



AIRFOG Atomizing  
Humidifiers

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# Installation, Operation, Maintenance, Spare Parts and Exploded Views Guide

**IMPORTANT:** Read and save this guide for future reference. This guide to be left with equipment owner.

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# INTRODUCTION

**NOTE:** Prior to installing any AIRFOG product carefully READ through this entire guide, it contains valuable information which will assist in all aspects of the installation.

## AIRFOG DEFINITION

NORTEC AIRFOG systems use the nozzle humidification technology of injecting droplets of cold water directly into the air. This method of humidification has the following advantages over steam humidification:

- Lower frequency of maintenance.
- Systems are mainly mechanical (water pipes and air pressure) with only a 24 Vac power requirement in the control panel.
- A “no cost” air cooling benefit due to latent heat of vaporization extracting heat from the air.
- Maintenance is primarily focused on keeping the air compressor operational.
- Change of components is fast and requires minimal system disassembly.

## NORTEC AIRFOG FAMILY OF PRODUCTS

Axair Nortec manufactures AIRFOG products in two groups. The first group is modular systems that require engineering design and component assembly while the second group is self contained. Both groups require connection to electrical power, water and compressed air.

The modular systems group consists of two families of humidifiers:

- AFE (AIRFOG Economical) Systems use subsonic air flows and commonly used in space.

Prepackaged self contained group consists of two families of humidifiers:

- AFE Mini Systems are wall mounted with 1 or 2 nozzles.
- AFE OCTO Systems are ceiling mounted with fog injection from two sides (dual configuration) from a rectangular case using 4, 6 or 8 AFE nozzles or as wall mounted with injection from one side (single configuration) using 3 or 4 AFE nozzles. AFE OCTO systems are available with or without a AFE Control Panel built into the case. AFE OCTO systems are available for use with normal tap water, reverse osmosis or de-ionized (DI) water.

## PRINCIPLE OF OPERATION AFE SYSTEM

The AFE nozzle uses air flow (based on Bernoulli principle) to siphon water out of zero psig water distribution pipes. Increases in air velocity (by increasing air pressure) will increase the vacuum pressure and hence more water is siphoned into the nozzle. As the water exits the nozzle it is broken down into a fine mist by a shearing action. Increases in air supply pressure also means that the exiting mixed flow is at a higher velocity.

Since AFE nozzle systems use a zero psig water pressure feed network, the water feed system and nozzles must be horizontal and at the same height as the water pressure reduction regulator (Vacuum Valve). Valleys or dips in altitude will adversely affect performance and in extreme cases will prevent the nozzles from producing any output. If obstructions prevent straight level piping, the water and air network delivery pipes must be routed under the obstruction. It is vital that the water pipes, downstream of the Vacuum Valve, never be elevated higher than the nozzles. The Vacuum Valve must also be at the same height as the nozzles.

## GENERAL AIRFOG TECHNICAL CONSIDERATIONS

### ADIABATIC COOLING PHENOMENA

There are no heating elements in any of NORTEC's AIRFOG humidifiers. Water is injected directly into the air at the temperature it is supplied. As the droplets evaporate they extract the required latent heat of vaporization from the surrounding air which causes the temperature of the air to decrease. This could be a significant energy saving technique if mechanical cooling is required. Since humidification is most often required when the exterior atmospheric temperature is below room temperature, there is a necessity to warm the air either prior to addition of the water droplets or after absorption of the droplets into the air. It is recommended to add the moisture after the air is heated as this dramatically reduces the time and distance taken for the water droplets to evaporate.

### ZONES FOR SPACE APPLICATIONS

Humidity variation can be controlled in a tight fashion by sealing the zone with air tight structures or the humidity can be controlled on a more global sense in a large factory volume. There are some situations where it makes more sense to control the humidity in a multiple floored structure using a separate system. Relative humidity will rapidly equalize with adjoining

spaces that are open to each other through doorways, elevator shafts and stairways.

## **ABSORPTION DISTANCE**

Injection of liquid water droplets from a nozzle into still air will require a certain amount of time prior to vaporization being complete. The time for this vaporization can be converted to a distance depending on the velocity of injection into still air. The absorption distance will increase with the speed of the absorbing air. If absorption is not completed and the droplets hit solid objects like machines, lights, piping and duct work, they will moisten that surface. To avoid water damage, it is important to prevent condensation on any object.

## **COMPRESSED AIR**

NORTEC AIRFOG systems use compressed air as the control fluid. Compressed air is provided by a compressor (supplied by others) or series of compressors. The modular approach to the NORTEC AIRFOG systems permits the designer to consider the cost implications of using multiple smaller horsepower compressors rather than one very large compressor and moving the compressed air over great distances. By using a multiple compressor design solution, system reliability is increased, maintenance is possible without shutting down all zones and capital cost is often reduced.

It is recommended that air free of oil and moisture (control quality air) be used with AIRFOG systems. All air compressors will produce moisture which must be removed using a refrigerated air dryer. Excessive amounts of water in the air lines will reduce nozzle performance, and in extreme cases will prevent the nozzle from producing any mist. Oil must also be removed from the compressed air through the use of oil removal filters.

Air pressure loss can be managed by reduction in the air pipe length, elimination of unnecessary elbows, valves and flow restrictions, increasing the diameter of the primary delivery pipe to the zones and elimination of leaks.

## **OLDER NORTEC AIRFOG SYSTEM COMPONENTS**

This document is applicable to all NORTEC AIRFOG system components purchased after February 2004. If the designer has access to system components purchased prior to February 2004, the Axair Nortec Technical Service Department should be consulted to determine compatibility with the newer equipment, parts and external interfaces.

## **INSTALLATION TOOLS AND EQUIPMENT**

The Designer should have already provided drawings of the proposed AIRFOG humidification system physical layout. These drawings and parts list should clearly identify the system components by name and part number, physical spacing, zone identification and comments on nozzle location and pointing directions.

During installation there will be a requirement to:

- Attach mounting brackets to walls, ceilings or other structures which may be higher than six feet off the floor.
- Cut and join copper, stainless steel or plastic pipe using standard plumbing joining techniques.
- Connect low voltage wiring to the control panel.
- Connect plastic tubing.
- The installer should have all the tools to perform these plumbing, mounting and electrical tasks.

## **PARTS**

A parts list should be included with the drawings developed by the Designer. Not all the necessary parts are provided by Axair Nortec. The following piece parts are supplied by others:

Pipe, elbows, pipe hanger and mounting hardware for inside HVAC units, T-joints, pipe size adapters, Teflon sealing tape and other plumbing supplies from a local plumbing supplier. Pipe material is either copper, stainless steel or plastic and should be specified on the Designer produced drawings.

Wire for the electrical connections is 18 gauge standard insulation which can carry 24 Volts AC at 1 amp. This wire can be purchased from most electrical suppliers.

Nails, screws, bolts, threaded rods, anchors, rivets etc. to attach mounting brackets to the structure. These fasteners will depend on the material used in the mounting surface.

Insulation for the cold water pipe feeding the system is required to prevent water vapor from condensing and dripping on other structures, machines, personnel or materials.

The NORTEC delivered parts should be checked against the Designer's drawings and parts list to ensure the correct quantity of the correct part numbers are available.

## **INSTALLATION**

### **NOZZLE SYSTEM LAYOUT**

If a drawing for the proposed system was not supplied, then it is recommended that one be created prior to installing the system. With reference to the AIRFOG Engineering Manual, Form #XX-216, review the site where the nozzle system is to be installed. The location of equipment, lights, pillars and other structures should be drawn on the floor plans. The proper selection and location of the nozzles is very dependent upon these obstructions. Figure #1 ("Typical Nozzle Layout") can be used as a guide for identifying the various components used with a system.

The supply and feed lines for the system should be kept in straight unobstructed lines where possible. Air and water distribution network pipes are to be installed level along walls, pillars or hung from the ceiling. Avoid placing the lines over top of equipment and other areas which will make it difficult to gain access at a later date. If the lines have to be routed around an obstacle such as a beam, always go under the obstacle, never over it.



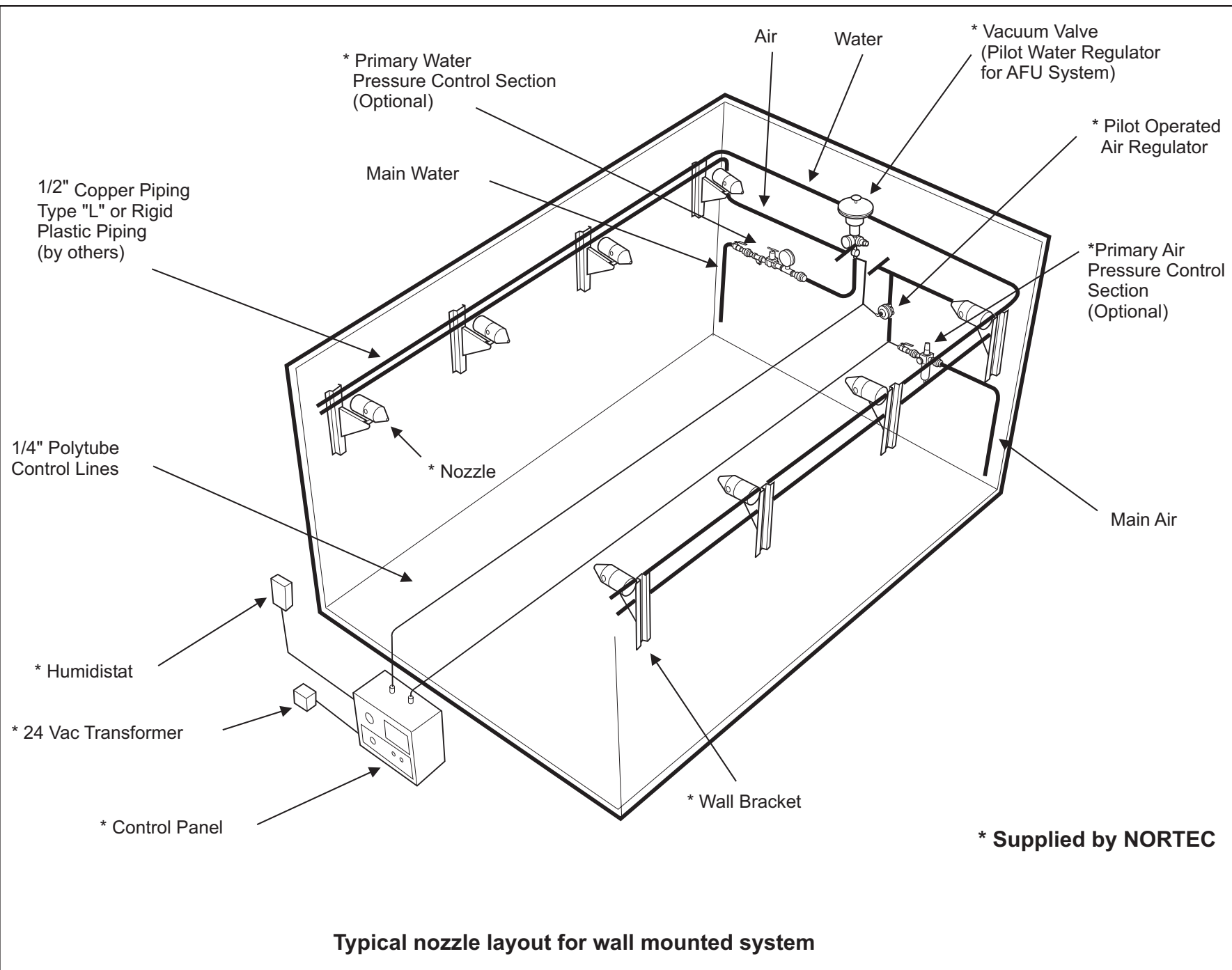
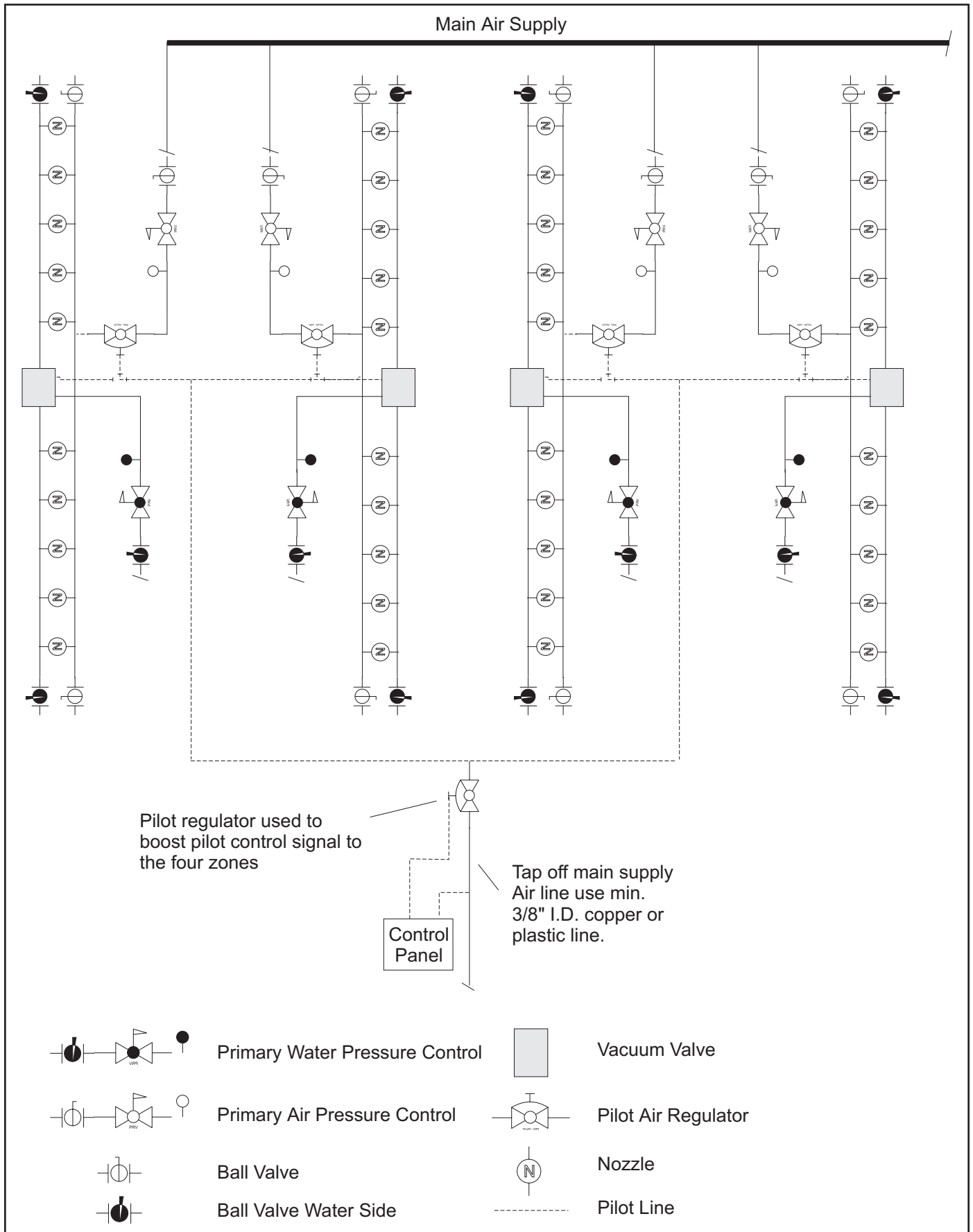


