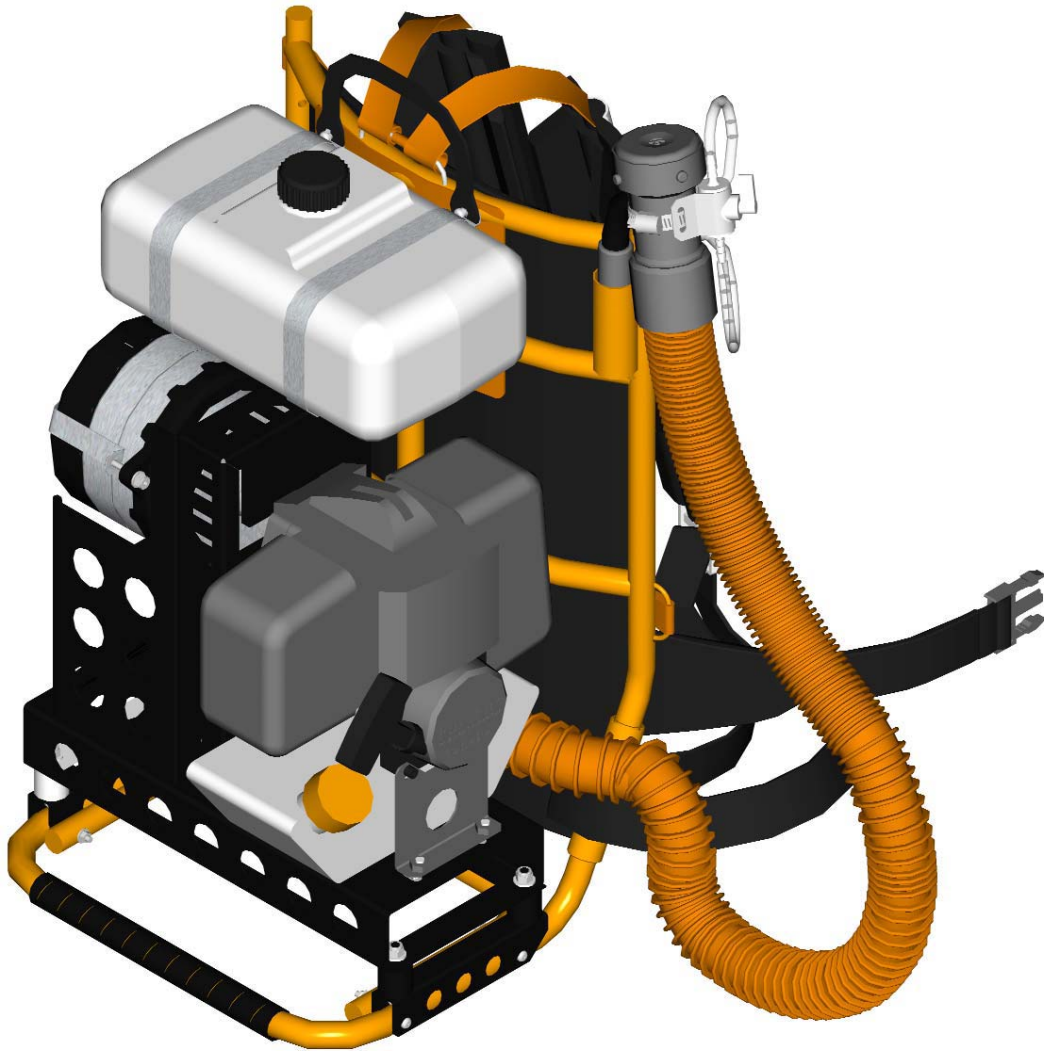


DYNA-FOG®  
TWISTER™ XL 3

MODEL 3950 SERIES 3  
MOTORIZED KNAPSACK ULV SPRAYER



MANUFACTURED BY:

**CURTIS DYNA-FOG**®  
Ltd.  
"Innovators of Spraying and Fogging Technology Since 1947"

17335 U.S. Highway 31 North  
Westfield, Indiana, U.S.A.  
[www.dynafog.com](http://www.dynafog.com)

**Instruction Manual For Installation, Operation and Maintenance**

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## To the New Owner

Dear Valued Customer,

Congratulations on selecting **Dyna-Fog®** and one of the finest Ultra-Low-Volume (ULV), machines in the world. The **TWISTER™XL 3** is the newest in the **Dyna-Fog®** family of professional spraying equipment, and represents the latest in portable spray technology. The **TWISTER™XL 3** was developed to provide a powerful yet affordable multi-purpose machine in a portable, lightweight package. Trials have proven the **TWISTER's** effectiveness, and that operator fatigue caused by the "gyroscopic effect" associated with other types of hand-held gasoline powered sprayers is virtually eliminated. Its simple operation and portable design, combined with the ability to produce variable flow rates make the **TWISTER™XL 3** is the most powerful machine of its type for dispensing liquids in the 20 micron range.

Backed by our *Quality, Workmanship* and more than *50 years of service*, we are confident that the **TWISTER™XL 3** will be a valuable addition to any spraying program.

**Thank you for choosing Dyna-Fog®.**

## Forward

The application of insecticides is the predominant method by which man attempts to control the size of insect populations. Due to environmental and economical reasons, it is desirable to treat a given area with the least amount of insecticide that can be made effective. The most efficient method is to break up the liquids into aerosols and distribute these fine droplets over the target area. The small droplets stay suspended for longer periods of time due to their size and are distributed more evenly, remaining effective longer.

The term ULV is an abbreviation for Ultra-Low-Volume, the technology used to treat areas with small amounts of chemical in an aerosol form. These chemicals are usually in a more concentrated state than chemicals used in other methods of application.

For best results, the Dyna-Fog ULV aerosol generator model 3950 should be operated and maintained in compliance with this manual. Insecticides must be applied in compliance with their label instructions.

## WARNING

**Read and thoroughly understand all information, cautions and warnings on the formulation label which may affect personal safety. Know any dangers of the solution used and know what to do in case of an accident involving the solution. Always use the appropriate safety equipment and dress accordingly to the chemical formulation which is being used.**

## **Machine Specifications**

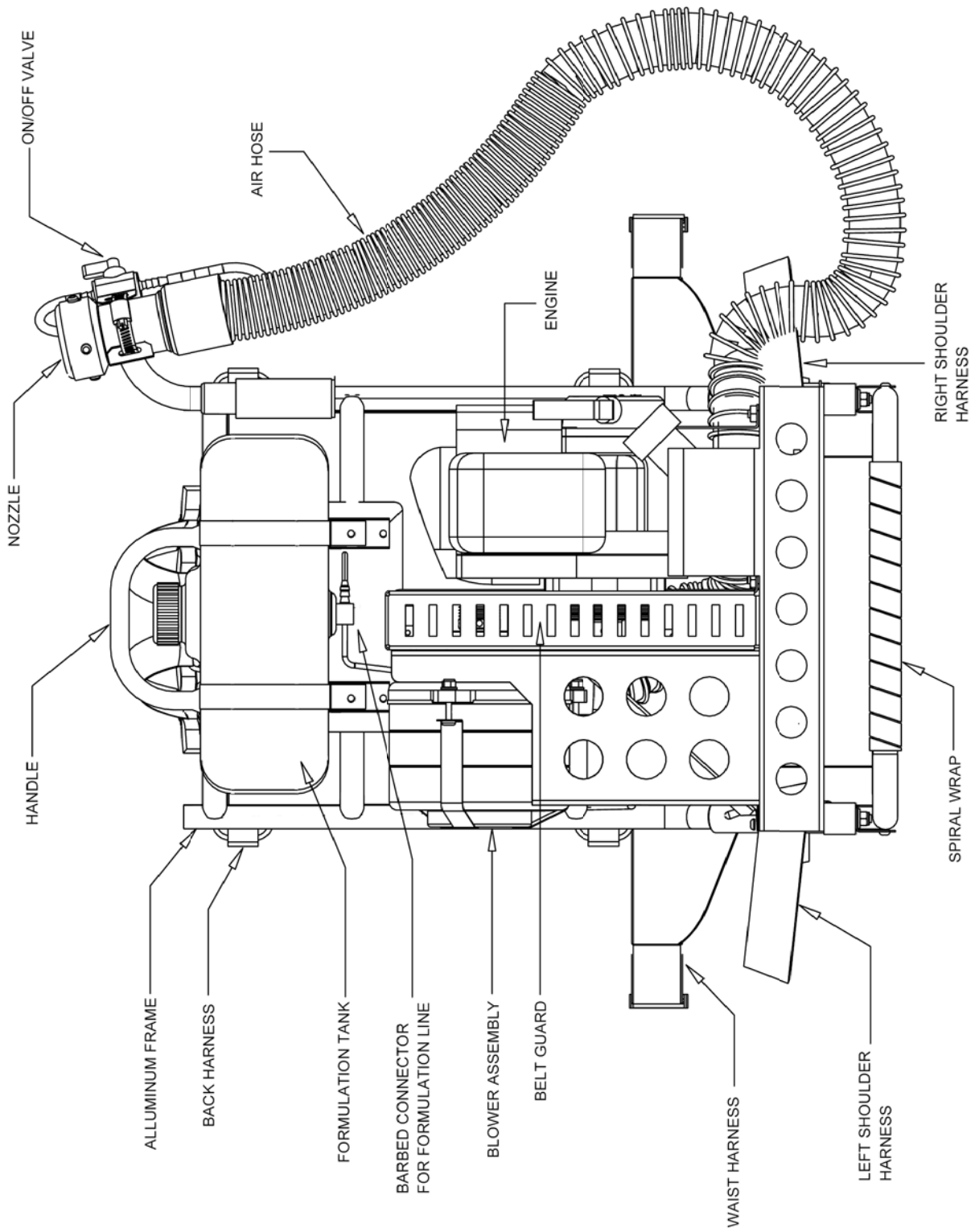
### **TWISTER™XL 3, MODEL 3950 SERIES 3**

