

ZENIT

Instruction book

67302603 - Version 1.00

US - 09.2007

HARDI® reserves the right to make changes in design, material, or specification without notice thereof.
HARDI® and other product names are registered trademarks of HARDI® NORTH AMERICA INC. in the U.S. and in other countries.

1 - Welcome	
Welcome letter	1
2 - Safety notes	
Operator safety	1
General info.....	1
Local poison information center	3
3 - Description	
General info	1
General View - Zenit with Axial Fan	1
Use of the ZENIT sprayer.....	2
Identification plates.....	2
Frame.....	2
Tank.....	2
Liquid system	3
HC/1 or HC/2 Hydraulic control	3
Valves and symbols	3
BK/2 Manual control	3
Safety valve (BK units).....	4
Pump	4
Pressure damper.....	4
Diagram - HC/2 Hydraulic controls	5
Diagram - BK manual control.....	6
Axial blower unit	7
Axial fan - Technical information.....	7
Protection guards	7
Air flow and power consumption.....	8
Gear box	9
Centrifugal blower unit	10
Centrifugal turbine - Technical information.....	10
Protection guards	10
Gear box.....	11
Pneumatic system	11
Hydro-pneumatic system	12
4 - Sprayer setup	
General info	1
Unloading the sprayer from the truck.....	1
Before putting the sprayer into operation.....	1
Transmission shaft - Operator's safety	1
Mechanical connections	2
Transmission shaft - Installation	2
Hydraulic systems	3
General info	3
Hydraulic requirements for HC/1 or HC/2 controls	3
Hydraulic requirements for B20 Manual boom	3
Hydraulic requirements for B20 Hydraulic boom	3
Hydraulic requirements for CANNON spout	3
Air systems	4
Adjusting the fan (axial system only)	4
Booms	5
Technical information	5
B11 - Fixed boom.....	5
B20 - Manual boom.....	5
B20 - Hydraulic boom.....	5

Table of contents

5 - Operation

Boom	1
Technical information	1
B11 Fixed boom	1
B20 Manual and Hydraulic boom	1
B20 Hydraulic boom operation	2
Hydraulic movements of the CANNON model	3
Liquid and air system	4
Filling through tank lid	4
Powder mixer	4
Filling of clean water tank	4
Diaphragm pump	5
Pressure damper adjustment	5
Gear box	5
Nozzles	6
HC1/ or HC/2 Control	7
BK/2 Manual control	8
Adjustment of pressure equalization	8
Operating the control unit while driving	8
Safety precautions - crop protection chemicals	9
Cleaning	10
General info	10
Cleaning the tank and liquid system	11
Cleaning and maintenance of filters	11

6 - Maintenance

Lubrication	1
General info	1
Recommended lubricants	1
Lubrication & oiling plan	1
Service and Maintenance intervals	2
After every 10 hours	2
After every 50 hours	2
After every 250 hours	2
After every 1000 hours	2
Regular Maintenance	3
10 hours service - Suction filter	3
10 hours service - In-Line filter	3
10 hours service - Transmission shaft	3
10 hours service - Spraying circuit	4
50 hours service - Transmission shaft	4
50 hours service - Diaphragm pump	4
50 hours service - Mechanical clutch	4
50 hours service - Filters and fittings	4
250 hours service - Hydraulic circuit	5
250 hours service - Gearbox oil change	5
250 hours service - Hydraulically controlled section valves	6
1000 hours service - Transmission shaft	6
Occasional maintenance	7
General info	7
Pump valves and diaphragms replacement	7
Adjustment of Manifold valve	7
Shield replacement on transmission shaft	8
Replacement of transmission shaft cross journals	8
Off-season storage	9
Off-season storage program	9
Preparing the sprayer for use after storage	9
Spare parts	10
Spare parts	10

7 - Fault finding	
Operational problems	1
General info	1
Common problems	2
8 - Technical specifications	
Dimensions	1
Overall dimensions	1
Weight	1
Specifications	2
Pump model 321/10.0	2
Filters and nozzles	3
Temperature and pressure ranges	3
Materials and recycling	3
Disposal of the sprayer	3
9 - Warranty	
Warranty policy and conditions	1

Table of contents

Welcome letter



Dear Owner,

Thank you for purchasing a HARDI® product and welcome to the ever-increasing family of HARDI® sprayer owners.

Our sprayers and accessories are rapidly becoming a familiar sight on North American farms. We believe that this results from growers becoming increasingly conscious of crop protection input costs and the vital need for cost effective spray application equipment.

Please take the time to thoroughly read the Operator's Manual before using your equipment. You will find many helpful hints as well as important safety and operation information.

Some of the features on your HARDI® sprayer were suggested by growers. There is no substitute for "on farm" experience and we invite your comments and suggestions. If any portion of this instruction book remains unclear after reading it, contact your HARDI® dealer or service personnel for further explanation before using the equipment.

For Product, Service or Warranty Information:

- Please contact your local HARDI® dealer.

To contact HARDI® directly:

- Please use the HARDI® Customer Service number: 1-866-770-7063

- Or send your email to CUSTSERV@hardi-us.com

HARDI® NORTH AMERICA INC.

1500 West 76th St.
Davenport, Iowa 52806
Phone: (563) 386-1730
Fax: (563) 386-1710

8550 W. Roosevelt Avenue
Visalia, California 93291
Phone: (559)651-4016
Fax: (559) 651-4160

Visit us online at: www.hardi-us.com

337 Sovereign Rd.
London, Ontario N6M 1A6
Phone: (519) 659-2771
Fax: (519) 659-2821

Sincerely,

A handwritten signature in black ink, appearing to read "Rex R. Guthland".

Rex R. Guthland
President

Operator safety



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



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



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

General info

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 is certified to use spray equipment. Adhere to the law.



The tractor P.T.O. should never exceed 540 r.p.m. as there is grave danger of causing the air kit to explode.



Wear protective clothing.



Rinse and wash equipment after use and before servicing.



Never service or repair the equipment while it is operating.



Always replace all safety devices or shields immediately after servicing.



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



Wash and change clothes after spraying. Wash tools if they have become contaminated.



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



Keep children away from the equipment.



Pressure test with clean water prior to filling with chemicals.

2 - Safety notes



Keep away from the air inlet and outlet while the fan is on. Some objects (small stones, etc.) may be expelled by the fan.



Do not attempt to enter the tank.



Tractor driver's seat is the intended working place during operation.



No persons are allowed in the operations area of the sprayer.

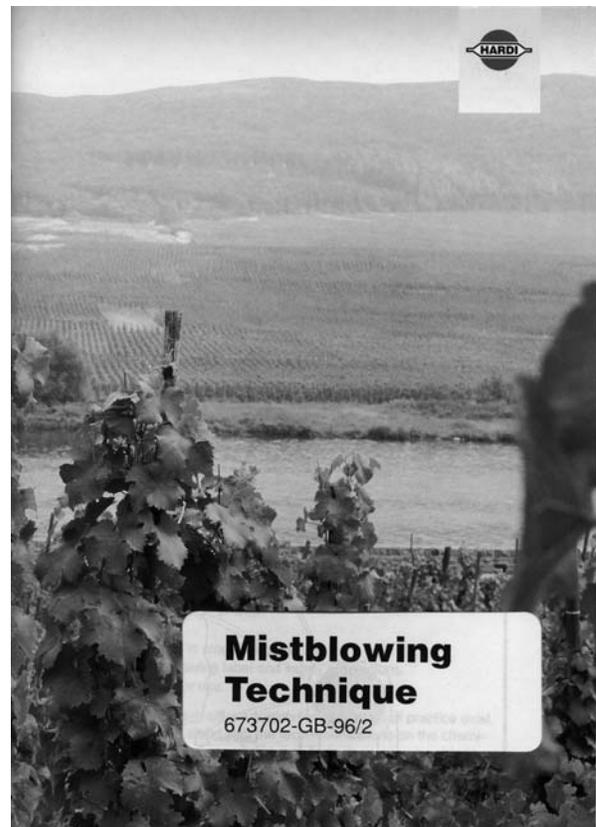


If any portion of this instruction book remains unclear after reading it, contact your HARDI® dealer for further explanation before using the equipment.

The safety and efficiency of this machine depends entirely on the care it receives. The first important step is to read carefully and pay attention to this instruction manual which contains essential information on the efficient use and maintenance of this high quality product.

As this instruction manual includes all the HARDI® ZENIT axial, pneumatic and hydropneumatic models, please pay special attention to the paragraphs dealing with the model you have acquired.

This manual should be read along with that of "Mistblowing Technique" (provided with the equipment) so that you can obtain the best possible results.



This product line is very versatile due to the large range of optional extras available and their possible combinations. The most commonly used technical data for air flow, power consumption and directions, is included in this manual. Please contact your nearest HARDI® dealer if you need additional information.

Local poison information center



If you live anywhere in the United States, the following toll free number will connect you to your Local Poison Information Center.

PHONE NO. 1 - 800 - 222 - 1222



If you live outside the United States, find the number for the poison control center in your phone book and write it in the space below:

PHONE NO. _____ - _____ - _____



Keep a list, in the space provided below, of all the chemicals that you have in use.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

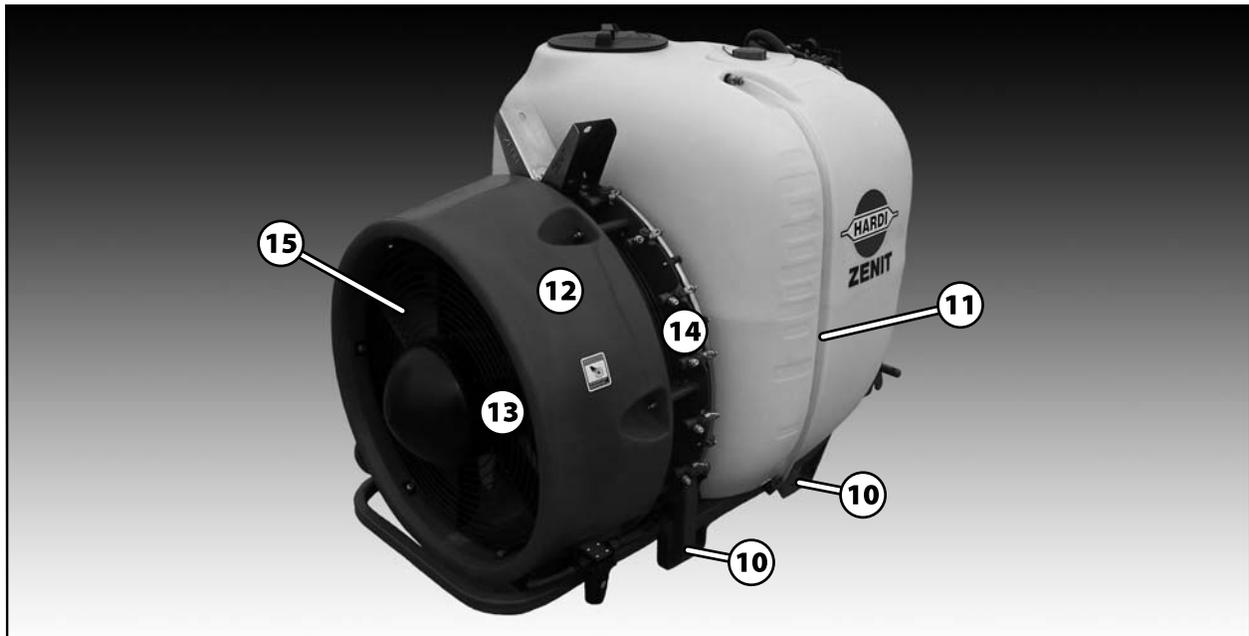
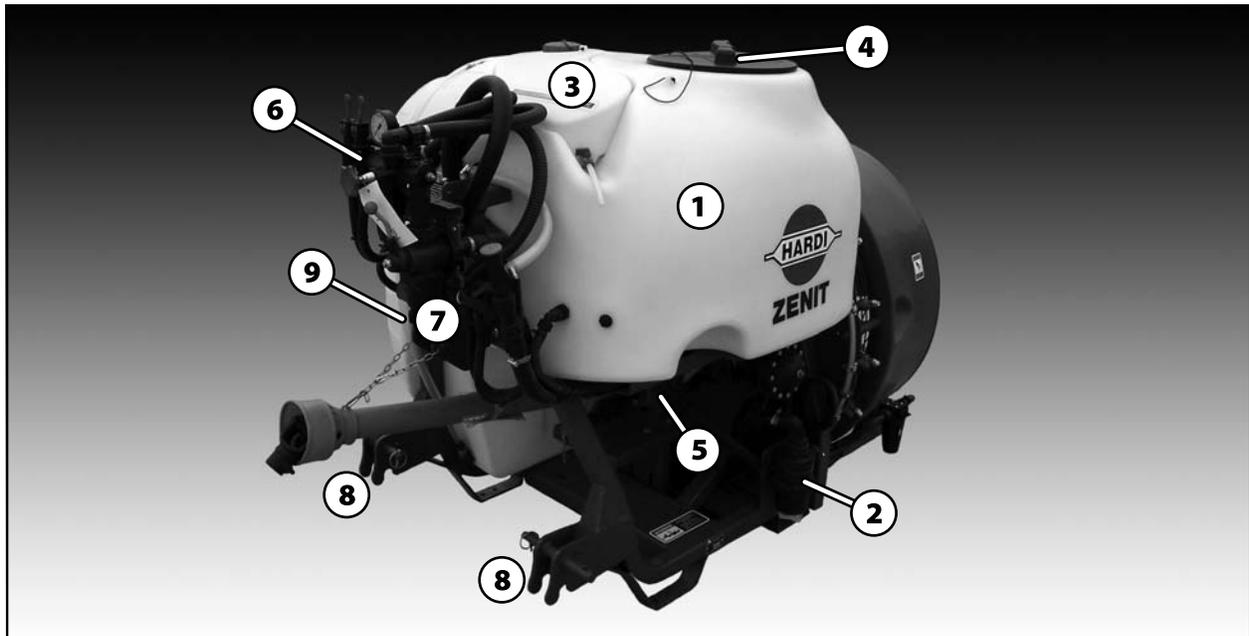
9. _____

10. _____

2 - Safety notes

General info

General View - Zenit with Axial Fan



- | | |
|------------------------------|--------------------------|
| 1. Main tank | 9. Front level indicator |
| 2. Suction filter | 10. Support legs |
| 3. Clean water tank | 11. Side level indicator |
| 4. Main tank lid | 12. Fan housing |
| 5. Pump | 13. Air inlet guard |
| 6. Operating unit | 14. Air outlet guard |
| 7. 3-point hitch upper link | 15. Fan |
| 8. 3-point hitch lower links | |

3 - Description

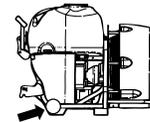
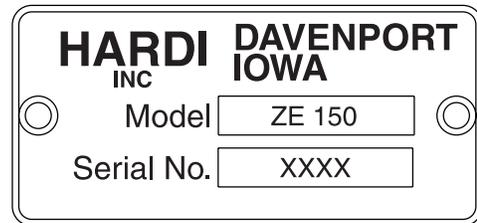
Use of the ZENIT sprayer

The HARDI® ZENIT sprayer is designed for the application of chemical crop protection products and liquid fertilizers. This equipment may only be used for this purpose. Using the sprayer for any other purpose is not allowed.

