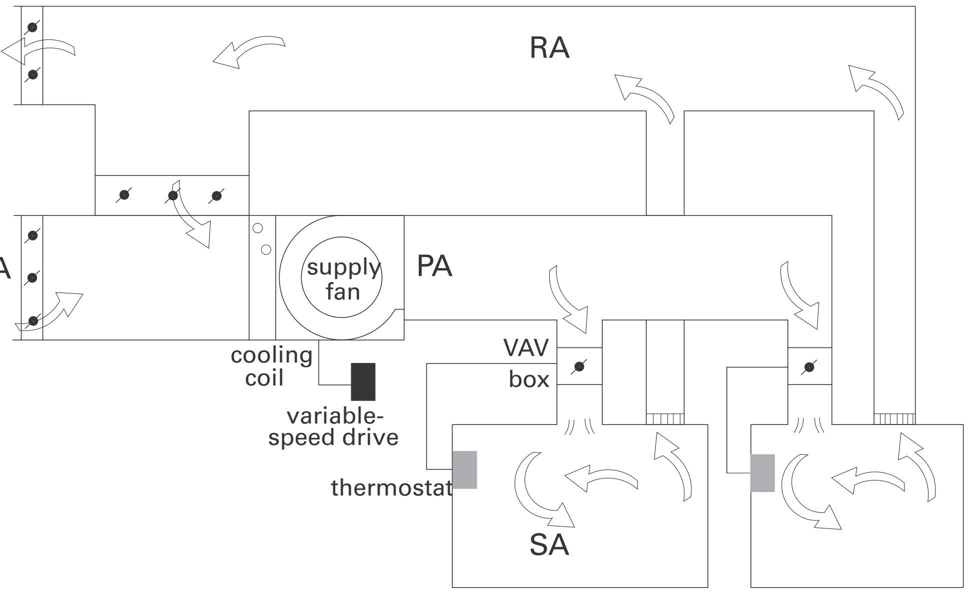
Product Catalog

VariTrane™ Products
Parallel and Series Fan-Powered

VPCF, VPWF, VPEF, VSCF, VSWF, VSEF,
LPCF, LPWF, LPEF, LSCF, LSWF, LSEF

Variable-Air-Volume (VAV) System



July 2013

VAV-PRC012-EN

Introduction

Fan-powered units offer energy savings due to intermittent fan control. The fan energizes only in heating mode when the space needs heat. Additional energy savings are obtained by using warm plenum air for free reheat. Motor heat is never wasted in parallel units. They are an excellent choice when minimal zone heating is needed.

Figure 1. Parallel fan-powered terminal unit (L) & series fan-powered terminal units (R)

Figure 2. Low height series: LSCF (L) & low height series: LSWF (R)

Figure 3. Low height series: LSEF (L) & low height parallel: LPCF (R)

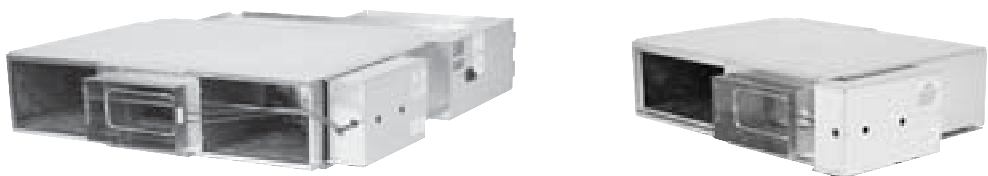
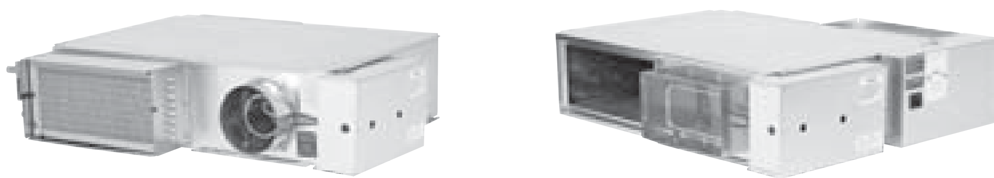


Figure 4. Low height parallel: LPWF (L) & low height parallel: LPEF (R)



Revision Summary

VAV-PRC012-EN (16 Jul 2013). Updated proportional water valve design.

VAV-PRC012-EN (27 June 2013). Updated controls information. Updated dimensions for units with attenuators.

Trademarks

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Table of Contents

Features and Benefits

VariTrane™ – VAV Leadership

VariTrane variable-air-volume (VAV) units lead the industry in quality and reliability and are designed to meet the specific needs of today's applications. This generation of VariTrane units builds upon the history of quality and reliability and expands the products into the most complete VAV offering in the industry.

Parallel Fan-powered units offer energy savings due to intermittent fan control. The fan energizes only in heating mode when the space needs heat. Additional energy savings are obtained by using warm plenum air for free reheat. Motor heat is never wasted in parallel units. They are an excellent choice when minimal zone heating is needed.

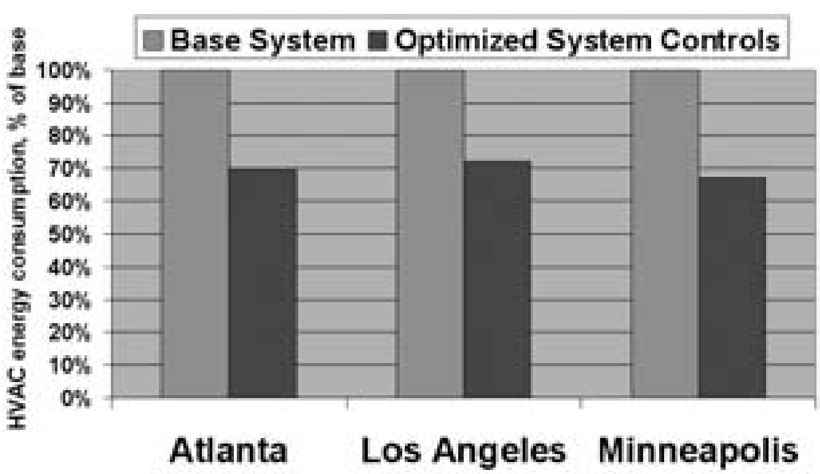
Series fan-powered units have fans which are always energized in occupied mode. They are common in applications such as conference rooms, cafeterias, etc., that desire constant airflow rates at all conditions.

Low-height parallel units provide the energy savings of an intermittent fan with the flexibility of an 11"–11.5" casing height. This is a good choice for tight plenum spaces.

Low-height series units have been used for years in projects with strict plenum height requirements. Units
are available in 11.0" height.

Energy Efficient Earthwise™ Systems

Figure 5. Rooftop VAV (office building)



A significant consumer of energy in commercial buildings is heating and air conditioning. One of the most energy-efficient HVAC solutions is the VAV system. This inherent system efficiency, along with high-quality, affordable DDC controls, has steadily increased demand for VAV systems over the years. VAV systems save significant energy, are able to deliver the required amount of ventilation air, and provide reliable occupant comfort.

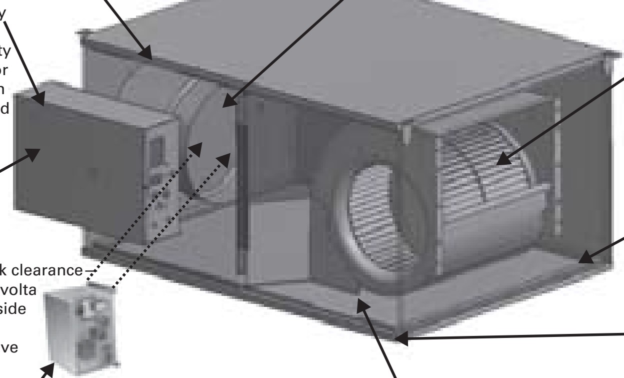
Energy saving features must go beyond a simple VAV unit to incorporate VAV unit level and system level control strategies like:

- Ventilation Optimization-Combines demand-controlled ventilation (using either a time-of-day schedule, an occupancy sensor, or a carbon dioxide sensor) at the zone level with ventilation reset at the system level to deliver the required amount of outdoor air to each zone, while minimizing costly over-ventilation.

Features and Benefits

- Fan Pressure Optimization- reduces supply fan energy by as much as 40% by intelligently reducing the pressure in the air distribution system to the lowest possible level without impacting occupant comfort.
- Night setback reduces energy consumption during unoccupied periods by raising or lowering space temperature setpoints.
- Supply Air Temperature Reset-reduces overall system energy use (balancing reduced cooling and reheat energy with increased fan energy) by raising the supply air temperature at part load, while avoiding elevated space humidity levels.
- Electrically Commutated Motors (ECM) improve the efficiency of fan-powered VAV units.
- Low Temperature Air Distribution can decrease overall system energy use by reducing airflows and the fan energy needed to move that air through the system.

To determine the potential energy savings a VAV system can bring to your applications, Trane offers energy-modeling software like System Analyzer™ and TRACE 700®. When TRACE™ was introduced into the HVAC industry in 1972, the HVAC design and analysis program was the first of its kind and quickly became a defacto industry standard. It continues to grow with the industry meeting requirements for ASHRAE Standard 140, ASHRAE 90.1, and the LEED® Green Building Rating System and has now been approved by the IRS to certify energy savings for building owners. Contact your local Trane Sales Engineer for additional information.



Construction

UL-listed products—

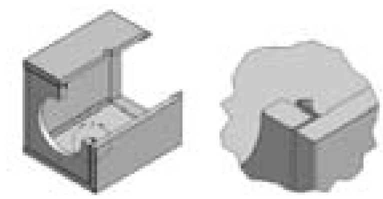
Safety and reliability are vital in commercial construction. All VariTrane units are completely listed in accordance with UL -1995 as terminal units. This listing includes the VAV terminal with electric heaters. Additionally, all insulation materials pass UL 25/50 smoke and flame safety standards.

AHRI Certified Performance—

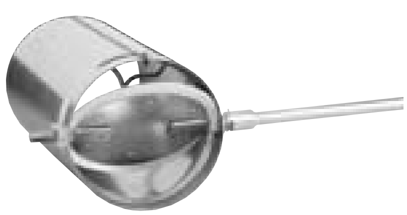
All VariTrane units are AHRI certified. AHRI 880 guarantees the pressure drop, flow performance, and acoustical performance provided is reliable and has been tested in accordance with industry accepted standards. AHRI 885 uses AHRI 880 performance and applies accepted industry methods to estimate expected “NC” sound levels within the occupied space.

Casing Design—

Interlocking Panels—VariTrane products are manufactured in the most state-of-the-art VAV facility in the world. The patent-pending interlocking panels are designed using integral I-beam construction technology. This limits deformation and creates tremendous product rigidity. An additional benefit is a smooth unit exterior with few exposed screws—ideal for exposed ceiling applications. VariTrane units are designed for use in systems that operate up to 5" w.c. of inlet pressure.



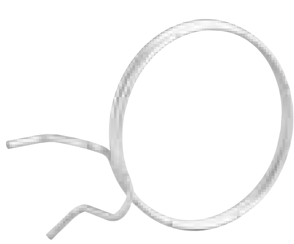
Metal Encapsulated Edges—All VariTrane units are complete with encapsulated edges to arrest cut fibers and prevent insulation erosion into the airstream. This is the standard of care in applications concerned with fiberglass erosion or projects with either double-wall or externally wrapped duct work.



The Trane Air Valve—is at the heart of VariTrane terminal units. This is where airflow is measured and controlled. Repeatability and ruggedness is vital. VariTrane products are the most rugged and reliable available.

18-gage Cylinder—limits deformation or damage during shipment and job site handling, and provides even airflow distribution across the flow ring for unmatched airflow measurement accuracy.

Continuously Welded Seam — an automated weld process creates the highest quality continuous seam, which is “right” every time. The welded seam improves air valve rigidity and creates consistent and repeatable airflow across the flow measurement device. The result is a truly round cylinder every time, with no flat spots caused by lower quality crimping and riviting technologies.



Flow Ring—The Trane flow ring is time tested to perform under the most demanding conditions. Additionally, Trane’s patented flow ring is recessed within the air valve cylinder to reduce the potential for damage during job site handling and installation.

External Shaft—The simple design provides controller flexibility and is designed to facilitate actuator field replacement.

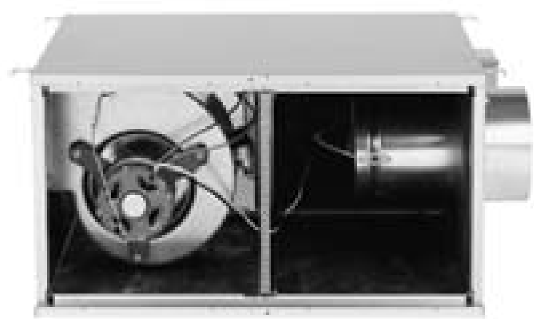
Position Indicator—The position indicator shows current air valve position to aid in system commissioning. Many times this can be seen from the floor without climbing a ladder.

External Actuator—This feature increases serviceability, control system compatibility, and actuator clutch access for simplified commissioning.

Indoor Air Quality (IAQ) Features

The oil embargo of the early 1970s created an energy crisis, which resulted in tighter buildings, and reduced ventilation rates. A fallout issue of tighter building construction was poor indoor air quality. This heightened IAQ awareness. IAQ issues have been featured in publications from the smallest towns to the largest cities. System design should consider applicable ventilation and IAQ standards.(See your local Trane Sales Engineer or visit www.trane.com for additional information). Good indoor air quality results from units and systems which:

- Provide the required amount of ventilation air to each zone during all operating conditions
- Limit particulates from entering occupied spaces
- Allow proper access for periodic cleaning.



Note: Access made easy on new VariTrane units, as shown on this Series Fan-Powered unit.

VariTrane units are designed with simplified access and a full line of insulation options including:

Matte-faced—Typical industry standard with reduced first cost.

Closed-cell—This insulation has an R-value and performance equivalent to matte-faced insulation. The main difference is the reduction of water vapor transmission. Closed-cell is designed for use in installations with a high chance of water formation. (It has been used to coat the exterior of chiller evaporator barrels for many years.)

Foil-faced—A fiberglass insulation with a thin aluminum coating on the air stream side to prevent fibers from becoming airborne. The aluminum lining is acceptable for many applications, however it is not as rugged as double-wall

Double-wall—Premium insulation often used in many health care applications with insulation locked between metal liners. This eliminates the possibility for insulation entering the airstream and allows for unit interior wipe-down as needed.

VariTrane VAV units are the most prepared IAQ units in the industry.

The end result is a reliable product designed for peak performance, regardless of job site conditions or handling.

Tracer™ Building Automation System

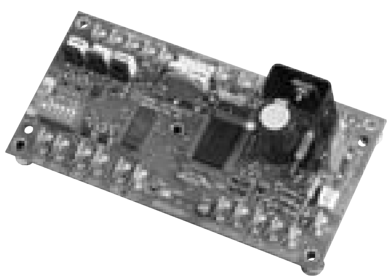
Tracer Building Automation System assures comfort within your building. Building controls have a bigger job description than they did a few years ago. It's no longer enough to control heating and cooling systems and equipment. Sophisticated buildings require smarter technology that will carry into the future. Tracer™ controls provide the technology platform – mobile, easy-to-use, cloud-based, scalable and open - for the next generation of data-driven, technology-enabled services that are creating high performance buildings. With a Trane Tracer Building Automation System, you'll:

- Reduce operating costs through energy management strategies
- Consistently provide occupant comfort
- Enjoy reliable operation with standard, pre-engineered and pretested applications
- Easily troubleshoot and monitor either on site or from a remote location
- Reduce installation time and simplify troubleshooting

Whether factory-mounted or field-installed, Trane offers a wide range of controllers to suit virtually any application. These units are compatible with a variety of building types and can be used for new construction or renovation. Through extensive usability testing internally and with building operators, we've designed our controls for real world ease of use.

(Additional control options and sequence-of-operations are located in the "Controls" section.)

Trane VAV UCM DDC Controller



DDC (communicating electronic)—DDC controllers are today's industry standard. DDC controllers provide system-level data used to optimize overall SYSTEM performance. Variables such as occupied/unoccupied, minimum and maximum cfm and temperature, valve position, ventilation fraction, etc. are available on a simple twisted-shielded wire pair. For additional information, see "Industry Issues: Energy Efficiency".

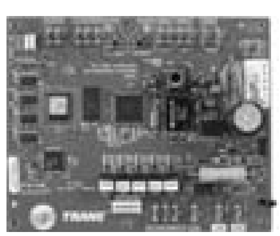
Note: One of many Trane DDC Control Options which are factory-installed, wired, calibrated, and fully tested before shipment.

Trane DDC controllers provide Trane-designed solid-state electronics intended specifically for VAV temperature control in space comfort applications. DDC control capabilities include:

- Pressure-independent (PI) operation—Provides airflow required by the room thermostat to maintain occupant comfort. The controller automatically adjusts valve position to maintain required airflow. Minimum and maximum airflow is factory-set and field-adjustable.
- Factory-set airflow and temperature setpoints
- Most advanced system integration in the industry.

Tracer VV550 LonTalk™ Controllers

LonTalk™ Controller

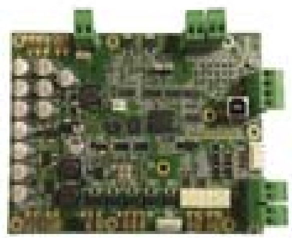


Trane now offers a full line of LonTalk™ controllers designed for simple integration into ANY system which can communicate via the LonMark Space Comfort Control (SCC) protocol. These controllers are also completely factory-commissioned.

Tracer BACnet™ Controllers

Trane now offers a full line of BACnet controllers designed for simple integration into any system which can communicate via the BACnet protocol. These controllers are factory-commissioned and shipped ready to be installed.

UC210 BACnet Controller



UC400 BACnet Controller

Trane Wireless Comm Interface (WCI)

WCI controller

Provides wireless communication between the Tracer SC, Tracer Unit Controllers, and BACnet™ Communication Interface (BCI) modules.

The Trane WCI is the perfect alternative to Trane's BACnet wired communication links (for example – Comm links between a Tracer SC and Tracer UC400).

Eliminating communication wire used between terminal products, zone sensors, and system controllers has substantial benefits.

- Installation time and associated risks are reduced.
- Projects are completed with fewer disruptions.
- Future re-configurations, expansions, and upgrades are easier and more cost effective.

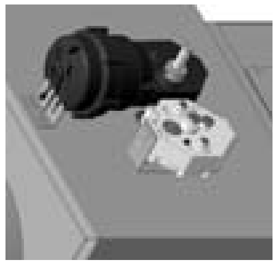
Trane Wireless Zone Sensor

Wireless Zone Sensor

Provides wireless communication between the Unit Controller and the zone sensor. This is an alterntive to the wired zone sensor when access and routing of communicaiton cable is an issue. It also allows very flexible mounting and relocation of zone sensors

Pneumatic Controller

Pneumatic Controller



Pneumatic—Pneumatic controllers provide proven reliability and performance. A full line of options provide:

- Highest quality PVR available, which maximizes zone temperature control.

Pressure-independent operation

- All VariTrane pneumatic controllers use the patented flow sensor input to provide the most accurate performance available.

Binary Input Controller

Integration Options (Interfacing with other control systems) - Trane offers three ways to interface with other control systems.

1. Use Trane LonMark, factory-commissioned VAV controllers
2. Use Trane Binary Input Controller (BIC). BIC allows system control through binary logic. This means that a control system on an existing campus, or those seeking "Analog non-communicating control" can control a Trane DDC VAV unit via basic binary contact closures, like relays, etc. This can be a cost effective interface option where a full Trane DDC VAV System is not available.
3. Use Trane BACnet™ factory-commissioned VAV controllers.

Factory-installed vs. Factory-commissioned:

The terms factory-installed and factory-commissioned are often used interchangeably. Trane takes great pride in being the industry leader in factory-commissioned DDC controllers. Table differentiates these concepts.

Factory-commissioned controllers provide the highest quality and most reliable units for your VAV system. Additional testing verifies proper unit operation including occupied/unoccupied airflow, temperature setpoints, communication link functionality, and output device functionality. The benefits of factory-commissioning are standard on VariTrane terminal units with Trane DDC controls. This means that factory-commissioned quality on VariTrane VAV units is now available on ANY manufacturer's control system that can communicate using the LonMark Space Comfort Control (SCC) protocol. (See Controls section for complete listing of variables which are communicated.

Table 1. Factory-installed vs. factory-commissioned

	Factory-installed	Factory-commissioned
Transformer installed (option)	X	X
Wires terminated in reliable/consistent setting	X	X
Controller mounted	X	X
Electric heat contactors and fan relay wired	X	X

Table 1. Factory-installed vs. factory-commissioned

	Factory-installed	Factory-commissioned
Testing of electric heat contactors and fan relay		X
Controller addressing and associated testing		X
Minimum & Maximum airflows settings (occupied/unoccupied)		X
Minimum & Maximum temperature setpoints (occupied/unoccupied)		X
Minimum ventilation requirements		X
Thumbwheel enable/disable		X
Heating offset		X
Wireless communications modules (WCI)	X	X
Wireless zone sensor	X	

Indoor Air Quality Management During Construction

LEED wrap option is a pressure sensitive covering that prevents contamination of the VAV box during the construction phase. It is utilized to seal all openings without constraining the installation process.

Trane VAV Systems - Proven Performance

Trane is the industry leader in VAV systems, including factory-commissioned controls and integration with other control systems. This leadership began with customers seeking the most reliable VAV products in the industry. The solution was factory-commissioned controls (see Factory-installed vs. Factory-commissioned). Since then, it has blossomed to include optimized system control strategies.

Control strategies are often made more complicated than necessary. VariTrane DDC controls simplify control strategies by pre-engineering control logic and sequencing into the controller. This information is available via a twisted-shielded wire pair, and accessible via a Trane Tracer™ SC building automation system. Data is easily accessed via a computer workstation.

Optimized system control strategies, such as ventilation optimization, fan-pressure optimization, and optimal start/stop, are pre-engineered in VariTrane™ unit-level DDC controllers and the Tracer SC building automation system.

This allows a Trane VAV system to meet or exceed the latest ASHRAE 90.1 Energy Efficiency standards. Pre-engineered controls allow consistent, high quality installations which are very repeatable. The end result is PROVEN control strategies you can rely on to perform. For more information on these and other control strategies, contact your local Trane Sales Office, or visit www.trane.com.

Purchasing VAV controllers and VAV hardware from a single manufacturer provides a single contact for all HVAC system related questions.

Agency Certifications

There are numerous regulations and standards in the industry that determine the construction and performance parameters for VAV terminal units. Some of the more important of those standards and regulations are listed below, along with a brief description of what each one addresses.

American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) - 41.1

ASHRAE - 41.2

ASHRAE - 41.3

These standards specify methods for temperature measurement (41.1), laboratory airflow measurement (41.2), and pressure measurement (41.3). While none of these standards specifically discusses VAV air terminals, they discuss topics that are aspects of terminal box systems. Therefore, some engineers will include these standards in their specifications as a primer on accepted measurement techniques.

ASHRAE - 62

This standard specifies the minimum ventilation rates and indoor air quality that are acceptable for occupied spaces.

ASHRAE - 111

This standard calls out procedures to be followed for testing and balancing HVAC systems. It includes descriptions of the equipment used, procedures followed, and field changes that must be made when a system is balanced.

Air-Conditioning, Heating and Refrigeration Institute (AHRI)

AHRI 880

This standard sets forth classifications, performance testing requirements, and test results reporting requirements for air terminal units. The standard contains very detailed procedures that are to be followed for the testing and certification program associated with this standard. This is one of the most commonly referenced standards in the VAV terminal unit industry. The AHRI-880 certification program is designed to police the accuracy of documented performance for terminal units. The certification program requires a sampling of at least four units be tested annually. The tested units are chosen at random by AHRI and sent to an independent laboratory for the testing. The performance is tested at one specific operating condition. The operating characteristics tested include discharge and radiated sound power (for the damper and, in the case of fan-powered boxes, the fan), wide-open damper pressure drop, and fan motor amp draw. **VariTrane terminal units are certified according to AHRI-880.**

AHRI 885

This document provides a procedure to estimate sound pressure levels in an occupied space. The standard accounts for the amount of sound pressure in the space due to the VAV air terminal, diffusers and their connecting low pressure ductwork. While sound generated from the central system fan and ductwork may be a significant factor in determining the sound pressure level in the room, this standard does not address those factors. It focuses solely on the VAV terminal and items downstream of it. This standard is related to AHRI-880 by using sound power determined using AHRI-880 methodology as a starting point for the AHRI-885 procedure.

Underwriter's Laboratory (UL) 1995

Underwriter's Laboratory is an independent testing agency that examines products and determines if those products meet safety requirements. Equipment manufacturers strive to meet UL guidelines and obtain listing and classifications for their products because customers recognize UL approval as a measure of a safely designed product. **VariTrane VAV air terminals are listed per UL-1995, Heating and Cooling Equipment.** The terminals are listed as an entire assembly.

National Fire Protection Association

NFPA 70

This standard is also known as the National Electrical Code (NEC). The Code gives standards for installation of wiring and electrical equipment for most types of commercial and residential buildings. It is often referred to in VAV air terminal specifications when fan-powered boxes, electric heat or electric controls are included.

NFPA 90A

This standard does not speak directly to VAV air terminals but does discuss central system considerations pertaining to a fire and/or smoke condition. The standard discusses safety requirements in design and construction that should be followed to keep the air-handling system from spreading a fire or smoke. The standard specifies practices that are intended to stop fire and smoke from spreading through a duct system, keep the fire-resistive properties of certain building structures (fire walls, etc.) intact, and minimize fire ignition sources and combustible materials.

Model Number Descriptions

Digit 1, 2—Unit Type

VP = VariTrane™ Fan-Powered Parallel
VS = VariTrane Fan-Powered Series
LP = VariTrane Fan-Powered Low-Height Parallel
LS = VariTrane Fan-Powered Low-Height Series

Digit 3—Reheat

C = Cooling Only
E = Electric Heat
W = Hot Water Heat

Digit 4—Development Sequence

F = Sixth

Digit 5, 6—Primary Air Valve

05 = 5" inlet (350 max cfm)
06 = 6" inlet (500 max cfm)
08 = 8" inlet (900 max cfm)
10 = 10" inlet (1400 max cfm)
12 = 12" inlet (2000 max cfm)
14 = 14" inlet (3000 max cfm)
16 = 16" inlet (4000 max cfm)
RT = 8" x 14" inlet (1800 max CFM)

Note: *10, 12, 14, 16 Not Available on Low-Height*

Digit 7, 8—Secondary Air Valve

00 = N/A

Digit 9—Fan

P = 02SQ fan (500 nominal cfm)
Q = 03SQ fan (1100 nominal cfm)
R = 04SQ fan (1350 nominal cfm)
S = 05SQ fan (1550 nominal cfm)
T = 06SQ fan (1850 nominal cfm)
U = 07SQ fan (2000 nominal cfm)
V = 08SQ Fan (500 nominal cfm)
W = 09SQ Fan (900 nominal cfm)
X = 10SQ Fan (1800 nominal cfm)

Digit 10, 11—Design Sequence

** = Factory assigned

Digit 12, 13, 14, 15—Controls

DD01= Cooling Only Control
DD02= N.C. On/Off Hot Water
DD03= Prop. Hot Water
DD04= Staged On/Off E-Heat
DD05= Pulse Width Mod of E-Heat
DD07= N.O. On/Off Hot Water
DD11= VV550 DDC Controller - Cooling Only
DD12= VV550 DDC Ctrl w/N.C. On/Off HW Valve
DD13= VV550 DDC Ctrl w/Prop. HW Valve
DD14= VV550 DDC Ctrl - On/Off Electric Heat
DD15= VV550 DDC Ctrl w/Pulse Width Modulation
DD17= VV550 DDC Ctrl w/N.O. On/Off HW Valve
DD23= VV550 DDC- Basic plus- Local (Electric heat- PWM) Remote (Staged EH)
DD28= VV550 DDC-Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.O. 2-position)
DD29= VV550 DDC-Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.C. 2-position)
DD30= VV550 DDC-Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.C. 2-position)
DD31= VV550 DDC-Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.O. 2-position)
DD32= VV550 DDC-Basic plus- Local (Electric heat- Staged) Remote (Staged EH)
DD41= UC400 DDC-Basic (No water or electric heat)
DD42= UC400 DDC-Basic (Water heat- Normally Closed- 2 position)
DD43= UC400 DDC-Basic (Water heat- Modulating)
DD44= UC400 DDC-Basic (Electric heat- staged)
DD45= UC400 DDC-Basic (Electric heat- PWM)
DD47= UC400 DDC-Basic (Water heat- Normally Opened- 2 position)
DD53= UC400 DDC-Basic plus- Local (Electric heat- PWM) Remote (Staged EH)
DD58= UC400 DDC-Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.O. 2-position)
DD59= UC400 DDC-Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.C. 2-position)
DD60= UC400 DDC-Basic plus- Local (Water heat- N.O. 2-position) Remote (Water- N.C. 2-position)
DD61= UC400 DDC-Basic plus- Local (Water heat- N.C. 2-position) Remote (Water- N.O. 2-position)
DD62= UC400 DDC-Basic plus- Local (Electric heat- Staged) Remote (Staged EH)
DD65= Basic (Electric Heat- Modulating SCR)
DD66= Basic plus – Local (Electric heat – Modulating SCR) Remote (Staged EH)
DD71= UC210 DDC-Basic (Cooling only)
DD72= UC210 DDC-Basic (Water heat-nc 2pos)
DD73= UC210 DDC-Basic (Water heat-Modulating)
DD74= UC210 DDC-Basic (Electric heat-staged)
DD75= UC210 DDC-Basic (Electric heat-pwm)
DD77= UC210 DDC-Basic (Water heat-NO 2pos)
DD83= UC210 DDC-Basic+ Local (Electric heat-pwm) Remote (Staged)
DD84= UC210 DDC-Basic+ Local (Water heat Modulating) Remote (Water-NC 2pos)
DD85= UC210 DDC-Basic+ Local (Water heat Modulating) Remote (Water-NO 2pos)
DD86= UC210 DDC-Basic+ Local (Water heat NO 2pos) Remote (Water-Modulating)
DD87= UC210 DDC-Basic+ Local (Water heat NC 2pos) Remote (Water-Modulating)
DD88= UC210 DDC-Basic+ Local (Water heat NO 2pos) Remote (Water-NO 2pos)
DD89= UC210 DDC-Basic+ Local (Water heat NC 2pos) Remote (Water-NC 2pos)
DD90= UC210 DDC-Basic+ Local (Water heat NO 2pos) Remote (Water-NC 2pos)
DD91= UC210 DDC-Basic+ Local (Water heat NC 2pos) Remote (Water-NO 2pos)
DD92= UC210 DDC-Basic+ Local (Electric heat-staged) Remote (Staged)
DD95= UC210 DDC-Ctrl w/Modulating SCR
DD96= UC210 DDC-Space Temp Ctrl w/ Local SCR & Remote Stge Elec Heat
DD00= Trane Actuator Only
ENCL= Shaft Only in Enclosure
ENON= Shaft Out Side for Electric Units
FM00= Other Actuator and Control
FM01= Trane supplied actuator, other control
PN00= N.O. Actuator and Linkage Only
PN05= N.O. 3000 Series, RA Stat
PN51= Pneumatic normally open w/3011,DPS fan
PN52= Pneumatic normally open w/3011, DPM fan
PNON= Shaft Out Side for Pneumatic Units
N.C. = Normally-closed
N.O. = Normally-opened
DA Stat = Direct-acting pneumatic t-stat (by others)
RA Stat = Reverse-acting pneumatic t-stat (by others)
PN = Pneumatic
FM = Factory installation of customer-supplied controller
PVR = Pneumatic Volume Regulator

Digit 16—Insulation

A = 1/2” Matte-faced
B = 1" Matte-faced
D = 1" Foil-faced
F = 1" Double-wall
G = 3/8” Closed-cell

Digit 17—Motor Type

D = PSC Motor
E = High-efficiency motor (ECM)

Digit 18—Motor Voltage

1 = 115/60/1
2 = 277/60/1
3 = 347/60/1
4 = 208/60/1
5 = 230/50/1

Digit 19—Outlet Connection

1 = Flanged
2 = Slip & Drive

Digit 20—Attenuator

0 = No Attenuator
W = With Attenuator

Digit 21—Water Coil

0 = None
1 = 1-Row–Plenum inlet installed RH
2 = 2-Row–Plenum inlet installed RH
3 = 1-Row–Discharge installed, LH
4 = 1-Row–Discharge installed, RH
5 = 2-Row–Discharge installed, LH
6 = 2-Row–Discharge installed, RH1
A = 1-Row–Premium water coil inlet
B = 2-Row–Premium water coil inlet
C = 1-Row–Premium hot coil on discharge, LH
D = 1-Row–Premium hot coil on discharge, RH
E = 2-Row–Premium hot coil on discharge, LH
F = 2-Row–Premium hot coil on discharge, RH

Note: *1- and 2-row not available with Low-Height*

Digit 22—Electrical Connections

L = Left (Airflow hitting you in the face)
R = Right (Airflow hitting you in the face)
W = Narrow Corridor LH, Hi-Volt Inlet Facing
X = Narrow Corridor RH, Hi-Volt Inlet Facing

Note: *(W & X) Fan Powered Series Only*

Digit 23—Transformer

0 = N/A (provided as standard)

Digit 24—Disconnect Switch

0 = None
W = With
Electric Reheat w/ door interlocking power disconnect, Cooling Only and Water Reheat w/ toggle disconnect

Digit 25—Power Fuse

0 = None
W = With

Digit 26—Electric Heat Voltage

0 = None
A = 208/60/1
B = 208/60/3
C = 240/60/1
D = 277/60/1
E = 480/60/1
F = 480/60/3
G = 347/60/1
H = 575/60/3
J = 380/50/3
K = 120/60/1

Note: *K not available with Low Height*

Digit 27, 28, 29—Electric Heat kW

000 = None
050 = 0.5 kW
010 = 1.0 kW
015 = 1.5 kW
260 = 26.0 kW

Note: *Electric Heat Voltage -*
0.5 to 8.0 kW–½ kW increments
8.0 to 18.0 kW –1 kW increments
18.0 to 46.0 kW–2 kW increments

Digit 30—Electric Heat Stages

0 = None
1 = 1 Stage
2 = 2 Stages Equal
3 = 3 Stages Equal

Note: *3 not available with Low Height*

Digit 31—Contactors

0 = None
1 = 24-volt magnetic
2 = 24-volt mercury
3 = PE with magnetic
4 = PE with mercury
5 = SCR heat UC400
6 = SCR heat FMTD/ENCL/DD00

Note: *SCR cannot be selected with the following configuration:*

- KW > 10, 208 volt 3 phase, Low Height
- KW > 22, 480 volt 3 phase, Low Height
- Voltage = 575 volt

Digit 32—Airflow Switch

0 = None
W = With

Digit 33—Not Used

0 = N/A

Digit 34—Actuator

0 = Standard
A = Belimo actuator

Digit 35—Wireless Sensors

0 = None
1 = Factory Mounted Wireless Receiver (Sensor Assembly)
2 = Wireless Comm Interface Modular FM

Note: *All sensors selected in accessories*

Digit 36—Pre-Wired Factory Solutions

0 = None
1 = Factory Mounted DTS
2 = HW Valve Harness
3 = Both DTS & HW Valve Harness

Selection Procedure

This section describes elements and process required to properly select fan-powered VAV terminals, and includes a specific examples. Selection procedure is iterative in nature which makes computer selection desirable. Selection of fan-powered VAV terminals involves four elements:

- Air valve selection
- Heating coil selection
- Fan size and selection
- Acoustics

Note: *Use the same procedures for selecting Low-Height Fan-Powered Units.*

Air Valve Selection

Provided in the Performance Data—Air Pressure Requirements section of the catalog is the unit air pressure drop at varying airflows. To select an air valve, determine the airflow required at design cooling. Next, select an air valve diameter that will allow proper airflow modulation, (a velocity of 1600 – 2000 FPM is recommended). Keep in mind that **modulation below 300 FPM is not recommended.** Proper selection requires defining the minimum valve airflow (in either heating or cooling) and maintaining at least 300 FPM through the air valve. The minimum is typically set based on ventilation requirements. If zone ventilation does not come through the VAV unit, a minimum valve position can also be zero.

Heating Coil Selection

Supply Air Temperature

The first step required when selecting a heating coil is to determine the heating supply air temperature to the space, calculated using the heat transfer equation. A recommended value is 90°F, although values between 85°F and 95°F are common. Discharge air temperatures that exceed 20 degrees above space temperature are not recommended for proper diffuser operation. Air temperature difference is defined as the heating supply air temperature to the space minus the winter room design temperature. The zone design heat loss rate is denoted by the letter Q. Supply air temperature to the space equals the leaving air temperature (LAT) for the terminal unit.

Coil Leaving Air Temperature

Once the terminal unit LAT is determined, the heating requirements for the coil can be calculated. The leaving air temperature for the coil of a parallel fan-powered terminal unit varies based on the type of unit installed heat being selected. Series unit leaving air temperatures do not vary because in each case the coil is located on the unit discharge.

Electric coil LAT equals terminal unit LAT because the coil is located on the unit discharge. Hot water coils can be located on either the discharge or, for maximum system efficiency, the plenum inlet when located on the entering air side of the fan. Coil LAT is calculated using a mixing equation. Given the unit heating airflow and LAT, minimum primary airflow at its supply air temperature, and the volume of heated plenum air, the leaving air temperature for the hot water coil can be determined (see the unit selection example that follows for more details).

Coil Entering Air Temperature

The entering air temperature (EAT) to the coil also varies based on the coil position on the unit for parallel units. The unit heat is mounted on the discharge of a series unit. Therefore the EAT equals the temperature of blended primary and plenum air.

Parallel electric coils are mounted on the unit discharge. Hot water coils can be mounted on the discharge or on the plenum inlet. Plenum inlet mounting creates a more efficient VAV system. This is because the parallel fan is energized only when in heating mode, and thus, when in cooling mode, the water coil is not in the airstream.

The EAT for discharge mounted coils equals the temperature of blended primary air and plenum air. For plenum inlet mounted water coils, the EAT equals the plenum air temperature.

Capacity Requirement

Once both coil EAT and LAT are determined, the heat transfer (Q) for the coil must be calculated using the heat transfer equation. For electric heat units, the Q value must be converted from Btu to kW for heater selection. The required kW should be compared to availability charts in the performance data section for the unit selected. For hot water heat units, reference the capacity charts in the performance data section for the required heat transfer Q and airflow to pick the appropriate coil.

Fan Size and Selection

Fan Airflow

Fan airflow is determined by calculating the difference between the unit design heating airflow and minimum primary airflow.

Fan External Static Pressure

Fan external static pressure is the total resistance experienced by the fan, which may include downstream ductwork and diffusers, heating coils, and sound attenuators. As total airflow varies so will static pressure, making calculation of external static pressure dependent on unit type.

In many applications of parallel terminals, a minimum primary airflow must be maintained to meet ventilation requirements. This primary airflow contributes to the total resistance experienced by the fan and should be accounted for in all components downstream of the fan itself, including electric coils. Hot water coils positioned on the fan inlet are not affected by the additional primary airflow. The static pressure resistance experienced by the fan due to the hot water coil is based on fan airflow only, not the total heating airflow.

With series fan-powered terminal units, all airflow passes through the fan. External static pressure requirements are the sum of the individual component pressure retirements at the design airflow of the unit.

Fan Motor Type

The fan motor type that will be used for the unit will need to be known before fan selection can begin. The ECM motor offers more efficient operation than the standard single-speed PSC motor and will use different fan curves. Because series fans operate in both heating and cooling mode, payback is typically 2–3 years for the premium ECM option. Refer to the Features and Benefits section to determine which motor is more appropriate for the unit

Selection

Once fan airflow and external static pressure are determined, reference the fan curves in the performance data section. Cross plot both airflow and external static pressure on each applicable graph. A selection between the minimum and maximum airflow ranges for the fan is required.

It is common to identify more than one fan that can meet the design requirements. Typically, selection begins with the smallest fan available to meet capacity. If this selection does not meet acoustical requirements, upsizing the fan and operating it at a slower speed can be done for quieter operation.

Acoustics

Air Valve Generated Noise

To determine the noise generated by the air valve, two pieces of information are required; design airflow and design air pressure drop. The design air pressure drop is determined by taking the difference between design inlet and static pressure (the valve's most over-pressurized condition) and external static pressure at design cooling flow. This represents a worst-case operating condition for the valve.

Fan Generated Noise

To determine fan noise levels, fan airflow, external static pressure and speed information is required.

Evaluation Elements

For parallel fan-powered terminal units, the air valve and fan operation must be evaluated separately because these operations are not simultaneous. For Series fan-powered units, the air valve and fan are evaluated together because they have simultaneous operation. Access the appropriate acoustics table(s) of the catalog and determine the sound power and NC prediction for both the discharge and radiated paths. It is important to understand that discharge air noise is generally not a concern with fan-powered terminals. Radiated noise from the unit casing typically dictates the noise level of the space. If the entire unit or any element of it is generating noise in excess of the Noise Criteria requirements, the size of the appropriate portion of the terminal should be increased. Because the selection procedure is iterative, care should be taken by the designer to confirm that the change in selection does not affect other elements of the unit or system design.

Selection Example—Parallel With Hot Water Heat

Air Valve Selection

Design Cooling Airflow:1000 cfm
Minimum Ventilation Airflow: 200 cfm
Maximum Unit APD: 0.25 in. wg
Choose 10" air valve
Check – Is minimum airflow above 300 FPM? Guidelines, FPP 8)
A 10" air valve is selected with unit pressure drop = 0.01 in. wg

Heating Coil Selection

Required Information:
Zone design heat loss: 20000 Btu
Unit heating airflow: 600 cfm
Winter room design temp.: 68°F
Coil entering water temp.: 180°F
Minimum primary airflow: 200 cfm
Fan Airflow: 400 cfm
Plenum temperature: 70°F
Coil flow rate: 2 gpm
Primary air temperature: 55°F

Heat Transfer Equation (Btu)

Q = 1.085 x Cfm x D Temperature

For the heating zone, the temperature difference is the zone supply air temperature (SAT) minus the winter room design temperature.

18000 Btu = 1.085 x 600 x (SAT - 68°F)
SAT = 95.6°F

Because the designer chose to maximize system efficiency by having the hot water coil on the plenum inlet, the unit supply air temperature is equal to the mix of the heated plenum air from the fan and the minimum primary airflow.

600 cfm x 95.6°F =
200 cfm x 55°F +
(600 cfm - 200 cfm) x Coil LAT

Coil LAT = 116°F

For the heating coil, the temperature difference is the calculated coil LAT minus the coil EAT (Plenum Air Temperature).
Coil Q = 1.085 x 400 x (116-70) = 19,964 Btu = 19.96 Mbh

Coil Performance Table

Selection:
Size 02SQ fan, 1-row coil with 2 gpm =20.53 Mbh (at 400 cfm)

1-row coil with 2 gpm = 2.57 ft WPD

Fan Selection

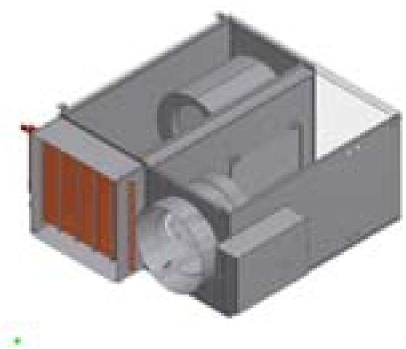
Required Information:

Design airflow: 400 cfm
Downstream static pressure at design airflow: 0.25 in. wg

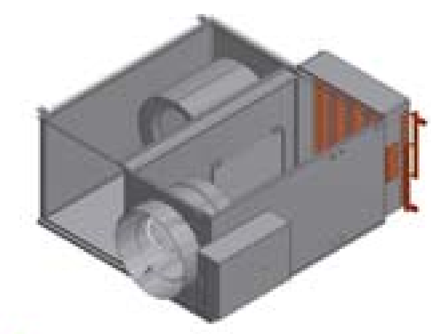
Fan external static pressure equals downstream static pressure (ductwork and diffusers) plus coil static pressure. The coil static pressure that the fan experiences is at the fan airflow (400 cfm). The downstream static pressure the fan experiences is at fan airflow plus minimum primary airflow. The sum of fan airflow and minimum primary airflow (600 cfm) is less than design airflow (1000 cfm) and therefore the 0.25 in. wg downstream static pressure at design airflow must be adjusted for the lower heating airflow.

Parallel Fan-Powered Unit with Water Coil (2 Options)

Plenum Inlet Mounted



Discharge Mounted



Using Fan Law Two:
Heating Downstream Static Pressure = (600/1000)2 x 0.25 = .09 in. wg

A size 02SQ fan has the capability to deliver approximately 650 cfm at 0.09 downstream static pressure. If an attenuator is required, use the attenuator air pressure drop tables to define additional fan static pressure.

Acoustics
Required Information:

Design inlet static press.: 1.0 in. wg
NC criteria: NC-35

The selection is a VPWF Parallel Fan-powered Terminal Unit, 10" primary, parallel fan size 02SQ, with a 1-row hot water coil.

Determine the casing radiated noise level because it typically dictates the sound level (NC) of the space. With a parallel unit, two operating conditions must be considered, design cooling and design heating.

Design Cooling (1000 cfm). Radiated valve typically sets the NC for parallel units in cooling mode. The closest tabulated condition (1100 cfm at 1.0 in. wg ISP) has an NC=31. (A more accurate selection can be done via TOPSS electronic selection program.):

Table 2. Selection Program Output (Radiated Valve):

Octave Band	2	3	4	5	6	7	NC
Sound Power	65	60	53	48	41	32	30

Design Heating (200 cfm valve, 400 cfm fan, 0.25 in. wg DSP). Radiated fan typically sets the NC for parallel units in heating mode. The closest cataloged condition (430 fan cfm , 0.25 in. wg DSP) has an NC=32. (A more accurate selection can be done via TOPSS electronic selection program.)

Table 3. Selection Program Output (Radiated Fan):

Octave Band	2	3	4	5	6	7	NC
Sound Power	66	58	56	52	48	41	31

The predicted NC level for design cooling is NC-30 and for design heating is NC-31. If the catalog path attenuation assumptions are acceptable, this unit meets all of the design requirements and the selection process is complete.

Computer Selection

The advent of personal computers has served to automate many processes that were previously repetitive and time-consuming. One of those tasks is the proper scheduling, sizing, and selection of VAV terminal units. Trane has developed a computer program to perform these tasks. The software is called the Trane Official Product Selection System (TOPSS).

The TOPSS program will take the input specifications and output the properly sized VariTrane VAV terminal unit along with the specific performance for that size unit.

The program has several required fields, denoted by red shading in the TOPSS screen, and many other optional fields to meet the criteria you have. Required values include maximum and minimum airflows, control type, and model. If selecting models with reheat, you will be required to enter information to make that selection also. The user is given the option to look at all the information for one selection on one screen or as a schedule with the other VAV units on the job.

The user can select single-duct, dual-duct, and fan-powered VAV boxes with the program, as well as most other Trane products, allowing you to select all your Trane equipment with one software program.

The program will also calculate sound power data for the selected terminal unit. The user can enter a maximum individual sound level for each octave band or a maximum NC value. The program will calculate acoustical data subject to default or user supplied sound attenuation data.

Schedule View

The program has many time-saving features such as:

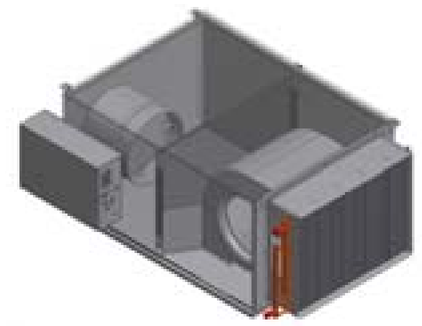
- Copy/Paste from spreadsheets like Microsoft® Excel
- Easily arranged fields to match your schedule
- Time-saving templates to store default settings

The user can also export the Schedule View to Excel to modify and put into a CAD drawing as a schedule.

Specific details regarding the program, its operation, and how to obtain a copy of it are available from your local Trane sales office.

Selection Example—Series With Hot Water Heat and ECM

Air Valve Selection



Required Information: Design cooling airflow: 1000 cfm
Minimum ventilation airflow: 200 cfm
Maximum unit APD: 0.40 in. wg

A 10" air valve is selected.

Check–is minimum airflow above 300 FPM?

Answer–Yes. Minimum cfm allowable = 165 cfm. (See General Data—Valve/Controller Guidelines pp FPS 8).

The 03SQ fan will be used in this instance. By interpolating, you can choose a 10" air valve with wide-open air pressure drop of 0.32 in. wg.

Heating Coil Selection

Required Information: Zone design heat loss: 30000 Btu
Design heating airflow: 1000 cfm
Winter room design temp.: 68°F
Coil entering water temp.: 180°F
Minimum primary airflow: 200 cfm
Plenum temperature: 70°F
Primary air temperature: 55°F
Coil flow rate: 2 gpm
Heat Transfer Equation (Btu) Q = 1.085 x Cfm x Δ Temperature

For the heating zone, the temperature difference is the zone supply air temperature (SAT) minus the winter room design temperature.

30000 Btu = 1.085 x 1000 x (SAT-68°F)
SAT = 96°F

Because the hot water coil is on the unit discharge of a series fan-powered unit, the unit supply air temperature is equal to the coil LAT. Coil entering air temperature (EAT) is a mix of plenum air and the minimum primary airflow.

1000 cfm x Coil EAT = 200 cfm x 55°F + (1000 cfm - 200 cfm) x 70°F

Coil EAT = 67°F

For the heating coil, the temperature difference is the calculated coil LAT minus the coil EAT (Plenum Air Temperature).

Coil Q =1.085 x 1000 x (96-70) = 31,465 Btu

On a series unit the hot water coil is located on the discharge, so the total heating airflow, 1000 cfm, passes through the coil.

Coil Performance Table

Selection:
Performance:
Size 03SQ fan, 1-row coil at 2 gpm = 32.23 MBh
1-row Coil at 2 gpm= 0.83 ft WPD

Fan Selection

Required Information. Fan airflow: 1000 cfm
Downstream static pressure at design airflow: 0.25 in. wg

A size 03SQ fan can operate at up to 1150 cfm (1-row coil) or 1100 (2-row coil) and 0.25" downstream static pressure. Inlet and coil selections should be verified with TOPSS electronic selections.

If an attenuator is required, use attenuator air pressure drop tables to define additional fan static pressure.

Acoustics

Required Information. Design inlet static press: 0.75 in. wg
NC criteria (general office space): NC-40

The selection is a VSWF Series Fan-Powered Terminal Unit, 10" primary, series fan size 03SQ, with a 1-row hot water coil.

Determine the casing radiated noise level because it typically dictates the sound level (NC) of the space. With a series unit, the air valve and fan operate simultaneously, so the chart for air valve and fan sound data must be consulted.

The results in the below table are for the acoustics value of a size 10" air valve with a size 03SQ fan.

The predicted NC level for design conditions is NC-38.

Octave Band	2	3	4	5	6	7	NC
Sound Power	70	65	63	61	59	59	38

Note: *Ensure water coil acoustical impact is considered. For this example, the appurtenance effect adds one (1) NC to fan-only radiated sound. Because this does not set NC for this selection, it can be overlooked. The addition of an attenuator (see same appurtenance effect tables reduces the NC four (4) points, resulting in a final selection NC = 30 (if required).*

Note: *Do not overlook the water coil impact on acoustics. A good rule of thumb is that it will add 1 to 2 NC to "fan only" radiated sound for most applications.*

Computer Selection

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User can select single-duct, dual-duct, and fan-powered VAV boxes with the program, as well as most other Trane products, allowing selection of all Trane equipment with one software program.

The program will also calculate sound power data for the selected terminal unit. The user can enter a maximum individual sound level for each octave band or a maximum NC value. The program will calculate acoustical data subject to default or user supplied sound attenuation data.

Schedule View

The program has many time-saving features such as:

- Copy/Paste from spreadsheets like Microsoft® Excel
- Easily arranged fields to match your schedule
- Time-saving templates to store default settings

User can also export Schedule View to Excel to modify and put into a CAD drawing as a schedule.

Specific details regarding program, its operation, and how to obtain a copy of it are available from your local Trane sales office.

Performance Data

Parallel Fan-Powered Terminal Units

Table 4. Primary airflow control factory setting-I-P

Control Type	Air Valve Size (in.)	Maximum Valve Cfm	Maximum Controller Cfm	Minimum Controller Cfm	Constant Volume Cfm
Direct Digital Control/ UCM	5	350	40-350	0, 40-350	40-350
	6	500	60-500	0, 60-500	60-500
	8	900	105-900	0, 105-900	105-900
	10	1400	165-1400	0, 165-1400	165-1400
	12	2000	240-2000	0, 240-2000	240-2000
	14	3000	320-3000	0, 320-3000	320-3000
	16	4000	420-4000	0, 420-4000	420-4000
Pneumatic with Volume Regulator	5	350	63-350	0, 63-350	63-350
	6	500	73-500	0, 73-500	73-500
	8	900	134-900	0, 134-900	134-900
	10	1400	215-1400	0, 215-1400	215-1400
	12	2000	300-2000	0, 300-2000	300-2000
	14	2885	408-2887	0, 408-2887	408-2887
	16	3785	536-3789	0, 536-3789	536-3789

Note: Maximum airflow must be greater than or equal to minimum airflow.

Table 5. Primary airflow control factory settings – SI

Control Type	Air Valve Size (in.)	Maximum Valve L/s	Maximum Controller L/s	Minimum Controller L/s	Constant Volume L/s
Direct Digital Control/ UCM	5	165	19-165	0, 19-350	19-350
	6	236	28-236	0, 28-236	28-236
	8	425	50-425	0, 50-425	50-425
	10	661	77-661	0, 77-661	77-661
	12	944	111-944	0, 111-944	111-944
	14	1416	151-1416	0, 151-1416	151-1416
	16	1888	198-1888	0, 198-1888	198-1888
Pneumatic with Volume Regulator	5	165	30-165	0, 30-165	30-165
	6	236	35-236	0, 35-236	35-236
	8	425	63-425	0, 63-425	63-425
	10	661	102-661	0, 102-661	102-661
	12	944	141-944	0, 141-944	141-944
	14	1362	193-1363	0, 193-1363	193-1363
	16	1787	253-1788	0, 253-1788	253-1788

Note: Maximum airflow must be greater than or equal to minimum airflow.

Table 6. Unit air pressure drop – in. wg (I-P)

Fan/Inlet Size	Airflow Cfm	Cooling Only
02SQ-05	40	0.01
	150	0.03
	250	0.08
	350	0.17
02SQ-06	60	0.01
	200	0.05
	350	0.17
	500	0.35
02SQ-08	105	0.01
	350	0.03
	600	0.09
	900	0.21

Fan/Inlet Size	Airflow Cfm	Cooling Only
04SQ-14	320	0.01
	1200	0.01
	2100	0.01
	3000	0.01
05SQ-10	165	0.01
	550	0.01
	950	0.02
	1400	0.05
05SQ-12	240	0.01
	750	0.01
	1350	0.01
	2000	0.01

Note: Unit pressure drops do not include hot water coil or attenuator pressure drops.

Table 6. Unit air pressure drop – in. wg (I-P) (continued)

Fan/Inlet Size	Airflow Cfm	Cooling Only
02SQ-10	165	0.01
	550	0.01
	950	0.01
	1400	0.01
03SQ-06	60	0.01
	200	0.06
	350	0.19
	500	0.40
03SQ-08	105	0.01
	350	0.03
	600	0.08
	900	0.20
03SQ-10	165	0.01
	550	0.01
	950	0.02
	1400	0.05
03SQ-12	240	0.01
	750	0.01
	1350	0.01
	2000	0.01
04SQ-08	105	0.01
	350	0.03
	600	0.08
	900	0.20
04SQ-10	165	0.01
	550	0.01
	950	0.02
	1400	0.05
04SQ-12	240	0.01
	750	0.01
	1350	0.01
	2000	0.01
05SQ-14	320	0.01
	1200	0.01
	2100	0.01
	3000	0.01
06SQ-10	165	0.01
	550	0.01
	950	0.01
	1400	0.01
06SQ-12	240	0.01
	750	0.01
	1350	0.01
	2000	0.01
06SQ-14	320	0.01
	1200	0.01
	2100	0.01
	3000	0.01
06SQ-16	420	0.01
	1600	0.01
	2800	0.01
	4000	0.01
07SQ-10	165	0.01
	550	0.01
	950	0.01
	1400	0.01
07SQ-12	240	0.01
	750	0.01
	1350	0.01
	2000	0.01
07SQ-14	320	0.01
	1200	0.01
	2100	0.01
	3000	0.01
07SQ-16	420	0.01
	1600	0.01
	2800	0.01
	4000	0.01

Note: Unit pressure drops do not include hot water coil or attenuator pressure drops.

Table 7. Coil air pressure drop – in. wg (I-P)

Fan Size	Airflow Cfm	1-Row HW (in. wg)	2-Row HW (in. wg)
02SQ	100	0.00	0.00
	200	0.01	0.01
	300	0.01	0.02
	400	0.02	0.03
	500	0.02	0.05
03SQ 04SQ 05SQ	250	0.01	0.02
	500	0.02	0.04
	750	0.04	0.08
	1000	0.07	0.13
	1250	0.10	0.19
	1400	0.12	0.23
06SQ 07SQ	600	0.02	0.04
	900	0.04	0.07
	1200	0.06	0.11
	1500	0.09	0.16
	1800	0.12	0.22
	2000	0.15	0.27

Note: HW Coil Only pressure drops do not include unit pressure drop.

Table 8. Attenuator air pressure drop (I-P)

Fan Size	Plenum Cfm	Attenuator
02SQ	50	0.00
	200	0.00
	350	0.01
	500	0.02
	650	0.04
	750	0.06
03SQ	50	0.00
	250	0.00
	500	0.00
	750	0.00
	1000	0.01
	1200	0.06
04SQ	50	0.00
	300	0.01
	600	0.02
	900	0.03
	1200	0.05
	1450	0.06

Fan Size	Plenum Cfm	Attenuator
05SQ	50	0.00
	300	0.00
	600	0.02
	900	0.06
	1200	0.13
	1550	0.24
06SQ	50	0.00
	500	0.01
	900	0.03
	1300	0.06
	1650	0.10
	1900	0.14
07SQ	50	0.00
	500	0.01
	1000	0.04
	1500	0.08
	2000	0.15
	2500	0.25

Note: Plenum cfm = (Fan cfm)

Table 9. Attenuator air pressure drop (SI)

Fan Size	Plenum L/s	Attenuator
02SQ	24	0
	94	0
	165	2
	236	5
	307	10
	354	14
03SQ	24	0
	118	0
	236	0
	354	0
	472	2
	566	14
04SQ	24	0
	142	3
	283	5
	425	8
	566	11
	684	14

Fan Size	Plenum L/s	Attenuator
05SQ	24	0
	142	1
	283	5
	425	15
	566	32
	731	61
06SQ	24	0
	236	2
	425	7
	613	15
	779	26
	897	35
07SQ	24	0
	236	2
	472	9
	708	21
	944	38
	1180	62

Note: Plenum cfm = (Fan cfm)

Table 10. Coil air pressure drop – Pa (SI)

Fan Size	Airflow L/s	1-Row HW (Pa)	2-Row HW (Pa)
02SQ	200	0	1
	300	1	3
	400	2	5
	500	4	8
	600	6	12
03SQ 04SQ 05SQ	118	2	4
	236	5	11
	354	10	21
	472	17	33
	590	25	47
	661	31	57

Table 10. Coil air pressure drop – Pa (SI)

06SQ 07SQ	900	5	10
	1200	9	18
	1500	15	28
	1800	22	41
	2150	30	56
	2500	36	67

Note: HW Coil Only pressure drops do not include unit pressure drop.

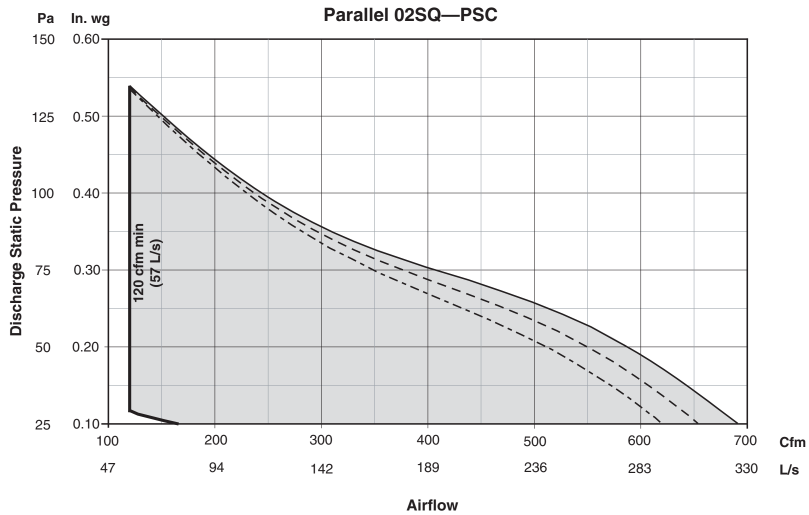
Table 11. Unit air pressure drop-Pa (SI)

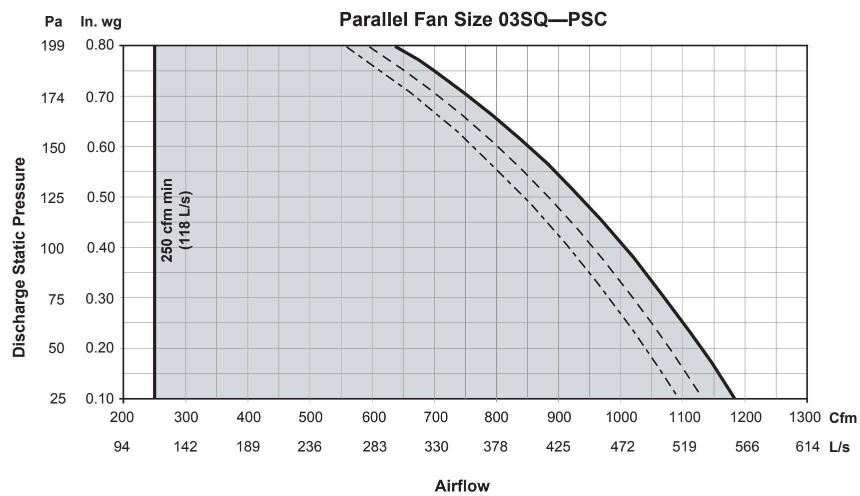
Fan/Inlet Size	Airflow L/s	Cooling Only
02SQ-05	19	2
	71	7
	118	20
	165	41
02SQ-06	28	2
	94	13
	165	41
	236	86
02SQ-08	50	2
	165	8
	283	23
	425	51
02SQ-10	78	2
	260	2
	448	2
	661	3
03SQ-06	28	2
	94	15
	165	48
	236	99
03SQ-08	50	2
	165	6
	283	21
	425	49
03SQ-10	78	2
	260	2
	448	6
	661	13
03SQ-12	113	2
	354	2
	637	2
	944	2
04SQ-08	50	2
	165	6
	283	21
	425	49
04SQ-10	78	2
	260	2
	448	6
	661	13
04SQ-12	113	2
	354	2
	637	2
	944	2

Fan/Inlet Size	Airflow L/s	Cooling Only
04SQ-14	151	2
	566	2
	991	2
	1416	2
05SQ-10	78	2
	260	2
	448	6
	661	13
05SQ-12	113	2
	354	2
	637	2
	944	2
05SQ-14	151	2
	566	2
	991	2
	1416	2
06SQ-10	78	2
	260	2
	448	2
	661	2
06SQ-12	113	2
	354	2
	637	2
	944	2
06SQ-14	151	2
	566	2
	991	2
	1416	2
06SQ-16	198	2
	755	2
	1321	2
	1888	2
07SQ-10	78	2
	260	2
	448	2
	661	2
07SQ-12	113	2
	354	2
	637	2
	944	2
07SQ-14	151	2
	566	2
	991	2
	1416	2
07SQ-16	198	2
	755	2
	1321	2
	1888	2

Note: Unit pressure drops do not include hot water coil or attenuator pressure drops.

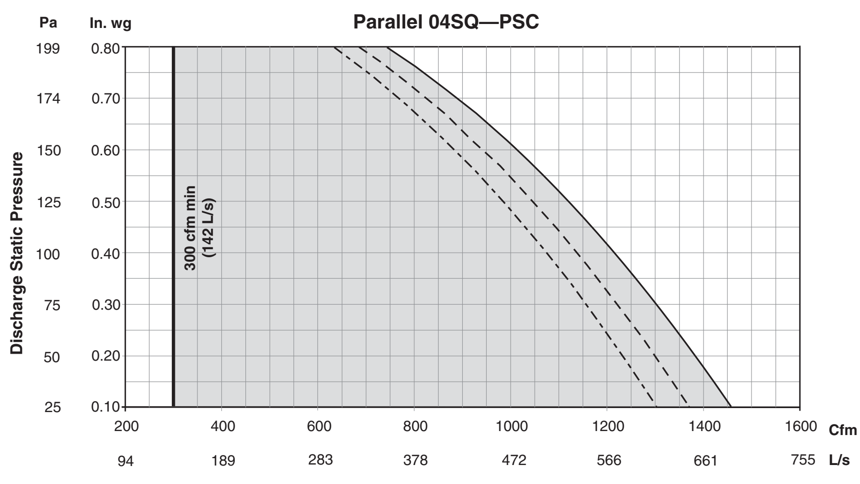
Performance Data

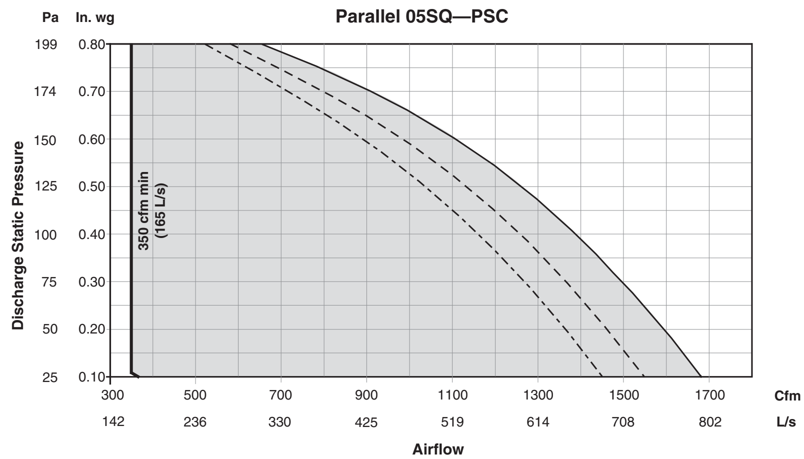


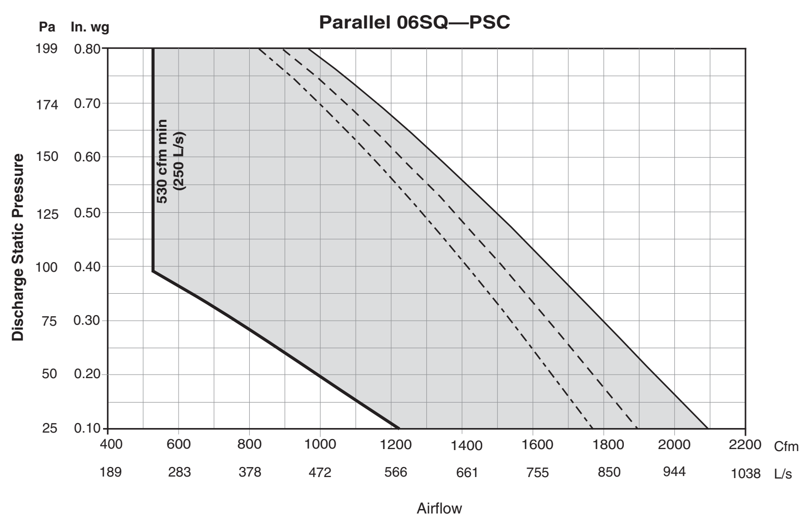


VPCF and VPEF maximum
Minimum
1-row coil maximum
2-row coil maximum

Note: When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.

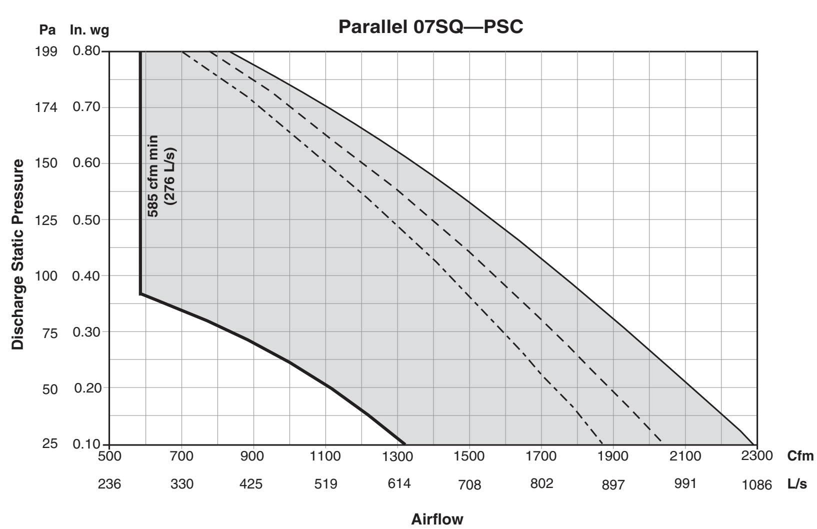




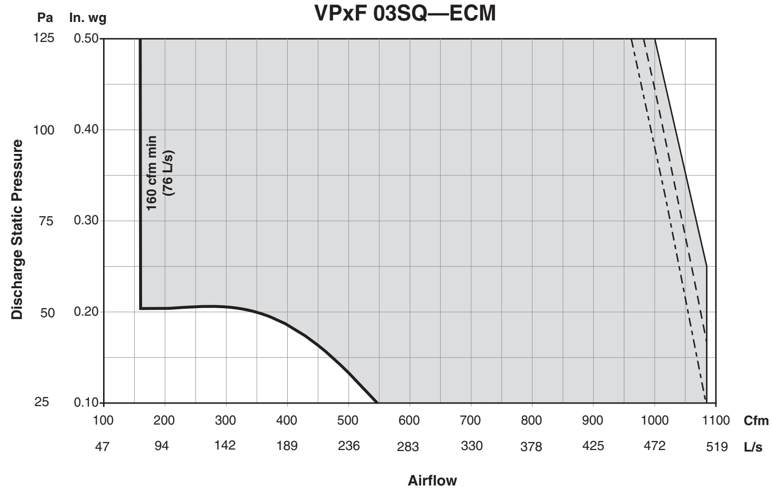


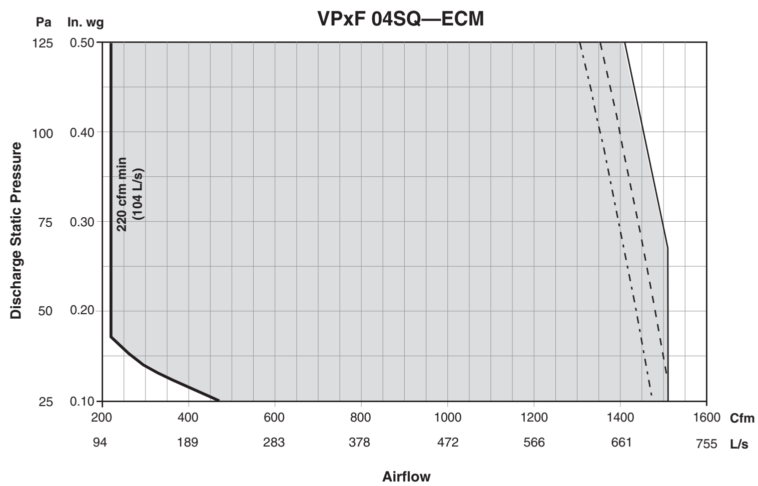
———	VPCF and VPEF maximum
▬▬▬	Minimum
— — —	1-row coil maximum
— · — ·	2-row coil maximum

Note: When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.



Performance Data

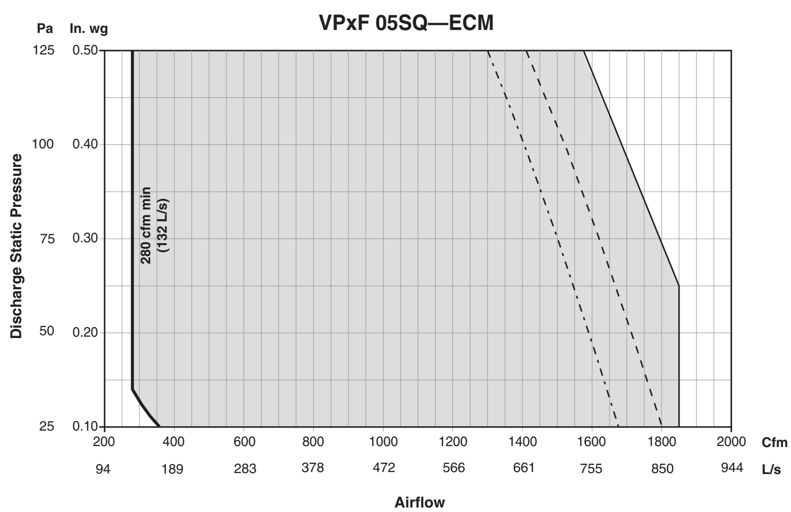


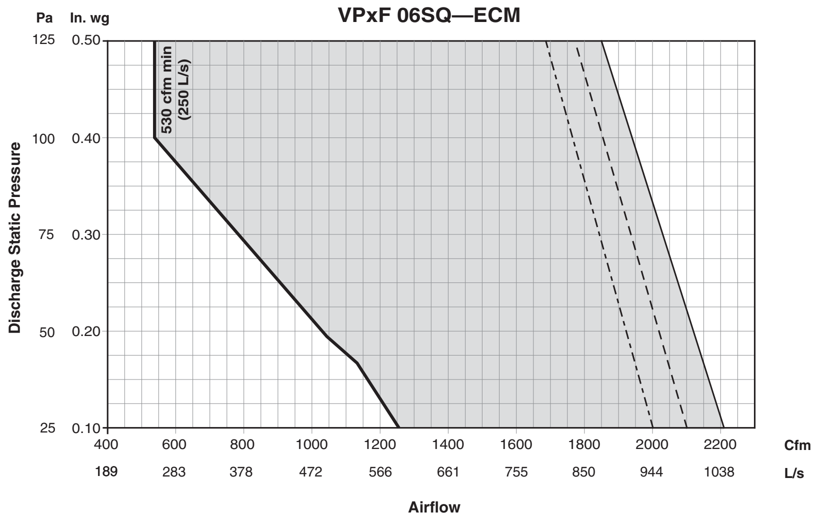


———	VPCF and VPEF maximum
———	Minimum
— — —	1-row coil maximum
— · — ·	2-row coil maximum

Notes:

1. ECMs (Electrically Commutated Motors) are ideal for systems seeking maximum motor efficiency.
2. When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.





Notes:
1. ECMs (Electrically Commutated Motors) are ideal for systems seeking maximum motor efficiency.
2. When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.

Table 12. Heating capacity (MBh) - fan size 02SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)										
			100	150	200	250	300	350	400	450	500	550	600
1-Row Capacity MBH	0.5	0.22	-	-	-	-	-	-	-	-	-	-	-
	1.0	0.76	9.20	11.49	13.14	14.45	15.56	16.52	17.38	18.16	18.93	19.64	20.30
	2.0	2.65	9.79	12.50	14.52	16.17	17.60	18.87	20.02	21.09	22.08	23.02	23.90
	3.0	5.54	10.01	12.87	15.04	16.84	18.39	19.79	21.07	22.26	23.38	24.44	25.44
	4.0	9.39	10.12	13.07	15.32	17.19	18.82	20.29	21.64	22.90	24.09	25.22	26.29
	5.0	14.17	10.19	13.19	15.49	17.41	19.09	20.60	22.00	23.30	24.54	25.71	26.83
2-Row Capacity MBH	1.0	1.30	9.97	13.83	17.07	19.81	22.13	24.13	25.85	27.35	28.67	29.83	30.86
	2.0	4.41	10.29	14.58	18.39	21.78	24.82	27.56	30.03	32.27	34.31	36.18	37.90
	3.0	9.08	10.40	14.83	18.83	22.46	25.76	28.77	31.54	34.09	36.45	38.63	40.67
	4.0	15.18	10.45	14.95	19.05	22.80	26.23	29.40	32.32	35.04	37.56	39.92	42.13
	5.0	22.66	10.48	15.03	19.18	23.00	26.52	29.78	32.80	35.62	38.25	40.72	43.03

Notes:
1. Fouling Factor = 0.0005 °F ft² h/Btu.
2. Capacity based on 70°F entering air temperature and 180°F entering water temperature.

Table 13. Heating capacity (MBh) - fan sizes 03SQ–05SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)										
			150	300	450	600	750	900	1050	1200	1350	1500	1650
1-Row Capacity MBH	1.0	0.28	-	-	-	-	-	-	-	-	-	-	-
	2.0	1.02	13.14	18.63	22.21	25.01	27.36	29.41	31.30	33.00	34.54	35.94	37.23
	3.0	2.22	13.62	19.69	23.78	27.05	29.86	32.34	34.58	36.63	38.52	40.31	41.99
	4.0	3.85	13.88	20.27	24.65	28.20	31.28	34.03	36.54	38.84	40.98	42.99	44.86
	5.0	5.92	14.04	20.64	25.21	28.95	32.21	35.14	37.82	40.31	42.62	44.80	46.85
	6.0	8.41	14.14	20.89	25.59	29.46	32.85	35.92	38.73	41.35	43.80	46.10	48.28
	7.0	11.32	14.22	21.08	25.88	29.85	33.34	36.50	39.41	42.13	44.67	47.08	49.36
	8.0	14.65	14.28	21.22	26.10	30.15	33.71	36.95	39.94	42.73	45.36	47.85	50.21
	9.0	18.40	14.33	21.33	26.28	30.38	34.01	37.31	40.36	43.22	45.91	48.46	50.89
	10.0	22.57	14.37	21.42	26.42	30.57	34.25	37.60	40.71	43.62	46.36	48.97	51.45
2-Row Capacity MBH	1.0	0.35	-	-	-	-	-	-	-	-	-	-	-
	2.0	1.28	15.08	25.87	33.70	39.58	44.13	47.77	50.73	53.20	55.29	57.08	58.63
	3.0	2.74	15.36	27.00	35.94	42.99	48.69	53.40	57.36	60.74	63.66	66.21	68.46
	4.0	4.72	15.50	27.57	37.11	44.82	51.20	56.57	61.15	65.13	68.60	71.68	74.42
	5.0	7.20	15.59	27.92	37.83	45.97	52.78	58.59	63.60	67.99	71.85	75.30	78.39
	6.0	10.18	15.64	28.15	38.31	46.74	53.87	59.99	65.32	70.00	74.15	77.87	81.23
	7.0	13.64	15.68	28.31	38.66	47.31	54.67	61.02	66.58	71.49	75.86	79.80	83.36
	8.0	17.59	15.71	28.44	38.93	47.74	55.28	61.81	67.55	72.64	77.19	81.29	85.01
	9.0	22.03	15.74	28.54	39.13	48.08	55.76	62.44	68.32	73.55	78.24	82.48	86.33
	10.0	26.94	15.76	28.62	39.30	48.35	56.15	62.95	68.95	74.30	79.10	83.45	87.42

Table 14. Heating capacity (MBh) - fan sizes 06SQ & 07SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)										
			900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900
1-Row Capacity MBH	0.5	0.11	-	-	-	-	-	-	-	-	-	-	-
	1.0	0.36	-	-	-	-	-	-	-	-	-	-	-
	2.0	1.24	32.17	33.60	34.93	36.17	37.34	38.43	39.47	40.45	41.38	42.27	43.12
	3.0	2.57	35.12	36.76	38.31	39.77	41.16	42.50	43.81	45.07	46.27	47.42	48.53
	4.0	4.32	36.78	38.60	40.32	41.95	43.51	45.01	46.44	47.82	49.14	50.42	51.68
	5.0	6.49	37.86	39.79	41.63	43.38	45.05	46.66	48.21	49.70	51.14	52.53	53.88
	6.0	9.04	38.61	40.63	42.55	44.38	46.14	47.83	49.46	51.04	52.56	54.04	55.47
	7.0	11.99	39.17	41.25	43.23	45.13	46.95	48.70	50.40	52.04	53.62	55.16	56.66
2-Row Capacity MBH	1.0	0.68	-	-	-	-	-	-	-	-	-	-	-
	2.0	2.24	51.03	53.38	55.46	57.32	58.98	60.47	61.83	63.07	64.20	65.24	66.20
	3.0	4.57	56.65	59.74	62.53	65.06	67.37	69.48	71.42	73.20	74.86	76.40	77.83
	4.0	7.59	59.73	63.27	66.50	69.46	72.18	74.69	77.02	79.18	81.19	83.08	84.84
	5.0	11.29	61.67	65.51	69.04	72.28	75.29	78.08	80.67	83.09	85.36	87.50	89.50
	6.0	15.64	63.00	67.05	70.79	74.24	77.45	80.44	83.24	85.86	88.31	90.63	92.81
	7.0	20.61	63.97	68.18	72.07	75.69	79.05	82.19	85.14	87.90	90.51	92.96	95.28

Water Coil Performance Notes (I-P)

1. Fouling Factor = 0.0005.
2. The off-coil temperature of the hot water coil on parallel fan-powered units must not exceed 140°F when mounted on plenum inlet.
3. The following equations may be used in calculating Leaving Air Temperature (LAT) and Water Temperature Difference (WTD).

$$LAT = EAT + \left(\frac{MBH \times 921.7}{Cfm}\right)$$

$$WTD = EWT - LWT = \left(\frac{2 \times MBH}{Gpm}\right)$$

4. Capacity based on 70°F entering air temperature and 180°F entering water temperature. Refer to correction factors for different entering conditions.
5. For premium coils (.020" wall), water side pressure drop increases 17% and water velocity increases 7% for fixed GPM.

Table 15. Temperature correction factors for water pressure drop (ft)

Average Water Temperature	200	190	180	170	160	150	140	130	120	110
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 16. Temperature correction factors for coil capacity (MBH)

Entering Water Minus Entering Air	40	50	60	70	80	90	100	110	120	130
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Table 17. Heating capacity (kW) - fan size 02SQ (SI)

		Water Pressure Drop	Airflow (L/s)										
Rows	L/s	(kPa)	47	71	94	118	142	165	189	212	236	260	283
1-Row Capacity kW	0.03	0.66	-	-	-	-	-	-	-	-	-	-	-
	0.06	2.26	2.69	3.37	3.85	4.24	4.56	4.84	5.09	5.32	5.55	5.76	5.76
	0.13	7.91	2.87	3.66	4.26	4.74	5.16	5.53	5.87	6.18	6.47	6.75	6.75
	0.19	16.57	2.93	3.77	4.41	4.93	5.39	5.80	6.18	6.52	6.85	7.16	7.16
	0.25	28.08	2.97	3.83	4.49	5.04	5.52	5.95	6.34	6.71	7.06	7.39	7.39
	0.32	42.34	2.99	3.87	4.54	5.10	5.59	6.04	6.45	6.83	7.19	7.53	7.53
2-Row Capacity kW	0.06	3.89	2.92	4.05	5.00	5.80	6.49	7.07	7.58	8.02	8.40	8.74	8.74
	0.13	13.19	3.02	4.27	5.39	6.38	7.27	8.08	8.80	9.46	10.06	10.60	10.60
	0.19	27.13	3.05	4.35	5.52	6.58	7.55	8.43	9.24	9.99	10.68	11.32	11.32
	0.25	45.38	3.06	4.38	5.58	6.68	7.69	8.62	9.47	10.27	11.01	11.70	11.70
	0.32	67.73	3.07	4.40	5.62	6.74	7.77	8.73	9.61	10.44	11.21	11.93	11.93

Table 18. Heating capacity (kW) - fan sizes 03SQ–05SQ (SI)

		Water Pressure	Airflow (L/s)										
Rows	L/s	Drop (kPa)	71	142	212	283	354	425	495	566	637	708	779
1-Row Capacity kW	0.06	0.82	-	-	-	-	-	-	-	-	-	-	-
	0.13	3.06	3.85	5.46	6.51	7.33	8.02	8.62	9.17	9.67	10.12	10.53	10.53
	0.19	6.63	3.99	5.77	6.97	7.93	8.75	9.48	10.14	10.74	11.29	11.81	11.81
	0.25	11.51	4.07	5.94	7.22	8.27	9.17	9.97	10.71	11.38	12.01	12.60	12.60
	0.32	17.68	4.11	6.05	7.39	8.48	9.44	10.30	11.08	11.81	12.49	13.13	13.13
	0.38	25.13	4.15	6.12	7.50	8.64	9.63	10.53	11.35	12.12	12.84	13.51	13.51
	0.44	33.83	4.17	6.18	7.58	8.75	9.77	10.70	11.55	12.35	13.09	13.80	13.80
	0.50	43.79	4.19	6.22	7.65	8.83	9.88	10.83	11.71	12.52	13.29	14.02	14.02
	0.57	55.00	4.20	6.25	7.70	8.90	9.97	10.93	11.83	12.67	13.46	14.20	14.20
	0.63	67.45	4.21	6.28	7.74	8.96	10.04	11.02	11.93	12.78	13.59	14.35	14.35
2-Row Capacity kW	0.06	1.06	-	-	-	-	-	-	-	-	-	-	-
	0.13	3.83	4.42	7.58	9.88	11.60	12.93	14.00	14.87	15.59	16.20	16.73	16.73
	0.19	8.20	4.50	7.91	10.53	12.60	14.27	15.65	16.81	17.80	18.66	19.40	19.40
	0.25	14.11	4.54	8.08	10.88	13.14	15.01	16.58	17.92	19.09	20.11	21.01	21.01
	0.32	21.52	4.57	8.18	11.09	13.47	15.47	17.17	18.64	19.92	21.06	22.07	22.07
	0.38	30.42	4.58	8.25	11.23	13.70	15.79	17.58	19.14	20.51	21.73	22.82	22.82
	0.44	40.78	4.60	8.30	11.33	13.87	16.02	17.88	19.51	20.95	22.23	23.39	23.39
	0.50	52.59	4.61	8.33	11.41	13.99	16.20	18.12	19.80	21.29	22.62	23.82	23.82
	0.57	65.84	4.61	8.36	11.47	14.09	16.34	18.30	20.02	21.56	22.93	24.17	24.17
	0.63	80.52	4.62	8.39	11.52	14.17	16.45	18.45	20.21	21.77	23.18	24.46	24.46

Table 19. Heating capacity (kW) - fan sizes 06SQ & 07SQ (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s) 425	472	519	566	613	661	708	755	802	849	897
1-Row Capacity kW	0.03	0.33	-	-	-	-	-	-	-	-	-	-	-
	0.06	1.09	-	-	-	-	-	-	-	-	-	-	-
	0.13	3.71	9.43	9.85	10.24	10.60	10.94	11.26	11.57	11.86	12.13	12.39	12.39
	0.19	7.68	10.29	10.77	11.23	11.66	12.06	12.46	12.84	13.21	13.56	13.90	13.90
	0.25	12.92	10.78	11.31	11.82	12.30	12.75	13.19	13.61	14.01	14.40	14.78	14.78
	0.32	19.39	11.10	11.66	12.20	12.71	13.20	13.67	14.13	14.57	14.99	15.40	15.40
	0.38	27.04	11.32	11.91	12.47	13.01	13.52	14.02	14.50	14.96	15.40	15.84	15.84
	0.44	35.84	11.48	12.09	12.67	13.23	13.76	14.27	14.77	15.25	15.72	16.17	16.17
2-Row Capacity kW	0.06	2.02	-	-	-	-	-	-	-	-	-	-	-
	0.13	6.70	14.96	15.64	16.25	16.80	17.28	17.72	18.12	18.48	18.82	19.12	19.12
	0.19	13.65	16.60	17.51	18.33	19.07	19.74	20.36	20.93	21.45	21.94	22.39	22.39
	0.25	22.70	17.51	18.54	19.49	20.36	21.15	21.89	22.57	23.20	23.80	24.35	24.35
	0.32	33.76	18.07	19.20	20.23	21.18	22.06	22.88	23.64	24.35	25.02	25.64	25.64
	0.38	46.74	18.46	19.65	20.75	21.76	22.70	23.58	24.39	25.16	25.88	26.56	26.56
	0.44	61.61	18.75	19.98	21.12	22.18	23.17	24.09	24.95	25.76	26.52	27.24	27.24

Water Coil Performance Notes (SI)

1. Fouling Factor = 0.0005.
2. The off-coil temperature of the hot water coil on parallel fan-powered units must not exceed 60°C when mounted on plenum inlet.
3. The following equations may be used in calculating Leaving Air Temperature (LAT) and Water Temperature Difference (WTD).

$$LAT = EAT + \left(\frac{kW \times 0.83}{L/s}\right)$$

WTD=EWT-LWT=kW/(4.19) L/s

4. Capacity based on 21°C entering air temperature and 82°C entering water temperature. Refer to correction factors for different entering conditions.
5. For premium coils (.020” wall), water side pressure drop increases 17% and water velocity increases 7% for fixed GPM.

