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# TWIN-STREAM

## Instruction book

674657-GB-96/1



# EC Declaration of Conformity

## Manufacturer,

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

## Importer,

declare that the following product;

.....  
.....

Adhere extra shipping package labels to inside cover.

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

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

Taastrup 01.11.2002

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Lars Bentsen  
Development Product Manager  
HARDI INTERNATIONAL A/S

## Operator safety

Watch for this symbol . It means WARNING, CAUTION, NOTE. Your safety is involved so be alert!

Note the following recommended precautions and safe operating practices.

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





We congratulate you for choosing a HARDI plant protection product. The reliability and efficiency of this product depend on 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.

As the instruction book covers all TWIN STREAM (MA-HAL) models, please pay attention to the paragraphs dealing with precisely your model. This book is to be read in conjunction with the "Spray Technique" book.

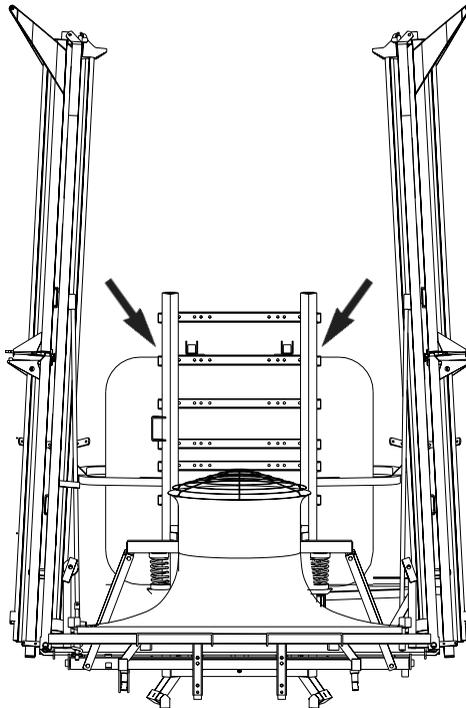


### Road transport

If the sprayer is to be transported on an open trailer travelling more than 30 km/h, the air bag must be prevented from flapping. Failure to do so will result in damage to the bag.

### Lifting points

When loading or unloading the sprayer from a truck or lorry with a crane, use the lifting points as shown.



## Description

The HARDI TWIN STREAM (MA-HAL) is for the application of crop protection chemicals and liquid fertilizers. It consists of a pump, MA type frame with tank of 600, 800, 1000 or 1200 litre capacity, operating unit, Self-Cleaning Filter, transmission shaft and HAL type boom. Options include Rinsing tanks and HARDI MANIFOLD SYSTEM valves.

The design of the diaphragm pump is simple, with easily accessible diaphragms and valves that ensure liquid does not contact the vital parts of the pump.

The tank, made of impact-proof and chemical resistant polyethylene, has a purposeful design with no sharp corners, for easy cleaning. A large, easy to read tank contents indicator is placed in front of the tank. The filling hole is placed at the right hand side of the sprayer.

The BK operating unit consists of; pressure agitator valve, safety valve, main ON/OFF valve, pressure filter with pressure gauge, distribution valves with pressure equalization and HARDI-MATIC pressure control valve.

The BK/EC and EC (Electric Control) operating unit consists of; pressure agitator valve, main ON/OFF valve, pressure control valve with HARDI-MATIC, pressure gauge and distribution valves with pressure equalization.

HARDI-MATIC ensures a constant volume per hectare of the liquid (l/ha) at varying speed in the same gear when the number of P.T.O. revolutions are between 300-600 r/min.

The left hand side of the sprayer is equipped with the basic connections for the HARDI MANIFOLD SYSTEM. It is wise to utilize the MANIFOLD SYSTEM in combination with a number of optional extras as this makes the operation of the sprayer more safe and simple.

With the Self-Cleaning Filter the impurities that exist in the spray liquid will by-pass the filter and be recirculated back to the tank via the return flow.

The HAL spray boom with blower is equipped with 4 hydraulic rams. The folding/unfolding, raising/lowering functions and angling of air outlet are done via the tractor hydraulics. The frame is connected to the boom by a trapeze suspension which is supported by two heavy duty coil springs. This helps to stabilize the boom and protect it from vibrations and shocks when driving on uneven ground. The outer sections incorporate a double-action breakaway.

The hydraulically operated axial blower is placed in the centre part of the boom. It generates the air stream which is ducted out under the length of the boom. TRIPLET SNAP-FIT nozzles are placed in front of





the air stream. The use of the blower reduces wind drift and in dense crops increases the penetration of spray liquid.

## Identification plates

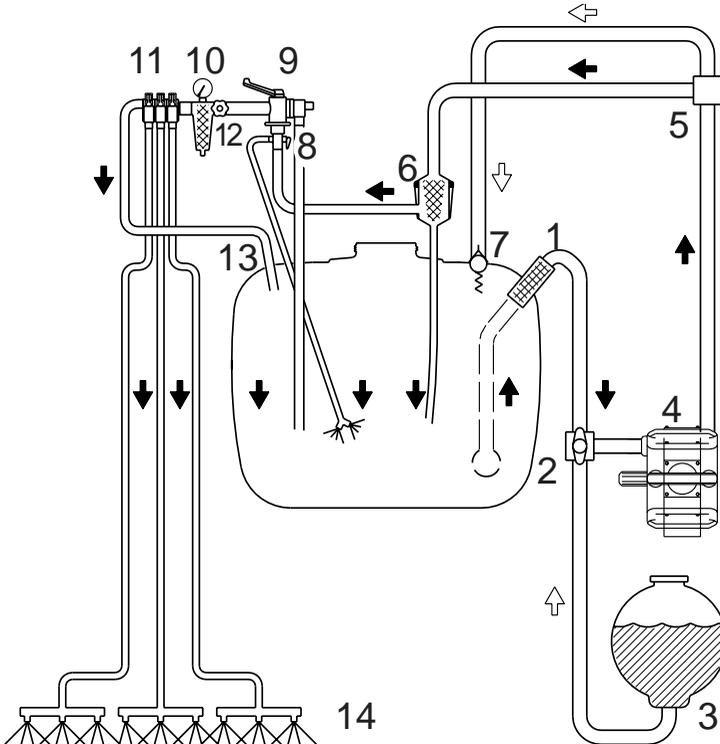
An identification plate fitted on the frame and pump is to indicate model, serial number and country of origin. Boom centre frame, and inner/outer sections also have identification plates indicating boom type and part no. of steel parts. If ordering spare parts, inform your dealer of these so the right model and version are described.



## Function diagram

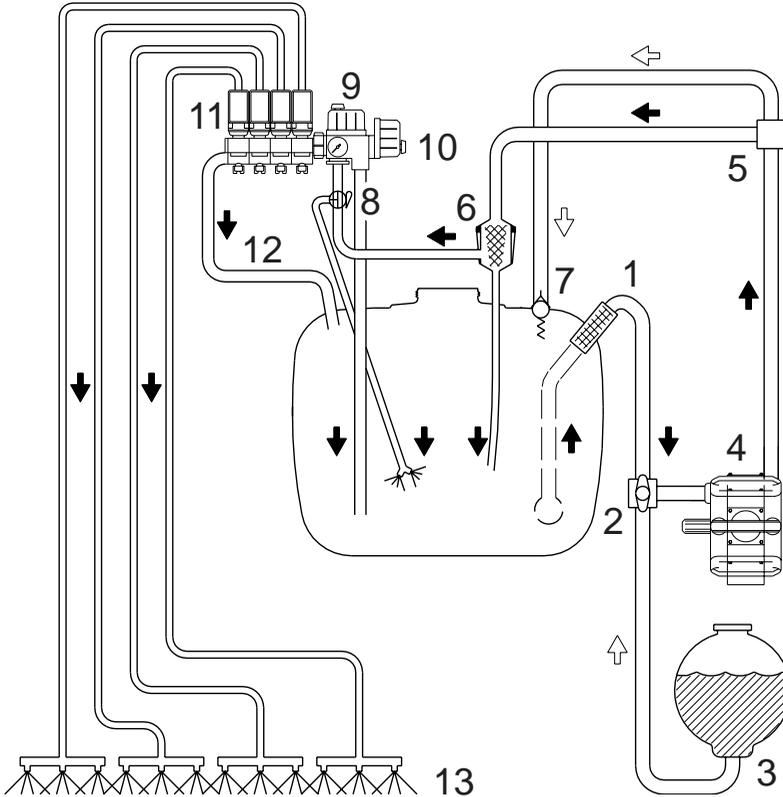
### BK operating unit

- |                             |  |
|-----------------------------|--|
| 1. Suction filter           | 9. Main ON/OFF valve                               |
| 2. Suction manifold         | 10. Pressure filter with pressure gauge            |
| 3. Rinsing tank (if fitted) | 11. Distribution valves with pressure equalization |
| 4. Pump                     | 12. Pressure control valve with HARDI-MATIC        |
| 5. Pressure manifold        | 13. Return to tank                                 |
| 6. Self-Cleaning Filter     | 14. Sprayer boom                                   |
| 7. Safety valve             |  |
| 8. Pressure agitator valve  |  |



## EC operating unit

1. Suction filter
2. Suction manifold
3. Rinsing tank (if fitted)
4. Pump
5. Pressure manifold
6. Self-Cleaning Filter
7. Safety valve
8. Pressure agitator valve
9. Main ON/OFF valve with pressure gauge
10. Pressure control valve with HARDI-MATIC
11. Distribution valves with pressure equalization
12. Return to tank
13. Sprayer boom



## Connecting the sprayer

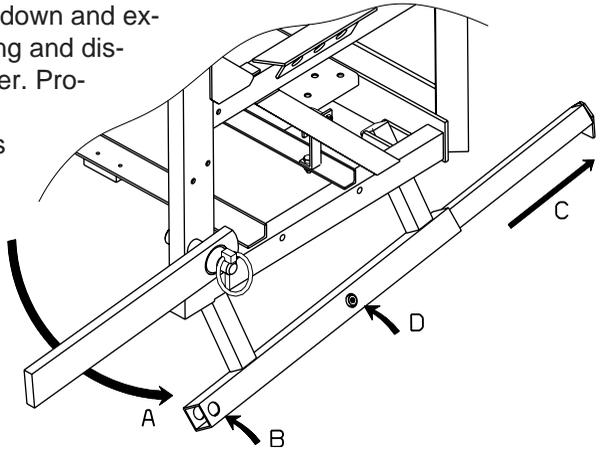
The sprayer is designed for three point suspension and is equipped with 28 mm pivots (cat. II). Use pins with a diameter of at least 10 mm when connecting the sprayer. The frame has retractable support legs that can be folded up to minimize crop damage.





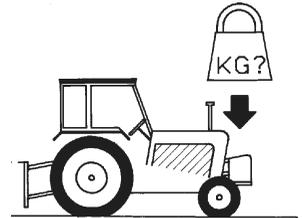
They must be folded down and extended before lowering and disconnecting the sprayer. Proceed as follows:

1. Swing support legs **A** down.
2. Push the black button **B** in.
3. Extend the legs **C** until the black button clicks out in location hole **D**.



**WARNING:** Note the weight of the sprayer. General recommendations are as follows:  
Add ballast to front of tractor.

- Increase tyre pressure (see tractor instruction book).
- Be careful when filling/lifting the sprayer for the first time.
- Ensure the operating unit and tractor do not touch.
- Travel at slower speeds when driving with a full tank. (The tractor braking effect will be reduced.)



## Transmission shaft

### Operator safety

To avoid accidents and personal injuries, note the following recommended precautions and safe operation practices.



Always STOP ENGINE before attaching the transmission shaft to tractor P.T.O. - most tractor P.T.O. shafts can be rotated by hand to facilitate spline alignment, when engine is stopped.

When attaching the shaft, make sure that the snap lock is FULLY ENGAGED - push and pull shaft until it locks.



**WARNING:** ROTATING TRANSMISSION SHAFTS WITHOUT PROTECTION GUARDS ARE FATAL.

Always keep protection guards and chains intact and make sure that they cover all rotating parts, including cross journals at each end of the shaft. Do not use without protection guard.

Do not touch or stand on the transmission shaft when it is rotating - safety distance: 1.5 metre.

Prevent protection guards from rotating by attaching the chains allowing sufficient slack for turns.

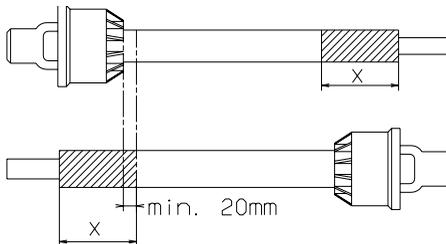
Make sure that protection guards around tractor P.T.O. and implement shaft are intact.

Always STOP ENGINE and remove the ignition key before carrying out maintenance or repairs to the transmission shaft or implement.

