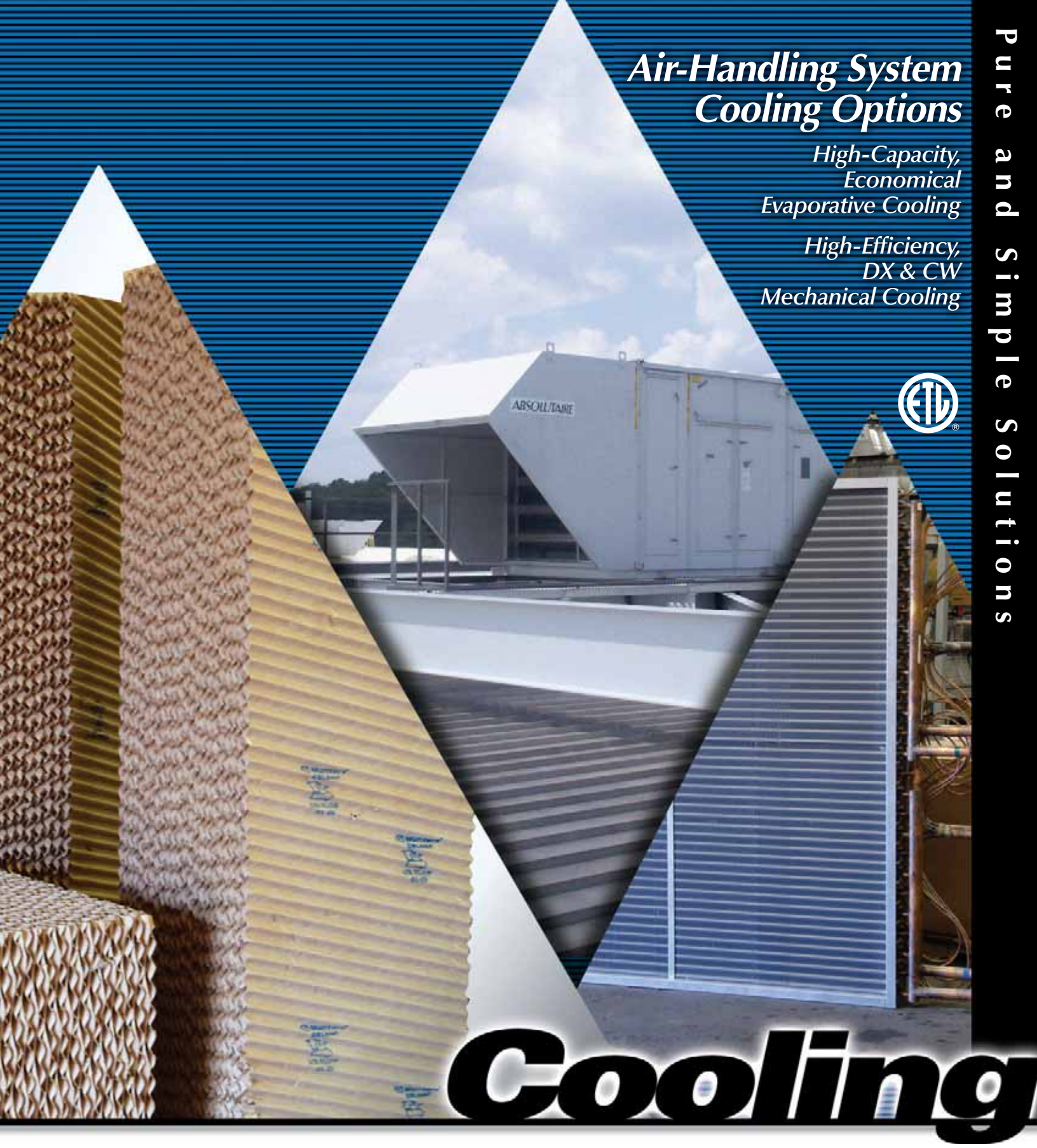
Air-Handling System Cooling Options

High-Capacity, Economical Evaporative Cooling

High-Efficiency, DX & CW Mechanical Cooling

Pure and Simple Solutions



Cooling

ABSOLUTAIRE

Cooling

AbsolutAire® Air-Handling System Cooling Options

Economical and effective cooling is easily added to your choice of AbsolutAire direct-fired heating, ventilating and make-up air systems. The cooling option selected can also be stand alone or coupled with steam, electric or hot-water heating systems.

Evaporative and mechanical cooling options are available. These cooling choices are low-cost, efficient answers for temperature and/or humidity control, increased worker comfort and improved indoor air quality. Based on your facility requirements, we can help if cooling only is needed or if adding or subtracting humidity is desired as well. We can develop an engineered solution based on the entering air and leaving dry bulb (db) and wet bulb (wb) objectives, along with elevation above sea level.

Evaporative cooling works by adding moisture to the air stream. These systems can be a viable low-cost option for summertime cooling and wintertime humidification in many areas. AbsolutAire has evaporative cooling with water recirculation (EVR) and without water recirculation (EVN). Evaporative cooling is most effective in dry climates.