Even if no local law requires that the operator must be certified to use the spray equipment, it is strongly recommended to be trained in correct plant protection and in safe handling of plant protection chemicals to avoid unnecessary risk for persons and the environment when doing the spray job.

Identification plates

The serial number plate is riveted onto the left hand side of the frame, indicating the make, model and serial number of the sprayer.



Frame

The frame is manufactured with a tubular profile which provides great durability and resistance to breakages and vibrations. To protect it from corrosion, it is sanded down and covered with a layer of special paint that contains a polyurethane bi-component with anti-corrosion additives and protection against ultraviolet rays.

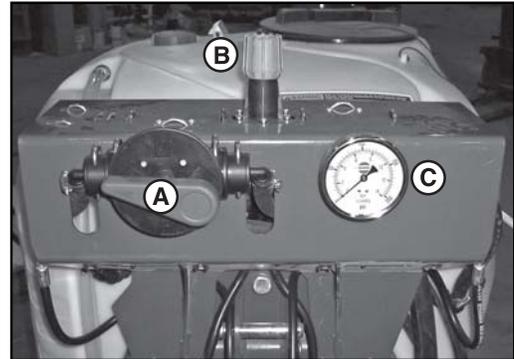
Tank

The tank is made of medium-density polyethylene with ultraviolet filters, it has smooth, rounded surfaces that facilitate agitation and cleaning. Range of volumes: 105 gal. (400 Liters) and 155 gal. (600 Liters).

Liquid system

HC/1 or HC/2 Hydraulic control

The HC/1 or HC/2 hydraulic control consists of a MANIFOLD valve (A) for operating agitation and the powder mixer, a manual pressure regulator (B) with built-in safety valve, and a manifold pressure gauge (C). The blower nozzles are operated with hydraulically controlled section valves using the tractor hydraulics. All of these controls are conveniently mounted in the control bracket located on the front of the sprayer.



Valves and symbols

The MANIFOLD valve is equipped with symbol decals located on the disc for easy identification and operation. A function is activated by turning the handle towards the desired function symbol.



ATTENTION! Only the function in use should be open - always close valve when function is no longer needed.

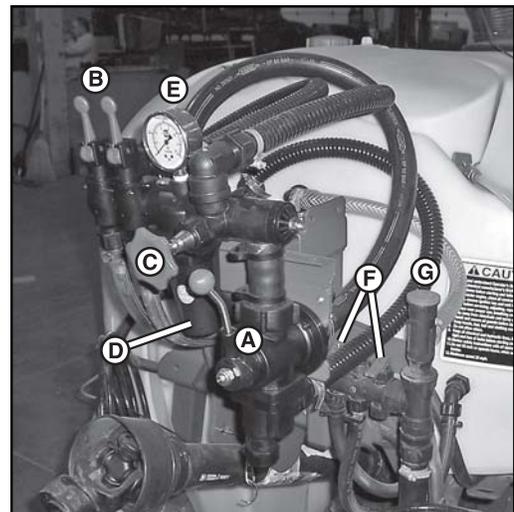


ATTENTION! If a MANIFOLD valve is too tight to operate - or too loose (= liquid leakage) - the valve needs to be serviced. Please see the "Maintenance" section for further information.

BK/2 Manual control

The BK/2 manual control consists of a Master On/Off valve (A), blower nozzle distribution valves (B) with pressure equalization, manual pressure adjustment valve (C), pressure filter (D), 2-1/2" pressure gauge (E) and HARDI-MATIC. The HARDI-MATIC is a mechanical rate controller that ensures a constant volume of spray solution per acre at varying speeds in the same gear.

Agitation and the powder mixer are operated with the distribution valves (F) located next to the safety valve (G).



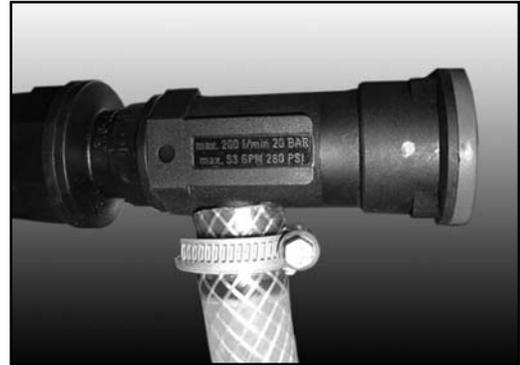
3 - Description

Safety valve (BK units)

The safety valve acts like a fuse when the circuit carries out an operation that causes a sudden increase in pressure.

This valve normally keeps the return to tank in a closed position by way of a spring and washer. When the amount of pressure in the circuit is above the maximum allowed for the valve, this opens and allows the flow to return.

The valve opens at 220 psi (15 bar).



Do not remove the safety valve from the liquid circuit as this could put your safety at risk.

Pump

Diaphragm pump with 2 diaphragms, model 321, with easily accessible valves and diaphragms. Standard = 540 r.p.m (6 splines).

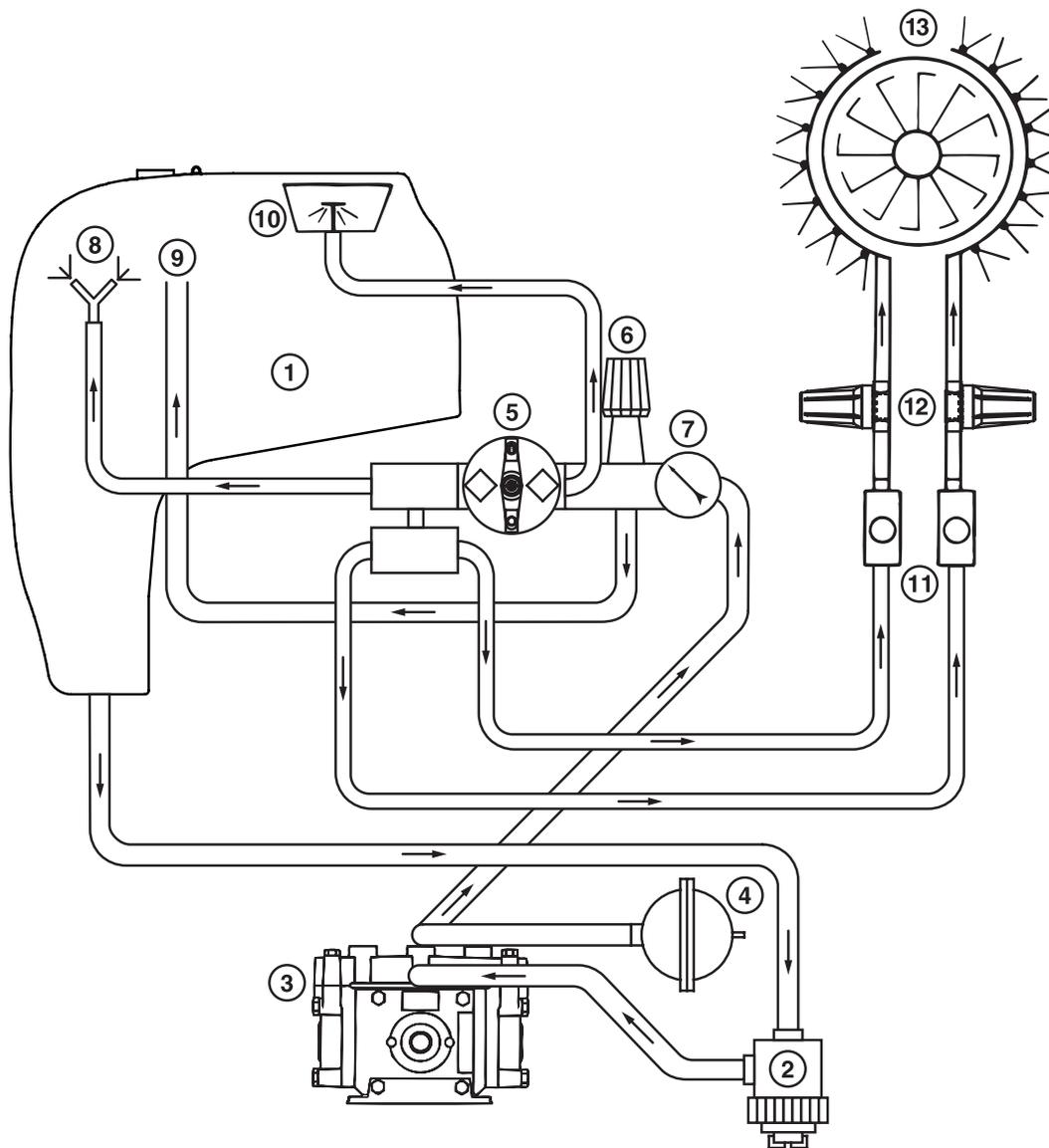
Pressure damper

To avoid the vibrations caused by pressure pulses in the liquid circuit, the 321 pumps are fitted with a pressure damper. The air pressure in the damper is preset at the factory. If adjustment is desired, see "Operation" section for adjustment procedures.



3 - Description

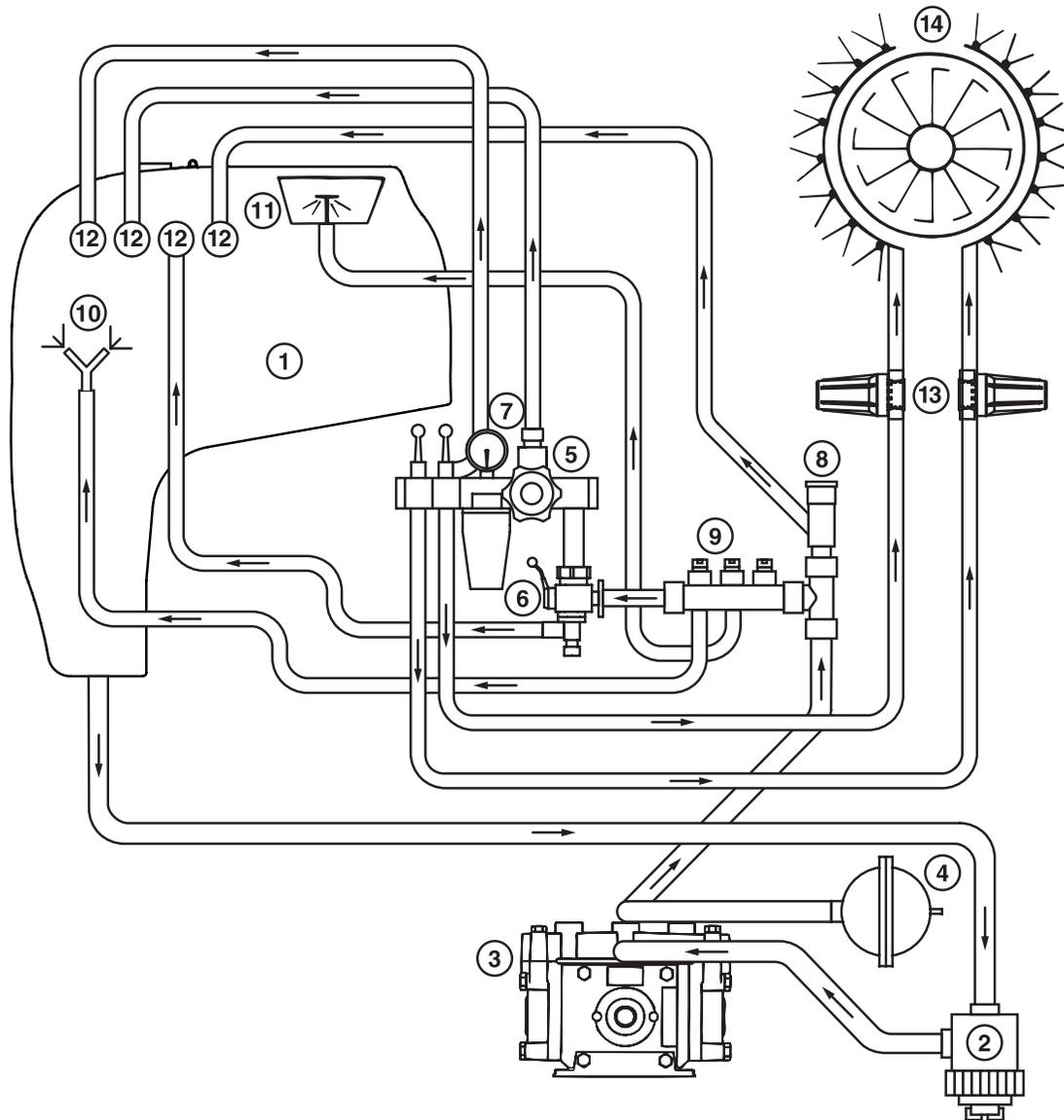
Diagram - HC/2 Hydraulic controls



- | | |
|------------------------------------|-------------------------------------|
| 1. Main tank | 8. Agitation |
| 2. Suction filter | 9. Return to tank |
| 3. Pump | 10. Powder mixer |
| 4. Pressure damper | 11. Hydraulic remote section valves |
| 5. Agitation/Powder mixer valve | 12. Pressure filters |
| 6. Pressure Regulator/Safety valve | 13. Blower nozzles |
| 7. Manifold pressure gauge | |

3 - Description

Diagram - BK manual control



- 1. Main tank
- 2. Suction filter
- 3. Pump
- 4. Pressure damper
- 5. BK Operating unit
- 6. Main On/Off valve
- 7. Manifold pressure gauge
- 8. Safety valve
- 9. Agitation/Powder mixer valves
- 10. Agitation
- 11. Powder mixer
- 12. Returns to tank
- 13. Pressure filters
- 14. Blower nozzles

Axial blower unit

Axial fan - Technical information

The axial fans on HARDI® ZENIT sprayers have been designed with composite blades. Their aerodynamic design offers a higher quantity and better distribution of air, less noise and less power consumption. They include a centrifugal clutch for smoother starting and stopping.

