



Operators Manual

MANLINK-4 REV C 01/03/07

**400L / 600L / 800L Super Series
Linkage Sprayer**



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Introduction

Silvan is an Australian owned company specialising in supply of crop protection equipment to primary producers. A leader in the design of agricultural sprayers, the company was established in 1962 and has grown to become the largest manufacturer and supplier of crop protection equipment in Australia.

Silvan's reputation for quality products backed by quality service is something of which we are extremely proud. Your investment in a Silvan sprayer is an investment in quality.

This manual covers the 400L, 600L and 800L Pasturepak units, which have been designed and manufactured to provide a high standard of performance and safety and incorporate many innovative features. To ensure continued efficient performance and safe operation of your sprayer, you need to read this manual thoroughly and fully familiarise yourself with all aspects of the sprayers operation, maintenance and safety procedures.

Now that you are a proud Silvan owner, all our services and dealer support is available to you should you need them. We assure you of our best attention at all times.

No liability can be accepted for any inaccuracies or omissions in this publication, although due care has been taken to make it as complete and accurate as possible.

The information, illustrations and technical data were considered to be correct at the time of preparation.

In accordance with our policy of continuous development, Silvan Australia Pty. Ltd. reserves the right to make changes at any time without notice.

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About Your Warranty

Silvan Australia Pty. Ltd. builds equipment to a high level of specification using components from quality suppliers. The following information is provided to assist you with any repairs required within the warranty period.

All warranty repairs on Silvan products are carried out by Silvan dealers. If any warranty repairs are required on Silvan products, it is recommended that the product be returned to the place of purchase.

It is good practice to keep a record of equipment maintenance both during and after the warranty period.

The following information on warranty coverage explains the extent and limitations of your Warranty coverage on Silvan Products.



New Product Warranty

Warranty

This warranty is the only warranty applicable to Silvan new products ('Products') and, to the maximum extent permitted by law, is expressly in lieu of any other conditions or warranties expressed or implied in relation to the Products.

Subject only to legislative obligations to the contrary, Silvan shall not be liable for incidental or consequential damage resulting from ownership or use of a Product.

Silvan does not authorize any person to create for it any other obligation or liability in connection with these products.

Silvan warrants its authorised Dealer, who in turn warrants the original purchaser (owner) of each new Silvan product that it will repair or replace the product, or, pay the cost of repair or replacement, as determined by Silvan without charge for labour or any defective or malfunctioning parts in accordance with the warranty limitations and adjustment schedule below.

The warranty period begins on the date the product is delivered to the first retail purchaser for a period of 12 months

This Warranty Covers

Only conditions resulting directly from defects in workmanship or material under normal use and service.

Warranty Exclusions

The Warranty does not cover:

- Conditions resulting from misuse, use of incompatible chemicals, exceeding machine specifications including overloading, impact damage, negligence, accidental damage or failure to perform recommended maintenance services.
- Any product which has been repaired by other than an authorised Silvan service outlet in a way which, in the sole and absolute judgment of Silvan, adversely affect its performance or reliability.
- The replacement of maintenance items such as diaphragms, batteries, V belts and ground engaging components, etc.
- Loss of time, inconvenience, loss of use of the product liability to third parties or any other consequential damages.
- Incidental costs associated with a warranty repair including any travel costs, out of hour's labour charges, cleaning costs, transportation costs, freight costs or any communication costs.

The repair of a defective product qualifying under this warranty will be performed by any authorised Silvan service outlet within a reasonable time following the delivery of the product, at the cost of the owner, to the service outlet's place of business. The product will be repaired or replaced, using new parts supplied by Silvan. Silvan, in its absolute discretion, may choose to pay the cost of replacement or repair of the product.

The owner is responsible for the performance of regular maintenance services as specified in the Owner/Operator Manual applicable to the product. Failure to carry out regular maintenance may invalidate warranty



Before operating the sprayer, read the following safety instructions.

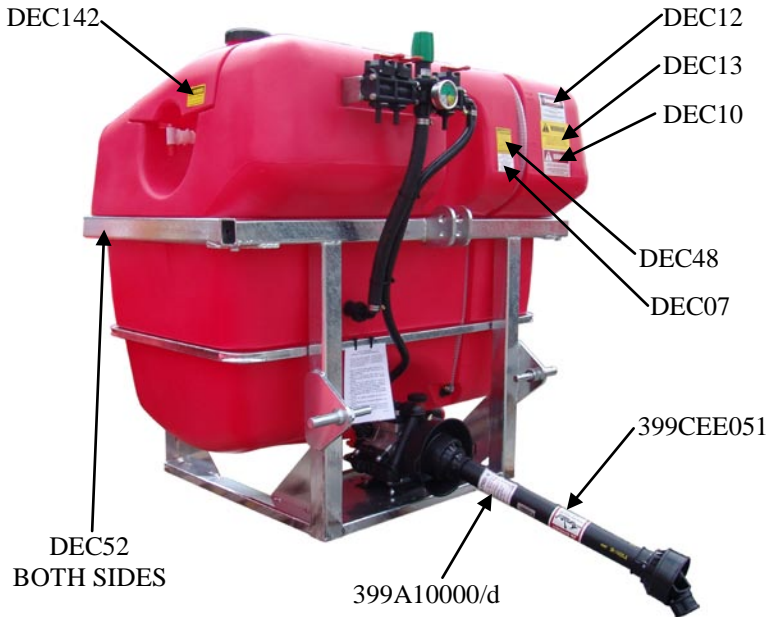
Failure to comply with these warnings may result in serious injury or death.

- This sprayer is designed and manufactured solely for the purpose of applying agricultural chemicals to crops. Under no circumstances should it be used for any other purpose.
- Before using the sprayer, carefully read and ensure you understand the contents of this manual and any other manual supplied with the sprayer.
- Before operating the sprayer, read all the safety warnings, which are carried on various parts of the machine. Refer to the next page for a location diagram and the wording of these warnings.
- Never allow an inadequately trained person to attach or operate the sprayer.
- Do not operate the sprayer whilst wearing loose clothing, unrestrained long hair, jewellery or anything which could become entangled in rotating components or limit your vision.
- Wear ear protection when operating the sprayer on a tractor which is not fitted with a sound proofed cabin.
- Ensure the linkage capacity of the tractor is suitable for the loaded mass of the sprayer. Refer to the tractor operator's manual for safe working loads and relevant tractor safety instructions.
- Exercise extreme care when operating in hilly or uneven terrain to ensure adequate stability. Refer also to the tractor manufacturer's operating and safety instructions.
- Do not operate the pump at speeds greater than 540 PTO rpm and less than 400rpm.
- Do not operate the sprayer without all of the tractor and sprayer safety shields in place. Carefully check that PTO and driveline shields are correctly installed.
- Stop the tractor PTO, apply the parking brake and switch off the tractor engine before approaching the sprayer and performing any work on it.
- Disconnect the PTO shaft at the tractor and ensure the sprayer is properly supported before performing any maintenance work.
- **Before use of any chemicals** refer to the chemical manufacturer's label and safety instructions for safe handling procedures and correct method of use. Always use the recommended personal protective clothing and equipment.
- Always wear gloves when removing and cleaning filters.
- Dispose of empty chemical containers in accordance with the instructions supplied by the chemical manufacturer.
- Ensure that all operators and associated personnel are familiar with the legal regulations and codes of practice that apply to the safe use and storage of spray chemicals.
- Ensure chemicals are kept away from the fresh water tank. **Never drink water from the fresh water tank.**
- Ensure all bystanders are at a safe distance from the machine.
- Do not use flammable liquids or gases in the sprayer.

