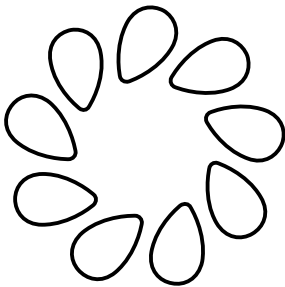


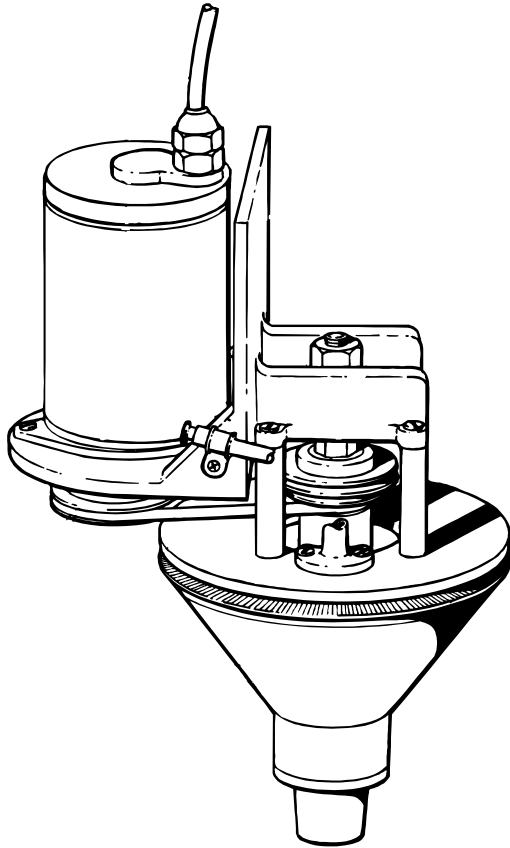
MICRON



Micromax

(segmental)

Instruction manual



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CONTENTS

This manual contains all the information required to ensure successful and safe application of agrochemicals using sprayers fitted with one or more MICROMAX SEGMENTAL atomisers. It should be treated as an integral part of the machine and made easily available to the spray operator for reference, as required, during the spraying operation.

Full instructions for the efficient, effective and safe operation of MICROMAX atomisers are included in this volume, along with all necessary information for installation, maintenance and repair. Reference may also be required to the spray vehicle and/or base sprayer handbooks.

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DESCRIPTION

ROTARY ATOMISER FOR VEHICLE MOUNTED SPRAYING

The MICROMAX 120 is a sectorial spinning disc rotary atomiser designed for the Controlled Droplet Application for vehicle mounting. It is intended primarily for directed and narrow band herbicide application, which produces a flat fan shaped spray pattern which ensures uniformity of deposits over the swath. The swath width of the unit can be varied by swivelling it on it's mounting bracket. The MICROMAX 120 has an internal venture system which re-circulates unsprayed liquid.

The unique design of the electrically driven MICROMAX 120 ensures controlled spray atomisation over a wide range of liquid feed rates and gives a choice of three disc rotational speeds, and thus spray droplet sizes, to suit different applications:

- 200 µm to 300 µm spray droplets for pre-emergent and post-emergent herbicide applications where drift avoidance is essential.
- 100 µm to 200 µm spray droplets for most post-emergent herbicides, defoliants, foliar feeds and fungicides to ensure good coverage of plant surfaces while minimising any risk of uncontrolled spray drift.
- 75µm to 150µm spray droplets for insecticides and fungicides.

The MICROMAX is designed primarily for use in agriculture, the materials used in its construction will withstand all standard products used for conventional agricultural spraying. The MICROMAX 120 can be used with both water and oil based sprays, but is not designed for use with liquid fertilisers or unusually aggressive, dense, or viscous products.

The low application volumes allowed by the MICROMAX 120 mean greater areas can be sprayed per tank load (or lighter vehicles used), with dramatic savings in the cost, time and effort of the spraying operation. This both speeds up the spraying process and allows more spraying days, thus allowing quick and cost-effective pesticide application to be undertaken when needed.

The MICROMAX is driven by a 12v DC electric motor, allowing it to be powered by the vehicle's electrical system. Disc rotational speed, and therefore droplet size, is selected using the three gear belt and pulley drive system. Standard plumbing can be used.

The MIRCOMAX 120 has been successfully used in orchards for directed spray to control weeds under trees.

2 – SPECIFICATION

Power consumption	25 watts
Power supply	12v DC (From vehicle battery)
Swath width	Range from 300mm to 1200mm

1. LOW DISC SPEED

Disc speed	2000 rpm
Liquid feed rate	500 to 1500 ml / minute
Spray drop size	200 to 300 micron
Application volume	30 to 60 Lt / ha
Application	Weeds

2. MIDDLE DISC SPEED

Disc speed	3500 rpm
Liquid feed rate	150 to 1000 ml / minute
Spray drop size	100 to 200 micron
Application volume	20 to 40 Lt / ha
Application	Weeds / Fungicides

3. FAST DISC SPEED

Disc speed	5000 rpm
Liquid feed rate	50 to 500 ml / minute
Spray drop size	75 to 150 micron
Application volume	10 to 20 Lt / ha
Application	Insecticides / Fungicides

TEN KEY POINTS FOR USERS

The following list is intended to be referred to prior to commencing each spraying operation, to remind users of the key points for the safe and efficient use of the MICROMAX atomiser.

- 1 **SAFETY:** Always refer to the product label for specific recommendations for each product, and to Section 4 'Safety and Environmental Considerations' before commencing any spraying operation.
- 2 Check that all atomisers rotate freely. If binding or roughness is felt, inspect the motor, belt drive and disc bearings.
- 3 Check that the pulleys and belts are clean and free from damage and that the appropriate gear is selected, see Section 7 'Calibration and Adjustment'.
- 4 Check that the atomiser discs are secure and free from damage or blockage by dried chemical.
- 5 Ensure that the atomisers are securely and correctly positioned on the boom or support structure, and are set to the correct distance from the crop/target to be sprayed, see Section 5 'Installation'.
- 6 Inspect the entire sprayer for damaged or twisted hoses, leaks in the chemical system, or damaged wires.
- 7 Check that the correct nozzles and flow restrictor orifices are fitted, and that the correct system pressure is set to provide the required liquid feed rate, see Section 7 'Calibration and Adjustment'.
- 8 Turn the atomiser motors on, to ensure they are rotating and at the correct speed, see Section 7 'Calibration and Adjustment'.
- 9 Whilst spraying, visually ensure that each atomiser is working, and verify the accuracy of the calibration of the sprayer by checking the volume of liquid used against the area being sprayed.
- 10 After use, always flush out the entire system with clean water or a suitable solvent. Never leave chemical residues in the tank or pipe work. Wash off outer surfaces of atomisers, booms, etc. to avoid build up of pesticide residues.

SAFETY AND THE ENVIRONMENT

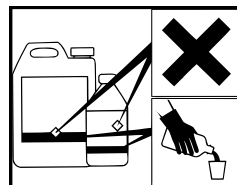
Using agrochemicals is a hazardous process. Operators should be familiar, and comply, with all relevant legislation and/or regulations.

Keep people and animals out of areas being sprayed. Observe all regulations on spraying near inhabited or public areas and waterways.

Never use a MICROMAX 120 in potentially explosive atmospheres, or spray flammable liquids, mixtures of incompatible chemicals, suspended insoluble particles, or anything other than agrochemicals through them.

Always read the product label carefully to discover:

- recommended application rate and dilution
- operator protection required
- necessary environmental protection measures
- action required in case of accidental spill, ingestion, skin or eye contact



Never eat, drink, or smoke when working with agrochemicals.

Always store agrochemicals safely to protect people and animals, and to safeguard the environment. Wash and rinse chemical product containers well using proper equipment. Make a hole in the bottom of empty containers to prevent re-use. Dispose of containers, unused agrochemicals, and washing residues in accordance with regulations.

4.1 OPERATOR PROTECTION

Always wear the protective clothing items listed on the product label for mixing and filling. After using agrochemicals or handling equipment always wash your hands and clothes thoroughly.

The minimum protective clothing required for spraying with the MICROMAX from an uncabbed vehicle, or of cleaning contaminated atomisers and sprayers is:

- rubber gloves
- boots/shoes & long trousers
- eye protection
- long sleeved shirt



INSTALLATION

The design of a sprayer incorporating one or more MICROMAX 120 atomisers will vary according to the application to be sprayed.

This section gives general advice and design data but is not intended to provide specific instructions for building every type of sprayer. Original Equipment Manufacturers (OEMs) should contact Micron if they require any further information for a particular application.



IMPORTANT SAFETY RECOMMENDATIONS

- The design of agricultural equipment is best done by a qualified and **competent engineer**. All relevant legislation and regulations should be adhered to.
- Agricultural equipment should only be worked on by suitably **trained personnel**. Manufacture and assembly work should be completed by trained and **competent technicians**.
- Ensure that all welds are sound, and that all fasteners used are correctly tightened.
- Use the correct tools for the job to avoid injury or damage.
- Use safe lifting methods when moving heavy components.

MOUNTING INSTRUCTIONS

1. The MICROMAX 120 can be mounted to square, round or angle iron frame
2. The MICROMAX 120 spray head is mounted with a drop bracket to spray either to the front or back and from horizontal to a 45 degree angle downwards
3. After mounting, the nozzle should always be at the lowest point of the spray head in order for the internal venture system to effectively recalculate the unsprayed liquid.
4. Swath width is controlled by:-
 - A. Height above ground level
 - B. Swivelling the head to the side
 - C. Angle from horizontal

NOTE:

SPRAY LIQUID IS EMITTED AT A 120 DEGREE ANGLE FROM THE CATCHER PLATE. THE UNSPRAYED LIQUID FLOWS DOWN INTO THE SUMP AND IS RECIRCULATED BEY THE VENTURI SYSTEM

LIQUID FEED SYSTEM

The design of the liquid feed system will depend on the number of MICROMAX atomisers to be used, the design of the sprayer, and whether the sprayer is newly built or a modified older sprayer.

Many of the components for the liquid feed system are available direct from Micron, otherwise contact your usual sprayer component supplier.

Flow regulation

The flow of spray liquid to each MICROMAX 120 atomiser must be regulated to give the correct total output from the sprayer and consequently the required volume application rate on the crop or target. See Section 7 'Calibration and adjustment' for volume application rate calculations.

The liquid feed rate is regulated by the MICROMAX 120 coloured nozzles, or a combination of nozzles and either a fixed restrictor or a Variable Restrictor Unit (VRU) in the feed pipe to each atomiser. The most common configuration is to use the coloured nozzles and a fixed 'orifice plate holder' unit. The restrictor unit should be placed in the spray line just before the MICROMAX atomiser, after any filters and the Diaphragm Check Valve (DCV). See Figure 11 'Typical spray liquid feed system' on page 14.

The appropriate nozzles and VRU setting or orifice plate that give a feed rate, at the nominal system pressure, nearest to that required for the application are selected. Fine adjustment of feed rate is then achieved by varying spray line pressure. See Section 7 'Calibration and adjustment' for details on using system pressure and nozzle and orifice selection to set the required volume application rate.

Unlike hydraulic nozzles, MICROMAX atomisers do not require pressure to operate and droplet size is unaffected by the system pressure. The pressure is therefore only selected to give the correct liquid flow.

Diaphragm Check Valves (DCVs)

It is strongly recommended that a suitable Diaphragm Check Valve (DCV) be fitted in the spray liquid line to each MICROMAX 120, just before the flow restrictor.

