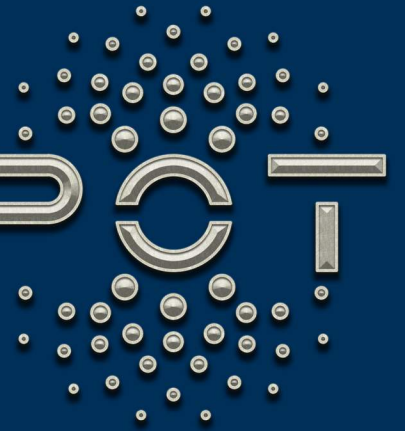


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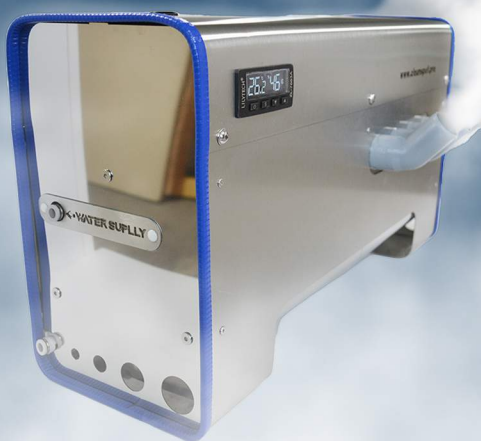
ULTRASONIC SOLUTIONS
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GENERAL DESCRIPTION

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What Is Humidity?

Humidity is water vapor in the air.

Relative Humidity is the amount of water vapor in a given volume and temperature of air compared with the maximum amount of water vapor that volume of air can hold at that temperature (saturation).

In a constant volume of air the amount of water vapor the air can hold increases as temperature increases. 1 m³ is the most common measurement of volume. Amount of water vapor is expressed in "grams".

1 m³ of air at 20°C holds 17.3g of water vapor.

1 m³ of air at 0°C holds 4.89g of water vapor.

If 1 cubic foot of air at 20°C is holding 17.3g of water vapor, then it is saturated and is at 100% relative humidity.

If 1 m³ of air at 20°F is holding 8.65g of water vapor, then it is at 50% relative humidity.

If 1 m³ of air at 0°C is holding 4.89g of water vapor (saturated) and is then heated to 20°C, the g of water vapor remain constant and the relative humidity is 6%.

Why Humidify?

Today's high tech environments require meticulous control of humidity to eliminate static electricity, ensure quality manufacturing processes, preserve precious documents and works of art and provide comfort while adhering to Indoor Air Quality standards. The specific reasons to humidify are as numerous as the applications, but the purpose is common across the board: to eliminate problems that can damage products, ruin buildings, or jeopardize health.

When RH reaches levels below 35%, static electricity may develop on surfaces and materials. Static electricity is not only annoying, it can wreak havoc on computers by burning microchips and wiping out memory cards. Elimination of static electricity also greatly reduces the risk of solvent fires in the printing industry. Commercial presses develop extraordinary amounts of electricity at the roller and ignite solvents in the ink wells. If you have ever wiped your finger across your television screen, you know that static electricity attracts dust. This is a real problem in the plastics and films manufacturing process where dust can ruin a product and in the healthcare industry, dust can jeopardize lives.

Indoor Air Quality affects man and machine, and both operate best at optimum environmental conditions. IEC standards are forcing manufacturers and building owners to adjust their management of air quality control. If a building's main HVAC system does not have the capacity to maintain RH levels within a comfort zone of 40% to 60%, then proper humidification can help reduce adverse effects of occupant discomfort, bacteria growth, viruses, fungi, mites, allergic reactions, respiratory infections, chemical interactions and ozone production.

Isothermal vs. Adiabatic Humidification

Isothermal type humidification systems use electricity or gas as an external heat source to change water to steam. Energy consumed from an external energy source is approximately 2,000 BTU/L of moisture.

