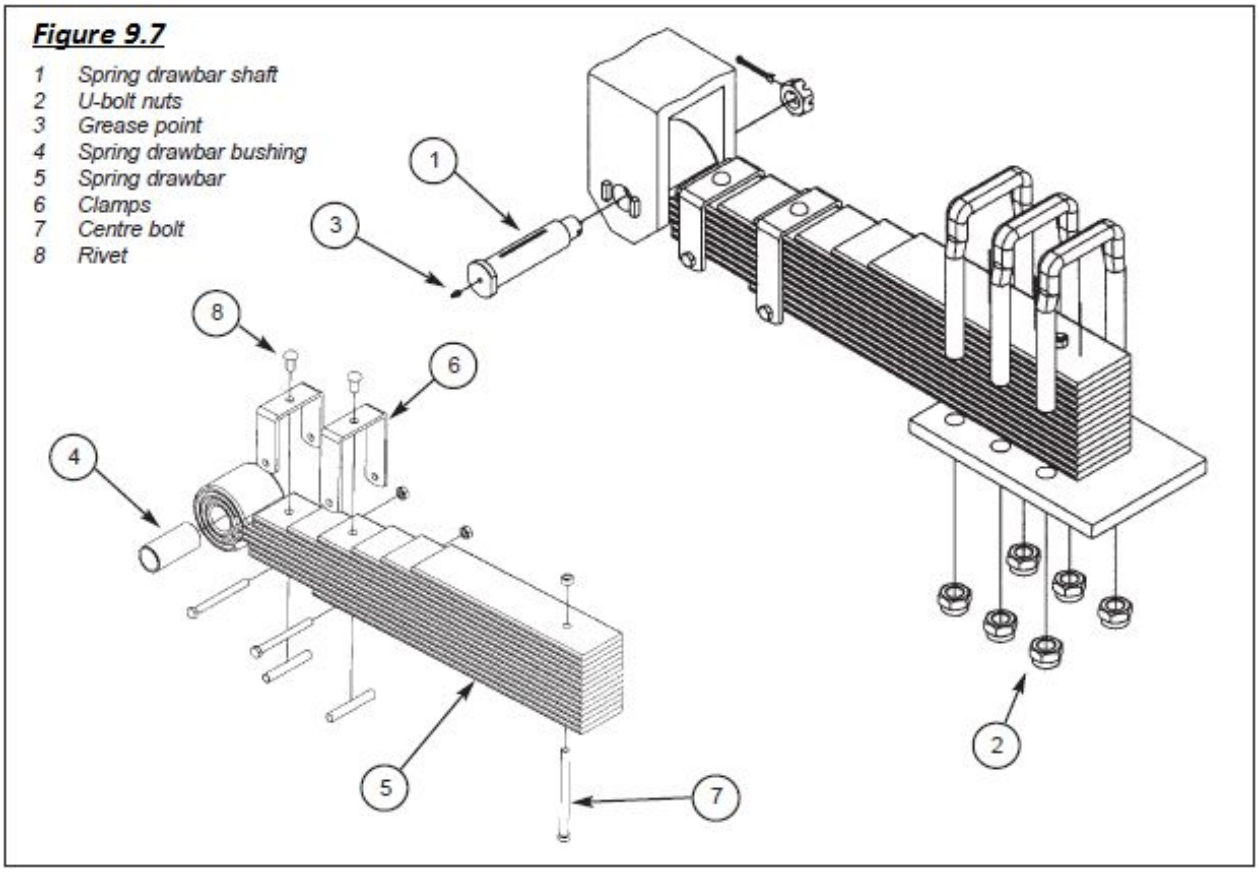
Under harsh or intensive operating conditions, maintenance should be carried out more frequently.

Every year:

- Check the play between the bushing *Item 4* and the spring drawbar shaft *Item 1*, and, if there is excessive play, replace the worn parts.
- Check the general condition of the spring *Item 5*, clean it thoroughly and brush the sides of the springs to check for cracks. Check the condition of the clamps *Item 6*.

Figure 9.7

1 *Spring drawbar shaft*
2 *U-bolt nuts*
3 *Grease point*
4 *Spring drawbar bushing*
5 *Spring drawbar*
6 *Clamps*
7 *Centre bolt*
8 *Rivet*



6.4.10 MINIMUM PROGRAM OF MAINTENANCE

This maintenance plan is intended for normal operating conditions. More frequent maintenance may be required for harsh operating conditions(construction sites, mountains, intensive use, etc)…

See the following paragraphs for detailed maintenance instructions.

	On commissioning	After the first laden journey	After the first 1000 km (620 mi)	Every 3 months	Every 6 months or 25 000 km (15 500 mi)	Before intensive service	Every 2 years of 50 000 km (31 000 mi)
Axle maintenance and adjustment							
Tightening and retightening wheel nuts	X	X	X		X		
Checking the hubcaps	X				X		
Checking the wheel bearing clearance			X		X	X	
Lubricating the wheel bearings							X
Brake maintenance and adjustment							
Initial checks	X	X		X		X	
Checking clearance and wear				X		X	
Adjusting brakes with fixed levers				X		X	
Adjusting brakes with adjustable levers				X		X	
Steering axles							
Normal maintenance				X		X	
Checking & adjusting the wheel alignment					X		
Locking cylinder maintenance & adjustment					X		
Adjusting the clearance, steering axles with tapered pins only						X	
Adjusting the steering angle						X	
Basic tandem suspension, tandem and tridem		X			X	X	
Rod half-tandem suspension, tandem and tridem		X			X	X	
Drawbar Spring		X			X	X	

7 TYRES AND WHEELS

7.1 TYRE AND WHEEL MAINTENANCE

Maintenance of correct inflation pressure is the basic essential factor in obtaining the best performance and life from a pneumatic tyre. The air inside the tyre enables it to carry a load. It is only when the inflation pressure is correctly matched that the tyre adopts its optimum cross-sectional shape and the tread rests correctly on the road surface with the correct pressure distribution across its whole width, thus allowing the sidewalls to provide the required degree of flexibility. Both performance and life of the tyres will suffer if pressures are unsuitable so both over or under inflation (or overload which has the same effect) are similary undesirable.

Underinflation results in excessive deflection which increases the heat generated by the tyre, this in turn leads to its eventual disintigration. In addition the distortion of the casing will result in the lifting of the centre of the tread, thus overloading the outer edges of the tread, producing rapid wear at those points.

Overinflation distorts the tyre's casing, but in this case it tends to lift the outer edges of the tread off the road surface and imposes extra load and more rapid wear on the centre of the tread. Owing to reduced flexibilty the tyre will be more vulnerable to impact damage, ride quality will be impaired and the wheels will be more liable to bounce which can result in skidding due to brakes locking.

Unlike cars on which tyre loads do not vary greatly it is not practicable to provide standard recommendations. This is because tyre loading and operating conditions vary widely.

Remember that spreaders travel laden one way and unladen in the opposite direction, it is therefore desirable to estabish a suitable mean pressure that mimimises both under inflation when loaded and excessive over inflation when running light.

7.2 ROAD USAGE

Maximum gross combination weight is 31000Kg and maximum gross spreader weight is 18290kg.

MACHINE WIDTH (metres)	SPEED LIMITATION
WIDTH > 2.55	Max. 25 mph
2.55 > WIDTH ≤ 3.5	Max. 20 mph
WIDTH > 3.5	Max. 12 mph + Attendant Police dispensation required

If in doubt contact your local authorities, where your machine will be operated.

7.3 PRESSURE SETTINGS STD TYRES – GENERAL

MAXIMUM TYRE PRESSURES				
WHEEL & TYRE	PRESSURE		WHEEL & TYRE	PRESSURE
	Bar	PSI		Bar	PSI
580/70 R 38 (170A8)	3.3	49	800/70 R 38 (173 A8/B)	1.9	27
580/70 R 38 (180A8)	5.5	80	710/70 R 42 (180A8)	3.8	55
710/70 R 38 (178A8)	3.3	49	650/65 R 38 (178A8)	4.2	61

Recommended rims in red

For stationary service (0 km/h) and speed up to 10 km/h inflation pressure must increase by 20%. Field dual: 88% of field load, field triple: of field load.
Alliance allows for free roliing application: Load capacity to be increased by 15%, after increasing the inflation pressure by 20%.

580/70 R 38 ALLIANCE

KPH MPH

STANDARD 170/A8 HIGH LOAD 180/A8

Size	Rim	Unloaded dimension SW	Unloaded dimension OD	Loaded Static Radius	Rolling Circum	PR,Stars Load Index	Infl. press	Recommend load, kg (lbs)								
						Speed, km/h (mph)		Not high and sustained torque; Road transport						Field operation		
														Low Torque		High Tor
		mm in	mm in	mm in	mm in	Speed Symbol	Bar psi	Static	10 6	25 16	30 19	40 25	50 31	10 6	20 12	10 6
580/70R 38	W18A	577 22.7	1817 71.5	816 32.1	5343 210.4		1	6760	4410	3260	3150	2940	2680	4120	3530	3150
							15	14890	9710	7180	6940	6480	5900	9070	7780	6940
							1.3	7890	5150	3810	3670	3430	3120	4800	4120	3670
							19	17380	11340	8390	8080	7560	6870	10570	9070	8080
						155A8	1.6	8910	5810	4300	4150	3875	3530	5430	4650	4150
						152 B	23	19630	12800	9470	9140	8540	7780	11960	10240	9140
							2	11340	7400	5470	5280	4930	4490	6900	5920	5280
							29	24980	16300	12050	11630	10860	9890	15200	13040	11630
						Reinforced	2.4	12600	8220	6080	5860	5480	4990	7670	6580	5860
						rim	35	27750	18110	13390	12910	12070	10990	16890	14490	12910
						170A8	2.8	13800	9000	6660	6420	6000	5460	8400	7200	6420
						167 B	41	30400	19820	14670	14140	13220	12030	18500	15860	14140
							3.2	14880	9710	7180	6920	6470	5890	9060	7760	6920
							46	32780	21390	15810	15240	14250	12970	19960	17090	15240
							3.6	15940	10400	7690	7420	6930	6310	9700	8320	7420
							52	35110	22910	16940	16340	15260	13900	21370	18330	16340
							4	16950	11060	8180	7890	7370	6710	10320	8840	7890
							58	37330	24360	18020	17380	16230	14780	22730	19470	17380
						Reinforced	4.4	17920	11690	8650	8340	7790	7090	10910	9350	8340
						rim	64	39470	25750	19050	18370	17160	15620	24030	20590	18370
						180A8	4.6	18400	12000	8880	8560	8000	7280	11200	9600	8560
							67	40530	26430	19560	18850	17620	16040	24670	21150	18850