Figure #1  
Typical Nozzle Layout

**Figure #2**  
**Multi Zone Layout**



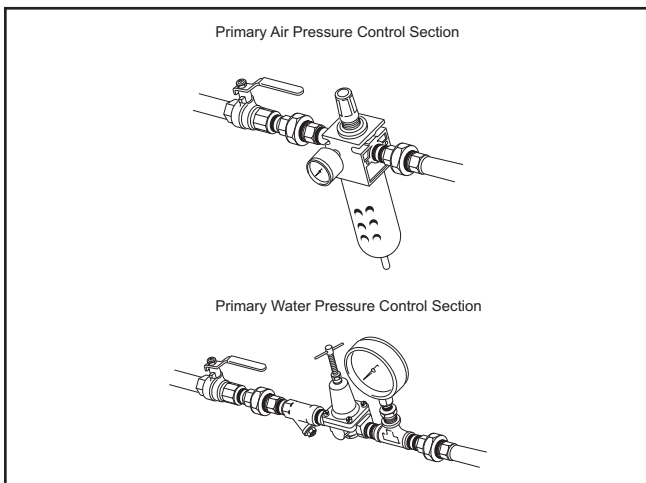
## ZONES

It may be necessary to break down the space to be humidified into zones. Limitation of the control devices and maximum run of feed piping may indicate the need for multiple zones. Refer to the Engineering manual for detailed limitation of components. Up to four zones can be controlled from one control panel, additional zone can be added with the use of a pilot air regulator acting as a volume booster for the pilot signal. See Figure #2 ("Multiple Zone Layout").

## SUPPLY AND FEED LINES

Main supply lines connecting to the system must be sized to handle system flow volumes and pressures. Connections to each zone should have an isolation valve installed by using a NORTEC supplied primary pressure control section as illustrated in Figure #3 ("Water and Air Line Pressure Control"). Primary air pressure feed to each zone should not exceed 90 psig. Water feed pressure is not to exceed 25 psig for AFE, Mini and Octo hardware. Water feed pressure is not to exceed 65 psig for AFD systems.

**Figure #3**  
**Water and Air Line Pressure Control**



Both water and air lines must be installed as per the mechanical drawings using standard plumbing joining techniques. The spans must not be greater than 5 feet without a supporting bracket. For long runs of piping, expansion joints may be needed and these joints must meet local building codes. All piping used to interface with the nozzles must not exceed 5/8"-11/16" O.D. when NORTEC supplied saddle clamps are used. If other than NORTEC supplied saddle clamps are used, then size the fittings to the pipe.

## CLEANING

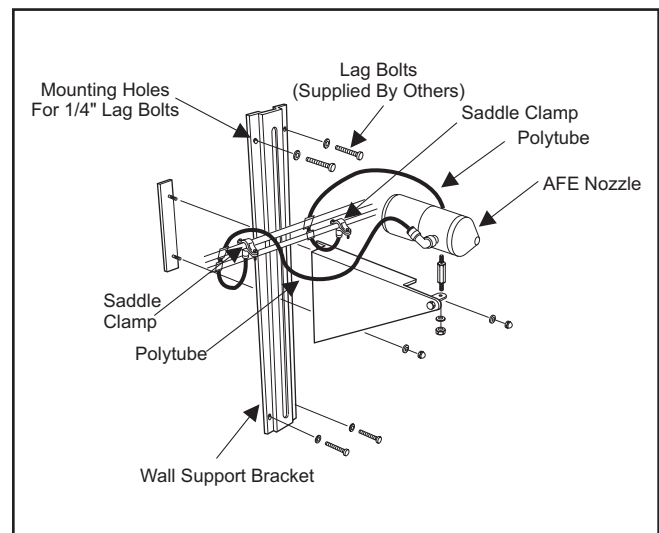
Clean out valves must be installed at the ends of all lines to facilitate cleaning and drainage of lines. Cleaning is done by temporarily connecting the pipes to a compressed air source at one end of the pipe. The other end of the pipe must not be connected to any equipment but be free to allow the egress of foreign matter. Care must be taken to protect personnel, animals, machines or other sensitive material from the potentially hazardous and contaminating matter which will exit at high speed from the opening.

**NOTE:** Cleaning of the lines of all foreign material prior to connecting any system component is very critical, failure to maintain clean lines may void the warranty.

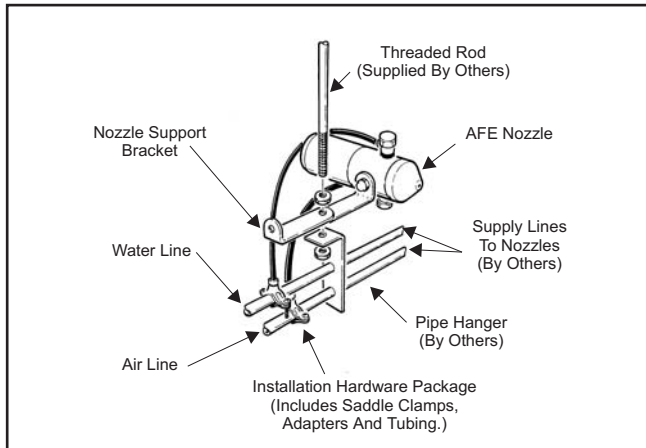
## MOUNTING OF NOZZLES

Each supplied NORTEC nozzle has a 3/8" NC 16 threaded port on the under side of the nozzle which is used to fasten the nozzle to a mounting bracket, as illustrated in Figure #4 ("Nozzle To Bracket Interface") or Figure #5 ("AFE Nozzle Ceiling Mounting"). If other than NORTEC supplied mounting hardware is to be used, ensure correct bolt and thread size is used. Nozzles can be mounted in any elevation angle as water throughput capacity is not affected by this orientation. However, AFE nozzle capacity is sensitive to vertical height differences to the vacuum valve. The maximum nozzle installation height allowable above the water supply line is 12" (30 cm).

**Figure #4**  
**Nozzle To Bracket Interface**



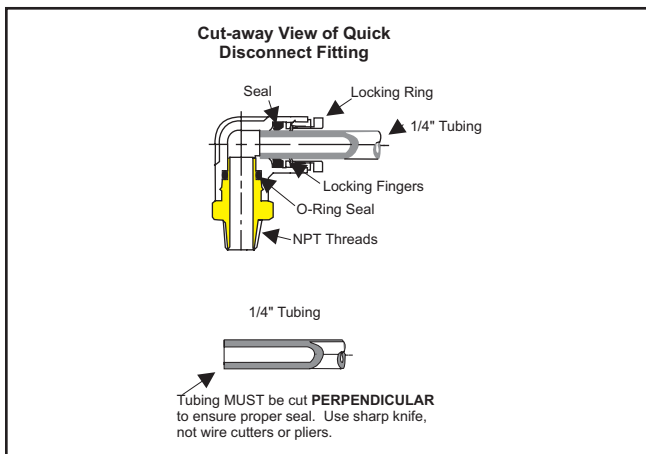
**Figure #5**  
**AFE Nozzle Ceiling Mounting**



### **CONNECTING NOZZLES**

All the supplied nozzles have two inlet ports with push in, quick release style fittings as shown in Figure #6 ("Quick Release Fittings"). These fittings are only designed for use with 1/4" O.D. plastic tubing. If other than NORTEC supplied tubing is to be used, it must be a high grade uniform tubing from a reputable supplier.

**Figure #6**  
**Quick Release Fitting**



The NORTEC supplied fitting uses an o-ring to seal the O.D. of the tubing and finger clamps to hold it in place. Failure to use proper size tubing may result in poor sealing and cause system failure. The tubing **MUST** be cut square using a knife or plastic tube cutter rather than pliers. To connect the tube to the nozzle simply push the tubing into the nozzle fitting until it reaches the bottom. Gentle pulling of the tube without movement is a good indication that a proper seal has been made.

Allow enough free tubing to permit the nozzle to swivel horizontally or vertically for future pointing alignment.

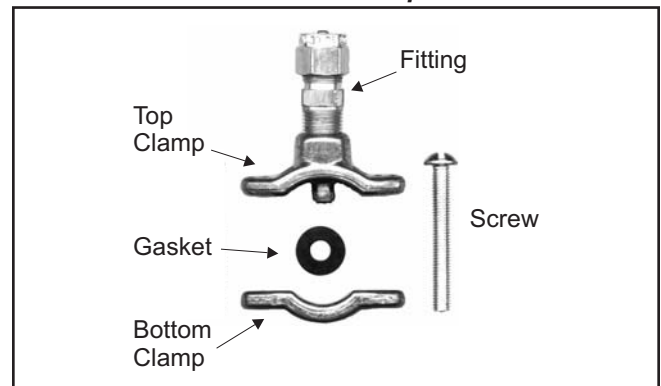
### **SADDLE CLAMP INSTALLATION**

The type of clamp used by NORTEC, as shown in Figure #7 ("Saddle Clamp"), requires that the pipe be drilled first. Drill a 1/4" hole squarely into the air and water pipes close to each nozzle within 24" (60 cm). Place the sealing gasket on the male part of clamp, insert it into the drilled hole, then clamp it into place using the provided screws. The saddle clamp has a 1/8" FNPT port, install either the supplied compression fitting or another style fitting suitable for plastic tubing. Two saddle clamps, one for air and one for water, are required for each nozzle.

