PASTURE SPRAYER CENTRIFUGAL

Operator's Manual

67302003 (11/03)

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Dear Owner,

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

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

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

Some of the features on your HARDI® PASTURE 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: (563) 386-1730
Fax: (563) 386-1710

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

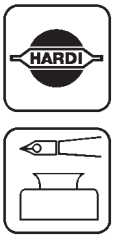
HARDI® GREAT LAKES
290 Sovereign Rd.
London, Ontario N6M 1B3
Phone: (519) 659-2771
Fax: (519) 659-2821

Sincerely,

Tom L. Kinzenbaw
President

Fig. 1

300 GALLON PASTURE SPRAYER



1.0 INTRODUCTION

The HARDI® PASTURE sprayers are available in 300 gallon (1100 L) or 550 gallon (2000 L) capacities. They consist of a centrifugal P.T.O. driven pump with P.T.O. shaft, frame and tank, BK-MAN manual controls, and a height adjustable nozzle bracket for mounting 2 pasture sprayer nozzles.

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 top operated tank drain valve is fitted for safe and easy draining. Bottom tank suction and a shut-off valve are standard for easy priming of the centrifugal pump.

The BK-MAN manual control unit consists of: Pressure control valve, pressure filter, 2-1/2" pressure gauge, adjustable pressure agitation, and 3 valves for feed lines (2 for nozzles, 1 for optional spraygun).

A height adjustable offset nozzle bracket bolted to the rear of the trailer frame is prepared for mounting either two HARDI® Giant End Nozzles or two "Boom Buster" nozzles (Evergreen Products, Inc.). The nozzle height is adjustable from 10" - 60" (.25 - 1.5m) through the adjustable U-bolts and by turning the nozzle bracket upside down.

The 2 HARDI® Giant End Nozzles provide a consistent spray pattern and droplet distribution. They are available in three different sizes ranging from 3.22 - 9.38 GPM (12.7 - 36 l/min) between 20 - 70 PSI (1.5 - 5 bar) spray pressure. Under optimal spraying conditions, the maximum spray swath covered by the two opposite mounted HARDI® Giant End Nozzles is 30', 40' or 50' (10m, 12m or 16m).

Available options include: 4 gallon (15 L) clean water dispenser, hose wrap with 50' or 25' of 3/8" hose and a model 60L HARDI® spray gun, foot step, filter basket, nurse tank quick fill, tank level indicator (liquid type), and a large 4" pressure gauge.

2.0 SAFETY INFORMATION

WARNING

ALWAYS READ OPERATOR'S 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 machine's 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 spray controls) and disengage the tractor power train.

3. Operate spray 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, the operator, should be on the machine when in operation.

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 operations 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. Keep hands, feet & clothing away from moving parts.

8. Wear relatively tight and belted clothing to prevent from being caught on some part of the machine.

9. Slow down when turning.

10. Always keep children away from your sprayer and/or tractor unit.

11. 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.

12. Understand service procedures before undertaking any maintenance. Never lubricate, service, or adjust the machine while it's moving. Securely support any components before working on them.

13. 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 debris.

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

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

PHONE NO. 1 - 8 0 0 - 2 2 2 - 1 2 2 2

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

PHONE NO. _____ - _____ - _____

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

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

3.0 HOOKING UP THE SPRAYER

3.1 Clevis Hitch Height

WARNING: **THE TRAILER FRAME MUST BE ADEQUATELY SUPPORTED AND WHEELS BLOCKED BEFORE ADJUSTING CLEVIS HITCH HEIGHT.**

Adjusting the height of the clevis is obtained by raising or lowering the tongue **D** (Fig. 2).

1. Loosen bolts **A** (Fig. 2) on both sides of the tongue.
2. Remove bolts **B** (Fig. 2) and raise or lower tongue. Re-insert bolts **B** (Fig. 2) into one of the other bolt locations **C** (Fig. 2).
3. Tighten bolts **A** & **B** (Fig. 2).
4. Adjust clevis **E** (Fig. 2) so that it is parallel with the ground. There are four different positions available by using both sets of holes and by inverting the clevis.

This will allow for an adjustment to suit tractor drawbar height and to keep the sprayer tank level.

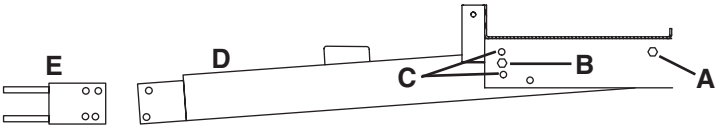


Fig. 2
Adjusting The Clevis Hitch

3.2 Wheel Tread And Ground Clearance

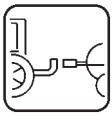
The HARDI® Pasture Sprayers are equipped with fixed axles:

Wheel Spacing & Clearance Table

Model	Wheel Spacing	Axle Clearance
300 Gallon	60"	17"
550 Gallon	60"	17"

WARNING: **DO NOT FIT DUAL WHEELS TO ANY OF THE AXLES ON THE HARDI® PASTURE SPRAYER MODELS.**

3.3 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 it covers 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.

