OPICO Nitro-Jet

Front Mounted Tank System

(Liquid Transfer & Application)

INSTRUCTION AND SPARE PARTS MANUAL

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The contents of this manual, although correct at time of publication, may be subject to alteration without prior notice.

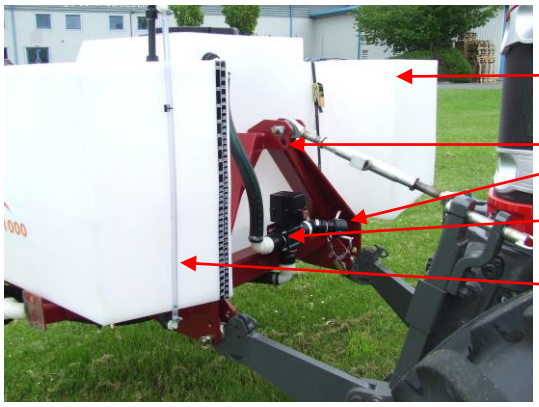
Team Sprayers Limited operates a policy of continual product development. Therefore, some illustrations and or text within this publication may differ from your machine.

SECTION ONE

Introduction to Manual 1.1

This manual provides the information for the operation and maintenance of the Team Front mounted tank/applicator range. To enable you to achieve the best results from the machine, the manufacturer recommends that you read the manual thoroughly prior to using the sprayer for the first time.

On delivery, check that the sprayer is complete as ordered and that it has not been damaged in transit. Please report any shortfall to your Team Sprayers Dealer.



Dealer/Distributor	
Address	
Telephone No	
Machine Model	
Serial No	

SAFETY PRECAUTIONS

Spraying and the Law 1.2

Current legislation requires the operator to assess the risk of all work prior to carrying it out. When planning chemical applications, consideration must be given to both personal safety and environmental damage. In both cases risks **must** be minimized.

It is suggested that the following questions are asked before starting application:

- Am I using the correct product consistent with the problem I am trying to solve?
- Can I fill the applicator in a way, which minimizes personal risk?
- Is my set up such that maximum beneficial effect will be achieved with minimum environmental damage?
- Am I working within **all** the guidelines laid down on the product label?
- Is my applicator set up to give the correct application rate consistent with my current planting rate?

ENSURE THAT THE ANSWER TO ALL OF THE ABOVE IS YES BEFORE SPRAYING

General Safety 1.2

Always disengage the pump before resetting the spray/ induction valve. NEVER LEAVE THE VALVE IN THE HALF WAY POSITION as this may cause serious damage to the pump.

Check nuts and bolts are tight after the first days use, and then regularly thereafter.
When opening the spray booms, if electrically operated onlookers should be kept clear of the machine and warnings should be given before opening and closing.
Any guards fitted are designed to comply with current legislation and are provided for your safety. The manufacturer will not accept liability for injury caused where safety devices have been removed.

Once the Sprayer has been used, assume that it is always contaminated. Always wear suitable protective clothing as specified on the product label when handling any part of the Sprayer. Take particular care to avoid chemical splashes. **WEAR A SUITABLE FACE VISOR.**
Do not eat, drink or smoke whilst working with the Sprayer and then not until contaminated clothing has been removed and all exposed skin has been thoroughly washed.

The utility vehicle must be of suitable size to carry the sprayer safely. Normal safe working procedures should be adopted at all times. Reduce speed when transporting the machine on sloping ground and when turning. Do not work on ground where there is a possibility of overturning or across steep slopes.

Description 1.3

The Team Front mounted tank range has been designed as a transfer system increasing the total spray volume carried on the tractor unit or as a liquid fertilizer application system. Tank sizes from 600 to 1500L combined with a high volume liquid transfer pump enabling the operator to either transfer solutions from the front to the rear tank when desired or accurately apply a solution when planting or drilling.

Standard fittings include (transfer system):

- Hydraulically driven transfer pump (Hypro 9324P - 700Lpm Max)
- In-cab liquid transfer control
- Bull bar c/w road lighting
- Water suction/tank fill valve
- CAT 2 3-point linkage chassis
- Demount/storage legs
- Transfer hoses (Q/coupled)

Standard fittings include: (application system)

- Hydraulically driven transfer pump (Hypro 9303C SP - 450Lpm Max)
- In-cab spray on/off control
- Manual pressure regulation
- Bull bar c/w road lighting
- Water suction/tank fill valve
- CAT 2 3-point linkage chassis
- Demount/storage legs
- Transfer hoses (Q/coupled)

INSTALLATION

Attaching the tank unit to the Tractor (transfer system) 1.4

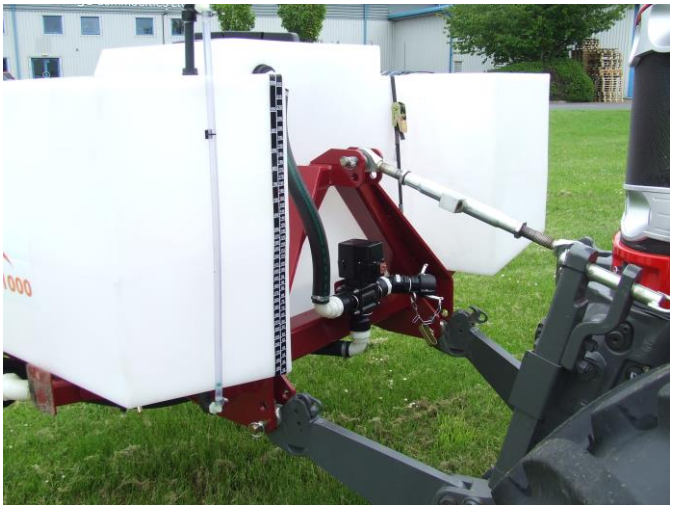
- Install liquid transfer hose from front to rear of tractor unit taking care not to obstruct access points or interfere with any moving parts
- **Care: transfer hose usually fitted to the top of the rear mounted tank, install an internal drop hose to reduce the risk of chemical frothing**
- Attach the tank unit to the tractors front 3 – point linkage (see below)
- Connect the hydraulic pump feed hoses to the tractor front connection (red – pressure, green – return)
- Connect the headlight power supply to the tractor connection (check headlights and turning indicators are working correctly)
- Lift the tank unit up away from the floor to desired operating height
- Adjust the top-link until the tank unit is horizontal in-line with the ground and tractor
- **Fold away storage legs and secure in place with locking pin and R' clip**

INSTALLATION

Attaching the tank unit to the Tractor (application system) 1.4

- Install liquid transfer hose from front to rear of tractor unit taking care not to obstruct access points or interfere with any moving parts
- Depending on system required fit all manifolds, nozzles or application tines to rear mounted planter/drill system taking care not to obstruct any moving parts
- Attach the tank unit to the tractors front 3 – point linkage (see below)
- Connect the hydraulic pump feed hoses to the tractor front connection (red – pressure, green – return)
- Connect the headlight power supply to the tractor connection (check headlights and turning indicators are working correctly)
- Lift the tank unit up away from the floor to desired operating height
- Adjust the top-link until the tank unit is horizontal in-line with the ground and tractor
- **Fold away storage legs and secure in place with locking pin and R' clip**

Tank unit attached to 3-point linkage, storage kegs folded for transport



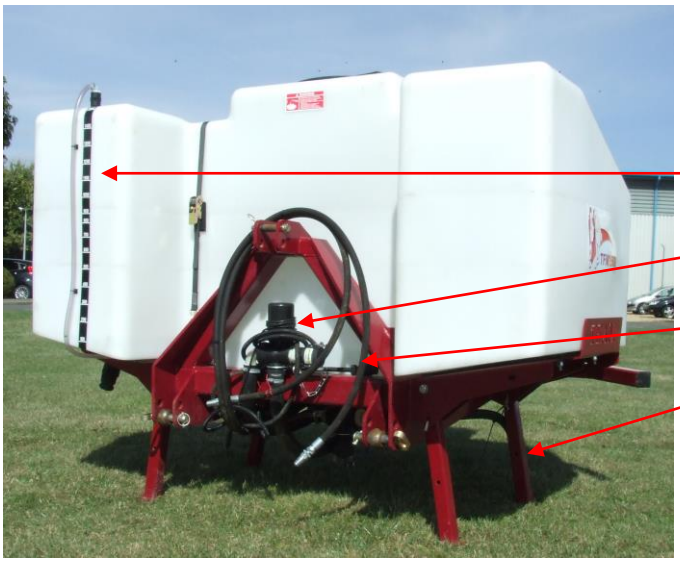
OPERATING THE SPRAYER

Transfer system 1.5

After attaching the tank unit to the tractors front linkage (as above):

- Fill tank with desired amount of water and chemical as required
- Ensure in-cab switch box is in agitate position with red light on (see below)
- Ensure transfer pump is primed with water (see pump instruction manual)
- **Care: refer to pump instruction manual for oil flow and pump set-up (section 1.14)**
- **Care: not to run pump to fast or run dry (section 1.14)**
- Engage tractor hydraulics to start pump running

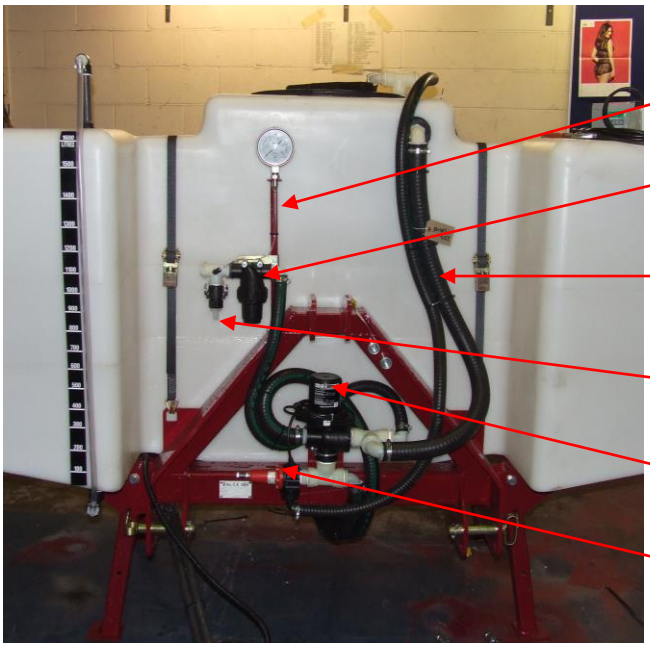
- With the pump running and the in-cab box in the agitate position the pump will return all liquids back to the main tank (agitation), check in main tank via the lid that there is liquid movement
- With the pump running and the in-cab box in the transfer position liquids will be transferred into the rear tank
- **Care when transferring/filling the rear tank that the amount of liquid being transferred is in balance with amount being used, slow pump speed if necessary!**



Application system (RDS 200 auto-rate controller) 1.6

After attaching the tank unit to the tractors front linkage:

- Fill tank with desired amount of water and chemical as required
- Ensure in-cab switch box or RDS system is in agitate or off position with red light on (see above)
- Ensure transfer pump is primed with water (see pump instruction manual)
- **Care: refer to pump instruction manual for oil flow and pump set-up (section 1.14)**
- **Care: not to run pump to fast or run dry (see pump instruction manual (section 1.14)**
- Engage tractor hydraulics to start pump running
- With the pump running and the in-cab box or RDS system is in the agitate or off position the pump will return all liquids back to the main tank (agitation), check in main tank via the lid that there is liquid movement
- With the pump running and the in-cab box or RDS system is in the spray position all liquids will be transferred to the rear mounted manifold
- **Care: refer to the RDS user manual for system set-up and calibration (section 1.14)**



Calculating Chemical Requirements 1.7

- Divide the tank volume by the application rate.
- **EXAMPLE:** 1000L Tank, 200L/Ha, 1000/200 = 5Ha
- If the area is larger than the area to be sprayed, reduce the volume accordingly.
- Multiply the area per tank full by the chemical dose rate.
- **EXAMPLE:** Dose rate 2L/Ha 5Ha x 2L = 10L

Add the required amount of chemical through the chemical inductor making sure that the mixture is well shaken. Allow the machine to run for 2-3 minutes to agitate the solution (item 1 section 1.5 in bypass position), and then continue to fill the tank with water.

Do not allow the tank to stand un-agitated

Flushing Through With Water 1.8

It is advisable that the sprayer is flushed out at the end of each day. **ALWAYS** dispose of flushed fluid safely.

Field Operation Notes 1.9

- Carry out two headland passes in order to ease turning and minimise the risk of boom damage in field margins.
- Avoid sharp turns with the sprayer turned on. Turn off the sprayer and reverse into corners.
- Switch off boom sections as appropriate in order to avoid double coverage.
- Avoid disposal problems by filling the sprayer accurately for the area to be covered.
- Keep the pump running between filling and spraying in order to maintain a thorough mix.
- Set the boom height above the target as recommended by the nozzle manufacturer.

ACCESSORIES

Water Suction 1.10

- Fit the suction hose to the sprayer quick coupler, turn suction valve to fill position.
- Engage pump.
- When tank is full disengage the pump and position suction valve to spray position.
- Remove the suction hose and refit dust cap.

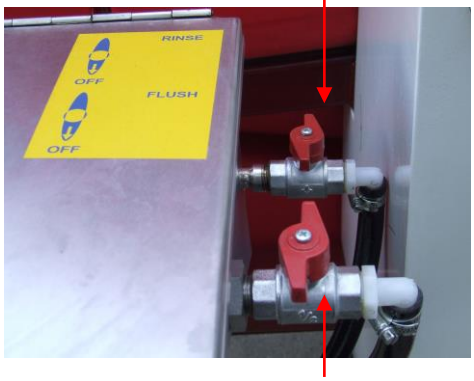
Chemical induction hopper 1.11

Before adding chemicals, ensure the calibration of the sprayer has been carefully checked.

- Half fill the sprayer tank with clean water.
- Set the front mounted spray/induction valve to induction
- Having followed the recommendations given on the spray product label, add the measured quantity of the chemical into the induction bowl and close lid.
- Engage the pump hydraulic supply
- Open the induction bowl rinsing valve and then open the chemical transfer valve see (see below) and wait for bowl to empty.
- When suction of air is heard, close the transfer valve.
- Open the induction bowl lid, turn on the chemical can rinse valve (see below), press the chemical container on to the rinse head and hold for a few seconds, close the chemical can rinse valve.
- Open the chemical transfer valve, wait for the bowl to empty and then close the transfer valve.
- Disengage the pump and reset the top and bottom valves to spray (see section 1.7)

Transfer valve

Chemical can rinse valve



Induction bowl rinse valve

Spray/induction valve

MAINTENANCE

Maintenance and Lubrication 1.12

The sprayer is a reliable and straightforward machine to use. However, the following maintenance recommendations should be observed:

- ALWAYS flush through with clean water after use. This will reduce problems due to blockages.
- CHECK the suction filter frequently and clean when required.
- CHECK all nuts, bolts and pipe unions are tight, particularly after use.
- CHECK for perished or chafed hoses.
- RINSE nozzles and filters in clean water.
- ENSURE the breather tank lid is kept clear.
- GREASE the PTO shaft and universal joints regularly.
- GREASE the boom pivot joints regularly.
- CHECK the pump oil level regularly and top up when necessary with SAE30 oil.

SEASONAL MAINTENANCE:

Drain pump oil. Strip down the pump and check the condition of all diaphragms and valves. Reassemble and refill carefully with SAE30 oil.

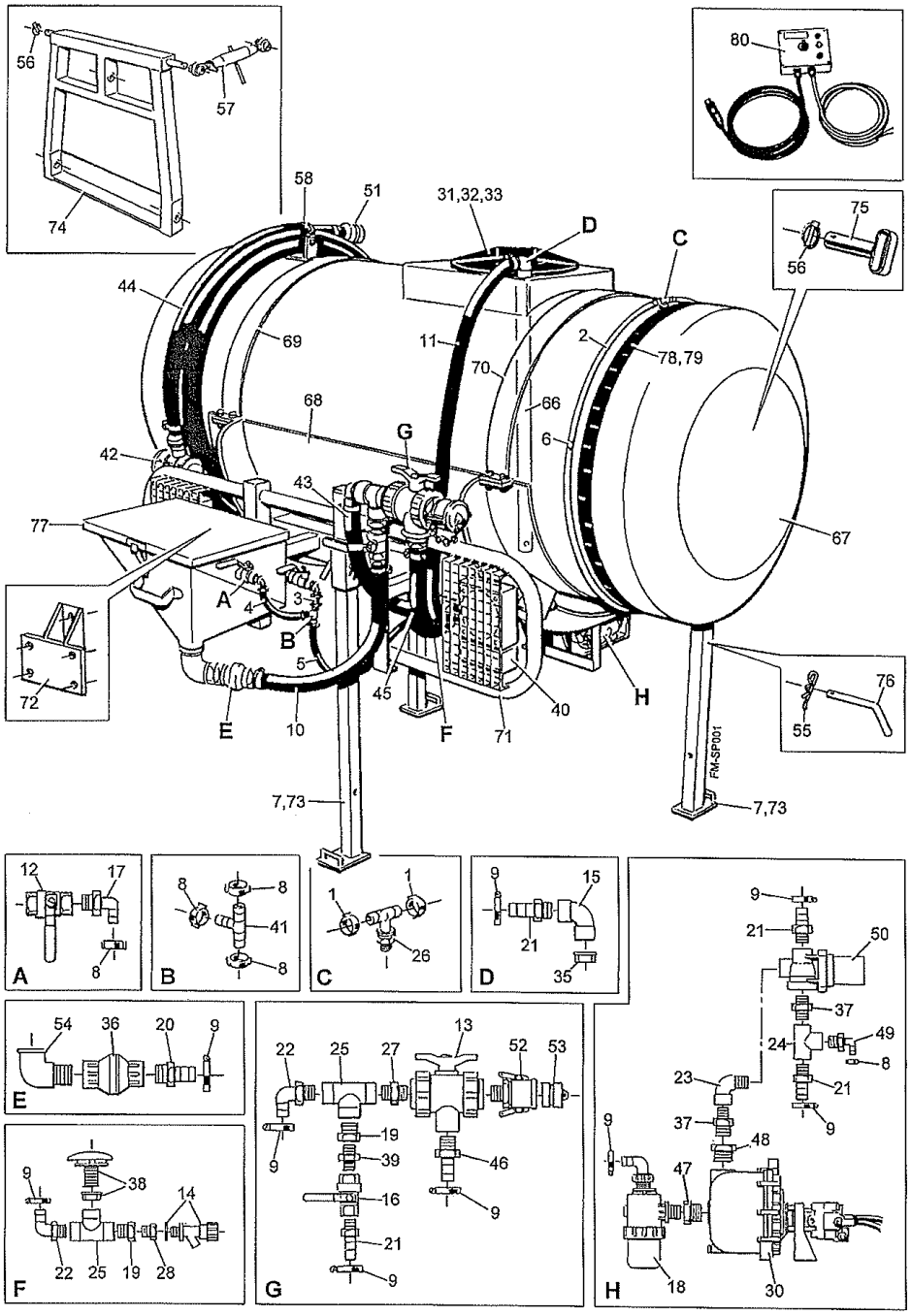
During times of frost and low temperatures, drain as mush liquid as possible from the sprayer and either remove the pump and store in warm place or add a small quantity of anti freeze and water to the sprayer and rotate pump a few times.

