

# MASTER HYS

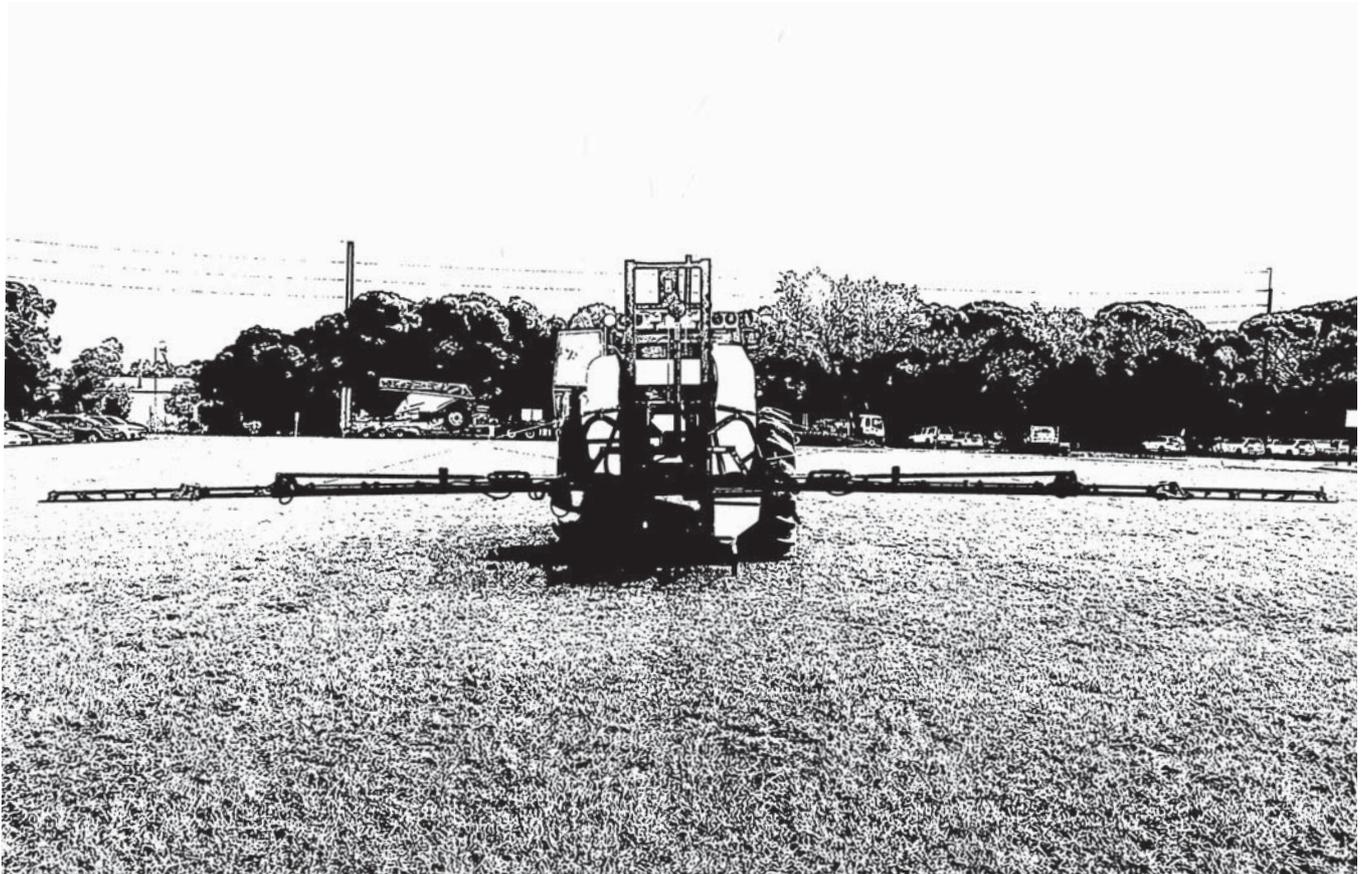


**Original**

## **Instruction book**

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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.

The original instruction book is approved and published in English. All other languages are translations of the original. In the event of any conflicts, inaccuracies or deviations between the English original and other languages the English version shall prevail.

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 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 is without any obligation in relation to implements purchased before or after such changes.

HARDI 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 more models and features or equipment, which are available in certain countries only, please pay attention to paragraphs dealing with precisely your model.

Published and printed by HARDI

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### Operator Safety

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#### Symbols

These symbols are used throughout the book to designate, where the reader has to pay extra attention. The four symbols have the following meanings.



This symbol means DANGER. Be very alert as your safety is involved!



This symbol means WARNING. Be alert as your safety can be involved!



This symbol means ATTENTION. This guides to better, easier and more safe operation of your sprayer!



This symbol means NOTE. Extra information is provided.

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#### Precautions

Please note the following recommended precautions and safe operating practices, before using the sprayer.

#### General Info



DANGER! 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.

If any portion of this instruction book remains unclear after reading it, contact your HARDI dealer for further explanation before using the equipment.



DANGER! Local law may demand, that the operator is certified to use spray equipment. Adhere to the local law.



DANGER! The tractor driver seat is the intended working place during operation.



DANGER! When driving on public roads, always ensure that there is no hydraulic pressure to the sprayer.



DANGER! Wear protective clothing. Clothing may differ depending on the chemical being sprayed. Adhere to the local law. Wash and change clothes after spraying. Wash tools if they have become contaminated.



DANGER! Do not eat, drink or smoke while spraying or working with contaminated equipment.

In case of poisoning, immediately seek medical advice. Remember to identify the chemicals used.

#### Filling and Spraying



DANGER! No persons are allowed in the operation areas of the sprayer. Be careful not to hit people or surroundings when manoeuvring the sprayer, especially when reversing.



DANGER! Slow down when driving in uneven terrain, as the machine might be in risk of turning over.



DANGER! Keep children and animals away from the equipment!



DANGER! Do not attempt to enter the tank.



DANGER! Do not walk under any part of the sprayer, unless it is secured. The boom is secured when placed in the transport brackets.

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## 2 - Safety Notes

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### Environment



WARNING! It is essential to reduce the environmental impact of plant protection chemicals to a minimum. Particularly the soil, subsoil water, streams, lakes, flora and fauna must be in focus. Contamination of subsoil water must be prevented by paying particular attention to avoidance of spot contamination of the soil in connection with filling and washing and parking of the sprayer.



WARNING! Do not overfill the main tank. The nominal volume inside the main tank is stated with large printed numbers on the outside of the tank. If overfilling, some sprayer functions may be disabled, and the spray liquid could also leak from the sprayer causing contamination of the soil.



WARNING! If any concentrated chemicals are spilled on the soil, the contaminated soil should be removed and sent for cleaning at a capable facility. This to avoid seepage of chemicals to the subsoil waters. Avoid spillage - use the chemical filling device for filling the sprayer with chemicals.



ATTENTION! Before filling the sprayer with plant protection chemicals, the sprayer must be calibrated to apply the precise dose rate selected. The important input sensors are the flowmeter and the speed sensor.



ATTENTION! It is recommended to establish a proper filling and washing location with hard, impenetrable surface drained to a receptacle if the sprayer is always filled or cleaned on the same spot at the farm. If a washing/filling location is NOT available, the following precautions should be taken:



ATTENTION! The sprayer should only be filled with clean water at the farm and the plant protection chemicals must be added and mixed in the field that is going to be sprayed. Select a different location each time the sprayer is refilled.

### Service



DANGER! Pressure test with clean water prior to filling with chemicals. Never dismount the hoses if the machine is in operation.

Do not exceed the maximum recommended speed (rpm) for the Power Take-Off (PTO).



DANGER! Never service or repair the equipment while it is operating. Always reassemble all safety devices or shields immediately after servicing.



DANGER! Disconnect electrical power before servicing and depressurize equipment after use and before servicing.



DANGER! If arc welding 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.



DANGER! The External Cleaning Device should not be used, if important parts of the equipment have been damaged, including safety devices, high pressure hoses etc.



WARNING! Rinse and wash equipment after use and before servicing.

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### Label Explanation

The labels are designating potential dangerous places on the machine. Anybody working with or being in close range of the sprayer must respect these labels!

The labels should always be clean and readable! Worn or damaged labels must be replaced with new ones. Contact your local dealer for new labels.



Note that not all labels shown hereafter will apply to your sprayer.



978437 Chemical handling!  
Carefully read the informations about chemical preparation before handling the machine. Observe instructions and safety rules when operating.



978443 Service!  
Carefully read operators instruction book before handling the machine. Observe instructions and safety rules when operating.



978436 Service!  
Shut off the engine and remove ignition key before performing maintenance or repair.



978440 Service!  
Tighten to the torque according to instruction book.



97802100 Risk of death!  
Do not attempt to enter tank.



978447 Risk of burn!  
Stay clear of hot surfaces.



978444 Risk of injury!  
Do not open or remove safety shields while engine is running.



978586 Risk of injury!  
Flying objects - keep a safe distance from the machine, as long as the engine is running.



978448 Risk of injury!  
Keep sufficient distance away from electrical power lines.



978435 Risk of injury!  
Keep hands away.

## 2 - Safety Notes



978441 Risk of squeezing!  
Stay clear of raised and unsecured loads.



978445 Risk of squeezing  
Never reach into the crushing danger area as long as parts are moving.



978434 Risk of squeezing!  
Keep hands away, when parts is moving.



978442 Risk of falling off!  
Do not ride on platform or ladder.



978446 Risk of sprayer tipping over!  
Be aware when disconnecting the sprayer.



978438 Grapping area!  
Manual handling of the boom etc.



97802200 Not for drinking!  
This water must never be used for drinking.



97802300 Not for drinking!  
This water must never be used for drinking.



97818100 Tank under pressure!  
Beware when moving lid.



97827000 EasyClean filter service!  
Open and clean filter monthly.

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### General Info

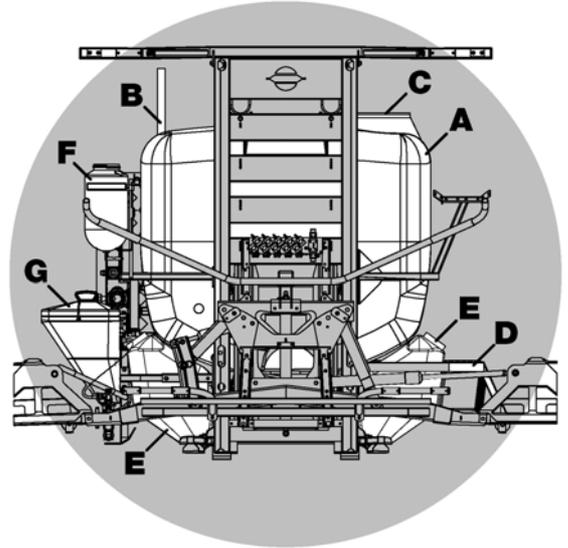
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#### Overview

An overview of the main components on the sprayer.

Some items are optional - so depending on your purchased sprayer, they might not be included.

- A. Main tank.
- B. Tank level indicator.
- C. Main tank lid.
- D. Footboard and SafetyLocker.
- E. Rinsing tank(s), 80 litres.
- F. Clean water tank, 15 litres.
- G. TurboFiller, 25 litres.



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#### Roadworthiness

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

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#### Sprayer Use

The HARDI sprayer is for the application of crop protection chemicals and liquid fertilizers. The equipment must only be used for this purpose. It is not allowed to use the sprayer for any 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 prevent unnecessary risk for persons and the environment, when carrying out your spray job.

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#### Frame

Very strong and compact steel frame with a strong chemically resistant and weatherproof electrostatic lacquer coat. Screws and bolts etc. have been Delta/Magni treated to be resistant to corrosion.

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#### Tanks

The main tank made of impact-proof, UV-resistant and chemically resistant polyethylene, has a purposeful design with no sharp corners for easy cleaning. The filling hole is placed so it can be accessed from the platform. This ensures an easy access for the filling of sprays, cleaning of the tank etc.

Nominal tank contents are 1000, 1200, 1500 or 1800 litres.

# 3 - Description

## Liquid System

### Pump

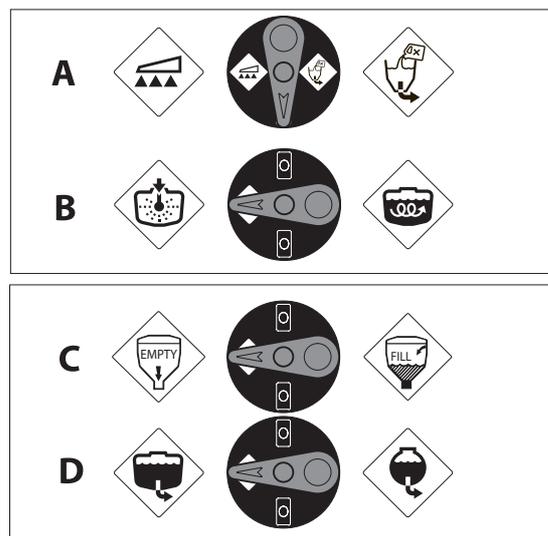
Diaphragm pump with 3 diaphragms, model 1303 or diaphragm pump with 6 diaphragms, model 363 or 364 or 464.

Standard = 540 rpm (6 splines shaft). The design of the diaphragm pump is simple, with easily accessible diaphragms and valves, which ensure that liquid does not contact the vital parts of the pump.

### Valves and symbols

The valves of the valve system are distinguished by coloured identification on the function labels. Symbols corresponding to every possible function of use are located on the discs for easy identification and operation. The modular MANIFOLD system facilitates the addition of optional extras on both pressure side and suction side. Furthermore the suction manifold can be fitted with a return valve which ensures better draining of the sprayer before cleaning. A function is activated by turning the handle towards the desired function. The valves are:

- A. Pressure valve
- B. Agitation valve (optional equipment)
- C. Hopper source valve
- D. Suction valve



#### (D) Suction valve

This valve selects suction from main tank (for spraying) or rinsing tank.

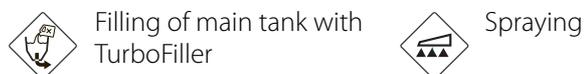
Turn the handle so the indicator points towards the label of the required function. If the handle is turned to vertical position (indicator not pointing to a label), the valve is closed.



#### (B) Pressure valve

This valve selects where to direct pressurized liquid.

The active function is indicated by the indicator. Turn the handle so that the indicator points to the label of the required function. If the handle is turned to a label-free position (unused function), the valve is closed.



#### (C) Chemical source valve (optional)

Turn the handle so the indicator points towards the label of the required function. If the handle is turned to vertical position (indicator not pointing to a label), the valve is closed.



#### (A) Agitation valve (optional)

With the Agitation valve you can select between agitation in the tank or tank cleaning with the rinsing nozzle.



### Control Unit

The sprayer is equipped with an EVC control unit.

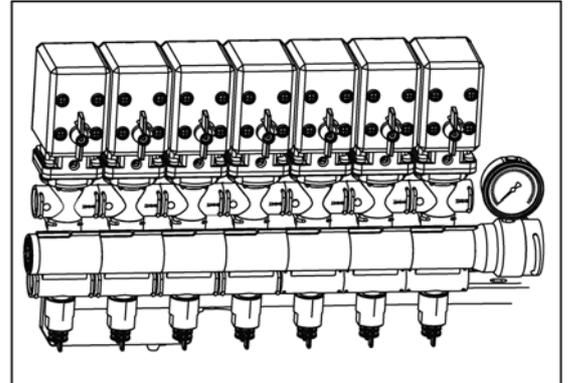
### EVC Control Unit

The system is based on EVC - Electrical Valve Control. The ON/OFF is linked to the section valves (one valve for each spray boom section), which results in a quick response to ON/OFF. The operating unit is of modular design, and it is electrically controlled by a remote control box.

The section valves are fitted with a constant pressure device and a pressure drop line.

These features allows the operator to shut off individual boom sections.

The unit has a built-in HARDI-MATIC system. This system ensures a constant liquid volume per hectare (l/ha) when driving forward at varying speed within the same gear, as long as the number of PTO revolutions are kept between 300-600 rpm.



### Clean Water Tank

The water in this tank is for hand washing, for cleaning of clogged nozzles etc. Only fill this tank with clean water from the well.

The clean water tank is placed on the sprayer's left side, right behind the manifold valves.

Capacity: approximately 15 litres.



**WARNING!** Although the clean water tank is only filled with clean water, this water must NOT be used for drinking.



## 3 - Description

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### Filters

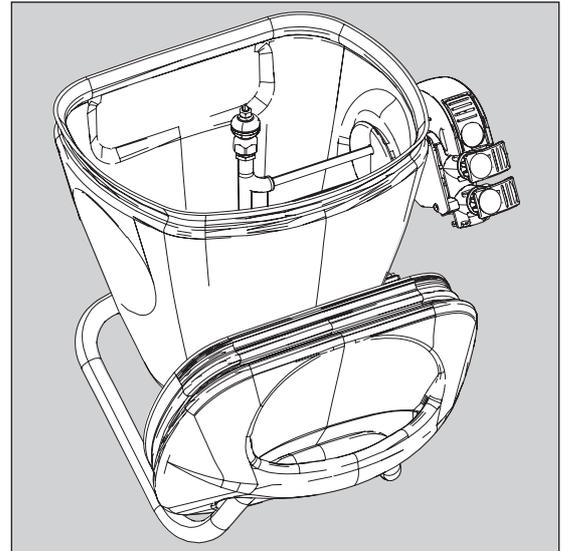
A suction filter is fitted at the top of the tank. It is indicated with a red hose tail.

In-line pressure filters can be fitted at each boom section as an option.

Nozzle filters are fitted at each nozzle.

All filters should always be in use and their function should be checked regularly. Pay attention to the correct combination of filter and mesh size. For more, see "Technical Specifications" in this book.

## TurboFiller

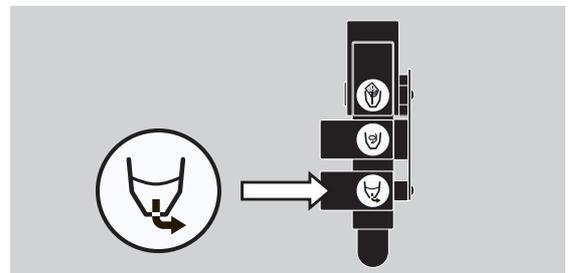


### TurboFiller Suction Valve

The valve is used simultaneously with the TurboFiller. The valve has 2 settings: Continuously open or spring loaded normally closed. Open the valve when chemicals are to be filled into the TurboFiller and transferred to main tank.



Suction from TurboFiller

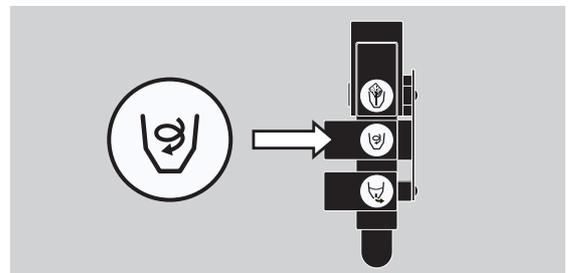


### TurboDeflector Valve

This TurboDeflector valve activates the vortex flushing of the TurboFiller. Lift the lever to lock it in open position for continuous liquid rotation in the hopper.



Start TurboDeflector



### Chemical Container Rinsing Lever

The upper lever is used for two purposes.

When the TurboFiller lid is open:

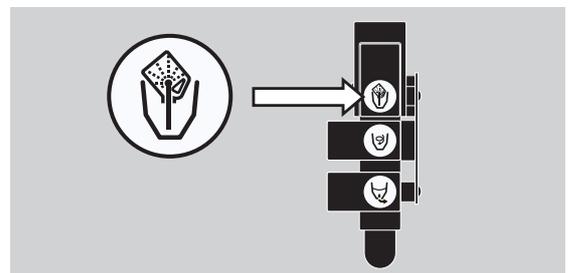
For rinsing empty containers. Place the container over the rotating flushing nozzle in the middle of the TurboFiller to rinse the inside of the container.

When the TurboFiller lid is closed:

Use the Chemical Container Rinsing lever to rinse the hopper, when the filling of chemicals is completed.



Chemical Container Rinsing



**DANGER!** Do not press the lever, unless the multi-hole nozzle is covered by a container, as spray liquid may otherwise hit the operator.

## 3 - Description

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### Spray Boom

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#### Boom and Terminology

The HYS boom is a bi/tri articulated boom, designed for manoeuvrability in fields with obstacles such as trees, posters etc. The fold of the boom is vertical. The articulated boom allows the operator to flip up individual section or single side fold described as follows.

