Nailor® Industries Inc.

TERMINAL UNITS
PRODUCT OVERVIEW

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WATUPL Terminal Units Product Overview. June 2019. Printed in U.S.A.

NAILOR'S COMPREHENSIVE PRODUCT LINE

MODEL SERIES 3000
MODELS 3001, 30RW, 30RE
SINGLE DUCT TERMINAL UNITS

Designed for cooling only, cooling with reheat, heating only or heat/cool changeover applications.

- Available in 11 sizes. 0 – 8330 cfm (0 – 3931 l/s).
- Unit sizes 4 through 16 – up to 3725 cfm (1758 l/s), are a maximum overall height of only 12 1/2" (318). The low profile design is advantageous where ceiling space is restricted. Unit sizes 12 through 16 feature flat oval inlet collars. Unit size 24 x 16 features rectangular inlet collar.
- High performance inclined opposed blade damper.
- 'Diamond Flow' multi-point averaging sensor on pressure independent models.
- Pressure dependent or independent airflow control.
- Digital, pneumatic or electric control.
- Options include attenuators, hot water coils or integral electric coils for reheat, various 'IAQ' linings and access doors.

Model 3001

Model 3001Q

MODEL SERIES 3000Q
MODELS 3001Q, 30RWQ, 30REQ
QUIET SINGLE DUCT TERMINAL UNITS

3000Q Series units are designed to operate at exceptionally quiet levels in noise sensitive applications such as libraries, studios, performance halls and classrooms. Compatible with applications requiring cooling, cooling with reheat, heating only or heat/cool changeover uses.

- 3000Q 'Quiet' Series with factory mounted dissipative silencer.
- Choice of terminal liners with three (3) independent silencer acoustic media options.
- IAQ liners available throughout.
- Hot water and electric coil options.
- Performance data for Close Coupled device.
- Shares components and features of the 3000 Series units.
- Available in 11 sizes. 0 – 8330 cfm (0 – 3931 l/s).

MODEL SERIES 30HQ
MODELS 30HQ, 30HQW, 30HQE
HOSPITAL GRADE SINGLE DUCT TERMINAL UNITS

The 30HQ Series terminal units are uniquely designed for use in hospitals. Using innovative construction methods, coupled with healthcare focused options, the 30HQ offers a quiet, simplified maintenance terminal that meets the demands of hospital applications.

- 30HQ "Hospital Grade" version with factory mounted dissipative silencer.
- "IAQ" compatible liner.
- Hot water and electric coil options.
- Durable, cleanable surfaces.
- Performance data for Close Coupled device.
- Internally lined dissipative silencer eliminates need to externally insulate unit.
- Available in 11 sizes. 0 – 8330 cfm (0 – 3931 l/s).

Model 30HQW

MODEL SERIES 30X
MODEL 30X
SINGLE DUCT EXHAUST TERMINAL UNITS

Series 30X terminals modulate exhaust flow from an occupied space in constant volume or variable volume applications. They are ideal for environments where IAQ is important such as laboratory, health care and pharmaceutical applications.

- Venturi Valve inlet reduces pressure drop.
- Available in 11 unit sizes to handle from 0 – 8575 cfm (0 – 4047 l/s).
- Removable flow sensor to aid in meeting sanitation/maintenance requirements.
- Optional Inlet attenuator.
- IAQ liners available.

Model 30X

Model 30HQX

MODEL SERIES 30HQX
MODELS 30HQX
SINGLE DUCT HOSPITAL GRADE EXHAUST TERMINAL UNITS

Sharing many components with the 30X Series, the 30HQX hospital grade exhaust series improves the basic design by adding a dissipative silencer to the inlet and making removable flow sensors with access doors as standard. Internal liners are specifically selected to offer durable cleanable surfaces with good sound attenuation performance. Although designed around the needs of hospitals, the 30HQX Series can be used in wide variety of Critical Environment applications.

- Standard inlet dissipative silencer.
- Standard Access Door.
- Easily removable flow sensor.
- IAQ liners as standard.
- 11 sizes to handle small to large airflow ranges.

MODEL SERIES 3200
MODELS 3210, 3230, 3240
DUAL DUCT TERMINAL UNITS

Designed for control of hot or neutral and cold air. Variable volume with or without mixing or constant volume applications.

- Three models. 0 – 4525 cfm (0 – 2135 l/s).
- Extra low leakage opposed blade dampers control cold and hot decks independently.
- 'Diamond Flow' multi-point averaging sensor.
- Mixing models include integral attenuator with internal mixing baffles to minimize downstream stratification.
- Pressure independent airflow control.
- Digital or pneumatic control.
- Options include total air discharge sensing and various 'IAQ' linings.

Model 3210

- For non-mixing applications.

Model 3230

- Better than 1 in 12 mixing.
- Economical compact design.
- Integral mixing attenuator.

Model 3240 "BlendMaster™"

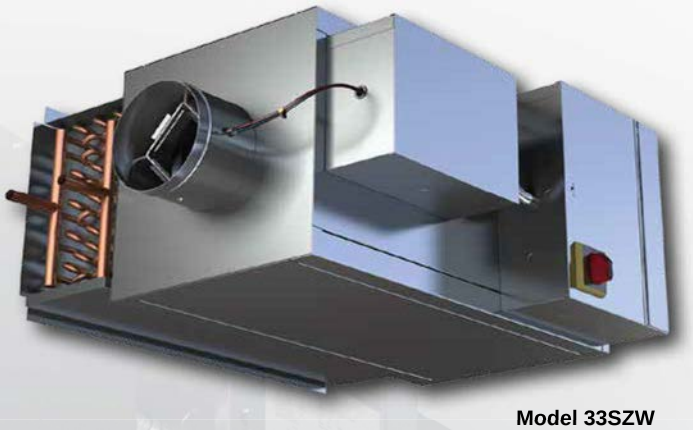
- Industry leading performance provides 1 in 30 mixing.
- Integral mixing attenuator.

Model 3230

Model 3240

MODEL SERIES 33SZ
MODELS 33SZ, 33SZW, 33SZE
FAN POWERED CHILLED WATER TERMINAL UNITS

- Sensible cooling coil on the induced air inlet handles zone sensible load.
- Energy Efficient, Direct Drive, EPIC Fan Technology®.
- Integral condensate drip pan as standard.
- MERV 8 induced air filters available.
- Airflow capacities of 250 – 2000 cfm (118 – 944 l/s).
- 2, 4, or 6 Row Chilled Water Coils; 1 or 2 row Hot Water Coils (33SZW units).
- Standard and Low-Profile sizes available.
- Versatile, Familiar, Simple.