Table 20. Temperature correction factors for water pressure drop (kPa)

Average Water Temperature	93	88	82	77	71	66	60	54	49	43
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 21. Temperature correction factors for coil capacity (kW)

Entering Water Minus Entering Air	22	27	33	38	44	50	55	61	67	72
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Series Fan-Powered Terminal Units

Table 22. Primary airflow control factory settings – I-P

Control Type	Air Valve Size (in.)	Maximum Valve Cfm	Maximum Controller Cfm	Minimum Controller Cfm	Constant Volume Cfm
Direct Digital Control/UCM	4	225	25-225	0, 25-225	25-225
	5	350	40-350	0, 40-350	40-350
	6	500	60-500	0, 60-500	60-500
	8	900	105-900	0, 105-900	105-900
	10	1400	165-1400	0, 165-1400	165-1400
	12	2000	240-2000	0, 240-2000	240-2000
	14	3000	320-3000	0, 320-3000	320-3000
	16	4000	420-4000	0, 420-4000	420-4000
Pneumatic with Volume Regulator	4	225	38-225	0, 38-225	38-225
	5	350	63-350	0, 63-350	63-350
	6	500	73-500	0, 73-500	73-500
	8	900	134-900	0, 134-900	134-900
	10	1400	215-1400	0, 215-1400	215-1400
	12	2000	300-2000	0, 300-2000	300-2000
	14	2885	408-2887	0, 408-2887	408-2887
	16	3785	536-3789	0, 536-3789	536-3789

Note: Maximum airflow must be greater than or equal to minimum airflow.

Table 23. Primary airflow control factory settings – SI

Control Type	Air Valve Size (in.)	Maximum Valve L/s	Maximum Controller L/s	Minimum Controller L/s	Constant Volume L/s
Direct Digital Control/UCM	4	106	12-106	0, 12-106	12-106
	5	165	19-165	0, 19-165	19-165
	6	236	28-236	0, 28-236	28-236
	8	425	50-425	0, 50-425	50-425
	10	661	77-661	0, 77-661	77-661
	12	944	111-944	0, 111-944	111-944
	14	1416	151-1416	0, 151-1416	151-1416
	16	1888	198-1888	0, 198-1888	198-1888
Pneumatic with Volume Regulator	4	106	18-106	0, 18-106	18-106
	5	165	30-165	0, 30-165	30-165
	6	236	35-236	0, 35-236	35-236
	8	425	63-425	0, 63-425	63-425
	10	661	102-661	0, 102-661	102-661
	12	944	141-944	0, 141-944	141-944
	14	1362	193-1363	0, 193-1363	193-1363
	16	1787	253-1788	0, 253-1788	253-1788

Note: Maximum airflow must be greater than or equal to minimum airflow.

Table 24. Unit air pressure drop – in. wg (I-P)

Fan/Inlet Size	Airflow Cfm	Unit
2SQ-04	200 225	0.03 0.03
2SQ-05	200 250 300 350	0.03 0.04 0.06 0.09
2SQ-06	200 300 400 500	0.03 0.06 0.12 0.19
2SQ-08	200 400 550 700	0.01 0.05 0.10 0.16
2SQ-10	200 400 550 700	0.01 0.02 0.06 0.11
03SQ-06	250 300 400 500	0.10 0.15 0.34 0.45
03SQ-08	250 500 700 900	0.05 0.16 0.31 0.49
03SQ-10	250 550 850 1200	0.03 0.11 0.24 0.44
03SQ-12	250 550 850 1200	0.01 0.07 0.16 0.32
04SQ-06	330 400 450 500	0.16 0.29 0.35 0.48

Fan/Inlet Size	Airflow Cfm	Unit
04SQ-12	330 750 1150 1550	0.02 0.11 0.28 0.51
04SQ-14	330 750 1150 1550	0.02 0.11 0.26 0.48
05SQ-10	400 750 1100 1400	0.01 0.08 0.22 0.39
05SQ-12	400 900 1400 1900	0.01 0.09 0.28 0.58
05SQ-14	400 900 1400 1900	0.01 0.09 0.26 0.53
6SQ-10	700 950 1200 1400	0.01 0.03 0.12 0.22
6SQ-12	700 1150 1600 2000	0.01 0.01 0.12 0.27
6SQ-14	700 1350 2000 2600	0.01 0.04 0.19 0.41
6SQ-16	700 1350 2000 2600	0.01 0.04 0.19 0.41
7SQ-10	850 1000 1200 1400	0.01 0.05 0.12 0.22

Note: Unit pressure drops do not include hot water coil or attenuator pressure drops.

Table 24. Unit air pressure drop – in. wg (I-P) (continued)

Fan/Inlet Size	Airflow Cfm	Unit
04SQ-08	330	0.04
	500	0.12
	700	0.25
	900	0.44
04SQ-10	330	0.02
	700	0.12
	1050	0.29
	1400	0.54

Fan/Inlet Size	Airflow Cfm	Unit
7SQ-12	850	0.01
	1200	0.02
	1600	0.12
	2000	0.27
7SQ-14	850	0.01
	1550	0.07
	2250	0.27
	3000	0.59
7SQ-16	850	0.01
	1550	0.07
	2250	0.27
	3000	0.59

Note: Unit pressure drops do not include hot water coil or attenuator pressure drops.

Table 25. Coil air pressure drop – in. wg (I-P)

Fan Size	Airflow Cfm	1-Row HW (in. wg)	2-Row HW (in. wg)
02SQ	200	0.01	0.03
	300	0.02	0.05
	400	0.04	0.08
	500	0.06	0.11
	600	0.08	0.15
03SQ 04SQ	250	0.01	0.02
	500	0.02	0.05
	750	0.05	0.10
	1000	0.08	0.15
	1250	0.12	0.22
	1500	0.16	0.30

Fan Size	Airflow Cfm	1-Row HW (in. wg)	2-Row HW (in. wg)
05SQ	400	0.01	0.03
	700	0.04	0.08
	1000	0.07	0.13
	1250	0.10	0.19
	1500	0.14	0.26
	1750	0.19	0.34
06SQ 07SQ	600	0.02	0.04
	1000	0.04	0.08
	1500	0.08	0.15
	2000	0.13	0.23
	2500	0.19	0.34
	3000	0.27	0.47

Note: HW Coil Only pressure drops do not include unit pressure drop.

Table 26. Attenuator air pressure drop (I-P)

Fan Size	Plenum Cfm	Attenuator
02SQ	50	0.00
	150	0.00
	350	0.02
	550	0.05
	750	0.10
	950	0.16
03SQ	50	0.00
	250	0.00
	500	0.02
	750	0.06
	1000	0.13
	1200	0.21
04SQ	50	0.00
	300	0.02
	600	0.07
	900	0.14
	1200	0.24
	1500	0.35

Fan Size	Plenum Cfm	Attenuator
05SQ	50	0.00
	300	0.01
	650	0.05
	1000	0.14
	1300	0.28
	1650	0.52
06SQ	50	0.00
	500	0.00
	900	0.02
	1300	0.07
	1700	0.17
	2100	0.36
07SQ	50	0.00
	800	0.01
	1200	0.05
	1600	0.14
	2000	0.30
	2400	0.58

Note: Plenum cfm = (Fan cfm) – (Min. valve cfm)

Table 27. Attenuator air pressure drop (SI)

Fan Size	Plenum L/s	Attenuator
02SQ	24	0
	71	1
	165	4
	260	12
	354	24
	448	40
03SQ	24	0
	118	1
	236	5
	354	15
	472	32
	566	52
04SQ	24	0
	142	5
	283	18
	425	36
	566	59
	708	88

Fan Size	Plenum L/s	Attenuator
05SQ	24	0
	142	2
	307	12
	472	36
	613	70
	779	129
06SQ	24	0
	236	1
	425	4
	613	16
	802	42
	991	90
07SQ	24	0
	378	3
	566	12
	755	34
	944	75
	1133	144

Note: Plenum cfm = (Fan cfm) – (Min. valve cfm)

Table 28. Coil air pressure drop – Pa (SI)

Fan Size	Airflow L/s	1-Row HW (Pa)	2-Row HW (Pa)
02SQ	250	3	7
	400	6	12
	500	10	19
	600	14	28
	700	20	38
03SQ 04SQ	118	2	5
	236	6	13
	354	12	24
	472	19	38
	590	29	55
	708	40	75

Fan Size	Airflow L/s	1-Row HW (Pa)	2-Row HW (Pa)
05SQ	189	4	8
	330	9	19
	472	17	33
	590	25	48
	708	35	65
	826	47	85
06SQ 07SQ	850	4	9
	1300	9	19
	1700	19	36
	2150	31	58
	2550	47	85
	3000	66	117

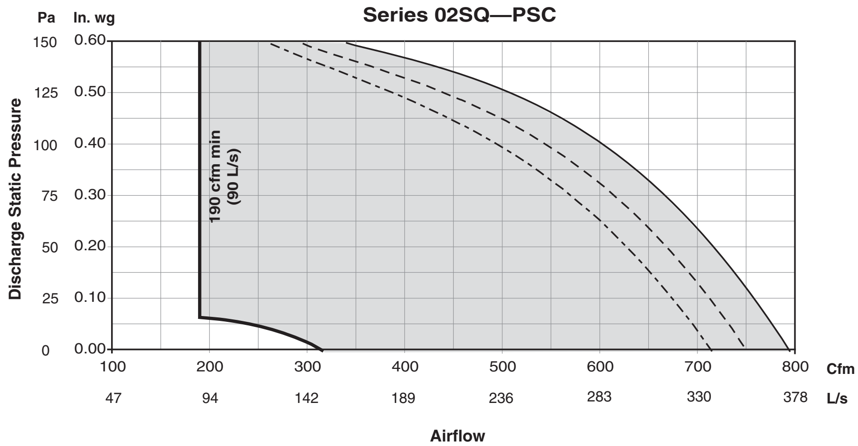
Note: HW coil only pressure drops do not include unit pressure drop.

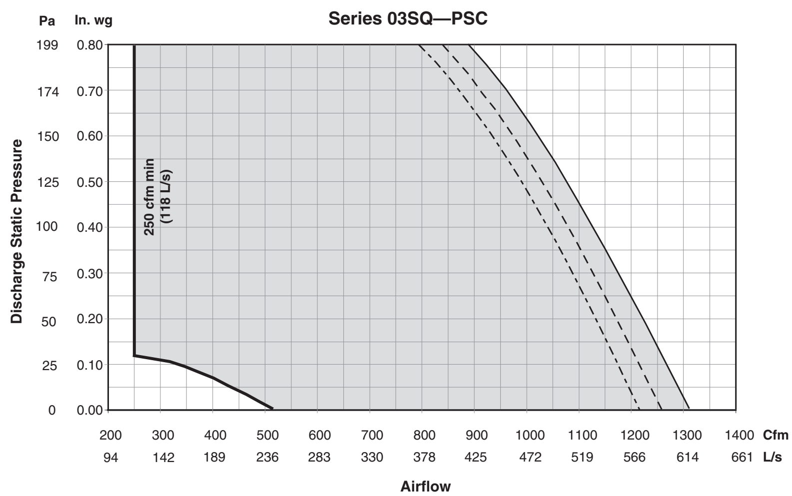
Table 29. Unit air pressure drop-Pa (SI)

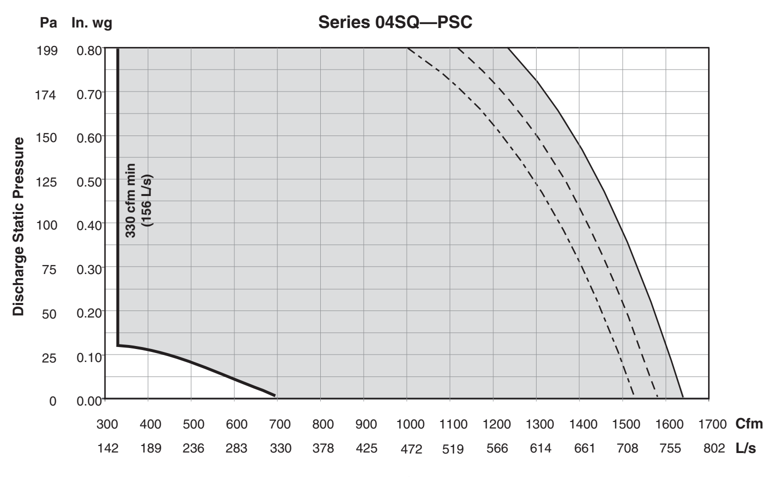
Fan/Inlet Size	Airflow Cfm	Unit
2SQ-04	94	7
	106	9
2SQ-05	94	7
	118	11
	142	16
	165	22
2SQ-06	94	7
	142	16
	189	29
	236	46
2SQ-08	94	2
	189	12
	260	24
	330	39
2SQ-10	94	2
	189	5
	260	14
	330	39
03SQ-06	118	25
	142	38
	189	85
	236	112
03SQ-08	118	12
	236	41
	330	76
	425	123
03SQ-10	118	8
	260	28
	401	59
	566	110
03SQ-12	118	4
	260	17
	401	40
	566	79
04SQ-06	156	40
	189	73
	212	88
	236	119
04SQ-08	156	10
	236	29
	330	63
	425	109
04SQ-10	156	5
	330	30
	495	73
	661	135
04SQ-12	156	5
	354	28
	543	69
	731	127
04SQ-14	156	5
	354	27
	543	65
	731	120
05SQ-10	189	1
	354	20
	519	55
	661	98
05SQ-12	189	2
	425	23
	661	71
	897	144
05SQ-14	189	2
	425	21
	661	65
	897	131
6SQ-10	330	2
	448	8
	566	31
	661	55
6SQ-12	330	2
	543	3
	755	31
	944	68
6SQ-14	330	2
	637	9
	944	47
	1227	101
6SQ-16	330	2
	637	9
	944	47
	1227	101
7SQ-10	401	2
	472	12
	566	
	661	55
7SQ-12	401	2
	566	5
	755	31
	944	68
7SQ-14	401	2
	731	18
	1062	67
	1416	147
7SQ-16	401	2
	731	18
	1062	67
	1416	147

Note: Unit pressure drops do not include hot water coil or attenuator pressure drops.

Performance Data

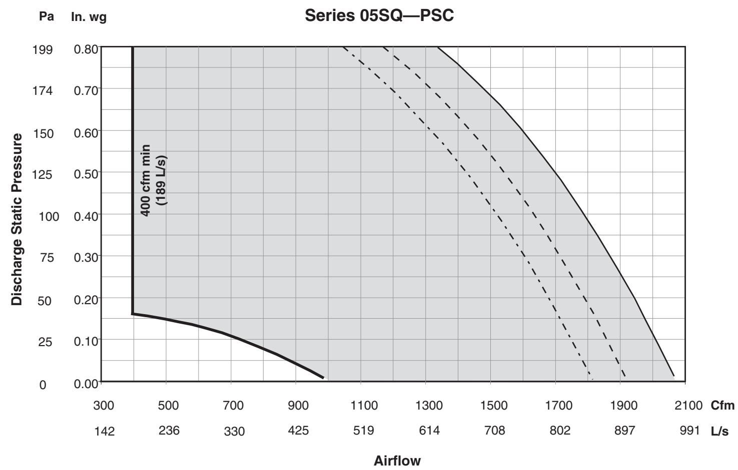


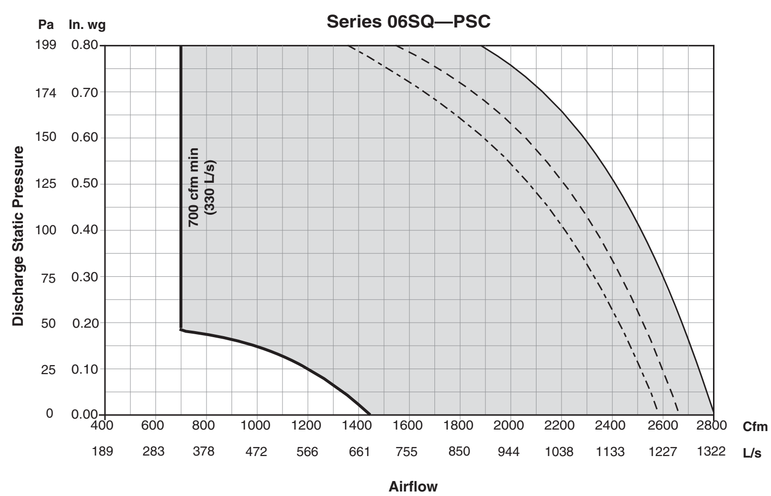




VSCF and VSEF maximum
Minimum
1-row coil maximum
2-row coil maximum

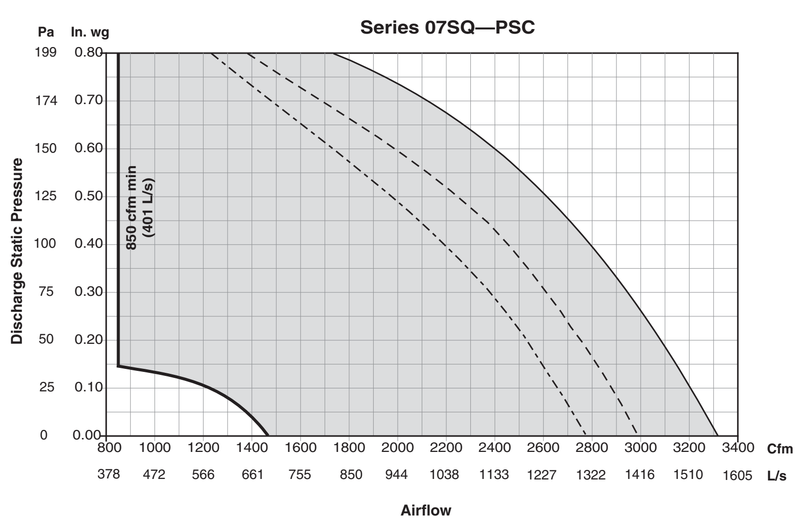
Note: When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.



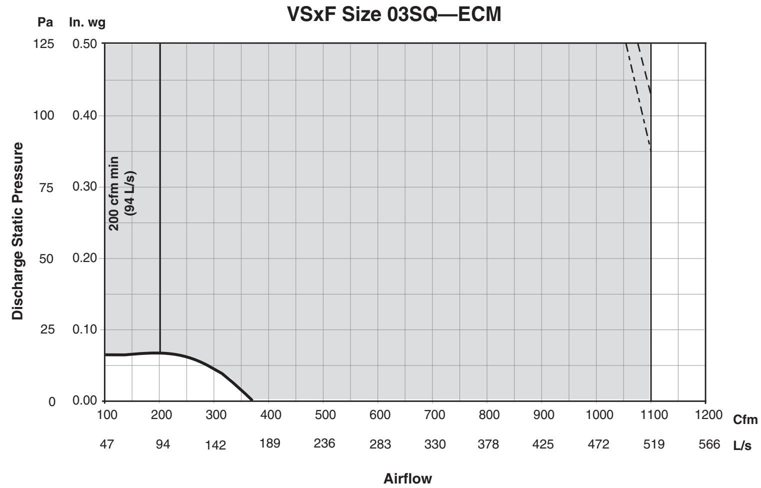


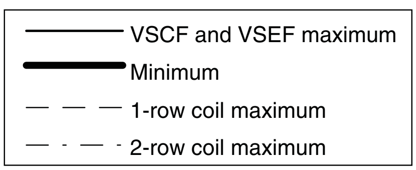
- VSCF and VSEF maximum
- Minimum
- 1-row coil maximum
- 2-row coil maximum

Note: When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.



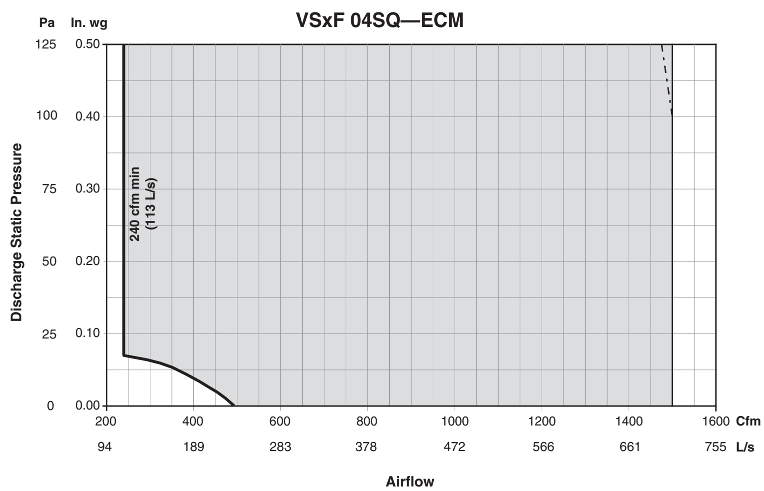
Performance Data

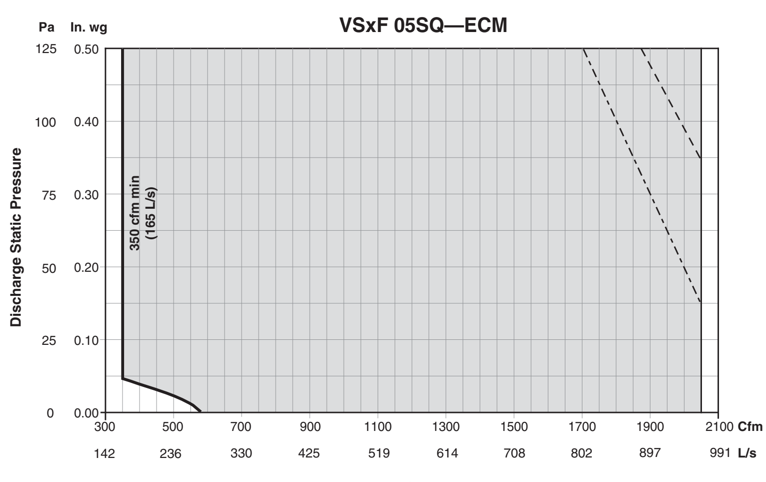


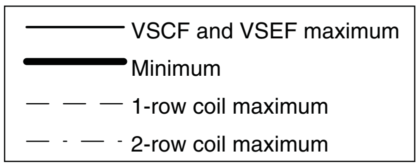


Notes:

1. ECMs (Electrically Commutated Motors) are ideal for systems seeking maximum motor efficiency.
2. When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.







Notes:
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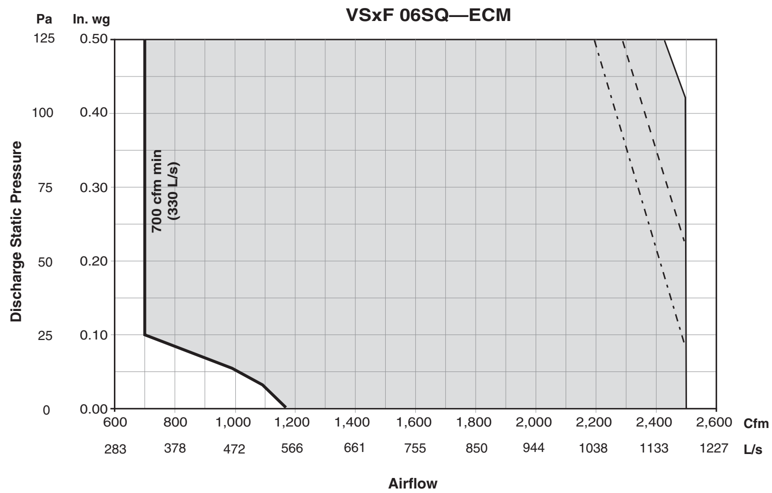


Table 30. Heating capacity (MBh) - fan size 02SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)										
			150	200	250	300	350	400	450	500	550	600	700
1-Row Capacity MBH	0.50	0.16	-	-	-	-	-	-	-	-	-	-	-
	1.0	0.53	9.14	10.34	11.34	12.20	12.97	13.67	14.32	14.93	15.51	16.05	17.02
	2.0	1.85	9.94	11.40	12.63	13.73	14.73	15.66	16.52	17.33	18.10	18.82	20.18
	3.0	3.85	10.25	11.80	13.14	14.34	15.43	16.45	17.41	18.32	19.18	20.01	21.56
	4.0	6.51	10.41	12.02	13.41	14.66	15.81	16.89	17.90	18.87	19.78	20.66	22.32
	5.0	9.79	10.51	12.15	13.58	14.87	16.05	17.17	18.21	19.21	20.17	21.08	22.81
2-Row Capacity MBH	1.0	1.00	12.59	15.23	17.40	19.21	20.74	22.06	23.19	24.19	25.07	25.85	27.19
	2.0	3.42	13.42	16.60	19.34	21.73	23.84	25.71	27.39	28.90	30.27	31.52	33.72
	3.0	7.05	13.71	17.08	20.04	22.66	25.00	27.12	29.03	30.77	32.37	33.84	36.46
	4.0	11.82	13.86	17.33	20.40	23.14	25.62	27.86	29.90	31.77	33.50	35.10	37.96
	5.0	17.68	13.94	17.48	20.62	23.44	25.99	28.32	30.44	32.40	34.21	35.89	38.92

Table 31. Heating capacity (MBh) - fan sizes 03SQ 04SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)										
			200	300	400	550	700	850	1000	1150	1300	1450	1600
1-Row Capacity MBH	1.0	0.27	-	-	-	-	-	-	-	-	-	-	-
	2.0	1.01	15.03	18.19	20.63	23.57	26.00	28.09	29.99	31.71	33.27	34.68	35.97
	3.0	2.19	15.70	19.23	22.00	25.41	28.29	30.81	33.08	35.15	37.05	38.83	40.51
	4.0	3.81	16.06	19.80	22.76	26.44	29.59	32.38	34.91	37.23	39.38	41.38	43.26
	5.0	5.85	16.29	20.16	23.24	27.11	30.43	33.40	36.11	38.60	40.93	43.10	45.15
	6.0	8.32	16.45	20.41	23.58	27.57	31.02	34.12	36.96	39.58	42.03	44.34	46.51
	7.0	11.20	16.56	20.59	23.82	27.91	31.46	34.66	37.59	40.31	42.86	45.26	47.54
	8.0	14.50	16.65	20.73	24.01	28.18	31.80	35.07	38.08	40.88	43.51	45.99	48.34
	9.0	18.22	16.72	20.84	24.17	28.39	32.08	35.41	38.48	41.34	44.03	46.57	48.99
	10.0	22.35	16.78	20.93	24.29	28.56	32.30	35.68	38.80	41.71	44.46	47.05	49.52
2-Row Capacity MBH	1.0	0.39	-	-	-	-	-	-	-	-	-	-	-
	2.0	1.41	18.93	25.58	30.93	37.20	41.99	45.78	48.85	51.38	53.52	55.34	56.92
	3.0	3.01	19.46	26.72	32.79	40.20	46.12	50.97	55.02	58.45	61.41	63.98	66.24
	4.0	5.16	19.72	27.30	33.75	41.80	48.38	53.88	58.54	62.56	66.05	69.14	71.88
	5.0	7.84	19.88	27.65	34.34	42.79	49.81	55.73	60.81	65.23	69.11	72.55	75.63
	6.0	11.06	19.98	27.88	34.74	43.47	50.79	57.01	62.40	67.10	71.26	74.98	78.31
	7.0	14.81	20.06	28.05	35.02	43.96	51.50	57.96	63.57	68.49	72.87	76.79	80.32
	8.0	19.07	20.12	28.18	35.24	44.34	52.05	58.68	64.46	69.57	74.11	78.19	81.88

Table 32. Heating capacity (MBh) - fan size 05SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm) 350	500	650	800	1000	1200	1400	1600	1800	2000	2150
1-Row Capacity MBH	1.0	0.29	-	-	-	-	-	-	-	-	-	-	-
	2.0	1.08	21.67	25.25	28.09	30.49	33.30	35.79	37.96	39.88	41.61	43.17	44.25
	3.0	2.33	23.02	27.14	30.49	33.38	36.75	39.71	42.39	44.89	47.17	49.26	50.73
	4.0	4.03	23.76	28.20	31.85	35.03	38.78	42.12	45.14	47.92	50.48	52.91	54.64
	5.0	6.18	24.23	28.87	32.72	36.10	40.11	43.71	46.98	50.01	52.81	55.44	57.30
	6.0	8.76	24.55	29.34	33.34	36.86	41.05	44.83	48.29	51.50	54.50	57.30	59.30
	7.0	11.79	24.79	29.69	33.79	37.42	41.75	45.67	49.28	52.63	55.76	58.71	60.82
	8.0	15.24	24.97	29.95	34.14	37.85	42.29	46.33	50.05	53.51	56.76	59.82	62.01
2-Row Capacity MBH	1.0	0.39	-	-	-	-	-	-	-	-	-	-	-
	2.0	1.39	29.95	37.69	43.62	48.30	53.17	56.95	59.97	62.43	64.49	66.24	67.38
	3.0	2.96	31.40	40.36	47.58	53.51	59.95	65.16	69.45	73.07	76.15	78.82	80.59
	4.0	5.08	32.14	41.74	49.69	56.37	63.77	69.90	75.05	79.45	83.26	86.60	88.84
	5.0	7.72	32.58	42.59	51.00	58.16	66.21	72.97	78.72	83.68	88.02	91.85	94.45
	6.0	10.90	32.87	43.16	51.88	59.39	67.90	75.11	81.30	86.69	91.42	95.63	98.49
	7.0	14.59	33.08	43.57	52.53	60.28	69.14	76.69	83.22	88.93	93.97	98.47	101.54
	8.0	18.79	33.24	43.88	53.02	60.96	70.09	77.91	84.70	90.66	95.95	100.69	103.93

Table 33. Heating capacity (MBh) - fan size 06SQ & 07SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm) 700	900	1100	1300	1500	1700	1900	2100	2300	2500	2700
1-Row Capacity MBH	0.5	0.12	-	-	-	-	-	-	-	-	-	-	-
	1.0	0.40	-	-	-	-	-	-	-	-	-	-	-
	2.0	1.37	31.21	34.50	37.47	40.06	42.33	44.37	46.21	47.89	49.43	50.85	52.16
	3.0	2.83	33.81	37.76	41.19	44.25	47.10	49.74	52.17	54.40	56.49	58.43	60.24
	4.0	4.76	35.27	39.61	43.42	46.86	50.00	52.91	55.63	58.24	60.68	62.97	65.14
	5.0	7.13	36.20	40.80	44.87	48.57	51.97	55.12	58.07	60.84	63.46	66.00	68.41
	6.0	9.93	36.85	41.64	45.90	49.78	53.36	56.70	59.83	62.79	65.59	68.24	70.77
2-Row Capacity MBH	1.0	0.77	-	-	-	-	-	-	-	-	-	-	-
	2.0	2.58	47.79	54.01	58.79	62.56	65.61	68.13	70.25	72.05	73.60	74.95	76.14
	3.0	5.27	52.10	60.08	66.51	71.79	76.21	79.96	83.19	86.00	88.47	90.65	92.61
	4.0	8.78	54.37	63.38	70.82	77.06	82.39	86.98	91.00	94.54	97.69	100.51	103.06
	5.0	13.07	55.77	65.44	73.55	80.45	86.40	91.60	96.18	100.26	103.91	107.20	110.19
	6.0	18.13	56.71	66.85	75.43	82.80	89.22	94.86	99.86	104.34	108.37	112.03	115.36

Water Coil Notes (I-P)

1. Fouling Factor = 0.0005.
2. The following equations may be used in calculating Leaving Air Temperature (LAT) and Water Temperature Difference (WTD):

$$LAT = EAT + \left(\frac{MBH x 921.7}{Cfm}\right)$$

$$WTD = EWT - LWT = \left(\frac{2 \times MBH}{Gpm}\right)$$

3. Capacity based on 70°F entering air temperature and 180°F entering water temperature. Refer to correction factors for different entering conditions.

Table 34. Temperature correction factors for water pressure drop (ft)

Average Water Temperature	200	190	180	170	160	150	140	130	120	110
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 35. Temperature correction factors for coil capacity (MBH)

Entering Water Minus Entering Air	40	50	60	70	80	90	100	110	120	130
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Table 36. Heating capacity (kW) - fan size 02SQ (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)										
			71	94	118	142	165	189	212	236	260	283	330
1-Row Capacity kW	0.03	0.47	-	-	-	-	-	-	-	-	-	-	-
	0.06	1.59	2.68	3.03	3.32	3.58	3.80	4.01	4.20	4.38	4.55	4.70	4.70
	0.13	5.52	2.91	3.34	3.70	4.02	4.32	4.59	4.84	5.08	5.30	5.52	5.52
	0.19	11.51	3.00	3.46	3.85	4.20	4.52	4.82	5.10	5.37	5.62	5.86	5.86
	0.25	19.45	3.05	3.52	3.93	4.30	4.63	4.95	5.25	5.53	5.80	6.06	6.06
	0.32	29.27	3.08	3.56	3.98	4.36	4.71	5.03	5.34	5.63	5.91	6.18	6.18
2-Row Capacity kW	0.06	3.00	3.69	4.46	5.10	5.63	6.08	6.46	6.80	7.09	7.35	7.58	7.58
	0.13	10.21	3.93	4.86	5.67	6.37	6.99	7.54	8.03	8.47	8.87	9.24	9.24
	0.19	21.07	4.02	5.01	5.87	6.64	7.33	7.95	8.51	9.02	9.49	9.92	9.92
	0.25	35.33	4.06	5.08	5.98	6.78	7.51	8.16	8.76	9.31	9.82	10.29	10.29
	0.32	52.84	4.09	5.12	6.04	6.87	7.62	8.30	8.92	9.50	10.03	10.52	10.52

Table 37. Heating capacity (kW) - fan sizes 03SQ 04SQ(SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)										
			94	142	189	260	330	401	472	543	613	684	755
1-Row Capacity kW	0.06	0.81	-	-	-	-	-	-	-	-	-	-	-
	0.13	3.02	4.40	5.33	6.04	6.91	7.62	8.23	8.79	9.29	9.75	10.16	10.16
	0.19	6.56	4.60	5.64	6.45	7.45	8.29	9.03	9.70	10.30	10.86	11.38	11.38
	0.25	11.39	4.71	5.80	6.67	7.75	8.67	9.49	10.23	10.91	11.54	12.13	12.13
	0.32	17.49	4.77	5.91	6.81	7.94	8.92	9.79	10.58	11.31	11.99	12.63	12.63
	0.38	24.86	4.82	5.98	6.91	8.08	9.09	10.00	10.83	11.60	12.32	12.99	12.99
	0.44	33.49	4.85	6.03	6.98	8.18	9.22	10.16	11.02	11.81	12.56	13.27	13.27
	0.50	43.36	4.88	6.08	7.04	8.26	9.32	10.28	11.16	11.98	12.75	13.48	13.48
	0.57	54.46	4.90	6.11	7.08	8.32	9.40	10.38	11.28	12.12	12.90	13.65	13.65
	0.63	66.80	4.92	6.13	7.12	8.37	9.47	10.46	11.37	12.22	13.03	13.79	13.79
2-Row Capacity kW	0.06	1.18	-	-	-	-	-	-	-	-	-	-	-
	0.13	4.22	5.55	7.50	9.07	10.90	12.31	13.42	14.32	15.06	15.68	16.22	16.22
	0.19	8.99	5.70	7.83	9.61	11.78	13.52	14.94	16.12	17.13	18.00	18.75	18.75
	0.25	15.41	5.78	8.00	9.89	12.25	14.18	15.79	17.16	18.33	19.36	20.26	20.26
	0.32	23.45	5.83	8.10	10.06	12.54	14.60	16.33	17.82	19.12	20.25	21.26	21.26
	0.38	33.07	5.86	8.17	10.18	12.74	14.88	16.71	18.29	19.67	20.89	21.97	21.97
	0.44	44.26	5.88	8.22	10.26	12.88	15.09	16.99	18.63	20.07	21.36	22.50	22.50
	0.50	57.00	5.90	8.26	10.33	12.99	15.25	17.20	18.89	20.39	21.72	22.92	22.92

Table 38. Heating capacity (kW) - fan size 05SQ(SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)										
			165	236	307	378	472	566	661	755	849	944	1015
1-Row Capacity kW	0.06	0.87	-	-	-	-	-	-	-	-	-	-	-
	0.13	3.22	6.35	7.40	8.23	8.94	9.76	10.49	11.12	11.69	12.19	12.65	12.65
	0.19	6.95	6.75	7.95	8.94	9.78	10.77	11.64	12.42	13.16	13.82	14.44	14.44
	0.25	12.04	6.96	8.26	9.33	10.27	11.37	12.34	13.23	14.04	14.79	15.51	15.51
	0.32	18.46	7.10	8.46	9.59	10.58	11.76	12.81	13.77	14.66	15.48	16.25	16.25
	0.38	26.20	7.19	8.60	9.77	10.80	12.03	13.14	14.15	15.09	15.97	16.79	16.79
	0.44	35.23	7.26	8.70	9.90	10.97	12.24	13.39	14.44	15.42	16.34	17.21	17.21
	0.50	45.57	7.32	8.78	10.01	11.09	12.40	13.58	14.67	15.68	16.63	17.53	17.53
2-Row Capacity kW	0.06	1.16	-	-	-	-	-	-	-	-	-	-	-
	0.13	4.16	8.78	11.05	12.78	14.16	15.58	16.69	17.57	18.30	18.90	19.41	19.41
	0.19	8.85	9.20	11.83	13.94	15.68	17.57	19.10	20.35	21.41	22.32	23.10	23.10
	0.25	15.17	9.42	12.23	14.56	16.52	18.69	20.48	21.99	23.28	24.40	25.38	25.38
	0.32	23.09	9.55	12.48	14.95	17.04	19.41	21.38	23.07	24.52	25.80	26.92	26.92
	0.38	32.57	9.63	12.65	15.21	17.40	19.90	22.01	23.83	25.41	26.79	28.03	28.03
	0.44	43.60	9.70	12.77	15.39	17.67	20.26	22.48	24.39	26.06	27.54	28.86	28.86
	0.50	56.16	9.74	12.86	15.54	17.87	20.54	22.83	24.82	26.57	28.12	29.51	29.51

Table 39. Heating capacity (kW) - fan sizes 06SQ & 07SQ (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)										
			330	425	519	613	708	802	897	991	1085	1180	1274
1-Row Capacity kW	0.03	0.36	-	-	-	-	-	-	-	-	-	-	-
	0.06	1.20	-	-	-	-	-	-	-	-	-	-	-
	0.13	4.10	9.15	10.11	10.98	11.74	12.41	13.00	13.54	14.03	14.49	14.90	14.90
	0.19	8.46	9.91	11.07	12.07	12.97	13.80	14.58	15.29	15.94	16.55	17.12	17.12
	0.25	14.22	10.34	11.61	12.73	13.73	14.66	15.51	16.30	17.07	17.78	18.46	18.46
	0.32	21.30	10.61	11.96	13.15	14.23	15.23	16.15	17.02	17.83	18.60	19.34	19.34
	0.38	29.68	10.80	12.20	13.45	14.59	15.64	16.62	17.54	18.40	19.22	20.00	20.00
2-Row Capacity kW	0.06	2.31	-	-	-	-	-	-	-	-	-	-	-
	0.13	7.71	14.01	15.83	17.23	18.33	19.23	19.97	20.59	21.11	21.57	21.97	21.97
	0.19	15.74	15.27	17.61	19.49	21.04	22.33	23.43	24.38	25.20	25.93	26.57	26.57
	0.25	26.24	15.94	18.58	20.75	22.58	24.14	25.49	26.67	27.71	28.63	29.46	29.46
	0.32	39.08	16.34	19.18	21.55	23.58	25.32	26.85	28.19	29.38	30.45	31.42	31.42
	0.38	54.19	16.62	19.59	22.11	24.27	26.15	27.80	29.27	30.58	31.76	32.83	32.83

Water Coil Notes (SI)

1. Fouling Factor = 0.0005.
2. The following equations may be used in calculating Leaving Air Temperature (LAT) and Water Temperature Difference (WTD).

$$LAT = EAT + \left(\frac{kW \times 0.83}{L/s}\right)$$

$$WTD = EWT - LWT = \left(\frac{kW}{4.19(L/s)}\right)$$

3. Capacity based on 21°C entering air temperature and 82°Centering water temperature. Refer to correction factors for different entering conditions.

Table 40. Temperature correction factors for water pressure drop (kPa)

Average Water Temperature	93	88	82	77	71	66	60	54	49	43
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 41. Temperature correction factors for coil capacity (kW)

Entering Water Minus Entering Air	22	27	33	38	44	50	55	61	67	72
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Low Height Parallel Fan-Powered Terminal Units

Table 42. Primary airflow control factory settings – I-P

Control Type	Air Valve Size (in.)	Maximum Valve Cfm	Maximum Controller Cfm	Minimum Controller Cfm	Constant Volume Cfm
Direct Digital Control/ UCM	5	350	40-350	0, 40-350	40-350
	6	500	60-500	0, 60-500	60-500
	8	900	105-900	0, 105-900	105-900
	8x14	2200	200-2200	0, 220-2200	220-2200
Pneumatic with Volume Regulator	5	350	63-350	0, 63-350	63-350
	6	500	73-500	0, 73-500	73-500
	8	900	134-900	0, 134-900	134-900
	8x14	2100	297-2100	0, 297-2100	297-2100
Analog Electronic	5	350	82-350	0, 82-310	82-310
	6	500	120-500	0, 120-360	120-360
	8	900	210-900	0, 210-660	210-660
	8x14	2200	440-2200	0, 440-1475	440-1475

Table 43. Primary airflow control factory settings – SI

Control Type	Air Valve Size (in.)	Maximum Valve L/s	Maximum Controller L/s	Minimum Controller L/s	Constant Volume L/s
Direct Digital Control/ UCM	5	165	19-165	0, 19-165	19-165
	6	236	28-236	0, 28-236	28-236
	8	425	50-425	0, 50-425	50-425
	8x14	1038	104-1038	0, 104-1038	104-1038
Pneumatic with Volume Regulator	5	165	30-165	0, 30-165	30-165
	6	236	35-236	0, 35-236	35-236
	8	425	63-425	0, 63-425	63-425
	8x14	991	140-991	0, 140-991	140-991
Analog Electronic	5	165	39-165	0, 39-146	39-146
	6	236	57-236	0, 57-170	57-170
	8	425	100-425	0, 100-311	100-311
	8x14	1038	208-1038	0, 208-696	208-696

Note: Maximum airflow must be greater than or equal to minimum airflow.

Table 44. Unit air pressure drop – in. wg (I-P)

Fan/Inlet Size	Airflow Cfm	Cooling Only Unit (in. wg)
08SQ-05	150	0.01
	200	0.02
	250	0.03
	350	0.05
08SQ-06	200	0.01
	300	0.04
	400	0.06
	500	0.09
08SQ-08	400	0.01
	600	0.09
	800	0.16
	900	0.20
09SQ-06	200	0.01
	300	0.04
	400	0.06
	500	0.09

Fan/Inlet Size	Airflow Cfm	Cooling Only Unit (in. wg)
09SQ-08	400	0.01
	600	0.09
	800	0.16
	900	0.20
09SQ-8x14	700	0.10
	1100	0.25
	1500	0.47
	1900	0.75
10SQ-08	400	0.01
	600	0.09
	800	0.18
	900	0.24
10SQ-8x14	725	0.18
	1000	0.36
	1200	0.53
	1450	0.78

Notes:
1. Units with Electric Coils per fan size add 0.01" (3 Pa) to cooling only value.
2. HW Coil only pressure drops are just for the heating coil.

Table 45. Unit air pressure drop – Pa (SI)

Inlet/Fan Size	Airflow L/s	Cooling Only Unit (Pa)
08SQ-05	71	2
	94	5
	118	7
	165	13
08SQ-06	200	0.01
	142	10
	189	16
	236	24
08SQ-08	189	2
	283	21
	378	40
	425	51
09SQ-06	94	2
	142	10
	189	16
	236	24

Inlet/Fan Size	Airflow L/s	Cooling Only Unit (Pa)
09SQ-08	189	2
	283	21
	378	40
	425	51
09SQ-8x14	330	26
	519	63
	708	116
	897	185
10SQ-08	189	2
	283	23
	378	45
	425	59
10SQ-8x14	345	47
	475	91
	565	131
	685	195

Notes:
1. Units with Electric Coils per fan size add 0.01" (3 Pa) to cooling only value.
2. HW Coil only pressure drops are just for the heating coil.

Table 46. Coil air pressure drop

in. wg (I-P)			
Fan Size	Airflow Cfm	1-Row HW (in. wg)	2-Row HW (in. wg)
08SQ	100	0.00	0.01
	200	0.01	0.02
	300	0.02	0.04
	400	0.03	0.06
	450	0.04	0.07
09SQ	250	0.01	0.03
	400	0.03	0.06
	550	0.05	0.10
	700	0.08	0.15
	850	0.11	0.20
10SQ	725	0.09	0.17
	800	0.11	0.20
	900	0.13	0.24
	1000	0.16	0.29
	1100	0.19	0.33
	1150	0.20	0.35

Note: HW Coil Only pressure drops do not include unit pressure drop.

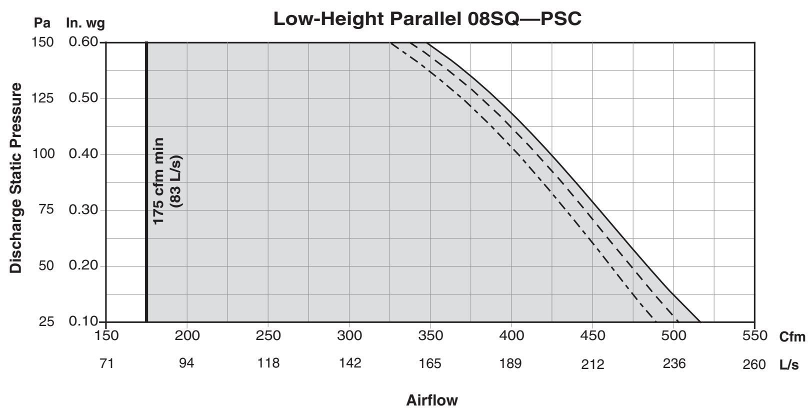
Pa (SI)			
Fan Size	Airflow L/s	1-Row HW (Pa)	2-Row HW (Pa)
08SQ	47	1	2
	94	2	5
	142	4	10
	189	7	15
	212	9	18
09SQ	118	3	7
	189	7	15
	260	12	25
	330	19	36
	401	27	51
10SQ	342	22	43
	375	26	49
	425	33	60
	475	40	72
	520	46	82
	543	49	87

Table 47. Attenuator air pressure drop

(I-P)		
Fan Size	Plenum Cfm	Attenuator
08SQ	150	0.01
	250	0.03
	350	0.05
	450	0.07
09SQ	350	0.05
	500	0.08
	650	0.13
	800	0.18
10SQ	not available	

(SI)		
Fan Size	Plenum L/s	Attenuator
08SQ	71	0.01
	118	0.01
	165	0.02
	212	0.02
09SQ	165	0.02
	236	0.03
	307	0.04
	378	0.05
10SQ	not available	

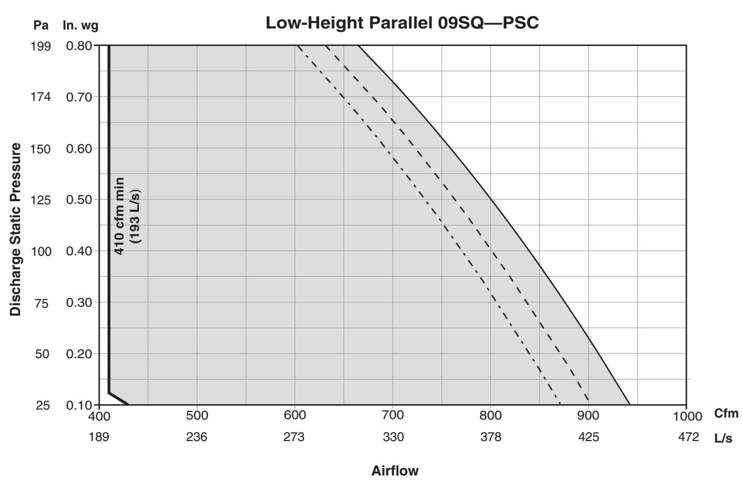
Performance Data Fan Curves

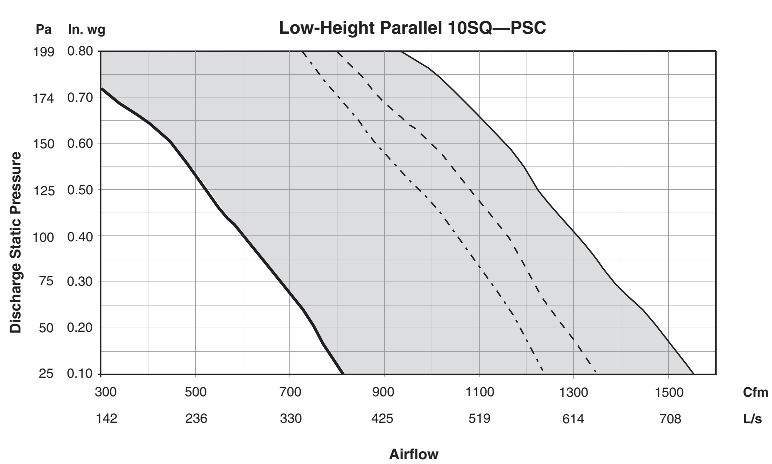


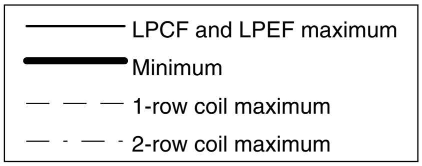
LPCF and LPEF maximum
Minimum
1-row coil maximum
2-row coil maximum

Notes:

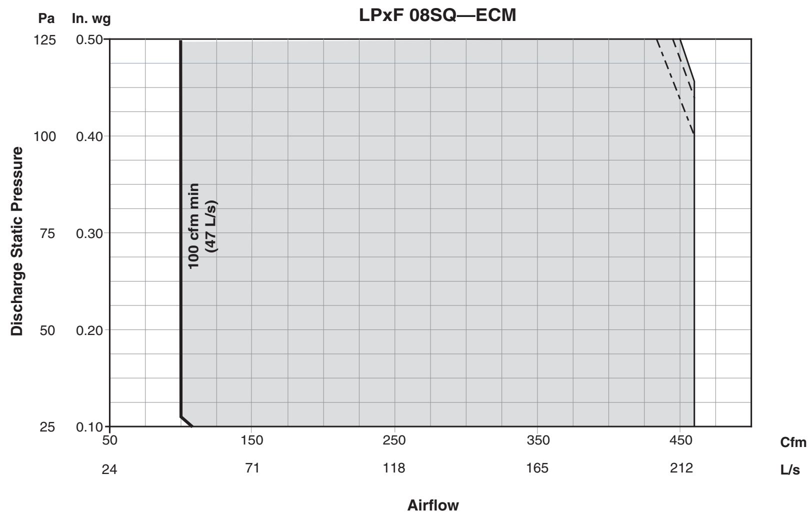
1. When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.
2. When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.







Notes:
1. ECMs (Electrically Commutated Motors) are ideal for systems seeking maximum motor efficiency.
2. When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.



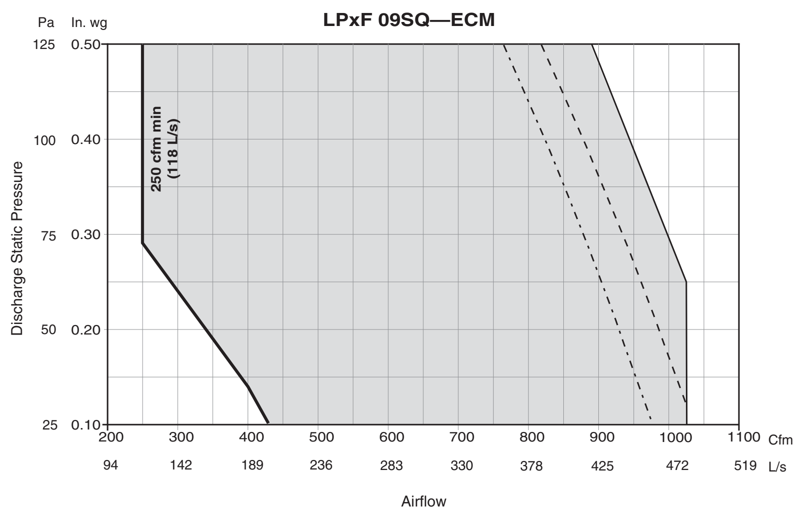


Table 48. Heating capacity (MBh) - fan sizes 08SQ & 09SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm) 100	200	300	400	500	600	700	800	900
1-Row Capacity MBH	0.5	0.80	7.73	10.43	12.20	13.50	14.51	15.33	16.03	16.63	17.15
	1.0	2.67	8.58	12.15	14.51	16.37	17.98	19.42	20.69	21.82	22.85
	1.5	5.43	8.90	12.83	15.52	17.69	19.56	21.21	22.72	24.15	25.46
	2.0	9.02	9.06	13.20	16.07	18.42	20.47	22.30	23.97	25.51	26.95
	2.5	13.39	9.17	13.43	16.43	18.89	21.06	23.00	24.79	26.45	28.00
2-Row Capacity MBH	1.0	0.89	9.36	15.49	19.69	22.72	25.00	26.79	28.23	29.41	30.41
	2.0	3.02	9.74	16.83	22.20	26.42	29.83	32.65	35.03	37.06	38.83
	3.0	6.24	9.86	17.29	23.11	27.82	31.72	35.02	37.85	40.32	42.49
	4.0	10.47	9.92	17.53	23.59	28.56	32.73	36.29	39.39	42.11	44.52
	5.0	15.66	9.96	17.67	23.88	29.01	33.36	37.10	40.36	43.24	45.81

Table 49. Heating capacity (MBh) - fan size 10SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm) 700	800	900	1000	1100	1200	1240
1-Row Capacity MBH	0.7	1.51	18.46	19.31	20.07	20.75	21.37	21.93	22.14
	1.0	2.80	20.69	21.82	22.85	23.78	24.64	25.43	25.72
	1.5	5.69	22.72	24.15	25.46	26.67	27.79	28.84	29.24
	2.0	9.45	23.97	25.51	26.95	28.32	29.62	30.84	31.30
	2.5	14.03	24.79	26.45	28.00	29.46	30.83	32.14	32.66
2-Row Capacity MBH	1.5	1.85	32.51	34.20	35.65	36.90	38.01	38.98	39.34
	2.0	3.07	35.03	37.06	38.83	40.38	41.76	42.99	43.44
	3.0	6.32	37.85	40.32	42.49	44.42	46.15	47.71	48.29
	4.0	10.58	39.39	42.11	44.52	46.68	48.62	50.39	51.06
	5.0	15.80	40.36	43.24	45.81	48.13	50.22	52.13	52.84

Water Coil Notes (I-P)

Note: *Fouling Factor = 0.0005.*

Note: *The off-coil temperature of the hot water coil on parallel fan-powered units must not exceed 140°F when mounted on plenum inlet.*

Note: *The following equations may be used in calculating Leaving Air Temperature (LAT) and Water Temperature Difference (WTD).*

$$LAT = EAT + \left(\frac{MBH \times 921.7}{Cfm}\right)$$

$$WTD = EWT - LWT = \left(\frac{2 \times MBH}{Gpm}\right)$$

Note: *Capacity based on 70°F entering air temperature and 180°F entering water temperature. Refer to correction factors for different entering conditions.*

Table 50.

Temperature correction factors for water pressure drop (WPD)										
Average Water Temperature	200	190	180	170	160	150	140	130	120	110
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150
Temperature correction factors for coil capacity (MBH)										
Entering Water Minus Entering Air	40	50	60	70	80	90	100	110	120	130
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Table 51. Heating capacity (kW) - fan sizes 08SQ & 09SQ (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)								
			47	94	142	189	236	283	330	378	425
1-Row Capacity kW	0.03	2.39	2.27	3.06	3.58	3.96	4.25	4.49	4.70	4.87	5.03
	0.06	7.98	2.51	3.56	4.25	4.80	5.27	5.69	6.06	6.40	6.70
	0.09	16.24	2.61	3.76	4.55	5.18	5.73	6.22	6.66	7.08	7.46
	0.13	26.97	2.66	3.87	4.71	5.40	6.00	6.54	7.03	7.48	7.90
	0.16	40.04	2.69	3.94	4.81	5.54	6.17	6.74	7.27	7.75	8.21
2-Row Capacity kW	0.06	2.65	2.74	4.54	5.77	6.66	7.33	7.85	8.27	8.62	8.91
	0.13	9.03	2.85	4.93	6.51	7.74	8.74	9.57	10.27	10.86	11.38
	0.19	18.65	2.89	5.07	6.77	8.15	9.30	10.26	11.09	11.82	12.45
	0.25	31.29	2.91	5.14	6.91	8.37	9.59	10.64	11.54	12.34	13.05
	0.32	46.82	2.92	5.18	7.00	8.50	9.78	10.87	11.83	12.67	13.43

Table 52. Heating capacity (kW) - fan size 10SQ (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s)						
			330	378	425	472	519	566	585
1-Row Capacity kW	0.04	4.51	5.41	5.66	5.88	6.08	6.26	6.43	6.49
	0.06	8.37	6.06	6.40	6.70	6.97	7.22	7.45	7.54
	0.09	17.02	6.66	7.08	7.46	7.81	8.14	8.45	8.57
	0.13	28.25	7.03	7.48	7.90	8.30	8.68	9.04	9.17
	0.16	41.94	7.27	7.75	8.21	8.63	9.03	9.42	9.57
2-Row Capacity kW	0.09	5.53	9.53	10.02	10.45	10.82	11.14	11.42	11.53
	0.13	9.19	10.27	10.86	11.38	11.84	12.24	12.60	12.73
	0.19	18.89	11.09	11.82	12.45	13.02	13.52	13.98	14.15
	0.25	31.61	11.54	12.34	13.05	13.68	14.25	14.77	14.96
	0.32	47.22	11.83	12.67	13.43	14.10	14.72	15.28	15.49

Water Coil Notes (SI)

1. Fouling Factor = 0.0005.
2. The off-coil temperature of the hot water coil on parallel fan-powered units must not exceed 60°C when mounted on plenum inlet.
3. The following equations may be used in calculating Leaving Air Temperature (LAT) and Water Temperature Difference (WTD).

$$LAT = EAT + \left(\frac{kW \times 0.83}{L/s}\right)$$

$$WTD = EWT - LWT = \left(\frac{kW}{(4.19)(L/s)}\right)$$

4. Capacity based on 21°C entering air temperature and 82°C entering water temperature. Refer to correction factors for different entering conditions.

Table 53.

Temperature correction factors for water pressure drop (kPa)										
Average Water Temperature	93	88	82	77	71	66	60	54	49	43
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150
Temperature correction factors for coil capacity (kW)										
Entering Water Minus Entering Air	22	27	33	38	44	50	55	61	67	72
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Low Height Series Fan-Powered Terminal Units

Table 54. Primary airflow control factory settings-I-P

Control Type	Air Valve Size (in.)	Maximum Valve Cfm	Maximum Controller Cfm	Minimum Controller Cfm	Constant Volume Cfm
Direct Digital Control/UCM	5	350	40-350	0, 40-350	40-350
	6	500	60-500	0, 60-500	60-500
	8	900	105-900	0, 105-900	105-900
	8x14	2200	200-2200	0, 220-2200	220-2200
Pneumatic with Volume Regulator	5	350	63-350	0, 63-350	63-350
	6	500	73-500	0, 73-500	73-500
	8	900	134-900	0, 134-900	134-900
	8x14	2100	297-2100	0, 297-2100	297-2100
Analog Electronic	5	350	82-350	0, 82-310	82-310
	6	500	120-500	0, 120-360	120-360
	8	900	210-900	0, 210-660	210-660
	8x14	2200	440-2200	0, 440-1475	440-1475

Table 55. Primary airflow control factory settings-SI

Control Type	Air Valve Size (in.)	Maximum Valve L/s	Maximum Controller L/s	Minimum Controller L/s	
Direct Digital Control/ UCM	5	165	19-165	0, 19-165	19-165
	6	236	28-236	0, 28-236	28-236
	8	425	50-425	0, 50-425	50-425
	8x14	1038	104-1038	0, 104-1038	104-1038
Pneumatic with Volume Regulator	5	165	30-165	0, 30-165	30-165
	6	236	35-236	0, 35-236	35-236
	8	425	63-425	0, 63-425	63-425
	8x14	991	140-991	0, 140-991	140-991
Analog Electronic	5	165	39-165	0, 39-146	39-146
	6	236	57-236	0, 57-170	57-170
	8	425	100-425	0, 100-311	100-311
	8x14	1038	208-1038	0, 208-696	208-696

Note: Maximum airflow must be greater than or equal to minimum airflow.

Table 56. Unit air pressure drop

in. wg (I-P)		
Fan/Inlet Size	**Airflow Cfm**	**Cooling Only**
08SQ-05	150	0.01
	250	0.03
	350	0.11
08SQ-06	150	0.02
	275	0.14
	400	0.35
	500	0.58
08SQ-08	150	0.01
	275	0.05
	400	0.13
	500	0.21
09SQ-06	350	0.17
	400	0.26
	450	0.37
	500	0.50

Pa (SI		
Fan/Inlet Size	**Airflow L/s**	**Cooling Only**
08SQ-05	71	2
	118	9
	165	28
08SQ-06	71	5
	130	34
	189	86
	236	143
08SQ-08	71	3
	130	14
	189	32
	236	52
09SQ-06	165	43
	189	66
	212	93
	236	124

Table 56. Unit air pressure drop (continued)

in. wg (I-P)		
09SQ-08	400	0.08
	600	0.24
	750	0.40
	900	0.61
09SQ-8x14	600	0.18
	700	0.27
	900	0.51
	1050	0.73
10SQ-08	400	0.08
	600	0.38
	800	0.84
10SQ-8x14	600	0.21
	900	0.50
	1100	0.77
	1500	1.47

Pa (SI		
09SQ-08	189	21
	283	59
	354	100
	425	151
8x14-09SQ	283	44
	330	66
	425	126
	495	182
10SQ-08	189	20
	283	94
	378	209
10SQ-8x14	283	51
	425	124
	519	191
	708	367

Table 57. Coil air pressure drop

in.wg (I-P)			
Fan Size	Airflow Cfm	1-Row HW (in. wg)	2-Row HW (in. wg)
08SQ	100	0.00	0.01
	200	0.01	0.03
	300	0.02	0.05
	400	0.03	0.07
	500	0.05	0.10
09SQ	400	0.03	0.07
	550	0.06	0.12
	700	0.09	0.17
	850	0.13	0.24
	1000	0.18	0.32
10SQ	400	0.01	0.02
	800	0.03	0.07
	1200	0.06	0.12
	1600	0.11	0.20
	2000	0.16	0.29

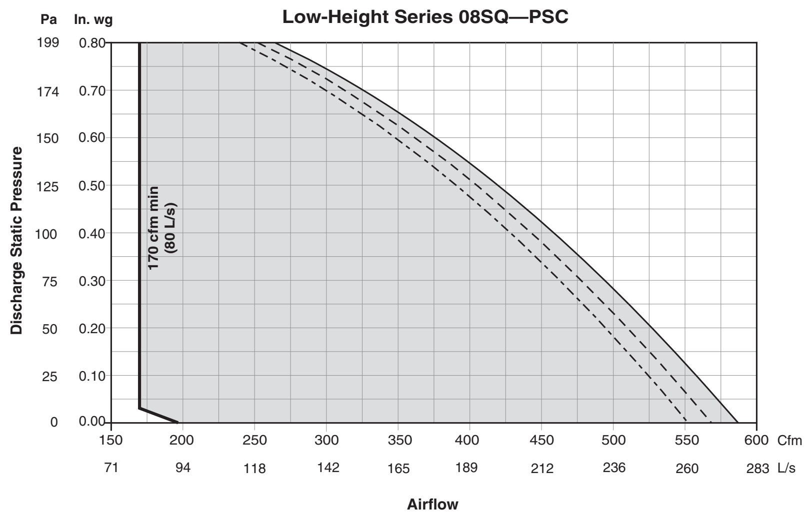
Note: HW Coil Only pressure drops do not include unit pressure drop.

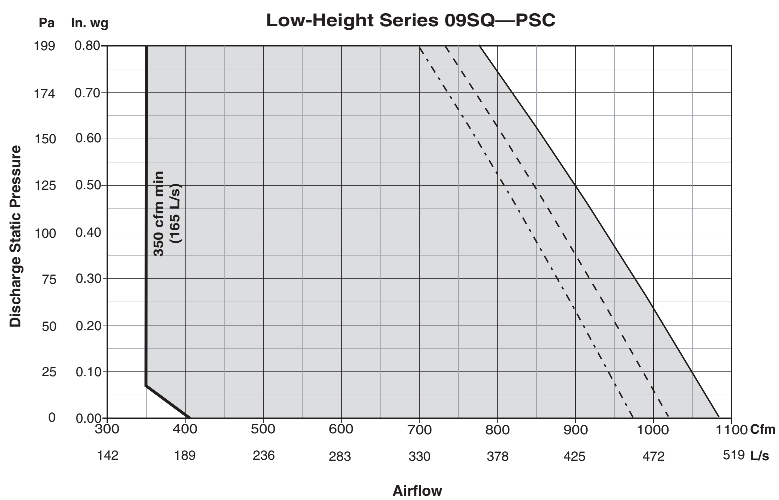
Pa (SI)			
Fan Size	Airflow L/s	1-Row HW (Pa)	2-Row HW (Pa)
08SQ	47	1	3
	94	3	6
	142	5	11
	189	9	18
	236	13	25
09SQ	189	9	18
	260	15	29
	330	23	43
	401	33	0
	472	44	80
10SQ	189	3	6
	378	8	16
	566	16	31
	755	27	50
	944	40	72

Table 58. Attenuator air pressure drop

(I-P)		
Fan Size	Plenum Cfm	Attenuator
08SQ	150	0.02
	250	0.04
	350	0.06
	450	0.09
09SQ	350	0.06
	500	0.10
	650	0.15
	800	0.22
10SQ	400	0.02
	700	0.05
	1000	0.09
	1300	0.14
	1600	0.20

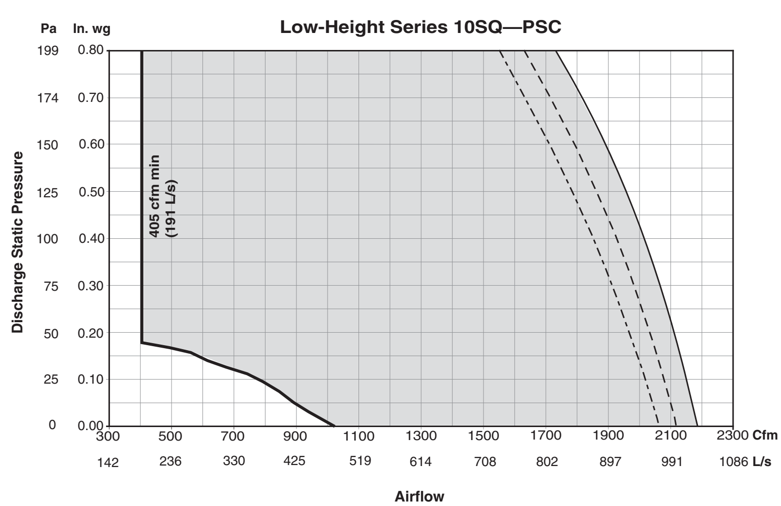
(SI)		
Fan Size	Plenum L/s	Attenuator
08SQ	71	0.01
	118	0.01
	165	0.02
	212	0.03
09SQ	165	0.02
	236	0.03
	307	0.05
	378	0.06
10SQ	189	0.01
	330	0.02
	472	0.03
	614	0.04
	755	0.06



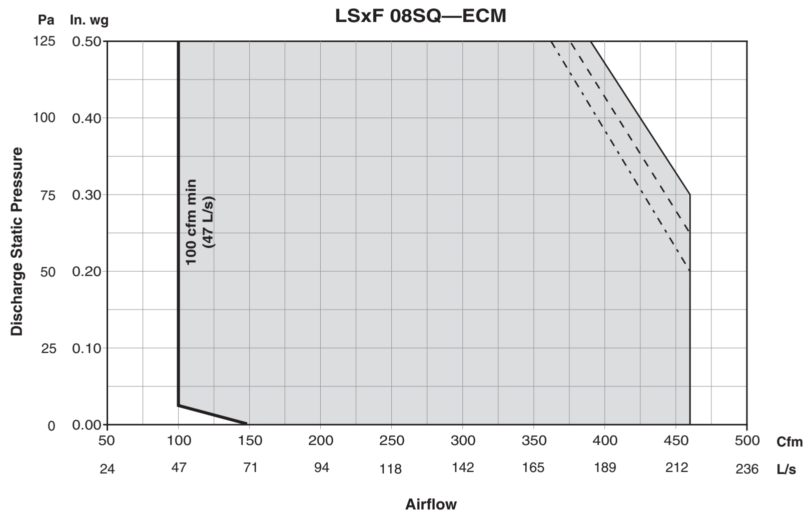


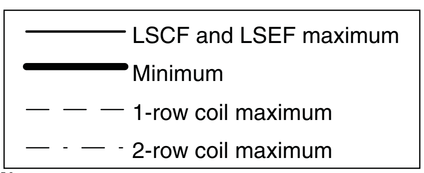
LSCF and LSEF maximum
Minimum
1-row coil maximum
2-row coil maximum

Note: When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.



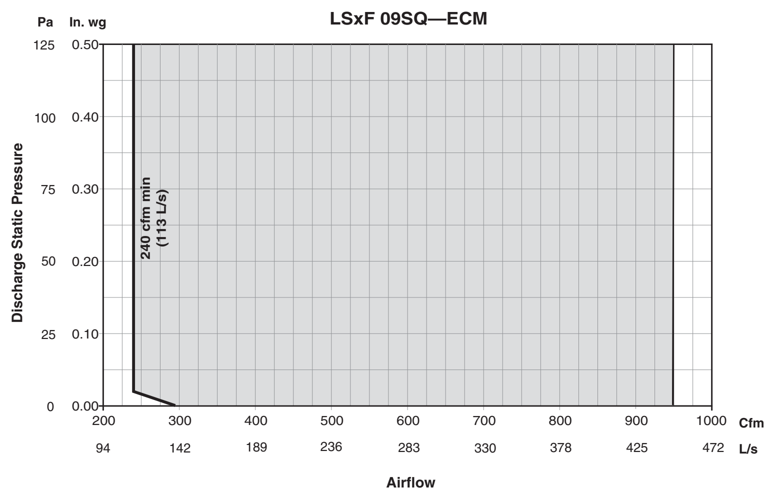
Performance Data





Notes:

1. ECMs (Electrically Commutated Motors) are ideal for systems seeking maximum motor efficiency.
2. When attenuator is required, add inlet attenuator pressure to discharge static pressure for final fan performance.



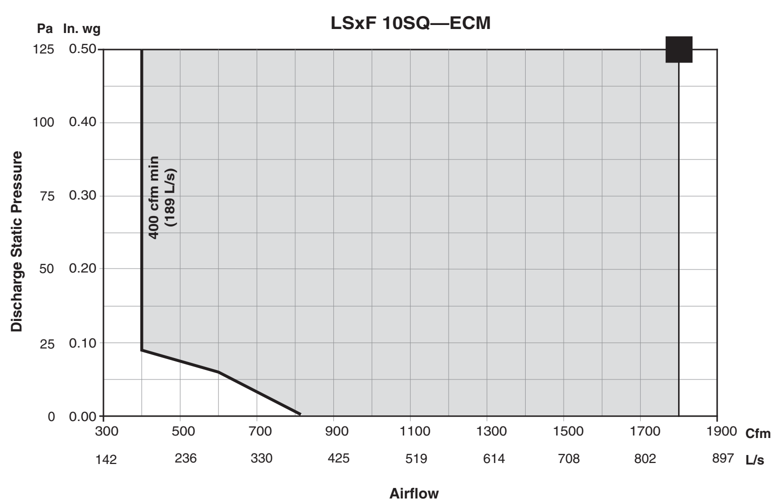


Table 59. Heating capacity (MBh) - fan sizes 08SQ & 09SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)									
			100	200	300	400	500	600	700	800	900	1000
1-Row Capacity MBH	1.0	0.15	-	-	-	-	-	-	-	-	-	-
	2.0	0.58	-	-	-	-	-	-	-	-	-	-
	3.0	1.27	7.92	11.16	13.45	15.34	16.97	18.42	19.73	20.92	22.01	23.02
	4.0	2.24	8.08	11.48	13.94	15.98	17.76	19.36	20.82	22.16	23.39	24.54
	5.0	3.48	8.17	11.69	14.25	16.39	18.28	19.99	21.54	22.98	24.32	25.57
	6.0	4.98	8.24	11.83	14.47	16.69	18.65	20.43	22.06	23.58	24.99	26.31
2-Row Capacity MBH	1.0	0.76	9.04	14.59	18.26	20.87	22.83	24.35	25.57	26.58	27.42	28.14
	2.0	2.60	9.45	15.95	20.70	24.34	27.24	29.61	31.59	33.28	34.74	36.02
	3.0	5.39	9.59	16.43	21.60	25.68	29.01	31.78	34.14	36.17	37.95	39.53
	4.0	9.06	9.66	16.68	22.08	26.40	29.96	32.96	35.54	37.78	39.75	41.51
	5.0	13.57	9.70	16.83	22.37	26.85	30.56	33.71	36.43	38.80	40.90	42.78

Table 60. Heating capacity (MBh) - fan size 10SQ (I-P)

Rows	Gpm	Water Pressure Drop (ft)	Airflow (Cfm)										
			450	600	750	900	1050	1200	1350	1500	1650	1800	1950
1-Row Capacity MBH	1.0	0.16	-	-	-	-	-	-	-	-	-	-	-
	2.0	0.61	-	-	-	-	-	-	-	-	-	-	-
	4.0	2.32	25.05	28.61	31.67	34.39	36.86	39.12	41.23	43.18	45.02	46.75	48.41
	6.0	5.09	26.10	30.00	33.40	36.45	39.26	41.85	44.28	46.57	48.73	50.77	52.71
	8.0	8.91	26.66	30.76	34.34	37.59	40.59	43.38	46.00	48.48	50.83	53.07	55.20
	10.0	13.77	27.02	31.23	34.95	38.32	41.44	44.36	47.11	49.72	52.20	54.56	56.83
2-Row Capacity MBH	1.0	1.29	28.40	32.18	34.87	36.88	38.43	39.66	40.66	41.49	42.19	42.79	43.30
	2.0	4.31	33.46	39.56	44.37	48.27	51.49	54.19	56.50	58.49	60.23	61.76	63.13
	3.0	8.84	35.30	42.41	48.23	53.10	57.23	60.78	63.88	66.61	69.03	71.20	73.16
	4.0	14.77	36.25	43.91	50.30	55.72	60.40	64.48	68.08	71.28	74.15	76.74	79.09
	5.0	22.03	36.83	44.83	51.58	57.37	62.41	66.84	70.78	74.30	77.48	80.36	82.99

Water Coil Notes

1. Fouling Factor = 0.0005.
2. The following equations may be used in calculating Leaving Air Temperature (LAT) and Water Temperature Difference (WTD).

$$LAT = EAT + \left(\frac{MBH \times 921.7}{Cfm}\right)$$

$$WTD = EWT - LWT = \left(\frac{2 \times MBH}{Gpm}\right)$$

3. Capacity based on 70°F entering air temperature and 180°F entering water temperature. Refer to correction factors for different entering conditions.

Table 61. Temperature correction factors for water pressure drop (ft)

Average Water Temperature	200	190	180	170	160	150	140	130	120	110
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 62. Temperature correction factors for coil capacity (MBH)

Entering Water Minus Entering Air	40	50	60	70	80	90	100	110	120	130
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Table 63. Heating capacity (kW) - fan size 08SQ & 09SQ (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s) 47	94	142	189	236	283	330	378	425	472
1-Row Capacity kW	0.06	0.44	-	-	-	-	-	-	-	-	-	-
	0.13	1.72	-	-	-	-	-	-	-	-	-	-
	0.19	3.81	2.32	3.27	3.94	4.50	4.97	5.40	5.78	6.13	6.45	6.75
	0.25	6.71	2.37	3.36	4.08	4.68	5.21	5.67	6.10	6.49	6.86	7.19
	0.32	10.40	2.39	3.42	4.18	4.80	5.36	5.86	6.31	6.74	7.13	7.49
	0.38	14.90	2.41	3.47	4.24	4.89	5.47	5.99	6.47	6.91	7.32	7.71
2-Row Capacity kW	0.06	2.27	2.65	4.28	5.35	6.12	6.69	7.14	7.49	7.79	8.04	8.25
	0.13	7.78	2.77	4.67	6.07	7.13	7.98	8.68	9.26	9.75	10.18	10.56
	0.19	16.11	2.81	4.82	6.33	7.53	8.50	9.31	10.00	10.60	11.12	11.58
	0.25	27.08	2.83	4.89	6.47	7.74	8.78	9.66	10.41	11.07	11.65	12.16
	0.32	40.58	2.84	4.93	6.56	7.87	8.96	9.88	10.68	11.37	11.99	12.54

Table 64. Heating capacity (kW) - fan size 10SQ (SI)

Rows	L/s	Water Pressure Drop (kPa)	Airflow (L/s) 212	283	354	425	495	566	637	708	779	849	920
1-Row Capacity kW	0.06	0.48	-	-	-	-	-	-	-	-	-	-	-
	0.13	1.82	-	-	-	-	-	-	-	-	-	-	-
	0.25	6.93	7.34	8.38	9.28	10.08	10.80	11.47	12.08	12.66	13.19	13.70	13.70
	0.38	15.22	7.65	8.79	9.79	10.68	11.50	12.27	12.98	13.65	14.28	14.88	14.88
	0.50	26.64	7.81	9.01	10.07	11.02	11.90	12.71	13.48	14.21	14.90	15.55	15.55
	0.63	41.16	7.92	9.15	10.24	11.23	12.15	13.00	13.81	14.57	15.30	15.99	15.99
2-Row Capacity kW	0.06	3.84	8.32	9.43	10.22	10.81	11.26	11.62	11.92	12.16	12.36	12.54	12.54
	0.13	12.90	9.81	11.59	13.00	14.15	15.09	15.88	16.56	17.14	17.65	18.10	18.10
	0.19	26.43	10.35	12.43	14.14	15.56	16.77	17.81	18.72	19.52	20.23	20.87	20.87
	0.25	44.15	10.62	12.87	14.74	16.33	17.70	18.90	19.95	20.89	21.73	22.49	22.49
	0.32	65.84	10.79	13.14	15.12	16.81	18.29	19.59	20.74	21.78	22.71	23.55	23.55

Water Coil Notes

1. Fouling Factor = 0.0005.|
2. The following equations may be used in calculating Leaving Air Temperature (LAT) and Water Temperature Difference (WTD).

$$LAT = EAT + \left(\frac{kW \times 0.83}{Lls}\right)$$

$$WTD = EWT - LWT = \left(\frac{kW}{(4.19)Lls}\right)$$

3. Capacity based on 21°C entering air temperature and 82°C entering water temperature. Refer to correction factors for different entering conditions.

Table 65. Temperature correction factors for water pressure drop (kPa)

Average Water Temperature	93	88	82	77	71	66	60	54	49	43
Correction Factor	0.970	0.985	1.000	1.020	1.030	1.050	1.080	1.100	1.130	1.150

Table 66. Temperature correction factors for coil capacity (kW)

Entering Water Minus Entering Air	22	27	33	38	44	50	55	61	67	72
Correction Factor	0.355	0.446	0.537	0.629	0.722	0.814	0.907	1.000	1.093	1.187

Electrical Data

Parallel Fan-Powered Terminal Units

Table 67. PSC motor units—electric coil kW guidelines – minimum to maximum (VPEF)

		Single-Phase Voltage						Three-Phase Voltage			
Fan Size	Stages	120V	208V	240V	277V	347V	480V	208V	480V	600V	380V/ 50Hz
02SQ	1	0.5-5.0	0.5-6.0	0.5-6.0	0.5-6.0	0.5-6.0	0.5-6.0	0.5-6.0	1.0-6.0	1.5-6.0	1.0-6.0
	2	0.5-5.0	0.5-6.0	0.5-6.0	1.0-6.0	1.0-6.0	1.0-6.0	1.0-6.0	2.0-6.0	3.0-6.0	1.5-6.0
03SQ	1	0.5-5.0	0.5-9.0	0.5-10.0	0.5-11.0	0.5-11.0	0.5-11.0	0.5-11.0	1.0-11.0	1.5-11.0	1.0-11.0
	2	0.5-5.0	0.5-9.0	0.5-10.0	1.0-11.0	1.0-11.0	1.0-11.0	1.0-11.0	2.0-11.0	3.0-11.0	1.5-11.0
04SQ	1	0.5-4.5	0.5-8.0	0.5-10.0	0.5-12.0	0.5-14.0	0.5-14.0	0.5-14.0	1.0-14.0	1.5-14.0	1.0-14.0
	2	0.5-4.5	0.5-8.0	0.5-10.0	1.0-12.0	1.0-14.0	1.0-14.0	1.0-14.0	2.0-14.0	3.0-14.0	1.5-14.0
05SQ	1	0.5-4.5	0.5-8.0	0.5-9.0	0.5-12.0	0.5-15.0	0.5-18.0	0.5-14.0	1.0-18.0	1.5-18.0	1.0-18.0
	2	0.5-4.5	0.5-8.0	0.5-9.0	1.0-12.	1.0-15.0	1.0-18.0	1.0-14.0	2.0-18.0	3.0-18.0	1.5-18.0
06SQ	1	-	0.5-9.0	-	0.5-12.0	0.5-15.0	0.5-16.0	0.5-15.0	1.0-16.0	1.5-16.0	1.0-16.0
	2	-	0.5-9.0	-	1.0-12.0	1.0-15.0	1.0-16.0	1.0-15.0	2.0-16.0	3.0-16.0	1.5-16.0
07SQ	1	-	0.5-8.0	-	0.5-11.0	0.5-15.0	0.5-20.0	0.5-14.0	1.0-20.0	1.5-20.0	1.0-20.0
	2	-	0.5-8.0	-	1.0-11.0	1.0-15.0	1.0-20.0	1.0-14.0	2.0-20.0	3.0-20.0	1.5-20.0

Table 68. ECM units—electric coil kW guidelines – minimum to maximum (VPEF)

		Single-Phase Voltage						Three-Phase Voltage			
Fan Size	Stages	120V	208V	240V	277V	347V	480V	208V	480V	600V	380V/ 50Hz
03SQ	1	0.5-4.5	0.5-8.0	0.5-10.0	0.5-11.0	-	0.5-11.0	0.5-11.0	1.0-11.0	-	-
	2	0.5-4.5	0.5-8.0	0.5-10.0	1.0-11.0	-	1.0-11.0	1.0-11.0	2.0-11.0	-	-
04SQ	1	0.5-4.5	0.5-8.0	0.5-9.0	0.5-12.0	-	0.5-14.0	0.5-14.0	1.0-14.0	-	-
	2	0.5-4.5	0.5-8.0	0.5-9.0	1.0-12.0	-	1.0-14.0	1.0-14.0	2.0-14.0	-	-
05SQ	1	0.5-4.0	0.5-7.0	0.5-8.0	0.5-11.0	-	0.5-18.0	0.5-12.0	1.0-18.0	-	-
	2	0.5-4.0	0.5-7.0	0.5-8.0	1.0-11.0	-	1.0-18.0	1.0-12.0	2.0-18.0	-	-
06SQ	1	0.5-4.0	0.5-7.0	0.5-8.0	0.5-11.0	-	0.5-16.0	0.5-12.0	1.0-16.0	-	-
	2	0.5-4.0	0.5-7.0	0.5-8.0	1.0-11.0	-	1.0-16.0	1.0-12.0	2.0-16.0	-	-

Notes:

1. Coils available with 24-VAC magnetic or mercury contactors, load carrying P.E. switches, and P.E. switch with magnetic or mercury contactors.
2. Available kW increments are by 0.5 from 0.5 kW to 8.0 kW, by 1.0 kW from 9.0 to 18.0 kW, and by 2.0 kW from 18.0 to 20.0 kW.
3. Each stage will be equal in kW output.
4. All heaters contain an auto reset thermal cutout and a manual reset cutout.
5. See section "Formulas," p. 73 for formulas used to calculate the current amp draw for the heater elements.
6. Recommended coil temperature rise = 20° to 30°F (-7° to -1°C). Maximum temperature rise = 55°F (12°C).
7. Heaters should not operate at cfms below the nameplate minimum.

Table 69. Fan electrical performance (PSC)

		Maximum Fan Motor Amperage (FLA)		
Fan Size	HP	115 VAC	208 VAC	277 VAC
02SQ	1/8	1.6	-	0.7
03SQ	1/3	4.3	-	1.6
04SQ	1/3	5.5	-	2.0
05SQ	1/2	6.7	-	2.4
06SQ	1/2	-	4.6	3.8
07SQ	1	-	6.6	4.7

Table 69. Fan electrical performance (PSC)

Notes:
1. Electric Heat Units - Units with fan sizes 02SQ to 05SQ and a primary voltage of 208/60/1, 208/60/3, or 240/60/1 have 115/60/1 VAC fan motors. Fan sizes 06SQ and 07SQ with the same voltages, have 208/60/1 VAC motors.
2. Electric Heat Units - Units with primary voltage of 277/60/1, 480/60/1 or 480/60/3 use 277 VAC fan motors.
3. Electric Heat Units - Units with primary voltage of 347/60/1 or 575/60/3 use 347 VAC fan motors.
4. With 380/50/3 and 230/50/1, use 230/50 motors.

Table 70. Fan electrical performance (ECM)

Fan Size	HP	Maximum Fan Motor Amperage (FLA)	
		115 VAC	277 VAC
03SQ	1/3	4.5	2.4
04SQ	1/2	6.5	3.5
05SQ	1	10.1	5.4
06SQ	1	9.5	5.1

Notes:
1. Electric heat units—units with primary voltages of 208/60/1, 208/60/3, or 240/60/1 have 115-VAC fan motors.
2. Electric heat units—units with primary voltages of 277/60/1, 480/60/1, or 480/60/3 have 277-VAC fan motors.
3. 347/60/1 and 230/50/1 voltage motors not available with ECMs.