Decal Positions 800L



The location and wording of the safety decals fitted to Silvan linkage sprayers is shown below. It is important that all operators read and follow the information on all safety decals before operating the sprayer. **Failure to comply with these warnings could result in serious injury or death.** Safety decals should be kept clean and legible at all times. If any decals are missing or unreadable they should be replaced by ordering new decals from your Silvan dealer using the part numbers shown below.



DEC48



DEC142



DEC10

IMPORTANT
P.T.O. SPEED MUST NOT EXCEED 540 R.P.M.
ENSURE P.T.O. SHAFT IS CORRECT LENGTH
EACH DAY
GREASE TELESCOPIC TUBE ON P.T.O. SHAFT.
GREASE UNIVERSAL JOINTS.
CLEAN SUCTION STRAINER.
CHECK PUMP OIL LEVEL.
FLUSH OUT PUMP WITH WATER AFTER USE.
FOR GENERAL MAINTENANCE,
REFER TO INSTRUCTION BOOKS.

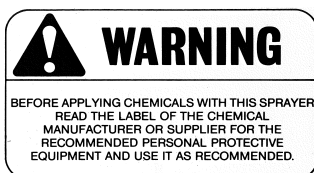
DEC07



DEC12



DEC52




DEC13



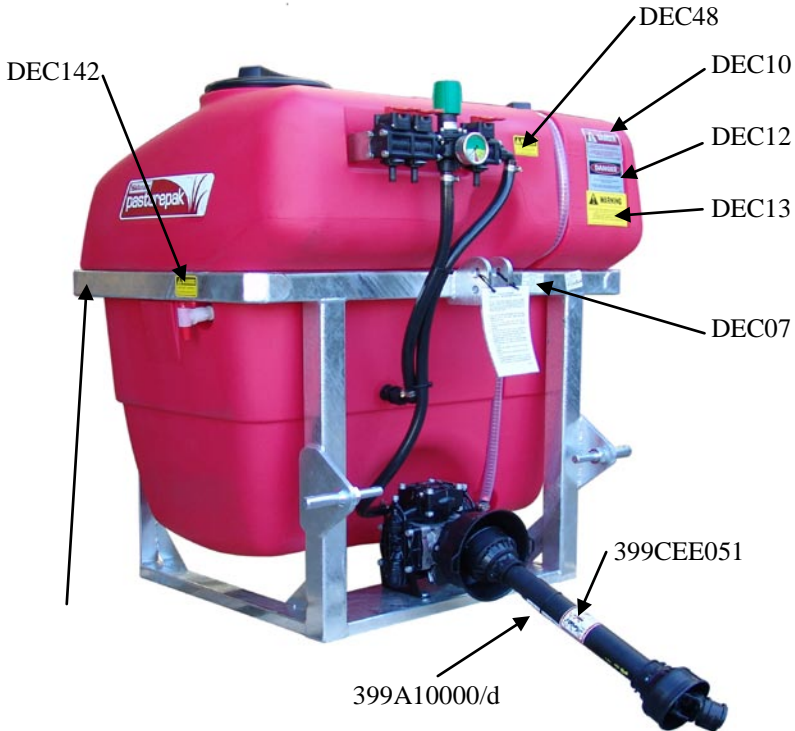
399CEE051



399A10000/d
INSTRUCTION
BOOKLET


WARNING

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DEC07



DEC52



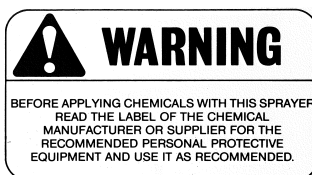
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399CEE051




399A10000/d
INSTRUCTION
BOOKLET



DEC13

Decal Positions 400L

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DEC142



DEC10

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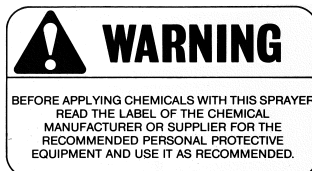
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399CEE051



399A1000/d
INSTRUCTION
BOOKLET

Pumps

Positive displacement oil-backed diaphragm pump of varying size depending on sprayer specification. Output at 540 PTO rpm and maximum operating pressure as shown below.

Pump Model	Output l/min	Pressure Bar	psi	No.of Diaphragms
BP 60/20	58	20	290	2
BP 75/15	68	15	218	3
BP 125/20	117	20	290	3

Note Maximum operating speed 540 rpm.

Minimum operating speed 400 rpm.

This pump has been designed and constructed solely to pump agricultural liquid chemicals, normally used for pest, weed and fungus control.

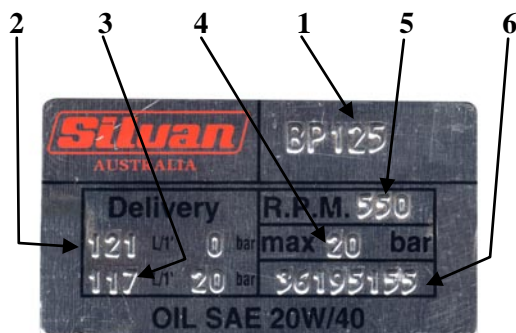
It must not be used to pump:

- Liquids with a density and viscosity greater than water.
- Chemical products if the compatibility with the materials of the pump is not known.
- Sea water or other salty concentrations.
- Water with a temperature above 40°C and less than 5°C.
- Any type of varnish.
- Solvents and thinners for any type of varnish.
- Any type of fuel or lubricant.
- Liquids containing granules or floating solid parts.
- Chlorine.
- For special liquids please contact Silvan service department.