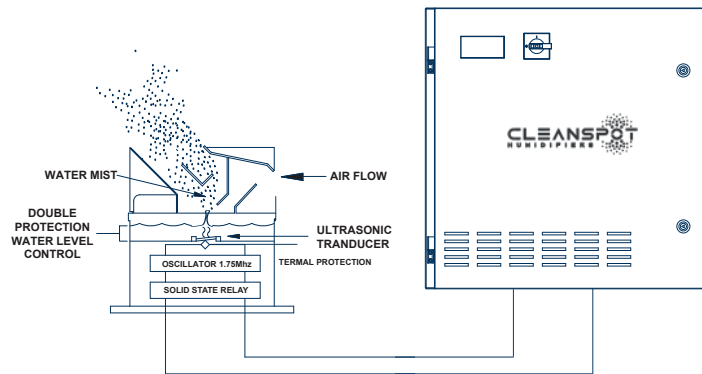
- Electrode Canister
- Infrared
- Electric Resistance
- Direct Steam Injection (Building Steam)
- Steam-to-Steam
- Gas-Fired

Adiabatic type humidification systems use mechanical energy to generate water particles and/or evaporate water to/from media. Energy extracted from air stream is approximately 1,000 BTU/L of moisture.

- Ultrasonic - piezoelectric transducer
- High Pressure Water Nozzle
- Compressed Air Nozzle
- Centrifugal Atomizing (sling type)
- Evaporative Pad

Principle of Operation

A piezo-electric transducer, immersed in a water, converts a high-frequency electronic signal into a high-frequency mechanical oscillation. The water tries to follow the high frequency mechanical oscillation but can not due to its mass inertia. A momentary vacuum and strong compression are produced in the water. In the negative oscillation of the transducer the momentary vacuum causes the water to cavitate into a vapor at low temperature and pressure. In the positive oscillation of the transducer, high pressure compression waves are produced and by focusing the pressure waves on the surface of the water, very tiny droplets (average one micron in diameter) of water are generated and are quickly absorbed into the air stream.



BENEFITS

• Maximum Energy Savings

Compared to Electrode Boiler or Infrared humidifiers the CLEANSPOT Ultrasonic Humidifiers require 93% less electrical energy.

• Lowest Electrical Wiring Costs

As the CLEANSPOT Ultrasonic Humidifier only requires 7% of the electrical power required for conventional systems, significant savings can be realized in the cost of wiring, electrical distribution boards, standby generation and even the main input transformer to the building.

• Reduced Air Conditioning Requirements

The CLEANSPOT Ultrasonic Humidifier is an adiabatic constant humidifying process which reduces air temperature during the process and reduces the air conditioning cooling load.

• Most Economical Water Consumption

Spray Humidifiers have a water loss of up to 70% through mist elimination and standard steam generators or infrared humidifiers have a water loss of up to 20% for the flushing cycles. CLEANSPOT Ultrasonic Humidifiers have no water loss.

• Clean Humidification

Deionized water is used for cleaner, mineral-free humidification.

• Freeze Protection

Auto drain, for freeze protection.

• No Fire Risk

Humidification is generated with no heating or boiling of water, thus the risk of fire is minimized.

• Redundancy by Design

Each humidification 12 disc module/transducer is independently wired, thus if one fails, redundancy is achieved through the other modules.

• Excellent Control Features

The CLEANSPOT Ultrasonic Humidifier has an immediate response to the call for humidification and also switches off immediately, preventing delay and overrun humidity cycles. The CLEANSPOT Ultrasonic Humidifier is also available with proportional control, utilizing return and hi-limit sensors.

• Very Fine Mist

CLEANSPOUT Ultrasonic Humidifiers produce a very fine mist of approximately 0.001 mm (1 micron) average diameter, which is quickly absorbed into the air stream.

• Long Service Life

All the main components of the CLEANSPOT Ultrasonic Humidifier are made from high-quality, stainless steel Brass or ABS plastic.

• Fast Payback Period

Energy analysis calculations show that due to lower electrical energy and water usage and due to reduced compressor operating hours, payback periods of less than one year are common.

ENERGY ANALYSIS

A CLEANSPOT Ultrasonic Humidifier needs only 7% of the power required by an electrode steam humidifier. Assuming a humidification requirement of 10 L/h., a FOGO-MODELS has a power requirement of 0.495 kW at 11.1 L/h. Using a comparable capacity steam electrode type humidifier, the power requirement is 6.8 kW at 10 L/h, which is an energy savings of approximately 93%, or **13 times less consumption**.