Table 71. Minimum unit electric heat Cfm guidelines (PSC)

Unit kW	Cfm					
	02SQ	03SQ	04SQ	05SQ	06SQ	07SQ
0.5	118	200	315	350	533	585
1	118	200	315	350	533	585
1.5	118	200	315	350	533	585
2	118	200	315	350	533	585
2.5	146	200	315	350	533	585
3	174	200	315	350	533	585
3.5	201	200	315	350	533	585
4	229	230	315	350	533	585
4.5	257	260	315	350	533	585
5	285	290	315	350	533	585
5.5	312	315	315	350	533	585
6	340	350	350	350	533	585
6.5	-	375	375	375	533	585
7	-	400	400	400	533	585
7.5	-	430	430	430	533	585
8	-	460	460	460	533	585
9	-	515	515	515	589	633
10	-	575	575	575	645	682
11	-	630	630	630	701	730
12	-	-	690	690	758	779
13	-	-	745	745	814	827
14	-	-	810	810	870	876
15	-	-	-	860	926	924
16	-	-	-	920	982	972
17	-	-	-	973	-	1021
18	-	-	-	1030	-	1069
20	-	-	-	-	-	1166

Table 72. Minimum unit electric heat L/s guidelines (PSC)

	L/s					
Unit kW	02SQ	03SQ	04SQ	05SQ	06SQ	07SQ
0.5	56	94	149	165	252	276
1	56	94	149	165	252	276
1.5	56	94	149	165	252	276
2	56	94	149	165	252	276
2.5	69	94	149	165	252	276
3	82	94	149	165	252	276
3.5	95	94	149	165	252	276
4	108	109	149	165	252	276
4.5	121	123	149	165	252	276
5	134	137	149	165	252	276
5.5	147	149	149	165	252	276
6	160	165	165	165	252	276
6.5	-	177	177	177	252	276
7	-	189	189	189	252	276
7.5	-	203	203	203	252	276
8	-	217	217	217	252	276
9	-	243	243	243	278	299
10	-	271	271	271	305	322
11	-	297	297	297	331	345
12	-	-	326	326	358	367
13	-	-	352	352	384	390
14	-	-	382	382	410	413
15	-	-	-	406	437	436
16	-	-	-	434	463	459
17	-	-	-	459	-	482
18	-	-	-	486	-	505
20	-	-	-	-	-	550

Table 73. Minimum unit electric heat Cfm guidelines (ECM)

	Cfm			
Unit kW	03SQ	04SQ	05SQ	06SQ
0.5	200	315	350	560
1	200	315	350	560
1.5	200	315	350	560
2	200	315	350	560
2.5	200	315	350	560
3	200	315	350	560
3.5	200	315	350	560
4	230	315	350	560
4.5	260	315	350	560
5	290	315	350	560
5.5	315	315	350	560
6	350	350	350	560
6.5	375	375	375	560
7	400	400	400	560
7.5	430	430	430	560
8	460	460	460	560
9	515	515	515	604
10	575	575	575	649

Table 73. Minimum unit electric heat Cfm guidelines (ECM) (continued)

Unit kW	Cfm			
	03SQ	04SQ	05SQ	06SQ
11	630	630	630	693
12	-	690	690	738
13	-	745	745	782
14	-	810	810	826
15	-	-	860	871
16	-	-	920	915
17	-	-	973	-
18	-	-	1030	-

Table 74. Minimum unit electric heat L/s guidelines (ECM)

Unit kW	L/s			
	03SQ	04SQ	05SQ	06SQ
0.5	94	149	165	264
1	94	149	165	264
1.5	94	149	165	264
2	94	149	165	264
2.5	94	149	165	264
3	94	149	165	264
3.5	94	149	165	264
4	109	149	165	264
4.5	123	149	165	264
5	137	149	165	264
5.5	149	149	165	264
6	165	165	165	264
6.5	177	177	177	264
7	189	189	189	264
7.5	203	203	203	264
8	217	217	217	264
9	243	243	243	285
10	271	271	271	306
11	297	297	297	327
12	-	326	326	348
13	-	352	352	369
14	-	382	382	390
15	-	-	406	411
16	-	-	434	432
17	-	-	459	-
18	-	-	486	-

Series Fan-Powered Terminal Units

Table 75. VSEF—electric coil kW guidelines – minimum to maximum (PSC motor units)

Fan Size	Stages	Single-Phase Voltage 120V	208V	240V	277V	347V	480V	Three-Phase Voltage 208V	480V	600V	380V/50Hz
02SQ	1	0.5-5.0	0.5-7.0	0.5-7.0	0.5-7.0	0.5-7.0	1.0-7.0	0.5-7.0	1.0-7.0	1.5-7.0	1.5-7.0
	2	0.5-5.0	0.5-7.0	0.5-7.0	1.0-7.0	1.0-7.0	1.5-7.0	1.0-7.0	3.5-7.0[a]	-	2.5-7.0
03SQ	1	0.5-5.0	0.5-9.0	0.5-10.0	0.5-12.0	0.5-14.0	1.0-13.0[b]	0.5-14.0	1.0-12.0	1.5-13.0	1.0-14[c]
	2	0.5-5.0	0.5-9.0	0.5-10.0	1.0-12.0	1.0-14.0	1.5-13.0[b]	1.0-14.0	3.5-12.0[a]	-	2.5-13[c]
04SQ	1	0.5-4.5	0.5-8.0	0.5-10.0	0.5-12.0	0.5-16.0	0.5-18.0	0.5-15.0	1.0-18.0	1.5-18.0[d]	1.0-18
	2	0.5-4.5	0.5-8.0	0.5-10.0	1.0-12.0	1.0-16.0	1.0-18.0	1.0-15.0	2.5-18.0	4.0-15.0	1.5-18
05SQ	1	0.5-4.5	0.5-8.0	0.5-9.0	0.5-12.0	0.5-15.0	0.5-20.0	0.5-14.0	1.0-20.0	1.5-22.0	1.0-22.0
	2	0.5-4.5	0.5-8.0	0.5-9.0	1.0-12.0	1.0-15.0	1.0-20.0	1.0-14.0	2.5-20.0	4.0-20.0[e]	1.5-22.0
06SQ	1	-	0.5-9.0	-	0.5-12.0	0.5-15.0	0.5-22.0	0.5-15.0	1.0-22.0	1.5-22.0	1.0-22
	2	-	0.5-9.0	-	1.0-12.0	1.0-15.0	1.0-22.0	1.0-15.0	2.0-22.0	3.0-22.0	1.5-22
07SQ	1	-	0.5-8.0	-	0.5-11.0	0.5-15.0	0.5-20.0	0.5-14.0	1.0-24.0	1.5-24.0	-
	2	-	0.5-8.0	-	1.0-11.0	1.0-15.0	1.0-20.0	1.0-14.0	2.0-24.0	3.0-24.0	-

(a) 4.5, 5.5, 6.5, 9, 11, 13 kW not available
(b) 12 kW not available
(c) 10, 13 kW not available
(d) 16, 17 kW not available
(e) 18 kW not available

Table 76. VSEF—electric coil kW guidelines – minimum to maximum (ECM units)

Fan Size	Stages	Single-Phase Voltage 120V	208V	240V	277V	347V	480V	Three-Phase Voltage 208V	480V	600V	380V/50Hz
03SQ	1	0.5-4.5	0.5-8.0	0.5-10.0	0.5-12.0	-	1.0-13.0[a]	0.5-14.0	1.0-12.0	-	-
	2	0.5-4.5	0.5-8.0	0.5-10.0	1.0-12.0	-	1.5-13.0[a]	1.0-14.0	3.5-12.0[b]	-	-
04SQ	1	0.5-4.5	0.5-8.0	0.5-9.0	0.5-12.0	-	0.5-18.0	0.5-14.0	1.0-18.0[c]	-	-
	2	0.5-4.5	0.5-8.0	0.5-9.0	1.0-12.0	-	1.0-18.0	1.0-14.0	2.5-15.0	-	-
05SQ	1	0.5-4.0	0.5-7.0	0.5-8.0	0.5-11.0	-	0.5-18.0	0.5-12.0	1.0-22.0	-	-
	2	0.5-4.0	0.5-7.0	0.5-8.0	1.0-11.0	-	1.0-18.0	1.0-12.0	2.5-20.0	-	-
06SQ	1	0.5-4.0	0.5-7.0	0.5-8.0	0.5-11.0	-	0.5-22.0	0.5-12.0	1.0-22.0	-	-
	2	0.5-4.0	0.5-7.0	0.5-8.0	1.0-11.0	-	1.0-22.0	1.0-12.0	2.0-22.0	-	-

Notes:
1. Coils available with electric, 24 VAC magnetic or contactors, load carrying P.E. switches, and P.E. switches with magnetic or mercury contactors.
2. Available kW increments are by 0.5 from 0.5 to 8.0 kW, by 1.0 kW from 9.0 to 17.0 kW, and by 2.0 kW from 18.0 to 24.0 kW.
3. Each stage will be equal in kW output.
4. All heaters contain an auto reset thermal cutout and a manual reset cutout.
5. See section "Formulas," p. 73 for formulas used to calculate the current amp draw for the heater elements.
6. Recommended coil temperature rise = 20°-30°F (-7° to -1°C). Maximum temperature rise = 55°F (12°C).
7. Heaters should not operate at cfms below the nameplate minimum.

(a) 12 kW not available
(b) 4.5, 5,5, 6.5, 9, 11 kW not available
(c) 16, 17 kW not available

Table 77. Fan electrical performance (PSC)

Fan Size	HP	Maximum Fan Motor Amperage (FLA) 115 VAC	208 VAC	277 VAC
02SQ	1/8	1.6	-	0.7
03SQ	1/3	4.3	-	1.6
04SQ	1/3	5.5	-	2.0
05SQ	1/2	6.7	-	2.4
06SQ	1/2	-	4.6	3.8

Table 77. Fan electrical performance (PSC)

07SQ	1	-	6.6	4.7

Notes:
1. Electric Heat Units—Units with fan sizes 02SQ to 05SQ and a primary voltage of 208/60/1, 208/60/3 or 0/60/1 use 115/60/1 VAC fan motors. Fan sizes 06SQ and 07SQ in these same voltages, have 208/60/1 VAC fan motors.
2. Electric Heat Units—Units with primary voltage of 277/60/1, 480/60/1 or 480/60/3 use 277 VAC fan motors.
3. Electric Heat Units—Units with primary voltage of 347/60/1 or 575/60/3 use 347 VAC fan motors.
4. With 380/50/3 and 230/50/1 use 230/50 motors.

Table 78. Fan electrical performance (ECM)

		Maximum Fan Motor Amperage (FLA)	
Fan Size	HP	120 VAC	277 VAC
03SQ	1/3	4.5	2.4
04SQ	½	6.5	3.5
05SQ	1	10.1	5.4
06SQ	1	9.5	5.1

Notes:
1. Acceptable selections are any point within the shaded area. The ECM will operate on a vertical performance line using the solid state speed controller provided.
2. The ECM motor provides constant volume with changing static pressure conditions. Therefore, the fan curves for the ECM are different compared to fan curves with PSC motors.
3. By using an ECM motor, less fan sizes are used because of the wider turn-down ratios.

Table 79. Minimum unit electric

	Heat Cfm Guidelines (PSC)					
Unit kW	02SQ	03SQ	04SQ	05SQ	06SQ	07SQ
0.5	191	260	315	400	700	850
1	191	260	315	400	700	850
1.5	191	260	315	400	700	850
2	191	260	315	400	700	850
2.5	191	260	315	400	700	850
3	214	260	315	400	700	850
3.5	236	260	315	400	700	850
4	259	260	315	400	700	850
4.5	282	260	315	400	700	850
5	304	290	315	400	700	850
5.5	327	315	315	400	700	850
6	350	350	350	400	700	850
6.5	372	375	375	400	700	850
7	395	400	400	400	700	850
7.5	-	430	430	430	700	850
8	-	460	460	460	700	850
9	-	515	515	515	700	850
10	-	575	575	575	700	850
11	-	630	630	630	713	850
12	-	690	690	690	792	902
13	-	745	745	745	872	954
14	-	810	810	810	951	1006
15	-	-	860	860	1031	1057
16	-	-	920	920	1110	1109
17	-	-	973	973	1190	1161
18	-	-	1030	1030	1269	1213
20	-	-	-	1150	1428	1317
22	-	-	-	1260	1587	1420
24	-	-	-	-	-	1524

Table 80. Minimum unit electric

Unit kW	Heat L/s Guidelines (PSC)					
	02SQ	03SQ	04SQ	05SQ	06SQ	07SQ
0.5	90	123	149	189	330	401
1	90	123	149	189	330	401
1.5	90	123	149	189	330	401
2	90	123	149	189	330	401
2.5	90	123	149	189	330	401
3	101	123	149	189	330	401
3.5	112	123	149	189	330	401
4	122	123	149	189	330	401
4.5	133	123	149	189	330	401
5	144	137	149	189	330	401
5.5	154	149	149	189	330	401
6	165	165	165	189	330	401
6.5	176	177	177	189	330	401
7	186	189	189	189	330	401
7.5	-	203	203	203	330	401
8	-	217	217	217	330	401
9	-	243	243	243	330	401
10	-	271	271	271	330	401
11	-	297	297	297	336	401
12	-	326	326	326	374	426
13	-	352	352	352	411	450
14	-	382	382	382	449	475
15	-	-	406	406	486	499
16	-	-	434	434	524	524
17	-	-	459	459	562	548
18	-	-	486	486	599	572
20	-	-	-	543	674	621
22	-	-	-	595	749	670
24	-	-	-	-	-	719

Table 81. Minimum unit electric

	Heat Cfm Guidelines (ECM)			
Unit kW	03SQ	04SQ	05SQ	06SQ
0.5	260	315	400	943
1	260	315	400	943
1.5	260	315	400	943
2	260	315	400	943
2.5	260	315	400	943
3	260	315	400	943
3.5	260	315	400	943
4	260	315	400	943
4.5	260	315	400	943
5	290	315	400	943
5.5	315	315	400	943
6	350	350	400	943
6.5	375	375	400	943
7	400	400	400	943
7.5	430	430	430	943
8	460	460	460	943
9	515	515	515	943
10	575	575	575	975
11	630	630	630	1006
12	690	690	690	1038
13	745	745	745	1069
14	810	810	810	1101
15	-	860	860	1133
16	-	920	920	1164
17	-	973	973	1196
18	-	1030	1030	1228
20	-	-	1150	1291
22	-	-	1260	1354

Table 82. Minimum unit electric

Unit kW	Heat L/s Guidelines (ECM)			
	03SQ	04SQ	05SQ	06SQ
0.5	123	149	189	445
1	123	149	189	445
1.5	123	149	189	445
2	123	149	189	445
2.5	123	149	189	445
3	123	149	189	445
3.5	123	149	189	445
4	123	149	189	445
4.5	123	149	189	445
5	137	149	189	445
5.5	149	149	189	445
6	165	165	189	445
6.5	177	177	189	445
7	189	189	189	445
7.5	203	203	203	445
8	217	217	217	445
9	243	243	243	445
10	271	271	271	460
11	297	297	297	475
12	326	326	326	490
13	352	352	352	505
14	382	382	382	520
15	-	406	406	535
16	-	434	434	549
17	-	459	459	564
18	-	486	486	579
20	-	-	543	609
22	-	-	595	639

Low Height Parallel Fan-Powered Terminal Units

Table 83. LPEF—electric coil kW guidelines – minimum to maximum (PSC motor units)

		Single-Phase Voltage						Three-Phase Voltage			
Fan Size	Stages	120V	208V	240V	277V	347V	480V	208V	480V	600V	380V/ 50Hz
08SQ	1	0.5-4.5	0.5-7.0	0.5-7.0	0.5-7.0	0.5-7.0	0.5-7.0	0.5-7.0	1.0-7.0	1.5-7.0	-
	2	0.5-4.5	0.5-7.0	0.5-7.0	1.0-7.0	1.0-7.0	1.0-7.0	1.0-7.0	2.0-7.0	3.0-7.0	-
09SQ	1	0.5-4.5	0.5-8.0	0.5-10.0	0.5-12.0	0.5-14.0	0.5-14.0	0.5-14.0	1.0-14.0	1.5-14.0	-
	2	0.5-4.5	0.5-8.0	0.5-10.0	1.0-12.0	1.0-14.0	1.0-14.0	1.0-14.0	2.0-14.0	3.0-14.0	-
10SQ	1	0.5-4.0	0.5-8.0	0.5-9.0	0.5-12.0	0.5-14.0	0.5-14.0	1.0-13.0	1.0-14.0	1.5-12.0	-
	2	0.5-4.0	0.5-8.0	0.5-9.0	1.0-12.0	1.0-14.0	1.0-14.0	1.0-13.0	2.0-14.0	3.0-12.0	-

Table 84. LPEF–electric coil kW guidelines – minimum to maximum (ECM units)

		Single-Phase Voltage						Three-Phase Voltage			
Fan Size	Stages	120V	208V	240V	277V	347V	480V	208V	480V	600V	380V/ 50Hz
08SQ	1	0.5-5.0	0.5-7.0	0.5-7.0	0.5-7.0	-	0.5-7.0	0.5-7.0	1.0-7.0	-	-
	2	0.5-5.0	0.5-7.0	0.5-7.0	1.0-7.0	-	1.0-7.0	1.0-7.0	2.0-7.0	-	-
09SQ	1	0.5-4.5	0.5-8.0	0.5-9.0	0.5-12.0	-	0.5-14.0	0.5-14.0	1.0-14.0	-	-
	2	0.5-4.5	0.5-8.0	0.5-9.0	1.0-12.0	-	1.0-14.0	1.0-14.0	2.0-14.0	-	-

Notes:

1. Coils available with 24 VAC magnetic or mercury contactors, load carrying P.E. switches, and P.E. switch with magnetic or mercury contractors.
2. Available kW increments are by 0.5 from 0.5 kW to 8.0 kW and by 1.0 kW from 9.0 to 14.0 kW.
3. Each stage will be equal in kW output.
4. All heaters contain an auto thermal cutout and a manual reset cutout.
5. The current amp draw for the heater elements is calculated by the formula below.

Table 85. Fan electrical performance (PSC)

		Maximum Fan Motor Amperage (FLA)		
Fan Size	HP	115 VAC	277 VAC	347 VAC
08SQ	1/3	5.5	2.5	1.8
09SQ	1/3	5.5	2.5	1.8
10SQ*	2 x 1/8	9.4	3.5	3.0

Notes:

1. Electric Heat Units - Units with Primary Voltage of 208/60/1, 208/60/3 or 240/60/1 use 115 VAC fan motors.
2. Electric Heat Units - Units with Primary Voltage of 277/60/1, 480/60/1 or 480/60/3 use 277 VAC fan motors.
3. Electric Heat Units - Units with Primary Voltage of 347/60/1 or 575/60/3 use 347 VAC fan motors.
4. Values are for standard, single-speed, permanent split capacitor type motors. Consult factory for non-standard motor performance.
5. Motor amps for 10SQ are total amps for two motors.

Table 86. Fan electrical performance (ECM)

		Maximum Fan Motor Amperage (FLA)	
Fan Size	HP	115 VAC	277 VAC
08SQ	1/2	2.0	1.1
09SQ	1/2	6.7	3.6

Table 87. Minimum unit electric heat guidelines

	Cfm (PSC)		
Unit kW	08SQ	09SQ	10SQ
0.5	173	440	720
1	173	440	720
1.5	173	440	720
2	173	440	720
2.5	173	440	720
3	173	440	720
3.5	202	440	720
4	232	440	720
4.5	261	440	720
5	290	440	720
5.5	319	440	720
6	349	440	720
6.5	378	440	720
7	407	440	720
7.5	-	468	720
8	-	496	720
9	-	552	720
10	-	608	720
11	-	664	720
12	-	720	720
13	-	776	720
14	-	832	-

	L/s (PSC)		
Unit kW	08SQ	09SQ	10SQ
0.5	82	208	340
1	82	208	340
1.5	82	208	340
2	82	208	340
2.5	82	208	340
3	82	208	340
3.5	95	208	340
4	109	208	340
4.5	123	208	340
5	137	208	340
5.5	151	208	340
6	164	208	340
6.5	178	208	340
7	192	208	340
7.5	-	221	340
8	-	234	340
9	-	261	340
10	-	287	340
11	-	313	340
12	-	340	340
13	-	366	340
14	-	393	-

Table 88. Minimum unit electric heat Cfm guidelines (ECM)

	Cfm (ECM)	
Unit kW	08SQ	09SQ
0.5	188	490
1	188	490
1.5	188	490
2	188	490
2.5	188	490
3	188	490
3.5	220	490
4	251	490
4.5	283	490
5	314	490
5.5	346	490
6	377	490
6.5	409	490
7	440	490
7.5	-	514
8	-	539
9	-	588
10	-	637
11	-	685
12	-	734
13	-	783
14	-	832

	L/s (ECM)	
Unit kW	08SQ	09SQ
0.5	89	231
1	89	231
1.5	89	231
2	89	231
2.5	89	231
3	89	231
3.5	104	231
4	118	231
4.5	133	231
5	148	231
5.5	163	231
6	178	231
6.5	193	231
7	208	231
7.5	-	243
8	-	254
9	-	277
10	-	300
11	-	323
12	-	347
13	-	370
14	-	393

Low Height Series Fan-Powered Terminal Units

Table 89. LSEF-electric coil kW guidelines-minimum to maximum (PSC motor units)

		Single-Phase Voltage						Three-Phase Voltage			
Fan Size	Stages	120V	208V	240V	277V	347V	480V	208V	480V	600V	380V/ 50Hz
08SQ	1	0.5-4.5	0.5-6.0	-	0.5-6.0	0.5-6.0	0.5-6.0	0.5-6.0	1.0-6.0	1.5-6.0	-
	2	0.5-4.5	0.5-6.0	-	0.5-6.0	1.0-6.0	1.0-6.0	1.0-6.0	3.0-6.0	5.0-5.0	-
09SQ	1	0.5-4.5	0.5-8.0	0.5-10.0	0.5-12.0	0.5-12.0	0.5-12.0	0.5-12.0	1.0-12.0	1.5-12.0	-
	2	0.5-4.5	0.5-8.0	0.5-10.0	1.0-12.0	1.0-12.0	1.0-12.0	1.0-12.0	3.0-12.0	4.5, 5, 9, 10	-
10SQ	1	0.5-4.0	0.5-7.5	0.5-8.0	0.5-11.0	0.5-15.0	0.5-18.0	0.5-13.0	1.0-18.0	1.5-18.0	-
	2	0.5-4.0	0.5-7.5	0.5-8.0	1.0-11.0	1.0-15.0	1.0-18.0	1.0-13.0	2.0-18.0	3.0-18.0	-

Table 90. LSEF-electric coil kW guidelines-minimum to maximum (ECM units)

		Single-Phase Voltage						Three-Phase Voltage			
Fan Size	Stages	120V	208V	240V	277V	347V	480V	208V	480V	600V	380V/ 50Hz
08SQ	1	0.5-5.0	0.5-6.0	0.5-6.0	0.5-6.0	-	0.5-6.0	0.5-6.0	1.0-6.0	-	-
	2	0.5-5.0	0.5-6.0	0.5-6.0	1.0-6.0	-	1.0-6.0	1.0-6.0	3.0-6.0	-	-
09SQ	1	0.5-4.5	0.5-8.0	0.5-10.0	0.5-12.0	-	0.5-12.0	0.5-12.0	1.0-12.0	-	-
	2	0.5-4.5	0.5-8.0	0.5-10.0	1.0-12.0	-	1.0-12.0	1.0-12.0	3.0-12.0	-	-
10SQ	1	0.5-4.5	0.5-8.0	0.5-9.0	0.5-12.0	-	0.5-18.0	0.5-14.0	1.0-18.0	-	-
	2	0.5-4.5	0.5-8.0	0.5-9.0	1.0-12.0	-	1.0-18.0	1.0-14.0	2.0-18.0	-	-

Notes:
1. Coils available with 24 VAC magnetic or mercury contactors, load carrying P.E. switches, and P.E. switch with magnetic or mercury contactors.
2. Available kW increments are by 0.5 from 0.5 kW to 8.0 kW and by 1.0 kW from 9.0 to 18.0 kW.
3. Each stage will be equal in kW output.
4. All heaters contain an auto thermal cutout and a manual reset cutout.
5. The current amp draw for the heater elements is calculated by the formula below.

Table 91. Fan electrical performance (PSC)

		Maximum Fan Motor Amperage (FLA)		
Fan Size	HP	115 VAC	277 VAC	347 VAC
08SQ	1/3	5.5	2.5	1.8
09SQ	1/3	5.5	2.5	1.8
10SQ*	2 x 1/3	11.0	5.0	3.5

Notes:
1. Electric Heat Units - Units with Primary Voltage of 208/60/1, 208/60/3 or 240/60/1 use 115 VAC fan motors.
2. Electric Heat Units - Units with Primary Voltage of 277/60/1, 480/60/1 or 480/60/3 use 277 VAC fan motors.
3. Electric Heat Units - Units with Primary Voltage of 347/60/1 or 575/60/3 use 347 VAC fan motors.
4. Values are for standard, single-speed, permanent split capacitor type motors. Consult factory for non-standard motor performance.
5. Motor amps for 10SQ are total amps for two motors.

Table 92. Fan electrical performance (ECM)

		Maximum Fan Motor Amperage (FLA)	
Fan Size	HP	115 VAC	277 VAC
08SQ	1/2	1.3	.7
09SQ	1/2	5.0	2.7
10SQ	2 x 1/2	7.5	4.0

Table 93. Minimum unit electric heat guidelines (PSC)

	Cfm		
Unit kW	08SQ	09SQ	10SQ
0.5	228	377	440
1	228	377	440
1.5	228	377	440
2	228	377	440
2.5	244	377	440
3	260	377	440
3.5	276	377	440
4	293	377	440
4.5	309	377	440
5	325	377	440
5.5	341	377	440
6	357	377	440
6.5	-	403	440
7	-	429	440
7.5	-	455	467
8	-	480	494
9	-	532	547
10	-	584	601
11	-	635	655
12	-	687	708
13	-	-	762
14	-	-	815
15	-	-	869
16	-	-	923
17	-	-	976
18	-	-	1030

	L/s		
Unit kW	08SQ	09SQ	10SQ
0.5	108	178	208
1	108	178	208
1.5	108	178	208
2	108	178	208
2.5	115	178	208
3	123	178	208
3.5	130	178	208
4	138	178	208
4.5	146	178	208
5	153	178	208
5.5	161	178	208
6	168	178	208
6.5	-	190	208
7	-	202	208
7.5	-	215	220
8	-	227	233
9	-	251	258
10	-	275	284
11	-	300	309
12	-	324	334
13	-	-	360
14	-	-	385
15	-	-	410
16	-	-	435
17	-	-	461
18	-	-	486

Table 94. Minimum unit electric heat guidelines (ECM)

	Cfm		
Unit kW	08SQ	09SQ	10SQ
0.5	128	377	480
1	128	377	480
1.5	128	377	480
2	128	377	480
2.5	159	377	480
3	190	377	480
3.5	221	377	480
4	253	377	480
4.5	284	377	480
5	315	377	480
5.5	346	377	480
6	377	377	480
6.5	-	403	480
7	-	429	480
7.5	-	455	505
8	-	480	530
9	-	532	580
10	-	584	630
11	-	635	680
12	-	687	730
13	-	-	779
14	-	-	829
15	-	-	879
16	-	-	929
17	-	-	979
18	-	-	1029

	L/s		
Unit kW	08SQ	09SQ	10SQ
0.5	60	178	227
1	60	178	227
1.5	60	178	227
2	60	178	227
2.5	75	178	227
3	90	178	227
3.5	104	178	227
4	119	178	227
4.5	134	178	227
5	149	178	227
5.5	163	178	227
6	178	178	227
6.5	-	190	227
7	-	202	227
7.5	-	215	238
8	-	227	250
9	-	251	274
10	-	276	297
11	-	300	321
12	-	324	345
13	-	-	368
14	-	-	391
15	-	-	415
16	-	-	438
17	-	-	462
18	-	-	486

Formulas

Fan-Powered Parallel

Minimum Circuit Ampacity (MCA) Equation

MCA = 1.25 x (Σ motor amps + heater amps)
Motor amps is the sum of all motor current draws if more than one is used in the unit.

Maximum Overcurrent Protection (MOP) Equation

MOP = (2.25 x motor1 amps) + motor2 amps + heater amps
motor1 amps = current draw of largest motor
motor2 amps = sum of current of all other motors used in unit

General Sizing Rules:

- If MOP = 15, then fuse size = 15
- If MOP = 19, then fuse size = 15 with one exception. If heater amps x 1.25 > 15, then fuse size = 20.
- If MOP is equal to or less than MCA, then choose next fuse size greater than MCA.
- Control fusing not applicable.
- Standard Fuse Sizes: 15, 20, 25, 30, 35, 40, 45, 50, and 60.

Example:

A model VPEF, electric reheat unit size 10-05SQ has 480/3 phase, 12 kW electric reheat with 2 stages and 277-Volt motor.

For MOP of fan-powered unit:

12 kW-480/3 heater:12x1000/480x1.73=14.45 amps

MCA = (2.4 + 14.45) x 1.25 = 21.06, MOP = (2.25 x 2.4) + 14.45 = 19.9.

Since MOP is less than or equal to MCA, then MOP = 25.

For total current draw of unit:

12kW-480/3 heater:12x1000/480x1.73=14.45

Two heat outputs (2 stages) @0.5 amps max each=1.00

Motor amps: 277 V (Fan size 0517) =2.4

Amps Max: 18.35

Useful Formulas:

$$kW = \frac{Cfm \times ATD}{3145}$$

$$ATD = \frac{kW \times 3145}{Cfm}$$

$$ATD = \frac{kW}{1214 \times L/s}$$

$$\phi amps = \frac{kW \times 1000}{PrimaryVoltage \times \surd}$$

$$\phi amps = \frac{kW \times 1000}{PrimaryVoltag}$$

kW = 1214 x L/s x ATD

Fan-Powered Series

Minimum Circuit Ampacity (MCA) Equation

- MCA = 1.25 x (Smotor amps + heater amps)
  Here motor amps is the sum of all motor current draws if more than one is used in the unit.

Maximum Overcurrent Protection (MOP) Equation

- MOP = (2.25 x motor 1amps) + motor2 amps + heater amps motor1 amps = current draw of largest motor
  motor2 amps = sum of current draw of all other motors used in units

General Sizing Rules:

- If MOP = 15, then fuse size = 15
- If MOP = 19, then fuse size = 15 with one exception. If heater amps x 1.25 > 15, then fuse size = 20.
- If MOP is less than/equal to MCA, then choose next fuse size greater than MCA.
- Control fusing not applicable.
- Standard Fuse Sizes: 15, 20, 25, 30, 35, 40, 45, 50, and 60.

Example:

A model VSEF, electric reheat unit size 10-0517 has 480/3 phase, 12 kW electric reheat with 2 stages and 277-Volt motor.

For MOP of fan-powered unit:

12 kW - 480/3 heater:12x1000/480x1.73=14.45 amps.

MCA=(2.4 + 14.45) x 1.25 = 21.06, MOP = (2.25 x 2.4) + 14.45 = 19.9.

Since MOP is less than/equal to MCA, then MOP = 25.

For total current draw of unit:

12 kW—480/3 heater:12x1000/480x1.73=14.45

Two heat outputs (2 stages)@0.5 amps max each=1.00
Motor amps: 277 V (Fan size 0517)=2.4
Total amps max: 18.35

Used Formulas:

$$\phi amps = \frac{kW \times 1000}{PrimaryVoltage \times \sqrt{}}$$

$$kW = \frac{Cfm \times \Delta TD}{3145}$$

$$\Delta TD = \frac{kW \times 3145}{Cfm}$$

$$\Delta TD = \frac{kW}{1214 \times L/s}$$

$$\phi amps = \frac{kW \times 1000}{PrimaryVoltag}$$

kW=1214 x L/s x ATD

Low Height Parallel Fan-Powered

Minimum Circuit Ampacity (MCA) = (motor amps + heater amps) x 1.25

Maximum Overcurrent Protection (MOP) = (2.25 x motor amps) + heater amps

General Sizing Rules:

- If MOP = 15, then fuse size = 15
- If MOP = 19, then fuse size = 15 with one exception. If heater amps x 1.25 > 15, then fuse size = 20.
- If MOP £ MCA, then choose next fuse size greater than MCA.
- Control fusing not applicable.
- Standard Fuse Sizes: 15, 20, 25, 30, 35, 40, 45, 50, and 60.

Useful Formulas:

$$kW = \frac{Cfm \times ATD}{3145}$$

$$ATD = \frac{kW \times 3145}{Cfm}$$

$$ATD = \frac{kW}{1214 \times L/s}$$

$$kW = 1214 \times L/s \times ATD$$

$$\phi amps = \frac{kW \times 1000}{PrimaryVoltage \times \sqrt{}}$$

$$\phi amps = \frac{kW \times 1000}{PrimaryVoltag}$$

Low-Height Series Fan-Powered

Minimum Circuit Ampacity (MCA) = (motor amps + heater amps) x 1.25

Maximum Overcurrent Protection (MOP) = (2.25 x motor amps) + heater amps

General Sizing Rules:

- If MOP = 15, then fuse size = 15
- If MOP = 19, then fuse size = 15 with one exception. If heater amps x 1.25 > 15, then fuse size = 20.
- If MOP is less than/equal to MCA, then choose next fuse size greater than MCA.
- Control fusing not applicable.
- Standard Fuse Sizes: 15, 20, 25, 30, 35, 40, 45, 50, and 60.

Useful Formulas

$$kW = \frac{Cfm \times ATD}{3145}$$

$$3\phi amps = \frac{kW \times 1000}{PrimaryVoltage \times \sqrt{3}}$$

$$ATD = \frac{kW \times 3145}{Cfm}$$

$$kW = 1214 \times LIs \times ATD$$

$$1\phi amps = \frac{kW \times 1000}{PrimaryVoltage}$$

$$ATD = \frac{kW}{1214 \times LIs}$$

Acoustics Data

Parallel Fan-Powered Terminal Units

Table 95. Discharge sound power (dB)[1, 2, 4]- valve only

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs[5]						1.0" Inlet Pressure ΔPs[5]						1.5" Inlet Pressure ΔPs[3]						2.0" Inlet Pressure ΔPs[5]						3.0" Inlet Pressure ΔPs[5]					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
02SQ	5	250	118													65	57	54	53	50	47												
02SQ	6	200	94	55	51	44	43	38	30	57	52	48	47	43	39							60	54	54	53	51	50	63	56	57	57	56	56
		300	142	60	53	49	48	44	35	62	56	54	53	50	43							64	58	57	56	54	50	66	60	61	59	57	55
		400	189	62	54	49	47	42	36	67	60	58	57	54	46	67	61	59	60	57	49	68	62	60	61	58	52	69	64	63	63	60	56
		500	236	64	57	53	51	47	41	70	63	60	59	55	47							71	65	64	65	62	55	73	68	66	68	65	58
02SQ	8	350	165	56	49	46	45	40	33	60	54	51	48	46	45							63	58	56	53	52	51	65	60	59	56	55	55
		520	245	61	54	50	49	44	37	64	58	55	52	50	47							66	62	60	57	55	52	68	64	63	60	58	56
		700	330	66	60	55	53	49	42	68	63	60	57	54	49	69	65	63	60	57	52	70	67	65	62	59	54	72	69	67	65	62	57
		900	425	70	64	59	57	52	45	73	67	64	61	57	52							74	70	69	66	62	57	76	72	71	68	65	60
02SQ	10	550	260	63	55	52	52	49	39	67	60	57	57	55	47							71	65	62	62	59	54	73	67	65	65	62	58
		820	387	66	58	56	56	54	44	71	64	61	61	59	51							76	70	67	67	65	58	78	72	70	70	67	61
		1100	519	69	61	59	59	58	48	73	67	64	65	63	55	77	70	68	68	66	58	79	72	70	70	68	60	82	75	73	74	71	64
		1400	661	71	65	62	62	60	51	76	70	67	67	65	57							82	75	72	73	71	63	85	78	76	76	74	67
03SQ	6	100	47	48	45	41	37	33	30	49	46	44	39	37	39							50	48	47	43	45	47	51	48	47	45	49	53
		200	94	52	48	43	40	35	29	55	51	47	44	41	40							57	53	52	48	47	48	58	55	54	50	51	54
		300	142	57	51	46	43	36	32	60	56	51	47	44	40							62	59	56	52	50	49	63	60	59	55	54	54
		400	189	59	53	48	44	38	34	64	59	54	50	46	42	65	61	57	53	50	46	66	63	59	55	52	49	68	64	62	58	56	54
		600	283	63	59	56	50	46	44	65	61	57	53	48	46							73	68	64	61	56	52	75	70	68	64	60	56
03SQ 04SQ	8	175	83	48	45	42	39	34	30	50	47	44	41	41	42							53	49	47	45	47	49	55	50	49	48	51	53
		350	165	52	48	44	41	35	31	56	52	49	46	43	41							60	57	55	52	51	51	62	58	58	54	54	55
		525	248	57	53	49	47	42	34	61	57	54	51	47	42							65	61	59	56	53	51	66	63	62	58	56	56
		700	330	62	57	53	51	47	40	64	60	57	55	51	45	66	63	60	57	54	49	68	65	63	60	56	52	70	67	66	62	59	57
		1050	496	68	64	60	59	51	46	72	68	65	63	59	53							73	70	68	67	63	57	75	72	71	69	65	60
03SQ 04SQ 05SQ	10	275	130	52	48	46	44	38	32	54	51	49	47	46	47							56	54	53	51	50	49	58	56	56	54	54	53
		550	260	57	52	50	47	42	35	60	57	54	51	48	43							63	62	60	57	55	54	65	64	63	60	58	56
		825	389	61	56	53	50	46	39	64	61	58	56	52	46							67	66	64	60	58	53	70	69	68	64	62	59
		1100	519	64	60	57	54	50	43	67	64	62	59	55	49	70	67	65	62	59	53	72	69	67	64	61	56	74	71	70	67	64	60
		1640	774	69	66	63	59	54	48	73	70	68	64	61	55							76	74	72	69	66	60	79	77	75	73	70	64
03SQ 04SQ 05SQ	12	385	182	52	48	47	41	38	34	56	52	51	46	43	41							59	57	57	52	50	48	59	59	60	55	54	53
		775	366	58	53	52	49	43	37	63	59	57	54	50	47							67	65	63	59	55	52	69	67	66	61	58	55
		1160	547	62	57	55	51	47	41	67	62	60	57	54	49							73	68	67	64	61	55	76	71	70	67	64	59
		1550	732	65	60	58	54	50	44	70	65	63	60	57	51							77	71	69	67	64	58	80	75	73	71	68	62
		1600	755													74	68	66	64	61	55												
		2350	1109	70	66	65	60	56	50	75	71	69	65	61	55							81	75	73	71	68	62	84	79	77	75	72	66
04SQ 05SQ	14	525	248	55	50	48	45	41	35	59	54	53	50	48	44							63	59	59	55	53	52	64	62	62	58	56	55
		1050	496	61	56	54	51	51	40	67	62	60	57	54	49							70	68	66	62	59	56	72	70	69	65	62	58
		1575	743	64	59	57	54	52	44	71	65	63	60	57	52							75	72	70	67	63	59	77	75	73	70	67	62
		2100	991	67	62	60	57	53	47	72	68	66	62	59	56	76	72	69	66	63	59	79	74	72	70	66	61	82	78	76	73	70	65
		3200	1510	72	68	67	63	59	55	77	72	71	67	64	59							83	78	76	73	70	65	87	82	79	77	74	69

Table 95. Discharge sound power (dB)[1, 2, 4]- valve only (continued)

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs[5]						1.0" Inlet Pressure ΔPs[5]						1.5" Inlet Pressure ΔPs[3]						2.0" Inlet Pressure ΔPs[5]						3.0" Inlet Pressure ΔPs[5]					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
06SQ 07SQ	10	550	260	53	49	46	43	38	31	56	54	51	49	45	41							60	60	58	54	52	54	62	63	62	58	56	54
		800	378	57	53	50	46	41	34	60	58	55	52	48	42							64	63	61	57	54	53	66	66	65	61	59	56
		1000	472	60	56	53	49	44	36	63	61	58	54	50	43							67	65	63	60	56	52	69	68	67	64	61	57
		1100	519													66	65	62	58	54	49												
		1200	566	62	59	56	52	46	39	66	64	61	57	52	46							70	68	66	62	58	53	72	70	69	66	62	58
		1350	637	64	61	58	54	48	42	68	66	63	59	54	48							72	70	68	64	60	54	74	72	71	67	63	59
06SQ 07SQ	12	800	378	63	56	55	54	51	42	68	62	61	61	59	51							71	67	65	66	64	57	73	70	68	69	67	60
		1100	519	65	57	56	54	52	43	72	65	63	63	60	53							75	71	69	70	67	60	77	74	72	73	71	64
		1400	661	66	59	58	54	52	44	74	67	64	64	62	54							79	73	71	72	70	62	81	77	74	76	74	66
		1600	755													78	72	69	69	67	60												
		1700	802	67	61	60	55	52	44	75	69	66	65	62	55							82	75	72	73	71	63	84	79	76	77	76	68
		2000	944	69	63	61	55	52	46	76	70	67	65	63	55							84	77	74	74	71	64	86	81	78	78	77	69
06SQ 07SQ	14	1100	519	60	54	53	51	48	41	65	60	58	57	54	48							69	66	64	61	60	55	73	71	69	64	62	59
		1600	755	64	58	56	55	52	45	69	64	62	61	58	52							74	70	68	66	64	59	77	73	71	69	67	62
		2100	991	67	61	60	57	55	47	72	67	66	64	61	55	75	70	68	67	64	58	77	72	71	69	67	61	80	76	74	72	70	65
		2500	1180	70	64	63	60	57	50	74	69	67	66	63	56							80	74	72	71	69	63	83	77	76	74	72	66
		3000	1416	73	67	66	63	60	53	77	71	69	68	65	58							83	76	74	73	71	65	87	79	78	76	74	68
06SQ 07SQ	16	1400	661	62	57	54	54	51	43	67	63	61	60	57	52							72	70	67	65	62	57	75	75	72	67	65	61
		2100	991	64	60	58	56	54	46	71	66	63	62	60	55							76	73	71	69	67	62	78	76	74	72	70	65
		2700	1274	67	63	61	59	56	49	73	68	66	65	62	57							79	74	72	71	69	64	82	78	76	75	73	68
		2800	1321													77	71	69	68	66	61												
		3400	1605	70	65	64	62	58	52	75	70	68	66	64	58							82	75	74	72	70	65	86	79	77	76	74	69
		4000	1888	73	68	67	64	61	55	77	72	70	68	65	60							84	77	75	74	71	66	89	80	78	77	75	70

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Data in this column constitute AHRI 880-2011 Standard Rating Conditions
4. Where ΔPs is the inlet static pressure minus discharge static.
5. Application ratings are outside the scope of the certification program.

Table 96. Radiated sound power (dB)[1, 2, 4]- valve only

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs[5]						1.0" Inlet Pressure ΔPs[5]						1.5" Inlet Pressure ΔPs[3]						2.0" Inlet Pressure ΔPs[5]						3.0" Inlet Pressure ΔPs[5]					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
02SQ	5	250	118													50	48	46	42	38	30												
02SQ	6	200	94	48	40	38	35	31	25	48	44	42	37	33	26							53	48	47	43	38	33	54	50	47	44	41	37
		300	142	51	45	42	35	29	24	54	49	46	39	33	26							57	51	50	44	38	32	60	55	53	48	42	37
		400	189	54	48	46	38	32	25	58	53	49	42	35	26	60	54	51	44	37	29	61	55	52	47	40	33	63	57	55	49	43	37
		500	236	52	50	48	40	33	27	62	56	52	45	37	29							65	59	56	50	42	34	65	60	57	52	45	38
02SQ	8	350	165	53	45	40	37	31	23	55	49	44	39	35	30							60	53	50	45	41	36	62	55	52	48	45	40
		520	245	57	49	44	40	34	26	59	53	48	42	37	31							64	57	53	47	43	38	66	59	56	51	46	41
		700	330	61	53	48	43	37	29	63	57	52	46	40	33	66	59	55	48	43	39	68	61	57	50	45	40	70	63	60	54	48	42
		900	425	66	58	53	47	41	33	68	62	56	50	44	37							72	65	61	53	48	42	73	67	63	56	50	44

Table 96. Radiated sound power (dB)[1, 2, 4]- valve only (continued)

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs[5]						1.0" Inlet Pressure ΔPs[5]						1.5" Inlet Pressure ΔPs[3]						2.0" Inlet Pressure ΔPs[5]						3.0" Inlet Pressure ΔPs[5]					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
02SQ	10	550	260	57	50	44	39	32	25	61	54	48	42	36	28							65	58	52	46	40	34	67	60	56	50	43	38
		"820	387	59	52	46	41	34	25	64	58	52	46	40	31							69	63	56	51	44	37	71	66	60	54	47	40
		1100	519	62	56	50	44	41	26	66	61	54	49	42	33	70	64	58	52	45	36	72	66	60	54	48	39	75	68	63	57	51	42
		1400	661	65	60	53	47	44	30	68	64	57	52	45	36							74	69	63	57	50	41	77	71	66	60	53	44
03SQ	6	100	47	49	44	38	37	31	24	50	46	41	41	35	29							52	47	44	46	41	36	53	48	45	48	45	40
		200	94	50	44	39	37	31	24	53	48	43	41	36	29							56	51	47	46	42	36	59	53	49	49	45	40
		300	142	52	45	40	38	31	25	54	50	45	42	36	30							59	53	50	47	42	37	60	55	53	49	45	40
		400	189	54	47	42	39	33	26	57	53	48	44	38	31	59	55	51	46	41	35	61	55	52	48	43	38	62	57	55	50	46	41
		600	283	58	53	50	45	40	34	58	56	54	48	42	35							64	61	58	51	45	39	67	62	60	53	48	42
03SQ 04SQ	8	175	83	52	45	39	36	33	26	54	47	42	41	36	30							57	50	45	46	42	36	59	52	46	49	45	39
		350	165	57	50	43	38	33	26	59	52	46	42	37	30							61	54	50	47	43	37	63	55	52	50	46	40
		525	248	58	51	45	39	34	27	61	55	48	43	38	31							64	57	53	48	44	37	66	58	56	51	47	41
		700	330	60	53	47	42	36	30	63	56	51	45	39	33	64	58	53	47	42	35	66	60	55	49	44	37	68	62	58	52	48	41
		1050	496	63	59	55	49	42	35	68	62	57	51	45	38							72	65	60	54	48	41	74	67	63	56	50	43
03SQ 04SQ 05SQ	10	275	130	55	49	43	38	34	27	57	51	45	42	37	30							58	53	48	47	43	36	59	54	50	50	46	40
		550	260	59	54	47	40	34	28	61	56	50	45	39	34							63	58	53	51	45	41	64	60	56	54	51	44
		825	389	61	55	49	42	36	29	63	58	53	46	40	35							66	61	57	51	46	41	69	64	60	54	50	44
		1100	519	62	56	50	44	38	32	66	60	54	49	43	37	68	62	57	51	46	40	70	64	59	53	48	43	72	66	62	56	51	46
		1640	774	65	61	55	50	43	37	70	65	58	53	46	40							76	69	64	58	51	45	79	72	67	61	55	49
03SQ 04SQ 05SQ	12	385	182	52	47	42	40	36	30	55	50	45	43	40	35							59	53	48	47	44	39	61	55	50	50	47	42
		775	366	59	51	45	40	35	28	63	55	48	43	38	33							66	59	52	48	44	39	69	62	56	52	48	42
		1160	547	63	54	47	41	35	30	67	58	51	46	39	35							72	63	56	51	45	40	75	67	60	54	49	43
		1550	732	66	58	50	43	37	31	71	62	54	48	42	36							75	66	59	53	46	41	78	70	63	56	50	44
		1600	755													73	64	57	51	44	39												
		2350	1109	69	64	55	49	42	36	74	68	59	52	45	40							79	72	64	57	50	44	82	75	67	60	54	47
04SQ 05SQ	14	525	248	58	51	45	40	34	27	61	53	48	44	38	31							64	56	51	49	44	37	66	59	54	51	47	40
		1050	496	62	56	49	42	37	30	66	59	52	46	42	34							71	63	57	51	46	39	74	66	60	54	49	42
		1575	743	65	59	52	44	37	31	70	62	55	48	42	35							75	67	61	54	48	40	78	70	64	57	51	43
		2100	991	67	60	54	45	38	33	72	64	58	50	43	36	75	66	60	53	46	40	78	69	63	56	49	43	83	74	68	61	54	46
		3200	1510	72	66	59	51	44	38	77	70	63	55	48	42							83	75	68	60	53	47	86	78	71	63	56	50
06SQ 07SQ	10	550	260	51	44	42	40	37	32	54	49	45	44	42	38							58	55	49	49	48	45	61	58	52	52	52	49
		800	378	53	48	43	41	37	32	57	52	47	45	42	38							62	58	52	50	48	45	65	61	55	53	52	49
		1000	472	55	51	44	42	38	33	59	55	48	46	42	38							65	61	54	51	48	45	68	63	57	54	52	49
		1100	519													63	59	53	49	46	42												
		1200	566	58	53	47	43	38	33	62	58	51	47	42	38							67	63	56	52	48	45	70	65	59	56	52	49
		1350	637	60	55	49	44	39	34	64	60	53	48	43	39							69	65	58	53	49	45	72	67	61	57	53	49
06SQ 07SQ	12	800	378	58	50	44	40	33	26	62	55	49	45	38	31							66	60	54	50	43	36	68	63	56	52	46	39
		1100	519	60	52	46	40	33	27	65	58	51	47	40	33							70	64	58	53	46	39	72	66	60	56	50	42
		1400	661	62	54	46	40	34	27	67	60	53	48	41	34							73	66	60	55	48	41	75	69	64	58	52	44
		1600	755													73	65	58	53	46	40												
		1700	802	64	56	48	42	34	28	68	62	54	48	41	35							76	68	61	56	49	42	78	72	66	60	54	46
		2000	944	65	58	49	47	36	31	70	63	55	50	42	35							77	70	62	57	50	43	79	73	67	61	55	48

Table 96. Radiated sound power (dB)[1, 2, 4]- valve only (continued)

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs[5]						1.0" Inlet Pressure ΔPs[5]						1.5" Inlet Pressure ΔPs[3]						2.0" Inlet Pressure ΔPs[5]						3.0" Inlet Pressure ΔPs[5]					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
06SQ 07SQ	14	1100	519	56	49	44	40	32	25	61	55	48	44	38	30							66	61	54	49	43	36	69	66	57	51	45	40
		1600	755	59	53	47	42	35	27	65	59	52	48	41	33							70	64	58	53	46	39	74	68	61	55	49	42
		2100	991	64	57	51	46	38	29	68	61	55	50	43	35	72	64	58	53	46	38	74	67	61	55	49	41	77	70	64	59	52	45
		2500	1180	67	59	53	48	40	31	71	63	57	52	44	36							76	68	62	56	50	42	79	72	66	60	54	46
		3000	1416	71	62	56	50	42	33	74	66	59	54	46	38							78	70	64	58	51	44	82	74	68	62	56	48
06SQ 07SQ	16	1400	661	63	54	48	41	36	29	67	59	53	46	42	35							70	66	58	52	48	40	72	70	61	54	50	43
		2100	991	66	57	51	44	39	32	71	63	56	49	45	38							75	69	63	56	52	44	77	72	66	59	55	47
		2700	1274	68	60	54	46	41	34	73	65	59	51	47	40							78	72	66	59	54	47	80	75	69	62	58	50
		2800	1321													76	69	62	55	51	44												
		3400	1605	70	63	57	51	46	42	76	68	61	54	48	42							81	74	68	60	56	48	83	76	70	64	59	52
		4000	1888	73	66	60	56	52	50	78	70	63	56	50	45							83	75	70	62	57	50	85	78	72	65	60	53

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Data in this column constitute AHRI 880-2011 Standard Rating Conditions
4. Where ΔPs is the inlet static pressure minus discharge static.
5. Application ratings are outside the scope of the certification program.

Table 97. Fan only sound power

Fan	Outlet SP	CFM	l/s	Discharge Lw (dB) Octave Bands						Radiated Lw (dB) Octave Bands					
				2	3	4	5	6	7	2	3	4	5	6	7
02SQ	0.25	200	94	59	51	50	46	42	35	63	55	53	50	44	37
		280	132	61	53	51	48	44	38	65	57	54	52	46	40
		350	165	62	54	52	50	46	40	66	58	55	52	48	42
		430	203	65	56	54	52	49	43	68	60	57	54	50	45
		500[a]	236	66	57	55	53	50	46	69	61	58	56	52	48
03SQ	0.25	250	118	57	50	51	45	40	39	61	55	53	49	42	35
		400	189	60	52	53	46	42	41	64	56	55	51	45	40
		610	288	67	59	57	53	48	47	70	62	60	56	51	48
		850	401	69	60	60	56	52	51	72	63	62	59	55	53
		1090[a]	514	74	65	65	63	58	58	77	68	66	64	60	59
04SQ	0.25	300	142	59	52	52	47	41	38	61	56	54	49	43	34
		530	250	60	54	55	50	45	42	63	57	56	51	47	41
		790	373	66	59	59	55	50	48	69	62	60	56	52	49
		1100	519	69	63	64	60	56	55	72	66	64	60	57	55
		1300[a]	614	71	65	66	64	59	58	74	68	66	63	60	59
		1350	637	72	66	66	65	60	59	75	69	67	64	61	60
05SQ	0.25	350	165	60	53	54	46	40	37	63	57	54	48	42	35
		650	307	62	56	57	50	45	42	65	60	57	51	47	43
		970	458	65	61	62	57	51	50	68	63	62	57	53	51
		1300	614	68	64	66	63	58	57	71	67	65	62	59	57
		1550[a]	732	70	66	67	66	61	60	74	69	68	65	62	61

Table 97. Fan only sound power (continued)

				Discharge Lw (dB)						Radiated Lw (dB)					
06SQ	0.25	920	434	66	61	60	56	51	48	71	64	62	56	51	47
		1200	566	69	64	61	59	54	51	73	65	63	59	53	51
		1400	661	71	65	63	61	56	54	75	67	64	60	55	53
		1700	802	73	68	65	63	58	57	77	69	66	63	58	56
		1960[a]	925	75	70	68	66	62	60	79	71	67	64	61	59
07SQ	0.25	1050	496	62	61	61	55	49	46	67	61	62	56	50	46
		1300	614	65	65	62	58	53	50	69	64	66	58	54	50
		1500	708	67	67	64	61	56	53	70	65	68	60	56	52
		1800	850	69	68	68	65	60	57	73	68	68	63	59	56
		2020[a]	953	70	69	69	66	62	59	74	69	69	65	61	58
06SQ ECM	0.25	800	378	68	61	60	57	51	49	71	65	63	57	52	49
		1100	519	71	64	62	59	54	52	73	66	64	58	54	51
		1500	708	74	67	65	63	58	56	76	70	66	62	57	55
		1800	850	76	69	67	66	60	58	78	72	67	64	60	58
		2100	991	78	71	69	68	63	62	80	74	69	66	63	61

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. all sound power levels, dB re: 10^{-12} Watts
3. application ratings are outside the scope of the certification program

(a) AHRI 880-2011 section 7.2 Standard Rating Conditions

Table 98. Sound noise criteria (NC) - fan only

				Fan-Only 0.25" Disch. Pres.	
Fan	Outlet SP	CFM	l/s	Discharge	Radiated
02SQ	0.25	200	94	--	27
		280	132	--	29
		350	165	--	30
		430	203	17	33
		500[a]	236	19	34
03SQ	0.25	250	118	--	27
		400	189	--	30
		610	288	17	35
		850	401	20	38
		1090[a]	514	26	44
04SQ	0.25	300	142	--	28
		530	250	--	31
		790	373	16	35
		1100	519	21	39
		1300[a]	614	23	41
		1350	637	24	43
05SQ	0.25	350	165	--	28
		650	307	--	32
		970	458	18	37
		1300	614	22	40
		1550[a]	732	24	44

Table 98. Sound noise criteria (NC) - fan only (continued)

				Fan-Only	
06SQ	0.25	920	434	18	37
		1200	566	21	39
		1400	661	23	42
		1700	802	26	44
		1960(a)	925	29	47
07SQ	0.25	1050	496	18	37
		1300	614	23	41
		1500	708	25	44
		1800	850	26	44
		2020(a)	953	27	45
06SQ ECM	0.25	800	378	18	38
		1100	519	22	39
		1500	708	26	43
		1800	850	29	45
		2100	991	31	48

Notes:
1. "--" represents NC levels below NC 15.
2. NC values are calculated using modeling assumptions based on AHRI 885-2008 Appendix E.
3. application ratings are outside the scope of the certification program.

(a) AHRI 880-2011 section 7.2 Standard Rating Conditions

Table 99. AHRI 885-2008 discharge transfer function assumptions:

	Octave Band					
	2	3	4	5	6	7
Small Box (<300 Cfm)	-24	-28	-39	-53	-59	-40
Medium Box (300-700 Cfm)	-27	-29	-40	-51	-53	-39
Large Box (>700 Cfm)	-29	-30	-41	-51	-52	-39

Notes: Subtract from terminal unit sound power to determine discharge sound pressure in the space.
1. NC Values are calculated using current Industry Standard AHRI 885-2008. Radiated Transfer Function obtained from Appendix E, Type 2 Mineral Fiber Insulation.
2. Application ratings are outside the scope of the Certification Program.

Table 100. AHRI 885-2008 radiated transfer function assumptions:

	Octave Band					
	2	3	4	5	6	7
Type 2- Mineral Fiber Insulation	-18	-19	-20	-26	-31	-36
Total dB reduction	-18	-19	-20	-26	-31	-36

Notes: Subtract from terminal unit sound power to determine discharge sound pressure in the space.
1. NC Values are calculated using current Industry Standard AHRI 885-2008. Radiated Transfer Function obtained from Appendix E, Type 2 Mineral Fiber Insulation.
2. Application ratings are outside the scope of the Certification Program.

Table 101. Sound noise criteria (NC) - valve only

				Discharge[1,2,4]					Radiated[1,2,4]				
				Inlet Pressure (ΔPs)[3,5]					Inlet Pressure (ΔPs)[3,5]				
Fan Size	Inlet Size (in)	CFM	l/s	0.5″	1.0″	1.5″	2.0″	3.0″	0.5″	1.0″	1.5″	2.0″	3.0″
02SQ	5	250	118			21					20		
02SQ	6	200	94	--	--		--	20	--	15		21	21
		300	142	--	--		16	19	15	20		24	27
		400	189	--	20	20	21	23	20	23	25	26	30
		500	236	16	23		25	28	22	26		31	32
02SQ	8	350	165	--	--		16	19	--	18		24	26
		520	245	--	16		21	23	19	22		27	31
		700	330	18	22	24	26	29	24	26	30	33	35
		900	425	23	27		30	32	30	33		38	39
02SQ	10	550	260	--	17		23	25	19	24		29	31
		820	387	16	22		29	31	21	27		34	37
		1100	519	20	25	30	32	36	25	31	35	38	42
		1400	661	23	29		36	40	30	34		40	44
03SQ	6	100	47	--	--		--	17	--	--		18	20
		200	94	--	--		--	18	--	16		21	23
		300	142	--	--		17	18	--	19		24	27
		400	189	--	17	19	22	23	15	22	25	26	30
03SQ 04SQ	8	175	83	--	--		--	17	--	15		19	21
		350	165	--	--		--	19	19	21		24	26
		525	248	--	--		19	22	20	24		27	31
		700	330	--	18	22	24	26	22	26	27	30	33
		1050	496	23	28		30	32	30	33		38	40
03SQ 04SQ	10	275	130	--	--		--	17	17	19		22	24
		550	260	--	--		19	22	23	25		27	31
		825	389	--	18		24	28	24	27		32	35
		1100	519	17	22	25	28	30	25	30	33	35	38
		1640	774	24	29		34	37	31	36		43	47
03SQ 04SQ 05SQ	12	385	182	--	--		--	17	15	19		22	24
		775	366	--	16		23	25	21	26		30	34
		1160	547	--	19		26	30	26	31		38	42
		1550	732	17	23		30	35	30	36		42	45
		1600	755			26					39		
		2350	1109	24	30		35	40	34	40		47	51
04SQ 05SQ	14	525	248	--	--		16	19	20	24		27	30
		1050	496	--	19		26	29	25	30		36	40
		1575	743	16	23		31	35	29	35		42	45
		2100	991	19	26	31	34	38	31	38	42	45	52
		3200	1510	26	31		38	43	38	44		52	56

Table 101. Sound noise criteria (NC) - valve only (continued)

				Discharge[1,2,4]					Radiated[1,2,4]				
06SQ 07SQ	10	550	260	--	--		18	20	15	19		24	27
		800	378	--	--		20	24	16	21		27	31
		1000	472	--	18		23	26	19	24		31	33
		1100	519			23					28		
		1200	566	16	21		26	29	21	27		33	36
		1350	637	18	24		29	31	24	30		36	38
06SQ 07SQ	12	800	378	--	19		25	29	20	25		30	33
		1100	519	15	24		30	33	22	29		35	38
		1400	661	16	27		33	37	25	31		39	42
		1600	755			32					39		
		1700	802	18	28		37	39	27	33		43	45
		2000	944	20	29		39	42	29	35		44	47
06SQ 07SQ	14	1100	519	--	17		24	30	18	24		31	37
		1600	755	--	21		29	32	21	29		35	40
		2100	991	18	25	29	31	36	27	33	38	40	44
		2500	1180	21	27		34	38	31	36		43	47
		3000	1416	25	30		38	43	36	40		45	51
06SQ 07SQ	16	1400	661	--	20		29	35	26	31		37	42
		2100	991	17	24		32	36	30	36		42	44
		2700	1274	20	26		33	38	33	39		45	48
		2800	1321			30					43		
		3400	1605	23	29		37	42	35	43		49	52
		4000	1888	26	31		39	46	39	45		52	54

Notes:
1. "--" represents NC levels below NC 15.
2. NC Values are calculated using modeling assumptions based on AHRI 885-98-02 Addendum
3. Data at 1.5" inlet pressure constitute AHRI 880-2011 Standard Rating Conditions.
4. Where ΔPs is the inlet static pressure minus discharge static.
5. Data at 0.5", 1.0", 2.0" and 3.0" are application ratings. These ratings are outside the scope of the certification program.

Table 102. Parallel inlet attenuator appurtenance effects (fan noise only)

	Discharge Sound Effect* (dB)						Radiated Sound Effect* (dB)					
Fan	2	3	4	5	6	7	2	3	4	5	6	7
Matte-faced and foil-faced insulation, solid double-wall**												
02SQ	2	1	1	2	1	2	1	-2	-8	-13	-15	-16
03SQ, 04SQ, 05SQ	2	1	1	2	1	2	0	-1	-8	-12	-16	-17
06SQ, 07SQ	2	1	1	2	1	2	1	0	-8	-12	-15	-18
Closed-cell insulation												
02SQ	1	1	1	1	1	1	1	-1	-3	-2	-4	-4
03SQ, 04SQ, 05SQ	1	1	1	1	1	1	0	-1	-3	-2	-4	-4
06SQ, 07SQ	1	1	1	1	1	1	1	-1	-3	-2	-4	-4

Notes:
* Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.
** Note- Attenuators on double-wall units contain foil-faced insulation.
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10-12 Watts.
3. Application ratings are outside the scope of the Certification Program.

Acoustics Data

Table 103. Parallel cabinet lining appurtenance effects (fan noise and valve noise)

	Discharge Sound Effect* (dB)						Radiated Sound Effect* (dB)					
Fan	**2**	**3**	**4**	**5**	**6**	**7**	**2**	**3**	**4**	**5**	**6**	**7**
Solid double-wall												
02SQ	3	1	1	-1	1	3	1	0	0	1	4	7
03SQ, 04SQ, 05SQ	1	-1	1	3	4	5	1	0	2	5	8	8
06SQ, 07SQ	3	1	1	1	3	5	-1	-1	-1	2	4	5
Closed-cell insulation												
02SQ	1	1	1	0	1	4	0	0	2	2	5	7
03SQ, 04SQ, 05SQ	1	1	2	2	2	3	1	2	4	4	4	5
06SQ, 07SQ	1	1	2	1	2	4	1	0	3	4	5	6

Note:
* Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10-12 Watts.
3. Application ratings are outside the scope of the Certification Program.

Table 104. Parallel heating coil appurtenance effects

	Discharge Sound Effect* (dB)						Radiated Sound Effect* (dB)					
Fan	**2**	**3**	**4**	**5**	**6**	**7**	**2**	**3**	**4**	**5**	**6**	**7**
Hot Water Coil**												
02SQ	-1	0	-1	-1	0	-1	-1	-1	0	-1	-1	-3
03SQ, 04SQ, 05SQ	2	2	2	2	2	1	1	1	1	1	0	0
06SQ, 07SQ	2	1	0	-1	0	0	0	0	0	-1	0	-1
Electric Heat***												
02SQ	0	0	0	-1	-2	-1	0	0	0	0	0	0
03SQ, 04SQ, 05SQ	0	0	0	0	0	1	0	0	0	0	0	0
06SQ, 07SQ	3	4	3	2	4	4	1	0	0	0	0	0

Notes:
* Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.
** Add to fan sound only, not valve sound.
***Add to both fan sound and valve sound.
Apply fan only data, not valve sound.
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10-12 Watts.
3. Application ratings are outside the scope of the Certification Program.

Series Fan-Powered Terminal Units

Table 105. Discharge sound power (dB)- fan and 100% primary

Fan Size	Inlet Size (in)	Cfm	l/s	0.5” Inlet Pressure ∆Ps						1.0” Inlet Pressure ∆Ps						2.0” Inlet Pressure ∆Ps						3.0” Inlet Pressure ∆Ps					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
02SQ	10	200	94	71	55	54	52	49	45	72	61	56	54	52	51	74	70	66	62	59	55	74	64	63	61	59	59
		300	142	71	56	55	52	49	46	72	61	57	54	52	52	74	69	65	61	58	56	75	67	66	63	60	60
		500	236	71	57	56	52	49	47	72	61	58	54	52	53	74	68	64	60	57	59	76	74	73	67	63	63
		600	283	72	60	59	55	52	50	74	63	60	56	54	55	75	67	64	60	58	59	76	72	69	64	61	62
		700	330	73	62	61	57	55	53	75	64	61	58	56	56	75	66	63	59	58	58	76	69	64	61	59	60
03SQ	10	250	118	57	49	47	43	38	34	57	50	48	43	39	34	58	52	48	44	40	36	59	53	48	45	41	39
		480	227	61	53	52	49	45	43	62	55	53	49	46	43	63	57	53	49	46	44	64	59	53	50	47	45
		720	340	66	58	58	55	53	52	68	60	59	56	54	52	68	63	58	55	53	52	70	65	59	55	53	52
		960	453	71	63	63	61	59	59	72	64	63	62	59	59	74	67	64	62	60	60	74	68	64	62	60	59
		1200	566	76	67	67	66	64	65	77	68	67	66	64	64	79	71	68	67	65	65	79	72	68	68	65	65
04SQ	12	330	156	58	52	49	45	39	34	59	53	49	45	40	35	62	57	50	46	40	38	63	59	51	46	42	40
		620	293	62	55	54	51	46	43	63	57	54	51	47	44	67	62	55	52	47	46	68	64	55	52	48	47
		930	439	66	59	59	57	54	53	68	61	59	57	55	53	72	67	60	58	55	54	73	69	60	58	55	54
		1250	590	72	64	64	63	60	60	74	66	65	64	61	61	76	69	65	65	62	62	78	72	66	65	63	62
		1550	732	77	69	68	68	66	66	77	70	68	69	66	66	80	72	69	70	67	67	81	75	70	70	68	67
05SQ	12	400	189	56	52	52	46	40	38	57	53	52	47	41	39	59	54	52	47	42	40	60	56	53	48	43	41
		760	359	61	58	58	54	49	48	62	58	57	54	49	48	65	60	57	53	49	48	66	62	58	54	50	48
		1140	538	67	64	64	62	59	58	67	63	63	61	58	57	71	66	63	60	57	56	73	69	64	61	58	56
		1500	708	73	69	69	68	65	64	73	69	69	67	65	64	75	70	69	68	65	64	77	72	69	68	65	64
		1900	897	77	74	73	74	71	71	78	74	73	74	71	70	79	74	73	73	70	70	79	75	73	73	70	70
06SQ	16	700	330	57	53	53	49	46	41	70	59	55	52	51	50	75	71	65	62	56	56	78	71	69	65	60	58
		1200	566	63	59	58	55	52	48	72	63	60	57	55	54	77	72	67	64	60	60	80	75	71	67	64	62
		1600	755	69	63	62	59	56	54	74	67	64	61	59	58	79	74	69	66	62	62	82	77	73	69	66	64
		2100	991	75	69	67	65	62	61	77	71	69	66	63	62	81	76	72	69	66	66	84	80	75	72	70	68
		2500	1180	77	72	69	67	65	64	79	74	71	69	66	65	83	78	74	71	69	68	86	82	77	74	72	70
07SQ	16	850	401	62	58	51	53	47	51	66	60	53	54	47	52	69	63	56	56	52	58	75	69	62	59	54	63
		1400	661	65	61	59	56	52	53	69	63	61	57	55	57	74	68	64	59	57	61	77	72	67	62	59	63
		1900	897	69	66	65	61	58	57	73	67	66	61	59	60	77	71	68	63	61	63	80	75	70	65	63	64
		2250	1062	72	69	68	64	62	61	75	70	69	64	62	62	79	73	71	65	64	65	82	77	72	67	65	66
		2500	1180	74	71	71	67	65	63	76	72	71	67	65	65	79	74	73	67	66	67	83	77	73	69	67	67
		3000	1416	77	75	75	71	69	68	79	75	75	71	69	69	81	77	76	71	70	70	85	79	76	72	70	70
04SQ ECM	12	275	130	56	51	49	44	38	37	57	52	49	44	38	38	58	53	49	44	39	39	59	55	50	45	41	40
		620	293	61	55	54	51	46	45	63	57	54	51	47	46	65	60	55	51	47	47	66	62	55	52	48	47
		930	439	66	59	59	57	54	53	68	61	59	57	55	53	72	67	60	58	55	54	73	69	60	58	55	54
		1250	590	72	64	64	63	60	60	74	66	65	64	61	61	76	69	65	65	62	62	78	72	66	65	63	62
		1550	732	77	69	68	68	66	66	77	70	68	69	66	66	80	72	69	70	67	67	81	75	70	70	68	67
		1660	783	79	71	69	70	68	68	78	71	69	71	68	68	81	73	70	72	69	69	82	76	71	72	70	69

Table 105. Discharge sound power (dB)- fan and 100% primary (continued)

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs 2	3	4	5	6	7	1.0" Inlet Pressure ΔPs 2	3	4	5	6	7	2.0" Inlet Pressure ΔPs 2	3	4	5	6	7	3.0" Inlet Pressure ΔPs 2	3	4	5	6	7
05SQ ECM	14	350	165	57	51	50	45	39	39	57	52	50	45	40	39	57	53	49	46	40	40	59	54	50	47	42	41
		760	359	62	58	57	54	49	49	62	58	57	53	49	48	64	60	56	53	49	48	66	62	57	54	50	49
		1140	538	67	64	64	62	59	58	67	63	63	61	58	57	71	66	63	60	57	56	73	69	64	61	58	56
		1500	708	73	69	69	68	65	64	73	69	69	67	65	64	75	70	69	68	65	64	77	72	69	68	65	64
		1900	897	77	74	73	74	71	71	78	74	73	74	71	70	79	74	73	73	70	70	79	75	73	73	70	70
		2350	1109	81	78	77	78	76	76	82	78	77	78	76	76	83	79	77	78	76	76	83	79	77	78	76	76
06SQ ECM	16	700	330	57	53	53	49	46	41	70	59	55	52	51	50	75	71	65	62	56	56	78	71	69	65	60	58
		1200	566	63	59	58	55	52	48	72	63	60	57	55	54	77	72	67	64	60	60	80	75	71	67	64	62
		1600	755	69	63	62	59	56	54	74	67	64	61	59	58	79	74	69	66	62	62	82	77	73	69	66	64
		2100	991	75	69	67	65	62	61	77	71	69	66	63	62	81	76	72	69	66	66	84	80	75	72	70	68
		2500	1180	77	72	69	67	65	64	79	74	71	69	66	65	83	78	74	71	69	68	86	82	77	74	72	70
		1500	708													75	74	70	68	64	63	76	74	70	69	64	63

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Where ΔPs is the inlet static pressure minus discharge static.
4. Application ratings are outside the scope of the certification program.

Table 106. Radiated sound power (dB)[1,2,4]- fan and 100% primary

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs[5] 2	3	4	5	6	7	1.0" Inlet Pressure ΔPs[5] 2	3	4	5	6	7	1.5" Inlet Pressure ΔPs[3] 2	3	4	5	6	7	2.0" Inlet Pressure ΔPs[5] 2	3	4	5	6	7	3.0" Inlet Pressure ΔPs[5] 2	3	4	5	6	7
02SQ	10	200	94	65	53	53	52	49	45	66	59	55	54	52	51							68	68	65	62	59	55	68	62	62	61	59	59
		300	142	65	54	54	52	49	46	66	59	56	54	52	52							68	67	64	61	58	56	69	65	65	63	60	60
		500	236	65	55	55	52	49	47	66	59	57	54	52	53							68	66	63	60	57	59	70	72	72	67	63	63
		600	283	66	58	58	54	52	50	68	60	58	56	54	54							69	66	63	60	58	60	71	72	70	66	62	63
		700	330	67	60	60	57	55	53	69	62	60	58	56	56	69	64	61	59	57	58	70	67	63	61	59	60	72	71	68	66	62	63
03SQ	10	250	118	53	49	47	44	40	35	56	51	49	47	44	42							58	54	53	52	49	48	59	56	56	55	52	52
		480	227	58	54	52	49	45	42	61	56	53	51	48	48							63	59	57	55	52	53	65	62	60	58	55	56
		720	340	63	59	57	54	51	50	66	61	58	55	53	54							69	65	61	58	56	59	71	68	64	61	58	61
		960	453	68	63	61	59	57	57	71	65	63	60	58	59							73	69	65	62	59	62	74	71	68	64	61	63
		1100	519													74	69	66	63	61	63												
		1200	566	72	67	65	63	61	62	75	69	66	64	62	63							77	72	68	66	63	65	78	74	70	67	64	66
04SQ	12	330	156	56	51	49	44	41	37	58	54	52	47	46	47							62	58	56	53	51	53	64	60	59	57	54	56
		620	293	60	55	54	49	46	44	62	58	55	51	50	51							67	63	60	56	54	57	69	65	63	60	57	60
		930	439	64	60	59	54	52	51	67	62	59	55	54	56							73	68	64	59	58	62	74	71	67	63	60	65
		1250	590	69	65	63	59	58	57	72	66	64	60	59	60							76	71	66	62	61	65	78	74	69	65	63	67
		1500	708													77	71	68	65	64	65												
		1550	732	74	69	67	65	63	63	76	71	68	65	64	64							79	73	69	66	65	67	80	76	72	68	66	68
05SQ	12	400	189	57	54	50	45	44	40	60	56	53	49	50	50							63	60	57	53	52	55	65	62	60	57	54	57
		760	359	61	58	55	51	50	47	64	60	57	53	54	54							68	64	60	56	55	59	70	67	64	60	57	61
		1140	538	65	63	60	57	56	54	68	65	61	58	58	58							73	69	64	60	59	63	75	73	68	63	61	65
		1500	708	69	67	65	63	62	60	72	69	65	63	62	62							76	72	68	64	63	65	78	75	70	66	65	67
		1900	897	74	72	69	68	67	66	76	73	70	69	67	67	76	73	70	68	67	67	79	75	71	68	67	68	81	77	72	69	68	69

Table 106. Radiated sound power (dB)[1,2,4]- fan and 100% primary (continued)

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs[5]						1.0" Inlet Pressure ΔPs[5]						1.5" Inlet Pressure ΔPs[3]						2.0" Inlet Pressure ΔPs[5]						3.0" Inlet Pressure ΔPs[5]					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
06SQ	16	700	330	54	52	53	49	46	41	67	58	55	52	51	50							72	70	65	62	56	56	75	70	69	65	60	58
		1200	566	60	58	58	55	52	48	69	62	60	57	55	54							74	71	67	64	60	60	77	74	71	67	64	62
		1600	755	66	62	62	59	56	54	71	66	64	61	59	58							76	73	69	66	62	62	79	76	73	69	66	64
		2100	991	72	68	67	65	62	61	74	70	68	66	63	62							78	74	72	69	66	66	81	79	75	72	70	68
		2500	1180	74	71	69	67	65	64	76	73	70	69	66	65	78	75	72	70	68	67	80	76	74	71	69	68	83	81	77	74	72	70
07SQ	16	850	401	59	57	51	53	47	51	63	59	53	54	47	52							66	62	56	56	52	58	72	68	62	59	54	63
		1400	661	62	60	59	56	52	53	66	62	61	57	55	57							71	67	64	59	57	61	74	71	67	62	59	63
		1900	897	66	65	65	61	58	57	70	66	66	61	59	60							74	70	68	63	61	63	77	74	70	65	63	64
		2250	1062	69	68	68	64	62	60	72	69	69	64	62	62							75	72	71	65	64	65	79	75	72	67	65	66
		2500	1180	71	70	71	67	65	63	73	71	71	67	65	65							76	73	73	67	66	67	80	76	73	69	67	67
		2800	1321													76	74	74	69	68	68												
		3000	1416	74	74	75	71	69	68	76	74	75	71	69	69							78	76	76	71	70	70	82	78	76	72	70	70
04SQ ECM	12	275	130	56	52	49	44	41	38	59	54	52	47	46	47							62	58	56	53	51	52	64	60	59	56	54	56
		620	293	60	56	54	49	47	45	63	58	56	51	50	52							68	63	60	56	55	57	69	66	63	60	57	61
		930	439	64	60	59	54	52	51	67	62	59	55	54	56							73	68	64	59	58	62	74	71	67	63	60	65
		1250	590	69	65	63	59	58	57	72	66	64	60	59	60							76	71	66	62	61	65	78	74	69	65	63	67
		1550	732	74	69	67	65	63	63	76	71	68	65	64	64							79	73	69	66	65	67	80	76	72	68	66	68
		1660	783	76	70	68	67	65	65	77	73	69	67	66	65							80	74	70	67	66	68	81	77	73	69	67	68
05SQ ECM	14	350	165	53	50	48	46	42	38	55	52	50	48	46	47							57	55	54	53	51	51	60	58	57	56	54	55
		760	359	58	56	54	51	49	46	61	58	56	53	51	52							64	61	59	57	55	57	66	64	62	59	58	60
		1140	538	63	62	60	56	55	53	66	63	61	57	56	57							71	67	63	60	59	62	72	70	66	62	61	64
		1500	708	69	67	65	62	61	60	70	67	65	62	62	61							72	68	66	63	62	63	73	70	66	64	63	65
		1900	897	73	71	69	68	66	66	74	71	69	67	66	66							76	73	69	68	67	68	77	75	71	68	67	69
		2350	1109	75	74	72	72	71	71	77	75	72	72	71	71							79	77	73	72	72	72	81	78	74	73	72	73
06SQ ECM	16	700	330	54	52	53	49	46	41	67	58	55	52	51	50							72	70	65	62	56	56	75	70	69	65	60	58
		1200	566	60	58	58	55	52	48	69	62	60	57	55	54							74	71	67	64	60	60	77	74	71	67	64	62
		1600	755	66	62	62	59	56	54	71	66	64	61	59	58							76	73	69	66	62	62	79	76	73	69	66	64
		2100	991	72	68	67	65	62	61	74	70	68	66	63	62							78	74	72	69	66	66	81	79	75	72	70	68
		2500	1180	74	71	69	67	65	64	76	73	70	69	66	65							80	76	74	71	69	68	83	81	77	74	72	70

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Data in this column constitute AHRI 880-2011 Standard Rating Conditions.
4. Where ΔPs is the inlet static pressure minus discharge static.
5. Application ratings are outside the scope of the certification program.

Acoustics Data

Table 107. Fan only sound power (dB)

Fan	Outlet SP	CFM	l/s	Discharge Lw (dB) Octave Bands 2	3	4	5	6	7	Radiated Lw (dB) Octave Bands 2	3	4	5	6	7
02SQ	0.25	200	94	64	53	52	46	41	33	56	49	47	43	36	28
		300	142	65	52	51	47	42	34	57	48	48	44	39	32
		500	236	70	58	56	54	50	47	61	56	54	50	47	43
		600	283	73	61	59	57	53	52	64	59	57	53	50	48
		690[a]	326	76	64	61	59	56	55	66	61	59	56	53	51
		700	330	76	64	61	60	56	55	66	62	60	56	53	51
03SQ	0.25	250	118	57	50	48	45	40	34	52	49	47	43	37	28
		480	227	60	52	54	49	45	41	55	52	51	47	42	39
		720	340	64	56	58	54	52	51	60	57	56	53	50	49
		960	453	71	62	63	61	59	58	67	63	61	59	56	56
		1100[a]	519	74	65	65	64	62	62	70	65	64	61	59	60
		1200	566	76	67	67	67	64	64	73	67	65	63	61	62
04SQ	0.25	330	156	58	51	48	45	40	34	56	51	48	42	37	30
		620	293	61	54	53	51	47	44	59	54	53	47	44	40
		930	439	66	59	59	58	54	53	63	58	58	53	51	49
		1250	590	74	66	65	65	62	61	69	64	63	59	58	56
		1500[a]	708	77	70	68	68	65	65	74	68	66	63	62	61
		1550	732	78	71	68	69	66	66	75	69	66	64	63	62
05SQ	0.25	400	189	58	54	52	48	42	39	54	52	51	44	40	33
		760	359	62	57	56	54	50	48	58	56	53	49	47	43
		1140	538	68	63	64	62	59	58	63	62	60	57	55	52
		1500	708	73	69	69	68	65	65	69	67	64	62	60	59
		1900	897	78	73	73	73	70	70	73	71	68	67	66	65
06SQ	0.25	700	330	57	56	52	50	44	39	58	55	52	47	41	34
		1200	566	59	58	57	55	51	49	60	58	58	51	47	44
		1600	755	64	62	62	61	57	56	63	62	62	57	53	51
		2100	991	69	67	67	67	64	64	68	67	66	62	60	59
		2500[a]	1180	73	71	71	71	69	69	72	71	69	66	64	63
07SQ	0.25	850	401	57	61	53	50	45	41	55	56	52	48	41	36
		1400	661	63	67	59	56	54	54	59	62	58	54	50	48
		1900	897	68	69	65	62	60	61	63	64	64	60	56	55
		2250	1062	71	72	69	66	64	65	66	67	68	64	61	59
		2500	1180	73	74	72	69	67	68	69	69	70	66	64	62
		2800[a]	1321	75	75	74	72	69	70	70	71	71	68	66	65
		3000	1416	76	76	76	73	71	72	71	72	72	70	68	67
03SQ ECM	0.25	200	94	56	49	47	44	38	37	51	48	48	42	35	34
		480	227	58	51	53	48	45	43	53	50	51	46	42	40
		720	340	64	56	57	54	52	51	57	55	55	51	49	47
		960	453	71	63	63	62	59	59	67	62	61	59	56	56
		1175	555	76	67	67	66	63	63	70	66	64	62	60	60

Table 107. Fan only sound power (dB)

Fan	Outlet SP	CFM	l/s	Discharge Lw (dB) Octave Bands 2	3	4	5	6	7	Radiated Lw (dB) Octave Bands 2	3	4	5	6	7
04SQ ECM	0.25	275	130	56	51	48	45	39	37	52	49	48	42	37	35
		620	293	60	54	55	51	48	47	55	52	52	48	45	43
		930	439	63	59	59	57	55	55	59	58	58	54	53	52
		1250	590	70	65	65	65	63	63	65	64	64	61	60	59
		1550	732	76	71	69	69	67	68	68	67	67	65	64	63
		1660	783	78	73	70	70	68	70	69	68	68	66	65	64
05SQ ECM	0.25	350	165	57	52	50	46	40	39	52	49	47	43	38	34
		760	359	60	55	55	52	49	48	56	52	51	48	46	43
		1140	538	65	61	62	60	57	57	61	59	58	55	54	52
		1500	708	72	67	68	66	64	64	67	65	63	61	61	60
		1900(a)	897	77	72	72	72	70	70	72	70	68	67	66	66
		2350	1109	82	77	76	77	75	76	76	75	72	71	71	71
06SQ ECM	0.25	700	330	56	52	53	51	45	44	56	50	50	46	43	36
		1200	566	60	57	57	55	50	49	57	54	55	51	48	45
		1600	755	63	61	61	59	55	55	60	57	60	56	52	51
		2100	991	69	67	67	66	62	63	66	63	64	62	59	58
		2500(a)	1180	73	71	70	70	66	67	70	67	68	66	63	62

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. all sound power levels, dB re: 10^{-12} Watts
3. application ratings are outside the scope of the certification program

(a) xAHRI 880-2011 section 7.2 Standard Rating Conditions

Table 108. Sound noise criteria (NC) fan and 100% primary

Fan Size	Inlet Size (in)	CFM	l/s	Discharge Inlet Pressure (ΔPs) 0.5″	1.0″	2.0″	3.0″	Radiated Inlet Pressure (ΔPs) 0.5″	1.0″	1.5″	2.0″	3.0″
02SQ	10	200	94	25	26	30	28	29	30		40	37
		300	142	25	26	29	30	29	31		39	40
		500	236	25	26	28	35	30	32		38	48
		600	283	26	28	30	32	33	33		38	46
		700	330	27	30	30	31	35	35	36	38	44
03SQ	10	250	118	--	--	--	--	21	23		27	31
		480	227	--	--	--	16	26	27		32	35
		720	340	16	18	21	23	32	33		36	39
		960	453	23	24	26	27	36	38		40	44
		1100	519							41		
		1200	566	29	30	33	33	40	42		44	46
04SQ	12	330	156	--	--	--	16	23	26		31	34
		620	293	--	--	19	22	28	30		35	38
		930	439	17	18	25	28	34	34		39	43
		1250	590	24	26	29	31	38	39		43	46
		1500	708							44		
		1550	732	30	30	34	35	43	44		47	49

Table 108. Sound noise criteria (NC) fan and 100% primary (continued)

Fan Size	Inlet Size (in)	CFM	l/s	Discharge Inlet Pressure (ΔPs)				Radiated Inlet Pressure (ΔPs)				
				0.5″	1.0″	2.0″	3.0″	0.5″	1.0″	1.5″	2.0″	3.0″
05SQ	12	400	189	--	--	--	--	24	27		32	35
		760	359	--	--	17	19	30	32		35	39
		1140	538	22	21	24	27	35	36		40	45
		1500	708	28	28	29	31	40	40		44	47
		1900	897	34	33	33	35	45	46	46	47	50
06SQ	16	700	330	--	21	30	32	27	31		42	45
		1200	566	15	24	31	34	33	35		43	47
		1600	755	20	26	33	37	37	39		45	49
		2100	991	28	30	36	40	43	44		48	52
		2500	1180	31	33	38	43	45	46	48	50	55
07SQ	16	850	401	--	17	22	28	26	28		32	39
		1400	661	18	21	26	31	34	36		39	43
		1900	897	24	25	30	34	40	41		44	46
		2250	1062	27	28	33	37	44	45		47	48
		2500	1180	30	31	33	38	47	47		49	49
		2800	1321							50		
		3000	1416	34	34	37	41	51	51		52	52
04SQ ECM	12	275	130	--	--	--	--	23	26		31	34
		620	293	--	--	17	19	28	31		35	38
		930	439	17	18	25	28	34	34		39	43
		1250	590	24	26	29	31	38	39		43	46
		1550	732	30	30	34	35	43	44		47	49
		1660	783	33	31	35	36	44	45		48	50
05SQ ECM	14	350	165	--	--	--	--	22	24		28	32
		760	359	--	--	17	19	28	31		34	37
		1140	538	22	21	24	27	35	36		38	42
		1500	708	28	28	29	31	40	40		41	42
		1900	897	34	33	33	35	45	45		45	47
		2350	1109	39	39	39	39	48	48		50	51
06SQ ECM	16	700	330	--	21	30	32	27	31		42	45
		1200	566	15	24	31	34	33	35		43	47
		1600	755	20	26	33	37	37	39		45	49
		2100	991	28	30	36	40	43	44		48	52
		2500	1180	31	33	38	43	45	46		50	55

Notes:
1. "--" represents NC levels below NC 15.
2. NC Values are calculated using modeling assumptions based on AHRI 885-98-02 Addendum
3. Data at 1.5" inlet pressure constitute AHRI 880-2011 Standard Rating Conditions.
4. Where ΔPs is the inlet static pressure minus discharge static.
5. Data at 0.5", 1.0", 2.0" and 3.0" are application ratings. These ratings are outside the scope of the certification program.

Table 109. AHRI 885-2008 discharge transfer function assumptions:

	Octave Band					
	2	3	4	5	6	7
Small Box (<300 Cfm)	-24	-28	-39	-53	-59	-40
Medium Box (300-700 Cfm)	-27	-29	-40	-51	-53	-39
Large Box (>700 Cfm)	-29	-30	-41	-51	-52	-39

Notes: Subtract from terminal unit sound power to determine discharge sound pressure in the space.
1. NC Values are calculated using modeling assumptions based on AHRI 885-2008.
2. Where DPs is inlet static pressure minus discharge static pressure.
3. Application ratings are outside the scope of the Certification Program.

Table 110. AHRI 885-2008 radiated transfer function assumptions:

	Octave Band					
	2	3	4	5	6	7
Type 2- Mineral Fiber Insulation	-18	-19	-20	-26	-31	-36
Total dB reduction	-18	-19	-20	-26	-31	-36

Notes: Subtract from terminal unit sound power to determine radiated sound pressure in the space.
1. NC Values are calculated using modeling assumptions based on AHRI 885-2008.
2. Where DPs is inlet static pressure minus discharge static pressure.
3. Application ratings are outside the scope of the Certification Program.

Table 111. Series inlet attenuator appurtenance effects

	Discharge Sound Effect* (dB)						Radiated Sound Effect* (dB)					
Fan	2	3	4	5	6	7	2	3	4	5	6	7
Matte-faced and foil-faced insulation, solid double-wall**												
02SQ	2	2	2	3	3	2	-3	-3	-9	-10	-12	-17
03SQ, 04SQ, 05SQ	2	2	2	3	3	2	-1	-3	-10	-14	-17	-20
06SQ, 07SQ	2	2	2	3	3	2	1	-3	-8	-9	-8	-10
Closed-cell insulation												
02SQ	2	2	2	3	3	2	1	-2	-5	-4	-6	-6
03SQ, 04SQ, 05SQ	2	2	2	3	3	2	1	-2	-5	-4	-6	-6
06SQ, 07SQ	2	2	2	3	3	2	1	-2	-5	-4	-6	-6

Notes:
* Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.
** Note – Attenuators on double-wall units contain foil-faced insulation.
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} watts.
3. Application ratings are outside the scope of the Certification Program.

Table 112. Series cabinet lining appurtenance effects

	Discharge Sound Effect* (dB)						Radiated Sound Effect* (dB)					
Fan	2	3	4	5	6	7	2	3	4	5	6	7
Solid double-wall												
02SQ	0	0	0	0	0	0	0	0	0	2	3	3
03SQ, 04SQ, 05SQ	0	0	0	0	0	0	0	0	1	2	3	4
06SQ, 07SQ	0	0	0	0	0	0	1	3	2	5	8	8
Closed-cell insulation												
02SQ	0	0	0	0	0	0	-1	-1	0	1	1	2
03SQ, 04SQ, 05SQ	0	0	0	0	0	0	1	1	2	2	2	2
06SQ, 07SQ	0	0	0	0	0	0	1	5	3	4	6	6

Note:
* Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10-12 watts.
3. Application ratings are outside the scope of the Certification Program.

Table 113. Series heating coil appurtenance effects

	Discharge Sound Effect* (dB)						Radiated Sound Effect* (dB)**					
Fan	2	3	4	5	6	7	2	3	4	5	6	7
Hot Water Coil												
02SQ	1	2	2	1	2	2	2	2	2	2	2	2
03SQ, 04SQ, 05SQ	1	3	1	2	2	1	0	2	1	2	2	2
06SQ, 07SQ	2	6	4	4	4	3	6	5	2	2	2	3
Electric Heat												
02SQ	-4	-1	0	0	1	0	-1	0	-1	0	0	0
03SQ, 04SQ, 05SQ	2	1	2	1	-1	-1	0	1	1	1	1	1
06SQ, 07SQ	4	4	2	2	3	1	2	3	3	4	3	2

Notes:
* Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.
** Radiated effect applies to "fan only" sound only. Do not apply to fan + valve sound.
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10-12 Watts.
3. Application ratings are outside the scope of the Certification Program.

