Retrofit & Conditioning

Humidification

STULZ Ultrasonic

Humidification Systems

Energy Efficient Ultrasonic Humidifiers
For Duct, AHU, Wall Mounted
& Stand-Alone Applications

EM Engineering Manual

STULZ®

STULZ

Our Mission:

STULZ mission is to be the premier provider of energy efficient temperature and humidity control solutions for mission critical applications.

STULZ is dedicated to providing innovative solutions for critical temperature and humidity control needs. STULZ designs and manufactures specialized, energy efficient, environmental control equipment. STULZ serves a diverse marketplace; our customers represent a variety of industries including telecommunications, information technology, medical, financial, educational, industrial process and government. Our world-class "island" manufacturing processes takes place in a modern, 218,000 ft^2 facility located in Frederick, MD USA. STULZ combines a global network of sales and service companies with an extensive factory engineering staff and highly flexible manufacturing resources dedicated to providing world-class quality, innovation and customer service.

This commitment to excellence, along with a standard two year warranty, fast lead times, and outstanding customer service, make STULZ the perfect choice for all your environmental control needs.

STULZ offers solutions that help you reach your goals.

- Precision Air Conditioning
  - Ceiling, Row & Floor Mounted from 1-200 tons
  - Air, Water, Glycol, Chilled Water
  - Free Cooling
  - Alternate Water Source
- Ultrasonic Humidifiers
  - 4.4 - 39.6 lbs per hour
  - Duct, AHU, Wall Mounted & Stand-alone
  - Clean, Energy Efficient
  - Adiabatic Cooling

ISO-9001 Quality Registered

STULZ is committed to satisfying customer expectations by meeting and exceeding requirements. Our Quality Policy ensures that every Employee is committed to Customer Satisfaction, Teamwork and utilizing Continuous Process Improvement methods in order to deliver an exceptional product. We will continually measure our performance to improve the effectiveness of our quality management system.

STULZ Ultrasonic Humidifiers

STULZ has engineered and installed humidification systems all over the world. With thousands of installations in Europe and Asia and the broadest customer base in North America, ultrasonic humidification is second nature to us.

We offer the most comprehensive and complete product line in the industry and can match an ultrasonic humidifier to any application you might have.

STULZ Ultrasonic Humidifiers use 93% less electrical energy than electrode boilers or infrared humidifiers. Water is not heated and wasted as with typical humidification flush cycles. No heat is added to the conditioned space, but instead, a cooling effect that helps reduce compressor run time is achieved due to the ultrasonic adiabatic humidification process. Because of all these savings, STULZ Ultrasonic humidifiers qualify for sizable rebates offered by utilities promoting energy efficiency.

Proudly Made in the USA

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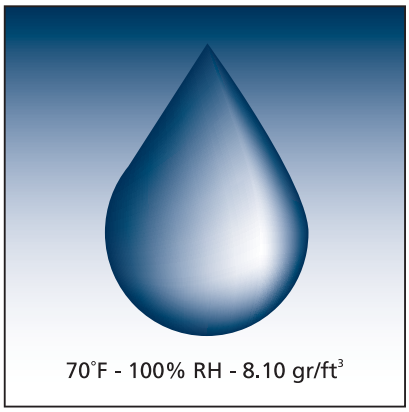
Humidity Control - Overview

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 cubic foot is the most common measurement of volume. Amount of water vapor is expressed in "grains".



1 cubic foot of air at 70ºF holds 8.10 grains of water vapor.
1 cubic foot of air at 0ºF holds 0.48 grains of water vapor.
If 1 cubic foot of air at 70ºF is holding 8.10 grains of water vapor, then it is saturated and is at 100% relative humidity.
If 1 cubic foot of air at 70ºF is holding 4.05 grains of water vapor, then it is at 50% relative humidity.
If 1 cubic foot of air at 0ºF is holding 0.48 grains of water vapor (saturated) and is then heated to 70ºF, the grains 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. IBC and 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 1,000 BTU/lb 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/lb of moisture.

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

Humidification Load Calculation

The humidification load for a given space depends on the amount of outside air introduced to that space. There are three different ways by which outside air can be introduced into a controlled space:

1) Through mechanical ventilation, such as make-up air or exhaust air, both of which are usually achieved through mechanical HVAC systems.

2) Through natural ventilation, such as with leaks through cracks usually found in the building structure, or through the opening and closing of doors and windows. On loose structures, use (2) air changes per hour; on medium, use (1 - 1.5) air changes per hour; on tight structures, use (0.5 - 0.75) air changes per hour.

3) Through the economizer cycle of an HVAC system wherever applicable.

To calculate the humidification load, always arrive to the difference in grains of water per cubic foot (see table below) between the outside air and the room design conditions. Whenever possible, use the three methods and pick the largest load to size your humidification equipment. See examples shown for reference.

Grains of Water Per Cubic Foot - Saturated Air (100% RH)

°C	°F	Grains	°C	°F	Grains	°C	°F	Grains	°C	°F	Grains	°C	°F	Grains	°C	°F	Grains
-23	-10	.29	4	40	2.86		58	5.41		76	9.75	35	95	17.28		114	29.34
	-5	.35		41	2.97		59	5.60		77	10.06		96	17.80		115	30.13
-18	0	.48		42	3.08	16	60	5.80		78	10.40		97	18.31	49	120	34.38
	5	.61	43	3.20		61	6.00			79	10.80	98	18.85		125	39.13	
-12	10	.78		44	3.32		62	6.20	27	80	11.04		99	19.39	54	130	44.41
-9	15	.99	7	45	3.44		63	6.41		81	11.40	38	100	19.95		135	50.30
-7	20	1.24		46	3.56		64	6.62		82	11.75		101	20.52	60	140	56.81
-4	25	1.56		47	3.69	18	65	6.85		83	12.11		102	21.11		145	64.04
-1	30	1.95		48	3.83		66	7.07		84	12.49		103	21.71	66	150	72.00
	31	2.04		49	3.97		67	7.31	29	85	12.87		104	22.32		155	80.77
	32	2.13	10	50	4.11		68	7.57		86	13.21	41	105	22.95	71	160	90.43
	33	2.21		51	4.26		69	7.80		87	13.67		106	23.60		165	101.00
	34	2.29		52	4.41	21	70	8.10		88	14.08		107	24.26	77	170	112.60
2	35	2.38		53	4.56		71	8.32		89	14.51		108	24.93		175	125.40
	36	2.47		54	4.72		72	8.59	32	90	14.94		109	25.62	82	180	139.20
	37	2.56	13	55	4.89		73	8.87		91	15.39	43	110	26.34		185	154.30
	38	2.66		56	5.06		74	9.15		92	15.84		111	27.07	88	190	170.70
	39	2.76		57	5.23	24	75	9.45		93	16.31		112	27.81		195	188.60
										94	16.79		113	28.57			

Example 1:

a. Make-up Air - assume that an HVAC system serving a meeting room with a total air volume of 10,000 cfm uses 15% outside air for make-up during the winter season. Worst case winter conditions for this area are 10°F at 30% RH. Room conditions are to be maintained at 72°F and 45% RH.

The amount of make-up air entering the HVAC system is:
.15 x 10,000 = 1500 cfm.

From Table 1, at 10°F there are 0.78 grains of water per cubic foot of 100% RH saturated air. At 30% RH there are 0.3 x 0.78 = 0.234 grains/ft^3.

For the room conditions @ 72°F and 45% RH: 0.45 x 8.59 = 3.866 grains/ft^3.

Humidification Load =

$$\frac{1500\text{cfm} \times (3.866-0.234)\ \text{grains/ft}^3 \times 60\ \text{min/hr}}{7000\ \text{grains/lb}}$$

$$H_a = 46.7\ \text{lbs/hr}$$

b. Exhaust Air - assume that the same room has a separate kitchen with a 200 cfm exhaust fan. The humidification load for the kitchen only is:

$$H_b = \frac{200\ \text{cfm} \times (3.866-0.234)\ \text{grains/ft}^3 \times 60\ \text{min/hr}}{7000\ \text{grains/lb}}$$

$$H_b = 6.2\ \text{lbs/hr}$$

Example 2:

Natural Ventilation - assume that this same meeting room has one side exposed to the outside and medium traffic (1 - 1.5 air changes/hr). Use 1.5. The room size is 50' x 40' with a 9' ceiling.

$$\text{Air volume} = 50' \times 40' \times 9' \times 1.5 = 27{,}000\ \text{ft}^3\text{/hr}$$

$$\text{Humidification Load} = \frac{27{,}000\ \text{ft}^3\text{/hr} \times (3.866-0.234)\ \text{grains/ft}^3}{7000\ \text{grains/lb}}$$

$$H = 14\ \text{lbs/hr}$$

Example 3:

Economizer Cycle - The economizer cycle is used to mix outside air and return air in varying amounts to reach a set mixed air temperature of usually 55°F. HVAC systems using economizer cycles usually have a fixed minimum outside percentage (eg. 10%) when outside air reaches the coldest design temperature. As outside air temperature increases, more outside air is mixed with return air to reach the set mixed air temperature of 55°F. Humidification load calculations must be performed at each temperature/mixing ratio to find the maximum load. However, for the purpose of this example, let us assume that maximum load will occur at 100% outside air with a 55°F, 40% RH outside air conditions.

$$H = \frac{10{,}000\text{cfm} \times [(3.866) - (0.4 \times 4.89)]\ \text{grains/ft3} \times 60\ \text{min/hr}}{7000\ \text{grains/lb}}$$

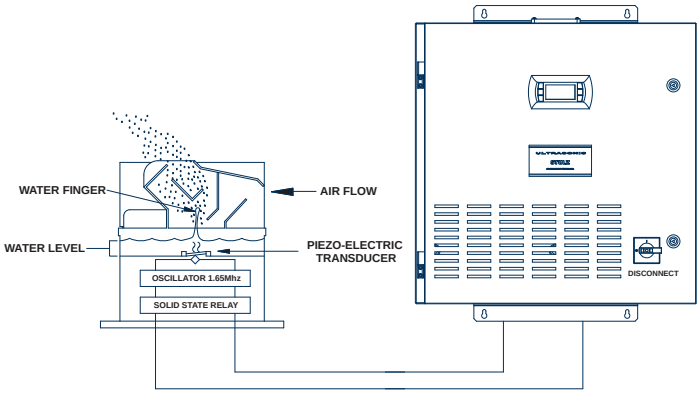
$$H = 163.7\ \text{lbs/hr}$$

Principle of Operation

A piezo-electric transducer, immersed in a water bed, 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.



STULZ Ultrasonic Advantages

• Maximum Energy Savings

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

• Lowest Electrical Wiring Costs

As the STULZ 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 STULZ Ultrasonic Humidifier is an adiabatic constant (enthalpy) 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. STULZ Ultrasonic Humidifiers have no water loss.

• Clean Humidification

Deionized (DI) 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 module/transducer is independently wired, thus if one fails, redundancy is achieved through the other modules.

• Excellent Control Features

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

• Very Fine Mist

STULZ 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 STULZ Ultrasonic Humidifier are made from high-quality, stainless steel 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 STULZ Ultrasonic Humidifier needs only 7% of the power required by an electrode steam humidifier. Assuming a humidification requirement or 20 lbs/hr., a DAH-16 has a power requirement of 0.495 kW at 21.1 lbs/hr. Using a comparable capacity steam electrode type humidifier, the power requirement is 6.8 kW at 20 lbs/hr, which is an energy savings of approximately 93%.

In a typical application, the yearly humidification requirement is approximately 2500-3000 hrs.
At a $0.08 per KWH utility rate:

Ultrasonic yearly **power requirement**.....	=	3,000 hrs x 0.495 kW
	=	1,485 kWH
Yearly electrical **energy cost**	=	1,485 x $0.08/kWH
	=	$118.80
Steam electrode yearly **power requirement**.....	=	3,000 hrs x 6.8 kW
	=	20,400 kWH
Yearly electrical **energy cost**	=	20,400 kWH x $0.08/kWH
	=	$1,632
Yearly electrical energy savings.....	=	**$1,513.20**

STULZ Ultrasonic Humidifiers

STULZ Ultrasonic Humidifier Model Nemneclatures

DAH Series

From 5.3 to 39.6 lb/hr (& Up)*
Duct Mounted and Rack Mounted
In Air Handling Units

DRH Series

From 4.4 to 17.6 lb/hr (& Up)*
Stand-Alone Wall or Shelf Mounted

DAH- 04-S

DAH = DUCTED AIR HUMIDIFIER
DRH = DIRECT ROOM HUMIDIFIER

NUMBER OF TRANSDUCERS

A = AUXILIARY TRIM
S = STANDALONE (NO ULTRA-SERIES CONTROL)
Blank = STANDARD ULTRA-SERIES CONTROL

*** Multiple humidifiers per control zone, typical for all.**

ULS- 4- DAH-08-

ULS = ULTRA SERIES CONTROL BOX
UXS = ULTRA SERIES AUXILIARY BOX
ULT = ULTRA SERIES TRIM CONTROL BOX
UXT = ULTRA SERIES TRIM AUXILIARY BOX

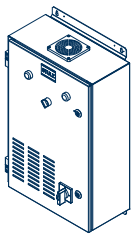
MODEL # OF HUMIDIFIERS TO BE CONTROLLED

NUMBER OF HUMIDIFIERS TO BE CONTROLLED

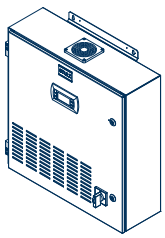
Examples:
ULS-6-DRH-08 = Ultra series control box, (6) humidifiers, Model DRH-08

UXT-4-DRH-08-A = Trim auxiliary box, (4) humidifiers, Model DRH-08-A

Controls

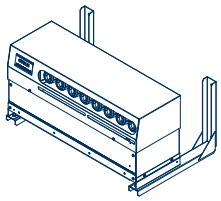


On/Off A-Series Controls

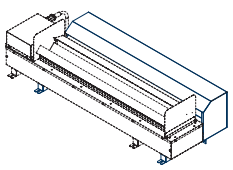


Proportional Ultra-Series Controls

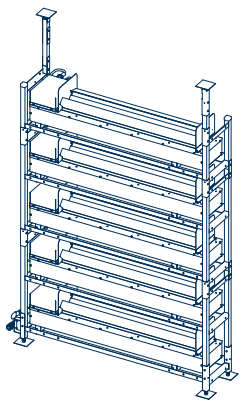
Accessories



Wall Mounting Brackets (DRH Series Humidifiers)



Add-on Booster Fans (DAH Series Humidifiers)



Mounting Racks (DAH Series Humidifiers)

DAH Series

The DAH Series STULZ Ultrasonic Humidifier is designed for use with central station Air Handling Units (AHU) and can be located conveniently in the air stream ductwork or rack mounted within the AHU itself.

