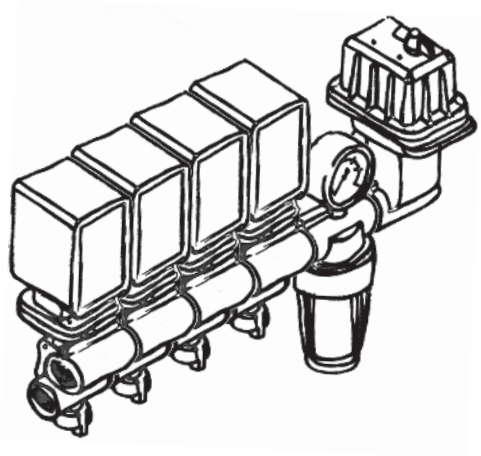
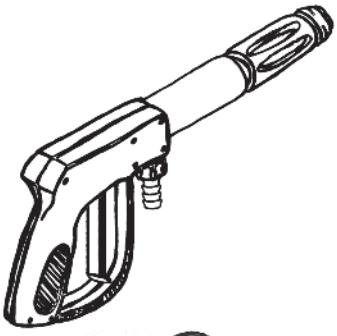
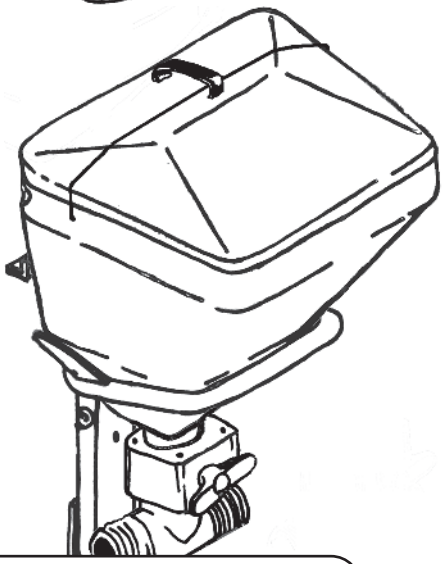
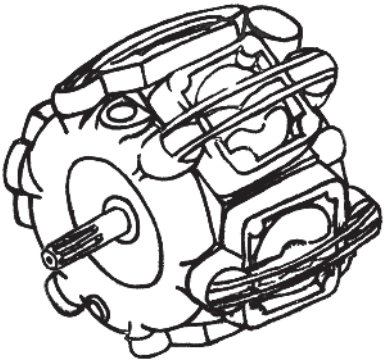
HARDI® SPRAYERS





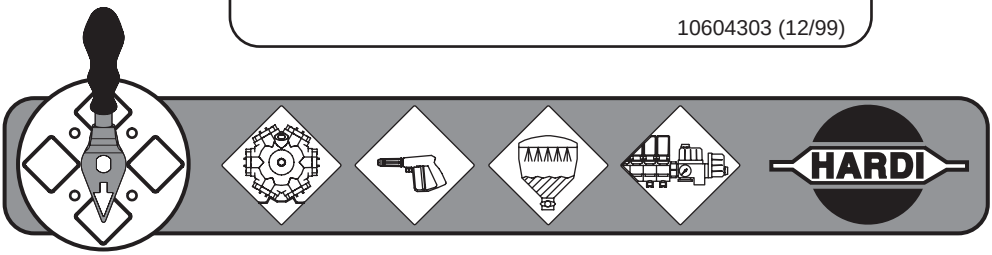




COMMANDER

OPERATOR'S MANUAL

10604303 (12/99)



COMMANDER

Operator's Manual

106043 (12/99)

TABLE OF CONTENTS

Dear Owner,

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

Our sprayers and accesories 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® COMMANDER sprayer were suggested by growers. There is no substitute for "on farm" experience and we invite your comments and suggestions.

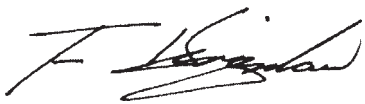
Please address your correspondence to the Service Manager at one of these branches:

HARDI® MIDWEST
1500 West 76th St.
Davenport, Iowa 52806
Phone: (319) 386-1730
Fax: (319) 386-1710

HARDI® GREAT LAKES
290 Sovereign Rd.
London, Ontario N6M 1B3
Phone: (519) 659-2771
Fax: (519) 659-2821

HARDI® WEST COAST
5646 W. Barstow, Suite 101
Fresno, California 93722
Phone: (559) 271-3106
Fax: (559) 271-3107

Sincerely,



Tom L. Kinzenbaw
President

COMMANDER 750

COMMANDER 875

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

1.0 INTRODUCTION

The COMMANDER 750, 875, and 1200 trailer sprayers consist of a powder coated frame with a tank, pump, EC controls (Electric Controls), Manifold System, Self-Cleaning Filter, Paralift Boom Lift System, and a 45', 50', 60', or 66' hydraulic folding EAGLE series spray boom. The 875 and 1200 trailer sprayers also offer an 80', 88' or 90' hydraulic folding EAGLE series spray boom.

The heart of your sprayer is the diaphragm pump. The design is simple, low maintenance requirements and pump life is guaranteed. The bearings and crankshaft are grease lubricated and are therefore protected from spray solution if any diaphragm fails in service. A drain hole is in the base of the crank case to facilitate the draining of any foreign matter. The pump is self-priming and can be run dry without damage.

The tanks, made of impact proof and chemical resistant polyethylene, have a purposeful design with rounded contours which allows for efficient cleaning and draining. The tanks are designed with a large deep sump, so that they can be completely emptied even when the sprayer is used on slopes up to 15% inclination. A remote operated valve drain is fitted for efficient draining.

The EC (Electric Control) is divided into two sections. The electric main on/off valve and pressure regulation valve is positioned at the front of the sprayer. The boom section control valves with pressure equalization are mounted at the rear of the sprayer.

HARDI-Matic is a mechanical rate controller that ensures a constant volume of spray solution per acre even at varying speeds in the same gear. Maximum performance of the HARDI-Matic is obtained with a P.T.O. shaft speed of 300-600 rpm.

The "Manifold System" features color coded three way valves on suction and pressure sides of the liquid control system. It allows for safe and simple use of the sprayer and accessories from one centralized location.

The Self-Cleaning Filter screens out impurities from the spray solution which are recirculated back to the main tank while clean solution is constantly being supplied to the boom.

The Paralift boom lift system consists of parallel lift arms that hydraulically lift and lower the boom assembly, ensuring that the boom remains parallel to the ground. A locking cylinder and arms are fitted to ensure that the paralift cylinders are relieved of any hydraulic pressure when the boom is in the transport position.

The HZ EAGLE coil spring suspended hydraulic series boom is fitted with 4 hydraulic cylinders. This enables the boom wings to be folded, unfolded, and tilted individually, all controlled from a joystick control handle in the tractor cab. An optional electric 'DH' hydraulic switch box for closed center hydraulic systems is available. The HZ EAGLE boom requires a single and double acting hydraulic outlet on the tractor as well as a 12V D.C. power connection.

2.0 SAFETY INFORMATION

WARNING

ALWAYS READ OPERATORS MANUAL BEFORE USING EQUIPMENT

DO NOT REMOVE ANY SAFETY DEVICES OR SHIELDS. NEVER SERVICE, CLEAN OR REPAIR A MACHINE WHILE IT IS OPERATING

WARNING

ALWAYS WATCH FOR THIS SYMBOL TO POINT OUT IMPORTANT SAFETY PRECAUTIONS

IT MEANS ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

RECOGNIZE SAFETY INFORMATION

This is the Safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.

2.1 Follow Safety Instructions

- Carefully read all the safety messages in this manual and the safety labels fitted to the machine. Keep safety labels in good condition. Replace missing or damaged safety labels. Be sure that new equipment components include any current safety labels. Replacement safety labels are available from your authorized HARDI® dealer.
- Learn how to operate the sprayer and how to use the controls properly. Do not let anyone operate the machine without proper instructions.
- Keep your sprayer in proper working condition. Unauthorized modifications or use may impair the function and/or safety and affect the machines life.
- If you do not understand any part of this manual and need assistance, please contact your authorized HARDI® dealer.

2.2 Operating The Sprayer Safely

1. Read the complete manual carefully and become familiar with the operation of the equipment before initial operation in each spraying season. Failure to do so may result in possible over or under application of spray solution which may drastically affect crop production and lead to personal injury.
2. Before starting the engine on the tractor unit, be sure all operating controls are in the off or neutral position, including but not limited to the P.T.O. shaft and/or spray controls. Be sure the tractor power train is disengaged.
3. Operate spray and boom functions only when seated in the operator's seat.
4. One of the most frequent causes of personal injury or death results from persons falling off or being run over. Do not permit others to ride on or in. Only one person should be working the machine when in operation.

2.2 Operating The Sprayer Safely (continued)

5. Before leaving the tractor seat, stop the engine, put all controls in neutral, and put the transmission control lever in the park position or neutral with the brakes locked. Read the tractor operation manual for added safety precautions.
6. P.T.O. driven equipment can cause serious injury. Before working on or near the P.T.O. shaft, servicing or cleaning the equipment, put P.T.O. lever in the DISENGAGE position and stop the engine.
7. Do not fold or unfold boom near overhead wires. Serious injury or death could result if contact is made with electric wires.
8. Keep hands, feet & clothing away from moving parts.
9. Wear relatively tight and belted clothing to prevent from being caught on some part of the machine.
10. Slow down when turning especially with boom unfolded.
11. Always keep children away from your sprayer and/or tractor unit.
12. Before transporting the sprayer ensure that the boom is fully folded and fully locked into transport position. Ensure all locking devices are fully engaged whether hydraulic or mechanical.
13. Slow moving tractors and spray equipment can create a hazard when on public roads. Avoid personal injury or death resulting from any accidents by using flashing lights. Local regulations may require installation of flashing warning lights.
14. Avoid injuries from high pressure fluids penetrating the skin by relieving system pressure before disconnecting hydraulics or other lines. Ensure all fittings are tight before applying pressure to the system.
15. Understand service procedures before undertaking any maintenance. Never lubricate, service, or adjust the machine while its moving. Securely support any components before working on them.
16. Keep all parts in good condition and properly installed. Fix damaged parts immediately. Replace worn or broken parts. Remove excessive buildup of grease, oil or debri.

2.3 Handling Chemical Products Safely

1. Direct exposure to hazardous chemicals can cause serious injury. These chemicals can include lubricants, coolants, paints, adhesives and agricultural chemicals. Material Safety Data Sheets (M.S.D.S.) are available for all hazardous chemicals which inform the user of specific details including, physical and health hazards, safety procedures, and emergency response techniques.
2. Protective clothing such as rubber gloves, goggles, coveralls and respirator must be worn while handling chemicals. All protective clothing should be kept in excellent condition and cleaned regularly or discarded.
3. If chemicals come in contact with any exposed skin areas, wash immediately with clean water and detergent. Never place nozzle tips or any other components that have been exposed to chemicals to lips to blow out obstructions. Use a soft brush to clean spray nozzles.
4. Dedicate an area to fill, flush, calibrate and decontaminate sprayer where chemicals will not drift or run off to contaminate people, animals, vegetation, water supply, etc. Locate this area where there is no chance of children coming in contact with this residue.
5. Decontaminate equipment used in mixing, transferring and applying chemicals after use. Follow the instructions on the chemical label for the correct procedure required. Wash spray residue from outside of the sprayer to prevent corrosion.
6. Extreme care should be taken in measuring spray products. Powders should be used in suitable sized packages or weighed accurately. Liquids should be poured into a suitable graduated container. Keep chemical containers low when pouring. Wear a filtered respirator and let the wind blow away from you to avoid dust and/or splashes contacting the skin or hair.
7. Store chemicals in a separate, plainly marked locked building. Keep the chemical in its original container with the label intact.
8. Dispose all empty containers after rinsing in accordance with local regulations & by-laws. Dispose of all unused chemicals and left over fertilizer in an approved manner
9. Keep a first aid kit and fire extinguisher available at all times when handling chemicals.

2.4 Local Poison Information Center

PHONE NO. _____ - _____ - _____

Find the phone number for the poison control center in your phone book and write it in the space above.

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. _____

2.5 Unloading And Lifting The Sprayer

WARNING: **IMPROPER LIFTING EQUIPMENT AND PROCEDURES CAN CAUSE SERIOUS INJURY OR DEATH.**

For the unloading and lifting of the sprayer, you will need to use a crane of fork lift. When lifting the sprayer with a crane, please observe the lifting points shown in (Fig. 1). Make sure that the straps or belts used for lifting are strong enough.