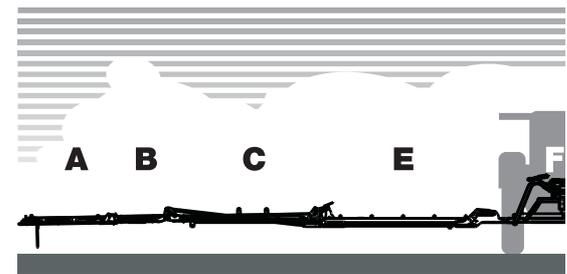
#### For 2-folded booms, the terminology is as follows:

- F - Centre section
- E- Inner section
- C - Middle section
- A - Breakaway section



#### For 3-folded booms, the terminology is as follows:

- F - Centre section
- E- Inner section
- C - Middle section
- B - Outer section
- A - Breakaway section



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#### Boom Y-Z versions

The boom is offered in two hydraulic versions the Y and the Z version

##### The Y version

All hydraulic functions will be operated through the tractor hydraulic outlets. The articulated boom allows the operator to flip up individual section or single side fold

##### The Z version

Direct Activated Hydraulics (DAH) being standard equipment on the MASTER sprayer provides comfort and manoeuvrability, just one double acting hydraulic outlet is needed, and via the control box in the cabin, the boom is operated, left right fold individual, with a high-end hydraulic system, that includes the open centre hydraulic block. It allows the hydraulic system to be operated from a tractor with open centre as well closed centre hydraulic system.

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### Equipment

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#### Nozzle Pressure Gauge

The remote pressure gauge is integrated at the front of the sprayer. This gauge measures the working pressure in the boom tubes as close to the nozzles as possible.

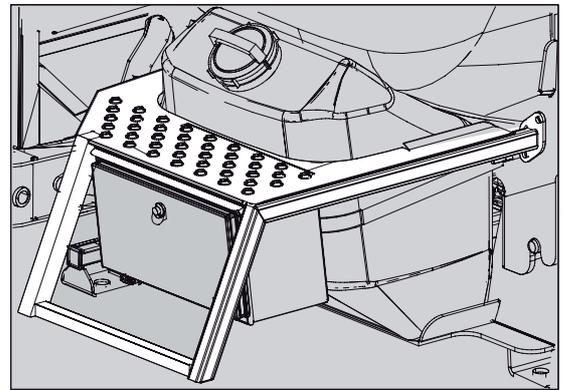
The outputs stated in the nozzle charts are always based on the pressure measured at the nozzle. Both when calibrating and spraying, the pressure must be adjusted according to the readings of this pressure gauge.



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#### Footboard

The footboard gives access to the main tank lid. It ensures easy access for filling of sprays, cleaning of tank, etc.



## 3 - Description

### Canister for Pesticide Information

This canister is for storing information about the present pesticide product in the tank - such as labels, instructions and safety data sheet (SDS) from the pesticide supplier.

The canister is placed on the side of the footboard.

Unscrew the lid and store this information inside the canister at all times when using the sprayer.

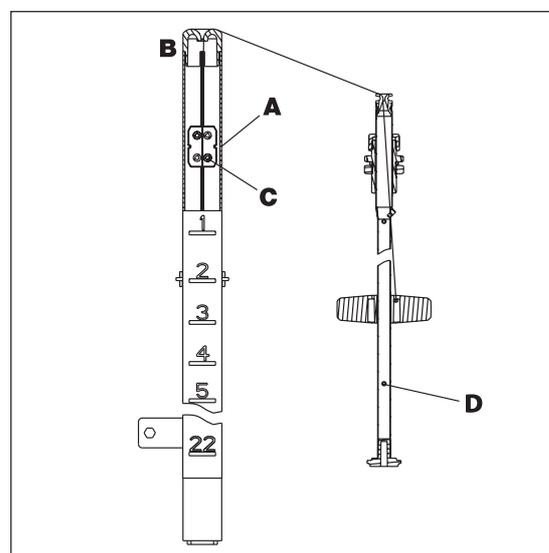


**ATTENTION!** Although this canister is meant for the storing of non-contaminated items, it must never be used for the storing of food, beverage or other items meant for human consumption.



### Tank Level Indicator

The actual tank level in the main tank can be observed on the tank level indicator. The scale is displayed in litres (or Imp. gal/US gal. for certain countries).



### External Cleaning Device (optional)

This equipment comprises a hose reel for cleaning the complete sprayer externally in the field with clean water. The External Cleaning Device is located on the boom centre section at the back.



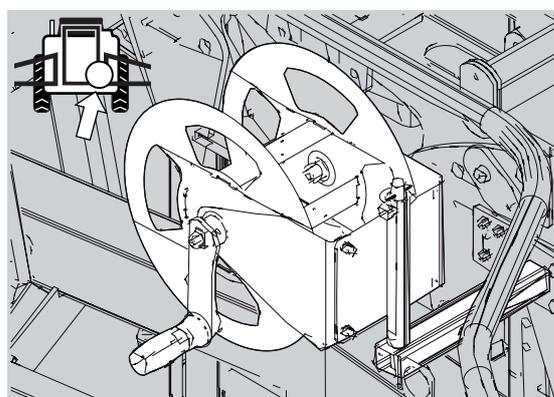
**WARNING!** The cleaning device produces a high water pressure. Incorrect use may result in injuries!



**DANGER!** Never work in bare feet or sandals. It is recommended to wear goggles during the cleaning work. It is recommended that the user, or anyone near the cleaning place, protects himself against particles bouncing up during the cleaning.



**DANGER!** For the safety of yourself and others, the following rules should always be observed:  
Never point the water jet at people, animals, electrical installations or other sensitive objects.  
Never try to clean clothing or footwear which you or other people are wearing.



### General Info

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#### Before Putting the Sprayer into Operation

Although the sprayer has been supplied with a strong and protective surface treatment on steel parts, bolts etc. in the factory, it is recommended to apply a film of anti-corrosion oil (e.g. CASTROL RUSTILO or SHELL ENSIS FLUID) on all metal parts in order to avoid chemicals and fertilizers 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 clean for many years. This treatment should be carried out every time the protection film is washed off.

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#### Unloading the Sprayer from the Truck

For the unloading of the sprayer, you need a fork lift. The sprayer is bolted to a shipping pallet or frame. Only lift from the shipping pallet or frame when unloading the sprayer.



## 4 - Sprayer setup

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### Checking the Suitability of the Tractor

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#### General Info

Before connecting the sprayer to your tractor, you must check the suitability of the tractor. Only connect a tractor which is suitable for the purpose.

Perform a brake test to check whether the tractor achieves the required braking rate with the sprayer connected.

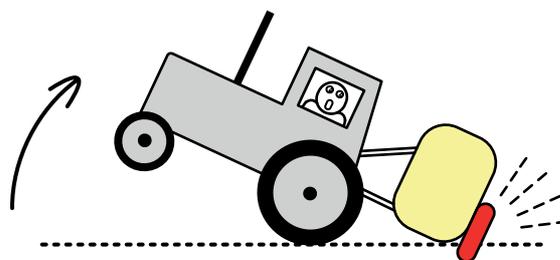


**DANGER!** An unsuitable tractor, or improper use of the tractor, causes a risk of:

- insufficient tractor stability, steering and braking power
- severe or fatal injuries
- the sprayer being damaged during operation

Requirements for the suitability of a tractor are, in particular:

- Permissible total weight
- Permissible approved axle loads
- Load capacity of the tyres fitted
- Approved front weights must be sufficient



You can find this data on the rating plate of the tractor or in the tractor's instruction manual or documentation. Ask your tractor dealer if in doubt.

The front axle of the tractor must always be subjected to at least 20% of the total weight of the vehicle.

The tractor must achieve the braking rate specified by the tractor manufacturer, even with the sprayer connected.

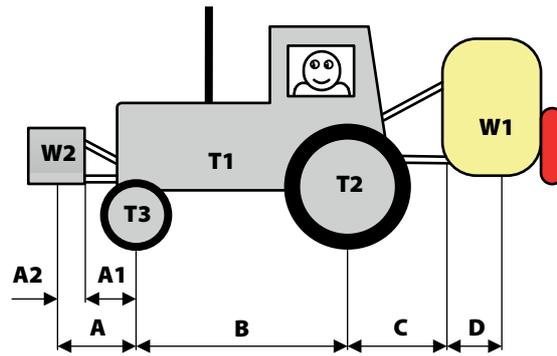
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### Calculating Actual Weights and Loads

The permissible total tractor weight, specified in the tractor documentation, must be greater than the sum of the:

- Tractor's tare weight
- Tractor's ballast and weights
- Sprayer's total weight

### Data Required for the Calculation



T1	(kg)	Tractor empty weight.	See tractor's instruction book or documentation.
T2	(kg)	Rear axle load of the empty tractor.	
T3	(kg)	Front axle load of the empty tractor.	
W1	(kg)	Total weight of rear-mounted sprayer with a full tank.	See the section "Technical Specifications" in this instruction book and add the weight of your spray liquid for a full tank.
W2	(kg)	Total weight of front weights or front-mounted sprayer with a full tank.	Front weights: Total weight of all front weights. Front-mounted sprayer: See technical data for this equipment and add the weight of your spray liquid for a full tank.
A	(m)	Distance between the centre of gravity of the front weights, or front-mounted sprayer with a full tank, and the centre of the front axle (total A1 + A2).	See tractor's instruction book or documentation, or data for front weights, or perform a measurement.
A1	(m)	Distance from the centre of the front axle to the centre of the lower link connection.	See tractor's instruction book or documentation, or perform a measurement.
A2	(m)	Distance between the centre of the lower link connection point and the centre of gravity of the front weights, or front-mounted sprayer with a full tank (centre of gravity distance).	Front weights: See technical data for front weights. Front-mounted sprayer: See technical data for this equipment and add the weight of your spray liquid for a full tank.  Or perform a measurement.
B	(m)	Tractor wheel base.	See tractor's instruction book or documentation, or perform a measurement.
C	(m)	Distance between the centre of the rear axle and the centre of the lower link connection.	See tractor's instruction book or documentation, or perform a measurement.
D	(m)	Distance between the centre of the lower link connection point and the centre of gravity of the rear-mounted sprayer with a full tank (centre of gravity distance).	0.7

### Calculation of Required Minimum Front Weight

To ensure the tractor's steering capability, the minimum front weight [ $W2_{min}$ ] is calculated:

$$W2_{min} = \frac{W1 \times (C + D) - T3 \times B + 0,2 \times T1 \times B}{A + B}$$

## 4 - Sprayer setup

### Calculation of Actual Front Axle Load [T3] of the Tractor

$$T3 = \frac{W2 \times (A + B) + T3 \times B - W1 \times (C + D)}{B}$$

### Calculation of Actual Total Weight [W] of the Combined Tractor and Sprayer(s)

$$W = W2 + T1 + W1$$

### Calculation of Actual Rear Axle Load [T2] of the Tractor

$$T2 = W - T3$$

### Calculation Compared to Permissible Values

	Actual value according to calculation		Permissible value according to the tractor's instruction book or documentation.
Minimum weight front / rear	<input type="text"/> / <input type="text"/> kg		--
Total weight	<input type="text"/> kg	is less than	<input type="text"/> kg
Front axle load	<input type="text"/> kg	is less than	<input type="text"/> kg
Rear axle load	<input type="text"/> kg	is less than	<input type="text"/> kg



NOTE! Fill in the values in the fields above. You can find the permissible values for the total tractor weight, axle loads and load capacities in the tractor's registration papers or in the tractor documentation.



ATTENTION! Add weights to your tractor at the front or rear, if the tractor axle load is exceeded on only one axle.



ATTENTION! If you do not achieve the minimum weight at the front ( $W_{2\min}$ ) from a front-mounted sprayer alone, you must add front weights to the tractor.



DANGER! It is forbidden to couple the sprayer to the tractor, if one of the actual calculated values is greater than the permissible value, or if there is no front ballast (if required) mounted on the tractor.



DANGER! When driving on hilly ground, the centre of gravity can change significantly for the combined tractor and sprayer - allow for this when calculating the minimum ballast for the tractor as well as driving carefully. Risk of the tractor turning over resulting in the driver being crushed or trapped. Risk of impact with the sprayer through insufficient stability of the tractor and insufficient steering abilities and braking power.

## Transmission Shaft

### Operator Safety

1. Always STOP THE ENGINE before attaching the transmission shaft to the tractor power take-off (PTO) - most tractor PTO shafts can be rotated by hand to facilitate spline alignment, when the engine is stopped.
2. When attaching the shaft, make sure that the snap lock is FULLY ENGAGED - push and pull the shaft until it locks.
3. Always keep protection guards and chains intact and make sure that it covers all rotating parts, including CV-joints at each end of the shaft. Do not use without protection guard.
4. Do not touch or stand on the transmission shaft, when it is rotating - keep your safety distance at 1.5 meter. Also NEVER cross over a rotating PTO shaft to reach the other side of the sprayer.
5. Prevent protection guards from rotating by attaching the chains allowing sufficient slack for turns.
6. Make sure that protection guards around the tractor PTO and the implement shaft are intact.
7. Always STOP THE ENGINE and remove the ignition key, before carrying out maintenance or repairs to the transmission shaft or implement.



DANGER! A ROTATING TRANSMISSION SHAFT WITHOUT PROTECTION GUARDS IS FATAL!

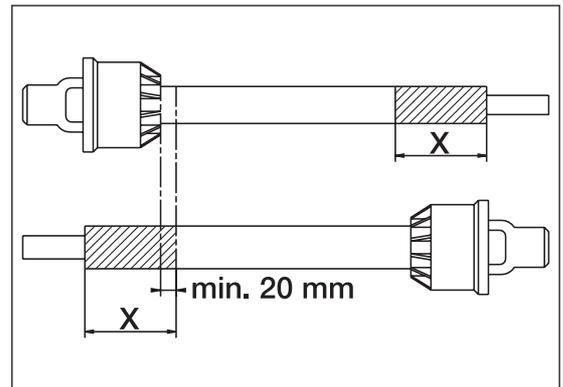
### PTO Installation



DANGER! As PTO shafts are dangerous in operation, always read the manufacturer's instruction book before applying any changes to the transmission shaft!

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

1. Attach the sprayer to the tractor and set the sprayer height in the position with the shortest distance between the tractor and the sprayer pump PTO shafts.
2. Stop the engine and remove the ignition key.
3. If the transmission shaft needs to be shortened, pull the shaft apart. Fit the two shaft parts to the tractor and the sprayer pump and measure how much the shaft needs to be shortened. Also mark the protection guards with the same length to be shortened.

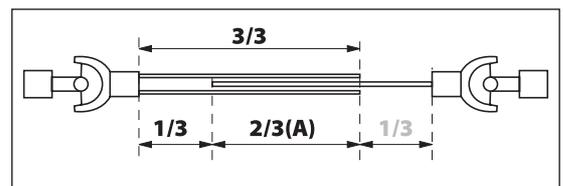
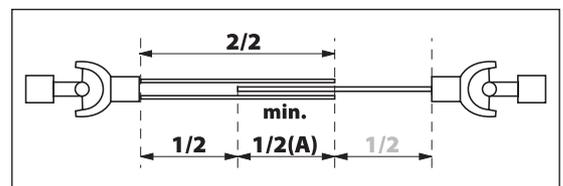


WARNING! Only shorten the shaft if it is absolutely necessary!



WARNING! The shaft must always have minimum overlap of half a shaft length!

The recommended overlap (A) of the two shaft parts is 2/3 of the length. The shaft must always have minimum overlap (A) of 1/2 of the length.



## 4 - Sprayer setup

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### Mechanical Connection

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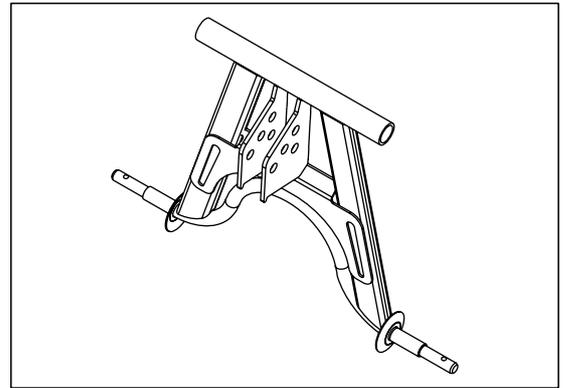
#### Quick Hitch

The sprayer is designed for a three point suspension (Category II). A Quick Hitch is supplied with the sprayer. Fit the Quick Hitch to the tractor for easy hook-up of the sprayer.

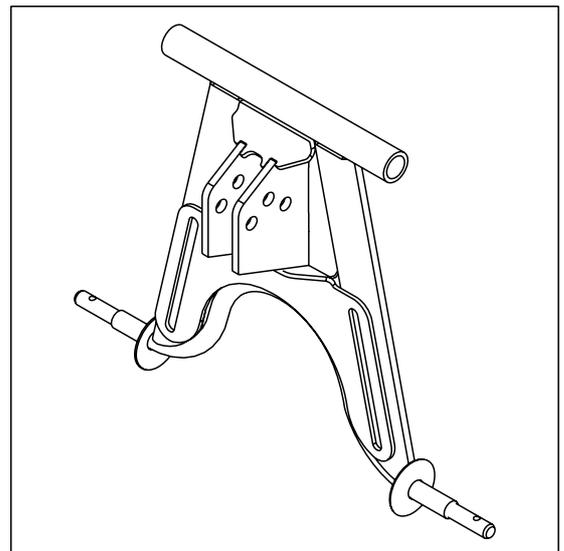


WARNING! When hooking up the sprayer, ensure the safety hooks are fully engaged, before driving.

Type for 1000 and 1200 litre sprayers



Type for 1500 and 1800 litre sprayers



### Hydraulic Systems

#### General Info

Ensure that the snap couplers are clean before connection!

After having operated the boom and the system has been filled with oil, check the tractor's hydraulic oil level and top up, if necessary.



**DANGER!** Test of the hydraulic system should be done very cautiously. There may be air trapped in the system which can cause violent movements of the boom.



**DANGER!** Hydraulic leaks: Never use your fingers to locate a leakage in any part of the hydraulic system. Due to high pressure, hydraulic oil may penetrate the skin.

#### Requirements for Tractor

The hydraulic system requires:

##### Y model

- One single-acting outlet to raise and lower the boom.
- One double-acting outlet to fold and unfold the boom.
- One double-acting outlet for hydraulic slanting control (Y option).

##### Z model

- One double-acting outlet for the electro-hydraulic operation of the boom functions.

Models without electrical activated boom lift also require:

- One single-acting outlet to raise and lower the boom.

The hydraulic hoses are marked with arrows to indicate the direction of oil flow.

The hydraulic system requires an oil flow between 25 and 130 l/min and a minimum oil pressure of 170 bar.

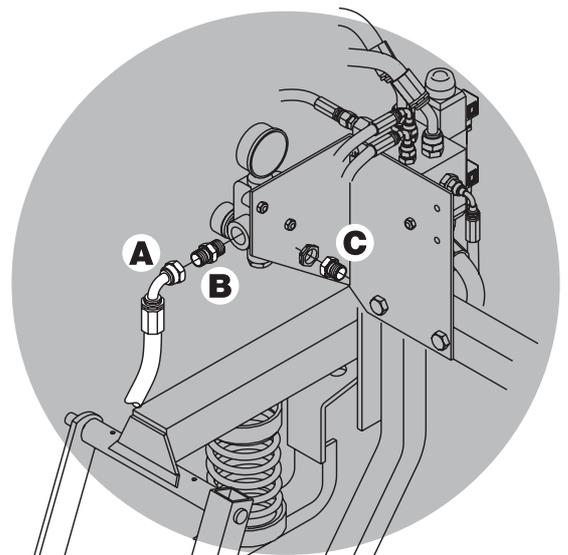
#### Closed Centre Hydraulics

The sprayer is delivered for use with open centre hydraulic systems. If the tractor is equipped with closed centre (load sensing) hydraulics, the bypass on the hydraulic valve block on the sprayer needs to be blocked off.

The sprayer is supplied with an extra 1/2" brass nipple with no perforation.

To convert the sprayer for closed centre hydraulics:

1. Disconnect hydraulic hose A
2. Swap standard 1/2" black nipple B with brass nipple C
3. Connect hydraulic hose A.



## 4 - Sprayer setup

### Open Centre Hydraulics

The open centre hydraulics block is necessary, if the tractor uses open centre hydraulics and/or load sensing.

The valve (1) and (2) is factory set for open centre hydraulics, but if closed centre hydraulics is used (also in combination with load sensing), screw in the valve (clockwise).

Certain tractor models are able to use Load Sensing without connecting an external sensing line. But if optimal sensing control pressure cannot be obtained, an external sensing line needs to be connected (3). Please consult your tractor dealer for correct setup and correct connection.



