SILVAN AUSTRALIA

SILVAN AUSTRALIA PTY. LTD.

ABN 48 099 851 144

Head Office

244 -264 Greens Road,

Dandenong, 3175

Victoria, Australia

Telephone: 1300 745 826

Facsimile: 1800 745 826

www.silvan.com.au

1000L NARROW

MAN1000N

13/11/13 **REVISION A**

YOUR SPRAYER DETAILS

Record the details of your 1000L Supaflo sprayer here for future reference when discussing service with your Silvan dealer, ordering service parts or making a warranty claim.

SERIAL NUMBER _____

PUMP MODEL _____

DATE OF DELIVERY _____

SELLING DEALER _____

ADDRESS _____

TELEPHONE NO. _____

INSTALLED BY _____

FLOW CONSTANT _____

WHEEL CONSTANT _____

NOTES

SILVAN 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 recommend-ed 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 warranty policy below explains the extent and limitations of your Warranty coverage on Silvan Products.

Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and for compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

We warrant our goods to be free from defects in materials and workmanship for the warranty period of 12 months from the date the product is delivered to the consumer.

Silvan warrants its authorised Dealer, who in turn warrants the original purchaser (consumer) 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 below.

This Warranty is in addition to any other rights and remedies available to consumers under the law.

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 as specified in the Owner/Operator Manual applicable to the product.
- Damage caused by continued use of a product after initial failure
- 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.

How to claim Warranty

Return the goods to the place of purchase at your cost and within the warranty period along with evidence of the purchase date. If the original supplier cannot be contacted then contact Silvan as below and we can direct you on how to proceed with your warranty claim.

How your claim will be managed

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 depending on the extent of the problem at the discretion of Silvan and the Silvan dealer.

Silvan Australia Pty Ltd
264 -266 Greens Rd
Dandenong Sth
Victoria 3164
1300 SILVAN (745 826)
support@silvanaust.com

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TROUBLESHOOTING

Diaphragm Pump does not prime

- No liquid in tank or insufficient to cover suction inlet.
- Suction filter blocked.
- Suction filter bowl loose or missing O-ring.
- Suction line loose allowing pump to suck air.
- Pump not in by-pass mode. Turn Master switch off.
- Pump valve springs broken or valves worn.

Diaphragm Pump does not reach correct pressure

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

Diaphragm 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.

Fan noisy and/or vibrating

- Gearbox bearings worn.
- Fan damaged or out of balance
- Tractor PTO incorrectly installed.
- Hitch point and PTO geometry not correct.

Driveshaft noisy

- PTO shaft not secured properly to shafts. Ensure locking pins engaged in the grooves.
- Universal joint crosses worn.
- Hitch point and PTO geometry not correct.

Air stream reduced

- Fan gearbox lever in neutral or low position.
- Not operating at full speed of 540 rpm.
- Fan mesh blocked with leaves or debris.

Poor tank agitation

- Chemical left in tank whilst not operating.
- Chemical incorrectly mixed before filling.

LUBRICATION & MAINTENANCE

The maintenance decals should be kept clean and legible at all times. If any are missing or unreadable they should be replaced by ordering new decals from your Silvan dealer under the part numbers shown.

WARNING

The locations and wording of the maintenance decals are shown below.

It is important that all operators read and follow the information given on all maintenance decals.

INTRODUCTION

Silvan Australia Pty. Ltd. is an Australian owned company specialising in the 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. At Silvan we are extremely proud of our reputation for quality products backed by quality service. Your investment in a Silvan sprayer is an investment in quality.

This manual covers the 1000 litre Supaflo air assist sprayers which are designed for efficient spraying in vineyards, berries and tomatoes by means of a highly efficient axial flow fan. The sprayer incorporates 12 flip-over twin jet spray nozzles to facilitate easy changing of the application rate and the spray pattern.

The main spraying system uses a PTO driven diaphragm pump to supply high pressure chemical solution to the spray nozzles where it is atomised. The air flow from the fan then takes the spray mixture into the canopy. An optional automatic spray rate controller can be fitted to provide a consistent chemical application rate and to monitor a number of operating functions.

The 1000L Supaflo sprayer is designed and manufactured to provide a high standard of performance and safety and incorporates 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 sprayer's operation, maintenance and safety procedures.

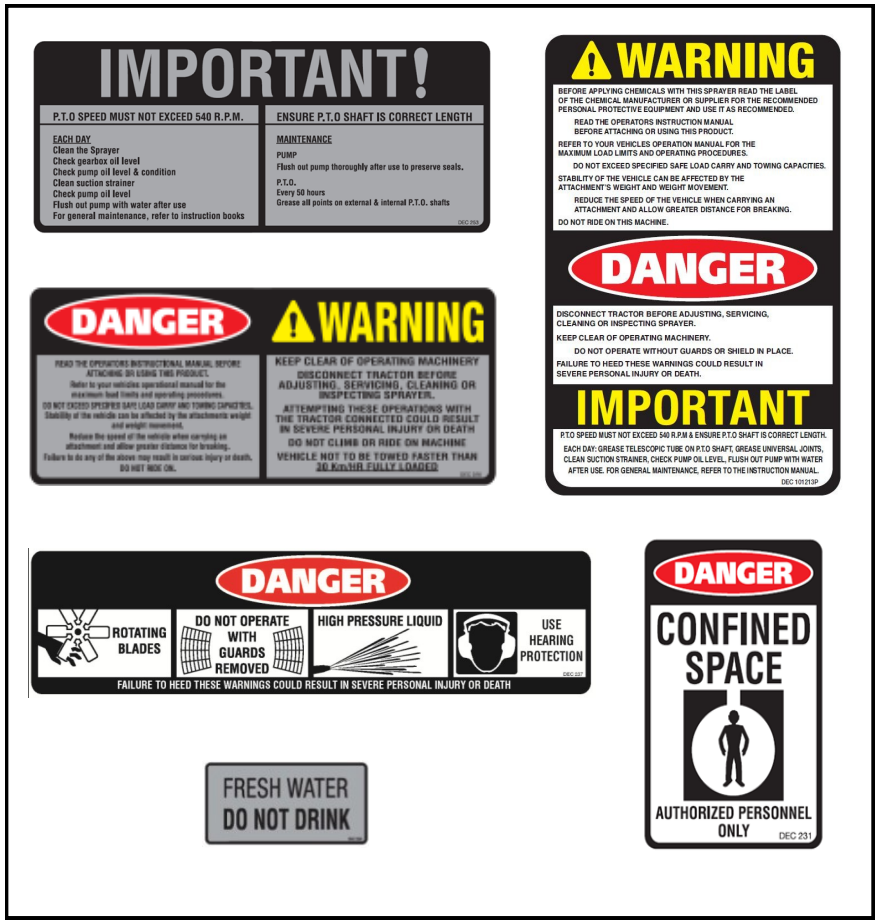
Now that you are a proud Silvan owner, all our services and dealer support are available to you should you need them. We assure you of our best attention at all times.

SAFETY INFORMATION

The wording of the safety decals are shown below and the locations are shown on the next page.

It is important that all operators read and follow the information given on all safety decals.

