

# COMMANDER TWIN FORCE

## Instruction book 670721-GB-99/3

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Illustrations, technical information and data in this book are to the best of our belief correct at the time of printing. As it is HARDI INTERNATIONAL A/S policy permanently to improve our products, we reserve the right to make changes in design, features, accessories, specifications and maintenance instructions at any time and without notice.

HARDI INTERNATIONAL A/S is without any obligation in relation to implements purchased before or after such changes.

HARDI INTERNATIONAL A/S cannot undertake any responsibility for possible omissions or inaccuracies in this publication, although everything possible has been done to make it complete and correct.

As this instruction book covers all models, features or equipment, which are available in certain countries only can be shown. Please pay attention to paragraphs dealing with precisely your model.

Published and printed by HARDI INTERNATIONAL A/S



**EC Declaration of Conformity**

**Manufacturer,**

HARDI INTERNATIONAL A/S  
Helgeshøj Allé 38  
DK 2630 Taastrup  
DENMARK

**Importer,**

declare that the following product;

.....  
.....

Adhere extra shipping package labels to inside cover.

**A.** was manufactured in conformity with the provisions in the COUNCIL DIRECTIVE of 14 June 1989 on mutual approximation of the laws of the Member States on the safety of machines (89/392/EEC as amended by directives 91/368/EEC and 93/368/EEC) with special reference to Annex 1 of the Directive on essential safety and health requirements in relation to the construction and manufacture of machines.

**B.** was manufactured in conformity with the standards current at that time that implements a harmonised standard in accordance with Article 5 (2) and other relevant standards.

Taastrup 1.4.98

Erik Holst  
Managing Director  
HARDI INTERNATIONAL A/S



**Operator safety**

Watch for this symbol . It means WARNING, CAUTION, NOTE. Your safety is

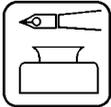
involved so be alert!

Note the following recommended precautions and safe operating practices.

- Read and understand this instruction book before using the equipment. It is equally important that other operators of this equipment read and understand this book.
- Local law may demand that the operator be certified to use spray equipment. Adhere to the law.
- Pressure test with clean water prior to filling with chemicals.
- Wear protective clothing.
- Rinse and wash equipment after use and before servicing.
- Depressurize equipment after use and before servicing.
- Never service or repair the equipment whilst it is operating.
- Disconnect electrical power before servicing.
- Always replace all safety devices or shields immediately after servicing.
- If an arc welder is used on the equipment or anything connected to the equipment, disconnect power leads before welding. Remove all inflammable or explosive material from the area.
- Do not eat, drink or smoke whilst spraying or working with contaminated equipment.
- Wash and change clothes after spraying.
- Wash tools if they have become contaminated.
- In case of poisoning, immediately seek medical advice. Remember to identify chemicals used.
- Keep children away from the equipment.
- Do not attempt to enter the tank.
- Do not go under any part of the sprayer unless it is secured. The boom is secure when placed in the transport brackets.
- If any portion of this instruction book remains unclear after reading it, contact your HARDI dealer for further explanation before using the equipment.



We congratulate you for choosing a HARDI plant protection product. The reliability and efficiency of this product depend upon your care. The first step is to carefully read and pay attention to this instruction book. It contains essential information for the efficient use and long life of this quality product.



## Description

### Frame

Strong and compact frame with several options of drawbars and wheel sizes. The frame has a strong chemical and weather resistant electrostatic lacquer coat. Screws, nuts, etc. have been DELTA-MAGNI treated to be resistant to corrosion.

### Tank

UV-resistant Polyethylene in a suitable design with no sharp corners for easy agitation, emptying, and cleaning. Nominal contents 2200, 2800, 3200 or 4200 l.

### Pump

Diaphragm pump with 6 diaphragms, model 363 or 463, depending on boom width, with easily accessible valves and diaphragms.

### MANIFOLD SYSTEM

All functions of the spray circuits are operated via the centrally situated MANIFOLD valves with colour-coded plates and pictorial symbols for easy operation.

### Operating unit

The operating unit is constructed of modules and consists of main ON/OFF valve, pressure gauge, pressure regulation with built-in HARDI-MATIC and distribution valves with pressure equalization. HARDI-MATIC ensures a constant volume per hectare of the liquid (l/ha) at varying forward speed within the same gear when the number of P.T.O. revolutions are between 300-600 r/min. The operating unit is fully electrically controlled (EC) via remote control box.

### Filters

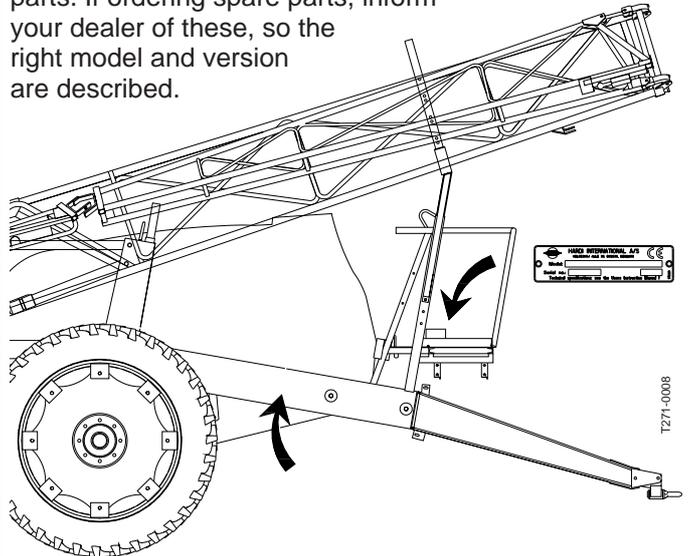
With the self-cleaning filter the impurities that exist in the spray liquid will by-pass the filter and be recirculated back to the tank via the return flow. Also suction filter and nozzle filters are standard. In-line pressure filters can be fitted as option.

### Booms

All booms are suspended in a strong, stable parallelogram boom lift. The HAY/HAZ booms are trapeze/pendulum suspended and fully hydraulically operated, including boom slanting control and air slot angling. HAZ models have Direct Acting Hydraulics (D.A.H) and individual boom tilt function as well. The TWIN blowers are driven by a built-in hydrostatic transmission powered via the tractor P.T.O. , and blower speed can be adjusted stepwise from the tractor cabin. The HAY/HAZ booms are available in 18, 20, 21, 24, 27 and 28m working width.

## Identification plates

An identification plate fitted on the frame indicates producer name, model, own weight, max. weight, max. pressure of the hydraulic system, and max. pressure of the spray liquid system. Frame, boom centre frame, and inner/outer sections also have identification plates indicating boom type and part number of spare parts. If ordering spare parts, inform your dealer of these, so the right model and version are described.



Write the information of your sprayer here:

		<b>HARDI INTERNATIONAL A/S</b> HELGESHOJ ALLE 38. DK2630, DENMARK		
Model:	<input type="text"/>			978661
Serial no.:	<input type="text"/>		<input type="text"/>	
Technical specifications: see the Users Instruction Manual !				

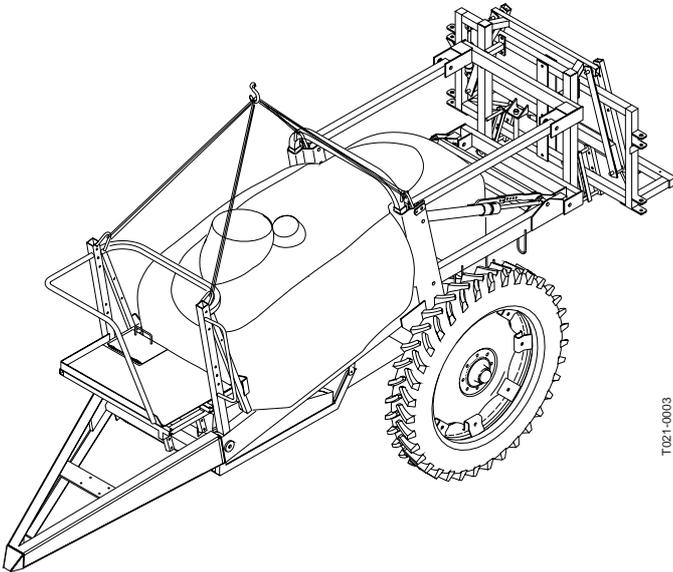
<b>HARDI</b>		HARDI INTERNATIONAL A/S TAASTRUP DENMARK		T279-0001	
Typ.	463/10	rpm .max. 700		T279-0001	
No.					
rpm	l/min.	bar	kW		
540	263	0	1.7		
540	243	10	5.4	T279-0001	
		max. 15			

## Sprayer use

The HARDI COMMANDER sprayer is for the application of crop protection chemicals and liquid fertilisers. The equipment must only be used for this purpose. It is not allowable to use the sprayer for other purposes. If no local law demands that the operator must be certified to use spray equipment, it is strongly recommended to be trained in correct plant protection and in safe handling of plant protection chemicals to avoid unnecessary risk for persons and the environment when doing your spray job.

## Unloading the sprayer from the truck

For the unloading of the sprayer you need a crane or a fork lift. When loading with a crane please observe the lifting points as shown on the sketch, and make sure that the straps or belts used for lifting are strong enough.

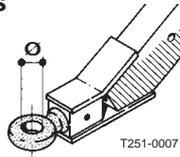


## Connecting the sprayer

### Drawbars

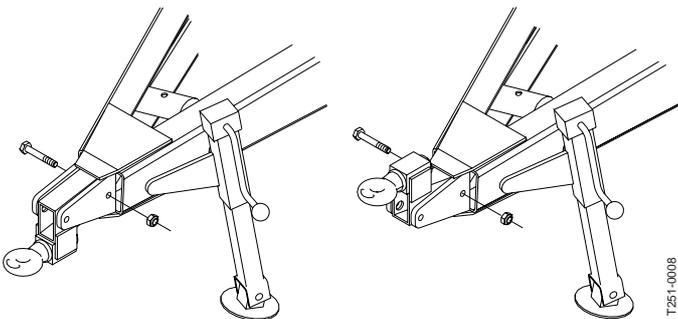
#### Standard and STEER TRACK drawbars

There are different drawbars available. Standard drawbar is with a Ø36 mm towing ring.

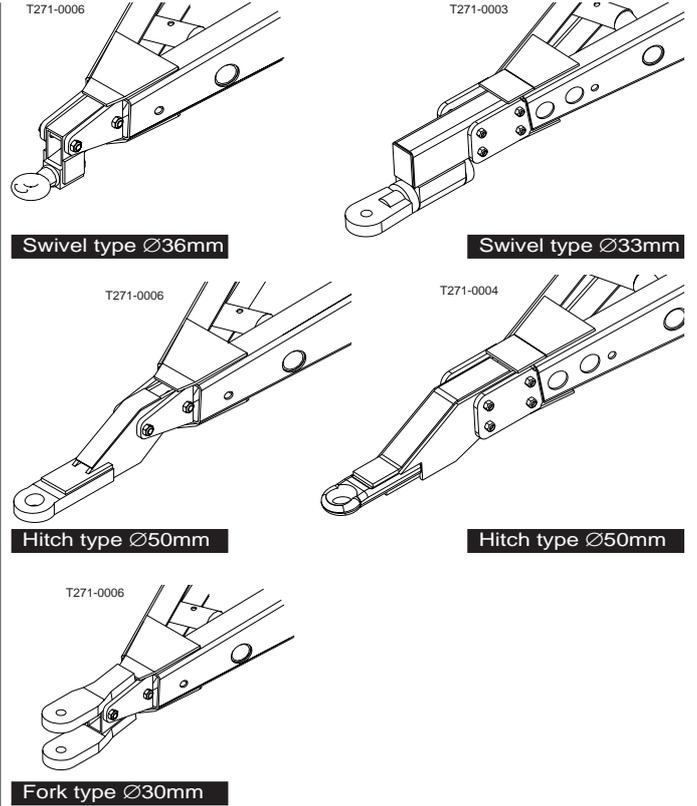


Standard drawbar .....	Ø36 mm
Hitch (option) .....	Ø51 mm (ISO 5692)
Jaw .....	Ø36 (option)
Drawbar for high hitch DIN 11 025 .....	Ø40 mm

The standard and hitch drawbar can be set at two different height positions altering the height approx. 200 mm (8 in) on 2200/2800 and 300 mm (12 in) for 3200/4200. Choose the setting where the platform appears level.



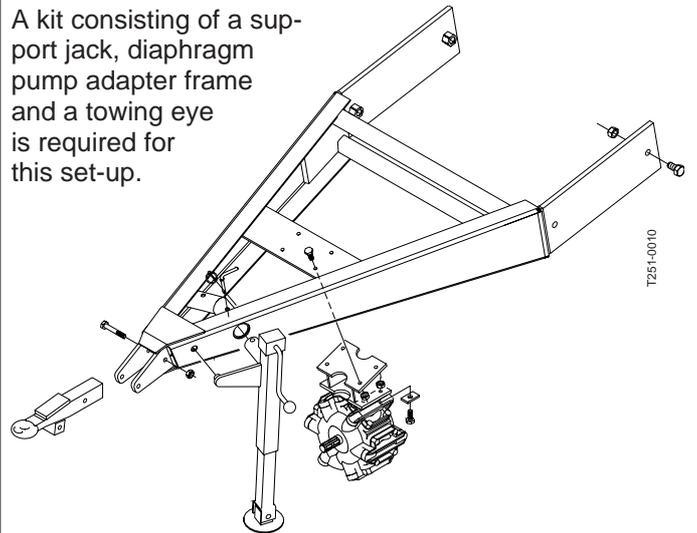
Swivel type Ø36mm



### Standard drawbar for DIN 11 025 trailer coupling 2200/2800 I:

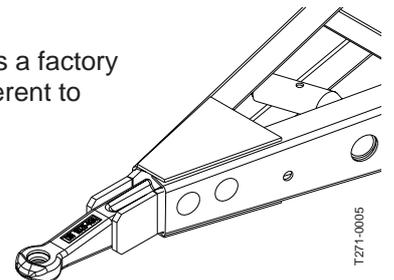
The standard trailer drawbar can be turned 180° and used for the high positioned trailer coupling (DIN 11 025) at the tractor (used in certain countries only).

A kit consisting of a support jack, diaphragm pump adapter frame and a towing eye is required for this set-up.



### 3200/4200 I:

The high hitch drawbar is a factory fitted option and it is different to the standard drawbar.





**WARNING!** The drawbar bolts must be retightened to the specified torque every 10 hours of work until the torque is stabilised and then at intervals according to service scheme.



**WARNING!** Always use a 40 mm (1.57 in) drawbar pin for attaching the drawbar and secure with linch pin or similar.

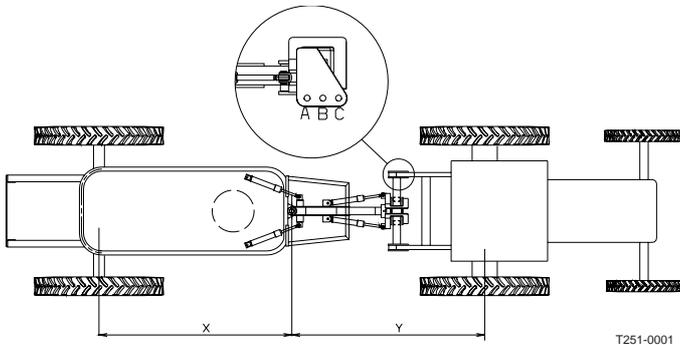
## Support leg

To remove the support leg: lift the leg, remove the securing pin and pull out the support leg.

The support leg is stored in the bracket when the sprayer is attached to the tractor.

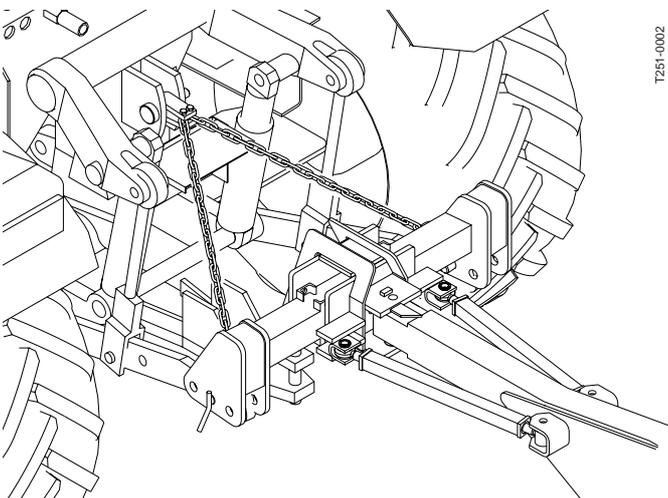
## SELF TRACK and MULTI TRACK drawbars (2200/2800/3200)

The SELF TRACK and MULTI TRACK are connected as follows:



T251-0001

1. Attach the tractor lower links in either hole **A**, **B** or **C**. To obtain best tracking, choose the holes where the distance **X** are equal to distance **Y**. Secure with linch pins.
2. Attach safety chains to top link clevis. The chain will prevent the transmission shaft from being damaged if the lift arms are lowered too far. Adjust the chain length so the chains are tight as the tractor P.T.O. and pump shaft are in a horizontal line.



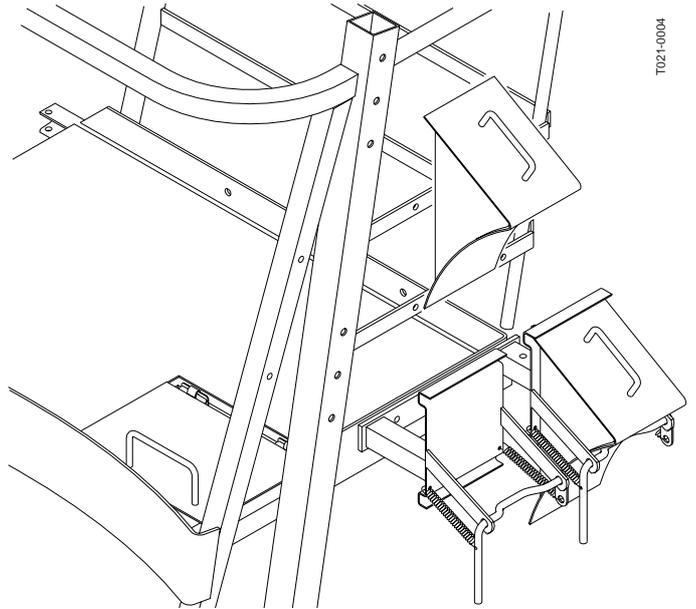
T251-0002

**NOTE!** If possible, lock the tractor hydraulic lever when the lift arms are in the correct position to avoid the sprayer weight resting on the stabiliser chains.

3. Tighten the lift arms stabiliser chains.

## Stop wedges (if fitted)

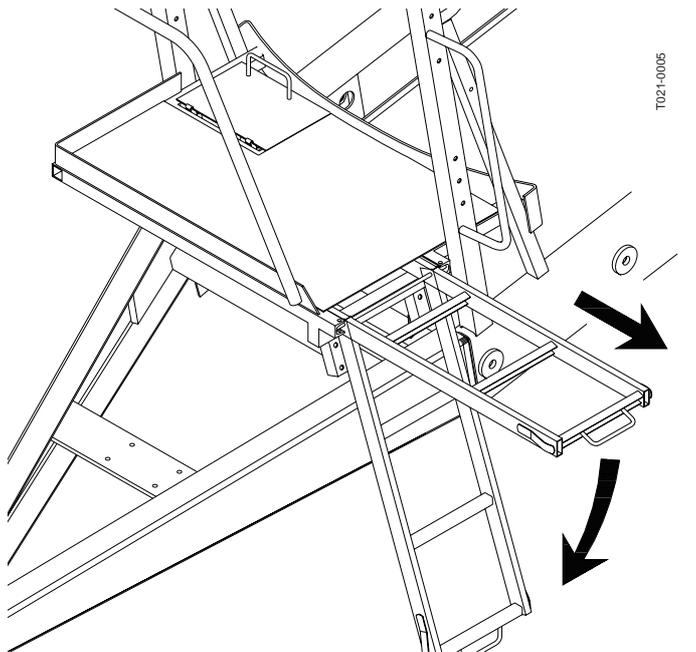
Before driving, remove the stop wedges and place them in the storage brackets.



T021-0004

## Ladder

To access the front platform the ladder is pulled out and folded down.



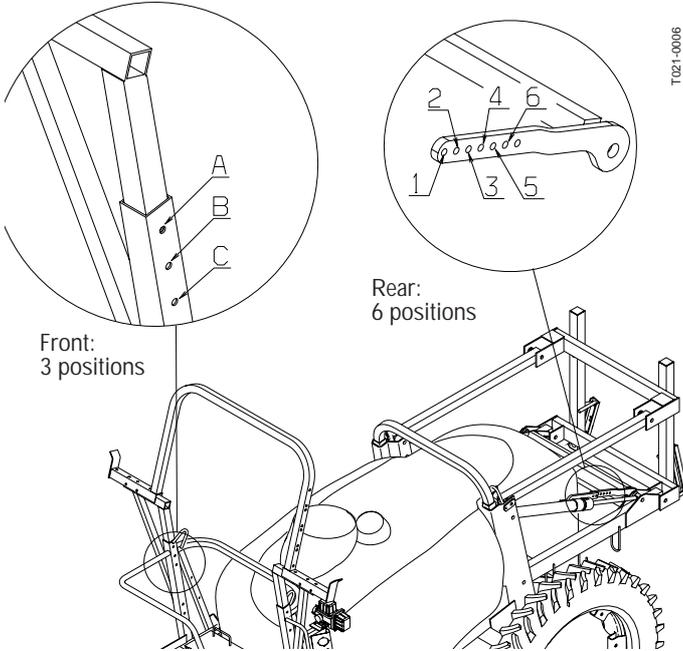
T021-0005

Always lift up and push the ladder in under the platform before driving. The ladder will lock automatically when it is pushed fully in.

## Transport brackets, height settings

The transport brackets can be set in different positions to have different transport heights to obtain suitable clearance above various tractor cabins.

The transport brackets are to be set at a combination which gives sufficient clearance to the tractor cab and a transport height as low as possible.



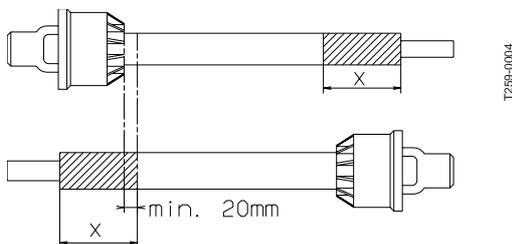
**NOTE!** The rear settings must correspond to the front settings so the boom is resting on the front as well as rear brackets.

**WARNING!** The max. transport height must never exceed 4.0 m (13.1 ft) Always measure the actual total height, and choose settings not exceeding 4.0 metre.

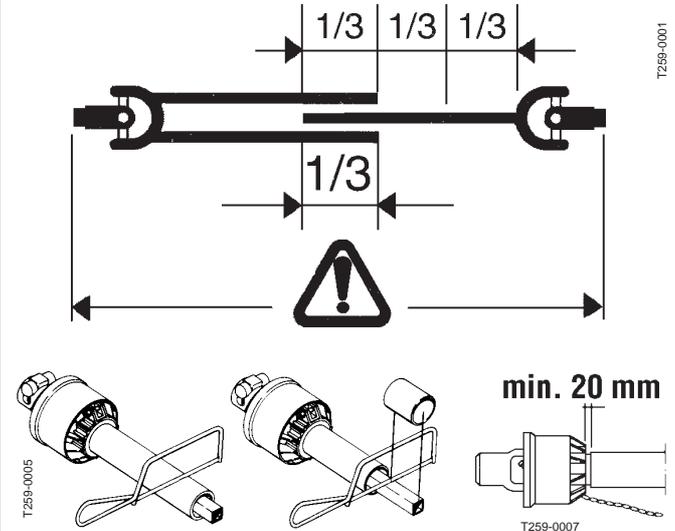
## Transmission shaft installation

First installation of the transmission shaft is done the following way:

1. Attach sprayer to tractor and set sprayer height in the position with shortest distance between the tractor and sprayer pump P.T.O. shafts.
2. Stop engine and remove ignition key.
3. If transmission shaft must be shortened, the shaft is pulled apart. Fit the two shaft parts at tractor and sprayer pump and measure how much it is necessary to shorten the shaft. Mark the protection guards.



**Note:** The shaft must always have an overlap of minimum 1/3 of the length.

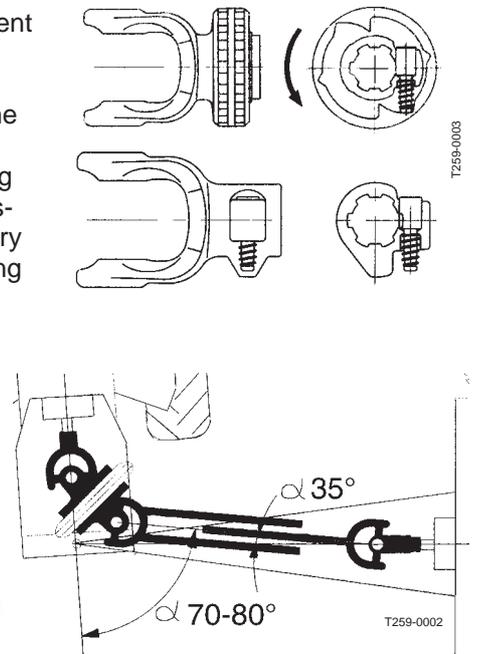


4. The two parts are shortened equally. Use a saw, and file the profiles afterwards to remove burrs.
5. Grease the profiles, and assemble male and female parts again.
6. Grease the tractor P.T.O. and pump shafts.
7. Fit the shaft to tractor P.T.O. and sprayer pump shaft.

**Note:** Female part marked with a tractor towards tractor! Twist the collar and slide the yoke onto the P.T.O. shaft. Make sure that the lock engages by pushing and pulling the shaft forwards and backwards.

Fit the chains to prevent the protection guards from rotating with the shaft.

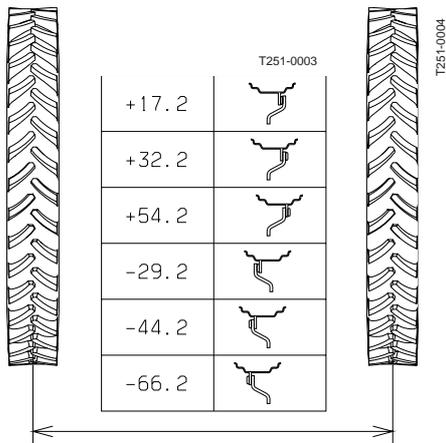
8. To ensure long life of the transmission shaft try to avoid working angles greater than 35°. The wide angle shaft with Constant Velocity Joint works in angles up to 70°- 80° for short periods (during turning etc.).



## Track gauge

The track gauge of the COMMANDER can be altered stepless as follows:

Model	2200/2800 mm (in)	3200/4200 mm (in)
Standard adjustment	1664-2214 (65.6-87.2)	1800-2250 (71.9-88.6)
Adjustment range, change of rim plate and rim position	1500-1664 (59.1-65.6) 2214-2250 (87.2-88.7)	----
Adjustment range, shortening ends	----	1500-1950 (59.1-76.8)



**WARNING!** When altering track gauge by turning rims and rim plates the max. permitted off-set between centre wheel and hub flange must be observed:

Max offsets, hub flange and centre rim

Model	Max rim offset
2200/2800 I	66 mm (2.6 in)
3200/4200 I	30 mm (1.18 in)

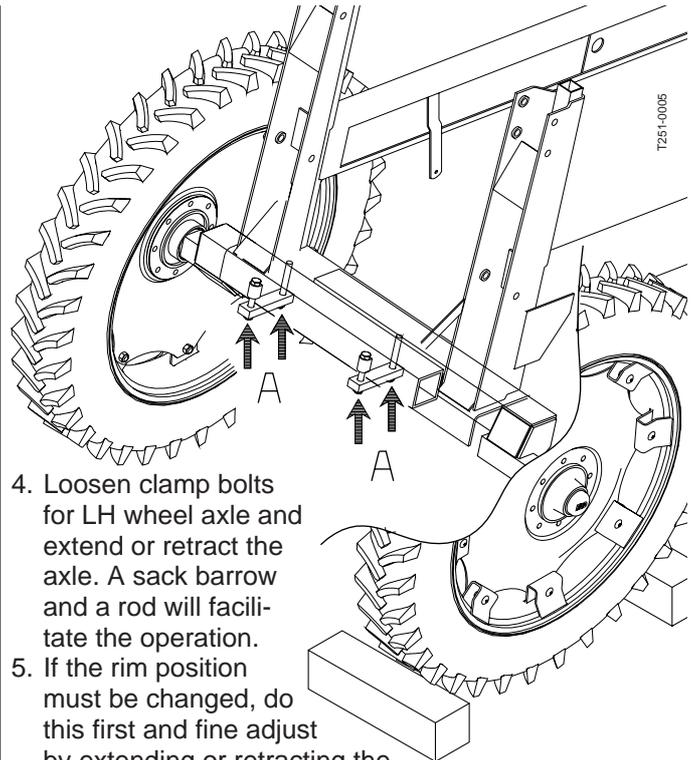
Use only the combinations shown. It is not permitted to fit dual wheels!

**IMPORTANT!** On TRACKER models a minimum track gauge of 1800 mm (71 in) is strongly recommended to ensure stability and avoid tipping over.

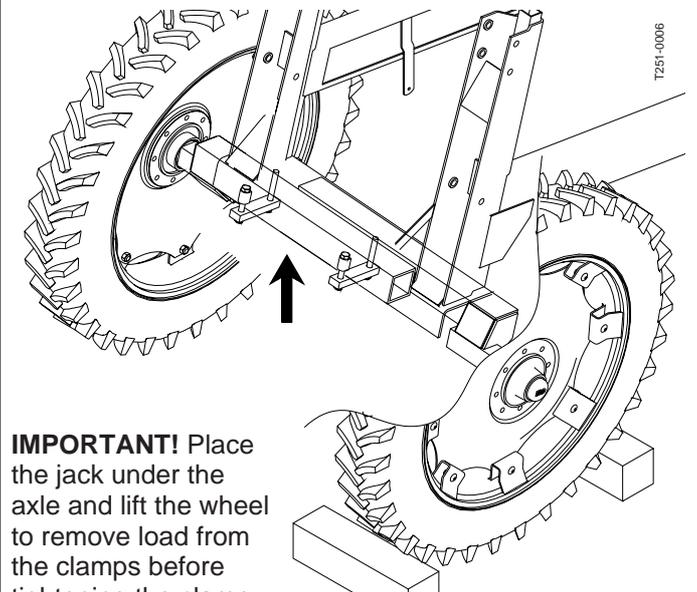
**NOTE!** The wider the track gauge, the better the stability of the sprayer and boom.

