

ENGINEERING GUIDE

# FS Fan-Coil Units Hi-Rise, Vertical



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**NOTES:**

- Johnson Controls offers Web-Select®, the industry’s first web-based rating and selection program for complete unit, coil and fan selection. See your representative for more information.
- Some drawings are not shown in this catalog.
- All data herein is subject to change without notice.
- Drawings not for installation purposes.
- ETL Report Number J99024557-003 for single FS units. For FSA/FSB units, see Report Number 3014576-002 (non fire rated) and 3016281 (UL 1479 fire rated).
- Vertical Hi-Rise models FSA/FSB were subjected to the fire test program and certified in compliance with the requirements of UL 1479 by Intertek Testing Services Ltd.

## FEATURES AND BENEFITS

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### HIGH PERFORMANCE

Johnson Controls FS Series Vertical Hi-Rise fan coil units are designed to maximize flexibility of selection and installation, and for ease of service.

The units are also designed to exceed the stringent quality standards of the institutional market, while remaining cost competitive in the commercial and residential segments of the market.

Johnson Controls Vertical Hi-Rise fan coil units set the new standards for innovation, quality, flexibility, and competitive pricing.

### DESIGN FLEXIBILITY

The extensive variety of standard options available on FS Series fan coils are where you find the versatility to fit any HVAC system designer's needs.

Options include: single wall stainless steel drain pans, foil faced or elastomeric closed cell foam insulation, double deflection aluminum discharge grilles, manual or motorized outside air dampers and electric heat with single point power connection and silent relays. All electric heat units are listed with ETL as an assembly and carry the cETL label.

All units comply with the latest edition of AHRI Standard 440 for testing and rating fan coil units, are certified, and display the AHRI symbol.

High efficiency motors, fan relays, disconnects and fusing mean easier coordination between mechanical and electrical trades.

Coil options allow for three or four row chilled water and one or two row hot water coils in the reheat position only. A total of five rows of coil are accommodated.

### CONVENIENT INSTALLATION

All FS Series fan coil units are shipped completely assembled, reducing field installation time and labor. All units are thoroughly inspected and tested prior to shipment, eliminating potential problems at startup. Motor wiring is brought to a control compartment on the inside of the unit, reducing electrical hook-up time.

Factory furnished pressure tested valve packages assure proper fit, operation and performance.

Factory furnished pressure tested risers with swaged connections are available in a variety of materials, diameters and lengths.

FS Series fan coil units have several standard features that provide for installation flexibility that are unmatched in the industry. Featuring internal stainless steel braided hoses that link the piping packages to the riser shut-off valves, the unique design of the FS Series allows for easy field configuration of left hand, right hand, or back riser connections without the need for thermal cutting and joining of piping. Both the sides as well as the back panels are manufactured with riser slot knockouts. Supply air opening knockouts are included on all sides, and the top of the unit. If requested, the FSC/FSM/FSS units ship from the factory with knockouts removed for the selected arrangement of supply air and riser location.

Risers may ship in advance of the unit to facilitate installation and fire safing of floor penetrations in limited space. Delaying the delivery of units until walls are in place protects the fan coil units from construction debris during installation and pressure testing of the risers.

### OPTIMUM BUILDING PERFORMANCE

The FS Series fan coil chassis is built from galvanized steel. This metal surpasses the ASTM 125 hour salt spray test for corrosion and rust. Decorator front panels, supply grilles, and exposed cabinet Model FSX are powder coated galvanized 18 gauge steel. Standard insulation is 1/2 inch thick fiberglass, complying with UL 181 and NFPA 90A. Optional foil faced or elastomeric closed cell foam insulation may be specified.

All units, with or without electric heat, are cETL listed and labeled. All wiring is in compliance with NEC, assuring safety and quality for the owner.

FS Series fan coil units have removable fans and coils. The entire coil assembly can be easily removed from the unit and replaced or serviced on a workbench, reducing equipment down time. Coils are accessible for cleaning and removable for service or replacement. Filters are easily replaceable when the decorator front panel is removed. As an option, the drain pan can be equipped for removal for cleaning or replacement without disturbing the coil assembly.

Tandem Master and Tandem Slave Models FSA/FSB ship complete with risers enclosed in a wall plenum with one layer of 5/8" gypsum for sound attenuation. As an option, Tandem Master and Tandem Slave Units may be ordered with two layers of 5/8" gypsum and fire blocking material. The Tandem Master and Tandem Slave fire rated unit has been tested and certified for 1 hour rating per UL 1479.

# CONSTRUCTION FEATURES

## MODELS FSC, FSM, FSS, FSA/FSB, FSX

FS Series fan coils have many standard and optional features which are unique to the industry (see page 7 for a complete listing).

Factory mounted chilled and hot water and condensate insulated risers (not shown). Risers may also ship in advance of the unit.

Powder coated 18 gauge steel decorator front panel return grille (not shown)

Model FSX exposed cabinet features durable, powder coat paint finish

ETL and AHRI 440 listed and labeled

Top discharge knockout permits ducted connection

Field configurable. Both side and back panels are manufactured with knockouts for riser piping and supply air openings. Facilitates field conversion of riser and supply air grille locations.

Double deflection discharge grille (optional)

Unit or wall mounted analog, digital display, or programmable thermostats

Optional electric heat is ETL listed as an assembly for safety compliance

Stainless steel flexible braided hoses provide installation flexibility and accommodate riser expansion and contraction

Entire electric heat assembly can be removed for servicing

Hinged, quick open control door allows easy access to all electrical components

Single point power connection on all units with and without electric heat

Permanently lubricated, three tap, PSC fan motors designed for quiet and efficient operation

1/2" thick fiberglass insulation (standard), or foil faced or elastomeric closed cell foam insulation (optional)

Factory mounted piping packages

Fan assembly can be easily removed for servicing on slide out rails

Integral 1" throw-away filter (standard), or 1" pleated or synthetic media filter (optional)

Optional blower shield (not shown) eliminates accidental contact with fan assembly

Double wall composite or stainless steel (optional) insulated drain pans are double sloped to drain connections

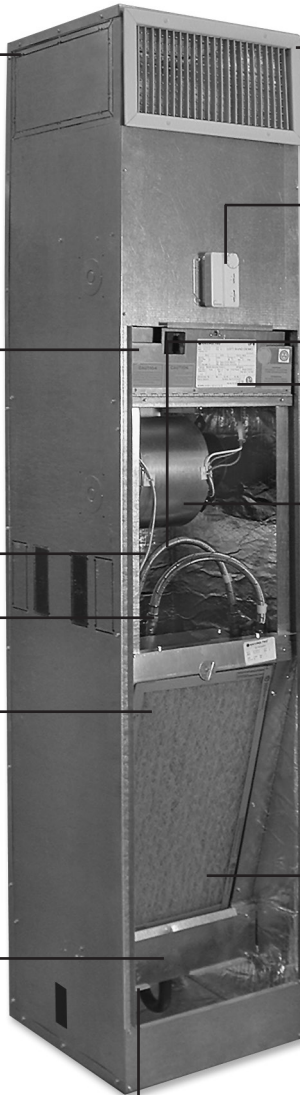
Chilled water cooling coils up to 4 rows

Hot water heating coils up to 2 rows are located in the reheat position

Maximum 5 total rows of coils combined

Optional removable drain pan

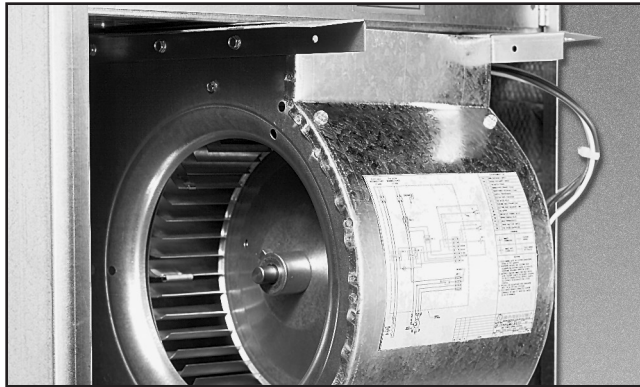
P-trap (removable) connection to condensate drain riser



Tandem Master and Tandem Slave Models FSA/FSB ship complete with risers enclosed in a wall plenum with one layer of 5/8" gypsum for sound attenuation. As an option, Tandem Master and Tandem Slave units may be ordered with two layers of 5/8" gypsum and fire blocking material for a one hour fire rating per UL 1479.



## CONSTRUCTION FEATURES



### FAN DECK

For ease of service, the fan/motor assembly is easily removed by unscrewing two locknuts located at the front of the assembly. Slide rails support the fan during removal and installation, and the electrical harness is equipped with a quick connect plug.



### DRAIN PAN

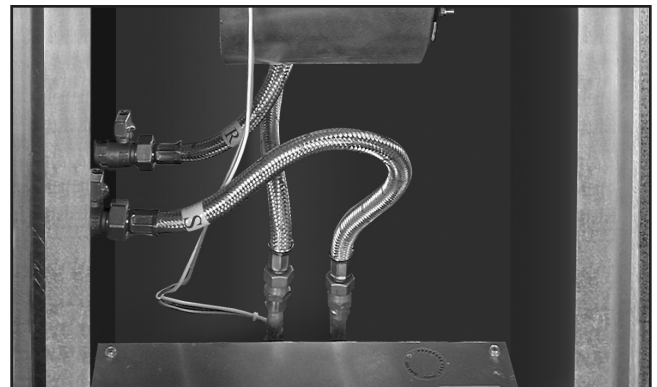
The sloped insulated drain pan is available in stainless steel construction. Standard drain pans are double wall, composite, extend under the entire coil section, double sloped, and are removable. As an option, the FS Series drain pan can be equipped for easy removal from the front of the unit for inspection and cleaning. For optimum moisture resistance and cleanability, the fan coil unit may be lined with foil faced fiberglass insulation (shown above) or elastomeric closed cell foam insulation.

### FILTERS

Filter options include 1" throwaway (standard), pleated MERV 8, or synthetic media. Filters are easily replaceable from the return air when the front panel is removed.

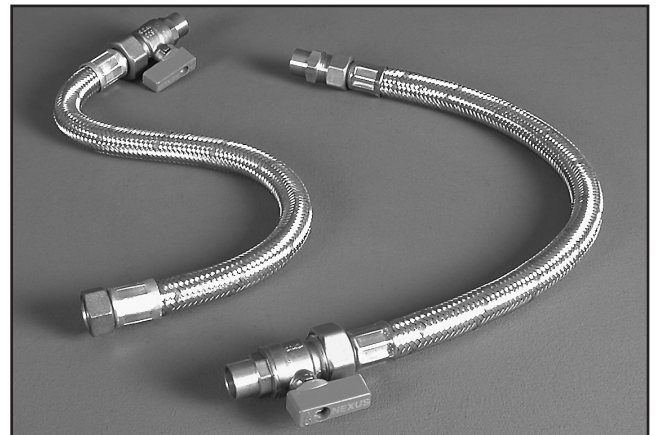
### POWDER COAT PAINTED SURFACE

Exposed cabinet Model FSX, as well as the front return textured decorator panel, feature a powder coat finish that resists scuffing, scratching, fading, and fingerprints.



### COILS AND PIPING

All fan coils are available in 2 or 4 pipe configurations. The heating coil is standard in the reheat position. Access for cleaning on both the entering and leaving air sides is available. Coils are removable from the front of the unit for service.



### STAINLESS STEEL BRAIDED HOSES

Stainless steel braided hoses allow for flexibility and thermal expansion within the unit cabinet. The hose-to-coil and hose-to-riser connections are made via a threaded swivel adapter, simplifying coil removal.

### RISERS

Risers, coils and piping packages are pressure tested and ship installed on the unit as a complete package. Risers may also ship in advance of the unit. This option greatly simplifies installation, while keeping the units free of construction debris during pressure testing of the risers.

### CONTROL ENCLOSURE

The spacious hinged electrical compartment houses all electric heat and control components. Terminal strips are furnished for simple power and control wiring connections.

## CONSTRUCTION FEATURES

### REDUCING MOLD GROWTH IN HI-RISE RESIDENTIAL PROJECTS

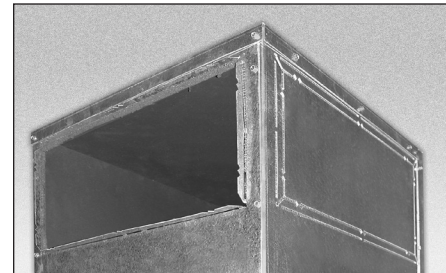
FS Series fan coils feature several options to mitigate mold and mildew when applied in a properly designed and constructed building. For humid climates, Johnson Controls offers innovations to ensure optimum humidity control at part load conditions.