Note: The main suction filter fitted to the machine should be checked frequently and cleaned when required.

Trouble Shooting 1.13

Fault	Possible Cause	Action
Sprayer does not Spray.	Spray/ induction valve (if fitted) in induction position.	Set to spray position.
	Suction/ fill valve in fill position.	Set to spray position.
	Suction Filter blocked.	Remove and clean filter element.
Pressure fluctuates widely, nozzles pulse.	Diaphragm pump valve stuck.	Remove and replace.
	Diaphragm pump air chamber pressure to low.	Set air chamber pressure to ½ to ¾ of spray pressure.
Gauge shows pressure when machine not running.	Thermal expansion of glycerin compressing bourdon tube.	Remove bleed screw on back of gauge to release internal pressure.
Foam in tank.	Too much air sucked in during chemical induction.	Close suction valve immediately when chemical fill is complete.
	Air leak on suction side of pump.	Stop pump, locate leak and repair.
Nozzle splutters or hisses when spraying.	Foam in tank.	See above.
	Air leak on suction side of pump.	See above.
Oil film seen in tank.	Broken diaphragm in pump.	Replace faulty diaphragm and change pump oil. If this fault is not detected immediately, the pump should be overhauled.
Pump reservoir overfills with milky liquid.	Broken diaphragm in pump.	See above.

2.1 FRONT MOUNTED TANK UNIT



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FRONT MOUNTED TANK UNIT 2.1a

Item	Part No.	Description	Qty.	Remarks
1	OP0204	Hose Clip	4	
2	OP0205/1.3	3/8"Clear Hose (1300mm)	2	
3	OP0206/0.06	1/2"Hose (60mm)	1	
4	OP0206/0.24	1/2"Hose (240mm)	1	
5	OP0206/1.25	1/2"Hose (1250mm)	1	
6	OP0213	Sight Gauge Ball (green)	2	
7	OP0220	Plastic Insert (50x50)	3	
8	OP0226	Hose Clip	6	
9	OP0232	W/Drive Clip	10	
10	OP0237/0.67	1 1/4"Hose (670mm)	1	
11	OP0237/1.9	1 1/4"Hose (1900mm)	1	
12	OP1248	1/2"BSP 2-way Valve	2	
13	OP0334	1 1/2"BSP 3-way Valve	1	
14	OP0382	3/4"BSP Drain Tap	1	
15	OP0475	1"BSP Female Elbow	1	
16	OP0553	1"BSP 2-way Valve	1	
17	OP1009	1/2"Hosebarb Elbow	2	
18	OP1024/C	Suction Filter	1	
19	OP1025	1 1/2"BSPx1 1/4"BSP Reducer	2	
20	OP1042	1 1/4"Hosebarb Straight	1	
21	OP1044	1"BSPx1 1/4"Hosebarb Straight	4	
22	OP1079	1 1/2"Hosebarb Elbow	2	
23	OP1154	1"Hosebarb Elbow	1	
24	OP1156	1"BSP Female Tee	1	
25	OP1166	1 1/2"BSP Tee	2	
26	OP1171	Hosebarb Tee c/w Nut	2	
27	OP1172	1 1/2"BSP Nipple	1	
28	OP1173	1 1/4"BSPx3/4"BSP Reducer	1	
29				
30	OP1193	Pump /Hydraulic Motor Unit	1	
31	OP1201	Neck Ring	1	
32	OP1202	Tank Lid	1	
33	OP1203	Filter Basket	1	
34				
35	OP1207	1"BSP Backnut	1	
36	OP1217/C	1 1/2"x1 1/4"BSP Non-return Valve	1	
37	OP1237	1"BSP Nipple	2	
38	OP1247	1 1/4"BSP Anti-vortex Fitting	1	
39	OP1267	1"BSPx1 1/4"BSP Nipple	1	
40	OP1335	Headlight/Indicator Unit	2	
41	OP1047	1/2"Hosebarb Tee	1	
42	OP1217	1 1/2"Suction Strainer Complete	1	
43	-	1 1/2"Hose (1000mm)	1	
44	-	1 1/2"Hose (5000mm)	1	
45	-	1 1/2"Hose (1100mm)	1	
46	OP1080	1 1/2"Hosebarb Straight	1	
47	OP1081	2"BSPx1 1/2"BSP Reducer	1	
48	OP1081/B	2"BSPx1 "BSP Reducer	1	
49	-	1"BSPx1/2"Hosebarb Elbow	1	
50	OP0291	1"BSP Electric On/Off Valve	1	
51	OP1030	1 1/2"Quick Coupler Adaptor	1	
52	OP1028	1 1/2"Quick Coupler	1	
53	OP1029	Quick Coupler Dust Cap	1	
54	-	1 1/2"BSP MF Elbow	1	
55	OP0323	R'Clip	3	
56	-	Spring Pin	2	
57	OP0300	Adjustable Link	2	Optional

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FRONT MOUNTED TANK UNIT 2.1b

Item	Part No.	Description	Qty.	Remarks
58	OP0509	Bungee Hook	1	
59				
60				
61				
62				
63				
64				
65				
66	TS0204	Stack Pipe	1	
67	TS1002/R	Tank	1	
68	TS2655/1	Chassis	1	
69	TS2655/2	Tank Strap RH	1	
70	TS2655/3	Tank Strap LH	1	
71	TS2655/4	Headlight Frame	1	
72	TS2655/5	Inductor Mounting Bracket	1	
73	TS2655/6	Parking Leg	3	
74	TS2655/10	Tractor Mounting Frame	1	Optional
75	-	Bottom Lift Pin	2	
76	TS1311	Locking Pin	3	
77	OP0575/B	Chemical Induction Bowl	1	
78	TS1194	Contents Decal	1	
79	TS1195	Contents Decal	1	
80	-	Control Box	1	

(Issue 1 10.01)

Electro-Magnetic Compatibility (EMC)
This product complies with EC Directive 2004/108/EC when installed and used in accordance with the relevant instructions.

Service and Technical Support
PLEASE CONTACT YOUR NEAREST DISTRIBUTOR
If unknown then fax: 44 (0) 1453 733322

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User Guide

"SPRAYMASTER 200"
Sprayer Monitor / Controller

Operation
Software Reference WZ402-002 rev.02

Contents

1. Overview

The *RDS Spraymaster 200* is designed for the accurate application of liquid spray products proportional to the forward speed of the vehicle, suitable for manual and electrically operated sprayers.

The system will work as either a pressure or flow based controller. Depending on the installation, if both a flow sensor and a pressure sensor are installed, the operator can select either flow-based or pressure-based regulation. On startup (and depending on the system configuration) the operator makes some or all of the following settings via the 'Startup Wizard'.

- Target Rate
- Regulation Method (Systems fitted with both flow and pressure sensors)
- Nozzles in use (systems fitted with pressure sensor only)
- Flow Sensor in use (systems fitted with flow sensor only)
- Boom Selection

The system is normally powered through the vehicle ignition system and will be on whenever the vehicle ignition is on. The display is permanently illuminated.

There are a total of 6 channels displaying the following information to the vehicle operator,

Ch.1 Forward Speed (km/hr or miles/hr)
Number of nozzles being used (if an Area Compensation Interface (ACI) is connected)

Ch.2 Partial and Total Area worked (hectares or acres)

Also displays the part width setting if a Width Correction Interface (WCI) is connected.

Ch.3 Part and Total Volume applied (l/ha or gals/acre)

Ch.4 Pressure (bar or psi)

Ch.5 Liquid Flow Rate (litres/min or galls/min)

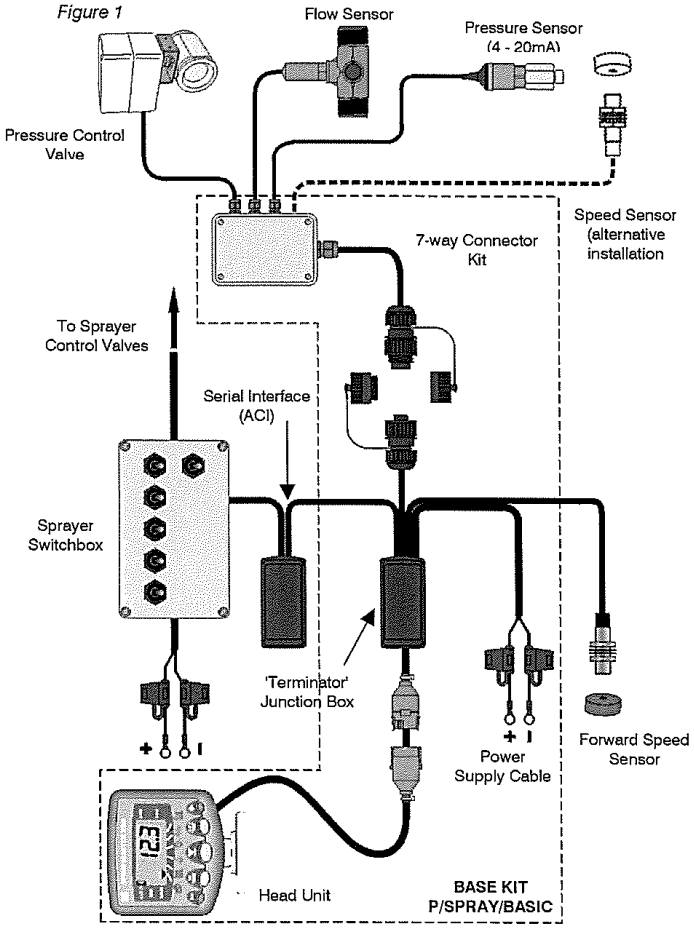
Ch.6 Application Rate (litres/ha or galls/acre)

1.1 Area Compensation Interface (ACI)

The instrument is connected to the existing sprayer switchbox via the RDS Serial Input Module (ACI). As the boom sections are switched on and off, the instrument will automatically calculate the working width and application rate, to ensure accurate monitoring and control when using partial implement width.

1.2 System Components

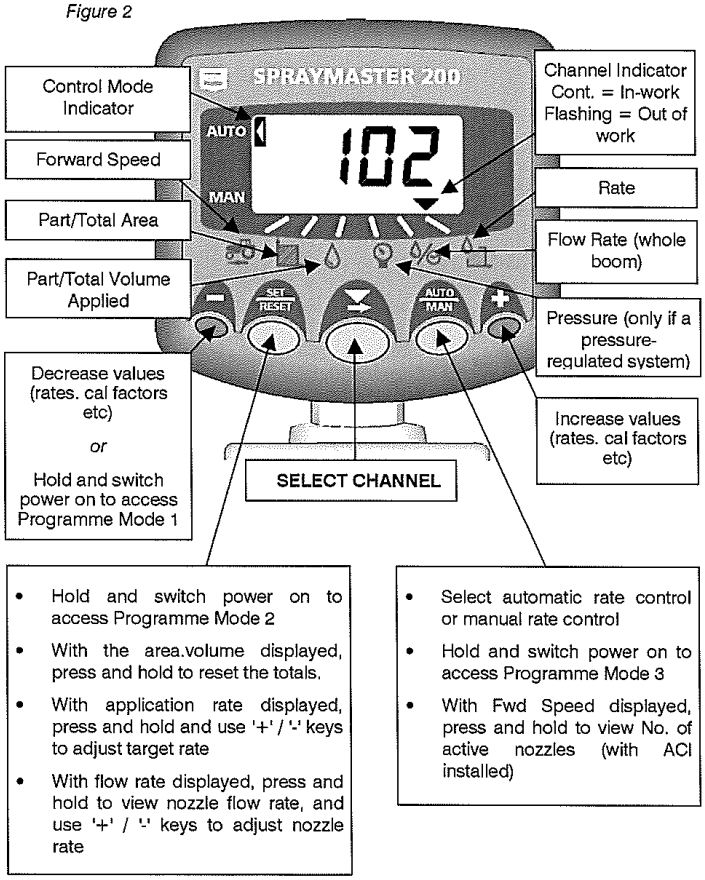
Figure 1



1.3 Instrument Facia and Controls

The five switches control all functions. The power on/off switch is located on the rear of the instrument.

Figure 2



- Hold and switch power on to access Programme Mode 2
- With the area.volume displayed, press and hold to reset the totals.
- With application rate displayed, press and hold and use '+' / '-' keys to adjust target rate
- With flow rate displayed, press and hold to view nozzle flow rate, and use '+' / '-' keys to adjust nozzle rate

- Select automatic rate control or manual rate control
- Hold and switch power on to access Programme Mode 3
- With Fwd Speed displayed, press and hold to view No. of active nozzles (with ACI installed)

2. Operation

2.1 Channel Selection

Simply press the button to cycle through the six different channels that can be displayed.

2.2 Startup Routine- the "Startup Wizard"

The head unit itself does not have a power on-off switch, so the instrument is normally powered on when the vehicle ignition is switched on.

On powering up the instrument it will always begin by flashing the previously programmed target rate. At this point you can simply switch the sprayer on, and the Spraymaster will default to AUTO mode and start regulating based on the previous settings.

If however you wish to change the rate / flow / pressure / nozzle etc settings, you can do so as part of a "startup routine" while the sprayer is switched off. The display will prompt you for the new settings. Refer to the appropriate section below.

NOTE 1:The Spraymaster 200 is also designed to accommodate the operating requirements of specialist sprayers such as vineyard sprayers in particular. With such installations, the instrument can be configured as part of the startup routine, to also prompt the operator to select the flow sensor and the boom configuration in use.

For clarity, the above options are described separately to sections 2.2.1 - 2.2.3, which will apply for the majority of installations.

2.2.1 Sprayers with Flow sensor only

In this case the "Startup Wizard" will prompt you to select the following (although see Note 1 above),

(i) ***Set (or confirm) the desired target rate.*** To change the target rate, press the "+" or "-" key then press key to confirm.

If you don't want to change the rate, simply press to confirm. The instrument then defaults to manual (MAN) rate mode, and the Forward Speed channel.

Press the key to select AUTO rate control and then switch the sprayer on.

2.2.2 *Sprayers with Pressure sensor only*

In this case the "Startup Wizard" will prompt you to select the following (although see Note 1 above),

(i) ***Set (or confirm) the desired target rate.*** To change the target rate, press the "+" or "-" key then press the key to confirm.

NOTE: If you don't want to change the rate, simply press to confirm.

The nozzle reference '**nn (x)**' where 'x' is one of 9 nozzle presets "A" to "I", is then displayed.

(ii) ***Select the nozzles in use.*** You can choose any of 9 as follows,

You can edit the default flow rate and pressure parameters as required on startup. The nozzle reference cannot be edited. The following table however, can be used to record your own settings, including your own nozzle reference (e.g. colour).

Default setting			User-defined		
Nozzle ref.	flow rate (l/min)	Pressure (bar)	flow rate (l/min)	pressure (bar)	Nozzle Reference
A	0.4	3			
B	0.6	3			
C	0.8	3			
D	1.0	3			
E	1.2	3			
F	1.6	3			
G	2.0	3			
H	2.4	3			
I	3.2	3			

Select the required nozzle using the "+'" / "-" key. If the default parameters are OK for that nozzle, then press to confirm (if not go to step (iii)).

(iii) ***Change the nozzle flow rate / pressure parameters***

Press and hold the key for 5 seconds. The display will then show the pressure (bar) as '**P#.##**'.

To change the value , continue holding the key and adjust using the '+' / '-' keys, otherwise quickly release and press the key again to display the flow rate (l/min) as '**F#.##**'.

As before , to change the value , continue holding the key and adjust using the '+' / '-' keys.

Releasing the key redisplays the nozzle reference. Press to confirm the selection.

The instrument then defaults to manual (MAN) rate mode, and the Forward Speed channel.

Press the key to select AUTO rate control and then switch the sprayer on.

2.2.3 *Sprayers with both Pressure sensor and Flow sensor*

The Spraymaster 200 system can include both a pressure sensor and a flow sensor, giving you the choice of regulation mode at startup.

In this case the "Startup Wizard" will prompt you to select the following (although see Note 1 above),

(i) Target Rate (ref. 2.2.1).

(ii) Regulation Mode - i.e. Flow-based (**turb**') or Pressure-based ('**PrES**').

(iii) Nozzle type (ref. 2.2.2).

The instrument then defaults to manual (MAN) rate mode, and the Forward Speed channel.

Press the key to select AUTO rate control and then switch the sprayer on.

2.3 Rate Display - Channel 6

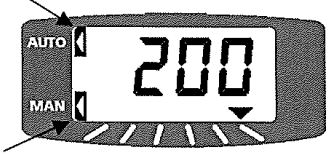
When in work, channel 6 displays the actual application rate.

Press and hold the key at any time to view the programmed Target Rate.

2.3.1 Automatic Rate Control

The instrument has two operating modes - **MAN**ual and **AUTO**matic. The current mode is indicated on the left of the display.

Figure 3: Rate Mode Indicators



In **AUTO** mode the instrument will maintain the application rate at the programmed target rate irrespective of the forward speed (within limits) or part width setting (i.e , the number of boom section switched on/off).

