



EAGLE 3PT Boom

Operator's Manual

105219 (10/99)

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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 chemical input costs and the vital need for cost effective chemical 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 EAGLE 3PT boom 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

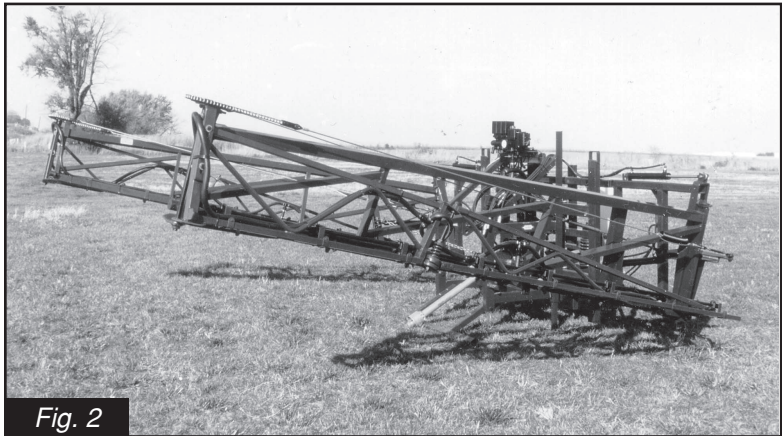
HARDI® WEST COAST
5646 W. Barstow, Suite 101
Fresno, California 93722
Phone: (209) 271-3106
Fax: (209) 271-3107

Sincerely,

Tom L. Kinzenbaw
President



HARDI EAGLE 3PT Boom shown mounted on tractor



HARDI EAGLE 3PT Boom shown in storage position

1.0 INTRODUCTION

The EAGLE 3-point boom is a fully suspended hydraulically operated spray boom featuring self-stabilizing trapeze suspension with coil springs and a shock absorber to control the rate of boom movement.

The 3-point hitch frame meets the requirements for mounting the sprayer to a CAT II or CAT III 3 point hitch or CAT II or CAT III-N quick hitch coupler. The Hitch frame has a pump mounting plate (for PTO and hydraulic drive pumps) as well as provision for mounting control units and other accessories.

The 48' and 60' EAGLE 3-point boom also has parking stands attached to the center frame which allows the boom to freestand when not in use.

Three versions of the EAGLE 3-point boom are available. The "HY" features simultaneous boom wing folding. The "HT" features simultaneous wing fold and individual wing tilt through three tractor double acting outlets. The "HZ" features electric hydraulic wing fold (same as "HY") plus individual wing tilt. This will require two tractor double acting outlets and a 12v power supply. The hydraulic hoses that attach to the tractor are fitted with 1/2" NPT quick couplers.

The EAGLE 3-point boom can be equipped with either single Snap-fit or triplet nozzle bodies. Two pump and control systems are available as options to the 3-point EAGLE boom. The Diaphragm pump system features a HARDI® 361 Diaphragm pump and electric control unit with HARDI-matic, a mechanical rate controller, and a self-cleaning pressure filter. The Centrifugal pump system features a Ace 206 hydraulically driven pump with an electric control unit. Both systems are complete with adjustable agitation, constant pressure feature, in-cab control box, system pressure gauge, and PTO shafts.





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 spray boom and controls properly. Do not let anyone operate the machine without proper instructions.
- Keep your EAGLE 3PT boom in proper working condition. Unauthorized modifications or use may impair the function and/or safety and affect the spray boom'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 EAGLE 3PT Boom Safely

1. Read the complete manual carefully and become familiar with the operation of the equipment before initial operation of each spraying season. Failure to do so may result in possible over or under application of spray solution which may drastically affect crop production or 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 - 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. 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 extended.
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 rests and stops. 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. Use flashing lights to avoid personal injury or death resulting from any accidents. Local regulations may require installation of 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 spray boom while it's operating. 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 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 during operation. 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 mouth 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 virtually no chance of children being 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. _____ - _____ - _____

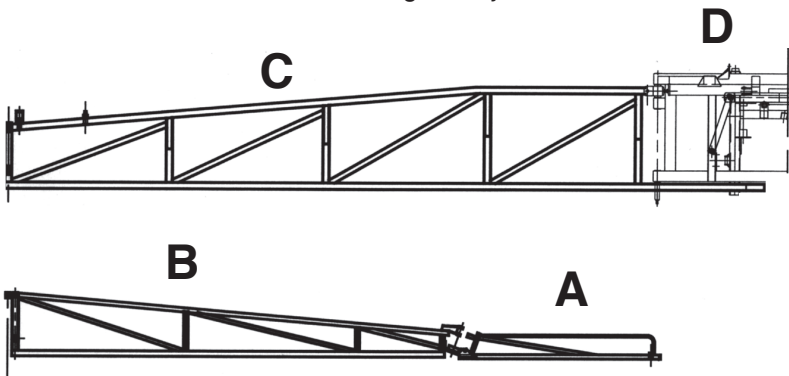
Find the phone number for the poison control center in your phone book and write it in the space above.

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. _____

3.0 GLOSSARY

- 1) **RIGHT HAND AND LEFT HAND SIDES-** Are determined by facing the forward direction of travel.
- 2) **HZ MODELS-** An EAGLE 3PT boom with electrically activated hydraulics. This boom can raise and lower, fold inner or outer wings simultaneously, and tilt each wing individually.
- 3) **FOLDED BOOM-** Refers to the boom in transport position.
- 4) **UNFOLDED BOOM-** Refers to the boom in the spraying position.
- 5) **WING-** Refers to the folding portion of the boom.
- 6) **LIFT FRAME-** Mounts to the upper and lower parallelogram arms.
- 7) **CENTER SECTION-** Refers to the portion of the boom that the wings attach to. The wings move up and down with the center.
- 8) **LINK ARMS-** Attaches the Center Section to the Lift Frame.
- 9) **INTERMEDIATE WING-** Refers to the inner portion of the wing.
- 10) **OUTER WING-** Refers to the outer portion of the wing.
- 11) **BREAKAWAY-** Refers to the part of the wing that allows movement in the event of striking an object.



- A - Breakaway Section*
- B - Outer Wing Section*
- C - Intermediate Wing Section*
- D - Center Frame*

Fig. 3



4.0 ASSEMBLING THE 3PT EAGLE BOOMS



WARNING: USE PROPER LIFTING EQUIPMENT. LIFTING HEAVY EQUIPMENT INCORRECTLY CAN CAUSE PERSONAL INJURY OR MACHINE DAMAGE. FOLLOW ALL RECOMMENDED PROCEDURES FOR REMOVAL AND INSTALLATION OF COMPONENTS IN THE MANUAL.

The 3-point EAGLE boom is shipped in 5 parts.

1. Center frame assembly
2. Wing assembly RH
3. Wing assembly LH
4. 3-point hitch frame
5. Boom mount kit

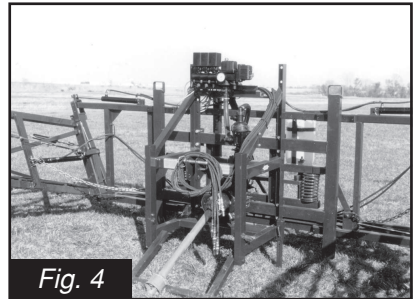


Fig. 4

4.1 Attaching Center Frame to 3-point Hitch Frame



WARNING: CENTER FRAME WILL NOT STAND ON ITS OWN, EVEN WITH 3PT HITCH FRAME ATTACHED. IT IS ADVISABLE TO ATTACH THE 3PT HITCH FRAME TO TRACTOR HITCH BEFORE STARTING TO ASSEMBLE THE SPRAYER.

Attach center frame to hitch frame with 4 (2"x6"x3/8") clamping plates (A) and 8 (5/8"x3-1/2"UNC) bolts & nuts (B). There are 4 height positions to chose from allowing a 10-1/2" (265mm) variation in spray height between each setting (Fig 5).

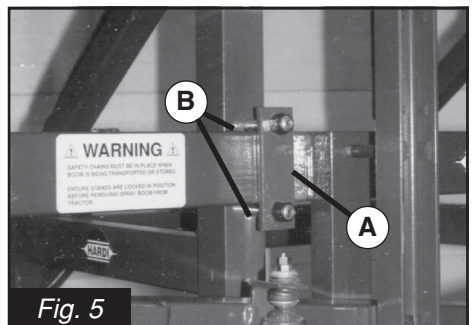
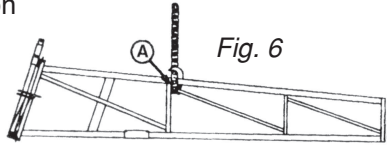


Fig. 5

4.2 Preparing Wings for Installation

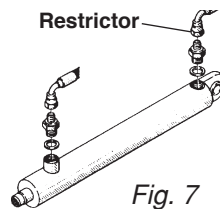
CAUTION: FOR SAFE HANDLING, TIE INNER & OUTER BOOM SECTIONS TOGETHER TO PREVENT ACCIDENTAL UNFOLD DURING INSTALLATION.

1. Tie outer boom sections to inner section.
2. Attach lifting chain at lift point (A) on inner boom section. Position chain between vertical and angled boom members so chain does not move from this point when boom is lifted.



4.3 Installing Boom Wings

- 1a. HY BOOM - Fit nut (1) washers (2) to the threaded end of the tie rod. Fit the rod under tab on mount plates on center frame. Fit remaining washers and lock nut to the rods.
- 1b. HZ BOOM - Attach tilt cylinders to center frame using pins and cotter pins. Remove plugs from cylinder ports and manually extend cylinders to their full extension. Install O-ring washers and restrictor fittings in both ports on hydraulic cylinders. The restrictor with the small hole is fitted to the fixed (base) end of the hydraulic cylinder. Fig. 7.
2. Position boom hinge on center frame with folded boom sections to the front.
3. Attach tie rod/tilt cylinder to hinge pin and cotter pins.
4. Line up lower hinge pin holes and insert pin. Insert threaded pin from the front through the center frame and hinge and retain with lock nut.
5. Attach safety chain from center section to extended pin on upper end of hydraulic cylinder - Fit locking ring to pin. This will prevent boom sections from accidentally unfolding during installation.
6. Repeat steps 3-6 for other wing.
7. Attach equalizer cables to inner boom sections using M12x50mm bolts and lock nuts.
8. Install O-ring washers and restrictor fittings in both ports of hydraulic fold cylinders. Restrictor with small hole goes in the fixed (base) end of the hydraulic cylinder (Fig 7).





4.4 Mounting Hydraulic Hoses

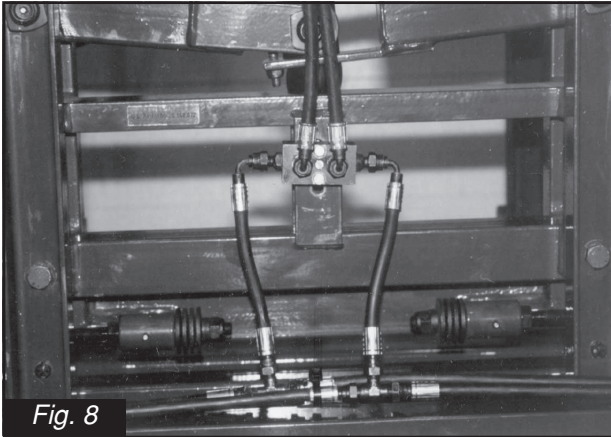


Fig. 8



WARNING:

- BE SURE TO HOOK UP HYDRAULIC LINES PROPERLY!
- MAKE SURE THE 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.