**WARNING!** Before operating the hydraulics, the valve should be set according to the specific tractor model. If you are unsure of the type of hydraulic system in your tractor, please contact your tractor dealer.

Combinations of settings for flow element and circuit value:

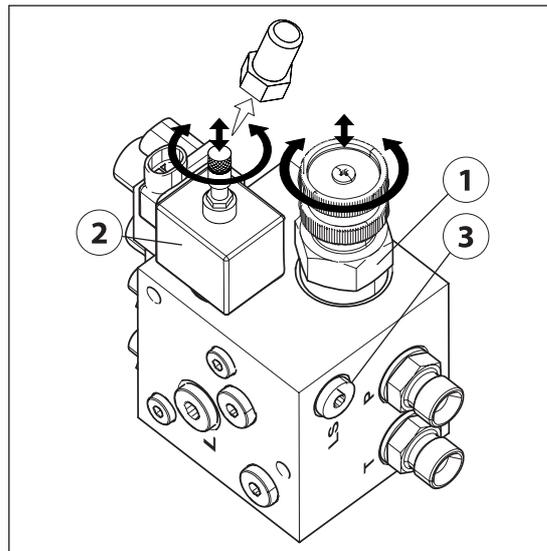
Valve no.	1	2	3 (LS port)
Open centre	Out	Out	Not connected
Closed centre	In	In	Not connected
Load sensing (LS)	In	Out*	Connected

\*If the tractor requires pressure relief, contact your tractor dealer for further advice.



**WARNING!** Always be sure to fully open or close the open/closed centre selection valves. Failure to do so may cause damage to vital pump parts.

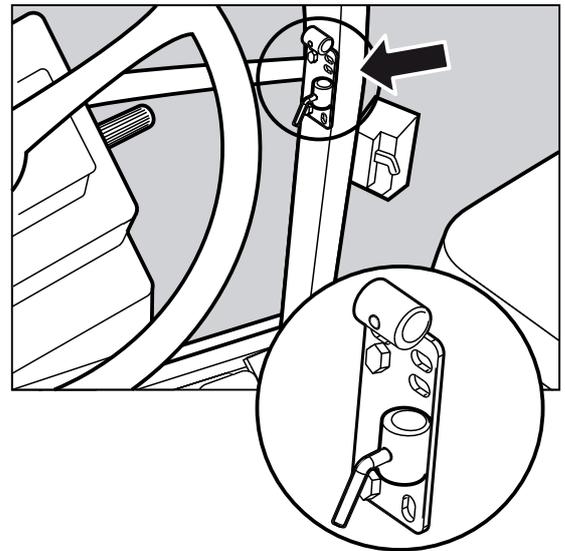
**WARNING!** It is essential that connectors on sensing line are kept totally clean. Failure to do so can result in impurities entering the pump and causing damage to vital pump parts.



### Electric Connections

#### Installation of Control Unit Brackets (optional)

Find a suitable place in the tractor cabin to mount the control units. Best recommended position is to the right of the driver seat.

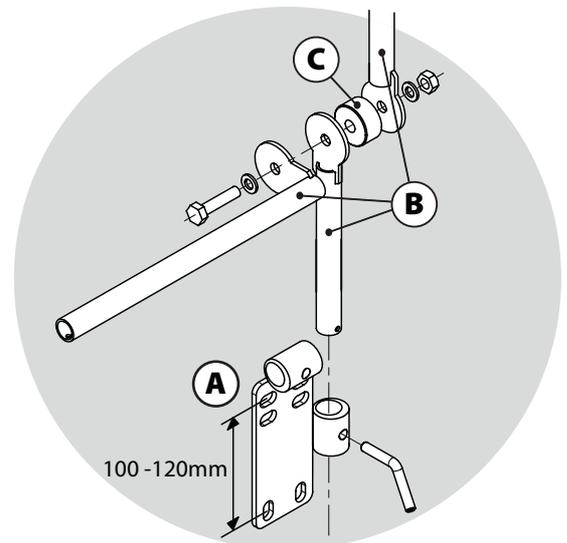


**i** Note! Mounting tubes are only supplied if rate controller is fitted

The supplied tractor pillar bracket (A) has a hole spacing of 100 and 120 mm, which fits most tractors. Threaded mounting holes may be hidden behind front corner cover. Check the tractor's instruction book for information regarding attachment points.

Three mounting tubes (B) are supplied. One, two or all three may be used. They can be bent and shortened. A spacer (C) is also supplied to allow further attachment possibilities. Find the best solution for your tractor or vehicle.

Tube (B) plate is staggered so that, if correctly orientated, all boxes will line up.

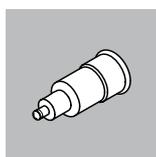
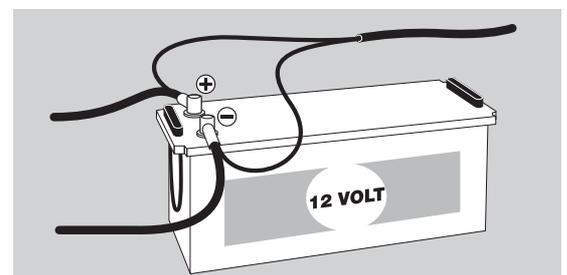


**ATTENTION!** See also the controllers instruction book for further details of fitting the controller equipment.

#### Power Supply

Power requirement is 12V DC. Always note polarity! For proper function of the electric equipment, the wires must have the following recommended cross sectional areas and correct fuses to ensure a sufficient power supply. The delivered power connectors follows the standard of most newer tractors. If you have a tractor with another power connector, it is necessary to disassemble the connector and fit it to the actual tractor connector.

The number and the type of connectors may vary on the specific sprayer, depending on its equipment.



Cigar connector  
 Spray control unit requires:  
 Wire 2.5 mm<sup>2</sup>, Fuse 10 Amp  
 Hydraulic control unit requires:  
 Wire 4.0 mm<sup>2</sup>, Fuse 16 Amp

## 4 - Sprayer setup

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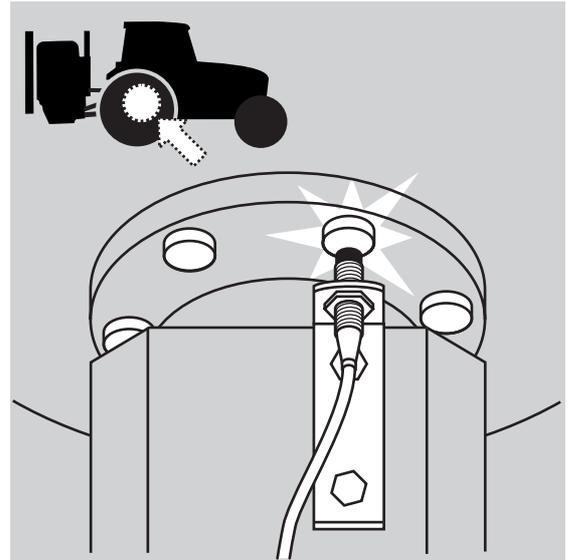
### Speed Transducer for Tractor

Note the following if the speed transducer is fitted to the tractor.

The speed transducer (A) and the speed ring should be located at the inside of the tractor's right wheel. The sensor is an inductive type that requires a metallic protrusion (e.g. a bolt head) passing by in order to trigger a signal. It should be adjusted, so that the transducer is placed to the centre of the holes in the speed ring (vertical direction).

Recommended distance between protrusion and transducer (A) is 3 to 6 mm. Check this in the entire circumference.

Correct fitting is indicated by a constant flashing of the transducer, when the wheel is rotating.



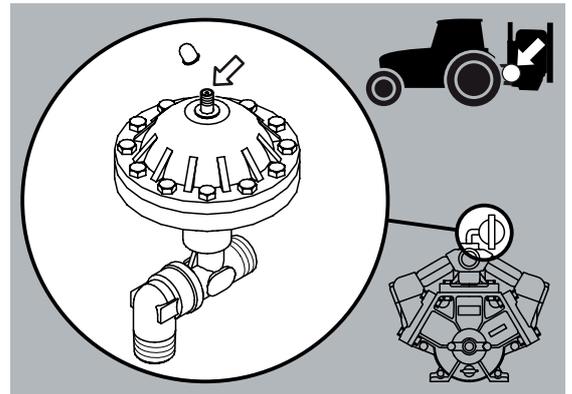
### Liquid System

#### Pulsation Damper (only for pump model 1303)

The air pressure in the pulsation damper is factory preset at 2 bar to cover spray working pressures between 3 and 15 bar.

When using spray pressures outside this range, the air pressure should be adjusted as shown in the diagram. The diagram is embossed on the damper.

Spray pressure (Bar)	Damper pressure (Bar)
1.5 - 3	0 - 1
3 - 15	1 - 3
15 - 25	3 - 4



## 4 - Sprayer setup

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### Spray Boom

#### Lock Bolt Safety Info

The boom must not be folded/unfolded while driving! Never use the folding/unfolding functions before the sprayer has been stopped! Failure to do so will damage the boom.



**DANGER!** Before unfolding the boom it is important to connect the sprayer to the tractor to prevent overbalancing of the sprayer.



**DANGER!** When folding or unfolding the boom, make sure that no persons or objects are within the operating area of the boom.



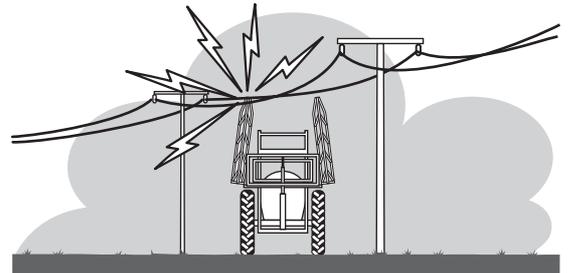
**DANGER!** Always follow the guidelines listed below when driving in areas with overhead power lines:

Never use the folding/unfolding functions in areas with overhead power lines.

Unintended boom movements may cause contact with overhead power lines.



**ATTENTION!** Only unfold and fold the boom on level ground.



#### Lock Bolt

Both versions Y and Z hold a lock bolt in the centre section.

On Y version use it when individual folding is required.

On Z version, remove it permanently, the slant function is used when folding individual left or right.



**Attention!** The lock should always be engaged during transportation



## 5 - Operation

### Manoeuvring of the boom - with Y hydraulics

The HYS boom is controlled solely by the tractor's hydraulic levers.

Following operations are carried out by the tractor's hydraulic control lever(s).

- Raising/lowering of the boom.
- Folding/unfolding of the boom.
- Slanting control (optional).



ATTENTION! Only unfold and fold the boom on level ground.

### Single-sided folding

#### Y hydraulics only:

1. Raise boom halfway to the top (at least).
2. Unfold either right or left inner section.
3. Unfold either right or left outer section.
4. Lower boom to desired working height.

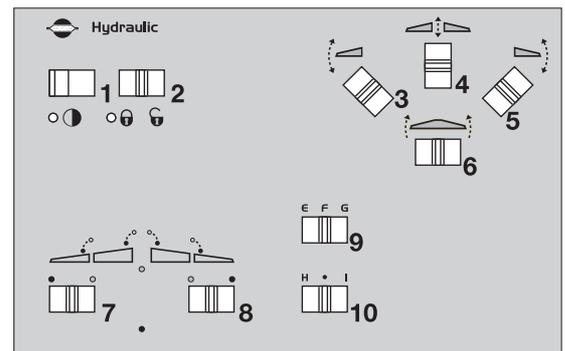


ATTENTION! Do not unlock the trapeze!

### Manoeuvring of the boom - Z hydraulics

The switches on the hydraulic control box controls the following functions:

1. Power ON/OFF.
2. Trapeze lock.
3. Boom tilt left.
4. Boom raise/lower.
5. Not active
6. Boom slant angle.
7. Boom outer folding left.
8. Boom outer folding right.
9. Optional functions E/F/G.
10. Optional functions H/I.



### Unfolding the boom

1. Check that the trapeze (2) is locked.
2. Push switch (4) upwards to raise the boom, until it is clear of the transport brackets.
3. Unfold inner sections by pressing switches (3) downwards.
4. Unfold outer sections by pressing switch (7) to the left and switch (8) to the right.
5. Push switch (6) to correct slant angle.
6. Push switch (4) downwards to lower boom to desired working height.
7. Unlock trapeze (2).

The folding procedure is the reverse of unfolding.



WARNING! If the boom is not symmetrically unfolded (e.g. when using alternative boom widths), the trapeze must be locked during driving. Failure to do so will damage the boom!

### Liquid system

#### Filling/Washing Location Requirements

When filling the sprayer with chemicals and water, it is important to avoid spot contamination by spraying chemicals in order to protect the subsoil water resources.

##### At a dedicated filling site

If the sprayer is always filled on the same location, a special filling/washing location should be established. This should have a hard, liquid-impenetrable surface (e.g. concrete) securing against seepage, together with edges securing against run-off to the surrounding areas. The location should be drained to an adequate receptacle (e.g. slurry tank or similar).

Any spillage or washings should be retained and diluted in order to be distributed in a larger area. This is to ensure minimal environmental impact and avoid build-up of larger chemical concentrations at one spot.

If no other requirements of distances exist, the following general recommendation of distance can be used. Filling location must be no closer than:

1. 50 metres from public water supplies for drinking purposes, and
2. 25 metres from non-public water supplies for drinking purposes and from treatment sumps and cesspools of drainage systems, and
3. 50 metres from surface water (watercourses, lakes and coastal waters) and from nature reserves.

##### In the field

Alternatively the sprayer can be filled in the field, where the spraying is to take place. If so, choose a different location for each refilling.

If no other requirements of distances exist, the filling should not take place closer than:

1. 300 metres from public or non-public water supplies for drinking purposes, and
2. 50 metres from surface water (watercourses, lakes and coastal waters), treatment sumps, cesspools of drainage systems, and nature reserves.



ATTENTION! Legislation and requirements vary from country to country. Always follow local legislation in force.



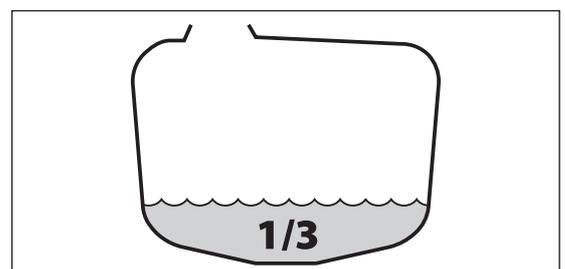
ATTENTION! It is the responsibility of the sprayer owner/operator to comply with all relevant legislation. HARDI cannot undertake any responsibilities for incorrect operation and use.

#### Filling of Water

The tank should normally be filled 1/3 with water before adding chemicals. Always follow the instructions given on the chemical container!



WARNING! If the sprayer is put aside with liquid in the main tank, all manifold valves must be closed.



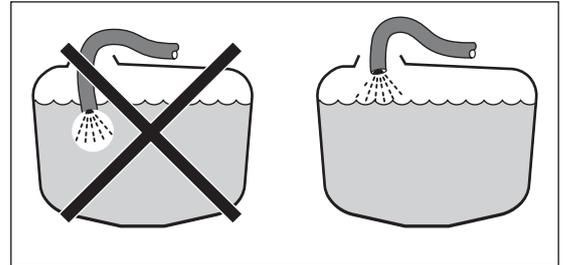
## 5 - Operation

### Filling Through Tank Lid

Water is filled into the tank by removing the big tank lid, which is located at the top of the tank on the sprayer's right side. The tank lid is accessible from the optional footboard. It is recommended to use as clean water as possible for spraying purposes. Always fill water through the strainer basket to prevent foreign particles from entering the tank. An overhead tank can be used in order to obtain high filling capacity.



**WARNING!** Do not let the filling hose enter the tank. Keep it outside the tank, pointing towards the filling hole. If the hose is led into the tank, and the water pressure drops at the water supply plant, chemicals may be sucked back and contaminate the water supply lines, supply plant and supply well.



**WARNING!** The water supply line should be provided with a check valve as additional safety precaution. Follow local legislation in force at any time.



**WARNING!** The water supply should be provided with a water meter to avoid spillage by overfilling. Follow local legislation in force at any time.

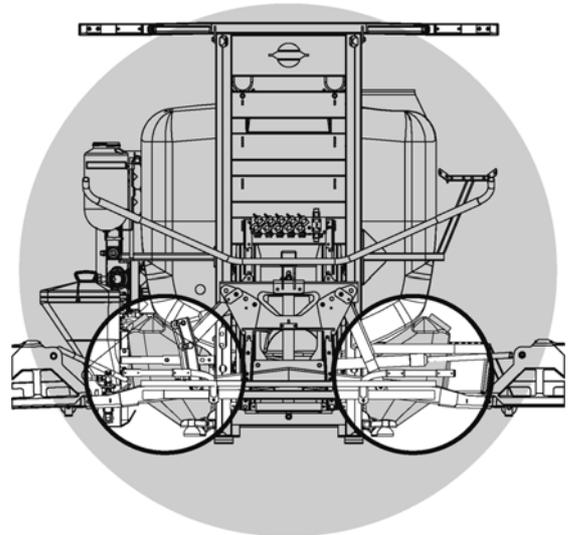
### Filling of Rinsing Tanks (optional)

1. If one or two rinsing tanks are fitted to the sprayer, they are filled via the lid on the top of the tanks: Remove the filler lid of the tank to be filled
2. Fill water into the tank. Keep an eye on the tank opening in order not to overfill the tank.
3. Stop filling and refit the lid.

Volume: approximately 80 litres each.



**ATTENTION!** Only fill rinsing tank with clean water! To avoid algae developing in the rinsing tank, always drain this tank, if the sprayer is not in use for a longer period of time.



### Filling of Clean Water Tank

To fill the clean water tank:

1. Remove the tank lid
2. Fill with clean water
3. Reposition the tank lid.

For use of water:

- Turn the ball valve lever to open (arrow).

The water from this tank is for hand washing, cleaning of clogged nozzles etc.



**ATTENTION!** Only fill this tank with clean water! To avoid algae developing in the clean water tank, always drain this tank, if the sprayer is not in use for a longer period of time.



**WARNING!** Although the clean water tank is only filled with clean water, this water must NOT be used for drinking.



### External Filling Device (optional)

The External Filling Device is operated as follows:

1. Remove cover and connect suction hose to the suction manifold.
2. Turn pressure valve to "Spraying", and, if the blue return valve is mounted, turn it to "Main tank".
3. Turn handle on External Filling Device valve towards Filling Device.
4. Engage diaphragm pump and set PTO revolutions at 540 rpm.
5. The tank is now filled with water. Keep an eye on the liquid level indicator.
6. Turn handle on suction manifold away from Filling Device to discontinue filling process. Now disengage the pump.
7. Disconnect suction hose and replace cover.



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



**WARNING!** Do not leave the sprayer while filling the tank, and keep an eye on the level indicator in order NOT to overfill the tank.



**ATTENTION!** 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 strongly recommended only to fill from closed reservoirs (mobile water tanks etc.) to prevent contamination.

### Safety Precautions - Crop Protection Chemicals

Always be careful when working with crop protection chemicals!



**WARNING!** Always wear proper protective clothing before handling chemicals!

### Personal protection

Depending on chemical type, protective gear/equipment should be worn to avoid contact with the chemicals, such as:

- Gloves
- Waterproof boots
- Headgear
- Respirator
- Safety goggles
- Coverall with chemical resistance



**WARNING!** Protective clothing/equipment should be used, when preparing the spray liquid, during the spray job and when cleaning the sprayer. Follow the chemical manufacturer's instructions given on the chemical label and/or local legislation.



**WARNING!** It is always advisable to have clean water available, especially when filling the sprayer with chemicals.



**WARNING!** Always clean the sprayer carefully and immediately after use.



**WARNING!** Only mix chemicals in the tank according to directions given by the chemical manufacturer.



**WARNING!** Always clean the sprayer before changing to another chemical.

## 5 - Operation

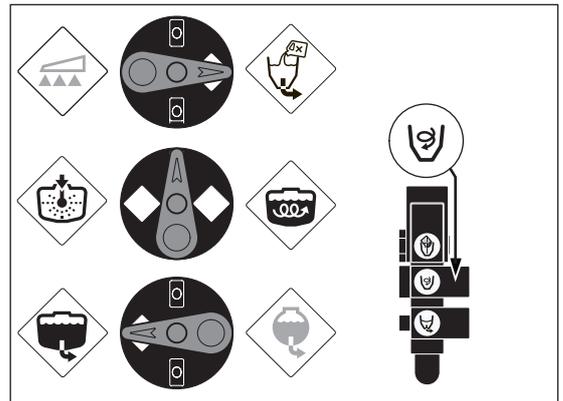
### Filling Liquid Chemicals by using HARDI TurboFiller (optional)

1. Fill the main tank at least 1/3 with water (unless otherwise stated on the chemical container label).
2. Turn the handle of the suction valve towards "suction from Main tank". Turn pressure valve to "TurboFiller". Close the Agitation Valve.



