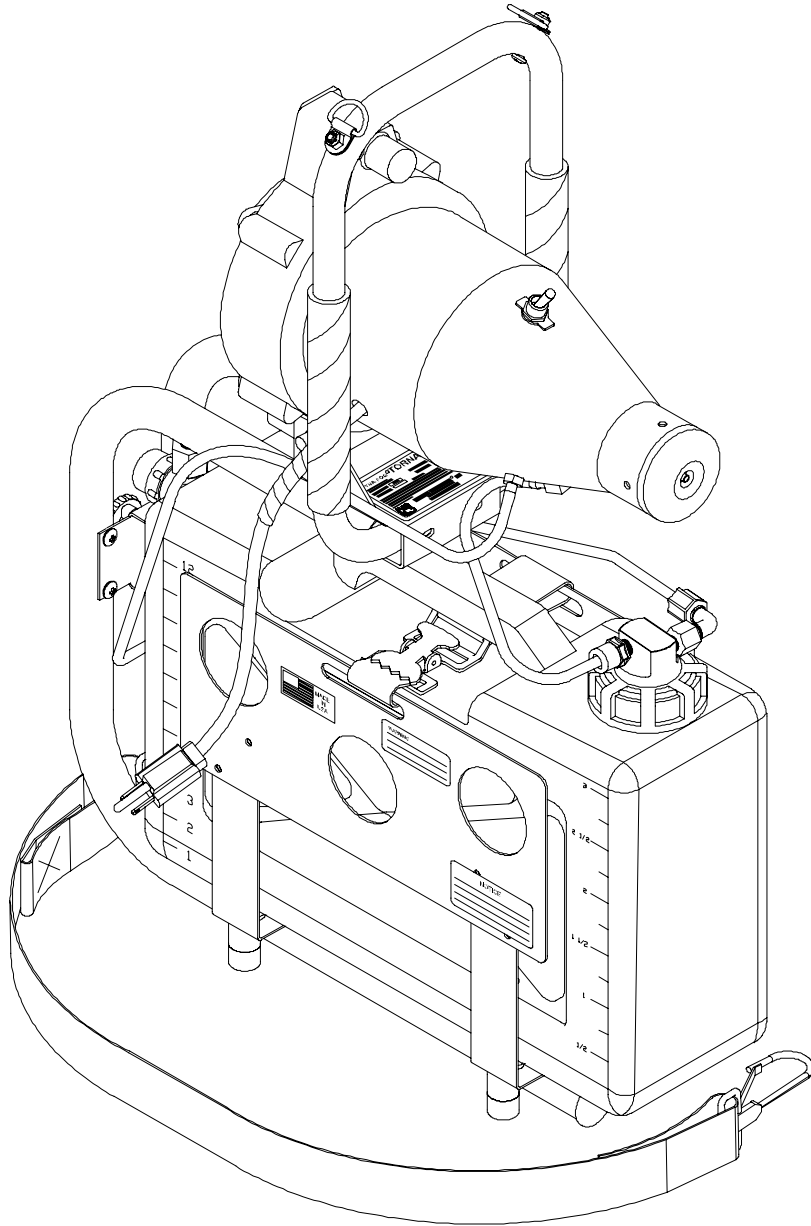


TORNADO™

Cold Fog ULV/Mist Sprayer
Model 2895 & 2897 Series 2



OPERATION AND MAINTENANCE MANUAL

CURTIS DYNA-FOG® Ltd.

"Innovators of Spraying and Fogging Technology Since 1947"

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SPECIFICATIONS

	<u>MODEL 2895</u>	<u>MODEL 2897</u>
INPUT POWER (Motor)	110-125 VOLTS AC 8.5 AMP 50/60 Hz	210-250 VOLTS AC 4.3 AMP 50/60 Hz
LENGTH:	20.5 inches	52 cm
WIDTH:	7.5 inches	19 cm
HEIGHT:	27.0 inches	68.5 cm
TANK CAPACITY:	3.0 gallons	11.4 liters
WEIGHT EMPTY:	18.8 pounds	8.6 kg
WEIGHT FILLED (Water):	43.4 pounds	19.7 kg
FLOW RATE	0-11.5 oz/min	0-340 ml/min

PARTICLE SIZE: 5.3 to 40 microns MMD.

NOTE: Maximum flow rates and particle size are dependent on viscosity of the liquid. For more detailed calibration information, see Tables 3 and 7.

<u>NOISE LEVEL MEASUREMENTS of Curtis Dyna-Fog AEROSOL APPLICATIONS</u>										
MODEL	LINEAR SOUND PRESSURE LEVEL							OVERALL WEIGHTED db (A)	OVERALL LINEAR SOUND PRESSURE	(FRENCH) MEASUREMENT METHOD
	63 Hz	125 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz			
HURRICANE	45	51	59	54	61	64	67	76	77	85
CYCLONE	45	53	53	54	67	62	68	76	76	90
TRAILBLAZER	74	82	86	79	82	78	70	90	97	103
GOLDEN										
EAGLE	75	87	91	83	78	81	71	92	97	
BLACKHAWK	90	88	84	77	68	68	60	92	100	
MISTER III	85	83	86	78	70	75	76	90	95	
MISTERMAX	89	89	89	85	82	83	81	96	102	
NIGHTHAWK	45	51	53	50	45	45	50	61	64	
**TYPHOON 2	73	73	73	76	76	73	79	90	93	
**MAXI-PRO	68	77	74	74	74	74	83	96	99	
TORNADO	45	53	53	54	67	62	68	76	76	

(TEST DATE: FEBRUARY 3, 1993)

TEST CONDITIONS AND PROCEDURES USED: To simulate an operator's position during normal use, all noise measurements were taken at a distance of 2.5 feet (.76 meters) from the machines.

Indoor tests were performed in a laboratory of 48 x 33 x 10 feet (14.6 x 10.1 x 3.0 meters) at an ambient air temperature of 70°F (21°C).

****These tests were taken outdoors and performed with an ambient air temperature of 40°F (4°C).**

EQUIPMENT USED: 1.) CERTIFIED GOLDLINE DIGITAL REAL TIME ANALYZER, MODEL 30
2.) CERTIFIED GENERAL RADIO SOUND-LEVEL-METER, MODEL 1565-B

DESCRIPTION

This chemical applicator is an electric portable aerosol applicator with a rugged anodized aluminum nozzle. This device is intended primarily for the application of wettable powders and wet flowables, but with proper precautions, can also be used to apply other oil or water based materials in aerosol form. The particle sizes generated range from 5 to 40 microns MMD depending on the flow rate and viscosity of the materials. Specific tables are provided elsewhere in this manual.

WORKING PRINCIPLES

The machine consists of a blower assembly, a nozzle, blower and nozzle housing, formulation tank, in-line filter and a metering valve.

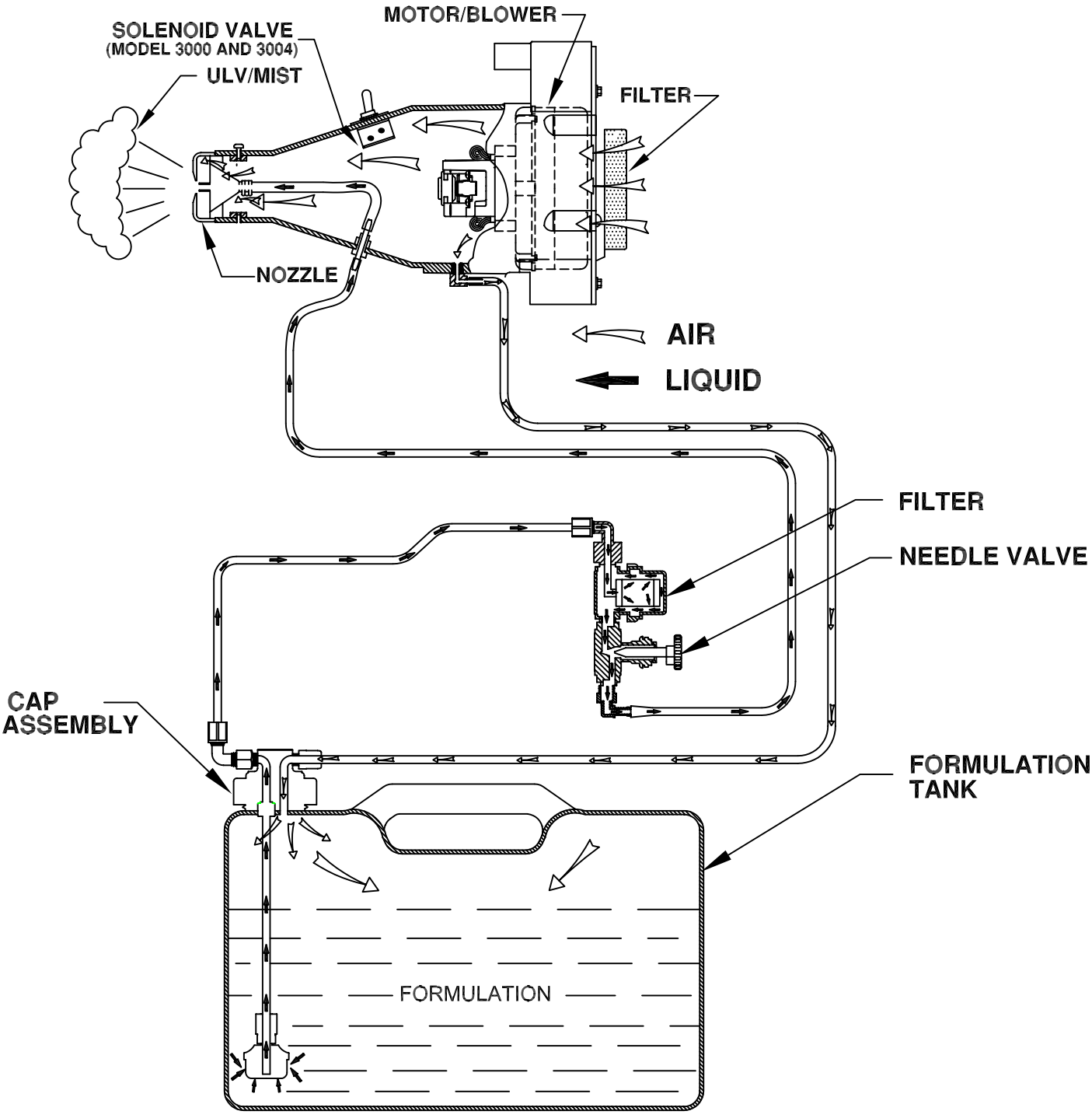
The blower is a two-stage axial compressor driven by a universal motor operating at a speed of 20,000 RPM. The blower moves a large amount of air through the nozzle system. The nozzle has six (6) stationary fins which direct the air to create a swirling effect of the air mass as it leaves the nozzle. In the center of this exiting swirling air, a liquid supply spout tube injects formulation. The formulation is sheared into tiny aerosol droplets and dispersed into the atmosphere.

