Product Data

WeatherMaster® Applied Rooftop Units

27.5 to 35 Nominal Tons

48V Single-Package Gas Heating/Electric Cooling Applied Rooftop Units
50V Single-Package Electric Cooling Applied Rooftop Units with Optional Electric or Hot Water Heat
with Greenspeed® Intelligence and Puron® Refrigerant

NOTE: This document is an advanced release product data. The information contained within is subject to change, deletion, or notation.

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Overview

The 48/50V Series continues Carrier's legacy of delivering reliable, efficient, and versatile applied rooftop units for new construction, retrofit, and replacement applications.

The WeatherMaster® 48/50V Series are Carrier's latest in a long line of applied rooftop products. This generation continues Carrier's tradition of designing new products that fit legacy curbs.

The 48/50V standard chassis models fit on legacy Carrier 48/50P and 48/50Z Series curbs with minimal changes required for electrical and gas connections, making replacement easy.

What's new is the ability to replace competitor units. 48/50V compact chassis models fit select competitor roof curbs and provide a replacement or an alternate for new construction or retrofit applications.

Other new features include a lead variable capacity digital scroll compressor, variable-speed condenser fans with Greenspeed® intelligence, a direct drive indoor fan array with electronically commutated motors (ECM), foil-faced insulation, electronic expansion valves (EXVs), and Carrier SmartVu™ controls.

The new WeatherMaster® applied rooftop units are highly adaptable and are selectable with options that improve unit performance, efficiency, comfort, or indoor air quality (IAQ).

Factory-installed options include modulating gas or electric heat for improved supply air temperature control, ultra-low leak economizer for ventilation and free cooling, low-sound condenser fans, and Humidi-MiZer® modulating dehumidification system for better comfort.

The Carrier SmartVu control provides flexibility while being user-friendly. Set-up and commissioning is simple with the included 7 in. touchscreen display and easy-to-navigate user interface. The SmartVu control can operate stand-alone, with Carrier i-Vu™ 8.0 web-based interfaces, or with other BACnet[1] building automation systems (BAS).

The SmartVu control includes multiple factory-programmed control methods for the indoor fan system, including modulation based on field-provided hardwired or network inputs.

Cooling and heating operation is based on supply air temperature, with user-adjustable setpoints. The control is configurable for single-zone or multi-zone applications using space or return air temperature sensors, a two-stage heat/cool thermostat, or network inputs.

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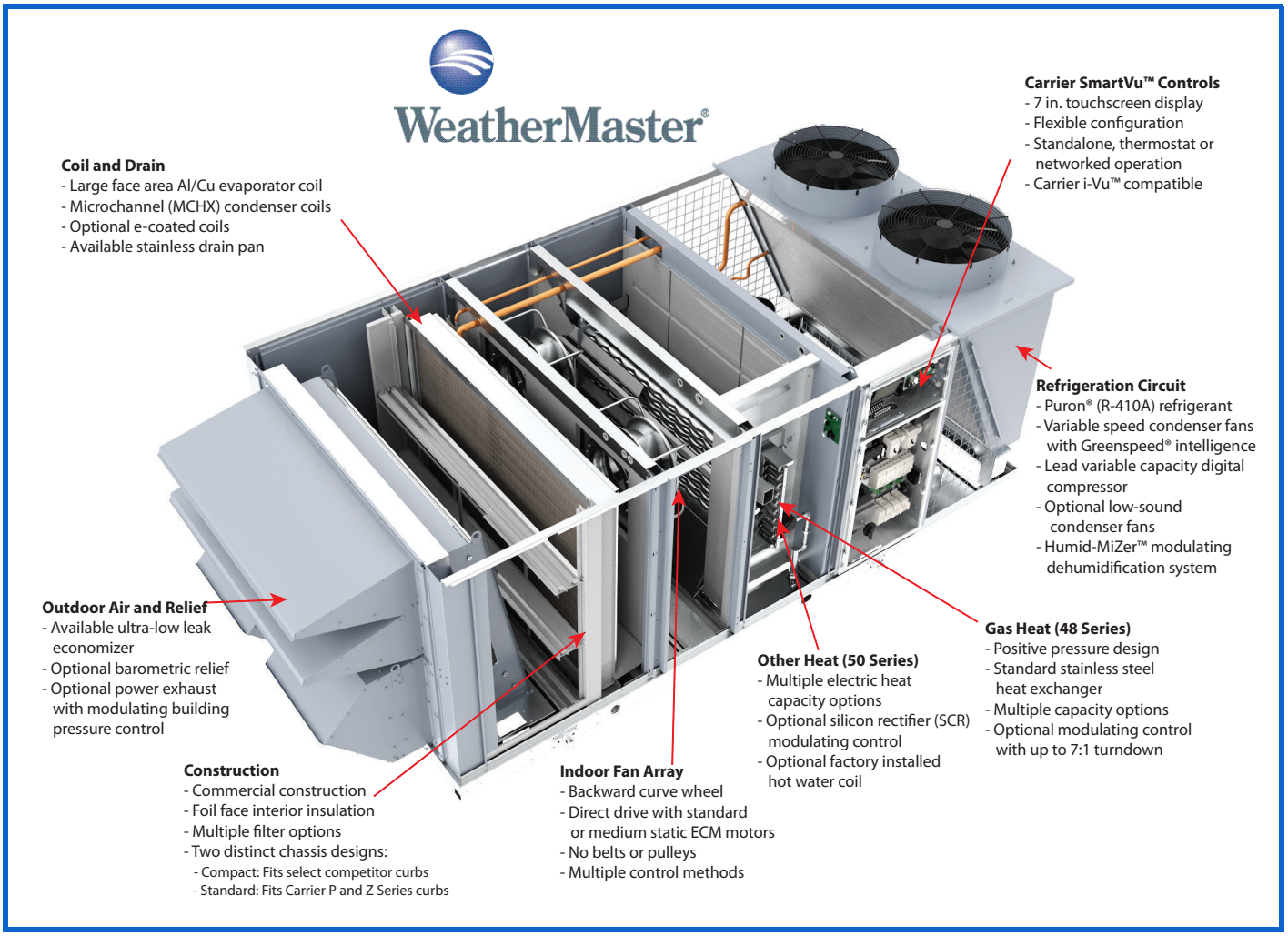

Model number nomenclature

48/50V STANDARD CHASSIS MODEL NUMBER NOMENCLATURE

Position:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Example:	5	0	V	2	A	H	2	7	A	0	-	1	A	0	A	0	A	0

Heat Type (1,2)
- 48 – Cooling/Gas Heat
- 50 – Cooling Only/Electric Heat/Hydronic Heat

Model Series (3)
- V – WeatherMaster™ Applied Rooftop Unit

Application, Supply and Return (4)
- 2 – SAV, Vertical Supply and Return
- 3 – VAV, Vertical Supply and Return
- 4 – SAV, Horizontal Supply and Return
- 5 – VAV, Horizontal Supply and Return

48V Chassis and Gas Heat (5)
- C – Standard Chassis, Low Gas Heat, 2-Stage, Stainless Steel HX
- D – Standard Chassis, High Gas Heat, 2-Stage, Stainless Steel HX
- E – Standard Chassis, Low Gas Heat, Modulating, Stainless Steel HX
- F – Standard Chassis, High Gas Heat, Modulating, Stainless Steel HX

50V Chassis and Heat (5)
- A – Standard Chassis, No Heat
- B – Standard Chassis, Low Electric Heat, 2-Stage
- C – Standard Chassis, Med Electric Heat, 2-Stage
- D – Standard Chassis, High Electric Heat, 2-Stage
- E – Standard Chassis, Low Electric Heat, SCR
- F – Standard Chassis, Med Electric Heat, SCR
- G – Standard Chassis, High Electric Heat, SCR
- H – Standard Chassis, Standard Hot Water Coil

Direct Expansion System (6)
- H – Lead Digital Compressor, Variable Speed Condenser Fans
- P – Lead Digital Compressor, Variable Speed Condenser Fans, Humidi-MiZer
- U – Lead Digital Compressor, Low Sound Variable Speed Condenser Fans, Sound Blankets
- W – Lead Digital Compressor, Low Sound Variable Speed Condenser Fans, Sound Blankets, Humidi-MiZer

Size and Refrigerant (7,8)
- 27 – 27.5 Tons, R-410A
- 31 – 30 Tons, R-410A
- 35 – 35 Tons, R-410A

Construction (9)
- A – Single Wall [Foil-Face Insulation]
- F – Single Wall, Extended Section
- L – Single Wall, Plenum Section
- R – Single Wall, Extended + Plenum Sections

Indoor Fan (10)
- 0 – Direct Drive Fan Array, Standard Static Motor
- 1 – Direct Drive Fan Array, Med Static Motor

Drain Pan and Coils (11)
- - – Galvanized DP, Al/Cu Evap, MCHX Cond
- A – Galvanized DP, Al/Cu Evap, E-Coat MCHX Cond
- B – Stainless DP, Al/Cu Evap, MCHX Cond
- C – Stainless DP, Al/Cu Evap, E-Coat MCHX Cond
- D – Stainless DP, E-Coat Al/Cu Evap, E-Coat MCHX Cond
- E – Galvanized DP, Al/Cu Evap, MCHX Cond, Hail Guard
- F – Galvanized DP, Al/Cu Evap, E-Coat MCHX Cond, Hail Guard
- G – Stainless DP, Al/Cu Evap, MCHX Cond, Hail Guard
- H – Stainless DP, Al/Cu Evap, E-Coat MCHX Cond, Hail Guard
- J – Stainless DP, E-Coat Al/Cu Evap, E-Coat MCHX Cond, Hail Guard

Voltage (12)
- 1 – 575V
- 5 – 208V/230V
- 6 – 460V

Design Series (13)
- A – Initial Design
- S – ETO

Indoor Air Quality (18)
- 0 – 4" Pre-Filter Rack with 2" Throwaway Filter
- 1 – 4" Pre-Filter Rack with 2" M8 Filter
- 2 – 4" Pre-Filter Rack with 4" M8 Filter
- 3 – 4" Pre-Filter Rack with 4" M13 Filter
- 4 – 4" Pre-Filter Rack with 2/4" M13 Filter, Ultraviolet Light (UV-C) Fixture
- 5 – Pre-Filter Rack with 2" M8 and 4" M13 Filter
- 6 – Pre-Filter Rack with 2" M8 and 4" M13 Filter, UV-C Fixture
- 7 – Pre-Filter Rack with 2" M8 and 12" M15 Cartridge Filter
- 8 – Pre-Filter Rack with 2" M8 and 12" M15 Cartridge Filter, UV-C Fixture
- 9 – Pre-Filter Rack with 2" M8 and 12" M14 Bag Filter
- A – Pre-Filter Rack with 2" M8 and 12" M14 Bag Filter, UV-C Fixture

Service and Safety (17)
- A – Standard [Hinged Doors, DX Pressure Sensors]
- B – Condensate Overflow Switch (COFS)
- C – Pre-Filter Status Switch + Access Door Retainer (FSS + ADR)
- D – Return Air Smoke Detector (RASD)
- E – Service Pack (Comp Isolation Valve, Replicable Core Filter Drier)
- F – COFS, FSS + ADR
- G – COFS, RASD
- H – COFS, Service Pack
- J – FSS + ADR, RASD
- K – FSS + ADR, Service Pack
- L – RASD, Service Pack
- M – COFS, FSS + ADR, RASD
- N – COFS, FSS + ADR, Service Pack
- P – COFS, RASD, Service Pack
- Q – RASD, FSS + ADR, Service Pack
- R – COFS, FSS + ADR, RASD, Service Pack
- S – Chicago Refrigerant Relief Valve (RRV), COFS, FSS + ADR, RASD, Service Pack
- T – Pre or Final Filter Measuring (FFM) + ADR, COFS
- U – FFM + ADR, COFS, RASD
- V – FFM + ADR, COFS, Service Pack
- W – FFM + ADR, COFS, RASD, Service Pack
- X – RRV, FFM + ADR, COFS, RASD, Service Pack

Electrical (16)
- 0 – Standard [Standard SCCR, Terminal Block]
- 1 – Factory Wired Convenience Outlet (C/O)
- 2 – Field Wired C/O
- 3 – Non-Fused Disconnect (NFD)
- 4 – NFD + Factory Wired C/O
- 5 – NFD + Field Wired C/O
- 6 – Phase Monitor (PM)
- 7 – PM + Factory Wired C/O
- 8 – PM + Field Wired C/O
- 9 – PM + Non-Fused Disconnect (NFD)
- A – PM + NFD + Factory Wired C/O
- B – PM + NFD + Field Wired C/O
- C – High SCCR [Terminal Block]
- D – High SCCR + Factory Wired C/O
- E – High SCCR + Field Wired C/O
- F – High SCCR + PM
- G – High SCCR + Factory Wired C/O + PM
- H – High SCCR + Field Wired C/O + PM

Outdoor Air and Relief (15)
- A – Manual OA Damper, No Relief
- B – Ultra Low Leak Economizer, No Relief
- C – Ultra Low Leak Economizer, Barometric Relief
- E – Ultra Low Leak Economizer, Low Static Power Exhaust (PE), Two-Stage Control
- G – Ultra Low Leak Economizer, Low Static PE, Modulating Building Pressure (BP) Control
- J – Ultra Low Leak Economizer, Medium Static PE, Modulating BP Control

Controls (14)
- 0 – Standard [SmartVu, OAT, RAT, DX LAT Sensors]
- 1 – Humidity and Enthalpy Sensing (Humidity Sensors)
- 2 – Return Air Carbon Dioxide Sensor (RA CO_2)
- 4 – Humidity Sensors, RA CO_2
- 8 – NGC I/O Expansion Board
- 9 – NGC, Humidity Sensors
- A – NGC, RA CO_2
- C – NGC, Humidity Sensors, RA CO_2

Model number nomenclature (cont)

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S – Compact Chassis, No Heat
T – Compact Chassis, Low Electric Heat, 2-Stage
U – Compact Chassis, Med Electric Heat, 2-Stage
V – Compact Chassis, High Electric Heat, 2-Stage
W – Compact Chassis, Low Electric Heat, SCR
X – Compact Chassis, Med Electric Heat, SCR
Y – Compact Chassis, High Electric Heat, SCR
Z – Compact Chassis, Standard Hot Water Heat

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V – FFM + ADR, COFS, Service Pack
W – FFM + ADR, COFS, RASD, Service Pack
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4 – 4" Pre-Filter Rack with 4" M13 Filter, Ultraviolet Light (UV-C) Fixture
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4 – Humidity Sensors, RA CO_2
9 – NGC, Humidity Sensors
A – NGC, RA CO_2
C – NGC, Humidity Sensors, RA CO_2

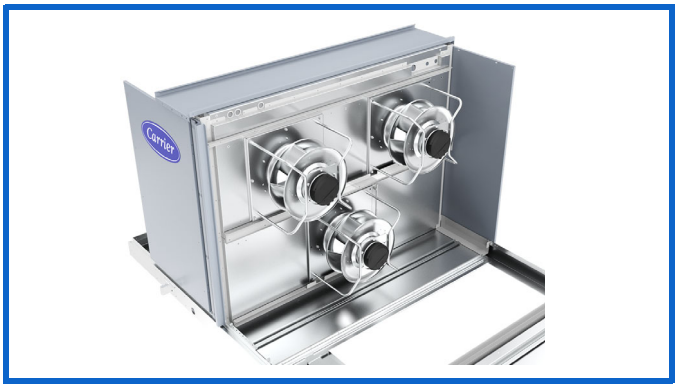
Features and benefits

Reliable operation

Carrier conducts rigorous testing to ensure each unit will perform as designed. The 48/50V Series completed testing in Carrier and third-party psychometric labs to verify performance and efficiency.

All 48/50V Series use all-aluminum microchannel heat exchanger (MCHX) condenser coils for their strength and resistance to galvanic corrosion. Electronic expansion valve (EXV) metering devices ensure reliable performance across a wide operating envelope.

The standard variable frequency drive (VFD) controlled condenser fan motors take advantage of Greenspeed® intelligence to optimize performance based on operating conditions, provide part-load energy savings and sound reduction, and mechanical cooling down to 10°F (–12.2°C) under appropriate conditions.



Belt slippage or breakage is not a concern for 48/50V units, which use a direct drive indoor fan array with electronically commutated motors (ECMs).

After production, every unit must pass a run test and quality check before shipment. Vibration and shake tests are performed on each model to ensure it withstands the rigors of shipping and installation.

Efficient by design

WeatherMaster® applied rooftop units are efficient in all modes of operation. Electronically commutated (ECM) indoor fan motors maintain near peak efficiency through the entire operating range. The direct drive indoor fan array provides optimum airflow and static performance and avoids the inefficiencies of belt drive fan systems.

Applied rooftop units spend most of their life operating at part-load cooling conditions, making part-load cooling efficiency important. The standard variable speed condenser fans use Greenspeed intelligence to optimize fan speeds based on refrigerant circuit conditions, resulting in energy savings during part-load conditions. MCHX condenser coils and EXV metering devices also provide improved efficiency under a wide range of conditions.

The 27.5-35 ton units utilize a single circuit design that allows for a fully active evaporator and condenser coils during cooling operation, which further maximizes cooling efficiency and performance. All 48/50V Series meet or exceed U.S. DOE 2023 efficiency requirements.

Flexible application

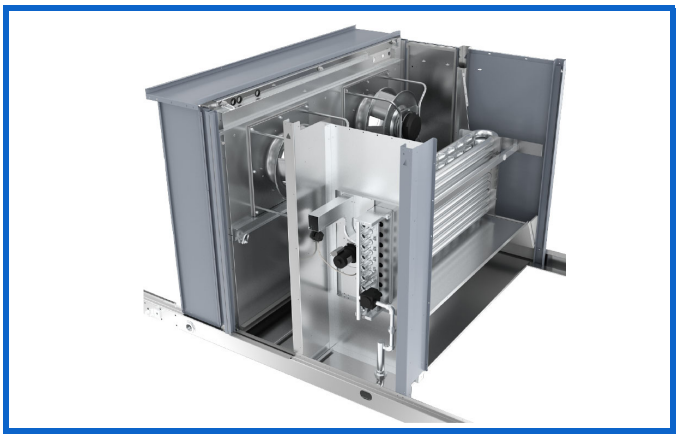
The 48/50V units are selectable between 27.5, 30, and 35 ton nominal cooling capacities in standard or compact chassis to meet project requirements. All models are available in 208V/230V-3Ph-60Hz, 460V-3Ph-60Hz, and 575V-3Ph-60Hz with a short circuit current rating (SCCR) of 10kA.

Compact chassis models provide a short footprint for new construction or retrofit applications with tight installation requirements and minimal return ducting. Compact models also fit on select competitor rooftop curbs, making them great for replacement applications.

Standard chassis models are a good fit for new construction or retrofit applications with high indoor air quality (IAQ) requirements or extensive return duct systems with optional high-grade filtration and medium static exhaust fans. Standard chassis units are also a direct curb fit for replacing Carrier 48/50P and 48/50Z models.

The 48/50V Series can be installed on roof curbs, structure mounted, or pad mounted with supply and return duct connections selectable for vertical or horizontal to meet a variety of applications.

All units are available with standard or medium static ECM indoor fan motors to support a variety of application airflow and static pressure requirements. Units can be selected for staged air volume (SAV™) for single-zone applications or for variable air volume (VAV) with supply duct pressure control for multi-zone variable air volume (MZ-VAV) applications with additional configurations being field-selectable.



Features and benefits (cont)

The 48V Series units include a factory-installed natural gas heater that is selectable for low or high capacity based on temperature rise requirements. All units have a stainless steel heat exchanger for high-temperature rise capability with cold entering air temperatures.

Easy to install

All 48/50V Series feature a heavy-duty base rail with integral lifting lugs for rigging.

Replacement installations are made easy with models that fit Carrier 48/50P Series, 48/50Z Series, and select competitor curbs. Power wiring, control wiring, and gas connections require minimal changes.

All units include a terminal block for a single-point power connection. Power wire can pass through the unit base or end, providing installation flexibility.

Field control wiring terminations are made at conveniently located and labeled terminal strips to simplify the installation of field wiring for sensors and communication wiring. Control wiring can pass through the base of the unit using the factory-installed couplings.

The 48V gas heat units include a single-point gas connection with a pre-punched gas access point for easy installation.

The SmartVu™ control is factory-installed and configured to match the unit order configuration for factory-installed sensors and options, which reduces setup time.

Factory-installed options

The 7 in. touch screen display provides a simple user interface for setup and commissioning. Navigation consists of a graphical menu with descriptive icons. Most setpoints and settings can be adjusted using the user-level password to simplify setup and configuration.

Plug and play compatibility with the Carrier i-Vu™ Building Automation System and Field Assistant reduces control setup time and complexity.

Simple to service

All 48/50V Series include hinged access doors with latches to access maintainable components, such as pre-filters, gas heat, and controls. Periodic maintenance is performed entirely from a single side of the unit.

The indoor fan section includes a hinged, locking access panel with a pressure catch and a fan shutoff interlock to prevent injury to service personnel if the door opens while the fans are operating.

Less frequently accessed components, such as electronic expansion valves (EXVs) and condenser fans, are accessible through large access panels for service.

The MCHX condenser coils are easy to maintain and can be brushed or rinsed with low-pressure water. Side panels are easily removable to access the back side of the coils for cleaning.

The SmartVu control provides maintenance reminders and an alarm history for easier maintenance and troubleshooting.

Factory-installed condensing and suction pressure sensors allow service personnel to monitor the refrigerant circuit from the SmartVu control or building automation system, minimizing the need to connect refrigerant gauges for start-up and troubleshooting.

Quality indoor air

Flexible filtration capability is integral to the 48/50V Series. Standard units include a 4 in. pre-filter rack (before evaporator) with spacers to accept a single 2 in. filter. With the spacer removed, the filter rack can accept two, 2 in. filters or a single 4 in. filter for easy field upgrades to meet the customer's indoor air quality requirements. Standard units ship with 2 in. throwaway pre-filters (MERV 5 equivalent).

All 48/50V units are standard with foil-faced fiberglass insulation on the interior top and side panels that touch the indoor air and help prevent fiber intrusion. The foil surface doesn't easily catch dirt and debris and can be wiped clean.

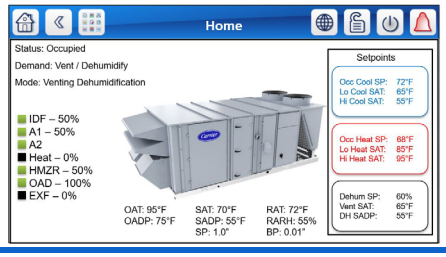
Base units include a factory-installed manual outdoor air damper. The pressure-activated damper (no actuator) opens when the indoor fan is on and closes when the indoor fan is off. The adjustable damper can allow up to 25% outdoor air when open.

The included outdoor air hoods and screens filter large debris from the outdoor air and help prevent rain and show ingress into the unit.

Adaptable controls

The SmartVu™ control allows for application and operation flexibility. The control is factory configured to meet the most common application types and is field configurable to meet project specific requirements.

Units selected for SAV are factory-configured for SAV indoor fan control for single-zone applications and are field-configurable for constant volume (CV) or third-party input control.



Single-zone cooling and heating demands can be established based on an accessory space temperature (SPT) sensor or 2-stage heat/cool thermostat inputs.

Units selected for VAV include a supply duct static pressure transducer for supply pressure control for multi-zone variable air volume (MZ-VAV) applications with air terminal units. Units are field configurable for SAV, CV, or third-party input control.

Multi-zone cooling and heating demands can be established based on the included return temperature (RAT) sensor or the network thermostat inputs to meet application specific needs.

For all units, cooling and heating operation is based on user-adjustable supply air temperature (SAT) setpoints with available SAT resets based on a temperature sensor or third-party inputs.

In addition to normal cooling and heating modes, all units can be configured for advanced modes of operation, including cool-tempered venting and heat-tempered venting (with heat source). Appropriately equipped units can be configured for dehumidification and heat-tempered cooling operation.

Factory-installed options (cont)

Modulating gas heat

The 48V Series is available with modulating gas heat in low or high heat capacities. With turndowns of up to 7:1 (14% of full capacity), modulating gas heat provides better low-load operation and supply air temperature control than two-stage gas heat.

Hot water coil

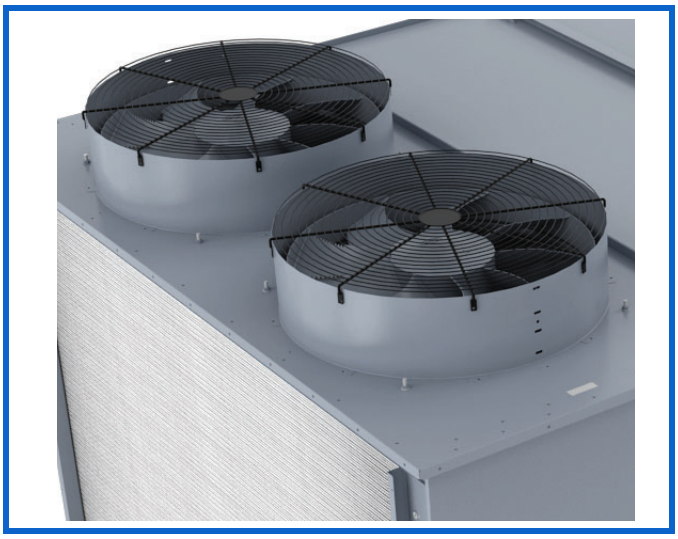
50V units can be selected with a factory-installed hot water coil in the heating section, eliminating the need for an extended cabinet. The 2-row hot water coil includes piping stubs inside the unit cabinet. Field-supplied water piping can pass through the side panel with field cut access holes. Hot water coil requires a field-provided and installed actuated water valve that can be controlled by SmartVu controls.

Two-stage electric heat

50V Series units are available with a factory-installed, 2-stage electric heater in low, medium, or high capacity. The electric heater is factory wired to the main power terminal block, eliminating the need for field power wiring or single-point kits.

Modulating electric heat

Factory-installed silicon rectifier controlled (SCR) modulating electric heat is available on 50V units in low, medium, or high capacities. The modulated heat control provides improved supply air temperature control over two-stage heat.



Low-sound condenser fans

The low-sound condenser fan option replaces all standard condenser fans with shrouded, AeroAcoustic™ condenser fans and low rpm motors that reduce unit radiated sound during cooling and dehumidification operation.

The combination of low-sound condenser fans and variable speed condenser fan control with Greenspeed® intelligence, reduces energy consumption during cooling and dehumidification operation and improves unit cooling efficiency ratings.

Humidi-MiZer® dehumidification

Carrier's patented Humidi-MiZer modulating dehumidification system provides unparalleled operation to meet varying environmental conditions.

The Humidi-MiZer system includes an e-coated reheat coil, a two-position reheat valve, and a modulating condenser bypass valve, which allows a variable mixture of hot gas and liquid refrigerant for modulated reheat operation during dehumidification mode.

Humidi-Mizer system also includes a cooling coil temperature sensor (used to approximate supply air dewpoint) and requires the humidity and enthalpy sensor option (for return air relative humidity sensor).

The SmartVu™ control can monitor return air relative humidity, space relative humidity, or dehumidify input to determine if there is a dehumidify demand.

Humidi-MiZer system is disabled when there is no dehumidify demand or if dehumidification is prevented (except at circuit start-up or reheat coil purge).

When there is a demand for both cooling and dehumidification, the Humidi-MiZer system operates in "subcooling mode" to provide cool, dehumidified air to the space. The subcooling operation increases the evaporator capacity, providing improved dehumidification compared to normal cooling mode.

When there is a demand for dehumidification and either ventilation or heating, the Humidi-MiZer system operates in "hot gas reheat mode" to provide neutral or warm, dehumidified air to the space.

Extended section

The extended section is available for the standard chassis and includes an extra section between the return air opening and the pre-filter rack. The extended section is required when replacing 48/50P and 48/50Z Series units with extended chassis. For 50V units, the extended section includes a larger filter access door for use with an optional factory-installed bag or cartridge filters.

Plenum section

The plenum section is available for the 50V standard chassis and includes an extra section between the return air opening and the pre-filter rack. The plenum section is required when replacing 50P and 50Z Series units with discharge plenum or replacing 48P or 48Z units with a 50V unit. The extended section includes a larger filter access door for use with an optional factory-installed bag or cartridge filters.

E-coated evaporator and condenser coils

Units are selectable for e-coated condenser coils or e-coated condenser and evaporator coils. E-coat is a durable epoxy coating that completely and uniformly encapsulates the coil.

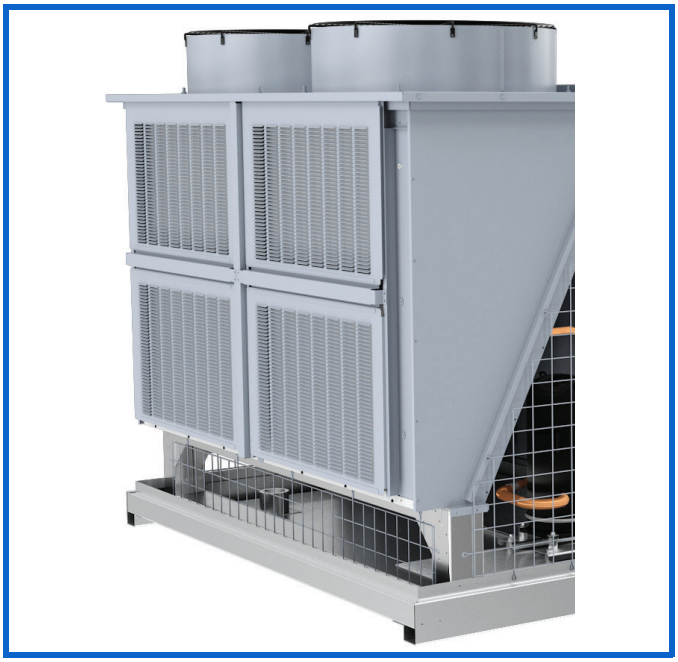
E-coat provides superior protection with unmatched edge coverage, metal adhesion, thermal performance, and corrosion resistance for mildly corrosive environments, such as coastal applications.

E-coated coils can withstand an 8,000-hour salt spray test per ASTM (American Society for Testing and Materials) Standard B-117.

Factory-installed options (cont)

Hail guard

A factory-installed louvered metal panel is installed on exterior condenser coil faces. This panel protects against hail damage and can act as a wind baffle for windy environments.



Humidity and enthalpy sensing

Units include factory-installed outdoor air and return air relative humidity sensors. These humidity sensors are used for dehumidification control with Humidi-MiZer system or for free cooling control with enthalpy, differential enthalpy, or dewpoint limit operation.

The SmartVu control uses the outdoor or return air temperature and relative humidity readings to calculate enthalpy and dewpoint.

NGC board

Units includes an additional I/O module that expands control input and output capability. The NGC board is required for select factory-installed options and optional for field use functionality, including:

- Pre-filter measuring
- Outdoor air CO_2
- Mixed air temperature
- Modulating gas heat
- Return air damper control (select configurations)

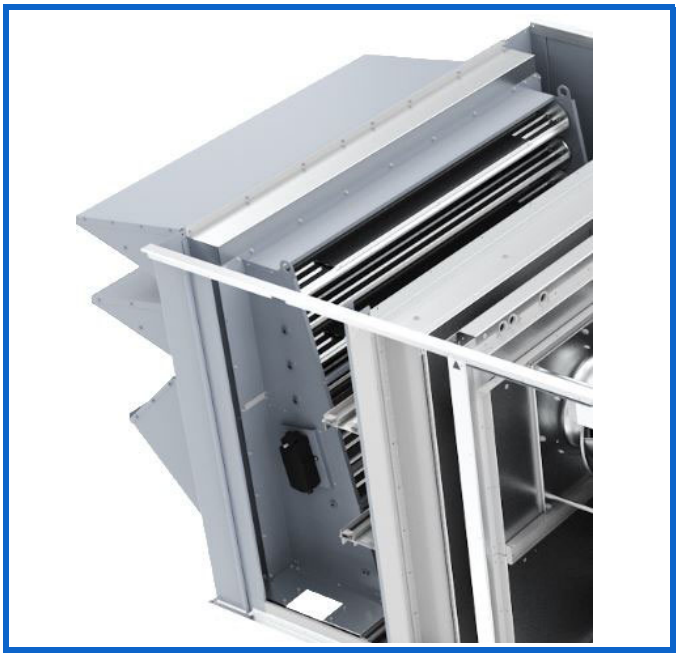
Ultra-low leak economizer

The factory-installed ultra-low leak economizer provides improved ventilation control over the manual outdoor air damper and enables free cooling operation with outdoor air.

The economizer assembly includes gear-driven return and outdoor air dampers with ultra-low leak blades and edge seals that restrict leakage to 3 cfm per sq ft at 1 in. water column when tested per AMCA (Air Movement and Control Association) Standard 500. Compact chassis with vertical discharge and economizer include a single actuator with mechanically interlocked outdoor air and return air dampers. Compact chassis with horizontal discharge and all standard chassis units with economizer include separate outdoor air and return air dampers with dedicated actuators.

SmartVu™ controls the economizer and includes fault detection and diagnostic (FDD) functionality and ventilation control based on indoor fan speed, return or space CO_2 levels, or a third-party modulation signal.

Free cooling operation based on outdoor air dry bulb temperature or differential outdoor and return air dry bulb temperatures is standard. Free cooling based on outdoor air enthalpy, differential outdoor and return air enthalpy, or outdoor air dewpoint are available with the humidity and enthalpy sensing option.



Low static exhaust fans

Standard and compact chassis models are available with a low static exhaust fan system, with axial exhaust fans and electronically commutating motors (ECMs).

The fans are configurable for operation based on economizer position, a third party modulation signal, or building pressure with the modulating building pressure control option with building pressure sensor.

Medium static exhaust fans

In addition to the low static exhaust fan option, standard chassis units are available with a medium static exhaust fan system with two airfoil exhaust fans with ECMs and a building pressure sensor.

The medium static exhaust fans discharge to the side of the unit and meet code requirements for separation of outdoor intake and exhaust on different sides of the unit.

The exhaust fan is configurable for operation based on economizer position, a third-party modulation signal, or modulating building pressure control with the included building pressure sensor.

Factory-installed options (cont)

Factory-wired 115-v convenience outlet

A dual plug, grounded receptacle in the unit control panel provides up to 10A at 115-v for light-duty use for charging devices or small power tools.

The transformer that powers the receptacle connects to the load side of the unit power feed. The outlet is not powered when the unit power is disconnected.

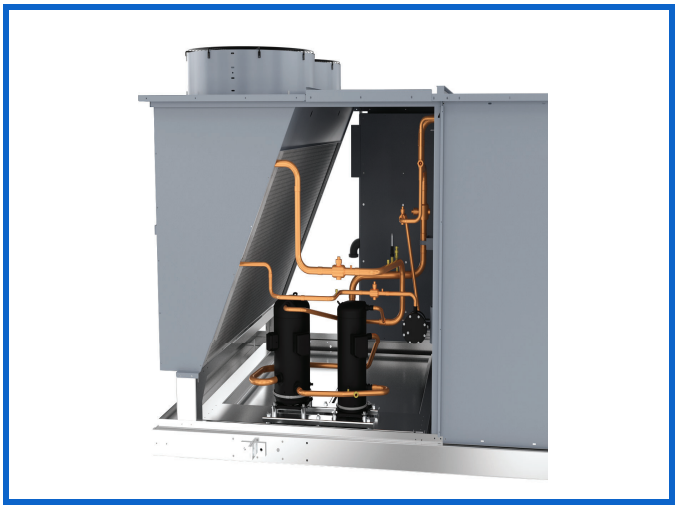
Field-wired 115-v convenience outlet

For applications that require a separate power supply or higher amperage operation, the field-wired convenience outlet includes a dual plug grounded receptacle that can handle up to 15A loads at 115-v with a field supplied and installed power feed.

High short circuit current rating (SCCR)

Upgraded power and control components improve the SCCR rating of 208/230-v and 460-v units to 65kA and 575-v units for 25kA.

High SCCR is only available with a terminal block power connection and for units without electric heat. Field-supplied J-type, current-limiting fuses must be installed before the terminal block in an external fuse box or fused disconnect.



Service pack

This service pack includes isolation valves for the tandem compressor assembly to allow removal of the compressors without recovering the entire refrigerant charge.

The service pack also includes a changeable core filter drier with isolation valves to allow easy changeout in the event of a compressor burnout or clogged filter drier.

Chicago refrigerant relief valve

This valve provides a mechanical relief device installed on the high-pressure side of the refrigerant circuit to comply with building code requirements for refrigerant safety.

Pre-filters

Units can be configured to ship with 2 in. MERV 8, 4 in. MERV 8, or 4 in. MERV 13 pleated filters in the standard pre-filter rack for improved indoor air quality to meet customer or code requirements.

Both standard and compact chassis units are available with a 2 in. and 4 in. pre-filter rack with 2 in. MERV 8 filters before 4 in. MERV 13 filters for improved filtration effectiveness and extended filter life, which can reduce maintenance costs.The 2 in. and 4 in. filter rack is not convertible to accept 6 in. filters.

For more demanding applications, all 48V standard chassis units, and 50V standard chassis units with extended or plenum sections are available with a 2 in. pre-filter rack with 2 in. MERV 8 pleated filters before 12 in. MERV 14 bag filters, or 12 in. MERV 15 cartridge filters.

Ultraviolet (UV-C) fixtures

All standard chassis and select compact chassis units are available with a factory-installed UV-C fixtures on the downstream side of the evaporator coil.

The UV-C light requires a field-installed 115-v power feed (10A minimum) and field-installed UV-C emitters (bulbs). Emitters are available as an accessory.

The UV-C fixtures include factory-installed fixtures with power wiring back to a shutoff switch for 115-v field-supplied power (10A minimum). The power wiring includes door interlock switches to disconnect the UV-C fixture power when the door is opened. A UV-C safe view port is installed in the access door to verify if the emitter is operational.

Other factory-installed options include:

- Barometric relief
- Return air CO_2 sensor
- Stainless steel condensate drain pan
- Non-fused disconnect
- Phase monitor
- Return air smoke detector
- Condensate overflow switch
- Pre-filter status switch with access door retainers
- Pre-filter measuring with access door retainers
- Compressor sound blankets

Field-installed accessories and warranty

Carrier non-communicating sensors

The SmartVu™ control supports a variety of field-provided non-communicating (33ZC Series) sensors and sensor functions, including:

- Space temperature
- Space relative humidity
- Space CO_2
- Occupancy override
- Space temperature adjustment
- Supply duct temperature
- Return air CO_2

Commercial thermostats

When the customer requires simple control over the unit, the SmartVu control supports two-stage heat/cool thermostats.

Carrier offers a variety of thermostats, including non-programmable, programmable, Wi-Fi, and BACnet. The SmartVu controls can accept a dehumidify input for dehumidification operation with Humidi-MiZer system.

Additional accessories include:

- Roof curbs
- Pleated filter kits
- Cartridge filter kits
- Bag filter kits
- Hot water control valve
- Hail guard
- Supply or return air smoke detector
- CCN to Modbus translator
- CCN to LON translator
- UV-C emitters
- Compressor sound blankets
- Flue vent extension
- High altitude gas heat kit
- Natural gas to propane heat conversion kit

Extended warranty protection and start-up service

All 48/50V units include Carrier's limited warranty coverage of five (5) year parts on ultra-low leak economizers, three (3) year parts on MCHX coils, ten (10) year parts on stainless steel heat exchangers (48V only), and one (1) year parts on all other non-consumable parts. Available extended warranty protection includes:

- Up to 5 year coverage on all non-consumable parts
- Up to 20 year coverage on gas heat exchanger parts (48V only)
- Up to 5 year labor coverage
- Cooling start-up by factory-trained personnel
- Heating start-up by factory-trained personnel

Extended warranty protection does not require factory start-up. See the Carrier commercial rooftop equipment limited warranty statement for details.

Features, options, and accessories

DESCRIPTION	STANDARD	OPTION	ACCESSORY
CHASSIS OPTIONS			
Compact Chassis (Fits select competitor curbs, shortest chassis)	X		
Standard Chassis (Fits select carrier curbs, highest filtration and exhaust fans)	X		
14 in. Knock-down Roof Curbs			X
APPLICATION AND CONFIGURATION			
SAV (For single-zone applications)	X		
VAV (Duct pressure control for multi-zone VAV applications)	X		
Vertical Supply and Return	X		
Horizontal Left Supply and Left Return	Compact Chassis		
Horizontal Left Supply and End Return	Standard Chassis		
NATURAL GAS HEAT (48 SERIES)			
Stainless Steel Gas Heat Exchanger	X		
Low or High Natural Gas Heat with Two-Stage Control	X		
Low or High Natural Gas Heat with Modulating Control (Up to 7:1 turndown)		X	
High Elevation Kit, Up to 7000 ft			X
Propane Conversion Kit			X
Flue Vent Extension			X
OTHER HEAT (50 SERIES)			
No Heat	X		
Low, Medium, or High Electric Heat with Two-stage Control		X[b]	
Low, Medium, or High Electric Heat with SCR Modulating Control		X[b]	
Hot Water Coil		X	
Hot Water Control Valve			X
COOLING			
Puron® (R-410A) Refrigerant	X		
Electronic Expansion Valve (EXV) Metering Device	X		
Uneven Tandem Scroll Compressors with Lead Variable Capacity Digital Scroll	X		
Standard Sound Condenser Fan with Metal Blades	X		
Variable Speed Condenser Fans with Greenspeed® Intelligence	X		
Low-Sound Condenser Fans		X	
Humidi-MiZer Modulating Dehumidification System with E-coated Reheat Coil		X	
Compressor Sound Blankets		X	X
CONSTRUCTION			
Single Wall with R4 Foil-Faced Fiberglass Insulation	X		
Extended Section		Standard Chassis	
Plenum Section (50V Only)		Standard Chassis	
INDOOR FAN			
Direct Drive, Airfoil Fan Array	X		
Standard Static ECM	X		
Medium Static ECM		X	
DRAIN AND COIL			
Galvanized Steel Drain Pan	X		
Stainless Steel Drain Pan		X	
Al/Cu Evaporator Coil	X		
MCHX Condenser Coil	X		
E-coated Condenser or Condenser and Evaporator Coils		X	
Condenser Coil Louvered Hail Guards		X	X

Features, options, and accessories (cont)

DESCRIPTION	STANDARD	OPTION	ACCESSORY
OUTDOOR AIR AND RELIEF			
Outdoor Air Hoods with Mesh Screens	X		
Manual Outdoor Air Damper (Non-Actuated)	X		
Ultra Low-leak Economizer		X	
No Relief	X		
Barometric Relief		X	
Low Static ECM Exhaust Fans		X	
Medium Static ECM Exhaust Fans		Standard Chassis	
Modulating Building Pressure Control (With BP sensor)		X	
SENSOR AND CONTROL			
Carrier SmartVu™ Controls with 7 in. Touchscreen	X		
BACnet Communication (MS/TP or IP)	X		
Carrier Comfort Network (CCN) Communication	X		
Plug and Play with Carrier i-Vu 8.0+ Building Automation System	X		
LonWorks and Modbus Translator (Limited points)			X
Terminal Blocks for Field-Installed Control Devices	X		
Factory-Installed Outdoor, Return, and DX Leaving Air Temperature Sensors	X		
Supply Air Temperature Sensor		X[a]	X
DX Condensing and Suction Pressure Transducers, Readable from SmartVu	X		
Humidity and Enthalpy Sensors for Dehumidification or Enthalpy Free Cooling		X	
Return Air CO_2 Sensor		X	
NGC I/O Expansion Board		X	
Non-Communicating Space Temperature, CO_2, and Relative Humidity Sensors			X
Supply Duct or Building Pressure Sensors		X	
Two-Stage Heating and Cooling Thermostats			X
ELECTRICAL			
208V/230V-3Ph-60Hz	X		
460V-3Ph-60Hz	X		
575V-3Ph-60Hz	X		
Thru-the-Base Power and Control Wiring Couplings	X		
Dedicated High and Low Voltage Sections	X		
Single Point Terminal Block Power Connection	X		
Non-Fused Disconnect		X[b]	
Powered or Non-Powered Convenience Outlet		X	
Standard SCCR (10kA)	X		
High SCCR (65kA for 208/230/460V or 25kA for 575V)		X	
Phase Monitor		X	
SERVICE AND SAFETY			
Single Side Maintenance Access with Hinged Access Doors	X		
IDF Access with Locking Hinged Access Door and Pressure Catch	X		
Removable Panels for Service Access	X		
Condensate Overflow Switch		X	
Pre-Filter Status Switch		X	X
Access Door Retainers		X	
Return Air Smoke Detector		X	X
Supply Duct Smoke Detector			X
Service Pack (Compressor Service Valves, Replaceable Core Filter Drier)		X	
Chicago Relief Valve (Refrigerant Circuit Pressure Relief)		X	
Pre-Filter Measuring		X	
IAQ OPTIONS			
4 in. Pre-Filter Rack Accepts 2 in., 2 in. + 2 in., or 4 in. Filters	X		
2 in. Throwaway Filters	X		
2 in. or 4 in. MERV 8, 4 in. MERV 13 Pleated Filters		X	X
2 in. + 4 in. Pre-Filter Rack with 2 in. MERV 8 Filters Before 4 in. MERV 13 Filters		X	
2 in. + 12 in. Pre-Filter Rack with MERV 8 Filters Before MERV 14 Bag Filters		Standard Chassis[c]	
2 in. + 12 in. Pre-Filter Rack with MERV 8 Filters Before MERV 15 Cartridge Filters		Standard Chassis[c]	
Replacement Filters			X
Ultraviolet (UV-C) Fixtures		X[d]	
Ultraviolet (UV-C) Emitters			X

Features, options, and accessories (cont)

DESCRIPTION	STANDARD	OPTION	ACCESSORY
WARRANTY AND START-UP			
Five (5) Year Ultra-Low Leak Economizer Damper Parts Coverage	X		
Three (3) Year MCHX Coil Parts Coverage	X		
Ten (10) Year Stainless Steel Gas Heat Exchanger Parts Coverage (48V)	X		
One (1) Year All Other Non-Consumable Parts Coverage		X	
Up To Five (5) Year Non-Consumable Parts Coverage		X	
Up To Twenty (20) Year Stainless Steel Gas Heat Exchanger Parts Coverage (48V)		X	
First (1) Year Labor Coverage		X	
Up To Five (5) Year Labor Coverage		X	
Cooling Start-Up Service By Factory Trained Personnel		X	
Heating Start-Up Service By Factory Trained Personnel		X	

NOTE(S):

a. Factory-supplied, field-installed with modulating heat (modulating gas, SCR electric, hot water coil).
b. Not available with high SCCR.
c. 50V standard chassis units require plenum or extended sections for bag or cartridge filters.
d. Not available on 50V compact chassis and 48V compact chassis with low heat or Humidi-MiZer. Emitters (bulbs) sold separately.

