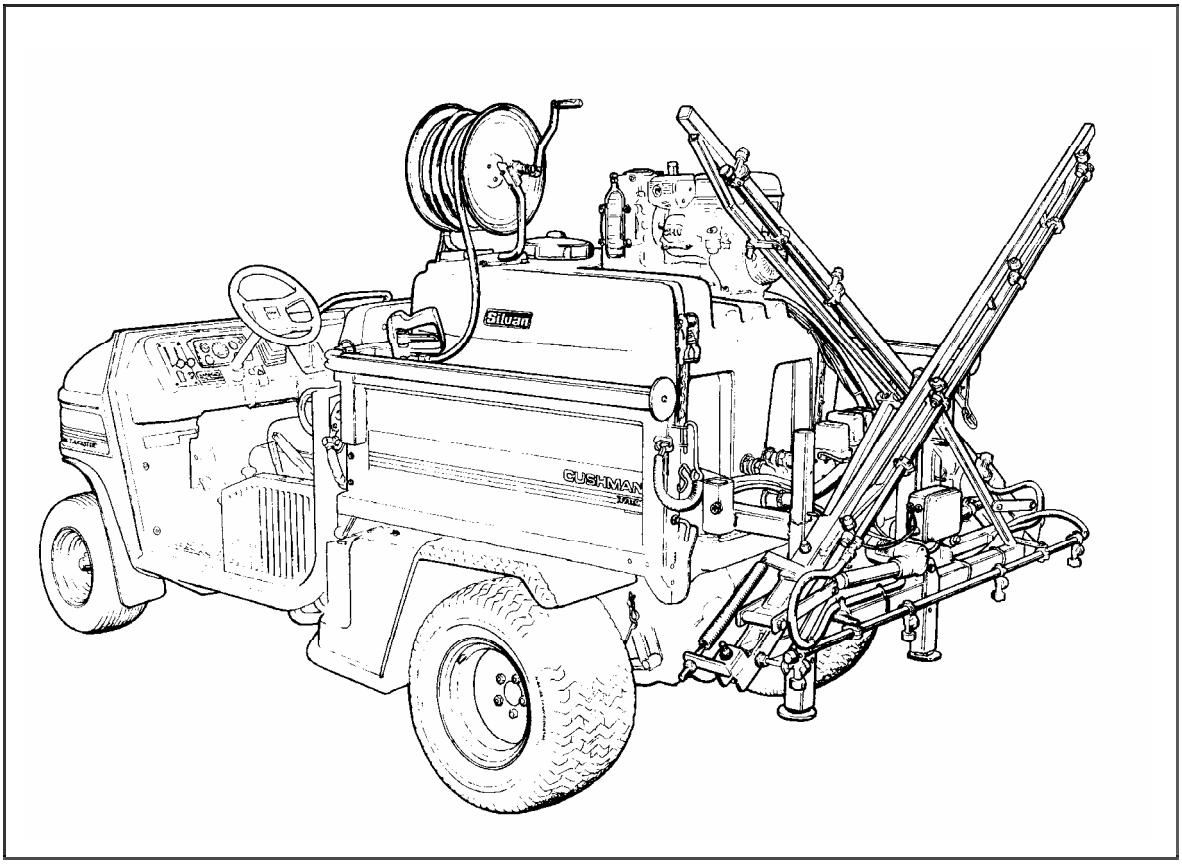
Operator's Manual

MANCUSH-1 Rev C 24/11/2006

Cushman 400L Sprayer



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Silvan

New Product Warranty

the Silvan 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 judgement 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

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.

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Safety Information

Before operating the sprayer read the following safety instructions.

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

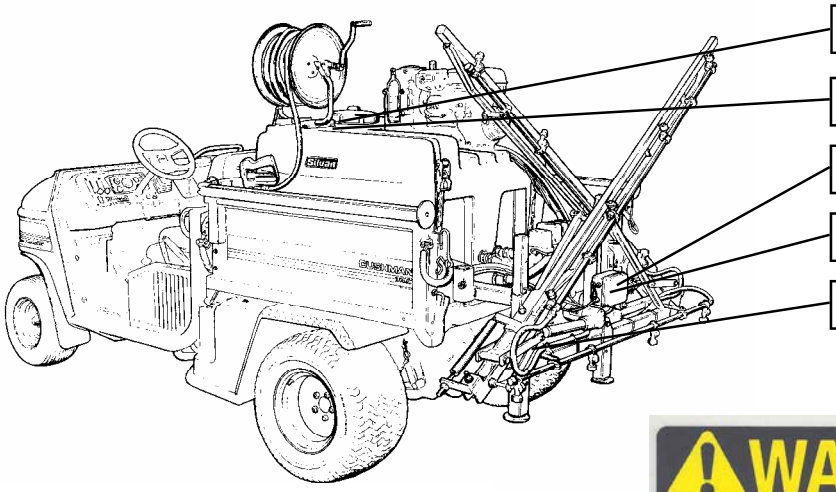
Whilst your Silvan Sled Sprayer has been designed and manufactured to incorporate all necessary safety features it is essential that any person who operates or works on the machine is aware of the safety precautions that should be exercised.