The liquid is delivered to the liquid spout by a combination of positive and negative pressures. A negative pressure is generated in the nozzle by the exiting air mass and a positive pressure is generated inside the blower housing and sampled to pressurize the formulation tank.

The rate of flow is controlled by a multi-turn metering valve located near the outlet end of the machine.

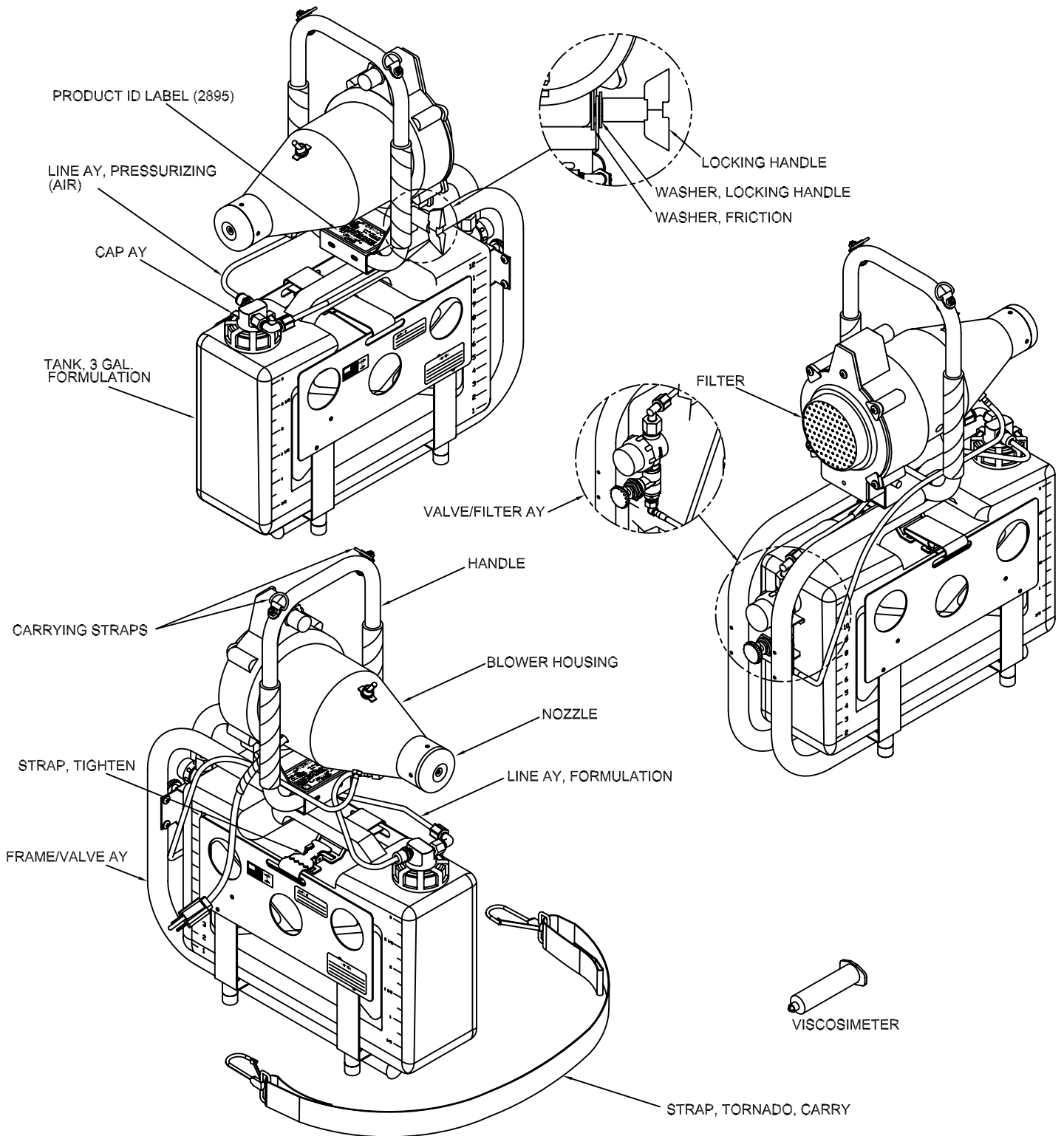
Generally, the sizes of the output droplets increase with increasing flow rates and with increasing viscosity of the liquid being dispensed. By measuring the flowability of the formulation, the rate of liquid through the machine and the particle sizes corresponding to these flow rates can be determined with reasonable accuracy.

FLUID SYSTEMS DIAGRAM



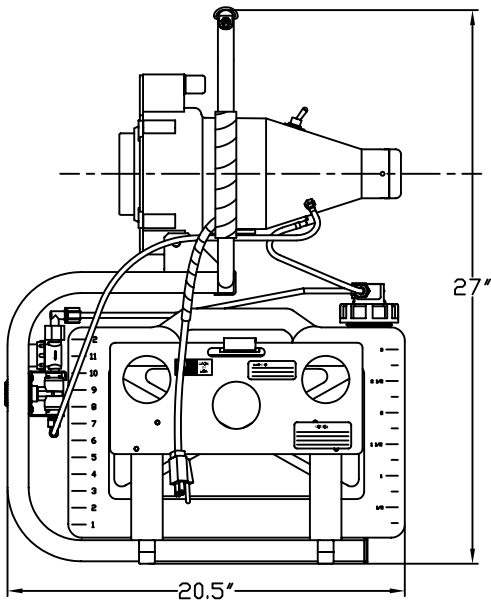
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MAJOR COMPONENTS DIAGRAM

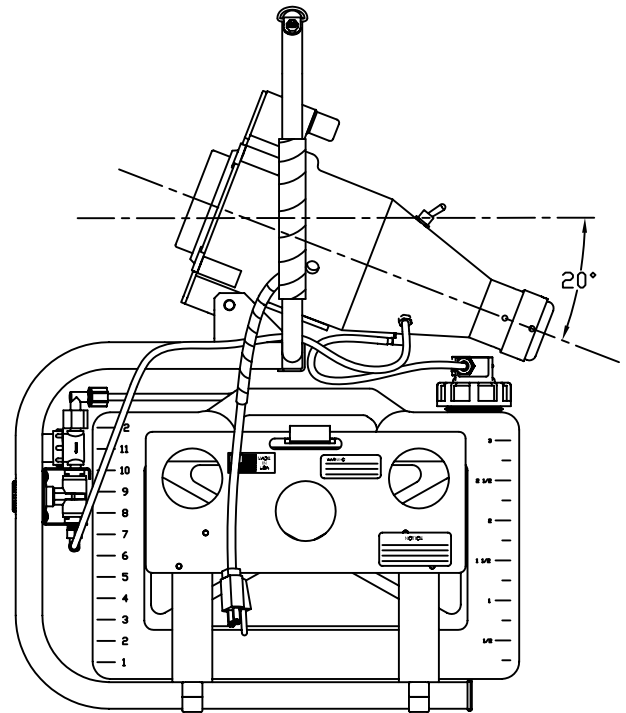
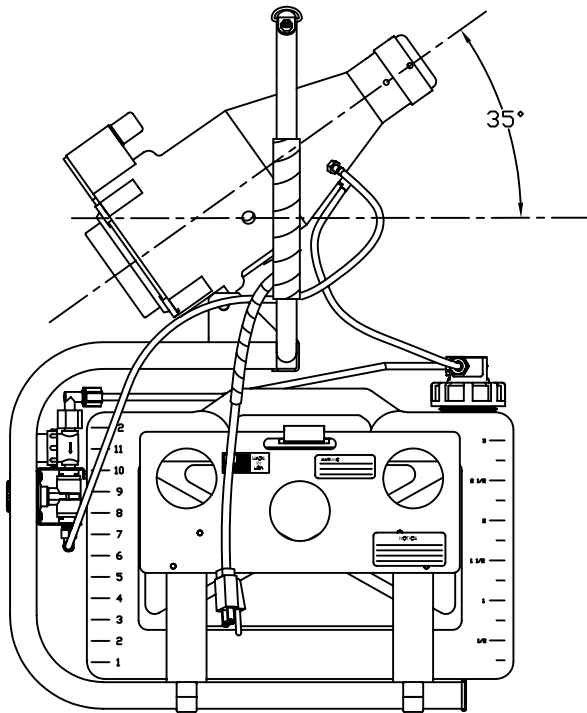


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GENERAL DIMENSIONS



LENGTH:	20.5 inches	52 cm
WIDTH:	7.5 inches	19 cm
HEIGHT:	27.0 inches	68.5 cm
TANK CAPACITY:	3.0 gallons	11.4 liters
WEIGHT EMPTY:	18.8 pounds	8.6 kg
WEIGHT FILLED (Water):	43.4 pounds	19.7 kg



HOUSING ORIENTATION

The machine allows adjusting the angle from the horizontal position to 30° above horizontal. Be careful not to over tighten the locking handle to avoid damage.

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SAFETY PRECAUTIONS

WARNING

READ and UNDERSTAND these safety pre-cautions before operating machine. FAILURE to properly follow these precautions may lead to a FIRE, EXPLOSION, or ELECTRICAL SHOCK HAZARD.

1. **ELECTRICAL POWER:** This machine uses electrical power at common commercially available voltages. When directly contacted, such voltages are hazardous to human life. All precautions commonly applicable to the use of this machine. This machine is designed to operate from three wire power systems where one of the wires is a safety ground. Do not disconnect the safety ground or use extension cords or “cheater” plugs to connect this machine to a two-wire system. This defeats the purpose of the safety ground and may result in a hazardous electrical shock condition.

When making repairs on the machine, use an area of workbench that is dry and not electrically conductive. Dry natural wood and plastics are generally non-conductive at the working voltages of this machine. Metals are usually conductive. Do not probe this machine.

