



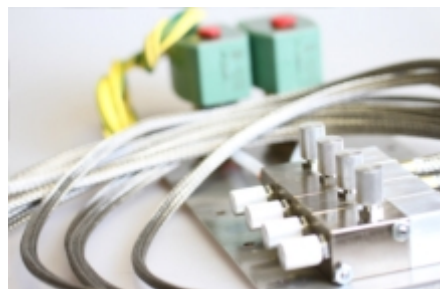
Coolant Mist Spray

For use in: Milling, Drilling, Grinding, Sawing, Tapping, Turning.

Manufactured in the USA by Ekstrom Carlson



Our Mistic Mist System is the best in industry for coolant spray mist systems. In addition to this line, we offer carbide and high speed steel end mills and router bits, custom cutting tools, cnc spindle motor repairs and chuck repairs, and new router motors, arbor motors and saw motors.



Mistic Mist™

Here is why Mistic Mist is considered the most efficient cooling method for machine operations: The air passing through the nozzle tip creates a vacuum in the liquid line which draws coolant from the tank. (Our tank is not pressurized.) The coolant is instantly vaporized and forms a conical mist pattern. At the same time, the compressed air expands absorbing heat surrounding the tool and work piece. The result is a cooling effect as well as lubrication.

Quality Components – 100% Inspected Prior to Shipment

- Stainless Steel nozzles made to extremely close tolerances for utmost efficiency, durability, and effective atomization of lubricant.
- Solid brass valve body and needle valve.
- Very flexible air/coolant lines.
- Corrosion-resistant metal or poly coolant tanks.
- Fine mesh screen in the air and coolant inlets to help filter out particles.

Advantages of Mistic Mist

1. **Cools and Lubricates** the cutter immediately improving work piece finishes and tolerance.
2. **Increases Tool Life** saving time and money by providing less downtime from tool replacement.
3. **Less Mess** No rancid sumps or filters to clean. No elaborate plumbing, guards, and pumps to maintain.
4. **Nothing to Dispose of** Only a trace of coolant may remain on the tool. Most of the coolant is used up during the machining.
5. **Low Operating Cost** Most units use only .3 CFM of shop air at 90 PSI. One gallon of coolant can last up to 14 hours depending on use and application.
6. **Easy to Install** Simply mount the unit to your machine tool, fill with coolant, connect shop air line to unit, and start using it. No need for pressure tanks, air regulators, filters, etc.
7. **Use Almost Anywhere** Compact nozzle design, flexible lines, mounting bracket, and adjustable nozzle holder, makes installation, location, and adjustments easy.
8. **We Make Special Models** and variations of our standard models to fit your application.

Note: If any mist unit is generating too much mist (fogging) simply reduce the coolant and air mixtures. When properly adjusted, most of the spray is used up during the machining process.

1ST Models

Standard Round Tank Unit 1 Gallon



Part No.	Model No.	Outlets
451-3077	1ST-1LC	1 with 1 magnet
451-3005	1ST-2LC	2 with 2 clips*

*If you require magnet nozzle holders, order P/N 420-3009 30lb. or P/N 420-3324 60 lb. pull power

This unit features:

- Straight 3 inch stainless steel mist generating nozzle 4 foot air/coolant lines encased in braided metal wire Fine mesh bronze filter in coolant and air inlets
- One gallon tanks are enamel paint finished metal with removable corrosion resistant inner liner Adjustable Air and Liquid Control Valve for each outlet
- Bracket for mounting tank on wall or machine Coolant level indicator alerts operator to low coolant level
- One long nozzle clip for permanent installations One 30-lb. magnetic nozzle holder - multiple outlet
- units include nozzle clips instead of magnetic base

Model 1ST-1LC with magnet nozzle positioner

1ST Models with Loc-Line Nozzle - 1 Gallon

Round One Gallon Units with Loc-Line Positioner



Part No.	Model No.	Outlets
451-3721	1ST-1LP	1
451-3722	1ST-2LP	2
451-3725	1ST-1MP	1
451-3726	1ST-2MP	2

Same basic unit as the first 1ST model, only that the spray nozzle is held in place with our Loc-Line Positioner.

