Product Data

WeatherMaster® Applied Rooftop Units

27.5 to 50 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 Puron Advance™ R-454B Refridgerant and SmartVu™ Controls

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

Table of contents

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.

The 48/50V Series also uses Carrier's new Puron Advance™ refrigerant. This innovative refrigerant, also known as R-454B, has a global warming potential (GWP) rating of 465, well below the Environmental Protection Agency's (EPA) 700 GWP limit, effective 2025 for packaged equipment.

Other new features include a standard or high capacity lead variable speed scroll compressor, low ambient mechanical cooling with variable-speed condenser fans, 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 high-capacity lead variable speed compressor, high efficiency-low sound package, modulating gas, or electric heat for improved supply air temperature control, ultra-low leak economizer for ventilation and free cooling, 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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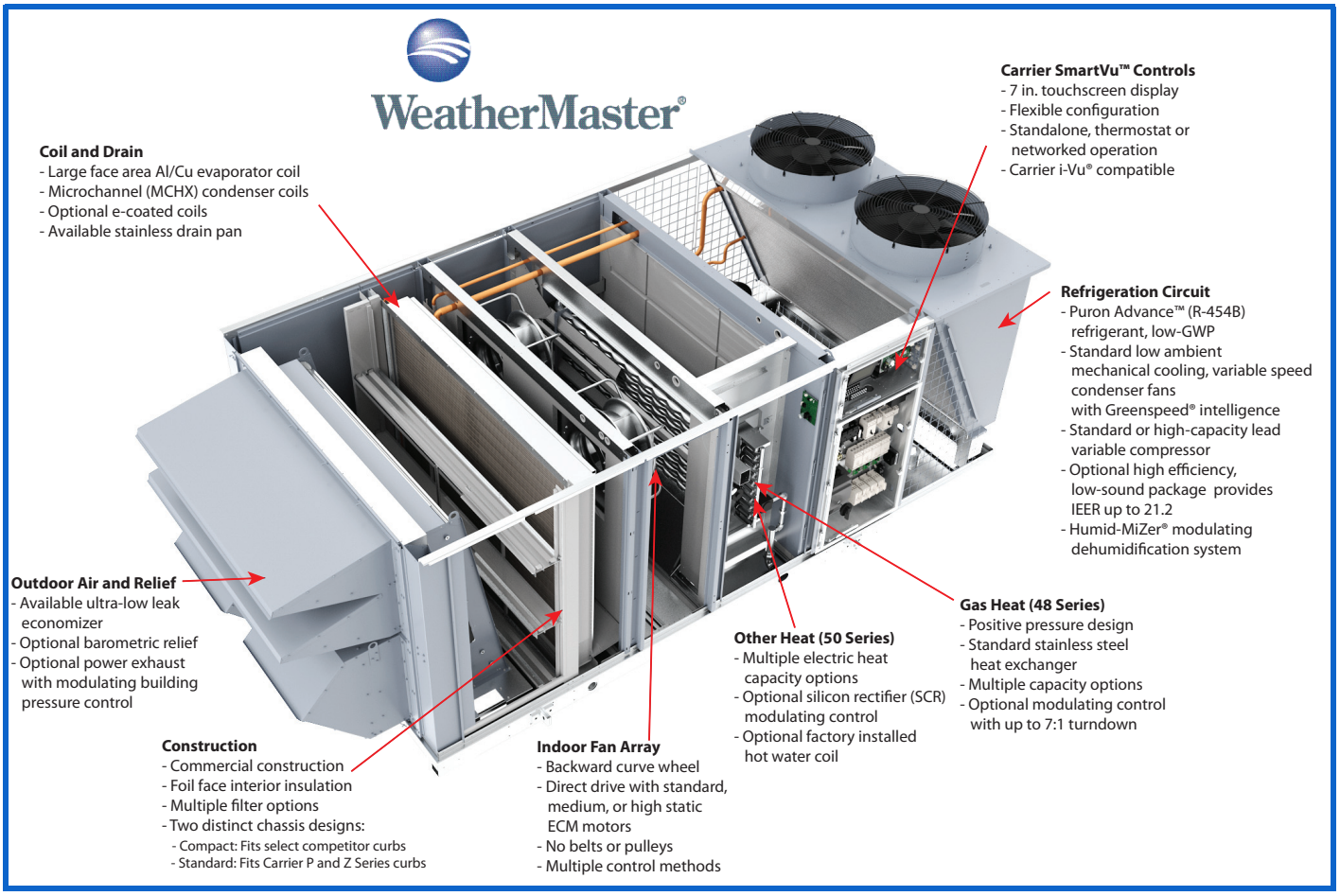

Model number nomenclature

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	Q	2	8	A	0	-	1	B	8	A	0	A	0

Heat Type (1,2)
- 48 – Packaged Cooling/Gas Heat
- 50 – Packaged 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)
- Q – Standard Efficiency, Low Ambient, Standard Capacity VSC
- R – Standard Efficiency, Low Ambient, Standard Capacity VSC Humidi-MiZer
- S – High Efficiency, Low Sound, Low Ambient, High Capacity VSC
- T – High Efficiency, Low Sound, Low Ambient, High Capacity VSC, Humidi-MiZer
- X – High Efficiency, Low Sound, Low Ambient, Standard Capacity VSC
- Y – High Efficiency, Low Sound, Low Ambient, Standard Capacity VSC, Humidi-MiZer

Size and Refrigerant (7,8)
- 28 – 27.5 Tons, R-454B
- 30 – 30 Tons, R-454B
- 34 – 35 Tons, R-454B
- 40 – 40 Tons, R-454B
- 50 – 50 Tons, R-454B

Construction (9)
- A – Single Wall
- C – Double Wall
- D – Agion®[1] Double Wall
- F – Single Wall, Extended Standard Chassis
- H – Double Wall, Extended Standard Chassis
- J – Agion®[1] Double Wall, Extended Standard Chassis
- L – Single Wall, Standard Chassis with Plenum
- N – Double Wall, Standard Chassis with Plenum
- P – Agion®[1] Double Wall, Standard Chassis with Plenum
- R – Single Wall, Extended Standard Chassis with Plenum
- T – Double Wall, Extended Standard Chassis with Plenum
- U – Agion®[1] Double Wall, Extended Standard Chassis with Plenum

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

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 4" M13 Filter, Ultraviolet Light (UV-C) Fixture
- 5 – 6" Pre-Filter Rack with 2" M8 and 4" M13 Filter
- 6 – 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 Service and Safety
- 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 Relief Valve (CRV), COFS, FSS + ADR, RASD, Service Pack
- T – Filter Measuring (FFM) + ADR, COFS
- U – FM + ADR, COFS, RASD
- V – FM + ADR, COFS, Service Pack
- W – FM + ADR, COFS, RASD, Service Pack
- X – CRV, FM + ADR, COFS, RASD, Service Pack

Electrical (16)
- 0 – Standard Electrical
- 1 – Powered Convenience Outlet (PCO)
- 2 – Unpowered Convenience Outlet (UCO)
- 3 – Non-Fused Disconnect (NFD)
- 4 – NFD + PCO
- 5 – NFD + OCO
- 6 – Phase Monitor (PM)
- 7 – PM + PCO
- 8 – PM + UCO
- 9 – PM + Non-Fused Disconnect (NFD)
- A – PM + NFD + PCO
- B – PM + NFD + UCO
- C – High SCCR (Terminal Block)
- E – High SCCR + UCO
- F – High SCCR + Field Wired C/O
- H – High SCCR + UCO + 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
- H – Ultra Low Leak Economizer, Standard Static PE, Modulating Building Pressure (BP) Control
- J – Ultra Low Leak Economizer, Medium Static PE, Modulating BP Control

Controls (14)
- 8 – Standard Controls
- 9 – Humidity Sensors
- A – Return Air Carbon Dioxide Sensor (RA CO_2)
- B – OA CFM
- C – Humidity Sensors, RA CO_2
- D – Humidity Sensors, OA CFM
- E – RA CO_2 ,OA CFM
- F – Humidity Sensors, RA CO_2 ,OA CFM

Design Series (13)
- B – First Revision
- S – ETO

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Model number nomenclature (cont)

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- 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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- 9 – PM + Non-Fused Disconnect (NFD)
- A – PM + NFD + PCO
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- C – High SCCR [Terminal Block]
- E – High SCCR + UCO
- F – High SCCR + PM
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- T – Filter Measuring (FFM) + ADR, COFS
- U – FM + ADR, COFS, RASD
- V – FM + ADR, COFS, Service Pack
- W – FM + ADR, COFS, RASD, Service Pack
- X – CRV, FFM + ADR, COFS, RASD, Service Pack

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- 1 – 4" Pre-Filter Rack with 2" M8 Filter
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- 3 – 4" Pre-Filter Rack with 4" M13 Filter
- 4 – 4" Pre-Filter Rack with 4" M13 Filter, Ultraviolet Light (UV-C) Fixture
- 5 – 6" Pre-Filter Rack with 2" M8 and 4" M13 Filter
- 6 – 6" Pre-Filter Rack with 2" M8 and 4" M13 Filter, UV-C Fixture

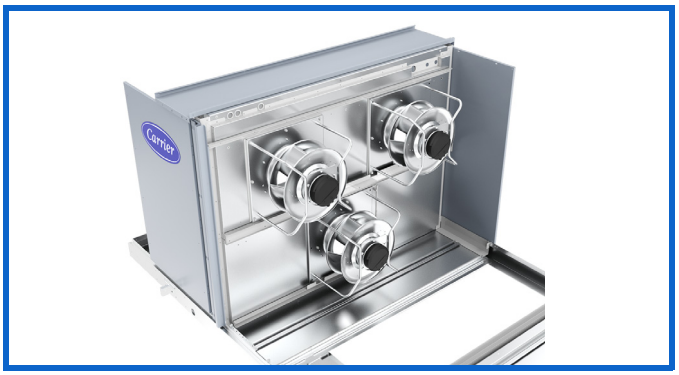
Features/Benefits

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.

Units are standard with variable frequency drive (VFD) controlled condenser fan motors with Greenspeed® intelligence to allow low ambient mechanical cooling down to –10°F (–23.3°C) and provide part-load energy savings and radiated sound reduction.



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 compressor and condenser fans modulate based on system operating conditions and control setpoints, 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 to 40 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. 50 ton units utilize a dual refrigerant circuit with intertwined evaporator coil. All 48/50V Series meet or exceed U.S. DOE 2023 efficiency requirements.

Flexible application

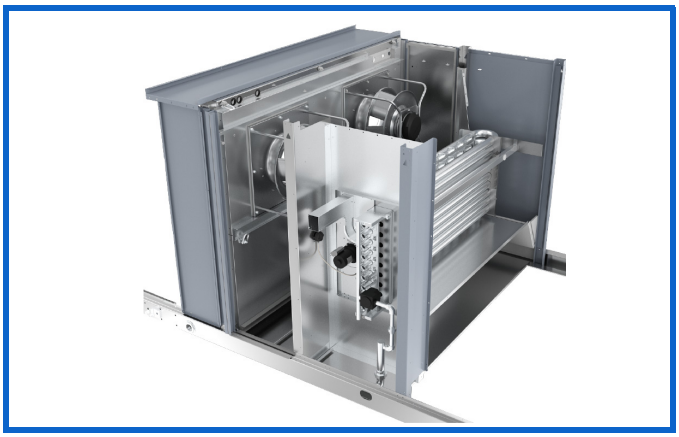
The 48/50V units are selectable between 27.5, 30, 35, 40, and 50 ton nominal cooling capacities in standard or compact chassis to meet project requirements. All models are available in 208V/230V-3Ph-60Hz, 460V-3Ph-60Hz, and 575V-3Ph-60Hz with a short circuit current rating (SCCR) of 10kA.

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 standard or 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) for single-zone VAV (SZ-VAV) or supply duct pressure control for multi-zone variable air volume (MZ-VAV) applications with additional configurations being field-selectable.



Features/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.

Units with Puron Advance™ R-454B refrigerant include A2L sensors with UL compliant dissipation control, eliminating the need for field provided and installed sensors and controls and simplifying compliance.

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.

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.

Features/Benefits (cont)

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 single-zone VAV (SZ-VAV), 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 input.

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

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

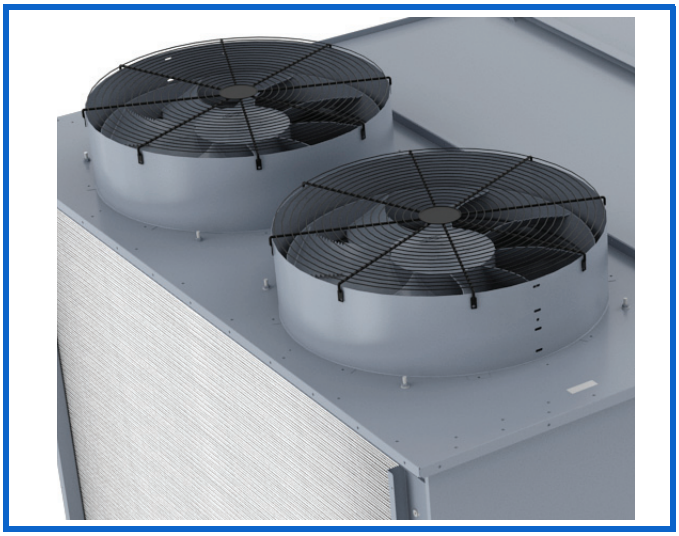
50V Series units are available with a factory-installed, 2-stage electric heater in low, medium, or high capacity. The electric heater is factory wired to the main power terminal block, eliminating the need for field power wiring or single-point kits.

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.

High-capacity variable speed compressor

For applications in hot or humid climates or where high cooling or dehumidification loads are present, the high-capacity variable speed compressor option provides enhanced full-load cooling and dehumidification capability.



High-efficiency, low-sound package

The high efficiency, low-sound option includes compressor sound blankets and 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 low sound condenser fans also provide high-efficiency cooling and dehumidification performance and improved efficiency ratings, 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.

Factory-installed options (cont)

Extended standard chassis

The extended standard chassis 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 standard chassis 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 extended 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

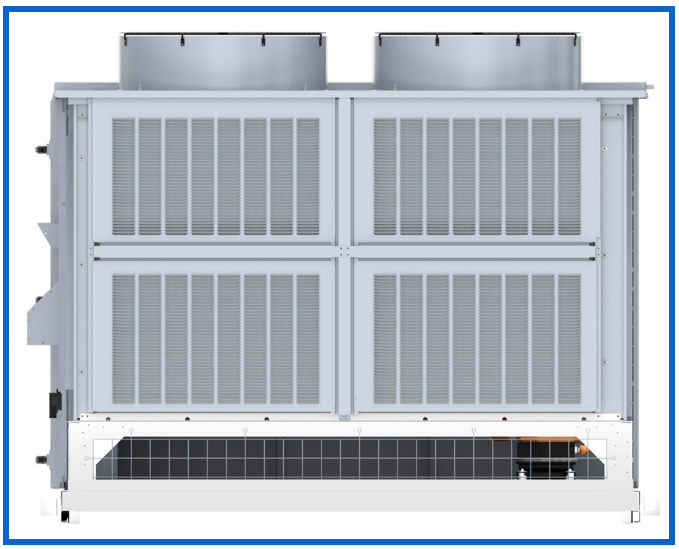
Units are selectable for e-coated condenser coils or e-coated condenser and evaporator coils. E-coat is a durable epoxy coating that completely and uniformly encapsulates the coil.

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.

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.

Outdoor airflow measuring

Units include a factory-installed outdoor air flow measuring station to measure the airflow through the economizer outdoor air damper. The SmartVu control uses the outdoor airflow readings for ventilation control.

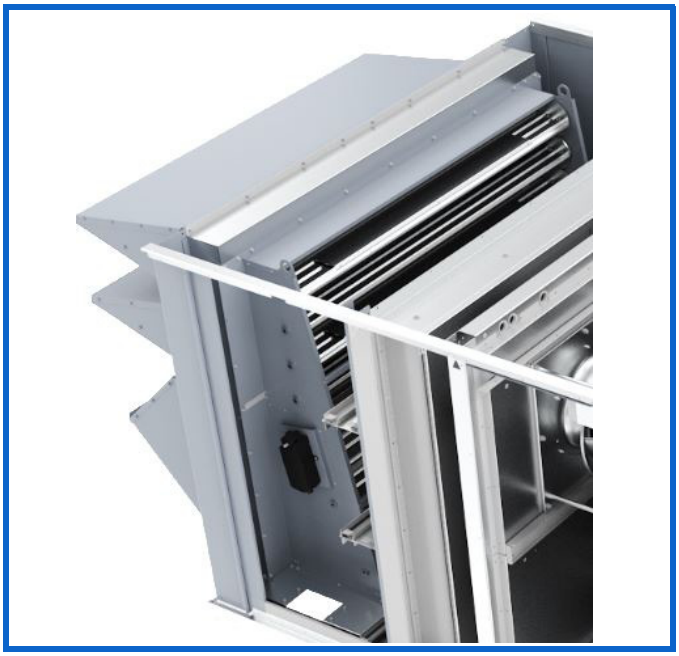
Ultra-low leak economizer

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.



Factory-installed options (cont)

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.

Standard and medium static exhaust fans

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

The standard or 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.

Powered 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.

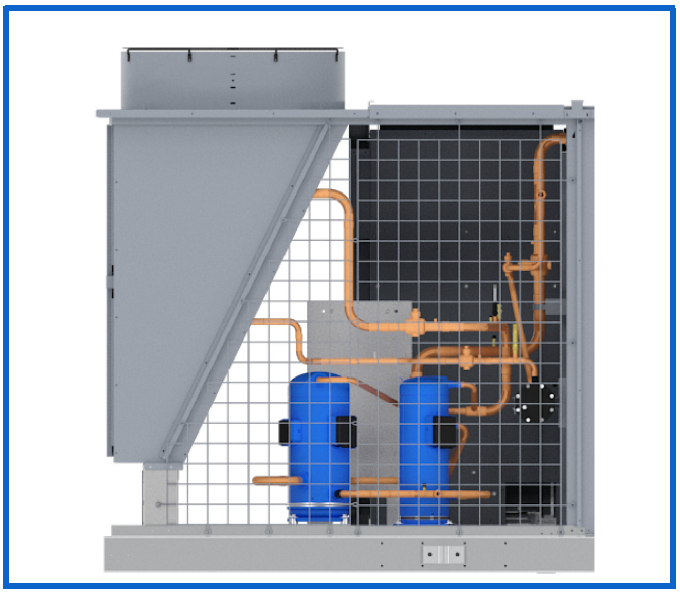
Unpowered 115-v convenience outlet

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.



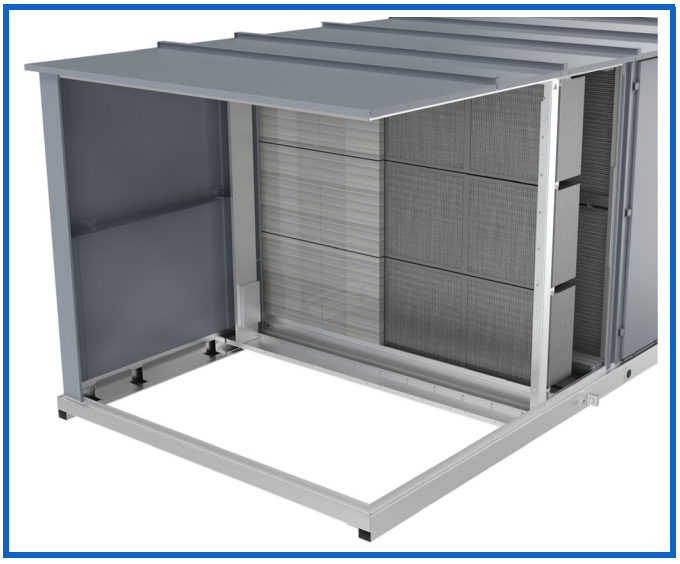
Service pack

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.



Factory-installed options (cont)

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, 50V standard chassis units with plenum and extended standard chassis units (with or without plenum) 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 40 to 50 ton 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

Field-installed accessories and warranty

Carrier non-communicating sensors

The SmartVu™ control supports a variety of field-provided communicating (Rnet) and 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:

- Competitive replacement centering kit
- 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 standard chassis curbs)	X		
14 in. Knock-down Roof Curbs			X
Centering Kit (For installing compact chassis on competitor curbs)			X
APPLICATION AND CONFIGURATION			
SAV (Staged indoor fan for single-zone applications)	X		
VAV (SZ-VAV for single-zone or supply duct pressure control for multi-zone VAV applications)	X		
Vertical Supply	X		
Horizontal Supply (Left)		X	
Vertical Return	X		
Horizontal Return (Left side on compact, end on standard chassis)		X	
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 Conversion Kit (up to 7000 ft)			X
Propane Conversion Kit			X
Flue Extension Kit			X
OTHER HEAT (50 SERIES)			
No Heat	X		
Low, Medium, or High Electric Heat with Two-Stage Control		X	
Low, Medium, or High Electric Heat with Modulating (SCR) Control		X	
Hot Water Coil (post-heat position)		X	
Hot Water Control Valve			X
COOLING			
Puron Advance™ (R-454B) Low Global Warming Potential (GWP) Refrigerant	X		
Refrigerant Leak Detection System with Leak Mitigation			
Electronic Expansion Valve (EXV) Metering Devices	X		
Single Refrigerant Circuit	Sizes 28-40		
Dual Refrigerant Circuits	Size 50		
Crankcase Heaters	X		
Low Ambient Mechanical Cooling (Variable Speed Outdoor Fans with Greenspeed® Intelligence)	X		
Standard Efficiency, Standard Sound Package (Metal Outdoor Fans)	X[a]		
High-Efficiency, Low Sound Package (Low Sound Outdoor Fans, Compressor Sound Blankets)		X	
Standard-Capacity, Lead Variable Speed Scroll Compressor	X		
High-Capacity, Lead Variable Speed Scroll Compressor		X[a]	
Fixed Speed Lag Scroll Compressors	X		
Humidi-MiZer Modulating Dehumidification System		X	
CONSTRUCTION			
Single Wall with R4 Foil-Faced Fiberglass Insulation	X		
Standard Chassis with Plenum (50V Only)		X	
Extended Standard Chassis		X	
Extended Standard Chassis with Plenum (50V Only)		X	
INDOOR FAN			
Direct Drive, Backward Curve Fan Array	X		
Standard Static ECM	X		
Medium Static ECM		X	
High Static ECM (All standard chassis or 40-50 ton compact chassis only)		X	
DRAIN AND COIL			
Galvanized Steel Condensate Drain Pan	X		
Stainless Steel Condensate Drain Pan		X	
Al/Cu Evaporator Coil	X		
MCHX Condenser Coil	X		
E-coated Condenser Coils		X	
E-coated Condenser and Evaporator Coils		X	
Louvered Hail Guards		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		X	
Standard or Medium Static ECM Exhaust Fans (Standard Chassis Only)		X	
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 Building Automation System (8.0+)	X		
LonWorks and Modbus Communication 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 (with Modulating Heat)		X	
DX Condensing and Suction Pressure Transducers, Readable from SmartVu	X		
Humidity and Enthalpy Sensors for Dehumidification or Enthalpy/Dew Point Free Cooling		X	
Return Air CO_2 Sensor		X	
Outdoor Air Measuring Station		X	
Non-Communicating Space Temperature, CO_2, and Relative Humidity Sensors			X
Communication Space Temperature, CO_2, and Relative Humidity Sensors			X[b]
Carrier TruVu™ Equipment Touch Display			X[b]
Two-Stage Heating and Cooling Thermostats			X
ELECTRICAL (v-Ph-Hz)			
208/230-3-60	X		
460-3-60	X		
575-3-60	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[c]	
Powered Convenience Outlet		X[c]	
Non-Powered Convenience Outlet			
Standard SCCR (10kA)	X		
High SCCR (65kA for 208/230/460-v or 25kA for 575-v)		X[d]	
Phase Monitor		X	
SERVICE AND SAFETY			
Hinged, Double-Wall Maintenance Access Doors	X		
Hinged, Double-Wall Indoor Fan Access Door with Pressure Catch and Safety Interlock	X		
Removable Service Access Panels	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 Pressure Safety Relief)		X	
Pre-Filter Measuring		X	

Features, options, and accessories (cont)

DESCRIPTION	STANDARD	OPTION	ACCESSORY
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	
6 in. Pre-Filter Rack with 2 in. MERV 8 Filters + 4 in. MERV 13 Pleated Filters		X	
14 in. Pre-Filter Rack with 2 in. MERV 8 Pleat + 12 in. MERV 14 Bag Filters (Standard Chassis Only)		X[e]	
14 in. Pre-Filter Rack with 2 in. MERV 8 Pleat + 12 in. MERV 15 Cartridge Filters (Standard Chassis Only)		X[e]	
Replacement Filters			X
Ultraviolet (UV-C) Fixtures (Standard Chassis Only)		X	
Ultraviolet (UV-C) Emitters			X
WARRANTY AND START-UP			
Five (5) Year 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 Twenty (20) Year Stainless Steel Gas Heat Exchanger Parts Coverage (48V)		X	
Up To Five (5) Year Non-Consumable Parts 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. Size 34 is not available with standard efficiency option or high capacity compressor option.
b. Rnet sensors require a field provided power supply.
c. Not available with high SCCR.
d. Requires field provided and installed current limiting fused before the unit terminal block.
e. 50V requires standard chassis w/plenum, extended standard chassis, or extended standard chassis with plenum.

Capacities and ratings

48/50V AHRI Ratings (Standard Chassis)[a]

SIZE	CHASSIS	SAV/VAV	EFFICIENCY	CAPACITY	48V		50V	
					EER	IEER	EER	IEER
28	Standard	SAV	Standard	Standard	9.8	20.1	10.0	20.4
		VAV	Standard	Standard	9.8	17.8	10.0	18.0
		SAV	High	Standard	10.4	20.9	10.5	21.2
		VAV	High	Standard	10.4	19.0	10.5	19.1
		SAV	High	High	10.4	20.8	10.5	21.1
		VAV	High	High	10.4	19.0	10.5	19.1
30	Standard	SAV	Standard	Standard	10.0	20.2	10.0	19.4
		VAV	Standard	Standard	10.0	17.9	10.0	17.1
		SAV	High	Standard	10.5	21.0	10.5	21.1
		VAV	High	Standard	10.5	19.0	10.5	19.1
		SAV	High	High	10.5	20.9	10.5	20.9
		VAV	High	High	10.5	19.0	10.5	19.1
34	Standard	SAV	High	Standard	9.8	19.4	10.0	19.7
		VAV	High	Standard	9.8	18.2	10.0	18.4
40	Standard	SAV	Standard	Standard	9.8	18.8	10.0	19.3
		VAV	Standard	Standard	9.8	16.9	10.0	17.2
		SAV	High	Standard	10.3	19.7	10.5	20.1
		VAV	High	Standard	10.3	17.9	10.5	18.2
		SAV	High	High	9.8	19.7	10.0	20.1
		VAV	High	High	9.8	17.9	10.0	18.2
50	Standard	SAV	Standard	Standard	9.8	17.5	10.0	17.9
		VAV	Standard	Standard	9.8	17.3	10.0	17.6
		SAV	High	Standard	9.8	17.8	10.0	18.2
		VAV	High	Standard	9.8	17.6	10.0	18.0
		SAV	High	High	9.8	17.8	10.0	18.2
		VAV	High	High	9.8	17.6	10.0	18.0

NOTE(S):

a. Ratings are in accordance with AHRI 340/360, as appropriate.

LEGEND

AHRI — Air Conditioning, Heating, and Refrigeration
EER — Energy Efficiency Ratio
IEER — Integrated Energy Efficiency Ratio
VAV — Variable Air Volume
SAV — Staged Air Volume

Capacities and ratings (cont)

48/50V AHRI Ratings (Compact Chassis)[a]

SIZE	CHASSIS	SAV/VAV	EFFICIENCY	CAPACITY	48V		50V	
					EER	IEER	EER	IEER
28	Compact	SAV	Standard	Standard	9.8	19.9	10.0	20.2
		VAV	Standard	Standard	9.8	17.8	10.0	17.9
		SAV	High	Standard	10.4	20.8	10.5	21.0
		VAV	High	Standard	10.4	18.9	10.5	19.0
		SAV	High	High	10.4	20.7	10.5	20.9
		VAV	High	High	10.4	18.9	10.5	19.0
30	Compact	SAV	Standard	Standard	9.8	19.1	10.0	19.4
		VAV	Standard	Standard	9.8	16.9	10.0	17.1
		SAV	High	Standard	10.3	20.4	10.5	20.8
		VAV	High	Standard	10.3	18.9	10.5	19.1
		SAV	High	High	10.3	20.3	10.0	20.7
		VAV	High	High	10.3	19.0	10.5	19.1
34	Compact	SAV	High	Standard	9.8	18.9	10.0	19.3
		VAV	High	Standard	9.8	18.1	10.0	18.4
40	Compact	SAV	Standard	Standard	9.8	18.5	10.0	18.8
		VAV	Standard	Standard	9.8	16.8	10.0	17.1
		SAV	High	Standard	9.8	19.2	10.0	19.5
		VAV	High	Standard	9.8	17.7	10.0	17.8
		SAV	High	High	9.8	19.2	10.0	19.5
		VAV	High	High	9.8	17.8	10.0	17.8
50	Compact	SAV	Standard	Standard	9.8	17.2	10.0	17.3
		VAV	Standard	Standard	9.8	17.1	10.0	17.0
		SAV	High	Standard	9.8	17.4	10.0	17.6
		VAV	High	Standard	9.8	17.5	10.0	17.9
		SAV	High	High	9.8	17.4	10.0	17.6
		VAV	High	High	9.8	17.5	10.0	17.9

NOTE(S):

a. Ratings are in accordance with AHRI 340/360, as appropriate.

LEGEND

AHRI — Air Conditioning, Heating, and Refrigeration
EER — Energy Efficiency Ratio
IEER — Integrated Energy Efficiency Ratio
SAV — Staged Air Volume
VAV — Variable 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]
28	Variable Capacity	Al/Cu (Standard)	2,750	5,500	13,750
		E-Coat Al/Cu			12,500
30		Al/Cu (Standard)	3,000	6,000	15,000
		E-Coat Al/Cu			12,500
34		Al/Cu (Standard)	3,500	7,000	17,500
		E-Coat Al/Cu			12,500
40		Al/Cu (Standard)	4,000	8,000	20,000
		E-Coat Al/Cu			15,000
50		Al/Cu (Standard)	5,000	10,000	25,000
		E-Coat Al/Cu			15,000

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, minimum cooling 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, maximum cooling capacity.

Capacities and ratings (cont)

Cooling Capacity Staging — Sizes 28, 30, 34, 40

COMPRESSOR	STAGE		
	0	1	2
	COMPRESSOR STATUS		
A1 (Variable)[a]	OFF	ON	ON
A2	OFF	OFF	ON
UNIT	CAPACITY 48/50V		
28	0%	13% to 51%	62% to 100%
30	0%	13% to 51%	62% to 100%
34	0%	13% to 51%	62% to 100%
40	0%	13% to 51%	62% to 100%

NOTE(S):

a. The A1 compressor is a variable speed compressor. The A2 compressor is a fixed speed and does not operate without A1.