Extension cords must be properly sized and rated for the voltage, current, and **LENGTH** of an individual cord. Consult the nameplate current and voltage rating of your machine and the marked rating of the extension cord. A single extension cord only should be used. When two or more extension cords are paced in series, the rated current carrying capacities of the cords may no longer be valid. If an extension cord gets warm to the touch, discontinue its use and obtain a cord with a higher current rating. Improper extension cords are not only hazardous, but may result in poor machine performance due to excessive voltage drop. Finally, since the machine uses oil-based formulations, the extension cord should be rated as oil resistant.

2. **FORMULATIONS:** Many formulations are combustible; that is, they all can be caused to burn. This is true of even high flash point or “no” flash point formulations (fine particle dust in a grain mill has “no” flash point). A combustible liquid vapor can more easily be ignited because it more readily forms a uniform mixture with the air, which contains oxygen needed for combustion.

However, fine particles of combustible liquids or solids suspended in the air very closely spaced are capable of propagating flame from one to another once ignition starts. A good analogy is the grain mill explosion. Although the fine particle dust in a grain mill has “no” flashpoint, the phenomena of the grain mill explosion is an all too common occurrence. While a high flash point or a “no” flash point liquid formulation will ignite far less readily than a low flash point liquid, and for the reason is strongly advocated, the high or “no” flash point formulation can ignite if the proper conditions exist. *These conditions are basically two;*(1) a sufficient volume of liquid in the form of fine particles suspended in the air; and (2) a sufficiently high energy source of ignition.

3. **AEROSOL CONCENTRATION**: It has been fully established that an acceptable level of liquid in the atmosphere is one gallon per 50,000 cubic feet (2.7 liters per 1,000 cubic meters). There is a safety margin of at least 5 to 1 in this figure. Do not exceed these values.
4. **AEROSOL IGNITION**: If a combustible atmosphere is established or a combustible deposit laid down, a source of ignition may cause a fire. Sources of ignition can be gas or oil pilot lights or sparks from electrical controls. Therefore, it is strongly recommended that all such sources be eliminated by extinguishing all pilot lights and turning off all unnecessary electric power. To avoid danger of fire or explosion in an enclosed space, the enclosed volume fogging time and required formulation volume should be carefully calculated.
5. **SAFETY EQUIPMENT**: Many formulations which can be dispensed with this machine are highly toxic and require special safety equipment. The formulation label should specify all safety precautions for the material being used. Read and observe the procedures, **CAUTIONS**, and **WARNINGS** on the formulation label.
6. **CHILDREN**: Keep children and all other persons out of the areas being treated. The small aerosol particles are easily ingested and contact exposure of some formulations may result in a toxic effect.
7. **PROPER AND IMPROPER USE**: The following rules apply to the operation of this machine:

DO

Read the engine before operating the machine and pay particular attention to all **CAUTIONS** and **WARNINGS**.

Store formulation in its original labeled container.

Use an extension cord which is properly rated for voltage, current and length and which is free from nicks, cracks and other signs of prior abuse. For lengths up to 100 feet (30.5 meters) cords with No. 12 AWG wire are usually adequate.

Replace damage or worn electric cord immediately.

Turn the flow valve **CLOCKWISE** to the **OFF** position after each spray application while the motor is operating to allow clearing of the lines. This will also prevent a siphon effect if the unit is ever accidentally knocked over with the valve remaining open.

Always comply with any requirements for protective clothing, goggles, gloves, facial masks or respirator required by the formulation label.

Ensure that the formulations are applied only in strict compliance with the formulation label as well as local, state and federal regulations.

DO NOT

Spray flammable liquids near open flame or other source of ignition.

Use a machine which is broken or damaged in anyway.

Alter the machine by adding or removing parts.

Restrict the motor blower inlet area.

Tamper with the output nozzle.

Allow the machine to operate unattended.

Apply more than one gallon of formulation per 50,000 cubic feet (2.7 liters per 1,000 cubic meters enclosed space). Exceeding this concentration is both hazardous and wasteful.

OPERATION

PREPARATION

NOTE

Preparation for the domestic or industrial pest control operations will differ slightly from those for agricultural or greenhouse purposes. This difference results from the methods used to specify the application rates. Chemical formulations for industrial and domestic application generally specify rates in fluid ounces per cubic foot (milliliters per cubic meter) while chemical formulations for agricultural applications specify gallons per acre or liters per hectare.

NOTE

1 Gallon	=	128 Fluid Ounces
1 Acre	=	43,560 Square Feet
1 Liter	=	1000 Milliliters
1 Hectare	=	10,000 Square Meters
1 Pound	=	16 Ounces

Further, rates for agricultural purposes may need to be scaled down for average green house application. Generally, these labels specify the active ingredient in terms of fluid ounces, pounds, milliliters, or kilograms to be mixed with a certain amount of water and the amount of water recommended can vary by as much as 2:1.

PREPARATION

— VOLUME APPLICATION —

Proper application of formulation with this machine for volumes requires 7 basic steps as follows:

1. Determine the APPLICATION RATE of the formulation from the formulation label.
2. Measure and calculate the ENCLOSED VOLUME to be treated.
3. Multiply the APPLICATION RATE by the ENCLOSED VOLUME to arrive at the AMOUNT REQUIRED.
4. Measure the FLOWABILITY of the liquid under the temperature conditions at which the liquid is to be applied.
5. Use the MACHINE FLOW RATE table to determine an appropriate particle size and MACHINE FLOW RATE and set the MACHINE VALVE accordingly.
6. Divide the AMOUNT REQUIRED by the MACHINE FLOW RATE to find the APPLICATION TIME in minutes.
7. Apply the formulation for the time determined by step 6.

NOTE

In calculating amounts, any consistent system of units may be used. For example, if the label shows ounces per 1,000 cubic feet, the space volume should be calculated in cubic feet. Further, if the label is milliliters per cubic meter, then the space volume should be calculated in cubic meters.

Tables 1, 2, and 4 show the results for sample calculations using ounces, minutes, and cubic feet. Similar tables 5, 6, and 8 use milliliters, minutes, and cubic meters.

PREPARATION
— AREA APPLICATION —

Proper application of formulation with this machine for AREAS requires 8 basic steps as follows:

1. Determine the APPLICATION RATE of the formulation from the formulation label.
2. Convert the RATE to a useful range for use by this machine.
3. Measure and calculate the AREA to be treated.
4. Multiply the APPLICATION RATE by the AREA to arrive at the AMOUNT REQUIRED.
5. Measure the FLOWABILITY of the mixture under the temperature conditions at which the liquid is applied.
6. Use the MACHINE FLOW RATE table to determine an appropriate particle size and MACHINE FLOW RATE and set the machine VAVLE SETTING accordingly.
7. Divide the AMOUNT REQUIRED by the MACHINE FLOW RATE to find the APPLICATION TIME in minutes.
8. Apply the formulation for the time determined by Step 7.

NOTE

In calculating amounts, any consistent system of units may be used. For example, if the label shows ounces per acre, the rate can be converted to ounces per 1,000 square feet. If the label shows liters per hectare, the area can be converted to milliliters per 100 square meters.

EXAMPLE

POUNDS – GALLONS

1. A wettable powder label required 1½ - 2 pounds per acre to be applied and mixed with 100 gallons of water.
2. Converting this to useful units for the greenhouse:

ACTIVE INGREDIENT:

$$\begin{aligned} 2 \text{ pounds/acre} & \quad \times \quad (1 \text{ acre} / 43,560 \text{ft}^2 \times 16 \text{ oz/pound}) \\ & = 0.00073 \text{ oz/ft}^2 \\ & = 0.73 \text{oz} / 1000 \text{ ft}^2 \end{aligned}$$

WATER:

$$\begin{aligned} 100 \text{ gal/acre} & \quad \times \quad (1 \text{ acre} / 43,560 \text{ft}^2 \times 1000) \\ & = 2.29 \text{gal} / 1000 \text{ ft}^2 \end{aligned}$$

3. Since the active ingredient is small compared with the amount of water, the application rate can be assumed to be:
293 ounces per 1000 sq. ft.
or .293 ounces per sq. ft.
4. The area to be treated is 40 by 125 feet of 5,000 square feet.
5. Multiply .293 by 5000 to obtain 1465 ounces as the AMOUNT REQUIRED.

NOTE

Since the tank holds approximately 3 gallons or 384 fluid ounces, four tanks will be required. If the active ingredient is used at 0.73 ounce per 1000 square feet and is applied in water at the rate of 2,29 gallons (293 ounces) per 1000 square feet, the mix is then made at $0.73 / 2.29 = 0.318$ ounce per gallon. Thus, in each tank $0.318 \times 3 = 0.95$ ounce of powder per tank of water.

6. Using the FLOWABILITY METER, (see meter instructions), it is determined that the time required for the material to drain from the top line to the bottom line is 32 seconds.
7. Using Table 3, the flow rate can be set consistent with the particle size required. See the flow rate section. For fully opened valve, the flow rate is about 11 oz/min.
8. The time required would be 1465 ounces divided by 11 ounces per minute and would equal 133 minutes.

EXAMPLE 4
METRIC

1. A wettable powder table requires 2.25 Kg per hectare to be applied 400 liters of water.
2. Converting these to units useful in a greenhouse:

ACTIVE INGREDIENT:

$$\begin{aligned} 2.25 \text{ KG/HA} & \quad \times \quad (1\text{HA} / 10,000\text{m}^2) \\ & = \quad 0.225\text{kg} / 1000\text{m}^2 \\ & = \quad 22.5\text{g} / 100\text{m}^2 \end{aligned}$$

WATER:

$$\begin{aligned} 400 \text{ liters/HA} & \quad \times \quad (1\text{HA} / 10,000\text{m}^2) \\ & = \quad 40\text{L} / 1000\text{m}^2 \\ & = \quad 4\text{L} / 100\text{m}^2 \end{aligned}$$

3. Since the active ingredient is small compared with the amount of water, the application rate can be assumed to be 0.04 liters per square meter.
4. The area to be treated is 20 by 25 meters or 500 square meters.
5. Multiply .04 by 500 to obtain 20 liters as the AMOUNT REQUIRED.

NOTE

Since the tank holds approximately 11.5 liters, two tanks will be required. If the active ingredient is used at 22.5 g/100 square meters and is applied in water at the rate of 4 liters per 100 square meters, the mix is then made at $22.5 / 4 = 5.6$ grams/liter. Thus, two tanks can be mixed each by placing 56 grams material in the tank and adding 10 liters of water.