To ensure a steady readout, the rate *display* 'locks-on' to the target rate when the actual application rate is within 3% of the target rate.

NOTE: *The 'lock-on' % is determined by the 'Deadband' setting in CAL 2, Ch.3. Refer to Calibration manual.*

If the forward speed drops is too high or too low, the system will exceed the operating range within which the target rate can be met. When this occurs, the rate display then displays the actual rate that the system is achieving, and the operator must increase or decrease the forward speed accordingly to get back to the target rate.

2.3.2 'Spot' Application Rate

You can manually vary the application rate in AUTO mode (e.g. for treating a problem area) by pressing the '+' / '-' keys to increase or decrease it in 5% steps (the step size is set in the CAL mode) as required.

Simply press the key to return to the programmed target rate.

2.3.3 Target Rate Adjustment after Startup

At any time in or out of work, you can adjust the target rate.

With channel 6 displayed, press and hold the key, and adjust the rate up or down using the '+' / '-' keys.

The system will then adjust to meet the new target rate.

2.3.4 Manual Rate Control

While spraying the application rate can be altered to suit localised crop conditions.

Press the key to select manual mode, then adjust the rate using the '+ / '-' keys.

Pressing the key again will resume the target rate in AUTO mode.

2.4 Forward Speed Display - Channel 1

Channel 1 displays the current forward speed. The instrument defaults to this channel after the "Startup Wizard" routine is completed.

Forward speed is measured via a sensor suitably mounted to a wheel hub or a convenient location to the vehicle drivetrain. Speed is displayed either in miles/hr or km/hr according to the units selected in the CAL Mode.

NOTE: *For speed to be accurately displayed, the forward speed factor ('SSF') must be correctly determined and programmed in CAL 1, Ch.1. Refer to the Calibration manual.*

2.5 Area Display - Channel 2

2.5.1 View/Reset Area Totals

Channel 2 displays accumulated area. It is calculated from distance travelled and the full boom width (Nozzle spacing x Total No of nozzles), and is displayed either in acres or hectares according to the units selected in the CAL Mode.

NOTE: *The accuracy of these totals is dependent on correct speed sensor calibration, and programmed width.*

There are two memory registers - a 'Part' total and a 'Full' Total, which can be independently reset. For example the part total register may be utilised for individual jobs, fields etc, whereas the 'full' total register may be the daily total.

(i) Part Area Total

Selecting channel 2 displays **'PArt'** for 3 seconds then the 'Part' total Area.

Press and hold the key for 5 seconds to zero the Part total. The instrument will beep and the display alternates between 0.000 and the part total before zeroing.

(ii) Full Area Total

To view the 'Full' Total register, press and release the key. The display will show **'tot'** for 3 seconds before displaying the Full total.

To zero the Full total, while the total is displayed press and hold the key as for the part total above.

NOTE: *Pressing again selects the 'volume applied' channel, and not back to the 'Part Area' total.*

2.5.2 Area Override and Part Width

There are two options depending on the installation.

(i) Area Compensation Interface

An Area Compensation Interface (ACI) connects between the Spraymaster and the sprayer switchbox. It detects which boom sections are on/off in order for the instrument to calculate the actual working width and apply the correct rate.

NOTE: *The Nozzle spacing and No of nozzles per section are programmed for each section in turn, in CAL 1 Channels.2 and 6. Refer to the Calibration manual.*

(ii) Override On-Off Switch

Depending on the installation, an alternative to the ACI is a simple override switch. The area will stop accumulating when the implement is put out of work.

The channel indicator will flash when area accumulation is overridden and will be on permanently when area is being recorded.

2.5.3 View Total No. of Nozzles

Select channel 1 (Forward Speed), then press and hold the key for 5 seconds.

If a standard on-off override switch is fitted, the display will show 'n 1' (1 x implement full width) when the machine is in work and 'n 0' when it is out of work.

If an ACI is fitted, the display will show the total number of nozzles currently switched on, e.g. 'n 48' (48 x 0.5m = 24m working width).

2.6 Volume Applied Display - Channel 3

2.6.1 View/Reset Volume Totals

Channel 3 displays the volume applied, and is displayed either in litres or gallons according to the units selected in the CAL Mode.

There are two memory registers - a 'Part' total and a 'Full' Total, which can be independently reset. For example the part total register may be utilised for individual jobs, fields etc, whereas the 'full' total register may be the daily total.

*NOTE: The display shows "**-HIG**" if the volume count has exceeded 9999 units.*

(i) Part Volume Total

Selecting channel 2 displays **'PArt'** for 3 seconds then the 'Part' total volume.

Press and hold the key for 5 seconds to zero the Part total. The instrument will beep and the display alternates between 0.000 and the part total before zeroing.

(ii) Full Volume Total

To view the 'Full' Total register, press and release the key. The display will show **'tot'** for 3 seconds before displaying the Full total.

To zero the Full total, while the total is displayed press and hold the key as for the part total above.

NOTE: Pressing again selects the 'Pressure' channel, and not back to the 'Part volume' total.

2.7 Pressure Display - Channel 4

The actual pressure is displayed (bar/psi according to the units selected in the CAL Mode) if a pressure sensor is installed, otherwise this channel is skipped.

2.8 Flow Rate Display - Channel 5

2.8.1 Boom Full-flow rate

With a flow-based system, the boom full-flow (l/min or galls/min) is displayed for all boom sections switched on.

2.8.2 Nozzle Flow Rate

Press and hold the key to display the individual nozzle flow rate (simply the boom full flow rate divided by the total number of nozzles).

The instrument will beep 5 times as the nozzle flow rate is displayed, after which you can adjust the nozzle flow rate if desired (see below).

2.8.3 Adjusting the Nozzle Flow Rate

NOTE: See also '2.9 - Flow Calibration'

With channel 5 displayed, press and hold the key for 5 seconds (the instrument sounds 5 beeps).

Continue holding the key and adjust the individual nozzle flow rate using the '+' / '-' keys.

2.9 Flow Calibration

2.9.1 Initial Calibration - The Jug Test

To calibrate the output, you should perform an initial jug test, using a simulated forward speed and target rate set to match the intended speed and application rate in the field.

(i) Select Nozzles

For a pressure-based system, make sure you have selected the appropriate nozzle (A - I) in the "Startup Wizard".

(ii) Set simulated Speed and Target Rate

Select the forward speed channel then press and hold the key for 5 seconds. The display will flash '**SiM**' and then show the simulated speed.

To adjust the speed, continue to hold the key and adjust the value using the '+' / '-' keys.

Select the application rate channel, press and hold the key, and adjust the target rate using the '+' / '-' keys.

(iii) Perform Jug Test

Do a normal jug test (average over several nozzles) and note the actual nozzle flow rate.

(iv) Adjust Nozzle Flow Factor

Select the flow rate channel (boom full-flow display). Press and hold the key. The instrument gives 5 beeps after which you can, using the '+' / '-' keys, then adjust the nozzle flow reading to equal the actual measurement.

NOTE: Changing the nozzle flow rate this way will have the following effect,

Flow-based only system:- Changes the currently selected Flow Sensor Cal factor (CAL 1, Ch. 5 or CAL 3, Ch. 4)

Pressure-based only system:- Changes the currently selected Nozzle factor (CAL 1, Ch. 4)

System with both Flow and Pressure Sensors:- If pressure-based regulation was selected at startup, it changes both the currently selected Flow Sensor and Nozzle factors. If flow-based regulation was selected at startup, it changes only the flow sensor factor, since the instrument doesn't use a nozzle factor.

The sprayer should be calibrated in the same way for different nozzle types.

2.9.2 *Full-tank Calibration*

The jug test is not the most accurate method of calibration particularly for flow-regulated systems, as the test volume is relatively small. It is therefore recommended to subsequently prove the accuracy by performing a full-tank calibration out on the field, and 'fine-tuning' the Flow sensor factor / Nozzle factor.

1. Reset the Part Volume total to zero.
2. Spray out a known volume, determined from the sight gauge reading(s).
3. Note the Part Volume reading on the instrument.
4. If the reading differs significantly, calculate the new factor as follows:-
5. With the volume channel selected, press and hold the key as if you are resetting to zero, but before it resets, use the '+' / '-' keys to adjust the indicated volume to match the actual volume sprayed out.

   The flow sensor factor/Nozzle Flow Rate is then automatically adjusted.

2.9.3 *Manually calculating a revised cal factor*

For information only, the cal factor correction can be calculated and entered manually as follows (the calculation applies to flow-based and pressure-based systems - just substitute Nozzle Flow Rate for Flow Sensor factor).

New factor = Existing factor x Indicated Volume

Known Volume

Example: On a flow-based system with a single flow sensor enabled, the existing flow sensor factor is 650.0 (pulses per litre). The part total indicated is 1915 litres but the actual volume sprayed out was 2000 litres.

The new factor = 650 x (1915/2000) = 622.4 (pulses per litre).

Either the flow sensor factor (flow-based)* or the Nozzle Flow Rate (pressure-based) can be adjusted as part of the startup routine.

To change the factor, enter CAL Mode 1, Channel 5 to display the existing Flow Sensor Cal Factor. Press and hold the key then adjust the factor using the '+' / '-' keys.

* *Only when more than one flow sensor is 'enabled' in the calibration mode.*

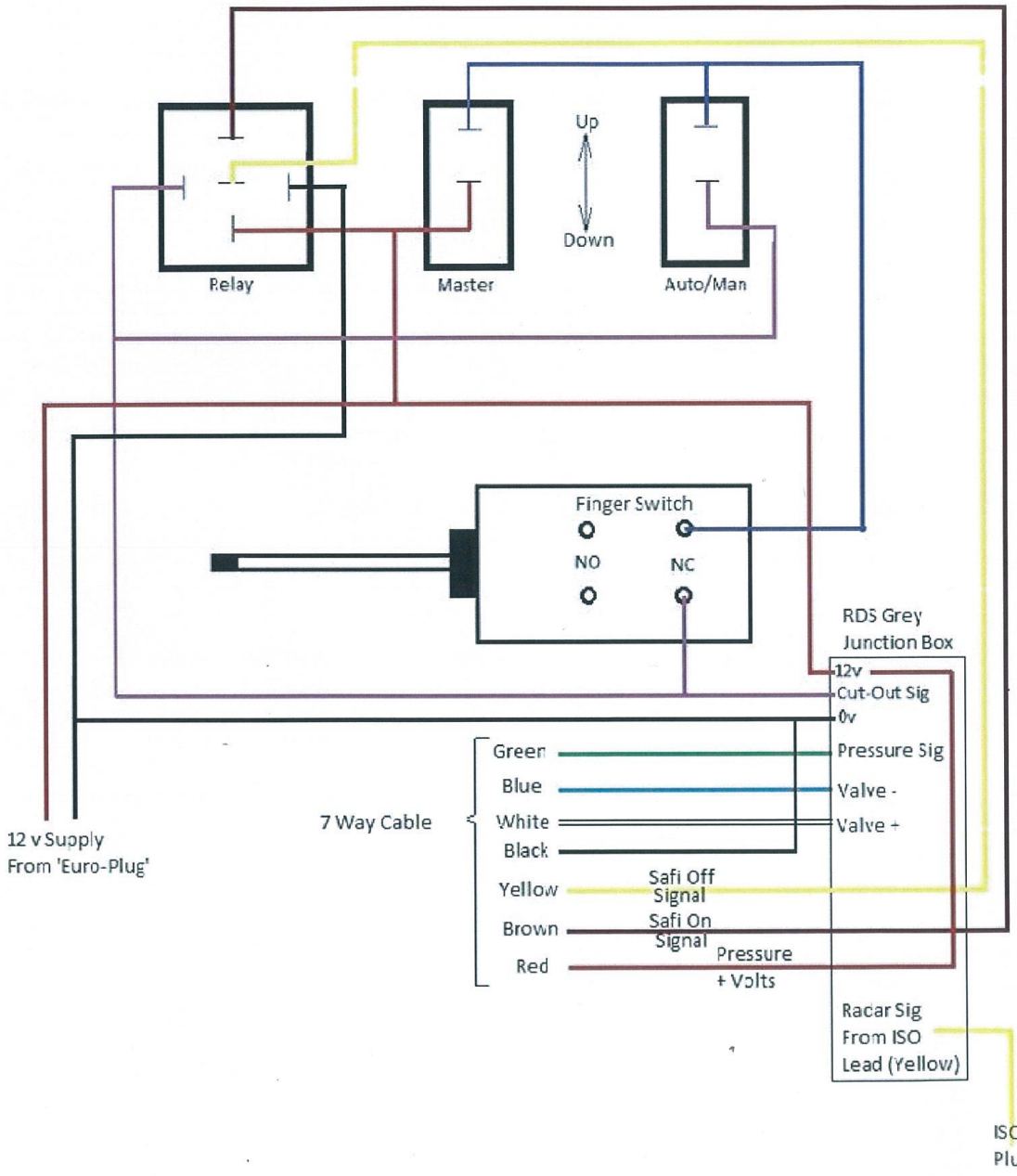
Functions summary

Mode	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6
Normal Display	View Fwd Speed	View Part /Total Area	Part / Total Volume	View Liquid Pressure	View Full Boom	Application Rate
+ Adjust	Set Sim. Speed		Volume Cal. adjust.		View Nozzle	
Hold and	View nozzles					
Cal 1 Hold and power up	View/Edit Speed Cal. Factor Start Autocal	Set Nozzle Spacing	Select Boom	Nozzle Wizard	Select Flow Sensor	Set No. of Nozzles per sectionr
Cal 2 Hold and power up	Select Pressure /Flow-based Regulation	Set Valve Response Farctor-	Set Valve Minimum Pulse	Set Valve Deadband	Set Valve Regulating Delay	Set AUTO rate - Step %
Cal 3 Hold and power up	Select Metric /Imperial Units	Pressure Sensor Calibration- AUTO Set Zero Set Press. MAN Set Zero Set Gain	Set No. of Booms-	View/Edit Flow Sensor Factor-	Set Sensed Width-	Select Return/Non-return Flow measurement-

RDS Wiring

RDS SM200 Wiring for front tank Installations.
Including Opico and Team units with Headland shutoff switch.

Key To Switch Operation
Both Down = Manual Spray 'On'
Auto/Man Up = 'Finger Switch' operation
Both Up = Emergency Stop



HYPRO®

Series 9342P Hydraulically-Driven Transfer Pump

Form L-1499

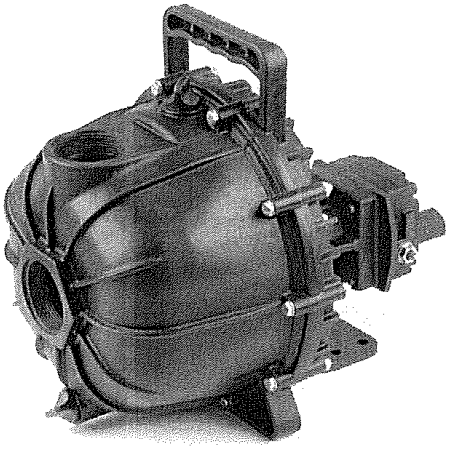
Installation, Operation, Repair and Parts Manual

11-05

Description

Hypro Self-Priming Polypropylene Centrifugal Pumps handle big, high-capacity, liquid transfer jobs with ease. Use them for transferring water, liquid fertilizers, and other chemicals compatible with pump materials.

Make short work of other farm jobs: filling nurse tanks, watering seedbeds, and transferring liquids. This self-priming model makes it ideal for de-watering applications.



Series 9342P
Polypropylene Centrifugal
Transfer Pump

Max. Flow Rate	200 GPM
Max. Pressure	60 PSI
Ports	2" NPT Inlet
.....	2" NPT Outlet
Hydraulic Ports	1/2" NPT Inlet
.....	1/2" NPT Tank

General Safety Information

NOTE

Notes are used to notify of installation, operation, or maintenance information that is important but not safety related.

⚠CAUTION

Caution is used to indicate the presence of a hazard, which will or may cause minor injury or property damage if the notice is ignored

⚠WARNING

Warning denotes that a potential hazard exists and indicates procedures that must be followed exactly to either eliminate or reduce the hazard, and to avoid serious personal injury, or prevent future safety problems with the product.

⚠DANGER

Danger is used to indicate the presence of a hazard that will result in severe personal injury, death, or property damage if the notice is ignored.

⚠DANGER

Do not pump flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. Do not use in explosive atmospheres. The pump should be used only with liquids compatible with the pump component materials. Failure to follow this notice may result in severe personal injury and/or property damage and will void the product warranty.

⚠CAUTION

1. Do not pump at pressures higher than the maximum recommended pressure.
2. Maximum liquid temperature is 140° F.
3. Disconnect power before servicing.
4. Release all pressure within the system before servicing any component.
5. Drain all liquids from the system before servicing any component. Flush with water.
6. Secure the outlet lines before starting the pump. An unsecured line may whip, causing personal injury and/or property damage.
7. Check hose for weak or worn condition before each use. Make certain that all connections are tightly secured.
8. Periodically inspect the pump and the system components. Perform routine maintenance as required (See Repair Instructions).
9. Use only pipe, hose and fittings rated for the maximum psi rating of the pump.
10. Do not use these pumps for pumping water or other liquids for human or animal consumption.

Hazardous Substance Alert

⚠CAUTION

1. Always drain and flush pump before servicing or disassembling for any reason.
2. Always drain and flush pump prior to returning unit for repair.
3. Never store pumps containing hazardous chemicals.
4. Before returning pump for service/repair, drain out all liquids and flush unit with neutralizing liquid. Then, drain the pump. Attach tag or include written notice certifying that this has been done. It is illegal to ship or transport any hazardous chemicals without United States Environmental Protection Agency Licensing.

⚠DANGER

Never use your hand to check the condition of hydraulic lines or hoses. If hydraulic fluid penetrates the skin, get medical help immediately. Failure to get proper medical help may result in loss of limb or life. The safest way to check hydraulic lines or hoses is by holding a piece of cardboard next to the hydraulic line or hose.

⚠WARNING

The sound pressure level of the Pump is 80dBA. Observe all safety precautions when operating the pump within close proximity for extended periods of time by wearing hearing protectors. Extended exposure to elevated sound levels will result in permanent loss of hearing acuteness, tinnitus, tiredness, stress, and other effects such as loss of balance and awareness.