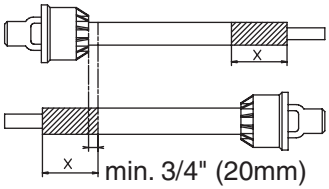
Make sure that protection guards around tractor P.T.O. and implement shaft are intact. Check every 40 hours.
Always **STOP ENGINE** and remove the ignition key before carrying out maintenance or repairs to the transmission shaft or implement.

3.4 Installation Of P.T.O. Shaft

WARNING: **THE P.T.O. SHAFT ANGLE WILL CHANGE WHEN RAISING AND LOWERING THE TONGUE AND 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 THIS OPERATION IS COMPLETED. THEN 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, pull the shaft apart. Fit the two shaft parts at tractor and sprayer pump and measure how much it is necessary to shorten the shaft. Mark the protection guards.

Installation Of P.T.O. Shaft (continued)



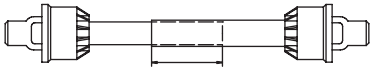


Fig. 3

Note: The shaft must always have a minimum overlap of 6" (150 mm) (Fig. 3).

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

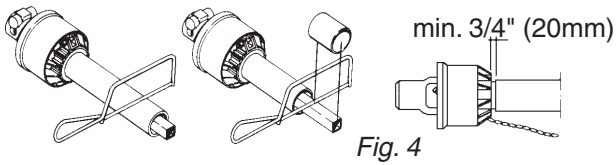


Fig. 4

5. Grease the profiles, and reassemble the male and female parts.
6. Fit the shaft to tractor and sprayer pump.

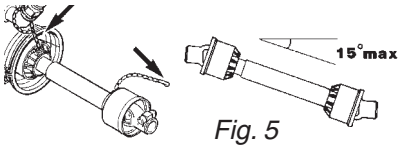


Fig. 5

Note: Female part towards tractor. Fit the chains to prevent the protection guards from rotating with the shaft.

7. To ensure long life of the P.T.O. shaft, try to avoid working angles greater than 15° (Fig. 5).

4.0 OPERATING INSTRUCTIONS

4.1 Filling The Main Tank

Water is filled into the tank by removing the tank lid located at front center of sprayer tank. It is recommended to use water as clean as possible for spraying purposes. Fill water through the strainer basket (optional) to prevent foreign particles from entering the tank.

WARNING: **DO NOT LET THE FILLING HOSE ENTER THE TANK. KEEP IT OUTSIDE THE TANK, POINTING TOWARDS THE FILLING HOLE (FIG. 6). IF THE END OF THE HOSE IS BENEATH THE SURFACE OF THE TANK CONTENTS AND THE WATER SUPPLY STOPS, CHEMICALS MAY BE SIPHONED BACK AND CONTAMINATE THE WATER SUPPLY SOURCE AND LINES.**

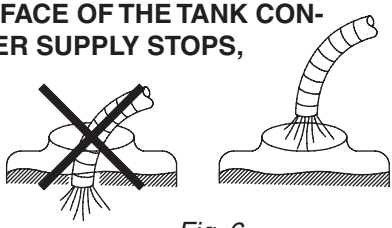


Fig. 6

4.2 ESC BK-MAN Plumbing Diagram

Review and study the following diagram. By following the flow through the diagram, you will better understand the various functions of your sprayer system.

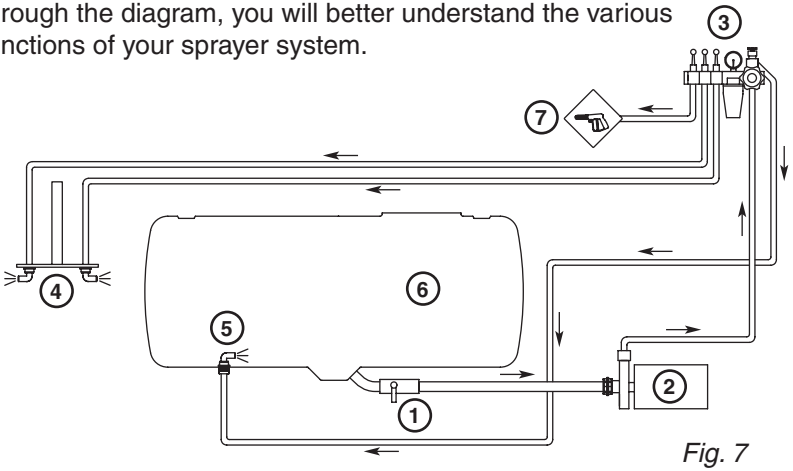


Fig. 7

1. Bottom Suction Valve
2. Centrifugal Pump
3. BK-Manual Control
4. Pasture Sprayer Nozzles
5. Agitation
6. Tank
7. Spraygun (optional)

