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# MASTER-MB

## Instruction book

673724-GB-94/12



# EC Declaration of Conformity

## Manufacturer,

HARDI INTERNATIONAL A/S  
Helgeshøj Allé  
DK 2630 Taastrup  
DENMARK

## Importer,

declare that the following product;

.....  
.....

Adhere extra shipping package labels to inside cover.

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

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

Taastrup 1.9.98

Erik Holst  
Managing Director  
HARDI INTERNATIONAL A/S

## Operator safety

Watch for his 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.



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





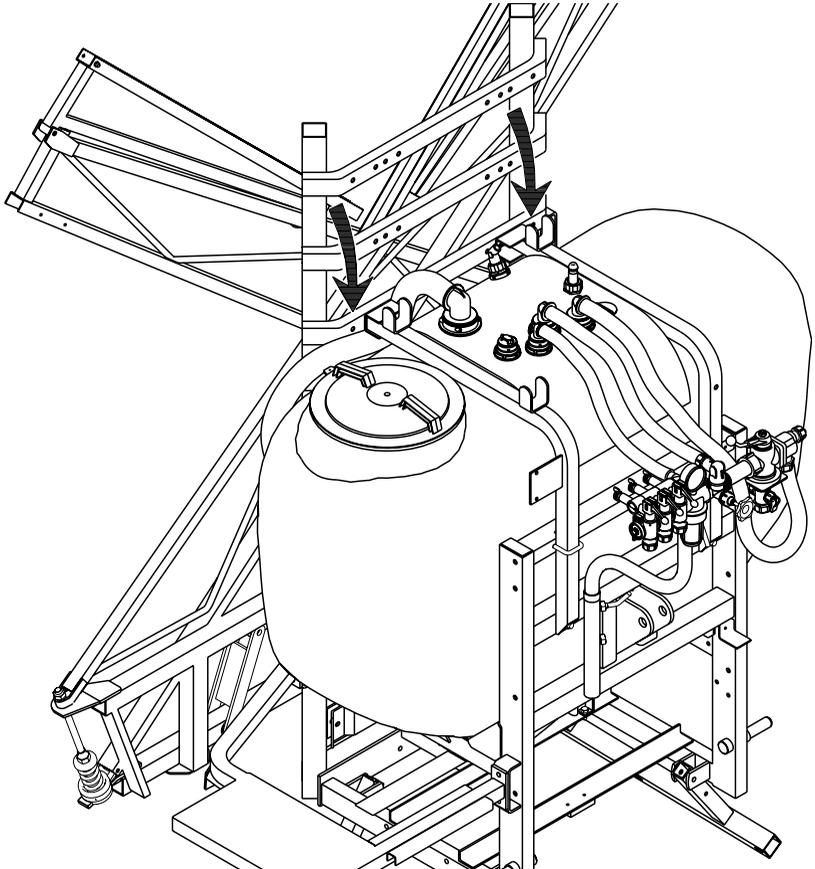
We congratulate you for choosing a HARDI plant protection product. The reliability and efficiency of this product depend on your care. The first step is to carefully **read and pay attention** to this instruction book. It contains essential information for the efficient use and long life of this quality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

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



## 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 MASTER (MA-MB) sprayers are for the application of crop protection chemicals and liquid fertilizers. They consist of a pump, MA type frame with tank of 600, 800, 1000 or 1200 litre capacity, operating unit, transmission shaft and MB type boom. Options include the Self-Cleaning Filter, Rinsing tank and HARDI MANIFOLD SYSTEM valves.

The design of the diaphragm pump is simple, with easily accessible diaphragms and valves that ensures 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 and a footboard is placed at the right hand side of the sprayer. This ensures an easy access for the filling of sprays, cleaning of the tank, etc.

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.

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 (if fitted) 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 manually folded 10 or 12 metre MB spray boom is fitted. It is supported by a trapeze which protects the boom against vibrations and shocks when driving on uneven ground. This ensures longer boom life and improves boom stability for better spray distribution. Height adjustment of the boom is hydraulic. The boom is fitted with a spring loaded breakaway at the pivots.





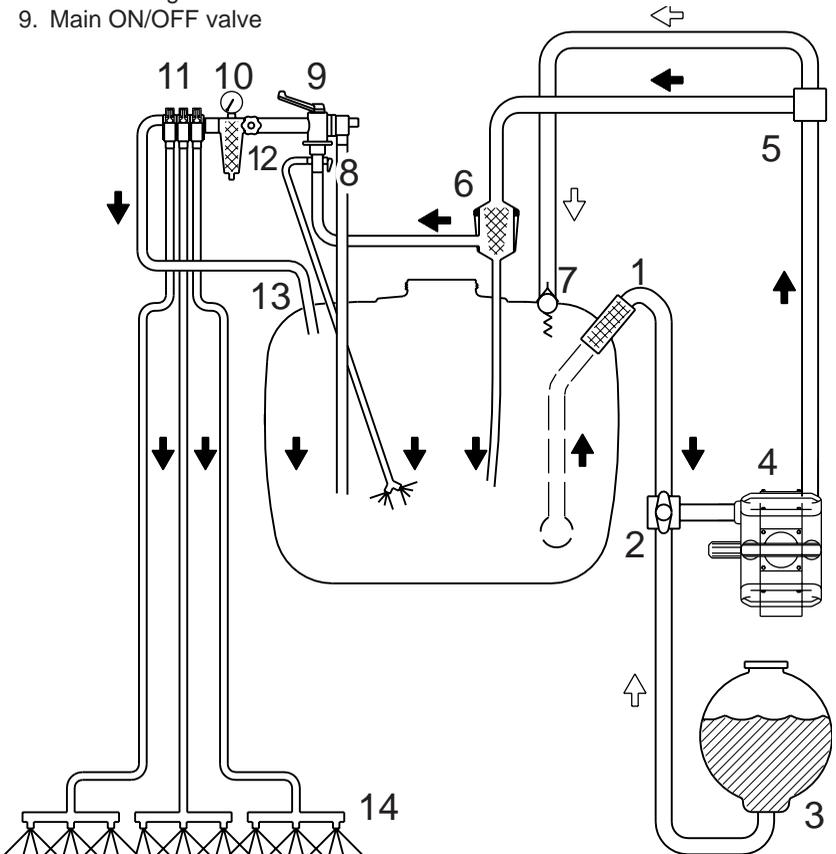
## Identification plates

An identification plate fitted on the frame and pump is to indicate model, year of production with serial number and country of origin. 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
2. Suction manifold
3. Rinsing tank (if fitted)
4. Pump
5. Pressure manifold
6. Self-Cleaning Filter (if fitted)
7. Safety valve
8. Pressure agitator valve
9. Main ON/OFF valve
10. Pressure filter with pressure gauge
11. Distribution valves with pressure equalization
12. Pressure control valve with HARDI-MATIC
13. Return to tank
14. Sprayer boom

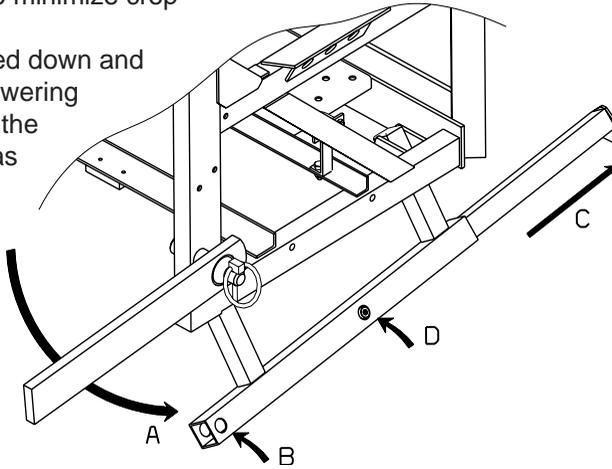


## Connecting the sprayer

The sprayer is designed for three point suspension and is equipped with 28 mm pivots (cat. II). The frame has retractable support legs that can be folded up to minimize crop damage.

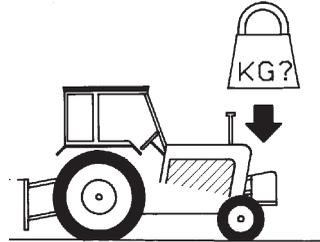
They must be folded down and extended before lowering and disconnecting the sprayer. Proceed as follows:

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**.



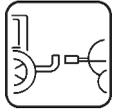
**WARNING:** Note the weight of the sprayer. General recommendations are as follows:

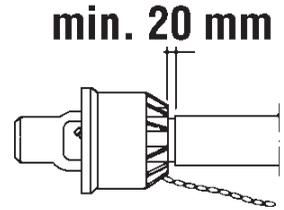
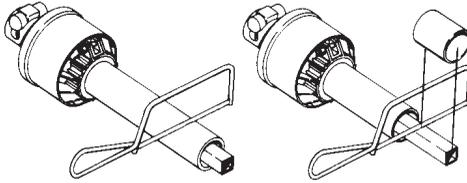
- Add ballast to front of tractor.
- Increase tyre pressure (see tractor instruction book).
- Be careful when filling/lifting the sprayer for the first time.
- Ensure the operating unit and tractor do not touch.
- Travel at slower speeds when driving with a full tank.  
(The tractor braking effect will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



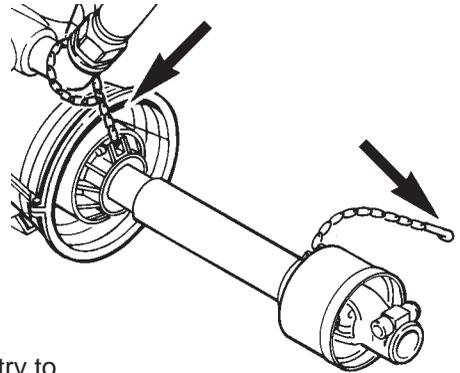
## Transmission shaft

When connecting the sprayer to the tractor the length of the transmission shaft should be checked and if necessary shortened. There should be at least **20 mm** free play between the male and female parts.

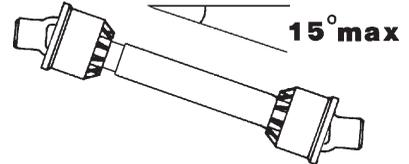




It is important for the personal safety of the operator that the transmission shaft is intact. The protection guards must cover the whole shaft. This includes the universal cross covers at each end of the shaft. The chains are connected so that the protection guards do not rotate with the shaft.



To ensure long life of the shaft, try to avoid working angles greater than  $15^\circ$ . For the same reason the pump is situated at the back of the tank frame. This permits a longer transmission shaft and thereby less angling of the cross journal when altering the position of the sprayer with the tractor lift arms.



### Hydraulics

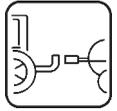
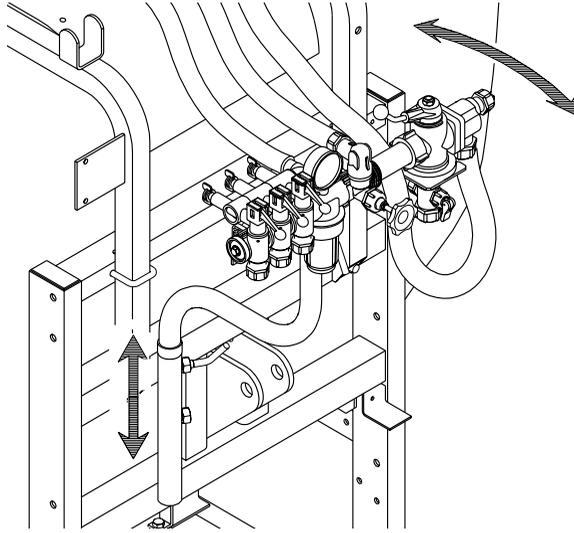
Connection requirements for MA-MB are a single outlet and return to raise or lower the boom. Ensure the snap couplers are clean before connection.



**NOTE:** The hydraulic system requires a minimum oil pressure of 100 bar and an oil capacity of approx. 2 litres. After having operated the boom and the system has been filled with oil, check tractor's hydraulic oil level and top up if necessary.

### **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.



### **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**

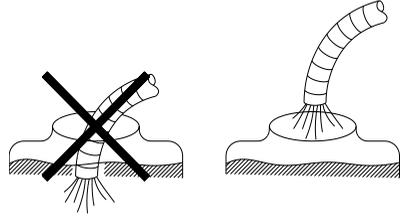
### **Filling the main tank**

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.



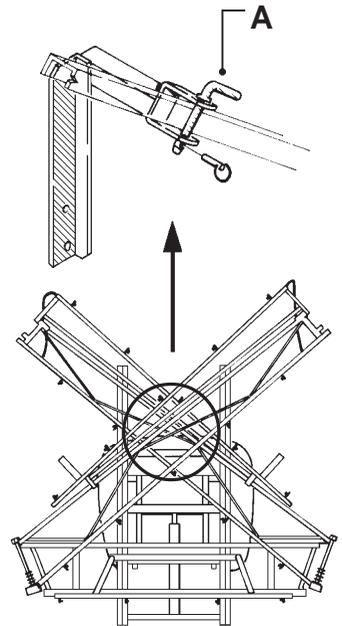
**WARNING:** Testing of the hydraulic system should be done very cautiously. There may be air in the system and this may cause violent movements of the boom. Therefore take care that no persons or objects are hurt or damaged in the process of testing.