**NOTE:** *Not to be used with DI water.*

**NOTE:** *For DI water use stainless steel tee.*

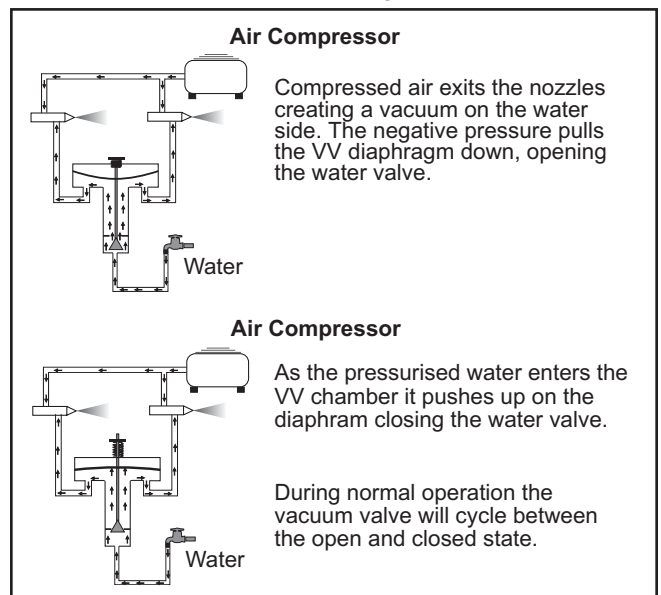
**Figure #7**  
**Saddle Clamp**



### **VACUUM VALVE**

The vacuum valve must be centrally located so there are approximately an equal number of nozzles being fed from each of its two output ports (one on the

**Figure #8**  
**Vacuum Valve Operation**

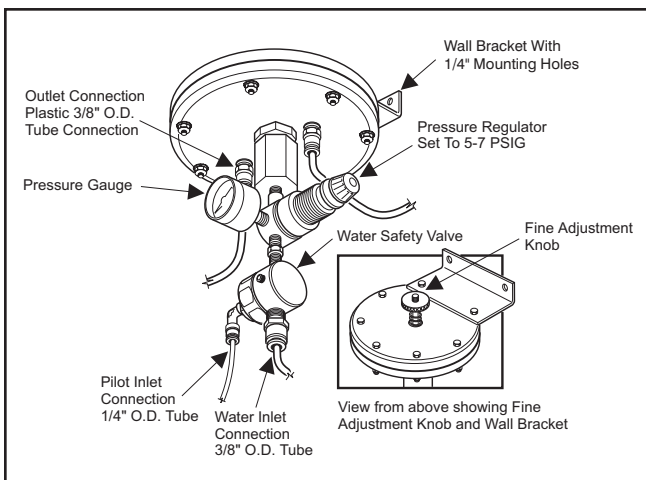


left side and the other on the right side). There is a mounting bracket supplied with each vacuum valve. Figure #9 ("Vacuum Valve Interfaces") illustrates the plumbing interface details. Elevation of the valve is very critical, as is the positioning of the nozzles. Maximum height above the water supply line the valve should be installed is 12" (30 cm). Never install the vacuum valve below the water feed lines.

The water flow rate through this valve is limited to 24 gph which limits the number of AFE nozzles it supplies to 16. If more than 16 nozzles are to be installed, then the system must be broken into zones using multiples of 16 (or less) nozzles with each zone controlled by its own vacuum valve. One control panel can control multiple zones by "T"ing off the single control panel air pilot output.

Air pressure from the control panel is used to open the water safety valve permitting water to enter the vacuum valve which controls the water feed to the nozzles. Figure #8 ("Vacuum Valve Operation") explains the operation of this water regulator. The vacuum valve assembly has three sub-components. As illustrated in Figure #9 ("Vacuum Valve Interfaces") First, the safety valve interfaces directly with the primary water supply with its only duty being opening or closing on command from the control panel. Loss of pilot air pressure below 10 psig will automatically close this valve to prevent water proceeding beyond this point. In series with and downstream of the safety valve is the water regulator used as the first stage of water pressure reduction. The water regulator reduces the supply water pressure to a range between 5 and 10 psig. This is set manually at installation but system performance is not sensitive to the exact setting as long as the pressure is within this range.

**Figure #9**  
**Vacuum Valve Interfaces**



The second stage of water pressure reduction is the vacuum diaphragm which drops the pressure to that of the room. Output is through one exit port on

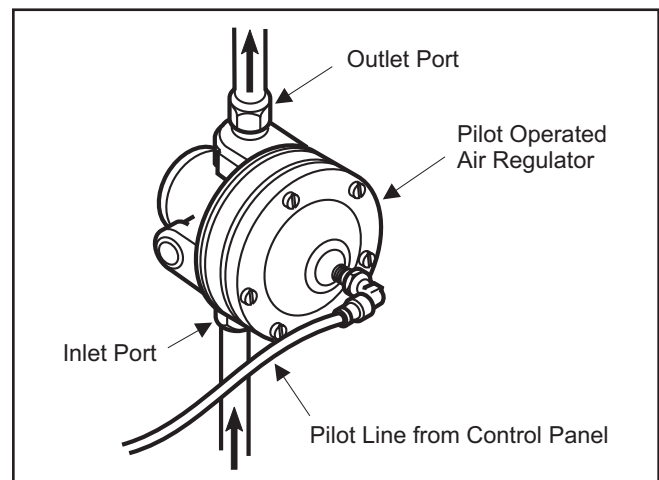
each of its two sides. This permits the nozzle to draw water from the supply as it is required rather than having pressure force it into the nozzle. This siphoning action of the nozzle is controlled by the pilot operated air regulator.

On top of the vacuum valve is a thumb wheel adjustment for adjustment of the AIRFOG droplet size. The adjustment changes the availability of water to the nozzles. Thus a reduction in available water for the same air consumption results in smaller droplets and a finer spray. This adjustment can be used to reduce the water throughput if there is a problem with water droplets reaching the floor.

## **PILOT OPERATED AIR REGULATOR**

The pilot operated air regulator controls the air feed to the nozzles and is illustrated in Figure #11 ("Pilot Air Regulator"). This pilot regulator is an analog flow controller rather than a simple On/Off valve. The greater the pilot air pressure, the greater the air pressure fed to the nozzle supply network. This means that the Control Panel is able to demand a proportional opening of the Air Regulator simply by varying the pilot pressure. There is a linear 1:1 relationship between the pilot pressure and the output pressure drop. A pilot air pressure of 25 psig (172.5 kPa) will drive the air regulator to have an output of 25 psig (172.5 kPa). A pilot pressure of 50 psig will drive the air regulator to have an output of 50 psig. The pilot air pressure range is from 0 to 70 psig.

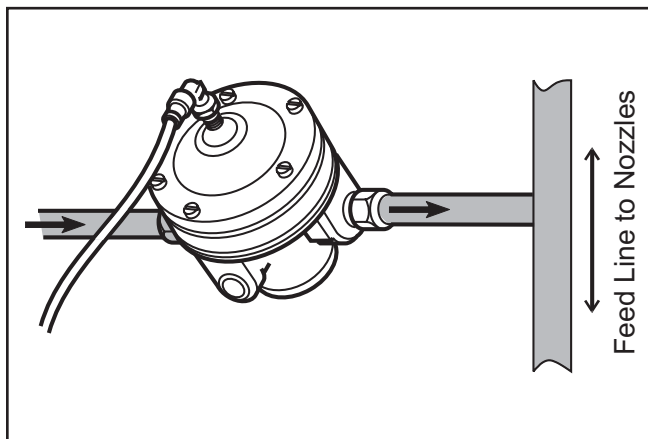
**Figure #10**  
**Pilot Air Regulator**



The four ports on the pilot operated air regulator are the pilot air pressure input from the control panel, the primary air supply input feed, the output air feed to the nozzles and to gauge port used to feed pilot signal

to the water regulator. There are no manual adjustments required.

**Figure #11**  
**Pilot Air Regulator Installation**

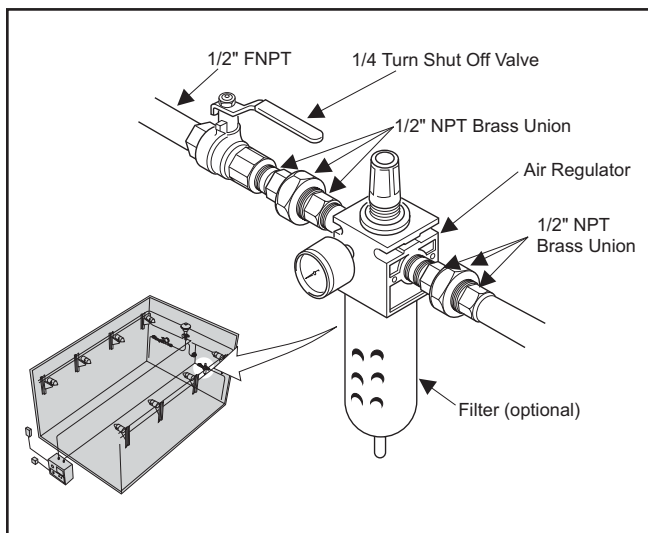


Install the pilot air regulator at the center of the feed line by splicing into the air feed line to the nozzles see Figure #11 ("Pilot Air Regulator Installation") for interface detail. Ensure the proper flow direction when installing this device.

### **PRIMARY AIR PRESSURE CONTROL SECTION**

The primary air pressure control section (with the shutoff valve) is connected to the air compressor or the compressed air source as specified in the Designer produced drawings. See Figure #12 ("Primary Air Pressure Control Section").

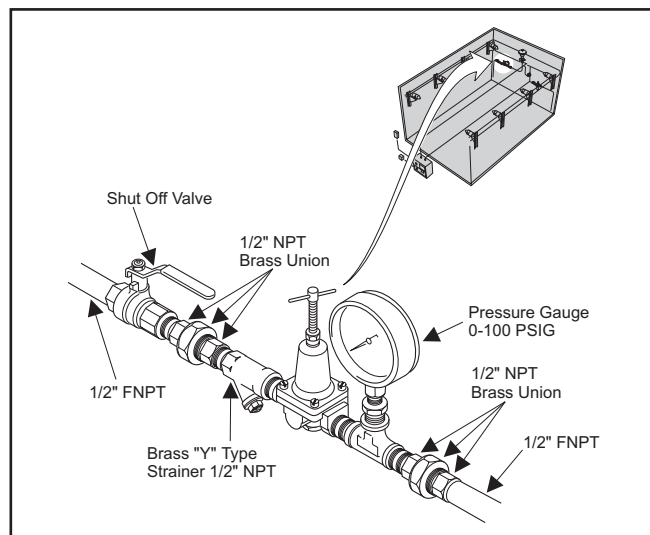
**Figure #12**  
**Primary Air Pressure Control Section**



### **PRIMARY WATER PRESSURE CONTROL SECTION**

The primary water pressure control section connects the main water supply. The shutoff valve end of section is the inlet. The gauge end of the section is joined to the water inlet of the vacuum valve for AFE systems. See Figure #13 ("Primary Water Pressure Control Section").