The safety decals should be kept clean and legible at all times. If any are missing or unreadable they should be replaced by ordering new decals from your Silvan dealer under the part numbers shown.



LUBRICATION & MAINTENANCE

- The grease fittings of the four universal joints can be reached through holes in the plastic joint covers.
- The telescoping sections of the internal PTO shafts do not require regular greasing as the shaft length is constant and the sections do not slide in operation. Check that the shaft is free to slide during annual inspection (350 hours).
- Ensure that the lubrication points on PTO protection covers of all shafts are also greased at 50 hr intervals. Failure to do this will result in premature wear of the cover bearing rings.

Gearbox

Check the oil level when the sprayer is started for the first time and then every 50 hours. If required drain the gearbox and fill with 3.5 litres of SAE 85W-140 gear oil. Keep the breather clean.

Tyres

Inspect regularly for wear and damage.

Recommended inflation pressures are:

Model	Inflation (Bar)	Inflation (psi)
1000 litre single axle	2.4 Bar	35psi

Wheel Hubs

- Remove the wheel hubs annually and check that the bearings are in good condition and adequately greased. Repack with multi-purpose grease as required.
- Adjust the wheel bearings by tightening the axle nut, then back it off by approximately 1/6 turn before installing a new cotter pin. Check that the hubs are free to rotate without any end-play.

Annual Inspection

At the end of each season or every 350 hours inspect the sprayer for any signs of damage, corrosion or leakage. Replace any parts that are affected by chemical contamination. Check that all bolts are securely tightened and that all hose connections are tight.

LUBRICATION & MAINTENANCE

Diaphragm Pump

Check the oil level in the reservoir of the pump every day, before starting the sprayer. The oil should be level with the mark on the reservoir. If necessary, top up with SAE 20W-40 multi-grade engine oil. Ensure that the 'O' ring is fitted before replacing the reservoir cover.

Diaphragm Pump Annual Maintenance

- Drain the oil from the pump annually, or at the end of each spraying season and refill with above oil.
- Remove the pump heads, carefully inspect the diaphragms and replace if necessary. Check the inlet and outlet valves, seats and springs for wear or chemical corrosion and replace as necessary.
- Check the air pressure in the surge chamber at the side of the pump. The air pressure behind the surge chamber's diaphragm smooths out the pulsations in fluid flow and should be set in accordance with the spraying pressure being used, as shown in the chart below.
- Adjust the pressure at the valve fitting on the chamber using a compressed air hose fitted with a tyre valve connection and pressure gauge.
- Refer to the pump instruction manual for further details on the above maintenance operations.

Spraying Pressure	**BAR**	2-5	5-10	10-20	20-50
	PSI	29-73	73-145	145-290	290-725
Surge Air Pressure	**BAR**	2	2-5	5-7	7
	PSI	29	29-73	73-102	102

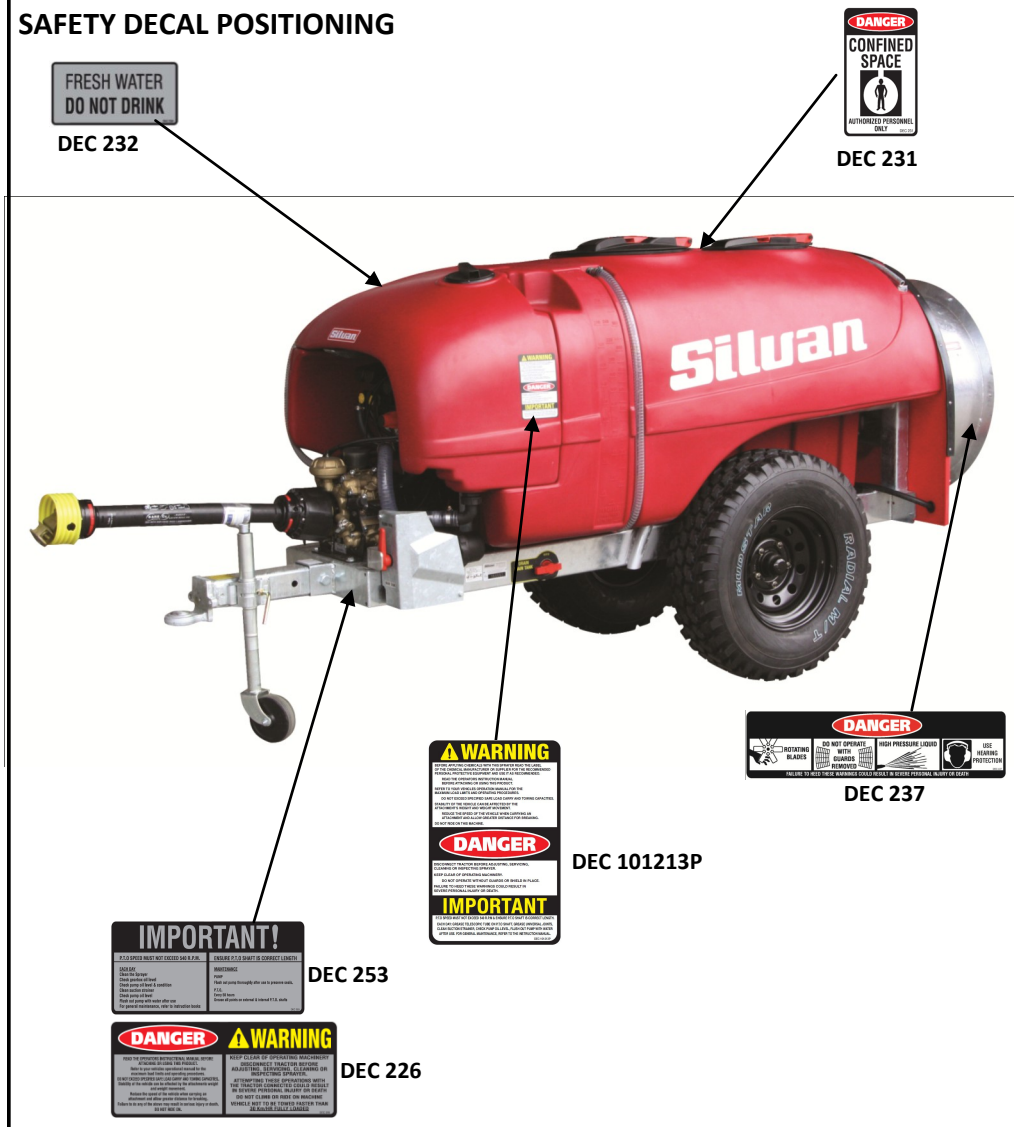
Fan PTO Drive System

Before lubricating any shafts on the sprayer ensure that the tractor is disconnected or shut down to avoid accidental activation of the PTO shafts.

- The drive system to the fan consists of a PTO shaft connected from the diaphragm pump to the fan gearbox. Grease points on the pump end of the internal shaft are accessible from the top and behind the pump.
- The universal joints and bearing housings of the fan drive system should be lubricated with multi-purpose grease. Grease the universals every 50 hours and the bearing housings every 50 hours. It will be necessary to use a grease gun with a flexible hose to reach the grease fittings

SAFETY INFORMATION

SAFETY DECAL POSITIONING



SAFETY INFORMATION

Whilst your sprayer has been designed and manufactured to incorporate all necessary safety features it is essential that any person who operates or works on the machine is aware of the safety precautions that should be exercised.