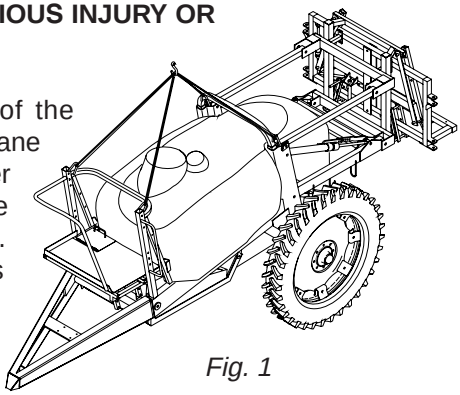


Fig. 1

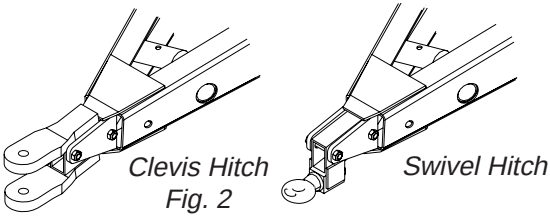
3.0 CONNECTING THE SPRAYER

WARNING: **ALWAYS USE THE CORRECT DIAMETER HITCH PIN FOR ATTACHING TO THE TRACTOR AND SECURE WITH A LINCH PIN OR SIMILAR.**

WARNING: **THE DRAWBAR BOLTS MUST BE RETIGHTENED TO THE SPECIFIED TORQUE EVERY 8 HOURS OF WORK UNTIL THE TORQUE IS STABILIZED AND THEN AT INTERVALS ACCORDING TO SERVICE SCHEME (Section 5.8).**

3.1 Hitches for CM750

There are two different hitches available. Standard hitch is a clevis type with a Ø1 1/2" (36mm) pin hole. An optional hitch with a swivel towing ring is available (Fig. 2).



Clevis Hitch *Swivel Hitch*

Fig. 2

The standard and hitch drawbar can be set at two different height positions. The standard hitch can be altered by $5^1/_2$(140mm). The swivel hitch can be altered by $8^3/_8$(210mm)(Fig. 3). Choose the setting where

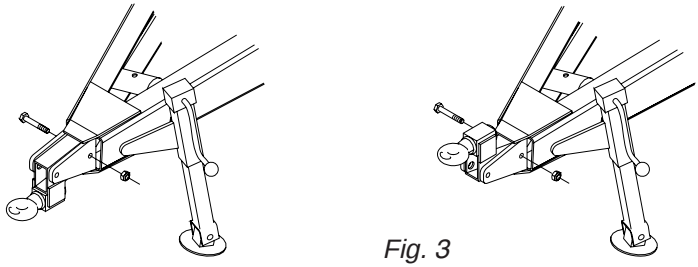
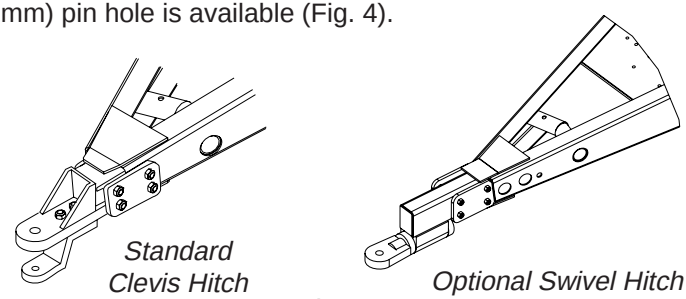


Fig. 3
(Optional swivel hitch shown)

3.2 Hitches for CM875/1200

There are two different hitches available. Standard hitch is a clevis type with a $1^5/_8$"(42mm) pin hole. An optional swivel type hitch with $1^5/_8$"(42mm) pin hole is available (Fig. 4).



Standard Clevis Hitch

Optional Swivel Hitch

Fig. 4

The standard and clevis hitches can be set at two different height positions. The standard hitch can be altered by app.11"(250mm). The clevis hitch can be altered by app. 6"(160mm)(Fig. 5). Choose the setting where the platform appears level.

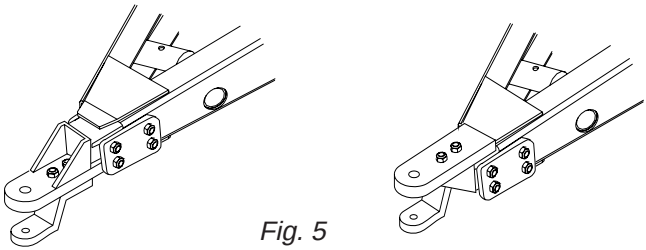
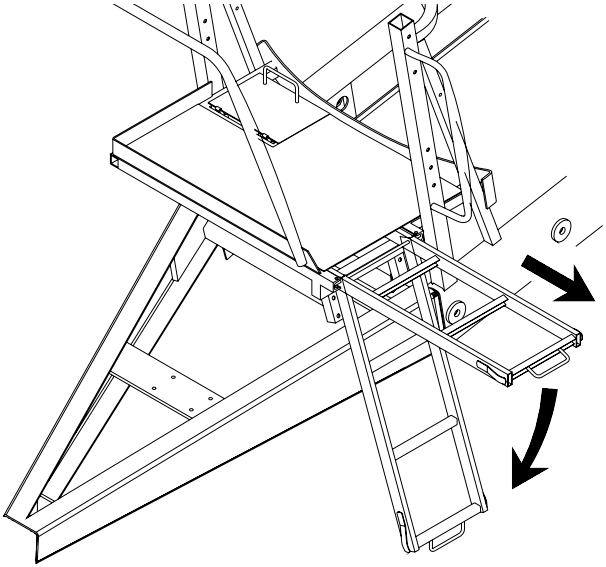


Fig. 5
(Clevis hitch shown)

3.3 Support Jack

To remove the support jack after attaching the sprayer to a tractor: lift the jack, remove the securing pin and pull out the support jack. The support jack is to be stored in the bracket on the front of the platform.



3.4 Ladder

To access the front platform, the ladder is pulled out and folded down. Always lift up and push the ladder in under the platform before driving. The ladder will lock automatically when it is pushed fully in.

3.5 Wheel Tread Adjustments: CM750

WARNING: **SECURELY SUPPORT THE SPRAYER DURING AXLE ADJUSTMENTS. NEVER ATTEMPT TO ADJUST AXLES WITH LIQUID IN THE TANK. ALWAYS BLOCK WHEELS ON OPPOSITE SIDE WHEN ADJUSTING AXLES.**

The wheel tread on the COMMANDER 750 can be altered infinitely from 60.5” (1540mm) to 88” (2235mm) by extending or retracting the wheel axle (Fig. 6). To obtain track gauges 78-88” (1980-2235mm) the wheels must be reversed and exchanged side to side.

WARNING: **IT IS NOT PERMITTED TO FIT DUAL WHEELS ON THE CM750.**

the platform appears level.

3.6 Wheel Tread Adjustments: CM875/1200

WARNING: **SECURELY SUPPORT THE SPRAYER DURING AXLE ADJUSTMENTS. NEVER ATTEMPT TO ADJUST AXLES WITH LIQUID IN THE TANK. ALWAYS BLOCK WHEELS ON OPPOSITE SIDE WHEN ADJUSTING AXLES.**

The standard axle system on the Commander 875/1200 allows for infinite adjustment of the wheel tread from 60” to 80” (Fig. 6). An optional axle system has infinite adjustment of the axle tread from 72” to 90”. In addition, a 120” or 132” fixed axle system is available which

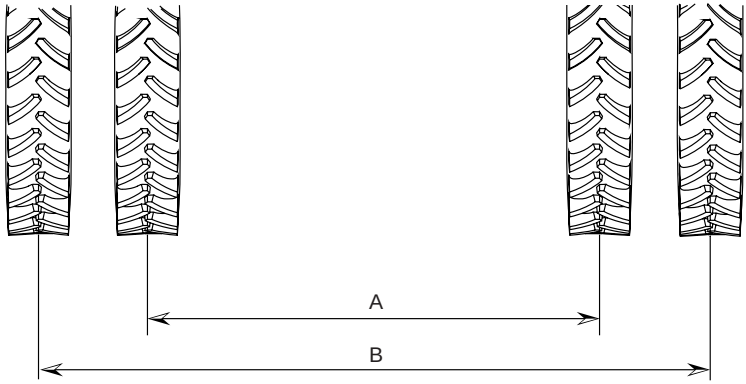


Fig. 6

CM750 (standard) - A = 60.5” (1540mm) to 80” (2035mm)
CM750 (wheels reversed) - A = 78” (1980mm) to 88” (2235mm)
CM875/1200 (standard) - A = 60” (1520mm) to 80” (2030mm)*****
CM875/1200 (optional axle) - A = 72” (1830mm) to 90” (2285mm)*****

DUAL WHEEL OPTION: CM875/1200 ONLY**
CM875/1200 (22” rows) - A = 88” (2235mm) B = 132” (3350mm)
CM875/1200 (30” rows) - A = 60” (1520mm) B = 120” (3050mm)

***Note:** With the CM875/1200 axle systems, wheels may have to be switched from one side to the other to obtain proper wheel spacing.
**** Note:** The dual wheel axle systems are fixed in width. There is no width adjustment possible other than using a different axle.

Note: The wider the wheel tread, the better the stability of the sprayer and boom. Wheel tread is altered the following way:

1. Measure the correct wheel tread (Fig. 6) (center right tire to center left tire). Each side must be extended or retracted half the desired alteration.
2. Attach the sprayer to tractor and engage tractor parking brake.
3. Place stop wedges in front of and behind right hand wheel. Jack up left hand wheel, support and secure sprayer body.
4. Loosen clamp bolts A (Fig. 7) for left hand wheel axle and extend or retract the axle (Fig. 8).
5. Remember to tighten the wheel nuts to the specified torque.
   Rim plate to hub:
   -CM750: 135 lb/ft (180Nm)
   -CM875/1200: 320 lb/ft (430Nm)
6. Tighten the clamp bolts to the specified torque:
   -CM750: 207 lb/ft (280Nm)
   -CM875/1200: 250 lb/ft (340Nm)

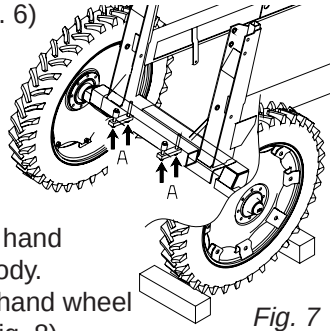


Fig. 7

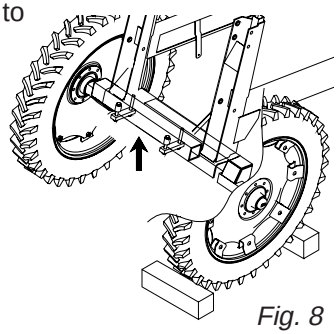
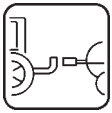


Fig. 8

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

7. Repeat the procedure on the right hand wheel.
8. Check distance from center tire to center of tank to make sure the distance is equal from left to right.
9. Retighten clamp bolts and wheel bolts to specified torque after 8 hours of work.



is not adjustable.

3.7 P.T.O. Shaft Operator Safety

WARNING: **ALWAYS STOP ENGINE BEFORE ATTACHING THE TRANSMISSION SHAFT TO TRACTOR P.T.O. MOST TRACTOR P.T.O. SHAFTS CAN BE ROTATED BY HAND TO FACILITATE SPLINE ALIGNMENT, WHEN ENGINE IS STOPPED.**

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

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

Always keep protection guards and chains intact and make sure that the guards cover all rotating parts, including CV-joints at each end of the shaft. Do not use without protection guard.
Do not touch or stand on the transmission shaft when it is rotating - safety distance: min 5' (1.5 meters).
Prevent protection guards from rotating by attaching the chains allowing sufficient slack for turns.

Make sure that protection guards around the tractor P.T.O. and implement shaft is intact. Always STOP ENGINE and remove the ignition key before carrying out maintenance or repairs to the transmission shaft or implement.

3.8 Installation Of P.T.O. Shaft

WARNING: **THE P.T.O. SHAFT ANGLE WILL CHANGE WHEN RAISING AND LOWERING THE CLEVIS. TO PREVENT EXCESSIVE LOADING AND BINDING ON THE P.T.O. SHAFT, IT MAY BE ADVISABLE TO LEAVE THE P.T.O. SHAFT DISCONNECTED UNTIL THE CLEVIS ADJUSTMENT IS COMPLETED. THEN THE P.T.O. SHAFT ADJUSTMENTS CAN BE MADE.**

Initial installation of the shaft is done as follows:

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

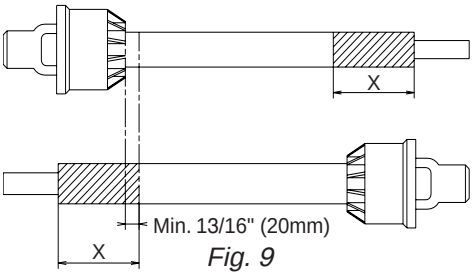


Fig. 9

it is necessary to shorten the shaft. Mark the protection guards.
Note: The shaft must always have a minimum overlap of

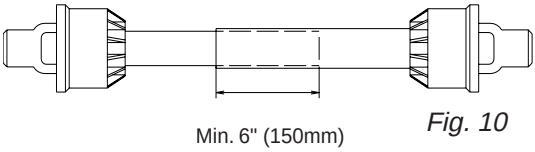


Fig. 10

6" (150 mm).