- **Elastomeric closed cell foam insulation** is a great alternative to fiberglass insulation in extremely humid climates, as well as educational and hi-rise residential facilities. The material's smooth and cleanable surface makes it naturally mold resistant, with no danger of fibrous material entering the airstream. Additional features include:
  - Easily cleaned surface resists dirt, moisture absorption, and microbial growth – even if torn or punctured.
  - Higher temperature limit than polyethylene CCF, able to withstand service temperature spikes without permanent failure.
  - More flexible than polyethylene CCF at 75°F, allowing expansion and contraction in hot and cold cycle applications.
  - Compression resistance; retains its thermal insulating capacity.
  - Outer moisture vapor barrier or liner not required.
  - Ratings: NFPA 90A and 90B, ASTM E84, ASTM G-21 (fungi resistance), UL 181 (mold growth/humidity and air erosion)
- **Motorized coil bypass damper** in conjunction with fan speed control increases dehumidification at part load and more closely matches cooling capacity to the room load during off peak operation.
- **Innovative temperature and humidity controller** improves part load relative humidity control.
- **Deep loading, synthetic media filtration** protects both the coil and the coil bypass air from airborne contaminants. Filter frame and media are non organic, and will not support mold growth.
- **Ship In Advance Risers** allow installation and pressure testing during building construction, prior to units arriving on job site.
- **Stainless Steel Drain Pans and Coil Casings** are available for use where added corrosion resistance or longevity are required.
- **Coils and piping packages are removable in minutes** through the standard front panel with only a screwdriver and pair of wrenches for periodic cleaning or service outside of the unit.
- **IAQ drain pan** is double sloped to prevent standing water. An optional drain pan is removable for effective cleaning.

Refer to the Guide Specifications in this catalog for additional information on many of these features.



Positively sloped drain pan prevents standing water; lined with closed cell foam insulation for added moisture protection.



Supply air opening knockouts may be left in place during building construction to keep units dry and free from construction debris.

# STANDARD AND OPTIONAL FEATURES

## STANDARD FEATURES

### Construction

- AHRI 440 certified and labeled
- Galvanized steel construction
- 1/2" thick fiberglass insulation
- Integral filter rack with 1" throwaway filter
- Riser slot knockouts
- Supply air knockouts

### Decorator Front Panel

- Stamped louver return air grille
- Durable powder coat paint
- Quarter-turn cam lock fasteners

### Supply Air

- Single outlet
- Front, side or top outlets

### Coils

- Cooling - 3 or 4 row chilled water
- Heating - 1 or 2 row hot water - reheat position
- 5 total rows of cooling and heating coils maximum
- High efficiency aluminum fin surface for optimizing heat transfer, pressure drop and carryover
- Easily removable for service
- Manual air vents

### Drain Pans

- \* Double wall, composite, anti-microbial,
- \* Double sloped to drain connection
- \* Removable, extend under the entire coil section.
- 7/8" O.D. drain connection
- P-trap factory installed

### Fan Assemblies

- Forward curved, DWDI centrifugal type blowers
- 115 volt, single phase, three tap PSC motors
- Quick disconnect motor connections
- Easily removable fan/motor deck for service

### Electrical

- ETL listed for safety compliance
- Electrical enclosure with access door for field wiring terminations
- Terminal block for field connections

### Electric Heat

- ETL listed as an assembly for safety compliance
- Integral electric heat assembly with removable elements for easy service
- Automatic reset primary and back-up secondary thermal limits
- Single point power connection

## OPTIONAL FEATURES

### Construction

- Master/Slave arrangements
- Foil faced fiberglass insulation
- Elastomeric closed cell foam insulation
- 1" pleated filter (MERV 8)
- Manual or motorized outside air damper
- Blower shield

### Decorator Front Panel

- Recessing frame
- Full faced aluminum grille

### Supply Air

- Double deflection discharge grille(s)
- Double outlets
- Sight and sound baffles for double outlet units
- Opposed blade damper

### Coils

- Automatic air vents
- Stainless steel coil casings

### Drain Pans

- Stainless steel construction with external insulation
- Removable for cleaning

### Fan Assemblies

- 208-230 & 277 volt, single phase, three tap PSC motors

### Electrical

- SCR fan speed controller
- Fan relay packages
- Silent solid state fan relays
- Toggle disconnect switch
- Condensate overflow switch (drain pan)
- Main fusing
- Unit and remote mounted three speed fan switches

### Electric Heat

- Manual reset secondary thermal limit
- Silent relay/contactors
- Door interlocking disconnect switches
- Main fusing

### Piping Packages

- Factory assembled and installed
- 1/2" 2-way and 3-way normally closed, two position electric motorized valves
- Stainless steel braided hoses (threaded swivel connections) for thermal expansion including isolation ball valves with memory stop
- Fixed and adjustable flow control devices
- P/T ports and Y-strainers
- Modulating control valves
- High pressure close-off actuators (50 PSIG max)

### Thermostats

- Analog, digital display, or programmable
- Unit and wall mounted
- 2 and 4-pipe control sequences
- Automatic and manual changeover
- Integral three speed fan switches
- ADA mounting location on front panel or unit sides

### Risers

- Type-M or L copper with swaged connections
- 3/4" to 3" diameters
- 1/2" and 3/4" closed cell insulation
- Type-M copper condensate riser
- Riser extensions
- Riser cover
- Ship in advance risers

## COILS, PHYSICAL DATA

### COILS

Johnson Controls offers hot water and chilled water coils for specific application with all FS Series fan coil units. Strict on-site inspection before, during, and after installation guarantees the highest quality and performance available.

#### STANDARD FEATURES

- Cooling - 3 or 4 row chilled water
- Heating - 1 or 2 row hot water
- 5 total rows of cooling and heating coils maximum
- High efficiency aluminum fin surface for optimizing heat transfer, pressure drop and carryover
- Manual air vents

#### OPTIONAL FEATURES

- Automatic air vents
- Stainless steel coil casings

Johnson Controls offers Web-Select®, the industry's first web-based fan coil rating and selection program for complete unit, coil and sound selection.

### ALTITUDE CORRECTION

ALTITUDE CORRECTION FACTORS								
ALTITUDE (FT.)	0	1000	2000	3000	4000	5000	6000	7000
AIR DENSITY (LB./FT.3)	0.075	0.0722	0.0697	0.0672	0.0648	0.0625	0.0601	0.0579
TOTAL CAPACITY	1.000	0.988	0.986	0.983	0.981	0.979	0.977	0.975
SENSIBLE CAPACITY	1.000	0.960	0.930	0.900	0.860	0.830	0.800	0.770
STATIC PRESSURE	1.000	0.960	0.930	0.900	0.860	0.830	0.800	0.770

**NOTE:** Capacity and static pressures will be affected for applications above sea level. To apply correction factors, multiply factor to desired coil capacity or fan curve data.

**Example:** FS03 with 3 row coil, high speed fan operation at 3000 ft. above sea level and with 0.1 IN. W.C. ESP.

**Solution:** Using correction factors from Altitude Correction chart for 3000 ft. above sea level, data from AHRI Standard Ratings table and fan curves.

Total capacity = 12,500 BTUH (.983) = 12,288 BTUH

Sensible Capacity = 8,000 BTUH (.90) = 7,200 BTUH

SP = .1 (.90) = .09 IN. W.C.

### FACE AREA, FREE AREA AND FILTER SIZES

UNIT SIZE	COIL FACE AREA	FILTER FACE AREA	ACTUAL FILTER SIZES
3	2.00 [.19]	2.09 [.20]	13.25 X 22.75 x 1" [338 x 581 x 25]
4	2.00 [.19]	2.09 [.20]	13.25 X 22.75 x 1" [338 x 581 x 25]
6	2.72 [.25]	2.83 [.27]	15.25 X 26.75 x 1" [389 x 683 x 25]
8	2.72 [.25]	2.83 [.27]	15.25 X 26.75 x 1" [389 x 683 x 25]
10	4.22 [.39]	4.32 [.41]	20.25 X 30.75 x 1" [517 x 785 x 25]
12	4.22 [.39]	4.32 [.41]	20.25 X 30.75 x 1" [517 x 785 x 25]



# PHYSICAL DATA

## AHRI STANDARD RATINGS

MODEL / SIZE	COIL		AIRFLOW CFM (DRY FLOW)	COOLING CAPACITY		WATER		POWER INPUT (WATTS)
	Rows	FPI		QT (BTUH)	QS (BTUH)	Flow Rate (GPM)	WPD ft-wg	
FS 03	3	14	347	13,560	9,350	2.7	7.4	66
FS 04	3	14	442	16,700	11,580	3.3	9.5	118
FS 06	3	14	601	22,620	15,700	4.5	9.0	142
FS 08	3	14	800	27,760	19,610	5.5	10.6	247
FS 10	3	14	1006	37,470	26,030	7.5	9.1	279
FS 12	3	14	1238	43,120	30,410	8.5	10.0	474
FS 03	4	14	337	16,390	10,780	3.3	12.5	66
FS 04	4	14	427	20,250	13,400	4.0	15.0	118
FS 06	4	14	588	27,740	18,370	5.5	14.4	142
FS 08	4	14	780	34,420	23,150	6.9	19.4	247
FS 10	4	14	990	43,350	29,350	8.7	7.7	279
FS 12	4	14	1206	50,540	34,600	10	9.1	474

**NOTE:** Based on 80°F DB and 67°F WB EAT, 45°F EWT, 10°F temperature rise, high fan speed. Motor type is PSC and motor voltage is 115/1/60. Airflow under dry coil conditions. All models tested at 0.0" external static pressure.

## UNIT WEIGHT DATA

COMPONENT	UNIT SIZE						
	3	4	6	8	10	12	
FS BASE UNIT	218 [99]	218 [99]	235 [107]	235 [107]	277 [126]	277 [126]	
FSA/FSB FIRE RATED WALL PLENUM	130 [59]	130 [59]	145 [66]	145 [66]	160 [73]	160 [73]	
FSA/FSB NON FIRE RATED WALL PLENUM	78 [35]	78 [35]	87 [40]	87 [40]	96 [44]	96 [44]	
(4) 2" RISERS & (1) 1" RISER (115" L & 3/4" INS)	100 [45]	100 [45]	100 [45]	100 [45]	100 [45]	100 [45]	
TOTAL COIL ROWS	3 ROW - DRY	15 [7]	15 [7]	17 [8]	17 [8]	24 [11]	24 [11]
	3 ROW - WET	19 [9]	19 [9]	22 [10]	22 [10]	31 [14]	31 [14]
	4 ROW - DRY	18 [8]	18 [8]	21 [10]	21 [10]	29 [13]	29 [13]
	4 ROW - WET	23 [10]	23 [10]	27 [12]	27 [12]	38 [17]	38 [17]
	5 ROW - DRY	21 [10]	21 [10]	24 [11]	24 [11]	34 [15]	34 [15]
	5 ROW - WET	27 [12]	27 [12]	32 [15]	32 [15]	45 [21]	45 [21]

**NOTE:** Unit weight data is in pounds [kilograms].

# ELECTRIC HEAT

## STANDARD FEATURES

- ETL listed as an assembly for safety compliance
- Single point power connection
- Mounted in preheat position
- Automatic reset primary and back-up secondary thermal limits
- Internal wiring rated at 105°C
- Integral electric heat assembly with removable element for easy service
- Stainless steel terminals and hardware



## USEFUL FORMULAS

$$kW^* = \frac{CFM \times \Delta T \times 1.085^{**}}{3413}$$

$$1\emptyset \text{ AMPs} = \frac{kW \times 1000}{Volts}$$

\* 1kW = 3413 BTU/H

\*\* Capacity at sea level

### Altitude Considerations:

Reduce by 0.034 for each 1000 ft. of altitude above sea level.

Example: 5000 ft./1000 ft. = 5

5 x 0.034 = 0.17

1.085 - 0.17 = 0.915

## OPTIONAL FEATURES

- Silent solid state relays
- Manual reset secondary thermal units
- Door interlocking disconnect switch
- Main fusing

## ELECTRICAL CALCULATIONS INFORMATION

1. Contact your local Johnson Controls representative for more information on electrical calculations, including FLA, MCA, and MOP.
2. Non-Fused Door Interlock Disconnect Switch shall be sized according to MCA.
3. Fused Door Interlock Disconnect Switch and Main Fusing shall be sized according to MOP.