Flow levels for the AG820 (32") fan can achieve 23,500 cfm (40,000 m³/h) depending on the adjustments made to its components.

 **DANGER!** The tractor P.T.O. should never exceed 540 r.p.m. as there is grave danger of causing the air kit to explode.

 **DANGER!** Keep away from the air inlets and outlets while the fan is on. Some objects may be expelled from the air outlet or a piece of cloth could be sucked into the air inlet.

The blower unit is the most dangerous part of the machine. Do not try to change any of the parts without consulting your nearest dealer beforehand. Adjusting blower units in order to change their characteristics should only be done by qualified people.

Protection guards

On all axial blower unit models, there are protection guards. They are fundamental for avoiding accidents and stopping foreign objects from getting inside the fan.

 **DANGER!** Use of the air kit without protection guards is not permitted.

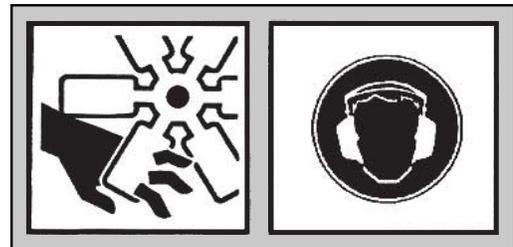
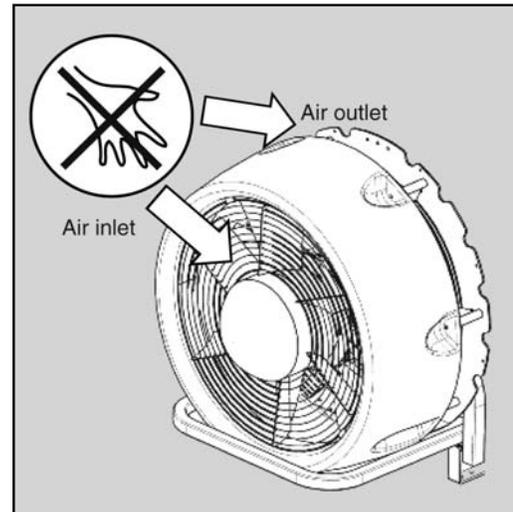
 **DANGER!** Do not take the protection guards off the equipment while it is in use.

 **DANGER!** Do not go near the fan when the equipment is in use if you are wearing light or loose clothing.

 **DANGER!** Never put foreign objects inside the fan via the guard, regardless of whether it's in use or not.

 **DANGER!** If you notice vibrations or hammering, turn the fan off immediately.

 **DANGER!** Protect your ears from the fan noise by wearing appropriate hearing protection.



3 - Description

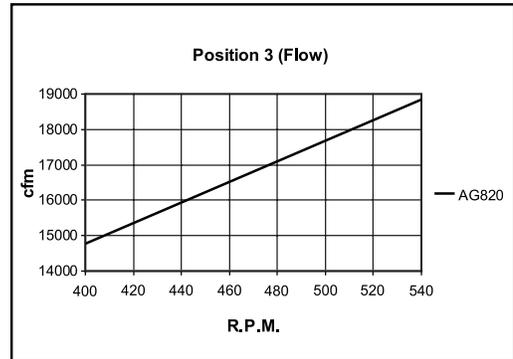
Air flow and power consumption

The following graphs show the air flow supplied by the fan and its power consumption. This result can be obtained using two possible blade positions, namely the 3rd and 4th. See "Sprayer Setup" section: "Adjusting the Fan".

Blades in position 3:

Flow

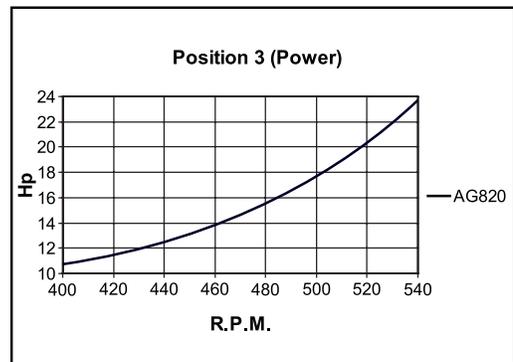
These results have been calculated when the fan is in top gear (high). To work out the results in first gear, decrease the values by 15%.



Blades in position 3:

Power consumption

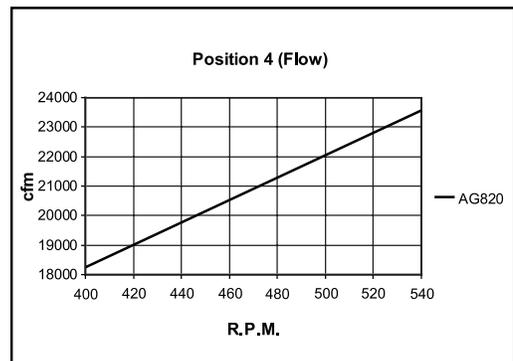
These results have been calculated when the fan is in top gear (high). To work out the results in first gear, decrease the values by 45%.



Blades in position 4:

Flow

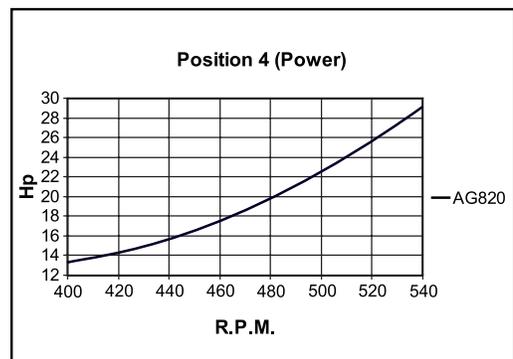
These results have been calculated when the fan is in top gear (high). To work out the results in first gear, decrease the values by 15%.



Blades in position 4:

Power consumption

These results have been calculated when the fan is in top gear (high). To work out the results in first gear, decrease the values by 45%.



Gear box

The gear box situated in the air kit is one of the mechanical elements which works the most. The AG280 (32") axial air kits on the Zenit sprayer are equipped with two speed gear boxes.

The gear box for the AG820 (32") air kit has two speeds. The speed ratio is as follows:

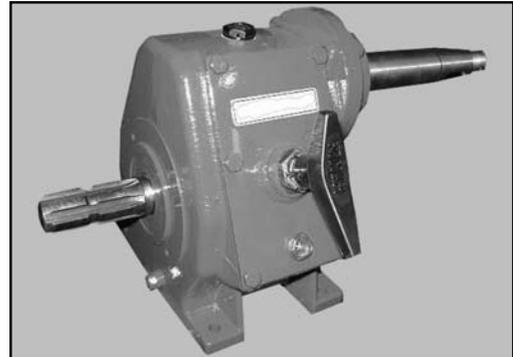
AG820

1st speed = $1/3.69$

2nd speed = $1/4.36$

The capacity is 44 oz. (1.3 Liters) of oil for cooling and lubrication. Use synthetic SAE 30 oil.

See "Maintenance" for how frequently the equipment needs to be checked.



3 - Description

Centrifugal blower unit

Centrifugal turbine - Technical information

The centrifugal turbines on HARDI® ZENIT sprayers have been designed with galvanized steel. Their aerodynamic design offers a higher quantity and better distribution of air, less noise and less power consumption. They include a centrifugal clutch for smoother starting and stopping.

Flow levels for the P540 (22") fan can achieve 6,500 cfm (11,000 m³/h).

 **DANGER!** The tractor P.T.O. should never exceed 540 r.p.m. as there is grave danger of causing the air kit to explode.

 **DANGER!** Keep away from the air inlets and outlets while the fan is on. Some objects may be expelled from the air outlet or a piece of cloth could be sucked into the air inlet.

The blower unit is the most dangerous part of the machine. Do not try to change any of the parts without consulting your nearest dealer beforehand. Adjusting blower units in order to change their characteristics should only be done by qualified people.

Protection guards

On all pneumatic blower unit models, there are protection guards. They are fundamental for avoiding accidents and stopping foreign objects from getting inside the fan.

 **DANGER!** Use of the air kit without protection guards is not permitted.

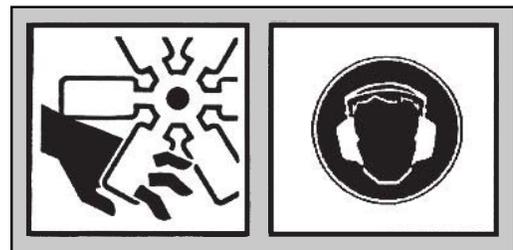
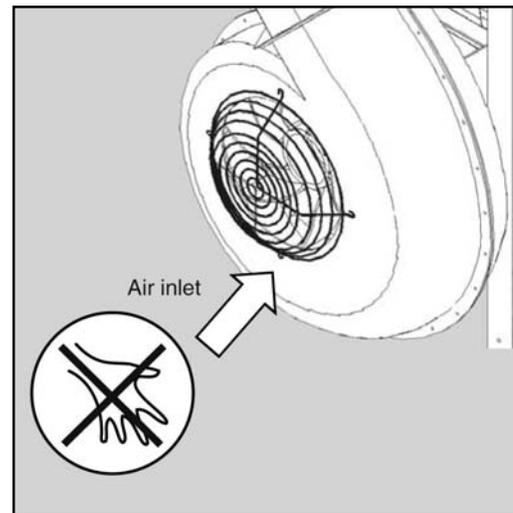
 **DANGER!** Do not take the protection guards off the equipment while it is in use.

 **DANGER!** Do not go near the fan when the equipment is in use if you are wearing light or loose clothing.

 **DANGER!** Never put foreign objects inside the turbine via the guard, regardless of whether it's in use or not.

 **DANGER!** If you notice vibrations or hammering, turn the fan off immediately.

 **DANGER!** Protect your ears from the fan noise by wearing appropriate hearing protection.



3 - Description

Gear box

The gear box situated in the air kit is one of the mechanical elements which works the most. The P540 (22") air kits on the Zenit sprayer are equipped with two speed gear boxes.

The gear box for the P540 (22") air kit has two speeds. The speed ratio is as follows:

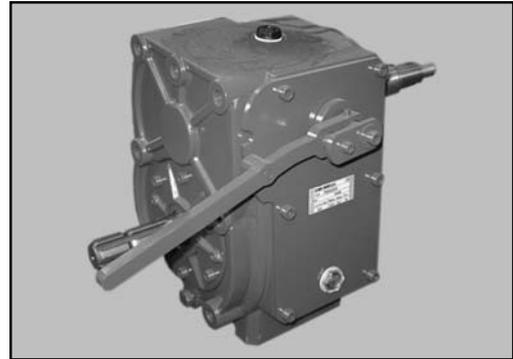
P540

1st speed = 1/5.7

2nd speed = 1/6.6

The capacity is 59 oz. (1.75 Liters) of oil for cooling and lubrication. Use synthetic SAE 30 oil.

See "Maintenance" for how frequently the equipment needs to be checked.



Pneumatic system

The pneumatic system is low pressure and takes advantage of the high air speed in the spout to break up the spray film and create a very fine mist that includes some turbulence. The atomizers in the spout spread the mist uniformly in the shape of a fan.

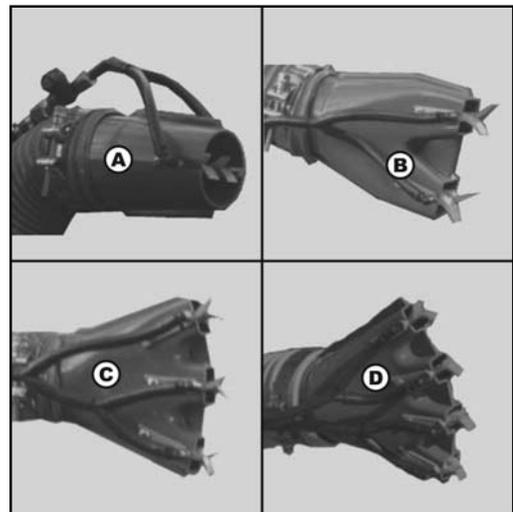
There are four types of spouts which make up the boom configuration you may have on your sprayer.