4. The two parts are shortened equally. Use a saw, and file the profiles afterwards to remove burrs (Fig. 11).

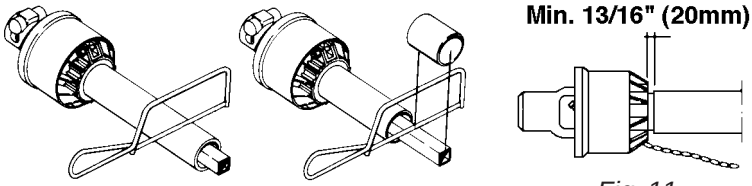


Fig. 11

5. Grease the profiles, and assemble male and female parts again.
6. Fit the shaft to tractor and sprayer pump.
   Note: Female part towards tractor. Fit the chains to prevent the protection guards to rotate with the shaft.
7. To ensure long life of the P.T.O. shaft, try to avoid working angles

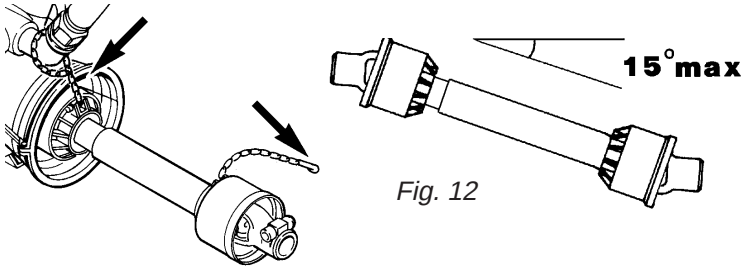
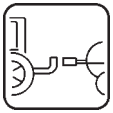


Fig. 12



greater than 15° (Fig. 12).

3.9 Hydraulic System Requirements with EAGLE Boom

The HZ EAGLE booms need one single outlet for the lift function of the spray boom and one double outlet for the folding function. Note that the hydraulic system requires an oil capacity of approximately 0.8 GPM (3 liters) and a minimum pressure of 1,950 PSI (130 bar).

- **BE SURE TO HOOK UP HYDRAULIC LINES PROPERLY!**
- **ENSURE HYDRAULIC LINES HAVE NOT BEEN DAMAGED DURING SHIPPING.**
- **ESCAPING HYDRAULIC FLUID UNDER PRESSURE CAN PENETRATE THE SKIN CAUSING SERIOUS INJURY. AVOID THIS HAZARD BY RELIEVING PRESSURE BEFORE DISCONNECTING HYDRAULIC LINES.**
- **ENSURE ALL CONNECTIONS ARE TIGHT BEFORE APPLYING PRESSURE, SEARCH FOR LEAKS WITH A PIECE OF CARDBOARD NOT YOUR HANDS!**
- **IMPROPER HOOK-UP CAN CAUSE DANGEROUS BOOM MOVEMENTS AND/OR DAMAGE TO THE SPRAYER HYDRAULICS.**
- **DO NOT ALLOW ANYONE NEAR A HYDRAULIC BOOM IN OPERATION.**
- **ALWAYS SHUT TRACTOR OFF WHEN CONNECTING, SERVICING OR ADJUSTING BOOM.**

Hydraulic Hook-up

1. Attach the heavier (3/8") hydraulic hose for the Paralift boom lift to the tractor's single acting outlet.
2. Attach the lighter (1/4") hydraulic hoses for boom folding & HZ tilt to the tractor's double acting outlet.

Note: The Eagle Boom transport lock cylinder is activated when the right hand wing fold cylinder is activated. While the boom is unfolding the transport lock arm is disengaged and when the boom is folding into transport position the lock arm is engaged to lock the Paralift into the transport position. If the right hand fold is not used and/or the left hand fold is desired the hydraulic plumbing can be removed from the right hand fold cylinder fittings on the hydraulic cylinder block and refitted to the left hand side fold cylinder fittings.

3.10 Control Boxes And Power Supply (if fitted)

The 12V power sockets on the control boxes can be plugged directly into either a HARDI® 4 outlet connection box (#817925) or a single female bayonet style plug (#260827). Both of these are available from you HARDI® Dealer.

Note the polarity:

Control Box for	Polarity (wire color)		Required Fuse, Amp
	Positive (+)	Negative (-)	
EC operating unit	Brown	Blue	8
Hydraulic System	Brown	Blue	5

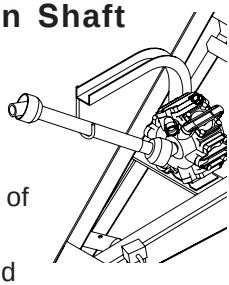
The control boxes are to be fitted in the tractor cabin at a convenient place.

The wires must have a cross-sectional area of at least 12wg (4mm^2) to ensure sufficient power supply. The boxes must be fused according to the table.

Fig. 13

12-volt junction box for 12-volt hook-up: EC controls, HARDI® PILOT, boom hydraulic controls, etc.

3.11 Hose Bracket And Transmission Shaft Support



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

Check the hoses and cables to make sure they are of sufficient length for tight turns.

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

3.12 Disconnecting The Sprayer

Always clean the sprayer, inside and out, before disconnecting and parking it.**(Refer to Section 5.1)**
Before disconnecting the sprayer from the tractor, make sure the support jack is properly fitted.

WARNING: **TO PREVENT THE SPRAYER FROM TIPPING OVER, DO NOT DISCONNECT THE SPRAYER FROM THE TRACTOR WITH THE BOOMS UNFOLDED UNLESS THE BOOM IS SUPPORTED.**

Place stop wedges in front of and behind the wheels.
Remember to disconnect all hoses and cables from the tractor.

3.13 Before Putting The Sprayer Into Operation

Although the sprayer has been supplied with a strong and protective surface treatment on steel parts, bolts, etc. in production, 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 be easy to clean the sprayer and keep the paint shiny for many years.

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

4.0 OPERATING INSTRUCTIONS

4.1 Operating the Boom

- **BEFORE UNFOLDING THE BOOM IT IS IMPORTANT TO HAVE THE SPRAYER HOOKED TO THE TRACTOR TO PREVENT OVERBALANCING THE SPRAYER. ONLY THEN LIFT THE BOOM OFF THE TRANSPORT BRACKETS WHICH HOLD IT IN THE TRANSPORT POSITION.**
- **ENSURE THAT BOOMS ARE BACK IN THE TRANSPORT POSITION BEFORE UNHOOKING THE SPRAYER FROM THE TRACTOR.**
- **THE HYDRAULIC SYSTEM SHOULD BE CHECKED VERY CAUTIOUSLY THE FIRST TIME OF OPERATION; THERE MAY BE AIR IN THE SYSTEM AND THIS COULD CAUSE VIOLENT MOVEMENTS OF THE BOOM. ENSURE THAT NO PERSONS OR OBJECTS ARE IN THE WAY WHILE CHECKING THE SYSTEM.**
- **FOR INFORMATION ON BOOM ADJUSTMENT SEE THE APPROPRIATE EAGLE BOOM OPERATORS MANUAL.**

4.2 Filling the Main Tank

Water can be filled into the main tank in the following ways:

1. Filled through tank lid.
2. Filled by diaphragm pump through a suction side fitted filling device (optional) using normal pump capacity directly to the tank.
3. Filled by the optional HARDI® quick fill kit which enables the connection of a nurse tank.

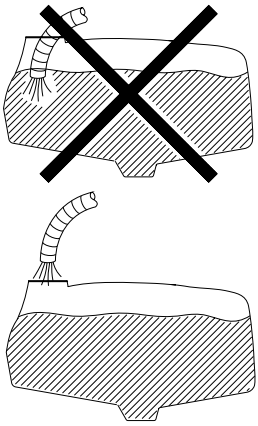
IMPORTANT: The tank should normally be filled 1/3 with water, before adding chemicals - always read instruction on chemical container.

Filling Through The Tank Lid

Remove the tank lid and fill water through strainer basket to prevent rust or other foreign particles from entering the tank.

An overhead tank can be used in order to obtain fast filling capacity. It is recommended to use as clean water as possible for spraying purposes.

WARNING: **DO NOT LET FILLING HOSE ETC. ENTER THE TANK. KEEP IT OUTSIDE THE TANK, POINTING TOWARDS THE FILLING HOLE. IF THE HOSE IS LEAD TO THE BOTTOM OF THE TANK, AND THE WATER PUMP AT THE WATER SUPPLY PLANT STOPS, CHEMICALS CAN BE SIPHONED BACK AND CONTAMINATE THE WATER SUPPLY.**

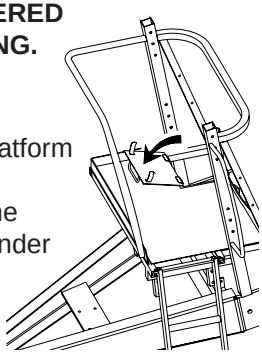


Note: Observe local legislation regarding use of Quick Filling Device. In some areas it is prohibited to fill from open water reservoirs (lakes, rivers, etc.). It is recommended only to fill from closed reservoirs (mobile water tank, etc.) to avoid contamination.

WARNING: **IF SUCTION HOSE/FILTER IS CARRIED ON THE SPRAYER, IT CAN BE CONTAMINATED BY SPRAY DRIFT WHICH WILL BE TRANSFERED TO WATER SUPPLY WHEN FILLING.**

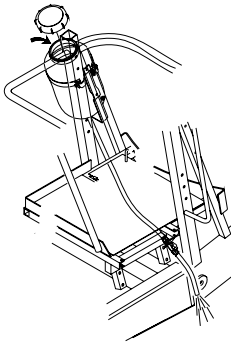
4.3 Filling The Flush Tank (if fitted)

The flush tank is situated at the front under the platform and main tank. Access to the flush tank lid on the CM750 is through the hatch in the platform. On the CM875/1200 a quick-connect fitting is mounted under the platform beside the step. Fill only with clean water. Flush tank capacity for the CM750 is approx. 70 gal. (265 l). Flush tank capacity for the CM875/1200 is approx. 110 gal. (415 l).



4.4 Filling Of Clean Water Tank

The clean water tank has a capacity of 4 gal. (15l). The water from this tank is for hand washing, cleaning of clogged nozzles etc. Only fill this tank with clean water.

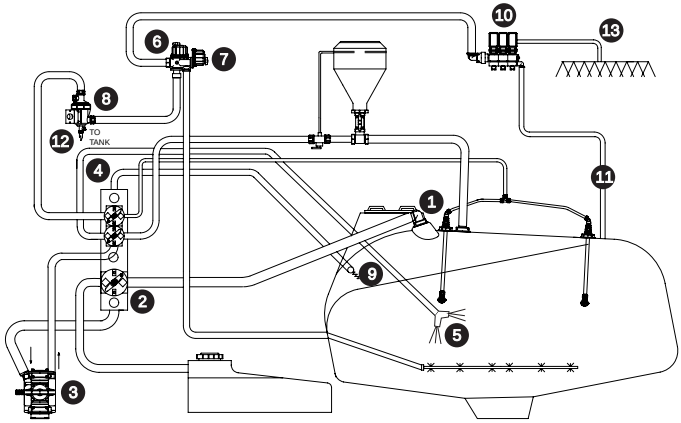


WARNING: **ALTHOUGH THE CLEAN WATER TANK IS ONLY FILLED WITH CLEAN WATER, IT MUST NEVER BE USED FOR DRINKING.**

4.5 Standard Sprayer Plumbing Diagrams

Review and study the following diagrams and following the flow through the system will help you better understand the various functions of the sprayer system.

EC (with optional equipment)



The diagram shows the Standard plumbing with examples of options available.

Function Diagram

1. Suction filter
2. Suction manifold (black)
3. Pump
4. Pressure manifold (green)
5. Pressure agitation nozzles (CM875/1200 Only)
6. On/Off valve
7. Pressure regulator
8. Self-cleaning filter
9. Safety valve
10. Distribution valves
11. Return from Press. Equalization
12. Check valve
13. To Spray boom

4.6 Manifold System

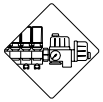
The “Manifold System” is located at the left hand side of the sprayer, permitting operation of most of the (fitted) accessories from one position.

The modular design of the Manifold system allows the easy addition of many accessories to the plumbing system of the sprayer. The system can be be expanded to a maximum of 4 valves on the pressure side. The suction side can not be expanded if equipped with Quick fill. The system can also be fitted with an agitation by-pass valve which ensures more complete drainage of the sprayer before cleaning or refilling.

The manifold valve faces are colored discs for easy indentification. The green face identifies the pressure manifold, the black disc identifies the suction manifold and a blue disc indicates the agitiation by-pass valve (when fitted.)

Symbols are fitted to the faces of the 3 way valves indicating the direction of flow of the liquid.

Green Disc = Pressure Valve



• To Self-Cleaning Filter/ EC Control

• To Hose Reel/Spray Gun

• To Chemical Filler

• To Tank Rinsing nozzle

• Pressure Agitation

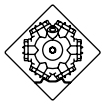
Black Disc = Suction Valve

• From Flush Tank

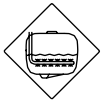
• From Main Tank

• Quick Fill

Blue Disc = Agitation Bypass Valve



• Pump



• Return From E.C. Operating Unit

4.7 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 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. The other handles are turned to “O”. If all the green pressure valves are closed the safety valve will open inside the tank to relieve the pressure in the Manifold System.

Black Suction Valves

Turn the handle so the arrow points towards the selected optional equipment (e.g. Rinsing Tank). To resume suction from the main tank, the arrow must point towards the main tank. Remaining valve must be closed.

Note: The quick fill valve (if fitted) is not connected to the manifold system and is not affected by the operation of the main tank suction valve.