This unit features:

- 12 inch Loc-Line Positioner with mounting foot, or magnetic base
- 3 inch stainless steel mist generating nozzle
- 3 foot air/coolant line encased in braided metal wire from unit to Loc-Line - extra lengths available

Model 1ST-2LP with LocLine nozzle positioner



Unit with magnetic base Loc-Line (MP Units)



1-3/4" mounting foot hole pattern for permanent mount (LPUnits)

2RH Models

Standard Rectangular Tank Unit - 2 Gallon



2RH Model – 2 Gallons

Mistic Mist Model 2 RH is a 2-gallon capacity Mist Coolant Generator that includes many deluxe features. Air and coolant line connections are completely housed within the removable lid so the tank can easily be cleaned or refilled.

Part No.	Model No.	Outlets
452-3337	2 RH-1	1 outlet w/ 1 magnet
452-4984	2 RH-2	2 outlets w/ 2 magnets
452-4985	2 RH-3	3 outlets w/ 2 magnets & 1 clip*
452-4986	2 RH-4	4 outlets w/ 2 magnets & 2 clips*
452-4987	2 RH-5	5 outlets w/ 2 magnets & 3 clips*

*If you require additional magnet nozzle holders, order P/N 420-3324 60-lb. pull.

The two gallon tank is 10"x 6"x 8" and is made of heavy gage corrosion resistant steel with epoxy paint exterior. A sight glass is provided so you'll know at a glance when refilling is necessary. The tank is easily removed from the furnished wall mounting bracket.

Air/coolant lines are four foot poly tubing encased in braided metal wire. The nozzle is a 3" straight type, held in place by a powerful 60-lb. pull magnet or mounted permanently with nozzle clips. Models are available with up to five outlets.

2 RH Models

With Loc-Line Nozzle Positioner - 2 Gallon



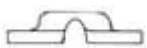
Model 2 RH-1LP with Loc-Line nozzle positioner

Same basic unit as the first 2 RH model, only that the spray nozzle is held in place with our Loc-Line Positioner.

This unit features:

- 12 inch Loc-Line Positioner with mounting foot, or magnetic base
- 3 inch stainless steel mist generating nozzle
- 4 foot air/coolant line encased in braided metal wire from unit to LocLine - extra lengths available

Part No.	Model No.	Outlets
452-3731	2 RH-1LP	1
452-3732	2 RH-2LP	2
452-3733	2 RH-3LP	3
452-3734	2 RH-4LP	4
452-3735	2 RH-5LP	5
452-3741	2 RH-1MP	1
452-3742	2 RH-2MP	2
452-3743	2 RH-3MP	3
452-3744	2 RH-4MP	4
452-3745	2 RH-5MP	5



1-3/4" mounting foot hole pattern for permanent mount (LP Units)



Unit with magnetic base
Loc-Line (MP Units)

Mistic-Mini
chip off the ol' block 1/2 Gallon



Same quality components as our deluxe models except they are mounted on a simple 1/2 gallon square container (note round tank shown, but current tank is square).

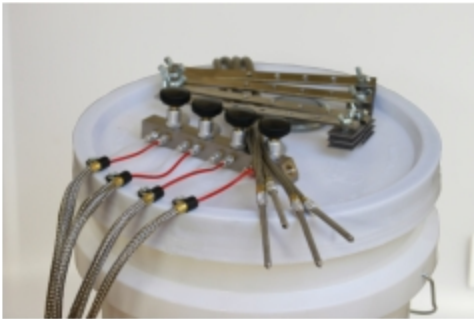
Complete - Ready to Go!

Part No.	Model No.	Outlets
450-2500	Mistic Mini	1

This unit features:

- Stainless steel mist generating nozzle - 3 inches long
- 3 foot air/coolant line encased in braided metal wire
- Fine bronze mesh coolant filter screen Adjustable air and liquid controls set in nickel plated brass body
- See thru square polyethylene tank - **1/2 gallon** capacity
- Magnetic nozzle holder - 30 pound pull magnet 80-120 PSI recommended operating pressure
- Uses only .3 CFM air at 90 PSI

5 RT Models
5 Large Style Units - 5 Gallons



Part No.	Model No.	Outlets
454-4988	5RT-1SS	1
454-4989	5RT-2SS	2
454-4991	5RT-4SS	4
454-4992	5RT-5SS	5
454-4995	5RT-8SS	8
454-4997	5RT-10SS	10
454-4999	5RT-12SS	12

* If you require additional magnet nozzle holders, order P/N 420-3324 60-lb. pull power.