Pump Identification

The following data is found on the pump name plate:

1. Pump Type
2. Maximum Delivery (at 0 Bar)
3. Delivery at Maximum Pressure
4. Maximum Pressure Permitted in Pump
5. Maximum RPM
6. Manufacturer's Serial No

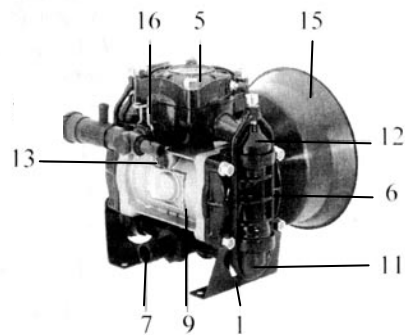


Component Identification

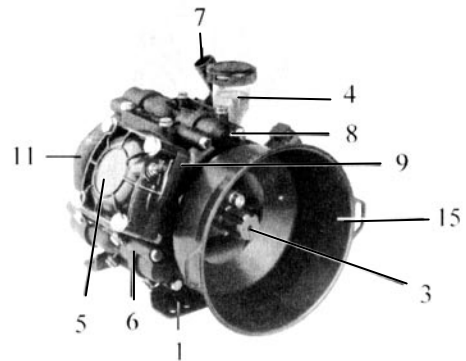
Refer to the following diagrams for the position of the various components relating to your pump.

- | | |
|-----------------------|-------------------------|
| 1. Mounting Base | 3. Pump Shaft |
| 4. Oil Reservoir | 5. Pressure Accumulator |
| 6. Pump Head | 7. Inlet Hose Barb |
| 8. Inlet Valve Cap | 9. Pump Crankcase |
| 11. Inlet Manifold | 12. Delivery Manifold |
| 13. Oil Level Cap | 15. PTO Safety Shield |
| 16. Delivery Coupling | 17. Oil Cap |

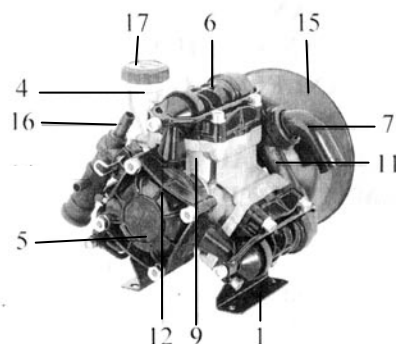
BP60/20



BP75/15



BP125/20



Specifications

Tank

Low-line designed tank constructed from Polytuff impact resistant polyethylene.
Capacity 400 / 600 / 800 litres with calibrated external sightline.
255mm diameter screw down lid with basket strainer.
15 litre fresh water tank with on/off tap.
4 litre toolbox with easy access Polyethylene lid.

Drive

540 rpm PTO shaft with safety shields.

Controls

Screw type pressure regulator.
Glycerin filled pressure gauge.
3 boom outlets.
Continuous by-pass Agitation.

Filtration

Three stage with removable elements on all units.
Standard mesh shown. Alternatives available.

- | | |
|--------------------------------|----------|
| 1) Tank lid strainer | 18 mesh. |
| 2) Suction line filter (blue). | 50 mesh |
| 3) Boom nozzle strainers | 50 mesh. |

Frame and Hitch

Heavy duty galvanized steel construction.
Reversible Category 1 & 2 linkage pins.

Factory or Dealer fitment options.

Note: not all options will fit all models.

Electric on/off 3 section Control

Hose Reels

Economy Hose Reel.

Spray Guns

PA Series or Triam Series.

Foam Marker

14 litre foam marker
30 litre Paddock foam Marker
30 litre Bubbler foam marker

Spray Booms

Field Boom 6m or 8m

Galvanized steel truss
Three section horizontal fold
Spring loaded break back.

Fieldmaster Boom 10m or 12 m

Galvanized steel truss with nozzle protection
Three section horizontal fold.
Double fold outer arms
Boom suspension provided in the transport and spraying positions with shock absorbing dampers.
Crank and cable height control
Spring loaded break back.

Devil Boom 6m, 8m or 10m

Galvanised steel truss
Hydraulic fold
Spring loaded break back
Hydraulic lift (Optional)

Vine Boom 8 or 10 Jet

Adjustable telescopic arms
Adjustable brass nozzles

Olive Boom 9 Jet

Adjustable sliding arm
Adjustable brass nozzles.

Under Viner Boom

Plated RHS frame
Telescopic sliding adjustment for boom width and height
Double swivel nozzle holders can be fitted with standard fan or off centre nozzles.

Dimensions and Weights

Mass (**kg**) with a full tank and no boom fitted.
Sprayer without boom

	L(mm)	W(mm)	H(mm)	kg
400 Litre	930	1020	1180	505
600 Litre	1025	1150	1300	730
800 Litre	1135	1335	1315	980

Width of Sprayer with boom folded for transport

<i>Field Boom</i>	6m	2.067m
	8m	2.067m
<i>Fieldmaster Boom</i>	10m	2.575m
	12m	2.575m
<i>Devil Boom</i>	6m	2.120m

Attaching to the Tractor

Most Silvan linkage sprayers are equipped to fit tractors with either Category 1 or 2 linkages. The inner end of each lower linkage pin is Category 1 and the outer end is Category 2. The lower holes in the top connection plates are Category 1 and the upper holes are Category 2.

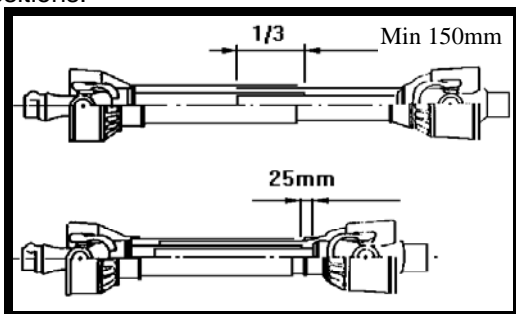
Remove the PTO shaft from the sprayer by depressing the locking pin. Lower the tractor linkage and attach it to the sprayer's lower hitch pins of the appropriate category, then connect the top link using the tractor's top link pin. Secure the linkage arms and top link pin with the tractor's lynch pins. Raise the tractor linkage to the desired spraying height and level the sprayer by adjusting the length of the top link and by using the lower arm leveling box.

Clean and grease the splines on the tractor and sprayer PTO stub shafts and install the PTO shaft making sure that the spring loaded locking pins engage in the interference grooves of both stub shafts. Ensure that the PTO shaft guard chains, if fitted, are attached to the sprayer and tractor.

PTO Shaft Length (Refer to instruction booklet 399A1000/d attached to PTO shaft)

Note: Upon delivery of a new PTO driven sprayer, it is the selling dealer's responsibility to install and set the PTO driveshaft to the correct length, as part of the installation service. The following information is provided for reference.