Electric Operated MANIFOLD valves (if fitted)

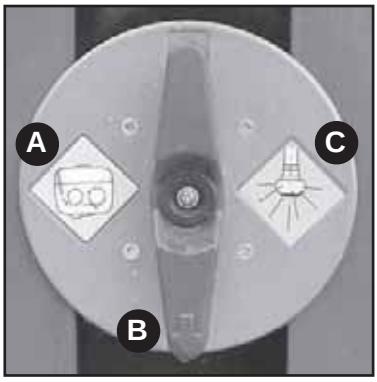
One or more MANIFOLD valves can be electrically operated via a control box in the tractor cab. In case of an emergency, these can be operated manually only when the 12V power to the valve motor is disconnected first.

4.8 Agitation By-Pass Valve Operation

The optional agitation shut-off valve is fitted when it is desired to cut the by-pass liquid to the tank at low tank levels and achieve more complete drainage of the tank. The by-passed liquid is directed back to the suction manifold and therefore is recirculated back through the pump.

This valve, when fitted, must have the handle positioned in either the "Tank" position or the "Pump" position. There is no "Off" position indicated on this valve.

4.9 Pressure Agitation Valve (CM875/1200 Only)

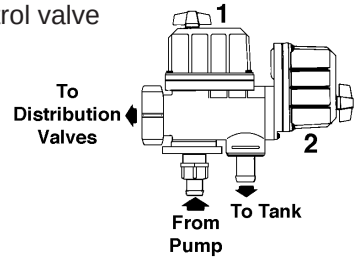


This valve controls the agitation nozzles inside the CM875/1200 tanks. If extra agitation is desired, turn the handle so the arrow points to the agitation decal (A). Turn the handle to “O” (B) to stop the flow to the agitation nozzles. The other position (C) is for the optional tank rinse.

4.10 Operation Of EC Operating Unit

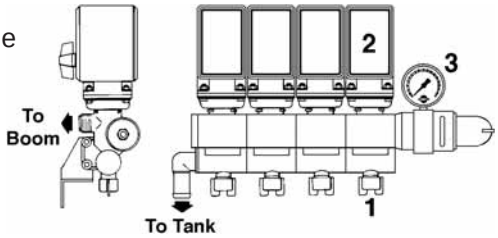
EC operating unit - ON/OFF Control Assembly

1. Main ON/OFF valve
2. Pressure control valve



EC operating unit - Distribution Valves Assembly

1. Adjustment for constant boom pressure
2. Distribution valves
3. System pressure gauge



EC Remote control box

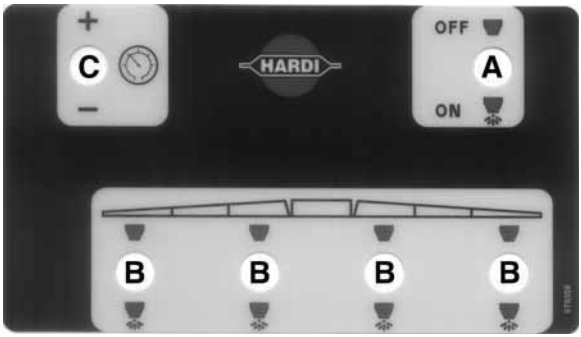


Fig. 14 (4 Section Control Box Shown)

A. Operating switch for main ON/OFF valve

B. Operating switches for distribution valves

C. Pressure control switch (to lower or raise)

4.11 Adjustment Of The EC Controls

1. Choose the correct nozzle (Section 4.19). Make sure that all the nozzles are the same type and capacity.
2. Put the tractor in neutral and adjust the P.T.O. RPM's until the number of revolutions of the pump corresponds to the intended traveling speed. Remember the number of revolutions on the P.T.O. must be kept between 300-600 rpm to ensure correct operation of the HARDI-MATIC system.
3. On-off switch **(A)** (Fig.14) is "ON" against green symbol (down position).
4. All distribution valves switch **(B)** (Fig.14) are also "ON" against green symbol (down position).

5. Hold pressure regulating switch **(C -)** (Fig.14) until handle **(2)** (Fig.14) stops rotating, this will be the "minimum pressure" setting.
6. Hold pressure regulating switch **(C+)** (Fig.14) until desired pressure is shown on the boom pressure gauge.

4.12 Adjustment Of Constant Pressure

Note: Adjust the constant distribution boom pressure one section at a time as follows: (Start with the valve turned closed before adjusting).

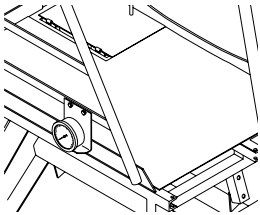
1. Shut-off the first boom distribution valve switch **(B)** (Fig. 14).
2. Turn the adjusting screw **(1)** (Fig. 14) until the pressure gauge **(7)** (Fig. 14) again shows the same pressure as set in step 6 above. (Turn the screw clockwise for higher pressure, counterclockwise for lower pressure).
3. Turn the first boom distribution valve switch **(B)** (Fig. 14) back on.
4. Repeat steps 1 and 2 for the remaining boom distribution valves.
   Note: Hereafter adjustment of the constant boom pressure 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.
5. Operating the EC control unit while driving: In order to shut off the entire boom activate on-off switch **(A)** (Fig. 14) to the off (red) symbol (up position). This returns all the pump outputs to the tank through the return system. The diaphragm anti-drip valves ensures instantaneous closing of all nozzles.

In order to shut off one or more sections of the boom, switch one or more unneeded boom distribution valves **(B)** (Fig. 14) to off position. The constant pressure system ensures that the pressure does not increase in the sections which are still open.

In case of electrical failure it is still possible to manually overide all functions of the operating unit. To operate manually, disconnect the multiplug from the EC control box first and operate the handles by hand. It is possible to change pressure, turn boom sections on or off, or shut off the complete control unit manually.

IMPORTANT: ***When the sprayer is stored, the EC control box and the multiplug must be protected against moisture and dirt. A plastic bag may be used to protect the multiplug. Store the control box in a clean dry place.***

4.13 Remote Pressure Gauge



The remote pressure gauge measures the working pressure in the center boom tubes as close to the nozzles as possible. The outputs stated in the nozzle charts are always based on the pressure measured at the nozzle.

Note: Always adjust the pressure when calibrating and spraying according to readings at the remote pressure gauge.

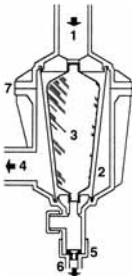
The gauge can be removed from the sprayer and mounted on the tractor. The red plastic hose can be extended using the fittings supplied with the sprayer. A magnetic base #105368 can be purchased from your Hardi® Dealer.

4.14 Self Cleaning Filters

This filter automatically flushes out particles and chemical deposits, reducing routine maintenance, nozzle plugging and operator exposure. No adjustments are required but different mesh screens may be installed for various types of products.The mesh size of the filter in use should always be smaller than the flow average of the nozzles used.

Self-Cleaning Filter

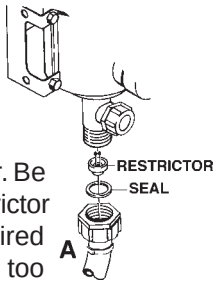
Operating Diagram



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

Choice Of Correct Restrictor for S.C.F.

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



The hose **(A)** is unscrewed from the self-cleaning filter. Be careful not to loose the seal ball or spring when the restrictor is put in the hose and the hose is refitted. If the required working pressure can not be obtained, the restictor is too large. 4 Restrictors are supplied. Use the **green** one (largest orifice) first. Choose the next smaller restrictor. Start with a **black** one, then a **white** and finally a **red** one.

4.15 Adjustment of Air Pressure in Pressure Damper (1302 Pump Only)

The air pressure in the damper on the 1302 pump is factory preset at 30psi (2 bar). This is suitable for nozzle spray pressures between 45psi (3 bar) and 225psi (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)**
45-225 (3-15)	**15-45 (1-3)**

4.16 Filling Of Chemicals

Chemicals can be filled into the tank two different ways:

1. Through the tank lid.
2. Filling with the HARDI® CHEMICAL FILLER
   Follow the instructions that are provided with the HARDI® CHEMICAL FILLER device.

WARNING: **BE CAREFUL NOT TO SLIP OR SPLASH CHEMICALS WHEN CARRYING CHEMICALS UP TO THE TANK LID.**

WARNING: **ALWAYS USE THE PERSONAL PROTECTION STATED ON THE CHEMICAL CONTAINER AND AS A MINIMUM, ALWAYS USE GLOVES, FACE PROTECTION SHIELD AND COVERALLS.**

4.17 Technical Residue

Inevitably a quantity of spray liquid will remain in the system, which cannot be sprayed properly on the crop, as the pump takes in air when the tank is about to be empty. The Technical Residue is defined as the remaining liquid qty. in the system as the first clear pressure drop on the pressure gauge is read.

	Residue, Gal. (liter)	
	With Blue Return Valve	With out Blue Return Valve
Dilutable Residue*	1.1-2.2 (5-10)	3.3-4.4 (15-20)
Total Residue **	6.6-8.4 (30-38)	8.8-10.6 (40-48)

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

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

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

4.18 Operation Of The Tank Drain Valve

WARNING: **BEFORE USING THE TOP DRAIN VERIFY THAT DISPOSAL OF WASTE IS DONE ACCORDING TO CHEMICAL LABEL INSTRUCTIONS AND LOCAL REGULATIONS.**

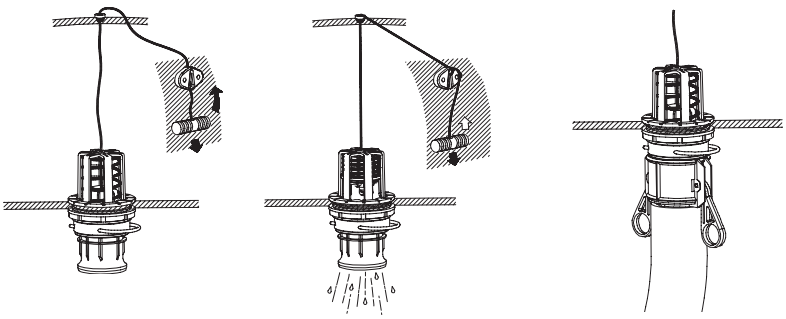


Fig. 15

Pull the red handle at left hand side of the tank to open the drain valve. The valve is spring loaded to close it, but can be kept open by pulling the string out and upwards in the V-shaped slot (Fig.15).

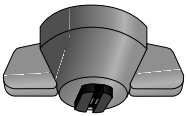
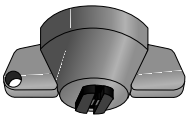
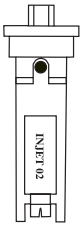
To release and close the drain valve again, pull the string downwards and the valve will close automatically (Fig.15).
If draining residues, e.g. liquid fertilizer into a reservoir, a snap-coupler with hose can rapidly be connected to the drain valve and the liquid safely drained.

Flush Tank Drain Valve (optional)
To avoid algae developing in the flush tank always drain the tank when the sprayer will not be in use for a long period.

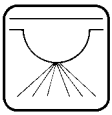
4.19 Nozzle Selection

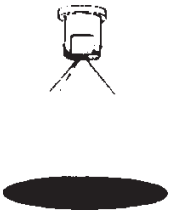
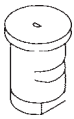
Correct selection of nozzles and the calibration of the sprayer are critical to achieve accurate and cost effective use of farm crop protection products. Your HARDI® sprayer has been supplied with 110° flat spray Red ISO Color Tips™ that will apply approximately 20 U.S. GPA at 30 PSI and 5 MPH. The 110° flat spray nozzle was chosen rather than the 80 degree nozzle for two reasons: 1- It may be used at a lower minimum height which reduces the risk of wind drift; 2- it's greater overlap permits better uniformity of spray distribution, particularly if boom height varies on rough ground. Normal boom height setting with 110° nozzles is 18" to 20" above the crop or weeds, whichever is taller.
Should you wish a different application rate or different type of nozzle, HARDI® manufactures a nozzle for virtually every need.

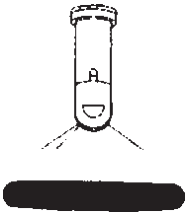
The following tables show what types of spray nozzles are suitable for different applications. It is important to use the correct nozzle.

	COLOR TIPS™ 110 degree flat fan,one piece cap and nozzle; color coded for flow rate selection. For herbicides, insecticides, and fertilizer applications. 50, 80, and 100 mesh screens are normally used.	S4110 ISO F-110
	LowDrift COLOR TIPS™ 110 degree flat fan,one piece cap and nozzle, 1553 solid stream nozzle; color coded for flow rate selection. In-Line Filters will normally be used.	SL4110 ISO LD-110
	INJET™ Nozzles; air inclusion nozzles with removable restrictor. Color coded for flow rate selection. In-Line Filters will normally be used.	