## ELECTRIC HEAT SELECTION CHART (AMPS)

UNIT SIZE	MBH	3.4	6.8	10.2	13.7	17.1	20.5	23.9	27.3	30.7	34.1
	KW	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
	VOLTS	AMPS									
03	115	8.7	17.4	26.1							
	208	4.8	9.6	14.4							
	230	4.4	8.7	13.1							
	277	3.6	7.2	10.8							
04	115	8.7	17.4	26.1	34.8						
	208	4.8	9.6	14.4	19.2						
	230	4.4	8.7	13.1	17.4						
	277	3.6	7.2	10.8	14.4						
06	115	8.7	17.4	26.1	34.8						
	208	4.8	9.6	14.4	19.2	24.1					
	230	4.4	8.7	13.1	17.4	21.8					
	277	3.6	7.2	10.8	14.4	18.1					
08	115	8.7	17.4	26.1	34.8						
	208	4.8	9.6	14.4	19.2	24.1	28.9	33.7	38.5		
	230	4.4	8.7	13.1	17.4	21.8	26.1	30.5	34.8		
	277	3.6	7.2	10.8	14.4	18.1	21.7	25.3	28.9		
10	115	8.7	17.4	26.1	34.8						
	208	4.8	9.6	14.4	19.2	24.1	28.9	33.7	38.5	43.3	
	230	4.4	8.7	13.1	17.4	21.8	26.1	30.5	34.8	39.2	43.5
	277	3.6	7.2	10.8	14.4	18.1	21.7	25.3	28.9	32.5	36.1
12	115	8.7	17.4	26.1	34.8						
	208	4.8	9.6	14.4	19.2	24.1	28.9	33.7	38.5	43.3	
	230	4.4	8.7	13.1	17.4	21.8	26.1	30.5	34.8	39.2	43.5
	277	3.6	7.2	10.8	14.4	18.1	21.7	25.3	28.9	32.5	36.1

### NOTES:

1. Shaded areas of the electric heat selection chart indicate kW and voltage options not available.
2. Available voltages are single phase, 60 hertz.
3. Size heater for Leaving Air Temperature (LAT) less than 104°F.
4. Silent, solid state heater relay is available for heater currents less than 18 amps.
5. Ask your Johnson Controls representative about continuously modulating electric heat using SSR and special control options.

## **RISER SELECTION AND DATA**

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### **RISER APPLICATION AND SIZING**

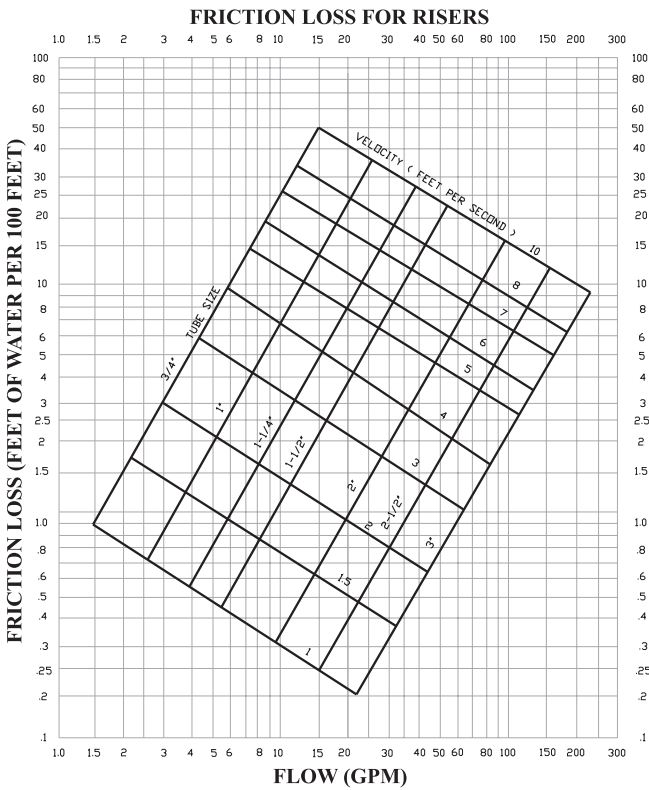
Technical information on heat transfer, fluid flow and pipe sizing can be found in the ASHRAE Fundamentals Handbook and various other technical documents and publications. Some of the factors affecting riser application and sizing are noise, tube erosion and economics. The Friction Loss For Risers chart (next page) displays riser tube diameter sizes as a function of flow (GPM), friction loss and water velocity. For maximum riser velocity on pressure drop per 100 ft., refer to ASHRAE 2001 Fundamentals 35.3 Table 6 for Riser Sizing. Riser sizes can be of a single diameter on low rise buildings, or varying sizes on medium to high rise buildings. Generally, riser copper type, size, length and insulation thickness are determined by the location of the fan coil unit in the building. Chilled water and hot water risers are available in Type-M or Type-L copper, varying diameters from 3/4" to 3", and with either 1/2" or 3/4" thick closed cell foam insulation. Condensate risers are available in Type-M copper, varying diameters from 3/4" to 1 1/4", and with 1/2" thick closed cell foam insulation.

### **RISER EXPANSION**

Generally, in medium to high rise buildings, allowance must be made for pipe expansion. Model FS hi-rise fan coil units are furnished with hoses which act as expansion loops integral to the unit. The hose will allow for +/- 1 1/2" of riser expansion and contraction. Additional expansion compensation must be made in the riser system in the field where movement is expected to exceed the factory allowances. The Allowable Riser Lengths Between System Expansion Loops chart (next page) displays the expansion characteristics of risers compared to water temperature difference. Technical information on pipe expansion, contraction and anchoring can be found in the ASHRAE HVAC Systems and Equipment Handbook and various other technical documents and publications.

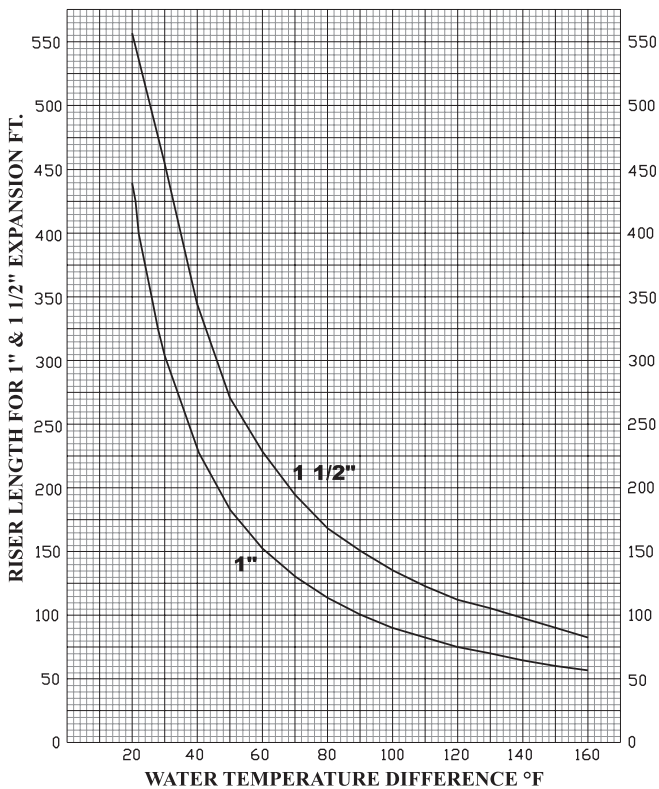
# RISER SELECTION AND DATA

## GENERAL FAN NOTES



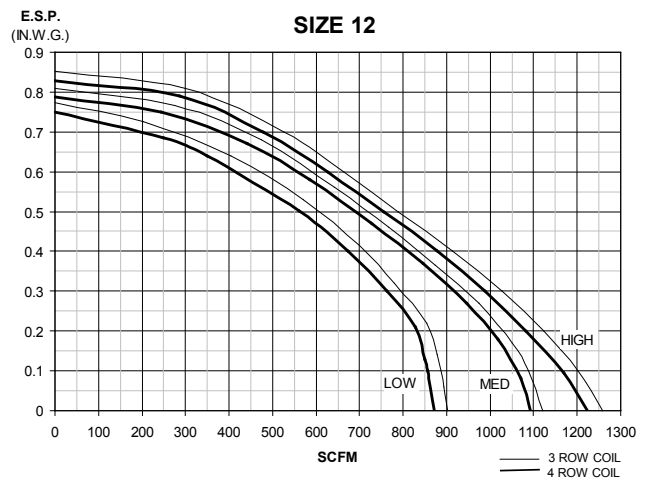
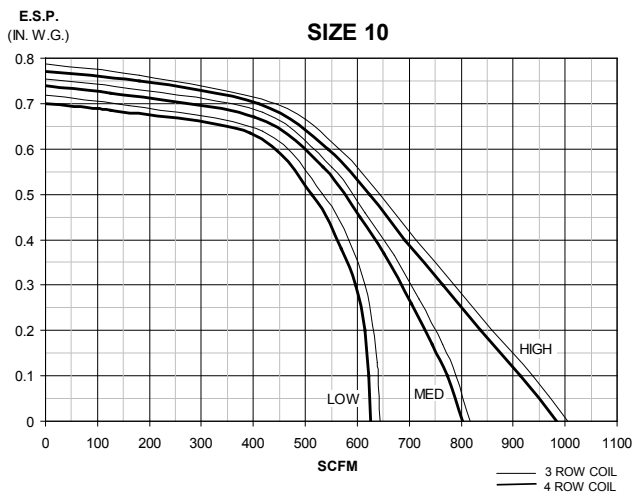
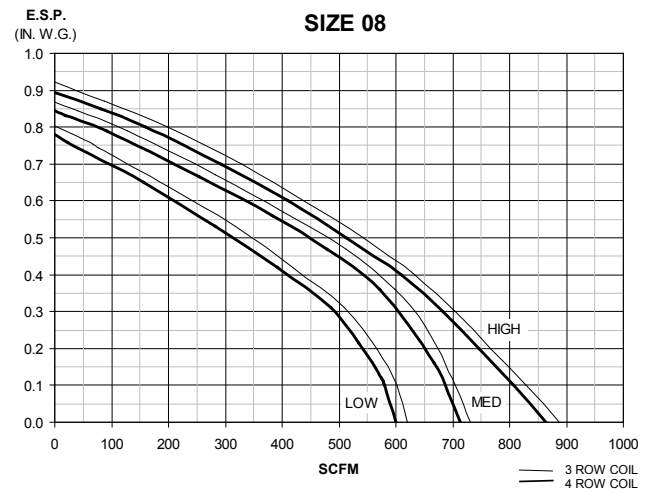
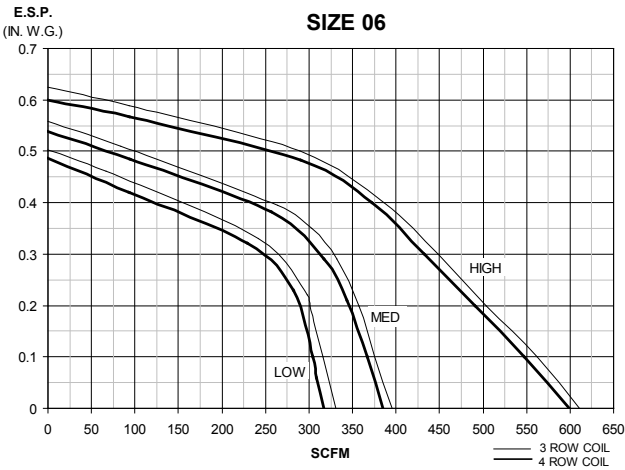
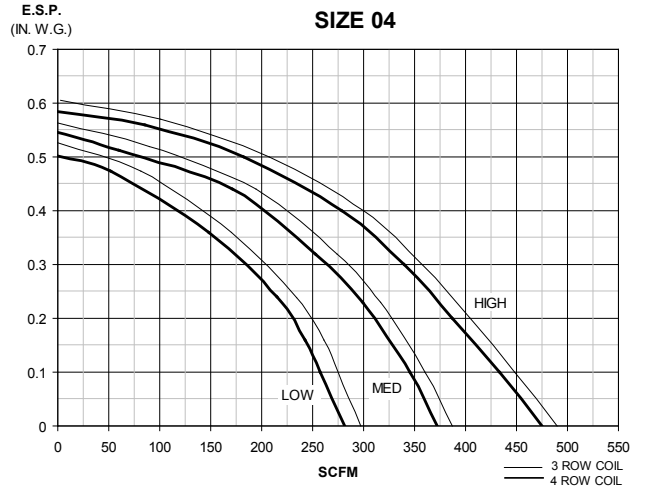
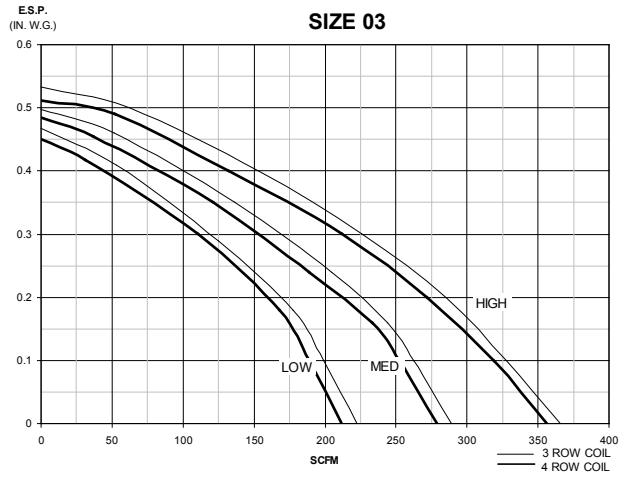
1. Fan curves on the following page depict actual performance of each motor tap without any additional fan balance adjustment. Actual capacities which fall below each curve can be obtained by adding an adjustment device.
2. Johnson Controls fan coil units are equipped with permanent split-capacitor (PSC) motors with three separate taps (High, Medium and Low) which provides variable horsepower outputs. Most often, size selections are conservative and actual CFM requirements and/or external static pressure requirements are lower than those specified. In this case, the unit fan motor can be run at low or medium tap, substantially reducing the operating cost of the unit.
3. All fan curves are for 115/1/60 motors and include losses for cabinet, return grilles, electric heater, 3 or 4 row coil and clean 1" throwaway filter. For other coil configurations, adjust performance curves based on pressure losses for the coils using Web-Select®.
4. See page 14 for fan motor electrical data.