General Application Parameters For All Types of STULZ Ultrasonic Humidifiers

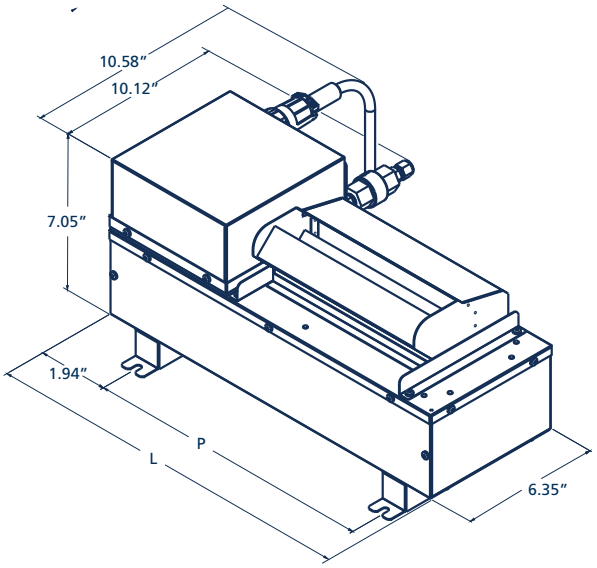
- Humidifier must be installed in a level horizontal position
- The operating air temperature range of humidifier is 34°F to 122°F.
- The operating air relative humidity range of humidifier is 90%
- Water pressure operating range at the inlet of humidifier is 30 psi to 75 psi.
- Inlet water temperature operating range is 40°F to 104°F.
- For dust-free humidifier mist generation, inlet water is to be demineralized by mixed cation/anion resin bed deionization to a 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. Check building code requirements.
- 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. Allowable voltage range at humidifier: 46 VDC to 51 VDC.
- 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 Control Section for information regarding maximum quantity of humidifiers possible per system based on options selected and system wiring requirements.
- To minimize voltage drop, wire gauge between control box and humidifier is dependent on model of humidifier and length of wire run. Refer to Controls Section for proper selection.
- Follow all local, state, and federal electrical and safety guidelines.

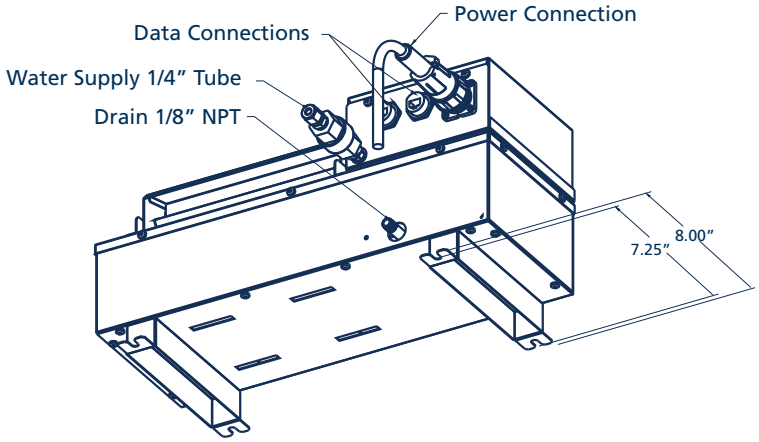
Application Parameters For Ducted and Air Handling Unit (AHU) Systems

- The STULZ Ultrasonic Type DAH Ultrasonic Humidifier is designed to be installed directly in air distribution ductwork or AHU
- The DAH type humidifiers are intended to be used only in horizontal air moving systems.
- Installation should allow for air flow around top, bottom and both sides of humidifier.
- Size the duct section housing the humidifier for air entering and downstream velocity of 300 to 600 fpm. Terminal velocity at the humidifier should be designed for 450-750 fpm. Refer to Table on next page for specific model cross sectional areas for calculation of terminal velocity.
- Use of STULZ Ultrasonic Booster Fan is recommended for terminal velocities below 300 fpm.
- Multiple humidifiers should be installed in vertical or side-by-side arrangement.
- STULZ vertical, stainless steel Rack Systems provide a single point water connection (up to 5 humidifiers per single point connection).
- A cascade arrangement may also be used, i.e. the uppermost humidifier to be closest to the entering air stream. See diagrams on following pages for recommended clearances.
- Cascade arrangement provides reduced humidifier cross sectional area for each humidifier plane when calculating terminal velocity. Provision for mounting of humidifiers in cascade arrangement by others.
- Do not locate one humidifier directly in front of another in direction of air stream.
- A stainless steel drain pan should be installed in such a manner that it is directly under the humidifier and extends two feet downstream past discharge side of lowest humidifier. A stainless steel duct section with drained/panned bottom may also be used. The pan is provided for incidental carryover and is not an "active" component of the humidifier system.
- To minimize potential for moisture impingement when ideal air temperature/humidity and velocity conditions are not met or are unknown, it is recommended that the humidifiers be installed at least 10-12 feet upstream from any turns, duct liner or obstructions in the ductwork (absorption distance).
- In cases where shorter absorption distances are desired due to space limitations, consult factory or your local STULZ Representative for assistance. The absorption distance is dependent on entering air velocity, air turbulence, and dry bulb/wet bulb temperatures. If duct design does not provide a distance allowing for full absorption, a mist eliminator may be applied.
- Laminar airflow throughout the humidification section should be provided for optimum operation.
- Where turbulent air is expected in the humidification section, use of field furnished perforated sheet metal serving as an equalizing grid or individual humidifier air deflectors applied upstream of humidifiers may alleviate potential for impingement on duct surfaces.
- An access door in the duct or AHU should be provided adjacent to the humidifier for service. The door may be furnished with viewing window to visually monitor operation of humidifier.
- High humidity (hi-limit) sensor is recommended to control humidity level in conditioned air and to reduce potential for oversaturating (wetting). Locate hi-limit downstream of humidifier beyond the range of complete mist absorption.
- A fan interlock or air proving device must be provided to ensure the humidifier will not operate when air flow is not present in air moving system.

Duct & Air Handling Unit Mounted

DAH-04 thru 16



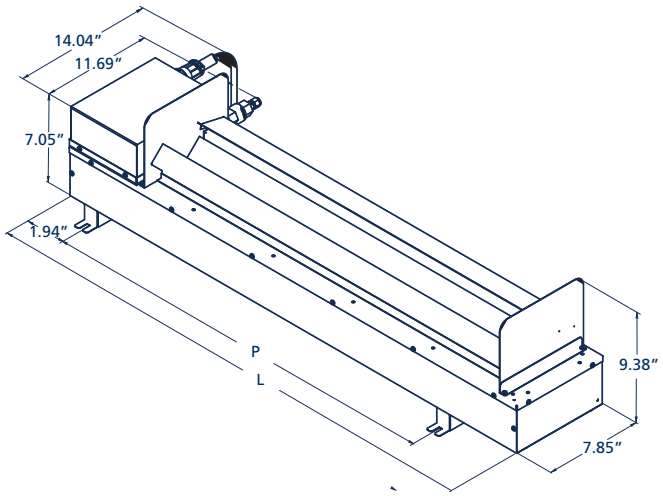


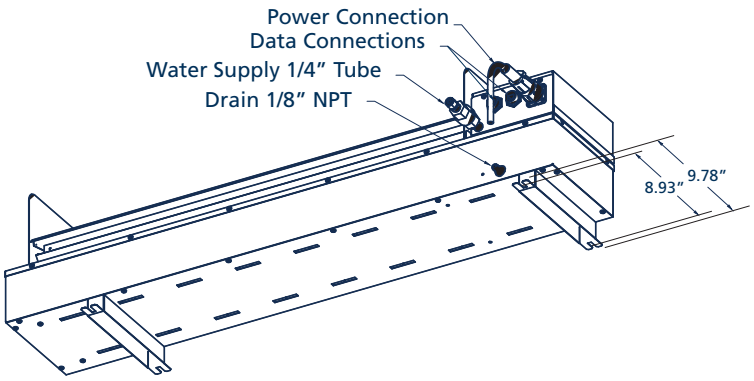
DAH TYPE
UL Listed - for Duct or Air Handling Unit Installation

Humidifier Model	Capacity (lbs/hr)*	Weight (lbs)	Number of Nebulizer Units	Dimensions Inches		Cross Section (ft^2)
				"L"	"P"	
DAH-04	**5.3**	15.4	4	16.97	13.00	0.98
DAH-08	**10.6**	21.7	8	25.71	21.75	1.48
DAH-12	**15.8**	28.0	12	34.46	30.50	1.99
DAH-16	**21.1**	34.3	16	43.21	39.24	2.49
DAH-24	**30.8**	37.5	24	34.46	25.68	2.54
DAH-30	**39.6**	44.1	30	41.02	32.24	3.02

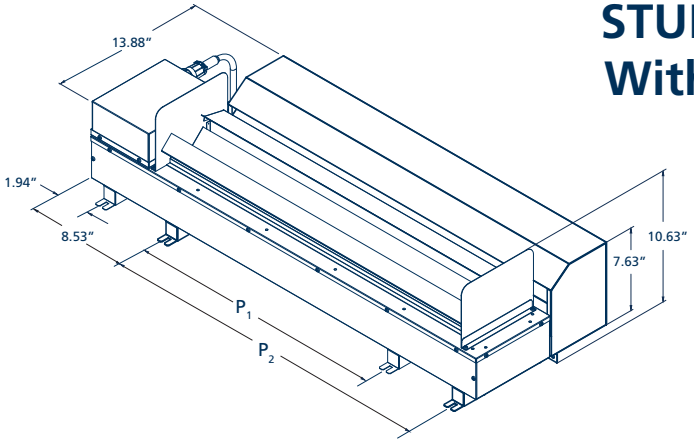
*Note: Capacity based on terminal velocity and may vary.