4.3 Adjustment Of The BK-Manual Controls

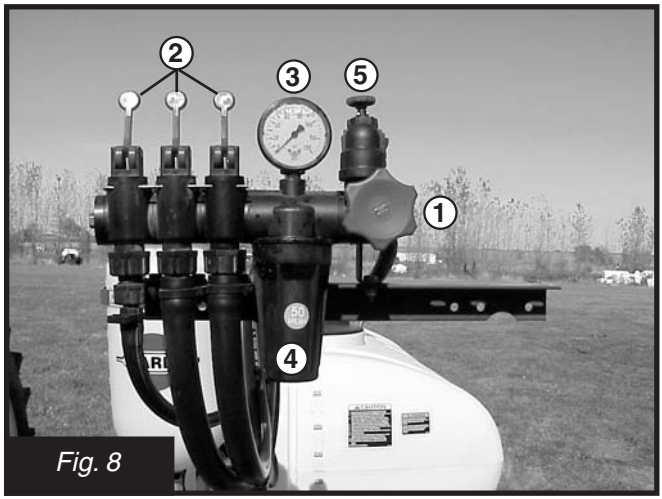


Fig. 8

1. Pressure control valve
2. Distribution valves
3. System pressure gauge
4. System pressure filter
5. Agitation valve

Operating the Pasture Sprayer Nozzles

1. Choose the correct pasture sprayer nozzles (Section 4.6). Make sure that both nozzles are the same type and capacity.
2. Set the two inside distribution valves **2** (Fig. 8) to the ON position (pull hand levers forward & down).

Note: The outside distribution valve is for the optional spraygun.

3. Turn the pressure control valve **1** (Fig. 8) counter-clockwise all the way out.
4. With the tractor in neutral, engage the tractor P.T.O. to start the pump. Adjust the R.P.M.'s until the number of revolutions corresponds to the intended traveling speed.
5. Increase pressure by turning the pressure control valve **1** (Fig. 8) clockwise. Adjust until the pressure gauge **3** (Fig. 8) indicates the recommended pressure (turning the pressure control valve **1** (Fig. 8) counter-clockwise decreases pressure).

Operating the Spraygun (optional)

Note: Pressure will be approximately 10 psi lower at the nozzles than the pressure shown on the system pressure gauge. A remote nozzle pressure gauge is available if desired (see page 37).

6. To operate the spraygun, set the outside distribution valve **2** (Fig. 8) to the ON position (pull hand lever forward & down).
7. Then depress the red handle **A** (Fig. 9) to spray fluid from the spraygun. Check the pressure on the pressure gauge **3** (Fig. 8) and follow step **5** to adjust.
8. To adjust the spray pattern, turn the black handle **B** (Fig. 9) OUT for a narrow spray pattern for long distances and IN for a wide pattern for more coverage at close distances.

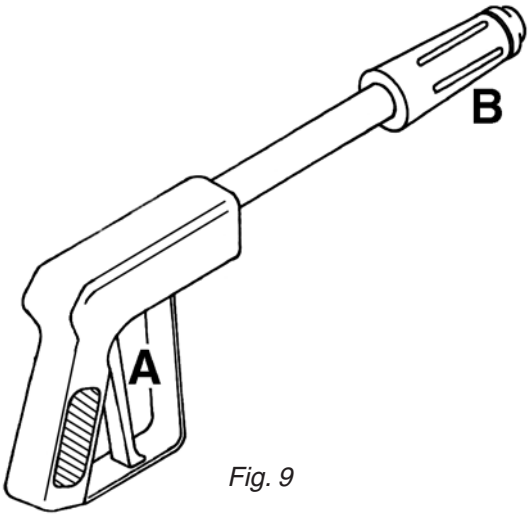


Fig. 9

4.4 Agitation Adjustment

Agitation is necessary to keep the solution in your tank properly mixed. Consult your chemical supplier for the recommended amount of agitation.

In general, maximum agitation is required but some products tend to foam easily. To reduce foaming in some instances anti-foaming agents may be added to the tank (Refer to chemical label). When running low liquid levels in the tank, agitation may be reduced to facilitate pump priming and avoid pressure fluctuations. Make sure that you have adjusted the agitation properly before sprayer calibration.

Turning the agitation valve **5** (Fig. 8) clockwise will reduce the agitation flow. Turning the valve counter-clockwise will increase the agitation flow.

4.5 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.**

The HARDI® Pasture Sprayer is equipped with a top operated tank drain valve located near the tank lid. To open the drain valve, turn the red drain valve handle (Fig. 10) counter-clockwise.

To close the drain valve again, turn the handle clockwise (Fig. 10).

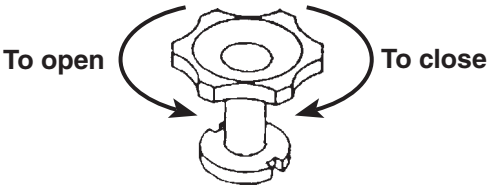


Fig. 10

4.6 Nozzle Selection

Correct selection of nozzles and calibration of the sprayer are critical to achieve accurate and cost effective use of farm crop protection products.

For sprayers equipped with "Boom Buster" nozzles (Evergreen Products, Inc.), consult the supplied nozzle application chart.

The two opposite mounted HARDI® Giant End Nozzles are available in three different sizes and provide a maximum spray width of 30', 40' or 50' (10m, 12m or 16m) under optimal spraying conditions at the recommended 20" (50 cm) nozzle spray heights (Fig. 11).

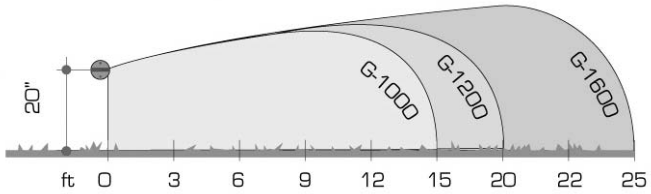
Giant End Nozzle characteristics:

- Off center spray nozzle
- Pressure range: 20 to 70 PSI
- Spray width up to 25 ft. (per nozzle)
- SYNTAL precision molded thermoplastic

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

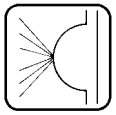
The following tables show which HARDI® Giant End Nozzles are suitable for different applications. It is important to use the correct nozzle.

