EVAPORATIVE COOLING AND HUMIDIFICATION

High-Pressure System
Wetted Media System

- *Energy efficient*
- *Provides both direct and indirect evaporative cooling*
- *Multiple zone capabilities in air handlers, ducts, and open spaces*
- *Complete water treatment options available from DriSteem*
- *Simple, reliable operation*

driSteem

Advanced, efficient cooling and humidification

ENERGY EFFICIENT

Evaporative cooling and humidification systems draw heat from air to evaporate unheated water introduced by either high-pressure nozzles or wetted media. This process raises the relative humidity (RH) level and lowers the dry bulb air temperature. Consequently, these systems humidify and cool air very efficiently.

REDUCES COOLING LOAD

As water is absorbed in air, the evaporative cooling effect reduces the building's cooling load. Twelve pounds of unheated evaporated water (vapor) reduces the cooling load by about one ton, saving about 12,000 Btus.

LOW MAINTENANCE

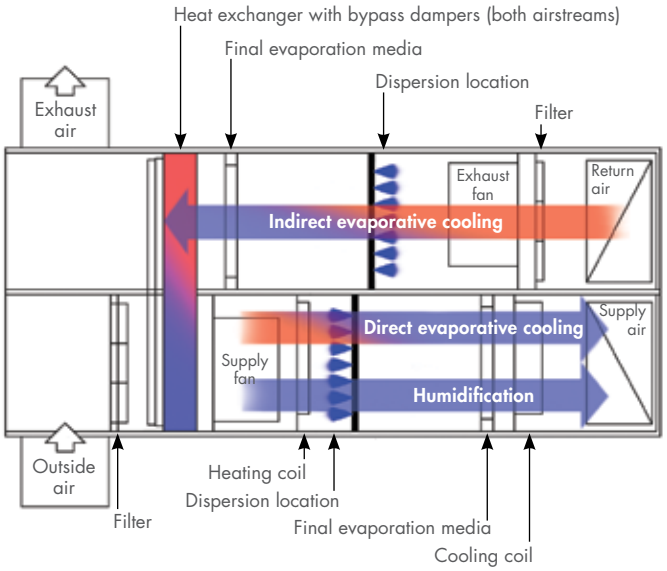
High-Pressure and Wetted Media Systems are very low maintenance systems.

The High-Pressure System's stainless-steel pump is designed to run for 8000 hours before its first maintenance check, and the stainless-steel dispersion nozzles and manifolds are maintenance free.

High-Pressure System water treatment options available from DriSteem provide ultra-pure water that leaves no white dust. The reverse osmosis (RO) system automatically flushes the membrane for extended membrane life.

Wetted Media Systems recirculates water, after it flows through the media, with robust centrifugal pumps. The Vapor-logic controller manages the concentration of dissolved solids in recirculated supply water to minimize scaling and lengthen media life. When required, new media cassettes easily drop into place.

DIRECT OR INDIRECT EVAPORATIVE COOLING



Direct evaporative cooling adds moisture to the supply air. Indirect evaporative cooling occurs in the heat exchanger without adding moisture. A High-Pressure System is shown here. Direct and indirect evaporative cooling can function similarly when using a Wetted Media System.

HIGH-PRESSURE SYSTEM

The DriSteem High-Pressure System delivers evaporative cooling and humidification to multiple zones in air handlers, ducts, and open spaces. The Vapor-logic controller provides comprehensive management of all system variables.

WETTED MEDIA SYSTEM

The DriSteem Wetted Media System with 8" (203 mm) and 12" (305 mm) media delivers evaporative cooling and humidification to air handlers and ducts. The Vapor-logic controller's sophisticated water and scale management capabilities optimize water and media life.

Feature	High-Pressure System	Wetted Media System
Application versatility	Suitable for any application; commonly used in data centers, agriculture, industrial manufacturing, printing facilities,and applications using air-side economizers	
Advanced technology	Precision-machined atomizing nozzles fragment water droplets into ultra-fine particles (90% are ten microns or less)	Controller anticipates cooling requirements, maximizes system on-time, monitors media performance and prompts for replacement, and provides temperature control
	Water delivered to nozzles at up to 1200 psi (8.27 MPa) requires no pressurized air	Water concentration management maximizes media life and water utilization
	Integral check valve in nozzle ensures no dripping when system shuts off	Multiple compact recirculation pumps provide redundancy with low system energy usage
Cooling effect saves energy	Every pound of atomized water absorbed in air removes approximately 1000 Btu of heat from the air (every kg absorbed removes approximately 2300 kJ of heat)	
	Significant energy savings when cooling and humidifying simultaneously	
	Utility rebates can offset costs	
Low maintenance	Stainless-steel pump is cooled by purified supply water; 8000 hours before maintenance check	Can be used with RO, DI, or potable water
	Stainless-steel nozzles and manifolds require no maintenance	Water concentration management minimizes media scaling, extending media life
	Thorough water filtration protects stainless-steel components from corrosion and undue wear	Easy-to-replace media cassettes drop into frames in seconds
	Final evaporation media as close as three feet (0.9 m) downstream from heating coil prevents downstream wetting	Powerful pumps keep solids in the holding tank in motion to be easily drained away
Comprehensive system control with Vapor-logic	Accurate, responsive RH control; PID control tunes system for maximum performance	
	Set up, view, and adjust system functions with intuitive keypad/display or Web interface	
	Integrates into any building automation system via and optional BACnet, LonTalk, or Modbus communication protocols	
User controlled	Not available	The user-controlled Wetted Media System saves on cost while maintaining the flexibility to work with an existing Building Automation System.
Multiple zone control capability	Individual zone monitoring and modulated staging valves provide tight control in all zones with optimized absorption and minimal water waste	Not available
	One system cools and humidifies multiple zones with separate demands	
Versatile	Cools and humidifies in air handlers, ducts, and open spaces	Cools and humidifies in air handlers and ducts
	Nozzle staging and pulsed modulation allow high turndown of system output	Media staging and predictive operation allow high turndown of system output; stages can remain active while other stages are in dry-out mode
	Capacities up to 5500 lbs/hr (2495 kg/h), multiple systems can be combined for larger capacities	Media sizes available in 8" (203 mm) or 12" (305 mm) sizes; multiple systems can be combined for larger capacities
	Flexibility to accommodate the most challenging applications; extensive network of DriSteem representatives available to assist with system layout and design	
Complete water treatment solution	Water treatment options available from DriSteem include RO hyperfiltration, particulate filtering, dechlorination, and duplex water softening	Not required
	Automatic back-flush technology ensures long RO membrane life	
	Ultra-pure water eliminates white dust fallout and bacteria/virus proliferation that can occur when using potable water	