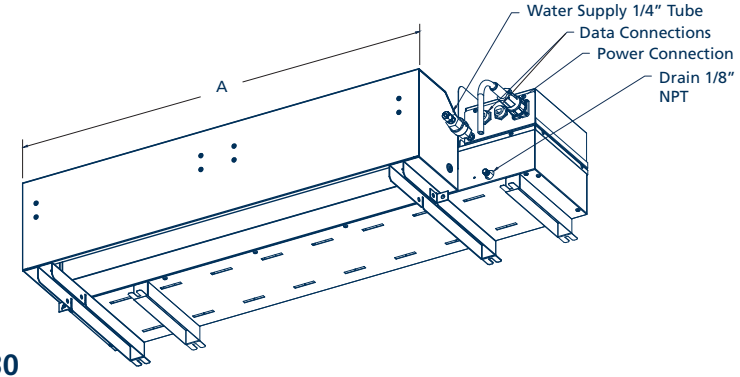
DAH-24 & DAH-30





STULZ Ultrasonic DAH With Booster Fan (BF)





Optional Booster Fan for DAH 24/30
(Use when air velocity is less than 300 fpm)

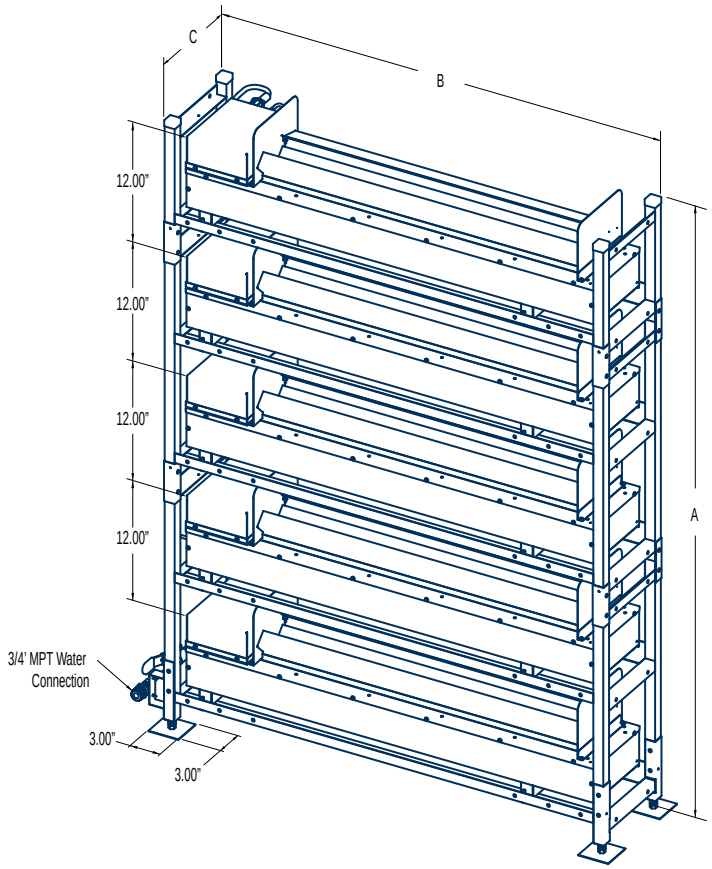
Model	Air Volume (CFM)	Weight (lbs)	Dimensions Inches		
			P_1	P_2	A
BF-24	235	11.0	17.30	25.68	27.77
BF-30	235	13.2	23.86	32.24	34.33

STULZ Ultrasonic Mounting Racks

Single piece rack with single-point water connection. Modules available up to 5 tiers high. Over 5 tiers require field coupling and additional water hookup.

A-Dimensions Inches	Min	Max
1 Tier	13.0	17.0
2 Tier	25.0	29.0
3 Tier	37.0	41.0
4 Tier	49.0	53.0
5 Tier	61.0	65.0

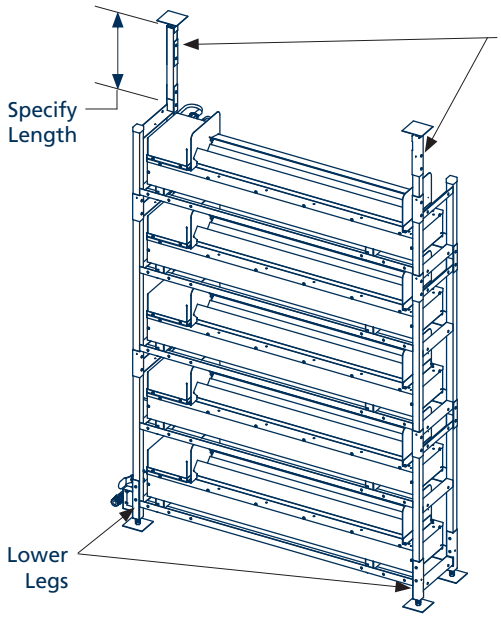
Note:
Height in table includes adjustable legs at bottom, standard. Reduce height 1.0" with legs removed. Stabilizer legs are available for mounting between top of the rack to ceiling of AHU duct (next page).



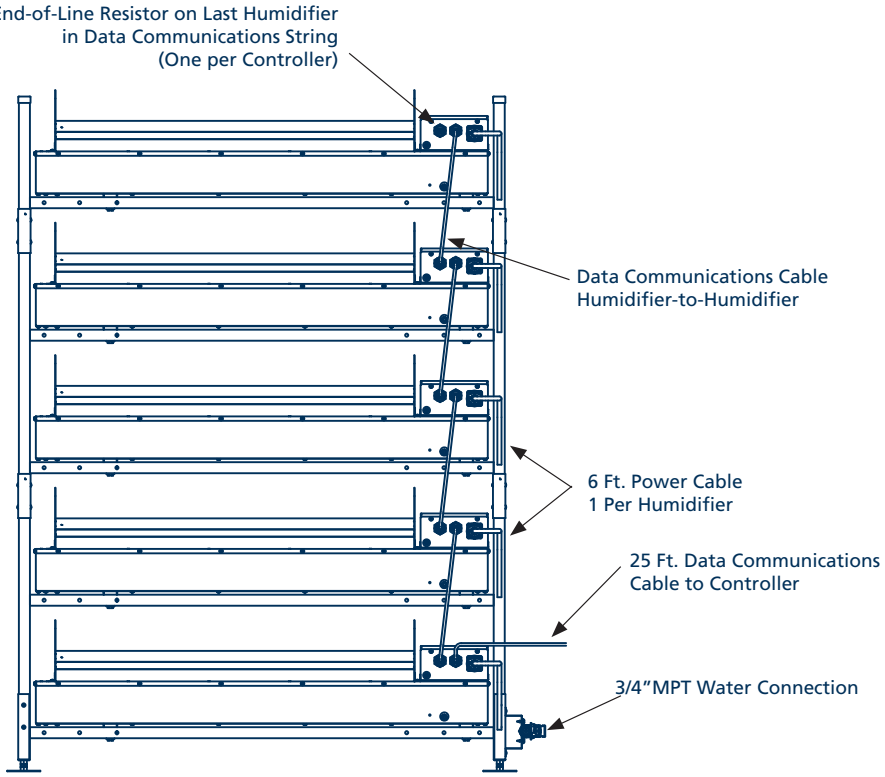
Model	B- Inches	C- Inches
DAH-04 & 08	36.0	8.5
DAH-12 & 16	46.0	8.5
DAH-24, & 30	44.0	10.0

Adjustable Stabilizer Legs

Optional adjustable legs are field installed at two diagonal corners on top of the mounting rack to stabilize the rack against the ceiling of the duct. Specify required length from top of rack (with lower legs fully extended) to ceiling of duct.



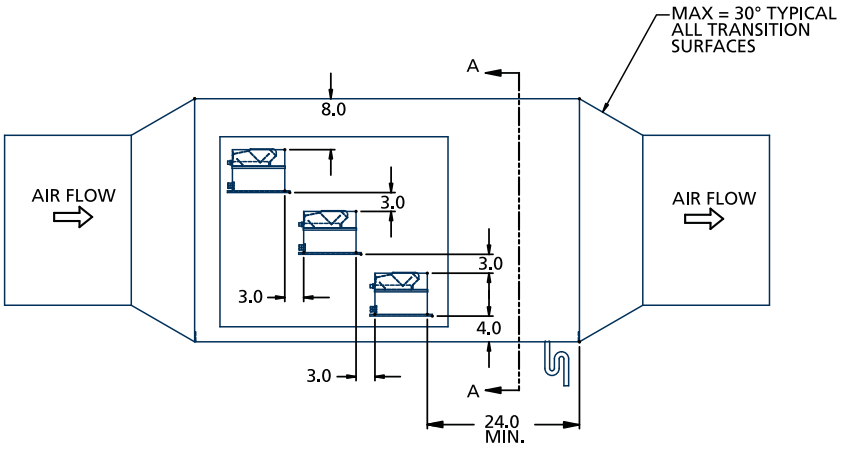
Multiple Humidifier Power and Data Communications Wiring

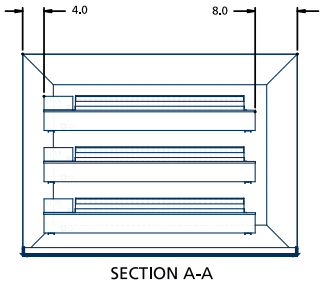


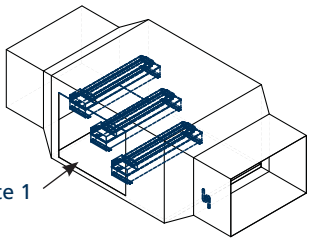
Mounting Rack Rear View

DAH-Series Humidifiers
Duct Mounted Recommended Installation

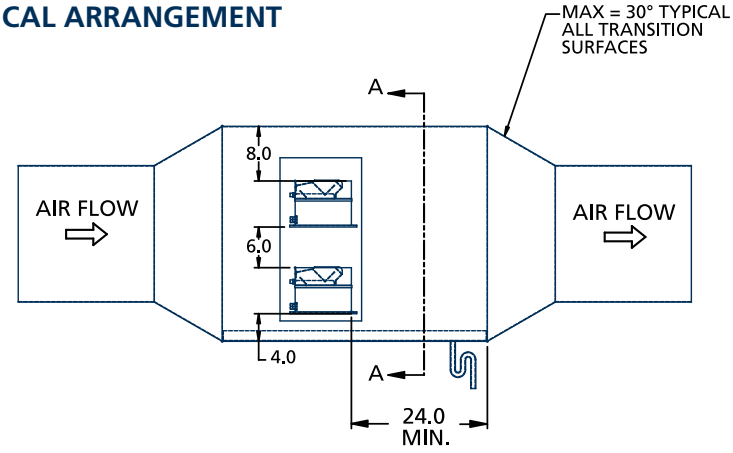
CASCADE ARRANGEMENT

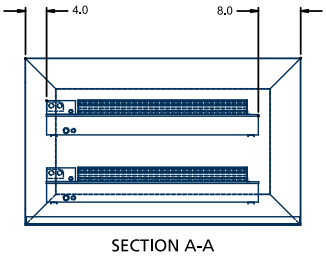


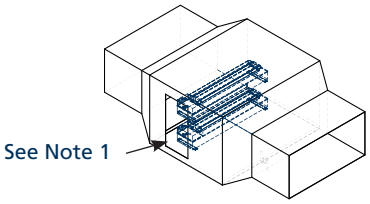




VERTICAL ARRANGEMENT

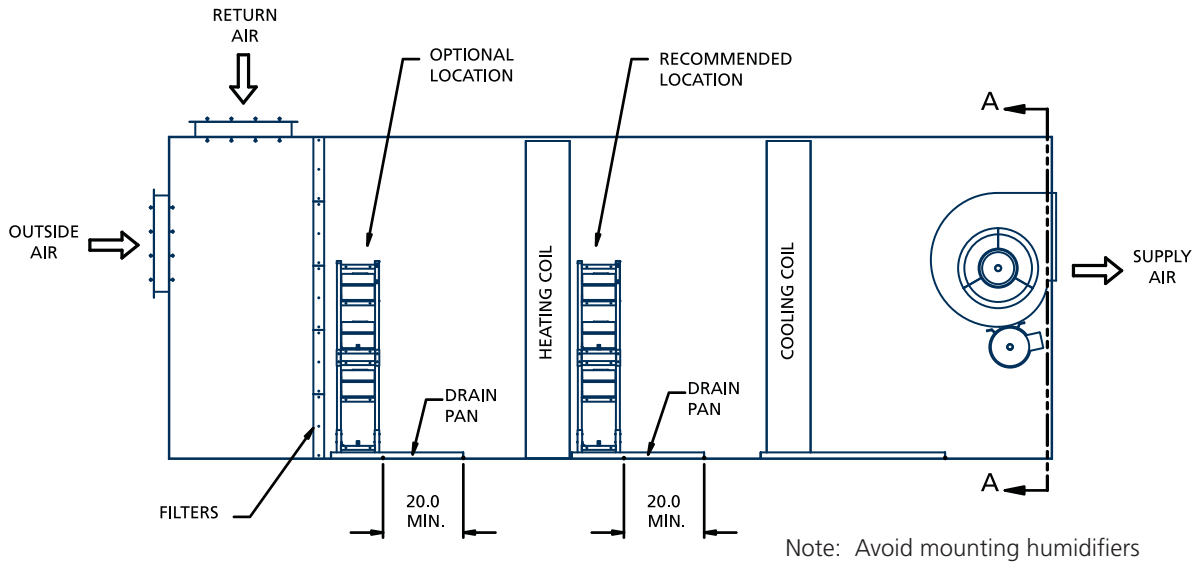




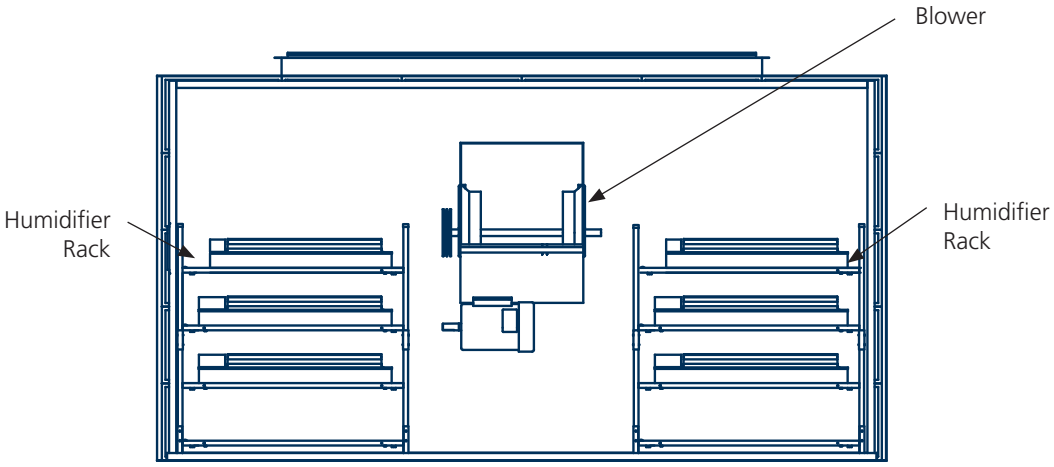


Note 1: **Provide access panel sufficient for units to be removed.**

DAH-Series Humidifiers
Air Handling Unit Recommended Installation



Note: Avoid mounting humidifiers directly upstream of blower housing.