ATTENTION! If filling water from an external tank, this can be continued while doing the next steps.

3. Engage the pump and set PTO speed at 540 rpm.
4. Open TurboFiller lid, engage the TurboDeflector valve. Measure the correct quantity of chemical and fill it into the hopper.

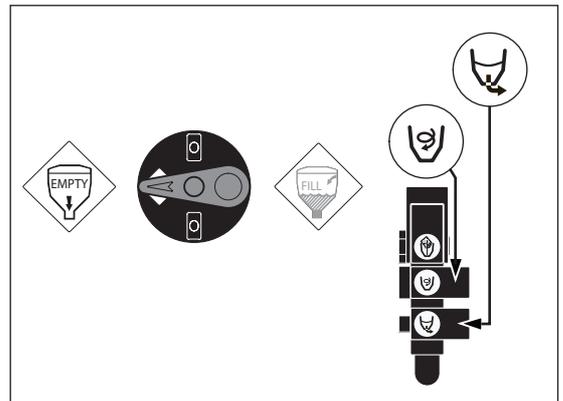


DANGER! Always wear face shield and other appropriate personal safety equipment, when filling chemicals.



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

5. To empty the hopper turn the Chemical Source valve to Empty Hopper. Engage the hopper transfer device by opening the TurboFiller suction valve to transfer chemicals to the main tank. The TurboFiller suction valve must be open for at least 20 seconds after the chemical is no longer visible in the hopper, in order to empty the transfer hoses completely into the main tank.



DANGER! If the TurboFiller and the transfer hoses are not completely emptied, there is a risk of chemicals being sucked out of the main tank!

6. If the chemical container is empty, it can be rinsed by the Chemical Container Cleaning device. Place the container over the multi-hole nozzle and push the container for cleaning.



DANGER! In order to avoid spray liquid hitting the operator, do not press the lever, unless the multi-hole nozzle is covered by a container, as spray liquid may otherwise hit the operator!



ATTENTION! The rinsing device uses spray liquid to rinse containers for concentrated chemicals. Before disposal, always rinse the chemical containers with clean water several times, until they are clean.

7. Flush the TurboFiller with clean water from the rinsing tank or from an external tank by shifting to suction. The TurboFiller suction valve must be open for at least 20 seconds after the rinse water is no longer visible in the hopper, in order to empty the transfer hoses completely into the main tank.



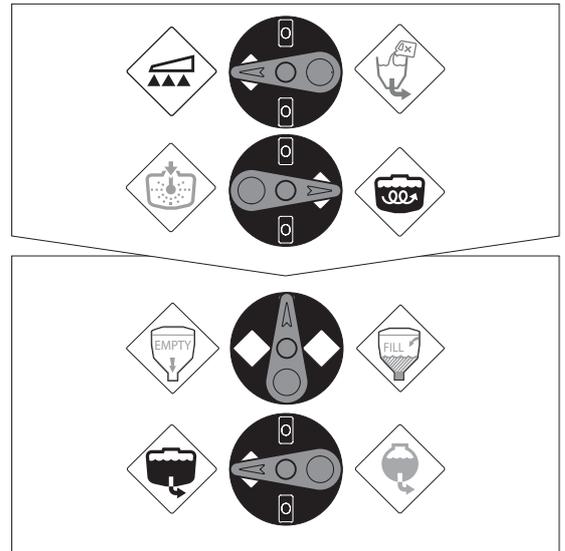
ATTENTION! If not flushed with clean water, the hopper rinsing device uses spray liquid for rinsing the hopper! Cleaning the TurboFiller must always be done, when the spray job is ended, and together with cleaning the entire sprayer. A cleaning after the last filling, and before spraying, does not ensure a clean TurboFiller!

8. Close the TurboFiller suction valve, when the hopper has been rinsed. Close the lid and turn the Chemical Source valve to neutral position (upwards).
9. Turn the Agitation Valve towards "Agitation".

- When the spray liquid is well agitated, turn handle of the pressure valve towards "Spraying" position. Keep PTO engaged, so that the spray liquid is continuously agitated, until it has been sprayed on the crop.



ATTENTION: If foaming is a problem, turn down the agitation.



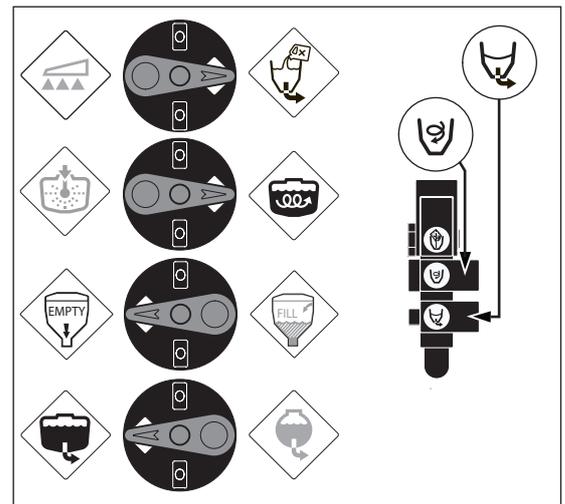
### Filling Powder Chemicals by using HARDI TurboFiller (optional)

- Fill the main tank at least 1/2 with water (unless otherwise stated on the chemical container label). See section "Filling of water".
- Turn the handle of the suction valve towards "suction from Main tank". Turn pressure valve to "TurboFiller". Turn the Agitation Valve towards "Agitation" if required. Close remaining valves.



ATTENTION! For increased suction from the TurboFiller the Agitation Valve can be kept closed.

- Engage the pump and set PTO speed at 540 rpm.
- Turn the Chemical Source valve to Empty Hopper, Open the TurboFiller lid. Open TurboDeflector valve and TurboFiller suction valve.
- Measure the correct amount of powdered chemical and sprinkle it into the hopper as fast as the transfer device can flush it down. The TurboFiller suction valve must be open for at least 20 seconds after the chemical is no longer visible in the hopper in order to completely empty the transfer hoses into the main tank.



DANGER! If the TurboFiller and the transfer hoses are not completely emptied, there is a risk of chemicals being sucked out of the main tank!



DANGER! Always wear face shield and other appropriate personal safety equipment, when filling chemicals.

- If the chemical container is empty, it can be rinsed by the Chemical Container Cleaning device. Place the container over the multi-hole nozzle and push the upper lever to the left of the TurboFiller.



DANGER! In order to avoid spray liquid hitting the operator, do not press lever unless the multi-hole nozzle is covered by a container, as spray liquid may otherwise hit the operator!



ATTENTION! The 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.

- Flush the TurboFiller with clean water from the rinsing tank by turning the Suction Valve to "Rinse Tank". The TurboFiller suction valve must be open for at least 20 seconds after the rinse water is no longer visible in the hopper, in order to completely empty the transfer hoses into the main tank.

## 5 - Operation

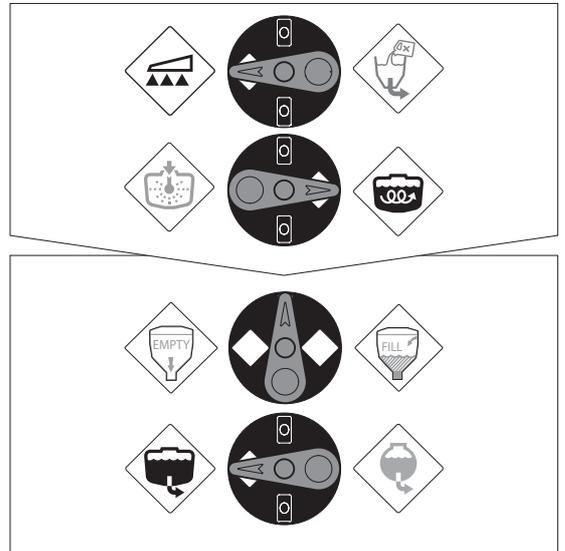


ATTENTION! If not flushed with clean water, the hopper rinsing device uses spray liquid for rinsing the hopper! Cleaning the TurboFiller must always be done, when the spray job is ended, and together with cleaning the entire sprayer. A cleaning after the last filling, and before spraying, does not ensure a clean TurboFiller!

8. Close TurboFiller suction valve, when the hopper has been rinsed. Close the lid.
9. If closed, turn the AgitationValve towards "Agitation".
10. When the spray liquid is well agitated, turn handle of the pressure valve towards "Spraying" position. Keep PTO engaged, so that the spray liquid is continuously agitated, until it has been sprayed on the crop.



ATTENTION! If foaming is a problem, turn down the agitation.



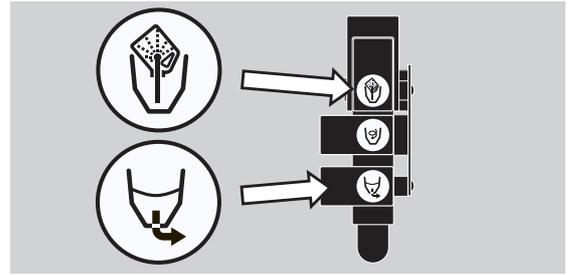
### TurboFiller Rinsing

**i** NOTE! It is important to suck from the rinsing tank or an external tank with clean water.

Rinse the TurboFiller and chemical containers as follows:

#### Cleaning empty containers - TurboFiller lid is open

1. Put container over the rotating flushing nozzle in the middle of the TurboFiller, so that the nozzle is inside the container.
2. Make sure the Hopper Source valve is turned to "Empty Hopper". Simultaneously press the Chemical Container Cleaning lever and the TurboFiller suction valve. This rinses the chemical container with the flushing nozzle, while the rinsing liquid is emptied out of the TurboFiller.



#### TurboFiller rinsing - TurboFiller lid is closed

1. Close TurboFiller lid.
2. Turn the suction SmartValve towards "Rinsing tank" or "Hopper Source valve to Fill", if clean water is available here.
3. Open the Turbo Deflector Valve  for 1 minute to get plenty of clean water through the hoses.
4. Turn the Hopper Source valve to "Empty Hopper"
5. Simultaneously press the Chemical Container Cleaning lever and the TurboFiller suction valve. This rinses the hopper with the flushing nozzle, while the rinsing liquid is emptied out of the TurboFiller.
6. Rinse the hopper for 30-40 seconds.
7. Open the lid to inspect if the TurboFiller is empty. If not, close the lid again and press the TurboFiller suction valve, until the TurboFiller is empty.
8. After the last flushing, the TurboFiller suction valve must be open for at least 20 seconds, after the rinse water is no longer visible in the hopper, in order to completely empty the transfer hoses into the main tank.

 ATTENTION! The TurboFiller needs to be cleaned thoroughly after finishing spraying. This is to ensure that it is clean, before spraying other crops that may be sensitive to the chemicals just used. See section "Cleaning" on page 45 for details.

## 5 - Operation

### Filling Liquid Chemicals by using probe (optional)

1. Fill the main tank at least 1/3 with water (unless otherwise stated on the chemical container label).
2. Connect the chem probe to an external fill source.
3. Turn the handle of the suction valve towards "suction from Main tank". Turn pressure valve to "TurboFiller". Close the Agitation Valve.
4. Engage the pump and set PTO speed at 540 rpm.
5. Turn the Chemical Source valve to Fill, and then open the Turbo filler suction valve.

 **DANGER!** Always wear face shield and other appropriate personal safety equipment, when filling chemicals.

6. When chemical filling is completed, Flush the chem probe hose with clean water by putting chem probe in a clean water source and let it transfer clean water to the main tank until the hoses are clean.

 **DANGER!** If the TurboFiller and the transfer hoses are not completely emptied, there is a risk of chemicals being sucked out of the main tank!

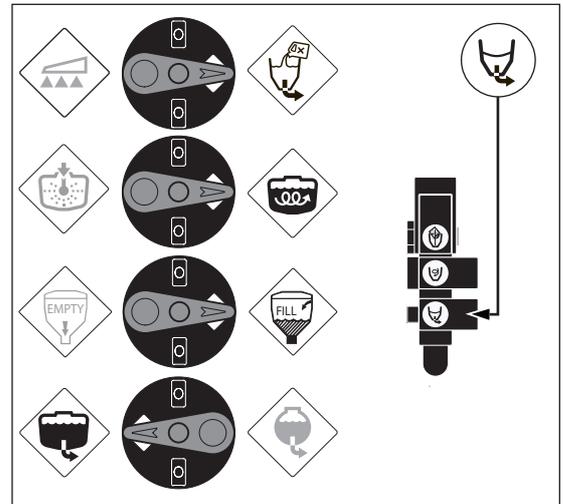
 **DANGER!** In order to avoid spray liquid hitting the operator, do not press the lever, unless the multi-hole nozzle is covered by a container, as spray liquid may otherwise hit the operator!

 **ATTENTION!** The rinsing device uses spray liquid to rinse containers for concentrated chemicals. Before disposal, always rinse the chemical containers with clean water several times, until they are clean.

 **ATTENTION!** If not flushed with clean water, the hopper rinsing device uses spray liquid for rinsing the hopper! Cleaning the TurboFiller must always be done, when the spray job is ended, and together with cleaning the entire sprayer. A cleaning after the last filling, and before spraying, does not ensure a clean TurboFiller!

7. Close the TurboFiller suction valve, Turn the Chemical Source valve to neutral position (upwards).
8. Turn the Agitation Valve towards "Agitation".
9. When the spray liquid is well agitated, turn handle of the pressure valve towards "Spraying" position. Keep PTO engaged, so that the spray liquid is continuously agitated, until it has been sprayed on the crop.

 **ATTENTION!** If foaming is a problem, turn down the agitation.



### Operating the Control Unit While Spraying - Spray Box III

EVC operating unit only



The switches of the spray control unit (Spray Box) control the following functions:

1. Power ON/OFF. Turns the Spray Box power on or off.
  2. Spray pressure regulation. Regulates the main spray pressure.
  3. Main valve ON/OFF. Turns all sections on or off. Lever up is OFF and down is ON.
  4. Optional function (A/OFF/B). If extra equipment is added, it can be controlled from here. Middle position is OFF.
  5. End nozzle (Left/OFF/Right). If end nozzles are fitted, they can be turned on for each side. Middle position is OFF.
  6. Foam marker blob interval. Foam marker equipment is not included from HARDI.
  7. Foam marker (Left/OFF/Right). Foam marker equipment is not included from HARDI.
  8. Section valves. Turns individual spray sections on or off. Lever up is OFF, and lever down is ON.
- In order to close the entire boom, switch main ON/OFF (3) 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 (7) to off position (upwards). The pressure equalization ensures that the pressure does not rise in the sections, which remain open.
  - On the sprayer the suction valve should be turned toward "Suction from Main tank" and the pressure valve should be turned toward "Spraying". Turn the agitation valve to "Agitation" if necessary.

## 5 - Operation

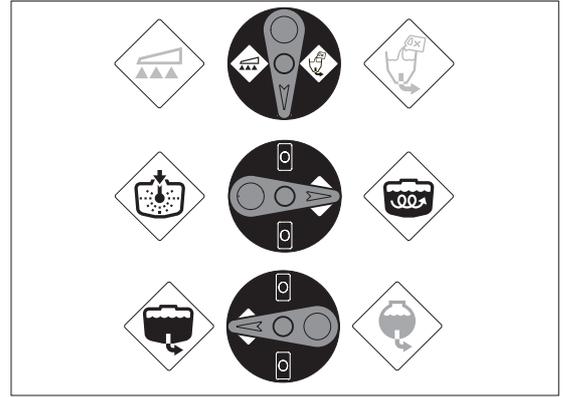
### Agitation Before Resuming a Spray Job

If a spray job has been interrupted for a while, severe sedimentation may occur depending on the chemicals being used. Before resuming the spray job, it might be necessary to agitate sediment material.

1. Turn the handle at the suction valve towards "Suction from main tank". Turn the pressure valve to closed position and turn the agitation valve towards "Agitation". Other valves are closed.
2. Engage the pump and set PTO speed to 540 rpm.
3. Agitation has started and should be continued for at least 10 minutes.



The spray job can now be resumed. Turn pressure valve towards "Spraying" and start spraying.



### Before Returning to Refill the Sprayer

If the sprayer is to be refilled at the farm, or at a fixed filling place without a filling space with hard surface and drain to a closed reservoir, the sprayer should be rinsed before returning to refill.

Dilute the residues of the spraying circuit, and spray it on the crop. Now rinse the sprayer on the outside with the External Cleaning Device (optional equipment), before returning to the farm.



WARNING! Always follow local legislation in force at any time.

### Parking the Sprayer

To avoid spot contamination, the sprayer should always be parked at either the washing/filling location or under roof.

This prevents rainfall from washing down chemical residues from the sprayer's surfaces.

- Parking at the washing/filling location will retain residues.
- Always park the machine out of reach of children, animals and unauthorized persons.

### Liquid Fertilizer

#### Spraying pressure

If you are spraying with liquid fertilizer instead of pesticides, the spraying pressure must be increased in comparison to pesticide spraying to get the desired output (l/ha).

The density for liquid fertilizer is normally higher than for water and spray liquids - so to get the correct output (l/ha), the spraying pressure must be adjusted.

#### Example:

Nozzle output is 2.40 l/min at 3.0 bar pressure. Density of liquid fertilizer is 1.20 g/cm<sup>3</sup>.

Multiply the pressure value with the density value:  $3.0 \times 1.2 = 3.6$ ; the adjusted pressure is then 3.6 bar for spraying the liquid fertilizer.

In the table below, adjusted pressure values can be found for different densities of liquid fertilizers.

Calibrated pressure (bar) - Pesticide spraying	Density (g/cm <sup>3</sup> ) - Liquid fertilizer				
	1.10	1.15	1.20	1.30	1.40
	Adjusted pressure (bar) - Liquid fertilizer spraying				
1.5	1.7	1.7	1.8	2.0	2.1
2.0	2.2	2.3	2.4	2.6	2.8
2.5	2.8	2.9	3.0	3.3	3.5
3.0	3.3	3.5	3.6	3.9	4.2
3.5	3.9	4.0	4.2	4.6	4.9
4.0	4.4	4.6	4.8	5.2	5.6
4.5	5.0	5.2	5.4	5.9	6.3
5.0	5.5	5.8	6.0	6.5	7.0



ATTENTION! Pressure values below 1.5 bar or above 5.0 bar are considered to be out of range for the nozzles.



NOTE! Find the density for your liquid fertilizer on the packaging or on the material safety data sheet (MSDS) included.

### Additional Information

See the other book delivered from HARDI - Spray Technique - to get further information about:

- Calibration of the sprayer
- Nozzle Choice
- Nozzle Wear
- Spray Distribution
- Spray Pressure
- Water Volume Rates
- Weather Influence on Spraying
- Useful Formulae

For Optional Extras - see other books delivered or contact HARDI.

## 5 - Operation

### Operating Limits

The following things are important when considering the performance of the sprayer.

- Maximum driving speed
- Pressure setting
- Minimum / maximum flow rate

The operating limits for your sprayer are closely related to:

4. Pump size
5. Boom width
6. Nozzle size

In the table below, the operating limits for volume rate are calculated, when driving at different speeds.

Nozzle size, type HARDI ISO F-110	Min. volume rate (l/ha) at 4 km/h	Max. volume rate (l/ha) at 4 km/h	Min. volume rate (l/ha) at 8 km/h	Max. volume rate (l/ha) at 8 km/h	Min. volume rate (l/ha) at 12 km/h	Max. volume rate (l/ha) at 12 km/h	Min. volume rate (l/ha) at 16 km/h	Max. volume rate (l/ha) at 16 km/h
02 (yellow)	171	309	86	155	57	103	43	77
025 (purple)	213	387	107	194	71	129	53	97
03 (blue)	255	465	128	233	85	155	64	116
04 (red)	339	621	170	311	113	207	85	155
05 (brown)	423	774	212	387	141	258	106	194
06 (grey)	510	930	255	465	170	310	128	233
08 (white)	678	1239	339	620	226	413	170	310
10 (light blue)	849	1548	425	774	283	516	212	387

 NOTE! The specified nozzle type is a standard flat fan nozzle. Other special nozzle types will show different results. Ask your HARDI dealer if in doubt.

 ATTENTION! It is recommended not to drive faster than 16 km/h when spraying.

 ATTENTION! The pressure range for the nozzles are 1.5 - 5 bar (except for HARDI INJET nozzles, which are ranging from 3-8 bar). The spraying pressure should be within these limits.

 ATTENTION! In the table below, the specified combination of nozzle size and sprayer setup is not suitable, as the full pressure range of 5 bar for the nozzle cannot be reached, when spraying the maximum volume rate (l/ha) on the crop. This is due to the nozzle design.