FILTRATION

A filter must be incorporated in the spray liquid supply. This should have a 0.5 mm (50 mesh/inch) or finer mesh filter.

The filter may be installed either in the suction or pressure line of the pump, but the filter must always be before any flow restrictors and should preferably be before the pressure regulator. It is most common to fit the filter to the suction line of the pump to protect the pump. Secondary filtration is strongly recommended to catch any smaller particles missed by the main filter, as well as any particles that may already be present in the spray lines, or rust particles etc.

Secondary filters (i.e. nozzle filters) should be fitted just before the DCV and flow restrictor for each MICROMAX 120 atomiser. A finer mesh 0.25 mm (100 mesh/inch) filter is recommended.

The main purpose of filtration in a MICROMAX 120 system is to protect the pump and valves, and to prevent partial or total blockage of the flow restrictors. The MICROMAX is itself very difficult to block, due to the nature of the rotary disc atomiser.

Pumps

If a new sprayer is being designed or an original pump is to be replaced, it is recommended that a diaphragm or centrifugal type is chosen. This should be able to provide a pressure of about 3 bar (45 psi), and should be capable of delivering the maximum flow rate required of the sprayer plus the flow required for tank agitation (if a mechanical agitator is not used).

Each MICROMAX 120 atomiser takes a maximum of 3 l/min (6.5 US pt/min). Consult the specifications of your base sprayer (or tank manufacturer) for the required flow for tank agitation.

Materials

All liquid feed system components should be rated for the system pressure to be used, and manufactured from materials that will not be degraded by weathering or agrochemicals. It is best to source components from Micron or other specialist agricultural sprayer component suppliers.

On/Off valve

An on/off valve must be fitted in the main liquid feed to the MICROMAX 120 atomisers. This may be mechanically or solenoid operated, but should be positioned so as to be easily and safely actuated by the sprayer operator whilst driving the sprayer.

Several on/off valves plumbed in parallel, or a multi-position valve, can be used to select different groups of MICROMAX 120 atomisers if required (for example for multiple boom sections).

Pipe and hose sizes

The bore size of the components and the pipes or hoses required will depend on the number of MICROMAX 120 atomisers connected to the system, and therefore the maximum flow required at the operating pressure. The use of rigid pipe or flexible hose is purely at the designer's discretion.

For pump connection, the pump manufacturer's guidelines should be followed. However, 20 mm (0.75 inch) bore hose on the suction side and 13 mm (0.5 inch) bore hose on the pressure side are recommended as a minimum for one atomiser systems. For systems with multiple atomisers, hose bore sizes up to 40 mm (1.5 inch) on the pump's suction side and 32 mm (1.25 inch) on the pressure side may be required.

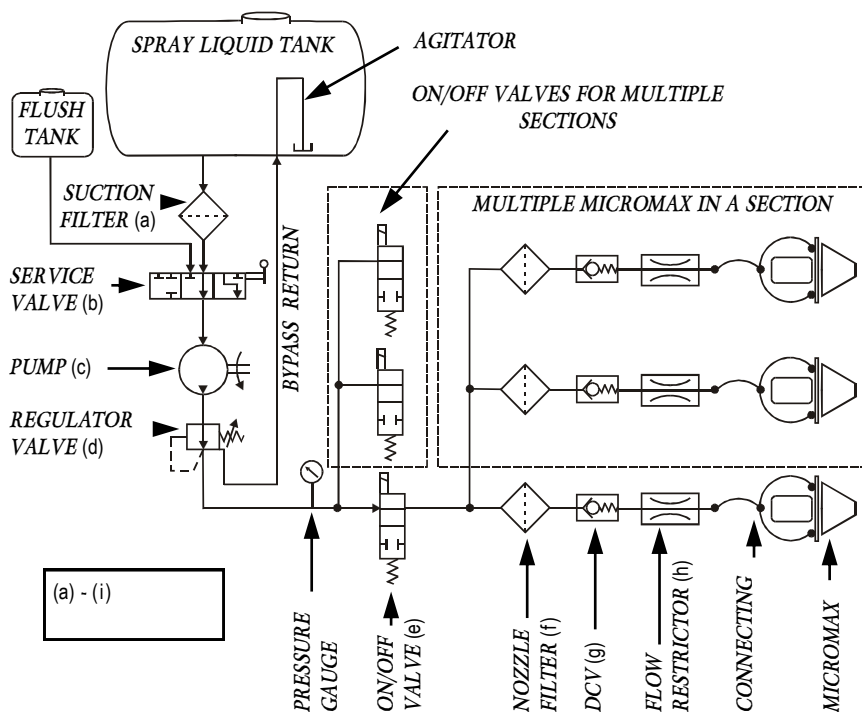
All hoses, pipes, and components upstream of the pump should be the same bore size as the pump's suction side hose.

All hoses, pipes, and components downstream of the pump, up to the on/off valve (or valves), should be the same bore size as the pump's pressure side hose (including the bypass return line).

If only one MICROMAX 120 is connected to the on/off valve, it is recommended that 13 mm (0.5 inch) bore hose or pipe is used to connect up to the nozzle filter. The bore size should then be reduced to 6mm (0.25 inch) for the remaining downstream components and connections.

For systems where more than one MICROMAX 120 is connected to the on/off valve, it is recommended that the pump pressure side hose bore size is continued up to the split. The bore size should then be reduced to 13 mm (0.5 inch), and connection continued as for the single atomiser system described above.

INSTALLATION



NOTES:

- a 0.5 mm (50 MESH/INCH) MESH FILTER
 - b 3 WAY LEVER OPERATED ISOLATING / CHANGEOVER VALVE
 - c DIAPHRAGM OR CENTRIFUGAL PUMP
3 BAR (45 PSI) OUTPUT AT REQUIRED FLOW RATE
 - d ADJUSTABLE SINGLE STAGE PRESSURE REDUCING VALVE
 - e 12v DC SOLENOID OPERATED TWO POSITION ON/OFF VALVE
POWER SUPPLIED BY SPRAYER'S ELECTRICAL SYSTEM
 - f OPERATED BY SWITCH IN SPRAYER'S CAB OR NEAR TO DRIVER
 - g 0.25 mm (100 MESH/INCH) MESH IN-LINE FILTER
 - h LOW PRESSURE DIAPHRAGM CHECK VALVE (DCV)
 - i ORIFICE PLATE HOLDER TYPE FIXED FLOW RESTRICTOR UNIT
- 6mm (0.25 INCH) BORE HOSE CONNECTION
SPLIT USING 6mm (0.25 INCH) BARB 'Y' PIECE

Typical spray liquid feed system

INSTALLATION

Flow indicators

It may be desirable to fit flow indicators in the feed lines to each MICROMAX atomiser. The flow indicators should be positioned so as to be clearly visible to the spray operator whilst driving the sprayer, without the operator needing to take their eyes off the direction of travel for more than a few seconds. Larger numbers of MICROMAX atomisers may be monitored in groups (such as boom sections) in order to reduce the number of indicators required and the complexity of the plumbing.

Modification of an existing system



IMPORTANT SAFETY RECOMMENDATIONS

- Before working on an existing liquid feed system, **always** flush out the entire system with clean water or a suitable solvent and wash off outer surfaces.
- When working on a sprayer that has been used with agrochemicals, **always** treat it as contaminated, even if it has been thoroughly flushed and cleaned. Refer to Section 4 'Safety and the environment' for recommended precautions.
- Legislation and regulations on the design of sprayers have changed significantly over the last few decades. Older sprayers should be upgraded to meet the latest requirements. If this is not practicable they should be replaced.

If an older sprayer is being modified, it is essential that the spray liquid feed system is thoroughly cleaned and overhauled. Any rusty or damaged pipes or hoses should be replaced, valves should be checked for correct operation, the pump should be serviced, and the filters cleaned or replaced.

The original spray pump can normally be retained. If this pump is a high pressure type or if it has excess capacity, it may be necessary to fit an adjustable pressure regulator in the liquid supply line to the atomisers. If a pressure regulator is already fitted but cannot be adjusted to a sufficiently low pressure, it will be necessary to either fit a second low pressure regulator to the output of the main regulator, or to replace it.

INSTALLATION

When retro-fitting multiple MICROMAX 120 atomisers to a boom sprayer it is common to utilise most of the existing spray system. MICROMAX 120 are generally plumbed to every other existing nozzle holder, the holders in between being blanked off, if nozzles are spaced at 0.5m (10 inches).

The usual arrangement is to fit a suitable DCV unit and nozzle filter into the nozzle holder. A nozzle cap, usually one for disc and core type hollow cone nozzles, is then fitted with a 6 mm (0.25 inch) hose barb adapter. This is fitted to the DCV unit in place of the conventional nozzle and cap, allowing connection of 6 mm (0.25 inch) bore hose. The MICROMAX plumbing is then continued as per Figure 11 ‘Typical spray liquid feed system’ on page 14.

Some DCV units allow an orifice plate to be fitted before the nozzle cap and hose barb, otherwise a separate orifice plate holder should be fitted in the line to the atomiser, before the split to feed the two nozzles.

The components required for attaching to most common nozzle holders can be obtained from Micron, otherwise contact your usual spray component supplier.

ELECTRICAL SYSTEM

The design of the electrical system will depend on the number of MICROMAX 120 atomisers to be used and the available electrical power. This section provides general advice and design data for use by a technically competent person.



IMPORTANT SAFETY RECOMMENDATIONS

- Failure to follow the recommendations in this section, and good electrical wiring practice, may lead to serious damage to the MICROMAX 120 motor. Unsafe conditions may also arise, such as; excessive heating of components, risk of fire, and damage to the spray vehicle's safety critical systems.
- It is strongly recommended that the electrical system be designed and installed by a qualified and competent electrician with reference to the vehicle manufacturer's recommendations.

INSTALLATION

All components needed to build the electrical system should be available from your usual specialist electrical component supplier, otherwise contact Micron for advice.

Motor rating

The MICROMAX is driven by a permanent magnet DC motor.

6000 rpm (achieved at approximately 14v DC) and 3A are the maximum recommended speed and current ratings.

Voltage vs. speed, current vs. flow

The MICROMAX motor's rotational speed is almost directly proportional to the voltage applied across it. Correct disc speed is essential to ensure appropriate spray quality (see section 6 – 'Basics of Controlled Droplet Application'). It is essential to ensure, therefore, that the voltage across the motor is as near to 12v DC as is practicable (max. +/- 1v DC).

The current drawn by the MICROMAX 120 motor will increase as the flow rate of chemical liquid is increased. Higher flow rates than the maximums quoted in Table A 'Typical Performance Data' on Page 3 should not be used. This risks overloading and damaging the MICROMAX 120 motor, and will also cause a deterioration in the droplet size spectrum.

Switch Box

A master on/off switch and 'power on' indicator should be fitted in order to be able to turn the MICROMAX 120 atomiser/s on and off as required. The switch should be large and easily operated with a gloved hand, yet difficult to accidentally actuate (i.e. when driving the sprayer). The indicator should be bright enough to be visible in all daylight conditions.

If more than one atomiser is to be controlled high power components should be used, since each MICROMAX 120 can use up to 36 watts and draw up to 3A. It is common for multi-atomiser systems, such as boom sprayers, to use a high power relay to effect switching, with the actual switch operating the relay actuation circuit.