Model 33SZW

Model 35SW

MODEL SERIES 35S
MODELS 35S, 35SW, 35SE
SERIES FLOW (CONSTANT VOLUME)
FAN POWERED TERMINAL UNITS

- Quiet constant fan operation.
- Available in 7 fan sizes, each with various primary air inlet size options for optimum design flexibility. 100 – 3700 cfm (47 – 1746 l/s) flow range.
- High performance inclined opposed blade primary air damper.
- 'Diamond Flow' multi-point averaging sensor.
- Ultra-high efficiency EPIC Fan Technology®.
- Solid state fan speed controller available with PSC motor option.
- Pressure independent airflow control.
- Digital or pneumatic control.
- Available 'Q' option induced air attenuator.
- Options include hot water coils or integral electric coils for supplementary heat.
- Various 'IAQ' linings.
- Available 90° or remote mounted line voltage enclosure.

MODEL SERIES 35SST STEALTH
MODELS 35SST, 35SWST, 35SEST
ULTRA QUIET STEALTH SERIES FLOW (CONSTANT VOLUME)
FAN POWERED TERMINAL UNITS

- Ultra quiet premium design. Constant fan operation.
- "Stealth™" design technology.
- Available in 7 fan sizes, each with various primary air inlet size options for optimum design flexibility. 100 – 3700 cfm (47 – 1746 l/s) flow range.
- High performance inclined opposed blade primary air damper.
- 'Diamond Flow' multi-point averaging sensor.
- Ultra-high efficiency EPIC Fan Technology®.
- Solid state fan speed controller available with PSC motor option.
- Pressure independent airflow control.
- Digital or pneumatic control.
- Options include hot water coils or integral electric coils for supplementary heat.
- Various 'IAQ' linings.
- Available 90° or remote mounted line voltage enclosure.

Model 35SEST

MODEL SERIES 35S AND 35SST WITH OAI
MODELS 35S-OAI, 35SW-OAI, 35SE-OAI, 35SST-OAI, 35SWST-OAI, 35SEST-OAI
SERIES FLOW (CONSTANT VOLUME) FAN POWERED TERMINAL UNITS WITH OUTSIDE AIR INLETS (OAI)

Incorporates the features and benefits found in the standard fan powered terminal unit design with a dual duct inlet configuration.

- Separate outside air ventilation inlet damper is provided in addition to the main primary air valve. This second valve is configured for constant volume operation and helps ensure that minimum outside air ventilation requirements are maintained at all times independent of the main AHU operation.
- Available with ultra-high efficiency EPIC Fan Technology®.

Model 35SST with OAI Option

Model 35SW-CVP

MODEL SERIES 35S WITH CVP (CONSTANT VOLUME PRESSURIZATION)
MODELS 35S-CVP, 35SW-CVP, 35SE-CVP
SERIES FLOW (CONSTANT VOLUME)
FAN POWERED TERMINAL UNITS

- Designed especially for critical environments such as hospital isolation rooms and bio-tech applications.
- Utilizes Nailor's EPIC Fan Technology® with an ultra-high efficiency 'Brushless DC' motor to provide a pressure independent assembly.
- Maintains precise volume control and compensates for changes in external static pressure as encountered across a HEPA filter.
- Up to 3000 cfm (1416 l/s) at 1" w.g. (250 Pa).

MODEL SERIES 37S
MODELS 37S, 37SW, 37SE
LOW PROFILE SERIES FLOW
FAN POWERED TERMINAL UNITS

- Only 11" (279) in height.
- Designed for applications where ceiling plenum space is restricted.
- Quiet constant fan operation.
- Available in 4 fan sizes, each with various primary air inlet size options for design flexibility. 100 – 2100 cfm (47 – 991 l/s) flow range.
- High performance inclined opposed blade primary air damper.
- 'Diamond Flow' multi-point averaging sensor.
- Ultra-high efficiency EPIC Fan Technology®.
- Pressure independent airflow control.
- Digital or pneumatic control.
- Options include hot water coils or integral electric coils for supplementary heat.
- Various 'IAQ' linings.
- Available 90° line voltage enclosure (Standard on 37SE).

Model 37SE

MODEL SERIES 37SST STEALTH
MODELS 37SST, 37SWST, 37SEST
LOW PROFILE SERIES FLOW (CONSTANT VOLUME)
FAN POWERED TERMINAL UNITS

Incorporates all of the features and benefits found in the 37S standard low profile terminal unit plus the following:

- Super quiet premium design.
- "Stealth™" design technology.
- Ultra-high efficiency EPIC Fan Technology®.

Model 37SWST

Model 35NW

MODEL SERIES 35N
MODELS 35N, 35NW, 35NE
PARALLEL FLOW (VARIABLE AIR VOLUME)
FAN POWERED TERMINAL UNITS

- Quiet intermittent fan operation.
- Pressure dependent or independent airflow control.
- Available in four fan sizes, each with various primary air inlet size options for optimum design flexibility. 150 – 2100 cfm (70 – 990 l/s) flow range.
- Primary air cfm range from 0 to 4525 cfm (0 – 2135 l/s).
- 'Diamond Flow' multi-point averaging sensor on pressure independent models.
- Custom high efficiency PSC motor/blower design.
- Solid state fan speed controller.
- Digital, pneumatic or electric control.
- Options include hot water coils or integral electric coils for supplementary heat.
- Various 'IAQ' linings.
- Induced air Inlet Attenuator 'Q' option.
- Available ultra-high efficiency EPIC Fan Technology®.

MODEL SERIES 37N
MODELS 37N, 37NW, 37NE
LOW PROFILE PARALLEL FLOW (VARIABLE AIR VOLUME)
FAN POWERED TERMINAL UNITS

- Quiet intermittent fan operation.
- Pressure dependent or independent airflow control.
- Available in three fan sizes, each with various primary air inlet size options. 150 – 1175 cfm (70 – 554 l/s) flow range.
- Primary air cfm range from 0 to 2950 cfm (0 – 1392 l/s).
- Options include hot water coils or integral electric coils for supplementary heat.
- Ultra-high efficiency EPIC Fan Technology®.
- Designed for applications where ceiling plenum space is restricted.

Model 37NW

MODEL SERIES 36VRR
ROUND DUCT EXTERNAL RETROFIT TERMINAL UNITS

Convert existing constant volume systems or old "system powered" mechanical regulator terminals to energy efficient variable volume operation.