The 5RT series uses a 5-gallon round plastic tank and is available with up to 12 outlets. Five-foot air/coolant lines for each outlet are standard. No Magnets are furnished with this model - nozzle clips are supplied instead.

5ST Models
Large Style Units 5 Gallons



Part No.	Model No.	Outlets
453-3396	5ST-1LC	1 with 1 clip
453-3397	5ST-2LC	2 with 2 clips
453-3028	5ST-4LC	4 with 4 clips
453-3036	5ST-5LC	5 with 5 clips

* If you require additional magnet nozzle holders, order P/N 420-3324 60-lb. pull power.

This unit features:

- Straight 3 inch stainless steel mist generating nozzle 5 foot air/coolant lines encased in braided metal wire
- Fine mesh bronze filter in coolant and air inlet
- Polyethylene coolant tank and cover Adjustable Air and Liquid Control Valve for each outlet
- Coolant level indicator
- Nozzle clips for permanent installations

Please order by Part No

Flexi-Mist Units Standard Output



Model 460-112-MD
(shown with optional on/off lever)

"Flexi-Mist" Standard output units use our newly developed "Loc-Line" Positioner. Individual needle valves precisely control air and coolant ratio. The basic unit includes: 3" straight nozzle, a 12" or 18" Loc-Line nozzle positioner, valve body assembly, 60-lb. pull magnetic base, and 5' liquid line with filter.

Part No.

460-112-M	12" flexi-mist unit, standard output, with magnetic base
460-112-MD	same unit as above with on/off lever
460-118-M	18" flexi-mist unit, standard output, with magnetic base
460-118-MD	same unit as above with on/off lever

Note: Round magnetic base can be removed so unit can be hard-mounted to machine tool with two screws.

Flexi Mist Hi-Flow Output



Model 465-124F3D
(shown with optional on/off lever)

"Flexi-Mist" Hi-Flow units develop up to nine times more output than our standard models. Yet it can be adjusted down to where the standard units max out. Their models utilize a "flexible plastic lockline" nozzle positioner in longer lengths than standard output models. The basic unit includes: 3" HF nozzle, 18" or 24" "plastic loc-line" nozzle positioner, valve body assembly, 60-lb. pull magnetic base, and 5' liquid line with filter.

Part No.

465-118F3	18" flexi-mist unit, hi-flow output, with magnetic base
465-118F3D	same unit as above with on/off lever
465-124F3	24" flexi-mist unit, hi-flow output, with magnetic base
465-124F3D	same unit as above with on/off lever

Note: Round magnetic base can be removed so unit can be hard-mounted to machine tool with two screws.

Mistic Mist Central Mist Cooling Spray Systems

Single Source for Multiple Machine Cooling

Ekstrom-Carlson Mistic Mist Central Systems can provide cooling to many machines from a single coolant supply source, eliminating the need for coolant tanks at each machine. Central Systems allow for easy expansion as future needs require.

How to Order

The following specific information should be answered when ordering central systems units:

1. Standard or Hi-Flow
2. Number of control valves required
3. Type and length of lines (between valve and nozzle)
4. Type of nozzle
5. Style and capacity of coolant tank
6. On/Off controls (lever or electric) optional
7. Spray nozzle holders

2 Valve Body

Standard 1/8" pipe threads are used on the valves for air and coolant supply connections. Each valve measures 1"x 1"x 2-5/16". All valves have mounting holes, an air control, and a liquid control.



Valve body - Standard Outlets

Part No.	Outlets
420-3401	CS-1V
420-3402	CS-2V
420-3403	CS-3V
420-3404	CS-4V

Valve body - Hi-Flow Outlets

Part No.	Outlets
420-3467	HF-1V
420-3468	HF-2V
420-3469	HF-3V
420-3470	HF-4V

Electric Solenoid

Cycle unit automatically with solenoid in air supply line. 110 VAC 60 Hz and 24 VDC are available (expect 3 to 4 second spray delay).