SECTION A-A

AHU Side Elevation

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. Stulz 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 970 btu/lb 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:

$$\Delta T\ (°F) = ((lbs/hr \times 970) / (cfm \times 1.08))$$

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 humidifier(s) 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. The table below may be used to assess DAH applications.

For DAH, 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 DRH, 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 DRH model to allow unrestricted path for absorption of mist onto the space.

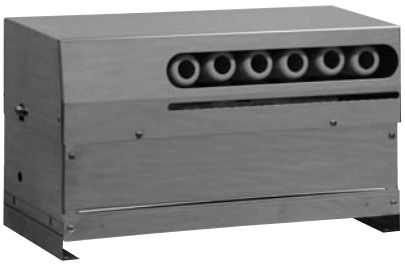
DAH Application Data				
System CFM		_____		CFM
Duct Cross section (HXW)		_____		ft²
Humidifier Model		_____		
Number of Humidifiers in airstream		_____		
Humidifier Cross section total		_____		ft²
Terminal Area (Duct cross section-Total humidifier cross section)		_____		ft²
Duct Velocity (CFM/Duct cross section)	(300-600 ft./min)	_____		ft./min
Terminal Velocity (CFM/Airstream Cross Section)	(450-750 ft./min)	_____		ft./min
Inlet air temperature to the humidifiers		_____		°F
Total system humidification		_____		lbs./hr.
Outlet air temperature from the humidifiers (Total system humidification * 1054)/ (CFM * 1.08)		_____		°F
Is a Booster Fan Being Provided for Low Terminal Velocity Application (under 450 ft./min)?		YES ☐	NO ☐	
Is there a minimum of 8 in of clearance between top of humidifiers and top of air handler/ductwork?		YES ☐	NO ☐	
Is there a minimum 4 in of clearance from bottom of air handler/ductwork and bottom of humidifiers?		YES ☐	NO ☐	
Is there a minimum of 4 in from connection side of the humidifiers and air handler/duct-work?		YES ☐	NO ☐	
Is there a minimum of 8 in from the right side (non-connection side) of the humidifier and the air handler/ductwork?		YES ☐	NO ☐	

DRH- Series
(Stand Alone - Ultrasonic Humidifiers)

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

General Application Parameters
For All Types STULZ Ultrasonic Humidifiers

- Humidifier must be installed in a level horizontal position.
- The operating air temperature range of humidifier is 34°F to 122°F.
- The operating air relative humidity range of humidifier is <75%.
- Optonal: 95% operating air relative humidity range available, consult factory.
- Water pressure operating range at the inlet of humidifier is 30 psi to 75 psi.
- Inlet water temperature operating range is 40°F to 104°F.
- For dust-free humidifier mist generation, inlet water is to be demineralized by mixed cation/anion resin bed deionization to a 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. Check building code requirements.
- 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.
- Allowable voltage range at humidifier: 46 to 51 VDC.
- 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.
- To minimize voltage drop, wire gauge between control box and humidifier is dependent on model of humidifier and length of wire run. Refer to Controls Section for proper selection.

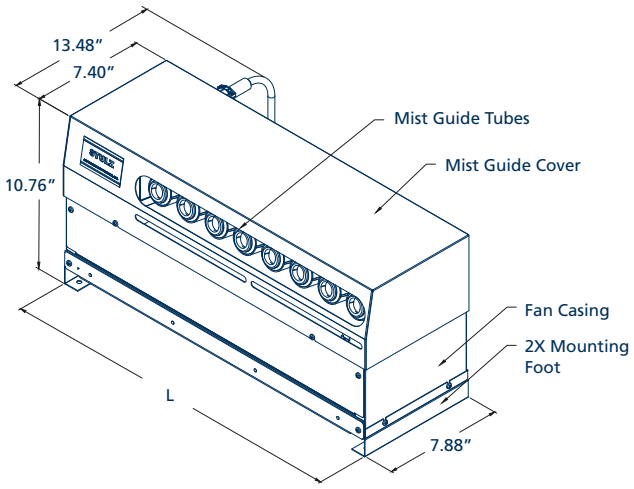


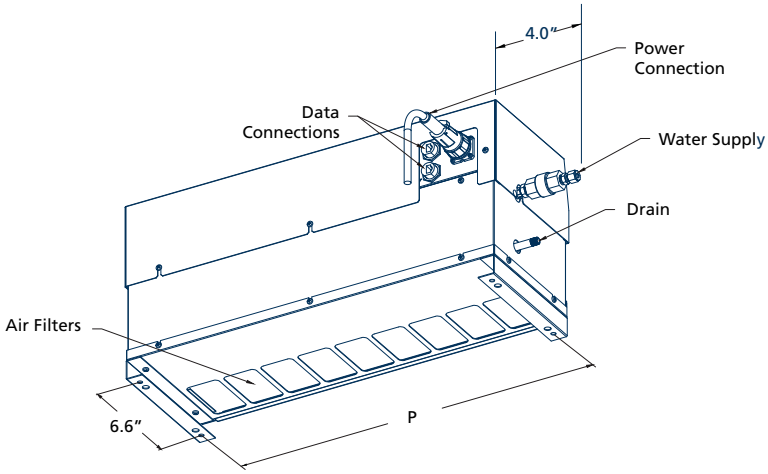
- Follow all local, state and federal electrical and safety guidelines.

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

- The STULZ Ultrasonic Type DRH 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 18 inches.
- 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 12 feet.
- To minimize mist blowing in the direction of personnel working in conditioned space, avoid humidifying directly over work areas. Install humidifier to discharge between work stations. Minimum distance from nozzle discharge to seated personnel in front of humidifier is 16 feet.
- Absorption distance varies with temperature and relative humidity of room air. Conditioned space with greater than 50% RH set point may require additional absorption distance.

DRH-Series

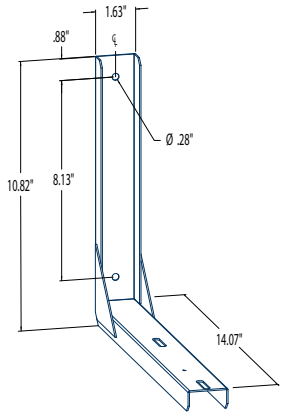




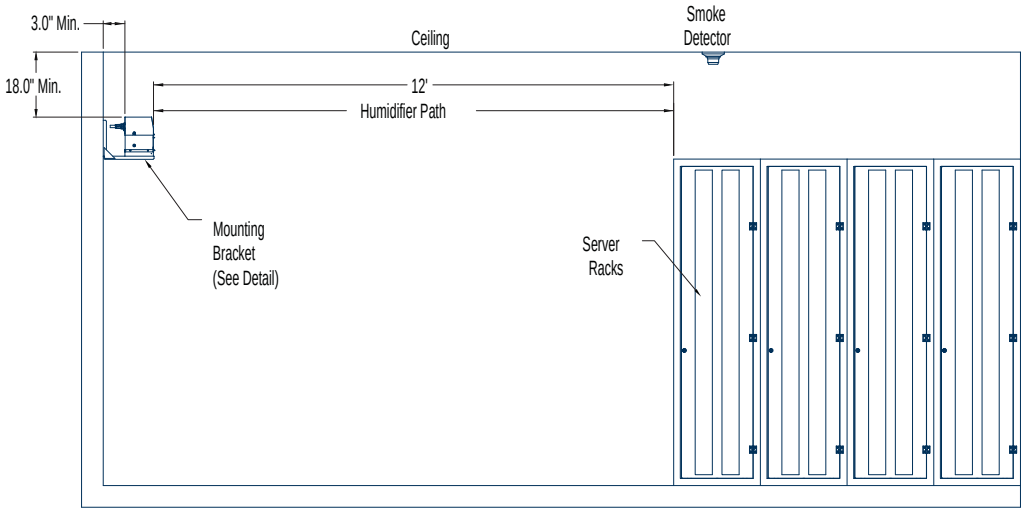
DRH Series
(UL Listed, Stand-Alone Humidifiers)

MODEL	Capacity (lbs / hr)	Weight (lbs)	Number of Nebulizer Units	Dimensions (Inches)		Rated CFM
				L	P	
DRH-04	4.4	19.8	4	14.20	13.31	59
DRH-06	6.6	24.3	6	18.51	17.63	82
DRH-08	8.8	30.9	8	22.83	21.94	91
DRH-16	17.6	50.7	16	40.07	39.19	182

DRH ROOM PLACEMENT DIAGRAM



Mounting Bracket Detail



General Specification

The humidifier unit shall be of a self-contained ultrasonic type operating on the principle of piezoelectric nebulization. The humidifier system will be comprised of humidifier unit and control box. Proportional control via variable input sensing device or external signal to the control box shall provide the primary humidifier control. The humidifier components shall be built to the highest engineering and manufacturing standards and shall be completely factory tested before shipment. The humidifier shall be described in the following specification and shall be manufactured by STULZ.

The main components of the STULZ Ultrasonic Humidifier unit shall be a water supply module; one or more nebulizing modules with piezoelectric converter (transducer), corresponding transducer printed circuit control board (print plate) and fitted nebula distribution device cover. The casing and distribution components shall be made of high-quality, stainless steel.

The water supply shall be strained for particulates and limited by a pressure compensating flow regulator that utilizes a flexible orifice to supply a constant flow rate across the full range of inlet line pressures. The water level in the unit shall be maintained by a solenoid valve. This valve is automatically controlled by two floats. One float senses high water level and the other senses low water level. The second serves as dry running protection. In the case of disruption of the water supply, overheating or detection of high mineral content levels in feed water supply, safety circuits shall shut off the humidifier. A heat sink dissipater shall be used to serve as temperature protection for the print plate and shall be located in the water tank of the nebulizing module.

The drain/overflow shall provide protection from overflow conditions. In addition, an internal solenoid valve shall provide for drain command from the internal controller and shall provide automatic drain if the humidifier is idle for 72 hours. Additionally, shorter drain-on-idle times may be set in the Ultra Series controller. A water filter shall be provided to prevent foreign materials from entering the system. When connected to a drain system, the plumbing shall include an air gap and conform to all local and national plumbing codes.

Each nebulizing module shall be equipped with two devices: a transducer print plate and a transducer. Each circuit shall use the "thickness vibration method" of humidification via the transducer. The transducer print plate shall generate electric high frequency energy in the oscillatory circuit and the transducer shall convert the electric energy into mechanical energy, causing the water particles to vibrate at high speed (cavitation) to produce high-energy vapor (nebula).

The nebula particles shall have an average diameter of 1 micron (0.001 mm). Any water particles of larger diameter shall be trapped by the nebula distribution device cover and collected back in the water tank. The vibrating frequency of the ultrasonic humidifier shall range from 1.65 to 1.75 MHz.

Nominal main power voltage to the control box shall be specified as 115/1/60, 208/1/60, 460/3/60, depending on number of humidifiers in the system and available power supply. Humidifier units shall operate from the control box with a nominal voltage of 48 VDC. Capacity output shall be 100% at 48 VDC supplied to the transducer. The ultrasonic humidifier shall have the capability to provide "instant on" and "instant off" operation for precise room humidity control.

Deionized water must be supplied to the ultrasonic humidifier in order to prevent any airborne mineral contaminants from being deposited into the room or air stream. The conductance of the deionized water shall be less than 5 microsiemens (purity).

Options:

- Booster fan for use in low-velocity air streams (model DAH only)
- AHU system vertical mounting rack (model DAH only)
- Wall-mounting brackets (designed for stand alone model DRH)

Code Conformance:

The humidifier unit shall be a UL recognized component. The supplied system shall be certified as meeting the following EMI compliance requirements:
EN-5501, EN-61000-3-3, EN61000-3-3, EN61000-6-1

Humidifier Control

All STULZ Ultrasonic Humidifiers require a UL Listed control box for each system providing power, component electrical protection, humidifier operation and alarm indication. Two types of control boxes are offered: A-Series On/Off and Ultra-Series Proportional. All control boxes have water quality monitoring as standard. The water quality monitoring is provided to ensure clean, mineral-free mist production. The control boxes are designed for indoor installation only.

A-Series control boxes are intended for single humidifier operation. For multiple humidifier groups, the Ultra-Series proportional control box is required.

A-Series On/Off control boxes are provided for a single humidifier per system.