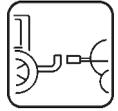
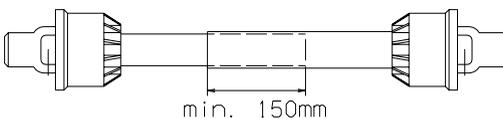
### Installation of transmission shaft

Initial installation of the shaft is done as follows:

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

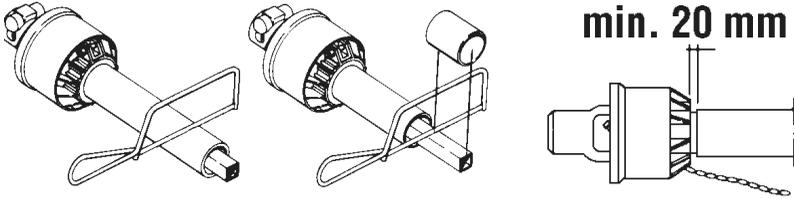


**NOTE:** The shaft must always have a minimum overlap of 150 mm.

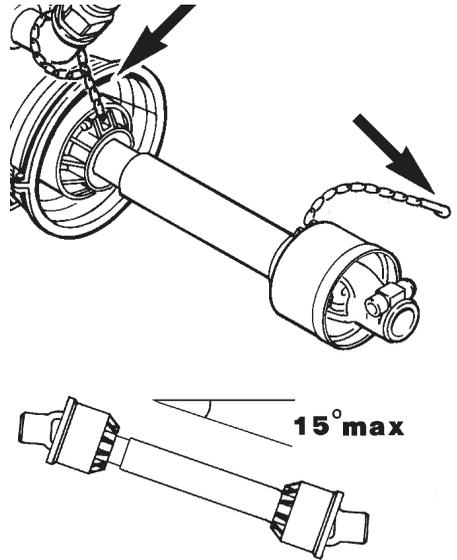




- The two parts are shortened equally. Use a saw, and file the profiles afterwards to remove burrs.
- Grease the profiles, and assemble male and female parts again.



- Fit the shaft to tractor and sprayer pump.  
**NOTE:** Female part towards tractor.  
Fit the chains to prevent the protection guards to rotate with the shaft.
- To ensure long life of the transmission shaft, try to avoid working angles larger than 15°.
- Transmission shafts with cone must be fitted by tightening the Allen screw to a torque of 40 Nm. Check again after 2 minutes' use.



## Hydraulics Requirements

Connection requirements are;

- single outlet to raise or lower the boom,
- double outlet to fold/unfold the boom and angle the outlet,
- single return drain line to the tractor.

The hydraulic hose with the red arrow indicates direction of oil flow to unfold the boom and turn the fan. Maximum permissible oil pressure is 180 bar. See also section on Technical specifications.



**CAUTION:** All hoses MUST be connected. Ensure the snap couplers are thoroughly clean before connection. Failure to do so will cause premature wear to the blower hydraulics.

## Drain line

The sprayer is supplied with a short hydraulic hose with coupler and fittings. Fit this as a permanent installation on the tractor. The connection must be made direct to the hydraulic oil reservoir of the tractor. Maximum permitted pressure in the drain line is 1 bar.

**Always connect the drain line.**

**NOTE:** Pressures over 1 bar or failure to connect the drain line will damage the hydraulic motor seal.

## Oil purity

Oil from the tractor to the sprayer must as minimum have been filtered according to ISO 4406 20/14. Particles measured over 25 micron Absolute must be filtered from the oil (Filtration quotient  $\beta_{25-75}$ , ISO 4572-81 Multipass test).

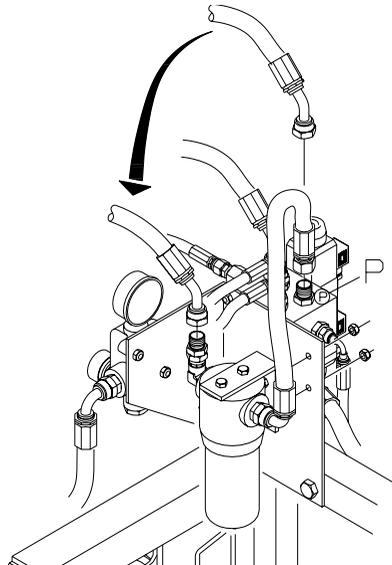
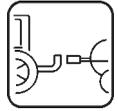
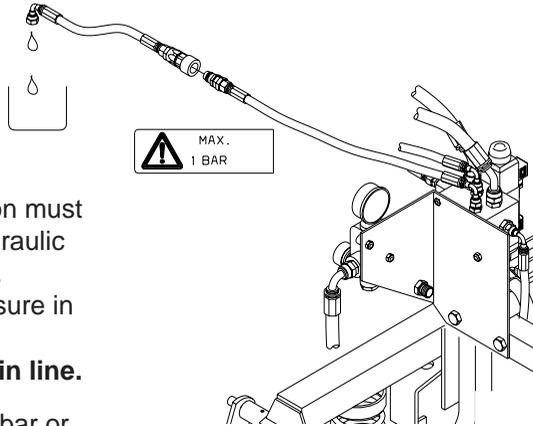
Follow the tractor oil change schedule as directed. Choose hydraulic oil with anti-foam and anti-oxidant additives.

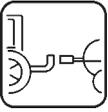
Be especially cautious where the tractor transmission oil is also the oil used for the implement hydraulics. Consult the tractor dealer if in doubt.

## Oil pressure line filter (if fitted)

An oil pressure line filter (HARDI ref. no. 729555) must be installed if the oil supplied to the sprayer does not fulfill the minimum oil filtration standard ISO 4406 20/14.

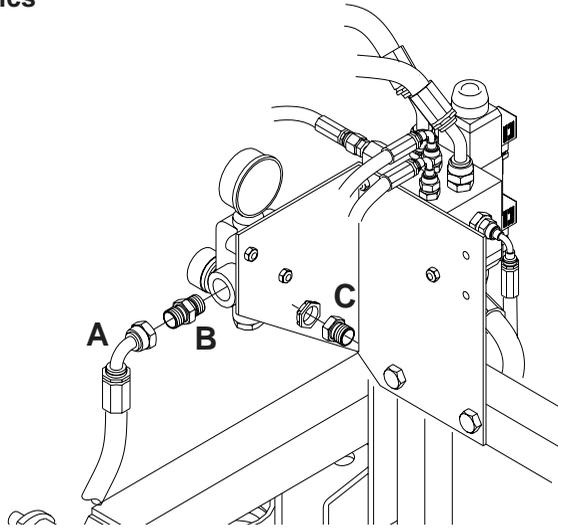
The HARDI filter has an indicator. Check that the indicator is green. If the indicator is red, the filter element is clogged and needs to be changed immediately. Ref. no. for filter element is 284852.





### Closed centre hydraulics

The sprayer is factory supplied for use with open centre hydraulic systems. If the tractor is equipped with closed centre (load sensing) hydraulics e.g. John Deere, the bypass on the hydraulic valve block of the sprayer needs to be blocked off. The sprayer is supplied with an extra 1/2" nipple made of brass with no perforation.



To convert sprayer for closed centre hydraulics:

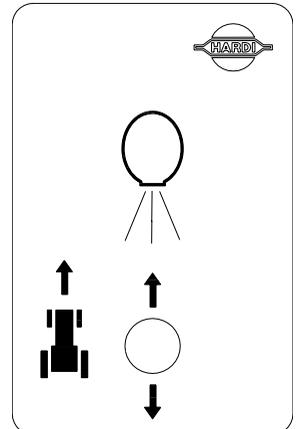
1. Disconnect hydraulic hose **A**.
2. Swap standard black 1/2" nipple **B** with brass nipple **C**.
3. Connect hydraulic hose **A**.

### Electric remote for air stream angle

The control box is fitted at a convenient location in the tractor cabin.

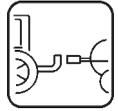
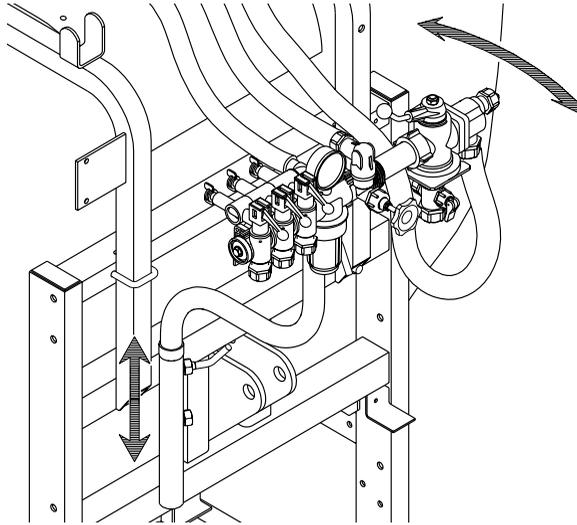
Power requirement is 12 V DC.

Note polarity. Brown pos. (+), Blue neg. (-). Use the HARDI Electric Distribution Box ref. no. 817925 if the tractor has a doubtful power supply.



### **BK operating unit**

The position of the operating unit can be adjusted forward or backward and up or down. Position it so it can be operated from the tractor without risk of damage to the sprayer or tractor.

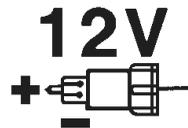


### **BK/EC and EC operating unit control box**

The control box is fitted at a convenient place in the tractor cabin. The control box has 4 screw holes in the back cover. Mount it on a flat surface.

Power requirement is 12 V DC.

Note polarity. Brown pos. (+), Blue neg. (-).



### **Rear lights (if fitted)**

Connect plug for rear lights to the tractors 7-poled socket and check that rear lights, stop lights and direction indicators work properly before driving anywhere.

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

### **Roadworthiness**

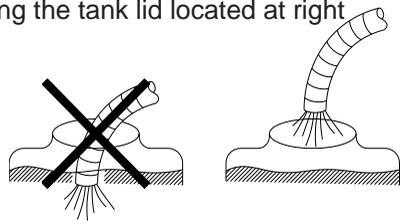
When driving on public roads and other areas where the highway code applies, or areas where there are special rules and regulations for marking and lights on implements, you should observe these and equip implements accordingly.

### **Operating instructions**



## Filling the main tank

Water is filled into the tank by removing the tank lid located at right hand side of sprayer tank. 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 lead into the tank and the water pressure drops at the water supply plant, chemicals may be syphoned back and contaminate the water supply lines, plant and well.

## Filling the Rinsing tank (if fitted)

Remove the tank lid and fill with clean water and replace lid.

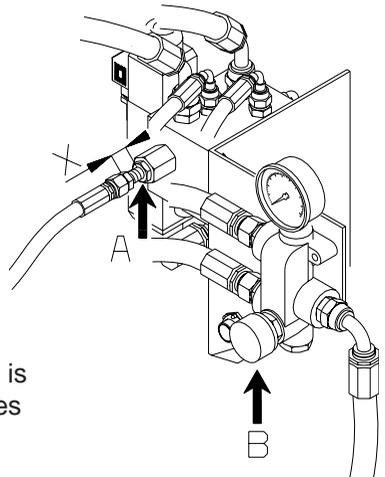
## Operating the boom

**WARNING:** Before unfolding the boom it is important to connect the tractor to prevent overbalancing of the sprayer. Unfolding and folding may only be done whilst the equipment is stationary.

**WARNING:** Testing of the hydraulic system should be done very cautiously. There may be air in the system and this may cause violent movements of the boom. Therefore take care that no persons or objects are hurt or damaged in the process of testing.

Speed regulation of the hydraulic movements can be altered. A restrictor valve is located at the hydraulic block on the blower. It must be adjusted so the boom operates smoothly.

Nut **A** is loosened, and the distance "**x**" is adjusted. Reducing the distance reduces the speed of the boom movements.

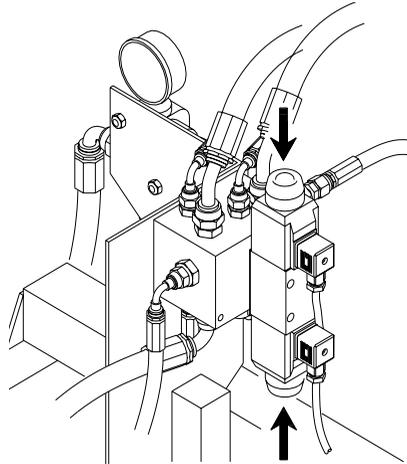


**NOTE:** If the boom has difficulty in unfolding, increase the oil flow to the blower by turning valve **B** on the blower.

### Air stream angle

The angle of the air stream can be altered from 18° forward to 18° backward. Unfold the boom. The angle of the air stream outlet is automatically set backward 18° by a small ram under the centre section.

The angle can be altered via the electric remote. If the electric power should fail, it is possible to manually change the angle by pushing the buttons on the solenoid valve on the blower.



### Blower

Unfold the boom and lock the tractor double activating hydraulic lever to open position and increase engine revolutions to correspond with forward speed.

To increase or decrease the fan revolutions and thereby air volume, adjust valve **B** on the hydraulic block.

**CAUTION:** For the safety of the operator, no other persons may carry out adjustments.

After the oil has driven the hydraulic motor, it then passes through a cooler before returning to the tractor. This ensures the hydraulic oil does not overheat.

**NOTE:** For maximum performance from the blower, the tractor hydraulic system must meet the following demands.

Boom size	Minimum oil flow l/min	Minimum pressure bar
12 m	38	180
15 m	44	165

The above table includes 25 bar back pressure on the tractor hydraulic system. See also section on Technical specifications. With load sens-





ing or constant pressure systems, back pressure may be higher. If in doubt, contact your tractor dealer.