Humidity Absorption Distance

Cooling Effect of Ultrasonic Humidification

The principle of using ultrasonic nebulizing technology to generate moist air for the purpose of humidification involves no heating or boiling of water. This lack of a heating process eliminates the main source of energy consumption. CLEANSPOT Ultrasonic humidifiers transform electrical energy into mechanical energy through the use of a vibrating piezoelectric element which produces fine water particles. The process of introducing this fine water mist into the air stream takes place under a constant enthalpy process which cools the air downstream of the humidifier. This cooling is usually referred to as the latent heat of vaporization and is approximately equal to 2000 btu/L of water vaporized at standard atmospheric conditions. When energy is removed from the air stream, the air temperature is cooled down by an approximate amount arrived at by using the following equation:

$$\Delta T (^{\circ}C) = ((L/hr \times 2000) / (cfm \times 2.16))$$

Absorption Distance

It is critical that the humidified area be properly designed for the environment that will be produced. Considerations will need to be applied to all portions of the space that can directly interact with the humidified area. Successful implementation of most humidification systems is highly dependent on the installation and control system applied.

The absorption distance is the distance downstream of the humidifiers that is required to insure the suspended water droplets are fully converted to vapor and therefore will not cause wetting on downstream obstructions.

The inlet air conditions to the humidifier must be dry enough to fully absorb the maximum humidifier capacity without saturating the air further than 80% R.H. A leaving relative humidity higher than 80% saturated may lead to wetting of surfaces.

There are several factors that affect the absorption distance of a given application, to insure full absorption into the air stream, the air flow velocity, air temperature, air moisture content and humidifier capacity must be reviewed and confirmed.

For GANO, ducted mounted models, the air velocity at the humidifier, also referred to as terminal velocity must be within the range of 450-750 fpm. This velocity range insures that the humidifier's output capacity can be achieved.

The GANO, Direct Room Humidifier models include integrated circulating fans to insure correct operating terminal velocities. Care must be taken to insure the inlet or outlet sections are not obstructed. Locate the GANO model to allow unrestricted path for absorption of mist onto the space.



(Stand Alone - Ultrasonic Humidifiers)

The GANO MODELS Ultrasonic Humidifiers are designed for stand-alone direct room applications. GANO humidifiers are typically mounted on a wall, column or suspended below the ceiling; serving such applications as medical cannabis indoor growing, printing houses, lithographic printing processes, bakeries, dairies, telephone exchanges, telecommunications rooms, electronics manufacturing, leather industry, wood and textile processing, plus many more.

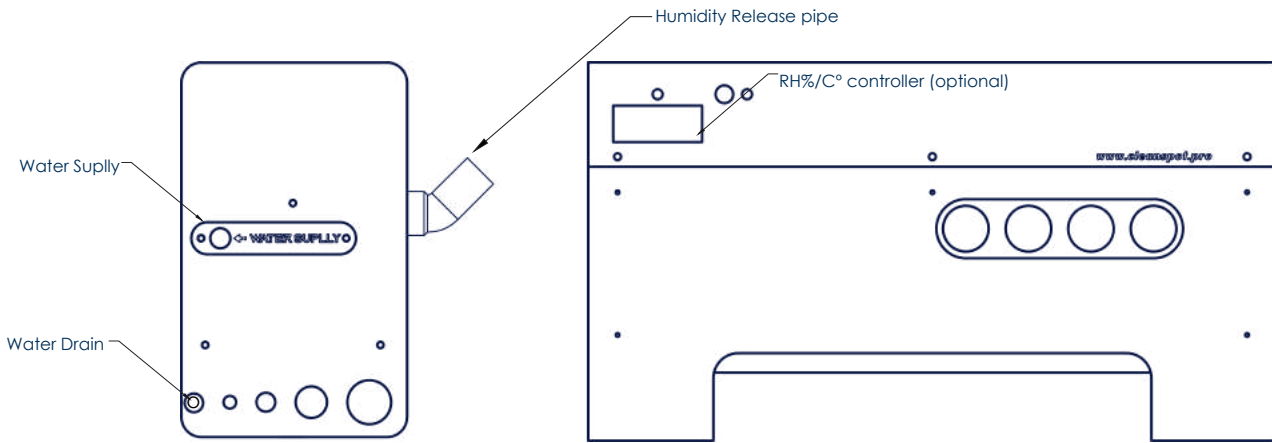
General Application Parameters For All Types CLEANSLOT Ultrasonic Humidifiers