- Type:** Aerosol Generator, Non Thermal, Insecticide, Ultra-Low-Volume (ULV).  
Using adequate orifice will produce larger droplets.
- Engine:** Tanaka, Purefire™, 2-cycle, 40 cc, low emission engine. Gasoline consumption: 26.7 oz/hour (800 ml/hour) approx.  
Operating Speed: 7,500 RPM, single Microtec™ nozzle.  
8,500 RPM, optional two Microtec™ nozzles.
- Blower:** High speed Rotary type, 3-Stage, Belt driven, 95 cfm (2.68 m<sup>3</sup>/min) unrestricted, pressure 3 psi. (.2 bar) max., tangential discharge, steel shaft with two ball bearings.
- Flow Control:** Interchangeable restricting orifice to produce different flow rates, from 1.5 oz/min (45 ml/min) to 17 oz/min (500 ml/min).
- Nozzle:** Single high output Microtec™ nozzle. Optional extra twin nozzle kit for higher output.
- Tanks:** Corrosion resistant, high density Polyethylene.  
Formulation: 1 U.S. Gallons (3.78 liters)  
Gasoline: 33.3 oz (1 Lt)
- Frame:** High Strength Aluminum Tube
- Droplet Size:** 90% of all droplets under 20 Microns (ULV) Mass Media Diameter (VMD) depending on flow rate and viscosity. When the high flow rate is discharged through the single nozzle, the machine will produce larger droplets for residual deposit.
- Accessories:** Visual warning flag with flexible telescopic mast, Flowmeter to determine the formulation viscosity, 2-cycle oil beaker, funnel.
- Weight:** 26 lbs. (11.8 Kg.)
- Dimensions:** 14.75" (37.5 cm) L, 12" (30.5 cm) W, 22.5" (57.2 cm) H

#### **Shipping Information (Boxed)**

- Dimensions:** 22.5" L x 19" W x 17" H (75 x 47 x 45 cm)
- Volume:** 4.34 cu.ft. (.122 cu. meter)
- Weight:** 36 lbs (16.3 Kg)

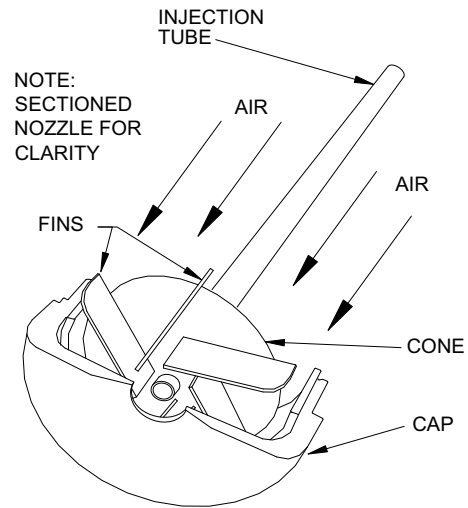
# TWISTER XL 3 Main Components Diagram



## Working Principles

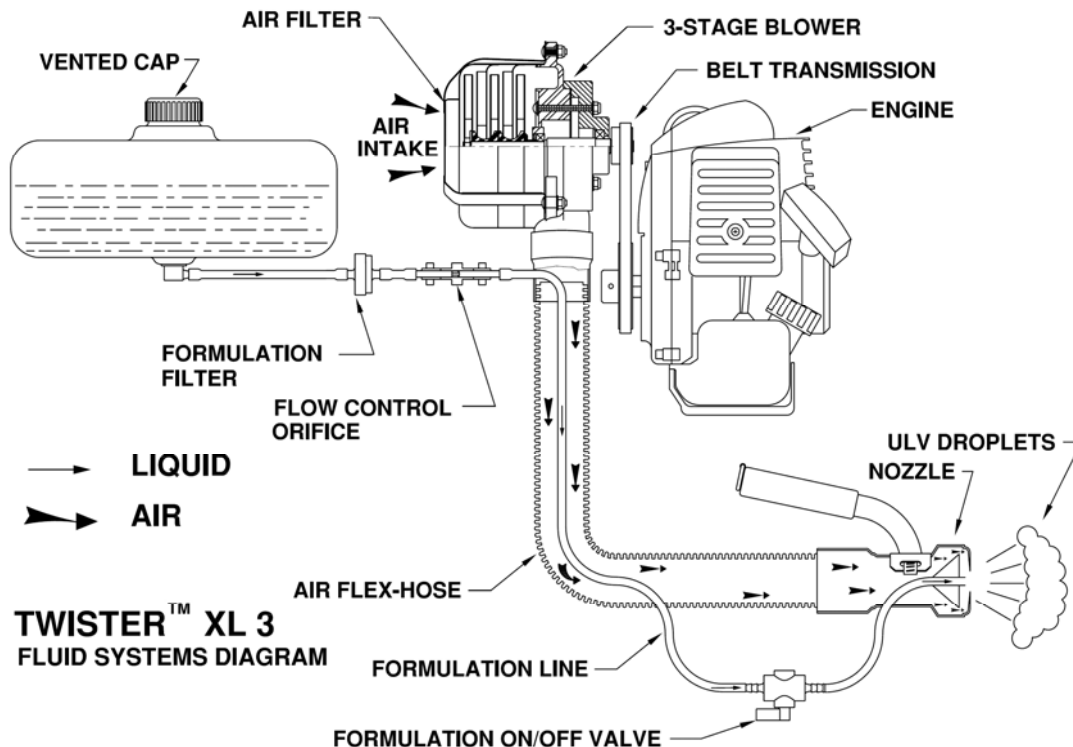
The **TWISTER™XL 3** is powered by a 40cc 2-cycle gasoline engine. The **TWISTER™XL 3** is designed to take the weight and stress off the operators hand and wrist to ensure ease and comfort when working. The engine and blower assembly are mounted on a lightweight, padded frame that is worn on the operator's back.

The Engine is used to belt drive a 3-stage High-Volume Blower. The engine has a "lever type" throttle control that allows both idle and working engine operating speeds. The blower supplies air thru a flexible hose to the nozzle where the air creates "suction" on the formulation supply tube. The suction in the formulation supply tube causes liquid to be drawn from the formulation tank, thru a restricting orifice, into a shutoff valve and to the nozzle. The nozzle has six stationary fins that create a swirling effect of the air mass as it leaves each nozzle. In the center of this swirling air mass is a liquid supply spray tube.



HOW THE MICROTEC NOZZLE WORKS

The spray tube directs the formulation into the air mass where it is sheared into billions of tiny droplets (10-20 micron) and propelled thru the air to their target.



## **Machine Operation**

### **CAUTION**

**READ THIS COMPLETE OPERATION SECTION AND THE SECTION ON SAFETY PRECAUTIONS BEFORE STARTING THE MACHINE FOR THE FIRST TIME.**

When operating this machine for the first time, move to an uncongested and well-ventilated work area away from flammable materials.