**ALLOWABLE RISER LENGTHS BETWEEN SYSTEM EXPANSION LOOPS**





# FAN PERFORMANCE CURVES



# MOTOR, FAN AND SOUND DATA

## MOTOR AND FAN DATA

UNIT SIZE	FAN SPEED	MOTOR H.P.	WATTS	115 VOLTS	208-230 VOLTS	277 VOLTS
				AMPS	AMPS	AMPS
3	High	1/35	66	0.6	0.3	0.3
	Medium		54			
	Low		40			
4	High	1/25	118	1.0	0.5	0.5
	Medium		76			
	Low		52			
6	High	1/15	142	1.3	0.6	0.5
	Medium		82			
	Low		69			
8	High	1/6	247	2.6	1.4	1.0
	Medium		245			
	Low		205			
10	High	1/5	279	2.7	1.2	1.0
	Medium		277			
	Low		202			
12	High	1/4	474	4.9	2.2	2.0
	Medium		420			
	Low		325			

### NOTES:

- Motor electrical data is nameplated data. Actual data will vary with application.
- 230 volt motor is nameplated for 208-230/1/60. Use 230 volt motor data for 208 volt applications.

## SOUND DATA

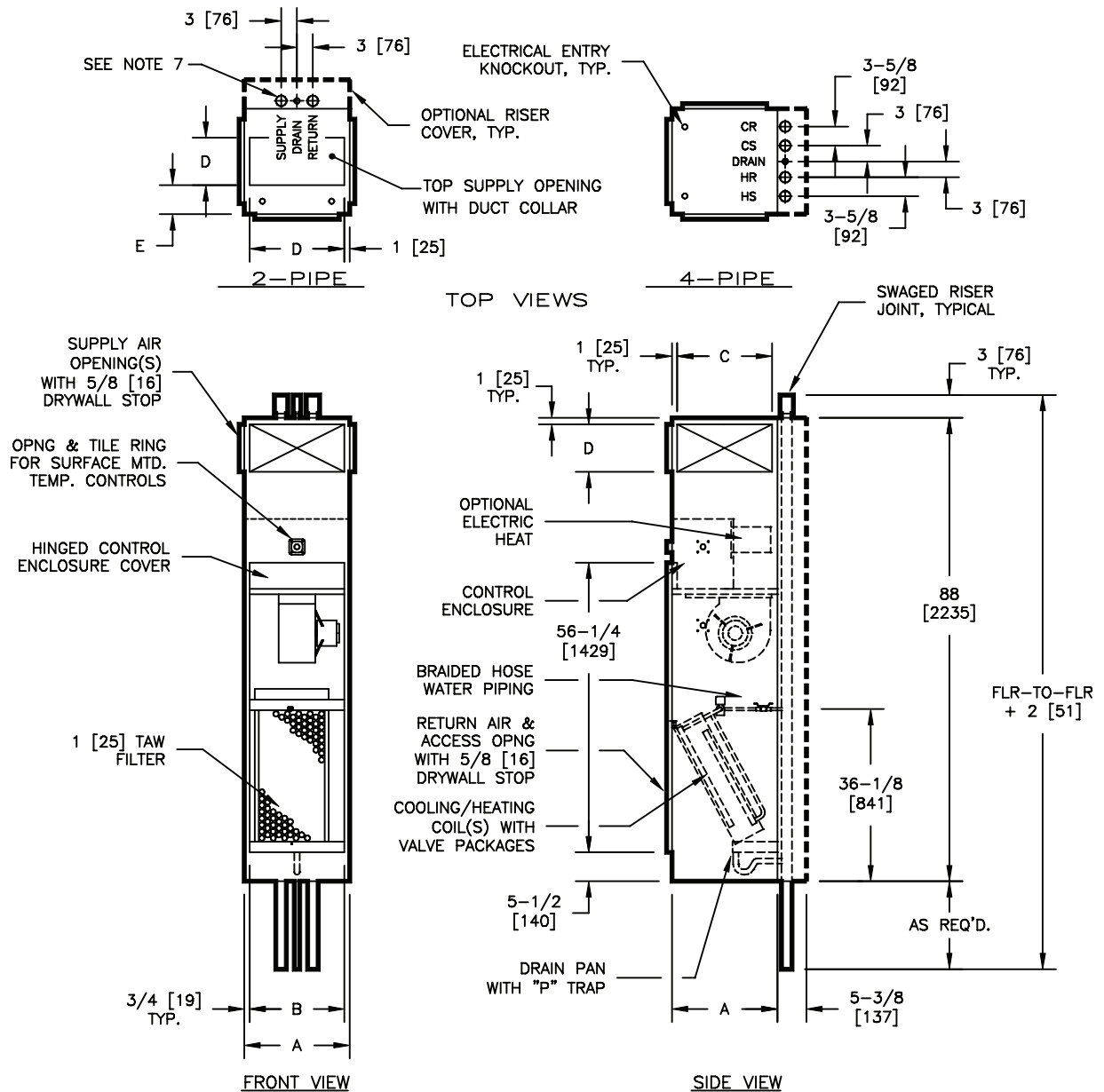
UNIT SIZE	FAN SPEED	SCFM	TOTAL SOUND POWER LEVEL						
			OCTAVE BAND / CENTER FREQUENCY (HZ)						
			2/125	3/250	4/500	5/1000	6/2000	7/4000	8/8000
3	High	356	59	52	49	44	34	29	27
	Medium	279	56	49	46	40	29	24	23
	Low	212	51	45	41	34	22	20	18
4	High	475	61	54	50	44	37	33	26
	Medium	372	56	49	46	39	31	27	26
	Low	281	53	44	41	33	24	21	18
6	High	601	68	58	55	49	44	40	33
	Medium	505	62	53	51	45	39	34	29
	Low	385	57	49	47	40	32	27	23
8	High	864	68	60	59	55	49	46	38
	Medium	712	65	58	57	52	46	43	31
	Low	600	62	54	55	48	42	38	30
10	High	985	70	65	62	61	51	48	44
	Medium	802	68	62	59	54	49	45	41
	Low	625	63	58	56	50	44	40	35
12	High	1224	73	70	68	64	58	55	47
	Medium	1092	69	66	64	58	53	50	41
	Low	902	63	60	58	51	46	42	35

### NOTES:

- Sound data tested in accordance with AHRI 350-2000.
- Sound levels are expressed in decibels, dB Re:  $1 \times 10^{-12}$  watts.
- Total sound power level data based on Model FSC with fan CFM at corresponding motor tap with 115/1/60 volt motor, 4 row coil, 1" throwaway filter, double deflection discharge grille, 0.0" external static pressure and standard rated internal pressure losses.

# DIMENSIONAL DATA

## MODEL FSC - CONCEALED UNIT



DIMENSIONS - In [mm]

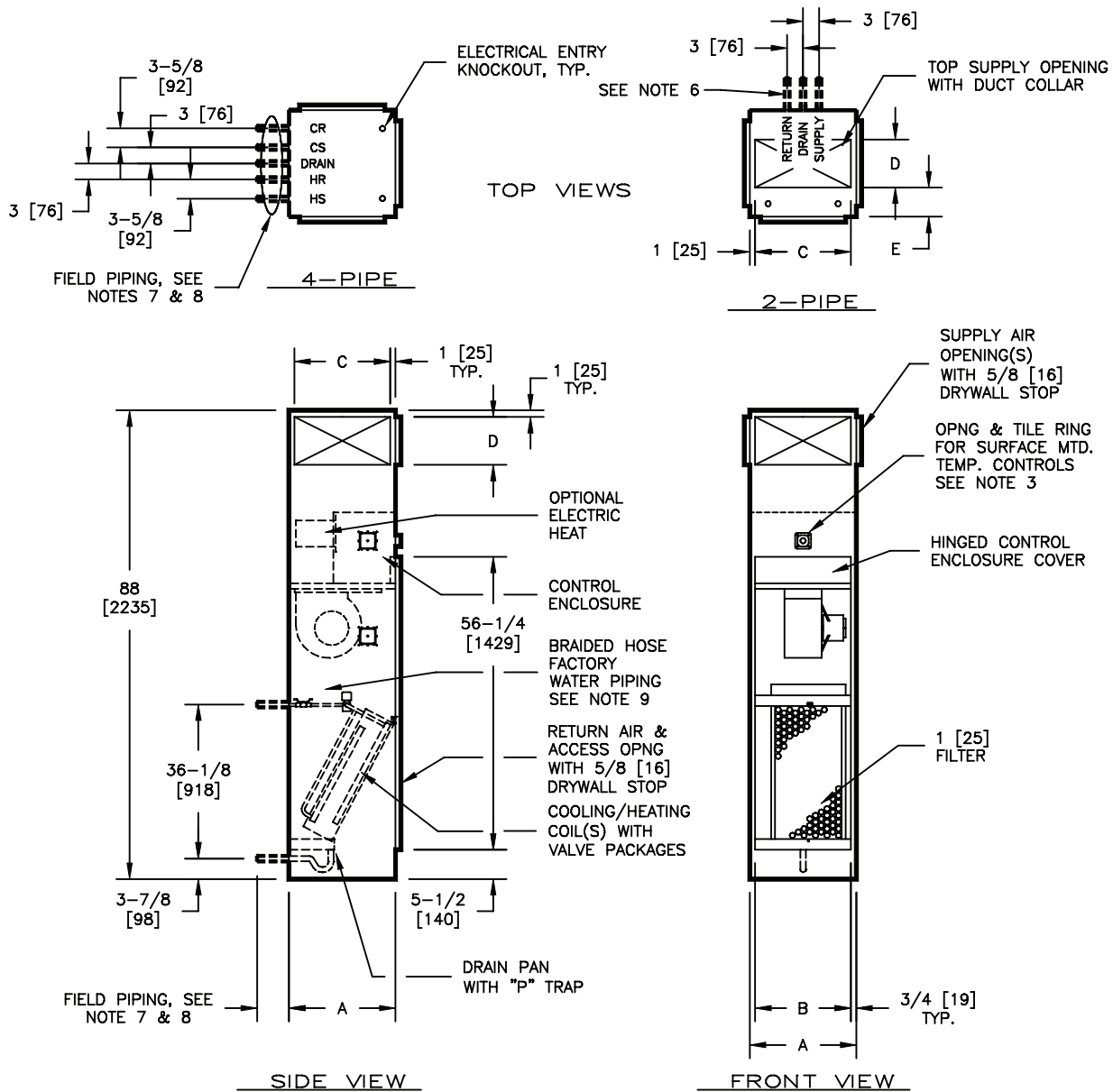
UNIT SIZE	A	B	SINGLE/DOUBLE SUPPLY		E
			C	D	
03 & 04	18 [457]	16-1/2 [419]	16 [406]	8 [203]	6 [152]
06 & 08	20 [508]	18-1/2 [470]	18 [457]	12 [305]	6 [152]
10 & 12	24 [610]	22-1/2 [572]	22 [559]	14 [356]	8 [203]

**NOTES:**

- All dimensions are inches [mm]. Metric values are soft conversion.
- All dimensions are ± 1/4 [6mm].
- Tile ring is installed on front of unit as shown, and may be moved to left or right side of unit in field.
- Wiring from electrical entry point to control enclosure is furnished and installed by others in field.
- Risers available from 3/4" [19mm] to 3" [76mm] diameter with 1/2" [13mm] thick insulation, and 3/4" [19mm] to 2 1/2" [64mm] diameter with 3/4" [19mm] thick insulation.
- Riser length is 120" [3048mm] max., 100" [2540mm] min.
- Back riser location shown. See arrangement drawings for available unit configurations.
- Factory mounted risers shown. Risers may also ship in advance of unit. See Ship In Advance Riser drawings for details.

