

Introduction: KQFS-FA

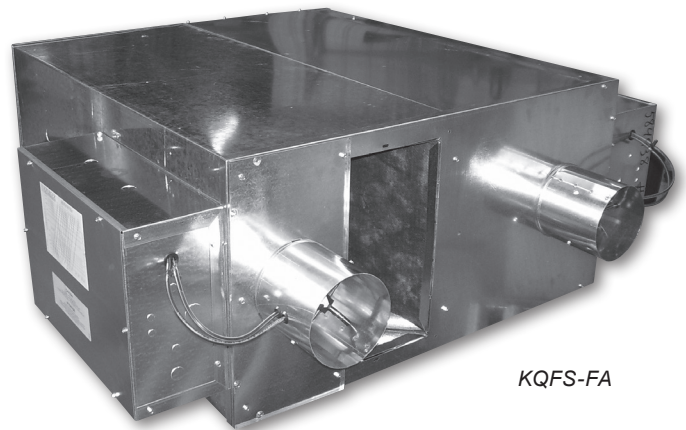
Providing adequate fresh air into a zone has become an important aspect for today's designs. With this in mind, Krueger designed the KQFS-FA, which offers a dedicated fresh air inlet on a series fan powered terminal unit. The primary air inlet is connected to a standard air handler to handle the cooling load in that space. A DOAS air handler supplies the fresh air inlet of the KQFS-FA to ensure that the proper ventilation rates are being met for the space. Adding a second pressure independent fresh air inlet to the KQFS-FA provides a simple way to meet the minimum ventilation rates in Table 6.1 of ASHRAE Standard 62.

MODEL

KQFS-FA - Ultra Quiet, Series Type Fan Powered Terminal Unit with Fresh Air Inlet

FEATURES

- Ultra quiet operation for critical sound applications.
- Airflow capacities up to 3000 CFM, providing airflow control for commercial applications.
- 20 gage galvanized steel casing construction provides advantages in acoustics, quality, unit strength, and product durability.
- Several types of casing liner options provide quiet and clean operation.
- Round inlet sizes ranging from 6" to 16" diameter are sized to fit standard spiral and flex duct for quick installation.
- Additional Fresh Air Inlet for outside air with available inlet sizes 4" to 8" diameter sized to fit standard spiral and flex duct for quick installation.
- Each unit size offers multiple primary inlet sizes to allow for flexible system design.
- Four quadrant, center averaging inlet airflow sensor provided in primary and fresh air inlets.
- Fully removable bottom access panel included with each unit for easy access to internal components for maintenance.
- Integral induced air attenuator; bolt-on attenuator not required.
- Two control enclosures located on each side for easy installation.
- Single point electrical connection minimizes the number of ceiling plenum electrical connections.
- Recirculation multi-voltage fan motors are quiet, reliable, and permanently lubricated; ECM motors are available.
- Electronic speed control (SCR) allows field adjustable fan airflow.
- Isolated motor/blower assembly limits casing acoustical transmission.
- ETL listings under UL 1995 electrical safety.
- External filter option for quick access and routine replacement.
- Auxiliary heat offers a wide range of options, including electric and hot water heat.
- Digital controls can be customized for many building systems.
- LineaHeat solid state electronic proportional control of electric heat is available with or without leaving air temperature control.
- AC solid state relays offer silent operation for staged electric heat.
- Revit models are available at www.krueger-hvac.com/revit.



KQFS-FA

FAN POWERED TERMINAL UNITS

KQFS-FA Airflow Ranges

KQFS-FA, AVAILABLE SIZES

Unit Size	Primary Inlet Sizes	Fresh Air Inlet
2	6, 8	4, 5, 6
3	6, 8, 10, 12	4, 5, 6
4	8, 10, 12	4, 5, 6, 7, 8
5	10, 12, 14	6, 7, 8
6	10, 12, 14, 16	6, 7, 8
7	10, 12, 14, 16	6, 7, 8

KQFS-FA, INLET CAPACITIES

Inlet Size	Max Primary CFM	Max Fresh Air CFM
4	-	230
5	-	360
6	515	515
7	700	700
8	920	920
10	1430	-
12	2060	-
14	2800	-
16	3660	-

KQFS Product Description**CASING**

- All KQFS unit casing panels are constructed of 20 gage galvanized steel.
- Removable bottom panel allows easy access to motor/blower assemblies.

INLET COLLARS

- All round 20 gage inlet collars accommodate standard spiral and flex duct sizes.
- The primary air inlet is located on either the left-hand or right-hand side of the unit inlet panel of the KQFS unit. (Hand is determined by looking at the unit in the direction of airflow with the unit in the installed position.)

OUTLET CONNECTIONS

- All outlet connections are rectangular and require a flanged duct connection.

DAMPER ASSEMBLY

- All units utilize a round volume control damper with a solid shaft that rotates in self lubricating Delrin® bearings.
- Damper blade incorporates a flexible gasket for tight airflow shutoff and operates over a full 90° rotation.
- The damper position is marked by an arrow embossment on the end of the damper shaft.

INDUCED AIR INLET ATTENUATOR

- Integral induced air sound attenuator is a standard component for reducing radiated sound.

INDUCED AIR INLET FILTER

- Induced air inlet filters (construction type or MERV 8) are available. These filters are typically used for job start-up and are provided with clip frames for easy filter replacement.

CASING LINERS

All liners are attached to the unit casing with both adhesive and weld pins to ensure long term durability (excludes Sterilwall and Perforated Doublewall). The standard liner option is 1/2" thick, 1 1/2 lb. dual density fiberglass insulation that meets UL 181 and NFPA 90A.

- **(Optional)** 1" Thick Insulation: 1" thick, 1 1/2 lb. dual density fiberglass insulation that meets UL 181 and NFPA 90A.
- **(Optional)** Steriliner Insulation: 13/16" thick, 4 lb. density, rigid board insulation with fiber reinforced foil covering insulation fibers that meets UL 181 and NFPA 90A. Liner shall be attached to unit casing by adhesive and weld pins with foil tape sealing the insulation cut edges.
- **(Optional)** Cellular Insulation: 1/2" or 1" thick, 1 1/2 lb. density, smooth surface, polyolefin, closed-cell foam insulation for fiber free application. Cellular insulation meets UL 181 and NFPA 90A and does not support mold or bacteria growth.
- **(Optional)** Foil Encapsulated Insulation: Foil reinforced, wrapped edges, 1/2" or 1" thick, 1 1/2 lb. density fiberglass insulation that meets UL 181 and NFPA 90A.
- **(Optional)** Sterilwall Insulation: 1/2" or 1" thick, 1 1/2 lb. dual density fiberglass insulation, that meets UL 181 and NFPA 90A, enclosed between the unit casing and a non-

perforated internal sheet metal cover extending over the fiberglass insulation, as well as covering the liner cut edges.

- **(Optional)** Perforated Doublewall Insulation: 1/2" or 1" thick, 1 1/2 lb. dual density fiberglass insulation, (additional options: 1/2" or 1" thick, 1 1/2 lb. density foil reinforced fiberglass insulation or 13/16" thick, 4 lb. density, rigid board insulation with fiber reinforced foil covering) that meets UL 181 and NFPA 90A, enclosed between the unit casing and a perforated internal sheet metal cover extending over the fiberglass insulation, as well as covering the liner cut edges.
- **(Optional)** No Liner: No internal insulation liner.

AIRFLOW SENSOR

- All units are equipped with a factory installed inlet airflow sensor device.
- K4 LineaCross: A four-quadrant, multi-point, center averaging airflow sensor is standard.
- **(Optional)** A linear, multi-point, velocity averaging airflow sensor with an amplified signal.
- Balancing taps are provided to allow for easy airflow verification.

FAN MOTORS

- Fan motors for model KQFS, units sizes 2 to 6 are multi-voltage, [120, 208/240, or 277 volt, single-phase] permanent split capacitor (PSC) type. Fan motor for model KQFS, unit size 7, is single voltage [208/240 or 277 volt, single-phase] permanent split capacitor (PSC) type.
- **(Optional)** [120, 208/240, or 277 volt, single-phase] ECM (electronically commutated motor) fan motor.
- Units equipped with [120, 208/240 or 277 volt, single-phase] electric heat have fan motors wired with the same line voltage. Units with [208 volt, three-phase, three-wire] electric heat utilize [208/240 volt] fan motors. Units with [480 volt, three-phase, four-wire] heat are equipped with [277 volt, single-phase] fan motors.
- A motor disconnect switch is available (not available if the unit is equipped with electric heat including the door locking disconnect option).
- Motor fusing is available.

FAN SPEED CONTROL

- All units with PSC motors are equipped with an SCR fan speed controller capable of reducing fan output by as much as 50 to 55%.
- All units with optional ECM motors include either a manual or remote adjustable speed controller. The manual adjustable speed controller features a digital display that alternates between the RPM of the motor and percentage of flow and can be set and adjusted in the field. The remote adjustable speed controller communicates with a DDC controller to remotely set and/or adjust the fan speed using either a 0-10 VDC or 2-10 VDC signal and provides a manual override capability to set and/or adjust the fan speed in the field.

CONTROLS

- Pneumatic, analog or direct digital control types are available. Digital controls can be provided by others or Krueger for factory mounting. A "no control" unit is also available for field mounting of electronic controls.

KQFS Product Description

HOT WATER HEAT

- The model KQFS coil is factory mounted to the unit discharge.
- One or two row coils are constructed of ten aluminum fins per inch with 5/8" O.D. sweat type connection. Left-hand or right-hand tubing connections are available. The coil tubing is water leakage tested to 400 PSIG.
- The standard unit access panel provides upstream cleaning capability of the coil fins for units with discharge mounted coils.
- Vent and drain option is available.

ELECTRIC HEAT

- Heaters are ETL listed and are constructed of 20 gage galvanized steel.
- Available combinations are [120, 208/240, 277 volt, single-phase], [208/240 volt, three-phase, three-wire], and [480 volt, three-phase, four-wire]. See fan motor description for electric heat/fan motor combinations.
- Standard heaters are equipped with automatic reset thermal cutout, magnetic contactors, airflow proving switch, and 80/20 Ni-Cr heating elements.
- Electric heater options include a fused or non-fused door interlocking disconnect switch, fuse-block, manual reset cutout, and dust tight enclosure construction.
- AC solid state relays offer silent operation for staged electric heat.

- LineaHeat solid state electronic proportional control of electric heat is available with or without leaving air temperature control. See Krueger's Terminal Unit Engineering section for additional information.

CONTROL TRANSFORMERS

- Units with and without electric heat include a factory supplied, mounted and wired control transformer, mounted inside the control enclosure for electronic control applications.