Hydraulic Pumps

Hydraulic pumps come in two basic types:

- **Constant displacement -** which will continue to put out its rated flow regardless of pressure, until the relief valve bypasses the flow.
- **Variable displacement -** which will produce only the flow needed by the implement until the total pump output is reached. If less than the full pump output is required, an automatic stroke control mechanism decreases the pump output to maintain a constant pressure and flow. The output varies according to demand.

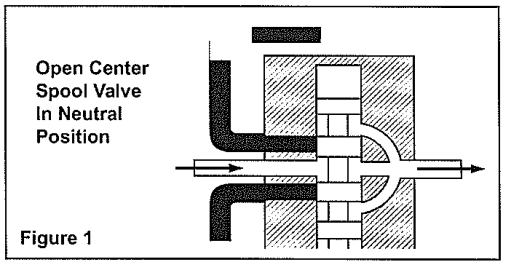


Figure 1

Spool Valves

There are two basic types of spool valves used in conjunction with these pumps — Open and Closed Center. In the Open Center Valve (See Figure 1), the flow goes straight through the valve when in the neutral position. This type is used for constant displacement pumps where the flow should never be shut off.

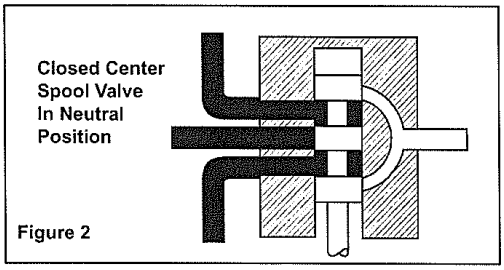


Figure 2

The Closed Center Valve (See Figure 2) is used with variable displacement pumps. The flow is completely shut off in the neutral position, causing the pump stroke to adjust to zero flow. The flow stops, but the pump maintains a static pressure up to the valve.

Hydraulic Motors

Figure 3 shows an internal gear motor (Gerotor) where pressure causes the cavities between the gears to expand on one side, developing torque. The Gerotor type of hydraulic motor is used on Hypro pumps for its superior performance characteristics, including cooler running and higher rpm capabilities.

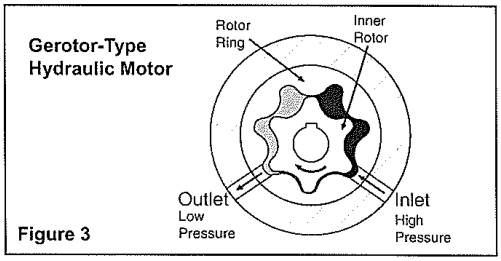


Figure 3

Three Systems

Fitting these components together and installing a motor, we have one of the three types of systems: Open Center, Closed Center (pressure compensated) and Closed Center Load Sensing (flow and pressure compensated).

Open Center Systems

In an Open Center System, the hydraulic pump puts out a constant flow. If the pump puts out more oil than the motor can use, a portion of the oil must be bypassed around the motor. When the oil is bypassed around a loop and does no work, the energy put into it by the pump turns into heat. Therefore, the amount of oil bypassed should be kept to a minimum. Use the largest motor possible.

Closed Center (Pressure-Compensated) Systems

The Closed Center Pressure-Compensated system has a variable displacement pump which will deliver flow at the necessary rate to maintain a specified pressure. It is desirable to equip implements with a motor of a low flow range that will cause the pump to operate between 1800 and 2100 psi [124 and 145 BAR]. A motor that requires a large volume to obtain the correct implement speed usually causes the hydraulic pump in a closed center system to operate at a lower pressure than desirable. This low pressure results in unnecessary flow and the generation of heat that lowers the lubricating quality of the oil and may damage transmission parts. Use the smallest motor possible.

Closed Center Load Sensing Systems (Flow and Pressure-Compensating)

The Closed Center Flow-Compensated System is a variation of the pressure-compensated system, designed primarily for more efficient operation and the generation of less heat. It works on the principle of maintaining a constant pressure drop from the pump to the work port of the selector valve. Any variation in demand at the motor will cause a change in flow. The system senses this change in flow due to the change in pressure drop across the valve and causes the pump to compensate by varying the pump flow. No restrictor is used in the pressure line and no oil is bypassed.

Installation Instructions

All Models — Open Center Systems

Models include Tank Port Adapter with built-in Check Valve Assembly and Pressure Port Adapter.

Preliminary to Mounting

Consult the owners manual to determine the type and capacity of the hydraulic system. Make sure the hydraulic system is recommended to operate with a continuous load. Refer to the Pump Selection Guide to confirm you have the proper pump for your hydraulic system.

Check to see that the pump impeller can be turned by hand. (Turn the shaft clockwise using a deep socket wrench on the impeller nut.) If it cannot be turned, open the pump casing to look for obstructions. Clean out any corrosion buildup where the casing fits over the eye of the impeller.

Pump Inlet Line

To achieve full capacity from the pump, the inlet line should be at least the same size as the inlet port on the pump. Reducing this line size will restrict the capabilities of the pump. The line must also be free of air leaks. Check all fittings and connections in the suction line for tightness. The introduction of air may affect the priming and pumping capabilities of the pump. Use good quality suction hose that will not be collapsed by suction.

Pump Outlet Line

The recommended orientation for the outlet port is pointing straight up. This allows liquid to stay in the pump while it is priming. The outlet line should be the same size as the pressure port on the pump to give the optimal flow. The line should have as few restrictions and elbows as possible to optimize the pump performance and reduce pressure drop from the pump to the discharge point.

Priming the Pump

NOTE

The pump must not be run dry.

Before starting the pump, the chamber needs to be filled with liquid. The pump must not be run unless it is completely filled with liquid because there is a danger of damaging the mechanical seal, which depends on the liquid for its lubrication.

Self-priming models can be primed by removing the top vent plug and filling the priming chamber. The priming chamber will fill to the level of the inlet port. After use, the priming chamber should be flushed and drained to avoid chemical corrosion and damage from freezing. Drain by removing the lower drain plug.

Hooking Up the Hydraulic Motor to the Tractor Hydraulic System

Hypro Series 9300HMC hydraulic motor-driven pumps can be mounted on either the tractor or sprayer. When hooking up, make sure that no dirt or liquid gets into the hydraulic motor. **Keep all hydraulic connections clean.** Be sure to connect the hydraulic motor into the system correctly by putting the pressure line to the pressure port adapter and return line to the tank port adapter. The port adapters on the hydraulic motor are sized to accommodate 1/2" NPT fittings. For maximum performance, the hydraulic lines should also be at least 1/2" [12.7 mm] in size. For lines longer than 8 feet [2.44 m], hydraulic line size should be at least 3/4" [19.05 mm] in order to reduce heat generation.

The tank (**OUT**) port adapter with a built-in check valve assembly will guard against reverse operation — allowing you to reverse oil flow to operate other equipment. **This adapter must not be removed.** Standard spool valves, which are found on all tractor hydraulic systems, may cause potentially damaging high peak pressures in the hydraulic system when closed, because of abrupt shut-off of oil flow in both the supply and return lines. When shutting off the pump, move the selector to the **FLOAT** position to allow the centrifugal pump to come to a stop gradually.

Operation

Open Center Systems - All Models
Adjusting Centrifugal Pump Output

NOTE

1. Install a shut-off valve and pressure gauge on the discharge line for initial setup.
2. Open the bypass adjustment screw 2-1/2 turns from fully closed. Turn the bypass screw in to achieve the flow for the desired gpm and psi.
3. Start the tractor. Leave the directional valve in the neutral position and allow hydraulic oil to circulate for approximately 10 to 15 minutes or until adequately warmed.
4. Prime the centrifugal pump with all valves open (See the Installation Instructions and System Configuration Diagram).
5. Once the pump is primed, shut off the dischage line and monitor the pressure. Shut-off pressure is not to exceed 60 PSI. Adjust discharge screw accordingly.

Closed Center (Pressure Compensated) HM2C and HM4C Models Only

On a pressure-compensated system, the amount of oil that is allowed to flow through the hydraulic motor is regulated by a metering orifice in the pressure port adapter. Three different sizes of orifices are supplied with the HM2C and HM4C model pumps to allow flexibility in the flow required for individual sprayer needs.

The smaller the orifice, the less hydraulic oil goes through the motor, so the pump will run slower and the flow of liquid pumped and the spray pressure will also be less. As the hydraulic oil flow is increased (by installing a larger orifice), the amount of liquid being pumped and the spray pressure is also increased.

Installing and Removing Metering Orifice

1. Shut off the hydraulic system.
2. Disconnect the line to the pressure port of the hydraulic motor.
3. Remove the adapter from the motor using a 1-1/16" wrench. Make sure the o-ring is on the metering orifice before installing into port adapter.
4. The orifice is removed or installed in the port adapter by tapping either in or out of the adapter.
   A. To remove, tap the orifice out from the small end of the adapter.
   B. To install, tap the orifice in from the large end of the adapter. The orifice is seated when a snap sound is heard.

Adjusting Centrifugal Pump Output

1. Install a shut-off valve and pressure gauge on the discharge line for initial setup.
2. Open the bypass adjusting screw in the hydraulic motor three (3) turns.
3. Start the tractor and allow the hydraulic oil to circulate for approximately 10 to 15 minutes or until adequately warmed.
4 Close and lock down the bypass adjusting screw in the hydraulic motor.
5. Prime the centrifugal pump with all valves open (See Installation Instructions).
6. Shut off the discharge valve and monitor the pressure. If deadhead pressure does not approach 60 PSI, install the #2 orifice and repeat steps 5 and 6.
7. If deadhead pressure still does not approach 60 PSI, install the #3 orifice and repeat steps 5 and 6.
8. If deadhead pressure still does not approach 60 PSI, remove the #3 orifice and repeat steps 5 and 6.

Closed Center (Load Sensing) All Models

Many tractors are being introduced with load sensing systems (also referred to as flow and pressure-compensated systems) which simplify system setup and eliminate many of the problems associated with using the wrong size pump motors on a given hydraulic system. Usually, any of Hypro's 9300HMC models may be used on this type of system, provided the hydraulic system produces sufficient oil flow for the hydraulic motor being used (Refer to the Pump Selection Guide).

This system maintains a constant flow of hydraulic oil for a given pressure drop. The flow is adjustable with a flow control valve installed in the hydraulic system (such as the Tortoise/Hare control on John Deere tractors). Because this system has adjustable flow, there is no need to bypass hydraulic oil as in an open center system, or to restrict the flow with orifices as in a closed center pressure-compensated system.

Adjusting Centrifugal Pump Output

1. Install a shut-off valve and pressure gauge on the discharge line for initial setup.
2. Make sure the orifice from the pressure port adapter of the hydraulic motor has been removed (HM2C and HM4C models only).
3. Close and lock down the bypass adjusting screw in the hydraulic motor.
4. Set the tractor hydraulic flow control valve for minimum hydraulic oil flow to the remote outlet (Tortoise position).
5. Start the tractor and allow the hydraulic oil to circulate for approximately 10 to 15 minutes or until adequately warmed.
6. Prime the centrifugal pump with all valves open (See the Installation Instructions and System Configuration Diagram).
7. Shut off the discharge valve and monitor the pressure. Slowly adjust the tractor hydraulic flow control valve until the pump deadhead pressure approaches 60 PSI.

Flush Pump After Use

One of the most common causes for faulty pump performance is gumming or corrosion inside the pump. Flush the pump and entire system with a solution that will chemically neutralize the liquid pumped. Mix this solution according to the manufacturer's directions. This will dissolve most residue remaining in the pump, leaving the inside of the pump clean for the next use.

To Prevent Corrosion

After cleaning the pump as directed above, flush it with a permanent-type automobile antifreeze (Prestone®, Zerex®, etc.) containing a rust inhibitor. Use a 50% solution, half antifreeze and half water, or fill the pump with FLUID FILM® and then drain it. A protective coating of FLUID FILM® will remain on the inner pump surfaces. Save the excess FLUID FILM® for the next application. Plug the ports to keep out air during storage. For short periods of idleness, noncorrosive liquids may be left in the pump, but air must be kept out. Plug the ports or the seal port connections.

Repair Instructions

Always flush pump with water or neutralizing agent before servicing.

Refer to parts breakdown on Page 11 for reference numbers.

PUMP HOUSING DISASSEMBLY

Seal replacement requires that the pump be fully removed from the hydraulic motor. Observe carefully the disassembly process to ensure an easy assembly process. Replace all worn and eroded parts.

1. Remove the 10 bolts and nuts (Ref. Nos. 3, 18, 19) holding the pump casing to the casing cover using a 10mm socket and a 10mm open end wrench. Tap pump casing on the discharge port with a rubber hammer, if necessary, to break it loose from the casing cover. Remove o-ring from casing cover. Inspect parts for wear. (See Fig. 1.)

2. Remove diffuser (Ref. 8) by removing the three screws (Ref. Nos. 6, 7) with a Phillips screwdriver. Inspect parts for wear. (See Fig. 2.)

3. Remove impeller bolt (Ref. 9) with a 13mm wrench. Pry impeller (Ref. 11) off hydraulic motor shaft using two flathead screwdrivers. Inspect impeller and ceramic (Ref. 12) for wear. Ceramic surface must not be scuffed or cracked. To remove ceramic seal from impeller bore, use a small blade screwdriver to wedge the seal out. (See Fig. 3.)

4. To remove mechanical seal from casing cover (Ref. 16), first remove the casing cover from the hydraulic motor bracket (Ref. 20) by loosening the four bolts three turns each using a 13mm wrench; then rotate the casing cover 45° clockwise to remove. From the hydraulic motor side of the casing cover, press the mechanical seal out using a 1" diameter piece of PVC pipe 4" long. Inspect parts for wear. (See Fig. 4.)

5. Inspect slinger ring (Ref. 21) on hydraulic motor shaft for wear. (See Fig. 5.)

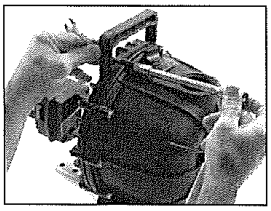


Fig. 1

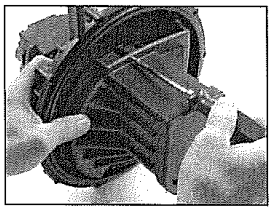


Fig. 2

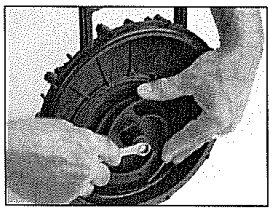


Fig. 3

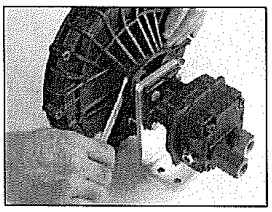


Fig. 4

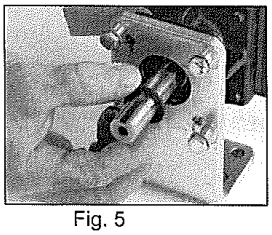


Fig. 5

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SEAL REPLACEMENT AND
PUMP HOUSING ASSEMBLY

1. Install slinger ring (Ref. 21) on hydraulic motor shaft. (See Fig. 5.)
2. Lubricate and install the o-ring (Ref. 13) around back side of metal portion of the seal (See Fig. 6). Insert the stationary portion of the new mechanical seal (Ref. 12) by carefully pushing only on the outer metal ring as you press it into the casing cover (Ref. 16). Use a tool with 1-1/2" ID, such as 1-1/2" diameter PVC pipe, 4" long that fits over the carbon face of the seal, but pushes only on the metal ring to insert the seal. The carbon surface of the seal must be facing you during installation. Be careful to avoid scratching the seal's carbon surface. (See Fig. 7.)
3. Apply medium strength (Blue) threadlocker onto the (4) flange mounting bolts (Ref. 17) and install about (4) turns into the motor bracket (Ref. 20). Install the pump flange by sliding over the hydraulic motor (Ref. 31) shaft 45° clockwise from the up position. Once the flange has mated to the motor bracket (Ref. 20), rotate the flange 45° counterclockwise (CCW) to lock the flange into the slots. Tighten the (4) mounting bolts with a 13mm wrench to a torque of 10-foot pounds.
   Note: Be sure to hold the pump flange (Ref. 16) in the "UP" position when tightening bolts. This will ensure that the pump bases will not be cocked off center in the final assembly. (See Fig. 8.)
4. Lubricate the seal cavity of the impeller (Ref. 11) with WD-40, LPS or equivalent, and carefully press the seal's mating ceramic ring in place, seating it squarely on the bottom of the cavity. The glossy, finished side of the ceramic seal must be facing you. IMPORTANT: Make sure both seal surfaces are clean and lubricated. Never run seal surfaces dry. (See Fig. 9.)
5. Install the impeller onto the hydraulic motor shaft using the bolt, washer and seal. Bolt seal (Ref. 10) must not be worn. Tighten the impeller bolt to 10 foot pounds. (See Fig. 10.)
6. Install diffuser onto the casing cover with three Phillips-head screws. (See Fig. 2.)
7. Install the pump casing onto the casing cover and o-ring, and secure with the 10 bolts, nuts and washers, using a 10mm socket and wrench. Torque the bolts to 45-inch pounds. (See Fig. 1.)
8. Assembly and inspection is now complete.

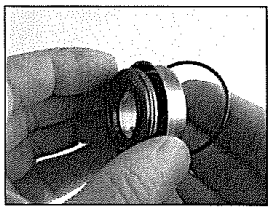
Fig. 6

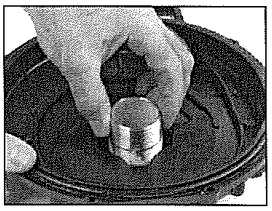
Fig. 7

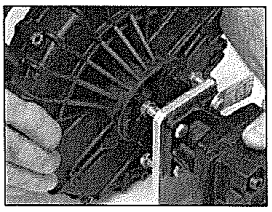
Fig. 8

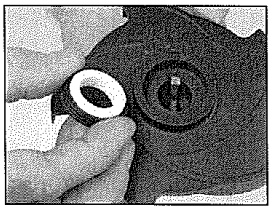
Fig. 9

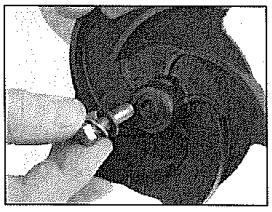
Fig. 10

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Disassembly and Repair of the Hydraulic Motor

NOTE

The work area and motor should be as clean as possible to prevent contamination of parts.