- ▲ This sprayer is designed and manufactured solely for the purpose of applying agricultural chemicals and fertilisers 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.
- ▲ Only operate the sprayer on a vehicle with suitable load carrying capacity and adequate tray area to accommodate the sprayer safely.
- ▲ Exercise extreme care when operating in hilly or uneven terrain to ensure proper stability. Refer also to the vehicle manufacturer's operating and safety instructions.
- ▲ Do not operate the sprayer without all safety shields in place.
- ▲ Never allow anyone to ride on the back of the vehicle while the sprayer is mobile, particularly when spraying.
- ▲ Apply the vehicle parking brake and switch off the vehicle and sprayer engines before performing any service work on the sprayer.
- ▲ Do not get under or perform maintenance work on the sprayer whilst it is off the vehicle and supported by the four removable legs. Support the sprayer at each corner with a steel stand or equivalent, on a firm, level surface when off the vehicle.
- ▲ Before travelling ensure the support legs are fully raised and locked.
- ▲ **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.
- ▲ 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.
- ▲ Dispose of empty chemical containers and chemical residue in accordance with the instructions supplied by the chemical manufacturer.
- ▲ Never attempt to refuel the engine whilst it is still running.
- ▲ Never touch the motor exhaust as this may result in harmful burns.

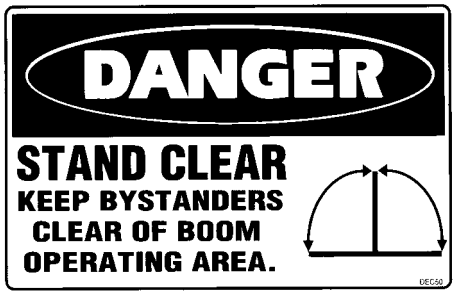
Safety Information

WARNING

The location and wording of the safety decals fitted to the Sled Sprayer is shown below. It is important that all operators read and follow the information on all safety decals before using 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 are missing or unreadable they should be replaced by ordering new decals from your Silvan dealer using the part numbers shown below.



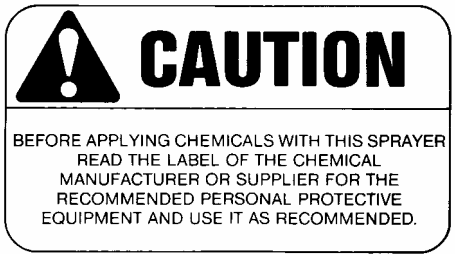
Both sides of boom



Part Number DEC 50

Part Number DEC 48

Part Number DEC 52



Part Number DEC 13

Part Number DEC 69

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Features and Specifications

The Silvan Cushman Sprayer has been designed for fitment to Cushman vehicles for the application of agricultural chemicals and fertilisers to turf.

Tank
Polytuff impact resistant polyethylene.
Capacity 400 litres.
255mm screw down lid with basket strainer.
Moulded litre calibration marks.
38 mm bottom drain with ball valve.

Bottom Fill
38 mm camlock hose coupling.

Agitation
Continuous agitation from by-pass flow line.

Engine
Honda GX160 5.5 HP single cylinder four stroke petrol engine direct coupled to pump.

Pump
Constant displacement oil backed diaphragm. Performance at full engine speed shown below.

Pump No.	Output	Max. Pressure	
	l/min	Bar	psi
BP 60/20	58	20	290

Control Box - Spraying
Master On/Off switch.
Boom section On/Off switches (3).
Spraying pressure regulating switch.
Pressure gauge 0 - 20 Bar.
Circuit protection fuse 10 amp.

Control Box - Boom Folding
Master On/Off power switch with display light.
Left and right independent boom fold.

Control Valve - Spraying
Electrically operated master On/Off valve.
Manual maximum pressure regulating valve.
Electric proportional pressure regulating valve.
Electric On/Off valves for 3 spray boom sections, with adjustable pressure compensation.
Glycerine filled pressure gauge.
Nylon bodies strengthened with glass fibre.
Stainless steel valves and seats. Viton seals.
Anti drip suck back device.
Total Flow Capacity = 120 litre/min
Maximum Pressure = 20 Bar

Spray Boom
6 or 8m Electric folding boom
Three spray sections.
Galvanized all steel construction with boom end breakback mechanism.
Stainless steel (1/2 “) spray lines.
Interchangeable nozzles at 50 cm spacing in non-drip bayonet holders with integral strainer.

Filtration
Three stage with removable elements.
Standard mesh shown. Alternatives available.
Tank lid strainer - 18 mesh.
Suction line filter - 50 mesh (blue).
Nozzle strainers - 50 mesh

Hose Reel and Spray Gun
A hose reel with 20 meters of 12mm ID hose and spray gun can be fitted. A variety of spray guns are available from your Silvan dealer.

Chassis
Heavy duty galvanised steel construction.
Retractable support legs.
Only for fitment to Cushman models:
-3 Wheel Trukster Model No’s 898650 & 898663
-4 Wheel Trukster Model No’s 898652 & 898664
and fitted with steel tipping tray (short box)
1.2m x 1.4m (47”x56”) as follows
-Flatbed Tray Model No 889983
-Box Tray with sides Model No 890010

Dimensions and Weights
With standard equipment fitted.
Mass with tanks empty. To calculate gross weight add 1 kg per litre of water fill.

	Length	Width	Height	Mass
	(dimensions in mm)			(kg)
With boom folded	1655	2000	1100	120

OPTIONAL EQUIPMENT:
Economy or De Luxe Foam Marker
The foam marker drops foam at the end of the boom to identify the area covered by the sprayer and to guide adjacent runs. The De Luxe system incorporates a cabin control for selecting either the right or left foam dropper whilst travelling.

Farmscan Primo 400 Spray Computer
This spray computer will automatically maintain the selected target spray rate regardless of speed or pressure. With user friendly touch button function selection, the Primo 400 is easy to navigate. It has 4 section control, or 3 sections with left and right foam marker control.

Installation

Before operating the sprayer it is necessary to fit the sprayer to the Cushman vehicle and secure it properly. The electrical connections for the controls then need to be attached.