A - Cannon with one outlet.

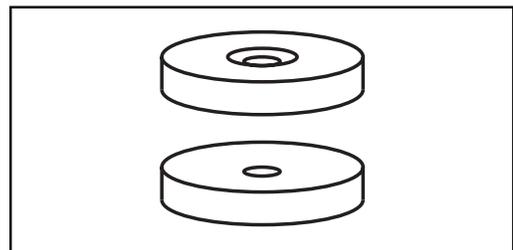
B - Spout with 2 outlets.

C - Spout with 3 outlets.

D - Spout with 4 outlets.



ATTENTION! For this system, ceramic discs are used to determine the flow rate. This type of disc has two possible positions. If the disc is placed so that the flow goes in through the cone-shaped side, the nozzle will give out more flow than if it is placed so that flow goes in through the flat side.



3 - Description

Hydro-pneumatic system

The hydro-pneumatic system is medium to high pressure. This system takes advantage of the great amount of turbulence in the cone-shaped, low-volume nozzle and distributes the sprayed mist correctly. The air enters the spout at high speed and spreads the mist in the shape of a fan.

The ZENIT sprayer uses spouts with three nozzles.

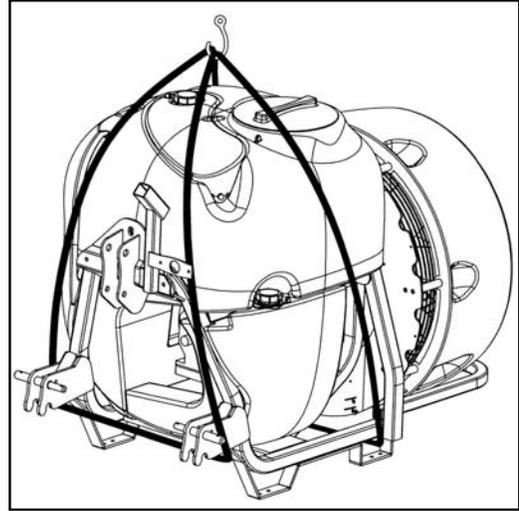


General info

Unloading the sprayer from the truck

When unloading with an overhead lifting device, please observe the lifting points as shown in the picture, and make sure that the straps or belts used for lifting are strong enough.

If using a forklift, be careful not to damage the fittings at the bottom of the tank.



Before putting the sprayer into operation

Although the sprayer has been applied with a strong and protective surface treatment on steel parts, bolts etc. in the factory, it is recommended to apply a film of anticorrosion oil (e.g. CASTROL RUSTILLO or SHELL ENSIS FLUID) on all metal parts in order to avoid chemicals and fertilizers discoloring the enamel. If this is done before the sprayer is put into operation for the first time, it will always be easy to clean the sprayer and keep the enamel clean for many years. This treatment should be carried out every time the protection film is washed off.

Transmission shaft - Operator's safety

1. 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.
2. When attaching the shaft, make sure that the snap lock is FULLY ENGAGED - push and pull shaft until it locks.
3. Always keep protection guards and chains intact and make sure that it covers all rotating parts, including CV-joints at each end of the shaft. Do not use without protection guard.
4. Do not touch or stand on the transmission shaft when it is rotating - safety distance: 5' (1.5 meter).
5. Prevent protection guards from rotating by attaching the chains allowing sufficient slack for turns.
6. Make sure that protection guards around tractor P.T.O. and implement shaft are intact.
7. Always STOP ENGINE and remove the ignition key before carrying out maintenance or repairs to the transmission shaft or implement.



DANGER! ROTATING TRANSMISSION SHAFTS WITHOUT PROTECTION GUARDS ARE FATAL.

4 - Sprayer setup

Mechanical connections

Transmission shaft - Installation

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

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



WARNING! Make sure the transmission shaft fits properly the first time it is installed to prevent damage to the sprayer or tractor.



WARNING! The shaft must always have an overlap (A) of a minimum of 1/3 the length.

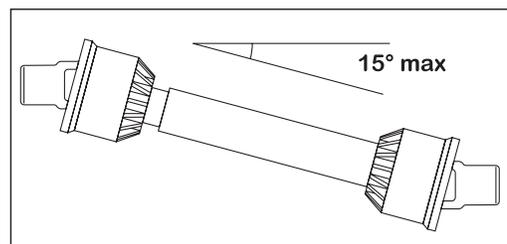
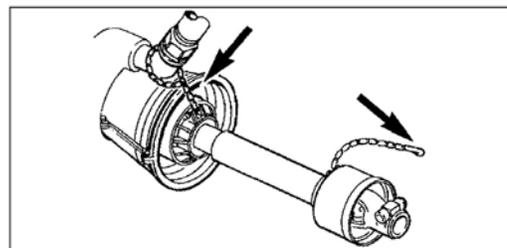
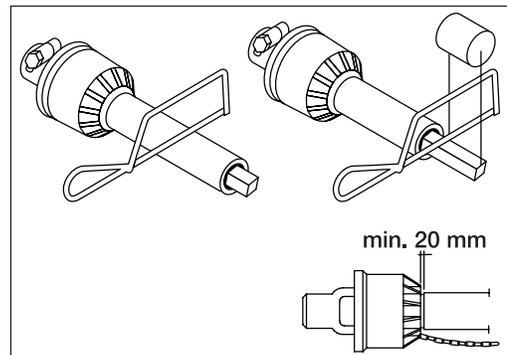
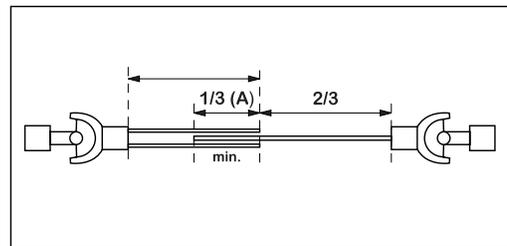
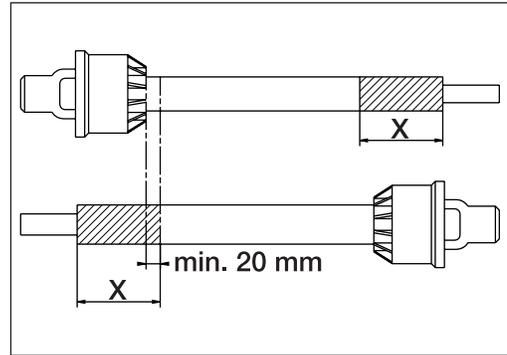
4. The two parts are shortened equally. Use a saw, and file the profiles afterwards to remove burrs.
5. Grease the profiles and assemble male and female parts again.
6. Fit the shaft to tractor P.T.O. and sprayer pump shaft.



ATTENTION! Female part marked with a tractor towards tractor!

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

8. To ensure long life of the transmission shaft, try to avoid working angles greater than 15°.



Hydraulic systems

General info

Ensure that snap couplers are clean before connection!

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



DANGER! Test of the hydraulic system should be done very cautiously. There may be air trapped in the system which can cause violent movements of the CANNON spout (optional).



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

Hydraulic requirements for HC/1 or HC/2 controls

The tractor hydraulic system requires:

Two single acting hydraulic outlets (one for each hydraulically controlled section valve).

Hydraulic requirements for B20 Hydraulic boom

The tractor hydraulic system requires:

One double acting hydraulic outlet for the lift cylinder.

One double acting hydraulic outlet for individual folding with 4 x 1 multiplier for hydraulic section valves (optional).

The 4 x 1 multiplier kit must be installed before first use (follow the instructions included with the kit). The 4-switch handle needs to be attached to a double acting hydraulic lever on the tractor. The electric switches are used with the hydraulic lever to control the left and right fold functions of the boom as well as the two hydraulically controlled section valves.

Hydraulic requirements for CANNON spout

The tractor hydraulic system requires:

One double acting hydraulic outlet for the 180° turning function of the spout.

One double acting hydraulic outlet for the lift cylinder.

4 - Sprayer setup

Air systems

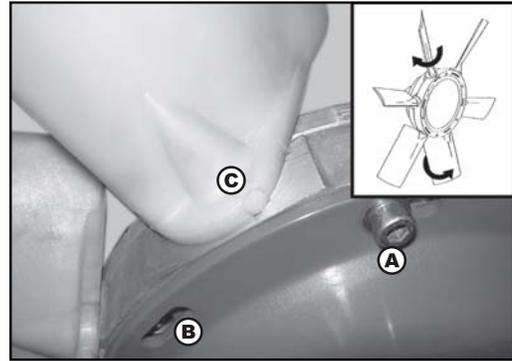
Adjusting the fan (axial system only)

The angle of the fan blades can be adjusted to 4 positions. They are normally factory set to position 3.

Decreasing the angle of the blades (minimum angle, position 1) lessens the flow and decreases power consumption. By increasing the angle (maximum angle, position 4) the flow increases, but so does the power consumption. In this way, the sprayer can adapt both to the different applications as well as the power of the tractor.

To change the position of the angle of the fan blades, you should follow these steps:

1. Take off the suction guard.
2. Loosen the Allen screws (A) without taking them out completely.
3. Loosen the Allen screws (B) holding the nut at the back of the fan.
4. With both hands on opposite blades, turn them to the position wanted between 1 and 4. All the blades should turn at the same time.
5. Finally, make sure all blades are in the same position (C) before tightening the Allen screws (A) and (B).



Booms

Technical information

The ZENIT sprayer equipped with a pneumatic blower unit can be attached to the B-11 fixed boom. This boom can be adapted to several different spout combinations, depending on whether it is a pneumatic or hydro-pneumatic air system.

B11 - Fixed boom

This type of boom is for treating one complete row. The spouts are totally adjustable as far as height and inclination is concerned. Loosen the screws on the spout supports and adapt the height and width. In order to direct the spout to the area to be treated, it can be rotated.

The three available spraying systems can be used with this boom.



B20 - Manual boom

This type of boom is for treating four row sides or two complete rows. The spouts are totally adaptable to the type of crop. Loosen the screws on the spout supports and adapt the height and width. In order to direct the spout to the area to be treated, it can be rotated.

The left and right side booms can be opened and closed manually.



B20 - Hydraulic boom

This type of boom is for treating four row sides or two complete rows. The spouts are totally adaptable to the type of crop. Loosen the screws on the spout supports and adapt the height and width. In order to direct the spout to the area to be treated, it can be rotated.

The entire boom is raised and lowered hydraulically. The left and right side booms are opened and closed hydraulically.



4 - Sprayer setup

Booms

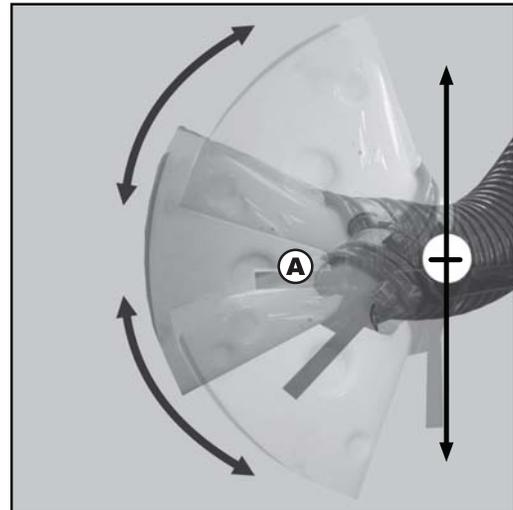
Technical information

The ZENIT sprayer that is equipped with a pneumatic system can be assembled with the B11 Fixed boom. Several different combinations of air spouts can be used, depending on whether it is the pneumatic or hydro-pneumatic air system.

B11 Fixed boom

This boom type is for treating one complete row. The spouts are totally adjustable as far as height and inclination is concerned (A).

The spouts can be totally adapted to the type of crop, either for treatment in specific areas or a generalized treatment.



B20 Manual and Hydraulic boom

This type of boom is for treating four row sides or two complete rows. The spouts are totally adjustable as far as height and inclination is concerned.

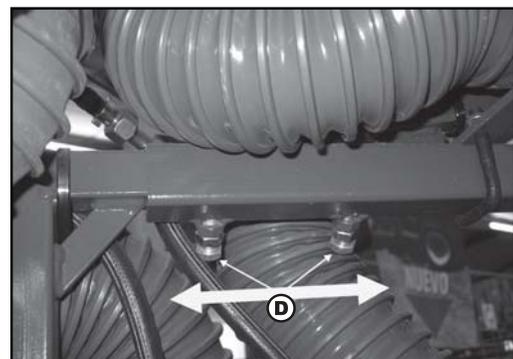
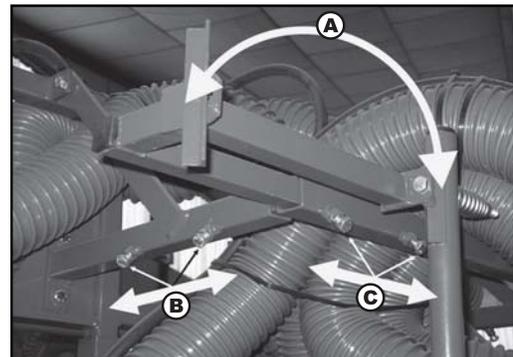
By adjusting bracket (A), it is possible to place the spouts closer or further away from the row, depending on how dense the crop is.

By adjusting bracket (B), it is possible to move all the spouts on the back forwards or backwards.

By adjusting bracket (C), it is possible to place the spouts closer or further away from the row, depending on how dense the crop is.

The spouts can be totally adapted to the crop type, either for treatment in specific areas, or a generalized treatment.

By adjusting bracket (D), it is possible to place the external spouts closer or further away from the row, depending on how dense the crop is.