Capacities and ratings

48/50V AHRI Ratings[a,b]

UNIT SIZE 48/50V	CHASSIS	APPLICATION	CF TYPE	AIRFLOW (cfm/ton)	48V		50V	
					EER	IEER	EER	IEER
27	Standard	SAV	STD	300	9.8	14.9	10	15.2
		VAV	STD		9.8	15.6	10	15.9
		SAV	LS		10.4	15.9	10.5	16.3
		VAV	LS		10.4	16.4	10.5	16.6
30		SAV	STD		9.8	14.7	10	15.1
		VAV	STD		9.8	15.1	10	15.4
		SAV	LS		10.3	15.2	10.5	15.7
		VAV	LS		10.3	15.9	10.5	16.1
35		SAV	STD		9.8	14.2	10	14.3
		VAV	STD		9.8	15	10	15.1
		SAV	LS		9.8	14.7	10	14.8
		VAV	LS		9.8	15.6	10	15.6
27	Compact	SAV	STD		9.8	14.6	10	14.8
		VAV	STD		9.8	15.6	10	15.8
		SAV	LS		10.4	15.6	10.5	15.8
		VAV	LS		10.4	16.3	10.5	16.4
30		SAV	STD		9.8	14.4	10	14.6
		VAV	STD		9.8	15	10	15.1
		SAV	LS		10.3	14.9	10.5	15.1
		VAV	LS		10.3	15.7	10.5	15.8
35		SAV	STD		9.8	13.9	10	14.1
		VAV	STD		9.8	15	10	15.1
		SAV	LS		9.8	14.4	10	14.6
		VAV	LS		9.8	15.4	10	15.5

NOTE(S):

a. Ratings are in accordance with AHRI 340/360, as appropriate.
b. Rated airflow is based on nominal cooling capacity (tons).

LEGEND

AHRI — Air Conditioning, Heating, and Refrigeration
LS — Low-Sound Condenser Fan
EER — Energy Efficiency Ratio
IEER — Integrated Energy Efficiency Ratio
STD ODF — Standard Condenser Fans
VAV — Variable Air Volume
SAV — Staged Air Volume

Cooling and Dehumidifying Airflow Limits

UNIT SIZE 48/50V	LEAD COMPRESSOR TYPE	EVAPORTAOR TYPE	MIN PART LOAD AIRFLOW (cfm)[a]	MIN FULL LOAD AIRFLOW (cfm)[b]	MAX FULL LOAD AIRFLOW (cfm)[b]
27	Digital	Al/Cu (Standard)	2,750	5,500	13,750
		E-Coat Al/Cu			12,500
31	Digital	Al/Cu (Standard)	3,000	6,000	15,000
		E-Coat Al/Cu			12,500
35	Digital	Al/Cu (Standard)	3,500	7,000	17,500
		E-Coat Al/Cu			12,500

NOTE(S):

a. Part-load cooling cfm is based on 67°F/57°F (19.4°C/13.9°C) entering evaporator, 67°F (19.4°C) ambient at lowest stage of capacity.
b. Full-load cooling cfm is based on 80°F/67°F (26.6°C/19.4°C) entering evaporator, 95°F (30°C) ambient at full capacity.

Capacities and ratings (cont)

Cooling Capacity Staging — Size 27 with Lead Capacity Digital Compressor

COMPRESSOR	STAGE			
	0	1	2	3
	COMPRESSOR STATUS			
A1 (Digital)[a]	OFF	ON	OFF	ON
A2	OFF	OFF	ON	ON
UNIT	CAPACITY 48/50V			
27	0%	25% to 64%	N/A[b]	65% to 100%

NOTE(S):

a. The A1 compressor is a variable capacity digital compressor. The A2 compressor is a fixed speed.
b. When the digital compressor is the larger compressor, the smaller compressor won't operate alone under normal staging conditions.

Cooling Capacity Staging — Sizes 31 and 35 with Lead Digital Compressor

COMPRESSOR	STAGE			
	0	1	2	3
	COMPRESSOR STATUS			
A1	OFF	OFF	ON	ON
A2 (Digital)[a]	OFF	ON	OFF	ON
UNIT	CAPACITY 48/50V			
31	0%	25% to 57%	N/A[b]	58% to 100%
35	0%	17% to 34%	66%	73% to 100%

NOTE(S):

a. The A1 compressor is a variable capacity digital compressors. The A2 compressor is a fixed speed.
b. When the digital compressor is the larger compressor, the smaller compressor won't operate alone under normal staging conditions.

Two-Stage Gas Heating Capacities — Natural Gas and LP Gas[a,b,c,d,e]

UNIT SIZE 48/50V	HEAT SIZE	INPUT CAPACITY (MBH)		OUTPUT CAPACITY (MBH)		EFFICIENCY (%)	TEMP RISE (°F)	AIRFLOW STAGE 1 (cfm)		AIRFLOW STAGE 2 (cfm)	
		Stage 1	Stage 2	Stage 1	Stage 2			Min	Max	Min	Max
27-35	Low Heat	285	380	231	308	81.0%	20 - 50	4,275	10,688	5,700	14,250
27-35	High Heat	488	650	395	527	81.0%	25 - 55	6,655	14,640	8,864	17,500

NOTE(S):

a. Ratings are approved for altitudes to 2000 ft. At altitudes over 2000 ft, ratings are 4% less for each 1000 ft above sea level.
b. At altitudes up to 2000 ft, the following formula may be used to calculate air temperature rise:

$$\Delta t = \frac{\text{maximum output capacity}}{1.10 \times \text{air quantity}}$$

c. At altitudes above 2000 ft, the following formula may be used:

$$\Delta t = \frac{\text{maximum output capacity}}{(.24 \times \text{specific weight of air} \times 60)\ (\text{air quantity})}$$

d. Temperature rise limits: see table.
e. For MZ-VAV applications, set the zone terminals to provide minimum unit heating airflow as indicated in the table upon command from the Damper Override Relay (DOR).

LEGEND

LP — Liquid Propane

Low Two-Stage Gas Heat Staging

HEATER	STAGE			
	0	1	2	3
	Heater Status			
Heater 1	OFF	Low Fire	High Fire	—
UNIT SIZE	Heating Capacity (Total)			
27-35	0%	75%	100%	—

High Two-Stage Gas Heat Staging

HEATER	STAGE			
	0	1	2	3
	Heater Status			
Heater 1	OFF	Low Fire	High Fire	—
Heater 2	OFF	Low Fire	High Fire	—
UNIT SIZE	Heating Capacity (Total)			
27-35	0%	75%	100%	—

Capacities and ratings (cont)

Modulating Gas Heating Capacities — Natural Gas and LP Gas[a,b,c,d,e]

UNIT SIZE 48/50V	HEAT SIZE	INPUT CAPACITY (MBH)		OUTPUT CAPACITY (MBH)		EFFICIENCY (%)	TEMP RISE (°F)	CAPACITY STEPS	AIRFLOW RANGE (cfm)	
		Min	Max	Min	Max				Min	Max
27-35	Low Heat	285	380	81	308	81.0%	20 - 50	26 - 100%	3,750	14,250
27-35	High Heat	488	650	75	527	81.0%	25 - 55	14 - 50%, 52 - 100%	2,778	17,500

NOTE(S):

a. Ratings are approved for altitudes to 2000 ft. At altitudes over 2000 ft, ratings are 4% less for each 1000 ft above sea level.
b. At altitudes up to 2000 ft, the following formula may be used to calculate air temperature rise:

$$\Delta t = \frac{\text{maximum output capacity}}{1.10 \times \text{air quantity}}$$

c. At altitudes above 2000 ft, the following formula may be used:

$$\Delta t = \frac{\text{maximum output capacity}}{(.24 \times \text{specific weight of air} \times 60)\ (\text{air quantity})}$$

d. Temperature rise limits: see table.
e. For MZ-VAV applications, set the zone terminals to provide minimum unit heating airflow as indicated in the table upon command from the Damper Override Relay (DOR).

LEGEND

LP — Liquid Propane

Low Modulating Gas Heat Staging

HEATER	STAGE			
	0	1	2	3
	HEATER STATUS			
Heater 1	OFF	MOD	—	—
UNIT SIZE	HEATING CAPACITY (TOTAL)			
27-35	0%	26-100%	—	—

High Modulating Gas Heat Staging

HEATER	STAGE			
	0	1	2	3
	HEATER STATUS			
Heater 1	OFF	MOD	MOD	MOD
Heater 2	OFF	OFF	LOW FIRE	HIGH FIRE
UNIT SIZE	HEATING CAPACITY (TOTAL)			
27-35	0%	17-50%	52-88%	64-100%

Electric Heater Capacities and Staging[a,b]

UNIT SIZE 48/50V	VOLTAGE	TYPE	CAPACITY STEPS	LOW HEAT		MEDIUM HEAT		HIGH HEAT		MAX FULL LOAD AIRFLOW (cfm)
				kW	MIN PART LOAD AIRFLOW (cfm)	kW	MIN PART LOAD AIRFLOW (cfm)	kW	MIN PART LOAD AIRFLOW (cfm)	
27-35	208V	2-Stage	50%,100%,	29	1,450	59	2,950	88	4,400	17,500
		SCR	0-100%							
	230V, 460V, 575V	2-Stage	50%,100%,	36	1,800	72	3,600	108	5,400	17,500
		SCR	0-100%							

NOTE(S):

a. For MZ-VAV applications, set the zone terminals to provide minimum unit heating airflow as indicated in the table upon command from the Damper Override Relay (DOR).
b. SCR heaters can modulate down to 0% output, but a minimum airflow is required to activate the heater air proving safeties.

Physical data

48V Physical Data — Sizes 027, 031, 035

BASE UNIT	48V...27		48V...31		48V...35	
NOMINAL CAPACITY (tons)	27.5		30		35	
OPERATING WEIGHT (lb, Med Static IDF, Vertical/Vertical)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
Low Heat Base Unit	4570	5170	4570	5170	4670	5270
High Heat Base Unit	4610	5210	4610	5210	4610	5310
COMPRESSOR	Digital Scroll + Scroll		Digital Scroll + Scroll		Digital Scroll + Scroll	
Circuit A, Qty…Model (A1, A2)	1...ZPD182, 1…ZP104		1…ZP137, 1…ZPD182		1…ZP233, 1...ZPD122	
Circuit A Oil Charge (oz, A1, A2)	110, 81 oz		110, 110 oz		81, 142 oz	
System Capacity Steps (%)	25-100%		25-100%		17%-34%, 66%, 73-100%	
Number of Refrigerant Circuits	1		1		1	
REFRIGERANT	Puron® (R-410A)		Puron® (R-410A)		Puron® (R-410A)	
Circuit A Operating Charge (lb)	37.0		37.0		38.4	
Circuit A Operating Charge with Humidi-MiZer (lb)	TBD		TBD		TBD	
High Pressure Switch Auto-Reset (psig)	500		500		500	
High Pressure Switch Cutout (psig)	650		650		650	
CONDENSER COIL	Aluminum, Novation (MCHX)		Aluminum, Novation (MCHX)		Aluminum, Novation (MCHX)	
Quantity	2		2		2	
Total Face Area (sq ft)	53.3		53.3		53.3	
EVAPORATOR COIL	Al/Cu RTPF		Al/Cu RTPF		Al/Cu RTPF	
Quantity	1		1		1	
Total Face Area (sq ft)	32.1		32.1		32.1	
Rows...Fins/in.	4…15		4…15		4…15	
Fin Type	Double Wavy		Double Wavy		Double Wavy	
Tube Type	Enhanced		Enhanced		Enhanced	
Circuit A/B, Metering Device Quantity, Type	2…EXV		2…EXV		2…EXV	
HUMIDI-MIZER SYSTEM (OPTIONAL)	Aluminum, Novation (MCHX)		Aluminum, Novation (MCHX)		Aluminum, Novation (MCHX)	
Coil Quantity	1		1		1	
Coil Total Face Area (sq ft)	26.5		26.5		26.5	
Reheat Valve Qty…Type	1…On/Off Three-Way		1…On/Off Three-Way		1…On/Off Three-Way	
Bypass Valve Qty…Type	1…Modulating Three-Way		1…Modulating Three-Way		1…Modulating Three-Way	
STANDARD CONDENSER FANS	Metal Propeller, Direct Drive		Metal Propeller, Direct Drive		Metal Propeller, Direct Drive	
Qty…Diameter (in.)	2…30		2…30		2…30	
Motor Qty…Type	2…AC		2…AC		2…AC	
Motor HP…RPM	1…1140		1…1140		1…1140	
Nominal cfm	18,000		18,000		18,000	
LOW SOUND CONDENSER FANS (OPTIONAL)	Composite AeroAcoustic™, Direct Drive		Composite AeroAcoustic™, Direct Drive		Composite AeroAcoustic™, Direct Drive	
Qty…Diameter (in.)	2…30		2…30		2…30	
Motor Qty…Type	2…AC		2…AC		2…AC	
Motor HP…RPM	1.5…850		1.5…850		1.5…850	
Nominal cfm	18,000		18,000		18,000	
INDOOR FAN	Backward Curve, Direct Drive		Backward Curve, Direct Drive		Backward Curve, Direct Drive	
Fan Qty…Diameter (in.)	3…17.7		3…17.7		3…17.7	
Motor Qty…Type	3...EC		3...EC		3...EC	
Standard/Medium Static Total Power (kW)	7.8 / 12		7.8 / 12		7.8 / 12	
Nominal cfm	8,250		9,000		10,500	
LOW STATIC EXHAUST (OPTIONAL)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
Fan Type	Composite Propeller, Direct Drive		Composite Propeller, Direct Drive		Composite Propeller, Direct Drive	
Fan Qty…Diameter (in.)	2…26	2...30	2…26	2...30	2…26	2...30
Motor Qty…Type	2...EC		2...EC		2...EC	
Total Motor Power (kW)	1.5	2.2	1.5	2.2	1.5	2.2
Nominal cfm	10,500	15,000	10,500	15,000	10,500	15,000

Physical data (cont)

48V Physical Data — Sizes 027, 031, 035 (cont)

BASE UNIT	48V...27		48V...31		48V...35	
NOMINAL CAPACITY (tons)	27.5		30		35	
MEDIUM STATIC EXHAUST (OPTIONAL)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
Fan Type	—	Backward Curve	—	Backward Curve	—	Backward Curve
Fan Qty…Diameter (in.)	—	2…19.7	—	2…19.7	—	2…19.7
Motor Qty…Type	—	2...EC	—	2...EC	—	2...EC
Total Motor Power (kW)	—	2.2	—	2.2	—	2.2
Nominal cfm	—	TBD	—	TBD	—	TBD
TWO-STAGE GAS HEAT	Low Heat	High Heat	Low Heat	High Heat	Low Heat	High Heat
Heat Exchanger Material	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel
Number of Heat Exchangers	1	2	1	2	1	2
Input (MBH)	380	650	380	650	380	650
Output (MBH)	308	527	308	527	308	527
Efficiency (%)	81	81	81	81	81	81
Burner Orifice Diameter (in...drill no)	0.1200...31	0.1200...31	0.1200...31	0.1200...31	0.1200...31	0.1200...31
Quantity	9	16	9	16	9	16
Stage 1/Stage 2 Manifold Pressure (in. wg)	2.0 / 3.4	1.8 / 3.2	2.0 / 3.4	1.8 / 3.2	2.0 / 3.4	1.8 / 3.2
Min...Max Line Pressure (in. wg)	5…13	5…13	5…13	5…13	5…13	5…13
Firing Stages	2	2	2	2	2	2
Number of Gas Valves	1	2	1	2	1	2
Gas Connection Qty...Size (in.)	1...1.5 NPT					
MODUALTING GAS HEAT (OPTIONAL)	Low Heat	High Heat	Low Heat	High Heat	Low Heat	High Heat
Heat Exchanger Material	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel
Number of Heat Exchangers	1	2	1	2	1	2
Input (MBH)	380	650	380	650	380	650
Output (MBH)	308	527	308	527	308	527
Efficiency (%)	81	81	81	81	81	81
Burner Orifice Diameter (in...drill no)	0.1200...31	0.1200...31	0.1200...31	0.1200...31	0.1200...31	0.1200...31
Quantity	9	16	9	16	9	16
Low Fire/High Fire Manifold Pressure (in. wg)	0.3 / 3.4	0.3 / 3.2	0.3 / 3.4	0.3 / 3.2	0.3 / 3.4	0.3 / 3.2
Min-Max Line Pressure (in. wg)	5…13	5…13	5…13	5…13	5…13	5…13
System Capacity Steps (%)	26-100%	14-50%, 52-100%	26-100%	14-50%, 52-100%	26-100%	14-50%, 52-100%
Number of Gas Valves	1	2	1	2	1	2
Gas Connection Qty...Size (in.)	1...1.5 NPT					
STANDARD PRE-FILTERS	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
2 in.Throwaway	Fiberglass		Fiberglass		Fiberglass	
Qty...Size (in.)	12...20" x 20" X 2"		12...20" x 20" X 2"		12...20" x 20" X 2"	
Outdoor Air Screen	Metal Mesh		Metal Mesh		Metal Mesh	
Qty...Size (in.)	8...16" x 25" x 1"		8...16" x 25" x 1"		8...16" x 25" x 1"	
OPTIONAL PRE-FILTERS	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
2 in. MERV 8	Pleated		Pleated		Pleated	
Qty...Size (in.)	12...20" x 20" X 2"		12...20" x 20" X 2"		12...20" x 20" X 2"	
4 in. MERV 8 & 13	Pleated		Pleated		Pleated	
Qty...Size (in.)	12...20" x 20" X 4"		12...20" x 20" X 4"		12...20" x 20" X 4"	
12 in. MERV 14 Bag	—	Bag	—	Bag	—	Bag
Qty...Size (in.)	—	12...20" x 20" x 12"	—	12...20" x 20" x 12"	—	12...20" x 20" x 12"
12 in. MERV 15 Cartridge	—	High Velocity Cartridge	—	High Velocity Cartridge	—	High Velocity Cartridge
Qty...Size (in.)	—	12...20" x 20" x 12"	—	12...20" x 20" x 12"	—	12...20" x 20" x 12"

Physical data (cont)

50V Physical Data — Sizes 027, 031, 035

BASE UNIT	50V...27		50V...31		50V...35	
NOMINAL CAPACITY (tons)	27.5		30		35	
OPERATING WEIGHT (lb)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
No Heat Base Unit	4070	4670	4070	4670	4170	4670
COMPRESSOR	V.C. Scroll + Scroll		V.C. Scroll + Scroll		V.C. Scroll + Scroll	
Circuit A, Qty…Model (A1, A2)	1...ZPD182, 1…ZP104		1…ZP137, 1…ZPD182		1…ZP233, 1...ZPD122	
Circuit A Oil Charge (oz, A1, A2)	110, 81 oz		110, 110 oz		81, 142 oz	
System Capacity Steps (%)	25-100%		25-100%		17%-34%, 66%, 73-100%	
Number of Refrigerant Circuits	1		1		1	
REFRIGERANT	Puron® (R-410A)		Puron® (R-410A)		Puron® (R-410A)	
Circuit A Operating Charge (lb)	37.0		37.0		38.4	
Circuit A Operating Charge with Humidi-MiZer (lb)	TBD		TBD		TBD	
Circuit B Operating Charge (lb)	—		—		—	
High Pressure Switch Auto-Reset (psig)	500		500		500	
High Pressure Switch Cutout (psig)	650		650		650	
CONDENSER COIL	Aluminum, Novation (MCHX)		Aluminum, Novation (MCHX)		Aluminum, Novation (MCHX)	
Quantity	2		2		2	
Total Face Area (sq ft)	53.3		53.3		53.3	
EVAPORATOR COIL	Al/Cu RTPF		Al/Cu RTPF		Al/Cu RTPF	
Quantity	1		1		1	
Total Face Area (sq ft)	32.1		32.1		32.1	
Rows...Fins/in.	4…15		4…15		4…15	
Fin Type	Double Wavy		Double Wavy		Double Wavy	
Tube Type	Enhanced		Enhanced		Enhanced	
Circuit A/B, Metering Device Quantity...Type	2…EXV		2…EXV		2…EXV	
HUMIDI-MIZER SYSTEM (OPTIONAL)	Aluminum, Novation (MCHX)		Aluminum, Novation (MCHX)		Aluminum, Novation (MCHX)	
Coil Quantity	1		1		1	
Coil Total Face Area (sq ft)	26.5		26.5		26.5	
Reheat Valve Qty…Type	1…On/Off Three-Way		1…On/Off Three-Way		1…On/Off Three-Way	
Bypass Valve Qty…Type	1…Modulating Three-Way		1…Modulating Three-Way		1…Modulating Three-Way	
STANDARD CONDENSER FANS	Metal Propeller, Direct Drive		Metal Propeller, Direct Drive		Metal Propeller, Direct Drive	
Qty…Diameter (in.)	2…30		2…30		2…30	
Motor Qity…Type	2…AC		2…AC		2…AC	
Motor HP…RPM	1…1140		1…1140		1…1140	
Nominal cfm	18,000		18,000		18,000	
LOW-SOUND CONDENSER FANS (OPTIONAL)	Composite AeroAcoustic™, Direct Drive		Composite AeroAcoustic™, Direct Drive		Composite AeroAcoustic™, Direct Drive	
Qty…Diameter (in.)	2…30		2…30		2…30	
Motor Qty…Type	2…AC		2…AC		2…AC	
Motor HP…RPM	1.5…850		1.5…850		1.5…850	
Nominal cfm	18,000		18,000		18,000	
INDOOR FAN	Backward Curve, Direct Drive		Backward Curve, Direct Drive		Backward Curve, Direct Drive	
Fan Qty…Diameter (in.)	3…17.7		3…17.7		3…17.7	
Motor Qty…Type	3...EC		3...EC		3...EC	
Standard/Medium Static Total Power (kW)	7.8 / 12		7.8 / 12		7.8 / 12	
Nominal cfm	8,250		9,000		10,500	
LOW STATIC EXHAUST (OPTIONAL)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
Fan Type	Composite Propeller, Direct Drive		Composite Propeller, Direct Drive		Composite Propeller, Direct Drive	
Fan Qty…Diameter (in.)	2…26	2...30	2…26	2...30	2…26	2...30
Motor Qty…Type	2...EC		2...EC		2...EC	
Total Motor Power (kW)	1.5	2.2	1.5	2.2	1.5	2.2
Nominal cfm	10,500	15,000	10,500	15,000	10,500	15,000

Physical data (cont)

50V Physical Data — Sizes 027, 031, 035 (cont)

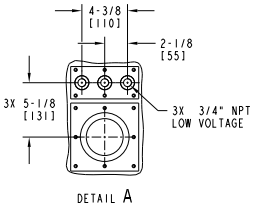
BASE UNIT	50V...27		50V...31		50V...35	
NOMINAL CAPACITY (tons)	27.5		30		35	
MEDIUM STATIC EXHAUST (OPTIONAL)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
Fan Type	—	Backward Curve	—	Backward Curve	—	Backward Curve
Fan Qty…Diameter (in.)	—	2…19.7	—	2…19.7	—	2…19.7
Motor Qty…Type	—	2...EC	—	2...EC	—	2...EC
Total Motor Power (kW)	—	2.2	—	2.2	—	2.2
Nominal cfm	—	TBD	—	TBD	—	TBD
HOT WATER COIL (OPTIONAL)	Al/Cu RTPF, Steel Header		Al/Cu RTPF, Steel Header		Al/Cu RTPF, Steel Header	
Coil Quantity	1		1		1	
Total Face Area (sq ft)	22.6		22.6		22.6	
Coil Rows…Fins Per Inch	2…8		2…8		2…8	
Tube Size (in.)…Circuiting	1/2" OD Half Circuit		1/2" OD…Half Circuit		1/2" OD…Half Circuit	
Supply Connection Qty…Size (in.)	1…2-1/2 NPT		1…2-1/2 NPT		1…2-1/2 NPT	
Return Connection Qty…Size (in.)	1…2-1/2 NPT		1…2-1/2 NPT		1…2-1/2 NPT	
Coil Internal Volume (gal)	6.36		6.36		6.36	
STANDARD PRE-FILTERS	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
2 in. Throwaway	Fiberglass		Fiberglass		Fiberglass	
Qty...Size (in.)	12...20" x 20" X 2"		12...20" x 20" X 2"		12...20" x 20" X 2"	
Outdoor Air Screen	Metal Mesh		Metal Mesh		Metal Mesh	
Qty...Size (in.)	8...16" x 25" x 1"		8...16" x 25" x 1"		8...16" x 25" x 1"	
OPTIONAL PRE-FILTERS	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
2 in. MERV 8	Pleated		Pleated		Pleated	
Qty...Size (in.)	12...20" x 20" X 2"		12...20" x 20" X 2"		12...20" x 20" X 2"	
4 in. MERV 8 & 13	Pleated		Pleated		Pleated	
Qty...Size (in.)	12...20" x 20" X 4"		12...20" x 20" X 4"		12...20" x 20" X 4"	
12 in. MERV 14 Bag	—	Bag	—	Bag	—	Bag
Qty...Size (in.)	—	12...20" x 20" x 12"	—	12...20" x 20" x 12"	—	12...20" x 20" x 12"
12 in. MERV 15 Cartridge	—	High Velocity Cartridge	—	High Velocity Cartridge	—	High Velocity Cartridge
Qty...Size (in.)	—	12...20" x 20" x 12"	—	12...20" x 20" x 12"	—	12...20" x 20" x 12"

48V 27-35 Ton Compact Chassis with High Heat

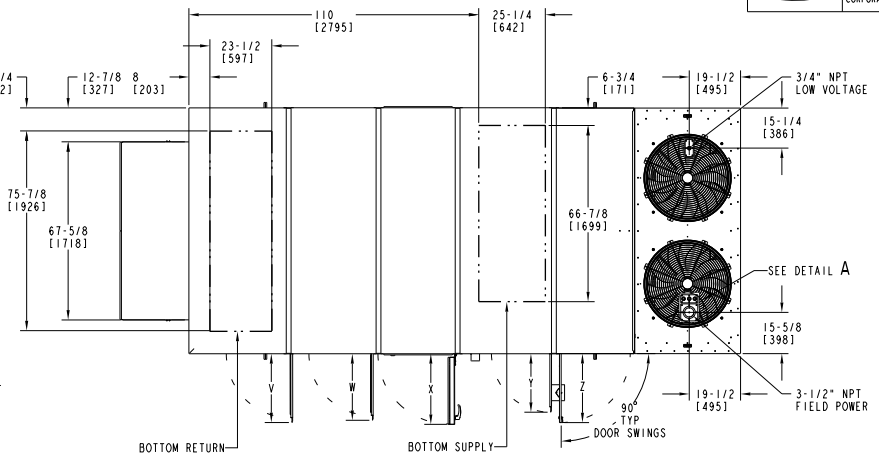
NOTES:

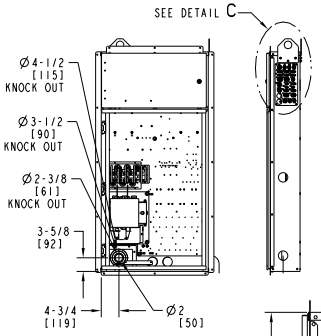
1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT)
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0", 8'-0" WITH EXHAUST FAN
   ECONOMIZER END - 6'-0"
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. DUCTWORK CANNOT ATTACH TO UNIT BASEPAN.
   DUCTWORK MUST ATTACH TO ROOF CURB OR UNIT SUPPORT STRUCTURE.
5. OUTDOOR AIR HOODS AND RELIEF HOODS SHIP AS SHOWN.

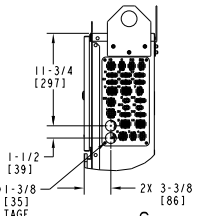
	DOOR WIDTH
V	26-1/8 [663]
W	25-1/4 [641]
X	26-3/4 [681]
Y	22-1/8 [563]
Z	26-1/8 [663]

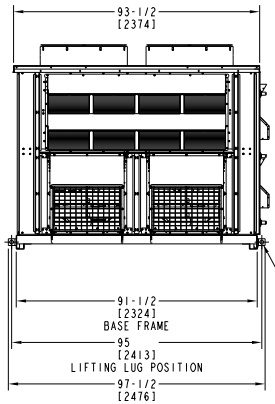


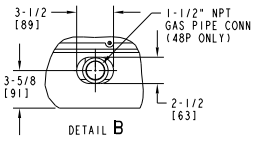
DETAIL A



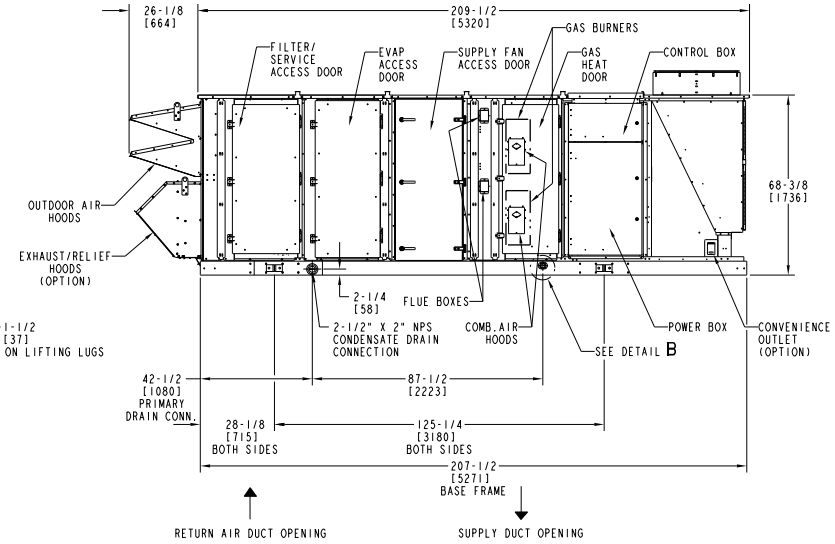


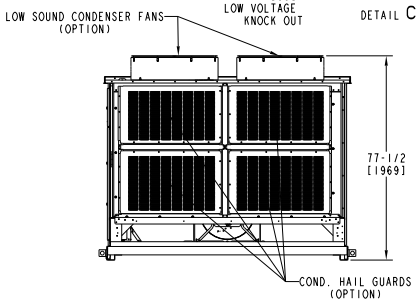


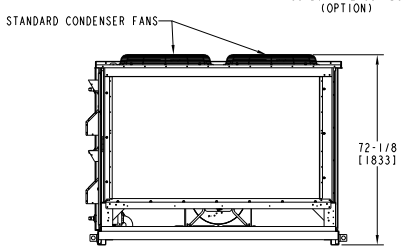




DETAIL B



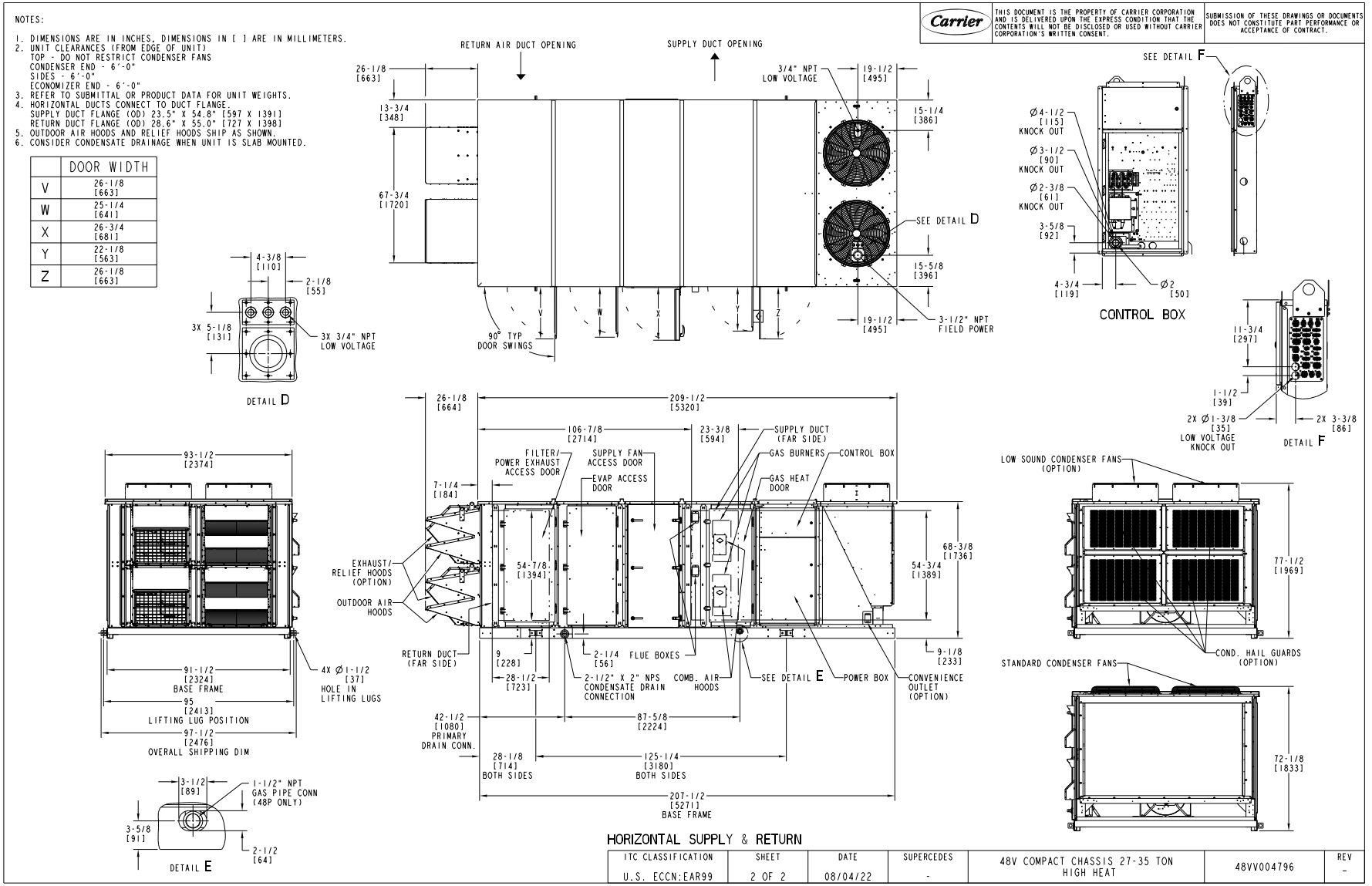




VERTICAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	48V COMPACT CHASSIS 27-35 TON HIGH HEAT		REV
U.S. ECCN:EAR99	1 OF 2	08/04/22	-		48VV004796	-

48V 27-35 Ton Compact Chassis with High Heat (cont)

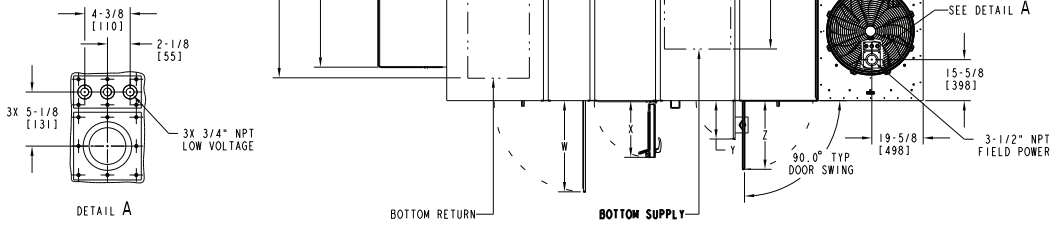


48V 27-35 Ton Compact Chassis with Low Heat

NOTES:

1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT)
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 6'-0"
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. DUCTWORK CANNOT ATTACH TO UNIT BASEPAN.
   DUCTWORK MUST ATTACH TO ROOF CURB OR UNIT SUPPORT STRUCTURE.
5. OUTDOOR AIR HOODS AND RELIEF HOODS SHIP AS SHOWN.

	DOOR WIDTH
W	34-3/4 [884]
X	21-5/8 [549]
Y	14-5/8 [372]
Z	26-1/8 [664]



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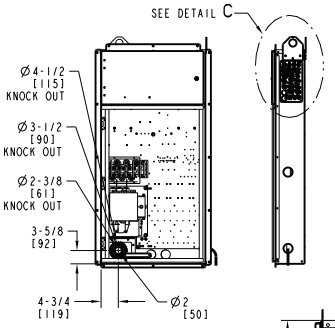
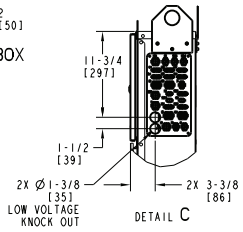


CONTROL BOX



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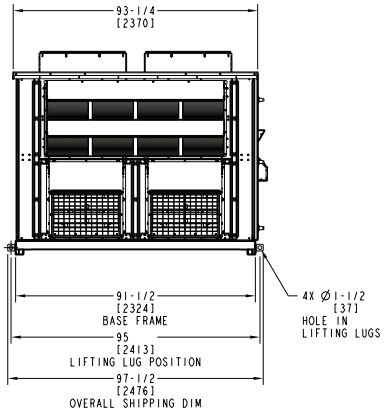

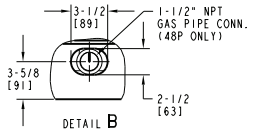

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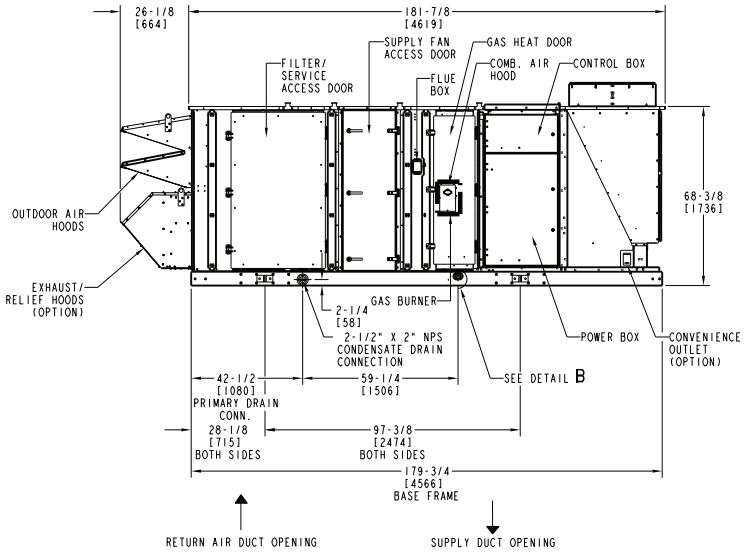
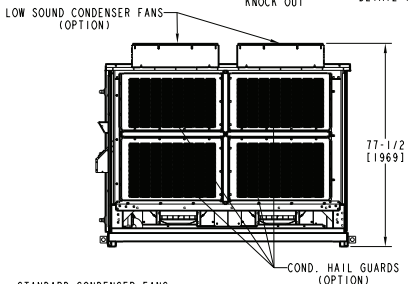
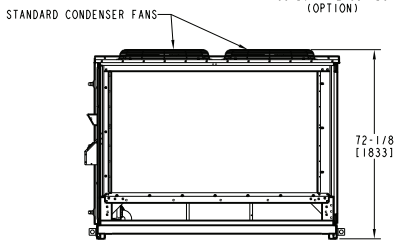


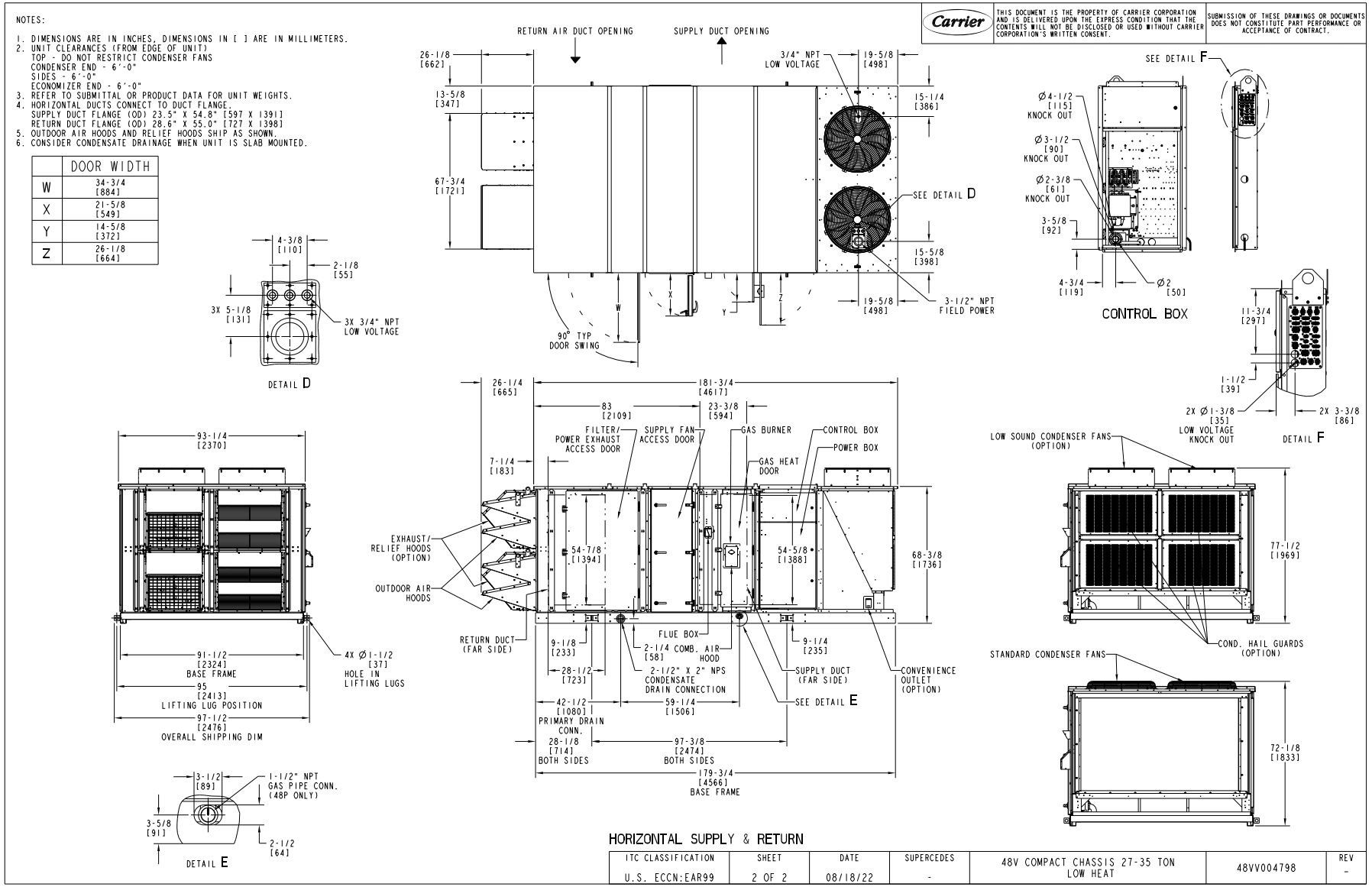




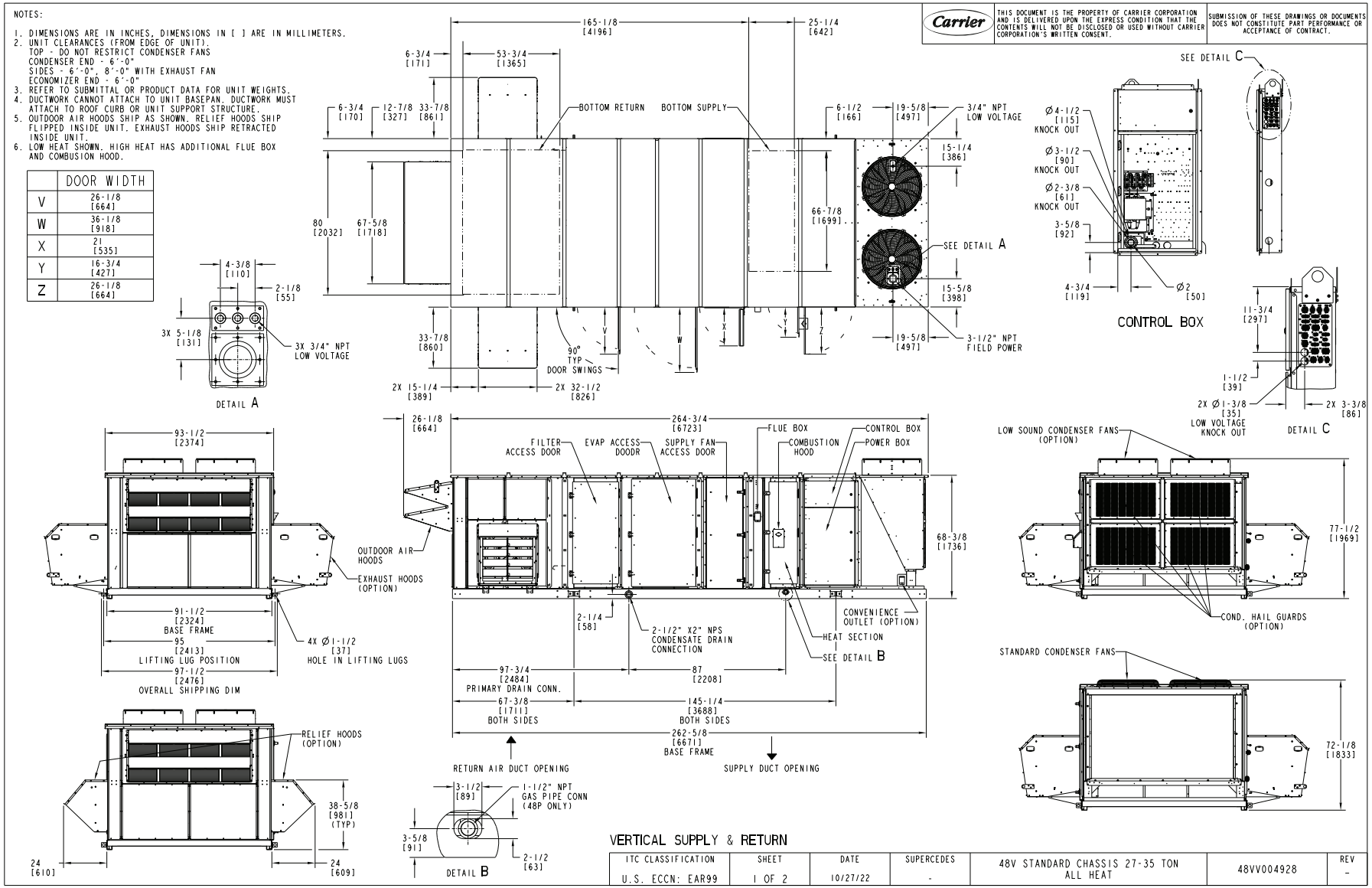
VERTICAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES		
U.S. ECCN:EAR99	1 OF 2	08/18/22	-	48V COMPACT CHASSIS 27-35 TON LOW HEAT	48VV004798	REV -