Cooling Capacity Staging — Size 50

COMPRESSOR	STAGE				
	0	1	2	3	3
	COMPRESSOR STATUS				
A2 (Variable)[a]	OFF	ON	ON	ON	ON
B1[b]	OFF	OFF	OFF	ON	ON
B2	OFF	OFF	ON	OFF	ON
UNIT	CAPACITY 48/50V				
50	0%	13% to 52%	53% to 71%	72% to 81%	82% to 100%

NOTE(S):

a. The A1 compressor is a variable capacity digital compressors. The A2 compressor is a fixed speed.
b. The B1 compressor is a fixed speed compressor larger than the B1 fixed speed compressor.

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

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	4,270	10,690	5,700	14,250
27-35	High Heat	488	650	395	527	81.0%	20-55	6,650	14,640	8,860	17,500
40-50	Low Heat	285	380	231	308	81.0%	20-50	4,270	10,690	5,700	14,250
40-50	High Heat	548	730	444	591	81.0%	25-55	7,470	16440	9,950	21,890

NOTE(S):

a. Natural Gas available on all units and, LP Gas on 27-100 Low Heat and 27-100 High Heat Units.
b. Ratings are approved for altitudes up to 2000 ft. At altitudes over 2000 ft, ratings are 4% less for each 1000 ft above sea level.
c. At altitudes up to 2000 ft, the following formula may be used to calculate air temperature rise:

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

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

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

e. Temperature rise limits: See table.
f. Minimum allowable temperature of mixed air entering the heat exchangers during half-rate (first stage) operation is 35°F. There is no minimum mixture temperature limitation during full-rate operation).
g. On VAV (variable air volume) applications set the zone terminals to provide minimum unit heating airflow as indicated in the table upon command from Heat Interlock Relay (HIR) function.

LEGEND

LP — Liquid Propane

Low Two-Stage Gas Heat Staging

HEATER	STAGE		
	0	1	2
	Heater Status		
Heater 1	OFF	Low Fire	High Fire
UNIT SIZE	Heating Capacity (Total)		
27-50	0%	75%	100%

High Two-Stage Gas Heat Staging

HEATER	STAGE		
	0	1	2
	Heater Status		
Heater 1	OFF	Low Fire	High Fire
Heater 2	OFF	Low Fire	High Fire
UNIT SIZE	Heating Capacity (Total)		
27-50	0%	75%	100%

Capacities and ratings (cont)

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

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	100	380	81	308	81.0%	20-50	29-100%	1,500	14,250
27-35	High Heat	93	380	75	527	81.0%	25-55	14-50%, 52-100%	1,500	17,500
40-50	Low Heat	100	650	81	308	81.0%	20-50	29-100%	1,500	14,250
40-50	High Heat	100	380	81	591	81.0%	25-55	14-50%, 52-100%	1,500	21,890

NOTE(S):

a. Natural Gas avaiable on all units and, LP Gas on 27-100 Low Heat and 27-100 High Heat Units
b. Ratings are approved for altitudes to 2000 ft. At altitudes over 2000 ft, ratings are 4% less for each 1000 ft above sea level.
c. At altitudes up to 2000 ft, the following formula may be used to calculate air temperature rise:

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

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

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

e. Temperature rise limits: See table.
f. Minimum allowable temperature of mixed air entering the heat exchangers during half-rate (first stage) operation is 35°F. There is no minimum mixture temperature limitation during full-rate operation.).
g. On VAV (variable air volume) applications set the zone terminals to provide minimum unit heating airflow as indicated in the table upon command from Heat Interlock Relay (HIR) function.

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)			
27-50	0%	29-100%	—	—

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)			
27-50	0%	14-50%	52-63%	64-100%

Electric Heater Capacities and Staging[a,b]

UNIT SIZE 48/50V	VOLTAGE	NO. OF STAGES	LOW		MEDIUM		HIGH		MIN. SCR CFM	MIN. FULL LOAD CFM (Low)	MIN. FULL LOAD CFM (High)	MAX. CFM
			Low (kW)	Capacity per Stage (%)	Med (kW)	Capacity per Stage (%)	High (kW)	Capacity per Stage (%)				
27-35	208/230, 460/575	2-Stage or SCR	27	50,100	54	50,100	81	50,100	5,000	7,500	9,000	17,500
			36	50,100	72	50,100	108	50,100				
			36	50,100	72	50,100	108	50,100				
			36	50,100	72	50,100	108	50,100				
40-50	208/230, 460/575	2-Stage or SCR	27	50,100	54	50,100	81	50,100	6,000	8,000	10,000	25,000
			36	50,100	72	50,100	108	50,100				
			36	50,100	72	50,100	108	50,100				
			36	50,100	72	50,100	108	50,100				

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

48-50V Physical Data — Sizes 028, 030, 034

UNIT 48/50V2,V3,V4,V5	28		30		34	
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 (48V) lb	4815	5415	4815	5415	4940	5540
No Heat Base Unit (50V) lb	4165	4765	4165	4765	4290	4890
COMPRESSOR	Variable Speed + Fixed Speed		Variable Speed + Fixed Speed		Variable Speed + Fixed Speed	
Refrigerant Circuits	1		1		1	
Circuit A Type (A1 / A2)	Variable Speed / Fixed Speed		Variable Speed / Fixed Speed		Variable Speed / Fixed Speed	
Circuit A, Qty...Model (A1/ A2)	1…VZH117 / 1… DSH140		1…VZH117 / 1… DSH140		1…VZH117 / 1… DSH184	
Circuit A Oil Charge (oz.) (A1/A2)	139 / 111		139 / 111		139 / 128	
Circuit B Type (B1 / B2)	—		—		—	
Circuit B, Qty...Model (B1/ B2)	—		—		—	
Circuit B Oil Charge (oz.) (B1/B2)	—		—		—	
System Capacity Steps (%)	13 to 51%, 62 to 100%		13 to 53%, 60 to 100%		13 to 47%, 64 to 100%	
REFRIGERANT	Puron Advance™ (R-454B)		Puron Advance™ (R-454B)		Puron Advance™ (R-454B)	
Circuit A Operating Charge (lb) Circuit A / Circuit B	35.7 / —		32.8 / —		34.6 / —	
Circuit A Operating Charge with Humidi-MiZer (lb) Circuit A / Circuit B	50.4 / —		46.3 / —		48.3 / —	
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	2.0-2.5… 1140		2.0-2.5… 1140		2.0-2.5… 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	1.5-1.75… 850		1.5-1.75… 850		1.5-1.75… 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/High Static Total Power (kW)[a]	8.4/11.7/16.8		8.4/11.7/16.8		8.4/11.7/16.8	
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 (hp)	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
STANDARD STATIC EXHAUST (OPTIONAL)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis

Physical data (cont)

48-50V Physical Data — Sizes 028, 030, 034 (cont)

UNIT 48/50V2,V3,V4,V5	28		30		34	
NOMINAL CAPACITY (TONS)	27.5		30		35	
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)	—	5.4	—	5.4	—	5.4
Nominal cfm	—	8,250	—	9,000	—	10,500
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)	—	14.0	—	14.0	—	14.0
Nominal cfm	—	8,250	—	9,000	—	10,500
TWO-STAGE GAS HEAT (48V)	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 48V (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"	

Physical data (cont)

48-50V Physical Data — Sizes 028, 030, 034 (cont)

UNIT 48/50V2,V3,V4,V5	28		30		34	
NOMINAL CAPACITY (TONS)	27.5		30		35	
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 and 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"	
2 in. MERV 8 and 4 in. MERV 13	Pleated		Pleated		Pleated	
Qty...Size (in.)	12…20" X 20" X 2 and 12…20" X 20" X 4"		12…20" X 20" X 2 and 12…20" X 20" X 4"		12…20" X 20" X 2 and 12…20" X 20" X 4"	
12 in. MERV 14 Bag	—	Pleated / Bag	—	Pleated / Bag	—	Pleated / Bag
Qty...Size (in.)	—	6…20" X 20" X 2", 6…20" X 24" X 2" / 6…20" X 20" X 12", 6…20" X 24" X 12"	—	6…20" X 20" X 2", 6…20" X 24" X 2" / 6…20" X 20" X 12", 6…20" X 24" X 12"	—	6…20" X 20" X 2", 6…20" X 24" X 2" / 6…20" X 20" X 12", 6…20" X 24" X 12"
12 in. MERV 15 Cartridge	—	Pleated / High Velocity Cartridge	—	Pleated / High Velocity Cartridge	—	Pleated / High Velocity Cartridge
Qty...Size (in.)	—	6…20" X 20" X 2", 6…20" X 24" X 2" / 6…20" X 20" X 12", 6…20" X 24" X 12"	—	6…20" X 20" X 2", 6…20" X 24" X 2" / 6…20" X 20" X 12", 6…20" X 24" X 12"	—	6…20" X 20" X 2", 6…20" X 24" X 2" / 6…20" X 20" X 12", 6…20" X 24" X 12"
HOT WATER COIL (50V) (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	

NOTE(S):

a. kW Maximums are voltage dependent. Please see specifics fan tables.

Physical data (cont)

48-50V Physical Data — Sizes 40 and 50

UNIT 48/50V2,V3,V4,V5	40		50	
NOMINAL CAPACITY (TONS)	40		50	
OPERATING WEIGHT (lb, Med Static IDF, Vertical/Vertical)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
Low Heat Base Unit (48V) lb	6075	6675	6225	6825
No Heat Base Unit (50V) lb	5425	6025	5575	6175
COMPRESSOR	Variable Speed + Fixed Speed		Variable Speed + Fixed Speed	
Refrigerant Circuits	1		2	
Circuit A Type (A1/ A2)	Variable Speed / Fixed Speed		Variable Speed / —	
Circuit A, Qty...Model (A1/ A2)	1…VZH170 / 1… DSH184		1…VZH170 / —	
Circuit A Oil Charge (oz.) (A1/A2)	260 / 128		260 / —	
Circuit B Type (B1/ B2)	—		Fixed Speed/Fixed Speed	
Circuit B, Qty...Model (B1/ B2)	—		1… DSH140 / 1… DSH090	
Circuit B Oil Charge (oz.) (B1/ B2)	—		111 / 101	
System Capacity Steps (%)	14 to 57%, 58 to 100%		13 to 100%	
REFRIGERANT	Puron Advance™ (R-454B)		Puron Advance™ (R-454B)	
Circuit A Operating Charge (lb) Circuit A / Circuit B	40.4 / —		29.1 / 29.4	
Circuit A Operating Charge with Humidi-MiZer (lb) Circuit A / Circuit B	55.5 / —		44.2 / 29.4	
High Pressure Switch Auto-Reset (psig)	500		500	
High Pressure Switch Cutout (psig)	650		650	
CONDENSER COIL	Aluminum, Novation (MCHX)		Aluminum, Novation (MCHX)	
Quantity	2		2	
Total Face Area (sq ft)	65.6		65.6	
EVAPORATOR COIL	Al/Cu RTPF		Al/Cu RTPF	
Quantity	1		1	
Total Face Area (sq ft)	38.3		38.3	
Rows...Fins (in.)	4… 16		6… 16	
Fin Type	Double Wavy		Double Wavy	
Tube Type	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)	
Coil Quantity	1		1	
Coil Total Face Area (sq ft)	26.5		26.5	
Reheat Valve Qty...Type	1...On/Off Three-Way		1...On/Off Three-Way	
Bypass Valve Qty...Type	1...Modulating Three-Way		1...Modulating Three-Way	
STANDARD CONDENSER FANS	Metal Propeller, Direct Drive		Metal Propeller, Direct Drive	
Qty...Diameter (in.)	3...30		4...30	
Motor Qty...Type	3...AC		4...AC	
Motor HP...RPM	2.0-2.5… 1140		2.0-2.5… 1140	
Nominal cfm	27,000		36,000	
LOW SOUND CONDENSER FANS (OPTIONAL)	Composite AeroAcoustic™, Direct Drive		Composite AeroAcoustic™, Direct Drive	
Qty...Diameter (in.)	3...30		4...30	
Motor Qty...Type	3...AC		4...AC	
Motor HP...RPM	1.5-1.75… 850		1.5-1.75… 850	
Nominal cfm	27,000		36,000	
INDOOR FAN	Backward Curve, Direct Drive		Backward Curve, Direct Drive	
Fan Qty...Diameter (in.)	3...17.7		3...17.7	
Motor Qty...Type	3...EC		3...EC	
Standard/Medium/High Static Total Power (kW)[a]	10.8/13.5/21		10.8/13.5/21	
Nominal cfm	12,000		15,000	
LOW STATIC EXHAUST (OPTIONAL)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
Fan Type	Composite Propeller, Direct Drive		Composite Propeller, Direct Drive	
Fan Qty...Diameter (in.)	2...30	2...30	2...30	2...30
Motor Qty...Type	2...EC		2...EC	
Total Motor Power (hp)	2.2	2.2	2.2	2.2
Nominal cfm	15,000	15,000	15,000	15,000

Physical data (cont)

48-50V Physical Data — Sizes 40 and 50 (cont)

UNIT 48/50V2,V3,V4,V5	40		50	
NOMINAL CAPACITY (TONS)	40		50	
STANDARD STATIC EXHAUST (OPTIONAL)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
Fan Type	—	Backward Curve	—	Backward Curve
Fan Qty...Diameter (in.)	—	2...19.7	—	2...19.7
Motor Qty...Type	—	2...EC	—	2...EC
Total Motor Power (kW)	—	8.0	—	8.0
Nominal cfm	—	12,000	—	15,000
MEDIUM STATIC EXHAUST (OPTIONAL)	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
Fan Type	—	Backward Curve	—	Backward Curve
Fan Qty...Diameter (in.)	—	2.19.7	—	2.19.7
Motor Qty...Type	—	2...EC	—	2...EC
Total Motor Power (kW)	—	14.0	—	14.0
Nominal cfm	—	12,000	—	15,000
TWO-STAGE GAS HEAT (48V)	Low Heat	High Heat	Low Heat	High Heat
Heat Exchanger Material	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel
Number of Heat Exchangers	1	2	1	2
Input (MBH)	380	730	380	730
Output (MBH)	308	591	308	591
Efficiency (%)	81	81	81	81
Burner Orifice Diameter (in...drill no.)	0.1200...31	0.1200...31	0.1200...31	0.1200...31
Quantity	9	18	9	18
Stage 1/Stage 2 Manifold Pressure (in. wg)	2.0 / 3.4	2.0 / 3.3	2.0 / 3.4	2.0 / 3.3
Min...Max Line Pressure (in. wg)	5…13	5…13	5…13	5…13
Firing Stages	2	2	2	2
Number of Gas Valves	1	2	1	2
Gas Connection Qty...Size (in.)	1...1.5 NPT			
MODUALTING GAS HEAT 48V (OPTIONAL)	Low Heat	High Heat	Low Heat	High Heat
Heat Exchanger Material	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel	409 Stainless Steel
Number of Heat Exchangers	1	2	1	2
Input (MBH)	380	730	380	730
Output (MBH)	308	591	308	591
Efficiency (%)	81	81	81	81
Burner Orifice Diameter (in...drill no.)	0.1200...31	0.1200...31	0.1200...31	0.1200...31
Quantity	9	18	9	18
Low Fire/High Fire Manifold Pressure (in. wg)	0.3 / 3.4	0.3 / 3.3	0.3 / 3.4	0.3 / 3.3
Min-Max Line Pressure (in. wg)	5… 13	5… 13	5… 13	5… 13
System Capacity Steps (%)	26-100%	14-50%, 52-100%	26-100%	14-50%, 52-100%
Number of Gas Valves	1	2	1	2
Gas Connection Qty...Size (in.)	1...1.5 NPT			
STANDARD PRE-FILTERS	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
2 in.Throwaway	Fiberglass		Fiberglass	
Qty...Size (in.)	12...20" x 24" X 2"		12...20" x 24" X 2"	
Outdoor Air Screen	Metal Mesh		Metal Mesh	
Qty...Size (in.)	8...16" x 25" x 1"		8...16" x 25" x 1"	

Physical data (cont)

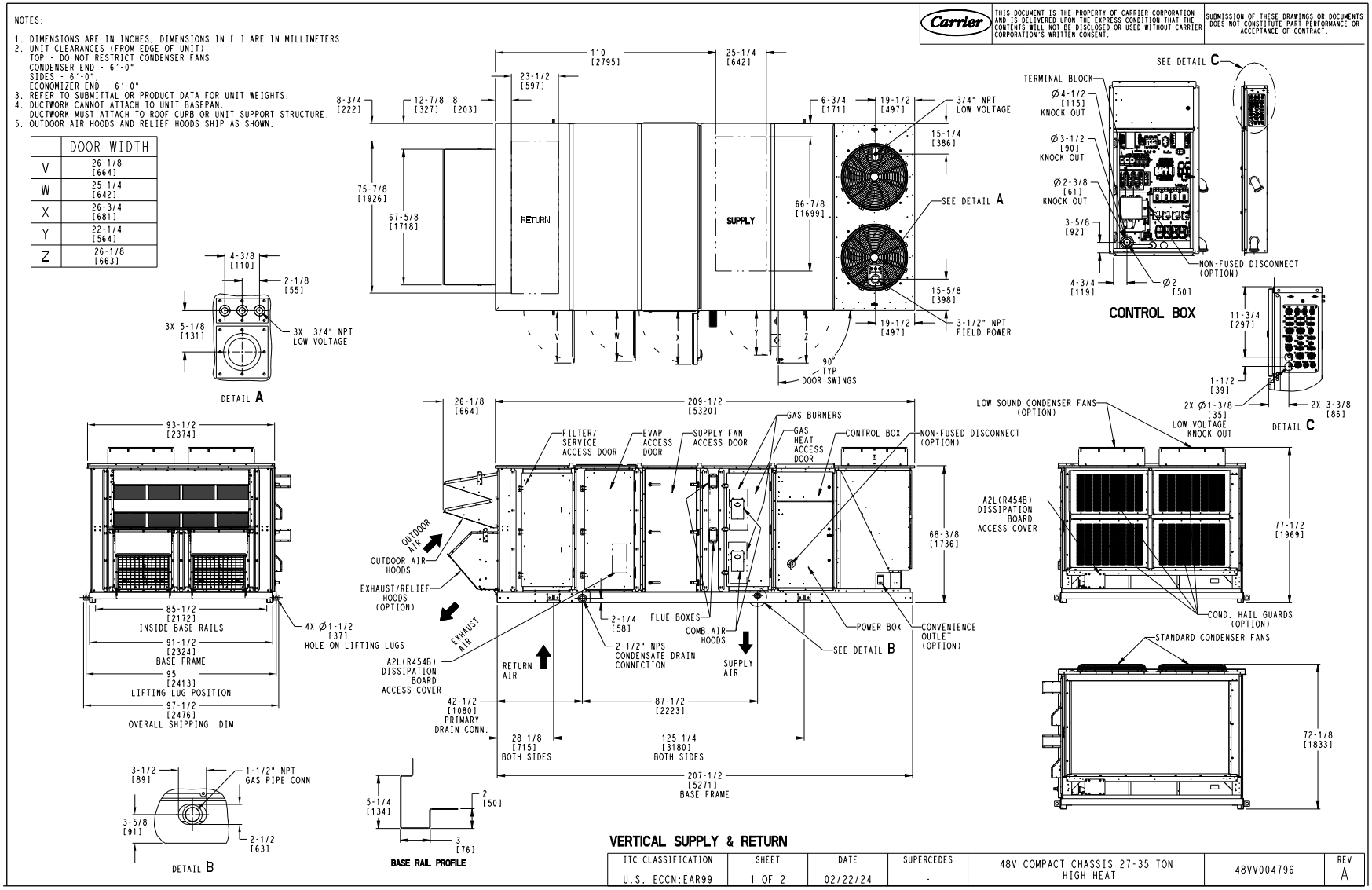
48-50V Physical Data — Sizes 40 and 50 (cont)

UNIT 48/50V2,V3,V4,V5	40		50	
NOMINAL CAPACITY (TONS)	40		50	
OPTIONAL PRE-FILTERS	Compact Chassis	Standard Chassis	Compact Chassis	Standard Chassis
2 in. MERV 8	Pleated		Pleated	
Qty...Size (in.)	12...20" X 24" X 2"		12...20" X 24" X 2"	
4 in. MERV 8 & 13	Pleated		Pleated	
Qty...Size (in.)	12...20" X 24" X 4"		12...20" X 24" X 4"	
2 in. MERV 8 & 4 in. MERV 13	Pleated		Pleated	
Qty...Size (in.)	12…20" X 24" X 2: and 12…20" X 24" X 4"		12…20" X 24" X 2: and 12…20" X 24" X 4"	
12 in. MERV 14 Bag	—	Pleated / Bag	—	Pleated / Bag
Qty...Size (in.)	—	6…20" X 24" X 2", 6…24" X 24" X 2" / 6…20" X 24" X 12", 6…24" X 24" X 12"	—	6…20" X 24" X 2", 6…24" X 24" X 2" / 6…20" X 24" X 12", 6…24" X 24" X 12"
12 in. MERV 15 Cartridge	—	Pleated / High Velocity Cartridge	—	Pleated / High Velocity Cartridge
Qty...Size (in.)	—	6…20" X 24" X 2", 6…24" X 24" X 2" / 6…20" X 24" X 12", 6…24" X 24" X 12"	—	6…20" X 24" X 2", 6…24" X 24" X 2" / 6…20" X 24" X 12", 6…24" X 24" X 12"
HOT WATER COIL (50V) (OPTIONAL)	Al/Cu RTPF, Steel Header		Al/Cu RTPF, Steel Header	
Coil Quantity	1		1	
Total Face Area (sq ft)	22.6		22.6	
Coil Rows...Fins Per Inch	2...8		2...8	
Tube Size (in.)...Circuiting	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	
Return Connection Qty...Size (in.)	1...2-1/2 NPT		1...2-1/2 NPT	
Coil Internal Volume (gal)	6.36		6.36	

NOTE(S):

a. kW Maximums are voltage dependent. Please see specifics fan tables.

48V 27-35 Ton Compact Chassis with High Heat



VERTICAL SUPPLY & RETURN

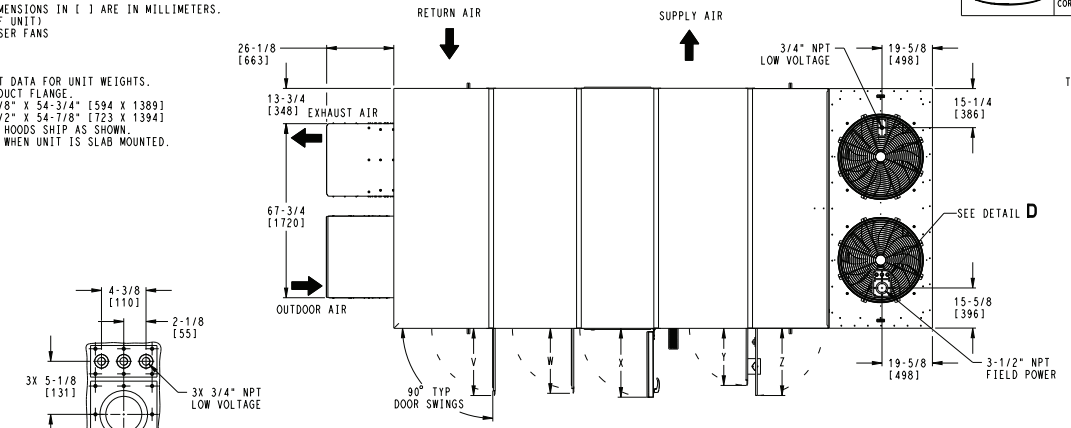
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES		
U.S. ECCN:EAR99	1 OF 2	02/22/24	-	48V COMPACT CHASSIS 27-35 TON HIGH HEAT	48VV004796	REV A

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

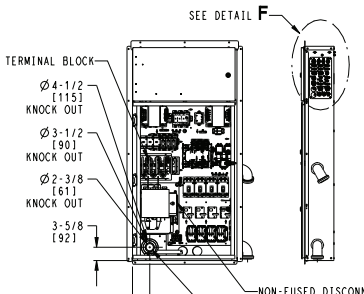
NOTES:

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) 23-3/8" X 54-3/4" [594 X 1389]
   RETURN DUCT FLANGE (OD) 28-1/2" X 54-7/8" [723 X 1394]
5. OUTDOOR AIR HOODS AND RELIEF HOODS SHIP AS SHOWN.
6. CONSIDER CONDENSATE DRAINAGE WHEN UNIT IS SLAB MOUNTED.

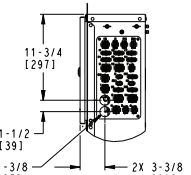
	DOOR WIDTH
V	26-1/8 [664]
W	25-1/4 [642]
X	26-3/4 [682]
Y	22-1/4 [564]
Z	26-1/8 [663]



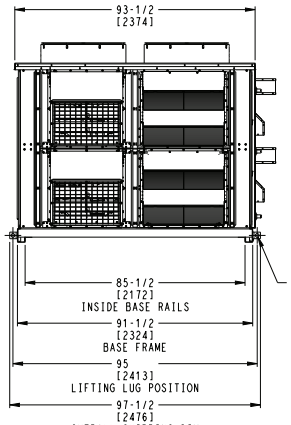
DETAIL D

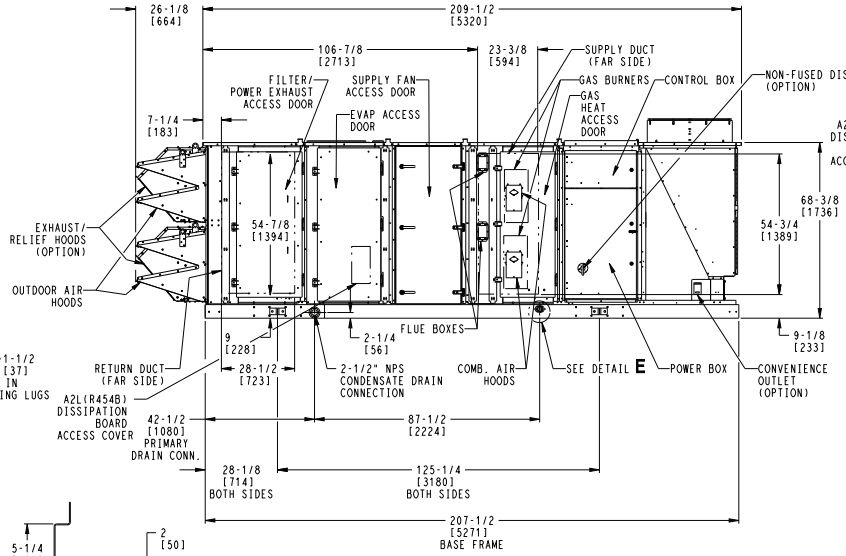


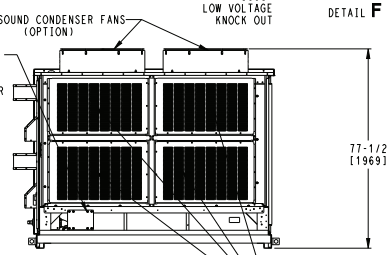
CONTROL BOX

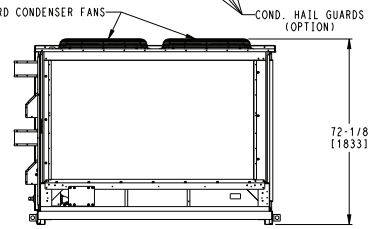


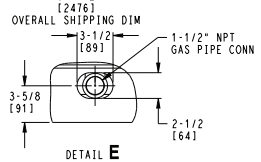
DETAIL F



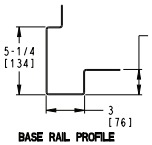








DETAIL E



BASE RAIL PROFILE

HORIZONTAL SUPPLY & RETURN

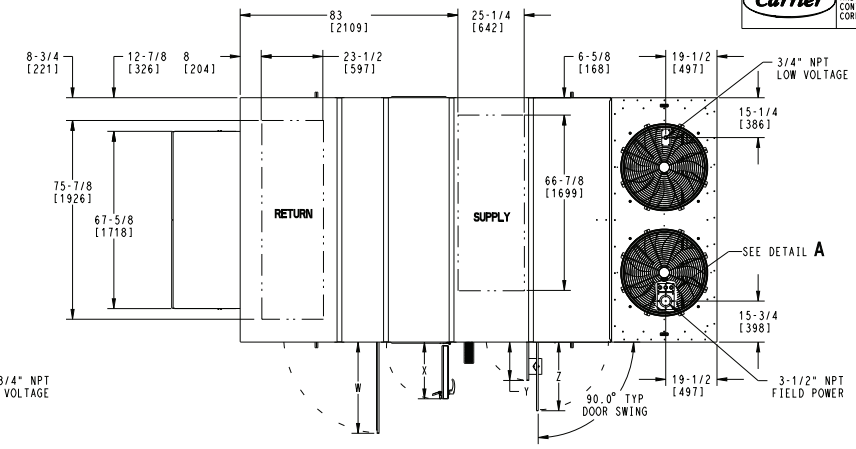
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:EAR99	2 OF 2	02/22/24	-	48V COMPACT CHASSIS 27-35 TON HIGH HEAT	48VV004796	A

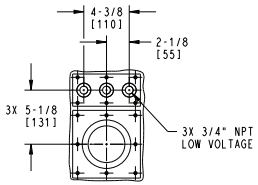
48V 27-35 Ton Compact Chassis with Low Heat

NOTES:

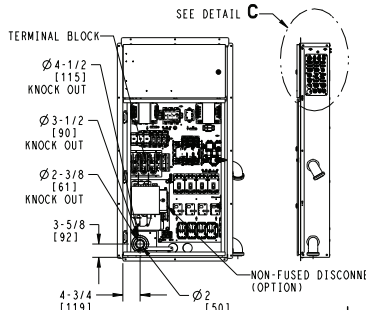
1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT)
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 6'-0"
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. DUCTWORK CANNOT ATTACH TO UNIT 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	21-1/2 [549]
Y	14-5/8 [372]
Z	26-1/8 [664]

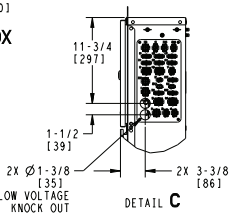




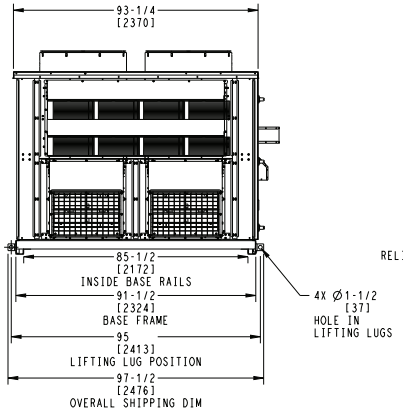
DETAIL A

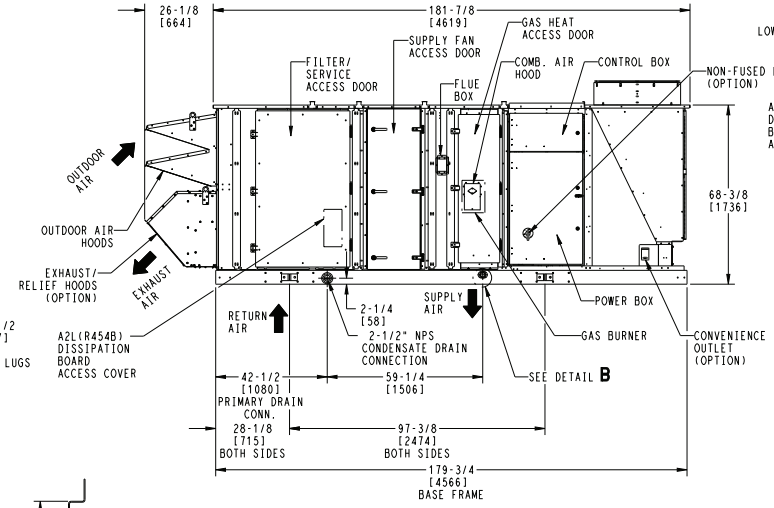


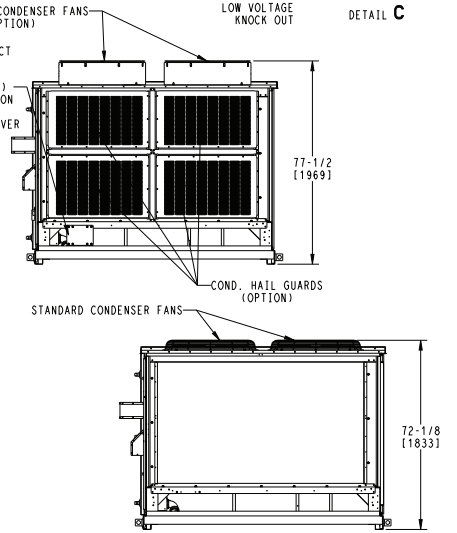
CONTROL BOX

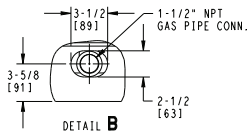


DETAIL C

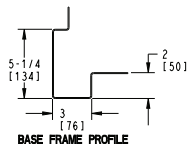








DETAIL B



BASE FRAME PROFILE

VERTICAL SUPPLY & RETURN

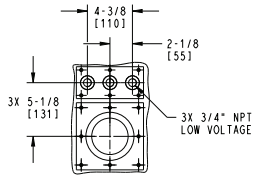
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES		
U.S. ECCN:EAR99	1 OF 2	2/22/24	-	48V COMPACT CHASSIS 27-35 TON LOW HEAT	48VV004798	REV A

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

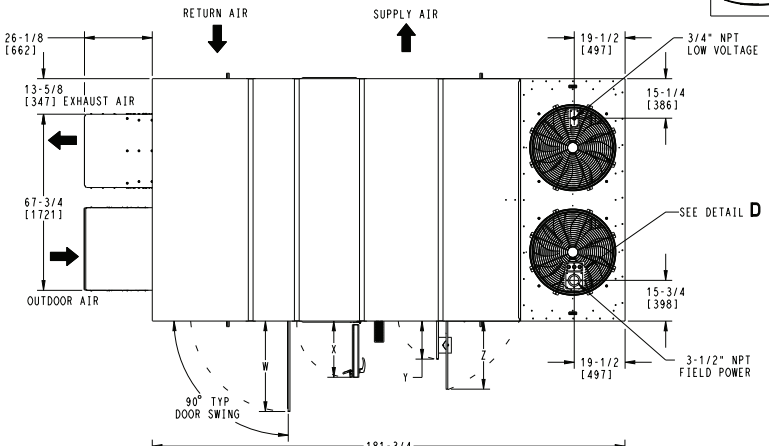
NOTES:

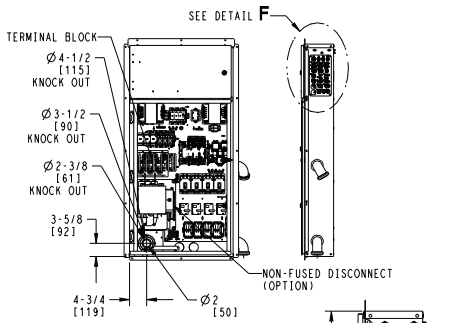
1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT)
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 6'-0"
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. HORIZONTAL DUCTS CONNECT TO DUCT FLANGE.
   SUPPLY DUCT FLANGE (OD) 23-3/8" X 54-3/4" [594 X 1388]
   RETURN DUCT FLANGE (OD) 28-1/2" X 54-7/8" [723 X 1394]
5. OUTDOOR AIR HOODS AND RELIEF HOODS SHIP AS SHOWN.
6. CONSIDER CONDENSATE DRAINAGE WHEN UNIT IS SLAB MOUNTED.

