RenewAire
Energy Recovery Ventilators

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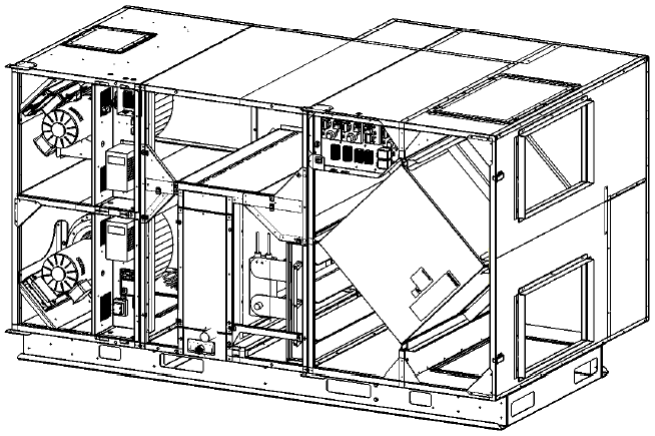
RD2XIN INSTALLATION AND OPERATION MANUAL

BOOK 1

OVERVIEW



ABOUT BOOK 1:

This book provides an overview of function and principles of operation of the RD2X. While it provides some guidelines, Specification Documents provided by a qualified Specifying Engineer are to be considered the Basis of System Design.

See Book 2 for product and performance specifications.

See Book 3 for the mechanical installation of the RD2X.

See Book 4 for basic electrical connections and wiring schematics.

See Book 5 for control system connections, VFD adjustment, Start-Up, Commissioning or Maintenance.

Following these instructions does not necessarily assure compliance with local codes and standards, which must always be observed.

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BOOK 1: RD2XIN OVERVIEW

PRODUCT FEATURES

The RD2X is an Energy Recovery Ventilator with available features designed for Dedicated Outdoor Air Systems.
Standard features include:

- Energy recovery by fixed-plate enthalpic energy exchanger
- Enthalpy- and temperature-controlled bypass of energy recovery
- Isolation dampers that shut down when ventilation is not needed
- Variable-Frequency Drive (VFD)-controlled direct-drive fresh air and exhaust air blowers
- Integrated disconnect switch
- Airflow measurement stations

Available features include:

- Heating and/or cooling coils for post-treatment of fresh air
- Double-wall construction

PRINCIPLE OF OPERATION

The RD2X can operate in up to four modes depending on options installed:

- Energy Recovery mode: the unit transfers heating or cooling energy from the exhaust air to the fresh air.
- Recovery Bypass mode: the unit takes advantage of free cooling from the outside air and doesn't transfer energy between air streams.
- Dehumidification mode: the unit conditions the fresh air to 53°F.
- Heating mode: the unit tempers the fresh air to 75°F.

The RD2X operates automatically. The unit receives an external call for ventilation. Its isolation dampers open and turn on the variable frequency drives and blowers. The unit determines the operating mode by continuously monitoring the air streams for temperature and enthalpy.

The RD2X does not include a condensing unit, chiller, heat pump or boiler. When a coil for dehumidification or cooling is part of the RD2X unit, the condensing unit, chiller, heat pump or boiler is separately installed to meet the needs of the complete system. RD2X units equipped with coils include electrical connection points to call for operation of the separate heating or cooling equipment. **However, no fluid or refrigerant flow control valve (TX valve) is provided, and must be specified by the designer of the overall system for separate sourcing.**

OPERATING CONTROLS

A wide variety of low voltage (24VAC) control schemes may be selected to meet the ventilation needs of the facility. These may include time clock, occupancy sensor, carbon dioxide sensor, and others. DDC systems may also control the unit with external control by other. **TX valves are not provided.**

⚠ WARNING

RISK OF FIRE, ELECTRIC SHOCK, OR INJURY.