Track gauge is altered the following way:

1. Measure the current track gauge (centre RH tyre to centre LH tyre). Each side must be extended or retracted half the desired alteration.
2. Attach the sprayer to tractor and engage tractor parking brake.
3. Place stop wedges in front of and behind RH wheel. Jack up LH wheel, support and secure sprayer body.



4. Loosen clamp bolts for LH wheel axle and extend or retract the axle. A sack barrow and a rod will facilitate the operation.
5. If the rim position must be changed, do this first and fine adjust by extending or retracting the axles. Remember to tighten the wheel nuts to the specified torque: Rim plate to rim: 280 + 30 Nm (207 + 22 lbf) Rim plate to hub: 490 Nm (288 lbf)
6. Tighten the clamp bolts to a torque of 280 Nm (207 lb.ft)



- IMPORTANT!** Place the jack under the axle and lift the wheel to remove load from the clamps before tightening the clamp bolts to the specified torque.
7. Repeat the procedure on RH wheel.
  8. Check distance from centre tyre to centre of tank frame is equal at RH and LH.
  9. Retighten clamp bolts and wheel bolts to specified torque after 8 hours of work.

## Emergency and parking brake (if fitted)

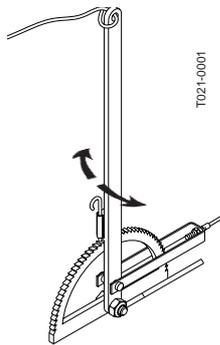
The parking brake lever can be set for two different function modes:

1. Normal parking brake function (pull to engage, pull again to disengage)
2. emergency brake (engaged by pulling, no disengagement when pulling again)

To change between the two modes turn the pawl control clip.

To disengage the parking brake: Set pawl clip in pos. 1. Pull the lever a little forward to release the ratchet tooth and then push the lever fully backwards.

To engage the parking brake: Pull the lever firmly forwards until parking brake is fully engaged.



T021-0001

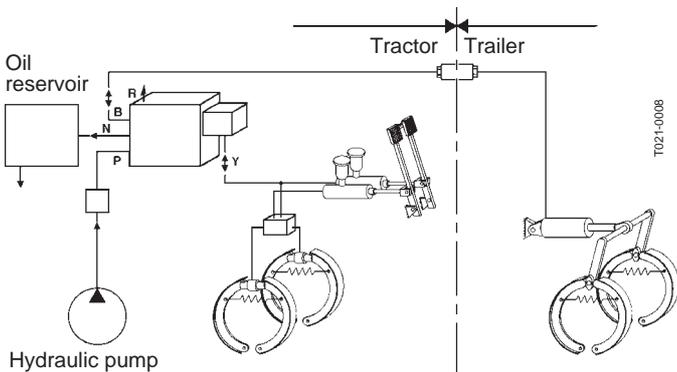
## Emergency brake:

Set pawl clip in pos. 2. Attach the rope from the hole in top of the handbrake lever to e.g. the tractor top link attaching point. If the sprayer is accidentally unhooked during transport the rope will apply the parking brake before the rope breaks.

**IMPORTANT!** To ensure safe engagement and to avoid damages to the parking brake use rope with an ultimate stress between 690 N (155 lb.) and 785 N (176 lb.).

## Hydraulic activated brakes (if fitted)

This requires a special trailer brake valve attached to the tractor hydraulic and brake system. Connect the snap coupler to the tractor brake out-let. When the tractor brakes are applied, the trailer brakes will work proportionally to the tractor brakes, and ensure safe and effective braking.



T021-0008

**WARNING!** Do not connect the brakes directly to the tractor hydraulics without the brake valve. The trailer brake power cannot be controlled, and braking will therefore be hazardous.

**IMPORTANT!** Max. oil pressure is 150 bar (2175 p.s.i.) in the brake line.

Relieve parking brake before driving.

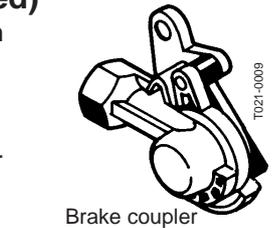
## Air activated brakes (if fitted)

This system requires a tractor with compressor and air brake system with out-let(s) for trailer brakes.

**IMPORTANT!** The load apportioning valve must be set at the position corresponding to the load on the trailer, for obtaining optimal air pressure to the trailer brakes!

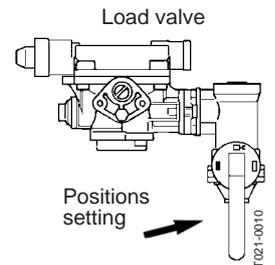


**WARNING!** Driving with wrong load apportioning valve setting, will make the brakes under- or over-apply, which can cause hazardous situations.



T021-0009

Brake coupler



T021-0010

**NOTE!** If the air hose(s) are disconnected with air in the brake air tank, control pressure will be dumped and the brakes will engage fully. If the sprayer must be moved with air in the tank and without the air hose(s) connected to the tractor, the load apportioning valve must be set at "relieved" to disengage the brakes. Remember to reset the handle to brake position again afterwards. When parking the sprayer always engage the parking brake, as the air brakes will only be engaged as long as there is air in the tank!

Cover the couplings with the dust flaps when hoses are disconnected.

## Single-line brakes (if fitted)

Flip the snap coupler protection flap away and connect the brake system snap coupler to the tractor outlet (black) and let the compressor fill the sprayer's air reservoir. Check brake circuit for leaks.

## Dual-line brakes (if fitted)

Flip the snap coupler protection flaps away and connect the two snap couplers for supply and control to the tractor out-lets, and check brake circuits for leaks.

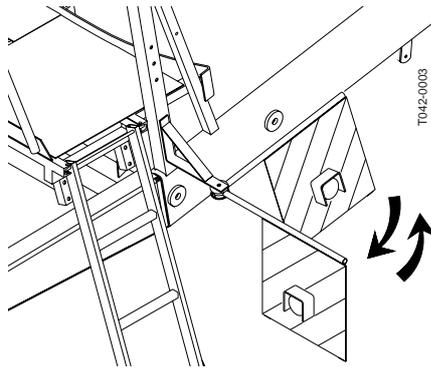
The couplers are colour coded and secured against incorrect attachment:

- Red = Supply line (RH)
- Yellow = Control line (LH)

Relieve parking brake before driving

**Rear lights (if fitted)**

Connect plug for rear lights to the tractor's 7-pin socket, and check function of rear lights, stop lights and direction indicators on both sides before driving.



Before transport on public roads the front warning boards with position lamps must be folded out (fitted in certain countries only).

The wiring is in accordance with ISO 1724. See section on Technical specifications.

**Hydraulic systems**

**Indirect Acting Hydraulics, I.A.H. (HAY models)**

Boom hydraulics is controlled via the tractors spool valves. The I.A.H. system requires one double acting and one single acting spool valve:

- Single acting valve: Boom lift, up/down
- Double acting valve: Boom folding

If hydraulic slanting control is fitted another double acting spool valve on the tractor is required.

**Direct Acting Hydraulics, D.A.H. (HAZ models)**

The D.A.H. system requires a double acting hydraulic outlet. The hydraulic hoses are marked with arrows to indicate direction of oil flow.

The D.A.H. system requires an oil flow between 10 and 90 l/min (19.8 Imp. gal/min.) and a min. pressure of 130 bar (1886 psi.). The system has a built-in flow regulator that maintains constant speed on hydraulic movements.

Before operating the hydraulics, the clip at the distribution valve (situated under the platform behind the pump) should be set for OPEN CENTRE or CLOSED CENTRE tractor hydraulics, depending on tractor model.

- Unlocked = Open centre hydraulics (Constant Flow)
- Locked = Constant Pressure (Closed Centre) and Load-Sensing hydraulics

If you doubt which type of hydraulic system your tractor is equipped, ask your tractor dealer.

**Control boxes and power supply**

12V power sockets are required for the control boxes. Note polarity!

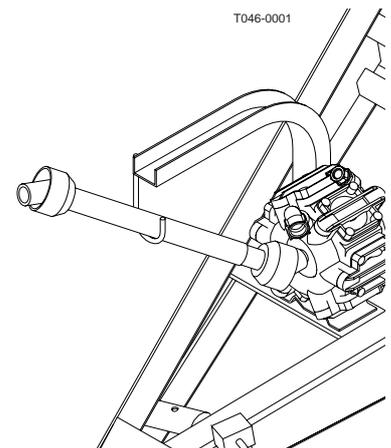
Control box for	Polarity (wire colour)		Required Fuse, Amp
	Positive (+)	Negative (-)	
EC operating unit	Brown	Blue	8
D.A.H Hydraulic + Electric air slot angle and fan speed adjustment	White	Black	20
Drawbar mode control (MULTI TRACK)	Brown	Blue	5
Electric air slot angle and fan adjustment (HYA)	Brown	Blue	20
MANIFOLD valve	Brown	Blue	8

The control boxes are to be fitted in the tractor cabin at a convenient place.

The wires must have a cross-sectional area of at least 4.0 mm<sup>2</sup> (#10 awg) to ensure sufficient power supply. The boxes must be fused according to the table.

**Hose package and transmission shaft support**

To prevent hoses and wiring from being damaged by the tractor wheels, all hoses, cables and wires are held by the hose bracket fitted to the drawbar. Check the length of the hoses and cables are sufficient by tight turns.



The transmission shaft is placed in the hook when not in use.

**Counter weight (TRACKER models only)**

To improve stability on TRACKER models, extra weight can be added by means of liquid-filled tyres.

The standard tyre valve is a universal air-water valve.

The tyres can be filled with liquid to max. 75% of their total volume. The table below indicates the 75% volume.

Tyre size	Max. liquid qty. litre each tyre
230/95R44 (9.5 X 44")	101
230/95R48 (9.5 X 48")	108
270/95R44 (11.2 X 44")	133
270/95R 48 (11.2 X 48")	144
300/95R46 (12.4 X 46")	178
18,4R38	390

1 litre = 0.264 US Gal.

1 litre = 0.220 Imp Gal.

# COMMANDER-TWIN FORCE

Use a mixture of water and CaCl<sub>2</sub> to avoid frost damage as described in table below:

CaCl <sub>2</sub> per litre water	Protection to
200 g (7.1 oz)	-15°C (30.6°F)
300 g (10.6 oz)	-25°C (12.6°F)
435 g (15.4 oz)	-35°C (-5.4°F)

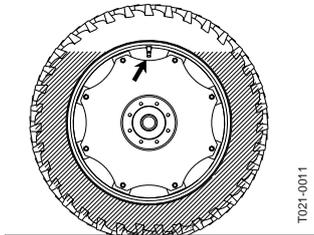


**WARNING!** It is very important that the CaCl<sub>2</sub> is added to the water and agitated until it is fully dissolved. Never pour water on to CaCl<sub>2</sub>! If you get CaCl<sub>2</sub> in the eyes, flush instantly with cold water for at least 5 minutes and seek medical advice afterwards.

**IMPORTANT!** The tyres must be liquid filled to max. 75 % of total tyre volume. Fill only the qty. of liquid necessary to obtain sufficient stability of the sprayer. Do not fill liquid and CaCl<sub>2</sub> mixture in tyres without tubes!

To fill the tyres:

1. Jack up the wheel and rotate wheel till the valve is positioned at "12 o'clock".
2. Remove the valve body and fill liquid until it reaches the valve.
3. When surplus liquid is drained through the valve stem fit the valve body again.
4. Adjust tyre pressure and lower the wheel. See section "Tyre pressure".

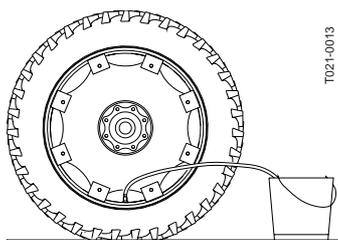


T021-0011

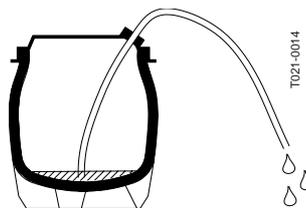
**NOTE!** When filling the tyres the valve should be positioned at 12 o'clock and when adjusting the tyre pressure, the valve should be positioned at 6 o'clock.

To empty tyres:

1. Rotate wheel till the valve is positioned at "6 o'clock."
2. Remove the valve body and let out the liquid. Retain liquid in an appropriate container.
3. To empty the tyre completely the tyre is inflated and a thin drain tube is lead to the bottom of the tyre. The air pressure will now empty the remaining liquid.
4. Remove the drain tube, fit the valve and inflate the tyre to specified pressure. See section "Tyre pressure".



T021-0013



T021-0014

**NOTE!** Disposal of CaCl<sub>2</sub> has to take place according to local legislation.

## Driving Technique, STEER TRACK, SELF TRACK and MULTI TRACK

A trailer sprayer with articulating drawbar (TRACKER) behaves differently than a normal trailer.

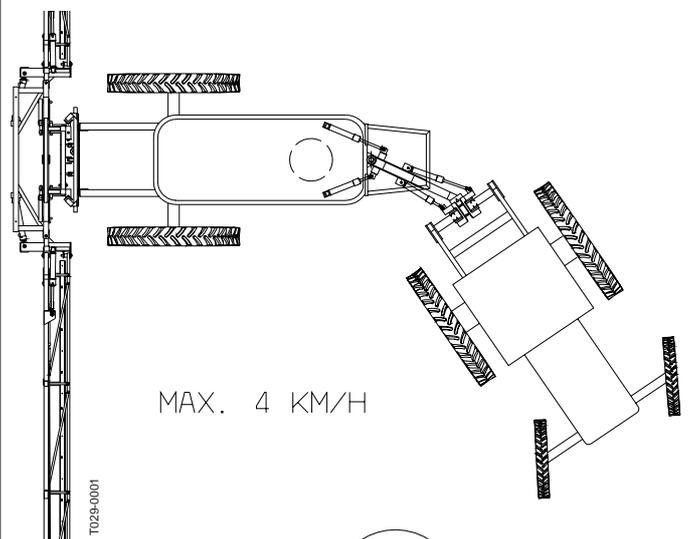
In tracking position the vehicle centre of gravity is displaced further more compared to the vehicle centre line than a normal trailer.

Compared to a conventional trailer a TRACKER has decreased stability when turning, especially when turning on hill-sides.

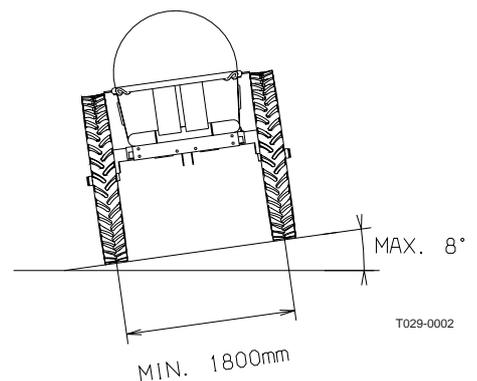
To avoid over-balancing, follow these guidelines:

- Avoid sudden, tight turns
- Slow down before entering a curve or turning, and drive with a constant, low speed during the turn.
- Never slow down too fast, brake heavily or stop suddenly in a curve, or when turning on a hill-side, when the sprayer is articulated.
- Be careful when turning on uneven ground
- Set the track gauge as wide as possible
- The proper function of the hydraulic damping is essential to obtain good stability
- Keep stabiliser chains on the tractor's liftarms tight
- For safety reasons following limitations are set for TRACKERS (with unfolded booms):

Speed by turning, max.	4 km/h (2.5 mph)
Ground inclination by turning, max.	8°
Track gauge, min.	1800 mm (71 in)



**NOTE!** HARDI cannot undertake any responsibility for any damages caused by the sprayer tipping over.

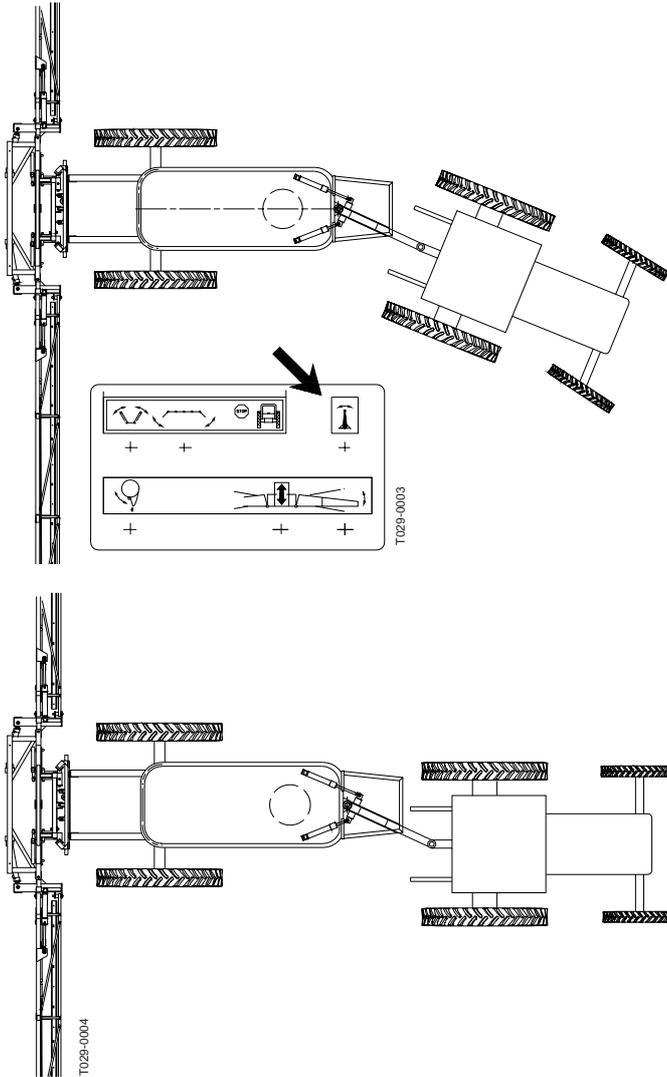


## STEER TRACK

The articulating drawbar on STEER TRACK is to be operated manually via the D.A.H.

The switch on the D.A.H. control box is pushed sideways to articulate the drawbar.

This is used when turning or as track correction when driving on slopes.



## SELF TRACK

The SELF TRACK is always in tracking mode. The SELF TRACK drawbar will always articulate when the tractor is turning and follow the tractor rear wheels. The SELF TRACK drawbar is hydraulically damped to obtain stable trailing.



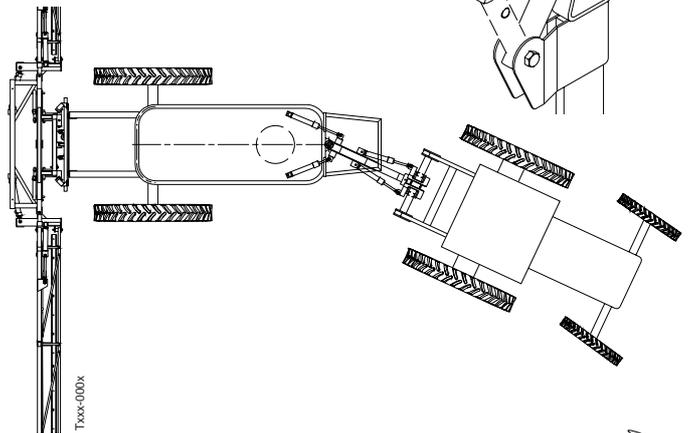
**WARNING!** Always drive the SELF TRACK very careful on public roads, and be aware of the sprayer behaviour. Slow down before turning to avoid the vehicle tipping over.

## MULTI TRACK

The MULTI TRACK has three modes.

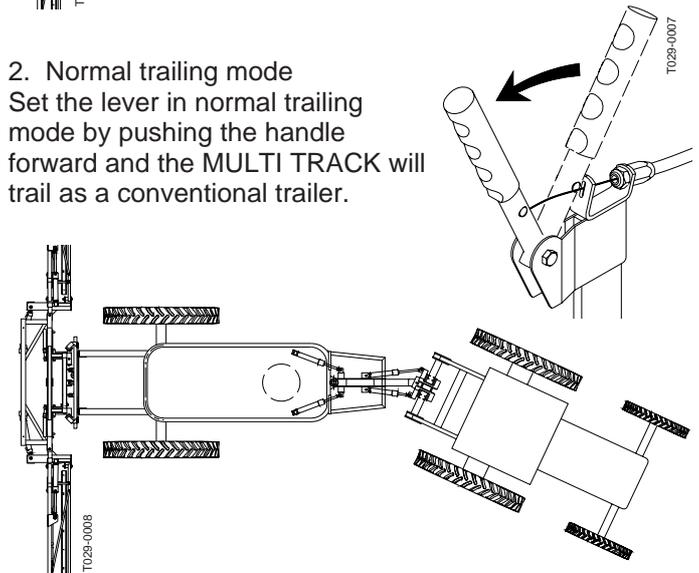
### 1. Tracking mode

Set lever in tracking mode by pushing the handle backward and the MULTI TRACK drawbar will articulate to track with the tractor rear wheels.



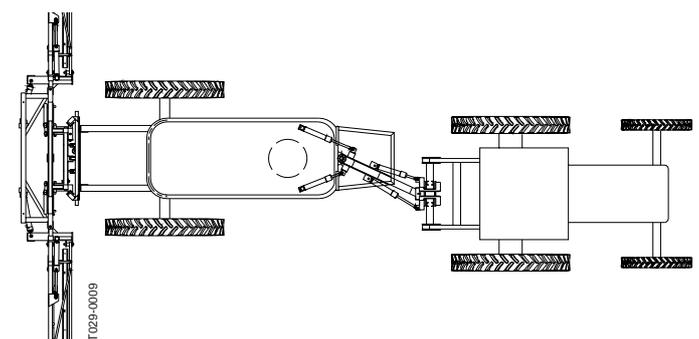
### 2. Normal trailing mode

Set the lever in normal trailing mode by pushing the handle forward and the MULTI TRACK will trail as a conventional trailer.



### 3. Track correction mode

When the lever is set in Tracking mode the switch at the D.A.H. control box can be activated sideways to off-set the trailing. This is used for track correction on hilly terrain.



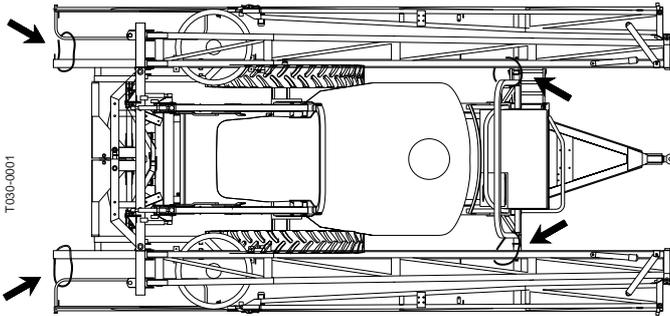
# COMMANDER-TWIN FORCE

**NOTE!** The MULTI TRACK drawbar must always be aligned before changing from tracking mode to normal trailing mode and vice-versa.

**IMPORTANT!** Always set the MULTI TRACK in normal trailing mode when driving on public roads.

## Boom transport safety chain (if fitted)

Fit the safety chains as shown before transport on public road.



## Roadworthiness

When driving on public roads and other areas where the highway code applies, or areas where there are special rules and regulations for marking and lights on implements, you should observe these and equip implements accordingly.

**NOTE!** Max. driving speed is 25 km/h (15.5 Mph).

## Disconnecting the sprayer

Always clean the sprayer - inside and outside - before disconnecting and parking it.

Before disconnecting from the tractor, make sure the support leg is properly fitted.



**WARNING!** To prevent the sprayer from tipping over, do not disconnect the sprayer from the tractor with the booms unfolded unless the boom is supported!

Always engage the parking brake (if fitted).

If no parking brake is fitted, or if local regulations requires so, place stop wedges in front of and behind the wheels.

Remember to disconnect all hoses and cables from the tractor.



**WARNING!** If the sprayer is parked unattended avoid unauthorised persons, children and animals having access to the sprayer.

## Before putting the sprayer into operation

Although the sprayer has been applied with a strong and protective surface treatment on steel parts, bolts etc. in the factories it is recommended to apply a film of anti-corrosion oil (e.g. CASTROL RUSTILLO or SHELL ENSIS FLUID) on all metal parts in order to avoid chemicals and fertilisers discolouring the enamel.

If this is done before the sprayer is put into operation for the first time, it will always be easy to clean the sprayer and keep the enamel shiny for many years.

This treatment should be carried out every time the protection film is washed off.



## Operating instructions MANIFOLD SYSTEM

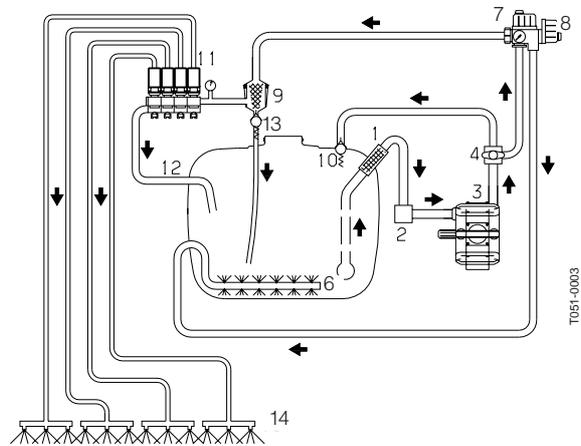
The MANIFOLD SYSTEM is located at the left side of the sprayer and permits operation of all HARDI optional extras from one position. The modular system facilitates the addition of up to three optional extras on the suction side and five extras on the pressure side. Furthermore the suction manifold can be fitted with a return valve which ensures better draining of the sprayer before cleaning.

## Function diagram

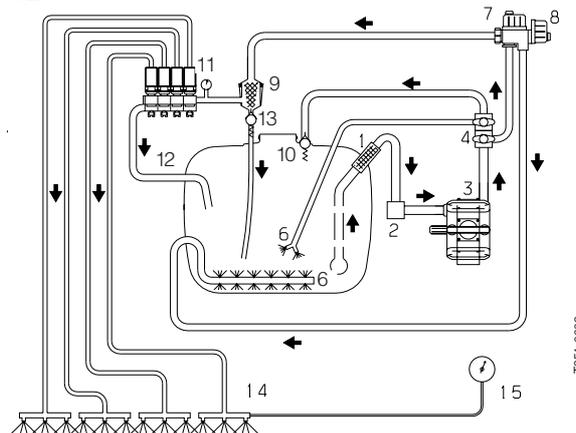
- |                              |                                       |
|------------------------------|---------------------------------------|
| 1. Suction filter            | 9. Self-Cleaning Filter               |
| 2. Suction manifold (black)  | 10. Safety valve                      |
| 3. Pump                      | 11. Distribution valves               |
| 4. Pressure manifold (green) | 12. Return from Pressure Equalisation |
| 5. Return valve (blue)       | 13. Check valve                       |
| 6. Pressure agitator         | 14. Sprayer boom                      |
| 7. On/off valve              | 15. Pressure gauge                    |
| 8. Pressure adjustment       |                                       |

## EC (standard)

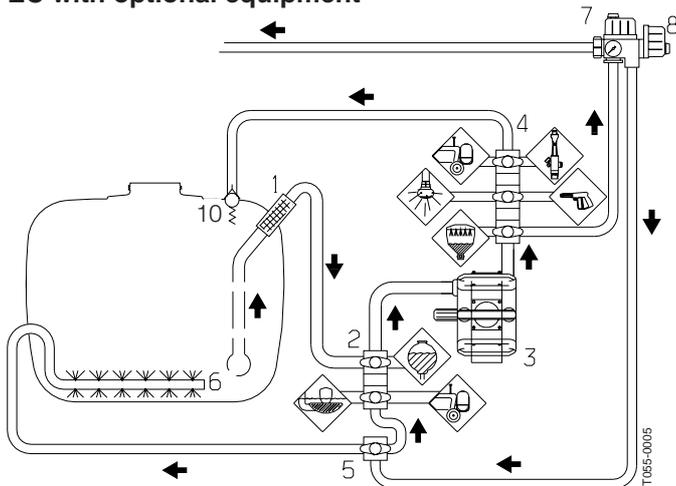
2200/2800



3200/4200



## EC with optional equipment

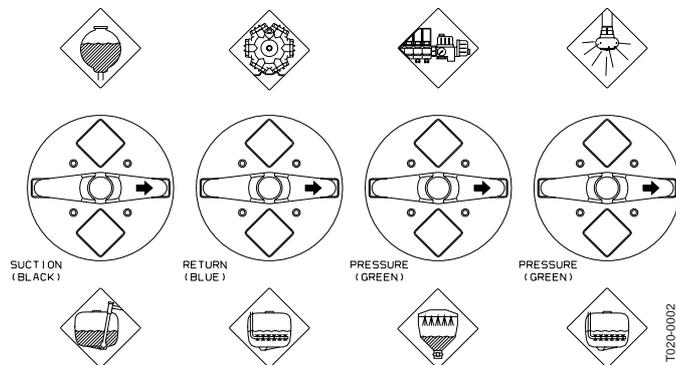


The diagram shows examples of options. These are individual for each sprayer.