Pump model	Boom width	Nozzle size
363/364	18 m	08 (white)
363/364	All	10 (light blue)
1303	15, 16, 18 m	05 (brown)
1303	16, 18 m	06 (grey)
1303	All	08 (white)
1303	All	10 (light blue)

 According to the standard for environmental requirements for sprayers, ISO 16119 / EC Directive 2009/127/EC (amending 2006/42/EC), the farmer shall be able to use the full pressure range.

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### Cleaning

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#### General Info

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



ATTENTION! Always read the individual paragraphs. Read instructions for service/maintenance jobs carefully before starting on the job. If any portion remains unclear, or if it requires facilities which are not available, then please leave the job to your HARDI dealer's workshop for safety reasons.



ATTENTION!

Clean sprayers are safe sprayers.

Clean sprayers are ready for action.

Clean sprayers cannot be damaged by pesticides and their solvents.

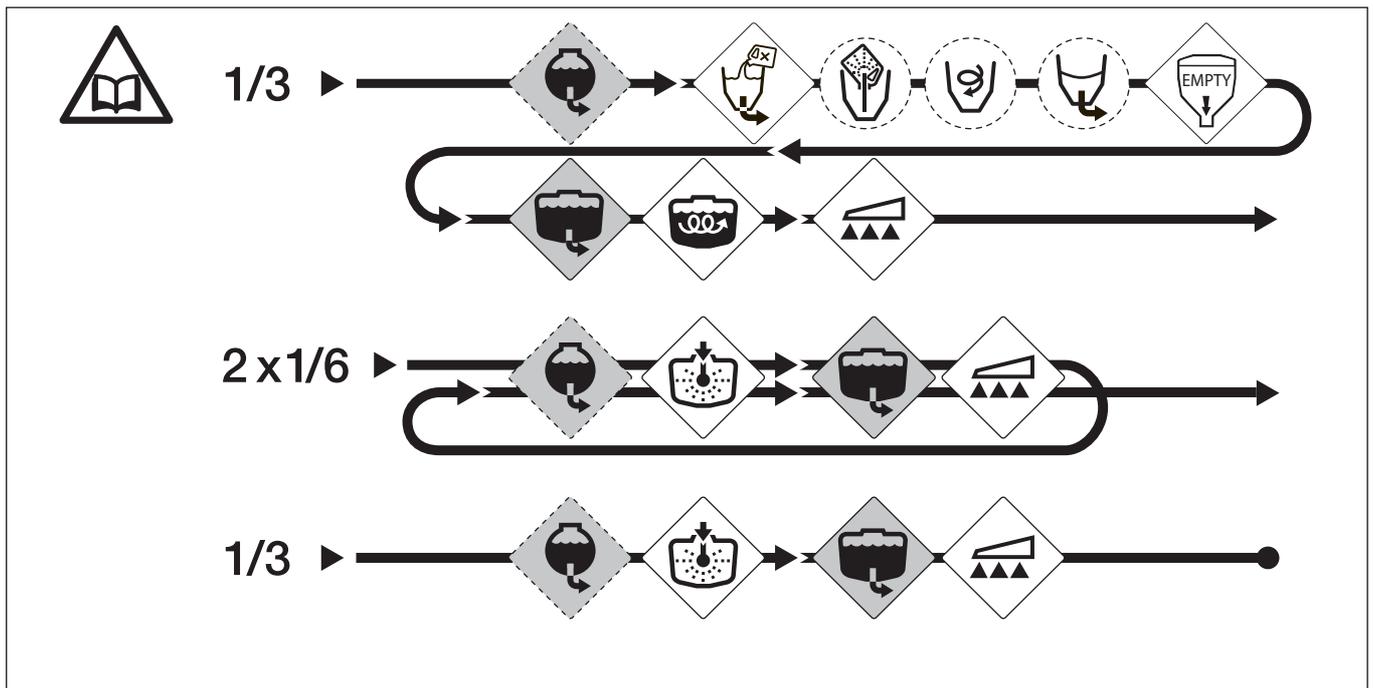
#### Guidelines

- 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 authority if you are in doubt.
- Pesticide washings can usually be sprayed out on the field just sprayed or at a suitable cultivated area. Avoid emptying the washings at the same spot every time and keep sufficient distance to the water environment. You must prevent seepage or runoff of residue into streams, watercourses, ditches, wells, springs, etc. The washings from the cleaning area must not enter sewers. Alternatively the washings can be retained in an appropriate receptacle, diluted and distributed over a larger cultivated area - see also "Filling/Washing Location Requirements" on page 33.
- 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, and thereby rendering the sprayer safe and ready for the next pesticide application. This also prolongs the life of the components. It is strongly advised to perform an internal cleaning of the sprayer, when high concentrations of acids or chloride are present in the active ingredients, or if the spray liquid is corrosive. For the best result, use a cleaning agent recommended by HARDI, e.g. AllClearExtra.
- 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. Unauthorized persons, children 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.
- The sprayer must always be parked under roof to avoid rain washing off pesticides as well as build-up of spot contamination in the soil. If parked outside, the sprayer should be parked on the filling/washing location in order to retain possible pesticides.

## 5 - Operation

### Quick Reference - Cleaning

In the following diagrams handle positions for different options are described.



### Cleaning the Tank and Liquid System



ATTENTION! Thorough cleaning of the sprayer is to be carried out when shifting to crops, which are very sensitive to chemicals just sprayed, or prior to storage for a longer period of time.



NOTE! Prior to the described cleaning, a standard cleaning should be carried out.

- Select and use the appropriate protective clothing. Select detergent suitable for cleaning and suitable deactivating agents if necessary.
  - Rinse and clean sprayer and tractor externally. Use detergent if necessary.
1. Remove tank filters and suction filters and clean the sprayer. Be careful not to damage the filter mesh. Put back the suction filter top. Put back all filters, when the sprayer is completely clean.
  2. With the pump running, rinse the inside of the tank. Do not forget to clean the tank roof. Rinse and operate all components and any equipment, which have 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 or on the seepage location.
  3. After spraying the liquid out, stop the pump and fill at least 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 effect ammonia. Special detergents for sprayer cleaning is recommended as some also lubricate ball valves etc.
  4. Start the pump and operate all controls enabling the liquid to come into contact with all the components. Operate the distribution valves as the last thing. Some detergents and deactivating agents work best, if they are left in the tank for a short period. Check the label.
  5. Drain the tank and let the pump run dry. Rinse inside of the tank, again letting the pump run dry.
  6. Stop the pump. If the pesticides used have a tendency to block nozzles and filters, remove and clean them immediately.
  7. Put back all the filters and nozzles and store the sprayer. If it is noted, from previous experiences, that the solvents in the pesticides are particularly aggressive, store the sprayer with the tank lid open.



ATTENTION! It is advisable to increase the forward speed (double, if possible) and reduce the spraying pressure to 1.5 bar, when spraying diluted remaining liquid in the field just sprayed.



ATTENTION! If a cleaning procedure is given on the chemical label, follow it closely.



ATTENTION! If the sprayer is cleaned with a high pressure washer, lubrication of the entire machine is recommended.

### Cleaning and Maintenance of Filters

Clean filters ensure:

- Sprayer components such as valves, diaphragms and operating units are not hindered or damaged during operation.
- Nozzle blockades 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. Check it regularly.

## 5 - Operation

### Use of Rinsing Tank(s) and Rinsing Nozzles

The integrated rinsing tank(s) can be used for two different purposes.



ATTENTION! If a cleaning procedure is given on the chemical label, follow it closely.

#### In-field diluting before cleaning

In-field diluting of remaining spray liquid residue in the spraying circuit should be carried out, before cleaning the sprayer.

Rinsing the main tank and liquid system:

1. Empty the sprayer as much as possible. Close the Agitation Valve (no agitation) and spray until air comes out of all nozzles.
2. Turn suction valve towards  and pressure valve towards . Set blue return valve to .
3. Engage the pump. Set the pump speed to approximately 300 rpm and increase the spraying pressure to 6 bar.
4. When 1/3 of the contents in the rinsing tank(s) is used, turn suction valve towards  and operate all valves on the pressure side of the system in the following order, so that all hoses and components are rinsed:
  - A. Turn the pressure valve towards  to activate the ejector and then turn the Chemical Source valve to Empty Hopper, then open the TurboFiller suction valve.
  - B. Open the TurboDeflector valve and close it again, when clean water comes out of nozzles.
  - C. Close the TurboFiller lid. and squeeze the Chemical Container Cleaning grip to clean this device.
  - D. Open the TurboFiller lid again, and make sure that the TurboFiller is empty.
  - E. When empty, close the TurboFiller suction valve again and turn the Hopper Source upwards to turn it off. Take care that the External fast filling connection and the line are not contaminated with chemicals.
5. Turn the suction valve towards  and the pressure valve towards , and spray the liquid in the field just sprayed.

Cleaning of Main Tank:

6. Turn the suction valve towards  and the pressure valve towards . Remove the filling strainer to avoid any cleaning shadows behind it.
7. When another 1/6 of the contents in the rinsing tank(s) is used, turn the suction valve towards .
8. Turn pressure valve towards , and spray the liquid in the field just sprayed.
9. Repeat step 6 - 8 one more time.



WARNING! When critical chemicals (like sulphonylurea) have been used, or a cleaning detergent is recommended, do an extra cleaning:

10. Fill the rinsing tank(s) again.
11. Fill the main tank to 1/3 of capacity (up to 500 litres) of clean water. See section "Suction filling Device" for filling procedure.
12. Add the cleaning detergent to the main tank by using the TurboFiller. Follow instructions on the label of the cleaning agent.
13. Clean the whole system again.
14. To get the best cleaning effect, the Self-Cleaning Filter and the Suction Filter sieves should be washed with clean water.
15. Rinse the sprayer with clean water afterwards.



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

### Rinsing when main tank is not empty

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

Cleaning of the liquid system:

1. Turn suction valve towards . (Keep pressure valve in -position). Close Self-Cleaning filter, if possible.
2. Close Agitation Valve (no agitation).
3. Engage the pump. Set the pump speed to approximately 300 rpm and increase the spraying pressure to 6 bar. Spray the water from the rinsing tank into the field, until all nozzle tubes and nozzles have been flushed with clean water.
4. Disengage the pump.



ATTENTION! It is advisable to increase the forward speed (double, if possible) and reduce the spraying pressure to 1.5 bar, when spraying diluted remaining liquid in the field just sprayed.

### Cleaning the sprayer on the outside



WARNING! External cleaning with a spray gun is only possible with emptied and cleaned main tank. Do a complete main tank cleaning, before attempting to use the spray gun!

1. Turn suction valve towards  and pressure valve towards . Keep other valves closed.
2. When another 1/3 of the contents in the rinsing tank(s) is used, turn the suction valve towards . Adjust the spraying pressure to 8 - 10 bar.
3. Open the manual valve at the operating unit and wash the sprayer with the cleaning device located on sprayer's rear side. If necessary, the pressure can be adjusted on the pressure regulation valve.
4. Disengage pump again.



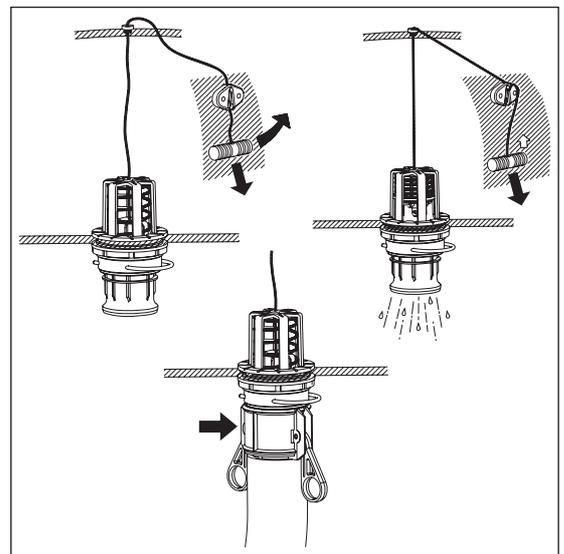
ATTENTION! If the sprayer is cleaned with a high pressure washer, lubrication of the entire machine is recommended.

### Using the Drain Valve

The drain valve is operated from the right side of the sprayer's front.

1. Pull the string to open the drain valve.
2. The valve is spring-loaded, but can be kept open by pulling the string upwards in the V-shaped slit.
3. To release, pull the string downward and the valve will close automatically.

If draining residues, e.g. liquid fertilizer into a reservoir, a snap coupler with hose can rapidly be connected to the drain valve, and the liquid is safely drained.





## Lubrication

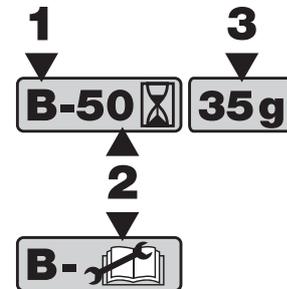
### General Info

Always store lubricants clean, dry and cool - preferably at a 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.

Always follow the quality and quantity recommendations. If no quantity is recommended, feed the lubricator until new grease becomes visible.

### Pictograms in lubrication & oiling plans designate:

1. Lubricant to be used (see "Recommended lubricants" below).
2. Recommended intervals. Shown in hours or with a symbol for occasional maintenance.
3. Amount to be used. Only shown if an amount is specified.



 **ATTENTION!** If the sprayer has been cleaned with a high pressure washer, lubrication of the entire machine is recommended.

### Recommended Lubricants

What to Lubricate?	Lubricant Type	Factory Use	Recommended Alternatives
 <b>A</b> BALL BEARINGS and PUMP	Lithium based grease Consistency NLGI grade 2 Viscosity (@40°C) > 460 cSt	SHELL Gadus S3 V550L 1 Hardi pump grease cartridge (400g); Item no. 28164600	MOBIL grease XHP 462 TOTAL Multis Complex SHD 460
 <b>B</b> SLIDE BEARINGS	Lithium based grease Consistency NLGI grade 1/2 Viscosity (@40°C) > 200 cSt	MOBIL XHP 222	SHELL Gadus S3 V220C 2 TOTAL Multis Complex SHD 220
 <b>C</b> OIL LUBRICATION POINTS	Engine or transmission oil Viscosity 20W-50 or 80W-90	OK Tractor UTTO GL 4 80W	SHELL Spirax S4 TXM CASTROL ACT EVO 4T MOBIL Mobilube HD 80W/90
 <b>D</b> GLIDE SHOES	Stearic or a non-greasy type of wax		
 <b>D</b> BOLTS	Anti-corrosive wax	PAVA PV 700	TECTYL 506 WD
 <b>D</b> VALVES and SEALS (O-RINGS)	NSF 51, NSF 61 silicone compound	DOW CORNING MOLYKOTE 111 Compound	

## 6 - Maintenance

### Grease Gun Calibration

Before lubricating the sprayer, you must calibrate your grease gun to ensure that the correct amount of grease is applied to each lubrication point. The correct amount of grease applied will prolong the lifetime of the sprayer.

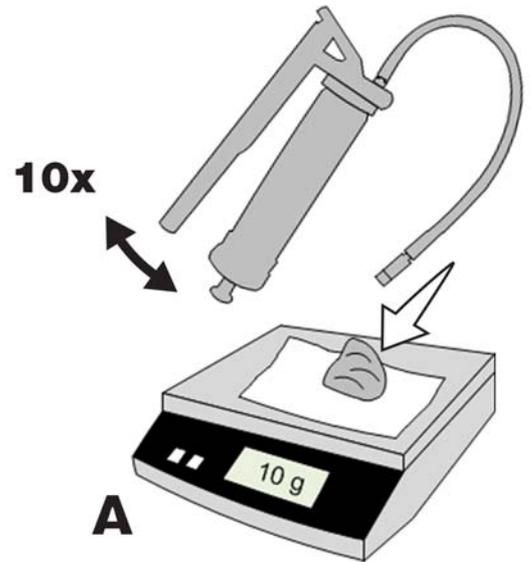
#### Calibration example

1. Insert the correct grease cartridge in your grease gun.
2. Apply grease onto a tissue or a piece of paper. Complete 10 full strokes of the grease gun.
3. Place the paper with grease on a scale (A).
4. If your grease pile weighs for example 10 grams, then 1 stroke equals 1 gram of grease.

When calibrated, you can count how many strokes to complete, when lubricating the different grease points on the sprayer according to the specifications.

#### Alternative method

1. Count the strokes, until you have 10 grams of grease piled up on the scale (A).
2. Now you can figure out how many strokes to use for applying a certain amount of grease to a lubrication point.



### PTO Lubrication & Oiling Plan

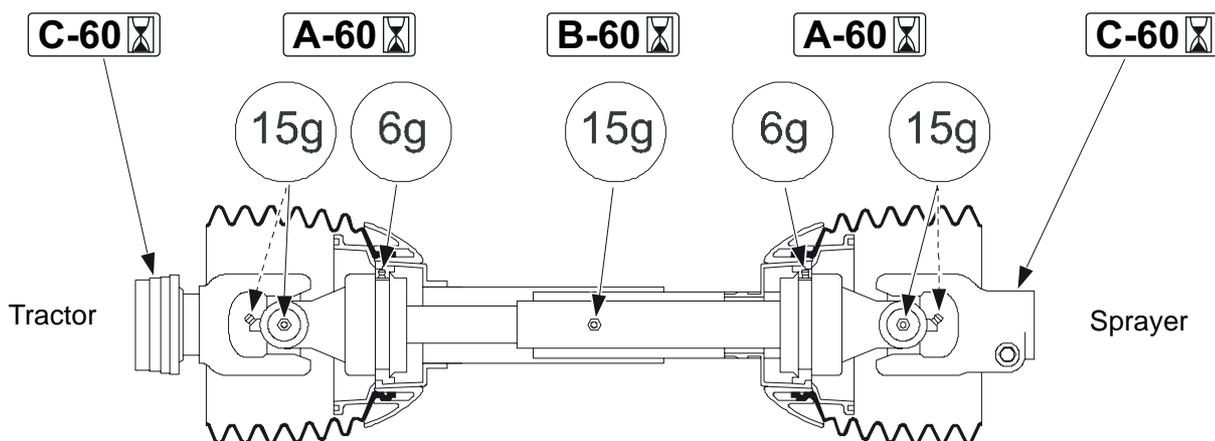


**ATTENTION!** The correct amount of grease applied at the intervals is important. Too little or too much grease will shorten the lifetime of the PTO.

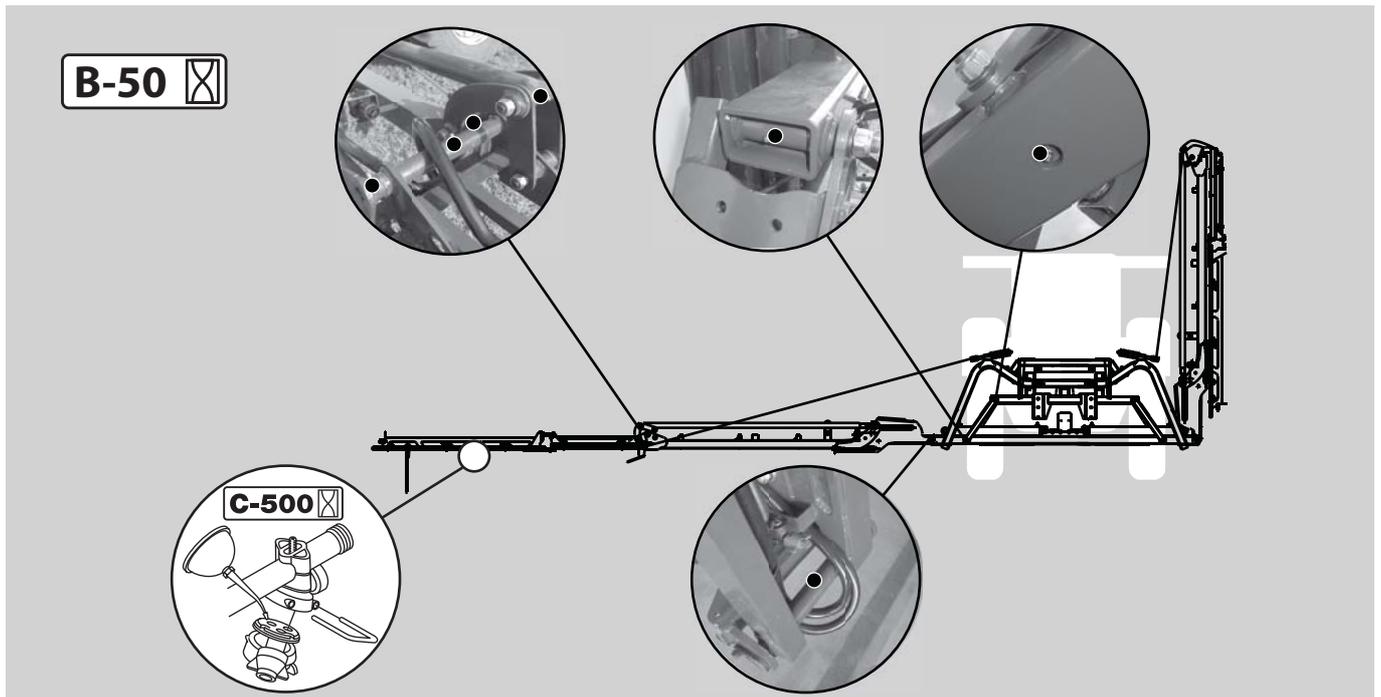
The amount of grease to be applied is mentioned in grams (g). Test your grease gun to see how many grams it provides, for example after 5 strokes.