- Available in ten sizes to suit and install simply in round ductwork. 0 – 4525 cfm (0 – 2135 l/s).
- Various configurations custom fabricated to suit individual application.
- Pressure dependent or independent airflow control.
- 'Diamond Flow' multi-point averaging flow sensor on pressure independent models.
- Digital, pneumatic or electric control.

Model 36VRR

Model 36VRS

MODEL SERIES 36VRS
RECTANGULAR SLIDE-IN RETROFIT TERMINAL UNITS

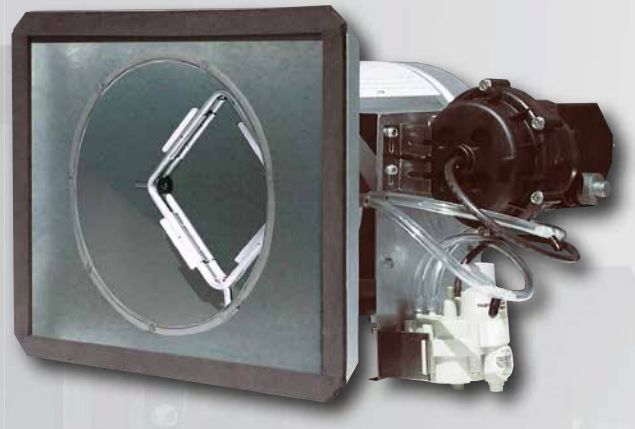
Convert existing constant volume systems to energy efficient variable volume operation.

- Available in 15 valve sizes to handle a large range of air volumes. 0 – 15000 cfm (0 – 7071 l/s).
- Custom fabricated to suit any duct size from 5" x 5" (127 x 127) up to 52" x 26" (1321 x 660).
- 'Diamond Flow' multi-point averaging sensor.
- Pressure independent airflow control.
- Digital or pneumatic control.

MODEL SERIES 36VR
INTERNAL RETROFIT TERMINAL UNITS

Designed to replace the mechanical regulators in old "system powered" terminal units in order to substantially lower the operational static pressure requirement. The air valves include a damper, flow sensor, actuator and can be outfitted with digital controls in order to reduce operating cost.

- Custom built on a specific project basis
- Variable or constant volume pressure independent airflow control.
- 'Diamond Flow' multi-point averaging flow sensor.
- Models available to retrofit most 'brand name' terminal units.
- Digital or pneumatic control.



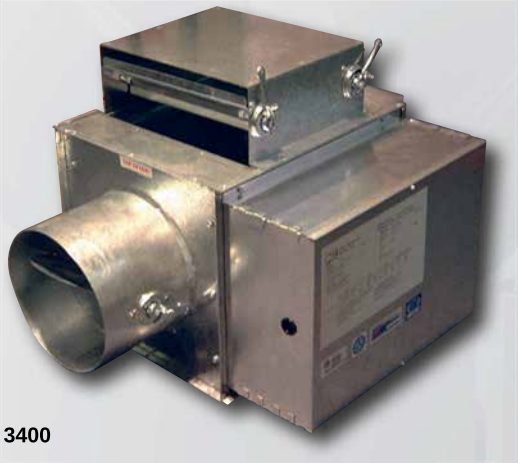
Model 36VRBS

MODEL SERIES 36FMSD
ROUND DUCT FLOW MEASURING STATION

Designed as a basic Flow Measuring Station for applications where manual balancing is required.

- Includes balancing damper with hand-locking quadrant.
- Inlet and outlet stiffening beads provide for a method of securing flexible ducts.
- Ideal for use with displacement ventilation diffusers.

Model 36FMSD



Model 3400

MODEL SERIES 3400
MODEL 3400, 34RW, 34RE
BYPASS TERMINAL UNITS

Designed to provide variable air volume supply when used with constant volume fan low pressure packaged air handling systems or roof-top air conditioning units. Excess air is diverted through a bypass opening and into the system return.

- Unique low torque "flow diverter" valve.
- Simple, inexpensive VAV control.
- Pressure dependent operation.
- Pneumatic control.
- Options include hot water and electric coils for reheat.

AHRI CERTIFICATION

Nailor is a participating company in the Air Conditioning and Refrigeration Institute's 880 certification program for variable air volume terminal units. Nailor has completed and received AHRI certification for our complete line of Single Duct, Dual Duct, Fan Powered and Bypass Terminal Units.

To comply with AHRI Standard 880, manufacturers must rate their products at "standard rating conditions" as specified by the standard. This permits direct comparison between manufacturers. In addition to standard ratings, Nailor also publishes application ratings. These application ratings are based upon tests conducted in accordance with the standard but at other conditions as well in order to provide the design engineer with a wider range of data from which to make his selection.

Participation in the AHRI program provides assurance that manufacturers' equipment will meet the claimed performance ratings. Compliance with AHRI 880 by participants in the certification program is assured by regular testing of random samples by an independent laboratory.

AHRI CERTIFIED™
www.ahridirectory.org
VAV Terminals
AHRI Standard 880

A Participating Corporation in the AHRI 880 Certification program.

INDEPENDENT LABORATORY CERTIFICATION

ENERGISTICS LABORATORY
AND JACK STEGALL RESEARCH FACILITY

Although AHRI Certification, as explained above, provides some assurance of product performance, the program only verifies a single "standard rating condition" (certification rating point) for each terminal size. This is for valid logistical reasons. However, the correlation of the AHRI rating points with the comprehensive application data is sometimes difficult to reconcile in some manufacturers catalogs.

In order to provide assurance and complete credibility to the engineering community, Nailor tests its product at Energistics Laboratory; one of the foremost North American HVAC laboratories.

TERMINAL UNITS COMMON COMPONENTS

'DIAMOND FLOW' SENSOR

The Nailor 'Diamond Flow' is a multi-point airflow sensor that is designed to provide an averaged and accurate flow signal for use with pressure independent controls.

Accuracy

Conventional airflow sensors function best under ideal inlet conditions. Space constraints, structural components and mechanical system machinery often influence inlet conditions, in many instances, creating less than ideal entering conditions. Without the several lengths of duct needed for ideal conditions, the air profile moving across the sensor can become distorted or turbulent. As a result, the non-uniform inlet condition provides an inaccurate airflow measurement.