- 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 the machine. Refer to the next page for the location and 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.
- Only operate the sprayer on a tractor fitted with a roll-over protective structure (ROPS), or a cab incorporating a ROPS, complying with AS1636 or equivalent.
- Wear ear protection when operating the sprayer on a tractor that is not fitted with a sound proofed cabin.
- Ensure the PTO power output and towing capacity of the tractor match the power requirement and loaded mass of the sprayer, as stated in the Specifications section of this manual. 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 proper stability. Refer also to the tractor manufacturer's operating- and safety instructions.
- Do not operate the sprayer without all the tractor and sprayer safety shields in place. Carefully check that the PTO and driveline shields are correctly installed.
- Never allow anyone to ride on the sprayer or tractor.
- Do not operate at more than 540 PTO rpm.
- Avoid standing on the tyres or tank to fill tanks through the top. The cam lock fill connections are recommended for the main tank.
- The flush and hand wash tanks are filled through the tank cap. See Operation section for details.

LUBRICATION & MAINTENANCE

Before carrying out any lubrication or maintenance, apply the tractor parking brake, switch off the engine and remove the key. Ensure the sprayer is properly supported and restrained before performing any maintenance work. Do not support the sprayer by the jack when the tank is full of liquid.

Start-up Inspection

During the first few days of operation, before starting each day check that all hardware is tight, in particular the wheel nuts. Inspect for any leaks whilst running and tighten all hose fittings.

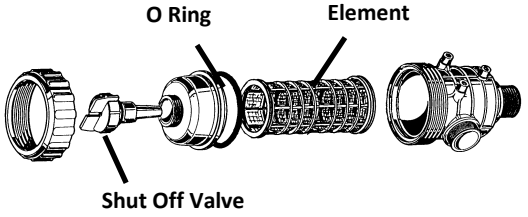
Tank and Spray Lines

- At the end of each day drain the tank and use the tank rinse nozzle to wash powdered chemicals from the inside of the tank and to run clean water from the flush tank through the system to purge it of chemicals. Refer to the Operation section for details.
- Never leave chemicals in the tank that may settle to the bottom, harden and break into lumps as this may block the suction filter. Refer to the Operation section for information on draining the tank and flushing the system.
- Dispose of unused chemicals, chemical mix, rinse water and chemical containers as recommended by the chemical manufacturer or the relevant government authority

Do not use a high pressure washer to clean around fan bearings, pump seals or electrical valves.

Suction Filters

Clean the PTO pump suction filter after each tank of chemicals is emptied and at the end of each day after flushing the system. Before removing the elements turn the shut-off valve to the off position to prevent fluid draining from the tank. Refer to the Operation section for further information. 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.



SUCTION FILTER COMPONENTS

OPTIONAL EQUIPMENT

- Connect the power supply cable directly to the 12 volt tractor battery. The method of connection and the positive and negative cable colours are shown in the Bravo manual.
- After connecting to the battery connect the power loom to the controller.
- The controller incorporates an overload switch that can be automatically reset if it trips out. Refer to the Bravo manual for details.
- Run the controller wiring loom back to the sprayer through a convenient outlet in the tractor cabin, ensuring that it does not rub on any sharp edges. Fit a rubber grommet if necessary to protect the loom from damage.
- Connect the controller loom to the sprayer loom at the quick release coupling and ensure that all wiring is clear of the PTO shaft and tractor wheels.
- Do not switch the power on at the controller until the installation is complete and the controller manual has been read and is fully understood.

Operating with Computerised Controller

- Other than the method of setting the application rate and the various functions to be monitored by the controller, the procedure for operating the sprayer is as described in the Operation section of this manual.
- The instructions given in the Operation section for starting the sprayer for the first time and starting for regular operation will differ slightly due to the different controller.

SAFETY INFORMATION

- Do not stand on the tank or fan housing. Use a step ladder.
- Before use of any chemicals refer to the chemical manufacturer's label and safety instructions-for safe handling procedures, correct method of use and required protective clothing and equipment. Always use the recommended personal protective clothing and equipment.
- Always wear gloves when carrying out any adjustments to the sprayer.
- Ensure that all operators and associated personnel are familiar with the legal regulations and codes of practice that apply to the safe use, storage and disposal of spray chemicals
- Apply the parking brake, switch off the tractor engine and remove the key before performing any service work on the sprayer. Ensure the sprayer is properly supported and restrained before performing maintenance work. Do not support the sprayer on the jack with full tanks.
- Do not stand near or perform adjustments on the fan or spray nozzles without first stopping the tractor engine and removing the key to ensure the sprayer can not inadvertently be started.
- Relieve all hydraulic pressure before disconnecting hoses. Oil escaping under pressure can penetrate the skin, causing serious injury. Seek medical advice immediately if injured by escaping oil.
- Do not enter the sprayer tank under any circumstances. If service to the tank is required contact Silvan for correct maintenance procedures.

CONNECTING TO THE TRACTOR

Hitching to the Tractor

- Attach the sprayer hitch to the tractor drawbar using the hitch pin supplied with the tractor. Make the connection on a level surface with the sprayer tanks empty.
- Use the sprayer jack to adjust the height of the hitch to match the tractor drawbar then back the tractor into position. Install the hitch pin and secure it with its locking pin.
- Lower the jack by winding the handle to transfer the weight of the sprayer onto the tractor. Wind the jack up fully, remove the attaching pin and install the jack on the transport bracket on the side of the sprayer drawbar using the attaching pin to secure it.
- Always fit the jack in the transport position when towing the sprayer.
- When connected, the sprayer frame should be level.

The height difference between the PTO joints should not be more than about 10cm. To achieve this it may be necessary to adjust the height of the tractor and/or sprayer drawbar.

The sprayer drawbar height can be adjusted using the "Adjusting Hitch Height and Length" procedure outlined below.

To unhitch the sprayer from the tractor, reverse the above procedure.

Adjusting the Hitch Height and Length

The hitch can be installed in the low position, or by turning it over it can be installed in the high position with the tow hitch uppermost.

- To reverse the hitch, support the weight of the sprayer under the front of the chassis and disconnect it from the tractor. Remove the bolt attaching the hitch, turn it over and reinstall the bolt.
- Tighten the bolt securely then refit the sprayer to the tractor and check the level of the frame.
- To lengthen/shorten the hitch support the weight of the sprayer under the front of the chassis and disconnect it from the tractor, remove the bolt attaching the hitch, lengthen or shorten it to the appropriate hole and reinstall the bolt.
- Tighten the bolt securely then refit the sprayer to the tractor and check the length of the hitch in relation to the tractor.

OPTIONAL EQUIPMENT

Bravo 180 Spray Controller

The standard electric controller is replaced with an Arag Bravo 180 unit incorporating a computer that controls and monitors the spraying functions and maintains a constant application rate as speed varies. A flow meter is fitted in the electric valve block and a speed sensor is fitted to one of the sprayer wheels. The application rate and various calibration parameters are set at the cabin control unit.