The switch (and relay if used) and indicator should be mounted in a suitable weatherproof enclosure, which shall be referred to as the 'switch box' in the following sections.

INSTALLATION

Location of the switch box

The switch box should be securely mounted, and located so as to minimise the length of the battery leads and the MICROMAX power cables. Care should be taken to position the switch box so that it causes no impediment to the safe operation of the sprayer.

It is desirable that the sprayer operator, whilst in the driving position, should be able to comfortably and safely operate the switch. This is not, however, essential if it is impractical. The spray liquid on/off valves are the primary method of turning the sprayer on and off whilst in operation (i.e. when turning at the end of rows).

Power supply

In most instances the MICROMAX 120 electrical system will be connected to the spray vehicle's system, powered by the alternator. It is recommended that connection is made directly to the vehicle's battery terminals. It is essential to check the spray vehicle manufacturer's specifications to ensure that the alternator has sufficient spare capacity to drive the required number of MICROMAX 120. If not, a larger alternator or dedicated electrical supply must be fitted.

A dedicated electrical supply may be preferred or needed, such as a PTO shaft driven generator. In this case it is recommended that the dedicated supply be used to charge a large capacity heavy duty battery. The MICROMAX electrical system should then be connected to the battery, which will act as a buffer or accumulator to smooth the supply.

Fuses and circuit protection

The vehicle's electrical system should be protected by fitting a master fuse into the positive battery lead. This should be located as near as possible to the battery terminal connection.

The master fuse should be a 'slow blow' automotive type. Some experimentation may be required to obtain the best balance between circuit protection and the avoidance of nuisance blowing. As a guide, allow 3A per MICROMAX 120 then add 10%. A circuit breaker may be used, if preferred, instead of a fuse.

INSTALLATION

The MICROMAX 120 motor and supply circuits should also be protected. Fit a ‘slow blow’ type 5A fuse in the positive power lead to each MICROMAX. The fuse should be located as near as possible to the atomiser itself (see Figure 12 ‘Typical electrical system’ on page 21). It is recommended that a weatherproof fuse holder is used, otherwise wrap the fuse holder in weatherproof tape.

Battery connection

The power leads from the battery to the switch box should be oversized, to minimise voltage drop. The following sizes are given as a guide:

<i>Number of MICROMAX 120</i>	<i>Cross Sectional Area (CSA) (each lead)</i>
1	4 mm ² (12 AWG)
2 to 6	6 mm ² (10 AWG)
7 to 12	10 mm ² (8 AWG)
13+	16 mm ² (6 AWG)

Battery lead size

The positive and negative leads should be twisted around each other along as much of their length as possible, to reduce impedance.

The connections to the battery must be secure and offer low resistance. High quality, heavy duty 8 mm (0.3125 inch) crimp rings are recommended, they will fit the terminal bolts used on most batteries.

MICROMAX connection

The leads from the switch box to each MICROMAX 120 should be oversized to minimise voltage drop. Guide sizes are given in Table C ‘MICROMAX 120 feed cable sizes’ on Page 20.

If more than one MICROMAX 120 atomiser is to be connected, they should always be connected in parallel (see ‘Typical electrical system’ on page 21). The lengths of the leads from the switch box to each atomiser should be kept as equal as practicable.

INSTALLATION

<i>Configuration</i>	<i>Area (CSA) each lead</i>	<i>Cross Sectional</i>
Single atomiser cable less than 3m (10 feet) long		1.5 mm ² (16 AWG)
Single atomiser cable more than 3m (10 feet) long		2.5 mm ² (14 AWG)
Up to 12 atomisers fed from a single master power cable split at a junction box (i.e. on a boom sprayer).		
• Master cable (max. 3m (10 feet) long)		6 mm ² (10 AWG)
• Individual atomiser power cable		as above

MICROMAX feed cable sizes

Connection to the MICROMAX 120 motor leads should be made in such a way as to facilitate quick and easy replacement of the atomiser. Waterproof automotive type in-line plug/socket connectors are recommended. Screw terminal blocks wrapped in weatherproof tape are an acceptable low cost alternative.

Any junction boxes used should be securely mounted and be weatherproof. Glands should be used on all cable entries.

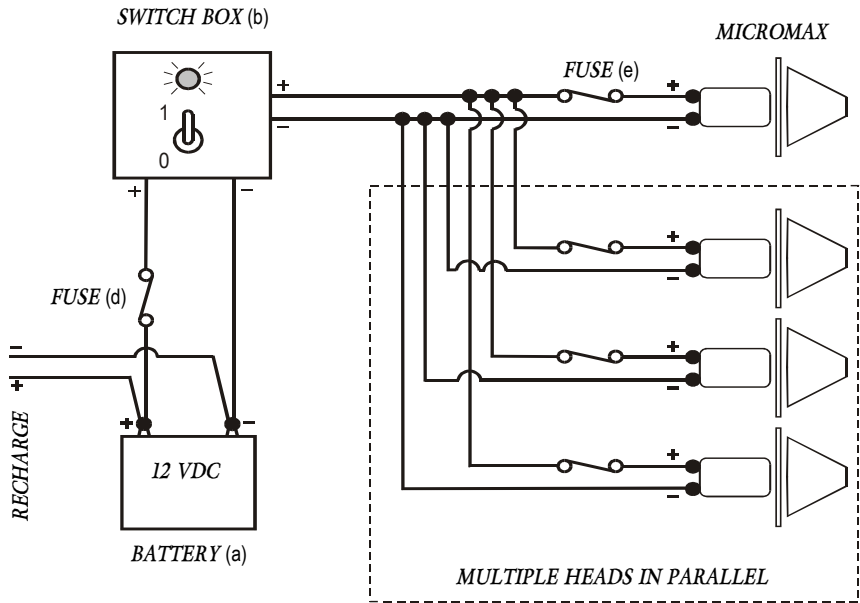
Materials and cable type

For most applications, all leads/cables can be PVC insulated multi-stranded flexible copper cable. Arctic grade PVC or CSP insulated cable may be required in unusually harsh environments.

It is strongly recommended that all leads/cables are protected using flexible polypropylene or nylon conduit, braided polyethylene sheath, or similar. This is especially important in areas where abrasion is likely, such as around folding boom pivot points.

Connections should be sealed with glands or weatherproof tape. Exposed components should be weatherproof and resistant to agrochemicals.

INSTALLATION



(a) - (e)

NOTES:	
a	HEAVY DUTY 12 VOLT DC BATTERY
b	SWITCH BOX GIVING ON/OFF CONTROL
c	USUALLY VEHICLE'S ALTERNATOR CIRCUIT
d	SLOW BLOW AUTOMOTIVE TYPE (SEE SECTION 5.3.6)
e	

Typical electrical system

Routing leads/cables

Leads/cables should be securely clipped in place and routed to avoid hot areas or possible pinching hazards. Care should be taken to ensure that no impediment is caused to the safe operation of the sprayer.

BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

This section is included as a brief introduction for spray operators new to Micron's MICROMAX 120 CDA technology. It is not intended to be a comprehensive spraying guide, or to offer detailed recommendations. Please contact Micron for application specific advice.

WHAT IS CDA?

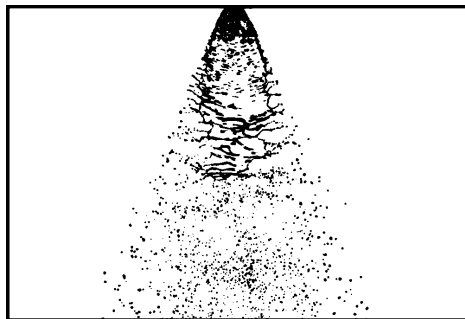
An agricultural sprayer may be used to treat many different targets, varying from the bare ground to an insect on top of foliage. For each application there is an optimum droplet size for maximum efficiency.

Ideally all spray liquid would leave the sprayer in optimum sized droplets. In reality this is impossible, all sprayers produce a range of droplet sizes.

The control of the size and range of droplets produced and applied is called Controlled Droplet Application (CDA). What defines a CDA sprayer is its ability to produce relatively even droplets, correctly sized to suit the application.

DROPLET FORMATION

Conventional hydraulic pressure nozzles force liquid under pressure through a hole, producing a sheet of liquid which then disintegrates randomly into droplets.

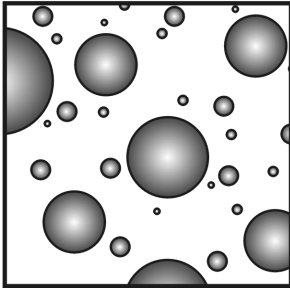


Conventional hydraulic pressure nozzle droplet formation by sheet disintegration.

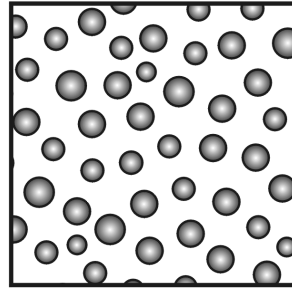
BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

The droplets formed can vary considerably in size, typically ranging from $1\mu\text{m}$ to $1000\mu\text{m}$. Droplets that are too big bounce off the target or run together and drip, whilst droplets that are too small drift away. At best both waste chemical, and at worst cause crop damage or pollution.

Uneven droplets from a conventional hydraulic pressure nozzle



Relatively even droplets from a MICROMAX CDA atomiser



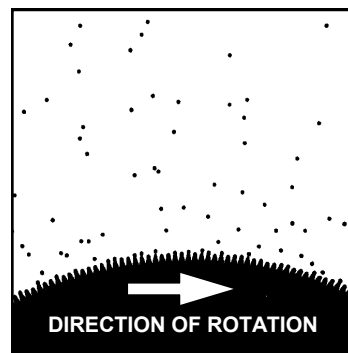
Uneven and even droplets

Micron's MICROMAX 120 CDA atomisers use spinning discs, with precision formed grooves and teeth, to produce droplets. When the disc speed and spray liquid feed rate are correctly set, they produce relatively even droplets sized to suit the application. Overly large and overly small droplets are avoided.

An understanding of how the droplets are formed is desirable, in order to correctly select disc speed and spray liquid flow rate.

At low flow rates, large single droplets are emitted from the atomiser disc's 'teeth'.

As the liquid feed rate increases ligaments form producing smaller droplets. A point is reached where all droplets become 'ligament formed' (see 'Ligament Atomisation' below).

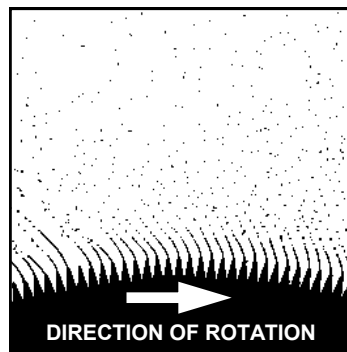


Single droplet atomisation

BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

The atomiser disc's speed determines the size of the droplets produced in each mode. The faster the disc spins, the smaller the droplets.

Further increasing the spray liquid feed rate will eventually 'flood' the grooves and teeth, causing 'sheeting'. Droplets are then formed by the random disintegration of the sheet, similar to a conventional hydraulic pressure nozzle.