Mechanical coil cooling works by transferring heat from the air stream to a coolant. It can achieve lower temperature levels than evaporative cooling and also dehumidify the supply air. AbsolutAire offers direct-expansion (DX) and chilled-water (CW) coil cooling options to meet specific application needs.

Committed to providing the *Best Available Value* in its advanced air-handling systems, AbsolutAire can engineer, integrate and deliver the solution for most any cooling and/or humidification requirement your customer demands.

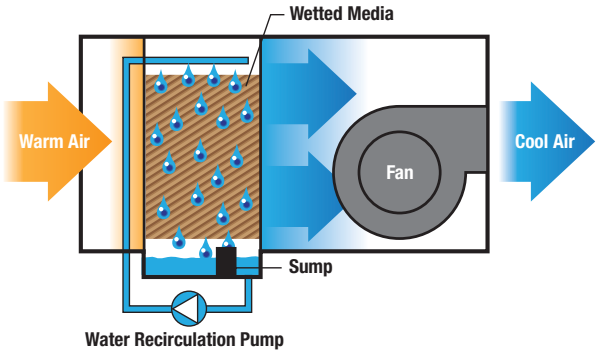
Evaporative Cooling: **Water-saturated rigid cellulose is used for evaporative cooling and addition of humidity to the supply air from an air-handling system. AbsolutAire models are available in a wide range of capacities from less than 1,000 CFM to more than 130,000 CFM.**

Mechanical Cooling: **DX or CW coils can be used for mechanical cooling of the supply air from an air-handling system. AbsolutAire models are available for single-unit, closed-loop systems and for multiple-unit, central-control systems.**

AbsolutAire Cooling Advantages

▲ Advanced Evaporative Cooling
- – Low-Cost Cooling & Humidification
- – High-Efficiency Wetted Media
- – Wide Range of Features & Models

▲ Mechanical Cooling Excellence
- – DX & CW System Choices
- – Low Service Requirements
- – Integrated All-Season Performance



Evaporative Cooling: Nature's Air Conditioner

Evaporative cooling is sometimes called "nature's air conditioner." Just as a breeze across wet skin provides cooling as the moisture evaporates, an evaporative cooler does the same. It reduces the dry bulb or sensible air temperature to the wet bulb or saturated air temperature by evaporating water and adding humidity to the facility supply air. The process is effective, economical, environmentally friendly and healthy.

With direct evaporative cooling, outside air is drawn through a water-saturated medium, usually cellulose, and cooled by evaporation. Direct evaporative cooling adds moisture to the air stream until the air volume is close to saturation. The dry bulb temperature is reduced, while the wet bulb temperature stays the same.

Mechanical Cooling: Refrigerant or Chilled Water

Mechanical cooling in an air-handling system can be provided by direct expansion (DX) coils with a refrigerant or by or chilled water (CW) coils. With relatively mild, ambient temperatures, the air-handling unit can efficiently provide cooling for a good portion of its operating cycle by varying the fan speeds or outside-return air blends. Both the dry-bulb temperature and the wet-bulb temperature are reduced when using mechanical cooling coils.

With DX cooling, refrigerant flows through the evaporator coils to absorb heat, thus cooling and dehumidifying the air. A compressor moves the coolant through the coils and a condenser removes the absorbed heat for exhaust outside. Based on the project objectives, these may or may not be part of the AbsolutAire-supplied air-handling unit.

With CW cooling, refrigeration equipment provides cold water, which is then pumped through coils in the air-handling unit to cool and dehumidify the air stream. To save energy, the flow can be modulated to provide dehumidification and reduced cooling.

AbsolutAire Evaporative Cooling

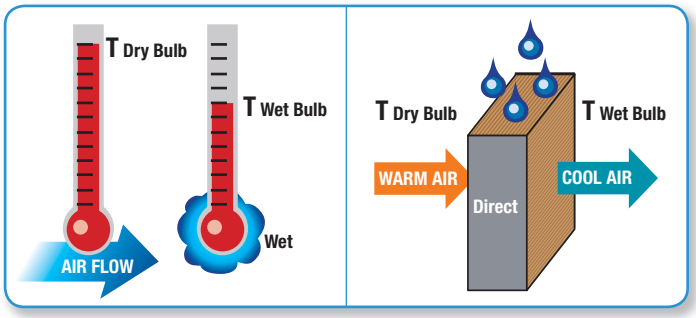
Evaporative cooling is the most economical alternative to chilled water (CW) or direct expansion (DX) cooling. When the site ambient conditions are "right" for the application, AbsolutAire evaporative cooling solutions offer low first cost, efficient operation, long-life performance and low maintenance expense.

The Concept

When warm air passes over cooler water, the water absorbs heat from the air and evaporates. Evaporative coolers use this concept to extract heat from outside air by passing it through a wetted media and cooling the building supply air.

Two types of air temperature are involved: dry bulb and wet bulb. Air ambient or *dry bulb* temperature is measured with a thermometer. The air saturation or *wet bulb* temperature is the lowest temperature that can be reached by the air absorbing moisture. *Saturation efficiency* is when the dry bulb temperature of the leaving air is the same as the wet bulb temperature of the entering air.