5 - Operation

B20 Hydraulic boom operation

The hydraulically activated section valves and boom fold functions are operated with one hydraulic lever on the tractor using the 4 x 1 multiplier kit. Connect the two hoses from the 4 x 1 multiplier to the double acting outlet on the tractor that has the electric 4-switch handle installed to the hydraulic lever (see Sprayer setup section).

The lift function of the boom is operated with a separate hydraulic lever. Connect the lift cylinder hydraulic hoses to any available double acting outlet on the tractor.

The boom is raised and lowered using the hydraulic lever connected to the lift cylinder.

The left or right boom is unfolded by pressing the left or right boom fold switch* on the 4-switch handle and pushing the lever one way. The boom is folded back in by pressing the same switch and pushing the lever the other way.

The left or right blower nozzles are turned "On" by pressing the left or right section switch* on the 4-switch handle and pushing the hydraulic lever one way. The section is turned "Off" by pressing the same switch* on the 4-switch handle and pushing the lever the other way. The hydraulic lever can be returned to the neutral position after switching "On" or "Off".

If you do not like the direction required to activate a function, switch positions of the hoses in the double-acting outlet for the 4 x 1 multiplier.

* The function of each of the 4 switches on the handle for the hydraulic lever is determined by how it is originally installed (see Sprayer setup section).

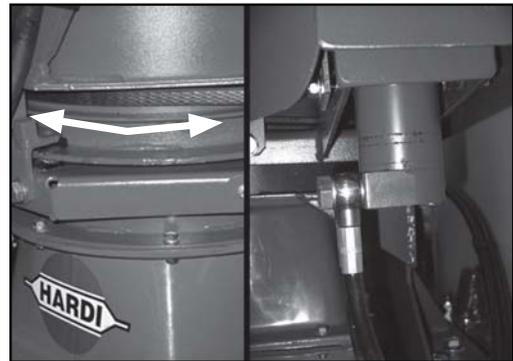


Hydraulic movements of the CANNON model

The lifting cylinder is controlled via a double acting outlet on the tractor and allows the CANNON to go from a horizontal position to a vertical one between -10° to 80° .



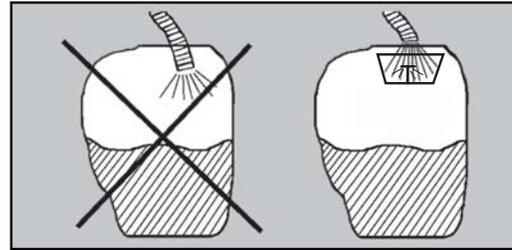
For a 180° rotation, another double acting outlet is necessary. This movement enables you to carry out the treatment on one side or the other of the CANNON, regardless of the direction the tractor is going.



Liquid and air system

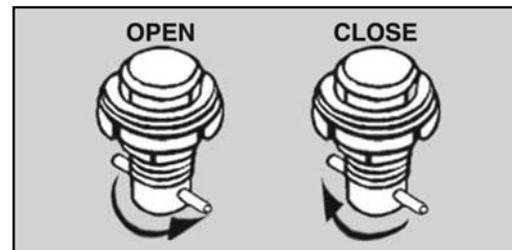
Filling through tank lid

Water is filled into the tank by removing the tank lid located on top of the sprayer tank. It is recommended to use water as clean 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 lowered into the tank and the water pressure drops at the water supply, chemicals may be siphoned back and contaminate the water supply lines and source.

To empty the tank, turn the pin on the drain valve located at the bottom of the tank. To close the drain valve, turn the pin back in the opposite direction.



Powder mixer

The powder mixer is used to rinse the filter basket when adding powdered products that do not dissolve properly and would otherwise form lumps on contact with water in the tank.

For operating instructions, see the controls section specific to your sprayer (e.g. HC/2, BK/2).



ATTENTION! After use, the powder mixer should be turned off as it uses a large amount of the available flow.



Filling of clean water tank

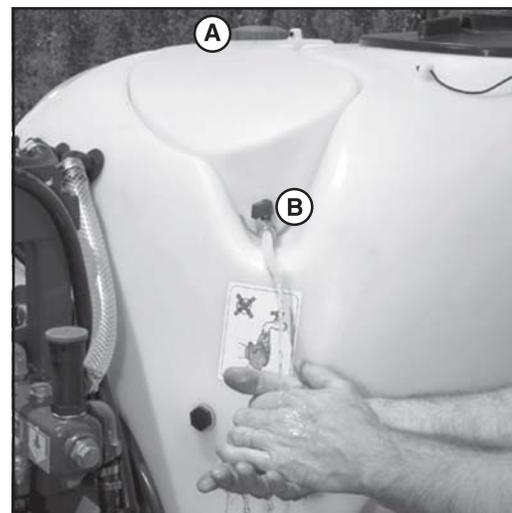
A clean water tank is integrated into the top of the main tank. Remove tank lid A, fill with clean water and replace tank lid.

For use of water, turn the ball valve lever B to open tap. The ball valve is located at the bottom of the clean water tank on sprayer's left side. The water from this tank is for hand washing, cleaning of clogged nozzles, etc. Only fill the clean water tank with clean water.

Capacity: 4 gal. (15 liters).



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



5 - Operation

Diaphragm pump

The maximum number of revolutions when in use is 540 rpm. The diaphragm pump is self-priming and can be run dry without damage.



WARNING! Make sure the pump is properly greased before operating the sprayer.

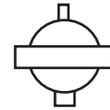
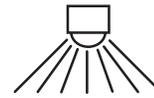


ATTENTION! See "Maintenance" section for how frequently the pump needs to be checked.



Pressure damper adjustment

The air pressure in the damper on the HARDI® diaphragm pump is factory preset at 30 psi (2 bar). This is suitable for nozzle spray pressures between 45 and 220 psi (3 and 15 bar). If different nozzle pressures are required, set pressure damper at pressures indicated.



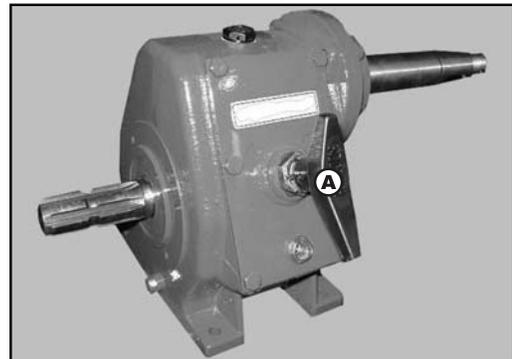
PSI (BAR)	PSI (BAR)
20-45 (1-3)	0-15 (0-1)
45-220 (3-15)	15-45 (1-3)
220-360 (15-25)	45-60 (3-4)

Gear Box

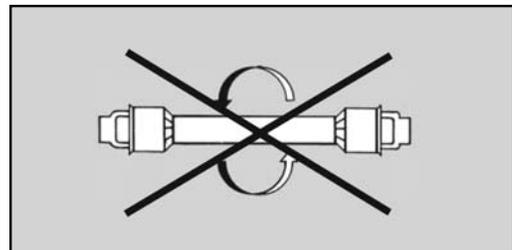
When working with the liquid circuit only, it is not necessary for the fan to be on. Therefore, it is advisable to put the gear box in the neutral (off) position.

The gear box is behind the pump. When the gear lever (A) is in the middle position, the gear box is in neutral.

If you cannot get the gearbox into gear because of interference between the teeth and sprockets, engage the PTO for a few seconds and try again.



WARNING! Both the pump and fan should be at a complete stop before attempting to change gears in the gear box.



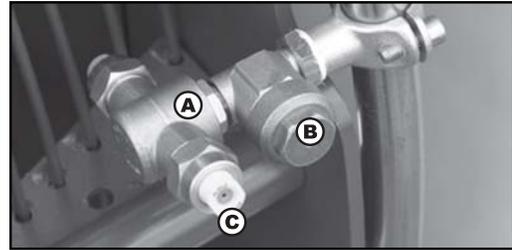
5 - Operation

Nozzles

The standard nozzle holders included in axial air kits are made of brass (A). They can be closed individually by turning them 90°. When open, they have a range of +/- 15° to vary their inclination. They are fitted with a non-drip valve (B) to avoid the loss of chemical product that remains in the lines when the different sections are shut off.

The nozzles (C) are turbulence (also known as ATR) nozzles. They are color-coded and their pressure ranges from 70 to 215 PSI (5 to 15 bar).

This type of nozzle can also be used with hydro-pneumatic equipment.



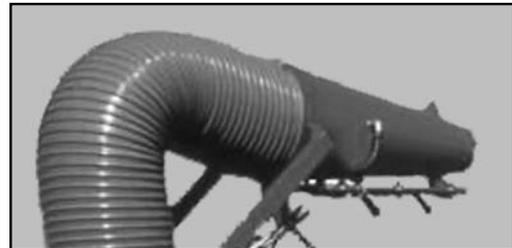
ATTENTION! It is not advisable to go over 215 PSI (15 bar) with ATR nozzles as the drops would be far too small and the product could evaporate in high temperatures or be carried off by the breeze or wind.

The pneumatic system is fitted with ceramic calibrated discs. This type of disc has two possible positions. If the disc is placed so that the flow goes in through the cone-shaped side, the nozzle will give out more flow than if it is placed so that flow goes in through the flat side.

The function of these nozzles in the pneumatic system is to control the amount of flow needed to break up the spray film. The pressure ranges in the pneumatic system range from 0 to 60 PSI (0 to 4 bar).



The CANNON model has a spout made of polyester and is only fitted on a pneumatic system. It includes 4 bi-jet holders with two nozzles each. Also included are three adjustable nozzles outside the spout which allow for proper treating of nearby crops.

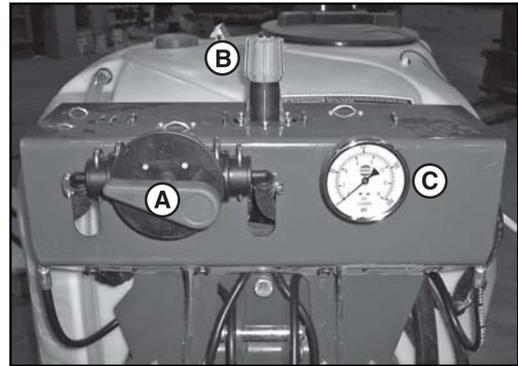


5 - Operation

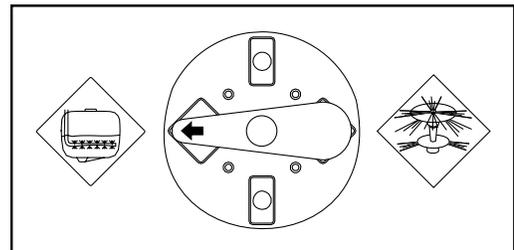
HC/1 or HC/2 Control

After filling the tank with clean water, locate your sprayer in a suitable location to spray water from the nozzles. Before starting the pump, make sure the pressure regulator valve (B) is turned all the way out (counter clockwise).

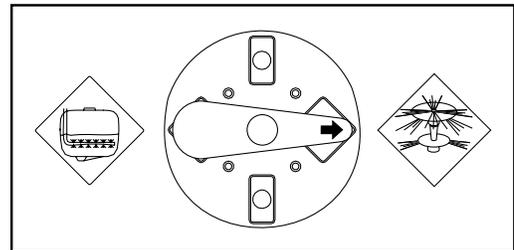
With the pump operating at 540 r.p.m., slowly turn valve (B) in (clockwise) until the desired pressure is shown on the pressure gauge (C).



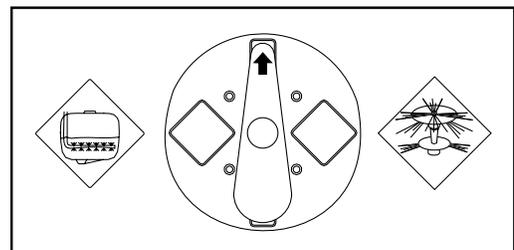
To activate pressure agitation, turn the manifold valve (A) to the left towards the agitation symbol.



To activate the powder mixer, turn the manifold valve (A) to the right towards the powder mixer symbol.



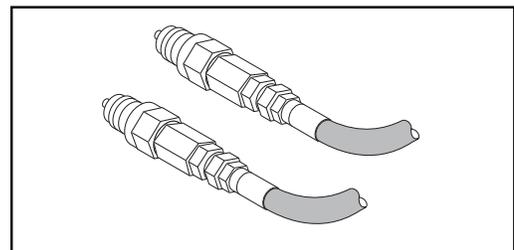
To turn off both the pressure agitation and the powder mixer, turn the manifold valve (A) straight up or down.



The left and right blower nozzles are turned on and off by the left and right hydraulic section valves.

Make sure each hydraulic hose is connected to a separate single-acting hydraulic outlet on the tractor. The nozzles for each section are turned "On" by pushing the hydraulic lever for that section in one direction, and turned "Off" by pushing the hydraulic lever for that section in the opposite direction. The hydraulic lever can be returned to the neutral position after switching "On" or "Off".

If you do not like the direction required to activate a nozzle section, switch positions of the hose in the single-acting outlet for that section.



ATTENTION! The HC/1 control for CANNON models has only one hydraulically controlled section valve.