High-Pressure System sequence of operation

A COMPLETE SYSTEM THAT INCLUDES WATER TREATMENT

1 Water enters system from municipal water supply

2 Dechlorinator (wall-mounted on smaller models)

3 Duplex water softener with brine tank

4 RO station with particulate filter and RO membranes

5 Pressurized RO holding tank

6 High-pressure pump station:

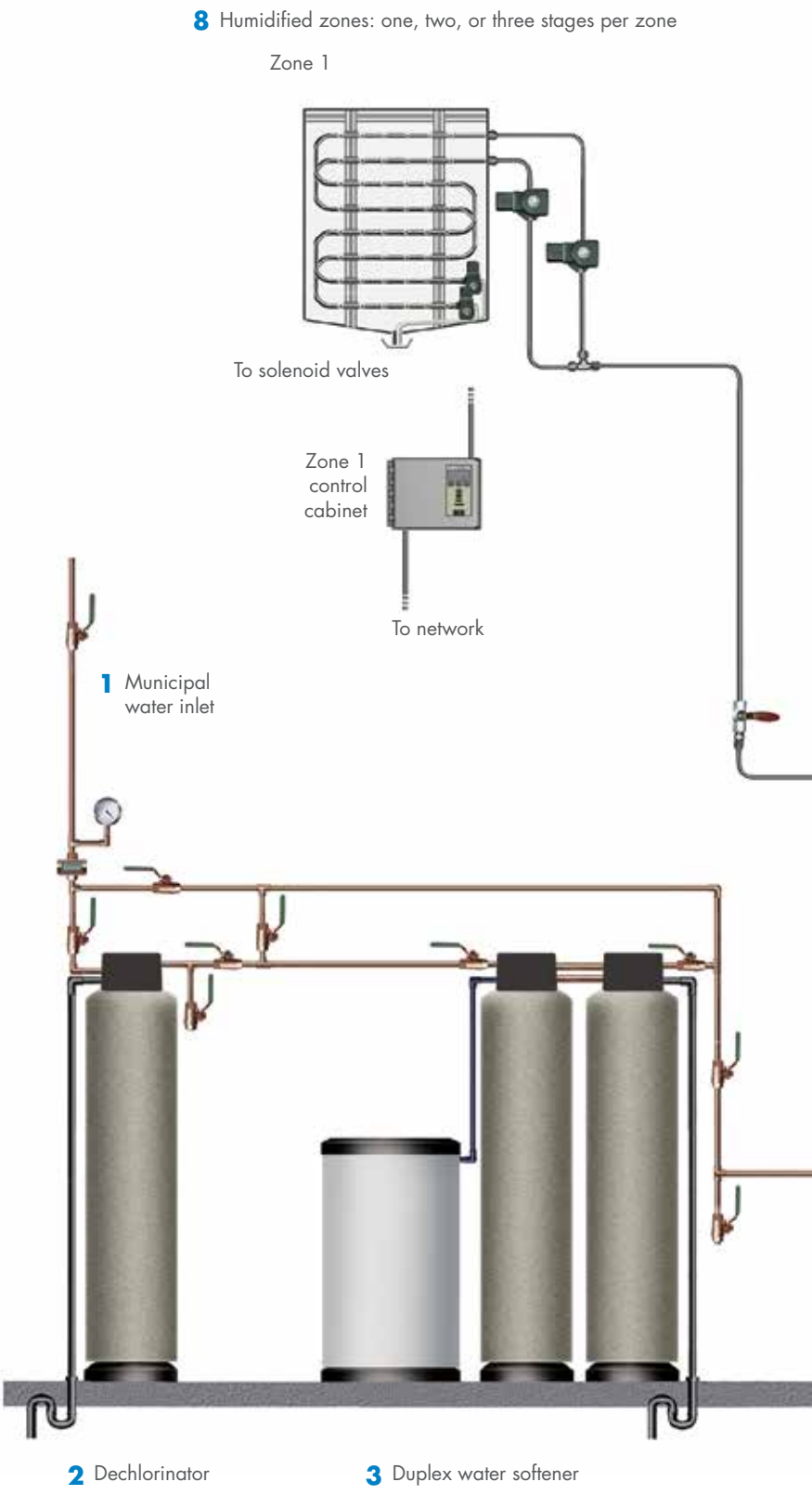
All-stainless-steel axial-piston high-pressure pump delivers purified, high-pressure water to atomizing nozzles

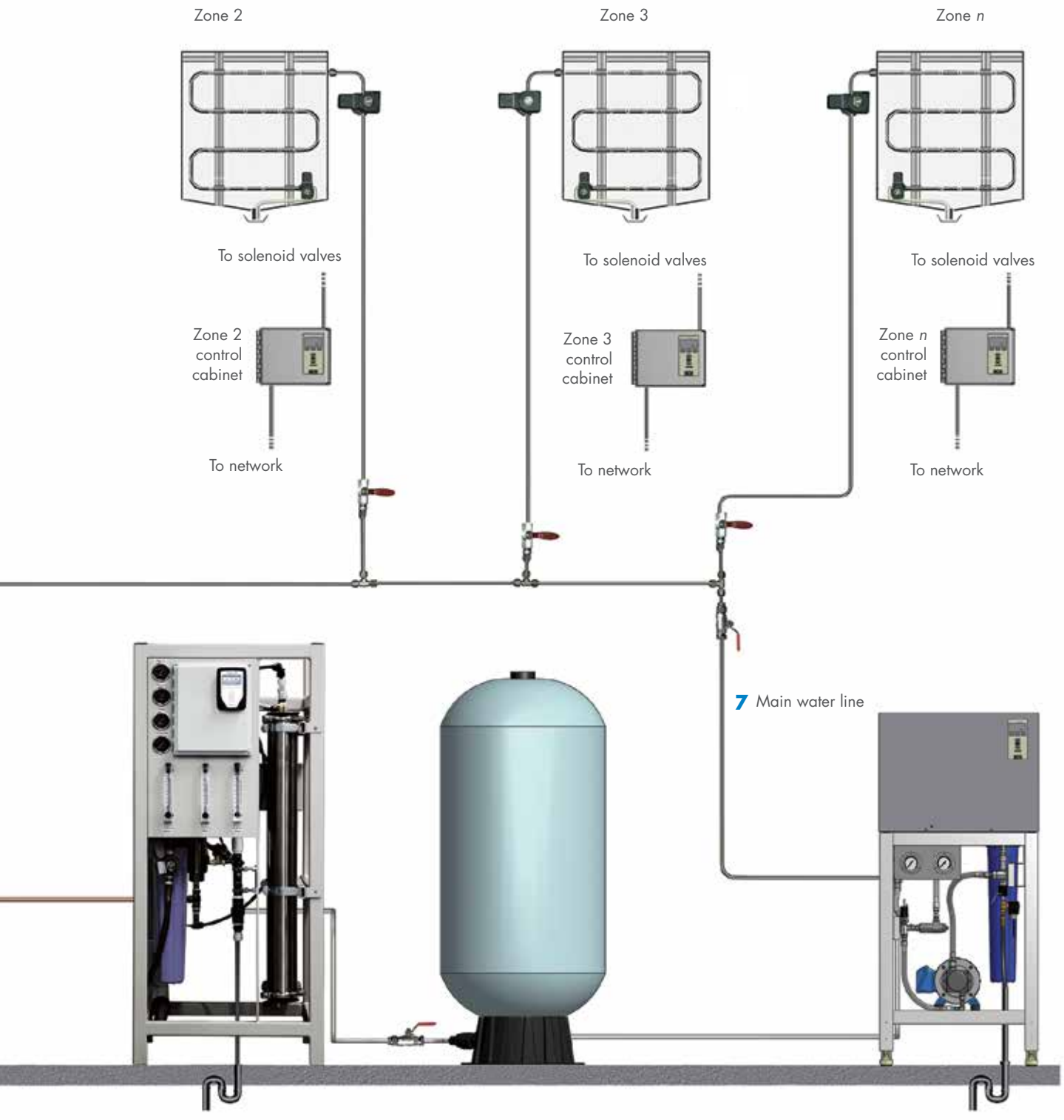
Vapor-logic controller optimizes absorption in multiple humidification zones