Dry Bulb vs. Wet Bulb Temperature Concepts



An evaporative cooler with 88% saturation efficiency will cool the air by 88% of the difference between the two air temperatures. For example, if the dry bulb temperature is 90°F and the wet bulb temperature is 70°F, this evaporative cooler can cool the air to about 72.4°F (90°-70° = 20° X 0.88 = 17.6° and 90°-17.6° = 72.4°)

Important Operating Formulas

Evaporative Cooling

$$\text{Efficiency} = 100\% \times \frac{EDBT - LDBT}{EDBT - WBT}$$

$$LDBT = EDBT - \frac{E\% \times (EDBT - WBT)}{100\%}$$

Air Flow

$$\text{Velocity} = \text{Feet per Minute} = \frac{CFM}{L \times H}$$

Water Evaporation and Bleed-Off

$$\text{Gallons per Hour Evaporated} = \frac{1.2 \times SCFM \times (EDBT - LDBT)}{10{,}000}$$

$$\text{Cycles of Concentration} = \frac{\text{Evaporation} + \text{Bleed-Off}}{\text{Bleed-Off}}$$

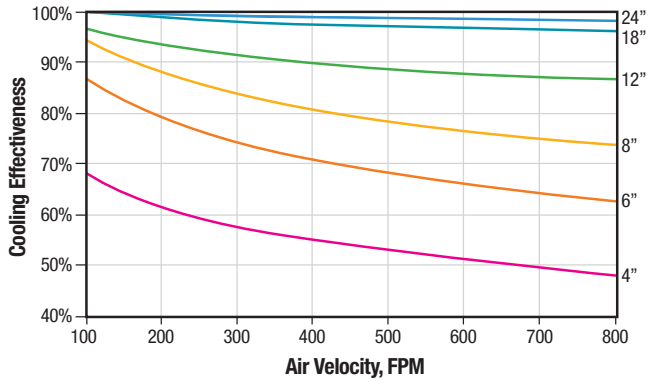
$$\text{Make-Up} = \text{Evaporations} + \text{Bleed-Off}$$

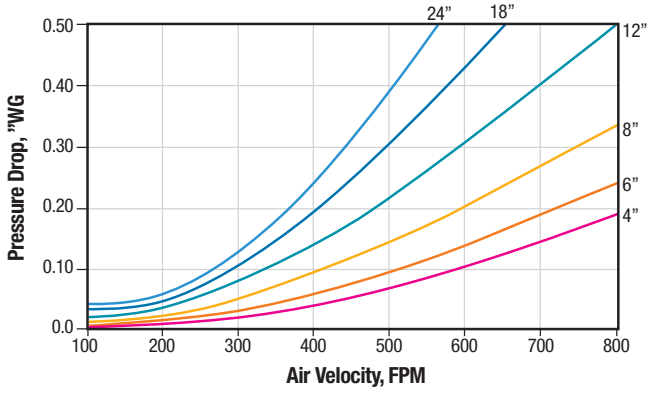
Abbreviations

EDBT = Entering dry bulb temperature (before cooling pad)
LDBT = Leaving dry bulb temperature (after cooling pad)
WBT = Wet bulb temperature (same before and after the pad)
SCFM = Standard cubic feet per minute of air
L = Length of pad wall in feet
H = Height of pad wall in feet

Evaporative Media Performance

Cooling effectiveness and pressure drop are impacted by the thickness of the wetted media and the air velocity.





Construction Features

Evaporative cooling systems from AbsolutAire offer a wide range of standard features, as well as numerous options. These are shown for both EVR and EVN models.

	STANDARD FEATURES	OPTIONS
AbsolutAire EVR Evaporative Cooling (With Water Recirculation)	• Submersible Pump • Pitched Stainless Steel Sump • Double-Wall Floor & Side Walls w/ 1" Insulation • 6" Deep CELdek® Evaporative Media • PVC Water Distribution Piping • Water Supply to Media • Water Level Control • Freeze Protection	• Copper Piping • Stainless Steel Interior • Fill & Drain Valves (Shipped Loose) • Automatic Flush & Drain Cycles • DRIFdek® Drift-Eliminator Mediae • 12" or 18" CELdek® Evaporative Media • GLASdek® Fiberglass Media; 6, 12 or 18" • Recirculation with Manual Bleed • Conductivity Sensor (Auto Makeup) • Flow Meter • Fan-Run Timing Sequence • Humidity Controls • More (Consult Factory)
AbsolutAire EVN Evaporative Cooling (Without Water Recirculation)	• Pitched Stainless Steel Sump • 6" Deep CELdek® Evaporative Media • PVC Water Distribution Piping • Freeze Protection • Moisture Sensor • Internal Water-Control Valve	• Copper Piping • 12" CELdek® Evaporative Media • GLASdek® Fiberglass Media; 6" or 12" • Flow Meter • Fan-Run Timing Sequence • Humidity Controls • More (Consult Factory)

Good Practices

Poor water quality and improper maintenance can cause problems including scale buildup, biological growth, and corrosion. These can foul the wetted media, reduce operating efficiency and service life, and degrade IAQ with objectionable odors and unhealthy microorganisms.