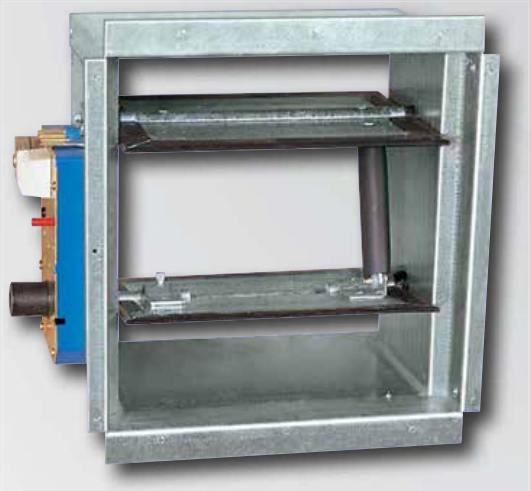
The 'Diamond Flow' is constructed of aluminum (stainless steel is optional) to ensure longevity and strength. Each sensor has a minimum of four pick-up points on each side which sample airflow in each quadrant of the inlet. Those readings are then averaged, providing an output signal available to a controller. Resulting flow measurements are therefore accurate when used within normal practices and often without ideal inlet conditions.

Signal Amplification

Another 'Diamond Flow' sensor advantage lies in the approximate 2.5 average amplification factor of the velocity pressure signal (ΔP) sent to the controller. By amplifying this signal 2.5 times, accuracy is enhanced primarily during low airflow conditions. Inside pneumatic reset controllers, the static pressure signal is subtracted from the total pressure signal by piping these pressures to opposite sides of the diaphragm. The combined diaphragm and spring assembly have a mass equivalent to about .03" w.g. (7.5 Pa). This mass defines the dead band and the minimum (ΔP) setting. By amplifying the velocity signal, the controller is "tricked" into a lower minimum capability and a narrower dead band. The same advantage is realized with digital controls utilizing a flow sensor and transducer. Low flow sensitivity is increased and lower settings can be held. Exact control at minimum settings is crucial in maintaining good IAQ design practices.

The sleek design of the sensor causes minimal disturbance to the airstream. Therefore, compared with other bulkier sensor designs, it produces a minimal pressure drop increase across the terminal unit damper, reducing the inlet static pressure requirement and increasing energy efficiency, while at the same time producing negligible sensor generated noise.

The Nailor 'Diamond Flow' Sensor



Nailor Inclined Opposed Blade Damper

OPPOSED BLADE DAMPER

Most Nailor single duct and fan powered terminals are equipped with inclined opposed blade dampers that provide premium performance and control accuracy. Blades shut-off at 45° in the direction of airflow. This ensures quiet operation with near linear performance for primary air control. Airflow disturbance and hence the turbulence created over a throttling opposed blade damper is less than that produced when compared with a similarly throttling round 'butterfly' type damper design, therefore generating less noise.

Controlled throttling of the airflow is achieved throughout the complete damper rotation from fully open to fully closed, desirable characteristics not found in round 'butterfly' dampers, thereby providing accurate control under all conditions. Opposed blade dampers ensure Nailor customers of a smooth response as airflow is adjusted in response to changing thermostat demand or the damper adjusts to compensate for varying static pressure conditions.

All Nailor dampers feature a solid plated steel 1/2" (13) dia. driveshaft with an indicator mark on the end of the shaft to show damper position.

TERMINAL UNITS COMMON COMPONENTS

ELECTRIC HEATERS

All Nailor single duct, fan powered and bypass terminal units supplied with electric heaters will have heaters manufactured by Nailor Industries. All electric heaters are factory mounted by Nailor and contain a control enclosure for mounting heater controls. Controls for heaters are described under the controls section of this Product Overview.

Nailor electric coils are options on most terminal units and offer an alternative to a hydronic (water) coil setup. A few advantages to electric over hydronic heating coils include reduced pressure drop across the coil, thus requiring lower central or terminal fan HP requirements. Another benefit is the lack of water lines which require specialized installation, maintenance and always have the possibility of leaking. Electrical coils can, in many cases, share the same power terminal as the basic terminal unit. This reduces first costs not found with hydronic coils.

Features of Nailor Electric Coils:

- Super quiet premium design.
- High performance ceramic insulators.
- Primary auto-reset high limit thermal cut-out (one per coil in control circuit) to protect against overheating in low airflow situations.
- Secondary manual reset thermal cut-outs.
- Hinged control enclosure access door.
- High grade nickel/chrome element wire with Class A 80/20 as an option.
- Staged heat or SCR control.
- ETL Listed.

HOT WATER COILS

Nailor single duct, fan powered and bypass terminal units are available with factory installed hot water coils with up to four rows for reheat and supplementary heating applications. Coils are custom designed specifically for Nailor terminal units. The number of circuits and header/connection size have been selected to optimize performance.

- Tubes are 1/2" (13) O. D. copper.
- Fins are rippled aluminum, 10 fins per inch.
- Connections: 1/2" (13), 7/8" (22) or 1 3/8" (35) O. D. male solder, dependent on size and number of rows.
- Coils are pressure tested to 350 psi (2413 kPa).
- Water coil valves for pneumatic, electric and electronic control are available from Nailor.
- AHRI Certified.

MOTOR • ECM

OVERVIEW

Nailor Fan Powered Terminal Units are available with the latest technology. Using ECM's (Electronically Commutated Motor) Nailor can offer functionality and benefits not found with traditional PSC (permanent split capacitor) motors. When coupled with Nailor's volume control solutions, Nailor ECM's offer large turn down ratios and unsurpassed energy savings.

Features:

- Variable speed, constant torque/airflow.
- Factory set airflow.
- Programmable.
- Ultra energy efficiencies[1] with Genteq® EON™ motors.
- Genteq® EON™ ECM's offer "drop-in upgrades" or backwards compatibility for existing 2.3 models.
- Efficient 2-point motor calibration decreases characterization time and simplifies algorithms.
- Ball bearings for improved lubrication and quieter operation.
- Improved electronic Drive efficiencies and reliability.
- Reduced operating temperature, decreases energy to offset motor heat gain.
- When paired with Nailor's EPIC Fan Technology® volume controller; offers functionality and flexibility not available by other commercial FPTU manufacturers.

PRE-SET AIRFLOW

Nailor has always offered the latest ECM technology and volume control solutions, a practice begun in 1997. Our Fan Powered Terminal Units with ECM incorporate our own custom EPIC volume control card. This motor and volume control combination allows for factory or field set airflow volume.

Through extensive lab testing, we generate a product and application specific calibration algorithm to optimize motor/blower efficiency during operation. This "program" provides the motor the logic necessary to constantly adjust speed and torque to maintain a set airflow. All of the research and development done in maintaining constant airflow provides a number of benefits, which include:

- Energy savings
- Reduced commissioning/balancing time
- Fewer headaches associated with accessing units in hard to access ceilings
- A product that dynamically compensates for system effect, such as filter loading.