6. Using the FLOWABILITY METER, (see meter instructions), it is determined that the time required for the material to drain from the top line to the bottom line is 32 seconds.
7. Using Table 7, the flow rate can be set consistent with the particle size required. If, for example, the machine valve is set at 4 turns, the flow rate would be 450 ml/min, and the particle size would be 28 microns MMD.
8. The time required would be 20,000 ounces divided by 450 ml/min and would equal 44 minutes.

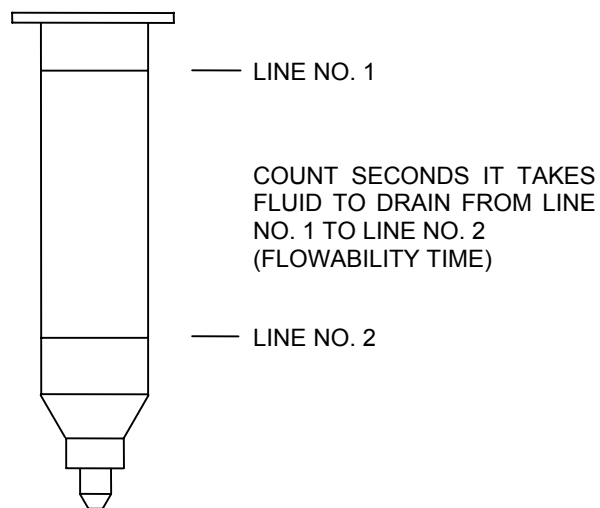
LIQUID FLOWABILITY MEASUREMENT

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 FLOWABILITY 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.

4. Use this value and Tables 3 and 7 to determine an appropriate MACHINE FLOW RATE.



FLOWABILITY TEST METER

APPLICATION

1. Determine the required machine valve setting and application time to the instructions under “Preparation”.
2. Set the machine valve to the required setting.

NOTE

VALVE IS MULTITURN - COUNT CAREFULLY

3. Disconnect the two quick disconnects at the top of the formulation tank (air and formulation lines).
4. Remove the formulation tank.
5. Place sufficient formulation tank to ensure that the pick-up standpipe remains submerged during application. The tank has a 3 gallon (11.3 liter) capacity.

NOTE

WHEN USING WETTABLE POWDERS OR LIQUID FLOWABLES, THEY SHOULD BE MIXED THOROUGHLY BEFORE BEING PLACED IN THE TANK. USE APPROPRIATE BLENDERS OR SHAKERS TO ENSURE MAXIMUM TIME OF SUSPENSION OF SOLID MATERIALS. ONLY SUCH MATERIAL AS NEEDED IMMEDIATELY SHOULD BE PLACED IN THE MACHINE.

6. Put the formulation tank back into the unit.
7. Reconnect both lines – air and formulation – with the quick disconnects (formulation: small to small; air: large to large).
8. Loosen the large wing locking handle located at the bottom side of power unit.
9. Set power unit at desired angle of spray then tighten wing locking handle.
10. Plug the unit into an appropriate source of power. Consult the identification label of your machine.

CAUTION

IF EXTENSION CORDS ARE NEEDED, SEE PARAGRAPH 1 OF SAFETY PRECAUTIONS.

11. Turn on the machine power switch to begin application.
12. To stop spraying or when application is completed, turn metering valve to close and then turn power off.

CAUTION

TURNING POWER OFF BEFORE CLOSING METERING VALVE MAY RESULT IN CHEMICAL DRIPPING FROM NOZZLE.

13. Turn power switch off before unplugging the unit.
14. When spraying is complete, loosen tank cap to ensure that positive pressure in the tank is relieved.

WARNING

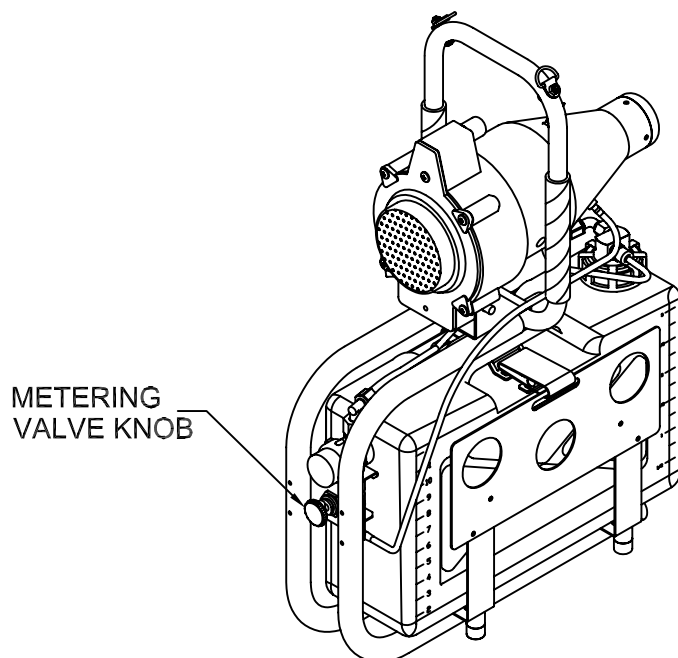
WHEN A FLAMMABLE LIQUID IS SPRAYED, THERE MAY BE DANGER OF FIRE OR EXPLOSION, ESPECIALLY IN ENCLOSED ROOMS OR AREAS.

DO NOT USE FORMULATIONS HAVING A HIGHLY FLAMMABLE BASE SUCH AS GASOLINE OR BENZENE.

FLOW RATE

Turning the Knob of the Metering Valve regulates the Flow Rate. If the Knob is rotated clockwise, the flow rate will be reduced. If the Knob is rotated counterclockwise, the flow rate will be increased.

As reference, the average flow rate is shown in the bottom table at different positions of the Metering Valve knob when using four different liquids (different viscosities).



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VALVE SETTING (TURNS OPEN)	VISCOSITY 32 SECONDS		VISCOSITY 40SECONDS		VISCOSITY 59 SECONDS		VISCOSITY 88 SECONDS	
	FLOW ML/MIN	FLOW OZ/MIN	FLOW ML/MIN	FLOW OZ/MIN	FLOW ML/MIN	FLOW OZ/MIN	FLOW ML/MIN	FLOW OZ/MIN
1/8	70	2.4	20	0.7	-	-	-	-
1/4	220	7.4	100	3.4	50	1.7	30	1.0
1/2	250	8.4	140	4.7	80	2.7	70	2.4
1	265	9.0	180	6.1	100	3.4	80	2.7
2	275	9.3	200	6.8				
3	290	9.8						
4	300	10.1						
5	310	10.5						
MAX	340	11.5						

CAUTION: Read and follow the instructions on the formulation manufacturer's label and in the operation manual.

IMPORTANT: This device is designed to dispense formulations in a SPRAY (Cold Fog) or MIST. Many of the formulations which may be dispensed with this machine require registration with or approval by various government agencies. Calibrate flow rate before attempting to spray.

SPACE VOLUME CUBIC FEET	APPLICATION RATE FLUID OUNCES PER 1000 CUBIC FT.							FORMULATION AMOUNT REQUIRED-FLUID OUNCES
	.25	.33	.50	.66	.75	1:00	1:50	
2,000	.50	.66	1.00	1.32	1.50	2.00	3.00	
3,000	.75	.99	1.50	1.98	2.25	3.00	4.50	
4,000	1.00	1.32	2.00	2.64	3.00	4.00	6.00	
5,000	1.25	1.65	2.50	3.30	3.75	5.00	7.50	
6,000	1.59	1.87	3.18	3.86	4.59	6.99	9.00	
7,000	1.75	2.31	3.50	4.62	5.25	7.00	10.50	
8,000	2.00	2.64	4.00	5.28	6.00	8.00	12.00	
9,000	2.25	2.97	4.50	6.00	6.75	9.00	13.50	
10,000	2.50	3.30	5.00	6.60	7.50	10.00	15.00	
20,000	5.00	6.60	10.00	13.20	15.00	20.00	30.00	
30,000	7.90	9.90	15.00	20.00	22.50	30.00	45.00	
40,000	10.00	13.20	20.00	26.40	30.00	40.00	60.00	

**FORMULATION VOLUME REQUIRED
VS.
SPACE VOLUME AND APPLICATION RATE
CUBIC FEET – FLUID OUNCES**

TABLE 1

WARNING

THIS TABLE IS FOR USE WITH WATER-BASED MATERIALS ONLY. USE OF THIS TABLE WITH FLAMMABLE-BASED MATERIALS IS EXTREMELY HAZARDOUS AND MAY LEAD TO FIRE OR EXPLOSION.

AREA SQUARE FEET	APPLICATION RATE FLUID OUNCES PER 1000 SQUARE FEET							FORMULATION AMOUNT REQUIRED - FLUID OUNCES
	29	73	103	147	179	220	293	
100	2.9	7.3	10.3	14.7	17.9	22	29	
250	7.3	18.2	28	36.7	44.7	55	73	
500	14	36.5	56.5	73.5	89.5	110	147	
1000	29	73	103	147	179	220	293	
2000	59	146	206	294	358	440	586	
2500	73	182.5	257.5	367.5	447.5	550	733	
3000	88	219	309	441	537	660	879	
4000	117	292	412	588	716	880	1172	
5000	145	365	515	735	895	1100	1465	

**FORMULATION VOLUME REQUIRED
VS.
AREA AND APPLICATION RATE
SQUARE FEET - FLUID OUNCES**

TABLE 2

FLOWABILITY METER TEST TIME - SECONDS				
32	40	59	88	
6.1	4.3	2.3	1.9	Particle Size in Microns Machine Flow Rate – Oz/Min
14.1	14.8	18.2	19.8	
8.6	6.1	3.1	2.4	
20.1	15.4	19.5	21.2	
14.0	7.4	8.5	6.5	
25.5	21.0	25.4	27.1	
16.4	14.0	10.1	7.8	
32.5	37.3	35.8	29.7	