Bar
PSI
KG
lbs

710/70 R 38 ALLIANCE

Size	Rim	Unloaded dimension SW	Unloaded dimension OD	Loaded Static Radius	Rolling Circum	PR,Stars Load Index	Infl. press	Recommend load, kg (lbs) / Speed, km/h (mph) / Not high and sustained torque; Road transport						Field operation / Low Torque		Field operation / High Tor
		mm in	mm in	mm in	mm in	Speed Symbol	Bar psi	Static	10 6	25 16	30 19	40 25	50 31	10 6	20 12	10 6
710/70R 38	DW23A	716 28.2	1948 76.7	877 34.5	5739 225.9	166A8	1.3	10790	7040	5210	5020	4690	4270	6570	5630	5020
						163B	19	23770	15510	11480	11060	10330	9410	14470	12400	11060
							1.5	11730	7650	5660	5460	5100	4640	7140	6120	5460
							22	25840	16850	12470	12030	11230	10220	15730	13480	12030
							1.6	12190	7950	5880	5670	5300	4820	7420	360	5670
							23	26850	17510	12950	12490	11670	10620	16340	14010	12490
						172A8	1.7	12810	360	6180	5960	5570	5070	7800	6680	5960
						169B	25	28220	18410	13610	13130	12270	11170	17180	14710	13130
							1.9	13660	8910	6590	360	5940	5410	8320	7130	360
							28	30090	19630	14520	14010	13080	11920	18330	15700	14010
							2.1	14490	9450	6990	6740	6300	5730	8820	7560	6740
							30	31920	20810	15400	14850	13880	12620	19430	16650	14850
							2.2	14970	9770	7230	6970	6510	5920	9110	7810	6970
							32	32970	21520	15930	15350	14340	13040	20070	17200	15350
							2.5	16150	10530	7790	7510	7020	6390	9830	8420	7510
							36	35570	23190	17160	16540	15460	14070	21650	18550	16540
						178A8	2.8	17250	11250	8330	8030	7500	6830	10500	9000	8030
						175B	41	38000	24780	18350	17690	16520	15040	23130	19820	17690

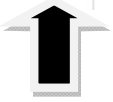
710/70 R 42 ALLIANCE

Size	Rim	Unloaded dimension SW	Unloaded dimension OD	Loaded Static Radius	Rolling Circum	PR,Stars Load Index	Infl. press	Recommend load, kg (lbs) / Speed, km/h (mph) / Not high and sustained torque; Road transport						Field operation / Low Torque		Field operation / High Tor
		mm in	mm in	mm in	mm in	Speed Symbol	Bar psi	Static	10 6	25 16	30 19	40 25	50 31	10 6	20 12	10 6
710/70R42 (Des.365)	DW23B	740 29.1	2055 80.9	936 36.9	6178 243.2	173A8	0.8	7870	5130	3800	3660	3420	3420	4790	4100	3660
						173 B	12	17330	11300	8370	8060	7530	7530	10550	9030	8060
							1	8950	5840	4320	4160	3890	3890	5450	4670	4160
							15	19710	12860	9520	9160	8570	8570	12000	10290	9160
							1.2	9960	6500	4810	4630	4330	4330	6060	5200	4630
							17	21940	14320	10590	10200	9540	9540	13350	11450	10200
							1.4	10900	7110	5260	5070	4740	4740	6640	5690	5070
							20	24010	15660	11590	11170	10440	10440	14630	12530	11170
							1.6	11800	7700	5690	5490	5130	5130	7180	6160	5490
							23	25990	16960	12530	12090	11300	11300	15810	13570	12090
							2	13430	8760	6480	6250	5840	5840	8180	7010	6250
							29	29580	19300	14270	13770	12860	12860	18020	15440	13770
							2.2	14210	9270	6860	6610	6180	6180	8650	7420	6610
							32	31300	20420	15110	14560	13610	13610	19050	16340	14560
							2.4	14950	9750	7220	6960	6500	6500	9100	7800	6960
							35	32930	21480	15900	15330	14320	14320	20040	17180	15330
						180A8	2.6	16280	10620	7860	7580	7080	7080	9910	8500	7580
						180B	38	35860	23390	17310	16700	15590	15590	21830	18720	16700
							2.8	17020	11100	8210	7920	7400	7400	10360	8880	7920
							41	37490	24450	18080	17440	16300	16300	22820	19560	17440
							3	17710	11550	8550	8240	7700	7700	10780	9240	8240
							44	39010	25440	18830	18150	16960	16960	23740	20350	18150
							3.2	18400	12000	8880	8560	8000	8000	11200	9600	8560
							46	40530	26430	19560	18850	17620	17620	24670	21150	18850

650/55 R 26.5 BKT

650/55 R 26.5	169 D/180 A8	AG 20.00	645	1389	600	4207	TL

km/h / bar	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
65	2440	2960	3425	3945	4470	4815	5340	5800
50	2950	3585	4145	4775	5410	5830	6460	7020
40	3360	4080	4720	5440	6160	6640	7360	8000
25	3850	4675	5410	6235	7060	7610	8435	9165
10	4385	5325	6160	7100	8040	8670	9605	10440



OPTION WHEELS & TYRES

600/55 R 22.5 ALLIANCE

Size	Rim	Unloaded dimension SW mm in	Unloaded dimension OD mm in	Loaded Static Radius mm in	Rolling Circum mm in	PR,Stars Load Index Speed Symbol	Infi press Bar psi	Recommend load, kg (lbs) / Speed, km/h (mph) / Mixed application: Static	10 6	25 16	30 19	40 25	50 31	60 37	65 40	70 44
600/55R 22.5	20.00DC	600 23.6	1245 49	562 22.1	3670 144.5	162 E	**0.8**	**4280**	**3520**	**3210**	**2980**	**2700**	**2420**	**2160**	**2030**	**1860**
							12	*9430*	*7750*	*7070*	*6560*	*5950*	*5330*	*4760*	*4470*	*4100*
							1.5	**6160**	**5070**	**4610**	**4290**	**3890**	**3480**	**3110**	**2920**	**2680**
							22	*13570*	*11170*	*10150*	*9450*	*8570*	*7670*	*6850*	*6430*	*5900*
							1.7	**6620**	**5440**	**4960**	**4610**	**4180**	**3740**	**3340**	**3140**	**2880**
							25	*14580*	*11980*	*10930*	*10150*	*9210*	*8240*	*7360*	*6920*	*6340*
							2	**7290**	**5990**	**5470**	**5070**	**4600**	**4120**	**3680**	**3460**	**3170**
							29	*16060*	*13190*	*12050*	*11170*	*10130*	*9070*	*8110*	*7620*	*6980*
							2.5	**8300**	**6820**	**6210**	**5780**	**5230**	**4690**	**4190**	**3930**	**3610**
							36	*18280*	*15020*	*13680*	*12730*	*11520*	*10330*	*9230*	*8660*	*7950*
							3.5	**10100**	**8300**	**7570**	**7020**	**6370**	**5710**	**5090**	**4790**	**4390**
							51	*22250*	*18280*	*16670*	*15460*	*14030*	*12580*	*11210*	*10550*	*9670*
							4	**10930**	**8980**	**8180**	**7600**	**6890**	**6180**	**5510**	**5180**	**4750**
							58	*24070*	*19780*	*18020*	*16740*	*15180*	*13610*	*12140*	*11410*	*10460*

650/65 R 38 ALLIANCE

Size	Rim	Unloaded dimension SW	Unloaded dimension OD	Loaded Static Radius	Rolling Circum	PR,Stars Load Index	Infl. press	Recommend load, kg (lbs) Speed, km/h (mph) Not high and sustained torque; Road transport Static	10 6	25 16	30 19	40 25	50 31	Field operation Low Torque 10 6	20 12	High Tor 10 6
		mm in	mm in	mm in	mm in	Speed Symbol	Bar psi									
650/65R38	DW20A	645 25.4	1835 72.2	830 32.7	5422 213.5	154A8 151B	1 15	7750 17070	5060 11150	3740 8240	3610 7950	3370 7420	3070 6760	4720 10400	4040 8900	3610 7950
							1.1 16	8190 18040	5340 11760	3950 8700	3810 8390	3560 7840	3240 7140	4980 10970	4270 9410	3810 8390
							1.2 17	8630 19010	5630 12400	4160 9160	4010 8830	3750 8260	3410 7510	5250 11560	4500 9910	4010 8830
						178A8 175B	2.4 35	13820 30440	9020 19870	6670 14690	6430 14160	6010 13240	5520 12160	8410 18520	6620 14580	6430 14160
							2.8 41	15130 33330	9870 21740	7300 16080	7040 15510	6580 14490	6040 13300	9210 20290	7250 15970	7040 15510
							3.5 51	17250 38000	11250 24780	8330 18350	8030 17690	7500 16520	6890 15180	10500 23130	9000 19820	8030 17690

7.4 WHEEL TYPE & TORQUE SETTINGS

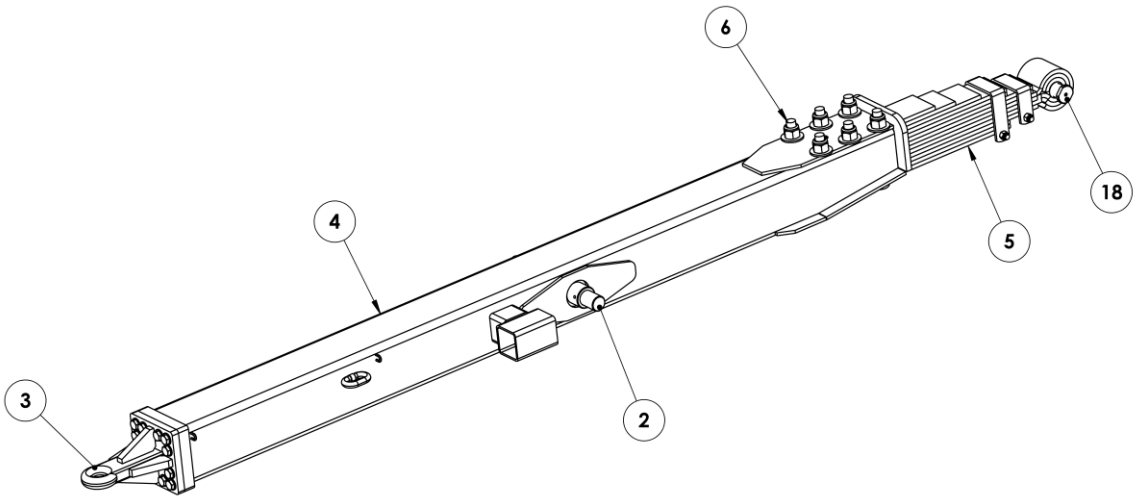
TYRE TYPE		WHEEL TYPE			WHEEL STUD			TORQUE SETTINGS	
SIZE	LOAD RATING	TYPE	BORE (mm)	OFFSET (mm)	QTY	SIZE	PCD (mm)	N-m	lb-ft
580/70 R 38	170A8	W18A x 38	281	Neg. 45	10	M22 x 1.5	335	510	376
580/70 R 38	180A8	W18A x 38	281	Neg. 45	10	M22 x 1.5	335	510	376
650/55 R 26.5	169D	AG20.00 x 26.5	281	0 (Centre Nave)	10	M22 x 1.5	335	510	376
650/65 R 38	178A8	DW23A x 38	281	Neg. 45	10	M22 x 1.5	335	510	376
710/70 R 38	181A8	DW23A x 38	281	Neg. 45	10	M22 x 1.5	335	510	376
710/70 R 42	180A8	W23B x 42	281	Neg. 45	10	M24 x 1.5	335	610	450
VF 710/70 R 42	185D	DW25B x 42	281	Neg. 20	10	M24 x 1.5	335	610	450