IMPORTANT: ***Always consult your chemical supplier for recommended chemical rate and water application rate. Always wear protective gloves when handling nozzles.***



	FLAT SPRAY NOZZLES in 65 degree, 80 degree, and 110 degree spray angles. For herbicides, insecticides, and fertilizer applications. 50, 80, and 100 mesh screens are normally used.	4665-65 degree 2080-80 degree 4110-110 degree Part # 330013- O-ring
	**FLOOD NOZZLES** set at 40" spacing. Designed for high volume application.	4598
	**HOLLOW CONE NOZZLES** for high pressure and high volume insecticide application in row crops. 1553 nozzles are ALWAYS used with swirl plates shown below EXCEPT when used as solid stream nozzles. 50,80, or 100 mesh screens are normally used with these nozzles.	1553 Must add swirl to produce hollow cone pattern
	**SWIRL PLATE** used in conjunction with cone nozzle to create desired spray pattern. These swirls work with 1553 series cone nozzles. Grey, blue, or black swirls are used to create hollow cone effect. White swirls are used to create full cone effect.	Grey Blue Black White
	**HOLLOW CONE CERAMIC NOZZLES** for high pressure and high volume fungicide and insecticide application.	1299

	**LARGE DROPLET HOLLOW CONE NOZZLE** for use where drift must be kept to a minimum. These nozzles must always be fitted with 1553 nozzles and grey swirl plates. 50,80 or 100 mesh screens are normally used with these nozzles.	371077
	**LARGE DROPLET FLAT SPRAY TIP IN 150 DEGREE SPRAY ANGLE.** Always used in conjunction with 1553-14-16-18 or 20 cone nozzle. 50,80 or 100 mesh screens are normally used with these nozzles.	371551
	**SOLID STREAM NOZZLE** for high volume liquid fertilizer application. In this application, the 1553 nozzle is always used with 330013 o-ring and 50,80 or 100 mesh screens.	1553 less swirl
	**3-HOLE NOZZLE-SYNTAL/ CERAMIC** this nozzle disperses the spray liquid in three solid streams, thereby reducing the number of plants at risk of scorching by the application of liquid fertilizer.	371537 thru 371543

4.20 Calibration

WARNING: **ALWAYS CALIBRATE YOUR SPRAYER WITH CLEAN WATER ONLY! IN ADDITION, WEAR PROTECTIVE CLOTHING WHEN CALIBRATING YOUR SPRAYER!**

Why must you calibrate a sprayer?

A nozzle selection chart will tell you what application rate you should expect. Variations due to nozzle wear, errors in pressure adjustment, and tractor speedometer can result in a possible error in application rate.

How do you calibrate a sprayer?
Calibration kits are available from HARDI®, #818103 for US gallons & #818104 for metric calibration.

Following are some tips to remember when using the calibration kit method:

- When determining the length of time required to drive the recommended distance, drive in actual field conditions with a half-full tank.
- Repeat the test several times, each time avoiding the tracks from the previous test. Take the average of the times recorded.
- Calibration of the sprayer should be completed at the beginning of the season and repeated after every 2 to 3 full days of spraying, and every time you change volume rate or use new nozzles.
- Before you calibrate, check the flow of each nozzle. If it puts out more than 10% of its original volume, replace it.

Select your calibration method- Ounce method or Formula method. Then follow the steps described below:

A.) Ounce Method

1. Determine how long it takes you to cover the test strip.
   Use the following chart (Fig. 16) to determine the length of your test strip.Row width for broadcast application is equal to your nozzle spacing. For your drop nozzle or band application, use row spacing.

Row width or nozzle spacing (in.)	Distance (ft.)
40	102
38	107
36	113
34	120
32	127
30	136
28	146
26	157
24	170
22	185
20	204
18	227
16	255
14	291

Fig. 16

2. Measure the amount of time it takes you to travel the test strip when throttle is set at spraying speed.
3. In a container (with oz. measurements), catch the spray from on nozzle for that amount of time. For drop or band nozzles, catch the spray from all nozzles for the row.
4. Read the ounces in the container. That is the actual U.S. GPA applied. (ounces - GPA)

B.) Formula Method

1. Check your spraying speed. Measure a test strip of at least 200 feet (300 feet is ideal). Travel the distance at the speed you plan on spraying and record the time it takes to travel the distance. Read from the chart' or use the formula to find your exact travel speed.

Formula:

$$\frac{\text{distance (ft.) x 0.68}}{\text{seconds}} = \text{MPH}$$

Travel Time (in seconds)

Speed in MPH	200 ft.	300 ft.
3.0	45	68
3.5	39	58
4.0	34	51
4.5	30	45
5.0	27	41
6.0	23	34
7.0	19	29
7.5	18	27
8.0	17	26
9.0	15	23

2. Calculate the required nozzle output. Use either the nozzle wheel (if nozzle spacing is 20 inches), or this formula:

Formula:

$$\text{GPM} = \frac{\text{GPA x MPH x W (in.)}}{5940}$$

Formula:

$$\text{GPM} = \frac{10 \text{ x } 7 \text{ x } 20}{5940} = .24 \text{ GPM}$$

Note: W=
- Nozzle spacing (in inches) for broadcast application.
- Row spacing (in inches) divided by number of nozzles per row for drop nozzle application.
- Sprayed band width or swath width (in inches) for band application divided by number of nozzles per band.
- Note that on the nozzle wheel, W = 20 inches.

3. Set correct pressure. Read the required pressure from the nozzle table in the nozzle catalogue or nozzle wheel. With clean water in the tank and line, turn on the sprayer and set the target pressure. Collect the spray from one nozzle for one minute in a container. Adjust pressure until you collect the precise GPM called for.

C.) Calibration for carriers other than water

Use the following water rate conversion chart to determine the right conversion factor. When you've determined the new converted GPM or GPA, you can follow the steps on either the pressure or ounce method of calibration.

Weight of solution	Specific Gravity	Conversion Factors
7.00 lbs/gal	.84	.92
8.00 lbs/gal	.96	.98
8.34 lbs/gal-water	1.00	1.00
9.00 lbs/gal	1.08	1.04
10.00 lbs/gal	1.20	1.10
10.65 lbs/gal-28% N	1.28	1.13
11.00 lbs/gal	1.32	1.15
12.00 lbs/gal	1.44	1.20
14.00 lbs/gal	1.68	1.30

Example: 20 GPA of 28% N
Then GPA (solution) x conversion factor = GPA (water)
20 GPA (28% N) x 1.13 = 22.6 GPA (water)
Calibrate for 22.6 GPA of water

For conversion to Imperial gallons per acre, multiply U.S. GPA by .833
For conversion to liters per hectare, multiply U.S. GPA by 9.34
For conversion to liters per acre, multiply U.S. GPA by 3.78
Formula for tractor speed: $\frac{\text{Distance (in feet)}}{\text{Second}} \times .682 = \text{MPH}$

5.0 MAINTENANCE

IMPORTANT: ***Always clean the boom at the end of your workday or before servicing is done to avoid unnecessary contact with chemicals.***

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

5.1 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. The Department of Agriculture.

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 chemical 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.

The HARDI® Flush & Rinse™ system is available on the COMMANDER sprayer that offers both the flushing of internal components and also a highly effective internal rinsing system of the sprayer tank.

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 110° Flat Fan nozzles, pressure may be reduced to 22 psi (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 pressure and suction filters and clean. Be careful not to damage the mesh. 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.
6. After spraying the liquid out again in the field, 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.
8. 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 orifice.
9. Drain the tank and let pump run dry. Rinse inside of tank, again letting the pump run dry.
10. Stop the pump. If the chemicals 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 Manifold System.
11. Replace all the filters and nozzles and store the sprayer. If, from previous experiences, it is noted that the solvents in the chemicals 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.

5.2 Service Intervals

Note: For service and maintenance of the Eagle Boom refer to the separate operation manual.

10 Hours or Daily (whichever comes first)

A. Suction Filter clean (Section 5.4)
B. Self-Cleaning filter, check and clean gauze if necessary.
C. In-Line filters (if fitted), clean
D. Nozzles filters, clean
E. Spraying circuit, check for leaks
F. Lubricate the sprayer (according to schedule)
G. Retighten bolts (Suspension only, Section 5.7)

50 Hours or Weekly (whichever comes first)

Do all the previous mentioned plus:
A. Wheel bolts and nuts, retighten
B. Draw bar bolts, retighten
C. Tires, check tire pressure
D. Transmission shaft, check condition of protection guards
E. Lubricate according to scheme (Section 5.3)
F. Check all fasteners

200 Hours or Monthly (whichever comes first)

Do all the previous mentioned plus:
A. Wheel bearings, check and adjust if necessary
B. Booms, re-adjust. (Refer to Eagle Boom Manual)
C. Hydraulic circuit, check for leaks
D. Hoses and tubes, check for damages and proper attachment

1000 Hours or Yearly (whichever comes first)

Do all the previous mentioned plus:
A. Wheel bearings, dismantle, check, grease and adjust
B. Transmission shaft, renew protection guard bearings

5.3 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.

See EAGLE BOOM Operators manual for boom greasing.

POS. Position on sprayer

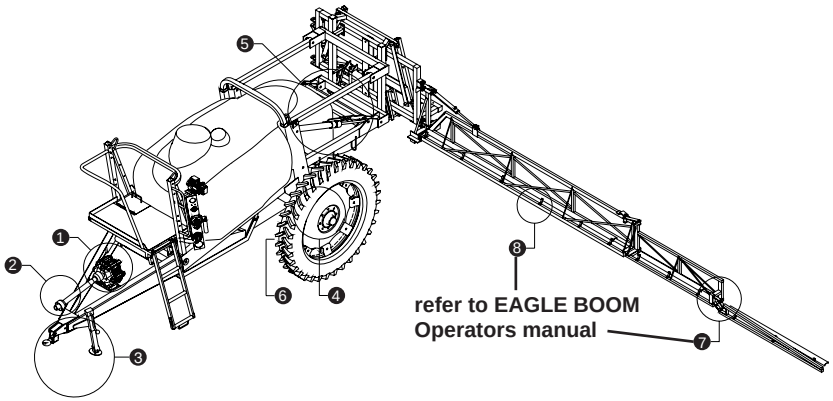
Grease

Page to find more information

Oil

Operation hours

Winter protection or off-season storage



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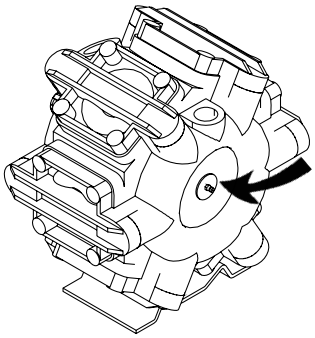
1		X	50		50

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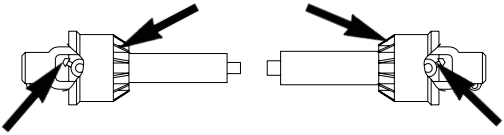
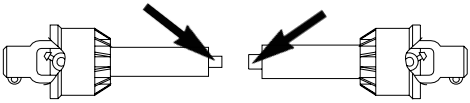
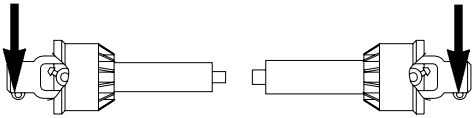
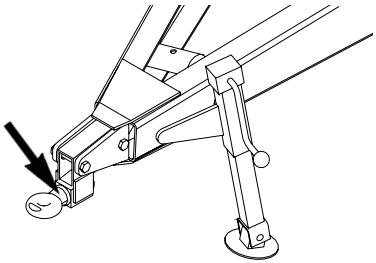
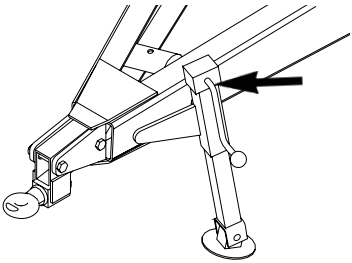
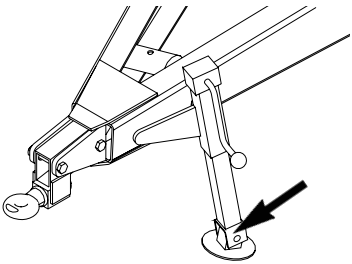
2		X	10		55
		X	50		18
	X		50		18
3		X	50		13
3		X	200		13
	X		200		13

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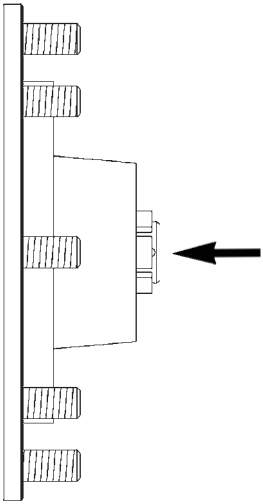
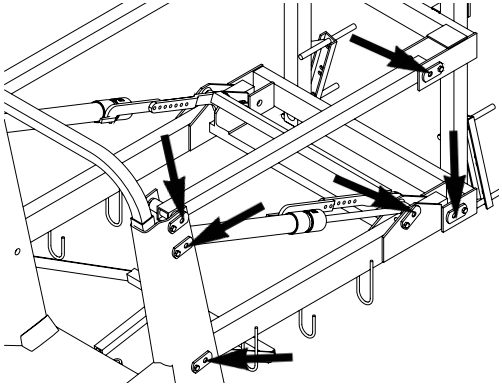
4		X	200		49
5		X	50		56

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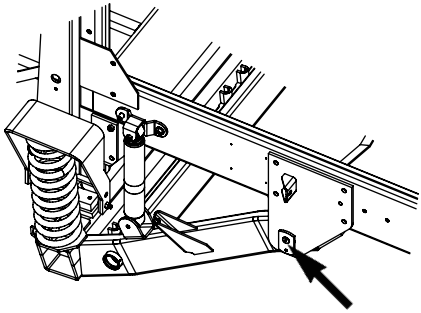
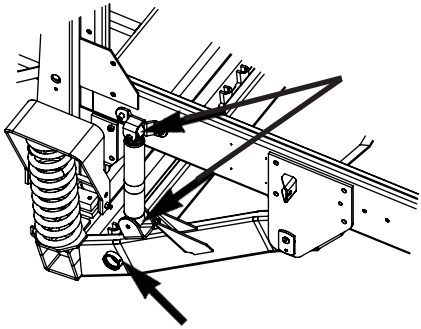
6		X	50		50
6		X	200		50

5.4 Filters

WARNING: **WEAR PROTECTIVE CLOTHING WHEN SERVICING & HANDLING COMPONENTS THAT HAVE BEEN IN CONTACT WITH SPRAY LIQUID.**

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 pump. A blocked suction or pressure filter will result in pump cavitation.