Low Height Parallel Fan-Powered Terminal Units

Table 114. Discharge sound power (dB)[1,2,4]

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs[5]						1.0" Inlet Pressure ΔPs[5]						1.5" Inlet Pressure ΔPs[3]						2.0" Inlet Pressure ΔPs[5]						3.0" Inlet Pressure ΔPs[5]					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
08SQ	5	150	71	55	48	44	39	32	29	58	51	49	45	38	38							58	52	50	47	44	46	60	54	52	49	47	50
		200	94	58	51	47	42	36	31	61	54	51	47	40	39							62	56	53	50	46	47	63	57	55	52	49	51
		250	118	62	54	49	45	40	33	63	57	53	48	42	40	65	59	56	51	45	44	65	60	56	53	48	48	66	61	58	54	51	52
		300	142	65	56	51	48	43	37	66	60	55	50	45	42							69	62	59	55	50	48	69	64	61	57	54	54
		350	165	67	59	54	50	46	41	69	62	57	53	49	44							71	65	61	57	51	49	73	68	64	61	58	55
08SQ 09SQ	6	200	94	56	49	45	40	34	29	58	52	50	44	38	37							61	55	52	50	47	48	63	57	54	51	49	52
		280	132	60	53	49	44	40	33	62	56	54	48	44	40							65	59	56	53	50	48	67	61	58	55	52	52
		350	165	63	57	53	48	44	37	65	60	57	52	48	42							68	62	59	56	53	49	70	64	61	58	55	53
		400	189													69	64	60	56	54	47												
		430	203	67	62	57	52	50	42	68	64	60	56	54	46							71	66	63	59	56	50	73	68	65	61	58	54
		500	236	71	65	61	56	53	45	71	67	63	59	57	49							73	69	66	62	60	53	75	71	68	64	62	56
08SQ 09SQ	8	350	165	58	51	48	44	39	31	61	55	53	48	44	40							65	60	57	53	50	49	67	62	60	55	53	52
		500	236	61	55	52	48	44	36	65	59	56	52	48	43							69	64	61	57	54	51	71	66	64	59	57	54
		600	283	64	58	54	50	47	39	67	61	59	54	51	45							71	67	64	60	57	53	73	69	66	62	59	56
		700	330													72	67	64	60	57	51												
		800	378	68	63	59	56	52	44	71	66	63	59	56	49							75	71	68	64	62	56	78	74	71	68	64	59
		900	425	70	65	61	58	55	47	73	68	64	61	58	51							77	72	69	66	63	57	80	75	73	70	67	61
09SQ	8 x 14	780	368	64	63	58	52	48	45	69	69	62	56	52	54							73	70	72	61	56	55	77	74	78	66	59	56
		1100	519	66	64	61	54	52	48	70	69	66	59	56	55							76	72	75	64	61	58	79	76	80	68	63	59
		1500	708	69	67	65	58	56	51	73	69	71	62	61	57							79	75	79	69	66	62	83	78	82	72	68	63
		1560	736													75	73	74	66	63	60												
		1800	850	71	69	68	61	59	53	75	71	74	65	63	58							81	76	80	71	68	63	83	78	82	73	70	65
		2200	1038							78	73	76	68	65	61							82	77	81	73	70	65	84	79	83	75	72	67
10SQ	8 x 14	780	368	65	60	52	48	41	34	68	66	60	57	45	42							70	68	66	65	51	50	72	69	69	69	56	54
		1170	552							72	69	62	58	51	46							75	74	70	68	56	52	76	76	75	73	59	56
		1560	736													76	74	70	65	59	53	78	76	72	68	60	55	79	79	76	74	63	59
		1800	850																			79	77	75	70	63	57	81	80	77	74	65	60
		2000	944																			80	78	78	71	65	59	82	80	78	74	67	61

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Data in this column constitute AHRI 880-2011 Standard Rating Conditions.
4. Where ΔPs is the inlet static pressure minus discharge static.
5. Application ratings are outside the scope of the certification program.

Table 115. Radiated sound power (dB)[1,2,4]

Fan Size	Inlet Size (in)	Cfm	l/s	0.5″ Inlet Pressure ΔPs[5]						1.0″ Inlet Pressure ΔPs[5]						1.5″ Inlet Pressure ΔPs[3]						2.0″ Inlet Pressure ΔPs[5]						3.0″ Inlet Pressure ΔPs[5]					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
08SQ	5	150	71	53	44	38	33	28	21	54	45	40	36	31	25							54	47	42	40	38	34	56	49	45	46	42	38
		200	94	55	46	41	35	29	21	56	48	42	37	32	25							57	50	45	42	38	34	58	51	47	46	42	38
		250	118	56	49	44	36	30	22	59	50	44	38	33	26	59	50	46	41	36	32	60	52	48	43	39	34	61	53	48	47	43	38
		300	142	59	50	45	38	31	24	62	52	47	40	34	28							62	54	50	45	40	34	63	55	50	48	44	38
		350	165	62	51	46	39	33	26	65	55	50	43	36	30							65	56	51	47	41	35	65	57	53	50	45	39
08SQ 09SQ	6	200	94	53	45	40	33	27	21	56	48	43	35	29	22							57	48	44	40	37	32	58	50	45	45	42	37
		280	132	54	46	40	33	27	22	57	50	45	37	30	24							59	51	47	42	37	33	61	53	48	46	42	37
		350	165	54	46	41	34	28	22	58	51	46	38	31	25							62	54	49	44	38	34	63	55	50	47	43	38
		400	189													62	55	50	42	36	31												
		430	203	56	49	43	36	30	25	60	53	48	40	33	27							64	57	52	46	39	35	66	58	53	49	43	38
		500	236	59	53	47	40	34	29	62	55	50	42	35	30							66	58	53	47	41	36	68	60	55	51	44	39
08SQ 09SQ	8	350	165	57	50	45	38	34	23	59	54	46	40	34	26							61	55	48	43	39	35	63	56	50	47	44	37
		500	236	60	53	47	40	34	24	62	56	49	42	36	28							65	58	51	46	41	35	67	60	54	50	45	38
		600	283	62	54	49	41	34	24	65	58	51	44	37	29							68	60	54	47	42	35	70	62	56	51	46	38
		700	330													69	61	55	47	40	33												
		800	378	65	57	52	44	36	26	69	61	54	46	40	32							73	64	58	50	44	36	74	66	60	54	48	40
		900	425	66	58	53	45	37	28	71	63	56	48	41	33							75	66	60	52	45	37	76	67	62	55	48	40
09SQ	8 x 14	780	368	62	59	55	48	40	31	66	61	57	51	44	38							70	63	61	53	48	43	72	66	63	55	51	46
		1100	519	64	60	56	47	40	32	68	63	60	52	45	38							72	66	65	57	52	45	74	68	66	59	54	48
		1500	708	68	62	58	47	39	32	71	65	64	53	46	39							75	69	70	62	56	47	77	72	70	63	58	50
		1560	736													73	68	67	58	51	43												
		1800	850	71	63	59	47	39	32	73	67	68	54	47	39							77	71	72	62	56	47	79	73	73	64	59	50
		2200	1038							76	70	73	55	48	40							80	74	75	62	55	47	82	75	76	65	58	49
10SQ	8 x 14	780	368	60	55	47	41	32	28	63	61	55	48	38	34							66	63	60	55	45	41	69	66	64	59	50	45
		1170	552							68	65	57	50	41	39							71	69	66	59	48	45	74	74	69	64	53	48
		1560	736													73	71	64	56	47	46	74	72	66	59	49	47	76	74	71	65	54	50
		1800	850																			75	74	68	61	51	49	77	76	72	65	55	51
		2000	944																			76	75	70	62	52	50	78	77	72	65	55	52

Notes:

1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Data in this column constitute AHRI 880-2011 Standard Rating Conditions.
4. Where ΔPs is the inlet static pressure minus discharge static.
5. Application ratings are outside the scope of the certification program.

Acoustics Data

Table 116. Fan only sound power (dB)

Fan	Outlet SP	CFM	l/s	Discharge Lw (dB) Octave Bands 2	3	4	5	6	7	Radiated Lw (dB) Octave Bands 2	3	4	5	6	7
08SQ	0.25	175	83	61	53	51	47	41	34	65	56	57	50	41	35
		250	118	64	56	55	50	44	40	68	58	60	53	44	38
		320	151	67	58	58	53	48	45	72	61	63	56	48	42
		400	189	71	62	61	58	54	51	75	64	65	61	52	47
		460(a)	217	73	64	64	62	58	56	76	66	69	63	55	50
		470	222	74	65	65	62	58	56	77	67	69	64	56	50
09SQ	0.25	400	189	70	61	58	54	48	44	69	65	62	56	46	38
		500	236	71	62	59	56	49	46	70	66	64	58	48	40
		700	330	74	65	63	61	54	53	72	69	68	64	54	46
		800	378	76	67	65	64	57	56	74	71	70	67	57	49
		900(a)	425	78	70	69	67	61	61	77	74	72	69	60	53
10SQ	0.25	700	330	67	59	56	51	45	40	67	61	57	54	49	44
		840	396	69	60	58	53	48	43	68	63	58	55	50	46
		980	463	70	63	59	56	51	47	70	65	60	57	53	50
		1200	566	74	67	64	61	56	54	73	69	64	61	57	55
		1400	661	77	71	67	65	60	57	76	72	67	64	60	58
		1420(a)	670	77	71	67	65	60	57	76	72	67	64	60	58
08SQ ECM	0.25	150	71	61	55	51	46	40	34	66	58	56	50	42	36
		230	109	64	57	54	49	44	39	69	60	58	52	44	40
		310	146	67	59	57	53	48	45	71	62	62	56	47	44
		380	179	70	61	61	57	51	50	74	64	64	59	50	47
		460(a)	217	72	65	64	61	55	54	76	67	66	63	54	51
09SQ ECM	0.25	400	189	71	61	58	54	47	45	69	64	61	56	47	41
		600	283	75	64	62	59	52	51	72	67	65	61	51	45
		700	330	77	66	64	63	56	56	75	71	68	64	55	49
		900(a)	425	81	71	70	68	62	62	79	75	72	69	61	55
		1020	481	83	73	72	70	65	64	81	78	74	72	64	58

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. all sound power levels, dB re: 10^{-12} Watts
3. application ratings are outside the scope of the certification program

(a) AHRI 880-2011 section 7.2 Standard Rating Conditions

Table 117. AHRI 885-2008 add discharge transfer function assumptions:

	Octave Band 2	3	4	5	6	7
Small Box (< 300 CFM)	-24	-28	-39	-53	-59	-40
Medium Box (300-700 CFM)	-27	-29	-40	-51	-53	-39
Large Box (> 700 CFM)	-29	-30	-41	-51	-52	-39

Notes: Subtract from terminal unit sound power to determine discharge sound pressure in the space.
1. NC Values are calculated using modeling assumptions based on AHRI 885-2008.
2. Where DPs is inlet static pressure minus discharge static pressure.
3. Application ratings are outside the scope of the Certification Program.

Table 118. AHRI 885-2008 radiated transfer function assumptions:

	Octave Band					
	2	**3**	**4**	**5**	**6**	**7**
Type 2- Mineral Fiber Insulation	-18	-19	-20	-26	-31	-36
Total dB reduction	-18	-19	-20	-26	-31	-36

Notes: Subtract from terminal unit sound power to determine radiated sound pressure in the space.
1. NC Values are calculated using modeling assumptions based on AHRI 885-2008.
2. Where DPs is inlet static pressure minus discharge static pressure.
3. Application ratings are outside the scope of the Certification Program.

Table 119. Sound noise criteria (NC) - valve only

Fan Size	Inlet Size (in)	CFM	l/s	Discharge[1,2,4] Inlet Pressure (ΔPs)[3,5]					Radiated[1,2,4] Inlet Pressure (ΔPs)[3,5]				
				0.5″	1.0″	1.5″	2.0″	3.0″	0.5″	1.0″	1.5″	2.0″	3.0″
		150	71	--	--		--	--	--	--		15	19
		200	94	--	16		17	19	16	17		19	21
08SQ	5	250	118	17	19	21	21	23	18	21	21	22	24
		300	142	21	23		26	26	21	25		25	26
		350	165	24	26		29	32	25	29		29	29
		200	94	--	--		--	16	--	17		19	20
		280	132	--	--		17	20	--	19		21	24
		350	165	--	18		21	24	--	20		25	26
08SQ 09SQ	6	400	189			23					25		
		430	203	20	22		25	28	17	22		27	30
		500	236	25	26		28	31	21	25		30	33
		350	165	--	--		18	20	19	23		24	26
		500	236	--	17		23	25	22	25		29	31
		600	283	16	20		26	28	25	29		33	35
08SQ 09SQ	8	700	330			26					34		
		800	378	21	25		31	34	29	34		39	40
		900	425	24	28		33	37	30	36		42	43
		780	368	20	27		28	33	30	32		36	38
		1100	519	21	27		31	36	31	35		40	41
		1500	708	25	27		34	38	33	39		46	46
09SQ	8x14	1560	736			32					43		
		1800	850	27	30		36	38	36	44		48	49
		2200	1038		32		37	39		49		51	52
		780	368	17	24		26	27	24	31		35	39
		1170	552		27		33	36		36		41	46
10SQ	8x14	1560	736			33	36	39			43	44	47
		1800	850				37	40				46	49
		2000	944				38	40				47	50

Notes:
1. "--" represents NC levels below NC 15.
2. NC Values are calculated using modeling assumptions based on AHRI 885-98-02 Addendum
3. Data at 1.5" inlet pressure constitute AHRI 880-2011 Standard Rating Conditions.
4. Where ΔPs is the inlet static pressure minus discharge static.
5. Data at 0.5", 1.0", 2.0" and 3.0" are application ratings. These ratings are outside the scope of the certification program.

Table 120. Sound noise criteria (NC) - fan only

				Fan-Only	
				0.25” Disch. Pres.	
Fan	Outlet SP	CFM	l/s	Discharge	Radiated
08SQ	0.25	175	83	--	32
		250	118	16	35
		320	151	20	38
		400	189	25	42
		460[(a)]	217	28	45
		470	222	29	45
09SQ	0.25	400	189	21	37
		500	236	23	39
		700	330	26	44
		800	378	29	46
		900[(a)]	425	32	48
10SQ	0.25	700	330	17	32
		840	396	20	33
		980	463	21	36
		1200	566	26	40
		1400	661	30	44
		1420[(a)]	670	30	44
08SQ ECM	0.25	150	71	--	31
		230	109	--	34
		310	146	17	37
		380	179	21	40
		460[(a)]	217	24	43
09SQ ECM	0.25	400	189	23	36
		600	283	28	40
		700	330	30	44
		900[(a)]	425	35	48
		1020	481	38	51

Notes:
1. “--” represents NC levels below NC 15.
2. NC values are calculated using modeling assumptions based on AHRI 885-2008 Appendix E.
3. Application ratings are outside the scope of the certification program.

(a) AHRI 880-2011 section 7.2 Standard Rating Conditions.

Table 121. Discharge sound power (dB)-fan only (AHRI conditions)

Fan Size	Inlet Size	Cfm	L/s	2	3	4	5	6	7
08SQ	5, 6, 8	460	217	68	62	63	62	58	56
09SQ	6, 8, 8x14	900	425	73	68	68	67	61	61
10SQ	8, 8x14	1420	670	72	69	66	65	60	57

Notes:
1. All sound data rated in accordance with current Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.

Table 122. Radiated sound power (dB)-fan only (AHRI conditions)

Fan Size	Inlet Size	Cfm	L/s	2	3	4	5	6	7
08SQ	5, 6, 8	460	217	76	66	69	63	55	50
09SQ	6, 8, 8x14	900	425	77	74	72	69	60	53
10SQ	8, 8x14	1420	670	76	72	67	64	60	58

Notes:
1. All sound data rated in accordance with current Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.

Table 123. Inlet attenuator appurtenance effects (fan noise only)

	Discharge Sound Effect[a] (dB)						Radiated Sound Effect[a] (dB)					
Fan	**2**	**3**	**4**	**5**	**6**	**7**	**2**	**3**	**4**	**5**	**6**	**7**
Matte-faced and foil-faced insulation[b]												
08SQ, 09SQ	2	3	4	5	5	6	2	0	-4	-8	-7	-7
Closed-cell insulation												
08SQ, 09SQ	2	3	4	5	4	5	2	1	2	-3	-4	-4

(a) Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.
(b) Attenuators on double-wall units contain foil-faced insulation.

All data are measured in accordance with Industry Standard AHRI 880-2011.
All sound power levels, dB re: 10^{-12} Watts.
Application ratings are outside the scope of the Certification Program.

Table 124. Cabinet lining appurtenance effects (fan noise and valve noise)

	Discharge Sound Effect[a] (dB)						Radiated Sound Effect[a] (dB)					
Fan	**2**	**3**	**4**	**5**	**6**	**7**	**2**	**3**	**4**	**5**	**6**	**7**
Solid double-wall												
08SQ, 09SQ	1	0	2	3	4	6	2	1	2	5	9	13
Closed-cell insulation												
08SQ, 09SQ	2	1	3	2	2	2	2	2	4	5	5	8

(a) Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.

All data are measured in accordance with Industry Standard AHRI 880-2011.
All sound power levels, dB re: 10^{-12} Watts.
Application ratings are outside the scope of the Certification Program.

Table 125. Heating coil appurtenance effects

	Discharge Sound Effect[a] (dB)						Radiated Sound Effect[a] (dB)					
Fan	**2**	**3**	**4**	**5**	**6**	**7**	**2**	**3**	**4**	**5**	**6**	**7**
Hot Water Coil (Fan Noise)												
08SQ, 09SQ	3	3	4	5	4	5	2	2	3	3	3	4
Electric Heat												
08SQ, 09SQ	0	-1	0	1	1	3	1	1	1	2	2	3

(a) Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.

All data are measured in accordance with Industry Standard AHRI 880-2011.
All sound power levels, dB re: 10^{-12} Watts.
Application ratings are outside the scope of the Certification Program.

Low Height Series Fan-Powered Terminal Units

Table 126. Discharge sound power (dB)

Fan Size	Inlet Size (in)	Cfm	l/s	0.5" Inlet Pressure ΔPs						1.0" Inlet Pressure ΔPs						2.0" Inlet Pressure ΔPs						3.0" Inlet Pressure ΔPs					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
08SQ	8	170	80	61	53	54	47	44	42	60	52	49	42	38	33	61	58	50	43	39	34	61	60	52	45	41	35
		250	118	64	56	57	52	49	47	63	55	54	48	44	40	64	60	55	49	45	41	64	62	55	50	46	42
		330	156	68	60	61	56	53	52	67	59	58	53	49	47	68	63	59	54	50	48	68	65	59	55	51	49
		410	193	71	63	64	61	57	57	71	63	63	59	55	55	72	65	63	60	56	55	72	67	63	60	56	56
		500	227	74	67	67	65	61	62	75	67	67	65	61	62	76	68	67	65	61	62	76	69	67	65	61	63
09SQ	8x14	350	165	63	59	55	51	45	41	64	60	59	52	45	41	65	62	59	53	47	42	66	63	59	54	48	44
		500	236	67	64	60	57	51	49	67	65	63	57	51	49	69	67	63	58	53	49	71	68	63	59	54	51
		700	330	71	70	66	64	59	59	72	71	67	64	59	59	75	73	67	65	60	59	77	75	69	66	61	61
		800	378	75	73	68	67	62	62	75	73	69	67	62	62	76	74	69	67	63	62	78	76	71	68	64	64
		890	420	77	75	70	69	65	64	77	75	71	69	65	64	78	76	71	69	65	64	79	77	72	70	66	66
10SQ	8x14	440	208	60	58	54	50	43	37	62	59	54	51	44	39	64	60	57	51	46	40	66	63	58	53	47	41
		700	330	63	60	57	53	47	43	64	61	57	54	48	44	66	63	59	55	49	45	69	64	65	56	51	46
		900	425	65	64	60	56	50	47	67	65	61	58	53	50	69	66	62	59	53	51	71	67	66	60	55	51
		1100	519							69	68	64	62	57	55	71	69	65	62	57	56	72	70	66	63	58	56
		1300	614													73	72	68	65	61	60	74	72	68	66	61	60
		1500	708													75	74	70	68	64	63	76	74	70	69	64	63
08SQ ECM	8	170	80	61	53	54	47	44	42	60	52	49	42	38	33	61	58	50	43	39	34	61	60	52	45	41	35
		250	118	64	56	57	52	49	47	63	55	54	48	44	40	64	60	55	49	45	41	64	62	55	50	46	42
		330	156	68	60	61	56	53	52	67	59	58	53	49	47	68	63	59	54	50	48	68	65	59	55	51	49
		410	193	71	63	64	61	57	57	71	63	63	59	55	55	72	65	63	60	56	55	72	67	63	60	56	56
		500	227	74	67	67	65	61	62	75	67	67	65	61	62	76	68	67	65	61	62	76	69	67	65	61	63
09SQ ECM	8x14	350	165	63	59	55	51	45	41	64	60	59	52	45	41	65	62	59	53	47	42	66	63	59	54	48	44
		500	236	67	64	60	57	51	49	67	65	63	57	51	49	69	67	63	58	53	49	71	68	63	59	54	51
		700	330	71	70	66	64	59	59	72	71	67	64	59	59	75	73	67	65	60	59	77	75	69	66	61	61
		800	378	75	73	68	67	62	62	75	73	69	67	62	62	76	74	69	67	63	62	78	76	71	68	64	64
		890	420	77	75	70	69	65	64	77	75	71	69	65	64	78	76	71	69	65	64	79	77	72	70	66	66
10SQ ECM	8x14	440	208	60	58	54	50	43	37	62	59	54	51	44	39	64	60	57	51	46	40	66	63	58	53	47	41
		700	330	63	60	57	53	47	43	64	61	57	54	48	44	66	63	59	55	49	45	69	64	65	56	51	46
		900	425	65	64	60	56	50	47	67	65	61	58	53	50	69	66	62	59	53	51	71	67	66	60	55	51
		1100	519							69	68	64	62	57	55	71	69	65	62	57	56	72	70	66	63	58	56
		1300	614													73	72	68	65	61	60	74	72	68	66	61	60
		1500	708													75	74	70	68	64	63	76	74	70	69	64	63

Notes:

1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Where ΔPs is the inlet static pressure minus discharge static.
4. Application ratings are outside the scope of the certification program.

Table 127. Radiated sound power (dB)[1,2,4]

Fan Size	Inlet Size (in)	Cfm	l/s	0.5″ Inlet Pressure ΔPs[5]						1.0″ Inlet Pressure ΔPs[5]						1.5″ Inlet Pressure ΔPs[5]						2.0″ Inlet Pressure ΔPs[5]						3.0″ Inlet Pressure ΔPs[5]					
				2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
08SQ	8	170	80	54	49	45	37	28	22	55	53	47	40	33	31							58	62	55	45	41	37	58	63	58	49	46	40
		250	118	57	52	48	42	33	27	58	56	50	43	36	33							60	63	56	47	42	38	60	64	59	50	46	41
		330	156	60	56	52	46	37	31	61	59	54	47	39	36							63	64	58	50	43	39	63	65	60	52	46	42
		410	193	63	60	56	50	41	36	64	62	57	50	42	38							65	65	59	52	44	41	65	67	62	53	46	43
		500	227	66	64	60	53	44	40	67	65	60	54	45	41	68	66	61	54	46	42	68	66	61	54	45	42	68	68	63	55	46	44
09SQ	8 x 14	350	165	58	53	47	39	32	27	59	56	56	43	37	34							62	63	61	52	45	42	64	65	62	54	49	45
		500	236	62	57	51	44	36	30	63	59	57	46	39	36							65	64	62	53	46	44	67	66	63	55	50	47
		700	330	68	63	56	50	40	33	68	64	58	50	42	39							69	65	62	53	47	46	71	67	64	56	51	50
		800	378	70	66	58	52	44	38	70	66	59	52	44	41	70	66	61	53	46	44	71	67	63	55	48	47	72	69	65	57	52	51
		890	420	72	67	59	54	46	40	72	67	60	54	46	42							73	69	64	56	49	48	74	71	67	59	53	51
10SQ	8 x 14	440	208	61	56	49	42	33	27	62	59	52	45	40	38							65	60	60	50	46	46	66	63	61	58	50	49
		700	330	62	58	51	45	37	31	64	61	55	48	43	41							68	64	62	53	48	48	70	66	67	57	52	51
		900	425	66	62	55	48	41	34	68	63	56	50	44	42							70	66	64	55	50	50	72	68	68	58	54	52
		1100	519							71	65	58	53	46	42							72	68	65	57	52	52	73	70	69	60	55	54
		1300	614																			74	69	65	58	53	52	76	72	69	61	56	55
																76	70	63	59	52	48												
		1500	708																			76	71	64	60	54	52	78	74	70	63	58	57
08SQ ECM	8	170	80	54	49	44	36	29	22	57	54	48	39	36	30							57	60	54	44	41	36	58	61	56	48	45	40
		250	118	57	52	47	40	32	27	59	56	50	42	37	32							59	62	56	46	42	38	60	63	58	50	46	41
		330	156	60	56	51	44	36	31	62	58	53	46	39	35							62	64	58	49	44	40	63	66	61	52	47	42
		410	193	63	59	55	48	40	36	64	60	56	49	41	38							65	66	60	52	45	42	66	68	63	54	48	44
		500	227	66	62	58	52	43	40	66	62	58	52	43	40							67	67	61	54	46	43	68	70	65	56	49	45
09SQ ECM	8 x 14	350	165	60	53	47	40	32	25	60	56	55	43	37	34							63	63	62	52	45	42	64	63	62	54	49	47
		500	236	64	57	51	44	36	29	64	59	56	46	39	36							67	64	63	53	46	44	68	65	63	55	50	48
		700	330	71	63	56	51	41	33	71	64	58	51	42	39							71	65	63	53	47	46	73	68	64	57	51	49
		800	378	73	66	58	53	44	38	73	66	59	53	44	40							73	67	63	55	48	46	75	69	64	58	52	49
		890	420	75	67	59	55	46	40	75	67	60	55	46	41							75	69	63	56	49	47	77	70	65	59	53	50
10SQ ECM	8 x 14	440	208	61	54	47	42	37	32	62	57	49	44	38	38							64	59	60	48	44	44	68	63	68	56	48	51
		700	330	64	57	50	45	37	32	66	60	54	49	43	43							69	64	60	53	47	49	71	66	68	56	51	51
		900	425	65	62	55	48	40	35	69	63	56	52	44	43							72	67	61	55	50	51	73	68	68	58	52	52
		1100	519							72	66	58	54	46	43							74	70	62	57	52	53	75	71	67	60	54	54
		1300	614																			76	71	63	59	53	53	77	72	67	61	56	55
		1500	708																			78	72	65	61	54	52	79	74	68	63	58	57

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts.
3. Data in this column constitute AHRI 880-2011 Standard Rating Conditions.
4. Where ΔPs is the inlet static pressure minus discharge static.
5. Application ratings are outside the scope of the certification program.

Acoustics Data

Table 128. Fan only sound power (dB)

Fan	Outlet SP	CFM	l/s	Discharge Lw (dB) Octave Bands 2	3	4	5	6	7	Radiated Lw (dB) Octave Bands 2	3	4	5	6	7
08SQ	0.25	170	80	61	51	52	46	42	38	53	47	44	36	26	21
		250	118	63	54	55	50	46	43	56	51	48	41	30	23
		330	156	67	58	59	54	50	49	59	56	52	46	36	27
		410	193	70	61	64	58	56	56	60	59	55	49	40	34
		480	227	73	64	66	62	60	59	63	62	58	53	44	37
		500(a)	236	73	65	67	63	60	60	64	62	59	54	45	38
09SQ	0.25	350	165	65	58	55	51	46	41	57	51	44	38	24	20
		500	236	69	62	60	57	52	49	61	55	48	42	30	23
		700	330	74	68	66	64	59	58	66	61	55	49	38	29
		800(a)	378	77	70	69	67	62	61	68	64	58	52	42	32
		890	420	79	73	71	70	65	64	70	67	60	55	45	36
10SQ	0.25	440	208	61	58	54	51	44	38	62	57	48	41	29	22
		700	330	63	61	58	56	49	45	64	60	51	45	33	24
		900	425	65	64	61	59	53	51	66	62	54	48	36	26
		1100	519	68	67	64	62	57	55	68	64	57	52	40	30
		1300	614	71	70	66	66	61	59	71	66	60	55	44	33
		1400(a)	661	72	71	68	68	62	61	72	68	61	56	46	35
		1500	708	73	73	69	69	64	63	74	69	62	58	48	36
08SQ ECM	0.25	170	80	60	48	47	42	36	30	53	46	41	36	25	23
		250	118	63	52	53	48	44	38	55	50	45	40	28	25
		330	156	67	57	59	53	50	47	58	54	50	44	33	28
		410	193	71	62	63	59	56	54	61	58	54	49	38	33
		480	227	74	65	67	64	61	59	66	61	57	53	43	37
09SQ ECM	0.25	350	165	64	60	57	53	48	46	60	53	45	39	28	23
		500	236	69	65	62	60	55	54	64	58	50	44	34	28
		700	330	73	71	67	67	62	61	69	63	56	51	40	33
		800	378	77	74	71	70	66	65	72	66	59	54	44	36
		890	420	80	78	74	74	70	69	76	70	62	57	48	40
10SQ ECM	0.25	440	208	62	59	58	55	49	48	62	55	48	41	30	23
		700	330	65	62	61	58	52	51	65	59	52	46	35	27
		900	425	67	64	63	61	55	54	67	62	55	50	39	30
		1100	519	69	67	66	64	58	58	70	66	58	54	42	33
		1300	614	72	70	68	67	62	62	73	69	61	57	46	36
		1500	708	75	73	70	70	65	65	75	71	63	59	49	40

Notes:
1. All data are measured in accordance with Industry Standard AHRI 880-2011.
2. All sound power levels, dB re: 10^{-12} Watts
3. Application ratings are outside the scope of the certification program

(a) AHRI 880-2011 section 7.2 Standard Rating Conditions

Table 129. Sound noise criteria (NC) - fan and 100% primary

Fan Size	Inlet Size (in)	CFM	l/s	Discharge Inlet Pressure (∆Ps) 0.5″	1.0″	2.0″	3.0″	Radiated Inlet Pressure (∆Ps) 0.5″	1.0″	2.0″	3.0″
08SQ	8	170	80	--	--	15.6	18.0	18.7	21.4	32.0	33.2
		250	118	17	15	18	20	22	25	33	34
		330	156	22	20	22	24	26	28	34	36
		410	193	26	26	27	27	31	32	36	38
		480	227	29	31	32	32	35	36	37	39
09SQ	8x14	350	165	16	17	19	20	21	31	36	37
		500	236	22	23	25	26	26	32	37	38
		700	330	29	30	32	35	33	34	37	39
		800	378	32	32	33	36	37	37	38	40
		890	420	35	35	36	37	38	38	40	43
10SQ	8x14	440	208	--	16	17	20	25	28	35	36
		700	330	17	18	20	22	27	31	37	43
		900	425	22	23	24	25	32	33	39	44
		1100	519		26	27	29		36	40	45
		1300	614			31	31			40	45
		1500	708			33	33			43	46
08SQ ECM	8	170	80	--	--	16	18	18	23	30	31
		250	118	17	15	18	20	21	25	32	33
		330	156	22	20	22	24	25	27	34	37
		410	193	26	26	27	27	30	31	37	39
		480	227	29	31	32	32	33	33	38	42
09SQ ECM	8x14	350	165	16	17	19	20	22	30	37	37
		500	236	22	23	25	26	27	31	38	38
		700	330	29	30	32	35	36	36	38	39
		800	378	32	32	33	36	39	39	39	42
		890	420	35	35	36	37	42	42	42	44
10SQ ECM	8x14	440	208	--	16	17	20	24	26	35	44
		700	330	17	18	20	22	27	30	35	44
		900	425	22	23	24	25	32	34	38	44
		1100	519		26	27	29		38	42	43
		1300	614			31	31			43	44
		1500	708			33	33			45	47

Notes:
1. "--" represents NC levels below NC 15.
2. NC Values are calculated using modeling assumptions based on AHRI 885-98-02 Addendum
3. Where ∆Ps is the inlet static pressure minus discharge static.
4. Data at 0.5", 1.0", 2.0" and 3.0" are application ratings. These ratings are outside the scope of the certification program.

Table 130. AHRI 885-2008 add discharge transfer function assumptions:

	Octave Band 2	3	4	5	6	7
Small Box (< 300 CFM)	-24	-28	-39	-53	-59	-40
Medium Box (300-700 CFM)	-27	-29	-40	-51	-53	-39
Large Box (> 700 CFM)	-29	-30	-41	-51	-52	-39

Notes: Subtract from terminal unit sound power to determine discharge sound pressure in the space.
1. NC Values are calculated using current Industry Standard AHRI 885-2008. Radiated Transfer Function obtained from Appendix E, Type 2Mineral Fiber Insulation.
2. Application ratings are outside the scope of the Certification Program.

Table 131. AHRI 885-2008 radiated transfer function assumptions:

	Octave Band					
	2	3	4	5	6	7
Type 2- Mineral Fiber Insulation	-18	-19	-20	-26	-31	-36
Total dB reduction	-18	-19	-20	-26	-31	-36

Notes: Subtract from terminal unit sound power to determine radiated sound pressure in the space.

1. NC Values are calculated using current Industry Standard AHRI 885-2008. Radiated Transfer Function obtained from Appendix E, Type 2Mineral Fiber Insulation.
2. Application ratings are outside the scope of the Certification Program.

Table 132. Inlet attenuator appurtenance effects

	Discharge Sound Effect[a] (dB)						Radiated Sound Effect[a] (dB)					
Fan	2	3	4	5	6	7	2	3	4	5	6	7
Matte-faced and foil-faced insulation, solid double-wall[b]												
08SQ, 09SQ	0	0	0	1	0	0	-1	-3	-3	-7	-7	-6
10SQ	2	2	2	2	2	2	-2	-3	-5	-10	-12	-12
Closed-cell insulation												
08SQ, 09SQ	0	1	0	0	0	0	-1	-1	-1	-4	-6	-4
10SQ	2	2	2	2	2	2	-1	-1	-2	-5	-9	-9

(a) Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.
(b) Attenuators on double-wall units have 1" foil-faced insulation. All edges are encapsulated with metal.

All data are measured in accordance with Industry Standard AHRI 880-2011.
All sound power levels, dB re: 10-12 Watts.
Application ratings are outside the scope of the Certification Program.

Table 133. Cabinet lining appurtenance effects

	Discharge Sound Effect[a] (dB)						Radiated Sound Effect[a] (dB)					
Fan	2	3	4	5	6	7	2	3	4	5	6	7
Solid double-wall												
08SQ, 09SQ	0	0	0	0	0	0	-1	-2	2	11	17	19
10SQ	0	0	0	0	0	0	1	0	2	9	14	16
Closed-cell insulation												
08SQ, 09SQ	0	0	0	0	0	0	2	3	6	7	8	12
10SQ	0	0	0	0	0	0	2	3	4	7	6	11

(a) Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.

All data are measured in accordance with Industry Standard AHRI 880-2011.
All sound power levels, dB re: 10-12 Watts.
Application ratings are outside the scope of the Certification Program.

Table 134. Heating coil appurtenance effects

	Discharge Sound Effect[a] (dB)						Radiated Sound Effect[a] (dB)					
Fan	2	3	4	5	6	7	2	3	4	5	6	7
Hot Water Coil[b]												
08SQ, 09SQ	1	1	1	1	2	1	1	2	2	3	7	12
10SQ	1	2	2	1	2	1	1	1	1	2	4	8
Electric Heat[b]												
08SQ, 09SQ	-1	-2	-1	-1	-1	-1	-3	-1	1	1	7	7
10SQ	1	0	-1	-1	-1	0	2	4	3	4	6	9

(a) Add to sound power, a negative effect represents a sound reduction, a positive effect represents a sound increase.
(b) Radiated effect applies to “fan only” sound only. Do not apply to fan + valve sound.

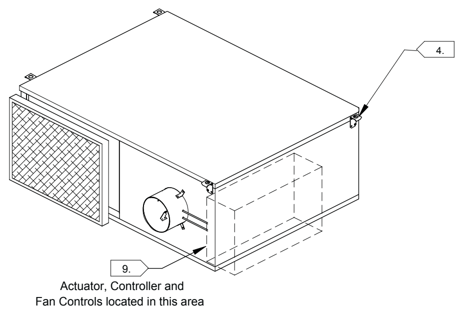
All data are measured in accordance with Industry Standard AHRI 880-2011.
All sound power levels, dB re: 10-12 Watts.
Application ratings are outside the scope of the Certification Program.

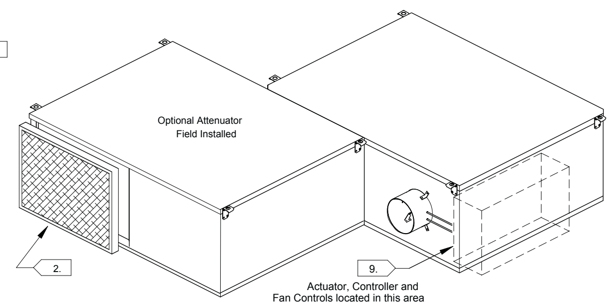
Dimensional Data

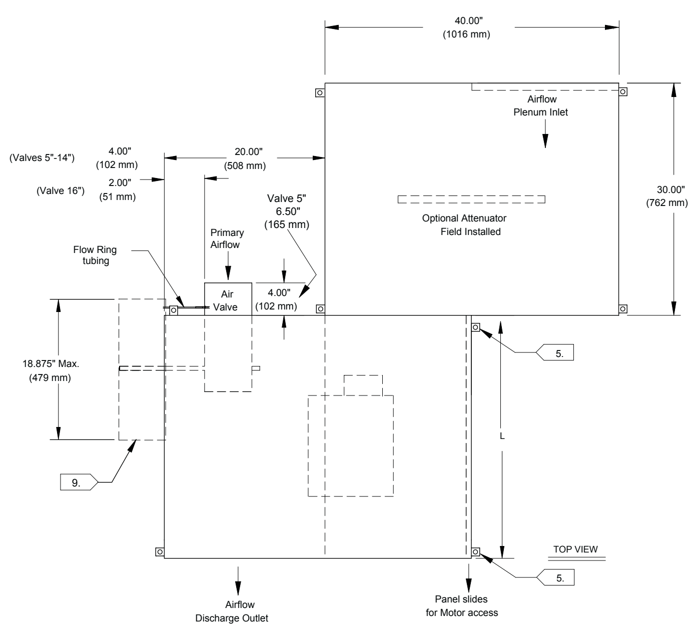
Parallel Fan-Powered Terminal Units

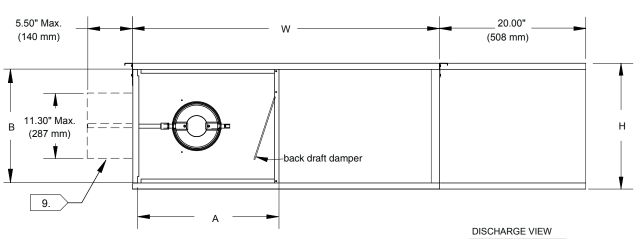
PARALLEL COOLING ONLY (VPCF)

FAN SIZE	INLET SIZE AVAILABILITY (NOMINAL Ø")	INLET SIZE AVAILABILITY (NOMINAL Ømm)	H	W	L	DISCHARGE DIMENSIONS		UNIT WT WT LBS (kg)
						A	B	
02SQ	5", 6", 8", 10"	127 mm, 152 mm, 203 mm, 254 mm	15.50" (394 mm)	40.00" (1016 mm)	30.00" (762 mm)	19.25" (489 mm)	14.00" (356 mm)	78 (35)
03SQ	6", 8", 10", 12"	152 mm, 203 mm, 254 mm, 305 mm	17.50" (445 mm)		32.50" (826 mm)		16.00" (406 mm)	96 (43)
04SQ	8", 10", 12", 14"	203 mm, 254 mm, 305 mm, 356 mm						97 (44)
05SQ	10", 12", 14"	254 mm, 305 mm, 356 mm	↓		↓		↓	111 (50)
06SQ	10", 12", 14", 16"	254 mm, 305 mm, 356 mm, 406 mm	21.50" (546 mm)		40.00" (1016 mm)		20.00" (508 mm)	117 (53)
07SQ	10", 12", 14", 16"	254 mm, 305 mm, 356 mm, 406 mm	↓	↓	↓	↓	↓	125 (57)









Fan Size	Filter Size	Attn. Weight Wt Lbs (kg)
02SQ	14" x 20" x 1" (356 mm x 508 mm x 25 mm)	46 (21)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)	48 (22)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)	54 (25)

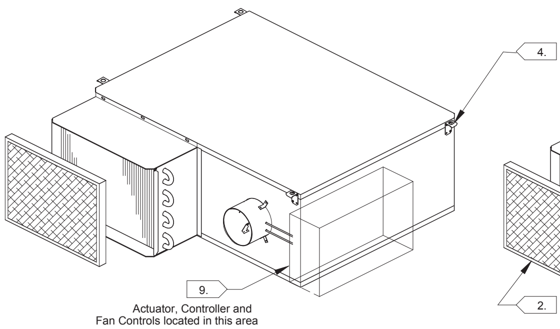
NOTES:

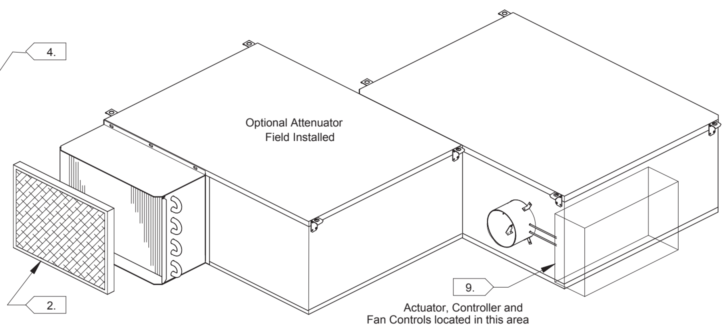
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator-factory assembled, field installed.
4. See Installation Documents for exact hanger bracket location.
5. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
6. When Attenuator option selected, water coil ships mounted to attenuator.
7. Air valve centered between top and bottom panel.
8. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
9. Maximum dimensions for controls area shown. Configurations and types of control boxes vary according to control type selected. See "Enclosure Details" for specific layout.
10. Graphic shown is for left-hand electrical. Right-hand electrical is a mirror image.

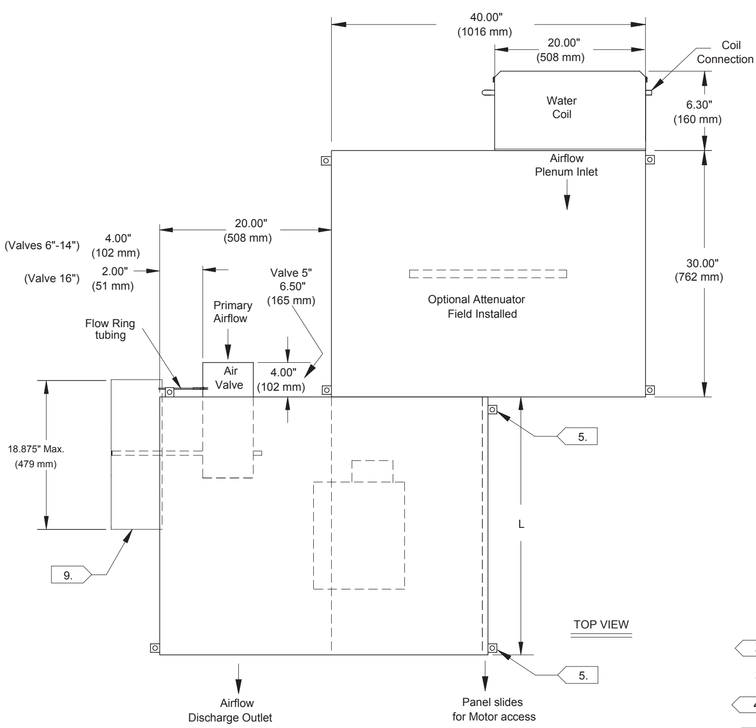
Dimensional Data

PARALLEL HOT WATER (VPWF)

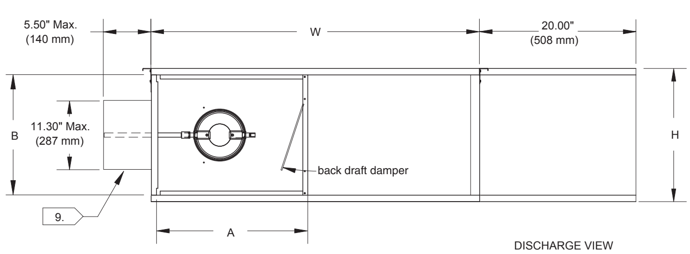
FAN SIZE	INLET SIZE AVAILABILITY (NOMINAL Ø")	INLET SIZE AVAILABILITY (NOMINAL Ømm)	H	W	L	DISCHARGE DIMENSIONS		UNIT WT WT LBS (kg)
						A	B	
02SQ	5", 6", 8", 10"	127 mm, 152 mm, 203 mm, 254 mm	15.50" (394 mm)	40.00" (1016 mm)	30.00" (762 mm)	19.25" (489 mm)	14.00" (356 mm)	78 (35)
03SQ	6", 8", 10", 12"	152 mm, 203 mm, 254 mm, 305 mm	17.50" (445 mm)		32.50" (826 mm)		16.00" (406 mm)	96 (43)
04SQ	8", 10", 12", 14"	203 mm, 254 mm, 305 mm, 356 mm						97 (44)
05SQ	10", 12", 14"	254 mm, 305 mm, 356 mm						111 (50)
06SQ	10", 12", 14", 16"	254 mm, 305 mm, 356 mm, 406 mm	21.50" (546 mm)		40.00" (1016 mm)		20.00" (508 mm)	117 (53)
07SQ	10", 12", 14", 16"	254 mm, 305 mm, 356 mm, 406 mm						125 (57)







Fan Size	Filter Size	Attn. Weight Wt Lbs (kg)
02SQ	14" x 20" x 1" (356 mm x 508 mm x 25 mm)	46 (21)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)	48 (22)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)	54 (25)

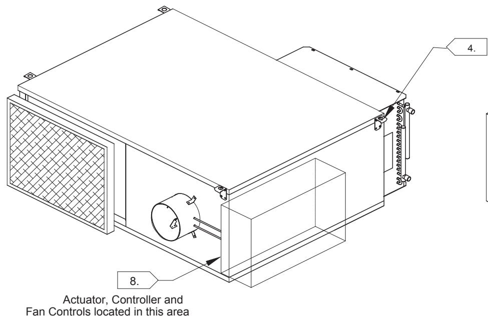


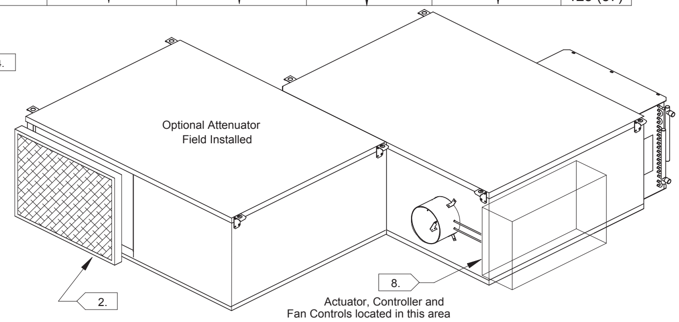
NOTES:

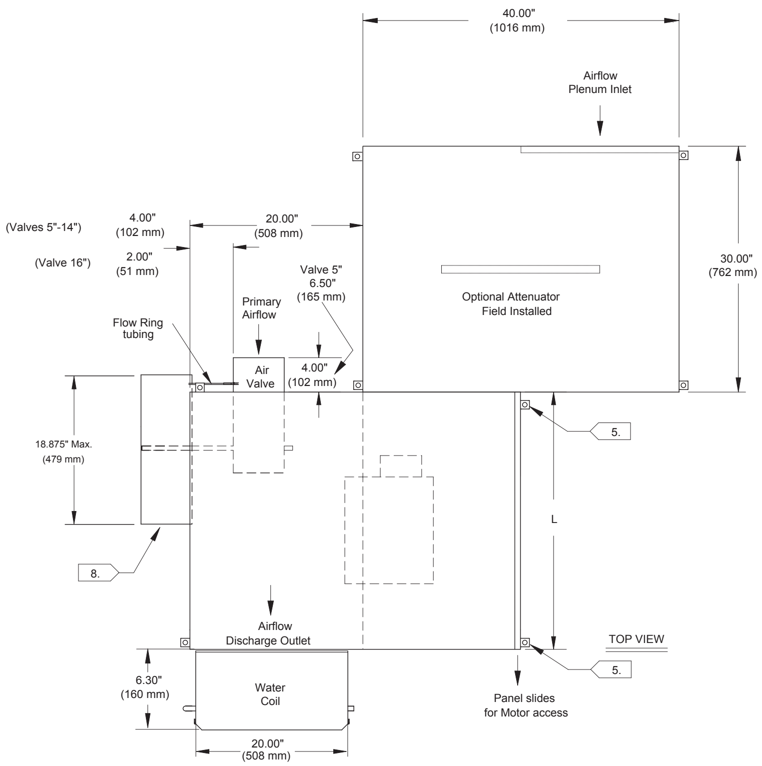
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator-factory assembled, field installed.
4. See Installation Documents for exact hanger bracket location.
5. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
6. When Attenuator option selected, water coil ships mounted to attenuator.
7. Air valve centered between top and bottom panel.
8. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
9. Maximum dimensions for controls area shown.

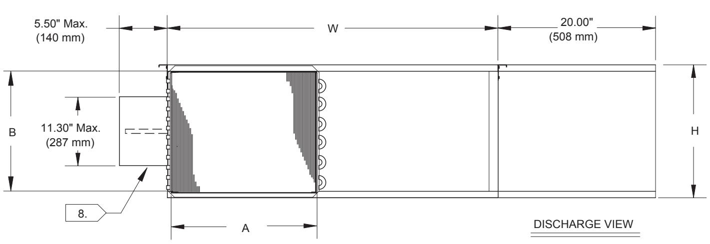
PARALLEL WITH HOT WATER ON DISCHARGE (VPWF)

FAN SIZE	INLET SIZE AVAILABILITY (NOMINAL Ø")	INLET SIZE AVAILABILITY (NOMINAL Ømm)	H	W	L	DISCHARGE DIMENSIONS		UNIT WT WT LBS (kg)
						A	B	
02SQ	5", 6", 8", 10"	127 mm, 152 mm, 203 mm, 254 mm	15.50" (394 mm)	40.00" (1016 mm)	30.00" (762 mm)	20.00" (508 mm)	14.00" (356 mm)	78 (35)
03SQ	6", 8", 10", 12"	152 mm, 203 mm, 254 mm, 305 mm	17.50" (445 mm)		32.50" (826 mm)		16.00" (406 mm)	96 (43)
04SQ	8", 10", 12", 14"	203 mm, 254 mm, 305 mm, 356 mm						97 (44)
05SQ	10", 12", 14"	254 mm, 305 mm, 356 mm	↓		↓		↓	111 (50)
06SQ	10", 12", 14", 16"	254 mm, 305 mm, 356 mm, 406 mm	21.50" (546 mm)		40.00" (1016 mm)		20.00" (508 mm)	117 (53)
07SQ	10", 12", 14", 16"	254 mm, 305 mm, 356 mm, 406 mm	↓	↓	↓	↓	↓	125 (57)









Fan Size	Filter Size	Attn. Weight Wt. Lbs. (kg)
02SQ	14" x 20" x 1" (356 mm x 508 mm x 25 mm)	46 (21)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)	48 (22)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)	54 (25)

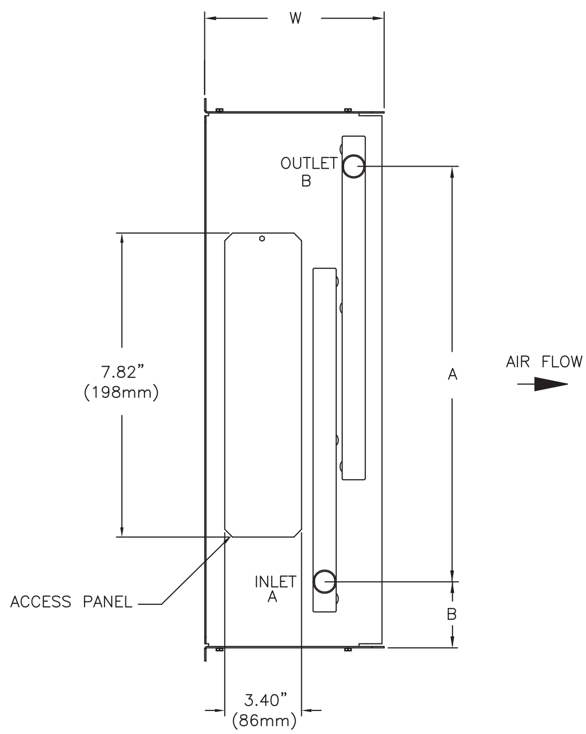
NOTES:

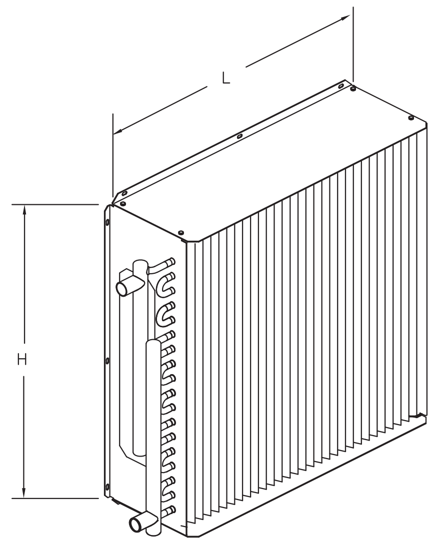
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator-factory assembled, field installed.
4. See Installation Documents for exact hanger bracket location.
5. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
6. Air valve centered between top and bottom panel.
7. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
8. Maximum dimensions for controls area shown.

Dimensional Data

PARALLEL DISCHARGE WATER COIL ASSY (1 Row)

FAN SIZE	COIL CONNECTION	A	B	L	H	W
02SQ	.875" (22 mm) O.D.	9.75" (248 mm)	2.50" (64 mm)	20.00" (508 mm)	14.00" (356 mm)	6.75" (171 mm)
03SQ	↓	13.75" (349 mm)	1.50" (38 mm)	↓	16.00" (406 mm)	↓
04SQ	↓	↓	↓	↓	↓	↓
05SQ	↓	↓	↓	↓	↓	↓
06SQ	↓	15.75" (400 mm)	2.50" (64 mm)	↓	20.00" (508 mm)	↓
07SQ	↓	↓	↓	↓	↓	↓





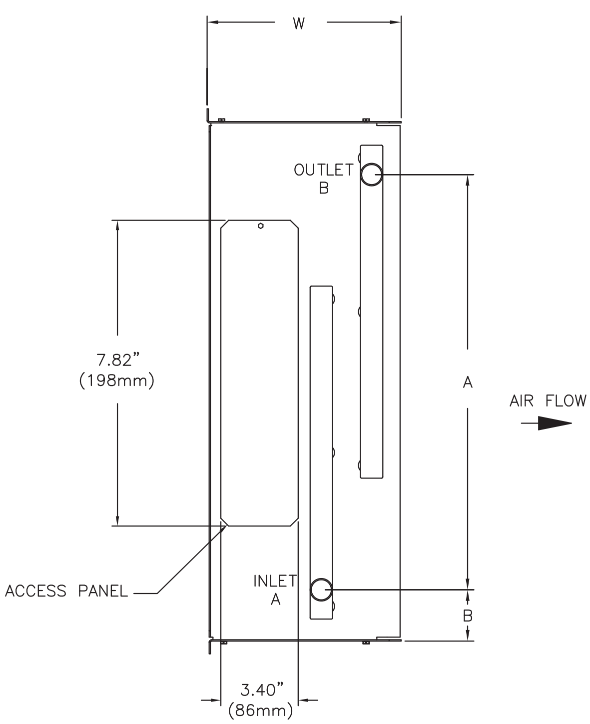
FAN SIZE	INTERNAL VOLUME GAL(L)	OPERATING WEIGHT LBS(KG)
02SQ	0.14 (.53)	12.3 (5.6)
03SQ 04SQ 05SQ	0.21 (.79)	21.9 (9.9)
06SQ 07SQ	0.22 (.83)	14.5 (6.6)

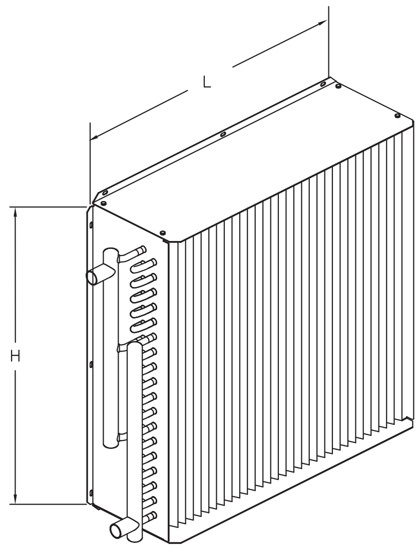
CUSTOMER NOTES:

1. Location of coil connections is determined by facing air stream. L.H. Coil connections shown, R.H. opposite.
2. Coil furnished with stub sweat connections.
3. Coil is rotated to achieve opposite hand connection. Water inlet is always on the bottom & outlet on the top.
4. Flanged water coil shown, Slip and Drive available.
5. Access Panel is standard.

PARALLEL DISCHARGE WATER COIL ASSY (2 Row)

FAN SIZE	COIL CONNECTION	A	B	L	H	W
02SQ	.875" (22 mm) O.D.	10.25" (260 mm)	2.00" (51 mm)	20.00" (508 mm)	14.00" (356 mm)	6.75" (171 mm)
03SQ	↓	14.25" (362 mm)	1.00" (25 mm)	↓	16.00" (406 mm)	↓
04SQ	↓	↓	↓	↓	↓	↓
05SQ	↓	↓	↓	↓	↓	↓
06SQ	↓	16.25" (413 mm)	2.00" (51 mm)	↓	20.00" (508 mm)	↓
07SQ	↓	↓	↓	↓	↓	↓





FAN SIZE	INTERNAL VOLUME GAL(L)	OPERATING WEIGHT LBS(KG)
02SQ	0.25 (.95)	16.8 (7.6)
03SQ 04SQ 05SQ	0.36 (1.36)	24.8 (11.2)
06SQ 07SQ	0.38 (1.44)	20.1 (9.1)

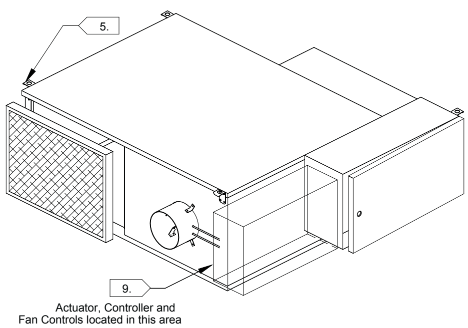
CUSTOMER NOTES:

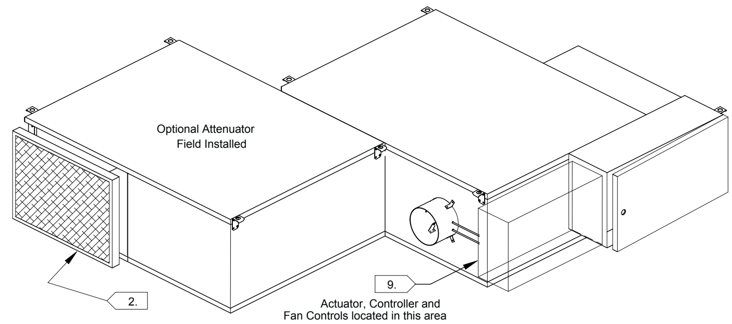
1. Location of coil connections is determined by facing air stream. L.H. Coil connections shown, R.H. opposite.
2. Coil furnished with stub sweat connections.
3. Use port at bottom for inlet and port at top for outlet. For 2-row coils, always plumb in counter flow orientation: Left hand unit's water inlet on bottom, and outlet on the top. Right hand unit's water inlet on top and outlet on bottom.
4. Flanged water coil shown, Slip and Drive available.
5. Access Panel is standard.

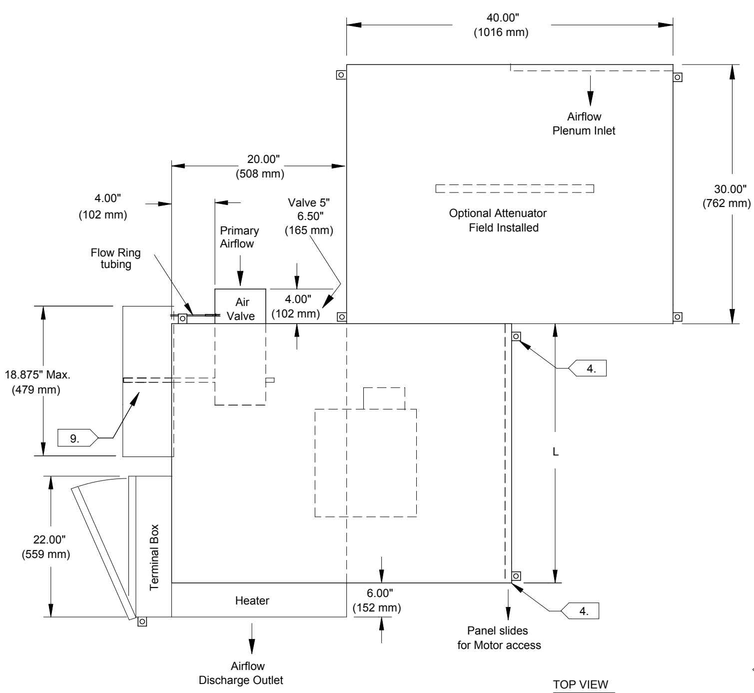
Dimensional Data

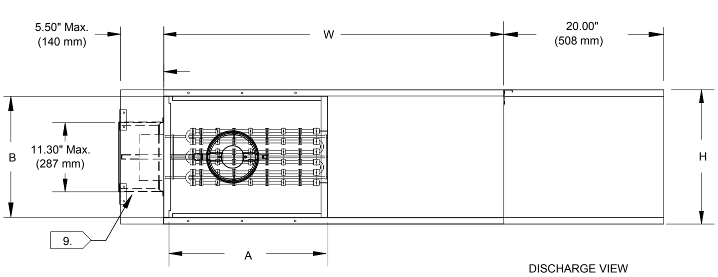
PARALLEL ELECTRIC HEAT (VPEF)

FAN SIZE	INLET SIZE AVAILABILITY (NOMINAL Ø")	INLET SIZE AVAILABILITY (NOMINAL Ømm)	H	W	L	DISCHARGE DIMENSIONS A	DISCHARGE DIMENSIONS B	UNIT WT WT LBS (kg)
02SQ	5", 6", 8", 10"	127 mm, 152 mm, 203 mm, 254 mm	15.50" (394 mm)	40.00" (1016 mm)	30.00" (762 mm)	20.00" (508 mm)	14.00" (356 mm)	120 (54)
03SQ	6", 8", 10", 12"	152 mm, 203 mm, 254 mm, 305 mm	17.50" (445 mm)		32.50" (826 mm)		16.00" (406 mm)	96 (43)
04SQ	8", 10", 12", 14"	203 mm, 254 mm, 305 mm, 356 mm						138 (63)
05SQ	10", 12", 14"	254 mm, 305 mm, 356 mm	↓		↓		↓	141 (64)
06SQ	10", 12", 14", 16"	254 mm, 305 mm, 356 mm, 406 mm	21.50" (546 mm)		40.00" (1016 mm)		20.00" (508 mm)	178 (80)
07SQ	10", 12", 14", 16"	254 mm, 305 mm, 356 mm, 406 mm	↓	↓	↓	↓	↓	186 (84)









Fan Size	Filter Size	Attn. Weight Wt. Lbs. (kg)
02SQ	14" x 20" x 1" (356 mm x 508 mm x 25 mm)	46 (21)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)	48 (22)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)	54 (25)

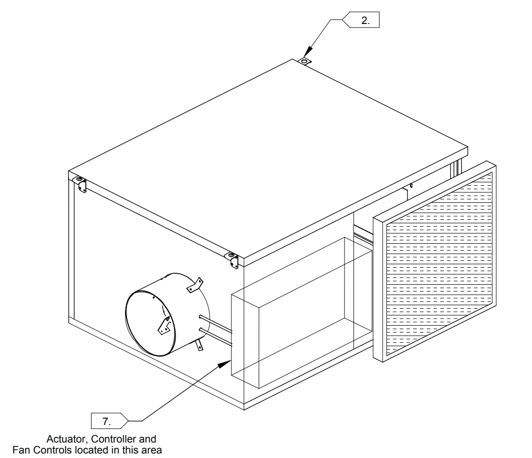
NOTES:

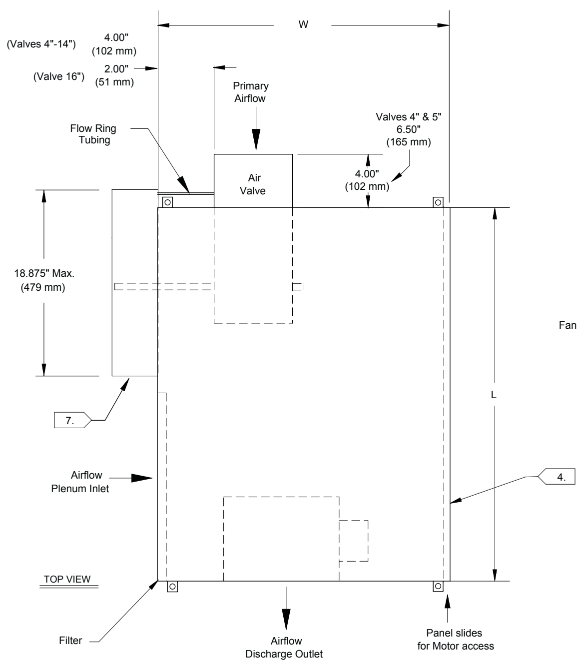
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuatory factory assembled, field installed.
4. For motor access, remove bottom screws on hanger brackets to slide panel as shown in drawing.
5. See Installation Documents for exact hanger bracket location.
6. Air valve centered between top and bottom panel.
7. Heating coil uninsulated. External insulation may be field supplied and installed as required.
8. All high & low voltage controls have same side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
9. Maximum dimensions for controls area shown.

Series Fan-Powered Terminal Units

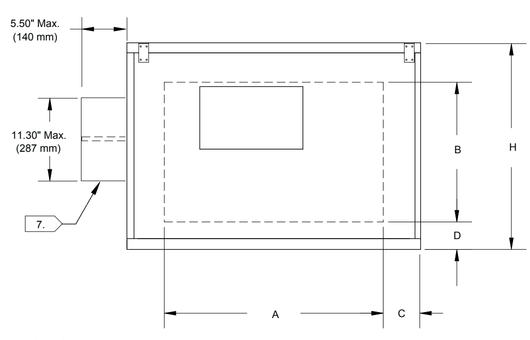
SERIES COOLING ONLY (VSCF) WITHOUT ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø INCHES	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	Unit Wt Lbs (kg)
						A	B			
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	14.00" (356 mm)	5.00" (127 mm)	.65" (17 mm)	78 (35)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	19.00" (483 mm)	16.00" (406 mm)	2.50" (64 mm)	.75" (19 mm)	85 (39)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356								86 (39)
05SQ	10, 12, 14	254, 305, 356		30.00" (762 mm)		24.00" (610 mm)		3.00" (76 mm)		100 (45)
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)				18.00" (457 mm)		1.66" (42 mm)	117 (53)
07SQ	10, 12, 14, 16	254, 305, 356, 406								125 (57)





Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)



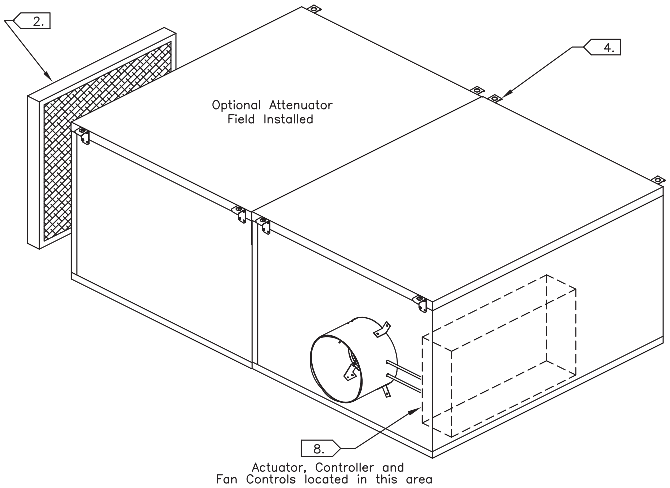
NOTES:

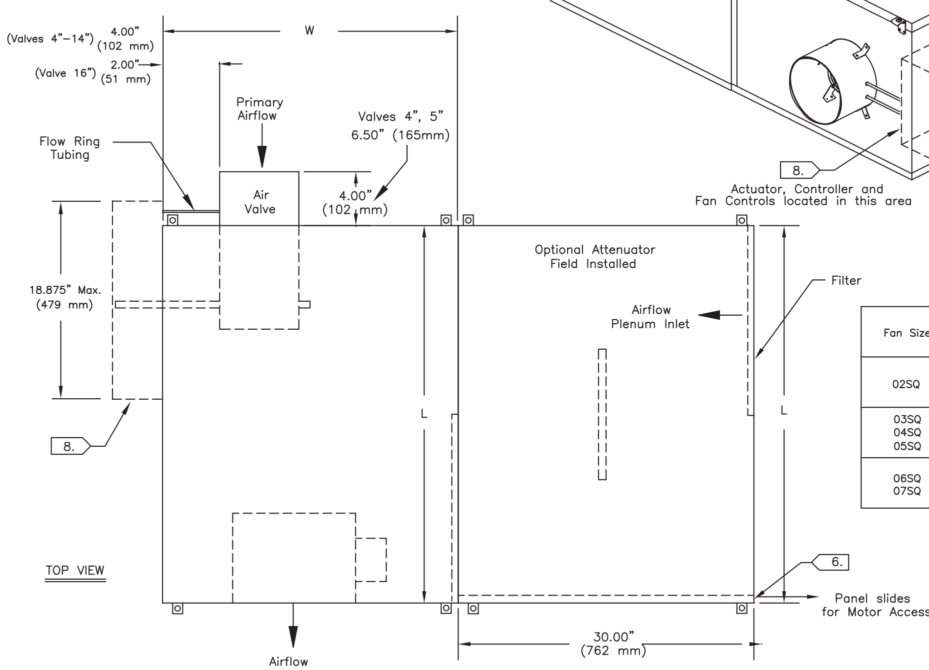
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. See Installation Documents for exact hanger bracket location.
3. Air valve centered between top and bottom panel.
4. For motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
5. Attenuator option not available with this unit layout.
6. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
7. Maximum dimensions for controls area shown.

Dimensional Data

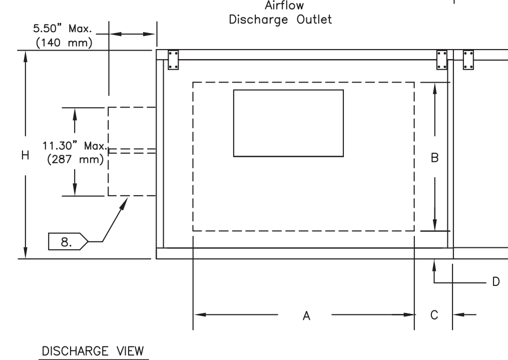
SERIES COOLING ONLY (VSCF) WITH OPTIONAL ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS A	DISCHARGE DIMENSIONS B	C	D	Unit Wt Lbs (kg)	Atten Wt Lbs (kg)
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	14.00" (360 mm)	5.00" (127 mm)	.65" (17 mm)	78 (35)	46 (21)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	19.00" (483 mm)	16.00" (406 mm)	2.50" (64 mm)	.75" (19 mm)	85 (39)	48 (22)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356	↓	↓	↓	↓	↓	↓	↓	86 (39)	↓
05SQ	10, 12, 14	254, 305, 356	↓	30.00" (762 mm)	↓	24.00" (610 mm)	↓	3.00" (76 mm)	↓	100 (45)	↓
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)	↓	↓	↓	18.00" (462 mm)	↓	1.66" (42 mm)	117 (53)	54 (25)
07SQ	10, 12, 14, 16	254, 305, 356, 406	↓	↓	↓	↓	↓	↓	↓	125 (57)	↓





Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)

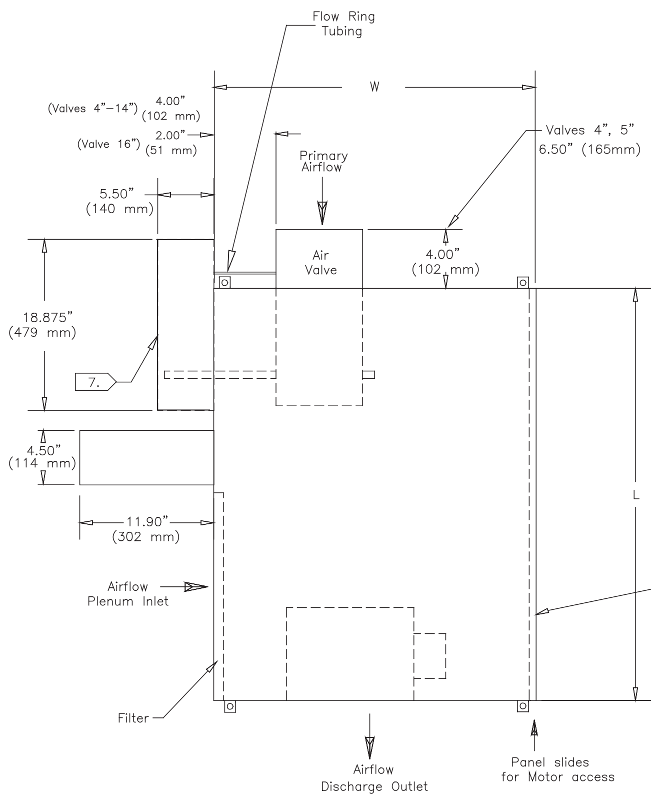


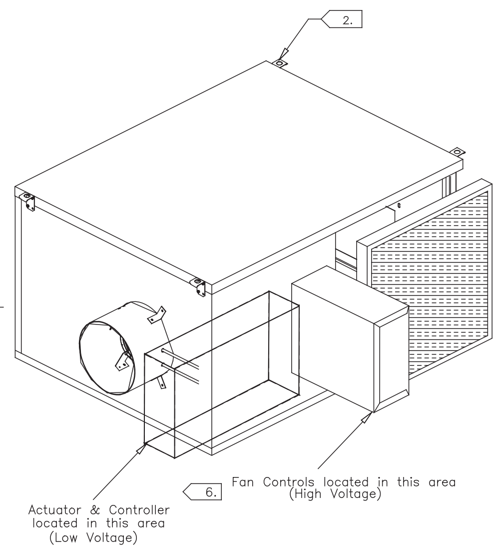
CUSTOMER NOTE:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator–factory assembled, field installed.
4. See Installation Documents for exact hanger bracket location.
5. Air valve centered between top and bottom panel.
6. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
7. All high & low voltage controls have same–side NEC jumpback clearance. (Left–hand shown, right–hand available.)
8. Maximum dimensions for controls area shown. Configurations and types of control boxes vary according to control type selected. See "Enclosure Details" for specific layout.

NARROW CORRIDOR DESIGN SERIES COOLING (VSCF) WITHOUT ATTENUATOR

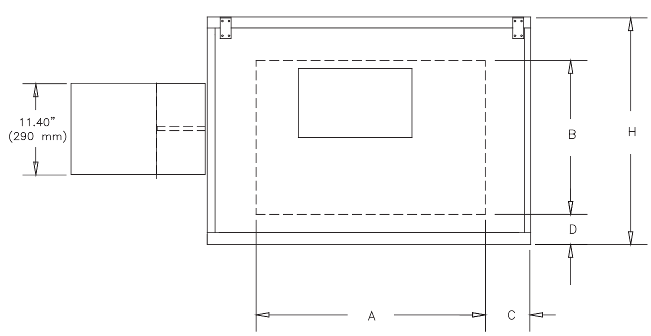
FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	Unit Wt Lbs (kg)
						A	B			
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	14.00" (356 mm)	5.00" (127 mm)	.65" (17 mm)	78 (35)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	19.00" (483 mm)	16.00" (406 mm)	2.50" (64 mm)	.75" (19 mm)	85 (39)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356								86 (39)
05SQ	10, 12, 14	254, 305, 356		30.00" (762 mm)		24.00" (610 mm)		3.00" (76 mm)		100 (45)
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)				18.00" (457 mm)		1.66" (42 mm)	117 (53)
07SQ	10, 12, 14, 16	254, 305, 356, 406								125 (57)





Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)

TOP VIEW



DISCHARGE VIEW

NOTES:

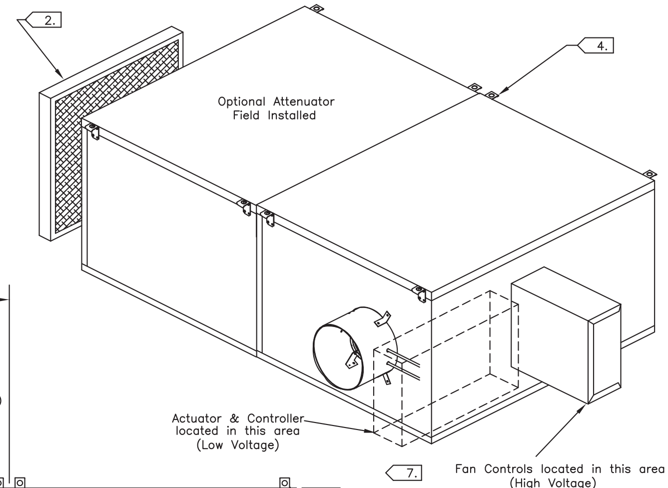
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. See installation Documents for exact hanger bracket location.
3. Air valve centered between top and bottom panel.
4. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
5. Attenuator option not available with this unit layout.
6. All high & low voltage controls have same-side NEC jumpback clearance. (unit shown w/left hand high & low voltage box connections [high voltage inlet facing]. Right hand connections available.)
7. Maximum dimensions for controls are shown.

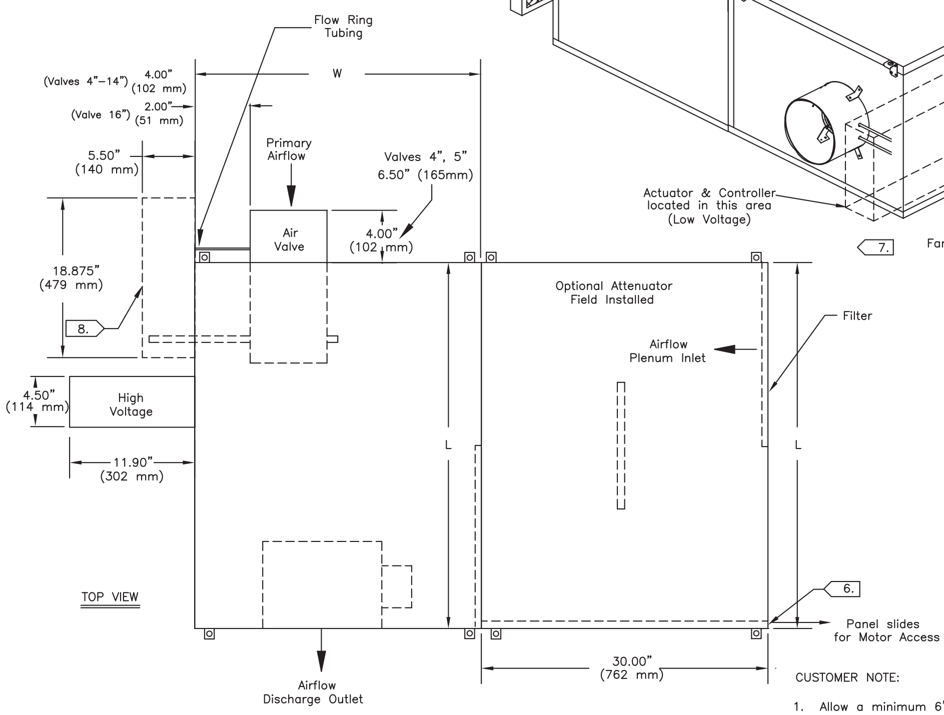
Dimensional Data

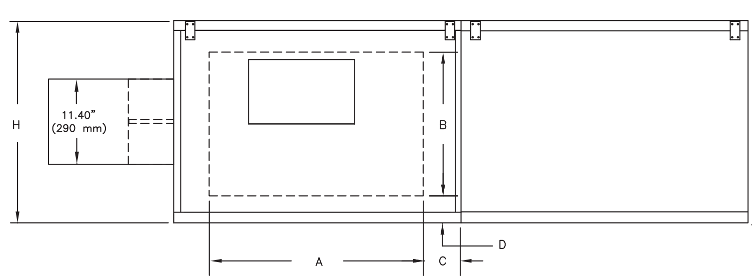
NARROW CORRIDOR DESIGN SERIES COOLING ONLY (VSCF) W/OPTIONAL ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS A	DISCHARGE DIMENSIONS B	C	D	Unit Wt Lbs (kg)	Atten Wt Lbs (kg)
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	14.00" (360 mm)	5.00" (127 mm)	.65" (17 mm)	78 (35)	46 (21)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	19.00" (483 mm)	16.00" (406 mm)	2.50" (64 mm)	.75" (19 mm)	85 (39)	48 (22)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356	↓	↓	↓	↓	↓	↓	↓	86 (39)	↓
05SQ	10, 12, 14	254, 305, 356	↓	30.00" (762 mm)	↓	24.00" (610 mm)	↓	3.00" (76 mm)	↓	100 (45)	↓
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)	↓	↓	↓	18.00" (462 mm)	↓	1.66" (42 mm)	117 (53)	54 (25)
07SQ	10, 12, 14, 16	254, 305, 356, 406	↓	↓	↓	↓	↓	↓	↓	125 (57)	↓

Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)





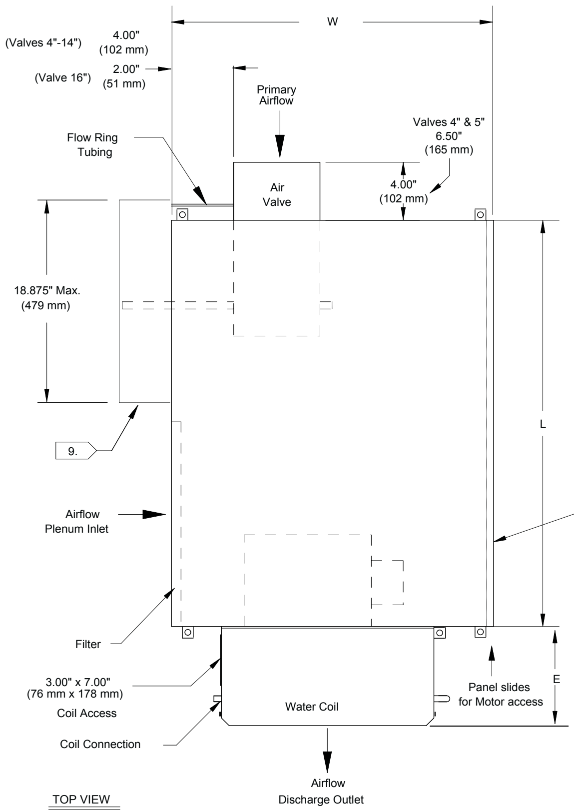


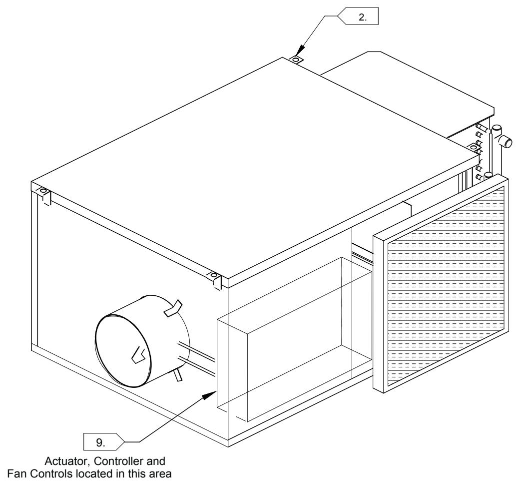
CUSTOMER NOTE:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator–factory assembled, field installed.
4. See Installation Documents for exact hanger bracket location.
5. Air valve centered between top and bottom panel.
6. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
7. All high & low voltage controls have same–side NEC jumpback clearance. (unit shown w/left hand high & low voltage box connections [high voltage inlet facing]. Right hand connections available.)
8. Maximum dimensions for controls area shown. Configurations and types of control boxes vary according to control type selected. See "Enclosure Details" for specific layout.

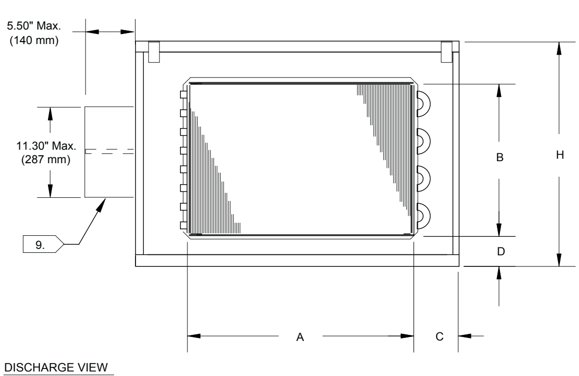
SERIES HOT WATER (VSWF) WITHOUT ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø INCHES	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS A	DISCHARGE DIMENSIONS B	C	D	E	Unit Wt Lbs (kg)
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	14.00" (356 mm)	5.00" (127 mm)	.65" (17 mm)	6.75" (171 mm)	78 (35)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	19.00" (483 mm)	16.00" (406 mm)	2.50" (64 mm)	.75" (19 mm)	10.75" (273 mm)	85 (39)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356	↓	↓	↓	↓	↓	↓	↓	↓	86 (39)
05SQ	10, 12, 14	254, 305, 356	↓	30.00" (762 mm)	↓	24.00" (610 mm)	↓	3.00" (76 mm)	↓	↓	100 (45)
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)	↓	↓	↓	18.00" (457 mm)	↓	1.66" (42 mm)	6.75" (171 mm)	117 (53)
07SQ	10, 12, 14, 16	254, 305, 356, 406	↓	↓	↓	↓	↓	↓	↓	↓	125 (57)





Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)



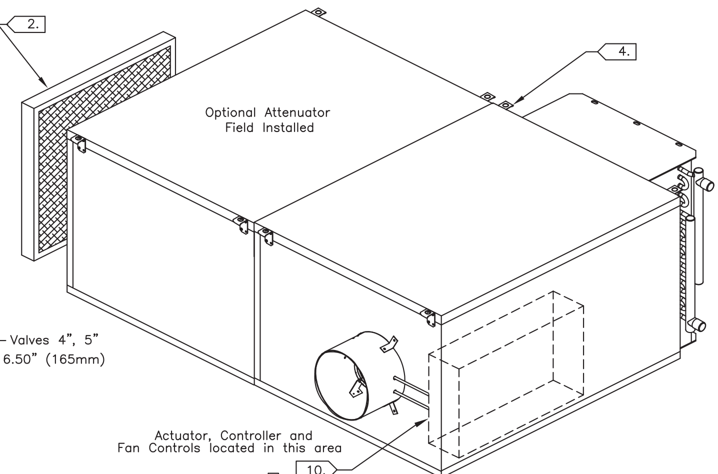
NOTES:

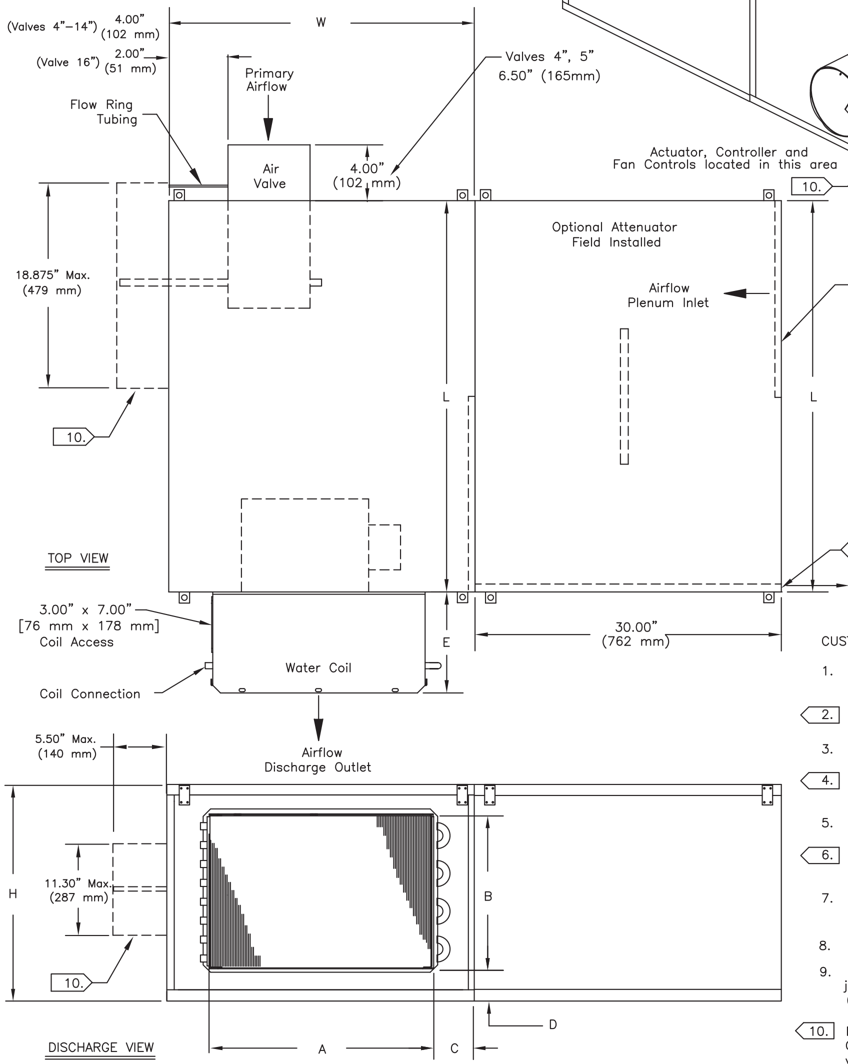
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. See Installation Documents for exact hanger bracket location.
3. Air valve centered between top and bottom panel.
4. For motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
5. Attenuator option not available with this unit layout.
6. Heating coil uninsulated. External insulation may be field-supplied and installed as required.
7. Rotate coil 180 for right-hand coil connection.
8. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
9. Maximum dimensions for controls area shown.