LABELS

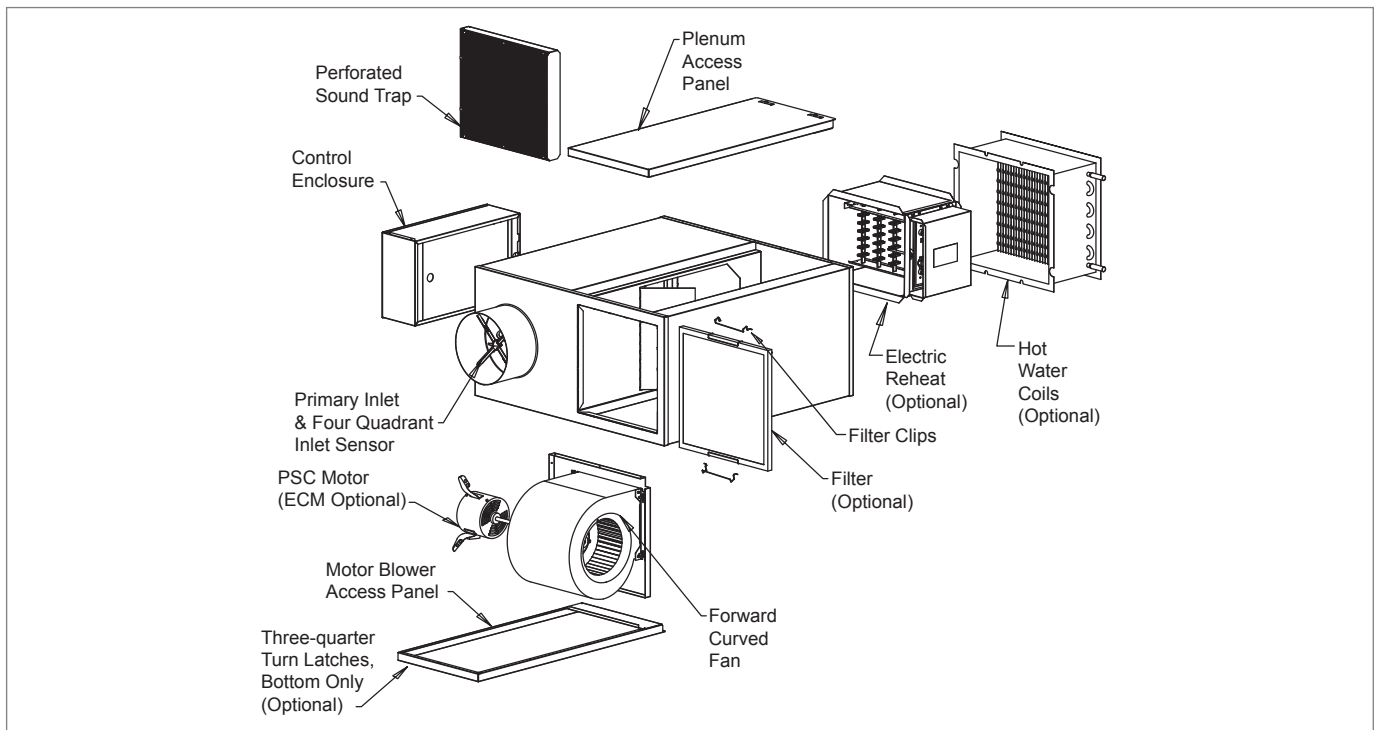
- Label information adhered to each unit includes model name, unit size, configuration code, airflow (CFM), balancing chart, tagging data, electrical ratings, removal of fan protection packing material information, and all required agency listings.

PACKAGING

- Units are palletized. Each pallet of units is banded and stretch wrapped with cellophane.

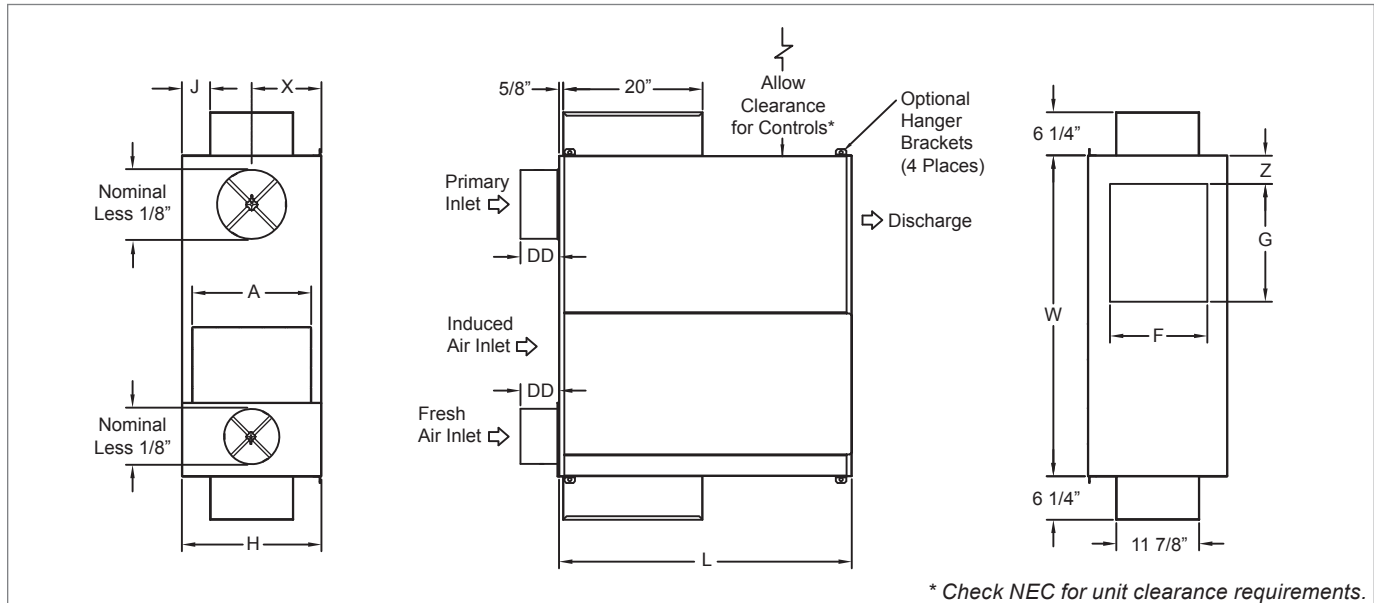
KQFS Exploded View

KQFS, EXPLODED VIEW



KQFS-FA Base Unit Dimensional Information

KQFS-FA BASE UNIT, INLET, PLAN, AND DISCHARGE VIEWS



FAN POWERED TERMINAL UNITS

KQFS-FA BASE UNIT, DIMENSIONAL DETAILS

Unit Size	Max. Fan CFM	PSC HP	ECM HP	L	W	H	A	F	G	J	X	Z
2	530	1/10	-	39 1/2"	36 1/8"	18 1/16"	15 1/8"	11"	14"	3 1/8"	9"	2 5/8"
3	1100	1/4	1/2	39 1/2"	36 1/8"	18 1/16"	15 1/8"	11"	14"	3 1/8"	9"	2 5/8"
4	1300	1/4	-	42 1/8"	46 1/8"	20 1/16"	17 1/8"	11"	14"	4 1/8"	10"	5 5/8"
5	1900	1/2	-	42 1/8"	46 1/8"	20 1/16"	17 1/8"	14 3/4"	16 3/4"	4 1/8"	10"	4 7/8"
6	2600	3/4	1	42 1/8"	46 1/8"	20 1/16"	17 1/8"	14 3/4"	16 3/4"	4 1/8"	10"	4 7/8"
7	3000	1	1	42 1/8"	46 1/8"	20 1/16"	17 1/8"	14 3/4"	16 3/4"	4 1/8"	10"	4 7/8"

NOTES: Left-hand base unit with electronic control enclosure shown; right-hand is available. Hand is determined by primary inlet side. For a complete list of available inlet sizes, see previous page.

KQFS-FA Base Unit Features & Options

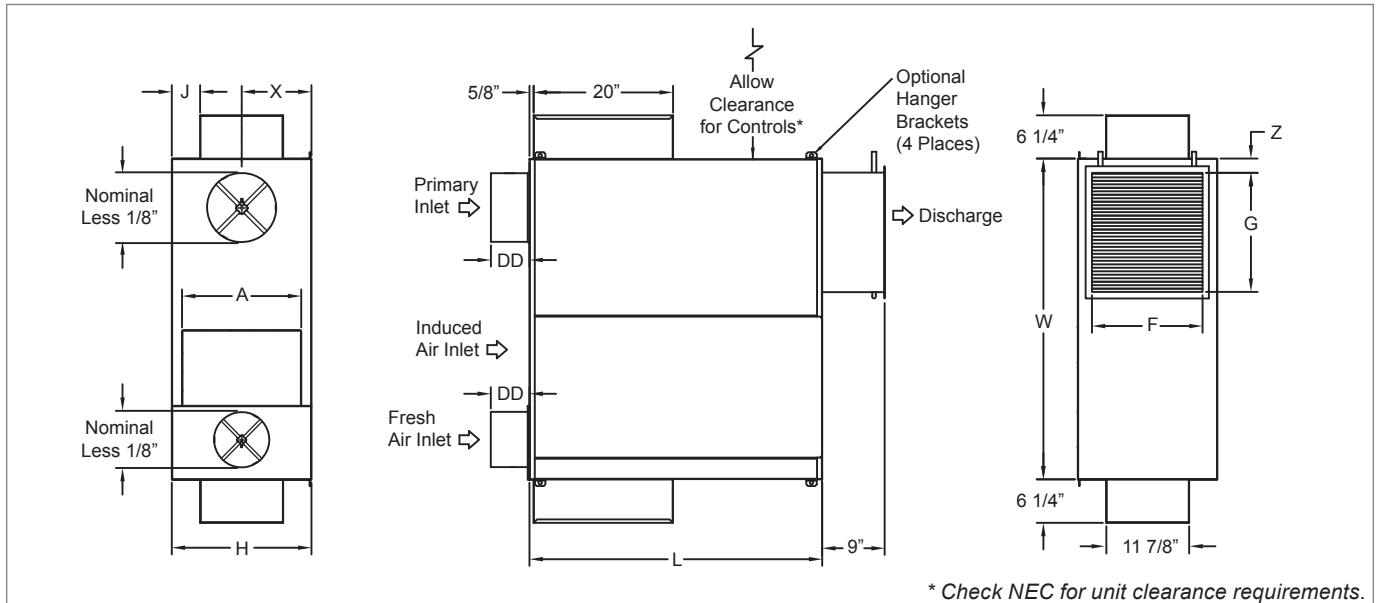
STANDARD FEATURES

- 20 Gage galvanized steel casing construction.
- Control enclosure for electronic components.
- 1/2" Thick, Dual density fiberglass insulation that meets NFPA 90A and UL 181 safety requirements.
- Unit sizes 2 to 6 include [120, 208/240, or 277 volt, multi-voltage, single-phase, single-speed, permanently lubricated PSC motors; unit size 7 includes [208/240 or 277 volt, single-phase, single-speed] permanently lubricated PSC motors.
- Field adjustable fan speed control.
- Integral induced air attenuator.
- Motor/blower isolation.
- Removable bottom panel allows easy access to motor/blower assembly and primary air damper.
- Four quadrant, center averaging airflow sensor; inlet sizes 6 - 10 (DD = 4 7/8"); sizes 12 - 16 (DD = 6 7/8").
- Discharge requires flanged duct; connection by others.
- Includes 24 volt control transformer.
- ETL listed; adherence to UL 1995 and CSA C22.2 No. 236.95.