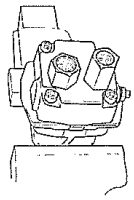


Figure 10

1. Remove the Mounting Flange from the motor body and place hydraulic motor in vise (Figure 10).
2. Remove Tank Port Adapter and Pressure Port Adapter with large crescent wrench or 1-1/16" box end wrench (See Figure 10).
3. Using a 9/16" box end wrench, loosen the nut on the Bypass Adjusting Screw (See Figure 10).
4. Using a small screwdriver, remove the Bypass Adjusting Screw from the motor. (This will remove the Screw, Nut, Washer and Thread-Seal Gasket.)
5. Using a 1/4" Allen wrench, remove the Socket Head Cap Screws from the Motor End Plate (See Figure 10).
6. If Motor End Plate will not lift off easily, use a small screwdriver to carefully pry apart the boss portion of the End Plate and Gerotor Housing until free (See Figure 11). If Gerotor Housing will not lift off easily, carefully pry apart the boss area between the Gerotor Housing and the Motor Body. (It may be necessary to alternate sides when prying apart Motor sections.)

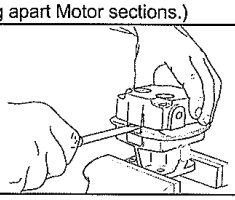


Figure 11

7. Inspect Motor End Plate, Body and Gerotor Housing for wear and/or gouging. If gouging has occurred in both the motor end plate and body, the motor is not repairable. If gouging has occurred in the Motor End Plate, Body or Gerotor Housing, the part that is worn must be replaced. If Gerotor Housing is damaged, gerotor parts must also be replaced.

To Remove the Shaft Assembly from the Motor Body

1. Remove the Slinger Ring from the Motor Shaft.

⚠WARNING

Special attention should be exercised when working with retaining rings. Always wear safety goggles when working with spring or tension-loaded fasteners or devices.

2. Using the large retaining ring pliers, remove the Retaining Ring next to the Ball Bearing in the Motor Body.

NOTE

If Bearing is binding against the Retaining Ring so that it cannot easily be removed, place the Motor Body (threaded portion of the shaft up) on arbor press. Using a piece of un-threaded metal pipe (1" dia. x 4" high [254. mm x 101.6 mm high]), slide over the shaft and gently press down with the arbor press just enough to relieve the pressure on the Retaining Ring.

3. Place Body in position on arbor press. Threaded portion

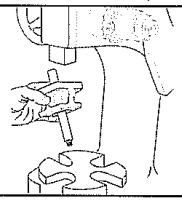


Figure 12

of the shaft should be inside the fixture. Press out shaft assembly with arbor press (See Figure 12).

Hydraulic Motor Shaft Disassembly and Repair

1. Remove Large Retaining Ring from shaft with a screwdriver. Remove Thrust Bearing Assembly from shaft (includes the Thrust Bearing and two Thrust Bearing Races) and the Seal Spacer.
2. Remove the Small Retaining Ring next to the Shaft Ball Bearing.
3. To remove the bearing from the shaft, place the shaft (threaded end up) in the arbor press fixture. Place the two support bars provided in the repair kit opposite each other

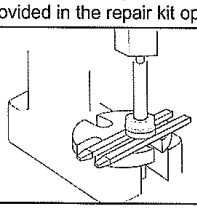


Figure 13

and between the seal on the shaft and the arbor press fixture. Using an arbor press, press the shaft through the bearing, seal spacer and seal (See Figure 13).

4. Inspect the sealing area of the shaft for wear. Inspect other shaft assembly components for wear, and replace if necessary.
5. While motor is completely disassembled, clean all parts in a solvent bath.

To Install New Shaft Seal

1. The sealing lips on a new seal must be expanded to fit on the shaft. Press seal onto large end of shaft with seal lip facing out. Do not push seal past keyway on shaft.
2. Once seal lip has been expanded, remove the seal from the shaft.
3. With the seal lip facing the large end of the shaft, slide the seal over the threaded end of shaft and gently push onto the raised area of the shaft, stopping approximately 1/4" [6.35 mm] from the Large Retaining Ring groove.
4. Over the large end of the shaft, install the Seal Spacer, Thrust Bearing Race, Thrust Bearing, second Thrust Bearing Race and the Large Retaining Ring.

To Install Shaft Bearing

1. Over the threaded end of the shaft, install the Spacer Ring and the Ball Bearing.
2. Insert the shaft (threaded end down) into the arbor press fixture. Place the two support bars opposite each other and between the bearing and the fixture. Place on an arbor press and carefully press the shaft down allowing just enough room for the Retaining Ring next to the Bearing to be installed.

NOTE

Make sure the spacer ring between the seal and bearing is free floating (not binding).

NOTE

Should the Main Needle Bearings in the hydraulic motor need replacement, a new body and/or end plate with the Main Bearing already installed, must be used. If this occurs, check other internal parts of the motor for damage and wear.

To Install the Shaft Assembly in the Motor Body

1. Place the Shaft Assembly into the Motor Body bearing bore with threaded end up (See Figure 14).

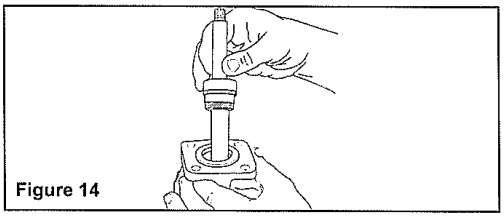


Figure 14

2. On arbor press, place body on arbor press fixture.

Make sure the surface edge of the fixture is smooth and clean.

An un-threaded piece of pipe (1" dia. x 4" [25.4 mm x 101.6 mm] high) is needed to support the outer bearing race on the shaft ball bearing. Place this pipe over the shaft and press shaft assembly down until retaining ring can be installed in its groove in the bearing core of the motor body (Figure 15).

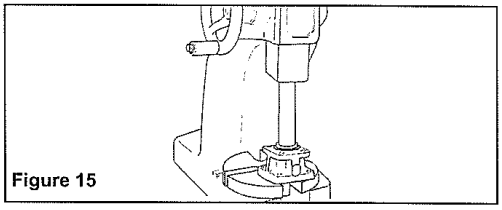


Figure 15

Reassembly of Remaining Hydraulic Motor Parts

1. Place motor body in a vise with large end of shaft facing up.
2. Install the o-ring in the body.
3. Install the Woodruff Key or Roll Pin on the shaft. Place the Inner Gear of the gerotor onto the shaft making sure gerotor slot lines up with the key in the shaft.

NOTE

The Woodruff Key can slide up behind the inner gear of the gerotor when the gear is installed. Make sure the key is visible in the slot after the gear is in place.

4. Install the outer portion of the gerotor, making sure the gerotor is centered within the o-ring groove on the body.
5. Install the Gerotor Housing, making sure the pins in the Gerotor Housing line up with their respective holes in the body.
6. Lightly lubricate the area between the Inner and Outer Gerotor, and the Outer Gerotor and Gerotor Housing, with hydraulic oil or mineral oil.

⚠WARNING

Special attention should be exercised when working with retaining rings. Always wear safety goggles when working with spring or tension-loaded fasteners or devices.

7. Install o-ring on the motor end plate.
8. Place end plate on gerotor housing, making sure holes in end plate line up with pins in the gerotor housing.
9. Install four Socket Head Cap Screws in Motor End Plate, and using a 1/4" Allen wrench, tighten Cap Screws alternately and evenly, in a crisscross pattern to approximately 15-foot pounds [20 Nm] of torque.
10. Install the Thread Seal Gasket on the Bypass Adjusting Screw. Put the gasket on from the slotted end and turn until four threads on the screw are showing. Install the washer and the nut. Install Bypass Adjusting Screw in the motor end plate.
    A. For closed-center hydraulic systems, turn the Bypass Adjusting Screw in until it bottoms out in the end plate. Tighten nut down with 9/16" box end wrench.

B. For open-center hydraulic systems, turn the Bypass Adjusting Screw in until it bottoms out in the end plate; then turn back out 1 1/2 full turns. Holding the Bypass Adjusting Screw with a screwdriver, tighten nut. (Motor will then have to be readjusted to tractor system.)

11. Replace o-ring on both port adapters.

12. Install Pressure Port Adapter and Tank Port Adapter back onto the motor. (For ease of installation, tighten the Pressure Port Adapter first, then the Tank Port Adapter.)

13. Remove hydraulic motor from the vise. Turn shaft by hand to check for binding.

14. Install Slinger Ring over motor shaft.

15. Install motor into Pump Mounting Flange. Insert four Hex Head Bolts; then, alternately and evenly tighten them.

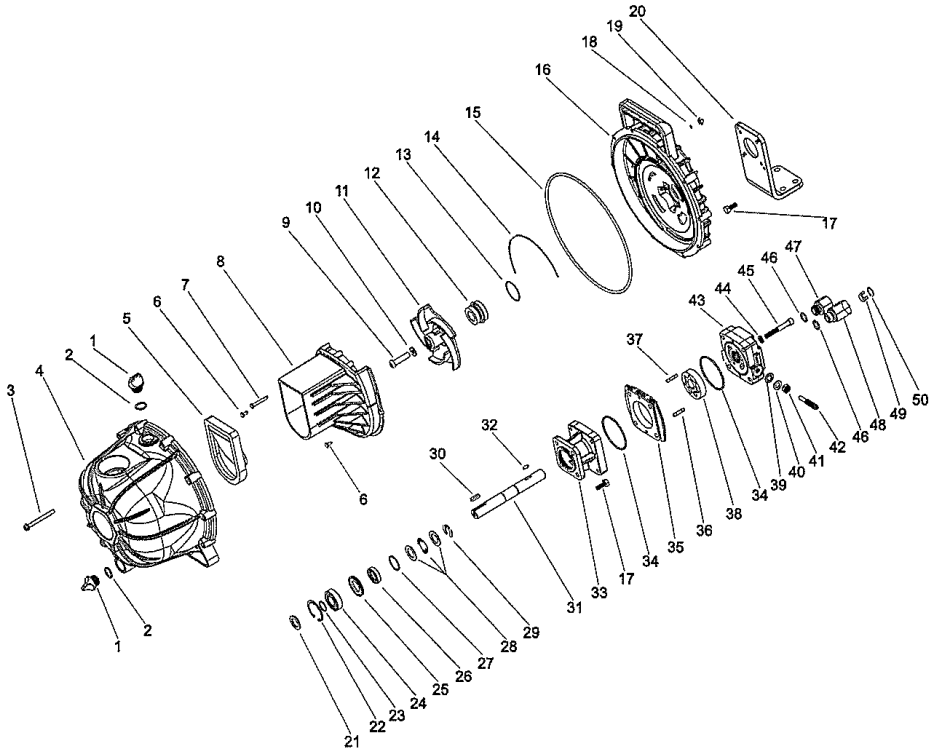
9342P-HM5C-SP	Hyd. Flow (GPM)	GPM at 10 PSI	GPM at 20 PSI	GPM at 30 PSI	GPM at 40 PSI	GPM at 50 PSI
	10	155	134	111	82	30
	Hyd. Flow (LPM)	LPM at 0.7 BAR	LPM at 1.4 BAR	LPM at 2.1 BAR	LPM at 2.8 BAR	LPM at 3.4 BAR
	37.9	587	507	420	310	114

9342P Parts List

Ref. No.	Qty. Req'd.	Part No.	Description
1	2	2404-0350P	Fill/Drain Plug
2	2	1720-0230	Plug O-Ring
3	10	2210-0141	Bolt
4	1	0100-1540P	Pump Housing
5	1	1700-0208	Flapper Valve
6	2	2210-0145	Diffuser Mounting Screw (Short)
7	1	2210-0144	Diffuser Mounting Screw (Long)
8	1	0150-1540P	Diffuser
9	1	2210-0142	Impeller Retaining Bolt
10	1	1700-0210	Impeller Gasket
11	1	0401-1540P	Impeller
12	1	2120-0044	Mechanical Seal
13	1	1720-0231	Seal O-Ring
14	1	1700-0209	Diffuser Gasket
15	1	1720-0229	Pump Body O-Ring
16	1	0750-1540P	Pump Flange
17	8	2210-0004	Mounting Bolt
18	10	1410-0115	Lock Washer
19	10	2250-0087	Nut
20	1	1510-0109	Motor Bracket
21	1	1410-0083	Slinger Ring
22	1	1820-0039	Retaining Ring
23	1	1810-0011	Snap Ring
24	1	2000-0017	Bearing
25	1	1410-0116	Spacer
26	1	2104-0006	Hydraulic Motor Shaft Seal
27	1	1410-0074	Seal Spacer
28	1	2029-0014	Thrust Bearing Assembly
29	1	1810-0026	Snap Ring
30	1	1610-0044	Key

Ref. No.	Qty. Req'd.	Part No.	Description
31	1	0525-2500	Shaft (HM1C and HM5C Models)
31	1	0526-2500	Shaft (HM2C and HM4C Models)
32	1	1610-0032	Key (HM2C and HM4C Models)
32	1	1610-0031	Key (HM1C and HM5C Models
33	1	0153-2500C	Motor Body (Includes Main Bearing)
34	2	1720-0110	O-Ring
35	1	0701-2500C	Spacer (HM2C Model) 1/4" Wide
35	1	0700-2500C	Spacer (HM1C Model) 1/2" Wide
35	1	0703-2500C	Spacer (HM4C Model) 5/16" Wide
35	1	0704-2500C	Spacer (HM5C Model) 5/8" Wide
36	1	1600-0044	Locating Pin (HM1C and HM5C)
36	1	1600-0045	Locating Pin (HM2C and HM4C)
37	1	1600-0037	Locating Pin (HM1C and HM5C)
37	1	1600-0042	Locating Pin (HM2C and HM4C)
38	1	3900-0022	Gerotor (HM1C Model)
38	1	3900-0023	Gerotor (HM2C Model)
38	1	3900-0025	Gerotor (HM4C Model)
38	1	3900-0048	Gerotor (HM5C Model
39	1	1700-0047	Gasket
40	1	2270-0027	Washer
41	1	2250-0038	Lock Nut
42	1	3220-0029	Bypass Adjusting Screw
43	1	0252-2500C	Motor End Plate (Includes Main Brng.)
44	4	2270-0039	Washer
45	4	2220-0045	Cap Screw
46	2	1720-0108	O-Ring
47	1	3360-0021	Pressure Port Adapter
48	1	3320-0049	Tank Port Adapter
49	1	3260-0068	Poppet
50	1	1820-0038	Retaining Ring

All 9342P Series Pumps



Hydraulic Motor Replacement Part # 2500-0043 contains: Ref. Nos. 21 thru 50.
Hydraulic Motor Repair Kit Part # 3430-0178 contains: Ref. Nos. 24, 26, 34, 39, 46.

Repair Kit 3430-0635 contains: (1) Ref. 14 Diffuser Gasket, (1) Ref. 13 Seal O-Ring, (1) Ref. 12 Mechanical Seal, (1) Ref. 10 Impeller Gasket and (1) Ref. 15 O-Ring.

Pump Head Kit 3430-0637 includes all items shown above, less motor components and mounting hardware (items 1-16, 18 and 19).

Ref. No.	Torque Spec.
9	10 ft/lbs.
17	10 ft/lbs.
19	45 in/lbs.
45	20 ft/lbs.

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Tel: 01353 661211 Fax: 01353 666642 Email: sales@team-sprayers.com Website: www.team-sprayers.com

Limited Warranty on Hypro Pumps and Other Hypro Products

Hypro warrants to the original purchaser of its products (the "Purchaser") that such products will be free from defects in material and workmanship under normal use for the period of one (1) year for all products except: oil crankcase plunger pumps will be free from defects in material and workmanship under normal use for the period of five (5) years, and accessories will be free from defects in material and workmanship under normal use for the period of ninety (90) days. In addition, Hypro warrants to the purchaser all forged brass pump manifolds will be free from defects in material and workmanship under normal use and from damage resulting from environmental conditions for the life of the pump.

"Normal use" does not include use in excess of recommended maximum speeds, pressures, vacuums and temperatures, or use requiring handling of fluids not compatible with component materials, as noted in Hypro product catalogs, technical literature, and instructions. This warranty does not cover freight damage, freezing damage, normal wear and tear, or damage caused by misapplication, fault, negligence, alterations, or repair that affects the performance or reliability of the product.

THIS WARRANTY IS EXCLUSIVE. HYPRO MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Hypro's obligation under this warranty is, at Hypro's option, to either repair or replace the product upon return of the entire product to the Hypro factory in accordance with the return procedures set forth below. **THIS IS THE EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.**

IN NO EVENT SHALL HYPRO BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND, WHETHER FOR BREACH OF ANY WARRANTY, FOR NEGLIGENCE, ON THE BASIS OF STRICT LIABILITY, OR OTHERWISE.

Return Procedures

All pumps or products must be flushed of any chemical (ref. OSHA Section 0910.1200 (d)(e)(f)(g)(h)) and hazardous chemicals must be labeled before being shipped* to Hypro for service or warranty consideration. Hypro reserves the right to request a Material Safety Data sheet from the Purchaser for any pump or product Hypro deems necessary. Hypro reserves the right to "disposition as scrap" pumps or products returned which contain unknown substances, or to charge for any and all costs incurred for chemical testing and proper disposal of components containing unknown substances. Hypro requests this in order to protect the environment and personnel from the hazards of handling unknown substances.