### Unfolding and folding the boom

The boom is operated as follows:

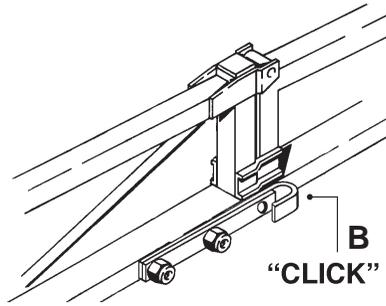
1. Remove boom transport lock pins **A**.
2. Swing the boom down. When unfolding (or folding) the initial force to release the spring loaded breakaway will be higher than the actual unfolding/ folding.

**CAUTION:** The breakaway must be correctly tensioned and lubricated. See section on Re-adjustment of the boom.



3. Unfold the outer sections. Do not let the outer sections fall into place. The outer boom locks **B** must click into place.

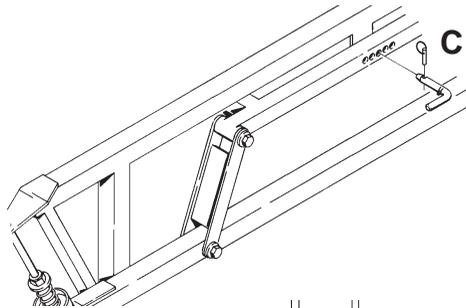
4. Reverse procedure to fold.



### Operation of trapeze

The trapeze suspension must be correctly adjusted and regularly lubricated if it is going to operate satisfactorily. The primary function of the suspension is to protect the boom against vibrations and shocks. It also helps maintain it a uniform height above the target.

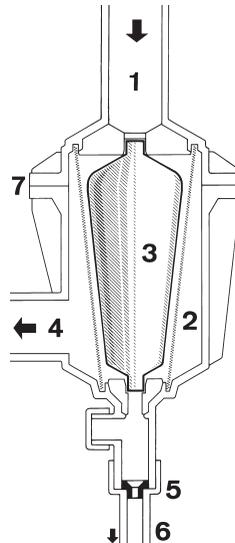
Under normal field operation, remove trapeze lock pin **C**. Replace pin to block function, for example before folding the boom or when spraying on sloping terrain.

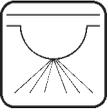


### Self-Cleaning Filter

#### 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.

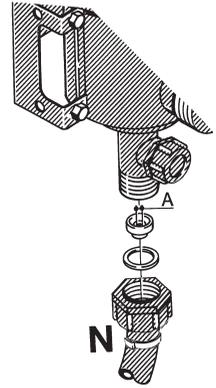
4 restrictors are supplied. Use the green one (largest orifice **A** first).

Hose **N** is unscrewed from the filter. Be careful not to loose 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.

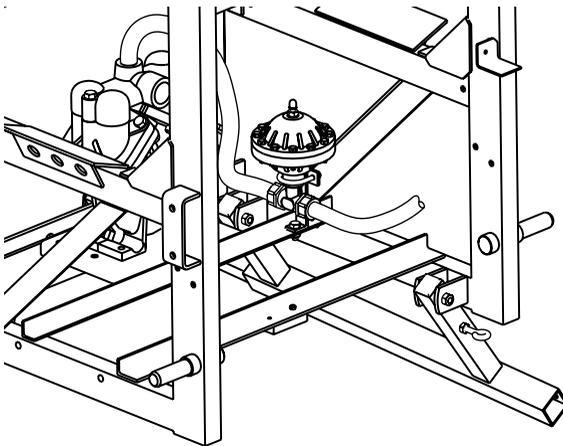
When cleaning the filter remove hose **N** and the hose at the safety valve and check there are no residues.

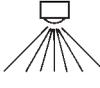
Standard filter size is 80 mesh. Filters of 50 and 100 mesh are available. To remove filter mesh undo the large ring nut. Check condition and placement of O-rings before reassembly.



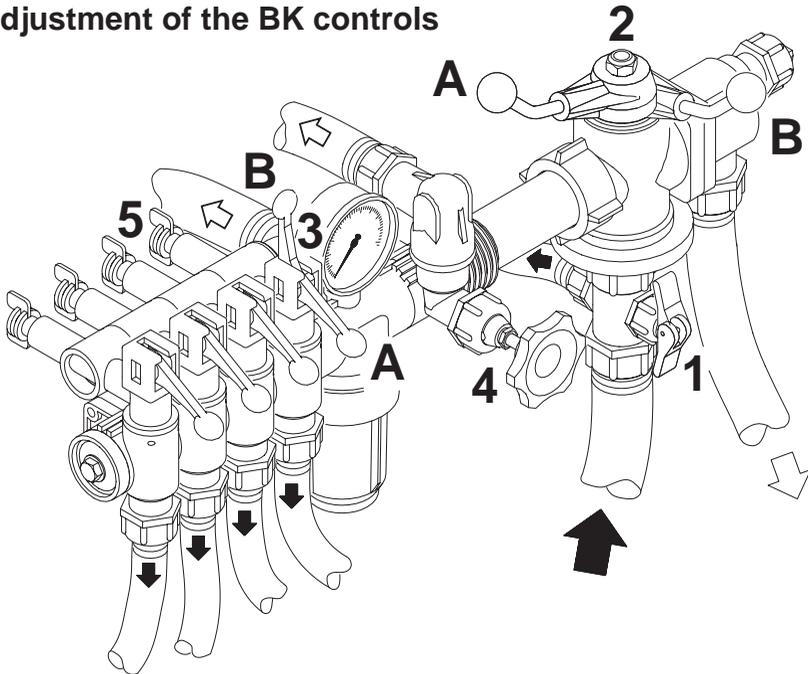
### Pulsation damper (if fitted)

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.



	
<b>bar</b>	<b>bar</b>
<b>15 - 3</b>	<b>0 - 1</b>
<b>3 - 15</b>	<b>1 - 3</b>

## Adjustment of the BK controls



1. Choose the correct nozzle. 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:

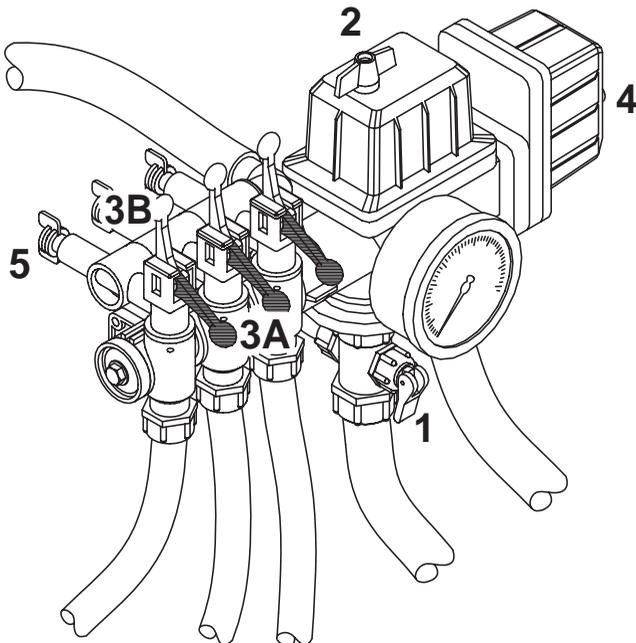
To stop the liquid flow to the boom turn the ON/OFF handle **2** to OFF position **B**. This returns the pump output to the tank through the return system. The diaphragm anti-drip valves ensure instantaneous closing of all nozzles.

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

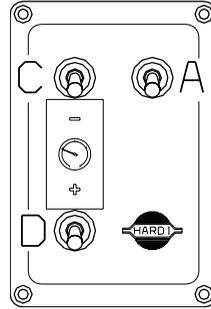
### BK/EC operating unit

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. 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.



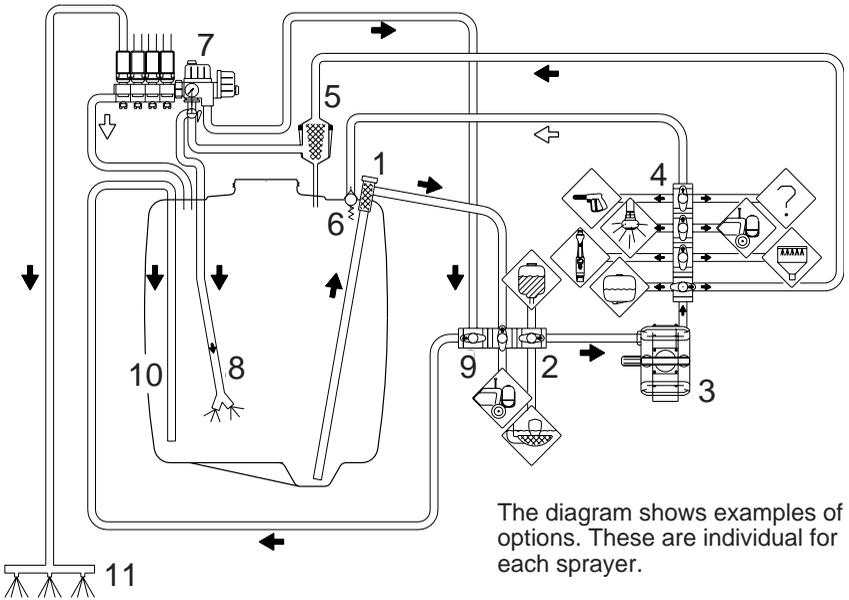
### Adjustment of MANIFOLD SYSTEM (if fitted)

The MANIFOLD SYSTEM is located at the left side of the sprayer 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                        | 6. Safety valve      |
| 2. Suction manifold BLACK with 2 valves  | 7. Operating unit    |
| 3. Pump                                  | 8. Pressure agitator |
| 4. Pressure manifold GREEN with 4 valves | 9. Return valve BLUE |
| 5. Self-Cleaning Filter                  | 10. Return to tank   |
|  | 11. Sprayer boom     |

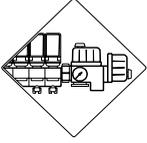


## Symbols

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.



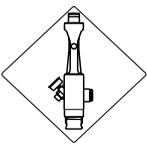
### Green disc = Pressure valve



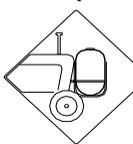
To Self-Cleaning  
Filter/operating  
unit



To Hose reel/spray gun



To Fast Filling  
Device



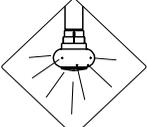
To Front Tank



To HARDI  
FILLER



To main tank



To Tank Flush-  
ing Nozzle



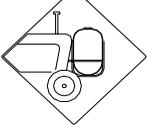
### Black disc = Suction valve



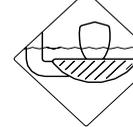
From main tank  
(suction filter)



From Rinsing Tank



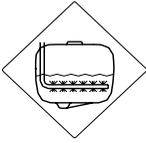
From Front Tank  
(suction filter)



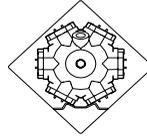
From Filling Device



**Blue disc = Return valve**



Return from  
operating unit



Pump

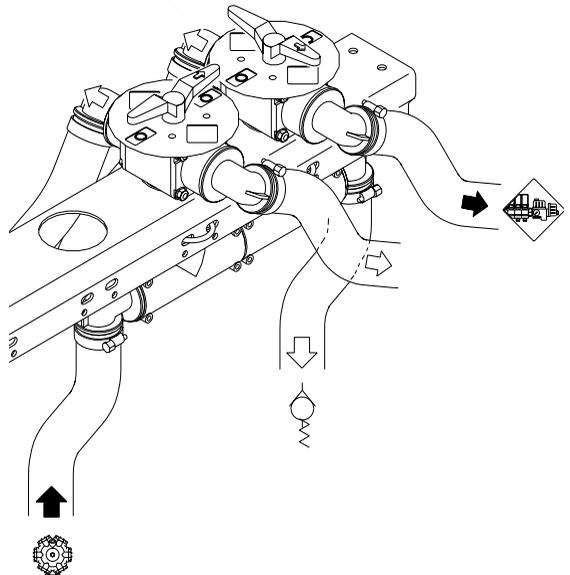
## Operating instructions

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.