OPTIONAL FEATURES

- Liners: 1/2" or 1" Cellular insulation, 1" Dual density fiberglass insulation, 1/2" or 1" Foil encapsulated fiberglass insulation, Sterilwall, Steriliner, Perforated doublewall, or no liner.
- Linear averaging airflow sensor; inlet sizes 6 - 10 (DD = 4 7/8"), sizes 12 - 16 (DD = 6 7/8").
- [120, 208/240, or 277 volt, single-voltage] ECM motor with manual or remote adjustable speed controller (on unit sizes 3, 6, and 7).
- Motor disconnect.
- Motor fusing.
- Dust tight control enclosure.
- Induced air filter, construction type; unit sizes 2 - 3 (9"x17"x1"); unit sizes 4 - 7 (14"x19"x1").
- Left-hand or right-hand control enclosure.
- Cam locks (access panel).
- Hanger brackets (not available with sterilwall or perforated doublewall liner options).

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KQFS-FA Unit with Hot Water Heat Dimensional Information
KQFS-FA UNIT WITH HOT WATER HEAT, INLET, PLAN, AND DISCHARGE VIEWS


* Check NEC for unit clearance requirements.

KQFS-FA UNIT WITH HOT WATER HEAT, DIMENSIONAL DETAILS

Unit Size	Max. Fan CFM	PSC HP	ECM HP	L	W	H	A	F	G	J	X	Z
2	530	1/10	-	39 1/2"	36 1/8"	18 1/16"	15 1/8"	15 1/8"	17"	3 1/8"	9"	2"
3	1030	1/4	1/2	39 1/2"	36 1/8"	18 1/16"	15 1/8"	15 1/8"	17"	3 1/8"	9"	2"
4	1295	1/4	-	42 1/8"	46 1/8"	20 1/16"	17 1/8"	15 1/8"	17"	4 1/8"	10"	3 3/16"
5	1780	1/2	-	42 1/8"	46 1/8"	20 1/16"	17 1/8"	17 5/8"	25"	4 1/8"	10"	1"
6	2550	3/4	1	42 1/8"	46 1/8"	20 1/16"	17 1/8"	17 5/8"	25"	4 1/8"	10"	1"
7	2850	1	1	42 1/8"	46 1/8"	20 1/16"	17 1/8"	17 5/8"	25"	4 1/8"	10"	1"

NOTES: Left-hand base unit with electronic control enclosure shown; right-hand is available. Hand is determined by primary inlet side. For a complete list of available inlet sizes, see page B2-19.

KQFS-FA Unit with Hot Water Heat Features & Options
STANDARD FEATURES

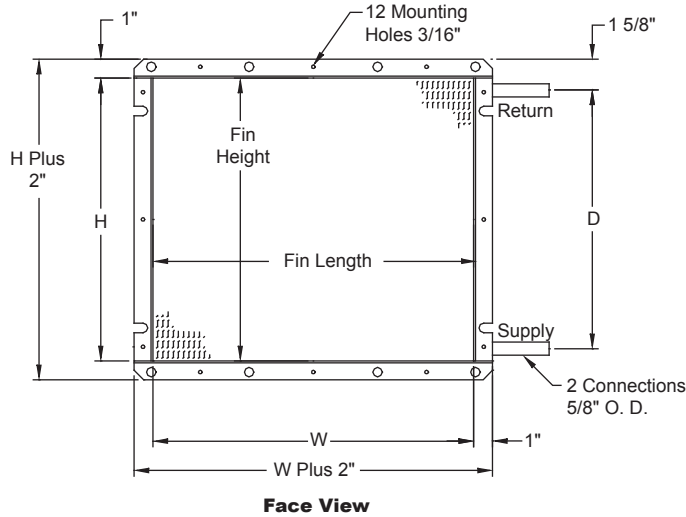
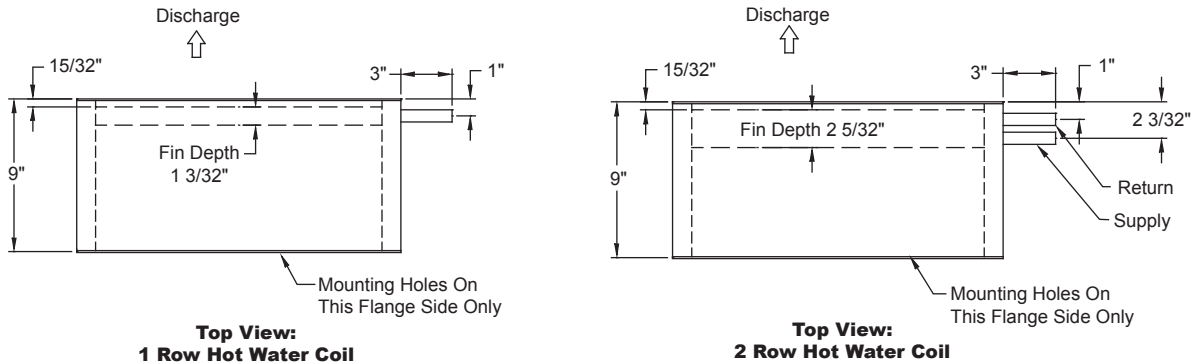
- 20 Gage galvanized steel casing construction.
- Control enclosure for electronic components.
- 1/2" Thick, Dual density fiberglass insulation that meets NFPA 90A and UL 181 safety requirements.
- Unit sizes 2 to 6 include [120, 208/240, or 277 volt, multi-voltage, single-phase, single-speed] permanently lubricated PSC motors. Unit size 7 includes [208/240 or 277 volt, single-phase, single-speed] permanently lubricated PSC motors.
- Field adjustable fan speed control.
- Integral induced air attenuator.
- Motor/blower isolation.
- Removable bottom panel allows easy access to motor/blower assembly and primary air damper.
- Four quadrant center averaging airflow sensor; inlet sizes 6 - 10 (DD = 4 7/8"); sizes 12 - 16 (DD = 6 7/8").
- Discharge requires flanged duct; connection by others.
- Includes 24 volt control transformer.
- ETL listed; adherence to UL 1995 and CSA C22.2 No. 236.95.

OPTIONAL FEATURES

- Liners: 1/2" or 1" Cellular insulation, 1" Dual density fiberglass insulation, 1/2" or 1" Foil encapsulated fiberglass insulation, Sterilwall, Steriliner, Perforated doublewall, or no liner.
- Linear averaging airflow sensor; inlet sizes 6 - 10 (DD = 4 7/8"), sizes 12 - 16 (DD = 6 7/8").
- [120, 208/240, or 277 volt, single-voltage] ECM motor with manual or remote adjustable speed controller (on unit sizes 3, 6, and 7).
- Motor fusing.
- Motor disconnect.
- Left-hand or right-hand control enclosure.
- Hot water coil vent and drain.
- Dust tight control enclosure.
- Induced air filter, construction type; unit sizes 2 - 3 (9"x17"x1"); unit sizes 4 - 7 (14"x19"x1").
- Cam locks (access panel).
- Hanger brackets (not available with sterilwall or perforated doublewall liner options).

KQFS Hot Water Coil Dimensional Information

KQFS HOT WATER COIL, TOP AND FACE VIEWS



KQFS HOT WATER COIL, DIMENSIONAL DETAILS

Unit Size	W	H	D
2	17"	15 1/8"	13 3/4"
3			
4			
5	25"	17 5/8"	16 1/4"
6			
7			

NOTE:

For hot water performance data tables, visit the Krueger website at www.krueger-hvac.com or download the Krueger selection software to run customized selections. The selection program can provide performance data with different entering air and water conditions as well as show effects of altitude and glycol on the heating performance of the water coil. The selection software also allows selections to be saved in a schedule format that can be imported onto a set of project drawings.

KQFS Hot Water Coil Features & Options

STANDARD FEATURES

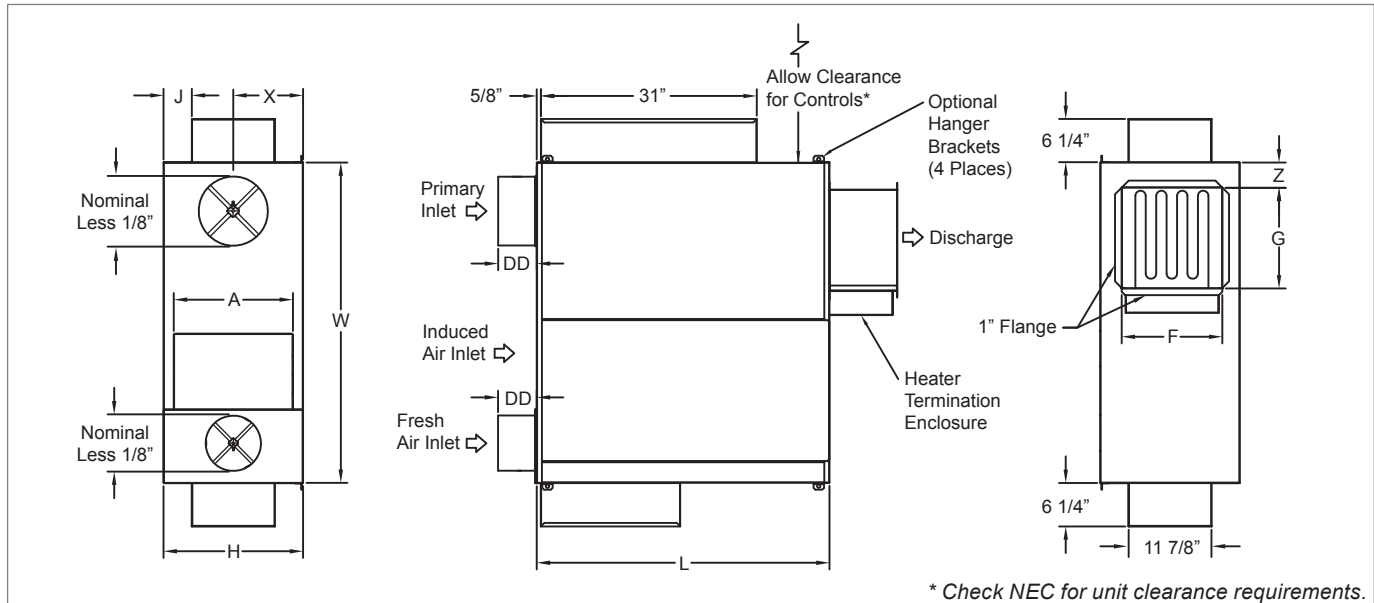
- KQFS Coils are shipped from the factory attached to the unit discharge.
- Hot water coils are configured for a flanged ductwork connection. Coil section is uninsulated.
- Coils are not for steam applications.
- Contact your Krueger Representative for high capacity or steam coil information.
- Connection Tubing - 5/8" O. D. male solder.
- Coil Casing - 20 gage galvanized steel.
- Coil Tubing - 1/2" O. D. x 0.016" thick copper.
- Coil Fins - 0.0045" thick aluminum, 10 per inch; mechanically bonded to tubing.
- Vent and drain option available.