	G-1000 Red	G-1200 White	G-1600 Blue
PSI	**GPM**		
20	3.224	3.762	5.015
30	3.949	4.607	6.143
40	4.560	5.320	7.093
50	5.098	5.948	7.930
70	6.032	7.037	9.383
Part #	371556	371557	371558



Example of spraying width at 45 PSI

Fig. 11



Use the following table to quickly determine which nozzle and spraying speed will work best for a wide range of application rates.

Note: Using this chart will bring you very close to your desired application rate. However, you must calibrate your sprayer with clean water before applying chemicals (Section 4.7).

				APPLICATION RATE (GALLONS PER ACRE)																		
				SPEED (MPH)																		
	PSI*	GPM†	SPRAY WIDTH (ft)‡	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
G-1000 RED	20	3.224	30.0	106.4	53.2	35.5	26.6	21.3	17.7	15.2	13.3	11.8	10.6	9.7	8.9	8.2	7.6	7.1	6.6	6.3	5.9	5.6	5.3
	30	3.949	30.0	130.3	65.2	43.4	32.6	26.1	21.7	18.6	16.3	14.5	13.0	11.8	10.9	10.0	9.3	8.7	8.1	7.7	7.2	6.9	6.5
	40	4.560	30.0	150.5	75.2	50.2	37.6	30.1	25.1	21.5	18.8	16.7	15.0	13.7	12.5	11.6	10.7	10.0	9.4	8.9	8.4	7.9	7.5
	50	5.098	30.0	168.2	84.1	56.1	42.1	33.6	28.0	24.0	21.0	18.7	16.8	15.3	14.0	12.9	12.0	11.2	10.5	9.9	9.3	8.9	8.4
	60	5.575	30.0	184.0	92.0	61.3	46.0	36.8	30.7	26.3	23.0	20.4	18.4	16.7	15.3	14.2	13.1	12.3	11.5	10.8	10.2	9.7	9.2
	70	6.032	30.0	199.1	99.5	66.4	49.8	39.8	33.2	28.4	24.9	22.1	19.9	18.1	16.6	15.3	14.2	13.3	12.4	11.7	11.1	10.5	10.0
G-1200 WHITE	20	3.762	40.0	93.1	46.6	31.0	23.3	18.6	15.5	13.3	11.6	10.3	9.3	8.5	7.8	7.2	6.7	6.2	5.8	5.5	5.2	4.9	4.7
	30	4.607	40.0	114.0	57.0	38.0	28.5	22.8	19.0	16.3	14.3	12.7	11.4	10.4	9.5	8.8	8.1	7.6	7.1	6.7	6.3	6.0	5.7
	40	5.320	40.0	131.7	65.8	43.9	32.9	26.3	21.9	18.8	16.5	14.6	13.2	12.0	11.0	10.1	9.4	8.8	8.2	7.7	7.3	6.9	6.6
	50	5.948	40.0	147.2	73.6	49.1	36.8	29.4	24.5	21.0	18.4	16.4	14.7	13.4	12.3	11.3	10.5	9.8	9.2	8.7	8.2	7.7	7.4
	60	6.500	40.0	160.9	80.4	53.6	40.2	32.2	26.8	23.0	20.1	17.9	16.1	14.6	13.4	12.4	11.5	10.7	10.1	9.5	8.9	8.5	8.0
	70	7.037	40.0	174.2	87.1	58.1	43.5	34.8	29.0	24.9	21.8	19.4	17.4	15.8	14.5	13.4	12.4	11.6	10.9	10.2	9.7	9.2	8.7
G-1600 BLUE	20	5.015	50.0	99.3	49.6	33.1	24.8	19.9	16.5	14.2	12.4	11.0	9.9	9.0	8.3	7.6	7.1	6.6	6.2	5.8	5.5	5.2	5.0
	30	6.143	50.0	121.6	60.8	40.5	30.4	24.3	20.3	17.4	15.2	13.5	12.2	11.1	10.1	9.4	8.7	8.1	7.6	7.2	6.8	6.4	6.1
	40	7.093	50.0	140.4	70.2	46.8	35.1	28.1	23.4	20.1	17.6	15.6	14.0	12.8	11.7	10.8	10.0	9.4	8.8	8.3	7.8	7.4	7.0
	50	7.930	50.0	157.0	78.5	52.3	39.3	31.4	26.2	22.4	19.6	17.4	15.7	14.3	13.1	12.1	11.2	10.5	9.8	9.2	8.7	8.3	7.9
	60	8.666	50.0	171.6	85.8	57.2	42.9	34.3	28.6	24.5	21.4	19.1	17.2	15.6	14.3	13.2	12.3	11.4	10.7	10.1	9.5	9.0	8.6
	70	9.383	50.0	185.8	92.9	61.9	46.4	37.2	31.0	26.5	23.2	20.6	18.6	16.9	15.5	14.3	13.3	12.4	11.6	10.9	10.3	9.8	9.3

* PSI is the pressure **at** the nozzle † GPM per nozzle ‡ Spray width is the total width (2 nozzles) at 20" spray height 10-15 GPA 15-25 GPA

Fig. 12

4.7 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®, #818493 for US gallons & #818492 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.