**PARTICLE SIZE DEPENDING ON FLOW RATE AND
VISCOSITY**

FLOW IN OZ/MIN

TABLE 3

AMOUNT REQUIRED OUNCES	MACHINE FLOW RATE OUNCES PER MINUTE								APPLICATION TIME MINUTES:SECONDS
	2	4	7	9	11	14	16	17	
2	1:00	0:30	0:17	0:13	0:10	0:08	0:07	0:07	
4	2:00	1:00	0:34	0:27	0:21	0:17	0:15	0:14	
6	3:00	1:30	0:51	0:40	0:32	0:26	0:23	0:21	
8	4:00	2:00	1:02	0:53	0:44	0:34	0:30	0:28	
10	5:00	2:30	1:25	1:06	0:54	0:43	0:38	0:35	
20	10:00	5:00	2:51	2:34	1:48	1:26	1:15	1:11	
40	20:00	10:00	5:43	4:27	3:38	2:51	2:30	2:21	
60	30:00	15:00	8:34	6:44	5:27	4:17	3:45	3:32	
80	40:00	20:00	11:26	8:52	7:16	5:43	5:00	4:42	
100	50:00	25:00	14:17	11:06	9:06	7:09	6:15	5:53	
400	200:00	100:00	57:12	44:25	36:25	28:38	25:00	23:31	
600	300:00	150:00	85:42	66:41	54:38	42:48	37:30	35:18	
800	400:00	200:00	114:24	88:43	72:42	57:07	50:00	47:06	
1000	500:00	250:00	142:48	111:07	90:54	71:25	62:30	58:42	
1200	600:00	300:00	171:25	133:24	109:04	85:42	75:00	70:35	
1400	700:00	350:00	200:00	155:31	127:18	100:00	87:30	82:19	
1500	750:00	375:00	214:18	166:39	136:24	107:07	93:42	88:17	

**FORMULATION REQUIRED
VS.
TIME
OUNCES PER MINUTE AND MINUTES: SECONDS**

TABLE 4

SPACE VOLUME CUBIC METERS	APPLICATION RATE MILLILITERS PER 100 CUBIC METERS							FORMULATION AMOUNT REQUIRED - MILLILITERS
	10	20	30	50	70	100	150	
30	3	6	9	15	21	30	45	
50	5	10	15	25	35	50	75	
100	10	20	30	50	70	100	150	
200	20	40	60	100	140	200	300	
300	30	60	90	150	210	300	450	
500	50	100	150	250	350	500	750	
1000	100	200	300	500	700	1000	1500	
2000	200	400	600	1000	1400	2000	3000	
3000	300	600	900	1500	2100	3000	4500	
5000	500	1000	1500	2500	3500	5000	7500	

FORMULATION REQUIRED

VS.

**SPACE VOLUME AND APPLICATION RATE
CUBIC METERS - MILLILITERS**

TABLE 5

WARNING

THIS TABLE IS FOR USE WITH WATER BASED MATERIALS ONLY. USE OF THIS TABLE WITH FLAMMABLE BASED MATERIALS IS EXTREMELY HAZARDOUS AND MAY LEAD TO FIRE OR EXPLOSION.

AREA SQUARE METERS	APPLICATION RATE LITERS PER 100 SQUARE METERS							FORMULATION AMOUNT REQUIRED - LITERS
	.4	.8	1	2	2.4	3	4	
10	.04	.08	0.1	0.2	0.24	0.3	0.4	
25	.08	.2	.25	0.5	0.6	0.75	0.8	
50	.2	.4	.5	1.0	1.2	1.5	2	
100	.4	.8	1.0	2.0	2.4	3.0	4	
200	.8	1.6	2.0	4.0	4.8	6.0	8	
250	1.0	2.0	2.5	5.0	6.0	7.5	10	
300	1.2	2.4	3.0	6.0	7.2	9.0	12	
400	1.6	3.2	4.0	8.0	9.6	12.0	16	
500	2.0	4.0	5.0	10.0	12.0	15.0	20	
600	2.4	4.8	6.0	12.0	14.4	18.0	24	
800	3.2	6.4	8.0	16.0	19.2	24.0	32	
1000	4.0	8.0	10.0	20.0	24.0	30.0	40	

**FORMULATION REQUIRED
VS.
AREA AND APPLICATION RATE
SQUARE METERS - LITERS**

TABLE 6

FLOWABILITY METER TEST TIME - SECONDS				Particle Size - Microns	Machine Flow Rate - MI/Min
32	40	59	88		
180	127	68	56		
14.1	14.8	18.2	19.8		
254	180	92	71		
20.1	15.4	19.5	21.2		
414	279	251	192		
25.5	21.3	25.4	27.1		
485	414	299	230		
32.5	37.3	35.8	29.7		

**PARTICLE SIZE DEPENDING ON FLOW RATE AND
VISCOSITY**

FLOW IN ML/MIN

TABLE 7

AMOUNT REQUIRED MILLILITERS	MACHINE FLOW RATE MILLILITERS PER MINUTE								APPLICATION TIME MINUTES:SECONDS
	50	150	200	275	350	400	450	500	
50	1:00	0:20	0:15	0:11	0:08	0:07	0:07	0:06	
150	3:00	1:00	0:45	0:33	0:26	0:23	0:20	0:18	
200	4:00	1:20	1:00	0:44	0:34	0:30	0:27	0:24	
250	5:00	1:40	1:15	0:55	0:43	0:37	0:33	0:30	
300	6:00	2:00	1:30	1:05	0:48	0:45	0:40	0:36	
600	12:00	4:00	3:00	2:11	1:43	1:30	1:20	1:12	
1200	24:00	8:00	6:00	4:22	3:26	3:00	2:40	2:24	
1800	36:00	12:00	9:00	6:33	5:08	4:30	4:00	3:36	
2400	48:00	16:00	12:00	8:44	6:51	6:00	5:20	4:48	
3000	60:00	20:00	15:00	10:55	8:35	7:30	6:40	6:00	
6000	120:00	40:00	30:00	21:49	17:09	15:00	13:20	12:00	
12000	240:00	80:00	60:00	43:39	34:18	30:00	36:39	24:00	
18000	360:00	120:00	90:00	65:30	51:25	45:00	40:00	36:00	
24000	480:00	160:00	120:00	87:18	68:35	60:00	53:32	48:00	
30000	600:00	200:00	150:00	109:06	87:42	75:00	66:40	60:00	
35000	700:00	233:19	175:00	127:18	100:00	87:30	77:47	70:00	
40000	800:00	266:40	200:00	145:24	114:17	100:00	88:53	80:00	

FORMULATION REQUIRED

VS.

TIME

MILLILITERS PER MINUTE AND MINUTES: SECONDS

TABLE 8

CLEAN UP

1. When using wettable powders, immediate steps should be taken to clean and flush the machine to avoid settling and caking of the materials in the tank, lines, filters and connections.
2. Remove the tank from the machine and properly store or dispose of any unused materials in accordance with the original formulation label.

CAUTION

AVOID STORING MATERIALS IN UNMARKED CONTAINERS.

3. Thoroughly flush the tank with clear water and a small amount of detergent.
4. Place about one to two quarts (liters) of water-detergent solution in the tank and re-connect the tank to the machine.
5. Move the machine to an area that will not be affected by the water-detergent solution and turn on the machine.
6. Open the metering valve fully and flush the lines, filters, and nozzles.

MAINTENANCE

1. Periodically clean the formulation tank using a hot water/detergent solution. Fully open the machine valve and operate the machine for 3 to 5 minutes, flushing the solution through the valve, lines, filter, and nozzle.
2. Clean and inspect the fine mesh stainless steel screen located inside the filter housing as follows:
 - a. Loosen and remove the bowl portion of the filter from the housing body, being careful not to lose the viton gasket seal ring.
 - b. Remove and clean the screen using a good detergent solution.
 - c. Check the viton gasket seal ring and replace it if necessary.

CAUTION

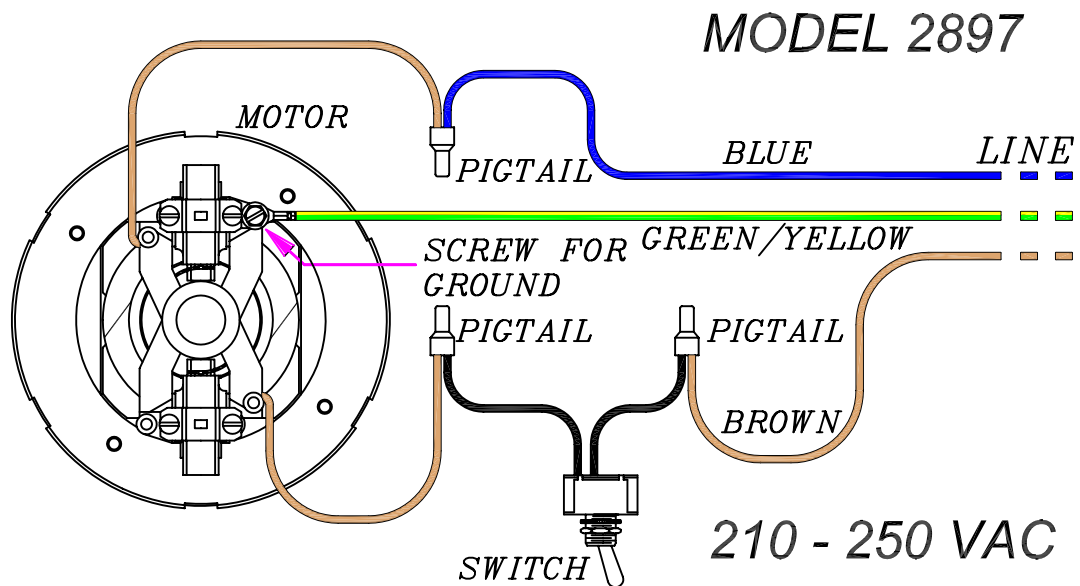
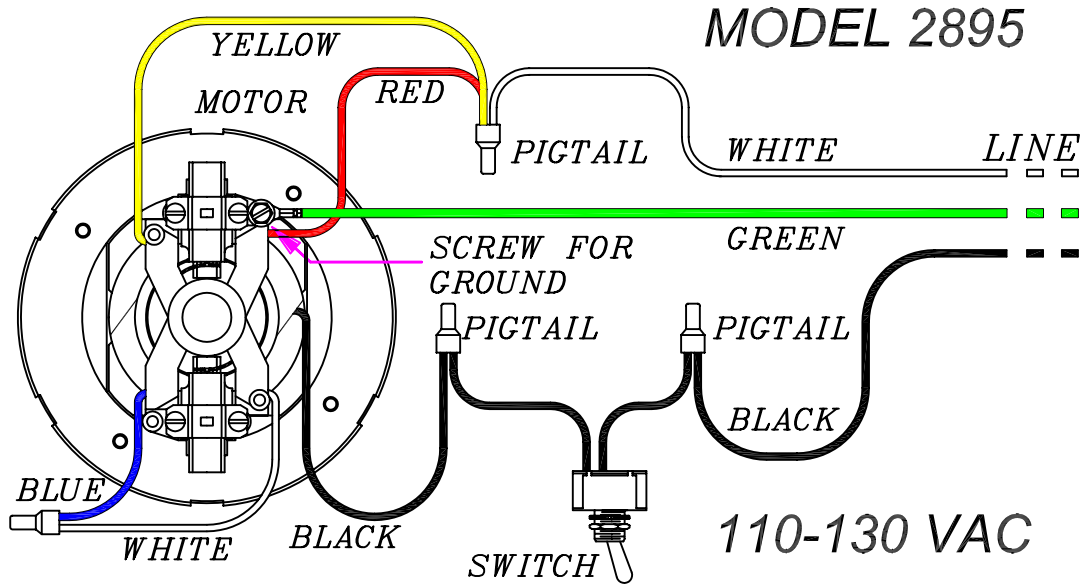
**DO NOT OVER TIGHTEN AS DAMAGE TO THE GASKET MAY OCCUR.
OVER TIGHTENING WILL NOT IMPROVE THE SEAL.**

NOTE

IF LEAKAGE OCCURS, OPEN THE FILTER AND CLEAN AND RE-INSPECT THE SEAL RING. A SUITABLE LUBRICANT APPLIED TO THE SEAL RING WILL HELP THE SEAL.