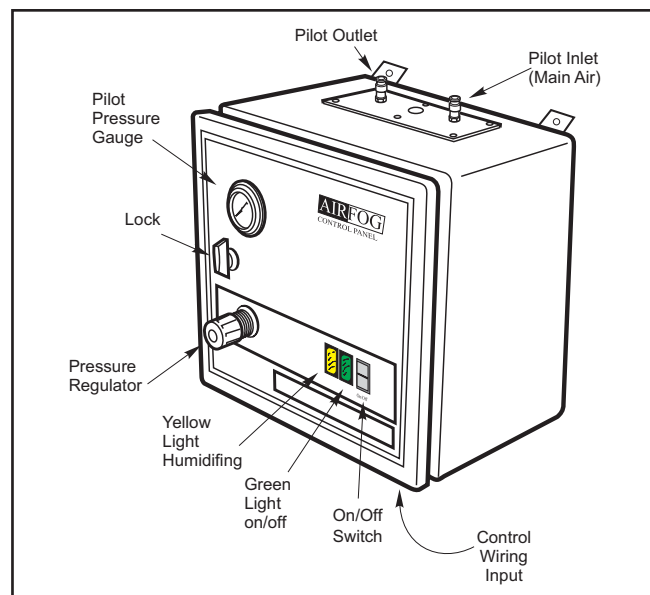
**Figure #13**  
**Primary Water Pressure Control Section**



### **CONTROL PANEL**

Bolt the panel directly to the surface through the mounting holes. Place the panel level against the

**Figure #14**  
**AFE Control Panel Interfaces**







# AFE SELF CONTAINED AIRFOG SYSTEMS

## AFE MINI SYSTEMS

AFE MINI systems are fully self contained requiring connections to the following interfaces:

- 3/8" O.D. plastic or soft copper water supply line rated at a minimum of 25 psig.
- 1/4" O.D. plastic or soft copper air supply line rated at a minimum of 90 psig
- Isolation valves for both air and water lines
- Mounting hardware
- Support anchors
- 1/4" lag bolts
- 120 Vac standard electrical receptacle
- Humidity control device (Humidistat)

The best location for a Mini is on a wall or column with the mist discharging down an aisle where it will not condense on solid surfaces. A clear run of at least 15 feet forward of the nozzles is normally a sufficient distance for complete absorption. Adiabatic cooling is often uncomfortable to people occupying workstations directly beneath the Mini systems.

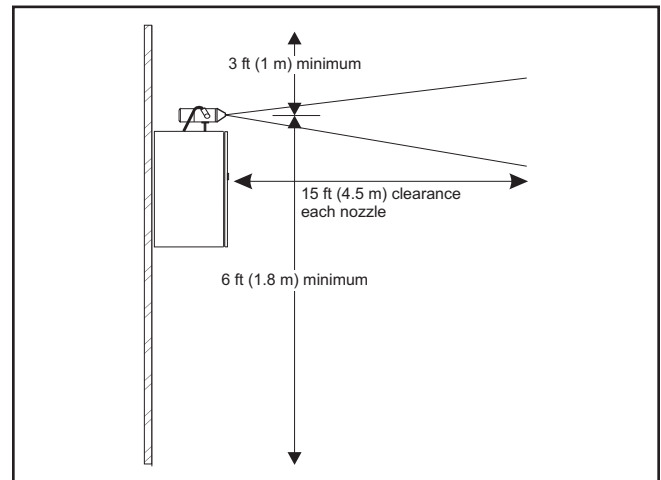
The Mini nozzles must be a minimum of 6 feet above the floor and 36" below the ceiling in order to prevent condensation on these surfaces. See Figure #17 ("Mini Installation").

Four accessible internal mounting holes are located in each corner of the rear panel. The mounting procedure is:

- Either attach the supplied mounting bracket hardware or bolt panel directly onto the wall surface via the mounting holes.
- Place the panel level against the surface and mark the drill holes.
- Remove the panel and drill the holes (hole size to match field supplied lag bolts and anchors).
- Replace the panel and secure using bolts.

**Figure #17**

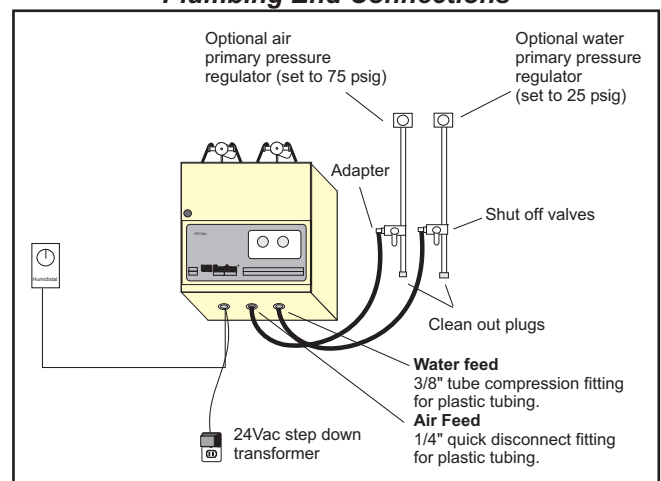
### Mini Installation



Install water and air supply lines. Both water and air lines should have an isolation valve installed near the unit. Water connection at the unit is designed for 3/8" plastic tubing but if soft copper pipe is to be used, replace the plastic sleeve in the fitting with the supplied brass sleeve. The air connection is designed for 1/4" plastic tubing. Figure #18 ("Plumbing End Connections") illustrates details of the interfaces.

**Figure #18**

### Plumbing End Connections



## AFE OCTO SYSTEMS

Octo systems are partially self contained and are between the simple Mini self-contained installation and the modular AFE systems. The Designer's drawings



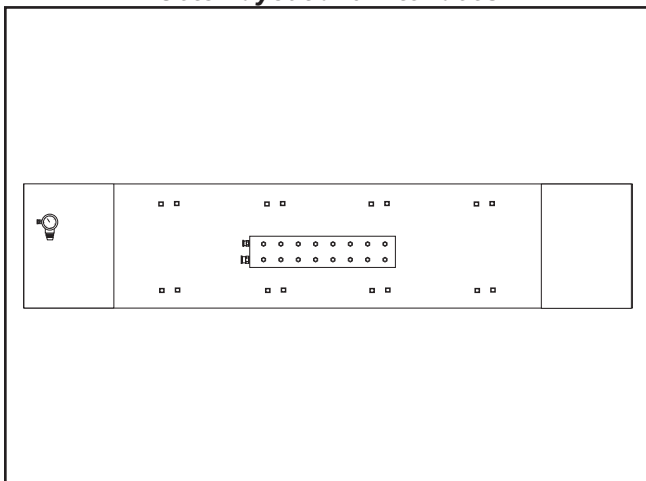
and parts list will define the configuration. The only installation difference between the full modular system and the Octo is that the vacuum valve and pilot air regulator are located inside the Octo case as illustrated in Figure #19 (“Octo Layout and Interfaces”).

The Octo interfaces are:

- 3/8" O.D. plastic or soft copper water supply line rated at a minimum pressure of 25 psig
- 1/2" O.D. plastic or soft copper air supply line rated at a minimum pressure of 90 psig
- 1/4" O.D. plastic tubing for command air pressure (pilot air)
- Isolation valves for both air and water lines

**Figure #19**

#### **Octo Layout and Interfaces**



- Hanging hardware
  - Chains
  - Threaded rod
  - Support anchors
- AFE Control panel
- 120 Vac standard electrical receptacle
- Humidity control device (Humidistat)

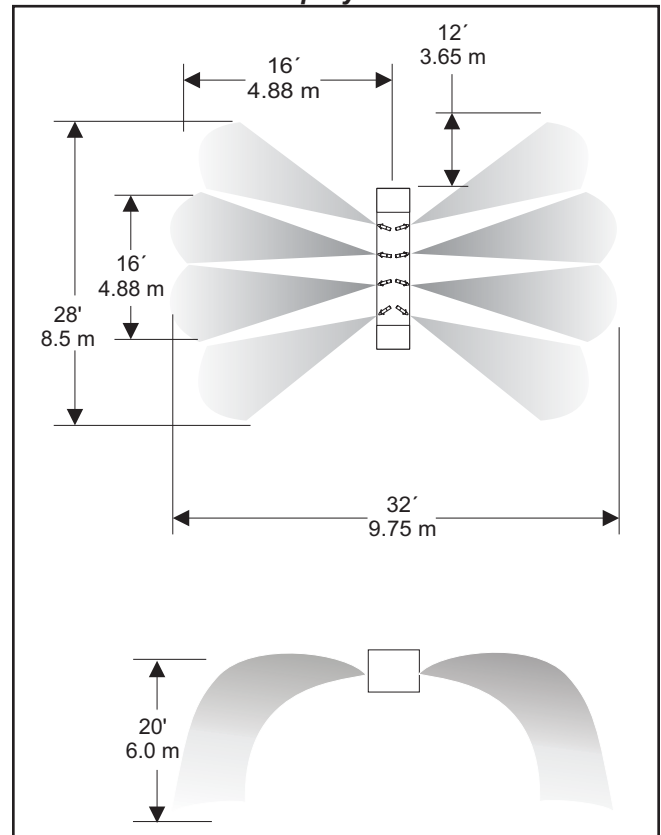
### **INSTALLATION PROCEDURE**

The Octo unit is designed to be hung from the ceiling with either threaded rod or supporting chains. Depending on the purchased configuration, it may also be mounted on a wall or pillar (single sided configurations). Prior to mounting, check the proposed location and ensure there are no obstacles such as

duct work, lighting, large equipment or other obstacles within the perimeter spray area of the unit. Figure #20 (“Octo Spray Pattern”) illustrates this restraint. The Octo unit should be installed as high as possible above the floor, any equipment or work space. Adiabatic cooling is often uncomfortable to people occupying workstations directly beneath the Octo systems. The recommended height above the floor is 20 ft (6.1 m) and 18" below ceiling joists.

**Figure #20**

#### **Octo Spray Pattern**

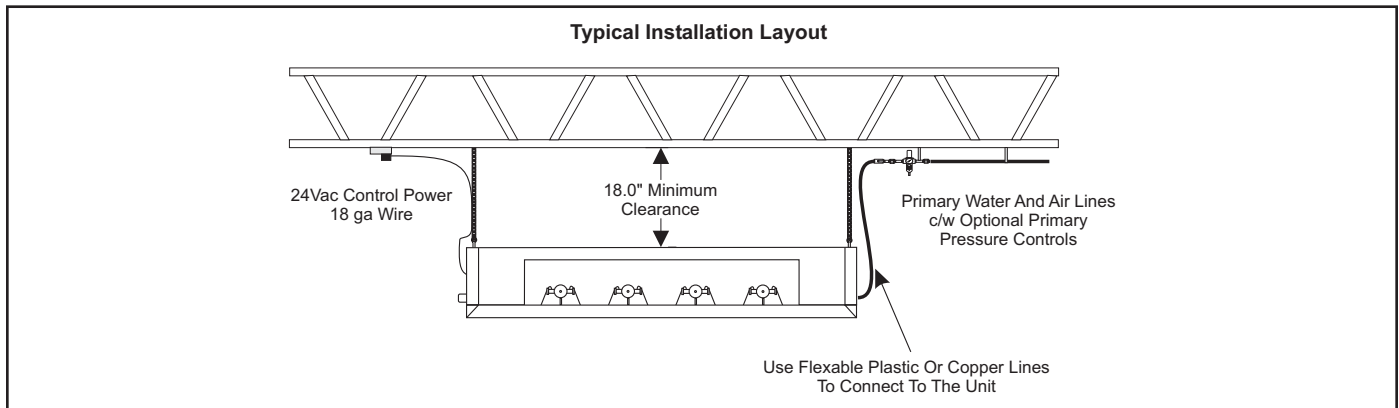


This manual cannot specify what type or how to install support chains as all methods of supporting equipment from a ceiling must comply with local building codes.

However, as a guide:

- Each Octo weighs up to 64 lbs (29 kg).
- Install the four 3/8" NC eye bolts into the four mounting holes on the unit using the supplied lock washers & nuts.
- Install field supplied supporting chains or rods from the ceiling then raise the unit up into location and secure in place.

**Figure #21**  
**Ceiling Mounting Of Octo**



**NOTE:** Always hang units, never use a cradle assembly which can interfere with spray pattern or restrict access for service.

Mounting using threaded rods requires installing field supplied 3/8" NC supporting rods from the ceiling, raising the unit up into location and securing it to the support rods using the supplied washers and nuts as shown in Figure #21 ("Ceiling Mounting Of Octo").