Dimensional Data

SERIES HOT WATER (VSWF) WITH OPTIONAL ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	E	Unit Wt Lbs (kg)	Atten Wt Lbs (kg)
						A	B					
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	14.00" (356 mm)	5.00" (127 mm)	.65" (17 mm)	6.75" (171 mm)	78 (35)	46 (21)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	19.00" (483 mm)	16.00" (406 mm)	2.50" (64 mm)	.75" (19 mm)	10.75" (273 mm)	85 (39)	48 (22)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356	↓	↓	↓	↓	↓	↓	↓	↓	86 (39)	↓
05SQ	10, 12, 14	254, 305, 356	↓	30.00" (762 mm)	↓	24.00" (610 mm)	↓	3.00" (76 mm)	↓	↓	100 (45)	↓
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)	↓	↓	↓	18.00" (457 mm)	↓	1.66" (42 mm)	6.75" (171 mm)	117 (53)	54 (25)
07SQ	10, 12, 14, 16	254, 305, 356, 406	↓	↓	↓	↓	↓	↓	↓	↓	125 (57)	↓





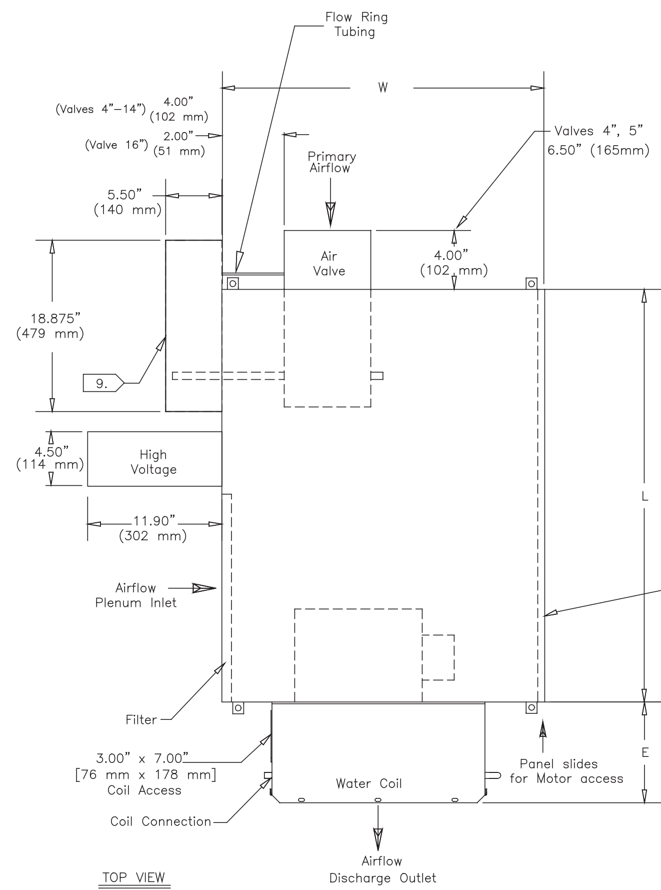
Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)

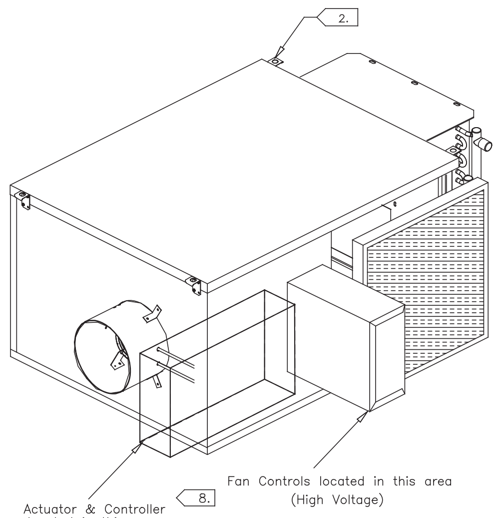
CUSTOMER NOTE:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator–factory assembled, field installed.
4. See Installation Documents for exact hanger bracket location.
5. Air valve centered between top and bottom panel.
6. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
7. Heating coil un–insulated. External insulation may be field supplied and installed as required.
8. Rotate coil 180° for right hand coil connection.
9. All high & low voltage controls have same–side NEC jumpback clearance. (Left–hand shown, right–hand available.)
10. Maximum dimensions for controls area shown. Configurations and types of control boxes vary according to control type selected.

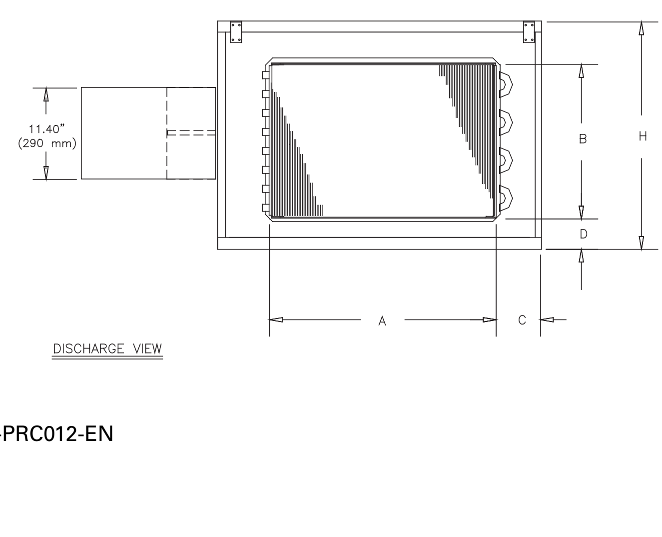
NARROW CORRIDOR DESIGN SERIES HOT WATER (VSWF) WITHOUT ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS A	DISCHARGE DIMENSIONS B	C	D	E	Unit Wt Lbs (kg)
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	14.00" (356 mm)	5.00" (127 mm)	.65" (17 mm)	6.75" (171 mm)	78 (35)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	19.00" (483 mm)	16.00" (406 mm)	2.50" (64 mm)	.75" (19 mm)	10.75" (273 mm)	85 (39)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356									86 (39)
05SQ	10, 12, 14	254, 305, 356		30.00" (762 mm)		24.00" (610 mm)		3.00" (76 mm)			100 (45)
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)				18.00" (457 mm)		1.66" (42 mm)	6.75" (171 mm)	117 (53)
07SQ	10, 12, 14, 16	254, 305, 356, 406									125 (57)





Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)



NOTES:

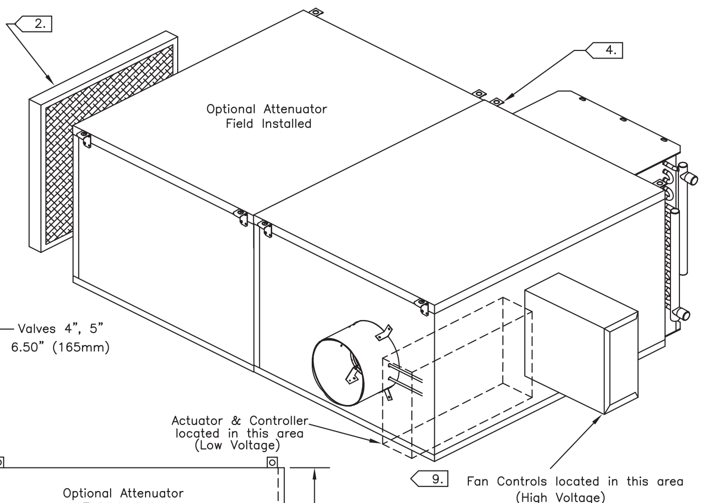
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. See Installation Documents for exact hanger bracket location.
3. Air valve centered between top and bottom panel.
4. For motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
5. Attenuator option not available with this unit layout.
6. Heating coil un-insulated. External insulation may be field supplied and installed as required.
7. Rotate coil 180° for right hand coil connection.
8. All high & low voltage controls have same-side NEC jumpback clearance. (unit shown w/left hand high & low voltage box connections [high voltage inlet facing]. Right hand connections available.)
9. Maximum dimensions for controls area shown.

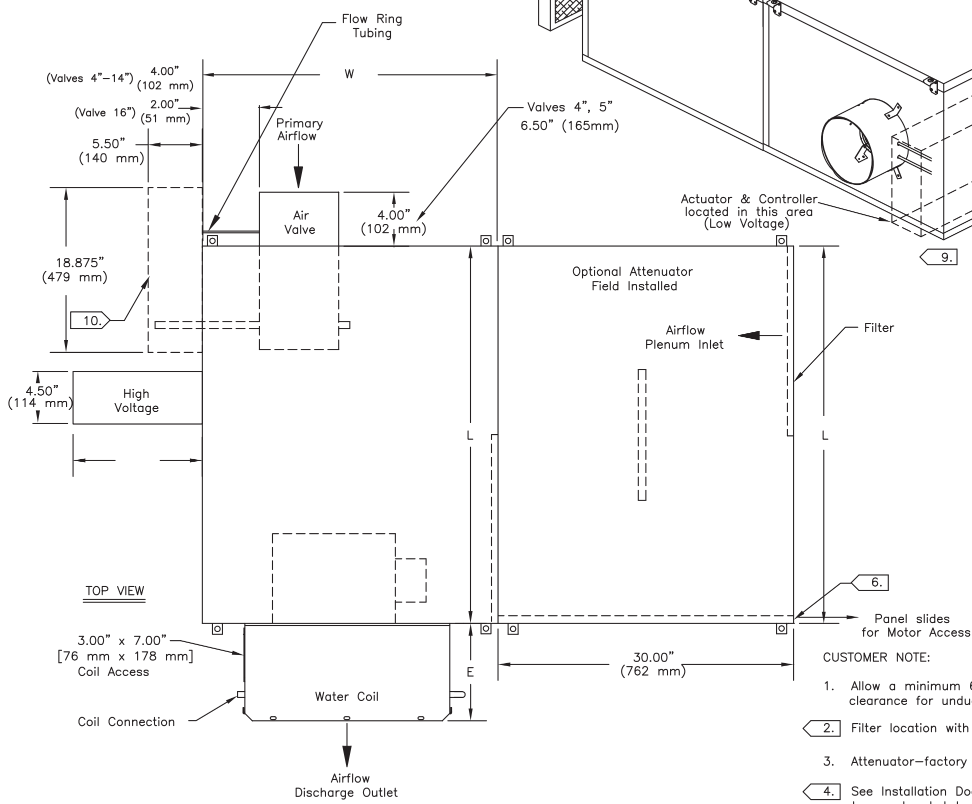
Dimensional Data

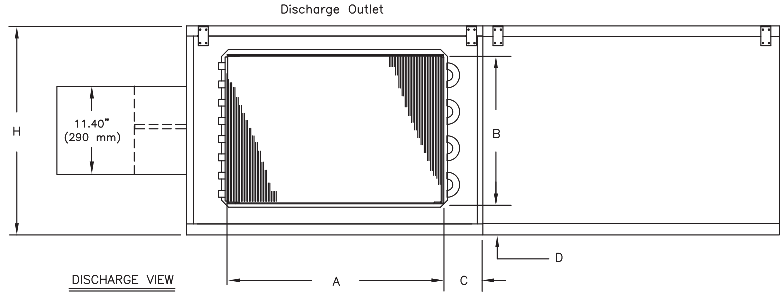
NARROW CORRIDOR DESIGN SERIES HOT WATER (VSWF) W/OPTIONAL ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	E	Unit Wt Lbs (kg)	Atten Wt Lbs (kg)
						A	B					
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	14.00" (356 mm)	5.00" (127 mm)	.65" (17 mm)	6.75" (171 mm)	78 (35)	46 (21)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	19.00" (483 mm)	16.00" (406 mm)	2.50" (64 mm)	.75" (19 mm)	10.75" (273 mm)	85 (39)	48 (22)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356									86 (39)	
05SQ	10, 12, 14	254, 305, 356		30.00" (762 mm)		24.00" (610 mm)		3.00" (76 mm)			100 (45)	
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)				18.00" (457 mm)		1.66" (42 mm)	6.75" (171 mm)	117 (53)	54 (25)
07SQ	10, 12, 14, 16	254, 305, 356, 406									125 (57)	

Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)





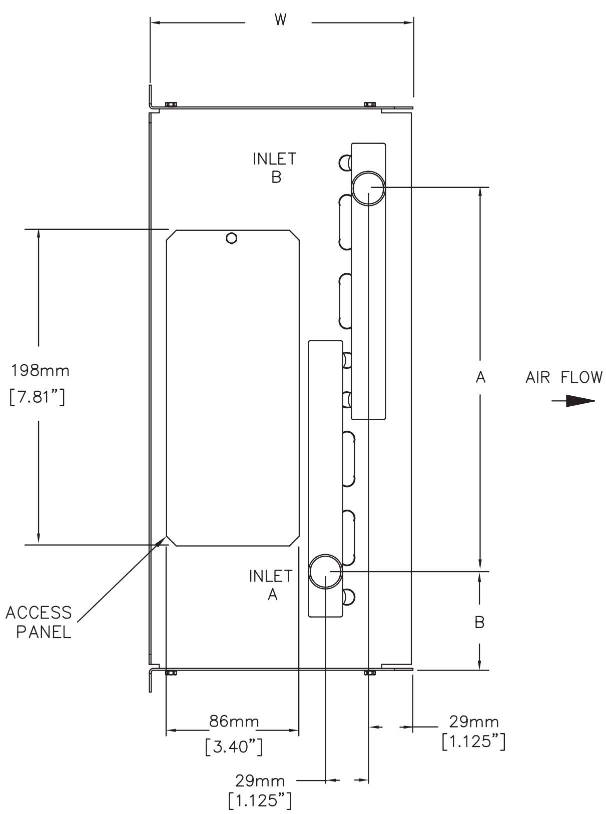


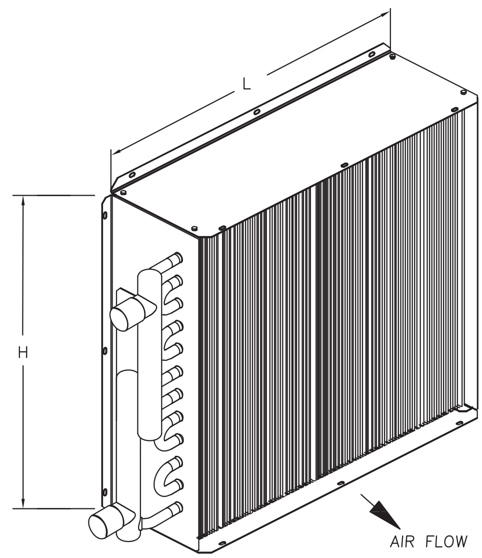
CUSTOMER NOTE:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator–factory assembled, field installed.
4. See Installation Documents for exact hanger bracket location.
5. Air valve centered between top and bottom panel.
6. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
7. Heating coil un–insulated. External insulation may be field supplied and installed as required.
8. Rotate coil 180° for right hand coil connection.
9. All high & low voltage controls have same–side NEC jumpback clearance.(unit shown w/left hand high & low voltage box connections [high voltage inlet facing]. Right hand connections available.)
10. Maximum dimensions for controls area shown. Configurations and types of control boxes vary according to control type selected. See "Enclosure Details" for specific layout.

COIL INFORMATION FOR SERIES 1-ROW COIL

COIL INFORMATION FOR SERIES COIL ASSY						
SIZE FAN	COIL CONNECTION 1 ROW	A	B	L	H	W
02SQ	22mm O.D.[.875"]	248mm [9.75"]	51mm [2.00"]	305mm [12.00"]	356mm [14.00"]	171mm [6.75"]
03SQ		349mm [13.75"]		483mm [19.00"]	406mm [16.00"]	273mm [10.75"]
04SQ				↓		
05SQ		↓	↓	610mm [24.00"]	↓	↓
06SQ		400mm [15.75"]	25mm [1.00"]		457mm [18.00"]	171mm [6.75"]
07SQ	↓	↓	↓	↓	↓	↓





Fan Size	INTERNAL VOLUME GAL(in.^{3})	OPERATING WEIGHT LBS(KG)
02SQ	0.10 (23.88)	7.8 (3.5)
03SQ 04SQ	0.21 (50.4)	22.9 (10.4)
05SQ	0.26 (60.3)	27.2 (12.3)
06SQ 07SQ	0.26 (60.4)	16.8 (7.6)

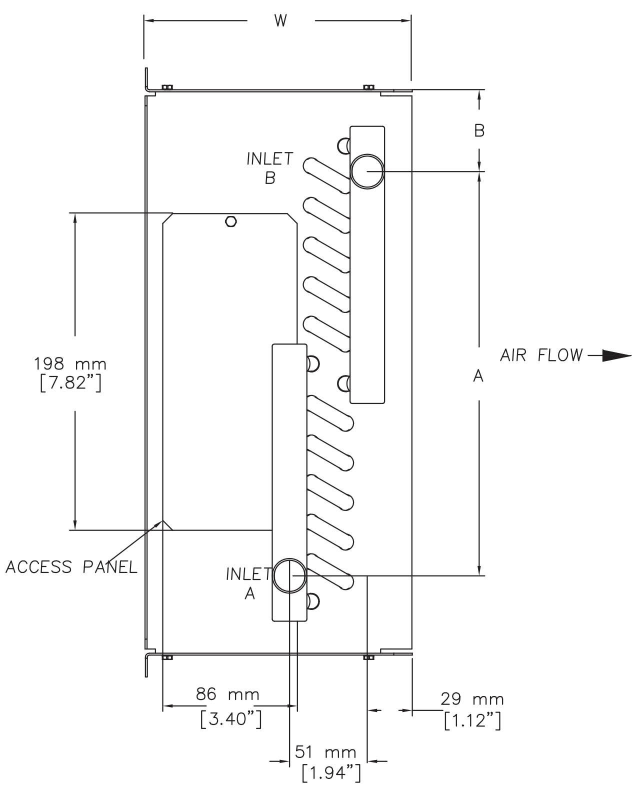
CUSTOMER NOTES:

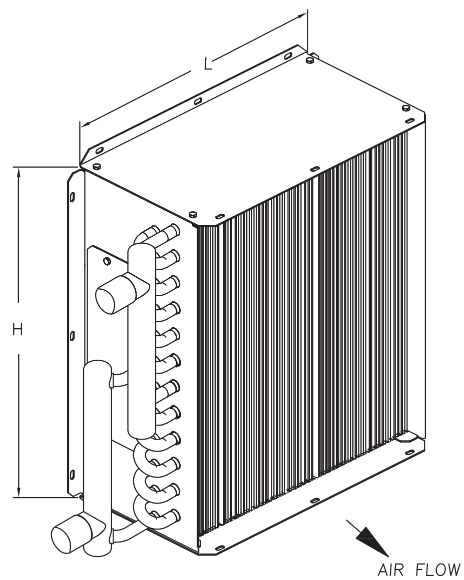
1. Location of coil connections is determined by facing air stream. L.H. coil connections shown, R.H. opposite.
2. Coil furnished with stub sweat connections.
3. Coil is rotated to achieve opposite hand connection. Water inlet is always on the bottom & outlet on the top.
4. Access Panel is standard.
5. Flanged Coil shown, Slip and Drive available.

Dimensional Data

COIL INFORMATION FOR SERIES 2-ROW COILS

COIL INFORMATION FOR SERIES COIL ASSY						
SIZE FAN	COIL CONNECTION 2 ROW	A	B	L	H	W
02SQ	22mm O.D.[.875"]	260mm [10.25"]	51mm [2.00"]	305mm [12.00"]	356mm [14.00"]	171mm [6.75"]
03SQ	↓	349mm [13.75"]	↓	482mm [19.00"]	406mm [16.00"]	273mm [10.75"]
04SQ	↓	↓	↓	↓	↓	↓
05SQ	↓	↓	↓	610mm [24.00"]	↓	↓
06SQ	↓	413mm [16.25"]	25mm [1.00"]	↓	457mm [18.00"]	171mm [6.75"]
07SQ	↓	↓	↓	↓	↓	↓





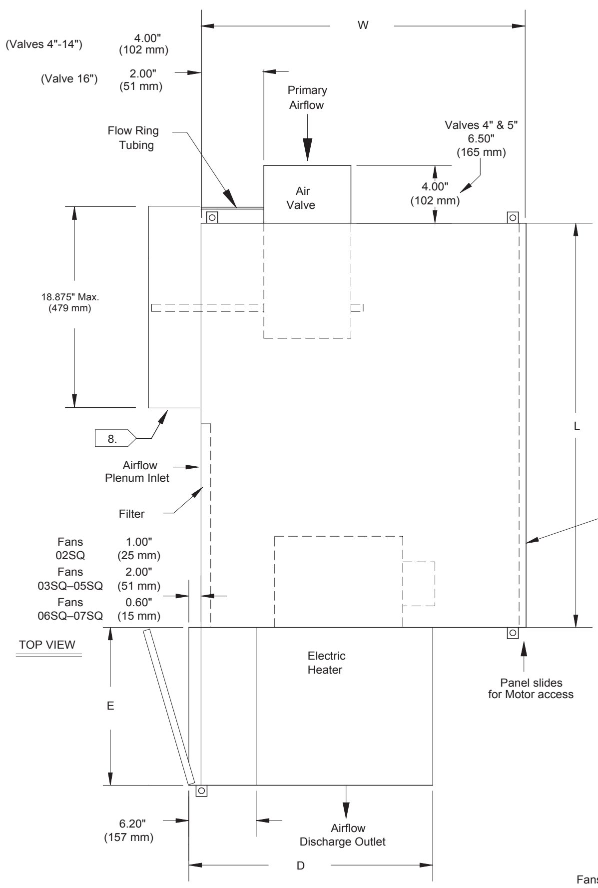
Fan Size	INTERNAL VOLUME GAL(in.^{3})	OPERATING WEIGHT LBS(KG)
02SQ	0.17 (40.61)	7.8 (3.5)
03SQ 04SQ	0.37 (87.5)	22.9 (10.4)
05SQ	0.46 (107.3)	31.2 (14.2)
06SQ 07SQ	0.46 (107.8)	23.7 (10.8)

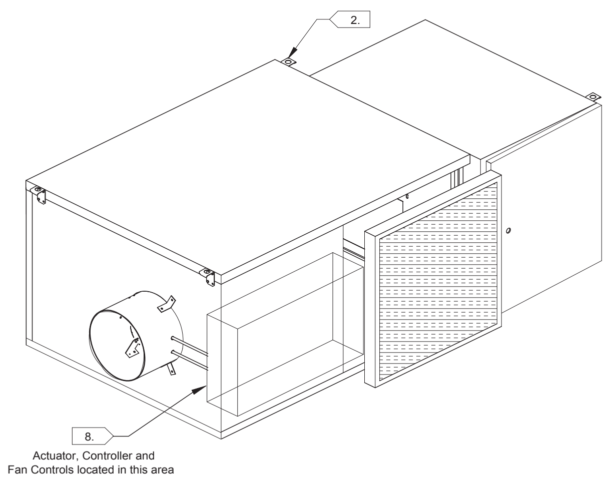
CUSTOMER NOTES:

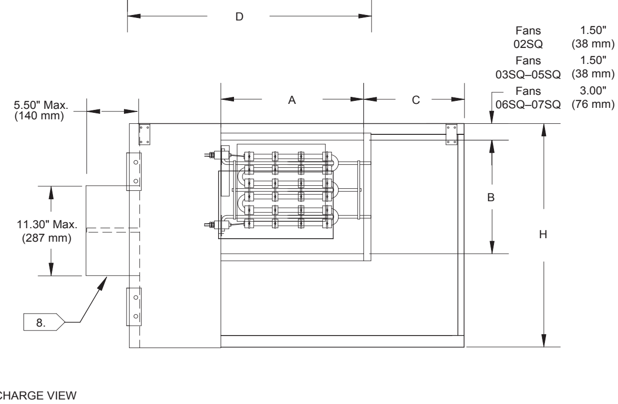
1. Location of coil connections is determined by facing air stream. L.H. Coil connections shown, R.H. opposite.
2. Coil furnished with stub sweat connections.
3. Use port at bottom for inlet and port at top for outlet. For 2—row coils, always plumb in counter flow orientation: Left hand unit's water inlet on bottom, and outlet on the top. Right hand unit's water inlet on top and outlet on bottom.
4. Coil height and width is dependent upon unit height and width.
5. Access Panel is standard.
6. Flanged coil shown. Slip & Drive available.

SERIES ELECTRIC (VSEF) WITHOUT ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø INCHES	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS A	DISCHARGE DIMENSIONS B	C	D	E	Unit Wt Lbs (kg)
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	10.00" (254 mm)	5.00" (127 mm)	18.00" (457 mm)	18.50" (470 mm)	78 (35)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)		12.00" (305 mm)	4.00" (102 mm)			85 (39)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356				16.00" (406 mm)		4.00" (102 mm)	22.00" (559 mm)		86 (39)
05SQ	10, 12, 14	254, 305, 356		30.00" (762 mm)				10.00" (254 mm)			100 (45)
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)			19.00" (483 mm)	14.00" (356 mm)	5.50" (140 mm)	25.00" (635 mm)	17.00" (432 mm)	117 (53)
07SQ	10, 12, 14, 16	254, 305, 356, 406									125 (57)







Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)

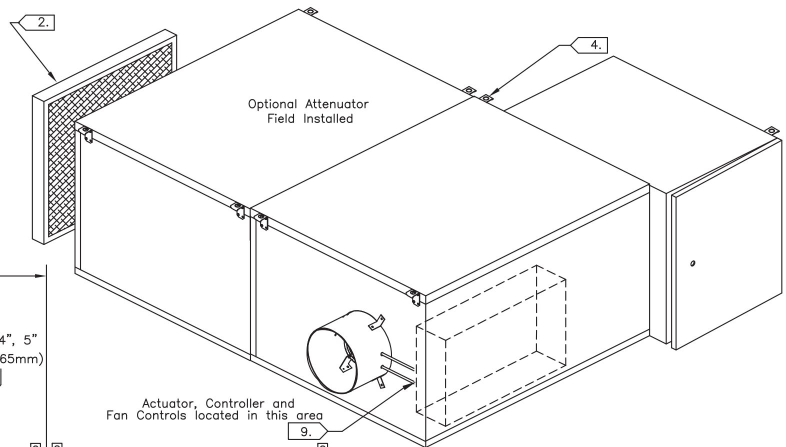
NOTES:

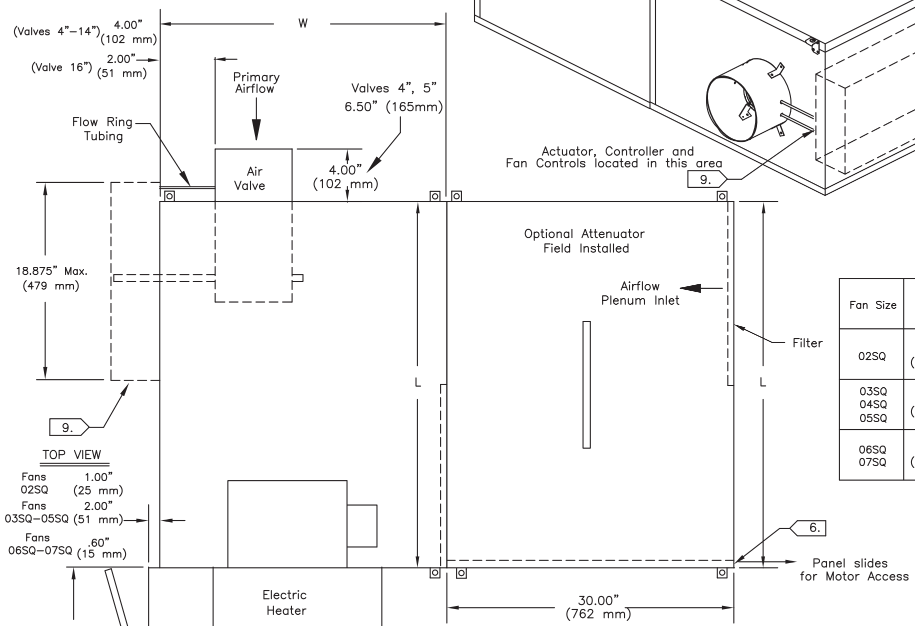
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. See Installation Documents for exact hanger bracket location.
3. Air valve centered between top and bottom panel.
4. For motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
5. Attenuator option not available with this unit layout.
6. Heating coil uninsulated. External insulation may be field-supplied and installed as required.
7. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
8. Maximum dimensions for controls area shown.

Dimensional Data

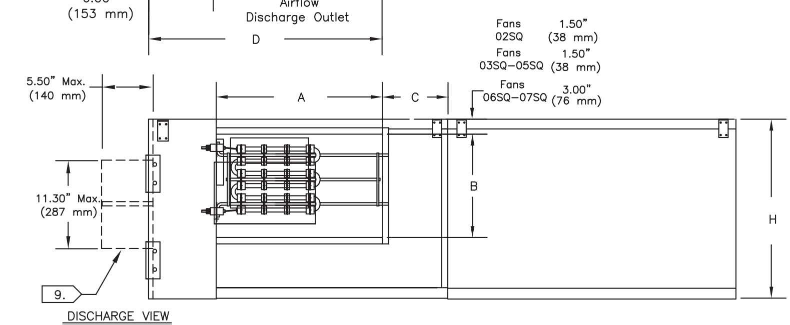
SERIES ELECTRIC (VSEF) WITH OPTIONAL ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	E	Unit Wt Lbs (kg)
						A	B				
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	10.00" (254 mm)	5.00" (127 mm)	18.00" (457 mm)	18.50" (470 mm)	78 (35)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	↓	12.00" (305 mm)	4.00" (102 mm)	↓	↓	85 (39)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356	↓	↓	↓	16.00" (406 mm)	↓	↓	22.00" (559 mm)	↓	86 (39)
05SQ	10, 12, 14	254, 305, 356	↓	30.00" (762 mm)	↓	↓	↓	10.00" (254 mm)	↓	↓	100 (45)
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)	↓	↓	19.00" (483 mm)	14.00" (356 mm)	5.50" (140 mm)	25.00" (635 mm)	17.00" (432 mm)	117 (53)
07SQ	10, 12, 14, 16	254, 305, 356, 406	↓	↓	↓	↓	↓	↓	↓	↓	125 (57)





Fan Size	Filter Size	Atten Wt Lbs (kg)
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)	46 (21)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)	48 (22)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)	54 (25)

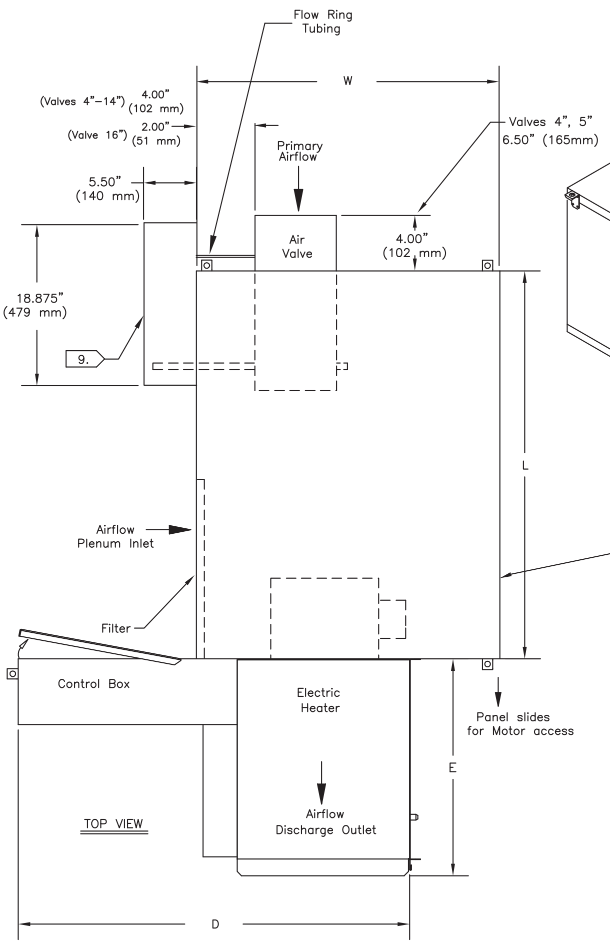


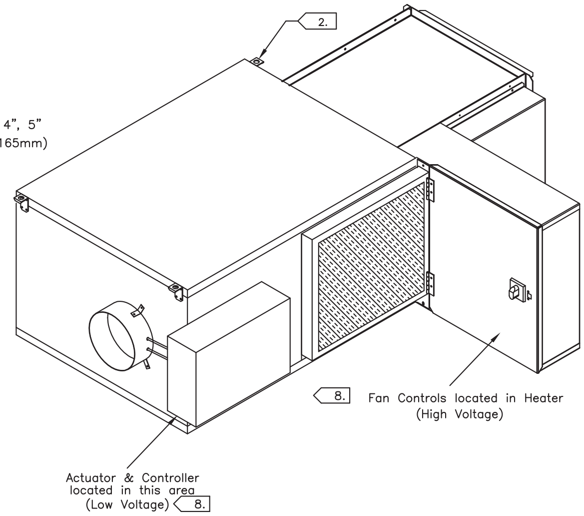
CUSTOMER NOTE:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator–factory assembled, field installed.
4. See Installation Documents for exact hanger bracket location.
5. Air valve centered between top and bottom panel.
6. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
7. Heating coil un-insulated. External insulation may be field supplied and installed as required.
8. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand available.)
9. Maximum dimensions for controls area shown. Configurations and types of control boxes vary according to control type selected. See "Enclosure Details" for specific layout.

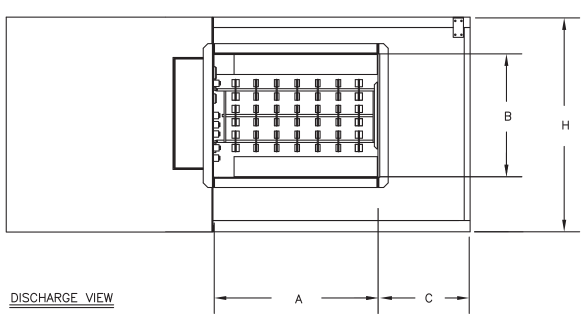
NARROW CORRIDOR SERIES ELECTRIC (VSEF) WITHOUT ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS A	DISCHARGE DIMENSIONS B	C	D	E	Unit Wt Lbs (kg)
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	10.00" (254 mm)	5.00" (127 mm)	33.00" (838 mm)	18.50" (470 mm)	122 (55)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)	↓	12.00" (305 mm)	4.00" (102 mm)	32.00" (813 mm)	↓	135 (61)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356	↓	↓	↓	16.00" (406 mm)	↓	↓	36.00" (914 mm)	↓	146 (66)
05SQ	10, 12, 14	254, 305, 356	↓	30.00" (762 mm)	↓	↓	↓	10.00" (254 mm)	↓	↓	149 (67)
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)	↓	↓	19.00" (483 mm)	14.00" (356 mm)	5.50" (140 mm)	37.00" (940 mm)	17.00" (432 mm)	167 (75)
07SQ	10, 12, 14, 16	254, 305, 356, 406	↓	↓	↓	↓	↓	↓	↓	↓	180 (81)





Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)



CUSTOMER NOTE:

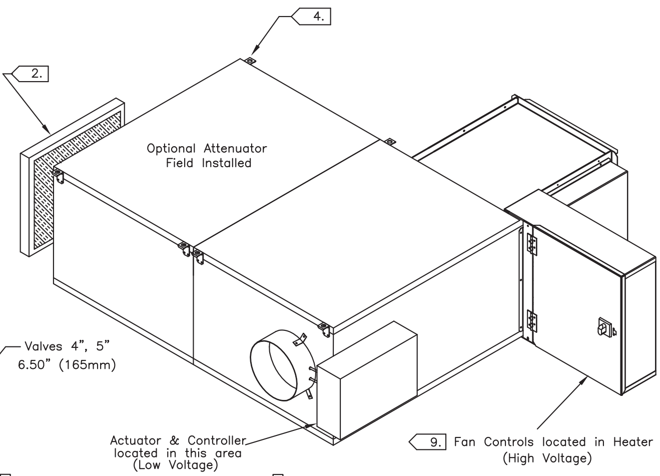
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. See Installation Documents for exact hanger bracket location.
3. Air valve centered between top and bottom panel.
4. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
5. Attenuator option not available with this unit layout.
6. Heating coil un–insulated. External insulation may be field supplied and installed as required.
7. Rotate coil 180° for right hand coil connection.
8. All high & low voltage controls have same–side NEC jumpback clearance. (unit shown w/left hand high & low voltage box connections [high voltage inlet facing]. Right hand connections available.)
9. Maximum dimensions for controls area shown. Configurations and types of control boxes vary according to control type selected.

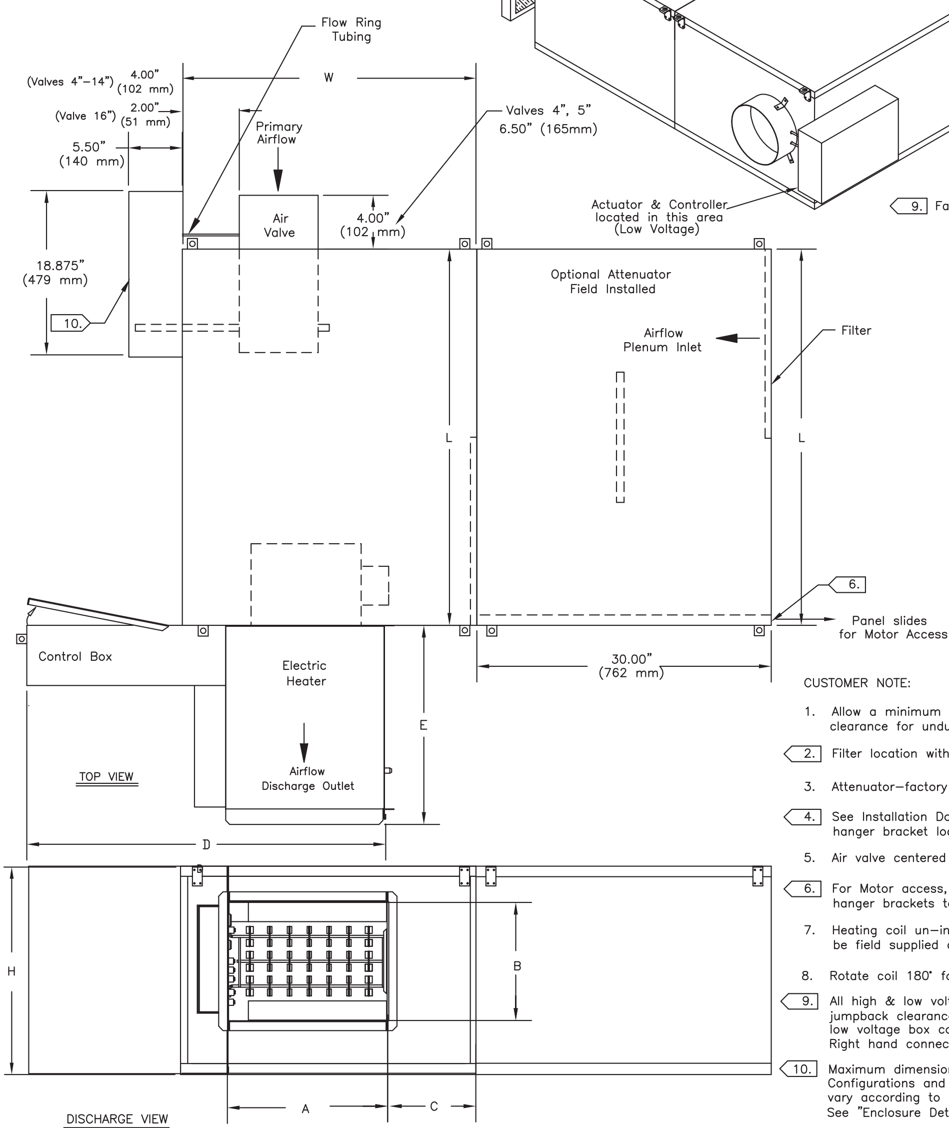
Dimensional Data

NARROW CORRIDOR SERIES ELECTRIC (VSEF) W/OPTIONAL ATTENUATOR

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	E	Unit Wt Lbs (kg)	Atten Wt Lbs (kg)
						A	B					
02SQ	4, 5, 6, 8, 10	104, 127, 152, 203, 254	15.50" (394 mm)	22.00" (559 mm)	34.00" (864 mm)	12.00" (305 mm)	10.00" (254 mm)	5.00" (127 mm)	33.00" (838 mm)	18.50" (470 mm)	122 (55)	46 (21)
03SQ	6, 8, 10, 12	152, 203, 254, 305	17.50" (445 mm)	24.00" (610 mm)	40.00" (1016 mm)		12.00" (305 mm)	4.00" (102 mm)	32.00" (813 mm)		135 (61)	48 (22)
04SQ	6, 8, 10, 12, 14	152, 203, 254, 305, 356				16.00" (406 mm)			36.00" (914 mm)		146 (66)	
05SQ	10, 12, 14	254, 305, 356		30.00" (762 mm)				10.00" (254 mm)			149 (67)	
06SQ	10, 12, 14, 16	254, 305, 356, 406	21.50" (546 mm)			19.00" (483 mm)	14.00" (356 mm)	5.50" (140 mm)	37.00" (940 mm)	17.00" (432 mm)	167 (75)	54 (25)
07SQ	10, 12, 14, 16	254, 305, 356, 406									180 (81)	

Fan Size	Filter Size
02SQ	14" x 14" x 1" (356 mm x 356 mm x 25 mm)
03SQ 04SQ 05SQ	16" x 20" x 1" (406 mm x 508 mm x 25 mm)
06SQ 07SQ	20" x 20" x 1" (508 mm x 508 mm x 25 mm)





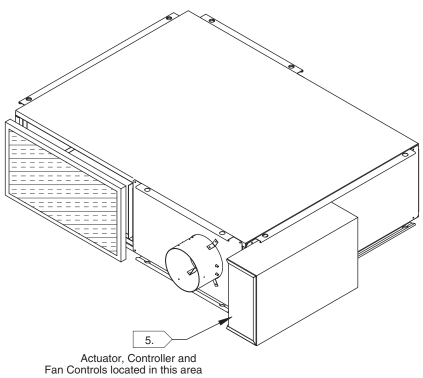
CUSTOMER NOTE:

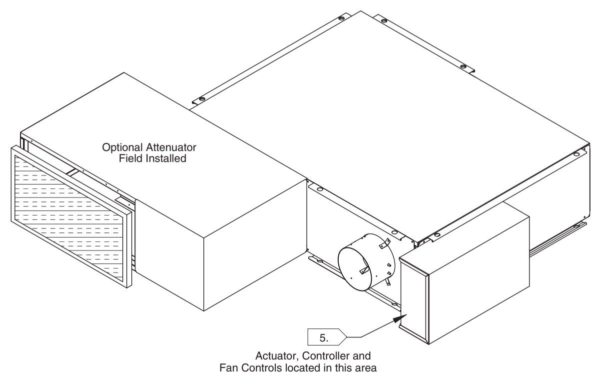
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator–factory assembled, field installed.
4. See Installation Documents for exact hanger bracket location.
5. Air valve centered between top and bottom panel.
6. For Motor access, remove bottom screw on hanger brackets to slide panel as shown in drawing.
7. Heating coil un–insulated. External insulation may be field supplied and installed as required.
8. Rotate coil 180° for right hand coil connection.
9. All high & low voltage controls have same–side NEC jumpback clearance.(unit shown w/left hand high & low voltage box connections [high voltage inlet facing]. Right hand connections available.)
10. Maximum dimensions for controls area shown. Configurations and types of control boxes vary according to control type selected. See "Enclosure Details" for specific layout.

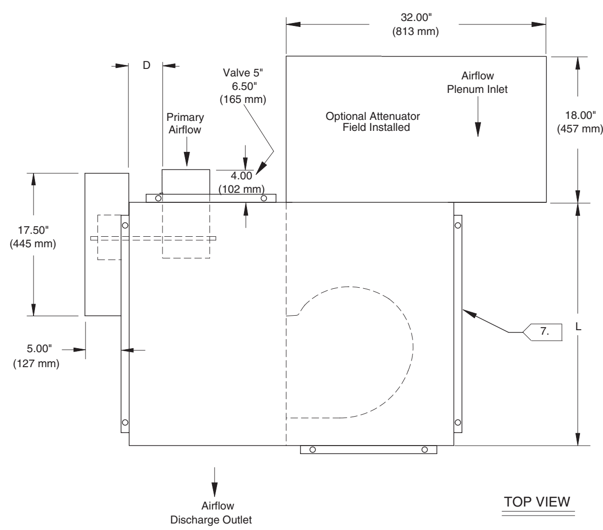
Low Height Parallel Fan-Powered Terminal Units

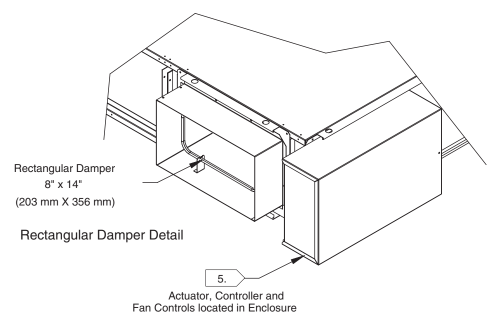
LOW-HEIGHT PARALLEL COOLING (LPCF) FAN SIZES 08SQ & 09SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		D	UNIT WT WT LBS (kg)
						A	B		
08SQ	5, 6, 8	127, 152, 203	11.00" (279 mm)	40.00" (1016 mm)	30.00" (762 mm)	19.25" (489 mm)	9.5" (241 mm)	4.00" (102 mm)	69 (31.3)
09SQ	6, 8	152, 203	↓	↓	↓	↓	↓	↓	74 (33.6)
09SQ	8 x 14	203 x 356	↓	↓	↓	↓	↓	3.25" (83 mm)	83 (37.7)

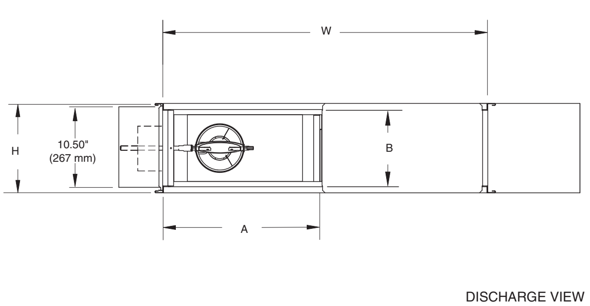








Fan Size	Filter Size	Attn Wt Wt. Lbs. (kg)
08SQ 09SQ	10" x 20" x 1" (254 mm x 508 mm x 25 mm)	10 (4.5)



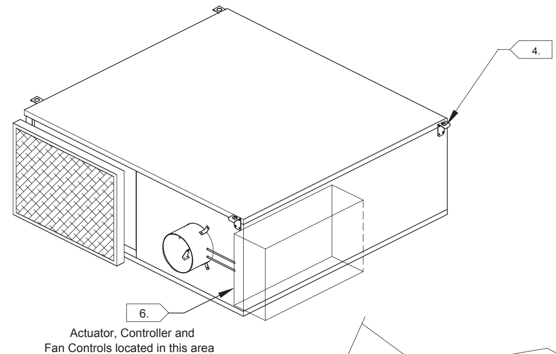
NOTES:

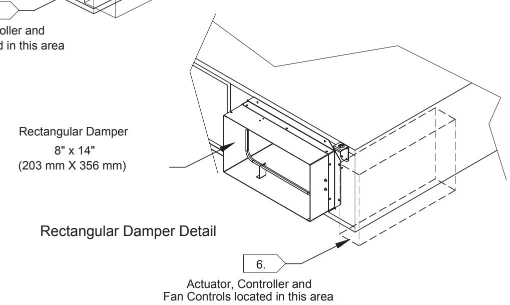
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Flanged discharge outlet accepts up to 1" (25 mm) duct flange.
3. Bottom Access panel standard.
4. Air valve centered between top and bottom panel.
5. Control box enclosure provided with all control types.
6. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
7. Flange adds 2" to width and length of unit.

Dimensional Data

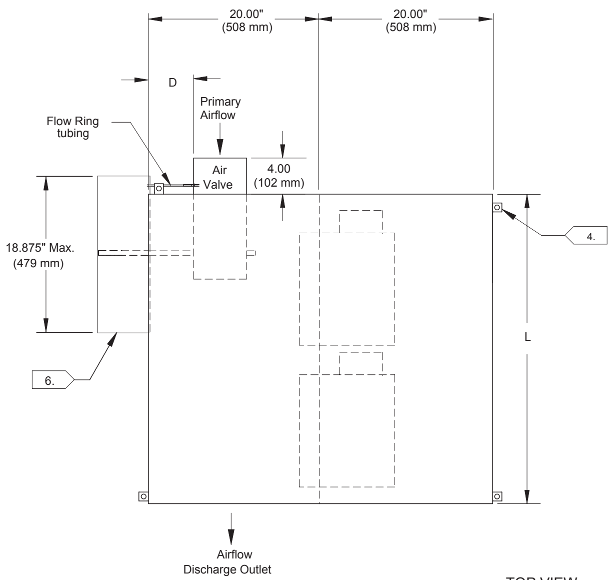
LOW-HEIGHT PARALLEL COOLING (LPCF) FAN SIZE 10SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		D	UNIT WT WT LBS (kg)
						A	B		
10SQ	8	203	11.50" (292 mm)	40.00" (1016 mm)	50.00" (1270 mm)	19.25" (489 mm)	10.00" (254 mm)	4.00" (102 mm)	90 (41)
10SQ	8 x 14	203 x 356	↓	↓	↓	↓	↓	3.25" (83 mm)	92 (42)





Rectangular Damper Detail

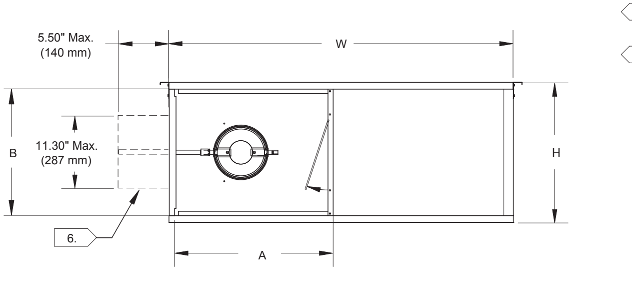


TOP VIEW

Fan Size	Filter Size
10SQ	10" x 20" x 1" (254 mm x 508 mm x 25 mm)

NOTES:

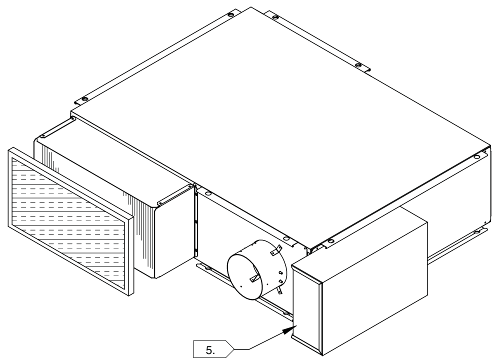
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Flanged discharge outlet accepts up to a 1" (25 mm) duct flange.
3. Bottom Access panel standard.
4. See Installation Documents for exact hanger bracket location.
5. Air valve centered between top and bottom panel.
6. Maximum dimensions for controls area shown.

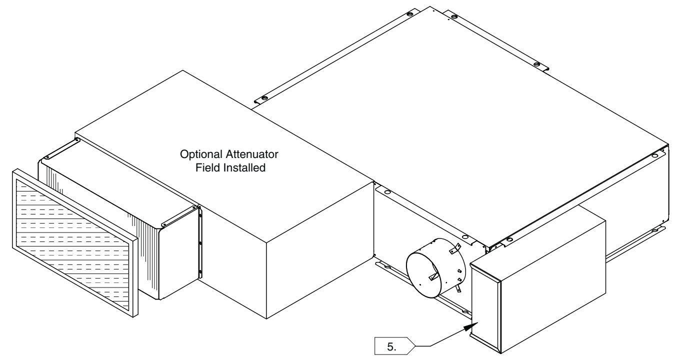


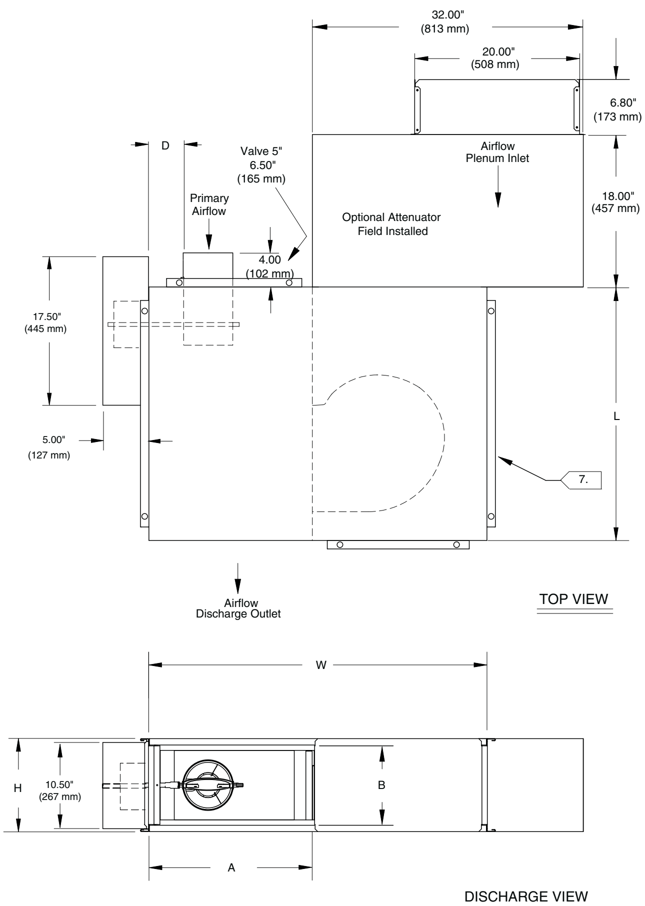
DISCHARGE VIEW

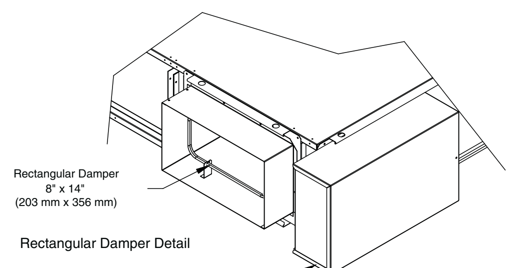
LOW-HEIGHT PARALLEL HOT WATER (LPWF) FAN SIZES 08SQ & 09SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		D	UNIT WT WT LBS (kg)
						A	B		
08SQ	5, 6, 8	127, 152, 203	11.00" (279 mm)	40.00" (1016 mm)	30.00" (762 mm)	19.25" (483 mm)	9.50" (241 mm)	4.00" (102 mm)	98 (44.5)
09SQ	6, 8	152, 203						↓	103 (46.7)
09SQ	8 x 14	203 x 356	↓	↓	↓	↓	↓	3.25" (83 mm)	112 (50.8)









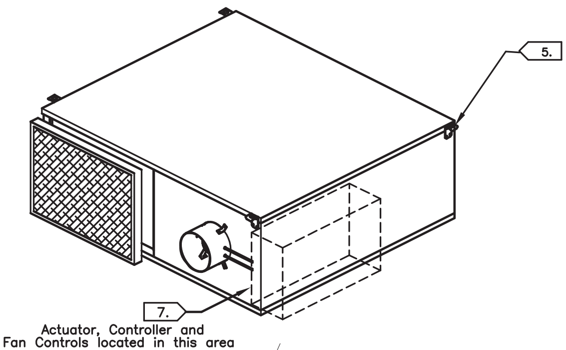
Fan Size	Filter Size	Attn Wt Wt Lbs (kg)
08SQ 09SQ	10" x 20" x 1" (254 mm x 508 mm x 25 mm)	10 (4.5)

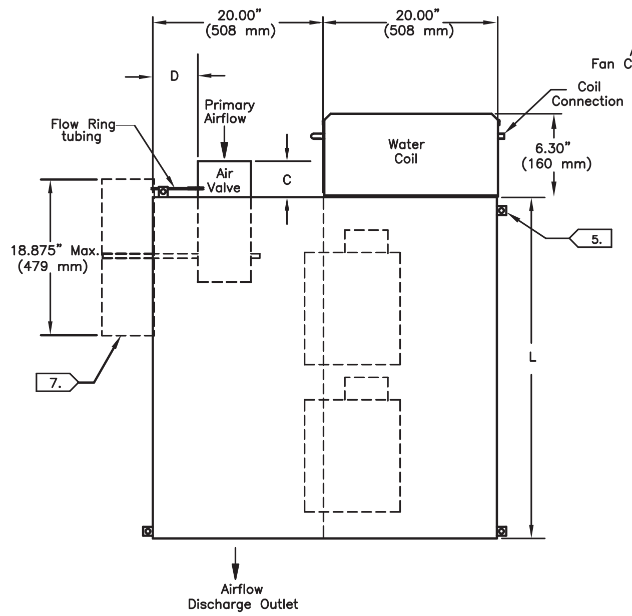
NOTES:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Flanged discharge outlet accepts up to a 1" (25 mm) duct flange.
3. Bottom Access panel standard.
4. Air valve centered between top and bottom panel.
5. Control box enclosure provided with all control types.
6. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
7. Flange adds 2" to width and length of unit.

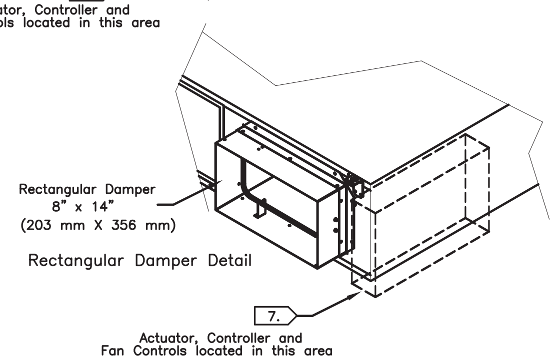
LOW HEIGHT PARALLEL HOT WATER (LPWF) FAN SIZE 10SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS A	DISCHARGE DIMENSIONS B	C	D	UNIT WT WT LBS (kg)
10SQ	8	203	11.50" (292 mm)	40.00" (1016 mm)	50.00" (1270 mm)	20.00" (508 mm)	10.00" (254 mm)	4.00" (102mm)	4.00" (102mm)	99 (45)
10SQ	8 X 14	203 X 356	↓	↓	↓	↓	↓	↓	3.25" (83mm)	101 (46)



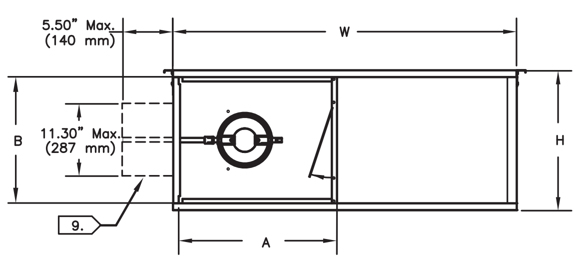


TOP VIEW



Rectangular Damper Detail

Fan Size	Filter Size
10SQ	10" x 20" x 1" (254 mm x 508 mm x 25 mm)



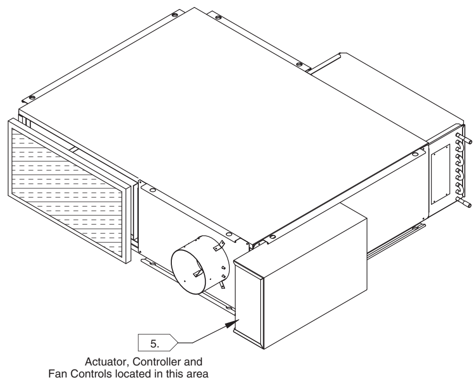
DISCHARGE VIEW

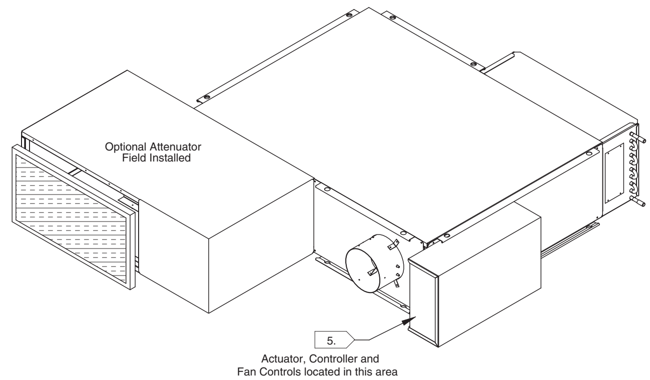
CUSTOMER NOTES:

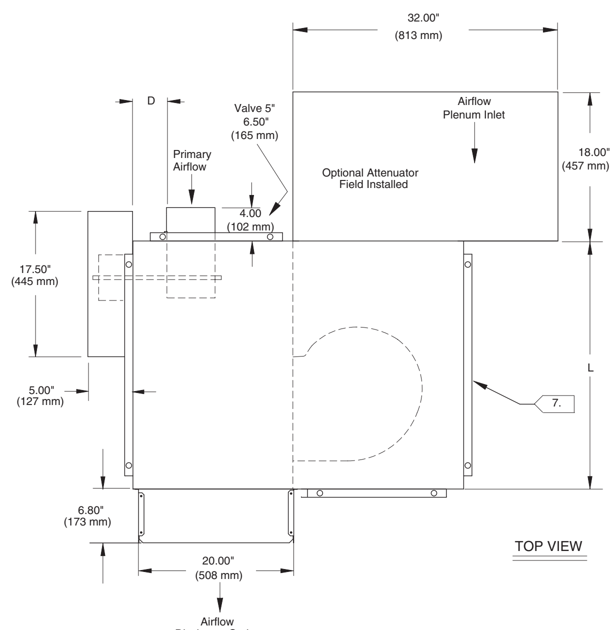
1. Coil furnished with female sweat connections.
2. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
3. Flanged discharge outlet accepts up to a 1" (25mm) duct flange.
4. Bottom Access panel standard.
5. See Installation Documents for exact hanger bracket location
6. Air valve centered between top and bottom panel.
7. Maximum dimensions for controls area shown. Configurations and types of control boxes vary according to control type selected. See "Enclosure Details" for specific layout.

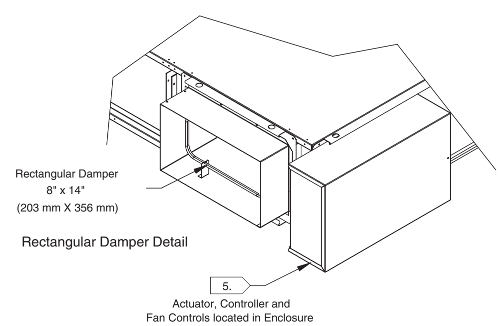
PARALLEL LOW-HEIGHT HOT WATER (LPWF) COIL ON DISCHARGE FAN SIZES 08SQ & 09SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		D	UNIT WT WT LBS (kg)
						A	B		
08SQ	5, 6, 8	127, 152, 203	11.00" (279 mm)	40.00" (1016 mm)	30.00" (762 mm)	20.00" (508 mm)	10.00" (254 mm)	4.00" (102 mm)	98 (44.5)
09SQ	6, 8	152, 203						↓	103 (46.7)
09SQ	8 X 14	203 X 356	↓	↓	↓	↓	↓	3.25" (83 mm)	112 (50.8)

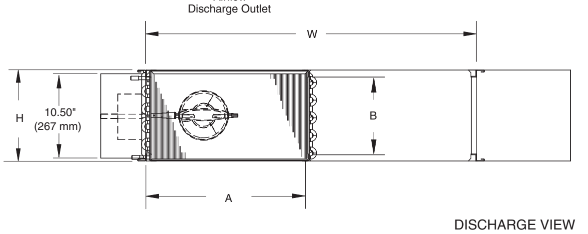








Fan Size	Filter Size	Attn Wt Wt Lbs (kg)
08SQ 09SQ	10" x 20" x 1" (254 mm x 508 mm x 25 mm)	10 (4.5)

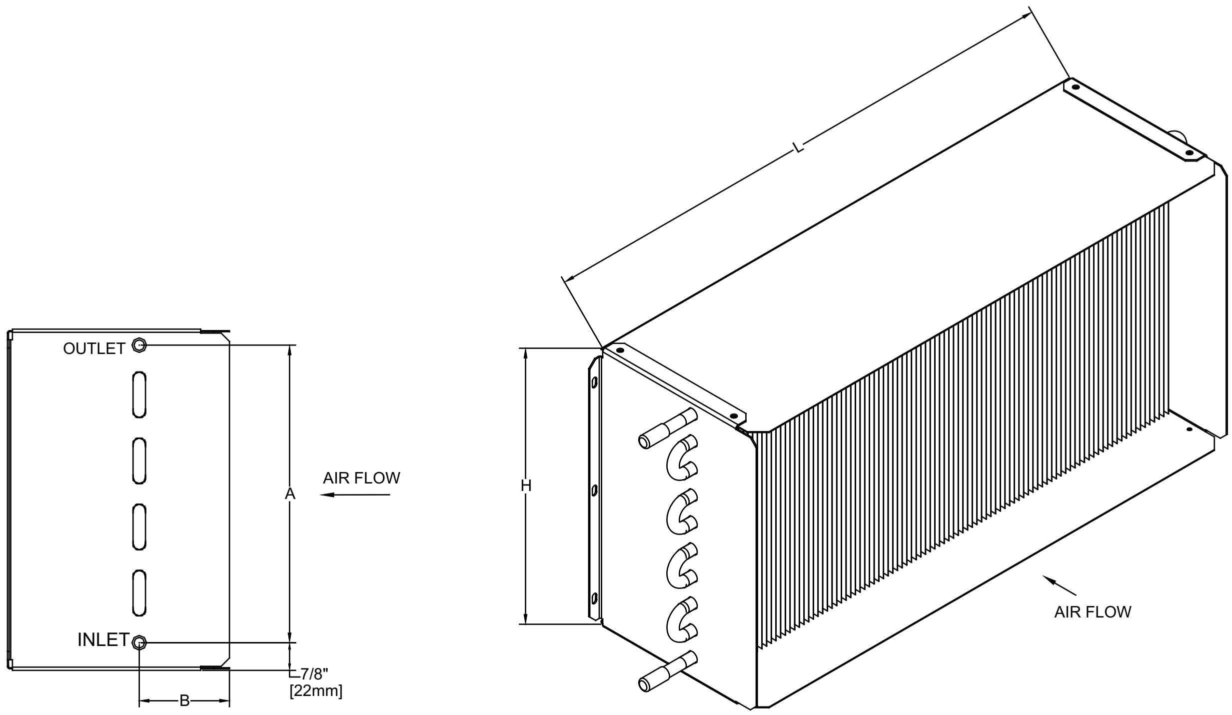


NOTES:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Flanged discharge outlet accepts up to a 1" (25 mm) duct flange.
3. Bottom Access panel standard.
4. Air valve centered between top and bottom panel.
5. Control box enclosure provided with all control types.
6. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
7. Flange adds 2" to width and length of unit.

Coil Information For Low Height Parallel Inlet-1 Row

Size Inlet/Fan	Coil Connection 1-Row	A	B	L	H
08SQ	3/8" (10 mm) O.D.	9" (229 mm)	2 7/8" (71 mm)	20" (508 mm)	10" (254 mm)
09SQ	3/8" (10 mm) O.D.	9" (229 mm)	2 7/8" (71 mm)	20" (508 mm)	10" (254 mm)
10SQ	.375" (10 mm) O.D.	9.00" (229 mm)	2.80" (71 mm)	20.00" (508 mm)	10.00" (254 mm)

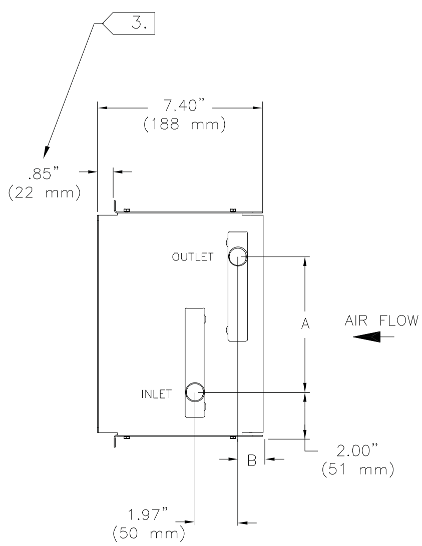


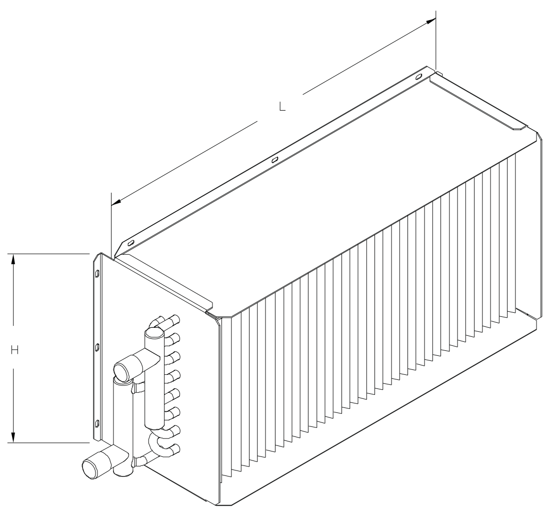
Fan Size	Internal Volume Gal (L)	Operating Weight Lbs (Kg)
08SQ	0.07 (16.7)	9.7 (4.4)
09SQ	0.07 (16.7)	9.7 (4.4)
10SQ	0.07 (.27)	9.7 (4.4)

Notes:
1. Location of coil connections is determined by facing air steam. R.H. Coil connections shown, L.H. not available.
2. Coil furnished with stub sweet connections.

Coil Information For Low Height Parallel Plenum Inlet 2-Row Coil

Fan Size	Coil Connection 2 Row	A	B	L	H
08SQ	7/8" (22 mm) O.D.	6 1/4" (157 mm)	2 1/8" (55 mm)	20" (508 mm)	10" (254 mm)
09SQ	7/8" (22 mm) O.D.	6 1/4" (157 mm)	2 1/8" (55 mm)	20" (508 mm)	10" (254 mm)
10SQ	.875" (22 mm) O.D.	6.20" (157 mm)	2.18" (55 mm)	20.00" (508 mm)	10.00" (254 mm)





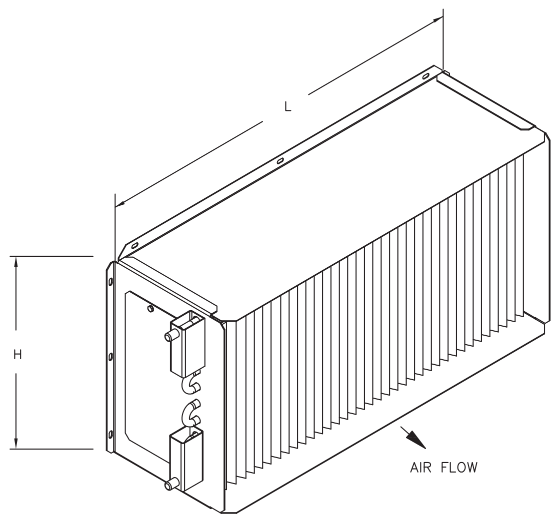
Fan Size	Internal Volume Gal (L)	Operating Weight Lbs (Kg)
08SQ	0.16 (39.0)	13.7 (6.2)
09SQ	0.16 (39.0)	13.7 (6.2)
10SQ	0.16 (.61)	13.7 (6.2)

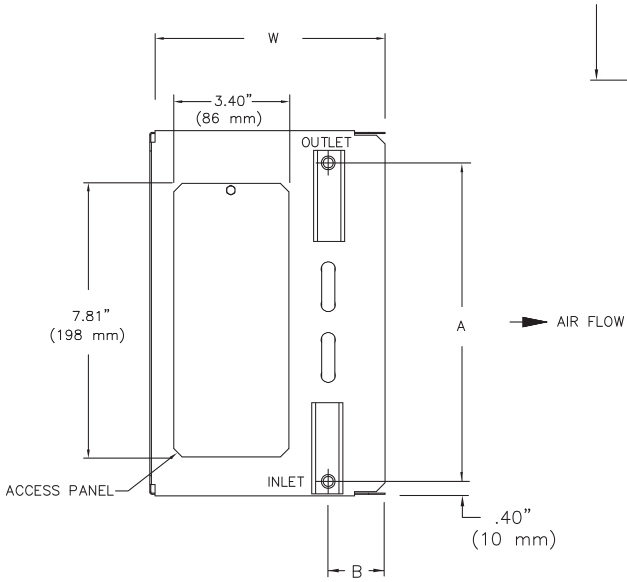
Notes:
1. Location of coil connections is determined by facing air steam. R.H. Coil connections shown, L.H. not available.
2. Coil furnished with female sweat connections.
3. 3. 0.85" lip NOT on 08SQ or 09SQ units.

Dimensional Data

Coil Information For Low Height Parallel Discharge 1-Row Coil

Fan Size	Coil Connection	A	B	L	H	W
08SQ	3/8" (10 mm) O.D.	9.00" (229 mm)	1.65" (42 mm)	20.00" (508 mm)	10.00" (254 mm)	6.75" (171 mm)
09SQ	3/8" (10 mm) O.D.	9.00" (229 mm)	1.65" (42 mm)	20.00" (508 mm)	10.00" (254 mm)	6.75" (171 mm)



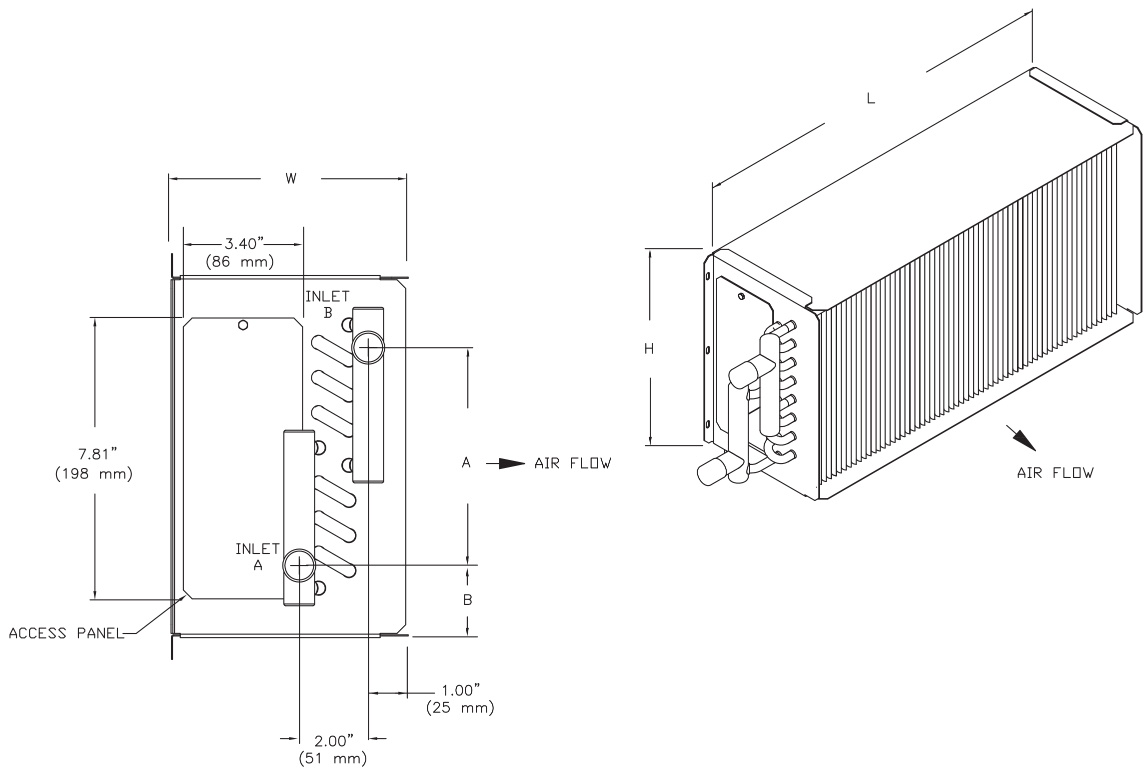


Fan Size	Internal Volume Gal (L)	Operating Weight Lbs (Kg)
08SQ	0.07 (.28)	9.7 (4.4)
09SQ	0.07 (.28)	9.7 (4.4)

Notes:
1. Location of coil connections is determined by facing air stream. L.H. Coil connections shown, R.H. opposit.
2. Coil furnished with stub sweat connections.
3. Coil is rotated to achieve opposite hand connection. Note: Water inlet is always on the bottom and outlet on the top.
4. Access Panel is standard.

Coil Information For Low Height Parallel Discharge 2 Row Coil

Fan Size	Coil Connection	A	B	L	H	W
08SQ	7/8" (22 mm) O.D.	6.25" (159 mm)	2.00 (51 mm)	20.00" (508 mm)	10.00" (254 mm)	6.75" (171 mm)
09SQ	7/8" (22 mm) O.D.	6.25" (159 mm)	2.00 (51 mm)	20.00" (508 mm)	10.00" (254 mm)	6.75" (171 mm)



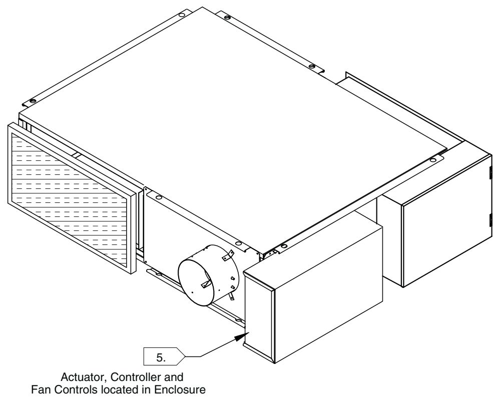
Fan Size	Internal Volume Gal (L)	Operating Weight Lbs (Kg)
08SQ	0.17 (.64)	13.7 (6.2)
09SQ	0.17 (.64)	13.7 (6.2)

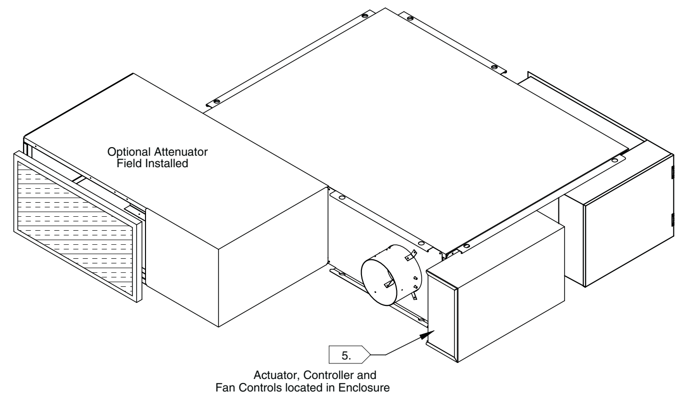
Notes:
1. Location of coil connections is determined by facing air stream. L.H. Coil connections shown, R.H. opposite.
2. Coil furnished with stub sweat connections.
3. Use port at bottom for inlet and port at top for outlet. For 2-row coils, always plumb in counter flow orientation: Left hand unit's water inlet on bottom, and outlet on the top. Right hand unit's water inlet on top and outlet on bottom.
4. Access Panel is standard.

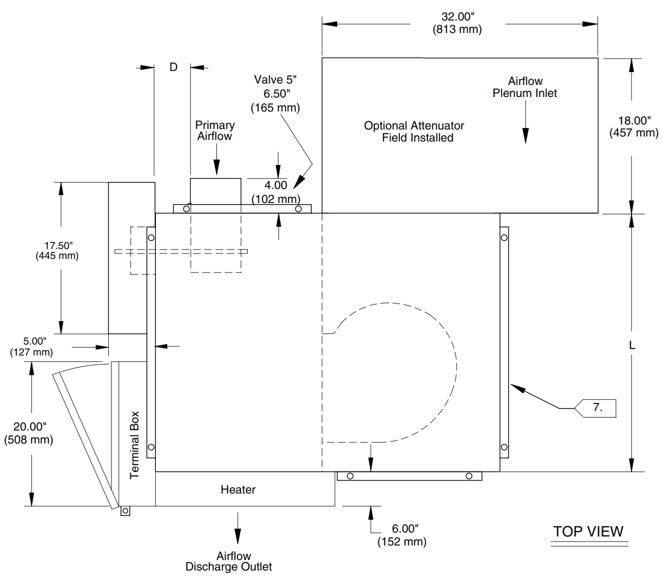
Dimensional Data

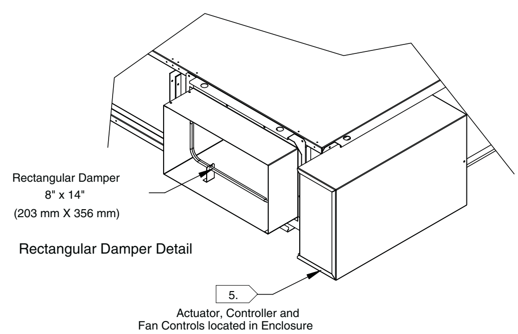
LOW-HEIGHT PARALLEL ELECTRIC HEAT (LPEF) FAN SIZES 08SQ & 09SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		D	UNIT WT WT LBS (kg)
						A	B		
08SQ	5, 6, 8	127, 152, 203	11.00" (279 mm)	40.00" (1016 mm)	30.00" (762 mm)	19.00" (483 mm)	9.50" (241 mm)	4.00" (102 mm)	104 (47.2)
09SQ	6, 8	152, 203	↓	↓	↓	↓	↓	↓	109 (49.4)
09SQ	8 x 14	203 x 356	↓	↓	↓	↓	↓	3.25" (83 mm)	118 (53.5)

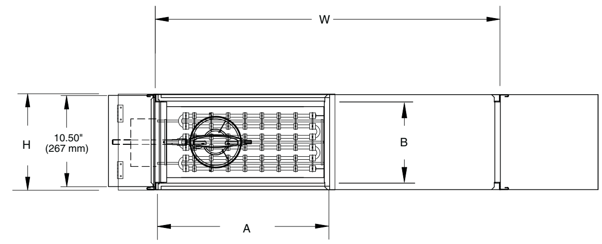








Fan Size	Filter Size	Atten Wt Lbs (kg)
08SQ 09SQ	10" x 20 " x 1" (254 mm x 508 mm x 25 mm)	10 (4.5)



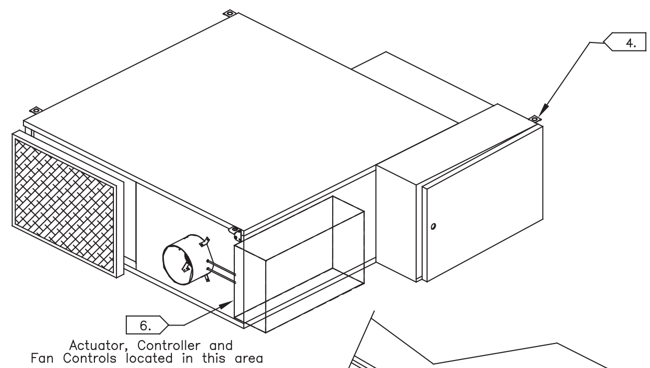
NOTES:

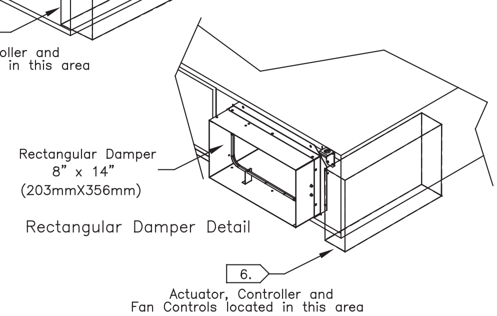
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Flanged discharge outlet accepts up to a 1" (25 mm) duct flange.
3. Bottom Access panel standard.
4. Air valve centered between top and bottom panel.
5. Control box enclosure provided with all control types.
6. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
7. Flange adds 2" to width and length of unit.

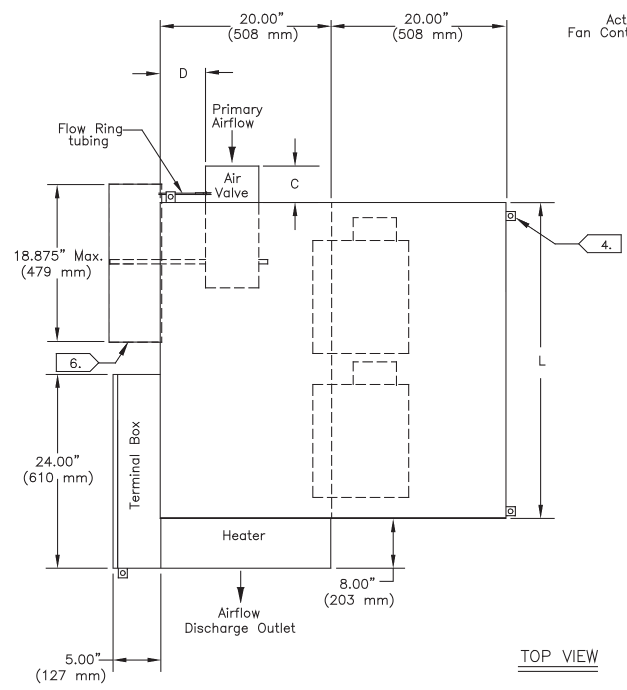
DISCHARGE VIEW

LOW-HEIGHT PARALLEL ELECTRIC (LPEF) FAN SIZE 10SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	UNIT WT WT LBS (kg)
						A	B			
10SQ	8	203	11.50" (292 mm)	40.00" (1016 mm)	50.00" (1270 mm)	20.00" (508 mm)	10.00" (254 mm)	4.00" (102mm)	4.00" (102mm)	105 (48)
10SQ	8 X 14	203 X 356	↓	↓	↓	↓	↓	6.00" (152mm)	3.25" (83mm)	107 (49)



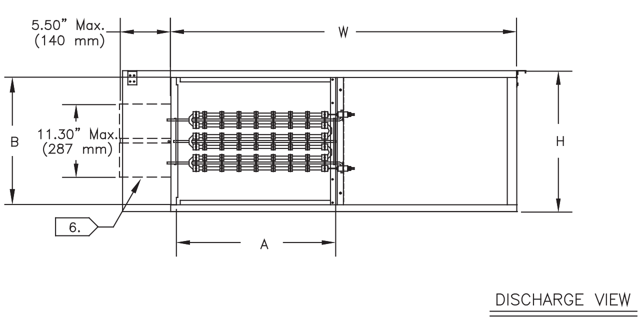




Fan Size	Filter Size
10SQ	10" x 20" x 1" (254 mm x 508 mm x 25 mm)

CUSTOMER NOTES:

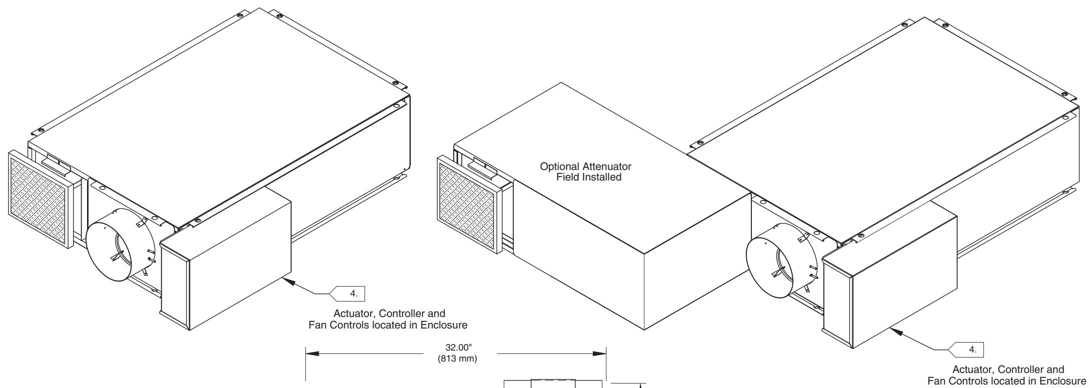
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Flanged discharge outlet accepts up to a 1" (25mm) duct flange.
3. Bottom Access panel standard.
4. See Installation Documents for exact hanger bracket location
5. Air valve centered between top and bottom panel.
6. Maximum dimensions for controls area shown.
7. Inside duct dimensions equal outlet size (A x B). Allow 48" (1219mm) of straight duct downstream of unit before first runout.
8. Terminal box access door is side hinged. Allow for clearance. (22" (559mm) long x 11.50" (292mm) high).
9. Knockouts for power supply provided in top and bottom of terminal box.
10. Coils are provided without internal insulation. If the unit is to be installed in a location with high humidity, external insulation around the heating coil should be installed as required.