7 Main water line feeds network of high-pressure, stainless-steel piping

8 Humidified zones: purified, ultra-fine water droplets exit nozzles and disperse in AHUs, ducts, and/or open spaces

9 Final evaporation media (shown on Page 9) installed downstream of AHU heating coil prevents downstream wetting





4 RO station:
- Particulate filter
- RO membranes

5 Pressurized RO holding tank

6 High-pressure pump station:
- High-pressure stainless steel pump
- Vapor-logic controller

High-Pressure System dimensions

Table 6-1:
DriSteem High-Pressure System dimensions[1]

Model	Dimension															
	A[2]		B		C		D		E		F		G		H	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
250	150	3810	24[3]	610[3]	55	1397	24	610	24	610	18	457	12	305	4[4]	102[4]
500	160	4064	24[3]	610[3]	55	1397	24	610	24	610	24	610	14	356	4[4]	102[4]
1000	176	4470	24[3]	610[3]	55	610	24	610	32	813	24	610	16	406	16	406
1750	176	4470	24[3]	610[3]	55	610	24	610	32	813	24	610	16	406	16	406
2500	197	5004	30	762	80	2032	24	610	32	813	30	762	21	533	21	533
3500	221	5613	30	762	72	1829	30	762	40	1016	39	991	24	610	24	610
5500	239	6071	30	762	90	2286	30	762	46	1168	39	991	30	762	30	762

Notes:
1. Water treatment component sizing is based on city-treated water, 20-grain hardness, and 50 °F (10 °C) or higher. City-treated water or well water with different hardness or temperature may require different components/dimensions. Call DriSteem with your water characteristics for component sizing.
2. Dimension given is maximum dimension when all components are located sequentially. Component locations are flexible; components may be placed in front of each other if floor space allows.
3. Add 6" (152 mm) when redundant high-pressure water pump option is used.
4. Wall-mounted dechlorinator.