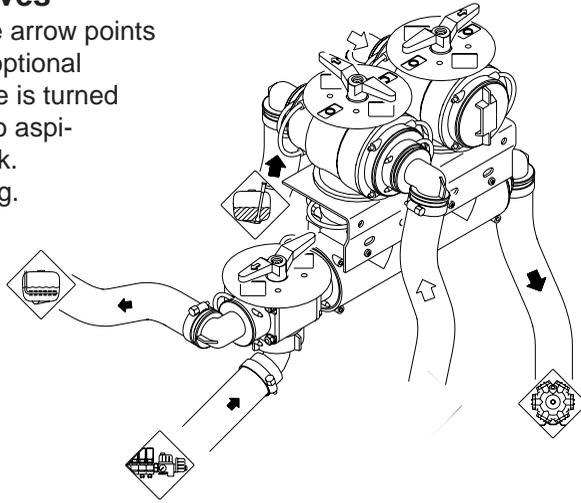
If 2 or more valves are fitted, the arrow must point towards the optional extra you select. Remaining handles are turned to “O” (closed). When spraying is to resume, select the Self-Cleaning Filter/operating unit. The other handles are turned to “O”.



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.

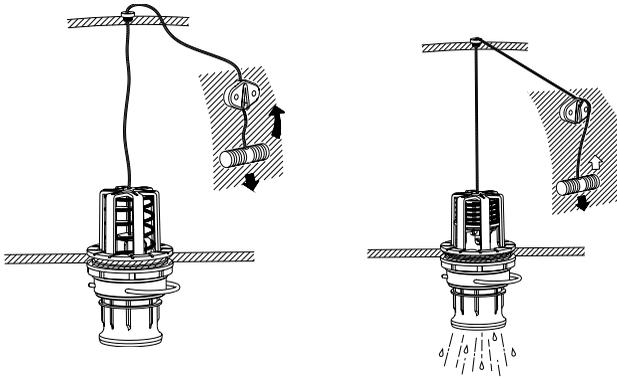


## Blue return valve

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.

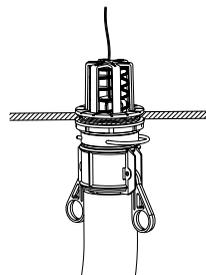
## Operation of the tank drain valve

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.**



## 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

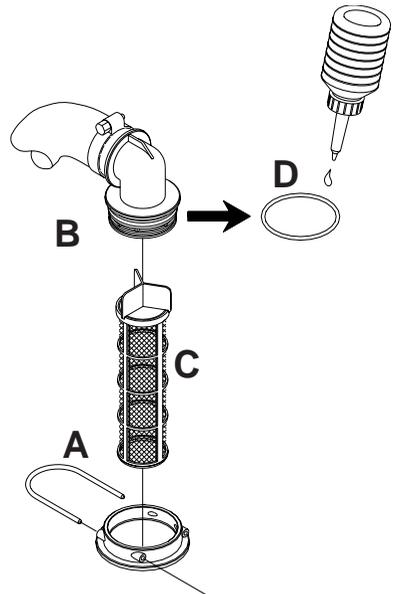
The main filter protecting sprayer components is the suction filter at the top of the tank. Check it regularly.

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



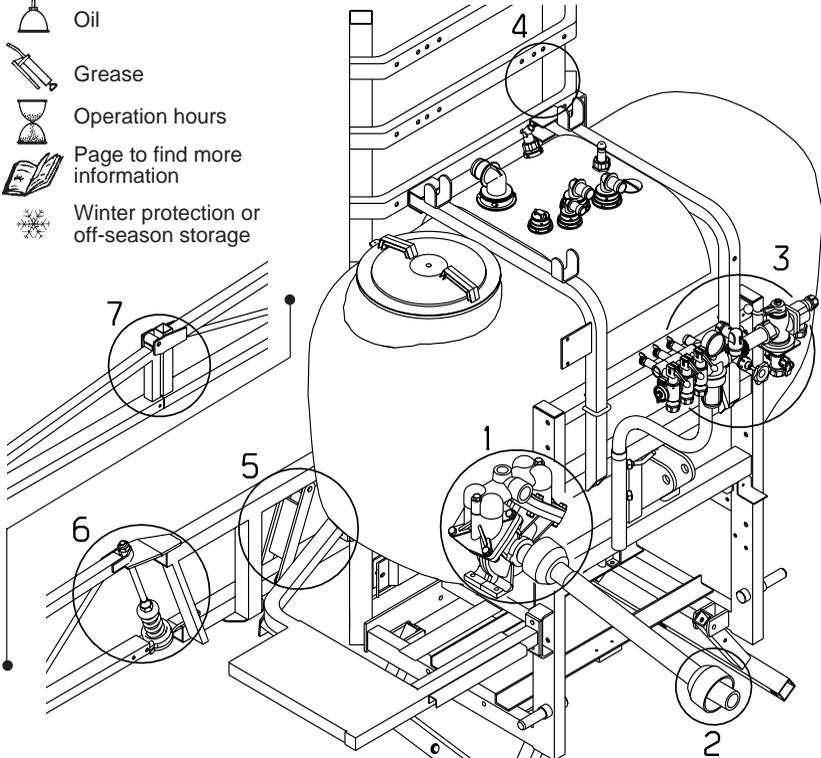
Operation hours

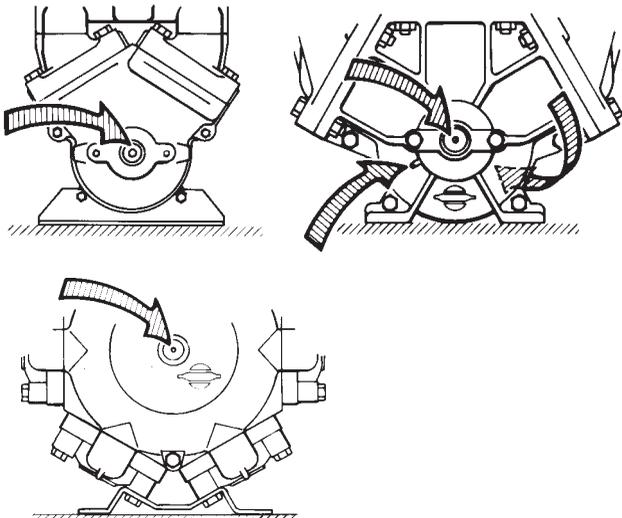
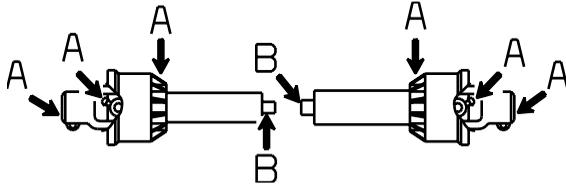
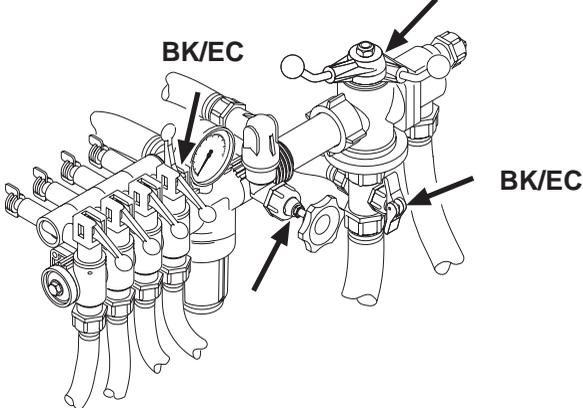


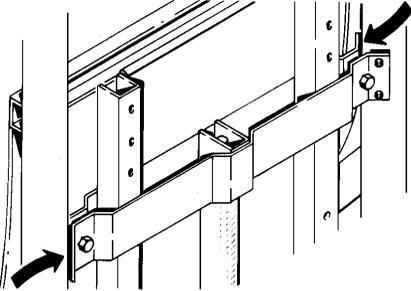
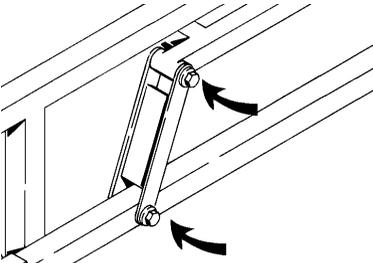
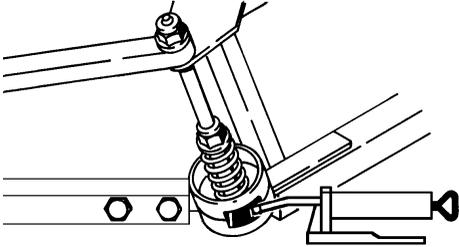
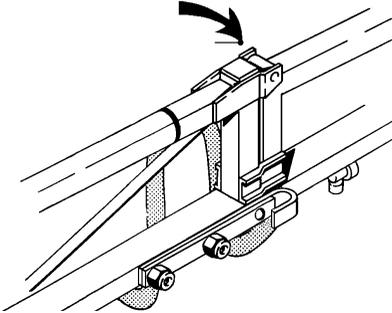
Page to find more information



Winter protection or off-season storage



POS.					
1		X	40		27 28 29
2 A B		X X	8 40		8
3	X		20		9 13 14 15

POS.					
4		X	40		26
5		X	40		27
6		X	40		10 26
7	X		40		11 26



## Re-adjustment of the boom

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

Carry adjustments out in the following (1, 2, 3...) order.

**NOTE:** Tractor and sprayer must be on level ground.

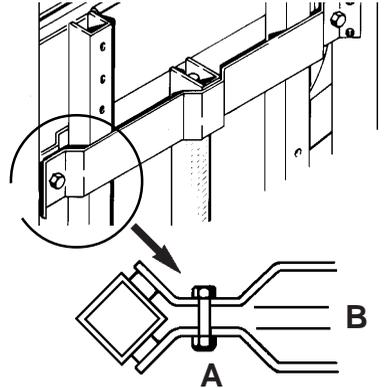
Sprayer must be lubricated. See section on Lubrication.



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

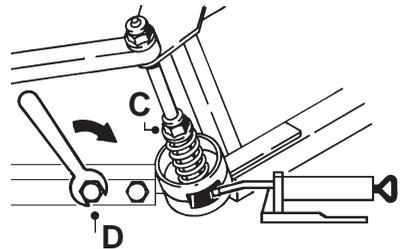
### 1. Boom lift

The boom lift should be adjusted so the boom can freely move up and down when the lift ram is operated. Adjust both sides. Adjust **A** so gap **B** is equal at all 4 points.



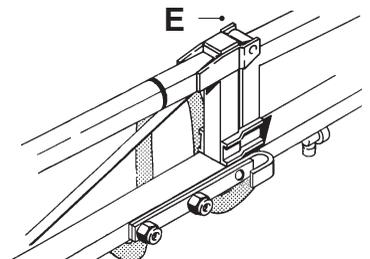
### 2. Boom breakaway

The function of the breakaway is to prevent or reduce boom damage if it should strike an object or the ground. If it is too tight, it will not function. If it is too loose, it will yaw (forward and back movement). Slacken screw nut **C** to decrease breakaway resistance. Do not overtighten; better to loose than too tight. Again minor adjustments in the field may be necessary. Ensure also channel bolts **D** are tight.



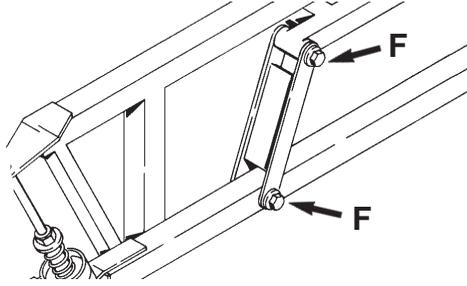
### 3. Outer section

The hinge should be firm. If too tight it is difficult to fold. To adjust, tighten or loosen nuts **E**.



#### 4. Trapeze suspension

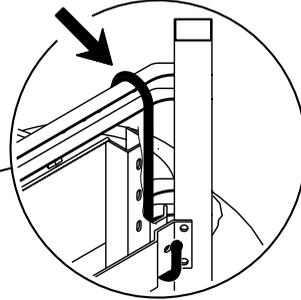
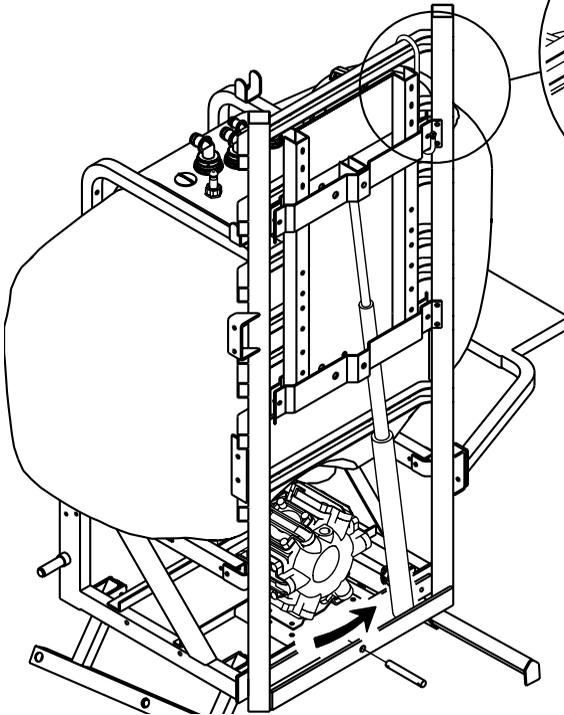
Remove the lock pin for the trapeze suspension. The trapeze must swing freely. If it is too tight it will not function and if too loose the boom will yaw which results in a poor spray distribution.