	DOOR WIDTH
W	34-3/4 [884]
X	21-1/2 [549]
Y	14-5/8 [372]
Z	26-1/8 [664]

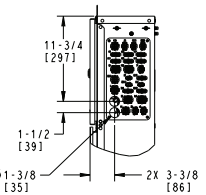


DETAIL D

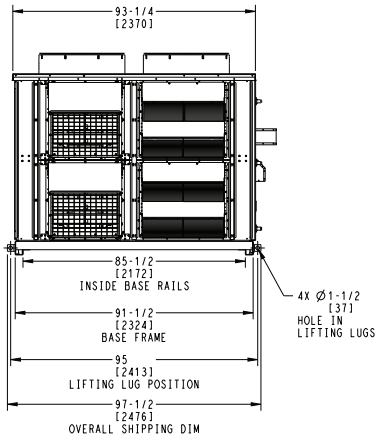


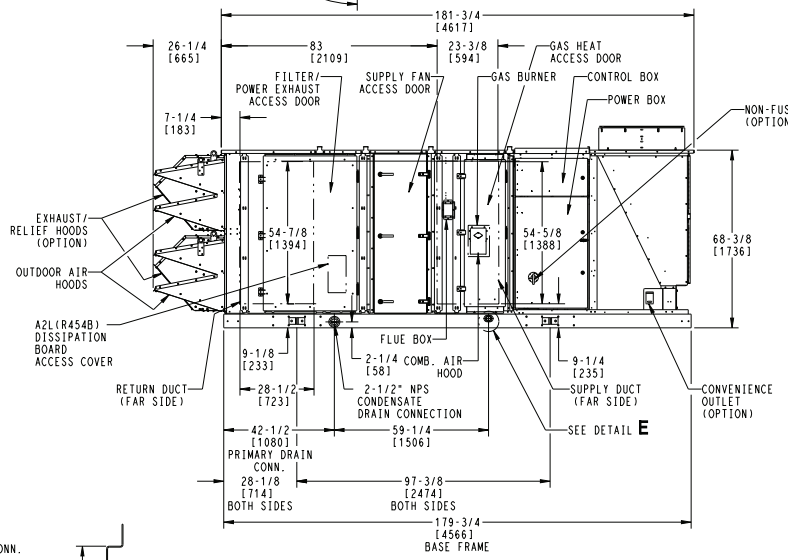


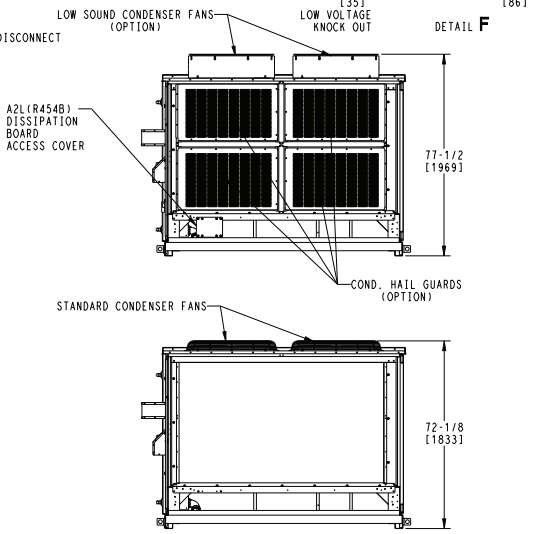
CONTROL BOX

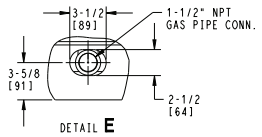


DETAIL F

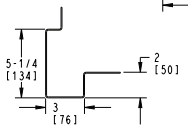








DETAIL E



BASE RAIL PROFILE

HORIZONTAL SUPPLY & RETURN

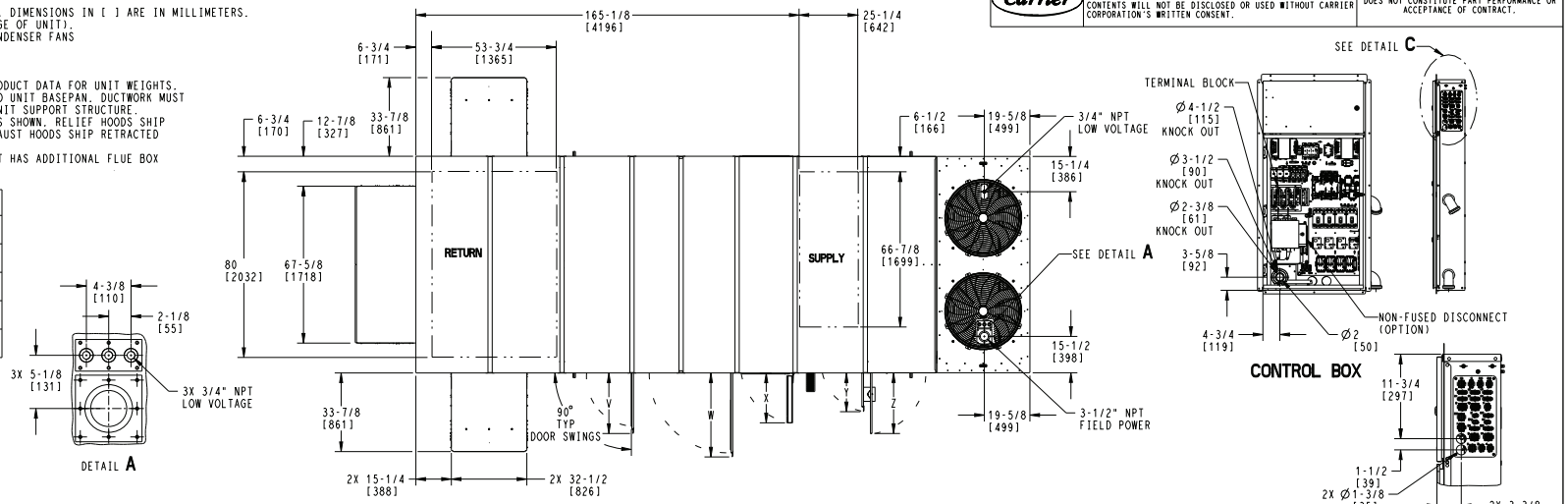
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:EAR99	2 OF 2	2/22/24	-	48V COMPACT CHASSIS 27-35 TON LOW HEAT	48VV004798	A

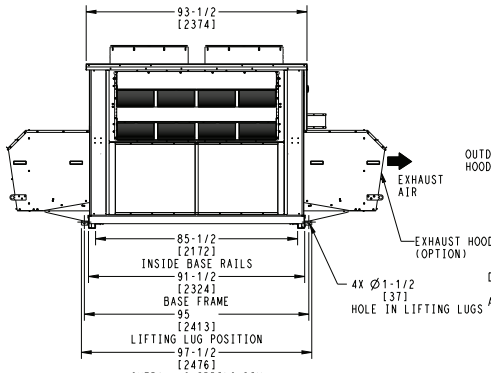
48V 27-35 Ton Standard Chassis

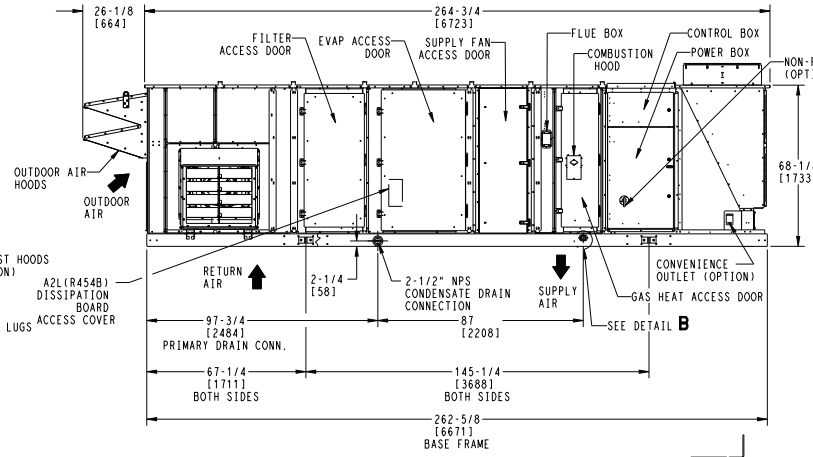
NOTES:

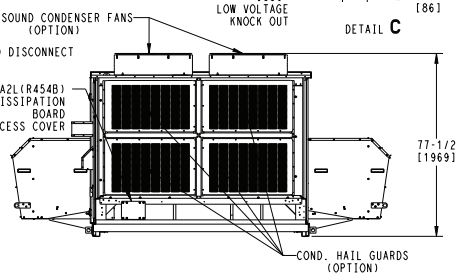
1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT).
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 6'-0"
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. DUCTWORK CANNOT ATTACH TO UNIT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

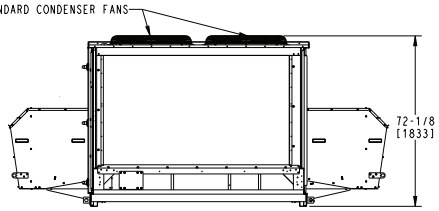
	DOOR WIDTH
V	26 [664]
W	36-1/8 [919]
X	21 [535]
Y	16-3/4 [427]
Z	26-1/8 [664]

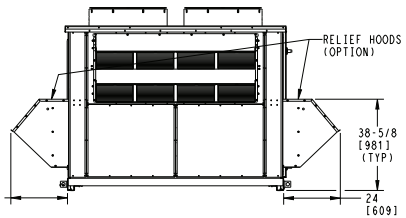


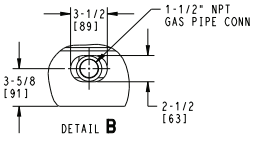


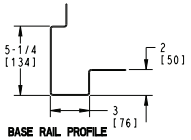








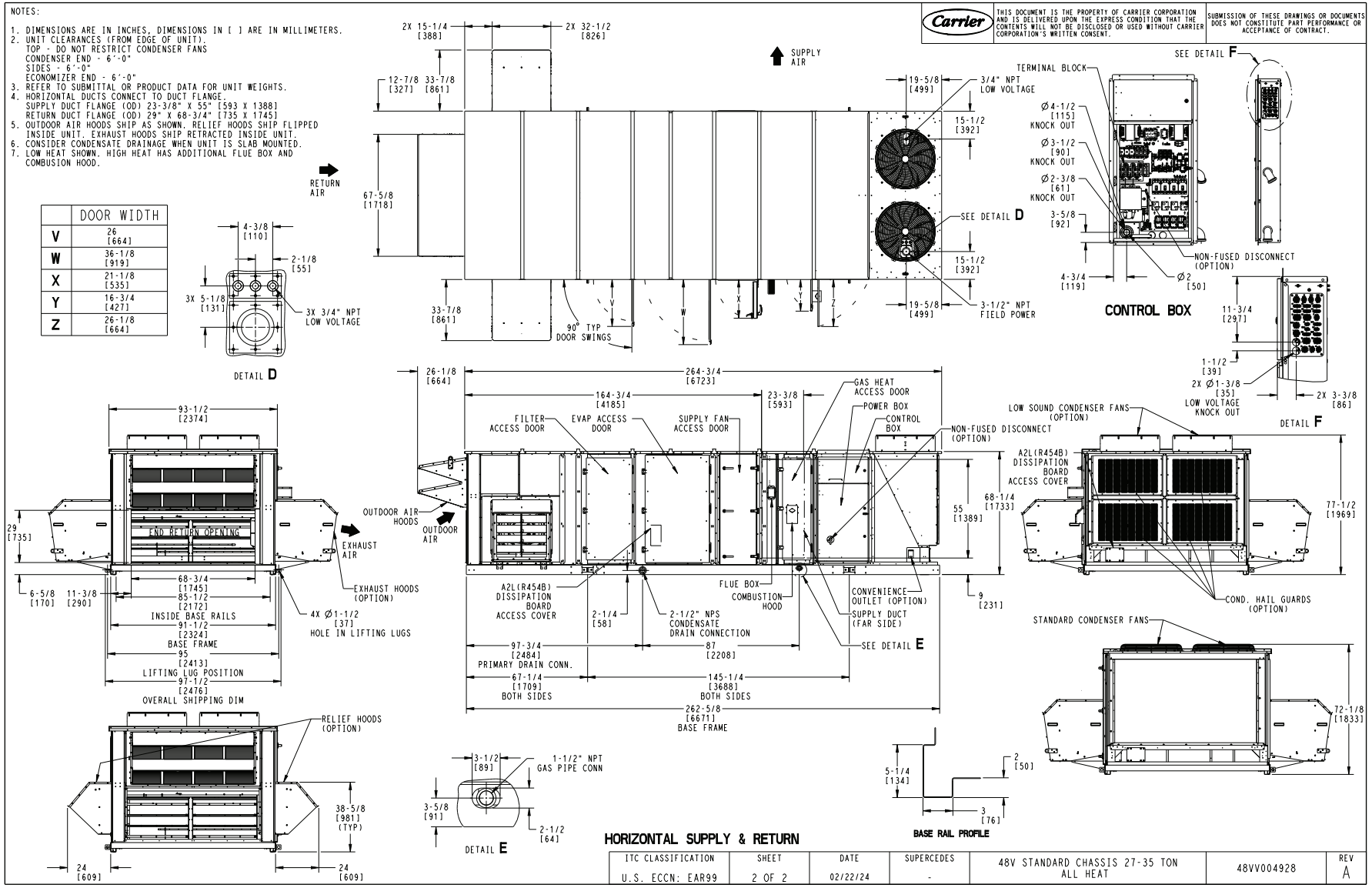




VERTICAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES		
U.S. ECCN: EAR99	1 OF 2	02/22/24	-	48V STANDARD CHASSIS 27-35 TON ALL HEAT	48VV004928	REV A

48V 27-35 Ton Standard Chassis (cont)

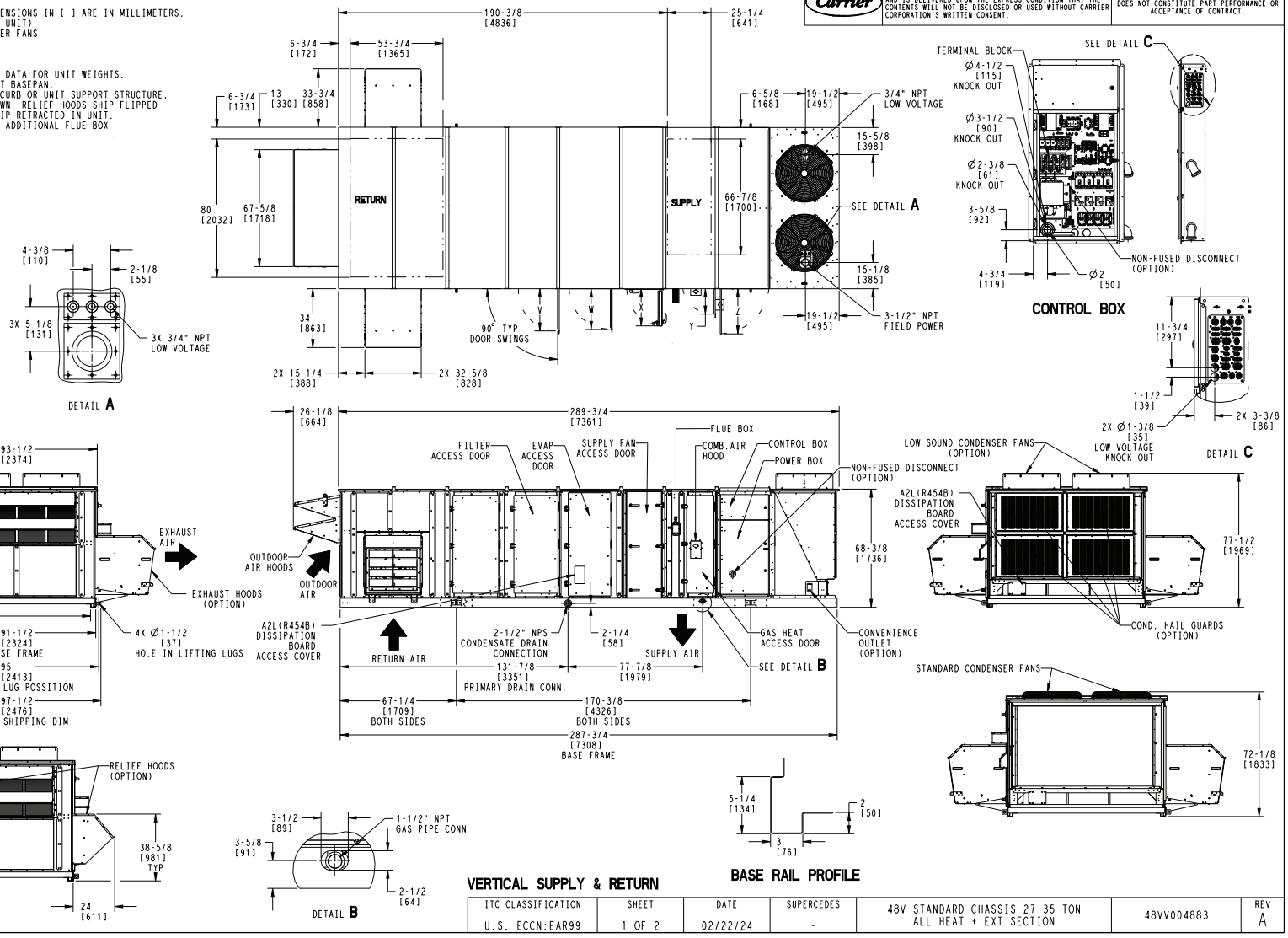


48V 27-35 Ton Extended Standard Chassis

NOTES:

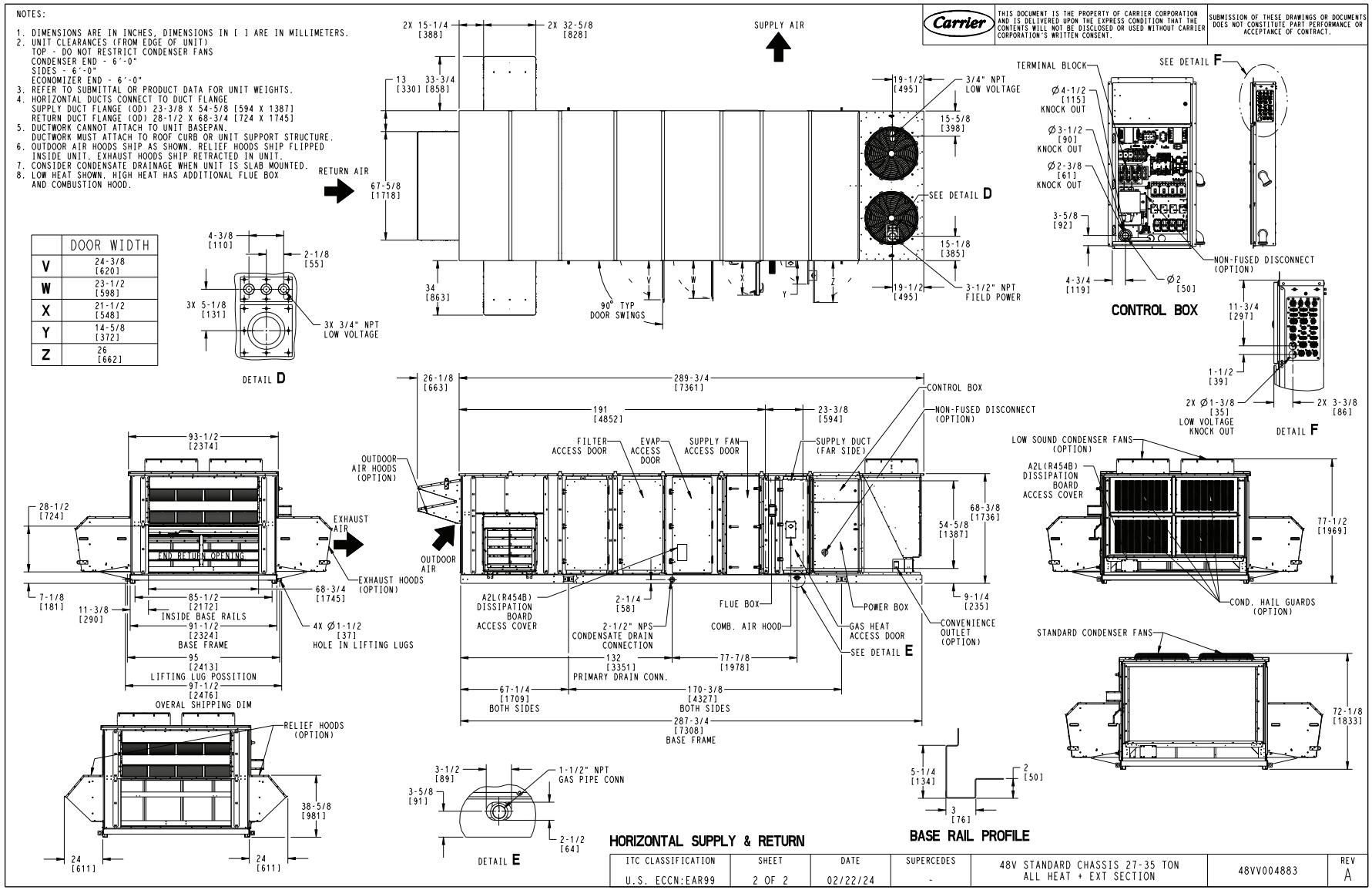
1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT)
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 6'-0"
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. DUCTWORK CANNOT ATTACH TO UNIT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

	DOOR WIDTH
V	24-3/8 [620]
W	23-1/2 [598]
X	21-1/2 [548]
Y	14-5/8 [372]
Z	26 [662]

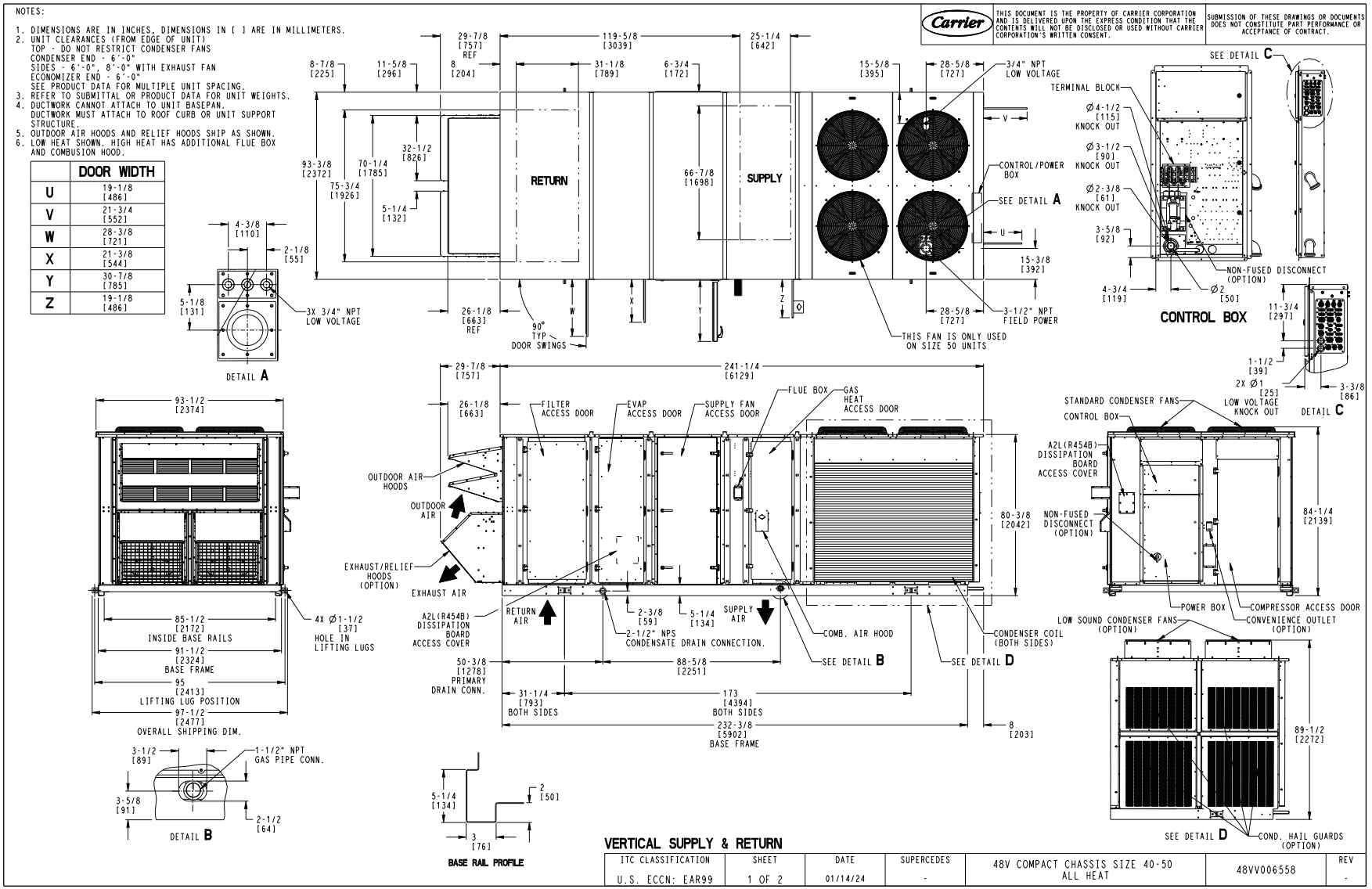


ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES		
U.S. ECCN:EAR99	1 OF 2	02/22/24	-	48V STANDARD CHASSIS 27-35 TON ALL HEAT + EXT SECTION	48VV004883	REV A