A) Suction filter

The main filter protecting sprayer components is the suction filter at the top of the tank. Check it regularly. It is readily identifiable as it is red.

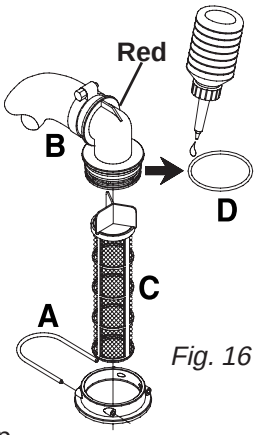


Fig. 16

To service the suction filter:

1. Pull the steel clip **(A)** (Fig. 16) out.
2. Lift the suction hose fitting **(B)** (Fig. 16) from housing.
3. Filter guide and filter **(C)** (Fig. 16) 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)** (Fig. 16) on the hose fitting is in good condition and lubricated.

Note:(use only vegetable oil)

7. Refit the suction hose **(B)** (Fig. 16) and steel clip **(A)** (Fig. 16).

B) Self-Cleaning Filter (Fig. 17)

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

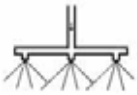
Fig. 17

C) In-Line Filter (if fitted)

If the boom is equiped with In-Line filters unscrew the filter bowl to inspect and clean the filter. Alternative filters are available.

D) Nozzle Filters

Check and clean.

Nozzle Size 	Suction Filter 	Self Cleaning Filter 	Inline Filter 	Nozzle Screen 
Lilac (08) Brown (10) Yellow (12) Orange (14)	50	100	100	100
Red (16) White (18)	50	80	80	80
Green (20) & Larger	30*	50*	50*	50*

***** Standard Equipment

FILTER SIZE SELECTION TABLE

5.5 Recommended Tire Pressure

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

Tire Size	Recommended Inflation Pressure PSI (kPa)
12.4x42 6 ply 320/90R46 270/95R48	25 (175) 35 (240) 35 (240)

WARNING: **NEVER INFLATE TIRES OVER PRESSURE SPECIFIED IN THE TABLE. OVER-INFLATED TIRES CAN EXPLODE AND CAUSE SEVERE PERSONAL INJURIES!**

The pressure is specified for a fully loaded trailer. When traveling on hard road surfaces with a maximum load, do not exceed 15 mph. Remember it is easier to let off a little pressure for a specific use than to re-inflate a tire in mid-field.

5.6 Wheel Nuts and Bearing Adjustments

A) Wheel Bolts and Nuts

1. Tighten wheel bolts and nuts as follows with following torque wrench settings:
   Wheel hub to rim plate: 120 lb/ft (180Nm)
   Tightening sequence: As shown

B) Wheel Bearings Adjustment

Check the condition of the bearing parts the following way:

1. Place stop wedges in front of and behind LH wheel and jack up RH wheel.
2. Support the trailer with axle stands.
3. Rock the RH wheel to discover possible play in the bearings.
4. (Fig.18) Remove hub cap **A** and cotter pin **B**. Turn the wheel and tighten the castle nut **C** until a slight resistance in the wheel rotation is felt.
5. Pull off the wheel hub. Use a wheel puller if necessary.
6. Check roller bearings for discoloration and wearing if worn or damaged.
7. Assemble the hub and bearings using a new seal **D**
8. Fill the hub and bearings with fresh grease before fitting it to the shaft.

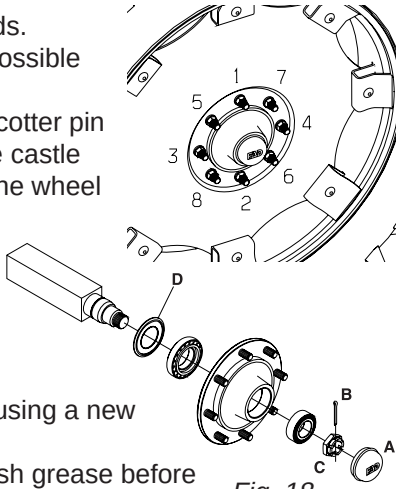


Fig. 18

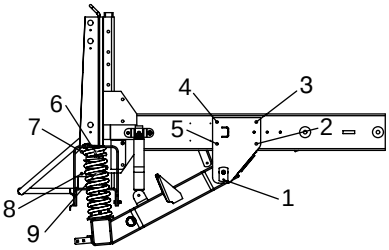
9. Fit the castle nut. Rotate the hub and tighten the castle nut until a slight rotation resistance is felt.
10. Loosen the castle nut again until the first notch is aligned with the cotter pin hole in the shaft.

Note: The shaft has a vertical and an horizontal cotter pin hole. Use the one first aligned with the notch when loosening the castle nut.

11. Fit a new cotter pin and bend.
12. Fill the hubcap with fresh grease and carefully press it onto the hub.
13. Fit the wheel again and tighten the wheel nuts. Tighten all bolts to half the specified torque first, then to the full specified torque.
    Settings: wheel hub to rim - CM750: 135 lb/ft (180Nm)
    - CM875/1200: 320 lb/ft (430 Nm)
14. Tighten again after 10 hours of work. Check the torque everyday until it is stabilized.

5.7 Retighten bolts (suspension only)

Check that these 9 bolts (on each side of the COMMANDER) are torqued to the following specifications. Retighten if necessary.



Tightening torque:
Bolt **1 = 20 lb/ft (24 Nm)**
(Secure nut with wrench on the back side of the mount bracket while adjusting bolt 1)
Bolts **2-9**: **= 205 lb/ft (280 Nm)**

5.8 Draw Bar Bolts

The draw bar bolts must be tightened as follows:

1. Jack up the frame so there is no load on the drawbar.
2. Tighten the bolts **A** (Fig. 19) between tank frame and draw bar. Torque setting: 554 lb/ft (750 Nm)
3. Tighten bolts **B** (Fig. 19) at the towing hitch. Torque setting: 162 lb/ft (220Nm)

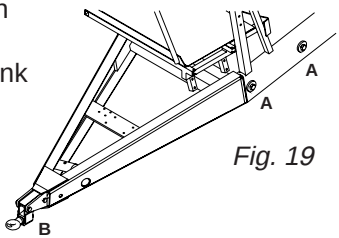
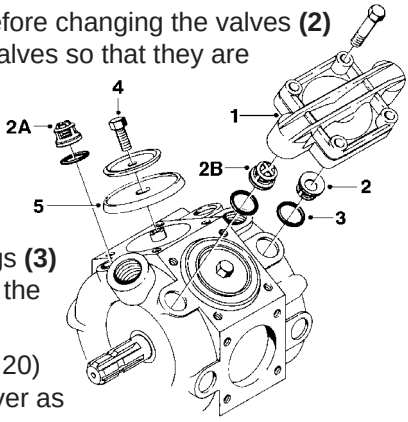


Fig. 19

5.9 Changing The Valves and Diaphragms 363/463 Pump

Note: It is recommended that if one or more diaphragms and/or valves need replacing they all should be replaced.
(#750342-Complete 363 rebuild kit, #750343-Complete 463 rebuild kit)

1. Remove valve cover **(1)** (Fig. 20). Before changing the valves **(2)** (Fig. 20) note the orientation of the valves so that they are replaced correctly.
   IMPORTANT: ***The two valves with vented flaps (2A and 2B) (Fig. 20) must be placed in the valve openings as shown.***
2. It is recommended to use new O-rings **(3)** (Fig. 20) when changing or checking the valves.
3. Remove the diaphragm bolt **(4)** (Fig. 20) after having dismantled the valve cover as indicated above. The diaphragm **(5)** (Fig. 20) may now be changed.



Model 361 Pump shown
363/463 similar
Fig. 20

4. If fluids have reached the crankcase, flush and regrease the pump thoroughly.

Re-assemble with the following torque settings.

Pump Model	Valve Cover Ft/lb(Nm)	Diaphragm Bolt Ft/lb(Nm)	Diaphragm Cover
1302	45 (60)	45 (60)	50 (70)
363	50 (70)	45 (60)	
463	65 (90)	60 (80)	

1 Nm = 0.74 lbft

5.10 Changing the Valves and Diaphragms 1302 Pump

Note: It is recommended that if one or more diaphragms and or valves need replacing they all should be replaced. (#750175-1302 Complete rebuild kit)

1. Remove valve covers **(1)** (Fig. 21). Before changing the valves **(2)** (Fig. 21) note the orientation of the valves so that they are replaced correctly.
2. It is recommended to use new O-rings **(3)** (Fig. 21) part # 330072 when changing or checking the valves.
3. Remove diaphragm covers **(4)** (Fig. 21) to gain access to the diaphragms.
4. Remove the diaphragm bolt **(5)** (Fig. 21) after having dismantled the valve cover as indicated above. The diaphragm **(6)** (Fig. 21) may now be changed.
5. If fluids have reached the crankcase, flush and regrease the pump thoroughly.

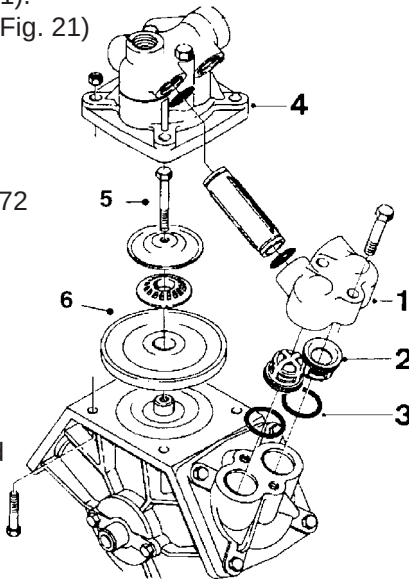


Fig.21

Model 1302 Pump shown

5.11 1000 RPM Gearbox Drive (Optional)

The oil should be changed after the first 100 hours of use, and thereafter every 1000 hours.

Use 1 pint of 15/40 HD oil.
The oil level should be checked every 50-100 hours. The oil must at all times be above the sight glass **(J)** (Fig. 22). If the oil level goes below the top of the sight glass, oil must be added immediately.

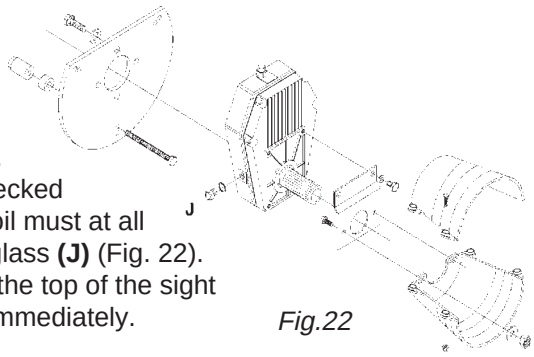


Fig.22

5.12 Ball Seat Check/Renewal, EC On/Off Valve

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

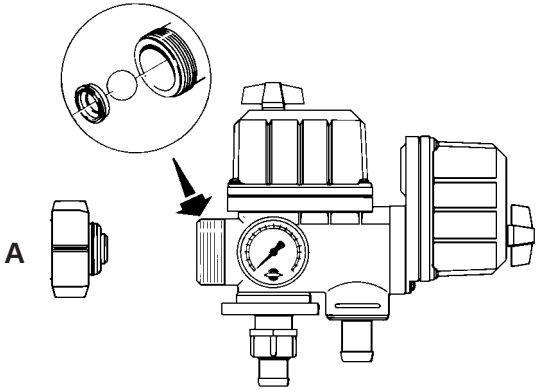


Fig.23

Remove the 1 1/4” hose from the main On/Off pressure valve unit. Unscrew the S67 connector fitting (**A**) to access the ball. Check the ball for sharp edges and scratches, and check the ball seat for cracks and wear - replace if necessary.

5.13 Checking The Valve Cone In Distribution Valves

Periodically check the distribution valves for proper sealing.