- Humidifier must be installed in a level horizontal position.
- The operating air temperature range of humidifier is 1°C to 50°C.
- The operating air relative humidity range of humidifier is max 95%.
- Water pressure operating range at the inlet of humidifier is 30 psi to 75 psi.
- Inlet water temperature operating range is 5°C to 40°C.
- For dust-free humidifier mist generation, inlet water is to be demineralized water conductance of <5 microsiemens (purity).
- DI water supply piping must be non-corrosive, i.e. stainless steel or plastic rated for use with de-ionized water.
- Humidifier overflow / drain pipe is to be directed to condensate pan or drain.
- Humidifier capacity rated at 48 VDC power supply via factory furnished control box.
- Humidifier power source must be isolated with a circuit breaker.
- Multiple humidifiers can be supplied and controlled by a single control box for larger capacity systems. Refer to Controls Section for information regarding maximum quantity of humidifiers possible per system based on options selected and system wiring requirements.



Application Parameters For Stand-Alone (direct in-space) Systems

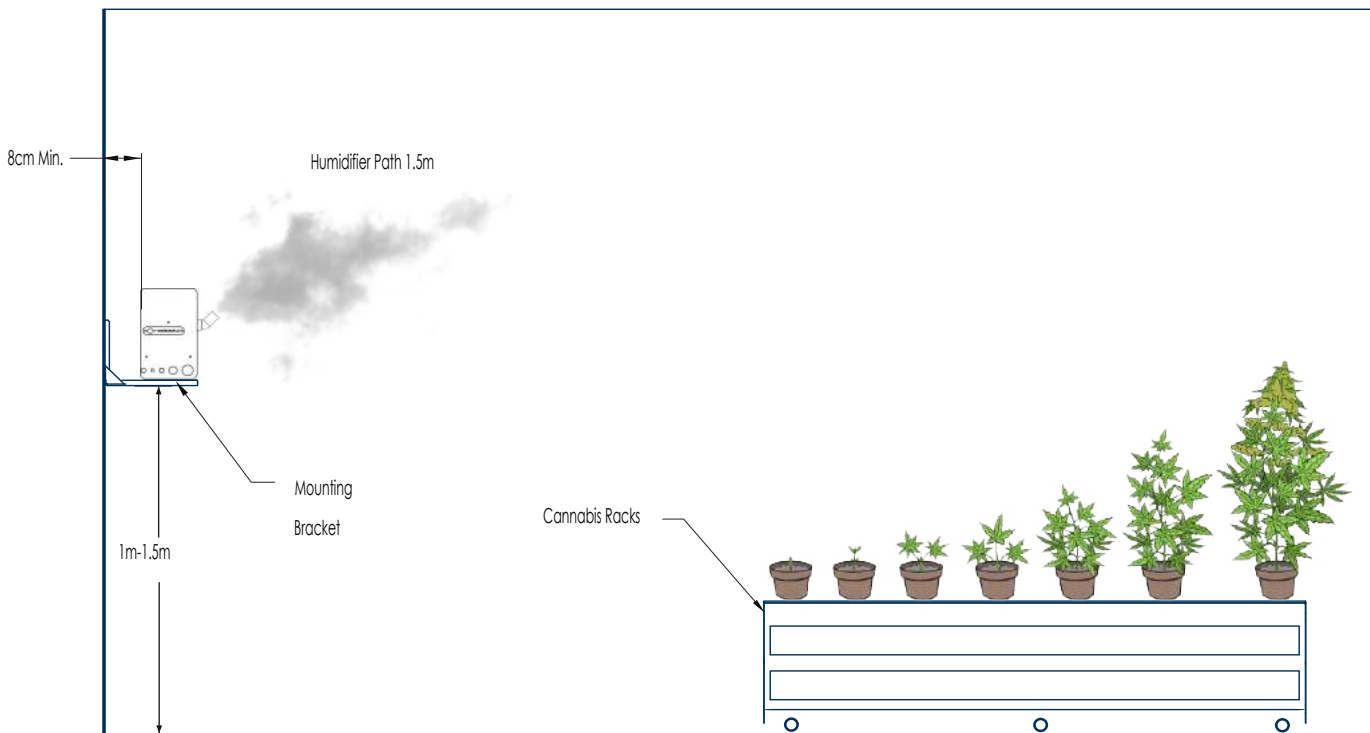
- The CLEANSLOT Ultrasonic GANO Ultrasonic Humidifier is designed to be installed directly in a room or conditioned space.
- Humidifier must be installed in a level, horizontal position.
- When selecting the installation location, attention should be paid to the air flow in the room so that the generated mist is not effected by HVAC system supply or return air terminal devices.
- Locate humidifier to allow unrestricted path for absorption of mist into the room air.
- Humidifier to be installed using brackets mounted to wall/column or suspended from overhead structure by hanger rods. Humidifier is designed to mount on top of brackets.
- Install humidifier with mounting hardware and attachment rated for weight of humidifier.
- Install so the air intake opening is not restricted and air filter is accessible for maintenance.
- Minimum distance from nozzle discharge to ceiling is 450 cm.
- Mount with sufficient space between humidifier and wall to allow for water and electrical connections.
- Minimum distance from air terminal or smoke detector in front of humidifier is 3,5 m.
- Absorption distance varies with temperature and relative humidity of room air.