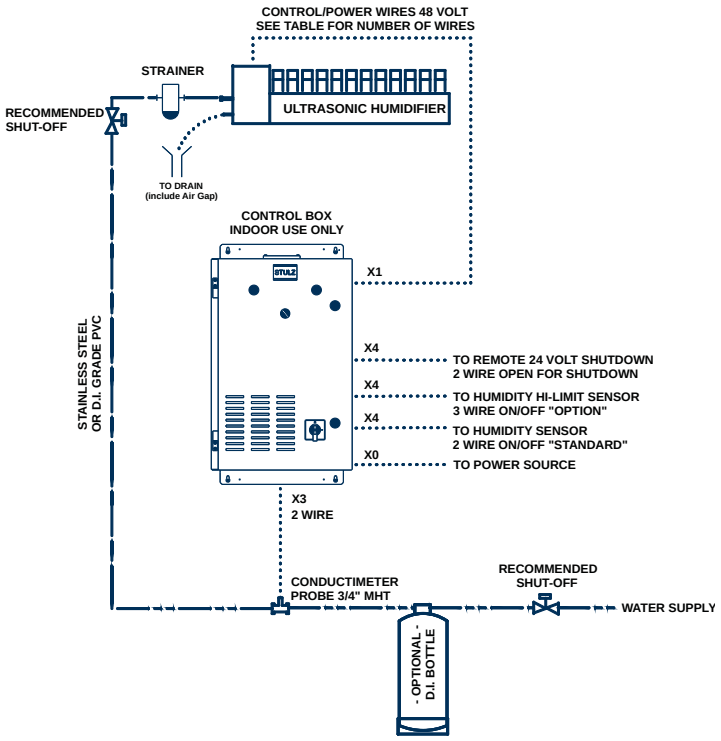
The A-Series On/Off control systems are supplied as standard with:

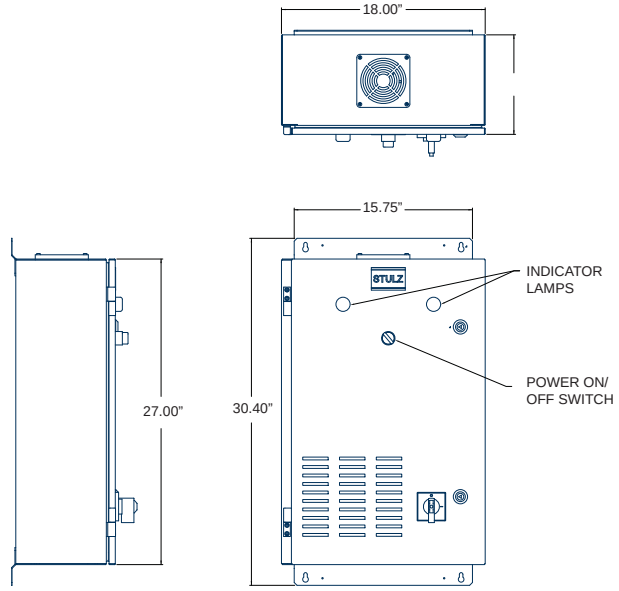
- Wall mount enclosure
- Rotary main power disconnect
- On/Off switch
- Component circuit protection
- 48 VDC power supply
- Humidifier contactor
- Conductivity circuit board
- Water quality indicator lights
- On/Off control humidistat (specify as wall or duct mount), ship loose
- Water quality probe, ship loose
- Remote shut down
- Cabinet thermostat controlled fan

Options include:

- Remote shut down dry contacts for remote indication of water quality alarms
- On/Off high-limit humidistat (specify as wall or duct mount), ship loose
- Air pressure proving switch, ship loose

A-Series Control System Diagram





Unit weight: 115 lbs

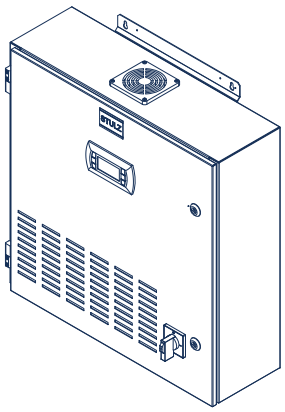
Humidifier Control

All STULZ Ultrasonic Humidifiers require a UL Listed control box for each system providing power, component electrical protection, humidifier operation and alarm indication. Two types of control boxes are offered: A-Series On/Off and Ultra-Series Proportional. All control boxes have water quality monitoring as standard. The water quality monitoring is provided to ensure clean, mineral-free mist production. The control boxes are designed for indoor installation only.

Ultra-Series

Proportional Control Boxes

The STULZ Ultra-Series Proportional control boxes are provided for single or multiple humidifiers per system. Each individual system is defined as the quantity of humidifiers controlled by one control input.



The Ultra-Series Proportional control systems are supplied as standard with:

- Wall mount enclosure
- Rotary main power disconnect with lockout feature
- Component circuit protection
- 48 VDC power supply, one per humidifier
- Proportional output control
- Microprocessor control board and backlit panel display/user interface
- Password protected menus
- Weekly timer and night setback function
- Remote start/stop
- Dry contact for remote indication of shut-down alarms
- Time stamping event log for 100 events
- Water conductivity probe. Ships loose.
- 4-20mA proportional humidity control sensor (specify as wall or duct mount). Ships loose.
- Cabinet thermostat controlled fan
- Proportional/Integral (P/I) control

The controller can accept the following proportional control signals from a Building Management System in lieu of the factory furnished sensor (Input 1):

0-5 VDC 0-1 VDC
0-20 mA 4-20 mA (Standard)
0-10 VDC with converter (Standard)

The controller can accept the following proportional high limit signals from a Building Management System in lieu of the factory furnished sensor (Input 2):

0-5 VDC 0-1 VDC
0-20 mA 4-20 mA (Standard)
0-10 VDC with converter (Standard)

Options include:

- Audible alarm
- Averaging control board for 2-4 sensors
- Temperature compensated control
- Capacity Assist control for groups of humidifiers
- Duct Proximity control for multiple humidifiers
- Serial port for remote BMS communication and control over ModBus RTU, BACnet MS/TP, BACnet over ethernet, BACnet over IP, HTTP, SNMP V1, V2c.
- Air pressure proving switch. Ships loose.
- Air velocity sensor
- On/Off high limit humidistat (specify as wall or duct mount). Ships loose.
- High RH limit sensor. Ships loose
- Water leak detector / Condensate pan detector

The Ultra-Series controller is capable of controlling up to 16 STULZ Ultrasonic Humidifiers per system. The control output is fully proportional from 0% to 100% call for humidification. Through pulse width modulation, all humidifiers are switched on and off, as segments of approximately one second, simultaneously dependant on the level of the control (Input 1) and high limit (Input 2, when used) inputs. A run hour meter is provided as standard function of the Ultra-Series controller to provide a sum total of time segments the humidifiers have operated. In conjunction with the built-in drain solenoid valves, the controller will drain the tank based on humidifier idle time. If a freeze alert condition exists, an automatic drain will initiate to protect the tank from freezing.

Information displayed during normal operation includes:

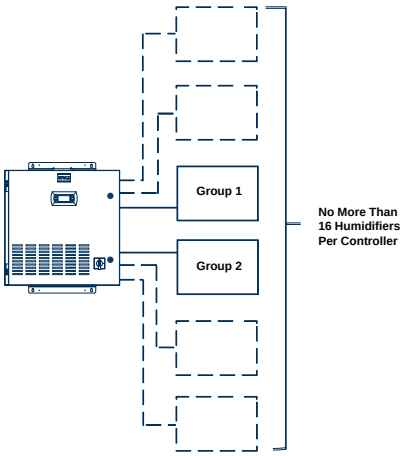
- Controller enabled via remote on/off
- General humidity production range: 0% - 100%
- Room or return duct humidity level (when control sensor is used)
- Control signal level (when BMS control is used)
- Humidity set point (when control sensor is used)
- Current alarm conditions
- Humidifier drain solenoid valve energized
- Humidifier fill solenoid valve energized
- Air velocity in duct (if configured)
- Room temperature (if configured)
- Duct temperature (if configured)

All shut-down alarms activate the standard, summary alarm dry contact for possibility of remote indication.

Multiple Humidifier Grouping

Ultra-Series controllers can be configured to provide 2 "Pulse Width Modulated" (PWM) output signals for two groups of humidifiers.

The 2 groups can be configured in three different ways: Standard, Capacity Assist and Proximity Limitation.



Multiple Humidifier Grouping

Standard Operation

In standard operation both humidifier groups receive identical output signals, and both humidifier groups function as one large group.

In proportional control, the Ultrasonic humidifiers require 48 volts DC and commands from the Ultra Series Controller. Communications is via an RS-485 interface daisy-chained from the Ultra Series Controller through each humidifier. The last humidifier on the daisy-chain requires a termination resistor included with the Ultra Series Control Box. Up to 16 ultrasonic humidifiers can be placed on this daisy-chain. The wiring is to be done with a three conductor 22 AWG shielded cable and cannot exceed 1000 feet.

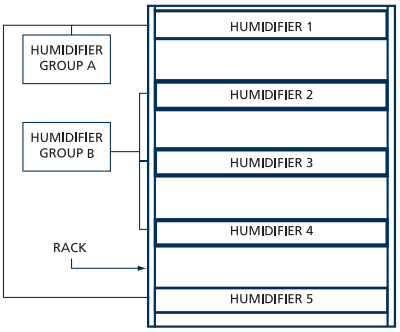
Power to the humidifiers is supplied by the Control Box and Auxiliary Boxes. The size of the humidifier controls the size of the power supply it needs. The Control Box and Auxiliary Boxes can hold as many as 8 power supplies for smaller humidifiers or 4 power supplies for larger humidifiers. The Ultra-Series Trim Control Box and Trim Auxiliary boxes can hold as many as 4 power supplies for smaller humidifiers or 2 power supplies for larger humidifiers. The location of each box can be optimized to be near the humidifiers powered from the boxes as the control of the humidifiers is done completely with the RS-485 interface. This minimizes wire runs from the boxes to the humidifiers, reducing both length and wire size. Each system must contain one Control Box and can have as many Auxiliary Boxes as needed.

Capacity Assist

This feature can be used to maximize efficiency for conservation of energy and allow more precise control of humidity production at low demand. The Capacity-Assist option enables one group of humidifiers to proportionally handle the demand for humidification up to their maximum capacity. If the output of the first group of humidifiers reaches 100% capacity and they are unable to satisfy the demand, the controller enables the second group of humidifiers to operate, controlling their output proportionally while the first group continues to operate at 100% capacity. As humidity conditions approach setpoint, the controller scales back the proportional output control signal to the second group accordingly until they are no longer required. At this point the humidifiers in the second group are turned off and the humidifiers in the first group return to proportional control.

Humidifier/Duct Proximity Limitation

The Proximity-Limitation option serves to limit the humidity production of the group of humidifiers that may be near the ceiling or floor of an AHU or in another position in which condensation losses may be common. In this case, the limited humidifiers would be in Group A and the standard operation humidifiers would be in Group B.
By default, both humidifier groups have identical output signals (Standard mode).



Proximity Humidifier Grouping

Control box size and type (wall or floor mount) are determined by the quantity of humidifiers per system. See table that follows for control box sizes.

The 48 VDC humidifier electrical power wiring between humidifier and control box must be sized according to the model of humidifier and the distance between humidifier and control box. See table on page 22 for wire gauge selection. All wire sizes listed are for stranded wire, either THHN or NTW. No solid wire is to be used. Insufficient electrical wire gauge will result in excessive voltage drop between control box and humidifier. Distances of over 75 ft. are not recommended.

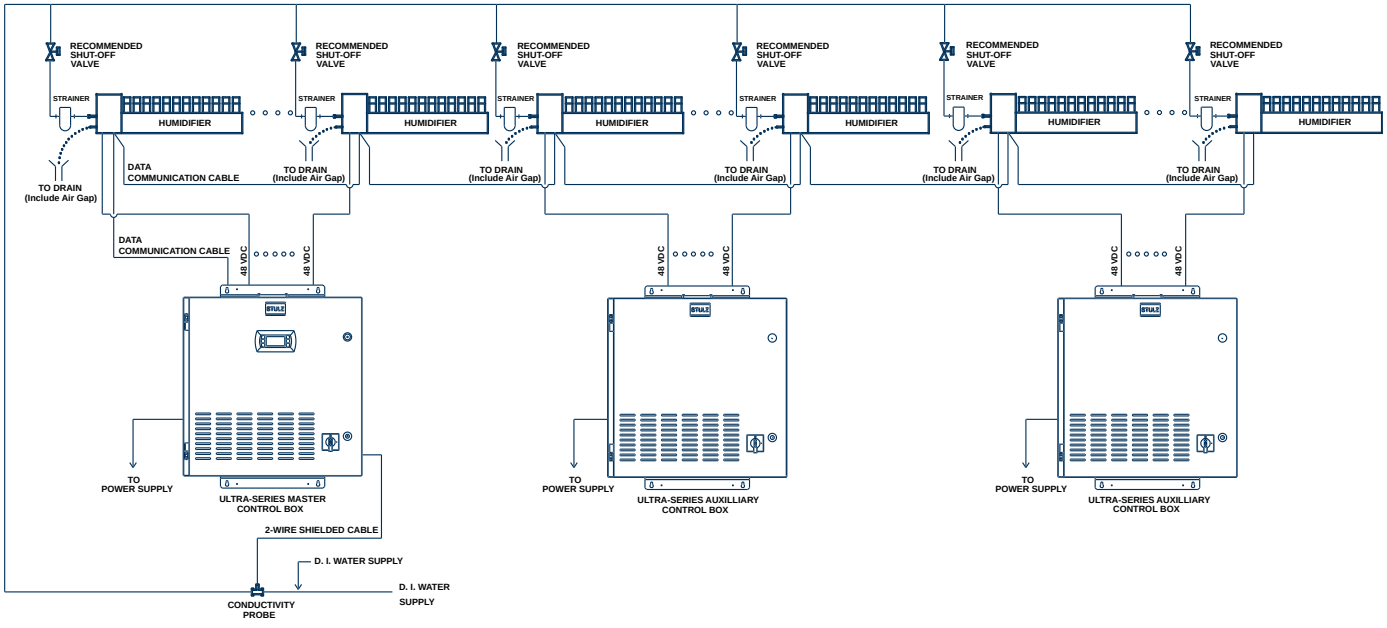
Water quality (mineral content) is expressed in a variety of measurements. The water quality specified for supply to STULZ Ultrasonic Humidifiers during normal operation is conductance of <5 microsiemens. The humidifier controller monitors water quality via the probe installed in the demineralized water supply piping. The controller will provide a visible alert when this water quality is not present by activating the pre-alarm status indicator. If water quality drops to conductance >20 microsiemens, the controller will shut-down humidifier operation and indicate via visible alert, common summary alarm dry contact closure (and audible alarm when option is provided). The unit is equipped with a 10 foot long, shielded control wire for the conductivity sensor. The conductivity circuit is sensitive to electromagnetic interference so the control wiring should not be run near high voltage wires. The length of the conductivity sensor control wiring should never exceed 25 feet.