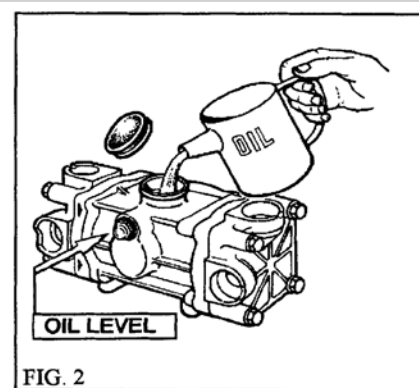
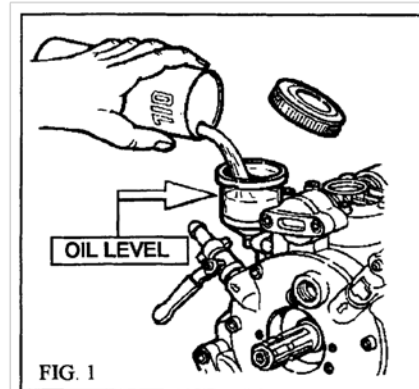
Set the linkage height so that the ends of the two shafts are at their closest distance. Install the PTO shaft making sure that there is at least 25mm of telescopic travel remaining between the male and female sections. Raise and lower the sprayer to check that the telescopic tubes of the PTO overlap by approximately 1/3rd of their length, and not less than 150mm, in all operating positions.



If the PTO shaft must be shortened, cut equal amounts from both male and female shafts and safety covers. Carefully remove all burrs then clean and lubricate before reassembling.

Pump

1. Check the oil level while the pump is standing still and sitting horizontally. The oil must reach the level indicated on the sight glass (BP125/20, BP75/15 fig 1) or be visible on the oil level plug (BP60/20 fig 2). Top up with SAE20W/40 oil if necessary.



2. Adjust the air pressure in the pressure accumulator if fitted in accordance with the operating pressure used to spray. Adjust according to Table A. The pressure can be measured using a reliable bicycle fork pressure gauge. (Note a car tyre or bicycle tyre gauge lets too much air escape to be accurate).

TABLE A

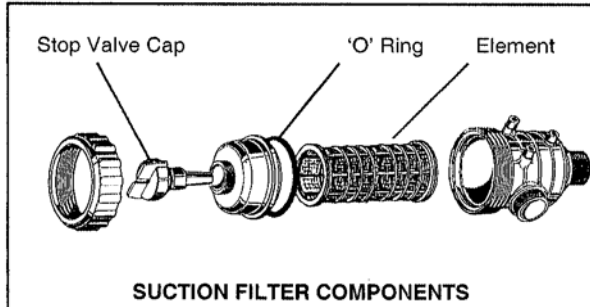
Spraying (Bar)	2 - 5	5 - 10	10 - 20
pressure (psi)	29 - 73	73 - 145	145 - 290
SURGE AIR (BAR)	2	2 - 5	5 - 7
PRESSURE (PSI)	29	29 - 73	73 - 102

Alternatively add air to the accumulator, to just above the required pressure (using a car tyre inflator is OK) start the pump and adjust the pressure regulator to the required pressure then bleed air from the accumulator until the pulsations of the pump are least noticeable, at this point the needle on the pressure gauge will be at its steadiest.

Operation

Filter

The suction filter is fitted with a stop valve which closes automatically when the valve cap is screwed off. This allows the filter cover to be unscrewed and the element to be removed for cleaning while there is fluid in the tank.

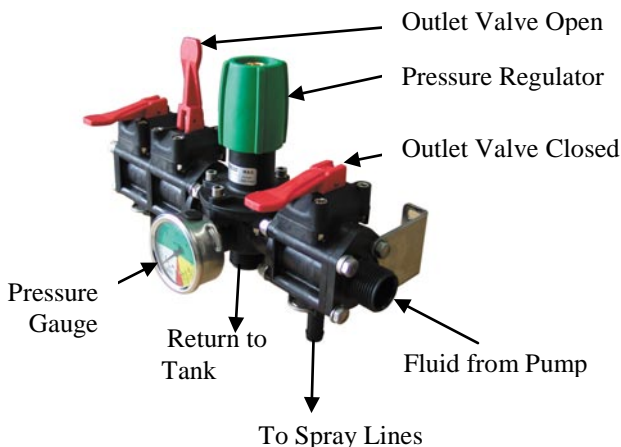


When the sprayer is operating, the valve must be fully screwed in to open the stop valve and allow fluid to pass through the filter. Directional arrows are moulded into the valve cap to show the opening and closing operation.

Three Outlet Control Units

System pressure is regulated by turning the green knob and observing the reading on the pressure gauge. Turning the knob clockwise increases the pressure and turning anti-clockwise decreases pressure.

Fluid is directed to the boom lines or other spraying devices by the outlet valves which may be operated individually. The outlet valves of the three way control are open when the levers are vertically up and closed when they are horizontal. Refer to diagram.



Fresh water tank

To fill the 15 fresh water tanks, remove the lid and fill. Ensure that the lid of the fresh water tank is not swapped with the chemical fill lid (applicable only to the 400 & 600 litre models).

Turn the tap fitted to the side of the fresh water tank to the on position to wash hands.

Warning! The fresh water tank should only be filled with fresh water. This water should not be used for drinking purposes.

Toolbox

To open the toolbox, remove each of the tri-screws holding the lid secure. Ensure the tri-screws are secured firmly when closing the lid.

Spray Booms

A variety of booms may be used with Silvan linkage sprayers depending upon the model and field application. All have stainless steel spray lines fitted with non-drip fan jet nozzles. Booms are part of the standard equipment on some models or in other cases they may be installed by the dealer.

On all types of boom, the setting of the correct operating height is most important to achieve a uniform spraying pattern. This needs to be at a height above the target which will achieve 50% overlap of the spray from adjacent nozzles - refer Calibration section of this manual.

Always ensure that no bystanders are close to the boom when it is unfolded and that it will not foul on any other objects.

Field Boom

For transport, the boom is folded horizontally by swinging the outer arms rearwards through 180° until against the fixed centre section, where they are retained by the action of the hinge springs. The arms are simply folded outwards to the spraying position when required.

The rear uprights of the sprayer frame include a series of holes to enable the boom to be attached at a height suitable for the tractor size and spraying application. Final spraying height is regulated by use of the tractor linkage control.

Fieldmaster Boom

The Fieldmaster boom features a suspension system which operates both in the transport and spraying positions using a parallelogram linkage with tension springs and shock absorbers. Boom height is manually adjusted using a crank and cable mechanism.