Ligament atomisation

COVERAGE DENSITY

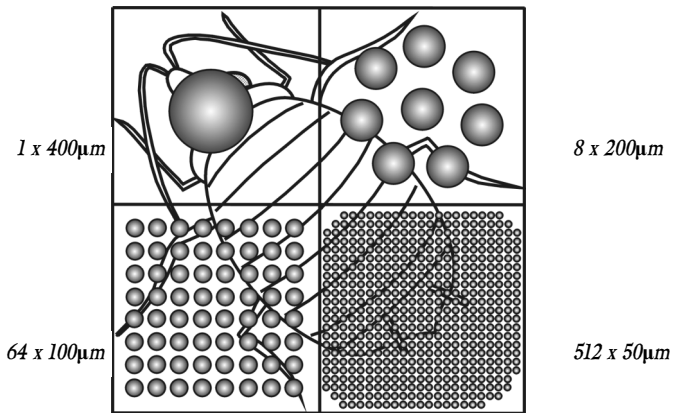
The objective of an agricultural sprayer is to distribute sufficient active ingredient evenly over a target area. The density of coverage required for excellent efficacy is mainly dependent upon the leaf area and growth stage of the crop or target and the type of chemical being

<i>Type of spray</i>	<i>Crop or target density</i>	<i>Leaf Area Index</i>	<i>Growth Stage (feekes)</i>	<i>Coverage Density droplets/cm² ground area (droplets/sq. inch)</i>
Pre emergent	Nil	Nil	Nil	50-100 (320-650)
Translocated post emergent herbicide	Sparse	1/2	1 - 2	50-100 (320-650)
Translocated post emergent herbicide	Medium-dense	1 - 2	3 - 7	100 (320)
Translocated fungicide and insecticide	Sparse-dense	1/2 - 2	1 - 10	50-100 (320-650)
All contact	Sparse-dense	1/2 - 2	1 - 10	150-200 (970-1300)

Coverage density in relation to chemical and target

BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

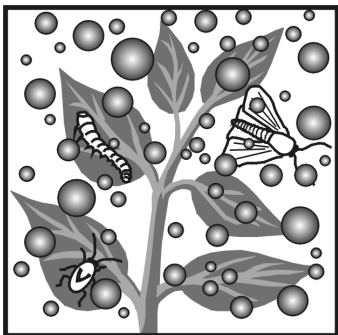
From a fixed volume of liquid, as the droplet size halves the number of droplets increases eight fold.



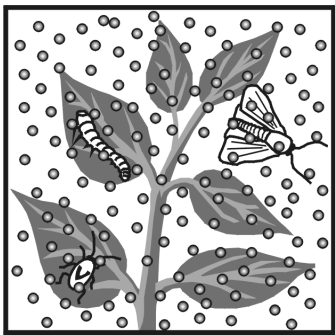
Number of droplets from a fixed volume of spray liquid

The ability of a MICROMAX 120 CDA atomiser to produce relatively even sized small droplets allows the volume of spray liquid to be drastically reduced, whilst maintaining the density of coverage. This is referred to as 'Low Volume' CDA spraying.

CONVENTIONAL SPRAYING



LOW VOLUME CDA SPRAYING



Volume reduction whilst maintaining coverage

BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

A Low Volume CDA sprayer should be calibrated to give the required coverage density.

	Volume application rate l/ha (US gpa)								
	5 (0.5)	10 (1)	15 (1.5)	20 (2)	25 (2.5)	30 (3)	35 (3.5)	40 (4)	
Droplet size (µm)	Number of droplets/cm² of ground area (droplets /sq. inch)								
80	185 (1200)	NOT NECESSARY!							
100	95 (610)								190 (1230)
120	55 (350)	110 (710)	165 (1060)	220 (1420)					
140	TOO LITTLE!	70 (450)	105 (680)	140 (900)					175 (1130)
160		50 (320)	75 (480)	100 (650)	125 (810)	150 (970)	175 (1130)	200 (1290)	
180				60 (390)	75 (480)	90 (580)	105 (680)	120 (770)	
200						50 (320)	60 (390)	70 (450)	80 (520)
250								48 (310)	55 (350)

Table E – Droplet size, volume application rate and coverage density

Low Volume CDA spraying allows dramatic savings to be made in the cost of the spraying operation. Greater areas can be sprayed per tank load, or lighter vehicles used. The spraying process is speeded up, allowing more spraying days and therefore a better chance of spraying at the optimum time.

The advantages of Low Volume CDA are even more pronounced if the chemical can be applied during the early phase of the recommended application period, particularly when applying herbicides. The target will have a relatively lower leaf area, and so will require less chemical for good coverage.

It is vital, however, that consideration be given to the stage of growth, and how receptive the target is, at the time of spraying.

BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

DROPLET TRANSPORT AND DEPOSITION

Most agricultural sprayers (excluding air-assisted and electrostatic) use various combinations of initial momentum, gravity, and controlled drift to transport the spray liquid droplets to, and deposit them on, the target.

Initial Momentum

Momentum is a function of an object's velocity multiplied by its mass, and is the force that makes an object continue to move once the force causing it to move in the first place has been removed.

A droplet gains its initial velocity and hence initial momentum during production, either by a rotary disc CDA atomiser or by a conventional hydraulic pressure nozzle.

Air resistance (drag) slows the droplet, usually reducing its initial momentum to zero within a relatively short distance. Gravity will also act against a droplet's initial momentum, if it is travelling upwards.

Rotary disc CDA atomisers and conventional hydraulic spray nozzles both use the initial momentum of droplets to spread them laterally, producing their characteristic spray patterns.

Many conventional hydraulic spray nozzles also use the initial momentum of large droplets to transport them to, and deposit them on, a target.

This is not an effective method for smaller droplets as their initial momentum is too low, due to their very low mass, resulting in the droplets being easily deflected from their target by small air currents.

BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

Gravity

Gravity is the force which accelerates objects downwards, and is a function of an object's mass. Air resistance (drag) acts against gravity to slow the object.

As gravity accelerates an object its downward velocity, and therefore momentum, increases.

The object, if unhindered, continues to accelerate until it reaches its 'terminal velocity', when the forces of gravity and air resistance are balanced causing the object to cease accelerating.

Rotary disc CDA atomisers and conventional hydraulic spray nozzles both use gravity to transport larger droplets vertically downwards, and to deposit them onto the top surfaces of a target.

This is not effective for smaller droplets as their terminal velocity and hence momentum is very low, due to their very low mass. This lack of momentum results in the droplets being easily deflected from their target by small air currents.

Controlled Drift

Drift is the lateral transportation of droplets away from their point of release by natural wind currents.

The distance a droplet will travel depends on the mass of the droplet and the strength of the wind. Tiny droplets in a strong wind may travel great distances, whereas large droplets in a light wind may hardly be deflected at all.

Uncontrolled off-target drift is always undesirable. However, in many applications, controlled drift is essential for good penetration and even coverage.

The droplets produced by a correctly set rotary CDA atomiser are relatively uniform, allowing better control of drift.

Better drift control improves coverage and reduces the risk of off-target spraying and subsequent crop and/or environmental damage.

BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

Deposition and retention

If the target is a crop (i.e. defoliants, fungicides), insects feeding on a crop (insecticides), or weeds within a crop (selective herbicides) the spray is most suitable if it is applied as droplets in the range 100µm to 200µm. This minimises any risk of uncontrolled spray drift whilst reducing the amount of chemical required, as CDA capitalises on two facts:

Larger droplets in the range 200µm to 500µm are most suitable for foliar fertiliser, soil applications, pre and post-emergent herbicide applications, and where drift avoidance is essential.

Smaller droplets in the range 75 to 150 are most suitable for contact insecticides, achieving high coverage levels and forming a dense mist effective against insects in-flight. Smaller droplets are also more easily distributed by the turbulent air currents within the crop canopy, achieving better under-leaf and vertical stem coverage.

Please contact Micron for the latest information (i.e. recommendations, trials reports, expert contacts) relating to specific areas of application.

Spray concentration effect

Experience with CDA has shown that results are often far better if an additive such as an adjuvant oil or wetter is included in the chemical mix.

Without an additive the spray may consist of droplets that have high viscosity and surface tension, preventing the droplet spreading on impact. When the liquid evaporates the chemical will be concentrated on a small area of the target. This may destroy the plant tissue (scorch) and inhibit intake and translocation of the chemical.

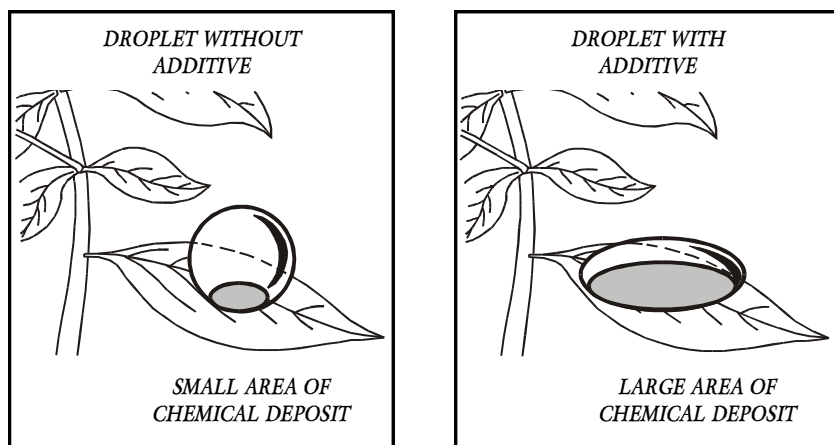
BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

The effect of the additive is to reduce the surface tension of the droplet. This significantly increases the area covered by the droplet, reducing the risk of scorch and increasing absorption.

Increased surfactant levels may also dissolve and penetrate the waxy surfaces of plants and insects. However, an excessive amount of wetter can lead to foaming of the spray mix at very low application volumes.

Several chemicals, including hormone herbicides, do not mix freely with adjuvant oils and can scorch a crop that is under stress.

Oil may also help to waterproof the chemical making it rain resistant.



The addition of a wetter reduces surface tension

In dry and/or sunny conditions the size of a water-based spray droplet decreases rapidly due to evaporation. The resulting droplet may be very concentrated, have a high surface tension, and may not spread on impact. This may result in plant tissue damage and make spraying less effective.

Evaporation will also increase the risk of drift.

The addition of an adjuvant oil at 2% - 5% of the total spray volume will help prevent evaporation.

BASICS OF CONTROLLED DROPLET APPLICATION (CDA)

CDA IN ACTION

Reducing volumes and dose rates

With some chemicals, the advantages that CDA gives in relation to more effective coverage allow the use of reduced dose rates whilst maintaining efficacy. However, the reduction of dose rates is undertaken at the individual user's own risk and is best done based on comprehensive trials data.

Reduced dose rates are not recommended in all situations. Care must be taken with respect to possible increases in weed, pest and disease resistance resulting from a sub-optimal treatments.

Reduced drift and run-off

The accurate control of droplet size allows not only more effective treatment, but also the selection of the most appropriate spray quality to reduce environmental damage due to drift and run-off.

Tiny droplets that cause drift and oversize droplets that cause run-off can be dramatically reduced.

Please call on Micron's extensive experience and library of trials data for further information on particular applications and current recommendations. Academic and experienced user contacts can also be provided.

CALIBRATION AND ADJUSTMENT

Before each use the sprayer must be calibrated for droplet size and application rate.

It is important to note that the data provided in the following section is based on performance with water and is intended as a guide. Actual performance will vary according to the formulation of chemical being used. It is therefore vital that the calibration of the system is checked whenever a new chemical is used.

The following sections describe the calibration procedure for a typical MICROMAX 120 based sprayer. The procedure may vary with some types of sprayer, contact Micron for advice if in doubt.