IMPORTANT: *Due to the wide variations in tractor hydraulic systems and capacities, care should be exercised when initially operating the sprayer hydraulic cylinders. It is advisable to adjust the hydraulic flow control down to the minimum rate before operating the system. Adjust/increase the flow control after the system is bled of any air, if necessary.*



A/Fold cylinders

1. Route hydraulic hoses to fold cylinders (Section 9.0)
2. Attach hydraulic hoses from right hand side of hydraulic block on center section to port on the hinge base end of hydraulic fold cylinders.
3. Attach hydraulic hoses from left hand side of hydraulic block on center section to the other port on the hydraulic fold cylinders.
4. Disconnect fold cylinder rod (adjustable eye end) from wing section.
5. Ensure cylinder is free for retraction and extension.
6. Connect hydraulic hoses to double acting outlet on tractor.
7. Start tractor engine and cycle fold cylinders by actuating double acting outlet 10 times to bleed air from hydraulic system.
8. Stop tractor engine, check hydraulic oil level and fill as necessary.
9. Attach fold cylinder rods to boom sections, using previously removed pins and cotter pins.

B/Tilt cylinders

1. Route hydraulic hoses to fold cylinders (Section 9.0)
2. If hydraulic tilt cylinders are fitted to spray boom, air should be bled from these lines before spraying.
3. Disconnect tilt cylinder rod eyes from wing section.

IMPORTANT: WING SECTION MUST BE SUPPORTED BEFORE REMOVAL OF HYDRAULIC CYLINDER ROD EYES.

4. Ensure cylinder is free for retraction and extension.
5. Start tractor engine and cycle fold cylinders by actuating double acting outlet 10 times to bleed air from hydraulic system.
6. Stop tractor engine, check hydraulic oil level and fill as necessary.
7. Reattach tilt cylinder rods to boom sections.

4.5 Installing Center Frame Spray Tube Assembly

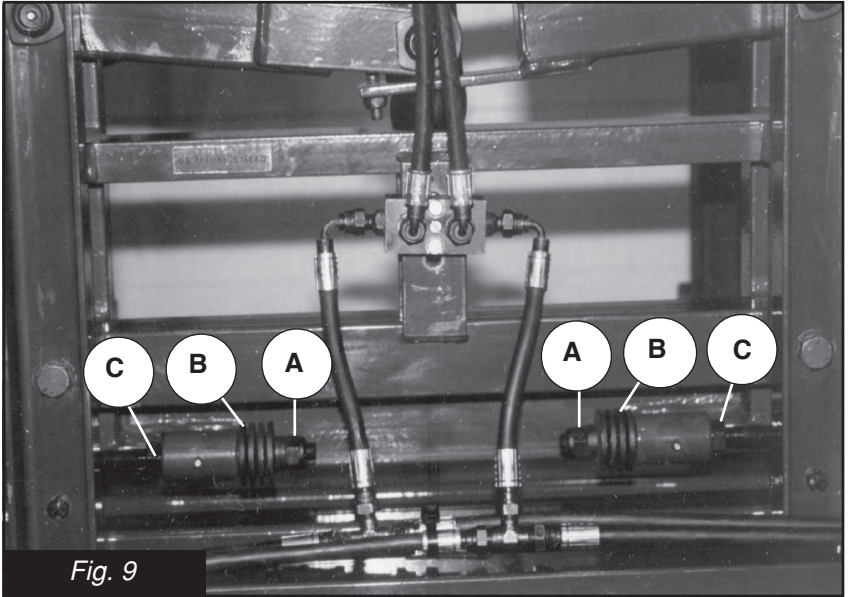
1. Attach brackets to center frame using M6x30mm cap screws and lock nuts. If necessary, loosen lock nut swivel pin and turn pin so bracket is flush against the frame.

NOTE: To gain access to mounting holes on the nozzle track, remove plastic nozzle retaining nuts closest to mount holes and move tube as necessary to install cap screws from the bottom.

2. Attach spray tube assembly using M6x20mm cap screws with lock nuts on top. The 4 nozzle tube is to be on the right -hand side.



4.6 Adjusting the Center Section Cables



WARNING: NEVER ATTEMPT TO ADJUST THE CENTER CABLES WITHOUT HAVING THE BOOM FOLDED ALL THE WAY INTO THE TRANSPORT POSITION.

The center section cables work together to keep the center frame square to the stationary frame, while folding boom in for transport or when spraying with one side raised and folded (HT and HZ only).

1. Fold boom into transport position.
2. Shut the tractor off.
3. Check that the tilt cylinders are COMPLETELY EXTENDED. Adjust if necessary (HT and HZ only).
4. Loosen jam nuts (C)(Fig 9).
5. Check that the cables are routed over the center section nozzle mount brackets.

IMPORTANT: ALTERNATE FROM SIDE-TO-SIDE WHILE MAKING ADJUSTMENTS. ADJUST ONE CABLE A SMALL AMOUNT AND THEN THE OTHER, TO EQUALIZE CABLE TENSION AND MAINTAIN A LEVEL CENTER FRAME. DO NOT OVERTIGHTEN THE CABLE. ADJUST TENSION UNTIL BELLEVILLE WASHERS JUST START TO COMPRESS, NOT BEYOND.

6. Adjust jam nuts as above.
7. Properly adjusted cables will be very tight and only deflect a small amount (fractions of an inch) when pulled on by hand.

Note: Cables will be loose when the booms are unfolded.

8. Tighten jam nuts (C)(Fig 9).
9. Unfold the boom to operating (spraying) position.
10. Fold the boom and check that the floating frame remains square to the stationary frame.

4.7 Attaching Feed Hoses - Two Valve System

1. Remove nuts from end nozzles to gain access to center section spray tubes.
2. Remove cap and plug from tube ends.
3. Lubricate adapter fitting radial seals, using vegetable based oils.
4. Attach solution hoses from boom wings to center section spray tubes.
5. Route main feed hoses from each boom section to control valves.

IMPORTANT: ENSURE ALL FEED HOSES ARE LONG ENOUGH TO ALLOW FOR MOVEMENT AT HINGE WHEN BOOMS ARE FOLDED.

6. Retain all hoses with tie straps.





4.8 Attaching Feed Hoses - Three Valve System

1. Remove nuts from end nozzles to gain access to center section spray tubes.
2. Remove cap and plugs from inner spray tube ends. Refit caps and plugs to outer ends of center section spray tubes.
3. Remove existing hoses and fittings from inner wing section spray tubes. Retain adapter fittings and clamps for use with the center section spray tubes.
4. Cut 3/4" ID hose into two unequal pieces - 1 of 250mm (10") and 1 of 100mm (4") long.



IMPORTANT: DO NOT USE PETROLEUM BASED LUBRICANTS. THEY WILL DETERIORATE HOSES, CAUSING THEM TO WEAKEN AND LEAK. LUBRICATE HOSE ENDS WITH LIQUID DISH SOAP TO MAKE INSTALLATION EASIER.

TO AVOID REWORK, BE SURE OF FITTING LOCATIONS PRIOR TO ATTACHING HOSES. PLASTIC FITTINGS USE VERY AGGRESSIVE HOSE BARB WHICH MAKES HOSE REMOVAL DIFFICULT.

5. Attach hoses to "T" piece using clamps.
6. Install adapter fittings in outer hose ends, using clamps.
7. Lubricate adapter fitting radial seals, using vegetable based oils.
8. Attach hose to center sections inner spray tube ends, with "T" inlet directed to rear of sprayer.
9. Install plastic nuts on nozzle retaining bolts. Be sure "T" fitting will not interfere with spray pattern from adjacent nozzles.
10. Install adapter fitting in 3/4" ID hose using clamps.
11. Lubricate radial seal with vegetable based oils and attach adapter fitting to tee.
12. Route hoses from each boom section to control valve.



IMPORTANT: ENSURE FEED HOSES HAVE SUFFICIENT SLACK AROUND HINGE TO PREVENT HOSE BINDING WHEN BOOM IS FOLDED.

13. Connect feed hoses to control valves.
14. Retain all hoses with tie straps.

4.9 Hydraulic Hook- Up

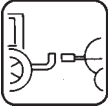
The booms hydraulic system requires an oil capacity of approximately .8 GPM (3 litres/min.) and a minimum pressure of 1,950 PSI (130 bar).

WARNING:

- **BE SURE TO HOOK UP HYDRAULIC LINES PROPERLY!**
- **MAKE SURE THE 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.**

IMPORTANT: *Due to the wide variations in tractor hydraulic systems and capacities, care should be exercised when initially operating the sprayer hydraulic cylinders. It is advisable to adjust the hydraulic flow control down to the minimum rate before operating the system. Adjust/increase the flow control after the system is bled of any air, if necessary.*





4.10 HZ Hydraulics Joystick Controls

A) Installation Of Handle

1. Attach the control handle to the hydraulic lever that operates the double acting outlet you intend to use (Fig. 10). The universal mounting bracket (E)(Fig. 10) is very flexible and a number of different mounting positions can be used.
2. Connect plug (F)(Fig. 10) to the tractor's 12V power system. Try to hook-up the handle as close as possible to the battery or the starter for a better power supply. HARDI recommends using electric distribution box #817925 to insure a good power supply to various 12V attachments.

Note: Check with your dealer or tractor operators manual for the best location to hook up the 12V system.

Note polarity:

BROWN WIRE = POSITIVE (+)

BLUE WIRE = NEGATIVE (-)

3. Connect electric plug (H)(Fig. 10) from sprayer hydraulics to plug (G) (Fig. 10) on handle.

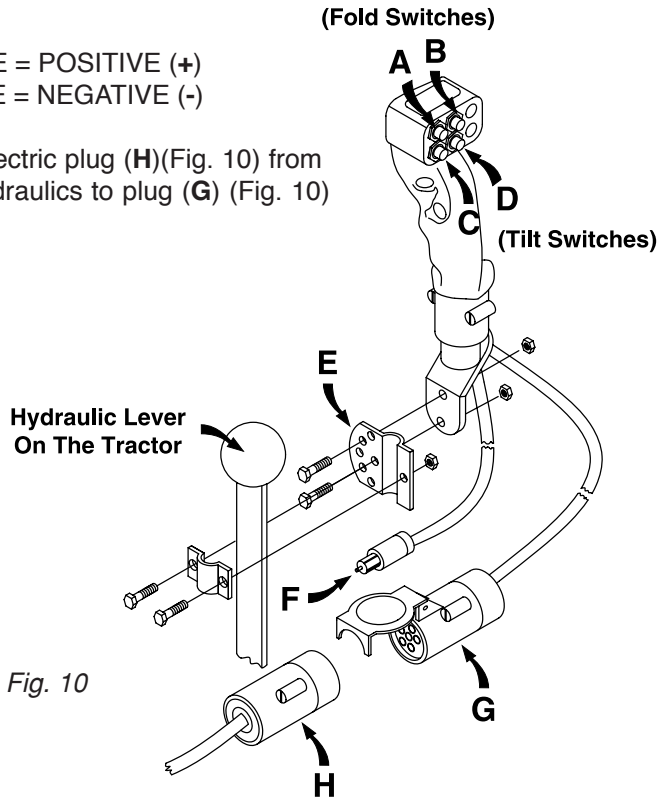


Fig. 10

4.11 'DH' Hydraulics (Optional)

Note: This kit can only be used on tractors with 'closed center' hydraulic systems.