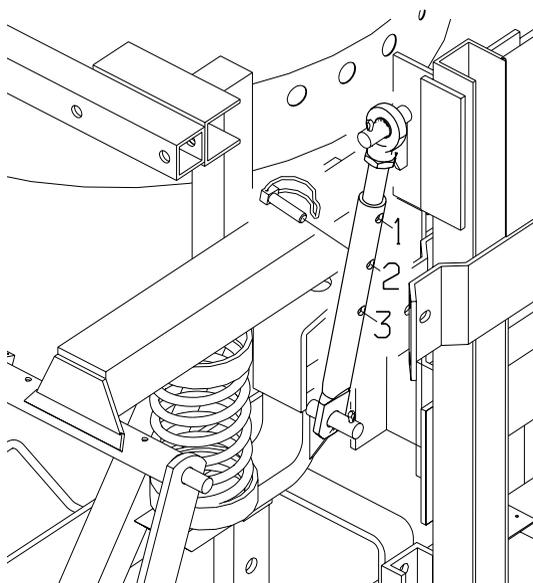
After initial operation of the boom and blower, check the hydraulic oil level of the tractor and top up if necessary.

### Trapeze

The trapeze suspension needs to be correctly adjusted and lubricated for satisfactory operation. Its function is to protect the boom from vibration and shock thereby prolonging boom life. It also helps to keep the boom a uniform height from the target. See also sections Lubrication and Re-adjustment of the boom.

At delivery the boom is locked in pos. **2** which is used when driving on horizontal grounds. When driving on slopes the boom can be slanted in pos. **1** or **3** in order to keep the trapeze effect. Hydraulic slanting can be supplied as optional extra.

If Hydraulic Slanting Control is fitted, another double acting outlet is required. Note that whilst activating this function, fan output may be reduced.



# Self-Cleaning Filter

## Function diagram

1. From pump
2. Filter screen
3. Guide cone
4. To operating unit
5. 3, 4, 5 or 6 mm restrictor
6. Return to tank
7. Ring nut

## Choice of restrictor

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

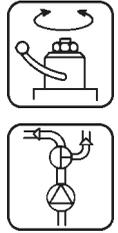
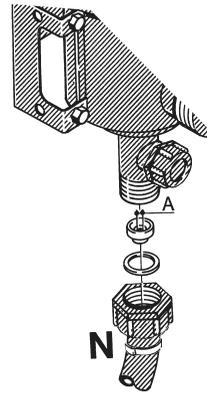
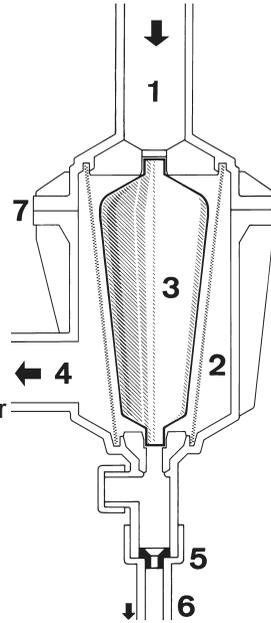
4 restrictors are supplied. Use the green one (largest **A** orifice first).

Hose **N** is unscrewed from the filter. Be careful not to lose the seal. The restrictor is placed in the hose and the hose is mounted again.

If the required working pressure cannot be obtained, the restrictor is too large. Choose a smaller restrictor. Start with a black one, then a white and finally a red one.

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

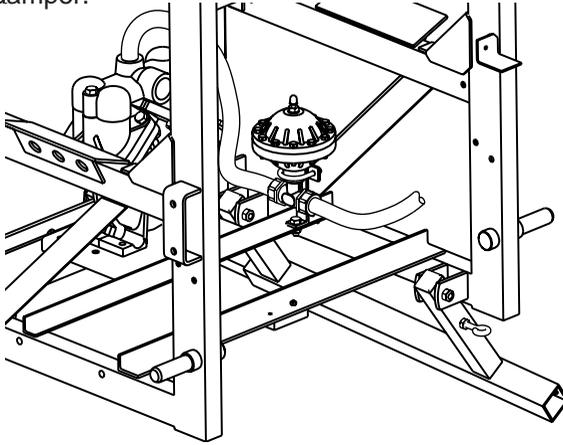
Standard filter size is 100 mesh. Filters of 50 and 80 mesh are available. To remove filter mesh undo the large ring nut. Check condition and placement of O-rings before reassembly.





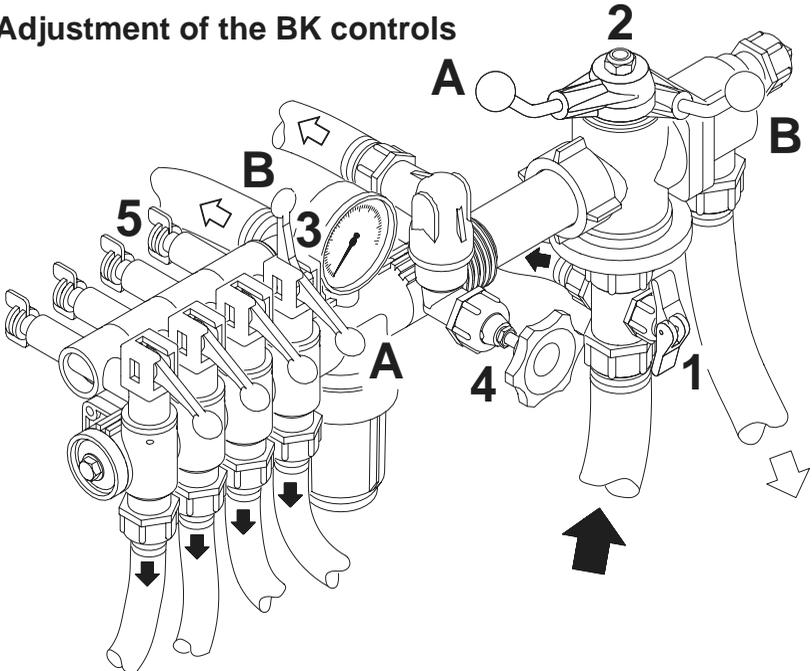
## Pulsation damper (if fitted)

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 also embossed on the damper.



bar	bar
1.5 - 3	0 - 1
3 - 15	1 - 3

## Adjustment of the BK controls



1. Choose the correct nozzle. TRIPLET nozzle turrets are turned to the suitable nozzle for the spray purpose. Make sure that all nozzles are the same type and capacity. See "Spray Technique" book.
2. Open or close lever **1** depending on whether pressure agitation is required. (Remember pressure agitation takes 5% to 10% of pump output).
3. Turn main ON/OFF handle **2** to ON position **A**.
4. Set all hand levers **3** on the distribution valve to ON position **A**.
5. Turn the HARDI-MATIC valve **4** anti-clockwise to its extreme position.
6. Put the tractor in neutral and adjust the P.T.O. thereby the number of revolutions of the pump corresponding to the intended travelling speed.  
**NOTE:** The P.T.O. revolutions must be kept between 300-600 r/min.
7. Adjust the HARDI-MATIC valve **4** so that the pressure gauge indicates the recommended pressure.

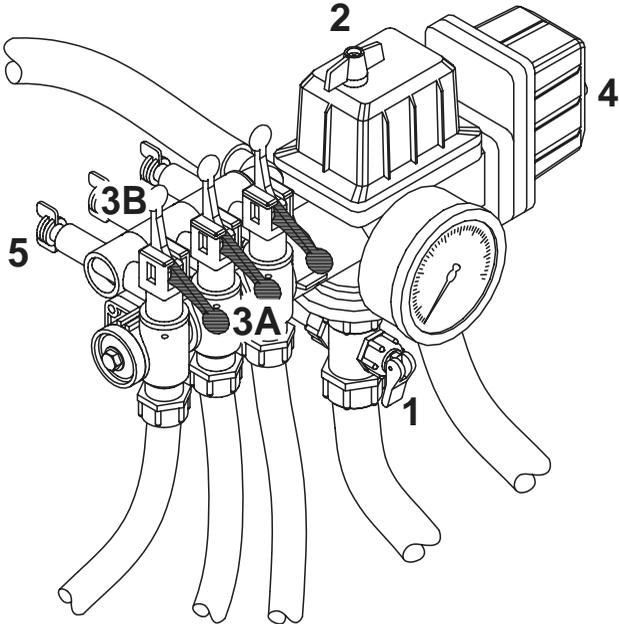


#### ADJUSTMENT OF PRESSURE EQUALIZATION:

8. Place the first lever **3** on the distribution valve in OFF position **B**.
9. Turn the adjusting screw **5** until the pressure gauge again shows the same pressure.
10. Adjust the other sections of the distribution valve in the same way.  
Hereafter adjustment of pressure equalization will only be needed if you change to nozzles of other capacities.
11. Operating the control unit while driving:  
To stop the liquid flow to the boom turn the ON/OFF handle **2** to OFF position **B**. This returns the pump output to the tank through the return system. The diaphragm anti-drip valves ensure instantaneous closing of all nozzles.  
To stop the liquid flow to one or more boom sections, turn lever **3** of the distribution valve to OFF position **B** for the section to be closed. The pressure equalization ensures that the pressure does not rise in the sections which are to remain open.



## Adjustment of the BK/EC controls



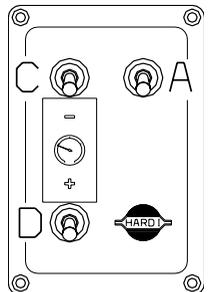
### BK/EC operating unit

1. Pressure agitation valve
2. Main ON/OFF valve
3. Distribution valve
4. Pressure control valve
5. Adjustment screw for pressure equalization

### BK/EC Remote control box

- A. Operating switch for main ON/OFF valve
- C. Pressure control switch (to lower)
- D. Pressure control switch (to raise)

1. Choose the correct nozzle. TRIPLET nozzle turrets are turned to the suitable nozzle for the spray purpose. Make sure that all nozzles are the same type and capacity. See "Spray Technique" book.
2. Open or close lever 1 depending on whether pressure agitation is required. (Remember pressure agitation takes 5% to 10% of pump output).



3. Main ON/OFF switch **A** is set to ON.
4. Set all hand levers **3** on the distribution valve to ON position **A**.
5. Pressure control switch **C** is activated until emergency handle **4**, stops rotating (minimum pressure).
6. Put the tractor in neutral and adjust the P.T.O. thereby the number of revolutions of the pump corresponding to the intended travelling speed.  
**NOTE:** The P.T.O. revolutions must be kept between 300-600 r/min.
7. Pressure control switch **D** is activated till the recommended pressure is shown on the pressure gauge.

#### ADJUSTMENT OF PRESSURE EQUALIZATION:

8. Place the first lever **3** on the distribution valve in OFF position **B**.
9. Turn the adjusting screw **5** until the pressure gauge again shows the same pressure.
10. Adjust the other sections of the distribution valve in the same way.  
 Hereafter adjustment of pressure equalization will only be needed if you change to nozzles of other capacities.
11. Operating the control unit while driving:  
 To stop the liquid flow to the boom switch ON/OFF **A** to OFF position. This returns the pump output to the tank through the return system. The diaphragm anti-drip valves ensure instantaneous closing of all nozzles.  
 To stop the liquid flow to one or more boom sections, turn lever **3** of the distribution valve to OFF position **B** for the section to be closed. The pressure equalization ensures that the pressure does not rise in the sections which are to remain open.

In case of power failure it is possible to activate the functions of the operating unit. To operate manually, disconnect the multiplug first.

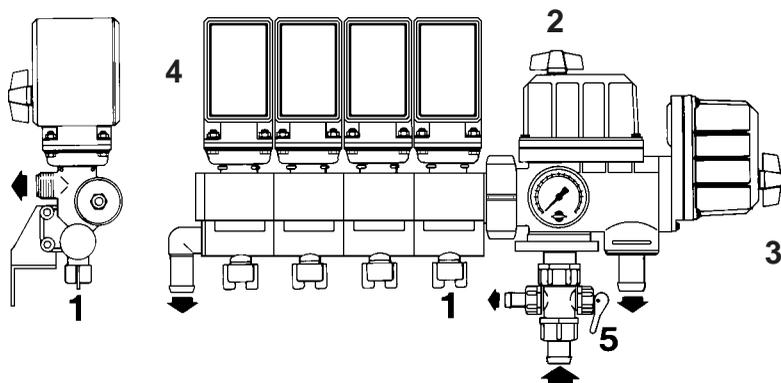
When the sprayer is put aside, the control box and the multiplug must be protected against moisture and dirt. A plastic bag may be used to protect the multiplug.





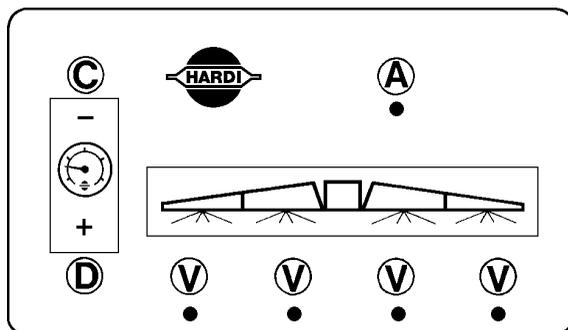
## Adjustment of the EC controls

### EC operating unit



1. Adjustment screw for pressure equalization
2. Main ON/OFF valve
3. Pressure control valve
4. Distribution valve
5. Pressure agitation valve

### EC Remote control box



- A. Operating switch for main ON/OFF valve
- V. Operating switch for distribution valves
- C. Pressure control switch (to lower)
- D. Pressure control switch (to raise)

1. Choose the correct nozzle. TRIPLET nozzle turrets are turned to the suitable nozzle for the spray purpose. Make sure that all nozzles are the same type and capacity. See "Spray Technique" book.