IMPORTANT SAFETY RECOMMENDATIONS

- Failure to correctly calibrate the sprayer may result in crop damage, ineffective treatment or environmental damage through excessive run-off and/or drift.
- When calibrating a sprayer, take safety precautions as per spraying

DROPLET SIZE AND ATOMISER SPEED

Atomiser Speed Selection

The MICROMAX has three speed settings or gears providing three droplet size ranges. Select the appropriate setting for the application from ‘Atomiser Speed Selection’ on Page 33. Refer to section 6 – ‘Basics of controlled droplet application’ for further guidance on droplet sizes.

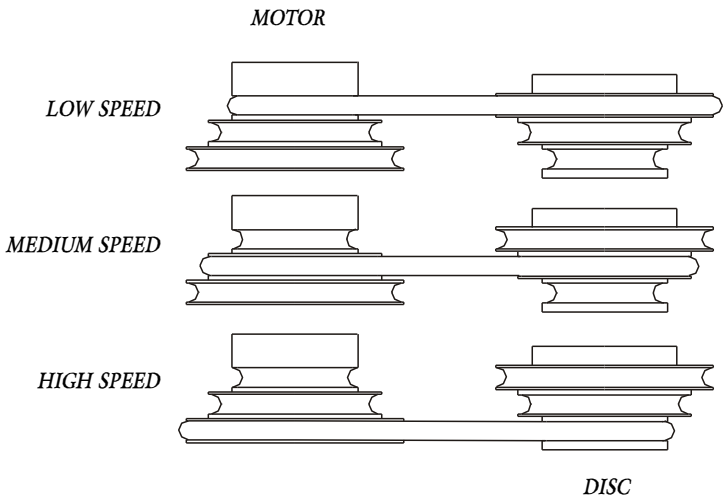
Atomiser Speed Setting

The chosen speed is set by moving the MICROMAX 120 drive belt, by hand, to one of the three available positions, see ‘Atomiser Speed Setting’ on page 33. Ensure that the belt is tight and level, and that the belt and pulleys are clean.

CALIBRATION AND ADJUSTMENT

<i>Application</i>	<i>Speed Setting</i>	<i>Nominal Disc Speed</i>	<i>Droplet Size Range</i>
Herbicides, Foliar Fertilisers, Soil Applications, and Drift Minimisation	Low	2000 rpm	200 – 500 µm
Fungicides and Insecticides	Medium	3500 rpm	100 – 200 µm
Contact Insecticides	High	5000 rpm	75 – 150 µm

Atomiser Speed Selection



Atomiser Speed Setting

CALIBRATION AND ADJUSTMENT

Checking Atomiser Speed

On first use, at the start of each spraying season, and periodically throughout the season MICROMAX 120 atomisers should be checked for correct running speed using an optical tachometer, timing strobe or other similar suitable device.

Fast running is usually due to a fault in the electrical system, whereas slow running may also be due to atomiser motor problems. See section 10 'Trouble shooting' should a significant deviation (+/- 10%) from the stated running speeds be experienced (see 'Typical performance data' on page 3).



IMPORTANT SAFETY RECOMMENDATIONS

- Be aware that when a MICROMAX atomiser is running it rotates at high speed, which can present an entanglement hazard and risk of injury by cutting by the discs' teeth.
- Secure loose clothing and long hair.
- Do not touch a rotating atomiser disc.

APPLICATION RATE AND FLOW RATE

Determining the required spray volume and dose rate

Choosing the appropriate chemical dose rate, concentration, and therefore spray liquid volume application rate is essential for successful spraying.

CDA technology allows significant reductions in spray liquid volume application rates, and often also chemical dose application rates, to be made whilst maintaining efficacy. Refer to section 6 – 'Basics of Controlled Droplet Application' for further discussion of the principles behind reducing volumes and dose rates.

The following guidelines should be followed, backed up where possible by data from field trials. Contact Micron for further guidance if required.

CALIBRATION AND ADJUSTMENT

GUIDELINES FOR THE APPLICATION OF PESTICIDES WITH CDA - REDUCED VOLUME SPRAYING.

Chemicals are categorised into three groups when applying through CDA equipment.

1. Chemicals whose labels give specific CDA instructions:

For chemicals available as CDA formulations or with label instructions on use with CDA equipment the label instructions should be followed.

2. Chemicals whose labels prohibit higher concentrations:

Including products where the label prohibits low volume spraying at the recommended dose, having a statutory maximum concentration, or classified as very toxic, corrosive or posing serious risk of eye injury.

Spray volumes may be reduced only if the product dose is reduced in line with the spray volume so as not to exceed the maximum concentration recommended on the label.

EXAMPLE:

The maximum label concentration of spray at 5 l/ha dose in 200 l/ha spray volume = 2.5% product in water.

So at 100 l/ha reduced volume spraying, maintaining the maximum concentration at 2.5% gives a maximum dose rate of 2.5 l/ha.

3. Chemicals whose labels allow increased concentration:

Spray volumes may be reduced at full dose rates. The maximum concentration permitted is 10X the maximum concentration recommended on the label for conventional spraying.

EXAMPLE:

The maximum label concentration of spray at 5 l/ha dose in 200 l/ha spray volume = 2.5% product in water.

So a full 5 l/ha dose can be used down to a spray volume of 20 l/ha, giving a spray concentration of 25% product in water.

At volumes below this the dose rate must be reduced to maintain a maximum 10x concentration as per 2 above.

'OFF-LABEL' USERS WILL HAVE TO ACCEPT RESPONSIBILITY FOR THE EFFICACY OF THE TREATMENT.

IN ALL CASES USE THE MINIMUM DOSE RECOMMENDED ON THE LABEL.

CALIBRATION AND ADJUSTMENT

Determining the area sprayed per minute

Once the required volume application rate and dose rate have been established, the area sprayed per minute must be determined in order to calculate the required sprayer output per minute.

The area sprayed per minute is dependant on the swath width and the forward speed of the sprayer.

Swath width

The swath width will depend on the design of the sprayer and the number of MICROMAX atomisers used. As a general guide for non-shrouded sprayers, one MICROMAX atomiser alone produces a swath approximately 2.4m wide. Two or more atomisers spaced equally will produce a swath width equal to:

$$2.4\text{m} + [\text{Atomiser spacing (m)} \times [\text{Number of atomisers} - 1]]$$

EXAMPLE:

For a 12m boom sprayer with 12 MICROMAX heads spaced at 1m the swath width would be calculated as:

$$\begin{aligned} &2.4\text{m} + [1\text{m} \times [12 - 1]] \\ &= 2.4\text{m} + [1\text{m} \times 11] \\ &= 2.4\text{m} + 11\text{m} \\ &= 13.4\text{m} \end{aligned}$$

However, this sprayer should be driven through the crop on a 12m track spacing in order to achieve the required spray pattern overlap for the end atomisers, and give equal coverage. Therefore the swath should be assumed to be 12m.

Forward speed

If the sprayer or tractor is fitted with a reliable and accurate forward speed indicator simply convert the forward speed to be used to metres per minute (m/min) using the calculations below:

CALIBRATION AND ADJUSTMENT

If the sprayer or tractor is not fitted with a forward speed indicator, use markers to determine the forward speed. Start the vehicle and adjust the throttle to achieve the required constant forward speed, drop the first marker, time 30 seconds then drop the second marker. Measure the distance in metres between the two markers. Simply multiply this by 2 to give the forward speed in metres per minute (m/min).

Calculation of area sprayed per minute

Using the figures obtained for swath width and forward speed determined as per the area sprayed in hectares per minute (ha/min) is calculated using the formula

$$\text{Area sprayed (ha/min)} = \frac{\text{Forward speed (m/min)} \times \text{Swath width (m)}}{10000}$$

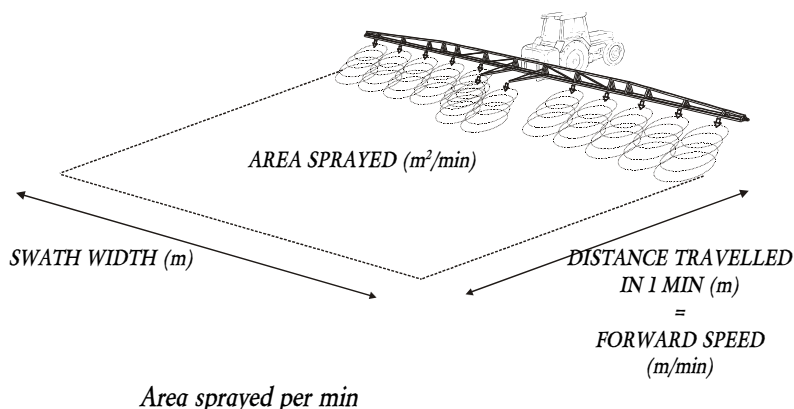
EXAMPLE:

If a forward speed of 9 kph and a swath width of 12m is used:

$$9 \text{ kph} = 9 \times 16.7 = 150.3 \text{ m/min (see 7.2.2.2 above)}$$

$$\text{Area sprayed (ha/min)} = \frac{150.3 \text{ m/min} \times 12 \text{ m}}{10000}$$

$$\text{Area sprayed} = 0.18 \text{ ha/min}$$



CALIBRATION AND ADJUSTMENT

Determining the total sprayer output per minute

Using the required spray liquid application rate in litres per hectare and the area sprayed per minute determined as per 7.2.1 and 7.2.2 above, the total sprayer output (litres per minute) is calculated as below.

$$\begin{array}{ccccc} \text{Total output} & & \text{Spray liquid} & & \text{Area sprayed} \\ (\text{l/min}) & = & \text{application rate} & \times & \text{per minute} \\ & & \text{required (l/ha)} & & (\text{ha/min}) \end{array}$$

EXAMPLE:

Using the example figures from 7.2.1, i.e. 9 kph forward speed with a 12m swath gives an area sprayed per min figure of 0.18 ha/min. Assume (as per 7.2.1) a required application rate of 30l/ha spray liquid, the sprayer total output is

$$\text{Total output (l/min)} = 30 \text{ l/ha} \times 0.18 \text{ ha/min}$$

$$\text{Total output (l/min)} = 5.4 \text{ l/min}$$

Determining the output per atomiser per minute

Using the total spray liquid output rate in litres per minute calculated in 7.2.3 above, and the known number of MICROMAX atomisers used, the output (litres per minute) per atomiser is calculated as below.

$$\begin{array}{ccc} \text{Output per MICROMAX} & & \text{Total output (l/min)} \\ (\text{l/min}) & = & \frac{\quad}{\quad} \\ & & \text{Number of atomisers} \end{array}$$

EXAMPLE:

Using the example figures from 7.2.1 and 7.2.2, apply 5.4 l/min through a 12 head boom sprayer gives:

$$\begin{array}{ccc} \text{Output per MICROMAX} & & 5.4 \text{ l/min} \\ (\text{l/min}) & = & \frac{\quad}{12} = 0.45 \text{ l/min (or 450 ml/min)} \end{array}$$

CALIBRATION AND ADJUSTMENT

MICROMAX spacing		Number of atomisers		Swath width	
2.4 + ([] X ([] - 1))				[] m	
SECTION 7.2.2.1					
Forward speed					
[] mph X 26.8					
or					
[] kph X 16.7					
or					
Distance travelled in 30 seconds					
[] m X 2		= [] m/min			
		SECTION 7.2.2.2			
Area sprayed					
[] ha/min		= [] m/min X [] m			
		10000			
SECTION 7.2.2.3					
[] ha/min		Application rate required		Total sprayer output	
[] ha/min		X [] l/ha		= [] l/min	
				SECTION 7.2.3	
				SECTION 7.2.4	
Output per MICROMAX					
[] l/min		= [] l/min			
		Number of atomisers []			

Figure 24 – Calculating flow rate (l/min) per MICROMAX

NOTE: MORE COPIES OF THIS CALCULATION GRID MAY BE FOUND IN SECTION 14 – 'USER NOTES'.