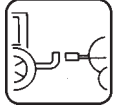
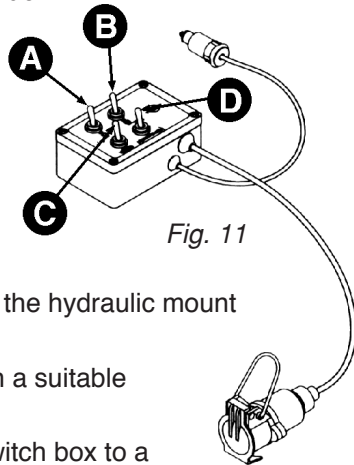
- Switch **A** operates: Left hand fold cylinder
- Switch **B** operates: Right hand fold cylinder
- Switch **C** operates: Left hand tilt cylinder
- Switch **D** operates: Right hand tilt cylinder

A) Installation Of The 'DH' Hydraulic Switch Box

1. Remove the joystick control handle complete with bayonet style 12V plug and 7 pin female plug (if previously fitted).
2. Route the cable, with the 7 pins, from the hydraulic mount plate to the tractor.
3. Mount the 'DH' hydraulic switch box in a suitable location in the tractor cab.
4. Connect the bayonet plug from the switch box to a 12V power supply. HARDI recommends using electronic distribution box #817925 to ensure a good power supply to various 12V attachments.

Note polarity: **BROWN WIRE = POSITIVE (+)**
BLUE WIRE = NEGATIVE (-)

5. Connect the female 7 pin plug from the switch box to the 7 pin male plug from the sprayer.



4.12 Performing Final Inspection

1. Check hydraulic system for leaks.
2. Check hydraulic hoses for clearance and freedom of movement throughout entire range of operation.
3. Lubricate all machine lubrication points. (Section 7.0)
4. Adjust machine for field operation.
5. Ensure all fasteners are tightened correctly.



5.0 OPERATING THE EAGLE 3PT BOOM

WARNING:

- **USE EXTREME CAUTION THE FIRST SEVERAL TIMES YOU OPERATE THE BOOM AS THE AIR IS BLED OUT.**
- **AIR MAY STILL BE TRAPPED IN THE HYDRAULICS SYSTEM. THE BOOM CAN MAKE SUDDEN AND UNEXPECTED MOVEMENTS!**
- **ALWAYS OPERATE BOOM ON LEVEL GROUND.**
- **BEFORE UNFOLDING THE BOOM, ENSURE THAT THE SPRAYER IS HITCHED TO THE TRACTOR UNIT.**
- **ENSURE THAT THERE ARE NO OBSTRUCTIONS OR PERSONS IN THE PATH OF TRAVEL BEFORE FOLDING OR UNFOLDING THE BOOM.**
- **ENSURE THAT THE SAFETY CHAINS ARE FITTED BETWEEN THE CENTER FRAME AND WING SECTIONS BEFORE TRANSPORTING AND STORING THE EAGLE 3PT BOOM.**

5.1 Folding & Unfolding the 3-point Boom (HY and HT booms only)

1. Disconnect safety chains from wings.
2. Activate the tractors double acting hydraulic lever to unfold the boom. Both wings will unfold simultaneously.
3. Set the desired spray height by raising or lowering the 3-point hitch arms on the tractor.
4. After 3-point hitch has been raised, manually retract the rear stands and lock in place. Swing front stand to stored position under frame and lock in place with lock pin and locking ring.
5. To fold the boom, actuate the double acting hydraulic lever.

5.2 Operating the Wing Tilt (If applicable)

1. The wing tilt cylinders are connected to the tractor hydraulics independently. Determine which hydraulic lever actuates the side to be tilted. Actuate the double acting outlet lever to tilt wing up or down.

WARNING:

- **NEVER ATTEMPT TO FOLD BOOM TO TRANSPORT POSITION WHEN WINGS ARE TILTED UP. ALWAYS LET WINGS DOWN TO HORIZONTAL POSITION PRIOR TO FOLDING.**
- **NEVER ATTEMPT TO WORK ON OR AROUND WING SECTION WHEN TILTED UP.**
- **UNEXPECTED BOOM MOVEMENTS MAY OCCUR IF WINGS ARE TILTED WHEN FOLDING.**
- **NEVER USE TILT FUNCTION WHEN BOOM IS FOLDED INTO TRANSPORT POSITION.**

5.3 Folding And Unfolding Boom (HZ Hydraulics)

A) Hydraulic Joystick Controls

1. Raise the boom to clear any obstructions
2. Depress switches **(A)** & **(B)** and move hydraulic handle forward or rearward to activate oil flow. Switch positions of the hoses in the double acting remote outlet if you do not like the direction required to activate the boom.
3. "One side folding" will be achieved by following the above procedure except that only one of the switches is depressed (Section 5.4).

B) 'DH' Hydraulics Control Box (Optional)

1. Raise the boom to clear any obstructions.
2. Engage the tractor's double acting remote outlet lever and lock it in the engaged position.
3. Activate switch **(A)**(Fig. 11) upwards and hold to unfold left hand boom (Holding the switch in the down position will fold the boom). To unfold right hand boom, activate switch **(B)**(Fig. 11).
4. "One side folding" will be achieved by following the above procedure except that only one of the switches is activated.

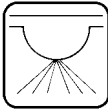




5.4 Folding One Side Only (HZ Hydraulics Only)

If only one side of the boom is to be used for spraying, first unfold the boom completely and then turn switches off, then flip the switch for the side that is to be folded and activate the double acting outlet to fold that side into transport position.

Note: It is not advisable to go directly from transport position to spray position with one side only. Both wings must first be completely unfolded.



5.5 Nozzle Selection

Correct selection of nozzle and 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 Green 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.

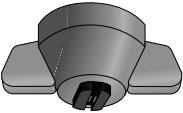
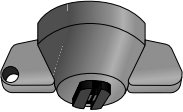






Should you wish a different application rate or different type of nozzle, HARDI manufactures a nozzle for virtually every need.

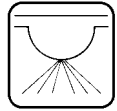


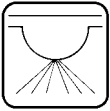
IMPORTANT: *Always consult your chemical supplier for recommended chemical rate and water application rate. Always wear protective gloves when handling nozzles.*




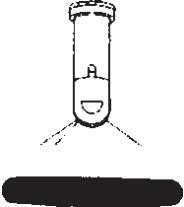

The following tables show what types of spray nozzles are suitable for different applications. It is important to use the correct nozzle.

	FLOOD NOZZLES set at 40" spacing. Designed for high volume application.	4598
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	<p>COLOR TIPS™ 110 degree flat fan,one piece cap and nozzle; color coded for flow rate selection.</p> <p>For herbicides, insecticides, and fertilizer applications. 50, 80, and 100 mesh screens are normally used.</p>	<p>S4110</p>
	<p>LowDrift COLOR TIPS™ 110 degree flat fan,one piece cap and nozzle, 1553 solid stream nozzle; color coded for flow rate selection.</p> <p>In-Line Filters will normally be used.</p>	<p>SL4110</p>
 	<p>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.</p>	<p>4665-65 degree 2080-80 degree 4110-110 degree</p> <p>Part # 330013-O-ring</p>
 	<p>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.</p>	<p>1553</p> <p>Must add swirl to produce hollow cone pattern</p>
 	<p>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.</p>	<p>371537 thru 371543</p>





	<p>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.</p>	<p>Grey Blue Black White</p>
	<p>HOLLOW CONE CERAMIC NOZZLES for high pressure and high volume fungicide and insecticide application.</p>	<p>1299</p>
	<p>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.</p>	<p>371077</p>
	<p>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.</p>	<p>371551</p>
	<p>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.</p>	<p>1553 less swirl</p>

5.6 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 on the following pages:



Ounce Method

1. Determine how long it takes you to cover the test strip.
Use the following chart 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.

<u>Row width or nozzle spacing (in.)</u>	<u>Distance (ft.)</u>
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

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)

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.



	Speed in MPH		Travel Time (in seconds)	
	200 ft.	300 ft.	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	

Formula:

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

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

Formula:

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

Formula:

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

- 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.



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.

<u>Weight of solution</u>	<u>Specific Gravity</u>	<u>Conversion Factors</u>
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: $\frac{\text{Distance (in feet)}}{\text{Second}} \times .682 = \text{MPH}$

6.0 ADJUSTMENTS

WARNING:

- **HARDI CANNOT ASSUME RESPONSIBILITY OR BE HELD LIABLE FOR ANY LOSS OR DAMAGE THAT OCCURS DUE TO LACK OF ADJUSTMENTS OR MAINTENANCE.**
- **WE URGE YOU TO FOLLOW THE ADJUSTMENT AND MAINTENANCE RECOMMENDATIONS FOR EVERYONE'S SAFETY.**
- **MAKE IT A DAILY HABIT TO INSPECT YOUR BOOM FOR NEED OF ADJUSTMENT OR MAINTENANCE.**
- **IMMEDIATELY REPLACE ANY PARTS ON THE BOOM THAT ARE WORN OR BROKEN.**
- **ALWAYS CLEAN YOUR BOOM BEFORE ADJUSTING IT TO AVOID UNNECESSARY CONTACT WITH CHEMICALS.**

The boom wing sections on the Eagle 3 point boom have been pre-assembled, adjusted and tested in the factory. The boom however, will require additional adjustments shortly after being taken into service (10 hours) and thereafter on a minimum annual basis to perform at its maximum levels.

To further insure the booms proper performance, the Eagle 3 point boom also has to be maintained on a regular basis.

PLEASE FOLLOW THE SUGGESTED MAINTENANCE INTERVALS.

Perform the adjustment procedures in the same sequence as they are written in this manual.

6.1 Adjustment And Maintenance Intervals

IMPORTANT: *To maximize boom life and performance, retighten all boom fasteners and inspect boom for proper adjustment after the first 10 hours of use. Thereafter adjust the boom at a minimum of once a year and check all fasteners at 50 hr. intervals. Lubrication of the boom should be done daily to ensure maximum performance and life.*





6.2 Checking And Adjusting Sprocket Timing

1. With the boom unfolded (in the spraying position) while standing on the rear side of the boom, check to ensure that the 7th pin connection in the timing chain (on the 48' and 66' boom) (**A**) (Fig. 12) is aligned with the center line between the sprocket cap screws (**B**) (Fig. 12).
2. To adjust timing, loosen the turnbuckles on the front and rear cables until slack.
3. Line up the chain and sprocket as indicated in step 1.
4. Adjust front and rear cable tension (Section 6.10).

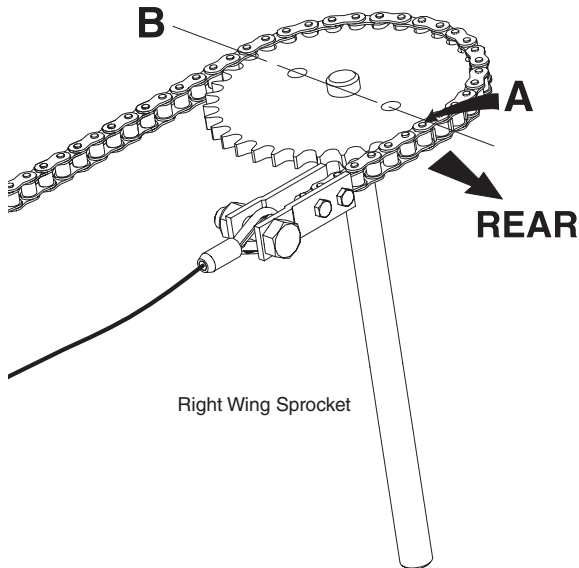


Fig. 12



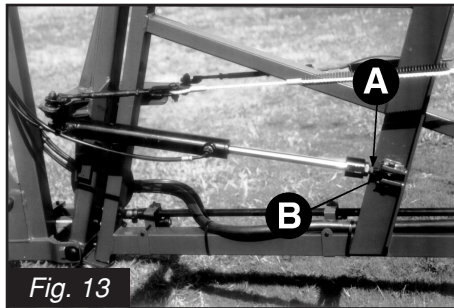
6.3 Alignment Of Wing Assemblies

1. With the boom unfolded (in the spraying position), check the alignment of the intermediate section with the center frame.
2. With the fold cylinder pressurized, determine if the intermediate section needs to be adjusted to the front or rear to come into alignment with center frame.