OBSERVE ALL CODES AND THE FOLLOWING:

1. The installation manuals shows the suggested installation method. Additional measures may be required by local codes and standards.
2. Installation work and electrical wiring must be done by qualified professional(s) in accordance with all applicable codes, standards and licensing requirements.
3. Any structural alterations necessary for installation must comply with all applicable building, health, and safety code requirements.
4. This unit must be grounded.
5. Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment that might be installed in the area affected by this equipment. If this unit is exhausting air from a space in which chimney-vented fuel burning equipment is located, take steps to assure that combustion air supply is not affected. Follow the heating equipment manufacturer's requirements and the combustion air supply requirements of applicable codes and standards.
6. Use the unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
7. This unit is intended for general ventilating only. Do not use to exhaust hazardous or explosive materials and vapors. Do not connect this unit to range hoods, fume hoods or collection systems for toxics.
8. This unit must be properly ducted to the outdoors.

CAUTION

To avoid motor bearing damage and noisy and/or unbalanced impellers, keep drywall spray, construction dust etc, out of unit.

BOOK 1: RD2XIN OVERVIEW

DE-COUPLED AND DEDICATED OUTDOOR AIR SYSTEMS OVERVIEW

DE-COUPLED SYSTEMS

There is great interest today in HVAC systems in which the function of providing and conditioning the outside ventilation air is de-coupled from the function of circulating, heating and cooling the air inside the building.

This is particularly interesting when the Outside Air fraction is greater than 30%, as is true with moderate- to high-density occupancies such as schools and offices. In these applications, the sensible heating or cooling loads are not well-coordinated in time or magnitude with the latent loads. The latent loads are primarily associated with the outside air ventilation, which is largely driven by occupancy schedules, not sensible loads. Thus proper control of latent loads and humidity can be difficult when just one piece of equipment is expected to handle sensible loads, latent loads and provide the outside air ventilation.

In addition, when multiple spaces are handled by a central air conditioner, often using Variable-Air-Volume (VAV) approaches, the ventilation needs of each space are not often well-matched to the air delivery needs imposed by the space's sensible and latent loads. As a result, the overall outside air delivery to the building is typically higher than necessary, in order to ensure that each of the separate spaces is receiving the necessary amount of outside air.

Decoupled systems in many cases are more efficient and less expensive to operate, as well.
In short, de-coupled systems in many cases offer several benefits:

- the latent loads are properly controlled, often without reheat;
- the correct amount of outside air can be delivered to each space, without having to over-ventilate some spaces;
- the overall energy efficiency of the HVAC system is enhanced.

DOAS SYSTEMS

Dedicated Outdoor Air Systems (DOAS) are a refinement of the De-coupled System concept. DOAS systems use two separate pieces of equipment:

1) Outside ventilation air is provided and pretreated by one piece of equipment that uses energy recovery to greatly reduce the sensible and latent loads of the outside air, then additionally cools air to address the remaining internal latent loads.
2) Sensible loads are addressed by a parallel piece of equipment, sometimes with separate ductwork, that provides the remaining circulation air needs. VAV, fan-coil, and radiant systems all have been used successfully.

Many DOAS units available on the market today are designed to provide very tight control of humidity, and some are capable of delivering air at very low wet bulbs, while reheating the supply air to room temperature but the tighter the control, the more complex and expensive.

RENEWAIRE'S RD2X

The RD2X brings the DOAS concept to smaller, less-demanding applications where the benefits of de-coupled systems and energy recovery are still important and valuable.

The RD2X includes the features you need to meet ASHRAE 62.2 and 90.1 requirements, such as energy recovery, recovery bypass, and isolation dampers.

Internal logic for the RD2X is provided by simple, easy-to-understand temperature and enthalpy controls, and the unit can be controlled by a variety of stand-alone controls or a Building Automation System.

Its direct-drive blowers with NEMA Premium motors are controlled by Variable Frequency Drives for maximum delivered efficiency at the required system airflow.