GANO-MODELS
(Stand-Alone Humidifiers)

MODEL	Capacity (L/ hr)	Weight (KG)	Number of Nebulizer Units	Dimensions (cm)		Power
				L	P	
GANO-7	7	20	12	55	24	350W
GANO-14	14	26	24	65	30	700W
GANO-28	28	38	48	68	30	1400W
GANO-35	35	44	60	70	34	2800W

GANO MODELS ROOM PLACEMENT DIAGRAM



Humidifier Control

All CLEANSLOT Ultrasonic Humidifiers have a Control box for each system providing power, component electrical protection and humidifier operation. Two types of control boxes are offered: Mono-box On/Off and Multy-box Proportional.

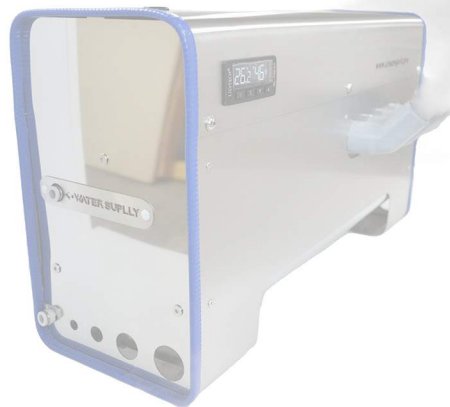
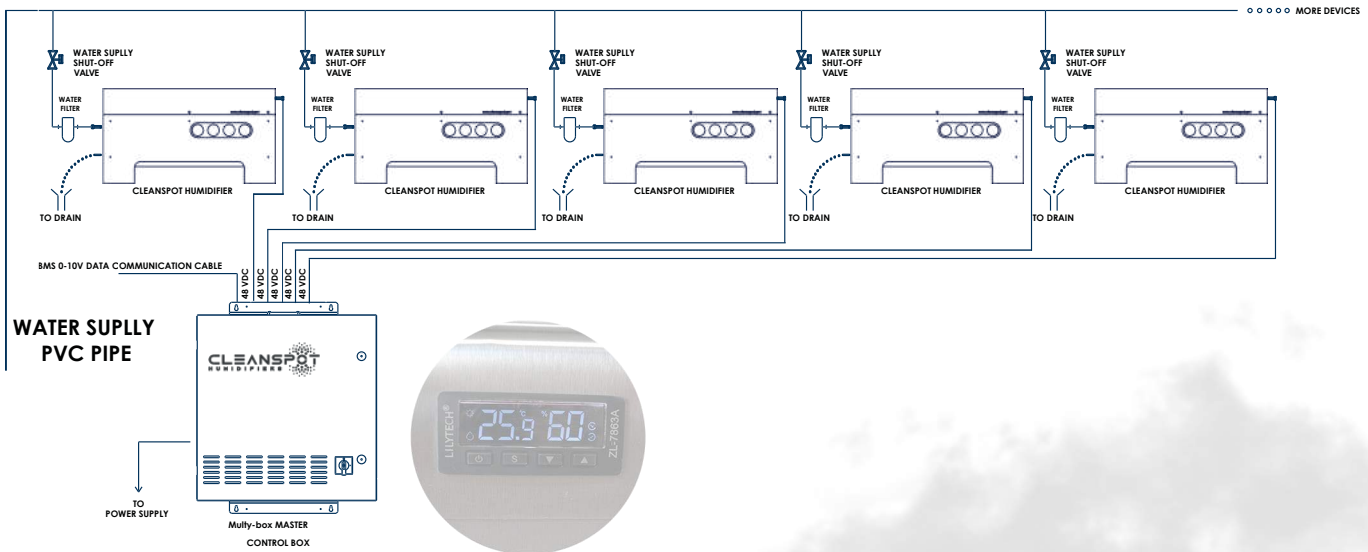
The control boxes are designed for indoor installation intended for single or multiple humidifier operation. For multiple humidifier groups, the Multy-box proportional control will be delivered.