Factory setting airflow on a FPTU with a PSC motor is impractical. The problem lies within replicating field conditions in the factory. Jobsite ductwork changes, diffuser choices, branch takeoffs and more, all affect the performance of the FPTU as PSC driven units are more susceptible to downstream static pressure fluctuations. Since ECM motors can vary their speed and torque to maintain design airflow, they are ideal for factory set point programming. The benefit is reduced costs and time for field balancing. However, field setting airflow is an option.

Two methods are available for field setting airflow, manual or remote. Manual setting requires a screwdriver and a voltmeter locally at the terminal. A more convenient approach is to remotely use a 0 – 10 VDC output from a digital controller linked to a BAS. Whether the airflow is factory set or done in the field the result is the same; the airflow set point remains constant, independent of external static pressure†.

[1] Compared to others ECM's available and application

† The set airflow will remain constant as long as the unit operates within the acceptable range indicated by the unit appropriate fan curve.

MOTOR • ECM • CONTROLLERS

OVERVIEW

EPIC Volume Controller

Nailor's newest EPIC ECM volume control card works with high efficiency Genteq® EON™ ECM motors. The 24 VAC volume controller allows for manual or remote BAS (0 – 10 VDC) control, not only on EON™, but any Genteq® ECM.

Features:

- Manual (at the terminal) or remote Dynamic Automation (BAS) control.
- Green LED indicator light; blinks to indicate airflow or solid for maximum RPM indication.
- Red LED indicates power.
- Remote (BAS) input.
- G1 output to motor for "true" motor on/off switching; if a voltage of 0.5 VDC or below is detected, the motor will turn off.
- Motor output control (Dual motor output optional - same signal for both motors).
- Improved circuit design for brownout conditions.
- Better circuitry robustness and accuracy.

Input Voltage	Operation
0 – .5 VDC	Motor OFF
.5 – 10 VDC	0 – 100%

OPTIONS

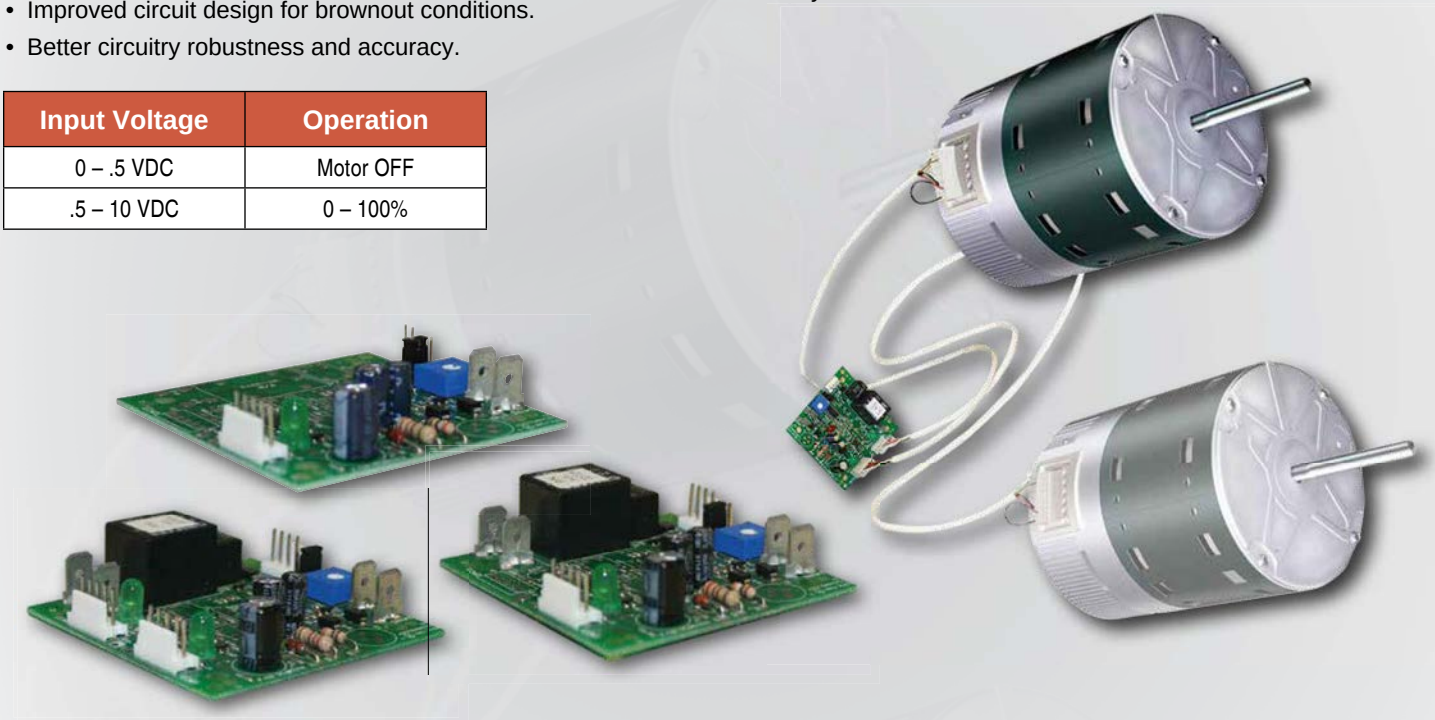
FSC – Fan Status Contact Closure

This option provides a digital output for use with Nailor or field mount digital controllers. Signal output indicates the motor is operating @ 200 RPM or greater.

- Eliminates CT's (Current Transformers) to prove motor/blower functionality.
- Works with single or dual motors.
- Durable solid state components increase reliability and accuracy.

FIR – Fan Interlock Relay

- Standard on all Fan Powered Terminal Units with Electric Resistive Heat.
- Replaces bulky mechanical airflow switch.
- Solid State components provide improved reliability for critical safety circuits.
- Digital output disengages below 200 RPM for additional level of safety.



CONTROLS

DIRECT DIGITAL CONTROLS (DDC)

- Factory mounting (supplied by controls contractor)

Nailor has a wealth of experience supplying terminal units for use with state-of-the-art digital controls. We have worked with all major controls companies in recent years and have developed standard factory mounting programs to ensure operational efficiency is maximized for all terminal types and applications. Nailor has designed its VAV terminal units to be generic in nature and compatible with all DDC controllers.