Finally, a range of factory-installed heating and cooling coils are available for integration of the RD2X units with the DX, heat pump, chilled or hot water systems which you are designing to best meet the overall HVAC needs of your project. Since the heating and cooling components other than the coil are specified by you, those components can be the ones you are most comfortable with and can be sourced most efficiently for the lowest delivered cost to your customer.

ENERGY RECOVERY WEATHER COMPRESSOR

Energy Recovery in the RD2X compresses the range of temperature and humidity of the outside ventilation air. This reduces the energy needed to condition the outside ventilation air. It also reduces the range of conditions that the downstream air conditioning equipment must be able to handle.

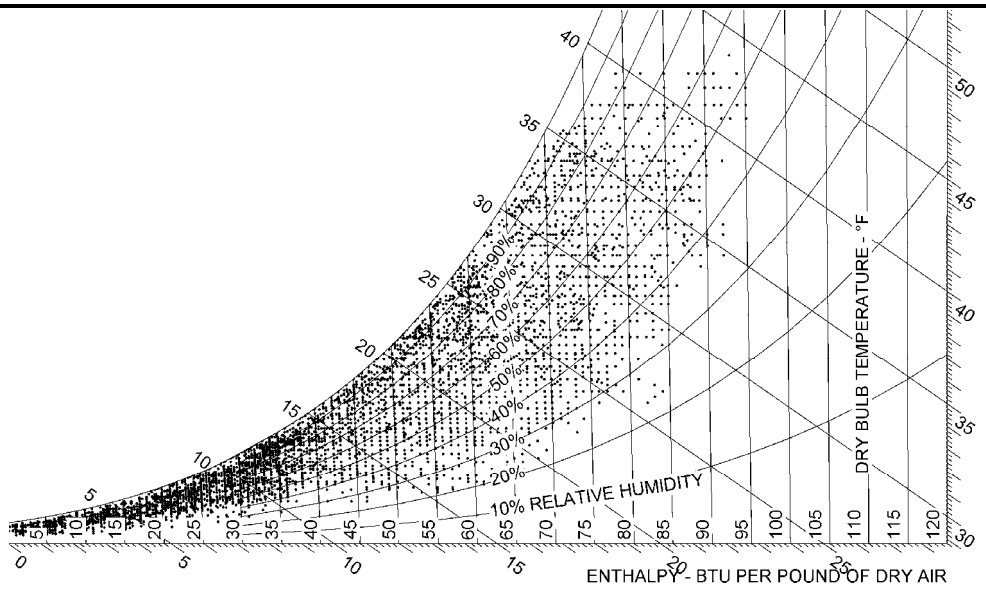

FIGURE 1-1
Typical Meteorological Year (TMY) bin data for outside air in Madison, Wisconsin.