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:

$$\frac{\text{Distance (ft.)} \times 0.68}{\text{Time (sec.)}} = \text{MPH}$$

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. After determining your forward speed and choosing your application rate according to the recommendations on the chemical container, use the following formula to calculate the total nozzle capacity:

Formula:

$$\text{Total GPM} = \frac{\text{W (ft.)} \times \text{GPA} \times \text{MPH}}{495}$$

Note: W = Total measured sprayed width (ft.) at operating pressure.

3. To initially calculate which nozzle to use, let W = 30 ft., 40ft. or 50 ft. for HARDI® Giant End Nozzles G-1000 Red, G-1200 White or G-1600 Blue, respectively (Fig. 11, page 19 & Fig. 12, page 20).

Example: Total sprayed width: 40 ft. (G-1200 White nozzles)
Application rate: 20 GPA
Forward speed: 7 mph

$$11.3 \text{ GPM} = \frac{40 \text{ ft.} \times 20 \text{ GPA} \times 7 \text{ mph}}{495}$$

Calibration (continued)

4. Divide the total nozzle capacity by 2 (the number of nozzles) to get the GPM needed per nozzle to match the speed, pressure and width used in the calculations (Example: 11.3 ÷ 2 = 5.65 GPM).

$$\text{Capacity of single nozzle in GPM} = \frac{\text{Total GPM}}{\text{Number of nozzles}}$$

5. For HARDI® Giant End Nozzles, use the nozzle chart (Fig. 11, page 19) to find the nozzle with the closest desired output and pressure. (The G-1200 White nozzle at 50 PSI is the closest for this example at 5.948 GPM).

IMPORTANT: ***Always check actual sprayed width at operating pressure once the correct nozzle has been chosen. Locate the sprayer in a suitable location and use clean water to check.***

6. If the measured sprayed width at operating pressure differs from the value used in step 2, re-calculate the total nozzle capacity using the measured sprayed width. Divide by 2 to get the nozzle capacity in GPM needed per nozzle (step 4). This will be the corrected nozzle capacity in GPM required from each nozzle for proper application rate.

7. Double-check the nozzle output with a measuring jug (using clean water at operating pressure). If the measured nozzle output matches the required calculated output, calibration is complete.

8. If necessary, use the following formulas to adjust either the spraying speed or operating pressure to achieve proper calibration.

$$\text{New speed (MPH)} = \frac{\text{Desired output (GPM)} \times \text{Previous speed (MPH)}}{\text{Measured output (GPM)}}$$

$$\text{New pressure (PSI)} = \frac{\text{Desired output (GPM)} \times \text{Previous pressure (PSI)}}{\text{Measured output (GPM)}}$$

Note: If the operating pressure is changed, the actual spraying width will need to be checked again. If spraying width differs, repeat steps 6-8.

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 in the formula 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 sprayer 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 few, but important rules should be followed.

5.1 Cleaning The Sprayer

Guidelines

Read the whole label for the chemical used. 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 (e.g. Dept. of Agriculture).

Cleaning starts with calibration, as a well calibrated sprayer will ensure a 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 application. This also prolongs the life of the components.

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

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

Remember: Clean sprayers are safe sprayers.
Clean sprayers are ready for action.
Clean sprayers can not be damaged by chemicals 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.

Cleaning The Sprayer (continued)

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 and clean the pressure filter (located beneath the pressure gauge). Be careful not to damage the mesh. Replace filter 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, e.g. 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. Drain the tank and let pump run dry, only for a few seconds. Rinse inside of tank, again letting the pump run dry again only for a few seconds.

Note: Do not run pump dry for longer than 3 seconds. Otherwise severe damage to the pump will occur.

9. Stop the pump. If the chemicals used have a tendency to block nozzles, remove and clean them now.

10. Replace the pressure filter 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.

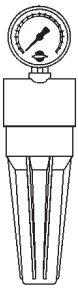
5.2 Pressure filter

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

A clean pressure filter ensures:

- Operating unit is not hindered or damaged during operation.
- Nozzle blockages do not occur while spraying.

Pressure Filter



Mesh	Part number
100 (Yellow)	615445
80 (Red)	615444
*50 (Blue)	615443

Fig. 13

***** Standard mesh

5.3 Recommended Tire Pressure

The tires should not run under-inflated. This only promotes instability and rapid wear.

Tire size:	Maximum pressure:
12.5L x 15"	36 psi (2.5 bar)

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.

5.4 Wheel Nuts And Bearings Adjustment

WARNING: **BLOCK WHEELS ON TRAILER TO PREVENT ROLLING.**

Check wheel bolt tension after the first 8 working hours, thereafter every 50 hours. Torque wheel nuts to 85 ft. lbs. maximum.

Check bearing for slack after the first 8 hours of operation and again after 50 hours of operation, thereafter every 100 hours. (Fig. 14)

If necessary, adjust as follows:

Wheel Nuts And Bearings Adjustment (continued)

1. Jack sprayer up. It is best to remove the wheel. (Make sure to adequately support the sprayer and completely drain tank.)
2. Remove hub cap and cotter pin.
3. Axle nut is tightened until slight rotation resistance of hub is noted.
4. Now loosen axle nut until first split pin hole is visible.
5. Insert cotter pin, fold and replace hub cap.