Note: Because of adjustments made later, it is better to start with the wing assemblies angled slightly to the rear.

3. Relieve pressure from cylinder by folding the boom in a few inches.
4. Disconnect cylinder rod eye (B)(Fig. 13) from the intermediate boom section.

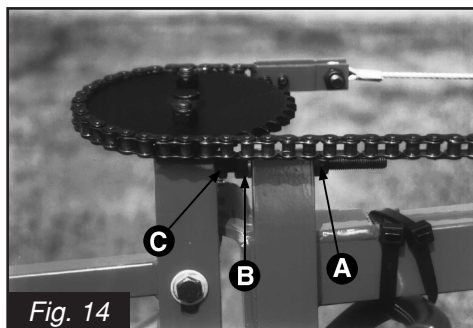
Note: Some cylinder rods have a machined flat which, if visible, can be used for adjustments. If using the machined flat for adjustment, leave the rod eye pinned to the boom and loosen the jam nut.



5. Loosen jam nut (A)(Fig. 13) and adjust the rod eye (B)(Fig. 13) IN to move the boom forward or OUT to move the boom rearward. Then retighten the jam nut (A)(Fig. 13).
6. Reattach the cylinder rod to the boom and pressurize the cylinder to check boom alignment.

6.4 Alignment Of Intermediate And Outer Boom Sections

1. Unfold the boom into operating (spraying) position.
2. Holding the M12x100 adjusting bolt, loosen the lock nut (A)(Fig.14), and turn nut (B)(Fig. 14) so the cap of the bolt head (C)(Fig. 14) contacts the top stop plate with the outer and intermediate boom sections aligned.



3. Check to ensure that the lock nut is tight.



6.5 Adjusting Front Fold Cable

The performance of the EAGLE 3 Point Boom, while spraying, depends greatly on the front fold cable adjustment. A correctly adjusted cable will also control the movement of the outer wing section.

WARNING: THE REAR CABLE CAN SNAP AND INJURE YOU OR SOMEONE ELSE IF TENSIONED WHEN THE BOOM IS UNFOLDED. ALWAYS ADJUST THE FRONT CABLE FIRST WITH THE BOOM UNFOLDED AND REAR CABLE LAST WITH THE BOOM FOLDED IN TRANSPORT POSITION.

1. Unfold boom into operating position.
2. Shut the tractor off.
3. Check the security of turnbuckle anchors to the hinge.
3. Slide a straight edge down the underside of the intermediate boom section until it just contacts the front cable.
4. Suspend a 10lb (4.5kg) weight from the straight edge-to-cable contact point and check deflection by measuring the distance from the straightedge to the cable. Cable should deflect .50-.75 in. (13-20mm).
5. Loosen jam nuts **(A)**(Fig. 15) on the turnbuckle assembly and adjust turnbuckle **(B)**(Fig. 15) for proper cable deflection.
6. Tighten jam nuts **(A)**(Fig. 15) and remove weight.

IMPORTANT: Check boom alignment again. If front cable was tightened, the wing assembly will move forward; or if loosened, wing will move rearward. Adjust fold cylinder (if necessary) as described in Aligning Wing Assemblies, (Section 6.3).

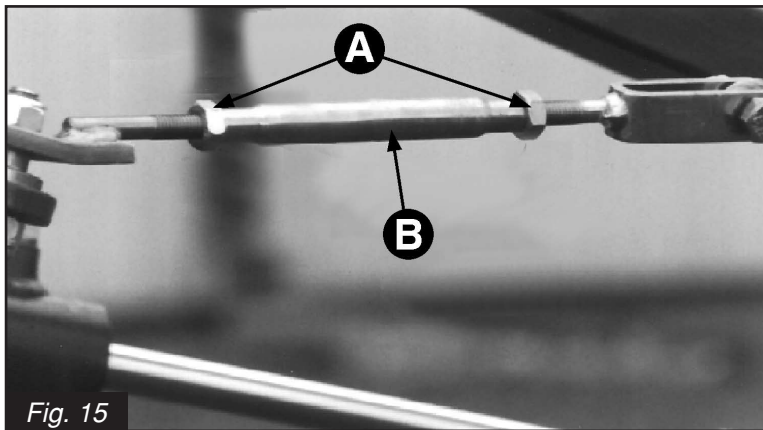


Fig. 15

6.6 Adjusting The Breakaway Clutch

WARNING: NEVER PLACE FINGERS INTO THE OPEN BREAKAWAY CLUTCH OR YOU MAY BE INJURED SHOULD THE CLUTCH SNAP CLOSED!

DO NOT TIGHTEN THE BREAKAWAY CLUTCH MORE THAN WHAT IS NECESSARY! OVER TIGHTENING CAN CAUSE DAMAGE TO THE BOOM!

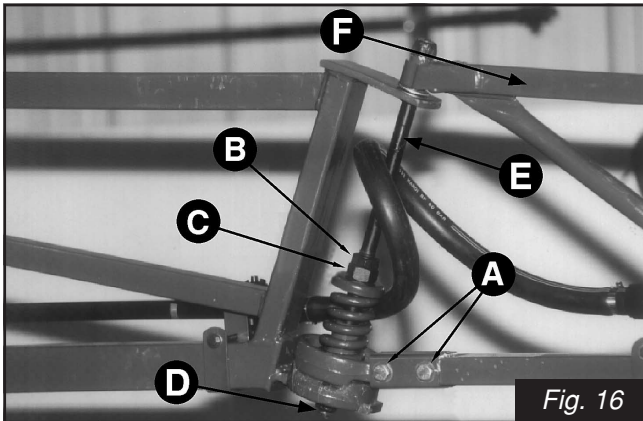


The tension on the breakaway for the outer wing can be adjusted by loosening or tightening the adjustment nut on top of the sprocket between the inner and outer wings (Fig. 16).

1. If the breakaway clutch releases too easily, tighten the nut.
2. If the breakaway clutch is too stiff, loosen the nut.

Note: Spring pressure from tensioned breakaway clutch only assists in returning outer boom section to alignment.

3. Check that the lower nut (**D**)(Fig. 16) is fully tightened.
4. The breakaway wing section should pivot around the axle shaft (**E**)(Fig. 16). Ensure that section (**F**)(Fig. 16) is free to move.
5. Loosen jam nut. (**B**)(Fig. 16).
6. Tighten nut (**C**)(Fig. 16) to stiffen clutch action. Clutch is properly tensioned when breakaway boom section returns to alignment with outer boom section after breaking away. Tighten jam nuts after adjustment.



IMPORTANT: *Properly lubricate clutch assembly before adjusting the tension. Breakaway clutch cap screws (A)(Fig. 16) must be torqued to 40lb-ft (55 N-m) every week (40 hours) to prevent boom damage. Lubricate every day (8 hours) to ensure maximum performance and life.*



6.7 Adjusting Wings Level To Ground

With boom unfolded (in the spraying position), check that boom sections are parallel to center frame and level to the ground. Adjust, if necessary, as detailed below.

A) *HY Booms*

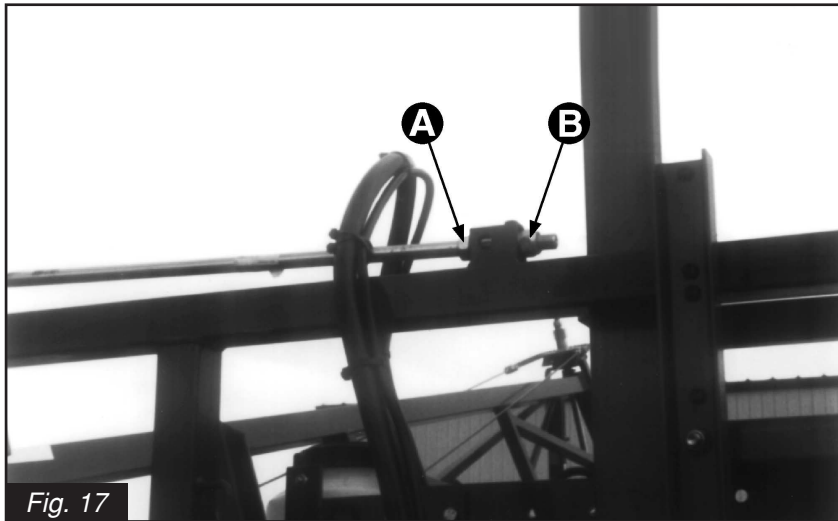


Fig. 17

1. Loosen jam nut **(A)**(Fig.17).
 2. Adjust nut **(B)**(Fig.17) in or out until wing is level to ground.
 3. Secure jam nut **(A)**(Fig.17).
- Same procedure applies to both sides.

C) *HZ and HT Booms*

1. Ensure cylinder is fully extended.
 2. Loosen jam nut **(A)**(Fig.18).
 3. Apply an adjustable wrench to the machined surface at **(B)**(Fig.18).
 4. Turn the cylinder rod until boom is level to the ground.
 5. Secure jam nut **(A)**(Fig.18).
- Same procedure applies to both sides.

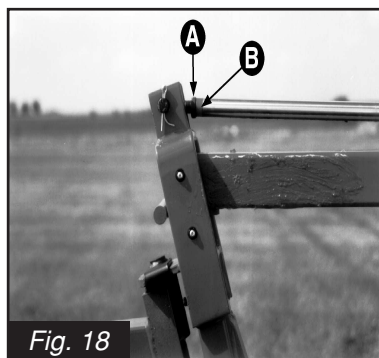


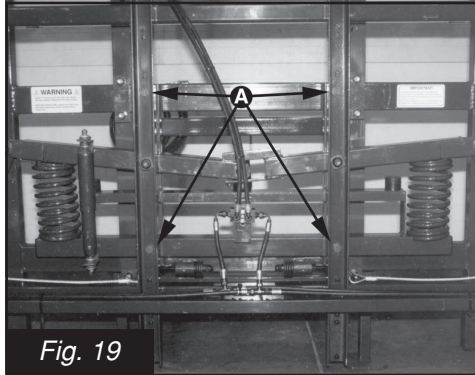
Fig. 18

6.8 Adjusting The Center Section

This adjustment will affect the suspension (trapeze function) and must therefore be done properly to optimize the EAGLE 3 Point Boom performance.

IMPORTANT: *Lubricate pivot linkage and grease skid plates prior to adjustment .*

1. Ensure that the sprayer is on level ground.
2. Tighten the four adjustment bolts (A)(Fig.19) approx. 1/2 turn.
3. Grasp the wing by the end and lift it approx. 20 in.(490mm). Release the wing and it should smoothly return to approximately the horizontal position.



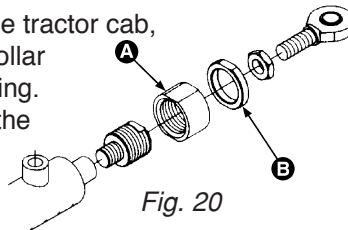
4. If the trapeze will not let the boom go back to horizontal position, the bolts must be loosened again. The spray boom is properly adjusted when it returns to the horizontal position under its own weight.

6.9 Adjusting the Boom Transport Position

1. Lift the boom all the way to the top.
2. Fold the boom into the transport position. With the fold cylinder pressurized, determine if the boom sections need to be adjusted inwards or outwards.

Note: Ensure that the boom wings will not interfere with the tractors wheels or structure.

3. Relieve the pressure from the fold cylinder by unfolding the boom a few inches.
4. If the boom comes too far in towards the tractor cab, loosen the nut (B)(Fig.20) and adjust collar (A)(Fig.20) in towards the cylinder housing.
5. If the boom goes too far out away from the tractor cab, adjust the collar (A)(Fig.20) away from the cylinder housing.
6. Secure the jam nut (B)(Fig.20).