Good system design and operating practices can minimize such problems. The primary approach is to provide sufficient water to the media to keep it completely wet and fully flushed. Good practices include using fresh clean water, de-ionized or municipal, not from open holding tanks or reverse-osmosis systems. Preventive measures may include chemical treatments, regular media flushing, adequate bleed-off for scale control, and fresh makeup water to replace evaporated water. Our "fan-run" timer option allows the fan to continue running for a pre-set time (field adjustable) to ensure the media is dry.

Evaporative Cooling: Capacities, Dimensions & Selection

Evaporative cooling solutions from AbsolutAire deliver economical, effective cooling and/or humidification for a wide range of industrial and commercial applications. EVR models provide maximum cooling and humidity utilizing a pump and a closed-loop, water recirculation system. EVN models provide similar cooling, but without water recirculation, and provide for reduced up-front costs, a simplified design and lower maintenance. Model selection is unique to specific application requirements.

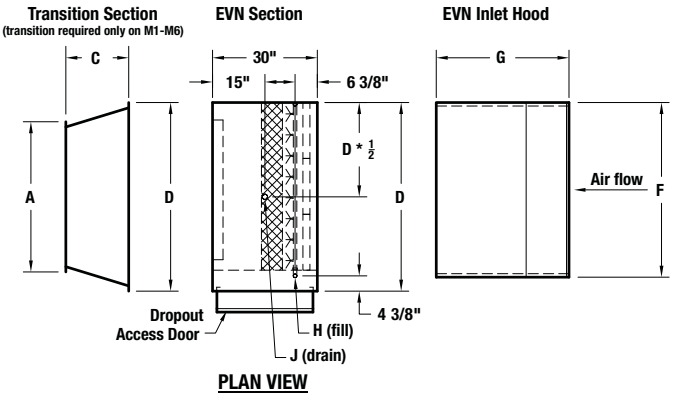
AbsolutAire EVN Evaporative Cooling

Model	CFM Range Min. – Max.	Used with Units	Dimensions, Inches A	B	C	D	E	F	G	Pipe Dia., In. H	J	*Sq Ft of Evap Media (6" or 12")
EVN1	800–2,200	M1	23	21	12	30	28	28	26	1/2	1	4.00
		V1 or AA1700	N/A	N/A	N/A							
EVN2	2,001–3,500	M2	28	24	12	38	30	35	32	1/2	1	5.78
		V2 or AA3000	N/A	N/A	N/A							
EVN3	3,501–5,000	M3	35	27	18	46	37	43	32	1/2	1	9.17
		V3, AA1, or AA2	N/A	N/A	N/A							
EVN4	5,001–7,500	M4	43	30	18	54	44	53	38	1/2	1-1/2	13.33
		V3, AA2, V4, or AA3	N/A	N/A	N/A							
EVN5	7,501–11,000	M5	48	35	24	66	52	63	46	1/2	1-1/2	20.00
		V4, AA3, V5, or AA4	N/A	N/A	N/A							
EVN6	11,001–14,000	M6	55	46	24	66	64	63	58	1/2	1-1/2	25.00
		V5 or AA4	N/A	N/A	N/A							

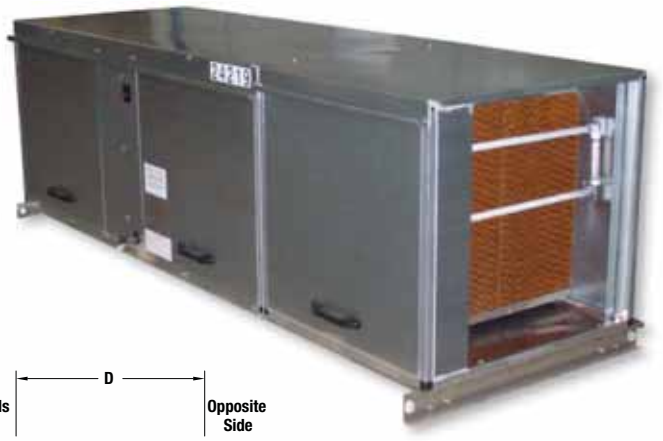
Notes:

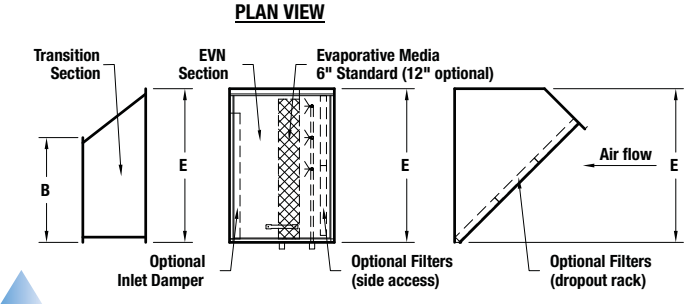
N/A = Not Applicable

*Velocity not to exceed 600 feet per minute (FPM)