IMPORTANT

CHECK WHEEL NUT TORQUE AFTER EACH LOAD FOR THE 1ST 10 LOADS AND THEN DAILY FOR THE FIRST WEEK AND ONCE A WEEK THEREAFTER.

8. OPTIONS

8.1 SPRUNG DRAWBAR

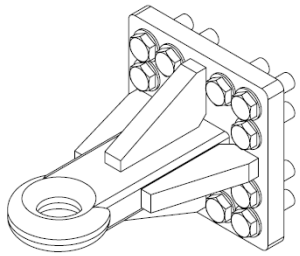
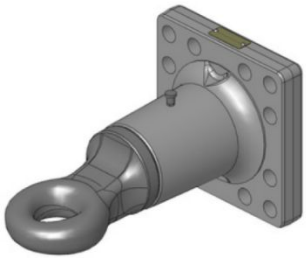
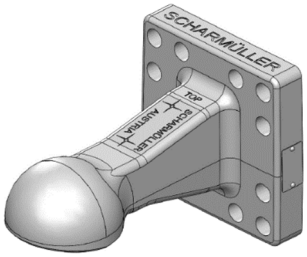
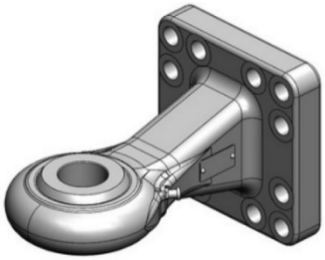


KEY	QTY	PART No.	DESCRIPTION
1	1	70440	GUDGEON PIN & NUT
2	2	70442/2	PIVOT PIN
3*	1	70322/1	BOLT ON FIXED - STD
	1	B5294	BOLT ON SCHARMULLER SWIVEL
	1	70323	BOLT ON SCHARMULLER K80 SPOON
4*	1	N/A	DRAWBAR TO SUIT MODEL
5	2	70438/1	SPRING 13 LEAF
6	3	70439/2	U-BOLT 30mm

*** NORTH AMERICAN STYLE CAT 3, 4 & 5 (Contact your local dealer or GT Bunning)**

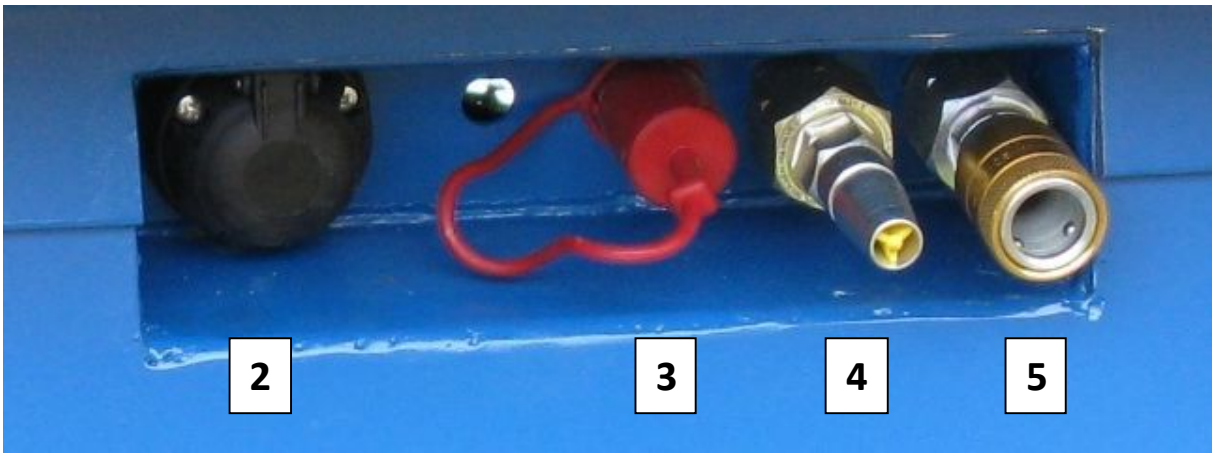
- **DRAWBAR ASSEMBLIES: The North American style mounting available upon request.**
- **HITCHES: The North American style Swivel and Clevis hitches available upon request.**

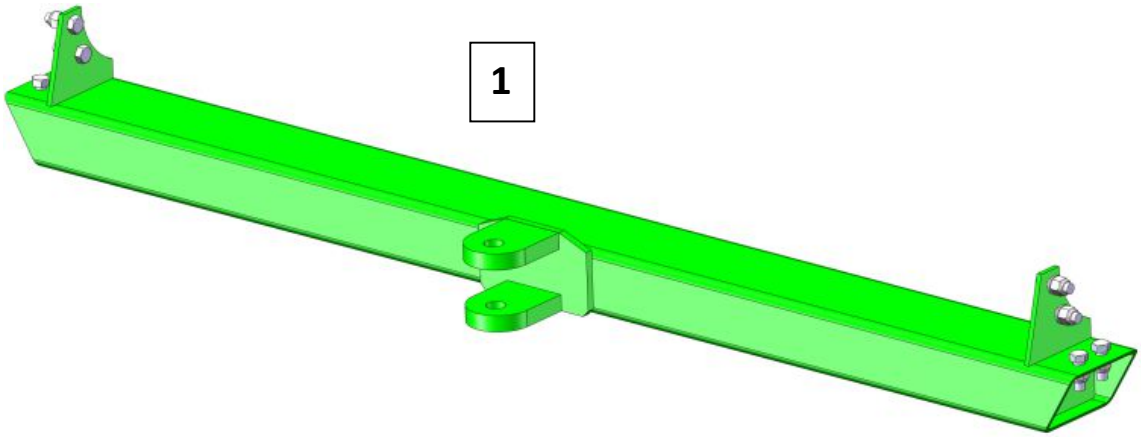
8.2 DRAWBAR HITCH OPTIONS

IMAGE	PART NO. & DESCRIPTION
	**70322/1** **STANDARD FIXED HITCH (PICKUP HITCHRING), 12 x M20 BOLT PATTERN**
	**B5294** **SCHARMULLER SWIVEL HITCH (PICKUP HITCHRING), 12 x M20 BOLT PATTERN**
	**70323** **SCHARMULLER FIXED K80 SPOON HITCH, 12 x M20 BOLT PATTERN**
	**B5294/1** **SCHARMULLER NORTH-AMERICAN CAT-4 SWIVEL HITCH, 12 x M20 BOLT PATTERN, 2in PIN**
	**B5294/2** **SCHARMULLER NORTH-AMERICAN CAT-4 SWIVEL HITCH, 3 x 26mm BOLT PATTERN, 2in PIN**
	**B5294/2** **BULL-PULL NORTH-AMERICAN CAT-4 SWIVEL HITCH, 3 x 26mm BOLT PATTERN, 2in PIN** • **COMES WITH 1 ½in (CAT-3) & 2in (CAT-4) DRAW PIN INSERTS**

PLEASE CONTACT YOUR LOCAL DEALER OR GT BUNNING FOR DETAILS.