CALIBRATION AND ADJUSTMENT

Compensating for MICROMAX performance parameters

In order to produce the droplet spectrum required, the MICROMAX atomiser must be used with a flow rate within the ranges specified in Table H 'Flow rate parameters' below.

<i>Application</i>	<i>Speed Setting</i>	<i>Minimum Flow Rate</i>	<i>Maximum Flow Rate</i>
Herbicides, Foliar Fertilisers, Soil Applications, and Drift Minimisation	Low	0.5 l/min	3 l/min
Fungicides and Insecticides	Medium	0.25 l/min	1 l/min
Contact Insecticides	High	0.125 l/min	0.5 l/min

Flow rate parameters

If the required flow rate per MICROMAX atomiser (see section 7.2.4) does not fall within the permissible range, for the speed setting for the application, action must be taken to compensate and bring the flow rate into the range. The suggested actions being:

Flow rate too high:

Reduce the application rate required whilst maintaining the dose rate by increasing the spray liquid concentration (see section 7.2.1 for limits).

Reduce the forward speed of the sprayer.

Flow rate too low:

Increase the application rate required whilst maintaining the dose rate by reducing the spray liquid concentration (see section 7.2.1 for limits).

Increase the forward speed of the sprayer.

Re-calculate the flow rate required after adjustment to check that it now falls within the required limits. Contact Micron for advice if it is not possible to make sufficient adjustment.

CALIBRATION AND ADJUSTMENT

Setting the required flow rate

The flow rate to each atomiser is usually set to be the same.

Flow is regulated by the MICROMAX 120 coloured nozzles and/or a flow restrictor fitted into the line before each MICROMAX head (see Section 5.2.1) and the spray line pressure.

Nominal spray line pressure and permitted adjustment

The spray line pressure should be maintained within the range allowed for correct operation of the diaphragm check valves fitted (normally 1.0 – 1.75 bar – check manufacturers specifications).

Higher pressures can be used to achieve higher flow rates, however it is better to select a higher VRU setting or larger orifice plate / nozzle. This will reduce the risk of blockages and also provide more consistent flow when applying wettable powders.

Lower pressures should not be used as they will prevent the diaphragm check valves from opening correctly.

It is recommended that a nominal pressure of 1.5 bar is used, with a maximum adjustment of +/- 0.25 bar to achieve flow calibration.

Coloured nozzles

The MICROMAX atomiser is supplied with three sets of two coloured nozzles, Blue, Yellow and Red. These equate roughly to the orifice plate sizes 31, 43, and 48 respectively.

Low cost flow control can be achieved by using these nozzles singly or in pairs (i.e. fit both but plumb spray line to only one or both) without fitting a separate flow restrictor.

Where this method is to be used follow the procedures in 7.2.6.4 'Orifice plates' below, equating the single coloured nozzles to the orifice plate sizes stated above. Use in pairs doubles the flow at any given pressure.

EXAMPLE:

A single Blue nozzle equates to an orifice plate size 31, giving approximately approx. 345 ml/min at 1.4 bar. A pair of blue nozzles equate to double the flow of an orifice plate size 31 giving approx. 690 ml/min at 1.4 bar.

CALIBRATION AND ADJUSTMENT

If a variable restrictor unit or orifice plate holder unit is to be used to control flow, simply fit the two Red nozzles and plumb spray line to both. These will then have no effect on the flow rate until it reaches over 1.3 l/min at 1 bar, when they will begin to act as a pair of orifice plate size 48 restrictors as described above.

Variable Restrictor Units (VRUs)

The procedures given below in section 7.6.2.4 'Orifice Plates' apply equally to variable restrictor units (VRU) utilising a number of selectable orifice sizes, however the manufacturers data will have to be consulted to obtain flow rate vs. pressure figures for each setting.

Infinitely variable restrictor units (i.e. needle valves) are not recommended due to their instability (particularly their susceptibility to vibration) and tendency to block easily. They also tend to be expensive.

Orifice plates.

Orifice plate type flow restrictors are most commonly used due to their robust simplicity and low cost, the following procedure is presented assuming their use.

Select the orifice plate size that gives nearest to the required flow rate at the nominal system pressure. Data for commonly used orifice plates are given in Figure 25 'Graph of Flow Rate vs. Pressure for common orifice plate sizes' on page 43, else refer to manufacturers data.

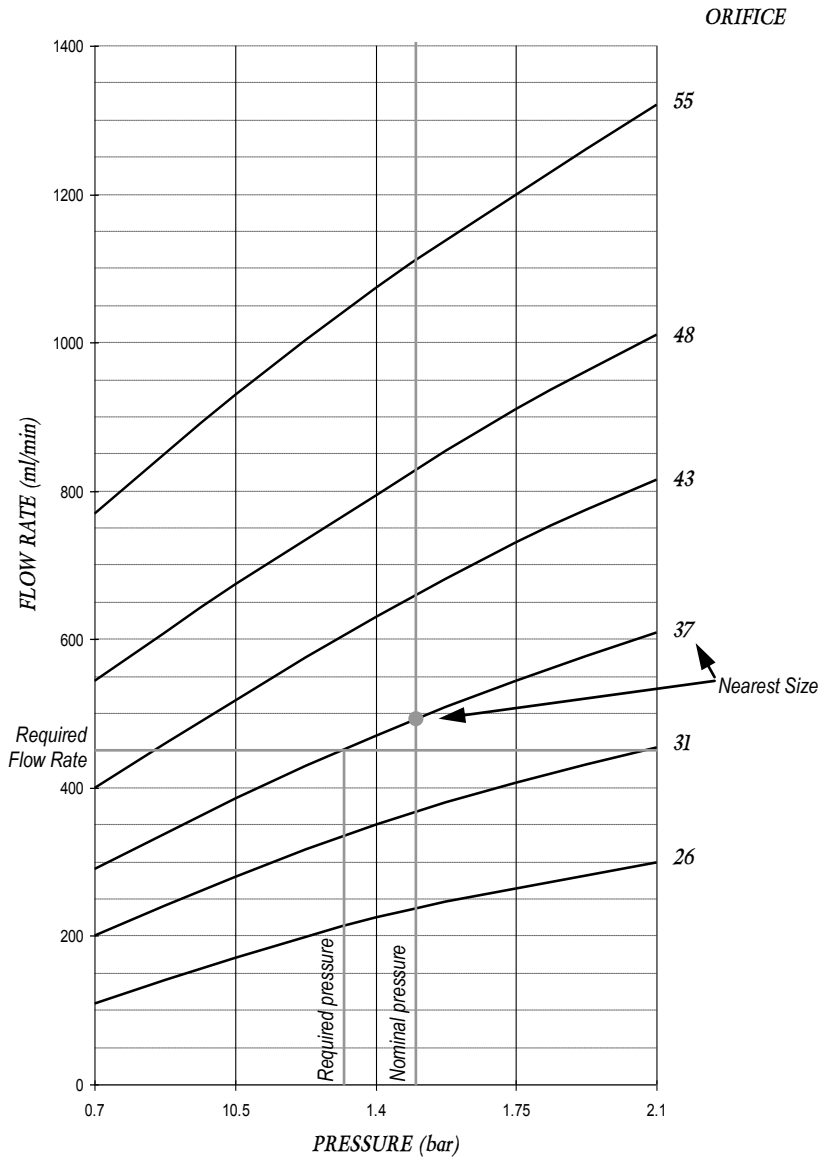
Spray line pressure is then adjusted up or down to give the correct flow rate.

EXAMPLE:

From section 7.2.6.1 a nominal system pressure of 1.5 bar is determined. Following on the example from previous sections, a flow rate of 450 ml/min is required.

Therefore from Figure 25 (page 43) we choose an orifice plate size 37, and adjust the spray line pressure down to approximately 1.3 bar to achieve 450 ml/min.

CALIBRATION AND ADJUSTMENT



Graph of flow rate vs. pressure for common orifice plate sizes.

CALIBRATION AND ADJUSTMENT

Checking and calibrating the flow rate

Before each use the sprayer should be calibrated to ensure that the flow rate output from each MICROMAX is as expected and desired. Firstly ensure that the correct VRU setting is selected if used, the correct orifice plates and coloured nozzles are fitted, and that the system pressure is adjusted to approximately the correct value.

Always calibrate the sprayer with the spray liquid to be used, variations in viscosity and density between formulations will effect the output. See section 8 'Operation' for guidance on mixing and filling before calibration.

CALIBRATION PROCEDURE:

- Place a pail under each MICROMAX head on the sprayer, making sure that the sides of the pail extend above the disc's teeth.
- Start the MICROMAX atomiser/s rotating.
- Turn the spray liquid on, time 1 minute accurately then turn off.
- Stop the MICROMAX/s.
- Measure the output (ml/min) from each MICROMAX by carefully pouring the spray liquid collected in each pail into an accurate measuring jug graduated in millilitres.
- If the output is not correct adjust the spray line pressure up or down as required and repeat the procedure above.
- The output from each atomiser should be the same. If not then check the nozzles, orifice plates / VRU settings, and nozzle filters and spray line for blockages or other restrictions. Once the cause of the variation has been



IMPORTANT SAFETY RECOMMENDATIONS

- Spray liquid collected during calibration should be poured back into the spray tank, or if contaminated disposed of according to local regulations.
- Collection and measuring vessels should not be used for any other purpose and should be washed thoroughly before storage.
- When calibrating a sprayer, take safety precautions as per spraying (see Section 4 'Safety and Environment').

Verifying application rate

During use the amount of spray fluid used and area covered should be monitored to check that the correct application rate (l/ha) is being achieved.

The simplest method to do this is to calculate the area sprayed per tank load.

If the sprayer or tractor is fitted with a 'distance travelled' meter this is calculated by:

$$\text{Area sprayed (ha)} = \frac{\text{Distance Travelled (m)} \times \text{Swath width (m)}}{10000}$$

NOTE: 1 mile = 1609 m, 1 kilometre = 1000 m

If no meter is fitted then the spraying time (in minutes) multiplied by the forward speed (m/min) calculated previously in section 7.2.2.2 will also give the distance travelled in metres. The area sprayed is then calculated as above. Else estimate area sprayed from known field size etc.

The spray fluid load (litres) in the tank is then divided by the area sprayed (ha) to give the actual application rate achieved in l/ha. If this varies from that required adjust the sprayer output up or down accordingly.

EXAMPLE:

From previous example figures used, an application rate of 30 l/ha is required using a 12m swath boom sprayer travelling at 9 kph (150.3 m/min). The sprayer is calibrated to give the theoretical output required, and loaded up with 250l of spray mixture. It then takes 50 minutes to empty the spray tank. Therefore:

⇒ distance travelled = 50 min x 150.3 m/min = 7515 m

⇒ area sprayed (ha) = 7515m x 12m / 10000 = 9.02 ha

⇒ application rate achieved = 250l / 9.02 ha = 27.7 l/ha

Therefore the output rate of the sprayer needs increasing by:

$$((30 / 27.7) - 1) \times 100 = 8\%$$



IMPORTANT SAFETY RECOMMENDATIONS

- Using agrochemicals is a hazardous process. Operators should take the recommended safety precautions, wear the necessary **personal protective clothing and equipment**, and be familiar and comply with all relevant legislation and/or regulations. Refer to section 4 ‘safety and the Environment’.
- Spray operators should be **fully trained** on the specific spraying machine to be used, certification is usually required – check local regulations in force.