1. Flush the sprayer with clean water and open master on/off and all distribution valves. (Shut sprayer off)
2. Remove clip **(A)** (Fig. 24) and remove hose **(B)** (Fig. 24) for the constant pressure device. When the housing is drained make sure the return fitting **(B)** and return hose are free from obstruction.
3. Start the sprayer, there should not be any leakage. If there is any leakage, the valve cone **(E)** (Fig. 24) must be changed. **(turn sprayer off.)**
4. Remove clip **(C)** (Fig. 24), and pull the EC motor off the valve housing.
5. Remove screw **(D)** (Fig. 24) and replace the valve cone **(E)** (Fig. 24).Reassemble in opposite sequence.

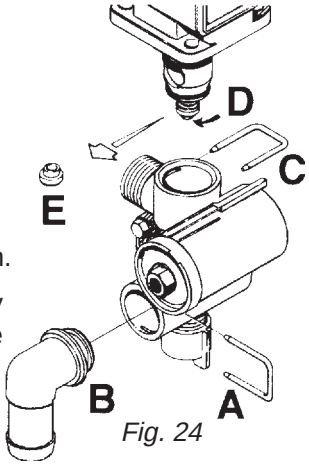


Fig. 24

5.14 Emergency Operation Of EC

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

The problem may be due to a blown fuse. The fuses are placed in the control box and are marked according to functions.
Spare fuses can be stored on the back cover plate

Fuse type: T 1.25 A
(HARDI® #261589)

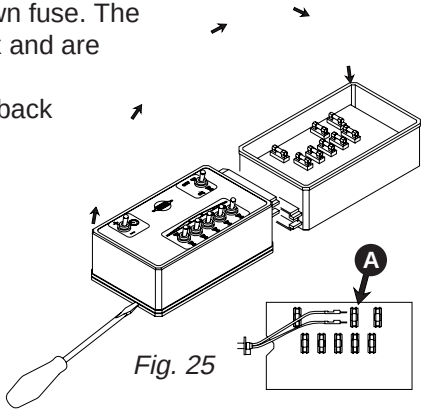


Fig. 25

5.15 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)** (Fig. 26).

If any deviation is found, pull out the plug **(B)** (Fig. 26), loosen the screws **(C)** (Fig. 26) and adjust the length of the cord.

Note: The level indicator is not ment to be an accurate indication of the specific volume of your tank. Variations due to the adjustment of the indicator, positioning of the sprayer and the production of the tank itself, are all factors leading to some inaccuracy. For precise measurement rely only on weight of the liquid or precise flowmeters when filling the tank.

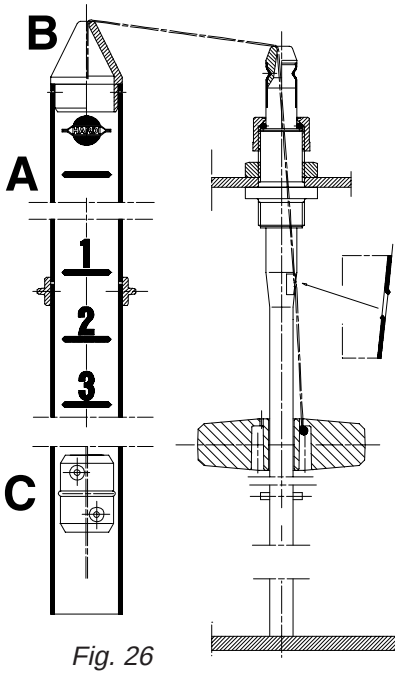


Fig. 26

5.16 Cord Renewal, Level Indicator

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

1. Remove the tank drain valve and loosen the fitting holding the pole in position. (Refer to Section 5.18 “Main Tank Drain Valve”)
2. Pull the pole down through the drain valve hole till it is free in the top of the tank.
3. The pole can now be taken out of the tank through the filling hole.

WARNING:DO NOT ATTEMPT TO ENTER THE TANK - THE FLOAT POLE CAN BE REMOVED FROM OUTSIDE THE TANK.

5.17 Replacement Of P.T.O. Shaft Protection Guards

The replacement of defective protection guards is easy to do.

1. Remove bolt **(A)** (Fig. 27), lock **(B)** (Fig. 27) and grease nipple **(C)** (Fig. 27)**.** Twist joint cover 1/4 turn and pull it backwards.
2. Remove the synthetic bearings and protection tube.
3. Remove inner bushing from protection tube.
4. Assemble again in reverse order, using new parts where necesary. Remember to fit chains again.
5. Grease bearings.

Note: Use only genuine HARDI® spare parts to service the P.T.O. shaft.

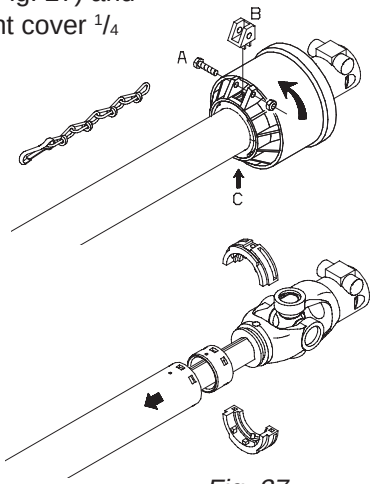


Fig. 27

5.18 Replacement Of P.T.O. Shaft Cross Journals.

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

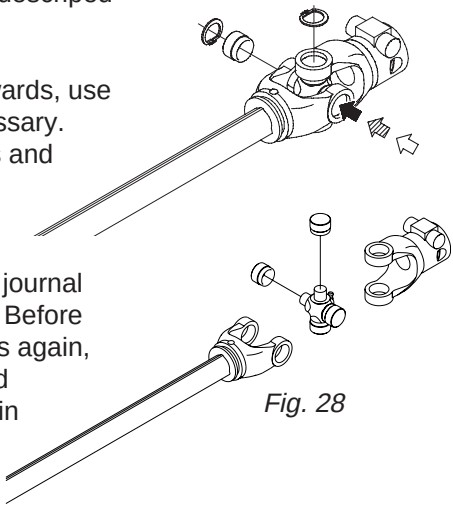


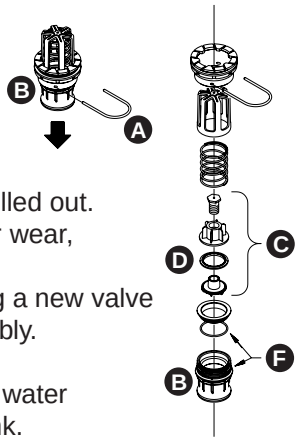
Fig. 28

5.19 Seal Renewal Main Tank, Drain Valve

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

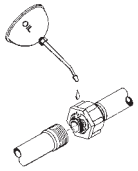
WARNING: DO NOT ATTEMPT TO ENTER THE TANK - THE PARTS CAN BE CHANGED FROM UNDERNEATH THE TANK.

WARNING: USE EYE / FACE PROTECTION MASK WHEN DISMANTLING THE TANK DRAIN VALVE.



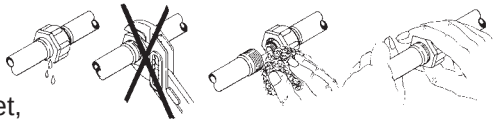
1. Make sure the tank is empty and clean.
2. The valve must be closed and the string loose.
3. Pull out the clip **A** and pull down connecting piece **B**.
   The entire valve assembly can now be pulled out.
4. Check cord and valve flap assembly **C** for wear, replace seal **D** and assemble again.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

5.20 Nozzle Tubes And Fittings

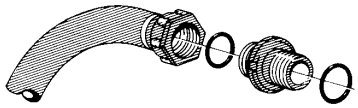


Poor seals are usually caused by:

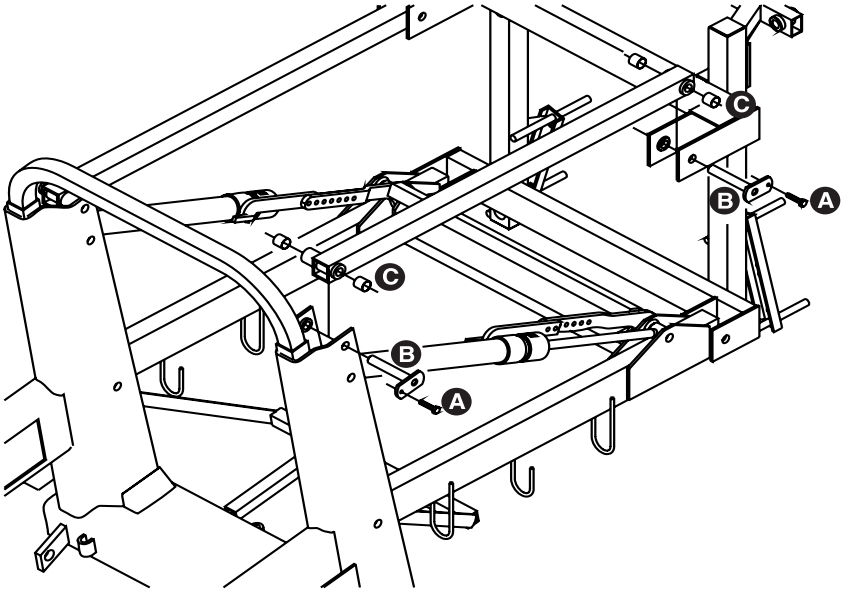
- missing O-rings or gaskets
- damaged or incorrectly seated O-rings
- dry or deformed O-rings or gaskets
- Foreign bodies



Therefore, in case of leaks:
DO NOT overtighten.
Disassemble, check condition and position of O-ring or gasket, clean, lubricate and reassemble.
For radial type seal (o-rings), hand tighten only, do not use pliers.



The O-rings must always be lubricated all the way round before refitting. For face type seals, a little mechanical leverage may be used.



5.21 Wear Bushing Renewal, Boom Lift

The wear bushings should be inspected regularly and renewed before they are worn excessively to reduce damage to structural components.

1. Connect the trailer to the tractor and unfold the booms to working position.
2. Lift the boom center frame with a lifting device and support it until the load is taken off the parallelogram arms.
3. Remove the screws **A**, and pull out the pins **B** at one of the upper parallelogram arms and renew the wear bushings **C**.
4. Refit the arm.
5. Repeat steps 1-4 on the other upper arm.
6. The lower arms must be disconnected simultaneously. Grease all grease nipples.
7. Remove the lifting gear again.

6.0 Off-Season Storage

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

1. Clean the sprayer completely - inside and outside - as described under "Cleaning of the sprayer". Make sure that all valves, hoses and auxiliary equipment have been cleaned with detergent and flushed with clean water afterwards, so no chemical residues are left in the sprayer.
2. Renew any damaged seals and repair any leaks.
3. Empty the sprayer completely and let the pump work for a few minutes. Operate all valves and handles to drain as much water out of the spraying circuit as possible. Let the pump run until air is coming out of all nozzles. Remember to drain the flush tank also.
4. Pour appr. 11 Imp.gal (50 litre) antifreeze mixture consisting of 1/3 automotive antifreeze and 2/3 water into the tank.
5. Engage the pump and operate all valves and functions on the MANIFOLD system, EC unit, CHEM FILLER etc. allowing the antifreeze mixture to be distributed around the entire circuit. Open the EC main on/off valve and distribution valves so the antifreeze is sprayed through the nozzles as well. The antifreeze will also prevent O-rings, seals, diaphragms etc. from drying out.
6. When the sprayer is dry, remove rust from any scratches or damages in the paint and touch up the paint.
7. Lubricate all lubricating points according to the lubricating scheme regardless of intervals stated.
8. Remove the glycerine-filled pressure gauges and store them in a vertical position in frost free conditions.
9. Apply a thin layer of anticorrosive oil (e.g. SHELL ENSIS FLUID, CASTROL RUSTILLO or similar) on all metal parts. Avoid oil on rubber parts, hoses and tires.
10. Fold the boom in transport position and relieve pressure from all hydraulic functions.
11. AII electric plugs and sockets are to be stored in a dry plastic bag to protect them against damp, dirt, and corrosion.

6.0 Off-Season Storage (continued)

12. Remove all the control boxes and if fitted the HARDI® PILOT control box and display from the tractor, and store them in a dry and clean condition.
13. Wipe hydraulic snap-couplers clean and fit the dust caps.
14. Apply grease on all hydraulic ram piston rods which are not fully retracted to protect against corrosion.
15. Jack up the axle and place wooden blocks under the wheels, to prevent moisture damage and deformation of the tires. Tire black can be applied to the tire side walls to preserve the rubber.
16. To protect against dust, the sprayer can be covered by a tarpaulin. Ensure ventilation to prevent condensation

6.1 Preparation After Off-Season Storage

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

1. Remove the cover. (If fitted)
2. Remove the blocks from under the wheels and adjust the tire pressure.
3. Wipe off the grease from hydraulic ram piston rods.
4. Fit the pressure gauges again. Seal with Teflon tape.
5. Connect the sprayer to the tractor including hydraulics and electric's.
6. Check all hydraulic and electric functions.
7. Empty the tank of remaining antifreeze.
8. Rinse the entire liquid circuit on the sprayer with clean water.
9. Fill with clean water and check all functions.

7.0 ACCESSORIES

7.1 Clean Water Dispenser

Fig. 29

Clean Water Dispenser & Mounting Bracket

A handy source of fresh water on the sprayer to clean up plugged nozzles and for rinsing gloves and hands after performing service or maintenance.