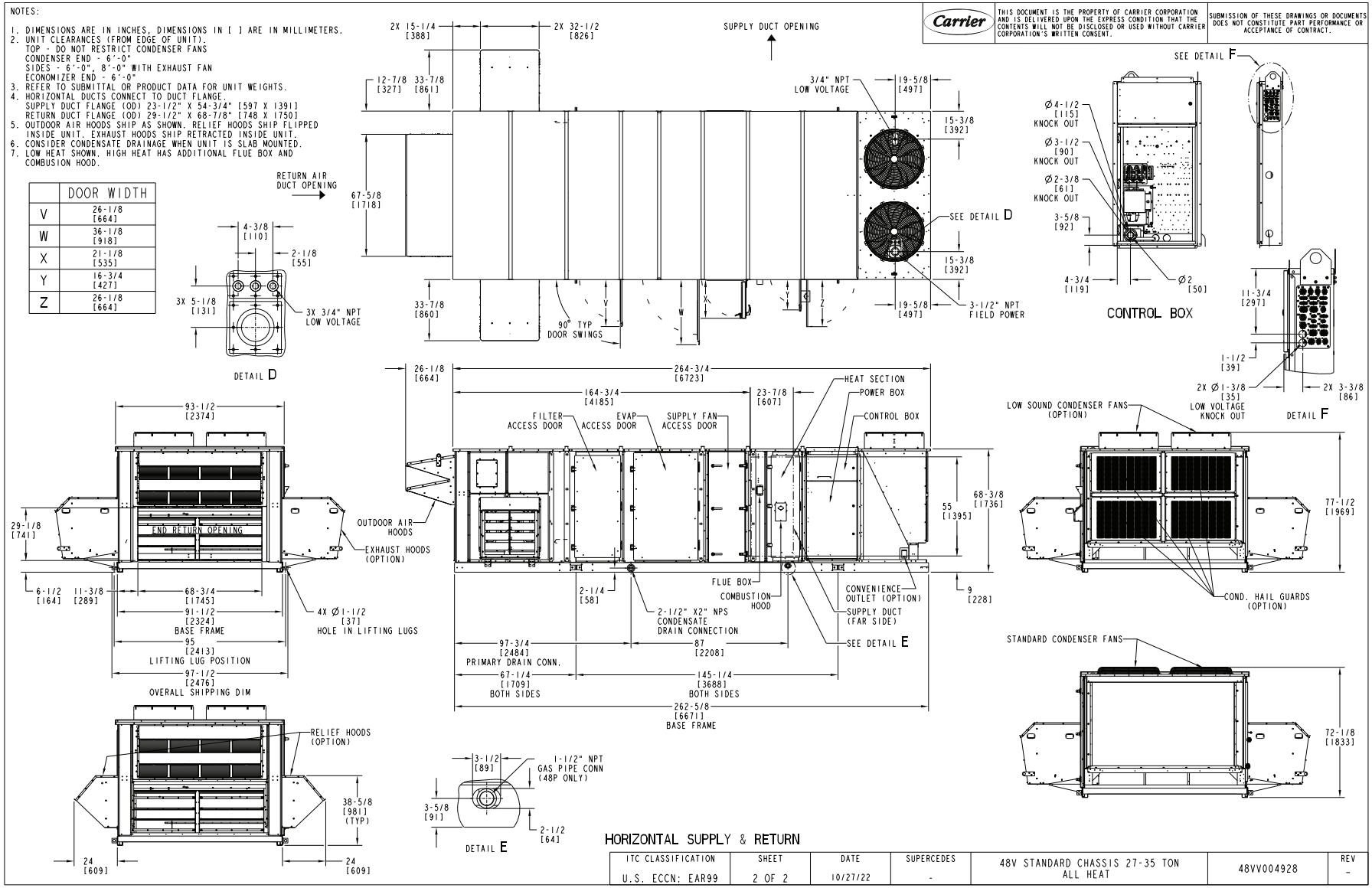
48V 27-35 Ton Compact Chassis with Low Heat (cont)



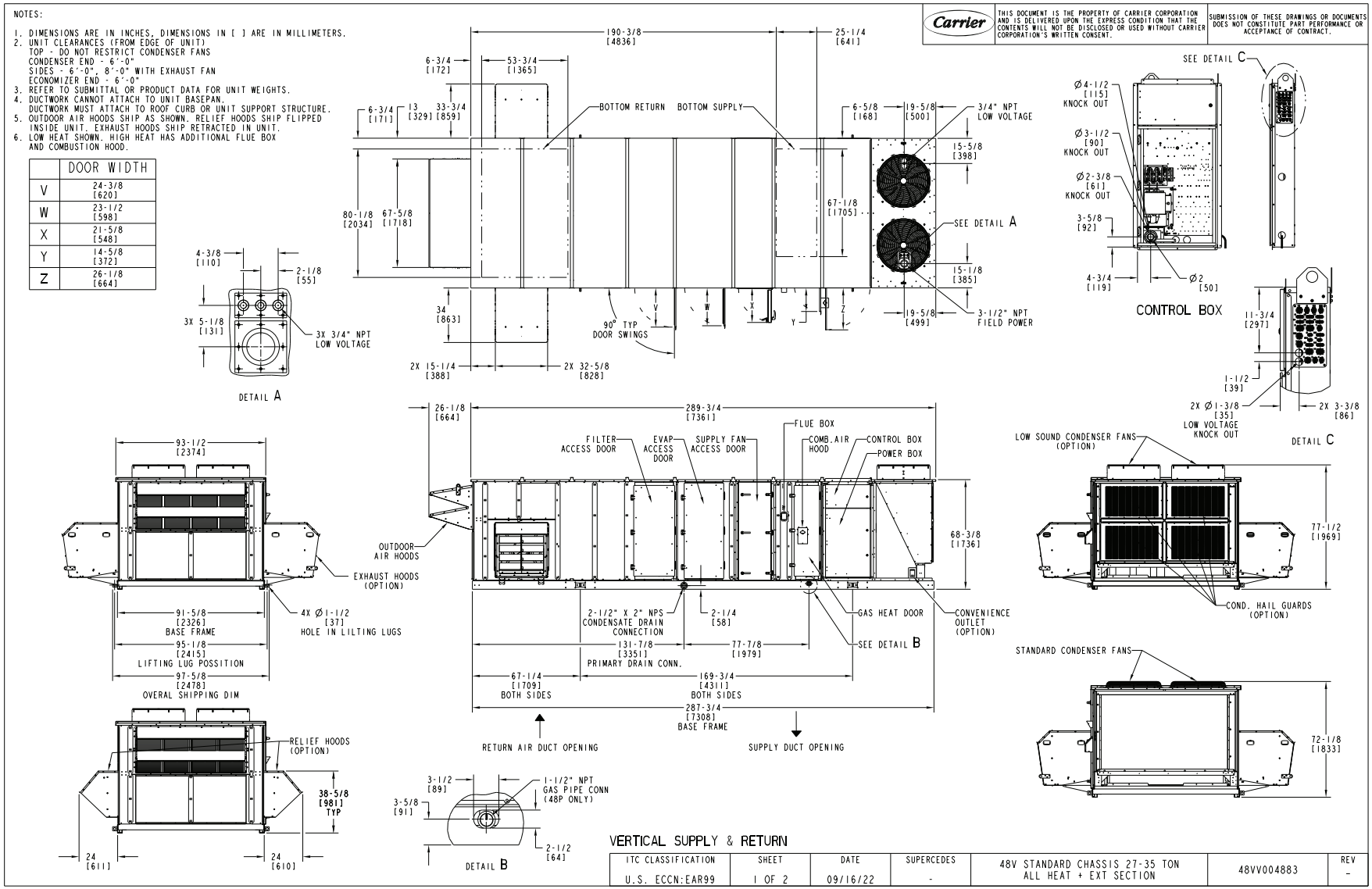
48V 27-35 Ton Standard Chassis



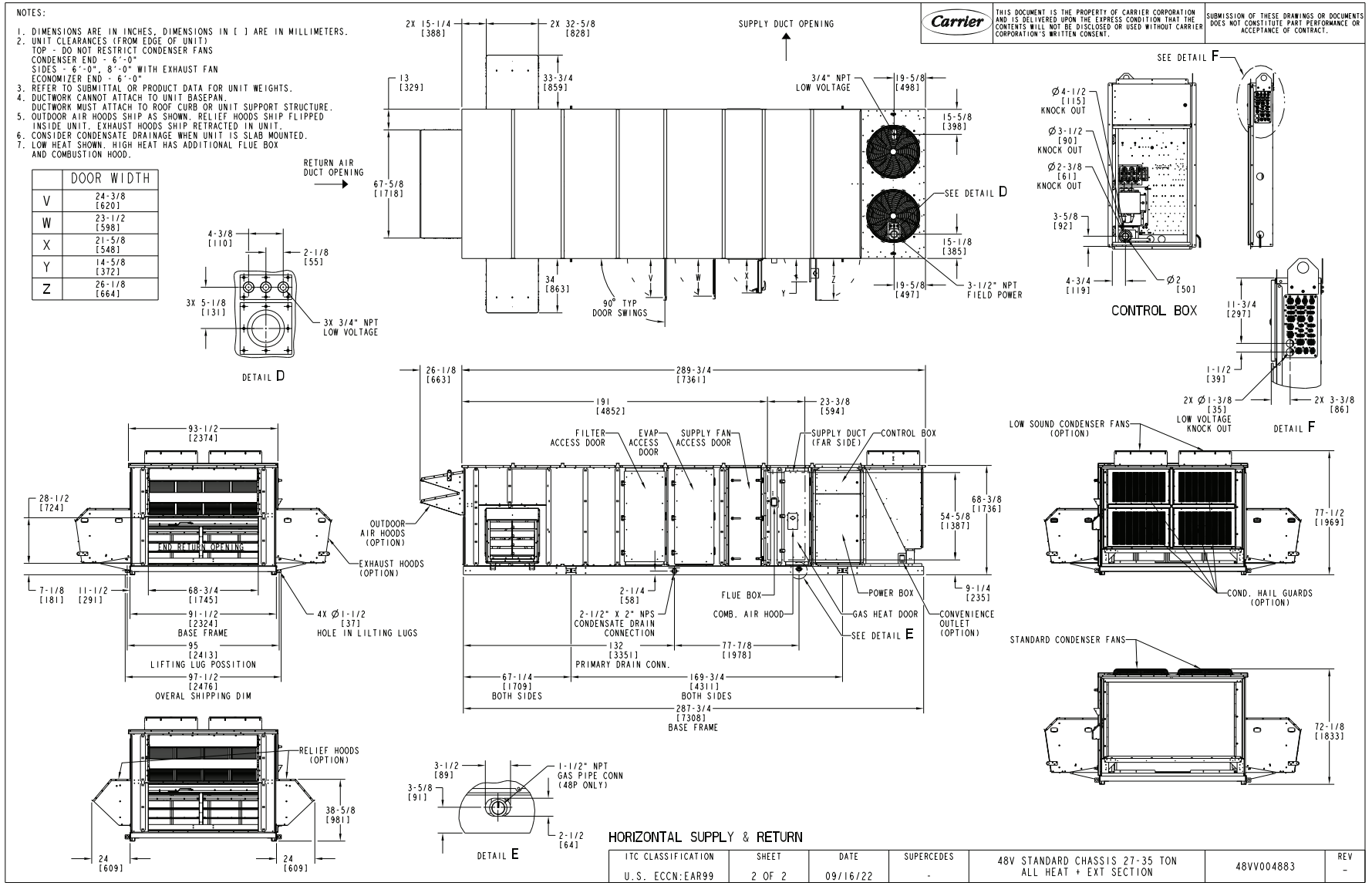
48V 27-35 Ton Standard Chassis (cont)



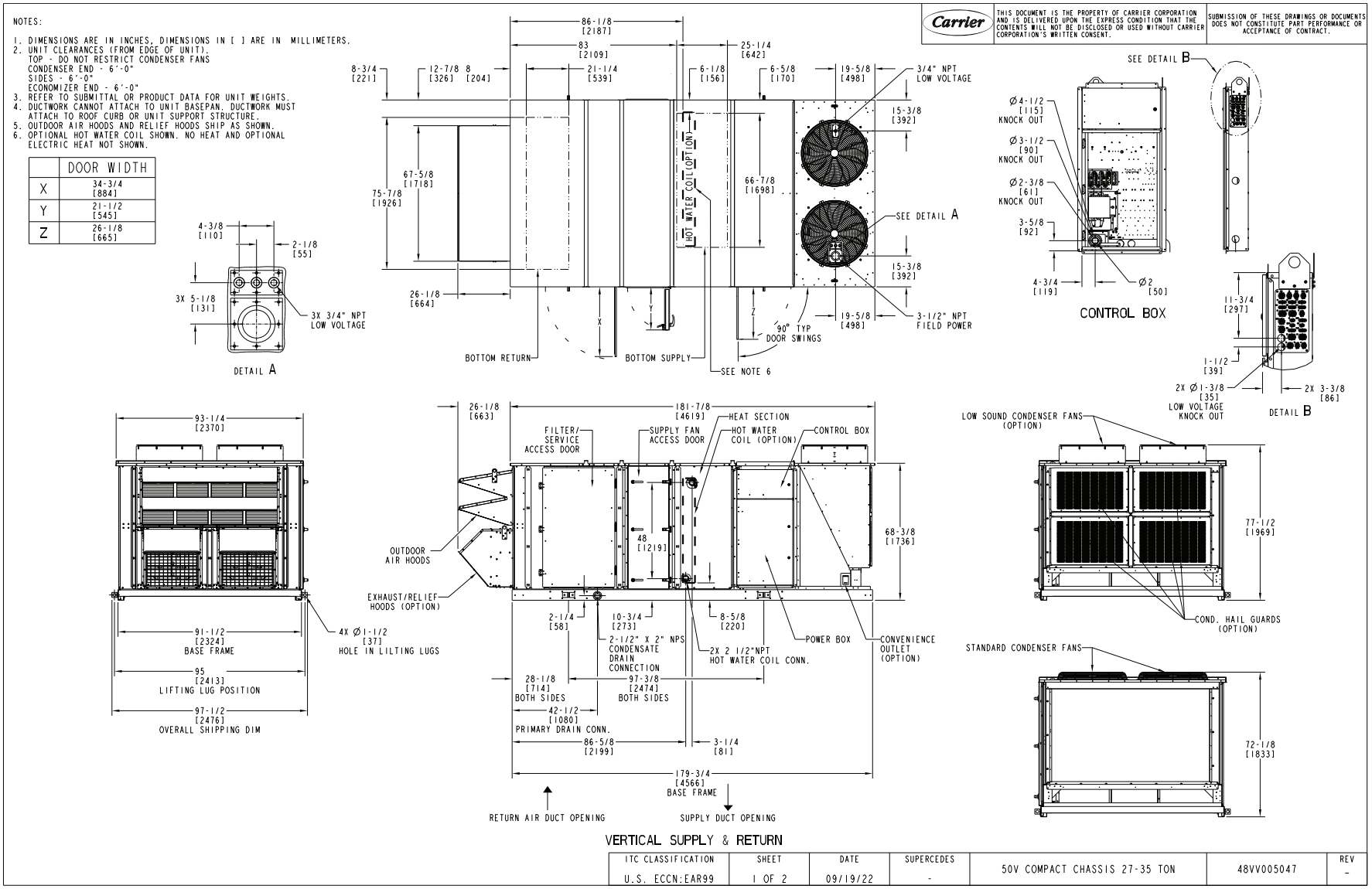
48V 27-35 Ton Standard Chassis with Extended Section



48V 27-35 Ton Standard Chassis with Extended Section (cont)



50V 27-35 Ton Compact Chassis

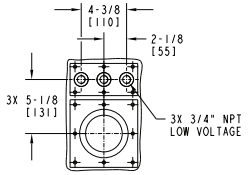


50V 27-35 Ton Compact Chassis (cont)

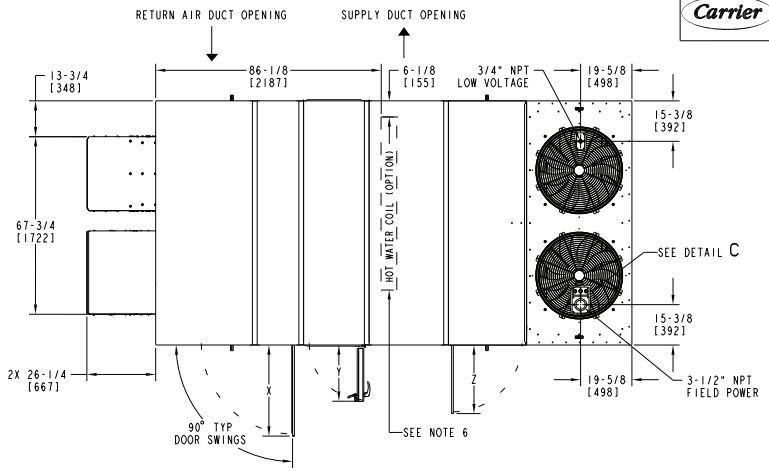
NOTES:

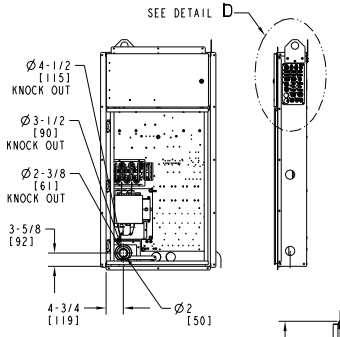
1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT).
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 6'-0"
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. HORIZONTAL DUCTS CONNECT TO DUCT FLANGE.
   SUPPLY DUCT FLANGE (OD) 23-1/2" X 54-3/4" [597 X 1391]
   RETURN DUCT FLANGE (OD) 28-5/8" X 55" [727 X 1398]
5. OUTDOOR AIR HOODS AND RELIEF HOODS SHIP AS SHOWN.
6. OPTIONAL HOT WATER COIL SHOWN. NO HEAT AND OPTIONAL ELECTRIC HEAT NOT SHOWN.
7. CONSIDER CONDENSATE DRAINAGE WHEN UNIT IS SLAB MOUNTED.

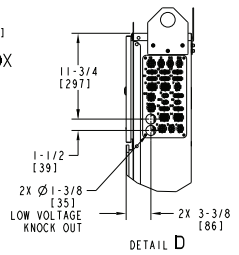
	DOOR WIDTH
X	34-3/4 [884]
Y	21-1/2 [545]
Z	26-1/8 [665]



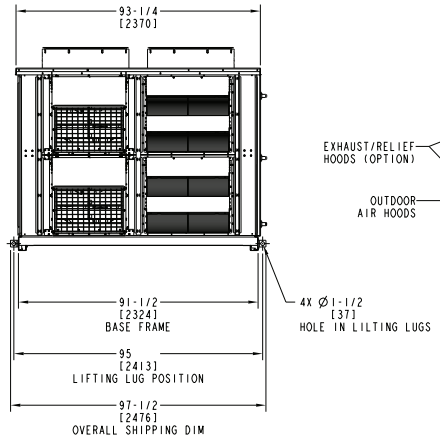
DETAIL C

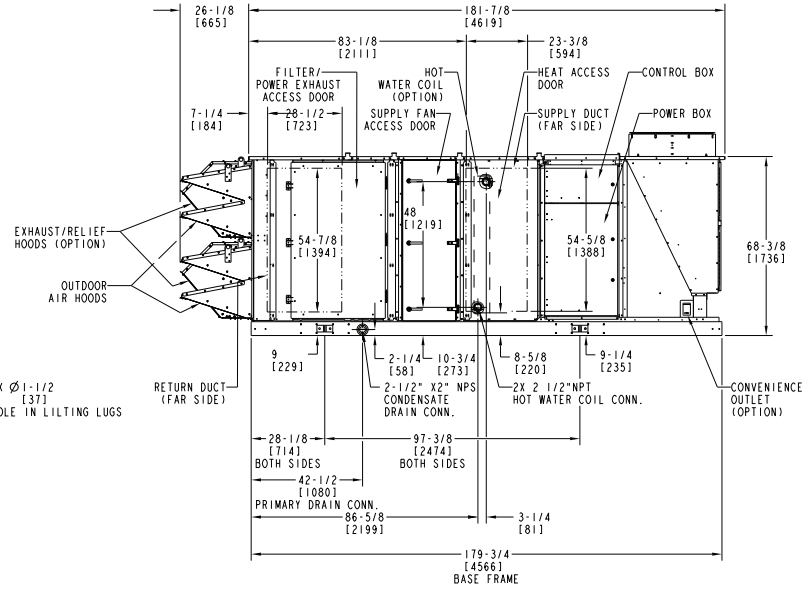




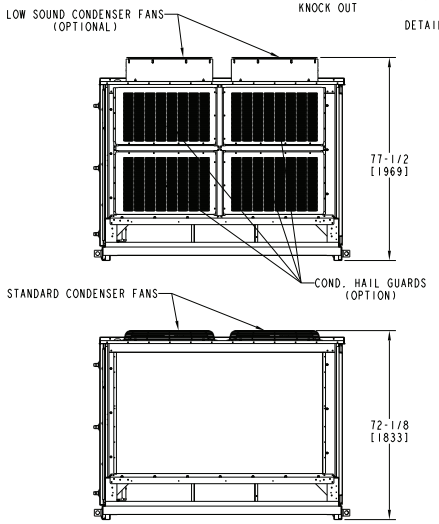


DETAIL D



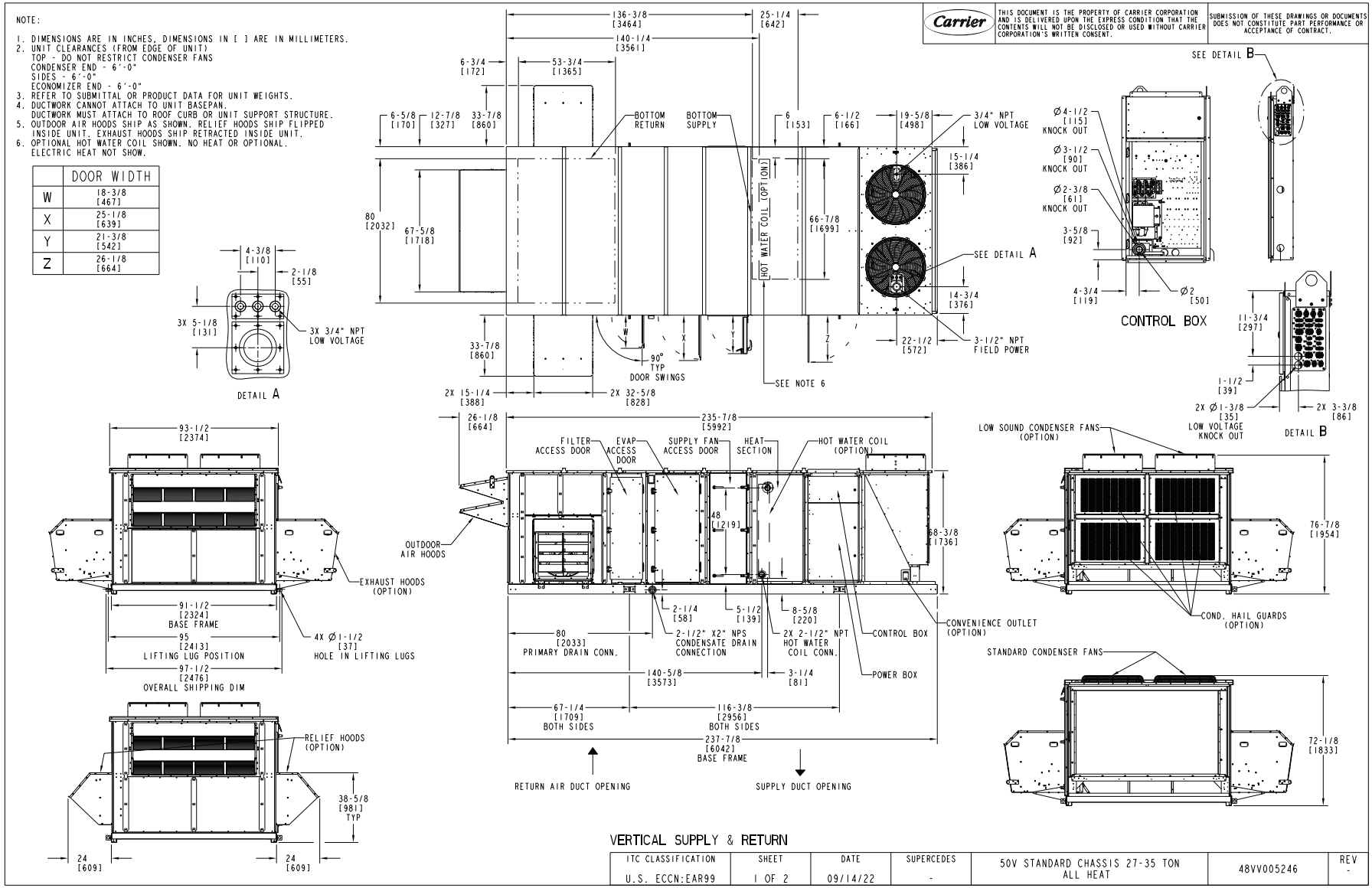


HORIZONTAL SUPPLY & RETURN

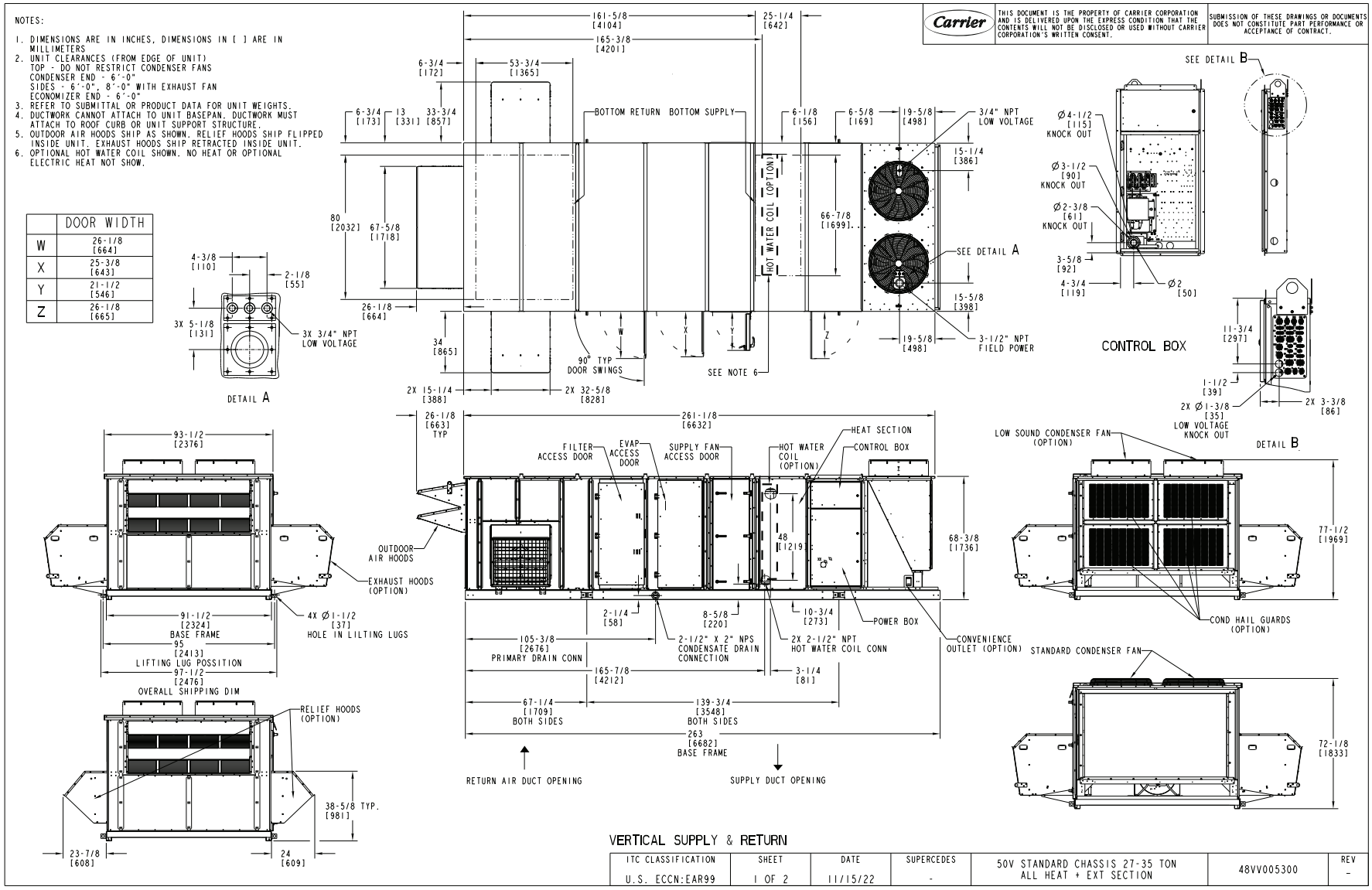


ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	50V COMPACT CHASSIS 27-35 TON	48VV005047	REV
U.S. ECCN:EAR99	2 OF 2	09/19/22	-			-

50V 27-35 Ton Standard Chassis



50V 27-35 Ton Standard Chassis with Extended Section

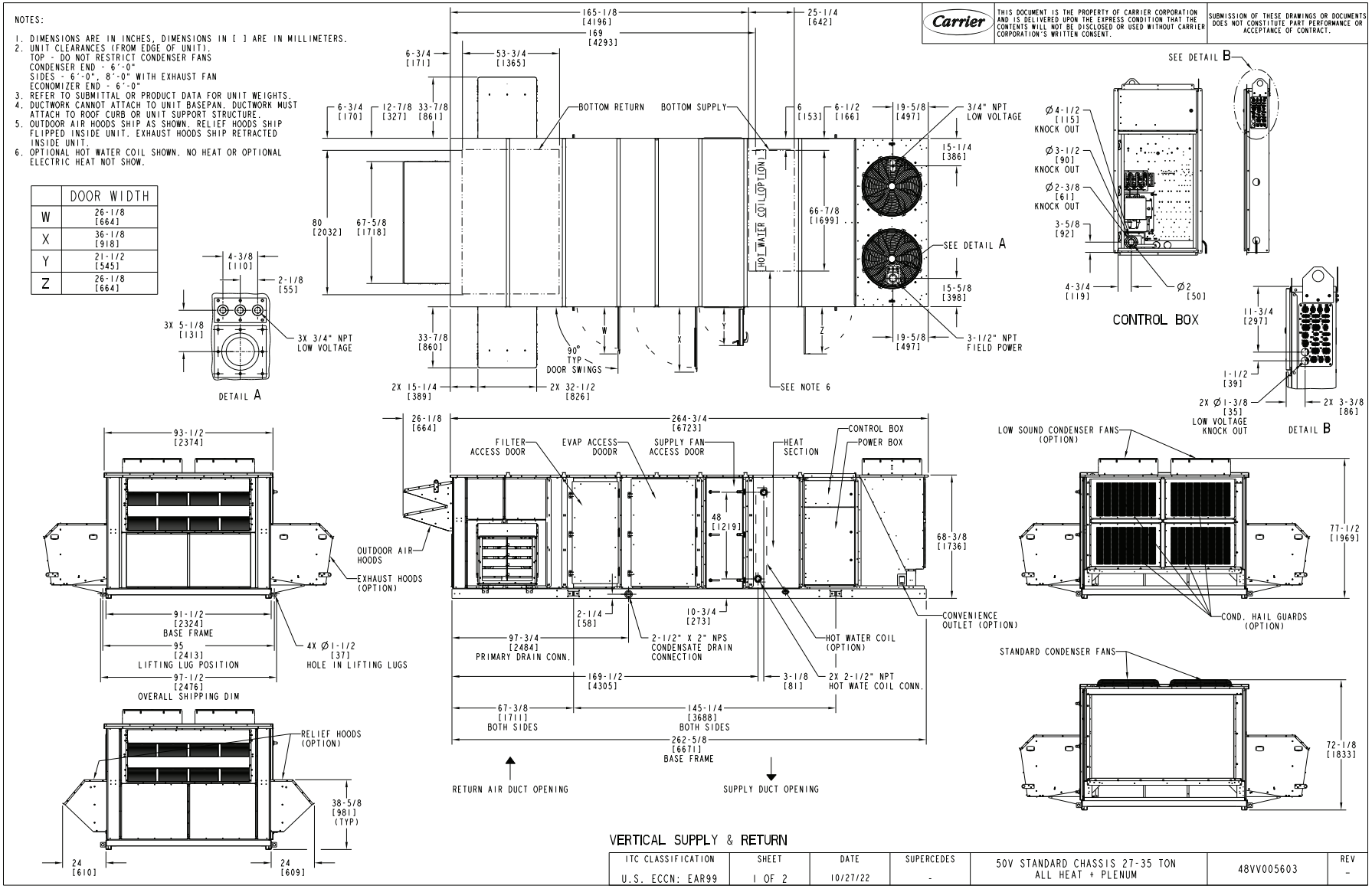


50V 27-35 Ton Standard Chassis with Plenum Section

NOTES:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT).
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0", 8'-0" WITH EXHAUST FAN
   ECONOMIZER END - 6'-0"
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. DUCTWORK CANNOT ATTACH TO UNIT BASEPAN. DUCTWORK MUST ATTACH TO ROOF CURB OR UNIT SUPPORT STRUCTURE.
5. OUTDOOR AIR HOODS SHIP AS SHOWN. RELIEF HOODS SHIP FLIPPED INSIDE UNIT. EXHAUST HOODS SHIP RETRACTED INSIDE UNIT.
6. OPTIONAL HOT WATER COIL SHOWN. NO HEAT OR OPTIONAL ELECTRIC HEAT NOT SHOW.

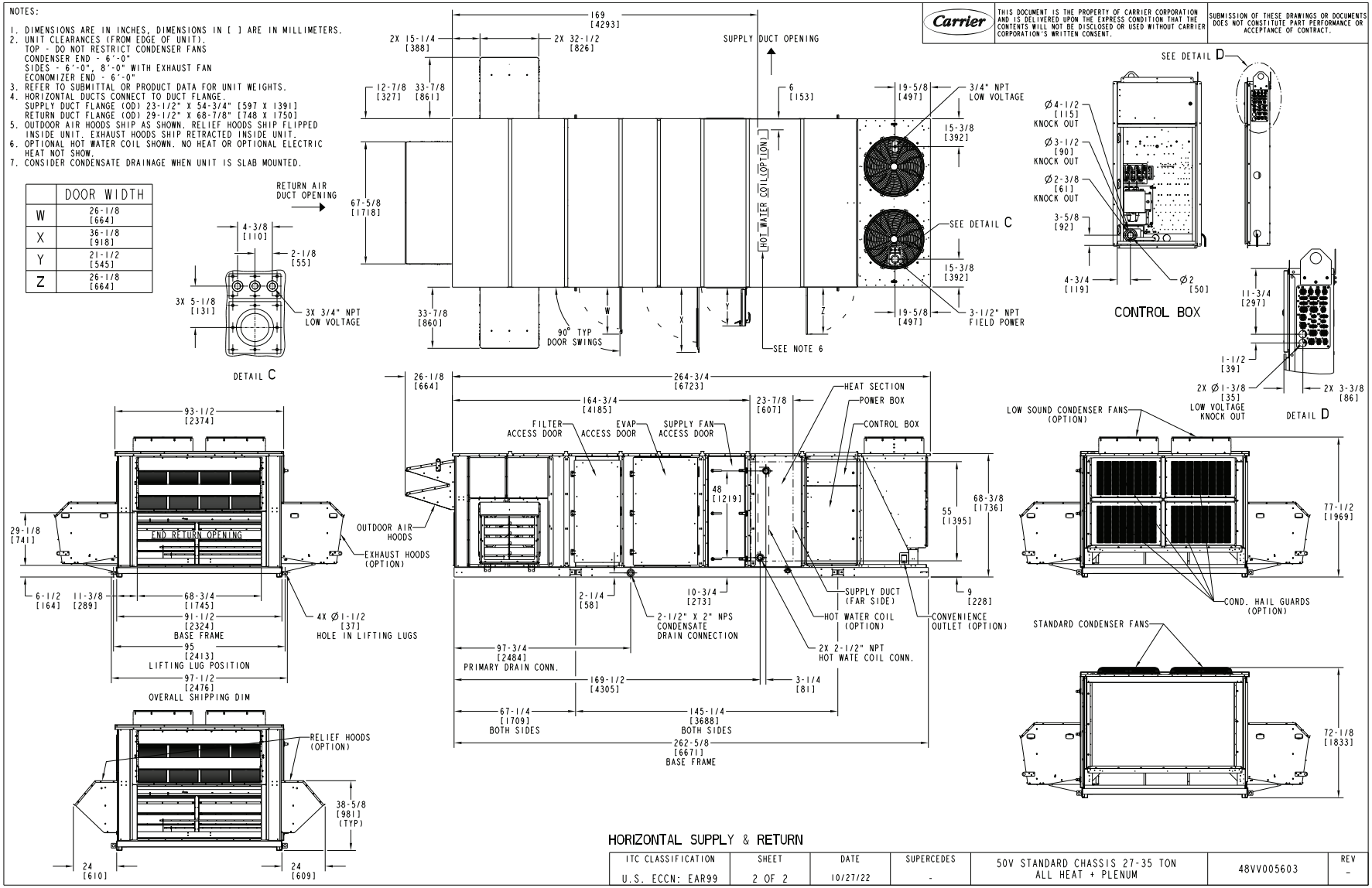
	DOOR WIDTH
W	26-1/8 [664]
X	36-1/8 [918]
Y	21-1/2 [545]
Z	26-1/8 [664]



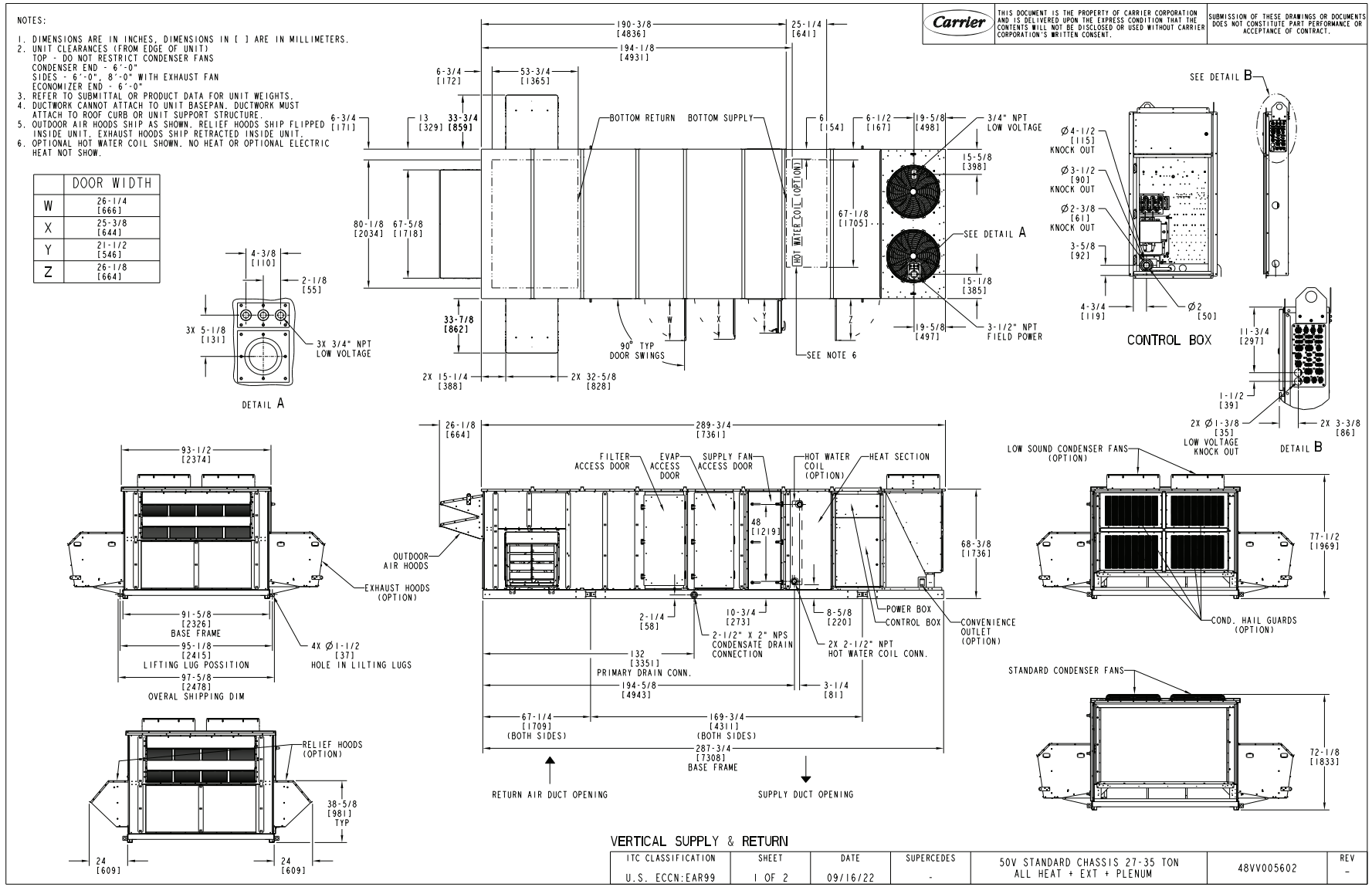
VERTICAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	50V STANDARD CHASSIS 27-35 TON ALL HEAT + PLENUM		REV
U.S. ECCN: EAR99	1 OF 2	10/27/22	-		48VV005603	-

50V 27-35 Ton Standard Chassis with Plenum Section (cont)



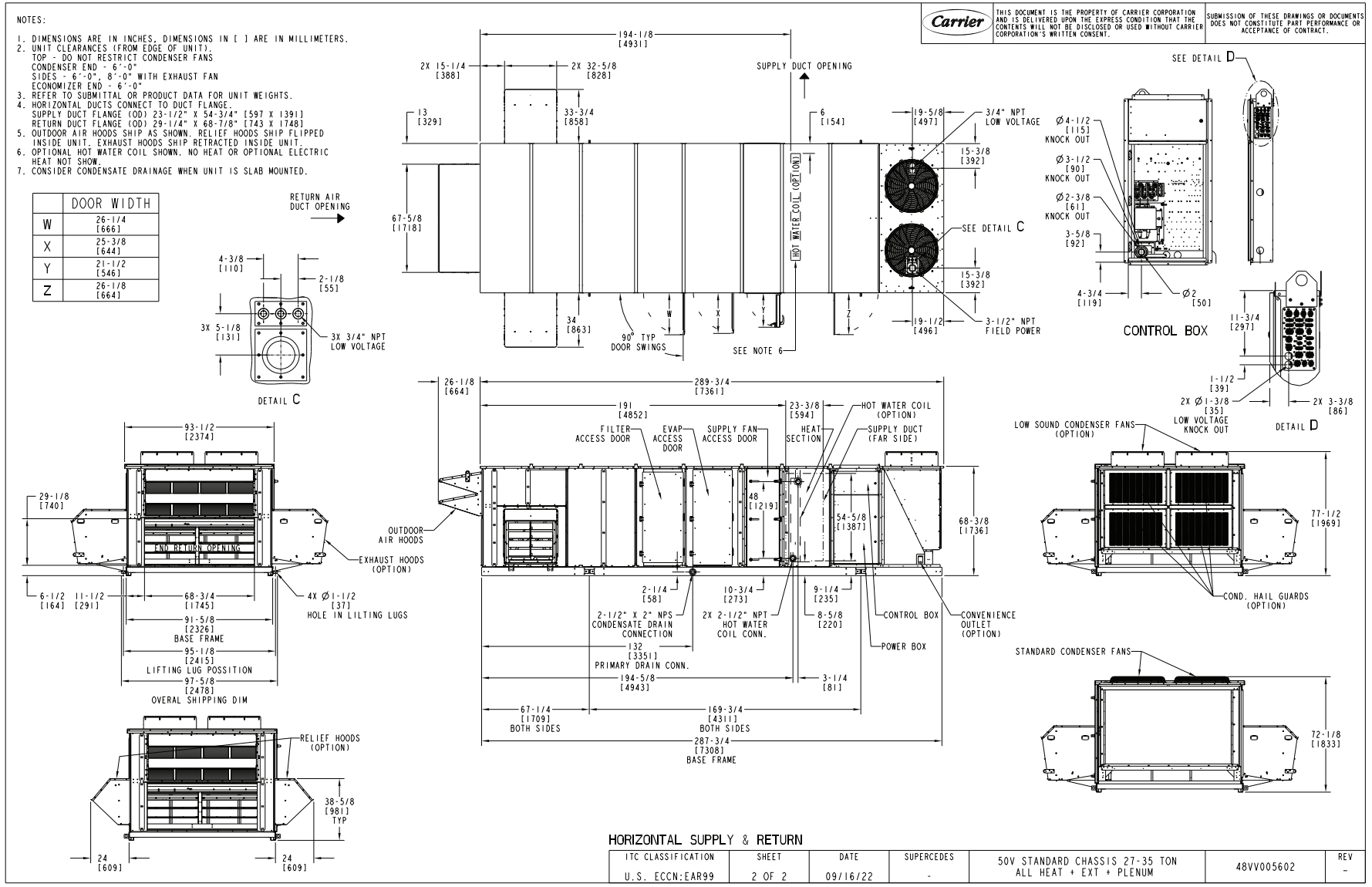
50V 27-35 Ton Standard Chassis with Extended and Plenum Sections



VERTICAL SUPPLY & RETURN

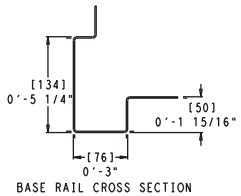
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	50V STANDARD CHASSIS 27-35 TON ALL HEAT + EXT + PLENUM	48VV005602	REV
U.S. ECCN:EAR99	1 OF 2	09/16/22	-			-

50V 27-35 Ton Standard Chassis with Extended and Plenum Sections (cont)

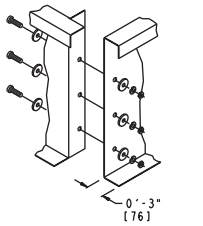


Roof Curb — 48/50V 27.5-35 Ton Standard Chassis

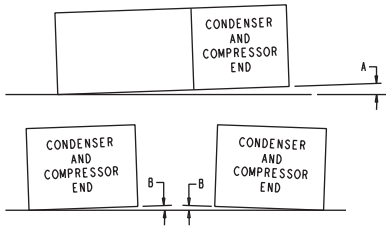
NOTES:
1. Roof curb is shipped disassembled.
2. Roofcurb: 14ga (VA03-56) STL.
3. Dimensions are inches (millimeters).



BASE RAIL CROSS SECTION
TYP ALL BASE RAILS



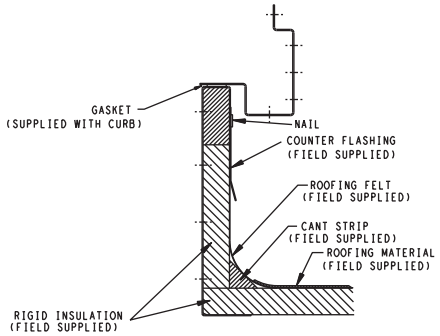
(CORNER CONNECTIONS AND
SPLICE PLATE CONNECTIONS)



DIMENSIONS
(degrees and inches)

A		B	
DEG.	IN.	DEG.	IN.
1.0	2.0	.50	.75

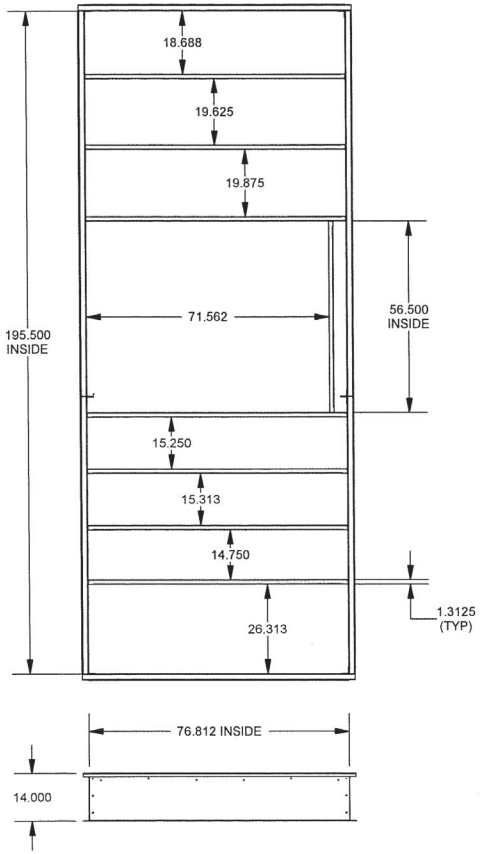
UNIT LEVELING TOLERANCES
*From edge of unit to horizontal.