### **WARNING**

**READ THE SECTION ON SAFETY PRECAUTIONS BEFORE PREPARING TO DISPENSE FORMULATION.**

**READ AND THOROUGHLY UNDERSTAND ALL INFORMATION, CAUTIONS AND WARNINGS ON THE FORMULATION LABEL WHICH MAY AFFECT PERSONAL SAFETY. KNOW ANY DANGERS OF THE SOLUTION USED AND KNOW WHAT TO DO IN CASE OF AN ACCIDENT INVOLVING THE SOLUTION.**

**ALWAYS USE THE APPROPRIATE SAFETY EQUIPMENT AND DRESS ACCORDING TO THE CHEMICAL FORMULATION WHICH IS BEING USED.**

### **WARNING**

- **DO NOT USE ANY SUBSTANCES FROM UNMARKED CONTAINERS OR FROM CONTAINERS WITH OBVIOUSLY ALTERED LABELS.**
- **READ AND FOLLOW THE INSTRUCTIONS ON THE CHEMICAL SOLUTION LABEL FOR ULV SPRAYING OF THE SOLUTION.**
- **DO NOT SPRAY NEAR AN OPEN FLAME OR HOT MATERIALS.**
- **DO NOT LEAVE THE MACHINE UNATTENDED.**

## Pre-Spray Checklist

1. Verify that the operator can easily find and operate the engine kill switch, to stop the machine, or allow it run.
2. Verify that the stem of the formulation (spray) ON/OFF valve is easy to rotate, to open and close the valve, remaining in off position.
3. Verify that the engine has sufficient gasoline, and that the gasoline was properly mixed with 2-cycle oil.
4. Verify that the air inlet filter of the blower is clean and unrestricted.
5. Inspect all hoses for abnormal conditions.
6. Verify that no foreign objects and tools have been left in or about the machine.
7. Verify that the sufficient amount of formulation is in the tank and that the tank filling cap is tight and air vent hole is not restricted.
8. Verify that the formulation line at the machine includes the appropriate flow control orifice for the viscosity and recommended flow rate of the formulation intended to dispense, in accordance with the manufacturer's label requirements.
9. Verify that the belt is in the right position on the sheave,
10. Verify the sight position of straps and belts on the frame before use the machine.
11. Verify that all safety equipment is in place and is in proper working order.

### CAUTION

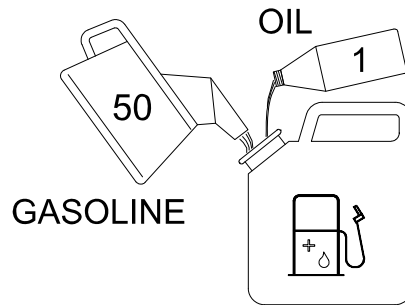
**BEFORE PROCEEDING WITH ANY SPRAYING OPERATION, THE OPERATOR SHOULD BE THOROUGHLY FAMILIAR WITH STARTING AND STOPPING THE MACHINE WITH ALL THE OPERATING CONTROLS. IF YOU ARE OPERATING THE MACHINE FOR THE FIRST TIME, EXERCISE THE MACHINE THROUGH ITS FULL OPERATIONAL SEQUENCES FROM A POSITION OF FULL VISIBILITY OF THE MACHINE BEFORE OPERATING THE MACHINE ON YOUR BACK. THIS IS ALSO A GOOD IDEA FOR EXPERIENCED OPERATORS WHO MAY BE OPERATING A NEW MACHINE OR WHO MAY BE REACTIVATING A MACHINE AFTER REPAIRS OR A PERIOD OF INACTIVITY. REFER TO THE ENGINE SECTION FOR STARTING AND STOPPING INSTRUCTIONS.**



# Engine Operation Instructions

## WARNING

The Twister™ XL 3 is equipped with a two-stroke engine. Always run the engine on gasoline, which is properly mixed with oil.



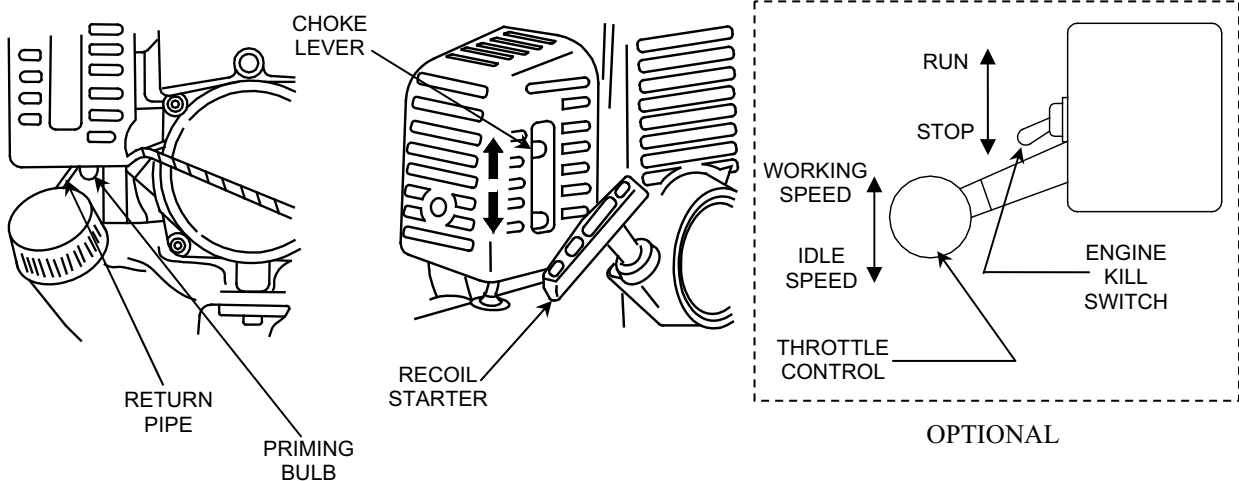
## FUEL

Use unleaded gasoline with an 89 octane or higher rating. Use a quality two-cycle at mixing ratio of 50:1 (right diagram). Always mix gas and oil in a separate clean container. Mix the gasoline thoroughly before filling the engine fuel tank.

## STARTING INSTRUCTIONS

Read and understand operation manual before attempting to operate machine.

1. Set ignition switch (engine kill switch) to ON (Run) position (bottom right).
2. Depress priming bulb several times to purge air in the carburetor, until the flows trough return pipe (bottom left diagram).
3. Pull choke lever upward to choke position/closed (bottom center diagram).
4. Pull recoil starter briskly, taking care to keep the handle in your grasp and not allowing it to snap back.
5. When you hear the engine want to start, return the choke lever to the run position (open). Then pull recoil starter briskly again.



*Note: If engine does not start, repeat procedures 4 to 6.*

6. After starting, allow the engine to warm-up 2 to 3 minutes (at idle speed) before operating at higher speeds for fogging operations.

### **WARNING**

**As recommended for any machine driven by an internal combustion engine, this equipment is intended to use outdoor and in a well ventilated area, in order to preventing Carbon Monoxide poisoning.**

### **CAUTION**

**Keep the flexible air hose far away from the engine exhaust to avoid damage to the hose. The nozzle holder is intended to use when the machine is OFF (for transportation purposes), and for a short period of time when the engine is at idle speed, for easy installation on the back operator.**

### **TO STOP THE MACHINE**

1. If the *formulation valve* is open (ON position), turn it close (OFF) position.
2. Return the *throttle control* lever to the *idle speed* (down) position.
3. Move the *engine kill* switch to the *stop* (down) position.

### **OPERATOR SAFETY**

Keep all loose items (i.e. Clothing, hair, jewelry, etc.) away from all moving parts.

Many of the formulations which can be dispensed with this machine are highly toxic and require special safety equipment. Read and observe the formulation label safety precautions, warnings and procedures before operating machine.

Always wear hearing protection.

Never let an inexperienced person operate machine.

Do not operate the machine if you are ill, or under the influence of alcohol, drugs or medication.

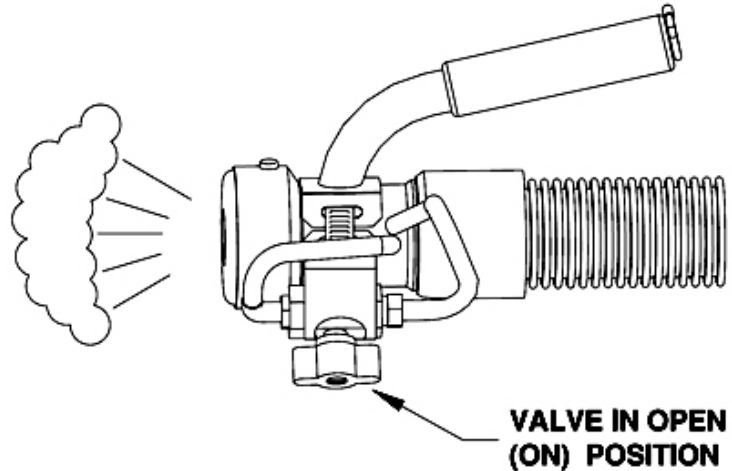
### **CAUTION**

**Do not start the machine without the belt guard and the heat shield cover installed.**

## Using the Spray On/Off Control Valve

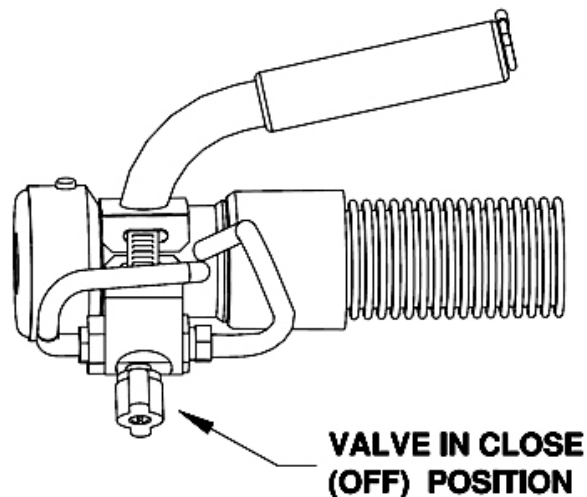
The flow of formulation to the nozzle is controlled by the Spray ON/OFF Valve. The valve is located between the nozzle and the carrying handle.