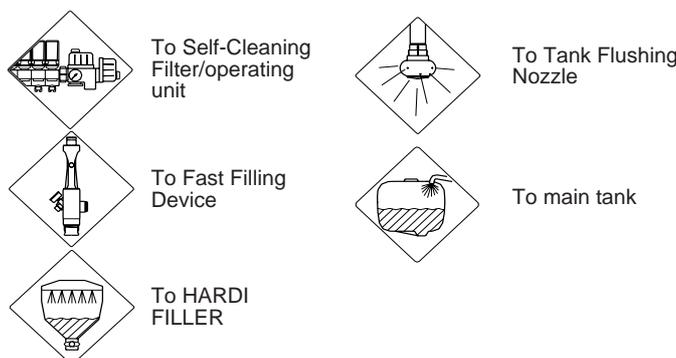
## Use of MANIFOLD valve system

The following pictograms and colours are used for the visualizing the function of the MANIFOLD valves:

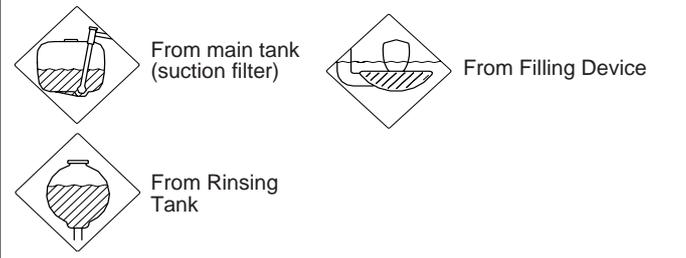
- Green disc = Pressure valve
- Black disc = Suction valve
- Blue disc = Return valve



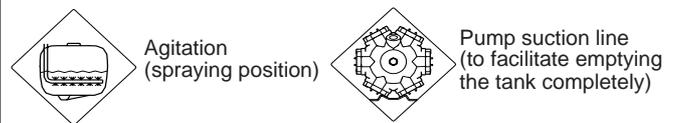
## Green disc = Pressure valve



## Black disc = Suction valve



## Blue disc = Return valve



## To operate the spraying functions:

- Turn the handle on a green pressure valve towards the function desired
- Turn the handle on a black suction valve towards the desired function
- Turn the handle on the blue return valve towards the desired direction of return flow
- Close all remaining valves by setting the handle(s) on "O"

**IMPORTANT!** The valves and functions may vary from machine to machine depending on optional equipment fitted. Only the functions to be used must be open - Always close remaining valves.

## Electric operated MANIFOLD valves (if fitted)

One or more MANIFOLD valves can be electrically operated via a control box in the tractor cab. These can only be operated manually when the power to the valve motor is disconnected first.

## Filling of water

Water can be filled into the main tank in following

1. Filled through tank lid.
2. Filled by diaphragm pump through a suction side fitted filling device (optional extra) using normal pump capacity directly to the tank.
3. Filled by diaphragm pump through a pressure side fitted injector/venturi type Fast Filling Device (optional extra) using up to 3 times normal pump capacity.
4. Combination of 2 and 3.

The tank should normally be filled 1/3 with water, before adding the chemicals - always read instruction on chemical container!

# COMMANDER-TWIN FORCE

**NOTE!** Max. permitted tank contents:

Model	Volume, Water litre (Imp. gal)	Volume Liquid fertilisers *) litre (Imp. gal)
2200	2200 (484)	1690 (372) *
2800	2800 (616)	2000 (440) *
3200	3200 (704)	3200 (704) *
4200	4200 (924)	3231 (711) *

\*) Based on liquid fertilisers with specific gravity 1.3

## Filling through tank lid

Remove tank lid and fill water through strainer to prevent rust or other particles to enter the tank.

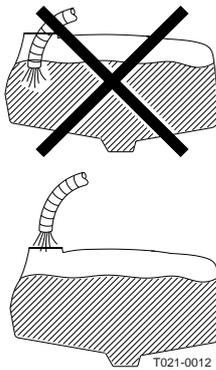
An overhead tank can be used in order to obtain high filling capacity.

It is recommended to use as clean water as possible for spraying purposes.



**WARNING!** DO NOT LET FILLING HOSE ETC. ENTER THE TANK. KEEP IT OUTSIDE THE TANK, POINTING TOWARDS THE FILLING HOLE.

IF THE HOSE IS LEAD TO THE BOTTOM OF THE TANK, AND THE WATER PUMP AT THE WATER SUPPLY PLANT STOPS, CHEMICALS CAN BE SIPHONED BACK AND CONTAMINATE THE WATER SUPPLY LINES.

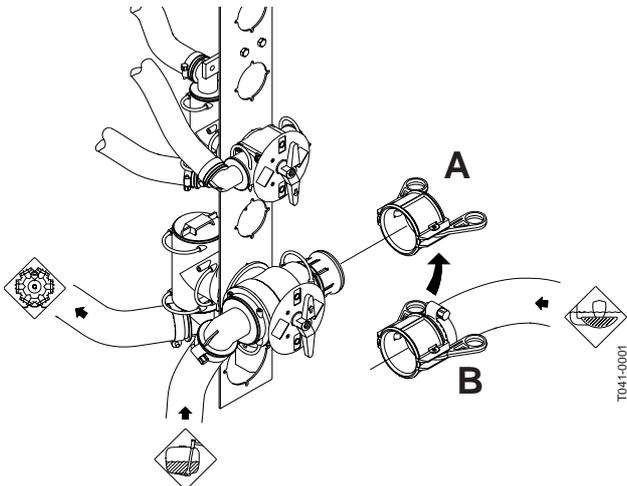


## Suction Filling Device (if fitted)

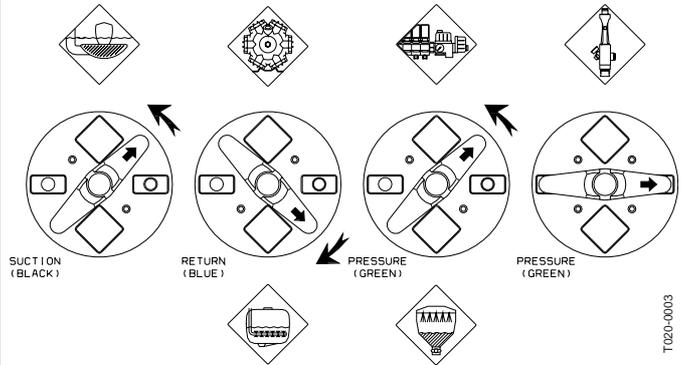


**WARNING!** Avoid contamination or personal injury. Do not open suction valve towards Suction Filling Device unless pump is running and filling hose is connected. If this valve is opened without pump running, liquid will stream out of the MANIFOLD.

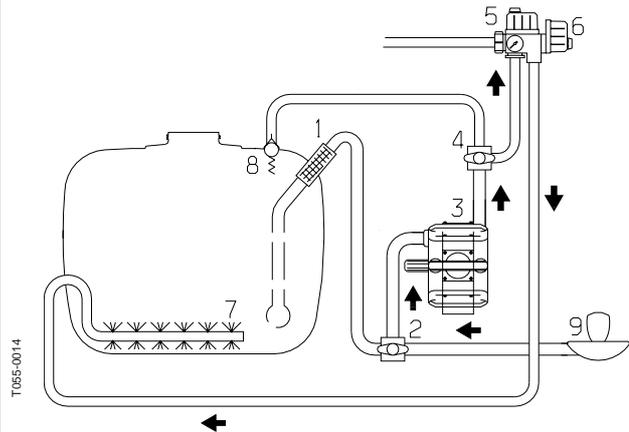
The Suction Filling Device is operated as follows:



1. Remove cover **A**, and connect suction hose **B** to Suction Manifold.
2. Engage diaphragm pump and set P.T.O. revolutions at 540 r/min. Turn handle on Suction Manifold towards Filling Device.



3. The tank is now filled with water. Keep an eye on liquid level indicator.
4. Turn handle on Suction Manifold away from Filling Device to discontinue filling process. Then disengage pump.
5. Disconnect suction tube **B** and replace cover.



**NOTE!** Observe local legislation regarding use of Filling Device. In some areas it is prohibited to fill from open water reservoirs (lakes, rivers etc.). It is recommended only to fill from closed reservoirs (mobile water tanks etc.) to avoid contamination.

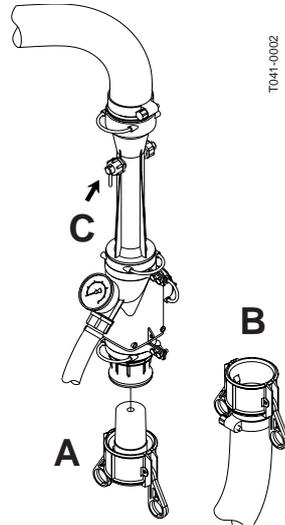


**WARNING!** If suction hose/filter is carried on the sprayer during spraying, it can be contaminated by spray drift which will be transferred to lake/river when filling!

## Fast Filling Device (if fitted)

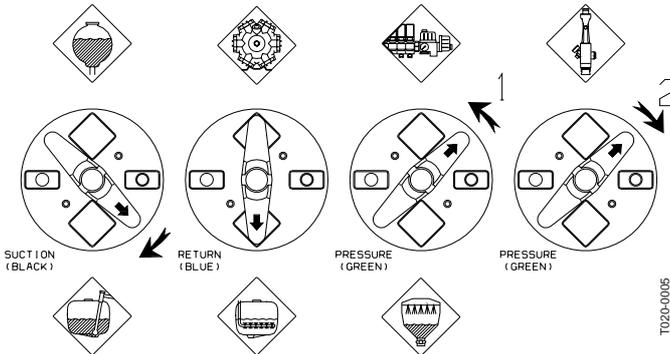
The Fast Filling Device is operated as follows:

1. Ensure spray liquid tank contains at least 50 litres of water.
2. Remove cover (A) and connect suction hose (B).
3. Turn handle on Pressure Manifold towards Fast Filler. With the P.T.O. at 540 r/min, the pressure gauge should indicate about 10 bar.
4. If water is not seen in transfer tube, prime by turning valve (C).
5. Keep eye on liquid level indicator.
6. Turn handle on Pressure Manifold away from Fast Filler to discontinue filling process.



T041-0002

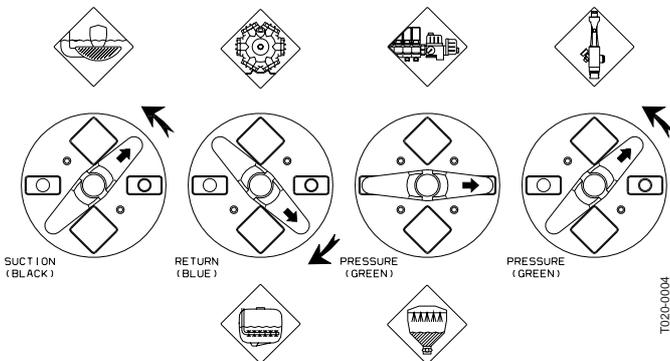
**NOTE:** Turn handle towards EC-operating unit **before** turning away from Fast Filler in order to avoid peak pressure blowing the safety valve!



T020-0005

7. Disconnect suction tube (B) and replace cover.

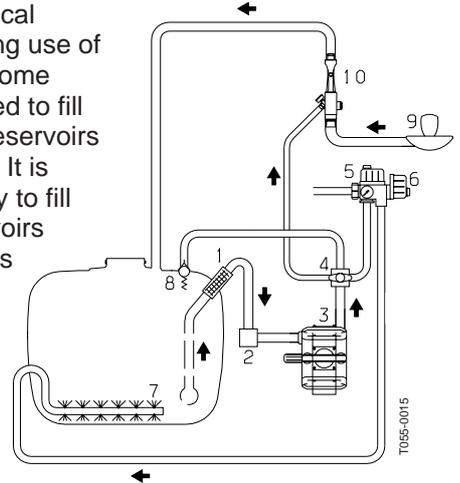
The Filling Device and the Fast Filling Device can be used simultaneously - this gives even bigger filling capacity.



T020-0004

**WARNING:** Do not leave the sprayer whilst refilling the tank, and keep an eye on the level gauge in order **NOT** to overfill the tank!

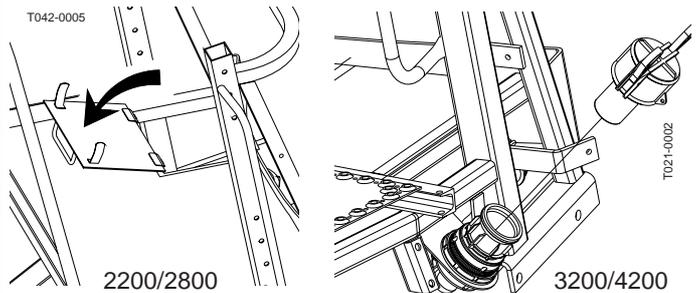
**NOTE!** Observe local legislation regarding use of Filling Device. In some areas it is prohibited to fill from open water reservoirs (lakes, rivers etc.). It is recommended only to fill from closed reservoirs (mobile water tanks etc.) to avoid contamination.



T056-0015

**WARNING!** If suction hose/filter is carried on the sprayer during spraying, it can be contaminated by spray drift, which will be transferred to lake/river when filling!

## Filling of rinsing tank (if fitted)



T042-0005

T021-0002

The rinsing tank is situated at the front under the platform and main tank. Access to the rinsing tank lid goes through the hatch in the platform. Only fill with clean water.

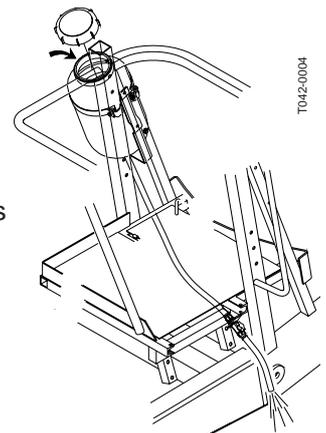
Capacities are:

Model	Rinsing tank capacity		
	l	imp. Gal.	US Gal.
2200/2800	260	57	70
3200/4200	460	101	120

## Filling of clean water tank

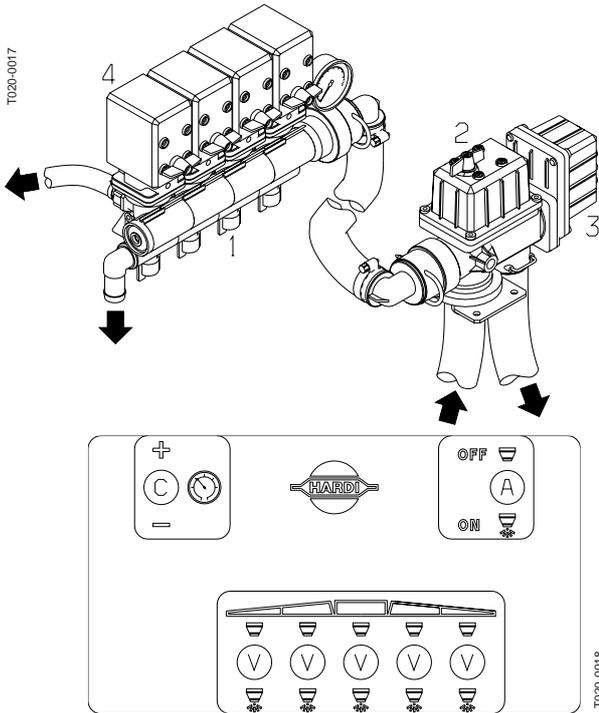
The clean water tank has a capacity of 15 l (3.3 Imp. gal). The water from this tank is for hand washing, cleaning of clogged nozzles etc. Only fill this tank with clean water from the well.

**WARNING!** Although the clean water tank is only filled with clean water, it must never be used for drinking.



T042-0004

## Adjustments of EC operating unit



Before spraying the EC operating unit is adjusted using clean water (without chemicals).

1. Choose the correct nozzle for the spray job by turning the TRIPLET nozzle bodies. Make sure that all nozzles are the same type and capacity. See the "Spray Technique" book.
2. On-off switch **A** is activated against green.
3. All distribution valve switches **V** are activated against green.
4. Pressure regulation switch **C** is activated until emergency handle **3** stops rotating (minimum pressure).
5. Put the tractor in neutral and adjust the P.T.O. and thereby the number of revolutions of the pump corresponding to the intended travelling speed. Remember the number of revolutions on the P.T.O. must be kept between 300-600 rpm.
6. Pressure regulation switch **C** is activated until the required pressure is shown on the pressure gauge.

### ADJUSTMENT OF PRESSURE EQUALISATION

1. Close the first distribution valve switch **V**.
2. Turn the adjusting screw **1** until the pressure gauge again shows the same pressure.
3. Adjust the other sections of the distribution valve in the same way.

**NOTE!** HEREAFTER ADJUSTMENT OF PRESSURE EQUALISATION WILL ONLY BE NEEDED WHEN:

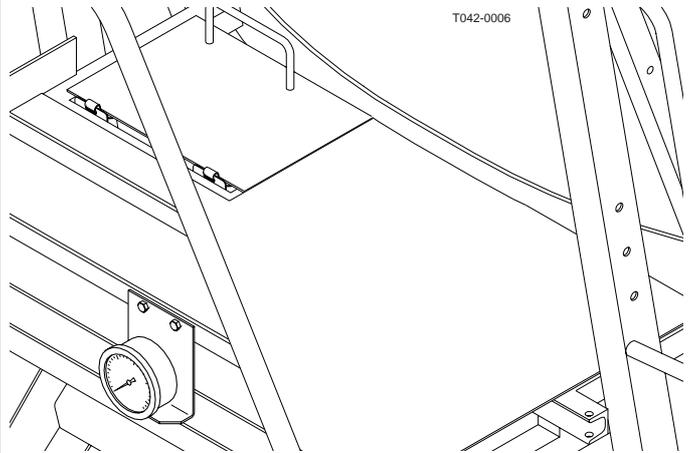
1. YOU CHANGE TO NOZZLES WITH OTHER CAPACITIES
2. THE NOZZLE OUTPUT INCREASES AS THE NOZZLES WEAR

## OPERATING THE CONTROL UNIT WHILE SPRAYING

In order to close the entire boom, switch ON/OFF **A** to off position. This returns the pump output to the tank through the return system. The diaphragm Non-drip valves ensure instantaneous closing of all nozzles. In order to close one or more sections of the boom, switch the relevant distribution valve **V** to off position. The pressure equalisation ensures that the pressure does not rise in the sections which are to remain open.

When the sprayer is put aside, the control box and the multi plug must be protected against moisture and dirt. A plastic bag may be used to protect the multi plug.

## Remote pressure gauge (if fitted)



The remote pressure gauge measures the working pressure in the boom tubes as close to the nozzles as possible. This pressure reading will always be slightly lower than the reading at the operating unit pressure gauge.

The outputs stated in the nozzle charts are always based on the pressure measured at the nozzle.

Always adjust pressure when calibrating and spraying according to readings at the Remote pressure gauge.

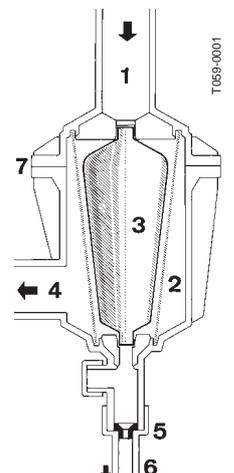
## Filters

All filters should always be used, and their function checked regularly. The mesh size of the filter in use should always be smaller than the flow average of the nozzles used. Therefore, pay attention to the correct combination of filters, mesh size.

### Self-cleaning filter

Operating diagram

1. From pump
2. Double filter screen
3. Guide cone
4. To operating unit
5. Replaceable restrictor
6. Return to tank
7. Screw-joint

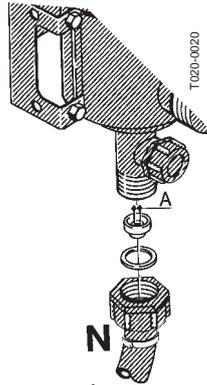


## Choice of correct restrictor

It is important to have a large flow through the filter. This is achieved by choosing the restrictor size in relation to the liquid consumption of the spray boom.

4 restrictors are supplied. Use the green one (largest orifice) first.

The hose **N** is demounted at the self-cleaning filter, the restrictor is put in the hose and the hose is mounted again. If the required working pressure cannot be obtained, the restrictor is too large. Choose a smaller restrictor. Start with a black one, then a white and finally a red one.



T020-0020

When cleaning the filter remove hose **N** and the hose at the safety valve, and check there are no residues.

Standard filter size is 80 mesh. Sizes of 50 and 100 mesh are available and can be changed by opening the filter top, and replace the strainer. Check the O-rings before reassembling the filter and replace if damaged.

## Filling of chemicals.

Chemicals can be filled in the tank in 2 ways:

1. Through tank lid.
2. By means of HARDI FILLER chemical filling device.

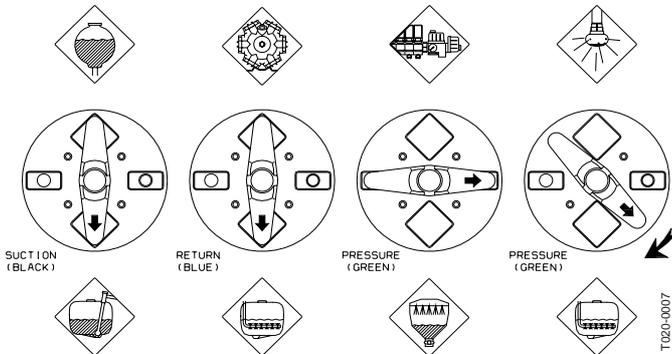
### Filling through tank lid

The chemicals are filled through the tank lid - Note instructions on the chemical container!



**WARNING!** Be careful not to slip or splash chemicals when carrying chemicals up to the tank lid!

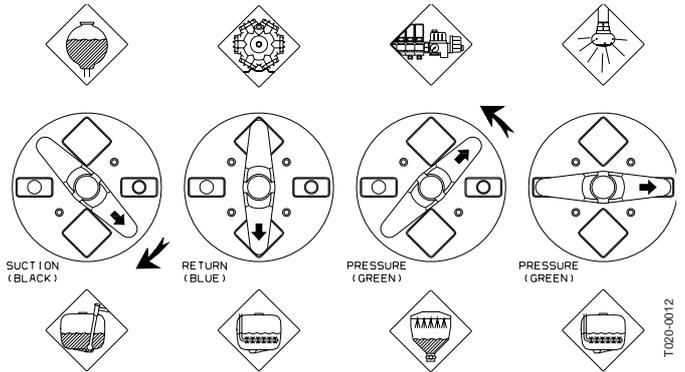
1. Make sure the EC on/off valve is switched off.
2. Set the MANIFOLD valves to correct position. Black valve "Suction from main tank", green valve towards "Agitation" and Blue valve towards "Agitation".



T020-0007

3. Engage the pump and set P.T.O. revs. to 540 r.p.m.
4. Add the chemicals through the main tank hole.
5. When the spray liquid is well mixed, turn handle on the Pressure Manifold towards "Spraying" position.

Keep P.T.O. engaged so the spray liquid is continuously agitated until it has been sprayed on the crop.

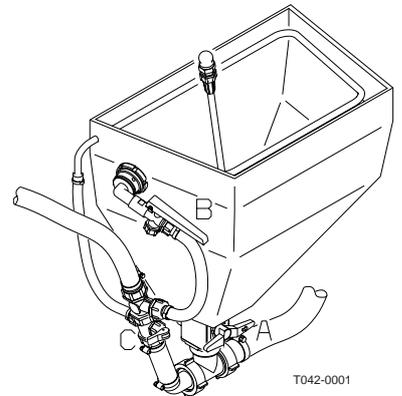


T020-0012

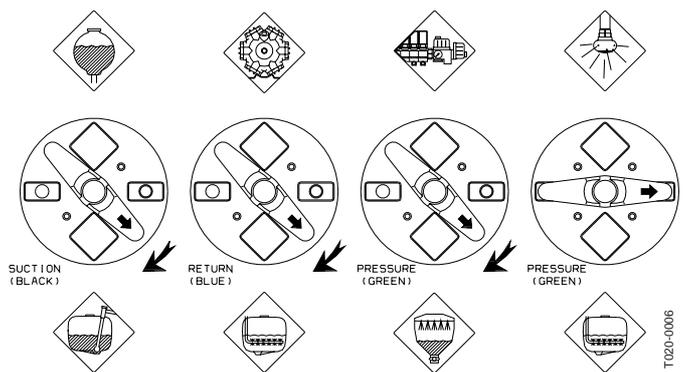
## Filling by HARDI FILLER chemical inductor

### Liquid chemicals:

1. Fill the main tank at least  $\frac{1}{3}$  with water (unless something else is stated on the chemical container label). See section "Filling of water".
2. Turn the handle at the Suction Manifold towards "Main tank" and turn blue return valve towards "Agitation". Close remaining valves.
3. Turn the handle at the Pressure Manifold towards "HARDI FILLER". Close remaining valves. Check that bottom valve **A** at the FILLER is closed.



T042-0001



T020-0006

4. Engage the pump and set P.T.O. speed at 540 r.p.m.
5. Open FILLER lid.
6. Measure the correct quantity of chemical and fill it into the hopper.

**NOTE!** The scale in the hopper can only be used if the sprayer is parked at level ground! It is recommended to use a measuring jug for best accuracy.

7. Open the bottom valve **A** and the chemical is transferred to the main tank.
8. If the chemical container is empty it can be rinsed by the container rinsing device (if fitted). Place the container over the multi-hole nozzle and press the lever **B**.

# COMMANDER-TWIN FORCE



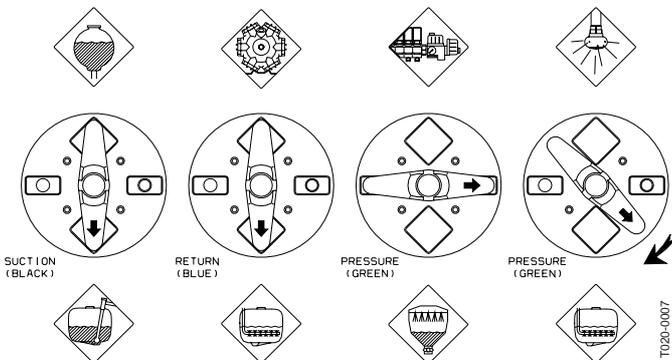
**WARNING!** Do not press lever **B** unless the multi-hole nozzle is covered by a container to avoid spray liquid hitting the operator.

**IMPORTANT!** Rinsing device uses spray liquid to rinse containers for concentrated chemicals. Always rinse the chemical containers with clean water several times until they are clean before disposal.

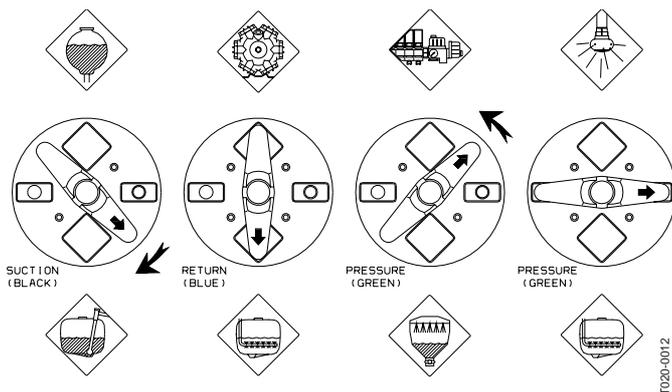
- Engage the hopper rinsing device by opening valve **C**.
- Close valve **C** again when the hopper is rinsed.

**IMPORTANT!** The hopper rinsing device is using spray liquid for rinsing the hopper for concentrated chemical! The FILLER must always be cleaned together with the rest of the sprayer when the spray job is done.

- Close valve **A** and the FILLER lid again.
- Turn handle at the Pressure Manifold towards "Intensive Agitation" and close remaining valves.



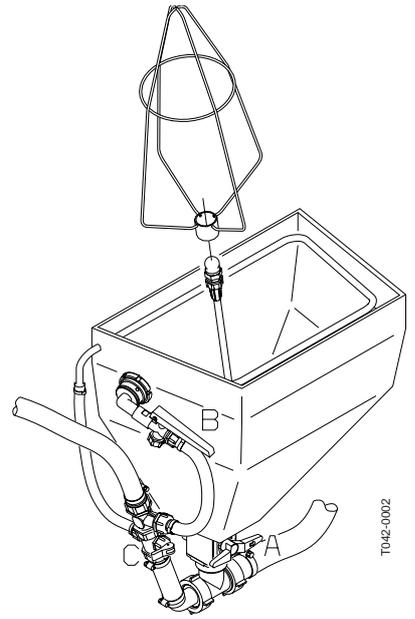
- When the spray liquid is well mixed, turn handle on the Pressure Manifold towards "Spraying" position. Keep P.T.O. engaged so the spray liquid is continuously agitated until it has been sprayed on the crop.



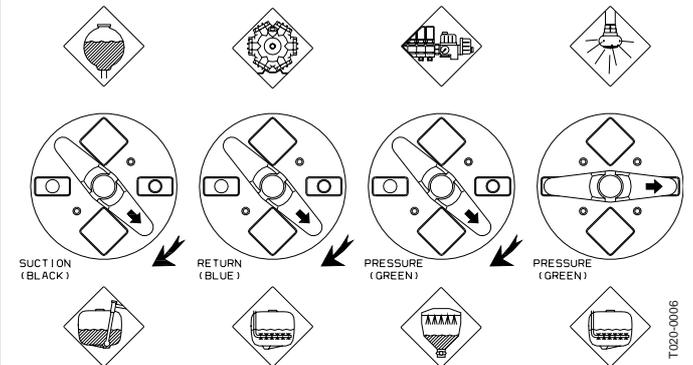
## Powder chemicals

Filling of powder chemicals is done as follows:

- Fill the main tank at least  $\frac{1}{2}$  with water (unless something else is stated on the chemical container label). See section "Filling of water".
- Turn the handle at the Suction Manifold towards "Main tank" and turn blue return valve towards "Agitation". Close remaining valves.



- Turn the handle at the Pressure Manifold towards "HARDI FILLER". Close remaining valves.



- Engage the pump and increase P.T.O. speed to 540 r.p.m.
- Open the bottom valve **A** at the FILLER. Open FILLER lid.
- Engage the hopper rinsing device by opening valve **C**.
- Measure the correct quantity of chemical and sprinkle it into the hopper as fast as the rinsing device can flush it down.
- If the chemical container is empty it can be rinsed by the container rinsing device (if fitted). Fit the bag bracket and place the powder bag over the multi-hole nozzle and press the lever **B**.