Adjust trapeze bolts **F** so it is not tight nor loose. Minor adjustment in the field may be necessary.

#### 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.

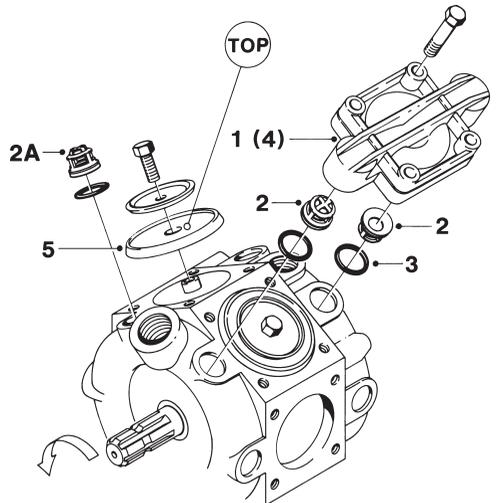
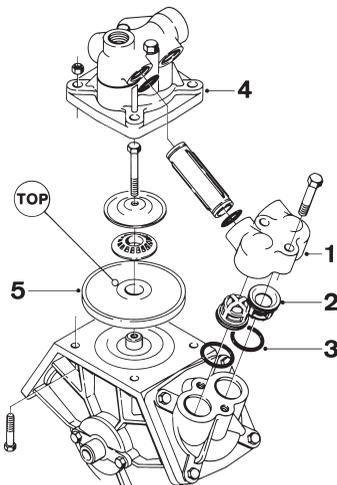
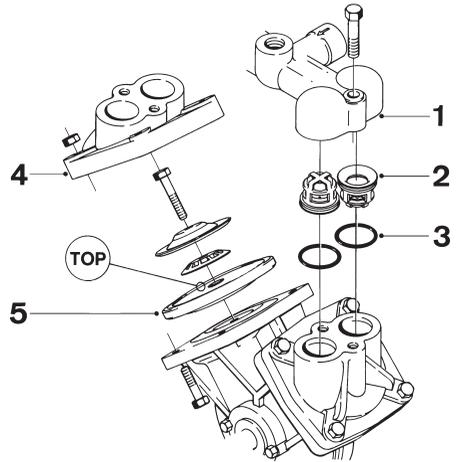


**NOTE:** One special valve with white flap **2A** is used on model 361. It has to be placed in the valve opening shown.

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
1202	70	70	60
1302	60	70	60
361	70		60

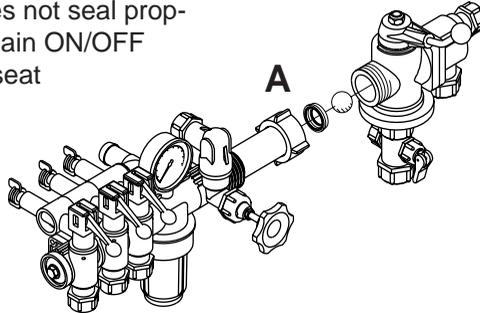


1 Nm = 0.74 ft-lb

## 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.

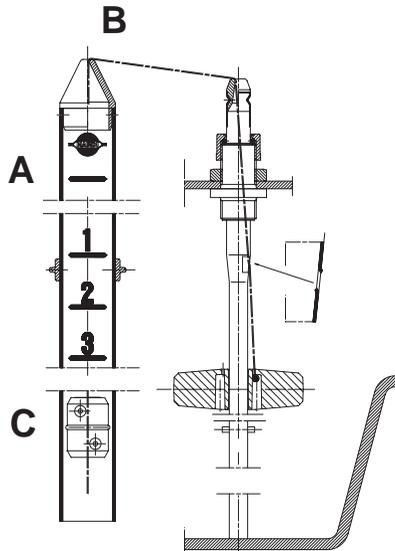


Check the ball for sharp edges and scratches, and check the ball seat for cracks and wear - replace if necessary.

## 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.



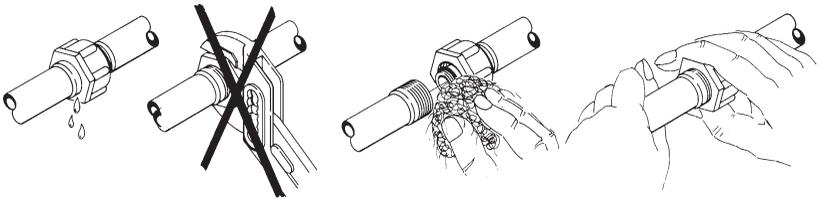
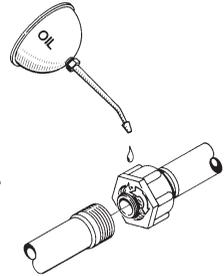


## Nozzle tubes and fittings

Poor seals are usually caused by;

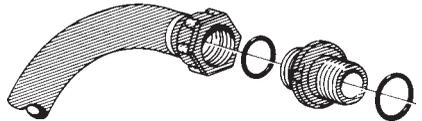
- missing O-rings or gaskets
- damaged or incorrectly seated O-rings
- dry or deformed O-rings or gaskets
- foreign bodies

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.



## 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.



## Transmission shaft

Check the shaft fulfills its security purpose, e.g. that shields and protective tubes are intact.

## 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. The anti-freeze solution also hinders the O-rings and gaskets from drying out.

## 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.





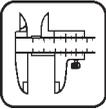
Fault	Probable cause	Control / remedy
<b>Liquid system</b>	Air leak on suction.	Check if suction filter O-ring is sealing.
		Check suction tube and fittings.
		Check tightness of pump diaphragm and valve covers.
Lack of pressure.	Air in system.	Fill suction hose with water for initial prime.
	Suction/pressure filters clogged.	Clean filters. Check yellow suction pipe is not obstructed or placed too near the tank bottom.
	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</b>		
BK/EC 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.



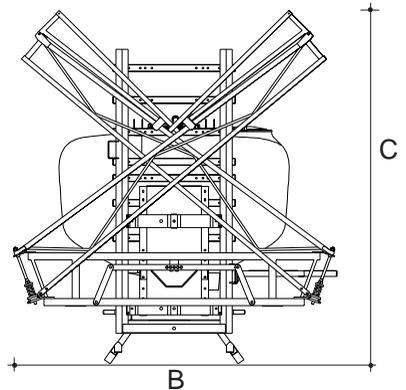
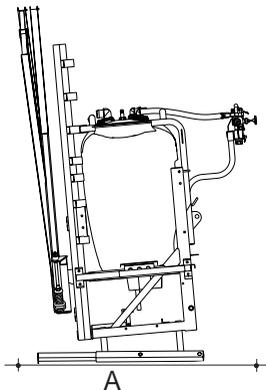
Fault	Probable cause	Control / remedy
<b>Hydraulic system</b>		
Boom lift slow/erratic.	Air in system.	Loosen ram connection and activate hydraulics until oil flow has no air in it (not whitish).
	Insufficient hydraulic pressure.	Check output pressure of tractor hydraulics. Minimum for sprayer is 130 bar.
	Insufficient amount of oil in tractor reservoir.	Check and top up if needed.
Ram not functioning.	Restrictor blocked.	Secure boom with "S" hook. Dismantle and clean.



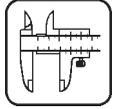
## Technical specifications

### Measure and weight

Tank size l	Spray width m	Pump model	Measure A x B x C cm	Weight kg
600	10	1202	125 × 226 × 245	404
		1302	125 × 226 × 245	416
	12	1302	125 × 226 × 245	422
800	10	1302	125 × 226 × 245	422
		1302	125 × 226 × 245	428
	12	361	125 × 226 × 245	443
1000	12	1302	125 × 226 × 245	437
		361	125 × 226 × 245	452
1200	12	1302	140 × 226 × 245	454
		361	140 × 226 × 245	469



## Pump power consumption and capacity



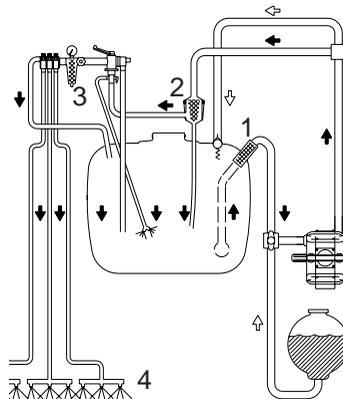
1202/9.0	r/min										
	300		400		500		540		600		
bar	l/min	kW	l/min	kW	l/min	kW	l/min	kW	l/min	kW	
0	56	0,91	72	1,28	93	1,52	99	1,63	112	1,79	
5	40	1,11	53	1,36	66	1,60	71	1,71	79	1,86	
10	38	1,38	52	1,74	64	1,79	69	1,87	77	2,07	
15	37	1,60	50	1,97	62	2,32	67	2,48	75	2,76	
Rotation per min.	r/min	Capacity				l/min	Suction height				0,0 m
Power consumption	kW	Max. pressure				15bar	Weight				24,0 kg

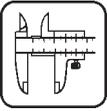
1302/9.0	r/min										
	300		400		500		540		600		
bar	l/min	kW	l/min	kW	l/min	kW	l/min	kW	l/min	kW	
0	63	0,90	84	1,19	103	1,51	114	1,61	125	1,80	
5	58	0,94	79	1,29	96	1,61	105	1,75	116	1,93	
10	56	1,30	76	1,80	94	2,30	101	2,48	111	2,72	
15	55	1,80	74	2,22	93	2,92	99	3,18	109	3,54	
Rotation per min.	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

## Filters and nozzles

Pos.	Mesh/ colour	Description/ nozzle
1	30	Suction filter
2	80	Self-Cleaning Filter (if fitted)
3	50	Pressure filter
4	50 blue	Nozzle S4110-16 Nozzle S4110-20





## Temperature and pressure ranges

Operating temperature range: 2° to 40° C.

Operating pressure for safety valve: 15 bar

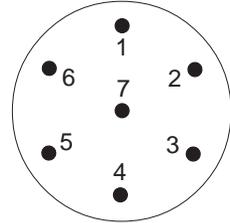
Max. pressure on the pressure manifold: 20 bar

Max. pressure on the suction manifold: 7 bar

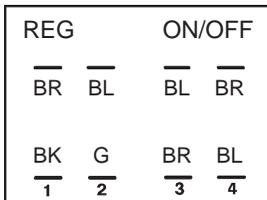
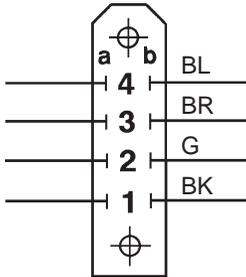
## Electrical connections

### Rear lights

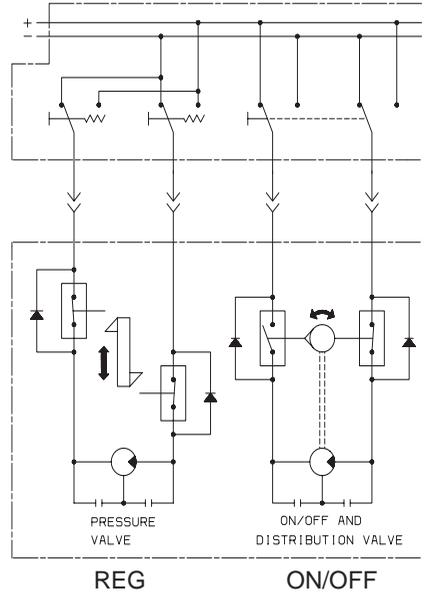
Position	Wire colour
1. LHS direction indicator	Yellow
2. Free	Blue
3. Frame	White
4. RHS direction indicator	Green
5. RHS rear position lamp	Brown
6. Stop lamps	Red
7. LHS rear position lamp	Black