7. Pressurize cylinder to see if the boom is properly adjusted. If not, repeat the above procedure until it is correctly adjusted.





6.10 Adjusting the Rear Cable

WARNING: THE REAR CABLES CAN BREAK AND INJURE YOU OR SOMEONE ELSE IF TENSIONED WHEN THE BOOM IS UNFOLDED. ALWAYS ADJUST FRONT CABLE FIRST WITH THE BOOM UNFOLDED INTO OPERATING (SPRAYING) POSITION.

1. Raise the boom to its highest position. Fold the boom to transport position with the tilt cylinders fully extended. Make sure the fold cylinders are pressurized and that the boom is folded all the way in.
2. Shut the tractor off.
3. Ensure the boom transport stop arms are in contact with the outer wing. Adjust if necessary.
4. Loosen the jam nuts on the turnbuckle. Adjust (tighten) the turnbuckle so that the outer wing section contacts the boom transport stop bracket. Tighten the turnbuckle another four complete turns and retighten the jam nuts.

7.0 MAINTENANCE

WARNING: ALWAYS CLEAN YOUR BOOM AT THE END OF THE WORK DAY OR BEFORE SERVICING IS DONE TO AVOID UNNECESSARY CONTACT WITH CHEMICALS!



7.1 Lubrication

Lubrication of the boom daily will ensure maximum performance and life. This lubrication includes the center frame, as well as the boom hinges and breakaway clutches.

7.2 Greasing the Center Frame

Every 8 hours (daily) new grease should be applied to the wear surfaces on the center frame (Fig. 21).

Every 50 hours the grease on the center frame should be completely cleaned off with a degreasing solvent and new grease applied. Follow the above steps when doing this.

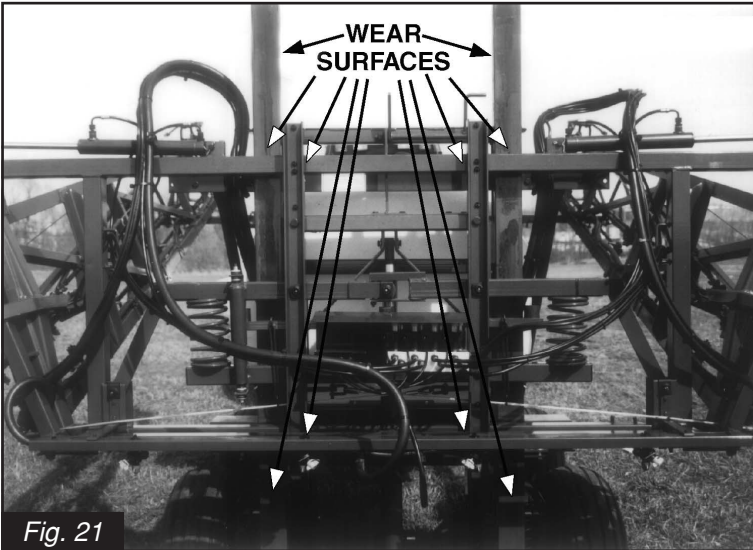


Fig. 21

7.3 Greasing The Suspension/Pivot Linkage

Every 8 hours the places indicated in the following pictures should be greased.

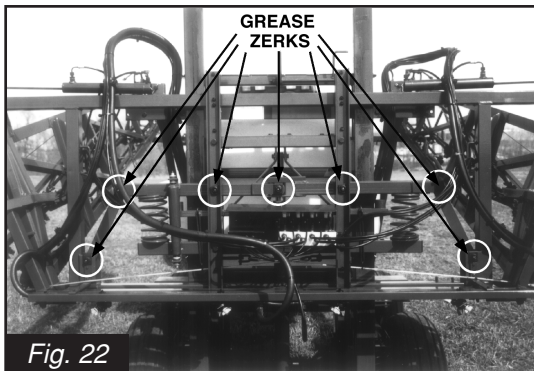


Fig. 22

7.4 Greasing The Boom

Grease the boom at all grease zerks in hinge, breakaway and chain sprocket. Every 25 hours the chain and sprocket should be lubricated with a chain lubricant.

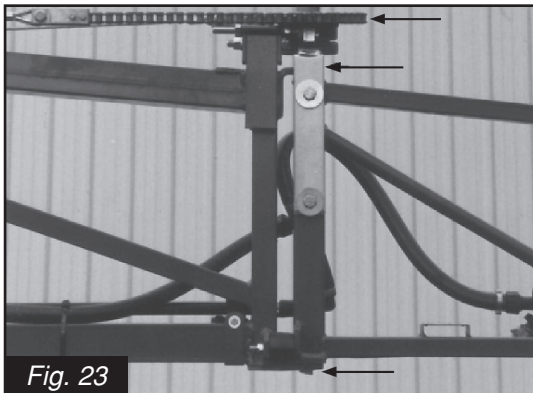


Fig. 23

7.5 Greasing The Breakaway Clutch

WARNING: NEVER PLACE FINGERS INTO OPEN BREAKAWAY CLUTCH OR YOU MAY BE INJURED SHOULD CLUTCH SNAP CLOSED!

1. Unfold the boom into operating (spraying) position.
2. Standing in front of the outer wing, snap the breakaway open by quickly pushing the boom away from you.
3. With the two clutches opened up, stick the nozzle of a grease gun into the clutch and apply a generous amount of grease. This should be done every 8 hours.
4. Apply oil to top of breakaway section hinge to lubricate bushing.





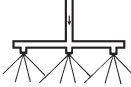
7.6 Nozzle Filters

Each nozzle assembly is equipped with a 50 mesh filter screen as standard on units equipped with 20 GPA green Color Tips™. Properly maintained filters will eliminate the plugging of the screens and nozzles.



7.7 In-Line Filters (Optional)

If in-line filters are fitted, they should be cleaned every 8hrs. (daily). Unscrew the bowl to remove sediment.

Nozzle Size 	Inline Filters (optional) 	Nozzle Screen 
Lilac (08) Brown (10) Yellow (12) Orange (14)	100	100
Red (16) White (18)	80	80
Green (20) & Larger	50*	50*

* Standard mesh

7.8 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 materials

Therefore, in case of leaks; **DO NOT** overtighten any fittings (Fig. 24). Disassemble, check the condition and position of the O-ring or gasket, clean, lubricate and then reassemble. For **radial** seals (O-rings) (Fig.24) only hand tighten the fittings. Do not use pliers or wrenches.



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

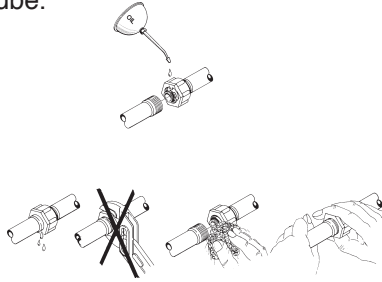


Fig. 24

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

7.9 Maintenance of Triplets (when fitted)

Every 50 hours the triplets should be disassembled removed and cleaned. This is done by pulling out the stainless clip on the side of the triplet assembly. Clean the bottom part as well as the top part thoroughly. Coat the O-ring with a light film of vegetable oil if the sprayer is to be stored for a long period of time.

If the triplets are not cleaned regularly they will not rotate readily and possible damage to them may occur.



Fig. 25

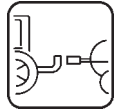
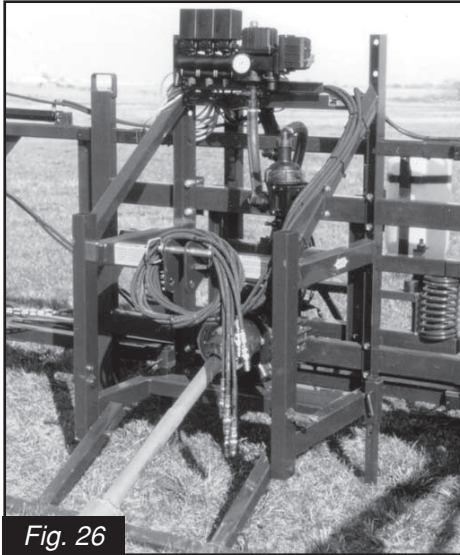


WARNING: NEVER SERVICE YOUR CONTAMINATED NOZZLES WITHOUT WEARING CHEMICAL RESISTANT GLOVES AND SAFETY GOGGLES.

8.0 PUMP & CONTROLS

There are two pump and control kits available, the first one featuring a model 361 PTO driven Diaphragm pump with self-cleaning filter and 3-section electric control with HARDI-matic. The second features a ACE 206 hydraulically driven Centrifugal pump with 3-section electric control.

The assembly, operation and maintenance required for these kits is covered in this section.



8.1 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.

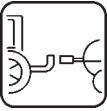
Always keep protection guards and chains intact and make sure that it covers all rotating parts, including CV-joints at each end of the shaft. Do not use without protection guard.

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.

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



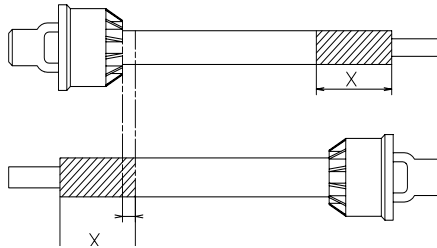


8.2 Installation of P.T.O. Shaft (361 pump only)

WARNING: THE P.T.O. SHAFT ANGLE WILL CHANGE WHEN RAISING AND LOWERING THE 3 POINT LINKAGE ARMS. 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 PTO LENGTH ADJUSTMENTS ARE COMPLETED.

Initial installation of the shaft is done as follows:

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



min. 3/4" (20 mm)

Fig. 27

Note: The shaft must always have a minimum overlap of 6" (150 mm) (Fig. 28).



min. 6" (150 mm)

Fig. 28

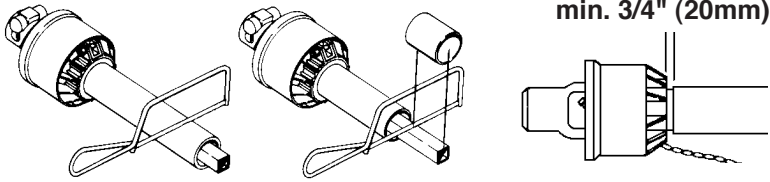
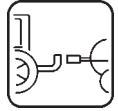


Fig. 29

4. The two parts are shortened equally. Use a saw, and file the profiles afterwards to remove burrs (Fig. 29).
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 from rotating with the shaft (Fig. 30).

7. To ensure long life of the P.T.O. shaft, try to avoid working angles greater than 15° (Fig. 30).

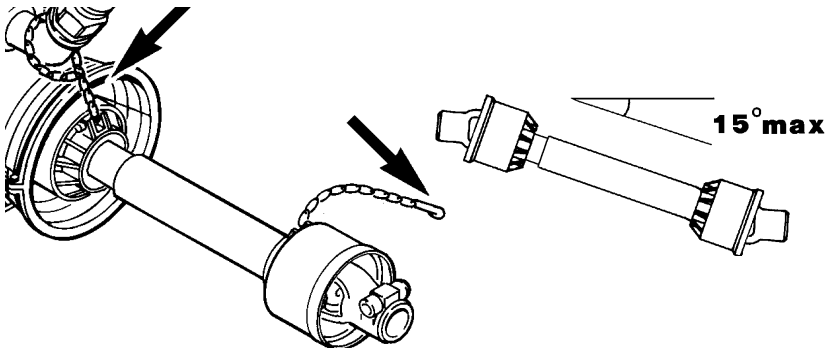
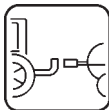


Fig. 30



8.3 Diaphragm Sprayer Plumbing Diagram

Review and study the following diagram(Fig.31). Following the flow through the system will help you better understand the various functions of the sprayer system.