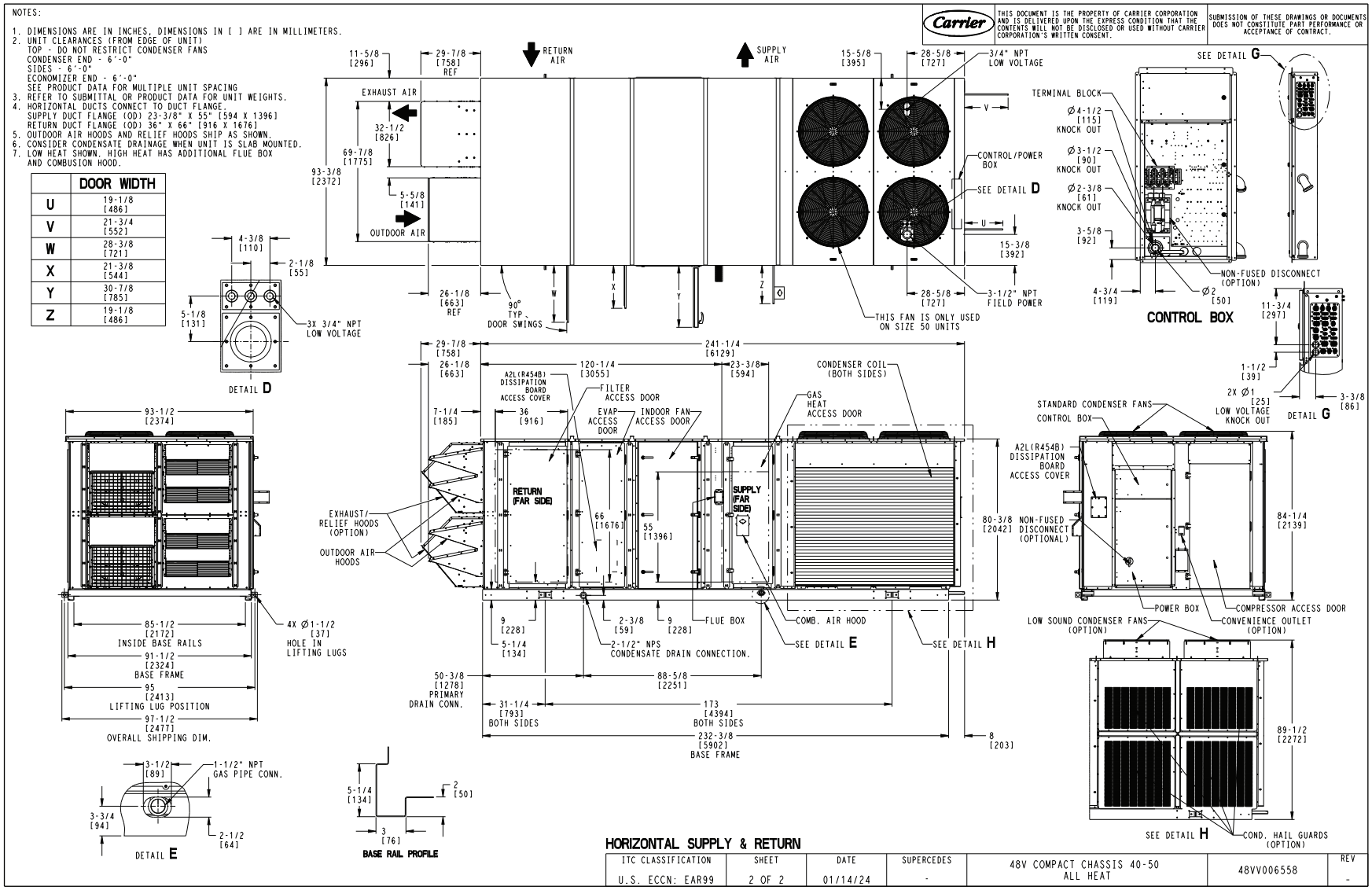
48V 27-35 Ton Extended Standard Chassis (cont)



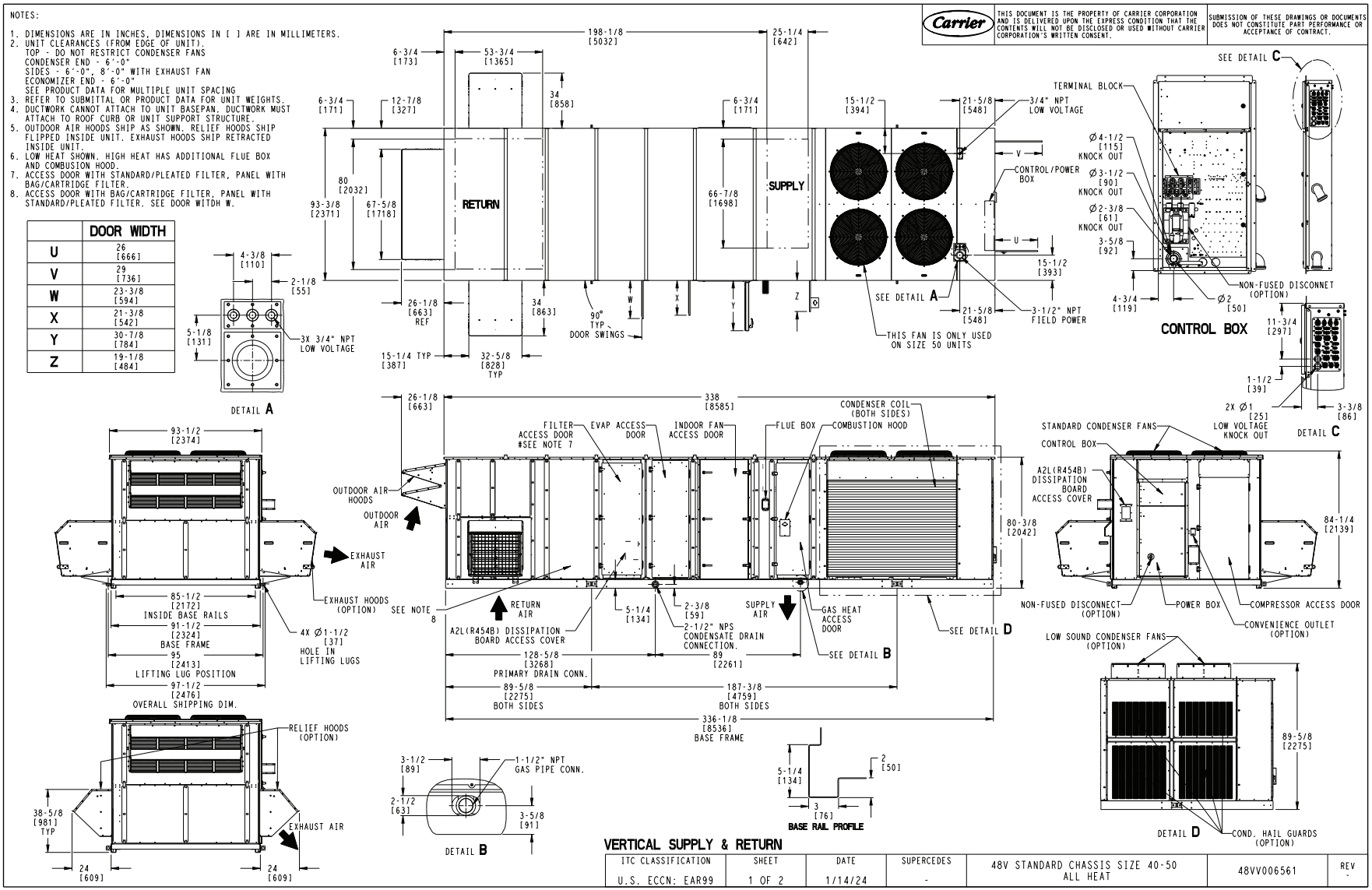
48V 40-50 Ton Compact Chassis



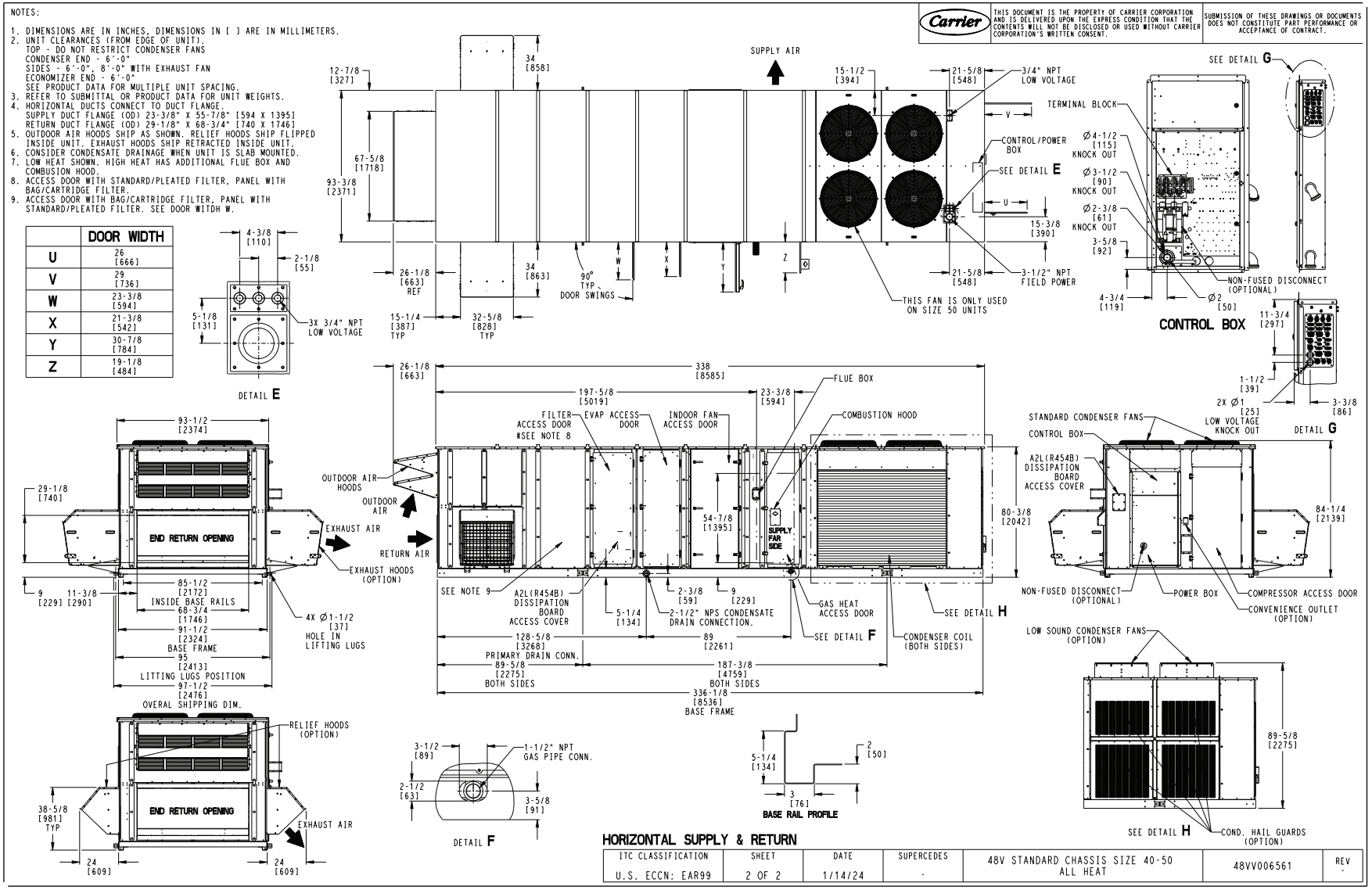
48V 40-50 Ton Compact Chassis (cont)



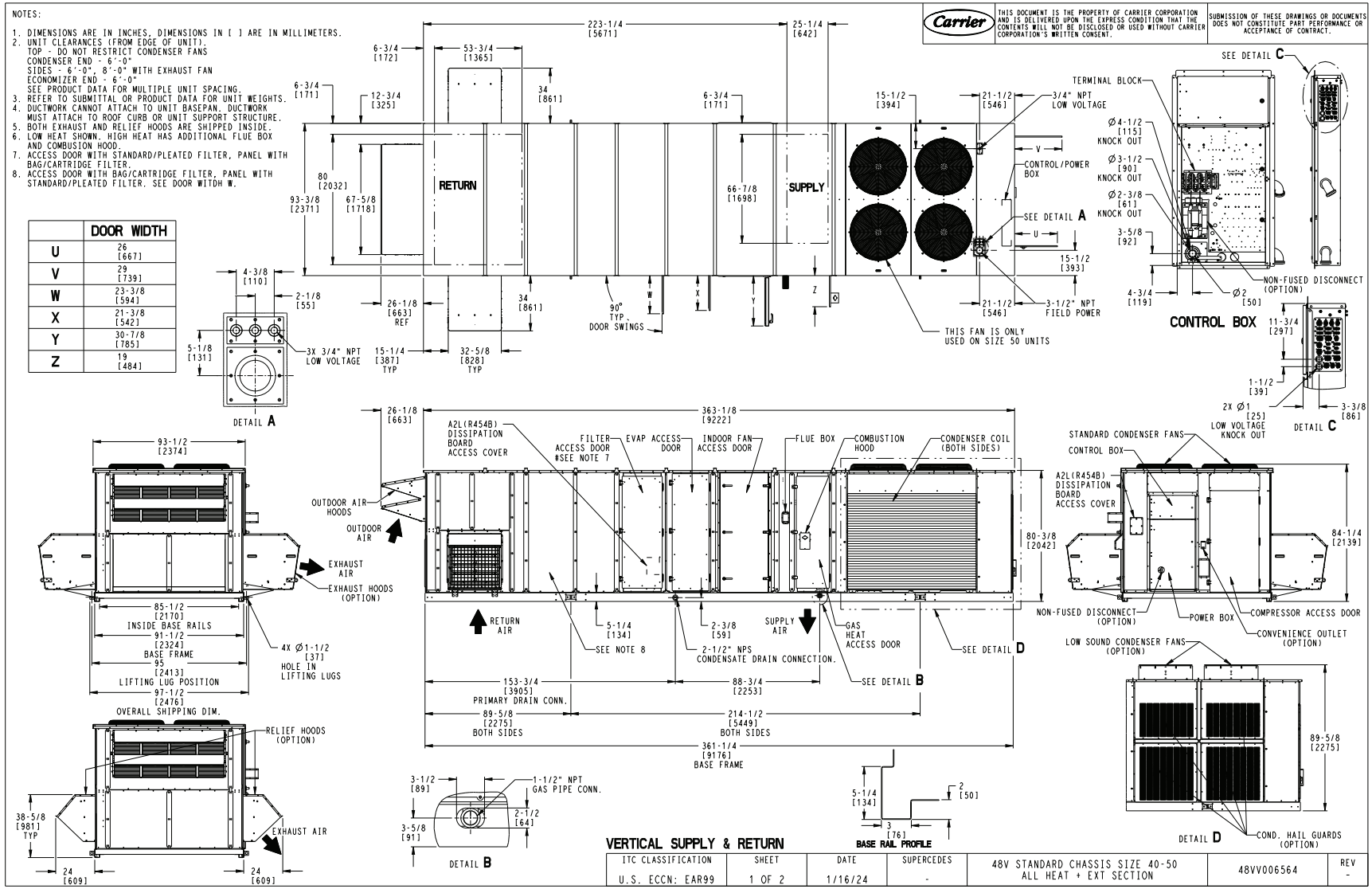
48V 40-50 Ton Standard Chassis



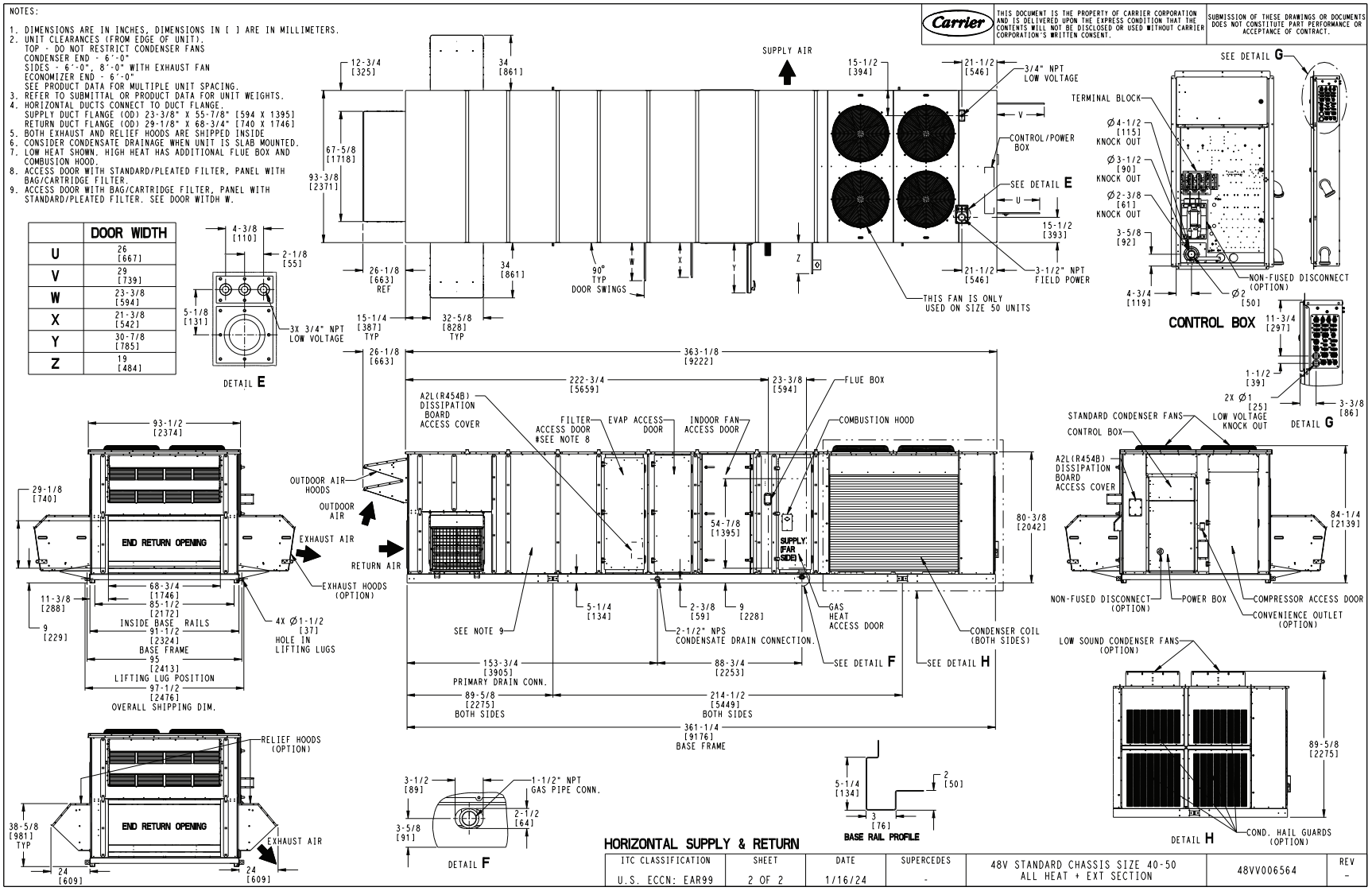
48V 40-50 Ton Standard Chassis (cont)



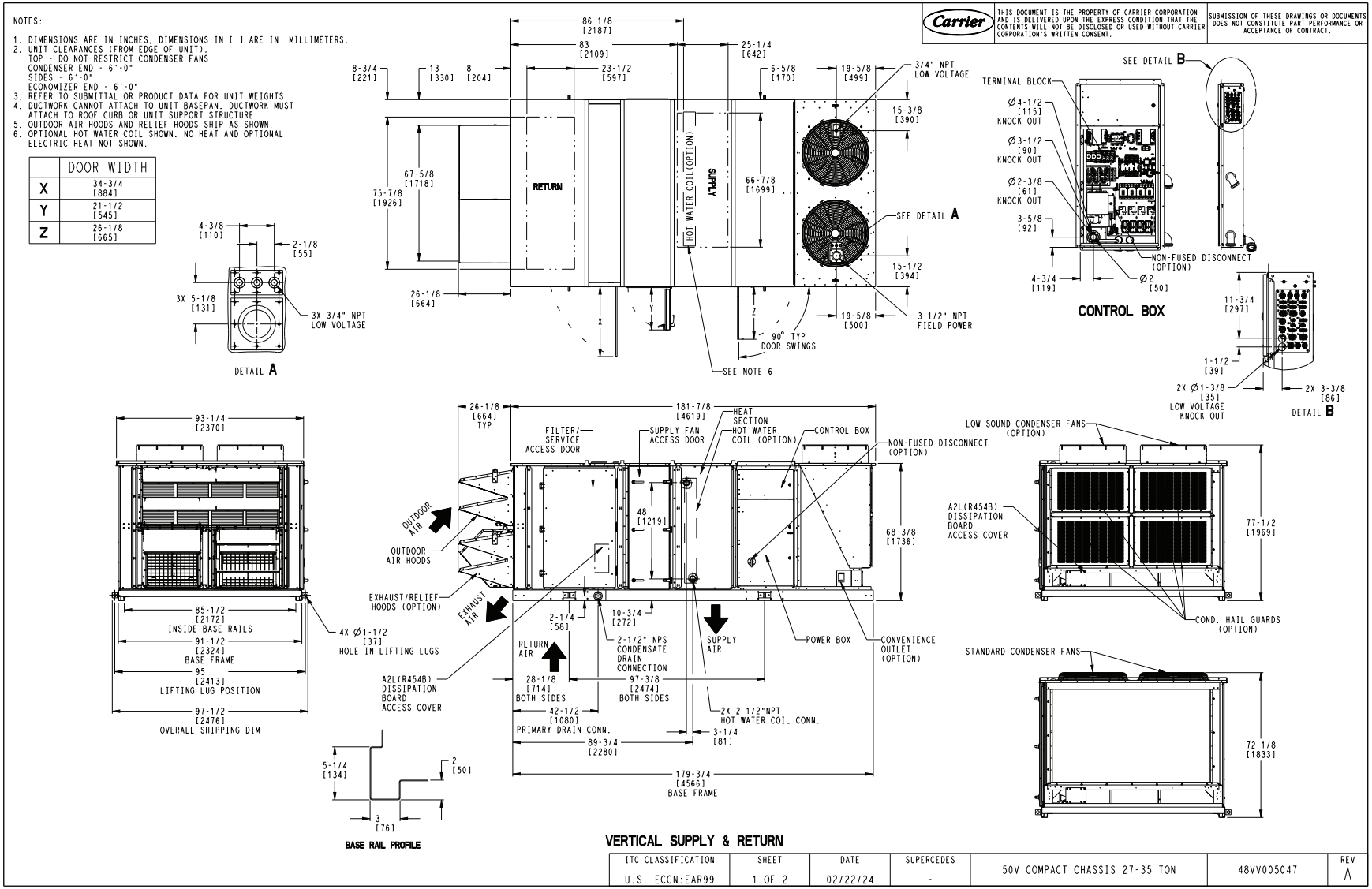
48V 40-50 Ton Extended Standard Chassis



48V 40-50 Ton Extended Standard Chassis Plenum (cont)



50V 27-35 Ton Compact Chassis

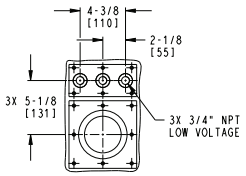


50V 27-35 Ton Compact Chassis (cont)

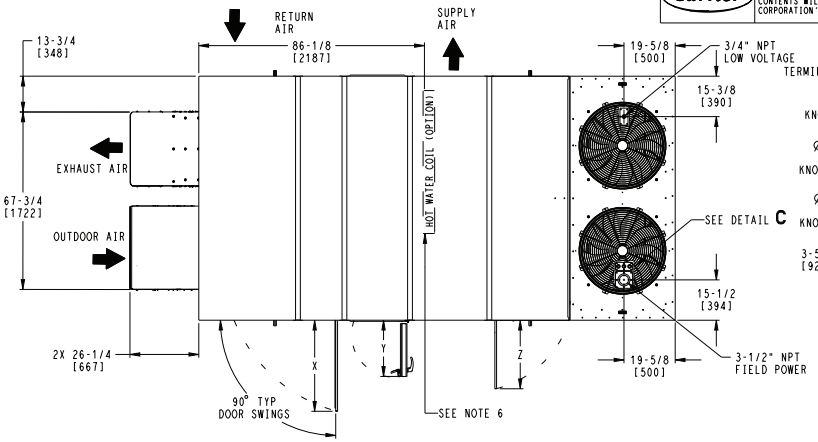
NOTES:

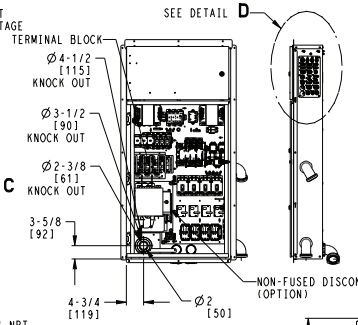
1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT).
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0"
   ECONOMIZER END - 6'-0"
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. HORIZONTAL DUCTS CONNECT TO 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]

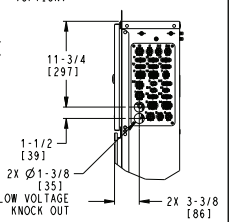


DETAIL C

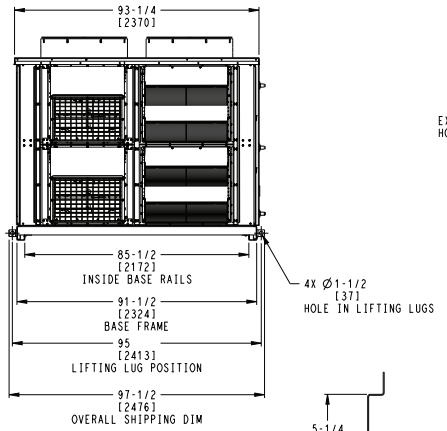


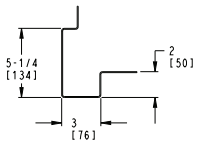


CONTROL BOX

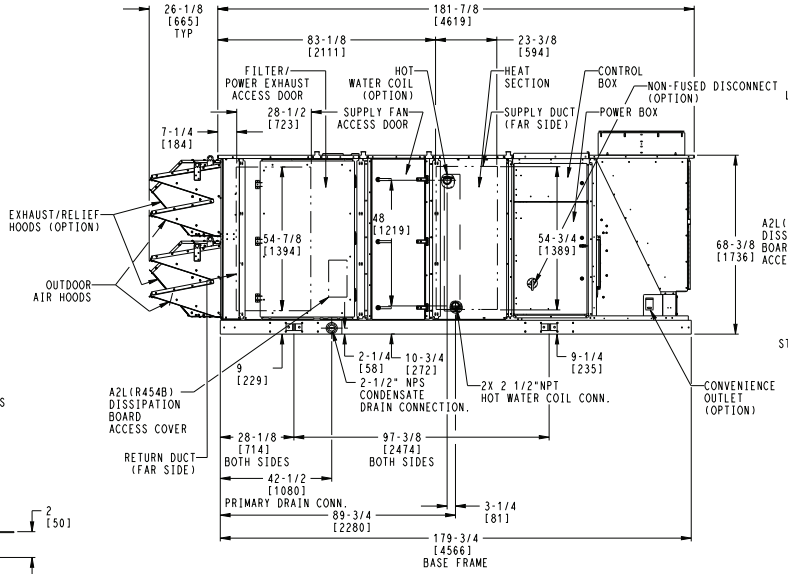


DETAIL D

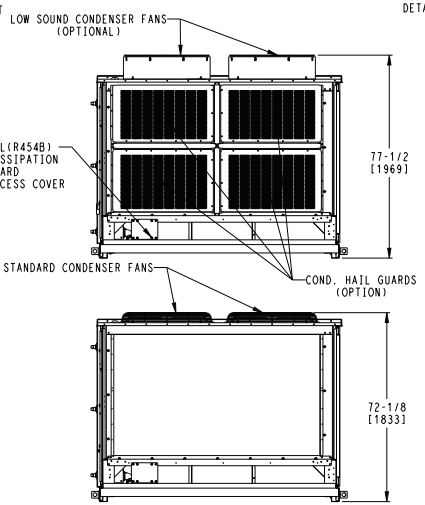




BASE RAIL PROFILE

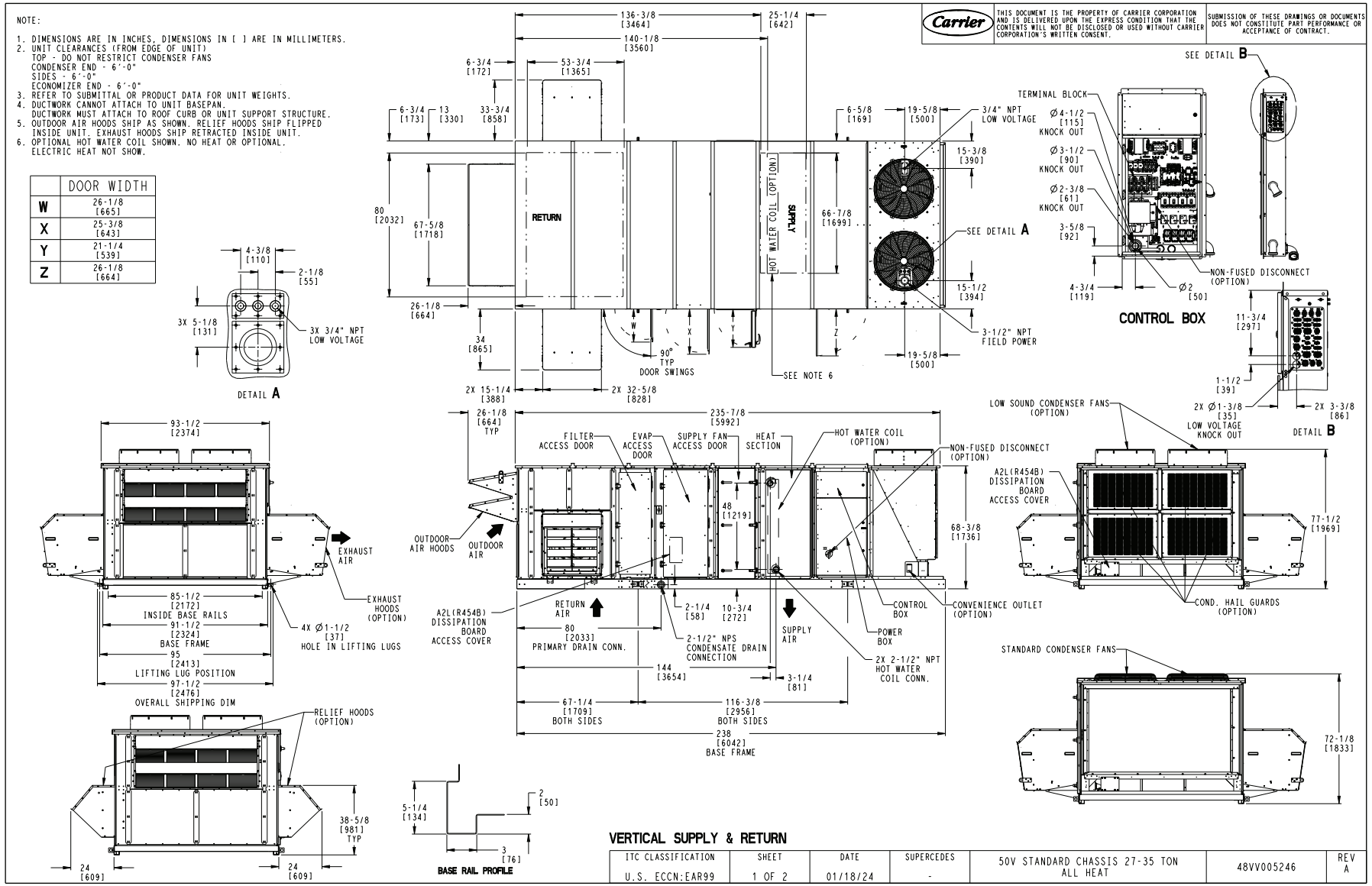


HORIZONTAL SUPPLY & RETURN



ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			
U.S. ECCN:EAR99	2 OF 2	02/22/24	-	50V COMPACT CHASSIS 27-35 TON	48VV005047	REV A