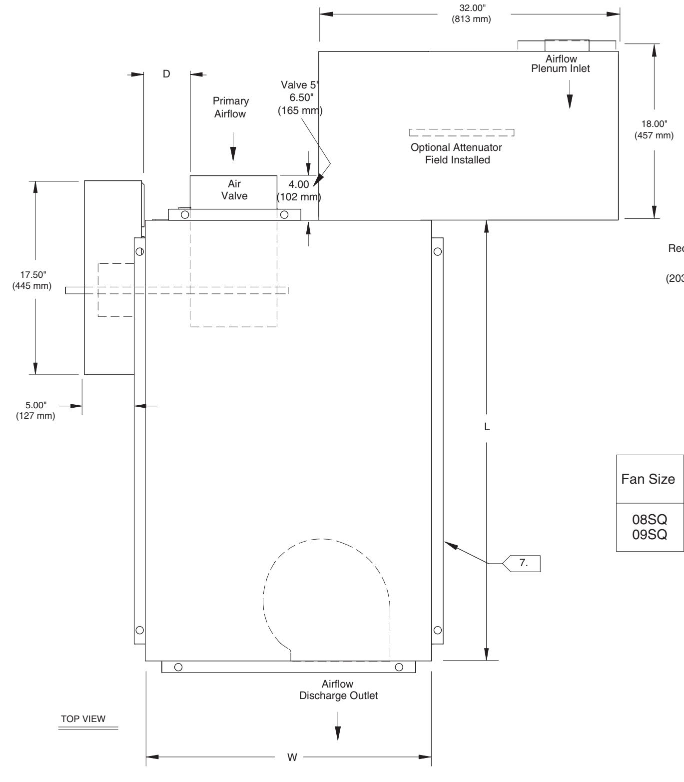


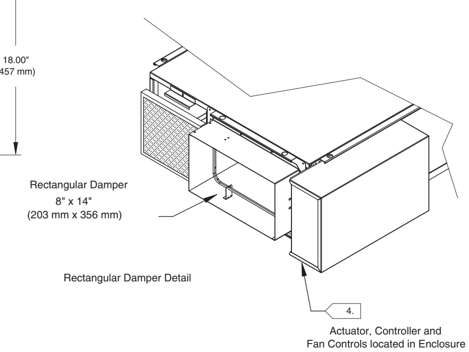
Low Height Series Fan-Powered Terminal Units

LOW-HEIGHT SERIES COOLING ONLY (LSCF) FAN SIZES 08SQ & 09SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (inches)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		D	Unit Wt Lbs (kg)
						A	B		
08SQ	5, 6, 8	127, 152, 203	11.00" (279 mm)	26.00" (660 mm)	40.00" (1016 mm)	18.00" (457 mm)	10.00" (254 mm)	4.00" (102 mm)	86 (39)
09SQ	6, 8	152, 203						↓	96 (44)
09SQ	8 x 14	203 x 355	↓	↓	↓	↓	↓	4.50" (114 mm)	105 (47)



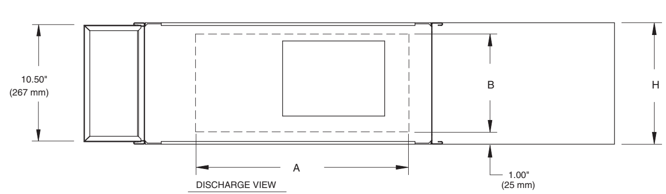




Fan Size	Filter Size	Atten Wt Lbs (kg)
08SQ 09SQ	10" x 10" x 1" (254 mm x 254 mm x 25 mm)	10 (4.5)

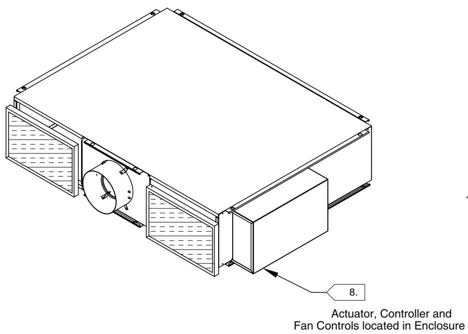
NOTES:

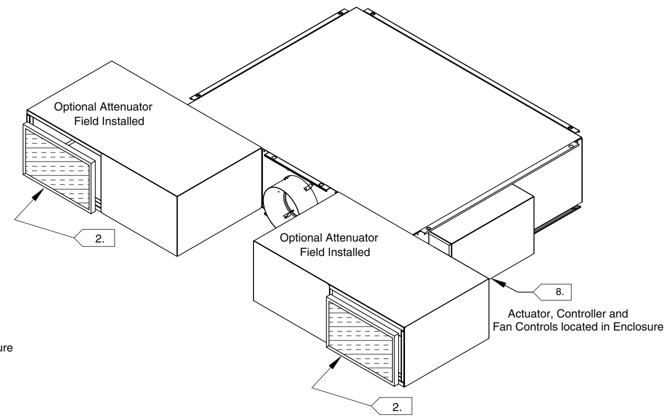
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Flanged discharge outlet accepts up to a 1" (25 mm) duct flange.
3. Bottom Access panel standard.
4. Control box enclosure provided with all control types.
5. Air valve centered between top and bottom panel.
6. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
7. Flange adds 2" to width and length of unit.

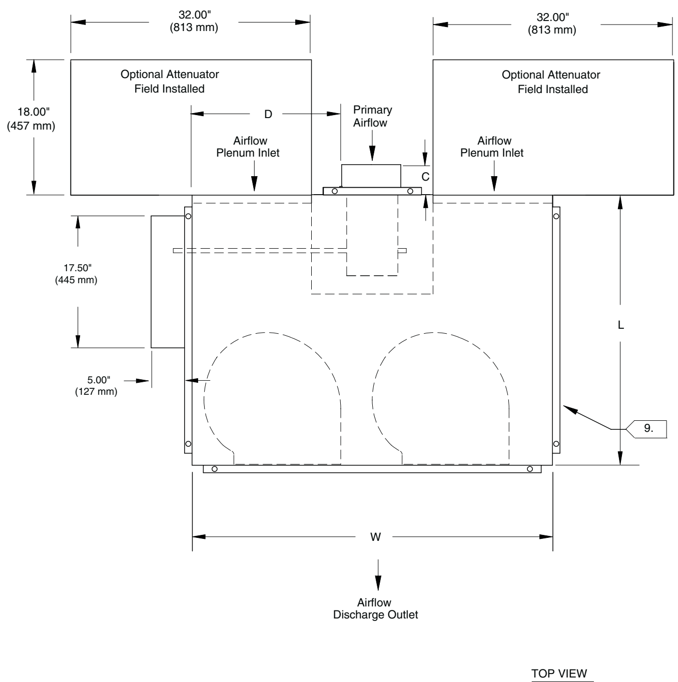


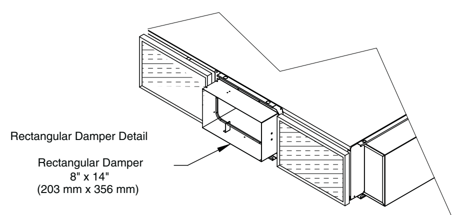
LOW-HEIGHT SERIES COOLING (LSCF) FAN SIZE 10SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	UNIT WT WT LBS (kg)
						A	B			
10SQ	8	203	11.00" (279 mm)	48.00" (1219 mm)	36.00" (914 mm)	38.00" (965 mm)	10.00" (254 mm)	4.00" (102 mm)	20.00" (508 mm)	120 (54)
10SQ	8 x 14	203 x 356	↓	↓	↓	↓	↓	↓	17.50" (445 mm)	130 (59)

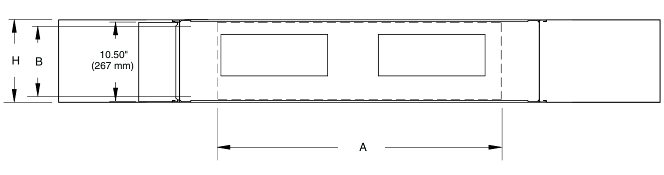








Fan Size	Filter Size	Atten Wt Lbs (kg)
10SQ	10" x 16" x 1" (254 mm x 406 mm x 25 mm)	20 (9)



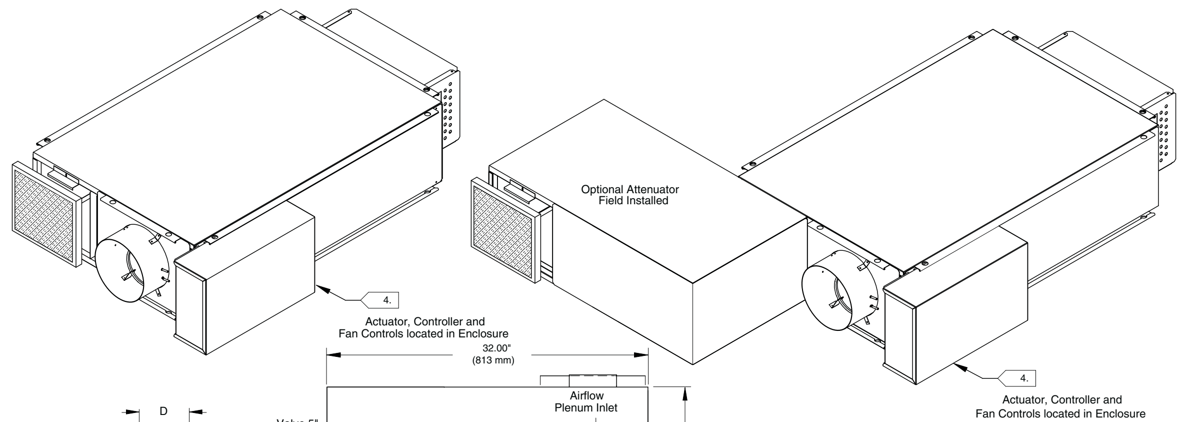
NOTES:

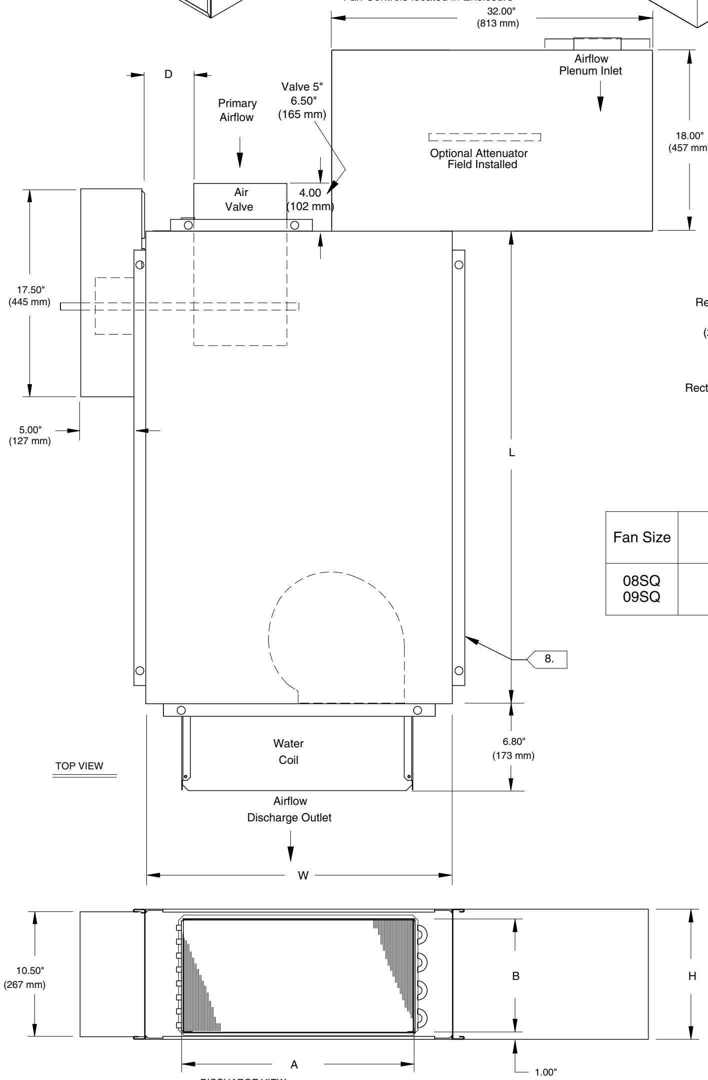
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator-factory assembled, field installed.
4. Air valve centered between top and bottom panel.
5. Heating coil uninsulated. External insulation may be field supplied and installed as required.
6. All high & low voltage controls have same-side NEC jumback clearance. (Left-hand shown, right-hand/mirror image optional.)
7. Bottom Access panel standard.
8. Control box enclosure provided with all control types.
9. Flange adds 2" to width and length of unit.

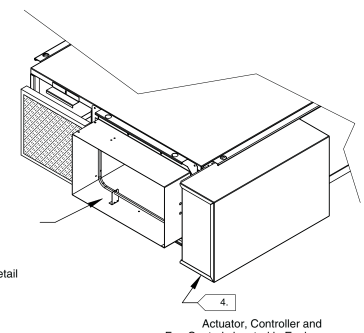
Dimensional Data

LOW-HEIGHT SERIES HOT WATER (LSWF) FAN SIZES 08SQ & 09SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		D	Unit Wt Lbs (kg)
						A	B		
08SQ	5, 6, 8	127, 152, 203	11.00" (279 mm)	26.00" (660 mm)	40.00" (1016 mm)	18.00" (457 mm)	10.00" (254 mm)	4.00" (102 mm)	95 (43)
09SQ	6, 8	152, 203	↓	↓	↓	↓	↓	↓	105 (48)
09SQ	8 x 14	203 x 355	↓	↓	↓	↓	↓	4.50" (114 mm)	114 (52)







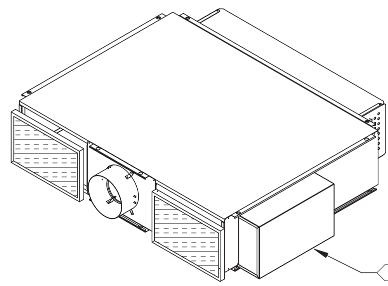
Fan Size	Filter Size	Atten Wt Lbs (kg)
08SQ 09SQ	10" x 10" x 1" (254 mm x 254 mm x 25 mm)	10 (4.5)

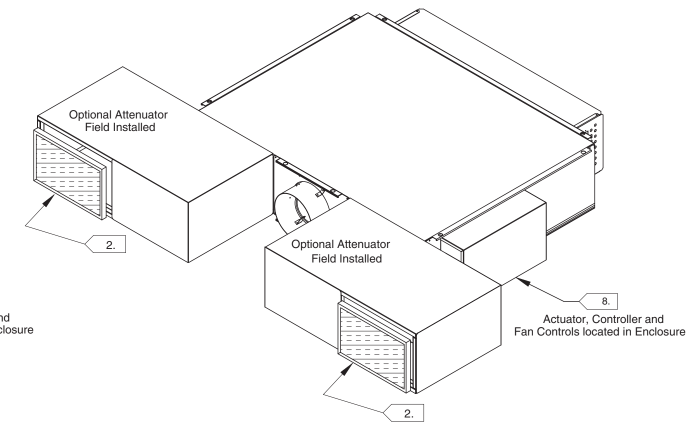
NOTES:

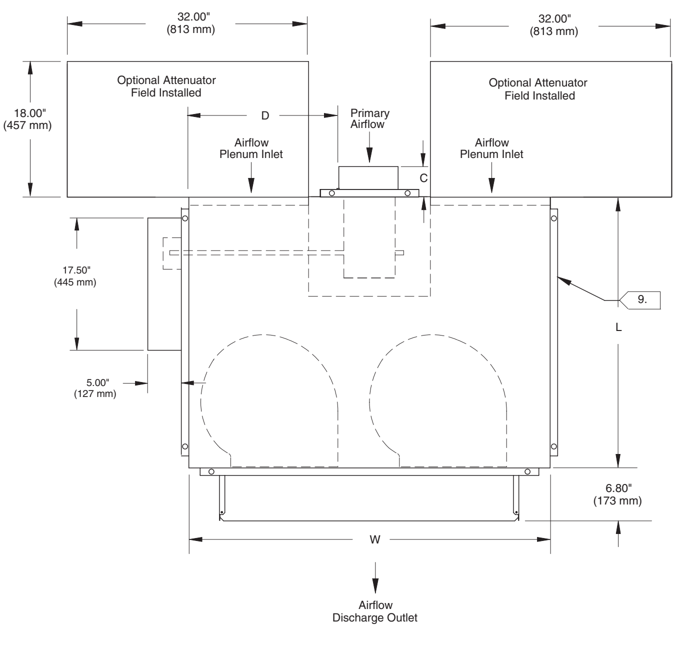
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Flanged discharge outlet accepts up to a 1" (25 mm) duct flange.
3. Bottom Access panel standard.
4. Control box enclosure provided with all control types.
5. Air valve centered between top and bottom panel.
6. Heating coil uninsulated. External insulation may be field supplied and installed as required.
7. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
8. Flange adds 2" to width and length of unit.

LOW-HEIGHT SERIES HOT WATER (LSWF) FAN SIZE 10SQ

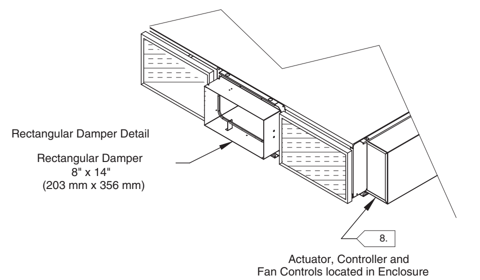
FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	UNIT WT WT LBS (kg)
						A	B			
10SQ	8	203	11.00" (279 mm)	48.00" (1219 mm)	36.00" (914 mm)	38.00" (965 mm)	10.00" (254 mm)	4.00" (102 mm)	20.00" (508 mm)	136 (62)
10SQ	8 x 14	203 x 356	↓	↓	↓	↓	↓	↓	17.50" (445 mm)	146 (66)







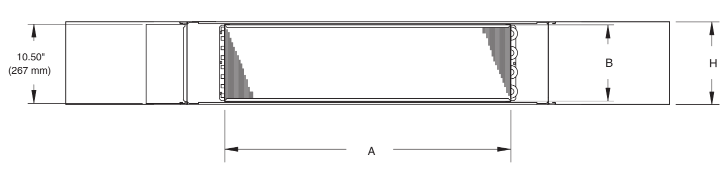
TOP VIEW



Fan Size	Filter Size	Atten Wt Lbs (kg)
10SQ	10" x 16" x 1" (254 mm x 406 mm x 25 mm)	20 (9)

NOTES:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator-factory assembled, field installed.
4. Air valve centered between top and bottom panel.
5. Heating coil uninsulated. External insulation may be field supplied and installed as required.
6. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
7. Bottom Access panel standard.
8. Control box enclosure provided with all control types.
9. Flange adds 2" to width and length of unit.

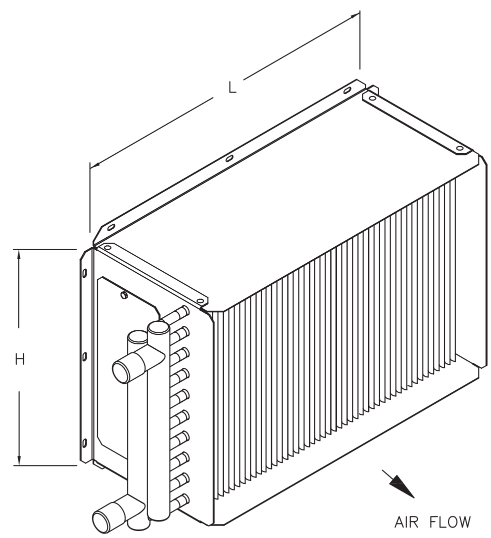


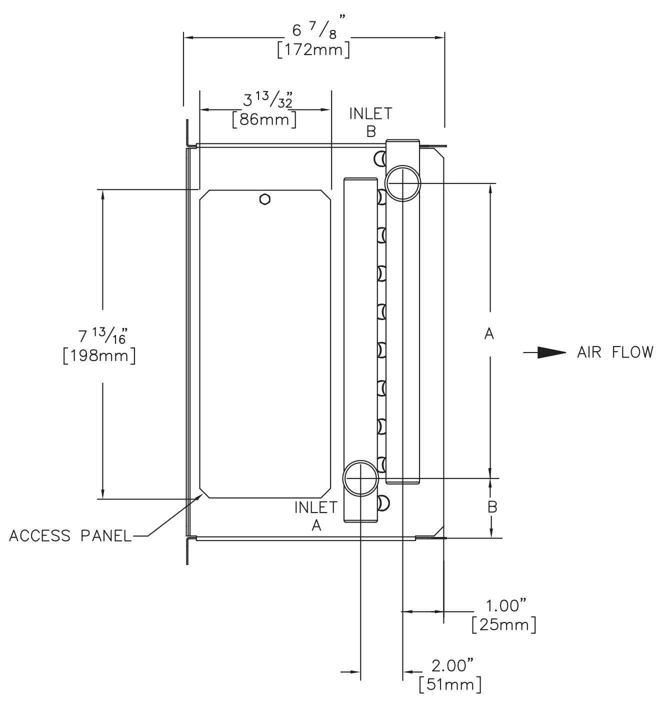
DISCHARGE VIEW

Dimensional Data

SERIES LOW HEIGHT COILS (1 ROW)

COIL INFORMATION FOR SERIES COIL ASSY					
FAN SIZE	COIL CONNECTION 1 ROW	A	B	L	H
08SQ	7/8" [22mm]O.D.	7 3/4" [197mm]	1 1/2" [38mm]	18" [457mm]	10" [254mm]
08SQ				↓	
10SQ	↓	↓	↓	38" [965mm]	↓





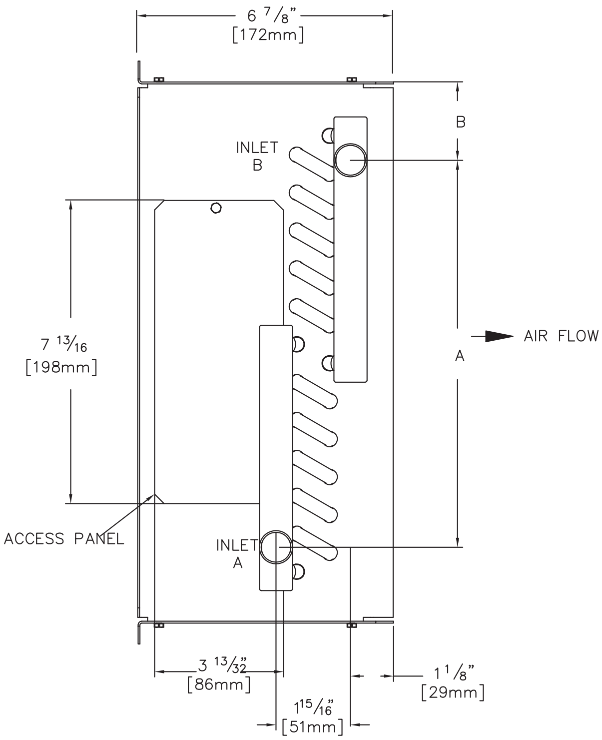
Fan Size	INTERNAL VOLUME GAL(in.^{3})	OPERATING WEIGHT LBS(KG)
08SQ 09SQ	0.07 (17.02)	10.4 (4.7)
10SQ	0.15 (35.94)	16.4 (7.4)

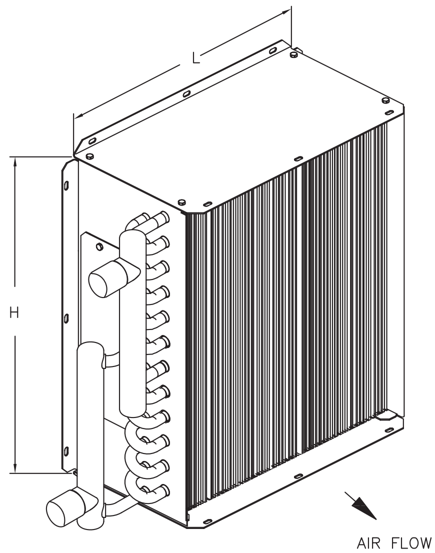
CUSTOMER NOTES:

1. Location of coil connections is determined by facing air stream. L.H. Coil connections shown, R.H. opposite.
2. Coil furnished with stub sweat connections.
3. Coil is rotated to achieve opposite hand connection. Water inlet is always on the bottom & outlet on the top.
4. Access Panel is standard.

SERIES LOW HEIGHT COILS (2 ROW)

COIL INFORMATION FOR SERIES COIL ASSY					
FAN INLET/FAN	COIL CONNECTION 2 ROW	A	B	L	H
08SQ	7/8"[22mm] O.D.	6 1/4" [159mm]	1 1/2" [38mm]	18" [457mm]	10" [254mm]
09SQ				↓	
10SQ	↓	↓	↓	38" [965mm]	↓





Fan Size	INTERNAL VOLUME GAL(in.^{3})	OPERATING WEIGHT LBS(KG)
08SQ 09SQ	0.10 (23.88)	7.8 (3.5)
10SQ	0.21 (50.4)	22.9 (10.4)

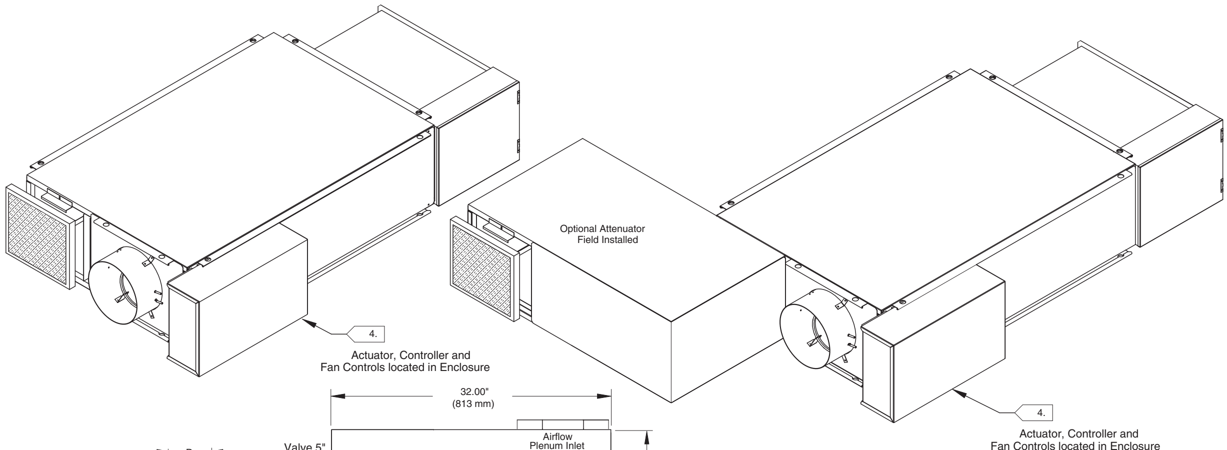
CUSTOMER NOTES:

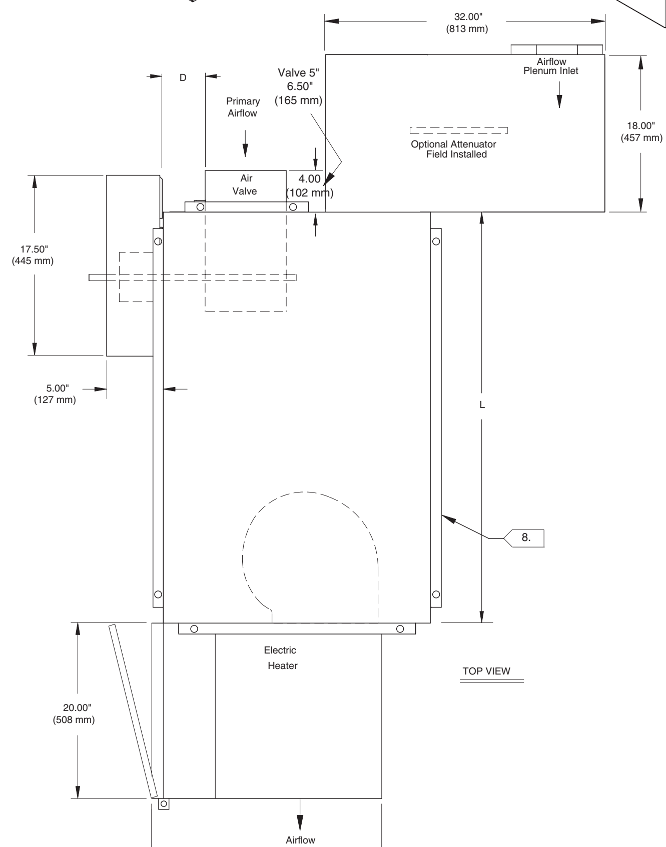
1. Location of coil connections is determined by facing air stream. L.H. Coil connections shown, R.H. opposite.
2. Coil furnished with stub sweat connections.
3. Use port at bottom for inlet and port at top for outlet. For 2–row coils, always plumb in counter flow orientation: Left hand unit's water inlet on bottom, and outlet on the top. Right hand unit's water inlet on top and outlet on bottom.
4. Access Panel is standard.

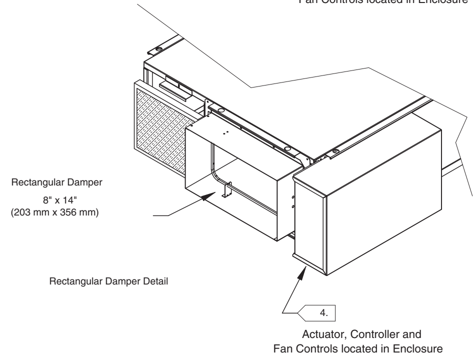
Dimensional Data

LOW-HEIGHT SERIES ELECTRIC HEAT (LSEF) FAN SIZES 08SQ & 09SQ

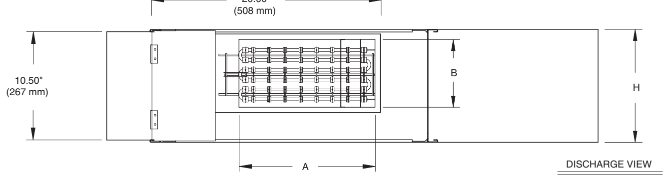
FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		D	Unit Wt Lbs (kg)
						A	B		
08SQ	5, 6, 8	127, 152, 203	11.00" (279 mm)	26.00" (660 mm)	40.00" (1016 mm)	14.00" (356 mm)	9.00" (229 mm)	4.00" (102 mm)	101 (45.8)
09SQ	6, 8	152, 203						▼	111 (50.3)
09SQ	8 x 14	203 x 355	▼	▼	▼	▼	▼	4.50" (114 mm)	120 (54.4)







Fan Size	Filter Size	Atten Wt Lbs (kg)
08SQ 09SQ	10" x 10" x 1" (254 mm x 254 mm x 25 mm)	10 (4.5)

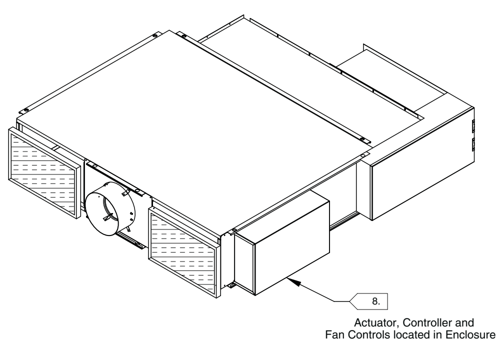


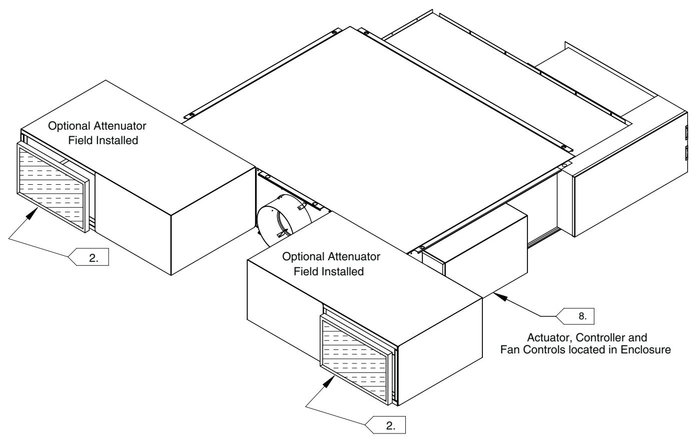
NOTES:

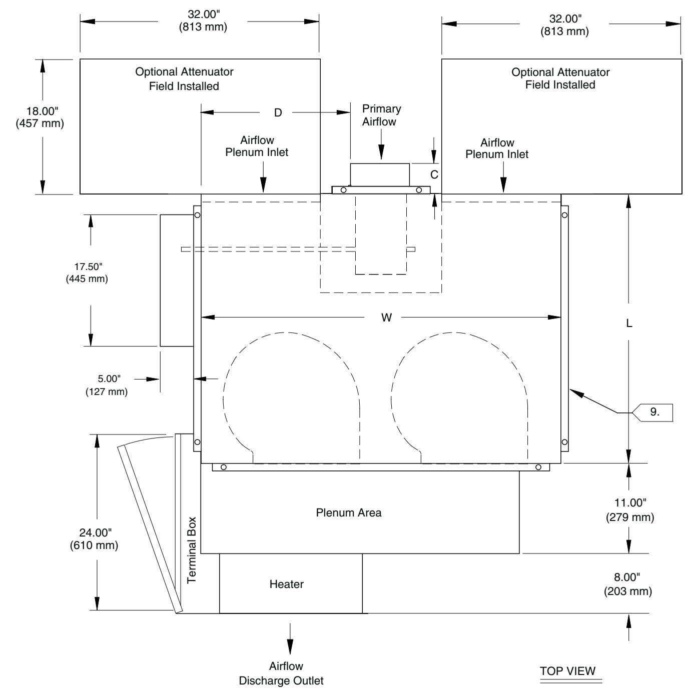
1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Flanged discharge outlet accepts up to 1" (25 mm) duct flange.
3. Bottom Access panel standard.
4. Control box enclosure provided with all control types.
5. Air valve centered between top and bottom panel.
6. Heating coil uninsulated. External insulation may be field supplied and installed as required.
7. All hight & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
8. Flange adds 2" to width and length of unit.

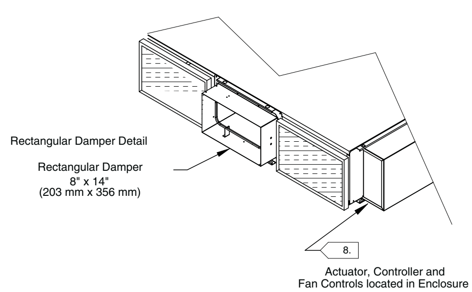
LOW-HEIGHT SERIES ELECTRIC (LSEF) FAN SIZE 10SQ

FAN SIZE	INLET SIZE AVAILABILITY NOMINAL Ø (INCHES)	INLET SIZE AVAILABILITY NOMINAL Ø (mm)	H	W	L	DISCHARGE DIMENSIONS		C	D	UNIT WT WT LBS (kg)
						A	B			
10SQ	8	203	11.00" (279 mm)	48.00" (1219 mm)	36.00" (914 mm)	19.00" (483 mm)	9.50" (241 mm)	4.00" (102 mm)	20.00" (508 mm)	145 (65.8)
10SQ	8 x14	203 x 356	↓	↓	↓	↓	↓	↓	17.50" (445 mm)	155 (70.3)





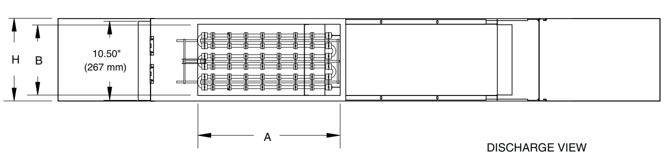




Fan Size	Filter Size	Atten Wt (Qty 2) Lbs (kg)
10SQ	10" x 16" x 1" (254 mm x 406 mm x 25 mm)	20 (9.1)

NOTES:

1. Allow a minimum 6" (152 mm) plenum inlet clearance for unducted installations.
2. Filter location with optional Attenuator.
3. Attenuator-factory assembled, field installed.
4. Air valve centered between top and bottom panel.
5. Heating coil uninsulated. External insulation may be field supplied and installed as required.
6. All high & low voltage controls have same-side NEC jumpback clearance. (Left-hand shown, right-hand/mirror image optional.)
7. Bottom Access panel standard.
8. Control box enclosure provided with all control types.
9. Flange adds 2" to width and length of unit.



Mechanical Specifications: Fan-Powered

MODELS: VPCF, VPWF, VPEF, VSCF, VSWF, VSEF, LPCF, LPWF, LPEF, LSCF, LSWF, & LSEF

VP, LP = Parallel Fan Powered Units
VS, LS = Series Fan Powered Units

Note: *L = Low Height*

Model Break Downs

- VPCF, VSCF, LPCF, & LSCF = Cooling Only
- VPWF, VSWF, LPWF, & LSWF = With Hot Water Coil
- VPEF, VSEF, LPEF, & LSEF = With Electric Coil

CASING

22-gage galvanized steel. Hanger brackets, side access (standard height - V model numbers) or bottom access (low height - L model numbers), and plenum filter are provided as standard.

AGENCY LISTING

The unit is UL and Canadian UL Listed as a room air terminal unit. Control # 9N65.

AHRI 880 Certified.

INSULATION

1/2" (12.7 mm) Matte-faced Insulation—. The interior surface of the unit casing is acoustically and thermally lined with ½-inch, 1.5 lb/ft3 (12.7 mm, 24.0 kg/m3) composite density glass fiber with a high-density facing. The insulation R-Value is 1.9. The insulation is UL listed and meets NFPA-90A and UL 181 standards. There are no exposed edges of insulation (complete metal encapsulation).

1" (25.4 mm) Matte-faced Insulation—. The interior surface of the unit casing is acoustically and thermally lined with 1 inch, 1.0 lb/ft3 (25.4 mm, 16.0 kg/m3) composite density glass fiber with a high-density facing. The insulation R-Value is 3.85. The insulation is UL listed and meets NFPA-90A and UL 181 standards. There are no exposed edges of insulation (complete metal encapsulation).

1" (25.4 mm) Foil-faced Insulation—. The interior surface of the unit casing is acoustically and thermally lined with 1-inch, 1.5 lb/ft3 (25.4 mm, 24.0 kg/m3) density glass fiber with foil facing. The insulation R-Value is 4.1. The insulation is UL listed and meets NFPA-90A and UL 181 standards as well as bacteriological standard ASTM C 665. There are no exposed edges of insulation (complete metal encapsulation).

1" (25.4 mm) Double-wall Insulation—. The interior surface of the unit casing is acoustically and thermally lined with a 1-inch, 1.0 lb./ft3 (25.4 mm, 16.0 kg/m3) composite density glass fiber with high-density facing. The insulation R-value is 3.8. The insulation is UL listed and meets NFPA-90A and UL 181 standards. The insulation is covered by an interior liner made of 26-gage galvanized steel. All wire penetrations are covered by grommets. There are no exposed edges of insulation (complete metal encapsulation).

3/8" (9.5 mm) Closed-cell Insulation—. The interior surface of the unit casing is acoustically and thermally lined with 3/8-inch, 4.4 lb/ft3 (9.5 mm, 70.0 kg/m3) closed-cell insulation. The insulation is UL listed and meets NFPA-90A and UL 181 standards. The insulation has an R-Value of 1.4. There are no exposed edges of insulation (complete metal encapsulation).

PRIMARY AIR VALVE

Air Valve Round—. The primary air inlet connection is an 18-gage galvanized steel cylinder sized to fit standard round duct. A multiple-point, averaging flow sensing ring is provided with balancing taps for measuring +/-5% of unit cataloged airflow. An airflow-versus-pressure differential calibration chart is provided. The damper blade is constructed of a closed-cell foam seal that is mechanically locked between two 22-gage galvanized steel disks. The damper blade assembly is connected to a cast zinc shaft supported by self-lubricating bearings. The shaft is cast with a damper position indicator. The valve assembly includes a mechanical stop to prevent over-stroking. At 4 in. wg, air valve leakage does not exceed 1% of cataloged airflow.

Air Valve Rectangular. —Inlet collar is constructed of 22-gage galvanized steel sized to fit standard rectangular duct. An integral multiple-point, averaging flow-sensing ring provides primary airflow measurement within +/-5% of unit cataloged airflow. Damper is 22-gage galvanized steel. The damper blade assembly is connected to a solid metal shaft supported by self-lubricating bearings. The shaft is cast with a damper position indicator. The valve assembly includes a mechanical stop to prevent over-stroking. At 3.0 in. wg, air valve leakage does not exceed 44 cfm (21 L/s).

Table 135. Fan-inlet combinations

	VPXF						LSXF		
Inlet	**02SQ**	**03SQ**	**04SQ**	**05SQ**	**06SQ**	**07SQ**	**08SQ**	**09SQ**	**10SQ**
5"	X						X		
6"	X	X					X	X	
8"	X	X	X				X	X	
10"	X	X	X	X	X	X			
12"		X	X	X	X	X			
14"			X	X	X	X			
16"					X	X			
8 x 14"								X	X

Attenuators

The attenuator is 22-gage galvanized steel with an internal acoustical liner. Attenuators have been tested in accordance with AHRI 880 standards.

Fan Motor

PSC—. Single-speed, direct-drive, permanent split capacitor type. Thermal overload protection provided. Motors will be designed specifically for use with an open SCR. Motors will accommodate anti-backward rotation at start up. Motor and fan assembly are isolated from terminal unit.

ECM—. Electrically Commutated Motor is designed for high-efficient operation with over 70% efficiency throughout the operating range.

FAN SPEED CONTROL

Variable Speed Control Switch (SCR)—. The SCR speed control device is provided as standard and allows the operator infinite fan speed adjustment.

Transformer

The 50-VA transformer is factory-installed in the fan control box to provide 24 VAC for controls.

Disconnect Switch

A toggle disconnect is provided as standard and allows the operator to turn the unit on or off by toggling to the appropriate setting. This switch breaks both legs of power to the fan and the electronic controls (if applicable)

Note: *Not provided on Low Height units with pneumatic controls.*

Outlet Connection

Flanged Connection—Rectangular opening on unit discharge to accept 90° flanged ductwork connection.

Filter

A 1" (25 mm) filter is provided on the plenum inlet and attaches to the unit with a filter frame.

Hot Water Coil

Parallel Water Coils—. factory- installed on the plenum inlet. The coil has 1-row with 144 aluminum-plated fins per foot (.305 m), and if needed 2-row with 144 aluminum-plated fins per foot (.305 m). Full fin collars provided for accurate fin spacing and maximum fin-tube contact. The 3/8" (9.5 mm) OD seamless copper tubes are mechanically expanded into the fin collars. Coils are proof tested at 450 psig (3102 kPa) and leak tested at 300 psig (2068 kPa) air pressure under water. Coil connections are brazed.

Series Water Coils. —factory-installed on the fan discharge. The coil has 1-row with 144 aluminum-plated fins per foot (.305 m) and, if needed, 2-row with 144 aluminum-plated fins per foot (.305 m). Full fin collars provided for accurate fin spacing and maximum fin-tube contact. The 3/8" (9.5 mm) OD seamless copper tubes are mechanically expanded into the fin collars. Coils are proof tested at 450 psig (3102 kPa) and leak tested at 300 psig (2068 kPa) air pressure under water. Coil connections are brazed. Gasketed access panels, which are standard, are attached with screws.

Electric Heat Coil

The electric heater is a factory-provided and installed, UL recognized resistance open-type heater. It also contains a disc-type automatic pilot duty thermal primary cutout, and manual reset load carrying thermal secondary device. Heater element material is nickel-chromium. The heater terminal box is provided with 7/8" (22 mm) knockouts for customer power supply. Terminal connections are plated steel with ceramic insulators. All fan-powered units with electric reheat are single-point power connections.

Electric Heat Options

Silicon-Controlled Rectifier (SCR). Optional electric heat control that provides modulation.

Magnetic Contactor. Optional electric heater 24V contactor for use with direct digital controls.

Mercury Contactor. Optional electric heater 24V contactor for use with direct digital controls.

P.E. Switch with Magnetic Contactor. This optional switch and magnetic contactor is for use with pneumatic controls.

P.E. Switch with Mercury Contactor. This optional switch and mercury contactor is for use with pneumatic controls.

Airflow Switch. Optional air pressure device designed to disable heater when system fan is off.

Power Fuse. If a power fuse is chosen with a unit containing electric heat, then a safety fuse is located in the electric heater's line of power to prevent power surge damage to the electric heater.

Any electric heat unit with a calculated MCA greater than or equal to 30 will have a fuse provided.

Disconnect Switch. A standard factory-provided door interlocking disconnect switch on the heater control panel disengages primary voltage to the terminal.

Unit Controls Sequence Of Operation

Parallel

The unit controller continuously monitors the zone temperature against its setpoint and varies the primary airflow as required to meet zone setpoints. Airflow is limited by minimum and maximum position set points. For a parallel unit, the controller will intermittently start the fan upon a call for heat. Upon a further call for heat, reheat is enabled.

1. Primary Airflow—The fan energizes when primary airflow drops below the fan setpoint airflow. The fan automatically starts when the zone temperature drops to the heating temperature setpoint.
2. Zone Temperature—The fan energizes when the zone temperature drops to a selectable number of degrees above the heating temperature setpoint.

Series

The controller will start and run the fan continuously during the occupied mode and intermittently during the unoccupied mode. Upon a further call for heat, any hot water or electric heat associated with the unit is enabled.

Direct Digital Controls

DDC Actuator—. Trane 3-wire, 24-VAC, floating-point quarter turn control actuator with linkage release button. Actuator has a constant drive rate independent of load, a rated torque of 35 in-lb, a 90-second drive time, and is non-spring return. Travel is terminated by end stops at fully-opened and -closed positions. An integral magnetic clutch eliminates motor stall.

DDC Actuator - Belimo — LMB24-3-TTN 3-wire, 24 VAC/DC, floating-point, quarter turn actuator with linkage release button. Actuator has a constant drive rate independent of load, a rated torque of 45 in-lb, a 95 second drive time, and is non-spring return. Travel is terminated by end stops at fully-opened and -closed positions. Internal electronic control prevents motor stall when motor reaches end stops.

Direct Digital Controller—. The microprocessor-based terminal unit controller provides accurate, pressure-independent control through the use of a proportional integral control algorithm and direct digital control technology. The controller, named the Unit Control Module (UCM), monitors zone temperature setpoints, zone temperature and its rate of change, and valve airflow using a differential pressure signal from the pressure transducer. Additionally, the controller can monitor either supply duct air temperature or CO2 concentration via appropriate sensors. The controller is provided in an enclosure with 7/8" (22 mm) knockouts for remote control wiring. A Trane UCM zone sensor is required.

DDC Zone Sensor—. The UCM controller senses zone temperature through a sensing element located in the zone sensor. In addition to the sensing element, zone sensor options may include an externally-adjustable setpoint, communications jack for use with a portable edit device, and an override button to change the individual controller from unoccupied to occupied mode. The override button has a cancel feature that will return the system to unoccupied. Wired zone sensors utilize a thermistor to vary the voltage output in response to changes in the zone temperature. Wiring to the UCM controller must be 18- to 22-awg. twisted pair wiring. The setpoint adjustment range is 50–88°F (10–31°C). Depending upon the features available in the model of sensor selected, the zone sensor may require from a 2-wire to a 5-wire connection. Wireless zone sensors report the same zone information as wired zone sensors, but do so using radio transmitter technology. Therefore with wireless, wiring from the zone sensor to the UCM is unnecessary.

Digital Display Zone Sensor with Liquid Crystal Display (LCD)—. The digital display zone sensor contains a sensing element, which sends a signal to the UCM. A Liquid Crystal Display (LCD) displays setpoint or space temperature. Sensor buttons allow the user to adjust setpoints, and allow space temperature readings to be turned on or off. The digital display zone sensor also includes a communication jack for use with a portable edit device, and an override button to change the UCM from unoccupied to occupied. The override button has a cancel feature, which returns the system to unoccupied mode.

Trane LonTalk/BACnet—. The controller is designed to send and receive data using LonTalk or BACnet. Current unit status conditions and setpoints may be monitored and/or edited from any of several LonTalk or BACnet compatible system-level controllers.

Pneumatic Controls

Normally Open Actuator—. Pneumatic 3 - 8 psig (20 - 55 kPa) spring-range pneumatic actuator.

3011 Pneumatic Volume Regulator (PVR)—. The regulator is a thermostat reset velocity controller, which provides consistent air delivery within 5% of cataloged flow down to 18% of unit cataloged cfm, independent of changes in system static pressure. Factory-calibrated, field-adjustable setpoints for minimum and maximum flows. Average total unit bleed rate, excluding thermostat, is 28.8 scim at 20 psig (7.87 ml/min at 138 kPa) supply.

UNIT OPTIONS

Power Fuse (VPCF, VPWF)—. Optional fuse is factory-installed in the primary voltage hot leg.

HOT WATER VALVES

Two-Position Valve—. The valve is a field-adaptable, 2-way or 3-way configuration and ships with a cap to be field-installed when configured as a 2-way valve. All connections are National Pipe Thread (NPT). The valve body is forged brass with a hard chrome-plated brass stem. Upon demand, the motor strokes the valve. When the actuator drive stops, a spring returns the valve to its fail-safe position. The valves come with a manual operating lever that allows for the valve to be opened for system flushing. It will reset to normal position the first time the valve is cycled.

Flow Capacity – 4.0 Cv
Overall Diameter – ½" NPT
Close-off Pressure – 30 psi (207 kPa)

Flow Capacity – 5.0 Cv
Overall Diameter – 3/4" NPT
Close-off Pressure – 14.5 psi (100 kPa)

Flow Capacity – 8.0 Cv
Overall Diameter – 1" NPT
Close-off Pressure – 9 psi (62 kPa)

Maximum Operating Fluid Temperature – 200 deg F (95ºC)

Maximum system pressure – 300 psi (2067 kPa)

Maximum static pressure – 300 psi (2067 kPa)

Electrical Rating – 7 VA at 24 VAC, 6.5 Watts, 50/60 Hz

18" wire leads are provided on each valve.

Proportional Water Valve—The valve is a field-adaptable, 2-way or 3-way configuration and ships with a plug in B port. This configures the valve for 2-way operation. For 3-way operation, remove the plug. The intended fluid is water or water and glycol (50% maximum glycol). The actuator is a synchronous motor drive. The valve is driven to a predetermined position by the UCM controller using a proportional plus integral control algorithm. If power is removed, the valve stays in its last position. The actuator is rated for plenum applications under UL 2043 and UL 873 standards.

Pressure and Temperature Ratings –The valve is designed and tested in full compliance with ANSI B16.15 Class 250 pressure/temperature ratings, ANSI B16.104 Class IV control shutoff leakage, and ISA S75.11 flow characteristic standards.

Flow Capacity – 0.70 Cv, 2.7 Cv, 6.60 Cv, 8.00 Cv

Overall Diameter – ½" NPT

Maximum Allowable Pressure – 300 psi (2068 kPa)

Maximum Operating Fluid Temperature – 201ºF (94°C)

Maximum Close-off Pressure – 60 psi (0.4 MPa)

Electrical Rating – 3VA at 24 VAC

8” plenum rated cable with AMP Mate-N-Lok connector

DDC Controls

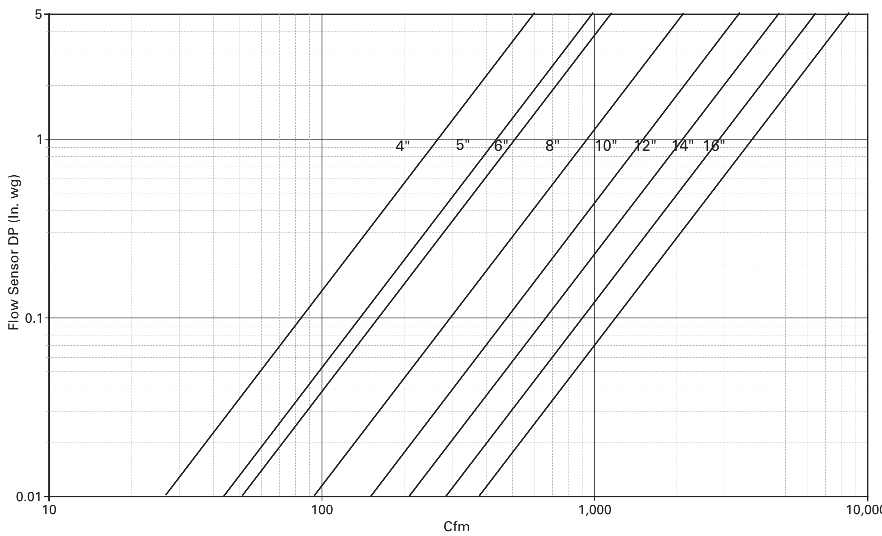
Control Logic

DDC controllers are today's industry standard. DDC controllers provide system-level data used to optimize system performance. Variables such as occupied/unoccupied status, minimum and maximum airflow setpoints, temperature and temperature setpoints, valve position, fan status (on or off, and mode of operation: series or parallel), reheat status (on or off), box type and air valve size, temperature correction offsets, flow correction values, ventilation fraction, etc. are available on a simple twisted-shielded wire pair.

Trane DDC controllers provide Trane-designed, solid-state electronics intended specifically for VAV temperature control in space comfort applications. DDC control capabilities include:

- Proportional plus integral control loop algorithm for determining required airflow needed to control room temperature. Airflow is limited by active minimum and maximum airflow setpoints.
- Pressure-independent (PI) operation, which automatically adjusts valve position to maintain required airflow. In certain low-flow situations or in cases where the flow measurement has failed, the DDC controller will operate in a pressure-dependent (PD) mode of operation.
- Cooling and heating control action of air valve. In cooling control action, the DDC controller matches cooling airflow to cooling load. In heating control action, the DDC controller matches the heating airflow to control heating load. The DDC controller will automatically change over to cooling control action if the supply air temperature is below the room temperature and will automatically change over to heating control action if the supply air temperature is 10°F or more above the room temperature. If the supply air temperature is between the room temperature and the room temperature plus 10°F, then the DDC controller will provide the active minimum airflow. The DDC controller first chooses the Tracer™ SC -supplied supply air temperature value to use for auto changeover. If this is not available, it uses the temperature provided by the optional auxiliary temperature sensor. If this is also not available, it uses the heating/cooling mode assigned by Tracer SC or the DDC controller's service tool (Everyware™ or Rover™ V4).
- Multiple reheat control options including staged electric, staged hot-water (normally on or normally off), proportional hot-water, and slow pulsed width modulation. Modulating reheat options utilize a separate reheat proportional-plus-integral control loop from that controlling airflow into the room. Staged reheat options utilize a control algorithm based on heating setpoint and room temperature.
- 24 VAC binary input that can be configured as a generic input or as occupancy input. When the DDC controller is operation with Tracer SC, the status of the input is provided to Tracer for its action. In stand-alone operation and when configured for an occupancy input, the input will control occupancy status of the DDC controller.
- Auxiliary temperature analog input that can be configured for an auxiliary temperature sensor or a 2-to-10 VDC CO_2 sensor. When sensor is mounted in the supply air duct and configured for temperature, the value of the input is used as status-only by Tracer SC if Tracer SC is providing a supply air temperature to the DDC controller. Otherwise, the input will be used for determining control action of the DDC controller. When configured for a CO_2 sensor, the value of the input is used as a status-only input by Tracer SC.
- Dual-duct support with two DDC controllers. One DDC controller controls the cooling air valve and the other controller controls the heating air valve. With constant-volume sequences, the discharge air volume is held constant by controlling discharge air volume with the heating UCM.

Figure 6. Flow sensor signal vs. airflow delivery



Note: Flow sensor DP (in. wg) is measured at the flow ring to aid in system balancing and commissioning. See "Valve/Controller Airflow Guidelines" in each section for unit performance.

DDC Remote Heat Control Options

When heat is added to the primary air at VAV unit before it enters zone, the air is said to be reheated. Operating characteristics of four basic types of VariTrane DDC terminal reheat are discussed.

Fan-Powered Terminal Units: On/Off Hot Water Reheat

Two stages of on/off hot water reheat are available. The water valves used are 2-position and are either fully-opened or fully-closed. The heating minimum airflow setpoint is enabled during reheat.

On parallel-configured fan-powered units, the fan is energized when the space temperature falls below the active fan on/off point (active heating setpoint plus fan offset). The parallel fan is turned off when the space temperature rises above the active fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series configured fan-powered terminal units utilize continuous fan operation during all occupied settings and while unoccupied when minimum airflows are being enforced.

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the zone temperature is 1°F (0.56°C) or more below the active heating setpoint, and de-energizes when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-Powered Terminal Units: Proportional Hot Water Reheat

Proportional hot water reheat uses 3-wire floating-point-actuator technology. The heating minimum airflow setpoint is enabled during reheat.

On parallel-configured fan-powered units, the fan is energized when the space temperature falls below the active fan on/off point (active heating setpoint plus fan offset). The parallel fan is turned off when the space temperature rises above the active fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series-configured fan-powered terminal units utilize continuous fan operation during all occupied settings and while unoccupied when minimum airflows are being enforced.

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

The water valve opens as space temperature drops below the heating setpoint. The degree to which the hot water valve opens is dependent on both the degree that space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already closed, the water valve fully closes when the zone temperature rises above the active heating setpoint by 0.5 °F (0.28 °C). When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-powered Terminal Units: On/Off Electric Reheat

Two stages of staged electric reheat are available. The heating minimum airflow setpoint is enabled during reheat.

On parallel-configured fan-powered units, the fan is energized when the space temperature falls below the active fan on/off point (active heating setpoint plus fan offset). The parallel fan is turned off when the space temperature rises above the active fan on/off point (active heating setpoint plus fan offset).

Series-configured fan-powered terminal units utilize the continuous fan operation during all occupied settings and while unoccupied when minimum airflows are being enforced.

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the space temperature is 1.0°F (0.56°C) or more below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-powered Terminal Units: Pulse-Width Modulation of Electric Heat

Electric heat is modulated by energizing for a portion of a three-minute time period. The heating minimum airflow setpoint is enabled during reheat. This allows exact load matching for energy efficient operation, and optimum zone temperature control. One or two stages can be used.

On parallel-configured fan-powered units, the fan is energized when the space temperature falls below the active fan on/off point (active heating setpoint plus fan offset). The parallel fan is turned off when the space temperature rises above the active fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series-configured fan-powered terminal units utilize the continuous fan operation during all occupied settings and while unoccupied when minimum airflows are being enforced. When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

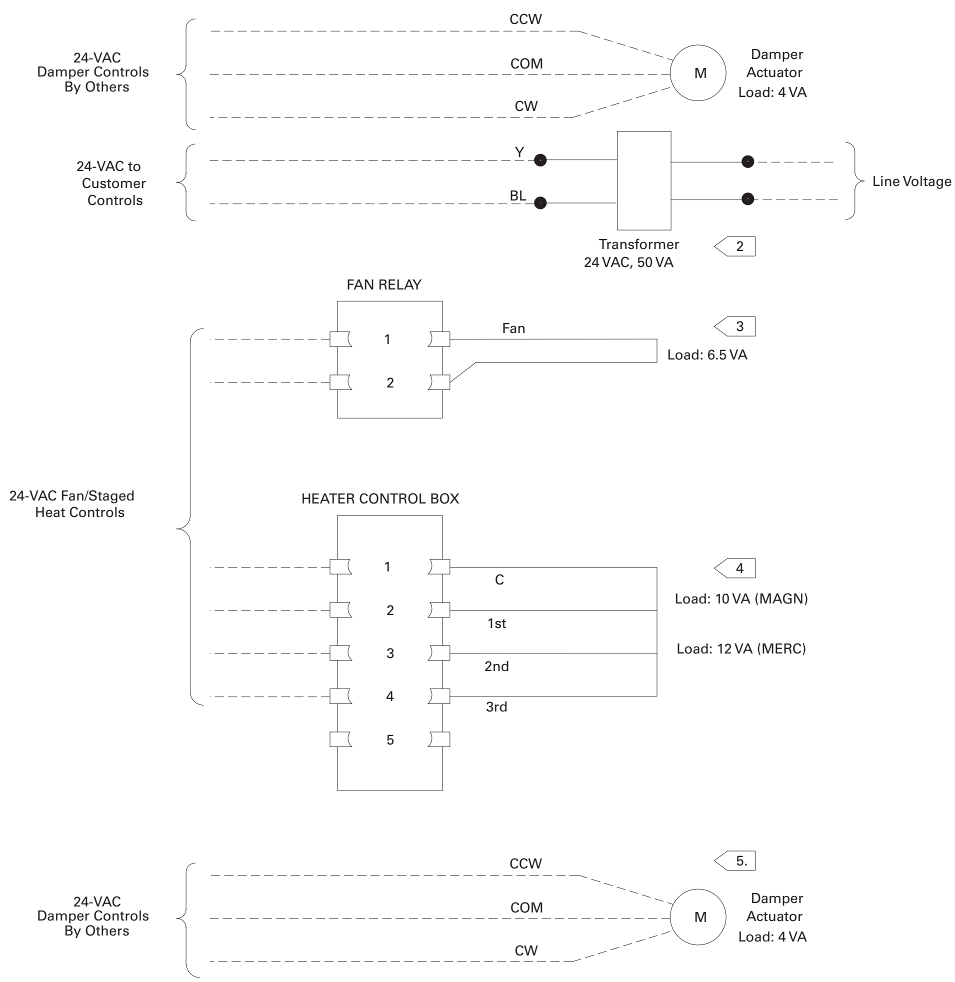
The amount of reheat supplied is dependent on both the degree that space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already off, reheat de-energizes when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. The Stage 1 “on” time is proportional to the amount of reheat required. For example, when 50% of stage 1 capacity is required, reheat is on for 90 seconds and off for 90 seconds. When 75% of stage 1 capacity is required, reheat is on for 135 seconds and off for 45 seconds. When 100% of stage 1 capacity is required, reheat is on continuously.

Stage 2 uses the same “on” time logic as stage 1 listed above, except stage 1 is always energized. For example, when 75% of unit capacity is required, stage 1 is energized continuously, and stage 2 is on for 90 seconds and off for 90 seconds. When reheat is de-energized, the cooling minimum airflow setpoint is activated. When reheat is de-energized, the cooling minimum airflow setpoint it activated.

DD00—Available for all VariTrane Units

(Trane actuator for field-installed DDC controls)

A unit controller is not provided. The air damper actuator is provided with an integral screw terminal block. The fan contactor (fan-powered units), 24-VAC control power transformer (optional for single- and dual-duct units), and factory-installed electric heater contactor wires are attached to the outside of the unit for field connection of controls. A second actuator is provided with an integral screw terminal for dual-duct units.



NOTES:

1. ——— Factory-installed
- - - - Field Wiring
—— – – —— Optional or installed by others

2. Located in Heater Terminal Box for electric heat on single-duct units. Located in Control Box for cooling only and hot water heat on single-duct units. Located in Control Box on all fan-powered units.

3. Only available with fan-powered units.

4. Located in Heater Terminal box.

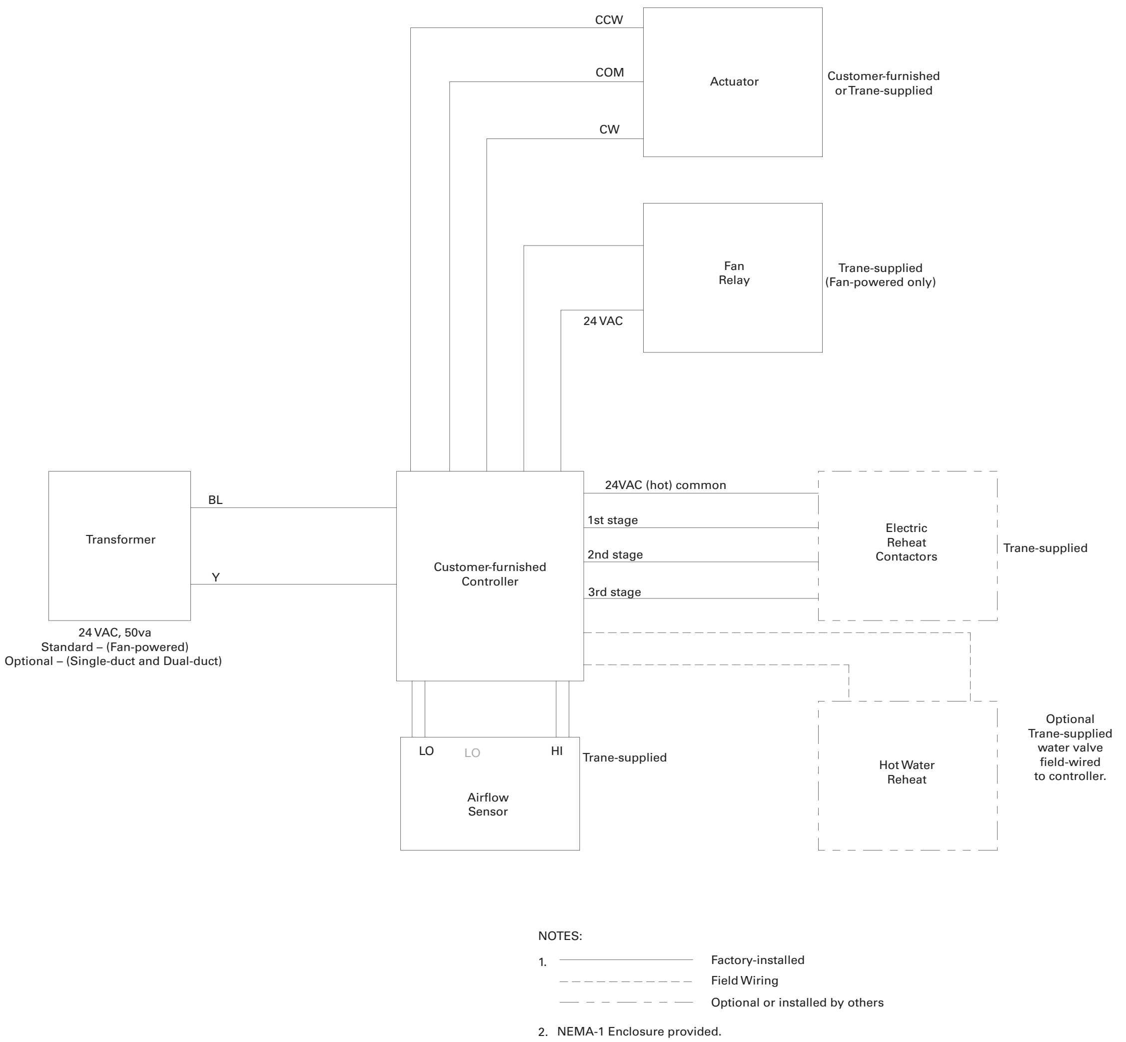
5. Only available with dual-duct units.

Available on all VariTrane Units

FM00 – Customer-supplied actuator and DDC controller factory-installed.

FM01 – Trane actuator and customer-supplied DDC controller factory-installed

All customer furnished controllers and actuators are installed and wired per control manufacturer's specifications. Metal control enclosure is standard.



Tracer™ UC400 and UC210 Programmable BACnet Controllers

Introduction

The Tracer UC400 and UC210 controllers are programmable general purpose BACnet, microprocessor-based, Direct Digital Controllers (DDC). When factory installed on Trane (Variable Air Volume) VAV terminal units, it is factory downloaded with appropriate VAV programs and configuration settings. Trane VAV units have been made with either pneumatic, analog electronic, or microprocessor controls (DDC VAV).

The Tracer UC400 or UC210 controller can be configured from the factory with three different application programs: Space Temperature Control (STC), Ventilation Flow Control (VFC), and Flow Tracking Control (FTC).

The Tracer UC400 or UC210 controller programmed for STC modulates a VAV's damper blade based on a zone temperature, measured airflow, and setpoints to continuously control conditioned air delivery to the space. The volume of incoming air is monitored and the damper adjusts to provide accurate control independent of the duct pressure. The damper modulates between operator setpoints depending on space conditions. Additionally, fan and heat outputs may be energized depending on the application.

The Tracer UC400 or UC210 controller configured for VFC can be applied to a VAV terminal and used to temper cold outdoor air (OA) that is brought into a building for ventilation purposes. The tempered air is intended to supply an air-handling unit (AHU), which provides comfort control to the zones it is serving. The VAV terminal supplies the correct amount of ventilation air, and when reheat is added, tempers the ventilation air to reduce the load on the air handler by sensing the discharge air temperature of the VAV unit and controlling its long-term average to the discharge air temperature setpoint.

The Tracer UC400 or UC210 controller can be configured for FTC and has two VAV units with Tracer UC400 controllers working together to provide flow tracking control. One Tracer UC400 or UC210 controller is configured from the factory with the Space temperature program and the other is downloaded with the FTC program. The STC airflow output is bound to the flow tracking controller airflow setpoint input. The flow tracking controller adds the configured airflow tracking offset (positive or negative) to the airflow setpoint (communicated airflow setpoint) and controls the airflow to this setpoint.

The Tracer UC400 or UC210 controller is BTL compliant with BACnet, an open standard building automation protocol. It meets the Application Specific Controller (ASC) profile per ASHRAE 135-2004. This allows the Tracer UC400 or UC210 controller to integrate with other BACnet systems.

Available Inputs

Inputs include a twisted/shielded communication link, zone sensor, duct temperature sensors (optional), Occupancy Sensor (optional), Discharge Air Temperature (DAT) and/or Supply Air Temperature (SAT), CO2 sensor, and 24 VAC power. In addition to the points used for the VAV application, the spare inputs and outputs on the Tracer UC400 or UC210 controller may be used for ancillary control, which can be programmed using Tracer TU Tracer Graphical Programming 2 (TGP2).

Note: *For more information on using spare points, see BAS-SVX20*-EN Tracer UC400 Programmable Controller Installation, Operation, and Maintenance.*

General Features and Benefits

Assured Accuracy

- Proportional-plus-integral control loop algorithm for determining required airflow needed to control room temperature. Airflow is limited by active minimum and maximum airflow setpoints.

- Pressure-independent (PI) operation that automatically adjusts valve position to maintain required airflow. In certain low-flow situations or in cases where the flow measurement has failed, the DDC controller will operate in a pressure-dependent (PD) mode of operation.
- When combined with the patented Trane Flow ring and pressure transducer, flow is repeatable to +/- 5% accuracy across the Pressure Independent (PI) flow range. (See Valve/Controller Airflow Guidelines section).
- Improved 2-Point Air Balancing is available – Assures optimized flow-sensing accuracy across the operating range. This provides a more accurate airflow balancing method when compared to typical single-point flow correction air balancing.
- Analog input resolution of +/- 1/8°F within the comfort range maximizes zone temperature control yielding excellent comfort control.

Reliable Operation

- Built for life – Trane products are designed to stand the test of time, with a proven design life that exceeds 20 years.
- Fully factory tested – fully screened and configured at the factory. All features are tested including fan and reheat stage energization, air valve modulation, and controller inputs and outputs.

Safe Operation

- All components, including the controller, pressure transducer, transformer, etc. are mounted in a NEMA 1 sheet metal enclosure and are tested as an assembly to UL1995 standards. The result is a rugged and safe VAV, controller, and thus, overall unit.
- When in PI-mode, EH is disabled when the sensed flow is below the minimum required.
- HW coil VAV units in ventilation flow control (VFC) have a Freeze protection algorithm to protect the water coil and the internal space from water damage. This is accomplished by driving the water valve to maximum position on alarm conditions.

System-Level Optimization

Trane controllers are designed to integrate into Tracer™ SC and leverage clear and clean unit-controller related data for system level control decisions. Integrating a Trane VV550 controller into a Tracer SC Control system provides the next step in building system control.

Specifically, system-level decisions on how to operate all components can be made. Energy efficient optimization strategies like Static Pressure Optimization, Ventilation Reset, and CO_2 Demand-controlled Ventilation can be employed with the simple press of a button. The end-result is the most efficient and reliable building control system available.

Simplified Installation

Factory Commissioned Quality – All Trane DDC VAV controllers are factory-commissioned. This means that the DDC boards are powered and run-tested with your specific sequence parameters. They are connected to a communication link to make sure that information and diagnostic data function properly. Before any VariTrane VAV unit ships they must pass a rigorous quality control procedure. You can be assured that a Trane VAV unit with Trane DDC VAV controls will work right out of the crate.

Zone sensor air balance – When applied to a Trane zone sensor with thumbwheel and on/cancel buttons, a balancing contractor can drive the primary air valve to maximum or minimum airflow from the sensor to determine the point of calibration to be used (maximum will result in optimum performance). The flow reading can then be calibrated from the sensor, without the use of additional service tools. (Non-LCD versions)

Tenant-Finish Heat Mode – In some office projects, the building is being constructed as tenants are being identified. Tenant-finish heat mode is designed for applications when a given floor has not been occupied. The main AHU system is used for heat and because the internal furnishings are not complete, the sensors have not been installed. In this case, the primary valve drives open using the heat of the main AHU to keep plumbing lines from freezing. When available, the operation of the VAV unit fan (series or parallel) remains unaffected.

Controller Flexibility

- 24 VAC binary input that can be configured as a generic input or as occupancy input. When the DDC controller is operating with Tracer™ SC, the status of the input is provided to Tracer SC for its action. In stand-alone operation and when configured for an occupancy input, the input will control occupancy status of the DDC controller.
- Auxiliary temperature analog input configured for an auxiliary temperature sensor. The value of the input is used as status-only by Tracer SC if Tracer SC is providing a supply air temperature to the DDC controller. Otherwise, the input will be used for determining heating/cooling control action of the VAV unit. When the auxiliary temperature sensor is located in the discharge of the unit, and attached to a Trane Tracer™ SC BAS, additional test sequencing and reporting is available to maximize VAV system capabilities and simplify system commissioning.
- Dual-duct support with two DDC controllers. One DDC controller controls the cooling air valve and the other controller controls the heating air valve. With constant-volume sequences, the discharge air volume is held constant by controlling discharge air volume with the heating Controller.
- Tracer™ UC400 Programmable BACnet Controller certified performance ensures that a Trane VAV with controller will provide state-of-the-art, consistent open communication protocol for integration with the industry's latest (Non-Trane) building automation control systems, including Johnson Control, Andover, Siemans, Honeywell, etc.
- CO_2 demand controlled ventilation enables a HVAC system to adjust ventilation flow based on critical zone, average CO_2 of specified zones, etc. Trane demand controlled ventilation strategies are pre-defined for simplified application and can be easily customized to meet the needs of a specific system.

Trane DDC VAV Controller Logic

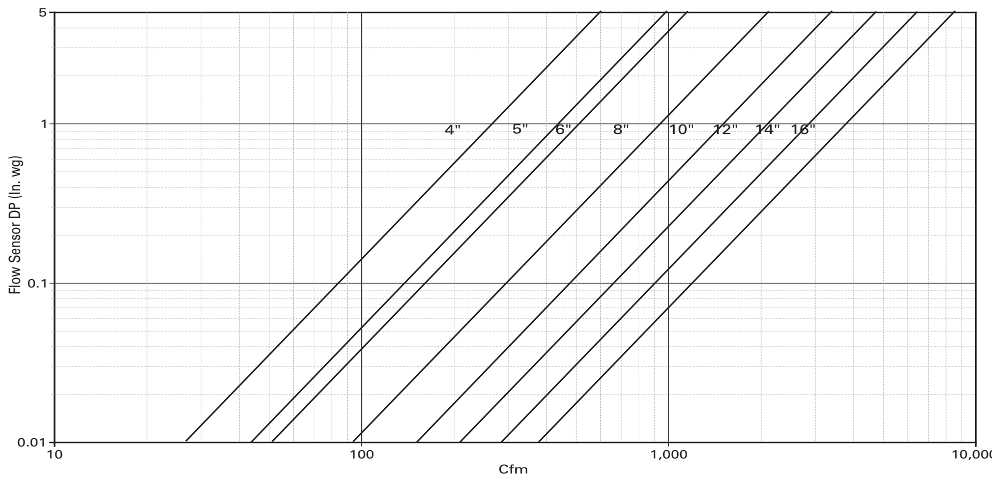
Control Logic

Direct Digital Control (DDC) controllers are today's industry standard. DDC controllers share system-level data to optimize system performance (including changing ventilation requirements, system static pressures, supply air temperatures, etc.). Variables available via a simple twisted-shielded wire pair include occupied/unoccupied status, minimum and maximum airflow setpoints, zone temperature and temperature setpoints, air valve position, airflow cfm, fan status (on or off), fan operation mode (parallel or series), reheat status (on or off), VAV unit type, air valve size, temperature correction offsets, flow correction values, ventilation fraction, etc.

With the advent of Tracer UC400 open protocol, the most reliable VAV controller is now available for ANY system. Gone are the days of being locked into a single supplier. Trane DDC controllers provide Trane-designed solid-state electronics intended specifically for VAV applications including:

3. Space Temperature Control
4. Ventilation Flow Control (100% outside air applications)
5. Flow Tracking Space Pressurization Control (New feature)

Figure 7. Flow sensor single vs. airflow delivery



Note: Flow sensor DP (in. wg) is measured at the flow ring to aid in system balancing and commissioning. See "Valve/Controller Airflow Guidelines" in each section for unit performance.

Space Temperature Control

Space temperature control applications are where Trane emerged as an industry leader in quality and reliability. This did not occur overnight and has continued to improve as our controller and control logic has improved over time. STC employs controller logic designed to modulate the supply airstream and associated reheat (either local or remote) to exactly match the load requirements of the space.

Additionally, minimum and maximum airflow and specific controller sequence requirements are pre-programmed to ensure that appropriate ventilation standards are consistently maintained. When connected to a Trane Tracer™ SC, trend logging, remote alarming, etc. are available to fully utilize the power and capabilities of your systems.

General Operation-Cooling

In cooling control action, the DDC controller matches primary airflow to cooling load. The DDC controller will automatically change over to heating control action if the supply air temperature is above a configured/editable setpoint. When the supply air temperature is less than 10 degrees below this setpoint, the controller will automatically switch to cooling control action. The DDC controller first chooses the Tracer SC -provided supply air temperature value to use for auto changeover. If this is not available, it uses the temperature provided by the optional auxiliary temperature sensor (must be installed for inlet temperature monitoring). If this is also not available, it uses the heating/cooling mode assigned by Tracer Building Automation System or the DDC controller's service tool.

General Operation-Reheat

In heating control action, the DDC controller matches primary airflow to heating load. The DDC controller will automatically change over to heating control action if the supply air temperature is above a configured/editable setpoint. When the supply air temperature is less than 10 degrees below this setpoint, the controller will automatically switch to cooling control action. The DDC controller first chooses the Tracer SC -provided supply air temperature value to use for auto changeover. If this is not available, it uses the temperature provided by the optional auxiliary temperature sensor (must be installed for inlet temperature monitoring). If this is also not available, it uses the heating/cooling mode assigned by Tracer SC or the DDC controller's service tool.

When heat is added to the primary air, the air is considered reheated. Reheat can be either **local** (integral to the VAV unit in the form of an electric coil or hot water coil) or **remote** (typically existing wall fin radiation, convector, etc.) or any combination of local and remote. The operating characteristics of the four basic types of VariTrane DDC terminal reheat are discussed.

Fan-Powered Terminal Units: On/Off Hot Water Reheat

One or two stages of on/off hot water reheat are available. Two position water valves complete the HW reheat system and are either fully opened or fully closed. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, the fan is energized upon a call for heating or cooling and de-energized when unoccupied zone set point is satisfied.

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the zone temperature is 1°F (0.56°C) or more below the active heating setpoint, and de-energizes when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-Powered Terminal Units: Proportional Hot Water Reheat

Proportional hot water reheat uses 3-wire floating-point-actuator technology. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5ºF (0.28ºC).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, the fan is energized upon a call for heating or cooling and de-energized when unoccupied zone setpoint is satisfied.

The water valve opens as space temperature drops below the heating setpoint. A separate reheat proportional-plus-integral control loop from that controlling airflow into the room is enforced. The degree to which the hot water valve opens is dependent on both the degree that the space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already closed, the water valve fully closes when the zone temperature rises above the active heating setpoint by 0.5 °F (0.28 °C). When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-powered Terminal Units: On/Off Electric Reheat

One or two stages of staged electric reheat are available. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, the fan is energized upon a call for heating or cooling and de-energized when unoccupied zone set point is satisfied.

Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the space temperature is 1.0°F (0.56°C) or more below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-powered Terminal Units: Pulse-Width Modulation of Electric Heat

One or two stages of pulse-width modulation of electric heat are available. Energizing for a portion of a three-minute time period modulates the electric heater. This allows exact load matching for energy efficient operation and optimum zone temperature control. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, fan is energized upon a call for heating or cooling and de-energized when unoccupied zone set point is satisfied.

The amount of reheat supplied is dependent on both the degree that the space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already off, reheat de-energizes when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. The Stage 1 "on" time is proportional to the amount of reheat required. For example, when 50% of stage 1 capacity is required, reheat is on for 90 seconds and off for 90 seconds. When 75% of stage 1 capacity is required, reheat is on for 135 seconds and off for 45 seconds. When 100% of stage 1 capacity is required, reheat is on continuously.

Stage 2 uses the same "on" time logic as stage 1 listed above, except stage 1 is always energized. For example, when 75% of unit capacity is required, stage 1 is energized continuously, and stage 2 is on for 90 seconds and off for 90 seconds. When reheat is de-energized, the cooling minimum airflow setpoint is activated. When reheat is de-energized, the cooling minimum airflow setpoint it activated.

Ventilation Control

Ventilation control enhances the usability of Trane DDC controllers in more select applications that require measurement of outside air (ventilation). Ventilation control is designed for use with constant volume single-duct VAV units which modulate the primary damper and associated reheat to maintain an average constant discharge air temperature. The reheat is modulated to provide discharge air temperature consistent with AHU supply air temperature (typically 50°–60°F). This is critical to ensure that ASHRAE Standard 62 Ventilation standards are attained, consistently maintained, and monitored. When connected to a Trane Building Automation System, trend logging, remote alarming, etc. is available. In fact, the Trane Tracer SC control system can provide unmatched "peace of mind" by calling/paging the appropriate person(s) when specific alarms occur.

Flow Tracking Control

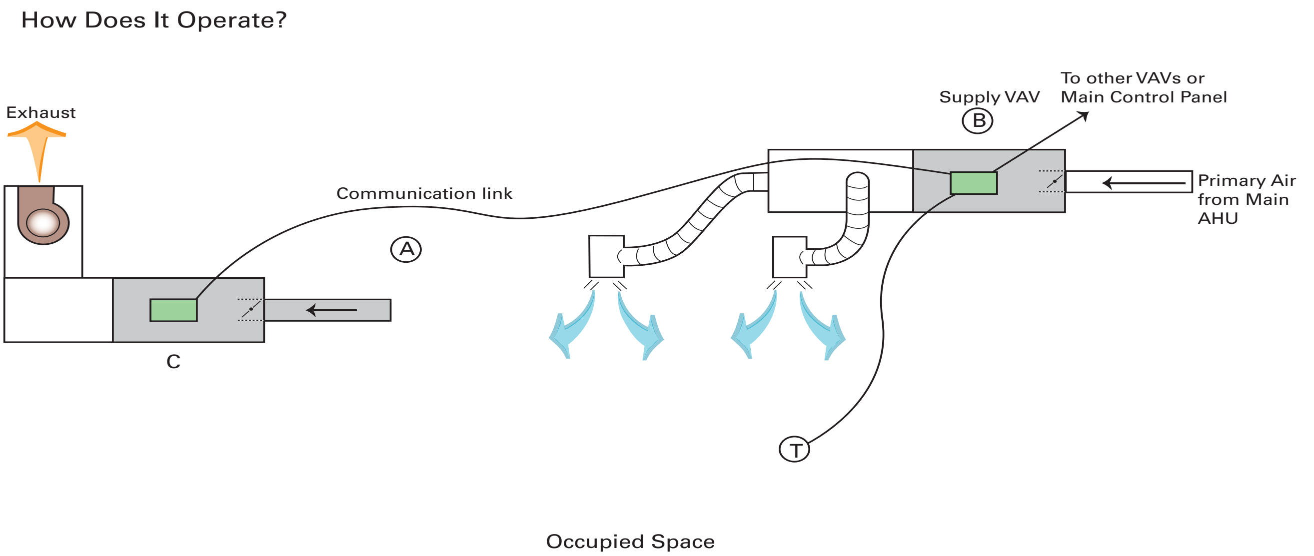
This enhanced VAV DDC controller feature allows two Trane VV550 controllers to coordinate modulation simultaneously. This allows a specific CFM offset to be maintained. The CFM offset provides pressurization control of an occupied space, while maintaining the comfort and energy savings of a VAV system. A flow tracking system in a given zone consists of a standard Space Comfort Control VAV (see B)unit plus a single-duct, cooling-only, exhaust VAV unit (see C). As the supply VAV unit modulates the supply airflow through the air valve to maintain space comfort, the exhaust box modulates a similar amount to maintain the required CFM differential. This is a simple, reliable means of pressurization control, which meets the requirements of the majority of zone pressurization control applications. Typical applications include:

- School and University laboratories
- Industrial laboratories

- Hospital operating rooms
- Hospital patient rooms
- Research and Development facilities
- And many more...

The CFM offset is assured and can be monitored and documented when connected to a Trane Tracer™ SC Building Automation System. Flow Tracking Control is designed to meet most pressurization control projects. If an application calls for pressure control other than flow tracking, contact your local Trane Sales Office for technical support.

Figure 8. How does it operate?



Tracer™ Programmable BACnet Controller — Unit Control Module

The Tracer UC400 direct digital controller Unit Control Module (DDC-UCM) is a microprocessor-based terminal unit with non-volatile memory which provides accurate airflow and room temperature control of Trane and non-Trane VAV air terminal units. Tracer UC400 provides a simple open protocol to allow integration of Trane VAV units and controls into other existing control systems. The UCM can operate in pressure-independent or pressure-dependent mode and uses a proportional plus integral control algorithm.

The controller monitors zone temperature setpoints, zone temperature and its rate of change and valve airflow (via flow ring differential pressure). The controller also accepts an auxiliary duct temperature sensor input or a supply air temperature value from Tracer SC. Staged electric heat, pulse width modulated electric heat, proportional hot water heat or on/off hot water heat control are provided when required. The control board operates using 24-VAC power. The Tracer UC400 is also a member of the Trane Integrated Comfort™ systems (ICS) family of products. When used with a Trane Tracer™ SC or other Trane controllers, zone grouping and unit diagnostic information can be obtained. Also part of ICS is the factory-commissioning of parameters specified by the engineer (see "Factory-Installed vs. Factory-Commissioned" in the Features and Benefits section for more details).

Specifications

Supply Voltage

24 VAC, 50/60 Hz

Maximum VA Load

No Heat or Fan

8 VA (Board, Transducer, Zone Sensor, and Actuator)

Note: *If using field-installed heat, 24 VAC transformer should be sized for additional load.*

Output Ratings

Actuator Output:24 VAC at 12 VA
1st Stage Reheat:24 VAC at 12 VA
2nd Stage Reheat:24 VAC at 12 VA
3rd Stage Reheat:24 VAC at 12 VA

Binary Input

24 VAC, occupancy or generic.

Auxiliary Input

Can be configured for discharge or primary air temperature sensor.

Operating Environment

32 to 140°F, (0 to 60°C)
5% to 95% RH, Non-condensing

Storage Environment

-40 to 180°F (-40 to 82.2°C),
5% to 95%RH, Non-Condensing

Physical Dimensions

Width: 5.5" (139.7 mm)
Length: 4.5" (69.85 mm)
Height: 2.0" (44.45 mm)

Connections

1/4" (6.35 mm) Stab Connections

Communications

Tracer UC400– Space Comfort Control (SCC) profile with FTT-10 transceiver.

22 awg. unshielded level 4 communication wire.

Fan Control

Series fan: On unless unoccupied and min. flow has been released.
Parallel fan: On when zone temperature is less than heating setpoint plus fan offset. Off when zone temperature is more than heating setpoint plus fan offset plus 0.5°F (0.28°C).

Heat Staging

Staged electric or hot water proportional or pulse-width modulation

Trane LonMark DDC VAV Controller

Introduction

This LonMark™ certified controller uses the Space Comfort Controller (SCC) profile to exchange information over a LonTalk™ network. Networks with LonMark certified controllers provide the latest open protocol technology. Being LonMark certified guarantees that owners and end-users have the capability of adding Trane products to other "open" systems and relieves owners of the pressure and expense of being locked into a single DDC supplier. The Trane VV550 VAV controller with VariTrane VAV units can be applied to more than just Trane systems. When a customer buys a Trane VAV unit with Trane DDC controller, they take advantage of:

- Factory-commissioned quality
- Knowing they have selected the most reliable VAV controllers in the industry
- Trane as a single source to solve any VAV equipment, or system-related issues
- The most educated and thorough factory service technicians in the controls industry
- Over 150 local parts centers throughout North America that can provide what you need, when you need it.