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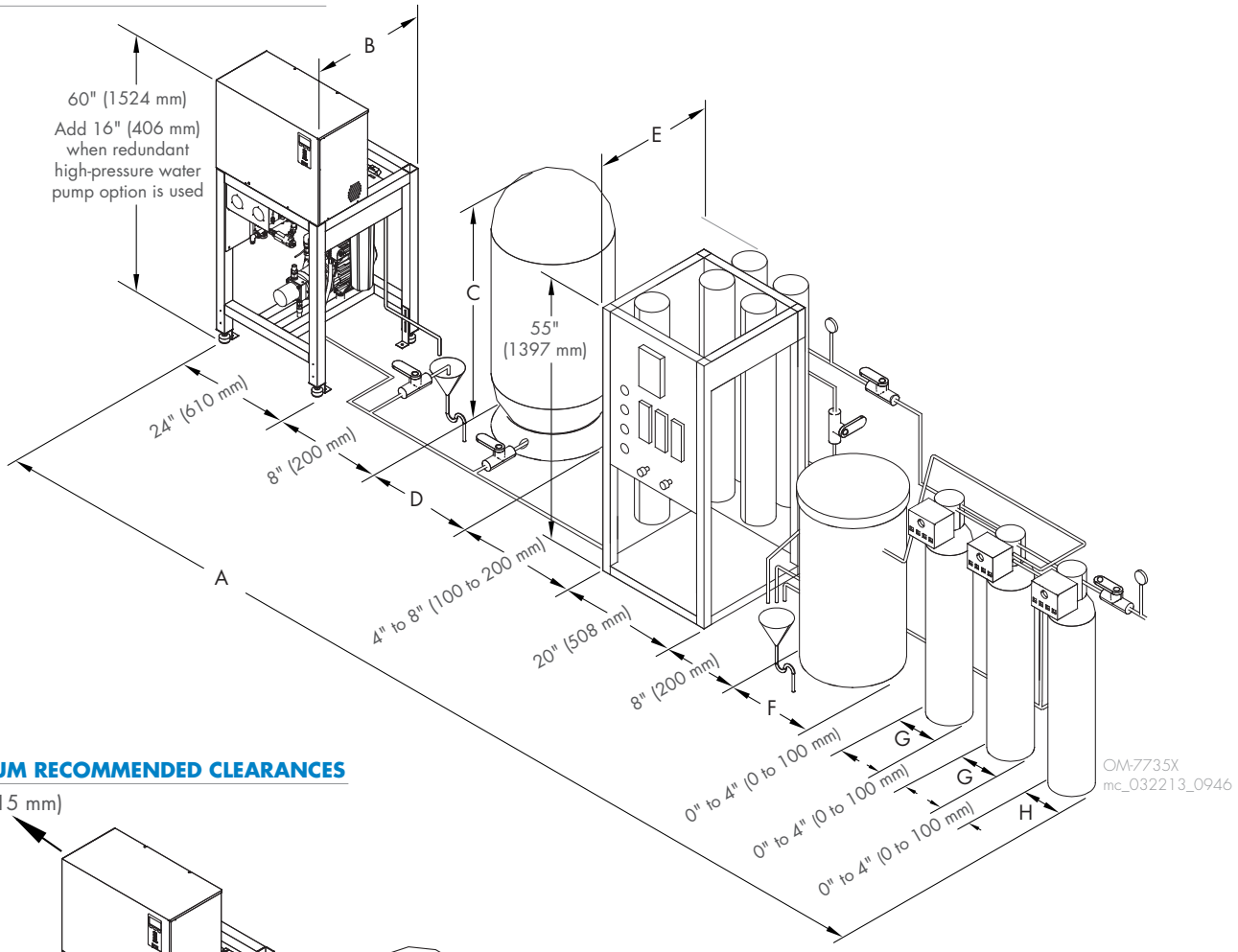
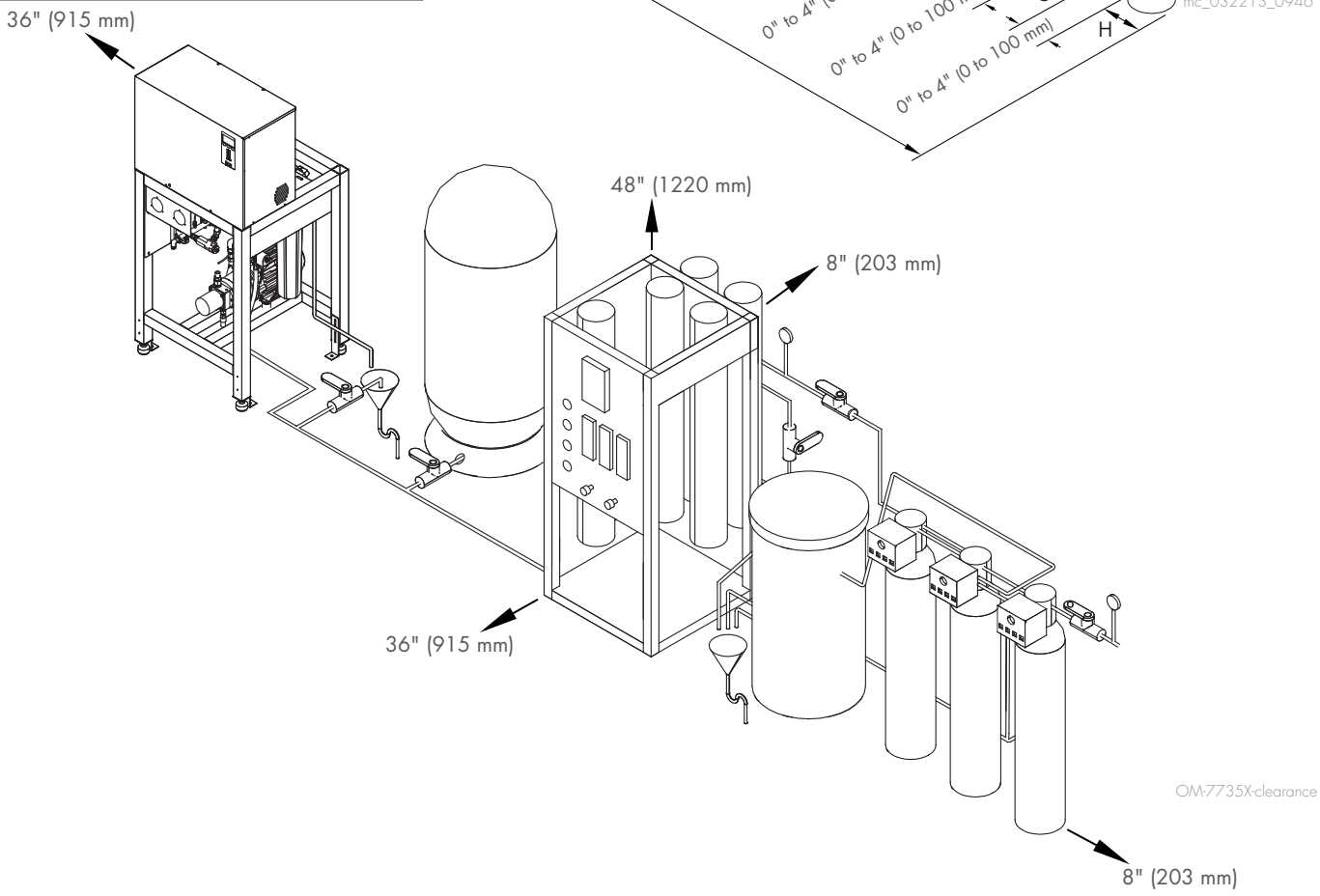
HIGH-PRESSURE SYSTEM DIMENSIONS



MINIMUM RECOMMENDED CLEARANCES



High-Pressure System specifications

Table 8-1: High-Pressure System pump station specifications							
Model	250	500	1000	1750	2500	3500	5500
System capacity, lbs/hr (kg/h)	250 (113)	500 (227)	1000 (454)	1750 (794)	2500 (1134)	3500 (1588)	5500 (2495)
System voltage/phase, Amp draw	240/1, 5.2 480/3, 1.6 600/3, 1.3	240/1, 7.3 480/3, 2.2 600/3, 1.8	240/1, 13.8 480/3, 4.0 600/3, 3.2	480/3, 6.6 600/3, 5.3	480/3, 6.6 600/3, 5.3	480/3, 9.2 600/3, 7.3	480/3, 12.6 600/3, 10.1
Fuse size *(see Note 1)*	240/1, 25 480/3, 16 600/3, 6	240/1, 35 480/3, 10 600/3, 6	240/1, 50 480/3, 15 600/3, 10	480/3, 30 600/3, 15	480/3, 30 600/3, 15	480/3, 35 600/3, 20	480/3, 40 600/3, 20
Dimensions (W/D/H), inches (mm)	24/24/60 (610/610/1524)	24/24/60 (610/610/1524)	24/24/60 (610/610/1524)	24/24/60 (610/610/1524)	24/30/60 (610/762/1524)	24/30/60 (610/762/1524)	24/30/60 (610/762/1524)
Dimensions (W/D/H) with redundant high-pressure pump option, inches (mm)	24/30/76 (610/762/1930)	24/30/76 (610/762/1930)	24/30/76 (610/762/1930)	24/30/76 (610/762/1930)	24/30/76 (610/762/1930)	24/30/76 (610/762/1930)	24/30/76 (610/762/1930)
Weight, lbs (kg)	275 (125)	300 (136)	325 (147)	325 (147)	350 (159)	400 (181)	450 (204)
Weight with redundant high-pressure pump option, lbs (kg)	375 (170)	400 (181)	475 (216)	475 (216)	500 (227)	625 (284)	700 (318)
Supply water connection diameter, inches *(see Note 2)*	3/4	3/4	3/4	3/4	3/4	3/4	3/4
High-pressure water connection diameter, inches *(see Note 2)*	1/2	1/2	1/2	1/2	1/2	1/2	1/2
5-micron prefilter diameter x height, inches (mm)	4 x 20 (102 x 508)	4 x 20 (102 x 508)	4 x 20 (102 x 508)	4 x 20 (102 x 508)	4 x 20 (102 x 508)	4 x 20 (102 x 508)	4 x 20 (102 x 508)
High-pressure pump flow rate, gpm (L/m)	0.5 (1.89)	1.0 (3.78)	2.0 (7.57)	3.5 (13.2)	5 (18.9)	7 (26.5)	11 (41.6)
High-pressure pump motor power, hp (kW)	1 (0.75)	1.5 (1.1)	3 (2.2)	5 (3.7)	5 (3.7)	7.5 (5.5)	10 (7.5)
High-pressure pump motor rpm	1000–1500	1000–2550	1000–2250	1000–2550	1000–2250	1000–2550	700–2450