The grease points and amount of grease to be applied are shown in the pictures below together with the intervals.

#### Standard PTO for tractor and sprayer



Boom lubrication & oiling plan



## 6 - Maintenance

### Service and Maintenance Intervals

#### General Info

National or regional laws may require regular inspection of the sprayers in use. Check with your local dealer which rules apply for your area. In case the inspection is obligatory, the user must have proof that the sprayer has passed an obligatory test performed by an authorized surveyor within the required time period.

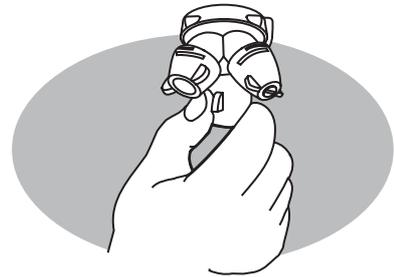
The following periodic service and maintenance work may be carried out by the user. Contact your HARDI dealer if in doubt. If this work is completed correctly, the sprayer will run efficiently and its lifetime will be prolonged.

#### 10 Hours Service - Spraying Circuit

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

#### 10 Hours Service - Nozzle Filters

The filters are located inside the nozzles. Check and clean.



#### 10 hours Service - Suction Filter

##### To service the suction filter:

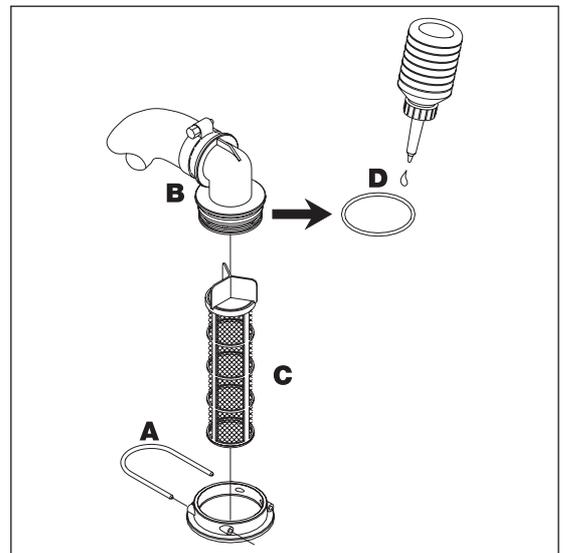
1. Pull out the steel clip (A).
2. Lift the suction hose fitting (B) from housing.
3. Filter guide and filter (C) can now be removed.

##### 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).



**WARNING!** Always wear protective clothing and gloves before opening the filter!



### 10 hours service - Self-Cleaning Filter

This filter should be cleaned every 10 hours.

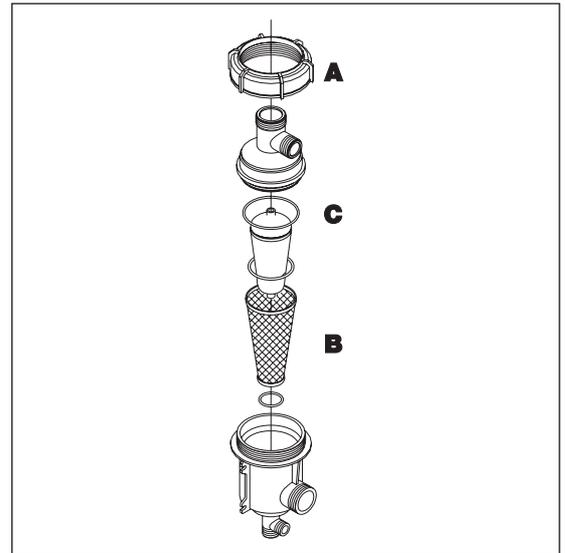
1. Unscrew the union nut (A) and open filter.
2. Check filter gauze (B), clean if necessary.
3. Grease the O-ring (C) on the filter lid.

#### To reassemble:

4. Assemble all filter parts in the order shown on the picture.
5. Turn union nut (A) clockwise to close filter.



WARNING! Always wear protective clothing and gloves before opening the filter!



### 10 Hours Service - InLine Filter (optional)

If the boom is equipped with In-Line Filters, unscrew the filter bowl to inspect and clean the filter. When reassembling, the O-ring should be greased.

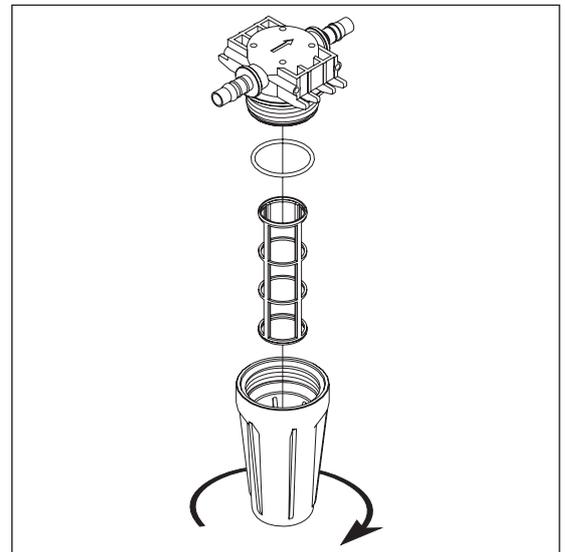
Alternative filter meshes are available. See section "Technical specifications" - Filters and nozzles.



WARNING! Be careful not to splash out liquid, when unscrewing the filter bowl.



WARNING! Always wear protective clothing and gloves, before servicing the filter!



### 50 Hours Service - Transmission Shaft

Check function and condition of the transmission shaft protection guard. Replace any damaged parts.

## 6 - Maintenance

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### 250 Hours Service - Hydraulic Circuit

Check the hydraulic circuit for leaks and repair, if needed.



WARNING! Hoses for boom lifting device must be changed after every 5 years of use.

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### 250 Hours Service - Hoses and Tubes

Check all hoses and tubes for possible damage and proper attachment. Replace damaged hoses or tubes.

---

### 250 Hours Service - Readjustment of the Boom

See the section "Occasional Maintenance".

### Occasional Maintenance

#### General Info

The maintenance and service intervals for the following components will depend very much on the conditions, under which the sprayer is operated, and therefore it is almost impossible to specify the intervals.

#### Lifting and Removing the Pump

When lifting and removing the pump, use a shackle fitted to the built-in lifting eye located between the heads (A).



**WARNING!** To prevent damages in case of a free-falling pump, use lifting gear and a steel shackle with at least 3.5 tonnes max. tensile strength.



**NOTE!** Pump weight is approximately 75 kg.



#### Greasing the Pump

The pump is greased as follows:

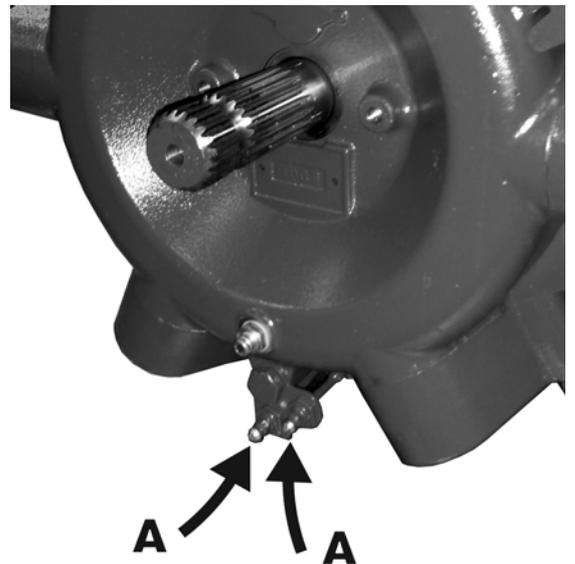
- Factory greased:  
300 g grease into each lubrication point (A).
- Normal operation:  
MUST be greased every 50 hours with 30 g grease into each lubrication point (A).
- After disassembling the pump (diaphragm renewal, etc.):  
MUST be greased with 200 g grease into each lubrication point (A).



**ATTENTION!** In order to prevent excessive wear, it is important to use a recommended lubricant! See the section "Recommended Lubricants" in this book.



**ATTENTION!** The pump MUST be stopped during greasing!

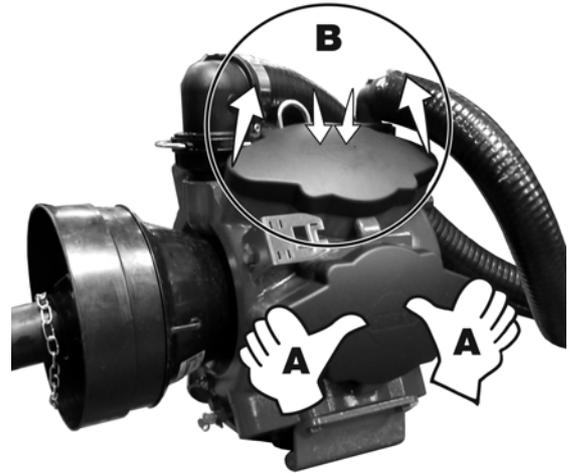


## 6 - Maintenance

### Pump Valves and Diaphragms Renewal

Pump model: 364 and 464.

1. Lift off the plastic covers (C) with your hands (A) by pulling with the finger tips while pushing with the thumbs in the centre, as shown in (B).



#### Valves

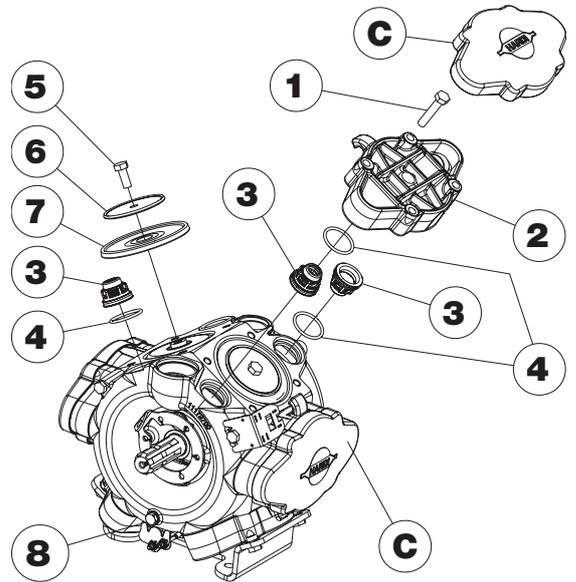
2. Loosen the 4 head bolts (1).
3. Remove the head (2).
4. Change the valves (3) - note their orientation, so that they are replaced correctly!



ATTENTION! It is recommended to use new gaskets (4), when changing or checking the valves.

#### Diaphragms

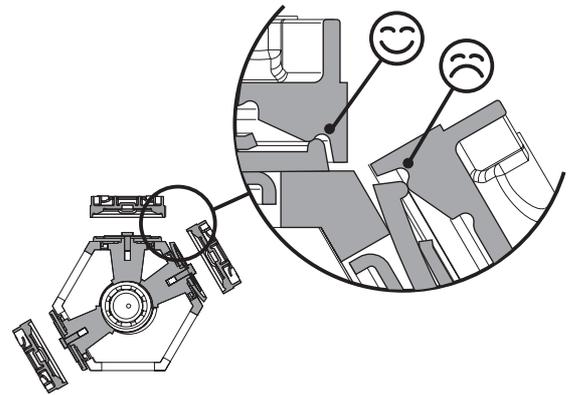
5. Loosen the diaphragm bolt (5).
6. Remove the diaphragm washer (6).
7. The diaphragm (7) may then be changed.
8. Check that the drain hole (8) at the bottom of the pump is not blocked.
9. Apply a small amount of pump grease on the underside of the diaphragms (between diaphragm and conrod washer).
10. Reassemble the pump with the following torque setting.
  - Diaphragm head bolts (1): 90 Nm.
  - Diaphragm bolt (5): 90 Nm.
11. Refit the plastic covers (C).



NOTE! The diaphragm bolt on 1000 rpm pumps must be secured with locking compound.



ATTENTION! Before tightening the 4 bolts for the head (2), the diaphragm must be positioned between centre and top to ensure correct sealing between diaphragm pump housing and diaphragm cover. Turn the crank shaft if necessary.



### Re-lubrication after assembly

After disassembling the pump (diaphragm renewal, etc.) the pump **MUST** be lubricated with 200 g grease into each lubrication point.

HARDI pump grease cartridge (400g): HARDI item no. 28164600

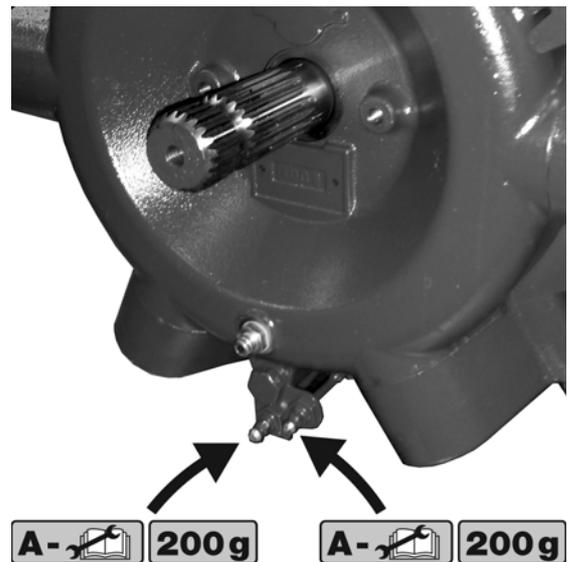
### Overhaul Kit

Pump model: 364 and 464.

Diaphragm pump overhaul kit (valves, seals, diaphragms etc.) can be ordered. Detect the pump model - the overhaul kit can be ordered by your local dealer.

Model 364: HARDI item no. 75585900.

Model 464: HARDI item no. 75586000.



## 6 - Maintenance

### Pump Valves and Diaphragms Renewal

Pump models: 1303.

#### Valves

Remove valve cover (1), before changing the valves (2) - note their orientation, so that they are replaced correctly!

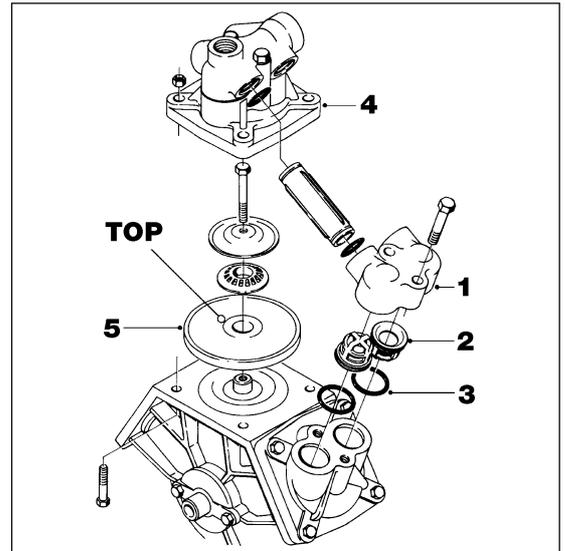


ATTENTION! A special valve with white flap (2A) is used at the two upper side inlets. It has to be placed in the valve openings as shown. All others are the type with black flap. It is recommended to use new gaskets (3), when changing or checking the valves.

#### Diaphragms

Please note that this instruction may contain pump models not available for the specific sprayer.

Remove the diaphragm cover (4). The diaphragm (5) may then be changed. If fluids have reached the crankcase, re-grease the pump thoroughly. Also check that the drain hole at the bottom of the pump is not blocked.



Reassemble pump with the following torque setting:

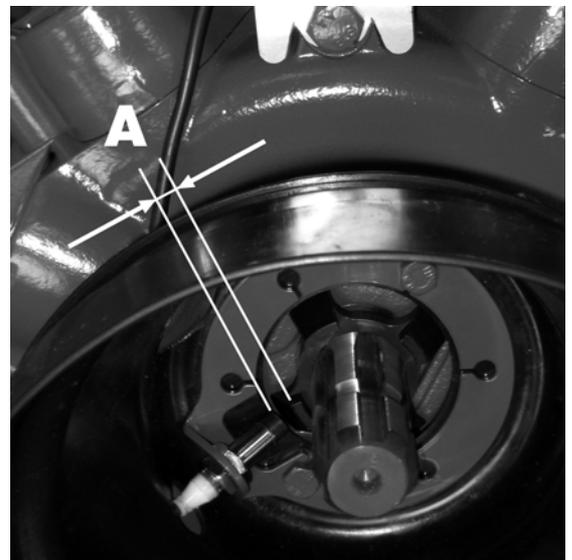
Valve cover	80 Nm
Diaphragm cover	80 Nm
Diaphragm bolt	80 Nm

### Speed Transducer for Pump

The speed transducer, measuring rpm, is located at the inner side of the PTO shield. This sensor is an inductive type, which requires metallic protrusions to pass by it to trigger a signal.

#### Adjustment

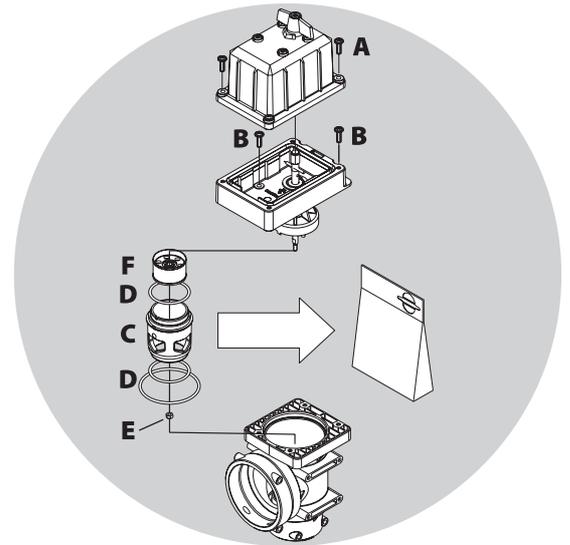
1. Adjust air gap (A) to 4 mm (+/-0.5 mm). Use a feeler gauge or similar tool.
2. After adjustment, turn the pump shaft. Verify air gap variations less than +/-0.5 mm. Check this at the entire circumference.
3. Verify transducer function:
  - HC 5500:  
Correct fitting is indicated by continuous flashing from transducer, when the shaft is rotating.
  - HC 6500/ISOBUS VT:  
Monitor the menu [4.5.4.9.6 PTO pump frequency].



### Cone Check/Renewal for Pressure Regulation Valve

If it becomes difficult to build up sufficient pressure or if pressure fluctuations occur, it may be necessary to renew cone and cylinder.

1. Remove 4 screws (A) and remove the housing.
2. Remove 4 screws (B).
3. Replace cylinder (C) and O-ring (D).
4. Loosen the nut (E), remove and replace the cone (F).
5. Reassemble in reverse order.



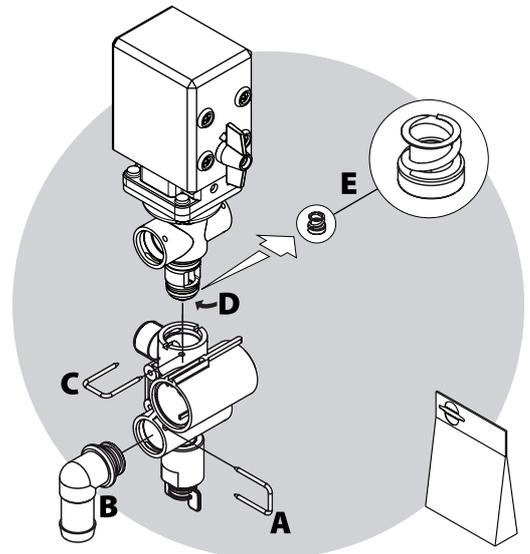
### Cone Check/Renewal for EVC Distribution Valve

Periodically check the distribution valves for proper sealing. Do this by running the sprayer with clean water and open all distribution valves. Cautiously remove the clip (A) and pull out the hose (B) for the return line. When the housing is drained, there should be no liquid flow through the return line.

If there is any leakage, the valve cone (E) must be changed.