8.3 REAR DRAWBAR



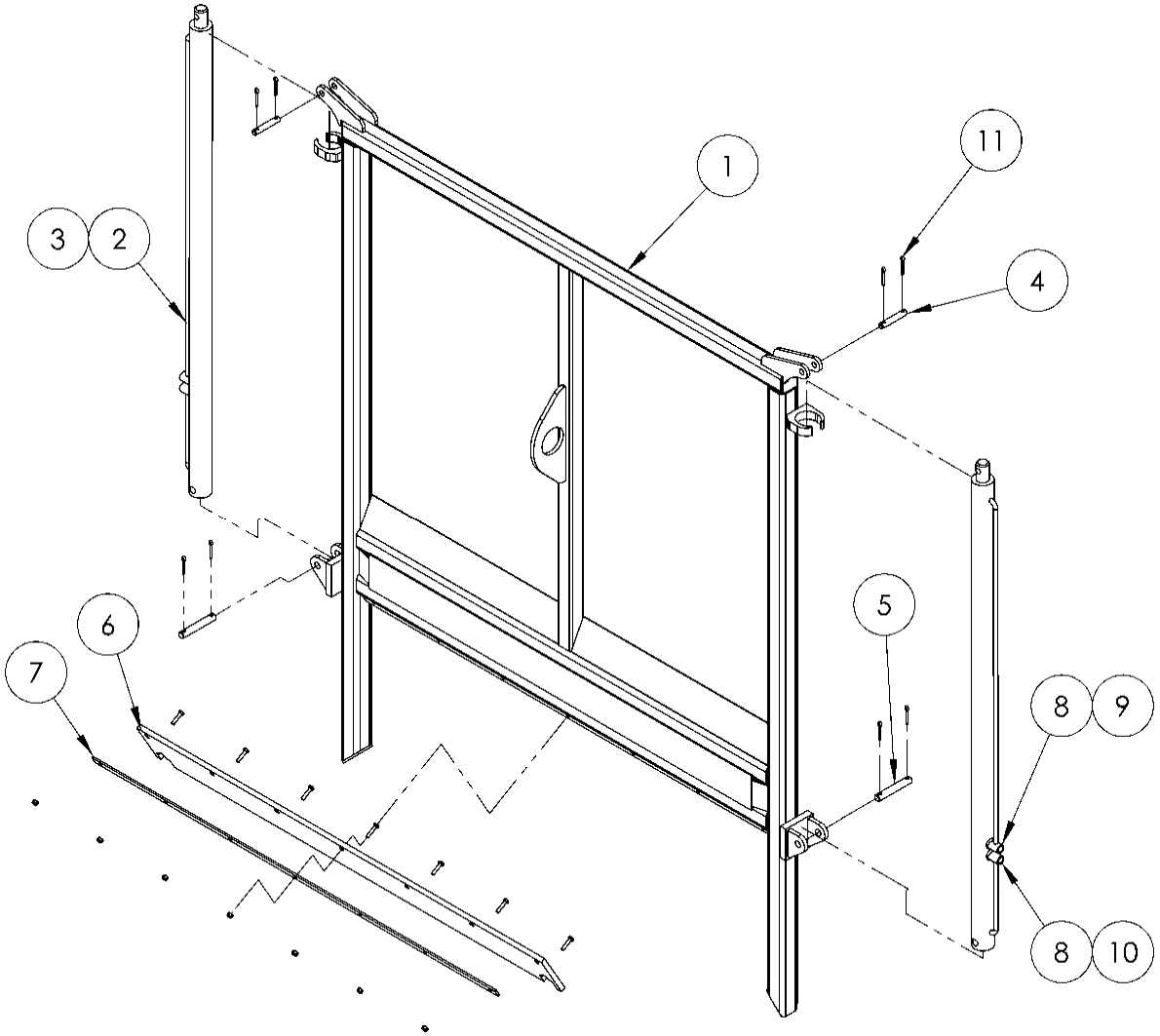


KEY	QTY	PART No.	DESCRIPTION
1	1	B5310	REAR DRAWBAR - CLEVIS (TVA ONLY)
2	1	70107	7 PIN LIGHT SOCKET
3	1	51569	HYDRAULIC BRAKE CONNECTION MALE
4	1		AIR COUPLING MALE
5	1		AIR COUPLING FEMALE

NOTE: The drawbar is designed for highway use **only** towing an unladen spreader.

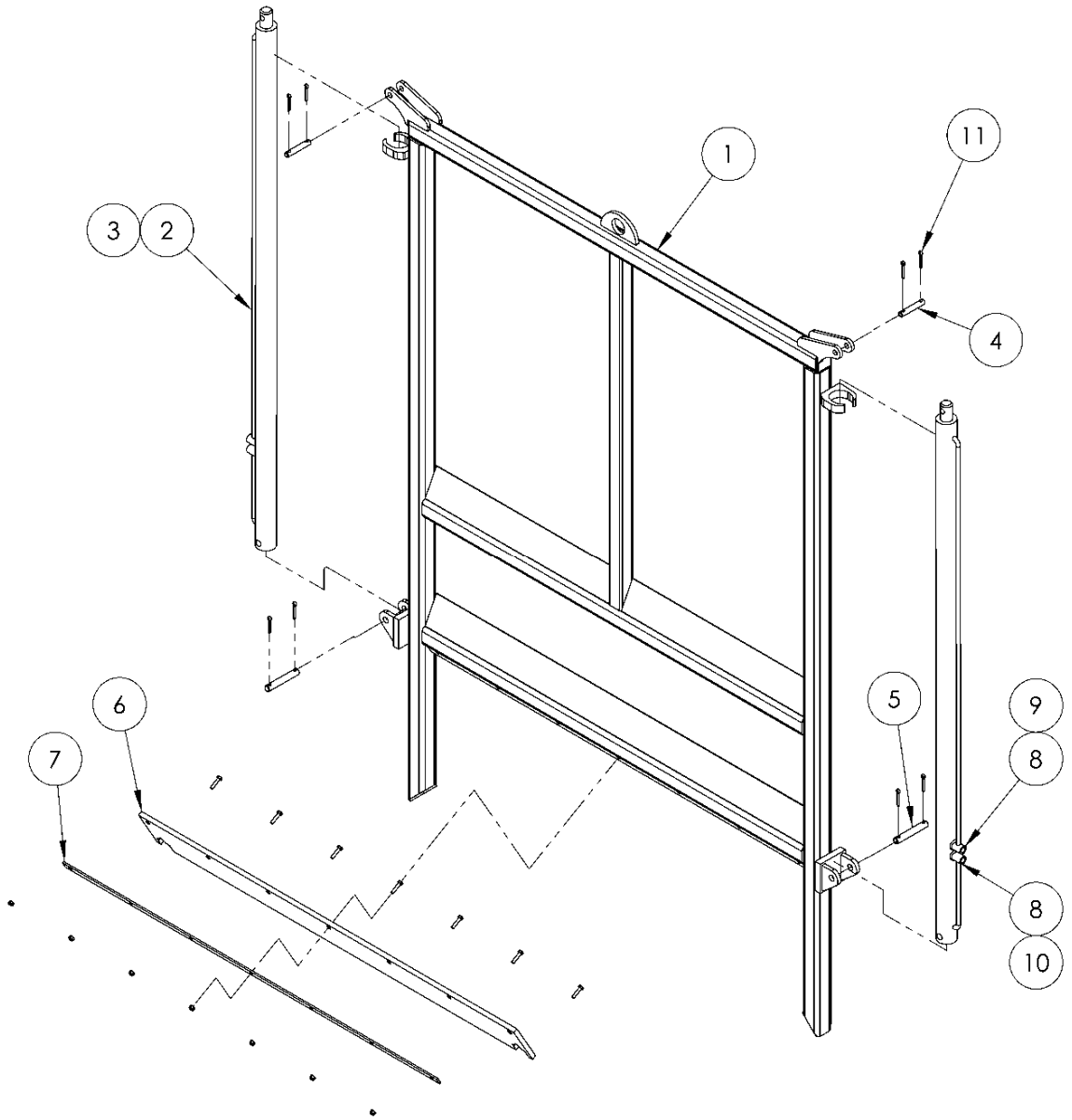
PLEASE CONTACT YOUR LOCAL DEALER OR GT BUNNING FOR DETAILS ON REAR DRAWBAR OPTIONS AND ATTACHMENTS.

8.4 GUILLOTINE SLURRY DOOR – TWIN VERTICAL AUGERS



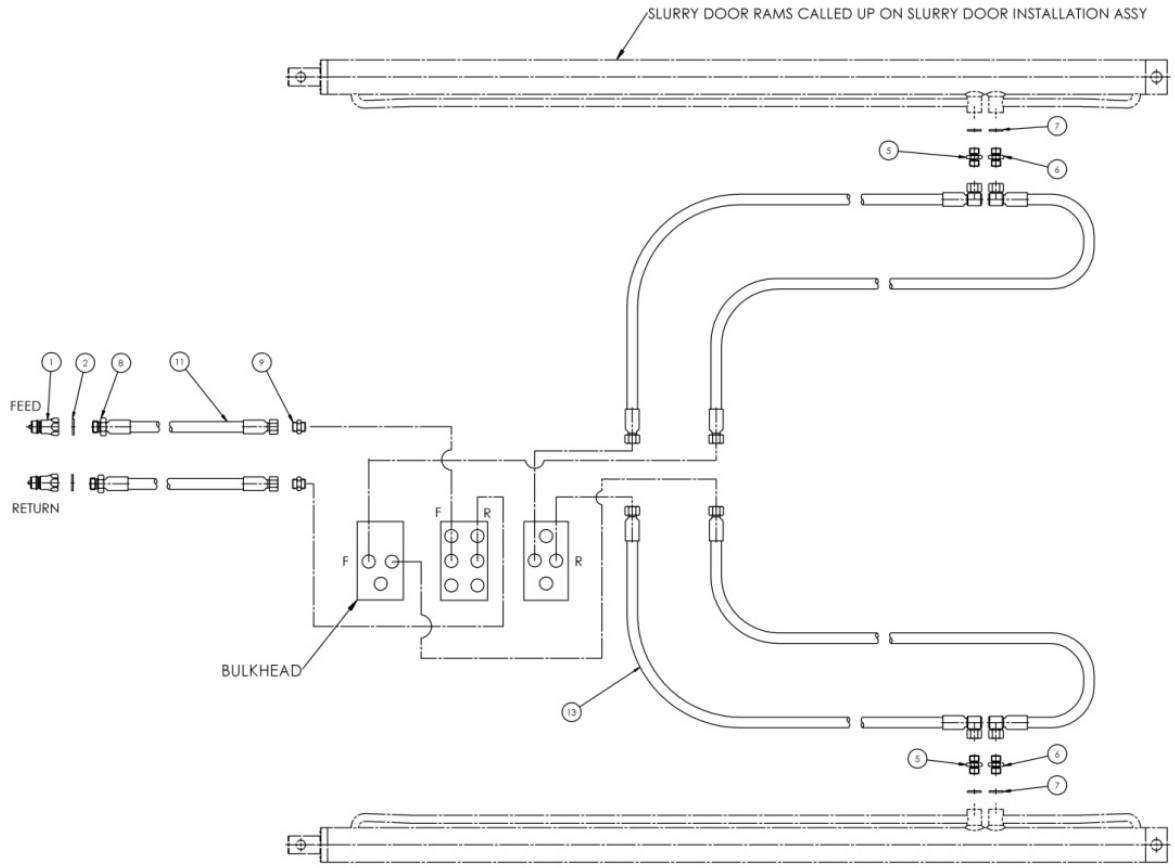
KEY	QTY	PART No.	DESCRIPTION
1	1	B4115	GUILLOTINE DOOR
2	2	B4138	HYDRAULIC RAM
3		65520	RAM SEAL KIT
4	2	B4130	TOP RAM PIN DIA 5/8"
5	2	B4132	BOTTOM RAM PIN DIA 3/4"
6	1	B4166	RUBBER SKIRT W.B
	1	B4162	RUBBER SKIRT HD MK2
7	1	B4188	CLAMP STRIP
8	4	51590	3/8" BONDED SEAL
9	2	51335	3/8" M/M ADAPTOR
10	2	10522	3/8" x 1/8" RESTRICTOR
11	8	50988	SPLIT PIN

8.5 GUILLOTINE SLURRY DOOR – HORIZONTAL BEATERS & DISCS



KEY	QTY	PART No.	DESCRIPTION
1	1	B4115	DOOR
	2	B4138	HYDRAULIC RAM
3		65520	SEAL KIT 50mm BORE
4	2	B4130	TOP RAM PIN DIA 5/8"
5	2	B4132	BOTTOM RAM PIN DIA 3/4"
6	1	B4166/1	RUBBER SEAL WITH WB AUGERS
7	1	B4121	CLAMPING STRIP & M8 x 35 BOLT C/W S.L NUTS
8	4	51590	3/8" BONDED SEAL
9	2	51335	3/8" M/M ADAPTOR
10	2	10522	3/8" x 1/8" RESTRICTOR
11	8	50988	SPLIT PIN