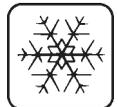
2. Open or close lever **5** depending on whether pressure agitation is required. (Remember pressure agitation takes 5% to 10% of pump output).
3. Main ON/OFF switch **A** is set towards green.
4. All distribution valves switches **V** are set towards green.
5. Pressure control switch **C** is activated until emergency handle **3**, stops rotating (minimum pressure).
6. Put the tractor in neutral and adjust the P.T.O. and thereby the number of revolutions of the pump corresponding to the intended travelling speed.  
**NOTE:** The P.T.O. revolutions must be kept between 300-600 r/min.
7. Pressure control switch **D** is activated till the recommended pressure is shown on the pressure gauge.

#### ADJUSTMENT OF PRESSURE EQUALIZATION:

8. Close the first distribution valve switch **V**.
9. Turn the adjusting screw **1** until the pressure gauge again shows the same pressure.
10. Adjust the other sections of the distribution valve in the same way.  
Hereafter adjustment of pressure equalization will only be needed if you change to nozzles of other capacities.
11. Operating the control unit while driving:  
To stop the liquid flow to the boom switch ON/OFF **A** to OFF position. This returns the pump output to the tank through the return system. The diaphragm anti-drip valves ensure instantaneous closing of all nozzles.  
To stop the liquid flow to one or more boom sections, switch the relevant distribution valve **V** to OFF position. The pressure equalization ensures that the pressure does not rise in the sections which are to remain open.

In case of power failure it is possible to activate all functions of the operating unit. To operate manually, disconnect the multiplug first.

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





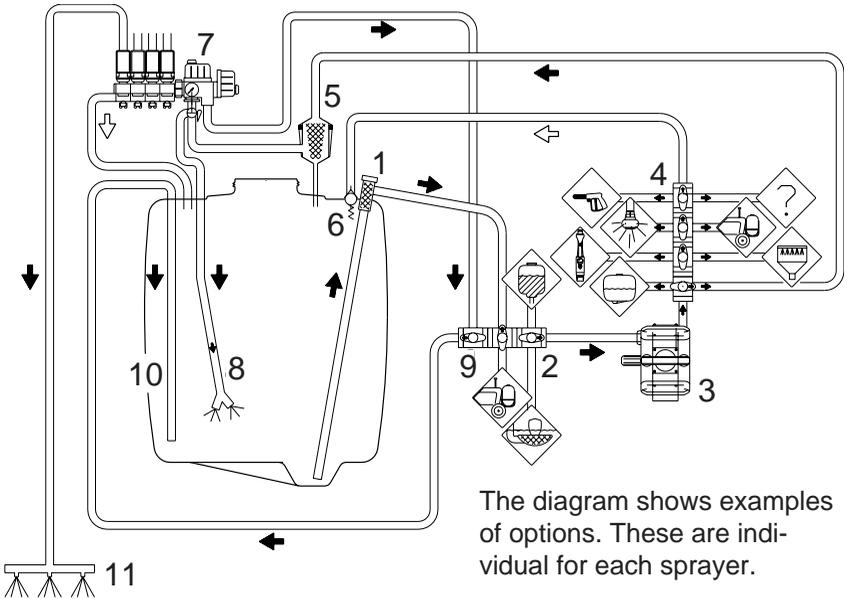
## Adjustment of MANIFOLD SYSTEM (if fitted)

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



## Function diagram

- |  |                         |
|--|-------------------------|
| 1. Suction filter                        | 5. Self-Cleaning Filter |
| 2. Suction manifold BLACK with 2 valves  | 6. Safety valve         |
| 3. Pump                                  | 7. Operating unit       |
| 4. Pressure manifold GREEN with 4 valves | 8. Pressure agitator    |
|  | 9. Return valve BLUE    |
|  | 10. Return to tank      |
|  | 11. Sprayer boom        |



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

## Symbols

The pressure, suction and return valves are distinguished by coloured identification discs on the 3-way valves. Symbols corresponding to the optional extras are located on the discs for easy identification and operation.



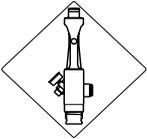
### Green disc = Pressure valve



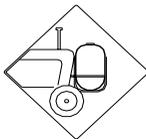
To Self-Cleaning  
Filter/operating  
unit



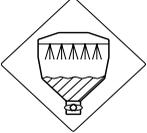
To Hose reel/spray gun



To Fast Filler



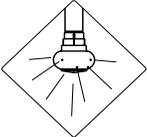
To Front Tank



To HARDI  
FILLER



To main tank



To Tank Flush-  
ing Nozzle



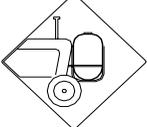
### Black = Suction valve



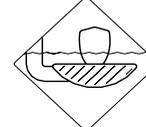
From main tank  
(suction filter)



From Rinsing Tank



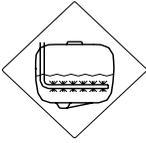
From Front Tank  
(suction filter)



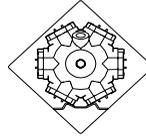
From Filling Device



**Blue = Return valve**



Return from  
operating unit



Pump

## Operating instructions

The green pressure valves and the black suction valves have 4 positions. Two positions are for options. The other two are marked “O” indicating the valve is closed. The blue return valve only has 2 positions. The arrow on the handle indicates which position is selected.

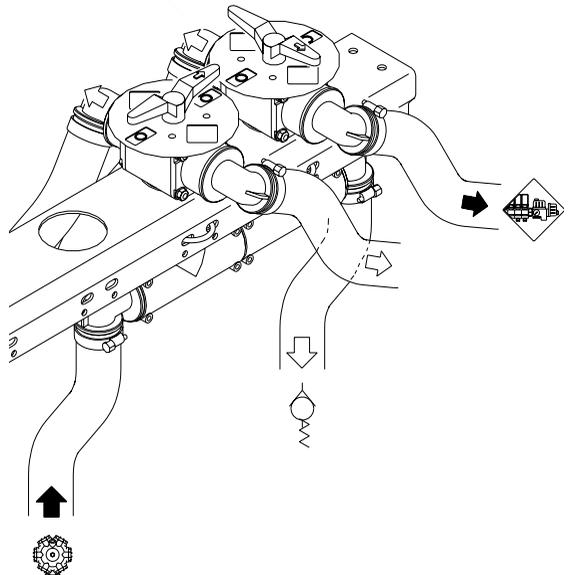
### Green pressure valves

To select the optional equipment, the handle is turned so the arrow and thereby liquid is directed to the optional extra instead of the Self-Cleaning Filter/operating unit. When spraying is to resume, turn the handle so the Self-Cleaning Filter/operating unit is selected.

If 2 or more valves are fitted, the arrow must point towards the optional extra you select. Remaining handles are turned to

“O” (closed). When spraying is to resume, select the Self-Cleaning Filter/operating unit. The other handles are turned to “O”.

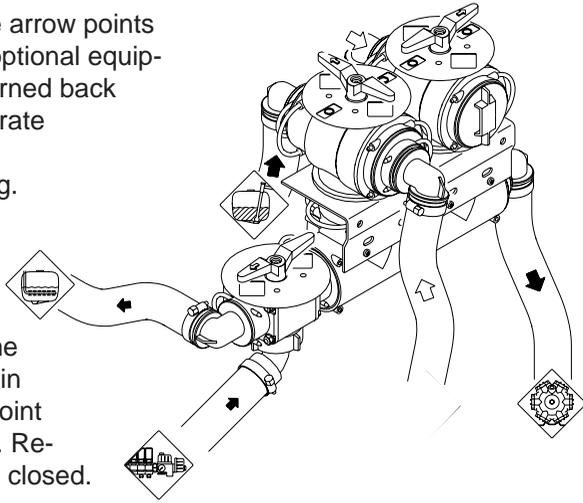
If all the green pressure valves are closed the safety valve will open inside the tank.



### Black suction valves

Turn the handle so the arrow points towards the selected optional equipment. The handle is turned back when you want to aspirate from the main tank.

If 2 valves are fitted, eg. Front Tank and Rinsing Tank, select optional extra and turn the other valve to "O" (closed). To resume aspiration from the main tank, the arrow must point towards the main tank. Remaining valve must be closed.

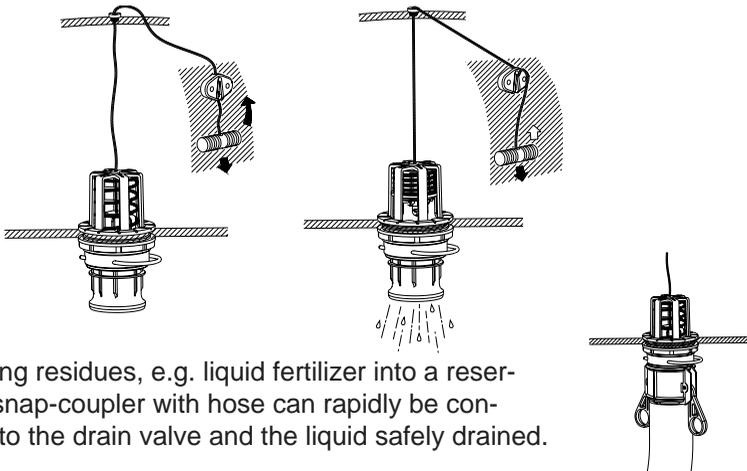


### Blue return valve

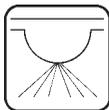
Normally the liquid is directed to the tank return. When the tank is nearly empty, the handle is turned so the liquid is directed to the suction side of the pump instead of the tank return.

### Operation of the tank drain valve

Pull the red handle on the side of the tank to open the drain valve. The valve is spring-loaded, but can be kept open by pulling the string out and upwards in the V-shaped slit. To release, 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 safely drained.



**Spray Technique - see separate book.**  
**Optional Extras - see separate books.**

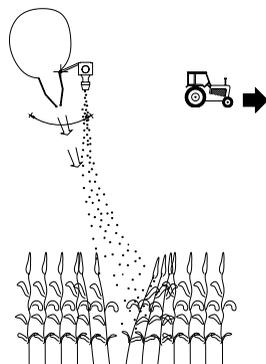
## Air technique

The function of the air assistance is to add energy to the spray droplets and to transport and guide them to the spray target.

### The principles

The angle between nozzles and air slot is fixed. The system can be angled hydraulically ranging from 18° forwards to 18° backwards.

( 0° = air vertical down )



### Adjustment of air outlet and nozzles.

The fan air speed is adjusted either at the blower or it can be set from the tractor cabin via a remote control (optional extra).

A guiding air speed can be read via the oil pressure gauge at the blower:

		low (L)	medium (M)	high (H)
	Air speed			
	m/s	5-10	10-20	20-30
	Oil pressure at blower (bar)*			
	12 m boom	60-80	80-120	120-180
	15 m boom	40-60	60-100	100-160
	Blower r/min	470-930	930-1870	1870-2800

\* Based on 25 bar back pressure.

Back pressure depends on tractor manufacture and series, and it may well be below 25 bar, which means that the blower r/min. and air speed could be higher than listed.

**NOTE:** Necessary oil flow: see Technical specifications.

## Spraying instructions - TWIN STREAM.

### Instruction for angling of air and liquid.

The angle should be used for adjusting the liquid/air flow towards the wind direction.

- When driving with head-winds, adjust the slot forwards.
- When driving with down-winds, adjust the slot backwards.
- When driving with side-winds, the slot should be adjusted as follows:

#### 1) Forward speed:

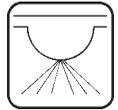
- When the speed exceeds 8 km/h the slot should be angled forwards (the faster the speed, the larger the angle).

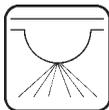
#### 2) Crop density and height:

- When spraying low crops e.g. weed spraying in beets or spraying bare soil a backwards angle is used. With this adjustment reflection of the spray liquid can be minimized as the air curtain works as a “shield” on top of the spray liquid.
- When spraying high and dense covering crops (e.g. potatoes) it would be an advantage to use the same adjustment because of the good penetration ability.
- When spraying medium to high cereal crops efforts are made - considering the forward speed - to obtain a spray angle which penetrates the crop directly. The crop should not be deflected so much during the air influence that further droplet transport towards the lower parts of the crop is blocked. When driving at generally recommended speeds and under neutral wind conditions the best adjustment will often be slightly forwards.
- It is recommended to check the spraying quality (deposit and penetration) with spray test paper.

#### Instruction for air speed adjustment

- The purpose of the air flow is to lead the droplets to the spraying target and to move the target plants and open dense crops when penetration is needed.
- The ability of the spray volume rate to penetrate deeply into the crop is directly proportional to the energy of each drop at the top of the crop.
- The more energy the droplets have, the greater their possibility of being transported from the top to the bottom of the crop.





- With the TWIN it is therefore possible even with small volume rates (droplets) to penetrate deeply into a dense crop.
- The rule-of-thumb is to supply exactly as much air to the liquid that wind drift is avoided without effecting the crop very much, unless it is a very dense crop with need for penetration. When spraying on bare soil or very small vegetation reflection is avoided by adding just enough air to prevent drift - excess air will cause reflection.
- Generally speaking the following factors may influence the adjustment of the air volume:

l/min

Spray volume rate: The smaller the volume rate applied, the greater the air velocity.

m/s

Wind speed: The greater the wind speed, in which spraying is made, the greater the air velocity needed.

km/h

Forward speed: The higher the forward speed applied, the higher the air velocity needed.