1. Remove the clip (C)
2. Lift the motor housing off the valve housing.
3. Unscrew the screw (D) and replace the valve cone (E).
4. Reassemble in reverse order.

 **ATTENTION!** Follow this procedure if you are having problems maintaining the chosen application rate.



## 6 - Maintenance

### Level Indicator Adjustment

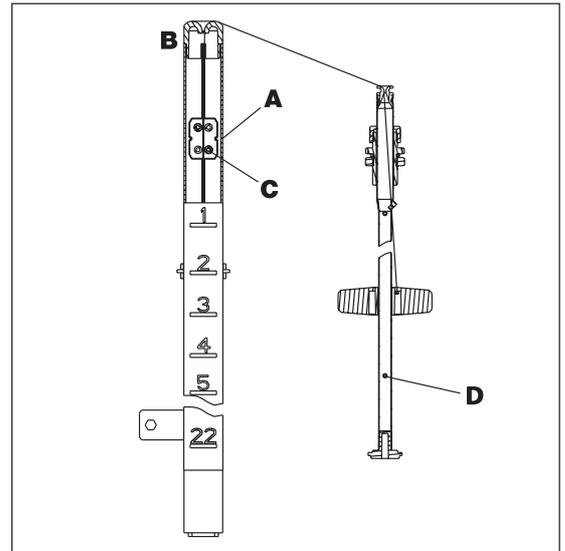
The level indicator reading should be checked regularly. When the tank is empty, the float should lie on the stop pin (D) of the rod, and the O-ring on the indicator should be positioned at the top position line (A).

If any deviation is found, do the following:

1. Pull out the plug (B).
2. Loosen screws (C).
3. Adjust the length of the cord, until it reads correctly.
4. Push the plug (B) back into place.



**NOTE!** To obtain the best accuracy, the adjustment shall be done with the sprayer attached to the tractor normally used.



### Level Indicator Cord Renewal

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

1. Remove the tank drain valve (see the following section "Drain Valve Seal Replacement") and loosen the fitting holding the pole in position.
2. Pull the pole down through the drain valve hole, until 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 enter the tank inside - the parts can be changed from the outside of the tank!

### Drain Valve Seal Replacement

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

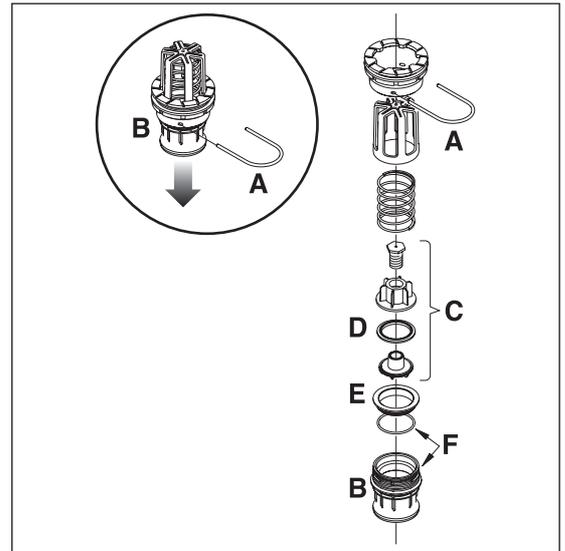


**DANGER!** Do not enter the inside of the tank - the parts can be changed from the outside of the tank!



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

1. Make sure that the tank is empty and clean.
2. The valve must be closed and the string must be loose.
3. Pull out the clip (A) and pull down the 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 reassemble.
5. Reassemble the valve using a new valve seat (E). Lubricate O-rings (F) before assembly.
6. Fit clip (A) again.



**ATTENTION!** Check the valve function using clean water, before filling chemicals into the tank.

### Adjustment of 3-Way Valve

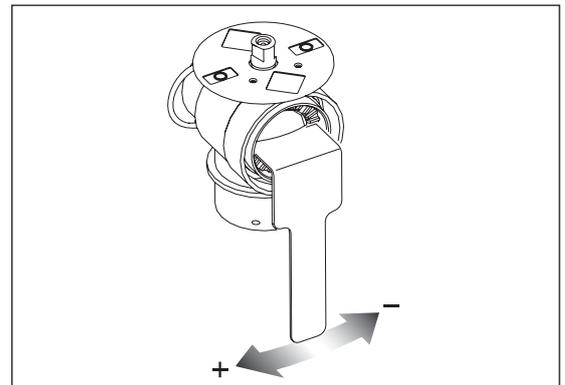
The large ball valve (type s93) can be adjusted, if it is too tight to operate - or if it is too loose (= liquid leakage).

- Correct setting is when the valve can be operated smoothly by one hand.

Use a suitable tool and adjust the toothed ring inside the valve as shown on the drawing.



**ATTENTION!** The small ball valves (type s67) cannot be adjusted.



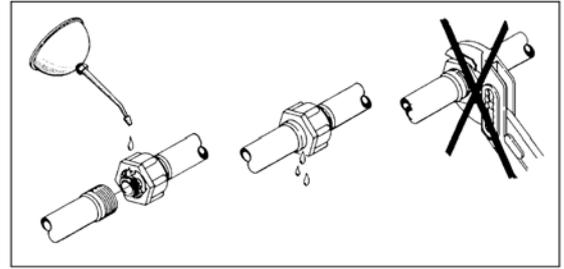
## 6 - Maintenance

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### Nozzle Tubes and Fittings

Poor sealings are usually caused by:

- Missing O-rings or gaskets
- Damaged or incorrectly seated O-rings
- Dry or deformed O-rings or gaskets
- Foreign objects



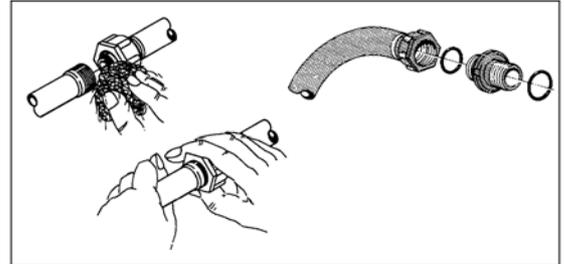
#### In case of leaks:

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

The O-ring must be lubricated ALL THE WAY AROUND, before fitting it on to the nozzle tube. Use a non-mineral lubricant.

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

For RADIAL connections, only tighten by hand.



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### Shield Replacement on Transmission Shaft

- See the manufacturer's instruction book.

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### Replacement of Transmission Shaft Cross Journals

- See the manufacturer's instruction book.

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### Change of Light Bulb

1. Switch off the light.
2. Loosen the screws on the lamp and remove the cover or lens.
3. Remove the bulb.
4. Fit a new bulb, refit the cover and tighten the screws.



ATTENTION! If halogen bulbs are used, never touch the bulb with your fingers. Natural moisture in the skin will cause the bulb to burn out, when the light is switched on. Always use a clean cloth or tissue when handling halogen bulbs.

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### Safety Valve Activation

To make the fluid system work perfectly over time, it is good practice to regularly provoke opening of the safety valve.

This prevents clogging and ensures proper function of the safety valve. Opening of the valve is done by turning the pressure valve to an unused function, when the pump is running. This is good practice for all sprayers; particularly for sprayers without optional equipment.

### Readjustment of Boom - General Info

Before commencing adjustment jobs, please go through this check list.

1. The sprayer must be well lubricated (see the section "Lubrication").
2. Connect the sprayer to the tractor.
3. Place tractor and sprayer on level ground (horizontal).
4. Unfold the boom.
5. Set slanting angle to neutral position (horizontal).



**WARNING!** No one is allowed under the boom, while the adjustment is carried out.



**ATTENTION!** Adjustment of hydraulic cylinders is to be carried out without pressure in the system.

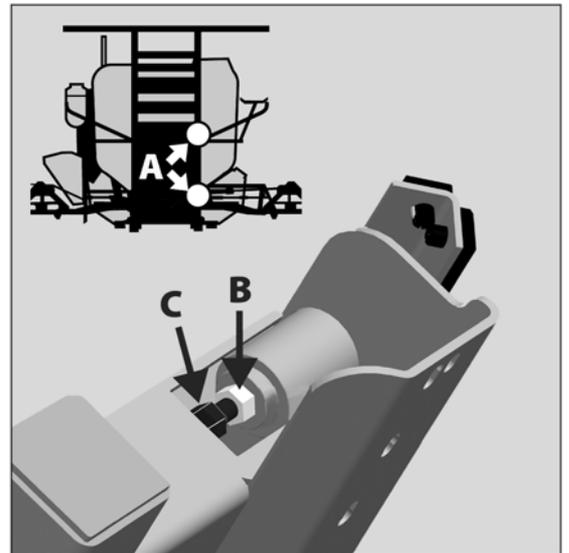
### Boom Lift Adjustment

If slack occurs (= backward and forward movements of the boom), the slide arrangements (A) should be adjusted:

1. Begin by loosening the conternuts (B).
2. Each slider arrangement (A) is adjusted by means of a bolt (C). Adjust the slider arrangements, until the same clearance has been reached at all 4 sliders and the boom carrier runs freely without play.
3. Tighten conternuts (B) again.

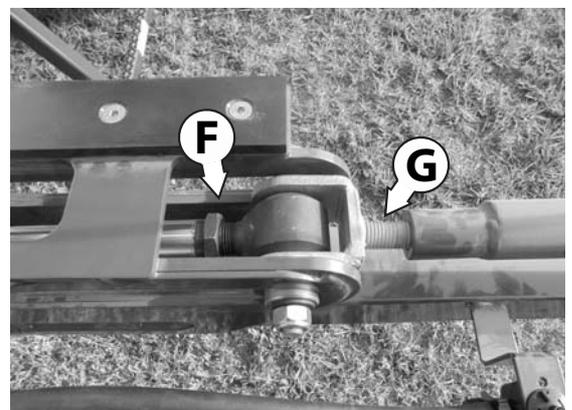


**ATTENTION!** It is very important that the boom carrier does not run unequally in the H-frame. It is important that there is no play in any of the sliders.



### Inner boom folding/unfolding adjustment

To make sure the boom is 100% in line for correct folding / unfolding. The rod marked **G** can be adjusted in combination with the end of piston **F**.

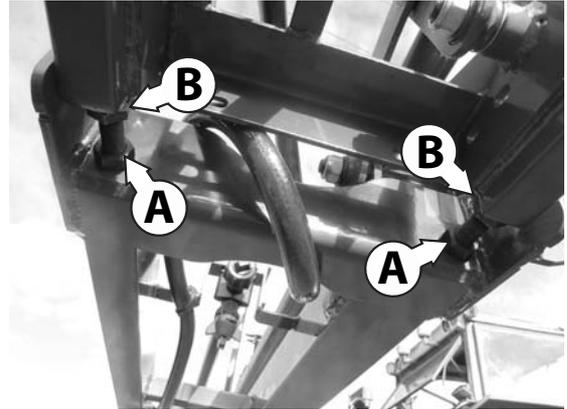


## 6 - Maintenance

### Vertical adjustment of first outer section

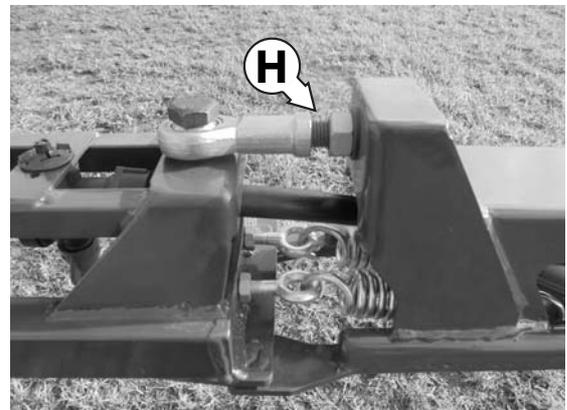
Adjust the outer section to be in level with the inner section, by adjusting bolt A.

To adjust it, undo both lock nuts A, then turn both bolt B equally until section is straight and in level. When adjusted re-tighten both lock nuts A



### Vertical adjustment of break-away

Adjust the brake away to be in level with the boom or a little higher, by adjusting screw H, do never let it be lower than the main boom, as it increased risk of interfering with the ground during the spray job.

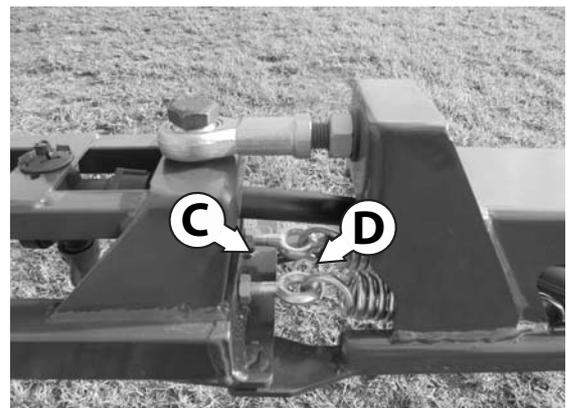


### Adjustment of break-away spring

The end sections of the boom can break away. The spring tension determines activation of break-away when the section encounters an obstacle.

- Change the spring tension by loosening the lock nuts **C**, then working equally on the eye-bolts (**D**) by turning the nylock nuts. Re-tighten the lock nuts after adjustments.

**i** NOTE! A tension value that is too low can cause untimely activation of the safety system.



### Off-season storage

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#### Off-Season Storage Program

To preserve the sprayer intact and to protect its components, the following off-season storage program is carried out.

#### Before 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 may reduce the life of its individual components.

1. Clean the sprayer completely - inside and outside - as described under "Cleaning" on page 51. Make sure that all valves, hoses and auxiliary equipment have been cleaned with detergent and flushed with clean water afterwards, so that no chemical residues are left in the sprayer.
2. Replace any damaged seals and repair any 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 comes out of all nozzles. The rinsing tank is also drained.
4. Pour approximately 50 litres of antifreeze mixture, consisting of 1/3 anti-freeze and 2/3 water, into the tank.
5. Engage the pump and operate all valves and functions, operating unit, chemical inductor etc., allowing the antifreeze mixture to be distributed around the entire circuit. Open the operating unit main valve ON/OFF and distribution valves, so that the antifreeze is sprayed through the nozzles as well. The antifreeze will also prevent O-rings, seals, diaphragms etc. from drying out. On sprayers with a FlexCapacity pump, this must also be engaged and flushed.
6. Lubricate all lubricating points according to the lubricating intervals.
7. When the sprayer is dry, remove rust from scratches or damage in the paint, if any, and touch up the paint.
8. Remove the glycerine-filled pressure gauges and store them frost-free in vertical position.
9. Apply a thin layer of anti-corrosion oil (e.g. SHELL ENSIS FLUID, CASTROL RUSTILO or similar) on all metal parts. Avoid oil on rubber parts, hoses and tyres.
10. Fold the boom in transport position and relieve pressure from all hydraulic functions.
11. All electric plugs and sockets are to be stored in a dry plastic bag to protect them against moisture, dirt and corrosion.
12. Remove the control boxes and computer display from the tractor. Store them dry and clean (indoor) in a non-condensing environment.
13. Wipe hydraulic snap couplers clean and fit the dust caps.
14. Apply grease to all hydraulic ram piston rods, which are not fully retracted in the housing, to protect against corrosion.
15. To protect against dust, the sprayer can be covered by a tarpaulin. Ensure ventilation to prevent condensation.

---

#### After storage

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

1. Remove the tarpaulin.
2. Wipe off the grease from hydraulic ram piston rods.
3. Fit the pressure gauges again. Seal with Teflon tape.
4. Connect the sprayer to the tractor, including hydraulics and electrics.
5. Check all hydraulic and electric functions.
6. Empty the tank for remaining antifreeze.
7. Rinse the entire liquid circuit of the sprayer with clean water.
8. Fill with clean water and check all functions.



### Operational problems

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#### General Info

Operational incidents are often due to the same reasons:

- A suction leakage reduces the pump pressure and may interrupt suction completely.
- A clogged suction filter may damage suction or interrupt and prevent the pump from running normally.
- A clogged pressure filter increases pressure in the fluid system in front of the pressure filter. This may blow the safety valve.
- Clogged in-line filters or nozzle filters increase pressure in the pressure gauge, but it decreases pressure at the nozzles.
- Impurities sucked in by the pump may prevent the valves from closing correctly, thus reducing the pump flow.
- A bad reassembly of the pump elements, especially the diaphragm covers, causes air intakes or leaks and reduces the pump flow.
- Rusted or dirty hydraulic components cause bad connections and early wears.
- A poorly charged or faulty battery causes failure and misbehaviour in the electrical system.

#### Therefore ALWAYS check that

- Suction and pressure filters, as well as nozzles, are clean.
- Hoses are free of leaks and cracks, especially suction hoses.
- Gaskets and O-rings are present and in good condition.
- Pressure gauges are in good working order. Dosage accuracy depends on it.
- Operating unit functions properly. Use clean water to check.
- Hydraulic components are clean.
- The tractor battery and its connectors are in good condition.

# 7 - Fault finding

## Liquid System

FAULT	PROBABLE CAUSE	CONTROL/REMEDY
No spray from boom when turned on.	SmartValve/Pressure valve positions are wrong. Suction/pressure filters are clogged. No suction from tank.	Set correct valve positions for spraying. Clean suction and pressure filters. See if suction fitting in main tank sump is free of sedimentation. Clean if needed.
Lack of pressure.	Incorrect assembly. Air in system. Too much agitation. Pump valves are blocked or worn. Blocked filters Defective pressure gauge.	Boost valve is open. Fill suction hose with water for initial priming. Close the agitation valve. Check for obstructions and wear. Clean all filters. Check for dirt at inlet of pressure gauge.
Pressure dropping.	Filters are clogging.  Nozzles are worn. Sucking air towards end of tank load.	Clean all filters. Fill with cleaner water. If using powders, make sure agitation is on. Check flow rate. Replace nozzles, if it exceeds 10%. Lower pump speed (rpm).
Pressure increasing.	Pressure filters beginning to clog.	Clean all filters.
Formation of foam.	Air is being sucked into system.  Excessive liquid agitation.	Check tightness/gaskets/O-rings of all fittings on suction side.  Lower pump speed (rpm). Check safety valve is tight. Ensure returns inside the tank are present. Use a foam damping additive.
Liquid leaks from bottom of the pump.	Damaged diaphragm.	Replace diaphragm. See relevant section.
Vibrations in system and unpleasant noise from the pump.	Air is being sucked into system.	Check for leaks, holes in hoses, tightness/gaskets/O-rings of all fittings on the suction side.
Operating unit is not functioning, or it is having a malfunction.	Blown fuse(s).  Wrong polarity. Valves not closing properly.  No power.	Check mechanical function of micro switches. Use cleaning/lubricating agent if the switch does not operate freely.  Check motor current, max. 450-500 mA. If over, change the motor. Brown to positive (+). Blue to negative (-). Check valve seals for obstructions. Check micro switch plate position. Loosen the screws holding the plate a 1/2 turn. Wrong polarity. Check that brown is positive (+), blue is negative (-). Check print plate for dry solders or loose connections. Check fuse holder is tight around fuse.

## Pump

Liquid leaks from the bottom of the pump.	Damaged diaphragm.	Replace diaphragm. See relevant section in this book.
Grease leaks from the bottom of the pump.	Grease used has too low viscosity.	Change to recommended grease type.
Grease leaks from the shaft grease seals.	Grease used has too low viscosity. Bearings worn/too high friction.	Change to recommended grease type. Replace pump bearings and grease seals.
Lack of pressure.	Pump valves are blocked or defect. Plugged filters in fluid system.	Check for obstructions or, if needed, replace valves. Clean filters.
Vibrations in system and unpleasant noise from the pump.	Pump valves are blocked or defect. Air is being sucked into system.	Check for obstructions or, if needed, replace valves. Check for leaks, pinholes in suction hoses, tightness/gaskets/O-rings of all fittings on the suction side.
Lack of flow/capacity.	Internal wear on conrod and conrod ring. Pump valves are blocked or defect.	Poor greasing. Replace parts as needed and observe proper grease quality and intervals. Check for obstructions or, if needed, replace valves.
Extreme internal erosion on diaphragm covers and housing.	Too high vacuum caused by clogged suction filter or excessive pump speed (rpm). Lack of internal cleaning. Lack of conservation of the fluid system during storage.	Replace affected pump parts. Clean suction filter and observe maximum pump speed (rpm). Use recommended cleaning procedures and add extra cleaning agents (e.g. AllClearExtra or similar). Always use a proper mixture of antifreeze during storage.
Short lifetime for diaphragm.	Overspeeding of the pump.	Observe maximum pump speed (rpm).

