

FXV

Closed Circuit Cooling Towers



Closed Circuit Cooling Towers

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FXV

Closed Circuit Cooling Towers

Single Cell Capacity:

26 – 624 Nominal Tons

78.7 – 1,872 GPM of water at 95°F/85°F/78°F

FXV Closed Circuit Cooling Towers deliver independently verified, fully rated thermal performance over a wide range of flow and temperature requirements. Standard design features satisfy today's environmental concerns, minimize installation costs, maximize year-round operating reliability, and simplify maintenance requirements.

FXV Closed Circuit Cooling Towers

- Low energy consumption
- Low installed cost
- Easy maintenance
- Application flexibility
- Reliable year-round operation
- Long service life
- ASME B31.5 compliant heat transfer coils
- Five-year warranty on mechanical equipment



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Closed Circuit Cooling Towers



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Benefits

Low Energy Consumption

- Evaporative cooled equipment minimizes the energy consumption of the entire system because it provides lower operating temperatures. The owner saves money while conserving natural resources and reducing environmental impact.
- The FXV provides heat rejection at the lowest possible energy input and maintenance requirements via:
 - High efficiency, low horsepower axial fans
 - Closed loop cooling, which minimizes process fouling
 - Patented combined flow technology, which reduces evaporation directly off the coil, minimizing the potential for scaling and fouling (see page E1)
 - Variable Frequency Drives (optional) (see page G1 for details)
 - ENERGY-MISER® Fan System (optional) (see page E20 for details)
 - BALTIGUARD PLUS™ Fan System (optional) (see page G1 for details)

Low Installed Cost

- **Support** — All models mount directly on parallel I-beams and ship complete with motors and drives factory-installed and aligned.
- **Modular Design** — Units ship in multiple sections to minimize the size and weight of the heaviest lift, allowing for the use of smaller, less costly cranes.



The unit shown ships in two pieces to minimize shipping and rigging costs

Easy Maintenance

- **Access** — Hinged access doors on each end wall and a standard internal walkway provide easy access to the unit interior.
- **Spacious Interior** — Provides easy access to the cold water basin, drift eliminators, fan drive system and heat transfer coil.



Oversized, hinged access door





- **Access to Spray Distribution** — Parallel flow of air and spray water over the coil allows for inspection and access to the top of the coil during full operation.



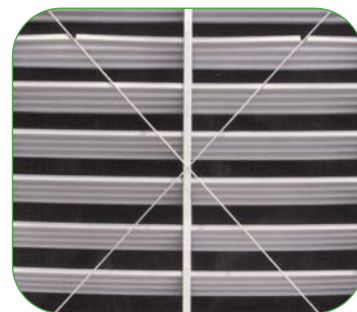
Spray distribution system

Application Flexibility

- **Difficult thermal duties** — The combined flow design is ideal for applications requiring a close approach and/or large range.
- **Replacement applications** — Single air inlet models are designed to mount directly on existing support steel of both crossflow and counterflow units.
- **Coil configurations** — Alternate coil configurations and materials available. ASME "U" Stamp available (see page E19 for details).
- **Highest capacity in the industry** — Dual air inlet models offer the highest single cell capacity of any closed circuit cooling tower in the industry. Projects benefit from fewer required cells, lower overall fan horsepower, and fewer piping connections.

Reliable Year-Round Operation

- **BALTIDRIVE® Power Train** — Backed by a 5-year fan motor and drive warranty, the BALTIDRIVE® Power Train utilizes special corrosion-resistant materials of construction and state-of-the-art technology to ensure ease of maintenance and reliable year-round performance.
- **Separate Air Inlet Louvers** — Reduce the potential for scale build-up and damaging ice formations at the air/water interface by providing a line of sight from the outside of the unit into the fill.



Air Inlet louvers

Long Service Life

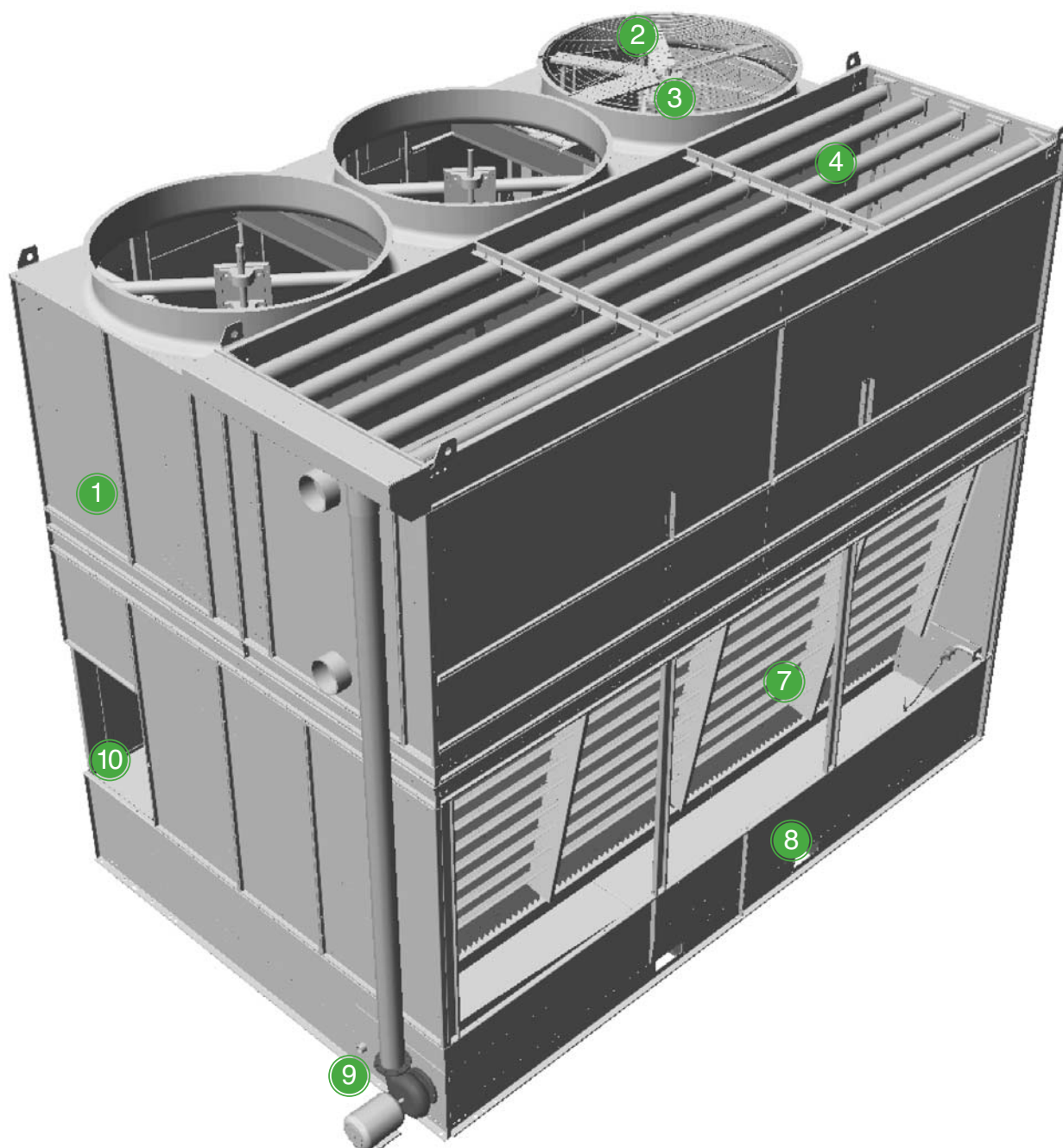
Materials of Construction — Various materials are available to meet the corrosion resistance, unit operating life, and budgetary requirements of any project (see page E19 for construction options).

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Construction Details

Single Air Inlet Models





① Heavy-Duty Construction

- G-235 (Z700 metric) hot-dip galvanized steel panels

② BALTIDRIVE® Power Train

- Premium quality, solid-backed, multi-groove belt
- Corrosion resistant cast aluminum sheaves
- Heavy-duty bearings (280,000 hour average life)
- Cooling tower duty fan motor
- 5-year motor and drive warranty



③ Low HP Axial Fan(s)

- High efficiency
- Quiet operation
- Corrosion resistant aluminium

④ Water Distribution System

- Visible and accessible during operation
- Overlapping spray patterns ensure proper water coverage
- Large orifice, 360° non-clog nozzles

⑤ Coil Section (Not Shown)

- Continuous serpentine, steel tubing
- Hot-dip galvanized after fabrication (HDGAF)
- Pneumatically tested at 375 psig
- Sloped tubes for free drainage of fluid
- ASME B31.5 compliant
- When required, orders shipping into Canada are supplied with a CRN

⑥ BACross® Fill with Integral Drift Eliminators (Not Shown)

- High efficiency heat transfer surface
- Polyvinyl chloride (PVC)
- Impervious to rot, decay and biological attack
- Flame spread rating of 5 per ASTM E84-77a

⑦ FRP Air Inlet Louvers

- Corrosion resistant
- UV resistant finish
- Maintenance free

⑧ Cold Water Basin

- Sloped cold water basin for easy cleaning
- Suction strainer with anti-vortex hood accessible from louver face
- Adjustable water make-up assembly
- Integral internal walkway