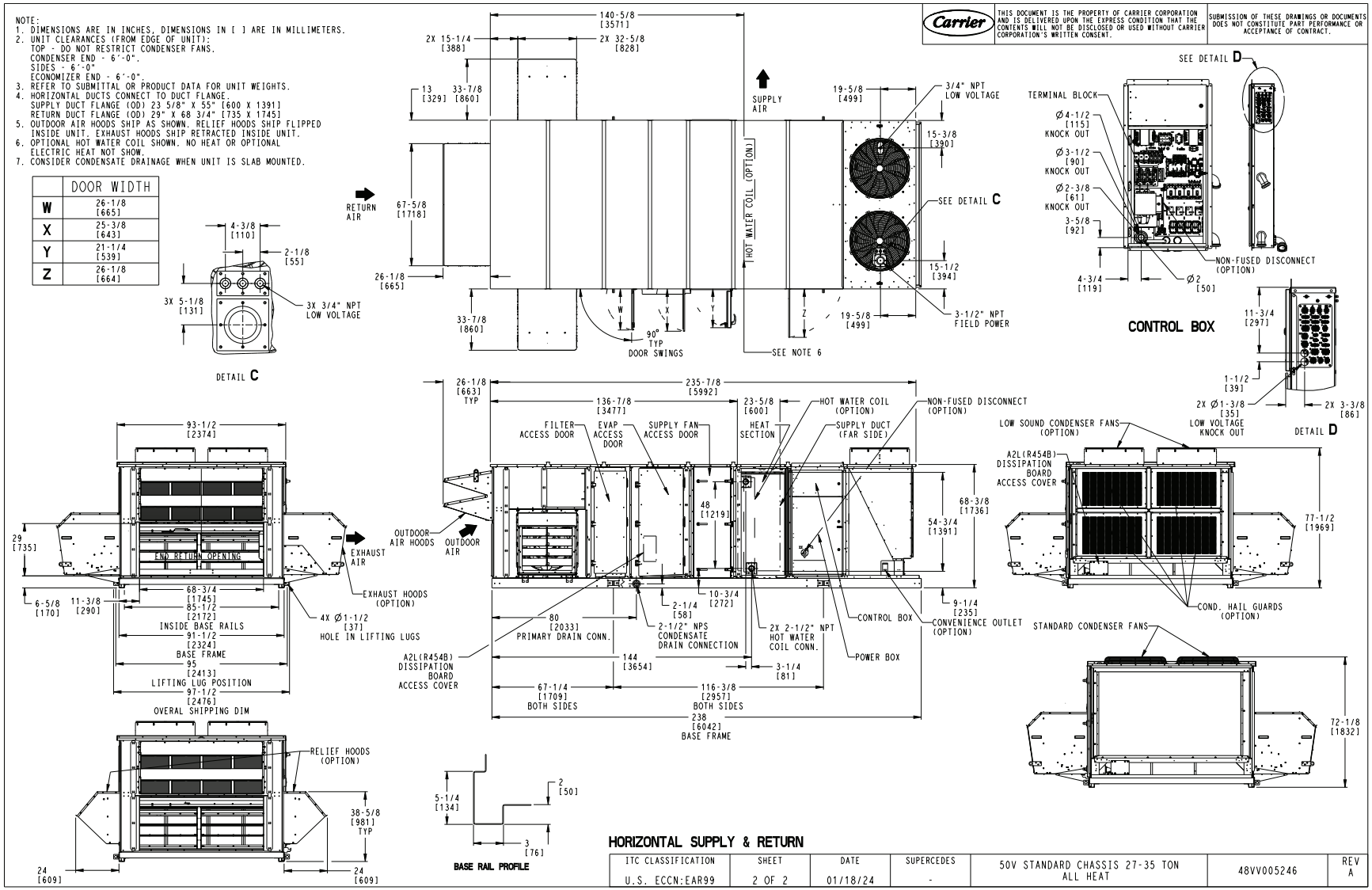
50V 27-35 Ton Standard Chassis



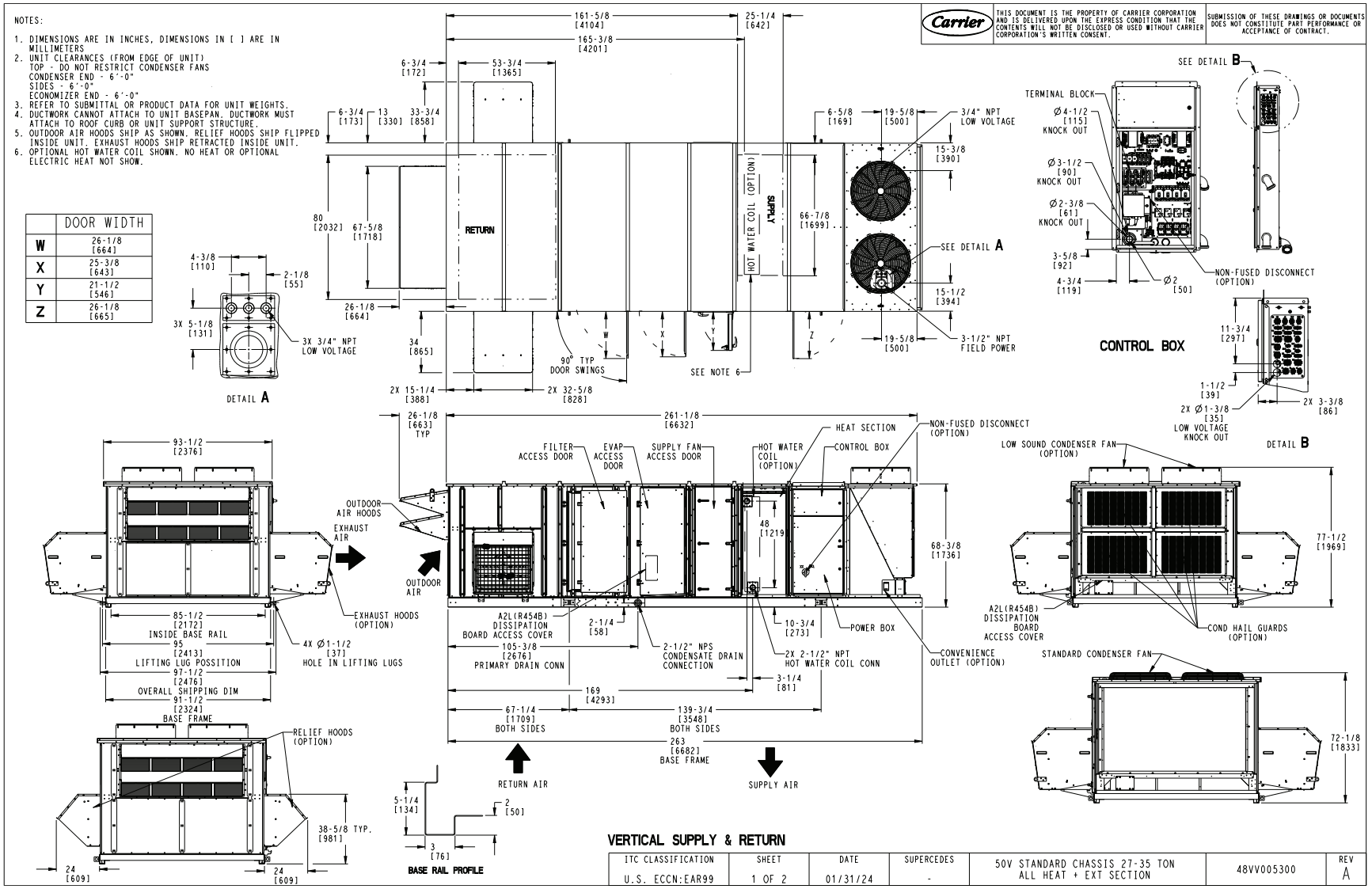
VERTICAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	50V STANDARD CHASSIS 27-35 TON ALL HEAT	48VV005246	REV
U.S. ECCN:EAR99	1 OF 2	01/18/24	-			A

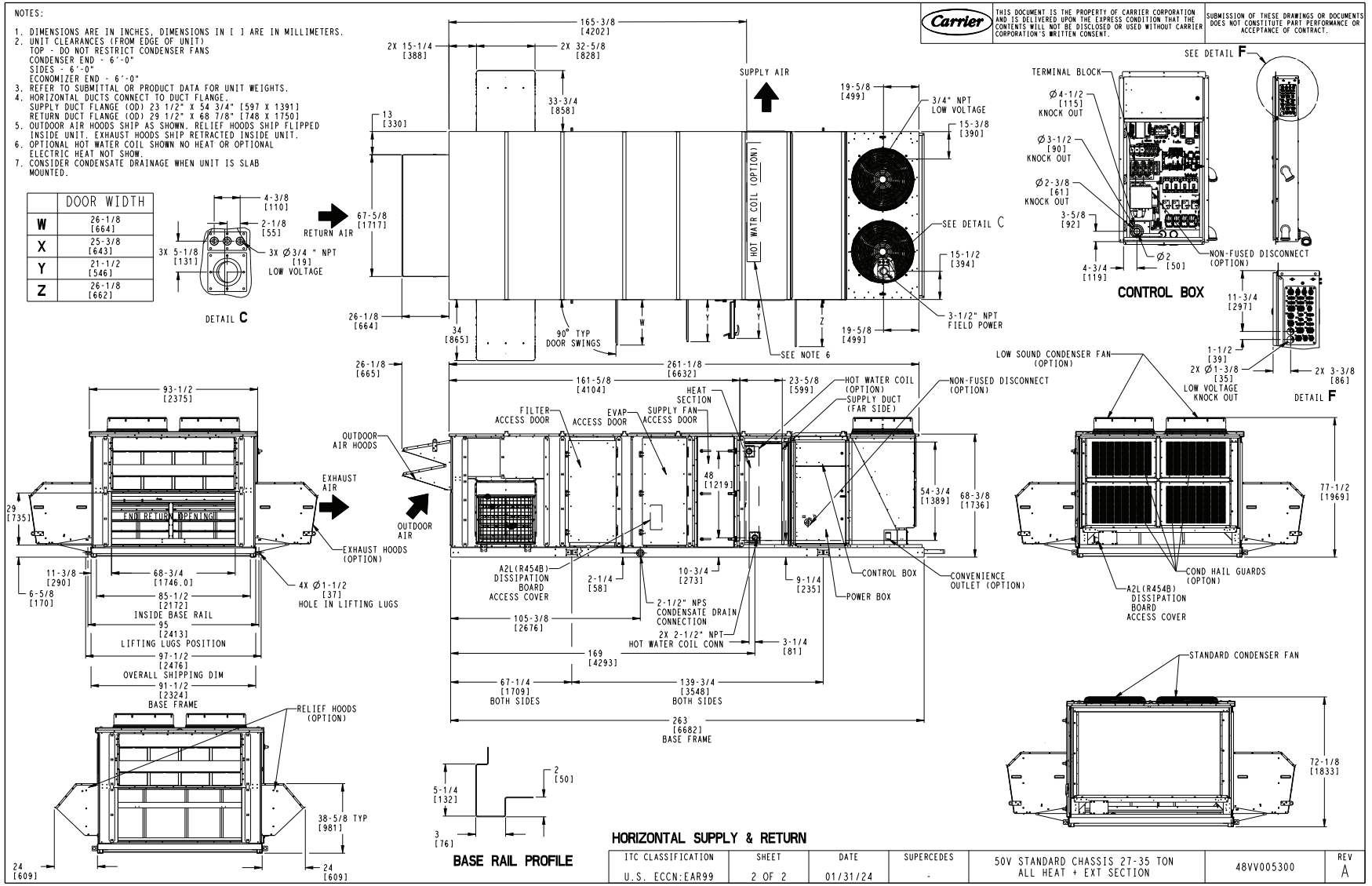
50V 27-35 Ton Standard Chassis (cont)



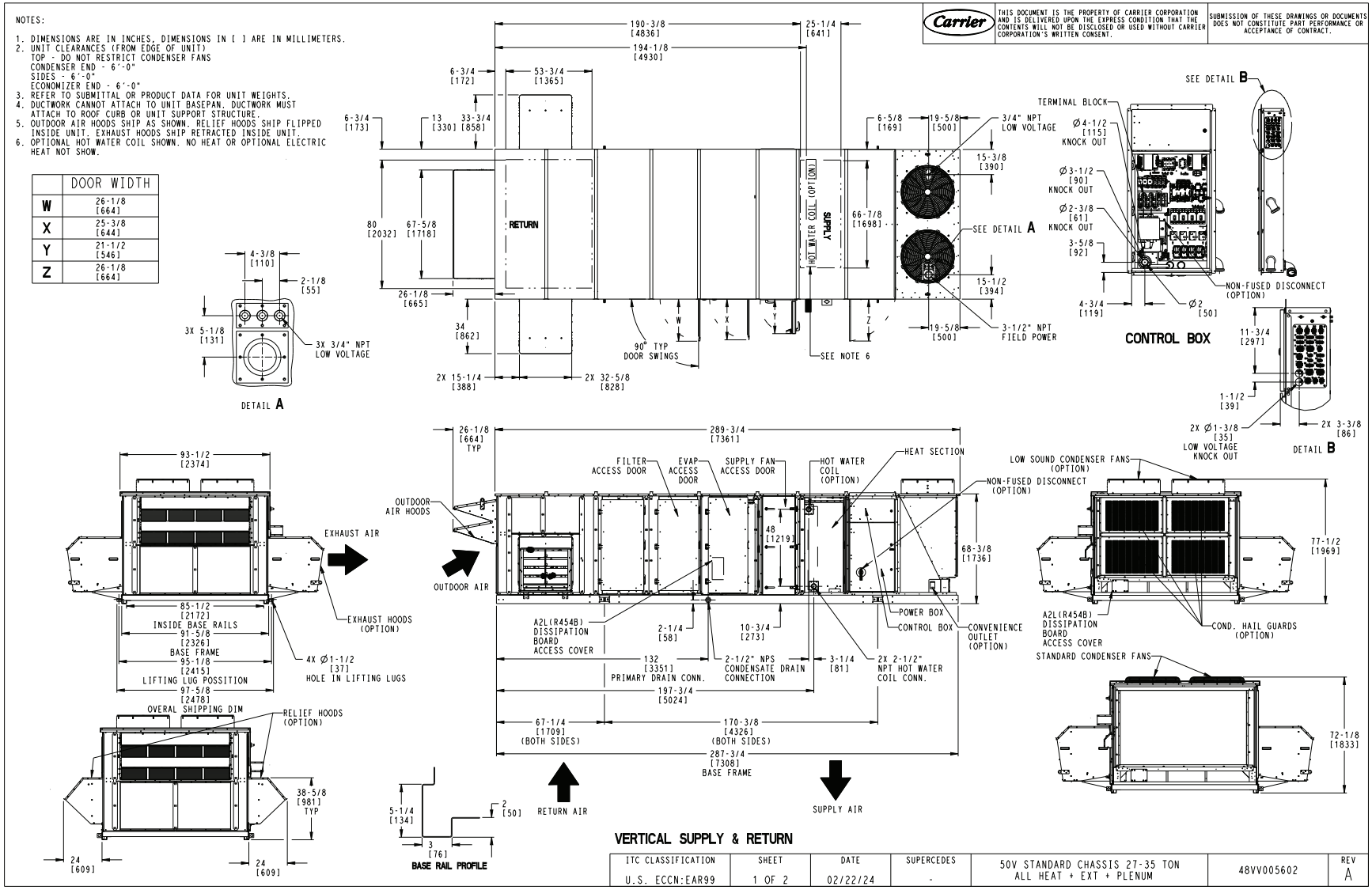
50V 27-35 Ton Extended Standard Chassis



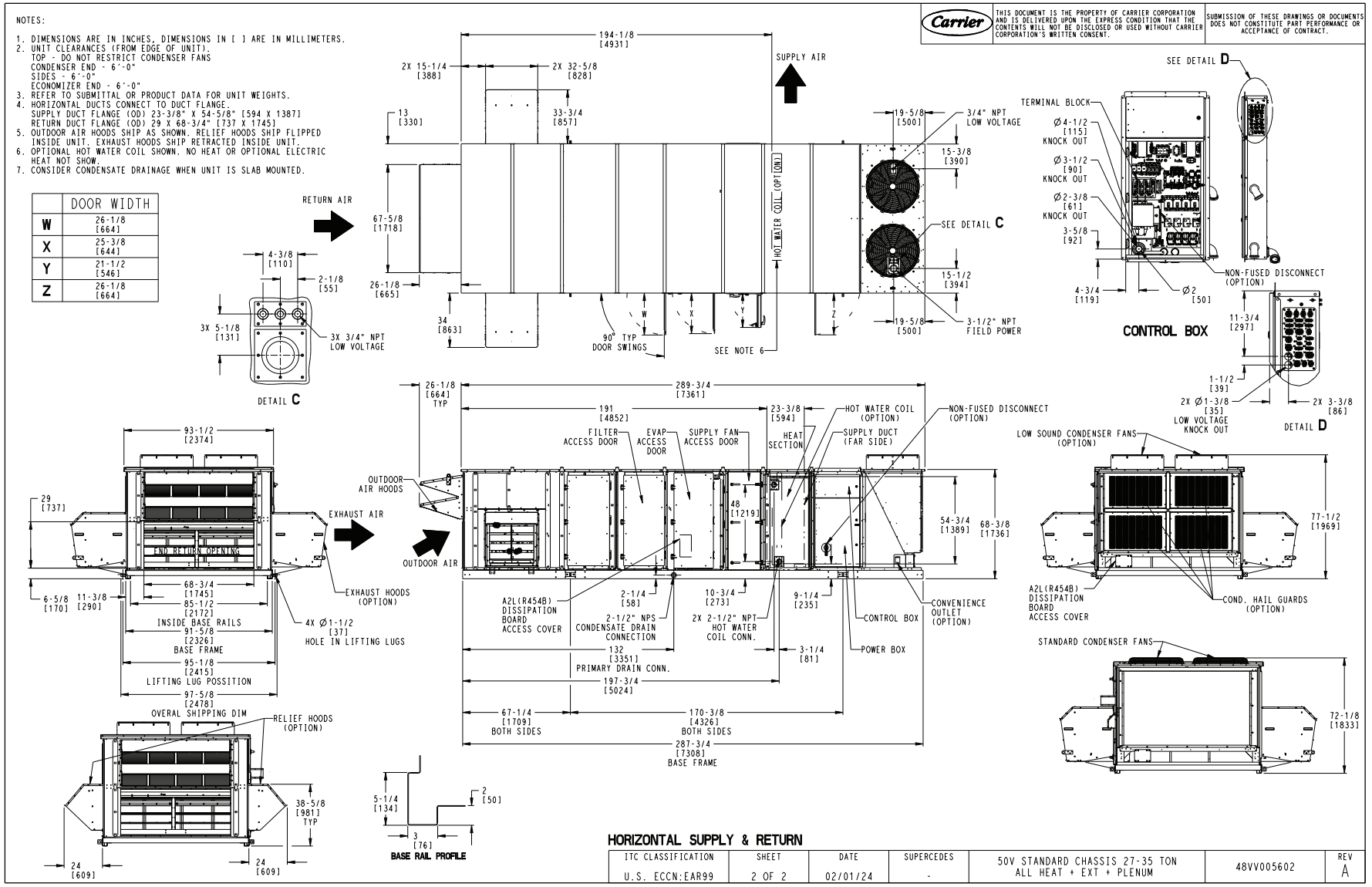
50V 27-35 Ton Extended Standard Chassis (cont)



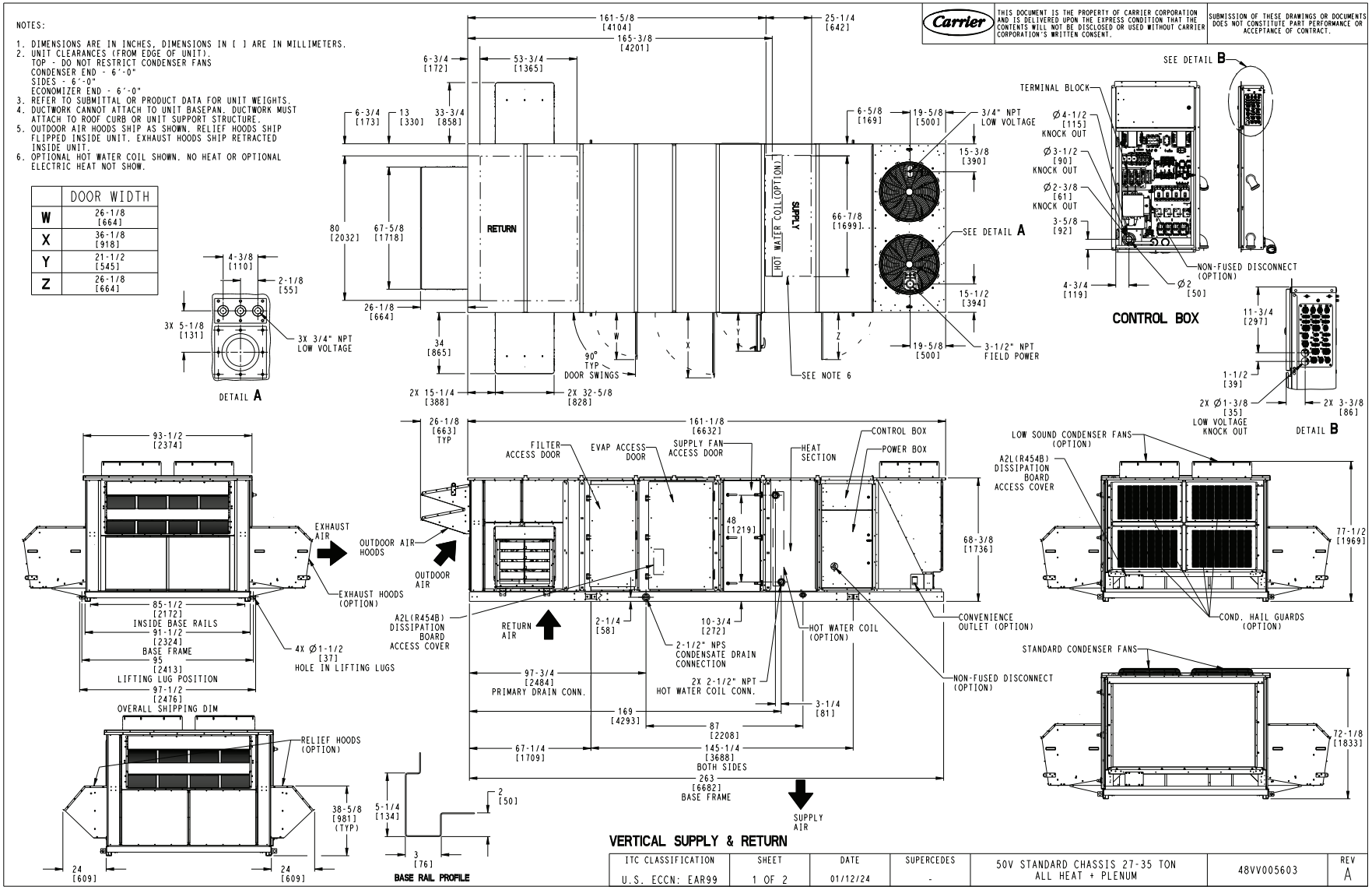
50V 27-35 Ton Extended Standard Chassis with Plenum Section



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



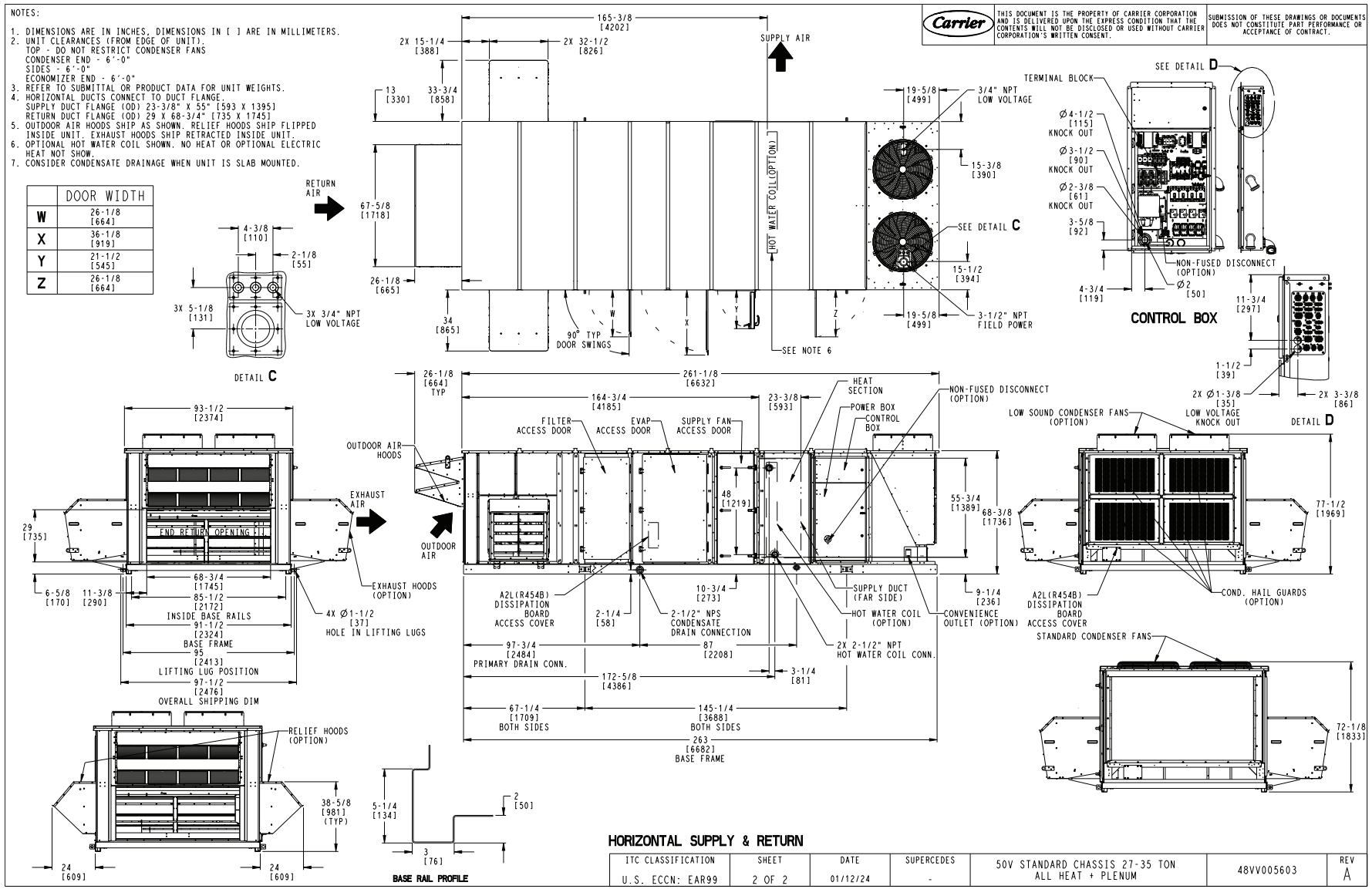
50V 27-35 Ton Standard Chassis with Plenum Section



VERTICAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	50V STANDARD CHASSIS 27-35 TON ALL HEAT + PLENUM	48VV005603	REV
U.S. ECCN: EAR99	1 OF 2	01/12/24	-			A

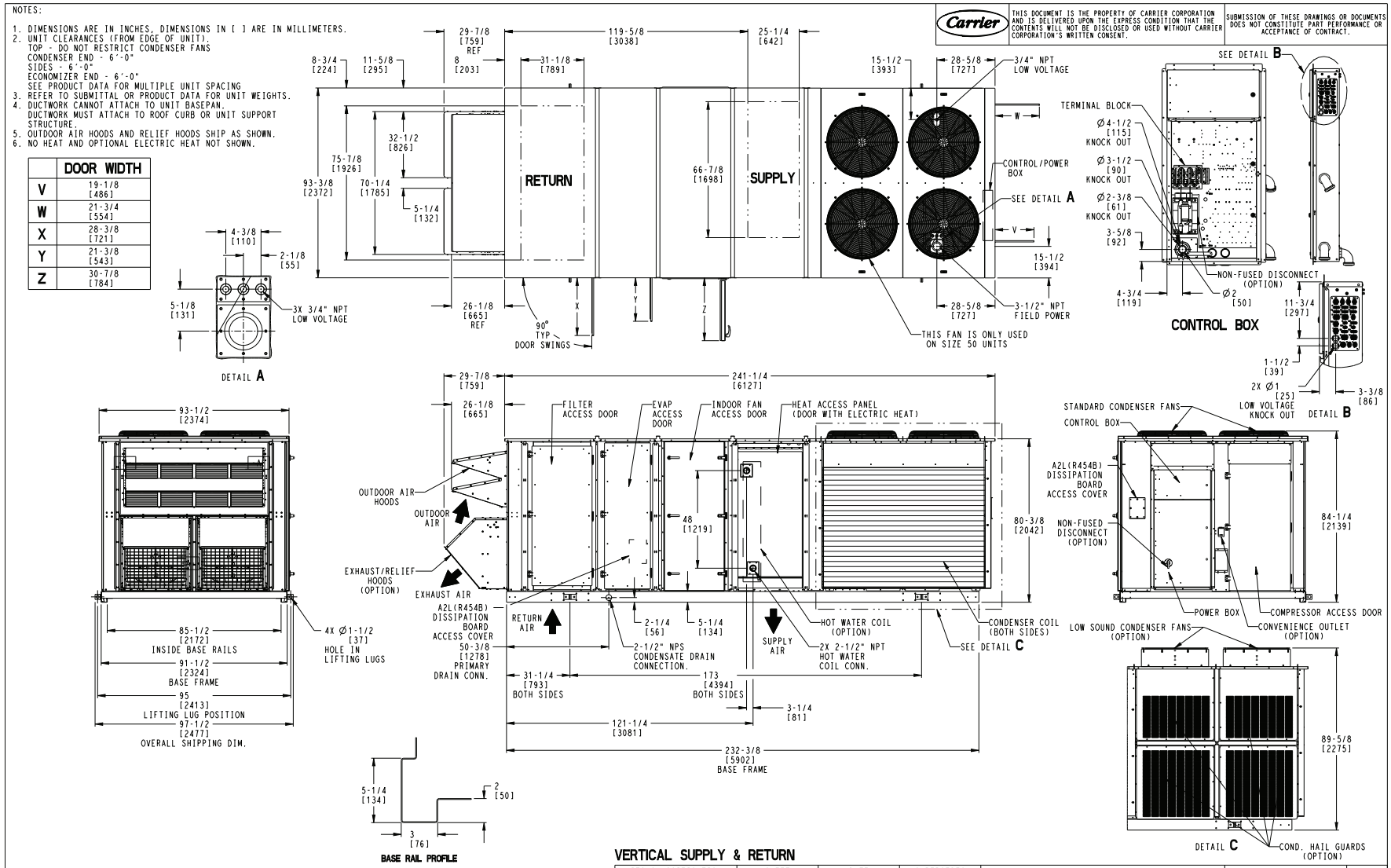
50V 27-35 Ton Standard Chassis with Plenum Section (cont)