When operating in automatic mode the flow meter measures the volume of liquid flowing to the section valves and the wheel sensor detects the speed of travel. Using this information and the required application rate the control unit adjusts the pressure regulator as needed to maintain a constant rate.

The digital display shows the application rate continuously plus one other function selected from those monitored by the controller. These include:-

- Travel speed
- Flow rate
- Area covered
- Volume sprayed
- Remaining tank volume
- Time

The controller can be operated in automatic or manual mode. Refer to the manual provided with the controller for full operating instructions.

Installing the Computerised Cabin Control Unit

Before installing the control unit in the cabin read the Bravo 180 manual thoroughly.

Use the bracket and hardware provided to install the control unit in a suitably protected position within the cabin where it will be easily seen and within convenient reach. Follow the installation precautions given in the Bravo 180 manual. All switches should be off whilst installing and do not connect the power cable until the installation is complete.

After connecting to the battery connect the power loom to the controller.

OPERATION

Calibration Worksheet

This worksheet below can be used to record the results of calibration tests on your sprayer:

Date of Test: _____

Application Rate: _____ **litres/ha**

Speed of Travel: _____ **km/hr**

Row Spacing: _____ **metres**

$$\text{Output (l/min)} = \frac{\text{Application Rate (l/ha) x Speed (km/h) x Row Width (m)}}{\text{600 x no. of nozzles}}$$

$$\text{Output (l/min)} = \frac{\qquad}{\text{600 x}}$$

Output per nozzle: _____ **litres/min**

Nozzle : _____

Pressure Setting: _____ **Bar**

Measured Output: _____ **litres/min**

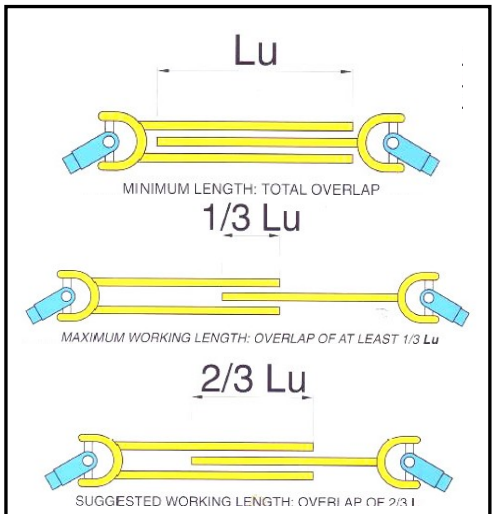
CONNECTING TO THE TRACTOR

Connecting the PTO Shaft

Upon delivery of a new sprayer it is the selling dealer's responsibility to install and set the PTO shaft to the correct length.

The following information is provided for reference. The telescoping tubes must overlap by at least 1/3 their length, but not less than 150mm, in all operating positions and there must be at least 25mm telescopic movement remaining at the minimum operating length, refer diagram. If the PTO shaft has to be shortened, cut equal amounts from both male and female shafts and safety covers.

Carefully remove all burrs then clean and relubricate before reassembling



PTO SHAFT LENGTH

To Fit The PTO Shaft

Clean and grease the splines on the tractor and sprayer PTO stub shafts and install the PTO shaft. The PTO shaft is fitted with self locking pin yokes. To fit the PTO onto the sprayer pump spline push the locking pin on the PTO yoke and align the splines and push the yoke firmly onto the spline shaft until the spring loaded pin positively engage into the grooves of the stub shaft. Check that the yoke is engaged by ensuring it does not move in either direction along the shaft. Repeat this sequence for the tractor end and then double check that both ends of the PTO shaft are positively engaged. Attach the chain on the PTO shaft to a fixed point on the tractor and the chain on the implement end to the position provided on the pump PTO guard.

After fitting the shaft ensure that the tractor PTO guard is fitted to the tractor.

FEATURES & SPECIFICATIONS

Tank

- Capacity 1000 litres
- Polytuff impact resistant, UV stabilised polyethylene.
- Dual screw down lockable lids
- Three position ball valve to draw fluid from main or flush tanks.
- Tank drain via separate ball valve
- Dual liquid level sightline, one visible from tractor.

Agitation

- Bypass and venturi agitation when spraying and when filling tank.

Flushing

- 80 litre Polytuff flush tank filled through cap.

Hand Washing Tank

- 15 litre Polytuff tank filled through cap (front).
- Discharge tap is fitted to bottom of the tank.

Pumps

- Spraying System - PTO Driven Pump
- Comet positive displacement oil backed nitrile diaphragm pump with corrosion resistant cast aluminium body direct coupled to shielded constant velocity (wide angle) PTO shaft.

Pump Model No.	
IDS960	IDS1401
Max flow (l/min)	
93	135
at 540 PTO rpm: Max pressure (kPa)	
5000	5000

Fan and Drive

- 700 mm diameter 8 blade axial flow fan with curved, nylon reinforced, adjustable pitch blades.
- 6 flip-over twin jet brass nozzles per side.
- Each nozzle includes one HCC ceramic jet per side.
- Stainless steel spray lines.
- PTO driven through single speed oil bath gearbox with neutral position.
- Wire mesh safety screen over fan

Spraying Controls

- Cab-mounted control box with master on/off switch, left/right section controls and pressure regulating switch.
- Manual pressure regulator on valve bank.
- 100mm dia. 60 Bar pressure gauge on PTO pump.
- Regulator, dump valve and section valves

Filtration

- Suction filter on pump - 50 mesh (blue)

Chassis and Wheels

- Heavy duty galvanised steel chassis.
- Adjustable height hitch.
- Removable jack with transport holder.
- Tyres rated at 30 kph road speed fully laden
- Duraflex single axle: 10 x 15'
- Tyre Pressure: 245 kPa (35 psi)

Optional Equipment

OPERATION

Calibration Example

STEP 1 Operating Factors

a) Required application rate	= 500 L/ha
b) Chosen speed	= 5 km/hr
c) Spraying width	= 2.5 m
d) No. nozzles operating	= 12
e) Spraying pressure	= 11 Bar

STEP 2 Output

This results in an output per spray nozzle of **0.87** L/min.

STEP 3 Nozzle selection and spraying pressure

From the HCC Nozzle Output Chart on the previous page find the setting that will give the output closest to 0.87 l/min. It can be seen that a brown HCC01 nozzle at a pressure slightly above 14 Bar will give the required rate.

$$\text{Output (l/min)} = \frac{\text{Application Rate (l/ha) x Speed (km/h) x Row Width (m)}}{\text{600 x No. of outlets operating}}$$

$$= \frac{\text{500 x 5 x 2.5}}{\text{600 x 12}}$$

STEP 4 Verify the Selection

- Install the selected jets on either side of the conveyor and conduct a test with water to verify the actual output, as described on page 32.
- Correct any small variation by adjusting the pressure
- Required Total Output from Step 2 = 10.4 l/min

Output from one side of conveyor = 10.4 / 2 = 5.2 l/min

OPERATION

STEP 4 Calibration Checking

- After installing the selected nozzles, test the sprayer with water to confirm the application rate.
- Fill the tank to the brim or a specific mark then run the sprayer for a measured time at operating pressure and with nozzles spraying. A run time of two minutes should be sufficient.
- Access the tank top lid using a step ladder and measure the volume of water, in litres, required to refill the sprayer to the brim or chosen mark then divide this volume by the time of the test run, in minutes.