5 - Operation

BK/2 Manual control

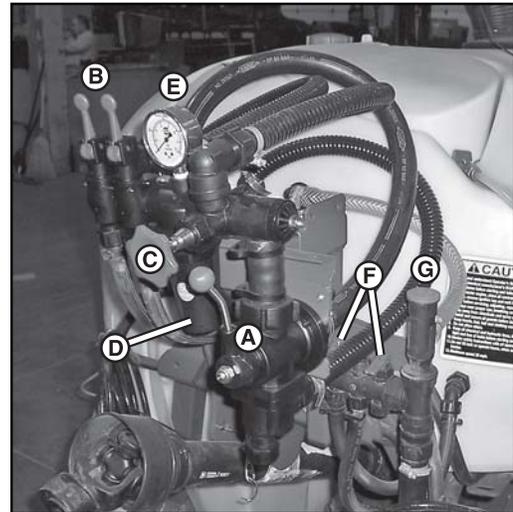
After filling the tank with clean water, locate your sprayer in a suitable location to spray water from the nozzles.

Before starting the pump, turn the main On/Off valve (A) to the "On" position ("Up" as shown) and turn the HARDI-MATIC valve (C) counter clockwise all the way out.

Open or close levers (F) depending on whether pressure agitation and/or the powder mixer is required.

Turn the left and right nozzle section valves "On" by pulling the levers (B) "Down" and towards you (the valves are shown in the "Off" position).

With the pump operating at 540 r.p.m., slowly turn the HARDI-MATIC valve (C) in (clockwise) until the desired pressure is reached on gauge (E). Note this pressure to adjust the pressure equalization valves below.

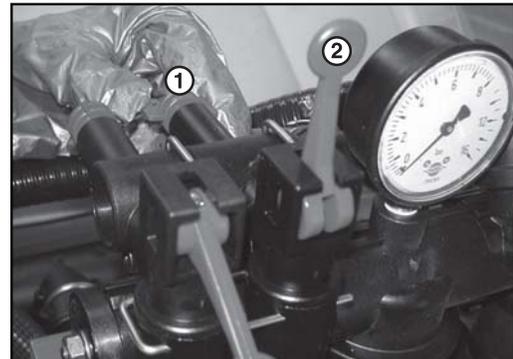


ATTENTION! The P.T.O. revolutions must be kept between 300-540 r.p.m. for the HARDI-MATIC to function properly.

Adjustment of pressure equalization

Before using the sprayer for the first time, it is necessary to adjust the constant pressure valves (1). Adjust the valves one section at a time as follows:

1. Place the first lever (2) in the "Off" position ("Up").
2. Turn the adjusting screw (1) until the pressure gauge (E) again shows the same pressure as when both valves were on (Turn the valve clockwise for higher pressure, counter clockwise for lower pressure).
3. Turn the lever (2) back to the "On" position ("Down").
4. Repeat steps 1 through 3 for the other section valve.



When properly adjusted, the pressure should remain the same whether both valves are open, or if either one of the section valves is closed.



ATTENTION! Hereafter, adjustment of the constant pressure valves will only be needed if you change to nozzles with other capacities, but not required if only changing pressure or application rate using the same nozzles.

Operating the control unit while driving

In order to shut off all nozzles, turn the "On/Off" valve (A) to the "Off" position ("Down"). This returns the pump output to the tank through the return system. The diaphragm non-drip valves ensure instantaneous closing of all nozzles.

In order to shut off one of the nozzle sections, turn the appropriate section valve lever (B) to the "Off" position ("Up"). The constant pressure device ensures that the pressure does not increase in the section which is still operating.

Safety precautions - crop protection chemicals



Always be careful when working with crop protection chemicals!



WARNING! Always wear correct protective clothing before handling chemicals!

Personal protection

Depending on chemical type, protective gear /equipment should be worn to avoid contact with the chemicals, e.g.:

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



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



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



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



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



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

5 - Operation

Cleaning

General info

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



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



ATTENTION!

Clean sprayers are safe sprayers.

Clean sprayers are ready for action.

Clean sprayers cannot be damaged by pesticides and their solvents.

Guidelines

1. Read the whole chemical label. Take note of any particular instructions regarding recommended protective clothing, deactivating agents, etc. Read the detergent and deactivating agent labels. If cleaning procedures are given, follow them closely.
2. Be familiar with local legislation regarding disposal of pesticides washings, mandatory decontamination methods, etc. Contact the appropriate department, e.g. Dept. of Agriculture.
3. 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 runoff of residue into streams, water courses, ditches, wells, springs, etc. The washings from the cleaning area must not enter sewers. Drainage must lead to an approved soakaway.
4. Cleaning starts with the calibration, as a well calibrated sprayer will ensure the minimal amount of remaining spray liquid.
5. It is good practice to clean the sprayer immediately after use and thereby render the sprayer safe and ready for the next application. This also prolongs the life of the components.
6. It is sometimes necessary to leave spray liquid in the tank for short periods, e.g. overnight, or until the weather becomes suitable for spraying again. Unauthorized persons and animals must not have access to the sprayer under these circumstances.
7. 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.

Cleaning the tank and liquid system

1. Dilute remaining spray liquid in the tank with at least 10 parts of water and spray the liquid over the crop you have just sprayed.
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 suction and pressure filters and clean. Be careful not to damage the mesh.
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 on the crop again or on the soakaway.
6. After spraying the liquid out, stop the pump and fill the tank 1/2 full with clean water. Note that some chemicals require the tank to be completely filled. Add appropriate detergent and/or deactivating agent, e.g. washing soda or Triple ammonia.
7. Start the pump and operate all controls enabling the liquid to come in contact with all the components. Leave the nozzles until last. Some detergents and deactivating agents work best if left in the tank for a short period. Check the label.
8. Drain the tank and let the pump run dry. Rinse inside of the tank, again letting the pump run dry.
9. Stop the pump. If the chemicals used have a tendency to block nozzles and filters, remove and clean them immediately.
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.



ATTENTION! It is advisable to increase the forward speed (double if possible) and reduce the pressure when spraying diluted remaining liquid on the crop just sprayed.



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



ATTENTION! If the sprayer is cleaned with a high pressure cleaner, it is recommended to lubricate the entire machine.

Cleaning and maintenance of filters

Clean filters ensure:

- Sprayer components such as valves, diaphragms and operating unit are not hindered or damaged during operation.
- Nozzle blockages do not occur while spraying.
- Long life of the pump. A blocked suction filter will result in pump cavitation. The main filter protecting sprayer components is the suction filter. Check it regularly.

Lubrication

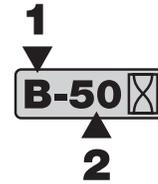
General info

Always store lubricants clean, dry and cool - preferably at a constant temperature - to avoid contamination from dirt and condensed water. Keep oil filling jugs, hoppers and grease guns clean, and clean the lubricating points thoroughly before lubricating. Avoid skin contact with oil products for longer periods.

Always follow the shown direction concerning recommended quantity. If no recommended quantity is given, feed lubricator until new grease becomes visible.

Pictograms in lubrication & oiling plans tell the following:

1. Lubricant to be used (see "Recommended lubricants").
2. Operating hours before next lubrication.



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

Recommended lubricants



A BALL BEARINGS:
Universal Lithium grease, NLGI No. 2
SHELL RETINAX EP2
CASTROL LMX GREASE

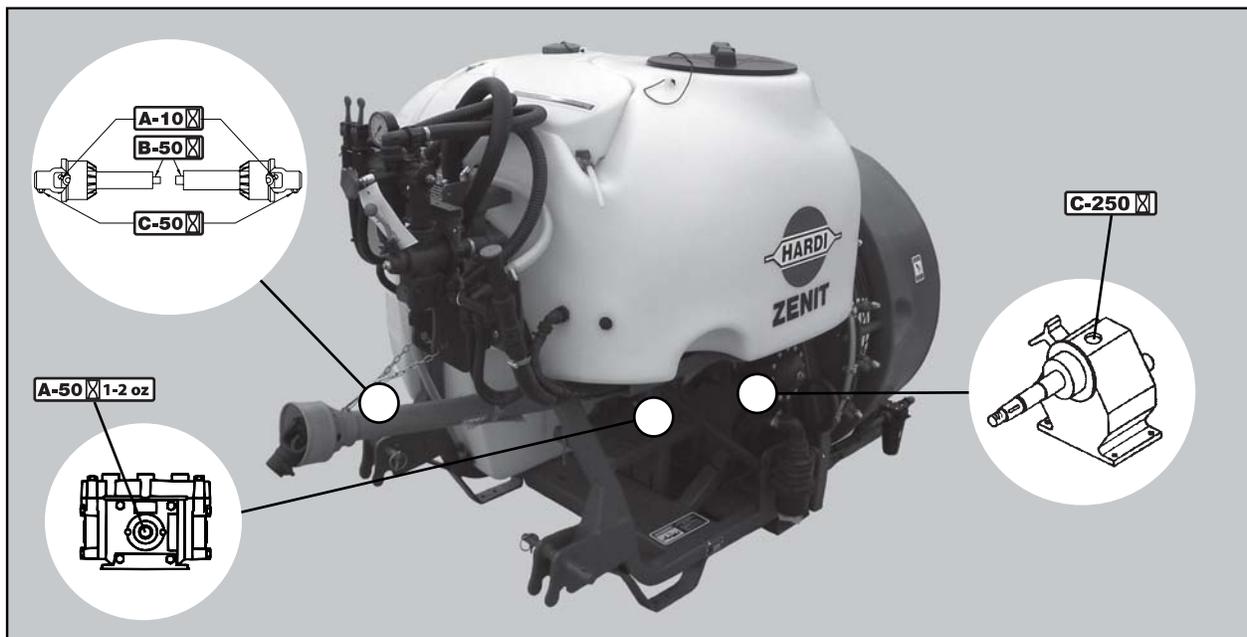


B SLIDE BEARINGS:
Lithium grease with
Molybdenumdisulphide or graphite
SHELL RETINAX HDM2
CASTROL MOLYMAX



C Oil Lubrication:
Synthetic SAE 30 oil

Lubrication & oiling plan



6 - Maintenance

Service and Maintenance intervals

After every 10 hours

1. Clean the suction filter
 2. Clean the pressure filters
 3. Clean the nozzles
 4. Check for leaks in the liquid circuit
 5. Make sure no air can get into the suction circuit
-

After every 50 hours

1. Carry out the maintenance mentioned above
 2. Check the pressure in the pressure damper
 3. Check the transmission shaft
 4. Check the mechanical clutch
 5. Grease the diaphragm pump
-

After every 250 hours

1. Carry out the maintenance mentioned above
 2. Check the hydraulic hoses (if equipped)
 3. Change the oil in the gearbox
-

After every 1000 hours

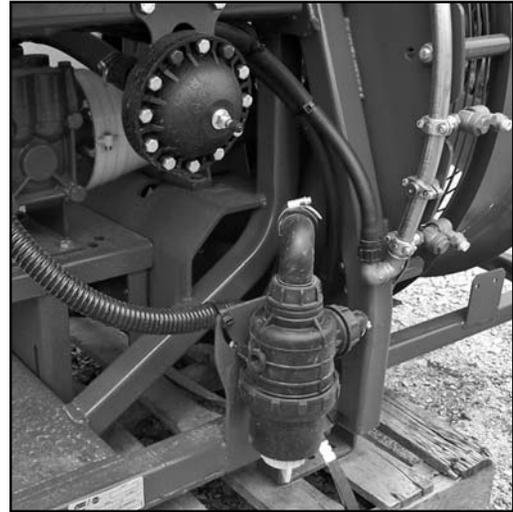
1. Carry out the maintenance mentioned above
 2. Service check of the transmission shaft
 3. Service check of seals in liquid circuit
 4. Service check of the pump
 5. Service check of the gearbox
 6. Check the pressure gauge
 7. Service check of the blower unit
-

Regular maintenance

10 hours service - Suction filter

The suction filter is located on the left side of the sprayer near the pump. Its primary purpose is to protect the pump from damage. It contains an automatic shut off valve to allow the operator to clean and service the filter with a full tank.

Turn the yellow handle counter-clockwise until it "pops out". This closes an internal valve to prevent the main tank from draining when cleaning the filter. Unscrew the large plastic nut and remove the lid. Remove the filter for cleaning, being very careful not to damage the O-ring of the filter lid. This would allow air to enter during suction and cause rattling of hoses and continual pressure variations. To prevent this, it is advisable to lubricate the O-ring with vegetable oil before closing the lid. Finally, replace the yellow valve handle and lock into position to allow flow through the filter.

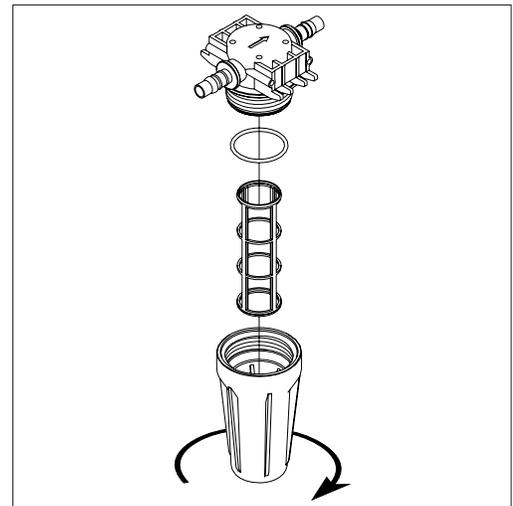


WARNING! The suction filter is one of the most important elements of the fluid circuit. The ability of the pump to take in air correctly largely depends on how well the filter has been cleaned and maintained. It is necessary to clean the filter after every working day in order to keep the filter free of blockage.

10 hours service - In-Line filter

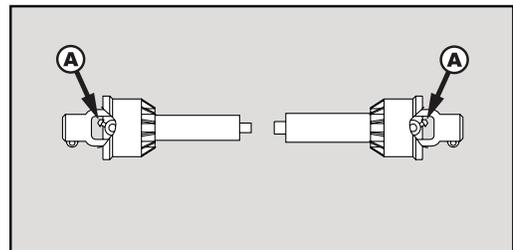
Unscrew the filter bowl to inspect and clean the filter. When reassembling, the O-ring should be lubricated with vegetable oil.