FAN POWERED TERMINAL UNITS

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KQFS-FA Unit with Electric Heat Dimensional Information

KQFS-FA UNIT WITH ELECTRIC HEAT, INLET, PLAN, AND DISCHARGE VIEWS



FAN POWERED TERMINAL UNITS

KQFS-FA UNIT WITH ELECTRIC HEAT, DIMENSIONAL DETAILS

Unit Size	Max. Fan CFM	PSC HP	ECM HP	L	W	H	A	F	G	J	X	Z
2	530	1/10	-	39 1/2"	36 1/8"	18 1/16"	15 1/8"	11 1/2"	14 1/2"	3 1/8"	9"	1 7/8"
3	1100	1/4	1/2	39 1/2"	36 1/8"	18 1/16"	15 1/8"	11 1/2"	14 1/2"	3 1/8"	9"	1 7/8"
4	1300	1/4	-	42 1/8"	46 1/8"	20 1/16"	17 1/8"	11 1/2"	14 1/2"	4 1/8"	10"	4 7/8"
5	1900	1/2	-	42 1/8"	46 1/8"	20 1/16"	17 1/8"	15"	17"	4 1/8"	10"	4 3/8"
6	2600	3/4	1	42 1/8"	46 1/8"	20 1/16"	17 1/8"	15"	17"	4 1/8"	10"	4 3/8"
7	3000	1	1	42 1/8"	46 1/8"	20 1/16"	17 1/8"	15"	17"	4 1/8"	10"	4 3/8"

NOTES: Left-hand base unit with electronic control enclosure shown; right-hand is available. Hand is determined by primary inlet side. See page B2-14 for electric heat standard features. For a complete list of available inlet sizes, see page B2-19.

KQFS-FA Unit with Electric Heat Features & Options

STANDARD FEATURES

- 20 Gage galvanized steel casing construction.
- Control enclosure for electronic components.
- 1/2" Thick Dual density fiberglass insulation that meets NFPA 90A and UL 181 safety requirements.
- Unit sizes include [120*, 208/240, or 277 volt, multi-voltage, single-phase, single-speed] permanently lubricated PSC motors. *Applies to unit sizes 2 to 6 only.
- Field adjustable fan speed control.
- Integral induced air attenuator.
- Removable bottom panel allows easy access to motor/blower assembly and primary air damper.
- Four quadrant center averaging airflow sensor; inlet sizes 6 - 10 (DD = 4 7/8"); sizes 12 - 16 (DD = 6 7/8").
- Discharge requires flanged duct; connection by others.
- Includes 24 volt control transformer.
- Motor/blower isolation.
- ETL listed; adherence to UL 1995 and CSA C22.2 No. 236.95.

OPTIONAL FEATURES

- LineaHeat solid state electronic proportional control of electric heat.
- Liners: 1/2" or 1" Cellular insulation, 1" Dual density fiberglass insulation, 1/2" or 1" Foil encapsulated fiberglass insulation, Sterilwall, Steriliner, Perforated doublewall, or no liner.
- Linear averaging airflow sensor; inlet sizes 6 to 10 (DD = 4 7/8"), sizes 12 to 16 (DD = 6 7/8").
- [120, 208/240, or 277 volt, single-voltage] ECM motor with manual or remote adjustable speed controller (on unit sizes 3, 6, and 7).
- Motor fusing.
- Fused or non-fused door interlocking disconnect.
- Dust tight control enclosure.
- Left-hand or right-hand control enclosure.
- Induced air filter, construction type; unit sizes 2 - 3 (9"x17"x1"); unit sizes 4 - 7 (14"x19"x1").
- AC solid state relays.
- Cam locks (access panel).
- Hanger brackets (not available with Sterilwall or Perforated doublewall liner options).

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KQFS Control Information

SEQUENCE OF OPERATION

The standard KQFS sequence of operation has the induced airflow fan operating continuously, providing a constant volume of discharge air to the conditioned space.

HEATING MODE

When the zone is at maximum heating demand, the primary air damper maintains a minimum flow and the fan runs constantly, inducing the maximum amount of warm ceiling plenum air. Electric or hot water heat, if supplied, operates at maximum capacity.

As the zone temperature rises, the optional heat, if supplied, cycles off. The fan continues to induce a maximum amount of ceiling plenum air. As the zone temperature rises above the thermostat setpoint, the KQFS unit enters the cooling mode.

COOLING MODE

As the zone temperature rises above setpoint, the primary air damper begins to modulate toward the full open damper position. As the amount of conditioned primary air increases, the amount of induced ceiling plenum air decreases proportionally.

When the conditioned zone is at maximum cooling demand, the primary air damper will maintain a constant maximum flow setting. With pressure independent controls, the damper will maintain the maximum flow setting regardless of system pressure fluctuations. The fan will discharge virtually 100% primary air if installed and balanced properly.

NIGHT SETBACK

One of the most popular KQFS control arrangements is the night setback feature. With this control arrangement, the KQFS induced air fan will operate whenever central system pressure is sensed (day mode). When the central system is off (night mode), the KQFS fan motor and optional heat will cycle on in response to thermostat demand.

CONTROL OPTIONS

- **Pneumatic Controls:** Pressure independent control packages are available with or without hot water or electric heat, night shutdown and/or unoccupied heating. All control arrangements include an inlet flow sensor and fan speed controller.
- **Analog Controls:** Pressure independent control packages are available with or without hot water or electric heat, automatic or remote night shutdown and automatic night setback. All control arrangements include an inlet flow sensor, control enclosure, fan speed controller, transformer to 24 volts, fan relay, and wall thermostat to match the control type.
- **Direct Digital Controls:** Smart Equipment control packages are provided and programmed by the factory for in-house mounting, piping, and wiring.
 - BACnet Compatible: 7201-7209
 - Standalone: 6201-6209

Other digital control packages can be supplied to the factory for mounting, piping, and wiring.

Contact your Krueger representative for a complete list of direct digital control arrangements.

- **No Control Unit:** Units are factory supplied without controls, assuming that the unit is being used for field mounting of direct digital control equipment. This arrangement includes an inlet flow sensor, control enclosure, fan speed controller, transformer to 24 volts, and fan relay.

NOTES: Visit Krueger's website at www.krueger-hvac.com or contact your local Krueger representative for a complete list of direct digital control arrangements.

To prevent the blower from spinning backwards, the simplest solution is to require that the building control system energize the series box fans prior to starting the central system air handler. Some DDC controls for series boxes have a start-up procedure that closes the damper, de-energizes the fan, (resets to zero on the pressure transducer while the damper is closed) and then returns control to the unit. Most manufacturers' Series Fan boxes are designed to maximize starting torque to overcome this backward rotation. If, however, the primary airflow is available for long enough, and the fan speed control is set at a low enough value, any series fan terminal can be expected to start and operate backward. This will not damage the unit, and it will deliver approximately 60% of designed airflow. Until the space load exceeds 60% of the design load, it is probable that no one will notice the unit is running backward. When the thermostat calls for more than 60% of the design load the excess primary will spill into the plenum and the likely result will be cold plenum air 'falling' from return grilles onto room occupants. No manufacturer offers a mechanical device to prevent backward rotation. Krueger can supply a special sequence that employs a pressure sensor installed in the high-pressure side of the inlet sensor to detect any airflow in the primary duct and energize the fan if the building's control system cannot be properly configured to avoid this problem.

KQFS Control Information

The following list shows the standard control arrangements available with the KQFS product offering. Each control approach offers a variety of pressure independent operating functions; combinations of control functions are identified by the Krueger control package number.

PNEUMATIC CONTROL ARRANGEMENTS

- 1300 - Single Function Controller; DA-NO with or without Hot Water or Electric Heat
- 1301 - Single Function Controller; DA-NO with or without Hot Water or Electric Heat and with Night Shutdown
- 1302 - Single Function Controller; DA-NO with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1303 - Single Function Controller; RA-NC with or without Hot Water or Electric Heat
- 1304 - Single Function Controller; RA-NC with or without Hot Water or Electric Heat and with Night Shutdown
- 1305 - Single Function Controller; RA-NC with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1306 - Multi-function Controller; DA-NO with or without Hot Water or Electric Heat
- 1307 - Multi-function Controller; DA-NO with or without Hot Water or Electric Heat and with Night Shutdown
- 1308 - Multi-function Controller; DA-NO with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1309 - Multi-function Controller; DA-NC with or without Hot Water or Electric Heat
- 1310 - Multi-function Controller; DA-NC with or without Hot Water or Electric Heat and with Night Shutdown
- 1311 - Multi-function Controller; DA-NC with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1312 - Multi-function Controller; RA-NC with or without Hot Water or Electric Heat
- 1313 - Multi-function Controller; RA-NC with or without Hot Water or Electric Heat and with Night Shutdown
- 1314 - Multi-function Controller; RA-NC with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1315 - Multi-function Controller; RA-NO with or without Hot Water or Electric Heat
- 1316 - Multi-function Controller; RA-NO with or without Hot Water or Electric Heat and with Night Shutdown
- 1317 - Multi-function Controller; RA-NO with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating

Pneumatic Control Legend:

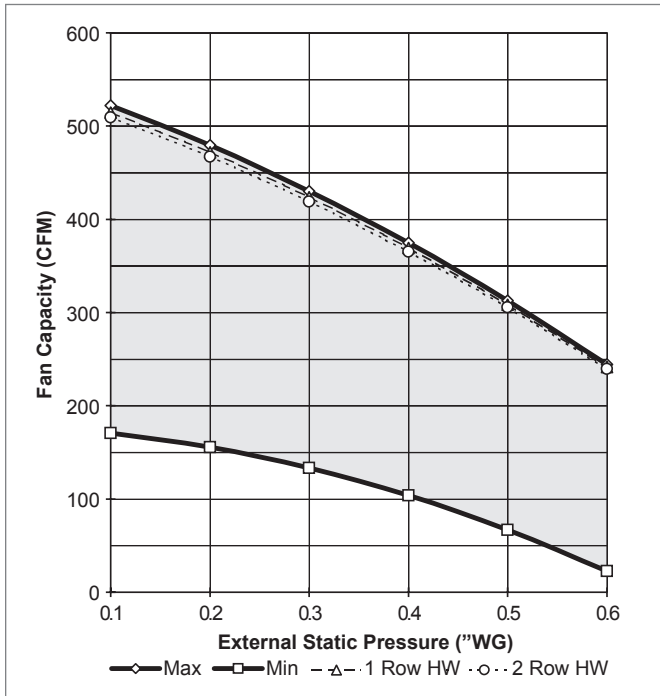
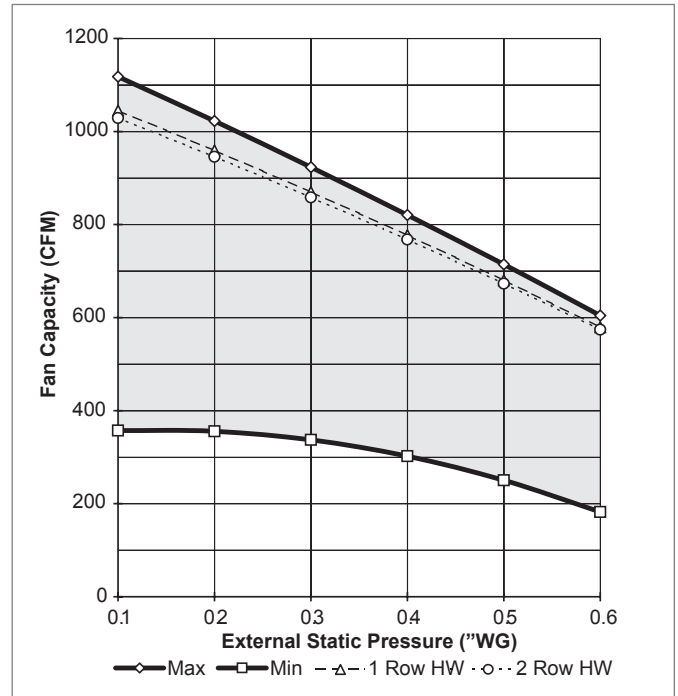
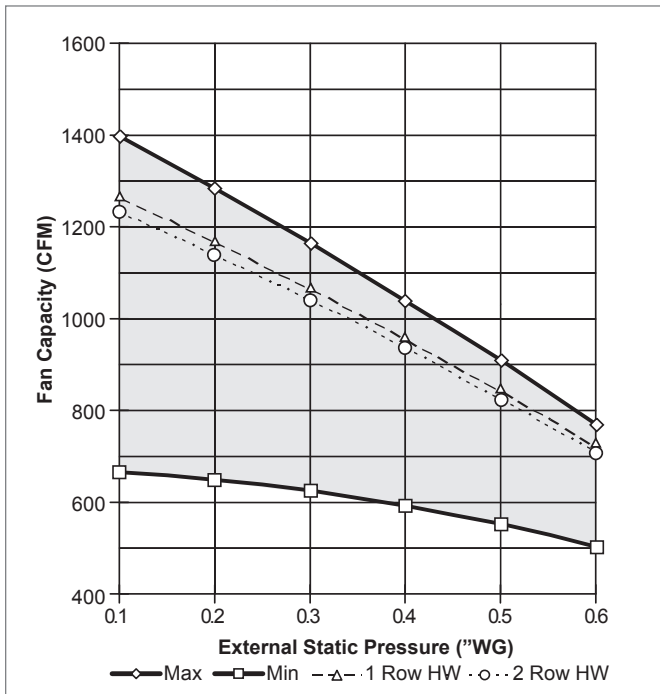
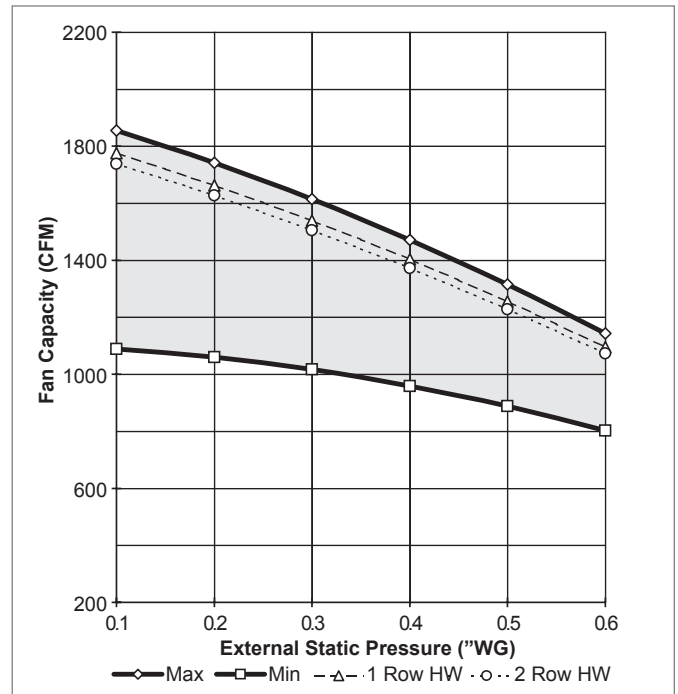
- DA - Direct Acting Thermostat
- RA - Reverse Acting Thermostat
- NO - Normally Open Damper Position
- NC - Normally Closed Damper Position
- Single Function Controller - Provides Single Function, DA-NO or RA-NC
- Multi-function Controller - Capable of Providing DA-NO, DA-NC, RA-NC or RA-NO Functions

ANALOG CONTROL ARRANGEMENTS

- 2200 - Cooling Only
- 2201 - Cooling Only with Automatic Night Shutdown
- 2203 - Cooling Only with Automatic Night Setback
- 2204 - Cooling with On/Off Hot Water Heat
- 2205 - Cooling with On/Off Hot Water Heat and Automatic Night Shutdown
- 2207 - Cooling with On/Off Hot Water Heat and Automatic Night Setback
- 2208 - Cooling with Proportional Hot Water Heat
- 2209 - Cooling with Proportional Hot Water Heat and Automatic Night Shutdown
- 2211 - Cooling with Proportional Hot Water Heat and Automatic Night Setback
- 2212 - Cooling with Up to Two Stages of Electric Heat
- 2213 - Cooling with Up to Two Stages of Electric Heat and Automatic Night Shutdown
- 2215 - Cooling with Up to Two Stages of Electric Heat and Automatic Night Setback
- 2217 - Cooling/heating with Automatic Changeover
- 2218 - Cooling with Proportional Electric Heat

DIRECT DIGITAL CONTROL ARRANGEMENTS

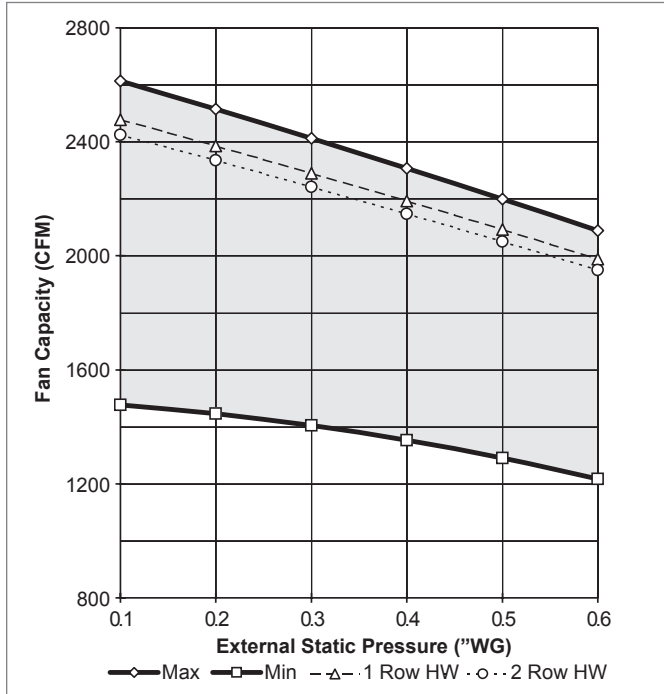
Visit Krueger's website at www.krueger-hvac.com or contact your Krueger representative for a complete list of factory mounted direct digital control arrangements.

KQFS PSC Fan Curves
KQFS PSC FAN CURVE, UNIT SIZE 2

KQFS PSC FAN CURVE, UNIT SIZE 3

KQFS PSC FAN CURVE, UNIT SIZE 4

KQFS PSC FAN CURVE, UNIT SIZE 5


NOTES: Fan speed controller (SCR) is standard with each unit. Fan curves indicate maximum and minimum achievable flow reductions using SCR speed control. Units must be selected to operate within the flow and external static pressure ranges as shown. Fan discharge air volume will be reduced approximately 5% when unit is equipped with optional factory supplied electric heat coils.