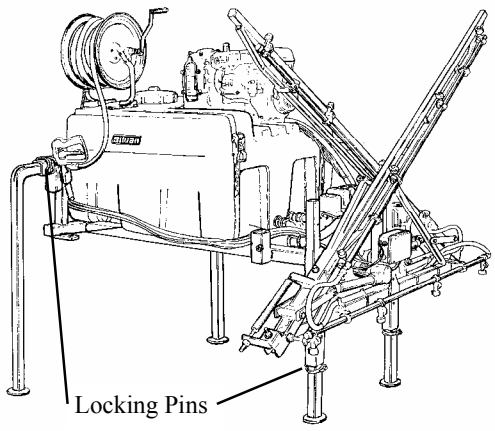
Vehicle Requirements

The Sprayer is designed for fitting only to those models shown on the specifications page.

Ensure that the tyres are inflated to the pressure recommended by the vehicle manufacturer for the weight of the sprayer with all tanks full.

Mounting the Sprayer onto the Vehicle

The sprayer is normally delivered with the four retractable legs fully raised in the transport position. Ensure that the unit will be placed on a firm, level surface. Have the unit lifted with a forklift or similar suitable lifting device and lower and fit the legs as shown in the diagram below. Do not fill the tank until the sprayer is completely installed.

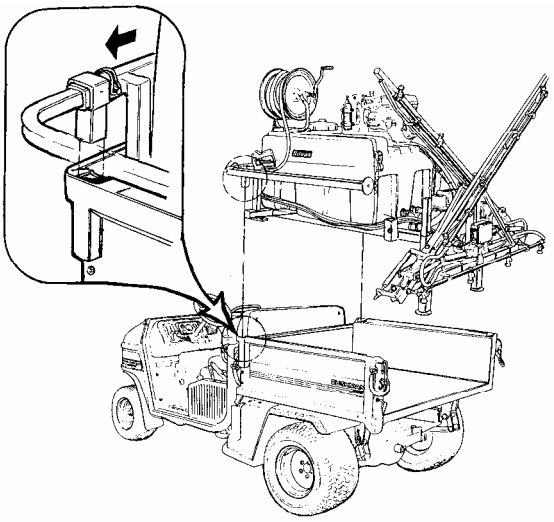


SPRAYER ON SUPPORT LEGS

Back the vehicle into place under the sprayer. The sprayer frame should be centred on the longitudinal axis of the vehicle tray and the front uprights of the frame should be approximately 100mm behind the vehicle cabin.

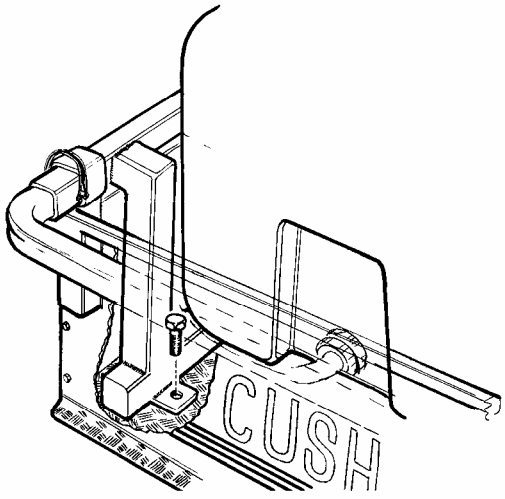
Raise the tray of the Cushman unit so that it lifts the front of the sprayer off the ground no more than 100mm. Remove the 2 front legs rotate them 90 degrees and refit them in the transport position. Lower the tray of the Cushman. The rear legs will now have lifted from the ground and can be retracted into the transport position.

The locating brackets can now be slid across into the recess in the Cushman tray and the locking pins placed in behind them.



LOCATING BRACKETS
Locate in Recess in the Cushman Tray

Attach the sprayer to the vehicle tray by drilling a 13mm diameter hole through the tray at each of the 2 attaching lugs on sprayer frame, as shown in the diagram below. Install with 12mm bolts, nuts and washers and tighten securely.



MOUNTING BOLT POSITION

Note that the legs are only intended for storing and supporting the sprayer when the tank is empty.

Installation

Control Boxes Mounting

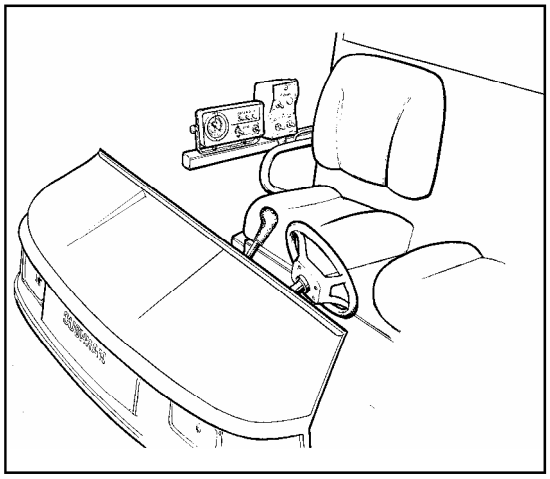
The electric control boxes are mounted using the bracket and hardware provided, so that it is clearly visible and within easy reach of the driver. The master switch should be in the “Off” position on the sprayer control box and the control box for the boom folding operations .