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



10 hours service - Transmission shaft

The universal joints and ball bearings should be lubricated with grease at the points (A) every 10 hours.



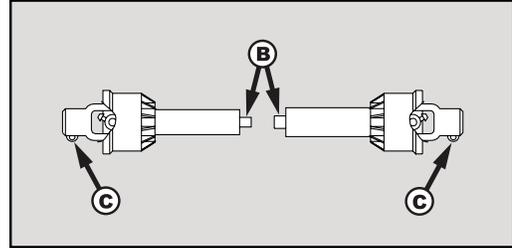
6 - Maintenance

10 hours service - Spraying circuit

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

50 hours service - Transmission shaft

Separate the two halves and grease (B) every 50 hours. Lubricate points (C) with oil. Check function and condition of the transmission shaft protection guard. Replace possible damaged parts.

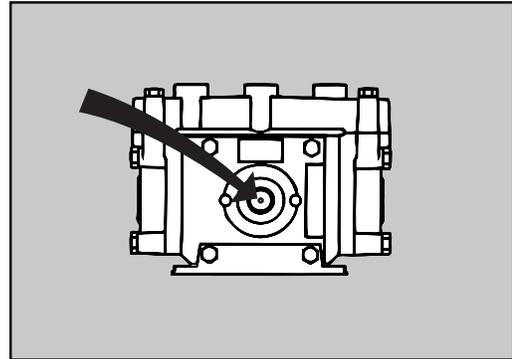


50 hours service - Diaphragm pump

Grease the pump after every 50 hours of use or once a month.



WARNING! A lack of grease in the pump could cause it to overheat and permanently damage internal parts.



50 hours service - Mechanical clutch

The function of the clutch is to transfer power from the pump into the gearbox. It consists of two pinions (1) and a double chain (2) which holds them together. The chain must be greased every 50 hours to avoid unnecessary wear.

When the chain is worn, it is recommended to change all parts, as a new chain on worn pinions will wear faster.



50 hours service - Filters and fittings

Check the filters after 50 hours of use. Make sure to carefully inspect the mesh. If it is not in perfect condition, the filter will not be effective. Replace the mesh with a new one.

Each time you dismantle a fitting to check the condition of a seal or for any reason, remember to lubricate the seal with vegetable oil to avoid twisting or damaging the seal when putting the fitting back in place.



ATTENTION! A broken O-ring or seal in the suction circuit will cause the pump to suck in air and create large pressure variations and shaking hoses.

250 hours service - Hydraulic circuit

Check the hydraulic circuit for leaks and repair if any.



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

250 hours service - Gearbox oil change

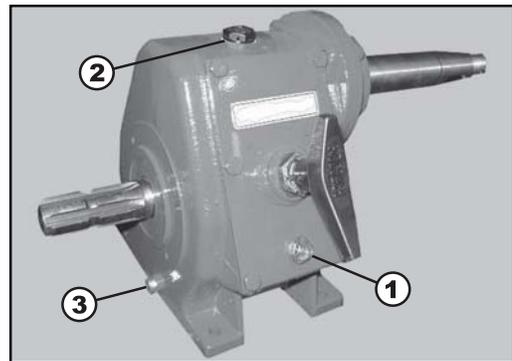
The blower unit's gearbox is one of the mechanical components that is put under the greatest strain. During the spraying season, the gearbox oil level should be checked regularly and changed every 250 hours.

Gearbox for Axial AG820 (32") Blower units:

1. Level indicator
2. Oil Fill
3. Oil Drain

Capacity: 44 oz. (1.3 Liters)

Use synthetic SAE 30 oil.

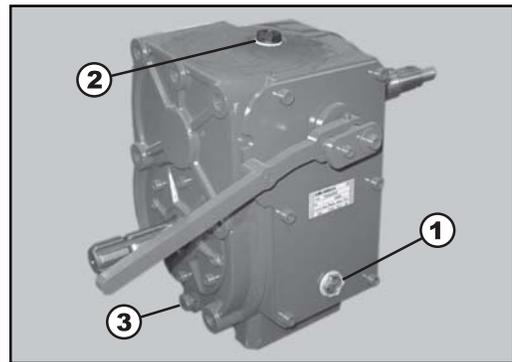


Gearbox for Pneumatic P540 (22") Blower units:

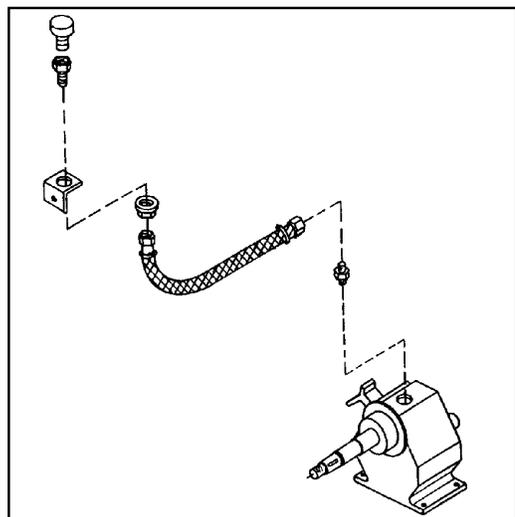
1. Level indicator
2. Oil Fill
3. Oil Drain

Capacity: 59 oz. (1.75 Liters)

Use synthetic SAE 30 oil.



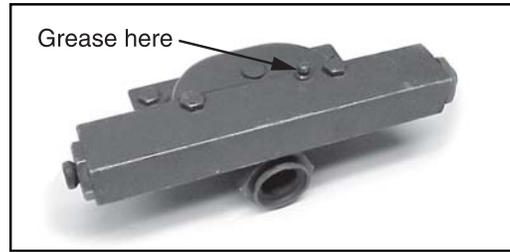
The oil fill is at the top of the blower unit, behind the tank.



6 - Maintenance

250 hours service - Hydraulically controlled section valves

Each hydraulically controlled section valve should be greased every 250 working hours or once a year or after cleaning the sprayer.



1000 hours service - Transmission shaft

Change the protection tube nylon bearings as described under "Shield replacement on transmission shaft".

Occasional maintenance

General info

The maintenance and replacement intervals for the following will depend very much on the conditions under which the sprayer will be operated and are therefore impossible to specify.

Pump valves and diaphragms replacement

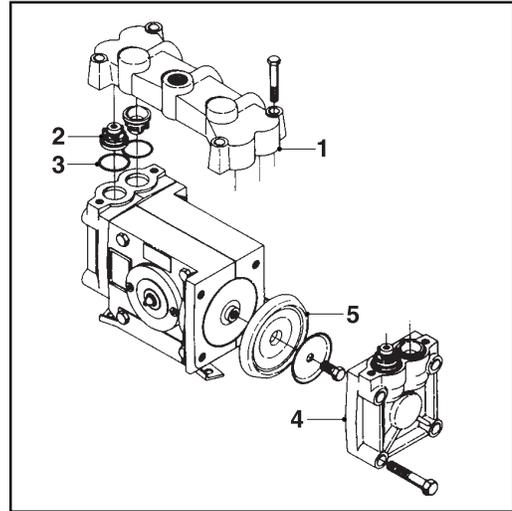
Model 321 pumps:

Valves

Remove valve compartment (1). Before changing the valves (2) - note their orientation so they are replaced correctly. It is recommended to use new gaskets (3) when changing or checking valves.

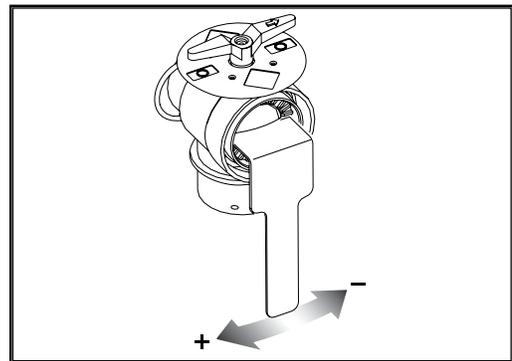
Diaphragms

Remove the diaphragm cover (4) after having dismantled the valve compartment as indicated above. The diaphragm (5) may then be changed. If fluids have reached the crankcase, re-grease the pump thoroughly.



Adjustment of Manifold valve

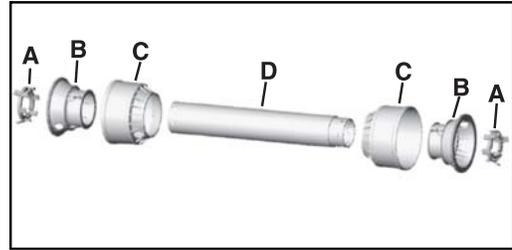
The MANIFOLD valve can be adjusted if it is too tight to operate - or if it is too loose (=liquid leakage). Correct setting is when the valve can be operated smoothly by one hand. Use a suitable tool and adjust the toothed ring inside the valve as shown on the drawing.



6 - Maintenance

Shield replacement on transmission shaft

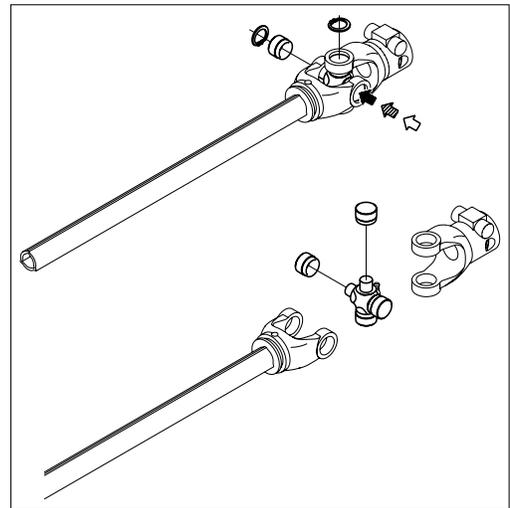
1. The retaining ring (A) holds the base cone (B) and shield bell (C) to the shield tube (D).
2. Locate the three white tabs on the retaining ring (A), visible through the shield bell (C). Pushing these tabs will release the retaining ring (A).
3. Remove the base cone (B) and shield bell (C) from the shield tube (D).
4. Assemble again in reverse order, using new parts where necessary.
5. Apply grease.



ATTENTION! Only use genuine HARDI® spare parts to service the transmission shaft.

Replacement of transmission shaft cross journals.

1. Remove protection guard as described previously.
2. Remove circlip rings.
3. Press the cross journal sideways - use hammer and punch 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 are placed correctly. Avoid dust and dirt in the new bearings.
6. Repeat procedure to the opposite end of the transmission shaft.



Off-season storage

Off-season storage program

When the spraying season is over, you should devote some extra time to the sprayer. If chemical residue is left over in the sprayer for longer periods, it can reduce the life of the individual components. To preserve the sprayer intact and to protect the components, carry out following off-season storage program.

1. Clean the sprayer completely - inside and outside - as described in "Cleaning" in the "Operation" section. Make sure that all valves, hoses and auxiliary equipment have been cleaned with detergent and flushed with clean water afterwards, so no chemical residue is left in the sprayer.
2. Replace possible damaged seals and repair possible leaks.
3. Empty the sprayer completely and let the pump work for a few minutes. Operate all valves and handles to drain as much water off the spraying circuit as possible. Let the pump run until air is coming out of all nozzles.
4. Pour appr. 3 gal. (11 liters) anti-freeze mixture consisting of 1/3 automotive anti-freeze and 2/3 water into the tank.
5. Engage the pump and operate all valves and functions on the MANIFOLD, operating unit, etc. allowing the anti-freeze mixture to be distributed around the entire circuit. Open the operating unit main on/off valve and distribution valves so the anti-freeze is sprayed through the nozzles as well. The anti-freeze will also prevent O-rings, seals, diaphragms etc. from drying out.
6. Lubricate all lubricating points according to the lubricating scheme - regardless of intervals stated.
7. When the sprayer is dry, remove rust from possible scratches or damages in the paint and touch up the paint.
8. Remove the glycerine-filled pressure gauges and store them frost free in vertical position.
9. Apply a thin layer of anti-corrosion oil (e.g. SHELL ENSIS FLUID, CASTROL RUSTILLO or similar) on all metal parts. Avoid oil on rubber parts, hoses and tires.
10. Relieve pressure from all hydraulic functions.
11. Wipe hydraulic snap-couplers clean and fit the dust caps.
12. Apply grease on all hydraulic ram piston rods which are not fully retracted in the barrel to protect against corrosion.
13. To protect against dust the sprayer can be covered by a tarpaulin. Ensure ventilation to prevent condensation.

Preparing the sprayer for use after storage

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

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

6 - Maintenance

Spare parts

Spare parts

To see updated spare part information the website www.agroparts.com can be visited. Here all parts information can be accessed when free registration has been made.