The upper drawing shows the Spray ON/OFF control valve in open (ON) position, allowing the flow of formulation from the formulation tank to the nozzle. It is recommended to move this valve to the ON position only if the machine is running.



The lower drawing shows the Spray ON/OFF control valve in close (OFF) position, stopping the flow of formulation.

Flow rate can be changed by partially opening the valve to the desired position. Flow rates shown in Table 1 are based on the ON/OFF valve in the maximum open position.



### **IMPORTANT:**

*To prevent dripping from the nozzle, turn the spray valve to close (OFF) before turning power off.*

The Spray ON/OFF valve will provide many hours of service. With the time, and depending on the corrosive action of the formulation used, the stem of the valve could begin to be harder to rotate. If the stem is too hard to rotate, change the valve before it breaks and gets inoperative.

## Measuring Liquid Flowability (Viscosity)

In order to achieve consistent results in generating aerosols with a volume median diameter (VMD) in the sub 20 micron range, several variables must be kept under control at the same time. The ability of an aerosol generator to consistently break up a liquid into appropriate sized droplets depends on 3 key elements:

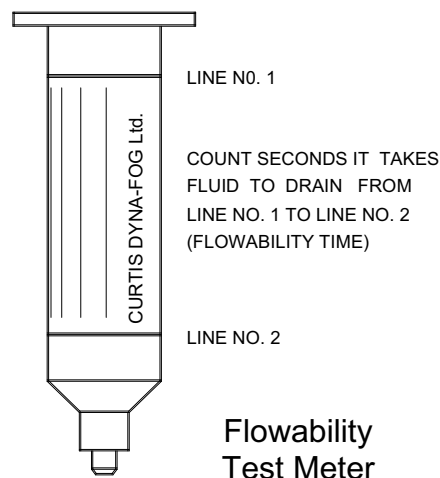
1. The available energy flow (air flow) through the nozzle is governed by the blower speed. As the air mass and its velocity through the nozzle decreases, the droplet size (MMD) will increase assuming that the liquids viscosity and flow rate remains constant.
2. The flow rate of the liquid governed by the diameter of the flow control orifice.
3. The viscosity of the liquid.

Various liquids have different viscosities. Viscosity is defined as a fluids resistance to flow commonly measured in units of centipoises (CP). Generally, the thicker the liquid, the greater the viscosity and the higher the CP number. Examples of some liquid viscosities are:

<u>LIQUID</u>	<u>VISCOSITY (CP)</u>
Water	1
Dibrom	3-4
Dow MFC	3-4
Pyrethrin, Resmethrin	6-7
Dursban 1.5 ULV	12-14
Technical Malathion	28

### To Measure the Flowability (Viscosity) of Your Formulation

1. Place a sample of the formulation liquid to be dispensed in the relative flowability meter provided with the machine such that the liquid level is above the top line.
2. Hold the meter vertical and allow the liquid to flow through the brass orifice at the outlet end of the meter into an appropriate container.
3. Using a stopwatch or a watch with a sweep second hand, determine the flowability time in seconds that it takes for the liquid level to fall from the top line to the bottom line.



*NOTE: Periodically calibrate the flow ability meter using plain water. Water should flow through the orifice such that the time between the top line and the bottom line is 32 ± 2 seconds.*

Once the flow ability of the liquid has been measured, Tables 1 and 2 can be used as an approximate guide for setting the Flow Control Orifice size for your spray application.

### **Flow Rate Chart**

TABLE 1

<b>SINGLE MICROTEC NOZZLE</b>		
32 SECONDS FORMULATION		
ORIFICE NUMBER	FLOW RATE	
	OZ/MIN	ML/MIN
19	1.5	45
28	3.3	100
36	5.3	160
NONE	17.0	500
70 SECONDS FORMULATION		
19	1.23	37
88 SECONDS FORMULATION		
19	1.2	36

TABLE 2

<b>DOUBLE MICROTEC NOZZLE*</b>		
32 SECONDS FORMULATION		
ORIFICE NUMBER	FLOW RATE	
	OZ/MIN	ML/MIN
54	12	360
NONE	19.0	570
* OPTIONAL TWO NOZZLE VERSION		

*NOTE: THE FLOW RATES SHOWN HIGHLIGHTED WILL PRODUCE DROPLETS OF 20 MICRONS (VMD) OR LESS (ULV). USING FORMULATIONS WITH HIGHER VISCOSITY THAN 32 SECONDS WILL REDUCE THE FLOW RATE BY APPROXIMATELY 20% OR MORE.*

**WARNING**  
**ALWAYS APPLY FORMULATIONS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.**

The flow rate in the Tables 1 and 2 are the average value of several machines tested, with the nozzle located at the level of the machine base.

The Dyna-Fog® Microtec™ Nozzle will produce 90% of the droplets below 20 microns (ULV) when used at the recommended flow rates. This meets the requirements of all current chemical labels for controlling flying insects.

When the high flow rate is discharged through a single nozzle the Twister™ XL 3 will produce larger droplets of 50 microns suitable for applying a residual deposit to vegetation and any other surface.

*NOTE: Always handle and dispose of all chemicals in accordance with the manufacturers' instructions and the material safety sheet for the chemical being used.*

## Engine Maintenance

Maintenance, replacement, or repair of the emission control devices and systems may be performed by any non-road engine repair establishment or individual.

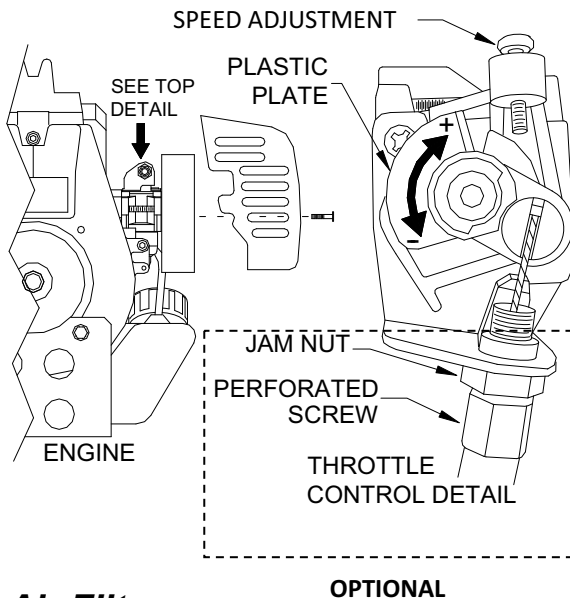
In the carburetor, fuel is mixed with air. When the engine is tested at the factory, the carburetor is pre-set.

### Speed Adjustment

When the Twister™ XL 3 is tested at the factory, the engine working and minimum speed is basically adjusted. The working speed for the engine is 7500 rpm (+/- 100 rpm) for single nozzle, and 8500 (+/- 100 rpm) for the optional two

nozzle attachment kit. A further adjustment may be required according to climate or altitude existing at the place to work with the machine.

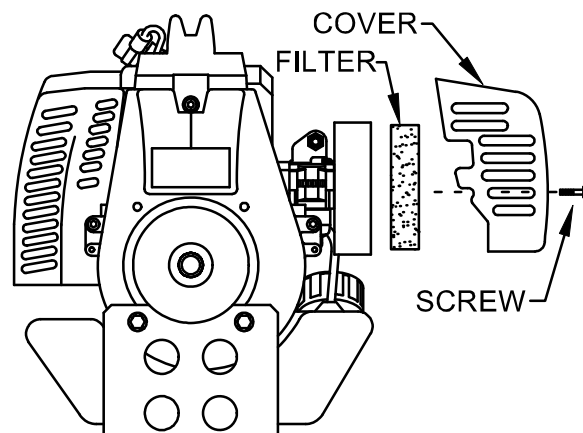
To adjust the engine speed, remove the plastic air cleaner cover from the engine, with optional throttle control. To increase the speed, unscrew the adjuster screw, to decrease the speed screw in the adjuster screw, check the speed with a tachometer meter after 5 or 7 minutes of operation, readjust if required. Reinstall the plastic air cleaner cover.



### Air Filter

The air filter must be cleaned periodically from dust and dirt in order to avoid: Carburetor malfunctions, Starting problems, Engine power reductions, Unnecessary wear on the engine parts and/or abnormal fuel consumption.

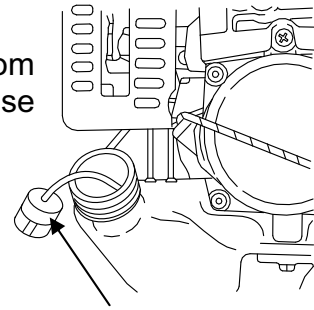
Clean the air filter daily or more often if working in exceptionally dusty areas. To clean the air filter, remove the air filter cover and the filter as shown in the right diagram. Rinse the filter in warm soap suds. Check that the filter is dry before reassembly. An air filter that has been used for some time cannot be cleaned completely. Therefore, it must regularly be replaced with a new one. A damaged filter must be replaced.