### BK/EC



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



REG

ON/OFF AND  
DISTRIBUTION VALVE

## Materials and recycling

Tank: HDPE

Valves: mainly glass-filled PA

Hoses: PVC

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

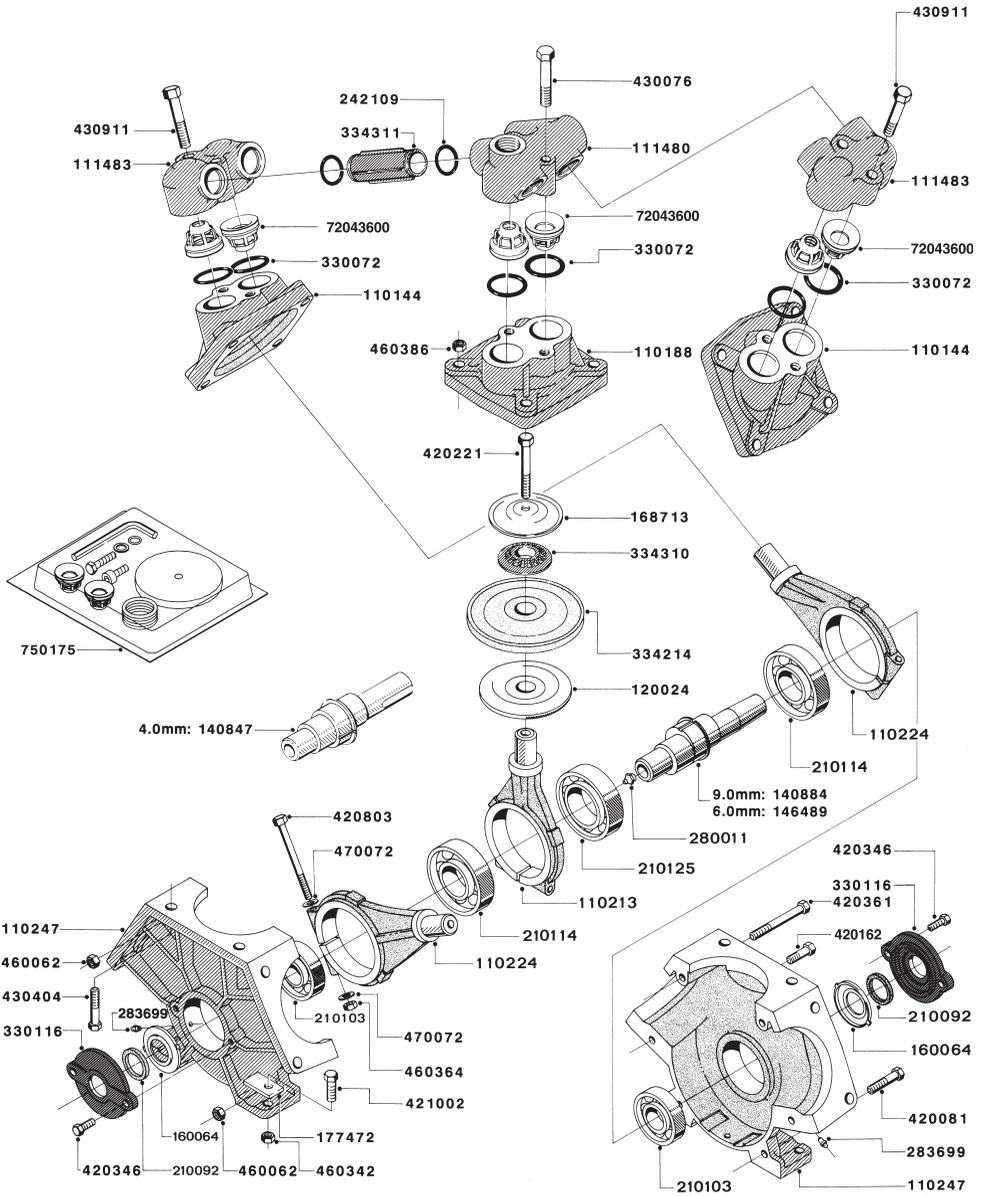


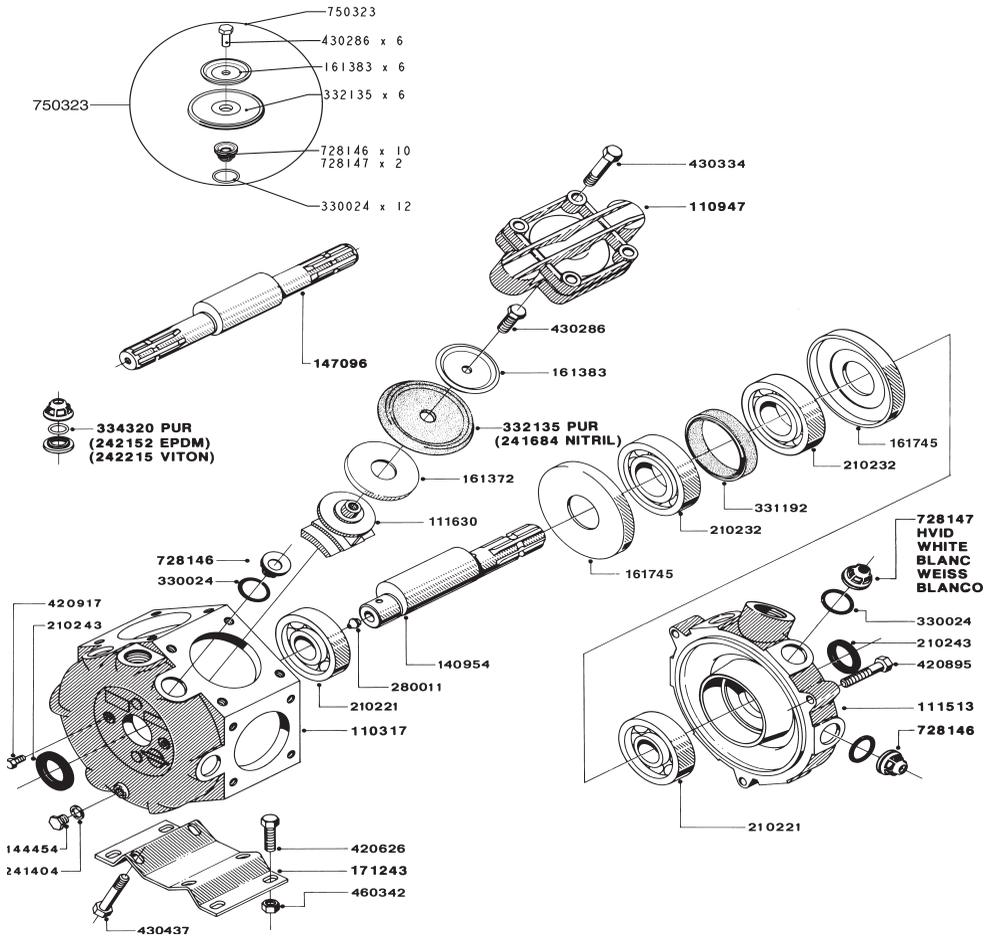
Operating

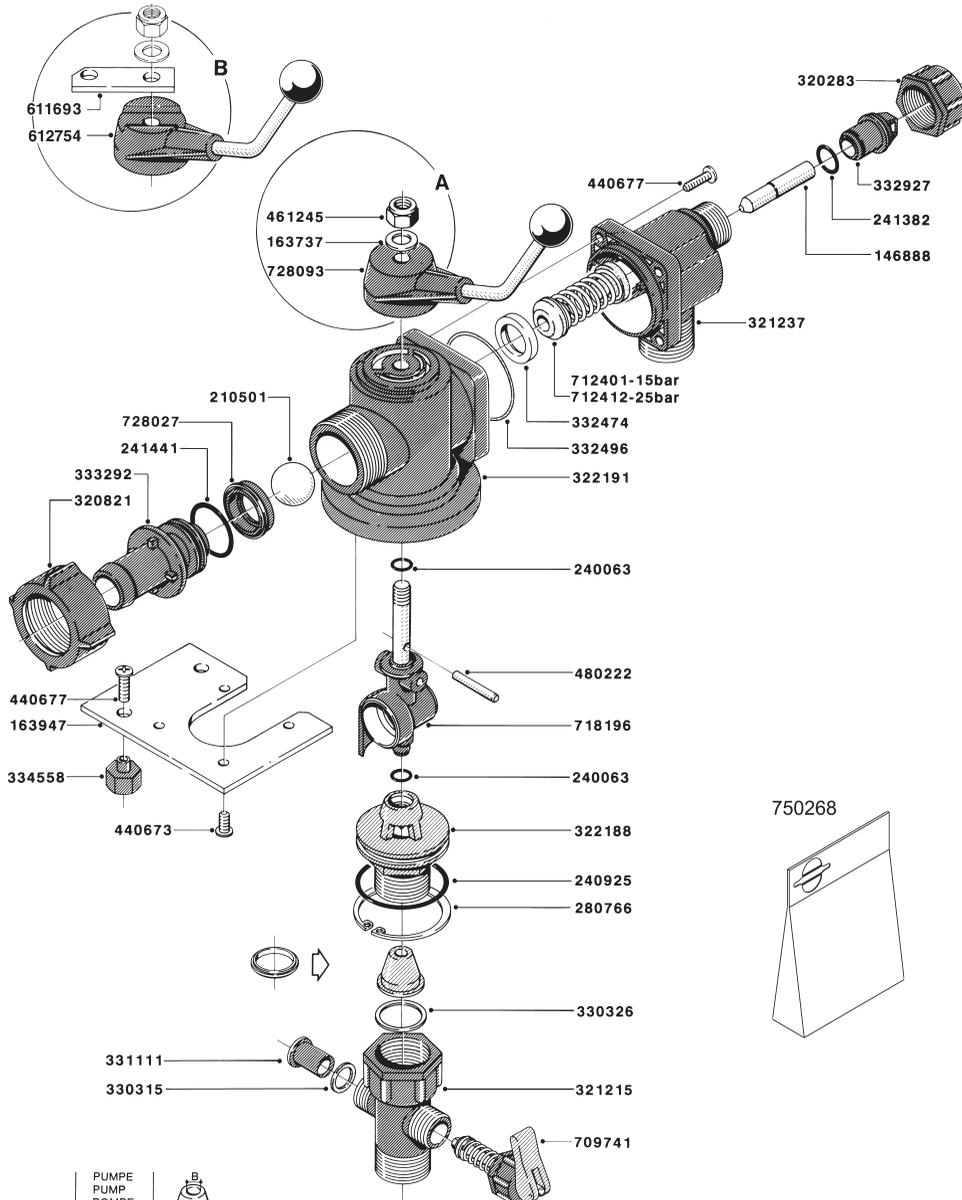


Lubrication

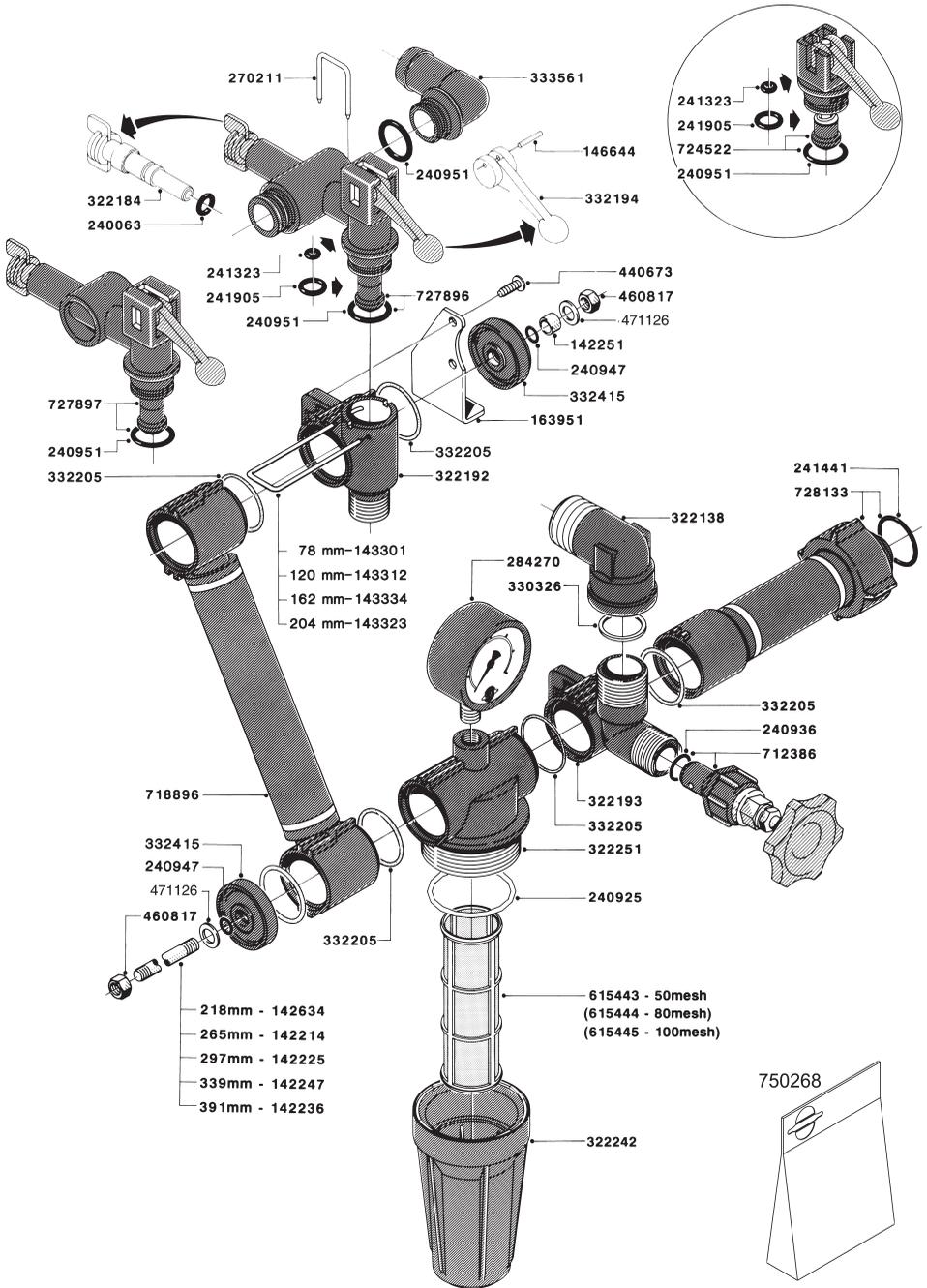


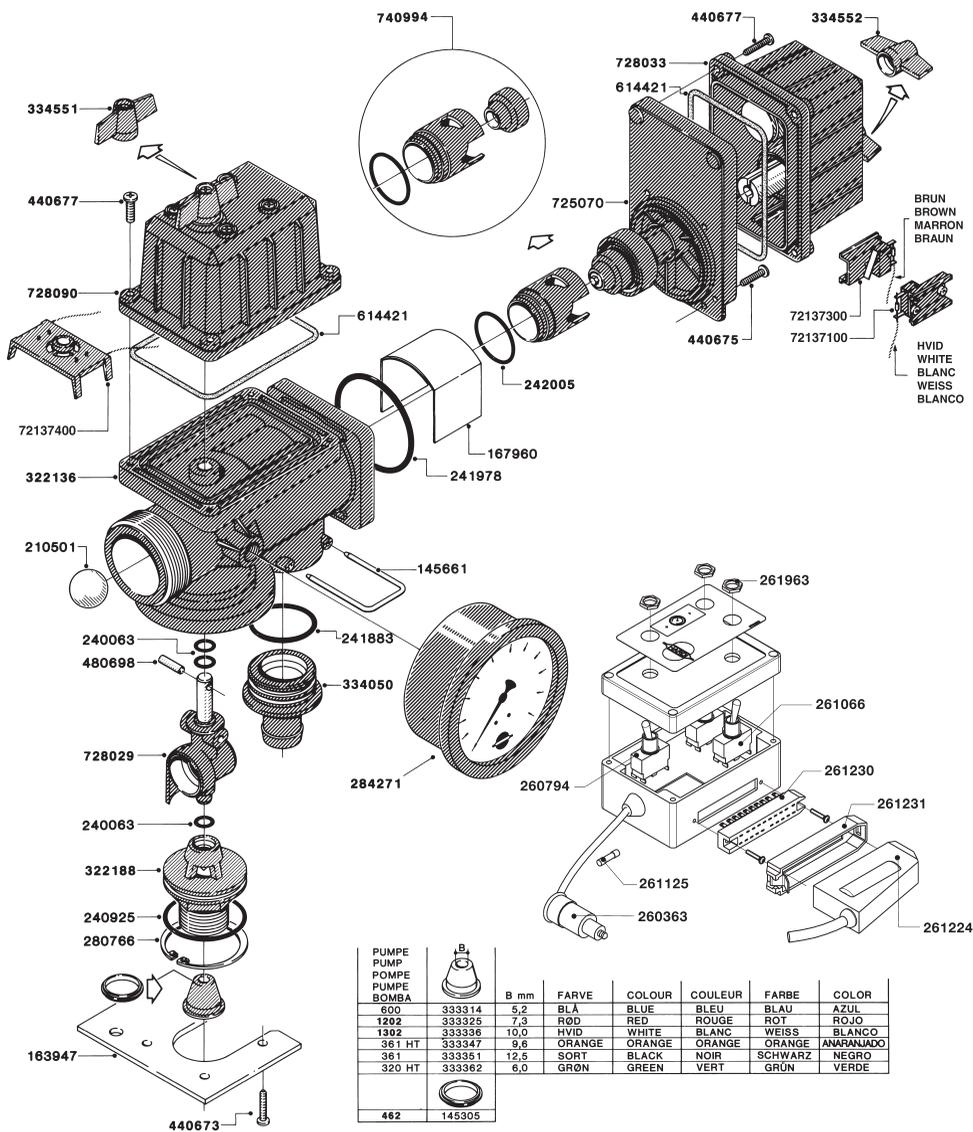