Part No. 250-3094-110

Part No. 250-3094-24 VDC

1 Standard Output Units/Hi-Flow Units

Standard Output Units deliver a spray capable of adequately cooling and lubricating small to approximately 5/8" diameter mills, drills, taps, wheels, etc., in light tool room and general purpose machining applications. For larger cutters, production, and high feed rates, where more lubrication is required, choose a spray unit with more than one spray nozzle or choose a **Hi-Flow Unit**. Standard output models use up to .3 cfm air @ 90 PSI.

High-Flow Units deliver up to **NINE** times more spray than our standard output models. Yet, they can be adjusted down to about where the standard nozzle leaves off. Hi-Flow units are recommended for higher feed rates, production machining, and large cutters over 1-1/4" diameter. Hi-Flow output units use 2.7 cfm air @ 90 PSI.

3 Air/Coolant Lines (Between Valve and Nozzle)

Choose a Line...Specify Length

When extreme flexibility is desired, ACT lines are recommended. The poly air coolant tubes are covered with braided metal wire. This type of line must be supported in the proper position. We offer magnetic bases or nozzle clips. Sold per foot.



Coolant ACT Lines

Part No.	Description
420-3252-__	Standard ACT
420-3609-__	Hi-Flow ACT

For machines requiring frequent nozzle adjustment, the air and coolant tubes are encased in flexible positioners. Position of the nozzle is held stiff yet flexible. Tube end is attached directly to valve body.



Standard Output

4 Spray Nozzles



Part No.	Description
420-3089	3" straight
420-3392	5" straight
420-3199	3" 45 degree offset
420-3395	3" 90 degree offset
420-3393	5" 45 degree offset
420-3394	5" 90 degree offset
420-3615	Hi-Flow 3" straight
420-3606	Hi-Flow 5" straight
420-3644	Hi-Flow 5" 45 degree offset
420-3645	Hi-Flow 5" 90 degree offset

Part No.	Description
420-4311-12	Nozzle positioner 12"
420-4311-18	Nozzle positioner 18"



Hi-Flow Output

Part No.	Description
420-3221-12	Plastic Loc-line 12"
420-3221-24	Plastic Loc-Line 24"

5 Metal and Plastic Coolant Tanks

2 gallon rectangular tanks are available with sight glass fluid level indicator, coolant filter with nipple, heavy gage corrosion resistant steel, and tough paint epoxy coating. 1 and 5 gallon round tanks are available in plastic and do not include sight glass fluid level indicators.

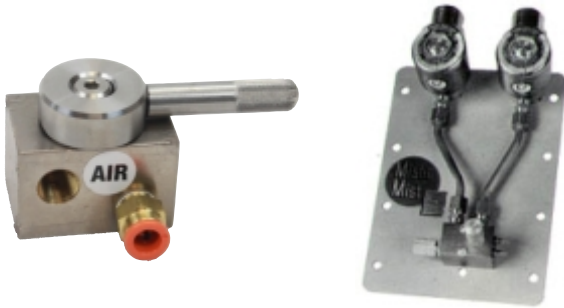
5 gallon semi-transparent, self-supporting, are well suited for use in medical, electronics, food, and chemical applications, where corrosion may be an issue. Tanks include filter with nipple, and lid. 2 gallon rectangular tanks are also available.



Part No.	Description
420-3339-F	2 gallon Rectangular 10"x 6"x 8" high
420-3066	1 gallon Round Metal
420-3156	5 gallon Round Plastic

6 On/Off Control Options

The **DALC** on/off lever avoids opening and closing individual air and liquid controls between operations. Manually operated. **420-3309**








Dual Solenoid Control Valve is an assembly of two valves which install in the air and coolant supply lines of the CS series valves.

Specify voltage 110V 60Hz or 24 VDC.

4204978-110VAC
420-4978-24VDC

7 Spray Nozzle Holders

2 and 5 gallon rectangular tanks are available with sight glass fluid level indicator, coolant filter with nipple, heavy gage corrosion resistant steel, and tough paint epoxy coating. 1 and 5 gallon round tanks are available and do not include sight glass fluid level indicators.