To fold the boom for transport, swing the outer arm up and over, on to the support saddle of the

inner arm. Swing the left hand inner arm horizontally rearwards through 180 degrees until it rests across the centre section, where it will be held by the action of the spring in the hinge. Repeat for the right hand side. Reverse the process to return the boom to the operating position.

To adjust the spraying height, first set the sprayer at the approximate height with the tractor linkage then adjust the boom lift. Insert the winch handle into the winch shaft on the right hand side of the boom support. Lift the locking pawl from the ratchet and wind the winch shaft to the required boom height. Reset the locking pawl to hold the boom in position then remove the handle from the winch shaft.

Check that the boom is horizontal. If levelling is needed this can be done by adjusting the length of the lifting cables. Lower the boom to minimum height and fully unwind the cables. Remove the U-clamp from the cable on the side to be raised, adjust the cable length and retighten the clamp. Raise the boom and check whether it is level.

The boom lift requires little maintenance but care should be taken to ensure that the parallel linkage arms are not allowed to become loose, allowing sideways movement of the boom. The lock nuts should be kept sufficiently tight to eliminate side clearance without the linkage binding. If the boom height setting restricts suspension travel, then the suspension assembly will have to be raised or lowered on its mountings.

Devil Boom

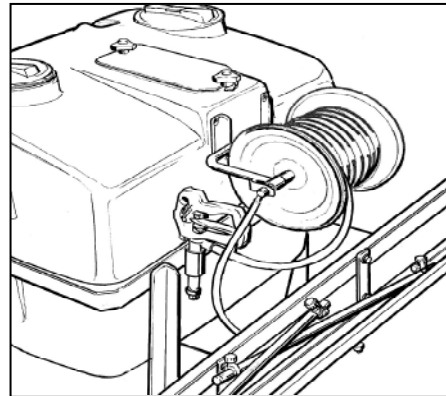
The boom is folded hydraulically by two independent rams using two sets of tractor remotes. Height adjustment can be achieved by two different methods either by using the same method as for the Field boom or an optional hydraulic lift kit is available.

Foam Marker

Refer to the Foam Marker Operator's Manual for installation and operating procedures relevant to the foam marker.

Spray Guns and Hose Reels

To operate the spray gun prime the pump as per normal then open the relevant control lever, set to the desired pressure (max 20 Bar). Depress the trigger to spray.



Starting the Sprayer

Before starting the sprayer for the first time insure the pre-delivery checks have been carried out.

When starting the sprayer for the first time, conduct a trial run using water to familiarize with the operation of the controls and to check that all systems are functioning correctly without any leakage.

When filling the tank, ensure that the basket strainer is in place and clean. Close the lid securely after filling.

Before engaging the PTO, the pressure regulator should be screwed fully out (anti clockwise) to allow by-pass to the tank and the outlet valves should be closed, using the individual valve levers (levers to be horizontal). (Repeat this procedure each time the pump has been emptied of liquid i.e. run dry.

Engage the PTO slowly and allow the sprayer to run in by-pass mode. Once the pump is primed, increase the PTO speed to 540 rpm.

The pressure can then be regulated by turning the regulator knob and observing the reading on the gauge.

The pumps are designed to operate up to a maximum pressure of 20 bar (290 psi) for BP125/20 & BP60/20 and 15 bar (218psi) for BP75/15. The pressure range used for boom spraying will usually be between 1 and 4 Bar depending upon the application rate and other factors - refer to the Calibration section of this manual.

Open the outlet valves that are connected to the boom or other spraying device to start spraying.

Under most boom spraying conditions, the PTO speed can be reduced (minimum 400 rpm) and the pump will still provide sufficient flow to suit the particular application rate being used. This will save fuel and unnecessary wear on the tractor and sprayer components.

Shutdown

After using chemicals in the sprayer flush the tank and pump by running clean water for a few minutes. If there is a risk of freezing run the pump dry for 2 to 3 minutes to insure all liquid is removed

General Spraying and Boom Information

When to Spray

Results will be best when the wind speed is low; temperature is low and relative humidity high. An ideal time is at sun up when these conditions are most likely to apply.

Field Patterns

For overall coverage, spray two swaths around the outer perimeter of the field to establish a wide headland on which to turn. Make subsequent passes across the field following the direction of drilling. Turn the sprayer on and off as the boom passes over the headland. Spraying into the established headland will only result in chemical wastage and overdosing.

Droplet Size

Although more research is needed to define which is the optimum droplet size collected by particular targets, certain generalizations can be made. The trend with herbicides has been to apply large droplets (250 microns) to reduce the risk of drift but smaller droplets are often the most effective as shown by the following table.

DROPLET SIZE	COMMENTS
Large (above 300 microns)	Poor coverage and penetration. Stripping or uneven deposit. Minimal drift
Medium (150 - 300 microns)	Coverage, deposit and penetration fair. Some drift.
Small (below 150 microns)	Good coverage and penetration. Uniform application. Drift increased.

Silvan has a range of standard flat fan nozzles designed for a normal operating pressure of 3.0 bar.

In general, the following factors can be varied to change droplet size.

- Reducing pressure increases droplet size.
- Reducing the nozzle fan angle (from 110° to 80°) increases droplet size.
- For an equivalent pressure and fan angle a larger size jet produces larger droplets.

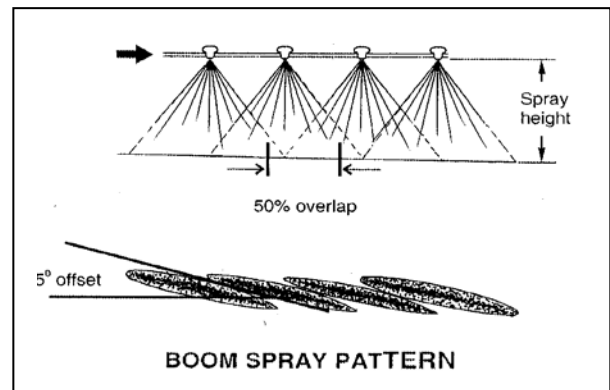
Nozzle Height and Spacing

To achieve a uniform spray pattern without gaps, the output from adjacent nozzles should overlap by 50% at the point of contact with the surface being sprayed.

Nozzles on Silvan booms are spaced at 50 cm intervals with caps offset 5° to the boom axis to

avoid interference between adjacent spray fans. They can be supplied in 110° or 80° fan angle.

The correct spray boom height to achieve 50% overlap is 35 cm for 110° nozzles and 60 cm for 80° but a variation in the order of 5 to 8 cm can be accommodated without noticeable effect. The height referred to is the distance above the target which may be either the vegetation or the ground surface depending upon the operation.



Application Rate

The application rate depends on the following:

- Speed of travel - increasing speed reduces application rate and vice versa.
- Operating pressure - increasing pressure increases application rate and vice versa.
- Nozzle size - increasing the nozzle size increases the application rate.