⑨ Recirculating Spray Water Pump

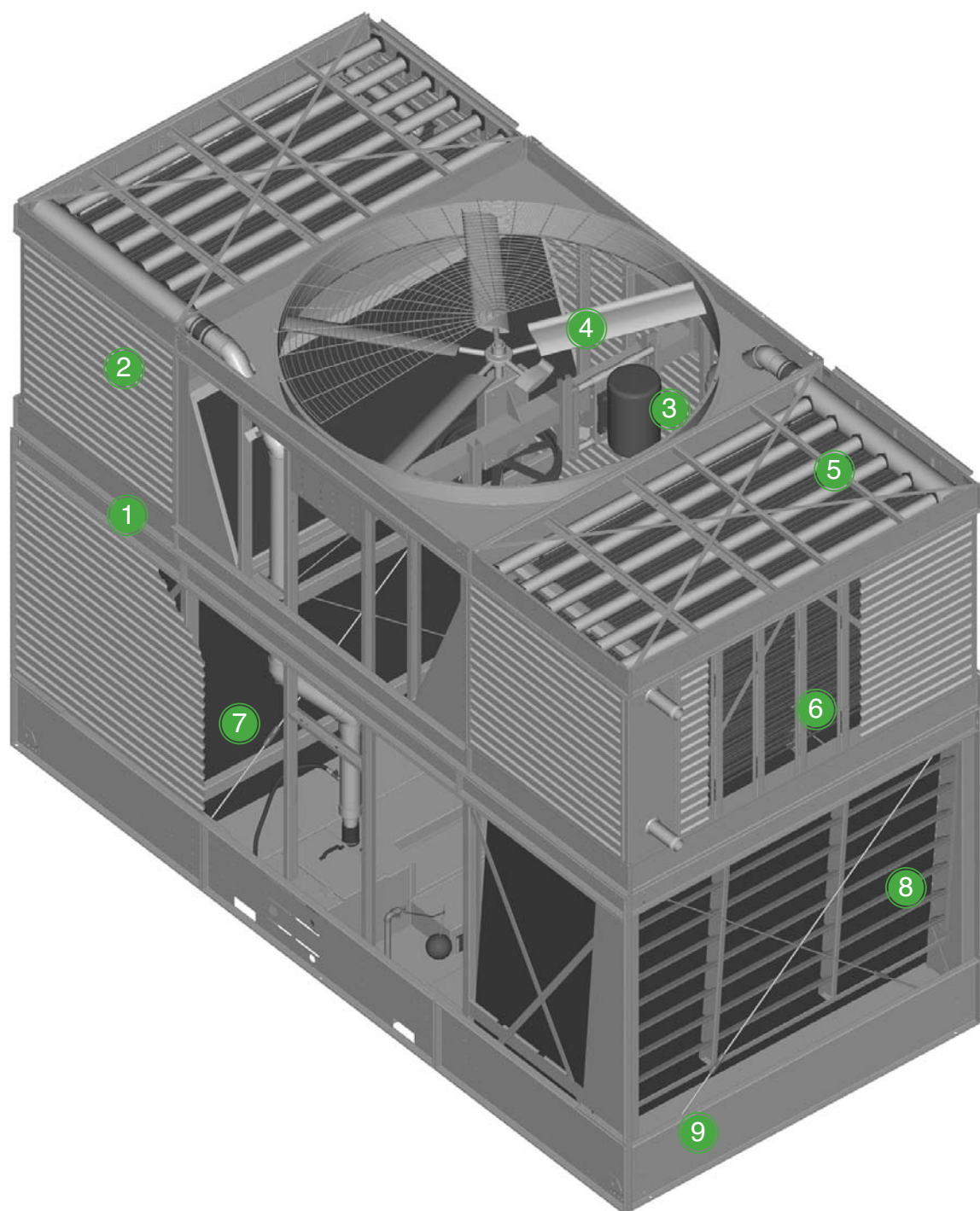
- Close coupled, bronze fitted centrifugal pump
- Totally enclosed fan cooled (TEFC) motor
- Bleed line with metering valve installed from pump discharge to overflow

⑩ Hinged Access Doors

- Inward swinging door on each end wall

Construction Details

Dual Air Inlet Models





① Heavy-Duty Construction

- G-235 (Z700 metric) hot-dip galvanized steel frame

② FRP Casing Panels

- Corrosion resistant
- Maintenance free
- UV resistant finish

③ BALTIDRIVE® Power Train

- Premium quality, solid backed, multi-groove belt
- Corrosion resistant cast aluminum sheaves
- Heavy-duty bearings (280,000 hour average life)
- Cooling tower duty fan motor
- 5-year motor and drive warranty



④ Low HP Axial Fan

- High efficiency
- Quiet operation
- Corrosion resistant

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- Corrosion resistant
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- Maintenance free

⑨ Cold Water Basin

- Sloped cold water basin for easy cleaning
- Suction strainer with anti-vortex hood
- Adjustable water make-up assembly

⑩ Integral Recirculating Spray Water Pumps (Not Shown)

- Close coupled, bronze fitted centrifugal pumps
- Totally enclosed fan cooled (TEFC) motors
- Bleed line with metering valve installed from pump discharge to overflow

⑪ Hinged Access Doors (Not Shown)

- Inward swinging door on each end wall

Custom Features and Options

Construction Options

- **Standard Construction:**

Models 421 - 661: All steel panels and structural elements are constructed of heavy-gauge G-235 (Z700 metric) hot-dip galvanized steel. Inlet louvers are constructed of UV-resistant, fiberglass reinforced polyester (FRP).

Models FXV-288 and 364: Casing panels and air inlet louvers are constructed of UV-resistant, fiberglass reinforced polyester (FRP).

- **Optional BALTIBOND® Corrosion Protection System:**

The BALTIBOND® Corrosion Protection System, a hybrid polymer coating used to extend equipment life, is applied to all hot-dip galvanized steel components of the closed circuit cooling tower (excluding heat transfer coil).

- **Optional Stainless Steel Cold Water Basin:**

A Series 300 stainless steel cold water basin is available. Seams between panels inside the cold water basin are welded. The basin is leak tested at the factory and welded seams are provided with a 5-year leak-proof warranty.

- **Optional Stainless Steel Construction:**

Steel panels and structural elements are constructed of Series 300 stainless steel. Seams between panels inside the cold water basin are welded. The basin is leak tested at the factory and welded seams are provided with a five-year leak-proof warranty.

Factory Mutual Approval

All multi-cell units are available with Factory Mutual (FM) Approved construction as an option.

Coil Configurations

- **Standard Serpentine Coil:**

The standard cooling coil is constructed of continuous lengths of all prime surface steel, hot-dip galvanized (outside surface) after fabrication (HDGAF). The coil is designed for low pressure drop with sloping tubes for free drainage of fluid. Each coil is pneumatically tested at 375 psig (2586 kPa) and is ASME B31.5 compliant.

- **Optional Cleanable Header Coil:**

The cleanable header tube bundle provides removable cover plates on the inlet and outlet header boxes to permit access to each serpentine tube circuit for solvent or air-pressure cleaning. Tubes are all prime surface steel tubing formed into a serpentine shape and welded into an assembly. Coil material options include carbon steel coils (hot-dip galvanized outside surface) or stainless steel coils. Each coil is pneumatically tested at 125 psig (860 kPa).





- **Optional Stainless Steel Coil:**

Coils are available in Series 300 stainless steel for specialized applications. The coil is designed for low pressure drop with sloping tubes for free drainage of fluid. Each coil is pneumatically tested at 375 psig (2586 kPa) and is ASME B31.5 compliant.

- **Optional Straight-Through Mechanically-Cleanable Coil:**

A header box with a removable cover plate at each end of the coil allows access to every tube end for mechanical cleaning or plugging. It is available in carbon steel (hot-dip galvanized inside and out) or stainless steel. Each coil is pneumatically tested at 125 psig (860 kPa).

- **Optional ASME “U” Stamp Coil:**

This serpentine coil is manufactured and tested in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and bears the ASME “U” stamp. ASME coils are hot-dip galvanized (outside surface) after fabrication (HDGAF). The coil is designed for low pressure drop with sloping tubes for free drainage of fluid. Each coil is pneumatically tested at 375 psig (2586 kPa).

When required, coils shipping into Canada are supplied with a CRN. Other coil configurations are available for specific applications. Contact your local BAC Representative for details.

Fan Drive System

The fan drive system provides the cooling air necessary to reject unwanted heat from the system to the atmosphere. The standard fan drive system on all models is the exclusive BALTIDRIVE® Power Train. This BAC engineered drive system consists of a specially designed powerband and two cast aluminum sheaves located on minimum shaft centerline distances to maximize belt life. A cooling tower duty fan motor, custom engineered for BAC to provide maximum performance for cooling tower service, is provided and backed by BAC's comprehensive 5-year motor and fan drive warranty.

ENERGY-MISER® Fan System

The ENERGY-MISER® Fan System consists of two standard single-speed fan motor and drive assemblies. One drive assembly is sized for full speed and load, and the other is sized approximately 2/3 speed and consumes only 1/3 the design horsepower. This configuration allows the system to be operated like a two-speed motor, but with the reserve capacity of a standby motor in the event of failure. As a minimum, approximately 70% capacity will be available from the low horsepower motor, even on a design wet-bulb day. Controls and wiring are the same as those required for a two-speed, two-winding motor. Significant energy savings are achieved when operating at low speed during periods of reduced load and/or low wet-bulb temperatures.

BALTIGUARD PLUS™ Fan System

The BALTIGUARD PLUS™ Fan System builds on the advantages of the ENERGY-MISER® Fan System by adding a VFD to the smaller motor. Using the VFD on the smaller fan motor, as opposed to the larger motor, reduces the cost of the VFD, and wiring for the motor. For more information on the BALTIGUARD PLUS™ Fan System refer to page G1.