PNEUMATIC CONTROLS

A comprehensive range of factory supplied, installed and calibrated controls are available for pressure independent control applications with all terminal types. Pressure dependent controls are also available for certain terminals and applications.

ANALOG CONTROLS

Superseded in recent years by similarly priced Digital Controls, Nailor is phasing out the Analog Control offerings. With today's increased demand on efficiency and performance, Nailor is the front runner for controls with the most up-to-date options in the Industry. Check out EZVAV for the best performance controls available.

DIGITAL ELECTRONIC COMPONENTS

DIRECT DIGITAL CONTROLS (DDC)

Microprocessor based technology is now commonplace in HVAC building management systems, particularly in larger building applications. Most controls companies have therefore developed DDC controllers and software programs for terminal units, to enhance energy efficient VAV systems and the well proven associated control strategies. VAV digital controllers are only one part of a much larger fully integrated building management system and the common availability and specification of terminal unit DDC controllers from control companies ensures compatibility and common protocol for trouble-free systems communication, maintenance support and trouble shooting. Digital VAV controls offer all the advantages of accurate, pressure independent operation plus the additional benefits of a networking capability and two-way communication. Parameters can be loaded and downloaded via communication with a remote PC.

Optional Nailor supplied and mounted 'Tri-State' MEP-5000 Series Actuator

Nailor has extensive experience factory mounting digital controls supplied by the controls contractor. Nailor has developed individual factory mounting programs for most manufacturers currently offering digital controls, providing the assurance of a high quality, professional installation and minimizing start-up problems.

Nailor has designed its VAV terminal units to be generic in nature and compatible with all DDC controllers.

- Nailor supplies as standard a NEMA 1 full controls enclosure for protection of the controls during shipment, installation and for the life of the building HVAC system. Dust tight construction is an option.
- The vast majority of digital controls require a flow sensor. Nailor's 'Diamond Flow' multi-point averaging sensor is compatible with all such controls. Nailor will mount its own sensor as standard, whether the digital controls are to be factory or field mounted, ensuring accurate measurement regardless of inlet conditions. Factors have been developed for loading into the flow control algorithm.
- UL Class 2 control transformers and disconnect switches are available from Nailor factory installed. All components carrying 120 VAC or higher should be supplied and installed by Nailor in order to maintain ETL listings.
- Separate isolation control transformers are available on fan terminal units to protect digital components from potentially harmful voltage spikes.
- An economical factory approved tri-state 24 VAC, 50 in. - lb. (5.7 Nm) torque direct drive actuator is available from Nailor when the DDC controller being mounted is available for use with a separate actuator.

Models: MEP-5061 18°/minute
MEP-5071 60°/minute

PNEUMATIC CONTROL COMPONENTS

PRESSURE INDEPENDENT OPERATION

The 'heart' or 'brain' of the control package is the reset controller, which processes signals from the room thermostat (temperature) and 'Diamond Flow' sensor and resets the primary air damper accordingly.

Airflow is controlled in response to the thermostat demand for heating and cooling to accurately meet the load conditions. At the same time, it holds the airflow rate dictated by the thermostat, regardless of fluctuations in upstream duct pressure. In other words, it is pressure independent. The flow control or reset function is between the minimum and maximum air volume limits. These limits are factory set to the job specification, but can be easily readjusted in the field as required.

In operation, the amplifying sensor located in the terminal inlet signals to the pneumatic reset controller which in turn energizes the pneumatic damper actuator to obtain the required airflow. There is actually a pressure signal feedback to the controller as a result of the damper movement which will correct itself for any velocity pressure fluctuations. Hunting and over controlling are minimized, resulting in stable operating conditions.

NAILOR 3000 CONTROLLER

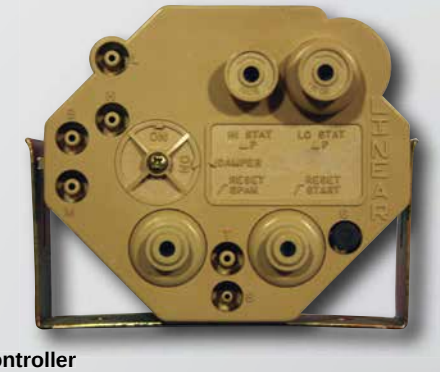
Currently the industry's most popular model. Universal pneumatic reset controller **(Model CSC-3011)** compensates for changes in duct pressure-flow. Control is pressure independent with adjustable minimum and maximum air volume settings. Can be used for any combination of direct or reverse acting thermostat action with a normally open or normally closed damper fail position.

Nailor 3000 Controller

PNEUMATIC CONTROL COMPONENTS

Features:

- The controller is factory calibrated to the specified airflow, and is field adjusted easily. Field adjustment is needed only when operating conditions change.
- Pressure independent.
- Reset span remains constant with both maximum and minimum cfm adjustments.
- Reset span is adjustable from 0 to 10 psi (69 kPa) to match any thermostat. Standard setting is 5 psi (35 kPa).
- Reset start point is adjustable from 0 to 10 psi (69 kPa) to work with auxiliaries such as reheat coils. Standard setting is 8 psi (55 kPa).
- Settings for either direct acting or reverse acting thermostat action. Settings for either normally-open or normally-closed damper position, without further controls.
- Accurate control over a duct velocity range of 0 – 3000 fpm (15 m/s).
- Adjustments are made on the face of the controller.
- Adjustments are directly accessible through a ceiling opening with controls mounted and facing downward.
- Operates at low system pressure. Effective from as low as 0.02" w.g. (5 Pa) Ps and as high as 6.0" w.g. (1.5 kPa) Ps.
- Control air consumption is no more than 1.0 SCFH @ 20 psi (0.472 l/min @ 138 kPa).
- Operates on a control air pressure of 15 to 30 psi (103 to 207 kPa).



Nailor 3500 Controller

NAILOR 3500 CONTROLLER

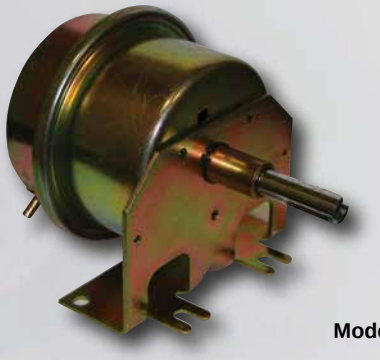
The CSC-3501 linear pneumatic reset controller provides an alternate to the Nailor 3000 controller. Actual velocity is reset linearly with thermostat pressure rather than velocity pressure resulting in a constant reset slope throughout the reset curve. Room stability is improved at low flow conditions.