## Fuel Filter

Drain all fuel from the fuel tank and pull fuel filter line from tank. Pull filter element out of holder assembly and rinse element in warm water with detergent.

Rinse thoroughly until all traces of detergent are eliminated. Squeeze, do not wring away excess water and allow element to dry.

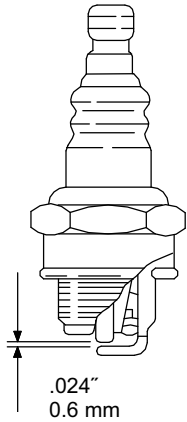


*NOTE: If element is hard due to excessive dirt build up, replace it.*

— FUEL FILTER

## Spark Plug

The spark plug condition is influenced by: an incorrect carburetor setting, wrong fuel mixture (too much oil in the gasoline), a dirty air filter and/or hard running conditions such as cold weather.

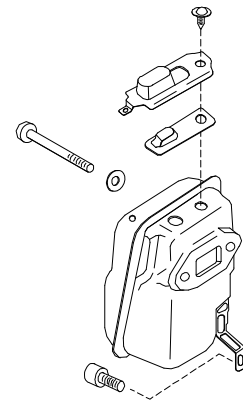


These factors cause deposits the spark plug electrodes, which may result in malfunction and starting difficulties. If the engine is low on power, difficult to start or runs poorly at idle speed, always check the spark plug first. If the spark plug is dirty, clean it and check the electrode gap. Readjust if required. The correct gap is .024" (.6 mm). The spark plug should be replaced after about 100 hours of operation, or early if the electrodes are badly eroded.

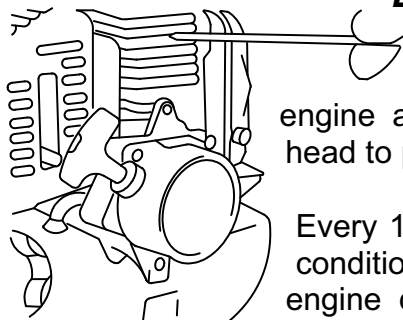
*NOTE: In some areas, local laws require using a resistor spark plug to suppress ignition signals. If this machine was originally equipped with resistor spark plug, use the same type of spark plug for replacement.*

## Muffler

Remove the muffler and clean out any excess carbon from the exhaust port or muffler inlet every 100 hours of operation. If you find corrosion on the muffler, replace it.



## Engine Fins



The engine is air cooled, and air must circulate freely around the engine and over cooling fins on cylinder head to prevent overheating.

Every 100 hours of operation, or once a year (more often if conditions require), clean fins and external surfaces of engine dust, dirt and oil deposits which can contribute to improper cooling.

*NOTE: Do not operate engine with engine shroud or muffler guard removed as this will cause overheating and engine damage.*

## Blower Assembly

The **TWISTER™** XL 3 is equipped with a high performance rotary blower, including special features as following:

Three -stage, 5.7" (145 mm) diameter.

Air delivery: 99 CFM Unrestricted.

Steel shaft mounted on double ball bearing.

Thermoset fan end bracket.

Aluminum (anodized) bearing housing.

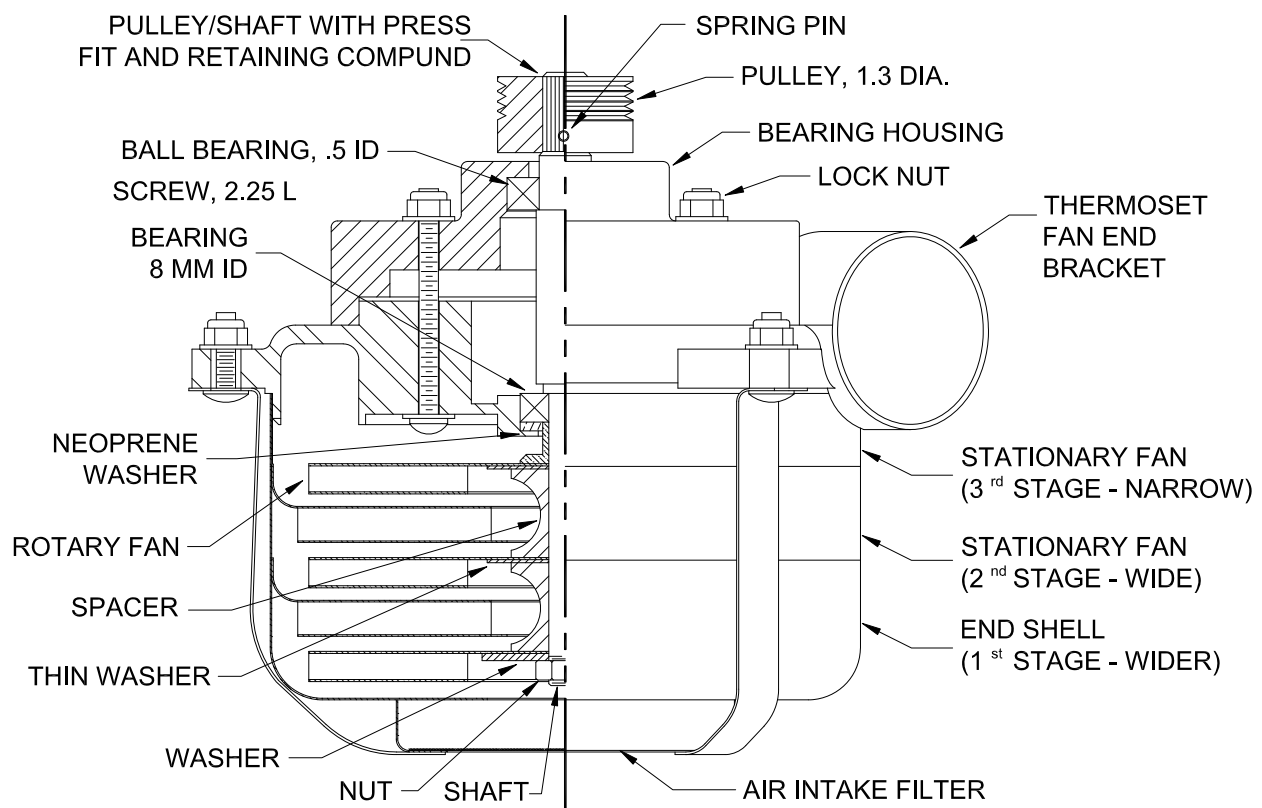
Aluminum commutator bracket.

Belt driven, aluminum Poly-V shave.

Stainless steel air filter/guard assembly.

Working pressure: 2 to 3 psi, depending of number of nozzles and engine speed.

Tangential bypass discharge to separate working air from bearing housing.



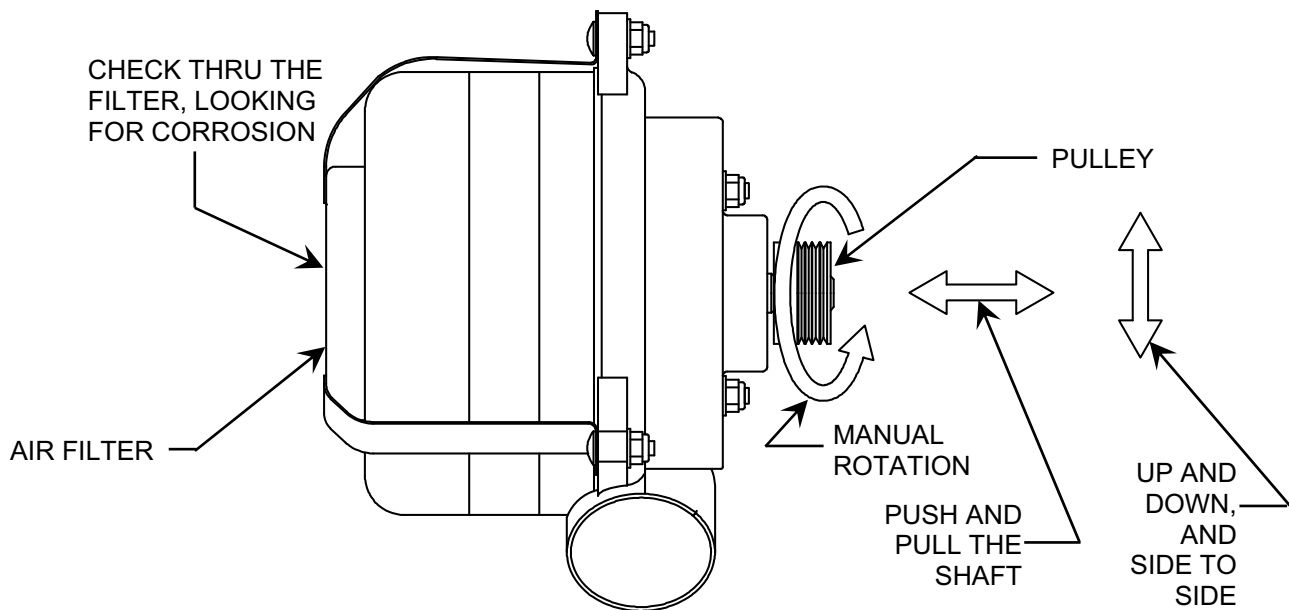
**BLOWER ASSEMBLY SHOWING CROSS SECTION**

### *Inspection of the Blower*

The Blower should be checked periodically, testing the bearings for abnormal conditions or excessive wear, checking the rotating fans and other components for corrosion, etc. To know if detailed inspection of the blower is required, a preliminary inspection is required.