Notes:
1. Wiring and branch circuit protection (Type RK1, J, or T fusing) to be provided by installer in accordance with National Electrical Code (NEC) requirements.
2. High-pressure compression fittings.
3. Unit ships with 36" x 1/2" high-pressure flexible hose and a 1/2" union for easy connection to dispersion piping.
4. 25 psi (170 kPa) supply water pressure at 125% of maximum flow rate, 60 psi (415 kPa) maximum

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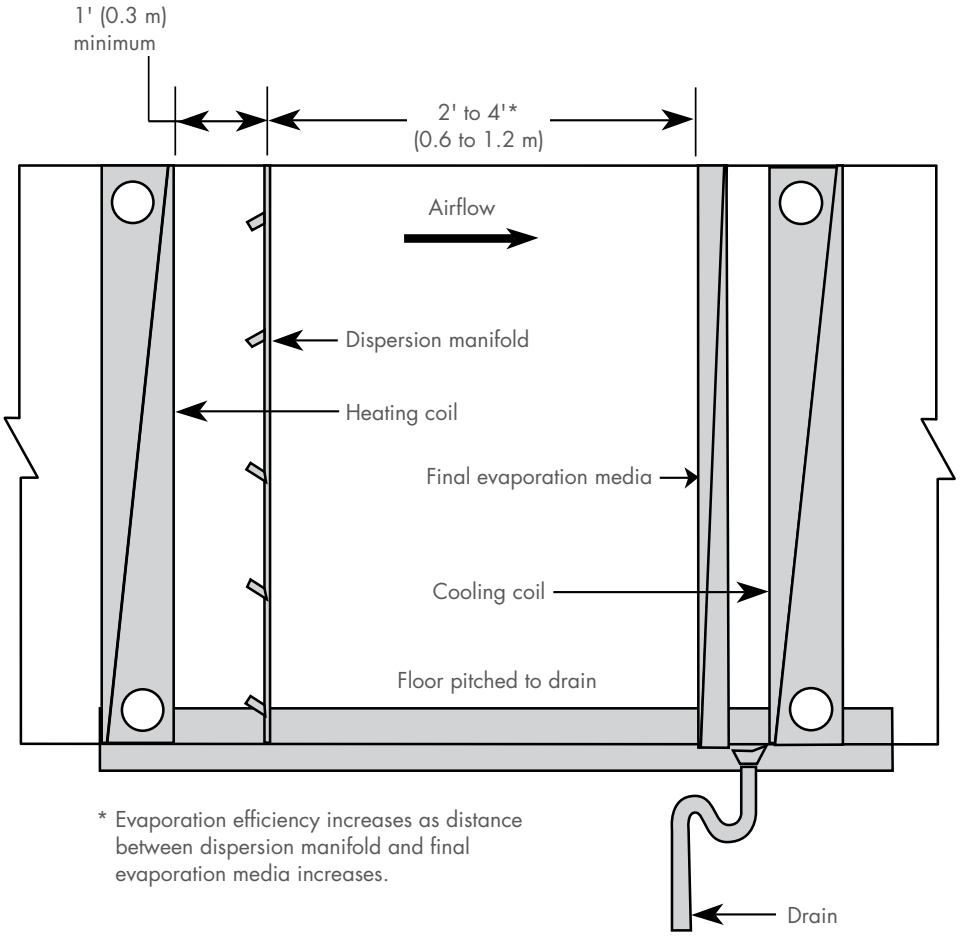
EVAPORATION EFFICIENCY IN AIR HANDLERS AND DUCTS

Once water is dispersed into a moving airstream, many factors affect evaporation efficiency, or how much of that water will evaporate. Factors affecting evaporation efficiency are included in the following example.

The following are known:

- Humidification load = 385 lbs/hr (175 kg/h)
- Available evaporation distance = 4 ft (1.2 m)
- Leaving air temperature = 55 °F (12.8 °C)
- Air velocity = 500 fpm (2.54 m/s)
- Entering air grains of moisture per pound of dry air = 15
  (Entering air grams of moisture per kilogram of dry air = 2.1)
- Entering air dew point temperature = 20 °F (–6.7 °C)
- Leaving air RH = 55%

AHU INSTALLATION EXAMPLE



* Evaporation efficiency increases as distance between dispersion manifold and final evaporation media increases.

High-Pressure System evaporation efficiency

USING THE EVAPORATION EFFICIENCY CHART

Using 55% leaving air RH and 15 grains of moisture per pound of dry air, the chart identifies:

- Required entering air temperature = 68 °F (20 °C)
- Evaporation efficiency = 70%