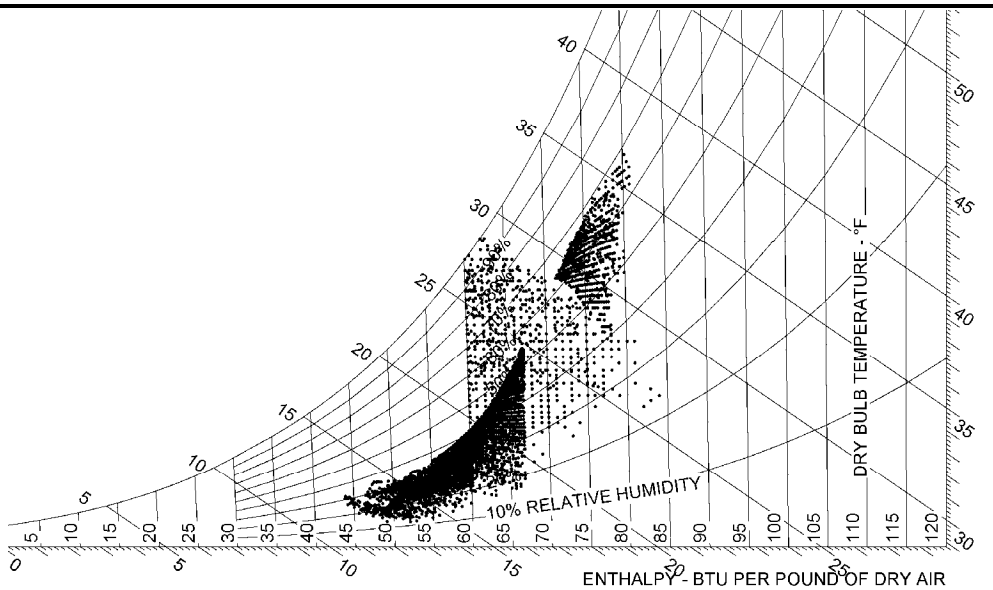

FIGURE 1-2
The same outside air bins after Weather Compression by Energy Recovery in the RD2X. In this example Recovery is Bypassed when the Outside Air is above 60°F and below the Room Air Enthalpy.

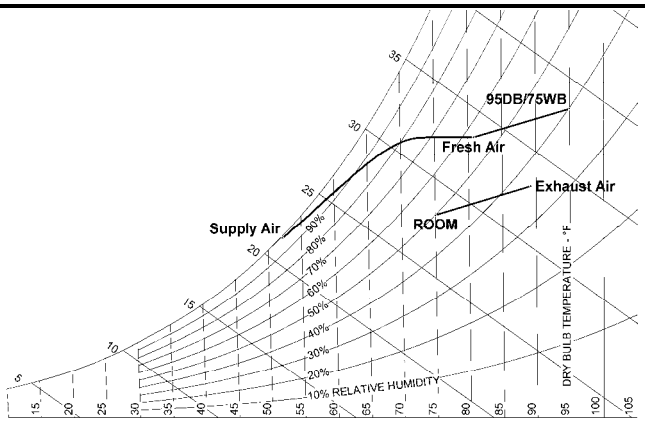

FIGURE 1-3
Full-Load Cooling

In this typical summer design condition, Room air is exhausted through the Energy Recovery Component, giving up coolness and dryness. Outside Air passing through the Energy Recovery Component is substantially reduced in temperature, moisture content and enthalpy ("Fresh Air" point). The air then passes through the dehumidification coil for delivery as cool, dry air to the space ("Supply Air" point).

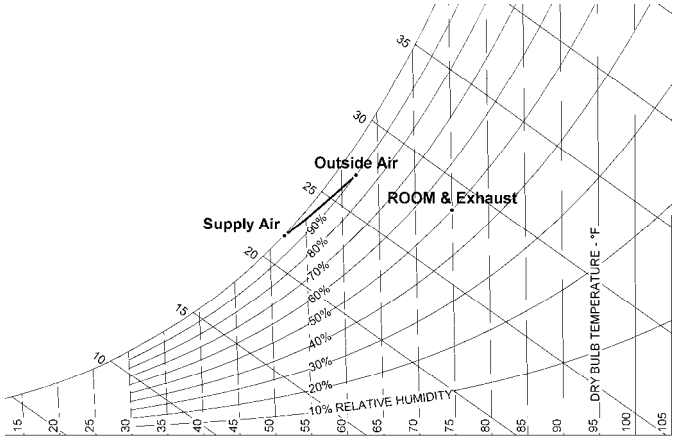

FIGURE 1-4
Energy Recovery Bypass

In this example, Outside Air is cooler than the Room Air, has somewhat more humidity, but is lower in Enthalpy. Energy Recovery is bypassed, so Room Air is exhausted without changing condition. The Outside Air still requires energy reduction to control inside humidity loads, so it passes through the dehumidification coil for delivery as cool, dry air to the space ("Supply Air" point).