Humidifier per Control Box Configurations

Power Source	Humidifier Model	Number of Humidifiers	Standard Control Box		Trim Control Box	
			Number of Control Boxes	Number of Auxiliary Boxes	Number of Control Boxes	Number of Auxiliary Boxes
1 Phase	D( )H-04 DRH-06	1 - 4	1	0	1	0
		5 - 8	1	0	1	1
		9 - 12	1	1	1	2
		13 - 16	1	1	1	3
	D( )H-08 D( )H-12 D( )H-16	1 - 2	1	0	1	0
		3 - 4	1	0	1	1
		5 - 6	1	1	1	2
		7 - 8	1	1	1	3
		9 - 10	1	2	1	4
		11 - 12	1	2	1	5
		13 - 14	1	3	1	6
		15 - 16	1	3	1	7
	DAH-24 DAH-30	1	1	0	1	0
		2	1	0	1	1
		3	1	1	1	2
		4	1	1	1	3
		5	1	2	1	4
		6	1	2	1	5
		7	1	3	1	6
		8	1	3	1	7
		9	1	4	1	8
		10	1	4	1	9
		11	1	5	1	10
		12	1	5	1	11
		13	1	6	1	12
		14	1	6	1	13
		15	1	7	1	14
		16	1	7	1	15
3 Phase	D( )H-04 DRH-06	1 - 4	1	0	1	0
		5 - 8	1	0	1	1
		9 - 12	1	1	1	2
		13 - 16	1	1	1	3
	D( )H-08 D( )H-12 D( )H-16 DAH-24 DAH-30	1 - 2	1	0	1	0
		3 - 4	1	0	1	1
		5 - 8	1	1	1	2
		9 - 12	1	2	1	3
		13 - 16	1	3	1	4

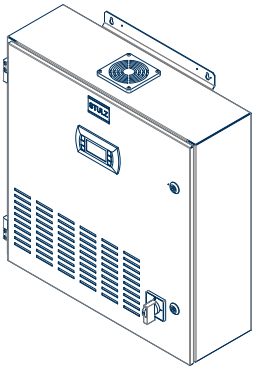
Note: See the following pages for control box dimensions.

Control + Auxiliary Box Sample Configuration

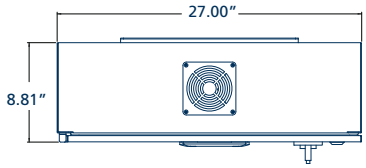


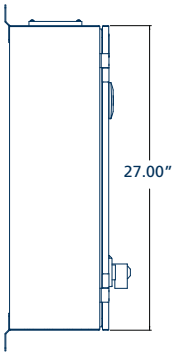
Ultra-Series Control Box

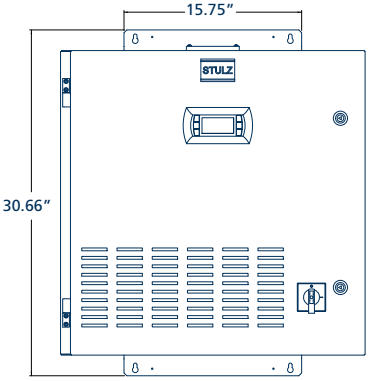
Ultra-Series Control Box (ULS)



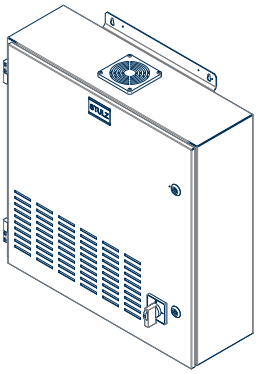
Unit weight: 250 lbs



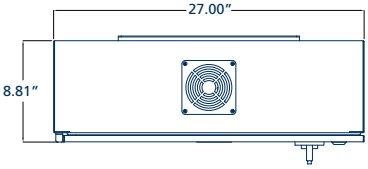


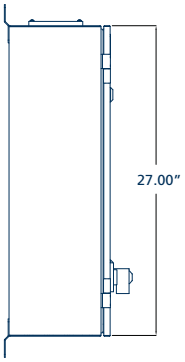


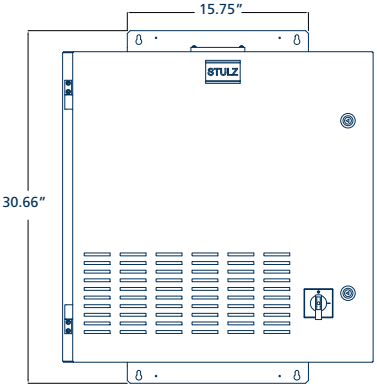
Ultra-Series Auxiliary Box (UXS)



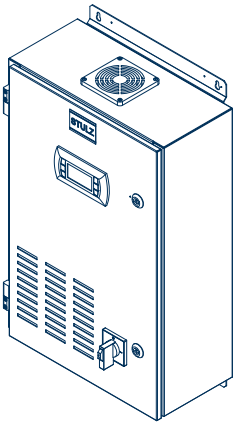
Unit weight: 250 lbs



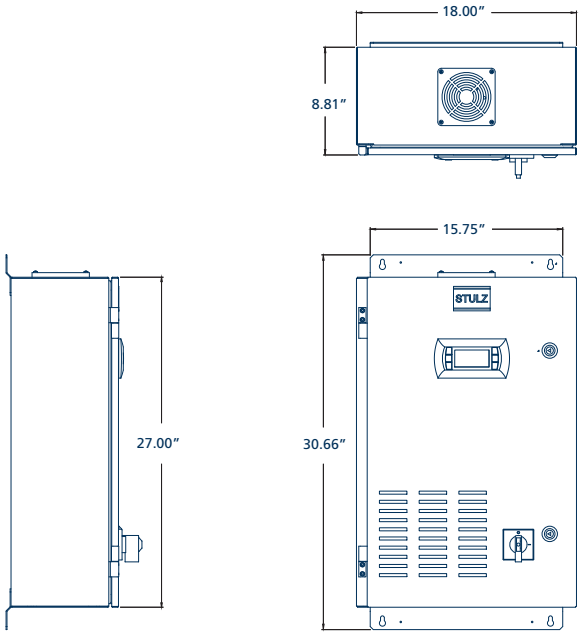




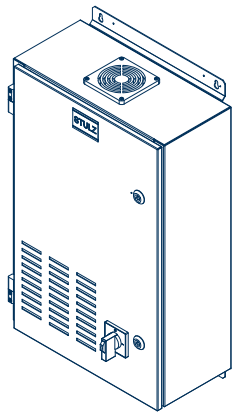
Ultra-Series Trim Control Box (ULT)



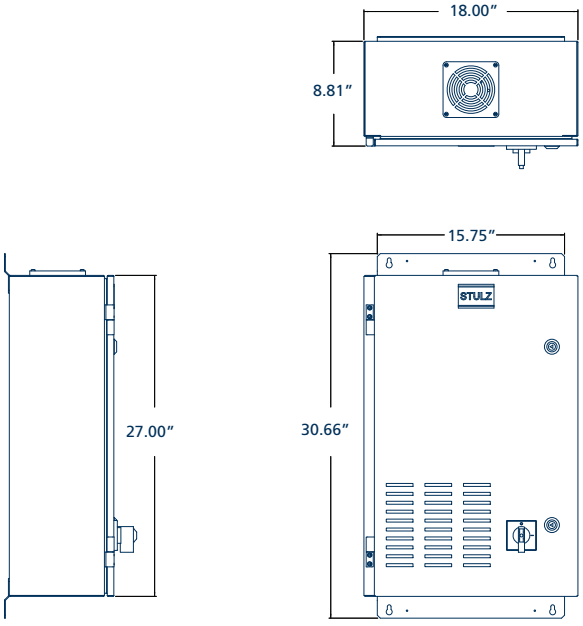
Unit weight: 115 lbs



Ultra-Series Trim Auxiliary Box (UXT)

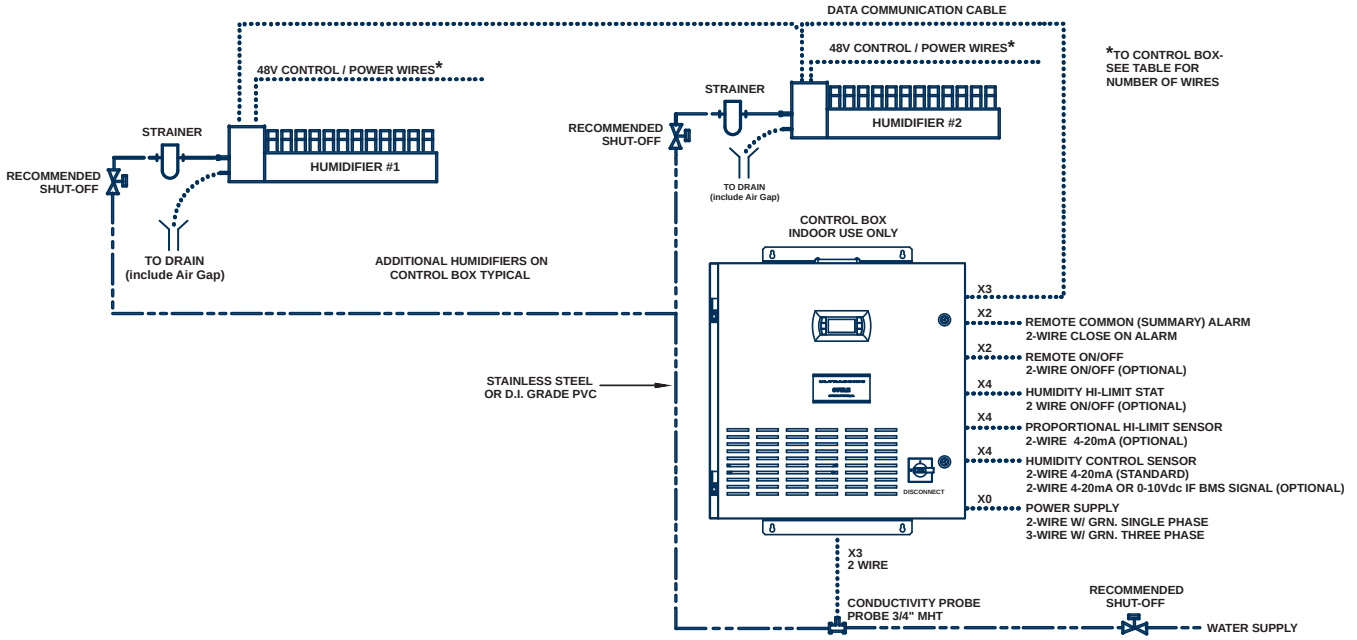


Unit weight: 115 lbs



Ultra-Series Control - System Diagram

Ultra-Series Control System Diagram



48 VDC WIRE SIZING FROM CONTROL BOX TO HUMIDIFIERS						
MODEL	POWER (WATTS)	CURRENT (AMPS)	WIRE SIZE (AWG)			# OF WIRES (Includes 1 Ground)
			25 FT	50 FT	75 FT	
DAH-04	125	2.6	16	16	14	3
DAH-08	246	5.0	16	16	14	3
DAH-12	366	7.6	16	14	12	3
DAH-16	486	10.1	16	14	12	3
DAH-24	726	14.6	16	14	12	5
DAH-24 w/ BF-24	766	15.4	16	14	12	5
DAH-30	906	20.0	16	14	12	5
DAH-30 w/ BF-30	946	20.8	16	14	12	5
DRH-04	134	2.8	16	16	14	3
DRH-06	195	4.0	16	16	14	3
DRH-08	256	5.3	16	14	12	3
DRH-16	505	10.5	16	14	12	3
*NOTE: Table reflects correct electrical wire sizing from the control box to the humidifiers for three different distances. All wire sizes are listed for stranded wire, either THHN or NTW only. No solid wire is to be used. **75 ft. maximum distance.**						

In addition to the above wires, humidifiers controlled by the Ultra-Series Controller require a 3 conductor shielded 22 AWG cable daisy chained from the control with a termination resister installed on the last humidifier, do not exceed 1000 feet total distance for this 3 conductor cable.