Ground Speed

The ground speed read out on modern tractors should be sufficiently accurate for spraying but if in doubt check it by the following method.

Measure and mark a distance of 100 metres. Fill the sprayer with water and engage the PTO to simulate normal spraying conditions. Approach the starting mark at the required spraying speed and accurately measure the time in seconds to reach the finishing mark. The ground speed can be calculated as follows.

$$\text{Speed (km/hr)} = \frac{360}{\text{Time in seconds for 100 m}}$$

Calibrating The Sprayer

Spray Pattern and Nozzle Uniformity

The overlap pattern of the boom, the spray pattern of individual nozzles and the uniformity of nozzle output can be tested in the following manner. Always keep one new nozzle aside from each set to use as comparator for this test.

1. Install the comparator nozzle, fill the sprayer tank with clean water and operate the boom at spraying pressure whilst stationary.
2. Examine the spray pattern from each nozzle against a dark background. Replace any that show streaks or signs of blockage.
3. Compare individual nozzle outputs by placing a container of equal size, such as the Silvan calibrated measuring jug, under each nozzle and run the sprayer for one minute. The water level in each container should be the same. Replace any nozzle giving more than 10% greater output than the comparator. Once several nozzles are worn to this extent it is good practice to replace the entire set.
4. Set the boom at the appropriate height for the nozzle angle, ie. 60 cm for 80° and 35 cm for 110°. Run the sprayer and check that the patterns from adjacent nozzles just meet as shown in the diagram on the previous page.
5. Remove and store the comparator nozzle.

Verifying the Calibration

After making the above tests to ensure pattern and output uniformity are correct, repeat the procedure at 3.0 Bar to compare the actual nozzle output with that shown on the nozzle selection charts. This may be done either as a test on an individual nozzle or the full boom.

a) Nozzle Test

Measure the fluid in litres, collected from one nozzle during one minute. The amount should agree with the flow rate shown in the Nozzle Selection Chart on the following pages, for the particular type and size fitted.

If the volume collected is too low the operating pressure may be increased and the test repeated, alternatively if the volume is too high the pressure can be lowered.

b) Boom Test

1. Partly fill the sprayer tank with water and mark the level or refer to the sight gauge.
2. Run the sprayer at 3.0 Bar for several minutes with all boom sections operating and measure the time carefully.

3. Refill the sprayer tank to the mark using a measuring jug and record the amount added.
4. The average output for one nozzle in l/min can be calculated as follows. It should agree with the flow rate shown at 3.0 Bar in the nozzle selection chart, for the particular type and size fitted.

$$\text{Nozzle output} = \frac{\text{Litres used}}{\text{No. nozzles} \times \text{No. minutes}}$$

5. If the nozzle output is lower than shown in the chart the pressure may be increased and the test repeated or, if more than shown, the pressure may be reduced.

Nozzle Care and Maintenance

Nozzles are one of the most critical components in the spraying system and yet are often the most neglected. Worn or damaged nozzles result in over application of expensive chemicals, crop damage and environmental contamination.

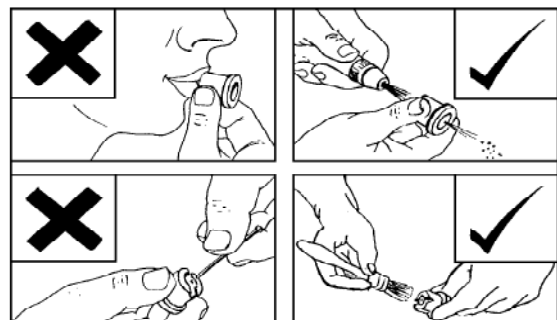
They should be examined and checked regularly to the method shown above. Replace nozzles which are not within 10% of the datum.

Always keep a quantity of spare nozzles with the sprayer for immediate replacement in the field when necessary.

Never attempt to clear a nozzle by blowing through by mouth and never remove stubborn deposits with a pin, wire or sharp instrument.

Blocked nozzles should be soaked in clean, warm water with a mild detergent added and carefully cleaned only with a soft brush or airline.

A new nozzle should be kept as a testing comparator and it is recommended that all nozzles are renewed once a year or at the first signs of deterioration, whichever occurs first.



Calibrating the Sprayer

Nozzle Selection

Refer to the chemical manufacturer's information to determine the recommended application rate in litres per hectare (l/ha) for your particular situation. Then determine the speed in kilometres per hour (km/hr) at which you intend to spray, taking into consideration the ground conditions of the area to be sprayed.

Using the appropriate chart for your boom, select the most suitable nozzle to use at the normal recommended pressure of 3.0 Bar. The leading digits in the nozzle number indicate whether it is an 80° or 110° fan angle and the last two digits refer to the size of the opening. Nozzles are colour coded for easy identification.

All Silvan booms other than the Fieldmaster are fitted with TP nozzles suitable for a pressure range from 2.0 to 4.0 Bar. The chart below applies to these booms.

The Fieldmaster is fitted with XR "Extended Range" nozzles suitable for a wider range of operating pressures from 1.0 to 4.0 Bar. The chart on the next page applies to these.

For sprayers fitted with a Vineyard boom refer to the calibrating chart supplied with the boom. If necessary obtain this information from your Silvan dealer.

Examples of how to use both charts are given on the next page.