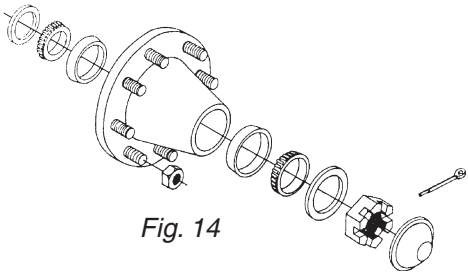


Fig. 14

After 1000 hours or once a year, the axle bearings should be repacked with new grease.

5.5 Nozzles 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 materials

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 seals (O-ring) hand tighten only, do not use pliers.

The O-rings need to be lubricated **ALL THE WAY AROUND** before fitting.

HARDI® recommends using a vegetable based oil to prolong the life of the O-ring.

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

The replacement of defective protection guards is easy to do.

1. Remove bolt **(A)** (Fig. 15), lock **(B)** (Fig. 15) and grease nipple **(C)** (Fig. 15)**.** Twist joint cover $^1/_4$ turn and pull it backwards.
2. Remove the synthetic bearings and protection tube.
3. Remove inner bush from protection tube.
4. Assemble again in reverse order, using new parts where necessary. Remember to fit chains again.
5. Grease bearings.

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

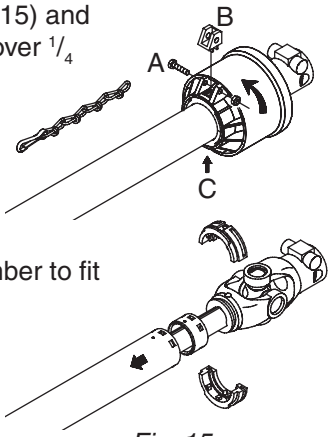


Fig. 15

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

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

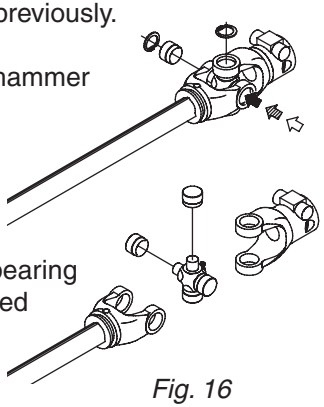


Fig. 16

5.8 Lubrication

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

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

POS. Position on sprayer

Grease

Page to find more information

Oil

Operation hours

Winter protection or off-season storage

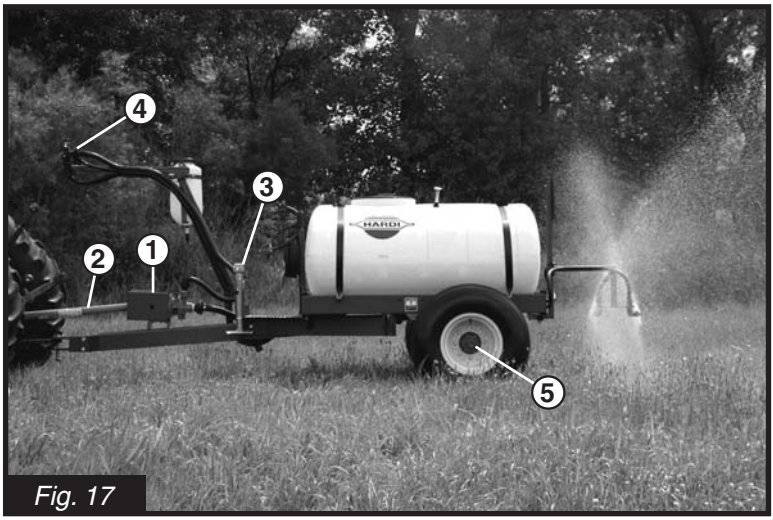
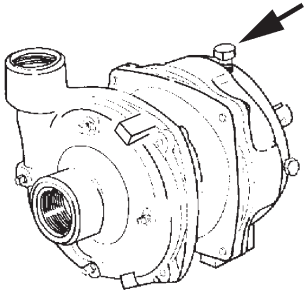
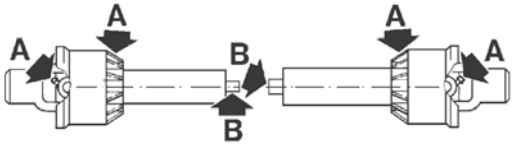
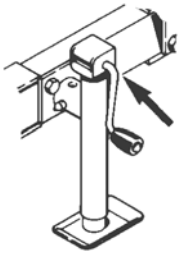
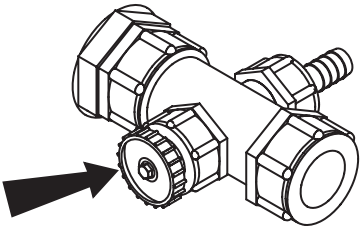
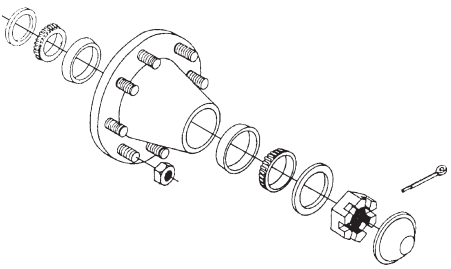


Fig. 17

300 GALLON PASTURE SPRAYER

1. Pump
2. PTO
3. Hitch Jack
4. Agitation Control
5. Wheel Bearings

POS.					
1	X		50		
2					
A		X	10		13
B		X	50		13
3		X	50		

POS.					
4	X		40		16
5		X	1000		27

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" (section 5.1). 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. Replace any damaged seals and repair any leaks.