# DIMENSIONAL DATA

## MODEL FSS - SLAVE UNIT



### DIMENSIONS — In [mm]

UNIT SIZE	A	B	SINGLE SUPPLY		E
			C	D	
03 & 04	18 [457]	16-1/2 [419]	16 [406]	8 [203]	6 [152]
06 & 08	20 [508]	18-1/2 [470]	18 [457]	12 [305]	6 [152]
10 & 12	24 [610]	22-1/2 [572]	22 [559]	14 [356]	8 [203]

**NOTES:**

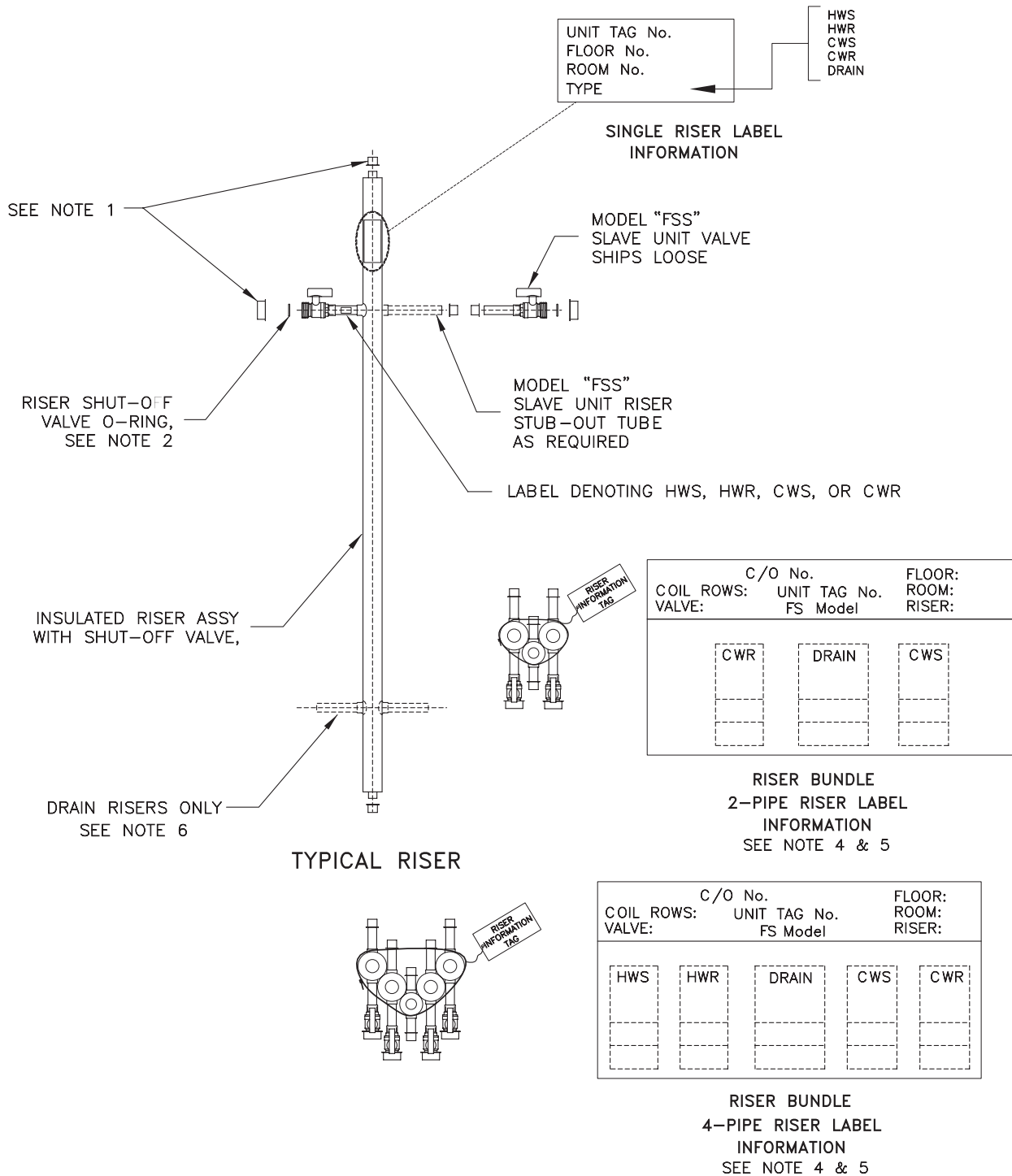
1. All dimensions are inches [mm]. Metric values are soft conversion.
2. All dimensions are ± 1/4 [6mm].
3. Tile ring is installed on front of unit as shown, and may be moved to left or right side of unit in field.
4. Wiring from electrical entry point to control enclosure is furnished and installed by others in field.
5. All piping and insulation between slave unit and risers is furnished and installed in the field by others.
6. Back connection location shown. See arrangement drawings for available unit configurations.
7. All coil and drain connections are "retracted" and braced internally for shipment.
8. Coil connections are 5/8" [16mm] O.D. female sweat. Drain p-trap is designed to accept 7/8" [22mm] O.D. copper tube.
9. Slave units are furnished with factory installed shutoff valves and field connection tubes, unless master unit risers are shipped in advance.





# DIMENSIONAL DATA

## SHIP IN ADVANCE RISER ASSEMBLY

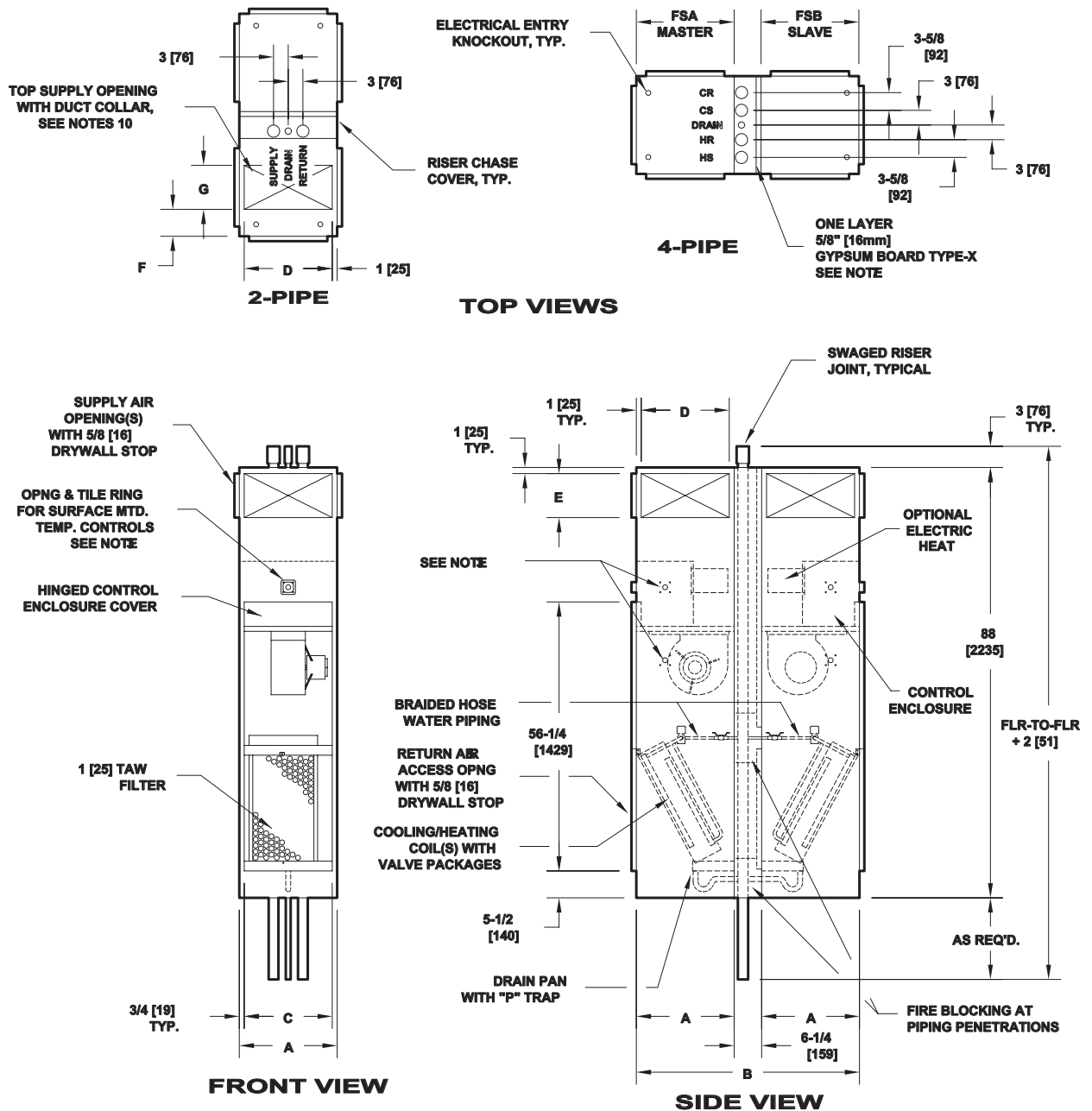


**NOTES:**

1. All risers and valves are shipped with protective caps. These caps should remain in place until installation of the unit.
2. Each valve is supplied with an o-ring that is bagged and shipped loose for field installation by others.
3. All risers are factory tested, and guaranteed to be leak free at time of shipment.
4. Riser information shown shall reflect matching unit identification labels.
5. FSS Slave units will have mirror image orientation and will be labeled in units.
6. Condensate p-trap and hose clamps ship installed in unit for field connections to drain riser.

# DIMENSIONAL DATA

## MODEL FSA/FSB - TANDEM UNITS (PAGE 1 OF 2)



**NOTES:**

1. All dimensions are inches [mm]. Metric values are soft conversion.
2. All dimensions are ± 1/4 [6mm].
3. Thermostat mounting – Tile ring is installed on front of unit as shown and may be moved to left or right of unit as shown and may be moved to left or right side of unit in field.
4. Wiring from electrical entry point to control enclosure is furnished and installed by others in field.
5. Risers available from 3/4" [19mm] to 2-1/2" (64mm) diameter with 1/2" [13mm] or 3/4" [19mm] thick insulation.
6. Riser length is 120" [2921mm] max, 100" [2540mm] min.
7. NON-FIRE RATED unit shown with type-X gypsum board at back of slave unit. FIRE RATED units have type-X gypsum board at back of both slave and master units. FIRE RATED unit design has been tested in accordance with UL1479 - Fire Test Of Through Penetration Fire Stops, and is approved to bear the ETL listing mark for Through Penetration Fire Stop Assemblies.
8. For further fire rating information refer to the Installation Instructions, drawing 70-74-023.
9. See page 2 of 2 for dimensions.
10. Refer to arrangement drawings for available Tandem Master and Tandem Slave unit configurations.