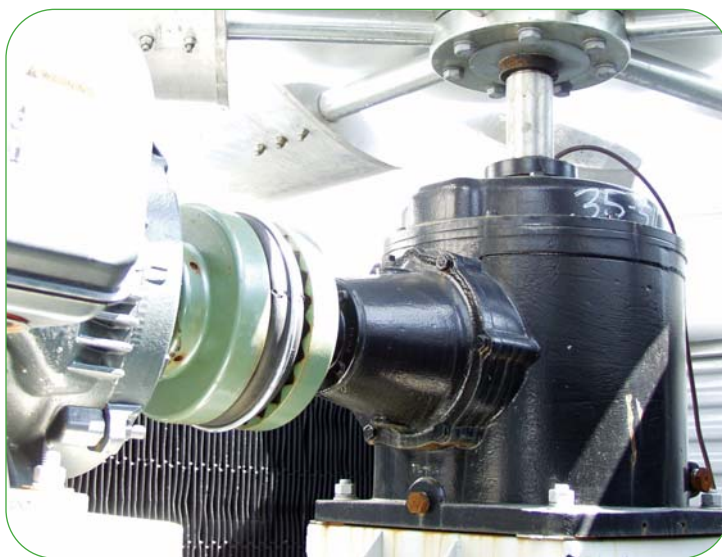
Custom Features and Options

Independent Fan Operation

Models FXV-43X, 44X, Q44X, 64X, and Q64X are provided with one fan motor driving two fans as standard. Models FXV-66X and Q66X are provided with two fan motors driving three fans as standard. The independent fan option consists of one fan motor and drive assembly for each fan to allow independent operation, adding an additional step of fan cycling and capacity control.

Gear Drive System, Close-Coupled Motor

Models FXV-288 and 364 are available with a close-coupled gear drive system. Both the gear drive and couplings are selected with a 2.0 service factor. Gear construction includes a nickel-alloy steel shaft, casehardened gears, self lubrication, and a single piece, gray iron housing. This drive system ships completely installed and aligned.



Gear drive system, close-coupled motor

Gear Drive System, Externally Mounted Motor

Models FXV-288 and 364 are available with a gear drive system with external TEFC motor. A non-corrosive carbon-fiber composite drive shaft with stainless steel hubs is selected with a 2.0 service factor. The motor and drive shaft ship separately for easy field installation.



VFD & safety switch

Equipment Controls

BAC control panels are specifically designed to work seamlessly with all BAC units and engineered to meet your particular application. For more on BAC Equipment Controls, see pages G1-G13.





Low Sound Operation

The low sound levels generated by FXV Closed Circuit Cooling Towers make them suitable for installation in most environments. For very sound sensitive installations, a low sound fan option is available to reduce the sound levels generated from the tower with minimal impact on thermal performance. The FXV thermal performance with the low sound fan has been certified in accordance with CTI Standard STD-201.

For extremely sound sensitive installations, factory designed, tested and rated sound attenuation is available for both the air intake and discharge.



Unit with intake and discharge sound attenuation

Whisper Quiet Fans

FXV single air inlet models (FXV-42X through FXV-Q66X) are available with a "Whisper Quiet" fan that significantly reduces the sound levels generated from the unit with minimal impact on thermal performance.



Basinless Unit Construction (FXV-288 and 364 Models Only)

The basinless unit construction option enables units to be directly installed on new or existing concrete cold water basins. This custom feature, reduces maintenance costs by eliminating the integral basin from traditional units. It simplifies piping and pumping requirements of multi-cell installations and provides a cost-effective solution for many field-erected replacement projects.



Installation on a concrete basin

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Accessories

External Service Platforms

For external service, louver face and access door platforms can be added to the unit, when purchased or as an aftermarket item. Safety cages and safety gates are also available. All components are designed to meet OSHA requirements.



External platform at louver face

Ladder, Safety Cage, Gate and Handrails (FXV-288 and 364 Models Only)

In the event the end-user elects to provide access to the fan deck, models FXV-288 and 364 can be furnished with ladders extending from the top of the unit to the base, as well as safety cages, safety gates, fan deck extensions and handrail packages. All components are designed to meet OSHA requirements. All access to the top of the equipment must be made in accordance with applicable government occupational safety standards.

Note: Partial or full grating above the coil air intake is recommended with this option.

Internal Ladder

For access to the motor and drive assemblies on single air inlet models, a moveable internal ladder is available.

Internal Service Platforms

For access to the motor and drive assemblies on single air inlet models FXV-L641 through FXV-Q661 and all dual air inlet models, an internal ladder and upper service platform with handrails is available. Safety gates are available for all handrail openings. All components are designed to meet OSHA requirements.



Internal ladder and service platform

Vibration Cutout Switch

A factory mounted vibration cutout switch is available to effectively protect against equipment failure due to excessive vibration of the mechanical equipment system. BAC can provide either a mechanical or solid-state electronic vibration cutout switch in a NEMA 4 enclosure to ensure reliable protection. Additional contacts can be provided to either switch type to activate an alarm.



Positive Closure Damper (PCD) Hoods

The FXV's innovative design results in a low heat loss when the unit is idle. When additional heat loss prevention is desired, coil air intake hoods with factory mounted PCDs and damper actuators can be provided. The addition of factory mounted insulation to the hood and casing further reduces the heat loss by minimizing losses due to conduction. See page E29 for heat loss data on all FXV models.

Basin Heaters

Closed circuit cooling towers exposed to below freezing ambient temperatures require protection to prevent freezing of the water in the cold water basin when the unit is idle. Factory-installed electric immersion heaters, which maintain +40°F (4.4°C) water temperature, are a simple and inexpensive way of providing such protection.



Basin heater

Heater Sizing Data

Model Numbers	0°F (-17.8°C) Ambient Heaters		-20°F (-28.9°C) Ambient Heaters	
	Number of Heaters	kW per Heater	Number of Heaters	kW per Heater
FXV - 42X	1	4	1	6
FXV - 43X	1	6	1	8
FXV - 44X	1	8	1	12
FXV - 64X	1	12	1	16
FXV - 66X	1	16	1	21
FXV - 288	2	12	2	15
FXV - 364	2	14	2	20

Electric Water Level Control Package

The electric water level control replaces the standard mechanical make-up valve when a more precise water level control is required. This package consists of a conductance-actuated level control mounted in the basin and a solenoid activated valve in the make-up water line. The valve is slow closing to minimize water hammer.



Electric water level control package

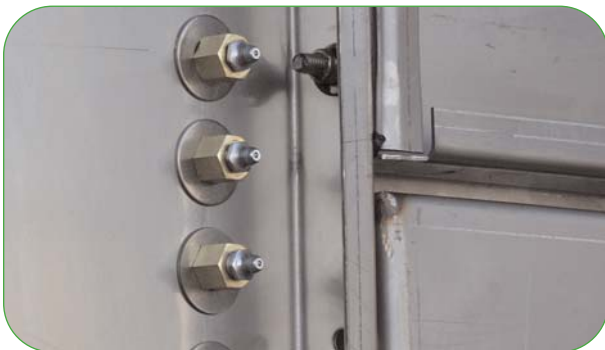
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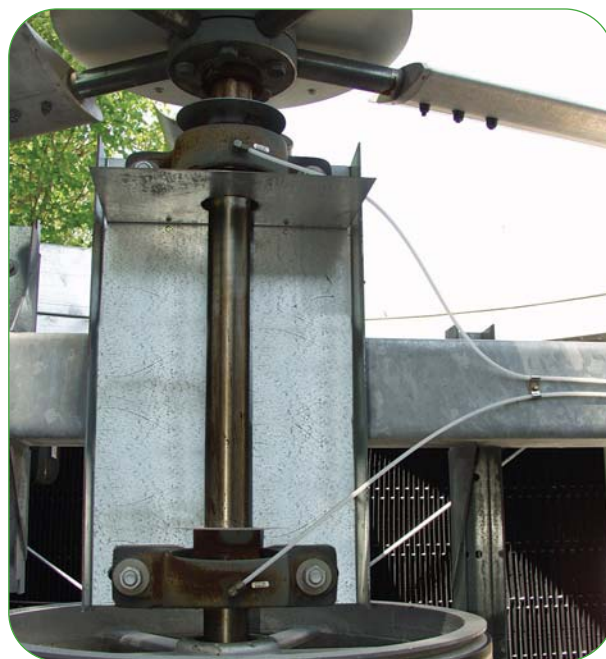
Accessories

Extended Lubrication Lines

Extended lubrication lines are available for lubrication of the fan shaft bearings. Grease fittings are located inside the plenum area next to the access door.



Grease fittings at the access door & bearings with the extended lubrication line option



High Temperature Fill

Optional high temperature fill material is available for high entering fluid temperatures.

Air Inlet Screens

Wire mesh screens can be factory-installed over the inlet louvers and the spray distribution system to prevent debris from entering the unit.

Basin Sweeper Piping

Basin sweeper piping provides an effective method of preventing debris from collecting in the cold water basin of the tower. A complete piping system, including nozzles, is provided in the tower basin for connection to side stream filtration equipment (by others). For more information on filtration systems, see page M159.