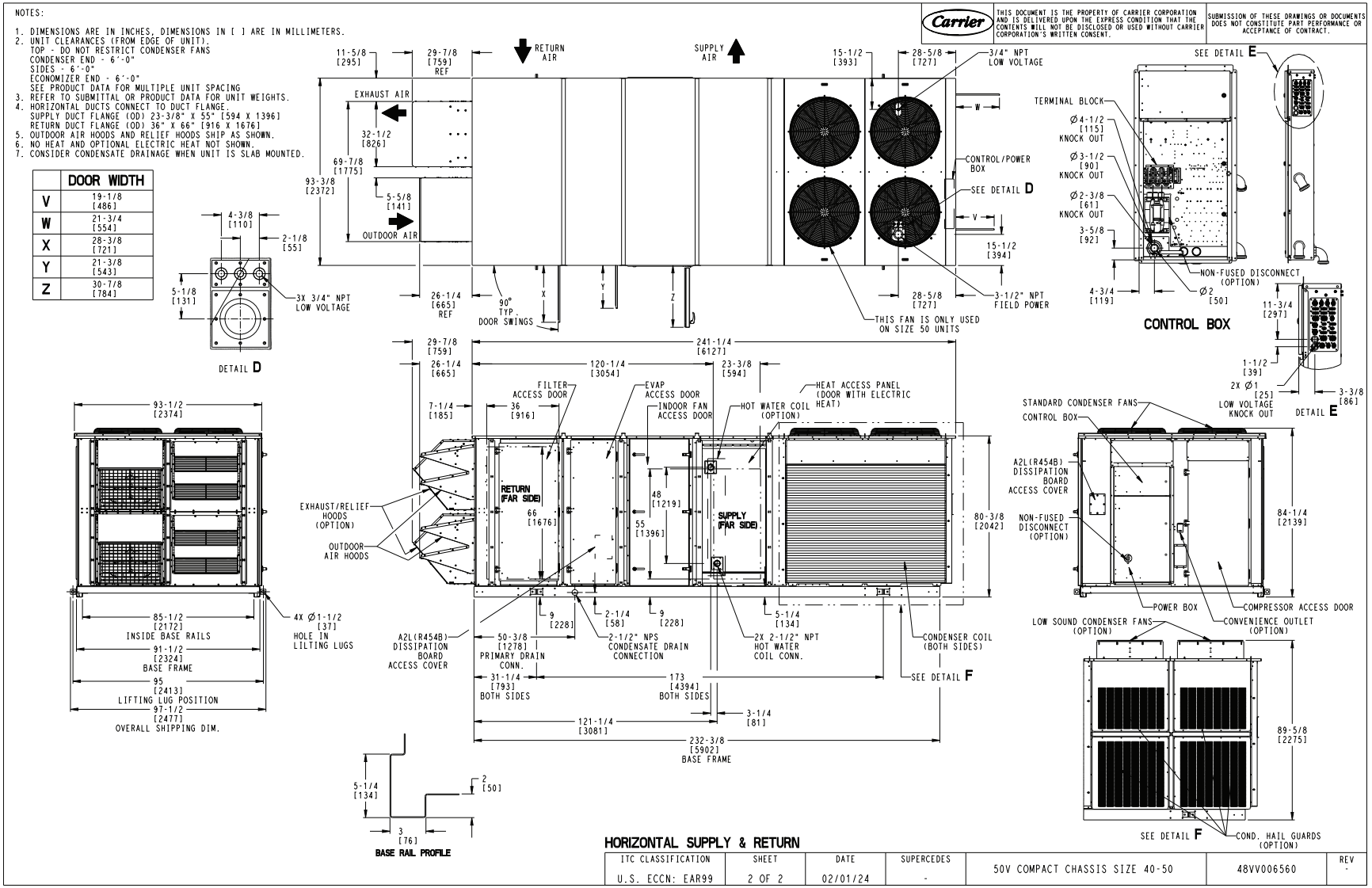
HORIZONTAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN: EAR99	2 OF 2	01/12/24	-	50V STANDARD CHASSIS 27-35 TON ALL HEAT + PLENUM	48VV005603	A

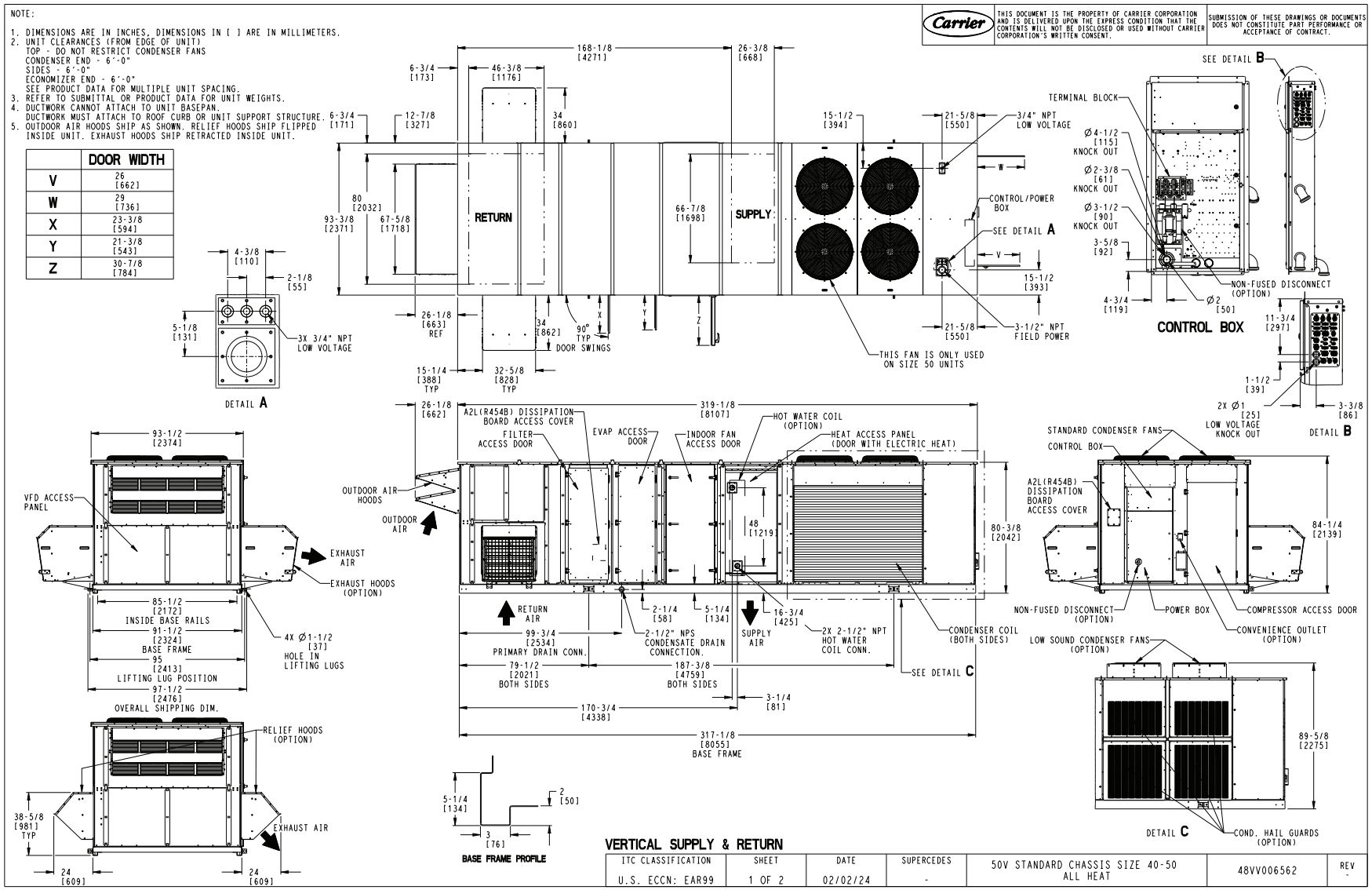
50V 40-50 Ton Compact Chassis



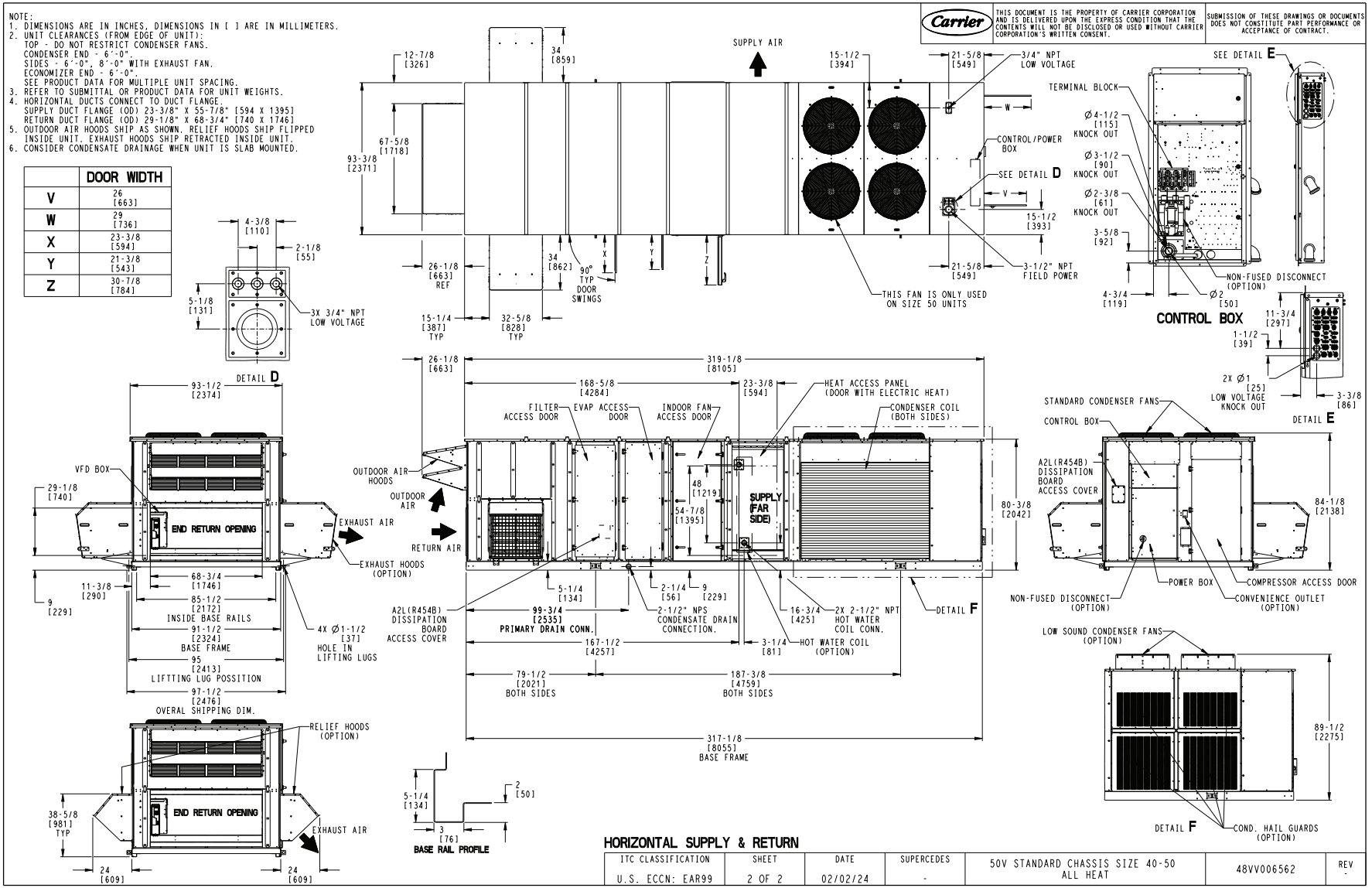
50V 40-50 Ton Compact Chassis (cont)



50V 40-50 Ton Standard Chassis



50V 40-50 Ton Standard Chassis (cont)

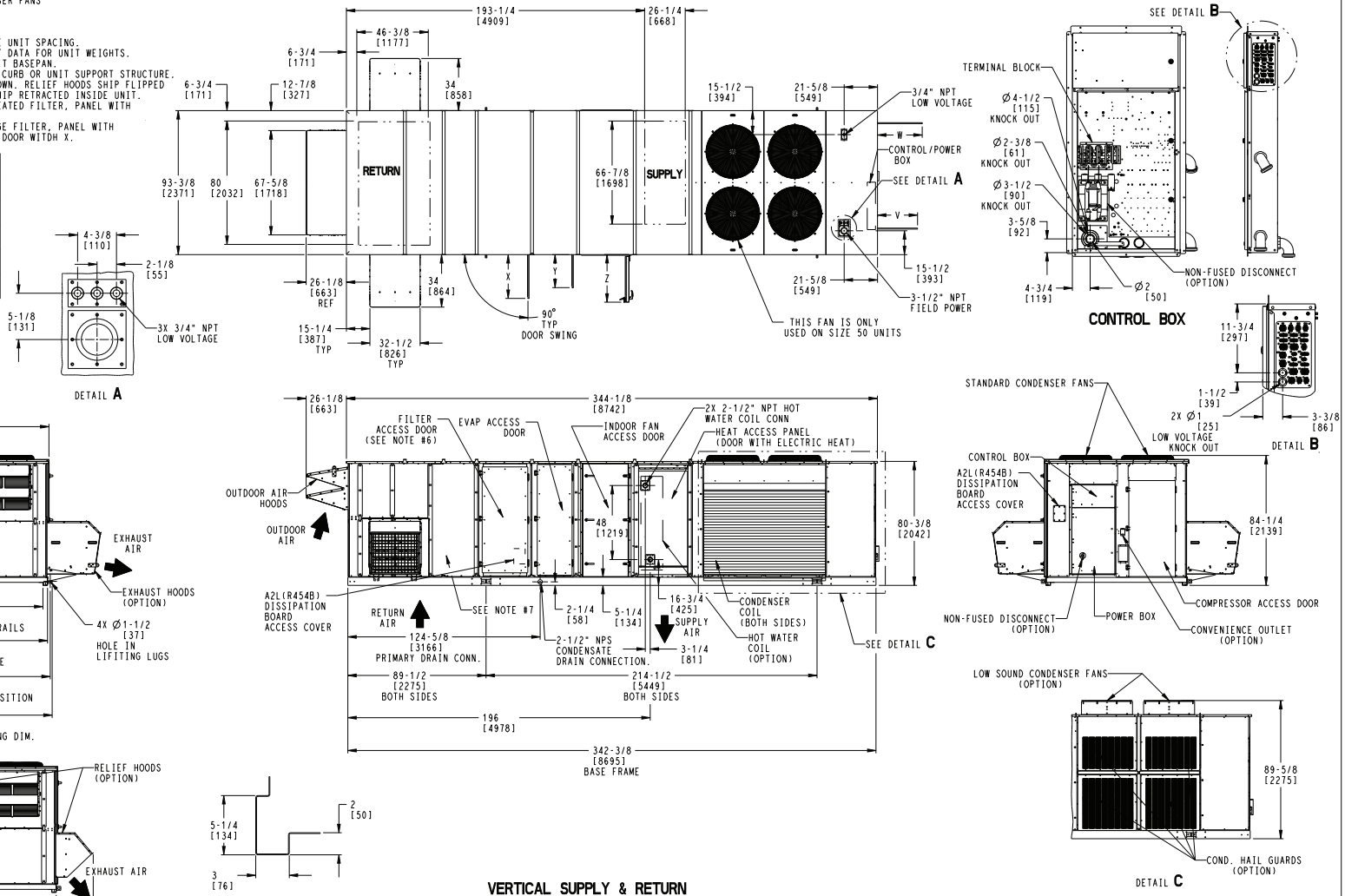


50V 40-50 Ton Extended Standard Chassis

NOTE:

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"
   SEE PRODUCT DATA FOR MULTIPLE UNIT SPACING.
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. ACCESS DOOR WITH STANDARD/PLEATED FILTER, PANEL WITH BAG/CARTRIDGE FILTER.
7. ACCESS DOOR WITH BAG/CARTRIDGE FILTER, PANEL WITH STANDARD/PLEATED FILTER. SEE DOOR WITDH X.

	DOOR WIDTH
V	26 [659]
W	29 [736]
X	28-3/8 [721]
Y	21-3/8 [543]
Z	30-7/8 [784]



VERTICAL SUPPLY & RETURN

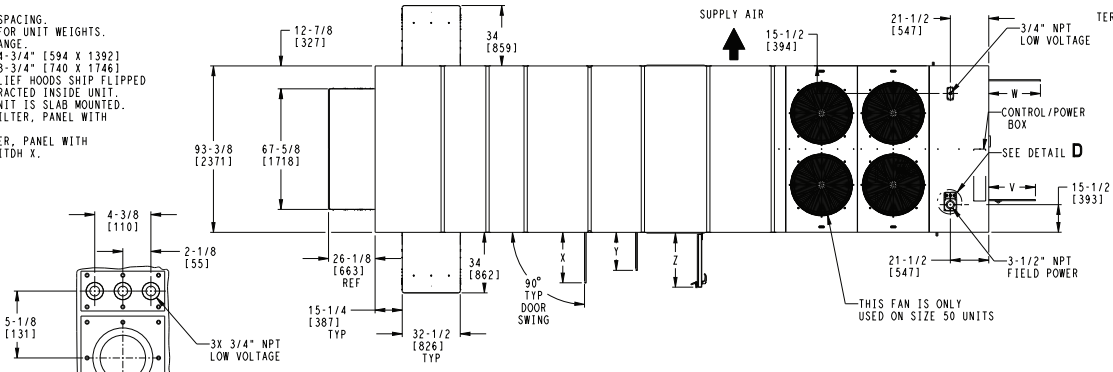
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:EAR99	1 OF 2	02/02/24	-	50V STANDARD CHASSIS 40-50 ALL HEAT + EXT SECTION	48VV006565	-

50V 40-50 Ton Extended Standard Chassis (cont)

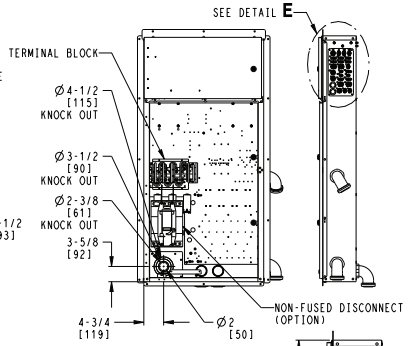
NOTES:

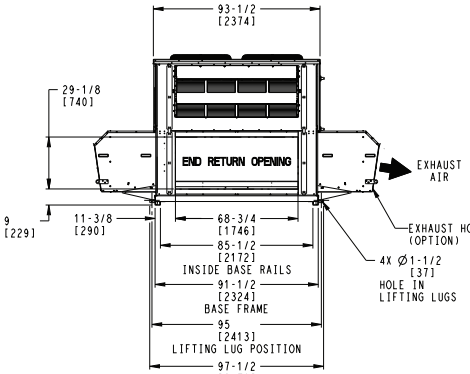
1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT).
   TOP - DO NOT RESTRICT CONDENSER FANS
   CONDENSER END - 6'-0"
   SIDES - 6'-0", 8'-0" WITH EXHAUST FAN
   ECONOMIZER END - 6'-0"
   SEE PRODUCT DATA FOR MULTIPLE UNIT SPACING.
3. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS.
4. HORIZONTAL DUCTS CONNECT TO DUCT FLANGE.
   SUPPLY DUCT FLANGE (OD) 23-3/8" X 54-3/4" [594 X 1392]
   RETURN DUCT FLANGE (OD) 29-1/8" X 68-3/4" [740 X 1746]
5. OUTDOOR AIR HOODS SHIP AS SHOWN. RELIEF HOODS SHIP FLIPPED INSIDE UNIT. EXHAUST HOODS SHIP RETRACTED INSIDE UNIT.
6. CONSIDER CONDENSATE DRAINAGE WHEN UNIT IS SLAB MOUNTED.
7. ACCESS DOOR WITH STANDARD/PLEATED FILTER, PANEL WITH BAG/CARTRIDGE FILTER.
8. ACCESS DOOR WITH BAG/CARTRIDGE FILTER, PANEL WITH STANDARD/PLEATED FILTER. SEE DOOR WITDH X.

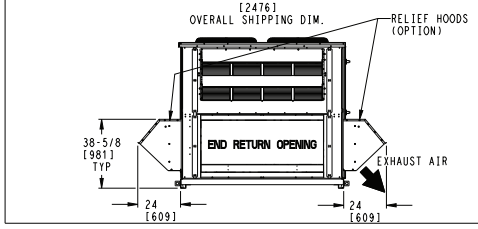
	DOOR WIDTH
V	26 [665]
W	29 [736]
X	28-3/8 [721]
Y	21-3/8 [543]
Z	30-7/8 [784]

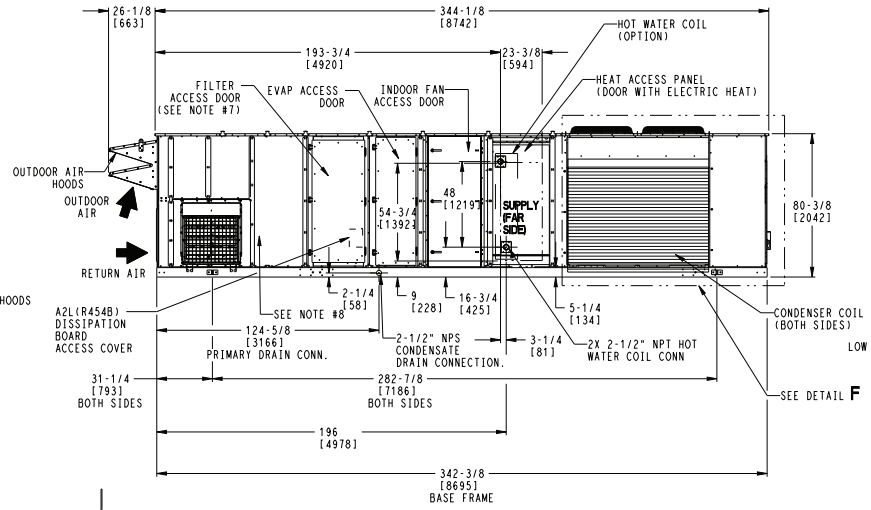


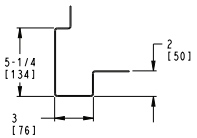
DETAIL D



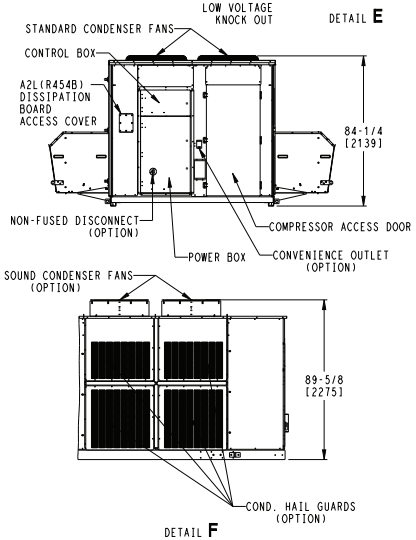








BASE FRAME PROFILE

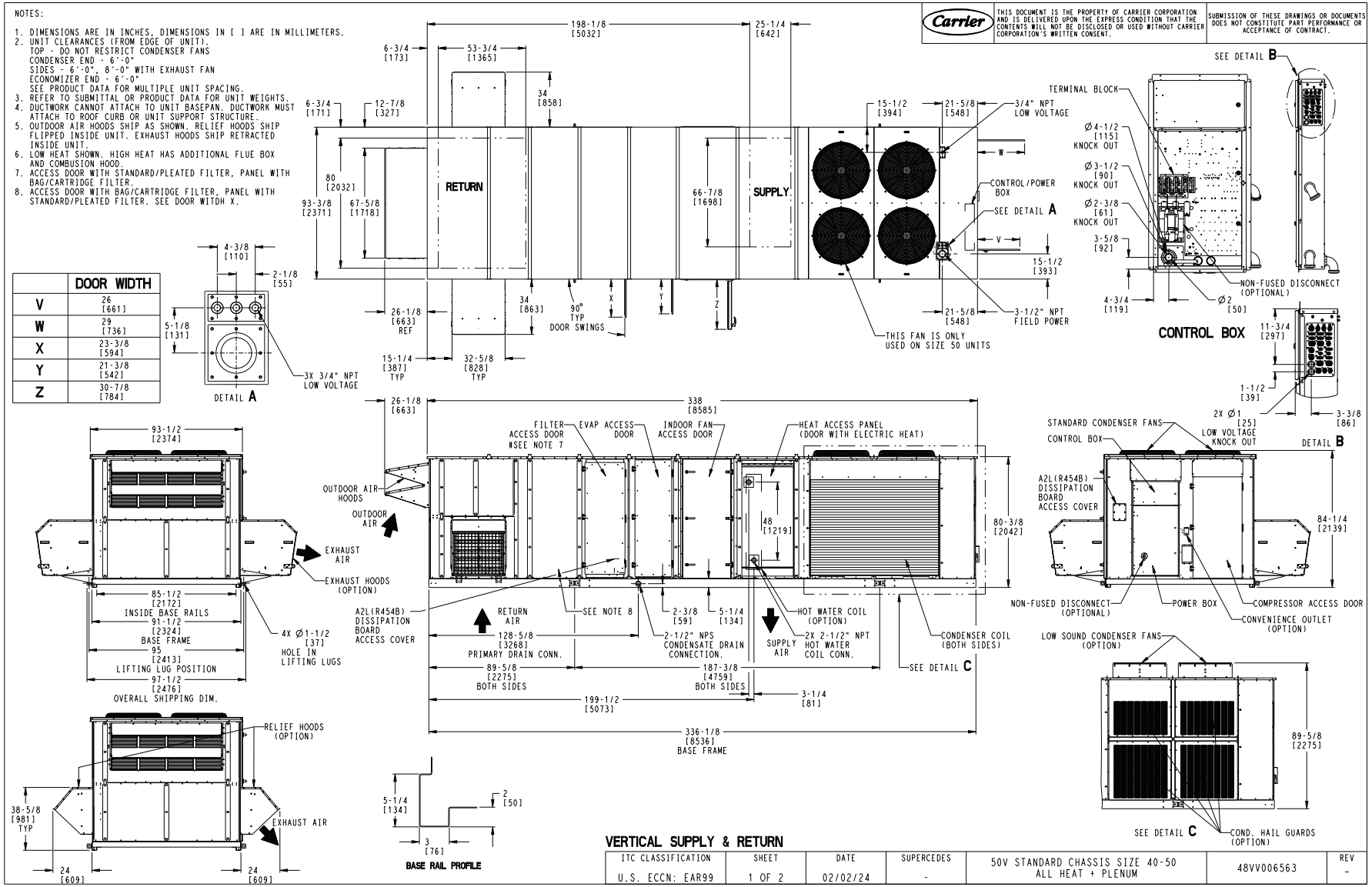


DETAIL F

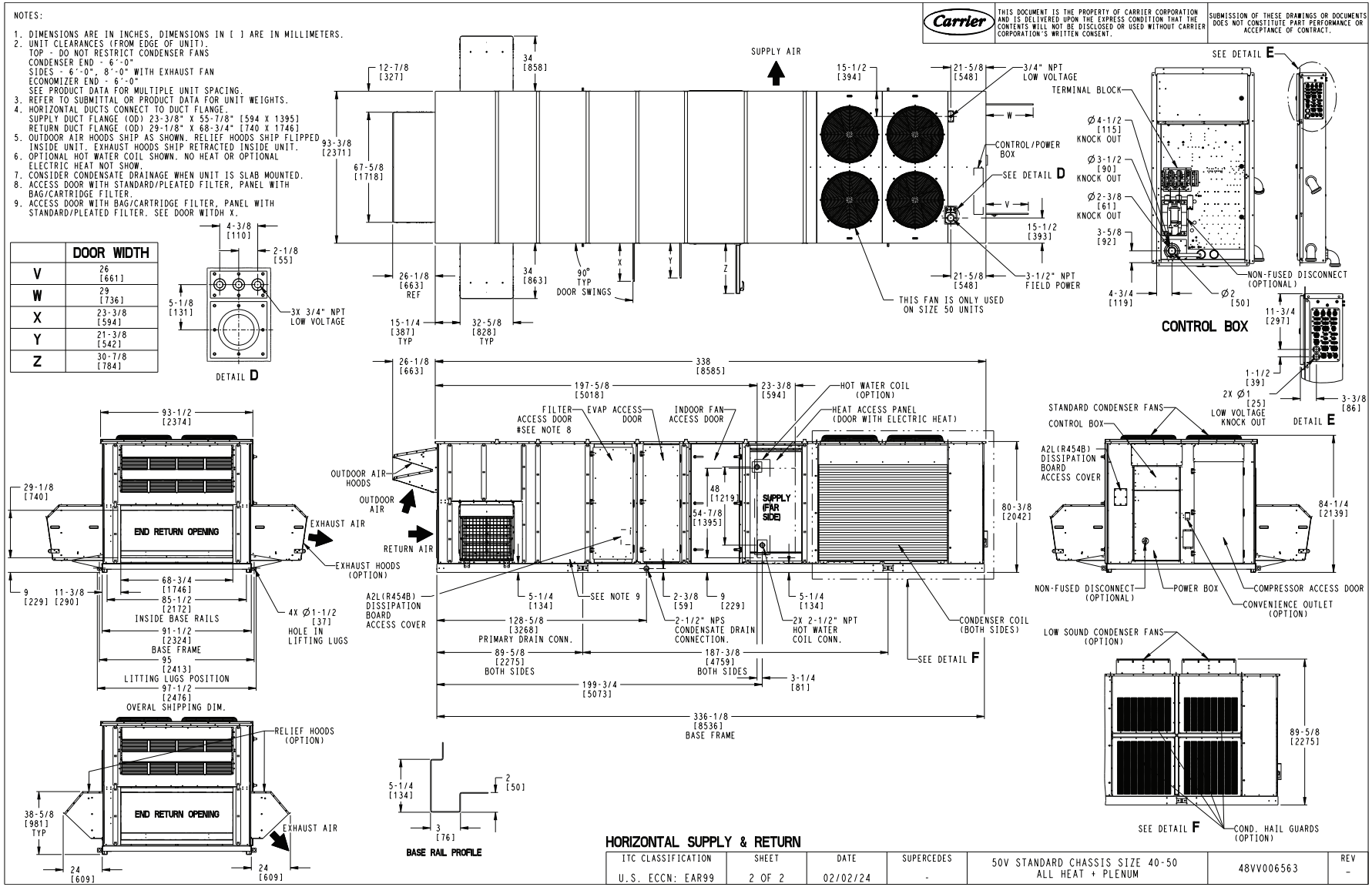
HORIZONTAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET		SUPERCEDES			REV
U.S. ECCN: EAR99	2 OF 2	02/02/24	-	50V STANDARD CHASSIS 40-50 ALL HEAT + EXT SECTION	48VV006565	-