# DIMENSIONAL DATA

## FSA/FSB - TANDEM UNITS CABINET DIMENSIONS (PAGE 2 OF 2)

DIMENSIONS — In [mm]						FSA/FSB SUPPLY AIR		
FSA (MASTER)	FSB (SLAVE)	A	B	C	D	SINGLE/ DOUBLE	TOP	
						E	F	G
03 or 04	03 or 04	18 [457]	42-1/4 [1073]	16-1/2 [419]	16 [406]	8 [203]	6 [152]	8 [203]
03 or 04	06 or 08	20 [508]	46-1/4 [1175]	18-1/2 [470]	18 [457]	12 [305]	6 [152]	12 [305]
03 or 04	10 or 12	24 [610]	54-1/4 [1378]	22-1/2 [572]	22 [559]	14 [356]	8 [203]	14 [356]
06 or 08	03 or 04	20 [508]	46-1/4 [1175]	18-1/2 [470]	18 [457]	12 [305]	6 [152]	12 [305]
06 or 08	06 or 08							
06 or 08	10 or 12	24 [610]	54-1/4 [1378]	22-1/2 [572]	22 [559]	14 [356]	8 [203]	14 [356]
10 or 12	03 or 04	24 [610]	54-1/4 [1378]	22-1/2 [572]	22 [559]	14 [356]	8 [203]	14 [356]
10 or 12	06 or 08							
10 or 12	10 or 12							

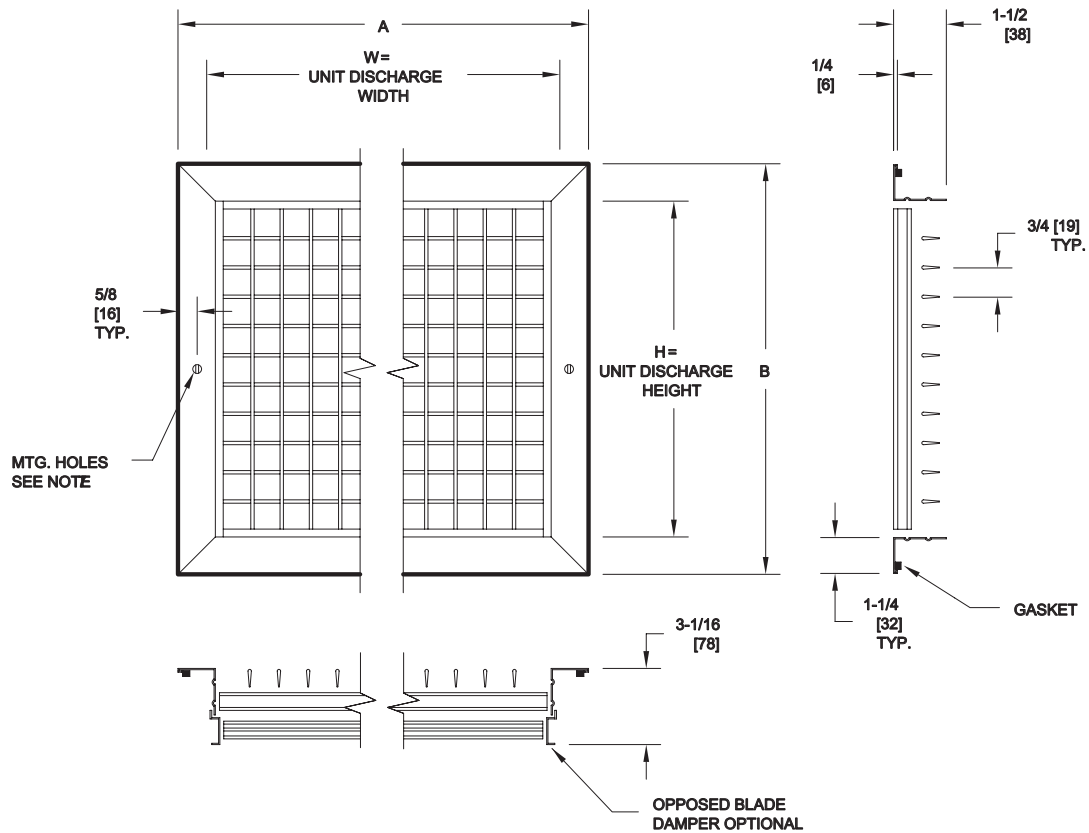
See page 1 of 2 for notes:

Tandem Master and Tandem Slave Models FSA/FSB ship complete with risers enclosed in a wall plenum with one layer of 5/8" gypsum for sound attenuation. As an option, Tandem Master and Tandem Slave unit may be ordered with two layers of 5/8" gypsum and fire blocking material for a one hour fire rating per UL 1479.



# DIMENSIONAL DATA

## DOUBLE DEFLECTION ALUMINUM DISCHARGE GRILLE



### DIMENSIONS - In [mm]

MODEL TYPE	UNIT SIZE	CABT. HGT.	SINGLE/ DOUBLE SUPPLY			
			W	H	A	B
VERTICAL HI-RISE & TANDEM MASTER AND TANDEM SLAVE SAME SIZE UNITS	03 or 04	STD.	16 [406]	8 [203]	17-11/16 [449]	9-11/16 [246]
		79" CABT.				
	06 or 08	STD.	18 [457]	12 [305]	19-11/16 [500]	13-11/16 [348]
		79" CABT.	18 [457]	8 [203]	19-11/16 [500]	9-11/16 [246]
	10 or 12	STD.	22 [559]	14 [356]	23-11/16 [602]	15-11/16 [398]
		79" CABT.	N/A	N/A	N/A	N/A

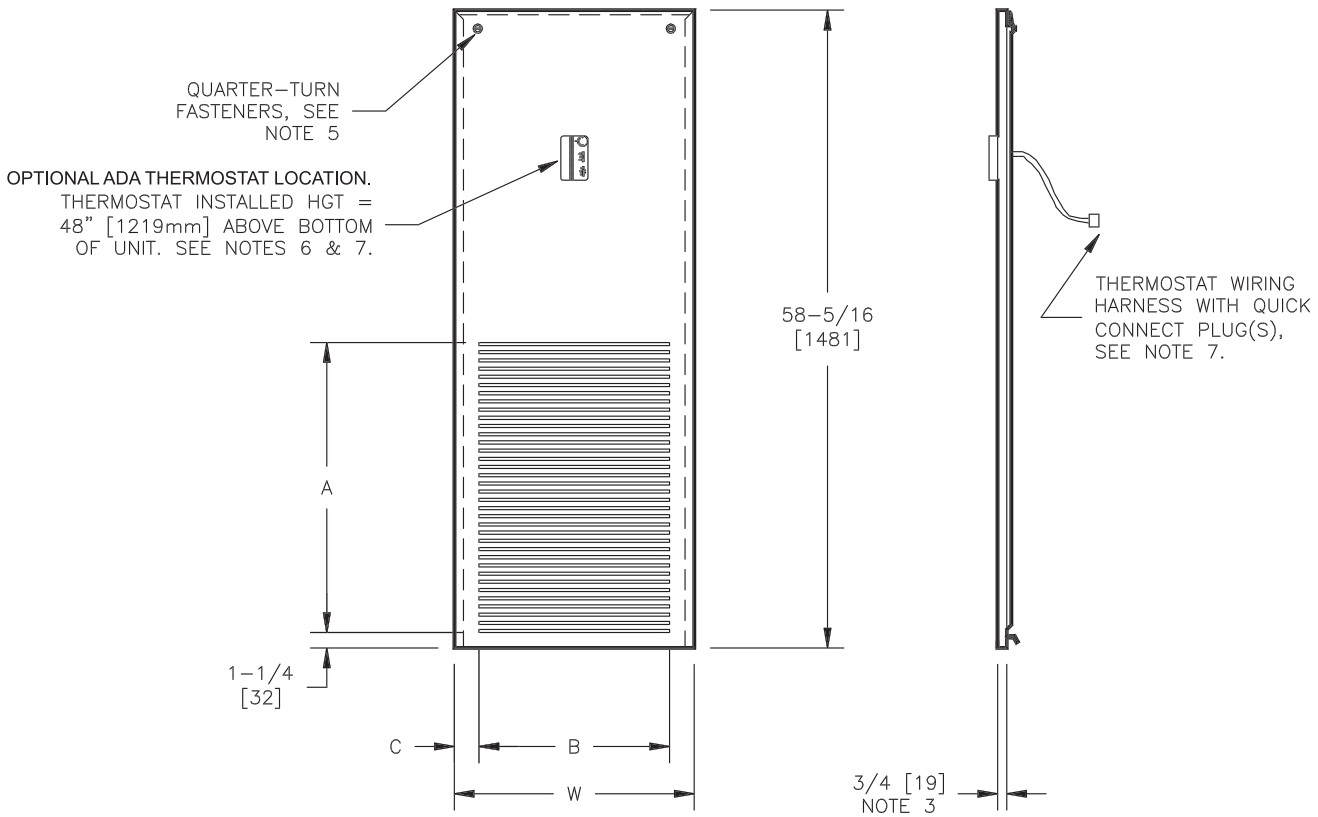
MODEL TYPE	UNIT SIZE	CABT. HGT.	SINGLE/ DOUBLE SUPPLY			
			W	H	A	B
TANDEM MASTER AND TANDEM SLAVE UP SIZED UNITS	03 or 04 mated to 06 or 08	STD.	18 [457]	12 [305]	19-11/16 [500]	13-11/16 [348]
		79" CABT.	18 [457]	8 [203]	19-11/16 [500]	9-11/16 [246]
	03 or 04 mated to 10 or 12	STD.	22 [559]	14 [356]	23-11/16 [602]	15-11/16 [398]
		79" CABT.	N/A	N/A	N/A	N/A
	06 or 08 mated to 10 or 12	STD.	22 [559]	14 [356]	23-11/16 [602]	15-11/16 [398]
		79" CABT.	N/A	N/A	N/A	N/A

**NOTES:**

- All dimensions are Inches [mm]. Metric values are soft conversion.
- All dimensions are ±1/4 [6mm].
- Discharge grilles are shipped loose for field installation.
- Construction is roll formed aluminum frame and blades.
- Standard finish is powder coat baked enamel. Color is "Pearl White Satin".
- Installation of grilles on adjacent unit sides may require furring one side away from unit to prevent interference of frames.
- Mounting hardware included.

# DIMENSIONAL DATA

## STAMPED LOUVER FRONT RETURN AIR PANEL



### DIMENSIONS - In[mm]

UNIT SIZE	W	A	B	C	UNIT SIZE (8)	W	A	B	C
03/04	17-1/2 [445]	24-1/8 [613]	15 [381]	1-1/4 [32]	0306-0408	19-1/2 [495]	24-1/8 [613]	15 [381]	2-1/4 [57]
06/08	19-1/2 [495]	24-1/8 [613]	15 [381]	2-1/4 [57]	0310-0412	23-1/2 [597]	24-1/8 [613]	21 [533]	1-1/4 [32]
10/12	23-1/2 [597]	28-1/2 [724]	21 [533]	1-1/4 [32]	0610-0812	23-1/2 [597]	24-1/8 [613]	21 [533]	1-1/4 [32]

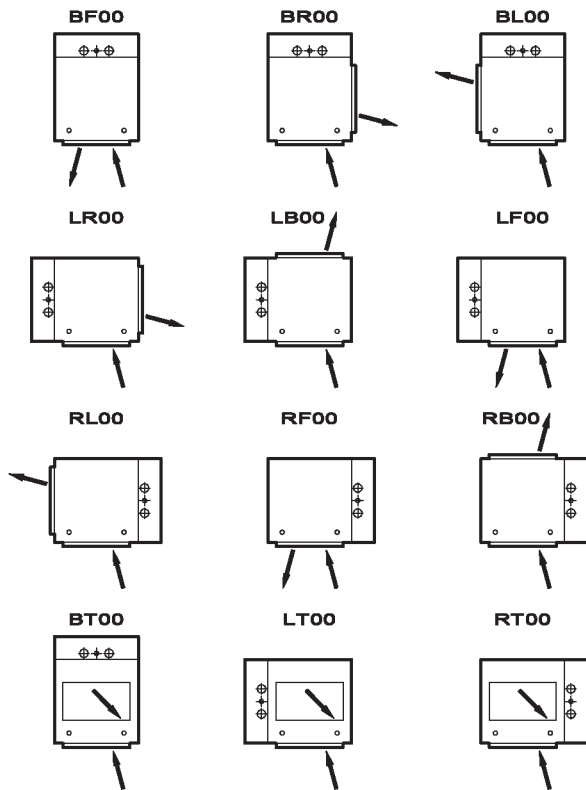
**NOTES:**

1. All dimensions are inches [mm]. Metric values are soft conversion.
2. All dimensions are ± 1/4 [6mm].
3. Installed wall panels extend approximately 3/4" [19mm] from finished wall surface.
4. Standard finish is powder coat baked enamel. Color is Pearl White Satin.
5. Mounting hardware is shipped loose for field installation.
6. ADA thermostat: actual installed height is determined by unit installation method and may vary.
7. ADA thermostat is shipped loose for field installation by others.
8. Sizes shown are for "up-sized" cabinet units used in Tandem Master and Slave pairs.