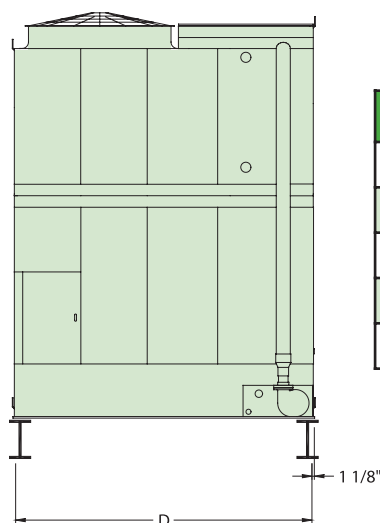
Basin sweeper piping



Structural Support

The recommended support arrangement for FXV Closed Circuit Cooling Towers consists of parallel I-beams positioned as shown on the drawings. Besides providing adequate support, the steel also serves to raise the unit above any solid foundation to assure access to the bottom of the tower. Alternate steel support designs include a cantilevered plan as indicated by the optional minimum "D" dimension in the table below. To support an FXV on columns or in an alternate arrangement not shown here, consult your local BAC Representative.

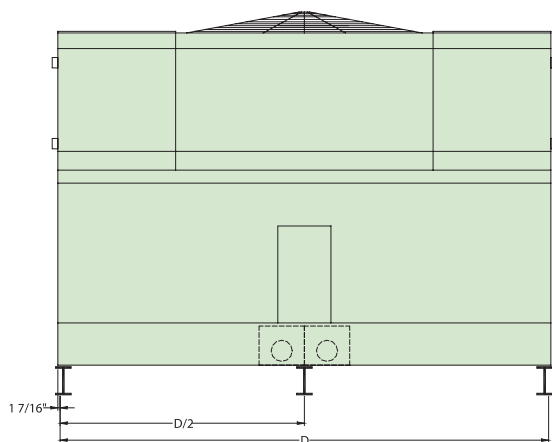
Single Air Inlet



Model Number	D	Optional Minimum D*	Maximum Deflection
FXV - 42x	8' 3"	5' 9"	3/16"
FXV - 43x	8' 3"	5' 9"	5/16"
FXV - 44x	8' 3"	5' 9"	3/8"
FXV - 64x	11' 7-3/4"	8' 0"	3/8"
FXV - 66x	11' 7-3/4"	8' 0"	1/2"

*When unit is supported with a cantilever plan, the side opposite the air inlet shall be cantilevered.

Dual Air Inlet



Model Number	D	Max. Deflection
FXV-288-xxx	23' 9-1/8"	1/2"
FXV-364-xxx	26' 5/8"	1/2"

Notes:

1. Support steel and anchor bolts to be designed and furnished by others.
2. All support steel must be level at the top.
3. Beams must be selected in accordance with accepted structural practice. Maximum deflection of beam under unit to be 1/360 of span, not to exceed 1/2 inch.
4. If vibration isolation rails are to be used between the unit and supporting steel, be certain to allow for the length of the vibration rails when determining the length of the supporting steel, as vibration rail length and mounting hole locations may differ from those of the unit.
5. If point vibration isolation is used with multi-cell units, the isolators must be located under the support steel, not between the support steel and the closed circuit cooling towers.

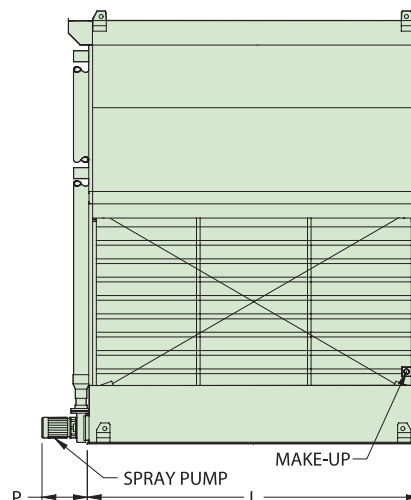
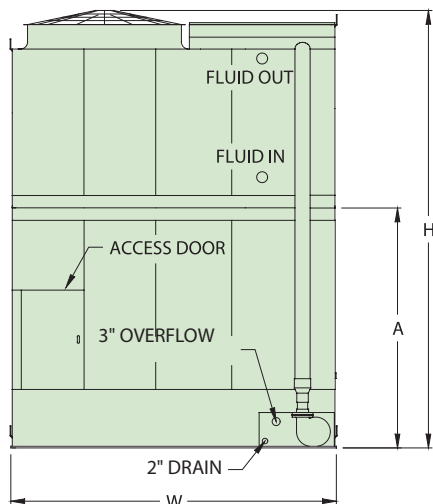
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Engineering Data

Do not use for construction. Refer to factory certified dimensions. This handbook includes data current at the time of publication, which should be reconfirmed at the time of purchase. Up-to-date engineering data, free product selection software, and more can be found at www.BaltimoreAircoil.com.

Single Air Inlet Models



Model Number	Nominal Tons ⁵	Motor HP		Weights (lbs)			Dimensions					Connection Sizes ^{2,3}		Spray Pump (GPM)	Internal Coil Volume (GAL)	
		Fan	Pump	Operating ¹	Shipping	Heaviest Section	L	W	H	A	P	Make-Up Water	Coil			
FXV-421	33	3 to 10	1.5	7,730	5,050	2,900	6' 1-1/4"	8' 5-1/4"	13' 2-3/4"	6' 3/4"	1' 3-3/4"	1/2"	4"	190	46	
FXV-422	46			8,190	5,370	3,220									60	
FXV-423	52			8,680	5,710	3,560									74	
FXV-424	59			9,160	6,050	3,900									88	
FXV-431	57	5 to 15	2	11,230	7,160	4,240	9' 1-1/4"	8' 5-1/4"	13' 2-3/4"	6' 3/4"	1' 4-1/4"	1/2"	4"	290	69	
FXV-432	73			11,930	7,650	4,730									90	
FXV-433	81			12,630	8,140	5,220									112	
FXV-434	95			13,380	8,680	5,760									133	
FXV-441	92	7.5 to 20	3	14,200	8,760	5,120	12' 1-1/4"	8' 5-1/4"	13' 2-3/4"	6' 3/4"	1' 8-1/4"	1/2"	4"	500	91	
FXV-442	111			15,150	9,410	5,770									120	
FXV-443	122			16,080	10,060	6,420									149	
FXV-444	140			17,070	10,770	7,130						1/2"	6"		178	
FXV-Q440	88			15,150	9,410	5,770									124	
FXV-Q441	125			17,070	10,770	7,130						1/2'	6"		182	
FXV-641	144	10 to 30	5	18,560	10,890	6,730	12' 1-1/4"	11' 10"	15' 10-3/4"	8' 8-3/4"	1' 8-3/4"	1"	4"	715	146	
FXV-642	175			20,050	11,930	7,770									192	
FXV-643	193			21,550	12,980	8,820									238	
FXV-644	215			23,050	14,040	9,880						1"	6"		284	
FXV-Q640	134			20,050	11,930	7,770									194	
FXV-Q641	186			23,050	14,040	9,880						1"	6"		286	
FXV-661	231	15 to 45	7.5	27,070	15,510	9,690	18' 1-1/4"	11' 10"	16' 4-1/4"	9' 2-1/4"	2' 3/8"	1"	4"	900	218	
FXV-662	267			29,290	17,070	11,250									288	
FXV-663	295			31,570	18,670	12,850									358	
FXV-664	331			33,810	20,280	14,460									429	
FXV-Q660	215			29,290	17,070	11,250						1"	8"		299	
FXV-Q661	299			33,810	20,280	14,460									439	

Notes:

- Operating weight is for the tower with the water level in the cold water basin at the overflow.
- The actual size of the inlet and outlet connection may vary with the design flow rate. Consult unit print for dimensions.
- Inlet and outlet connections are beveled for welding.
- Standard make-up, drain and overflow connections are MPT.
- Nominal tons of cooling represents 3 GPM of water from 95°F to 85°F at a 78°F entering wet-bulb temperature.

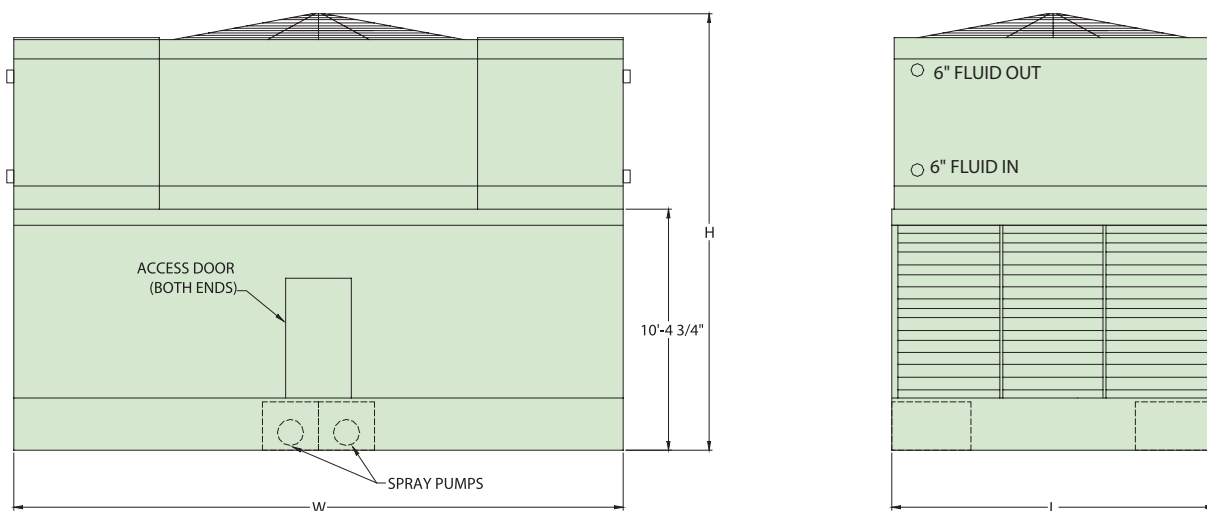


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See page E81
for Engineering
Considerations.