3. Examine the electric cord for evidence of damage and replace any worn or damaged cord immediately.
4. After 500 hours of operation, carefully remove the Blower Assembly and examine the brushes and the commutator of the blower motor. If the brushes or the commutator is damaged, replace the blower.

ELECTRICAL SCHEMATIC



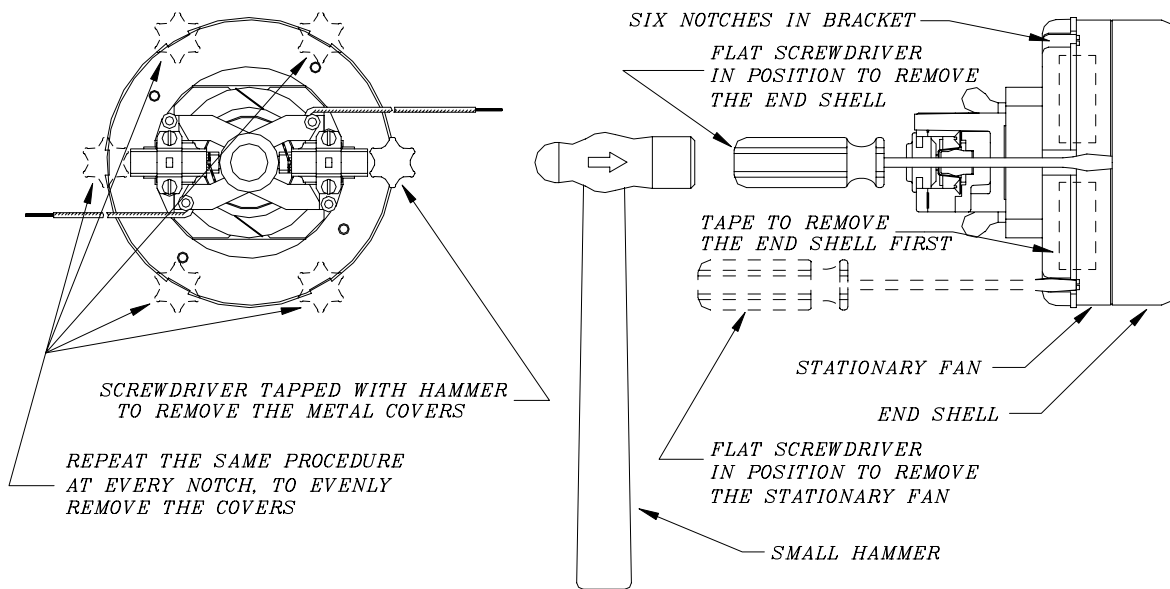
ROTARY FAN REPLACEMENT

CAUTION:

The Blower of your machine rotates at a high speed (approximately 20,000 RPM). The replacement of the Rotary Fan, if required, should be performed by a certified Dyna-Fog representative.

If the machine has been working in a closed room, the intake air filter gets saturated, and liquid (chemical) is introduced to the blower. The first contact point is the center section of the rotary fan, which could be attacked for the chemical. Then the debilitated wall of the fan fails. As result of the broken fan, the motor increases the speed, the air flow and the mist stops. The machine has to be shut off immediately.

The deterioration process of the fan material is accelerated if the machine is operated without air intake filter, or if disinfectant is applied in a closed room. The Fresh Air Intake hose P/N 62060 is recommended for those kinds of applications.



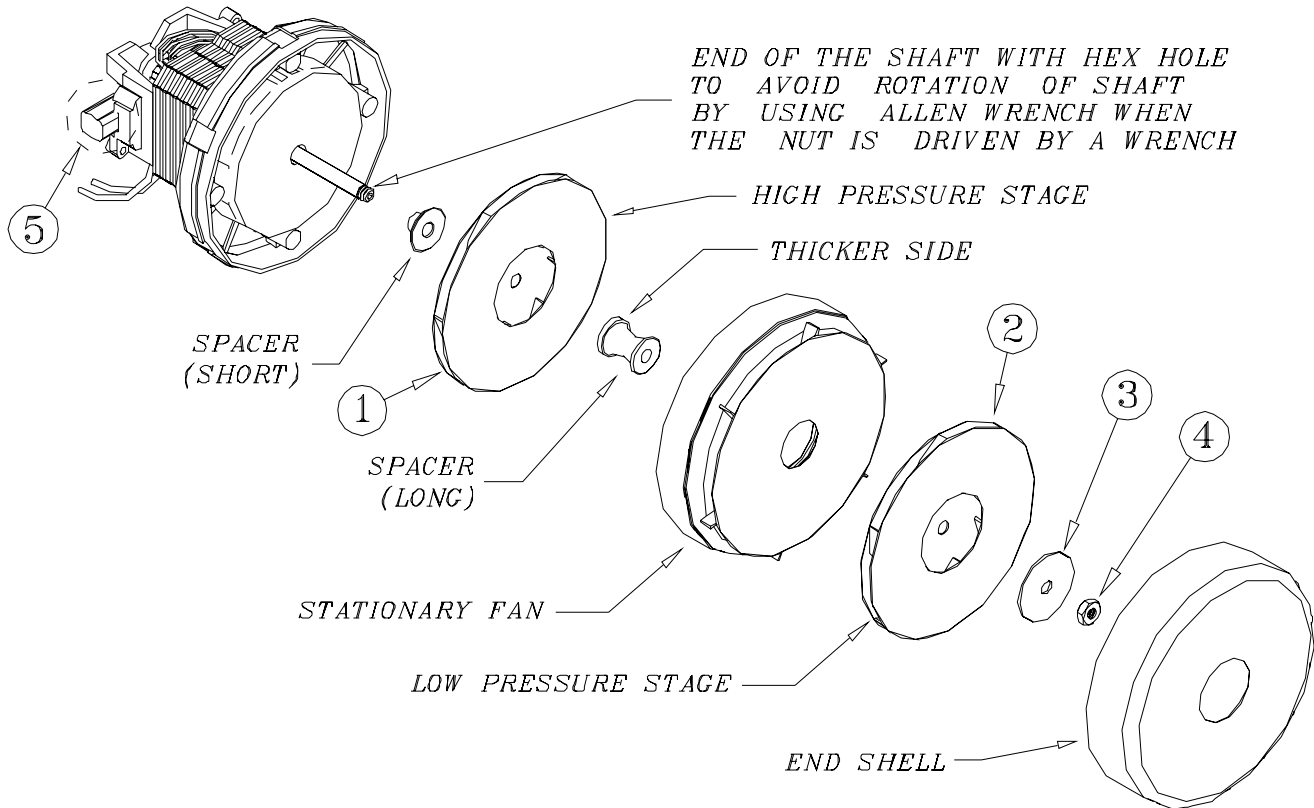
When the machine is disconnected from the power supply, remove the rear cover and pull the motor out the plastic housing. Some cables will keep the motor close to the housing.

TO DISASSEMBLE THE BLOWER:

- 1) To remove the metal end shell, add some pieces of industrial strength tape and use a screwdriver and hammer to lightly tap as indicated in above diagram. Gently tap the edges gradually working around the entire diameter.
- 2) After removing the end shell, use a 1/8" Allen Wrench and a 1/2" open end wrench to loosen and remove the nut. Remove the circular section of the remaining material from the broken fan.

3) Remove tape and proceed to remove the stationary fan by using the screwdriver and hammer. Remove the long spacer and the rotary fan of the second stage (item 1).

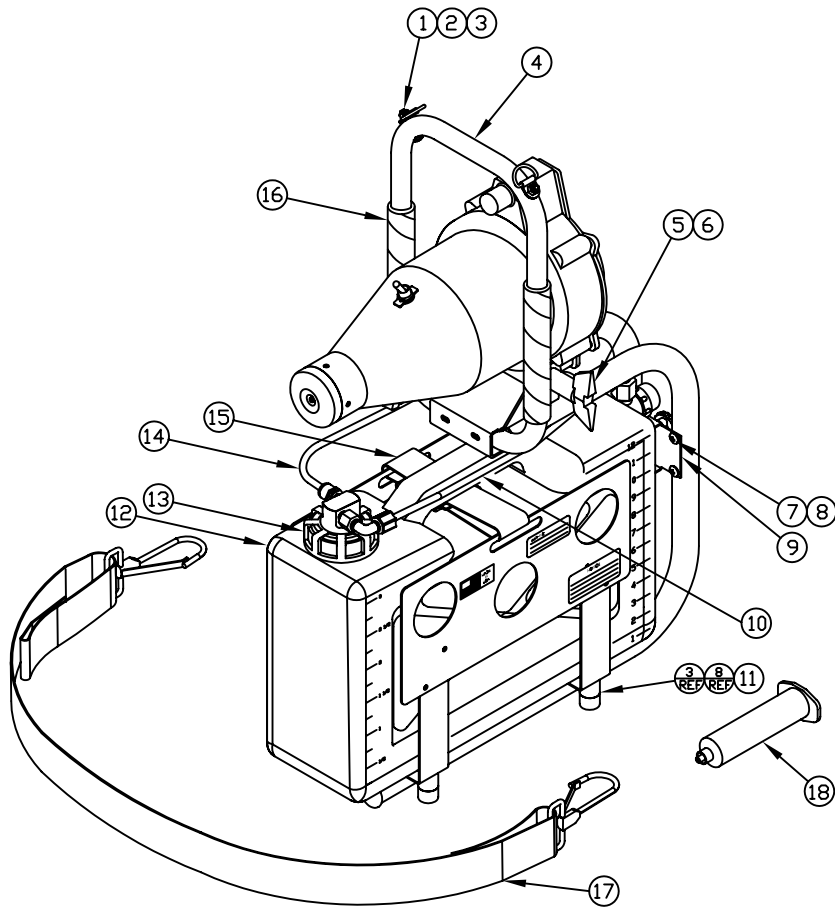
4) Add the new fans positioning them as shown in below diagram, place the big washer with the smooth outside edge against the fan material, tighten out the nut to a torque of 20 to 25 Lb-Inch, and reinstall the end shell. A thread lock product like Loctite 222 (purple) is recommended prior to reinstalling the nut onto the shaft thread.