<p>Magnetic Nozzle Holder</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>30 lb. pull</p> </div> <div style="text-align: center;">  <p>60-lb. pull</p> </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;"> <p>Standard Output Model 420-3009</p> </div> <div style="text-align: center;"> <p>Standard Output Model 420-3324</p> <p>Hi-Flow Output Model 420-3626</p> </div> </div>	
<p>Bridgeport Mounting</p> <div style="text-align: center;">  </div> <div style="margin-top: 10px;"> <p>Standard Output Model 420-3011</p> <p>Hi-Flow Output Model 420-3628</p> </div>	<p>Permanent Nozzle Clip</p> <div style="text-align: center;">  </div> <div style="margin-top: 10px;"> <p>Standard Output Model 420-3087</p> <p>Hi-Flow Output Model 420-3625</p> </div>
<p>12" Magnetic "Loc-Line" Positioner includes 3' ACT line (nozzle not included)</p> <div style="margin-top: 10px;"> <p>Standard Output Model 420-4395</p> <div style="text-align: center; margin-top: 20px;">  </div> </div>	

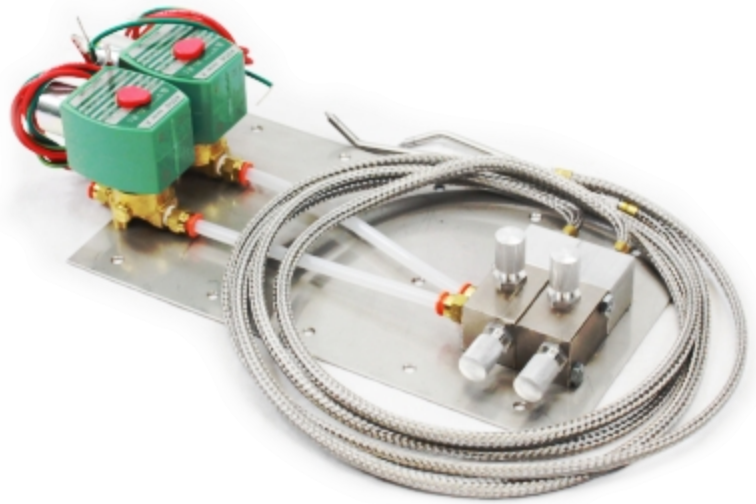
Instant On / Off Units

Single Source for Multiple Machine Cooling

Instant on/off models are complete units that incorporate a pair of electronic operated solenoid valves to start and stop mist application. When the solenoid valves open, air and coolant is allowed to flow through the unit creating spray mist at the nozzle tip. When the solenoids close, air and coolant flow is halted, stopping mist application. Unit sprays only when needed, eliminating waste and overspray.

Includes: Mixing valve, 4' air/coolant lines, 5" nozzle with 45 degree offset, nozzle holder clips, dual solenoids 110 VAC assembled on 5"x 8" mounting plate, 5' coolant supply line, and tank of your choice.

Options: longer air/coolant lines, **420-3324** magnetic nozzle holder 60 lb., 2 gallon, or 5 gallon metal reservoir with mounting brackets, 2 gallon or 6 gallon stand alone poly reservoirs, 24 VDC solenoids.



Standard Output Units

Part No.	Description
460-100-STD1	One-outlet model
460-100-STD2	Two-outlet model
460-100-STD3	Three-outlet model
460-100-STD4	Four-outlet model

Hi-Flow Output Units

Part No.	Description
100-HF1	One-outlet model
460-100-HF2	Two-outlet model
460-100-HF3	Three-outlet model
460-100-HF4	Four-outlet model

Circular Saw Mist Unit

This Hi-Flow system provides cooling for cutting, notching and slotting operations. The two nozzles attach to the machine guard assembly and are in proper position regardless of size or shape of material. As the saw is lowered, a roller operated limit switch activates them and liquid solenoid valves, providing mist only when cutting.

Includes: 2 outlet Hi-Flow Valve Assembly, 5 gallon tank and cover, double solenoid valve 110 volt AC standard, 3 ft. Hi-Flow ACT LEADS, 5" 45 degree Hi-Flow nozzles, nozzle holder clips, limit switch and roller, 5' coolant supply line to connect tank and valve.