Dual Air Inlet Models



Model Number	Nominal Tons ^a	Motor HP		Weights (lbs)			Dimensions			Spray Pump (GPM)	Internal Coil Volume (GAL)
		Fan	Pump	Operating ¹	Shipping	Heaviest Section	L	W	H		
FXV-288-31x	468	20 to 60	15	46,470	28,150	8,050	11' 11"	24' 1/2"	18' 10-3/8"	1,720	600
FXV-288-41x	502			50,160	30,910	9,430					712
FXV-288-10x	439			50,160	30,910	9,430					706
FXV-364-31x	579	25 to 75	15	54,440	32,170	9,390	13' 11-1/8"	26' 3-1/2"	19' 0-3/8"	1,720	696
FXV-364-41x	624			58,800	35,450	11,030					828
FXV-364-10x	550			58,800	35,450	11,030					862

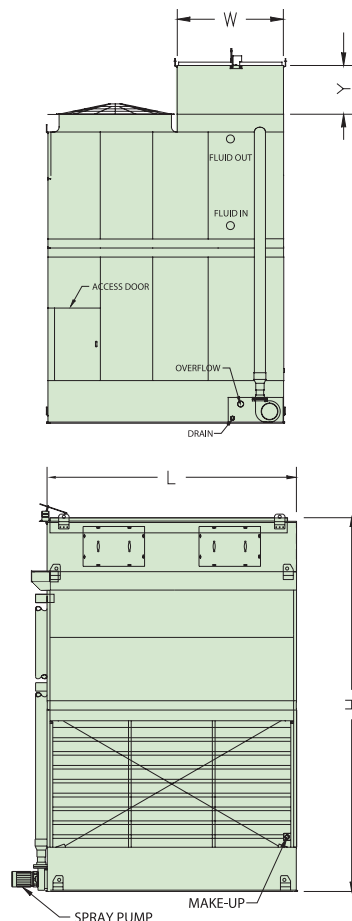
Notes:

- Operating weight is for the tower with the water level in the cold water basin at the overflow.
- The actual size of the inlet and outlet connection may vary with the design flow rate. Consult unit print for dimensions.
- Inlet and outlet connections are beveled for welding.
- Standard make-up, drain and overflow connections are located on the bottom of the unit. Make-up connection is 1-1/2" MPT standpipe, drain is 2" FPT and overflow is 3" FPT.
- Models shipped with an optional gear drive or low sound fan may have heights up to 10.5" greater than shown.
- Nominal tons of cooling represents 3 GPM of water from 95°F to 85°F at a 78°F entering wet-bulb temperature.

Engineering Data: Cold Weather Operation

FXV Heat Loss Data (BTUH)

Model Number	Standard Unit	Unit w/ PCD Hood	Unit w/ PCD Hood & Insulation
FXV-421	68,400	43,500	30,100
FXV-422	87,100	47,100	32,300
FXV-423	105,200	50,500	34,700
FXV-424	122,400	54,000	37,000
FXV-431	102,800	60,800	43,200
FXV-432	131,200	65,600	46,500
FXV-433	158,000	70,600	49,600
FXV-434	183,000	74,900	52,800
FXV-441	135,700	76,700	55,200
FXV-442	172,900	82,100	59,100
FXV-443	208,000	87,600	62,900
FXV-444	241,000	92,900	66,500
FXV-Q440	172,900	82,100	59,100
FXV-Q441	241,000	92,900	66,500
FXV-641	203,400	103,800	75,300
FXV-642	259,800	109,700	79,300
FXV-643	313,100	115,600	83,200
FXV-644	362,900	121,300	86,900
FXV-Q640	259,800	109,700	79,300
FXV-Q641	362,900	121,300	86,900
FXV-661	304,500	158,200	118,000
FXV-662	387,500	165,500	123,000
FXV-663	404,700	172,400	127,600
FXV-664	536,900	179,100	132,200
FXV-Q660	387,500	165,500	123,000
FXV-Q661	536,900	179,100	132,200
FXV-288-31x	760,200	280,700	202,000
FXV-288-41x	881,100	294,500	211,000
FXV-288-1Qx	881,100	294,500	211,000
FXV-364-31x	894,000	330,100	237,600
FXV-364-41x	1,036,200	346,400	248,100
FXV-364-1Qx	1,036,200	346,400	248,100



Notes:

- Heat loss based on 50°F entering coil water and -10°F ambient with 45 MPH wind (fans and pump off).
- One inch thick PVC nitrite rubber blend thermal insulation on both the PCD hood and the casing panels surrounding the coil.

Dimensional Data of Positive Closure Damper Hood

Model Number	Hood Ship. Weight (lbs.)	Operating Weight Add (lbs.)	Length (L)	Width (W)	Hood Height (Y)	Unit Height (H)
FXV-42x	390	320	5' 11-7/8"	3' 5-1/4"	2' 5-1/8"	15' 1-3/4"
FXV-43x	540	430	8' 11-7/8"	3' 5-1/4"	2' 5-1/8"	15' 1-3/4"
FXV-44x	720	570	11' 11-7/8"	3' 5-1/4"	2' 5-1/8"	15' 1-3/4"
FXV-64x	1,160	920	11' 11-7/8"	5' 3-1/2"	2' 5-1/8"	17' 9-3/4"
FXV-66x	1,650	1,300	17' 11-7/8"	5' 3-1/2"	2' 5-1/8"	17' 9-3/4"
FXV-288-xxx	1,300	1,040	11' 11"	6' 3-3/8"	2' 5-1/8"	20' 2-5/8"
FXV-364-xxx	1,500	1,200	13' 11-1/8"	6' 3-3/8"	2' 5-1/8"	20' 2-5/8"

Notes:

- Hood shipping weight includes shipping skid weight.



Engineering Specifications

See our website at www.BaltimoreAircoil.com for an electronic copy of product engineering specifications.

1.0 Closed Circuit Cooling Tower

1.1 General: Furnish and install, as shown on the plans, ___ factory-assembled closed circuit cooling tower(s) of induced draft design with vertical air discharge. Overall dimensions shall not exceed approximately ___ ft (mm) x ___ ft (mm), with an overall height not exceeding approximately ___ ft (mm). Operating weight shall not exceed ___ lbs (kg). The closed circuit cooling tower shall be Baltimore Aircoil Company Model FXV-___.

1.2 Thermal Capacity (water as heat transfer fluid): The closed circuit cooling tower shall be warranted by the manufacturer to have capacity to cool ___ USGPM (l/s) of water from ___°F (°C) to ___°F (°C) at ___°F (°C) entering wet-bulb temperature. Coil pressure drop shall not exceed ___ psi (kPa). The performance shall be certified by the Cooling Technology Institute in accordance with CTI Certification Standard STD-201 or, lacking such certification, a field acceptance test shall be conducted within the warranty period in accordance with CTI Acceptance Test Code ATC-105, by the Cooling Technology Institute, or other qualified independent third party testing agency. Manufacturers' performance guarantees or performance bonds without CTI Certification of water ratings shall not be accepted.

(Alternate) 1.2 Thermal Capacity (aqueous glycol solution as heat transfer fluid): The closed circuit cooling tower(s) shall be warranted by the manufacturer to cool ___ USGPM (l/s) of ___% by volume ethylene/propylene glycol solution from ___°F (°C) to ___°F (°C) at ___°F (°C) entering wet-bulb temperature. Coil pressure drop shall not exceed ___ psi (kPa). Basis for thermal performance rating shall be the Cooling Technology Institute (CTI) certified rating for water cooling appropriately adjusted for the thermal properties of the aqueous glycol solution used. Additionally, the thermal performance of the product line with water as the heat transfer fluid shall be certified by the CTI in accordance with CTI Certification Standard STD-201. Manufacturers' performance guarantees or performance bonds without CTI Certification of water ratings shall not be accepted.

1.3 Quality Assurance: The cooling tower manufacturer shall have a Management System certified by an accredited registrar as complying with the requirements of ISO-9001:2000 to ensure consistent quality of products and services.

2.0 Construction Details

2.1 Corrosion Resistant Construction (standard): Unless otherwise noted in this specification, all steel panels and structural elements shall be constructed from heavy-gauge, G-235 (Z700 metric) hot-dip galvanized steel, with cut edges given a protective coat of zinc-rich compound.

(Alternate) 2.1 Corrosion Resistant Construction: Unless otherwise noted in this specification, all steel panels and structural members shall be protected with the BALTIBOND® Corrosion Protection System. The system shall consist of G-235 (Z700 metric) hot-dip galvanized steel prepared in a four-step (clean, pre-treat, rinse, dry) process with an electrostatically sprayed, thermosetting, hybrid polymer fuse-bonded to the substrate during a ther-

mally activated curing stage and monitored by a 23-step quality assurance program. Coatings other than the BALTIBOND® Corrosion Protection System must be submitted to the engineer for pre-approval. Approved equals must have undergone testing, resulting in the following results as a minimum:

1. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of 5% salt spray per ASTM B117 without blistering, chipping, or loss of adhesion;
2. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of exposure to acidic (pH=4.0) and alkaline (pH=11.0) water solutions at 95°F (35°C) without signs of chemical attack;
3. Shall withstand impact of 160 in-lbs per ASTM D2794 without fracture or delamination of the polymer layer;
4. Shall withstand 6000 hours of ultraviolet radiation equivalent to 120,000 hours of noontime sun exposure without loss of functional properties;
5. Shall withstand 200 thermal shock cycles between -25°F and +180°F (-32°C and 82°C) without loss of adhesion or other deterioration;
6. Shall withstand 6000 hours of exposure to 60 psi (42,184 kg/m²) water jet without signs of wear or erosion.