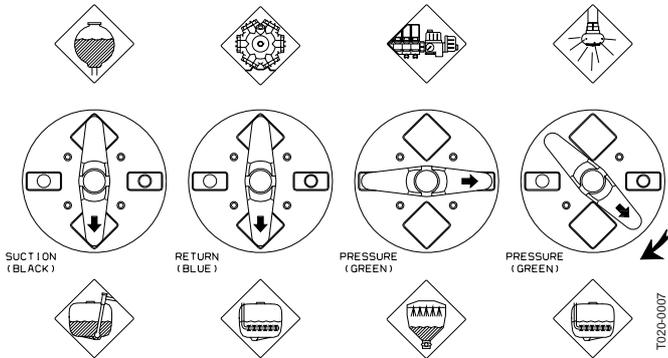
**WARNING!** Do not press lever **B** unless the multi-hole nozzle is covered by a container to avoid spray liquid hitting the operator.

**IMPORTANT!** Rinsing device uses spray liquid to rinse containers for concentrated chemicals. Always rinse the chemical containers with clean water several times until they are clean before disposal.

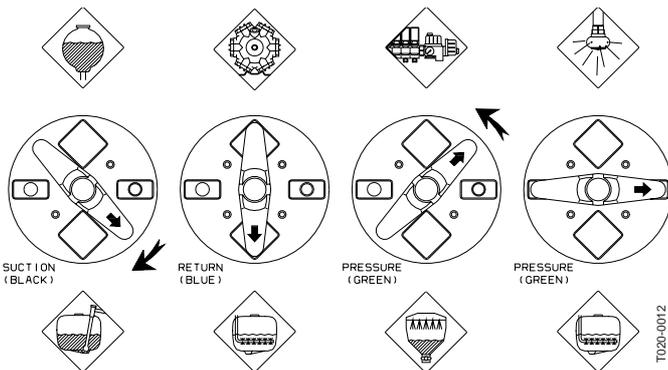
- Close valve **C** again when the hopper is rinsed.

**IMPORTANT!** The hopper rinsing device is using spray liquid to rinse the hopper for concentrated chemical. The FILLER must always be cleaned together with the rest of the sprayer when the spray job is done.

10. Close valve **A** and the FILLER lid again.  
 11. Turn handle at the Pressure Manifold towards "Intensive Agitation" and close remaining valves to mix the spray liquid.



12. When the spray liquid is well mixed, turn handle on the Pressure Manifold towards "Spraying" position. Keep P.T.O. engaged so the spray liquid is continuously agitated until it has been sprayed on the crop.



## Safety precautions

Always be careful when working with crop protection chemicals!

### Personal protection

Dependant on which type of chemical used, the following protective clothing/equipment should be used:

- Gloves
- Waterproof boots
- Headgear
- Respirator
- Safety goggles
- Chemical resistant overall

This equipment should be worn to avoid contact with the chemicals.

Protective clothing/equipment should be used when preparing the spray liquid, during the spraying work and when cleaning the sprayer. Also follow the recommendations on the chemical label.

It is always advisable to have clean water available, especially when filling the sprayer with the chemical.

Always clean the sprayer carefully and immediately after use.

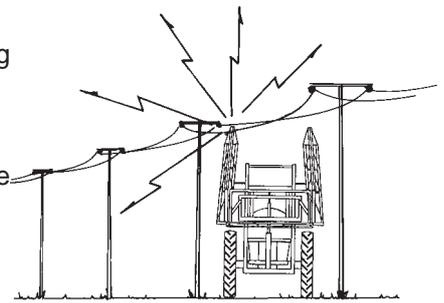
Do not mix different chemicals in the tank.

Always clean the sprayer before changing to another chemical.

## Operating the boom (all models)

**WARNING:** Be cautious with initial use of the hydraulic systems. If there is air in the system, this may cause violent movements of the boom. Therefore, take care that no persons or objects are hurt or damaged in the process of testing.

**DANGER!** When folding and unfolding the boom, be sure that no persons or objects are in the operating area of the boom, and that the boom cannot touch any electrical conductors!



### HAY models:

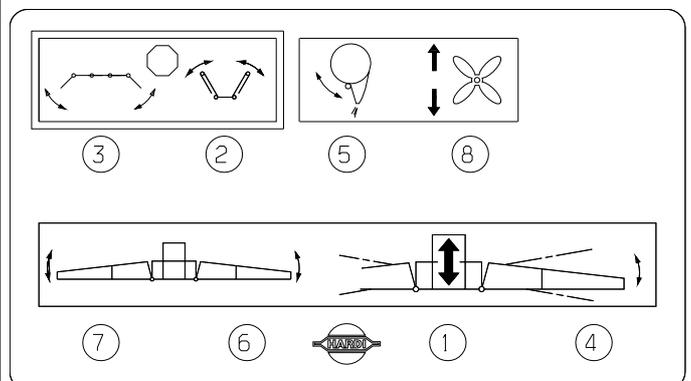
The boom unfolding/folding can be done according to instructions below.

1. Lift up the boom lift until the boom is clear of the transport brackets using the single acting spool valve
2. Unfold the boom completely using the double acting spool valve
3. Lower the boom to correct working height above the ground/crop 50 cm/20 in

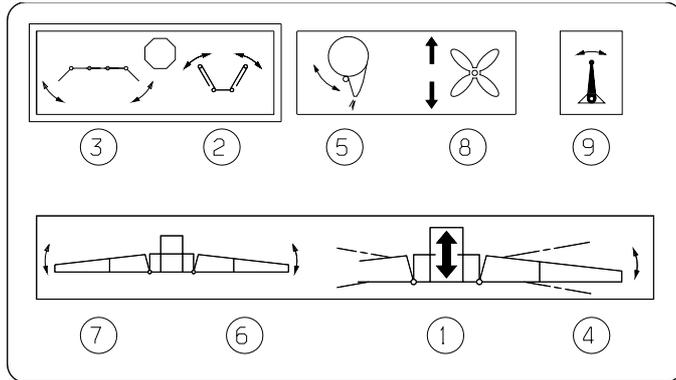
Folding is to be done in reverse order.

### HAZ models:

Functions of the control box:



T030-0003



T030-0004

1. Raising and lowering of boom
2. Unfolding/folding of inner sections
3. Unfolding/folding of outer sections
4. Slanting of boom
5. Angling of air slot/nozzle assembly
6. Boom tilt, RH
7. Boom tilt, LH
8. Fan speed adjustment
9. Drawbar mode (MULTI TRACK+ STEER TRACK only)

## The boom unfolding/folding can be done according to instructions below

### Unfolding of boom

**NOTE!** Ensure that the transport safety chains are removed and the booms are clear from the transport brackets before unfolding.

1. Push switch **1** upwards to lift the boom clear of the transport brackets.
2. Push switch **2** upwards to unfold the inner sections. Rear transport hooks disengage automatically.
3. Push switches **6** and **7** downwards to lower individual tilt rams.
4. Push switch **3** upwards to unfold outer sections.
5. Push switch **4** to correct slant angle.
6. Push switch **1** downwards to lower the boom to correct height above crop or ground level.
7. In order to reduce wind drift and/or increase penetration of spray liquid in the crop, the slot angle can be changed backwards and forwards with switch **5**.

**NOTE!** The two upper functions in the red rectangle with STOP signs must only be operated when sprayer is stationary! Failure to do so will damage the boom!

### Folding the boom

1. Check that the slanting function is midway **4**.
2. Set slot angle at midway **5**.
3. Raise boom **1** to upper position.
4. Fold outer sections **3**
5. Lift individual boom tilt **6** and **7**
6. Fold inner sections **2**. Rear transport hooks engage automatically.
7. Lower boom **1** until boom rests on transport brackets.

### Hydraulic slanting control

The hydraulic slanting control **4** enables slanting of the entire boom hydraulically. This is advantageous when spraying across hillsides.

Reset position to neutral (midway) before folding the boom.

### Boom tilt function

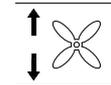
The boom tilt function control **6** and **7** enables you to adjust the boom height individually in right and left-hand side.

### Air slot angling

The air slot and nozzle assembly can be angled approx. 40° forwards and 30° backwards compared to vertical position. Regarding adjustments - see section on "Air technique".

### Electric fan speed adjustment (if fitted)

Increasing of fan speed



Decreasing of fan speed



T030-0004

8

The max. Revolutions for the fan is 3100 r.p.m., which will give full air speed of approx. 40 m/sec (90 mph).

The fan speed is indicated by the transmission working pressure by means of a pressure gauge.

Conversion table between pressure and fan speed - see section "Air Technique"

**IMPORTANT!** To avoid shock starting the fans always set fan speed to 0 before engaging the P.T.O.

### Boom support wheels

The boom is equipped with two support wheels. When spraying with low boom heights on bare ground or plants in the first growth stage it is recommended to fold down the support wheels. In later growth stages the wheels should remain folded up.

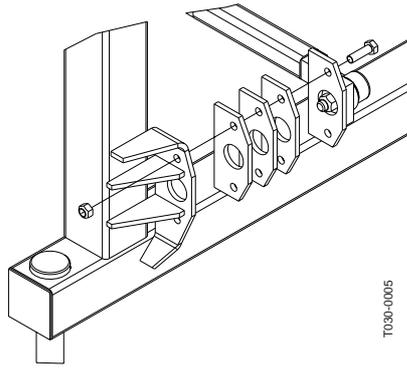
**IMPORTANT!** When driving on public roads the support wheels should be folded up and secured in order to keep the machine overall width according to the regulations!

### Boom suspension sensitivity

The boom suspension would normally suit most conditions and would not require any adjustment. The suspension will keep the boom parallel to the ground and compensate for uneven ground.

However special conditions or situations can require the suspension to react less or more slowly.

When the RH and LH guide rods are parallel to each other (factory setting) the boom suspension will react immediately, and the boom will move independently of the trailer or tractor.



T030-0005

If the boom should follow the movements or inclinations of the trailer the guide rods should be inclined towards each other at the rear.

Add 1-4 pcs. of 10 mm spacers as shown at each rod until the desired function is reached.

**Spray Technique - see separate book.**

**Air technique**

With TWIN air assistance energy is added to the spray droplets to improve control with the spray liquid. This way TWIN makes it possible to:

- carry the spray droplets safely to the target and increase plant deposit
- minimize off-target deposit due to wind drift or loss on the ground
- open the crop and obtain good penetration even with a low volume rate
- ensure a high coverage.

**Air speed / Air volume**

The fan speed is infinitely variable and can produce from 0 to 35 m/s (78 mph) air speed at the air outlet. This equals from 0 to 2000 m<sup>3</sup> air/m boom/hour (3.872 CFM/A boom/hour).

The air speed must be adjusted to the spray job. The tables below give a rough guide line.

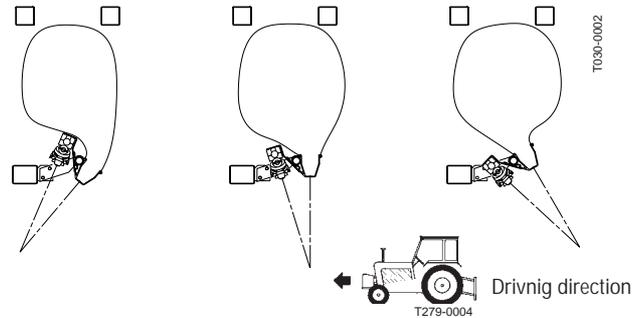
	Air assistance			
	Low (L)	Medium (M)	High (H)	Very high (VH)
Air speed (m/s.)	5-10	10-20	20-30	30-35
Fan r.p.m.	400-1000	1000-1900	1900-2700	2700-3100
	Oil press (bar)			
Boom 18 m	20-40	40-75	75-125	125-180
Boom 20-21 m	25-50	50-90	90-150	150-200
Boom 24-28 m	30-70	70-140	140-190	190-240

Spray job	Air assistance
Bare ground/low vegetation/early stage row crop	low/medium
Spraying only the top of a crop i.e. ear spraying in wheat*	low
Penetration in open crop*	medium/high
Penetration in dense crop*	high/very high

\*Can be checked with water sensitive paper

**Angling of air and liquid.**

The main purpose of the TWIN angling system is to counteract for the negative influence which wind direction and driving speed have on the quality of the spray job. Further the "co-angling" of air and liquid can help "opening" dense crops for better penetration. The TWIN FORCE air system can be set at any angle from 40° forward to 30° back (defined by the air stream).



T030-0002

**Adjusting the air assistance**

The air speed and angling must always be adjusted individually for each spray job and the given weather conditions.

It is always a good idea to get used to a new sprayer out in a field with only water in the tank, on this occasion the following routine for air adjustment should be practised:

1. Start with the air vertical
2. Set the air speed ..... **A**
3. Find the best angling ... **B**
4. Readjust the air ..... **A**

**IMPORTANT!** Fine turning of air speed and angling will often be necessary all through the spraying job.

It is easiest to find the best air setting to reduce drift when the sun is low and behind the boom (backlight). These conditions make the drift more visible.

**A Setting of air speed, rules of thumb**

- Step 1:** Find the range of air speeds that can control drift:
1. Start with the air setting at zero and keep increasing the air speed just to the point where you can see that the drift cloud is minimised - note minimum setting.
  2. Then increase the air speed until you see drift again - note maximum setting.
  3. Now you know the range of air speeds that can be used with minimum drift.

**Bare ground / low crop**

The range of air speeds is usually very small.

**Taller crop**

The taller the crop the wider the range of air speeds that can reduce drift.

**At higher wind speeds**

More air is needed on the sprayer and it is advisable to drive more slowly and use minimum boom height (40 cm)/(16 in).

**NOTE!** Too high air speed over bare ground/low crop can cause reflection of the spray liquid and leave dust on the leaves, which can again reduce the effect of the plant protection product.

**Step 2.:** Set the optimal air speed within possible the range mentions above.

Conditions	Air speed recommendations
Bare ground / low crop:	Use maximum air within the possible range
Taller crop:	Deeper crop penetration requires more air on the sprayer (if you are in doubt check with water sensitive paper).
Forward speed:	Higher forward speeds require more air on the sprayer.
Volume rate:	Lower volume rates require more air assistance to avoid drift.

## **B** Angling of air and liquid, rules of thumb

To control wind drift the influence of wind speed and wind direction as well as the horizontal air current around the boom due to forward speed must be minimised. Because it is a sum of two forces with variable direction and size that we have to counteract for, the following can only be very rough guidelines.

**NOTE!** Often it will be necessary to drive with two different anglings, so the angling is changed when changing driving direction after turning at the headland.

Wind direction	Angle / air speed
Head wind:	Angle forward
Down wind:	Angle back (if the forward speed is higher than the wind speed: angle forward)
Side wind / No wind:	Angle vertical or back. Only high forward speeds may require forward angling.

Crop condition	Angle / air speed
Bare ground/ low vegetation:	Low air speed and angling back will often be the best setting to avoid reflection of spray liquid.
Dense crop:	The angling feature is ideal to help opening the canopy and improve penetration. If you follow the crop movement as you are varying the angling you will find that at certain settings the crop will open more for penetration.

If wind speed, wind direction or for some reason forward speed changes during spraying the optimum angling is likely to change too. Be aware that with certain combinations of air speed and angling you can "close" or flatten

the crop and make penetration impossible - follow the crop movement intensively especially when setting the air assistance and keep an eye on the crop all through the application.

## **NOTE!**

- It is most important that the sprayer operator is familiar with the above rules of thumb before using the TWIN sprayer
- All volume rates, pressures and air adjustments stated in the following tables are, of course, guiding. Special conditions regarding climate, crop quality, spraying time and applied chemical can change the procedure. The tables are showing practice in northern Europe, and conditions may be very different in other countries. If you want some local advice you are very welcome to contact the TWIN application expert at the HARDI importer or daughter company in your country.
- The volume rate can generally be reduced to half of what is applied with a conventional sprayer, but with a minimum of 50-60 l/ha at 7-8 km/h (5.5-6.5 GPA at 4.5-5 mph. Exceptions are of course liquid fertiliser and herbicides whose selectivity is based large droplets that will only stick to the weeds,
- Low drift nozzles can also be fitted on a TWIN sprayer and help reduce drift even further.
- If there is a detailed spraying instruction on the chemical label regarding drop size, spray pressure, spray volume rate etc. this should be followed. Enclose 1 bag of water sensitive paper and instruction of how to use with all TWIN sprayers.

## **Water sensitive paper**

USE WATER SENSITIVE PAPER TO HELP FIND THE BEST AIR SETTING. Some time spent in different types of crops with clean water in the tank and some water sensitive paper will be valuable experience for the future work with your TWIN sprayer. The paper can be cut into smaller pieces (to simulate the target) and fixed with double sided tape at relevant places in the crop. Then spray with pure water and check the blue spots (droplets) on the paper. This way you can test different spraying techniques. Water sensitive paper is available at your local HARDI dealer, part No. 893211

**Potatoes - Tractor Speed 6 Km/h**

Spray task	Growth stage	Volume rate l/ha	Nozzle ISO	Pressure bar	Air setting
Herb.spraying	Pre-emergence	75	F-01-110	2.7	L
Herb.spraying	Post-emergence	75	F-01-110	2.7	L/M*
Herb.spraying	Haulm 15 cm high	75	F-01-110	2.7	M
Diseases (potato blight)	1. spraying latest July 1	150	F-02-110	2.6	H/(VH)
Same treatment to be repeated with 10 days' interval until 2 weeks before harvest.					
Desiccation	When the tubers have the size required	200	F-03-110	2.1	H/(VH)

**Spring Barley - Tractor speed 8 Km/h**

Spray task	Growth stage Feekes scale	Volume rate l/ha	Nozzle ISO	Pressure bar	Air setting
Herb.spraying	2-4	75	F-015-110	2.1	L/M
Wild oat spraying	3-5	100	F-015-110	3.6	M
1. Fungicide spraying	5-7	50	F-01-110	2.1	M
Aphids spraying	7-10.1	100	F-015-110	3.6	H
Growth regulation	8-10.1	50	F-01-110	2.1	H
2. Fungicide spraying	9-10.1	100	F-015-110	3.6	H
Herb.spraying Couch grass	Latest 10 days before harvest	50	F-01-110	2.1	M/H

**Winter Wheat - Tractor Speed 8 Km/h**

Spray task	Growth Feekes scale	Volume rate l/ha	Nozzle ISO	Pressure bar	Air setting
Herb. spraying pre-emergence	0	75	F-015-110	2.1	L
Herb. spraying post-emergence	1-2	100	F-015-110	3.6	L/M*
Fungicide autumn	2-3	75	F-015-110	2.1	M
Herb. spraying spring	4	75	F-015-110	2.1	M
Growth regulation	4	75	F-015-110	2.1	M
Eyespot	5-6	75	F-015-110	2.1	M
1. Fungicide, leaf disease	7	75	F-015-110	2.1	M
Growth regulation	8-9	75	F-015-110	2.1	M/H
1. Aphids spraying	8-9	75	F-015-110	2.1	M/H
2. Fungicide, leaf disease	9-10	75	F-015-110	2.1	M/H
2. Aphids spraying	10-10.5	50	F-01-110	2.1	L
Fungicide, Ear diseases	10-11	50	F-01-110	2.1	L
Herb.spraying Couch grass	Latest 10 days before harvest	50	F-01-110	2.1	M/H

**Sugar Beets - Tractor Speed 6 Km/h**

Spray task	Growth stage	Volume rate l/ha	Nozzle ISO	Pressure bar	Air setting
Herb.spraying residual type	Pre-drilling	75	F-01-110	2.7	L
Pests	Seed-leaf stage	100	F-015-110	2.1	L/M*
1. Herb.spraying	Cotyledon + 2 true leaves of same size	100	F-015-110	2.1	L/M
Pests	Between 1. and	100	F-015-110	2.1	L/M
2. Herb.spraying	7-10 days later than 1. herb. spraying	100	F-015-110	2.1	L/M
1. Herb.spraying Couch grass	Couch grass has 3-4 leaves	75	F-01-110	2.7	M/H
2. Herb.spraying Couch grass	3-4 weeks later than 1. couch grass spraying	75	F-01-110	2.7	M/H
Pests (aphids)	Months of June	150	F-02-110	2.6	H
Fungicide (mildew)	Beginning of August	100	F-015-110	2.1	H

NOTE! All volume rates, pressures and air suggestions indicated in these tables are only guiding. Special conditions regarding climate, quality of the crop, spraying time and chemicals applied (burning) may partially change the procedure.

\* NOTE! If dust is deposited on leaves the air speed must be reduced.

## Winter Rape - Tractor speed 8 km/h

Spray task	Growth Stage Feekes scale	Volume rate l/ha	Nozzle ISO	Pressure bar	Air setting
Herb. spraying	Pre-drilling	75	F-015-110	2.1	L
Herb. spraying	Post-drilling	100	F-015-110	3.6	L*
Volunteer cereal	Pre-emergence	100	F-015-110	3.6	L
Pests	At emergence	75	F-015-110	2.1	L/M*
Volunteer cereal	4 leaf stage	100	F-015-110	3.6	M
Pests	2-3 beetles/ plant when in bud	75	F-015-110	2.1	M
Pests, brassica pod midge and cabbage seed weevil	Beginning of flowering	100	F-015-110	3.6	M/H
Pests	Full flowering	100	F-015-110	3.6	H
Fungicide	Full flowering and until ceasing	100	F-015-110	3.6	H/VH
Herb. spraying, Couch grass + desiccation	2 weeks before harvest	100	F-02-110	2.1	H/VH

## Peas (yellow) - Tractor speed 8 km/h

Spray task	Growth Stage Feekes scale	Volume rate l/ha	Nozzle ISO	Pressure bar	Air setting
Herb. spraying	Pre-emergence	75	F-015-110	2.1	L
Pests (pea and bean weevil + thrips)	Post-emergence	100	F-02-110	2.1	L
Herb. spraying	2-5 cm high	100	F-02-110	2.1	M
Fungicide spraying (grey mould + leaf and stem pod spot and pea weevil)	Prior to flowering	100	F-02-110	2.1	M/H
Fungicide spraying (grey mould + pea weevil)	14 days later	100	F-02-110	2.1	H
Aphids spraying	At flowering until ceasing	100	F-02-110	2.1	M
Herb. spraying, Couch grass + desiccation by systemic herbicide	2-4 weeks before harvest	100	F-015-110	3.6	H
Withering by contact herbicide	2-4 weeks before harvest	150	F-02-110	4.6	H

## Rye - Tractor speed 8 km/h

Spray task	Growth Stage Feekes scale	Volume rate l/ha	Nozzle ISO	Pressure bar	Air setting
Herb. spraying, residual type	0	75	F-015-110	2.1	L
Herb. spraying, post-emergence	1-2	100	F-015-110	3.6	L/M*
Autumn fungicide	2-3	75	F-015-110	2.1	M
Herb. spraying, spring	4	75	F-015-110	2.1	M
Growth regulation	5-6	100	F-015-110	3.6	M
Fungicide, Eyespot	5-6	100	F-015-110	3.6	M/H
Fungicide, leaf disease	7-8	100	F-015-110	3.6	M/H
Growth regulation	8-9	75	F-015-110	2.1	M
Insecticide spraying	10-10.5	75	F-015-110	2.1	M
Herb. spraying,	At the latest				
Couch grass	10 days before harvest	75	F-015-110	2.1	M/H

## Spring Rape - Tractor speed 8 km/h

Spray task	Growth Stage Feekes scale	Volume rate l/ha	Nozzle ISO	Pressure bar	Air setting
Herb. spraying	Pre-drilling	75	F-015-110	2.1	L
Herb. spraying	Post-drilling	75	F-015-110	2.1	L
Pests	At emergence	75	F-015-110	2.1	L*
Herb. spraying broad-leaf-species	3-4 true leaves	100♦	F-02-110	2.1	L/M
Herb. spraying monocotyledonous species	4 true leaves	100	F-015-110	3.6	M
Pests; blossom beetle	1 beetle/plant when in bud	75	F-015-110	2.1	M
Pests; brassica pod midge and cabbage seed weevil	Beginning flowering	75	F-015-110	2.1	M/H
Pests; brassica pod midge and cabbage seed weevil	At full flowering	75	F-015-110	3.6	H
Fungicide	At end of flowering	100	F-015-110	3.6	H/VH
Herb. spraying, Couch grass + desiccation	2 weeks before harvest	100	F-015-110	3.6	H/VH

♦ If applying full dose rate Benasalox (Benazolin - ethyl + Clopyralid) and Bladex (Cyanazin) in a tank mix, use water rate 150 l/ha.

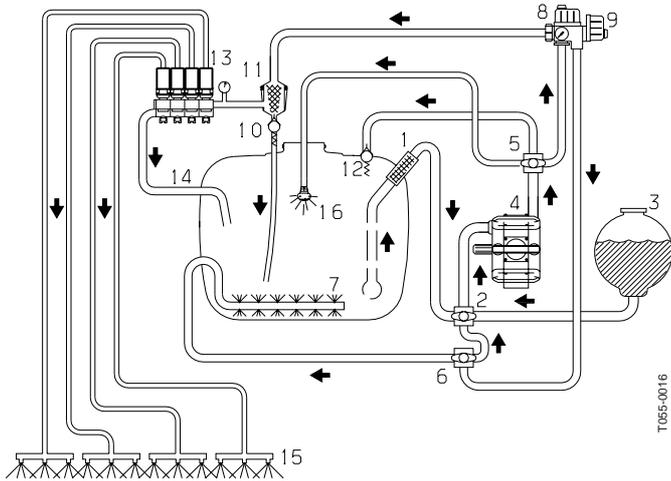
NOTE! All volume rates, pressures and air suggestions indicated in these tables are only guiding. Special conditions regarding climate, quality of the crop, spraying time and chemicals applied (burning) may partially change the procedure.

\* NOTE! If dust is deposited on leaves the air speed must be reduced.

## Use of rinsing tank and rinsing nozzles (if fitted)

The incorporated 260 l (57 Imp.gal) rinsing tank can be used for two different purposes.

**A. In-field diluting of remaining spray liquid residues in the spraying circuit for spraying the liquid in the field, before cleaning the sprayer.**



1. Empty the sprayer as much as possible. Turn the blue valve **6** towards pump and spray till air comes out of all nozzles.
2. Remove the tank filter basket.
3. Turn suction valve **2** towards rinsing tank.
4. Turn pressure valves **5** towards rinsing nozzle (if fitted).
5. Engage and set the pump at appr. 300 r.p.m.
6. When rinsing water corresponding to appr. 10 times the spray liquid residue (see paragraph "Technical Residue") is used, turn back suction valve towards suction from main tank and operate all valves, so all hoses and components are rinsed.
7. Turn pressure valve **5** back to EC operating unit and spray liquid in the field you have just sprayed.
8. Repeat point 3-7 until the rinsing tank is empty.

**B. Rinsing the pump, operating unit, spray lines, etc. in case of stop in spraying before main tank is empty (e.g. beginning rain etc.).**

1. Turn suction valve **2** towards rinsing tank.
2. Turn blue return valve **6** (if fitted) towards pump suction line.
3. Engage the pump and spray water from rinsing tank in the field until all nozzle tubes/nozzles are flushed with clean water.
4. Disengage pump again.



**WARNING!** The rinsing nozzles cannot always guarantee a 100% cleaning of the tank. Always clean manually with a brush afterwards, especially if crops sensitive to the chemical just sprayed are going to be sprayed afterwards!

## Technical Residue

Inevitably a quantity of spray liquid will remain in the system, which cannot be sprayed properly on the crop, as the pump takes in air when the tank is about to be empty.

This Technical Residue is defined as the remaining liquid qty. in the system as the first clear pressure drop on the pressure gauge is read.

	Residue, litre (Imp gal)			
	With Blue Return Valve		Without Blue Return Valve	
	2200/28000	3200/4200	2200/28000	3200/4200
Dilutable Residue*)	5-10 (1.1-2.2)	13-20 (2.9-4.4)	15-20 (3.3-4.4)	28-41 (6.2-9.0)
Total Residue**)	30-38 (6.6-8.4)	26-33 (5.7-7.3)	40-48 (8.8-10.6)	41-54 (9.0-11.9)

1 litre = 0.264 US Gal.

1 litre = 0.220 Imp Gal.

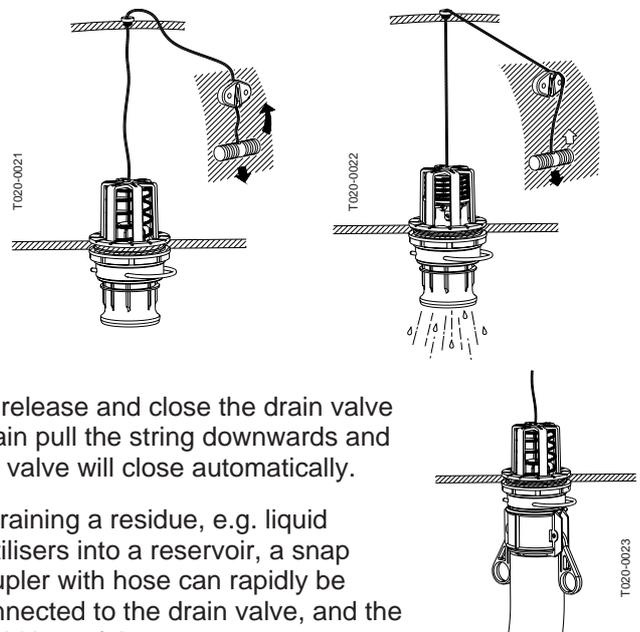
\*) Residue in main tank, possible to dilute with water from rinsing tank

\*\*\*) Total residue in tank and spraying circuit on standard sprayer. Variations due to different ground inclinations etc.

The dilutable residue must be diluted 10 times with clean water and sprayed to the crop just sprayed before cleaning the sprayer - See paragraph "Cleaning".

## Operation of the tank drain valve

Pull the string at left hand side of the tank to open the drain valve. The valve is spring-loaded but can be kept open by pulling the string out and upwards in the V-shaped slit.



To release and close the drain valve again pull the string downwards and the valve will close automatically.

If draining a residue, e.g. liquid fertilisers into a reservoir, a snap coupler with hose can rapidly be connected to the drain valve, and the liquid let safely out.

## Rinsing tank drain valve

To avoid algae developing in the rinsing tank always drain the rinsing tank when the sprayer is not in use for a long period.



## Maintenance

In order to derive full benefit from the sprayer for many years the following service and maintenance program should be followed.

**IMPORTANT!** Always read the individual paragraphs regarding service/maintenance jobs carefully through before starting on the job. If any portion remains unclear or require facilities which are not available, then for safety reasons please leave the job to your HARDI dealers workshop.