465-3038-110VAC or 465-3038-24VDC



Mistic Mist 2000 Lube Dispensers

For Vegetable & Synthetic Lubricant

Limited-Flow / Continuous-Output Lube Dispensers - Gen II

For Vegetable-based and Synthetic Lubricants

Here is why Mistic 2000 Lube Dispensers are considered the most efficient for applying Vegetable-based and Synthetic Lubricants for all machine operations.

Advantages of Mistic 2000

- 1. Simple Design** • top quality features and highest cooling/lubricating performance for all machining operations.
- 2. Continuous-Output** • delivers an un-interrupted flow of lubricant throughout the cut, providing the tool with even coverage protection. Thus, eliminates random spitting of lubricant that may leave dry areas and hot spots.
- 3. Limited-Flow** • provides precise control of lubricant, applying as little as a few ounces per eight hour shift. Eliminates fogging, waste, and overuse.
- 4. Chill** • lube units chill the lubricant at point of application.
- 5. .3 CFM Air** • uses only .3 CFM of air at 90 PSI per outlet.
- 6. Curved Nozzle Tip Design** • gets lube deep into holes.

Consider This Option... a manual ON/OFF lever control for your convenience. Once you have the air and liquid controls set for the desired amount of lubricant, simply lift the lever to start and stop the flow of lubrication... **Or...** add **our electric solenoid for automatic operation.**

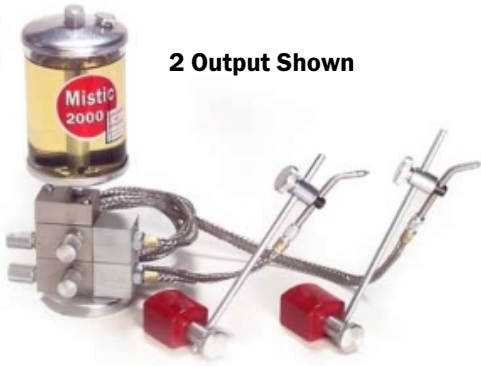
Specify voltage: **110VAC-60Hz or 24VDC**

All Models Complete With:

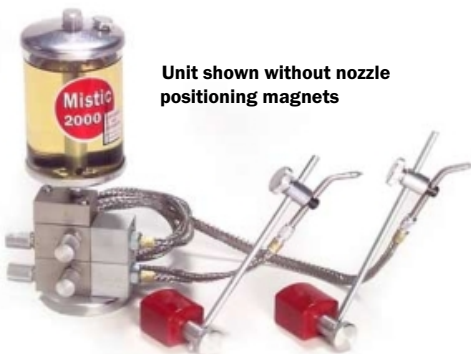
- 3" stainless steel nozzle with 45 degree curved tip
- 65 lb. pull mounting magnet for simple unit mounting
- Mounting bracket for permanent mounting (except models 1F, 1FL, and 1FS)
- Limited-flow needle valves for precise control of air and liquid output
- durable 9 ounce acrylic reservoir with filling funnel
- 6oz sample of V-Lube vegetable based lubricant
- 6oz sample of S-Lube synthetic based lubricant



Flexi-Mist Units Standard Output



2 Output Shown



Unit shown without nozzle positioning magnets

Part No.	Description
M2000-1A	Single outlet, 2' ACT line, and nozzle positioning magnet
M2000-1AL	Single outlet, 2' ACT line, and nozzle positioning magnet, with ON/OFF Lever control
M2000-1AS	Single outlet, 2' ACT line, and nozzle positioning magnet, with electric solenoid (specify voltage)

Part No.	Description
M2000-1B	Single outlet, 2' ACT line with 12" Flex-Line nozzle positioner
M2000-1BL	Single outlet, 2' ACT line with 12" Flex-Line nozzle positioner, and On/Off Lever control
M2000-1BS	Single outlet, 2' ACT line with 12" Flex-Line nozzle positioner, with electric solenoid (specify voltage)
M2000-1F	Single Outlet, with 12 inch Flex-Line Nozzle Positioner
M2000-1L	Single Outlet, 12 inch Flex-Line nozzle positioner, with On/Off Lever control
M2000-1FS	Single Outlet, 12 inch Flex-Line nozzle positioner, with electric solenoid, specify voltage