Power supply cables have been wired together so that it is only necessary to make 1 connection to the battery. The preferred connection is to mount directly to the battery terminals, however aligator clips are provided so that power can be quickly disconnected when the sprayer is removed. The connections are:

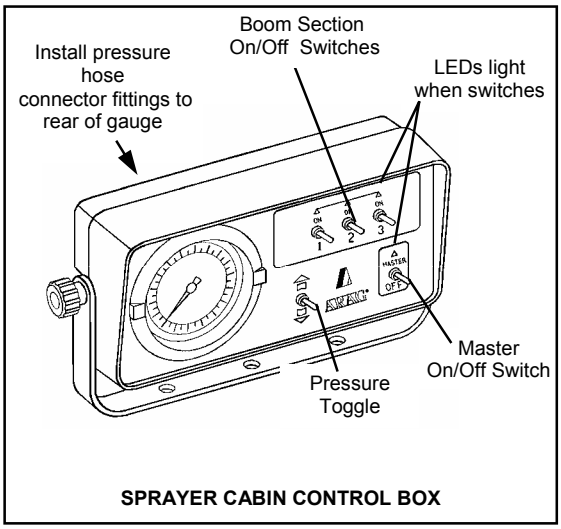
Positive = Brown Negative = Blue

If the cable needs to be extended it is important to use wire of the same diameter (not less than 0.75mm^2).

If not already fitted to the control box remove the protective cap from the threaded connection of the pressure gauge on the rear of the cabin control and install the reduction fitting, then screw the 1/8in threaded hose connector to the reduction fitting. Use a small amount of sealant on the threads but take care to avoid clogging the gauge inlet.



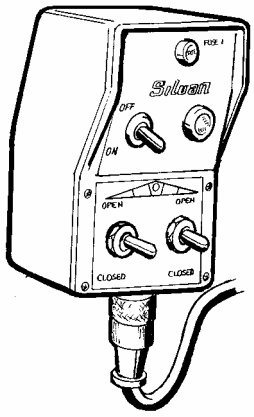
Insert the small bore pressure hose into the connector on the cabin control pressure gauge and securely tighten the coupling.



SPRAYER CABIN CONTROL BOX

Control Box for Sprayer

The sprayer control box is used for the operation of the sprayer functions, it includes 3 x on/off switches for individual operation of boom spraying sections, a pressure adjustment switch and master on/off switch. The pressure gauge for the boom is also mounted in the control box.



Control Box for Folding the Boom

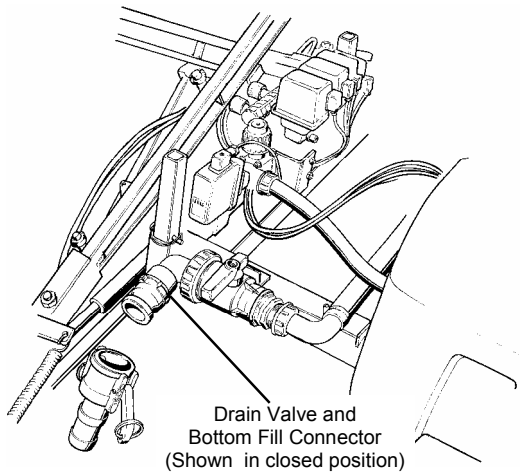
The boom folding control box is used only for folding and unfolding the boom. A light is fitted to indicate when power is connected.

Operation

Filling the Main Tank

The main tank can be filled through either the top or bottom, but the recommended method is through the bottom fill connection which is more convenient and prevents chemicals frothing.

The valve controlling the bottom fill also acts as the drain valve for the main tank. It is located under the RH side of the main tank and is closed when the handle is across the valve body and open when the handle is aligned parallel to the fluid path.



DRAIN VALVE AND BOTTOM FILL CONNECTOR

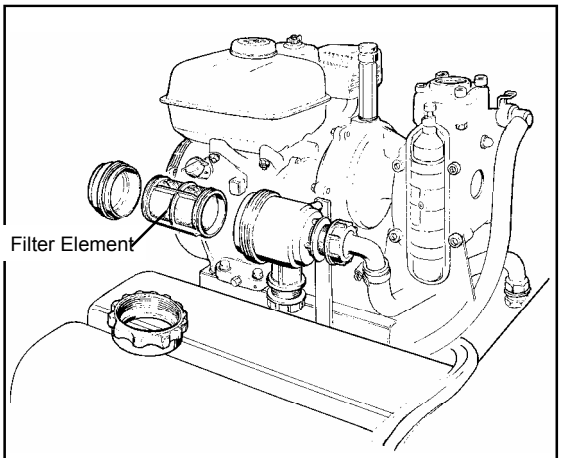
If filling the tank through the top, first check that the drain valve is closed and ensure that the basket filter in the top opening is fitted and that it is clean. Refit the lid securely after filling.

To fill through the bottom connection, ensure that the valve is closed then attach the filling hose. A 38mm ($1\,^1/_2$ inch) female hose coupling is supplied with the sprayer for fitment to the filling hose. Turn the valve handle to the “Open” position and turn on the water supply.

When filling is complete turn the drain valve handle to the “Closed” position. Disconnect the hose.

Suction Filter

The suction filter is located next to the pump on the RH side of the sprayer and should be cleaned after each tank of chemical mixture is emptied. Clean with a soft bristle brush. Ensure that the sealing O-ring is correctly replaced. This routine ensures it is ready for the next filling.



SUCTION FILTER

Pump Lubrication

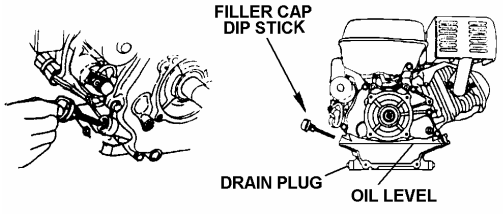
Check the oil level of the diaphragm pump and gearbox and if necessary top up with SAE 20-40 multigrade engine oil. Refer to the pump instruction manual for further details.