8.6 GUILLOTINE SLURRY DOOR HYDRAULIC CIRCUIT.

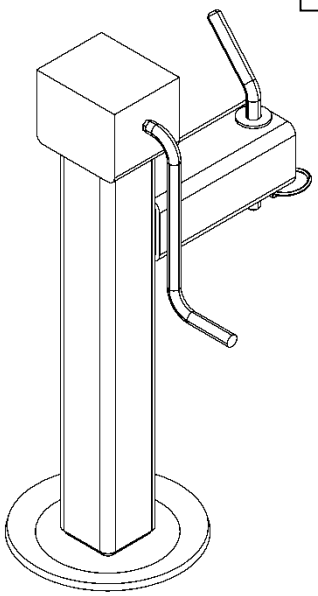


KEY	QTY	PART No.	DESCRIPTION
1	2	51576	1/2" PROBE MALE SELF SEALER
2	2	51583	DUMMY 1/2" FEMALE
3	2	51463	3/8"-3/8"- BPT BULKHEAD
4	2	51447	3/8"-3/8"-3/8" MALE TEE
5	2	51335	3/8"-3/8" BPT NIPPLE
6	2	10522	3/8"-3/8" BPT NIPPLE 1/8" REDUCED
7	4	51590	DIA 3/8" DOWTY WASHER
8	2	51591	DIA 1/2" DOWTY WASHER
9	6	51338	3/8-1/2" M/M ADAPTOR
10	8	52311	HOSE END DIA 3/8"-3/8" BPT FEMALE
11	6	52313	HOSE END DIA 3/8"-3/8" BPT 90 DEG FEM
12	2		HOSE 3/8" BORE 2 WIRE x 2500mm
13	2		HOSE 3/8" BORE 2 WIRE x 8620mm
14	4		HOSE 3/8" BORE 2 WIRE x LENGTH
16	REF	SEE NOTE	HYD RAM 50mm BORE DOUBLE ACTING

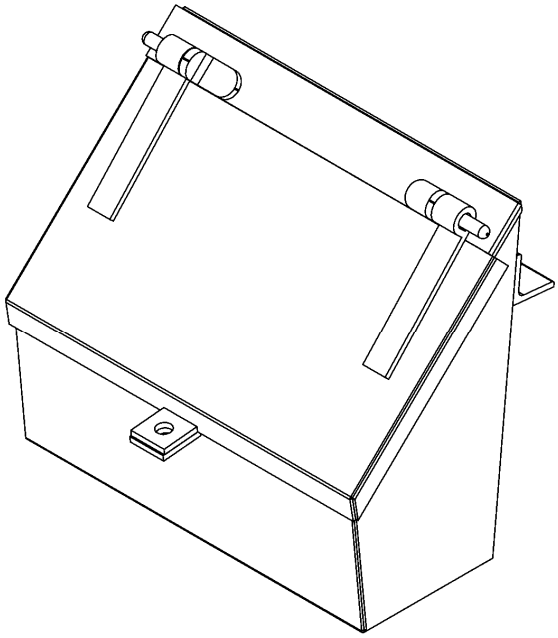
NOTE: This slurry door has longer legs than the standard for TVA machines.

8.7 SUPPORT LEG PART No. 70306

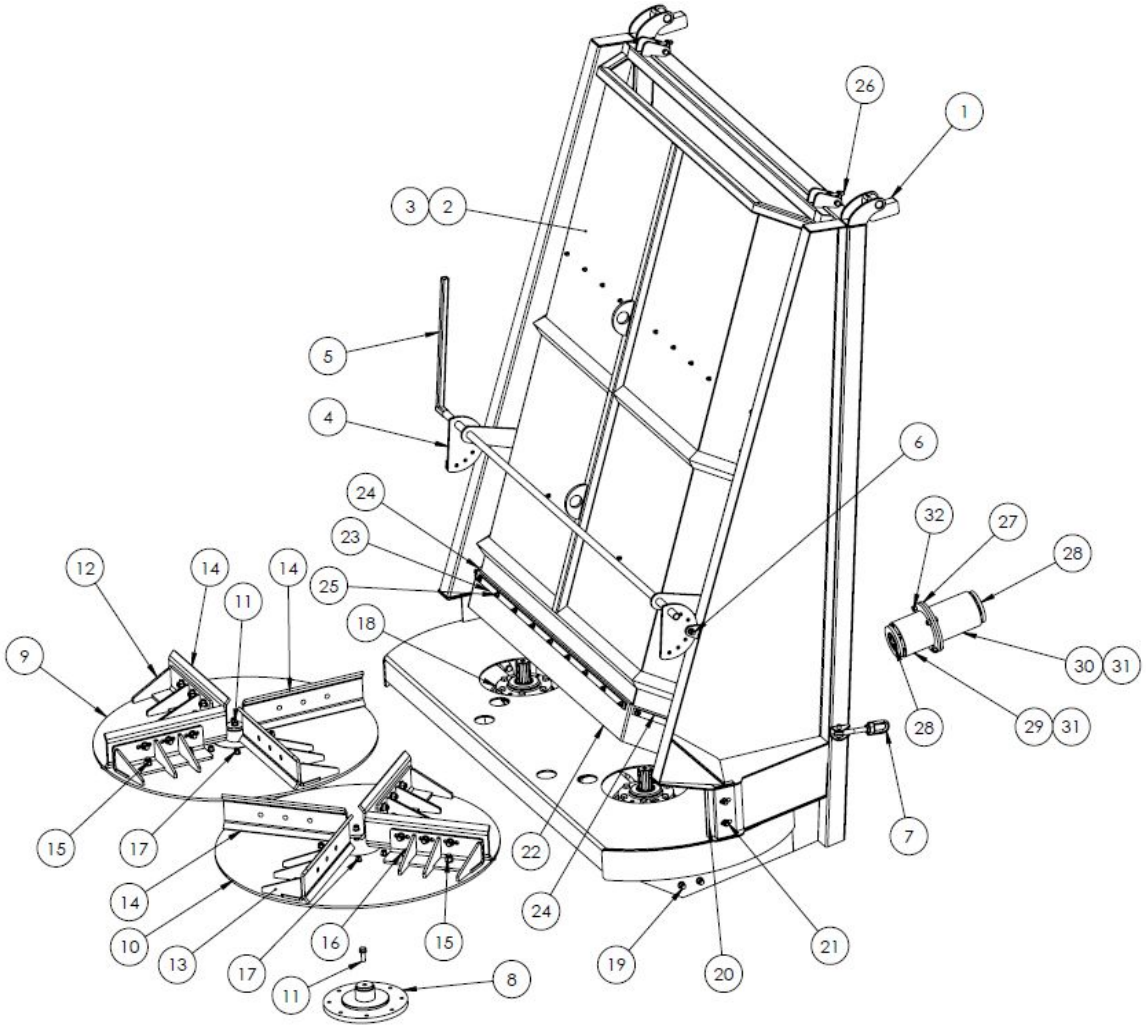
Use unladen only



8.8 TOOLBOX PART No. 80136



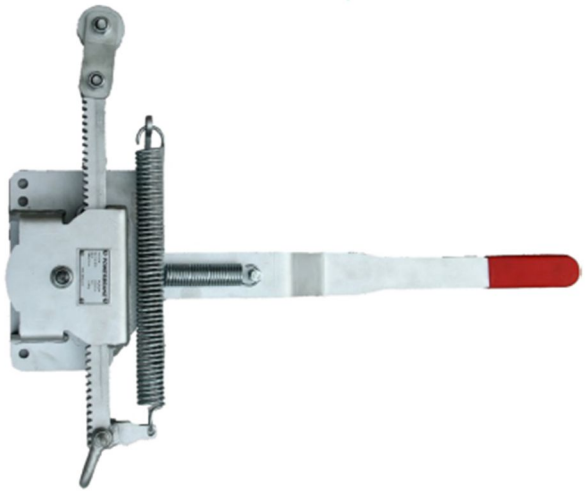
8.9 DETACHABLE SPINNER DECK – ADD ON OPTION



KEY	QTY	PART No.	DESCRIPTION
1	2	B8810	BUCKET HOOK
2	1	AMS3700	REAR CANOPY ASSEMBLY
3	1	50759/4	RUBBER LINING
4	1	AMS3633-2	CANOPY ADJUSTER ASSY
5	2	DMS4385-1	CANOPY ADJUSTER HANDLE
6	2	73095	BOLT & NUT M12x50
7	2	A2134	HOOK BOLT
8	2	B8336	DISC MOUNTING FLANGE
9	1	B8370H	LHS SPINNING DISC ASSY
10	1	B8342H	RHS SPINNING DISC ASSY
11	2	73128/1 + 74703	BOLT & SPRING WASHER M14x45 GR 10.9
12	2	B8356/18	BLADE HOLDER LHS
13	2	B8357/18	BLADE HOLDER RHS
14	8	B1130/18	PADDLE (C/W FASTENERS)
15	8	73155 + 73375	BOLT & NUT M16x50 G8.8 (OUTER)
16	8	73155/1 + 73375	BOLT & NUT M16x50 G12.9 (INNER)

KEY	QTY	PART No.	DESCRIPTION
17	16	73095	BOLT & NUT M12x50
18	1	B3190	GRBX SRT18-1830 1000/520
19	16	73129 + 73371 + 74685	BOLT, NUT & WASHER M14x50 GR8.8
20	2	B5326	WEAR END PLATE
21	2	73830 + 73367 + 74684	CSK BOLT, NUT & WASHER M12x50
22	1	DMS1090	RUBBER SKIRT
23	1	DMS0511	CLAMPING STRIP
24	2	DMS0512	CLAMPING STRIP
25	13	73034 + 73359	BOLT & NUT M8x35 GR8.8
26	2	73070 + 73363	BOLT & NUT M10x70 GR8.8
27	1	B8484/1	FLEXIDRIVE COUPLER COMPLETE ASSY
28	2	B8486	FLEXIDRIVE COUPLING
29	1	B8489	FLEXIDRIVE TUBE 130
30	1	B8489/1	FLEXIDRIVE TUBE 190
31	12	B1142	RUBBER DRIVE BLOCK
32	4	73092 + 73367	BOLT & NUT M12x35 GR8.8