Penetration: The deeper the penetration requested the higher the air velocity needed. (However, the crop should not be deflected preventing penetration).

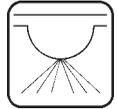
- It is most important that the sprayer operator is aware of the above rules-of-thumb before the following tables are used.
- All the volume rates, pressures and air adjustments stated in the tables are, of course, guiding. Special conditions regarding climate, crop quality, spraying time and applied chemical can partly change the procedure.

**NOTE:** The operator must be aware that the chemical supplier is not responsible for any off-label applications.

It is always the farmer's own responsibility when he - based on his own knowledge and judgement of the spraying situation on location - reduces dose and/or volume rates.

## Potatoes - tractor speed 6 km/h

Spray task	Growth stage	Volume rate l/ha	Nozzle	Pressure bar	Air speed
Herb.spraying	Pre-emergence	75	4110-10	1.9	L
Herb.spraying	Post-emergence	75	4110-10	1.9	L
Herb.spraying	Haulm 15 cm high	75	4110-10	1.9	M
Diseases (potato blight)	1. spraying latest July 1	150	4110-12	3.2	H
Same treatment to be repeated with 10 days' interval until 2 weeks before harvest.					
Desiccation	When the tubers have the size required	200	4110-12	5.5	H

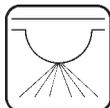


## Winter wheat - tractor speed 8 km/h

Spray task	Growth Feekes scale	Volume rate l/ha	Nozzle	Pressure bar	Air speed
Herb. spraying pre-emergence	0	75	4110-10	3.4	L
Herb. spraying post-emergence	1-2	100	4110-12	2.5	L
Fungicide autumn	2-3	75	4110-10	3.4	M
Herb. spraying spring	4	75	4110-10	3.4	M
Growth regulation	4	75	4110-10	3.4	M
Eyespot	5-6	75	4110-10	3.4	M
1.Fungicide, leaf disease	7	75	4110-10	3.4	M/H
Growth regulation	8-9	75	4110-10	3.4	M/H
1. Aphids spraying	8-9	75	4110-10	3.4	M/H
2.Fungicide, leaf disease	9-10	75	4110-10	3.4	M/H
2. Aphids spraying	10-10.5	50	4110-08	3.6	M/H
Fungicide, Ear diseases	10-11	50	4110-08	3.6	L
Herb.spraying Couch grass	Latest 10 days before harvest	50	4110-08	3.6	M

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

L = low      M = medium      H = high



## Spring barley - tractor speed 8 km/h

Spray task	Growth stage Feekees scale	Volume rate l/ha	Nozzle	Pressure bar	Air speed
Herb.spraying	2-4	75	4110-10	3.4	L
Wild oat spraying	3-5	100	4110-12	2.5	L/M
1. Fungicide spraying	5-7	50	4110-08	3.6	M
Aphids spraying	7-10.1	100	4110-12	2.5	M/H
Growth regulation	8-10.1	50	4110-08	3.6	M/H
2. Fungicide spraying	9-10.1	100	4110-12	2.5	M/H
Herb.spraying Couch grass	Latest 10 days before harvest	50	4110-08	3.6	M

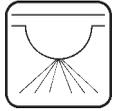
## Sugar beets - tractor speed 6 km/h

Spray task	Growth stage	Volume rate l/ha	Nozzle	Pressure bar	Air speed
Herb.spraying residual type	Pre-drilling	75	4110-10	1.9	L
Pests	Seed-leaf stage	100	4110-10	3.4	L
1. Herb.spraying	Cotyledon + 2 true leaves of same size	100	4110-10	3.4	L
Pests	Between 1. and	100	4110-10	3.4	L
2. Herb.spraying	7-10 days later than 1. herb. spraying	100	4110-10	3.4	L
1. Herb.spraying Couch grass	Couch grass has 3-4 leaves	75	4110-10	1.9	M
2. Herb.spraying Couch grass	3-4 weeks later than 1. couch grass spraying	75	4110-10	1.9	M
Pests (aphids)	Months of June	150	4110-12	3.2	H
Fungicide (mildew)	Beginning of August	100	4110-10	3.4	H

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

L = low            M = medium            H = high

# Air adjustment



L													
M													
H													
	0	1-3	4-6	7-8	9-10	10.1-11							

Growth stage (feekes)



= Insecticide



= Herbicide



= Fungicide



= Growth regulator



= Backwards



= Vertical

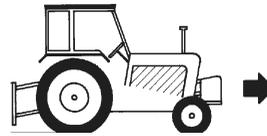


= Forwards

L = Low

M = Medium

H = High



Driving direction



Air outlet

General adjustment proposals in cereal crops. The conditions described above may necessitate a readjustment.



## Maintenance

In order to derive full benefit from the sprayer for many years the following few but important rules should be kept:



## Cleaning the sprayer

### Guidelines

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

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

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

Cleaning starts with the calibration, as a well calibrated sprayer will ensure the minimal amount of remaining spray liquid. It is good practice to clean the sprayer immediately after use thereby rendering the sprayer safe and ready for the next pesticide application. This also prolongs the life of the components.

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

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

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

### Cleaning

1. Dilute remaining spray liquid in the tank with at least 10 parts water and spray the liquid out in the field you have just sprayed.

**NOTE:** It is advisable to increase the forward speed (double if possible) and reduce the pressure. For S4110 nozzles, pressure may be reduced to 1.5 bar.

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





## Filters

Clean filters ensure :

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

### Suction filter

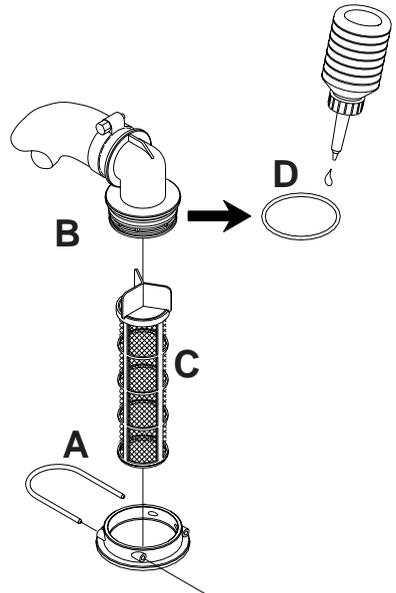
The main filter protecting sprayer components is the suction filter at the top of the tank. Check it regularly.

To service the suction filter:

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

To reassemble:

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



### BK Pressure filter / In Line Filters (if fitted)

The BK operating unit has a built in pressure filter. Unscrew the filter bowl to inspect and clean the filter.

The boom may be equipped with In Line Filters. Unscrew the filter bowl to inspect and clean the filter.

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

# Lubrication

Recommended lubrication is shown in following tables. Use ball bearing grease (lithium grease No. 2).

**NOTE:** If the sprayer is cleaned with a high pressure cleaner or fertilizer has been used, we recommend lubrication of all sections.

**POS.** Position on sprayer



Oil



Grease



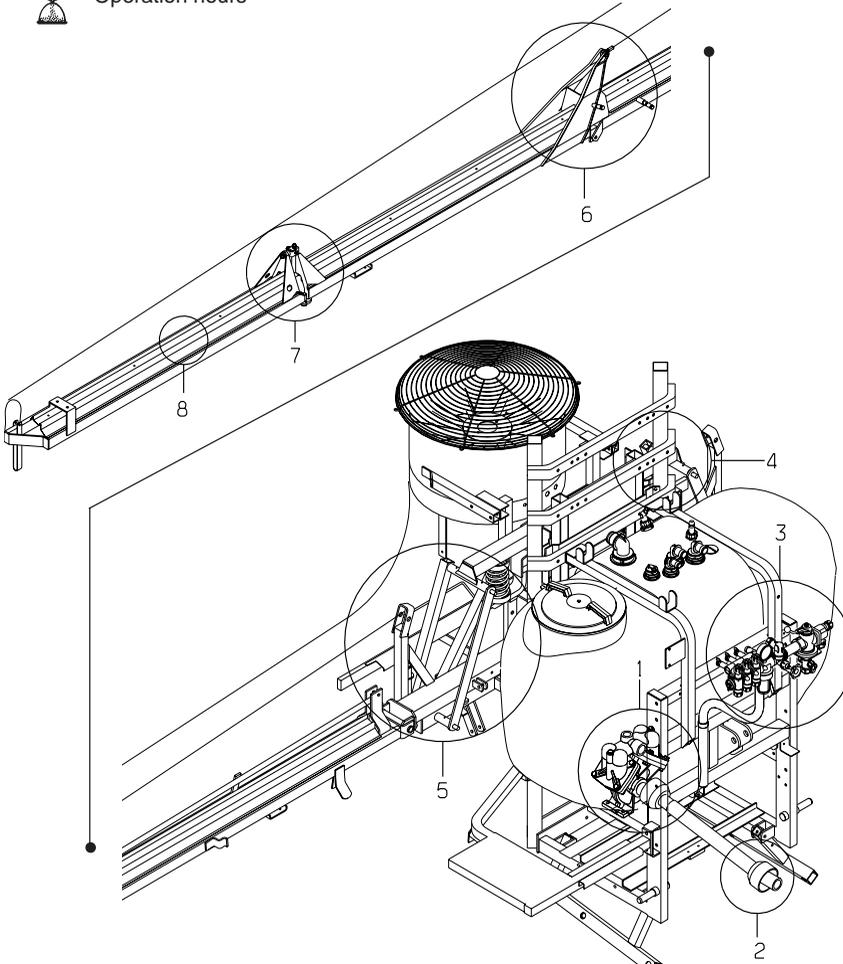
Operation hours

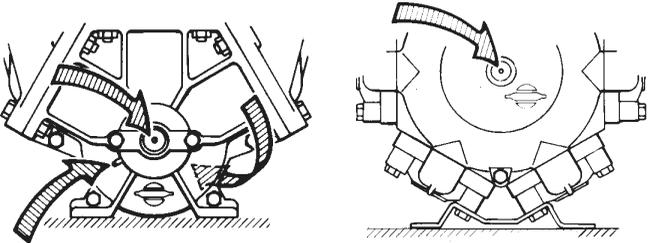
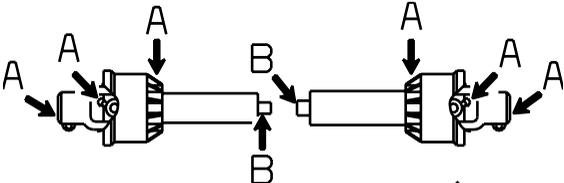
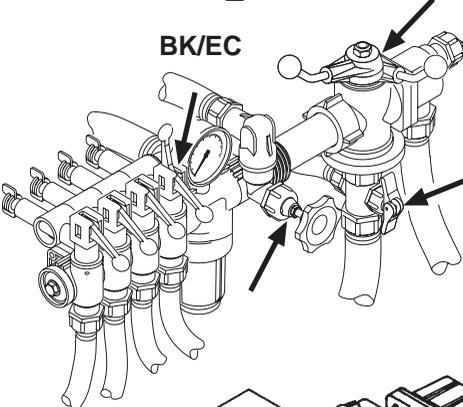
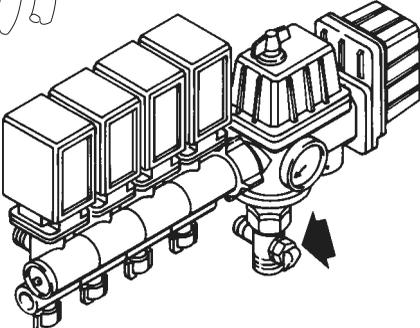


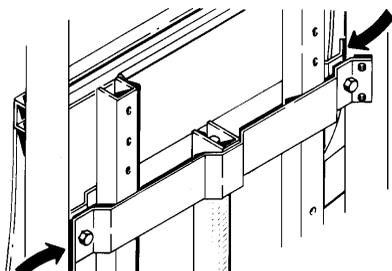
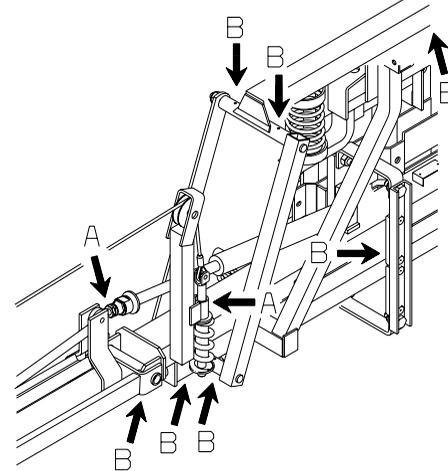
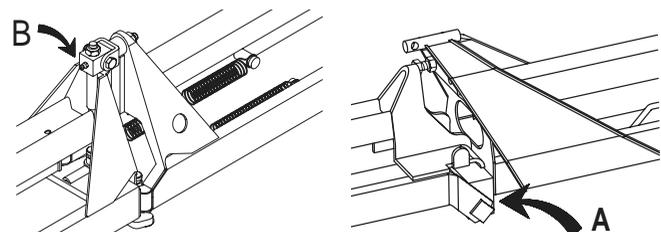
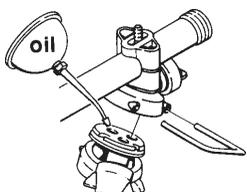
Page to find more information