For technical or application assistance, call the **Hypro Technical/Application number: 1-800-445-8360.**
To obtain service or warranty assistance, call the Hypro Service and Warranty number: 1-800-468-3428;
or call the Hypro Service and Warranty FAX: (651) 766-6618.
Be prepared to give Hypro full details of the problem, including the following information:

1. Model number and the date and from whom you purchased your pump.
2. A brief description of the pump problem, including the following:
   - Liquid pumped. State the pH and any non-soluble materials, and give the generic or trade name.
   - Temperature of the liquid and ambient environment.
   - Suction lift or vacuum (measured at the pump).
   - Discharge pressure.
   - Size, type, and mesh of the suction strainer.
   - Drive type (gas engine/electric motor; direct/belt drive; tractor PTO) and rpm of pump.
   - Viscosity (of oil, or other than water weight liquid).
   - Elevation from the pump to the discharge point.
   - Size and material of suction and discharge line.
   - Type of spray gun, orifice size, unloader/relief valve.

Hypro may request additional information, and may require a sketch to illustrate the problem. Contact the factory to receive a return material authorization before sending the product. All pumps returned for warranty work should be sent shipping charges prepaid to:

HYPRO
Attention: Service Department
375 Fifth Avenue NW
New Brighton, Minnesota 55112

* Carriers, including U.S.P.S., airlines, UPS, ground freight, etc., require specific identification of any hazardous materials being shipped. Failure to do so may result in a substantial fine and/or prison term. Check with your shipping company for specific instructions.

Note: This warranty does not apply to Hypro Pump Kit 3430-0637. This is because the user could incorrectly assemble the parts and cause the pump to work improperly.

HYPRO®
Pentair Water
SPRAY GROUP
375 Fifth Avenue NW • New Brighton, MN 55112
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www.hypropumps.com

Hypro 2005
Printed in USA

Pump operation (application system) Series 9303C SP

HYPRO

Series 9300 Hydraulically-Driven Centrifugal Pumps

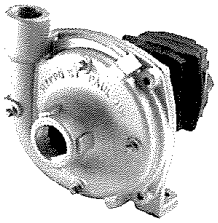
Form L-1526
1/10

Installation, Operation, Repair and Parts Manual

Description

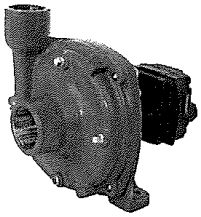
Hypro centrifugal pumps are designed for agricultural and industrial spraying and transfer of a variety of fluids: water, insecticides, herbicides, wettable powders, emulsives, liquid fertilizers, etc. Polypropylene centrifugal pumps may also be used to pump acid fertilizer, calcium chloride and other highly corrosive liquids such as sulfuric and phosphoric acids.

Hypro Series 9300 hydraulic motor-driven centrifugal pumps provide smooth performance. They can be conveniently mounted on the tractor or sprayer, becoming part of the vehicle's hydraulic system and freeing the PTO for other uses. The Hypro "close-coupled" design reduces the mounting space required, eliminating long shafts and couplers between the pump and motor.



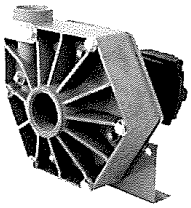
SERIES 9302C & 9302S
Cast Iron & Stainless Steel Centrifugal Pumps

Max. Flow Rate: .....100 gpm
Max. Pressure: .....120 psi
Ports: .....1-1/4" NPT Inlet
.....1" NPT Outlet
Hydraulic Ports: .....1/2" NPT Inlet
.....1/2" NPT Tank



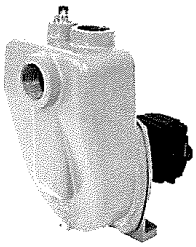
SERIES 9303C & 9303S
Cast Iron & Stainless Steel Centrifugal Pumps

Max. Flow Rate: .....147 gpm
Max. Pressure: .....145 psi
Ports: .....1-1/2" NPT Inlet
.....1-1/4" NPT Outlet
Hydraulic Ports: .....1/2" NPT Inlet
.....1/2" NPT Tank



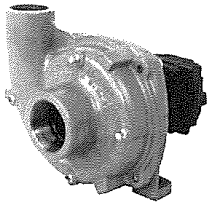
SERIES 9303P
Polypropylene Centrifugal Pumps

Max. Flow Rate: .....113 gpm
Max. Pressure: .....125 psi
Ports: .....1-1/2" NPT Inlet
.....1-1/4" NPT Outlet
Hydraulic Ports: ....1/2" NPT Inlet
.....1/2" NPT Tank



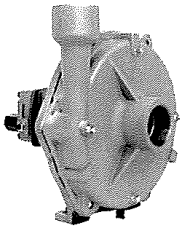
SERIES 9303C-SP
Cast Iron Centrifugal Pumps

Max. Flow Rate: .....122 gpm
Max. Pressure: .....140 psi
Ports: .....1-1/2" NPT Inlet
.....1-1/4" NPT Outlet
Hydraulic Ports: .....1/2" NPT Inlet
.....1/2" NPT Tank



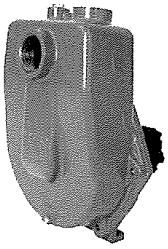
SERIES 9304C
Cast Iron Centrifugal Pumps

Max. Flow Rate: .....190 gpm
Max. Pressure: .....130 psi
Ports: .....2" NPT Inlet
.....1-1/2" NPT Outlet
Hydraulic Ports: ....1/2" NPT Inlet
.....1/2" NPT Tank



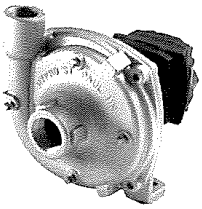
SERIES 9305C-HM3C
Cast Iron Centrifugal Pumps

Max. Flow Rate: .....190 gpm
Max. Pressure: .....180 psi
Ports: .....2" NPT Inlet
.....1-1/2" NPT Outlet
Hydraulic Ports: .....1/2" NPT Inlet
.....1/2" NPT Tank



SERIES 9305C-HM3C-SP, -BSP
Cast Iron Centrifugal Pumps

Max. Flow Rate: .....178 gpm
Max. Pressure: .....154 psi
Ports: .....2" NPT or BSP Inlet
.....2" NPT or BSP Outlet
Hydraulic Ports: .....1/2" NPT Inlet
.....1/2" NPT Tank



SERIES 9306C & 9306S
Cast Iron & Stainless Steel Centrifugal Pumps

Max. Flow Rate: .....214 gpm
Max. Pressure: .....150 psi
Ports: .....2" NPT Inlet
.....1-1/2" NPT Outlet
Hydraulic Ports: ....1/2" NPT Inlet
.....1/2" NPT Tank

General Safety Information

NOTE

Notes are used to notify of installation, operation, or maintenance information that is important but not safety related.

⚠CAUTION

Caution is used to indicate the presence of a hazard, which will or may cause minor injury or property damage if the notice is ignored.

⚠WARNING

Warning denotes that a potential hazard exists and indicates procedures that must be followed exactly to either eliminate or reduce the hazard, and to avoid serious personal injury, or prevent future safety problems with the product.

⚠DANGER

Danger is used to indicate the presence of a hazard that will result in severe personal injury, death, or property damage if the notice is ignored.

⚠DANGER

Do not pump flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. Do not use in explosive atmospheres. The pump should be used only with liquids compatible with the pump component materials. Failure to follow this notice may result in severe personal injury and/or property damage and will void the product warranty.

⚠CAUTION

1. Do not pump at pressures higher than the maximum recommended pressure.
2. Maximum liquid temperature is 140° F for Series 9300 centrifugal pumps.
3. Disconnect power before servicing.
4. Release all pressure within the system before servicing any component.
5. Drain all liquids from the system before servicing any component. Flush with water.
6. Secure the outlet lines before starting the pump. An unsecured line may whip, causing personal injury and/or property damage.
7. Check hose for weak or worn condition before each use. Make certain that all connections are tightly secured.
8. Periodically inspect the pump and the system components. Perform routine maintenance as required (See Repair Instructions).
9. Use only pipe, hose and fittings rated for the maximum psi rating of the pump.
10. Do not use these pumps for pumping water or other liquids for human or animal consumption.

Hazardous Substance Alert

⚠CAUTION

1. Always drain and flush pump before servicing or disassembling for any reason.
2. Always drain and flush pumps prior to returning unit for repair.
3. Never store pumps containing hazardous chemicals.
4. Before returning pump for service/repair, drain out all liquids and flush unit with neutralizing liquid. Then, drain the pump. Attach tag or include written notice certifying that this has been done. It is illegal to ship or transport any hazardous chemicals without United States Environmental Protection Agency Licensing.

⚠DANGER

Never use your hand to check the condition of hydraulic lines or hoses. If hydraulic fluid penetrates the skin, get medical help immediately. Failure to get proper medical help may result in loss of limb or life. The safest way to check hydraulic lines or hoses is by holding a piece of cardboard next to the hydraulic line or hose.

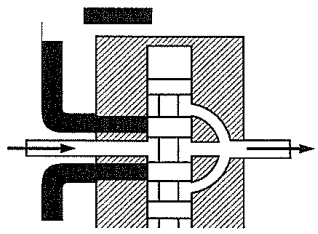
⚠WARNING

The sound pressure level of the pump is 80dBA. Observe all safety precautions when operating the pump within close proximity for extended periods of time by wearing hearing protectors. Extended exposure to elevated sound levels will result in permanent loss of hearing acuteness, tinnitus, tiredness, stress, and other effects such as loss of balance and awareness.

Hydraulic Pumps

Hydraulic pumps come in two basic types:

- **Constant displacement -** which will continue to put out its rated flow regardless of pressure, until the relief valve bypasses the flow.
- **Variable displacement -** which will produce only the flow needed by the implement until the total pump output is reached. If less than the full pump output is required, an automatic stroke control mechanism decreases the pump output to maintain a constant pressure and flow. The output varies according to demand.

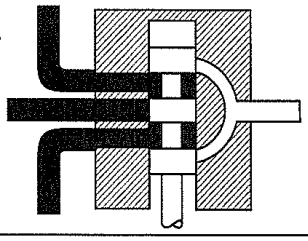


Open Center Spool Valve In Neutral Position

Figure 1

Spool Valves

There are two basic types of spool valves used in conjunction with these pumps — Open and Closed Center. In the Open Center Valve (See Figure 1), the flow goes straight through the valve when in the neutral position. This type is used for constant displacement pumps where the flow should never be shut off.



Closed Center Spool Valve In Neutral Position

Figure 2

The Closed Center Valve (See Figure 2) is used with variable displacement pumps. The flow is completely shut off in the neutral position, causing the pump stroke to adjust to zero flow. The flow stops, but the pump maintains a static pressure up to the valve.

Hydraulic Motors

Figure 3 shows an internal gear motor (Gerotor) where pressure causes the cavities between the gears to expand on one side, developing torque. The Gerotor type of hydraulic motor is used on Hypro pumps for its superior performance characteristics, including cooler running and higher rpm capabilities.

Gerotor-Type Hydraulic Motor

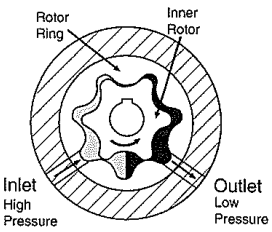


Figure 3

Three Systems

Fitting these components together and installing a motor, we have one of the three types of systems: Open Center, Closed Center (pressure compensated) and Closed Center Load Sensing (flow and pressure compensated).

Open Center Systems

In an Open Center System, the hydraulic pump puts out a constant flow. If the pump puts out more oil than the motor can use, a portion of the oil must be bypassed around the motor. When the oil is bypassed around a loop and does no work, the energy put into it by the pump turns into heat. Therefore, the amount of oil bypassed should be kept to a minimum. Use the largest motor possible.

Closed Center (Pressure-Compensated) Systems

The Closed Center Pressure-Compensated system has a variable displacement pump which will deliver flow at the necessary rate to maintain a specified pressure. It is desirable to equip implements with a motor of a low flow range that will cause the pump to operate between 1800 and 2100 psi [124 and 145 BAR]. A motor that requires a large volume to obtain the correct implement speed usually causes the hydraulic pump in a closed center system to operate at a lower pressure than desirable. This low pressure results in unnecessary flow and the generation of heat that lowers the lubricating quality of the oil and may damage transmission parts. Use the smallest motor possible.

Closed Center Load Sensing Systems (Flow and Pressure-Compensating)

The Closed Center Flow-Compensated System is a variation of the pressure-compensated system, designed primarily for more efficient operation and the generation of less heat. It works on the principle of maintaining a constant pressure drop from the pump to the work port of the selector valve. Any variation in demand at the motor will cause a change in flow. The system senses this change in flow due to the change in pressure drop across the valve and causes the pump to compensate by varying the pump flow. No restrictor is used in the pressure line and no oil is bypassed.

All Models — Open Center Systems

Models include Tank Port Adapter with built-in Check Valve Assembly and Pressure Port Adapter.

HM2C and HM4C Models Only — Closed Center and Small Open Center Systems.

Models include Tank Port Adapter with built-in Check Valve Assembly and Pressure Port Adapter with three different size metering orifices for HM4C models. The orifices are not required for use with closed center systems with flow control, such as John Deere closed center systems. Also, do not use for small open center systems with a maximum flow of 8 gpm [30.28 lpm] for HM2C model; 10 gpm [37.85 lpm] for HM4C model. If necessary, the pressure port adapter may be used without a metering orifice installed in any closed center system. For best results, the pressure differential across the motor should be less than 2500 psi (170 bar).

Preliminary to Mounting

Consult the owners manual to determine the type and capacity of the hydraulic system. Make sure the hydraulic system is recommended to operate with a continuous load. Refer to the Pump Selection Guide to confirm you have the proper pump for your hydraulic system.

Check to see that the pump impeller can be turned by hand. (Turn the shaft clockwise using a deep socket wrench on the impeller nut.) If it cannot be turned, open the pump casing to look for obstructions. Clean out any corrosion build up where the casing fits over the eye of the impeller.

Pump Inlet Line

To achieve full capacity from the pump, the inlet line should be at least the same size as the inlet port on the pump. Reducing this line size will restrict the capabilities of the pump. The line must also be free of air leaks. Check all fittings and connections in the suction line for tightness. The introduction of air may affect the priming and pumping capabilities of the pump. Use good quality suction hose that will not be collapsed by suction.

For non self-priming models, the centrifugal pump should be mounted below the liquid level and as near to the liquid source as possible to allow for the shortest suction line practical. To achieve optimal performance, the suction line should slope down into the pump. Avoid rises and humps that could trap air in the line to the pump. The suction line and pump should be filled with liquid prior to starting the pump, and all discharge lines should be open.

Pump Outlet Line

The recommended orientation for the outlet port is pointing straight up. This allows liquid to stay in the pump while it is priming. The outlet line should be the same size as the pressure port on the pump to give the optimal flow. The line should have as few restrictions and elbows as possible to optimize the pump performance and reduce pressure drop from the pump to the spray tips.

Priming the Pump

NOTE

The pump must not be run dry.

Before starting the pump, the inlet line and pump must be filled with liquid and all discharge lines must be open. On self-priming models, only the pump chamber needs to be filled with liquid. The pump must not be run unless it is completely filled with liquid because there is a danger of damaging the mechanical seal, which depends on the liquid for its lubrication.

Non-self-priming models should be mounted below the level of the liquid. The suction line should slope down to the pump and be free of dips and bends. If this cannot be done, a foot valve should be installed in the end of the inlet line so that the line can be completely filled with liquid before starting the pump.

For best priming results, the top vent plug should be removed from the pump casing. A vent line (1/4" [6.35 mm] tubing is sufficient) should be installed running back to the top of the tank. This line prevents air lock and allows the pump to prime itself by bleeding off trapped air. The small stream of liquid that returns to the tank during operation is negligible. The discharge from this line should be positioned in the tank above the high liquid level. Self-priming models can be primed by removing the top vent plug and filling the priming chamber. The priming chamber will fill to the level of the inlet port. After use, the priming chamber should be flushed and drained to avoid chemical corrosion and damage from freezing. Drain by removing the lower drain plug.

Controlling the Pump Flow

The best way to control the flow is by incorporating two control valves in a pipe tee immediately after the strainer in the discharge line. This permits controlling agitation flow independently of nozzle flow.

In any centrifugal pump, it is the large volume of liquid which puts load on the drive. Use only the flow needed to develop the pressure required at the boom and to maintain adequate agitation. Hydraulic motor-driven centrifugal pumps are easily adjusted to the exact flow required, as explained in the Operating Instructions of this manual.

Centrifugal Pump Control

Hypro now offers many different components for spraying systems. The Hypro centrifugal pump control incorporates the electric flow control valve, a self-cleaning line strainer, a visual pressure gauge and a manual agitation control valve.

Flow Control Valve

A high-flow electric proportional valve allows for maximum flow control to the boom valves. It provides smooth, rapid control that can be controlled from either an electronic rate controller or switch box.

Strainers

The recommended placement of the strainer for a centrifugal pump is in the pump outlet line. This will eliminate any possible restriction that the strainer could

Plumbing Installation

create if it were installed in the inlet line. Ensure that the proper strainer size and screen mesh are used to limit the pressure drop and achieve the best filtration. Line strainers can also be installed in the tank fill line to filter liquid as it is loaded into the tank as well as in the boom lines to further filter the solution prior to the spray tips. Tank baskets can also be used to filter material added through the tank lid.

Agitation

The centrifugal pump control contains a manual agitation control valve that can be adjusted to provide the right amount of flow to the jet agitators in the tank to ensure proper mixing within the tank.

Flowmeter

To eliminate the mechanical problems of a turbine flowmeter, we recommend that an electromagnetic flowmeter be used. These flowmeters have no moving parts to wear out and will provide a more consistent and accurate flow reading. They can be input into just about any electronic rate controller or switch box.

Boom Section Valves

For rapid response and reliability, we recommend electric plunger valves be used for boom control. The valves should be sized accordingly to minimize the pressure drop and maximize the flow rate. The boom tubing or hose should be sized accordingly to ensure that a pressure drop in the lines does not occur, causing inconsistent pressures at the nozzles.

Nozzle Bodies

Nozzle bodies with shut-off check valves are recommended to eliminate dripping from the spray tips when the boom valves are shut down.