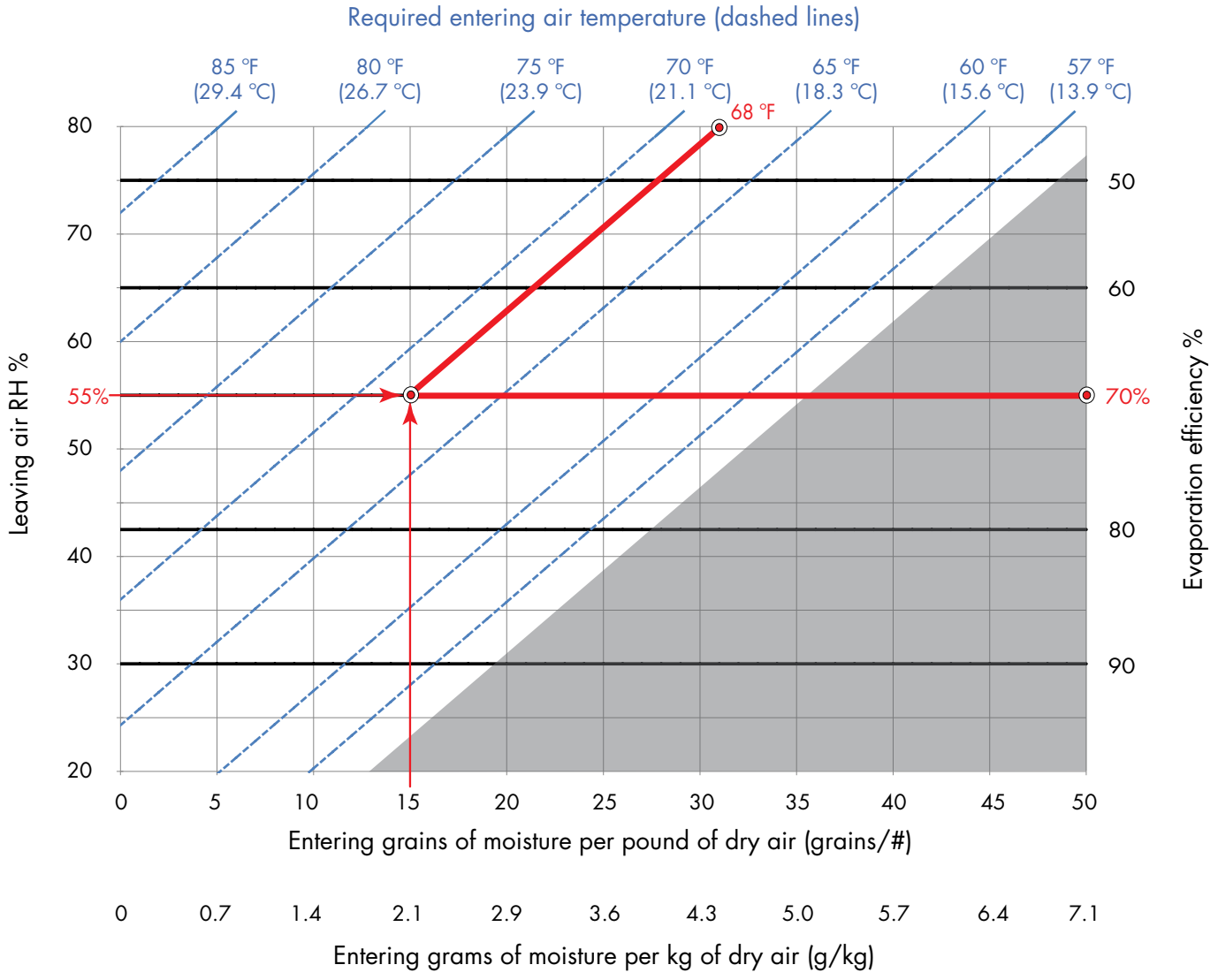
From these values, required system capacity can be calculated:

$$\frac{\text{Load}}{\text{Evaporation efficiency}} = \text{Required system capacity}$$

$$\frac{385 \text{ lbs/hr}}{0.7} = 550 \text{ lbs/hr} \quad \text{or} \quad \frac{174.6 \text{ kg/h}}{0.7} = 249.4 \text{ kg/h}$$

To accurately size a High-Pressure System, first define all the values, as shown in this section. This will ensure a system that maximizes efficiency and delivers consistent output.

EVAPORATION EFFICIENCY CHART*



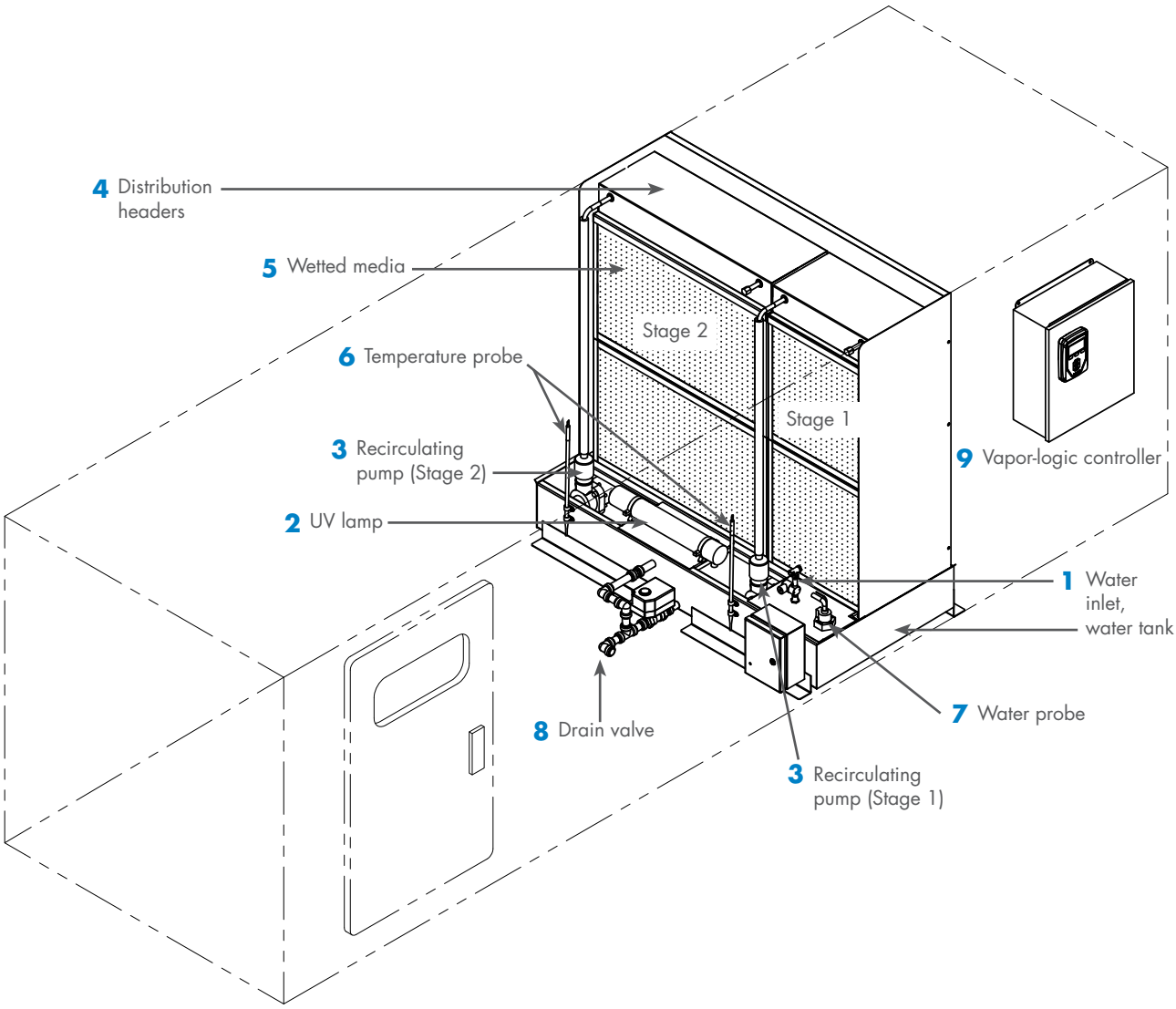
* *Evaporation efficiency shown here is based on 4-ft evaporation distance, 55 °F leaving air temperature, and 500 fpm air velocity.*