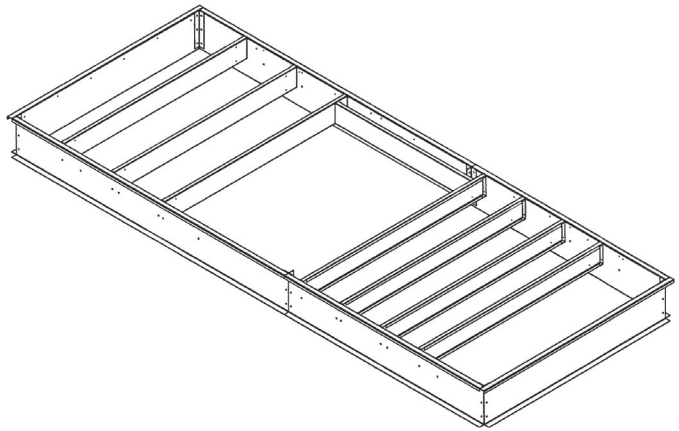


Accessory Part No.	Unit Type	Dimension	Unit size (27.5-35)
CRRFCURB064A00	50V Standard Chassis	A	19' 2-3/8"
		B	10' 10-3/8"
CRRFCURB065A00	50V Standard Chassis w/ Extended Section	A	21' 3-9/16"
		B	12' 11-9/16"
CRRFCURB057A00	48V Standard Chassis	A	20' 9-1/16"
	50V Standard Chassis w/ Plenum	B	13' 3-11/16"
CRRFCURB058A00	48V Standard Chassis w/ Extended Section	A	22' 10-1/4"
	50V Standard Chassis w/ Extended Plenum	B	15' 4-7/8"

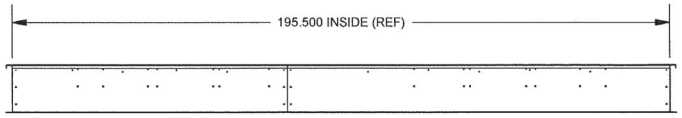
Roof Curb - 48V 27-35 Compact Chassis High Heat

Accessory Part No.	Unit Type
CRRFCURB041A00	48V Compact Chassis - High Heat



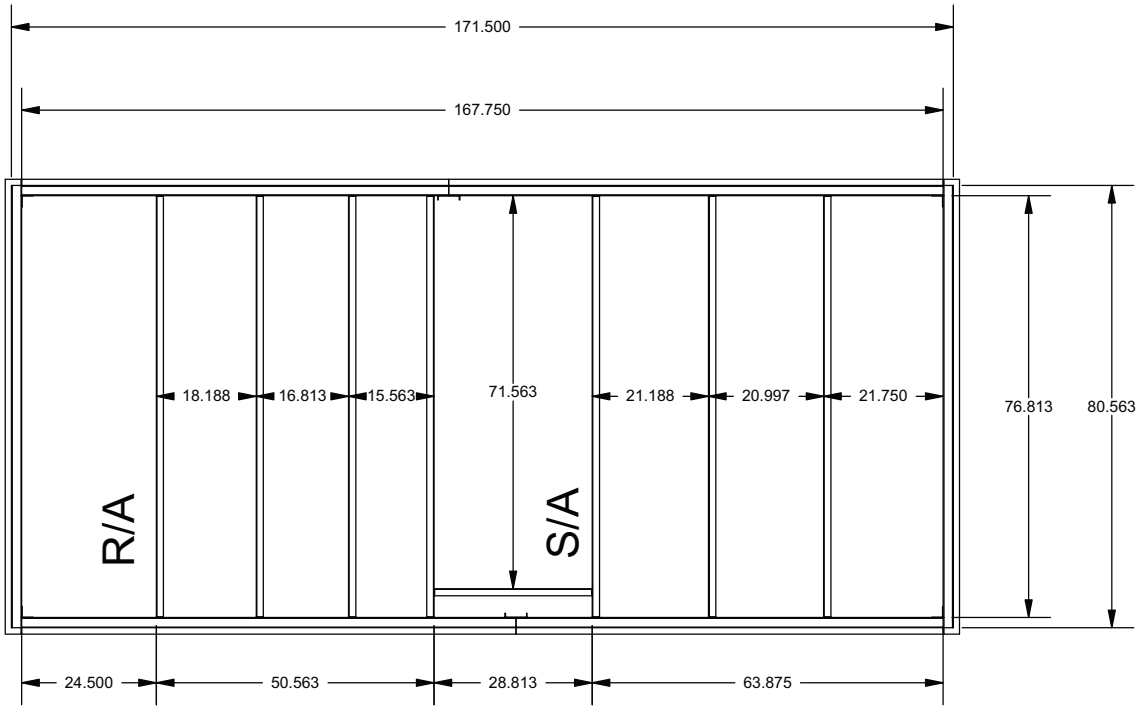


NOTES:
1. SHIPS KNOCKED DOWN
2. FULL PERIMETER WOOD NAILER
3. INCLUDE 100' x 1.50W x 0.25THK. GASKETING
4. INCLUDE HARDWARE BAG

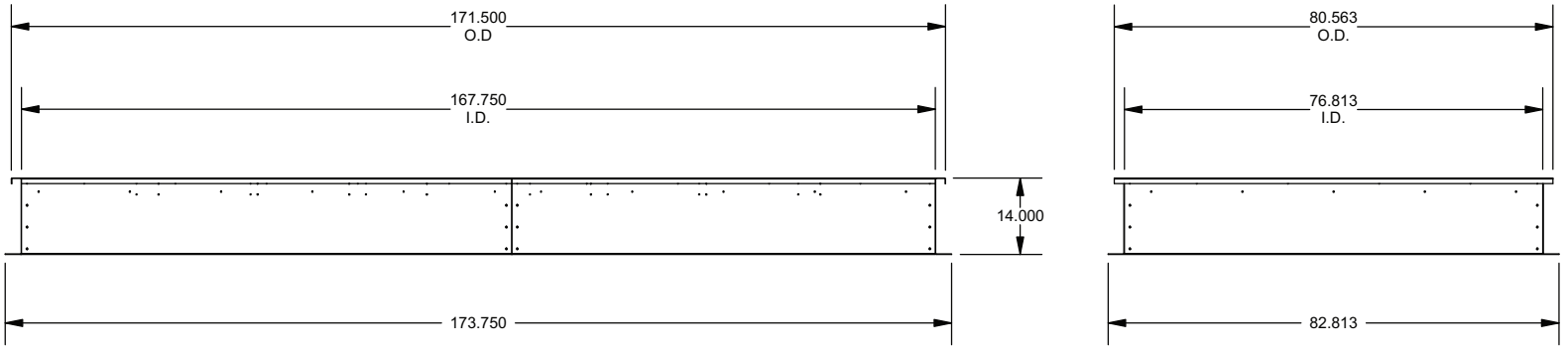


NOTE: Dimensions are in inches.

Roof Curb — 48V 27-35 Compact Chassis Low Heat/50V 27-35 Compact Chassis



Accessory Part No.	Unit Type
CRRFCURB040A00	48V Compact Chassis - Low Heat
	50V Compact Chassis



NOTE: Dimensions are in inches.

Dimensions and weights (cont)

See Physical Data Tables for base unit weights. Use Carrier ECAT selection tool for actual weights by unit configuration.

Indoor Fan Performance Data — 48V Size 27 Low Heat[a,b,c]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	0.2		0.4		0.6		0.8		1.0		1.2		1.4	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
2,750	794	485	794	485	794	485	884	659	966	851	1041	1057	1110	1275
3,500	788	491	788	491	845	600	936	804	1017	1019	1091	1245	1160	1483
5,500	812	530	917	779	1009	1043	1092	1319	1167	1605	1237	1899	1302	2202
7,500	1033	1071	1119	1391	1197	1726	1270	2074	1338	2432	1402	2800	1463	3177
9,000	1206	1688	1280	2062	1350	2450	1416	2851	1479	3263	1538	3685	1595	4116
10,500	1383	2527	1448	2956	1511	3399	1570	3853	1628	4318	1682	4793	1735	5277
12,000	1562	3625	1621	4110	1677	4607	1731	5114	1783	5634	1834	6162	1883	6699
13,500	1744	5019	1796	5560	1847	6112	1896	6674	1944	7247	1991	7828	2037	8418

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	1.6		1.8		2.0		2.2		2.4		2.6		2.8	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
2,750	1175	1504	1235	1745	1293	1997	1347	2260	1400	2533	1450	2816	1498	3108
3,500	1224	1730	1284	1987	1341	2255	1395	2532	1447	2818	1497	3114	1545	3418
5,500	1364	2514	1422	2833	1478	3159	1531	3493	1582	3834	1631	4182	1678	4537
7,500	1521	3560	1576	3951	1629	4348	1679	4752	1728	5162	1775	5578	1821	6000
9,000	1649	4554	1701	5000	1752	5452	1800	5911	1847	6376	1893	6846	1937	7322
10,500	1786	5770	1835	6270	1883	6776	1929	7289	1974	7809	2018	8334	2060	8865
12,000	1930	7244	1977	7798	2022	8359	2065	8926	2108	9499	2149	10078	2190	10663
13,500	2081	9017	2124	9623	2167	10237	2208	10858	2248	11485	2288	12118	2326	12758

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	3.0		3.2		3.4		3.6		3.8		4.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
2,750	1544	3410	1589	3722	1633	4042	1676	4371	1717	4708	1757	5054
3,500	1592	3731	1637	4052	1680	4383	1723	4721	1764	5067	1804	5421
5,500	1723	4899	1768	5268	1811	5644	1852	6025	1893	6414	1933	6810
7,500	1865	6427	1909	6861	1950	7300	1991	7744	2031	8193	2070	8649
9,000	1980	7803	2022	8290	2063	8782	2102	9278	2141	9780	2179	10286
10,500	2101	9402	2142	9943	2181	10488	2220	11039	2258	11595	2295	12156
12,000	2230	11255	2269	11852	2307	12453	2344	13058	—	—	—	—
13,500	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance is based on standard chassis with wet coils and clean 2 in. filters.
b. See Component Pressure Drop data table before using Fan Performance tables.
c. Conversion — 1 watt = 0.00134102 bhp.

LEGEND

— Medium Static Motor

Performance data (cont)

Indoor Fan Performance Data — 48V Size 31 Low Heat[a,b,c]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	0.2		0.4		0.6		0.8		1.0		1.2		1.4	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	794	491	794	491	809	517	901	704	3000	794	1058	1116	1127	1340
4,500	788	496	825	569	924	797	1011	1036	4500	788	1162	1545	1229	1814
6,000	866	639	965	906	1054	1188	1134	1481	6000	866	1277	2099	1341	2420
7,500	1033	1071	1119	1391	1197	1726	1270	2074	7500	1033	1402	2800	1463	3177
9,000	1206	1688	1280	2062	1350	2450	1416	2851	9000	1206	1538	3685	1595	4116
10,500	1383	2527	1448	2956	1511	3399	1570	3853	10500	1383	1682	4793	1735	5277
12,000	1562	3625	1621	4110	1677	4607	1731	5114	12000	1562	1834	6162	1883	6699
13,500	1744	5019	1796	5560	1847	6112	1896	6674	13500	1744	1991	7828	2037	8418
15,000	1926	6745	1974	7343	2020	7951	2065	8567	2110	9193	2153	9829	2195	10473

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	1.6		1.8		2.0		2.2		2.4		2.6		2.8	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	1191	1575	1252	1821	1309	2077	1363	2344	1415	2621	1465	2907	1514	3203
4,500	1292	2091	1351	2377	1408	2671	1462	2974	1513	3285	1563	3604	1610	3931
6,000	1402	2749	1459	3085	1514	3429	1567	3780	1617	4137	1666	4501	1712	4872
7,500	1521	3560	1576	3951	1629	4348	1679	4752	1728	5162	1775	5578	1821	6000
9,000	1649	4554	1701	5000	1752	5452	1800	5911	1847	6376	1893	6846	1937	7322
10,500	1786	5770	1835	6270	1883	6776	1929	7289	1974	7809	2018	8334	2060	8865
12,000	1930	7244	1977	7798	2022	8359	2065	8926	2108	9499	2149	10078	2190	10663
13,500	2081	9017	2124	9623	2167	10237	2208	10858	2248	11485	2288	12118	2326	12758
15,000	2237	11125	2277	11784	2317	12452	2356	13125	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	3.0		3.2		3.4		3.6		3.8		4.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	1560	3508	1605	3823	1649	4146	1691	4477	1732	4817	1772	5165
4,500	1656	4265	1701	4607	1744	4958	1786	5314	1827	5679	1867	6050
6,000	1758	5250	1802	5633	1845	6023	1886	6420	1927	6822	1966	7231
7,500	1865	6427	1909	6861	1950	7300	1991	7744	2031	8193	2070	8649
9,000	1980	7803	2022	8290	2063	8782	2102	9278	2141	9780	2179	10286
10,500	2101	9402	2142	9943	2181	10488	2220	11039	2258	11595	2295	12156
12,000	2230	11255	2269	11852	2307	12453	2344	13058	—	—	—	—
13,500	—	—	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance is based on standard chassis with wet coils and clean 2 in. filters.
b. See Component Pressure Drop data table before using Fan Performance tables.
c. Conversion — 1 watt = 0.00134102 bhp.

LEGEND

— Medium Static Motor

Performance data (cont)

Indoor Fan Performance Data — 48V Size 35 Low Heat[a,b,c]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	0.2		0.4		0.6		0.8		1.0		1.2		1.4	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,500	794	502	794	502	845	600	936	804	1017	1019	1091	1245	1160	1483
4,500	788	496	825	569	924	797	1011	1036	1090	1286	1162	1545	1229	1814
6,000	866	639	965	906	1054	1188	1134	1481	1208	1786	1277	2099	1341	2420
8,000	1090	1254	1172	1592	1247	1945	1318	2311	1384	2687	1447	3073	1506	3467
10,000	1324	2220	1392	2631	1457	3056	1518	3492	1577	3940	1633	4397	1688	4863
12,000	1562	3625	1621	4110	1677	4607	1731	5114	1783	5634	1834	6162	1883	6699
14,000	1804	5556	1855	6115	1904	6686	1952	7266	1999	7857	2045	8456	2089	9064
15,000	1926	6745	1974	7343	2020	7951	2065	8567	2110	9193	2153	9829	2195	10473
17,500	2232	10464	2273	11155	2314	11856	2354	12566	2393	13283	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	1.6		1.8		2.0		2.2		2.4		2.6		2.8	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,500	1224	1730	1284	1987	1341	2255	1395	2532	1447	2818	1497	3114	1545	3418
4,500	1292	2091	1351	2377	1408	2671	1462	2974	1513	3285	1563	3604	1610	3931
6,000	1402	2749	1459	3085	1514	3429	1567	3780	1617	4137	1666	4501	1712	4872
8,000	1563	3870	1617	4278	1669	4694	1719	5116	1767	5544	1814	5978	1859	6418
10,000	1740	5337	1790	5819	1838	6308	1885	6803	1931	7304	1975	7812	2018	8323
12,000	1930	7244	1977	7798	2022	8359	2065	8926	2108	9499	2149	10078	2190	10663
14,000	2132	9681	2175	10304	2216	10936	2257	11575	2296	12219	2335	12870	—	—
15,000	2237	11125	2277	11784	2317	12452	2356	13125	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	3.0		3.2		3.4		3.6		3.8		4.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,500	1592	3731	1637	4052	1680	4383	1723	4721	1764	5067	1804	5421
4,500	1656	4265	1701	4607	1744	4958	1786	5314	1827	5679	1867	6050
6,000	1758	5250	1802	5633	1845	6023	1886	6420	1927	6822	1966	7231
8,000	1903	6863	1946	7314	1987	7771	2028	8232	2067	8698	2106	9170
10,000	2060	8842	2101	9365	2141	9893	2180	10425	2218	10963	2256	11506
12,000	2230	11255	2269	11852	2307	12453	2344	13058	—	—	—	—
14,000	—	—	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance is based on standard chassis with wet coils and clean 2 in. filters.
b. See Component Pressure Drop data table before using Fan Performance tables.
c. Conversion — 1 watt = 0.00134102 bhp.

LEGEND

— Medium Static Motor

Performance data (cont)

Indoor Fan Performance Data — 50V Size 27 No Heat[a,b,c]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in.wg)													
	0.2		0.4		0.6		0.8		1.0		1.2		1.4	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
2,750	794	418	794	418	794	418	882	553	965	689	1041	814	1112	928
3,500	788	410	788	410	840	501	932	684	1014	869	1088	1053	1158	1232
5,500	799	387	907	587	1000	802	1083	1037	1159	1288	1229	1553	1295	1828
7,500	1013	743	1102	1020	1183	1289	1257	1567	1326	1858	1391	2164	1452	2484
9,000	1180	1127	1258	1474	1331	1801	1399	2124	1462	2452	1523	2790	1580	3140
10,500	1350	1631	1420	2056	1486	2449	1548	2828	1607	3205	1663	3584	1716	3969
12,000	1524	2277	1586	2780	1646	3246	1703	3691	1757	4125	1809	4555	1859	4986
13,500	1699	3081	1755	3665	1810	4208	1862	4725	1912	5224	1961	5714	2008	6199

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	1.6		1.8		2.0		2.2		2.4		2.6		2.8	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
2,750	1177	1027	1239	1114	1297	1185	1353	1243	1406	1287	1457	1316	1507	1332
3,500	1222	1404	1283	1567	1341	1721	1397	1866	1449	2000	1500	2123	1549	2235
5,500	1357	2111	1415	2398	1471	2689	1524	2980	1576	3272	1625	3563	1672	3852
7,500	1509	2817	1565	3162	1618	3517	1669	3881	1718	4252	1765	4630	1811	5013
9,000	1635	3502	1687	3875	1738	4261	1787	4658	1834	5064	1879	5481	1924	5905
10,500	1768	4363	1818	4768	1866	5183	1912	5608	1957	6043	2001	6489	2044	6944
12,000	1908	5420	1955	5861	2001	6310	2045	6766	2088	7232	2130	7707	2171	8190
13,500	2054	6682	2098	7168	2141	7656	2183	8150	2224	8652	2264	9159	2303	9675

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	3.0		3.2		3.4		3.6		3.8		4.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
2,750	1554	1333	1600	1321	1645	1295	1688	1256	1731	1203	1772	1137
3,500	1596	2337	1642	2427	1687	2507	1730	2575	1772	2631	1813	2677
5,500	1719	4138	1763	4421	1807	4701	1849	4976	1890	5246	1931	5511
7,500	1855	5400	1899	5792	1941	6185	1982	6580	2022	6977	2061	7376
9,000	1967	6337	2009	6776	2050	7222	2090	7673	2129	8128	2167	8588
10,500	2086	7409	2126	7882	2166	8363	2204	8853	2242	9348	2279	9852
12,000	2211	8684	2250	9186	2288	9696	2325	10217	2362	10743	2398	11279
13,500	2342	10198	2379	10730	2416	11270	2452	11816	—	—	—	—

NOTE(S):

a. Fan performance is based on standard chassis with wet coils and clean 2 in. filters.
b. See Component Pressure Drop data table before using Fan Performance tables.
c. Conversion — 1 watt = 0.00134102 bhp.

LEGEND

— Medium Static Motor

Performance data (cont)

Indoor Fan Performance Data — 50V Size 31 No Heat[a,b,c]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in.wg)													
	0.2		0.4		0.6		0.8		1.0		1.2		1.4	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	794	423	794	423	805	440	898	599	981	754	1057	901	1127	1039
4,500	788	389	817	438	917	633	1004	847	1083	1074	1156	1308	1224	1545
6,000	851	461	954	678	1044	904	1125	1148	1199	1410	1268	1686	1332	1975
7,500	1013	743	1102	1020	1183	1289	1257	1567	1326	1858	1391	2164	1452	2484
9,000	1180	1127	1258	1474	1331	1801	1399	2124	1462	2452	1523	2790	1580	3140
10,500	1350	1631	1420	2056	1486	2449	1548	2828	1607	3205	1663	3584	1716	3969
12,000	1524	2277	1586	2780	1646	3246	1703	3691	1757	4125	1809	4555	1859	4986
13,500	1699	3081	1755	3665	1810	4208	1862	4725	1912	5224	1961	5714	2008	6199
15,000	1875	4066	1927	4731	1977	5353	2025	5946	2072	6516	2117	7072	2161	7618

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	1.6		1.8		2.0		2.2		2.4		2.6		2.8	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	1192	1165	1253	1279	1312	1381	1367	1470	1420	1546	1471	1609	1521	1659
4,500	1287	1784	1347	2022	1404	2257	1458	2488	1510	2714	1561	2934	1609	3148
6,000	1393	2273	1451	2579	1506	2890	1559	3205	1610	3522	1658	3840	1706	4159
7,500	1509	2817	1565	3162	1618	3517	1669	3881	1718	4252	1765	4630	1811	5013
9,000	1635	3502	1687	3875	1738	4261	1787	4658	1834	5064	1879	5481	1924	5905
10,500	1768	4363	1818	4768	1866	5183	1912	5608	1957	6043	2001	6489	2044	6944
12,000	1908	5420	1955	5861	2001	6310	2045	6766	2088	7232	2130	7707	2171	8190
13,500	2054	6682	2098	7168	2141	7656	2183	8150	2224	8652	2264	9159	2303	9675
15,000	2204	8158	2246	8694	2287	9233	2327	9772	2366	10314	2404	10861	2441	11413

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	3.0		3.2		3.4		3.6		3.8		4.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	1568	1696	1614	1720	1659	1731	1702	1730	1744	1716	1785	1689
4,500	1656	3355	1701	3555	1745	3748	1788	3932	1829	4108	1870	4277
6,000	1751	4476	1796	4792	1839	5107	1881	5419	1922	5728	1962	6032
7,500	1855	5400	1899	5792	1941	6185	1982	6580	2022	6977	2061	7376
9,000	1967	6337	2009	6776	2050	7222	2090	7673	2129	8128	2167	8588
10,500	2086	7409	2126	7882	2166	8363	2204	8853	2242	9348	2279	9852
12,000	2211	8684	2250	9186	2288	9696	2325	10217	2362	10743	2398	11279
13,500	2342	10198	2379	10730	2416	11270	2452	11816	—	—	—	—
15,000	2478	11971	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance is based on standard chassis with wet coils and clean 2 in. filters.
b. See Component Pressure Drop data table before using Fan Performance tables.
c. Conversion — 1 watt = 0.00134102 bhp.

LEGEND

— Medium Static Motor

Performance data (cont)

Indoor Fan Performance Data — 50V Size 35 No Heat[a,b,c]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	0.2		0.4		0.6		0.8		1.0		1.2		1.4	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,500	794	420	794	420	840	501	932	684	1014	869	1088	1053	1158	1232
4,500	788	389	817	438	917	633	1004	847	1083	1074	1156	1308	1224	1545
6,000	851	461	954	678	1044	904	1125	1148	1199	1410	1268	1686	1332	1975
8,000	1068	859	1153	1158	1231	1445	1303	1737	1371	2039	1434	2355	1493	2685
10,000	1293	1449	1366	1847	1434	2217	1497	2577	1558	2936	1615	3300	1670	3672
12,000	1524	2277	1586	2780	1646	3246	1703	3691	1757	4125	1809	4555	1860	4986
14,000	1757	3388	1812	3999	1865	4568	1916	5110	1965	5633	2013	6143	2059	6648
15,000	1875	4066	1927	4731	1977	5353	2025	5946	2072	6516	2117	7072	2161	7618
17,500	2171	6162	2216	6962	2260	7719	2303	8442	2344	9138	2385	9814	2425	10473

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	1.6		1.8		2.0		2.2		2.4		2.6		2.8	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,500	1222	1404	1283	1567	1341	1721	1397	1866	1449	2000	1500	2123	1549	2235
4,500	1287	1784	1347	2022	1404	2257	1458	2488	1510	2714	1561	2934	1609	3148
6,000	1393	2273	1451	2579	1506	2890	1559	3205	1610	3522	1658	3840	1706	4159
8,000	1550	3027	1605	3382	1657	3748	1707	4123	1755	4509	1802	4901	1848	5299
10,000	1723	4055	1774	4449	1822	4854	1870	5269	1915	5695	1960	6132	2003	6577
12,000	1908	5420	1955	5861	2001	6310	2045	6766	2088	7232	2130	7707	2171	8190
14,000	2103	7150	2147	7652	2189	8155	2231	8665	2271	9178	2310	9698	2349	10225
15,000	2204	8158	2246	8694	2287	9233	2327	9772	2366	10314	2404	10861	2441	11413
17,500	2464	11122	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	3.0		3.2		3.4		3.6		3.8		4.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,500	1596	2337	1642	2427	1687	2507	1730	2575	1772	2631	1813	2677
4,500	1656	3355	1701	3555	1745	3748	1788	3932	1829	4108	1870	4277
6,000	1751	4476	1796	4792	1839	5107	1881	5419	1922	5728	1962	6032
8,000	1892	5703	1935	6113	1976	6526	2017	6942	2057	7362	2096	7783
10,000	2045	7032	2086	7495	2126	7966	2165	8443	2204	8927	2241	9417
12,000	2211	8684	2250	9186	2288	9696	2325	10217	2362	10743	2398	11279
14,000	2387	10760	2424	11302	2460	11852	—	—	—	—	—	—
15,000	2478	11971	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance is based on standard chassis with wet coils and clean 2 in. filters.
b. See Component Pressure Drop data table before using Fan Performance tables.
c. Conversion — 1 watt = 0.00134102 bhp.

LEGEND

— Medium Static Motor

Performance data (cont)

Exhaust Fan Performance — Low Static (Compact Chassis)[a]

AIRFLOW cfm	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	0.0		0.1		0.2		0.3		0.4		0.5		0.6	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	343	36	588	220	720	431	822	659	910	905	989	1165	1062	1441
4,000	457	85	677	317	810	581	911	861	996	1153	1072	1458	1142	1776
5,000	571	165	765	442	900	761	1001	1093	1086	1438	1161	1793	—	—
6,000	686	285	854	603	988	974	1091	1361	1176	1760	—	—	—	—
7,000	800	453	946	811	1076	1229	1179	1671	—	—	—	—	—	—
8,000	914	676	1042	1075	1164	1536	—	—	—	—	—	—	—	—
9,000	1029	963	1141	1402	—	—	—	—	—	—	—	—	—	—
9,500	1086	1133	1192	1592	—	—	—	—	—	—	—	—	—	—
10,500	1200	1529	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Conversion — 1 watt = 0.00134102 bhp

Exhaust Fan Performance — Low Static (Standard Chassis)[a]

AIRFLOW cfm	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																	
	0.0		0.1		0.2		0.3		0.4		0.5		0.6		0.7		0.8	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	244	25	522	253	658	494	758	739	841	989	912	1247	976	1510	1035	1779	1089	2054
4,000	273	34	580	350	723	671	828	991	914	1315	988	1641	1054	1972	—	—	—	—
5,000	341	66	633	455	783	859	892	1261	981	1661	1058	2062	—	—	—	—	—	—
6,000	409	115	684	570	839	1059	952	1544	1044	2025	—	—	—	—	—	—	—	—
7,000	478	182	735	701	892	1270	1008	1839	—	—	—	—	—	—	—	—	—	—
8,000	546	272	787	851	943	1496	1062	2149	—	—	—	—	—	—	—	—	—	—
9,000	614	387	840	1025	994	1741	—	—	—	—	—	—	—	—	—	—	—	—
11,000	750	706	950	1462	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13,000	887	1165	1065	2040	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15,000	1023	1790	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Conversion — 1 watt = 0.00134102 bhp

Performance data (cont)

Exhaust Fan Performance — Medium Static[a]

Airflow (cfm)	Available External Static Pressure (in. wg)													
	0.2		0.4		0.6		0.8		1.0		1.2		1.4	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
5,500	675	141	751	221	823	311	893	408	959	510	1022	615	1081	722
7,000	819	231	883	328	942	430	1000	541	1056	657	1111	780	1164	908
8,500	966	360	1023	475	1075	593	1124	717	1171	846	1218	982	1265	1123
10,000	1116	534	1168	669	1214	805	1258	944	1300	1088	1341	1236	1381	1390
11,500	1266	761	1315	918	1358	1073	1398	1230	1436	1389	1473	1552	1509	1720
13,000	1418	1048	1464	1228	1504	1404	1541	1580	1576	1757	1610	1936	1643	2119
14,500	1571	1404	1614	1607	1652	1805	1687	2000	1720	2196	1751	2394	1782	2593
16,000	1724	1837	1764	2063	1801	2283	1834	2500	1865	2716	1895	2932	1924	3150
17,500	1877	2353	1916	2603	1950	2846	1982	3085	2012	3322	2041	3558	2068	3795
19,000	2031	2962	2068	3236	2101	3502	2131	3763	2160	4022	2187	4278	2214	4535

Airflow (cfm)	Available External Static Pressure (in. wg)													
	1.6		1.8		2.0		2.2		2.4		2.6		2.8	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
5,500	1136	830	1189	941	1239	1054	1287	1168	1334	1286	1379	1405	1423	1528
7,000	1216	1038	1266	1171	1314	1305	1360	1441	1405	1579	1448	1718	1489	1858
8,500	1311	1270	1356	1421	1400	1575	1443	1732	1485	1891	1526	2052	1566	2215
10,000	1421	1549	1461	1713	1500	1882	1539	2055	1578	2231	1615	2411	1653	2594
11,500	1544	1892	1579	2068	1614	2249	1649	2435	1683	2624	1718	2818	1751	3015
13,000	1675	2305	1707	2495	1739	2689	1770	2887	1801	3089	1832	3295	1862	3505
14,500	1812	2795	1841	3000	1870	3209	1899	3420	1927	3635	1955	3854	1983	4076
16,000	1952	3369	1979	3590	2006	3814	2033	4040	2059	4269	2085	4503	2111	4738
17,500	2094	4032	2120	4271	2146	4511	2171	4754	2195	4999	—	—	—	—
19,000	2239	4791	—	—	—	—	—	—	—	—	—	—	—	—

Airflow (Cfm)	Available External Static Pressure (in. wg)											
	3.0		3.2		3.4		3.6		3.8		4.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
5,500	1465	1653	1507	1782	1548	1913	1588	2048	1627	2186	1666	2327
7,000	1530	2000	1569	2143	1608	2288	1645	2435	1682	2584	1718	2735
8,500	1605	2379	1643	2544	1680	2710	1717	2878	1752	3047	1787	3217
10,000	1689	2778	1726	2965	1761	3153	1796	3343	1830	3535	1864	3727
11,500	1785	3216	1818	3420	1851	3627	1884	3836	1916	4047	1948	4260
13,000	1893	3718	1923	3936	1953	4157	1983	4380	2013	4608	2042	4837
14,500	2011	4302	2038	4532	2066	4765	—	—	—	—	—	—
16,000	2136	4976	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Conversion — 1 watt = 0.00134102 bhp

Application guidance

General

Overview

Consider the following guidance on unit installation and application.

Climate

Verify the geographic location of the installation. The location's climate determines the outdoor air and entering condenser air conditions for sizing and selecting the equipment.

The location can impact the type of operation the unit will need to perform. Warm climates may only require cooling, while mild climates may require both cooling and heating. Humid climates may require dehumidification.

Environment

Consider the areas around the installation site that can impact the unit. Forests, gardens, and fields generate pollen and seeds that can clog condenser coils, outdoor air intake screens, and filters.

Air conditioning units installed near coastlines or in highly polluted areas require special consideration for protecting coils and other metal surfaces from corrosion.

Elevation and altitude

Verify the jobsite elevation as it can impact selection conditions. Air is less dense as elevation increases and affects selection conditions, airflow performance, and gas heat performance.

High altitude units may be subject to high winds and require special attention. The condenser coils may require wind baffles for mechanical cooling during high winds. Gas heat units exposed to high winds may require flue vent extensions.

Units exposed to very high winds require mechanical attachment to the curb or mounting structure with curb clips or anchor bolts.

Codes

Municipalities can have code requirements for packaged air conditioning and heating equipment. Examples include:

- California Title 24 energy code has specific requirements for HVAC units, including economizer operation, demand control ventilation, and demand shedding.
- Chicago Construction Code mandates refrigerant relief valves on any circuit with more than four pounds of refrigerant.
- Florida Building Code has requirements for wind load and full perimeter roof curbs

Review local codes before configuring and installing packaged air conditioning equipment.

Unit location

Overview

Review plans or site notes for obstructions that impede the installation, service access, or airflow. Note utility connection points and sources, including power and control wiring, condensate disposal, gas connections (48V), and hot water connections (50V with hot water coil). Review local code requirements for clearances before finalizing the unit location. Ensure equipment is not accessible by the general public.

Installation clearances

Verify access is available for the rigging and installation of equipment. Review the equipment path for rigging and obstructions that may be present. Avoid rigging equipment over power lines or occupied areas.

Consider access requirements for installing accessories, condensate pipe connections, and power and control wiring connections. Verify clearance for gas piping connections and flue vents for gas heat units. Verify coil piping connection clearances for units with hot water coil.

Service clearances

Refer to the certified drawings for service clearance requirements. Clearances are from the end or side of the unit. The provided dimensions allow for the removal of the largest component in each unit section.

Consider additional service clearances for equipment, such as cranes, gantries, or hoists required to support equipment service.

Control and power box service clearance may be higher if the control box is adjacent to a conductive surface. Review local code requirements for clearance requirements with conductive surfaces.

Condenser airflow clearances

Consider airflow clearance for the condenser. Airflow may be required on the sides and the end of the condenser. Overhead obstructions (within 20 ft) of the condenser fans are not permitted. Side or end obstructions may be permitted if they allow air to pass or do not obstruct more than 10% of the condenser surface.

Do not locate condenser coils near exhaust or scrubber outlets, as the contaminants from the exhaust system can clog or damage the condenser coils.

Keep the condenser coils away from corrosive sources. Use e-coated coils where the environment is mildly corrosive, such as coastal locations.

Outdoor air intake clearances

Do not locate outdoor air intakes within 10 ft of exhaust air sources, flue vent outlets, or other sources of contaminated air. If possible, locate the outdoor air intake away from prevailing winds.

Gas heat clearances

For units with gas heat, clearance is required for the combustion air inlet and flue exhaust. Do not locate combustion inlets near combustible or highly contaminated exhaust air sources.

Do not locate flue gas outlets near the outdoor air intakes of other air conditioning units or ventilation devices.

Exhaust outlet clearance

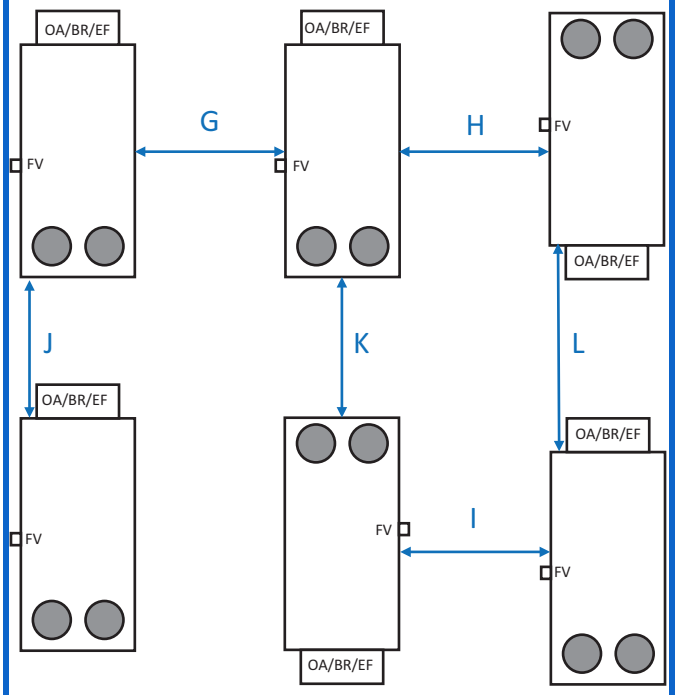
For units with factory-installed exhaust fans, do not locate the exhaust air outlets near the outdoor air intake of other air conditioning units or ventilation devices. Do not locate exhaust outlets of heavily contaminated air near condenser coils or combustion gas inlets.

Multi-unit spacing

For applications with multiple units installed side-by-side or end-by-end, see figure below for minimum unit separation distances. When units have different clearance requirements, use the higher spacing requirement.

Application guidance (cont)

Multiple Unit Spacing — 48/50V Compact Chassis



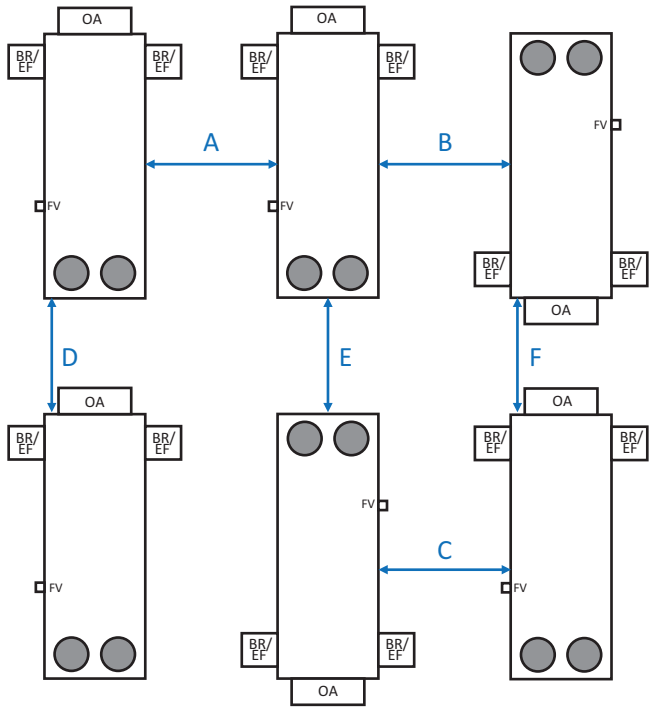
Minimum Unit Spacing (ft)

UNIT	CHASSIS	RELIEF	G	H	I	J	K	L
48V	Compact	None/BR	6	6	8	8	8	8
		EF	6	6	8	8	8	12
50V	Compact	None/BR	6	6	6	8	8	8
		EF	6	6	6	8	8	12

LEGEND

BR — Barometric Relief
EF — Exhaust Fan
FV — Flue Vent (Gas Heat Only)
OA — Outside Air Intake

Multiple Unit Spacing — 48/50V Standard Chassis



Minimum Unit Spacing (ft)

UNIT	CHASSIS	RELIEF	A	B	C	D	E	F
48V	Standard	None/BR	6	6	8	8	8	8
		EF	12	8	12	8	8	8
50V	Standard	None/BR	6	6	6	8	8	8
		EF	12	8	8	8	8	8

LEGEND

BR — Barometric Relief
EF — Exhaust Fan
FV — Flue Vent (Gas Heat Only)
OA — Outside Air Intake

Utility sources

Verify the distance and location of the unit compared to utility sources. Power wire length may be limited by the unit minimum circuit ampacity, available wire size, and the factory terminal block or disconnect lug size.

Control wiring distances can be limited based on wiring size and type. Long wire-length installations may require repeaters.

For gas heat units, verify the distance between the unit and the main gas line and the gas shut-off.

For units with a hot water coil, verify the distance between the hot water coil and the nearest pipe connection. Verify the pump is sized for the flow and pressure drop of the hot water coil and piping.

Unit support

Consider how the unit will be mounted. Direct ground installation is not recommended. Verify structure weight, service clearances and clearances for ducting, power and control wiring, and condensate draining for all support types. Use the following recommended unit support methods: roof curb, support structure or slab mount.

Roof curb

Units can be installed on an accessory or field-provided roof curb. The roof curb support rails must support the unit base pan, not the unit base rail. For field-provided roof curbs, the location and size of curb rails should be no less than the accessory Carrier roof curbs.

Verify sufficient structure is available to support the roof curb and unit weight, as well as any additional loads from wind or heavy snow.

For units with vertical supply or return duct connections, the ductwork must connect to the roof curb, not the unit base pan.

Application guidance (cont)

The air handling section of the unit must use a full perimeter roof curb. The end of the condenser section can rest on a sleeper rail.

For applications that require mechanical attachment of the unit to the roof curb, use field-provided curb clips. The curb clips must connect to the side of the unit base rail.

Consider power and control wire routing when using roof curbs. All units include couplings for thru-the-base power and control wiring.

Support structure

Units can be installed on a field-provided support structure. The structure can support the unit base pan or the base rails.

For a base pan support structure, the structure must provide the same support as a Carrier accessory roof curb. For 27.5-35 ton units support must be provided along the entire perimeter edge of the unit base pan and around the supply and return duct openings.

For a base rail support structure, the support structure must provide support along the entire length of the side base rails. Additional support under the two base pan ends is recommended.

For units with a support structure and vertical supply or return duct connections, the ductwork must connect to the support structure, not the unit base pan or base rails.

Verify that the support structure and other supporting members can support the unit weight and additional loads from wind or heavy snow. Verify that the structure height provides sufficient clearance for condensate drainage.

For applications that require mechanical attachment of the unit to the support structure, use field-provided curb clips or anchor bolts. The curb clips or anchor bolts must connect to the side of the unit base rail.

For installations where the unit bottom is exposed to the elements, protection is required for the base pan insulation. A special order double-wall base pan is available.

Consider power and control wire routing when using support structures. All units include couplings for thru-the-base power and control wiring.

Slab mount

Units can be installed on a field-provided slab. The slab must provide adequate height for condensate drainage.

The slab should be a minimum of 8 in. thick and at least 4 in. above grade. Extend the slab 6 in. beyond the cabinet edge to ensure sufficient space for unit placement.

Carrier recommends using four, semi-equally spaced vibration pads on each side base rail to reduce vibration and sound transmission. The end vibration pads should be within 12 in. of the end of the unit.

Do not locate the slab near roads, exhaust systems, or foliage, where dirt, debris, and pollen can clog the condenser coil, outdoor air screens, and filters. Use a gravel apron near the outdoor air intake, condenser, and gas heat inlet (if equipped) to inhibit the growth of foliage next to the unit.

For installations where the unit bottom is exposed to the elements, protection is required for the base pan insulation. A special order double-wall base pan is available.

Screening

For installation where screening is required, Carrier does not recommend supporting the screen from the unit or curb. The screen should have a separate support system.

For solid panel screens, maintain airflow clearances for the condenser, outdoor air intake, exhaust (if equipped), and gas heat (if equipped) systems.

For perforated or screened panels that allow airflow to pass, airflow clearances may be reduced depending on the panel airflow resistance and air entrapment.

In applications where the screening system is not removable, service clearances must be maintained.

In applications where the screens are removable, the screen can be installed closer to the unit if service clearances can be maintained when the screens are removed.

Ductwork

Review project plans or site reports for supply and return duct orientations and connection locations.

For units with vertical supply or return, the ductwork must connect to the roof curb or support structure. Do not attach the ductwork to the base pan or base rails.

For units with horizontal supply or return, a factory-provided flange is included for ductwork connections.

NOTE: Unit supply and return duct connection orientations are not field convertible.

Condensate drainage

All units require a field-connected condensate drain. The unit must be installed with allowed tolerances to promote drainage. Roof curb, support structures, or slabs should provide adequate clearance to install a condensate drain.

A drain trap is recommended to prevent unfiltered air from entering the unit The drain trap size must be sized for a draw-thru application based on the installed static pressure. Consider waterless traps or trap shutoffs for indoor air quantity-conscious applications.

NOTE: The unit does not have any secondary drain connections in the unit base rails.

Power wiring and protection

For new construction installations, review project documentation for voltage, minimum circuit ampacity (MCA), maximum overcurrent protection (MOCP), and short circuit current rating (SCCR).

For retrofit or replacement installations, review the existing unit information for voltage, minimum circuit ampacity, maximum overcurrent protection, and short circuit current rating. Also review the existing power feed information (if re-used) for voltage, wire size, breaker size, fuse size, disconnect size, and maximum short circuit fault current.

The unit voltage must match the power feed voltage. The units are not field convertible for alternate voltages. For applications with high voltage fluctuations (>10% of nominal), a phase monitor or isolation transformer may be required.

Review the unit minimum circuit ampacity (MCA). This information is used to size the power conductors feeding the unit. The conductors must be rated to handle no less than the MCA value based on the installation length, rated temperature, and wiring arrangement.

Review the unit maximum overcurrent protection (MOCP). This value is used to size the breaker or fuses for the unit power feed. The installed overcurrent protection device cannot be rated higher than the unit MOCP.

It may be acceptable to install an overcurrent protection device that is rated lower than the nameplate MOCP if it has a protection rating no lower than the unit MCA. Using an overcurrent protection device that is rated lower than the MOCP can lead to nuisance trips.

The field-provided power wiring enters the power box through the back panel on the bottom left side (when looking at the front of the power box). Power conductors must be copper. Aluminum conductors are not allowed.

Power wiring connections are made in the dedicated high voltage power box at the terminal block or non-fused disconnect.

For units without a factory-installed non-fused disconnect, a field-provided disconnect is required.

Verify the required short circuit current rating (SCCR) for the unit as specified in the National Electric Code (NEC).

For units with the high short circuit current rating option, a field-provided disconnect or fuse block with J-type current-limiting fuses must be installed and wired upstream of the unit terminal block.

For units without a factory-installed non-fused disconnect, a field-provided disconnect is required.

All units have factory-installed couplings for thru-the-base power and control wiring. The couplings must be sealed-up in the field during installation.

Controls

Review project documentation or jobsite reports on control requirements. Review application details for control methodology and required sensors and control inputs.

For job sites with a building automation system (BAS), verify communication type (BACnet, CCN, Modbus, etc.) and method (MS/TP, IP, etc.)

Most field control wiring connections are made at the terminal blocks in the front of the dedicated low voltage control box. The control wiring enters the control box through the top of the right-side panel (when looking at the front of the control box).

Acoustics

To minimize sound transmitted to the space or areas around the unit, consider the following recommendations:

Location

Avoid locating the unit above sound-sensitive areas. Locate the unit above restrooms, storage areas, corridors, or other noise-tolerant areas.

Locate the units at least 25 ft away from critical areas. If this is not possible, the ductwork and ceiling structure should be acoustically treated. Consider the use of vibration isolators or an acoustic curb.

Avoid locating the unit next to exterior walls or windows of sound-sensitive areas. If unavoidable, locate the condenser away from the occupied space. Use the low-sound condenser fans and compressor sound blankets to reduce radiated sound levels. Use sound barriers as necessary.

Avoid mounting the unit in the middle of large roof expanses between vertical supports. This will minimize the phenomenon known as roof bounce. Install the units close to vertical roof supports (columns or load-bearing walls).

Ductwork

Use flexible connectors between the unit and the supply and return ducts. Supply and return air main trunk ducts should be located over hallways and/or public areas. Provide trailing edge turning vanes in ductwork elbows and tees to reduce air turbulence. Make the ductwork as stiff as possible. Use round duct wherever possible because it is less noisy.

Seal all penetrations around ductwork entering the space. Make sure that ceiling and wall contractors do not attach hangers or supports to ductwork. Provide as smooth and gradual transition as possible when connecting the rooftop unit discharge to the supply duct.

If a ceiling plenum return is used, provide a return elbow or tee to eliminate line-of-sight noise to the space. Face the entrance of the return duct away from other adjacent units.