Part No.	Description
M2000-2A	Dual outlet, 2' ACT lines, and nozzle positioning magnets
M2000-2AL	Dual outlet, 2' ACT lines, and nozzle positioning magnets, and On/Off Lever control
M2000-2AS	Dual outlet, 2' ACT lines, and nozzle positioning magnets, and electric solenoid (specify voltage)
M2000-2B	Dual outlet, 2' ACT line with 12" Flex-Line nozzle positioner
M2000-2BL	Dual outlet, 2' ACT line with 12" Flex-Line nozzle positioner, and On/Off Lever control
M2000-2BS	Dual outlet, 2' ACT line with 12" Flex-Line nozzle positioner, with electric solenoid (specify voltage)

Mistic Mist II Concentrate

Synthetic Lubricant



Part No.

260-3000-01	1 gallon
260-3000-05	5 gallon
260-3000-55	55 gallon

Benefits

- Synthetic non-hazardous formula
- Outstanding heat removal
- Economical to use
- Eliminates foul odors
- Excellent rust protection
- No wheel loading
- Non-irritating to skin
- Anti-gumming formula
- Many types of metals

"Mistic Mist" Concentrate is a synthetic fluid, compounded especially for spray mist applications. It is fortified with high-tech rust inhibitors for complete protection of parts and machines. Special biocide additives are used to prevent bacteria and odor due to tramp oil contaminants. Product is a non-hazardous industrial chemical. Under normal use and dilution, it is not irritating to skin. Product is non-flammable, biodegradable, and can generally be disposed of thru sewer in compliance with acceptable local, state and federal regulations. (Sample included with most units)

Mistic Mist Lubra HD

Heavy Duty Concentrate



Part No.

260-3100-01	1 gallon
260-3100-05	5 gallon
260-3100-55	55 gallon

Benefits

- Synthetic non-hazardous formula
- Enhanced lubricity properties
- Better finishes
- Longer tool life
- Used in heavier duty applications
- Developed for flood and mist applications
- Non-irritating to skin
- Rust protection
- Microbial protected

Developed for flood cooling applications and heavy-duty spray mist lubrication needs. "Mistic Lubra HD" Heavy Duty Concentrate incorporates all of the above features found in our Mistic Mist concentrate, except with enhanced lubricity properties to perform in heavier duty machining applications. (Sample included with most units)

Mistic Mist V-Lube
Vegetable / Organic Formula



Part No.	
M2000-V-1	1 gallon
M2000-V-1C	Case of 4 - 1 gallon bottles
M2000-V-5	5 gallon
M2000-V-55	55 gallon

Benefits

- Heavy duty boundary and extreme pressure lubricants for tough machining applications.
- Advanced non-hazardous vegetable oil blend lubricant. Refined one extra step to remove impurities and oxidation compounds. Contains no hazardous ingredients per OSHA Rule 29 CFR 1910.1200.
- Effective in small amounts – as little as a few ounces per eight hour shift to cool and lubricate.
- Anti-Friction Formula – provides heavy duty boundary and extreme pressure lubricants between cutter and work piece.
- Improved finishes and cutter life
- Clings to the tool
- Transfers Heat
- Excellent wetting and penetrating qualities
Nothing to dispose of – used up during the machining process
- Compatible with most limited flow, micro and drip applicators
- Use freely with ferrous and non-ferrous metals

Mistic Mist S Lube
Synthetic Lubricant



Part No.	
M2000-S-1	1 gallon
M2000-S-5	5 gallon
M2000-S-35	35 gallon
M2000-S-55	55 gallon

Benefits

- 100% Synthetic non-hazardous formulation – no oils or hazardous ingredients per OSHA Rule 29 CFR 1910.1200
- Effective in small amounts – as little as a few ounces per eight hour shift to cool and lubricate.
- Stable anti-gumming formula
- Anti-Friction Formula – provides heavy duty boundary and extreme pressure lubricants between cutter and work piece.
- Improved finishes and cutter life
- Clings to the tool
- Transfers Heat
- Excellent wetting and penetrating qualities
Nothing to dispose of – used up during the machining process
- Compatible with most limited flow, micro and drip applicators
- Use freely with ferrous and non-ferrous metals