SPRAY NOZZLE SELECTION CHART - TEEJET TF NOZZLES																
FAN TIP COLOUR & NUMBER	FILTER	LIQUID PRESSURE (Bar)	FLOW RATE (L/Min)	APPLICATION RATE: LITRES PER HECTARE												
				6 km/h	8 km/h	10 km/h	12 km/h	14 km/h	16 km/h	18 km/h	20 km/h	22 km/h	24 km/h	26 km/h	28 km/h	30 km/h
GREEN	100	2.0	0.49	98	74	59	49	42	37	33	29	27	25	23	21	20
		2.5	0.55	110	82	66	55	47	41	37	33	30	27	25	23	22
		3.0	0.60	120	90	72	60	51	45	40	36	33	30	28	26	24
		3.5	0.65	130	97	78	65	56	49	43	39	35	32	30	28	26
YELLOW	80	2.0	0.65	131	98	78	65	56	49	44	39	36	33	30	28	26
		2.5	0.73	146	110	88	73	63	55	49	44	40	37	34	31	29
		3.0	0.80	160	120	96	80	69	60	53	48	44	40	37	34	32
		3.5	0.86	173	130	104	86	74	65	58	52	47	43	40	37	35
BLUE	80	2.0	0.98	196	147	118	98	84	74	65	59	53	49	45	42	39
		2.5	1.10	219	164	131	110	94	82	73	66	60	55	51	47	44
		3.0	1.20	240	180	144	120	103	90	80	72	65	60	55	51	48
		3.5	1.30	259	194	156	130	111	97	86	78	71	65	60	56	52
RED	50	2.0	1.31	261	196	157	131	112	98	87	78	71	65	60	56	52
		2.5	1.46	292	219	175	146	125	110	97	88	80	73	67	63	58
		3.0	1.60	320	240	192	160	137	120	107	96	87	80	74	69	64
		3.5	1.73	346	259	207	173	148	130	115	104	94	86	80	74	69
BROWN	50	2.0	1.63	326	245	196	163	140	122	109	98	89	82	75	70	65
		2.5	1.82	364	273	218	182	156	137	121	109	99	91	84	78	73
		3.0	2.00	400	300	240	200	171	150	133	120	109	100	92	86	80
		3.5	2.16	432	324	259	216	185	162	144	130	118	108	100	93	86
GREY	50	2.0	1.96	392	294	235	196	168	147	131	118	107	98	90	84	78
		2.5	2.19	438	329	263	219	188	164	146	131	120	110	101	94	88
		3.0	2.40	480	360	288	240	206	180	160	144	131	120	111	103	96
		3.5	2.59	518	389	311	259	222	194	173	156	141	130	120	111	104
WHITE	50	2.0	2.61	522	392	313	261	224	196	174	157	142	131	120	112	104
		2.5	2.92	584	438	350	292	250	219	195	175	159	146	135	125	117
		3.0	3.20	640	480	384	320	274	240	213	192	175	160	148	137	128
		3.5	3.46	692	519	415	346	297	260	231	208	189	173	160	148	138
		4.0	3.70	740	555	444	370	317	278	247	222	202	185	171	159	148

Calibrating the Sprayer

Using the Calibration Charts

For example, a rate of 96 l/ha can be achieved at a ground speed of 10 km/hr using 3.0 Bar pressure with either an TP8002 or TP11002 yellow nozzle - refer to the TP nozzle selection chart on the previous page. An almost identical rate of 95 l/ha can be achieved at the same speed and pressure with an XR8002, XR11002 refer to the nozzle chart below. Of course the spray boom will have to be set to a different height depending on whether an 80° or 110° nozzle is chosen.

If the exact application rate does not appear in the chart it can be achieved by slightly adjusting the speed or pressure. For example, if a rate of 100 l/ha is required rather than 96 l/ha (or 95 l/ha), it can be achieved with the same yellow nozzles by reducing the speed to 9.5 km/hr or increasing pressure to approximately 3.2 Bar.

Alternatively, the same rate of 100 l/ha could also be achieved with a larger nozzle and faster operating speed. By referring to the TP nozzle chart on the previous page it can be seen that a TP8003 or TP1103 blue nozzle will give this rate at a little under 14 km/hr and 3.0 Bar (the rate shown on the chart at 14 km/hr is 103 l/ha). Similarly an XR8003, XR11003 blue nozzle will also give 100 l/ha at a little under 14 km/hr and pressure of 3.0 Bar (the rate shown on the chart below at 14 km/hr is 101 l/ha.)

It can thus be seen that a variety of choices exist for most application rates and the final selection of nozzle, speed and pressure will depend upon the factors which best suit your conditions.

Always perform a calibration check to confirm your nozzle selection, as described on page 12.

SPRAY NOZZLE SELECTION CHART TEEJET XR NOZZLES													
FAN TIP COLOUR & NUMBER	FILTER	LIQUID PRESSURE (Bar)	CAPACITY (L/Min)	APPLICATION RATE: LITRES PER HECTARE									
				6 km/h	8 km/h	10 km/h	12 km/h	14 km/h	16 km/h	18 km/h	20 km/h	22 km/h	24 km/h
ORANGE XR8001 XR11001	100 MESH	1.0	0.23	46	35	28	23	20	17	15	14	13	12
		1.5	0.28	56	42	34	28	24	21	19	17	15	14
		2.0	0.32	64	48	38	32	27	24	21	19	17	16
		3.0	0.39	78	59	47	39	33	29	26	23	21	20
		4.0	0.46	92	69	55	46	39	35	31	28	25	23
GREEN XR80015 XR110015	100 MESH	1.0	0.34	68	51	41	34	29	26	23	20	19	17
		1.5	0.42	84	63	50	42	36	32	28	25	23	21
		2.0	0.48	96	72	58	48	41	36	32	29	26	24
		3.0	0.59	118	89	71	59	51	44	39	35	32	30
		4.0	0.68	136	102	82	68	58	51	45	41	37	34
YELLOW XR8002 XR11002	50 MESH	1.0	0.46	92	69	55	46	39	35	31	28	25	23
		1.5	0.56	112	84	67	56	48	42	37	34	31	28
		2.0	0.64	128	96	77	64	55	48	43	38	35	32
		3.0	0.79	158	119	95	79	68	59	53	47	43	40
		4.0	0.91	182	137	109	91	78	68	61	55	50	46
BLUE XR8003 XR11003	50 MESH	1.0	0.68	136	102	82	68	58	51	45	41	37	34
		1.5	0.84	168	126	101	84	72	63	56	50	46	42
		2.0	0.97	194	146	116	97	83	73	65	58	53	49
		3.0	1.18	236	177	142	118	101	89	79	71	64	59
		4.0	1.37	274	206	164	137	117	103	91	82	75	69
RED XR8004 XR11004	50 MESH	1.0	0.91	182	137	109	91	78	68	61	55	50	46
		1.5	1.12	224	168	134	112	96	84	75	67	61	56
		2.0	1.29	258	194	155	129	111	97	86	77	70	65
		3.0	1.58	316	237	190	158	135	119	105	95	86	79
		4.0	1.82	364	273	218	182	156	137	121	109	99	91
BROWN XR8005 XR11005	50 MESH	1.0	1.14	228	171	137	114	98	86	76	68	62	57
		1.5	1.40	280	210	168	140	120	105	93	84	76	70
		2.0	1.61	322	242	193	161	138	121	107	97	88	81
		3.0	1.97	394	296	236	197	169	148	131	118	107	99
		4.0	2.28	456	342	274	228	195	171	152	137	124	114
GREY XR8006 XR11006	50 MESH	1.0	1.37	274	206	164	137	117	103	91	82	75	69
		1.5	1.67	334	251	200	167	143	125	111	100	91	84
		2.0	1.93	386	290	232	193	165	145	129	116	105	97
		3.0	2.37	474	356	284	237	203	178	158	142	129	119
		4.0	2.74	548	411	329	274	235	206	183	164	149	137

Before carrying out any maintenance

▲ Disconnect the tractor PTO and ensure the sprayer is adequately supported before performing any operation on the sprayer.