$$\text{Output (l/min)} = \frac{\text{Volume to refill (litres)}}{\text{Time (min)}}$$

The chart below is used to select the HCC nozzles to use in each individual nozzle. For the method of using the chart refer to the procedure in Step 3 a) and b) and the Jet Selection Examples on the following pages:

COD.	q (l/min)																	
	3 bar	4 bar	5 bar	6 bar	7 bar	8 bar	9 bar	10 bar	11 bar	12 bar	13 bar	14 bar	15 bar	16 bar	17 bar	18 bar	19 bar	20 bar
HCC005	0.19	0.22	0.25	0.27	0.29	0.31	0.33	0.35	0.36	0.38	0.40	0.41	0.42	0.44	0.45	0.47	0.48	0.49
HCC0075	0.30	0.35	0.39	0.42	0.46	0.49	0.52	0.55	0.57	0.60	0.62	0.65	0.67	0.69	0.71	0.73	0.75	0.77
HCC01	0.40	0.46	0.52	0.57	0.61	0.65	0.69	0.73	0.77	0.80	0.83	0.86	0.89	0.92	0.95	0.98	1.01	1.03
HCC015	0.60	0.69	0.77	0.85	0.92	0.98	1.04	1.10	1.15	1.20	1.25	1.30	1.34	1.39	1.43	1.47	1.51	1.55
HCC02	0.80	0.92	1.03	1.13	1.22	1.31	1.39	1.46	1.53	1.60	1.67	1.73	1.79	1.85	1.90	1.96	2.01	2.07
HCC025	1.00	1.15	1.29	1.41	1.53	1.63	1.73	1.83	1.91	2.00	2.08	2.16	2.24	2.31	2.38	2.45	2.52	2.58
HCC03	1.20	1.39	1.55	1.70	1.83	1.96	2.08	2.19	2.30	2.40	2.50	2.59	2.68	2.77	2.86	2.94	3.02	3.10
HCC035	1.40	1.62	1.81	1.98	2.14	2.29	2.42	2.56	2.68	2.80	2.91	3.02	3.13	3.23	3.33	3.43	3.52	3.61
HCC04	1.60	1.85	2.07	2.26	2.44	2.61	2.77	2.92	3.06	3.20	3.33	3.46	3.58	3.70	3.81	3.92	4.03	4.13
HCC05	2.00	2.31	2.58	2.83	3.06	3.27	3.46	3.65	3.83	4.00	4.16	4.32	4.47	4.62	4.76	4.90	5.03	5.16

FEATURES & SPECIFICATIONS

- Bravo 180 automatic spray rate controller
- Two-sided deflector
- Bottom air deflectors

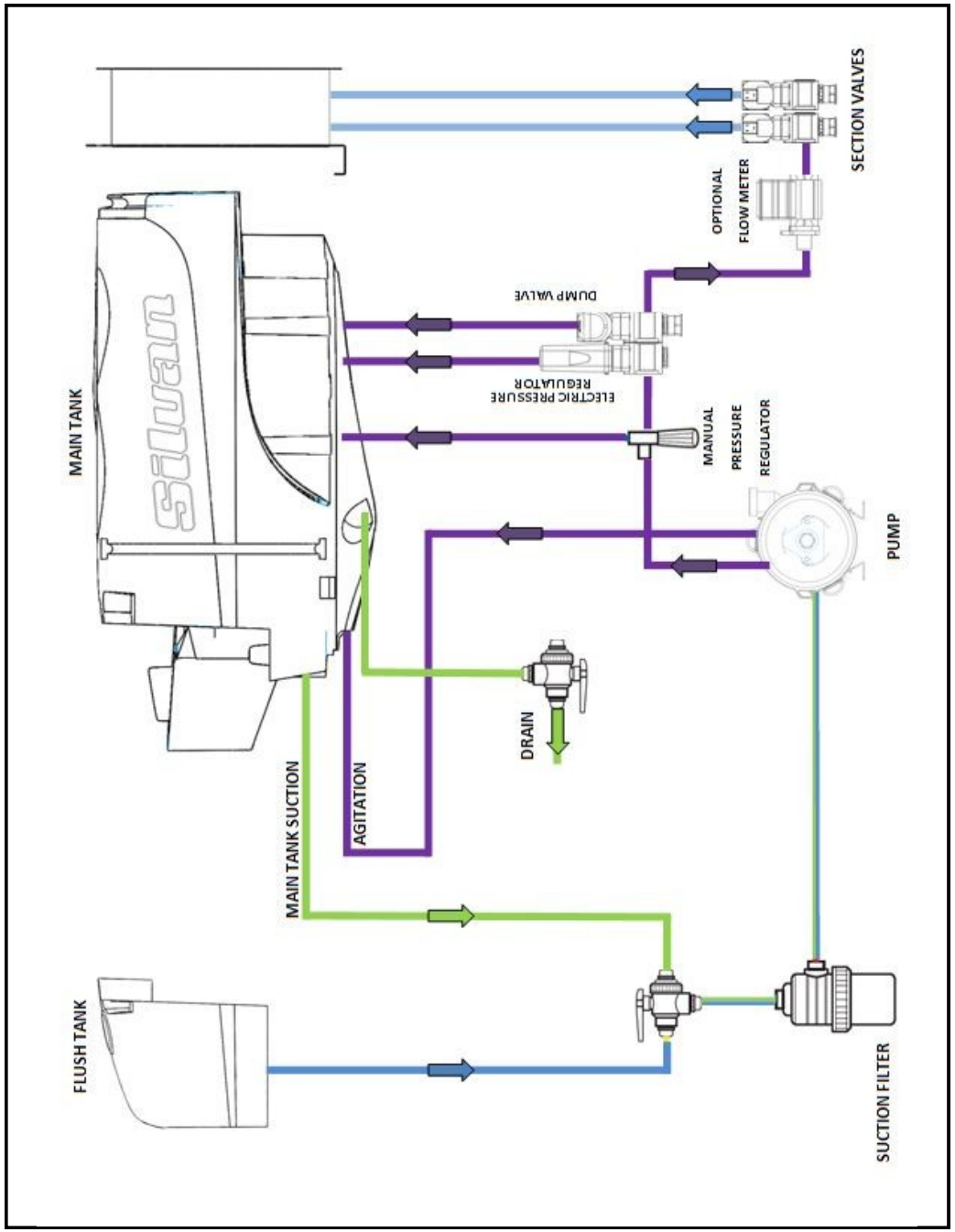
Dimensions and Weights
(with std equipment)

- Mass with tanks empty. To calculate gross weight add 1 kg per litre of water fill.
- Length: 2921mm
- Width: 1100mm
- Height: 1500mm
- Mass (dry): 300 Kg

Tractor Requirement

Minimum recommended power rating at the PTO - 30kW (40 PTO HP).