Don't let your existing controls supplier lock you out of the most recognized name in VAV system control in the industry. Specify Trane open-protocol systems.

What are the new features of this controller? Read on to find out more.

General Features and Benefits

Assured Accuracy

- Proportional-plus-integral control loop algorithm for determining required airflow needed to control room temperature. Airflow is limited by active minimum and maximum airflow setpoints.
- Pressure-independent (PI) operation that automatically adjusts valve position to maintain required airflow. In certain low-flow situations or in cases where the flow measurement has failed, the DDC controller will operate in a pressure-dependent (PD) mode of operation.
- When combined with the patented Trane Flow ring and pressure transducer, flow is repeatable to +/- 5% accuracy across the Pressure Independent (PI) flow range. (See Valve/Controller Airflow Guidelines section).
- Improved 2-Point Air Balancing is available – Assures optimized flow-sensing accuracy across the operating range. This provides a more accurate airflow balancing method when compared to typical single-point flow correction air balancing.
- Analog input resolution of +/- 1/8°F within the comfort range maximizes zone temperature control yielding excellent comfort control.

Reliable Operation

- Built for life – Trane products are designed to stand the test of time, with a proven design life that exceeds 20 years.
- Fully factory tested – fully screened and configured at the factory. All features are tested including fan and reheat stage energization, air valve modulation, and controller inputs and outputs.

Safe Operation

- All components, including the controller, pressure transducer, transformer, etc. are mounted in a NEMA 1 sheet metal enclosure and are tested as an assembly to UL1995 standards. The result is a rugged and safe VAV, controller, and thus, overall unit.

- When in PI-mode, EH is disabled when the sensed flow is below the minimum required.
- HW coil VAV units in ventilation flow control (VFC) have a Freeze protection algorithm to protect the water coil and the internal space from water damage. This is accomplished by driving the water valve to maximum position on alarm conditions.

System-Level Optimization

Trane controllers are designed to integrate into Trane Tracer Building Automation Systems and leverage clear and clean unit-controller related data for system level control decisions. Integrating a Trane VV550 controller into a Tracer Control System provides the next step in building system control.

Specifically, system-level decisions on how to operate all components can be made. Energy efficient optimization strategies like Static Pressure Optimization, Ventilation Reset, and CO_2 Demand-controlled Ventilation can be employed with the simple press of a button. The end-result is the most efficient and reliable building control system available.

Simplified Installation

Factory Commissioned Quality – All Trane DDC VAV controllers are factory-commissioned. This means that the DDC boards are powered and run-tested with your specific sequence parameters. They are connected to a communication link to make sure that information and diagnostic data function properly. Before any VariTrane VAV unit ships they must pass a rigorous quality control procedure. You can be assured that a Trane VAV unit with Trane DDC VAV controls will work right out of the crate.

Zone sensor air balance – When applied to a Trane zone sensor with thumbwheel and on/cancel buttons, a balancing contractor can drive the primary air valve to maximum or minimum airflow from the sensor to determine the point of calibration to be used (maximum will result in optimum performance). The flow reading can then be calibrated from the sensor, without the use of additional service tools. (Non-LCD versions)

Tenant-Finish Heat Mode – In some office projects, the building is being constructed as tenants are being identified. Tenant-finish heat mode is designed for applications when a given floor has not been occupied. The main AHU system is used for heat and because the internal furnishings are not complete, the sensors have not been installed. In this case, the primary valve drives open using the heat of the main AHU to keep plumbing lines from freezing. When available, the operation of the VAV unit fan (series or parallel) remains unaffected.

Controller Flexibility

- 24 VAC binary input that can be configured as a generic input or as occupancy input. When the DDC controller is operating with Tracer SC, the status of the input is provided to Tracer for its action. In stand-alone operation and when configured for an occupancy input, the input will control occupancy status of the DDC controller.
- Auxiliary temperature analog input configured for an auxiliary temperature sensor. The value of the input is used as status-only by Tracer SC if Tracer SC is providing a supply air temperature to the DDC controller. Otherwise, the input will be used for determining heating/cooling control action of the VAV unit. When the auxiliary temperature sensor is located in the discharge of the unit, and attached to a Trane Tracer Building Automation System, additional test sequencing and reporting is available to maximize VAV system capabilities and simplify system commissioning.
- Dual-duct support with two DDC controllers. One DDC controller controls the cooling air valve and the other controller controls the heating air valve. With constant-volume sequences, the discharge air volume is held constant by controlling discharge air volume with the heating Controller.
- LonMark certified performance ensures that a Trane VAV with controller will provide state-of-the-art, consistent open communication protocol for integration with the industry's latest (Non-

Trane) building automation control systems, including Johnson Control, Andover, Siemans, Honeywell, etc.

- CO_2 demand controlled ventilation enables a HVAC system to adjust ventilation flow based on critical zone, average CO_2 of specified zones, etc. Trane demand controlled ventilation strategies are pre-defined for simplified application and can be easily customized to meet the needs of a specific system.

Trane DDC VAV Controller Logic

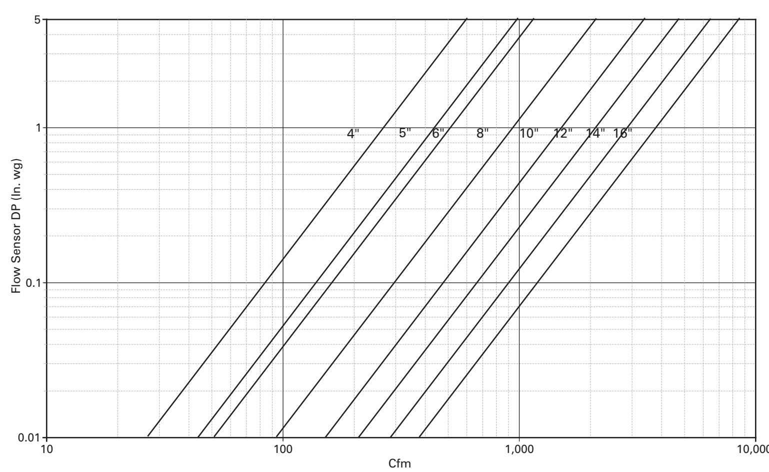
Control Logic

Direct Digital Control (DDC) controllers are today's industry standard. DDC controllers share system-level data to optimize system performance (including changing ventilation requirements, system static pressures, supply air temperatures, etc.). Variables available via a simple twisted-shielded wire pair include occupied/unoccupied status, minimum and maximum airflow setpoints, zone temperature and temperature setpoints, air valve position, airflow cfm, fan status (on or off), fan operation mode (parallel or series), reheat status (on or off), VAV unit type, air valve size, temperature correction offsets, flow correction values, ventilation fraction, etc.

With the advent of LonMark open protocol, the most reliable VAV controller is now available for ANY system. Gone are the days of being locked into a single supplier. Trane DDC controllers provide Trane-designed solid-state electronics intended specifically for VAV applications including:

1. Space Temperature Control
2. Ventilation Flow Control (100% outside air applications)
6. Flow Tracking Space Pressurization Control (New feature)

Figure 9. Flow sensor single vs. airflow delivery



Note: Flow sensor DP (in. wg) is measured at the flow ring to aid in system balancing and commissioning. See "Valve/Controller Airflow Guidelines" in each section for unit performance.

Space Temperature Control

Space temperature control applications are where Trane emerged as an industry leader in quality and reliability. This did not occur overnight and has continued to improve as our controller and control logic has improved over time. STC employs controller logic designed to modulate the supply airstream and associated reheat (either local or remote) to exactly match the load requirements of the space.

Additionally, minimum and maximum airflow and specific controller sequence requirements are pre-programmed to ensure that appropriate ventilation standards are consistently maintained.

When connected to a Trane Tracer Building Automation System, trend logging, remote alarming, etc. are available to fully utilize the power and capabilities of your systems.

General Operation-Cooling

In cooling control action, the DDC controller matches primary airflow to cooling load. The DDC controller will automatically change over to heating control action if the supply air temperature is above a configured/editable setpoint. When the supply air temperature is less than 10 degrees below this setpoint, the controller will automatically switch to cooling control action. The DDC controller first chooses the Tracer™ SC -provided supply air temperature value to use for auto changeover. If this is not available, it uses the temperature provided by the optional auxiliary temperature sensor (must be installed for inlet temperature monitoring). If this is also not available, it uses the heating/cooling mode assigned by Tracer SC or the DDC controller's service tool.

General Operation-Reheat

In heating control action, the DDC controller matches primary airflow to heating load. The DDC controller will automatically change over to heating control action if the supply air temperature is above a configured/editable setpoint. When the supply air temperature is less than 10 degrees below this setpoint, the controller will automatically switch to cooling control action. The DDC controller first chooses the Tracer-provided supply air temperature value to use for auto changeover. If this is not available, it uses the temperature provided by the optional auxiliary temperature sensor (must be installed for inlet temperature monitoring). If this is also not available, it uses the heating/cooling mode assigned by Tracer SC or the DDC controller's service tool.

When heat is added to the primary air, the air is considered reheated. Reheat can be either **local** (integral to the VAV unit in the form of an electric coil or hot water coil) or **remote** (typically existing wall fin radiation, convector, etc.) or any combination of local and remote. The operating characteristics of the four basic types of VariTrane™ DDC terminal reheat are discussed.

Fan-Powered Terminal Units: On/Off Hot Water Reheat

One or two stages of on/off hot water reheat are available. Two position water valves complete the HW reheat system and are either fully opened or fully closed. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, the fan is energized upon a call for heating or cooling and de-energized when unoccupied zone set point is satisfied.

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the zone temperature is 1°F (0.56°C) or more below the active heating setpoint, and de-energizes when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-Powered Terminal Units: Proportional Hot Water Reheat

Proportional hot water reheat uses 3-wire floating-point-actuator technology. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, the fan is energized upon a call for heating or cooling and de-energized when unoccupied zone setpoint is satisfied.

The water valve opens as space temperature drops below the heating setpoint. A separate reheat proportional-plus-integral control loop from that controlling airflow into the room is enforced. The degree to which the hot water valve opens is dependent on both the degree that the space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already closed, the water valve fully closes when the zone temperature rises above the active heating setpoint by 0.5 °F (0.28 °C). When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-powered Terminal Units: On/Off Electric Reheat

One or two stages of staged electric reheat are available. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, the fan is energized upon a call for heating or cooling and de-energized when unoccupied zone set point is satisfied.

Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the space temperature is 1.0°F (0.56°C) or more below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Fan-powered Terminal Units: Pulse-Width Modulation of Electric Heat

One or two stages of pulse-width modulation of electric heat are available. Energizing for a portion of a three-minute time period modulates the electric heater. This allows exact load matching for energy efficient operation and optimum zone temperature control. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, fan is energized upon a call for heating or cooling and de-energized when unoccupied zone set point is satisfied.

The amount of reheat supplied is dependent on both the degree that the space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already off, reheat de-energizes when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. The Stage 1 “on” time is proportional to the amount of reheat required. For example, when 50% of stage 1 capacity is required, reheat is on for 90 seconds and off for 90 seconds. When 75% of stage 1 capacity is required, reheat is on for 135 seconds and off for 45 seconds. When 100% of stage 1 capacity is required, reheat is on continuously.

Stage 2 uses the same “on” time logic as stage 1 listed above, except stage 1 is always energized. For example, when 75% of unit capacity is required, stage 1 is energized continuously, and stage 2 is on for 90 seconds and off for 90 seconds. When reheat is de-energized, the cooling minimum airflow setpoint is activated. When reheat is de-energized, the cooling minimum airflow setpoint it activated.

Ventilation Control

Ventilation control enhances the usability of Trane DDC controllers in more select applications that require measurement of outside air (ventilation). Ventilation control is designed for use with constant volume single-duct VAV units which modulate the primary damper and associated reheat to maintain an average constant discharge air temperature. The reheat is modulated to provide discharge air temperature consistent with AHU supply air temperature (typically 50°–60°F). This is critical to ensure that ASHRAE Standard 62 Ventilation standards are attained, consistently maintained, and monitored. When connected to a Trane Building Automation System, trend logging, remote alarming, etc. is available. In fact, the Trane Tracer Control System can provide unmatched "peace of mind" by calling/paging the appropriate person(s) when specific alarms occur.

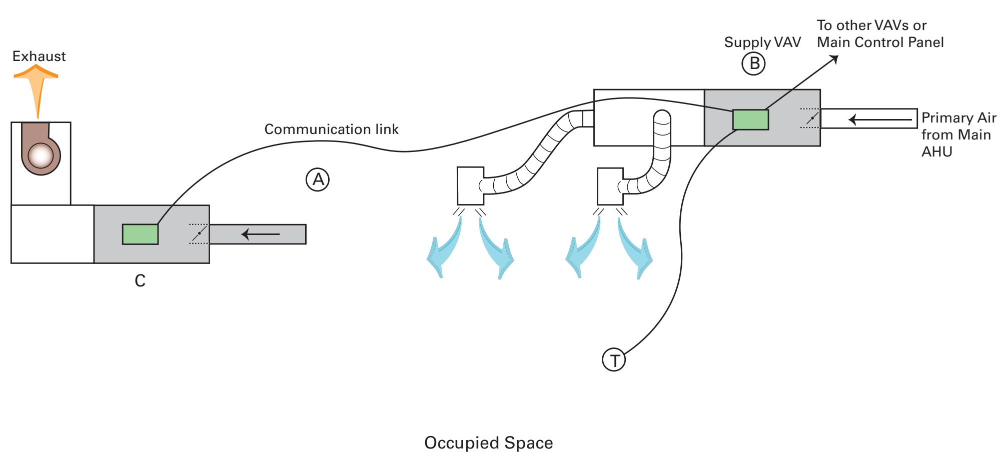
Flow Tracking Control

This enhanced VAV DDC controller feature allows two Trane VV550 controllers to coordinate modulation simultaneously. This allows a specific CFM offset to be maintained. The CFM offset provides pressurization control of an occupied space, while maintaining the comfort and energy savings of a VAV system. A flow tracking system in a given zone consists of a standard Space Comfort Control VAV (see B)unit plus a single-duct, cooling-only, exhaust VAV unit (see C). As the supply VAV unit modulates the supply airflow through the air valve to maintain space comfort, the exhaust box modulates a similar amount to maintain the required CFM differential. This is a simple, reliable means of pressurization control, which meets the requirements of the majority of zone pressurization control applications. Typical applications include:

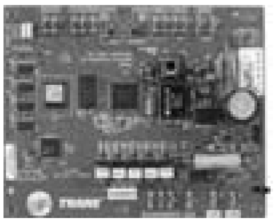
- School and University laboratories
- Industrial laboratories
- Hospital operating rooms
- Hospital patient rooms
- Research and Development facilities
- And many more...

The CFM offset is assured and can be monitored and documented when connected to a Trane Tracer Building Automation System. Flow Tracking Control is designed to meet most pressurization control projects. If an application calls for pressure control other than flow tracking, contact your local Trane Sales Office for technical support.

Figure 10. How does it operate?



LonMark™ Direct Digital Controller—Unit Control Module



The Trane LonMark direct digital controller Unit Control Module (DDC-UCM) is a microprocessor-based terminal unit with non-volatile memory which provides accurate airflow and room temperature control of Trane and non-Trane VAV air terminal units. LonMark provides a simple open protocol to allow integration of Trane VAV units and controls into other existing control systems. The UCM can operate in pressure-independent or pressure-dependent mode and uses a proportional plus integral control algorithm.

The controller monitors zone temperature setpoints, zone temperature and its rate of change and valve airflow (via flow ring differential pressure). The controller also accepts an auxiliary duct temperature sensor input or a supply air temperature value from Tracer™ SC. Staged electric heat, pulse width modulated electric heat, proportional hot water heat or on/off hot water heat control are provided when required. The control board operates using 24-VAC power. The Trane LonMark DDC-UCM is also a member of the Trane Integrated Comfort™ systems (ICS) family of products. When used with a Trane Tracer™ SC or other Trane controllers, zone grouping and unit diagnostic information can be obtained. Also part of ICS is the factory-commissioning of parameters specified by the engineer (see "Factory-Installed vs. Factory-Commissioned" in the Features and Benefits section for more details).

Note: *Trane LonMark DDC-UCM controllers can also take advantage of factory-commissioned quality on non-Trane systems through LonMark open protocol.*

Specifications

Supply Voltage

24 VAC, 50/60 Hz

Maximum VA Load

No Heat or Fan

8 VA (Board, Transducer, Zone Sensor, and Actuator)

Note: *If using field-installed heat, 24 VAC transformer should be sized for additional load.*

Output Ratings

Actuator Output:24 VAC at 12 VA
1st Stage Reheat:24 VAC at 12 VA
2nd Stage Reheat:24 VAC at 12 VA
3rd Stage Reheat:24 VAC at 12 VA

Binary Input

24 VAC, occupancy or generic.

Auxiliary Input

Can be configured for discharge or primary air temperature sensor.

Operating Environment

32 to 140°F, (0 to 60°C)
5% to 95% RH, Non-condensing

Storage Environment

-40 to 180°F (-40 to 82.2°C),
5% to 95%RH, Non-Condensing

Physical Dimensions

Width: 5.5" (139.7 mm)
Length: 4.5" (69.85 mm)
Height: 2.0" (44.45 mm)

Connections

1/4" (6.35 mm) Stab Connections

Communications

LonMark – Space Comfort Control (SCC) profile with FTT-10 transceiver.

22 awg. unshielded level 4 communication wire.

Fan Control

Series fan: On unless unoccupied and min. flow has been released.
Parallel fan: On when zone temperature is less than heating setpoint plus fan offset. Off when zone temperature is more than heating setpoint plus fan offset plus 0.5°F (0.28°C).

Heat Staging

Staged electric or hot water proportional or pulse-width modulation

Table 136. Input listing

Input description	Input	SNVT type
Space temperature	nviSpaceTemp	SNVT_temp_p
Setpoint	nviSetpoint	SNVT_temp_p
Occupancy, schedule	nviOccSchedule	SNVT_tod_event
Occupancy, manual command	nviOccManCmd	SNVT_occupancy
Occupancy sensor	nviOccSensor	SNVT_occupancy
Application mode	nviApplicMode	SNVT_hvac_mode
Heat/cool mode input	nviHeatCool	SNVT_hvac_mode
Fan speed command	nviFanSpeedCmd	SNVT_switch
Auxiliary heat enable	nviAuxHeatEnable	SNVT_switch
Valve override	nviValveOverride	SNVT_hvac_overid
Flow override	nviFlowOverride	SNVT_hvac_overid
Emergency override	nviEmergOverride	SNVT_hvac_emerg
Source temperature	nviSourceTemp	SNVT_temp_p
Space CO2	nviSpaceCO2	SNVT_ppm
Clear alarms/diagnostics	nviRequest[a]	SNVT_obj_request
Air flow setpoint input	nviAirFlowSetpt	SNVT_flow

(a) Part of the node object

Table 137. Output listing

Output description	Output	SNVT type
Space temperature	nvoSpaceTemp	SNVT_temp_p
Unit status, mode	nvoUnitStatus	SNVT_hvac_status
Effective setpoint	nvoEffectSetpt	SNVT_temp_p
Effective occupancy	nvoEffectOccup	SNVT_occupancy
Heat cool mode	nvoHeatCool	SNVT_hvac_mode
Setpoint	nvoSetpoint	SNVT_temp_p
Discharge air temperature	nvoDischAirTemp	SNVT_temp_p
Space CO2	nvoSpaceCO2	SNVT_ppm
Effective air flow setpoint	nvoEffectFlowSP	SNVT_flow
Air flow	nvoAirFlow	SNVT_flow
File table address	nvoFileDirectory[a]	SNVT_address
Object status	nvoStatus[a]	SNVT_obj_status
Alarm message	nvoAlarmMessage	SNVT_str_asc

(a) Part of the node object.

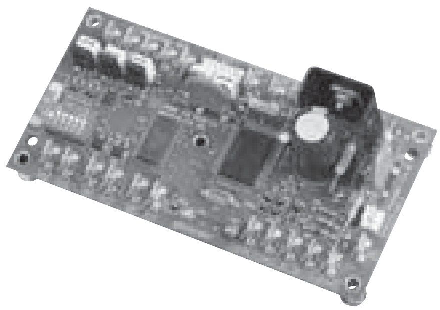
Table 136, p. 167 provides an input listing for Tracer VV550/551 VAV controllers, and Table 137, p. 168 provides an output listing for Tracer VV550/551 VAV controllers. Table 138, p. 168 provides the configuration properties for the controller. The content of the lists conforms to both the LonMark SCC functional profile 8500 and the LonMark node object.

Table 138. Configuration properties

Configuration property description	Configuration property	SNVT type	SCPT reference
Send heartbeat	nciSndHrtBt	SNVT_time_sec	SCPTmaxSendTime (49)
Occ temperature setpoints	nciSetpoints	SNVT_temp_setpt	SCPTsetPnts (60)
Minimum send time	nciMinOutTm	SNVT_time_sec	SCPTminSendTime (52)
Receive heartbeat	nciRecHrtBt	SNVT_time_sec	SCPTmaxRcvTime (48)
Location label	nciLocation	SNVT_str_asc	SCPTlocation (17)
Local bypass time	nciBypassTime	SNVT_time_min	SCPTbypassTime (34)
Manual override time	nciManualTime	SNVT_time_min	SCPTmanOverTime (35)
Space CO2 limit	nciSpaceCO2Lim	SNVT_ppm	SCPTlimitCO2 (42)
Nominal air flow	nciNomFlow	SNVT_flow	SCPTnomAirFlow (57)
Air flow measurement gain	nciFlowGain	SNVT_multiplier	SCPTsensConstVAV (67)
Minimum air flow	nciMinFlow	SNVT_flow	SCPTminFlow (54)
Maximum air flow	nciMaxFlow	SNVT_flow	SCPTmaxFlow (51)
Minimum air flow for heat	nciMinFlowHeat	SNVT_flow	SCPTminFlowHeat (55)
Maximum air flow for heat	nciMaxFlowHeat	SNVT_flow	SCPTmaxFlowHeat (37)
Minimum flow for standby	nciMinFlowStdby	SNVT_flow	SCPTminFlowStby (56)
Firmware major version	nciDevMajVer[a]	n/a	SCPTdevMajVer (165)
Firmware minor version	nciDevMinVer[a]	n/a	SCPTdevMinVer (166)
Flow offset for tracking applications	nciFlowOffset	SNVT_flow_f	SCPToffsetFlow (265)
Local heating minimum air flow	nciMinFlowUnitHt	SNVT_flow	SCPTminFlowUnitHeat (270)
Minimum flow for standby heat	nciMnFlowStbyHt	SVNT_flow	SCPTminFlowStbyHeat(263)

(a) Part of the node object.

Direct Digital Controller—Unit Control Module



The Trane direct digital controller Unit Control Module (DDC-UCM) is a microprocessor-based terminal unit with non-volatile memory which provides accurate airflow and room temperature control of Trane VAV air terminal units. The UCM can operate in a pressure-independent or a pressure-dependent mode and uses a proportional plus integral control algorithm. The controller monitors zone temperature setpoints, zone temperature and its rate of change and valve airflow (via flow ring differential pressure).

The controller also accepts an auxiliary duct temperature sensor input or a supply air temperature value from Tracer™ SC. Staged electric heat, pulse width modulated electric heat, proportional hot water heat or on/off hot water heat control are provided when required. The control board operates using 24-VAC power. The Trane DDC-UCM is a member of the Trane Integrated Comfort™ systems (ICS) family of products. When used with a Trane Tracer Building Automation System or other Trane controllers, zone grouping and unit diagnostic information can be obtained. Also part of ICS is the factory-commissioning of parameters specified by the engineer (see "Factory-Installed vs. Factory-Commissioned" in the Features and Benefits section for more details).

Specifications

Supply Voltage

24 VAC, 50/60 Hz

Maximum VA Load No Heat or Fan

12 VA (Board, Transducer, Zone Sensor, and Actuator)

Note: *If using field-installed heat, 24 VAC transformer should be sized for additional load.*

Output Ratings

Actuator Output: 24 VAC at 12 VA
1st Stage Reheat: 24 VAC at 12 VA
2nd Stage Reheat: 24 VAC at 12 VA
3rd Stage Reheat: 24 VAC at 12 VA

Binary Input

24 VAC

Auxiliary Input

Can be configured for an optional 2–10 VDC CO_2 sensor, or auxiliary temperature sensor.

Operating Environment:

32 to 140°F, (0 to 60°C)
5% to 95% RH, Non-condensing

Storage Environment

-40 to 180°F (-40 to 82.2°C),
5% to 95%RH, Non-Condensing

Physical Dimensions

Width: 5.5" (139.7 mm)
Length: 2.8" (69.85 mm)
Height: 1.8" (44.45 mm)

Connections

1/4" (6.35 mm) Stab Connections

Communications

RS-485; Stranded wire, twisted pair, shielded, copper conductor only, 18–20 awg

Fan Control

- Series fan: On unless unoccupied and min. flow has been released.
- Parallel fan: On when zone temperature is less than heating setpoint plus fan offset. Off when zone temperature is more than heating setpoint plus fan offset plus 0.5°F (0.28°C).

Heat Staging

Staged electric or hot water proportional or pulse-width modulation

Wireless Comm Interface (WCI)

WCI controller

The Trane® Wireless Comm Interface (WCI) enables wireless communication between system controls, unit controls, and wireless sensors for the new generation of Trane control products. The WCI replaces the need for communication wire in all system applications.

Note: *See BAS-SVX40A-EN, Installation, Operation and Maintenance, Wireless Comm for more information.*

Quantity of WCIs per Network. Each Trane wireless network can have a total of 31 WCIs (30 member WCIs plus 1 coordinator WCI). Each network requires one WCI to function as network coordinator.

Quantity of Networks per Tracer SC. A Tracer SC can support up to 8 wireless networks.

Automatic Network Formation. When a WCI is connected to a Tracer SC, it is auto-assigned as the coordinator. To enable the coordinator, Tracer SC must be configured for wireless communication. The coordinator WCI opens the network to allow all WCIs having matching addresses to automatically join the network.

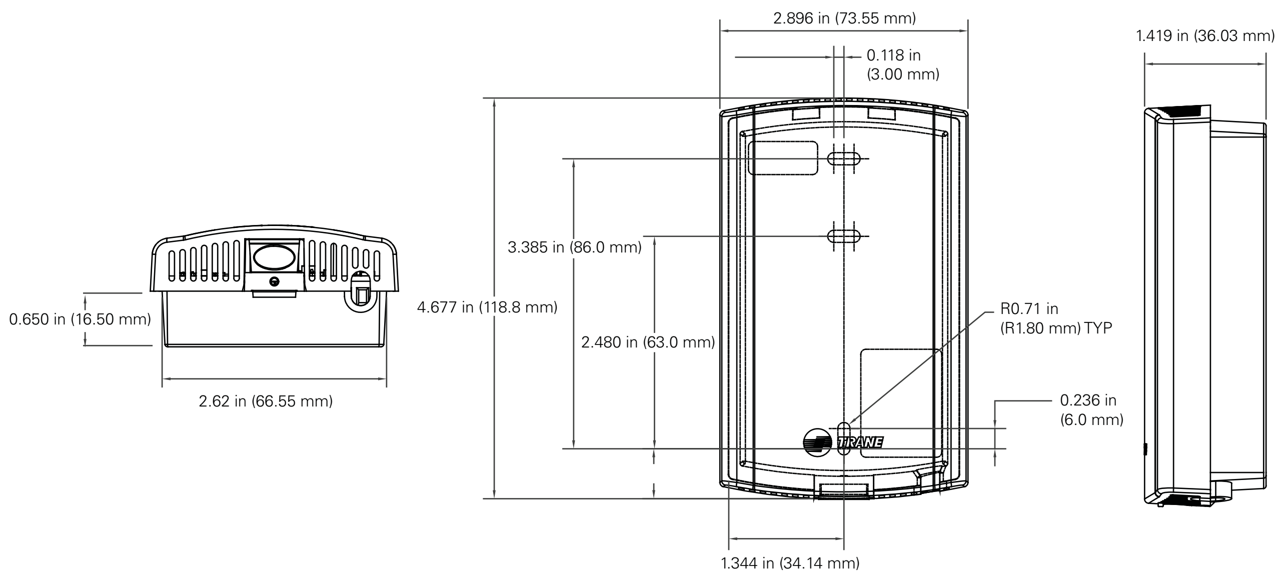
If no Tracer SC is present, a centrally located WCI must be designated to act as the coordinator. You can manually set the coordinator WCI so all WCIs having matching addresses automatically join the network.

Wireless Zone Sensors. The WCI also communicates with Trane wireless zone sensors, eliminating the need for analog receivers.

Wired Zone Sensors.

Systems using Wireless Comm can also use wired zone sensors.

Dimensions



Specifications

Operating Temperature

-40 to 158°F (-40 to 70°C)

Storage temperature

-40 to 185°F (-40 to 85°C)

Storage and operating humidity range

5% to 95% relative humidity (RH), non-condensing

Voltage

24 Vac/Vdc nominal ± 10%. If using 24 Vac, polarity must be maintained.

Receiver power consumption

<2.5 VA

Housing material

Polycarbonate/ABS (suitable for plenum mounting), UV protected, UL 94: 5 VA flammability rating

Mounting

3.2 in (83 mm) with 2 supplied mounting screws

Range

Open range: 2,500 ft (762 m) with packet error rate of 2%

Indoor: Typical range is 200 ft (61 mm); actual range is dependent on the environment. See BAS-SVX55 for more detail.

Note: *Range values are estimated transmission distances for satisfactory operation. Actual distance is job specific and must be determined during site evaluation. Placement of WCI is critical to proper system operation. In most general office space installations, distance is* *not the limiting factor for proper signal quality. Signal quality is ffected by walls, barriers, and general clutter. For more information os available at http://www.trane.com.*

Output power

North America: 100 mW

Radio frequency

2.4 GHz (IEEE Std 802.15.4-2003 compliant) (2405–2480 MHz, 5 MHz spacing)

Radio channels

16

Address range

Group 0–8, Network 1–9

Mounting

Fits a standard 2 in. by 4 in. junction box (vertical mount only). Mounting holes are spaced 3.2 in. (83 mm) apart on vertical center line. Includes mounting screws for junction box or wall anchors for sheet-rock walls. Overall dimensions: 2.9 in. (74 mm) by 4.7 in. (119 mm)

Wireless protocol

ZigBee PRO—ZigBee Building Automation Profile, ANSI/ASHRAE Standard 135-2008 Addendum q (BACnet™ /ZigBee)

Wireless Receiver/Wireless Zone Sensor

The wireless zone sensor system eliminates the wiring problems associated with VAV temperature sensors. It provides the flexibility to move zone sensors after the occupants have revised the space floor plan layout. The zone sensor houses the space temperature sensor, local setpoint adjustment thumbwheel, OCCUPIED/UNOCCUPIED button, battery life, signal strength indicators, and spread spectrum transmitter.

The spread spectrum receiver/translator can be field or factory installed and functions as a communication translator between spread spectrum radio communications and the VAV communications link.

Specifications

Power Requirements

Receiver: 24 V nominal AC/DC ± 10% < 1VA

Zone Sensor: (2) AA lithium batteries

Sensor Operating Environments

32 to 122°F, (0 to 50°C); 5 to 95%RH, Non-condensing

Receiver Operating Environments

-40 to 158°F, (-40 to 70°C); 5 to 95%RH, Non-condensing

Storage Environment—Sensor/Receiver

-40 to 185°F, (-40 to 85°C); 5 to 95%RH, Non-condensing

Mounting

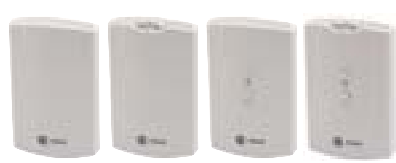
Receiver: Suitable for mounting above or below ceiling grid. Requires 24V power. Factory installed receiver comes mounted to the VAV unit with power provided by associated unit controller transformer. Field installed option provided with associated wire harness for similar power and communication connection.

Sensor: Mounts to a 2x4 handi-box or directly to the wall by attaching the backplate and then snapping the sensor body into place.

Dimensions

	Receiver/Translator
Enclosure:	Plastic
Height:	4.75" (120.6 mm)
Width:	2.90" (73.5 mm)
Depth:	1.08" (27.5 mm)
	Sensor/Transmitter
Enclosure:	Plastic
Height:	4.78" (121.4 mm)
Width:	2.90" (73.5 mm)
Depth:	1.08" (27.5 mm)

DDC Zone Sensor



The DDC zone sensor is used in conjunction with the Trane direct digital controller to sense the space temperature and to allow for user adjustment of the zone setpoint. Models with external zone setpoint adjustments and occupied mode override pushbuttons are available.

Specifications

Thermistor Resistance Rating

10,000 Ohms at 77°F (25°C)

Setpoint Resistance Rating

Setpoint potentiometer is calibrated to produce 500 Ohms at a setting of 70°F (21.11°C)

Electrical Connections

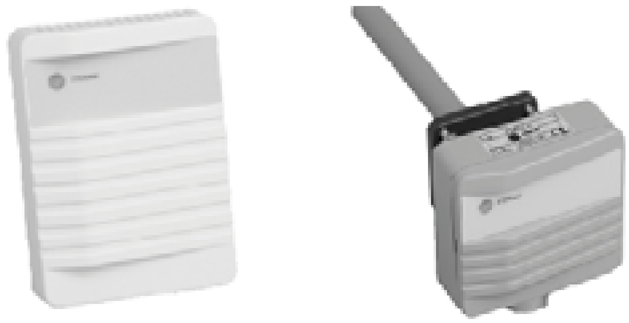
Terminal Block – Pressure Connections
Communications Jack – WE-616 (available for field installation)

Physical Dimensions

Width: 2.75" (69.85 mm)
Height: 4.5" (114.3 mm)
Depth: 1.0" (25.4 mm)

CO_2 Wall Sensor and Duct CO_2 Sensor

Figure 11. CO_2 wall sensor (L) and duct CO_2 sensor (R)



The wall- and duct-mounted carbon dioxide (CO_2) sensors are designed for use with Trane DDC/ UCM control systems. Installation is made simple by attachment directly to the DDC/ UCM controller. This allows the existing communication link to be used to send CO_2 data to the higher-level Trane control system.

Wall-mounted sensors can monitor individual zones, and the duct-mounted sensor is ideal for monitoring return air of a given unit. Long-term stability and reliability are assured with advanced silicon based Non-Dispersive Infrared (NDIR) technology.

When connected to a building automation system with the appropriate ventilation equipment, the Trane CO_2 sensors measure and record carbon dioxide in parts-per-million (ppm) in occupied building spaces. These carbon dioxide measurements are typically used to identify under-ventilated building zones and to override outdoor airflow beyond design ventilation rates if the CO_2 exceeds acceptable levels.

Specifications

Measuring Range

0–2000 parts per million (ppm)

Accuracy at 77°F (25°C)

< ± (40 ppm CO_2 + 3% of reading)
(Wall only)

< ± (30 ppm CO_2 + 3% of reading)

Recommended calibration interval

5 years

Response Time

1 minute (0–63%)

Operating Temperature

59 to 95°F (15 to 35°C) **(Wall only)**

23 to 113°F (-5 to 45°C)

Storage Temperature

-4 to 158°F (-20 to 70°C)

Humidity Range

0–85% relative humidity (RH)

Output Signal (jumper selectable)

4-20 mA, 0–20 mA,
0–10 VDC

Resolution of Analog Outputs

10 ppm CO_2

Power Supply

Nominal 24 VAC

Power Consumption

<5 VA

Housing Material

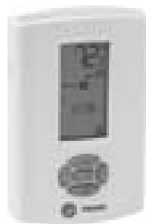
ABS plastic

Dimensions

4 1/4" x 3 1/8" x 1 7/16" **(Wall only)**
(108 mm x 80 mm x 36 mm) (Wall only)

3 1/8" x 3 1/8" x 7 ¾"
(80 mm x 80 mm x 200 mm)

DDC Zone Sensor with LCD



The DDC zone sensor with LCD has the look and functionality of the standard Trane DDC zone sensor but has a LCD display. The sensor includes setpoint adjustment, the display of the ambient temperature, a communication jack, and occupied mode override pushbuttons. Also, it can be configured in the field for either a Fahrenheit or Celsius display, a continuous display of the setpoint and the offset of displayed temperatures.

Specifications

Thermistor Resistance Rating

10,000 Ohms at 77°F (25°C)

Setpoint Resistance Rating

Setpoint potentiometer is calibrated to produce 500 Ohms at a setting of 70°F (21.11°C)

Temperature Range

Displays 40 to 99°F (5 to 35°C)
With Setpoints 50 to 90°F (10 to 32°C)

Electrical Connections

Terminal Block – Pressure Connections
Communication Jack – WE – 616
4 VA maximum power input.

Physical Dimensions

Width: 2.8" (71.12 mm)
Length: 4.5" (114.3 mm)
Height: 1.1" (27.94 mm)

Zone Occupancy Sensor

The zone occupancy sensor is ideal for spaces with intermittent occupancy. It is connected to the Trane DDC UCM and allows the zone to shift to unoccupied setpoints for energy savings when movement is not detected in the space.

The zone occupancy sensor has a multi-cell, multi-tier lens with a maximum field of view of 360°. The maximum coverage area of the sensor is 1200 square feet with a maximum radius of 22 feet from the sensor when mounted at 8 feet above the floor.

Sensor ships with 30-minute time delay pre-set from the factory. Time delay and sensitivity can be field-adjusted.

Specifications

Power Supply

24 VAC or 24 VDC, ± 10%

Maximum VA Load

0.88 VA @ 24 VAC,
0.72 VA @ 24 VDC

Isolated Relay Rating

1 A @ 24 VAC or 24 VDC

Operating Temperature

32 to 131°F (0 to 55°C)

Storage Temperature

-22 to 176°F (-30 to 80°C)

Humidity Range

0 to 95% non-condensing

Effective Coverage Area

1200 sq ft

Effective Coverage Radius

22 feet

Housing Material

ABS Plastic

Dimensions

3.3" dia. x 2.2" deep (85 mm x 56 mm). Protrudes 0.36" (9 mm) from ceiling when installed.

Factory or Field Wired Auxiliary Temperature Sensor

The auxiliary temperature sensor is used in conjunction with theTrane DDC controller to sense duct temperature. When the DDC controller is used with a Building Automation System, the sensor temperature is reported as status only. When the DDC control is used as stand alone configuration and the sensor is placed in the supply air duct, the sensor determines the control action of the UCM in a heat/cool changeover system.

When factory mounted, the sensor is terminated. If sensor is field mounted, it is shipped loose and is terminated in the field.

Specifications

Sensing Element

Thermistor 10,000 Ohms @ 77°F (25°C)

Operating Environment

-4 to 221°F (-20 to 105°C), 5%-95%RH
Non-Condensing

Wiring Connection

8 ft 18 awg

Sleeving for wire leads is acyrlic #5 awg grade C rated @ 155°C

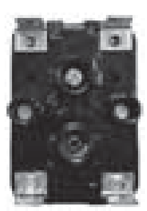
Probe Dimensions

3.4" long x 5/16" diameter
(86 mm x 7.9 mm diameter)

Mounting

In any position on duct.
Mount the sensor to the duct using
#10 x ¾" (19.05 mm) sheet metal screws.

Control Relay



The control relay is an output device used to provide on/off control of electrical loads. The SPST relay also will isolate the electrical load from the direct digital controller.

Specifications

Coil Rating

24 VAC, 50/60 Hz, pull in at 85%,
4 VA inrush, 3 VA sealed, Class B insulation

Contact Rating

120 VAC, 12 FLA , 60 LRA, 18A Resistive Pilot Duty – 125 VA/3A

277 VAC, 7 FLA, 42 LRA, 18A Resistive Pilot Duty – 277 VA/3A

347 VAC, 25 FLA, 50 LRA, 30A Resistive

Two-Position Water Valve

Two-position hot water valves are used with Trane DDC/UCM controls and analog electronic controls. Valve actuation is by a hysteresis synchronous motor.

All valves are field-installed and convertible from three-way to two-way by means of an included cap.

Specifications

Valve Design

Body: Brass
Cover: Aluminum
Case: Stainless Steel

Stem: Brass, Hard Chrome Plate
"O" Ring Seals: Viton
Operating Paddle: Buna N

Valve Body Ratings

UL 873 Listed File E27743

Plenum Rated CSA C22.2 No. 139
Certified, File LR85083, Class 3221 01

Temperature Limits

200°F (93.33°C) Fluid
104°F (40°C) Ambient

Maximum Operating Pressure

300 psi (2069 kPa)

Electrical Rating

Motor Voltage – 24 VAC, 50/60 Hz

Power Consumption – 7.0 VA of 24 VAC

Valve Offerings

All valves are spring returned.
1.17 Cv – ½" (12.7 mm) O.D. NPT
3.0 Cv – ¾" (19.1 mm) O.D. NPT
6.4 Cv – 1" (25.4 mm) O.D. NPT

Cv offered (Close-off Pressure):
1.1730 psi (207 kPa)
3.014.5 psi (100 kPa)
6.49 psi (62 kPa)

Proportional Water Valve

The proportional water valve is used to provide accurate control of a hot water heating coil to help maintain a zone temperature setpoint. The valve is a ball design and comes in available in four different flow capacities for proper controllability. The valves are field-adjustable for use as a two- or three-way configuration. The valves ship in a two-way configuration with a plug that is installed loose in the bypass port. Conversion to three-way operation is accomplished by removing the plug from the "B" port. The valve actuator contains a three-wire synchronous motor.

The direct digital controller uses a time-based signal to drive the motor to its proper position. When power is removed from the valve, it remains in its last controlled position.

Specifications

Valve Design:

Ball valve construction designed for chilled/hot water or water with up to 50% glycol

Temperature Limits

32 to 201°F (0 to 94°C) Fluid
23 to 122°F (-5 to 50°C) Ambient

Rated Body Pressure

300 psi (2.06 mPa)

Maximum Actuator Close-Off Pressure

60 psi (0.4 mPa)

Electrical Rating

Motor Voltage – 24 VAC, 50/60 Hz

Power Consumption – 3.0 VA at 24 VAC

Valve Offerings

All valves are proportional control with ½" (12.7 mm) O.D. NPT connections

Cv offered:

0.7

2.7

6.6

8.0

Differential Pressure Transducer

The differential pressure transducer is used in conjunction with the Trane direct digital controller and analog electronic controller. The pressure transducer measures the difference between the high-pressure and low-pressure ports of the Trane flow ring. The transducer is self-adjusting to changes in environmental temperature and humidity.

Specifications

Input Pressure Range

0.0 to 5.0 in. wg
(Maximum input pressure 5 psig)

Operating Environment

32 to 140° F, (0 to 60°C)
5% to 95% RH, Non-Condensing

Storage Environment

-40 to 180° F, (-40 to 82.2°C)
5% to 95%RH, Non-condensing

Electrical Connections

V_{in} = 5.0 VDC nominal
(4.75 to 5.25 VDC acceptable)
Current Draw = 5 mA maximum
Null Voltage = 0.250 VDC ± 0.06 VDC
Span = 3.75 VDC ± 0.08 VDC

Note: *Null and Span are ratiometric with V_{in}*

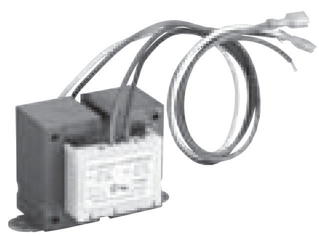
Physical Dimensions

Width: 2.5" (63.5 mm)
Length: 3.0" (76.2 mm)
Height: 1.5" (38.1 mm)

Pressure Connections

1/8" (3.175 mm) barbed tubing connections

Transformers



The transformer converts primary power supply voltages to the voltage required by the direct digital controller and analog. The transformer also serves to isolate the controller from other controllers which may be connected to the same power source.

Specifications

Primary Voltage

120 VAC
208 VAC
240 VAC
277 VAC
347 VAC
480 VAC
575 VAC

Secondary Voltage

24 VAC

Power Rating

50 VA

Physical Dimensions

For all voltages:

The transformers will be no larger than the following dimensions:
Width: 2.63" (66.7 mm)
Length: 2.50" (63.5 mm)
Height: 2.30" (58.4 mm)

Trane Actuator – 90 Second at 60 Hz Drive Time

This actuator is used with DDC controls and retrofit kits. It is available with a 3-wire floating-point control device. It is a direct-coupled over the shaft (minimum shaft length of 2.1"), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator has an external manual gear release to allow manual positioning of the damper when the actuator is not powered. The actuator is Underwriters Laboratories Standard 873 and Canadian Standards Association Class 3221 02 certified as meeting correct safety requirements and recognized industry standards.

Specifications

Actuator Design

3-wire, 24-AC floating-point control. Non-spring return.

Actuator Housing

Housing type-NEMA 1

Rotation Range

90° clockwise or counterclockwise

Electrical Rating

Power Supply –24 VAC (20 to 30 VAC) at 50/60 Hz

Power Consumption – 1.8 VA maximum, Class 2

Electrical Connection

Box Lug Terminals

Manual Override

External clutch release lever

Shaft Requirement

½" round

2.1" length

Humidity

5% to 95% RH, Non-Condensing

Temperature Rating

Ambient operating: 32 to 125°F
(0 to 52°C)

Shipping and storage: -20 to 130°F
(-29 to 66°C)

Torque

Running: 35 in.-lb (4 N-m)

Breakaway: 35 in.-lb (4 N-m) minimum

Stall: 60 in.-lb (4.5 N-m) minimum

Belimo Actuator – 95 Second Drive Time

This actuator is used with DDC controls and retrofit kits. It is available with a 3-wire floating-point control device. it is a direct-coupled over the shaft enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator has an external manual gear release to allow manual positioning of the damper. The actuator is UL listed and caries the CE mark.

Specifications

Actuator Design

3-wire, 24-AC floating-point control. Brushless DC motor with internal control electronics and constant drive time.

Rotation Range

95° clockwise or counterclockwise

Electrical Rating

Power Supply –24 VAC/DC

Power Consumption – 2VA, 1.5W

Electrical Connection

Three box-type terminals for bare wire connections.

Manual Override

External clutch release lever.

Shaft Requirement

½" round

2.1" length

Humidity

5% to 95% Non-Condensing

Temperature Rating

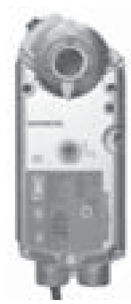
Ambient operating: 32 to 125°F (0 to 52°C)

Shipping and storage: -20 to 130°F(-29 to 66°C)

Torque

45 in.-lb (5 N-m)

Trane Spring Return Actuator



This actuator is used with DDC controls and is a floating-point control device. It is direct-coupled over the shaft (minimum shaft length of 2.1"), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator is Underwriters Laboratories Standard 60730 and Canadian Standards Association C22.2 No. 24-93 certified as meeting correct safety requirements and recognized industry standards.

Specifications

Actuator Design

24-VAC, floating-point control. Spring return

Actuator Housing

Housing Type-NEMA IP54

Rotation Range

Adjustable from 0° to 90° at 5° intervals, clockwise or counterclockwise

Electrical Rating

Power Supply – 24 VAC (19.2 to 28.8 VAC) at 50/60 Hz

Power Consumption – 4VA holding, 5VA running maximum, Class 2

Electrical Connection

6-pin female connector for Trane UCM (for Trane DDC controls)

Manual Override

Manual override key provided

Shaft requirement:
¼" to ¾" round

2.1" length

Humidity

95% RH, Non-Condensing

Temperature Rating

Ambient operating: 32 to 130°F
(0 to 54°C)

Shipping and storage: -40 to 158°F
(-40 to 70°C)

Torque

62 in.-lbs (7N-m)

VariTrane DDC Retrofit Kit

The retrofit kit provides the system advantages of VariTrane DDC controls to building owners for existing systems. The kit can be applied when converting from pneumatic or analog controlled systems to a DDC controlled system. The kit may be used on existing single-duct units with hot water and electric reheat (three stages), dual-duct units, and all fan-powered units (both series and parallel) with hot water and electric reheat (two stages).

A VariTrane DDC-UCM, an electronic differential pressure transducer, and a six-pin connector with wiring for an actuator, make up the assembly of the retrofit kit. All are housed inside a metal enclosure. For maximum flexibility, the kit is available with one of two actuators or without an actuator. If a kit is ordered without an actuator, ensure the actuator used has 24VAC three-wire floating control. Other accessories are available with the retrofit kit which include zone sensors, flow bars (used with units without a flow sensor), power transformers, control relays, and E/P solenoid valves.

Retrofit Kit Actuator

This actuator is available with the DDC Retrofit Kit and is a 3-terminal, floating-point control device. It is direct-coupled over the damper shaft so there is no need for connecting linkage. The actuator has an external manual gear release to allow manual positioning of the damper when the actuator is not powered. A three-foot plenum-rated cable with bare ends will be sent separately. The actuator is listed under Underwriters Laboratories Standard 873, CSA 22.2 No. 24 certified, and CE manufactured per Quality Standard SO9001.

Specifications

Actuator Design

on-off/floating-point

Actuator housing

Housing Type-NEMA type 1

Housing Material Rating- UL 94-5V

Angle of Rotation

Max 95°, adjustable with mechanical stops

Electrical Rating

Power Supply – 24 VAC ± 20% 50/60 Hz 24 VDC ± 10%

Power Consumption – 2VA, 1.5W

Manual Override

External push button

Humidity

5% to 95% RH, Non-Condensing

Ambient Temperature

-22 to 122°F (-30C to 50°C)

Storage Environment

-40 to 176°F (-40 to 80°C)

Torque

45 in.-lb (5N-m)

Running Time

95 sec. for 0 to 45 in-lb

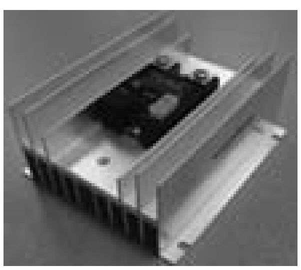
Noise Rating

Less than 35 dB (A)

Weight

1.2 lbs (0.55 kg)

Silicon-Controlled Rectifier (SCR)



- Microprocessor based burst-fire controller / SSR
- Low-voltage control
- Output status indicator
- 0-100% Control Range
- Synchronized triggering output (P3)
- 20 AC Cycles Base Period

Specifications

Input Specifications	DC Control
Supply Voltage Range (VDC) (P1)	8-28
Input Current Range [mA]	20-30
Nominal Input Impedance [Ohms]	30K
PLV Range [VDC][P4]	0-10
Nominal Input Impedance [ohms][P4]	20K

Output Status Functions	LED
Initial Logic Supply On	Flash Once
Load Voltage Missing / Load Open (W/ PLV = 0V)	Flash Once Intermittenly
Load Voltage Missing / Load Open (W/ PLV > 0V)	Flash Twice Intermittently

General Specifications	Parameters
Dielectric Strength, Input/Output/Base (50/60Hz)	4000 Vrms
Minimum Insulation Resistance (@ 500 V DC)	10^9 Ohm

General Specifications	Parameters
Maximum Capacitance, Input/Output	10 pF
Ambient Operating Temperature Range	-20 to 80°C
Ambient Storage Temperature Range	-40 to 125 °C
Encapsulation	Thermally conductive Epoxy
Input connector	Header Connector 3.5mm
Output Terminals	Screws and Saddle Clamps Furnished, Installed
Output Max Wire Size	Output:2 x AWG 8 (3.8mm)
Output Screws Maximum Torque	20 in lbs (2.2 Nm)

Assembly Specifications	
Weight (typical)	1.38 Lb (0.628 Kg.)
Heat Transfer Material Used	Thermal Pad
Material	Steel
Finish	Nickel Plate
Torque Applied	20 in/lbs ± 10%.

Pneumatic Controls

3011 Pneumatic Volume Regulator

The pneumatic volume regulator (PVR) is a controller that provides a consistent airflow to the space, regardless of varying inlet duct pressure conditions, in response to a pneumatic thermostat signal. The controller maintains minimum and maximum airflow setpoints. The 3011 PVR can be set to control either normally open or normally-closed air valve actuators and can be calibrated to accept either direct-acting or reverse-acting thermostat signals. Fixed reset control of maximum and minimum airflow setpoints is provided.

Specifications

Differential Pressure Range

0-1 in. wg (0–249 Pa)

Minimum Setpoint Range

0-1 in. wg (0–249 Pa)

Maximum Setpoint Range

0.05 in. wg (12.5 Pa) above minimum to 1 in. wg (249 Pa) above minimum

Operating Static Pressure Range

0.25 in. wg—6.0 in. wg (62.3–1494 Pa)

Reset Pressure Span

Factory-set at 5 psig (34.5 kPa)
Field-adjustable from 0 to 10 psig
(0 to 68.9 kPa)

Reset Start Point

Field-adjustable from 0 to 10 psig
(0 to 68.9 kPa)

Main Air Pressure

15 to 30 psig (103 to 207 kPa)

Air Consumption

28.8 scim (0.472 L/m) at 20 psig (138 kPa) main air pressure

Operating Environment

40 to 120°F (4 to 49°C)

Storage Environment

-40 to 140°F (-40 to 60°C)

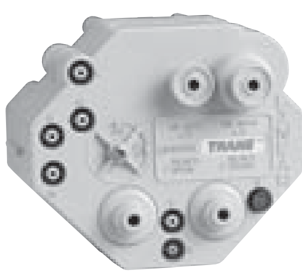
Output Sensitivity

5 psig/0.02 in. wg (34.5 kPa/5.0 Pa)

Physical Dimensions

Width: 4.5" (114.3 mm)
Length: 2.3" (58.4 mm)
Height: 3.87" (98.3 mm)
Weight: 11 oz (312 g)

3501 Pneumatic Volume Regulator



Tubing Connections:
1/4" O.D. tubing connections
The 3501 PVR can be set to control either normally open or normally-closed air valve actuators and can be calibrated to accept either direct-acting or reverse-acting thermostat signals. Fixed reset control of maximum and minimum airflow setpoints is provided. The controller is used primarily in dual-duct constant-volume applications because of its linear output response characteristics. The controller resets the primary air velocity linearly with a change in thermostat pressure.

This is in contrast to the 3011 PVR, which resets velocity pressure with a change in thermostat pressure. This allows the 3501 PVR to have improved stability at low flows.

Specifications

Differential Pressure Range

0–1.0 in. wg (0–249 Pa)

Minimum Setpoint Range

0–1.0 in. wg (0–249 Pa)

Maximum Setpoint Range

Minimum to 1.0 in. wg (249 Pa)

Operating Static Pressure Range

0.25–6.0 in. wg (62.3–1494 Pa)

Reset Pressure Span

Factory-set at 5 psig (34.5 kPa)
Field-adjustable from 0 to 7 psig
(0 to 48.3 kPa)

Reset Start Point

Factory-set at 8 psig (55.2 kPa)
Field-adjustable from 0 to 10 psig
(0 to 68.9 kPa)

Main Air Pressure

15–30 psig (103 to 207 kPa)

Air Consumption

43.2 scim (0.708 L/m) at 20 psig (138 kPa) main air pressure

Operating Environment

40 to 120°F (4 to 49°C)

Storage Environment

-40 to 140°F (-40 to 60°C)

Output Sensitivity

5 psig/ 0.02 in. wg (34.5 kPa/ 5.0 Pa)

Physical Dimensions

Width: 4.5" (114.3 mm)
Length: 3.87" (98.3 mm)
Height: 4.1" (104.1 mm)
Weight: 12 oz (340 g)

Pneumatic Damper Actuator

The pneumatic actuator is designed for use on VAV terminal units in HVAC systems. The damper actuator mounts to a standard ½" diameter shaft by a pin and cross hold arrangement, retaining clip, and non-rotation bracket. Two model actuators are offered with spring ranges of 3–8 psi or 8–13 psi.

Specifications

Effective Area

8 sq inches (51.6 sq cm)

Normal Rotation

100 degrees

Spring Ranges

Model 3631–5000: 8-13 psi (55.2–89.6 kPa)

Model 3631–8000: 3-8 psi (20.7–55.2 kPa)

Supply Connection

3/16" (4.8 mm) nipple for ¼" (6.4 mm) O.D. tubing

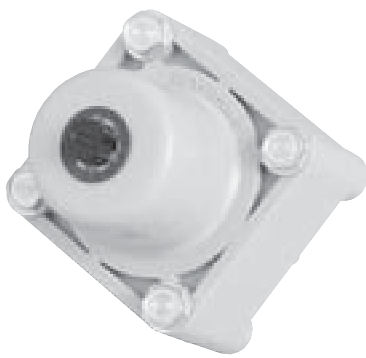
Weight

1.5 lbs (680 g)

Ambient Limits:

Operating:-20 to 120°F
(-28.889 to 48.889°C)
Shipping:-40 to 140°F (-40 to 60°C)

Reversing Relay



Tubing Connections:
1/4" O.D. tubing connections
The pneumatic reversing relay is a proportional device that reverses the action of the input signal. It is used to change a direct-acting signal into a reverse-acting signal or to change a reverse-acting signal into a direct-acting signal.This relay is used to match the operating pressure range of controlled devices (valves, pressure switches, etc.) to the output pressure range of a controller (such as a thermostat).The output response will always remain in 1:1 proportion to the input signal, but the relay includes the capability to bias the output signal.

Specifications

Factory Setting

Contingent upon the selected control option

Generally set for 8 psig in. = 8 psig out or 9 psig in=9 psig out (55.2 kPa in. = 55.2 kPa out or 62.1 kPa in. = 62.1 kPa out)

Bias Adjustment

+/- 15 psig (103 kPa)

Main Air Pressure

15-30 psig (103–207 kPa)

Air Consumption

18 scim (0.295 L/m) at 20 psig (138 kPa) main air pressure

Operating Environment

40 to 120°F (4°C to 49°C)

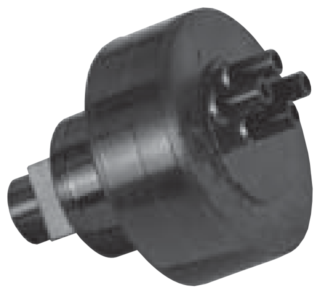
Storage Environment

-40 to 140°F (-40 to 60°C)

Physical Dimensions

Width: 1.5" (38.1 mm)
Length: 1.5" (38.1 mm)
Height: 2.5" (63.5 mm)

Signal Limiter



Tubing Connections:
3/16" (4.8 mm) nipples for 1/4" (6.4 mm) polyethylene tubing
The pneumatic signal limiter is a pressure limiting type device. The output pressure from the signal limiter is not allowed to rise above the signal limiter's setting. Adjustments to the output pressure setting are made via a screw on the back side of the valve.

Specifications

Factory Setting

Maximum output = 8 psig (55.2 kPa) Adjustable from 2–12 psig (13.8–82.7 kPa)

Main Air Pressure

Nominal 20 psig (138 kPa) 22 psig
(152 kPa) maximum acceptable pressure

Air Consumption

10 scim (0.164 L/m) at 20 psig (138 kPa) main air pressure

Operating Environment

50 to 120°F (10 to 48.89°C)

Physical Dimensions

Width:. 1.1" (27.94 mm)|
Length: 0.9" (22.86 mm)
Height: 0.9" (22.86 mm)

Tubing Connections

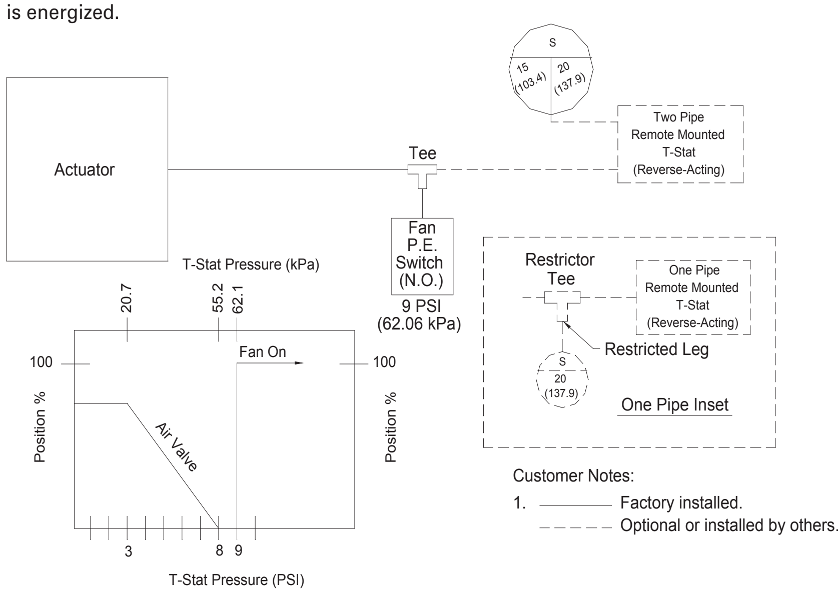
9/100" (2.3 mm) nipples

PN00 – VPCF, LPCF Parallel Fan-Powered Without Reheat

(Normal Operation: Cooling Only)

Normally-Open Damper and Actuator (Reverse-Acting Thermostat)

With an increase in room temperature, the thermostat output pressure is decreased and the actuator opens to increase primary cooling airflow to the space. With a decrease in room temperature, the opposite action occurs until the damper is fully closed. Upon a continued decrease in zone temperature below setpoint, the parallel fan is energized.

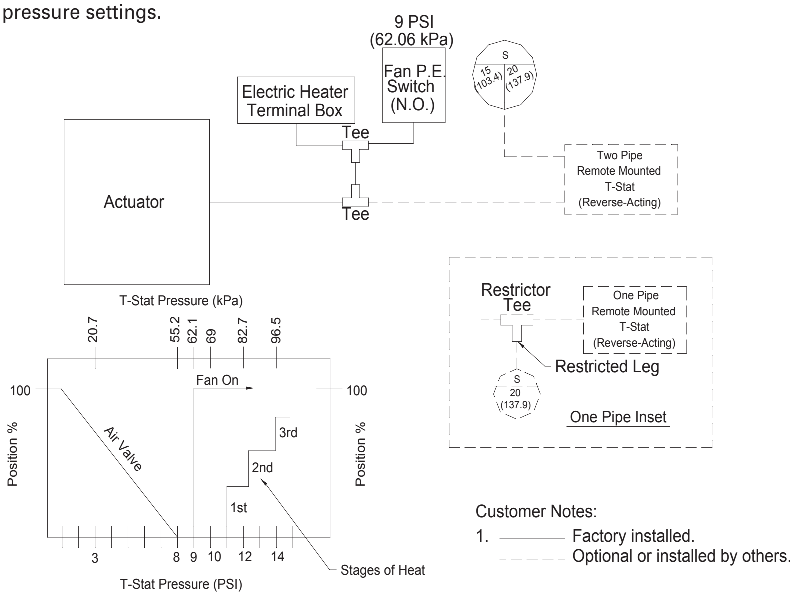


PN00 – VPEF, LPEF Parallel Fan-Powered with Electric Heat

(Normal Operation: Cooling Only)

Normally-Open Damper and Actuator (Reverse-Acting Thermostat)

With an increase in room temperature, the thermostat output pressure is decreased and the actuator opens to increase primary cooling airflow to the space. With a decrease in room temperature, the opposite action occurs until the damper is fully closed. Upon a continued decrease in zone temperature below setpoint, the parallel fan is energized. If zone temperature continues to decrease after the fan has been energized, heating stages are energized at the appropriate pressure settings.

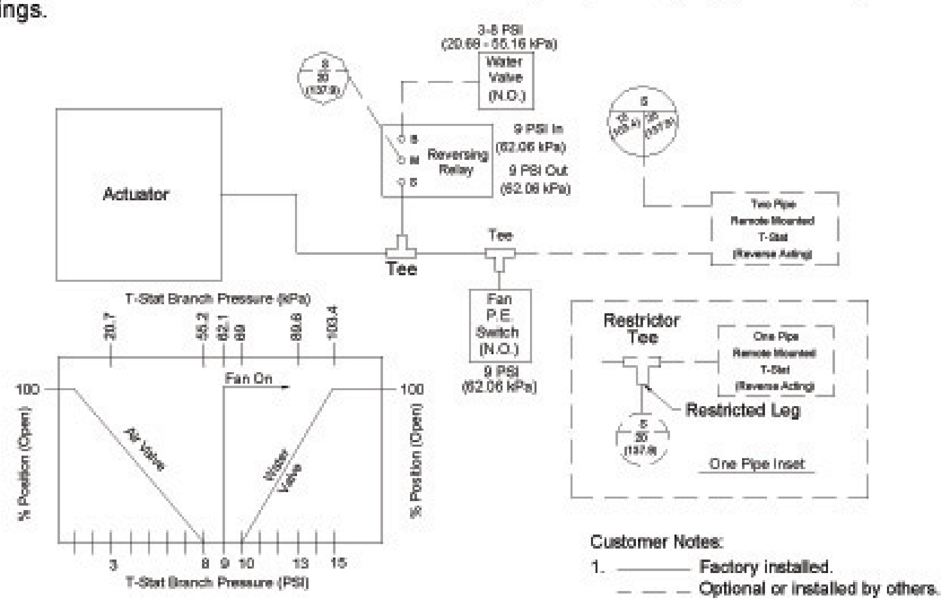


PN00 – VPWF, LPWF Parallel Fan-Powered with Water Coils

(Normal Operation: Cooling with Hot Water Reheat)

Normally-Open Damper, Actuator, and 3011 Pneumatic Volume Regulator (Reverse-Acting Thermostat)

With an increase in room temperature, the thermostat output pressure is decreased and the actuator opens to increase primary cooling airflow to the space. With a decrease in room temperature, the opposite action occurs until the damper is fully closed. Upon a continued decrease in zone temperature below setpoint, the parallel fan is energized. If the zone temperature continues to decrease after the fan has been energized, heating stages are energized at the appropriate pressure settings.

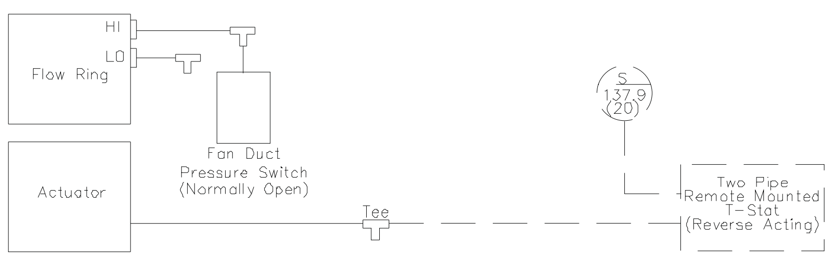


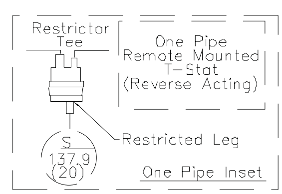
PN00-VSCF, LSCF series fan-powered without reheat

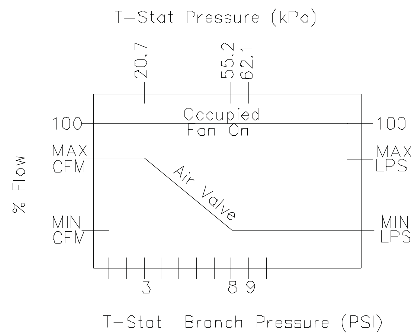
PN00

Normally Open Damper, actuator only (Reverse Acting Thermostat) w/Duct Pressure Switch

This unit is energized by sensing inlet static pressure by the duct pressure switch. The unit Fan runs continually during occupied opertation.
With an increase in room temperature above setpoint, thermostat pressure is decreased. The actuator opens to increase primary cooling flow to the space. With a decrease in room temperture, the opposite action occurs until the damper is closed.







Customer Notes:

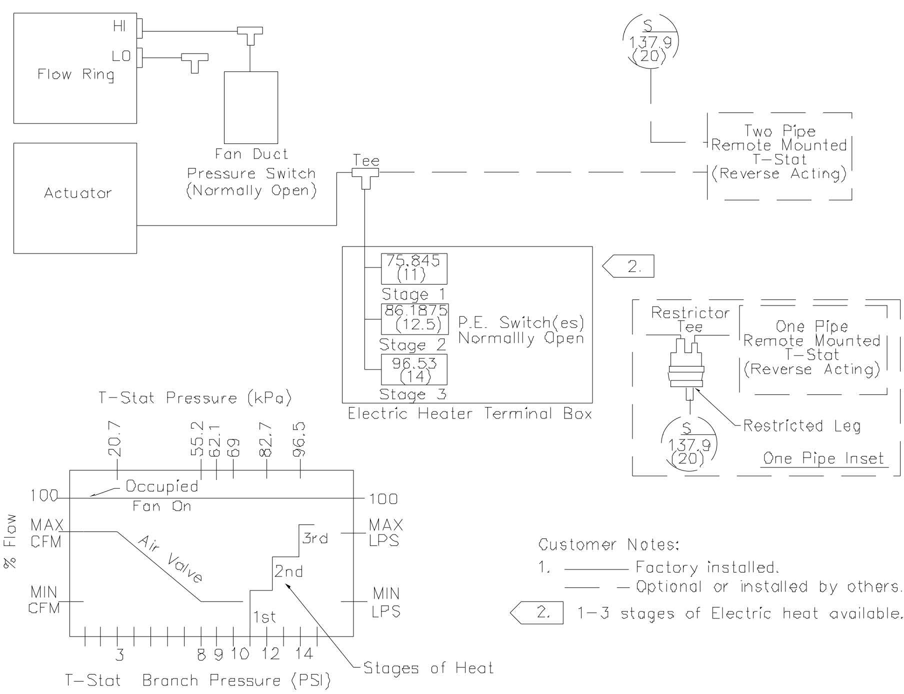
1. ——— Factory installed.
   — — Optional or installed by others.

PN00-VSEF, LSEF series fan-powered with electric heat

PN00

Normally Open Damper, actuator only (Reverse Acting Thermostat) w/Duct Pressure Switch

This unit is energized by sensing inlet static pressure by the duct pressure switch. The unit Fan runs continually during occupied opertation.
With an increase in room temperature above setpoint, thermostat pressure is decreased. The actuator opens to increase primary cooling flow to the space. With a decrease in room temperture, the opposite action occurs until the damper is closed. If the zone temperature continues to decrease after the fan has been energized the reheat water valve will be modulated open.



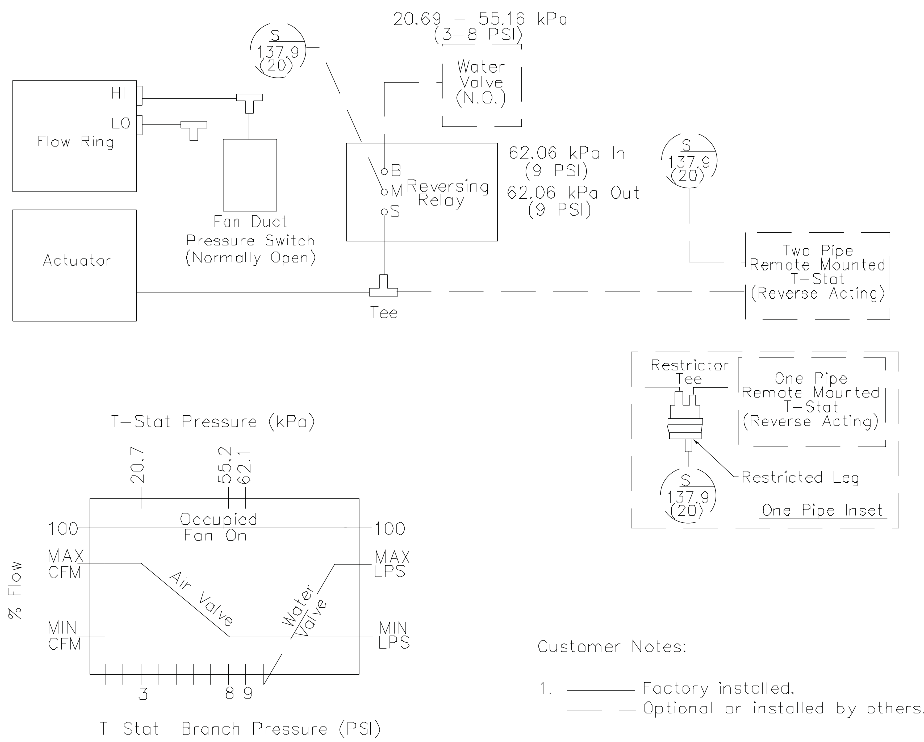
Customer Notes:
1. ——— Factory installed.
— — Optional or installed by others.
2. 1–3 stages of Electric heat available.

PN00-VSWF, LSWF series fan-powered with water coils

PN00

Normally Open Damper, actuator only (Reverse Acting Thermostat) w/Duct Pressure Switch

This unit is energized by sensing inlet static pressure by the duct pressure switch. The unit Fan runs continually during occupied opertation.
With an increase in room temperature above setpoint, thermostat pressure is decreased. The actuator opens to increase primary cooling flow to the space. With a decrease in room temperture, the opposite action occurs until the damper is closed. Upon a continued decrease in zone temperature below setpoint, the parallel fan is energized. If the zone temperature continues to decrease after the fan has been energized the reheat water valve will be modulated open.

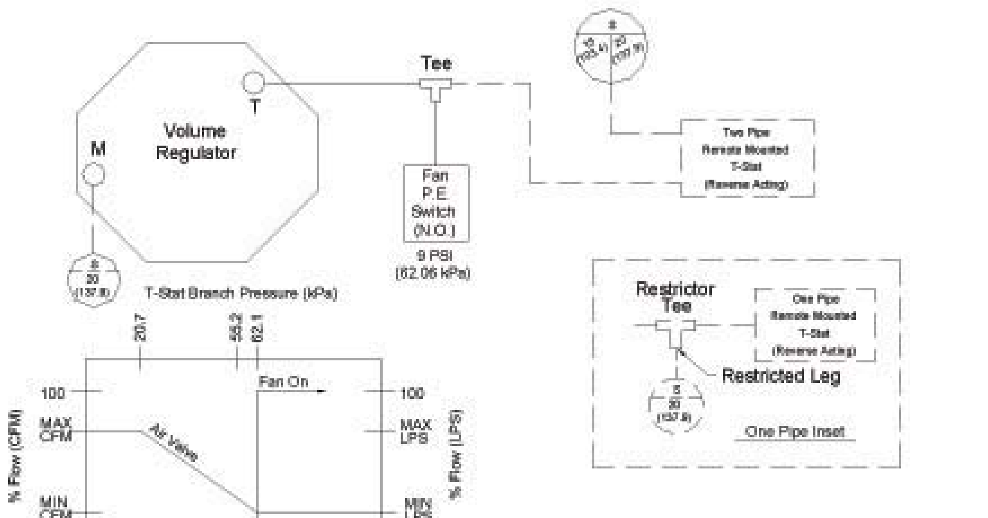


PN05 – VPCF, LPCF - Fan-Powered Terminal Units

(Normal Operation: Cooling Only)

Normally-Open Damper, Actuator, and 3011 Pneumatic Volume Regulator (Reverse-Acting Thermostat)

With an increase in room temperature, the thermostat output pressure is decreased. This signal is input to the volume regulator, which also received the inputs from the high- and low-pressure from the flow ring. The volume regulator outputs a signal compensated for changing duct pressures to the valve actuator, which opens the damper and increases primary cooling flow to the space. With a decrease in room temperature, the opposite action occurs. Minimum and maximum primary airflow settings are maintained by the volume regulator.



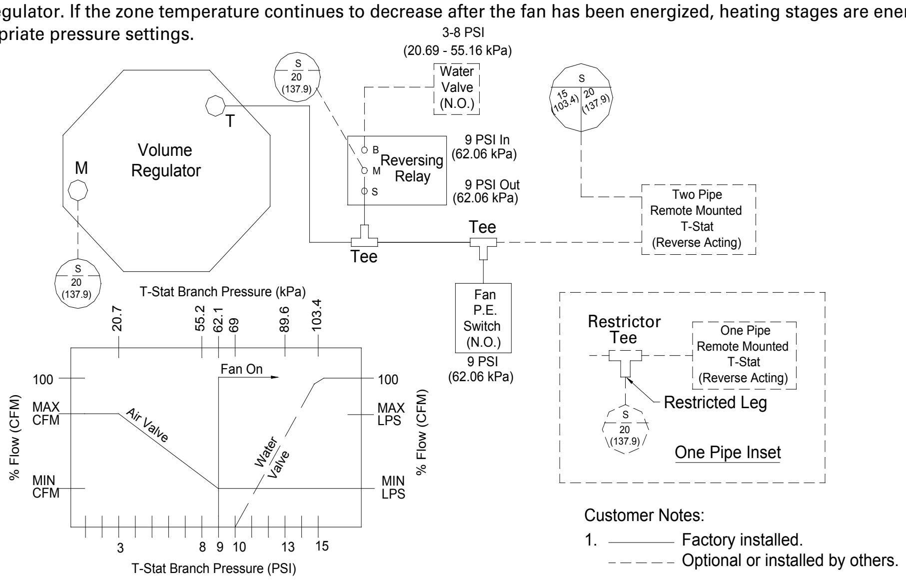
Customer Notes:

1. ———— Factory installed.
— — — — Optional or installed by others.

PN05 – VPWF, LPWF - Fan-Powered Terminal Units

(Normal Operation: Cooling with Hot Water Reheat)
Normally-Open Damper, Actuator, and 3011 Pneumatic Volume Regulator
(Reverse-Acting Thermostat)

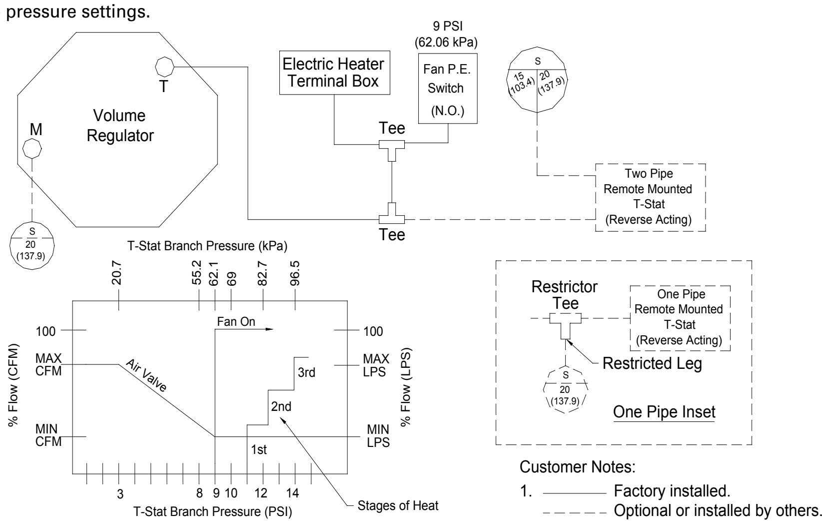
With an increase in room temperature, the thermostat output pressure is decreased. This signal is input to the volume regulator, which also receives the inputs from the high- and low-pressure from the flow ring. The volume regulator outputs a signal compensated for changing duct pressures to the valve actuator, which opens the damper and increases primary cooling flow to the space. With a decrease in room temperature, the opposite action occurs. Minimum and maximum primary airflow settings are maintained by the volume regulator. If the zone temperature continues to decrease after the fan has been energized, heating stages are energized at the appropriate pressure settings.



PN05 – VPEF, LPEF - Fan-Powered Terminal Units

(Normal Operation: Cooling with Electric Reheat)
Normally-Open Damper, Actuator, and 3011 Pneumatic Volume Regulator
(Reverse-Acting Thermostat)

With an increase in room temperature, the thermostat output pressure is decreased. This signal is input to the volume regulator, which also receives the inputs from the high- and low-pressure from the flow ring. The volume regulator outputs a signal compensated for changing duct pressures to the valve actuator, which opens the damper and increases primary cooling flow to the space. With a decrease in room temperature, the opposite action occurs. Minimum and maximum primary airflow settings are maintained by the volume regulator. If the zone temperature continues to decrease after the fan has been energized, heating stages are energized at the appropriate pressure settings.

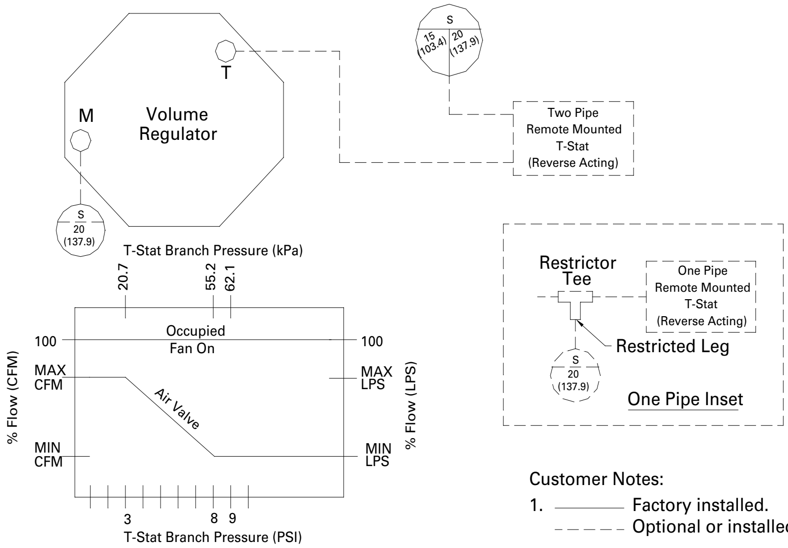


PN51 – VSCF, LSCF - Fan-Powered Terminal Units

(Normal Operation: Cooling Only - Duct Pressure Switch)

Normally-Open Damper, Actuator, and 3011 Pneumatic Volume Regulator (Reverse-Acting Thermostat)

This unit is energized by sensing inlet static pressure by the duct pressure switch. The unit fan runs continually during occupied operation. With an increase in room temperature, the thermostat output pressure is decreased. This signal is input to the volume regulator, which also receives the inputs from the high- and low-pressure from the flow ring. The volume regulator outputs a signal compensated for changing duct pressures to the valve actuator which opens the damper and increases primary cooling flow to the space. With a decrease in room temperature, the opposite action occurs. Minimum and maximum primary airflow settings are maintained by the volume regulator.



Customer Notes:

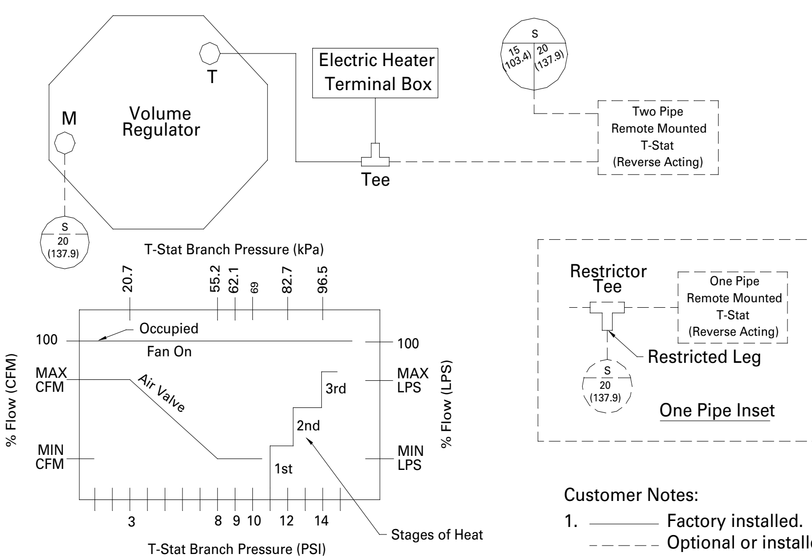
1. ——— Factory installed.
   – – – – Optional or installed by others.

PN51 – VSEF, LSEF - Fan-Powered Terminal Units

(Normal Operation: Cooling with Electric Reheat - Duct Pressure Main)

Normally-Open Damper, Actuator, and 3011 Pneumatic Volume Regulator (Reverse-Acting Thermostat)

This unit is energized by sensing inlet static pressure by the duct pressure switch. The unit fan runs continually during occupied operation. With an increase in room temperature, the thermostat output pressure is decreased. This signal is input to the volume regulator, which also receives the inputs from the high- and low-pressure from the flow ring. The volume regulator outputs a signal compensated for changing duct pressures to the valve actuator which opens the damper and increases primary cooling flow to the space. With a decrease in room temperature, the opposite action occurs. Minimum and maximum primary airflow settings are maintained by the volume regulator. If the zone temperature continures to decrease after the fan has been energized, heating stages are energized at the appropriate pressure settings.



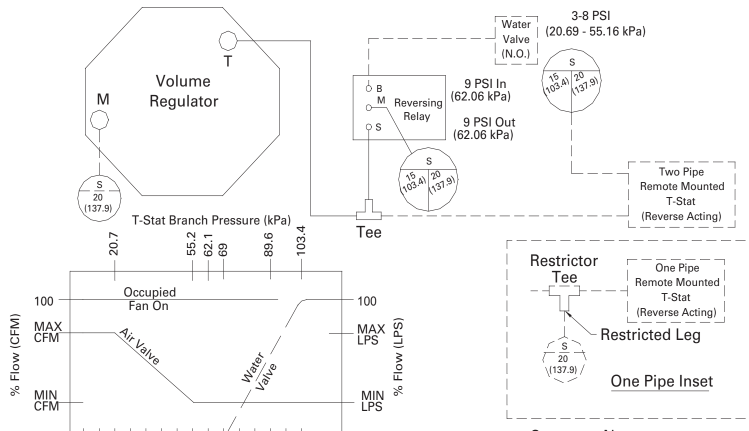
Customer Notes:

1. ——— Factory installed.
   – – – – Optional or installed by others.

PN51 – VSWF, LSWF - Fan-Powered Terminal Units

(Normal Operation: Cooling with Hot Water Reheat - Duct Pressure Switch) Normally-Open Damper, Actuator, and 3011 Pneumatic Volume Regulator (Reverse-Acting Thermostat)

This unit is energized by sensing inlet static pressure by the duct pressure switch. The unit fan runs continually during occupied operation. With an increase in room temperature the thermostat output pressure is decreased. This signal is input to the volume regulator, which also receives the inputs from high- and low-pressure from the flow ring. The volume regulator outputs a signal compensated for changing duct pressures to the valve actuator which opens the damper and increases primary cooling flow to the space. With a decrease in room temperature, the opposite action occurs. Minimum and maximum primary airflow settings are maintained by the volume regulator. If the zone temperature continues to decrease after the fan has been energized, heating stages are energized at the appropriate pressure settings.



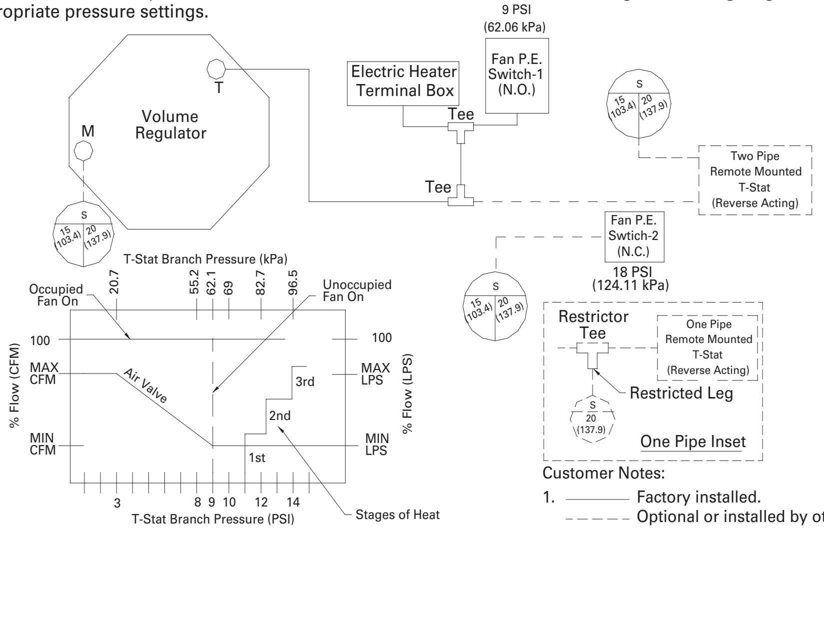
Customer Notes:

1. ———— Factory installed.
– – – – Optional or installed by others.

PN52 – VSEF, LSEF - Fan-Powered Terminal Units

(Normal Operation: Cooling with Electric Reheat - Duct Pressure Switch) Normally-Open Damper, Actuator, and 3011 Pneumatic Regulator (Reverse-Acting Thermostat)

The unit is energized into occupied status by a setting of main system air pressure to 15 psi (103 kpa). At unoccupied, the main system air is set to 20 psi (138 kpa). The unit fan cycles on as 1st stage heat when called for by the unit t-stat. Dual setpoint pneumatic thermostat is suggested for this option. With an increase in room temperature, the thermostat output pressure is decreased. This signal is input to the volume regulator, which also receives the inputs from the high- and low-pressure from the flow ring. The volume regulator outputs a signal compensated for changing duct pressures to the valve actuator, which opens the damper and increases primary cooling flow to the space. With a decrease in room temperature, the opposite action occurs. If the zone temperature continues to decrease after the fan has been energized, heating stages are energized at the appropriate pressure settings.