To perform a preliminary inspection, the machine has to be stopped and cold. Remove the three screws of the Belt Guard Assembly and take the guard off; loosen the four bolts that hold the Blower to the Upright Channel (vertical plate), move the blower down on the sides and remove the belt. You will be able to rotate the blower with your hand at the pulley side. Also try to move the shaft axially and transversely, looking for bearing play. If the rotation of the shaft is not smooth or if a considerable play is not found, a detailed inspection should be performed. Additionally, at this point, it is convenient to check the fan for high corrosion by using a flashlight and looking thru the air filter, the critical point is around the nut/washer, on the aluminum of the fan. If high corrosion is present, a detailed inspection should be performed also.



### PRELIMINARY INSPECTION OF THE BLOWER

After inspection, if the Blower Assembly looks in good condition reassemble the belt, tighten the blower bolts and apply tension to the belt as indicated at the "Belt Transmission" section, reinstall the Guard Assembly and the Heat Shield Assembly.

The Blower Assembly is a very critical component which works at high speed (about 20,000 RPM), then we recommend that the detailed inspection (if needed) will be performed by your nearest Dyna-Fog® distributor.

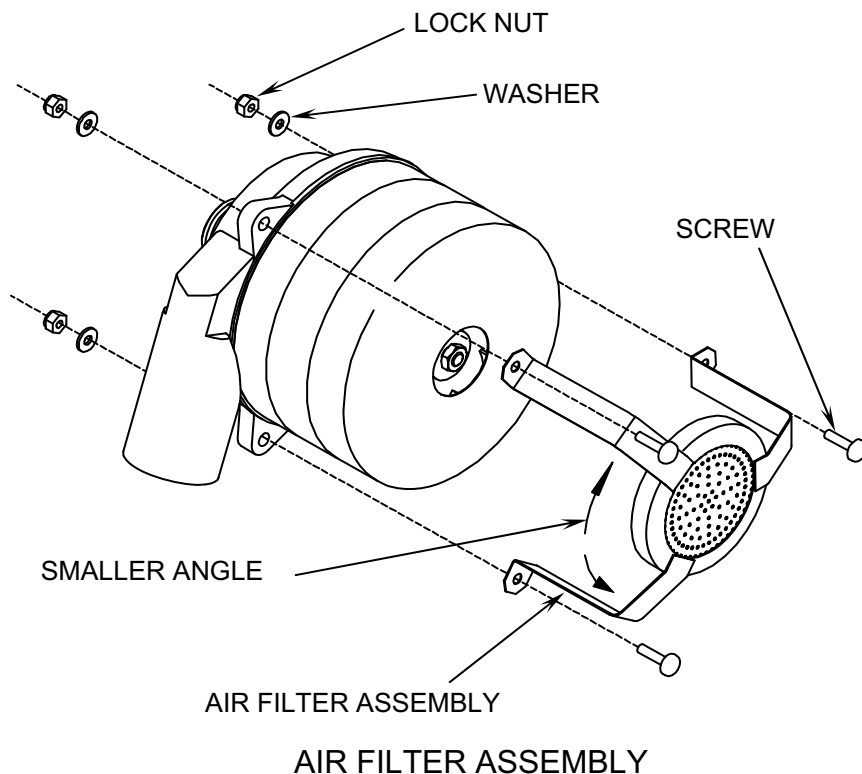
### CAUTION

**Do not run the machine if the belt guard is removed in order to prevent possible danger to person(s).**

## ***Air Filter Assembly:***

The Intake Filter Assembly is mounted on the blower, and it is performing three main functions:

- Dirt and other foreign particles are filtered from the incoming air by the reusable stainless steel element.
- It works as a safety guard, avoiding the contact of body parts (as fingers) from rotary parts (fan/shaft end).
- It allows positive hold down between the external shells and the thermoset fan end bracket.



Before every operation of the machine, verify that the air filter assembly is in the right place and the screw/nuts that hold it to the thermoset fan and bracket are tight.

**CAUTION**  
Do not run the machine without the Inlet Filter assembly; as this would cause serious damage to the blower unit or personal injury.

## ***Removal and Cleaning***

If cleaning procedure is required for the inlet filter, loosen and remove the three nylock nuts/washers/bolts that hold the filter assembly to the thermoset fan end bracket.

Clean the stainless screen in an approved solvent, dry with compressed air, or shake to remove excess solvent and allow drying naturally.

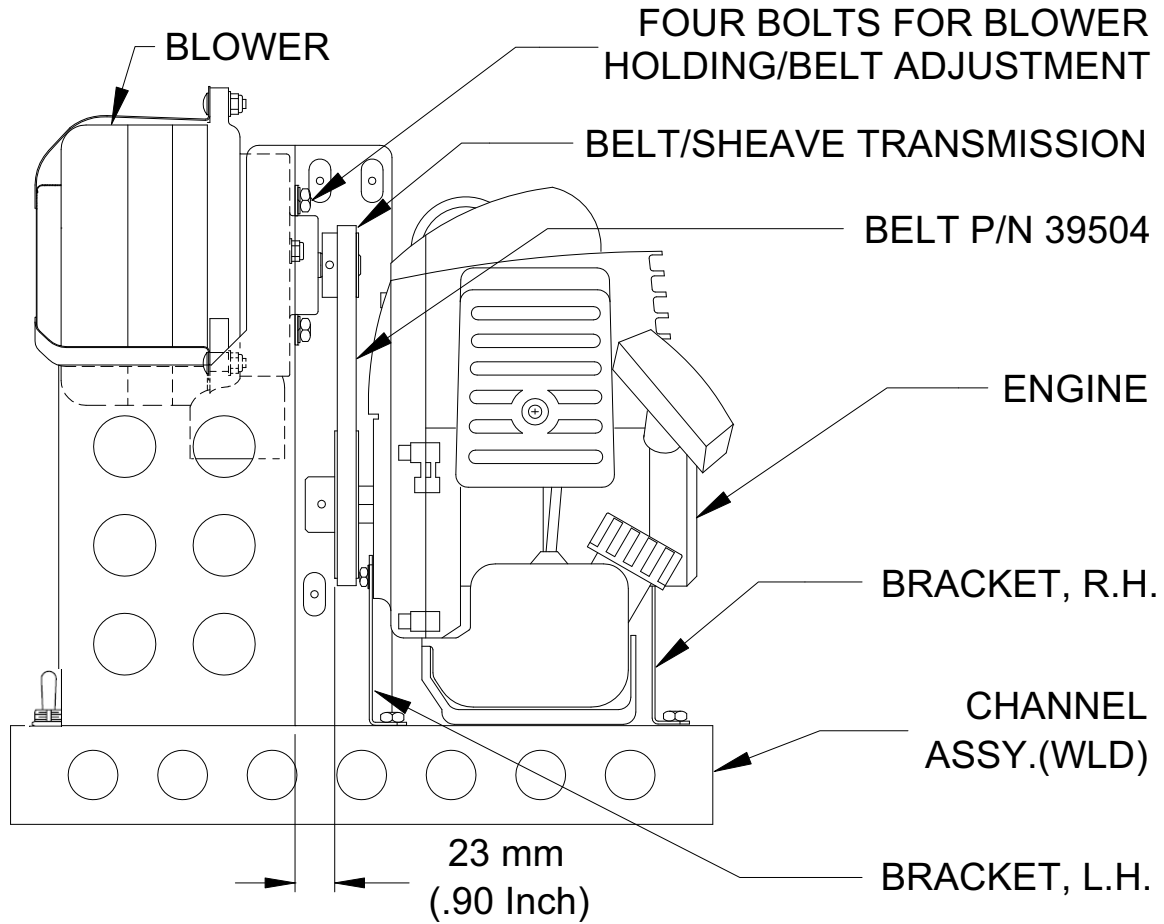
Inspect the screen for defects that may permit dirt or other foreign particles to enter into the blower, inspect the outer shell and hold down strips for cracks or breaks, and replace if required.

To reassemble the filter, take into account that the hold down strips does not have symmetrical angular distribution. Please see above diagram for reference.

## Poly-V Belt and Sheave Drive

In order to obtain the appropriated blower speed and use low weight components, the Poly-V drive provide the best of all the power transmission , including the superior driving force of multiple V-belts without the matching problems associated with individual belts.