(Alternate) 2.1 Optional Stainless Steel Construction: All steel panels and structural elements shall be constructed from heavy-gauge, Series 300 stainless steel.

2.2 Coil Section: The heat transfer section of the closed circuit cooling tower shall be encased with removable heavy-gauge galvanized steel panels (or corrosion resistant, fiberglass reinforced polyester (FRP) on Models FXV-288 to 364). The coil shall be constructed of continuous serpentine all prime surface steel, be pneumatically tested at 375 psig (2,685 kPa), and be hot-dip galvanized after fabrication. The coil shall be designed for free drainage of fluid and shall be ASME B31.5 compliant. Maximum allowable working pressure shall be 300 psig (280 psig for coils supplied with a CRN).

(Alternate) 2.2 Optional Cleanable Header Coil: Coil(s) to be constructed of continuous serpentine prime surface carbon steel, with a hot-dip galvanized (after fabrication) outside surface. Inlet and outlet headers have removable cover plates, and elbowed fluid inlet and outlet connections to allow removal of the cover plates without disturbing fluid piping. Coil(s) shall be pneumatically tested at 125 psig (895 kPa).

(Alternate) 2.2 Optional Cleanable Tube Coil: Coil(s) to be constructed with straight full-length tubes, pitched in the direction of fluid flow for free drainage, and pneumatically tested at 125 psig (895 kPa). Full-height box headers and removable cover plates allow access to all tubes at both ends. The entire assembly is hot-dip galvanized after fabrication, inside and out.

(Alternate) 2.2 Optional ASME Coil: Coil(s) shall be designed and constructed to meet the requirements of ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and bear the U stamp.

(Alternate) 2.2 Optional Stainless Steel Coil: Coil(s) shall be constructed of Series 300 stainless steel serpentine tube. Tubes shall be sloped for free drainage and coil assembly shall be pneumatically tested at 375 psig (2,685 kPa). Coil(s) shall be ASME B31.5 compliant.

2.3 Cold Water Basin: The cold water basin shall be constructed of heavy-gauge hot-dip galvanized steel. The basin shall include a depressed section with drain/clean-out connection. Standard accessories shall include large area, lift-out steel strainers with perforated openings sized smaller than water distribution nozzle orifices, an integral anti-vortexing hood to prevent air entrainment, waste water bleed line, and brass make-up valve with large diameter plastic float arranged for easy adjustment.

(Alternate) 2.3 Optional Stainless Steel Cold Water Basin: The cold water basin shall be made of Series 300 stainless steel. All factory seams in the cold water basin shall be welded, leak tested at the factory to ensure watertight assembly and shall be warranted against leaks for 5 years.

2.4 Casing Panels: Models FXV-4xx, 6xx, Lxxx, & Qxxx: Casing panels shall be constructed of steel matching the structure defined in section 2.1.

Or, for Models FXV-288 and 364:

Casing panels shall be constructed of corrosion resistant, fiberglass reinforced polyester (FRP).

3.0 Spray Water System

3.1 Spray Water Pump(s): The closed circuit cooling tower shall include an appropriate number of close-coupled, bronze-fitted centrifugal pump and motor assemblies equipped with mechanical seal, mounted in the basin and piped from the suction connection to the water distribution system. The pump motor(s) shall be the totally enclosed fan cooled (TEFC) type suitable for _____ volts, _____ phase, and _____ hertz electrical service. The system shall include a metering valve and bleed line to control the bleed rate from the pump discharge to the overflow connection.

3.2 Water Distribution System: Water shall be distributed evenly over the coil at a flow rate sufficient to ensure complete wetting of the coil at all times. Large diameter, non-clog, 360° plastic distribution nozzles shall utilize a two stage diffusion pattern to provide overlapping, umbrella spray patterns that create multiple intersection points with adjacent nozzles. The branches and spray nozzles shall be held in place by snap-in rubber grommets, allowing quick removal of individual nozzles or complete branches for cleaning or flushing.

4.0 Fill and Drift Eliminators

4.1 Fill and Drift Eliminators: The fill and integral drift eliminators shall be formed from self-extinguishing (per ASTM-568) polyvinyl chloride (PVC) having a flame spread rating of 5 per ASTM E84 and shall be impervious to rot, decay, fungus and biological attack. The fill shall be

manufactured and performance tested by the closed circuit cooling tower manufacturer to provide single source responsibility and assure control of the final product. A separate set of drift eliminators shall be removable in easily handled sections for quick access to the coil. Eliminators shall have a minimum of three changes in air direction.

(Alternate) 4.1 Fill and Drift Eliminators: The high temperature fill and integral drift eliminators shall be formed from self-extinguishing (per ASTM-568) polyvinyl chloride (PVC) having a flame spread rating of 5 per ASTM E84 and shall be impervious to rot, decay, fungus and biological attack. The high temperature fill shall be suitable for entering water temperatures up to 140°F (60.0°C). The fill shall be manufactured, tested and rated by the cooling tower manufacturer and shall be elevated above the cold water basin to facilitate cleaning.

5.0 Air Inlet Louvers

5.1 Air Inlet Louvers: Air inlet louvers shall be wave-formed, fiberglass-reinforced polyester (FRP), spaced to minimize air resistance and prevent water splash-out.

6.0 Mechanical Equipment

6.1 Fan(s): Fan(s) shall be heavy-duty, axial flow, with aluminum alloy blades. Air shall discharge through a fan cylinder designed for streamlined air entry and minimum fan blade tip clearance for maximum fan efficiency. Fan(s) and shaft(s) shall be supported by heavy-duty, self-aligning, grease-packed ball bearings with moisture-proof seals and integral slinger rings, designed for minimum L_{10} life of 40,000 hours. Fan(s) shall be drive by a one-piece, multi-groove neoprene/polyester belt designed specifically for evaporative cooling service. Fan and motor sheave(s) shall be fabricated from cast aluminum.

6.2 Fan Motor: Fan motor(s) shall be totally enclosed air over (TEAO), reversible, squirrel cage, ball bearing type with 1.15 service factor, designed specifically for evaporative cooling duty on _____ volt/ _____ hertz/ _____ phase electrical service. The motor shall be furnished with special moisture protection on windings, shafts, and bearings. Each motor shall be mounted on an easily adjusted, heavy-duty motor base.

(Alternate) 6.2 Fan Motor: Fan motor(s) shall be totally enclosed air over (TEAO), reversible, squirrel cage, ball bearing type designed specifically for evaporative cooling duty on _____ volt/ _____ hertz/ _____ phase electrical service. The motor shall be furnished with special moisture protection on windings, shafts, and bearings. Fan motors shall be inverter duty type designed per NEMA Standard MG1, Section IV, Part 31.

6.3 Mechanical Equipment Warranty: The fan(s), fan shaft(s), sheaves, bearings, mechanical equipment support and fan motor shall be warranted against defects in materials and workmanship for a period of five (5) years from date of shipment.





6.4 ENERGY-MISER® Fan System (optional): Two single-speed fan motors, one sized for full speed and load, the other sized for 2/3 speed and approximately 1/3 the full load horsepower, shall be provided for capacity control and stand-by protection from drive or motor failure. Two-speed motor(s) are not an acceptable alternative.

(Alternate) 3.4 BALTIGUARD PLUS™ Fan System: Two single speed fan motors, one sized for load, the other sized for 1/3 of the full load horsepower shall be provided in each cell for capacity control and standby protection from drive or motor failure. The manufacturer of the equipment shall supply controls for the larger motor, a VFD for the smaller motor and factory programmed logic controller to maximize energy saving for off peak load and wet-bulb conditions.

7.0 Access

7.1 Plenum Access: A large, hinged access door shall be provided on each end wall for access to the coil, drift eliminators, and fan plenum section. The water make-up valve, float ball, and suction strainer shall be easily accessible. On single side air inlet units, the access door shall open to an internal walkway.

8.0 Sound

8.1 Sound Level: To maintain the quality of the local environment, the maximum sound pressure levels (dB) measured 50 ft (15,240 mm) from the closed circuit cooling tower operating at full fan speed shall not exceed the sound levels detailed below.

(Alternate) 8.1 Sound Level: To maintain the quality of the local environment, the closed circuit cooling tower shall be furnished with a low sound fan. The thermal performance of the closed circuit cooling tower shall be certified by the Cooling Technology Institute in accordance with paragraph 1.2 of this specification when furnished with the low sound fan. Maximum sound pressure levels (dB) measured 50 ft (15,240 mm) from the closed circuit cooling tower operating at full fan speed shall not exceed the sound levels detailed below.

Location	63	125	250	500	1000	2000	4000	8000	dB(A)
Discharge									
Air Inlet									
Cased Face									

9.0 Accessories

9.1 Vibration Isolation Rails (Available on single air inlet models only): Spring-type vibration isolation rails, constructed of steel channels and base plates, painted with a rust-resistant primer shall be provided to minimize vibration transmission from the tower to the building structure. The isolators shall be designed for a static deflection of 1" (25.4 mm) and a maximum wind speed of 50 mph (80 km/h).

(Alternate) 9.1 Vibration Isolation Rails (Available on single air inlet models only): Spring-type vibration isolation rails, constructed of steel channels and base plates, coated with a 0.003" (.076 mm) layer of zinc after fabrication shall be

provided to minimize vibration transmission from the tower to the building structure. The isolators shall be designed for a static deflection of 1" (25.4 mm) and a maximum wind speed of 50 mph (80 km/h).