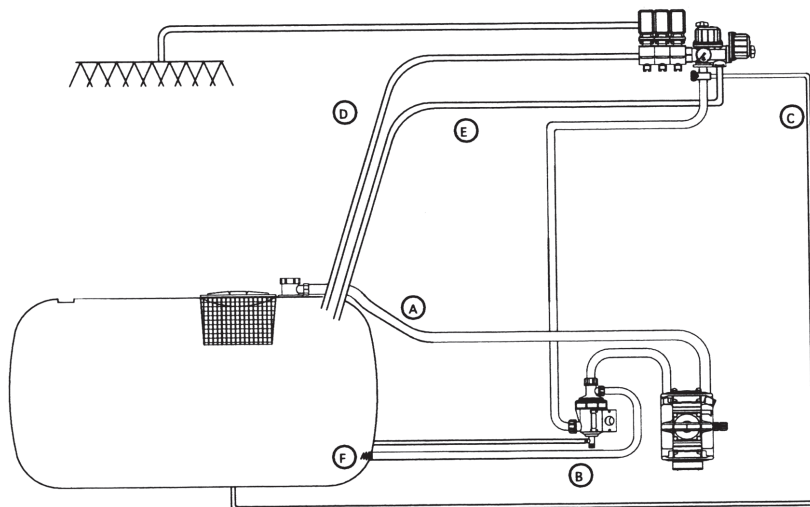


Fig. 31

The following hoses will need to be connected to the spray tanks fitted to the tractor. (Refer to Fig.31)

- A. Suction hose to pump (1 1/2" hose). Should be used with a minimum of a 30 mesh filter or larger in this hose.
- B. Self-cleaning filter to safety valve (1" hose) **the safety valve is supplied in kit, and must be fitted to sprayer tank.**
- C. Agitation hose (1/2" hose) from adjustable agitation valve.
- D. Constant pressure return hose (1" hose), from Electric Control Unit.
- E. Return line from main on/off valve. (1" hose), from Electric Control Unit.
- F. Safety valve.

If the tanks to be used are polyethylene, HARDI can supply bulkhead fittings with quick disconnect features for easier assembly & disassembly of the Eagle 3-Point Boom to the tractor.

8.4 Adjustment of the EC Controls

EC operating unit

1. Adjustment screw for consistant boom pressure
2. Main ON/OFF valve
3. Pressure control valve
4. Distribution valves
5. Pressure agitation valve
6. System pressure gauge

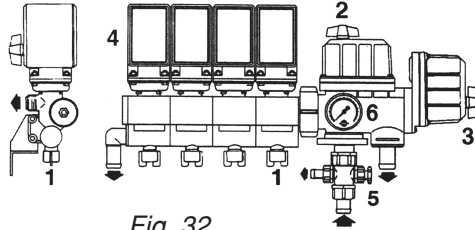
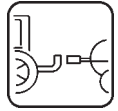


Fig. 32



EC Remote control box

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

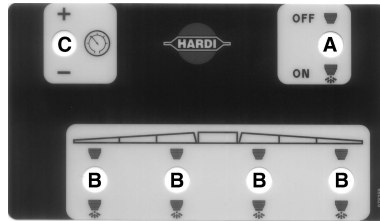
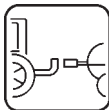


Fig. 33

1. Choose the correct nozzle (Section 5.5). 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.
3. Open or close knob (5) (Fig.32) depending on whether pressure agitation is required. (Remember pressure agitation takes 5% to 10% of pump output).
4. On-off switch (A) (Fig.33) is "ON" against green dot.
5. All distribution valves switch (B) (Fig.33) are also "ON" against green dot.
6. Hold pressure regulating switch (C-) (Fig.33) until handle (3) (Fig.32) stops rotating, this will be the "minimum pressure" setting.
7. Hold pressure regulating switch (C+) (Fig.33) until desired pressure is shown on the pressure gauge.



8.5 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.33).
2. Turn the adjusting screw **(1)** (Fig. 32) until the control unit pressure gauge **(7)** (Fig. 32) 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. 33) back on.
4. Repeat steps 7 through 9 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.33). 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.33) to off position. The constant pressure device ensures that the pressure does not increase in the sections which are still operating.

In case of electrical failure it is still possible to manually override 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.*

8.6 Agitation Adjustment (Agitation nozzles only)

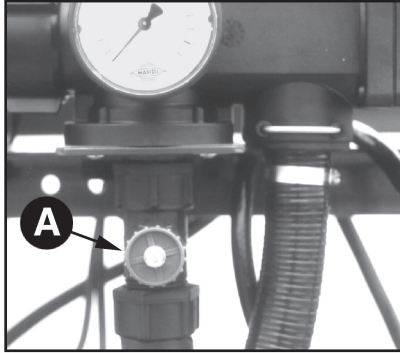
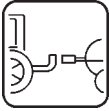


Fig. 34

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 (**A**) (Fig.34) clockwise will reduce the agitation flow. Turning the valve counter clockwise will increase the agitation flow.



8.7 Self Cleaning Filter

1. From pump
2. To safety valve
3. Filter housing cover
4. To operating unit
5. Return line/
constant agitation
6. Filter housing cover nut

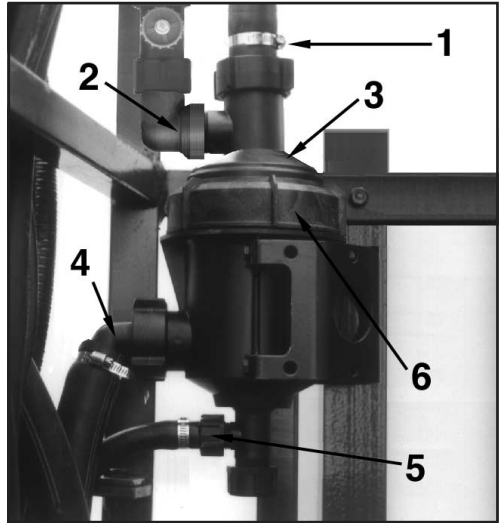


Fig. 35

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. A good practice is having the necessary new O-rings on hand at the time of changing screens or when performing routine maintenance. O-ring part numbers are #242020, #241953, #242047.

Note: It is advisable to have the sprayer tank empty before carrying out any maintenance on the self-cleaning filter.

To clean or replace filter, loosen nut (6) (Fig.35) to remove filter housing cover (3) (Fig.35) lift filter screen out. Replace screen and filter housing cover. Press down on cover (3) (Fig.35) and turn the cover nut (6) (Fig.35) clockwise until snug.

8.8 Checking Ball Seat in EC Controls

If problems with on/off valve occurs (dripping nozzles when on/off valve is closed), the ball and ball seat should be checked.



1. Remove the 2 bolts attaching the on/off-pressure valve unit to the bracket.
2. Unscrew the union nut **(A)** (Fig. 36) and pull the on/off pressure valve away from the distribution valves.
3. Check the ball for sharp edges and scratches and check the ball seat for cracks and wear. Replace if necessary.

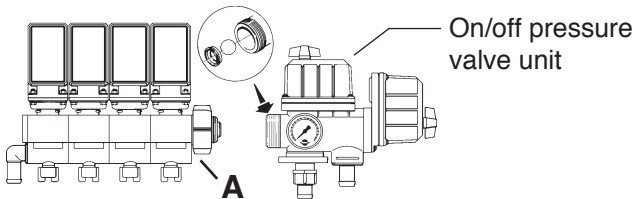


Fig. 36

8.9 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. 37) and remove hose **(B)** (Fig. 37) for the constant pressure device. When the housing is drained make sure everything is clear from part **(B)** (Fig. 37).
3. Start the sprayer, there should not be any flow of liquid through the constant pressure passage. If there is any leakage, the valve cone **(E)** (Fig. 37) must be changed. (Shut sprayer off.)
4. Remove clip **(C)** (Fig. 37), and pull the EC motor off the valve housing.
5. Remove **(D)** (Fig. 37) screw and replace the valve cone **(E)** (Fig. 37). Reassemble in opposite sequence.

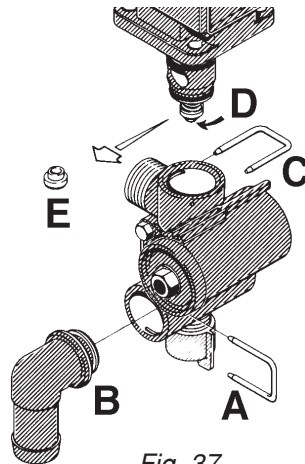


Fig. 37



8.10 Changing The Valves & Diaphragms in a 361/462 Pump

Note: It is recommended that if one or more diaphragms and/or valves need replacing they all should be replaced. (#750342-Complete 361 rebuild kit, #750324-Complete 462 rebuild kit)

1. Remove valve cover (1) (Fig. 38). Before changing the valves (2) (Fig. 38) note the orientation of the valves so that they are replaced correctly.

IMPORTANT: *The two valves with vented flaps (2A and 2B) (Fig. 38) must be placed in the valve openings as shown.*

2. It is recommended to use new O-rings (3) (Fig. 38) #330024 when changing or checking the valves.
3. Remove the diaphragm bolt (4) (Fig. 38) after having dismantled the valve cover as indicated above. The diaphragm (5) (Fig. 38) may now be changed.
4. If fluids have reached the crank case, regrease the pump thoroughly.

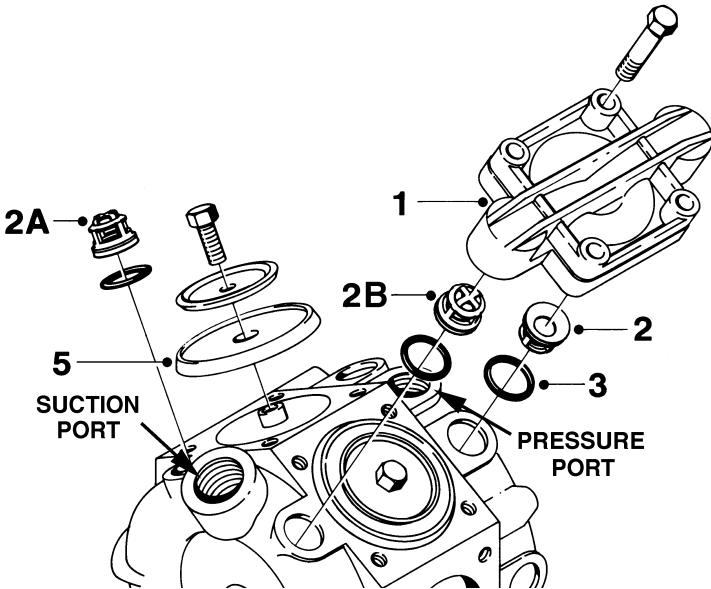


Fig. 38
Model 361 Pump Shown 462 Similar

8.11 Centrifugal Sprayer Plumbing Diagram

Review and study the following diagram(Fig.39). Following the flow through the system will help you better understand the various functions of the sprayer system.