ULTRA-SERIES CONTROL ELECTRICAL DATA										
Humidifier Model	Quantity of Humidifiers Per Control Box	115/1/60			208/1/60			460/3/60		
		FLA	MCA	MFS	FLA	MCA	MFS	FLA	MCA	MFS
DAH-04	1	1.6	2.0	15	0.7	0.9	15	0.4	0.4	15
DAH-04	2	3.2	3.9	15	1.4	1.7	15	0.7	0.9	15
DAH-04	3	4.7	5.9	15	2.1	2.6	15	1.1	1.3	15
DAH-04	4	6.3	7.9	15	2.7	3.4	15	1.4	1.8	15
DAH-04	5	7.9	9.9	15	3.4	4.3	15	1.8	2.2	15
DAH-04	6	9.5	11.8	15	4.1	5.1	15	2.1	2.7	15
DAH-04	7	11.1	13.8	20	4.8	6.0	15	2.5	3.1	15
DAH-04	8	12.6	15.8	20	5.5	6.8	15	2.8	3.6	15
DAH-08	1	3.1	3.8	15	1.3	1.7	15	0.7	0.9	15
DAH-08	2	6.2	7.7	15	2.7	3.3	15	1.4	1.7	15
DAH-08	3	9.2	11.5	15	4.0	5.0	15	2.1	2.6	15
DAH-08	4	12.3	15.4	20	5.3	6.7	15	2.8	3.5	15
DAH-12	1	4.6	5.7	15	2.0	2.5	15	1.0	1.3	15
DAH-12	2	9.2	11.4	20	4.0	4.9	15	2.1	2.6	15
DAH-12	3	13.7	17.2	30	5.9	7.4	15	3.1	3.9	15
DAH-12	4	18.3	22.9	40	7.9	9.9	15	4.1	5.1	15
DAH-16	1	6.1	7.6	15	2.6	3.3	15	1.4	1.7	15
DAH-16	2	12.1	15.2	20	5.3	6.6	15	2.7	3.4	15
DAH-16	3	18.2	22.8	30	7.9	9.9	15	4.1	5.1	15
DAH-16	4	24.3	30.4	40	10.5	13.1	20	5.5	6.8	15
DAH-24	1	9.1	11.3	15	3.9	4.9	15	2.0	2.5	15
DAH-24	2	18.1	22.7	30	7.8	9.8	15	4.0	5.0	15
DAH-24	3							6.0	7.5	15
DAH-24	4							8.0	10.0	15
with BF-24	1	9.4	11.7	15	4.1	5.1	15	2.0	2.6	15
with BF-24	2	18.8	23.5	30	8.1	10.2	15	4.0	5.2	15
with BF-24	3							6.0	7.7	15
with BF-24	4							8.0	10.3	15
DAH-30	1	11.3	14.1	20	4.9	6.1	15	2.5	3.1	15
DAH-30	2	22.6	28.3	40	9.8	12.2	20	5.0	6.2	15
DAH-30	3							7.5	9.3	15
DAH-30	4							10.0	12.5	20
with BF-30	1	12.0	15.0	20	5.0	6.3	15	2.6	3.2	15
with BF-30	2	23.8	30	40	10.1	12.6	20	5.1	6.4	15
with BF-30	3							7.7	9.6	15
with BF-30	4							10.2	12.8	20
DRH-04	1	1.7	2.1	15	0.7	0.9	15	0.4	0.5	15
DRH-04	2	3.4	4.2	15	1.5	1.8	15	0.8	0.9	15
DRH-04	3	5.0	6.3	15	2.2	2.7	15	1.1	1.4	15
DRH-04	4	6.7	8.4	15	2.9	3.6	15	1.5	1.9	15
DRH-04	5	8.4	10.5	15	3.6	4.5	15	1.9	2.4	15
DRH-04	6	10.1	12.6	20	4.4	5.4	15	2.3	2.8	15
DRH-04	7	11.8	14.7	20	5.1	6.4	15	2.6	3.3	15
DRH-04	8	13.4	16.8	30	5.8	7.3	15	3.0	3.8	15
DRH-06	1	2.4	3.0	15	1.1	1.3	15	0.5	0.7	15
DRH-06	2	4.9	6.1	15	2.1	2.6	15	1.1	1.4	15
DRH-06	3	7.3	9.1	15	3.2	4.0	15	1.6	2.1	15
DRH-06	4	9.7	12.2	20	4.2	5.3	15	2.2	2.7	15
DRH-06	5	12.2	15.2	20	5.3	6.6	15	2.7	3.4	15
DRH-06	6	14.6	18.3	30	6.3	7.9	15	3.3	4.1	15
DRH-06	7	17.1	21.3	30	7.4	9.2	15	3.8	4.8	15
DRH-06	8	19.5	24.4	40	8.4	10.5	15	4.4	5.5	15
DRH-08	1	3.2	4.0	15	1.4	1.7	15	0.7	0.9	15
DRH-08	2	6.4	8.0	15	2.8	3.5	15	1.4	1.8	15
DRH-08	3	9.6	12.0	15	4.2	5.2	15	2.2	2.7	15
DRH-08	4	12.8	16.0	20	5.5	6.9	15	2.9	3.6	15
DRH-16	1	6.3	7.9	15	2.7	3.4	15	1.4	1.8	15
DRH-16	2	12.6	15.8	20	5.5	6.8	15	2.8	3.6	15
DRH-16	3	18.9	23.7	30	8.2	10.2	15	4.3	5.3	15
DRH-16	4	25.3	31.6	40	10.9	13.7	20	5.7	7.1	15

NOTE: Electrical data based on UL (508) requirements to indicate full component loading.

Controls - Guide Specification

A-Series Control Box (On/Off)

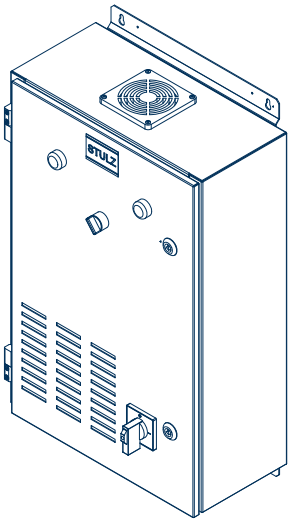
The STULZ Ultrasonic control box shall be the A-Series one step control type. The control box shall work with a wall or duct humidistat that will automatically turn ON or OFF the ultrasonic humidifier. A water conductivity measurement circuit board shall be provided and be integral to the control box. A conductivity probe shall ship loose and is to be installed in the water line supplying the humidifier and connected to the control box to monitor mineral content of feed water. The control box shall operate one humidifier.

Each A-Series control box shall contain a power supply, contactor, circuit breaker, fan, switch and lights necessary to control the humidifier system and shall be housed in an enclosure designed for indoor use only. The control boxes shall be UL listed as a complete assembly.

A-Series Options

- Wall or duct mount high limit humidistat
- Dry contact for remote annunciation of water quality alarm
- Air pressure fan proving switch

On/Off
A-Series Controls



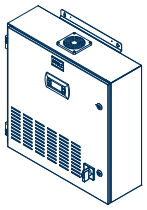
Ultra-Series Control Box (Proportional)

The STULZ Ultrasonic control box shall be the Ultra-Series proportional control type. The control box shall be equipped with a microprocessor-based ultrasonic controller which shall be used to monitor, operate and control the humidifier system. The controller shall have an LCD interface mounted on the door of the control box (optionally wall mounted) to continuously display current conditions and allow the user to change parameters. The control box shall operate the scheduled quantity of humidifiers.

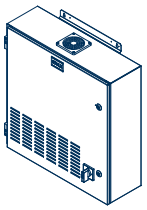
The controller shall take into account the specific features of ultrasonic humidification and control all outputs to meet those specific requirements. The microprocessor shall be capable of recording the humidity upstream and if provided for, downstream of the humidifying process via sensors. Alternatively, the controller shall operate in response to external analog signals in lieu of closed system sensors. The microprocessor shall be capable of monitoring water conductivity via a ship loose probe.

Proportional control is by pulse width modulation. Upon receiving a call for humidification, the microprocessor shall switch on the humidifiers for a time interval segment of one second, which is dependent on the strength of the control signal. The stronger the control signal, the longer the interval. Furthermore, the maximum output of the humidifier can be set at 100% or lower which further allows the user to customize the humidification output to meet the application requirements.

Proportional Ultra-Series Controls

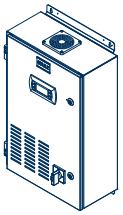


Standard (ULS) Control Box)

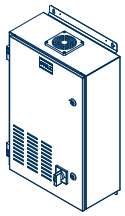


Auxiliary (UXS) Box
(Not always required.)

Proportional Ultra-Trim Controls



Trim (ULT) Control Box



Trim Auxiliary (UXT) Box
(Not always required.)

Auxiliary boxes shall be used to locate power supplies near the humidifiers to maintain the maximum wire length requirement and to provide power for additional humidifiers when the capacity of the control box is exceeded.

All alarms, outputs, displays and signals associated with the microprocessor are listed below for reference. All points may not necessarily be utilized depending on the configuration of the system. Each control box contains a transformer, power supplies, contactors, circuit breakers, switches and fan necessary to control the humidification system and shall be housed in enclosures designed for indoor-use only. The microprocessor shall be password-protected to ensure against unauthorized change of parameter settings. The control boxes shall be UL listed as a complete assembly.

CONTROL ALARMS, DISPLAYS AND SIGNALS

Alarms

Water Conductivity Pre-alarm
Water Conductivity Alarm
High Humidity
Low Humidity
Sensor Input Alarm
Low Temperature
Water Leak Detection
Low Air Flow
High Air Flow
Control Enclosure High Temp.
Summary Alarm
User Configurable Alarm
High Temperature

Displays

Actual Humidity
Humidity Setpoint
Current Capacity Output %
Fill Cycle
Drain Valve Activated
Unit Output %
Flush Cycle Frequency
Weekly On/Off Timer
High Humidity Alarm Setpoint
Low Humidity Alarm Setpoint
Room Temperature (If configured)
Duct Temperature (If configured)
Air Velocity in Duct (If configured)
Conductivity of Water
Freeze Alarm (if configured)

Outputs

Summary Alarm
User Configurable Alarm
Cabinet Cooling Fan
ModBus Communications to Humidifiers

Inputs

Possible input signals from control sensor or an external controller:

0-5 VDC
4-20 mA
0-20 mA
0-1 VDC
0-10 VDC (with optional converter)

Ultra-Series Options

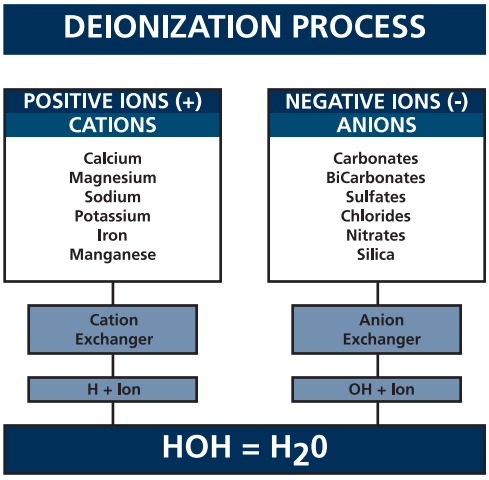
- Serial port for remote BMS communication and control over pLAN, ModBus RTU, BACnet MS/TP, BACnet over ethernet, BACnet over IP, HTTP, SNMP V1, V2c
- Duct or wall mount high limit analog humidity sensor
- Duct or wall mount on/off high limit humidistat
- Air pressure fan proving switch
- Return temperature / humidity sensor (dewpoint)
- Remote temperature / humidity sensor for temperature / humidity dewpoint limit
- Air velocity sensor/transmitter
- Water Leak Detector(s)

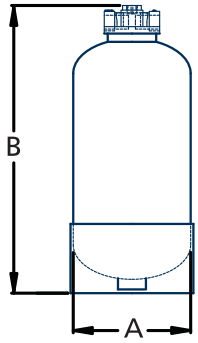
Water Treatment (Demineralization)

Raw water contains minerals. When water is atomized, any minerals present in the water will not evaporate and will drop out of the air as fine dust. While ultrasonic humidifiers will operate with raw water, there is a maintenance and IAQ benefit in the use of demineralized water. In order to provide clean, mineral-free humidification, it is recommended that all STULZ Ultrasonic Humidifier systems incorporate water demineralization.

Principles of Demineralization

There are two types of demineralization processes presented in this manual: Mixed Bed Deionization (DI) and Reverse Osmosis (RO). RO systems defined in this manual include DI as a polishing step to achieve the specified water purity.