PRE-OPERATION CHECKS

Before commencing each spray operation the sprayer should be thoroughly checked for safety and correct operation. Each type of sprayer will require different checks, but they should include at least the following:

- Check that the atomisers rotate freely.
- Check that the pulleys and belts are clean and free from damage.
- Check that all atomiser discs are secure and free from damage or blockage by dried chemical.
- Ensure that the atomisers are securely and correctly positioned on the boom or support structure, and that they are set to the correct distance from the crop/target to be sprayed, see Section 5 ‘Installation’.
- Inspect the entire sprayer for damaged or twisted hoses, leaks in the chemical system, or damaged wires.
- Clean all filters.
- Turn the atomiser’s motors on, ensure all are rotating.

OPERATION

WHEN TO SPRAY

Application timing

The recommendations for CDA spraying are the same as for conventional spraying, however the advantages of CDA are more easily achieved if the chemical can be applied during the early phase of the recommended application time, particularly when applying herbicides. See section 6 'Basics of controlled droplet application'.

Suitable 'spraying days'

CDA spraying should only be carried out on days suitable for conventional spraying.

When using the MICROMAX 120 at its medium or high speed wind movement is beneficial as it imparts lateral movement to the spray aiding penetration and coverage of denser canopies, 8 to 16 kph is recommended.

Also at the medium and higher speeds the droplets produced are prone to evaporation, a suitable anti-evaporant (1-1.5%) should be used. This is particularly important in warm climates or on warmer days.

FILLING & MIXING

Mixing and filling is generally the most hazardous process in the spraying operation. **Always follow the label instructions.** It is important that all necessary protective safety clothing is used, refer to section 4 'Safety and the Environment'.

Tank Filling

Agricultural sprayers should only be filled indirectly by open and free falling water, particularly when filling from the water mains. This is to avoid contamination of the water supply by reverse suction of the filling pipe back into the water source. The filling tube must not come into contact with the liquid inside the tank.

Sprayer designs will vary, but most tanks are fitted with a filling filter, which should be used, and equipped with graduations indicating the precise quantity of liquid inside the tank. These are designed to be read when the sprayer is level, so

OPERATION

Only the quantity of spray liquid needed for the spray operation should be mixed, eliminating the need to store or dispose of any excess. Mixed chemical solution should not be left in the spray tank overnight.

The manufacturers recommendations should be followed, but in general the water is added to the spray tank first.

To calculate the quantity of water needed first calculate the total spray liquid required by multiplying the area to be sprayed (ha) by the application rate (l/ha) previously determined

Remembering that the spray fluid will usually (for CDA spraying) consist of the chemical product, a wetting agent, an anti-evaporant and the water carrier, the

$$\begin{array}{ccccccc} \text{Percentage} & & & & \text{Percentage} & & \text{Percentage} \\ \text{water in} & = & 100 & - & \text{chemical} & - & \text{wetting} \\ \text{tank mix} & & & & \text{product} & & \text{agent} \\ & & & & & & - \\ & & & & & & \text{anti-} \\ & & & & & & \text{evaporant} \end{array}$$

$$\begin{array}{ccccccc} \text{Water} & & & & \text{Area} & & \text{Application} \\ \text{required} & = & \text{Percentage} & \times & \text{sprayed*} & \times & \text{rate*} \\ & & \text{water in} & & \text{(ha)} & & \text{(l/ha)} \\ & & \text{tank mix} & & & & \end{array}$$

$$100$$

* NOTE: Substitute ‘tank capacity (l)’ for ‘area sprayed (ha) x application rate (l/ha)’ if using a full tank load.

However, most sprayer’s tank graduations are in tens of litres. It is simplest to put half the water load into the tank, then add the chemicals, then top the water level up to give the desired total volume.

EXAMPLE:

The tank mix to be used will consist of 2.5% chemical product, 1% wetting agent and 1% anti-evaporant. Therefore:

$$\text{Percentage water in tank mix} = 100\% - 2.5\% - 1\% - 1\% = 95.5\%$$

The tank will hold 250l and it is desired to spray the maximum between fills at 20l/ha (area to be sprayed = 250l / 20l/ha = 12.5 ha per tank load). Therefore:

$$\text{Water required} = 95.5\% \times 250 \text{ litres} / 100 = 238.75 \text{ litres}$$

OPERATION

Adding chemicals

In general for CDA spraying a chemical product, a wetting agent and an anti-evaporant are added to the mix. The quantities required of each spray mix constituent are calculated as below.

Quantity of
spray mix
constituent
required (l)

=

Percentage of
spray mix
constituent in
tank mix

X

Area
sprayed*
(ha)

X

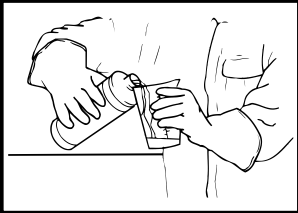
Application
rate*
(l/ha)

100


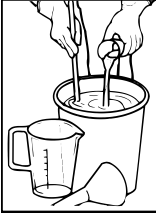
* NOTE: Substitute ‘tank capacity (l)’ for ‘area sprayed (ha) x application rate (l/ha)’ if using a full tank load.

!

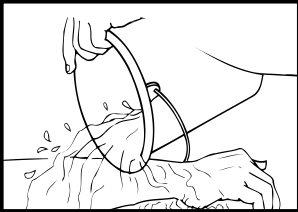
IMPORTANT SAFETY RECOMMENDATIONS



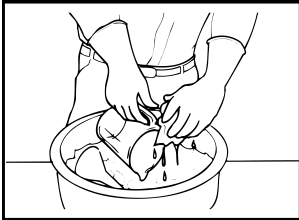
Always wear gloves.



Always use the correct equipment.



Always wash off any skin contamination.



Always clean all

OPERATION

EXAMPLE:

As per the previous example, the tank mix to be used will consist of 2.5% chemical product, 1% wetting agent and 1% anti-evaporant. The tank mix will total 250l. Therefore:

Chemical product required = $2.5\% \times 250 \text{ litres} / 100 = 6.25 \text{ litres}$

Wetting agent required = $1\% \times 250 \text{ litres} / 100 = 2.5 \text{ litres}$

Anti-evaporant required = $1\% \times 250 \text{ litres} / 100 = 2.5 \text{ litres}$

To check calculations, the quantities calculated for each constituent should add up to the total spray load. From 8.3.1 the quantity of water required was calculated as 238.75 litres. Add the quantities calculated above:

Mixing

Good mixing and a good agitation before and during the spraying operation are very important for a correct distribution of agrochemicals onto the crop or target.

In order to achieve adequate mixing of products in the tank prior to spraying, with the spray line pressure valve set to zero so that the pump bypass returns all product to the tank, run the pump for 10-15 minutes to thoroughly agitate and mix the spray solution. This should be done prior to calibration.

Ensure that the spray system has aggressive tank agitation. Spray solutions formulated for CDA spraying will normally be more concentrated than for conventional spraying, requiring thorough and continuous mixing.

SPRAYING

Before commencing spraying operations the MICROMAX 120 atomisers should be set to the correct speed for the application and the sprayer's output should be set and calibrated (see – 'Calibration')

The actual method used for the spraying operation will depend on the type of machine, the crop or target and the application type. For further advice on specific operations consult a qualified and experienced agronomist, Micron can also offer advice on many aspects.

OPERATION

The following points should, however, be noted for all types of application and spraying methods.

NOTES FOR SPRAY OPERATION:

- **Always** turn the atomisers on before the spray liquid.
- **Always** use the spray liquid controls to turn chemical flow on and off (i.e. when turning at row ends) whilst spraying. Leave the atomisers running.
- **Always** turn the liquid flow off several seconds before the atomisers.
- Whilst spraying periodically check (visually) that all atomisers are turning. A stopped atomiser will be highlighted by the fact that it will be dripping chemical rather than producing a spray.
- Take care to prevent contact between the atomisers and the ground, obstacles or the crop.
- The atomisers should be oiled twice daily with two drops of light engine oil (see section 9 – ‘Maintenance’).
- Check the filters twice daily and clean as required.

AFTER SPRAYING

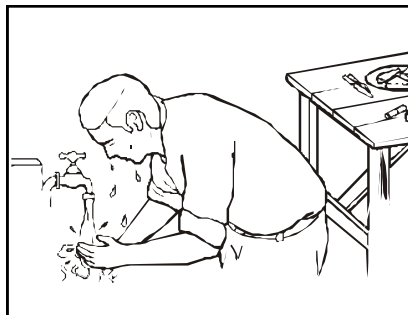
Dispose of any surplus spray mix according to the product approval. Store products safely, locked up and out of the reach of children.



It is **essential** to flush the spray system out and to clean the sprayer and tank thoroughly using a pressure washer or similar. In order to clean most thoroughly (important when using a variety of types of product on different crops) add soda to the washing liquid. Dispose of contaminated washing liquid according to local regulations in force.

OPERATION

After working with agrochemicals, or handling spraying equipment, **always** thoroughly wash hands and exposed skin. All protective clothing should be washed separately from other clothing and stored. Contaminated gloves should be washed inside and out.



STORAGE

If the sprayer is to be stored for an extended period of time before next use, after cleaning the sprayer oil the MICROMAX 120 atomisers (see 'Maintenance' and turn the disc several full rotations by hand. The atomiser discs, pulleys and belt should be cleaned thoroughly (see 'Maintenance') and the MICROMAX 120 electrical system should be disconnected from the battery.

The entire sprayer should be kept under cover if possible (use a tarpaulin if no shed space is available) with each MICROMAX 120 atomiser covered individually with plastic. Consult the manufacturer for guidelines on storage preparations for the base sprayer / spray vehicle.

It is recommended that the entire sprayer is checked and serviced sufficiently before the start of the next spraying season to allow time to rectify any problems without losing spraying time.

The procedures for checking and servicing the MICROMAX 120 atomisers and their associated electrical and spray line systems are given in 'Maintenance'.

MAINTENANCE

REGULAR MAINTENANCE

To ensure a long life and trouble free operation, the MICROMAX atomiser requires some regular maintenance. Refer also to the base sprayer or spray vehicle manufacturer's guidelines for their recommended maintenance schedule.

Your local Micron distributor / dealer may have special recommendations based on in-depth knowledge of local applications and climates.

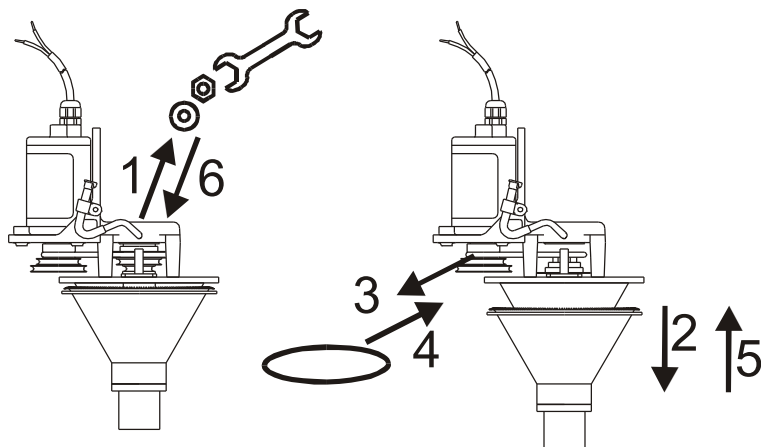
Daily Maintenance

The following maintenance is required daily, or several times per day, during spraying:

MAINTENANCE

Checking the drive belts

Before the start of spraying each day check the drive belts are tight and undamaged. Replace damaged, worn or loose (stretched) drive belts.