## Cleaning the sprayer

### Guidelines

Read the whole chemical label. Take note of any particular instructions regarding recommended protective clothing, deactivating agents, etc. Read the detergent and deactivating agent labels. If cleaning procedures are given, follow them closely.

Be familiar with local legislation regarding disposal of pesticides washings, mandatory decontamination methods, etc. Contact the appropriate body, e.g. Dept of Agriculture.

Pesticide washings can usually be sprayed out on a soakaway. This is an area of ground that is not used for cropping. You must avoid seepage or run-off of residues into streams, water courses, ditches, wells, springs, etc. The washings from the cleaning area must not enter sewers. Drainage must lead to an approved soakaway.

Cleaning starts with the calibration, as a well calibrated sprayer will ensure the minimal amount of remaining spray liquid.

It is good practice to clean the sprayer immediately after use thereby rendering the sprayer safe and ready for the next pesticide application. This also prolongs the life of the components.

It is sometimes necessary to leave spray liquid in the tank for short periods, e.g. overnight, or until the weather becomes suitable for spraying again. Unauthorised persons and animals must not have access to the sprayer under these circumstances.

If the product applied is corrosive, it is recommended to coat all metal parts of the sprayer before and after use with a suitable rust inhibitor.

Remember: Clean sprayers are safe sprayers.  
Clean sprayers are ready for action.  
Clean sprayers cannot be damaged by pesticides and their solvents.

## Cleaning

1. Dilute remaining spray liquid in the tank with at least 10 parts of water and spray the liquid out in the field you have just sprayed - See paragraph "Use of rinsing tank and rinsing nozzles". **NOTE:** It is advisable to increase the forward speed (double if possible) and reduce the pressure. For S4110 nozzles, pressure may be reduced to 1.5 bar (20 psi).

2. Select and use the appropriate protective clothing. Select detergent suitable for cleaning and suitable deactivating agents if necessary.
3. Rinse and clean sprayer and tractor externally. Use detergent if necessary.
4. Remove tank and suction filters and clean. Be careful not to damage the mesh. Replace suction filter top. Replace filters when the sprayer is completely clean.
5. With the pump running, rinse the inside of the tank. Remember the tank roof. Rinse and operate all components and any equipment that has been in contact with the chemical.  
Before opening the distribution valves and spraying the liquid out, decide whether this should be done in the field again or on the soakaway.
6. After spraying the liquid out, stop the pump and fill at least  $\frac{1}{5}$  of the tank with clean water. Note that some chemicals require the tank to be completely filled. Add appropriate detergent and/or deactivating agent, e.g. Washing soda or Triple ammonia.  
**NOTE:** If a cleaning procedure is given on the chemical label, follow it closely.
7. Start the pump and operate all controls enabling the liquid to come in contact with all the components. Leave the distribution valves until last. Some detergents and deactivating agents work best if left in the tank for a short period. Check the label.  
The Self-Cleaning Filter can be flushed by removing the by-pass hose from the bottom of the filter. Stop the pump and remove the hose. Start the pump for a few seconds to flush filter. Be careful not to lose the restrictor nozzle.
8. Drain the tank and let pump run dry. Rinse inside of tank, again letting the pump run dry.
9. Stop the pump. If the pesticides used have a tendency to block nozzles and filters, remove and clean them now. Check also for sediment on the pressure side of the safety valve for the Self-Cleaning Filter.
10. Replace all the filters and nozzles and store the sprayer. If, from previous experiences, it is noted that the solvents in the pesticide are particularly aggressive, store the sprayer with the tank lid open.  
**NOTE!** If the sprayer is cleaned with a high pressure cleaner lubrication of the entire machine is recommended.

## Cleaning and maintenance of filters

Clean filters ensure:

- Sprayer components such as valves, diaphragms and operating unit are not hindered or damaged during operation.
- Nozzle blockages do not occur whilst spraying.
- Long life of the pump. A blocked suction filter will result in pump cavitation.

The main filter protecting sprayer components is the suction filter at the top of the tank. Check it regularly.



## Lubrication

Recommended lubrication is shown in following tables. Following lubricants are to be used:

Lubricating point	Lubricant
Ball bearings 	<b>A</b> Universal Lithium grease, NLGI No. 2 SHELL RETINAX A CASTROL LM GREASE
Slide bearings 	<b>B</b> Lithium Grease with Molybdenumdisulphide and Graphite SHELL SAS 4000 CASTROL MOLYMAX
Oil lub. points 	<b>C</b> Engine oil

Hydrostatic fan transmission

Hydraulic oil type ISO HV 68  
SHELL TELLUS T 68 \*)  
CASTROL HYPIN AWH 68  
TEXACO RANDO OIL 68

Gear box

Engine or universal oil SAE 15W40

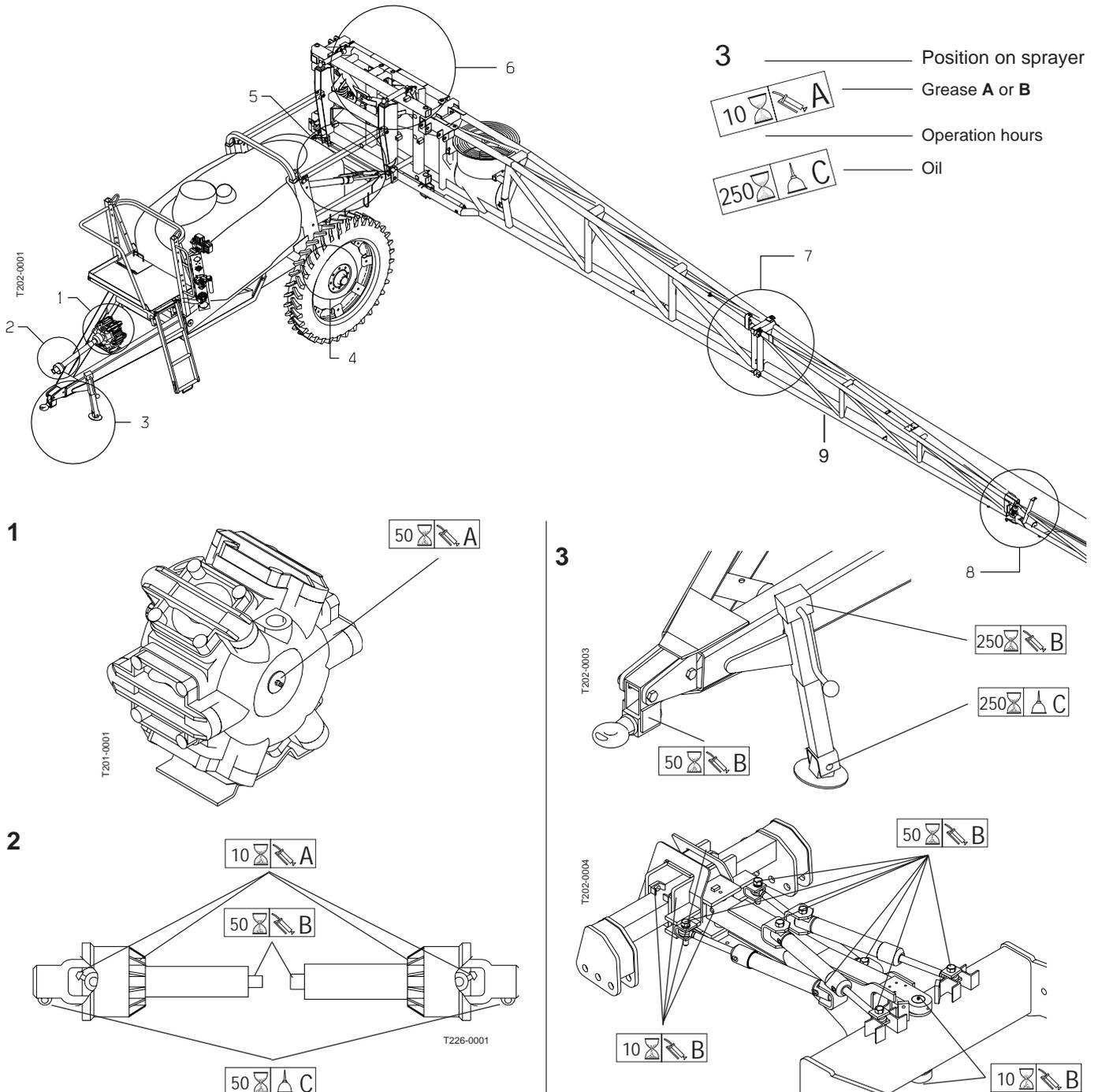
\*) This quality is filled in the factory

Always store lubricants clean dry and cool - preferably at constant temperature - to avoid contamination from dirt and condensed water.

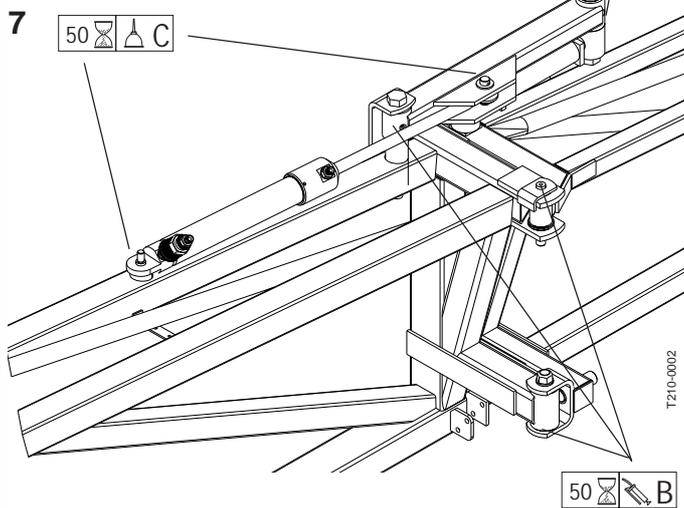
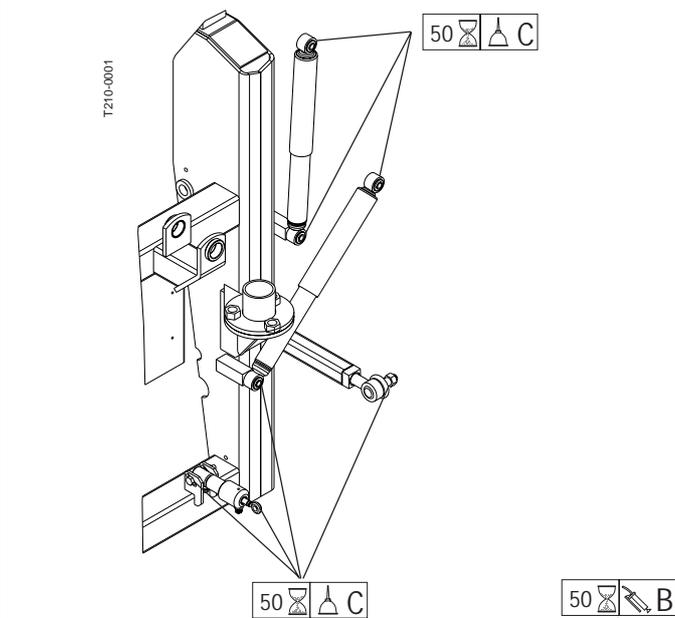
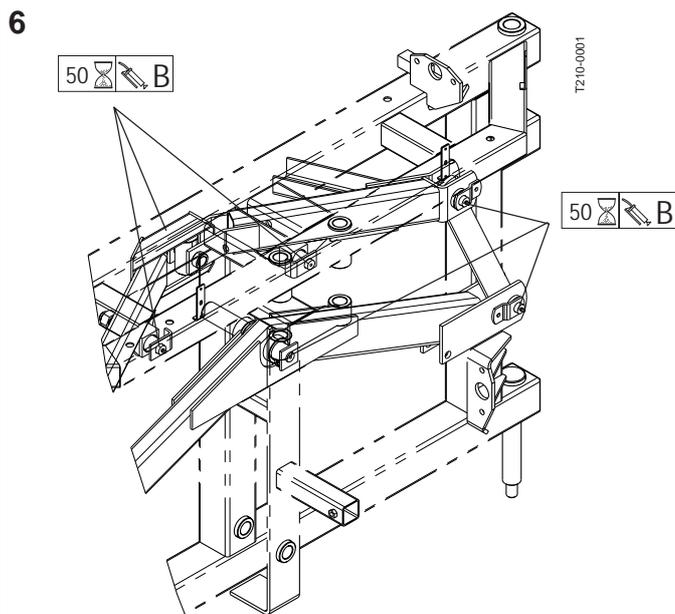
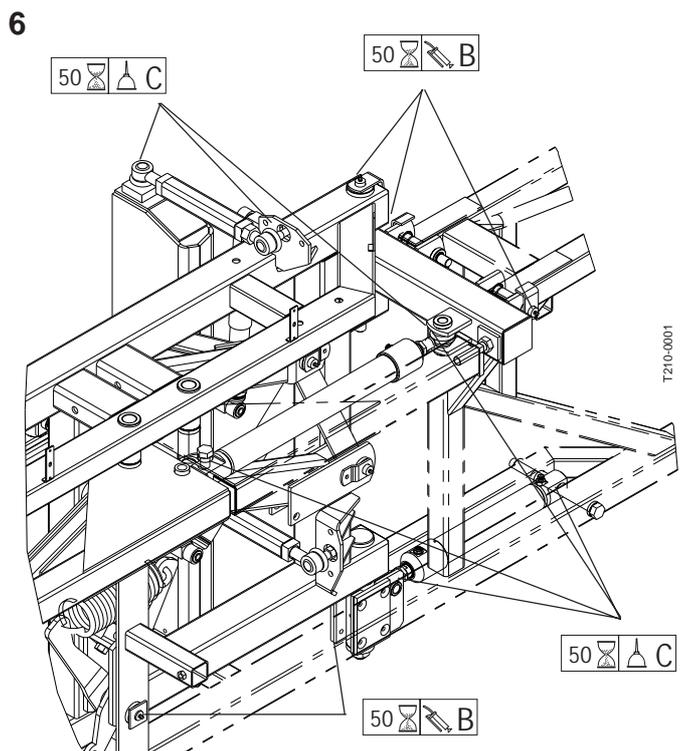
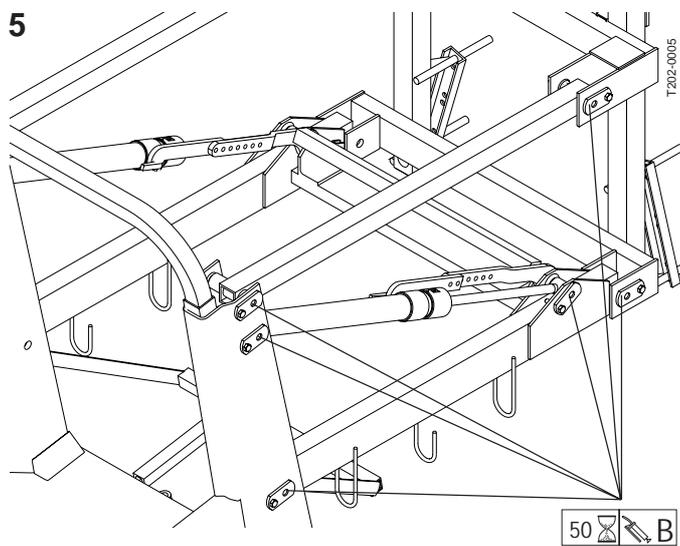
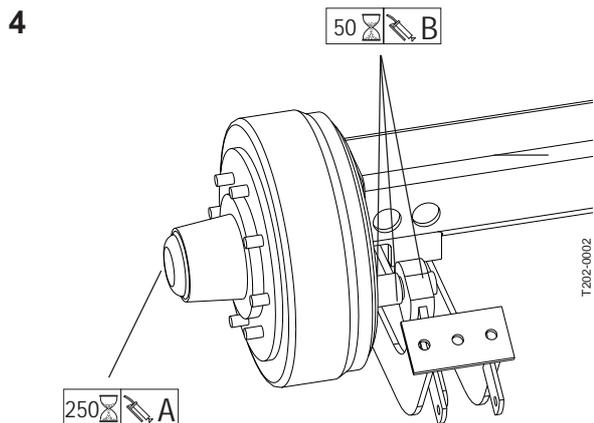
Keep oil filling jugs, hoppers and grease guns clean, and clean the lubricating points thoroughly before lubricating.

Avoid skin contact with oil products for longer periods.

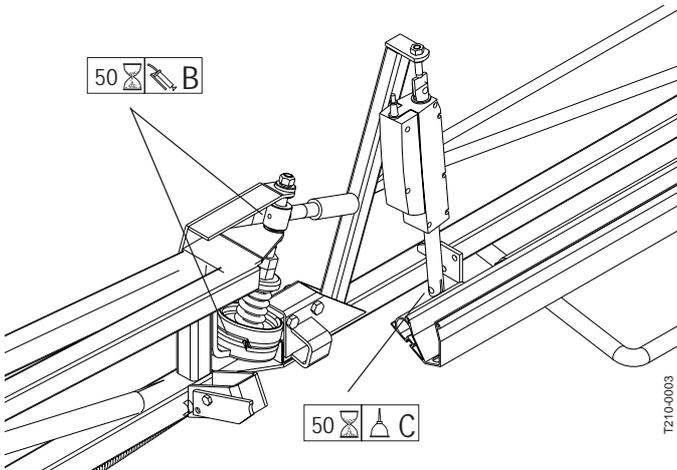
**NOTE!** If the sprayer is cleaned with a high pressure cleaner or fertiliser has been used, it is recommended lubrication of all sections.



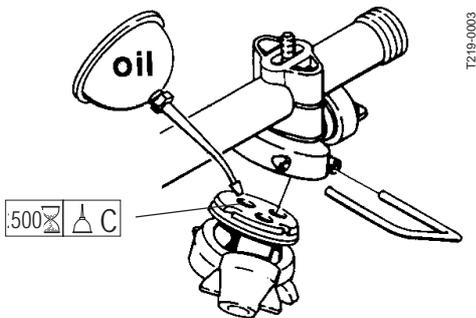
# COMMANDER-TWIN FORCE



8



9



## SERVICE AND MAINTENANCE CHARTS

Service and Maintenance intervals for HARDI COMMANDER:

### 10 hours or daily (whichever comes first)

1. Suction filter, clean
2. Self-Cleaning filter, check and clean gauze if necessary.
3. In-Line filters, clean
4. Nozzle filters, clean
5. Spraying circuit, check for leaks
6. Brakes air tank, drain water
7. Brakes, check function (hydraulic and air brakes)
8. Hydraulic oil level
9. Gear box oil level

### 50 hours or weekly (whichever comes first)

Do all previous mentioned +

1. Wheel bolts and nuts, retighten
2. Drawbar bolts, retighten
3. Air brakes, check circuit for leaks
4. Expansion bottle, check air pressure (SELF-TRACK)
5. Tyres, check tyre pressure
6. Transmission shaft, check condition of protection guards
7. Lubricate according to scheme
8. Gear box bolts, retighten

### 250 hours or monthly (whichever comes first)

Do all previous mentioned +

1. Wheel bearings, check and adjust if necessary
2. Brakes, check adjustment
3. Parking brake cables, check for wear/damages
4. Air brake filters, clean
5. Hydraulic brakes, check for leaks
6. Hydraulic circuit, check for leaks
7. Expansion bottle, check oil level (SELF TRACK)
8. Safety valve, check adjustment (MULTI TRACK)
9. Hoses and tubes, check for damages and proper attachment

### 500 hours or twice a year (whichever comes first)

1. Hydraulic oil filter, renew

### 1000 hours or yearly (whichever comes first)

Do all previous mentioned +

1. Wheel bearings and brakes, dismantle, check, grease and adjust \*)
2. Transmission shaft, renew protection guard bearings
3. Hydraulic oil change
4. Gear box oil change
5. Hydraulic tank air filter

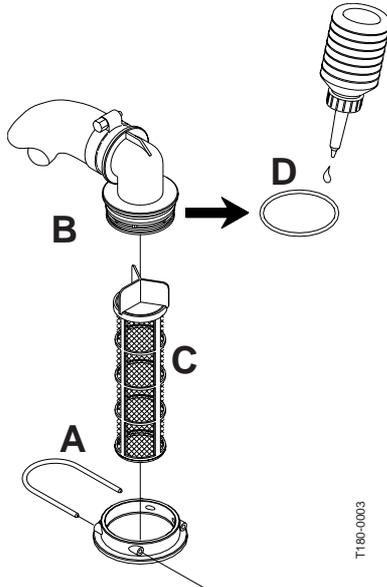
\*) If brakes are used intensively the interval is reduced to 500 hours or twice a year (whichever comes first).

## 10 hours service

### 1. Suction filter

To service the suction filter:

1. Pull the steel clip **A** out.
2. Lift the suction hose fitting **B** from housing.
3. Filter guide and filter **C** can now be removed.



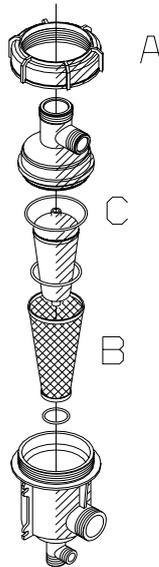
To reassemble:

4. Press the guide onto filter end.
5. Place the filter into housing with guide facing up.
6. Ensure the O-ring **D** on the hose fitting is in good condition and lubricated.
7. Refit the suction hose **B** and steel clip **A**.

T180-0003

### 2. Self-Cleaning Filter

1. Unscrew nut **A** and open filter.
2. Check filter gauze **B**, clean if necessary
3. Lubricate O-ring **C**
4. Assemble filter again.

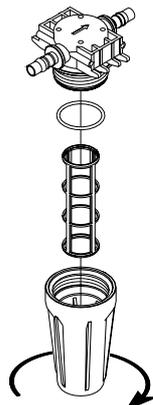


T180-0004

### 3. In-Line filter (if fitted)

If the boom is equipped with In-Line Filters unscrew the filter bowl to inspect and clean the filter.

Alternative filters are available. See section on Technical specifications - Filters and nozzles.



T180-0005

### 4. Nozzle filters

Check and clean.



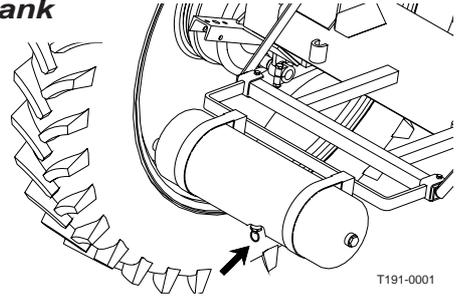
T180-0006

### 5. Spraying circuit

Fill with clean water, operate all functions and check for leaks, use higher spray pressure than normal. Check nozzle spray patterns visually using clean water.

### 6. Brakes Air tank

Drain the air tank for condensed water at the drain valve.



T191-0001

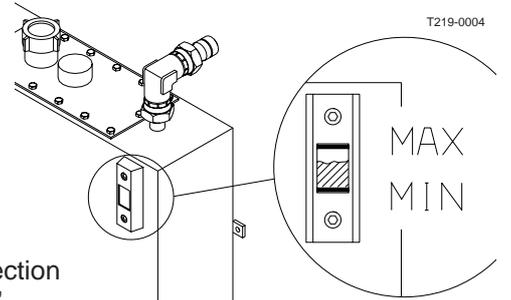
### 7. Brakes

Apply brake pedal and check function of trailer brakes.

### 8. Hydraulic oil level

Check that the oil level is between min. and max. on the sight glass.

Clean the area around the filling cap carefully and add fresh, clean oil if the level is low. Regarding oil quality - see section on "Lubricants".

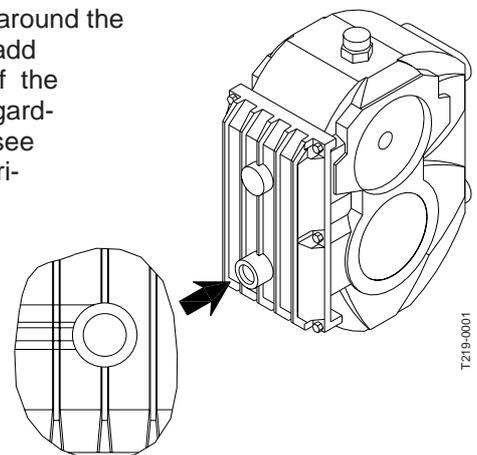


T219-0004

### 9. Gear box oil level

Check the gear box oil level is reaching the sight glass.

Clean the area around the filling plug and add fresh, clean oil if the level is low. Regarding oil quality - see paragraph "Lubricants"



T219-0001

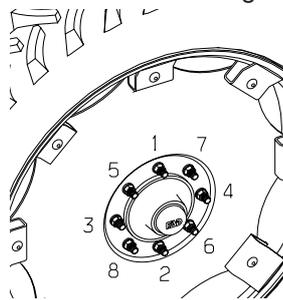
## 50 hours service

### 1. Wheel bolts and nuts

Tighten wheel bolts and nuts as follows with following torque wrench settings:

- Wheel hub to rim plate:  
490 Nm (362 lbft)
- Rim plate to rim:  
280 + 30 Nm  
(207 + 22 lbft)

Tightening sequence:

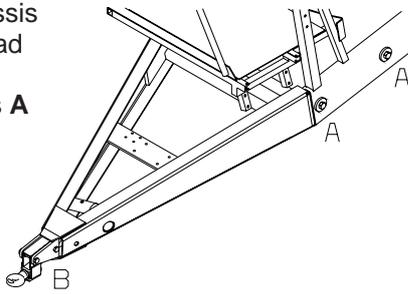


T191-0002

### 2. Draw bar bolts

The draw bar bolts must be tightened as follows:

1. Jack up the chassis so there is no load on the drawbar
2. Tighten the bolts **A** between tank frame and draw bar.  
Torque wrench setting: 750 Nm (554 lbft)
3. Tighten bolts **B** at the towing eye.  
Torque wrench setting: 220 Nm (162 lbft)



T191-0003

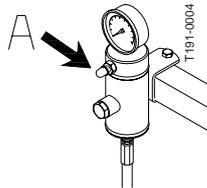
### 3. Air brakes

The air brakes are checked for leaks by following procedure:

1. Connect the snap-couplers to the tractor and fill the trailer air tanks.
2. Check for leaks with brakes released.
3. Apply the brake up to full pressure.
4. Check for leaks with brakes applied.

### 4. Expansion bottle (SELF TRACK only)

Check air pressure in the expansion tank for the hydraulic damping at the pressure gauge. Fill through valve **A** if necessary.



T191-0004

Air pressure: 5 bar (73 p.s.i.)

### 5. Tyre pressure

Check the tyre pressure to be according to the table below.

Tyre size	Recommended inflation pressure kPa (p.s.i.)	Minimum Load Index A8 / A2
230/95R44 (9.5x44)	400 (58)	134/145
230/95R48 (9.5x48)	380 (55)	136/147
270/95R44 (11.2x44)	320 (46)	140/151
270/95R48 (11.2x48)	300 (44)	142/153
300/95R46 (12.4x46)	240 (35)	145/156
18.4R38	200(30)	146/----

**IMPORTANT!** If renewing tyres always use tyres with min. load index as specified in the table.



**WARNING!** Never inflate tyres more than to the pressure specified in the table. Over-inflated tyres can explode and cause severe personal injuries! See paragraph "Tyre safety".

### 6. Transmission shaft

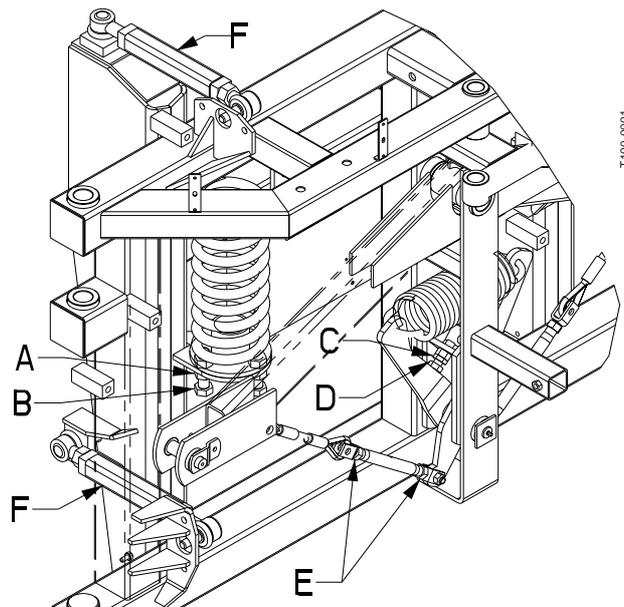
Check function and condition of the transmission shafts protection guards. Replace possible damaged parts instantly.

### 7. Boom readjustment

1. Park the sprayer on a level surface
2. Unfold the boom completely
3. Lower tilt rams completely
4. Set the slanting control midway (piston rod length is 60 mm)

Following adjustments can now be carried out:

#### Boom center section



T100-0001

#### Suspension spring tension

1. Loosen the counter nuts **A** in either side and adjust the tension of the vertical springs on the bolts **B** to suit the boom weight. The adjustment is correct when the guide rods are approximately level.
2. Tighten the counter nuts again.

#### Pendulum return spring and cables

1. Ensure that the slanting ram is set midway
2. Loosen the counter nuts **C** and adjust the stop screws **D** until the V-shaped mechanism is in symmetry.
3. Allow max. 1 mm play between stop screw and arm.
4. Loosen the counter nuts **E** on the rigging screws, and adjust the length of the rigging screws until the boom is level. The correct adjustment is reached when the spring opens 1 mm between the threads
5. Tighten the counter nuts again.

## Guide rods length adjustment

The guide rods length should normally not be necessary to adjust. If the suspension has been dismantled, the length must be checked or adjusted if necessary.

The trapeze and pendulum must hang freely. Adjust the length of the rods **F** accordingly.

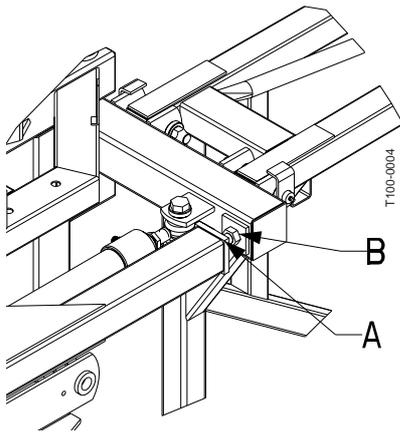
Loosen the counter nuts and adjust the rods.