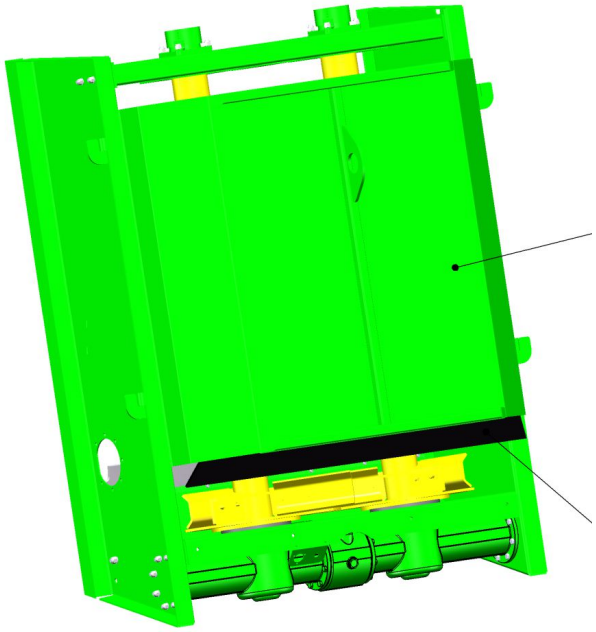
8.10 HANDBRAKE CONTROL

IMAGE	PART NO. & DESCRIPTION
	**70321** **MULTI-STROKE HANDBRAKE**
	**70321/1** **POWERBRAKE-RT HANDBRAKE**

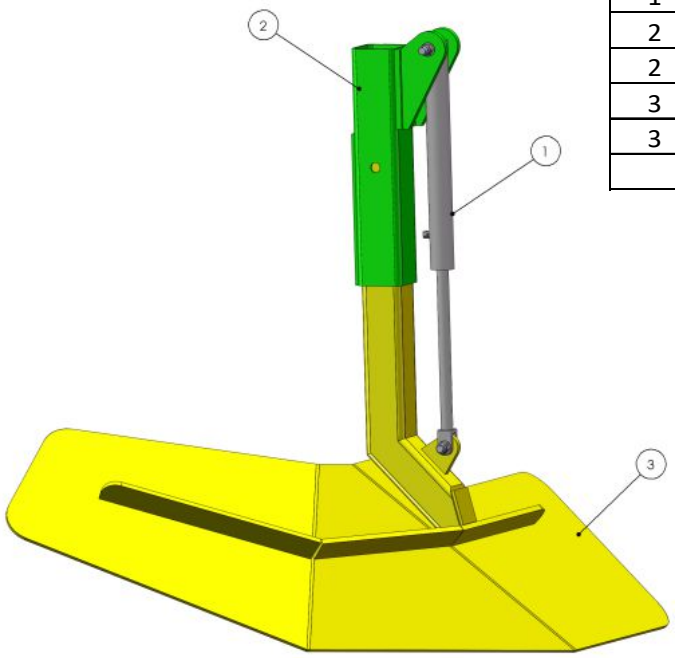
8.11 BODY SEAL RUBBERS

KEY	QTY	PART No.	DESCRIPTION
1	1	B4166/1	SLURRY DOOR RUBBER
2	1	B4166/1	FRONTWALL RUBBER
3	1	B4123	DOUBLE WIPER RUBBER STRIP
4	1	B4176/1	DECK RUBBER
5	1	B4171/1	HORIZONTAL BEATER CANOPY LOWER
6	1	B4172/1	HORIZONTAL BEATER TOP WIPER

8.12 SIMPLE CANOPY

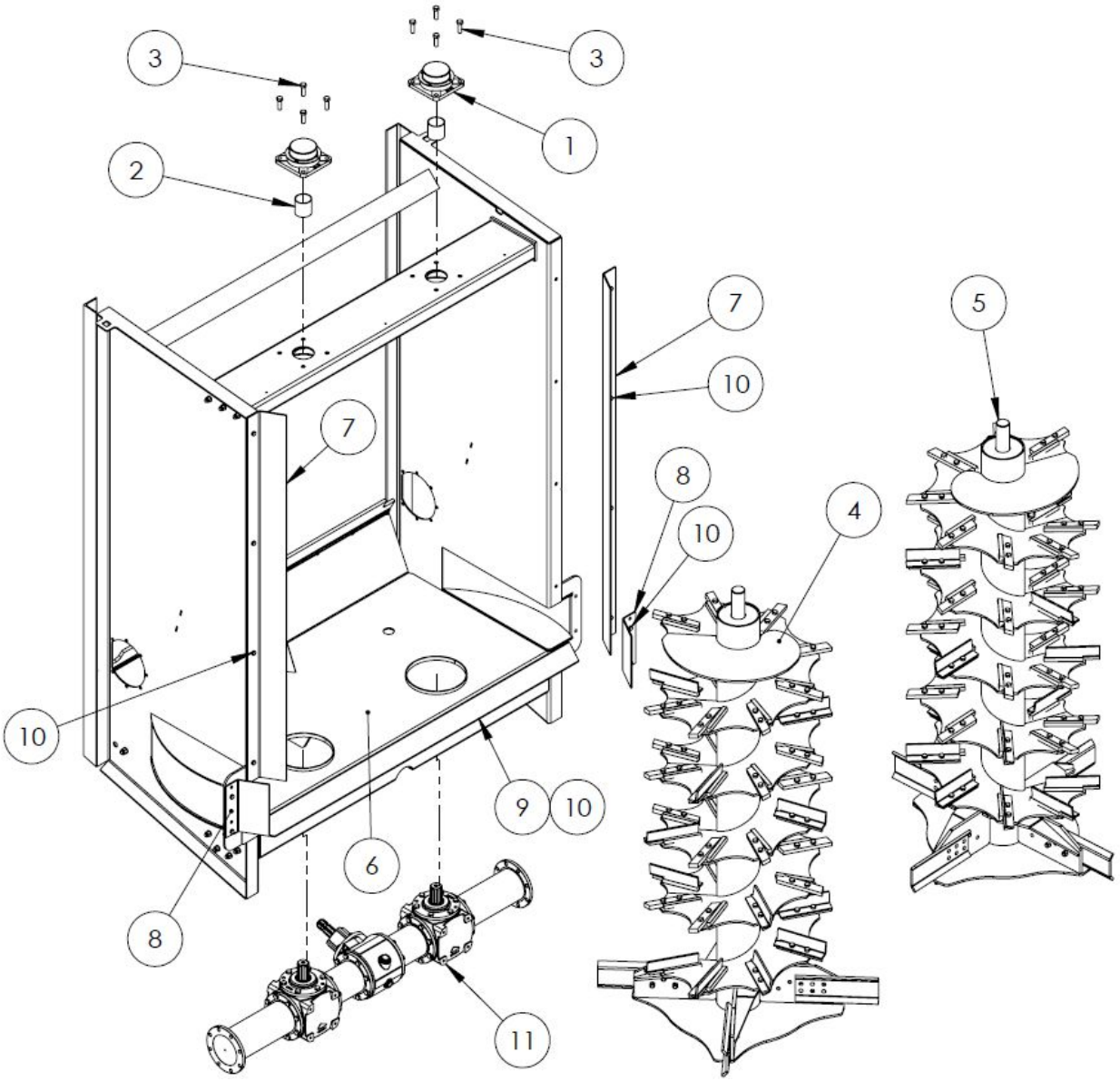


8.13 HYDRAULIC BORDER CONTROL



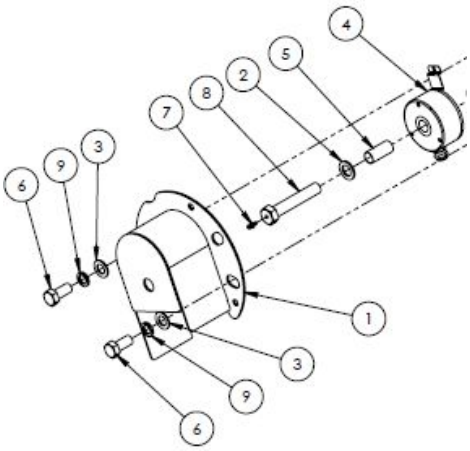
KEY	QTY	PART No.	DESCRIPTION
1	1	65078	RAM DA30 20 255
2	1	B4191	MOUNT BRACKET LH
2	1	B4191/1	MOUNT BRACKET RH
3	1	B4190	DEFLECTOR PLATE LH
3	1	B4190/1	DEFLECTOR PLATE RH
		65505	30/20 SEAL KIT

8.14 SLUDGE CAKE BUILD



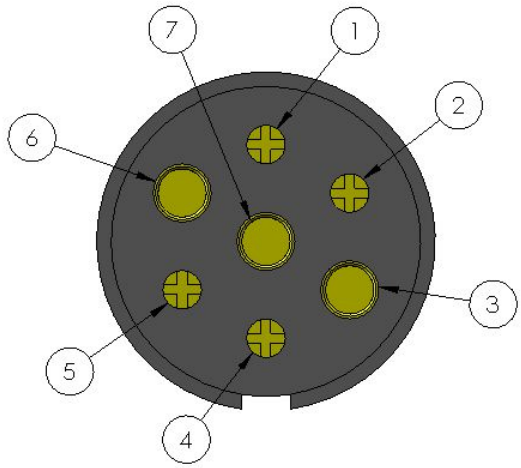
KEY	QTY	PART No.	DESCRIPTION
1	2	B1180/1	BEARING Ø60 C/W CAP
2	2	B2352	SPACER
3	8	73154	BOLT & NUT M16x50
4	1	B1048	AUGER ASSEMBLY LH (SEE SECTION 4.3 FOR PARTS)
5	1	B1049	AUGER ASSEMBLY RH (SEE SECTION 4.3 FOR PARTS)
6	1	B5321/2	AUGER DECK ASSY SLUDGE HD MK2
	1	B5321/3	AUGER DECK ASSY SLUDGE + CLEANING COVERS HD MK2
	1	B5322/2	AUGER DECK ASSY SLUDGE WB
	1	B5322/3	AUGER DECK ASSY SLUDGE + CLEANING COVERS WB
7	2	B5304	VERTICAL ANGLE SLUDGE KIT
8	2	B5305	LOWER VERTICAL ANGLE SLUDGE KIT
9	1	B5306/1	BOTTOM ANGLE SLUDGE KIT
10	16	73092 + 74684	BOLT, NUT & WASHER M12x35
11	1	B3182	AUGER GEARBOX

8.15 WEIGH CELL SPARES

IMAGE	PART No.	DESCRIPTION
	B9097 B9098	LOAD CELL 6.4m LEAD LOAD CELL 12.2m LEAD
	B9073	PRINTER UNIT
	B9025 B9021	REAR SHAFT ROTARY SENSOR KIT REAR SHAFT ROTARY SENSOR ONLY (ITEM NO. 4)
	B9096	REAR SHAFT ROTARY SENSOR LEAD
	B9069	ISOBUS KIT
	B9099	ISOCAN KIT

9. ELECTRICS

9.1 WIRING FOR 12v 7 PIN PLUG



1) YELLOW –Y– L.H INDICATOR
2) BLUE –B– FOG
3) WHITE -W– EARTH
4) GREEN – G- R.H. INDICATOR
5) BROWN –BR- TAIL
6) RED –R- STOP
7) BLACK –BL- SIDE MARKERS

Pins 5 & 7 may be linked.