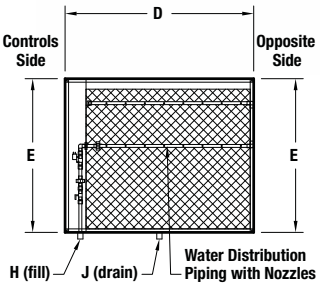


PLAN VIEW





CONTROLS SIDE VIEW

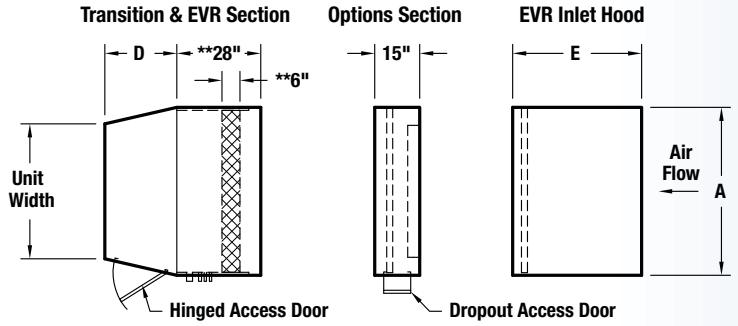


EVN SECTION INLET VIEW

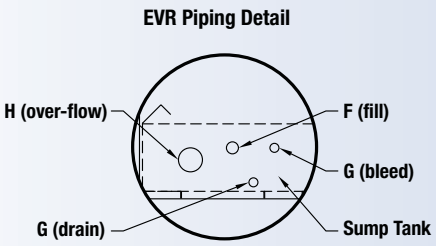
AbsolutAire EVR Evaporative Cooling

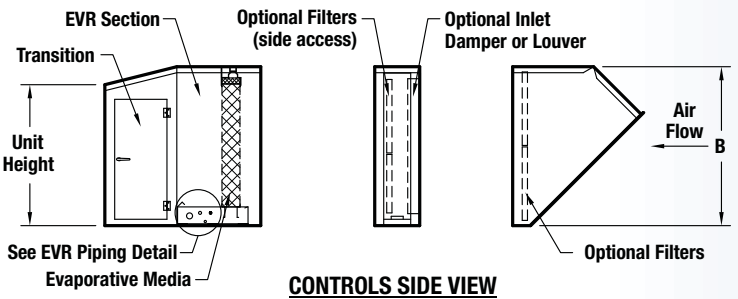
Model	CFM Range	Dimensions, Inches					Pipe Dia., In.			**6" Media (28" EVR)			**12" Media (34" EVR)			**18" Media (40" EVR)		
	Min. – Max.	A	B	C	D	E	F	G	H	*Sq Ft of Media	Pump HP	Max GPM	*Sq Ft of Media	Pump HP	Max GPM	*Sq Ft of Media	Pump HP	Max GPM
EVR1	800–2,250	32	31	31	24	30	3/4	1/2	1-1/2	4.2	1/6	1.5	3.8	1/6	3.0	3.8	1/6	4.5
EVR2	2,251–3,600	38	37	37	24	30	3/4	1/2	1-1/2	6.5	1/6	2.3	6.0	1/6	4.5	6.0	1/6	6.8
EVR3	3,601–6,200	50	44	44	24	36	3/4	1/2	1-1/2	11.0	1/6	3.0	10.3	1/6	6.0	10.3	1/6	9.0
EVR4	6,201–8,775	56	53	52	24	42	3/4	1/2	1-1/2	15.4	1/6	3.4	14.6	1/6	6.8	14.6	1/6	10.1
EVR5	8,776–9,750	62	53	52	24	42	3/4	1/2	1-1/2	17.1	1/6	3.8	16.3	1/6	7.5	16.3	1/6	11.3
EVR6	9,751–12,000	62	62	61	24	48	3/4	1/2	1-1/2	20.8	1/6	3.8	20.0	1/6	7.5	20.0	1/6	11.3
EVR7	12,001–14,400	74	62	61	30	48	3/4	1/2	1-1/2	25.0	1/6	4.5	24.0	1/6	9.0	24.0	1/6	13.5
EVR8	14,401–19,950	86	71	70	30	54	1	3/4	1-1/2	34.4	1/6	5.3	33.3	1/6	10.5	33.3	1/6	15.8
EVR9	19,951–22,000	98	71	70	30	54	1	3/4	1-1/2	38.0	1/6	6.0	36.7	1/3	12.0	36.7	1/3	18.0
EVR10	22,001–29,250	110	81	80	30	60	1	3/4	1-1/2	50.3	1/6	6.8	48.8	1/3	13.5	48.8	1/3	20.3
EVR11	29,251–32,500	122	81	80	30	60	1	3/4	1-1/2	55.8	1/6	7.5	54.2	1/3	15.0	54.2	1/3	22.5
EVR12	32,501–40,150	134	89	88	36	66	1	1	1-1/2	68.8	1/6	8.3	66.9	1/3	16.5	66.9	1/3	24.8
EVR13	40,151–52,800	146	104	103	36	72	1	1	1-1/2	90.0	1/3	9.0	88.0	1/3	18.0	88.0	1/3	27.0
EVR14	52,801–61,100	158	110	109	39	78	1	1-1/4	2-1/2	104.0	1/3	9.8	101.8	1/3	19.5	101.8	1/2	29.3
EVR15	61,101–75,600	170	124	123	42	84	1	1-1/4	2-1/2	128.3	1/3	10.5	126.0	1/3	21.0	126.0	1/2	31.5
EVR16	75,601–85,500	182	130	129	42	96	1	1-1/4	2-1/2	145.0	1/3	11.3	142.5	1/3	22.5	142.5	3/4	33.8
EVR17	85,501–98,600	206	132	131	42	96	1	1-1/4	2-1/2	167.2	1/3	12.8	164.3	1/2	25.5	164.3	3/4	38.3
EVR18	98,601–104,400	218	132	131	48	96	1	1-1/2	2-1/2	177.0	1/3	13.5	174.0	3/4	27.0	174.0	3/4	40.5
EVR19	104,401–110,200	230	132	131	54	96	1	1-1/2	2-1/2	186.8	1/3	14.3	183.7	3/4	28.5	183.7	3/4	42.8
EVR20	110,201–121,800	254	132	131	66	96	1	1-1/2	2-1/2	206.5	1/3	15.8	203.0	3/4	31.5	203.0	3/4	47.3
EVR21	121,801-133,400	278	132	131	78	96	1	1-1/2	2-1/2	226.2	1/3	17.3	222.3	3/4	34.5	222.3	3/4	51.8