SPARE PARTS FOR THE MOTOR

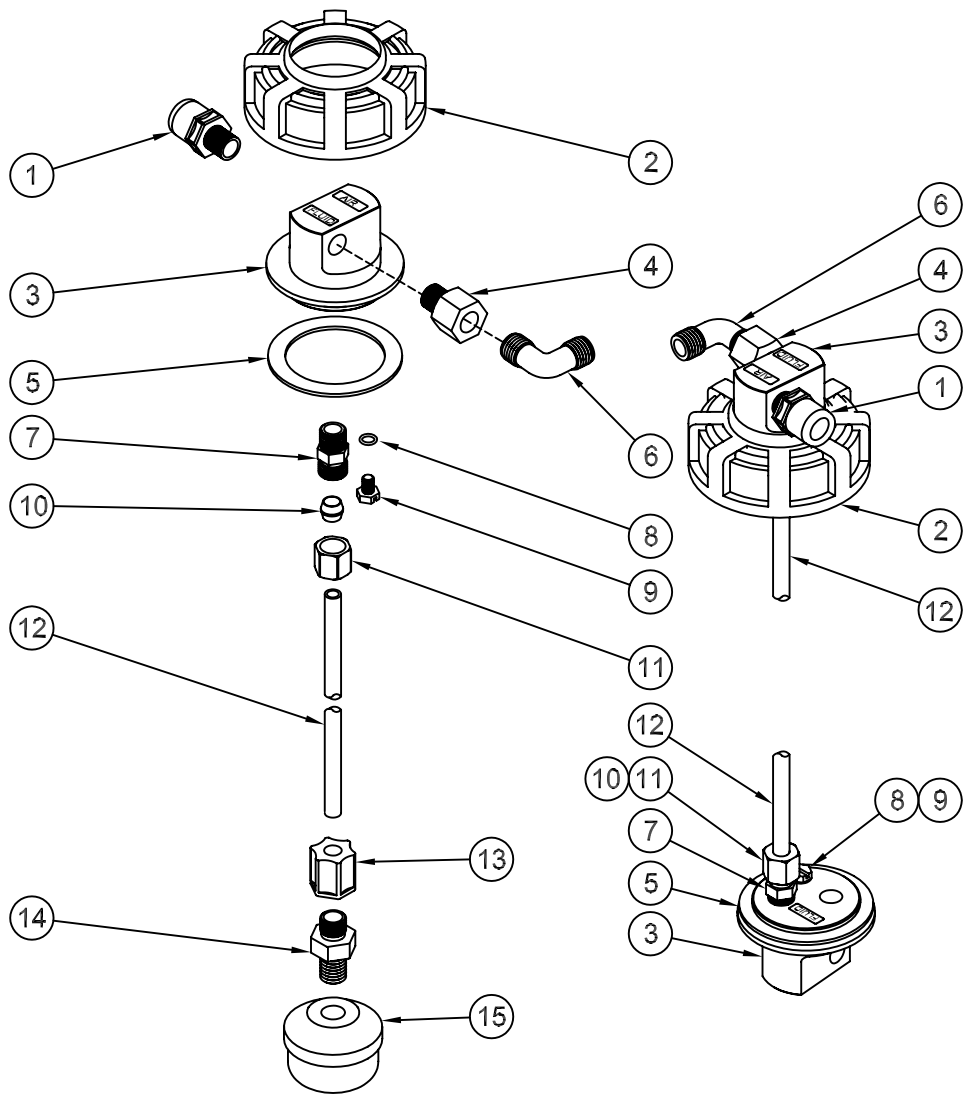
<u>ITEM</u>	<u>QTY</u>	<u>P/N</u>	<u>DESCRIPTION</u>	<u>VOLTAGE</u>	
1	1	39651-5	Rotary Fan, 4.93" O.D.	110-130 VAC	} BLOWER (120 VAC) SERVICE KIT P/N 63534
2	1	39651-5	Rotary Fan, 4.93" O.D.	110-130 VAC	
3	1	39651-13	Flat Washer	ANY	
4	1	39651-11	Nut	ANY	
5	2	62309-2	Brush Mechanism	110-130 VAC	
1	1	39592	Rotary Fan, 4.18" O.D.	210-250 VAC	} BLOWER (220 VAC) SERVICE KIT P/N 63535
2	1	39591	Rotary Fan, 4.72" O.D.	210-250 VAC	
3	1	39651-13	Flat Washer	ANY	
4	1	39655-11	Nut	ANY	
5	2	62340-2	Brush Mechanism	210-250 VAC	

PARTS DIAGRAM



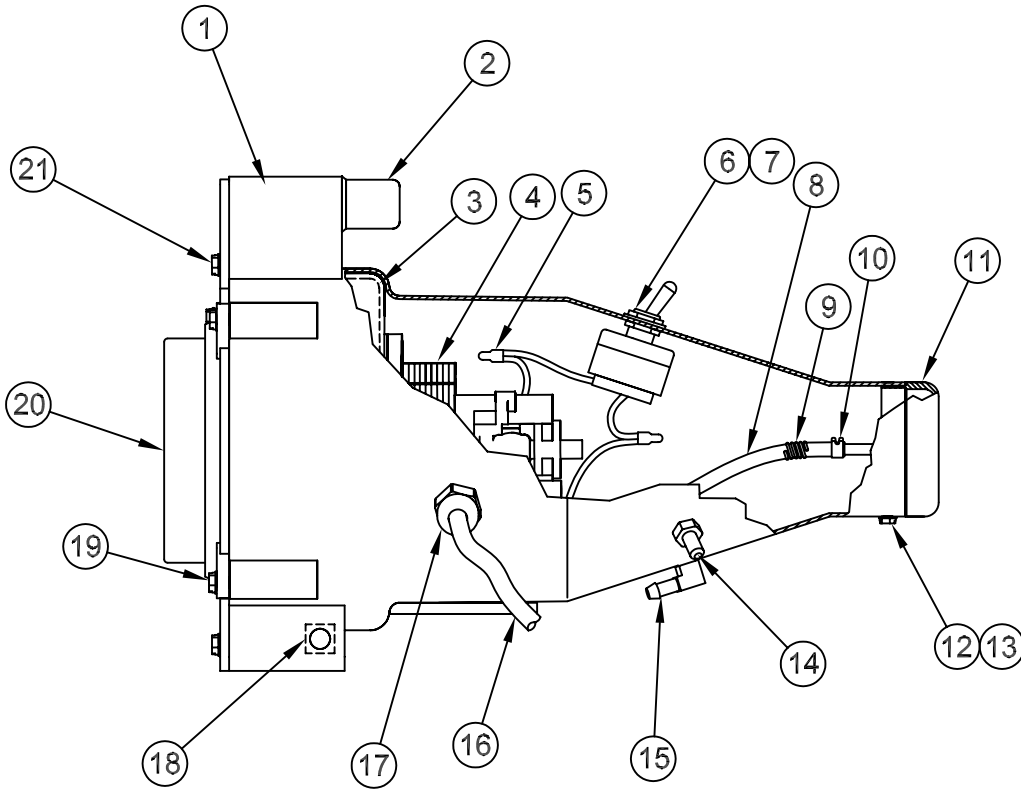
CURTIS DYNA-FOG[®] Ltd. TORNADO[™]

<u>ITEM</u>	<u>QTY</u>	<u>P/N</u>	<u>DESCRIPTION</u>
1	2	11719	CLAMP CARRY STRAP
2	2	190254	NUT, 10-24 LOCK, HEX
3	6	159957	SCREW, 10-24 x 1, PNCR
4	1	62381	FRAME/VALVE AY
5	1	62083	WASHER, FRICTION
6	1	62118	KIT, LOCK HANDLE, BLK
7	4	85361	SCREW, 10-16 x 1/5 AB
8	8	121801	WASHER, LOCK, #10 INTO
9	1	62399	FORM. CONTROL AY, TORNADO
10	1	22247	LINE AY, FORMULATION
11	8	58284	FOOT, RUBBER
12	1	86231-1	TANK, 3 GAL (MACHINED)
13	1	22246-1	CAP AY, FORMULATION
14	1	63803	LINE AY, PRESSURIZING
15	1	62403	STRAP, TIGHTEN, 2895
16	12"	RM39705	WRAP, SPIRAL, 1" OD
17	1	85574-1	STRAP, TORNADO, CARRY
18	1	62332	VISCOSIMETER