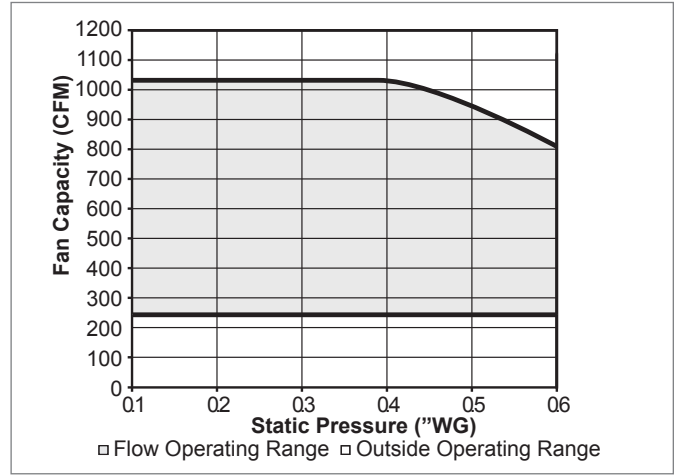
KQFS PSC Fan Curves

KQFS PSC FAN CURVE, UNIT SIZE 6

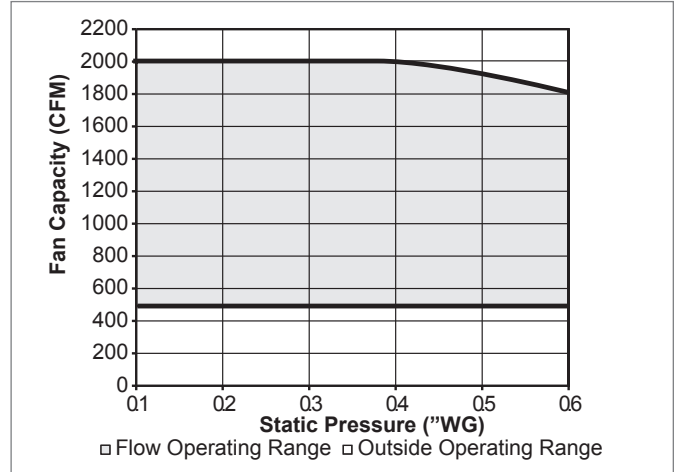


KQFS ECM Fan Curves

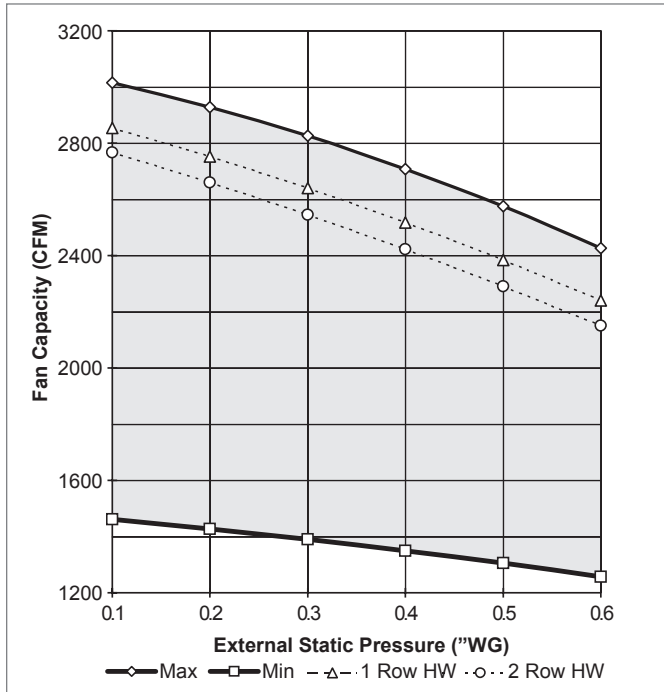
KQFS ECM FAN CURVE, UNIT SIZE 3



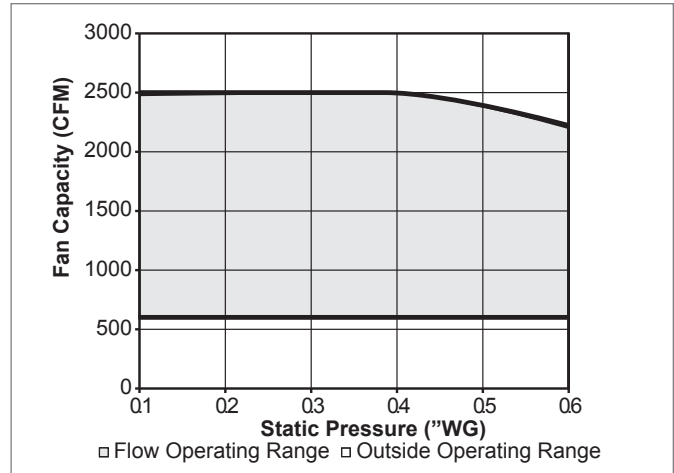
KQFS ECM FAN CURVE, UNIT SIZE 6



KQFS PSC FAN CURVE, UNIT SIZE 7



KQFS ECM FAN CURVE, UNIT SIZE 7



NOTES: Fan speed controller (SCR) is standard with each unit. Fan curves indicate maximum and minimum achievable flow reductions using SCR speed control. Units must be selected to operate within the flow and external static pressure ranges as shown. Fan discharge air volume will be reduced approximately 5% when unit is equipped with optional factory supplied electric heat coils.

NOTES: Manual or remote adjustable speed controller is standard with each unit. Fan curves indicate the maximum and minimum achievable airflows. See Product Description section, page B2-8 for definitions of manual and remote adjustable speed controllers. Units must be selected to operate within the airflow and external static pressure ranges shown.

AHRI Certified Performance Data for Series Fan Powered Terminal Units

KQFS, ULTRA QUIET SERIES FAN POWERED TERMINAL UNIT

Unit Size	Inlet Size	Primary CFM	Min. Ps	Fan		Discharge Data							Radiated Data											
						Fan Only Sound Power, Lw							Fan Only Sound Power, Lw							Fan + Primary @ 1.5" Inlet Ps				
				CFM	Watts	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	
2	6	400	0.100	450	190	73	63	56	49	43	45	67	55	52	48	43	35	68	57	55	51	47	44	
3	8	700	0.100	900	430	73	69	68	63	63	63	65	58	58	55	48	44	67	62	61	57	50	47	
4	10	1100	0.100	1200	480	73	71	70	66	63	64	62	57	59	50	44	41	69	63	63	55	51	49	
5	12	1600	0.100	1750	780	75	72	69	70	67	68	71	63	63	60	52	48	71	66	65	60	54	52	
6	14	2100	0.100	2400	1100	78	77	72	76	73	73	72	64	65	63	55	51	72	67	65	63	57	55	
7	16	2800	0.100	2800	1470	86	81	75	77	75	76	75	69	67	65	59	55	78	71	70	67	61	59	

QFC, SERIES FAN POWERED TERMINAL UNIT

Unit Size	Inlet Size	Primary CFM	Min. Ps	Fan		Discharge Data							Radiated Data											
						Fan Only Sound Power, Lw							Fan Only Sound Power, Lw							Fan + Primary @ 1.5" Inlet Ps				
				CFM	Watts	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	
2	6	400	0.100	450	200	65	65	66	62	58	57	65	64	57	54	46	42	70	71	65	57	52	49	
3	8	700	0.100	850	380	67	68	68	67	65	66	69	67	61	57	50	48	74	75	67	61	55	52	
4	10	1100	0.100	1350	555	67	67	70	68	65	61	69	67	61	57	53	49	75	73	67	61	56	53	
5	12	1600	0.100	2050	950	74	74	73	75	73	73	75	70	66	62	57	57	79	76	69	64	60	57	
6	14	2100	0.100	2400	1150	76	74	76	76	74	73	72	69	66	65	63	61	78	77	70	67	65	61	
7	16	2800	0.100	3600	2750	79	78	76	76	72	72	78	75	70	67	63	62	83	79	74	70	66	64	

KLPS, LOW PROFILE SERIES FAN POWERED TERMINAL UNIT

Unit Size	Inlet Size	Primary CFM	Min. Ps	Fan		Discharge Data							Radiated Data											
						Fan Only Sound Power, Lw							Fan Only Sound Power, Lw							Fan + Primary @ 1.5" Inlet Ps				
				CFM	Watts	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	
1	6	400	0.100	400	70	71	67	67	64	61	58	62	56	53	49	43	39	66	63	62	56	51	47	
2	8	700	0.100	700	150	79	76	76	75	74	73	70	64	60	57	51	48	75	73	70	64	59	55	
3	8	700	0.100	1000	460	78	69	67	67	65	63	69	60	58	56	51	44	69	62	60	56	51	46	
4	8x14	1400	0.100	1500	665	81	64	63	61	62	60	73	65	62	60	53	44	77	74	69	66	58	52	
5	12	1600	0.100	1700	680	78	73	72	73	70	69	68	60	57	53	48	42	68	65	61	56	55	58	

NOTES: All sound data is based on tests conducted in accordance with AHRI 880-11. ΔPs is the difference in static pressure from inlet to discharge. Sound power levels are in dB, re 10⁻¹² Watts. Discharge sound power is the sound emitted from the unit discharge. Discharge sound power has been corrected for end reflection. Radiated sound power is the sound transmitted through the casing walls. NC application data is from AHRI Standard 885-08 Appendix E. See Krueger's selection program for specific sound data for optional liners; 1/2", dual density liner shown. Dash indicates a NC is less than 20. See Krueger's Terminal Unit Engineering section for reductions and definitions. AHRI certification points are shown in bold white text in the sound performance data section for each of the corresponding models.



FAN POWERED TERMINAL UNITS

CERTIFIED - DATA

KQFS Discharge Sound Performance Data
KQFS, DISCHARGE SOUND DATA

Unit Size	Inlet Size	Primary Flow Rate		Fan Flow Rate		Min. Δ Ps		Fan Only							Fan + Primary @ 0.75" Δ Ps							Fan + Primary @ 1.5" Δ Ps						
								Octave Band Sound Power, Lw							Lp	Octave Band Sound Power, Lw							Lp	Octave Band Sound Power, Lw				
		CFM	(L/s)	CFM	(L/s)	"WG	(Pa)	2	3	4	5	6	7	NC	2	3	4	5	6	7	NC	2	3	4	5	6	7	NC
2	6	150	(71)	200	(94)	0.014	(3.50)	68	59	54	46	39	39	25	68	59	54	46	39	39	25	68	61	54	46	39	39	25
		250	(118)	300	(142)	0.039	(9.72)	70	61	55	47	41	42	24	70	63	57	47	41	42	24	70	64	57	47	41	42	24
		300	(142)	350	(165)	0.056	(14.00)	71	62	56	48	42	43	25	71	65	58	48	42	43	25	71	65	58	48	42	43	25
		350	(165)	400	(189)	0.077	(19.05)	72	63	56	48	43	44	26	72	65	58	48	43	44	26	72	66	59	48	43	44	26
		400	(189)	450	(212)	0.100	(24.88)	73	63	56	49	43	45	27	73	66	59	49	43	45	27	73	67	59	49	43	45	27
3	8	450	(212)	500	(236)	0.041	(10.28)	65	61	58	50	52	51	-	65	63	58	50	52	51	21	65	64	58	50	52	51	22
		500	(236)	600	(283)	0.051	(12.70)	67	63	61	54	55	55	21	67	63	61	54	55	55	21	67	66	61	54	55	55	24
		550	(260)	700	(330)	0.062	(15.36)	70	66	64	58	58	58	23	70	66	64	58	58	58	23	70	68	64	58	58	58	25
		625	(295)	800	(378)	0.080	(19.84)	71	67	66	60	61	61	25	71	67	66	60	61	61	25	71	70	66	60	61	61	27
		700	(330)	900	(425)	0.100	(24.88)	73	69	68	63	63	63	27	73	69	68	63	63	63	27	73	71	68	63	63	63	29
4	10	650	(307)	700	(330)	0.035	(8.69)	67	64	62	56	53	53	21	67	67	62	56	53	53	24	69	68	62	56	55	55	26
		800	(378)	850	(401)	0.053	(13.16)	69	67	65	60	57	57	24	69	69	65	60	57	57	27	71	70	67	60	59	59	28
		900	(425)	1000	(472)	0.067	(16.66)	71	69	67	63	60	60	27	71	71	67	63	60	60	29	73	72	67	63	60	62	30
		1000	(472)	1100	(519)	0.083	(20.57)	72	70	69	65	61	62	28	72	72	69	65	61	62	30	74	73	69	65	61	64	32
		1100	(519)	1200	(566)	0.100	(24.88)	73	71	70	66	63	64	30	73	73	70	66	63	64	32	75	74	70	66	63	66	33
5	12	1000	(472)	1100	(519)	0.039	(9.72)	71	65	63	58	56	57	22	71	68	63	58	56	57	26	71	70	63	58	56	57	27
		1100	(519)	1250	(590)	0.047	(11.76)	72	67	64	61	59	60	25	72	70	64	61	59	60	28	72	71	64	61	59	60	29
		1250	(590)	1400	(661)	0.061	(15.19)	73	69	66	64	62	63	27	73	71	66	64	62	63	29	73	72	66	64	62	63	30
		1400	(661)	1600	(755)	0.077	(19.05)	75	71	68	67	65	66	30	75	71	68	67	65	66	30	75	73	68	67	65	66	32
		1600	(755)	1750	(826)	0.100	(24.88)	75	72	69	70	67	68	32	75	72	69	70	67	68	32	75	75	69	70	67	68	33
6	14	1300	(614)	1400	(661)	0.038	(9.54)	74	70	67	64	62	63	28	76	70	67	64	62	63	28	77	70	67	64	62	63	30
		1650	(779)	1750	(826)	0.062	(15.36)	75	73	69	69	67	67	31	77	73	69	69	67	67	31	79	73	69	69	67	67	32
		1850	(873)	2100	(991)	0.078	(19.31)	77	75	71	73	70	71	35	77	75	71	73	70	71	35	80	75	71	73	70	71	35
		2000	(944)	2250	(1062)	0.091	(22.57)	77	76	72	75	71	72	36	79	76	72	75	71	72	36	80	76	72	75	71	72	36
		2100	(991)	2400	(1133)	0.100	(24.88)	78	77	72	76	73	73	37	78	77	72	76	73	73	37	80	77	72	76	73	73	37
7	16	1500	(708)	1500	(708)	0.029	(7.14)	74	66	63	63	60	61	26	76	69	63	63	60	63	29	77	70	63	63	60	61	29
		1825	(861)	1825	(861)	0.042	(10.57)	77	71	67	68	65	66	30	79	73	67	68	65	68	33	80	74	67	68	65	66	33
		2150	(1015)	2150	(1015)	0.059	(14.67)	81	75	70	71	69	70	34	81	76	70	71	69	72	36	82	77	70	71	69	70	37
		2475	(1168)	2475	(1168)	0.078	(19.44)	83	78	73	74	72	73	38	83	78	73	74	72	75	39	83	80	73	74	72	73	40
		2800	(1321)	2800	(1321)	0.100	(24.88)	86	81	75	77	75	76	41	86	81	75	77	77	78	42	86	82	77	77	77	76	43