9.2 Basin Heater(s): The cooling tower cold water basin shall be provided with electric heater(s) to prevent freezing in low ambient conditions. The heater(s) shall be selected to maintain 40°F (4.4°C) pan water temperatures at ____° F(°C) ambient. The heater(s) shall be ____V/ ____ phase/____Hz electric and shall be provided with low water cutout and thermostat.

(Alternate) 9.2 Basin Heaters (Available on single air inlet models only): A steam coil shall be factory installed in the cooling tower depressed sump of the cold water basin to prevent freezing during cold water shutdown. The steam coil shall be capable of maintaining 40°F (4.4°C) pan water temperature at a -20°F (-28.9°C) ambient temperature given 5 psig (34 kPa) at the coil inlet connection.

9.3 Basin Water Level Control: The cooling tower manufacturer shall provide an electric water level control (EWLC) system. The system shall consist of water level sensing and control units in quantities and locations as indicated on the drawings. Each water level sensing and control unit shall consist of the following: NEMA 4 enclosure with gasketed access cover; solid state controls including all necessary relays and contacts to achieve the specified sequence of operation; stainless steel water level sensing electrodes with brass holder; Schedule 40 PVC standpipe assembly with vent holes, and all necessary stainless steel mounting hardware. Provide PVC union directly below the control enclosure to facilitate the removal and access of electrodes and control enclosure.

The number and position of water level sensing electrodes shall be provided to sense the following: high water level, low water level, high water alarm level, low water alarm, and heater safety cutout.

9.4 Vibration Cutout Switch: Provide mechanical local reset vibration switch. The mechanical vibration cutout switch will be guaranteed to trip at a point so as not to cause damage to the cooling tower. To ensure this, the trip point will be a frequency range of 0 to 3,600 RPM and a trip point of 0.2 to 2.0 g's.

(Alternate) 9.4 Vibration Cutout Switch: Provide electronic remote reset vibration switch with contact for BAS monitoring. Wiring shall be by the installing contractor. The electronic vibration cut out switch shall be set to trip at a point so as not to cause damage to the cooling tower. The trip point will be 0.45 in/sec (0.0114 m/sec).

9.5 Basin Sweeper Piping: The cold water basin of the cooling tower shall be equipped with PVC sump sweeper piping for a separator (supplied by others).

9.6 Intake Sound Attenuation: The unit shall be equipped with intake sound attenuators consisting of fiberglass acoustical baffles encased in steel to further reduce sound levels.

9.7 Sound Attenuation: The unit shall be equipped with a straight hood lined with sound absorbing fiberglass acoustical baffles to reduce sound levels from the top of the unit.

9.8 Heat loss: The heat loss for the FXV shall be equal to or less than _____ BTUH using either a standard unit, a unit with a hood, positive closure dampers, insulation or a combination.

9.9 External platform with ladder: A galvanized steel platform and aluminum ladder to grade shall be provided at all access doors to access the plenum section of the cooling tower. All working surfaces shall be able to withstand 50 psf live load or 200 pound concentrated load.

(Alternate for Dual air inlet FXVs only) 9.9 Ladder: An aluminum ladder (with galvanized steel safety cage) shall be provided for access to the fan deck. Access door or service platforms shall not be accepted as equal.

(Alternate for Dual air inlet FXVs only) 9.9 Handrails: 1-1/4" galvanized steel pipe handrail shall be provided around the perimeter of the cooling tower cells. The handrails shall be provided with knee and toe rails and shall conform to the requirements of OSHA.

9.10 Internal Walkway for Dual Air inlet FXV: An internal walkway shall be provided in the plenum section to provide for inspection and maintenance. All working surfaces shall be able to withstand 50 psf (244 Kg/m²) live load or 200 pound (90.7 Kg) concentrated load. Other components of the cooling tower, i.e. basin and fill/drift eliminators, shall not be considered an internal working surface. Manufacturers that require that these surfaces be used as a working platform shall provide a two-year extended warranty to the Owner to repair any damage to these surfaces caused by routine maintenance.

9.11 Internal Platform: An internal platform shall be provided in the plenum section to provide for inspection and maintenance. All working surfaces shall be able to withstand 50 psf live load or 200 pound concentrated load. Other components of the cooling tower, i.e. basin floor and fill/drift eliminators, shall not be considered an internal working surface. Manufacturers that require that these surfaces be used as a working platform shall provide a two-year extended warranty to the Owner to repair any damage to these surfaces caused by routine maintenance.

9.12 Fan Cylinder Extension: To extend the height of the tower equal to the surrounding enclosure, the cooling tower shall be provided with _____ of fan cylinder extension. The fan cylinder extension shall match the construction of the fan deck.

10.0 Equipment Controls (Optional)

10.1 Variable Frequency Drive(s): A variable frequency drive (VFD) shall be provided for each fan motor. The supplier of the VFD shall be the manufacturer of the evaporative cooling equipment. The VFD shall have a 3-contactor bypass, 3% input line reactor, a removable keypad, an RS232 terminal for PC connection, and a circuit breaker disconnect. Fuse protection will not be accepted. Control voltage shall be 24V to minimize the size of the enclosure which should not exceed _____ ft x _____ ft x _____ ft and the weight should not exceed _____ lbs. VFD shall be provided in a NEMA (1)(3R)(12) enclosure. The VFD shall be compatible with a (ModBus) (LonWorks) (Johnson N2) Building Automation System.

OR

10.1 Enclosed Controls: An enclosed control panel shall be provided for each cell of the evaporative cooling equipment. The panel shall include full voltage, non-reversing (FVNR) fan motor and pump motor (if applicable) starters in a common enclosure. The panel shall be provided with a main a circuit breaker disconnect and a separate circuit breaker for each motor or speed. Fuse protection will not be accepted. Panels containing basin heaters shall have an Earth Leakage Breaker containing ground fault protection. Starters above 25 A shall be NEMA rated. IEC starters will be accepted for motors below 25 A. Panel shall include a 120V/60Hz control power transformer, Hand-Off-Auto switches for each starter or contactor, and pilot lights for each component. Enclosed controls shall be provided in a NEMA (1)(3R)(4)(4X)(12) enclosure.

Optional enclosed control features: (A temperature sensor shall be provided with the enclosed controls.)(A temperature controller shall be provided with the enclosed controls.)(A basin heater contactor with circuit breaker shall be provided.)(A vibration cutout switch input shall be provided.)

10.2 Safety Switch(es): A heavy-duty, non-fusible safety disconnect switch shall be provided by the manufacturer of the evaporative cooling equipment. Switch shall be single-throw, 3-pole design, rated up to 600 VAC. Switch shall have triple padlocking capability, a visible double break rotary blade mechanism, a clearly visible On/Off handle, an interlocking mechanism to prevent door opening with handle in On position, and a clear line shield. Safety switch shall be provided in a NEMA (1)(3R)(12) enclosure.



Engineering Considerations - Closed Circuit Cooling Towers

Location

Units must have an adequate supply of fresh air to the air inlet(s). When units are located adjacent to building walls or in enclosures, care must be taken to ensure that the warm, saturated discharge air is not deflected off surrounding walls or enclosures and drawn back to the air inlet(s).

CAUTION:

Each unit should be located and positioned to prevent the introduction of the warm discharge air and the associated drift, which may contain chemical or biological contaminants including Legionella, into the ventilation systems of the building on which the unit is located or those of adjacent buildings.

For detailed recommendations on layout, refer to our web site, www.BaltimoreAircoil.com, or consult your local BAC Representative.

For Series V products, bottom screens or solid bottom panels may be desirable or necessary for safety, depending on the location and conditions at the installation site.

Piping and Valves

Piping must be sized and installed in accordance with good piping practice. All piping should be supported by pipe hangers or other supports, not by the unit.

Some installations may require flow balancing valves (supplied by others) at the coil inlets to balance the flow to individual coils and cells. External shutoff valves on the closed circuit loop (supplied by others) may also be required if the system design necessitates the isolation of individual cells.

Although equalizing lines can be used to balance water levels between multi-cell closed circuit cooling towers, the spray water for each cell must be treated separately, and a separate make-up must be provided for each cell. Note that a common remote sump for multi-cell installations can simplify make-up and water treatment – see page M167 for details. See page E83 or the appropriate Operating and Maintenance Manual for more information on water treatment.





Capacity Control

Variable Frequency Drives (VFD)

Installations which are to be controlled by Variable Frequency Drives (VFD) require the use of an inverter duty motor as designed per NEMA Standard MG.1, Section IV, Part 31, which recognizes the increased stresses placed on motors by these drive systems. Inverter duty motors must be furnished on VFD applications in order to maintain the motor warranty.

WARNING:

When the fan speed is to be changed from the factory-set speed, including through the use of a variable speed control device, steps must be taken to avoid operating at or near fan speeds that cause a resonance with the unit or its supporting structure. At start-up, the variable frequency drive should be cycled slowly between zero and full speed and any speeds that cause a noticeable resonance in the unit should be “locked out” by the variable speed drive.

Fan Cycling

Fan cycling is the simplest method of capacity control. The number of steps of capacity control can be increased using the ENERGY-MISER® Fan System, BALTI GUARD PLUS™ Fan System, the independent motor option, or two-speed fan motors in conjunction with fan cycling (see “Custom Features & Options” section of the appropriate product line to determine whether the ENERGY-MISER® Fan System, BALTI GUARD PLUS™ Fan System, or the independent fan motor option are available for the particular product line; two-speed motors are available for all product lines with either belt or gear fan drive systems. All of these options provide substantial energy savings when compared to simple fan cycling, especially the BALTI GUARD PLUS™ Fan System, which provides energy savings and redundancy at a low cost.