Winter protection or off-season storage



POS.					
1		X	40		43 44
2 A B		X X	8 40	 <p data-bbox="557 703 639 727"><b>BK/EC</b></p>  <p data-bbox="897 831 981 855"><b>BK/EC</b></p>	9 10 46  13 18 20 21 53
3	X		20		22 23 53

POS.					
4 A B	X	X	40 40		40
5		X	40		41 42 43
6-7 A B	X	X	40 40		41
8	X				49



## Re-adjustment of the boom

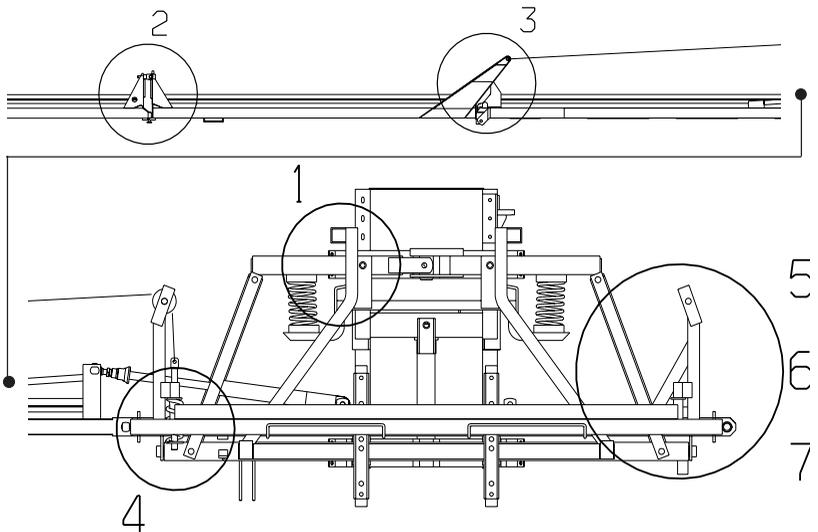
After having used the sprayer for some days the boom should be adjusted according to the following instructions:

**NOTE:** Tractor and sprayer must be on level ground with unfolded boom. Sprayer must be lubricated. See section on Lubrication.

Adjustment of hydraulic rams is done without pressure in the hydraulic system. Carry adjustments out in the following order. (1, 2, 3...) order.

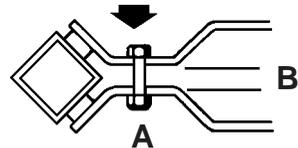


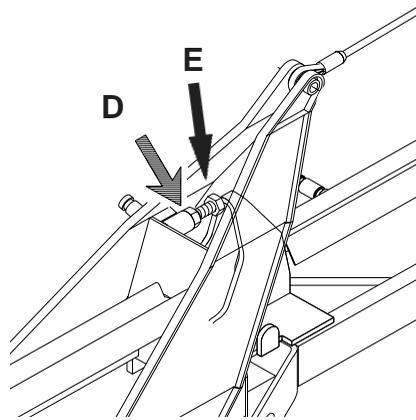
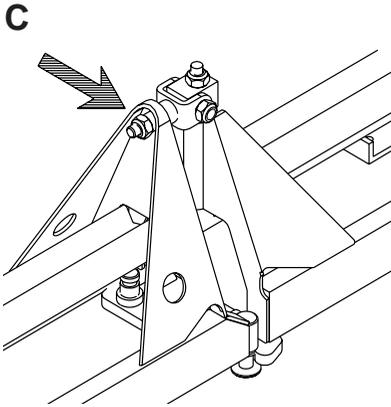
**WARNING: NOBODY MUST BE UNDER THE BOOM WHILST ADJUSTMENT IS CARRIED OUT.**



### 1. Boom lift

The boom lift must be adjusted so it is firm and yet can freely move up and down when the lift ram is operated. Adjust both sides. Adjust **A** so gap **B** is equal at all 6 points.





## 2. Breakaway

Adjust nut **C** at swivel so the breakaway is parallel with the outer section.

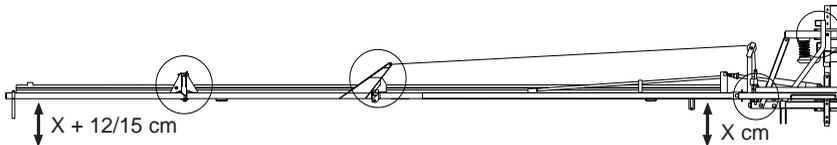
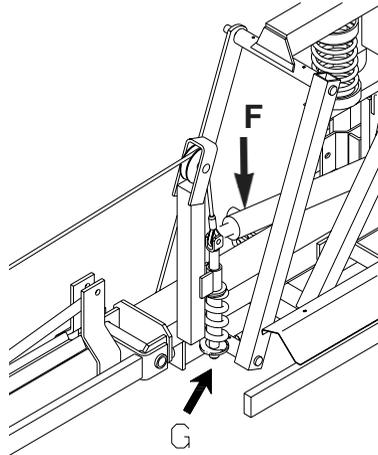
## 3. Parallel adjustment of outer section

Loosen counter nut **D** and turn screw **E** until the outer section of the boom is parallel with the inner section of the same side.

## 4. Wire

The wire function is to carry the boom wings. Adjustment of the wire should be undertaken with the boom unfolded and the hydraulic rams **F** disconnected from the boom wings.

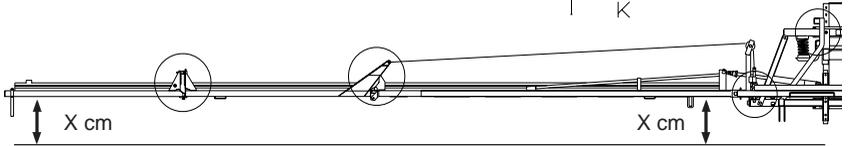
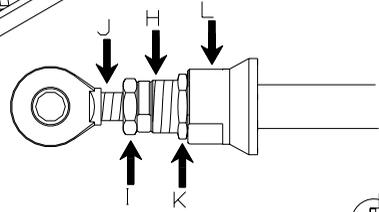
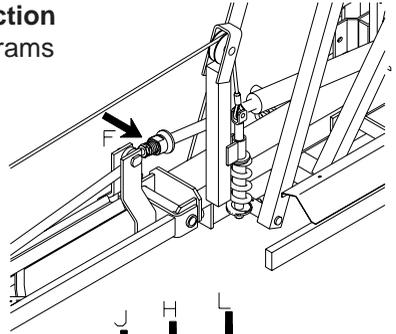
Tighten nut **G** so that the tip is raised 12 cm for the 12 m boom and 15 cm for the 15 m boom from the horizontal line of the centre section.





## 5. Parallel adjustment of inner section

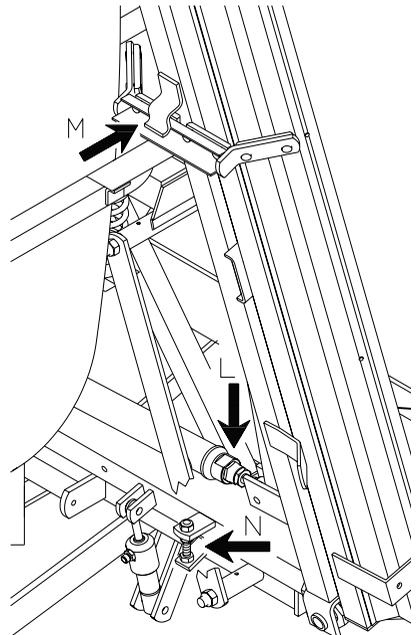
1. Cautiously activate the hydraulic rams **F** so they are fully extended. Make sure the extension **H** is screwed in and tight.
2. Loosen counter nut **I** and adjust the ram eye **J** so that when connected, the boom wings are parallel with the centre section. The ram must force the boom tip down so distance "X" is equal.



## 6. Adjustment for transport brackets and air stream angle

Fold boom and lower cautiously into transport brackets. Loosen counter nut **K** and adjust **L** so the boom rests in the middle of the brackets. When the boom is lowered, it must be firmly hooked onto the transport bracket **M**. Loosen counter nuts and adjust bolt **N** so that the boom hooks firmly into place without exerting excessive force on the boom wings.

Unfold the boom. Loosen counter nut and screw bolt **O** in fully. Set air stream to angle forward so the ram is fully extended. Now adjust bolt **O** up to the stop and turn furthermore a turn.

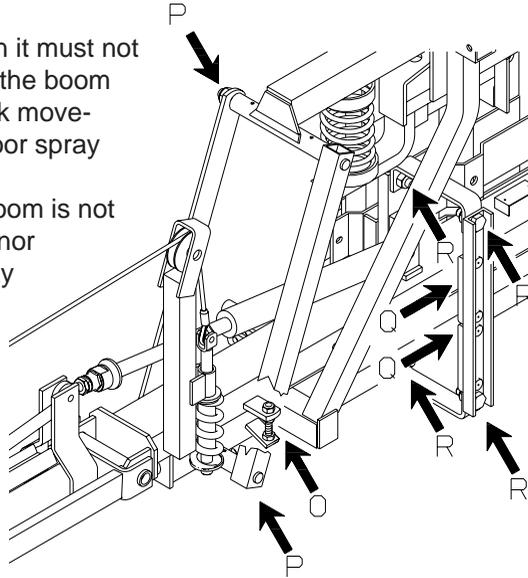


## 7. Trapeze suspension

For the trapeze to function it must not be too tight. If it is too loose the boom will yaw (forward and back movement). This results in a poor spray distribution.

Adjust tension **P** so the boom is not too tight nor too loose. Minor adjustment in the field may be necessary.

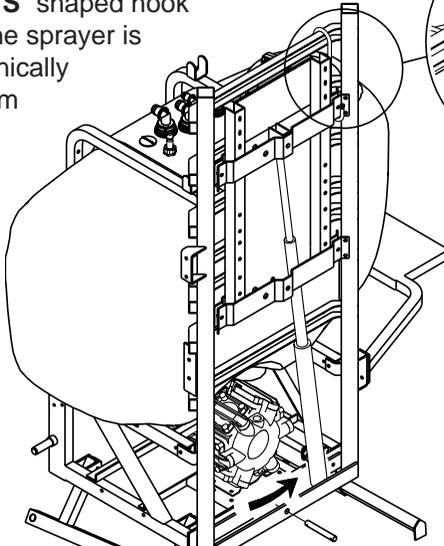
Check distance **Q**. The synthetic pads should only just touch the centre beam. Relocate washers on each of the 4 bolts **R** if the distance is excessive.



**IMPORTANT:** Check all counter nuts are tight after adjustment.

## Changing of valves and diaphragms

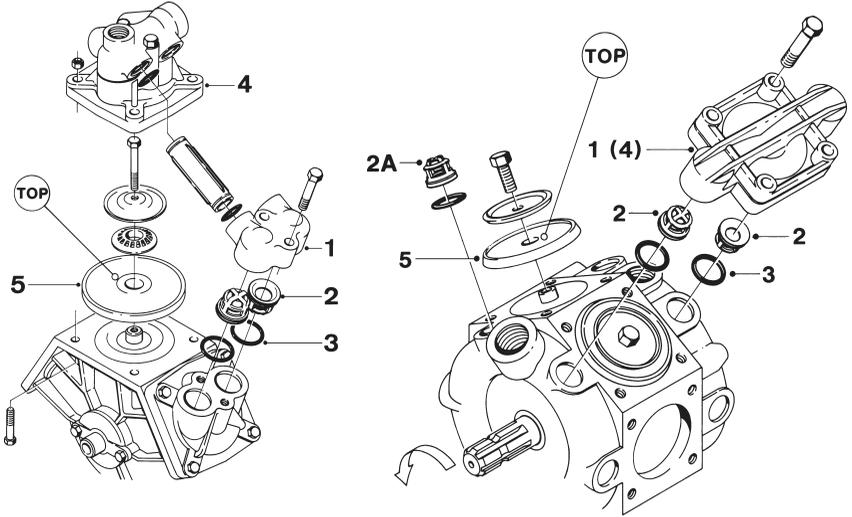
Access to the pump is best from the rear of the sprayer. A “S” shaped hook supplied with the sprayer is used to mechanically secure the boom from lowering whilst servicing the pump. Raise the boom with the hydraulic boom lift and use the hook as shown.



**WARNING:** Always secure the boom before servicing the pump.

**NOTE:** For servicing model 361 pump, it is best to remove the lower anchor bolt of the lift ram and push the ram over to one side.





### Valves

Remove valve cover **1**. Before changing the valves **2** note their orientation so they are replaced correctly.

**NOTE:** One special valve with white flap **2A** is used on model 361. It has to be placed in the valve opening shown.

It is recommended to use new gaskets **3** when changing or checking the valves.