Operating the Sprayer Engine

Before starting the engine for the first time, read the safety and operating instructions in the Honda Owner’s Manual supplied with the sprayer.

1. Pre-Operation Checks

Unscrew the oil filler cap, wipe the dipstick clean and check the oil level. The oil should be at the mark half way up the dipstick when it is inserted but not screwed home. If necessary add a high detergent, premium quality SAE 10W-30 engine oil. Do not overfill. Replace the filler cap. Fill the fuel tank with standard grade, unleaded petrol. The capacity is 3.6 litres. Do not refuel with engine running



ENGINE OIL LEVEL

2. Starting the Engine

Turn the ignition switch on. Slide the fuel valve to “On” and close the choke lever. Do not use the choke if the engine is warm or the air temperature is high.

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Operation

Open the throttle slightly by moving the lever towards the fast running position.

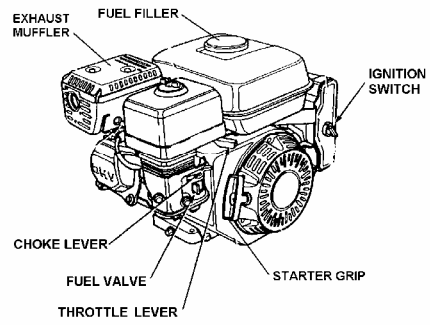
Pull the starter grip gently until resistance is felt, then pull briskly and the engine should start. Return the starter grip gently. Do not allow it to snap back or the starter may be damaged. If the engine does not start repeat the process.

Open the choke fully when the engine is warm and running smoothly.

> **WARNING** Do not touch the engine exhaust muffler as it becomes very hot and may cause serious physical burns.

3. Stopping the Engine

To stop the engine under normal circumstances, return the throttle lever to the idle position, close the fuel valve and turn the ignition switch off.



HONDA ENGINE CONTROLS

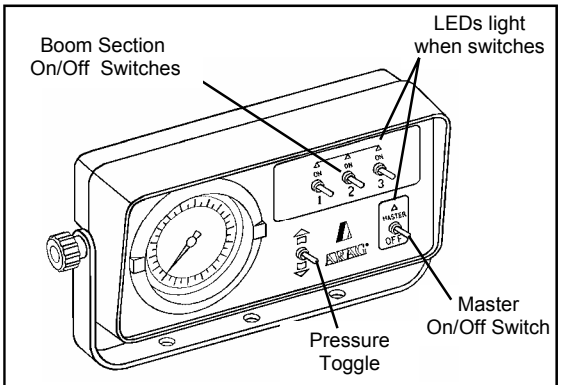
In an emergency the engine can be quickly stopped by simply turning the ignition switch off.

Starting the Sprayer for the First Time

When starting the sprayer for the first time conduct a trial run using water only (no chemicals) to familiarize yourself with the operation of the controls and to check that all systems are functioning correctly, without any leakage. Fill the tank through the bottom fill for the start up run.

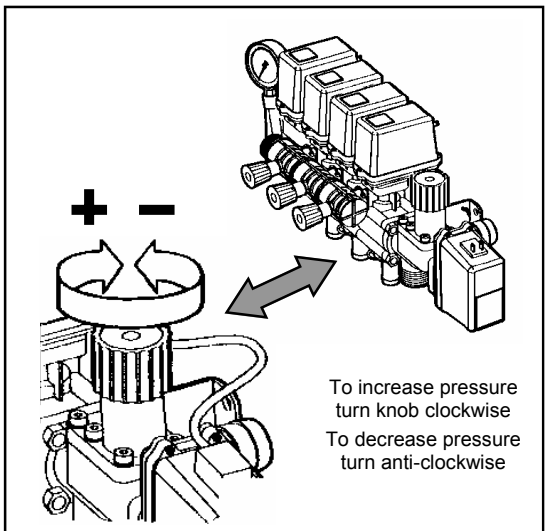
The sprayer should be started in by-pass mode with the cabin controls set so that boom will not operate. At the cabin control, turn the master switch “Off” (lever down) and set all boom switches to the closed position (levers down).

So the sprayer will start without pressure in the system, hold the pressure toggle switch down for a few seconds to fully open the electric pressure regulating valve The motor will wind the valve open until stopped by its limit switch.
No damage will occur if the toggle switch is held on.



CABIN CONTROL BOX

At the valve block, open the manual pressure regulator fully by screwing the knob anti-clockwise to the end of its travel.



SETTING MAXIMUM SYSTEM PRESSURE WITH MANUAL REGULATOR VALVE

Start the engine and run at a fast idle. Once the engine is warmed up and the sprayer is running satisfactorily the engine speed can be increased.

Set the master switch to “On” then progressively increase the pressure with the pressure toggle switch while observing the gauge. Raising the switch increases pressure and lowering it decreases pressure. For the initial trial set the pressure to the upper end of the range to be used for spraying.

Operation

Open all the boom section valves by raising the numbered switches. All sections of the boom should now be spraying.