D.I. BOTTLE DIMENSIONS		
Capacity (CUBIC FT)	Diameter "A"	Minimum Clearance "B"
0.45	8.0"	21.0"
1.0	9.0"	48.0"
2.0	12.0"	48.0"

Mixed Bed Deionization

Mixed Bed Deionization (DI) is a method used for the removal of all ionized organic and inorganic minerals and salts from water, using a concurrent ion exchange procedure. The positively charged ions are removed by cation exchange resin in exchange for a chemically equivalent amount of hydrogen ions. The negatively charged ions are removed by anion exchange for a chemically equivalent amount of hydroxide ions. The hydrogen and hydroxide ions introduced in this process unite to form deionized water molecules. (See illustration left.) The mixed bed DI resin is housed in plastic bottles and has a nominal mineral removal capacity of 10,000 grains. When the mineral removal capacity of the resin has been exhausted, the bottles are exchanged out with bottles containing new or regenerated resin as part of a service interval. DI regeneration is a common service available in most areas. Contact your local STULZ representative for a list of water service companies in your area.

Reverse Osmosis

Reverse Osmosis (RO) is a crossflow membrane separation process. RO removes virtually all organic compounds and 90 to 99 percent of all ions. RO rejects 99.9 percent of viruses, bacteria and pyrogens. Pressure, on the order of 200 to 1,000 psig (13.8 to 68.9 bar), is the driving force of the RO purification process. Complete RO systems are made up of multiple components.

RO/DI systems include as standard:

- Carbon dechlorinator
- Sediment filter
- Softener
- RO plant
- RO water storage
- Repressurization (for atmospheric storage only)
- DI polishing
- Resilite water purity monitoring
- Ultraviolet (UV) sterilization

Water Purity

The demineralized water specified for use in STULZ Ultrasonic Humidifiers has conductivity less than 5 microsiemens (resistivity greater than 200,000 ohms). See the STULZ Water Treatment Technical Documentation CD for conversions between all common expressions of water purity. Water purity (conductance) monitoring is standard with all STULZ Ultrasonic control boxes.

Water Piping

Demineralized water piping is to be of non-corrosive material, either plastic or stainless-steel. Refer to local codes and project requirements for selection of specific piping material and schedule.

Water Treatment Options

Mixed Bed Deionization (DI) For Small Capacity

For total humidifier capacities up to 50 lb/hr and raw water quality of fewer than 10 grains per gallon, mixed bed deionization may be used. The raw untreated water is passed through one or two mixed bed DI bottles to obtain the required water quality for operating ultrasonic humidification systems. The quantity and size of bottles are determined by total humidifier capacity, seasonal hours of operation, raw water quality and desired service intervals. See DI Bottle Life Analysis Calculation on page 8-3 to determine if DI-only is sufficient. Larger bottles and/or two bottles in series can be used to increase total DI media capacity. For critical DI-only applications, two bottles should be used in series with an intermediate water purity indicator to alert that service is required on first bottle, (worker) prior to second bottle (polisher) being exhausted. If the desired service intervals cannot be met with DI-only, an RO/DI system should be applied.

Demi-Cabinet Deionization For Small Capacity

The Demi-Cabinet system consists of two DI bottles connected in series pre-piped with flexible hoses and housed in a painted-finish, steel cabinet with a lockable, hinged, access door. A water shut-off valve is factory pre-piped in the supply side piping to the DI bottles. A 115v-120v / 60 hz / single phase water quality monitor for visual water quality indication shall be factory mounted. Water inlet and outlet connections are made available from the outside of the DI cabinet. The Demi-Cabinet does not require a utility drain connection.
STULZ Demi-Cabinet systems are available in the following sizes:

DI-.45 – Two .45 cubic ft. bottles (9,000 grains TDS capacity)
DI-1.0 – Two 1.0 cubic ft. bottles (20,000 grains TDS capacity)
DI-2.0 – Two 2.0 cubic ft. bottles (40,000 grains TDS capacity)

Reverse Osmosis (RO) / DI Systems for Large Capacity

For total humidifier capacities greater than 50 lb/hr or for applications requiring increased service frequency due to hours of operation and/or poor raw water quality, RO with DI polishing is applied. There are two types of complete systems offered and defined by method of water storage and product water pressurization.

Hydropneumatic (Pressurized) vs. Atmospheric (Re-Pressurized) Water Storage

When applying RO/DI systems, proper storage/system pressurization must be selected.

A. Pressurized storage utilizes the pressure generated by the RO plant within the system to provide for DI water distribution. The RO process water is stored in a hydropneumatic tank. Control of the RO plant is via pressure switch on distribution side set at 30 psi-On and 50 psi-Off. Pressurized storage systems are designed for localized applications with DI water distribution losses of less than 20 feet of head. Pressurized storage minimizes water system floor space and cost.

B. Atmospheric storage utilizes a large volume non-pressurized tank and an independent pump to repressurize the water for distribution. A float assembly integral to the storage tank controls the On/Off operation of the RO plant. The standard repressurization assembly is a 1 HP pump mounted on a pressure tank (to minimize pump cycling) and will deliver up to 15 GPM at 50 psi. Atmospheric storage systems are designed for remote applications with DI water distribution losses of more than 20 feet of head. If higher flows and/or system losses are required than standard, please contact your local STULZ representative for special repressurization pump selection.

Standard RO/DI systems ship with individual components loose for installation and application of intermediate water piping in the field.

RO/DI Systems Options

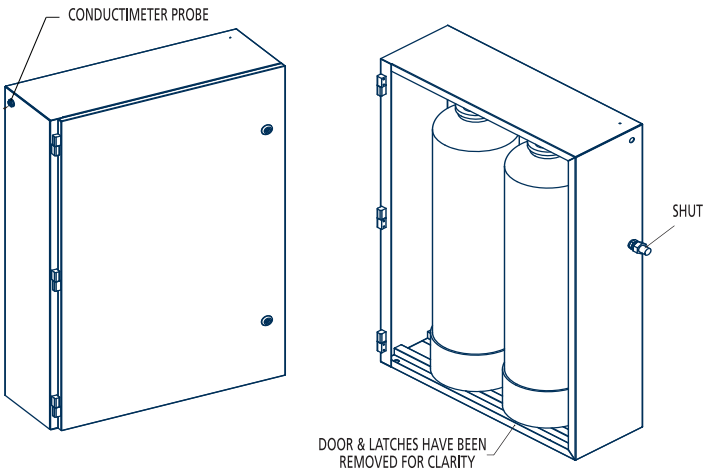
• Skid mounting: provides all system components (except atmospheric storage tank and salt brine storage) on a corrosion resistant coated steel base with all intermediate water piping installed. Brine tank and atmospheric tank ship loose.

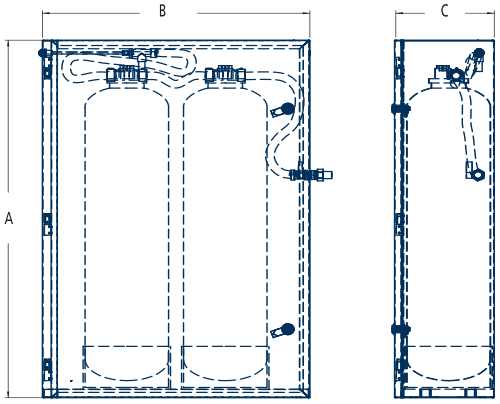
• Single point power connection: only available with skid mount option. Combines all electric device (RO plant, repressurization pump when applicable, water purity monitoring, and UV sterilizer) power connection in common junction/distribution box.

• Analog resistivity meter: provides actual water purity measurement in addition to or in lieu of standard resistivity lamp.

DEMI Cabinet Dimensions

DEMI Cabinet with (2) bottles





DEMI Cabinet Dimensions			
DEMI-Cabinet with:	"A"	"B"	"C"
(2) 0.45 ft³ bottles	24.75"	27.10"	10.00"
(2) 1.0 ft³ bottles	64.00"	33.13"	13.76"
(2) 2.0 ft³ bottles	64.00"	33.13"	13.76"

To calculate estimated DI bottle service intervals per season:

- (A) = total mixed bed DI media volume. If worker/polisher arrangement is used, use volume of first bottle only
- For each cubic ft. of mixed bed DI media: 10,000 grains TDS (Total Dissolved Solids) removal capacity
- Raw water quality (C) must be known from utility company data or water lab test results
- Humidifier capacity (F) is total of all humidifiers served by water system
- (H) = hours per season of full load humidifier operation. Season depends on application and geographic location of installation. Typically, for HVAC systems utilizing an outside air component, the season and hours of operation will be dependent primarily on percentage of and ambient conditions of outside air. For full recirculation applications, load and run hours will be primarily dependent on latent removal of HVAC system or process and should be calculated for year round use.

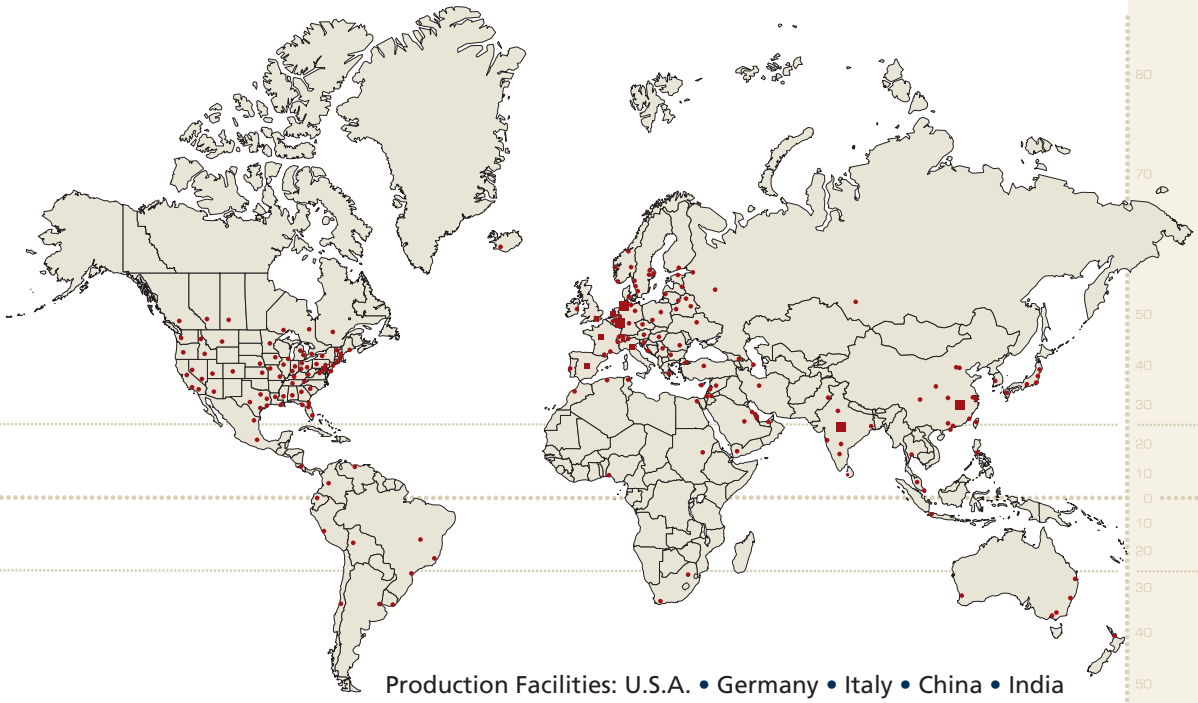
(A) cubic ft. of mixed bed DI media X 10,000 grains TDS = (B) grains TDS removal capacity
(B) grains / (C) grains per gallon TDS = (D) gallons of pure water capacity
(D) gallons X 8.3 lbs./gallon = (E) lbs. of pure water capacity
(E) lbs. / (F) lbs./hr humidifier cap. = (G) hours of full load humidifier operation capacity
(H) hours full load humidifier operation / (G) hours = ____ service intervals per season

Example:

21.1 lbs./hr humidification system @ 2,750 hours/season full load operation with 2.0 cubic ft. DI only water treatment system (consisting of either one 2.0 cubic ft. bottle or two 1.0 cubic ft. bottles in series). Raw water quality is 10 grains TDS.

2.0 cubic ft. of mixed bed DI media X 10,000 grains TDS = 20,000 grains TDS removal capacity
20,000 grains / 10 grains per gallon TDS = 2,000 gallons of pure water capacity
2,000 gallons X 8.3 lbs./gallon = 16,600 lbs. of pure water capacity
16,600 lbs. / 21.1 #/hr = 787 hours
2,750 hours / 787 = 3.5 service intervals per season

- Application of Reverse Osmosis (RO) system as a pretreatment to DI provides approximately 10 times the bottle life of DI only, based on average RO mineral removal capacity of 90%.
- Minimum once per year service interval recommended for all water treatment systems.



Production Facilities: U.S.A. • Germany • Italy • China • India

STULZ mission is to be the premier provider of energy efficient temperature and humidity control solutions for mission critical applications.

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ISO-9001 Quality Management System - Requirements

QEUU004B
Specifications subject to change without notice.