DESCRIPTION OF FLUID FLOW



OPERATION

STEP 2 Output Required

Calculate the spray output required in litres per minute (l/min) using the following formula.

$$\text{Output (l/min)} = \frac{\text{Application Rate (l/ha) x Speed (km/h) x Row Width (m)}}{600}$$

STEP 3 Nozzle Selection

3a) Uniform Nozzle Output

- For an application where the same volume of spray is required from each nozzle divide the Total Output by the number of nozzles that will be operating on both sides of the sprayer.
- If some nozzles are flipped to the closed position then the number in operation will vary accordingly.
- Use the Single Nozzle Output Charts to select the jet that is the closest match to the required output at the chosen pressure.

3 b) Non-uniform Nozzle Output

- This applies to an application where a different volume of spray is required from the nozzles in each section of the conveyor. The jet for each nozzle can be selected by calculating the requirements for one side of the sprayer, then copying the pattern on the other side.
- Decide on the number of nozzles to be used on one side then halve the total output from Step 2.
- Use the Single Nozzle Output Charts to select the jet that is the closest match to the required output at the chosen pressure at each nozzle position.
- Add up the flow rates of the individual jets to check whether the total output per side matches the required value. Small variations can be corrected by increasing pressure to increase the output or reducing pressure to reduce output.
- Verify that the measured output matches the value calculated at Step 2. For small variations increase the spraying pressure to increase the output or reduce the pressure to reduce the output.

OPERATION

Nozzle Selection and Calibration

Chemical application rates and hence nozzle selections will vary greatly depending on the crop type, stage of crop development and the regional area. Information on application rates should be available from your chemical supplier.

Nozzle selection can be made by following the four simple steps shown on the following page. The final step, checking calibration after nozzle selection, is essential for spraying efficiency by ensuring a known amount of spray is applied per hectare.

STEP 1 Operating Factors

First establish the following factors:

1. Application rate in litres per hectare (l/ha).
2. Travel speed (km/hr) The speed indicated by your tractor can be checked by timing the sprayer over a measured distance. The timing should be done in seconds over 100 metres with the PTO engaged and water in the tank to simulate real spraying conditions. In hilly terrain the sprayer should be timed driving up and down the hill and the two times averaged. The speed can be calculated according to the following formula.

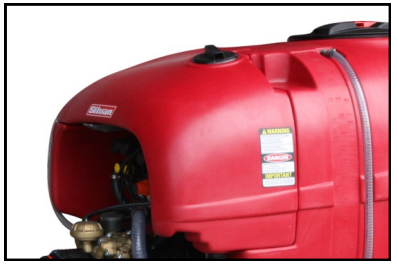
$$\text{Speed (km/h)} = \frac{360}{\text{Time in seconds for 100m}}$$

Note: the spray rate controller will automatically maintain the application rate if the speed alters.

3. Row width (m) The distance between rows measured in metres in one pass.
4. Number of nozzles operating
5. Spray pressure (Bar) The HCC nozzles generally operate between 3 and 20 Bar depending on nozzle size and environmental conditions. Lower spray pressures will produce larger droplets which are generally less effective for leaf coverage than the smaller droplets produced at higher pressures.

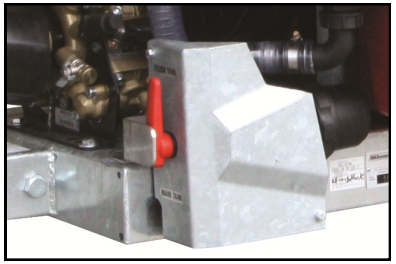
DESCRIPTION OF FLUID FLOW

The schematic diagram on the previous page shows the fluid flow for the standard version of the 1000L Supaflo sprayer. The main tank can be filled through one of the tank lids.



The level of liquid in the main tank is shown by either the front or side sightlines on the sprayer. The flush tank can be filled through the threaded cap. To use the flush tank to clean the pump, filters, spray lines and nozzles the suction valve is turned to Flush Tank and the sprayer is operated as outlined in following pages.

To operate the sprayer the suction valve is turned to the Main Tank position. Chemical solution is drawn from the tank sumps through the suction line to the inlet side of the PTO driven diaphragm pump. A filter in the suction line prevents foreign material entering the pump. The filter incorporates a replaceable element which can be cleaned when the integrated shut off valve in the filter body is closed.



The manual pressure regulator on the discharge side of the pump is used to set the system maximum pressure, which is set higher than that required for spraying to ensure correct operation of the electric pressure regulator. Excess fluid from the pump is by-passed through the manual regulator back to the tank and helps keep the contents agitated.

Pressurised fluid is directed to the electric valve block which includes a pressure regulator, dump valve, on/off section valves that direct liquid to the left and right sides of the sprayer.

The electric controls include switches for the section valves, master on/off switches that change the pump between by-pass and spraying mode, and up/down switches to set spraying pressure at the electric pressure regulator.

DESCRIPTION OF FLUID FLOW

System pressure is shown on the gauge at the front of the sprayer. With the Master valve ”OFF” all fluid is by-passed back to the tank and with the valve “ON” spraying pressure is shown.

Bypass fluid from the electric pressure regulator is returned to the main tank and acts as extra agitation, keeping the chemical solution mixed.

Conveyor Circuit

The section valves direct fluid to the spray nozzles on either side of the sprayer Once the pattern is set with the section on/off switches, spraying is stopped and started with the master switch. The spray line on each side of the sprayer is connected to 6 flip-over twin jet nozzles.

Each nozzle holder contains two HCC hollow cone nozzles. Different size jets can be fitted to either side of the nozzle to enable a rapid change of application rate. The outward facing jet is open and the inward facing jet is closed. To vary the pattern each nozzle can be turned off by flipping it to the mid position.

Hand Wash Tank

The hand wash water tanks are not connected to the spraying circuit. They provide clean water for washing purposes and *under no circumstances should it be used for drinking.*

Optional Automatic Spray Rate Controller

The changes made to the sprayer circuit when these options are fitted are described in the relevant pats of the Optional Equipment section of this manual.

Supplying Power to the Sprayer

Connect the electrical cables provided directly to the battery. Positive = Red Negative = Black
If the cable needs to be extended it is important to use wire of the same diameter. These cables supply power to the electric valves.

If controllers are used refer to appropriate installation manuals.

Run the controller wiring loom back to the sprayer through a convenient outlet in the tractor cabin, ensuring that it does not rub on any sharp edge. Connect the tractor loom to the sprayer loom at the quick release coupling and ensure that all wiring is clear of the PTO shaft and tractor wheels.

OPERATION

Spray Nozzles

The spray nozzles have an outlet at each end but only the jet that is flipped to the outward facing position is “on”. This facilitates easy changing between jets of different sizes, for example when requiring different application rates to suit concentrate or dilute solution spraying. Both sides of each nozzle are fitted with HCC nozzles that provides a more precise droplet spectrum for improved crop coverage.

- The HCC nozzles can be used in different combinations.
- Individual nozzles can be turned off when not needed by flipping the nozzle 90 degrees so that neither of its jets is facing outwards.
- The nozzle direction can be adjusted by +/- 15 degrees. Greater adjustment can be made by loosening the attaching nut and angling the nozzle.
- The above features enable the spray pattern to be regulated to achieve the required coverage.