The 3500 controller has real advantages in dual duct terminal applications where hot and cold decks track each other more accurately as 'reset curve' hysteresis is eliminated and therefore maintain an accurate and near constant total volume flow level during mixing.

MCP-8031 CONTROLLER

'Piston type' spring return pneumatic damper actuator; totally enclosed all metal casing with neoprene diaphragm. (8 sq. inch effective area). Standard 5 – 10 psi spring range on pressure independent reset controller applications, maximizes performance. Standard on all single duct, dual duct and fan powered pneumatic control terminal units.

MCP-8031-3101 5 – 10 psi spring range
MCP-8031-5101 8 – 13 psi spring range
MCP-8031-8101 3 – 8 psi spring range



Model Series MCP-8031

Model Series MCP-3631

MCP-3631 SERIES ROTARY CONTROLLER

Unique rotary-drive design with spring return action upon main air failure. Glass-filled nylon body with neoprene diaphragm (8 sq. inch effective area). Direct drive operation eliminates any possible linkage play. Compact design is suited to tight or restricted installations, such as internal retrofit applications. Standard on 3200 Series Dual Duct and 3400 Mk II Series Bypass terminal units. Optional on other models.

MCP-3631-3000 5 – 10 psi spring range
MCP-3631-5000 8 – 13 psi spring range
MCP-3631-8000 3 – 8 psi spring range

PRESSURE DEPENDENT OPERATION

In pressure dependent control operation, the pneumatic controller and flow sensor are omitted and the pneumatic actuator is controlled directly by the thermostat. Airflow is entirely pressure dependent. This version of the pneumatic terminal unit is used where neither pressure independent nor regulated maximum airflow settings are required.

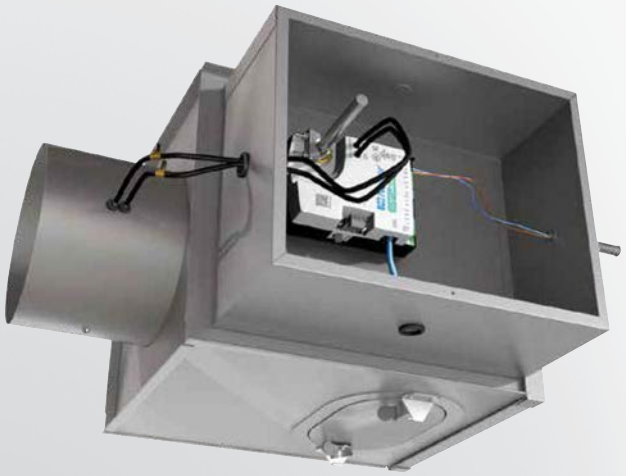
One example is a single duct variable air volume supply in which the supply duct pressure is held constant by other controls. A mechanical airflow setting can be made as a function of the damper driveshaft rotation. Bypass terminal units, due to their design, are inherently pressure dependent.

EZvav DIGITAL CONTROLLERS

The new EZvav Digital Controls by Nailor bring simplicity to the Variable Air Volume (VAV) terminal unit market. Designed for both stand-alone applications and for integration with BACnet building automation systems, EZvav are precise P+I pressure independent VAV controllers that are pre-configured for standard control sequences that cover the vast majority of terminal unit applications.

All terminal units with electric or hot water heating coils are supplied as standard with a DAT Discharge Air Temperature control sensor that can limit the discharge air temperature to a maximum of 15°F above room set point, helping compliance with ASHRAE Standard 62.1 and 55.

Field commissioning and balancing can all be performed using the standard digital display room temperature sensor, which has an intuitive menu driven setup. No laptop, expansion modules, communication interface or software is required.



FEATURES & BENEFITS:

- Integrated controller/actuator/transducer.
- Factory mounted and wired for new building applications.
- Ideal for retrofitting and upgrading pneumatic and analog controls to a digital solution.
- Room temperature sensor (thermostat) options include Digital Display, Occupancy Sensor and compact Rotary Dial models.
- Remote fan volume adjustment from 0 – 100% for EPIC ECM fan powered terminals.
- Simple menu driven setup.
- BACnet BMS network integration ready.

APPLICATION CONTROL SEQUENCES INCLUDE:

- Single Duct VAV or CAV Cooling only and Heat/Cool Changeover.
- Single Duct VAV Cooling with reheat.
- Dual Duct Variable Volume or Constant Volume control.
- Series Fan Powered Constant Volume with/without supplementary heat.
- Parallel Fan Powered Variable Volume with/without supplementary heat.

HEATING CONTROL OPTIONS:

Binary (up to 3 stages of electric heat), Modulating (0 – 10 Vdc analog) or Floating heat control.

NATIVE BACnet

All models are BACnet Applications Specific Controllers that are ready to connect to a BACnet MS/TP network. Device instance, MAC address and baud rate are set from an STE-8001W36 without special software.

EZ TO ORDER

Nailor Representatives' Automated Pricing Program (RAPP) features EZ quick select options for control sequences and room temperature sensor options based on terminal unit type and application requirement.

EZ TO INSTALL

For field retrofit applications, the EZvav controller is mounted within a terminal unit controls enclosure and directly coupled to the damper shaft. The flow sensor, power supply, heat and temperature sensors are then connected. The EZvav controller automatically detects them without programming or software tools.

EZ TO SETUP, COMMISSION AND BALANCE

All options can be set by using an STE-8001W36 sensor as a technician's service tool or installed as a permanent room sensor. The EZvav Controller can be stocked by representatives to provide a simple digital solution to their customers that wish to upgrade their pneumatic or analog inventory to a new digital solution, perfect for retrofit applications!

EZvav DIGITAL CONTROLLERS:

Model Number	Application
BAC-8001-36	Single Duct Cooling and Heat/Cool changeover
BAC-8005-36	Single Duct with Reheat and Fan Powered Applications
BAC-8007-36	Dual Duct Master
TSP-8001-36	Dual Duct Secondary Actuator

ROOM TEMPERATURE SENSOR (THERMOSTAT) OPTIONS:

STE-8001W36

Digital Display

- Temperature readout in deg F or C. (and time of day when networked). User Set point adjustment
- Field Commissioning Tool
- Password Capable

STE-8201W36

Digital Display with Occupancy Sensor

- Same Features as STE-8001W36 with Occupancy Motion Sensor that provides unoccupied, setback and standby control

STE-6014W36

Rotary Dial

- Small, compact and discreet
- Economical
- Set point Adjustable Only

TECHNICAL SPECIFICATIONS:

INPUTS AND OUTPUTS

All inputs and outputs for EZvav controllers are set up at the factory and do not require field programming.