*Velocity not to exceed 600 feet per minute (FPM)

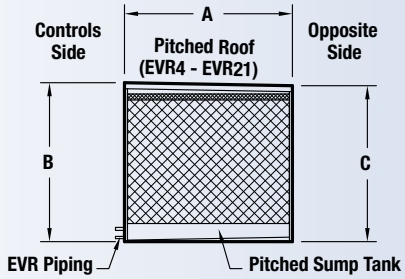


PLAN VIEW





CONTROLS SIDE VIEW



EVR SECTION INLET VIEW

Cooling

AbsolutAire Mechanical Coil Cooling

Some applications require temperature and humidity levels lower than evaporative cooling can provide. In such cases, AbsolutAire can provide mechanical cooling options. These systems cost more than evaporative cooling because added equipment is needed – such as chillers, condensers and compressors.

Direct Expansion (DX) cooling is the usual choice for smaller systems, while Chilled Water (CW) cooling is the choice for larger tonnage systems. Both types of cooling systems reduce the dry bulb temperature and wet bulb temperature.

Direct Expansion (DX) Coils

Direct expansion evaporator coils offer single, dual or quad circuits to ensure precise control of cooling capacity on AbsolutAire units. Interlaced circuiting as well as face or run control options ensure uniform refrigerant distribution over the face of the coil. Wide fin spacing is available to reduce frost buildup on low-temperature applications.

Many options are available. These include special coil coatings, such as phenolic or urethane; special coil construction, such as copper fins, stainless steel, thicker fins or tubes; a choice of different refrigerants; and other features to meet requirements.

Chilled Water (CW) Coils

Chilled water coils are a common choice for low-cost cooling and dehumidification on AbsolutAire units. These coils are typically available in a range of sizes and circuiting selections to optimize heat-transfer capacities. The design and selection process ensures easy cleaning for lasting performance. Glycol is sometimes used as the cooling fluid.

Construction Features

Mechanical coil cooling systems from AbsolutAire offer a wide range of standard features, as well as numerous options. These include:

STANDARD FEATURES

- Liquid & Suction Connections Piped to Unit Exterior
- Heavy Gauge Stainless Steel Condensate Pans
- Hot Gas Bypass (DX Coil Units)
- 5/8” Diameter, 0.016” Wall (Minimum) Copper Tubes
- 0.006” Thick (Minimum) Aluminum Fins

OPTIONS

- Interlaced Circuits

Good Practices

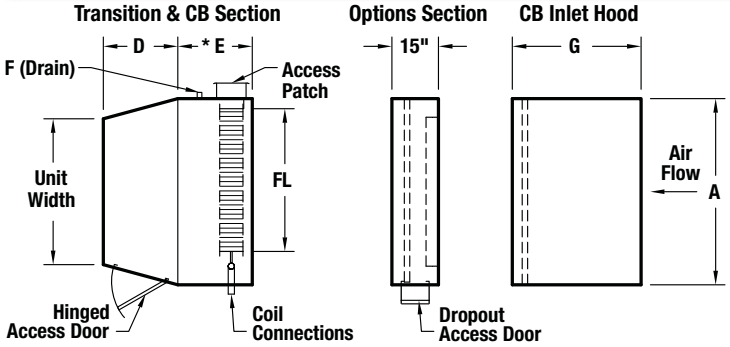
Mechanical cooling coils perform their heat-transfer functions in extremely hostile environments, which may degrade performance as well as shorten coil life. Regular cleaning and adjustments are recommended to prevent dirt from accumulating and moisture causing corrosion. Upstream filters must be maintained as specified. Other good practices include:

- Specify copper tubes with aluminum fins for corrosion resistance;
- Clean coils annually with pressurized water and a mild detergent; and,
- Replace coils that show excessive pressure drop. Fouled coils may contain a sticky sludge deep inside, which is biologically active and may cause IAQ problems.