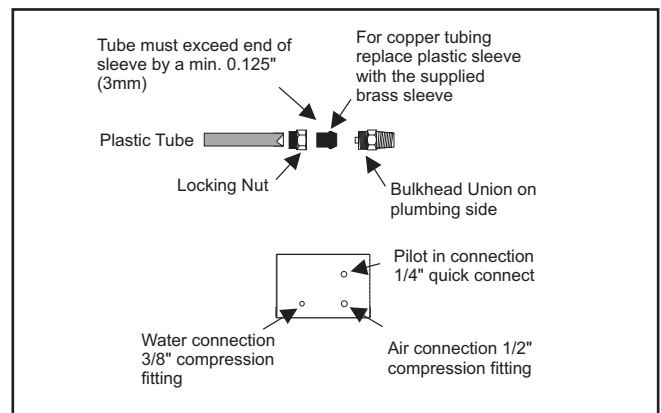
If water and air supply lines are not already installed at this location then complete this installation. Both water and air lines should have an isolation valve installed near the unit as illustrated in Figure #22 ("Octo Air And Water Interfaces"). Water connection at the unit is designed for 3/8" plastic tubing; however, if soft copper pipe is to be used, replace the plastic sleeve in the fitting with the supplied brass sleeve. Air connection is designed for 1/2" plastic tubing. If soft copper pipe is to be used, replace the plastic sleeve in the fitting with the supplied brass sleeve.

For a standard Octo unit, a separate control panel and 1/4" O.D. plastic tubing for pilot line is required. To install this line the fitting on the unit is a push in style located above the main air connection. Simply cut the tubing square and push one end into the fitting. Route the line back to control panel location.

If multiple Octo units are to be controlled from a single control panel then "T" off the pilot air pressure line to connect the other OCTO units as illustrated in Figure #23 ("Four Octo Units With A Single Control Panel"). If more than four Octo's are to be controlled from one control panel, use a pilot air regulator or a volume booster for the pilot line.

Octo Plus units do not require a separate control panel as there is one mounted within the unit. All that is necessary is to connect it electrically as explained on page 10 of this manual under Electrical Wiring.

**Figure #22**  
**Octo Air And Water Interfaces**

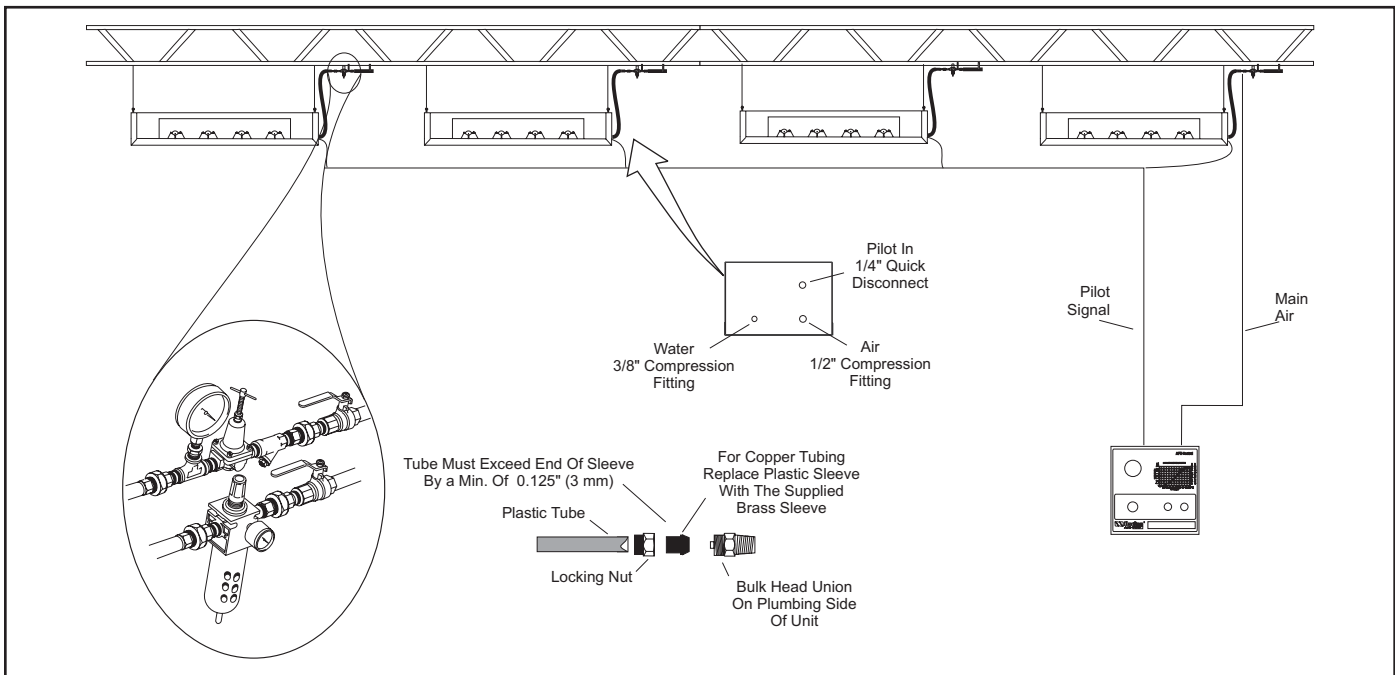


Control Panel installation for standard Octo hardware is explained on page 9 of this manual under Control Panel.

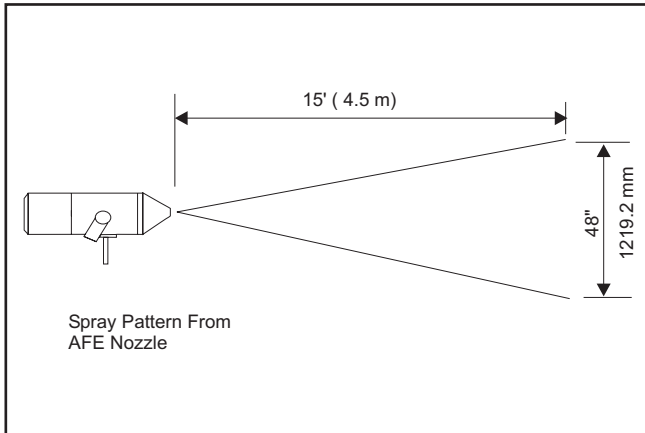
The nozzles on the Octo units are pointed straight forward when shipped but these can be oriented in any direction that will not have the plume strike a solid object or another plume for at least 16 feet. Figure #24 ("AFE Octo Nozzle Plumes") helps in visualization of these AIRFOG plumes.

Figure #29. The center vertical rail is to be mounted in the center of the duct and attached to the manifold rails using the supplied hardware. It is important that the center vertical rail is sized correctly and securely fastened to the top and bottom of the duct.

**Figure #24**  
**Four Octo Units With A Single Control Panel**



**Figure #25**  
**AFE Octo Nozzle Plumes**



## STARTUP PROCEDURES

The operator must make reference to Figure #1 (“Typical Nozzle Layout”) when following these instructions. The configuration prior to startup operations must be as follows:

- All components have been visually checked for proper connections. Corrective actions to repair or adjust components must be completed.
- All supply and feed lines have been cleaned.

- The on/off valve of the primary water pressure control section is OFF.
- Water at 25 psig pressure from the main supply is ON.
- The on/off valve of the primary air pressure control section is OFF.
- The air compressor is running and providing a minimum of 90 psig.
- The control panel switch is OFF.
- The 24 Vac transformer is plugged into a 110 Vac source and the control panel power indicator light is illuminating.
- The humidistat is set at 100% relative humidity.

## COMPRESSED AIR SUPPLY

- The clean out valves on the ends of the supply pipes must be closed.
- The on/off valve of the primary air pressure control section is opened to the ON position. The handle should be in line with the pipe (as opposed to 90 degrees to it).
- The control panel switch is turned to the ON position.

- Adjust the air pressure regulator in the control panel to about 70 psig to get near maximum water throughput in each nozzle for this startup test.
- There should be an audible hissing sound as the compressed air works its way through the piping to the nozzles. If this is not detected and air can't be felt by hand directly in front of the nozzle orifice, then air is not being provided to the system. Check the compressed air line back to the compressor for other valves that may not be open.
- The air pressure regulator knob in the primary air pressure control section is to be adjusted until its gauge indicates 90 psig.
- Most significant air pressure leaks can be detected by sensing the air flow with the hand or by spraying on soapy water to observe the growth of bubbles around the leak. If an AFE nozzle is sucking some air rather than 100% water through the water pipes, the nozzles will sputter/spit and behave irregularly as opposed to a steady production of uniform mist. A thorough survey should be conducted to identify and fix leaking joints.

### **WATER SUPPLY**

- The clean out valves on the ends of the water supply pipes must be closed.
- The on/off valve of the primary water pressure control section is turned ON. The handle should be in line with the pipe (as opposed to 90 degrees to it).
- Adjust the water regulator valve in the primary water pressure control section until the gauge reads 25 psig (65 psig for AFD systems).
- The pressure regulator on the vacuum valve should be adjusted to read between 5 and 7 psig.
- Manually depressing the thumb screw on top of the vacuum valve will permit water to flow into the pipes and fill them.
- AIRFOG water throughput can be controlled at the control panel by adjusting the air pressure. This air pressure must never be greater than 75 psig. If water spray should reach the floor, then the water throughput can be reduced by adjustment AFE, Mini and Octo systems.

- Reducing the air pressure feed to the nozzles. Refer to Chart #1 ("Capacity Output vs. Vacuum Valve Adjustment"), Chart #2 ("AFE Capacity Chart").
- Adjustment of the thumb screw on the vacuum valves done by turning the adjustment wheel on top of the vacuum valve clockwise, the water flow rate can be decreased until there is a fine spray pattern from the nozzles. Some experiments adjusting this valve will produce an optimum "look and feel" of the spray pattern. The finer the water droplets the less the throughput of the system. Often there is some excess capacity built into the AIRFOG system by the designer. This means that some amount of water flow adjustment will not have critical impact on the performance of the system. If there is any doubt, discuss this with the designer. Often an adjustment to the water spray using this means is sufficient to prevent water collection on the factory floor due to over sizing during initial design. See Chart #1 ("Capacity Output vs. Vacuum Valve Adjustment").

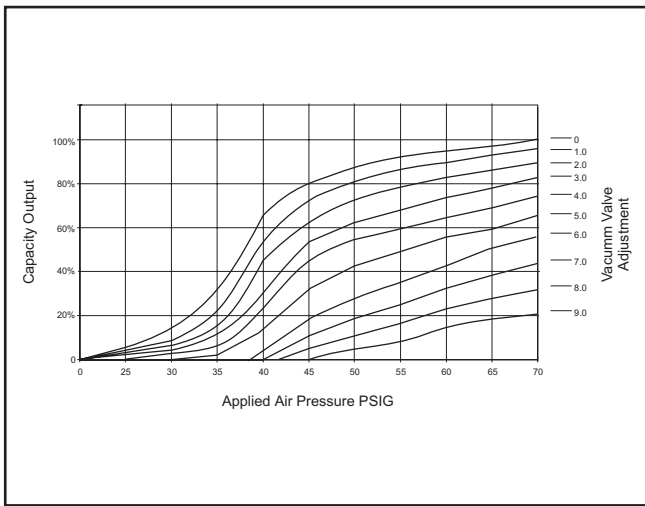
### **CONTROL PANEL AND HUMIDISTAT ADJUSTMENT (AFE, MINI, AND OCTO ONLY)**

Each time the system air pressure is reduced below 10 psig the nozzle cleaning mechanism is automatically activated. The water orifice cleaning pin is extended to clean away accumulations of dirt or minerals. A control panel timer is provided for extended periods of use to automatically execute this cleaning action. The factory setting of 60 minutes can be adjusted to accommodate conditions where the processed water or air is dirty. Failure to keep the nozzles clean will result in reduced performance and in extreme conditions, failure to produce a humidifying fog.