HCC Nozzles

- HCC hollow cone ceramic nozzles produce a defined droplet spectrum and are fitted to one side of each nozzle. They use the standard nozzle cap.
- Nozzle output can be varied by fitting a different size ceramic jet. Refer to the HCC Chart on page 28.

and the hub cover is attached with two bolts. The cylindrical stub at the inner end of each fan blade is located in a recess in the hub and is clamped in place by a capping block attached by two hexagonal head screws.

- The blade angle can be altered by loosening the balance screw either side of the hub and the clamp screw that goes through the hub. The blade can then be rotated. The pitch setting is regulated by teeth moulded into the base of the blade and a locking tab attached to the hub clamp screw.
- Each tooth on the blade is equivalent to 5 degrees of pitch angle. A reference line on the blade is marked as 35 degrees of pitch and the blade can be set between 20 and 45 degrees. The standard pitch setting as delivered is 30 degrees.

Maximum operating pitch is 40 degrees. Any higher than this may result in excessive clutch wear

- Adjust one blade at a time and ensure that each is set to the same pitch angle.
- Check that the blade is positioned so that the tooth on the locking tab engages the blade teeth at the desired pitch setting.

The tightening of the hub clamps is very important. The Bolts that hold the balance washers must NOT have any excessive torque applied when tightening them. They should be just done up to the point that the bolt head or washer if fitted is just sitting against the hub clamp and no tighter. Please follow carefully the instructions below.

- Then securely tighten the **hub clamp screw** to approx 20 N/M of torque (15 ft/lb).
- The balance washer bolts can then be tightend by just bring the head of the bolt, or the washer if fitted into contact with the hub clamp. Do not tighten these any further
- Do not remove the washers from the screws attaching the clamping blocks as these are used as weights to balance the fan. If the blades or washers are removed or replaced the fan should be rebalanced by your Silvan dealer.
- Refit the hub cap and safety mesh after adjusting the blade pitch.

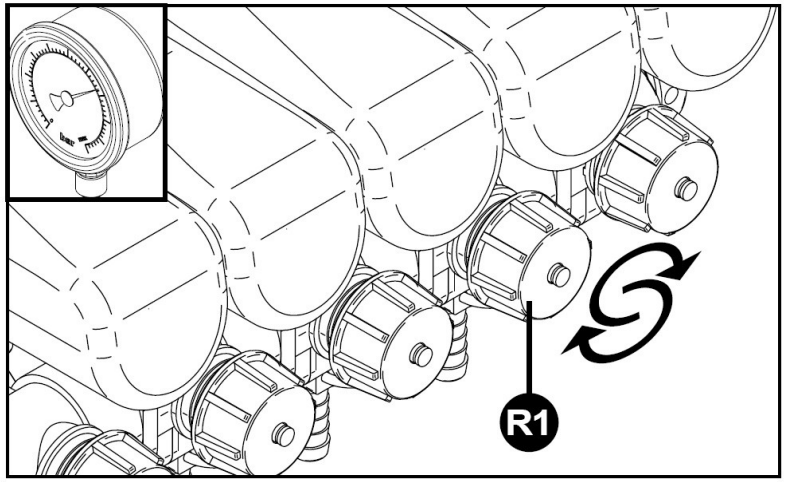
Valves

The valve blocks comprise the manual pressure regulator, master valve, electric pressure regulator and two section valves incorporating regulating bypass compensators. A pressure line filter is incorporated into the valve bock. If fitted with a rate controller the flow meter is located in the valve block.

The section valves are fitted with compensating ports that when adjusted correctly will keep the system pressure at the same level when individual sections are turned on and off.

To adjust the compensation ports:

- Start the sprayer and set the spray pressure with the master off and all sections on.
- Then turn off the first section and adjust the compensation knob R1 until the pressure is exactly the same as it was with all sections on.
- Turn the section back on and off to check the pressure remains constant.
- Turn all sections on again and repeat for the remaining sections.



The sprayer is then adjusted correctly.

If using an optional rate controller the compensating knobs can be set to off and the valve type should then be set to two way valves.

OPERATION

Main Tank Liquid Level Indicator

There are main tank sightline indicators located at the front and left-hand side of the sprayer so the level of the main tank contents can be observed whilst spraying and filling.

Please note: this is a level indicator only and should not be relied upon for accurate batching of spray chemicals.

Suction Filter

- The element of the suction filter located at the front of the chassis should be cleaned after each tank of chemical is emptied. This routine ensures it is ready for the next filling. It should also be cleaned at the end of each day after flushing the system and rinsing the tank.
- To clean the filter element first remove the yellow central locking knob by pushing it in, turning anti clockwise and pulling out (this shuts the internal valve in the filter body).
- Remove the knurled ring on the filter body by turning it anti clockwise.
- Separate the outer filter body, taking care of the rubber O-ring. Remove the filter element and clean in running water. Refit by the opposite procedure to removal.
- Refer to the Maintenance section for filter cleaning information.

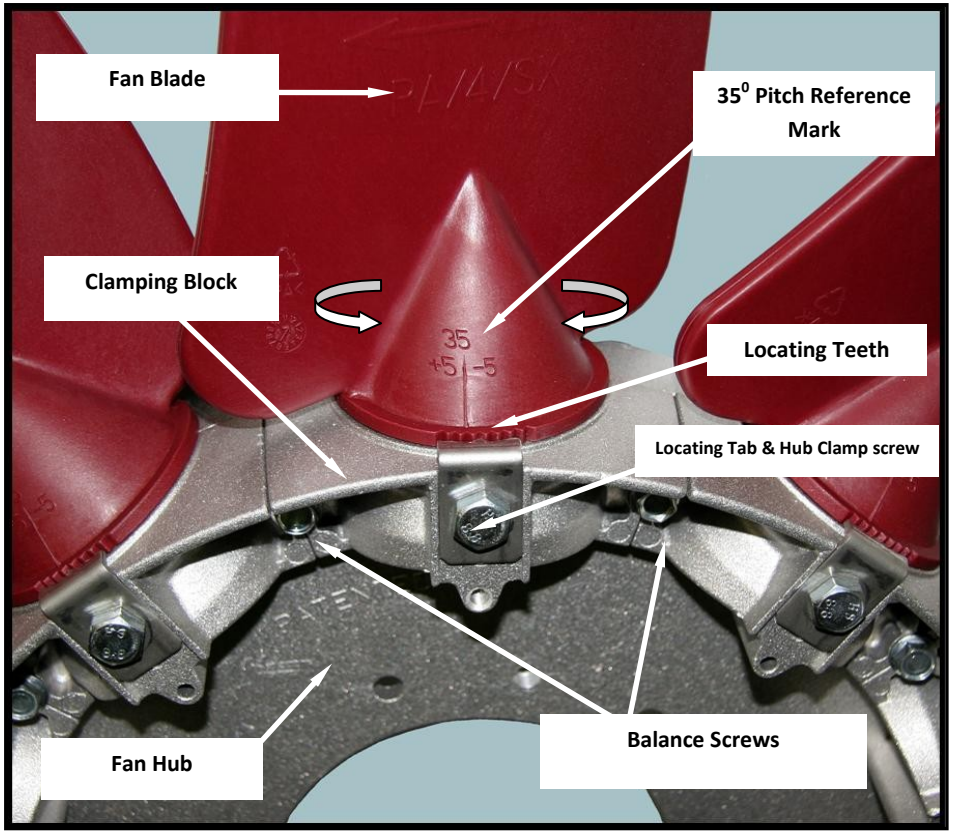
Venturi Agitator

Fluid supply to the venturi agitator is via a ball valve connected directly to the pump manifold.