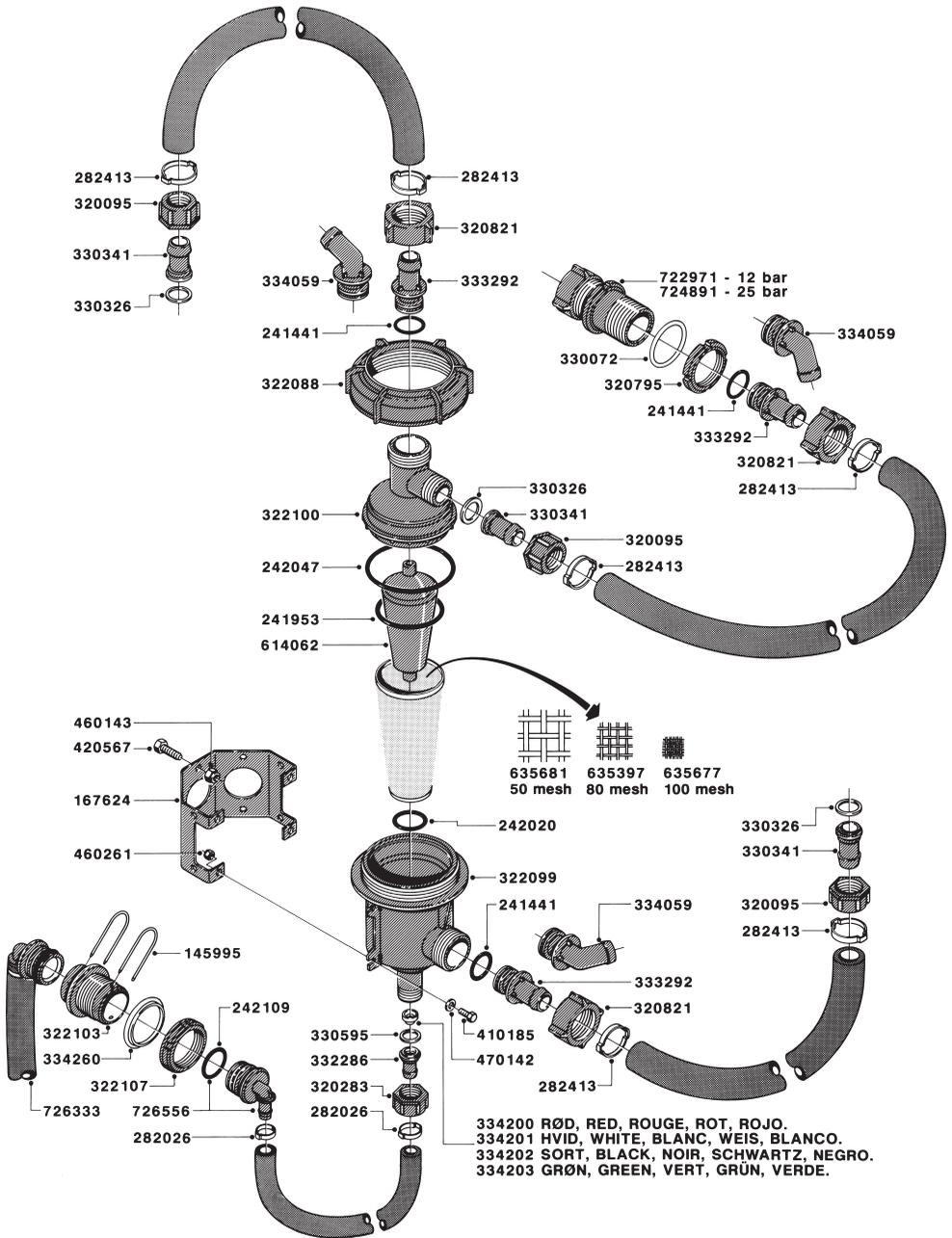


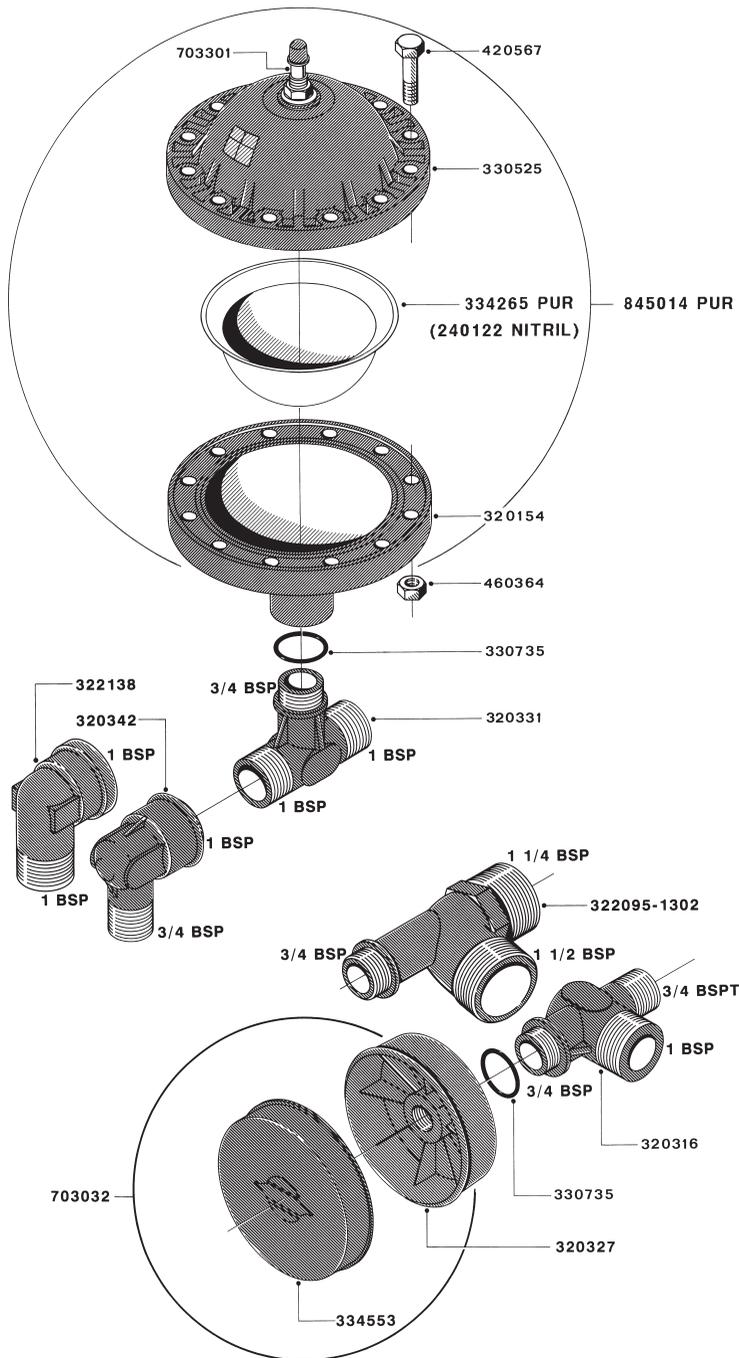


		B mm	FARVE	COLOUR	COULEUR	FARBE	COLOR	
PUMPE								
PUMP								
POMPE								
PUMPE								
BOMBA								
600	333314	5,2	BLÅ	BLUE	BLEU	BLAU	AZUL	
1202	333325	7,3	RØD	RED	ROUGE	ROT	ROJO	
1302	333336	10,0	HVID	WHITE	BLANC	WEISS	BLANCO	
361 HT	333347	9,6	ORANGE	ORANGE	ORANGE	ORANGE	ANARANJADO	
361	333351	12,5	SORT	BLACK	NOIR	SCHWARZ	NEGRO	
320 HT	333362	6	GRØN	GREEN	VERT	GRUN	VERDE	
462								145305