Inputs

- Sensors are automatically detected.
- Inputs accept industry-standard 10K ohm thermistor sensors.
- Input overvoltage protection up to 24 volts AC, continuous.
- 12-bit analog-to-digital conversion.

Triac outputs

- Optically isolated triac output.
- Maximum switching 24 volts AC at 1.0 ampere for each output.
- Maximum for controller is 3.0 amperes.

Analog outputs

- Short-circuit protected.
- Output voltage 0–10 volts DC.
- 30 mA per output, 30 mA total for all analog outputs.
- 12–bit digital-to-analog conversion.

Airflow sensor

CMOS differential pressure 0–2 inches of water (0–500 Pa) measurement range. Internally linearized and temperature compensated.

- Configured as BACnet analog input object.
- Span accuracy 4.5% of reading.
- Zero point accuracy 0.0008 in. H2O/0.2 Pa at 77° F (25° C).
- Barbed connections for 1/4 inch FR tubing.

Actuator

Torque	40 in-lb. (4.5 N.m)
Angular Rotation	0 to 95° Adjustable end stops at 45 and 60° rotation

Motor Timing

90 sec./90°at 60 Hz. 108 sec./90° at 50 Hz

Shaft size

Directly mounts on 3/8 to 5/8 inch (9.5 to 16 mm) round or 3/8 to 7/16 inch (9.5 to 11 mm) square damper shafts.

BACnet communication

- Integrated peer-to-peer BACnet MS/TP network communications.
- Network speed from 9600 to 76,800 baud.
- Meets or exceeds ANSI/ASHRAE BACnet Standard 135-2008 for Application Specific Controllers.

Installation:

Supply voltage	24 volts AC (–15%, +20%), 50–60 Hz, 5 VA, Class 2 only
Weight	13.2 ounces (376 grams)
Case material	Gray and black flame retardant plastic

Environmental limits

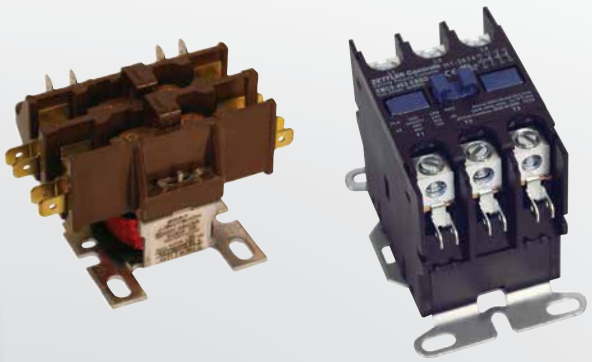
Operating	32 to 120° F (0 to 49° C)
Shipping	–40 to 140° F (–40 to 60° C)
Humidity	0–95% relative humidity (non-condensing)

Regulatory

- UL 916 Energy Management Equipment.
- BACnet Testing Laboratory listed as Application Specific Controller (ASC).
- CE compliant.
- SASO PCP Registration KSA R-103263.
- FCC Class B, Part 15, Subpart B and complies with Canadian ICES-003 Class B.

ELECTRIC HEATER CONTROLS

Nailor offers three control options for controlling electric heat on terminal units, conventional staged heat, SCR (Silicon Controlled Rectifier) and SCR with discharge temperature control (DTC). All options provide a method for controlling, dependent on demand, the amount of heat needed within an occupied space. By adjusting the heat output into the occupied zone, energy is conserved by more precisely regulating output to closely match demand. Each control type subsequently requires a control signal, a control interface and device to energize heating coil elements.



2 & 3 Pole Contactor

CONVENTIONAL

Nailor's conventional staged heat works with pneumatic, electronic and digital (DDC) control systems. A maximum of 3 stages are available. When heating is needed an on/off control signal, typically 24 VAC, powers a mechanical contactor to energize a set of heating elements connected to line voltage. If the unit is equipped with more than one stage of heat, additional mechanical contactors can be triggered as demand requires. This setup allows for a wide range of line voltages, as well as, phase requirements needed to meet job specifications.

SCR Controller with SSR

SCR

Nailor offers 2 versions of SCR proportional heat control, basic SCR and SCR with DTC. SCR heater controls provide proportional modulation over the full heater operating range. Since the SCR unit is controlled by solid state electronics, the control signal is very precise, reliable and silent. SCR control works with pneumatic (additional component required), digital (DDC) controls packages. When heating is required, a control input signal is sent to the SCR controller board as 4 – 20 mA, 2 – 10 VDC or 0 – 10 VDC. In turn, a 1 – 24 VDC pulsed output will be sent to a single or multiple SSR's (Solid State Relay) to energize the heating elements. Simultaneously, all the heater elements will be pulsed on and off based on the time proportional signal from the SCR controller. The result is proportioned heat to meet demand, thus conserving energy.

SCR WITH DTC

To further increase efficiency, Nailor offers an SCR controller with a DTC option. By measuring differential temperature across the heating coils, the SCR controller will update the proportional signal sent to the SSR's to ensure the heat output of the elements is optimized. As an added benefit and safety measure, during low flow situations the heater will de-energize if it detects too great a temperature differential across the heater. This saves both energy and costs, as a mechanical airflow switch is no longer needed. SCR heat is very precise, energy efficient, silent and compatible with modern controls packages.

FAN POWERED CHILLED WATER TERMINAL UNIT

33SZ SERIES

The 33SZ Series Fan Powered Chilled Water Terminal Units (FPCWTU) enhance Nailor's already efficient and flexible Series Fan Powered Terminal Unit product line. The 33SZ Series incorporates a draw-thru cooling induction coil to use in conjunction with a DOAS (Dedicated Outdoor Air System). Useful in a variety of commercial and educational applications, like classrooms, office spaces, laboratories and auditoriums, the 33SZ provides a flexible, industry familiar unit that excels at zone sensible cooling while the dedicated outdoor air inlet delivers ASHRAE 62.1 ventilation requirements.

The unit can be used in a variety of applications including zone sensible cooling, supplemental heating, or even used together with an AHU to take advantage of economizer model. Depending on application, the 33SZ provides a universal product in a footprint similar to well established fan powered terminal units. Additionally, the ducted discharge can service a larger zone than say, a chilled beam product. Whether the project uses a factory ready product or requires customization, Nailor is capable and ready to provide complete air control & distribution solutions.

Nailor®

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Complete Air Control and Distribution Solutions

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