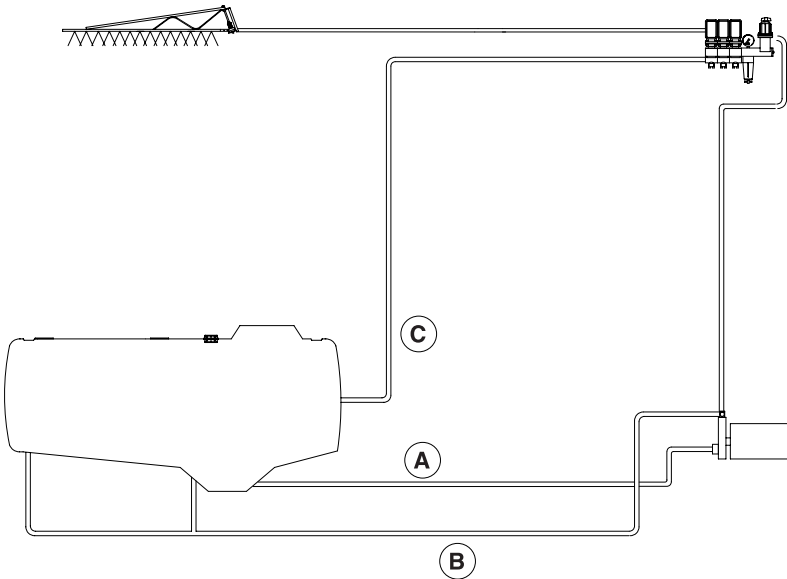
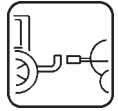
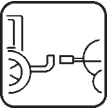


Fig. 39

The following hoses will need to be connected to the spray tanks fitted to the tractor. (Refer to Fig.39)

- A. Suction hose to pump (1 1/2" hose). Should be used with a minimum of a 30 mesh filter or larger in this hose.
- B. Agitation hose (1/2" hose) from adjustable agitation valve.
- C. Constant pressure return hose (1" hose), from Electric Control Unit.

If the tanks to be used are polyethylene, HARDI can supply bulkhead fittings with quick disconnect features for easier assembly & disassembly of the 3-point boom to the tractor.



8.12 Operation of the ESC Controls

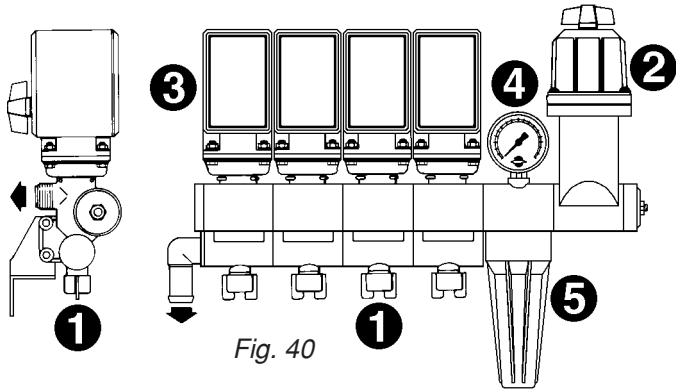


Fig. 40

ESC Operating Unit

1. Adjustment screw for constant boom pressure
2. Pressure control valve
3. Distribution valves
4. System pressure gauge
5. System pressure filter

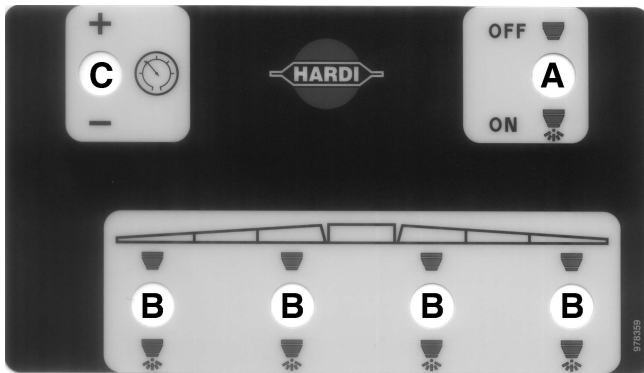
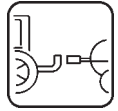


Fig. 41

ESC Control Box

- A. Master operating switch for on-off valves
- B. Operating switches for distribution valves
- C. Pressure regulating switch (-) lower, (+) raise

8.13 Adjustment of the ESC Controls



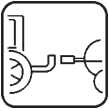
1. Put the tractor in neutral and adjust the P.T.O. RPM's until the number of revolutions of the pump corresponds to the intended traveling speed. Remember the number of revolutions on the P.T.O. must be kept between 300-600 rpm.
2. Open or close knob 5 depending on whether pressure agitation is required. (Remember pressure agitation takes 5% to 10% of pump output).
3. On-off switch **(A)** (Fig. 41) is "ON" against green dot.
4. All distribution valves switch **(B)** (Fig. 41) are also "ON" against green dot.
5. Hold pressure regulating switch **(C -)** (Fig. 41) until handle **(3)** (Fig. 40) stops rotating, this will be the "minimum pressure" setting.
6. Hold pressure regulating switch **(C+)** (Fig. 41) until desired pressure is shown on the pressure gauge.

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

7. Shut-off the first boom distribution valve switch **(B)** (Fig. 41).
8. Turn the adjusting screw **(1)** (Fig. 41) until the control unit pressure gauge **(7)** (Fig. 40) again shows the same pressure as set in step 6 above. (Turn the screw clockwise for higher pressure, counterclockwise for lower pressure).
9. Turn the first boom distribution valve switch **(B)** (Fig. 41) back on.
10. Repeat steps 7 through 9 for the two 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.

11. Operating the control unit while driving: In order to shut off the entire boom activate on-off switch **(A)** (Fig. 41). 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. 41) to off position. The constant pressure device ensures that the pressure does not increase in the sections which are still operating.

In case of electrical failure it is still possible to manually override 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 ESC 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.*

8.14 Agitation Adjustment (Agitation nozzles only)

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 (**A**) (Fig.42) clockwise will reduce the agitation flow. Turning the valve counter clockwise will increase the agitation flow.

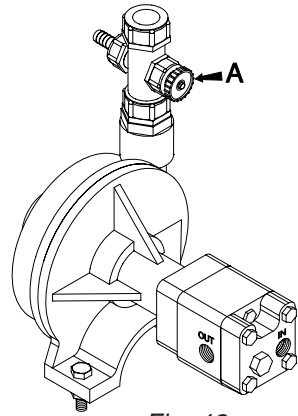


Fig. 42

8.15 Control Box for Electric Control Units

The control box for EC/ECS controls should be mounted at a convenient place in the tractor cab. The control box has 4 screw holes in the back cover, which need to be drilled out for mounting on a flat surface. There should be a minimum of a 8 amp fuse protecting this circuit. Power requirement is 12 volt DC.

Note polarity:

Brown positive (+)
Blue negative (-)

Use the optional HARDI Electric 12 volt outlet box (No. 817925) if more than one power outlet is required.

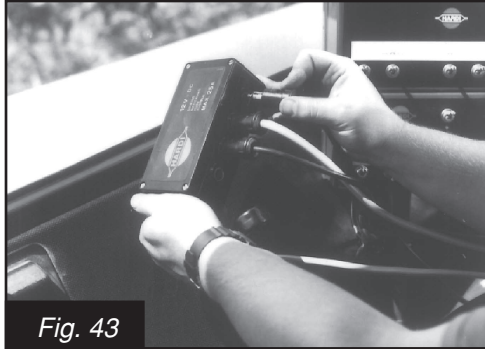
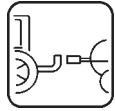


Fig. 43

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





9.0 TRANSPORTATION AND STORAGE

9.1 Follow Safe Transport And Towing Procedures

WARNING: KEEP AWAY FROM OVERHEAD POWER LINES TO AVOID SERIOUS INJURY OR DEATH TO YOURSELF OR SOMEONE ELSE. KNOW THE TRANSPORT HEIGHT OF YOUR MACHINE.



- Keep all persons away from machine when folding boom.
- It is imperative that safety chains are attached between center section and boom wings before storing or transporting sprayer.
- Transport 3-Point Eagle boom only with booms folded.
- Maximum transport speed is 15 mph (24 km/h).
- Have warning lights flashing when transporting or towing sprayer.



9.2 Storage of the EAGLE 3-Point Boom

WARNING: DO NOT DISCONNECT CENTER FRAME FROM TRACTOR WITH WINGS UNFOLDED OR REMOVED. CENTER FRAME WILL BE UNSTABLE AND COULD RESULT IN PERSONAL INJURY.

Ensure that all stands are locked in the down position before removing the spray boom from the tractor.

After use, clean the sprayer according to the instructions given with the chemical used.

Store sprayer in a safe dry location away from children and animals. Protect from direct sunlight.

TO PLACE SPRAYER IN STORAGE:

- a. Lower parking stands into position. (refer to Fig. 45)
- b. Lower the tractor 3-point hitch lift arms to park the boom on its stands.
- c. Disconnect sprayer hydraulics from tractor hydraulics.
- d. Disconnect PTO shaft & control wires from the tractor (If so equipped).
- e. Disconnect solution hoses from tractor to sprayer.
- f. Remove 3-point hitch frame from the tractor.





9.3 Winter Storage

When the spraying season is over you should devote some extra time to cleaning and preparing the sprayer for storage.

Hoses

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

Paint

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

EC Operating unit (When fitted)

When the sprayer is put away the control box and the multi-plug must be protected against moisture and dirt. If possible use a plastic bag to cover the plug.

PTO Transmission Shaft (If applicable)

Check that the transmission shaft is in good working condition, e.g. that the shield and protective tubes are in place and in good condition.

Anti-freeze Precaution

If the EAGLE 3 point boom is not stored in a frost-free place, you should take the following precautions:

1. Drain as much water as possible from spray boom hoses and nozzle tubes.
2. Pour in a mixture of ethylene glycol base anti-freeze and water at the ratio for the desired temperature protection (Volume of mixture should be about 1% of tank volume).
3. Run the sprayer and circulate the anti-freeze in the pump, controls and boom lines. The anti-freeze solution prevents the O-rings and gaskets from drying out.



WARNING: NEVER USE OIL OR DIESEL FUEL IN A SPRAYER.

Remove nozzles and screens. Clean and store in a safe, dry location away from children and animals. Remove pressure gauges and store upright in a warm dry location.

10.0 TROUBLESHOOTING

10.1 Hydraulic Systems

General Hydraulics

Problem

1. The boom moves too quickly when unfolding/folding.

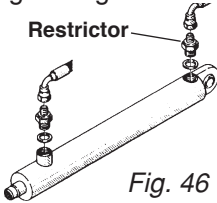


Fig. 46

2. Hydraulic system fold/tilt functions will not operate. (HZ Only)

3. One function (fold or tilt) will not operate. (HZ Only)

4. Multiple hydraulic functions with one switch activated. (HZ Only)

'DH' Hydraulics

Problem

1. Hydraulic cylinder only moves one way.

Solution

- A. Adjust the hydraulic flow control on the tractor.
- B. Check for restrictor (0.7mm) in return side of cylinder.
- C. Bleed air from hydraulic system.

- A. Check for proper 12V power supply.

- A. Check for defective switch(s).
- B. Check continuity of cables.
- C. Check for operation of applicable solenoid (coil not activating or plunger stuck).
- D. Check for short circuit in wiring junction box at rear of sprayer.
- E. Dirt in the restrictor port of the cylinder.

- A. Check for correct solenoid electric/hydraulic hook-up.
- B. Check for short circuit in wiring in the junction box at rear of sprayer.

Solution

- A. Check for electrical operation of Directional Solenoid Valve.
- B. Check hook-up of hydraulic hoses on Directional Solenoid Valve block.

P = Pressure from tractor

T = Return to tractor

- A,B** = Supply/return to solenoid block on spray boom





2. One hydraulic function will not operate.
 - A. Check for electric operation of directional solenoid valve.
 - B. Check for electric continuity through multi-pin plugs.