Acoustic insulation

Provide acoustic interior lining for the first 20 ft of supply and return duct or until the first elbow is encountered. The elbow prevents line-of-sight transmission in the supply and return ducts.

Install a double layer of 2 in. acoustical pads with mass-loaded vinyl facing on top of the roof deck before building insulation and roofing installation occur. Place the material inside the curb and for 4 to 8 ft beyond the unit perimeter.

Openings in the pad should only be large enough for the supply and return ducts. An alternate approach is to use two layers of gypsum board with staggered seams in addition to the acoustical pad.

Indoor fan control

Consider using an indoor fan control method that allows for incremental levels of speed modulation, such as variable air volume (VAV) control. The incremental fan speed changes are less noticeable to occupants than discrete fan speed changes.

Application type

General

Consider how the unit is being applied, as the application type can dictate required operation and factory-installed options.

Single-zone

For most single-zone comfort cooling applications, precise supply air temperature isn't required. In these applications, it may be acceptable to use SAV™ or CV indoor fan control with staged cooling and heating systems, such as staged compressor and two-stage heat.

If precise supply air temperature control is required, then modulating cooling and heating systems, such as variable-capacity compressor and modulating heat, are required. Modulating cooling and heating systems should also be used for third-party modulated indoor fan operation.

Consider using a dehumidification system, like Humidi-MiZer, in applications in humid climates or with high latent loads. Having a dedicated dehumidification mode will allow the unit to dehumidify the space without overcooling. A variable-capacity compressor is recommended with dehumidification operation.

Application guidance (cont)

Multi-zone variable air volume (VAV)

Multi-zone VAV applications with air terminal units require VAV indoor fan control based on duct static pressure. The wide airflow range of multi-zone VAV systems requires modulating cooling and heating systems (such as variable-capacity compressor and modulating heat).

Multi-zone VAV systems do not typically require dedicated dehumidification operation, as the unit typically provides constant cool, dehumidified air whenever there isn't a ventilate or heating demand.

Advanced applications

Contact your local Carrier applied sales representative for guidance on advanced applications, including:

- Process applications
- Mission or condition critical
- Two or more units on a common duct system, "twinned"
- 100% outdoor air or high mixed air (>90°F/32.2°C) operation
- Applications above 115°F (46.1°C) ambient

Application conditions

Consider both full and part-load operating conditions, including airflows, static pressures, and temperatures to ensure the unit is appropriately sized and configured for the application.

For new construction or major retrofit applications, the operating conditions are often subject to the project plans and mechanical schedules.

For replacement applications, operating conditions can be difficult to determine and "like-for-like" replacement isn't always the best option. Information on operating conditions can be obtained from original plans and mechanical schedules, air balance documentation, and BAS trends. If application direct data isn't available, compare existing unit operating parameters (fan speeds, sheave settings, DX temperatures and pressures, etc.) to product data. Also consider changes to the climate and to building loads since the original equipment was installed.

Mechanical cooling and dehumidification airflow

This ensures the application full-load airflow for cooling and dehumidification is within the minimum and maximum full load airflows for the unit. Ensure the part-load airflow for cooling, cool-tempered venting, and part-load dehumidification is at or above the minimum part-load airflow. See "Capacities and ratings" on page 16 for airflow limits.

Mechanical cooling and dehumidification temperatures

- Minimum entering evaporator air temperature: 67°F (19.4°C)
- Maximum entering evaporator air temperature: 90°F (32.2°C)
- Minimum entering condenser air temperature: –10°F (–23.3°C)
- Maximum entering condenser air temperature: 115°F (46.1°C)

Heating airflow

Heating airflow ensures the application full-load airflow for heating is within the minimum and maximum full-load airflows for the heat type. Ensure the part-load airflow for heating, heat-tempered venting, or heat-tempered cooling is above the minimum airflow for heat stage 1 or modulating heat. See "Capacities and ratings" on page 16 for airflow limits by heat type.

Alternate minimum or maximum temperatures may be allowable based on application airflow or unit configuration. Contact your local Carrier applied sales representative for guidance.

Heating temperatures

- Minimum gas heat entering air temperature: 20°F (–6.7°C)
- Maximum gas heat entering air temperature: 75°F (23.8°C)
- Minimum electric heat entering air temperature: 50°F (10°C)
- Maximum electric heat entering air temperature: 75°F (23.8°C)

Alternate minimum or maximum temperatures may be allowable based on application airflow or unit configuration. Contact your local Carrier applied sales representative for guidance.

Construction operation

Operating the unit during the construction phase or before significant building completion is not recommended.

Construction debris and off-gassing from construction materials can enter the unit and damage system components.

Operating the unit with incomplete duct systems, and without proper unit control setup or associated building controls can damage the indoor fan system. Carrier recommends completing a system air balance before operating the indoor fan in automatic mode.

Running cooling, dehumidification, or heating systems without sufficient load, due to lack of airflow, lack of building load, or improper setup and configuration can damage unit systems.

Contact your local Carrier applied sales representative if construction or pre-occupancy operation is required.

Factory-installed option guidance

General

Consider the following guidance on when to use factory-installed options based on application or customer requirements.

NOTE: Factory-installed options cannot be field installed unless they are available as an accessory.

Application type

Staged air volume (SAV™)

Units are intended for use in single-zone applications without air terminal units for space temperature or thermostat input control.

SAV units default to SAV indoor fan control and are field configurable for CV, or third-party input control.

SAV units can be field converted to supply duct static pressure control for true constant volume operation by adding the appropriate duct static pressure sensor and required pneumatic tubing and wiring.

Variable air volume (VAV)

Units are intended for VAV indoor fan based on supply duct static pressure for MZ-VAV applications with air terminal units and return air temperature control.

VAV units default to MZ-VAV supply duct static pressure control. Units can be field configured for third-party modulating control, SAV, or CV.

A modulating heat source (modulating gas, SCR electric, or hot water coil) or no heat is recommended for VAV applications.

Chassis type

Compact chassis

Compact chassis models fit select competitor roof curbs for retrofit applications and provide a small footprint for new construction or retrofit applications with space constraints or lower filtration and static pressure requirements.

Due to the short chassis length, the compact chassis is limited to a maximum of up to 6 inches of total filtration, with a 2 in. pre-filter before a 4 in. pre-filter, and with low static exhaust fans, which can handle up to 0.5 inches of external static pressure.

Standard chassis

Standard chassis models have a larger footprint for retrofit applications of Carrier 48/50P and 48/50Z Series units and have increased fan and filtration capabilities for new construction or retrofit applications.

The longer chassis length allows for up to 12 in. MERV 14 bag or MERV 15 cartridge pre-filters and for medium static exhaust fan motors that can handle up to 43 inches of external static pressure.

Direct expansion options

Low-sound condenser fans

Low-sound condenser fans replace the standard condenser fans with shrouded, AeroAcoustic™ condenser fans with low speed motors, which combine to reduce radiated sound output during cooling and dehumidification operation. Recommended for sound-sensitive applications.

When combined with variable speed control with Greenspeed® intelligence, the lower condenser fan speed and efficient AeroAcoustic fan reduce condenser fan energy consumption during cooling and dehumidification operation. Recommended for applications with high mechanical cooling hours to reduce energy consumption or high electricity costs to reduce operating costs. It is also recommended for applications where higher EER or IEER ratings are required for code or utility rebates.

The lower condenser fan speed can increase condensing temperatures at peak conditions, so use caution when applying this option in high ambient applications or where condenser airflow is restricted (installation, recirculation, debris, etc.).

Humidi-MiZer® adaptive dehumidification

Adaptive dehumidification provides a reheat source that allows the unit to dehumidify without overcooling the space. Humid-MiZer can also improve system performance during simultaneous cooling and dehumidification.

It is recommended for applications where dedicated dehumidification operation is required, such as humid climates, spaces with high humidity loads (gymnasiums, conference areas), or applications with high quantities of outdoor air.

Construction options

Extended section

Required for replacing Carrier 48/50P and 48/50Z Series extended chassis units or to fit an optional factory-installed bag or cartridge filters on 50V standard chassis units.

Plenum section

Required for replacing Carrier 50P and 50Z Series discharge plenum. Also required for replacing legacy gas heat (48P and 48Z) units with cooling only/electric heat/hot water heat (50V) unit. Can be used to fit a factory-installed bag or cartridge filters on 50V standard chassis units.

Drain pan and coil

Stainless steel drain pan

This drain pan is required for applications with mildly corrosive indoor environments or with mildly corrosive outdoor environments and operation with outdoor air.

E-coated MCHX condenser coil

Provides condenser coil protection, which can help maintain unit efficiency and performance.

NOTE: It is required for applications in mildly corrosive environments.

Recommended in rainy climates or applications with frequent condenser coil cleaning to help prevent moisture entrapment in the coil, which can cause head pressure issues or reduces efficiency.

Factory-installed option guidance (cont)

E-coated (Al/Cu) evaporator coil

Provides evaporator coil protection, which can help maintain unit efficiency and performance. E-coated evaporator coils are more susceptible to moisture carry-over than non-coated coils, so the allowable maximum cooling airflow may be limited.

Required for applications with mildly corrosive indoor environments or with mildly corrosive outdoor environments and operation with outdoor air.

E-coat coils have a lower water carry-over threshold and limits the maximum application cooling airflow.

Sensors and controls

Humidity and enthalpy sensors

Provides SmartVu controls with the ability to read return air and outdoor air relative humidity, which are also used to calculate outdoor and return air enthalpy.

Required for applications with Humidi-MiZer system or dehumidification with a field-provided reheat source. Also required for applications with ultra-leak economizer and free cooling based on outdoor air enthalpy or differential outdoor air and return air enthalpy.

Return air CO_2

Allows SmartVu controls to read return air CO_2 levels to approximate indoor air quality or occupancy for units with an ultra-low leak economizer.

Recommended for multi-zone applications where demand-controlled ventilation (DCV) operation is required.

NGC I/O expansion board

Provides SmartVu controls with expanded input capability. Required for the following functionality:

- Outdoor air quality (CO_2) to disable free cooling or ventilation
- Pre-filter pressure drop measuring
- Modulating gas heat (48V only)
- Return air damper actuator

Outdoor air intake and relief options

Ultra-low leak economizer

Provides a modulating outdoor and return air damper for improved ventilation and free cooling.

Required in applications that need constant ventilation rates at varying indoor fan speeds, modulated ventilation rates based on space occupancy, or free cooling using outdoor air. Frequently required by code.

Consider the building pressure control that will be used in conjunction with the ultra-low leak economizer. Configure the unit without building pressure relief or with:

Barometric relief

Allows the relief excess building pressure to be relieved when the outdoor air damper is almost fully opened, and the return air section is mostly fully closed, which commonly occurs during free cooling operation.

Barometric relief should only be used to relieve building pressure during free cooling economizer operation in applications with very low return duct static pressure drops (<0.1 in. wg). An exhaust fan should be used to control building pressure during normal ventilation operation or in applications with more than 0.5 in. wg return duct static pressure drops.

Low static ECM exhaust fans with 2-stage control

Enables two-stage, mechanical building pressure relief based on outdoor air damper position.

Recommended for buildings with low return duct static pressure drops (0.8 in. wg.) where the unit isn't required to maintain a specific building pressure.

Low static ECM exhaust fans with modulating building pressure control

Provides modulated mechanical building pressure relief based on a building pressure reading.

Recommended for buildings with low return duct static pressure drops (<0.8 in. wg) where specific building pressure control is required.

Medium static ECM exhaust fans with modulating building pressure control

Allows modulated mechanical building pressure relief based on a building pressure reading.

Recommended for buildings with 1-4 in. wg return duct static pressure drops.

Electrical

High short circuit current rating (SCCR)

Provides an upgraded power box with terminal block. Required for applications that require SCCR ratings over 10kA. Field-provided, J-type current-limiting fuses must be installed before the unit terminal block in field-supplied fuse box or disconnect. This option is not available for units with electric heat (50V).

Non-fused disconnect

Non-fused disconnect provides the ability to disconnect and lock out electrical service to the unit.

Recommended for most applications with standard SCCR requirements for reduced installation time.

Factory-wired convenience outlet

Includes a 115-v, 10A duplex power outlet that is powered by the main unit power feed using a transformer.

Recommended for most applications to provide power for charging mobile devices or battery-powered tools to facilitate equipment maintenance.

Field-wired convenience outlet

Provides a 115-v duplex power outlet for a field-provided power feed.

Recommended for applications where the outlet is used to support high-power draw devices, such as air compressors or vacuum pumps or where the outlet needs to remain energized when the unit power feed is de-energized (NEC compliance).

Phase monitor

Protects against phase loss, voltage imbalance, and reversed phases.

Recommended for applications with poor power quality to help protect the unit against damage.

Factory-installed option guidance (cont)

Service and safety options

Condensate overflow switch

Protects against drain pan overflow caused by clogged drains.

Recommended for humid climates or where the unit is installed over the occupied space.

Pre-filter status switch and access door retainers

Improves serviceability and can help promote equipment maintenance.

Recommended for ease of service and applications concerned with energy savings or high indoor air quality.

Return air smoke detector

Allows SmartVu controller to shut down the unit when smoke is detected in the return air stream.

May be required by code. Recommended for applications for reduced installation time compared to a field-provided smoked detector.

Direct expansion service package

Provides provisions to isolate the compressors from the refrigerant circuit to allow compressor removal without recovering the entire refrigerant charge. Also includes a replaceable core filter drier for easy refrigerant circuit clean-up in the event of refrigerant charge contamination.

Recommended for applications that require minimum downtime, ease of service, or have high annual compressor run hours.

Chicago refrigerant relief valve

Includes a mechanical refrigerant circuit pressure relief device installed on all unit refrigerant circuits.

Required by select building codes (Chicago) for systems with more than 4 pounds of refrigerant.

Pre-filter measuring and access door retainers

Improves serviceability and can help promote equipment maintenance.

Recommended for applications with MERV 14 or higher filters to promote high indoor air quality and help reduce wasted energy caused by operation with dirty filters.

Indoor air quality

4 in. MERV 8 pleated pre-filters

Effective at filtering contaminants from 3-10 microns in size, such as pollen, mold, and some types of dust.

Recommended for most commercial applications with basic indoor air quantity requirements.

4 in. MERV 13 pleated pre-filters

Effective at filtering contaminants from 1-3 microns in size, such as bacteria, smoke, and most types of dust.

Recommended for applications with high indoor air quantity requirements.

12 in. MERV 14 bag pre-filter

Effective at filtering contaminants from 1-3 microns in size, such as bacteria, smoke, and most types of dust.

Recommended for applications that require very high indoor air quality and low replacement filter costs. Not recommended for applications with airflows below 250 ft per minute or in humid applications.

12 in. MERV 15 cartridge pre-filter

Effective at filtering contaminants from 1-3 microns in size, such as bacteria, smoke, and most types of dust.

Recommended for applications that require very high indoor air quality and have airflows below 250 ft per minute or high humidity.

Ultraviolet wavelength C fixtures (UV-C)

The field-installed UV-C emitters can help inhibit microbial growth on the evaporator coil and in the condensate drain pan.

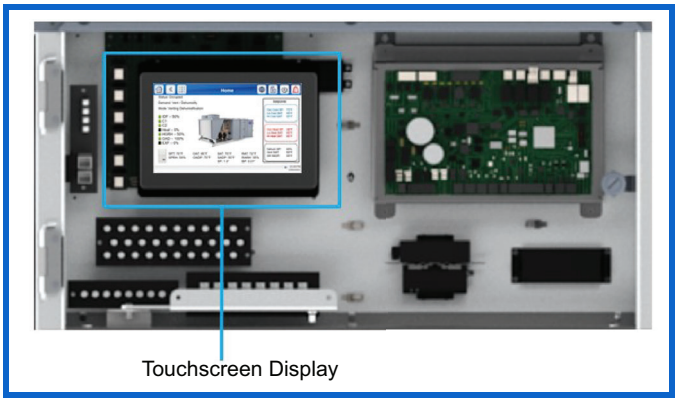
Recommended for applications that require high indoor air quality.

Controls

All 48/50V units feature the factory-installed Carrier SmartVu™ control which is factory-configured to match factory-installed options and can be configured for accessories or field-use devices.

Control interface

The SmartVu touchscreen display is the primary method of interfacing with the controls for setup and equipment start-up. The touchscreen is a resistive-type, 7 in. LCD that can be activated with a finger, touch-compatible gloves, or stylus. The display is in the dedicated low voltage control box.



The SmartVu control can also be accessed remotely by a web browser using the built-in ethernet port. The web browser interface matches the touchscreen display for ease of use.

The control navigation is user-friendly with icon-based navigation and descriptive point and properties names. Menus and settings are protected by multiple levels of user access control, with basic user level access allowing basic equipment setup and start-up capability. Service level access for advanced setup and troubleshooting is available using the Carrier® SMART Service mobile app.

NOTE: This iteration of SmartVu control is not compatible with System Touch or Rnet displays, including the Equipment Touch, and Equipment Touch TruVu™.

Sensors

The SmartVu control system for the 48/50V Series includes a wide array of standard and optional factory-installed sensors. SmartVu control provides the ability to expand functionality by adding an accessory or field-provided sensors using the easy-to-access terminal strip connection.

Sensors

TYPE	INSTALLED
Supply Air Temperature	Standard
Return Air Temperature	Standard
Outdoor Air Temperature	Standard
Space Temperature	Accessory
DX Leaving Air Temperature	Standard
Cooling Coil Air Temperature	Option (HZMR)
Supply Air Temperature	Option or Accessory
Space Relative Humidity	Accessory
Return Air Relative Humidity	Option
Outdoor Air Relative Humidity	Option
DX Leaving Refrigerant Temperature	Field
Condensing Pressure	Standard
Suction Pressure	Standard
Supply Duct Pressure	Option or Accessory
Building Pressure	Option or Accessory
Return Air Co_2	Option or Accessory
Space Co_2	Accessory

NOTE: This iteration of the SmartVu control is not compatible with Rnet sensors, including ZS sensors.

Field-use control inputs

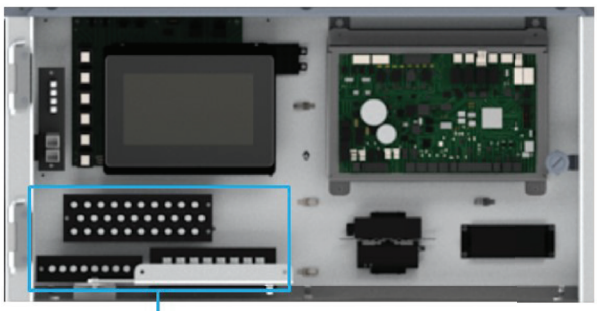
The SmartVu control system supports a range of field-use control inputs for field-supplied sensors or control inputs to adapt unit operation to project-specific needs.

Field-Use Inputs

INPUT TYPE	AVAILABLE
Space Temperature Adjustment	Standard
Space Temperature	Standard
Thermostat Style Inputs (Y1, Y2, W1, W2, G)	Standard
Dehumidify Input	Standard
Demand Limit Switch (X2)	Standard
Demand Limit or Third-party Supply Air Temperature Reset	Standard
Pre-filter Status	Standard
Third-party IDF Modulation or Supply Static Pressure Reset	Standard
Third-party EXF Modulation	Standard
Remote Shutdown or Occupancy Switch	Standard
Emergency Shutdown or Phase Monitor	Standard
Smoke Detector/fire Shutdown Input	Standard
Smoke Purge	Standard
Fire Pressurization	Standard
Fire Evacuation	Standard
Outdoor Air Enthalpy or Outdoor Air Quality Switch	Standard
Indoor Air Quality Switch	Standard
Outdoor Air Quality	With NGC
Pre-filter Measuring	With NGC
Filter Measuring	With NGC

Controls (cont)

Most connections for accessory sensor or field-use control inputs are made at conveniently located terminal blocks in the control panel. See figure below for terminal block locations.



Field-Use Terminal Blocks

Communication

The SmartVu™ control supports native Carrier Comfort Network® (CCN) and BACnet MS/TP and IP communication. The control is plug-and-play with Carrier i-Vu™ 8.0+ systems and supports auto-discovery, built-in unit graphics, and organized point and properties pages.

Modbus®[1] and LonWorks[1] communication are available with accessory translator devices with support for a limited amount of network points.

Sequence of operation

The 48/50V operating sequence will vary based on the unit and control configurations. SmartVu controls all aspects of the unit operation; the cooling system, Humidi-MiZer® system, heating system, indoor fan, exhaust fan, and the economizer. See the 48/50V controls, service, and troubleshooting manual for details. Below is a summary of control configurations and the resulting operating sequence:

Occupancy sources

The occupancy source determines if the unit is in the occupied or unoccupied period and affects active setpoints and available modes. The occupied period provides optimal comfort control for occupants, and the unoccupied period provides reduced or no comfort control for energy savings.

Occupancy Sources

NAME	DESCRIPTION
Occupancy Switch	An input switch status determines occupancy.
BAS Occupancy	A network input determines occupancy.
Unit Schedule	The local unit schedule (in SmartVu) determines occupancy.

Simultaneous use of multiple occupancy sources is allowed. The SmartVu controller uses the higher priority occupancy source when sources conflict. The level of priority (highest first) and description of the source types are as follows:

Occupancy switch

A hardwired, normally open occupancy switch controls occupancy. The unit is unoccupied when the occupancy switch is open, and the unit is occupied when the switch is closed. A field-provided relay and control signal is required to operate the occupancy switch.

BAS occupancy

The unit will monitor the network occupancy command point to determine occupancy. A field-provided and installed BAS system is required.

Local schedule

SmartVu controls determine occupancy based on user-configured schedules. Eight standard schedules are available with optional holiday and override schedules. Each schedule allows a single occupancy start time and stop time, selectable in hour/minute increments and for each day of the week.

Indoor fan operation

The indoor fan operation configurations determine when the indoor fan operates based on the occupancy period. The indoor fan control type can limit indoor fan operation.

Occupied Indoor Fan Operation

NAME	DESCRIPTION
Continuous	The indoor fan operates continuously during the occupied period.
Demand	The indoor fan operates only when there is a cool, heat, ventilate, or dehumidify demand during the occupied period.

The sequence of operation is as follows:

Continuous

The indoor fan is on when the unit is in the occupied period. Continuous indoor fan is the recommended configuration for most applications where the unit is the primary source of ventilation.

Demand

The indoor fan will only operate when there is an occupied cool, heat, ventilate, or dehumidify demand. The indoor fan is off when there isn't an active demand.

Demand operation is not available when the indoor fan control is configured for supply duct pressure. Do not use occupied demand indoor fan control in applications where the unit is the primary source of ventilation.

Unoccupied Indoor Fan Operation

NAME	DESCRIPTION
Demand	The indoor fan operates only when there is a cool, heat, ventilate, or dehumidify demand during the unoccupied period.
Disabled	The indoor fan is off during the unoccupied period.

The sequence of operation is as follows:

Demand

The indoor fan will only operate when there is an unoccupied cool, heat, ventilate, or dehumidify demand. The indoor fan is off when there isn't an active demand.

Disabled

The indoor fan is off during the unoccupied period. This configuration prevents the selection of cooling, heating, or dehumidification modes during the unoccupied period.

1. Third-party trademarks and logos are the property of their respective owners.

Indoor fan control

The indoor fan control configuration determines how the indoor fan operates when it's on. This control configuration may be limited based on the cooling and heating demand determination configuration.

Indoor Fan Control Methods

NAME	DESCRIPTIONS
Constant Volume (CV)	Indoor fan operates at a constant speed for cool or heat demands.
Staged Air Volume (SAV)	Indoor fan stages between discrete speeds based on demand levels or cooling capacity.
Multi-Zone VAV (MZ-VAV)	Indoor fan modulates based on supply duct static pressure.
Third-party Control	Indoor fan modulates based on a third-party signal.

The sequence of operation is as follows:

Constant volume (CV)

The indoor fan operates at the high cool indoor fan speed with a vent, cool, or dehumidify demand. The indoor fan operates at the high heat indoor fan speed with a heat demand.

CV control is intended for single-zone space air conditioning or multi-zone variable volume and temperature (VVT) applications with a bypass damper. Consult local code requirements before using CV control in single-zone space air conditioning applications.

Staged air volume (SAV)

SAV is configurable for two types of operation, SAV Demand or SAV Capacity.

When the indoor fan is configured for SAV Demand, the indoor fan will operate at the IDF min speed with a vent demand, the IDF low cool speed with a low cool demand, the IDF high cool speed with a high cool, VAV cool, or dehumidify demand, the IDF low heat speed with a low heat demand, or the IDF high heat speed with a high heat demand.

When the indoor fan is configured for SAV Capacity, the indoor fan will operate at the IDF min speed with a vent demand, the IDF low cool speed when the cooling capacity is at or below the low cool capacity threshold, the IDF med cool speed when the cooling capacity between the low cool and high cool capacity thresholds, the high cool IDF speed when the system capacity is at or above the high cool capacity threshold or there is a dehumidify demand, the IDF low heat speed when the heating capacity is at or below 75%, and the IDF high heat speed when the heating capacity is above 75%.

SAV control is intended for single-zone space air conditioning applications to provide energy savings, quieter operation, and better dehumidification at part-load conditions compared to CV operation.

Multi-zone variable air volume (MZ-VAV)

When the indoor fan is enabled during a cooling, venting, dehumidifying, or heating mode with modulating heat, the fan will modulate between the minimum and maximum indoor fan speeds to maintain the supply duct static pressure at the static pressure setpoint.

For units equipped with a two-stage heat source, the duct pressure control signal is ignored when heat mode is activated. The indoor fan will operate at the low heat fan speed when the first stage of heat is activated, and the high heat fan speed when the second stage of heat is activated.

MZ-VAV duct static pressure control requires the VAV factory-installed option (supply duct pressure transducer) or a field-provided supply duct pressure transducer.

Supply duct static pressure control is intended for multi-zone variable air volume (VAV) or variable volume and temperature (VVT) applications with pressure-independent air terminal units. Supply duct static pressure control can be used for single-zone space air conditioning applications for true constant volume operation to account for filter loading.

Third-party control

A field-provided binary or network input is required to enable the indoor fan. When enabled, the indoor fan speed modulates between the minimum and maximum fan speeds based on the third-party input signal. For units equipped with a two-stage heat source, the third-party signal is ignored when heat mode is activated. The indoor fan will operate at the low heat fan speed when the first stage of heat is activated, and the high heat fan speed when the second stage of heat is activated.

Third-party indoor fan control is for applications with field-provided direct digital control or building automation system control where a specific method of indoor fan operation is required.

Supply duct static pressure reset

For applications that require reduced operating static at part load for reduced sound, energy savings, or code compliance. Static pressure reset can only be used with MZ-VAV control and should not be used in applications with pressure dependent air terminal units.

Supply Duct Static Pressure Reset

NAME	DESCRIPTION
None	No reset.
SPT	Reset is based on the cooling space temperature.
RAT	Reset is based on the cooling return air temperature.
Third-Party	Reset is based on a third-party input.

The sequence of operation is as follows:

None

Supply pressure reset is not performed. The indoor fan will operate to a constant static pressure setpoint. This configuration is recommended for CV, SAV, or third-party indoor fan control application.

Space temperature (SPT)

When the unit is configured for MZ-VAV, is in a cooling or vent mode, and the space temperature is below the occupied cooling setpoint, the duct static pressure control point is reduced. The static pressure reset is disabled when there is a heat or dehumidify demand.

SPT static pressure reset is recommended for multi-zone VAV applications with a large central zone.

Return air temperature (RAT)

When the unit is configured for MZ-VAV, is in a cooling or vent mode, and the return air temperature is below the occupied cooling setpoint, the duct static pressure control point is reduced. The static pressure reset is disabled when there is a heat or dehumidify demand.

RAT static pressure reset is recommended for multi-zone VAV applications without a dominant central zone.

Third-party reset

When the unit is configured for VAV, is in a cooling or vent mode, and a third-party input is present, the duct static pressure control point is reduced. The static pressure reset is disabled when there is a heat or dehumidify demand.

Third-party static pressure reset is recommended for applications as an alternate to third-party indoor fan control.

Exhaust fan control

The exhaust fan control configuration determines how the exhaust fans are enabled and how they operate. Requires the factory-installed exhaust fan option, which consists of two or more fans. The exhaust fans operate simultaneously and at the same speed.

Exhaust Fan Control

NAME	DESCRIPTION
None	No exhaust fans.
Two-stage Exhaust	Exhaust fans operate at one of two speeds based on outdoor air damper position.
Building Pressure Control	Exhaust fans modulate based on building pressure.
Third-party Control	Exhaust fans modulate based on a third-party signal.

The sequence of operation is as follows:

Two-stage exhaust

The exhaust fans are enabled and will operate at low fan speed when the outdoor air damper position is at or above the first damper position configuration. The exhaust fans will operate at high fan speed when the outdoor air damper position is at or above the second adjustable damper position configuration.

The exhaust fans are off when the outdoor air damper position is below the first adjustable outdoor air damper position, or the outdoor air damper is closed.

Two-stage exhaust control is intended for single-zone space air conditioning applications.

Building static pressure control

When the outdoor air damper is open and the building static pressure is above the building static pressure setpoint, the exhaust fans turn on and simultaneously modulate between the minimum and maximum speeds to maintain the building static pressure at the building static pressure setpoint.

When the building static pressure drops below the building static pressure setpoint or the outdoor air damper closes, the exhaust fans turn off.

Building pressure control requires a factory-installed exhaust fan with the building pressure control option or a field-provided building pressure sensor.

Building pressure control is recommended for multi-zone applications or in applications where building pressure is regulated by code (accessibility).

Third-party control

The exhaust fans are enabled and will modulate based on the outdoor air damper operation and a third-party hard-wired or network input. When the outdoor air damper is open, and the third-party input is active. the exhaust are enabled and will modulate between minimum and maximum speed. Otherwise, the exhaust fans are off.

Third-party indoor fan control is for applications with field-provided direct digital control or building automation system control where a specific method of exhaust fan operation is required.

Outdoor air damper ventilation control

Requires the factory-installed economizer. This configuration determines how the economizer outdoor air damper provides building ventilation during the occupied period.

Outdoor Air Ventilation Control

NAME	DESCRIPTION
Indoor Fan Mapping	Outdoor air damper stages based on the indoor fan speed.
IAQ Control	Outdoor air damper modulates based on CO_2.
Third-party Minimum Position Control	Outdoor air damper modulates the minimum position based on a third-party input.
Third-party Full Control	Outdoor air damper modulates based on a third-party input.

The sequence of operation is as follows:

Indoor fan mapping

When the indoor fan is on during the occupied period, the economizer outdoor air damper opens and modulates between the minimum and maximum positions to maintain a constant ventilation rate at varying indoor fan speeds. The damper position is based on a field configurable four-point damper position curve at four different indoor fan speeds.

Ventilation is not normally performed during the unoccupied period or when the indoor fan is off during the occupied period (demand-based operation).

Indoor fan mapping is intended for use in applications with modulating indoor fan control, including SAV, and supply duct pressure control, or third-party control.

IAQ control

Requires factory-installed return air CO_2 sensor option or field-provided and installed return air or space CO_2 sensor. When the indoor fan is on during the occupied period, the outdoor air damper opens and modulates between the minimum and maximum positions to maintain return air or space CO_2 levels at the indoor air quality (IAQ) level setpoint.

Ventilation is not normally performed during the unoccupied period or when the indoor fan is off during the occupied period (demand-based operation).

IAQ control is intended for use in applications with variable space occupancy levels, such as gymnasiums, conference areas, and cafeterias.

Third-party minimum position control

When the indoor fan is on during the occupied period, the outdoor air damper modulates between the closed and maximum position based on the third-party analog or network signal. Free cooling operation or IAQ reset overrides the third-party commanded damper position.

Ventilation is not normally performed during the unoccupied period or when the indoor fan is off during the occupied period (demand-based operation).

Third-party control is intended for use in applications that require operations that differ from the factory ventilation control methodology but still want SmartVu controls to perform free cooling or IAQ override.

Third-party full control

When the indoor fan is on during the occupied period, the economizer outdoor air damper modulates between the minimum and maximum position based on the third-party analog or network signal. Free cooling operation or IAQ reset are not allowed to override the third-party commanded outdoor air damper position.

Ventilation is not normally performed during the unoccupied period or when the indoor fan is off during the occupied period (demand-based operation).

Third-party control is intended for use in applications that require operations that differ from the factory ventilation control methodology and do not require SmartVu controls to provide free cooling or IAQ overrides.

Cool and heat demand source

The cool and heat demand source configuration determines which inputs control monitors to establish a cool or heat demand. The demand source configuration also affects how the unit operates and must match the intended application type.

Cool and Heat Demand Sources

NAME	DESCRIPTION
Space Temperature (SPT)	Cool and heat demands are based on space temperature (intended for single-zone applications).
Return Air Temperature (RAT)	Cool and heat demands are based on return air temperature (intended for multi-zone applications).
Third-party Input (TSTAT)	Cool and heat demands are based on thermostat-style hardwired or network inputs (Y1, Y2, W1, W2).

For temperature-based demand sources (SPT and RAT), the control compares the demand source temperature sensor reading to the occupied or unoccupied cooling and heating setpoints.

The control will use the occupied setpoints during the occupied period. If the indoor fan is configured for unoccupied demand operation, the control will use the unoccupied setpoint during the unoccupied periods. If the indoor fan is configured for disabled during the unoccupied period, unoccupied demands are ignored.

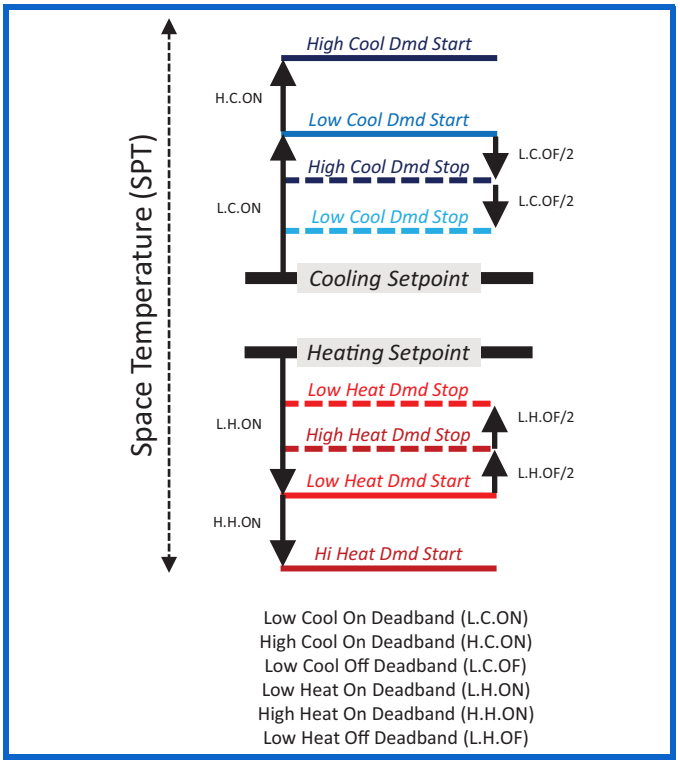
For the input-based cool and heat demand source (TSTAT), the control will monitor the hardwired or networked control inputs to determine if there is a cooling or heating demand.

Once a cool or heat demand is established, the control sets the demand supply air temperature to the supply air temperature setpoint associated with the active demand level.

The following is a summary of each configuration and demand determination:

Space temperature (SPT)

SPT is intended for single-zone space air conditioning applications. Requires a field-installed space temperature sensor.



A cool demand is established when the space temperature is above the space temperature setpoint plus the applicable deadband. A heat demand is established when the space temperature is below the space temperature setpoint minus the applicable deadband. Below is a summary of available demands, demand determination, and supply air temperature setpoints for the SPT demand source:

Low cool (occupied or unoccupied)

If the space temperature is above the occupied or unoccupied cooling setpoint plus the low cool on deadband, the demand is set to low cool. The control sets the demand supply air temperature to the low cool supply air temperature setpoint.

When the space temperature drops below the occupied or unoccupied cooling temperature, plus the low cool on deadband, minus the low cool off deadband, the low cool demand stops.

High cool (occupied or unoccupied)

If the space temperature rises above the occupied or unoccupied cooling setpoint, plus the low cool on deadband, plus the high cool on deadband, the demand is set to high cool. The control sets the demand supply air temperature to the high cool supply air temperature setpoint.

When the space temperature drops below the occupied or unoccupied cooling setpoint, plus the low cool on deadband, and minus one-half of the low cool off deadband, the high cool demand stops.

Controls (cont)

Low heat (occupied or unoccupied)

If the space temperature is below the occupied or unoccupied heating setpoint minus the low heat on deadband, the demand is set to low heat. For units with a modulating or multi-stage heat source, the control sets the demand supply air temperature to the low heat supply air temperature setpoint.

When the space temperature rises above the occupied or unoccupied heating setpoint, minus the low heat on deadband, plus the low heat off deadband, the low heat demand stops.

High heat (occupied or unoccupied)

If the space temperature drops below the occupied or unoccupied heating setpoint, minus the low heat on deadband, minus the high heat on deadband, the demand is set to high heat. For units with a modulating or multi-stage heat source, the control sets the demand supply air temperature to the high heat supply air temperature setpoint.

When the space temperature rises above the occupied or unoccupied heating setpoint, minus the low heat on deadband, plus one-half of the low heat off deadband, the high heat demand stops.

Ventilate (occupied or unoccupied)

When there is no cool or heat demand and the indoor fan is on, demand is set to ventilate. The supply air temperature control point is set to the vent supply air temperature setpoint.

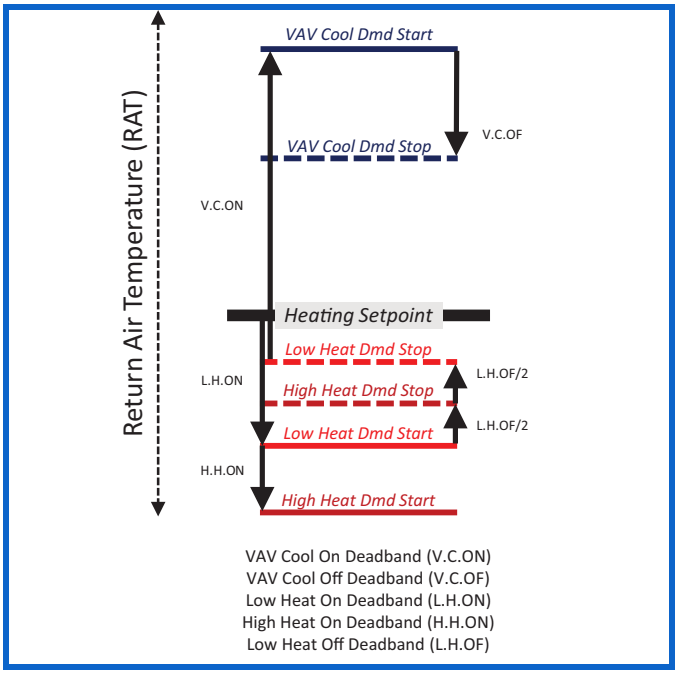
None (occupied or unoccupied)

When there is no cool or heat demand and the indoor fan is off, demand is set to none.

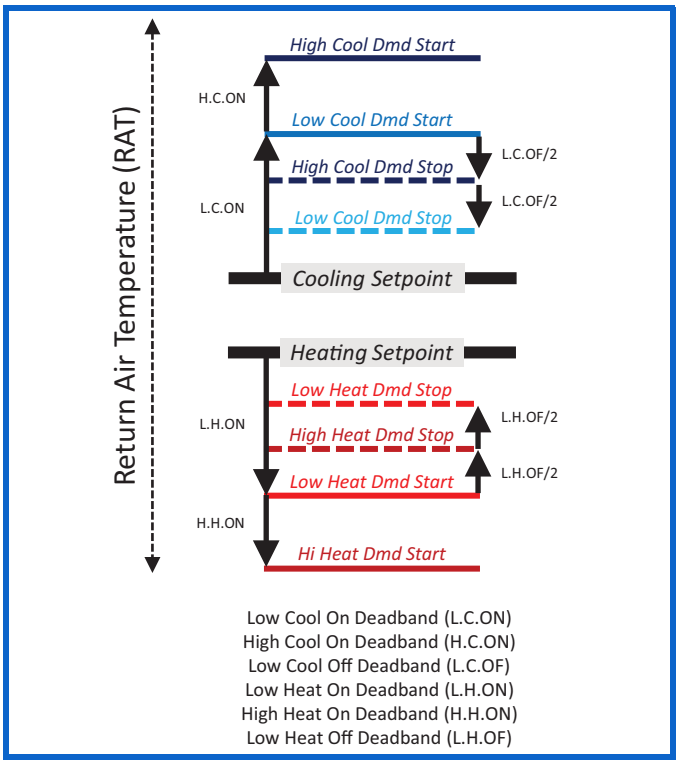
Return air temperature (RAT)

RAT is intended for multi-zone space air conditioning applications with air terminal units. RAT may be used in other applications without air terminal units. The return air temperature sensor used for RAT control is standard on all units.

The figure below illustrates RAT Occupied Demand Levels.



The figure below illustrates RAT Unoccupied Demand Levels.



During the occupied period, the control compares the return air temperature to the occupied heating setpoint and applicable deadbands to establish a VAV cool demand. During the unoccupied period, the control compares the return air temperature to the unoccupied cooling setpoint plus applicable deadbands to establish a low or high cool demand.

A heat demand is established when the return air temperature is below the occupied or unoccupied heating setpoint minus the applicable deadband. Below is a summary of available demands, demand determination, and supply air temperature setpoints for the RAT demand source.

VAV cool (occupied only)

If the return air temperature is above the occupied heating setpoint, minus the low heat on deadband, plus the low heat off deadband, plus the VAV cool on deadband, the demand is set to VAV cool. The control sets the demand supply air temperature to the VAV cool supply air temperature setpoint.

When the return air temperature drops below the occupied heating setpoint, minus the low heat on deadband, plus the low heat off deadband, plus the VAV cool on deadband, minus the VAV cool off deadband, the VAV cool demand stops.

Low cool (unoccupied only)

If the return air temperature is above the unoccupied cooling setpoint plus the low cool on deadband, the demand is set to low cool. The control sets the demand supply air temperature to the low cool supply air temperature setpoint.

When the return air temperature drops below the unoccupied cooling temperature, plus the low cool on deadband, minus the low cool off deadband, the low cool demand stops.

High cool (unoccupied only)

If the return air temperature is above the unoccupied cooling setpoint, plus the low cool on deadband, plus the high cool on deadband, the demand is set to high cool. The control sets the demand supply air temperature to the high cool supply air temperature setpoint.

When the return air temperature drops below the unoccupied cooling setpoint, plus the low cool on deadband, and minus one-half of the low cool off deadband, the high cool demand stops.

Low heat (occupied or unoccupied)

If the return air temperature is below the occupied or unoccupied heating setpoint minus the low heat on deadband, the demand is set to low heat. For units with a modulating or multi-stage heat source, the control sets the demand supply air temperature to the low heat supply air temperature setpoint.

When the return air temperature rises above the occupied or unoccupied heating setpoint, minus the low heat on deadband, plus the low heat off deadband, the low heat demand stops.

High heat (occupied or unoccupied)

If the return air temperature is below the occupied or unoccupied heating setpoint, minus the low heat on deadband, minus the high heat on deadband, the demand is set to high heat. For units with a modulating or multi-stage heat source,the controls set the demand supply air temperature to the high heat supply air temperature setpoint.

When the return air temperature rises above occupied or unoccupied heating setpoint, minus the low heat on deadband, plus one-half of the low heat off deadband, the high heat demand stops.

Ventilate (occupied only)

When there is no cool or heat demand and the indoor fan is on, demand is set to ventilate. The supply air temperature control point is set to the vent supply air temperature setpoint.

None (occupied or unoccupied)

When there is no cool or heat demand and the indoor fan is off, demand is set to none.

Thermostat/third-party input (TSTAT)

TSTAT is intended for single-zone space air conditioning applications with a field-installed, two-stage heat/cool thermostat or single or multi-zone applications with a field-provided digital control system. The cool and heat demand inputs can be enabled using hardwired inputs or network inputs.

A cool demand is established when the Y1 or Y2 inputs are activated. A heat demand is established when the W1 or W2 inputs are activated. An alert is triggered if both a Y and W input are active at the same time. Below is a summary of available demands, demand determination, and supply air temperatures setpoints for the TSTAT demand source:

Low cool (occupied or unoccupied)

When the Y1 input is activated, the demand is set to low cool. The control sets the demand supply air temperature to the low cool supply air temperature setpoint.

When the Y1 input is deactivated, the low cool demand stops.

High cool (occupied or unoccupied)

When the Y1 and Y2 inputs are activated, the demand is set to high cool. The control sets the demand supply air temperature to the high cool supply air temperature setpoint.

If the Y2 input is activated without the Y1 input being activated, the control issues an alarm but the demand is still set to high cool.

Low heat (occupied or unoccupied)

When the W1 input is activated, the demand is set to low heat. For units with a modulating or multi-stage heat source, the controls set the demand supply air temperature to the low heat supply air temperature setpoint.

When the W1 input is deactivated, the low heat demand stops.

High heat (occupied or unoccupied)

When the W1 and W2 inputs are activated, the demand is set to high heat. For units with a modulating or multi-stage heat source, the control sets the demand supply air temperature to the high heat supply air temperature setpoint.

If the W2 input is activated without the W1 input being activated, the control issues an alarm but the demand is still set to high heat.

When the W2 input is deactivated, the high heat demand stops.

Ventilate (occupied or unoccupied)

When there is no cool or heat demand and the indoor fan is on, demand is set to ventilate. The supply air temperature control point is set to the vent supply air temperature setpoint.

None (occupied or unoccupied)

When there is no cool or heat demand and the indoor fan is off, demand is set to none.

Free cooling control

The free cooling control configurations determine if free cooling with outdoor air is allowed during the occupied and unoccupied periods. Requires the factory-installed economizer option.

Occupied Free Cooling

NAME	DESCRIPTION
Disabled	Free cooling is not allowed during the occupied period.
Enabled	Free cooling is available during the occupied period.

The sequence of operation is as follows:

Disabled

Free cooling is disabled during the occupied period. Intended for applications without factory-installed economizers or where code does not require free cooling.

Enabled

Free cooling using outdoor air is available during the occupied period. Intended for applications for energy savings or where required by code.

Unoccupied Free Cooling

NAME	DESCRIPTION
Disabled	Free cooling is not allowed during the unoccupied period.
Enabled	Free cooling is available during the unoccupied period.

The sequence of operation is as follows:

Disabled

Free cooling is disabled during the unoccupied period. Intended for applications without factory-installed economizers or where code does not require unoccupied free cooling.

Enabled

Free cooling using outdoor air is available during the unoccupied period. Intended for applications for energy savings or where required by code.

Free cooling checks

When free cooling is allowed, the control will try to satisfy a cooling demand using free cooling before enabling mechanical cooling. The free cooling checks configurations determine what sensors and setpoints the control checks to prevent free cooling mode.

Free cooling requires the factory-installed economizer and for free cooling operation to be enabled during either the occupied or unoccupied periods. Where allowed, multiple free cooling checks can be used simultaneously.

Outdoor Air Dry Bulb Limit

NAME	DESCRIPTION
Disabled	Outdoor air dry bulb temperature is not checked to prevent free cooling.
Enabled	Outdoor air dry bulb temperature is checked to prevent free cooling.

A factory-installed outdoor air temperature sensor is standard on all units and can be used for dry bulb limit control. Dry bulb limit is recommended for most applications. The sequence of operation is as follows:

Disabled

The outdoor air dry bulb temperature is not checked to prevent free cooling.