50V 40-50 Ton Standard Chassis with Plenum Section



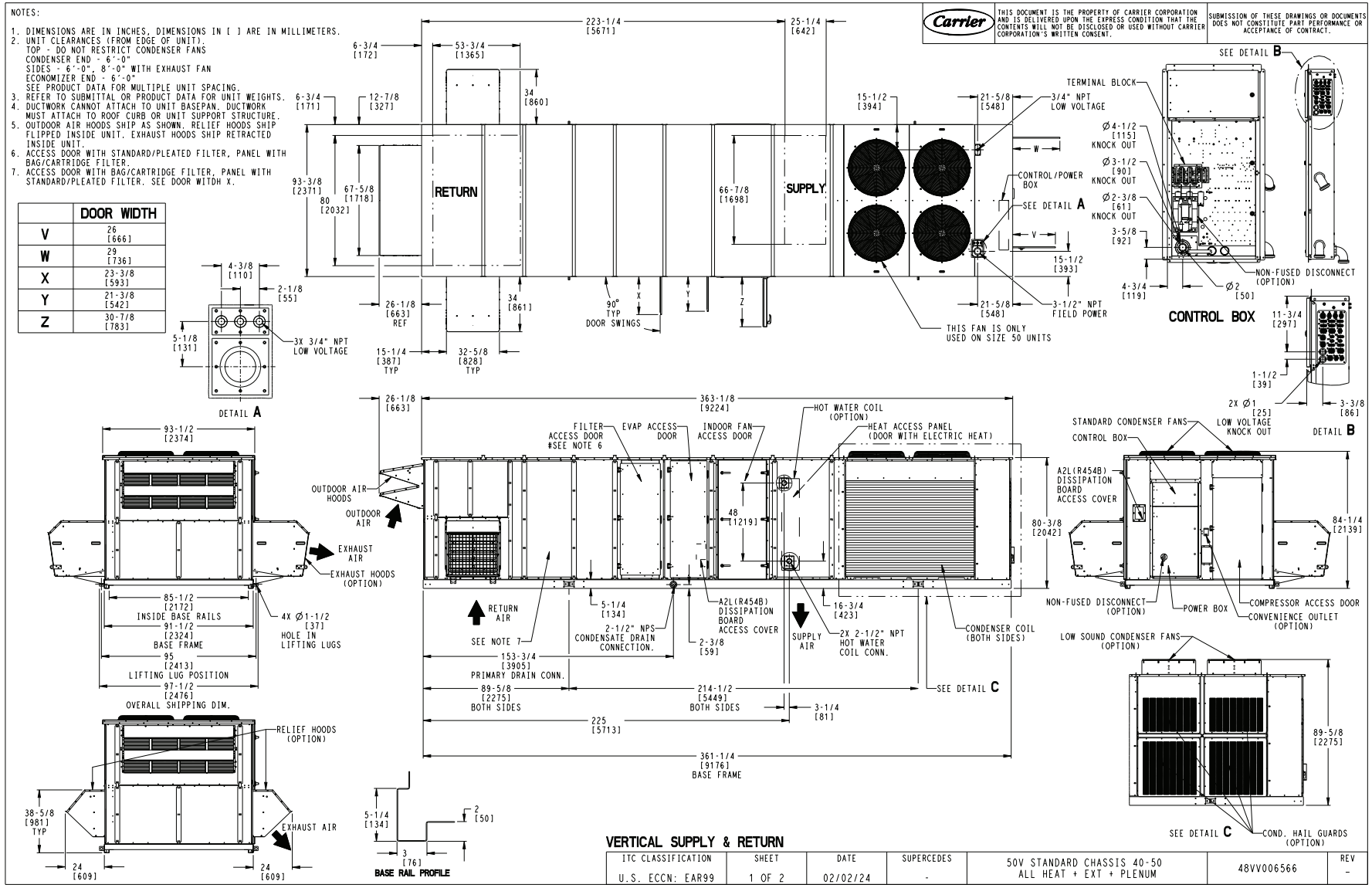
50V 40-50 Ton Standard Chassis with Plenum Section (cont)



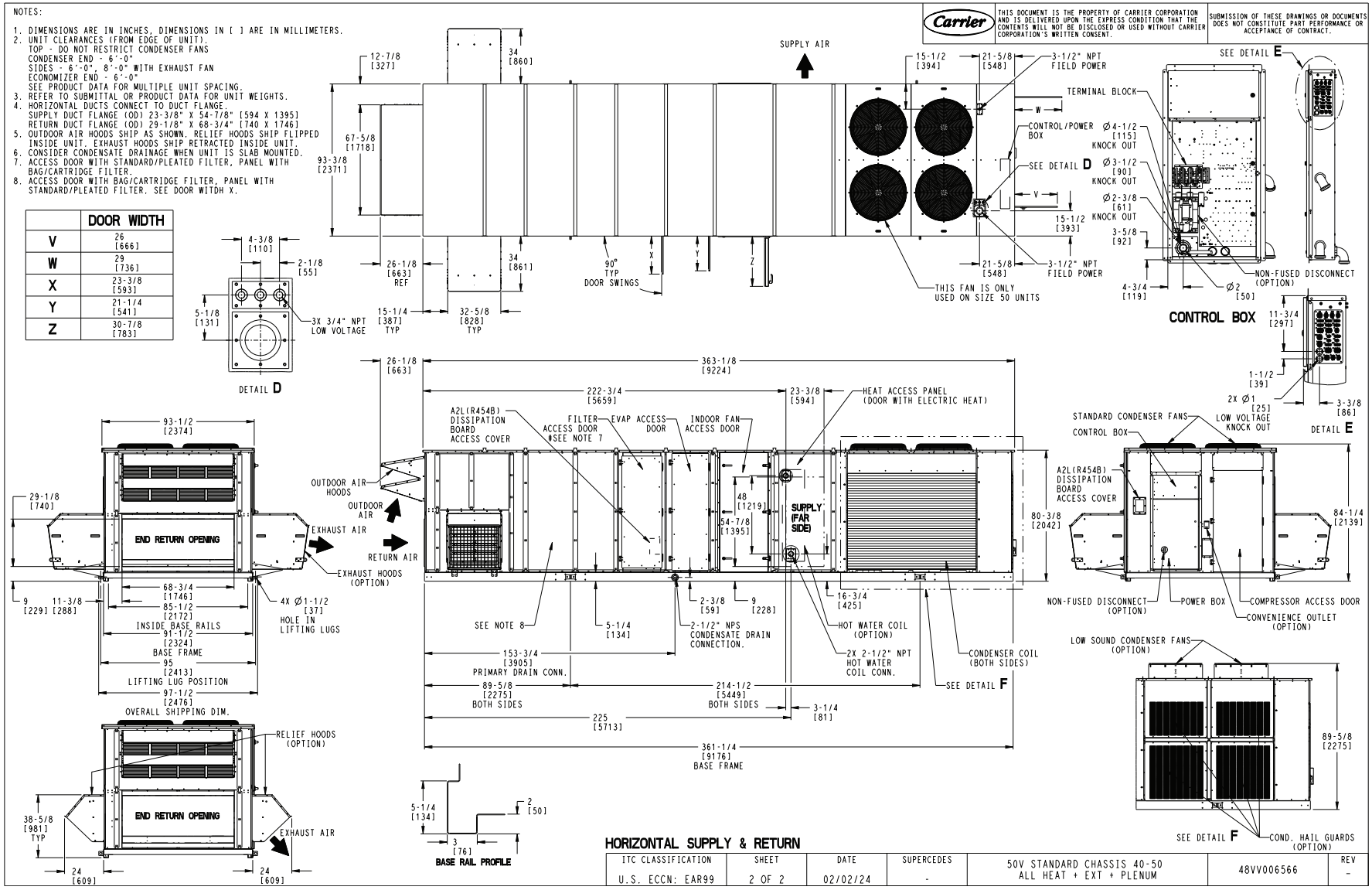
HORIZONTAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	50V STANDARD CHASSIS SIZE 40-50 ALL HEAT + PLENUM	48VV006563	REV
U.S. ECCN: EAR99	2 OF 2	02/02/24	-			-

50V 40-50 Ton Extended Standard Chassis with Plenum Section

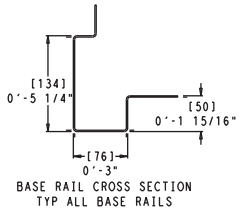


50V 40-50 Ton Extended Standard Chassis with Plenum Section (cont)

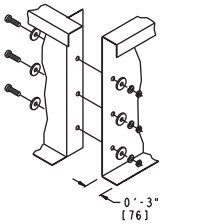


Roof Curb — 48/50V 27.5-35 Ton Standard Chassis

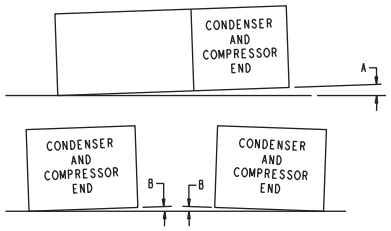
NOTES:
1. Roof curb is shipped disassembled.
2. Roofcurb: 14ga (VA03-56) STL.
3. Dimensions are inches (millimeters).



BASE RAIL CROSS SECTION
TYP ALL BASE RAILS



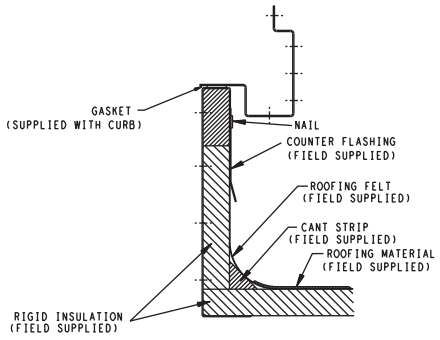
(CORNER CONNECTIONS AND
SPLICE PLATE CONNECTIONS)



DIMENSIONS
(degrees and inches)

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

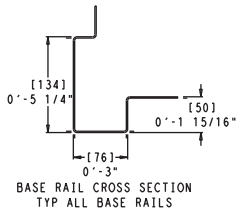
UNIT LEVELING TOLERANCES
*From edge of unit to horizontal.



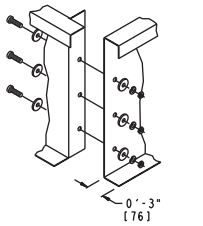
Accessory Part No.	Unit Type	Dimension	Unit size (27.5-35)
CRRFCURB064A00	50V Standard Chassis	A	19' 2-3/8"
		B	10' 10-3/8"
CRRFCURB065A00	50V Standard Chassis w/ Extended Section	A	21' 3-9/16"
		B	12' 11-9/16"
CRRFCURB057A00	48V Standard Chassis	A	20' 9-1/16"
	50V Standard Chassis w/ Plenum	B	13' 3-11/16"
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 — 48/50V 40-50 Ton Standard Chassis

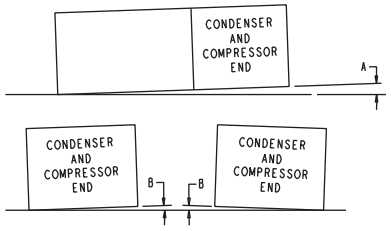
NOTES:
1. Roof curb is shipped disassembled.
2. Roofcurb: 14ga (VA03-56) STL.
3. Dimensions are inches (millimeters).



BASE RAIL CROSS SECTION
TYP ALL BASE RAILS



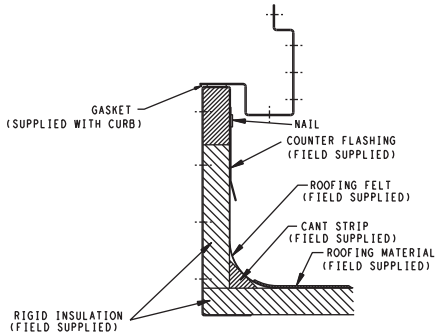
(CORNER CONNECTIONS AND
SPLICE PLATE CONNECTIONS)



DIMENSIONS
(degrees and inches)

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

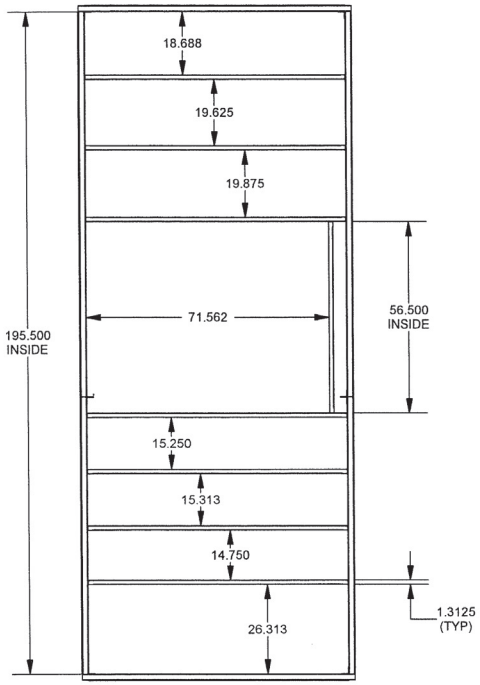
UNIT LEVELING TOLERANCES
*From edge of unit to horizontal.

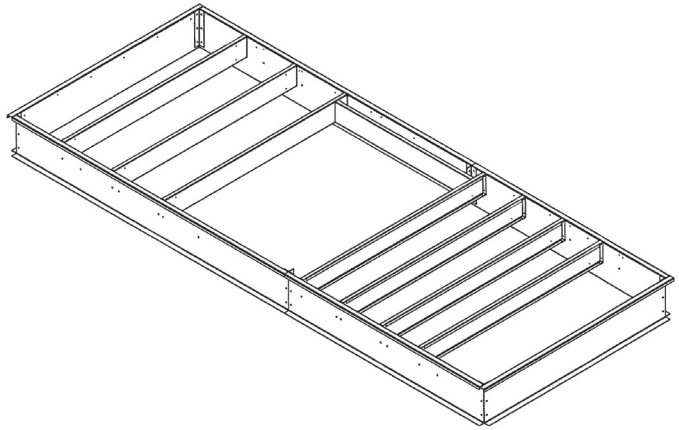


Accessory Part No.	Unit Type	Dimension	Unit size (27.5-35)
CRRFCURB064A00	50V Standard Chassis	A	19' 2-3/8"
		B	10' 10-3/8"
CRRFCURB065A00	50V Standard Chassis w/ Extended Section	A	21' 3-9/16"
		B	12' 11-9/16"
CRRFCURB057A00	48V Standard Chassis	A	20' 9-1/16"
	50V Standard Chassis w/ Plenum	B	13' 3-11/16"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

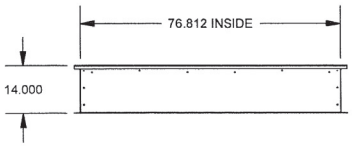
Roof Curb - 48V 27-35 Ton Compact Chassis High Heat

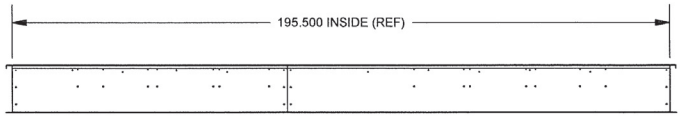
Accessory Part No.	Unit Type
CRRFCURB041A00	48V Compact Chassis - High Heat





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

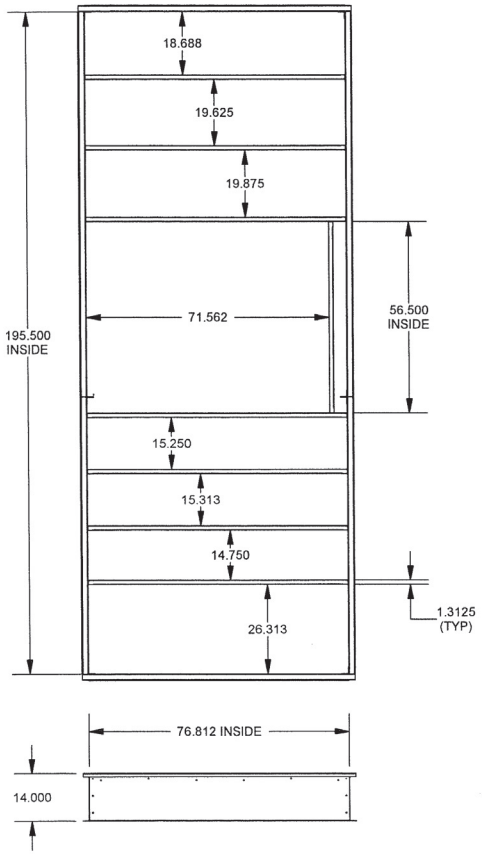


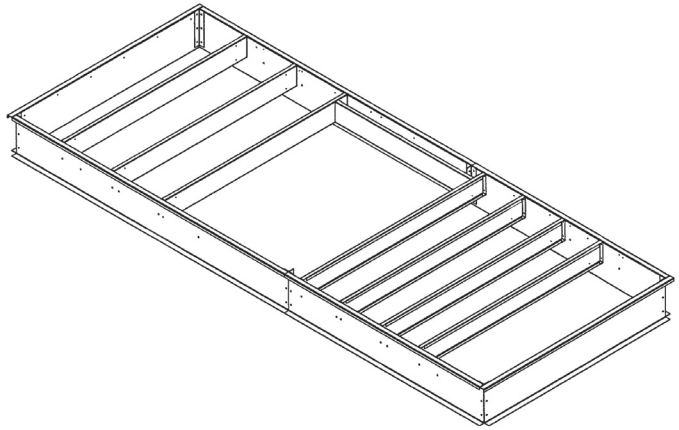


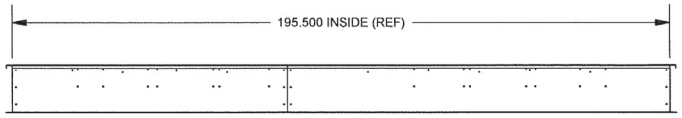
NOTE: Dimensions are in inches.

Roof Curb - 48V 40-50 Ton 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.

Dimensions and weights (cont)

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

Performance data

Indoor Fan Performance Data — 48V Size 28-34[a,b,c,d,e]

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	567	185	701	344	809	517	901	704	983	904	1058	1116	1127	1340
4,000	659	289	781	484	884	693	973	914	1053	1146	1126	1388	1194	1641
5,000	759	437	870	667	966	913	1051	1171	1128	1438	1199	1715	1265	2000
6,000	866	639	965	906	1054	1188	1134	1481	1208	1786	1277	2099	1341	2420
7,000	976	908	1066	1210	1148	1528	1224	1858	1294	2198	1359	2548	1421	2905
8,000	1090	1254	1172	1592	1247	1945	1318	2311	1384	2687	1447	3073	1506	3467
9,000	1206	1688	1280	2062	1350	2450	1416	2851	1479	3263	1538	3685	1595	4116
10,000	1324	2220	1392	2631	1457	3056	1518	3492	1577	3940	1633	4397	1688	4863
11,000	1442	2863	1505	3310	1566	3771	1623	4242	1679	4726	1732	5219	1784	5720
12,000	1562	3625	1621	4110	1677	4607	1731	5114	1783	5634	1834	6162	1883	6699
13,000	1683	4519	1737	5041	1790	5575	1841	6119	1890	6673	1938	7237	1985	7810
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
16,000	2048	8100	2093	8736	2137	9380	2180	10033	2222	10696	2263	11367	2304	12047
17,000	2171	9629	2213	10303	2255	10985	2295	11675	2335	12375	2375	13083	2413	13797
17,500	2232	10464	2273	11155	2314	11856	2354	12566	2393	13283	2431	14009	2469	14742

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	1251	1821	1309	2077	1363	2344	1415	2621	1465	2907	1514	3203
4,000	1257	1902	1317	2173	1374	2453	1428	2742	1480	3040	1530	3347	1577	3661
5,000	1327	2295	1386	2596	1442	2907	1496	3224	1547	3550	1596	3883	1644	4223
6,000	1402	2749	1459	3085	1514	3429	1566	3780	1617	4137	1665	4501	1712	4872
7,000	1480	3271	1536	3644	1589	4023	1641	4409	1690	4801	1738	5199	1784	5604
8,000	1563	3870	1617	4278	1669	4694	1719	5116	1767	5544	1814	5978	1859	6418
9,000	1649	4554	1701	5000	1752	5452	1800	5911	1847	6376	1893	6846	1937	7322
10,000	1740	5337	1790	5819	1838	6308	1885	6803	1931	7304	1975	7812	2018	8323
11,000	1833	6230	1882	6748	1928	7273	1974	7805	2018	8342	2061	8885	2103	9434
12,000	1930	7244	1977	7798	2022	8359	2065	8926	2108	9499	2149	10078	2190	10663
13,000	2030	8391	2074	8980	2118	9576	2160	10179	2201	10788	2241	11404	2280	12025
14,000	2132	9681	2175	10304	2216	10936	2257	11575	2296	12219	2335	12870	2373	13529
15,000	2237	11125	2277	11784	2317	12452	2356	13125	2394	13806	2432	14494	2468	15185
16,000	2343	12734	2382	13430	2420	14132	2458	14842	2494	15558	2531	16280	2566	17009
17,000	2451	14522	2488	15252	2525	15989	2561	16735	2597	17486	2631	18244	2666	19006
17,500	2506	15483	2542	16231	2578	16987	2614	17751	2648	18520	2683	19296	2716	20076

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	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	1812	5522
4,000	1624	3984	1669	4316	1712	4654	1754	5001	1795	5356	1835	5718	1874	6088
5,000	1690	4571	1734	4925	1777	5288	1819	5656	1860	6033	1900	6416	1939	6804
6,000	1758	5250	1802	5633	1845	6023	1886	6420	1927	6822	1966	7231	2005	7646
7,000	1829	6014	1872	6430	1914	6852	1955	7279	1996	7713	2035	8151	2073	8596
8,000	1903	6863	1945	7314	1987	7771	2028	8232	2067	8698	2106	9170	2143	9647
9,000	1980	7803	2022	8290	2063	8782	2102	9278	2141	9780	2179	10286	2216	10797
10,000	2060	8842	2101	9365	2141	9893	2180	10425	2218	10963	2256	11506	2292	12053
11,000	2143	9989	2183	10549	2222	11113	2260	11682	2298	12256	2335	12836	2370	13419
12,000	2230	11255	2269	11852	2307	12453	2344	13058	2380	13670	2416	14285	2451	14905
13,000	2319	12652	2356	13284	2393	13922	2430	14564	2465	15213	2500	15864	2535	16521
14,000	2410	14191	2447	14860	2483	15534	2518	16212	2553	16895	2587	17585	2621	18278
15,000	2505	15885	2540	16589	2575	17299	2609	18012	2643	18732	2676	19457	2709	20187
16,000	2601	17742	2635	18482	2669	19228	2703	19979	—	—	—	—	—	—
17,000	2700	19778	—	—	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 67 for maximum rpm and watts by fan motor static for alternate voltages.
e. See legend on page 67.

Performance data (cont)

Indoor Fan Performance Data — 48V Size 28-34 (cont)[a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	4.4		4.6		4.8		5.0		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	1850	5886	1887	6258	1924	6638	1960	7025	1995	7419
4,000	1912	6464	1950	6848	1986	7239	2022	7638	2057	8042
5,000	1977	7201	2014	7604	2050	8013	2086	8428	2121	8851
6,000	2042	8067	2079	8495	2115	8927	2151	9365	2186	9810
7,000	2110	9046	2147	9501	2183	9962	2218	10429	2252	10900
8,000	2180	10128	2217	10616	2252	11108	2287	11604	2321	12106
9,000	2253	11314	2289	11835	2324	12359	2358	12890	2392	13424
10,000	2328	12604	2363	13160	2398	13720	2432	14285	2465	14854
11,000	2406	14006	2440	14599	2474	15194	2508	15794	2541	16400
12,000	2486	15529	2520	16156	2553	16790	2586	17425	2619	18067
13,000	2569	17181	2602	17846	2635	18516	2667	19188	2699	19865
14,000	2654	18975	2686	19676	2719	20382	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	2029	7821	2063	8230	2096	8647	2129	9069
4,000	2091	8454	2125	8873	2158	9298	2191	9730
5,000	2155	9280	2189	9713	2222	10154	2254	10601
6,000	2220	10260	2253	10716	2286	11179	2319	11646
7,000	2286	11377	2320	11859	2352	12345	2385	12838
8,000	2355	12612	2388	13125	2420	13639	2452	14161
9,000	2425	13963	2458	14507	2490	15055	2522	15606
10,000	2498	15427	2530	16004	2562	16585	2594	17172
11,000	2573	17007	2605	17620	2636	18236	2667	18858
12,000	2650	18712	2682	19360	2713	20012	—	—
13,000	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
208/203	Standard	2,000	8,000
	Medium	2,290	1,155
	High	2,260	16,800
575	Standard	2,000	8,000
	Medium	2,477	14,000
	High	2,685	18,180

LEGEND

— Standard Static (460v)
— Medium Static (460v)
— High Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 48V Size 40 Standard and Medium Static [a,b,c,d]

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
8,000	1021	962	1101	1285	1176	1621	1245	1963	1310	2311	1372	2664	1431	3024
9,000	1129	1278	1202	1634	1271	2005	1336	2385	1397	2770	1456	3161	1512	3556
10,000	1238	1665	1305	2052	1369	2458	1430	2875	1487	3298	1543	3726	1596	4159
11,000	1348	2130	1411	2549	1470	2988	1527	3440	1581	3900	1634	4366	1684	4837
12,000	1460	2682	1518	3132	1573	3603	1626	4090	1678	4586	1727	5089	1775	5596
13,000	1572	3329	1626	3810	1678	4313	1728	4832	1776	5363	1824	5901	1869	6447
14,000	1685	4078	1735	4589	1784	5124	1831	5675	1877	6240	1922	6814	1966	7395
15,000	1798	4938	1845	5479	1891	6045	1936	6629	1980	7226	2022	7834	2064	8451
16,000	1912	5916	1956	6488	2000	7084	2042	7698	2084	8328	2124	8970	2164	9621
17,000	2026	7020	2068	7622	2109	8249	2149	8895	2189	9556	2228	10230	2266	10915
18,000	2140	8258	2180	8891	2219	9548	2257	10225	2295	10918	2332	11625	2369	12343
19,000	2254	9638	2292	10301	2330	10988	2366	11697	2402	12421	2438	13158	—	—
20,000	2369	11168	2405	11862	—	—	—	—	—	—	—	—	—	—

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
8,000	1488	3391	1542	3764	1594	4146	1645	4535	1694	4933	1741	5339	1787	5753
9,000	1566	3957	1618	4363	1668	4776	1716	5194	1763	5619	1809	6052	1854	6492
10,000	1648	4596	1697	5037	1745	5484	1792	5935	1838	6392	1882	6854	1925	7322
11,000	1733	5311	1781	5789	1827	6272	1872	6758	1916	7249	1958	7745	2000	8245
12,000	1822	6109	1868	6625	1912	7145	1955	7668	1997	8195	2038	8726	2079	9261
13,000	1914	6996	1957	7551	2000	8108	2041	8670	2082	9233	2122	9801	2160	10372
14,000	2008	7982	2050	8574	2090	9168	2130	9767	2169	10368	2208	10974	2245	11582
15,000	2105	9074	2144	9702	2183	10334	2222	10971	2259	11610	2296	12254	2332	12899
16,000	2203	10280	2241	10943	2279	11613	2315	12287	2351	12964	—	—	—	—
17,000	2303	11608	2339	12308	2375	13013	—	—	—	—	—	—	—	—
18,000	2404	13069	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	1832	6177	1876	6608	1918	7047	1960	7497	2000	7952	2040	8418	2079	8890
9,000	1897	6939	1940	7393	1981	7854	2022	8324	2062	8802	2100	9286	2139	9778
10,000	1967	7797	2008	8278	2049	8765	2088	9259	2127	9760	2165	10267	2202	10781
11,000	2041	8750	2081	9261	2120	9777	2158	10298	2196	10827	2233	11360	2269	11899
12,000	2118	9799	2157	10343	2195	10890	2232	11442	2268	12000	2304	12562	2340	13129
13,000	2199	10946	2236	11524	2273	12105	2309	12690	—	—	—	—	—	—
14,000	2282	12194	2318	12808	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 69 for maximum rpm and watts by fan motor static for alternate voltages.

LEGEND

— Standard Static (460v)
— Medium Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 48V Size 40 Standard and Medium (cont)[a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	4.4		4.6		4.8		5.0		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	2118	9371	2155	9859	2192	10356	2228	10859	2264	11369
9,000	2176	10278	2213	10785	2249	11299	2284	11820	2319	12350
10,000	2238	11302	2274	11829	2310	12365	2344	12905	—	—
11,000	2305	12444	2340	12995	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	2299	11887	2333	12412	2367	12943	—	—
9,000	2354	12886	—	—	—	—	—	—
10,000	—	—	—	—	—	—	—	—
11,000	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
208/203	Standard	2,200	10,800
	Medium	2,600	16,800
575	Standard	2,200	10,800
	Medium	2,477	14,000

LEGEND

— Standard Static (460v)
— Medium Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 48V Size 40 High Static [a,b,c,d]

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
8,000	911	1281	977	1595	1040	1922	1100	2260	1157	2609	1211	2968	1264	3335
9,000	1000	1686	1060	2034	1118	2393	1174	2763	1227	3142	1278	3532	1328	3929
10,000	1084	2137	1140	2517	1194	2908	1246	3309	1296	3719	1344	4139	1391	4567
11,000	1165	2633	1218	3044	1268	3466	1317	3897	1364	4338	1409	4788	1454	5245
12,000	1244	3173	1293	3614	1340	4066	1386	4528	1431	4998	1474	5478	1516	5964
13,000	1320	3756	1366	4226	1411	4708	1454	5199	1497	5699	1538	6207	1578	6722
14,000	1395	4381	1438	4880	1480	5390	1522	5911	1562	6439	1602	6976	1640	7520
15,000	1467	5047	1509	5575	1549	6114	1588	6662	1627	7219	1665	7783	1702	8356
16,000	1539	5754	1578	6310	1616	6876	1654	7452	1691	8037	1727	8630	1763	9229
17,000	1609	6500	1647	7085	1683	7677	1719	8280	1755	8893	1790	9513	1824	10141
18,000	1679	7288	1714	7898	1750	8519	1784	9148	1818	9787	1852	10434	1885	11088
19,000	1747	8115	1781	8752	1815	9398	1849	10055	1881	10719	1914	11391	1946	12072
20,000	1815	8981	1848	9645	1880	10315	1913	10999	1944	11688	1975	12389	2006	13095

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
8,000	1314	3713	1363	4099	1411	4495	1457	4898	1501	5310	1545	5730	1587	6157
9,000	1376	4336	1422	4752	1467	5175	1511	5607	1554	6046	1596	6494	1636	6947
10,000	1437	5003	1481	5447	1524	5899	1566	6359	1607	6827	1647	7301	1686	7783
11,000	1497	5711	1539	6184	1581	6664	1621	7153	1660	7649	1699	8151	1737	8659
12,000	1558	6459	1598	6961	1638	7471	1676	7987	1714	8510	1751	9040	1788	9577
13,000	1618	7247	1657	7777	1695	8316	1732	8860	1768	9411	1804	9969	1840	10533
14,000	1678	8072	1715	8631	1752	9197	1788	9771	1823	10350	1858	10935	1892	11527
15,000	1738	8935	1774	9523	1809	10118	1844	10717	1878	11326	1911	11938	1944	12558
16,000	1798	9837	1833	10452	1866	11074	1900	11703	1933	12338	1965	12978	1997	13625
17,000	1858	10775	1891	11416	1924	12067	1956	12723	1988	13384	2019	14053	2050	14726
18,000	1918	11750	1950	12419	1981	13094	2013	13778	2043	14466	2074	15161	2104	15861
19,000	1977	12761	2008	13456	2039	14160	2069	14868	2099	15584	2128	16305	2158	17034
20,000	2037	13808	2067	14531	2096	15258	2126	15995	2155	16734	2183	17483	2212	18236

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	1629	6593	1669	7037	1709	7487	1747	7946	1785	8411	1822	8884	1859	9364
9,000	1676	7410	1715	7878	1754	8355	1791	8839	1828	9328	1864	9825	1899	10329
10,000	1725	8271	1762	8767	1799	9269	1836	9779	1871	10293	1906	10816	1941	11344
11,000	1774	9175	1810	9697	1846	10226	1881	10762	1916	11304	1950	11851	1983	12405
12,000	1824	10120	1859	10669	1894	11226	1928	11786	1961	12355	1994	12928	2027	13509
13,000	1874	11104	1908	11680	1942	12264	1975	12853	2008	13446	2040	14046	2071	14653
14,000	1925	12126	1958	12729	1991	13340	2023	13956	2055	14577	2086	15203	2117	15836
15,000	1977	13183	2009	13816	2040	14451	2071	15095	2102	15744	2133	16397	2163	17056
16,000	2029	14277	2060	14936	2090	15601	2121	16269	2150	16944	2180	17626	2209	18312
17,000	2081	15407	2111	16091	2141	16784	2170	17480	2199	18182	2228	18890	2257	19602
18,000	2133	16569	2163	17281	2192	17999	2220	18724	2249	19453	2277	20186	2304	20925
19,000	2186	17766	2215	18505	2243	19250	2271	20001	2299	20757	2326	21517	—	—
20,000	2240	18998	2267	19762	2295	20532	2322	21310	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 71 for maximum rpm and watts by fan motor static for alternate voltages.