AbsolutAire CB Mechanical Cooling

Model	CFM Range Min. – Max.	Dimensions, Inches A	B	C	D	*E Quantity of Rows in Coil 1–5	6 or 8	10 or 12	F (dia.)	G	Coil Data Qty of Coils	FH (Max) Fin Height	FL (Max) Fin Length
CB1	800–2,200	43	31	31	24	24	30	36	3/4	30	1	21	30
CB2	2,201–3,500	50	37	37	24	24	30	36	3/4	30	1	27	37
CB3	3,501–5,200	58	43	43	24	24	30	36	3/4	36	1	33	45
CB4	5,201–6,800	66	46	46	24	24	30	36	3/4	36	1	36	53
CB5	6,801–9,000	74	53	52	24	24	30	36	3/4	42	1	42	60
CB6	9,001–11,500	82	59	58	24	24	30	36	3/4	48	1	48	68
CB7	11,501–14,000	90	63	62	30	24	30	36	1-1/2	48	1	51	76
CB8	14,001–19,000	104	72	71	36	24	30	36	1-1/2	54	1	60	90
CB9	19,001–25,000	122	78	77	42	24	30	36	1-1/2	60	1	66	108
CB10	25,001–30,000	128	87	86	42	24	30	36	1-1/2	66	1	75	114
CB11	30,001–35,000	134	96	95	42	24	30	36	1-1/2	72	1	84	120
CB12	35,001–40,000	134	112	111	54	24	30	36	1-1/2	78	2	48	120
CB13	40,001–45,000	146	112	111	54	24	30	36	1-1/2	78	2	48	132
CB14	45,001–50,000	146	124	123	66	24	30	36	1-1/2	84	2	54	132
CB15	50,001–55,000	158	129	128	72	24	30	36	2-1/2	90	3	36	144
CB16	55,001–60,000	170	129	128	60	24	30	36	2-1/2	90	3	36	156
CB17	60,001–65,000	176	134	133	60	24	30	36	2-1/2	96	3	37-1/2	162
CB18	65,001–70,000	188	134	133	60	24	30	36	2-1/2	96	3	37-1/2	174
CB19	70,001–75,000	200	134	133	66	24	30	36	2-1/2	96	3	37-1/2	186
CB20	75,001–80,000	212	134	133	66	24	30	36	2-1/2	96	3	37-1/2	198

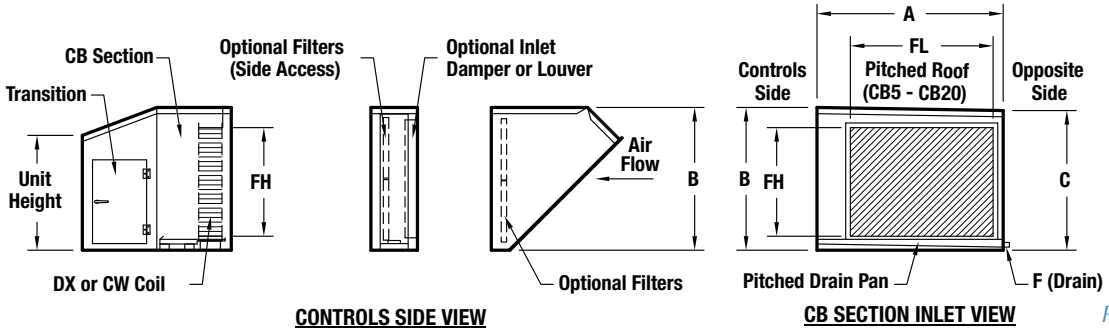
*Once the factory performs the coil selection, the CB section length (dim. E) is determined by the quantity of rows in coil(s).



- PLEASE NOTE THE FOLLOWING -

* Consult factory representative for DX or CW coil selection
* Coil connections are standard as shown - opposite side connections are available
* Drain piping is standard as shown - opposite side, floor, or special drain locations are available
* Horizontal draw through configuration shown - discharge, upright, and special configurations are available
* Split system configuration shown - packaged systems, including condensing units, are available - consult factory representative for proper selection

PLAN VIEW



CONTROLS SIDE VIEW

CB SECTION INLET VIEW

Cooling

AbsolutAire Cooling Solutions

Direct Expansion (DX) Cooling:

Worthington Trailer — Montoursville, PA

- AbsolutAire R349-UMXDX
- 40,000 CFM Modulating 85/15 Recirculation Unit
- 3,650 MBH Direct Gas-Fired Heat
- 100-Ton Split-System DX Cooling

Direct Expansion (DX) Cooling:

Toyota Fork Lift — Columbus, IN

- AbsolutAire R444-HVXDX
- 30,000 CFM Modulating 85/15 Recirculation Unit
- 2,736 MBH Direct Gas-Fired Heat
- Integral 60-Ton Condensing Unit & DX Cooling Package

Chilled Water (CW) Cooling:

Caterpillar — Lafayette, IN

- AbsolutAire R466-UMXCW
- 75,000 CFM Modulating 85/15 Recirculation Unit
- 1,450 MBH Direct Gas-Fired Heat
- 100-Ton Chilled water Cooling System

EVR Evaporative Cooling:

Johns Manville — Scottsboro, AL

- AbsolutAire R366-UOXEV
- 75,000 CFM 100% OA Make-Up Air Unit
- 7,800 MBH Direct Gas-Fired Heat
- 12″ CELdek Evaporative Media