## Inner section folding adjustment

The boom tip must point slightly forward.

If necessary adjust the inner section folding as follows:

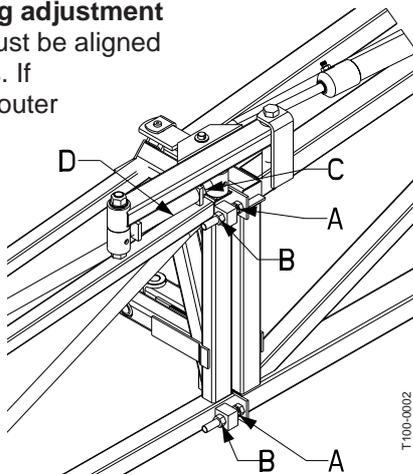
1. Depressurize the folding rams
2. Loosen counter nut **A**
3. Adjust stop screw **B** until the correct setting is reached.
4. Tighten counter nuts again



## Outer section folding adjustment

The outer sections must be aligned with the innersections. If necessary adjust the outer sections as follows:

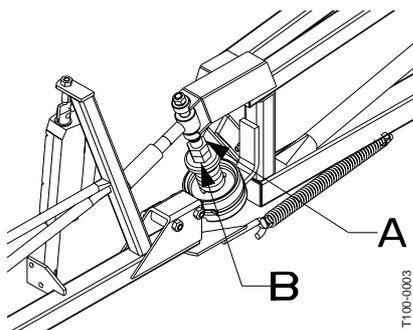
1. Depressurize the folding rams
2. Loosen counter nuts **A** and **C**.
3. Loosen the screws **B**.
4. Adjust on the rigging screw **D** until the correct setting is reached.
5. Adjust the stop screws **B** up against the inner section.
6. Tighten counter nuts again



## Break-away section adjustment

The break-away section must release when a force of approximately 150 N (34 lb) is applied to the extremity of the break-away section. If necessary the release force is adjusted as follows:

1. Make sure the claw coupling is correctly lubricated.

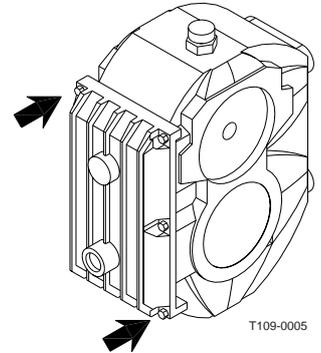


2. Loosen the counter nut **A**
3. Adjust the nut **B** until the break-away will release at a force of 150 N (34 lb) applied at the extremity of the section.
4. Tighten the counter nut again.

## 9. Gear box bolts

Check/Retighten the gear box housing bolts to the specified torque.

70 Nm (51 lbft)

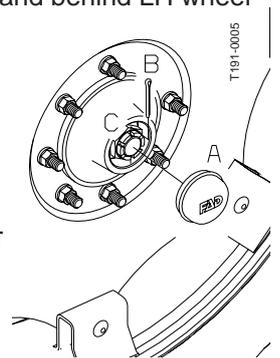


## 250 hours service

### 1. Wheel bearings

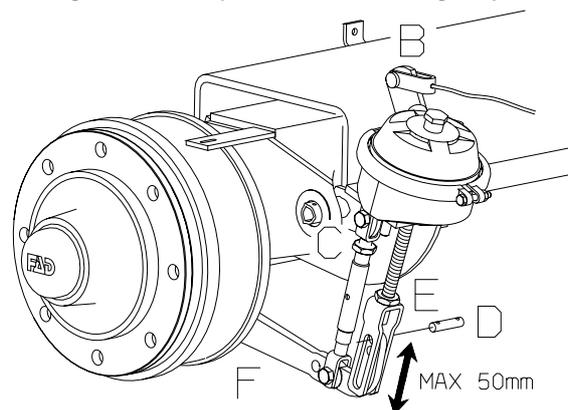
Check for play in the wheel bearings:

1. Place stop wedges in front of and behind LH wheel and jack up RH wheel
2. Rock the RH wheel to discover possible play in the bearings.
3. If any play, support the wheel axle to prevent trailer from falling down from the jack.
4. Remove hub cap **A** and cotter pin **B**. Turn the wheel and tighten the castelated nut **C** until a slight resistance in the wheel rotation is felt.
5. Loosen the castelated nut until the first notch - horizontal or vertical - is aligned with the cotter pin hole in the shaft.
6. Fit a new cotter pin and bend it.
7. Fill the hub cap with fresh grease and press it on to the hub again.
8. Repeat the procedure on LH wheel.

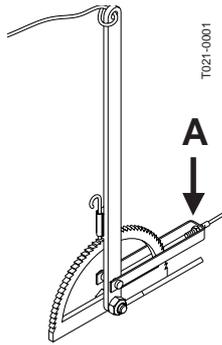


### 2. Brake adjustments

The parking brake is adjusted the following way:



1. Place stop wedges in front of and behind the LH wheel and lift the RH wheel from the ground.
2. Loosen the handbrake adjusting mechanism **A** allowing the arm **B** to rest against the axle.
3. Loosen the counter nut **C** and shorten the rigging screw until the brake is locked.
4. Loosen the rigging screw again until the wheel is just turning freely again and tighten the counter nut again.
5. Repeat on LH wheel.
6. The handbrake adjusting mechanism must be shortened until the activating arm **B** starts to move when the 2nd ratchet on the hand brake lever mechanism is reached.
7. If either hydraulic or air brakes is fitted, the stroke of the rams or brake chamber rods must be adjusted subsequently.
8. If the stroke of the air brake chamber rod or hydraulic ram rod are exceeding 50 mm (2.0 in) the brakes must be adjusted.
9. Remove the clevis pin **D** and adjust by turning the clevis **E**.  
Fit clevis pin again and secure with cotterpin.  
**NOTE!** If the stroke cannot be adjusted to max. 25 mm (1.0 in) the lever **F** must be repositioned on the splines of the actuating shaft. This requires full readjustment of the parking brake again.
10. Check that the two rods are travelling the same length from disengaged to engaged position. If not, adjust again.
11. Make a brake test on a hard, even surface to see if both wheels are braking equally. If not, fine adjust till even braking is obtained.

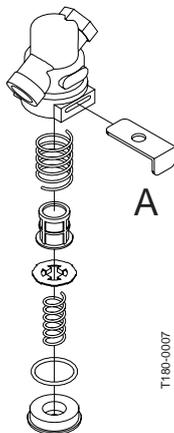


### 3. Parking brake cables

Inspect the parking brake cables for possible wear or damages. Replace worn or damaged parts.

### 4. Air brake filters (if fitted)

1. Clean the area around air filter(s) and disconnect air hose from the tractor.
2. Hold one hand under the filter housing, and pull out the retainer clip **A**. The filter cartridge assembly will be pushed out by the springs inside the filter housing.
3. Clean the filter cartridge. Use water and an appropriate detergent or compressed air.
4. Dry the parts and reinstall in the order shown. The O-ring should be lightly lubricated with silicone grease before installation.



### 5. Hydraulic brakes

Apply brakes to full pressure and inspect brake lines for damages or leaks. Replace damaged parts.

**IMPORTANT!** If the hydraulic brake lines have been dismantled the circuit must be primed afterwards:

1. loosen brake hose at both brake cylinders.
2. Apply brake until oil without air bubbles come out.
3. Tighten brake hose before relieving the brake again.

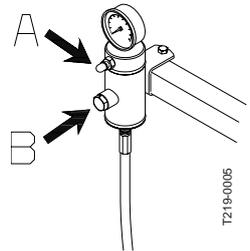
### 6. Hydraulic circuit

Check the hydraulic circuit for leaks and repair if any.

### 7. Expansion bottle (SELF TRACK only)

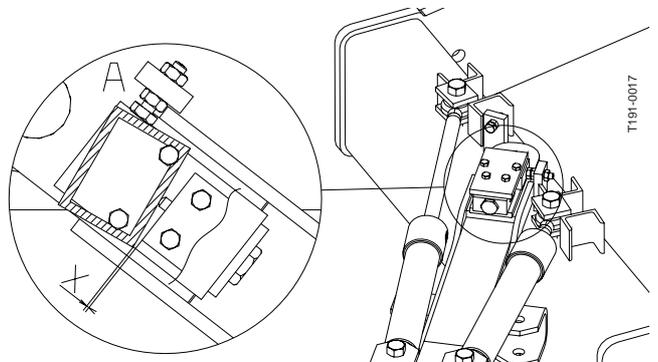
Check the oil level:

1. Depressurize the expansion bottle through valve **A** first.
2. Remove the level plug **B** and check that the oil level is reaching the level hole. Add if the level is low.
3. Tighten the plug again and inflate the bottle to 5 bar (73 p.s.i.) air pressure.



### 8. Safety valve (MULTI TRACK only)

The safety valve must open to allow the yoke to turn if the rear hydraulic rams are fully extended/retracted. The clearance between valve and activating mechanism must be checked and adjusted if necessary.



1. Articulate the drawbar fully to one side.
2. Check the clearance **X** with a feeler gauge, adjust the screw **A** till the clearance is 2 mm  $\pm$  0.1 mm (0.0787 in  $\pm$  0.00039 in). Tighten the counter nut.
3. Articulate the drawbar fully to the other side and repeat point 2.

### 9. Hoses and tubes

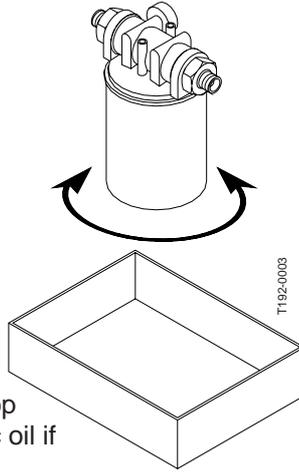
Check all hoses and tubes for possible damages and proper attachment. Renew damaged hoses or tubes.

## 500 hours service

### 1. Hydraulic oil filter

Change the hydraulic oil filter after the **first 50 hours** and then every 500 hours or once a year - whichever comes first. Always change the oil filter if the vacuummeter indicator is in the red area. Check when the oil has reached working temperature.

1. Place a drain pan under the filter to retain waste oil and unscrew the filter cartridge CCW.
2. The new filter cartridge is filled with fresh **clean** hydraulic oil. Apply a thin oil film to the cartridge seal.
3. Screw the filter cartridge on CW until the seal is lying against the flange.
4. Tighten the filter cartridge another 1/2 to 3/4 turn.
5. Check hydraulic oil level - top up with fresh clean hydraulic oil if necessary.
6. Set the blower in neutral, start the tractor P.T.O. and let it run idle for 5 min. to prime the system.
7. After 5 min. the blower r.p.m. can gradually be increased to full speed.



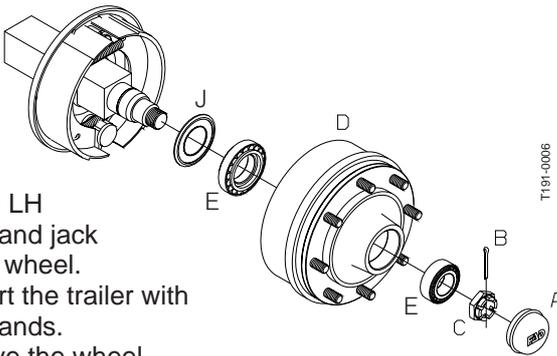
Disposal of used hydraulic filter cartridges must only take place in accordance with local legislation.

## 1000 hours service

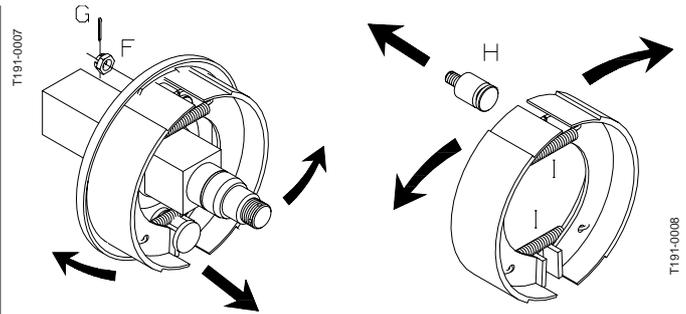
### 1. Wheel bearings and brakes

Check the condition of the bearings and brake wear parts the following way:

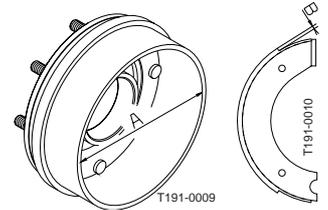
1. Place stop wedges in front of and behind LH wheel and jack up RH wheel.
2. Support the trailer with axle stands.
3. Remove the wheel.
4. Remove the hub cap **A**, cotter pin **B** and castle nut **C**.
5. Pull off the wheel hub and brake drum assembly. Use a wheel puller if necessary.
6. Vacuum clean the brake drum **D** for brake dust or rinse with water.



**WARNING!** Brake dust can cause severe health injuries! Avoid inhalation of brake dust! Use respirator when servicing the brakes. Do not clean brakes with compressed air! Use vacuum cleaner or rinse with water to avoid brake dust being blown around.



7. Rinse the remaining parts on the brake carrier plate with water and dry them.
8. Remove roller bearings **E**, clean all parts in degreasing detergent and dry them.
9. Check the brake drum diameter and lining thickness - renew if worn.



Max. Wear rates on brake components, mm (in)

Model	2200/2800	3200/4200
Max. drum diameter <b>A</b>	302 (11.8897)	402 (15.8388)
Min. lining thickness <b>B</b>	2.0 (0.07874)	4.0 (0.15748)

**IMPORTANT!** The specified min. thickness is the absolute minimum which must never be exceeded. Renew the parts if they would reach the above dimensions before next service inspection.

**IMPORTANT!** Renewal of brake linings or brake drums must be done both sides at the same time.

**NOTE!** If the brake drum must be removed from the hub, a hydraulic press is required to press the wheel studs out.

10. Remove the clevis pin between the air diaphragm cylinder and brake cam lever.
11. Remove the cotterpin **G** and nut **F**, the brake shoe anchor bolt **H** and slide the brake shoes over the cam. Twist the pair of brake shoes to remove the shoe return springs **I**. Replace brake shoes if the linings are worn.
12. Apply a small qty. of copper paste on moving parts and assemble the brake shoes and shoe return springs again.



**WARNING!** Do not get oil, grease or copper paste in contact with the brake linings and drums.

13. Fit the shoe assembly with the anchor bolt first. Then pull the shoes away from each other and slide them over the cam afterwards. Tighten the anchor bolt castelated nut again and fit a new cotter pin.
14. Check roller bearings for discoloration and wear - renew if worn or damaged.
15. Assemble the hub and bearings using a new sealing ring **J**.

16. Fill the hub and bearings with fresh grease before fitting it to the shaft.
17. Fit the castelated nut. Rotate the hub and tighten the castelated nut until a slight rotation resistance is felt.
18. Loosen the castelated nut again until the first notch is aligned with the cotter pin hole in the shaft.

**NOTE!** The shaft has a vertical and an horizontal cotter pin hole. Use the one first aligned with the notch when loosening the castelated nut.

19. Fit a new cotter pin and bend it.
20. Fill the hub cap with fresh grease and carefully press it on to the hub.
21. Adjust the brakes as described in "200 hours service".
22. Fit the wheel again and tighten the wheel nuts. See section "50 hours service" regarding torque wrench setting.  
Tighten all bolts to half the specified torque first, then to the full specified torque.
23. Tighten again after 10 hours of work. Check the torque every day until it is stabilised.



**WARNING!** If you do not feel totally confident changing wheel bearings or brake shoes contact your HARDI dealers workshop.

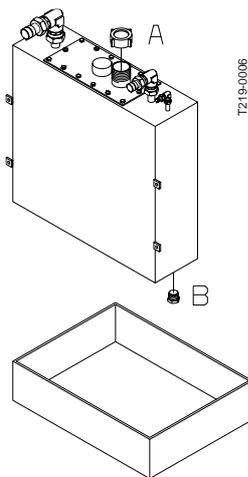
## 2. Transmission shaft

Change the protection tube nylon bearings as described under "Replacement of transmission shaft protection tubes".

## 3. Hydraulic oil change

The hydraulic oil is changed every 1000 hours or once a year - whichever comes first. The hydraulic oil change is best done when the fan has been working for at least one hour so the oil has reached working temperature.

1. Clean the area around the oil filling cap **A** and the drain plug **B**. Unscrew the filling cap and drain plug, and drain the oil into an appropriate container.
2. When the oil is drained, fit and tighten the drain plug again.
3. Fill the tank with fresh, **clean** hydraulic oil until the level is between min. and max. on the level glass. The tank contains approx. 32 l (7.2 Imp.gal.) (8.5 US.gal.). Regarding oil specification - see section on "Lubricants"
4. Fit the filling cap again.  
Note local legislation regarding disposal of waste oil.

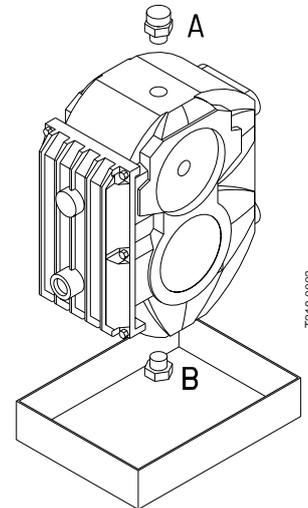


T219-0006

## 4. Gear box oil change

The first gear box oil change must be done after 50 hours, then every 1000 hours or once a year - whichever comes first. The gear box oil change is best done when the machine has been working for at least one hour and the oil has reached working temperature.

1. Clean the area around filling plug/breather **A**, dip stick **B** and drain plug **C** thoroughly. (15 m and 16 m HAB has a sight glass - do not remove this).
2. Place a tray under the drain plug to retain the waste oil.
3. Unscrew the filling and drain plugs and drain the gear box oil.
4. Refit the drain plug using a new seal - retighten.
5. Fill with fresh, clean oil until the level reaches the sight glass.  
Approx. oil quantity: 1.0 l (35.2 fl.oz.)  
Regarding oil quality, see section on "Lubricants"
6. Refit the dip stick and filling plug - retighten.



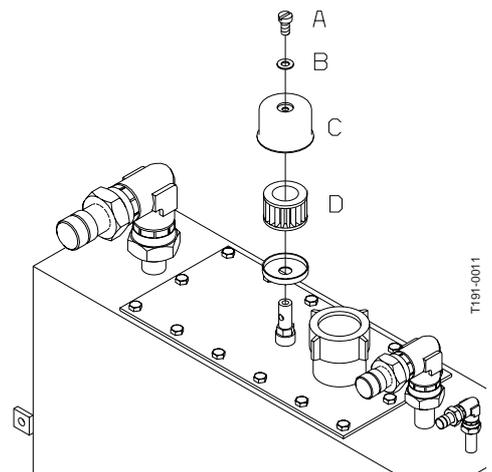
T219-0002

Disposal of waste oil must only be carried out in accordance with local legislation.

## 5. Hydraulic tank air filter

Change the hydraulic tank breathing filter.

1. Clean the area around the air filter thoroughly.
2. Remove screw **A**, washer **B** and cap **C**.
3. Renew the filter cartridge **D**.
4. Reassemble in reverse order.

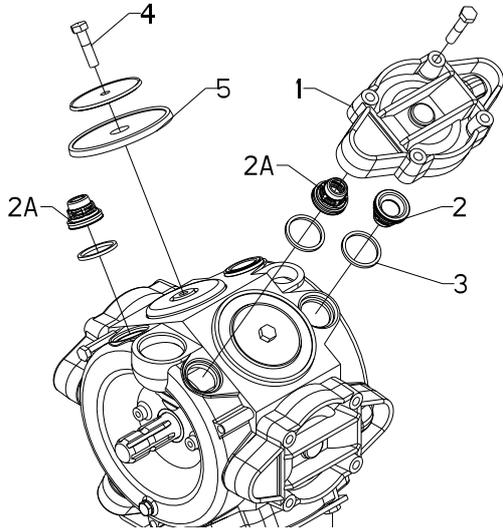


T191-0011

## Occasional maintenance

The maintenance and renewal intervals for the next points will depend very much on the conditions under which the sprayer will operate, and are therefore impossible to specify.

### Pump valves and diaphragms renewal



T261-0001

Diaphragm pump overhaul kits (valves, seals, diaphragms etc.)

Pump model	HARDI part No.
361	750323
363	750342
462	750324
463	750343

### Valves

Remove valve cover **1**. Before changing the valves **2** note their orientation so they are replaced correctly. **NOTE:** One special valve with white flap **2A** is used. It has to be placed in the valve opening shown. It is recommended to use new gaskets **3** when changing or checking the valves.

### Diaphragms

Remove the diaphragm cover **4**. The diaphragm **5** may then be changed. If fluids have reached the crankcase, re-grease the pump thoroughly. Check also the drain hole at the bottom of the pump is not blocked. Reassemble with the following torque setting.

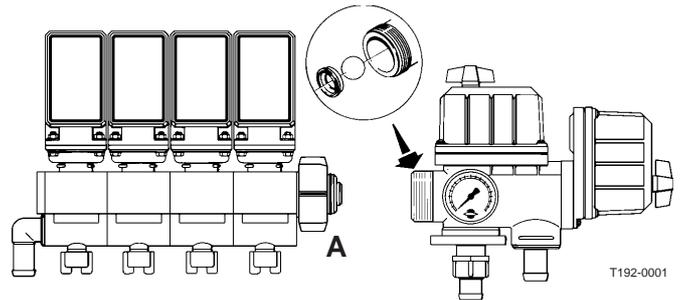
Pump Model	Diaphragm cover Nm	Diaphragm bolt Nm
363	90	90
463	90	90

1 Nm = 0.74 lbft

### Ball seat check/renewal, EC on/off valve

If the main ON/OFF valve does not seal properly (dripping nozzles when main ON/OFF valve is closed), the ball and seat should be checked.

Remove the 2 bolts fixing the main ON/OFF-pressure valve unit to the bracket, unscrew the union nut **A** and pull the valve away from the distribution valves.



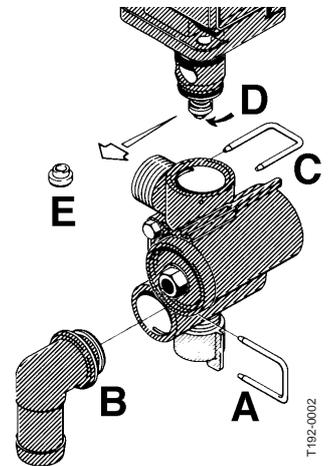
T192-0001

Check the ball for sharp edges and scratches, and check the ball seat for cracks and wear - replace if necessary.

### Cone check/renewal, EC distribution valve

Periodically check the distribution valves for proper sealing. Do this by running the sprayer with clean water and open on/off valve and all distribution valves.

Cautiously remove the clip **A** and pull out the hose **B** for the pressure equalisation device. When the housing is drained, there should be no liquid flow through the pressure equalisation device. If there is any leakage, the valve cone **E** must be changed.

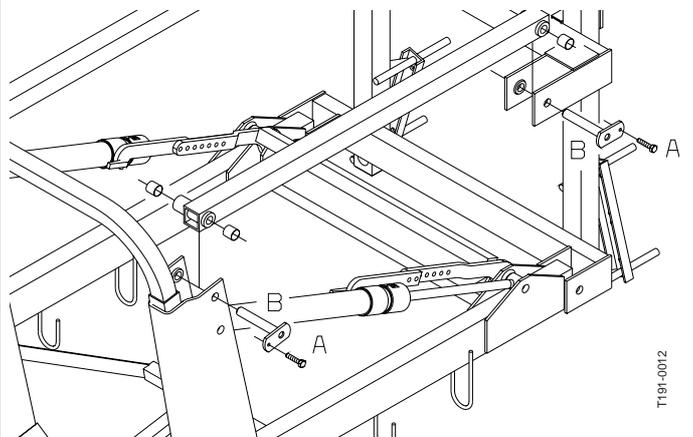


T192-0002

Remove the clip **C** and lift the EC-motor housing off the valve housing. Then unscrew the screw **D** and replace the valve cone **E**. Reassemble in reverse order.

### Wear bush renewal, boom lift

The wear bushes are inspected and renewed before they are worn through.



T191-0012

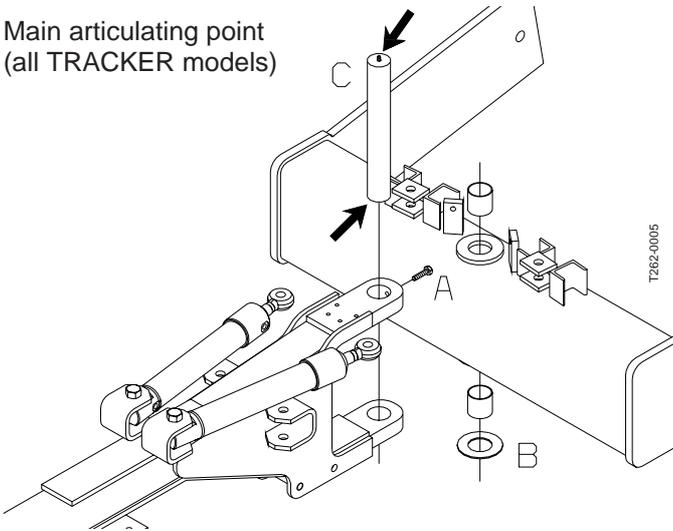
1. Connect the trailer to a tractor and unfold the booms to working position.
2. Lift the boom centre frame with a lifting device and support it until the load is taken off the parallelogram arms.

3. Remove the screws **A**, and pull out the pins **B** at one of the upper parallelogram arms and renew the wear bushes.
4. Refit the arm.
5. Repeat this on the other upper arm.
6. The lower arms must be disconnected simultaneously.  
Grease all grease nipples.
7. Remove the lifting gear again.

### Wear bush renewal, drawbar (TRACKER models only)

If too much play in the drawbar is found the wear bushes must be renewed.

Main articulating point  
(all TRACKER models)

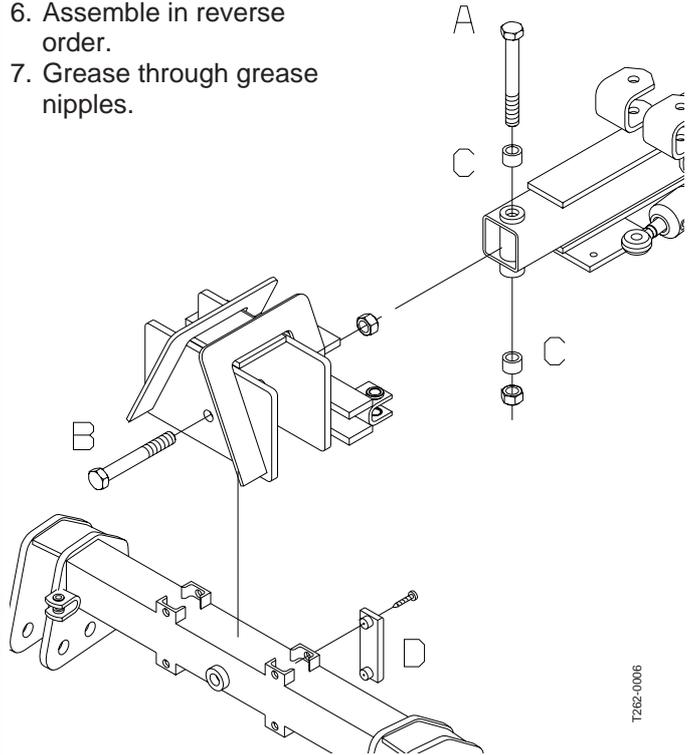


1. Place stop wedges in front of and behind both wheels.
2. Jack up the frame and support it properly.
3. Without dismantling the hydraulic system the rear hydraulic rams are removed from the drawbar.
4. Support the drawbar and remove the screw **A**, washer **B** and the pin **C**.
5. Move the drawbar sideways and support it.
6. Press out the worn bushes and fit new ones.
7. Assemble again in reverse order.
8. Grease through grease nipples and remove jack and wedges.
9. Place the sprayer on the support leg

### Front articulating points (SELF and MULTI TRACK only)

1. Disconnect the sprayer from the tractor.
2. Without dismantling the hydraulic system remove the front rods or hydraulic rams from the cardan joint.
3. Dismantle by removing the bolts **A** and **B** and press out the bushes **C**.
4. Fit new bushes. Ensure that the bushes are situated at each end of the pin hole.
5. Replace the wear pads **D** if worn. Max. clearance between wear pads and yoke is 1 mm (0.03937 in). Check with feeler gauge and add 1 mm shims if clearance is over 1 mm.

6. Assemble in reverse order.
7. Grease through grease nipples.



8. On SELF TRACK the support rods must be extended as much as possible so they are pressing against the yoke.

### Priming the hydraulic damping system (TRACKER only)

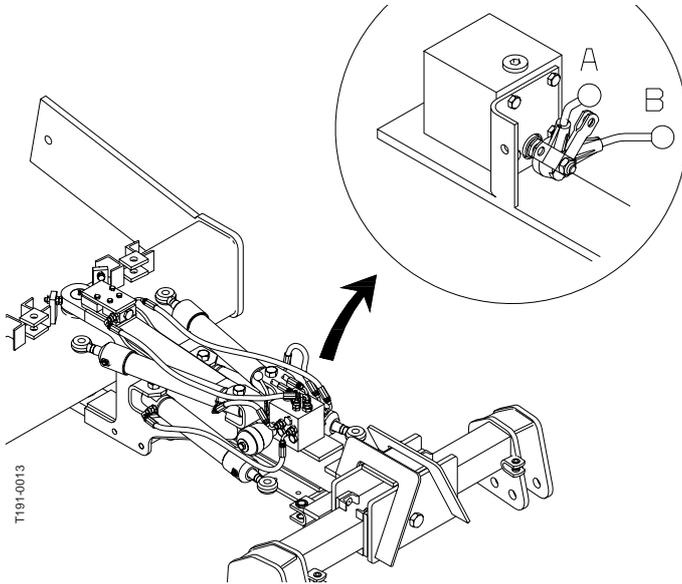
If the hydraulic damping system has been dismantled the system needs to be refilled and primed again.