## Hydraulic System, Z-boom version

FAULT	PROBABLE CAUSE	CONTROL/REMEDY
No boom movements when activated.	Insufficient hydraulic pressure.	Check oil pressure.
	Insufficient oil supply.	Check tractor hydraulic oil level. Oil flow must be min. 25 l/min. and max. 130 l/min. Check tractor hydraulic oil level.
	Blown fuse(s).	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 for power supply.
	Defective relay / diodes in junction box.	Check relays, diodes and soldering at PCB in junction box. LED diodes indicate boom functions.
	Clogged restrictors in bypass block.	Remove and clean restrictors in bypass block (See hydraulic diagram). Change hydraulic oil + filter.
	Wrong polarity.	Check polarity. Red positive (+), black negative (-).
ParaLift lock does not lock. Boom lift raises to max. position, when tractor hydraulics are engaged.	Back pressure in return line exceeds 15 bar.	Connect the return line with a 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.	Bypass valve does not close properly. Internal leaks in flow regulator.	Check / close (screw in) by-pass valve. Replace flow regulator O-rings and backup rings. Replace flow regulator.
Individual hydraulic piston does not move.	Clogged restrictor.	Dismantle and clean restrictor.

## Hydraulic System, Y-boom version

FAULT	PROBABLE CAUSE	CONTROL/REMEDY
Boom slow/erratic.	Air in system.	Loosen ram connection and activate hydraulics until oil flow has no air in it (not whitish).
	Regulation valve incorrectly set.	Open or close until desired speed is achieved (clockwise = less speed). Remember oil must be at operating temperature.
	Insufficient hydraulic pressure.	Check output pressure of tractor hydraulics. Minimum for sprayer is 170 bar.
	Insufficient amount of oil in tractor reservoir.	Check and top if needed.
Ram not functioning.	Restrictor or regulation valve blocked.	Secure boom. Dismantle and clean.
Hydraulic system fold/tilt functions will not operate.	Power supply.	Check for proper 12V power supply.
One function (fold or tilt) will not operate.	Various.	Check for defective switch(s).
		Check continuity of cables.
		Check for operation of applicable solenoid (coil not activating or plunger stuck).
		Check for short circuit in wiring junction box at rear of sprayer.
		Dirt in the restrictor port of the cylinder.
Multiple hydraulic functions with one switch activated.	Various.	Check for correct solenoid electric/hydraulic hook-up.
		Check for short circuit in wiring in the junction box at rear of sprayer.

## 7 - Fault finding

---

### Mechanical Problems

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#### Emergency Operation - Liquid system

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. A fuse is placed inside the control box. Fuse type: Thermo.

## Specifications

### Pump Model 464/10.0

<b>HARDI</b>		HARDI INTERNATIONAL A/S TAASTRUP DENMARK	
Type 464/10		r/min.max. 700	
No.			
r/min.	l/min.	bar	kW
540	280	0	1.8
540	259	max.15	8.3
			9761500

### Pump Model 464/12.0

<b>HARDI</b>		HARDI INTERNATIONAL A/S TAASTRUP DENMARK	
Type 464/12		r/min.max. 600	
No.			
r/min.	l/min.	bar	kW
540	334	0	2.2
540	310	max.15	9.7
			9761500

### Pump Model 1303/9.0

<b>HARDI</b>		HARDI INTERNATIONAL A/S TAASTRUP DENMARK	
Type 1303/9		r/min.max. 700	
No.			
r/min.	l/min.	bar	kW
540	114	0	1.6
540	100	10	2.5
		max.15	
			976122

---

## Filters and Nozzles

Options:

Mesh	Gauze width	Color	Filter			Tank strainer	Nozzle
			Top-mounted	Self-cleaning	In-line**		
18	1.00 mm	White	-	-	-	Yes	-
30	0.58 mm	Green	Yes	-	-	-	-
50	0.30 mm	Blue	Yes, standard	-	Yes*	-	Yes*
80	0.18 mm	Red	Yes	Yes	Yes*	-	Yes*
100	0.15 mm	Yellow	-	-	Yes*	-	Yes*

\*depending on selected nozzles

\*\*not with PrimeFlow system

---

## Temperature and Pressure Ranges

<b>Spray liquid system</b>	
Operating temperature range	2 - 40 °C
Operating pressure for the safety valve	15 bar
Max. pressure on the pressure manifold	20 bar
Max. pressure on the suction manifold	1.5 bar
<b>Hydraulic system</b>	
Max. operating temperature	75 °C
Operating pressure from the tractor	190 - 210 bar

---

## Technical Residue

Residue in the dilutable volume is mentioned in the table below.

The non-dilutable volume varies depending on the boom width and installed options in the fluid system.

Sprayer combination	Dilutable volume for tank and fluid system
Main tank: 1000 litres Boom width: 12 meters	16 litres

---

## Power Consumption

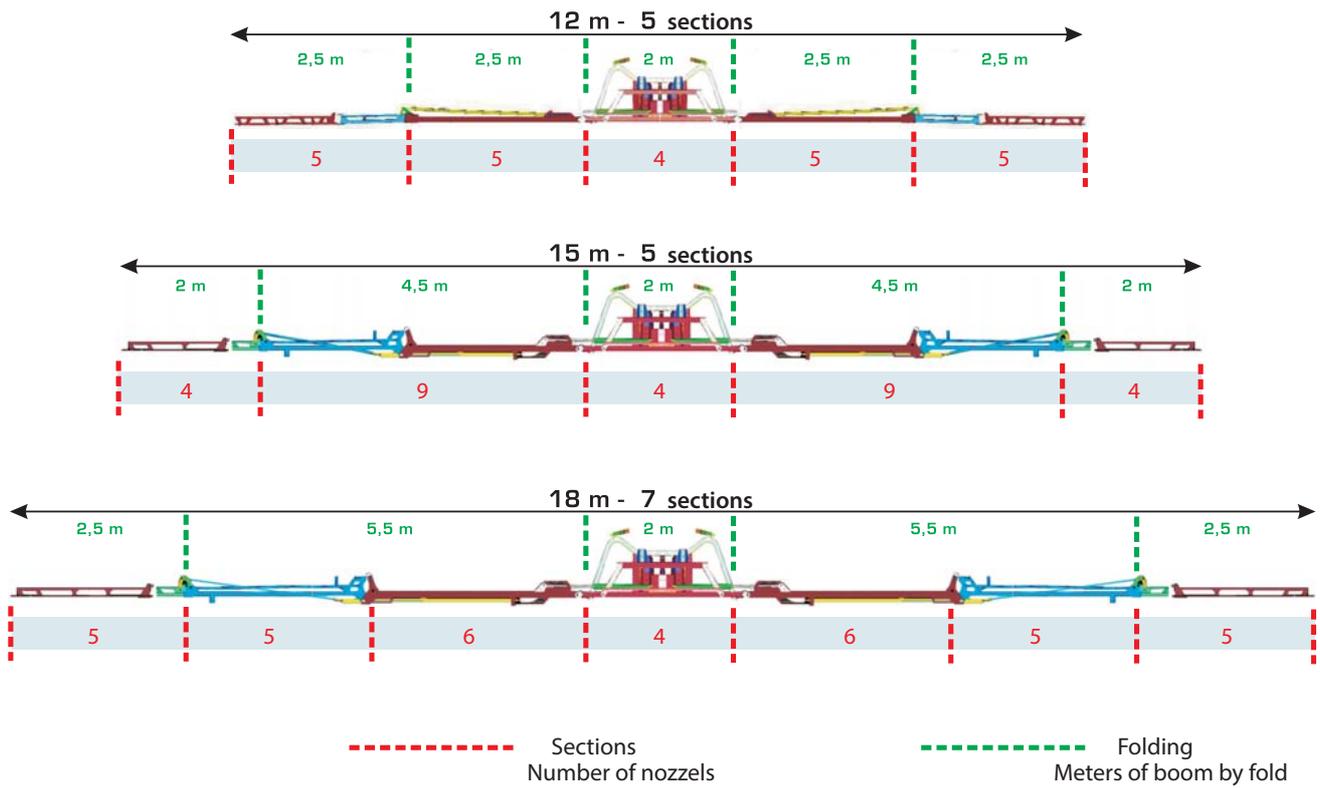
Sprayer tank volume	Output	Output
1000 litres	100 hp	75 kW
1200 litres	115 hp	86 kW
1500 litres	132 hp	99 kW
1800 litres	152 hp	114 kW

---

## Airborne Noise Emission

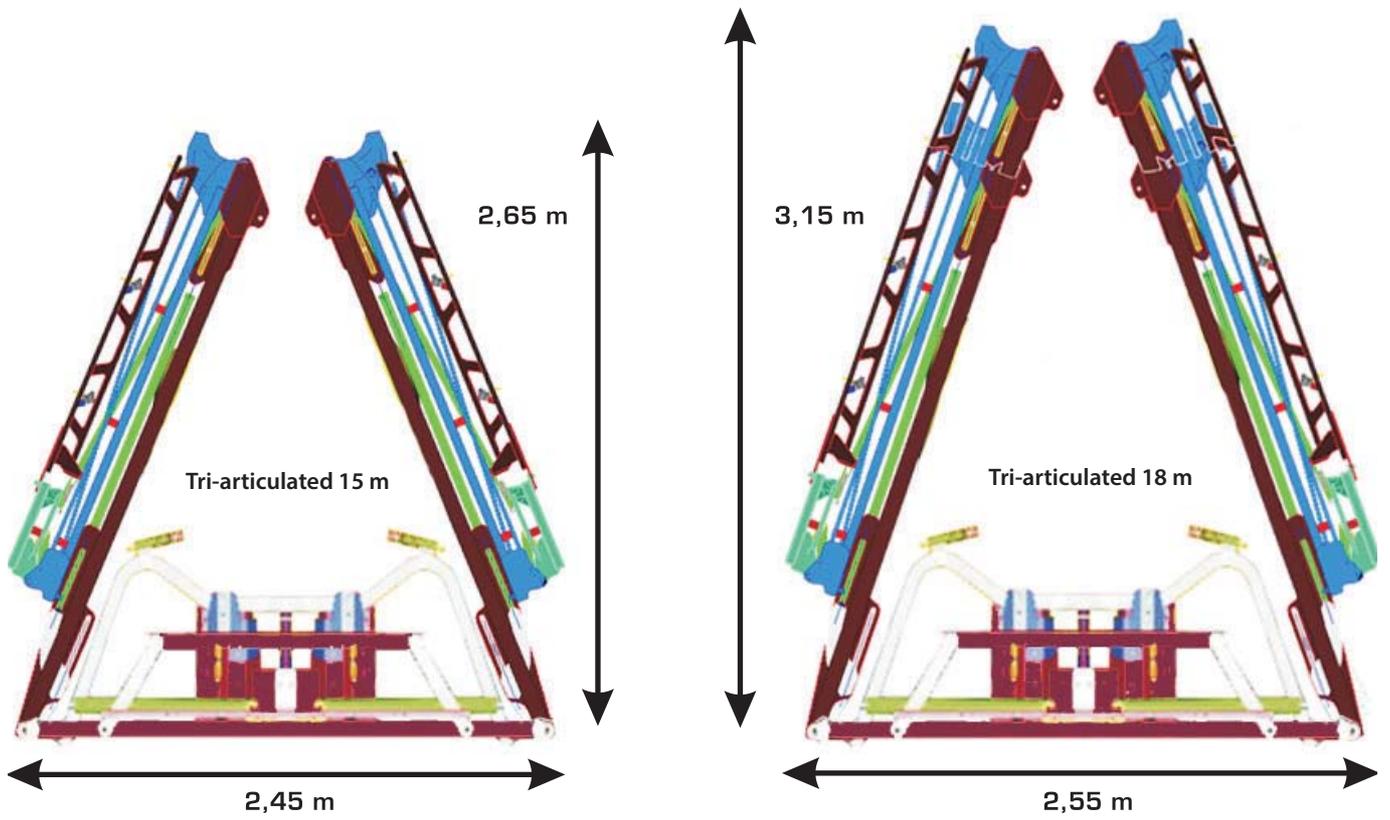
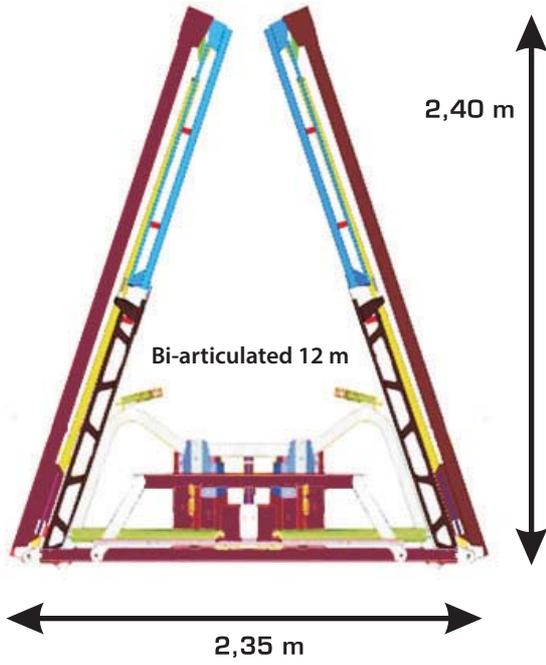
Airborne noise emission from operating the sprayer relates to the two defined operator positions (in the tractor cab or operating the chemical incorporator/filling device/TurboFiller). Reference measurements indicate only in the latter case (operating the chemical filling device) a contribution from the sprayer of additionally 4 dB(A).

## Boom sections and nozzels



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## Dimensions folded



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## Weights table

 Note! Weights below is with empty tank.

CAPACITY	BOOM	WEIGHT
1000 Liters	12 m	773 kg
	15 m	882 kg
	18 m	926 kg
1200 Liters	12 m	781 kg
	15 m	890 kg
	18 m	934 kg
1500 Liters	12 m	922 kg
	15 m	1031 kg
	18 m	1075 kg
1800 Liters	12 m	930 kg
	15 m	1039 kg
	18 m	1083 kg

---

## Materials and Recycling

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### Disposal of the Sprayer

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

Materials used:

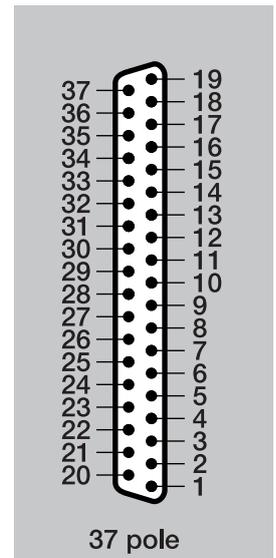
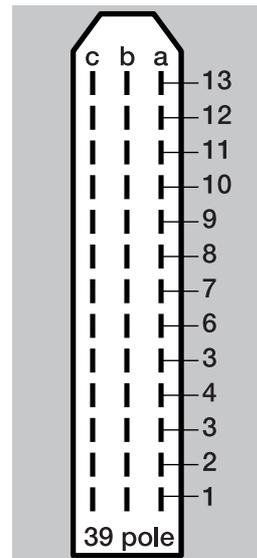
Tanks:	Plastic (HDPE)
Chassis, frame:	Steel (various types)
Boom:	Steel (various types)
Pump housing:	Grey cast iron (GG200)
Pump diaphragms:	Plastic (PUR)
Hoses (suction):	Plastic (PVC)
Hoses (pressure):	Rubber (EPDM)
Valves:	Glass reinforced plastic (PA)
Hose and pipe fittings:	Glass reinforced plastic (PA)
Filter housings:	Plastic (PP)
Nozzles:	Plastic (POM)

## Electrical connections

### Electrical Connections for Spraybox II and III

39- or 37-poled plug with cable.

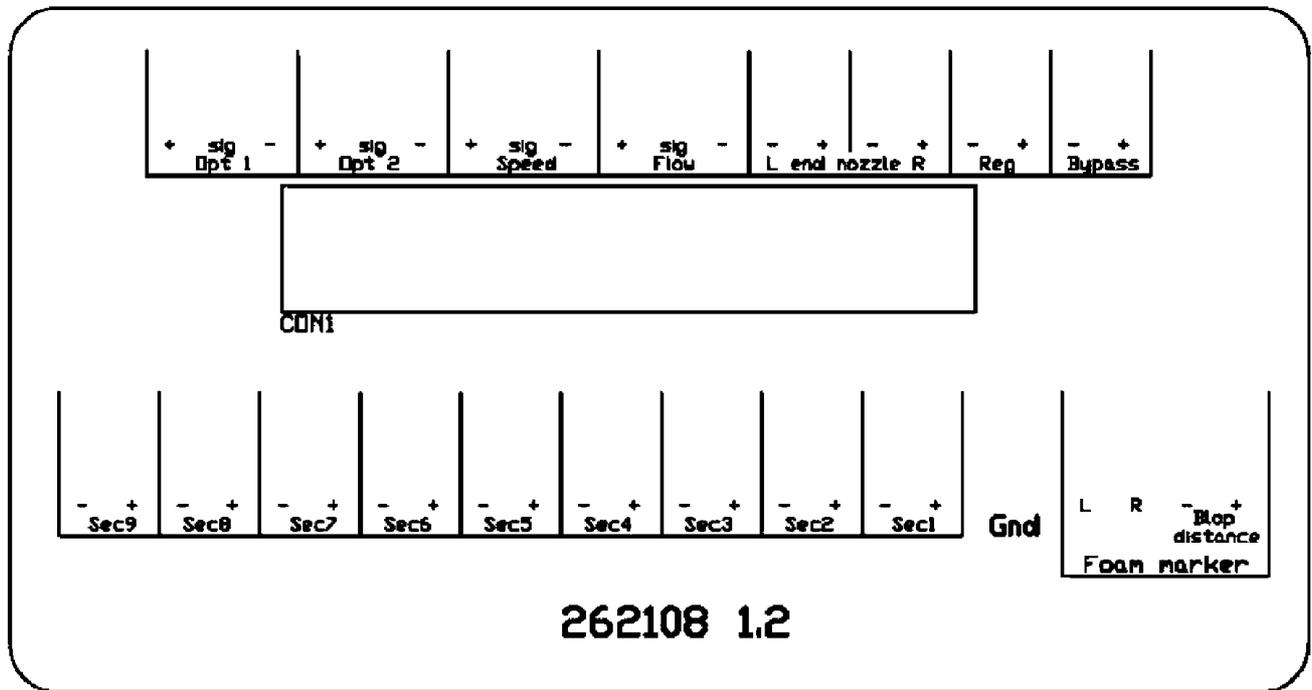
39-pole	37-pole	Spraybox II and III
1a	5	S1+
1b	6	S1-
1c	26	End nozzle L
2a	7	S2+
2b	8	S2-
2c	25	End nozzle R
3a	9	S3+
3b	10	S3-
3c	29	+12V sensor
4a	11	S4+
4b	12	S4-
4c	4	PWM 1TX
5a	14	S5+
5b	15	S5-
5c	27	GND
6a	16	S6+
6b	17	S6-
6c	13	Optional 5 Reg. feedback
7a	18	S7+
7b	19	S7-
7c	33	Option 1 4-20mA
8a	37	S8+
8b	36	S8-
8c	32	Option 2 Frq
9a	35	S9+/Air angle 0-5V
9b	34	S9-/Fan speed 0-5V
9c	not connected	Option 3/Tank gauge
10a	21	On/off+
10b	22	On/off-
10c	not connected	PWM Output option
11a	23	Pressure+
11b	24	Pressure-
11c	28	Flow
12a	20	Foam blop 0-5V
12b	1	Option 4 Rx
12c	31	Speed
13a	3	FM L
13b	2	FM R
13c	30	Gnd sensor



## EVC Junction Box

The EVC operating unit fulfils the EC noise reduction standards.

When connecting an optional function, be aware that maximum current for every connector is 2 amps. Total current for the whole connector box may not exceed 10 amps.



HC 5500	Function	+	Signal	-		
Option 1	Pressure sensor	Brown	Blue	-		
Option 2	RPM sensor	Brown	Blue	Black		
Speed		Brown	Blue	Black		
Flow		Brown	Blue	Black		
Left end nozzle	Pendulum lock at HAY/LPY	Brown		Blue		
Right end nozzle	Pendulum lock at HAY/LPY	Brown		Blue		
Regulation (Yellow)		Brown		Blue		
Bypass	EC on/off	Brown		Blue		
Section 9		x		x		
Section 8	User defined A&B	x		x		
Section 7		Brown		White		
Section 6		Yellow		Grey		
Section 5		Brown		Blue		
Section 4		Brown		Blue		
Section 3		Brown		Blue		
Section 2		Brown		Blue		
Section 1		Brown		Blue		
		Ground	Left	Right	-	+
Foam marker	No. 4 Not used	Black	Brown	Red		Orange

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**Spare parts**

To see updated spare part information the website [www.agroparts.com](http://www.agroparts.com) can be visited. Here all parts information can be accessed when free registration has been made.



**HARDI Australia P/L**

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