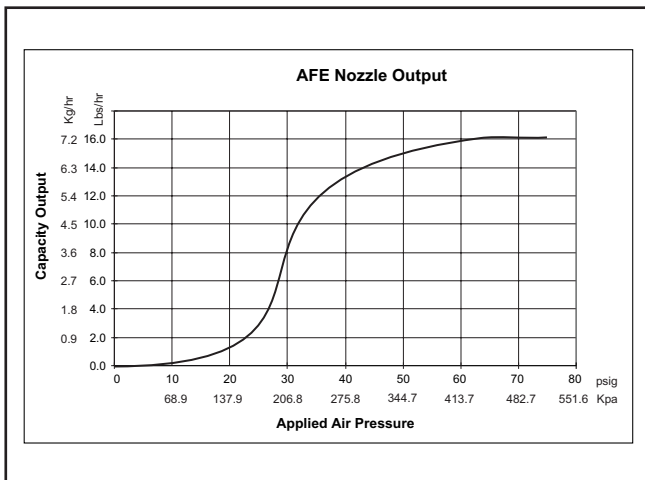
The following steps are required:

- The humidistat is normally a simple relay that opens and closes depending on the sensed relative humidity compared to its set point. Operations are normally not very complex as they consist of some method of adjusting and locking the set point only. Instructions are supplied with the humidistat.
- Turn the humidistat set point down from 100% until the AIRFOG system shuts itself Off. Audio cues will be a reduction in air flow noise and the deactivation of a solenoid valve in the control panel. Visual cues will be the termination of the fine sprays from the nozzles.

**Chart #1**  
**Capacity Output vs. Vacuum Valve Adjustment**



**Chart #2**  
**AFE Capacity Chart**



- The cleaning timer range bands can be adjusted by setting the 6 DIP timer switches in accordance with Table #1 ("Cleaning Timer Switch Settings").

As an example, suppose the switch settings were:

This means that the timer and the AIRFOG system would be OFF (i.e. in the scale 1 to 10 minutes) for a period of time defined in this range and set by the OFF adjustment dial on the top of the timer. Say this was set to 1 then, during each cleaning cycle the whole system would be deactivated for 1 minute.

The timer and the AIRFOG system would be ON (i.e. in the scale 1 to 10 hours) for a period of time defined in this range and set by the ON adjustment dial on top of the timer. If this ON adjustment dial was set to 2, then the system would operate for 2 hours between cleaning cycles.

These example settings would activate the cleaning cycle every 2 hours and the length of time the AIRFOG system was automatically turned off would be 1 minute in duration. Using settings that produce an OFF cycle less than 10 seconds are not recommended. Using settings that produce an ON cycle of less than 15 minutes are not recommended.

If short ON cycles (less than 15 minutes) are necessary to maintain system performance, then addition of mechanical air and water filters would be a far superior method to control nozzle cleanliness and system performance.

### **FINAL STEPS**

Once the humidistat is set and locked, the control panel door can be secured and the locking nuts on the primary air and water regulators can be tightened.

## **AIRFOG SYSTEM SHUT DOWN PROCEDURES**

Controlled system shutdowns are conducted for either maintenance (scheduled or repair) or long term seasonal reasons. If the shutdown is for short term maintenance then it may be possible to shorten this full procedure.

The following procedures are the recommended method to manually terminate AIRFOG operations for long periods of time. Typically this would be after the heating season (winter) is over.

Turn off the water supply valve on the primary water pressure control section

Allow 10 minutes of operations to extract as much of the water as possible from the water pipes.

Open the clean out valves on the water supply lines to permit the AFE system to suck the remaining water from the pipe and drain the system of water. A bucket should be used to collect any water that may exit the pipe at the clean out valve.

Disconnect the 24 Vav transformer from the 110 Vav supply.

Turn off the air supply valve on the primary air pressure control system.

Turn the system off at the control panel.

Turn the air compressor off.

For long periods (weeks or longer) of system down time, it is recommended that high pressure air is used to blow all water out of the system.

**Table #1**  
**Cleaning Timer Switch Settings**

Time OFF			Time ON			Time Range
1	2	3	4	5	6	
hours	minutes	X 0.1	hours	minutes	X 0.1	
Down	Down	Down	Down	Down	Down	0.1 to 1 second
Down	Down	Up	Down	Down	Up	1 to 10 seconds
Down	Up	Down	Down	Up	Down	0.1 to 1 minute
Down	Up	Up	Down	Up	Up	1 to 10 minutes
Up	Down	Down	Up	Down	Down	0.1 to 1 hour
Up	Down	Up	Up	Down	Up	1 to 10 hours

## SHORTENED SHUTDOWN PROCEDURE

Time OFF			Time ON		
1	2	3	4	5	6
hours	minutes	X 0.1	hours	minutes	X 0.1
Down	Up	Up	Up	Down	Up

It is important to NOT undertake disconnection and removal of components when they are connected to or are part of the delivery system of either air or water under pressure. Turning the master switch off in the control panel will isolate all high pressure water system components downstream of the vacuum valve (AFE systems). This control panel switch will also isolate all high pressure air system components downstream of the pilot air regulator. This is often all that is required.

If there is any doubt about whether a component, pipe or tube is under pressure, then turn off the main

switch in the control panel, turn off the water pressure at the main water pressure control section and turn off the air pressure at the primary air pressure control section. Bleed off the remaining pressures prior to disconnection of any plumbing interface fittings.

## MAINTENANCE

Maintenance is possible at three different levels. Level I consists of those activities which are normally minor in nature requiring nozzle pointing adjustments, pipe joint leak repairs and cleaning operations while the hardware is in its operational configuration. Level II maintenance includes the activities associated with component replacement with spare parts and subsequent verification that the system is once again operating in full compliance with the design requirements. Level III is the activity normally conducted in the repair workshop which consists of disassembly of system parts so that repair kits can be used to return parts to the operational spare category.

The two most probable maintenance problems are:

- The accumulation of dirt and mineral deposits in/on the nozzle
- Air and water leaks that may be due to marginal workmanship during installation but not obvious until after many hours of operations.

Nozzle cleaning is recommended at least once a year. Remove the nose cone from the nozzle body by turning it by hand and mechanically remove deposits by gentle scraping or scrubbing with a brush or steel wool. Care must be taken not to damage the nozzle or its surfaces. Wipe clean using a clean dry rag.

Leaks in the air and water delivery system could develop over time as the mechanical seals age. Full nozzle replacement, taken from the spare parts purchased as part of initial acquisition, is the recommended maintenance procedure if a nozzle should cease to perform. The nozzle can be repaired back at the workshop using a Level III maintenance nozzle repair kit. Leaks in the piping can be repaired using standard plumbing methods.

Leak repair kits for the AFE nozzle, Vacuum Valve, Air Regulator and the Water Regulator (AFD systems only) are available.



## SPARE PARTS

Part of the Designer's job is to prepare the system parts list which includes spare parts and leak repair kits. These parts and kits are to be retained in some safe location in a workshop for immediate access.

It is recommended that spare parts and repair kits be replaced as soon as they are consumed.

Some NORTEC AIRFOG humidification system owners choose to not maintain in-house spares or repair kits as there is sufficient redundancy built into the original design to remain fully operational even if a few nozzles have to be shut down (disconnecting the air pressure tube or removal and capping off the water and air delivery nozzle tubes). The lead time to obtain replacement parts or repair kits is considered an acceptable risk. Other owners decide that this risk is too high and choose to maintain spare parts and repair kits in-house so that rapid repairs can be made.

## SEASONAL MAINTENANCE

In most cases there is a humidification season but if this is not the case, it is recommended that the following actions be conducted once a year.

- A detailed visual leak inspection using soapy water and low pressure (less than 10 psig) of all air and water transport pipes and system components is to be recorded on a sketch to indicate leak locations and severity.
- Comparison with previous inspection records could indicate systematic problems as compared to random events.
- Repair leaks and verify the system is fully operational using the procedure described in the Start Up section of this guide.
- The AIRFOG system is to be shutdown in accordance with the procedure described in the Shut Down section of this guide.
- Each nozzle shall be cleaned of mineral water deposits and accumulated dirt using the procedure described in the Maintenance section of this guide.
- Each nozzle should be lubricated using a silicone based lubricant.
- The compressor manual should be consulted for its recommended seasonal maintenance.

## SEASONAL STARTUP PROCEDURE

- A detailed visual inspection of all air and water transport pipes and components is to be recorded on a humidification system sketch to indicate damage, non-conformance's and abnormalities.
- Comparison with previous inspection records could indicate systematic problems as compared to random events.
- Repair the identified problems and verify the system is fully operational using the procedure described in the Start Up section of this guide.

## UNSCHEDULED MAINTENANCE

Normally an unscheduled maintenance activity is initiated by a visual observation of a leak or other failure.

- The AIRFOG system is to be shutdown in accordance with the procedure described in the Shut Down section of this guide.
- Execute repair action either by repairing the leak or replacement of the suspected component.
- Record the date, nature of the problem, the repair action taken, other pertinent details and sign the failure report.
- Comparison with previous inspection records and failure reports could indicate systematic problems as compared to random events.
- Verify the system is fully operational using the procedures described in the Start Up section of this guide.

## VACUUM VALVE TESTING

Setup for test:

- Adjust air feed pressure from the control panel to 70 psig.
- Adjust water feed to vacuum valve to 25 psig.
- Adjust vacuum valve regulator to 7 psig. (This adjustment cannot be made until the system is turned on and a pilot signal of 15 psig or greater is applied.)

- Adjust vacuum valve thumb wheel to zero force (spring backed off).

While system in operating, visually watch the spray pattern from the nozzles.

If the system is completely sealed (no vacuum leaks in the water line) then once the system is turned on for the first time all nozzles should start spraying starting with the nozzles closest to the vacuum valve. The negative pressure created in the water line by the high velocity air exiting the nozzles will cause the water line to fill with water, the farther the nozzle is from the vacuum valve the longer it will take for the water to reach that nozzle. Once the system has gone through the priming stage, it should start spraying within seconds after the system has been turned on after a shut down. The priming stage should not take any longer than five minutes. If the system fails to fully prime after five minutes this may indicate a problem.

### **CHECKING FOR VACUUM LEAKS**

The best way to check for leaks is to disconnect the water line from the vacuum valve outlet fitting and connect it directly to the water supply line. This will pressure the line and any leaks should cause dripping allowing location and repair of the leaks.

To test the operation of the vacuum valve;

- Reduce the control panel pressure to 40 psig.
- Adjust thumb wheel tension by turning it in a clockwise direction. There should be a visual difference in the output of the nozzles as more tension is applied to the spring. Be sure not to press down on the thumb wheel while turning it.
- Release the thumb wheel tension and, once again, there should be a noticeable change in the nozzle output.

The spring tension of the vacuum valve restricts the flow of water to the nozzles by changing the required amount of vacuum needed to operate the vacuum valve. Since the nozzles can only generate a fixed amount of vacuum (negative pressure) the flow rate of water is reduced which causes a finer spray and less output. If there was a vacuum leak in the water line it may not be noticeable with the vacuum valve spring tension set to zero, but it should become noticeable with greater tension applied to the spring. A good indication of a small leak would be very little visual difference in nozzle output while performing this test.