#### SELF TRACK

1. Depressurize the expansion bottle, remove the hydraulic hose and connect it to an oil pump.
2. Disconnect the hydraulic ram piston rods and loosen the hose fittings at each ram. Retain waste oil in an appropriate container.
3. Retract both rams fully to remove all air from the rams.
4. With the rams fully retracted, pump clean oil through the hydraulic system until all air is out.
5. Tighten the hose fittings again.
6. Pump oil till the rams extend again. Connect the piston rods again.
7. Disconnect the hose from the pump and connect it to the expansion bottle again.
8. Fill with clean oil until it reaches the level hole again. Fit the plug.
9. Inflate the expansion tank to 5 bar (78 p.s.i.) and fit the dust cap again.
10. When the TRACKER is connected to the tractor the hydraulic ram piston rods are allowed to move max. 5 mm (0.19685 in) when the sprayer is pushed hard by hand from side to side. If more than 5 mm repeat the priming procedure again.

## MULTI TRACK

1. The sprayer shall be disconnected from the tractor except for the hydraulics and D.A.H. control box.
2. Loosen the hydraulic hose connections on all rams and retract all hydraulic rams fully. Retain waste oil in an appropriate container.

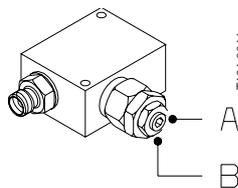


3. The lever on the hydraulic valve block is set vertical (pos. **A**).
4. Start the tractor and activate the track correction switch on the D.A.H. control box until oil free from air is streaming out of the hoses.
5. When all air is out the hose fittings are retightened. Activate again, and let the oil pressure extend the rams until they reach the drawbar again. Then fit bolts again.
6. Set the lever in horizontal pos. **B**.
7. Activate the track correction switch until oil free from air is streaming out.
8. Tighten the hose fittings again, and let the oil pressure extend the rams till they reach the yoke again. Fit the bolts.
9. When the damping system is primed the rams must not be able to move more than 1 mm (0.03937 in) when the trailer is pushed hard from side to side by hand.
10. If the rams are moving more than 1 mm the priming procedure is repeated.

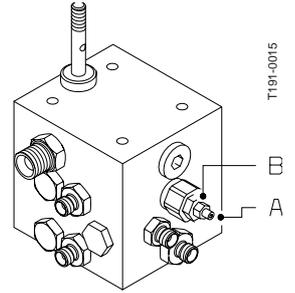
## TRACKER damping pressure setting

The hydraulic pressure relief valves in the TRACKER's damping system is factory set to open at appr. 40 bar (580 p.s.i.) which is adequate for most conditions.

If the damping seems too "soft" or too "hard", the settings can be adjusted on the screws shown.



Connect pressure gauges to the minimesh gauge connectors and check that pressure setting is equal to both sides. **A** = adjustment, **B** = counter nut

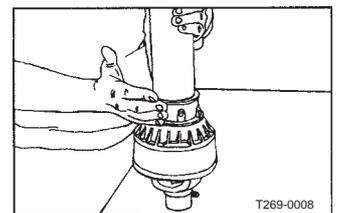
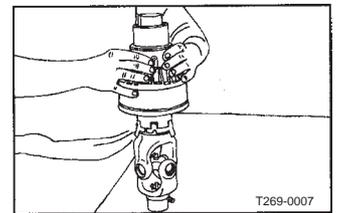
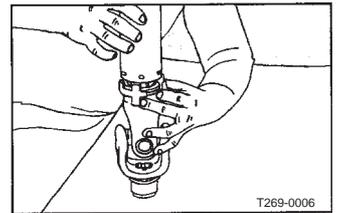
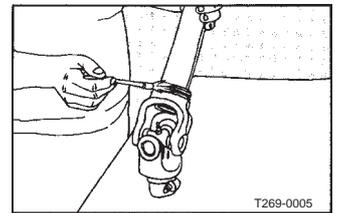
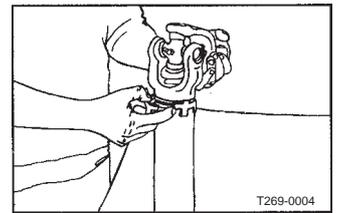
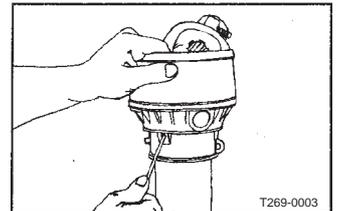


**NOTE!** Too low setting will cause instability of the sprayer, and too high pressure setting will cause problems with the tractor steering.

## Transmission shaft, shield renewal

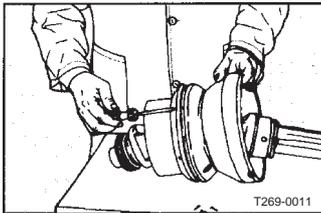
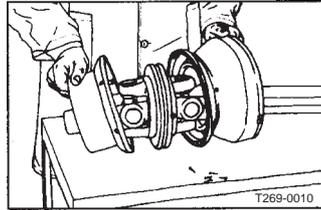
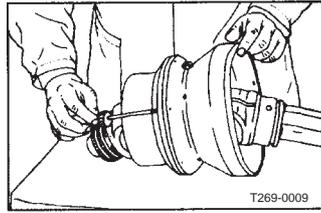
The replacement of defective shields is done as follows:

1. Push down on the universal cross cover and press in the tabs with a screwdriver. Maintain pressure until all three tabs are released.
2. Remove the nylon bearing and pull off the protection tube.
3. Grease protection tube bearing groove on the inner yoke.
4. Slide on the shield tube and fit the bearings tabs into the slots.
5. Slide the universal cross cover over the protection tube and align the grease nipple with the grease channel on the bearing. Press the universal cross cover onto the tabs until they lock.
6. Check alignment and locking of the tabs by tapping the universal cross cover lightly.



## Constant Velocity joint shielding

1. Remove the screws holding the two halves of the shield together.
2. Separate the shield and remove it from the joint. Check and replace any worn or damaged parts.
3. Lubricate the bearing surfaces on the central body of the joint. Align the two halves of the shield and secure with screws.



**NOTE!** Use only genuine spare parts to service the transmission shaft. For any other service or repair jobs on the transmission shaft contact your HARDI dealer.

## Shock absorbers

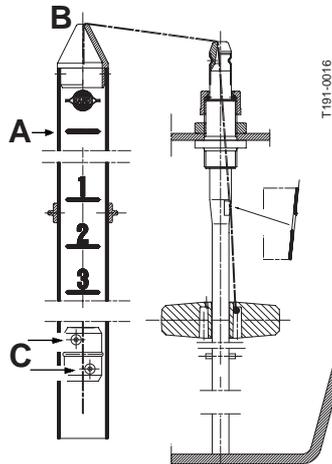
If the shock absorbers does loses their efficiency or starts leaking oil, they should be replaced.

## Level indicator adjustment

The level indicator reading should be checked regularly.

When the tank is empty, the float should lie on the stop pin, of the rod, and the O-ring on the indicator should be positioned at the top position line **A**.

If any deviation is found, pull out the plug **B**, loosen screws **C**, and adjust the length of the cord.



## Cord renewal, level indicator

If the cord on the level indicator has to be changed, the float guide pole is removed:

1. Remove the tank drain valve (see paragraph "Main tank drain valve") and loosen the fitting holding the pole in position.
2. Pull the pole down through the drain valve hole till it is free in the top of the tank.
3. The pole can now be taken out of the tank through the filling hole.



**DANGER!** Do not attempt to enter the tank - the float pole can be removed from outside the tank!

## Seal renewal, drain valve

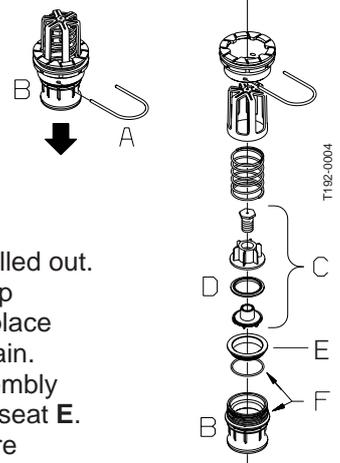
If the main tank drain valve leaks, the seal and seat can be changed the following way.

**NOTE!** Do not enter the inside of the tank - the parts can be changed from underneath the tank!



**WARNING!** Use eye / face protection mask when dismantling the tank drain valve!

1. Make sure the tank is empty and clean.
2. The valve must be closed and the string loose.
3. Pull out the clip **A** and pull down connecting piece **B**. The entire valve assembly can now be pulled out.
4. Check cord and valve flap assembly **C** for wear, replace seal **D** and assemble again.
5. Assemble the valve assembly again using a new valve seat **E**. Lubricate O-rings **F** before assembly.
6. Fit clip **A** again.



**NOTE!** Check function of valve with clean water before filling chemicals into the tank!

## Air sleeve repair

If the boom air sleeve should be torn, it can be mended. Clean the bag with a suitable solvent and mend it using the mending kit, Part No. 728746, which include glue and cloth.

## Light equipment, bulb renewal

Following bulb renewal procedures:

### Rear combi lamp, HELLA

Function	Bulb type (DIN)	Volt / Watt
Rear lamp	R5W	12V / 5W
Stop lamp	P21W	12V / 21W
Direction indicator	P21W	12V / 21W

### Number plate lamp, HELLA

Number plate lamp	R10W	12V / 10W
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### Rear combi lamp, GEKA (with warning boards)

Function	Bulb type (DIN)	Volt / Watt
Rear lamp	R5W	12V / 5W
Stop lamp	P21W	12V / 21W
Direction indicator	P21W	12V / 21W
Position lamp, front (GEKA)		12V / 5W

# COMMANDER-TWIN FORCE

Side marking combi lamp (DK only):

Prise out the lens carefully from the rubber housing to remove the bulb

Function	Bulb type (DIN)	Volt / Watt
Side marking combi lamp, white, red, yellow	R5W	12V / 5W

For wiring diagrams see section on technical specifications.

## Fan speed adjustment

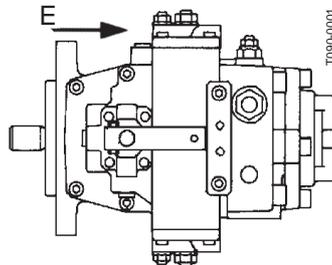
(Bowden cable adjusted pumps only). The boom fan speed base adjustments are carried out as follows. A tachometer is required for this job.

1. Fit a piece of light-reflecting tape to the fan wing and to the tractor P.T.O.
2. Unfold the boom to working position.
3. Set tractor P.T.O. at 540 r.p.m. - check with the tachometer.
4. Set the fan speed control lever to max. speed.
5. Measure the fan speed with the tachometer. The fan speed must be 3100 r.p.m.



**WARNING!** Do not wear loose hanging clothes! Hold the tachometer firmly in your hands in order not to be sucked into the fan. **DO NOT REMOVE THE PROTECTION GRID!**

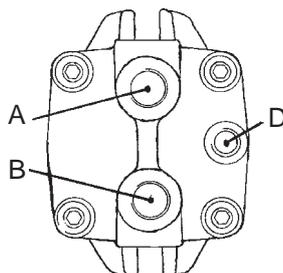
6. Turn the swash plate adjustment screw **E** CW to decrease or CCW to increase the blower r.p.m.. Remember to tighten the counter nut. Repeat 3. and 4. until the correct setting is obtained.
7. If the correct fan r.p.m. cannot be reached, the hydraulic transmission pressure settings must be checked - see section on "Fan transmission pressure adjustment".



## Fan transmission priming

If the hydraulic fan transmission has been dismantled, or pump or motor has been changed, the following priming procedure must be carried out before starting up the transmission:

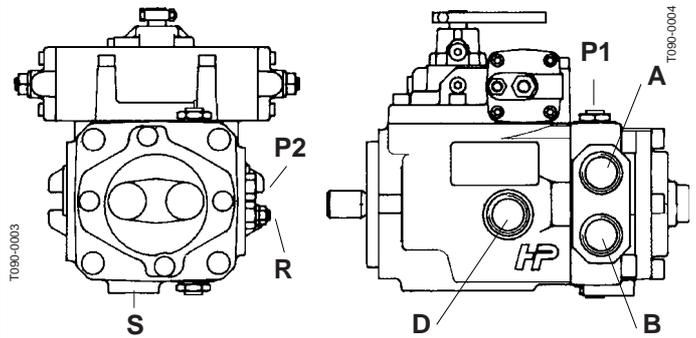
1. Fill the oil reservoir with fresh, clean oil to the top of the sight glass.
2. Fill the pump housing with oil through the drain pipe **D** which is dismantled at the tank connection. Reconnect and tighten.
3. Check the oil level in the gear box.
4. Remove the drain hose **D** from the motor outside the



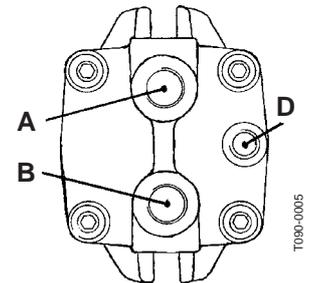
blower housing.

5. Set the fan r.p.m. at 0, engage the tractor P.T.O. with the engine running idle - wait a few minutes.
6. Set the fan speed at 200 r.p.m.
7. After a while the oil will start dripping constantly. Refit the drain hose and tighten.
8. With the tractor P.T.O. at 540 r.p.m. the fan should rotate at max. revolutions/min.
9. Recheck oil level at tank sight glass.
10. Check vacuummeter at the suction filter.
11. Retighten hose connections and check for leaks.
12. Check fan speed and feed pressure adjustments - see sections on "Fan speed adjustment" and "Fan transmission pressure adjustment".

## Fan transmission pressure adjustment



- A = Pressure port
- B = Return port
- D = Drain port
- P1 = Connector for working pressure measurement
- P2 = Connector for feed pressure
- R = Adjustment Screw for feed pressure
- S = Suction port



The transmission feed and working pressure are checked as follows:

1. Connect a 40 bar (580 p.s.i.) pressure gauge to the feed pressure connector **P2**, and a 400 bar (5800 p.s.i.) pressure gauge at the working pressure connector **P1**.
2. Set the tractor P.T.O. at 540 r.p.m. - check with tachometer.
3. Set the blower at max. speed.
4. Check the feed and working pressure:

Feed pressure, **P2** 15-20 bar (218-290 p.s.i.)

Working pressure, **P1**, approx.

15 m	160 bar (2321 p.s.i.)
16 m	170 bar (2466 p.s.i.)
18 m	180 bar (2610 p.s.i.)
20 m	190 bar (2755 p.s.i.)
21 m	200 bar (2900 p.s.i.)
24 m	210 bar (3045 p.s.i.)
27 m	240 bar (3721 p.s.i.)
28 m	240 bar (3721 p.s.i.)

Adjust feed pressure if necessary.

Failure to reach feed and working pressure indicates that the transmission needs overhauling.

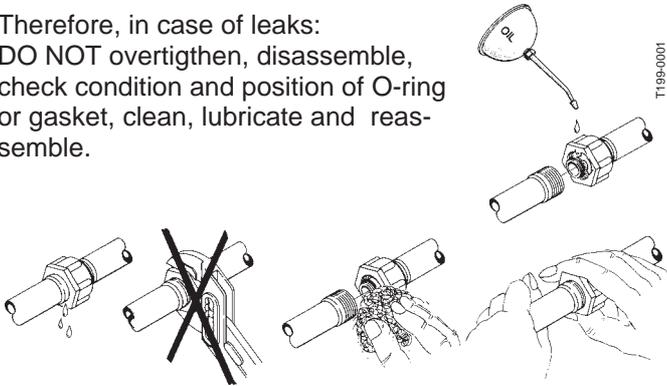
## Nozzle tubes and fittings

Poor seals are usually caused by:

- missing O-rings or gaskets
- damaged or incorrectly seated O-rings
- dry or deformed O-rings or gaskets
- foreign bodies.

Therefore, in case of leaks:

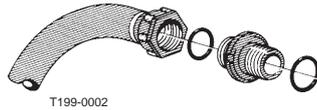
DO NOT overtighten, disassemble, check condition and position of O-ring or gasket, clean, lubricate and reassemble.



For radial connections only hand tighten them.

The O-rings must always be greased all the way round before refitting.

For face connections, a little mechanical leverage may be used.



## Tyre safety

Should it be necessary to replace tyres it is recommended to leave this to a specialist and follow the mentioned rules.

- Always clean and inspect the rim before mounting.
- Always check that the rim diameter corresponds exactly to the rim diameter moulded on the tyre.
- Always inspect inside of the tyre for cuts, penetrating objects or other damages. Repairable damages should be repaired before installing the tube. Tyres with unrepairable damages must never be used.
- Also inspect inside of the tyre for dirt or foreign bodies and remove it before installing the tube.
- Always use tubes of recommended size and in good condition. When fitting new tyres always fit new tubes.
- Before mounting always lubricate both tyre beads and rim flange with approved lubricating agent or equivalent anti-corrosion lubricant. Never use petroleum based greases and oils because they may result in damage to the tyre. Using the appropriate lubricant the tyre will never slip on the rim.
- Always use specialised tools as recommended by the tyre supplier for mounting the tyres.
- Make sure that the tyre is centred and the beads are perfectly seated on the rim. Otherwise danger of bead wire tear can occur.
- Inflate the tyre to 100-130 kPa (14.5-19 p.s.i.) then check whether both beads are seated perfectly on the rim. If any of the beads does not seat correctly deflate the assembly, re-centre the beads before starting inflation of the tyre. If the beads are seated correctly

on the rim at 100-130 kPa inflate the tyre to a maximum of 250 kPa (36 p.s.i.) until they seat perfectly on the rim.

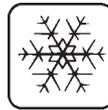
- Never exceed the maximum mounting pressure moulded on the tyre!
- After mounting tyres adjust inflation pressure to operation pressure recommended by the tyre manufacturer.
- Do not use tubes in tubeless tyres.



**WARNING!** Non observance of mounting instructions will result in the bad seating of the tyre on the rim and could cause the tyre to burst leading to serious injury or death!

Never mount or use damaged tyres or rims!

Use of damaged, ruptured, distorted, welded or brazed rim is not allowed!



## Off-season storage

When the spraying season is over, you should devote some extra time to the sprayer.

If chemical residues are left over in the sprayer for longer periods, it can reduce the life of the individual components.

To preserve the sprayer intact and protect the components, carry out following off-season storage program.

1. Clean the sprayer completely - inside and outside - as described under "Cleaning of the sprayer". Make sure that all valves, hoses and auxiliary equipment has been cleaned with detergent and flushed with clean water afterwards, so no chemical residues left in the sprayer.
2. Renew possible damaged seals and repair possible leaks.
3. Empty the sprayer completely and let the pump work for a few minutes. Operate all valves and handles to drain as much water off the spraying circuit as possible. Let the pump run until air is coming out of all nozzles. Remember to drain the rinsing tank also.
4. Pour appr. 50 litre (11 Imp.gal) anti-freeze mixture consisting of 1/3 automotive anti-freeze and 2/3 water into the tank.
5. Engage the pump and operate all valves and functions on the MANIFOLD, operating unit, FILLER etc. allowing the anti-freeze mixture to be distributed around the entire circuit. Open the operating unit main on/off valve and distribution valves so the anti-freeze is sprayed through the nozzles as well. The anti-freeze will also prevent O-rings, seals, diaphragms etc. from drying out.
6. Lubricate all lubricating points according to the lubricating scheme regardless of intervals stated.
7. Change hydraulic oil and hydraulic oil filter as described in section on "Maintenance"

8. When the sprayer is dry remove rust from possible scratches or damages in the paint and touch up the paint.
9. Remove the glycerine-filled pressure gauges and store them frost free in vertical position.
10. Apply a thin layer of anti-corrosion oil (e.g. SHELL ENNIS FLUID, CASTROL RUSTILLO or similar) on all metal parts. Avoid oil on rubber parts, hoses and tyres.
11. Fold the boom in transport position and relieve pressure from all hydraulic functions.
12. All electric plugs and sockets are to be stored in a dry plastic bag to protect them against damp, dirt and corrosion.
13. Remove the control boxes and the HARDI PILOT control box + display from the tractor, and store them dry and clean (in-house).
14. Wipe hydraulic snap-couplers clean and fit the dust caps.
15. Apply grease on all hydraulic ram piston rods which are not fully retracted in the barrel to protect against corrosion.
16. Chock up the wheels, to prevent moisture damage and deformation of the tyres. Tyre blacking can be applied to the tyre walls to preserve the rubber.
17. Drain air brake tank for condensed water.
18. To protect against dust the sprayer can be covered by a tarpaulin. Ensure ventilation to prevent condensation.

## Preparation after off-season storage

After a storage period the sprayer should be prepared for the next season the following way:

1. Remove the cover
2. Remove the support from the wheel axle and adjust the tyre pressure.
3. Wipe off the grease from hydraulic ram piston rods.
4. Fit the pressure gauges again. Seal with Teflon tape.
5. Connect the sprayer to the tractor including hydraulics and electric's.
6. Check all hydraulic and electric functions.
7. Empty the tank for remaining anti-freeze.
8. Rinse the entire liquid circuit on the sprayer with clean water.
9. Fill with clean water and check all functions.
10. Check function of brakes. Please note that brake power will be reduced until the rust are worn off the drums. Always brake lightly until the drums are clean.



## Fault-finding

### Operational problems

In cases where breakdowns have occurred, the same factors always seem to come into play:

- Minor leaks on the suction side of the pump will reduce the pump capacity or stop the suction completely.
- A clogged suction filter will hinder or prevent suction so that the pump does not operate satisfactorily.
- Clogged up pressure filters will result in increasing pressure at the pressure gauge but lower pressure at the nozzles.
- Foreign bodies stuck in the pump valves with the result that these cannot close tightly against the valve seat. This reduces pump efficiency.
- Poorly reassembled pumps, especially diaphragm covers,
  - will allow the pump to suck air resulting in reduced or no capacity.
- Hydraulic components that are contaminated with dirt result in rapid wear to the hydraulic system.

### Therefore ALWAYS check:

1. Suction, pressure and nozzle filters are clean.
2. Hoses for leaks and cracks, paying particular attention to suction hoses.
3. Gaskets and O-rings are present and in good condition.
4. Pressure gauge is in good working order. Correct dosage depends on it.
5. Operating unit functions properly. Use clean water to check.
6. Hydraulic components are maintained clean.

## COMMANDER-TWIN FORCE

Fault	Probable cause	Control / remedy
<b>Liquid system</b> No spray from boom when turned on.	Air leak on suction line.	Check if suction filter O-ring is sealing. Check suction tube and fittings. Check tightness of pump diaphragm and valve covers.
	Air in system.	Fill suction hose with water for initial prime.
	Suction/pressure filters clogged.	Clean filters. Check yellow suction pipe is not obstructed or placed too near the tank bottom.
Lack of pressure.	Incorrect assembly.	Restrictor nozzle in Self-Cleaning Filter not fitted. Safety valve spring for Self-Cleaning Filter not tight. Too little distance between yellow suction pipe and tank bottom.
	Pump valves blocked or worn.	Check for obstructions and wear.
	Defect pressure gauge.	Check for dirt at inlet of gauge.
Pressure dropping.	Filters clogging.	Clean all filters. Fill with cleaner water. If using powders, make sure agitation is on.
	Nozzles worn.	Check flow rate and replace nozzles if it exceeds 10%.
	Tank is air tight.	Check vent is clear.
	Sucking air towards end of tank load.	Lower pump r.p.m.
Pressure increasing	Pressure filters beginning to clog.	Clean all filters.
Formation of foam.	Air is being sucked into system.	Check tightness / gaskets / O-rings of all fittings on suction side.
	Excessive liquid agitation.	Reduce pump r/min. Check safety valve for Self-Cleaning Filter is tight. Ensure returns inside tank are present. Use foam damping additive.
Liquid leaks from bottom of pump.	Damaged diaphragm.	Replace. See Changing of valves and diaphragms.

# COMMANDER-TWIN FORCE

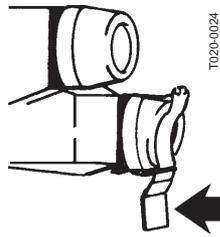
Fault	Probable cause	Control / remedy
<b>EC Operating unit</b> Operating unit not functioning	Blown fuse(s).	Check mechanical function of microswitches. Use cleaning/lubricating agent if the switch does not operate freely. Check motor. 450-500 milli-Amperes max. Change motor, if over.
	Wrong polarity.	Brown - pos. (+). Blue - neg. (-).
	Valves not closing properly.	Check valve seals for obstructions. Check microswitch plate position. Loosen screws holding plate a 1/2 turn.
	No power.	Wrong polarity. Check that brown is pos. (+), Blue is neg. (-). Check print plate for dry solders or loose connections. Check fuse holder are tight around fuse.
	<b>D.A.H. Hydraulic system</b> No boom movements when activated	Insufficient oil pressure
	Insufficient oil supply.	Oil flow must be min. 10 l/min. and max. 90 l/min. Check tractor hydraulic oil level.
	Blown fuse.	Check / replace fuse in junction box.
	Bad / corroded electrical connections	Check / clean connections, multi plugs etc.
	Insufficient power supply.	Voltage on activated solenoid valve must be more than 8 Volts. Use wires of at least 4 mm <sup>2</sup> for power supply.
	Defect relay / diodes in junction box.	Check relays, diodes and soldering at PCB in junction box
	Clogged restrictors <b>B</b> or <b>C</b> in by-pass block.	Remove and clean restrictors <b>B</b> and <b>C</b> in by-pass block (See hydraulic diagram) Change hydraulic oil + filter
	Wrong polarity.	Check polarity. White pos. (+) Blue neg. (-).
Boom lift raises to max. pos. when tractor hydraulics are engaged.	Wrong oil inlet to by-pass block.	Connect hydraulic snap couplers opposite in tractor outlets, or engage spool valve lever in opposite direction
	Back pressure in return line exceeds 20 bar	Connect the return line with free flow to hydraulic oil reservoir. Divide return line in two and lead return oil back to reservoir via two spool valves.
Oil heats up in Closed Centre systems	By-pass valve <b>0</b> does not close properly	Check / replace locking clip on by-pass valve <b>0</b> .
	Internal leaks in flow regulator	Replace flow regulator O-rings and back-up rings. Replace flow regulator.
Individual ram does not move	Clogged restrictor	Dismantle and clean restrictor

Fault	Probable cause	Control / remedy
<b>TRACKER damping system</b>		
Sprayer trails unstable	Air pockets in the hydraulic circuit	Prime hydraulic circuit
	Hydraulic circuit leaking	Repair leak, prime
	Pressure relief valve(s) set too low	Adjust pressure relief valves
Front hydraulic rams will not allow the yoke to turn when rear rams are extended/retracted to the maximum (MULTI TRACK)	Safety valve incorrectly adjusted	Adjust safety valve
Rear hydraulic rams are too tight and vehicle continues straight ahead when trying to turn	Insufficient counter weight on front of tractor	Ad ballast on front of tractor
	Pressure relief valve set too high	Adjust pressure relief valves
<b>Hydraulic fan transmission</b>		
Max. revolutions cannot be obtained	Tractor P.T.O. speed is lower than 540 r.p.m. (reading failure on tractometer)	Check tractor's P.T.O. r.p.m. Check tractometer
	Feed pressure is too low	Adjust feed pressure to correct setting
	Max. fan r.p.m. is not adjusted correctly (models with bowden cable adjustment only)	Adjust the max. fan r.p.m.
	Pump/motor is worn	Get transmission checked by your HARDI dealer
Noisy fan transmission	Wrong oil quality (foam)	Change oil to correct quality
	Feed pressure too low	Adjust feed pressure
	Oil filter clogged (vacuummeter indicator in red area)	Change oil filter
Formation of foam in oil tank	Pump/motor is worn	Get the fan transmission checked by your HARDI dealer
	Wrong oil quality	Change the oil to correct quality
	Mixture of hydraulic oil and other quality (e.g. universal oil)	Change the oil to correct quality
	Oil change interval not kept	Change the oil to fresh, clean oil of correct quality
	Leak on the pump suction line	Check hydraulic pump suction line for leaks
Fan speed will not stay at adjusted level	No signal from speed sensor at the fan	Check the wire connection between sensor and actuator for damages
	Bad connections	Check the wire connection between sensor and actuator for damages
Fan r.p.m. control does not start up	Fuse blown	Check power supply and fuse
Oil leaks from pump/motor shaft seal (seal pressed out)	Drain hoses from motor/pump housing is blocked	Check the drain hose(s) for bendings, damages, and proper attachment
	Too much pressure in pump/motor housing (pump/motor worn)	Get the transmission checked by your HARDI dealer

## Emergency operation of the sprayer

### The boom

In case of power failure the boom can be operated manually by pressing the individual buttons on the solenoid valves. This is done by locking the by-pass valve, as is done when using tractors with closed centre hydraulics.



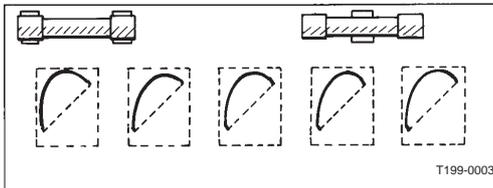
Remove the protection box of the solenoid valves at the boom. The boom can now be operated by pressing the individual buttons on the solenoid valves.

Remember to reset the system to Open Centre hydraulic, if the tractor has an Open Centre (Constant Flow) hydraulic system.

The problem may be due to a blown fuse. One spare fuse is located inside the junction box.

Fuse type:  
T10 A 250 V

HARDI ref.  
No. 261272

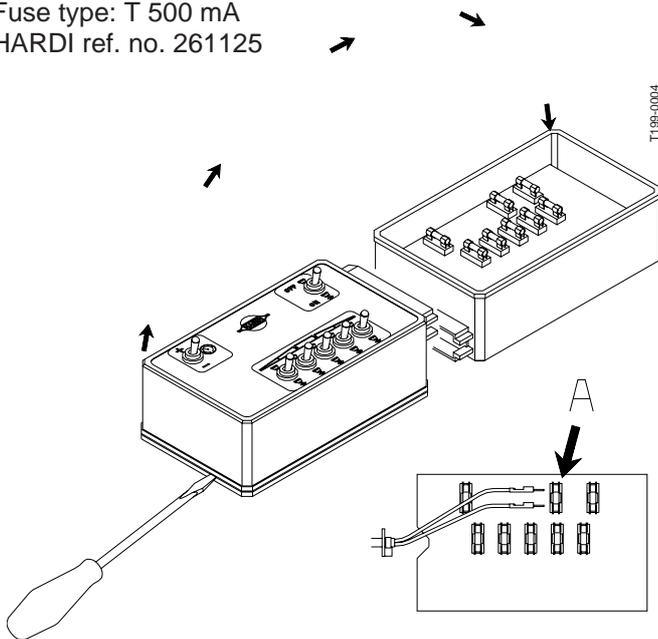


### EC operating unit

In case of power failure it is possible to operate all functions of the operating unit manually. First disconnect the multi plug from the control box. Now manually turn the emergency control knobs.