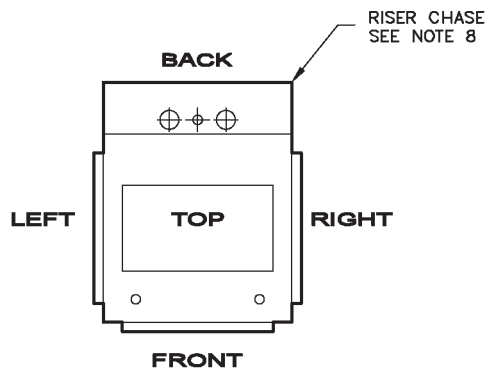
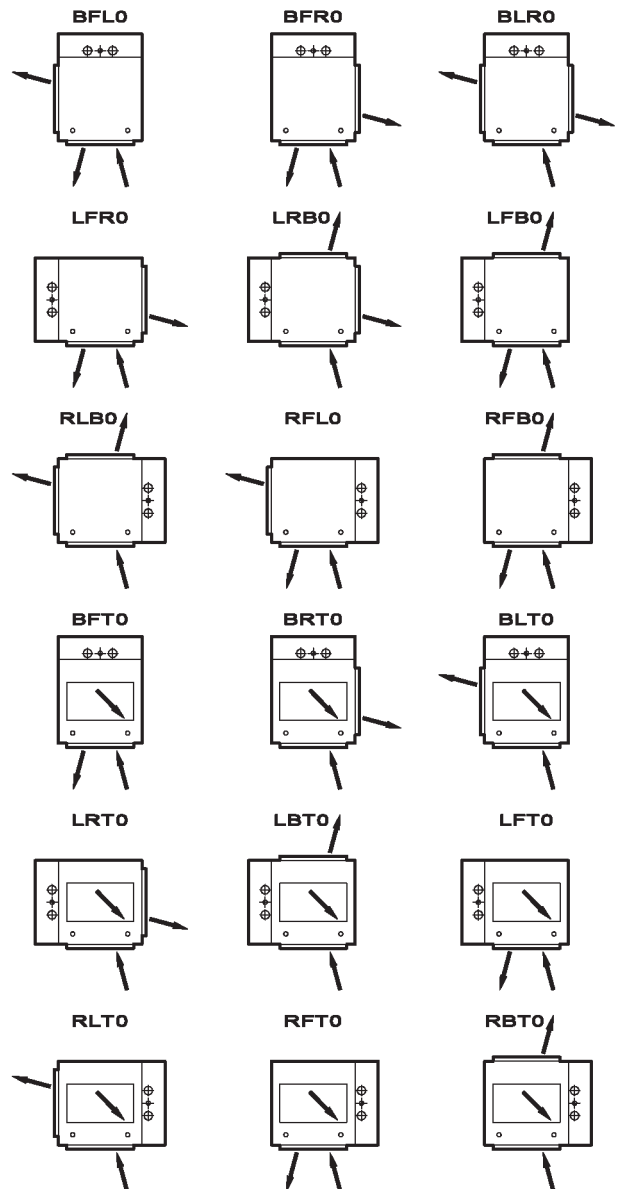
# UNIT ARRANGEMENT

## ARRANGEMENT DRAWING • FSC, FSM, FSA

### SINGLE SUPPLY



### DOUBLE SUPPLY



F = FRONT                      L = LEFT  
 T = TOP                         R = RIGHT  
 B = BACK                        O = NONE



### UNIT SIDE DESIGNATIONS

(UNIT ARRANGEMENTS TYPICAL FOR ALL MODELS)

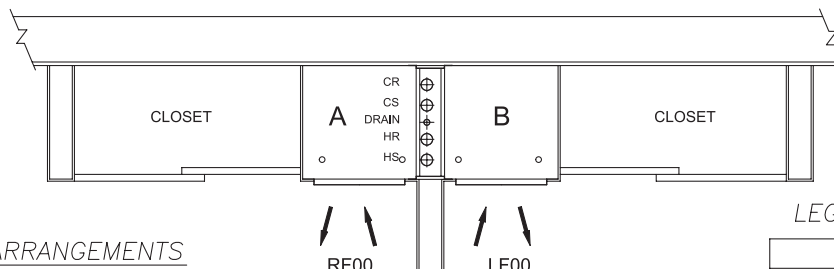
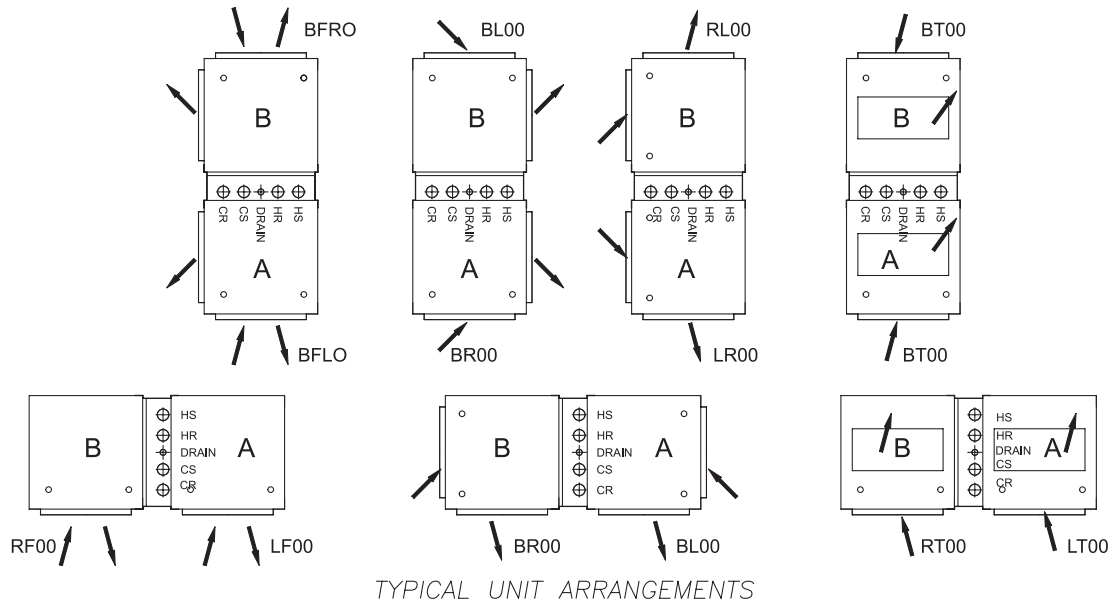
### NOTES:

1. All drawings subject to change without prior notice.
2. Return air and access are always on front of unit.
3. Sight & Sound baffle provided as required.
4. Sight & Sound baffle not available on units with top supply outlet.
5. Opposed blade damper is optional on one supply grille for units with double supply outlets.
6. This drawing applies to single and master units.
7. Fourth character indicates outside air location.
8. Model FSC units shown above with optional riser chase. Riser chase not available on FSM units. FSA units must be mated to FSB units.
9. Model FSX available with arrangement BF00 only.
10. For field configured arrangements, specify 0000 when ordering.



# UNIT ARRANGEMENT

## MODEL FSM, FSA, FSC TANDEM MASTER AND TANDEM SLAVE UNIT CONFIGURATION

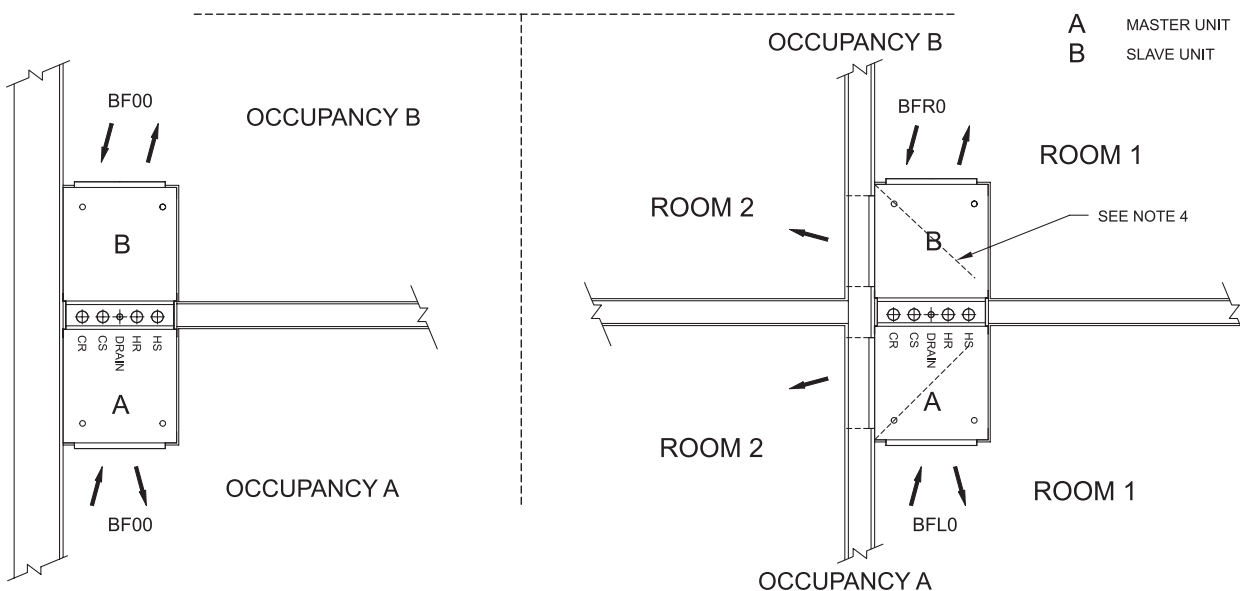


**NOTES:**

1. All drawings subject to change without prior notice.
2. For other possible combinations, see pages 23, 24, and 25.
3. Fire rated units shown non fire rated is standard.
4. Sight & Sound baffles provided as required.

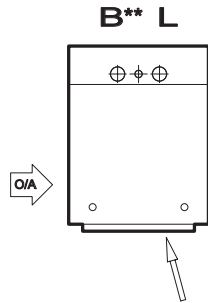
**LEGEND**

- EXTERIOR WALL
- INTERIOR WALL
- TANDEM MASTER & SLAVE FIRE RATED
- TANDEM MASTER & SLAVE NON-FIRE RATED
- AIR FLOW
- A** MASTER UNIT
- B** SLAVE UNIT

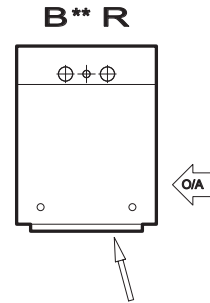


# UNIT ARRANGEMENT

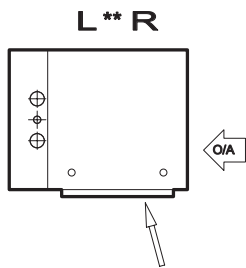
## OUTSIDE AIR INLET DESIGNATIONS



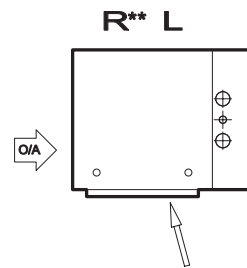
BACK RISER - LEFT O/A



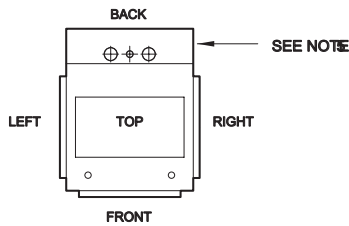
BACK RISER - RIGHT O/A



LEFT RISER - RIGHT O/A



RIGHT RISER - LEFT O/A



F = FRONT  
T = TOP  
B = BACK

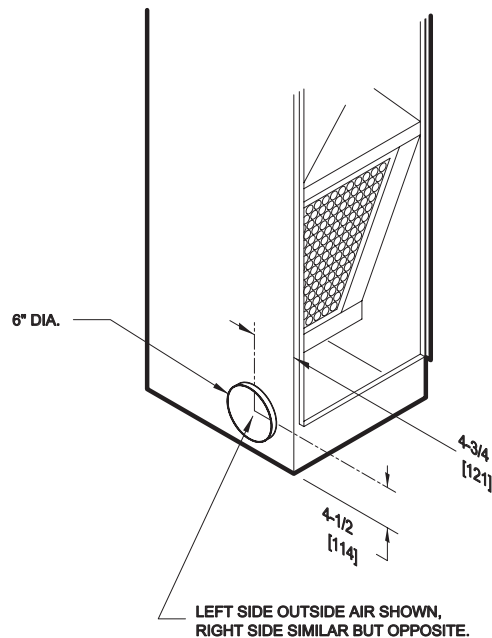
L = LEFT  
R = RIGHT  
0 = NONE



## UNIT SIDE DESIGNATIONS

**NOTES:**

1. RETURN AIR AND ACCESS ARE ALWAYS ON FRONT OF UNIT.
2. THIS DRAWING SHOWS AVAILABLE RETURN AND OUTSIDE AIR INLET LOCATIONS.
3. SEE ARRANGEMENT DRAWINGS FOR COMPLETE UNIT RISER, SUPPLY, AND RETURN CONFIGURATION DETAILS.
4. OUTSIDE AIR INLET LOCATION IS ALWAYS LAST CHARACTER IN ARRANGEMENT CODE.
5. FSC UNIT WITH OPTIONAL RISER CHASE SHOWN. OUTSIDE AIR LOCATION DESIGNATIONS ARE TYPICAL FOR ALL FS MODELS.