**Table #2  
Rebuild Kits**

Part #	Description
1603115	Rebuild Kit for 1603104 Norgren pilot water regulator
1603117	Diaphragm kit for 1609412 watts pilot air regulator.
1603118	Rebuild kit for 1603001 Norgren panel mounted air regulator.
1603119	Rebuild kit for 1603002 Norgren Brass water pressure regulator for vacuum valves
1603120	Seal Rebuild kit for 1609209 AFE Nozzle.
1603122	Vacuum Valve Diaphragm Rebuild kit

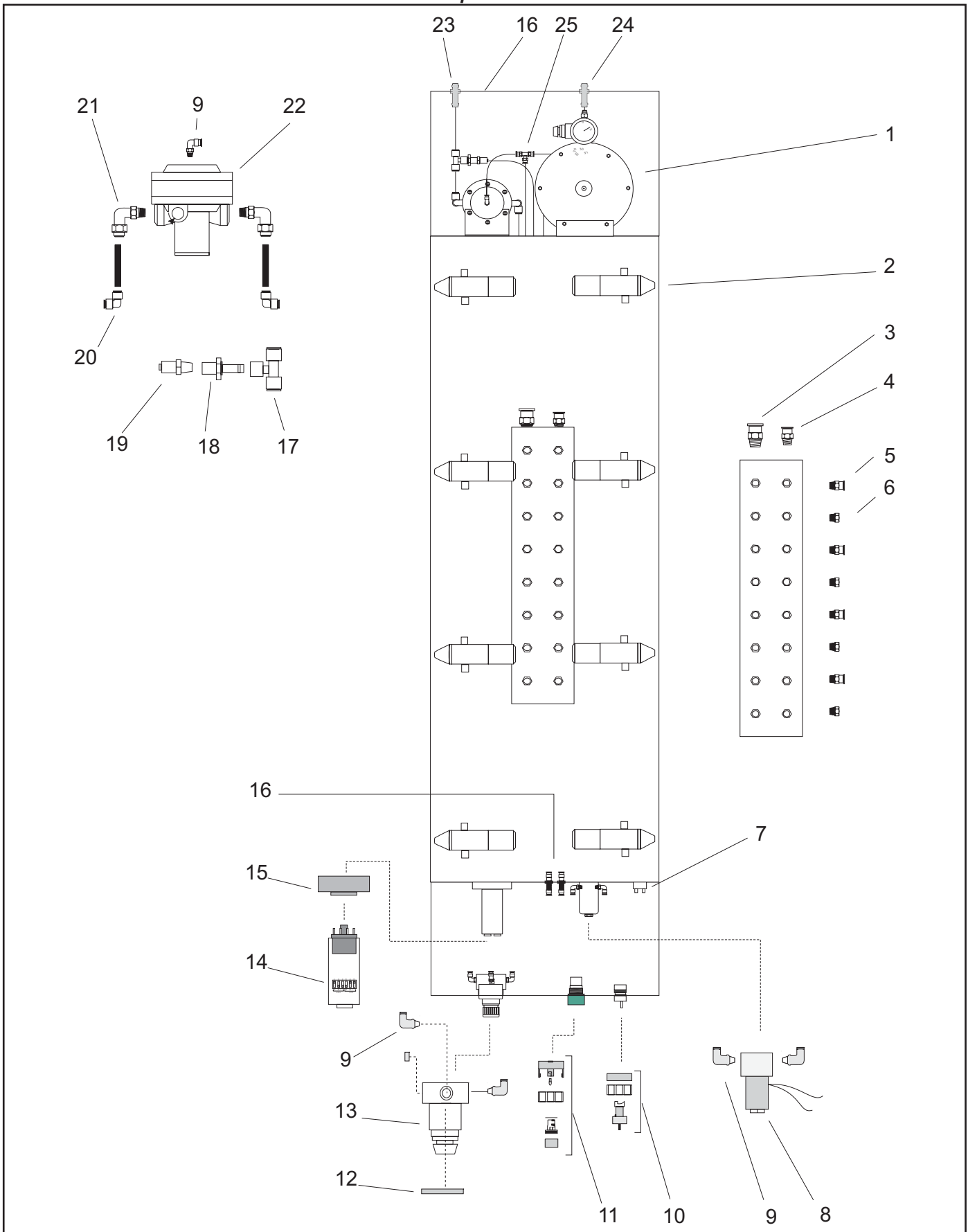


# TROUBLESHOOTING

Part	Possible Failure	Symptoms	Solution
Vacuum Valve	Diaphragm Failure	Nozzle sputter. Low output. No output.	Replace defective component.
	Pilot Safety Regulator Diaphragm Ripped	Nozzles sputter. Air in water line. Low output. No Output. Water drips from bonnet.	Repair regulator using repair kit.
	Valve Seat O-Ring	Pressure water line resulting in heavy mist. Could damage main diaphragm. No control of output.	Replace o-ring, rebuilt vacuum valve.
	Other O-rings	Vacuum leak, low output, no output. Water leaks out.	Replace.
	Cracked Housing	Vacuum leak or water dripping from valve.	Replace damaged component.
	Blockage	Reduced output. No output.	Clean.
Pilot Air Regulator	Damaged Diaphragm	Loss in air pressure. No air pressure. Uncontrolled air pressure.	Repair.
	Stuck Closed Or Open	Unable to adjust pressure.	Disassemble and clean.
Pilot Water Regulator	Damaged Diaphragm	Loss in water pressure. No water pressure. Uncontrolled water pressure.	Repair.
	Stuck Closed Or Open	Unable to adjust pressure.	Disassemble and clean.
Solenoid Valve	Burnt Coil	Valve does not activate.	Replace.
	Blocked	No pressure leaving the valve.	Clean.
	Stuck Closed Or Open	Dirty plunger.	Clean and install external filters.
Timer	Wrong Timer Settings	System will not come on. System only stays on for a few seconds.	Reduce the off cycle. Increase the on cycle.
	Burnt Timer	The timer lights are not on. Burnt smell from inside the control panel.	Replace.
Panel Regulators	Damaged Diaphragm	Loss in air pressure. No air pressure. Uncontrolled air pressure.	Repair.
AFE Nozzle	Stuck Cleaning Needle	Nozzle does not clean itself.	Lubricate seal and shaft of needle.
	Nozzle Drips	Water on the floor.	Replace damaged o-ring on end of needle.

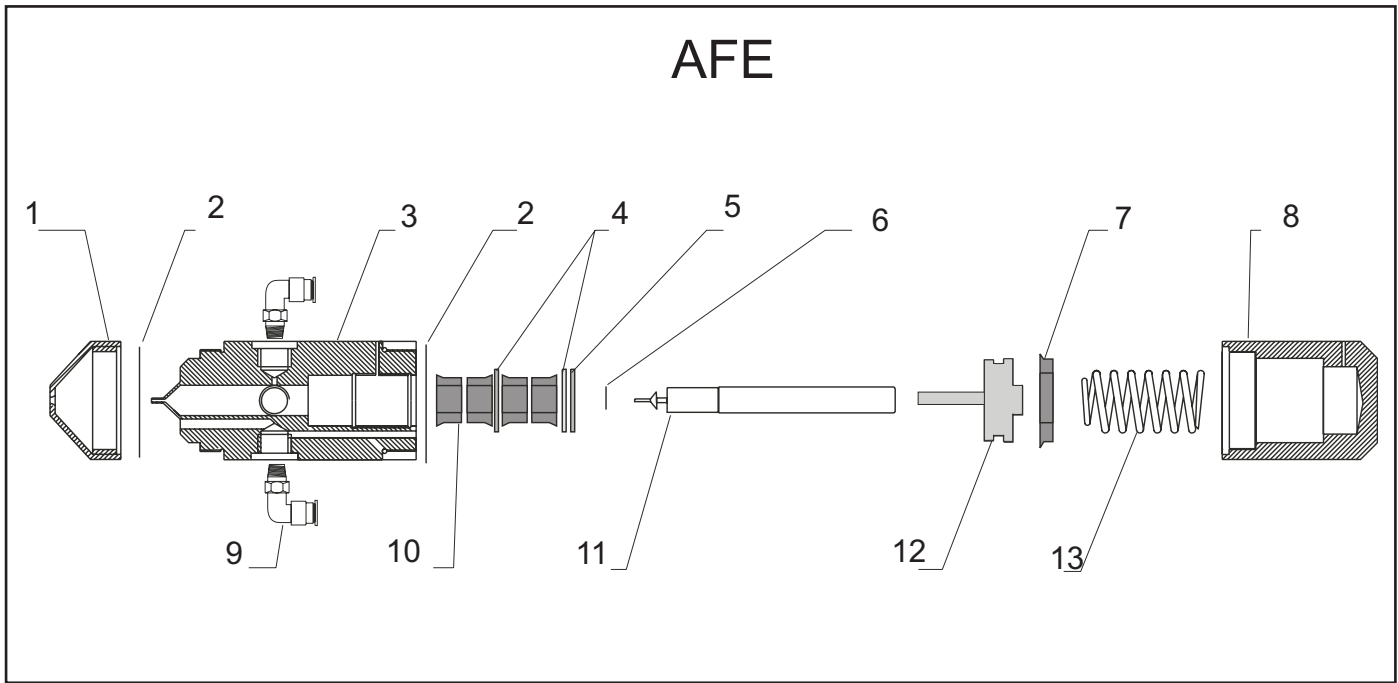
**Figure #25**

**Octo Exploded Views**

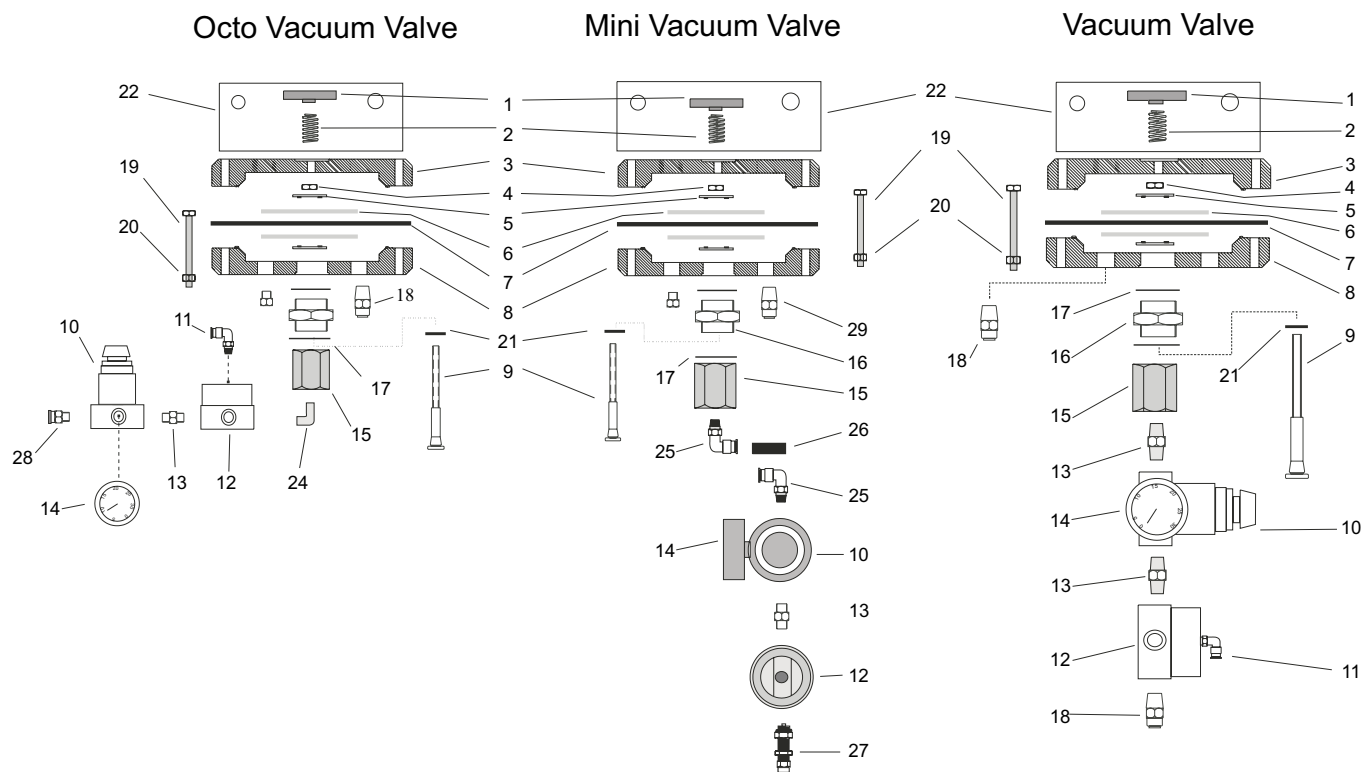


ITEM	PART #	DESCRIPTION	OCTO			OCTO PLUS		
			4	6	8	4	6	8
1	160-8000	Vacuum Valve For Octo	1	1	1	1	1	1
2	160-9209	AFE Nozzle	4	6	8	4	6	8
3	160-5233	Ftfg Male Straight ½" - 3/8" NPT	1	1	1	1	1	1
4	160-5232	Ftfg Male Straight 3/8" - 1/4" NPT	1	1	1	1	1	1
5	160-5213	Ftfg Male Straight 1/4" T - 1/8" NPT	8	12	16	8	12	16
6	160-5248	Ftfg Plug Plastic 1/8" NPT	8	4	0	8	4	0
7	160-3907	LV Strip 7 Point	0	0	0	1	1	1
8	160-3062	3-Way Solenoid Valve 24 VAC	0	0	0	1	1	1
9	160-5202	Ftfg Male Swivel 1/4" T 1/8" NPT	1	1	1	6	6	6
10	160-3020	On/Off Switch Assembly	0	0	0	1	1	1
11	160-3021	Pilot Lamp Assembly	0	0	0	1	1	1
12	160-3006	Plastic Panel Nut	0	0	0	1	1	1
13	160-3001	Regulator Air Panel Mount	0	0	0	1	1	1
14	160-3050	Repeat Cycle Timer	0	0	0	1	1	1
15	160-3051	Mount For Timer 8 Pin Socket	0	0	0	1	1	1
16	160-5208	Bulkhead Union 1/4" T	1	1	1	2	2	2
17	160-5241	Ftfg Plastic Union Tee ½" T	0	0	0	1	1	1
18	160-5242	Ftfg T Stem AD ½" T - 1/4" NPT	0	0	0	1	1	1
19	160-5243	Ftfg Plastic 1/4" T 1/4" NPT	0	0	0	1	1	1
20	160-5240	Ftfg Plastic Elbow ½" T	0	0	0	2	2	2
21	160-5235	Ftfg Elbow ½" T 3/8" NPT	0	0	0	2	2	2
22	160-3112	Regulator Pilot Air	0	0	0	1	1	1
23	160-5231	Bulkhead Union ½" T	1	1	1	1	1	1
24	160-5230	Bulkhead Union 3/8" T	1	1	1	1	1	1
*	160-1038	Bulkhead Union 3/8" T SST	1	1	1	1	1	1
25	160-5201	Ftfg Union Tee 1/4" T	1	1	1	1	1	1