Hooking Up the Hydraulic Motor to the Tractor Hydraulic System

Hypro Series 9300HMC hydraulic motor-driven pumps can be mounted on either the tractor or sprayer. When hooking up, make sure that no dirt or liquid gets into the hydraulic motor. **Keep all hydraulic connections clean.** Be sure to connect the hydraulic motor into the system correctly by putting the pressure line to the Pressure Port Adapter and return line to the Tank Port Adapter. The adapters on the hydraulic motor are sized to accommodate 1/2" NPT fittings on the pressure port and 3/4" NPT on the tank port. For maximum performance, the hydraulic lines should also be at least 1/2" [12.7 mm] in size for the pressure line and 3/4" [19.05 mm] for the tank line.

The tank (**OUT**) port adapter with a built-in check valve assembly will guard against reverse operation — allowing you to reverse oil flow to operate other equipment. **This adapter must not be removed.** On HM2C and HM4C model pumps, the pressure (**IN**) port adapter is a two-piece assembly consisting of an open (unrestricted) adapter with three orifices packed loose with the pump. (See the Operations Section.)

When using the HM2C or HM4C unit on any flow-compensated (load sensing) closed center system, or any small open center system with a maximum flow of 8 gpm [30.28 lpm] for HM2C or 10 gpm [37.85 lpm] for HM4C, the metering orifice should be removed from the pressure port adapter. When using these units on flow-compensated systems, connect to the motor priority circuit if your tractor has one.

Standard spool valves, which are found on all tractor hydraulic systems, may cause potentially damaging high peak pressures in the hydraulic system when closed because of abrupt shut-off of oil flow in both the supply and return lines. When shutting off the pump, move the selector to the **FLOAT** position to allow the centrifugal pump to come to a stop gradually.

For further information regarding Hypro products, contact your local dealer or Hypro directly at www.hypropumps.com or by calling 1-800-424-9776.

Operation

Open Center Systems— All Models
Adjusting Centrifugal Pump Output

NOTE

HM1C, HM3C & HM5C motors have bypass screw fully closed from the factory. HM2C & HM4C motors have bypass screw set at 1-1/2 turns from fully closed from the factory.

1. Open the bypass adjustment screw 2-1/2 turns from fully closed. Turn the bypass screw in to achieve the flow for the desired gpm and psi.
2. Start the tractor. Leave the directional valve in the neutral position and allow hydraulic oil to circulate for approximately 10 to 15 minutes or until adequately warmed.
3. Prime the centrifugal pump with all valves open (See the Installation Instructions and System Configuration Diagram).
4. Close the agitation line valve and keep the control valve and the boom shut-off valve open. Note the spray pressure.
5. Open the agitation line valve until you have desired circulation in the tank. Recheck the spray pressure. If it is too low, close down the agitation line valve until the desired spray pressure is reached. If the spray pressure is too high, throttle the centrifugal pump by closing down the control valve.

Closed Center (Pressure-Compensated) — HM2C and HM4C Models Only

On a pressure-compensated system, the amount of oil that is allowed to flow through the hydraulic motor is regulated by a metering orifice in the pressure port adapter. Three different sizes of orifices are supplied with the HM2C and HM4C model pumps to allow flexibility in the flow required for individual sprayer needs.

The smaller the orifice, the less hydraulic oil goes through the motor, so the pump will run slower and the flow of liquid pumped and the spray pressure will also be less. As the hydraulic oil flow is increased (by installing a larger orifice), the amount of liquid being pumped and the spray pressure is also increased.

Installing and Removing Metering Orifice

1. Shut off the hydraulic system.
2. Disconnect the line to the pressure port of the hydraulic motor.
3. Remove the adapter from the motor using a 1-1/16" wrench. Make sure the o-ring is on the metering orifice before installing into port adapter.
4. The orifice is removed or installed in the port adapter by tapping either in or out of the adapter.
   A. To remove — tap the orifice out from the small end of the adapter.
   B. To install — tap the orifice in from the large end of the adapter. The orifice is seated when a snap sound is heard.

Adjusting Centrifugal Pump Output

1. Open the bypass adjusting screw in the hydraulic motor three (**3**) turns.
2. Start the tractor and allow the hydraulic oil to circulate for approximately 10 to 15 minutes or until adequately warmed.
3. Close and lock down the bypass adjusting screw in the hydraulic motor.
4. Prime the centrifugal pump with all valves open (See Installation Instructions and System Configuration Diagram).
5. Close the agitation line valve and the control valve; open the boom shut-off valve.
6. With the pump running, open the control valve until the pressure gauge indicates the desired spraying pressure.
7. Open the agitation line valve until sufficient agitation is observed. Then, if spray pressure drops, readjust the control valve to restore to the desired pressure.
8. If a sufficient boom pressure cannot be attained, install the #2 size orifice and repeat Steps **5** through **7**.
9. If a sufficient boom pressure still cannot be attained with the #2 size orifice, install the #3 size orifice and repeat Steps **5** through **7**.
10. If a sufficient boom pressure still cannot be attained with the #3 size orifice, remove the orifice and repeat Steps **5** through **7**.

Closed Center (Load Sensing) — All Models

Many tractors are being introduced with load sensing systems (also referred to as flow and pressure-compensated systems) which simplify system setup and eliminate many of the problems associated with using the wrong size pump motors on a given hydraulic system. Usually, any of Hypro's 9300HMC models may be used on this type of system, provided the hydraulic system produces sufficient oil flow for the hydraulic motor being used (Refer to the Pump Selection Guide).

This system maintains a constant flow of hydraulic oil for a given pressure drop. The flow is adjustable with a flow control valve installed in the hydraulic system (such as the Tortoise/Hare control on John Deere tractors). Because this system has adjustable flow, there is no need to bypass hydraulic oil as in an open center system, or to restrict the flow with orifices as in a closed center pressure-compensated system.

Adjusting Centrifugal Pump Output

1. Make sure the orifice from the pressure port adapter of the hydraulic motor has been removed (HM2C and HM4C models only).
2. Close and lock down the bypass adjusting screw in the hydraulic motor.
3. Set the tractor hydraulic flow control valve for minimum hydraulic oil flow to the remote outlet (Tortoise position).
4. Start the tractor and allow the hydraulic oil to circulate for approximately 10 to 15 minutes or until adequately warmed.
5. Prime the centrifugal pump with all valves open (See the Installation Instructions and System Configuration Diagram).
6. Close the agitation line valve and open the control valve and the boom shut-off valve.
7. Slowly adjust the tractor hydraulic flow control valve until the desired boom pressure is attained.
8. Open the agitation line valve until sufficient agitation is observed. If spray pressure drops, readjust the tractor hydraulic flow control valve to restore it to the desired pressure.

Flush Pump After Use

One of the most common causes for faulty pump performance is gumming or corrosion inside the pump. Flush the pump and entire system with a solution that will chemically neutralize the liquid pumped. Mix this solution according to the manufacturer's directions. This will dissolve most residue remaining in the pump, leaving the inside of the pump clean for the next use.

To Prevent Corrosion

After cleaning the pump as directed above, flush it with a permanent-type automobile antifreeze (Prestone®, Zerex®, etc.) containing a rust inhibitor. Use a 50% solution, half antifreeze and half water. A protective coating will remain on the inner pump surfaces. Save the excess antifreeze for the next application. Plug the ports to keep out air during storage. For short periods of idleness, noncorrosive liquids may be left in the pump, but air must be kept out. Plug the ports or the seal port connections.

Repair Instructions

Hypro Repair Tools:
Tool Box No. 3010-0168 • 1/4" Allen Wrench No. 3020-0008
Support Bars (2) No. 3010-0064 • Port Brush No. 3010-0066
1/16" Allen Wrench No. 3020-0009 • Brush Holder No. 3010-0067 • Large Retaining Ring Pliers No. 3010-0084 • Small Retaining Ring Pliers No. 3010-0167

Shop Tools Needed
Bench Vice • Arbor Press • Air or Hand Drill • Small Knife
Metal Pipe - 1" dia. x 4" high (Bearing Seating Tool)
PVC Pipe - 3/4" dia. x 4" - 6" high (Seal Seating Tool)
12" Crescent Wrench • Two Flat Screwdrivers (approx. 10" long)
1/2", 9/16", 5/8" and 7/8" sockets • Hammer or Rubber Mallet
Small Screwdriver (recommended) • Large File (optional)
1/2" and 9/16" Box End Wrench • Lubricating Spray (WD-40 or LPS)
Small amount Hydraulic Oil • Cleaning Solvent Tank (recommended)

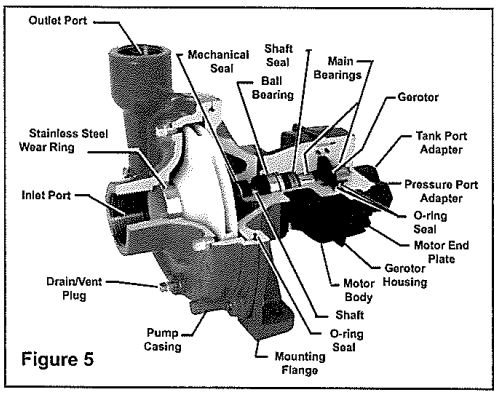


Figure 5

Pump Housing Disassembly

NOTE

Instructions in italics describe procedures for the Series 9300P Polypropylene Centrifugal Pumps, when different than the cast iron pumps.

1. Using a 9/16" box end wrench, remove the four Hex Head Bolts holding the Pump Casing to the Mounting Flange. (If necessary, tap Pump Casing Outlet Port with rubber mallet or hammer to separate.) [*Using a 1/2" wrench, remove the six bolts from the front. For the two bottom bolts securing the base, you will need to hold the two nuts with another 1/2" wrench. Also remove the 5/16" screw from the rear, near the outlet port.*]
2. To remove the Impeller Nut, insert a large screwdriver or file (at least 10" [254 mm] long) into Impeller Vanes to prevent Impeller from turning when loosening nut. Use a 5/8" socket wrench to remove the Impeller Nut by turning it counterclockwise (See Figure 6). [*Use 7/8" deep socket wrench to remove Plastic Seal Nut, then 9/16" deep socket to remove Metal Jam Nut and Washer.*]

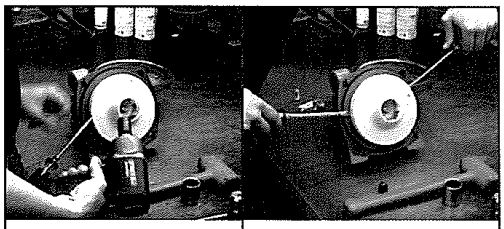


Figure 6 | Figure 7

3. Once nut [*and washer*] is removed, place a screwdriver on each side behind the Impeller and pry away from the Mounting Flange (See Figure 7). Remove Woodruff Key from the Shaft. Remove O-ring from the Mounting Flange.

Pump Seal Removal

1. Lightly lubricate the Shaft for easier removal of the Seal. Using two screwdrivers positioned opposite each other, pry the rotary portion of the Seal from the Shaft (See Figure 8).

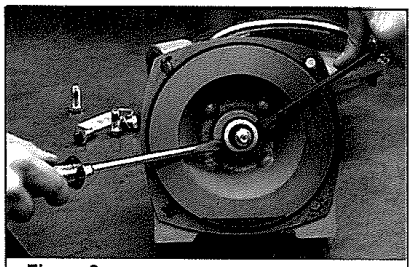


Figure 8

NOTE

In the case of a severe pump seal leak, inspect the Shaft/Bearing Assembly in the hydraulic motor for possible contamination.

2. Using a 1/2" box end wrench, remove the four bolts holding the Motor to the Mounting Flange. Remove Motor. [*Remove the Plastic Back Cover flange. Knock the Seal out from back with a hammer and screwdriver. Use a 1/2" socket wrench and 1/2" box end wrench to remove the Mounting Flange from the Hydraulic Motor.*]

apart the boss area between the Gerotor Housing and the Motor Body. (It may be necessary to alternate sides when prying apart Motor sections.)

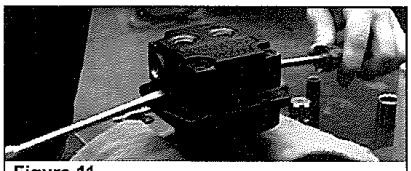


Figure 11

7. Remove both parts of the Gerotor.
8. On HM3C models, remove the Woodruff Key from the Shaft. On HM1C, HM2C and HM4C models, remove the Roll Pin from the Shaft.
9. Remove the o-ring from the Motor End Plate and Body with a flat instrument such as a knife blade.
10. Inspect Motor End Plate, Body and Gerotor Housing for wear and/or gouging. If gouging has occurred in both the Motor End Plate and Body, the motor is not repairable. If gouging has occurred in the Motor End Plate, Body or Gerotor Housing, the part that is worn must be replaced. If Gerotor Housing is damaged, Gerotor parts must also be replaced.

To Remove the Shaft Assembly from the Motor Body

1. Remove the Slinger Ring from the Motor Shaft.

⚠WARNING

Special attention should be exercised when working with retaining rings. Always wear safety goggles when working with spring or tension loaded fasteners or devices.

2. Using the large retaining ring pliers, remove the Retaining Ring next to the Ball Bearing in the Motor Body.

NOTE

If bearing is binding against the retaining ring so that it cannot easily be removed, place the motor body (threaded portion of the shaft up) on arbor press. Using a piece of un-threaded metal pipe (1" dia. x 4" high [254. mm x 101.6 mm high]), slide over the shaft and gently press down with the arbor press just enough to relieve the pressure on the retaining ring.

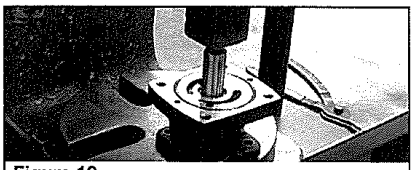


Figure 12

3. Place body in position on arbor press. Threaded portion of the Shaft should be inside the fixture. Press out shaft assembly with arbor press (See Figure 12).

Hydraulic Motor Shaft Disassembly and Repair

1. Remove Large Retaining Ring from Shaft with a screwdriver. Remove Thrust Bearing Assembly from Shaft (includes the Thrust Bearing and two Thrust Bearing Races) and the Seal Spacer.
2. Remove the Small Retaining Ring next to the Shaft Ball Bearing.
3. To remove the Bearing from the shaft, place the shaft (threaded end up) in the arbor press fixture. Place the two support bars provided in the repair kit opposite each other and between the seal on the shaft and the arbor press fixture. Using an arbor press, press the shaft through the Bearing, Seal Spacer and Seal (See Figure 13).
4. Inspect the sealing area of the shaft for wear. Inspect other Shaft Assembly Components for wear and replace if necessary.

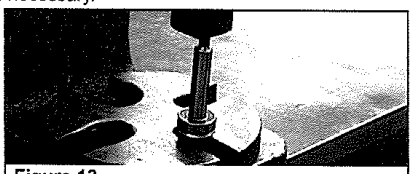


Figure 13

5. While motor is completely disassembled, clean all parts in a solvent bath.

Build Shaft Sub-Assembly

1. To assemble the seal cartridge, remove the old seal from the cartridge by pressing it out. The cartridge is reused by assembling the new seal into cartridge, ensuring the new seal is pressed in with the lip seal on the opposite side as shown in Fig.1.

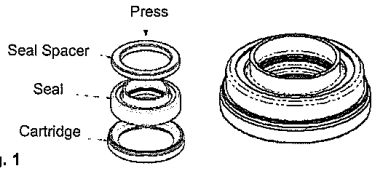


Fig. 1

Important: To prevent damage to the seal lip extending out, use seal spacer as shown to guard lip during assembly.

2. Install the large retaining ring onto large diameter end of shaft.
3. From the small, threaded end of the shaft, install the following parts in this order: thrust bearing race, thrust bearing, 2nd thrust bearing race.

Note: The thrust bearing and races should not be reused if they are showing any signs of wear.

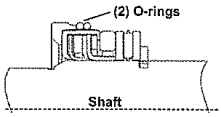
4. Install new type seal spacer (looks like a thick washer, approx .130 inch thick).
5. Before installing the new seal, its lip must be expanded to fit on the shaft. With the seal lip facing out, slide the seal over the threaded end of the shaft and gently push the seal onto the raised area of the shaft. Do not push the seal past the large retaining ring groove on the shaft.

6. Once the seal has been expanded, remove the seal from the shaft.
7. Install seal cartridge assembly: With seal lip facing the large end of the shaft, slide the seal cartridge assembly over the threaded end of the shaft and gently push into the raised area of the shaft. Align the seal lip to enter the center diameter of the seal spacer and push until seal body touches seal spacer.

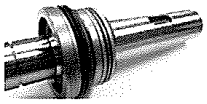
Important: If the seal lip is longer than the seal spacer's width, please stop the assembly and review parts being used.

8. Assemble two o-rings on the outside body of the new seal cartridge assembly as shown in Fig 2. Install o-rings one at a time and do not roll over each other.

Fig. 2



9. Finished shaft sub-assembly should look like this:



10. Do not press, but place the shaft sub-assembly into the motor body with threaded end of shaft up. Lubricate the two o-rings with hydraulic or mineral oil before assembling.

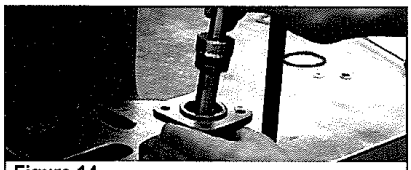


Figure 14

Install Shaft Sub-Assembly Into Motor Body

Important: Make sure the surface edge of the arbor press fixture is smooth and clean. An unthreaded piece of pipe (1" x 4" high) is needed to support the outer race of the seal cartridge sub-assembly and outer race of the ball bearing during assembly. Place this pipe over the shaft threaded end for assembly of the following steps.

1. Place the body on a support fixture in the arbor press. Using an unthreaded piece of pipe (1" dia. x 4" high), press the shaft subassembly down into the body until it bottoms out. This is a light press fit and should be done slow and easy.
2. Install the new ball bearing onto the threaded end of the shaft. Press down using the 1" x 4" pipe until the retaining ring can be installed in its groove in the bearing core of the motor body. Install the retaining ring.