CURTIS DYNA-FOG[®] Ltd. TORNADO[™]
CAP ASSEMBLY, FORMULATION
P/N 22246-1

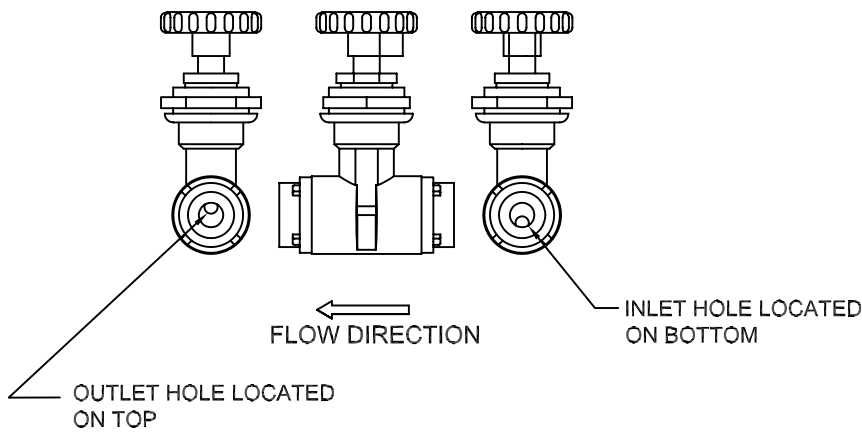
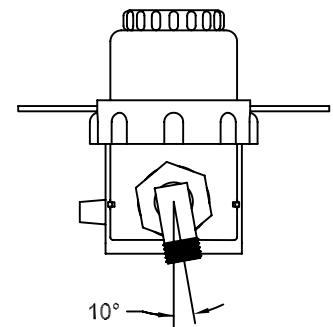
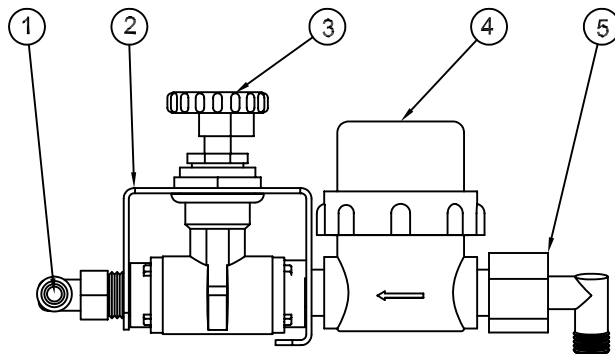
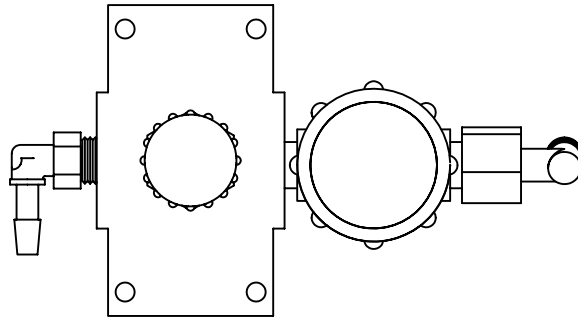
ITEM	QTY	P/N	DESCRIPTION
1	1	43298	FITTING, 1/8MPT – 1/4T
2	1	21010	CAP, FORMULATION
3	1	43290	INSERT, CAP
4	1	63254	ADAPTOR, 1/8MP – 1/8FP
5	1	22232	GASKET, VITON
6	1	62641-1	ELBOW, 1/8MP – 1/4T
7	1	10105	CONNECTOR, STANDPIPE
8	1	10100-8	O-RING
9	1	43308	SCREW, 10-32 x ¼ NYLON
10	1	114628	SLEEVE, ¼ TUBE
11	1	14563	NUT, ¼ TUBE
12	1	22244-1	STANDPIPE, FORM
13	1	62550-1	NUT, .25, STL GRIP
14	1	62573-1	CONNECTOR, MM, MODIFIED
15	1	86643	FILTER, ¼ NPT, 40 x 40



CURTIS DYNA-FOG® Ltd. TORNADO™

BLOWER HOUSING

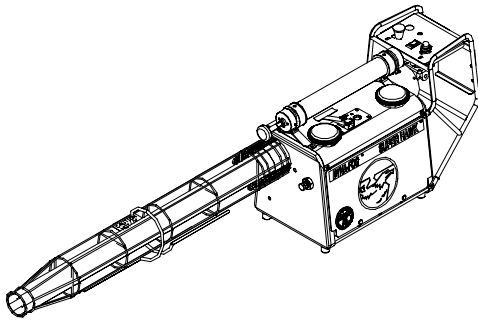
<u>ITEM</u>	<u>QTY</u>	<u>P/N</u>	<u>DESCRIPTION</u>
1	1	63505-2	TORNADO HOUSING
2	1	64174	CAP
3	1	62366	BLOWER GASKET
4	1		MOTOR
		62309-1	120 VOLT
		62340	240 VOLT
5	4	20510	PIGTAIL WIRE CONNECTORS
6	1	62325	INDICATOR PLATE
7	1	62312	TOGGLE SWITCH
	1	54078-1	TOGGLE SWITCH COVER
8	1	62392	INJECTION TUBE AY
9	1	62017-2	TUBE GUARD
10	2	80296-11	HOSE CLAMP
11	1	62313	NOZZLE AY
12	4	62163	SCREW, 8-32 x 3/8 TAP, PHCR, SS
13	4	62343-1	EYELET
14	1	62472	UNION, 1/4T BULKHEAD
15	1	85916	MALE ELBOW, 18 NPT
16	1		POWER CORD AY
		62031-2	POWER CORD, 120 VOLT
		62051-1	POWER CORD, 240 VOLT
17	1	20180-3	STRAIN REL. POWER CORD
18	1	62367	NUT, 3/8 - 24, SQUARE
19	5	62161	SCREW 10-16 x 3/4, HIGH-LOW THR, S.S.
20	1		REAR HOUCING CLOSURE
		62002-1	120 VOLT
		62002-2	240 VOLT
21	1	62160	SCREW 10-16 x 1.25, SELF TAP, S.S.



CURTIS DYNA-FOG[®] Ltd. TORNADO[™]
FORMULATION CONTROL AY P/N 62399

ITEM	QTY	P/N	DESCRIPTION
1	1	39730	ELBOW, PLST, ¼ MPT - BARB
2	1	62396	BRACKET, NEEDLE VALVE
3	1	63569	VALVE, NEEDLE, PLASTIC, ¼ FPT
4	1	62558-5	FILTER/O'RING AY
5	1	62554-6	ELBOW, FEM. 1/4T – 1/4P

DYNA-FOG® Offers a complete and wide assortment of aerosol generator systems.



PULSE-JET POWERED THERMAL FOGGERS:

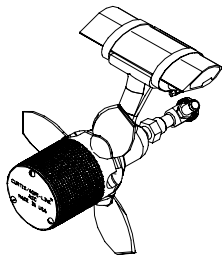
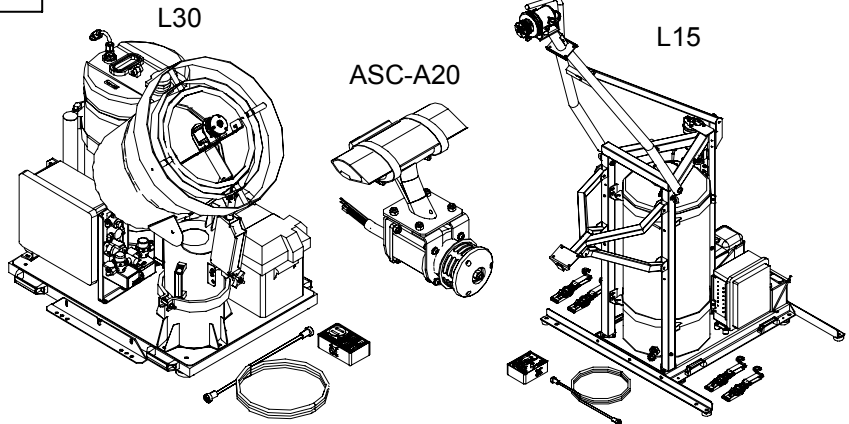
From 0-120 GPH (0-453 LPH) output. Our complete line include different models like the Superhawk, Golden Eagle, Trailblazer, Patriot, Blackhawk, Mister III, Mister Max, SilverCloud and Model 1200. Portable or Truck mounted machines. Different models are available for Oil base or Water base formulations.

ELECTRIC ROTARY ATOMIZERS:

DYNA-JET L30: State of the Art, Electric Rotary Atomizer ULV Aerosol Generator. 12 VDC, Light Weight, Truck mounted Machine with FMI pump. Optional Radar Syncroflow.

DYNA-JET L15: Drift Sprayer for migratory pest control like Locust. Flow Rate from 0 to 2000 ml/min. Optional Radar Syncroflow.

ASC-A20: State of the Art, Electric Rotary Atomizer, for use on Fixed Wing and Rotary Wing aircraft.

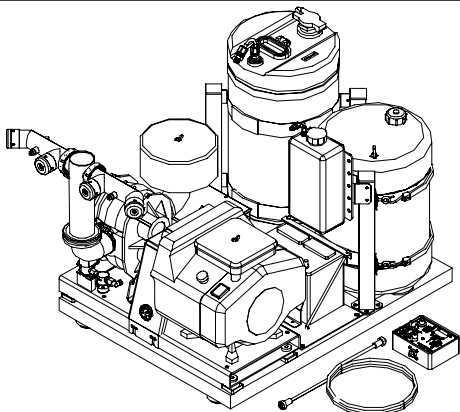
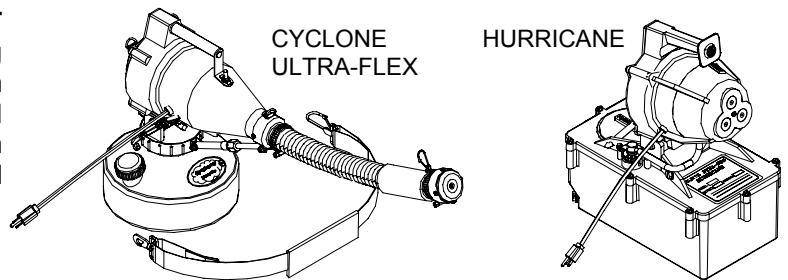


WIND DRIVEN ROTARY ATOMIZERS:

The ASC-A10 is a wind driven atomizer designed for Fixed Wing aircraft. The rotational speed of the atomizer controls the droplet size and can be adjusted by changing the angle of the blades. Also available is the ASC-A10H for Rotary Wing application. No other Rotary atomizer for aircraft can handle the amount of Flow rate as the ASC Atomizer.

Several accessories are available to meet your requirements. Also available in 12 or 24 VDC, see rotary atomizers above model ASC-A20.

ELECTRIC HAND-HELD ULV/MIST GENERATORS: Full line of electric cold fog applicators with 1 Gal (3.8 L) tank, available in 115 and 230 VAC. An Electric Thermal version is available. For bigger Formulation capacity we have some models with 3 Gal (11.4 L) tank.



COMBUSTION ENGINE DRIVEN ULV AEROSOL GENERATORS:

Truck mounted Units powered by 8, 9, 11 or 18 HP four cycle, OHV Gasoline Engine. Diesel version available. One, two or four nozzles. Optional full remote control of boom functions (rotation of turntable and angle of nozzles).

Diversity of pumping systems, Gear, Piston and Diaphragm. Pressurized system available for overseas market.

Optional Radar Syncroflow. 40 cc Two cycle portable machines also available.

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