Gano-Models On/Off control boxes are provided for a single humidifier per system.

The Mono-box On/Off control systems are supplied as standard with:

- Wall mount enclosure
- On/Off switch
- Component circuit protection
- 48 VDC power supply
- Humidifier contactor
- Cabinet thermostat controlled fan

Connection System Diagram



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CLEANSPOUT UltraSonic Solutions KLINSPOT DOOEL - System for Air Handling humidification

Humidification Test Report			
INSTALLATION DATE: _____		COMPANY: _____	
Air Handling unit application: _____		INDUSTRY TYPE: _____	
Number of humidifiers in arrangement: _____ / _____		<input type="checkbox"/> Electrical connections checked	
Humidity sensor 1 connected <input type="checkbox"/> Yes		Type of el. cable used: _____	
Temperature sensor 1 connected <input type="checkbox"/> Yes		Type of BMS signal _____	
Power connector connected <input type="checkbox"/> Yes		External signal connected <input type="checkbox"/> Yes	
Water supply connected <input type="checkbox"/> Yes		Water drain valve connected <input type="checkbox"/> Yes	
Room temp. setpoint: _____ °C		Safety overflow connected <input type="checkbox"/> Yes	
Room humidity setpoint: _____ %RH		Room volume/size: _____ m ³	
Water intake pressure: _____ bar		Water drains freely <input type="checkbox"/> Yes	
Feed water quality <input type="checkbox"/> Drinking water pipe <input type="checkbox"/> Well water <input type="checkbox"/> Demineralized <input type="checkbox"/> Water softening			
Direct room applications			
Room volume/size WxHxL m x x / m ³		Number of humidifiers in arrangement: _____ / _____	
Free mist blowout distance: _____ m		Min. distance from ceiling complied with <input type="checkbox"/> Yes	
Controller: <input type="checkbox"/> No <input type="checkbox"/> Yes		Wall brackets installed <input type="checkbox"/> Yes	
Room temp. setpoint: _____ °C		Power connector connected: <input type="checkbox"/> Yes	
Room humidity setpoint: _____ %RH		Water drain connected <input type="checkbox"/> Yes	
Water supply connected: <input type="checkbox"/> Yes		BMS connected <input type="checkbox"/> No <input type="checkbox"/> Yes	
Feed water quality <input type="checkbox"/> Drinking water pipe <input type="checkbox"/> Well water <input type="checkbox"/> Demineralized <input type="checkbox"/> Water softening			
Duct applications			
Duct size WxH: _____ x _____ mm		Number of humidifiers in arrangement: _____ / _____	
Airflow: _____ m ³ /h		Humidifier distance, straight: _____ m	
Air speed: _____ m/s		Outside airflow: _____ m ³ /h	
Supply air temp. /return air temp.: _____ / _____ °C		Supply air humidity/return air humidity: _____ / _____ %RH	
Humidifier locked with airflow: <input type="checkbox"/> Yes		Room temp. setpoint: _____ °C	
Installation: <input type="checkbox"/> Pressure side <input type="checkbox"/> Intake side		Room humidity setpoint: _____ %RH	
Feed water quality: <input type="checkbox"/> Drinking water pipe <input type="checkbox"/> Well water <input type="checkbox"/> Demineralized <input type="checkbox"/> Water softening			
Unit documentation / induction			
Documentation handed to plant operator <input type="checkbox"/> Yes		Induction of plant operator/personnel <input type="checkbox"/> Yes	
Final check of entire system <input type="checkbox"/> OK <input type="checkbox"/> NOT OK			
Warranty 1 year from date: _____			
Comments		Date	Company seal: Signature

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N.72 Small Industrial Zone