To obtain the longer life of the belt transmission components, please follow the instructions indicated in this section.



### DISTANCE FOR BELT ALIGNMENT

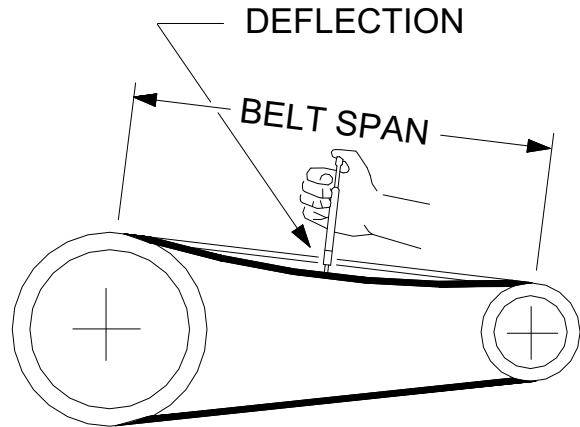
### BELT ALIGNMENT

If the engine was removed from the machine for maintenance purposes, use a metal strip (or similar) of .90" (23 mm) wide as spacer to reinstall the engine in the appropriated place. Be sure the surface of the big pulley of the engine makes flat contact with the spacer, and the other edge of the spacer makes full contact with the vertical wall of the channel assembly. The .90" distance should remain after tighten down the bolts to the engine brackets. In that position the belt/sheaves will be aligned.

## BELT TENSION

Belt tension is highly important. When in operation both tight and slack strands of the belt should be in a straight line from sheave to sheave; a very small sag or bow could be acceptable at the slack strand. Check belt tension after eight (8) hours operation, followed by periodic inspections to be sure belt is under sufficient tension and that belt is not slipping or jumping from the groove.

Proper Tension is found when a force of one pound is applied to the center of the belt span, and a deflection between .18 (minimum) and .25 (maximum) inches is present. The maximum value is indicated for "New Belt" and new belt should be tensioned at this value to allow for expected tension loss. Used belts should be maintained at the minimum value of deflection. For reference please see right diagram.



BELT DEFLECTION

An excessive belt tension could produce non desirable effects, as shorter life of bearings (engine and blower), power reduction, higher temperature, etc.

Do not install a new belt on worn sheaves. Such sheaves should be replaced to insure a proper fit of the belt in the grooves and prevent slippage and premature belt wear.

If sheave(s) change is required, they are sold already assembled with the shaft (for the blower) or on the shaft adapter (for the engine). Under normal conditions, the sheaves will last hundreds of hours before a change could be required.

Do not force belt over sheave grooves. Slack off drive for easy mounting of belt. Adjust drive and check that belt operates free and clear of all obstructions.

Keep belt clean. Do not use belt dressing. If belt slips, clean and readjust belt tension.

Keep extra belts stored in a cool, dark and dry place.

### CAUTION

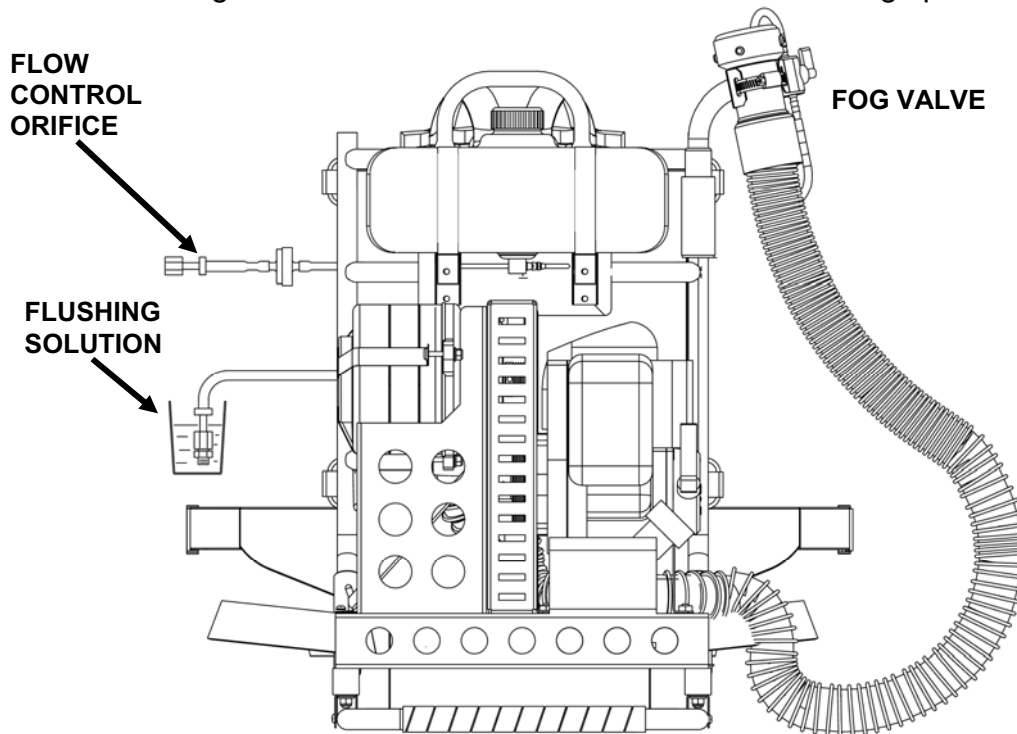
**Because of the possible danger to person(s) with accidents which may result in the use of this belt transmission, is important to install the belt guard before to run the engine. Do not use the machine if the belt guard is not installed.**

## Flushing the System

In order to avoid accumulations of sediment, or premature degradation of hoses, valve and nozzle, it is recommended to flush the fluid system with flushing solution immediately after every use of the machine.

To flush the system, locate the machine in an open and well ventilated place, and perform the following procedure:

1. With the machine OFF (engine stopped), hold the nozzle at the highest possible position and turn “ON” the shut off valve (open). By doing this, most of the formulation will return into the tank by siphon. After about one (1) minute, close the shut off valve (OFF position).
2. Start the engine and allow the machine to run at the working speed.



3. Disconnect the formulation line right after the flow control orifice, as indicated on the diagram, and introduce the end of the hose in about 300 milliliters of flushing solution.
4. Open the “Fog” valve (shut off valve) to position “ON”. The flushing solution will pass through the hose, valve and nozzle, flushing the system.
5. When the flushing solution is finished, close the shut off valve (“OFF”), reduce the engine RPM to idle speed, stop the engine with the engine kill switch, and re-connect the formulation line to the flow control orifice.

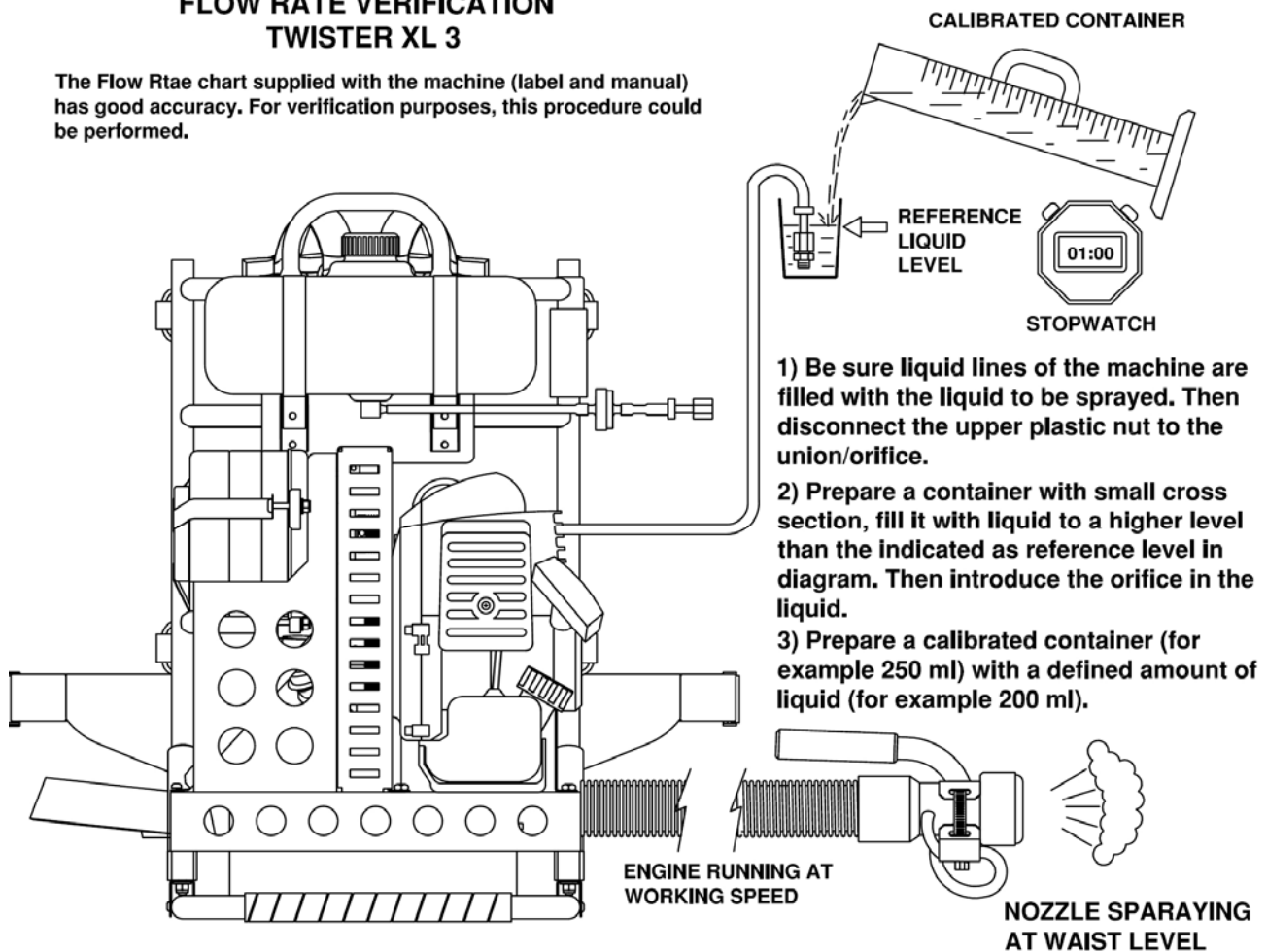
## Preventive Maintenance Schedule - Twister™ XL 3