FAN POWERED TERMINAL UNITS

NOTES: Discharge sound power is the sound emitted from the unit discharge. All sound data is based on tests conducted in accordance with AHRI 880-11 and corrected for end reflection. Sound power levels are in dB, re 10⁻¹² Watts. ΔPs is the difference in static pressure from inlet to discharge. NC application data is from AHRI Standard 885-08 Appendix E, as a function of flow rate shown. AHRI certification points are shown in bold, white font. For a complete list of AHRI certified data, see pages B2-4 and B2-5. All other data points listed are application ratings outside the scope of the Certification Program. See Krueger's selection program for specific sound data for optional liners; 1/2", dual density liner shown. Dash indicates a NC is less than 20. See Krueger's Terminal Unit Engineering section for reductions and definitions.

KQFS Radiated Sound Performance Data

KQFS, RADIATED SOUND DATA

FAN POWERED TERMINAL UNITS

Unit Size	Inlet Size	Primary Flow Rate		Fan Flow Rate		Min. Δ Ps		Fan Only							Fan + Primary @ 0.75" Δ Ps							Fan + Primary @ 1.5" Δ Ps						
		CFM (L/s)		CFM (L/s)		"WG	(Pa)	Octave Band Sound Power, Lw							Octave Band Sound Power, Lw							Octave Band Sound Power, Lw						
		2	3	4	5	6	7	NC	2	3	4	5	6	7	NC	2	3	4	5	6	7	NC						
2	6	150 (71)	200 (94)	0.014	(3.50)	55	44	43	39	33	26	-	55	44	43	39	33	26	-	55	44	43	39	36	32	-		
		250 (118)	300 (142)	0.039	(9.72)	61	49	47	44	38	31	23	61	49	47	44	38	31	23	61	51	50	45	42	38	24		
		300 (142)	350 (165)	0.056	(14.00)	63	51	49	45	40	32	26	63	51	49	45	40	32	26	63	54	52	47	44	40	26		
		350 (165)	400 (189)	0.077	(19.05)	65	53	50	47	41	34	28	65	53	50	47	41	34	28	65	55	53	49	46	42	28		
		400 (189)	450 (212)	0.100	(24.88)	67	55	52	48	43	35	31	67	55	52	48	43	35	31	68	57	55	51	47	44	33		
3	8	450 (212)	500 (236)	0.041	(10.28)	58	52	50	46	40	36	25	58	52	50	46	40	36	25	61	56	53	48	43	39	27		
		500 (236)	600 (283)	0.051	(12.70)	60	54	53	49	43	38	27	60	54	53	49	43	38	27	63	58	55	51	45	41	30		
		550 (260)	700 (330)	0.062	(15.36)	62	55	55	51	45	41	29	62	55	55	51	45	41	29	64	59	57	51	47	43	32		
		625 (295)	800 (378)	0.080	(19.84)	63	57	57	53	47	43	31	63	57	57	53	47	43	31	66	61	59	55	49	45	34		
		700 (330)	900 (425)	0.100	(24.88)	65	58	58	55	48	44	33	65	58	58	55	48	44	33	67	62	61	57	50	47	36		
4	10	650 (307)	700 (330)	0.035	(8.69)	62	55	52	49	43	38	27	62	55	52	49	43	40	27	62	58	54	49	46	46	29		
		800 (378)	850 (401)	0.053	(13.16)	62	56	55	49	43	39	29	62	56	55	49	43	41	29	65	60	57	52	48	47	32		
		900 (425)	1000 (472)	0.067	(16.66)	62	56	57	50	44	40	32	62	56	57	50	44	42	32	66	61	60	53	49	48	35		
		1000 (472)	1100 (519)	0.083	(20.57)	62	56	58	50	44	40	33	64	56	58	50	44	42	33	67	62	61	54	50	48	37		
		1100 (519)	1200 (566)	0.100	(24.88)	62	57	59	50	44	41	35	65	59	59	53	46	43	35	69	63	63	55	51	49	38		
5	12	1000 (472)	1100 (519)	0.039	(9.72)	60	52	53	48	40	35	27	60	54	55	50	43	39	29	60	57	56	50	46	44	31		
		1100 (519)	1250 (590)	0.047	(11.76)	63	55	56	51	44	39	30	63	55	56	51	46	42	30	63	59	58	53	48	46	33		
		1250 (590)	1400 (661)	0.061	(15.19)	65	58	58	54	46	42	33	65	58	58	54	46	44	33	65	61	61	54	50	48	36		
		1400 (661)	1600 (755)	0.077	(19.05)	69	61	61	57	50	45	36	69	61	61	57	50	45	36	69	64	63	57	52	50	39		
		1600 (755)	1750 (826)	0.100	(24.88)	71	63	63	60	52	48	39	71	63	63	60	52	48	39	71	66	65	60	54	52	41		
6	14	1300 (614)	1400 (661)	0.038	(9.54)	61	54	55	51	44	39	30	61	56	55	53	46	42	30	61	58	58	53	48	47	33		
		1650 (779)	1750 (826)	0.062	(15.36)	65	58	59	56	49	44	34	65	58	59	56	49	46	34	65	62	62	56	52	50	37		
		1850 (873)	2100 (991)	0.078	(19.31)	69	62	62	60	52	48	38	69	62	62	60	52	48	38	69	65	64	60	55	53	40		
		2000 (944)	2250 (1062)	0.091	(22.57)	70	63	64	61	54	49	39	70	63	64	61	54	49	39	70	66	65	61	56	54	41		
		2100 (991)	2400 (1133)	0.100	(24.88)	72	64	65	63	55	51	40	72	64	65	63	55	51	40	72	67	65	63	57	55	40		
7	16	1500 (708)	1500 (708)	0.029	(7.14)	68	57	57	54	46	41	33	68	57	57	54	48	46	33	70	59	59	54	48	49	35		
		1825 (861)	1825 (861)	0.042	(10.57)	70	61	60	57	50	46	36	70	61	60	57	52	49	36	72	63	63	59	52	52	38		
		2150 (1015)	2150 (1015)	0.059	(14.67)	72	64	63	60	54	49	38	74	64	65	62	56	52	40	74	66	66	62	56	54	41		
		2475 (1168)	2475 (1168)	0.078	(19.44)	74	67	65	62	57	52	41	76	67	67	64	58	54	43	76	69	68	64	59	57	44		
		2800 (1321)	2800 (1321)	0.100	(24.88)	75	69	67	65	59	55	43	77	71	69	67	61	55	45	78	71	70	67	61	59	46		

NOTES: Radiated sound power is the sound transmitted through the casing walls. All sound data is based on tests conducted in accordance with AHRI 880-11. Sound power levels are in dB, re 10⁻¹² Watts. ΔPs is the difference in static pressure from inlet to discharge. NC application data is from AHRI Standard 885-08 Appendix E. AHRI certification points are shown in bold, white font. For a complete list of AHRI certified data, see pages B2-4 and B2-5. All other data points listed are application ratings outside the scope of the Certification Program. See Krueger's selection program for specific sound data for optional liners; 1/2", dual density liner shown. Dash indicates a NC is less than 20. See Krueger's Terminal Unit Engineering section for reductions and definitions.

K Q F S

KQFS Engineering Specification & Configuration

KQFS UNIT

Fan powered terminal unit shall be designed to provide low sound levels. Unit shall be completely factory assembled and wired with motor, blower, mixing plenum and primary air damper contained in a single unit housing. Unit shall be Krueger model KQFS.

The induced air fan shall operate continuously during central system operation. Primary airflow controller shall compensate for central system pressure fluctuations. When room temperature requires maximum heating, the (direct digital) (analog) (pneumatic) pressure independent velocity controller maintains the minimum primary airflow setting by modulating the damper. The electric heating coil or hot water coil, if supplied, is energized (activated). As room temperature begins to rise, the heating coil is de-energized (deactivated). As room temperature rises above the setpoint, the primary air damper will modulate to maintain room temperature. When the room temperature calls for maximum cooling, the velocity controller maintains the maximum primary airflow setting.

To prevent the fan/motor from running in the backward direction, the unit induced air fan shall be field wired so that it is electrically or pneumatically interlocked with the central system fan.

Terminals shall be certified by use of the AHRI Standard 880 Certification Program and carry the AHRI seal.

The terminal unit shall be ETL listed as a complete assembly. All electrical components shall be UL listed and installed in accordance with the National Electric Code. All electrical components shall be mounted in sheet metal control enclosures. Electrical connection shall be single point.