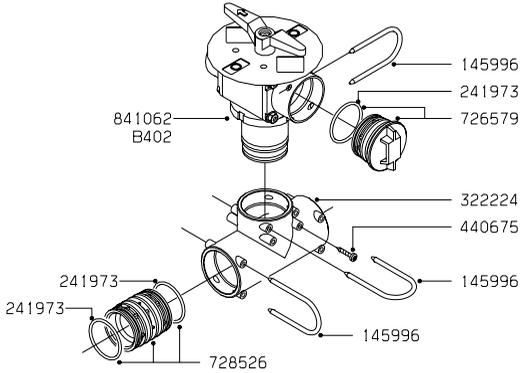
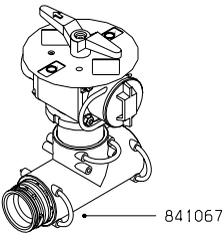
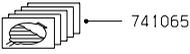
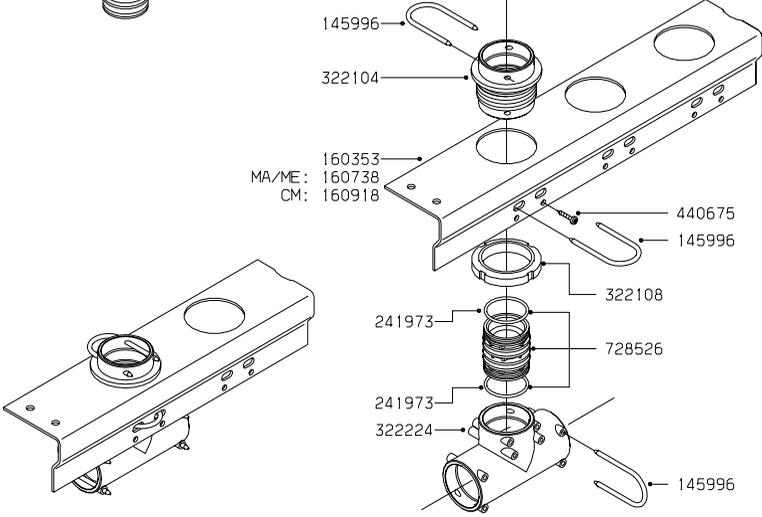
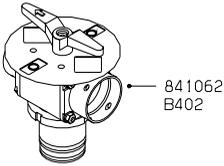






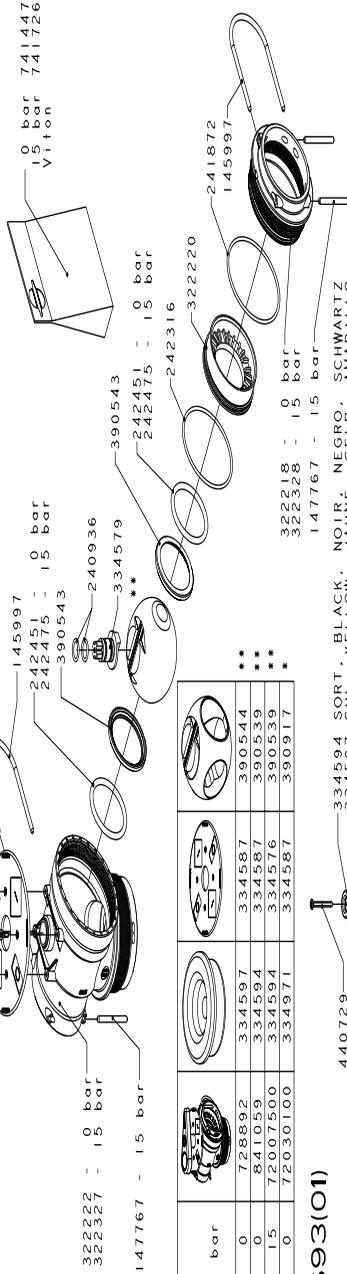






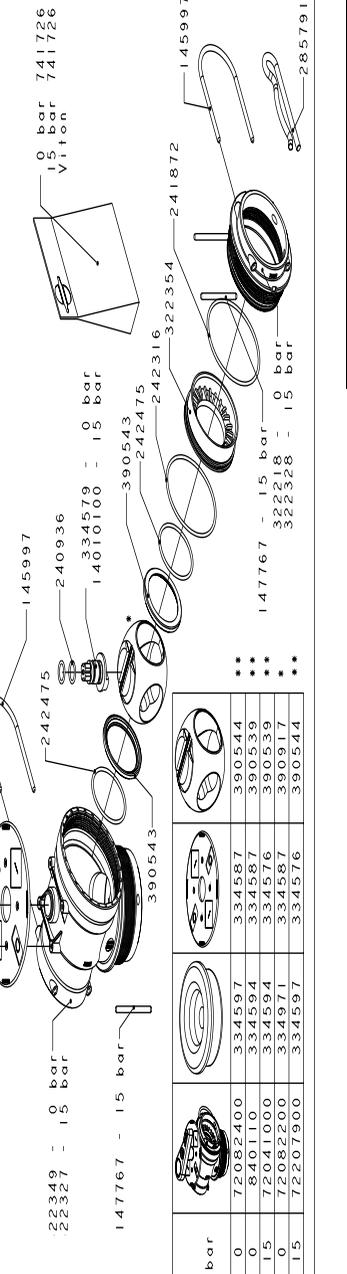
**S93**

- 440681 334594 SORT, BLACK; NOIR, NEGRO; SCHWARTZ
- 334597 GUL, YELLOW; JAUNE, GELB; AMARILLO
- 334578 334576 GRØN, GREEN; VERT, GRÜN, VERDE
- 440685 334587 SORT, BLACK; NOIR, NEGRO; SCHWARTZ



**S93(O1)**

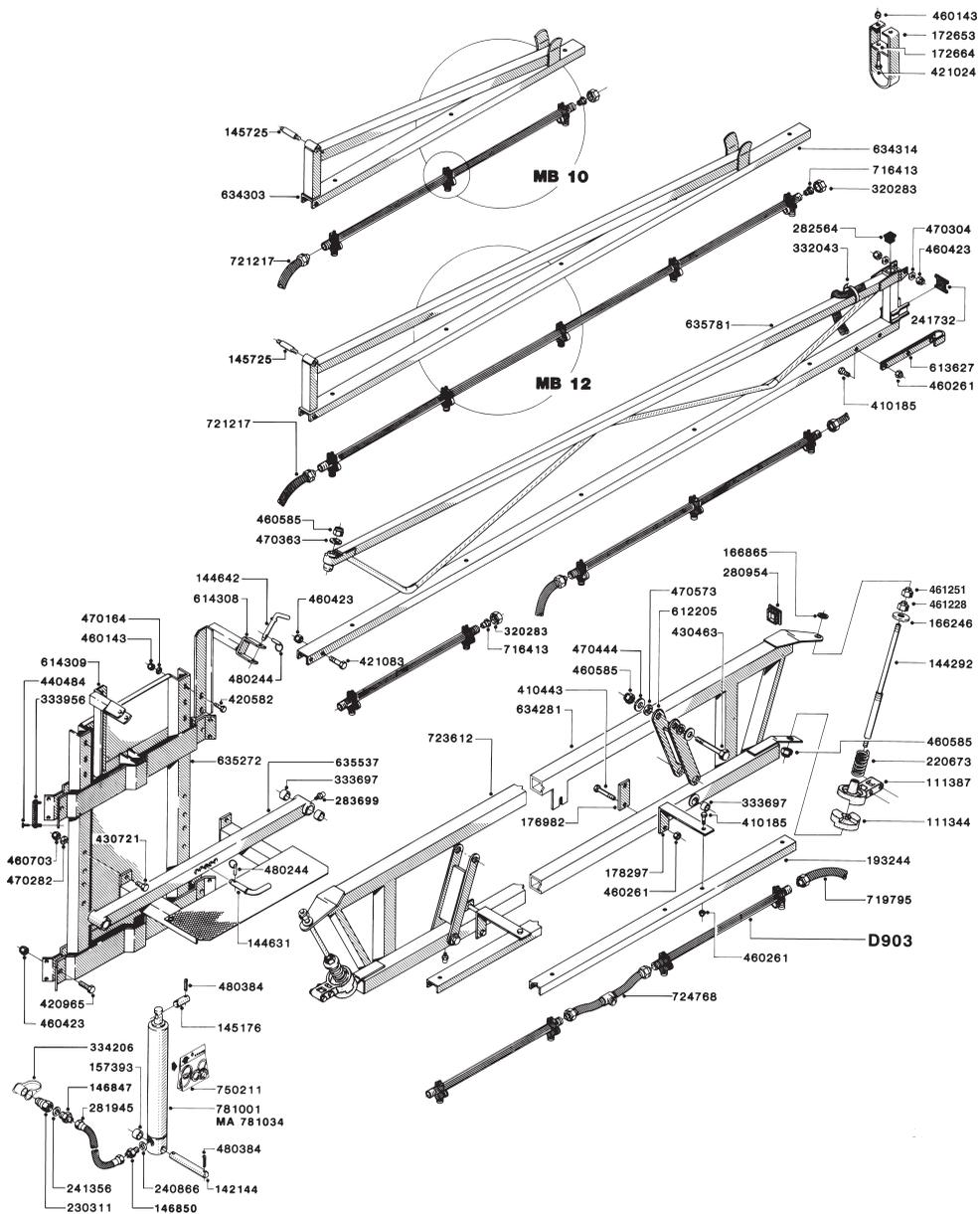
- 22349 - 0 bar
- 22327 - 15 bar
- 147767 - 15 bar
- 390543
- 242475
- 240936
- 334579 - 0 bar
- 14010100 - 15 bar
- 390543
- 242475
- 242316
- 322354
- 241872
- 145997
- 322218 - 15 bar
- 322328 - 15 bar
- 285791

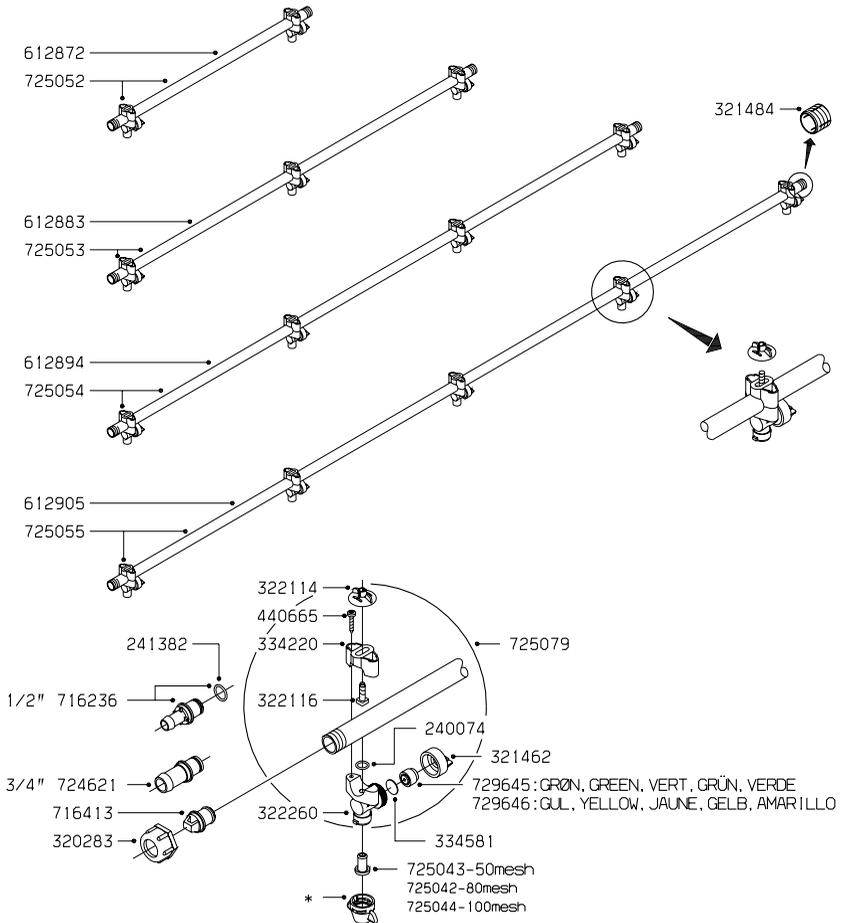


bar				
0	72082400	334597	334587	390544
15	72041000	334594	334576	390539
0	72082200	334971	334587	390917
15	72207900	334597	334576	390544