**Figure #26**  
**Nozzles Exploded Views**



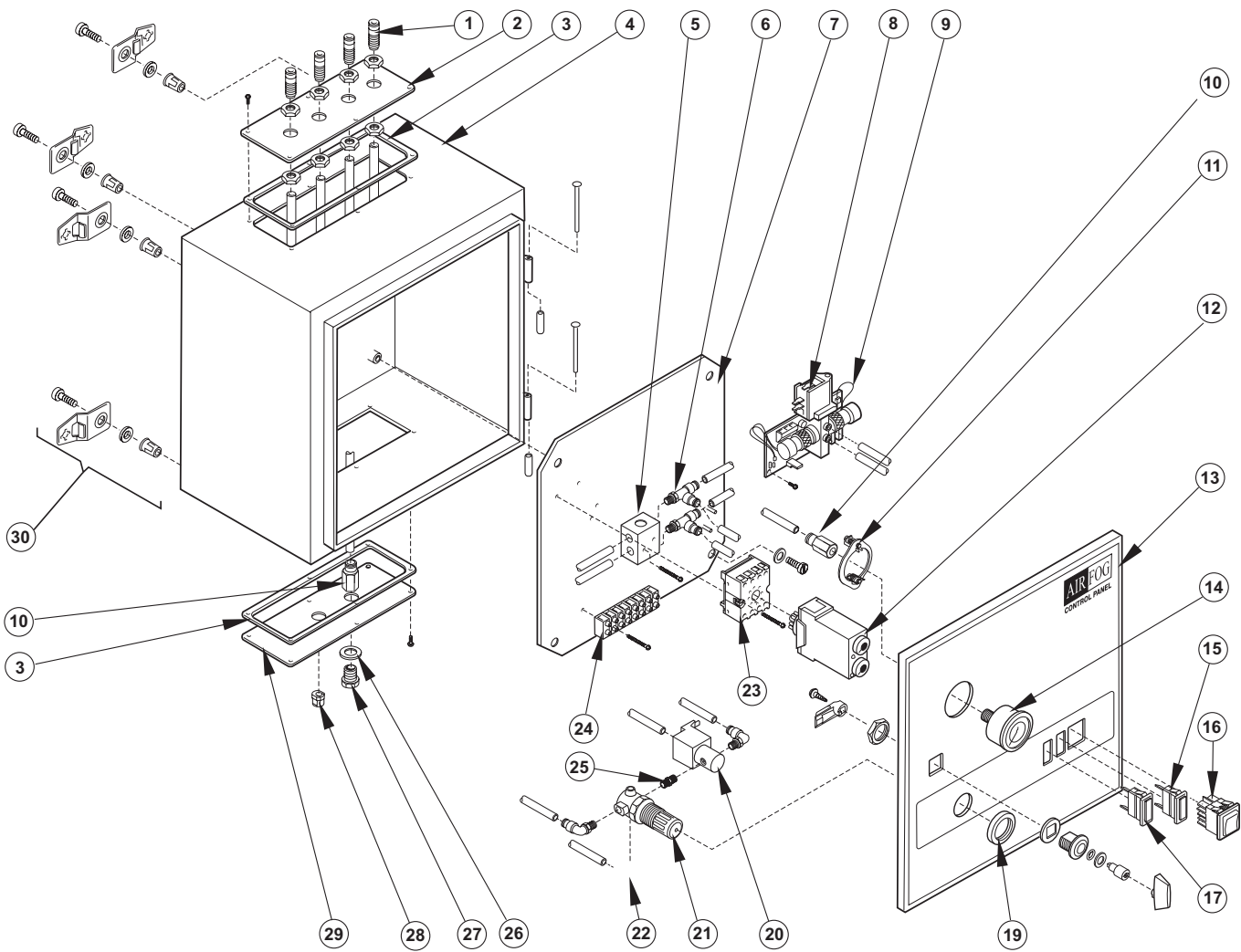
ITEM #	PART #	DESCRIPTION	AFE
1	160-4002	Nose Cone	1
2	160-4009	O-Ring Seal	2
3	160-4001	AFE Body	1
4	160-4008	Flat Washer	2
5	160-4038	Retaining Clip SST	2
6	160-4124	O-Ring Valve Seat	1
7	160-4011	Piston Seal	1
8	160-4003	AFE End Cap	1
9	160-5202	Swivel Male Elbow	2
10	160-4010	Rod Seal	4
11	160-4040	Cleaning Needle	1
12	160-4039	Piston	1
13	160-4036	Spring	1



**Figure #27**  
Vacuum Valve Exploded Views

ITEM #	PART #	DESCRIPTION	OCTO	MINI	STANDARD
1	160-4027	Thumb Wheel	1	1	1
2	160-4006	Spring SS 1.5 in	1	1	1
3	160-4021	V.V. Top Plate	1	1	1
4	160-4033	Nut 1/4" UNF SST	1	1	1
5	160-4034	Washer Self Sealing	2	2	2
6	160-4026	Polypropylene Disc	2	2	2
7	160-4025	Diaphragm 1/16 Neoprene	1	1	1
8	160-4020	V.V. Bottom Plate	1	1	1
9	160-4024	Valve Stem	1	1	1
10	160-3002	Panel Mount Water Reg. 1/4" P	1	1	1
*	160-3114	Panel Mount Water Reg. 1/4" P SST for DI	1	1	1
11	160-5202	Swivel Male Elbow 1/8" NPT	1	1	1
12	160-3104	Pilot Water Regulator	1	1	1
*	160-3110	Pilot Water Regulator SST for DI	1	1	1
13	160-1019	Ftting Nipple 1/4" NPT hex x 1	0	0	1
*	160-1044	Ftting Nipple 1/4" NPT hex x 1 Plastic	0	0	1
14	160-3008	Pressure Gauge 1-1/2" 1/8 CB 0-30	1	1	1
15	160-4022	Valve Body	1	1	1
16	160-4023	Valve Seat	1	1	1
17	160-4122	O-Ring Body Valve #118	2	2	2
18	160-5217	Ftting 3/8" T 1/4" NPT	1	0	3
19	160-4028	Bolt 1/4 x 2 UNF	6	6	6
20	160-4029	Nut 1/4" c/w star washer	6	6	6
21	160-4031	O-Ring	1	1	1
22	160-4032	Bracket Wall Mounting	1	1	1
23	160-5249	Plug 1/4" NPT Plastic	1	1	0
24	160-1018	Ftting Elbow 1/4" NPT Brass	1	0	0
*	160-5218	Ftting Elbow 1/4" NPT SST	1	0	0
25	160-5219	Ftting 3/8" Tube - 1/4" NPT	0	2	0
26	160-5226	3/8" Tube Plastic	0	2.25"	0
27	160-1036	Ftting 3/8" Tube - 1/4" NPT Bulkhead Adapt	0	1	0
28	160-5230	Ftting Bulkhead 3/8" Tube	1	0	0
*	1601038	Ftting Bulkhead 3/8" -1/4" NPT	1	1	0
29	1605205	Male Connector 1/4" NPT	0	2	0

**Figure #28**  
Control Panel Exploded Views



ITEM #	PART #	DESCRIPTION	MINI I/II	AFE
1	160-5208	Bulkhead union 1/4" tube	3 / 5	2
2	160-7050	Top cover plate	0	1
3	160-7039	Gasket for cover plate	2	2
4	160-7030	AFE enclosure	1	1
5	160-0027	Valve 4-way 24 Vac solenoid	0	0
6	160-5201	Union tee manifold panel	1 / 2	0
7	160-7037D	Back plate	1	1
8	160-3080	Pressure switch (modulation only)	0	0
8b	160-3081	Pressure switch (modulation only)	0	1
9	150-6260	E/P converter (modulation only)	0	1
10	160-5203	Fitting female union 1/4" - 1/8" NPT	1	2
11	160-3009	Mounting bracket for 160-3003	1	1
12	160-3050	Repeat cycle timer	1	1
13	160-7043	Control panel door	1	1
14	160-3200	Pressure gauge panel mtg bars	1	1
15	149-3096	Lamp green indicator	1	1
16	145-3001	Switch on/off	1	1
17	160-3023	Lamp amber indicator	1	1
19	160-3006	Plastic panel nut	1	1
20	160-3062	Valve 3-way 24 Vac solenoid	0	1
21	160-3001	Regulator panel mount air	1	1
22	160-5202	Fitting swivel male elbow	4	3
23	160-3051	Mount for timer 8 pin	1	1
24	145-3907	Control Strip LV 7 position	1	1
25	160-1010	Nipple male 1/8" NPT x 1 brass	1	1
26	160-1081	Washer nylon	0	1
27	160-1080	Silencer 1/8" NPT brass	0	1
28	160-3036	Strain relief bushing	1	1
29	160-7051	Bottom cover plate	0	1
29b	160-7052	MINI bottom cover plate	1	0
30	160-7029	Mounting bracket for 160-7030		



# LIMITED WARRANTY

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AXAIR NORTEC INC. and/or AXAIR NORTEC LTD. (hereinafter collectively referred to as THE COMPANY), warrant for a period of two years from date of shipment, that THE COMPANY's manufactured and assembled products, not otherwise expressly warranted, are free from defects in material and workmanship. No warranty is made against corrosion, deterioration, or suitability of substituted materials used as a result of compliance with government regulations.

THE COMPANY's obligations and liabilities under this warranty are limited to furnishing replacement parts to the customer, F.O.B. THE COMPANY's factory, providing the defective part(s) is returned freight prepaid by the customer. Parts used for repairs are warranted for the balance of the term of the warranty on the original humidifier or 90 days, whichever is longer.

The warranties set forth herein are in lieu of all other warranties expressed or implied by law. No liability whatsoever shall be attached to THE COMPANY until said products have been paid for in full and then said liability shall be limited to the original purchase price for the product. Any further warranty must be in writing, signed by an officer of THE COMPANY.

THE COMPANY's limited warranty on accessories, not of AXAIR NORTEC's manufacture, such as controls, humidistats, pumps, etc. is limited to the warranty of the original equipment manufacturer from date of original shipment of humidifier.

THE COMPANY makes no warranty and assumes no liability unless the equipment is installed in strict accordance with a copy of the catalog and installation manual in effect at the date of purchase and by a contractor approved by THE COMPANY to install such equipment.

THE COMPANY makes no warranty and assumes no liability whatsoever for consequential damage or damage resulting directly from misapplication, incorrect sizing or lack of proper maintenance of the equipment.

THE COMPANY retains the right to change the design, specification and performance criteria of its products without notice or obligation.

# AxAir Nortec

a WMH Company

Axair Nortec Inc.  
P.O. Box 698  
826 Proctor Avenue  
Ogdensburg, NY 13669

Tel: (315) 425-1255  
e-mail: [nortec@humidity.com](mailto:nortec@humidity.com)

Axair Nortec Ltd.  
2740 Fenton Road  
Ottawa, ON K1T 3T7

Tel: (613) 822-0335  
Fax: (613) 822-7964



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