AFTER EVERY TANK

Oil Condition

The condition of oil should be frequently checked (eg. each time the tank is filled) as it effects the operation of the pump and the condition and life of the diaphragm. If the oil becomes white (water present in oil), it may be a symptom of failure of one or more diaphragms. It is necessary to **stop work** and inspect the condition of the diaphragms. If broken, it is necessary to replace the complete set.

Continued use with water in the oil will cause serious damage to internal parts of the pump.

If it is not possible to replace broken diaphragms within one day of failure, empty the crankcase of water and pour in oil to stop rust from forming on the internal components.

Oil Level

When the pump is stationary, the oil level must correspond to the reference indicator found on the oil sight glass (fig 2) or oil level cap (fig 1) depending on the type of pump. The oil level may vary when the diaphragm pump is working: As the pump is started, the oil level will initially drop and then return to functioning level when the liquid begins to pump.

During operation, pay attention to any drop in the oil level:

- If this happens during the first few hours of operation it is normal and it is sufficient to top up with SAE 20W/40 type oil.
- If this happens after many hours of operation and continues after 1 or 2 top

ups, it is a symptom of diaphragm swelling caused by restricted suction (dirty filter, collapsed suction hose or chemical attack to diaphragm). In this case check the filter and suction system and/or refer to your Silvan dealer to check the diaphragm.

Filters

Always clean the suction filter before each tank refill (especially if powder based products are used) and at the end of the day. Close the stop valve by pushing the cap in and turning it in the direction indicated on the cap out, then unscrew the filter cover to remove the filter element - refer diagram in Operation section. Ensure the 'O' ring is in good condition when refitting.

Re-assemble in reverse order

Check and if necessary clean the basket strainer under the tank lid before each fill.

DAILY MAINTENANCE

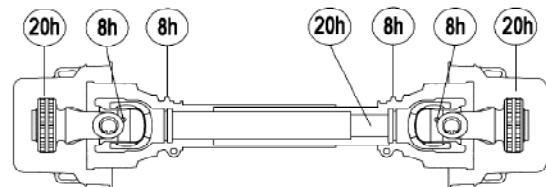
General

During the first few days of operation, before starting each day check that all hardware is tight and inspect the unit for leaks while running and tighten all hose clamps.

PTO Shaft

For safety considerations, it is **very important** to inspect the condition of the PTO guard and chains daily and to maintain as necessary.

Grease the PTO shaft and guard with multi-purpose grease at the time intervals shown below. This is the amount of lubrication recommended for normal operation. More frequent inspection and lubrication may be needed under very dusty conditions.



Remove the shaft from the tractor and sprayer, slide the PTO shaft apart, clean the telescopic tubes and female ends with kerosene and apply multi-purpose grease to the sliding surfaces, then reassemble. This is most important in dusty conditions.



Maintenance

Filters

Clean all filters daily. More frequent cleaning may be found necessary depending upon circumstances. The best method for cleaning filters is to wash them with a soft bristle brush. Check for any tears or holes and replace if damaged.

Pump Mounting

Check daily, especially when there is vibration during use that the pump mounting bolts on the machine frame are tight and if necessary re-tighten.

Tank and Spray Lines

At the end of each day run clean water through the pump and lines to purge them of chemicals. Rinse out the tank to remove powdered material.

Never leave chemicals in the tank that may settle to the bottom, harden and break into lumps as this may block the suction filter.

Freezing Conditions

If frosts or freezing conditions are likely to occur then drain all water from the pump to ensure the pump is not damaged by freezing water expanding inside the pump.

EVERY 50 HOURS

Diaphragm Pump

Check the inflation of the pressure accumulator, if fitted, according to Table A (in the operations section of this manual) especially if there are vibrations on the delivery hose and/or the pressure gauge.

Pressure Regulator

Grease rotating and sliding parts.

Plumbing

The suction system must be inspected to ensure:

1. There are no suction air leaks. Check for entry of air caused by:
 - entry of air caused by hose wear;
 - loose fittings;
 - worn joints;
2. There are no small leaks or drips on the suction side of the pump when it is stationary. If this occurs it means air will enter the pump when in operation.

3. There are no leaks around all hoses and fittings.

Hardware

Check all bolts are tight. Refer to Silvan Torque setting chart available from Silvan Technical Support Dept.

EVERY 300 HOURS

Diaphragm Pump

Every 300 hours (or more often if sandy or abrasive liquids are used) change the oil and the diaphragms in the pump and inspect the mechanical condition of the components. This must be carried out by an authorized Silvan dealer.

Pressure Regulator

Check the pressure adjustment valve.

PTO Shaft and Guard

Check the shaft and guard for wear and if necessary have it repaired by an authorized Silvan Dealer.

ANNUALLY

Diaphragm Pump

Check diaphragms and replace if necessary.
Replace the oil.

Pressure Regulator

Check and replace the inner diaphragm where required and check screws are tight.

Hardware

At the end of each season, generally inspect the sprayer for any signs of damage and check that all bolts are securely tightened.

Storage in cold areas

The pump is not frost proof therefore it is recommended that motor grade anti-freeze (diluted to the recommended proportions) be pumped through the system for 2 minutes. The system should then be drained by operating the pump for a further 2 minutes without taking up any liquid.

TROUBLE SHOOTING

Pump does not prime

- No liquid in tank or not covering suction inlet.
- Suction filter blocked.
- Suction filter stop valve closed.
- Suction filter bowl loose or missing O-ring.
- Suction line loose allowing pump to suck air.
- Control lever not in by-pass position.
- Pump valve springs broken or valves worn.

Pump does not reach correct pressure

- Pump not operating at full 540 rpm.
- Suction filter blocked.
- Suction filter stop valve partly closed
- Pressure regulator not correctly adjusted
- Pressure regulator valve and seats worn.
- Pressure gauge faulty
- Pump diaphragms ruptured (pump oil grey or milky).
- Worn nozzles or capacity of nozzles greater than capacity of the pump.
- Worn pump inlet / outlet valves

Pump and hoses vibrating.

- Pump surge chamber pressure incorrectly adjusted or surge diaphragm ruptured.
- Air entering the suction line through loose or damaged fittings.
- Pump valves or valve springs worn or damaged.
- Worn nozzles or capacity of nozzles greater than capacity of the pump.
- Air trapped in filter or suction lines.

Water in oil (oil is a whitish grey colour)

- Broken diaphragms.

Pressure regulator valve vibrates

- Worn adjustment plate seat

Pressure regulator leaking water

- Loose screws
- Damaged diaphragm in regulator