10.2 Mechanical Problems

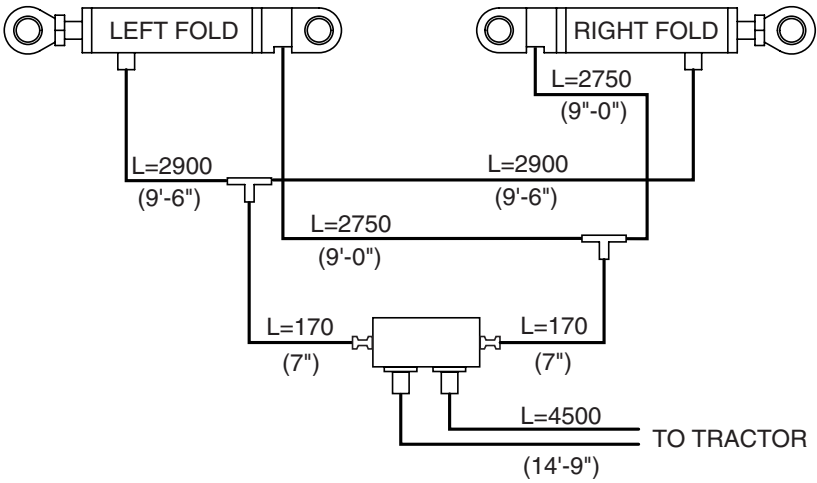
Problem

Solution

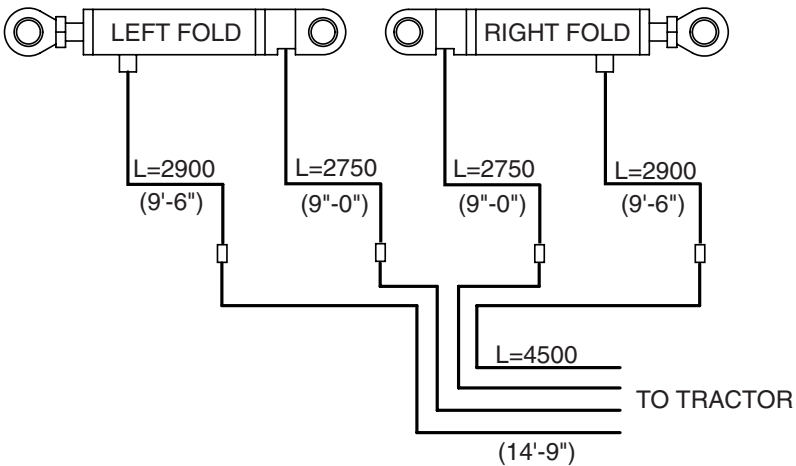
1. Boom will not completely fold in or out.
 - A. Adjust the fold cylinder. (Section 7.3)
2. Boom won't fold completely in.
 - A. Check adjustment of center cables. (Section 7.12)
3. Boom not in alignment.
 - A. Adjust and grease complete boom cables and stops. (Section 7.0)
4. Boom won't stay in spray position.
 - A. Check for hydraulic leak through solenoid block.
 - B. Check for a solenoid that is stuck open.
5. Wing to be kept folded swings out when unfolding other side of boom.
 - A. Boom must be completely unfolded, then fold the desired wing in.
 - B. Check for hydraulic leak through solenoid block.
 - C. Check for a solenoid that is stuck open.
6. Breakaway won't hold outer wing stable.
 - A. Adjust breakaway (Section 7.6), replace clutches if worn.
7. Boom won't go up or down.
 - A. H-frame needs to be greased.
 - B. Grease on H-frame is dry and dirty, clean and regrease.
 - C. Boom slide is too tight to H frame. Readjust boom slide to H-frame. (Section 7.9)

10.3 Hydraulic Schematics

A) HY Schematics

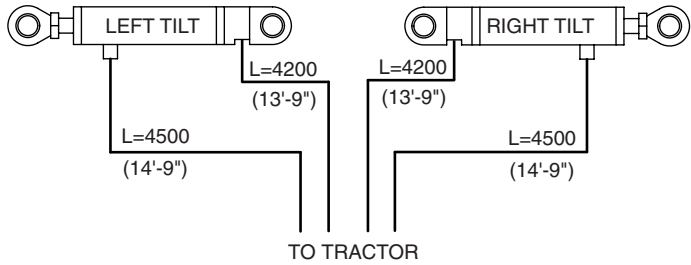
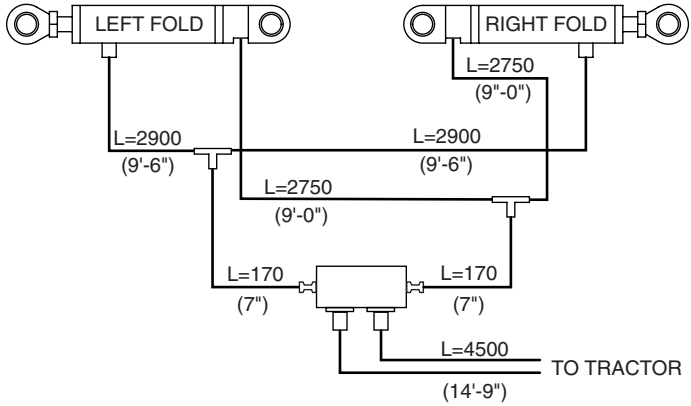


B) HY OPTION Schematic

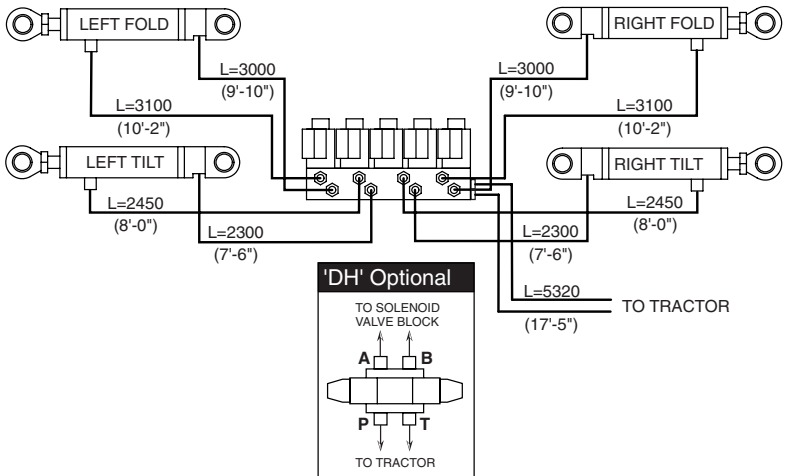




C) HT Schematic



D) HZ Schematic



10.4 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. Self cleaning filter inner cone filled with liquid. 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 plate in self cleaning filter. F. Cracked internal housing or bad seal on HARDI-matic valve. 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.)
3. Pressure jumping	A. Output from by-pass lines causing a disturbance around suction hose. B. Small tear or pin hole in suction hose.





3. Pressure jumping (con't)
 - 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.

5. Liquid leaking from 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

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 get tank empty.
- 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- 1302,361 pumps
White- 462 pump.





10.5 Foam Marker

Problem

1. Compressor will not run.

2. Compressor runs but will not make foam.

3. Will not make enough foam.

4. Foam drops will not last.

5. Keeps blowing fuses.

Cause

- 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

- A. Bad Printboard
- B. Not enough foam concentrate
- C. Solenoid valve plugged.
- D. Solenoid not working

- A. Line leak or line pinched
- B. Solenoid valve plugged
- C. Weak foam concentrate mixture.
- D. Water too hard (add water softener).

- A. Not enough foam concentrate.
- B. Frequency valve not opened enough.
- C. Weak foam concentrate.
- D. Water too hard (Add water softener)

- A. Short in electrical system or bad compressor.
- B. Bad relay on printboard.
- C. Tank filter plugged.

10.6 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)

10.7 Chemical Filler

- | | |
|--------------------------------------|---|
| 1. Filler tank will not empty. | A. Pressure selection valve not in correct position. |
| | B. Sprayer pump not running. |
| 2. Filler tank empties too slow. | A. Bottom tank discharge valve not open all the way. |
| | B. Restrictor cone from pump supply not the correct size.
Black- 361 pump
White-462 pump |
| 3. Filler tank backfills when bottom | A. Restrictor cone from pump supply line not the correct size (Black- 1302 & 361 pump, White - 462 pump). |
| | B. Restrictor cone missing. |
| | C. Restrictor cone on wrong side of the valve. |





11.0 ACCESSORIES

11.1 Clean Water Dispenser



Fig. 47

Clean Water Dispenser & Mounting Bracket (Eagle boom shown)

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.

11.2 Pump & Control System

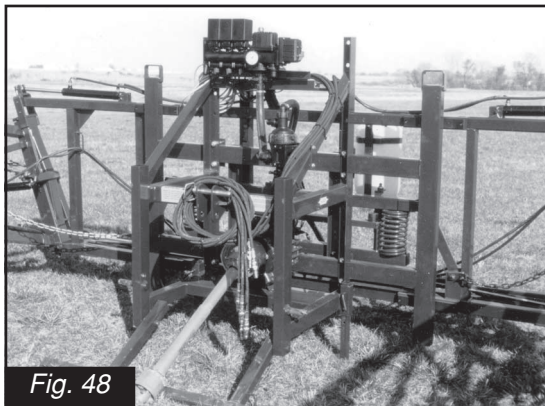


Fig. 48

To provide a self contained 3-point hitch mounted spraying system, two PTO driven pumps & control systems are available to mount to the EAGLE 3-point Boom

11.3 Foam Marker System



Fig. 49

Foam Marker Tank & Compressor



Fig.50

Foam Marker Drop Assembly

The Foam Marker helps prevent skipping or over lapping during spray application of 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.



11.4 1000 RPM Drive Gearbox (For 361/462 Diaphragm Pumps)

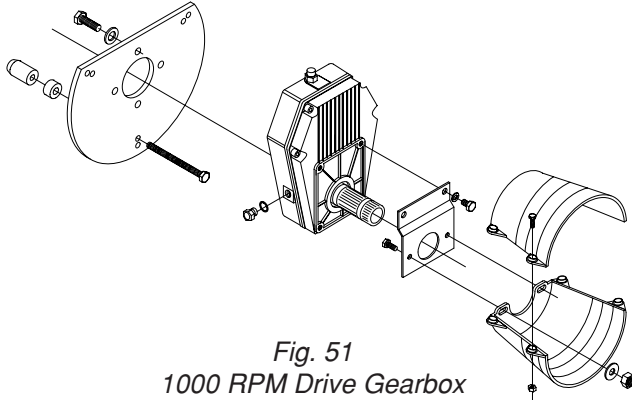


Fig. 51
1000 RPM Drive Gearbox

1000 RPM Gearbox Drive provides a means to use larger tractors having only 1000 RPM PTO system. Available for the model 361 and 462 pumps only. The gearbox has an oil filled case to provide long life and service.

11.5 Handgun And Hose Wrap

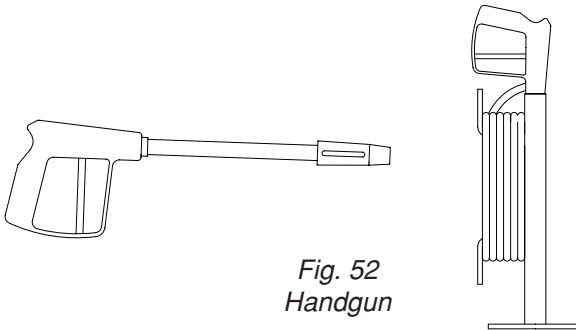


Fig. 52
Handgun

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.

12.0 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 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 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 and conditions, HARDI® extends the warranty on polyethylene tanks on mistblower sprayers with axial or centrifugal fans (excluding fittings, lids and gaskets) to TEN YEARS. To qualify for this extended warranty, the tank must be drained and flushed with fresh water after each day of use. HARDI®'s liability is limited to replacement of the tank, FOB our plants in Davenport, IA, USA; Fresno, CA, USA, and London, Ontario, Canada at no cost to the purchaser during the first ten years. This ten year extended warranty is subject, in each instance, to the tank being inspected and approved for replacement or repair by HARDI® personnel before HARDI® will accept any liability hereunder.
9. 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, IA, 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 its 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.