SEQUENCE OF OPERATION

1. Water enters and fills the tank.
2. The recirculation pump cycles tank water through the Ultra-violet (UV) lamp and then through the tank to keep solids in suspension for easy drainage.
3. Dedicated pumps supply water to each stage of media (up to three stages available).
4. Distribution headers evenly distribute water over each media stage.
5. Air flowing through the wetted media is cooled and humidified.
6. Temperature probe measures downstream air temperature for each stage.
7. Probe measures water level and usage.
8. System draining is optimized to minimize water usage and media scaling.
9. Optional Vapor-logic controller manages staged response to system demand and water cycles of concentration.

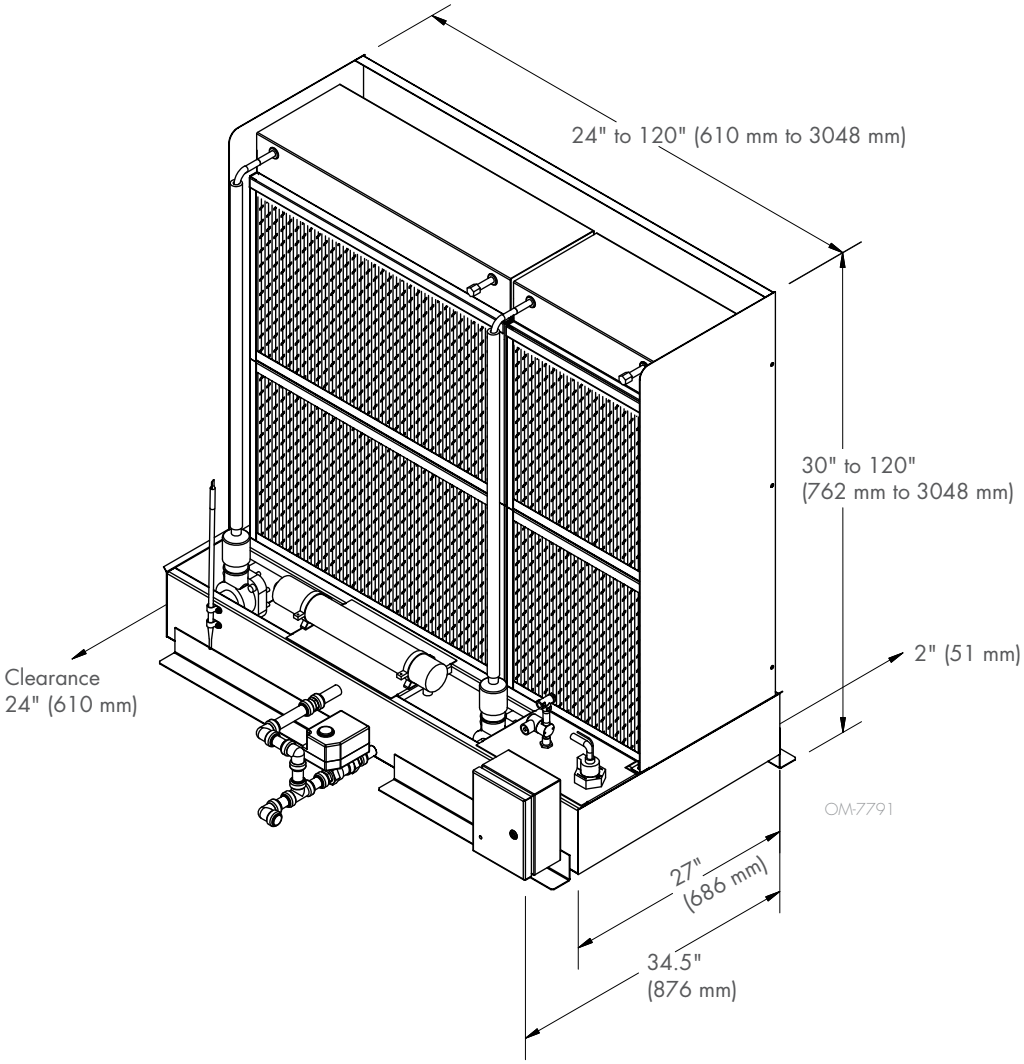
WETTED MEDIA SYSTEM WITH DROPLET SEPARATOR

Built-in droplet separator removes water droplets that can form when operating at higher air velocities.

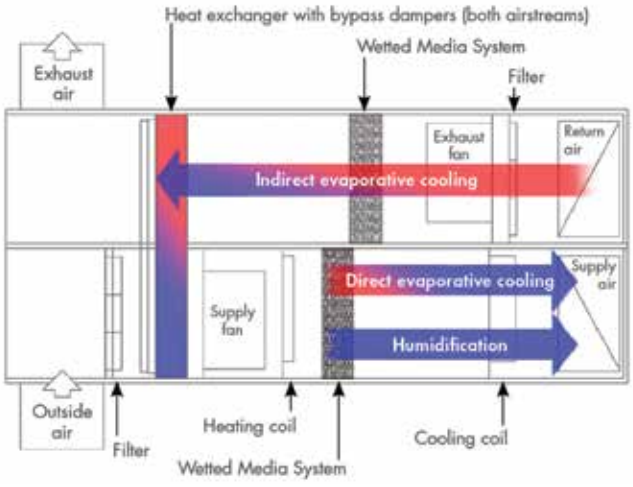


Wetted Media System dimensions

DIMENSIONS AND MINIMUM RECOMMENDED CLEARANCES



DIRECT OR INDIRECT EVAPORATIVE COOLING



Direct evaporative cooling adds moisture to the supply air. Indirect evaporative cooling occurs in the heat exchanger without adding moisture. A Wetted Media System is shown here. See page 2 for an illustration of direct/indirect cooling using a High-Pressure System.