### Diaphragms

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

Pump Model	Valve cover Nm	Diaphragm cover Nm	Diaphragm bolt Nm
1302	60	70	60
361	70		60

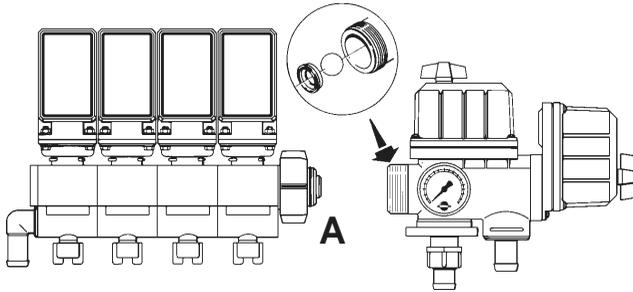
1 Nm = 0.74 ft-lb



## Changing the ball seat in operating unit

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

Remove the 2 bolts fixing the main ON/OFF-pressure valve unit to the bracket, unscrew the



union nut **A** and pull the valve away from the distribution valves.

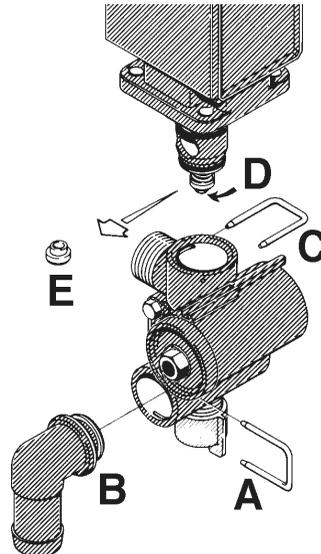
Check the ball for sharp edges and scratches, and check the ball seat for cracks and wear - replace if necessary.

## Checking the valve cone - EC only

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

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

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



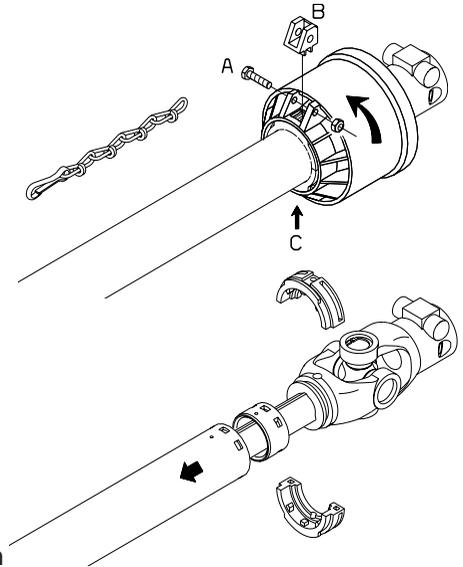


## Replacement of transmission shaft protection guards

The replacement of defective protection guards is easy to do.

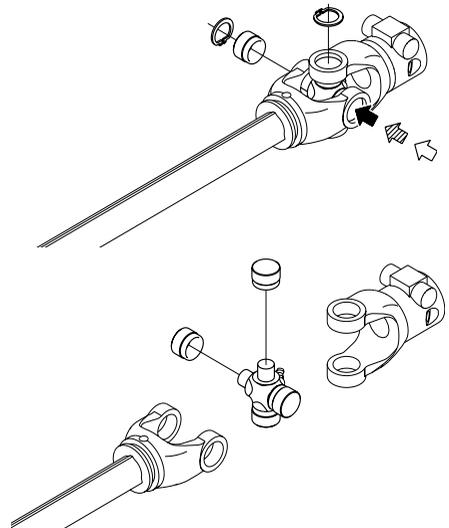
1. Remove bolt **A**, lock **B** and grease nipple **C**. Twist universal cross cover 1/4 turn and pull it backwards.
2. Remove the synthetic bearings and protection tube.
- 2a. Remove inner bush from protection tube.
3. Assemble again in reverse order, using new parts where necessary. Remember to fit chains again.
4. Grease bearings.

Use only genuine HARDI spare parts to service the transmission shaft.



## Replacement of transmission shaft cross journals.

1. Remove protection guard as described previously.
2. Remove Seeger circlip rings
3. Press the cross journal sideways - use hammer and mandrel if necessary.
4. Remove needle bearing cups and cross journal can now be removed.
5. Carefully remove needle bearing cups from new cross journal and install it in reverse order. Before fitting the needle bearing cups again, check that needles is placed correctly. Avoid dust and dirt in the new bearings.

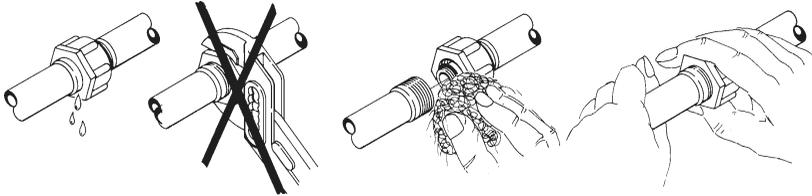


## Nozzle tubes and fittings

Poor seals are usually caused by;

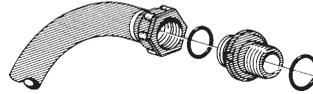
- missing O-rings or gaskets
- damaged or incorrectly seated O-rings
- dry or deformed O-rings or gaskets
- foreign bodies

Therefore, in case of leaks: **DO NOT** overtighten. Disassemble, check condition and position of O-ring or gasket, clean, lubricate and reassemble. The O-ring is lubricated **ALL THE WAY ROUND** before fitting on to the nozzle tube. Use non-mineral lubricant.



For **radial** connections only hand tighten them.

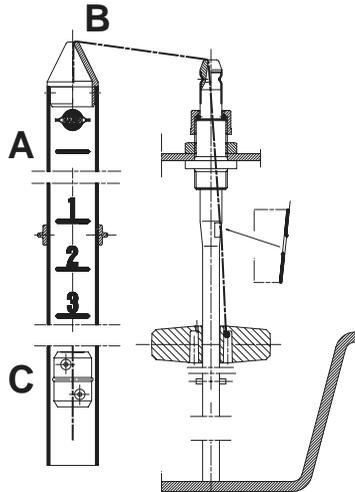
For **axial** connections, a little mechanical leverage may be used.



## Level indicator

The level indicator should be checked regularly. When the tank is empty, the floater should rest on the stop pin on the rod and the O-ring at the indicator should be positioned at the top position line **A**.

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





## Repair of the bag

If the air bag is damaged it can be repaired by sewing or gluing a patch on it. A repair kit is available; HARDI ref. no. 728746.

## Oil cooler

The cooler under the fan must be inspected externally at least yearly and cleaned if necessary. Remove the bag and check that the cooler ribs are clean. A pressure cleaner can be used to clean the ribs. When the bag is replaced, unfold the boom to check it is centred and angle the air outlet forward to check there is no slack in the bag.

## Hydraulic transmission

If the hydraulic motor has been dismantled or replaced, the following start-up procedure has to be done:

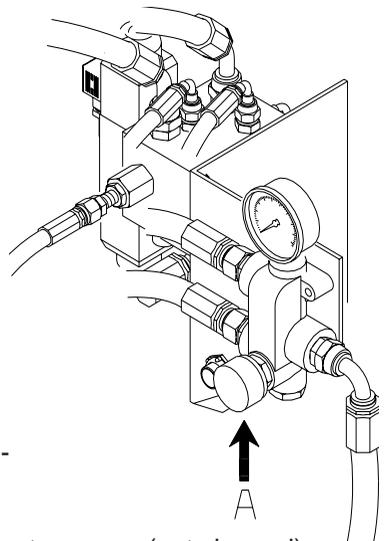
1. The boom needs to be unfolded so choose a location where this is possible.

2. Remove the snap coupler from hy. motor the drain line and place the hose in a small container. Set the valve for blower fan revolutions at or near minimum and with the tractor engine at idle, unfold the boom.

3. Adjust valve **A** for blower fan revolutions so the fan rotates between 300 to 500 r/min for 5 minutes or until oil comes from the drain line. The sprayer hydraulics are now filled with oil and the valve can be set to maximum and tractor r/min increased to check for possible leakage.

4. Check oil pressure filter (if fitted) indicates green (not clogged).

5. Replace the drain line snap coupler. Check the tractor hydraulic oil level and top up if needed.



## Off-season storage

When the spraying season is over you should devote some extra time to the sprayer before it is stored.

### Hoses

Check that none of the hoses are caught or have sharp bends. A leaky hose can give an annoying delay in the middle of the spraying job. Therefore check all the hoses and change if there is any doubt about the durability.

### Paint

Some chemicals are very rough on paints. It is therefore well advised to remove rust, if any, and then touch up the paint.

### Tank

Check that no chemical residues are left from the last spraying. Chemical residues must not be left in the tank for a long time. It will reduce the life of the tank. See section on Cleaning the sprayer.

### BK/EC and EC operating unit

When the sprayer is put away the control box and the multiplug must be protected against moisture and dirt. Possibly use a plastic bag.

### Transmission shaft

It is important that the push pins are clean and well lubricated, to ensure safe function.

Every 40 hours: Inspection of protection guards, function and condition. Replace possible damaged parts.

Every 1000 hours: Check condition of protection guards and replace nylon bearings.

Check general condition of cross journals and push-pin/quick release - replace if necessary.

### Anti-freeze precaution

If the sprayer is not stored in a frost free place you should take the following precautions: Put at least 10 litres of 33% anti-freeze mixture in the tank and let the pump run a few minutes so that the entire system including spray hose are filled. The anti-freeze solution also hinders the O-rings and gaskets from drying out.

Remove the glycerine filled pressure gauge and store it frost free in vertical position.





## Operational problems

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

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

### Therefore ALWAYS check:

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



Fault	Probable cause	Control / remedy	
<b>Liquid system</b>			
No spray from boom when turned on.	Air leak on suction.	Check if suction filter O-ring is sealing.	
		Check suction tube and fittings.	
		Check tightness of pump diaphragm and valve covers.	
	Air in system.	Fill suction hose with water for initial prime.	
	Suction/pressure filters clogged.	Clean filters.	
		Check yellow suction pipe is not obstructed or placed too near the tank bottom.	
Lack of pressure.	Incorrect assembly.	Agitation nozzles not fitted.	
		Restrictor nozzle in Self-Cleaning Filter not fitted.	
		Safety valve spring for Self-Cleaning Filter not tight.	
		Too little distance between yellow suction pipe and tank bottom.	
		Pump valves blocked or worn.	Check for obstructions and wear.
	Defect pressure gauge.	Check for dirt at inlet of gauge.	
Pressure dropping.	Filters clogging.	Clean all filters. Fill with cleaner water.	
		If using powders, make sure agitation is on.	
		Nozzles worn.	Check flow rate and replace nozzles if it exceeds 10%.
		Tank is airtight.	Check vent is clear.
	Sucking air towards end of tank load.	Excessive agitation, turn off.	
		Returns inside tank need relocation.	



<b>Fault</b>	<b>Probable cause</b>	<b>Control / remedy</b>
Pressure increasing	Pressure filters beginning to clog.	Clean all filters.
	Agitation nozzles clogged.	Check by turning agitation off and on.
Formation of foam.	Air is being sucked into system.	Check tightness / gaskets / O-rings of all fittings on suction side.
	Excessive liquid agitation.	Turn agitation off. Reduce pump r/min.
		Check safety valve for Self-Cleaning Filter is tight.
		Ensure returns inside tank are present.
		Use foam damping additive.
Liquid leaks from bottom of pump.	Damaged diaphragm.	Replace. See Changing of valves and diaphragms.
<b>Operating unit BK/EC and EC</b>		
Operating unit not functioning	Blown fuse(s).	Check mechanical function of microswitches. Use cleaning/lubricating agent if the switch does not operate freely.  Check motor. 450-500 milli-Amperes max. Change motor, if over.
	Wrong polarity.	Brown - pos. (+). Blue - neg. (-).
	Valves not closing properly.	Check valve seals for obstructions.  Check microswitch plate position. Loosen screws holding plate a 1/2 turn.
	No power.	Wrong polarity. Check that brown is pos. (+), Blue is neg. (-).  Check print plate for dry solders or loose connections.
		Check fuse holder are tight around fuse.

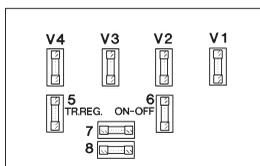
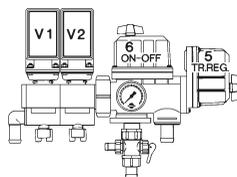
Fault	Probable cause	Control / remedy
<b>Hydraulic system</b>		
Boom slow/erratic.	Air in system.	Loosen ram connection and activate hydraulics until oil flow has no air in it (not whitish).
	Regulation valve incorrectly set	Open or close until desired speed is achieved (clockwise = less speed). Remember oil must be at operating temperature.
	Insufficient hydraulic pressure.	Check output pressure of tractor hydraulics. Minimum for sprayer is 130 bar.
	Insufficient amount of oil in tractor reservoir.	Check and top up if needed.
Ram not functioning.	Restrictor or regulation valve blocked.	Secure boom with "S" hook. Dismantle and clean.
Boom will not unfold.	Oil bypassing rams.	Increase fan r/min at valve block.
Excessive noise from hydraulic motor.	Air in hydraulics.	Top tractor reservoir up. Use oil that does not foam.
Tractor hydraulics safety valve operating constantly (open centre).	Sprayer hydraulics set to closed centre hydraulics.	Swap nipple at valve block.

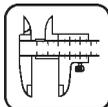


## Emergency operation of BK/EC and EC

In case of power failure it is possible to operate all functions of the operating unit manually. First disconnect the multiplug from the control box. Now manually turn the emergency control knobs. The problem may be due to a blown fuse. The fuses are placed in the control box and are marked according to functions. Fuses 7 and 8 are spare fuses.