FOR NORTH AMERICAN UNITS / COMMERICAL PLUG

1) WHITE (EARTH) – R – STOP
2) BLACK – G – R.H. INDICATOR
3) YELLOW – BR – TAIL
4) RED – W – EARTH
5) GREEN – BL – SIDEMARKERS
6) BROWN – Y – L.H. INDICATOR
7) BLUE – B – FOG

9.2 LIGHTING COMPONENTS

IMAGE	PART No.	DESCRIPTION	QUANTITY	
			STD	EXTRA
	70009/3	REAR LAMPS	2	2 / 4
	70081	TRIANGLE REFLECTOR – RED	2	2
	70154	MARKER LAMPS – WHITE – FRONT • 2 AT FRONT OF MACHINE • 2 AT FRONT OF MUDGUARDS (EXTRA)	2	2 / 4
	70155	MARKER LAMPS – RED – REAR • 2 AT REAR OF MUDGUARDS (EXTRA)		2
	70080	RECTANGULAR REFLECTOR – AMBER	2	
	70022	SIDE MARKER LAMPS – AMBER		2 / 4
	B7993	RECTANGULAR REFLECTOR – WHITE *(Only fitted to machines going to EU countries)* • 2 AT FRONT OF MACHINE • 2 AT FRONT OF MUDGUARDS (EXTRA)		2 / 4
	70015/1	LICENSE NUMBER PLATE HOLDER WITH LED LIGHT	1	

10. HEALTH AND SAFETY

10.1 HAZARDOUS MACHINERY WARNING

This machine is hazardous if improperly used and may cause serious injury or death if not used in accordance with these operating instructions and safety warnings. Employers are required to train and supervise all operators and assistants to observe safety precautions described by this handbook, the installation process and by warning decals.

10.2 LOSS OF CONTROL

Overloading, excessive speed or use on excessive slopes may result in loss of control. The towing tractor must be suitable for the trailer weight and other operating conditions. Trailer brakes must always be used. The balance of the spreader can be affected by the load lowering during spreading.

10.3 OPERATION AROUND BYSTANDERS

Do not operate this machine in proximity to bystanders who may be injured by projectiles or other functions including being run over or entangled in the auger.

10.4 HYDRAULIC FLUID PENETRATION OR BURNING

Operators must be trained to avoid risks relating to the possibility of hydraulic fluid penetration resulting from high pressure fluid sprays directly contacting an operators skin. Hydraulic components may also be hot and may cause burning if touched.

10.5 ELECTROCUTION

An operator or a bystander could be electrocuted if the guillotine door was raised where there is a possibility of contact with overhead electrical wires..

NOTE: The UK statutory height for the 11kv overhead power lines across a field is 5.2 m (17 ft).

10.6 BODY ENTRY

A person must not enter the body of the machine.
The machine is supplied with a ladder (item 1) welded to the body and a service ladder (item 2) attached to it. The service ladder is attached to facilitate machine entry for purpose of transportation, Pre-Delivery Inspection (PDI) and setup of the machine before first use.

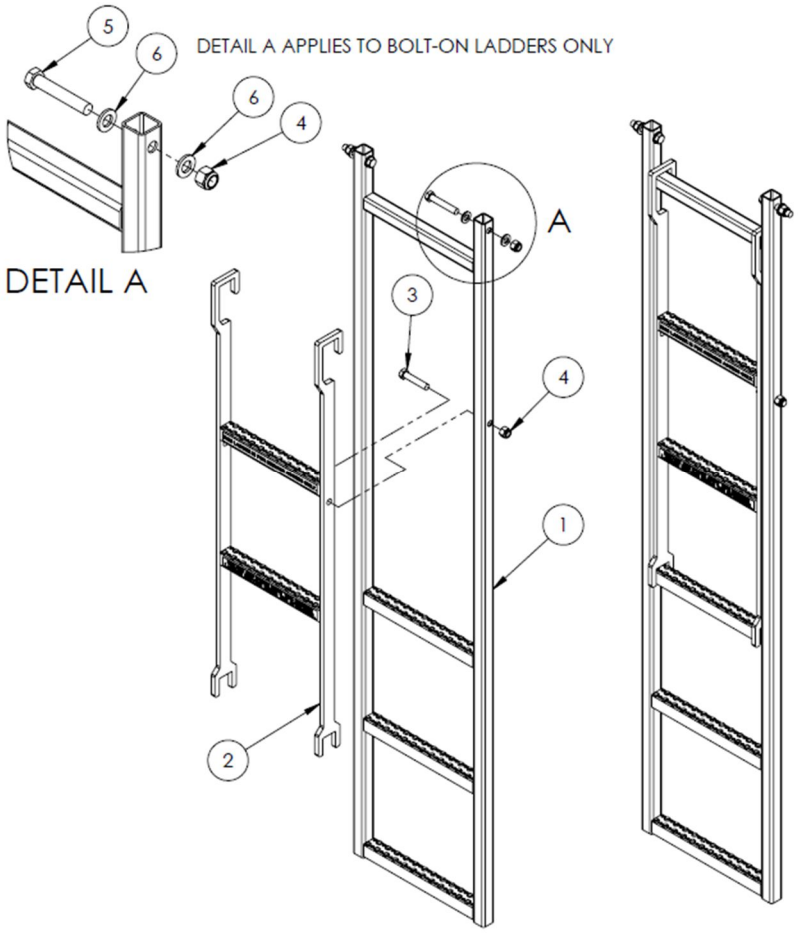
The service ladder is for use when the machine is being serviced while not attached to the tractor and so it MUST be removed and stored away prior to the use of the machine.

The ladder, which will have no mid-upper rungs/steps, is only to be used to look inside the machine.

WARNING

IT IS STRICTLY FORBIDDEN TO ENTER INTO THE MACHINE WHEN IT IS WORKING.

REMOVE AND RETAIN THE IGNITION KEY, AND DISCONNET ALL THE POWER SOURCES BEFORE SERVICING.



10.7 COUPLING / DECOUPLING

Care must be taken to avoid crushing an assistant when coupling or decoupling the machine to a tractor.

10.8 MACHINERY START UP

Sound the horn before starting this machine.

10.9 MACHINERY SHUT DOWN

This machine must be operated from a tractor driver's seat. The tractor and machine must be shut down, the key removed and hydraulics lowered, if the driver leaves the seat or before any adjustments or repairs are made.

10.10 ADDITIONAL DRIVER PROTECTION

Extra protection can be achieved by lowing the slurry door as the load decreases in height.

10.11 PTO CONNECTION AND GAURDING

Improper PTO connection and operation may cause machine failure and injury to an operator.
PTO shaft guards must be used at all time. See PTO manual.

10.12 PERSONAL PROTECTIVE EQUIPMENT (PPE)

When maintaining and operating this machine make sure appropriate PPE is worn.
i.e. Overalls, gloves, safety shoes, eye and ear protection.

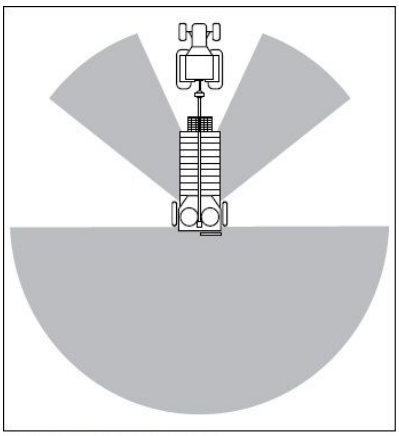
10.13 SAFETY DECAL LOCATION

i) WARNING – When spreading , lower slurry door to cover exposed augers as the load reduces.

ii) DANGER – Keep hands clear of taildoor and mechanism during operation.

iii) WARNING – It is strictly forbidden to enter into the machine when it is working. Remove and retain the igniting key, and disconnect all the power sources before servicing.

10.14 OPERATING HAZARD AREA



- Objects can be thrown out from the rotors with enough force to severely injure people. Stay away from machine when it is running. Keep others away.
- Stay out of shaded hazard area.
- Always know where all additional personnel are located when operating the spreader. Never allow anyone within the hazard area.
- Stay away from the sides and rear of the spreader when it is running to prevent being hit by flying debris. Rotors can expel solid objects with enough force to cause severe injury. Stay out of the hazard area.

NOTE: *Remember any foreign objects hidden in the material i.e. stones, bricks, wood etc. can be thrown further than the actual material, which could result in serious injury or loss of life.*

10.15 WARNINGS

WARNING

Keep all limbs clear of the spreading augers when in motion. Do not attempt to remove obstacles or carry out adjustments without stopping spreader operation first and turning of the tractor engine off and removing the keys. Taking short cuts can result in permanent injury or loss of life.

Before attempting to carry out any checks or adjustments disengage the PTO and stop the tractor engine and remove key.

Guards are provided for your safety. **Never** operate the spreader with any removed or open.

Before engaging the PTO make sure that there is no person standing to the rear or side of the spreader. Please observe at all times during spreading operation that no person or persons are present within the working proximity. Remember any foreign objects hidden in the material i.e. stones, bricks, wood etc can be thrown further than the actual material, which could result in serious injury or loss of life.

HEALTH AND SAFETY EXCUTIVE

NEVER try to clear blockages from a PTO-driven machine while it is moving. Always:

- Disengage the power drive;
- Stop the tractor engine;
- Ensure controls are in neutral and the hand brake is applied;
- Remove the engine key;
- Wait for all movement to cease before attempting to clear any blockage and use a tool to clear the blockage.

11. WARRANTY

During the 3 year warranty period any failures which occur due to faulty components or workmanship must be reported to G.T. Bunning & Sons Ltd before any repairs or replacements of components is carried out. The warranty period commences on the despatch date from the factory. All parts not guaranteed by G.T. Bunning & Sons Ltd are covered by the component manufacturer and are subject to their own warranty. The warranty terms only apply to machines that have been subject to fair wear and tear operation and where routine maintenance has been carried out.