EVR Evaporative Cooling:

Metalsa Corporation — Monterrey, Mexico

- AbsolutAire R373-HOXEV
- 75,000 CFM 100% OA Units (4)
- 3,277 MBH Direct Gas-Fired Heat
- 12″ CELdek Evaporative Media

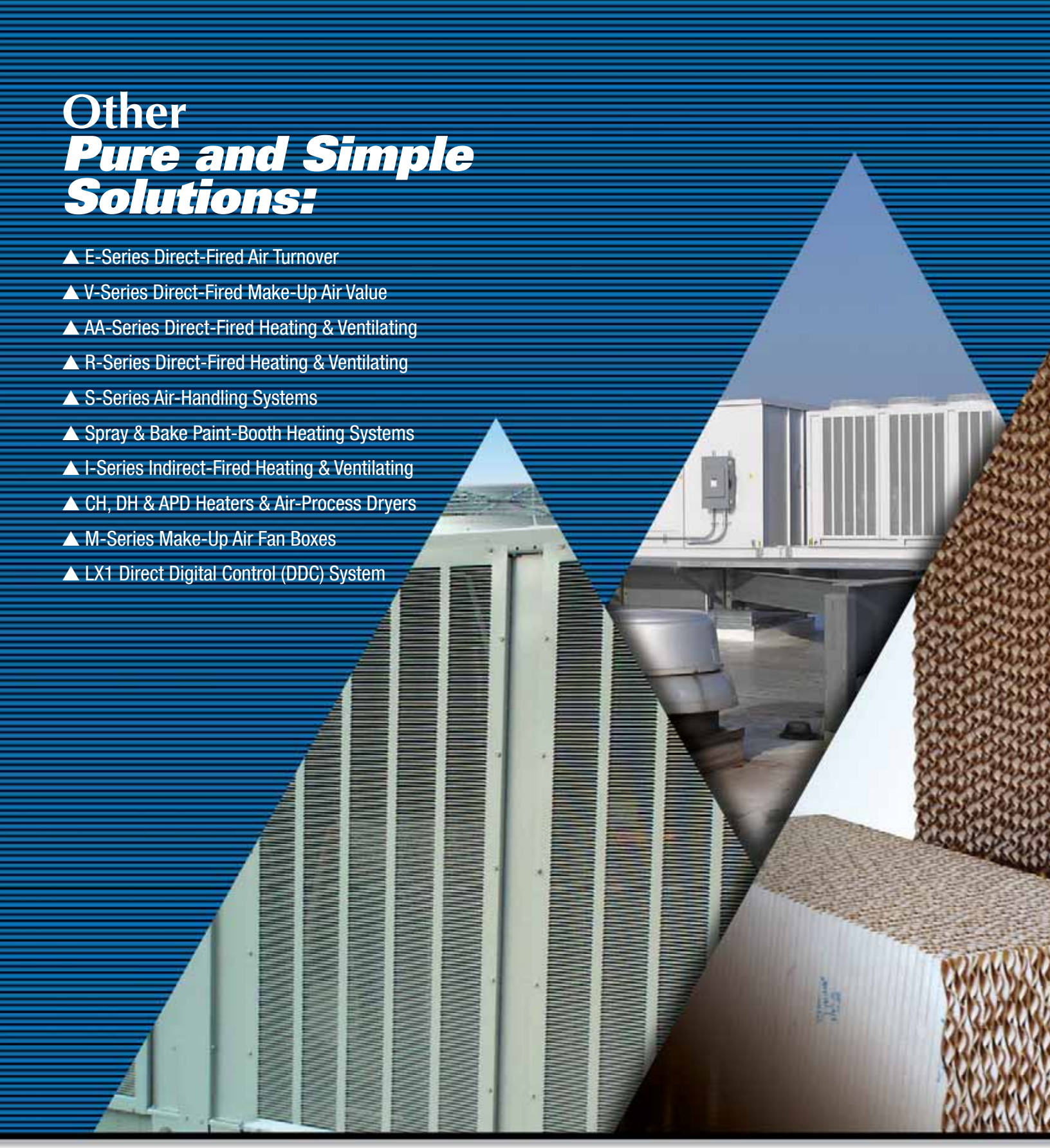
EVR Evaporative Cooling:

Federal Mogul — Lake City, MN

- AbsolutAire R336-HOXEV
- 20,000 CFM 100% OA Units (2)
- 2,179 MBH Direct Gas-Fired Heat
- 12″ CELdek Evaporative Media

Other *Pure and Simple Solutions:*

- ▲ E-Series Direct-Fired Air Turnover
- ▲ V-Series Direct-Fired Make-Up Air Value
- ▲ AA-Series Direct-Fired Heating & Ventilating
- ▲ R-Series Direct-Fired Heating & Ventilating
- ▲ S-Series Air-Handling Systems
- ▲ Spray & Bake Paint-Booth Heating Systems
- ▲ I-Series Indirect-Fired Heating & Ventilating
- ▲ CH, DH & APD Heaters & Air-Process Dryers
- ▲ M-Series Make-Up Air Fan Boxes
- ▲ LX1 Direct Digital Control (DDC) System



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