Enabled

When free cooling is allowed and there is a demand for cooling, the control compares the outdoor air dry bulb temperature to the dry-bulb temperature. If the outdoor air temperature is at or above the dry bulb limit setpoint, free cooling mode is prevented.

If the outdoor air temperature is below the dry bulb limit setpoint and other free checks prevent free cooling, free cooling mode is prevented.

If the outdoor air temperature is below the dry bulb limit setpoint and no other checks prevent free cooling, free cooling mode is enabled.

Outdoor Air Dewpoint Limit

NAME	DESCRIPTION
Disabled	Outdoor air dewpoint is not checked to prevent free cooling.
Enabled	Outdoor air dewpoint is checked to prevent free cooling.

The outdoor air dewpoint limit requires the factory-installed humidity and enthalpy sensor option (OARH and RARH sensors). The control calculates the dewpoint from outdoor air temperature and relative humidity. The dewpoint limit is recommended for humid climates. The sequence of operation is as follows:

Disabled

The outdoor air dewpoint is not checked to prevent free cooling.

Enabled

When free cooling is available and there is a demand for cooling, the control compares the outdoor air dewpoint to the dewpoint limit. If the outdoor air dewpoint is at or above the dewpoint limit setpoint, free cooling mode is prevented.

If the outdoor air dewpoint is below the dewpoint limit setpoint and other checks prevent free cooling, free cooling mode is prevented.

If the outdoor air dewpoint is below the dewpoint limit setpoint and no other checks prevent free cooling, free cooling mode is enabled.

Free Cooling Changeover

NAME	DESCRIPTION
None	Differential outdoor and return air dry bulb, outdoor air enthalpy, and differential outdoor and return air enthalpy are not checked to prevent free cooling.
Differential Dry Bulb	The differential between outdoor air and return air dry bulb temperatures is checked to prevent free cooling.
Outdoor Enthalpy	Outdoor air enthalpy is checked to prevent free cooling.
Differential Enthalpy	The differential between outdoor air and return air enthalpy is checked to prevent free cooling.

A factory-installed return air temperature sensor is standard on all units and can be used for differential dry bulb changeover. Dewpoint limit is recommended in addition to differential dry bulb changeover.

Enthalpy or differential enthalpy control requires factory-installed humidity and enthalpy sensor option (OARH and RARH). The control calculates enthalpy from outdoor and return air temperature and relative humidity. The dry bulb limit is recommended with enthalpy or differential enthalpy changeover. The sequence of operation is as follows:

None

Differential enthalpy, outdoor air enthalpy, or differential outdoor and return air enthalpy are not checked to prevent free cooling.

Differential dry bulb

Requires the humidity and enthalpy sensing option (OARH and RARH). When free cooling is available and there is a demand for cooling, the control calculates the temperature differential between the outdoor air temperature and return air temperature and compares it to the differential dry bulb threshold.

If the temperature differential is at or above the differential dry bulb limit setpoint, free cooling mode is prevented.

If the temperature differential is below the differential dry bulb limit setpoint and other checks are enabled and prevent free cooling, free cooling mode is prevented.

If the temperature differential is below the differential dry bulb limit setpoint and no other checks are enabled or no other checks prevent free cooling, free cooling mode is enabled.

Enthalpy

Requires the humidity and enthalpy sensing option (OARH and RARH). When free cooling is available and there is a demand for cooling, the control calculates the outdoor air enthalpy.

If the outdoor air enthalpy is at or above 28 Btu/lb, free cooling mode is prevented.

If the outdoor air enthalpy is below 28 Btu/lb and other checks are enabled and prevent free cooling, free cooling mode is prevented.

If the outdoor air enthalpy is below 28 Btu/lb and no other checks are enabled or no other checks prevent free cooling, free cooling mode is enabled.

Differential enthalpy

When free cooling is available and there is a demand for cooling, the control calculates the outdoor air and return air enthalpy levels.

If the outdoor air enthalpy is at or above the return air enthalpy, free cooling mode is prevented.

If the outdoor air enthalpy is below the return air enthalpy and other checks are enabled and prevent free cooling, free cooling mode is prevented.

If the outdoor air enthalpy is below the return air enthalpy and no other checks are enabled or no other checks prevent free cooling, free cooling mode is enabled.

Occupied heating control (morning warm-up)

For units equipped with a heat source and configured for RAT control, the control is configurable to allow morning warm-up only or heating operation anytime during the occupied period.

Occupied Heating

NAME	DESCRIPTION
Disabled	Heating is only allowed at the start of the occupied period.
Enabled	Heating is allowed anytime during the occupied period.

The sequence of operation is as follows:

Disabled (morning warm-up only)

Heating modes are only allowed at the start of the occupied period before a cooling mode starts. The heating mode can start and stop multiple times, up until a cooling mode is enabled. After the cooling mode is enabled, the heating mode is disabled until the start of the next occupied period (or if unoccupied heating is enabled).

Enabled

Heating modes are allowed anytime during the occupied period.

Supply air temperature reset

SAT reset is intended for applications with constant cooling supply air temperatures (VAV) to provide energy savings at part-load conditions.

When the system is cooling and the SAT reset input indicates that the system is at part-load conditions, the supply air temerature control point is increased to save compressor energy. SAT reset is prevented when a dehumidify demand is present.

Supply Air Temperature Reset

NAME	DESCRIPTION
None	No SAT reset.
SPT	Space temperature is used as the SAT reset source.
RAT	Return air temperature is used as the SAT reset.
Third-Party Input	A third-party analog input is used as the SAT reset source.

The sequence of operation is as follows:

None

SAT reset is not performed. Recommended for single-zone applications or multi-zone applications in humid climates.

Space temperature (SPT)

When the unit is configured for RAT, is in a cooling mode, and the space temperature is below the occupied cooling setpoint, the SAT control point is increased based on the SAT reset ratio. The SAT reset is disabled when there is a vent, heat, or dehumidify demand.

SPT SAT reset is recommended for multi-zone VAV applications with a large central zone.

Return air temperature (RAT)

When the unit is configured for RAT, is in a cooling mode, and the return air temperature is below the occupied cooling setpoint, the SAT control point is increased based on the SAT reset ratio. The SAT reset is disabled when there is a vent, heat, or dehumidify demand.

RAT SAT reset is recommended for multi-zone VAV applications without a dominant central zone.

Third-party input (TSTAT)

When the unit is configured for RAT, is in a cooling mode, and a third-party input is present, the SAT control point is increased based on a scale of the input signal between 0°F and 3°F (default). The SAT reset is disabled when there is a vent, heat, or dehumidify demand.

Third-party static pressure reset is recommended for applications as an alternate to third-party input control.

Cooling and heating modes

When there is a cool or heat demand during the occupied period and a cooling or heating source is available, a cooling and heating mode is selected to satisfy the demand. Except for units with a two-stage heat source, heating and cooling operation is based on the supply air temperature control point, which is determined from the demand supply air temperature and any applicable resets (SAT control point = demand SAT ± SAT reset). For units with a 2-stage heat source, operation is based on the demand level.

When there is a cool or heat demand during the unoccupied period, the indoor fan is configured for demand operation during the unoccupied demand, and a cooling or heating source is available, a cooling and heating mode is selected to satisfy the demand.

If the indoor fan is configured for disabled during the unoccupied period, the unit is off during the unoccupied period and will not initiate a cooling or heating mode if there is a cool or heat demand.

The cooling or heating mode that is selected will depend on the supply air temperature control point, the unit and control configuration, and the mixed air temperature. Below is a summary of available cooling and heating modes:

Mechanical cooling

When there is a cool demand, free cooling is disabled or not available, compressors are available, and the mixed air temperature is above the active supply air temperature control point, the mechanical cooling mode is enabled. The compressors turn on and operate to maintain the unit supply air temperature at the supply air temperature control point.

Free cooling (requires economizer)

When there is a cool demand and free cooling is available, and the mixed air temperature is above the supply air temperature control point, free cooling mode is enabled. The outdoor air damper opens and modulates between the ventilation position and maximum position to maintain the unit supply air temperature at the supply air temperature control point.

Integrated cooling (requires economizer)

When there is a cool demand, free cool and compressors are available, and the outdoor air temperature is above the supply air temperature control point, integrated cooling mode is enabled. The outdoor air damper opens to its maximum position and the lowest stage of compression is enabled. Additional stages of compression can be added to maintain the supply air temperature at the supply air temperature control point.

Heat-tempered cooling (requires modulating heat)

When there is a cool demand, and the mixed air temperature is below the supply air temperature control point by the heat tempered cool deadband, the heat-tempered cooling mode is enabled. The modulating heat source turns on and operates to maintain the unit supply air temperature at the supply air temperature control point.

Two-stage heating (requires 2-stage gas or 2-stage electric heat)

When there is a heat demand and the heat source is available, the two-stage heating mode is enabled. Heat stage 1 turns on with a low heat demand, and heat stage 2 turns on with a high heat demand.

Modulated heating (requires modulating gas, modulating electric, or hot water heat)

When there is a heat demand and the heat source is available, modulated heating mode is enabled. The heat source turns on and modulates to maintain the unit supply air temperature at the supply air temperature control point.

Fan-only venting

When there is a demand for ventilate and the mixed air temperature is within the vent supply air temperature setpoint by the vent deadbands, fan-only venting mode is enabled. The indoor fan is on, the outdoor air damper operates at the ventilation control point, and the heating and cooling sources are off.

Cool-tempered venting

When there is a demand for ventilate and the mixed air temperature is above the vent supply air temperature setpoint plus the vent deadband, cool-tempered venting mode is enabled. The compressors turn on and operate to maintain the unit supply air temperature at the vent supply air temperature setpoint.

When the mixed air temperature drops below the vent supply air temperature setpoint, plus the vent deadband, minus one-half of the vent deadband, cool-tempered venting stops.

Heat-tempered venting (requires modulating heat)

When there is a demand for ventilate and the mixed air temperature is below the vent supply air temperature setpoint minus the vent deadband, heat-tempered venting mode is enabled. For units with a modulating or multi-stage heat source, the heat source turns on and operates to maintain the unit supply air temperature at the vent supply air temperature setpoint. For units with a two-stage heat source, heat stage 1 is enabled.

When the mixed air temperature rises above the vent supply air temperature setpoint, minus the vent deadband, plus one-half of the vent deadband, heat-tempered venting stops.

Standby

When there is no cool, heat, or ventilate demand, standby mode is enabled. All components are off.

Oil recovery

If the refrigerant circuit is operating at low capacity for an extended period of time, oil recovery mode will be initiated. The refrigerant circuit capacity will be temporarily increased to promote oil recovery from the refrigerant circuit.

Electronic expansion valve (EXV) recalibration

If the refrigerant circuit has been operating continuously for an extended period of time, the refrigerant circuit is shut down to allow recalibration of the EXVs.

Dehumidify demand source

The dehumidify demand source configuration determines which input is monitored to establish a dehumidify demand. Dehumidify demands are only established if the unit is configured for dehumidification with a reheat source, such as Humidi-MiZer system.

Dehumidify Demand Sources

NAME	DESCRIPTION
Space Relative Humidity (SPRH)	Dehumidify demand is based on space relative humidity(intended for single-zone applications).
Return Air Relative Humidity (RARH)	Dehumidify demand is based on return air relative humidity (intended for multi-zone applications).
Dehumidify Input (HSTAT)	Dehumidify demand is based on dehumidify input.

For relative humidity-based demand sources (SPRH or RARH), the control compares the demand source relative humidity sensor reading to the dehumidify relative humidity setpoint.

For the input based dehumidify demand source (TSTAT), the control will monitor the hardwired or networked control inputs to determine if there is a dehumidify demand.

Once a dehumidify demand is established, the control sets the cooling coil temperature control point to the dehumidify cooling coil temperature setpoint. The cooling coil temperature is an approximate for the supply air dewpoint temperature.

A dehumidify demand can co-exist with a cool, heat, or ventilate demand. If the current demand is none and a dehumidify demand starts, the demand is changed to ventilate. Below is a summary of each configuration and demand determination:

Space relative humidity (SPRH)

Requires a field-provided and installed space relative humidity sensor. SPRH is intended for single-zone space air conditioning applications. The following figure illustrates SPRH Demand Levels.

When the space relative humidity is above the dehumidify relative humidity setpoint, plus the dehumidify deadband, a dehumidify demand starts. The control set the cooling coil temperature control point to the dehumidify cooling coil temperature setpoint.

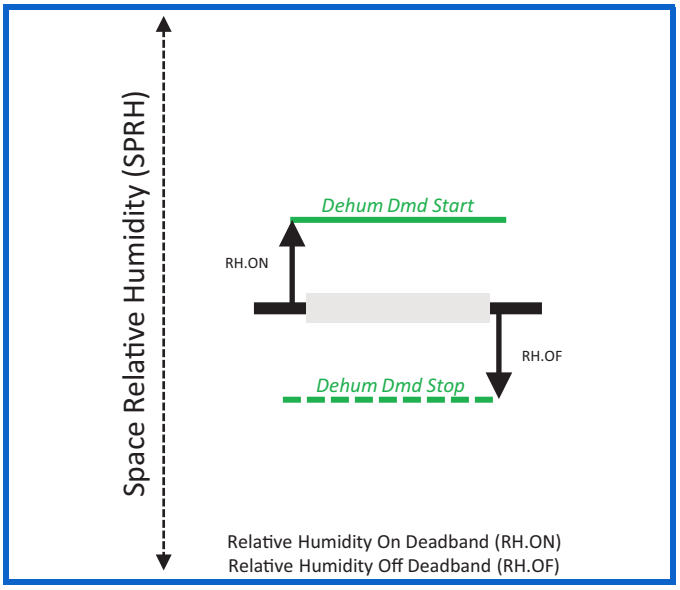
When the space relative humidity drops below the dehumidify relative humidity setpoint, minus the dehumidify off deadband, the dehumidify demand stops.

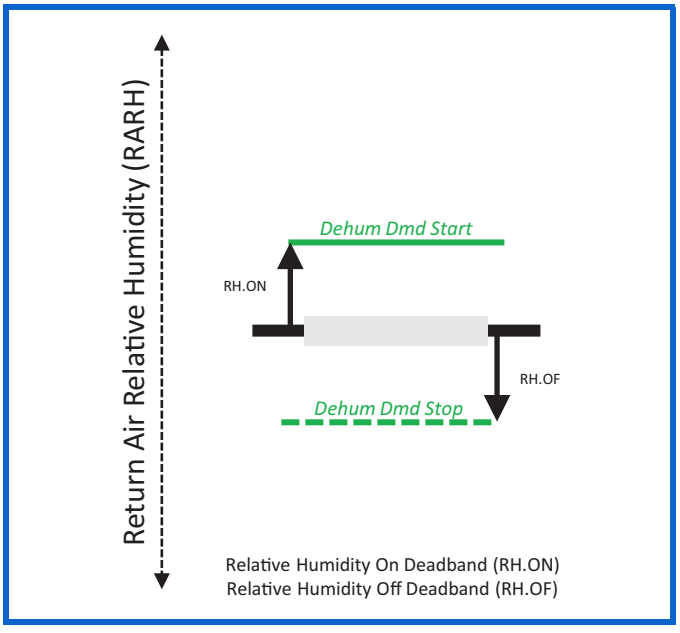
Return air relative humidity (RARH)

Requires the humidity and enthalpy sensor option (OARH and RARH sensors). RARH is intended for multi-zone space air conditioning applications but can also be used for single-zone applications.

When the return air relative humidity is above the dehumidify relative humidity setpoint, plus the dehumidify deadband, a dehumidify demand starts. The control set the cooling coil temperature control point to the dehumidify cooling coil temperature setpoint.

When the return air relative humidity drops below the dehumidify relative humidity setpoint, minus the dehumidify off deadband, the dehumidify demand stops.





Dehumidify input (HSTAT)

HSTAT requires a field-provided humidistat or thermostat with dehumidification output for single-zone space air conditioning applications. A digital control with hardwired or network dehumidification output can be used for single or multi-zone applications.

When the dehumidify input is active, a dehumidify demand starts. The control set the cooling coil temperature control point to the dehumidify cooling coil temperature setpoint. When the dehumidify input is deactivated, the dehumidify demand stops.

Dehumidify co-demands

The dehumidify co-demand configuration determines when the system is allowed to satisfy a dehumidification demand based on the existence of a cooling, heating, or ventilate demand.

The control can be configured to ignore a dehumidify demand when there is a cooling demand (low, high, or VAV cool) or a heating demand (low or high heat) for applications where temperature control is paramount. A dehumidify demand is always allowed with a ventilate demand.

For single-zone comfort cooling applications, the recommended configuration is to allow dehumidification with a low cool or ventilate demand. For multi-zone applications with constant cooling supply air temperatures, the recommended configuration is dehumidification only with a ventilate demand.

Dehumidification modes

If the unit is equipped with a reheat source, such as Humidi-MiZer® system, the compressors are available and a dehumidify demand isn't prevented, The SmartVu controller can enable a dehumidification mode to satisfy a dehumidify demand. When a dehumidification mode is activated, the compressors are controlled to maintain the cooling coil (evaporator) leaving air temperature at the dehumidify cooling coil temperature (CCT) setpoint. The reheat system is controlled to maintain the supply air temperature at the demand supply air temperature. Since SAT reset is disabled during dehumidification mode, the supply air temperature control point is the demand supply air temperature.

Dehumidification modes are available during the occupied period and are only available during the unoccupied period when the indoor fan is configured for demand unoccupied operation.

Below is a summary of available dehumidification modes and with the modulating Humidi-MiZer adaptive dehumidification system. The dehumidification operation will be similar for other reheat types.

Venting dehumidification

When there is a dehumidify demand, but no cool or heat demand, venting dehumidification mode is enabled.

The compressors are enabled and will operate to maintain the cooling coil leaving air temperature at the dehumidify CCT setpoint.

The Humidi-MiZer system is enabled, and mostly hot refrigerant gas is directed to the Humidi-MiZer coil. The mix of hot gas and warm liquid refrigerant entering the Humidi-Mizer coil modulates to maintain the unit supply air temperature at the ventilate demand supply air temperature.

Cooling dehumidification

When cooling dehumidification mode is available, and there is both a dehumidify and a cool demand, cooling dehumidification mode is enabled.

The compressors are enabled, and will operate to maintain the cooling coil leaving air temperature at the dehumidify CCT setpoint.

The Humidi-MiZer system is enabled mostly warm refrigerant liquid is directed to the Humidi-MiZer coil to sub-cool the refrigerant and increase the evaporator capacity, which improves dehumidification performance. The mix of hot gas and warm liquid refrigerant entering the Humidi-Mizer coil modulates to maintain the unit supply air temperature at the active cool demand supply air temperature. Under some conditions, the Humidi-MiZer leaving air temperature may be higher than the cool demand air temperature.

Heating dehumidification (requires modulating heat)

When heating dehumidification mode is available, and there is both a dehumidify and a heat demand, heating dehumidification mode is enabled.

The compressors are enabled and will operate to maintain the cooling coil leaving air temperature at the dehumidify CCT setpoint.

The Humidi-MiZer system is enabled, and mostly hot refrigerant gas is directed to the Humidi-MiZer coil. The mix of hot gas and warm liquid refrigerant entering the Humidi-Mizer coil modulates to maintain the unit supply air temperature at the heat demand supply air temperature.

Humidi-MiZer recharge

At the first start-up of a cooling circuit with Humidi-MiZer (for cooling or dehumidification) and periodically during extended Humidi-MiZer operation, a Humidi-MiZer recharge is initialed to recharge the Humidi-MiZer coil with liquid refrigerant.

Humidi-MiZer purge

When the Humidi-MiZer system is operating for extended periods with the bypass valve mostly open, a Humidi-MiZer purge is initiated to recovery any oil that may be trapped in the condenser coils.

Special Operating Modes

SmartVu™ controls are available with special operating modes to override normal unit operation to meet unique conditions.

Special Operating Modes

NAME	DESCRIPTION
Service Test	Normal operation is disabled to allow component or system testing.
Service Run	Normal unit operation is enabled and unit components and systems can be manipulated for testing.
Pre-occupancy Purge	The outdoor air damper is open, and the indoor fan is on to ventilate the building before occupancy.
Temperature Compensated Start	The indoor fan and cooling or heating systems are on to pre-cool or pre-heat the building before occupancy.
Emergency Shutdown	The unit operation is disabled due to: – Indoor fan door switch – Phase monitor shutdown – Active emergency shutdown input – Emergency shutdown from the user interface
Fire Shutdown	The unit operation is disabled due to an active fire or smoke shutdown input.
Fire Pressurization	The indoor fans are on at the max speed and the outdoor air damper is open to its max position to pressurize the building. The exhaust fans are off.

Special Operating Modes

NAME	DESCRIPTION
Fire Evacuation	The indoor fans are off, and the outdoor air damper is closed. The exhaust fans are on at the max speed to de-pressurize the building.
Smoke Purge	The indoor fans and exhaust fans are on at max speed and the outdoor air damper is open to max position to purge smoke from the building.

Advanced Control Functions

SmartVu™ controls are available with additional advance control functions to meet application or operational requirements.

Advanced Control Functions

NAME	DESCRIPTION
Cool Demand Limit	Increases the effective occupied cooling setpoint based on a setpoint, limit switches, or analog input.
Heat Demand Limit	Decreases the effective occupied heating setpoint based on a setpoint, limit switches, or analog input.
Cool Capacity Limit	Restricts the maximum cooling capacity (%) based on a setpoint, limit switches, or analog input.
Heat Capacity Limit	Restricts the maximum heating capacity (%) based on a setpoint, limit switches, or analog input.
Economizer FDD	Provides economizer fault detection and diagnostics.
RAD Mapping	For units with an independent return air damper actuator, this allows modification of RAD position based on OAD position.
IAQ Reset	Resets the damper ventilation position based on IAQ switch or sensor.
OAQ Shutoff	Prevents free cooling and ventilation based on an OAQ sensor or switch.

48V Electrical Data[a]

UNIT SIZE 48V	V-Ph-Hz	VOLTAGE RANGE		COMPRESSOR A1		COMPRESSOR A2		STANDARD CDFM		LS[b] CDFM		IFM			PEM			WIRED C/O	CONTROLS
		Min	Max	RLA	LRA	RLA	LRA	Qty	FLA (ea)	Qty	FLA (ea)	Qty	STATIC	FLA (ea)	Qty	STATIC	FLA (ea)	FLA	FLA
27	208-3-60	187	253	55.8	340	28.2	239	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	4.8
													Med	11.6		Low STD	3.75		
													High	TBD		Med	18		
	230-3-60	187	253	55.8	340	28.2	239	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	4.8
													Med	11.6		Low STD	3.75		
													High	TBD		Med	18		
	460-3-60	414	506	26.9	173	14.7	130	2	3.4	2	2.8	3	Std	TBD	2	Low CPT	2	2.7	2.4
													Med	6.8		Low STD	2.1		
													High	TBD		Med	8.7		
	575-3-60	518	633	23.7	132	11.3	93.7	2	2.6	2	2.4	3	Std	TBD	2	Low CPT	1,6	2.3	2
													Med	5		Low STD	1.8		
													High	N/A		Med	4.4		
31	208-3-60	187	253	55.8	340	48.1	245	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	4.8
													Med	11.6		Low STD	3.75		
													High	TBD		Med	18		
	230-3-60	187	253	55.8	340	48.1	245	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	4.8
													Med	11.6		Low STD	3.75		
													High	TBD		Med	18		
	460-3-60	414	506	26.9	172	18.6	125	2	3.4	2	2.8	3	Std	TBD	2	Low CPT	2	2.7	2.4
													Med	6.8		Low STD	2.1		
													High	TBD		Med	8.7		
	575-3-60	518	633	23.7	132	14.7	100	2	2.6	2	2.4	3	Std	TBD	2	Low CPT	1,6	2.3	2
													Med	5		Low STD	1.8		
													High	N/A		Med	4.4		
35	208-3-60	187	253	62.1	528.2	34.0	240	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	4.8
													Med	11.6		Low STD	3.75		
													High	TBD		Med	18		
	230-3-60	187	253	62.1	528.2	34.0	240	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	4.8
													Med	11.6		Low STD	3.75		
													High	TBD		Med	18		
	460-3-60	414	506	33	264.9	16	140	2	3.4	2	2.8	3	Std	TBD	2	Low CPT	2	2.7	2.4
													Med	6.8		Low STD	2.1		
													High	TBD		Med	8.7		
	575-3-60	518	633	24	180	12.9	107.6	2	2.6	2	2.4	3	Std	TBD	2	Low CPT	1,6	2.3	2
													Med	5		Low STD	1.8		
													High	N/A		Med	4.4		

NOTE(S):

a. Data is preliminary and subject to change.
b. LS is a low-sound condenser fan.

LEGEND

CDFM — Condenser Fan Motor
LS CDFM — Low-Sound Condenser Fan Motor
C/O — Convenience Outlet
CPT — Compact CHassis
EXF — Exhaust Fan Motor
IFM — Indoor Fan Motor
STD — Standard Chassis

50V Electrical Data[a]

UNIT SIZE 50V	V-Ph-Hz	VOLTAGE RANGE		COMPRESSOR A1		COMPRESSOR A2		STANDARD CDFM		LS[b] CDFM		IFM			PEM			WIRED C/O	ELECTRIC HEAT			CONTROLS
		Min	Max	RLA	LRA	RLA	LRA	Qty	FLA (ea)	Qty	FLA (ea)	Qty	STATIC	FLA (ea)	Qty	STATIC	FLA (ea)	FLA	SIZE	APP kW	FLA	FLA
27	208-3-60	187	253	55.8	340	28.2	239	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	Low	27	74.9	4.8
													Med	11.6		Low STD	3.75		Med	54	149.9	
													High	TBD		Med	18		High	81	224.8	
	230-3-60	187	253	55.8	340	28.2	239	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	Low	36	86.6	4.8
													Med	11.6		—	3.75		Med	72	172.3	
													High	TBD		Med	18		High	108	259.8	
	460-3-60	414	506	26.9	173	14.7	130	2	3.4	2	2.8	3	Std	TBD	2	Low CPT	2	2.7	Low	36	43.3	2.4
													Med	6.8		—	2.1		Med	72	86.6	
													High	TBD		Med	8.7		High	108	129.9	
	575-3-60	518	633	23.7	132	11.3	93.7	2	2.6	2	2.4	3	Std	TBD	2	Low CPT	1.6	2.3	Low	36	34.6	2
													Med	5		—	1.8		Med	72	69.3	
													High	N/A		Med	4.4		High	108	103.9	
31	208-3-60	187	253	55.8	340	48.1	245	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	Low	27	74.9	4.8
													Med	11.6		—	3.75		Med	54	149.9	
													High	TBD		Med	18		High	81	224.8	
	230-3-60	187	253	55.8	340	48.1	245	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	Low	36	86.6	4.8
													Med	11.6		Low STD	3.75		Med	72	172.3	
													High	TBD		Med	18		High	108	259.8	
	460-3-60	414	506	26.9	173	18.6	125	2	3.4	2	2.8	3	Std	TBD	2	Low CPT	2	2.7	Low	36	43.3	2.4
													Med	6.8		Low STD	2.1		Med	72	86.6	
													High	TBD		Med	8.7		High	108	129.9	
	575-3-60	518	633	23.7	132	14.7	100	2	2.6	2	2.4	3	Std	TBD	2	Low CPT	1.6	2.3	Low	36	34.6	2
													Med	5		Low STD	1.8		Med	72	69.3	
													High	N/A		Med	4.4		High	108	103.9	
35	208-3-60	187	253	62.1	5282	34.0	240	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	Low	27	74.9	4.8
													Med	11.6		Low STD	3.75		Med	54	149.9	
													High	TBD		Med	18		High	81	224.8	
	230-3-60	187	253	62.1	528.2	34.0	240	2	6.8	2	5.8	3	Std	TBD	2	Low CPT	3.3	5.3	Low	36	86.6	4.8
													Med	11.6		Low STD	3.75		Med	72	172.3	
													High	TBD		Med	18		High	108	259.8	
	460-3-60	414	506	33	264.9	16	140	2	3.4	2	2.8	3	Std	TBD	2	Low CPT	2	2.7	Low	36	43.3	2.4
													Med	6.8		Low STD	2.1		Med	72	86.6	
													High	TBD		Med	8.7		High	108	129.9	
	575-3-60	518	633	24	180	12.9	107.6	2	2.6	2	2.4	3	Std	TBD	2	Low CPT	1.6	2.3	Low	36	34.6	2
													Med	5		Low STD	1.8		Med	72	69.3	
													High	N/A		Med	4.4		High	108	103.9	

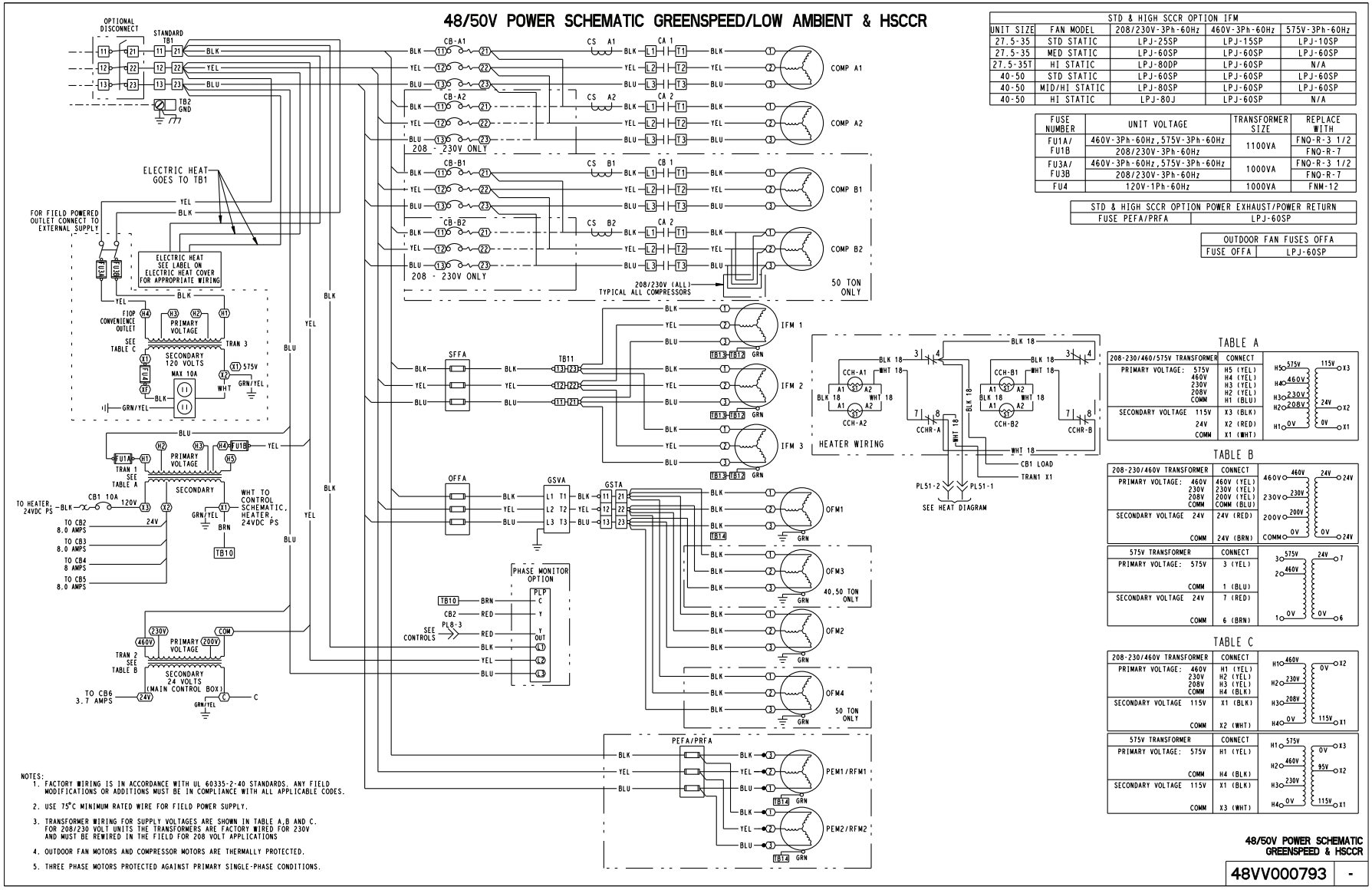
NOTE(S):

a. Data is preliminary and subject to change.
b. LS is a low-sound condenser fan.

LEGEND

CDFM — Condenser Fan Motor
LS CDFM — Low-Sound Condenser Fan Motor
C/O — Convenience Outlet
CPT — Compact Chassis
EXF — Exhaust Fan Motor
IFM — Indoor Fan Motor
STD — Standard Chassis

48/50V Power Schematic



STD & HIGH SCCR OPTION IFM				
UNIT SIZE	FAN MODEL	208/230V-3Ph-60Hz	460V-3Ph-60Hz	575V-3Ph-60Hz
27.5-35	STD STATIC	LPJ-25SP	LPJ-15SP	LPJ-10SP
27.5-35	MED STATIC	LPJ-60SP	LPJ-60SP	LPJ-60SP
27.5-35T	HI STATIC	LPJ-80DP	LPJ-60SP	N/A
40-50	STD STATIC	LPJ-60SP	LPJ-60SP	LPJ-60SP
40-50	MID/HI STATIC	LPJ-80SP	LPJ-60SP	LPJ-60SP
40-50	HI STATIC	LPJ-80J	LPJ-60SP	N/A

FUSE NUMBER	UNIT VOLTAGE	TRANSFORMER SIZE	REPLACE WITH
FU1A/ FU1B	460V-3Ph-60Hz,575V-3Ph-60Hz	1100VA	FNQ-R-3 1/2
	208/230V-3Ph-60Hz		FNQ-R-7
FU3A/ FU3B	460V-3Ph-60Hz,575V-3Ph-60Hz	1000VA	FNQ-R-3 1/2
	208/230V-3Ph-60Hz		FNQ-R-7
FU4	120V-1Ph-60Hz	1000VA	FNM-12

STD & HIGH SCCR OPTION POWER EXHAUST/POWER RETURN	
FUSE PEFA/PRFA	LPJ-60SP

OUTDOOR FAN FUSES OFFA	
FUSE OFFA	LPJ-60SP

TABLE A

208-230/460/575V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 575V	H5 (YEL)
460V	H4 (YEL)
230V	H3 (YEL)
208V	H2 (YEL)
COMM	H1 (BLU)
SECONDARY VOLTAGE 115V	X3 (BLK)
24V	X2 (RED)
COMM	X1 (WHT)

TABLE B

208-230/460V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 460V	460V (YEL)
230V	230V (YEL)
208V	200V (YEL)
COMM	COMM (BLU)
SECONDARY VOLTAGE 24V	24V (RED)
COMM	24V (BRN)

575V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 575V	3 (YEL)
COMM	1 (BLU)
SECONDARY VOLTAGE 24V	7 (RED)
COMM	6 (BRN)

TABLE C

208-230/460V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 460V	H1 (YEL)
230V	H2 (YEL)
208V	H3 (YEL)
COMM	H4 (BLK)
SECONDARY VOLTAGE 115V	X1 (BLK)
COMM	X2 (WHT)

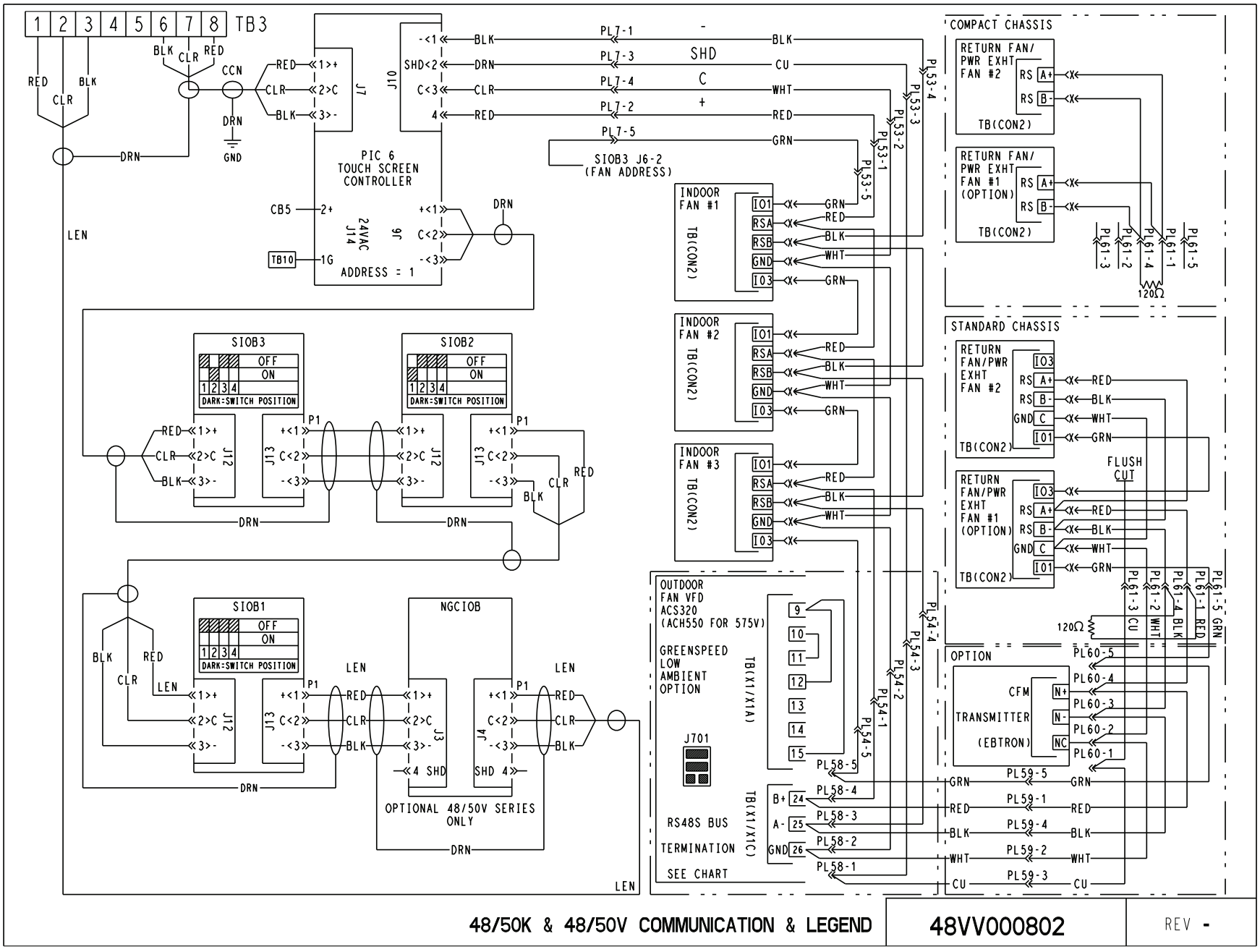
575V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 575V	H1 (YEL)
COMM	H4 (BLK)
SECONDARY VOLTAGE 115V	X1 (BLK)
COMM	X3 (WHT)

NOTES:
1. FACTORY WIRING IS IN ACCORDANCE WITH UL 60335-2-40 STANDARDS. ANY FIELD MODIFICATIONS OR ADDITIONS MUST BE IN COMPLIANCE WITH ALL APPLICABLE CODES.
2. USE 75°C MINIMUM RATED WIRE FOR FIELD POWER SUPPLY.
3. TRANSFORMER WIRING FOR SUPPLY VOLTAGES ARE SHOWN IN TABLE A,B AND C. FOR 208/230 VOLT UNITS THE TRANSFORMERS ARE FACTORY WIRED FOR 230V AND MUST BE REWIRED IN THE FIELD FOR 208 VOLT APPLICATIONS
4. OUTDOOR FAN MOTORS AND COMPRESSOR MOTORS ARE THERMALLY PROTECTED.
5. THREE PHASE MOTORS PROTECTED AGAINST PRIMARY SINGLE-PHASE CONDITIONS.

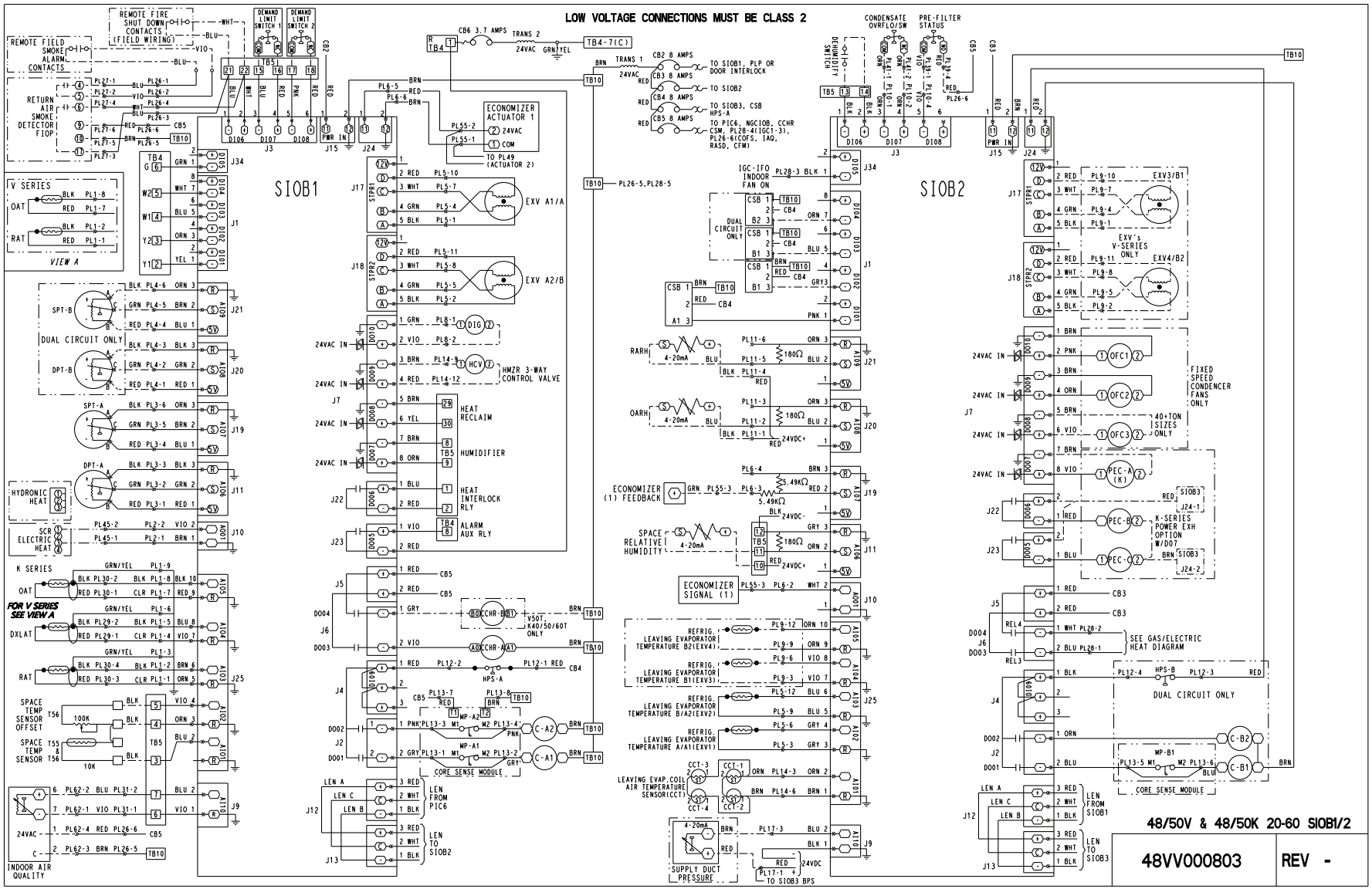
48/50V POWER SCHEMATIC GREENSPEED & HSCCR