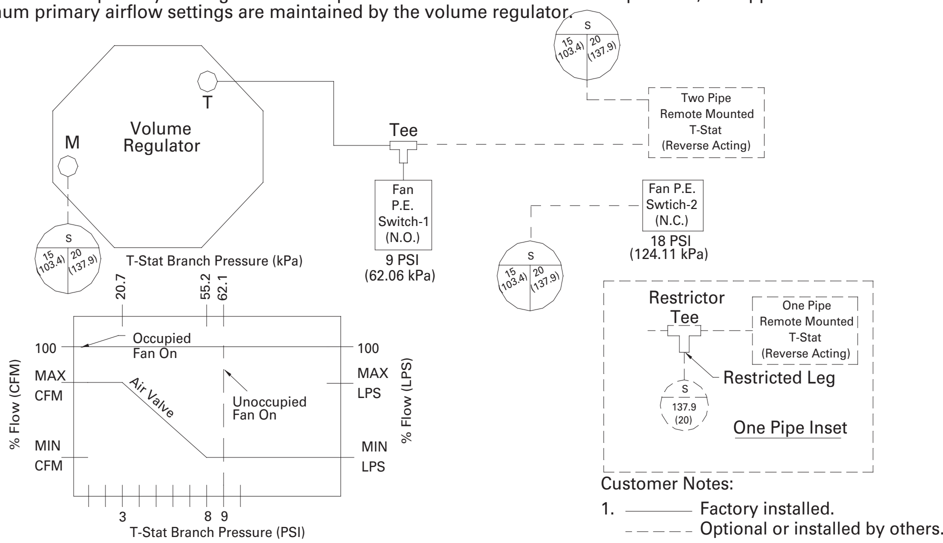
Customer Notes:

1. ———— Factory installed.
– – – – Optional or installed by others.

PN52 – VSCF, LSCF - Fan-Powered Terminal Units

(Normal Operation: Cooling with Electric Reheat - Dual Pressure Main) Normally-Open Damper, Actuator, and 3011 Pneumatic Volume Regulator (Reverse-Acting Thermostat)

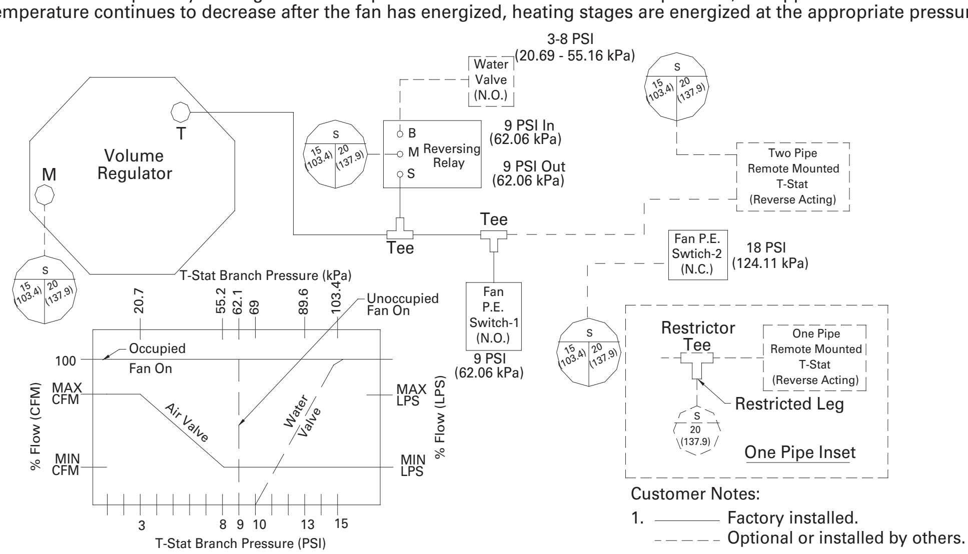
The unit is energized into occupied status by a setting of main system air pressure to 15 psi (103 kpa). At unoccupied, the main system air is set to 20 psi (138 kpa). The unit fan cycles on as 1st stage heat when called for by the unit's thermostat. Dual setpoint pneumatic thermostat is suggested for this option. With an increase in room temperature, the thermostat output pressure is decreased. This signal is input to the volume regulator, which also receives the inputs from the high- and low-pressure from the flow ring. The volume regulator outputs a signal compensated for changing duct pressures to the valve actuator which opens the damper and increases primary cooling flow to the space. With a decrease in room temperature, the opposite action occurs. Minimum and maximum primary airflow settings are maintained by the volume regulator.



PN52 – VSWF, LSWF - Fan-Powered Terminal Units

(Normal Operation: Cooling with Electric Reheat - Dual Pressure Main) Normally-Open Damper, Actuator, and 3011 Pneumatic Volume Regulator (Reverse-Acting Thermostat)

The unit is energized into occupied status by a setting of main system air pressure to 15 psi (103 kpa). At unoccupied, the main system air is set to 20 psi (138 kpa). The unit fan cycles on as 1st stage heat when called for by the unit's thermostat. Dual setpoint pneumatic thermostat is suggested for this option. With an increase in room temperature, the thermostat output pressure is decreased. This signal is input to the volume regulator, which also receives the inputs from the high- and low-pressure from the flow ring. The volume regulator outputs a signal compensated for changing duct pressures to the valve actuator which opens the damper and increases primary cooling flow to the space. With a decrease in room temperature, the opposite action occurs. If the zone temperature continues to decrease after the fan has energized, heating stages are energized at the appropriate pressure settings.



Controls Specifications

For all VariTrane units, the unit controller continuously monitors the zone temperature and varies the primary airflow as required to meet zone setpoints. Airflow is limited by adjustable minimum and maximum setpoints.

Additionally, for series fan-powered units, the controller will start and run the fan continuously during the occupied mode and intermittently during the unoccupied mode. Upon a further call for heat, any hot water or electric heat associated with the unit is enabled.

For parallel fan-powered units, the controller energizes the fan upon a call for heat. Upon a further call for heat, reheat is enabled.

Fan Speed Control

Variable Speed Control Switch (SCR)

The SCR speed control device is standard on all fan-powered units. The SCR adjusts the fanspeed and provides simplified system balancing.

Direct Digital Controls (DDC)

LonMark Direct Digital Controller

Trane-designed LonMark certified controller uses the space comfort control (SCC) profile to exchange information over a LonTalk Network. LonMark networks provide the latest open protocol technology.

Direct Digital Controller

The microprocessor-based terminal unit controller provides accurate, pressure-independent control through the use of a proportional integral control algorithm and direct digital control technology. The UCM, monitors zone temperature setpoints, zone temperature, the rate of temperature change, and valve airflow. With the addition of optional sensors, room occupancy or supply duct air temperature can be monitored. The controller is provided in an enclosure with 7/8" (22 mm) knockouts for remote control wiring. A Trane DDC zone sensor is required.

DDC Actuator

Trane 3-wire, 24-VAC, floating-point quarter turn control actuator with linkage release button. Actuator has a constant drive rate independent of load, a rated torque of 35 in-lb, a 90-second drive time, and is non-spring return. Travel is terminated by end stops at fully opened and closed positions. An integral magnetic clutch eliminates motor stall.

DDC Actuator - Belimo

LMB24-3-TTN 3-wire, 24 VAC/DC, floating-point, quarter turn actuator with linkage release button. Actuator has a constant drive rate independent of load, a rated torque of 45 in-lb, a 95 second drive time, and is non-spring return. Travel is terminated by end stops at fully-opened and -closed positions. Internal electronic control prevents motor stall when motor reaches end stops.

DDC Zone Sensor

The UCM controller measures zone temperature through a sensing element located in the zone sensor. Other zone sensor options may include an externally-adjustable setpoint, communications jack for use with a portable service tool, and an override button to change the individual controller from unoccupied to occupied mode. The override button has a cancel feature that will return the system to unoccupied. Wired zone sensors utilize a thermistor to vary the voltage output in response to changes in the zone temperature. Wiring to the UCM controller must be 18 to 22 awg. twisted pair wiring. The setpoint adjustment range is 50–88ºF (10–31°C) Depending upon the features available in the model of sensor selected, the zone sensor may require from a 2-wire to a 7-wire connection. Wireless zone sensors report the same zone information as wired zone sensors, but do so using radio transmitter technology. No wiring from the zone sensor to the UCM controller is necessary.

Digital Display Zone Sensor with Liquid Crystal Display (LCD)

The direct digital zone sensor contains a sensing element which sends a signal to the UCM. A Liquid Crystal Display (LCD) indicates setpoint, or space temperature. Sensor buttons allow setpoint adjust, and allow space temperature readings to be turned on or off. The digital display zone sensor also includes a communication jack, for use with a portable edit device, and an override button to change the UCM from unoccupied to occupied. The override button has a cancel feature, which returns the system to unoccupied mode. The digital display zone sensor requires seven wires, one for 24-VAC power.

System Communications

The Controller UCM sends and receives data from a Tracer SC or other Trane Controller. Current unit status and setpoints may be monitored and/or edited via this data communication feature. The network type is a twisted wire pair shielded serial communication.

The following direct digital control features are available with VariTrane terminal units:

- Controls Option – DD00: Trane actuator for field-installed DDC controllers
- Controls Option – DD01: Cooling Only (DDC/UCM)
- Controls Option – DD02: Cooling with Normally-Closed On/Off hot water valve (Normally-Open outputs) (DDC/UCM)
- Controls Option – DD03: Cooling with proportional hot water valve with optional spare On/Off Output) (DDC/UCM)
- Controls Option – DD04: Cooling with staged On/Off electric heat (DDC/UCM)
- Controls Option – DD05: Cooling with pulse-width modulation electric heat (DDC/UCM)
- Controls Option – DD07: Cooling with Normally-Open On/Off hot water valve (Normally-Closed outputs) (DDC/UCM)
- Controls Option – DD08: Cooling and Heating - Dual-Duct Constant Volume (DDC/UCM)
- Controls Option – FM00: Factory installation of customer supplied actuator and DDC controls. Controls supplier is responsible for providing factory-installation and wiring instructions.
- Controls Option – FM01: Trane actuator with factory installation of customer supplied DDC controls. Controls supplier is responsible for installing and wiring instructions.
- Controls Option – ENON: Shaft only for field-installation of customer-supplied actuator and controls. The following override commands may be received by the Unit Control Module (UCM) from a Tracer SC or other Trane controllers.
- Control Mode – The UCM Control Mode may be edited from occupied to unoccupied to accommodate night setback/setup.
- Control Action – The Control Action may be edited from cooling to heating, changing the primary air damper to a heating source. This will accommodate a cooling/heating changeover system.
- Control Offset – Enabling Control Offset will increase the cooling temperature setpoint and decrease the heating temperature setpoint by a control-offset value (Stored at limiting in the occupied mode).
- Drive damper fully open
- Drive damper fully closed
- Drive damper to maximum airflow setpoint
- Drive damper to minimum airflow setpoint
- Disable unit heat

- Reset-Enabling the reset function forces the controller and the flow sensor to recalibrate
- Programmable hot water valve drive time
- Programmable air damper drive time

The following unit setpoints reside in the UCM in nonvolatile memory. These setpoints are editable from the Tracer via the communications link.

- Occupied cooling temperature setpoint (60–80ºF (15–26°C))
- Occupied heating temperature setpoint (60–80ºF (15–26°C))
- Unoccupied cooling temperature setpoint (60–100ºF (15–37°C))
- Unoccupied heating temperature setpoint (30–100ºF (15–37°C))
- Minimum cooling flow setpoint (0, 10–110% of unit equivalent nominal airflow)
- Minimum heating flow setpoint (0, 10–110% of unit equivalent nominal airflow)
- Maximum flow setpoint (0, 50–100% of unit equivalent nominal airflow)
- Fan Control Offset – This determines at what operating point the fan in a parallel fan-powered unit is energized. This can be specified as a function of temperature, degrees above heating setpoint, or primary airflow (0–10°F (-17–12°C) or 0,10–100% of unit equivalent nominal airflow).
- Heating Setpoint Offset – This determines at what point the first stage of reheat turns on. Expressed in degrees below cooling setpoint. (Only applicable when local thumbwheel is enabled.)
- Zone temperature, auxiliary temperature, and zone setpoint calibration corrections (adjustable from +/-10.0ºF (+/- -12°C)).
- Flow measurement calibration correction (50–150%)
- Cooling Setpoint Low Limit – Applies low limit to programmed occupied cooling setpoint or zone sensor cooling setpoint (30–100°F (-1–37°C)).
- Heating Setpoint High Limit – Applies high limit to programmed occupied heating setpoint or zone sensor heating setpoint (30–100ºF (-1–37°C)).
- RTD / Thermistor – Determines what type of zone temperature sensor will be used.
- Occupied and Unoccupied Outside Air Requirements – Determines the percent of outdoor air required in the zone for air quality requirements.
- Series Fan Configuration – allows option of series fan-powered box to shut off fan and close air valve when unit is unoccupied. Fan will operate in unoccupied mode if reheat is active.
- Heating setpoint low limit.
- Cooling setpoint high limit.
- Local heating flow setpoint enable/disable and setpoint.
- Auxiliary analog input mode select for either auxiliary temperature sensor or CO_2 detector.
- Binary input mode select for either generic or occupancy detector. In addition to the above setpoints, the following status information can be transmitted to a Tracer SC or other Trane controllers.
- Active cooling temperature setpoint
- Active heating temperature setpoint
- Current unit primary airflow
- Current zone temperature
- Re-heat status (On/Off)
- Auxiliary Air Temperature – Available only if the unit has an auxiliary temperature sensor.

- Failure Indicators –The UCM will indicate the following: 1)Temperature Sensor Failure; 2) Flow Sensor Failure; and 3) Local Zone Sensor Setpoint Failure.
- Ventilation Ratio
- Fan Status (on/off)
- Calibration Status (calibration/not-calibrating)
- BIP state
- CO_2 Concentration—Available only if the unit has an auxiliary CO_2 sensor. This mode and auxiliary air temperature are mutually exclusive.

Pneumatic Controls

Normally-Open Actuator

Pneumatic 3 to 8 psig (20 to 55 kPa) spring-range pneumatic actuator.

Normally-Closed Actuator

Pneumatic 8 to 13 psig (55 to 90 kPa) spring-range pneumatic actuator.

3011 Pneumatic Volume Regulator (PVR)

The regulator is a thermostat reset velocity controller, which provides consistent air delivery within 5% of cataloged flow down to 15% of unit cataloged cfm, independent of changes in system static pressure. Factory-calibrated, field-adjustable setpoints for minimum and maximum flows. Average total unit bleed rate, excluding thermostat, is 28.8 scim at 20 psig (7.87 mL/min at 138 kPa) supply.

3501 Pneumatic Volume Regulator (PVR)

The 3501 regulator is a linear-reset volume controller. This PVR is used to maintain a constant volume of airflow from the dual-duct unit when constant volume control is used. Average total unit bleed rate, excluding thermostat, is 43.2 scim at 20 psig (11.8 mL/min at 138 kPa) supply.

Considerations for Pneumatic Thermostat

Field-supplied and -installed based on chosen control options, a direct-acting or a reverse- acting, one-pipe or two-pipe pneumatic room thermostat will control the available air valve, reheat and fan switch to maintain room temperature setpoint.

The following pneumatic control options features are available with VariTrane terminal units:

- PN00: Cooling with Normally-Open damper and actuator only (Reverse-Acting Thermostat)
- PN04: Cooling with hot water reheat, Normally-Open damper, 3011 PVR (Direct-Acting Thermostat)
- PN05: Cooling with electric reheat, Normally-Open damper, 3011 PVR (Reverse-Acting Thermostat)
- PN08: Cooling and Heating, Normally-Open dampers, actuators only (Reverse-Acting Thermostat)
- PN09: Cooling and Heating, Normally-Open dampers, 3011 PVR's (Direct-Acting Thermostat)
- PN10: Cooling and Heating, Normally-Open dampers, 3501 PVR's, Dual-Duct Constant Volume (Direct-Acting Thermostat)
- PN11: Cooling with hot water reheat, Normally-Open damper, 3011 PVR - Auto Dual Minimum (Direct-Acting Thermostat) (N.O. Water Valve)
- PN32: Cooling with hot water reheat, Normally-Open damper, 3011 PVR - Constant Volume (Direct-Acting Thermostat)
- PN34: Cooling with electric reheat, Normally-Open damper, 3011 PVR - Constant Volume (Reverse-Acting Thermostat)
- PN51: Cooling with reheat, Normally-Open damper, 3011 PVR Duct Pressure Switch (Reverse-Acting Thermostat)
- PN52: Cooling with reheat, Normally-Open damper, 3011 PVR - Dual Pressure Minimum (Reverse-Acting Thermostat)

- PC00: Cooling Only with Normally-Closed damper - Direct-Acting Thermostat
- PC03: Cooling and Heating, Normally-Closed heating damper, Normally-Open cooling damper, actuators only - Direct-Acting Thermostat
- PC04: Cooling with hot water reheat, Normally-Closed damper, 3011 PVR - Direct-Acting Thermostat
- PC05: Cooling with electric reheat, Normally-Closed damper, 3011 PVR - Reverse-Acting Thermostat

Options

Power Fuse (cooling only and hot water units, and VDDF)

An optional fuse is factory-installed in the primary voltage hot leg.

Transformer (Standard on fan-powered, optional on VCCF, VCWF, VDDF)

The 50-VA transformer is factory-wired and installed in an enclosure with 7/8" (22 mm) knockouts to provide 24 VAC for controls.

Wireless Zone Sensor/Receiver

Factory mounted Receiver with field mounted Sensor accessory eliminates the need for the wiring between the zone sensor and unit level controller. See specifications on Page C67XXX.

Disconnect Switch (Optional on VCCF, VCWF, VDDF)

Disengages power.

DDC Retrofit Kit (VRTO)

The kit consists of a Trane DDC Unit Control Module (UCM) VAV terminal unit controller and a pressure transducer installed in a metal enclosure. The mechanical specifications of accessories such as DDC zone sensors, hot water valves, and transformers are found elsewhere in this section.

Retrofit Kit Options

Flow Bar Sensor

The flow bar sensor is a multiple-point, averaging, pitot tube type flow sensor. It is intended for field installation on terminal units that have no flow measurement device. The total and static pressure outputs of the sensor are field-piped to the high and low inputs of the pressure transducer in the retrofit kit.

Retrofit Kit Actuator

The electric actuator is a direct-coupled type actuator that utilizes three-wire, floating-point control. The actuator is field-installed to the damper shaft and field-wired to the controller.

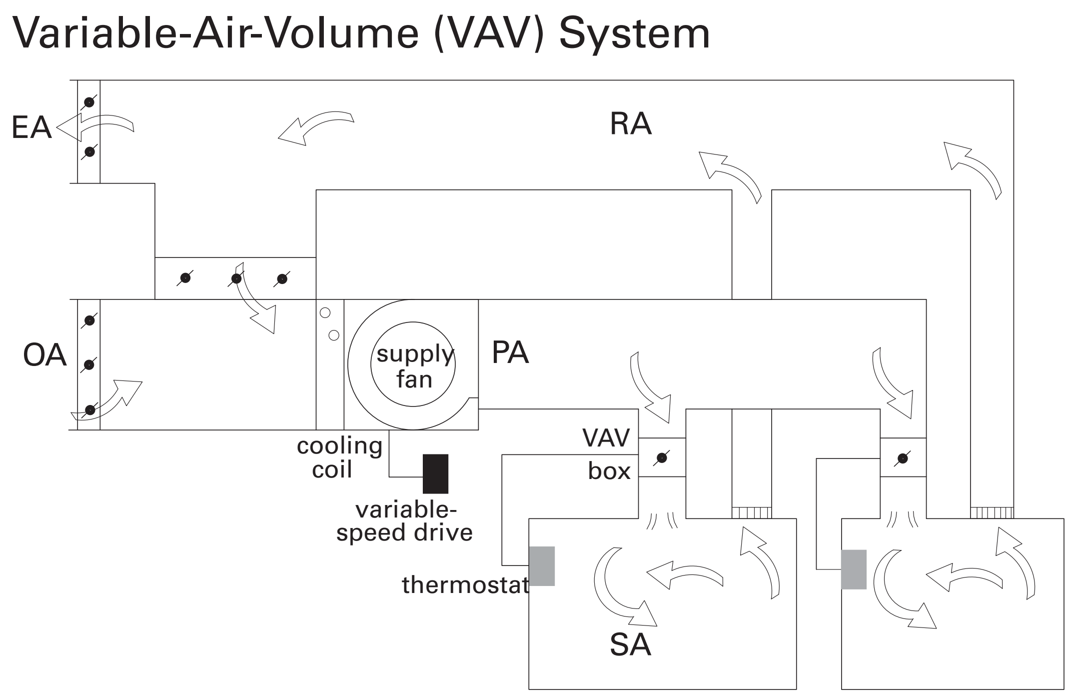
Trane Actuator – Actuator is rated at 4 VA at 24 VAC. Drive time is 90 seconds with 35 in.-lb (4 N-m).

Retrofit Actuator – Actuator is rated at 3 VA at 24 VAC. Drive time is 80 to 110 seconds for 0 to 35 in.-lb (0 to 4 N-m).

Other Options Available

- DDC Zone Sensors
- 2-Position & Modulating Water Valves
- Control Transformer (Ships loose with mounting plate for 4x4 junction box)
- Auxiliary Temperature Sensor
- Zone Occupancy Sensors
- Co_2 Sensors (Room- or duct-mounted)

Application Considerations



VAV System

No Heat

Central Cooling Only—In some systems, the central air handler provides only cooling and ventilation during zone occupied periods. The supply air is maintained at a constant temperature and the supply airflow is modulated to match the VAV airflow rate with the zone cooling requirements.

Central Heat

Central Heat for Morning Warm-up—Many buildings cool down during the night. To be at a comfortable temperature in the morning when the building is again occupied, heat must be added to the spaces. Heat provided by the central air handler for morning warm-up is supplied at constant air volume to the zones, prior to the time of occupancy. During the morning warm-up period, the VAV terminal units must open to allow heated air to flow into the zones. In most instances very little additional heat is needed once the building is occupied.

Central Occupied Heating-Changeover—Some buildings use the same air handler to provide both occupied cooling and occupied heating. This is commonly referred to as a changeover system. The system changes between heating and cooling depending on the need of the zones on the system. In a changeover system, the operation of the VAV terminal units must also change over, opening to provide heat in the heating mode and opening to provide cooling in the cooling mode. Trane's main product in this type of application is called VariTrac™. VariTrane products can also be used in these systems. (These types of systems are beyond the scope of this manual and are discussed in detail in the VariTrac II Manual.

Terminal Heat

Remote Heat—In some zones of a single-duct VAV system, perimeter heating equipment, remote from the terminal unit, is used to add heat to the zone when the cooling load is lower than the minimum cooling capacity of the VAV terminal unit. Heat is added directly to the zone while cool supply air continues to enter the zone at a minimum rate for zone ventilation.

Terminal Reheat—In some zones of a single-duct VAV system, a minimum flow of cool supply air is reheated at the terminal unit before entering the zone. Terminal reheat can be provided by electrical resistance heaters or by hot water coils.

Parallel Fan-Powered Heat—In some zones of a single-duct VAV system, cool supply air at minimum flow is mixed with warm plenum air before entering the zone at a constant flow rate. A fan in the terminal unit, in parallel with the central fan, draws air from the plenum whenever the zone requires heat.

Series Fan-Powered Heat—In some zones of a single-duct VAV system, the airflow to the zone is held constant, during both heating and cooling, by a terminal unit fan that is in series with the central fan. The terminal unit fan runs continuously. When the zone requires heat, cool supply air at minimum flow is mixed with warm, return plenum air before entering the zone.

VariTrane VAV Terminal Units

The function of the VariTrane terminal unit in a VAV control zone is to vary the volumetric airflow rate to the zone. VariTrane units are available with either microprocessor-based DDC controls or pneumatic or analog electronic controls. Factory-installed controls are available with all types of terminal units.

Figure 12. Parallel fan-powered unit cooling only

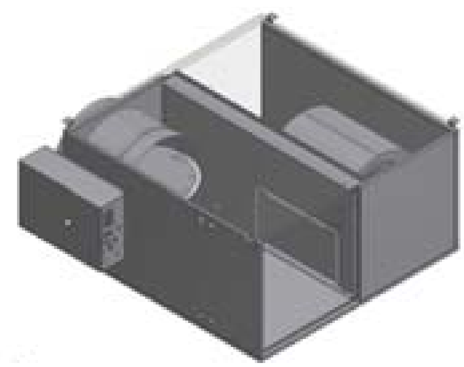
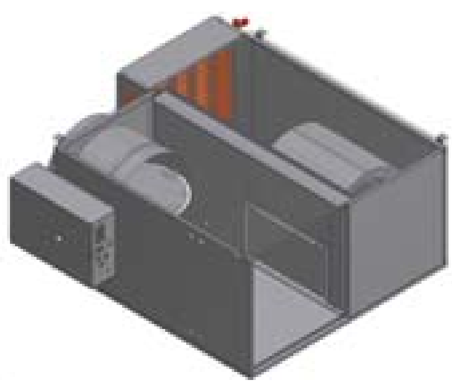


Figure 13. Parallel fan-powered unit with hot water coil (L) and parallel fan-powered unit with electric coil (R)



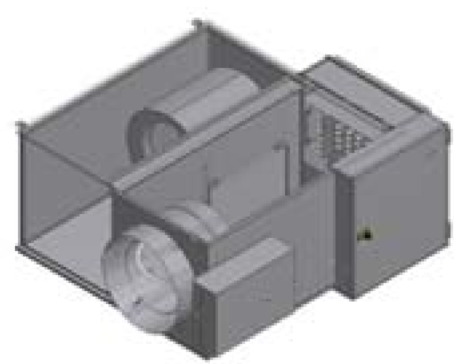
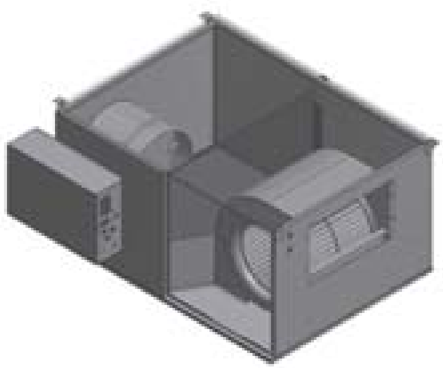
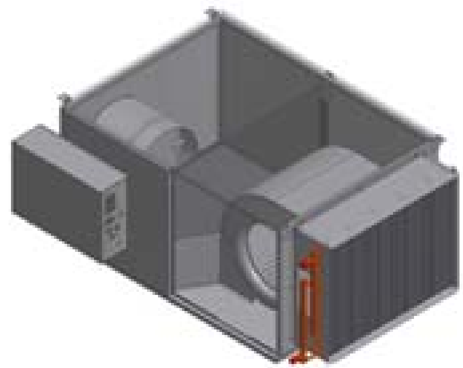


Figure 14. Series fan-powered unit cooling only (L) and series fan-powered unit with hot water coil (R)





VAV Terminal Unit Types

Parallel Fan-Powered

Parallel fan-powered units are commonly used in VAV zones which require some degree of heat during occupied hours—when the primary supply air is cool. The terminal unit fan is in parallel with the central unit fan; no primary air from the central fan passes through the terminal unit fan. The terminal unit fan draws air from the space return plenum.

When no heat is needed, the local parallel fan is off and a backdraft damper on the fan's discharge is closed to prevent cool air entry into the return plenum. When cool airflow to the VAV zone is at a minimum and the zone temperature drops below setpoint, the local parallel fan is turned on and the backdraft damper opens. A constant volume of air is delivered to the zone because the fan delivers a constant volume of warm plenum air which is mixed with cool primary air at a minimum flow. Remote heat or terminal reheat can provide additional local heating.

Series Fan-Powered

Series fan-powered terminal units are used commonly in VAV zones that require heat during occupied hours, desire constant air volume delivery, and are willing to pay for the additional energy consumption required. The terminal unit fan is in series with the central fan. Primary air from the central fan always passes through the terminal unit fan.

The local series fan within the terminal unit operates whenever the unit is in the occupied mode. The volume of air delivered to the VAV zone is constant, but the temperature of the delivered air varies. As the zone requires less cooling, the primary air damper closes. As the primary air damper closes, the air mixture supplied to the zone contains less cool air and more warm plenum air. Remote heat or terminal reheat can provide additional local heating.

Series fan-powered terminal units are also useful in low supply air temperature systems, since the terminal unit fan can be sized so that warm plenum air is always mixed with low temperature supply air. This raises the supply air temperature to an acceptable distribution level and reduces condensation potential.

Low-Height Fan-Powered

Low-height fan-powered terminal units are a slightly modified version of a fan-powered terminal unit. As its name suggests, the low-height fan-powered unit has a shorter height dimension to accommodate applications where ceiling space is limited. To reduce the height, shorter terminal unit fans are integrated into the standard height series or parallel terminal unit. The result is a unit with a maximum height of 11.0" to 11.5".

For low-height units with the smaller fan sizes (sizes 08SQ and 09SQ), a single low-profile fan is used. Low-height units with the largest fan size (size 10SQ) use two low-profile fans. Each fan operates off a separate motor. The fans still remain in series or parallel with the primary system central fan. Low acoustic levels are much more challenging in these low ceiling space applications, due to the reduced radiated ceiling pleunum effect.

The operation of the low-height terminal unit is exactly the same as that of a series or parallel terminal unit, as are the options for high-efficiency ECMs, insulation options, etc. As with the other fan-powered terminal units, additional local heating can be provided by remote heat or terminal reheat.

Parallel vs. Series

In many climates, fan-powered systems are a lower operating cost alternative than single-duct systems. The energy inefficiencies inherent in reheating cold primary air can be eliminated with a key design characteristic of fan-powered terminal units, plenum air heating. Heating with warmer plenum air allows for recovery of heat from lighting and other heat sources in the building.

Comparison of Parallel and Series Models

Once it has been determined that a fan-powered system is to be specified, the designer must decide between parallel and series configurations. Each model carries its own characteristics of delivered airflow, energy consumption, and acoustics. For the end user, the designer might consider three goals: a comfortable and productive tenant environment, acceptable installed cost, and low operating costs.

Parallel and series fan-powered terminal units offer specific advantages for particular applications. Table 139 compares the key similarities and differences between the models that the designer should consider in performing an engineering analysis.

Typical Application of Parallel Units

Parallel intermittent fan-powered terminal units are very common in perimeter zones or buildings where loads vary during occupied hours. Core zones, which maintain a more constant cooling requirement, are better suited for variable airflow (single-duct) units. Typical jobs combine parallel fan-powered units (exterior) and single-duct units (interior) to provide an efficient system with lowest first cost. Although the overall NC of parallel systems is lower than an equivalent series system, the intermittent fan is sometimes noticed when energized. To minimize the impact of this NC change, an ECM (Electrically Commutated Motor) can be used which has soft-start technology.

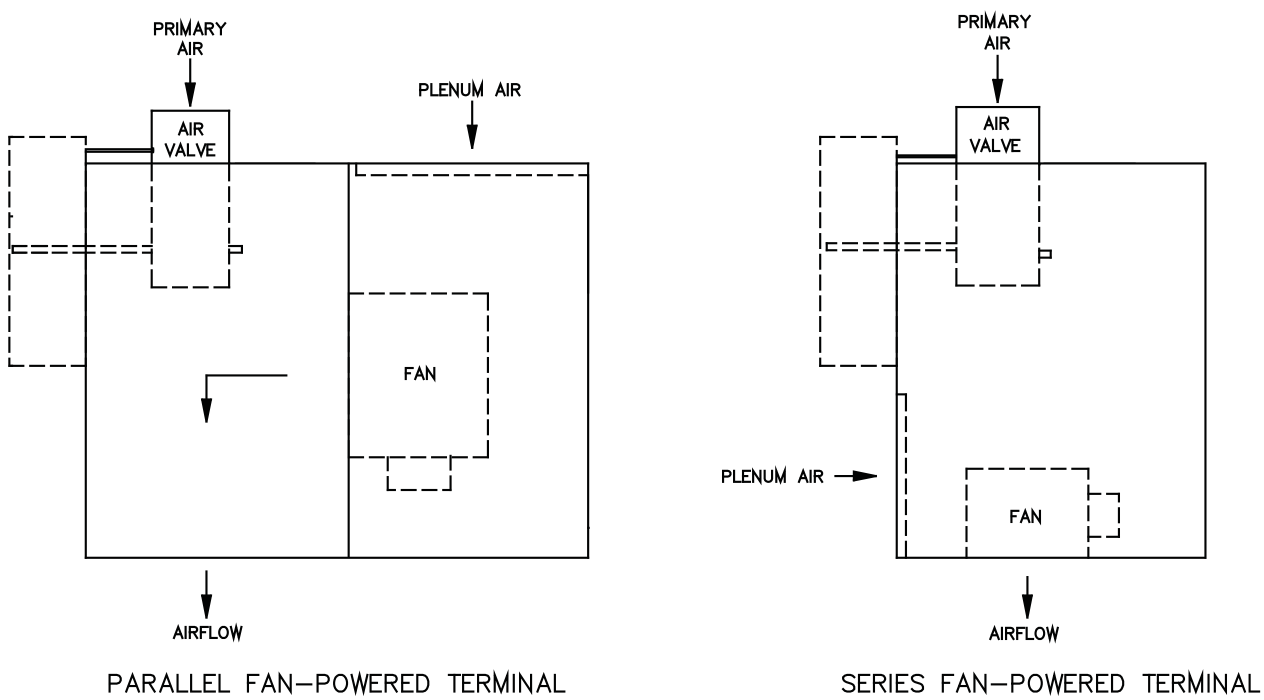
Typical Application of Series Units

Applications requiring constant air movement or blending utilize series constant fan-powered terminal units. Conference rooms, laboratories, and lobbies are common applications. Because the series fan also adds to the system external static pressure, office buildings take advantage of this design feature and down size main air handling equipment. Finally, series terminals are used in low-temperature air systems to temper cold primary air with warm plenum air and deliver it to the zone.

Table 139. Parallel vs. series

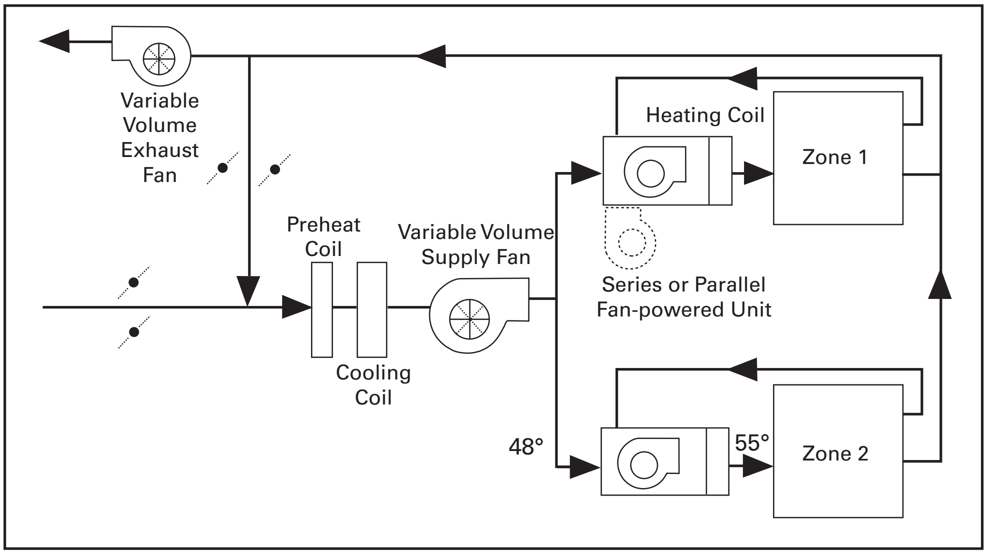
	Parallel	Series
Fan Operation	Intermittent operation during occupied and unoccupied modes.	Continuous operation during the occupied modes. Intermittent operation during unoccupied mode.
Operating Sequence	Variable-volume, constant-temperature device during cooling. Constant-volume, variable-temperature during heating.	Constant-volume, variable-temperature device at all times. Delivers design airflow regardless of the load.
Fan Energization	Based on zone temperature deviation from setpoint. No interlock with central system fan required.	Interlocked with central system fan to deliver required air to the zone in both heating and cooling modes.
Terminal Fan Operating and Size	Fan runs during heating load. Size for design heating load. Typically this is 40 to 60% of design primary cooling airflow.	Fan runs continually. Fan sizing should meet the greater of design cooling or heating airflow to the zone.
Air valve Sizing	Design cooling airflow.	Design cooling airflow.
Minimum Inlet Static Pressure Required for Central Fan Sizing	Sufficient to overcome unit, heating coil, downstream duct and diffuser pressure losses.	Sufficient to overcome air valve pressure loss only.
Acoustics	When operating under cooling loads the terminal fan does not run, offering superior acoustic performance similar to single-duct VAV. Under heating loads, the fan operates intermittently. Acoustical impact can be minimized by use of a ECM.	Produces slightly higher background sound pressure levels in the occupied space. This sound level remains constant and is less noticeable than intermittent fan operation with PSC motors.

Figure 15. Parallel & series fan-powered terminal



Low-Temperature Air

Figure 16. Low temperature air system layout



Benefits of Low-Temperature Air

The benefits of low-temperature air systems include reduced first cost, reduced operating cost and increased revenue potential. Since low-temperature air transports more energy per cubic foot, smaller fans and ducts can be used. An EarthWise™ system takes that a step farther and includes optimizing the waterside of the HVAC system as well with low flow rates through the chilled water and condenser loops.

Since low-temperature water can transport more thermal energy per gallon, smaller pumps, pipes, and valves can be used. Smaller HVAC equipment consumes less energy so both electrical demand and consumption are lowered, reducing operating costs. The amount of revenue generated by a commercial building is related to the amount and quality of rental floor space. The amount of rental floor space is increased in a low-temperature air system, since air handlers, riser ducts, and equipment rooms are smaller. Since smaller ducts reduce the required ceiling plenum, additional floors may be included without increasing building height.

The concept of the EarthWise system is to deliver superior comfort and be less expensive to install and operate. The method to do this involves both waterside optimization and airside optimization. The waterside is optimized using techniques of low water flow through the evaporator and condenser of the chiller as well as using chiller-tower optimization control strategies. For more information on the waterside of the EarthWise system, contact your local Trane representative or visit www.trane.com.

Airside savings are obtained using a combination of lower air temperature and intelligent control strategies. The ability of the VAV unit to communicate information is vital to system coordination.

System Operation

A low-temperature air system could be done with chilled water or direct expansion equipment. A chilled water system includes a chiller plant, VAV air handlers, and series or parallel fan-powered VAV terminal units. The VAV air handlers use cold water, typically around 40°F (4.4°C), from the chiller plant, to cool the supply air to 45–50°F (7.2–10°C). The volume of supply air is determined by the airflow needs of the VAV terminal units. A direct-expansion system would include a VAV air handler or rooftop with series or parallel fan-powered VAV terminal units. The supply air would be cooled to 48–52°F (8.9–11.1°C).

The VAV terminal units include a parallel or series fan with the central air handler or rooftop fan. The terminal unit fan operates continuously, mixing 45-50°F (7.2–10°C) supply air with warm plenum air, to provide 50–55°F (10–12.8°C) cooling air to the occupied space at design conditions. As the cooling load in the space decreases, the VAV terminal air valve closes to reduce the flow of cold supply air and increase the flow of warm plenum air in the case of series terminal units. The temperature of air supplied to the space rises, but the volume flow rate to the space is constant for the series unit.

Considerations for VAV products

To achieve the maximum benefit from the low-temperature air system, several VAV considerations must be addressed.

Insulation

The units must be insulated to ensure that no condensation occurs on the units. How much insulation is needed? Trane has tested its insulation with the goal of developing a thermal resistance ratio for each type of insulation. The thermal resistance (TR) ratio can be used, along with the properties of the insulation and the system operating conditions to determine the necessary insulation thickness required.

In the low-temperature air system with fan-powered units, the ducts and diffusers downstream from the terminal unit handle air that is 55°F (12.8°C) or warmer. Therefore, condensation considerations are no different from conventional systems. Linear slot diffusers are recommended to take advantage of the Coanda effect described in the Diffusers section later in the catalog.

Terminal unit surfaces that are traditionally not insulated—electric and hot water reheat coils and the primary air inlet for example—should be thoroughly field-insulated.

Leakage

When the terminal unit fan is off, the air valve will close, and not leak. Ducts upstream of the terminal unit must also be thoroughly insulated and constructed for very low leakage.

Duct and terminal unit insulation can be internal or external. Keep in mind that internal insulation has hidden thermal leaks at joints and seams. These areas must be located and insulated externally to avoid condensation. External Insulation, on the other hand, allows a complete, uniform thermal seal.

Minimum settings and IAQ

Indoor air quality is usually best when a specific quantity of outside ventilation air reaches each building occupant. Maintaining a minimum ventilation rate is a challenge in any VAV system because the amount of supply air that reaches a particular space decreases as the cooling load decreases. To insure that a minimum amount of supply air reaches the space at all times, a minimum flow setting on the terminal unit is used. In low-temperature air systems, when the space needs heating, this minimum flow setting results in increased heating load. Therefore, it is important to include the additional load imposed by the cold supply air when calculating heating loads. Reheat may be required since the ventilation values are absolute requirements and not percentage of total airflow requirements.

EarthWise or Low-Temperature Air Distribution Design Considerations with Parallel Fan-powered Terminal Units

The parallel fan-powered unit needs to be set up to run continuously rather than intermittently. Since it is in parallel, the airflow required by the fan is less than a comparable series unit. This results in energy savings. Running the parallel fan continuously will take some minor control changes. It will, however, create a better acoustical installation.

The parallel fan should be large enough to temper the design cooling airflow at 45–50°F to 50–55°F (7.2–10°C to 10–12.8°C). For instance, if the design cooling airflow is 1000 cfm at 55°F (472 L/s at 12.8°C), you will need 781 cfm of 48°F (368 L/s of 8.9°C) supply air and 219 cfm of 80°F (103 L/s of 26.7°C) plenum air. The parallel fan can be sized for the 219 cfm (103 L/s) rather than the total room airflow.

The fan airflow plus the minimum primary airflow must be checked with the minimum airflow of the diffuse

rs to insure that dumping doesn't occur. If that is a concern, the minimum could be adjusted up or the fan airflow could be adjusted up.

As the valve closes, the downstream static pressure will decrease because the pressure is related to the airflow. The fan will supply more air at the valve minimum condition than at design due to the decreased static pressure. This should be a consideration when calculating how much airflow would occur at the minimum valve plus fan airflow condition. The new fan airflow would be found by looking at a fan curve at the new SP point. The new SP can be calculated:

$$\left\langle \frac{\text{Fan Airflow} + \text{Valve Minimum}}{\text{Fan Airflow} + \text{Valve Design}} \right\rangle X\, SP_1 = SP_2$$

Table 140, p. 215 can be used to determine what percentage of the total airflow should come from the fan to temper the supply air, assuming 80°F (26.7°C) plenum air.

Table 140. Percentage of airflow from fan

Supply Air Temp. (deg. F (C)	Primary Air Temperature (deg. F (C)) 45 (7.2)	46 (7.8)	47 (8.3)	48 (8.8)	49 (9.4)	50 (10)
50 (0)	14%	12%	9%	6%	3%	0%
51 (10.6)	17%	15%	12%	9%	6%	3%
52 (11.1)	20%	18%	15%	13%	10%	7%
53 (11.7)	23%	21%	18%	16%	13%	10%
54 (12.2)	26%	24%	21%	19%	16%	13%
55 (12.8)	29%	26%	24%	22%	19%	17%

If anything other than 80°F (26.7°C), the following equation can be used to calculate the percentage: Supply Temperature =(%*primarytemperature)+(1-%)*plenum temperature

Low-Temperature Air Distribution Design Considerations with Series Fan-powered Terminal Units

The VAV terminal unit includes a fan that operates continuously. The series fan should be large enough to insure that the mixture of cold supply air and warm plenum air is 50–55°F (10–12.8°C) at design cooling flow conditions. In these types of systems, it is a good design practice to develop the system based upon 55°F (12.8°C) air being provided to the space from the fan-powered terminal unit. If a lower temperature air is used downstream of the VAV terminal unit, the system designer will have some concerns related to condensation on diffusers and other low-pressure ductwork accessories. For instance, if the occupied space must receive 1000 cfm of 55°F (472 L/s at 12.8°C) air to satisfy to design cooling load, 715 cfm must be 45°F (337 L/s must be at 7.2°C) supply air and 285 cfm must be 80°F (135 L/s must be 26.7°C) plenum air. Therefore, the series fan-powered terminal must be sized to have the air valve deliver 715 cfm (337 L/s) of supply air at design conditions, but the fan must be sized to deliver 1000 cfm (472 L/s).

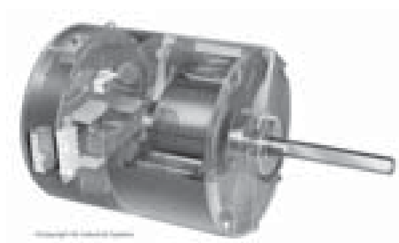
Airside System Factors

A couple of system related factors should be noted as they apply to condensation. The first is the advantage the colder primary air has from a humidity standpoint. As noted in the description above, the low-temperature system operates at space relative humidity of 30–45% while a standard system operates at space relative humidity of 50–60%. The drier zone air means that the plenum air returning to the series terminal unit will also be drier and, therefore, less of a problem with condensation.

The second condensation factor to note is related to systems that shut down in the evening. Many people believe that immediately sending low-temperature primary air to these boxes that have been off for some time will cause a shock to the system and may cause condensation problems at startup. The solution to this has been the advent of gradual pull-down or "soft start" systems. In this type of system, the primary air temperature is higher on initial startup (typically 55°F(12.8°C)) and then gradually reduced to the normal operating point over the next 30 to 60 minutes.

Energy Savings & System Controls

Electrically Commutated Motor



The ECM provides an additional energy-saving option to the system designer. Some of the advantages of the motor include high efficiency, quiet operation, short payback, and easy installation. There are several considerations that need to be addressed when deciding whether to use these motors or not. The primary benefit may be seen as increased efficiency.

Operating Hours—The added cost of an ECM can be offset more quickly in applications which require a relatively high number of hours of operation. However, if a space does not require extensive running time for the unit fan, then it may not be a good candidate for this type of motor based solely on payback. Therefore, the decision about using the ECM may be based on other benefits, depending on the needs of the customer.

Airflow Flexibility—The ECM allows a greater airflow range per fan size. If a space is going to change uses and load components frequently, the ability to change supply airflow with the ECM without changing units will be a benefit.

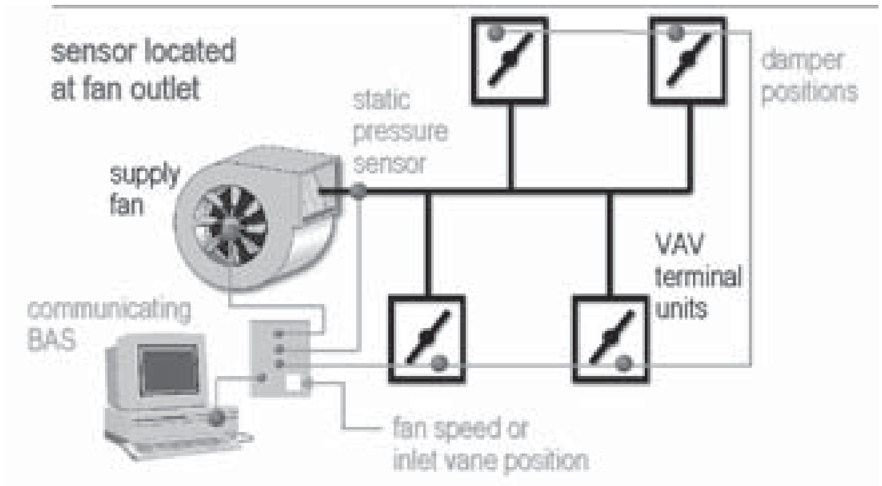
Airflow Balancing—The ability of the ECM motor to self-balance to an airflow regardless of pressure can be an asset when trying to air balance a job. This will help eliminate additional dampers or changes to downstream ductwork to ensure proper airflow. For more information, please contact your local Trane sales engineer.

Fan-Pressure Optimization

With Trane's Integrated Comfort System, the information from VAV terminal units can be used for other energy-saving strategies. Fan-pressure optimization is the concept of reducing the supply fan energy usage based on the position of the terminal unit dampers.

The control system allows this scenario. The system polls the VAV units for the damper position on each unit. The supply fan is modulated until the most wide-open damper is between 85% and 95% open. The correct airflow is still being sent to the zones since the controls of the VAV units are pressure-independent, and the fan modulates to an optimal speed and duct static pressure which results in fan energy savings.

Figure 17. Optimized static-pressure control



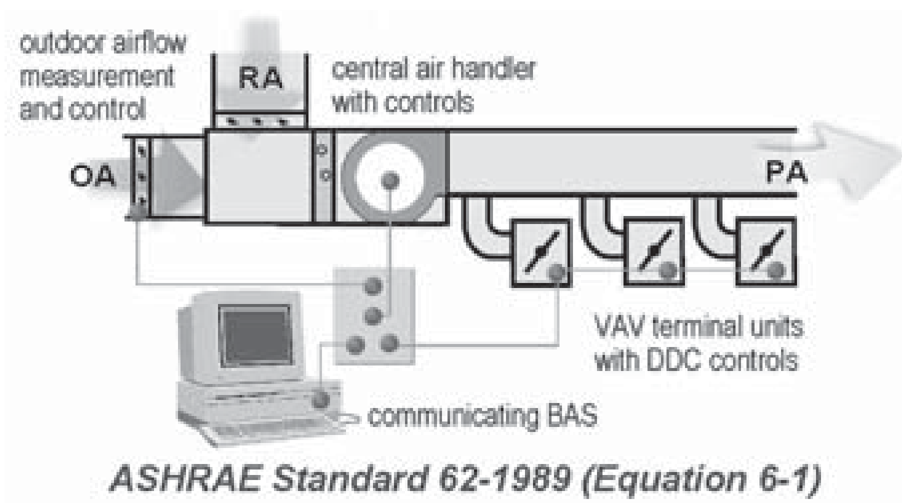
Ventilation Reset

The Ventilation Reset control strategy enables a building ventilation system to bring in an appropriate amount of outdoor air per **ASHRAE Standard 62.1.** The basis for the strategy is measuring airflow at each zone, calculating current system ventilation efficiency using the multiple-zone system equations of the standard, and communicating a new outdoor airflow setpoint to the air handler.

This strategy continually monitors the zone ventilation needs and system outdoor air intake flow, minimizing the amount of ventilation air and increasing the energy efficiency of the system. This insures that the right amount of air is brought in at all times and that proper ventilation can be documented. Trane has integrated this control ability into the VAV controls, air-handler controls, and building controls.

For more detailed information on these energy-saving strategies, please refer to the "Additional References" section at the end of this chapter for appropriate material.

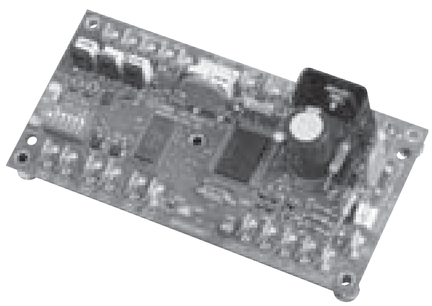
Figure 18. Ventilation reset



Control Types

VAV terminal units are available with many different options. These options fall into three main categories of controls: direct digital (DDC), pneumatic, and analog electronic. All of these control types can be used to perform the same basic unit control functions, yet differences exist in accuracy of performance, versatility, installed cost, operating cost, and maintenance cost.

Direct Digital Control (DDC) Systems



Direct digital control (DDC) systems became available as advances in computer technology made small microprocessors available and affordable. Much of the hardware in DDC systems is similar to analog electronic systems. The primary difference is that DDC controllers allow system integration, remote monitoring, and adjustment. The microprocessor is programmed using software that gives the controller a higher level of capability than either the pneumatic or analog electronic options.

Benefits:

Performance—DDC controls offer PI control capability. A PI control scheme is the most accurate and repeatable control scheme available in the VAV terminal unit industry.

Versatility—DDC controls accepts software commands to determine how its outputs will be controlled. When a control sequence must be modified, making changes to the software instructions is easier and quicker than changing hardware.

Operating and Maintenance Costs—DDC controls can be networked together to provide system-control strategies for energy savings. Multiple controllers can be easily monitored and adjusted from a remote location. DDC controls also have system and individual diagnostic capability.

Disadvantages:

Versatility—The communications protocol between controllers will be different from one controller manufacturer to another.

Installed Cost—DDC controls are the most expensive of the three control types.

Operating and Maintenance Costs—Building personnel must be trained to operate and maintain the system.

Pneumatic Control Systems

Pneumatic control systems use compressed air through simple mechanical control devices, such as diaphragms, springs, and levers to change an output in response to a change in a monitored variable. With VAV terminal units, the output is typically a primary airflow and the monitored variable is zone temperature.

Benefits:

Performance—Pneumatic controls are a proven technology that is effective and has a long life cycle.

Installed Cost—When a source of compressed air exists at the facility, pneumatics generally have a lower installed cost than other types of controls when only a basic functionality is required.

Operating and Maintenance Costs—Pneumatics are still the most familiar control technology to many building designers and maintenance people.

Large Installed Base—Pneumatic systems are very common in existing buildings. This eliminates the need to purchase the most expensive piece of equipment in a pneumatic control system—the control air compressor. Extensions to existing pneumatic systems are generally very simple and extremely cost-effective.

Disadvantages:

Performance—Pneumatic controls provide proportional-only control for VAV terminal unit systems. This control scheme is less accurate than the more advanced control schemes. Improper calibration of pneumatic controls leads to poor energy utilization.

Versatility—A central pneumatic control system, where each of the control zones can be monitored and adjusted from a remote location, is extremely costly to configure and to modify.

Operating and Maintenance Costs—Pneumatics easily drift and require constant upkeep and scheduled maintenance. Diagnostic capability for pneumatics is not available. A main compressor which is not maintained and becomes contaminated with oil or water can pump those contaminants into the compressed-air-distribution system. This may require costly cleaning of the system and a possible replacement of system components.

DDC Controls Basic Information

DDC controls have become the industry standard for VAV terminal unit control systems. DDC systems use electronic field devices such as a flow transducer, a primary air modulating damper, and an electronic thermostat. These field devices report software instructions of how the outputs are positioned in relation to the inputs to a controller. The VariTrane system uses a primary air valve and flow transducer for both DDC systems and analog electronic systems. However, the DDC zone sensor is different from the analog electronic thermostat.

DDC controls provide much flexibility and considerable diagnostic capability. DDC controllers can be connected together to form a network of controllers. Once the controllers are networked, they can be monitored for proper operation from a remote location. Commands and overrides can be sent for groups of controllers at one time to make system-wide changes. Commands and overrides can be sent to individual units to allow problem diagnosis, temporary shutdown, startup schedules or other specialized changes. When integrated into a building management system, the operation of the VAV terminal unit system can be modified to do such things, as coincide with occupancy schedules and reduce energy charges.

DDC control of VAV terminal units is a key element in providing intelligent and responsive building management. Precision control, flexible comfort, and after hours access are all available with the VariTrane DDC control system for VAV terminal units.

Key features of the system include:

- An advanced unit controller
- Flexible system design
- User-friendly interaction

Pneumatic Controls Basic Information

Pneumatic controls modulate air pressure of a controller to maintain setpoint. For VAV systems, there are two primary types of pneumatic controllers—the room thermostat and the pneumatic volume regulator (PVR).

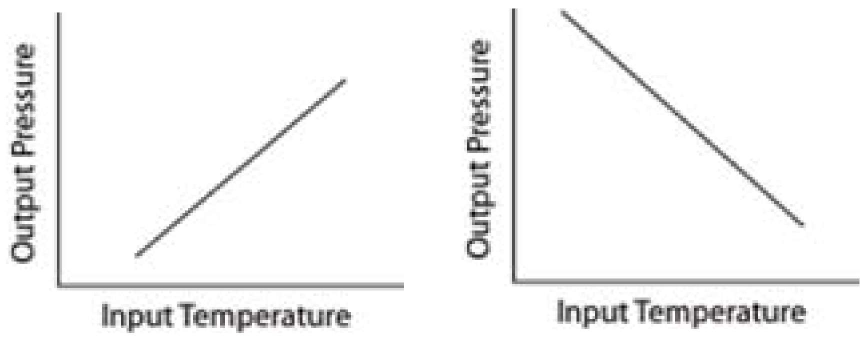
Room Thermostats

The most visible controller to the customer is the room thermostat. Pneumatic room thermostats can be classified by two characteristics: the tubing connection(s) to the thermostat and the action of the thermostat output in response to a change in the input.

Room thermostats are available in models that require a one-pipe or a two-pipe configuration. The name is derived from the number of tubes that must run to the thermostat location. The difference is really in the construction of the thermostats. The two-pipe thermostats have a constant pressure supply connected via an air tube to the thermostat supply air port. The supply air travels through the thermostat's relays, levers, diaphragm, and bleed port to produce an output. The output line is connected to the output port of the thermostat and extends to the controlled device. The one-pipe thermostat has, as its name suggests, only one air line connection. The thermostat works by opening and closing an air bleed valve. This will either decrease or increase the pressure on the controlled device, which is connected to the same line that runs to the thermostat.

Room thermostats also can be classified by their reaction to a change in temperature. Room thermostats classified this way are denoted as either direct-acting or reverse-acting. Direct-acting thermostats will increase their output pressure as the temperature the thermostat measures increases.

Figure 19. Direct-acting thermostat response (L) and direct-acting thermostat response (R)



On the contrary, reverse-acting thermostats will decrease their output pressure as the temperature the thermostat measures increases.

Pneumatic Volume Regulators

These controllers accept the room thermostat signal and modulate the VAV terminal unit primary air damper. The primary air damper is controlled for an airflow setpoint that is determined by the room thermostat. The thermostat increases the PVR's airflow setting when the temperature in the space is warm. On the other hand, the thermostat decreases the PVR's airflow setting when the temperature in the space is cold.

Currently, VariTrane offers two models of pneumatic volume regulators in its controls offering—the 3011 regulator (used in most applications) and the 3501 model (used in dual-duct constant-volume applications). The primary difference is the 3501 PVR's ability to change the velocity pressure linearly with a change in thermostat pressure, which results in improved stability at low flows. In contrast, the 3011 PVR resets the velocity pressure with a change in thermostat pressure.

Reset Control of Minimum and Maximum Flow—The 3011 PVR and 3501 use fixed reset control of minimum and maximum flow settings. The primary benefit of fixed reset in a pneumatic volume regulator is stable flow control without excessive damper movement.

Fixed Reset—A fixed reset controller operates over a thermostat signal change of 5 psi between minimum and maximum flow, regardless of the differential pressure flow sensor signal. The thermostat is usually set for a gain of 2.5; i.e. it produces a 2.5 psi output change per degree of space temperature change. This control strategy provides stable flow control with the primary air valve throttling between minimum and maximum flow over a 2°F space temperature change.

Example 1: Air valve with a 6" inlet, Pneumatic thermostat gain = 2.5 psi/degree:

Minimum Flow=0 cfm, 0.0 in. wg flow signal

Maximum Flow=680 cfm, 2.0 in. wg flow signal

2.0 in. wg signal range

The damper will modulate from zero to maximum position over a 2°F temperature change.

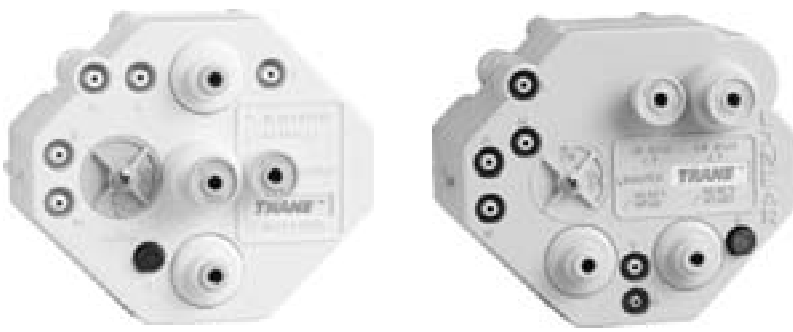
Bleed Port to Atmosphere—Bleeding air to the atmosphere is a normal operation for a volume regulator. The 3011 volume regulator addresses this function with a dedicated bleed port. When air is bled through the flow sensor, the differential pressure signal from the sensor is affected. As a result, the flow sensor signal can be radically altered if the volume regulator is bleeding air, and may cause excessive damper movement.

Calibration—The minimum and maximum settings are independent of each other and need to be set only once during calibration.

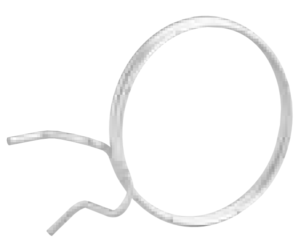
Signal Configuration Flexibility—Both can be configured to work with both normally-open and normally-closed pneumatic air valves, and both direct-acting and reverse-acting thermostats.

Pneumatic Volume Regulators

Figure 20.



Flow Measurement and Control



One of the most important characteristics of a VAV terminal unit is its ability to accurately sense and control airflow. The VariTrane terminal unit was developed with exactly that goal in mind. The patented, multiple-point, averaging flow ring measures the velocity of the air at the unit primary air inlet.

The differential pressure signal output of the flow ring provides the terminal unit controller a measurement of the primary airflow through the inlet. The terminal unit controller then opens or closes the inlet damper to maintain the controller airflow setpoint

Flow Measurement

Most VAV terminal units contain a differential pressure airflow measurement device, mounted at the primary air inlet, to provide a signal to the terminal unit controller. Numerous names exist for the differential pressure measurement device—flow sensor, flow bar, flow ring. The differential pressure measured at the inlet varies according to the volumetric flow rate of primary air entering the inlet.

The total pressure and the static pressure are measurable quantities. The flow measurement device in a VAV terminal unit is designed to measure velocity pressure. Most flow sensors consist of a hollow piece of tubing with orifices in it. The VariTrane air valve contains a flow ring as its flow measuring device. The flow ring is two round coils of tubing. Evenly spaced orifices in the upstream coil are the high-pressure taps that average the total pressure of air flowing through the air valve. The orifices in the downstream ring are low-pressure taps that average the air pressure in the wake of flow around the tube. By definition, the measurement of static pressure is to occur at a point perpendicular to the airflow. The low-pressure taps on the VariTrane flow ring measure a pressure that is parallel to the direction of flow but in the opposite direction of the flow. This "wake pressure" that the downstream ring measures is lower than the actual duct static pressure. The difference between the "wake pressure" and the static pressure can be accounted for so that the above relationship between flow and differential pressure remain valid. The difference also helps create a larger pressure differential than the velocity pressure. Since the pressures being measured in VAV terminal box applications are small, this larger differential allows transducers and controllers to measure and control at lower flow settings than would otherwise be possible.

The average velocity of air traveling through the inlet is expressed in the equation:

$$FPM = 1096.5\sqrt{\frac{VP}{DENS}}$$

Where:

FPM =	Velocity of air in feet per minute
1096.5 =	A constant
VP =	The velocity pressure of the air expressed in inches of water
DENS =	The density of the air expressed in pounds per cubic foot

Often, the density is assumed to be a constant for dry air at standard conditions (68°F (20°C)) and sea level pressure of 14.7 psi (101.4 kPa)). These conditions yield the following commonly used equation:

$$FPM = 4005\sqrt{VP}$$

The velocity pressure is defined as the difference between the total pressure in the duct and the static pressure in the duct:

VP = TP - SP (All units are expressed in inches of water)

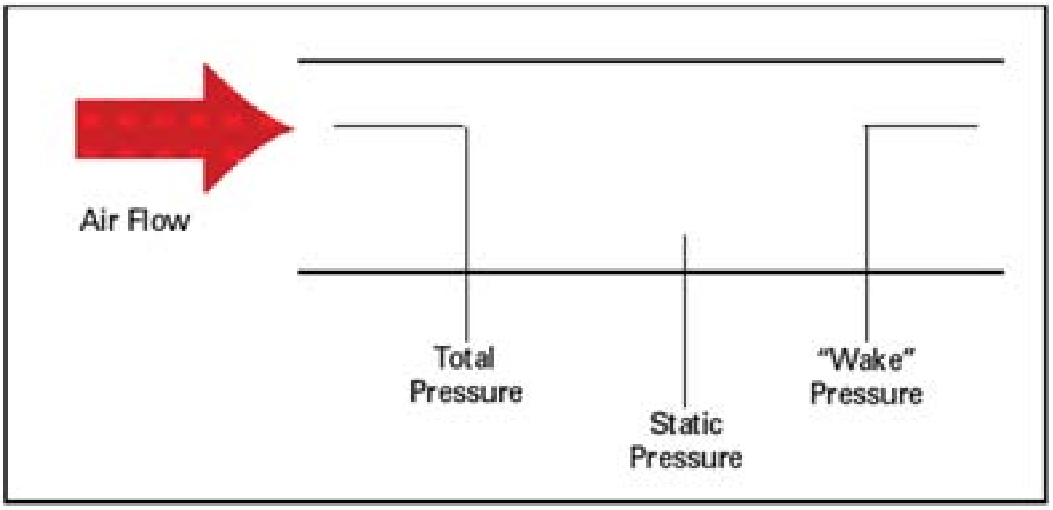
The amount of air traveling through the inlet is related to the area of the inlet and the velocity of the air:

AIRFLOW = AREA (square feet) x AVERAGE VELOCITY (feet per minute)

Accuracy

The multiple, evenly spaced orifices in the flow ring of the VariTrane terminal unit provide quality measurement accuracy even if ductwork turns or variations are present before the unit inlet. For the most accurate readings, a minimum of 1½ diameters, and preferably 3 diameters, of straight-run ductwork is recommended prior to the inlet connection. The straight-run ductwork should be of the same diameter as the air valve inlet connection. If these recommendations are followed, and the air density effects mentioned below are addressed, the flow ring will measure primary airflow within ±5% of unit nominal airflow.

Figure 21. Air pressure measurement orientations



Air Density Effects

Changes in air density due to the conditions listed below sometimes create situations where the standard flow sensing calibration parameters must be modified. These factors must be accounted for to achieve accuracy with the flow sensing ring. Designers, installers, and air balancers should be aware of these factors and know of the necessary adjustments to correct for them.

Elevation

At high elevations the air is less dense. Therefore, when measuring the same differential pressure at elevation versus sea level the actual flow will be greater at elevation than it would be at sea level. To calculate the density at an elevation other than standard conditions (most manufacturers choose sea level as the point for their standard conditions), you must set up a ratio between the density and differential pressure at standard conditions and the density and differential pressure at the new elevation.

$$\frac{\Delta P\ \text{Standard Conditions}}{\text{DENS Standard Conditions}} = \frac{\Delta P\ \text{New Conditions}}{\text{DENS New Conditions}}$$

Since the data from the manufacturer is published at standard conditions, this equation should be solved for the differential pressure at standard conditions and the other quantities substituted to determine the ratio for the differential pressure measured at the new conditions.

Duct Pressure and Air Temperature Variations

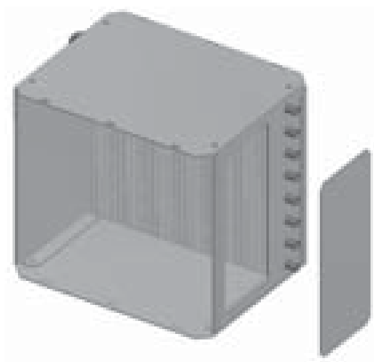
While changes in these factors certainly affect the density of air, most operating parameters which VAV systems need keep these effects very small. The impact on accuracy due to these changes is less than one half of one percent except in very extreme conditions (extreme conditions are defined as those systems with static pressures greater than 5 in. wg (1245 Pa) and primary air temperatures greater than 100°F (37.8°C)). Since those types of systems occur so infrequently, we assume the effects of duct pressure and air temperature variations to be negligible.

Linearity

With the increase in DDC controls over pneumatic controls, the issue of linearity is not as great as it once was. The important aspect of flow measurement versus valve position is the accuracy of the controller in determining and controlling the flow. Our units are tested for linearity and that position versus airflow curve is downloaded and commissioned in the factory to insure proper control of the unit.

Reheat Options

Figure 22. Hot water coil (L) & hot water valves (R)



Hot water heating coils are generally applied on VAV terminal units as reheat devices. When applying these coils it is important to make sure that they are operating in the proper air flow and water flow range. Either a two-way or a three-way valve controls the coils.

The most important factor when sizing valves is the coefficient of velocity or C_v. The C_v is defined as the flow rate, in gallons of 60°F (15.56°C) water, that will pass through the valve in one minute with a one pound pressure drop. The coefficient of velocity, which is commonly called the flow coefficient, is an industry standard rating. Valves having the same flow coefficient rating, regardless of manufacturer, will have the same waterside performance characteristics.

The equation that governs valve sizing is:

$$C_V = \frac{GPM}{\sqrt{\Delta P}}$$

Where

C_V=Flow coefficient

GPM=The maximum water flow rate through the valve in gallons per minute

ΔP=The maximum allowable differential pressure across the valve in psi

The flow and differential pressure are generally the known quantities. The equation is solved for the flow coefficient. The flow coefficient is then compared to the published C_v values for the control valves that are available. The control valve with the C_v that is the closest, but greater than, the calculated flow coefficient is the correct choice for the control valve. This choice will keep the valve pressure drop below the maximum allowable valve pressure drop. The valve pressure drop should then be checked against the coil pressure drop. If the coil pressure drop is appreciably larger than the valve pressure drop, a valve with a smaller C_v should be selected to produce a larger control valve pressure drop. If this new valve has a pressure drop that is much larger than the maximum allowable pressure drop for valves, the system designer should be consulted to make sure that the system hot water pumps can deliver the water at the new conditions.

Electric Reheat

Electric heating coils are applied on VAV terminal units as terminal reheat devices. Electric heat coil capacity is rated in kilowatts (kW). Coils are available with the total capacity divided into one, two, or three stages.

Electric heat coils are available in single-phase or three-phase models. This refers to the type of power source connected to the coil. Single-phase models have resistance elements internally connected in parallel. Three- phase models have resistance elements internally connected in a delta or a wye configuration.

The current draw for the electric coil will depend upon whether it is a single-phase coil or a three-phase coil. The current draw is necessary for determining what size wire should be used to power the electric coils and how big the primary power fusing should be.

The equations for current draw for these coils are:

$$1\phi amps = \frac{kW \times 1000}{Primary\ Voltage}$$

$$3\phi amps = \frac{kW \times 1000}{Primary Voltage \sqrt{3}}$$

VariTrane three-phase electric heat is available in balanced configurations. For example, a 9 kW three-phase coil, each stage would carry 1/3 or 3 kW of the load.

It is important to note that these coils have certain minimum airflow rates for each amount of kW heat the coil can supply to operate safely. These airflow values are based upon a maximum rise across the electric heat coil of 50°F (28°C).

The equation that relates the airflow across an electric coil to the temperature rise and the coil change in temperature is:

$$CFM = \frac{kW \times 3145}{\Delta T}$$

Where

CFM=Minimum airflow rate across the coil

kW=The heating capacity of the electric coil

3145=A constant

ΔP=The maximum rise in air temperature across the coil (usually 50 degrees F (28 degrees C))

Electric heat coils are available with magnetic or mercury contactors. Magnetic contactors are less expensive than mercury contactors. However, mercury contactors can be cycled at a more rapid rate without failing. Mercury contactors are rated for heavier duty use and should be used in as many applications as possible. For pneumatic applications the electric coils are available with factory-installed pressure-electric switches.

Insulation

Encapsulated edges

Insulation in a VAV terminal unit is used to avoid condensation on the outside of the unit, to reduce the heat transfer from the cold primary air entering the unit, and to reduce the unit noise. The VariTrane line offers four types of unit insulation. The type of facing classifies the types of insulation. To enhance IAQ effectiveness, edges of **all insulation types have metal encapsulated edges**.

Matte-Faced

This type of insulation is used for typical applications. It consists of a fiberglass core covered by a high-density skin. The dual-density construction provides good sound attenuation and thermal performance.

Foil-Faced

This type of insulation is used in applications where there is some concern regarding airborne contaminants entering the space, or dirt being trapped in the fibers of the insulation. The insulation is composed of a fiberglass core laminated to a foil sheet. Foil-faced insulation will provide the same sound attenuation performance as matte-faced insulation.

Double-Wall

This type of insulation is used in applications where there is extreme concern regarding airborne contaminants entering the space or dirt being trapped in the fibers of the insulation. The insulation is the same as the matte-faced insulation. However, after the insulation is installed, a second solid wall of 26-gage steel covers the insulation. All wire penetrations of this insulation are covered by a grommet. This type of insulation will result in higher discharge and radiated sound power.

Closed-Cell

This type of insulation is used in applications where IAQ and fibers are of primary concern. The acoustics of the closed-cell insulation are similar to double-wall insulation. The thermal properties are similar to fiberglass insulation. This insulation contains no fiberglass.

Acoustics

Acoustical Best Practices

Acoustics with terminal units is sometimes more confusing than it needs to be. As we know, lower velocities within a unit leads to improved acoustical performance. Additionally, if the VAV terminal unit has a fan, a lower RPM provides better Acoustical performance. It is as simple as that—there are some catches, however.

Additional considerations will be discussed in more detail throughout this portion of Application Considerations, such as unit size and type, appurtenance affects (due to insulation, attenuation, etc.), certification, and computer modeling. Let’s take a look at the first consideration, sizing of units.

Sizing of Units

Before blindly increasing the size of units, we must first understand what is setting the acoustics within the space. In general, over 95% of acoustics in VAV terminal units, which set the sound pressure levels and ultimately the NC within the space, is from radiated sound. This is readily known for fan-powered units, but less commonly known for single- and dual-duct units. Radiated sound emanates from the unit and enters the occupied space via means other than through the supply ductwork. The most typical path is through the plenum space, then through the ceiling, then into the occupied space. While discharge sound should never be ignored, radiated sound is the most dominant and usually the most critical sound source.

When increasing **air valve** sizes, BE CAREFUL. **Oversizing an air valve can adversely impact the ability to modulate and properly control temperature in the space.** In extremely oversized situations, the air valve will operate like a two-position controlled device, with air either being "on", or "off", and not really much in between. The best way to avoid this is to understand that the minimum for most air valves is 300 FPM. This is a function of the flow sensing device and the ability of the pressure transducer and controller to properly read and report flow. This is not manufacturer specific, as physics applies to all. Therefore, when sizing air valves, regardless of the max cooling velocity the minimum velocity for proper pressure independent flow is 300 FPM.

Modulation capability and range is vital for proper operation of VAV systems. With oversized units, the unit will act as a constant volume system eliminating the energy savings and individual zone control advantages of VAV systems. A good rule of thumb is to size cooling airflow for around 2000 FPM. VAV systems only operate at full flow when there is a maximum call for cooling in the zone. The greatest portion of the time, an air valve will be operating at partial flows.

When sizing fan-powered units, the fan airflow range can be determined by looking at the fan-curve. Because parallel and series fan-powered units operate at a constant fan flow, selections can be made all the way to the lowest flow ranges of the fan curve. A good balance of performance and cost is to select fans at 70-80% of maximum fan flow.

Series vs. Parallel Fan-Powered Units

Acoustical considerations may affect whether a series or parallel fan-powered terminal unit is selected. Both units have their advantages.

The parallel unit has the advantage of fan energization and fan acoustical impact only when heating is needed. Parallel fans are smaller than series units because they are sized for 30–60% of total unit flow. This creates a unit which is quieter than series units. The disadvantage of the parallel unit is intermittent sound. This impact can be minimized by using an ECM, which has slow fan ramp-up speed.

The primary acoustic benefit to the series fan-powered unit is that the fan runs continuously. Sometimes the unit can be selected at slightly higher sound levels due to the constant nature of the sound.

The primary acoustic disadvantage the series unit has compared to the parallel unit is the need to size the unit fan for the total room airflow. Series units require a larger, louder fan than parallel configurations.

Note: *Operating parallel units with a continuously operating fan may be considered for some applications. This provides the quietest overall fan-powered system with the benefit of continuous fan operation. See your local Trane sales engineer for more details.*

Insulation types

Insulation is a factor to consider when dealing with the acoustics of terminal units. Most insulation types will provide similar acoustical results, but there are exceptions. Double-wall and closed-cell foam insulation will generally increase your sound levels because of the increased reflective surface area that the solid inner-wall and closed-cell construction provides. This increase in sound will have to be balanced with the IAQ and cleanability considerations of the dual-wall and closed-cell construction.

Placement of units

Unit placement in a building can have a significant impact on the acceptable sound levels. Locating units above non-critical spaces (hallways, closets, and storerooms) will help to contain radiated sound from entering the critical occupied zones.

Unit Attenuation

Terminal unit-installed attenuators are an option available to provide path sound attenuation. Manufacturer-provided attenuators on the discharge of a terminal unit are targeted at reducing discharge path noise and are typically a simple lined piece of ductwork. It would often be easier and less expensive to design the downstream ductwork to be slightly longer and require the installing contractor to include lining in it. Attenuators on the plenum inlet of fan-powered terminals are targeted at reducing radiated path noise since the plenum opening on a fan-powered terminal unit is typically the critical path sound source. Significant reduction in radiated path noise can result from a well-designed inlet attenuator. The attenuation from these attenuators is due to simple absorption from the attenuator lining and occupant line of sight sound path obstruction. Therefore, longer attenuators and attenuators that require the sound to turn multiple corners before reaching the occupied space provide superior results, particularly in the lower frequency bands.

Table 141. Octave band frequencies

Octave Band	Center Frequency	Band Edge Frequencies
1	63	44.6-88.5
2	125	88.5-177
3	250	177-354
4	500	354-707
5	1000	707-1414
6	2000	1414-2830
7	4000	2830-5650
8	8000	5650-11300

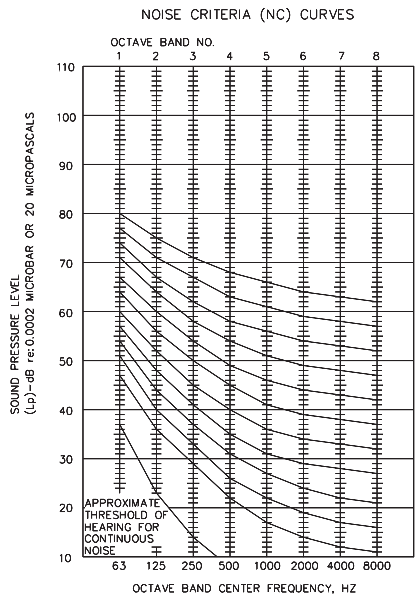
Attenuators that are simple “cups” at the plenum inlet(s) have been shown in Trane’s acoustical mock-up to provide no measurable reduction in sound pressure in the critical octave bands which set the occupied space noise criteria.

Certification and Testing

Terminal units should be submitted based on the same criteria. There are several ways to ensure this by certification and testing.

Raw unit sound data can be good measurement criteria for evaluation. In using this as a basis for comparison, the designer needs to make sure that the information is based on the AHRI Standard 880 that gives the procedure for testing.

Specifying NC or RC sound levels is a possible comparison, but the designer needs to be sure the comparison is fair. Two options are to specify the attenuation effect on which you would like the units to be evaluated or to specify that AHRI Standard 885-2008 transfer functions be used. The importance of AHRI Standard 885-2008 is that it is the first AHRI Standard that specifies exact transfer functions to be used for evaluation. Previous versions of the standard gave guidelines, but the manufacturers could choose their own set of factors.



By using NC sound levels, it is possible to express acceptable sound levels for various types of buildings or environments. A few examples are:

Concert Hall	NC-22
Hospital Room	NC-30
School Room	NC-35
General Office	NC-40
Cafeteria	NC-45
Factory	NC-65

Path Attenuation

Sound is generated by a terminal unit can reach the occupied space along several paths. The terminal unit generated sound will lose energy—i.e., the energy is absorbed by path obstacles—as it travels to the occupied space. This acoustical energy dissipation as it travels to the occupied space is called path attenuation. The amount of energy lost along a particular path can be quantified and predicted using the procedure outlined in AHRI-885. Each path must be considered when determining acceptable sound power generated by a terminal unit.

The term “transfer function” is often used to describe the entire path attenuation value for each octave band (i.e., the sum of all components of a particular path).

Examples of path attenuation include locating the terminal unit away from the occupied space, increasing the STC (sound transmission classification) of the ceiling tile used, internally lining ductwork, drywall lagging the ceiling tiles or enclosing the terminal unit in drywall. All of these choices have costs associated with them that must be weighed against the benefits. Some of these alternatives can be acoustically evaluated from application data provided in AHRI-885. Others may require professional analysis from an acoustical consultant.

Computer Modeling

Computer modeling of acoustical paths is available to help estimate sound levels and determine problem sources. The software used by Trane for computer modeling is called Trane Acoustics Program (TAP™).

TAP can analyze different room configurations and materials to quickly determine the estimated total sound levels (radiated and discharged) in a space. The Trane Official Product Selection System (TOPSS™) can also be used to determine sound levels of terminal units. You can base selections on a maximum sound level and enter your own attenuation factors (defaults based on AHRI-885 are also available).

Other Resources

Refer to "Additional References" at the end of this chapter to see a list of publications to help with the basics of acoustical theory and modeling. You can also contact your local Trane salesperson to discuss the issue.

Duct Design

Designing cost-effective VAV duct systems is challenging. Some duct design methods result in better pressure balance than others do. Duct shape and duct material can influence duct system design and cost. In addition, duct layout is properly designed for optimal duct installation and operation.

Duct Design Program

Trane has developed a computer program, VariTrane™ Duct Designer, to aid in the duct design process. This program is used to calculate duct sizes, fitting sizes, terminal unit sizes, and pressure drops according to the equal friction or static regain method. The duct design program can be easily incorporated into the selection of VAV terminal units. The inputs and outputs for the program enable VariTrane units to be selected based on the conditions you require. This makes selecting and scheduling units much easier. Contact the local sales office or the Trane C.D.S.™ department for more details on this program.

Design Methods

The two most widely used supply duct design methods—equal friction and static regain—are discussed below.

Equal Friction – Using this method, ducts are sized at design flow to have roughly the same static pressure drop for every 100 feet of duct. Static pressures throughout the duct system can be balanced at design flow using balancing dampers, but are no longer balanced at part load flows. For this reason, equal friction duct designs are better suited for constant volume systems than for VAV systems. If the equal friction method is used for the VAV supply duct design, the terminal units usually require pressure-independent (PI) control capability to avoid excessive flow rates when duct pressures are high.

In VAV systems, the ducts located downstream of the terminal unit are usually sized for equal friction. The advantage of this design method is its simplicity. Often, calculations can be made using simple tables and duct calculators. Drawbacks include increased higher total pressure drops and higher operating costs.

Static Regain – In the static regain method, ducts are sized to maintain constant static pressure in each section, which is achieved by balancing the total and velocity pressure drops of each section. In other words, static pressure is “regained” by the loss of velocity pressure. Since the static pressures throughout the duct system are roughly balanced at design and part load flow, static regain duct designs can be used successfully for either constant volume or VAV systems. When the static regain method is used for VAV systems, the system is roughly pressure balanced at design.

Advantages of the static regain method include reduced total pressure drops, lower operating costs, and balanced pressures over a wide range of flows. The drawback of this design is the time-consuming, iterative calculation procedure and for large systems, it is essential to have a duct design computer program.

Best Practices

Common Mistakes

Some of the most common system or installation errors are discussed below.

Reducers at Unit Inlet

This problem is a very common issue that is seen in applications of VariTrane products. It is often mistaken by those in the field as an unacceptably large static pressure drop through the unit. It is also sometimes mistaken as a malfunctioning flow ring, pressure transducer (if DDC or analog electronic controls are present) or PVR (if pneumatic controls are present).

This problem is sometimes unknowingly encountered because of the capability of the VariTrane unit to allow greater airflow for a specific size duct than other terminal units. For example, a project engineer specifies an 8" (203 mm) round take off from the main duct trunk to the VAV terminal unit. The person supplying the VAV terminal unit checks the required airflow and finds that a VariTrane unit with a 6" (152 mm) inlet will provide the specified terminal unit performance. The terminal unit supplier submits, receives approval, and orders the 6" (152 mm) inlet unit. While this is happening, the installing contractor has run the connecting duct from the main trunk to the terminal unit in the specified 8" (152 mm) round. The unit arrives at the job site, and the installer notices that the 8" (203 mm) duct and the 6" (152 mm) terminal unit inlet do not match. To get the unit installed, an 8- to 6-inch reducer is placed at the inlet to the terminal unit air valve.

The reducer will cause a phenomenon called flow separation at the unit inlet. Fluid dynamics analysis can present a detailed technical explanation of flow separation, but the characteristics important to this discussion are the production of pressure loss and turbulence. The reducer will have a significant static pressure drop associated with it since the air velocity is increased (i.e., static pressure is given up for increased velocity pressure). The pressure loss is sometimes mistaken as a loss due to the function of the terminal unit. The turbulence is at its greatest just downstream of the reducer. Unfortunately, this is the location of the flow ring at the air-valve inlet. The reducer will cause the flow ring to give an inaccurate and inconsistent reading because of the turbulent air.

The solutions to this situation are:

- Locate the reducer upstream of the terminal unit at least three duct diameters to eliminate flow separation and turbulence at the unit inlet and to improve the airflow measurement accuracy.
- Consider proper sizing of the terminal unit in the duct design and account for the pressure loss of the reducer in the central fan selection if a reducer is required. Be cautious of “oversizing” a VAV terminal. It is good practice to make sure that the inlet duct velocity at the minimum airflow setting is no lower than 500 feet per minute.

Improper Use of Flexible Ductwork

While flexible ductwork has many benefits, improper use can cause numerous problems in a VAV system. Flexible ductwork causes turbulent airflow and relatively large static pressure drops. Flexible ductwork at a primary damper inlet (i.e., the flow sensor location) may cause flow accuracy and repeatability problems due to turbulence. The use of flexible ductwork should be primarily limited to the downstream side of the terminal units in a VAV system. Use of flexible ductwork upstream of terminal units should be kept to an absolute minimum. All runs of flexible ductwork should be kept as short as possible. While most know these guidelines, the ease of installation which flexible ductwork provides is always an enticement to push the limits of what are acceptable practices.

Static Pressure Measurement Errors

Improper measurement techniques for static pressure can lead many to mistakenly believe that the terminal unit is causing a large pressure drop in the system. The chief error made here is taking a static pressure measurement in turbulent locations such as flexible ductwork or near transitions. This produces invalid static pressure readings. Another error commonly made is trying to read the static pressure at the same point as the flow sensing device. The inlets to VAV terminal units produce turbulence and will give poor readings. Flow sensors with their multiple-point averaging capability are best equipped to deal with this type of flow, while a single-point static probe is not. Another common error is the incorrect orientation of the static pressure probe. The static pressure is correctly measured when the probe is oriented perpendicular to the direction of airflow. The probe, or a part of it, should never be facing the direction of airflow, because the total pressure will influence the reading of the probe.

Unit Conversions

Table 142. Conversions of length and area

To convert	From	To	Multiply by
Length Length	In. Ft	m m	0.0254 0.3048
Length	m	In.	39.3701
Length	m	Ft	3.28084
Area	$In.^2$	m^2	0.00064516
Area	Ft^2	m^2	0.092903
Area	m^2	$In.^2$	1550
Area	m^2	Ft2	10.7639

Table 143. Conversions of velocity, pressure, and flow rate

To convert	From	To	Multiply by
Velocity Velocity	Ft/min M/s	M/s Ft/min	0.00508 196.850
Pressure	Psi	Pa	6894.76
Pressure	Ft of water	Pa	2988.98
Pressure	In. of water	Pa	249.082
Pressure	Pa	Psi	0.000145038
Pressure	Pa	Ft of water	0.000334562
Pressure	Pa	In. of water	0.00401474
Flow Rate	Cfm	L/s	0.4719
Flow Rate	Cfm	m^3/s	0.000471947
Flow Rate	Gpm	L/s	0.0630902
Flow Rate	m^3/s	Cfm	2118.88
Flow Rate	L/s	Cfm	2.1191
Flow Rate	L/s	Gpm	15.8503

Additional VAV System and Product References

VAV Systems Air Conditioning Clinic

This clinic is designed to explain the system components, the system configurations, many of the VAV system options and applications. A great resource for VAV system understanding.

Literature Order Number: TRG-TRC014-EN

Indoor Air Quality – A guide to understanding ASHRAE Standard 62-2001

The guide helps to explain the ASHRAE Standard as well as the fundamentals of good indoor air quality. A great resource for understanding the standard and ways of designing VAV systems around that standard.

Literature Order Number: ISS-APG001-EN

Managing Outdoor Air – Traq™ Comfort Systems

This brochure is a good, quick reference of the issues of managing outdoor air for a VAV system.

Literature Order Number: CLCH-S-26

Ventilation and Fan Pressure Optimization for VAV Systems

An engineering bulletin designed to how a Trane Integrate Comfort™ system can effectively control building ventilation and supply fan pressure for increased comfort and IAQ while keeping energy costs to the lowest possible.

Literature Order Number: SYS-EB-2

Trane DDC/VAV Systems Applications Engineering Manual

This manual gives detailed descriptions of the Trane DDC/VAV system. Topics include system components, how the system interacts and specific inputs and outputs of the system.

Literature Order Number: ICS-AM-6

Acoustics in Air Conditioning Applications Engineering Manual

This manual describes the basic fundamentals, behavior, measurement, and control of sound, all directed at the design of quiet systems.

Literature Order Number: FND-AM-5

VariTrac® Catalog

The catalog will help explain features and benefits of VariTrac, how the VariTrac product works, applications for the product, and selection procedures.

Literature Order Number: VAV-PRC003-EN

ASHRAE Handbook of Fundamentals

ASHRAE Handbook of HVAC Systems and Equipment

ASHRAE Handbook of HVAC Applications

ASHRAE Handbook of Refrigeration

Web sites:

- www.ashrae.org
- www.ahrinet.org
- www.trane.com

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AHRI CERTIFIED™
www.ahridirectory.org
VAV Terminals
AHRI Standard 880

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