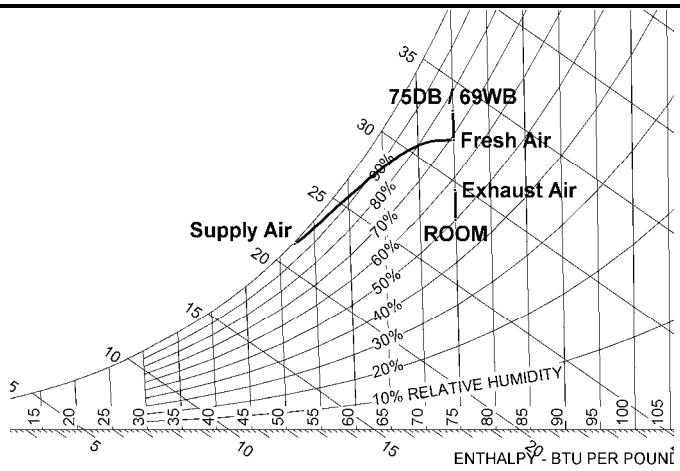

FIGURE 1-5
Part-Load Cooling

In this case, Outside Air is the same temperature as the Room Air, but has much more humidity. Room air exhausted through the Energy Recovery Component, gives up dryness. Outside Air passing through the Energy Recovery Component is reduced in moisture content ("Fresh Air" point). The air then passes through the dehumidification coil for delivery as cool, dry air to the space ("Supply Air" point).

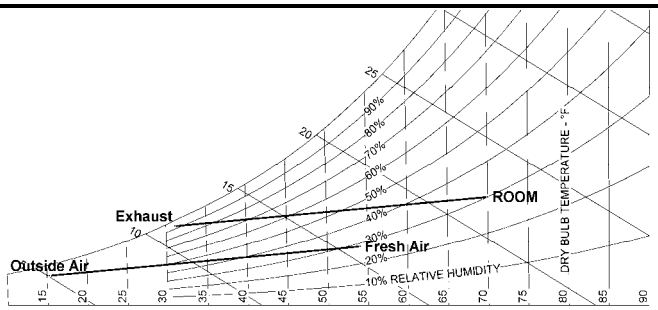

FIGURE 1-6
Heating

In this example, Outside Air is much cooler and also is dryer than the Room Air. Room air is exhausted through the Energy Recovery Component, giving up heat and humidity. Outside Air passing through the Energy Recovery Component is substantially increased in temperature, moisture content and enthalpy ("Fresh Air" point). Because the Room air gives up humidity as it cools, it stays below the saturation point and cannot freeze.

SYSTEM INTEGRATION

The RD2X can be integrated with many types of HVAC systems. Following are three extremely simplified examples.

A simple but not ideal system uses the RD2X to provide outside ventilation air to the return of a Variable Air Volume (VAV) air handler (see Figure 1-7, this page). But as illustrated, if different zones require different outside air fractions, the total amount of outside air that must be delivered exceeds the sum of the zone requirements.

A better VAV-based system uses parallel delivery of the outside ventilation air to each zone (see Figure 1-8, this page). Only the required amount of outside air is delivered to each zone, so the RD2X need not provide excess air. Since the VAV air handler need provide only enough air volume to address the sensible loads, it can be smaller.

Another system with similar advantages uses Fan-Coil Units or radiant heating/cooling with parallel delivery of the outside ventilation air to each zone (see Figure 1-9, this page). Again, only the minimum required outside ventilation air volume need be delivered.

REHEAT

When the volume of outside air delivered to each space is properly controlled by use of a de-coupled system, reheat is rarely needed.

OPERATING CONTROLS

A wide variety of low voltage (24VAC) control schemes may be selected by the engineer, installer, or owner to meet the ventilation needs of the facility. These may include time clock, occupancy sensor, carbon dioxide sensor, and others. DDC systems may also control the unit with external control by other. Most control schemes will operate the unit only when needed.