- 1 REMOVE THE SHAFT RETAINING NUT AND WASHER.
- 2 DROP THE DISC ASSEMBLY UNTIL THE BELT CAN BE MANOEUVRED OVER THE TOP OF THE SHAFT.
- 3 REMOVE THE OLD BELT AND DISCARD.
- 4 FIT A NEW BELT – USE ONLY GENUINE MICRON PARTS.
- 5 LIFT THE DISC ASSEMBLY BACK INTO POSITION.
- 6 FIT THE SHAFT RETAINING WASHER AND NUT AND TIGHTEN TO A FIRM HAND TIGHTNESS – DO

Changing the drive belt

Cleaning

The MICROMAX 120 atomiser should be cleaned at the end of each spraying day using a pressure washer or similar. Avoid directing the water jet upwards into the nose of the motor.

MAINTENANCE

Filters and the spray fluid system

The pump suction filter and nozzle filters should be checked, and cleaned or replaced if required, at least daily. The rest of the spray system should also be checked daily for leaks and damage, and repairs made as required.

Periodical Maintenance

The following maintenance should be carried out before the start, as required during, and at the end of each spraying season:

1. Check strainers daily for blockage
2. Check the flow rate daily prior to operation. Nozzles will change in time with use, adjust pressure or replace nozzles where necessary.
3. Check the drive belts regularly for slippage and replace the belts yearly or whenever necessary
4. Electric connections should be tightened regularly and checked for chemical corrosion. Loose and damaged connections will result in voltage drop and therefore affect the speed.
5. Fuses (when used) should be removed from the holders and cleaned periodically.
6. After spraying, wash the system and run water through the spray head to flush all chemical spray solution from the system. Daily cleaning is recommended.

Cleaning the belt and pulleys

At the end of each spraying season, ready for the next, the motor and disc pulleys and the drive belt should be washed thoroughly using warm water and a small brush. Do not use a soap or detergent as residues may cause the belt to slip.

Securing electrical connections

If screw type electrical connections have been used in the wiring system these should be nipped up periodically.

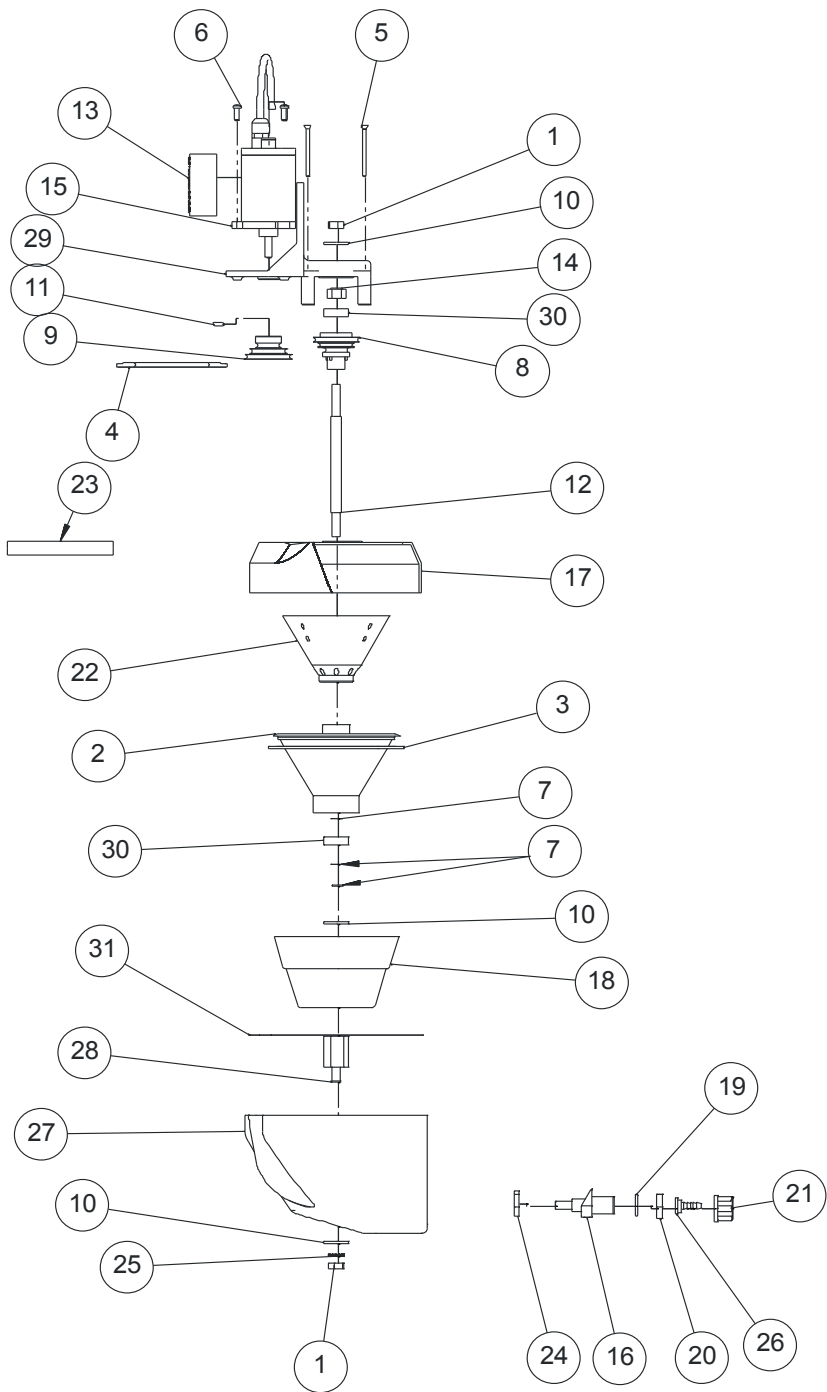
TROUBLE SHOOTING

<i>PROBLEM</i>	<i>POSSIBLE CAUSE</i>	<i>SUGGESTED SOLUTION</i>
Motor doesn't run	Blown fuse	Replace blown fuse
	Break in wiring	Repair break
	Failed switch or relay	Replace as required
	Failed motor	Replace motor
Motor runs but disc doesn't turn	Slipping or broken drive belt	Replace drive belt (see Page 54)
	Slipping motor pulley	Tighten grub screw
	Seized disc bearings	Replace bearings
Disc speed is too high in all gears	Electrical system is producing over 12V	Get electrical system serviced and adjusted
Disc speed is too low in all gears	Motor pulley rubbing on bracket	Replace motor and pulley
	Disc bearings binding	Replace bearings
	Voltage drop in wiring too high	Rewire with larger size cable
Spray pattern is uneven	Blocked feed hole in inner cup	Clean inner cup (see Page 56)
	Damaged disc	Replace disc
Droplet spectrum is poor	Feed rate too high or too low for disc speed	Adjust feed rate or change gear
	Blocked disc grooves	Clean disc (see Page 56)
	Damaged disc	Replace disc

PARTS LIST AND DIAGRAM

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	3282	NUT 5/16" BSCY, HEX	2
2	4469/RG	ATOMISER DISC	1
3	4497	PROTECTIVE RING	1
4	4553	DRIVE BELT BS229	1
5	4676	SCREW NO.6 X 2"	4
6	4677	SCREW No.8 x 1/2" (B)	3
7	4687	WASHER, SHIM	4
8	4708	DISC PULLEY	1
9	4709	MOTOR PULLEY	1
10	4757	WASHER 5/16" X 3/8" FLAT	3
11	4836	GRUB SCREW No.4 x 3/8"	1
12	4839	SHAFT	1
13	4840	LABEL, MICROMAX	1
14	4844	NUT, 5/16" BSCY SHAFT	1
15	5097	MOTOR 12 VOLT	1
16	5223	VENTURI BODY	1
17	5228	CATCHER PLATE	1
18	5232	SPLASH GUARD	1
19	5233	O'RING	1
20	5234	NUT	1
21	5235	UNION NUT	1
22	5236	INNER CUP	1
23	5336_49	TUBE 8.0MM I.D X 13.0MM O.D	1
24	5413	CLIP HOSE SIZE BB	1
25	5488	WASHER	1
26	5512	HOSE BARB	1
27	5558	SUMP	1
28	5559	SPACER	1
29	5819	BRACKET, MOTOR MOUNTING	1
30	6089	BEARING 628 ZRS	2
31	6090	FILTER MESH	1

PARTS LIST AND DIAGRAM



EC DECLARATION OF INCORPORATION

<i>Name of manufacturer or supplier:</i>	Micron Sprayers Ltd.
<i>Full postal address:</i>	Bromyard Industrial Estate, BROMYARD, Herefordshire
<i>Country of origin:</i>	England
<i>Post code:</i>	HR7 4HS
<i>Description of Product:</i>	Electrically (12V DC) powered agricultural atomiser.
<i>Name and model number of machine:</i>	MICROMAX 3 SPEED UK
<i>Place of Issue:</i>	Bromyard, England
<i>Name of authorised representative:</i>	G. S. Povey
<i>Position of authorised Representative:</i>	Joint Managing Director

STATEMENT:

This product must not be put into service within the European Economic Area (EEA) until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Machinery Directive 89/392/EEC as amended by 91/368/EEC, 93/44/EEC, 93/68/EEC and 98/37/EC and is certified to be in compliance with the relevant essential health and safety requirements.

Signature of authorised Representative:



USER NOTES

APPLICATION:

Calculations:

MICROMAX

Number of

Swath width

2.4 + (X (- 1)) = m

SECTION 7.2.2.1

Forward

mph X 26.8

or

kph X 16.7

or

Distance travelled in

m X 2

Forward

= m/min

SECTION 7.2.2.2

Area sprayed

ha/min = m/min X m

10000

SECTION 7.2.2.3

ha/min X l/ha = l/min

SECTION 7.2.3

Application rate required

Total sprayer

SECTION 7.2.4

Output per MICROMAX

l/min = l/min

Number of atomisers

Calculation Notes:

Settings:

Speed Setting: Low / Medium / High

Nozzles: Red / Blue / Yellow 1 / 2

VRU Setting / Orifice Plate Number:

Spray Line Pressure:

Notes:



USER NOTES

APPLICATION:

Calculations:

MICROMAX

Number of

Swath width

2.4 + (X (- 1)) = m

SECTION 7.2.2.1

Forward

mph X 26.8

or

kph X 16.7

or

Distance travelled in

m X 2

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= m/min

Area sprayed

ha/min = m/min X m

10000

SECTION 7.2.2.2

SECTION 7.2.2.3

ha/min

Application rate required

X l/ha = l/min

SECTION 7.2.3

SECTION 7.2.4

Output per MICROMAX

l/min = l/min

Number of atomisers

Calculation Notes:

Settings:

Speed Setting: Low / Medium / High

Nozzles: Red / Blue / Yellow 1 / 2

VRU Setting / Orifice Plate Number:

Spray Line Pressure:

Notes:

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USER NOTES

USER NOTES