Fuse type T 500 mA HARDI ref. no. 261125





## Technical specifications

### Pump power consumption and capacity

1302/9,0	r/min									
	300		400		500		540		600	
bar	l/min	kW	l/min	kW	l/min	kW	l/min	kW	l/min	kW
0	63	0,90	84	1,19	103	1,51	114	1,61	125	1,80
5	58	0,94	79	1,29	96	1,61	105	1,75	116	1,93
10	56	1,30	76	1,80	94	2,30	101	2,48	111	2,72
15	55	1,80	74	2,22	93	2,92	99	3,18	109	3,54
Rotation per min.	r/min	Capacity			l/min	Suction height			0,0 m	
Power consumption	kW	Max. pressure			15bar	Weight			35,0 kg	

361/9,5	r/min									
	300		400		500		540		600	
bar	l/min	kW	l/min	kW	l/min	kW	l/min	kW	l/min	kW
0	95	0,92	127	1,33	158	1,56	171	1,69	189	1,85
5	92	1,49	123	1,93	151	2,38	165	2,63	183	2,98
10	91	2,22	120	2,89	148	3,69	163	4,02	180	4,74
15	89	3,03	119	3,92	148	4,90	160	5,40	177	6,15
Rotation per min.	r/min	Capacity			l/min	Suction height			0,0 m	
Power consumption	kW	Max. pressure			15bar	Weight			54,0 kg	

### Temperature and pressure ranges

Operating temperature range:	2° to 40° C.
Operating pressure for safety valve:	15 bar
Max. oil flow for hydraulics:	48 l/min
Max. pressure for the hydraulics:	180 bar

### Oil specifications

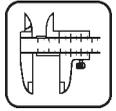
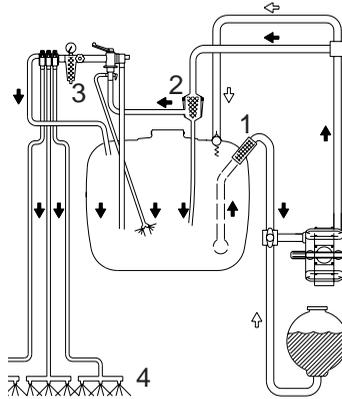
Type	Hydraulic oil with anti-foam and anti-oxidant additives.
Purity	ISO 4406 20/14. Filtration quotient $\beta_{25-75}$ , ISO 4572-81
Multipass test.	25 micron Absolute.
Viscosity	10 mm /s (Cst) minimum 100 mm /s (Cst) maximum 15 - 35 mm /s (Cst) normal work

### Blower specifications

	12 m	15 m
Boom size		
Minimum oil flow	38 l/min	44 l/min
Minimum pressure	180 bar	165 bar
Power consumption	10 kW	14 kW
Hydraulic motor make	HP Hydraulics	HP Hydraulics
Type	HP M4 MF13	HP M4 MF15
Blade angle	27.5°	30.0°
Max. fan revolutions	3,100 r/min	3,100 r/min

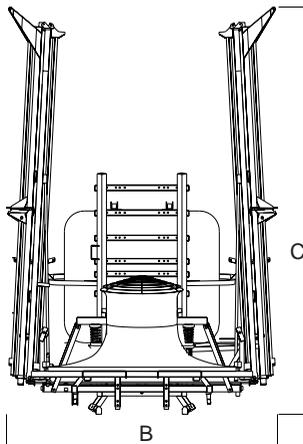
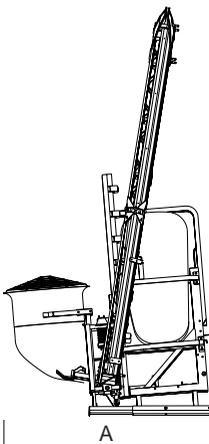
## Filters and nozzles

Pos.	Mesh/ colour	Description/ nozzle
1	30 green	Suction filter
2	100 yellow	Self-Cleaning Filter
3	50 blue	Pressure filter (BK)
4	50 blue	Nozzle S4110-18
	80 red	Nozzle S4110-12
	80 red	Nozzle S4110-08

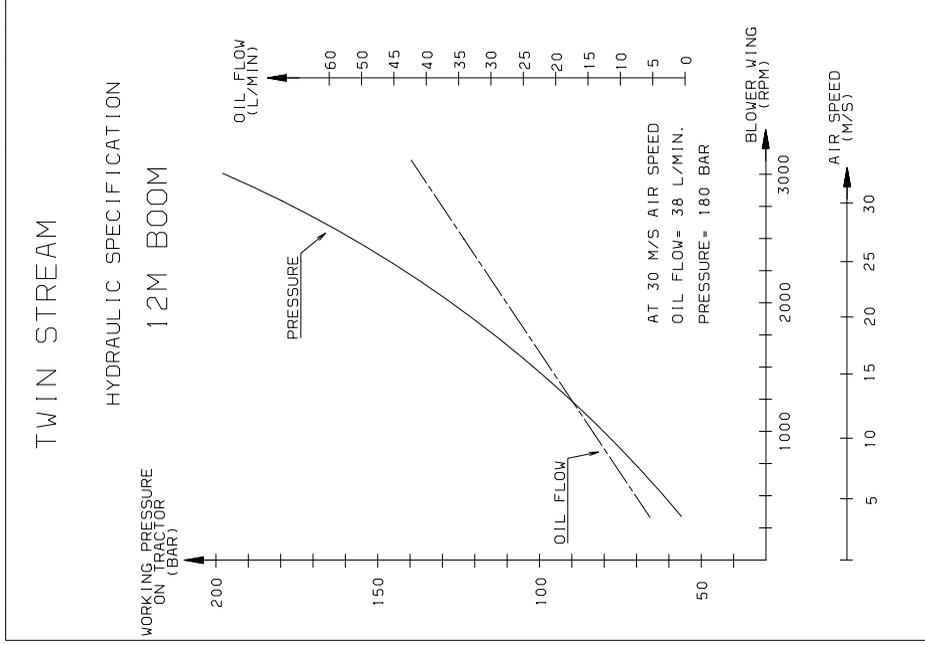


## Measure and weight

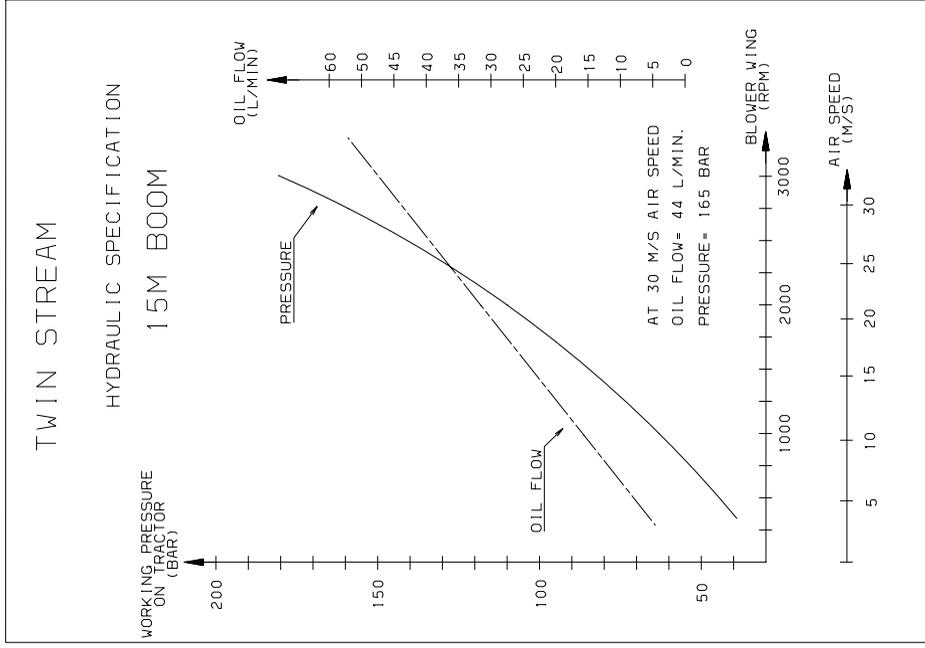
Tank size l	Spray width m	Pump model	Pump capacity l/min	Measurement A × B × C cm	Weight kg
600	12	1302	114	190 × 263 × 240	654
800	12	1302	114	190 × 263 × 240	660
	15	361	171	190 × 263 × 325	675
1000	12	1302	114	190 × 263 × 240	670
	12	361	171	190 × 263 × 240	685
	15	361	171	190 × 263 × 325	774
1200	12	361	171	205 × 263 × 240	702
	15	361	171	205 × 263 × 325	791



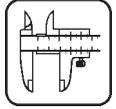
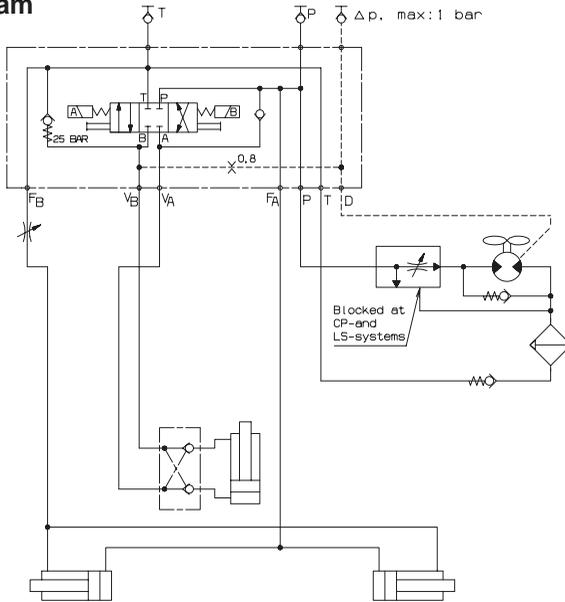
# GRAPHS



Based on 25 bar back pressure.

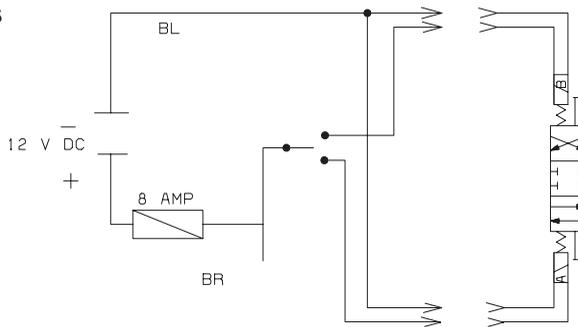


## Hydraulics diagram



## Electrical connections

### Air outlet controls



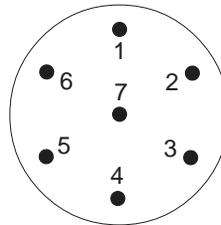
### Rear lights

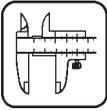
#### Position

1. LHS direction indicator
2. Free
3. Frame
4. RHS direction indicator
5. RHS rear position lamp
6. Stop lamps
7. LHS rear position lamp

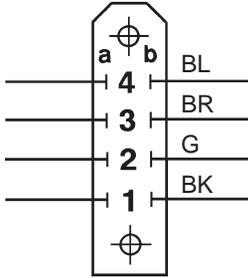
#### Wire colour

- Yellow
- Blue
- White
- Green
- Brown
- Red
- Black





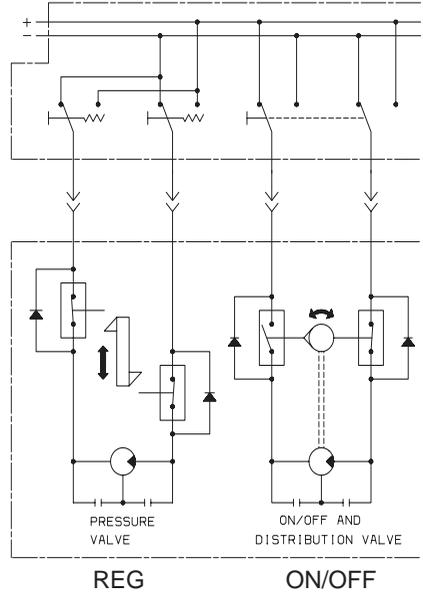
### BK/EC



REG		ON/OFF	
—	—	—	—
BR	BL	BL	BR
—	—	—	—
BK	G	BR	BL
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>

BL = Blue    G = Gray  
BR = Brown    BK = Black

### BK/EC and EC



### EC

	Number of distribution valves		
	2 / 3 / 4	5 / 6	7
Valve	Wire number or colour code		
V1	1-2	1-2	1-11
V2	3-4	3-4	2-12
V3	5-6	5-6	3-13
V4	7-8	7-8	4-14
V5		9-10	5-15
V6		11-12	6-16
V7			7-17
REG	9-10	13-14	9-10
ON/OFF	11-G/Y	15-G/Y	8-G/Y

G/Y = green/yellow

## Materials and recycling

Tank: HDPE  
Hoses: PVC  
Valves: mainly glass-filled PA.  
Fittings: PA

## Disposal of the sprayer

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

## Pictorial symbols



Description



Service/adjustment



Winter storage



Function



Liquid flow



Operational problems



Connection



Pressure



Technical specifications



Warning



Cleaning



EC Declaration of Conformity



Operating



Lubrication