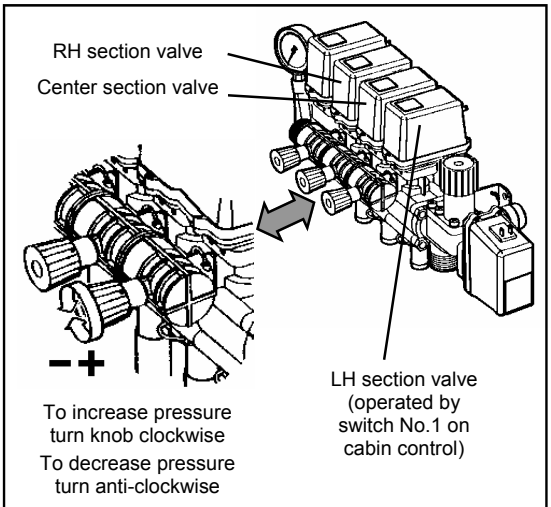
At the valve block, set the maximum system pressure by screwing the knob on the manual pressure regulator and observing the pressure gauge on the valve block. Turning clockwise increases pressure and turning anti-clockwise decreases pressure. Set the system pressure higher than that which will be used for spraying but below the maximum allowable safe working pressure of 20 Bar.

Spraying is normally carried out in the pressure range of 2 to 4 Bar but the maximum system pressure should be set at least 50% higher so that the proportional pressure regulator can function correctly.

With the switch on the cabin control, adjust the pressure to that which is required for spraying. Refer to Calibrating the Sprayer and the Nozzle Selection Chart for information on spraying pressures.

Setting the Pressure Compensators

The pressure compensators on the boom section valves can now be adjusted. The compensators ensure that spraying pressure remains constant when one or more boom sections are closed or opened during spraying operations.



ADJUSTING THE BOOM VALVE PRESSURE COMPENSATORS

Close the LH section valve (closest to pressure regulator) with its switch on the cabin control (No.1), observe the pressure gauge and adjust the red knob on the side of the LH valve until the pressure is restored to the original setting. Screwing the knob clockwise raises the pressure and screwing it anti-clockwise lowers pressure.

Open and close the section valve several times and observe whether the pressure remains constant and adjust the compensator if necessary. Repeat with each section valve in turn. The pressure compensators should now be correctly adjusted.

When all compensators have been adjusted make a final check by opening and closing each valve in turn and observing whether the pressure remains constant. Re-adjust the compensators if necessary until each valve can be opened or closed without any change in system pressure.

Once correctly set the compensators will not require adjustment if the spraying pressure is changed.

With the sprayer running at operating pressure and with all boom sections open check for any leaks and tighten hoses as required.

The spraying operation can now be controlled from the vehicle cabin unit and chemicals can be added to the system.

Starting Procedure for Regular Operation

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

1. Set the cabin control master switch to “Off” and close all boom switches.
2. Start the sprayer engine.
3. Set the manual pressure regulator to the required maximum system pressure.
4. Turn master switch “On” and set the required spraying pressure with the pressure switch.
5. Open and close each boom section with its switch and check that the pressure remains constant. If necessary adjust the pressure compensators as previously described.
6. To commence spraying open the required boom sections with their control switches.
7. Spraying may then be stopped and started using the master switch, so as to maintain the required boom configuration.

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Operation

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

Adding Chemicals

Chemicals can be added to the tank through the top opening.

Before adding any chemicals fill the tank with approximately 100 litres of water and run the sprayer to circulate the mixture whilst the chemicals are being added. Ensure that the boom sections are switched off so that the pump output will be by-passed and returned to the tank to mix the solution.

Add the chemicals through the top opening. When all chemical has been added continue filling the main tank with water and keep the sprayer running to thoroughly mix the solution.

Adding through the Top Opening

If adding liquid chemicals through the top opening of the tank use the basket strainer, after checking that it is clean. If adding powdered chemical remove the strainer.

Foam Marker (Optional)

The Sled sprayer can be fitted with an optional foam marker. Full information is provided in the Operator's Manual supplied with the marker unit.

Draining the Tank

The ball valve which operates the tank drain is located under the LH side of the tank. Before draining the tank ensure that any chemical residue will not be discharged into, or near, a prohibited area or an environmentally sensitive location. If necessary drain chemical residue into containers for disposal.

To drain the tank turn the valve to the "Open position with the handle aligned with the valve body. After draining turn the valve to the "Closed" position with the handle across the valve body.

Flushing the System

At the end of each day run clean water through the pump and the lines to purge them of any chemicals.

Rinse the tank out thoroughly to remove all 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.

When flushing the tank with water leave the drain valve open until uncontaminated water runs through the valve.

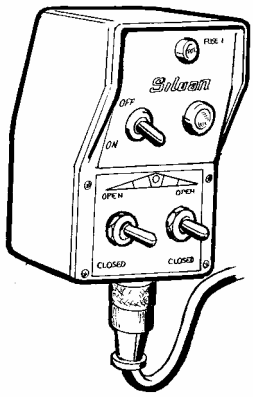
Operating the Hose Reel

The hose is connected so that pressurised fluid is available at the spray gun whenever the pump is running. To use the hose and gun, set the required pressure with the manual maximum system pressure regulator on the valve block, pull out the required length of hose and operate the trigger of the spray gun. Use the handle of the reel to rewind the hose.

Spray Boom

The Sled sprayer is fitted with a three section boom of either 6 or 8 meter width which is of galvanized steel truss construction. The arms are folded by electric rams for convenient transporting.

Boom height is manually adjusted by unbolting and repositioning the boom.



Boom Fold Control Box

Folding and Unfolding the Boom

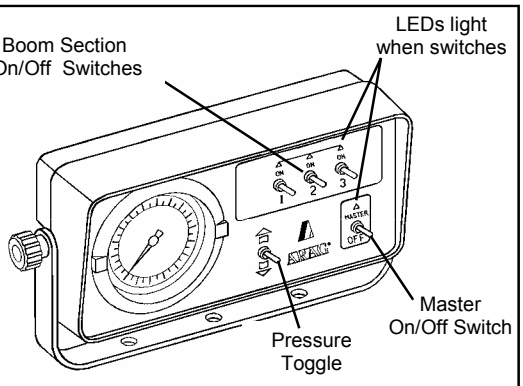
Folding and unfolding the boom is carried out by from the cabin using the control box. Raise the individual switches to unfold the individual boom arms.