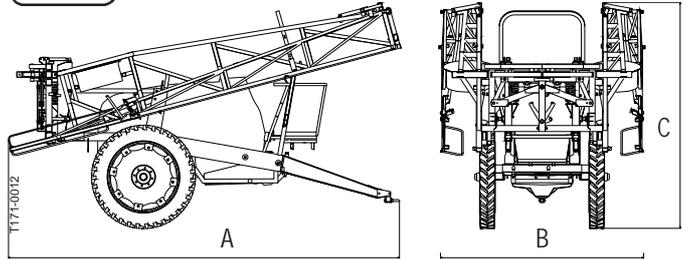
The problem may be due to a blown fuse. The fuses are placed in the control box and are marked according to functions. Fuses 7 and 8 are spare fuses.

Fuse type: T 500 mA  
HARDI ref. no. 261125



## Technical specifications

### Measure and weight



### Overall dimensions

Boom width, m	A	B	C
<b>CM-2200/2800-HAY/Z</b>			
18	5950	3000	≤3800
20/21	5950	3000	≤3800
24	5950	3000	≤3800
27	6900	3000	≤3800
28	6900	3000	≤3800
<b>CM-3200/4200-HAY/Z</b>			
18	7025	3000	≤3800
20/21	7025	3000	≤3800
24	7025	3000	≤3800
27	7025	3000	≤3800
28	7025	3000	≤3800

All measurements are in mm

### Weights

#### CM-2200-HAY/Z

Boom width m	Empty			Full		
	Axle load, kg	Drawbar load, kg	Own weight, kg	Axle load, kg	Drawbar load, kg	Total weight, kg
18	2495	505	3000	4408	926	5334
20	2505	510	3015	4418	931	5349
21	2518	517	3035	4432	937	5369
24	2545	530	3075	4458	951	5409
27	2601	559	3160	4514	980	5494
28	2610	565	3175	4523	986	5509

#### CM-2800-HAY/Z

Boom width m	Empty			Full		
	Axle load, kg	Drawbar load, kg	Own weight, kg	Axle load, kg	Drawbar load, kg	Total weight, kg
18	2514	511	3025	4785	1019	5804
20	2524	516	3040	4795	1024	5819
21	2538	522	3060	4808	1031	5839
24	2565	535	3100	4835	1044	5879
27	2620	565	3185	4891	1073	5964
28	2629	571	3200	4900	1079	5979

#### CM-3200-HAY/Z

Boom width m	Empty			Full		
	Axle load, kg	Drawbar load, kg	Own weight, kg	Axle load, kg	Drawbar load, kg	Total weight, kg
18	3141	452	3593	5796	997	6793
20	3152	456	3608	5807	1001	6808
21	3167	461	3628	5822	1006	6828
24	3197	471	3668	5852	1016	6868
27	3261	492	3753	5916	1037	6953
28	3271	497	3768	5926	1042	6968

## CM-4200-HAY/Z

Boom width m	Empty			Full		
	Axle load, kg	Drawbar load, kg	Own weight, kg	Axle load, kg	Drawbar load, kg	Total weight, kg
18	3173	460	3633	6640	1193	7833
20	3184	464	3648	6652	1196	7848
21	3200	468	3668	6667	1201	7868
24	3230	478	3708	6697	1211	7908
27	3293	500	3793	6760	1233	7993
28	3304	504	3808	6771	1237	8008

**NOTE!** All weights are approximate values, and based on machines equipped with rinsing tank, 12.4R46" wheels, brakes and HARDI FILLER. (1 kg = 2.2 lb).

For MULTI TRACK and SELF TRACK models the values in above tables must be increased as follows:

Empty: + 255 kg on Drawbar and Total weights

Full: + 400 kg on Drawbar and Total weights

## P.T.O. power consumption

Boom size	kW	Hp
18 m	34	46
20 m	42	57
21 m	42	57
24 m	54	73
27 m	54	73
28 m	54	73

The power consumption is stated at a working pressure of 10 bar.

## Pump capacity

363/10.0 bar	Rotation per min					
	200	300	400	500	540	600
	Capacity l/min					
0	69	102	135	171	183	200
3	68	100	133	166	180	196
6	66	98	131	164	177	193
9	65	96	129	162	176	190
12	64	95	128	160	173	189
15	63	93	126	157	177	186
Max. pressure: 15bar		Weight: 54 kg		Suction height: 0.0 m		

463/10.0 bar	Rotation per min					
	200	300	400	500	540	600
	Capacity l/min					
0	101	147	196	245	263	290
3	96	142	191	237	245	282
6	93	138	186	233	250	276
9	90	136	182	226	245	270
12	88	132	179	221	239	266
15	85	130	175	215	235	261
Max. pressure: 15bar		Weight: 70 kg		Suction height: 0.0 m		

## Filters and nozzles

Filter gauze width

30 mesh: 0.58 mm                      50 mesh: 0.30 mm

80 mesh: 0.18 mm                      100 mesh: 0.15 mm

## Temperature and pressure ranges

Operating temperature range:                      2° to 40° C. (36°F to 104°F)

Operating pressure for safety valve:                      15 bar (220 psi)

Max. pressure on the pressure manifold:                      20 bar (290 psi)

Max. pressure on the suction manifold:                      7 bar (100 psi)

## Brakes

### Brake linings

Thickness (new): 4.5 mm (0.1773 in)

Minimum allowable thickness: 2 mm (0.07874 in)

### Hydraulic brakes

Max. hydraulic pressure: 150 bar (2176 p.s.i.)

### Air brakes, single line:

Air pressure, relieved brakes: 5.3 - 5.6 bar (77-81 psi)

Air pressure drop to activate: 0.8 - 1.3 bar (12-19 psi)

### Air brakes, dual line

Load apportioning valve pressure settings:

Relieved: 0 bar

Empty: 1.6 bar (23.2 p.s.i.)

Half: 3.4 bar (49.3 p.s.i.)

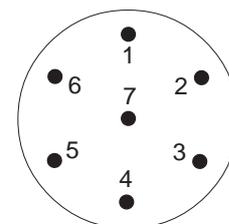
Full: Air tank pressure

## Electrical connections

### Rear lights

Position	Wire colour
----------	-------------

- |                           |        |
|---------------------------|--------|
| 1. LH direction indicator | Yellow |
| 2. Free                   | Blue   |
| 3. Frame                  | White  |
| 4. RH direction indicator | Green  |
| 5. RH rear position lamp  | Brown  |
| 6. Stop lamps             | Red    |
| 7. LH rear position lamp  | Black  |



The wiring is in accordance with ISO 1724.

## EC

The EC-operating unit fulfils the EU noise reduction standards.

## Materials and recycling

Tank: HDPE

Hoses: PVC

Valves: mainly glass-filled PA.

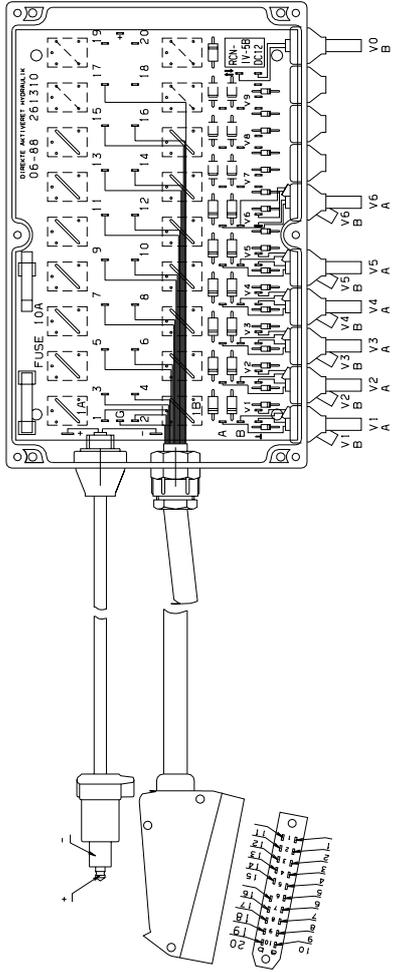
Fittings: PA

## Disposal of the sprayer

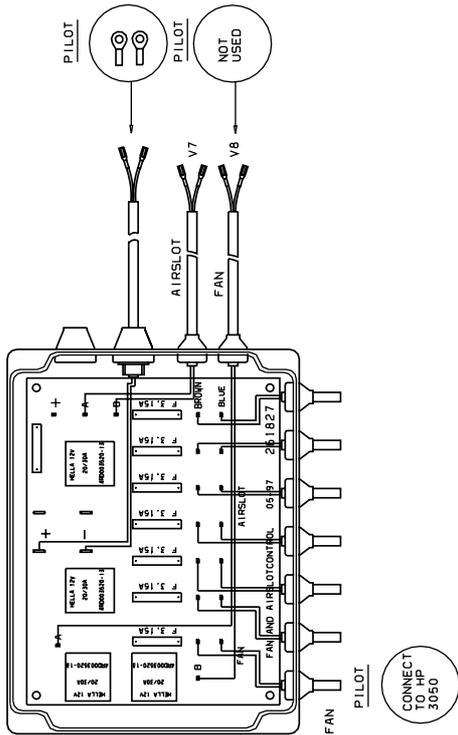
When the equipment has completed its working life, it must be thoroughly cleaned. The tank, hose and synthetic fittings can be incinerated at an authorised disposal plant. The metallic parts can be scrapped. Always follow local legislation regarding disposal.

## Electric and hydraulic charts

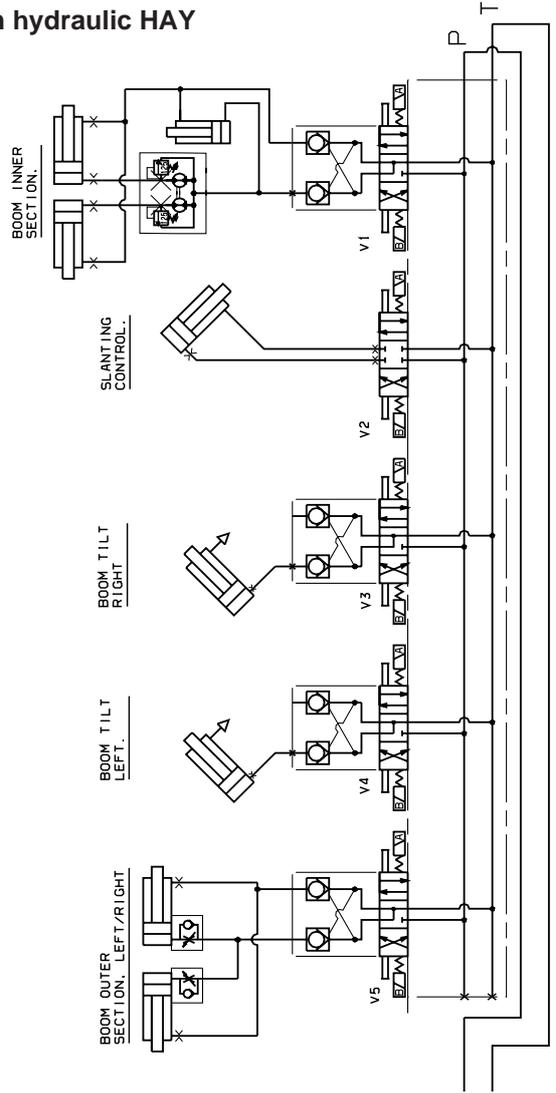
### Junction box HAZ



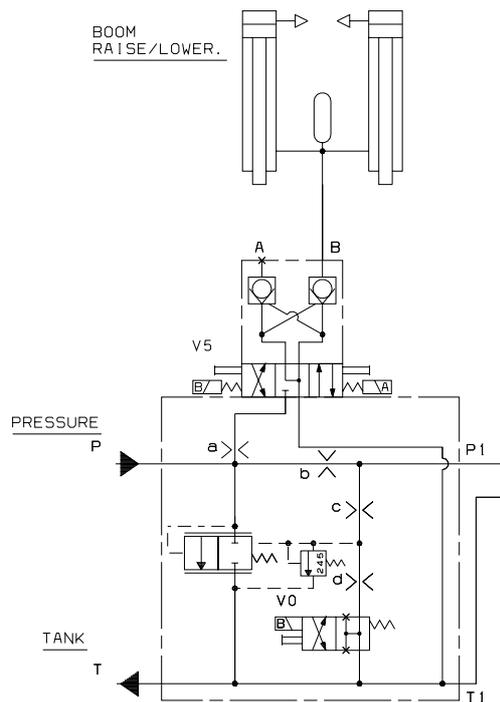
### Junction box HAZ



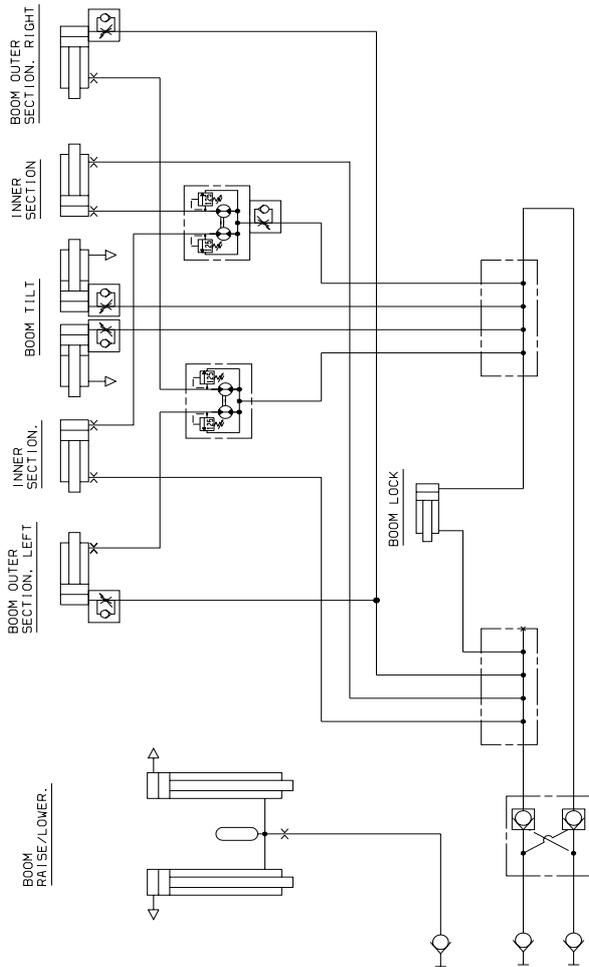
## Boom hydraulic HAY



## Boom lift and by-pass



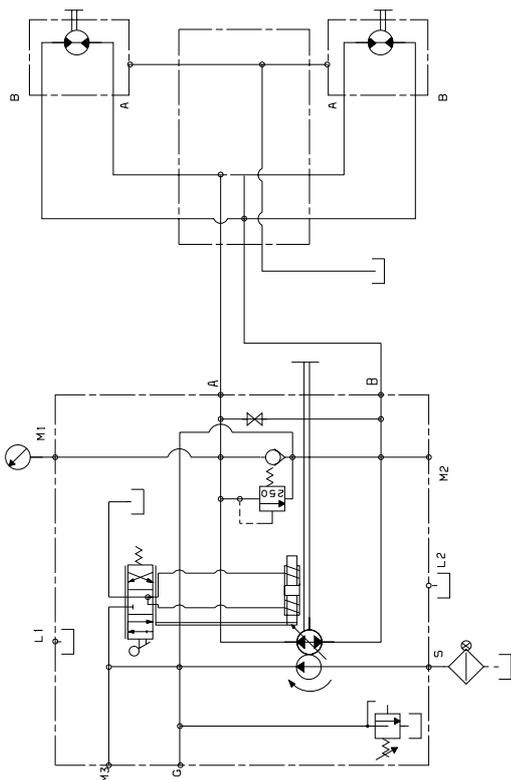
## Boom hydraulic HAY



## Pictorial symbols

	Description		Pressure
	Function		Cleaning
	Connection		Lubrication
	Warning		Winter storage
	Operating		Operational problems
	Service/adjustment		Technical specifications
	Liquid flow		EC Declaration of Conformity

## Transmissions HAY/HAZ



# COMMANDER-TWIN FORCE

## Track gauge

Overview of tyre dimensions and track widths

2200/2800

Wheel dimension	Tyre width	Min. track width	Max. track width
	mm	mm	mm
9,5 x 44"	235	1701	2250
9,5 x 48"	235	1701	2250
11,2 x 44"	276	1742	2250
11,2 x 48"	276	1742	2250
12,4 x 46"	310	1776	2250
16,9 x 38"	429	1895	2250
18,4 x 38"	467	1933	2250
20,8 x 38"	528	1994	2250

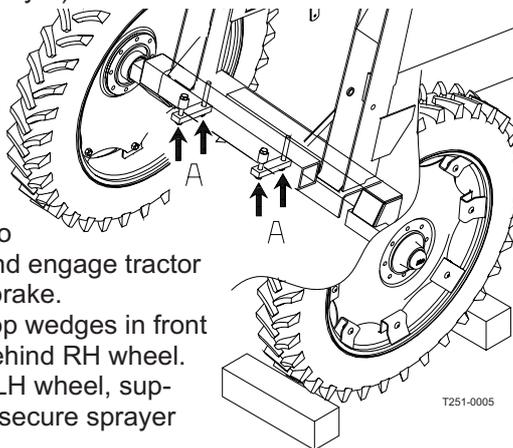
3200/4200

Wheel dimension	Tyre width	Min. track width	Max. track width
	mm	mm	mm
9,5 x 44"			
9,5 x 48"			
11,2 x 44"	276	1766	2250
11,2 x 48"	276	1766	2250
12,4 x 46"	310	1800	2250
16,9 x 38"	429	1919	2250
18,4 x 38"	467	1957	2250
20,8 x 38"	528	2018	2250

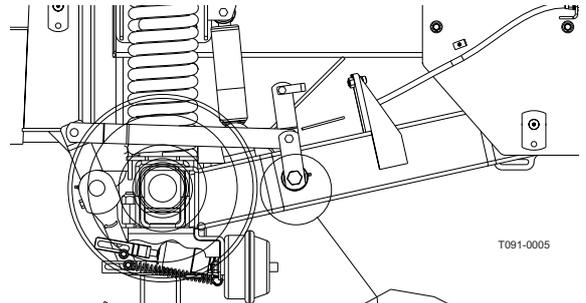
Min. track width is the practical minimum figure, independently of rim/rim plate setup.

The track gauge of the COMMANDER with suspension can be altered stepless as follows:

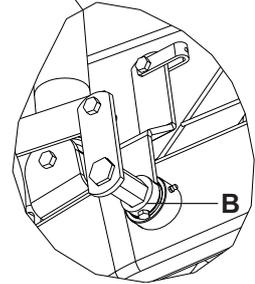
1. Measure the current track gauge (centre RH tyre to centre LH tyre). Each side must be extended or retracted half the desired alteration.
2. Attach the sprayer to tractor and engage tractor parking brake.
3. Place stop wedges in front of and behind RH wheel. Jack up LH wheel, support and secure sprayer body.



4. Loosen the 3 clamp bolts (A) for LH wheel axle.

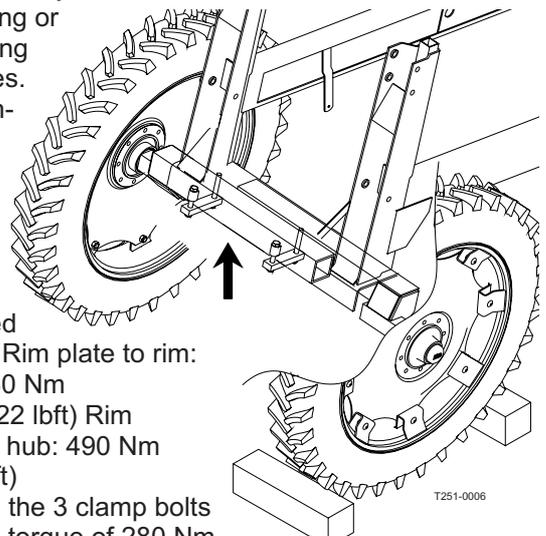


5. Loosen the screw B on the brake operating arm. Extend/retract this arm according to the adjustment of the axle.



6. Then extend or retract the axle. A sack barrow and a rod will facilitate the operation.

7. If the rim position must be changed, do this first and fine adjust by extending or retracting the axles. Remember to tighten the wheel nuts to the specified torque:



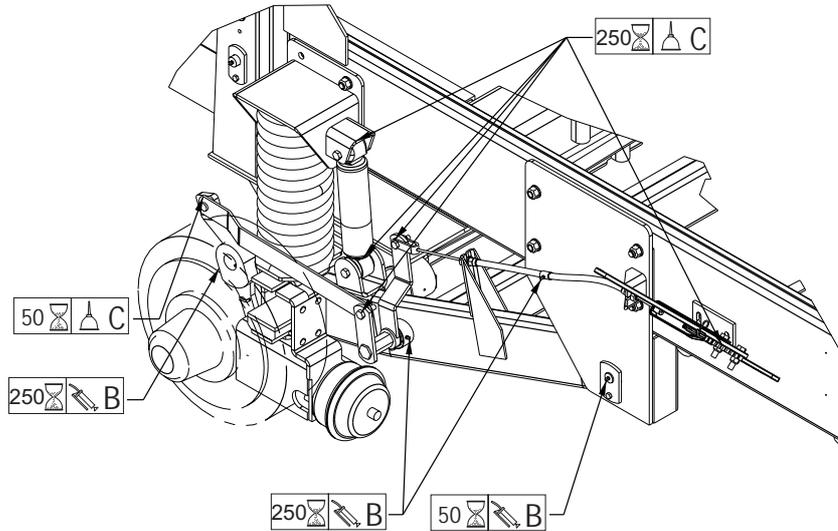
- Rim plate to rim: 280 + 30 Nm (207 + 22 lbft)
- Rim plate to hub: 490 Nm (288 lbft)

8. Tighten the 3 clamp bolts (A) to a torque of 280 Nm (207 lbft) for the COMMANDER 2200/2800 and 390 Nm (289 lbft) for the COMMANDER 3200/4200.
9. Tighten nut B again.

**IMPORTANT!** Place the jack under the axle and lift the wheel to remove load from the clamps before tightening the clamp bolts to the specified torque.

10. Repeat the procedure on RH wheel.
11. Check the distance from centre tyre to centre of tank frame is equal at RH and LH.
12. Re-tighten clamp bolts and wheel bolts to specified torque after 8 hours of work.

## Lubrication



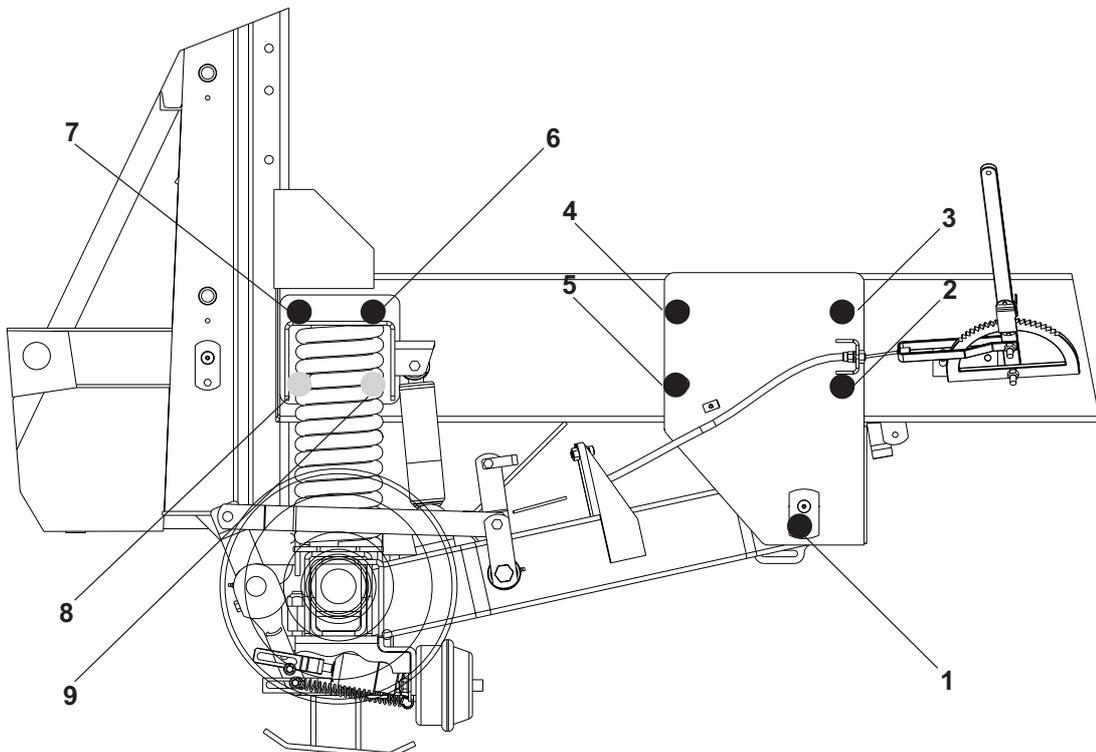
T202-0007

## Service and Maintenance

### 10 hours service

### Retighten bolts

Check that these 9 bolts - on each side of the COMMANDER - are tight. Retighten if necessary!  
Tightening torque: Bolt 1= 24 Nm (Retain the nut on the backside of the mounting by a spanner while adjusting bolt 1).  
Bolt 2-9 = 280 Nm



T091-0004

Bolt 8 and 9 are situated behind the spring.

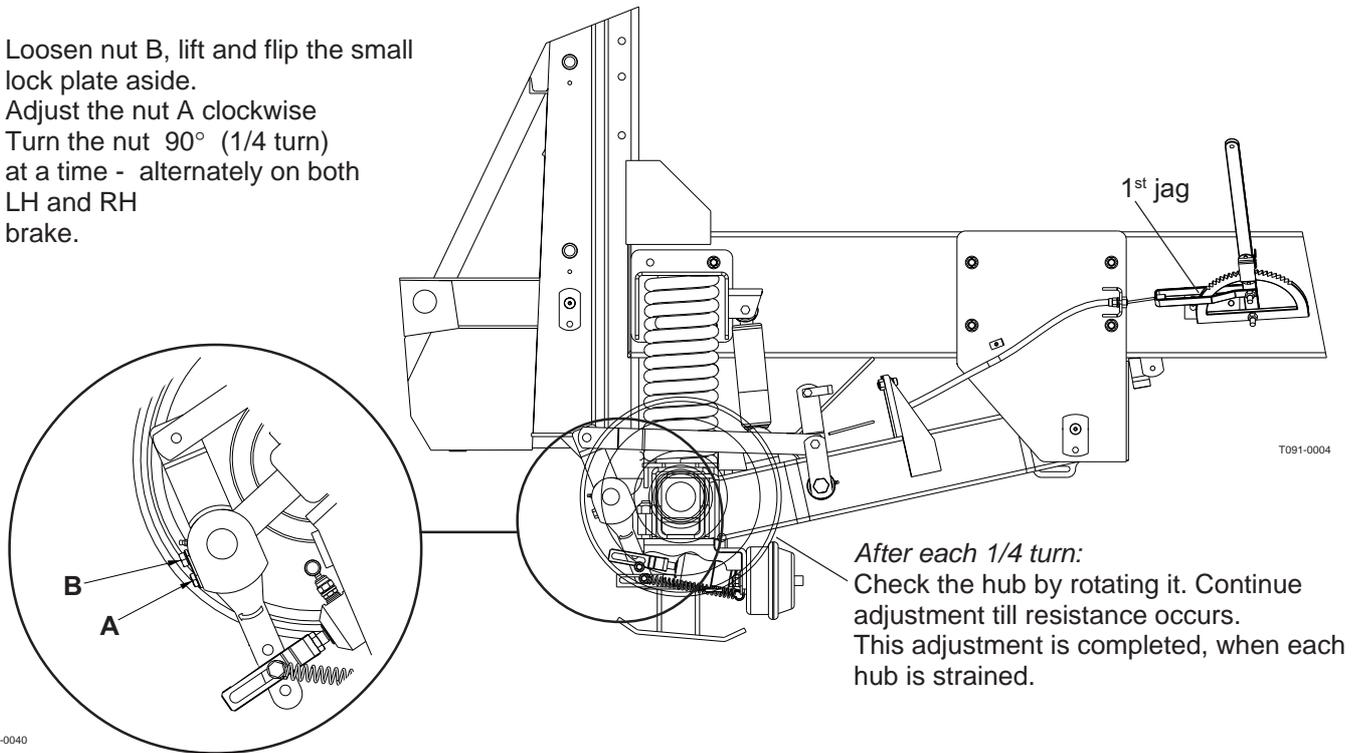
## 250 hours service

### Brake adjustment

1. Lift the back of the COMMANDER from the ground. It is recommended to use two lifting jacks, placed underneath the axle. Make sure the COMMANDER is stable and secured before carrying out any adjustments.
2. Place the handbrake in the first jag from the left (please refer to illustration).

**NOTE!** The following adjustment must be carried out simultaneously on both brakes. Therefore, alternately adjust on both LH brake and RH brake.

3. Loosen nut B, lift and flip the small lock plate aside.
4. Adjust the nut A clockwise  
Turn the nut 90° (1/4 turn)  
at a time - alternately on both  
LH and RH  
brake.



### Technical specifications

#### Weight

Additional weight (own weight):

COMMANDER 2200/2800	App. 220 kg
COMMANDER 3200/4200	App. 250 kg

#### Dimensions

Unchanged.

#### Ground clearance (under axle)

COMMANDER 2200/2800: 600 mm (9,5 x 44" wheels)
COMMANDER 3200/4200: 750 mm (12,4 x 46" wheels)