3. Empty the sprayer completely. Operate all valves and handles to drain as much water out of the spraying circuit as possible. Let the pump run dry, only for a few seconds.

Note: Do not run pump dry for longer than 3 seconds. Otherwise severe damage to the pump will occur.

4. Pour in a mixture of ethylene glycol base antifreeze and water at the ratio for the desired temperature protection (there will be a small amount of water left in the hoses, pump and bottom of tank). The volume of the mixture needs to be enough keep the tank sump full while the pump is running fluid through the entire circuit.

5. Engage the pump and operate all valves and functions of the plumbing system, BK-MAN unit, spraygun etc. allowing the antifreeze mixture to be distributed around the entire circuit. Open the 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 gauge and store 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.

Off-Season Storage (continued)

10. 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.
11. 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. Fit the pressure gauge again. Seal with Teflon tape.
4. Connect the sprayer to the tractor.
5. Empty the tank of remaining antifreeze.
6. Rinse the entire liquid circuit on the sprayer with clean water.
7. Fill with clean water and check all functions.

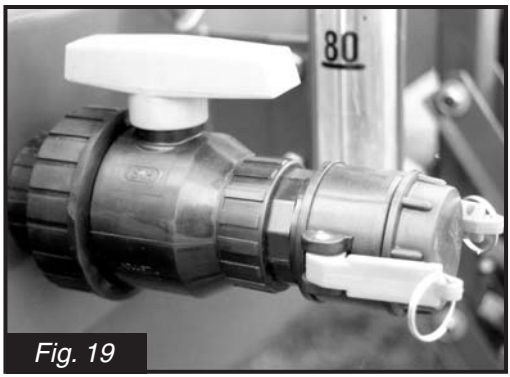
7.0 ACCESSORIES

7.1 Clean Water Dispenser

Clean Water Dispenser

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 Nurse Tank Quick Fill (optional)



Nurse Tank Quick Fill

A quick attach hook-up for filling the sprayer tank from a nurse tank. Liquid is fed into the bottom of the tank through a one-way valve providing a better mix of water and chemical . The quick fill is equipped with a handy 1/4 turn shut-off valve.

7.3 Spraygun And Hose Wrap (optional)

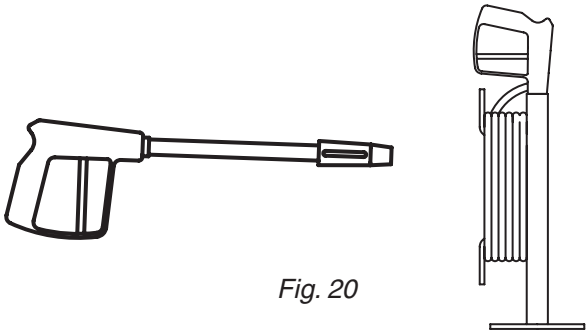


Fig. 20

A spraygun with adjustable spray pattern and 25 or 50 ft. of hose for spraying fence row or spot spraying a small area can be installed onto your sprayer. A handy hose wrap and spraygun holder can be conveniently located on the sprayer to transport the spraygun.

7.4 Large 4" Pressure Gauge (optional)

Fig. 21

A large and easy to read 4" pressure gauge is available to replace the standard 2-1/2" gauge.