Table 13-1: Wetted Media System specifications

Item	Specification	
System capacity	Varies with application. See graph on page 6 for system efficiencies and to calculate system capacity.	
System voltage/phase/Amp draw*	120 Volts, Max 7 Amps, 1 phase, 60 Hz	230 Volts, Max 15 Amps, 1 phase, 50 Hz
Fuse size**	120 Volts,1 phase, 60 Hz: 10 Amps 230 Volts, 1 phase, 50 Hz: 20 Amps	
Height	30" to 120" (762 mm to 3048 mm)	
Width	24" to 120" (610 mm to 3048 mm)	
Depth	34.5" (876 mm)	
Operating weight***	System operating weight = tank operating weight + media operating weight Pounds = 65 lbs/ft of width + 20 lbs/ft2 Kilograms = 98 kg/m of width + 30 kg/m2	
Shipping weight***	System shipping weight = tank shipping weight + media shipping weight Pounds = 30 lbs/ft of width + 10 lbs/ft2 Kilograms = 45 kg/m of width + 15 kg/m2	
Supply water pressure	25 to 80 psi (170 to 550) kPa	
Supply water connection, diameter	3/8" to 3/4", (DN10 to DN20) depending on flow rate	
Drain connection, diameter	1" (DN25), copper	
Recommended inlet water flow rate	3x system capacity or 11 gpm (42 L/m) max.	
Air velocity, maximum recommended	700 fpm (3.5 m/s) through wetted media without droplet separator (900 fpm [4.6 m/s] with droplet separator)	
Water quality requirements	Using RO/DI water significantly extends the life of the media and prevents loss of efficiency System recycle rate depends on water quality. Contact DriSteem for more information.	

* Cataloged amperages assume one pump per stage. Some large systems may require additional pumps depending on operating conditions. Contact DriSteem for system amperages.

** Wiring and branch circuit protection (Type RK1, J, or T fusing) to be provided by installer in accordance with National Electrical Code (NEC) requirements or (in Europe) IEC 60364 requirements.

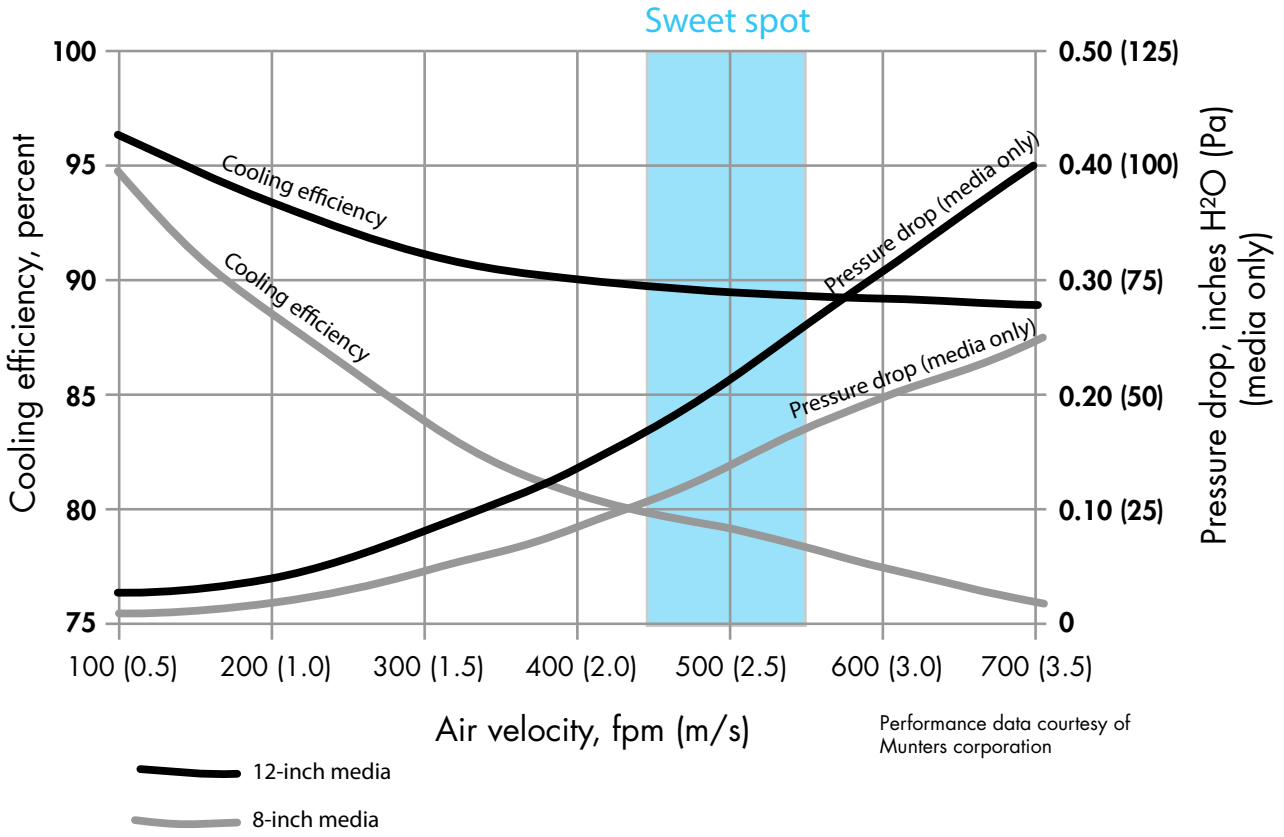
*** **System weight calculation examples**

Operating weight in *pounds* for a 6-ft-high x 8-ft-wide Wetted Media System):
= (65 lbs/ft) x (8 ft wide) + (20 lbs/ft^2) x (8 ft wide) x (6 ft high – 1 ft tank height)
= 520 lbs + 800 lbs = 1320 lbs

Operating weight in *kilograms* for a 2-meter-high x 3-meter-wide Wetted Media System):
= (98 kg/m) x (2 m wide) + (30 kg/m^2) x (3 m wide) x (2 m high – 0.3 m tank height)
= 196 kg + 153 kg = 349 kg

Wetted Media System cooling efficiency and pressure drop

WETTED MEDIA SYSTEM COOLING EFFICIENCY AND PRESSURE DROP



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EXPECT QUALITY FROM THE INDUSTRY LEADER

For more than 45 years, DriSteem has been leading the industry with creative and reliable humidification solutions. Our focus on quality is evident in the construction of DriSteem Evaporative Cooling Systems. DriSteem leads the industry with a Two-year Limited Warranty and optional extended warranty.

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