48VV000793 -

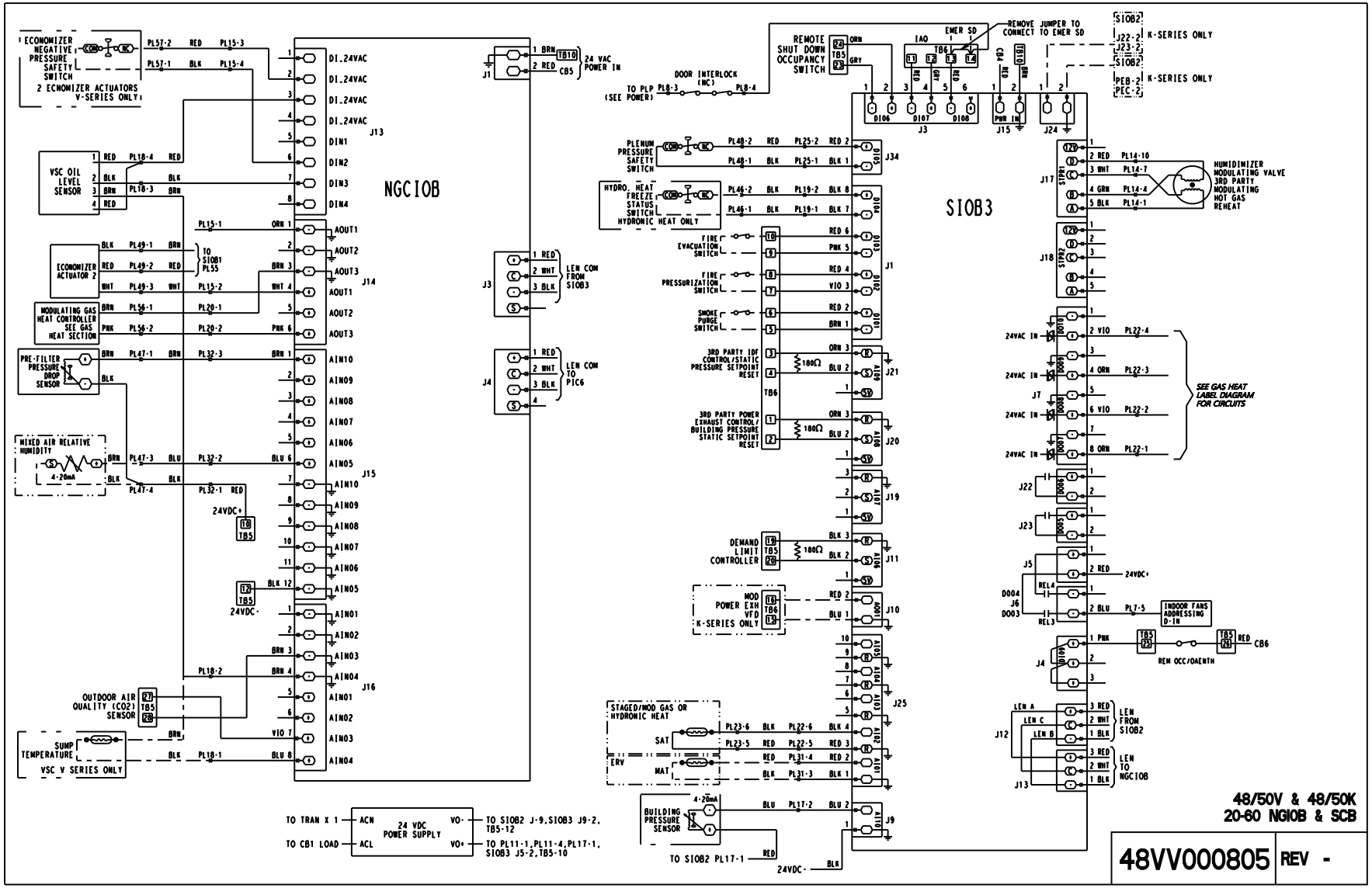
48/50V Communication Schematic



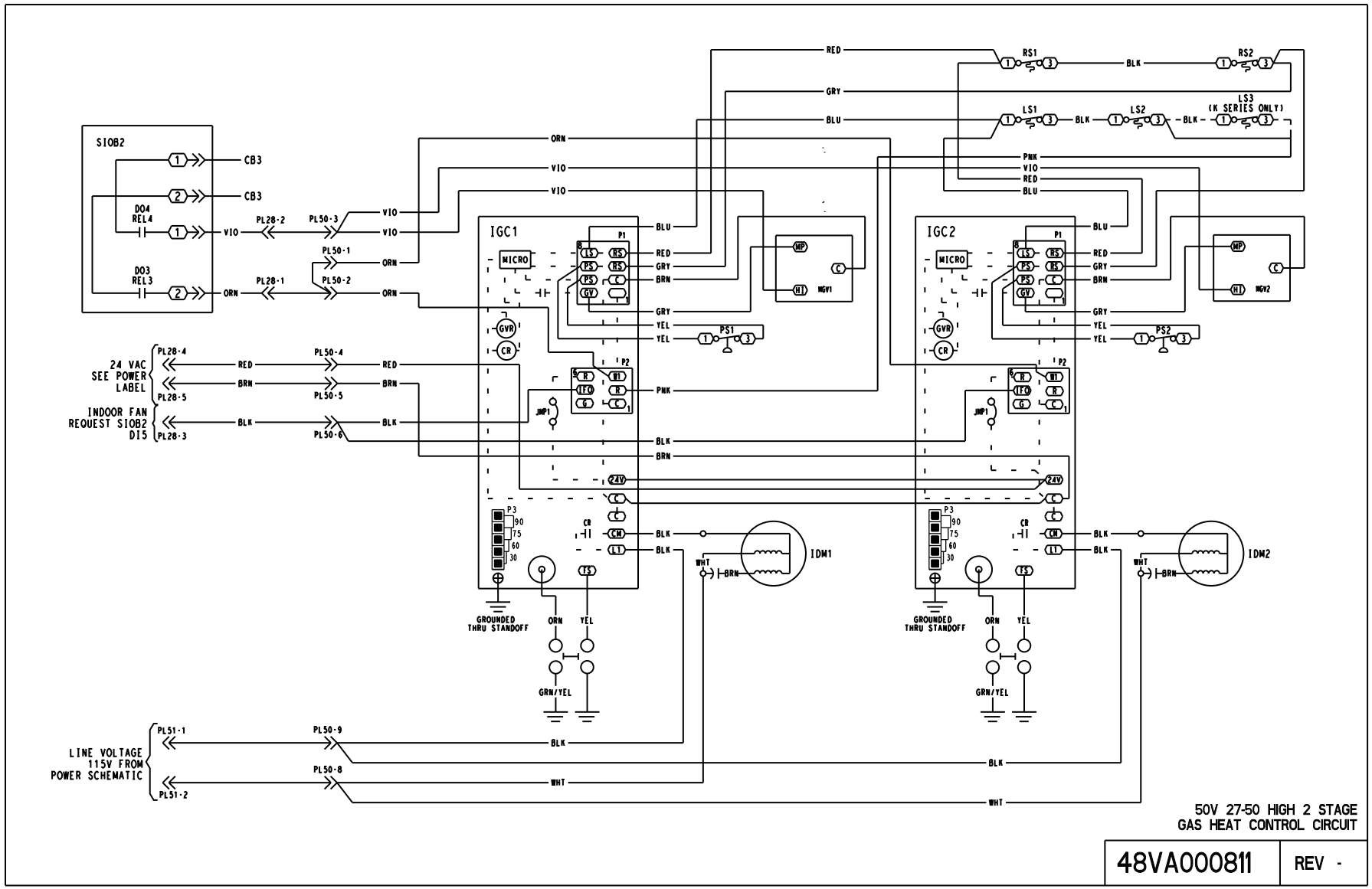
48/50V SIOB 1/2



48/50V NGIOB and SCB



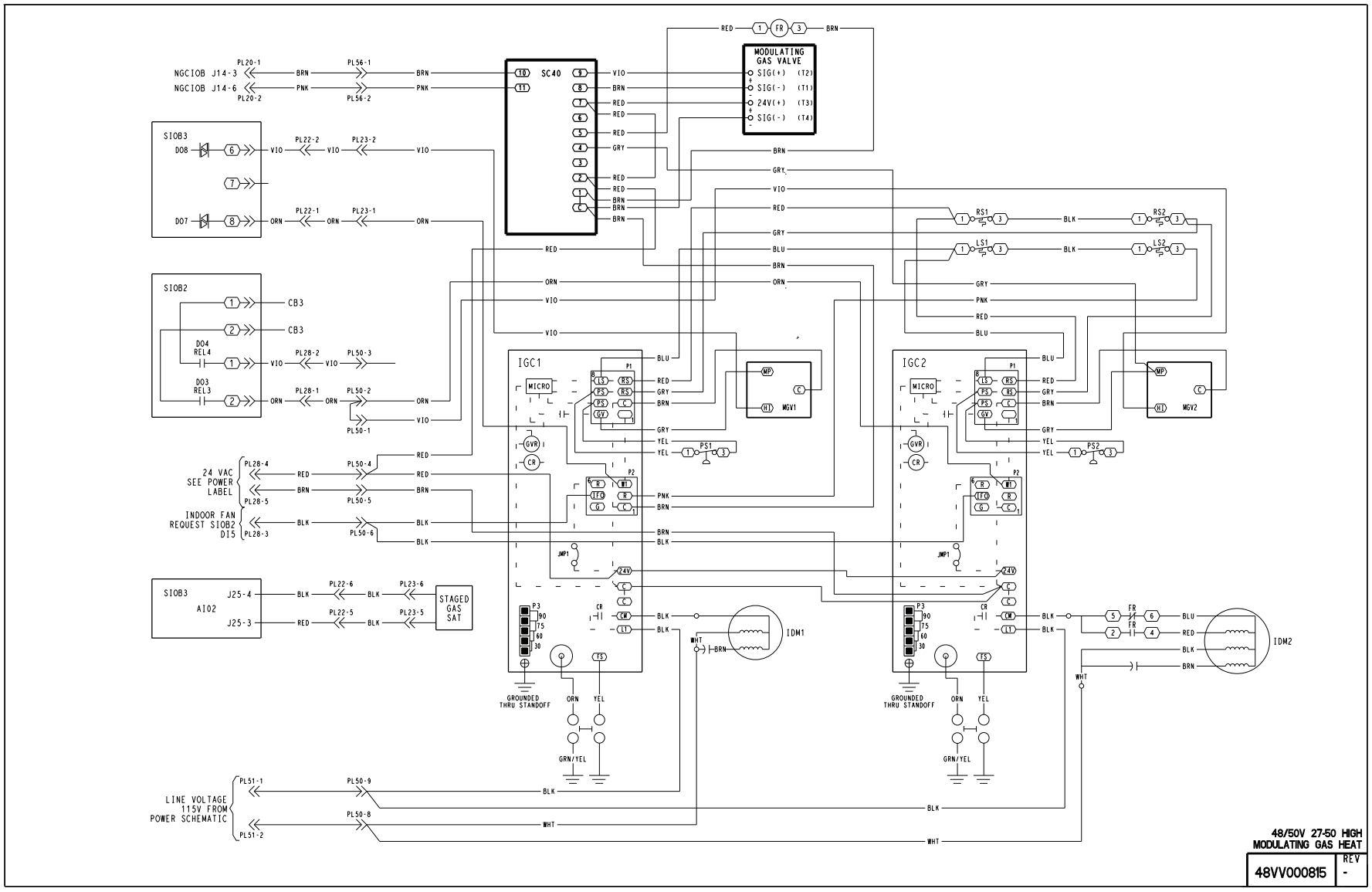
48/50V High 2-Stage Gas Heat Control Circuit



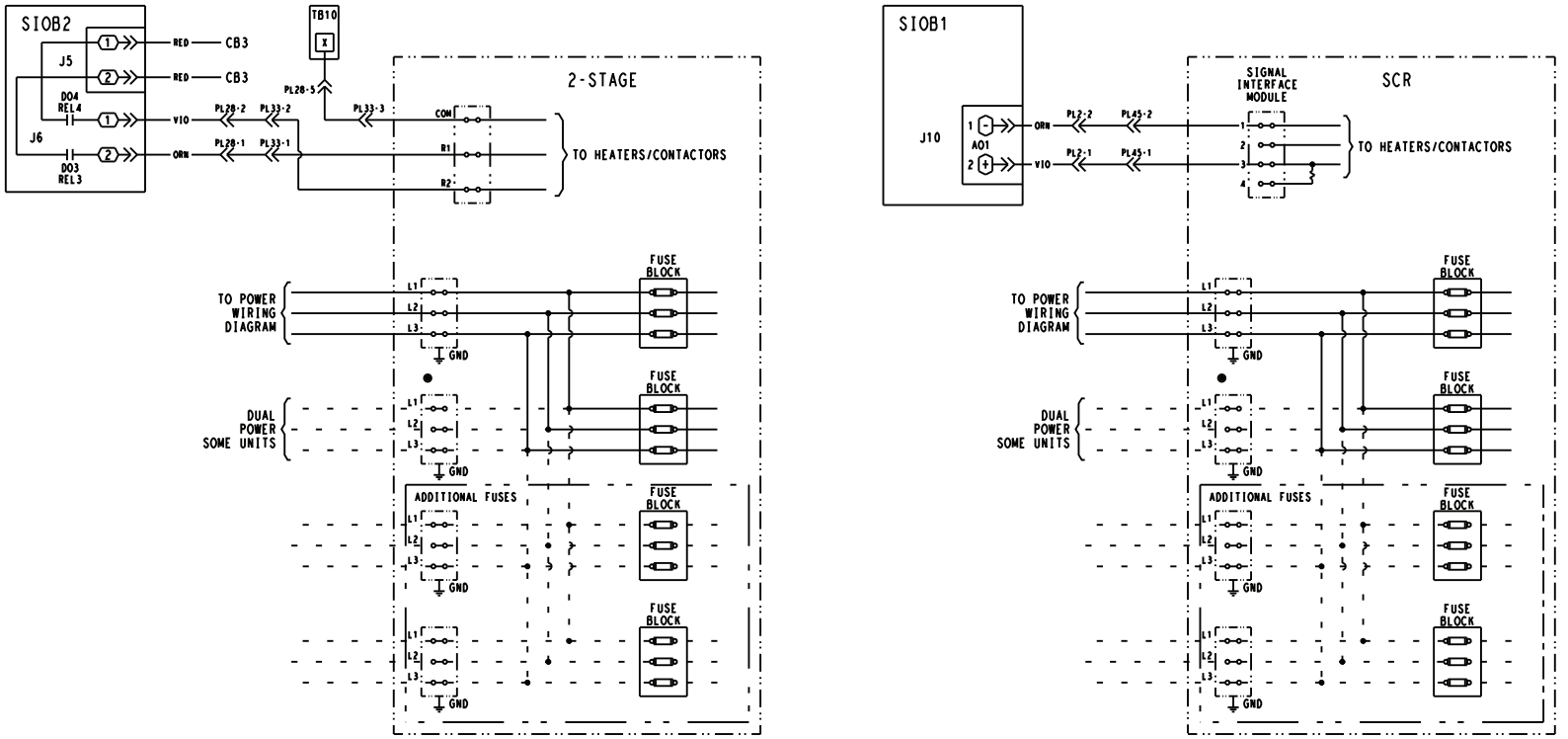
50V 27-50 HIGH 2 STAGE
GAS HEAT CONTROL CIRCUIT

48VA000811	REV -

48/50V High Modulating Gas Heat



50V Electric Heat Staged SCR



50V 27-50 ELECTRIC HEAT STAGED SCR

48VV00816	REV -

48/50V Component Arrangement

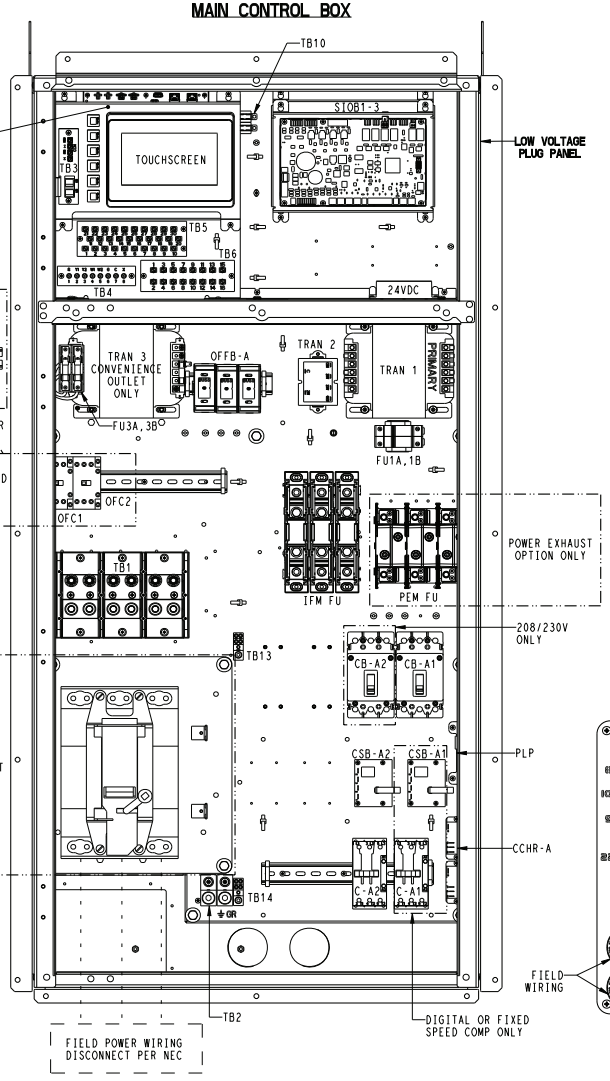
NOTES:
1. FACTORY WIRING IS IN ACCORDANCE WITH UL 1995 STANDARDS. ANY FIELD MODIFICATIONS OR ADDITIONS MUST BE IN COMPLIANCE WITH ALL APPLICABLE CODES.
2. USE 75°C MIN WIRE FOR FIELD POWER SUPPLY. USE COPPER WIRES FOR ALL UNITS.
3. ALL CIRCUIT BREAKERS "MUST TRIP AMPS" ARE EQUAL TO OR LESS THAN 156% RLA.
4. COMPRESSOR AND FAN MOTORS ARE THERMALLY PROTECTED--THREE PHASE MOTORS PROTECTED AGAINST PRIMARY SINGLE PHASE CONDITIONS.
5. REPLACE OFC1 AND OFC2 WITH GSF AND GST (GREENSPEED FUSE BLOCK AND TERMINAL BLOCK). GSV (GREENSPEED VFD) TO CONTROL BOTH FANS IN PARALLEL.

LEGEND

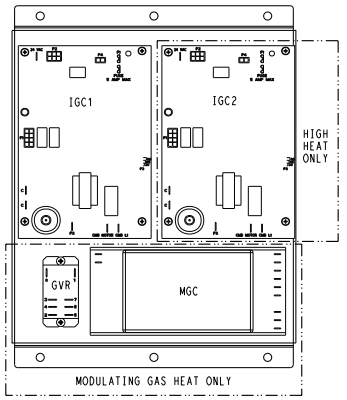
	TERMINAL BLOCK
	TERMINAL (UNMARKED)
	TERMINAL (MARKED
	SPLICE
———	FACTORY WIRING
- - -	FIELD WIRING
▬▬	TO INDICATE COMMON POTENTIAL ONLY. NOT TO REPRESENT WIRING
—·—	TO INDICATE FIOP OR ACCESSORY

ACCSY	ACCESSORY
AF	AIR FOIL
AN	ANALOG
APS	AIR PRESSURE SWITCH
BM	BLOWER MOTOR
BR	BLOWER RELAY
C	COMPRESSOR CONTACTOR
CAP	CAPACITY
CB	CIRCUIT BREAKER
CBT	CIRCUIT BREAKER, TRANSFORMER
CCB	CONTROL CIRCUIT BREAKER
CCN	CARRIER COMFORT NETWORK
CCT	COOLING COIL THERMISTOR
CCH	CRANKCASE HEATER
CM	COMBUSTION MOTOR
CMR	COMPRESSOR MODULATION RELAY
COFS	CONDENSATE OVERFLOW SWITCH
COMP	COMPRESSOR
COND	CONDENSER
CO2	CARBON DIOXIDE
CR	CONTROL RELAY
CSB	CURRENT SENSOR BOARD
DGS	DIGITAL SCROLL
DI	DIGITAL INPUT
DPT	DISCHARGE PRESSURE TRANSDUCER
DTT	DISCHARGE TEMPERATURE THERMISTOR
DUS	DIGITAL UNLOADER SOLENOID
ECM	ELECTRICALLY COMMUTATED MOTOR
ECON	ECONOMIZER
EH	ELECTRIC HEAT
EQUIP	EQUIPMENT
EVAP	EVAPORATOR
EXH	EXHAUST
EXV	ELECTRONIC EXPANSION VALVE
FU	FUSE
GND	GROUND
GSF	GREENSPEED FUSE
GST	GREENSPEED TERMINAL
GSV	GREENSPEED VFD
GVR	GAS VALVE RELAY
HC	HEATER CONTACTOR
HIR	HEAT INTERLOCK RELAY
HMV	HUMIDIMIZER MODULATING VALVE
HPS	HIGH PRESSURE SWITCH
HV	HIGH VOLTAGE
HVS	HUMIDIMIZER VALVE SOLENOID
I	IGNITOR
IAQ	INDOOR AIR QUALITY
IDM	INDUCED DRAFT MOTOR
IFM	INDOOR FAN MOTOR
IGC	INTEGRATED GAS CONTROLLER
LEN	LOCAL EQUIPMENT NETWORK
LLS	LIQUID LINE SOLENOID
LS	LIMIT SWITCH
MGC	MODULATING GAS CONTROLLER
MGV	MAIN GAS VALVE
MLV	MINIMUM LOAD VALVE
MOD PE	MODULATING POWER EXHAUST
OAQ	OUTDOOR AIR QUALITY
OAT	OUTDOOR AIR THERMISTOR
OFC	OUTDOOR FAN CONTACTOR
OFB	OUTDOOR FAN FUSE BLOCK
OFM	OUTDOOR FAN MOTOR
OPT	OPTION
PE	POWER EXHAUST
PL	PLUG ASSEMBLY
PLP	PHASE LOSS PROTECTION
PMR	PHASE MONITOR RELAY
PS	PRESSURE SWITCH
RA	RETURN AIR
RAT	RETURN AIR THERMISTOR
RET	RETURN
RF	RETURN FAN
RS	ROLLOUT SWITCH
SAT	SUPPLY AIR THERMISTOR
SC	SIGNAL CONDITIONER
SCR	SILICON CONTROLLED RECIFIER
SEN	SENSOR
SIOB	STARTFIRE IO BOARD
SPT	SUCTION PRESSURE TRANSDUCER
TB	TERMINAL BLOCK
TRAN	TRANSFORMER
T'STAT	THERMOSTAT
VAC	VOLTS ALTERNATING CURRENT
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FREQUENCY DRIVE

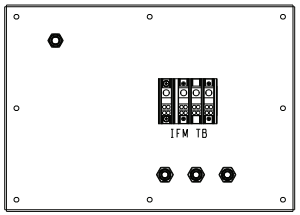
COMPONENT ARRANGEMENT 27, 30, 35 (V-SERIES)



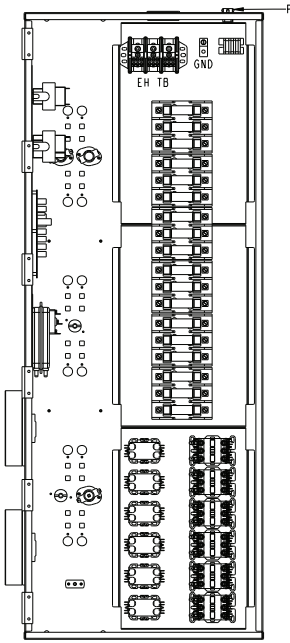
GAS HEAT SECTION (48V ONLY)

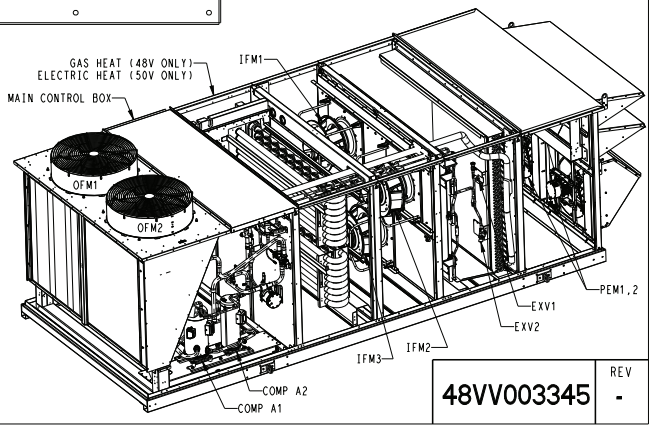


IFM TERMINAL BLOCK



ELECTRIC HEAT SECTION (50V ONLY)



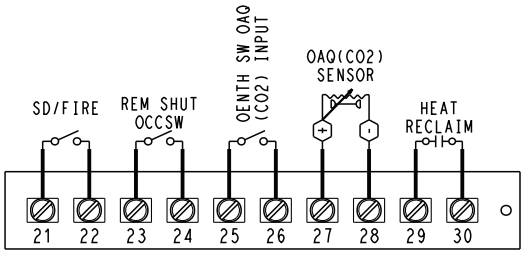


48VV003345	REV -

48/50V Field Wiring Terminal Board Layout

FIELD WIRING TERMINAL BOARD LAYOUT - 48/50V

TB5 - HY84DA028



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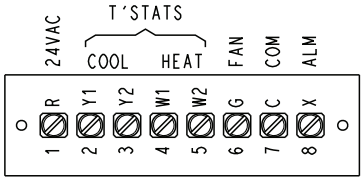
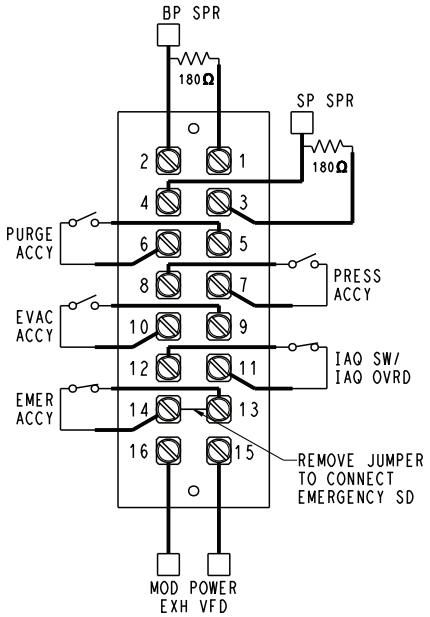


TB6 - HY84HA101



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MATERIAL	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON:	TITLE	TERMINAL BOARD(S) LAYOUT
ENGINEERING REQUIREMENTS	1 DEC ± 2 DEC ± 3 DEC ± ANG° ± °	DRAWING RELEASE LEVEL	Design
MFG LOCATION	NEXT DRAWING	SIZE D	DRAWING NUMBER 48VV004617 SHEET 2 OF 2
WEIGHT	CAD MODEL 48VV004617 -.16	REV -	ITR 16

Guide specifications 48V

NOTE: this specification is in the "Masterformat" as published by the Construction Specification Institute for use in a mechanical specification.

Electric Cooling/Gas Heat Packaged Applied Rooftop Unit

HVAC Guide Specifications

Size Range: **27.5 to 35 Nominal Tons**

Carrier Model Number: **48V**

Part 1 — (23 06 80) Schedules for Decentralized HVAC Equipment

1.01 23 06 80.13) Decentralized Unitary HVAC Equipment Schedule:

A. 23 06 80.13.A.) Rooftop unit (RTU) schedule:

1. Schedule is per the project specification requirements.

Part 2 — (23 07 16) HVAC equipment insulation

2.01 (23 07 16.13) Decentralized, Rooftop Units:

A. (23 07 16.13.A.) Air handling compartment (standard construction):

1. Interior cabinet surfaces shall be insulated with a minimum 1/2 in. thick, minimum 1-3/4 lb density, flexible fiberglass insulation with aluminum foil-faced on the air side.
2. Access doors shall be insulated with a minimum 1/2 in. thick, minimum 1-3/4 lb density, flexible fiberglass insulation covered with galvanized steel liner on the air side (double wall).
3. The gas heat compartment shall be insulated with a minimum 1/2 in. thick, minimum 1-3/4 lb density, flexible fiberglass insulation covered with galvanized steel liner on the air side (double wall).
4. The bottom of the base pan (exterior) shall be insulated with a minimum 1/2 in. thick, minimum 1-3/4 lb density, flexible fiberglass insulation with aluminum foil-faced on the exterior facing side.
5. Air touching doors and panels shall have a minimum nominal thermal efficiency rating of R4.
6. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

Part 3 — (23 09 13) Instrumentation and control devices for HVAC

3.01 (23 09 13.23) Sensors and Transmitters:

A. (23 09 13.23.A.) Thermostats:

1. Thermostat shall:
   a. Energize both "W" and "G" when calling for heat.
   b. Have capability to energize up to two-stages of cooling, and two-stages of heating.
   c. Include capability for occupancy scheduling.

B. (23 09 13.23.B.) Sensors:

1. Standard sensors shall have outdoor air temperature, return air temperature, evaporator/DX reheat coil leaving air temperature, suction pressure (all circuits), condensing pressure (all circuits), and leaving evaporator refrigerant temperature (all circuits).

Part 4 — (23 09 23) Direct Digital Control system for HVAC

4.01 (23 09 23.13) Decentralized, Rooftop Units:

A. (23 09 23.13.A.) Carrier SmartVu™ intelligent integrated unit controller with Direct Digital Control (DDC) shall:

1. Provide integrated unit operation for cooling, heating, and ventilation as well as monitoring, recording, and reporting capabilities. Controller shall also provide diagnostics and alarms of abnormal unit operation through the user interface.
2. Operate standalone, with a two-stage cooling, two-stage heating thermostat, or via building automation system (BAS) without the need for additional control modules, licenses, or adapters.
3. Have plug-and-play compatibility with Carrier i-Vu® Open building automation system, including communication, points and properties pages, and graphics.
4. Include a 7 in. color touch screen user interface with intuitive icon based navigation as the primary user interface. Keypad or rotary interfaces or touchscreens less than 7 in. are not acceptable.
5. Allow control access via web browser using a secure, direct ethernet connection between the control and PC, without the need for special licenses or proprietary interface adapters or programs. The web browser interface shall match the local control interface.
6. Provide a minimum of four control interface access levels, including basic access (no password), user access (static password), service access (app authenticated password), and factory access (controlled password).
7. Provide the ability to read refrigerant pressures at local display, web browser, or via BAS network without the use of external refrigerant gauges.
8. Include a USB data port to allow for software upgrades without the need for special tools or programs.
9. Provide service capabilities of:
   a. Manual component test
   b. Service run mode
   c. Track component run hours and starts
   d. Data trending
   e. Alarm history

10. Allow the use of multiple occupancy sources, including BAS, remote input, local schedules with 365 day real time clock, 8 occupancy schedules and 16 holiday schedules.
11. Include field use control inputs, including space temperature, space temperature offset, space relative humidity, supply air temperature, mixed air temperature, two-stage cool/heat thermostat (Y1, Y2, W1, W2, G), dehumidify switch, two demand/capacity limit switches, analog demand limit/third-party supply air temperature reset, pre-filter status switch, indoor air quality (IAQ)/third-party outdoor air damper control, IAQ switch, outdoor air quality (OAQ)/outdoor air enthalpy (OAE) switch, third-party supply static pressure reset/third-party indoor fan control, third-party exhaust fan control, remote shutdown/occupancy switch, smoke detector/fire shutdown, emergency shut-down, smoke purge, fire pressurization, and fire evacuation, as standard.
12. Include field use control outputs, including field provided modulating heat, field provided heat enable, alarm/aux relay, and damper override relay, as standard.
13. Provide cooling and heating demand source configurations for space temperature sensors, two-stage cool/heat thermostat or network inputs, or return air temperature.
14. Provide supply air temperature based operation for cooling and modulating heat with user adjustable supply air temperature setpoints for low cool, high cool, VAV cool, low heat, high heat, and vent demands.
15. Include occupied cooling, unoccupied cooling, occupied heating, and unoccupied heating setpoints and maintain a 5°F temperature difference between cooling and heating set points to meet the latest ASHRAE 90.1 Energy Standard. Single setpoint configurations are not allowed.
16. Provide the ability to perform cool-tempered venting and heat-tempered venting operation to prevent hot or cold discharge air during vent mode.
17. Allow mechanical cooling operation down to –10°F (–23.3°C) entering condenser coil through the modulation of condenser fan speeds as standard using Greenspeed® intelligence.
18. Provide user-adjustable compressor lockouts based on outdoor air temperature and mixed air temperature, and user-adjustable heating lockouts based on outdoor air temperature.
19. Shall read and display the indoor fan motor, voltage, current, temperature, and modulation level.

Part 5 — (23 09 33) Electric and Electronic Control System for HVAC

5.01 (23 09 33.13) Decentralized, Rooftop Units:

A. (23 09 33.13.A.) General:
   1. Shall be complete with self-contained low-voltage control circuit.
   2. Shall utilize color-coded wiring.
   3. Shall have wiring diagrams affixed to the interior door panels of each section.

B. (23 09 33.13.B.) Safeties:
   1. Compressors:
      a. Over-temperature.
      b. Over-current.
      c. High refrigerant circuit pressure switch.
   2. Indoor fan
      a. Overcurrent protection.
      b. Line under voltage detection.
      c. Phase loss detection.
      d. Blocked rotor detection.
      e. Rotor position detection error.
      f. Indoor fan door interlock switch to prevent indoor fan operation with the fan access door open.
   3. Heating section shall be provided with the following minimum protections:
      a. Indoor fan switch.
      b. Inducer fan speed sensor.
      c. High temperature limit switches.
      d. Flame rollout switch.
      e. Flame proving controls.

Part 6 — (23 09 93) Sequence of Operations for HVAC Controls

6.01 (23 09 93.13) Decentralized, Rooftop Units:

A. (23 09 93.13.A.) INSERT SEQUENCE OF OPERATION

Part 7 — (23 40 13) Panel Air Filters

7.01 (23 40 13.13) Decentralized, Rooftop Units:

A. 23 40 13.13.A.) Standard Pre-filter Section
   1. Shall consist of factory-installed, disposable 2 in. fiberglass filters of commercially available sizes, unless optional filters are selected.

Part 8 — (23 81 19) Self-Contained Air Conditioners

8.01 (23 81 19.16) Large-Capacity Self-Contained Air Conditioners:

A. (23 81 19.13.A.) General:

1. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing a fully hermetic scroll compressor(s) for cooling duty and gas combustion for heating duty.
2. Factory-assembled, single-piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, refrigerant charge, operating oil charge, microprocessor-based control system and associated hardware, and all special features required prior to field start-up.
3. Unit shall use Puron® (R-410A) refrigerant and include a factory refrigerant charge. The unit exterior must be marked as using Puron and the nameplate must contain the refrigerant change weight.
4. Unit shall ship as a single piece and shall be installed in accordance with the manufacturer's instructions.
5. Unit must be selected and installed in compliance with local, state, and federal codes.

B. (23 81 19.13.B.) Quality Assurance:

1. Unit meets and exceeds ASHRAE 90.1 (latest edition) minimum efficiency requirements.
2. Unit performance shall be certified in accordance with AHRI Standards 340/360 (latest edition).
3. Unit shall be designed to conform to ASHRAE 15 and 62.1 (latest editions).
4. Gas heater shall be designed to conform with in accordance with ANSI Standard Z21.47 (U.S.A.)-20212021/CSA Standard 2.3 (Canada).
5. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
6. Unit casing shall be capable of withstanding a minimum 500-hour salt spray exposure per ASTM B117 (scribed specimen).
7. Unit shall be manufactured in a facility registered by ISO 9001:2015.
8. Roof curb shall be designed to conform to National Roofing Contractors Association (NRCA) criteria per Guideline B-1986.
9. Unit shall pass an automated factory run test, including validation of refrigerant circuit performance, verification of operation of key components. A run test certificate shall ship with the unit.
10. Unit shall be designed in accordance with UL Standard 1995 or 60335-2-40, including tested to withstand rain. Compliance shall be listed with UL and UL Canada.

C. (23 81 19.13.C.) Delivery, Storage, and Handling:

1. Unit shall be stored and handled per manufacturer's recommendations.
2. Lifted by crane requires spreader bars.
3. Unit shall only be stored or positioned in the upright position.

D. (23 81 19.13.D.) Project Conditions:

1. As specified in the contract.

E. (23 81 19.13.E.) Operating Characteristics:

1. Unit shall be capable of starting and running in mechanical cooling from –10°F (–23.3°C) to 115°F (46.1°C) entering condenser air temperature.
2. Unit shall meet or exceed ASHRAE 90.1 requirements for a minimum of 4 stages of cooling capacity with the lowest stage being no higher than 25% of unit capacity.
3. Unit shall discharge supply air vertically or horizontally as shown on drawings.
4. Unit shall provide supply air temperature control in cooling.
5. Unit shall provide two-stages of gas heat.

F. (23 81 19.13.F.) Electrical Requirements:

1. Main power supply voltage, phase, and frequency must match those required by the manufacturer.
2. The unit power panel shall have a short circuit current rating (SCCR) of no less than 10kA.
3. The single point electrical connection shall be at a factory-installed terminal block in the power panel.
4. Power wiring shall be a copper conductor (no aluminum) sized for no less than 167°F (75°C).
5. Separate enclosures shall be provided for high and low voltage components.

G. (23 81 19.13.G.) Unit Cabinet:

1. Unit cabinet shall be constructed of galvanized steel (designated G60 per ASTM Standard A653) and shall be bonderized with a pre-painted finish or powder-coat on the outer surface.
2. Unit cabinet exterior shall be capable of withstanding ASTM Standard B117 500-hour salt spray test.
3. Unit cabinet interior top and side panels/doors (supply air touching) shall be lined minimum 1/2 in. thick, 1 lb density, aluminum foil-faced fiberglass insulation.
4. Unit cabinet shall have an insulation rating of R4.

5. Unit shall be available in dedicated compact or standard chassis footprints to facilitate replacement of existing units or meet new construction requirements.
6. Drawings shall be available to show the dimensions of the specified cabinet configurations. Certified drawings with a table to decode unit lengths is not acceptable.
7. Basepan:
   a. Unit shall have base rails on a minimum of 2 sides.
   b. Include a minimum of four lifting lugs to support rigging shackles for maneuvering and overhead rigging.
   c. Base rail shall be a minimum of 16 gauge thickness.
   d. Shall have a single thru-the-base power coupling and primary and secondary thru-the-base control couplings.
   e. Bottom shall be lined with minimum 1/2 in. thick, 1 lb density, fiberglass insulation.
8. Condensate Pan:
   a. Shall be a sloped condensate drain pan made of galvanized steel.
   b. Shall comply with ASHRAE Standard 62.
   c. Shall use a single, drain connector through the side of the unit base rail. Connection shall be made per manufacturer's recommendations.
9. Gas Connections:
   a. All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location on side of unit.
10. Electrical Connections:
    a. All unit power wiring shall enter the power box at the bottom or back.
    b. Thru-the-base capability.
       1) Standard unit shall have a thru-the-base power and control couplings in the basepan.
       2) No basepan penetration, other than those authorized by the manufacturer, is permitted.
11. Access Doors:
    a. Hinged access doors shall be provided on a single side of the unit to facilitate single side maintenance access.
    b. At a minimum, doors must be provided on the filter section, indoor fan section, gas heat section, control box, and power box. The door shall deal against a rubber gasket to prevent air and water leakage.
    c. All doors shall require the use of tools to open the door to help prevent unauthorized access.
    d. The indoor fan section door shall have a minimum of one locking handle and pressure safety latch.
12. Access Panels:
    a. Removable panels shall be provided on areas that require infrequent access.

H. (23 81 19.13.H.) Gas Heat:
1. General:
   a. Low and high capacity gas heat options shall be available.
   b. Shall be factory configured for natural gas (NG) and shall be field convertible to propane (LP) using an accessory kit.
   c. Heat exchanger shall be an induced draft design. Positive pressure heat exchanger designs shall not be allowed.
   d. Shall incorporate a direct-spark ignition system and redundant main gas valve.
   e. Gas supply pressure at the inlet to the rooftop unit gas valve must match that required by the manufacturer.
   f. High-corrosion areas such as flue gas collection and exhaust areas shall be lined with corrosion-resistant material.
   g. The heat assembly shall be mounted on rollers for easy inspection and servicing.
2. Control:
   a. The gas heater shall be controlled by an integrated gas controller (IGC) microprocessor.
   b. IGC board shall notify users of fault using an LED (light-emitting diode).
   c. Unit shall be equipped with anti-cycle protection with one short cycle on unit flame rollout switch or 4 continuous short cycles on the high temperature limit switch. Fault indication shall be made using an LED.
   d. Required gas heat stage signals shall be provided by SmartVu controls.
3. Heat Exchanger:
   a. The heat exchanger shall be constructed of minimum 18-gauge Type 409 Stainless Steel. Tubing material shall be suited for high temperature and corrosion resisting service. Tubing material shall comply with ASTM A268, Grade TP409. Tubing shall be welded and annealed.
   b. Burners shall be of the in-shot type constructed of aluminum-coated steel.
   c. Burners shall incorporate orifices for rated heat output up to 2000 ft (610 m) elevation. Additional accessory kits may be required for applications above 2000 ft (610 m) elevation, depending on local gas supply conditions.
   d. Each heat exchanger tube shall contain multiple dimples for increased heating effectiveness.

4. Induced Draft System:
   a. Shall be a direct-drive, single inlet, forward-curved centrifugal type.
   b. Shall be made from steel with a corrosion resistant finish.
   c. Shall have permanently lubricated sealed bearings.
   d. Shall have inherent thermal overload protection.

I. (23 81 19.13.I.) Coils:
1. Evaporator (Standard):
   a. Shall be round tube, plate fin style coil with aluminum fins mechanically bonded to copper tubes (Al/Cu).
   b. Tube diameter shall be 1/2 in. OD (outside diameter).
   c. Coil shall be fully active during full and part load operation.
   d. Intertwined circuiting constructed of aluminum fins mechanically bonded to seamless copper tubes.
   e. Full-face active type during full and part load conditions.
   f. Coils shall be leak tested at 150 psig and pressure tested at 650 psig.
2. Condenser (Standard):
   a. Shall be a microchannel design, constructed of an aluminum alloy. The coils shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds.
   b. Microchannel coils shall consist of a two-pass arrangement.
   c. Coils shall be leak tested at 150 psig and pressure tested at 650 psig.

J. (23 81 19.13.J.) Refrigerant Circuit:
1. Refrigerant circuit shall have the following control, safety, and maintenance features:
   a. Single circuit refrigerant circuit on sizes 27.5-35 for optimal performance and efficiency.
   b. Electronic expansion valve (EXV) metering devices on all models. Thermostatic expansion valves (TXV) are not acceptable.
   c. Refrigerant filter drier.
   d. Service ports on suction and discharge lines.
   e. Sight glass.
   f. Fusible plug.
2. Compressors:
   a. The unit shall have a maximum of two compressors per refrigerant circuit to ensure proper oil management. Units must have a minimum of one variable capacity (digital or variable speed) compressor for improved supply air temperature control and load matching.
   b. Compressors shall be mounted on rubber-in-shear vibration isolation.
   c. Each compressor shall have crankcase heater that is only on when the compressor is off and the outdoor air temperature is below 80°F (26.6°C).

K. (23 81 19.13.K.) Pre-Filter Section:
1. The standard pre-filter is specified in the filter of this specification.
2. Shall have a minimum 4 in. vertical pre-filter rack with 2 in. spacer.
3. Must be able to accept a single 2 in. filter, two 2 in. filters, or a single 4 in. filter by removing the spacer.
4. Filters shall be accessible through a hinged access door.

L. (23 81 19.13.L.) Indoor Fan:
1. Motor:
   a. Shall be an electronically commutated (ECM) motor, available in standard or medium static.
   b. Must have IP20 or IP55 ingress protection rating, a Moisture (F)/Environmental (H) protection class if H1, and an insulation class of F.
   c. Shall communicate with the unit controller over Modbus and shall be capable of receiving at least one configurable discrete input, one configurable analog input, and one configurable analog output. Analog or pulse width modulation control is not acceptable.
   d. Must have permanently lubricated bearings.
   e. Shall be controlled directly from the Carrier SmartVu™ control system. External PWM control is not acceptable.
   f. Provide internal diagnostics and EMI/RFI (electromagnetic/radio frequency interference) filters.
   g. The indoor fan wall must include track to support the bottom of the fan frame for easy fan removal and installation.
   h. Bearings shall have an L10 life of over 100,000 hours.
2. Fan:
   a. Unit shall have a direct drive indoor fan array containing no less than three fans. Belt drive fans are not acceptable.
   b. Shall be single width, single inlet (SWSI) backward curve impeller.
   c. Impeller, shaft, bearings, drive components, and motor shall be mounted on a formed steel assembly bolted to a galvanized steel mounting plate.

d. Fans shall have a galvanized steel inlet nozzle, aluminum impeller with five blades, and die cast aluminum electronics housing. Composite impellers are not acceptable.
e. Impellers shall be designed for continuous operation at the maximum rated fan speed and motor power.
f. Fan and motor shall be statically and dynamically balanced as an assembly to G6.3.

3. Control:
a. The indoor fan speed shall be controlled by SmartVu conrols.
b. SAV™: The control shall default to Staged Air Volume (SAV) indoor fan control for single zone applications.
1) Staged air volume (SAV) shall be field configurable for operation based on cool demands (2 fan speeds) or cool capacity (3 fan speeds).
2) The control shall be field configurable for Constant volume (CV), Third-party modulation, or MZ-VAV duct pressure (with field-installed sensor).
c. VAV: The control shall default to multi-zone variable air volume (MZ-VAV) duct pressure indoor fan control for multi-zone applications.
1) Shall have a duct pressure transducer with –0 to 5 in. wg. range and low side pressure port reading atmospheric pressure. Requires field-supplied and installed high side pressure tubing and duct pressure pick-up port.
2) The control shall be field configurable for Staged Air Volume (SAV™), Constant volume (CV), or Third-party modulation.

M. (23 81 19.13.M.) Condenser Fans:
1. Motor:
a. Shall be a three-phase, 8-pole, totally enclosed motor. Single-phase motors are not acceptable.
b. Shall use permanently lubricated bearings.
c. Must be statically and dynamically balanced.
d. Shall be variable speed (electronically commutated or variable frequency drive).
e. The fan speed shall be modulated by the unit control based on saturated condensing temperature for improved efficiency and low ambient mechanical cooling. Fixed speed or staged fans are not acceptable.
2. Fans (Standard):
a. Shall be a direct-driven propeller type fan constructed of metal.
b. Must be protected by PVC-coated steel wire safety guards.
c. Shall discharge air vertically.

N. (23 81 19.13.N.) Manual Outdoor Air Damper (Standard):
1. Shall have pressure activated (no actuator) damper assembly, sized to allow up to 25% outdoor air at maximum position. The damper is open when the indoor fan is on and closes when the indoor fan is off.
2. Must include an adjustable maximum position stopper.
3. Must include factory-installed outdoor air intake hoods that ship in the installation location to reduce installation time. Field installed outdoor air hoods are not acceptable.

O. (23 81 19.13.O.) Factory-installed Options:
1. Modulating Gas Heat:
a. The unit shall have a factory-installed modulating gas heat system with stainless steel heat exchanger for improved supply air temperature control.
b. Low capacity gas heat shall have a minimum output of no more than 26% of full capacity (3.8:1 turn-down).
c. High capacity gas heat shall have a minimum output of no more than 14% of full capacity (7:1 turndown).
d. Includes a factory-supplied, field-installed supply air temperature (SAT) duct sensor.
2. Low-Sound Condenser Fans:
a. The unit shall have factory-installed low-sound condenser fans that reduce sound output during cooling or dehumidification operation.
b. Shall include only AeroAcoustic™ composite condenser fans with swept fan blades and blade edge optimization to reduce radiated sound and allows for lower RPM operation. Metal condenser fans are not acceptable.
c. Must include vertically extended shrouds on all condenser fans to reduce radiated sound at ground levels.
3. Compressor Sound Blankets:
a. The unit shall have factory-installed sound blankets on all compressors to reduce radiated sound. If factory-installed sound blankets are not available, field-installed sound enclosures shall be provided.
4. Humidi-MiZer Adaptive Dehumidification:
a. The unit shall have a factory-installed dehumidification system that allows dehumidification in cooling, venting, or heating modes using a variable mixture of warm liquid refrigerant and hot gas refrigerant as a reheat source. Reheat systems that use only hot gas or liquid refrigerant in dedicated coils are not acceptable.

b. During dehumidification mode, the compressors shall control to cooling coil temperature (CCT, an approximation of supply air dew point temperature) and the reheat system shall be modulated to supply air temperature (SAT).

c. The dehumidification system shall have an e-coated reheat coil, on/off reheat valve, modulating condenser bypass valve, interconnecting refrigerant piping, and a cooling coil leaving air temperature sensor. Requires the enthalpy and humidity sensing options (OARH and RARH).

d. When the dehumidification system must provide cool, dehumidified air, the reheat coil shall utilize liquid refrigerant as a reheat source (sub-cooling mode). The further cooling of the liquid refrigerant increases the evaporator dehumidification capacity and improves latent capacity.

e. When the dehumidification system must provide warm, dehumidified air, the reheat coil shall utilize hot gas refrigerant as a reheat source (hot gas mode). The use of hot gas refrigerant allows for higher discharge air temperatures to be achieved compared to sub-cooling mode.

f. When the dehumidification system must dehumidify air and supply it between cool and warm, a modulated mix of hot gas and warm liquid refrigerant is supplied to the reheat coil as a reheat source.

g. The control shall provide configurations for dehumidification demands based on space relative humidity, return air relative humidity, or a discrete dehumidification input.

h. The control shall provide configurations to prevent dehumidification demands with low cool, high cool, VAV cool, low heat, high heat, or vent demands for improved space temperature control.