Operation

Spraybar Operation with Cabin Control

To commence spraying, open the required boom sections with the numbered switches on the cabin control box. Switch No.1 controls the LH boom section, switch No.2 the center section and switch No.3 the RH section.

Once the required boom sections are selected, spraying may be stopped and started in this configuration by using the master switch.



CABIN CONTROL BOX

Removing and Storing the Sprayer

If it is necessary to remove the sprayer from the vehicle for storage between spraying operations first drain the main tank and flush the system. Drain the foam marker tank, flushing tank and clean water tank if fitted. When draining chemical solutions observe the safety precautions previously described under Adding Chemicals.

Park the vehicle in a location on a hard level surface where the rear support legs of the sprayer can be lowered. Disconnect the electrical leads and pressure gauge hose at the couplings. Remove the mounting bolts which attach the sprayer frame to the vehicle. Store these bolts with the sprayer for future use.

Lift the tilt tray of the Cushman unit so that the front support legs can be fitted. Lower the tilt tray, it should now be possible to drive the vehicle away. Never store the sprayer on its legs with the tank full or partially full.

Calibrating the Sprayer

General Information

When to Spray

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

Droplet Size

Although more research is needed to define which is the optimum droplet size collected by particular targets, certain generalisations 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 poor penetration. Stripping or uneven deposit. Minimal drift.
Medium (250 - 300 microns)	Coverage, deposit and penetration fair. Some drift.
Small (below 250 microns)	Good coverage and good penetration. Uniform application. Drift increased.

Silvan has a range of standard flat fan nozzles designed for a normal operating pressure of 3.0 bar. For larger droplets there is also a range of low pressure flat fan nozzles designed for a normal operating pressure of 1.0 bar.

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

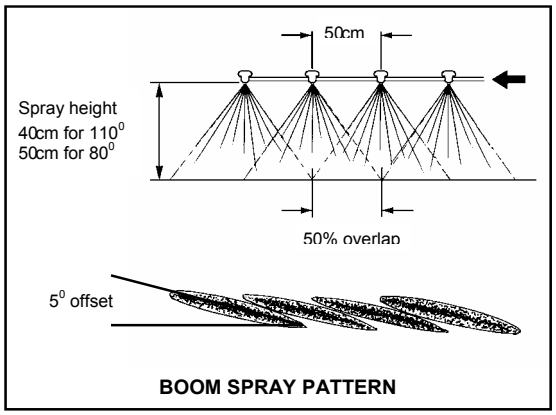
- Reducing pressure increases droplet size.
- Reducing the nozzle fan angle (from 110^0 to 80^0) increases droplet size.
- For an equivalent pressure and fan angle a larger size jet produces larger droplets.

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.

The boom nozzles are spaced at 50 cm intervals and the nozzle caps are offset 5^0 to the axis of the spray line to avoid interference between adjacent spray fans. They can be supplied in either 110^0 or 80^0 fan angle.

The correct spray boom height to achieve 50% overlap is 40 cm for 110^0 nozzles and 50 cm for 80^0 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.



BOOM SPRAY PATTERN

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 the application rate and reducing pressure decreases the rate.
- Nozzle size - increasing the nozzle size increases the application rate.

Ground Speed

The speedometer on many vehicles may not be sufficiently accurate at the slow speeds used when spraying. If in doubt it should be checked by the following method.

Fill the sprayer with water to simulate the normal spraying weight of the vehicle. Ensure that the tyres are correctly inflated.

Measure and mark a distance of 100 meters. 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 then be calculated as follows.

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

Calibrating the Sprayer

Testing the Spray Pattern

The overlap pattern of the boom and the spray pattern of individual nozzles can be tested in the following manner.

1. Fill the sprayer tank with clean water and operate the boom at spraying pressure with the vehicle stationary.
2. Examine the spray pattern from each nozzle against a dark background. Discard and replace any nozzles that show streaks or signs of blockage.
3. Compare the nozzles by placing a container of equal size under each nozzle and run the sprayer for one minute. The water level in each jar should be the same. Any nozzles showing too much or too little output should be replaced until all are within plus or minus 10% of the specification.
4. Set the boom height at the appropriate height above the ground for the spray nozzle angle, ie. 40 cm for 80^0 nozzles and 50 cm for 110^0 nozzles. Run the sprayer and check that the spray patterns from adjacent nozzles just meet as shown in the diagram on the previous page.

Verifying the Calibration

a) Nozzle Test

After conducting the above tests to ensure the spray pattern is correct and the output from all nozzles is uniform, repeat the procedure at 3.0 bar and measure the amount of fluid collected in the container during one minute. The amount should agree with the flow rate shown in the Spray Nozzle Selection Chart on the next page, for the particular nozzles 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 for several minutes with all booms 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 litres per minute can be calculated as follows.

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

The output calculated should agree with the flow rate shown in the Spray Nozzle Selection Chart, for the particular nozzles fitted.