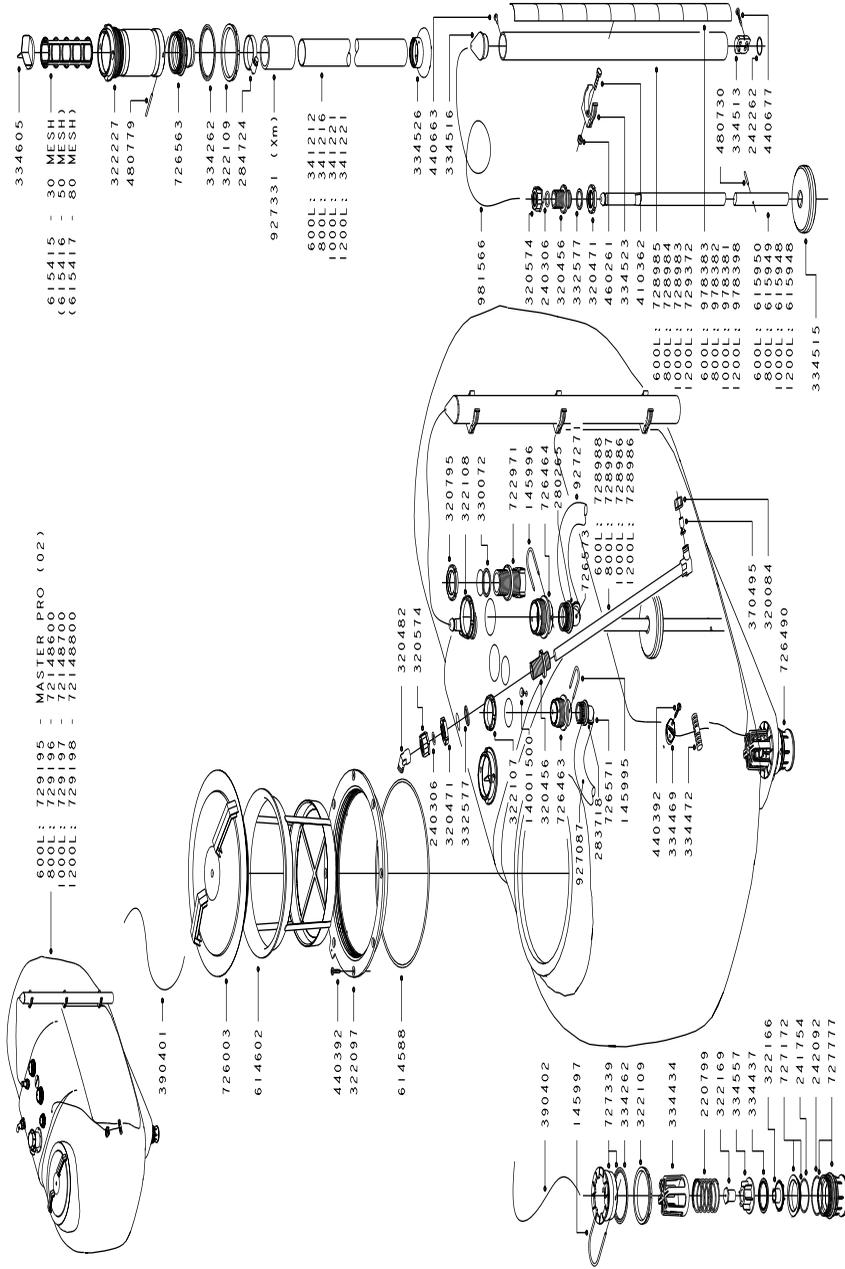
Step:	1	Tegn. af:	MON	PDM:	1.10+
Side:	1 af 1	Dato:	16-Dec-02	Rev. af:	OLN

<b>B404</b>	
Rev. d.	16-12-02

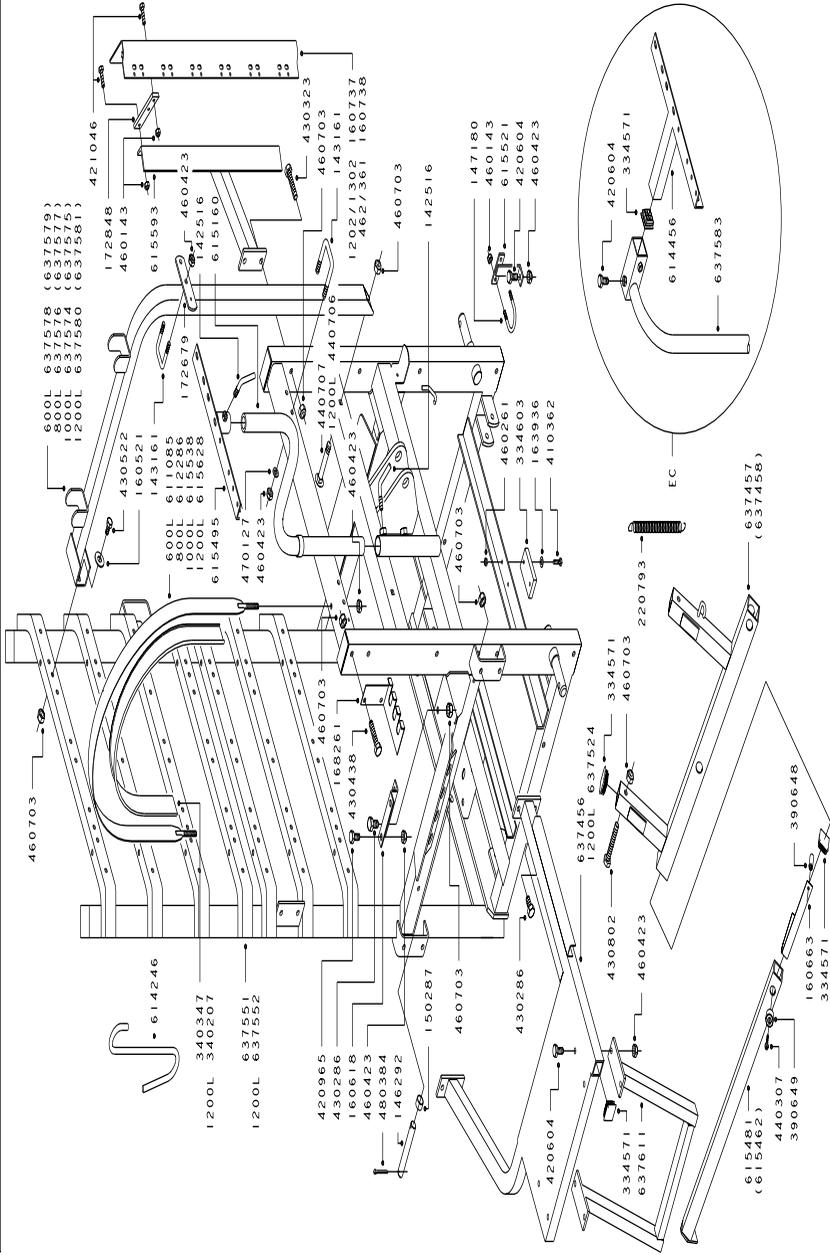




*		FARVE	COLOUR	COULEUR	FARBE	COLOR
371469	S4110-08	VIOLET	VIOLET	VIOLET	VIOLETT	VIOLETA
371470	S4110-10	BRUN	BROWN	BRUN	BRAUN	MARRON
371471	S4110-12	GUL	YELLOW	JAUNE	GELB	AMARILLO
371472	S4110-14	ORANGE	ORANGE	ORANGE	ORANGE	ANARANJADO
371473	S4110-16	RØD	RED	ROUGE	ROT	ROJO
371474	S4110-18	HVID	WHITE	BLANC	WEISS	BLANCO
371475	S4110-20	GRØN	GREEN	VERT	GRÜN	VERDE
371476	S4110-24	TURKIS	TURQUOISE BLUE	BLEU TURQUOISE	TÜRKIS	AZUL TURQUI
371477	S4110-30	BLÅ	BLUE	BLEU	BLAU	AZUL
371478	S4110-36	GRÅ	GREY	GRIS	GRAU	GRIS
371479	S4110-44	ELFENBEN	IVORY	IVOIRE	ELFENBEIN	MARFIL

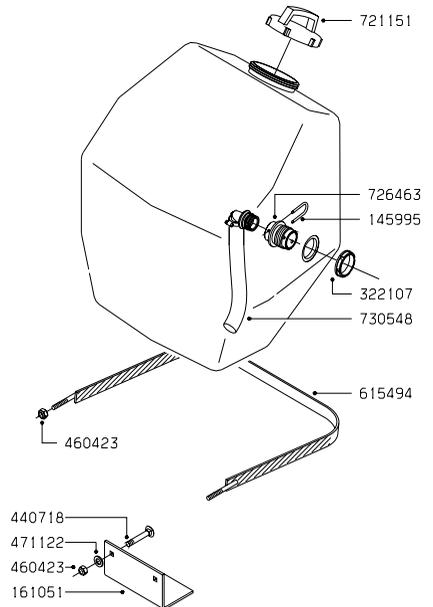
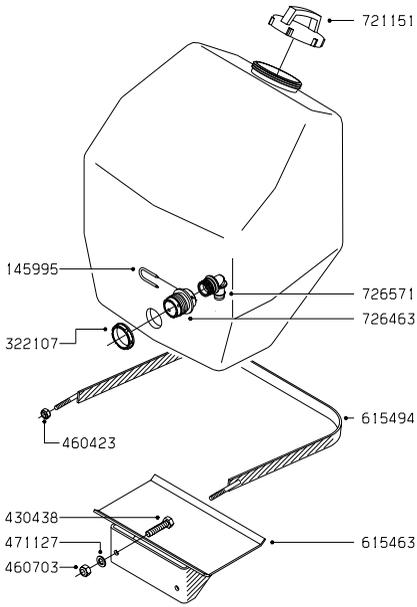
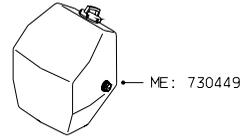
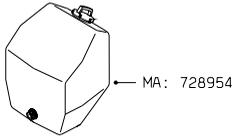


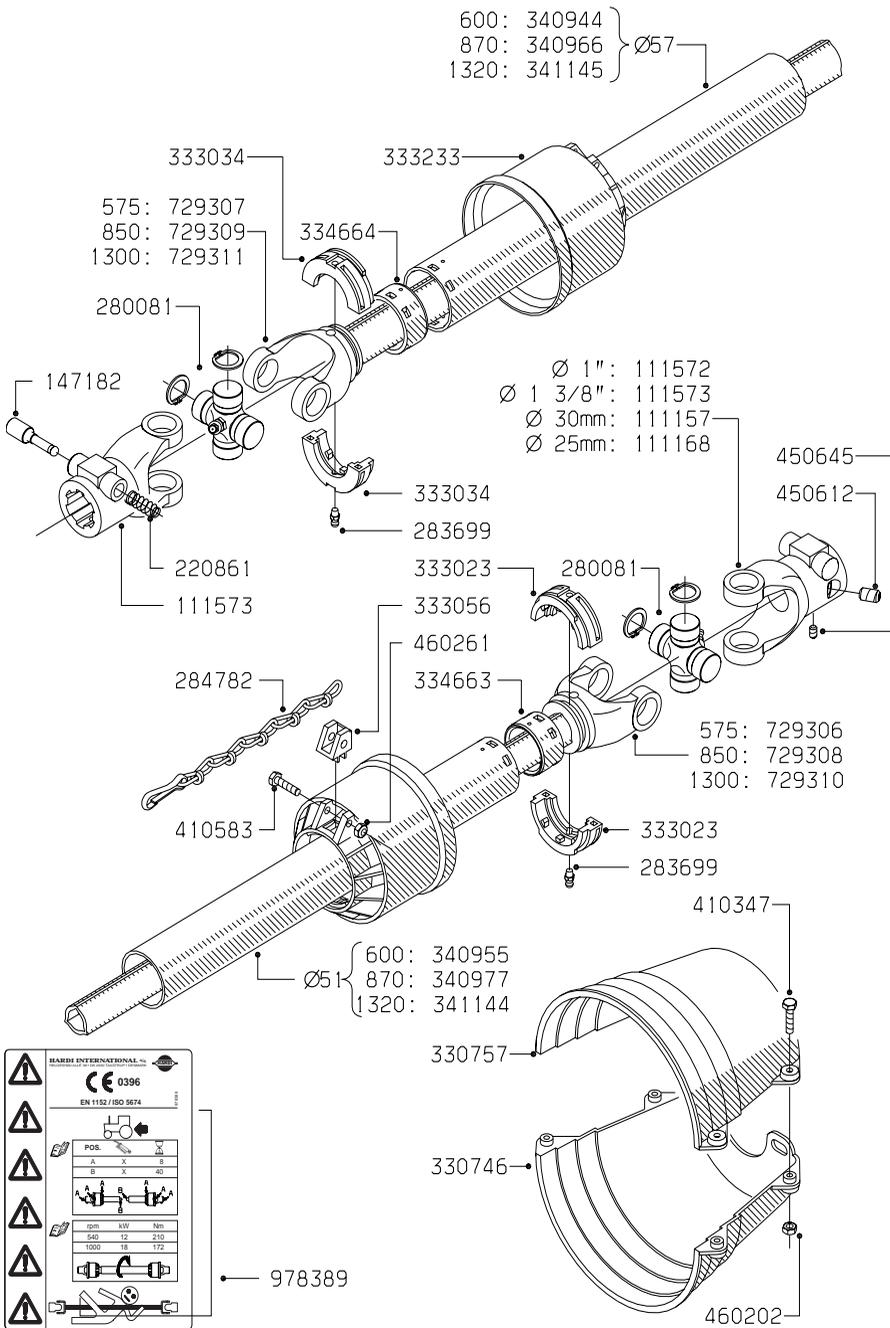
MA 600/800/1000/1200 (welded)



E113  
Rev. d. 23-07-01

I a f I	Tegn. af:	MON	PDM:	***
	Dato:	16-Mar-00	Rev. af:	MON





**HARDES INTERNATIONAL**

CE 0396  
 EN 1152 / ISO 5674

POS.		A	X	B
		A	X	B
		B	X	A0

rpm	kW	Nm
540	12	210
1020	18	172