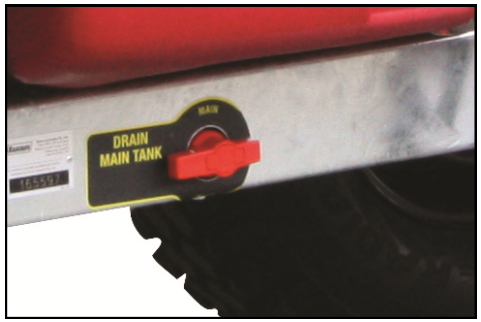
OPERATION

Fan Blade Pitch Adjustment

- If necessary, the pitch angle of the fan blades can be adjusted to match the power of the tractor or to fine tune the air output
- Normally when there is sufficient tractor power the fan should be operated at the standard factory pitch setting with the gearbox in the high speed position. If a lower volume of air is required the fan gearbox should be set in the low speed position.
- If the pitch angle is increased more air will be displaced but higher power will be consumed, and conversely, if the pitch is reduced less air will be displaced and less power will be consumed.
- If tractor power is limited, then the pitch of the fan blades should be reduced so that the power absorbed- by the fan in the high speed position will leave sufficient power for the tractor to tow the sprayer with full tanks at the required operating speed over the prevailing ground conditions.
- To adjust the pitch, remove the mesh guard and fan hub cover. The mesh is attached with six bolts



Draining and Flushing the Sprayer



- Carry out the following routine at the end of each day after spraying and before storing the sprayer. The PTO should be disengaged during these operations.
- Drain any unused solution from the tank through the drain connection by turning the Drain valve located on the left hand side of the sprayer to the Open (forward) position.
- Never leave chemicals in the tank that could settle to the bottom and break into lumps that may block the suction filter.
- Turn off the pump, select the Flush Tank position on the main valve and restart the pump. Open the section valves and allow the clean flush water to clean the pump, filters, valves, spray lines and nozzles.
- Dispose of unused chemical mix, rinse water and containers as recommended by the chemical manufacturer or relevant government authority.

Road Travel

- When towing the sprayer on a public road always ensure that it is equipped with all the necessary lights and signs to comply with local regulations.
- Remove the jack from the drawbar.
- Attach a pair of safety chains between the tractor and the sprayer.
- The master switch should be switched off on the electric controls or spray rate controller.
- Remove the PTO shaft and stow it on the sprayer.
- Travel at slow speed and only with the main tank empty. The weight of the sprayer when all tanks are full could overload the braking capability of the tractor and result in an accident. The tyres are rated to 30 kph for road travel.

When filling the main or flush tanks for safety reasons do not climb on the tank or stand on the tyres

Filling the Main Tank

- The main tank can be filled through the top lids.

Filling the Flush Tank

- The flush tank is located at the front of the sprayer and provides a convenient water supply for flushing the pump, valves, spray lines and nozzles whilst still in the field. This should be done whenever spraying is stopped for any length of time to avoid chemical sediment blocking nozzles or accumulating in the lines or working parts.
- The flush tank should be filled with water at the same time as the main tank. The flush tank can be filled through the top using the screw lid.

Filling the Hand Wash Tank

- The hand wash tanks provide a convenient water supply for washing purposes. **Warning: Under no circumstances should it be used for drinking.**
- The tank should be filled with clean water through the top screw lid.
- The tap is fitted to the bottom of the tank.

Fan Speed

The fan is connected to a single speed gearbox driven by the PTO and is designed to operate at a maximum PTO speed of 540 rpm. The pitch of the blades can be adjusted but the factory setting should be suitable for normal operation. If pitch adjustment is required refer to the Fan Blade Pitch Adjustment section.

- Fan speed is selected by moving the lever on the LH side of the gearbox at the rear of the sprayer. Stop the tractor engine and disengage the PTO when changing fan speed.
- The neutral position of the gearbox enables the PTO pump to be operated without the fan. This position could be used when filling the sprayer to mix the chemical solution and for hand spray operations.
- To maintain correct airflow the sprayer should always be operated at 540 PTO rpm.
- Never engage the fan drive with the tractor engine running or the PTO engaged.

Manual Pressure Regulator

- The system maximum pressure is set with the manual pressure regulator at the diaphragm pump. Turning the knob clockwise increases pressure and turning it anti-clockwise decreases pressure. The pressure is shown on the gauge, which can be seen from the tractor seat.
- The system maximum pressure should be set higher than the required spraying pressure so that the electric pressure regulator can function correctly to set the spraying pressure.
- The maximum allowable operating pressure of the diaphragm pump is 50 Bar.

Starting the Sprayer for the First Time

- Before starting the sprayer for the first time grease the lubrication points on the PTO shaft and check the oil levels in the diaphragm pump and gearbox. Refer to the Maintenance section for information.
- Conduct a trial run using water only to become familiar with the controls and to check that all systems are functioning correctly without leakage.
- Fill the sprayer with about 500 litres of water through the bottom fill for this trial run.
- Check that the fan gearbox is engaged.
- Turn the manual pressure regulator fully anti-clockwise to start the sprayer without pressure.
- Set the Master switch of the electric control to “OFF”.
- Start the tractor, run the engine at low speed and engage the PTO. Once running satisfactorily, gradually increase speed to 540 PTO rpm.

- Turn the master valve on to pressurise the system and set the system maximum pressure.
- Use the up/down switch to set the required spraying pressure, which will be displayed on the pressure gauge. Refer to the Calibration section for information on spraying pressure.
- Turn all section switches on and check that all nozzles are spraying. Make sure all bystanders are clear when testing the nozzles.
- Spraying may now be started and stopped with the master switch whilst maintaining the pressure settings.

Starting Procedure for Regular Operation

After the initial trials the following starting procedure can be used for regular spraying.

1. Start the tractor, engage the PTO and slowly bring the speed up to 540 PTO rpm.
2. With the master switch “ON”, check the system maximum pressure and adjust to 10 Bar above spraying pressure with the manual pressure regulator if necessary.
3. With the master switch on, set the required spraying pressure with the toggle switch.
4. Operate each section with the button to check all spray nozzles are spraying correctly.
5. Spraying may then be started and stopped with the master switch to maintain the settings.

Adding Chemicals

- Carefully read and follow all safety precautions provided by the chemical manufacturer.
- Always wear gloves, eye protection and all the recommended protective clothing whilst mixing and filling the sprayer with chemicals. Take care to avoid spillage of chemicals or mixed solution. Wash your hands after filling if they have come into contact with concentrate or mixed solution.
- Store unused chemicals and dispose of empty chemical containers as recommended by the chemical manufacturer or relevant authority.

Before adding chemicals read and follow the chemical manufacturer's instructions and wear the recommended personal protective clothing.