5. If the nozzle output is lower than shown in the table 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.

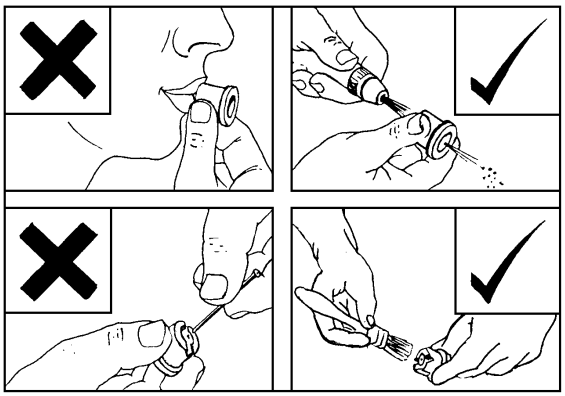
Always keep a new nozzle available as a basis for comparison.

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.

It is recommended that nozzles are renewed once a year or at the first signs of deterioration, whichever occurs first.



Silvan

Calibrating the Sprayer

Nozzle Selection

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

Using the chart below select the most appropriate nozzle to use at the normal recommended pressure of 3.0 bar. The Chart is also shown on a decal affixed to the tank of the sprayer. The leading digits in the nozzle number indicate whether it is an 80^0 or 110^0 fan angle and the last two digits refer to the size. Nozzles are colour coded for easy identification.

For example a rate of 95 l/ha can be achieved at 10 km/hr using 3.0 bar pressure with either an XR8002 or XR11002 nozzle. The boom will have to be set to a different height depending on whether an 80^0 or 110^0 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/min is required rather than 95 l/min, it can be achieved with the same nozzles by reducing the speed to 9.5 km/hr or increasing pressure to approximately 3.2 bar.

Alternatively the required rate could also be achieved with an XR8003 or an XR11003 blue nozzle at 14 km/hr and 3.0 bar pressure (the rate shown is 101 l/ha.).

It is possible that a variety of choices exist for most application rates and the final selection will depend upon the circumstances which best suit your conditions.

After selection always perform a calibration check to confirm your nozzle choice - refer to the previous page.

SPRAY NOZZLE SELECTION CHART

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 110-UF-01	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 110-UF-015	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 110-UF-02	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 110-UF-03	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

Lubrication and Maintenance

Start-up Inspection
During the first few days of operation, before starting each day check that all hardware is tight, in particular the sprayer mounting bolts. Inspect the unit for leaks while running and check all hose clamps.

Honda Engine
Check the oil level in the engine daily. Use a high detergent, premium quality SAE 10W-30 engine oil. For further details refer Pre-Operation Checks in Operation section. Change the engine oil after the first 20 hours then every 100 hours.

Remove the air cleaner cover daily, check the elements and if necessary clean or replace. Routine cleaning should be done every 50 hours or more frequently in dusty conditions.

Clean the foam element by washing in a solution of household detergent and warm water, then rinse thoroughly, or wash in nonflammable or high flash point solvent. Allow to dry thoroughly then soak in clean engine oil and squeeze out the excess. The engine will smoke at start-up if too much oil is left in the element.

Clean the paper element by tapping it lightly several times on a hard surface to remove any excess dirt, or blow compressed air through from the inside. Never brush the dirt off as this will damage the fibres. Replace if excessively dirty.

Pump
Check the oil level in the viewer daily and if necessary top up with SAE 20-40 multigrade engine oil.

Filters
Clean all filters daily or as stated below. More frequent cleaning may be found necessary depending upon circumstances.

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

Always clean the suction filter after each tank of chemicals is emptied. Refer to the Operation section for details about removing the filter.

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. Take care that the sealing 'O' ring is not damaged and is correctly refitted.

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. Refer to the Operating section for information on draining the tank and flushing the system.

Annual Maintenance (or every 300 hours)
Inspection and Hardware
At the end of each season generally inspect the sprayer for any signs of damage, leakage or chemical corrosion. Rectify any items that are defective.

Check that all bolts are tight. Do not overtighten the tank strap bolts as this may distort the tank.

Honda Engine
Drain and refill the engine oil.

Replace the paper element in the air cleaner. Clean the foam element, check for damage and replace if necessary.

Remove the spark plug and clean with a wire brush. Replace if there is excessive erosion on the electrodes or the insulator is damaged or cracked. Reset electrode gap to 0.70 - 0.80mm (.028 - .031 "). When reinstalling do not over tighten; apply 1/8 to 1/4 turn after it seats.

With the fuel tap off, remove the bowl under the carburettor and clean out any sediment. Check for leaks after reinstalling and replace the O-ring if necessary.

After servicing, run the engine until warm then check that it idles correctly. If necessary adjust the throttle stop screw to achieve an idle speed of 1,400 rpm +/- 150 rpm.

Refer to the Honda Owner's Manual supplied with the sprayer for further information. Engine parts are available from your Honda dealer.

Pump
Refer to the pump Operator's Manual supplied with the sprayer for all specifications. Generally note the following.

Drain the oil from the diaphragm pump annually, or at the end of each spraying season, and refill with SAE 20-40 multi-grade engine oil.

Silvan

Lubrication and Maintenance

Remove the pump heads, carefully inspect the diaphragms for wear and/or fractures and replace if necessary. Also check the inlet and outlet valves, seats and springs for wear, damage or chemical corrosion and replace as necessary.

Complete parts service kits are available from your Silvan servicing dealer.

The pump is fitted with a surge chamber which smooths out the pulsations in fluid flow. It is located on top of the pump and the air pressure behind the diaphragm should be checked and, if necessary, set in accordance with the spraying pressure being used, as shown in the chart below.

SPRAYING PRESSURE (Bar)	2 - 5	5 - 1 0	10 - 20
SURGE AIR PRESSURE (Bar)	2	2 - 5	5 - 7

Adjust the pressure at the valve fitting on the chamber using a compressed air hose fitted with a tire valve connection and a reliable pressure gauge.

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