<u>Operation</u>	<u>Frequency</u>				
	After Each Use	8 Hours or Daily	25 Hours or New Season	50 Hours or New Season	100 Hours or New Year
Engine					
Clean Air Filter					
Check Muffler					
Clean Gasoline Filter					
Clean Cooling Fins					
Check RPM					
Clean or Replace Spark Plug					
Rotary Blower					
Check Air Filter					
Preliminary Inspection					
Belt Transmission					
Check Belt and Pulleys					
Adjust Belt Tension		New Belt			
Check Pulleys					
Others					
Flush Liquid System					
Check Harness					
Check Frame, Guards					
Check Flow Control Orifice					

The intervals shown represent an approximate time period to perform the preventive maintenance. Depending on the actual operating environmental conditions, it may be necessary to perform each operation more or less frequently than what is shown in the above maintenance schedule.

## FLOW RATE VERIFICATION TWISTER XL 3

The Flow Rate chart supplied with the machine (label and manual) has good accuracy. For verification purposes, this procedure could be performed.



1) Be sure liquid lines of the machine are filled with the liquid to be sprayed. Then disconnect the upper plastic nut to the union/orifice.

2) Prepare a container with small cross section, fill it with liquid to a higher level than the indicated as reference level in diagram. Then introduce the orifice in the liquid.

3) Prepare a calibrated container (for example 250 ml) with a defined amount of liquid (for example 200 ml).

4) Start the machine, the engine running at working speed, the nozzle at waist level. The open the shut-off valve. As soon as the liquid in the small container reach the "reference level" start the stopwatch, and beging to pour liquid from the calibrated container to the small container, keeping constant "reference level".

5) After one minute, stop pouring liquid, and close the valve. Check the remaining amount of liquid in the calibrated container (for example 40 ml), the difference between the initial and the final volume is the flow rate in ml/min (160 ml/min for our example).

6) Stop the engine and reinstall orifice in place.

### NOTES:

Smaller flow rates requires longer sample time, for example three minutes for orifice # 19, and the difference between the initial volume and the final volume should be divided by three (or sampling time) to obtain the flow rate.

# Trouble Shooting Guide

<u>SYMPTOM</u>	<u>POSSIBLE CAUSE</u>	<u>CORRECTIVE ACTION</u>
<b>1) Recoil Starter Fails to Crank the Engine</b>	<ul style="list-style-type: none"> <li>a) Defective recoil starter</li> <li>b) Belt transmission with obstructions.</li> <li>c) Engine locked up.</li>   <li>d) Blower locked up.</li> </ul>	<ul style="list-style-type: none"> <li>a) Check recoil starter. Service it if required.</li> <li>b) Check belt and pulleys for obstructions.</li> <li>c) Check the engine for rotation. Consult the nearest service center.</li> <li>d) Inspect blower for rotation. Consult the nearest service center.</li> </ul>
<b>2) Engine Hard to Start or Stops.</b>	<ul style="list-style-type: none"> <li>a) Start – Stop switch on speed control in stop position.</li> <li>b) Faulty Start – Stop Switch on speed control.</li> <li>c) No fuel or contaminated fuel.</li> <li>d) Clogged fuel filter.</li> <li>e) Spark plug faulty.</li> <li>f) Terminal loose or wiring defective.</li> <li>g) Spark plug wire disconnected.</li> <li>h) Loosen gasoline hose or perforated gasoline hose.</li> </ul>	<ul style="list-style-type: none"> <li>a) Place switch in “ON” or “RUN” position.</li> <li>b) Replace faulty switch.</li> <li>c) Add fuel or clean tank and refuel.</li> <li>d) Clean filter (if possible) or replace it.</li> <li>e) Clean or replace spark plug.</li> <li>f) Tighten loose terminals, replace defective wiring.</li> <li>g) Connect spark plug wire.</li> <li>h) Tighten loose clamps or change the gasoline hose.</li> </ul>
<b>3) Engine Misses or Runs Erratically</b>	<ul style="list-style-type: none"> <li>a) Start – Stop switch on speed control in stop position.</li> <li>b) Faulty Start – Stop Switch on speed control.</li> <li>c) No fuel or contaminated fuel.</li> <li>d) Clogged fuel filter.</li> <li>e) Carburetor mounted gasket leaks.</li> <li>h) Vacuum created inside fuel tank.</li> </ul>	<ul style="list-style-type: none"> <li>a) Place switch in “ON” or “RUN” position.</li> <li>b) Replace faulty switch.</li> <li>c) Add fuel or clean tank and refuel.</li> <li>d) Clean filter (if possible) or replace it.</li> <li>e) Tighten bolts, replace gasket if required.</li> <li>h) Loosen the fuel tank cap, if improves, check or replace tank vent.</li> </ul>
<b>4) Engine Knocks or Develops Noise</b>	<ul style="list-style-type: none"> <li>a) Spark arrestor clogged.</li> <li>b) Flywheel loose.</li> <li>c) Shaft adaptor/pulley loose.</li> <li>d) Broken rotary fan at blower.</li> </ul>	<ul style="list-style-type: none"> <li>a) Clean or replace.</li> <li>b) Consult nearest service center.</li> <li>c) Consult nearest service center.</li> <li>d) Check blower and consult nearest service center.</li> </ul>
<b>5) Engine does not Idle Smoothly</b>	<ul style="list-style-type: none"> <li>a) Carburetor dirty or out of internal adjustment.</li> </ul>	<ul style="list-style-type: none"> <li>a) Clean and check carburetor.</li> </ul>
<b>6) Engine Overheats</b>	<ul style="list-style-type: none"> <li>a) Fuel without 2 cycles oil.</li> <li>b) Exhaust restricted.</li> <li>c) Spark arrestor clogged.</li>   <li>d) Dirty cooling fins.</li> </ul>	<ul style="list-style-type: none"> <li>a) Always use gasoline with 2-cycles oil, proportion of 50:1.</li> <li>b) Clean or replace muffler.</li> <li>c) Clean or replace.</li>   <li>d) Clean fins.</li> </ul>



**7) Engine Does Not Deliver Full Power**

- a) Carburetor choke valve partially open.
- b) Air cleaner dirty.
- c) Carburetor defective.
- d) Exhaust restricted.
- e) Spark arrestor clogged.
- f) Rotary blower over loaded.

- a) Adjust choke.
- b) Service air cleaner.
- c) Clean, adjust, or replace.
- d) Clean or replace muffler.
- e) Clean or replace.
- f) check obstructions after blower outlet, like bent air hose or obstructed nozzle air outlet.

**8) Blower Will Not Operate While Engine is Running**

- a) Defective belt.
- b) Broken rotary fan
- c) Nut loose at the blower shaft.

- a) Check alignment and tension. Replace if required.
- b) Consult nearest service center.
- c) Consult nearest service center.

**9) Blower Extremely Noisy**

- a) Loosen intake air filter.
- b) Nut loose at the blower shaft.
- c) Bearings wearing out.

- a) Tighten loose screws/nuts.
- b) Consult nearest service center.
- c) Consult nearest service center.

**10) Blower Runs But No Flow of Liquid**

- a) Air leak in the suction line (hose).
- b) Shut off valve does not open.
- c) Formulation Filter Clogged.
- d) Flow control orifice clogged.
- e) Formulation filter above formulation level.

- a) Check hoses, tighten connectors. Replace hose if required.
- b) Check stem of valve for rotation.
- c) Clean or replace filter.
- d) Check orifice and clean if required using liquid or air jet.
- e) Relocate filter to a better position.