Unit casing shall be constructed of not less than 20 gage galvanized steel. All primary air inlet collars shall accommodate standard flex duct sizes. Unit discharge shall be rectangular, suitable for flanged duct connections.

Unit labels shall be adhered to each unit including model, size, airflow (CFM), balancing chart, electrical information, and tagging data.

The unit casing shall incorporate an integral recirculated air inlet sound attenuator to achieve sound levels shown on equipment schedule. KQFS unit shall be equipped with a factory installed airflow sensing device. Provide a K4 LineaCross, four quadrant, multi-point center averaging sensor with an amplified signal.

- **(Optional)** Provide a linear, multi-point, velocity averaging sensor with an amplified signal.
- Provide balancing taps to allow for easy airflow verification.

The primary air damper assembly shall be constructed of heavy gage galvanized steel with 1/2" solid shaft rotating in self lubricating Delrin® bearings. Damper shaft shall be marked on the end to indicate damper position. Damper blade shall incorporate a flexible gasket for tight airflow shutoff and operate over a full 90° rotation.

Fan motor and all interior components must be accessible through a removable bottom access panel.

Fan shall be of the forward curve, centrifugal type. The fan motor shall be single speed, multi-voltage (120, 208/240, 277), 60 Hz, single phase, energy efficient design, permanently lubricated, using permanent split capacitor for starting and be specifically designed for use with an SCR fan speed controller. Motor must have thermal overload protection. The fan motor shaft shall be connected directly to the fan and the entire fan assembly shall be isolated from the unit casing to prevent transmission of vibration.

- **(Optional)** ECM Fan Motor: The fan motor shall be [120, 208/240, or 277 volt, Single-Phase] ECM (electronically commutated motor) fan motors including either a manual or remote adjustable speed controller. The manual adjustable speed controller is field set adjustable with digital display alternating between RPM and percentage full flow. The remote adjustable speed controller provides a means to remotely set and/or adjust the fan speed.

The radiated and discharge attenuation factors for the specified NC levels shall be based on attenuation factors from AHRI Standard 885-08 Appendix E, which includes room absorption, environmental adjustment factor, duct insertion, end reflection and duct branching.

CASING LINERS

Unit casing shall be lined with 1/2" thick, 1 1/2 lb. dual density fiberglass insulation that meets UL 181 and NFPA 90A. Insulation shall be attached to the unit casing by adhesive and weld pins.

- **(Optional)** 1" Thick Insulation: Unit casing shall be lined with 1" thick, 1 1/2 lb. dual density fiberglass insulation that meets UL 181 and NFPA 90A. Insulation shall be attached to the unit casing by adhesive and weld pins.
- **(Optional)** Steriliner Insulation: Unit casing shall be lined with 13/16" thick, 4 lb. density, rigid board insulation with fiber reinforced foil covering insulation fibers that meets UL 181 and NFPA 90A. Liner shall be attached to unit casing by adhesive and weld pins with foil tape sealing the insulation cut edges.
- **(Optional)** Cellular Insulation: Unit casing shall be lined with 1/2" or 1" thick, 1 1/2 lb. density, smooth surface, polyolefin, closed-cell foam insulation for fiber free application. Cellular insulation meets UL 181 and NFPA 90A and does not support mold or bacteria growth. Insulation shall be attached to the unit casing by adhesive and weld pins.
- **(Optional)** Foil Encapsulated Insulation: Unit casing shall be lined with foil reinforced, wrapped edges, 1/2" or 1" thick, 1 1/2 lb. density fiberglass insulation that meets UL 181 and NFPA 90A. Insulation shall be attached to the unit casing by adhesive and weld pins.
- **(Optional)** Sterilwall Insulation: Unit casing shall be lined with 1/2" or 1" thick, 1 1/2 lb. dual density fiberglass insulation that meets UL 181 and NFPA 90A, enclosed between the unit casing and a non-perforated internal sheet metal cover extending over the fiberglass insulation, as well as covering the liner cut edges.

KQFS Engineering Specification & Configuration

- **(Optional)** Perforated Doublewall Insulation: Unit casing shall be lined with 1/2" or 1" thick, 1 1/2 lb. dual density fiberglass insulation, (additional options: 1/2" or 1" thick, 1 1/2 lb. density foil reinforced fiberglass insulation or 13/16" thick, 4 lb. density, rigid board insulation with fiber reinforced foil covering) that meets UL 181 and NFPA 90A, enclosed between the unit casing and a perforated internal sheet metal cover extending over the fiberglass insulation, as well as covering the liner cut edges.
- **(Optional)** No Liner: Unit casing shall be equipped with no internal insulation liner.

ELECTRIC HEATING COILS

Electric coils shall be supplied by the terminal unit manufacturer and shall be ETL listed in accordance with UL standards. Construct coil casing with minimum of 20 gage galvanized steel. Elements shall be 80/20 Ni-Cr and supported by ceramic insulators. The integral control panel shall be housed in a NEMA 2 enclosure with access to all controls and safety devices.

Electric coils shall contain a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow.

- **(Optional)** Electric coils shall include fused or non-fused door interlocking disconnect switch, AC solid state relay, fuse-block, manual reset cutout, and/or dust tight enclosure construction.
- **(Optional)** LineaHeat solid state electronic proportional control of electric heat shall meet the requirements of ASHRAE Standard 62, Addenda N.
- **(Optional)** LineaHeat solid state electronic controlled heater with control of the leaving air temperature limiting the unit discharge temperature to a set value.

HOT WATER COILS

Hot water coil casing shall be constructed with minimum 20 gage galvanized steel with flanged discharge for attachment to downstream ductwork. Coils shall be factory installed on the terminal unit. Fins shall be rippled and corrugated heavy gage aluminum, mechanically bonded to tubes. Tubes shall be copper with minimum wall thickness of 0.016" and with male solder header connections. Coils shall be leak tested to 400 psi. Number of coil rows and circuits shall be selected to provide performance as required by the plans. Coil performance data shall be based on tests run in accordance with AHRI Standard 410.

KQFS Engineering Specification & Configuration

- 1. SERIES: (XXXXXX)**
 KQFS - Quiet Fan Terminal Unit
 KQFS-FA - Quiet Fan Terminal Unit with Fresh Air Inlet
- 2. SENSOR TYPE: (X)**
 1 - Linear Averaging
 3 - K4 LineaCross (Four Quadrant, Standard)
- 3. LINER TYPE: (X)**
 0 - 1/2" Liner
 1 - 1" Liner
 2 - Steriliner
 3 - No Liner
 4 - Sterilwall with 1/2" Dual Density
 6 - 1/2" Foil Encapsulated
 8 - Sterilwall with 1" Dual Density
 9 - 1" Foil Encapsulated
 A - Perforated Double Wall with 1/2" Dual Density
 B - Perforated Double Wall with 1" Dual Density
 C - Perforated Double Wall with 1/2" Foil Encapsulated
 D - Perforated Double Wall with 1" Foil Encapsulated
 E - Perforated Double Wall with Steriliner
 F - 1/2" Cellular
 H - 1" Cellular
- 4. UNIT CASING CONTROLS: (XX)**
 1L - Left-hand Side, 20 Gage
 1R - Right-hand Side, 20 Gage
- 5. UNIT SIZE: (X)**
 2 - Available Inlet Sizes: 6", 8"
 3 - Available Inlet Sizes: 6", 8", 10", 12"
 4 - Available Inlet Sizes: 8", 10", 12"
 5 - Available Inlet Sizes: 10", 12", 14"
 6 - Available Inlet Sizes: 10", 12", 14", 16"
 7 - Available Inlet Sizes: 10", 12", 14", 16"
- 6. INLET CODE: (XX)**
 06 - 6" 08 - 8"
 10 - 10" 12 - 12"
 14 - 14" 16 - 16"
- 7. MOTOR VOLTAGE: (X)**
 1 - 120V, 1-Phase *
 2 - 208/240V, 1-Phase
 3 - 277V, 1-Phase
 4 - ECM Motor, 120V, 1-Phase **
 5 - ECM Motor, 208/240V, 1-Phase **
 6 - ECM Motor, 277V, 1-Phase **
- 8. CONTROL TYPE: (XXXX)**
 (2XXX) - Analog
 (7XXX) - Digital, BACnet Compatible
 (6XXX) - Digital, Standalone
 (XXXX) - Factory Mounted, Provided by Others
 (1XXX) - Pneumatic
- 9. CONTROL ACCESSORIES: (X)**
 0 - None
 A - 4" Fresh Air Inlet, Available on Unit Size 2, 3
 B - 5" Fresh Air Inlet, Available on Unit Size 2, 3
 C - 6" Fresh Air Inlet, Available on Unit Size 2, 3, 4, 5, 6, 7
 D - 7" Fresh Air Inlet, Available on Unit Size 4, 5, 6, 7
 E - 8" Fresh Air Inlet, Available on Unit Size 4, 5, 6, 7
- 10. UNIT ACCESSORIES: (X) (X) (X) (X) (X) (X)**
 0 - None
 A - Motor Toggle Disconnect *
 E - Dust-tight Control Enclosure
 F - Fan Motor Fuse
 P - Cam Lock for Access Panels
 R - Induction Inlet Filter
 S - Hanger Brackets ■
- 11. WATER HEAT: (ROWS/CONNECTION HAND) (XXX)**
 000 - None
 W11 - 1 Row/Right/Unit Discharge
 W12 - 2 Row/Right/Unit Discharge
 W21 - 1 Row/Left/Unit Discharge
 W22 - 2 Row/Left/Unit Discharge
- 12. ELECTRIC HEAT: (XX) LINEAHEAT: (XX)**
 00 - None L1 - 120v/1-Phase
 E1 - 120v/1-Phase L2 - 208v/1-Phase
 E2 - 208v/1-Phase L3 - 240v/1-Phase
 E3 - 240v/1-Phase L4 - 277v/1-Phase
 E4 - 277v/1-Phase L6 - 208v/3-Phase/3-Wire
 E6 - 208v/3-Phase/3-Wire L9 - 480v/3-Phase/4-Wire
 E9 - 480v/3-Phase/4-Wire
- 13. ELECTRIC HEAT STEPS: (X)**
 0 - None
 1 - 1-Stage
 2 - 2-Stage
 3 - 3-Stage
- 14. HEAT COIL ACCESSORIES: (X) (X) (X) (X) (X)**
 0 - None
 C - Fuse Block
 E - Chicago Code Construction
 F - Manual Reset Cutout
 G - Dust-tight Construction
 H - Staged Solid State Relays
 K - Door-interlocking Fused Disconnect
 L - Door-interlocking Non-fused Disconnect
 P - Water Coil Vent & Drain
- * KQFS unit size 7 not available with 120V.
 ** Manual or remote adjustable speed controller for ECM motor option is required.
 • Motor Toggle Disconnect not available with electric heat.
 ■ Hanger brackets not available with Sterilwall or Perforated Doublewall liners.