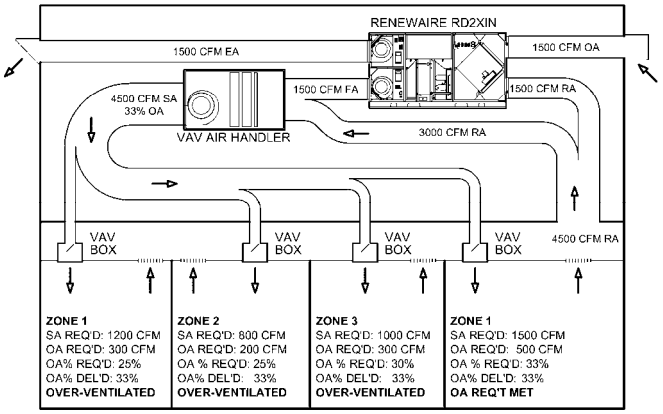

FIGURE 1-7
RD2X with Series VAV System

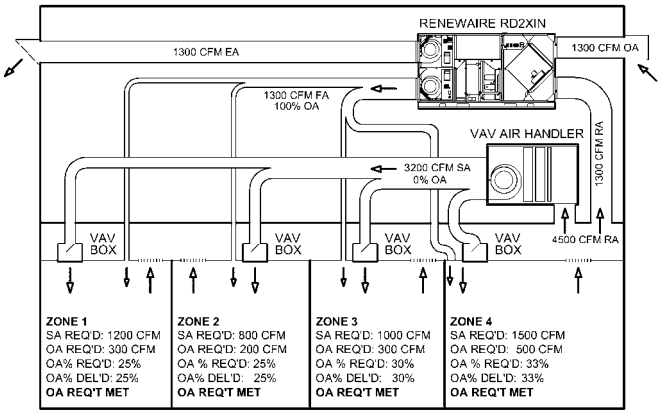

FIGURE 1-8
RD2X with Parallel VAV System

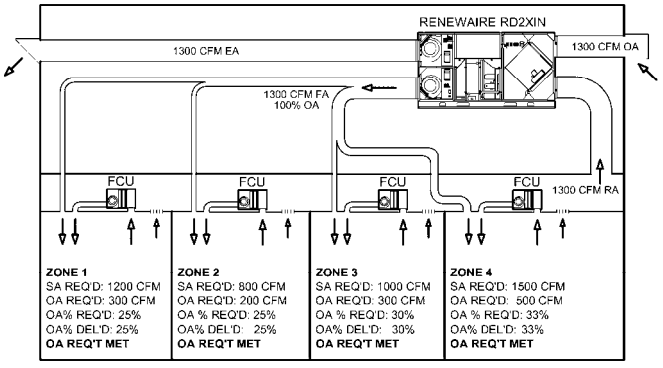

FIGURE 1-9
RD2X with Parallel Fan Coil Units

BOOK 1: RD2XIN OVERVIEW

CRITICAL WARNINGS

SAFETY WARNINGS

Be aware of the following safety warnings found in Books 3, 4 & 5:

⚠ WARNING

DO NOT SUSPEND OR HANG UNIT.
Secure the unit to meet applicable seismic requirements.

See "BOOK 3: MECHANICAL", page 9.

⚠ WARNING

The fresh air inlet should be at least 10' away from any exhaust, such as dryer vents, chimneys, furnace and water heater exhausts, or other sources of contamination or carbon monoxide. Do not locate the fresh air inlet where vehicles may be serviced or left idling. Never locate the fresh air inlet inside a structure.

See "BOOK 3: MECHANICAL", page 10.

⚠ CAUTION

Danger of condensation and resultant equipment damage or biological growth if ducts are not properly installed, sealed and insulated. Observe guidelines above as well as all applicable codes.

See "BOOK 3: MECHANICAL", page 10.