WARNING:

Rapid on-off cycling can cause the fan motor to overheat. It is recommended that controls be set to allow a maximum of 6 on-off cycles per hour.

Note: Spray water pump cycling should not be used for capacity control. This method of control often results in short cycling of the pump motor as capacity changes substantially with pump cycling. In addition, alternate wetting and drying of the coil promotes scaling of the heat exchanger coil surface.

Capacity Control Dampers (Series V Models Only)

On Series V models, modulating capacity control dampers are available to provide better leaving water temperature control than can be obtained from fan cycling alone. See page E46 or contact your local BAC Representative for more details.

Vibration Cutout Switches

Vibration cutout switches are recommended on all installations. Vibration cutout switches are designed to interrupt power to the fan motor and/or provide an alarm to the operator in the event of excessive vibration. BAC offers both electronic and mechanical vibration cutout switches on all closed circuit cooling tower models.

Water Treatment

As water evaporates in an evaporative cooling unit, the dissolved solids originally present in the water remain in the system. The concentration of these dissolved solids increases rapidly and can cause scale and corrosion. In addition, airborne impurities and biological contaminants, including Legionella, may be introduced into the circulating water. To control all potential contaminants, a water treatment program must be employed. In many cases, a simple bleed-off may be adequate for control of scale and corrosion.

Note: Bleed lines are to be provided and installed by others. However, biological contamination, including Legionella, can be controlled only through the use of biocides. Such treatment should be initiated at system startup, after periods of equipment shutdown, and continued regularly thereafter. Accordingly, it is strongly recommended a biocide treatment be initiated when the unit is first filled with water and continued regularly thereafter. For more information, consult the appropriate Operating and Maintenance Manual.

When a water treatment program is employed, it must be compatible with construction materials. The pH of the circulating water must be maintained between 6.5 and 9.0. Units having galvanized steel construction and a circulating water pH of 8.3 or higher will require periodic passivation of the galvanized steel to prevent the accumulation of white, waxy, nonprotective zinc corrosion called white rust. Batch feeding of chemicals into the unit is not recommended. If units are constructed with optional corrosion resistant materials, acid treatment may be considered; however, the water quality must be maintained within the guidelines set forth in the Operating and Maintenance Manual.

Note: Unless a common remote sump is utilized, each cell of a multi-cell installation must be treated as a separate entity, even if the cold water basins are flumed together or equalized.

For complete Water Quality Guidelines, see the appropriate Operating and Maintenance Manual, available at www.baltimoreaircoil.com

For specific recommendations on water treatment, contact a competent water treatment supplier.

Fill Compatibility (FXV Models Only)

The standard fill in FXV Closed Circuit Cooling Towers is constructed of polyvinyl chloride (PVC) and has a flame spread rating of 5 per ASTM Standard E84. This PVC fill is compatible with the water found in most evaporative cooling applications. For applications where the entering fluid temperature exceeds 140°F, contact your local BAC Representative to confirm that the standard PVC fill is acceptable.

Sound Levels

Sound rating data is available for all BAC Closed Circuit Cooling Towers. When calculating the sound levels generated by a unit, the designer must take into account the effects of the geometry of the tower as well as the distance and direction from the unit to noise-sensitive areas. Low sound fans and intake and discharge sound attenuation can be supplied on certain models to provide reduced sound characteristics (see the “Custom Features and Options” section of the appropriate product line for details). The ENERGY-MISER® Fan System, two-speed motors, or variable frequency drives can also be used to reduce sound during periods of non-peak thermal loads. For more information on sound and how it relates to evaporative cooling equipment, see page M124. For detailed low sound selections, please consult your local BAC Representative.





Protection Against Basin Water Freezing

When a unit is shut down in freezing weather, the basin water must be protected by draining to an indoor auxiliary remote sump tank (see page H5 for remote sump engineering data; page M32 for sizing guidelines) or by providing supplementary heat to the cold water basin. Supplementary heat can be provided by electric immersion heaters or in some cases, hot water or steam coils, or steam injectors. All exposed water piping, make-up lines, and spray pumps (if applicable) that do not drain at shutdown should be traced with electric heater tape and insulated.

When dry operation is planned for low ambient conditions, centrifugal fan units should be supplied with oversized fan motors to prevent motor overload when the spray water is not operating. Dry operation with standard fan motors is acceptable for axial fan units. For remote sump applications, the spray water pump must be selected for the required flow at a total head which includes the vertical lift, pipe friction (in supply and suction lines) plus the required pressure at the inlet header of the water distribution system (2.0 psi for FXV models; 1.0 psi for Series V models). A valve should always be installed in the discharge line from the pump to permit adjusting flow to the unit requirement. Inlet water pressure should be measured by a pressure gauge installed in the water supply riser at the spray water inlet, and adjusted to the specified inlet pressure. See page M32 for more information.

Indoor Installations (Applicable to Series V Models Only)

Many indoor installations require the use of inlet and/or discharge ductwork. **Units installed with inlet ductwork must be ordered with solid-bottom panels.** Generally, intake ducts are used only on smaller units while the equipment room is used as a plenum for larger units. Discharge ductwork will normally be required to carry the saturated discharge air from the building.

Both intake and discharge ductwork must have access doors to allow servicing of the fan assembly, drift eliminators, and water distribution system. All ductwork should be symmetrical and designed to provide even air distribution across the face of air intakes and discharge openings.

WARNING:

The discharge opening must be positioned to prevent the introduction of discharge air into the fresh air intakes serving the unit or the ventilation systems of adjacent buildings.

Note: Axial fan units are not suitable for indoor installations.

Safety

Adequate precautions, appropriate for the installation and location of these products, should be taken to safeguard the public from possible injury and the equipment and the premises from damage. Operation, maintenance and repair of this equipment should be undertaken only by personnel qualified to do so. Proper care, procedures and tools must be used in handling, lifting, installing, operating, maintaining, and repairing this equipment to prevent personal injury and/or property damage.

Fluid Compatibility

The fluid to be cooled must be compatible with the coil material (standard serpentine and cleanable header coils are carbon steel, hot-dip galvanized on the outside only). **Fluids not compatible with coil materials can lead to corrosion and tube failure.** Certain fluids may require occasional pressure cleaning or mechanical cleaning of the inside of coil tubes. In such cases the coil must be designed to provide this capability (Optional Coil Configurations: for FXV see page E19, for Series V see page E41, and for HXV see page E67).

Open/Closed System

The standard galvanized steel serpentine and cleanable header serpentine coils are carbon steel, hot-dip galvanized on the outside only, and are intended for application on closed, pressurized systems which are not open to the atmosphere. Stainless steel coils or cleanable coil units (with tubes hot-dip galvanized inside and out) are available to cool corrosive fluids or water and ethylene/propylene glycol solutions in systems open to the atmosphere (Optional Coil Configurations: for FXV see page E19, for Series V see page E41, and for HXV see page E67).

Protection Against Coil Freezing

At below freezing ambient conditions, the closed circuit cooling tower can experience heat loss even without the recirculating spray water pump and fans in operation. Without a heat load on the circulating fluid, coil freezing can occur even at full flow. Protective means are readily available to avoid potential freeze problems. Where the system will permit, the best protection against coil freeze-up is the use of an industrially inhibited anti-freeze solution. When this is not possible, the system must be designed to meet both of the following conditions:

1. Maintain minimum recommended flow through the coil at all times, as per the table below:

MODEL	MINIMUM FLOW (GPM)
FXV-42X, 43X, 44X	75
FXV-Q44X	150
FXV-64X, 66X	110
FXV-Q64X, Q66X	220
FXV-288-X1X	275
FXV-288-XQX	550
FXV-364-X1X	275
FXV-364-XQX	550
HXV-6XX	110
HXV-Q6XX	220
VFL-012 thru 048	65
VFL-072 thru 096	125
VF1-009 thru 036	50
VF1-048	75
VF1-072	100
VF1-096 thru 144N	125
VF1-192 thru 288N	250
VF1-144 thru 216	200
VF1-288 thru 432	400

See product sections for applicable heat loss data:

FXV - page E29
Series V - page E54
HXV - page E74





2. Maintain a heat load on the circulating fluid so that the temperature of the fluid leaving the coil will not be below 45°F (7.2°C).

If the process load is extremely light, or if the process is periodically shut off entirely, then an auxiliary heat load must be applied to the circulating fluid when below freezing ambient temperatures exist to prevent damage to the coil. Refer to the Heat Loss Data table (for FXV see page E29, for Series V see page E54, and for HXV see page E74) for the auxiliary heat load requirement. The amount of auxiliary heat necessary to prevent coil freezing can be further reduced by the use of a positive closure damper hood and insulation. Draining the coil is not recommended as a normal method of freeze protection. However, draining is acceptable as an emergency method of freeze protection. Frequent draining can promote corrosion inside the coil tubes. If the coil is not protected by an industrially inhibited anti-freeze solution, an automatic drain valve and air vent is recommended to drain the coil if flow stops or fluid temperature drops below 45°F (7.2°C) when the ambient temperature is below freezing. Note that cold water basin heaters **will not** provide freeze protection for the coil.

Code Requirement

Standard coils are ASME B31.5 compliant and are provided with a Canadian Registration Number (CRN) when required. State or local codes, or certain applications may require the use of pressure vessels designed, fabricated, tested and "U" stamped in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division I. In such cases, the optional ASME "U" Stamp coil must be provided.

Warranties

Please refer to the Limitation of Warranties applicable to and in effect at the time of the sale/purchase of these products.



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