7.2 Chemical Filler

Will inject all types of chemical formulations, liquid, powder or granules, into the bottom of the tank near the agitation flow. A cleaning ring ensures that chemical residue is removed from the Chemical filler tank.

Fig. 30

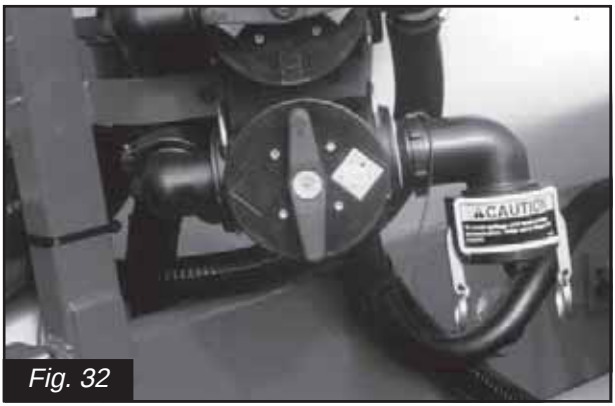
Chemical Filler Attachment Installed

7.3 Chemical Filler Rinse Kit

Chemical-Filler Rinse Kit

A container rinse kit for liquid containers or plastic bags is also available for installation into the chemical filler hopper. Refer to the Chemical Filler Operators Manual for instructions.

7.4 Nurse Tank Quick Fill



Nurse Tank Quick Fill

A quick attach hook-up for filling the sprayer tank from a nurse tank. Liquid is fed into the top of the tank through a two-way valve providing a better mix of water and chemical. The valve may be shut off by turning the handle 1/4 turn (Fig. 32).

7.5 Foam Marker System

Foam Marker Tank

Foam Marker Drop Assembly

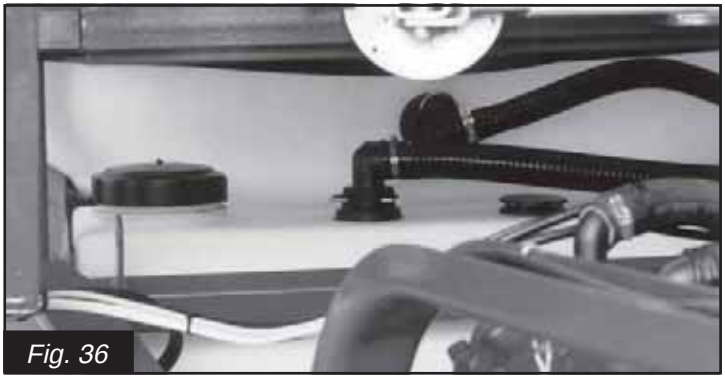
The Foam Marker helps prevent skipping or over lapping during spray application of spray solution, both which can be costly. HARDI® Foam Marker features a trailer mounted compressor, poly tank, extruded foamer hoses and in-cab electrical controls providing right or left drop selection and the rate/quality of foam droplets.Refer to the Foam Marker Operators Manual for complete operation instructions.

7.6 4" Boom Pressure Gauge

4" Boom Pressure Gauge

A large and easy to read 4" boom pressure gauge to replace the standard 2-1/2" gauge. This gauge is to be mounted near the tractor cab allowing the operator to monitor the boom pressure for more accurate control of the application rate. (Section 4.13)

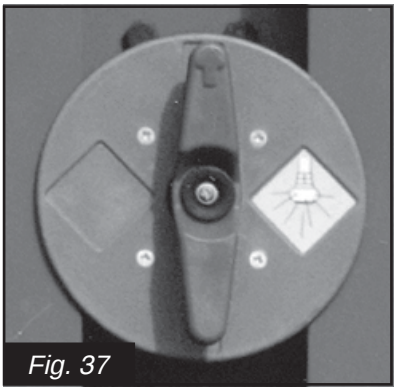
7.7 Flush System



Flush & Rinse Tank (70 gal. shown)

Flush system provides a means to be able to flush the pump, controls, boom feed lines and complete boom and nozzles with clean water from a 70 gallon tank. Refer to the Flush & Rinse System™ Operators Manual for complete operational instructions.

7.8 Tank Rinse System

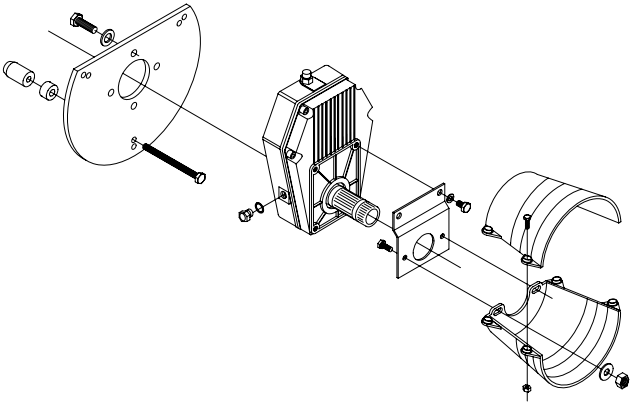


Rinse Valve

Rinse Nozzle on Top of Tank

The Rinse system can be added to the flush system. This provides a means to rinse the main tank using pressurized water to spray the inside of the tank through specially designed spinning nozzles. See the Flush & Rinse™ System Operator Manual for complete operational instructions.

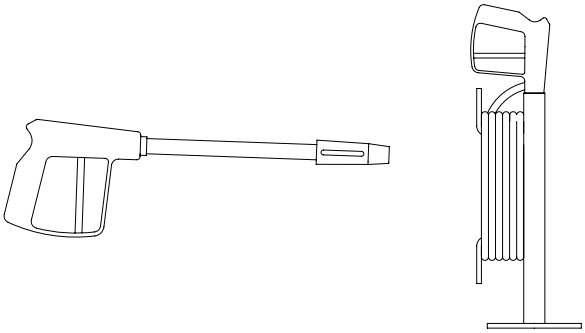
7.9 1000 RPM Drive Gearbox (For 363/463 Diaphragm Pumps)



1000 RPM Drive Gearbox

1000 RPM Gearbox Drive provides a means to use larger tractors having only 1000 RPM PTO system. Available for the model 363 and 463 pumps only. The gearbox has an oil filled case to provide long life and service.

7.10 Handgun And Hose Wrap



Handgun

A handgun with adjustable spray pattern and 25ft of hose for spraying fence row or spot spraying a small area can be installed onto your sprayer. A handy hose wrap and handgun holder can be conveniently located on the sprayer to transport the handgun.

7.11 HARDI PILOT

HARDI® PILOT 3880 Rate Controller shown

The HARDI® PILOT is a advanced data processing system for sprayers and other implements. The unique design combines practical function in a compact, uncluttered presentation. Components can be added for your individual requirements to control your operating unit, boom hydraulics and optional equipment.

8.0 TROUBLESHOOTING

Fault Finding

Operational problems

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

- Minor leaks on the suction side of the pump will reduce the pump capacity or stop the suction completely.
- A clogged suction filter will hinder or prevent suction so that the pump does not operate satisfactorily.
- Clogged pressure filters will result in increased 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 effciency.
- Poorly reassembled pumps, especially diaphragm covers, will allow the pump to suck air resulting in reduced or no capacity.
- Hydraulic components that are contaminated with dirt result in rapid wear to the hydraulic system.

8.1 General Spray Systems

Problem	Cause
1. No liquid getting to the pump.	A. Bottom of suction tube plugged. B. PTO shaft slipping on pump crank shaft.
2. Lack of pressure	A. Bottom of suction tube plugged. B. Too little distance between suction tube and tank bottom. C. Self cleaning filter bottom support broke off inner cone. D. Self cleaning filter safety valve stuck open or valve spring weak or broke. E. No restrictor orifice in self cleaning filter. F. Cracked internal housing or bad seal on HARDI-matic valve.

2. Lack of pressure (continued)	G. Motor shaft coupling loose or fork pin missing. H. Bad seat on spool valve for boom section control. I. PTO speed not fast enough. J. Flush valve not in correct position. (Units equipped with Flush & Rinse™ system only) K. Bad suction valve or suction side air leak. L. P.T.O. not engaged. M. Rinse valve not in correct position. (Unit equipped with Flush & Rinse™ system only.) N. Check for dirt at pressure gauge inlet.
3. Pressure jumping	A. Output from by-pass lines causing a disturbance around suction hose inside tank. B. Small tear or pin hole in suction hose. C. Pump valve broke or seat missing. D. PTO shaft slipping on pump crankshaft. E. Self Cleaning filter safety valve stuck open or valve spring weak or broke. F. Bad suction valve or suction side air leak. G. Rinse valve not in correct position. (Units equipped with Flush & Rinse™ System Only) H. No air in pressure damper (1302 pumps only)

4. Pressure dropping	A. Output from by-pass lines causing a disturbance around suction tube. B. Suction filter plugging. C. Pump valve broke or seat missing. D. PTO shaft slipping on pump crankshaft. E. Cracked internal housing or bad seal on HARDI-matic valve. F. Bad seat on spool valve for boom section control. G. Bad suction valve or suction side air leak. H. Clean all filters
5. Liquid leaking from base of pump	A. Damaged pump diaphragm.
6. Electric control not functioning	A. Motor bad or micro-switch plate loose. B. Bad seat on spool valve. C. Bad switch or plug on control box. D. Print board at back of control corroded or damaged. E. Fuse blown F. Check micro-switch plate position
7. Less spray out of one boom section than others.	A. Bad seat on spool valve for boom section control.
8. Poor agitation	A. Self cleaning filter inner cone filled with liquid. B. Self cleaning filter bottom support broke off inner cone. C. Agitation valve not open. D. Agitation nozzle plugged. E. Agitation nozzle missing.

9. Excessive vibrations in hoses	A. Bottom of suction tube plugged. B. Pump valve broke or seat missing. C. PTO shaft slipping on pump crank shaft. D. Restrictor cone not the right size. E. Bad suction valve or suction side air leak. F. Rinse valve not in correct position (Unit equipped with Flush & Rinse™ system only).
10. Can't empty tank.	A. Output from by-pass lines causing a disturbance around suction tube. B. Crack or pin hole in suction tube. C. Tank is not level (change angle of tongue).
11. Boom nozzle leaking.	A. Seat on master shut-off valve worn or cracked. B. Bad seat on spool valve. C. Bad Non-Drip valve diaphragm
12. Pressure hose blowing off.	A. Restrictor cone in Chem-Filler not the correct size. (Units equipped with chemical filler option) Black- 1302,363 pumps White- 463 pump.

8.2 Foam Marker

Problem	Cause
1. Compressor will not run.	A. Short in electrical system or bad compressor. B. 12 volt supply not connected or bad connection. C. Bad printboard. D. Defective switch in control box. E. Fuse blown
2. Compressor runs but will not make foam.	A. Bad Printboard B. Not enough foam concentrate C. Solenoid valve plugged. D. Solenoid not working
3. Will not make enough foam.	A. Line leak or line pinched B. Solenoid valve plugged C. Weak foam concentrate mixture. D. Water too hard (add water softener).
4. Foam drops will not last.	A. Not enough foam concentrate. B. Frequency valve not opened enough. C. Weak foam concentrate. D. Water too hard (Add water softener)
5. Keeps blowing fuses.	A. Short in electrical system or bad compressor. B. Bad relay on printboard. C. Tank filter plugged.

8.3 Flush & Rinse™

1. System will not flush (pump, control, and boom)	A. Flush valve not in correct position. B. PTO not engaged.
2. System will flush but not rinse.	A. Rinse valve not in correct position.
3. Rinse nozzle has poor output.	A. Bad flush valve or suction side air leak. B. Rinse valve not in correct position. C. Chemical filler pressure selection not in correct position. (if so equipped)

8.4 Chemical Filler

1. Filler hopper will not empty.	A. Pressure selection valve not in correct position. B. Sprayer pump not running.
2. Filler hopper empties too slow.	A. Bottom tank discharge valve not open all the way. B. Restrictor cone from pump supply not the correct size. Black-1302 & 363 pump White-463 pump
3. Filler hopper backfills when bottom tank discharge valve is open.	A. Restrictor cone from pump supply line not the correct size (Black- 1302 & 363 pump, White - 463 pump). B. Restrictor cone missing. C. Restictor cone on wrong side of the valve.

9.0 WARRANTY POLICY AND CONDITIONS

HARDI® INC. , 1500 West 76th Street, Davenport, Iowa USA; 5646 W. Barstow, Fresno, California, USA; and 290 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 one year from the date of delivery to the end user providing the machine is used and serviced in accordance with the recommendations in the Operators Manual and is operated under normal farm conditions.

1. This limited warranty is subject to the following exceptions:

   a) Parts of the machine are not manufactured by HARDI®, (i.e. engines, tires, tubes, electronic controls, and other components or trade accesories, 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 operators 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 polyethylenetanks (excluding fittings, lids and gaskets) to FIVE 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 twelve months; at 20% of the then current price during the second year ; 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 tank being inspected and approved for replacement or repair by HARDI® personnel before HARDI® will accept any liability hereunder.
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 plants in Davenport, Iowa, USA; Fresno, CA, USA; and London, Ontario, Canada at no cost to the purchaser during the first twelve months after date of purchase, at 20% of the then current retail price during the second year ; 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 tank 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 filled 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.

10.0 NOTES

NOTES

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

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

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