⚠ WARNING

Danger of Electrical Shock! Variable Frequency Drive capacitors retain charge after power is removed. Disconnect power and wait a minimum of three minutes before servicing drive.

Do not cycle input power to drive more than once every two minutes

See "BOOK 4: ELECTRICAL", page _.

SERVICE DISCONNECT

The unit comes from the factory with a load switch installed in the blower module door. To open the blower module door the switch must be turned to the 'OFF' position. However, line voltage is still present at the input to the load switch. Local codes may require installation of another Disconnect Switch.
See "BOOK 4: ELECTRICAL", page 4.

DAMAGE CAUTIONS

Be aware of the following damage cautions found in Books 3, 4 & 5:

CAUTION

To avoid motor bearing damage and noisy and/or unbalanced impellers, keep drywall spray, construction dust etc, out of unit.

See "BOOK 3: MECHANICAL", page 2.

CAUTION

Do not vent exhaust duct up through roof except as shown. Otherwise, condensate will form in cold weather and run back into unit.

See "BOOK 3: MECHANICAL", page 12.

CAUTION

Make sure clean filters are installed in the RD2X before balancing air flow. Dirty or clogged filters reduce air flow through the unit.

See "BOOK 5: START-UP, COMMISSIONING AND MAINTENANCE", page _.

CAUTION

Filters must be used or the energy exchange core will become blocked by dust and the unit will not do its job. In extreme cases components may be damaged.

See "BOOK 5: START-UP, COMMISSIONING AND MAINTENANCE", page _.

CAUTION

Very low air flow rates may result in fouling of the energy exchanger core. Do not reduce air flow to below 500cfm.

See "BOOK 5: START-UP, COMMISSIONING AND MAINTENANCE", page _.

BOOK 1: RD2XIN OVERVIEW

CHECKLIST FOR SPECIFYING ENGINEER

	ITEM	REQUIREMENT	MORE INFORMATION
	Location	Indoor (not necessarily conditioned space)	Book 2, page 10 Book 3, pages 10-12
	Service Access	Access to front of unit is required.	Book 2, page 10
	Ducting	4 required, some must be insulated and sealed inside and outside	Book 3, pages 10-12
	Duct layout and Outside Terminations	Must meet requirements to exclude rain.	Book 3, pages 11-12
	Power Requirements	Unit is available in all North American voltages except 115VAC 1P. Desired voltage must be specified so the unit can be properly ordered.	Book 2, pages 6, 8
	Service Disconnect	Integrated Service Disconnect Provided with Unit. Check for compliance with local codes.	Book 2, page 9
	Unit Configuration	A variety of inlet/outlet locations are possible and should be specified so that unit can be properly ordered.	Book 2, pages 6-7
	Configuration Code	Defines the inlet/outlet configuration, coil type and capacity, input voltage and optional features. Required so the unit can be properly ordered.	Book 2, page 6
	Optional Features	Must be specified so that unit can be properly ordered.	Book 2, page 3, 6
	Unit Mounting/Securing	Unit must be secured to meet seismic/safety requirements. Unit is not designed to be suspended.	Book 3, page 9
	Coil Specification	If coil is desired, it must be selected along with external heating/cooling equipment to meet required system output conditions.	Book 2, pages 12-15
	Coil Connections	(see above)	Book 2, page 10, 12-15 Book 3, page 13
	External Heating/Cooling Equipment	(see above)	Book 2, pages 12-15, 19 Book 4, pages 6, 16
	Drain Connections	If cooling coil is provided, the condensate drain must be plumbed.	Book 2, page 10
	Control System	Must be specified	Book 2, pages 2, 3, 16-19 Book 4, pages 6, 9-16
	Airflow	Must be specified for both supply and exhaust.	Book 2, page 8
	Control Temperature Setpoints	Factory defaults can be adjusted	Book 5, page 6
	VFD parameters	Factory defaults can be adjusted	Book 4, page 8 Book 5, page 8-39