## GUIDE SPECIFICATIONS

### General

Furnish and install Johnson Controls FS Series Vertical Hi-Rise Direct Drive Fan Coil Units where indicated on the plans and in the specifications. Units shall be completely factory assembled, tested and shipped as one piece. All units shall be capable of meeting or exceeding the scheduled capacities for cooling, heating and air delivery. All unit dimensions for each model and size shall be considered maximums. Units shall be ETL listed in compliance with UL/ANSI Standard 1995, and be certified as complying with the latest edition of AHRI Standard 440.

### CONSTRUCTION

All unit chassis shall be fabricated of heavy gauge galvanized steel panels able to meet 125 hour salt spray test per ASTM B-117. All exterior panels shall be insulated with 1/2" thick insulation with a maximum k value of .24 (BTU • in) / (hr • ft<sup>2</sup> • °F) and rated for a maximum air velocity of 5000 f.p.m. Insulation must meet all requirements of ASTM C1071 (including C665), UL 181 for erosion, and carry a 25/50 rating for flame spread/smoke developed per ASTM E-84, UL 723 and NFPA 90A.

**Option:** For units with multiple outlets, include an insulated sheet metal baffle inside the discharge plenum to break the sight lines between the two discharge outlets and to attenuate room noise that could be transmitted through the openings.

All unit panels shall have knockouts for supply air openings and riser slots to facilitate the field conversion of riser location and supply air grille location.

**Option:** Supply air opening knockouts shall be factory sealed and left in place during shipping and staging at the job site.

All units shall have decorator front panels fabricated of not less than 18 gauge galvanized steel. The front panel shall include a stamped louver return air grille and be attached with quarter turn quick open fasteners to allow for easy removal and access for service.

All concealed units shall have a duct collar on the discharge.

All exposed units shall have exterior panels fabricated of not less than 18 gauge galvanized steel. The front panel shall be attached with quarter turn quick open fasteners to allow for easy removal and access for service.

**Option:** Provide an architectural grade double deflection aluminum discharge grille.

**Option:** Provide foil faced insulation in lieu of standard. Foil insulation shall meet or exceed the requirements stated above, and in addition meet ASTM Standards C-665 and C-1136 for biological growth in insulation. Insulation shall be lined with aluminum foil, fiberglass scrim reinforcement, and 30 pound kraft paper laminated together with a flame resistant adhesive. All exposed edges shall be sealed to prevent any fibers from reaching the air stream.

**Option:** Provide Elastomeric Closed Cell Foam Insulation in lieu of standard. Insulation shall conform to UL 181 for erosion and NFPA 90A for fire, smoke and melting, and comply with a 25/50 Flame Spread and Smoke Developed Index per ASTM E-84 or UL 723. Additionally, insulation shall comply with Antimicrobial Performance Rating of 0, no observed growth, per ASTM G-21. Polyethylene insulation is not acceptable.

**Option:** Tandem Master and Tandem Slave units. Master and slave units shall be supplied joined together by a nominal six-inch wall that contains the supply, return and condensate risers. The cabinets of both units in the pair will be the same height and width regardless of capacity and will be the standard dimension of the unit with the greater capacity.

The slave unit will have a 5/8" layer of type-X gypsum board mechanically fastened to the unit wall adjacent to the risers.

Where a one hour rating of the partition between the units is required, a second layer of type-X gypsum board shall be mechanically fastened to the master unit wall adjacent to the risers. An 18 gauge steel blower shield shall be provided for both the master and slave units. Piping penetrations in the partition walls shall be provided with fire blocking material. The unit shall be cETL listed in compliance with ANSI/UL-1479 Standard Test Method for Fire Tests of Through Penetration Fire Stops. A copy of the Authorization to Mark certifying compliance by a nationally recognized testing laboratory shall be provided with the unit submittal.

### PAINTED FINISH

All painted cabinet exterior panels shall be finished with a heat cured anodic acrylic powder paint of the standard factory color.



## GUIDE SPECIFICATIONS

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### SOUND

Units shall have published sound power level data tested in accordance with AHRI Standard 350-2000.

### FAN ASSEMBLY

Unit fan shall be dynamically balanced, forward curved, DWDI centrifugal type constructed of 18 gauge galvanized steel for corrosion resistance. Motors shall be high efficiency, permanently lubricated sleeve bearing, permanent split-capacitor type with UL and CSA listed automatic reset thermal overload protection and three separate horsepower taps. Single speed motors are not acceptable.

**Option:** Provide a blower shield to cover the entire fan assembly. The blower shield shall be tight fitting to prevent air bypass and prohibit accidental contact with the fan assembly. Units that allow accidental contact with the fan assembly with the decorator front panel removed are not acceptable.

The fan assembly shall be removed and serviced through the front and safety panels. The entire assembly shall be able to come out of the unit easily by removing two lock nuts and unplugging the motor.

**Option:** Provide an electronic fan speed controller (SCR) wired to high motor tap for aid in balancing the fan capacity. The speed controller shall have a turn down stop to prevent the possibility of harming the motor bearings, and incorporate electrical noise suppression to minimize noise on the incoming power lines.

**Option:** Devices used to energize and de-energize (switch) fan speeds must be totally silent. Magnetic, mercury, and/or quiet relays and/or contactors are not acceptable.

### COILS

All cooling and heating coils shall optimize rows and fins per inch to meet the specified capacity. Coils shall have seamless copper tubes and shall be mechanically expanded to provide an efficient, permanent bond between the tube and fin. Fins shall have high efficiency aluminum surface optimized for heat transfer, air pressure drop and carryover.

All coils shall be hydrostatically tested at 450 PSIG air pressure under water, and rated for a maximum 300 PSIG working pressure at 200°F.

Heating coils shall be furnished in the reheat position as standard.

All water coils shall be provided with a manual air vent fitting to allow for coil venting.

**Option:** Provide automatic air vents in lieu of manual air vents.

**Option:** Provide a motorized two-position coil bypass damper. Damper shall be sized such that when it is opened, 30% of the fan airflow capacity will be drawn through the damper opening, bypassing the cooling coil.

**Option:** Coil casing shall be fabricated from stainless steel.

### DRAIN PANS

Primary condensate drain pan shall be double wall composite and extend under the entire coil section. Drain pans shall be of one piece construction and be positively sloped for condensate removal.

Drain pan shall carry no more than a 25/50 Flame Spread and Smoke Developed Rating per ASTM E-84 and UL 723 and an Antimicrobial performance rating of 0, no observed growth, per ASTM G-21.

The P-Trap shall be easily removed and serviced through the front panel.

**Option:** Provide a removable primary drain pan to allow for inspection and cleaning. The drain pan shall be easily removed through the front panel without disturbing the coils. Drain pan access that requires removal of coils is not acceptable.

**Option:** Provide a primary drain pan constructed entirely of heavy gauge type stainless steel for superior corrosion resistance. Stainless steel drain pans shall be externally insulated and meet or exceed the requirements stated above.

### FILTERS

All units shall be furnished with a minimum 1" nominal glass fiber throwaway filter. Filters shall be tight fitting to prevent air bypass. Filters shall be easily removable from the return air opening with the front panel removed, without the need for tools.

**Option:** Provide unit with 1" pleated filter (MERV 6).

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**Option:** Provide unit with 1" self-gasketing filter consisting entirely of synthetic media and frames. Filter shall be tight fitting to prevent air bypass. Filter shall be easily removable from the return air opening with the front panel removed. Filter efficiency shall be 40% at 1.5 microns.

### ELECTRICAL

Units shall be furnished with single point power connection. Provide an electrical junction box with terminal strip for motor and other electrical terminations. The factory mounted terminal wiring strip consists of a multiple position screw terminal block to facilitate wiring terminations for the electric control valves and thermostats.

### ELECTRIC HEAT

Furnish an electric resistance heating assembly as an integral part of the fan coil unit, with the heating capacity, voltage and kilowatts scheduled. The heater assembly shall be rated for installation on the fan coil unit and be located so as not to expose the fan assembly to excessive leaving air temperatures that could affect motor performance.

The heater and unit assembly shall be listed for zero clearance and meet all NEC requirements, and be ETL listed with the unit as an assembly in compliance with UL/ANSI Standard 1995.

All heating elements shall be open coil type Ni-Chrome wire mounted in ceramic insulators and located in an insulated heavy gauge galvanized steel housing. All elements shall terminate in a machine staked stainless steel terminal secured with stainless steel hardware for corrosion resistance. The element support brackets shall be spaced no greater than 3-1/2" on center. All internal wiring shall be rated for 105°C minimum.

All heaters shall include overtemperature protection consisting of an automatic reset primary thermal limit and back-up secondary thermal limit. All heaters shall be single stage.

**Option:** Provide a manual reset secondary thermal limit.

All units with electric heat shall be provided with an incoming line power distribution block, designated to accept single point power wiring capable of carrying 125% of the calculated load current.

**Option:** Devices used to energize and de-energize (switch) electric heat must be totally silent. Magnetic,

mercury, and/or quiet relays and/or contactors are not acceptable.

### PIPING PACKAGES

Provide a standard factory assembled valve piping package to consist of a 2 or 3-way, on/off, motorized electric control valve and two ball isolation valves. Control valves shall be piped normally closed to the coil. Maximum entering water temperature on the control valve shall be 200°F, and maximum close-off pressure 25 PSIG. Maximum operating pressure shall be 300 PSIG.

Piping packages shall include stainless steel braided hoses to allow for thermal expansion within the unit cabinet. The hose shall be EPDM inner lined and Kevlar® reinforced, with stainless steel FNPT swivels and/or fittings. The hoses shall be rated for a maximum 450 PSIG working pressure at 250°F, and shall conform to NFPA 90A and carry no more than a 25/50 Flame Spread and Smoke Developed Rating, per ASTM E-84 and UL 723.

**Option:** Provide 3-wire floating point modulating control valve (fail-in-place) in lieu of standard 2-position control valve with factory assembled valve piping package.

**Option:** Provide high pressure close-off actuators for 2-way on/off control valves. Maximum close-off pressure is 50 PSIG (1/2").

**Option:** Provide either a fixed or adjustable flow control device for each piping package.

**Option:** Provide pressure-temperature ports for each piping package.

Piping packages shall be completely factory assembled, including interconnecting pipe, and mounted inside the unit in a serviceable location over the coil and primary drain pan.

### RISERS

Furnish chilled and hot water supply and return risers mounted to the unit. Risers shall be Type-M seamless copper tube and include swaged connections at the top for connection to the unit above. Slip couplings are not acceptable.

**Option:** Provide Type-L copper risers that meet or exceed the requirements stated above.

Risers shall be insulated with 1/2" closed cell foam

## GUIDE SPECIFICATIONS

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insulation covering the entire riser. Insulation shall conform to NFPA 90A and carry no more than a 25/50 Flame Spread and Smoke Developed Rating, per ASTM E-84 and UL 723.

**Option:** Provide 3/4" closed cell foam insulation that meets or exceeds the requirements stated above.

Condensate drain risers shall be Type-M seamless copper tube and meet the requirements stated above.

**Option:** Risers shall be factory fabricated, bundled, and tagged separate from the fan coil units, allowing for shipment and installation of risers prior to the fan coil

units. The riser tag must show the corresponding FCU tag, floor number, room number, riser number, CW, HW, and condensate pipe diameters. Refer to submittal drawing on Ship in Advance risers.

### **OUTSIDE AIR DAMPER**

**Option:** Provide a manual outside air damper with locking mechanism integral to the unit.

**Option:** Provide a motorized outside air damper integral to the unit and interlocked with the fan motor. The damper actuator shall be spring return closed.

**NOTES**

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**NOTES**

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