Operational problems

General info

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

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

Therefore ALWAYS check:

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

7 - Fault finding

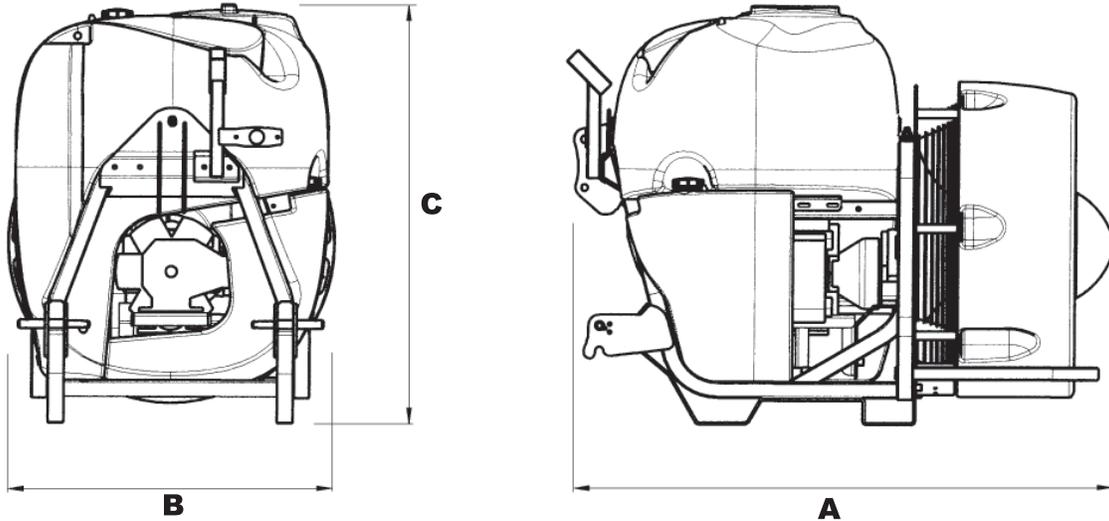
Common problems

FAULT	PROBABLE CAUSE	CONTROL/REMEDY
No spray from nozzles when turned on.	Air leak on suction line.	Check if suction filter O-ring is sealing. Check suction hose 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 for obstructions near suction fitting in the bottom of the tank. Check pin in suction filter check valve. A bent pin can prevent flow into the filter.
Lack of pressure.	Incorrect assembly.	Check for missing agitation restrictor(s). Make sure safety valve spring closes properly. Check for obstructions near suction fitting in bottom of tank.
	Pump valves blocked or worn.	Check for obstructions and wear.
	Defective 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 that exceed it by 10%.
	Tank is air tight.	Check vent in tank lid is clear.
	Sucking air towards end of tank load.	Turn agitation off to empty the tank.
Pressure increasing.	Pressure filters beginning to clog.	Clean all filters.
	Agitation nozzle is blocked.	Check by opening, closing agitation. Clean if blocked.
Formation of foam.	Air is being sucked into system.	Check tightness/gaskets/O-rings of all fittings on suction side.
	Excessive liquid agitation.	Reduce pump r.p.m. Check safety valve is tight. Turn agitation off. Use foam damping additive.
Liquid leaks from bottom of pump.	Damaged diaphragm.	Replace. See "Maintenance" section.
Excessive noise or vibrations in the blower unit	The fan has lost its counterweight.	Take the fan to you dealer to have it re-balanced.
	The blower unit's nuts are broken or worn.	Replace or tighten the nuts.
	Mechanical clutch chain worn.	Replace the entire mechanical clutch assembly.
Vibrations or noises in the gear box.	The gear is not properly engaged.	Put the gear lever in the correct position.
	Oil level below minimum.	Fill to proper level.
	Worn gears, sprockets.	Replace gears, sprockets.

8 - Technical specifications

Dimensions

Overall dimensions



ZENIT AXIAL	A	B	C
105 Gal. (400 Liters)	65" (1660 mm)	39" (980 mm)	50" (1275 mm)
155 Gal. (600 Liters)	65" (1660 mm)	47" (1200 mm)	53" (1350 mm)

ZENIT PNEUMATIC (B11 Boom)	A	B	C
105 Gal. (400 Liters)	65" (1660 mm)	77" (1950 mm)	67" (1700 mm)
155 Gal. (600 Liters)	65" (1660 mm)	77" (1950 mm)	67" (1700 mm)

ZENIT PNEUMATIC (B20 Boom)	A	B	C
105 Gal. (400 Liters)	96" (2450 mm)	77" (1950 mm)	87" (2200 mm)
155 Gal. (600 Liters)	96" (2450 mm)	77" (1950 mm)	87" (2200 mm)

Weight

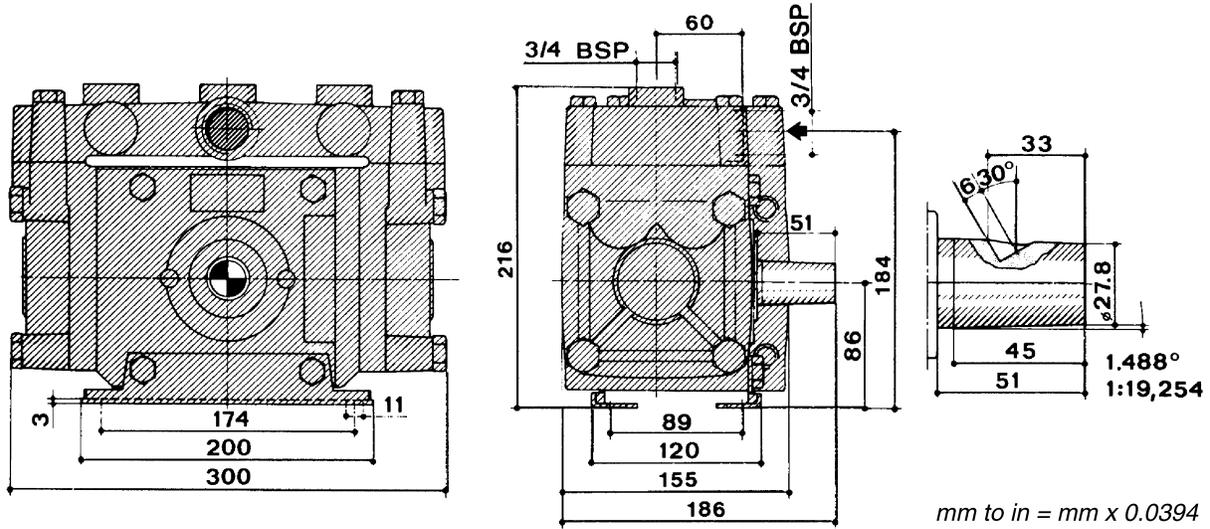
ZENIT AXIAL	EMPTY	FULL
105 Gal. (400 Liters)	805 lbs. (365 kg)	1900 lbs. (863 kg)
155 Gal. (600 Liters)	827 lbs. (375 kg)	2450 lbs. (1113 kg)

ZENIT PNEUMATIC (B11 Boom)	EMPTY	FULL
105 Gal. (400 Liters)	838 lbs. (380 kg)	1940 lbs. (880 kg)
155 Gal. (600 Liters)	860 lbs. (390 kg)	2490 lbs. (1130 kg)

8 - Technical specifications

Specifications

Pump model 321/10.0



	rpm											
	300		400		500		540		600		700	
PSI	gpm	hp										
0	10.3	0.4	13.7	0.5	17.2	0.7	18.5	0.8	20.6	0.9	24.0	1.1
73	10.3	0.4	13.7	0.7	17.2	0.8	18.5	0.8	20.6	0.9	24.0	1.1
145	10.3	0.9	13.7	1.2	17.2	1.5	18.5	1.6	20.6	1.9	24.0	2.1
218	10.3	1.3	13.7	1.9	17.2	2.3	18.5	2.4	20.6	2.7	24.0	3.2
290	10.3	1.9	13.7	2.4	17.2	3.1	18.5	3.2	20.6	3.6	24.0	4.3
363	10.3	2.3	13.7	3.1	17.2	3.8	18.5	4.0	20.6	4.6	24.0	5.4
bar	l/min	kW										
0	39	0.3	52	0.4	65	0.5	70	0.6	78	0.7	91	0.8
5	39	0.3	52	0.5	65	0.6	70	0.6	78	0.7	91	0.8
10	39	0.7	52	0.9	65	1.1	70	1.2	78	1.4	91	1.6
15	39	1.0	52	1.4	65	1.7	70	1.8	78	2.0	91	2.4
20	39	1.4	52	1.8	65	2.3	70	2.4	78	2.7	91	3.2
25	39	1.7	52	2.3	65	2.8	70	3.0	78	3.4	91	4.0

Maximum pressure: 363 PSI (25 bar)
 Weight: 53 lbs. (23.9 kg)
 Normal working revolutions: 540 rpm

8 - Technical specifications

Filters and nozzles

Suction filter gauze width: 35 mesh (0.5 mm)

50 mesh (0.3 mm)

80 mesh (0.18 mm)

Pressure filter gauze width: 50 mesh (0.3 mm)

80 mesh (0.18 mm)

100 mesh (0.15 mm)

Temperature and pressure ranges

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

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

Max. pressure on the pressure manifold: 435 psi (30 bar)

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

8 - Technical specifications

Materials and Recycling

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.

Materials used:

Tank: HDPE

Hoses: PVC

Valves: mainly glass-filled PA.

Fittings: PA

Warranty policy and conditions

HARDI® NORTH AMERICA INC. , 1500 West 76th Street, Davenport, Iowa, USA; 8550 W. Roosevelt Avenue, Visalia, California, USA and 337 Sovereign Road, London, Ontario, Canada hereinafter called "HARDI®", offers the following limited warranty in accordance with the provisions below to each original retail purchaser of HARDI® new equipment of its own manufacturer, from an authorized HARDI® dealer, that such equipment is at the time of delivery to such purchaser, free from defects in material and workmanship and that such equipment will be warranted for a period of two years from the date of delivery to the end user providing the machine is used and serviced in accordance with the recommendations in the Operator's Manual and is operated under normal farm conditions.

1. This limited warranty is subject to the following exceptions:
 - a)Parts of the machine not manufactured by HARDI®, (i.e. engines, tires, tubes, electronic controls, and other components or trade accessories, etc.) are not covered by this warranty but are subject to the warranty of the original manufacturer. Any claim falling into this category will be taken up with the manufacturer concerned.
 - b)This warranty will be withdrawn if any equipment has been used for purposes other than for which it was intended or if it has been misused, neglected, or damaged by accident, let out on hire or furnished by a rental agency. Nor can claims be accepted if parts other than those manufactured by HARDI® have been incorporated in any of our equipment. Further, HARDI® shall not be responsible for damage in transit or handling by any common carrier and under no circumstances within or without the warranty period will HARDI® be liable for damages of loss of use, or damages resulting from delay or any consequential damage.
2. We cannot be held responsible for loss of livestock, loss of crops, loss because of delays in harvesting or any expense or loss incurred for labor, supplies, substitute machinery, rental for any other reason, or for injuries either to the owner or to a third party, nor can we be called upon to be responsible for labor charges, other than originally agreed, incurred in the removal or replacement of components.
3. The customer will be responsible for and bear the costs of:
 - a)Normal maintenance such as greasing, maintenance of oil levels, minor adjustments, etc.
 - b)Transportation of any HARDI® product to and from where the warranty work is performed.
 - c)Dealer travel time to and from the machine or to deliver and return the machine from the service workshop for repair.
 - d)Dealer traveling costs.
4. Parts defined as normal wearing items, (i.e. tires and V-belts) are not in any way covered under this warranty.
5. This warranty will not apply to any product which is altered or modified without the express written permission of HARDI® and/or repaired by anyone other than an Authorized Service Dealer.
6. Warranty is dependent upon the strict observance by the purchaser of the following provisions:
 - a)That this warranty may not be assigned or transferred to anyone.
 - b)That the Warranty Registration Certificate has been correctly completed by dealer and purchaser with their names and addresses, dated, signed and returned to the appropriate address as given on the Warranty Registration Certificate.
 - c)That all safety instructions in the operator's manual shall be followed and all safety guards regularly inspected and replaced where necessary.
7. No warranty is given on second-hand products and none is to be implied.
8. Subject to the following terms, conditions and contributions, HARDI® extends the warranty on polyethylene tanks on vineyard and orchard sprayers with axial or centrifugal fans (excluding fittings, lids and gaskets) to TEN YEARS. To qualify for this extended warranty, the tank must be drained and flushed with fresh water after each day of use. HARDI®'s liability is limited to replacement of the tank, FOB our plant at no cost to the purchaser during the first ten years. This ten year extended warranty is subject, in each instance, to the tank being inspected and approved for replacement or repair by HARDI® personnel before HARDI® will accept any liability hereunder.

9 - Warranty

9. Subject to the following terms, conditions, contributions, HARDI® extends the warranty on HARDI® diaphragm pumps (excluding wearing parts such as diaphragms, valves, etc.) to FIVE YEARS. To qualify for this extended warranty, the pump must be drained and flushed with fresh water after each day of use. HARDI®'s liability is limited to replacement of defective parts, FOB our plant at no cost to the purchaser during the first twenty four months after date of purchase, at 40% during the third year ; at 60% during the fourth year ; and at 80% during the fifth year. This five year extended warranty is subject, in each instance, to the pump being inspected and approved for replacement or repair by HARDI® personnel before HARDI® will accept any liability hereunder.
10. HARDI® reserves the right to incorporate any change in design in its products without obligation to make such changes on units previously manufactured.
11. The judgement of HARDI® in all cases of claims under this warranty shall be final and conclusive and the purchaser agrees to accept its decisions on all questions as to defect and to the exchange of any part or parts.
12. No employee or representative is authorized to change this warranty in any way or grant any other warranty unless such change is made in writing and signed by an officer of HARDI® at it's head office.
13. Any warranty work performed which will exceed \$400.00 MUST be approved IN ADVANCE by the Service Manager.
14. Any pump replacement must be approved in advance by the Service Manager.
15. Claims under this policy must be filed with HARDI® within thirty (30) days of work performed or warranty shall be void.
16. Parts requested must be returned prepaid within thirty (30) days for warranty settlement.
17. Warranty claims must be COMPLETELY filled out properly or will be returned.

DISCLAIMER OF FURTHER WARRANTY

THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, EXCEPT AS SET FORTH ABOVE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION OF THE PRODUCT CONTAINED HEREIN. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES (SUCH AS LOSS OF ANTICIPATED PROFITS) IN CONNECTION WITH THE RETAIL PURCHASER'S USE OF THE PRODUCT.