12. IMPORTANT INFORMATION

When using the speader in conjunction with a tractor which has a fast and slow response control on the spool valves, check that the control on the spool valve is not in the slow position in respect of the floor drives, as this will over ride the variable floor speed.

The spreader always runs very quietly when working, if loud banging noises are heard this will mean that foreign objects are in the material. Obviously the shearbolt may well break. If the shearbolts on the PTO has not sheared and the noises persists **STOP THE SPREADER SWITCH OFF TRACTOR ENGINE** and check the spreader.

From new, it is strongly recommended that you do not use a high pressure cold washer and definatley not a hot pressure washer to the outside of the spreader for **12 weeks**.

This will damage the paintwork whilst normal curing of the paint takes place.

Careful low pressure washing is acceptable.

Do not let manure dry and set on fresh paint for the first 3-4 weeks. During this period it is advisable to clean the machine after use as instructed.

13. NOTES

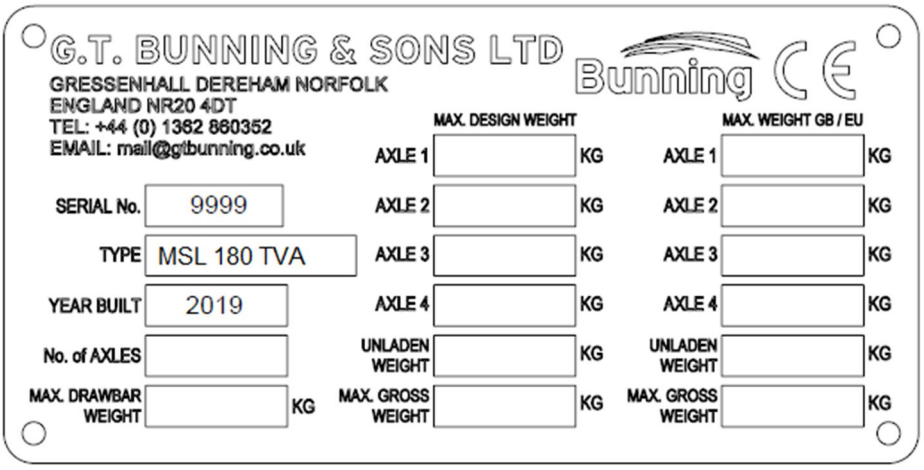
14. IDENTIFICATION PLATE

The machine serial number (VIN) is required with all orders for spare parts and technical enquires. This is necessary in order to ensure correct delivery of spare parts.

The identification plate with the machine number is either attached to the middle right side of the machine drawbar, front left hand side of the sprung drawbar frame, or the left hand side of the full-length chassis.

IMPORTANT
It is absolutely forbidden to alter and/or erase the data written on the identification plate of the machine. The operator is required to verify frequently the legibility of the data and, when this in doubt, to communicate with the Manufacturer. The data will be transferred to a new plate to replace the old one.

The CE mark certifies that the Manufacturer has complied with regulations in force governing machinery and covering health and safety matters as specified for all EU Member states (Machinery Directive). In practical terms, the CE mark guarantees that the Manufacturer has designed and constructed the machine in such a way as to avoid and minimize risk and danger, in anticipation of the function and the conditions under which the equipment will be used. The equipment may be used in Europe only if it is equipped with the identification plate and provided with the declaration of conformity.



15. TECHNICAL DATA & SPECIFICATIONS

15.1 MECHANICAL DATA & SPECIFICATIONS

MODEL				
	150HD	**175HD**	**180**	**230**
GROSS DESIGN Kg	21750	25750	25000	31000
AXLE DESIGN Kg	18000	22000	20000	13000x2
AXLE GB Kg	10170	10170	10170	9000x2
EYE Kg	3570	3750	5000	5000
TARE WEIGHT Kg	6540	7350	7000	8000
PAYLOAD Kg	15000	17500	18000	23000
PAYLOAD + TARE Kg	21540	24850	23000	31000
AXLE SIZE	150 SQ	150SQ	150 SQ	130 SQ

Bunning tolerance +/- 2%

MODEL				
	150HD	**175HD**	**180**	**230**
Axle	SINGLE	SINGLE	SINGLE	TANDEM
Axle beam size	150mm	150mm	150mm	110mm
Carrying capcacity	15000 Kg	17500 Kg	18000 Kg	23000 Kg
Cubic meters	13 level/17 heaped	18 level/22 heaped	10 level/14 heaped	10 level/14 heaped
Extended sides	N/A	N/A	17 up to 26 heaped	17 up to 26 heaped
Body size (int.mm)	5950x1600x1295mm	5950x1600x1580mm	6050x1830x950	6050x1830x950
Floor drive	Hydraulic	Hydraulic	Hydraulic	Hydraulic
Floor speed control	Hydraulic variable speed c/w reverse			
Floor chain size	20mm	20mm	20mm	20mm
Brake size mm	406x140	420x200	406x140	400x80
Tyre size	580/70 R38HL	710/70 R42	710/70 R38	650/55 R26.5
Spread Mech	Twin vertical augers	Twin vertical augers	Twin vertical augers	Twin vertical augers
Spread width	Up to 20 meters	Up to 20 meters	Up to 20 meters	Up to 20 meters
PTO speed	1000 RPM	1000 RPM	1000 RPM	1000 RPM
Floor plate	5mm	5mm	5mm	5mm
Side plate	4mm	4mm	4mm	4mm

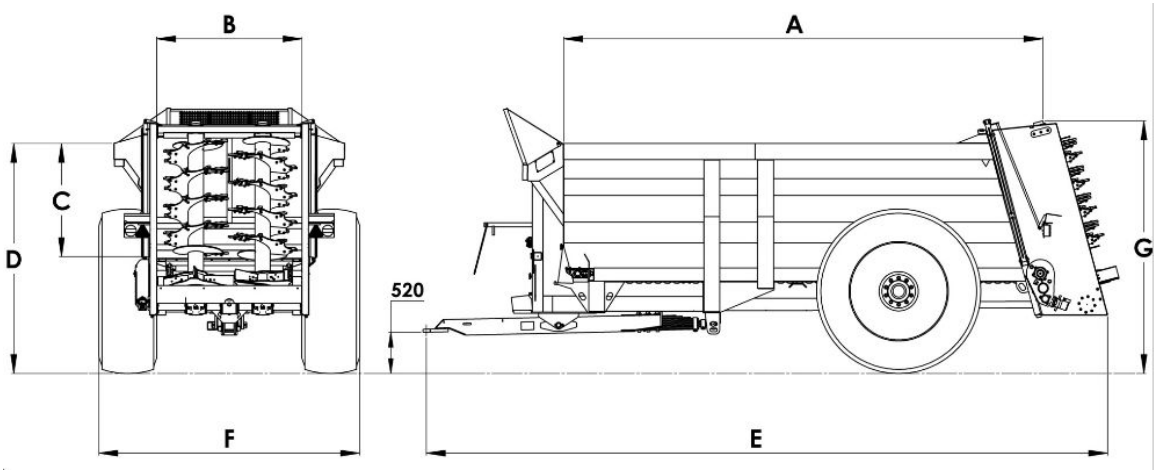
NB – Machines with extension sides or built-in flares are designed for use with light materials. DO NOT EXCEED THE PLATED WEIGHTS.

USE ON HIGHWAYS (UK)

Maximum gross combination weight is **31000 Kg.**

Maximum spreader weight is **18290 Kg.**

15.2 MACHINE DIMENSIONS



MODEL	A	B	C	D	E	F	G
150HD	6000	1830	1250	2450	8560	3020	3080
175HD	6000	1830	1580	2890	8560	3280	3135
180	6000	1830	960	2150	8560	3516	3080
230	6000	1830	960	2150	8560	3550*	3080

- * 2900mm with wheels under body
- Bunning tolerance +/- 2%

FOR PROMPT SUPPLY OF SPARES, ALWAYS QUOTE THE CHASSIS SERIAL NUMBER, (FOUND ON THE CHASSIS IDENTIFICATION PLATE)

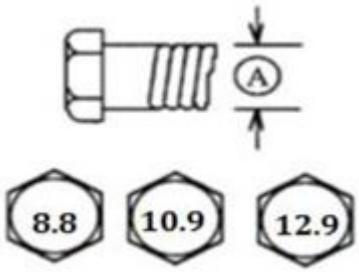
15.3 BOLT TORQUE

CHECKING BOLT TORQUE

The table(s) shown below give correct torque values for various bolts and cap-screws. Tighten all bolts to the torques specified in chart unless otherwise noted. Check tightness of bolts periodically, using bolt torque chart as a guide. Replace hardware with the same strength bolt.

NOTE: Tighten the plastic insert (nylon lock) or crimped steel-type lock nuts to approximately 50% of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten the toothed or serrated-type lock nuts to the full torque value.

METRIC TORQUE SPECIFICATIONS



Bolt Diameter "A"	Spanner / Wrench Size (mm)	Bolt Torque*					
		Bolt G8.8 (Nut G8)		Bolt G10.9 (Nut G10)		Bolt G12.9 (Nut G12)	
		(N.m)	(lb-ft)	(N.m)	(lb-ft)	(N.m)	(lb-ft)
M3	5.5	0.5	0.4	1.8	1.3	2	1.5
M4	7	3	2.2	4.5	3.3	5	4
M5	8	6	4	9	7	10	7.5
M6	10	10	7	15	11	18	13
M8	13	25	18	35	26	45	33
M10	16	50	37	70	52	85	63
M12	18	90	66	125	92	150	111
M14	21	140	103	200	148	240	177
M16	24	225	166	310	229	370	273
M18	27	305	225	435	321	510	376
M20	30	435	321	610	450	725	535
M22	33	590	435	840	620	985	726
M24	36	750	553	1050	774	1255	926
M30	46	1495	1103	2100	1550	2490	1837
M36	55	2600	1917	3675	2710	4280	3157

Torque figures indicated above are valid for non-greased or non-oiled threads and heads unless otherwise specified. Therefore, do not grease or oil bolts or cap-screws unless otherwise specified in this manual. When using locking elements, increase torque values by 5%. Reduce value by 10% if threads are oiled before assembly.

* Torque value for bolts and cap-screws are identified by their head markings.
**Always install new or unused locking nuts whenever possible or practical to ensure the full locking benefit.

This manual must stay with the machine/operator at all times.

This manual is an original English language copy.

Bunning®

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