7.5 Remote Nozzle Pressure Gauge (optional)

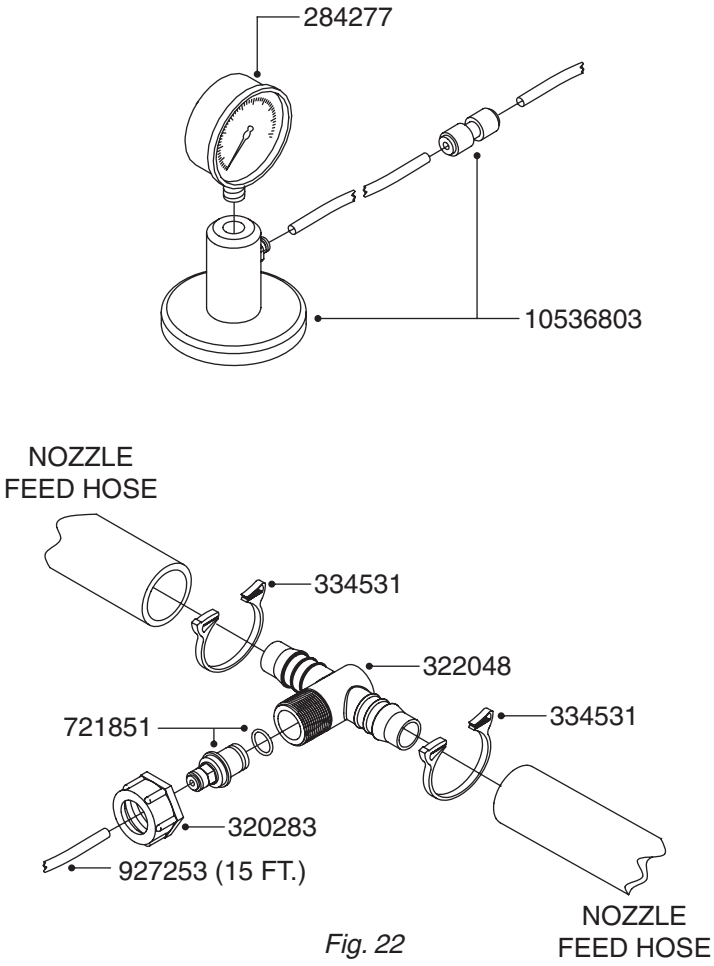


Fig. 22

A remote nozzle pressure gauge may be added by ordering the parts listed above. To install, cut one of the nozzle feed hoses at the rear of the sprayer and insert the tee (#322048) as shown above. The hose (#927253) is then run to the pressure gauge (#284277) mounted on the magnetic base (#10536803). The magnetic base may be placed near the operator to better monitor the pressure at the nozzles for more accurate control of the application rate.

8.0 TROUBLESHOOTING

8.1 General Spray Systems

Problem	Cause
1. No liquid getting to the pump.	A. Suction side plugged.
2. Lack of pressure	A. Suction side plugged. B. P.T.O. speed not fast enough C. Suction side air leak. D. P.T.O. not engaged.
3. Pressure jumping	A. Small tear or pin hole in suction hose. B. P.T.O. shaft slipping on pump crank shaft. C. Suction side air leak.
4. Pressure dropping	A. P.T.O. shaft slipping on pump crank shaft. B. Suction side air leak.
5. Liquid leaking from pump	A. Damaged pump seal.
6. Poor agitation	A. Agitation valve not open. B. Agitation nozzle plugged. C. Agitation nozzle missing.
7. Excessive vibrations in hoses	A. P.T.O. shaft slipping on pump crank shaft. B. Suction side air leak.
8. Can't get tank empty.	A. Crack or pin hole in suction tube. B. Tank is not level (change angle of tongue).

9.0 WARRANTY POLICY AND CONDITIONS

HARDI® INC. , 1500 West 76th Street, Davenport, Iowa USA: 5646 W. Barstow, Fresno, CA, 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 Operator's Manual and is operated under normal farm conditions.

1. This limited warranty is subject to the following exceptions:
   a) Parts of the machine not manufactured by HARDI®, (i.e. engines, tires, tubes, electronic controls, and other components or trade accessories, etc.) are not covered by this warranty but are subject to the warranty of the original manufacturer. Any claim falling into this category will be taken up with the manufacturer concerned.

   b) This warranty will be withdrawn if any equipment has been used for purposes other than for which it was intended or if it has been misused, neglected, or damaged by accident, let out on hire or furnished by a rental agency. Nor can claims be accepted if parts other than those manufactured by HARDI® have been incorporated in any of our equipment. Further, HARDI® shall not be responsible for damage in transit or handling by any common carrier and under no circumstances within or without the warranty period will HARDI® be liable for damages of loss of use, or damages resulting from delay or any consequential damage.

2. We cannot be held responsible for loss of livestock, loss of crops, loss because of delays in harvesting or any expense or loss incurred for labor, supplies, substitute machinery, rental for any other reason, or for injuries either to the owner or to a third party, nor can we be called upon to be responsible for labor charges, other than originally agreed, incurred in the removal or replacement of components.

3. The customer will be responsible for and bear the costs of:

   a) Normal maintenance such as greasing, maintenance of oil levels, minor adjustments, etc.

   b) Transportation of any HARDI® product to and from where the warranty work is performed.

   c) Dealer travel time to and from the machine or to deliver and return the machine from the service workshop for repair.

   d) Dealer traveling costs.

4. Parts defined as normal wearing items, (i.e. tires and V-belts) are not in any way covered under this warranty.

5. This warranty will not apply to any product which is altered or modified without the express written permission of HARDI® and/or repaired by anyone other than an Authorized Service Dealer.

6. Warranty is dependent upon the strict observance by the purchaser of the following provisions:

   a) That this warranty may not be assigned or transferred to anyone.

   b) That the Warranty Registration Certificate has been correctly completed by dealer and purchaser with their names and addresses, dated, signed and returned to the appropriate address as given on the Warranty Registration Certificate.

   c) That all safety instructions in the operator's manual shall be followed and all safety guards regularly inspected and replaced where necessary.

7. No warranty is given on second-hand products and none is to be implied.

WARRANTY POLICY AND CONDITIONS

8. Subject to the following terms, conditions and contributions, HARDI® extends the warranty on polyethylene tanks (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. HARDI® reserves the right to incorporate any change in design in its products without obligation to make such changes on units previously manufactured.

10. 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.

11. 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.

12. Any warranty work performed which will exceed $400.00 MUST be approved IN ADVANCE by the Service Manager.

13. Claims under this policy must be filled with HARDI® within thirty (30) days of work performed or warranty shall be void.

14. Parts requested must be returned prepaid within thirty (30) days for warranty settlement.

15. 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.