5. Extended Section (STANDARD CHASSIS ONLY):
   a. The unit shall have a factory-installed blank cabinet section with access panels installed before the filter section for replacement of legacy Carrier 48P and Z Series units with extended chassis.
6. Stainless Steel Drain Pan:
   a. The unit shall have a factory-installed condensate drain pan constructed of 409 stainless steel for corrosion protection.
7. E-Coated Condenser Coils:
   a. The unit shall have factory-installed e-coated MCHX condenser coils for corrosion protection.
   b. Coating shall be flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins or louvers. Coating process shall ensure complete coil encapsulation, including all exposed fin edges.
   c. E-coat thickness of 0.8 to 1.2 mil with topcoat having a uniform dry thickness from 1.0 to 2.0 mil on all external coil surface areas, including fin edges, shall be provided.
   d. Coated coils shall have a hardness characteristics of 2H per ASTM D3363-00 and crosshatch adhesion of 4B-5B per ASTM D3359-02.
   e. Coated coils shall have superior impact resistance with no cracking, chipping, or peeling per NSF/ANSI 51-2002 Method 10.2. Impact resistance shall be up to 160 in./lb per ASTM D2794-93.
   f. E-coated aluminum microchannel coils shall be capable of withstanding more than 8,000-hour salt spray test in accordance with the ASTM (U.S.A.) B-117 Standard.
8. E-coated Evaporator Coil:
   a. The unit shall have factory-installed, e-coated Al/Cu evaporator coil(s) for corrosion protection.
   b. Coating shall be flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins or louvers. Coating process shall ensure complete coil encapsulation, including all exposed fin edges.
   c. E-coat thickness of 0.8 to 1.2 mil with topcoat having a uniform dry thickness from 1.0 to 2.0 mil on all external coil surface areas, including fin edges, shall be provided.
   d. Coated coils shall have a hardness characteristics of 2H per ASTM D3363-00 and crosshatch adhesion of 4B-5B per ASTM D3359-02.
   e. Coated coils shall have superior impact resistance with no cracking, chipping, or peeling per NSF/ANSI 51-2002 Method 10.2. Impact resistance shall be up to 160 in./lb per ASTM D2794-93.
   f. E-coated aluminum microchannel coils shall be capable of withstanding an 3,000-hour salt spray test in accordance with the ASTM (U.S.A.) B-117 Standard.
9. Condenser Hail Guard:
   a. The unit shall have factory-installed louvered panels on all vertically mounted condenser coils for hail protection.
   b. Louvered panel shall be constructed of galvanized steel (designated G60 per ASTM Standard A653) and shall be bonderized and pre-painted on the outer surface.

c. Unit cabinet exterior shall be capable of withstanding ASTM Standard B117 500-hour salt spray test.

d. Hail guard shall attach mechanically to the unit frame. Factory provided hardware shall be used to reduce the risk of coil and refrigerant piping puncture.

10. Humidity and Enthalpy Sensing:
    a. The unit shall have factory-installed outdoor air relative humidity and return air relative humidity sensors for use with dehumidification (return air relative humidity demand) or free cooling control (enthalpy or differential enthalpy changeover, outdoor air dew point lockout).
11. Return Air CO_2:
    a. The unit shall have a factory-installed return air CO_2 sensor to help detect space IAQ.
    b. The sensor shall be mounted in the unit return air section and shall measure carbon dioxide (CO_2) concentration in parts per million with an accuracy of ± 3%.
    c. The sensor shall be connected to the control system to display the IAQ and for use as part of demand controlled ventilation (DCV) or IAQ override control.
12. NGC I/O Expansion Board:
    a. The unit shall have a factory-installed control I/O expansion module.
    b. The NGC expansion module shall be required with factory-installed modulating gas heat, standard chassis units with economizer, or compact chassis units with horizontal return and economizer.
13. Ultra-Low Leak Economizer:
    a. The unit shall have a factory-installed economizer assembly with modulating outdoor air and return air dampers with damper actuator(s) for ventilation and free cooling operation.
    b. The economizer shall be controlled by the unit controller. Separate, standalone economizer control systems are not acceptable.
    c. Dampers shall be a gear-driven ultra low leakage type with blade and edge seals. Dampers shall exhibit a maximum leakage rate of 3 cfm per square foot of area at 1 in. wg pressure differential when tested in accordance with AMCA (Air Movement and Control Association) Standard 500.
    d. Actuator shall have a spring-return feature which shuts dampers upon a power interruption or unit shutdown. Actuators are capable of internal diagnostics.
    e. The unit controller shall have configuration to control ventilation based on indoor fan speed, outdoor air cfm, demand controlled ventilation (DCV), Third-party minimum position control, or third-party full control.
    f. The economizer shall be controlled by the unit controller and shall meet California Title 24, ASHRAE 90.1 and IECC Fault Detection and Diagnostic (FDD) requirements.
    g. The unit controller shall have configurations to allow free cooling based on outdoor air temperature and differential outdoor air and return air temperature as standard. Configurations shall also be available for outdoor air enthalpy, differential outdoor air and return air enthalpy, outdoor air enthalpy switch, or outdoor air dew point (optional or accessory sensors required).
    h. Must include factory-installed outdoor air intake hoods that ship in the installation location to reduce installation time. Field installed outdoor air hoods are not acceptable.
    i. COMPACT CHASSIS: The outdoor air intake shall be on the same side of the unit as exhaust or relief outlets.
    j. STANDARD CHASSIS: The outdoor air intake shall be on a different side of the unit than the exhaust or relief outlets to prevent recirculation and support proper ventilation.
14. Barometric Relief:
    a. The unit shall have a factory-installed barometric relief system with relief hoods and two pressure-activated damper assemblies in the unit return air section for relieving building pressure during free cooling operation.
    b. The damper shall start to open when back pressure exceeds approximately 0.04 in. wg and shall gravity close when back-pressure is reduced.
    c. COMPACT CHASSIS: The relief hoods and dampers ship in the installation location.
    d. STANDARD CHASSIS: The relief hoods and dampers ship rotated into the unit and are field rotated to their final installation location.
15. Low Static Power Exhaust:
    a. The unit shall have a factory-installed exhaust system with two, direct-drive propeller fans with ECM motors, barometric dampers, and exhaust air hoods for relieving building pressure.
    b. The control system shall have configurations to control the exhaust fan based on outdoor air damper position, or a third-party signal.
    c. COMPACT CHASSIS: The exhaust hoods and fans ship in the final shipping location. Exhaust hoods are a tip out design to allow easy inspection and servicing.

d. STANDARD CHASSIS: The exhaust hoods and fans ship retracted into the unit and are field slid into their final installation location. Access panels are included on the hood for fan inspection and servicing.

16. Low Static Power Exhaust with Building Pressure Control:
    a. The unit shall have a factory-installed exhaust system with two, direct-drive propeller fans with ECM motors, barometric dampers, and exhaust air hoods for relieving building pressure.
    b. The unit shall have a factory-installed building pressure transducer with –0.25 to 0.25 in. wg range and low side pressure port reading atmospheric pressure. Requires field-supplied and installed high side pressure tubing and space pressure pick-up port.
    c. The control system shall have configurations to control the exhaust fan based on outdoor air damper position, building pressure, or a Third party signal.
    d. COMPACT CHASSIS: The exhaust hoods and fans ship in the final shipping location. Exhaust hoods are a tip out design to allow easy inspection and servicing.
    e. STANDARD CHASSIS: The exhaust hoods and fans ship retracted into the unit and are field slid into their final installation location. Access panels are included on the hood for fan inspection and servicing.
17. Medium Static Power Exhaust with Building Pressure Control (STANDARD CHASSIS ONLY):
    a. The unit shall have a factory-installed exhaust system with two direct-drive backward curve (SWSI) fans with ECM motors, barometric dampers, and exhaust air hoods for relieving building pressure.
    b. The unit shall have a factory-installed building pressure transducer with –0.25 to 0.25 in. wg range and low side pressure port reading atmospheric pressure. Requires field-supplied and installed high side pressure tubing and space pressure pick-up port.
    c. The control system shall have configurations to control the exhaust fan based on outdoor air damper position, building pressure, or a third-party signal.
    d. The exhaust hoods and fans ship retracted into the unit and are field slid into their final installation location. Access panels are included on the hood for fan inspection and servicing.
18. Factory-Wired Convenience Outlet:
    a. The unit shall have a factory-installed 115-v, ground-fault protected (GFI) duplex outlet for loads of up to 10A total.
    b. The outlet shall be powered from the unit power feed, using a factory-installed mains to 115-v transformer connected to the load side of the unit terminal block. When the main unit power feed is disconnected, power to the outlet is also disconnected.
    c. Fusing shall be provided on both the line side and load side of the transformer.
    d. The outlet shall be accessible from outside the unit.
    e. The unit nameplate minimum circuit ampacity (MCA) and maximum over-current protection (MOCP) shall have the outlet amp draw.
19. Field-Wired Convenience Outlet:
    a. The unit shall have a factory-installed 115-v, ground-fault protected (GFI) duplex outlet for loads of up to 15A total.
    b. The outlet requires a field-supplied and installed 115-v power source.
    c. The outlet shall be accessible from outside the unit.
    d. Does not include a transformer.
20. Non-Fused Disconnect:
    a. The unit shall have a factory-installed, non-fused disconnect for disconnecting the unit power feed during maintenance or servicing.
    b. The disconnect shall be installed in the unit power box with an interlocking, through-the-door style disconnect handle. External disconnects are not acceptable.
    c. The disconnect shall be nominally sized to meet or exceed National Electric Code (NEC) requirements for combination loads. Field-provided breakers or fuses are still required for over-current protection.
    d. The disconnect handle shall support lock-out, tag-out locks.
21. Power Monitor:
    a. The unit shall have a factory-installed power monitor to help protect against damage from abnormal power.
    b. The monitor shall be normally closed and shall detect phase loss and phase reversal.
    c. The monitor shall trigger the control emergency shutdown to shut down the unit when a fault is detected.
22. High Short Circuit Current Rating (SCCR):
    a. The unit shall have factory-installed power box with upgraded high voltage components to provide an SCCR rating of 65kA for 208/230/460-v units or 25kA for 575-v units.
    b. Includes a terminal block for power connection.

c. The unit nameplate must reflect the high SCCR rating.

d. Requires field-provided J-type fuses and fuse holder to be installed and wired before the unit terminal block.

23. Condensate Overflow Switch:
    a. The unit shall have a factory-installed condensate overflow switch to help protect against clogged drain pans.
    b. The overflow switch shall be an conducting type. Float switches are not acceptable.
24. Pre-Filter Status Switch and Access Door Retainers:
    a. The unit shall have a factory-installed pressure measuring switch across the entire pre-filter bank to detect when the filters are dirty.
    b. The unit shall have factory-installed retainers on all access doors to hold the doors open during maintenance.
    c. The pressure switch shall be field-set and adjustable from 0-2 in. wg.
    d. The dirty filter alert shall be viewable from the control interface.
    e. The door retainer shall be rod and stopper type with multiple stopping points.
25. Return Air Smoke Detector:
    a. The unit shall have a factory-installed smoke detector in the return air section of the unit, to shut down the unit when smoke is detected.
26. Service Pack:
    a. The unit shall have factory-installed discharge and suction line isolation valves on the compressor tandem assembly and a replaceable core filter drier assembly with isolation valves on all circuits to facilitate faster service.
27. Chicago Refrigerant Relief Valve:
    a. The unit shall have a factory-installed, pressure-activated, mechanical relief valve in all refrigerant circuits to comply with Chicago Building Code. Fusible plugs are not acceptable.
    b. The relief valve shall activate at 650 psig.
    c. The relief valve shall have a National Pipe Thread (NPT) connection for field relief outlet piping.
28. 2 in. MERV 8, 4 in. MERV 8, or 4 in. MERV 13 Pre-Filters:
    a. The unit shall have a factory-installed 4 in. pre-filter rack with either 2 in. MERV 8, 4 in. MERV 8, or 4 in. MERV 13 pleated filters.
29. 2 in. MERV 8 and 4 in. MERV 13 Pre-Filters:
    a. The unit shall have a factory-installed 2 in. and 4 in. pre-filter rack with in. MERV 8 pleated filters before 4 in. MERV 13 pleated filters for improved filtration and extended filter life.
30. 2 in. MERV 8 and 12 in. MERV 14 Bag Pre-Filters (STANDARD CHASSIS ONLY):
    a. The unit shall have a factory-installed 2 in. pre-filter rack with 2 in. MERV 8 pleated filters before a bag filter track with 12 in. MERV 14 bag filters for high filtration and extended filter life.
    b. Bag filter header shall be constructed of thermoplastic polymer and media shall be synthetic. Paper headers or fiberglass media is not acceptable.
31. 2 in. MERV 8 and 12 in. MERV 15 Cartridge Pre-Filters (STANDARD CHASSIS ONLY):
    a. The unit shall have a factory-installed 2 in. pre-filter track with 2 in. MERV 8 pleated filters before a cartridge filter track with 12 in. MERV 15 pleated filters for improved filtration and extended filter life.
    b. Cartridge filter header shall be constructed of galvanized steel and media shall be synthetic. Fiberglass media is not acceptable.
32. Ultraviolet (UV-C) Fixtures:
    a. Unit shall have factory-installed fixtures for field-provided and installed UV-C emitters.
    b. Fixtures shall be mounted down stream of the evaporator coil.
    c. Fixtures shall have factory wiring with evaporator door interlock switch, disconnect switch, and UV safe view port.
    d. Fixtures require field-provided and installed 115-v power supply.

Guide specifications 50V

NOTE: This specification is in the "Masterformat" as published by the Construction Specification Institute for use in a mechanical specification.

Electric Cooling Only or Electric Heat/Hot Water Heat Applied Rooftop Unit

Part 1 — HVAC Guide Specifications

Size Range: **27.5 to 35 Nominal Tons**

Carrier Model Number: **50V**

Part 1 — (23 06 80) Schedules for Decentralized HVAC Equipment

1.01 (23 06 80.13) Decentralized Unitary HVAC Equipment Schedule:

A. 23 06 80.13.A.) Rooftop unit (RTU) schedule:

1. Schedule is per the project specification requirements.

Part 2 — (23 07 16) HVAC equipment insulation

2.01 (23 07 16.13) Decentralized, Rooftop Units:

A. (23 07 16.13.A.) Air handling compartment (standard construction):

1. Interior cabinet surfaces shall be insulated with a minimum 1/2 in. thick, minimum 1-3/4 lb density, flexible fiberglass insulation with aluminum foil-faced on the air side.
2. Access doors shall be insulated with a minimum 1/2 in. thick, minimum 1-3/4 lb density, flexible fiberglass insulation covered with galvanized steel liner on the air side (double wall).
3. The heat compartment shall be insulated with a minimum 1/2 in. thick, minimum 1-3/4 lb density, flexible fiber-glass insulation covered with galvanized steel liner on the air side (double wall).
4. The bottom of the base pan (exterior) shall be insulated with a minimum 1/2 in. thick, minimum 1-3/4 lb density, flexible fiberglass insulation with aluminum foil-faced on the exterior facing side.
5. Air touching doors and panels shall have a minimum nominal thermal efficiency rating of R4.
6. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

Part 3 — (23 09 13) Instrumentation and control devices for HVAC

3.01 (23 09 13.23) Sensors and Transmitters:

A. (23 09 13.23.A.) Thermostats:

1. Thermostat shall:
   a. Have capability to energize up to two-stages of cooling, and two-stages of heating (for units with heating).

B. (23 09 13.23.B.) Sensors:

1. Standard sensors shall have outdoor air temperature, return air temperature, evaporator/DX reheat coil leaving air temperature, suction pressure (all circuits), discharge pressure (all circuits), and leaving evaporator refrigerant temperature (all circuits).

Part 4 — (23 09 23) Direct Digital Control system for HVAC

4.01 (23 09 23.13) Decentralized, Rooftop Units:

A. (23 09 23.13.A.) Carrier SmartVu™ intelligent integrated unit controller with Direct Digital Control (DDC) shall:

1. Provide integrated unit operation for cooling, heating, and ventilation as well as monitoring, recording, and re-porting capabilities. Controller shall also provide diagnostics and alarms of abnormal unit operation through the user interface.
2. Operate standalone, with a two-stage cooling, two-stage heating thermostat, or via building automation system (BAS).
3. Have plug-and-play compatibility with Carrier i-Vu® Open building automation system, including communication, points and properties pages, and graphics.
4. Include a 7 in. color touch screen user interface with intuitive icon based navigation as the primary user interface. Keypad or rotary interfaces or touchscreens less than 7 in. are not acceptable.
5. Allow control access via web browser using a secure, direct ethernet connection between the control and PC, without the need for special licenses or proprietary interface adapters or programs. The web browser interface shall match the local control interface.
6. Provide a minimum of four control interface access levels, including basic access (no password), user access (static password), service access (app authenticated password), and factory access (controlled password).
7. Provide the ability to read refrigerant pressures at local display, web browser, or via BAS network without the use of external refrigerant gauges.
8. Include a USB data port to allow for software upgrades without the need for special tools or programs.
9. Provide service capabilities of:
   a. Manual component test.
   b. Service run mode.
   c. Track component run hours and starts.
   d. Data trending.
   e. Alarm history.
10. Allow the use of multiple occupancy sources, including BAS, remote input, local schedules with 365 day real time clock, 8 occupancy schedules and 16 holiday schedules.

11. Include field use control inputs, including space temperature, space temperature offset, space relative humidity, supply air temperature, mixed air temperature, two-stage cool/heat thermostat (Y1, Y2, W1, W2, G), dehumidify switch, two demand/capacity limit switches, analog demand limit/third-party supply air temperature reset, pre-filter status switch, indoor air quality (IAQ)/third-party outdoor air damper control, IAQ switch, outdoor air quality (OAQ)/outdoor air enthalpy (OAE) switch, third-party supply static pressure reset/third-party indoor fan control, third-party exhaust fan control, remote shutdown/occupancy switch, smoke detector/fire shutdown, emergency shut-down, smoke purge, fire pressurization, and fire evacuation, as standard.
12. Include field use control outputs, including field provided modulating heat, field provided heat enable, alarm/aux relay, and damper override relay, as standard.
13. Provide cooling and heating demand source configurations for space temperature sensors, two-stage cool/heat thermostat or network inputs, or return air temperature.
14. Provide supply air temperature based operation for cooling and modulating heat with user adjustable supply air temperature setpoints for low cool, high cool, VAV cool, low heat, high heat, and vent demands.
15. Include occupied cooling, unoccupied cooling, occupied heating, and unoccupied heating setpoints and maintain a 5°F temperature difference between cooling and heating set points to meet the latest ASHRAE 90.1 Energy Standard. Single setpoint configurations are not allowed.
16. Provide the ability to perform cool-tempered venting and heat-tempered venting operation to prevent hot or cold discharge air during vent mode.
17. Allow mechanical cooling operation down to –10°F (–23.3°C) entering condenser coil, through the modulation of condenser fan speeds as standard using Greenspeed® intelligence.
18. Provide user-adjustable compressor lockouts based on outdoor air temperature and mixed air temperature, and user-adjustable heating lockouts based on outdoor air temperature.
19. Shall read and display the indoor fan motor, voltage, current, temperature, and modulation level.

Part 5 — (23 09 33) Electric and Electronic Control System for HVAC

5.01 (23 09 33.13) Decentralized, Rooftop Units:

A. (23 09 33.13.A.) General:
   1. Shall be complete with self-contained low-voltage control circuit.
   2. Shall utilize color-coded wiring.
   3. Shall have wiring diagrams affixed to the interior door panels of each section.

B. (23 09 33.13.B.) Safeties:
   1. Compressors.
      a. Over-temperature.
      b. Over-current.
      c. High refrigerant circuit pressure switch.
   2. Indoor Fan
      a. Overcurrent protection.
      b. Line under voltage detection.
      c. Phase loss detection.
      d. Blocked rotor detection.
      e. Rotor position detection error.
      f. Indoor fan door interlock switch to prevent indoor fan operation with the fan access door open.

Part 6 — (23 09 93) Sequence of Operations for HVAC Controls

6.01 (23 09 93.13) Decentralized, Rooftop Units:

A. (23 09 93.13.A.) INSERT SEQUENCE OF OPERATION:

Part 7 — (23 40 13) Panel Air Filters

7.01 (23 40 13.13) Decentralized, Rooftop Units:

A. (23 40 13.13.A.) Standard Pre-filter Section:
   1. Shall consist of factory-installed, disposable 2 in. fiberglass filters of commercially available sizes, unless optional filters are selected.

Part 8 — (23 81 19) Self-Contained Air Conditioners

8.01 (23 81 19.16) Large-Capacity Self-Contained Air Conditioners:

A. (23 81 19.13.A.) General:
   1. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing a fully hermetic scroll compressor(s) for cooling duty.
   2. Factory-assembled, single-piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, refrigerant charge, operating oil charge, microprocessor-based control system and associated hardware, and all special features required prior to field start-up.

3. Unit shall use Puron® (R-410A) refrigerant and include a factory refrigerant charge. The unit exterior must be marked as using Puron and the nameplate must contain the refrigerant change weight.
4. Unit shall ship as a single piece and shall be installed in accordance with the manufacturer's instructions.
5. Unit must be selected and installed in compliance with local, state, and federal codes.

B. (23 81 19.13.B.) Quality Assurance:
1. Unit meets and exceeds ASHRAE 90.1 (latest edition) minimum efficiency requirements.
2. Unit performance shall be certified in accordance with AHRI Standards 340/360 (latest edition).
3. Unit shall be designed to conform to ASHRAE 15 and 62.1 (latest editions).
4. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
5. Pre-painted exterior coating shall be capable of withstanding a minimum 500-hour salt spray exposure per ASTM B117 (scribed specimen).
6. Unit shall be manufactured in a facility registered by ISO 9001:2015.
7. Roof curb shall be designed to conform to National Roofing Contractors Association (NRCA) criteria per Guideline B-1986.
8. Unit shall pass an automated factory run test, including validation of refrigerant circuit performance, verification of operation of key components. A run test certificate shall ship with the unit.
9. Unit shall be designed in accordance with UL Standard 1995 or 60335-2-40, including tested to withstand rain. Compliance shall be listed with UL and UL Canada.

C. (23 81 19.13.C.) Delivery, Storage, and Handling:
1. Unit shall be stored and handled per manufacturer's recommendations.
2. Lifted by crane requires spreader bars.
3. Unit shall only be stored or positioned in the upright position.

D. (23 81 19.13.D.) Project Conditions:
1. As specified in the contract.

E. (23 81 19.13.E.) Operating Characteristics:
1. Unit shall be capable of starting and running in mechanical cooling from –10°F (–23.3°C) to 115°F (46.1°C) entering condenser air temperature.
2. Unit shall meet or exceed ASHRAE 90.1 requirements for a minimum of 4 stages of cooling capacity with the lowest stage being no higher than 25% of unit capacity.
3. Unit shall discharge supply air vertically or horizontally as shown on drawings.
4. Unit shall provide supply air temperature control in cooling

F. (23 81 19.13.F.) Electrical Requirements:
1. Main power supply voltage, phase, and frequency must match those required by the manufacturer.
2. The unit power panel shall have a short circuit current rating (SCCR) of no less than 10kA.
3. The single point electrical connection shall be at a factory-installed terminal block in the power panel.
4. Power wiring shall be a copper conductor (no aluminum) sized for no less than 167°F (75°C).
5. Separate enclosures shall be provided for high and low voltage components.

G. (23 81 19.13.G.) Unit Cabinet:
1. Unit cabinet shall be constructed of galvanized steel (designated G60 per ASTM Standard A653) and shall be bonderized with a pre-painted finish or powder-coat on the outer surface.
2. Unit cabinet exterior shall be capable of withstanding ASTM Standard B117 500-hour salt spray test.
3. Unit cabinet interior top and side panels/doors (supply air touching) shall be lined minimum 1/2 in. thick, 1 lb density, aluminum foil-faced fiberglass insulation.
4. Unit cabinet shall have an insulation rating of R4.
5. Unit shall be available in dedicated compact or standard chassis footprints to facilitate replacement of existing units or meet new construction requirements.
6. Drawings shall be available to show the dimensions of the specified cabinet configurations. Certified drawings with a table to decode unit lengths is not acceptable.
7. Basepan:
   a. Unit shall have base rails on a minimum of 2 sides.
   b. Include a minimum of four lifting lugs to support rigging shackles for maneuvering and overhead rigging.
   c. Base rail shall be a minimum of 16 gauge thickness.
   d. Shall have a single thru-the-base power coupling and primary and secondary thru-the-base control couplings.
   e. Bottom shall be lined with minimum 1/2 in. thick, 1 lb density, fiberglass insulation.

8. Condensate Pan:
   a. Shall be a sloped condensate drain pan made of galvanized steel.
   b. Shall comply with ASHRAE Standard 62.
   c. Shall use a single, drain connector through the side of the unit base rail. Connection shall be made per manufacturer's recommendations.
9. Electrical Connections:
   a. All unit power wiring shall enter the power box at the bottom or back.
   b. Thru-the-base capability.
      1) Standard unit shall have a thru-the-base power and control couplings in the basepan.
      2) No basepan penetration, other than those authorized by the manufacturer, is permitted.
10. Access Doors:
    a. Hinged access doors shall be provided on a single side of the unit to facilitate single side maintenance access.
    b. At a minimum, doors must be provided on the filter section, indoor fan section, control box, and power box. The door shall deal against a rubber gasket to prevent air and water leakage.
    c. All doors shall require the use of tools to open the door to help prevent unauthorized access.
    d. The indoor fan section door shall have a minimum of one locking handle and pressure safety latch.
11. Access Panels:
    a. Removable panels shall be provided on areas that require infrequent access.

H. (23 81 19.13.H.) Coils:
1. Evaporator (Standard):
   a. Shall be round tube, plate fin style coil with aluminum fins mechanically bonded to copper tubes (Al/Cu).
   b. Tube diameter shall be 1/2 in. OD (outside diameter).
   c. Coil shall be fully active during full and part load operation.
   d. Intertwined circuiting constructed of aluminum fins mechanically bonded to seamless copper tubes.
   e. Full-face active type during full and part-load conditions.
   f. Coils shall be leak tested at 150 psig and pressure tested at 650 psig.
2. Condenser (Standard):
   a. Shall be an microchannel design, constructed of an aluminum alloy. The coils shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds.
   b. Microchannel coils shall consist of a two-pass arrangement.
   c. Coils shall be leak tested at 150 psig and pressure tested at 650 psig.

I. (23 81 19.13.I.) Refrigerant Circuit:
1. Refrigerant circuit shall have the following control, safety, and maintenance features:
   a. Single circuit refrigerant circuit on sizes 27-35 for optimal performance and efficiency.
   b. Electronic expansion valve (EXV) metering devices on all models. Thermostatic expansion valves (TXV) are not acceptable.
   c. Refrigerant filter drier.
   d. Service ports on suction and discharge lines.
   e. Sight glass.
   f. Fusible plug.
2. Compressors:
   a. The unit shall have a maximum of two compressors per refrigerant circuit to ensure proper coil management.
   b. Units must have a minimum of one variable capacity (digital or variable speed) compressor for improved supply air temperature control and load matching.
   c. Compressors shall be mounted on rubber-in-shear vibration isolation.
   d. Each compressor shall have crankcase heater that is only on when the compressor is off and the outdoor air temperature is below 80°F (26.6°C).

J. (23 81 19.13.J.) Pre-Filter Section:
1. The standard pre-filter is specified in the filter of this specification.
2. Shall have a minimum 4 in. vertical pre-filter rack with 2 in. spacer.
3. Must be able to accept a single 2 in. filter, two 2 in. filters, or a single 4 in. filter by removing the spacer.
4. Filters shall be accessible through a hinged access door.

K. (23 81 19.13.K.) Indoor Fan:
1. Motor:
   a. Shall be an electronically commutated (ECM) motor, available in standard or medium static.
   b. Must have IP20 or IP55 ingress protection rating, a Moisture (F)/Environmental (H) protection class if H1, and an insulation class of F.

c. Shall communicate with the unit controller over Modbus and shall be capable of receiving at least one configurable discrete input, one configurable analog input, and one configurable analog output. Analog or pulse width modulation control is not acceptable.
d. Must have permanently lubricated bearings.
e. Shall be controlled directly from the Carrier SmartVu control system. External PWM control is not acceptable.
f. Provide internal diagnostics and EMI/RFI (electromagnetic/radio frequency interference) filters.
g. The indoor fan wall must include track to support the bottom of the fan frame for easy fan removal and installation.
h. Bearings shall have an L10 life of over 100,000 hours.

2. Fan:
   a. Unit shall have a direct drive indoor fan array containing no less than three fans. Belt drive fans are not acceptable.
   b. Shall be single width, single inlet (SWSI) backward curve impeller.
   c. Impeller, shaft, bearings, drive components, and motor shall be mounted on a formed steel assembly bolted to a galvanized steel mounting plate.
   d. Fans shall have a galvanized steel inlet nozzle, aluminum impeller with five blades, and die cast aluminum electronics housing. Composite impellers are not acceptable.
   e. Impellers shall be designed for continuous operation at the maximum rated fan speed and motor power.
   f. Fan and motor shall be statically and dynamically balanced as an assembly to G6.3.
3. Control:
   a. The indoor fan speed shall be controlled by SmartVu controls.
   b. SAV™: The control shall default to Staged Air Volume (SAV) indoor fan control for single zone applications.
      1) Staged air volume (SAV) shall be field configurable for operation based on cool demands (2 fan speeds) or cool capacity (3 fan speeds).
      2) The control shall be field configurable for Constant volume (CV), Third party modulation, or MZ-VAV duct pressure (with field-installed sensor).
   c. VAV: The control shall default to mutli-zone variable air volume (MZ-VAV) duct pressure indoor fan control for multi-zone applications.
      1) Shall have a duct pressure transducer with –0 to 5 in. wg range and low side pressure port reading atmospheric pressure. Requires field-supplied and installed high side pressure tubing and duct pressure pick-up port.
      2) The control shall be field configurable for Staged Air Volume (SAV), Constant volume (CV), or Third-party modulation.

L. (23 81 19.13.L.) Condenser Fans:
   1. Motor:
      a. Shall be a three-phase, 8-pole, totally enclosed motor. Single-phase motors are not acceptable.
      b. Shall use permanently lubricated bearings.
      c. Must be statically and dynamically balanced.
      d. Shall be variable speed (electronically commutated or variable frequency drive).
      e. The fan speed shall be modulated by the unit control based on saturated condensing temperature for improved efficiency and low ambient mechanical cooling. Fixed speed or staged fans are not acceptable.
   2. Fans (Standard):
      a. Shall be a direct-driven propeller type fan constructed of metal.
      b. Must be protected by PVC-coated steel wire safety guards.
      c. Shall discharge air vertically.

M. (23 81 19.13.M.) Manual Outdoor Air Damper (Standard):
   1. Shall have pressure activated (no actuator) damper assembly, sized to allow up to 25% outdoor air at maximum position. The damper is open when the indoor fan is on and closes when the indoor fan is off.
   2. Must include an adjustable maximum position stopper.
   3. Must include factory-installed outdoor air intake hoods that ship in the installation location to reduce installation time. Field-installed outdoor air hoods are not acceptable.
   4. Outdoor air screens shall ship inside the unit for field installation.

N. (23 81 19.13.N.) Factory-installed Options:
   1. Two-Stage Electric Heat:
      a. The unit shall have a factory-installed electric heater with two-stages of operation, powered from the unit power feed to reduce installation cost.
      b. The heater shall be available in low, medium, and high capacity options.
      c. The heater shall have nickel-chromium (NiCr) resistive heating elements, internal fusing, and manual reset thermal cut-outs.

2. Silicon Rectifier Controlled (SCR) Modulating Electric Heat:
   a. The unit shall have a factory-installed modulating electric heater with SCR control for improved supply air temperature control. Solid state relay (SSR) controlled electric heat is not acceptable.
   b. The heater shall be powered from the unit power feed to reduce installation cost.
   c. The heater shall be available in low, medium, and high capacity options.
   d. The heater shall have nickel-chromium (NiCr) resistive heating elements, internal fusing, and manual reset thermal cut-outs.
   e. Shall include a factory-provided, field-installed supply air temperature sensor.
3. Hot Water Coil:
   a. The unit shall have a factory-installed hot water coil in the heat section of the unit, downstream of the indoor fans.
   b. The hot water coil shall have inlet and outlet stubs to allow field-installed water piping connections inside the unit cabinet.
   c. The field-installed hot water piping shall be able to pass through the heat section door.
   d. The hot water control valve shall be field-provided and installed and controlled by the unit controller using and analog control signal.
   e. Shall include a factory-provided, field-installed supply air temperature sensor.
4. Low-Sound Condenser Fans:
   a. The unit shall have factory-installed low-sound condenser fans that reduce sound output during cooling or dehumidification operation.
   b. Shall include only AeroAcoustic™ composite condenser fans with swept fan blades and blade edge optimization to reduce radiated sound and allows for lower RPM operation. Metal condenser fans are not acceptable.
   c. Must include vertically extended shrouds on all condenser fans to reduce radiated sound at ground levels.
5. Compressor Sound Blankets:
   a. The unit shall have factory-installed sound blankets on all compressors to reduce radiated sound. If factory-installed sound blankets are not available, field installed sound enclosures shall be provided.
6. Humidi-MiZer Adaptive Dehumidification:
   a. The unit shall have a factory-installed dehumidification system that allows dehumidification in cooling, venting, or heating modes using a variable mixture of warm liquid refrigerant and hot gas refrigerant as a reheat source. Reheat systems that use only hot gas or liquid refrigerant in dedicated coils are not acceptable.
   b. During dehumidification mode, the compressors shall control to cooling coil temperature (CCT, an approximation of supply air dew point temperature) and the reheat system shall be modulated to supply air temperature (SAT).
   c. The dehumidification system shall have an e-coated reheat coil, on/off reheat valve, modulating condenser bypass valve, interconnecting refrigerant piping, and a cooling coil leaving air temperature sensor. Requires the enthalpy and humidity sensing options (OARH and RARH).
   d. When the dehumidification system must provide cool, dehumidified air, the reheat coil shall utilize liquid refrigerant as a reheat source (sub-cooling mode). The further cooling of the liquid refrigerant increases the evaporator dehumidification capacity and improves latent capacity.
   e. When the dehumidification system must provide warm, dehumidified air, the reheat coil shall utilize hot gas refrigerant as a reheat source (hot gas mode). The use of hot gas refrigerant allows for higher discharge air temperatures to be achieved compared to sub-cooling mode.
   f. When the dehumidification system must dehumidify air and supply it between cool and warm, a modulated mix of hot gas and warm liquid refrigerant is supplied to the reheat coil as a reheat source.
   g. The control shall provide configurations for dehumidification demands based on space relative humidity, return air relative humidity, or a discrete dehumidification input.
   h. The control shall provide configurations to prevent dehumidification demands with low cool, high cool, VAV cool, low heat, high heat, or vent demands for improved space temperature control.
7. Extended Section (STANDARD CHASSIS ONLY):
   a. The unit shall have a factory-installed blank cabinet section installed before the filter section and a larger filter access door, for replacement of legacy Carrier 50P and 50Z Series units with extended chassis or for an optional factory-installed bag or cartridge filters.
8. Plenum Section (STANDARD CHASSIS ONLY):
   a. The unit shall have a factory-installed blank cabinet section installed before the filter section and a larger filter access door, for

replacement of legacy Carrier 50P and 50Z Series units with discharge plenum or for an optional factory-installed bag or cartridge filters.

9. Stainless Steel Drain Pan:
   a. The unit shall have a factory-installed condensate drain pan constructed of 409 stainless steel for corrosion protection.
10. E-coated Condenser Coils:
   a. The unit shall have factory-installed E-coated MCHX condenser coils for corrosion protection.
   b. Coating shall be flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins or louvers. Coating process shall ensure complete coil encapsulation, including all exposed fin edges.
   c. E-coat thickness of 0.8 to 1.2 mil with topcoat having a uniform dry thickness from 1.0 to 2.0 mil on all external coil surface areas, including fin edges, shall be provided.
   d. Coated coils shall have a hardness characteristics of 2H per ASTM D3363-00 and crosshatch adhesion of 4B-5B per ASTM D3359-02.
   e. Coated coils shall have superior impact resistance with no cracking, chipping, or peeling per NSF/ANSI 51-2002 Method 10.2. Impact resistance shall be up to 160 in./lb per ASTM D2794-93.
   f. E-coated aluminum microchannel coils shall be capable of withstanding more than 8,000-hour salt spray test in accordance with the ASTM (U.S.A.) B-117 Standard.
11. E-coated Evaporator Coil:
   a. The unit shall have factory-installed, E-coated Al/Cu evaporator coil(s) for corrosion protection.
   b. Coating shall be flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins or louvers. Coating process shall ensure complete coil encapsulation, including all exposed fin edges.
   c. E-coat thickness of 0.8 to 1.2 mil with topcoat having a uniform dry thickness from 1.0 to 2.0 mil on all external coil surface areas, including fin edges, shall be provided.
   d. Coated coils shall have a hardness characteristics of 2H per ASTM D3363-00 and crosshatch adhesion of 4B-5B per ASTM D3359-02.
   e. Coated coils shall have superior impact resistance with no cracking, chipping, or peeling per NSF/ANSI 51-2002 Method 10.2. Impact resistance shall be up to 160 in./lb per ASTM D2794-93.
   f. E-coated aluminum microchannel coils shall be capable of withstanding an 3,000-hour salt spray test in accordance with the ASTM (U.S.A.) B-117 Standard.
12. Condenser Hail Guard:
   a. The unit shall have factory-installed louvered panels on all vertically mounted condenser coils for hail protection.
   b. Louvered panel shall be constructed of galvanized steel (designated G60 per ASTM Standard A653) and shall be bonderized and pre-painted on the outer surface.
   c. Unit cabinet exterior shall be capable of withstanding ASTM Standard B117 500-hour salt spray test.
   d. Hail guard shall attach mechanically to the unit frame. Factory provided hardware shall be used to reduce the risk of coil and refrigerant piping puncture.
13. Humidity and Enthalpy Sensing:
   a. The unit shall have factory-installed outdoor air relative humidity and return air relative humidity sensors for use with dehumidification (return air relative humidity demand) or free cooling control (enthalpy or differential enthalpy changeover, outdoor air dew point lockout).
14. Return Air CO_2:
   a. The unit shall have a factory-installed return air CO_2) sensor to help detect space IAQ.
   b. The sensor shall be mounted in the unit return air section and shall measure carbon dioxide (CO_2) concentration in parts per million with an accuracy of ± 3%.
   c. The sensor shall be connected to the control system to display the IAQ and for use as part of demand con-trolled ventilation (DCV) or IAQ override control.
15. NGC I/O Expansion Board:
   a. The unit shall have a factory-installed control I/O expansion module.
   b. The NGC expansion module shall be required with, standard chassis units with economizer, or compact chassis units with horizontal return and economizer.
16. Ultra-Low Leak Economizer:
   a. The unit shall have a factory-installed economizer assembly with modulating outdoor air and return air dampers with damper actuator(s) for ventilation and free cooling operation.
   b. The economizer shall be controlled by the unit controller. Separate, standalone economizer control systems are not acceptable.

c. Dampers shall be a gear-driven ultra low leakage type with blade and edge seals. Dampers shall exhibit a maximum leakage rate of 3 cfm per square foot of area at 1 in. wg pressure differential when tested in accordance with AMCA (Air Movement and Control Association) Standard 500.

d. Actuator shall have a spring-return feature which shuts dampers upon a power interruption or unit shutdown. Actuators are capable of internal diagnostics.

e. The unit controller shall have configuration to control ventilation based on indoor fan speed, outdoor air cfm, demand controlled ventilation (DCV), third-party minimum position control, or third-party full control.

f. The economizer shall be controlled by the unit controller and shall meet California Title 24, ASHRAE 90.1 and IECC Fault Detection and Diagnostic (FDD) requirements.

g. The unit controller shall have configurations to allow free cooling based on outdoor air temperature and differential outdoor air and return air temperature as standard. Configurations shall also available for outdoor air enthalpy, differential outdoor air and return air enthalpy, outdoor air enthalpy switch, or outdoor air dew point (optional or accessory sensors required).

h. Must include factory-installed outdoor air intake hoods that ship in the installation location to reduce installation time. Field installed outdoor air hoods are not acceptable.

i. COMPACT CHASSIS: The outdoor air intake shall be on the same side of the unit as exhaust or relief outlets

j. STANDARD CHASSIS: The outdoor air intake shall be on a different side of the unit than the exhaust or relief outlets to prevent recirculation and support proper ventilation.

17. Barometric Relief:

a. The unit shall have a factory-installed barometric relief system with relief hoods and two pressure-activated damper assemblies in the unit return air section for relieving building pressure during free cooling operation.

b. The damper shall start to open when back pressure exceeds approximately 0.04 in. wg and shall gravity close when back-pressure is reduced.

c. COMPACT CHASSIS: The relief hoods and dampers ship in the installation location.

d. STANDARD CHASSIS: The relief hoods and dampers ship rotated into the unit and are field rotated to their final installation location.

18. Low Static Power Exhaust:

a. The unit shall have a factory-installed exhaust system with two, direct-drive propeller fans with ECM motors, barometric dampers, and exhaust air hoods for relieving building pressure.

b. The control system shall have configurations to control the exhaust fan based on outdoor air damper position, or a third-party signal.

c. COMPACT CHASSIS: The exhaust hoods and fans ship in the final shipping location. Exhaust hoods are a tip out design to allow easy inspection and servicing.

d. STANDARD CHASSIS: The exhaust hoods and fans ship retracted into the unit and are field slid into their final installation location. Access panels are included on the hood for fan inspection and servicing.

19. Low Static Power Exhaust with Building Pressure Control:

a. The unit shall have a factory-installed exhaust system with two, direct-drive propeller fans with ECM motors, barometric dampers, and exhaust air hoods for relieving building pressure.

b. The unit shall have a factory-installed building pressure transducer with –0.25 to 0.25 in. wg range and low side pressure port reading atmospheric pressure. Requires field-supplied and installed high side pressure tubing and space pressure pick-up port.

c. The control system shall have configurations to control the exhaust fan based on outdoor air damper position, building pressure, or a third-party signal.

d. COMPACT CHASSIS: The exhaust hoods and fans ship in the final shipping location. Exhaust hoods are a tip out design to allow easy inspection and servicing.

e. STANDARD CHASSIS: The exhaust hoods and fans ship retracted into the unit and are field slid into their final installation location. Access panels are included on the hood for fan inspection and servicing.

20. Medium Static Power Exhaust with Building Pressure Control (STANDARD CHASSIS ONLY):

a. The unit shall have a factory-installed exhaust system with two direct-drive backward curve (SWSI) fans with ECM motors, barometric dampers, and exhaust air hoods for relieving building pressure.

b. The unit shall have a factory-installed building pressure transducer with –0.25 to 0.25 in. wg range and low side pressure port reading atmospheric pressure. Requires field-supplied and installed high side pressure tubing and space pressure pick-up port.

c. The control system shall have configurations to control the exhaust fan based on outdoor air damper position, building pressure, or a third-party signal.

d. The exhaust hoods and fans ship retracted into the unit and are field slid into their final installation location. Access panels are included on the hood for fan inspection and servicing.

21. Factory-Wired Convenience Outlet:
    a. The unit shall have a factory-installed 115-v, ground-fault protected (GFI) duplex outlet for loads of up to 10A total.
    b. The outlet shall be powered from the unit power feed, using a factory-installed mains to 115-v transformer connected to the load side of the unit terminal block. When the main unit power feed is disconnected, power to the outlet is also disconnected.
    c. Fusing shall be provided on both the line side and load side of the transformer.
    d. The outlet shall be accessible from outside the unit.
    e. The unit nameplate minimum circuit ampacity (MCA) and maximum over-current protection (MOCP) shall have the outlet amp draw.
22. Field-Wired Convenience Outlet:
    a. The unit shall have a factory-installed 115-v, ground-fault protected (GFI) duplex outlet for loads of up to 15A total.
    b. The outlet requires a field-supplied and installed 115-v power source.
    c. The outlet shall be accessible from outside the unit.
    d. Does not include a transformer.
23. Non-Fused Disconnect:
    a. The unit shall have a factory-installed, non-fused disconnect for disconnecting the unit power feed during maintenance or servicing.
    b. The disconnect shall be installed in the unit power box with an interlocking, through-the-door style disconnect handle. External disconnects are not acceptable.
    c. The disconnect shall be nominally sized to meet or exceed National Electric Code (NEC) sizing for combination loads. Field-provided breakers or fuses are still required for over-current protection.
    d. The disconnect handle shall support lock-out, tag-out locks.
24. Power Monitor:
    a. The unit shall have a factory-installed power monitor to help protect against damage from abnormal power.
    b. The monitor shall be normally closed and shall detect phase loss and phase reversal.
    c. The monitor shall trigger the control emergency shutdown to shut down the unit when a fault is detected.
25. High Short Circuit Current Rating (SCCR):
    a. The unit shall have factory-installed power box with upgraded high voltage components to provide an SCCR rating of 65kA for 208/230/460-v units or 25kA for 575-v units.
    b. Includes a terminal block for power connection.
    c. The unit nameplate must reflect the high SCCR rating.
    d. Requires field-provided J-type fuses and fuse holder to be installed and wired before the unit terminal block.
26. Condensate Overflow Switch:
    a. The unit shall have a factory-installed condensate overflow switch to help protect against clogged drain pans.
    b. The overflow switch shall be an conducting type. Float switches are not acceptable.
27. Pre-Filter Status Switch and Access Door Retainers:
    a. The unit shall have a factory-installed pressure measuring switch across the entire pre-filter bank to detect when the filters are dirty.
    b. The unit shall have factory-installed retainers on all access doors to hold the doors open during maintenance.
    c. The pressure switch shall be field-set and adjustable from 0-2 in. wg
    d. The dirty filter alert shall be viewable from the control interface.
    e. The door retainer shall be rod and stopper type with multiple stopping points.
28. Return Air Smoke Detector:
    a. The unit shall have a factory-installed smoke detector in the return air section of the unit, to shut down the unit when smoke is detected.
29. Service Pack:
    a. The unit shall have factory-installed discharge and suction line isolation valves on the compressor tandem assembly and a replaceable core filter drier assembly with isolation valves on all circuits to facilitate faster service.
30. Chicago Refrigerant Relief Valve:
    a. The unit shall have a factory-installed, pressure-activated, mechanical relief valve in all refrigerant circuits to comply with Chicago Building Code. Fusible plugs are not acceptable.

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b. The relief valve shall activate at 650 psig.

c. The relief valve shall have a National Pipe Thread (NPT) connection for field relief outlet piping.

31. 2 in. MERV 8, 4 in. MERV 8, or 4 in. MERV 13 Pre-Filters:
    a. The unit shall have a factory-installed 4 in. pre-filter rack with either 2 in. MERV 8, 4 in. MERV 8, or 4 in. MERV 13 pleated filters.
32. 2 in. MERV 8 and 4 in. MERV 13 Pre-Filters:
    a. The unit shall have a factory-installed 2 in. and 4 in. pre-filter rack with 2 in. MERV 8 pleated filters before 4 in. MERV 13 pleated filters for improved filtration and extended filter life.
33. 2 in. MERV 8 and 12 in. MERV 14 Bag Pre-Filters (STANDARD CHASSIS ONLY):
    a. The unit shall have a factory-installed 2 in. pre-filter rack with 2 in. MERV 8 pleated filters before a bag filter track with 12 in. MERV 14 bag filters for high filtration and extended filter.
    b. Bag filter header shall be constructed of thermoplastic polymer and media shall be synthetic. Paper headers or fiberglass media is not acceptable.
34. 2 in. MERV 8 and 12 in. MERV 15 Cartridge Pre-Filters (STANDARD CHASSIS ONLY):
    a. The unit shall have a factory-installed 2 in. pre-filter track with 2 in. MERV 8 pleated filters before a cartridge filter track with 12 in. MERV 15 pleated filters for improved filtration and extended filter life.
    b. Cartridge filter header shall be constructed of galvanized steel and media shall be synthetic. Fiberglass media is not acceptable.
35. Ultraviolet (UV-C) Fixtures:
    a. Unit shall have factory-installed fixtures for field-provided and installed UV-C emitters.
    b. Fixtures shall be mounted down stream of the evaporator coil.
    c. Fixtures shall have factory wiring with evaporator door interlock switch, disconnect switch, and UV safe view port.
    d. Fixtures require field-provided and installed 115-v power supply.

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