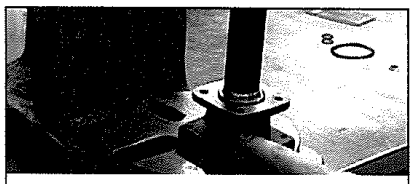


Figure 15

3. Turn the motor body assembly over (threaded shaft end down) on the arbor press. Press the shaft down into its "final position" until the small retaining ring can be installed in the shaft next to the ball bearing.
4. Install small retaining ring on shaft.
5. Check shaft rotation at this point. It should rotate smoothly with only slight resistance from the seal lip pressure on the shaft. If you feel any gritty or sticking movement, return assembly to the arbor press and lightly press on the threaded end of the shaft to relieve press fit compression on the thrust bearing. **Note:** Don't over do this press. The objective is to move the small outer retaining ring installed in the previous step back to " touching only" the ball bearing inner race.

Important: If gritty or sticky movement persists, it's likely due to re-used parts or the body needle bearing is in need of replacement.

Reassembly of Remaining Hydraulic Motor Parts

1. Place Motor Body in a vise with large end of shaft facing up.
2. Install the o-ring in the body.
3. Install the Roll Pin on the shaft. Place the Inner Gear of the Gerotor onto the shaft making sure Gerotor slot lines up with the key in the shaft.

The Roll Pin can slide up behind the inner gear of the gerotor when the gear is installed. Make sure the key is visible in the slot after the gear is in place.

4. Install the outer portion of the Gerotor, making sure the Gerotor is centered within the o-ring groove on the body.
5. Install the Gerotor Housing, making sure the pins in the Gerotor Housing line up with their respective holes in the body.

6. Lightly lubricate the area between the Inner and Outer Gerotor, the Outer Gerotor, and Gerotor Housing with hydraulic oil or mineral oil.

Special attention should be exercised when working with retaining rings. Always wear safety goggles when working with spring or tension-loaded fasteners or devices.

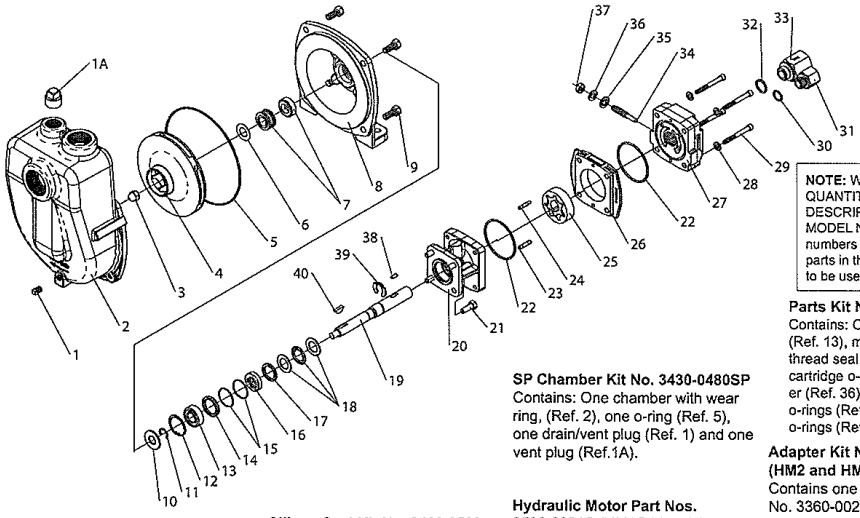
7. Install o-ring on the motor end plate.
8. Place end plate on gerotor housing, making sure holes in end plate line up with pins in the gerotor housing.
9. Install four Socket Head Cap Screws in Motor End Plate, and using a 1/4" Allen wrench, tighten Cap Screws alternately and evenly in a crisscross pattern to approximately 15 foot pounds [20 Nm] of torque.
10. Install the Thread Seal Gasket on the Bypass Adjusting Screw. Put the Gasket on from the slotted end and turn until four threads on the screw are showing. Install the Washer and the Nut. Install Bypass Adjusting Screw in the motor end plate.
    A. For closed center hydraulic systems, turn the Bypass Adjusting Screw in until it bottoms out in the End Plate. Tighten nut down with 9/16" box end wrench.
    B. For open center hydraulic systems, turn the Bypass Adjusting Screw in until it bottoms out in the End Plate; then turn back out 1½ full turns. Holding the Bypass Adjusting Screw with a screwdriver, tighten Nut. (Motor will then have to be readjusted to tractor system.)
11. Replace o-ring on both port adapters.
12. Install Pressure Port Adapter and Tank Port Adapter back onto the motor. (For ease of installation, tighten the Pressure Port Adapter first, then the Tank Port Adapter.)
13. Remove Hydraulic Motor from the vise. Turn shaft by hand to check for binding.
14. Install Slinger Ring over Motor Shaft.
15. Install Motor into Pump Mounting Flange. Insert four Hex Head Bolts; then alternately and evenly tighten them. [*For polypropylene models, secure the Hydraulic Motor to the Mounting Flange with four Hex Head Cap Screws and Nuts. The nuts should be visible when the assembly is complete.*]

Troubleshooting

If the proper Hydraulic Pump Unit has been selected according to Hypro recommendations, and the unit has been correctly plumbed into the hydraulic system, operation should be quite satisfactory. If spraying performance is unsatisfactory or hydraulic system heat is excessive etc., check the following troubleshooting guide for possible problems and solutions.

Troubleshooting Guide

Symptom	Probable Cause(s)	Corrective Action(s)
Low discharge	Pump not primed.	— Remove top most vent plug from face of pump and run pump to expel trapped air (see Installation Instructions).
	Air leaks in inlet line.	— Check and reseal inlet fittings.
	Blocked or clogged line strainer.	— Inspect strainer and clear any debris from screen.
	Impeller plugged.	— Inspect and clear obstruction.
	Undersize inlet line or collapsed hose.	— Suction line should be the same diameter as inlet port of pump or larger.
	Improperly sized hydraulic motor.	— Refer to Pump Selection Guide to determine proper size hydraulic motor for your hydraulic system.
	Bypass Adjustment Screw not set properly.	— Adjust bypass screw on side of hydraulic motor in until the desired output is attained.
	Eye of impeller rubbing on volute.	— Remove volute (front cover) and inspect the impeller. If wear detected, sand the impeller eye O.D. with emery cloth.
Hydraulic system overheating	Improper hydraulic motor size.	— Refer to Pump Selection Guide to determine proper size for your hydraulic system.
	Bypass Adjustment Screw set to bypass too much oil.	— Close adjustment screw on side of hydraulic motor to lessen the amount of oil being bypassed.
	Improper metering orifice installed in pressure port.	— Install proper size orifice. Refer to Installation section for proper sizing.
	Insufficient hydraulic hose size.	— Check hydraulic hose size. Hose should be at least 1/2" [12.7 mm] on the pressure port and 3/4" [19.05mm] on the tank port.



NOTE: When ordering parts, give QUANTITY, PART NUMBER, DESCRIPTION, and COMPLETE MODEL NUMBER. Reference numbers are used ONLY to identify parts in the drawing and are NOT to be used as order numbers.

Parts Kit No. 3430-0748
Contains: One each ball bearing (Ref. 13), motor shaft seal (Ref. 16), thread seal gasket (Ref. 35), two cartridge o-rings (Ref. 15) and washer (Ref. 36); two each motor housing o-rings (Ref. 22), and port adapter o-rings (Ref. 30 & 32).

SP Chamber Kit No. 3430-0480SP
Contains: One chamber with wear ring, (Ref. 2), one o-ring (Ref. 5), one drain/vent plug (Ref. 1) and one vent plug (Ref.1A).

Adapter Kit No. 3430-0187 (HM2 and HM4 Models Only):
Contains one each:
No. 3360-0021 Pressure Port Adapter
No. 3373-0020 (Size #1)
No. 3373-0021 (Size #2)
No. 3373-0022 (Size #3)
No. 1720-0108 Adapter O-ring and
No. 1720-0105 Orifice O-ring (Qty. 3).

Hydraulic Motor Part Nos.
2500-0081C (HM1C Models)
2500-0082C (HM2C Models)
2500-0083C (HM3C Models)
2500-0084C (HM4C Models)
2500-0085C (HM5C Models)

Repair Parts Kit No. 3430-0332
Contains: One o-ring (Ref. 5), one rubber gasket (Ref. 6), and one mechanical seal (Ref 7).

Silicon Seal Kit No. 3430-0589
Contains one each:
1720-0083 o-ring (Ref. 5)
and mechanical seal (silicon carbide) (Ref. 7).

Ref. No.	Qty. Req'd.	Part No.	Description
1	1	2406-0007	Drain/Vent Plug (9303C-SP)
1	1	2406-0016	Drain/Vent Plug (9303S-SP)
1A	1	2406-0001	Vent Plug (9303C-SP)
1A	1	7SP34	Vent Plug (9303S-SP)
2	1	3430-0480SP	Pump Casing (9303C-SP)
2	1	0150-9070S	Pump Casing (9303S-SP)
3	1	2253-0002	Impeller Nut (9303C-SP)
3	1	2253-0006	Impeller Nut (9303S-SP)
4	1	0401-9100P	Impeller (Nylon Std. 9303C-SP)
4	1	0402-9100P	Impeller (Polypropylene Optional) (Std 9303S-SP)
5	1	1720-0083	O-ring
6	1	1700-0100	Gasket
7	1	2120-0009	Mechanical Seal (Viton/Ceramic) (Std 9303C-SP)
7	1	3430-0589	Mechanical Seal (Silicon Carbide) (Std 9303S-SP)
8	1	0750-9300C	Mounting Flange (9303C-SP)
8	1	0756-9300S	Mounting Flange (9303S-SP)
9	4	2210-0020	Hex Head Cap Screw (9303C-SP)
9	4	2210-0125	Hex Head Cap Screw (9303S-SP)
10	1	1410-0056	Slinger Ring
11	1	1810-0014	Snap Ring
12	1	1820-0013	Retaining Ring
13	1	2000-0010	Ball Bearing
14	1	1410-0131	Cartridge, Front
15	2	1720-0268	O-ring
16	1	2104-0010	Lip Seal
17	1	1410-0130	Seal Spacer
18	1	2029-0014	Thrust Bearing Assembly
19	1	0531-2500	Shaft (HM2C/HM4C)
19	1	0533-2500	Shaft (HM1C/HM5C)
19	1	0536-2500	Shaft (HM3C)
20	1	0150-2500C	Motor Body (includes needle bearing)
21	4	2210-0005	Hex Head Cap Screw
22	2	1720-0110	O-ring
23	1	1600-0045	Dowel Pin (HM2C/HM4C)

Ref. No.	Qty. Req'd.	Part No.	Description
23	1	1600-0044	Dowel Pin (HM1C/HM5C)
23	1	1600-0052	Dowel Pin (HM3C)
24	1	1600-0042	Dowel Pin (HM2C/HM4C)
24	1	1600-0037	Dowel Pin (HM1C/HM5C)
24	1	1600-0068	Dowel Pin (HM3C)
25	1	3900-0022	Gerotor (HM1C)
25	1	3900-0023	Gerotor (HM2C)
25	1	3900-0024	Gerotor (HM3C)
25	1	3900-0025	Gerotor (HM4C)
25	1	3900-0048	Gerotor (HM5C)
26	1	0701-2500C1	Gerotor Housing (HM2C Models) 1/4" wide
26	1	0700-2500C1	Gerotor Housing (HM1C Models) 1/2" wide
26	1	0703-2500C1	Gerotor Housing (HM4C Models) 5/16" wide
26	1	0702-2500C1	Gerotor Housing (HM3C Models) 1" wide
26	1	0704-2500C1	Gerotor Housing (HM5C Models) 5/8" wide
27	1	0254-2500C2	Motor End Plate (includes needle bearing)
28	4	2270-0039	Washer
29	4	2220-0045	Cap Screw (HM2C/HM4C Models)
29	4	2220-0021	Cap Screw (HM1C Models)
29	4	2220-0044	Cap Screw (HM3C Models)
29	4	2220-0032	Cap Screw (HM5C Models)
30	1	1720-0108	O-ring
31	1	3360-0021A	Pressure Port Adapter (includes o-ring)
32	1	1720-0262	O-ring
33	1	3320-0051A	Tank Port Adapter (includes o-ring)
34	1	3220-0029	Bypass Adjusting Screw
35	1	1700-0047	Gasket
36	1	2270-0027	Washer
37	1	2250-0038	Lock Nut
38	1	1610-0032	Roll Pin (HM2C/HM4C)
38	1	1610-0031	Roll Pin (HM1C/HM5C)
38	1	1610-0055	Roll Pin (HM3C)
39	1	1810-0026	Snap Ring
40	1	1610-0012	Woodruff Key (9303C-SP)
40	1	04432	Woodruff Key (9303S-SP)

Warranty Notice

Please ensure all fitting instructions are followed, warranty will be void if applicator is incorrectly fitted.

Team Sprayers Limited recommends that all applicators are fitted by one of our Specialised Machinery Dealers.

1. Team Sprayers warrants the original purchaser for parts & machines supplied for up to 12 months.
2. Warranty claims must be in writing & all faulty parts/machines must be returned with the original proof of purchase for evaluation.
3. ALL CHEMICALS MUST BE FLUSHED OUT BEFORE RETURNING MACHINES/PARTS & DETAILS OF ANY CHEMICALS USED MUST BE SUPPLIED.
4. Any parts supplied while evaluation is in process will be invoiced, if upon evaluation it is deemed the parts/machines have not been used according to manufacturer's instructions these invoices will stand, if evaluation deems these to be warranty issues these invoices will be credited.
5. Warranty will not cover machinery/parts which have been misused (Maximum Speeds, Pressures & Temperatures exceeded), incorrectly fitted or not maintained according to instructions given in manual (Frost or Freezing damage).
6. Wearing parts such as Tyres, O' rings, diaphragms and valves are not covered under any warranty.
7. Warranty will only cover circumstances where a part/machine has failed due to a manufacturing fault.

TEAM SPRAYERS LTD Unit 3 Lancaster Way Business Park, Witchford, Ely, Cambs. CB6 3NW
Tel: 01353 661211 Fax: 01353 666642 Email: sales@team-sprayers.com Website: www.team-sprayers.com

TERMS & CONDITIONS

1. PRICING

1a. All prices given are subject to VAT at current rate.

1b. All prices are correct at time of publishing and are subject to change without prior notice.

1c. When ordering specialised machinery, quotation No. must be stated on order, along with price agreed & full details in writing, including any critical measurements.

2. PAYMENT TERMS

2a. Terms of payment are 30 days net monthly for all approved credit accounts.

2b. We accept Credit Card, Cash, Cheques or BACS payments.

Bank Details
Name: Lloyds TSB – Ely
Account No. 0238825
Sort code: 30.93.05

2c. No payments shall be deemed received until Team Sprayers have received cleared funds.

2d. If cheque received is rejected by bank all charges incurred by Team Sprayers will be passed onto purchaser.

3. DESPATCH & DELIVERY

3a. Next Day delivery charges will be quoted at time of order.

3b. Parts sent via 1st class post are not guaranteed to arrive next day.

3c. Pallet services are available Next Day within the UK including Jersey & Guernsey (See Below).

3d. Postcode area's PA, IV, KW, HS, ZE, Ireland & Isle of man 2-3 Day service only.

3e. All delivery charges will be confirmed at time of order.

3f. Any claims for shortages or damaged goods must be made to Team Sprayers within 3 days of receipt.

3g. Claims for non-delivery must be made to Team Sprayers within 10 days of despatch date (shown on invoice).

3h. Team Sprayers reserves the right to charge a 15% handling fee for return of non-faulty parts.

3i. Any period of time named by Team Sprayers for the delivery of goods or services is an estimate only, every effort will be made to meet these times, however Team Sprayers will not be held liable for any consequences due to late delivery.

4. PRODUCT INFORMATION

4a. Team Sprayers operate a policy of continual product development. Therefore some information within publications may differ from exact machine purchased.

4b. Teams Sprayers reserve the right to change any manual or publication without prior notice.

5. WARRANTY

5a. **Team Sprayers warrants the original purchaser for parts & machines supplied for a 12-month period from the original invoice date.**

5b. **Any warranty work to be undertaken only by authorised Team Sprayers dealer or Team Sprayers.**

5c. **Any warranty claims for labour/mileage must be agreed with Team Sprayers prior to any invoicing.**

5d. Warranty claims must be in writing & all faulty parts/machines must be returned to Team Sprayers with the original proof of purchase for evaluation.

5e. ALL CHEMICALS MUST BE FLUSHED OUT BEFORE RETURNING MACHINES/PARTS & DETAILS OF ANY CHEMICALS USED MUST BE SUPPLIED.

5f. Any parts supplied while evaluation is in process will be invoiced, if upon evaluation it is deemed the parts/machines have not been used according to manufacturer's instructions these invoices will stand, if evaluation deems these to be warranty issues these invoices will be credited.

5g. Warranty will not cover machinery/parts, which have been misused (Maximum Speeds, Pressures & Temperatures exceeded), incorrectly fitted or not maintained according to instructions given in manual (Frost or Freezing damage).

5h. All wearing parts such as tyres, 'O' rings, pump diaphragms and valves are not covered under any warranty.

5i. Warranty will only cover circumstances where a part/machine has failed due to a manufacturing fault.

EC - DECLARATION OF CONFORMITY

Manufacturer:

Team Sprayers Ltd.
Unit 3 Lancaster Way Business Park
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Email: sales@team-sprayers.com
Website: www.team-sprayers.com

Machinery Directive 2006 / 37/ EC

We declare that the product stated below conforms to the relevant health and safety requirements of the Machinery Directive 2006/37/EC.

Product: Team Front mounted range

Serial Number:

The product complies with The Supply of Machinery (Safety) Regulations 2008.
The following Standards were used in complying with the Directive:

BS EN ISO 12100 : 2010	Safety of Machinery. General principles for design, risk assessment and risk reduction.
BS EN 982 : 1996 + A1 : 2008	Safety of Machinery. Fluid power systems and components. Hydraulics.
BS EN ISO 13857 : 2008	Safety of Machinery. Safety distances to prevent hazard zones being reached by upper and lower limbs.
Name:Danny Hubbard	Declaration and Technical File on behalf of Team Sprayers Ltd.

Position: Managing Director

Date: 12/04/11 Issue Location: Address as above.