LEGEND

— High Static (208/230/460v)

Performance data (cont)

Indoor Fan Performance Data — 48V Size 40 High Static (cont)[a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	4.4		4.6		4.8		5.0		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	1895	9851	1930	10344	1965	10845	1999	11352	2033	11866
9,000	1934	10840	1969	11357	2002	11881	2036	12410	2068	12947
10,000	1975	11879	2008	12420	2041	12967	2073	13521	2106	14081
11,000	2016	12966	2049	13532	2081	14103	2113	14681	2144	15265
12,000	2059	14095	2091	14685	2122	15284	2153	15887	2183	16495
13,000	2103	15264	2133	15883	2164	16505	2194	17133	2224	17767
14,000	2147	16474	2177	17119	2207	17766	2236	18420	2265	19080
15,000	2192	17720	2221	18391	2250	19065	2279	19746	2307	20431
16,000	2238	19002	2267	19700	2295	20401	2323	21107	—	—
17,000	2285	20319	2313	21044	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	2066	12387	2098	12912	2130	13445	2162	13985
9,000	2101	13489	2132	14038	2164	14592	2195	15154
10,000	2137	14646	2168	15218	2199	15796	2229	16379
11,000	2174	15853	2205	16449	2235	17050	2264	17656
12,000	2213	17108	2243	17728	2272	18353	2301	18984
13,000	2253	18405	2282	19050	2311	19700	2339	20354
14,000	2294	19746	2322	20415	2350	21089	—	—
15,000	2335	21122	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
575	High	2,174	16,230

LEGEND

— High Static (208/230/460v)

Performance data (cont)

Indoor Fan Performance Data — 48V Size 50 Standard and Medium Static [a,b,c,d]

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
10,000	1264	1863	1333	2247	1398	2644	1459	3053	1518	3472	1575	3901	1629	4339
11,000	1376	2392	1440	2811	1501	3242	1559	3683	1614	4136	1668	4598	1719	5068
12,000	1490	3021	1549	3474	1606	3938	1660	4414	1713	4899	1763	5394	1812	5897
13,000	1604	3758	1659	4244	1713	4744	1764	5253	1814	5771	1862	6299	1908	6836
14,000	1719	4611	1771	5132	1821	5665	1869	6209	1916	6761	1962	7322	2007	7891
15,000	1835	5589	1883	6146	1931	6713	1976	7290	2021	7877	2065	8471	2107	9074
16,000	1951	6701	1997	7294	2041	7896	2085	8507	2127	9126	2169	9755	2209	10391
17,000	2067	7958	2110	8586	2153	9223	2194	9867	2234	10522	2274	11184	2313	11854
18,000	2184	9368	2225	10030	2265	10701	2304	11381	2343	12069	2381	12766	—	—
19,000	2300	10938	2339	11634	2378	12340	2415	13055	—	—	—	—	—	—
20,000	2417	12679	—	—	—	—	—	—	—	—	—	—	—	—

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
10,000	1681	4785	1732	5239	1780	5701	1828	6170	1874	6646	1919	7129	1962	7619
11,000	1769	5547	1817	6034	1864	6527	1910	7028	1954	7536	1997	8051	2040	8573
12,000	1860	6409	1906	6928	1951	7454	1995	7987	2038	8528	2080	9075	2120	9628
13,000	1954	7379	1998	7932	2041	8490	2083	9057	2125	9629	2165	10208	2204	10794
14,000	2050	8468	2092	9053	2134	9645	2174	10243	2214	10848	2253	11460	2291	12077
15,000	2149	9684	2189	10302	2229	10927	2268	11557	2306	12195	2344	12839	—	—
16,000	2249	11036	2288	11686	2326	12344	2364	13008	—	—	—	—	—	—
17,000	2351	12531	2388	13216	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	2005	8116	2047	8618	2087	9128	2127	9643	2166	10165	2205	10691	2242	11224
11,000	2081	9100	2121	9634	2161	10174	2200	10720	2238	11272	2275	11828	2312	12392
12,000	2160	10186	2200	10752	2238	11324	2276	11901	2313	12484	2349	13073	—	—
13,000	2243	11385	2281	11981	2318	12585	2355	13194	—	—	—	—	—	—
14,000	2329	12702	—	—	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 73 for maximum rpm and watts by fan motor static for alternate voltages.

LEGEND

— Standard Static (460v)
— Medium Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 48V Size 50 Standard and Medium Static (cont)[a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in.wg)									
	4.4		4.6		4.8		5		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	2279	11762	2316	12306	2351	12856	—	—	—	—
11,000	2348	12961	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	—	—	—	—	—	—	—	—
11,000	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
208/203	Standard	2,200	10,800
	Medium	2,600	16,800
575	Standard	2,200	10,800
	Medium	2,477	14,000

LEGEND

— Standard Static (460v)
— Medium Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 48V Size 50 High Static [a,b,c,d]

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
10,000	1098	2226	1153	2608	1207	3001	1258	3404	1307	3817	1355	4238	1402	4668
11,500	1219	3014	1269	3444	1317	3883	1364	4332	1410	4790	1454	5256	1497	5731
13,000	1335	3907	1381	4381	1425	4866	1468	5359	1510	5862	1551	6372	1591	6891
14,500	1447	4902	1489	5420	1530	5948	1570	6485	1609	7032	1648	7586	1685	8148
16,000	1556	5999	1595	6559	1633	7130	1671	7710	1707	8298	1743	8894	1779	9498
17,500	1663	7196	1699	7799	1735	8411	1770	9031	1804	9661	1838	10299	1872	10944
19,000	1768	8494	1802	9138	1835	9789	1868	10452	1901	11121	1933	11799	1965	12484
20,500	1871	9893	1903	10575	1935	11267	1966	11967	1997	12677	2027	13394	2057	14120
22,000	1973	11394	2003	12115	2033	12845	2063	13582	2092	14330	2121	15086	2149	15849
23,500	2073	12996	2102	13752	2131	14521	2159	15297	2187	16081	2214	16874	2242	17674
25,000	2173	14699	2200	15493	2227	16297	2254	17109	2281	17932	2307	18762	2334	19598
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
10,000	1447	5107	1491	5553	1534	6007	1576	6469	1616	6937	1656	7413	1695	7897
11,500	1539	6213	1580	6703	1620	7200	1659	7704	1698	8215	1735	8733	1772	9258
13,000	1631	7417	1669	7949	1707	8489	1744	9036	1780	9591	1816	10150	1851	10717
14,500	1722	8715	1758	9292	1794	9874	1829	10463	1863	11059	1897	11662	1930	12269
16,000	1813	10109	1848	10727	1881	11352	1914	11982	1947	12621	1979	13264	2011	13913
17,500	1905	11596	1937	12255	1969	12922	2001	13594	2032	14273	2062	14958	2093	15646
19,000	1996	13176	2027	13876	2057	14582	2087	15295	2117	16015	2146	16740	2175	17472
20,500	2087	14852	2116	15591	2145	16337	2174	17088	2202	17848	2230	18612	2258	19382
22,000	2178	16620	2206	17397	2233	18182	2261	18973	2288	19773	2315	20575	2341	21385
23,500	2269	18484	2295	19300	2322	20122	2348	20952	—	—	—	—	—	—
25,000	2359	20443	—	—	—	—	—	—	—	—	—	—	—	—
AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	1734	8388	1771	8885	1808	9389	1844	9899	1880	10416	1915	10939	1949	11470
11,500	1809	9790	1844	10327	1879	10871	1914	11421	1948	11979	1981	12540	2014	13108
13,000	1885	11290	1919	11868	1953	12453	1986	13043	2018	13639	2050	14242	2081	14849
14,500	1963	12883	1996	13504	2028	14130	2059	14760	2090	15398	2121	16040	2151	16687
16,000	2042	14568	2073	15229	2104	15896	2134	16568	2164	17247	2193	17930	2222	18617
17,500	2123	16345	2152	17045	2181	17753	2210	18467	2239	19184	2267	19909	2295	20637
19,000	2204	18208	2232	18950	2260	19698	2288	20451	2315	21209	—	—	—	—
20,500	2285	20161	2312	20941	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 75 for maximum rpm and watts by fan motor static for alternate voltages.

LEGEND

— High Static(208/230/460v)

Performance data (cont)

Indoor Fan Performance Data — 48V Size 50 High Static (cont)[a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in.wg)									
	4.4		4.6		4.8		5.0		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	1983	12007	2016	12548	2049	13098	2081	13653	2113	14214
11,500	2046	13683	2078	14264	2110	14850	2141	15442	2172	16038
13,000	2113	15463	2143	16082	2174	16707	2204	17338	2233	17972
14,500	2181	17341	2210	17999	2239	18664	2268	19333	2297	20007
16,000	2251	19310	2279	20009	2307	20713	2335	21422	—	—
17,500	2322	21370	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—
20,500	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—
23,500	—	—	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	2144	14781	2175	15354	2206	15933	2236	16518
11,500	2202	16641	2232	17252	2261	17865	2291	18485
13,000	2262	18613	2291	19259	2320	19912	2348	20567
14,500	2325	20686	2353	21371	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,500	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—
23,500	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
575	High	2,174	16,230

LEGEND

— High Static (208/230/460v)

Performance data (cont)

Indoor Fan Performance Data — 50V Size 28-34[a,b,c,d,e]

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	563	179	697	333	805	504	898	691	981	894	1057	1111	1126	1343
4,000	652	277	775	467	878	671	967	887	1048	1116	1121	1357	1190	1610
5,000	749	416	861	642	958	882	1043	1132	1121	1393	1192	1664	1259	1945
6,000	851	605	954	867	1044	1144	1125	1430	1199	1726	1268	2031	1332	2344
7,000	958	855	1052	1153	1135	1466	1212	1789	1283	2121	1349	2461	1411	2809
8,000	1068	1176	1153	1509	1231	1858	1303	2218	1371	2586	1434	2963	1493	3348
9,000	1180	1579	1258	1946	1331	2330	1399	2726	1462	3132	1523	3545	1580	3966
10,000	1293	2073	1366	2475	1434	2894	1497	3325	1558	3767	1615	4217	1670	4674
11,000	1408	2669	1475	3105	1539	3559	1599	4025	1656	4503	1711	4990	1763	5483
12,000	1524	3377	1586	3848	1646	4336	1703	4837	1757	5350	1809	5872	1859	6403
13,000	1640	4207	1699	4713	1755	5234	1808	5771	1860	6318	1910	6876	1958	7442
14,000	1757	5169	1812	5709	1865	6266	1916	6836	1965	7419	2013	8011	2059	8613
15,000	1875	6274	1927	6849	1977	7439	2025	8045	2072	8662	2117	9290	2161	9926
16,000	1993	7532	2042	8142	2089	8766	2135	9406	2180	10057	2223	10719	2265	11390
17,000	2112	8951	2158	9596	2203	10256	2247	10929	2289	11616	2331	12312	2371	13017
17,500	2171	9726	2216	10388	2260	11066	2303	11756	2344	12459	2385	13172	2425	13895

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	1588	1253	1846	1312	2116	1367	2399	1420	2694	1471	3000	1521	3317
4,000	1254	1874	1314	2150	1372	2437	1427	2734	1479	3042	1530	3361	1578	3689
5,000	1321	2235	1380	2535	1437	2845	1491	3164	1542	3493	1592	3831	1640	4177
6,000	1393	2665	1451	2995	1506	3333	1559	3679	1610	4033	1658	4395	1706	4766
7,000	1470	3165	1526	3527	1579	3897	1631	4274	1681	4659	1729	5050	1775	5447
8,000	1550	3739	1605	4136	1657	4541	1707	4950	1755	5368	1802	5791	1848	6221
9,000	1635	4394	1687	4827	1738	5267	1787	5713	1834	6165	1879	6622	1924	7085
10,000	1723	5139	1773	5610	1822	6086	1870	6568	1915	7055	1960	7549	2003	8047
11,000	1814	5984	1863	6491	1910	7004	1956	7524	2000	8047	2043	8577	2085	9111
12,000	1908	6939	1955	7483	2001	8034	2045	8589	2088	9150	2130	9716	2171	10286
13,000	2005	8016	2050	8596	2094	9182	2136	9774	2178	10372	2219	10975	2259	11582
14,000	2103	9222	2147	9839	2189	10461	2231	11091	2271	11724	2310	12363	2349	13008
15,000	2204	10570	2246	11222	2287	11881	2327	12546	2366	13216	2404	13892	2441	14573
16,000	2307	12070	2347	12758	2386	13451	2425	14153	2463	14859	2500	15571	2536	16288
17,000	2411	13733	2450	14456	2488	15184	2525	15922	2561	16664	2597	17411	2632	18165
17,500	2464	14628	2502	15368	2539	16115	2576	16870	2611	17629	2647	18396	2681	19166

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	1568	3644	1614	3983	1659	4332	1702	4690	1744	5059	1785	5436	1825	5823
4,000	1625	4027	1671	4375	1715	4733	1758	5099	1800	5475	1841	5859	1881	6252
5,000	1687	4533	1732	4897	1775	5269	1818	5651	1859	6040	1900	6437	1939	6844
6,000	1751	5144	1796	5530	1839	5924	1881	6325	1922	6734	1962	7150	2001	7574
7,000	1820	5853	1864	6266	1906	6685	1947	7111	1988	7543	2027	7984	2066	8429
8,000	1892	6656	1935	7098	1976	7546	2017	8001	2057	8462	2096	8928	2134	9401
9,000	1967	7554	2009	8029	2050	8508	2090	8995	2129	9485	2167	9982	2204	10484
10,000	2045	8550	2086	9059	2126	9573	2165	10091	2204	10615	2241	11144	2278	11678
11,000	2126	9650	2167	10195	2206	10743	2244	11297	2281	11855	2318	12417	2354	12986
12,000	2211	10863	2250	11442	2288	12027	2325	12617	2362	13210	2398	13808	2433	14411
13,000	2297	12195	2335	12812	2373	13432	2409	14059	2445	14688	2480	15323	2515	15960
14,000	2387	13658	2424	14311	2460	14969	2496	15631	2531	16298	2565	16969	2599	17643
15,000	2478	15259	2514	15949	2549	16645	2584	17344	2618	18046	2652	18754	2685	19465
16,000	2572	17012	2607	17739	2641	18471	2675	19206	2708	19947	—	—	—	—
17,000	2667	18924	2701	19687	—	—	—	—	—	—	—	—	—	—
17,500	2715	19943	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 77 for maximum rpm and watts by fan motor static for alternate voltages.
e. See legend on page 77.

Performance data (cont)

Indoor Fan Performance Data — 50V Size 28-34 (cont) [a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	4.4		4.6		4.8		5.0		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	1864	6218	1903	6624	1940	7038	1977	7460	2013	7892
4,000	1920	6654	1958	7065	1995	7483	2031	7910	2067	8345
5,000	1978	7258	2016	7679	2053	8108	2089	8545	2124	8990
6,000	2039	8006	2076	8443	2113	8889	2149	9341	2184	9800
7,000	2104	8883	2140	9342	2177	9808	2212	10281	2247	10760
8,000	2171	9879	2207	10364	2243	10856	2278	11352	2313	11855
9,000	2241	10991	2277	11505	2312	12023	2347	12548	2381	13077
10,000	2314	12217	2349	12761	2384	13310	2418	13864	2452	14424
11,000	2390	13558	2424	14135	2458	14715	2492	15302	2525	15892
12,000	2468	15018	2502	15629	2536	16244	2569	16864	2601	17487
13,000	2549	16603	2582	17249	2615	17899	2647	18554	2679	19213
14,000	2632	18321	2665	19003	2697	19691	2729	20380	—	—
15,000	2717	20180	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
3,000	2048	8331	2083	8779	2117	9235	2150	9697
4,000	2102	8788	2137	9239	2171	9697	2204	10162
5,000	2159	9442	2194	9901	2227	10368	2260	10841
6,000	2219	10268	2253	10741	2286	11220	2319	11707
7,000	2281	11246	2315	11738	2348	12236	2381	12740
8,000	2346	12363	2380	12877	2413	13398	2445	13924
9,000	2414	13612	2447	14152	2480	14697	2511	15248
10,000	2485	14987	2517	15555	2549	16129	2581	16707
11,000	2558	16487	2590	17087	2621	17690	2652	18299
12,000	2633	18115	2664	18747	2696	19385	2726	20025
13,000	2711	19875	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
208/203	Standard	2,000	8,000
	Medium	2,290	1,155
	High	2,260	16,800
575	Standard	2,000	8,000
	Medium	2,477	14,000
	High	2,685	18,180

LEGEND

— Standard Static (460v)
— Medium Static (460v)
— High Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 50V Size 40 Standard and Medium Static [a,b,c,d]

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
8,000	998	877	1080	1194	1156	1527	1226	1868	1293	2214	1356	2566	1415	2924
9,000	1103	1166	1178	1513	1248	1880	1314	2258	1377	2642	1436	3031	1493	3424
10,000	1210	1520	1279	1896	1344	2296	1406	2710	1465	3130	1521	3557	1575	3988
11,000	1319	1949	1382	2353	1443	2784	1501	3231	1556	3687	1610	4151	1661	4619
12,000	1428	2457	1487	2890	1544	3351	1598	3830	1651	4322	1701	4821	1750	5327
13,000	1538	3054	1593	3515	1647	4006	1698	4516	1747	5041	1795	5575	1842	6116
14,000	1649	3748	1701	4236	1751	4755	1799	5296	1846	5852	1892	6421	1936	6996
15,000	1761	4544	1809	5060	1856	5608	1902	6178	1946	6765	1990	7365	2032	7976
16,000	1872	5451	1918	5995	1962	6571	2006	7170	2048	7788	2090	8420	2130	9062
17,000	1984	6476	2028	7049	2070	7652	2111	8279	2151	8928	2191	9589	2229	10264
18,000	2097	7626	2138	8228	2178	8858	2217	9516	2256	10191	2293	10883	2330	11590
19,000	2210	8909	2248	9539	2287	10199	2324	10883	2361	11587	2397	12310	2432	13046
20,000	2322	10333	2360	10992	2396	11680	2432	12391	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	1.6		1.8		2.0		2.2		2.4		2.6		2.8	
8,000	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
9,000	1473	3289	1527	3660	1580	4039	1631	4426	1680	4822	1728	5226	1775	5638
10,000	1548	3823	1600	4227	1651	4637	1700	5054	1748	5477	1794	5907	1839	6344
11,000	1628	4423	1678	4863	1727	5307	1774	5756	1820	6211	1865	6671	1908	7137
12,000	1711	5093	1759	5569	1806	6049	1851	6534	1896	7023	1939	7516	1981	8014
13,000	1798	5836	1844	6351	1889	6868	1932	7389	1975	7915	2017	8444	2057	8976
14,000	1887	6663	1931	7215	1974	7771	2016	8329	2057	8892	2098	9456	2137	10025
15,000	1979	7579	2021	8168	2063	8761	2103	9357	2143	9956	2181	10560	2219	11166
16,000	2073	8594	2114	9217	2154	9848	2192	10481	2230	11118	2268	11759	2305	12402
17,000	2170	9714	2208	10373	2246	11039	2284	11708	2320	12382	2357	13061	—	—
18,000	2267	10950	2305	11642	2341	12342	2377	13047	—	—	—	—	—	—
19,000	2367	12307	2402	13031	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	1820	6058	1864	6488	1907	6926	1948	7371	1989	7826	2029	8288	2069	8759
9,000	1883	6789	1926	7241	1968	7700	2008	8167	2048	8642	2088	9124	2126	9613
10,000	1951	7609	1992	8088	2033	8572	2073	9064	2112	9561	2150	10067	2187	10578
11,000	2022	8517	2062	9025	2102	9539	2141	10058	2179	10582	2216	11114	2252	11651
12,000	2097	9513	2136	10054	2175	10599	2212	11150	2249	11704	2285	12263	2321	12829
13,000	2176	10598	2213	11173	2251	11753	2287	12337	2323	12923	—	—	—	—
14,000	2257	11775	2293	12386	2329	13001	—	—	—	—	—	—	—	—
15,000	2341	13048	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 79 for maximum rpm and watts by fan motor static for alternate voltages.

LEGEND

— Standard Static (460v)
— Medium Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 50V Size 40 Standard and Medium Static (cont)[a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	4.4		4.6		4.8		5.0		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	2107	9236	2145	9723	2182	10217	2218	10718	2254	11227
9,000	2164	10111	2201	10615	2237	11127	2273	11646	2308	12172
10,000	2224	11096	2260	11620	2296	12153	2331	12692	—	—
11,000	2288	12192	2324	12742	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	2289	11743	2324	12266	2358	12796	—	—
9,000	2342	12706	—	—	—	—	—	—
10,000	—	—	—	—	—	—	—	—
11,000	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
208/203	Standard	2,200	10,800
	Medium	2,600	16,800
575	Standard	2,200	10,800
	Medium	2,477	14,000

LEGEND

— Standard Static (460v)
— Medium Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 50V Size 40 High Static [a,b,c,d]

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
8,000	891	1196	959	1507	1023	1831	1084	2166	1141	2512	1196	2867	1249	3233
9,000	979	1573	1041	1917	1099	2272	1156	2638	1209	3015	1261	3401	1311	3796
10,000	1061	1990	1119	2366	1173	2752	1226	3149	1276	3556	1325	3972	1373	4397
11,000	1141	2448	1194	2853	1245	3271	1294	3697	1342	4134	1389	4580	1434	5033
12,000	1217	2943	1267	3379	1315	3825	1362	4282	1407	4748	1451	5223	1494	5705
13,000	1292	3476	1338	3940	1384	4415	1428	4901	1471	5396	1513	5898	1554	6409
14,000	1364	4043	1408	4537	1451	5041	1493	5554	1534	6076	1575	6607	1614	7147
15,000	1435	4647	1477	5168	1518	5699	1558	6240	1597	6790	1636	7348	1673	7914
16,000	1504	5284	1544	5832	1584	6389	1622	6957	1659	7534	1696	8121	1733	8715
17,000	1573	5955	1611	6528	1648	7113	1685	7707	1721	8311	1757	8923	1791	9542
18,000	1640	6658	1677	7258	1713	7868	1748	8487	1783	9117	1817	9756	1850	10401
19,000	1707	7394	1742	8019	1776	8655	1810	9299	1844	9954	1876	10617	1909	11290
20,000	1772	8161	1806	8812	1839	9472	1872	10142	1904	10821	1936	11510	1967	12206

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
8,000	1301	3608	1350	3992	1398	4384	1444	4786	1489	5195	1533	5613	1576	6039
9,000	1360	4200	1407	4613	1452	5033	1497	5462	1540	5899	1582	6344	1623	6795
10,000	1419	4830	1463	5271	1507	5720	1549	6177	1591	6641	1631	7113	1671	7592
11,000	1477	5496	1520	5965	1562	6443	1603	6927	1642	7419	1681	7918	1720	8425
12,000	1536	6195	1577	6693	1617	7199	1656	7713	1694	8232	1732	8759	1769	9291
13,000	1594	6928	1633	7454	1672	7989	1709	8529	1746	9077	1783	9630	1818	10191
14,000	1652	7693	1690	8247	1727	8809	1763	9377	1799	9952	1834	10534	1868	11121
15,000	1710	8489	1747	9072	1782	9660	1817	10255	1852	10857	1885	11466	1919	12081
16,000	1768	9315	1803	9925	1837	10539	1871	11163	1905	11792	1937	12428	1970	13069
17,000	1826	10171	1859	10806	1893	11450	1925	12099	1958	12754	1989	13416	2021	14085
18,000	1883	11055	1916	11717	1948	12385	1980	13061	2011	13743	2042	14433	2072	15126
19,000	1941	11969	1972	12655	2003	13350	2034	14051	2064	14759	2094	15475	2124	16194
20,000	1998	12910	2029	13624	2059	14342	2089	15070	2118	15803	2147	16543	2176	17288

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	1617	6471	1658	6913	1698	7363	1737	7818	1775	8282	1812	8753	1849	9230
9,000	1663	7255	1702	7721	1741	8195	1779	8676	1816	9165	1852	9660	1888	10161
10,000	1710	8077	1748	8570	1785	9070	1821	9576	1857	10089	1893	10609	1927	11135
11,000	1757	8937	1794	9457	1830	9982	1865	10515	1900	11053	1934	11598	1968	12149
12,000	1805	9831	1840	10377	1875	10929	1910	11488	1944	12054	1977	12624	2010	13201
13,000	1853	10758	1888	11330	1922	11909	1955	12495	1988	13087	2020	13684	2052	14286
14,000	1902	11716	1936	12314	1969	12921	2001	13532	2033	14151	2064	14774	2096	15403
15,000	1952	12703	1984	13330	2016	13962	2048	14601	2079	15243	2109	15894	2140	16549
16,000	2002	13717	2033	14370	2064	15031	2095	15696	2125	16366	2155	17043	2184	17724
17,000	2052	14759	2082	15440	2112	16125	2142	16817	2172	17513	2201	18216	2230	18925
18,000	2102	15828	2132	16535	2161	17246	2190	17964	2219	18689	2247	19416	2275	20149
19,000	2153	16923	2182	17653	2211	18393	2239	19136	2267	19884	2294	20641	2322	21399
20,000	2204	18040	2232	18798	2260	19562	2288	20334	2315	21108	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 81 for maximum rpm and watts by fan motor static for alternate voltages.

LEGEND

— High Static (208/230/460v)

Performance data (cont)

Indoor Fan Performance Data — 50V Size 40 High Static (cont)[a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	4.4		4.6		4.8		5.0		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	1885	9716	1920	10207	1955	10706	1990	11211	2023	11722
9,000	1923	10670	1957	11185	1991	11705	2025	12233	2057	12767
10,000	1961	11667	1995	12206	2028	12751	2061	13302	2093	13859
11,000	2001	12707	2034	13270	2066	13839	2098	14414	2129	14996
12,000	2042	13783	2074	14371	2105	14967	2136	15566	2167	16171
13,000	2084	14894	2115	15509	2145	16127	2176	16753	2206	17383
14,000	2126	16038	2156	16676	2186	17323	2216	17972	2245	18628
15,000	2169	17210	2199	17875	2228	18546	2257	19224	2286	19904
16,000	2213	18410	2242	19101	2271	19799	2299	20501	2327	21209
17,000	2258	19637	2286	20355	2314	21078	—	—	—	—
18,000	2303	20890	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
8,000	2057	12242	2089	12767	2121	13297	2153	13835
9,000	2090	13308	2122	13853	2153	14407	2185	14966
10,000	2125	14422	2156	14992	2187	15566	2217	16148
11,000	2160	15581	2191	16175	2221	16772	2251	17376
12,000	2197	16781	2227	17399	2257	18021	2286	18647
13,000	2235	18018	2264	18659	2293	19307	2322	19958
14,000	2274	19290	2303	19955	2331	20625	2359	21304
15,000	2314	20590	2342	21282	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
575	High	2,174	16,230

LEGEND

— High Static (208/230/460v)

Performance data (cont)

Indoor Fan Performance Data — 50V Size 50 Standard and Medium Static [a,b,c,d]

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
10,000	1235	1716	1306	2094	1372	2486	1435	2890	1495	3305	1553	3730	1608	4164
11,000	1346	2205	1411	2617	1473	3042	1532	3479	1589	3927	1643	4384	1696	4851
12,000	1457	2787	1518	3232	1576	3690	1632	4161	1685	4641	1737	5130	1787	5629
13,000	1570	3469	1626	3949	1681	4440	1733	4944	1784	5457	1833	5979	1880	6510
14,000	1683	4260	1736	4774	1787	5300	1836	5836	1884	6381	1931	6936	1976	7501
15,000	1796	5169	1846	5717	1894	6275	1941	6846	1987	7425	2031	8013	2074	8609
16,000	1910	6203	1957	6785	2003	7379	2047	7981	2091	8595	2133	9216	2174	9846
17,000	2025	7372	2069	7990	2112	8616	2155	9253	2196	9899	2236	10553	2276	11216
18,000	2139	8684	2181	9335	2223	9997	2263	10667	2302	11346	2341	12035	2379	12731
19,000	2254	10147	2294	10833	2334	11529	2372	12234	2410	12947	—	—	—	—
20,000	2370	11770	2408	12491	—	—	—	—	—	—	—	—	—	—

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
10,000	1661	4608	1712	5059	1761	5518	1809	5984	1856	6458	1901	6938	1945	7425
11,000	1746	5325	1795	5808	1843	6298	1889	6797	1934	7301	1978	7813	2020	8332
12,000	1835	6136	1882	6652	1927	7174	1972	7704	2015	8240	2057	8783	2099	9334
13,000	1926	7050	1971	7596	2015	8151	2058	8713	2100	9281	2141	9857	2181	10439
14,000	2020	8072	2064	8652	2106	9240	2147	9833	2187	10433	2226	11041	2265	11654
15,000	2117	9215	2158	9827	2198	10446	2238	11071	2277	11704	2315	12344	2352	12989
16,000	2215	10482	2254	11127	2293	11780	2331	12438	2369	13104	—	—	—	—
17,000	2315	11887	2353	12564	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	1988	7920	2030	8420	2071	8926	2112	9440	2151	9957	2190	10483	2228	11014
11,000	2062	8856	2103	9389	2143	9925	2182	10469	2220	11018	2258	11571	2295	12132
12,000	2139	9889	2179	10453	2218	11020	2256	11595	2293	12173	2330	12759	—	—
13,000	2220	11025	2258	11619	2296	12219	2333	12824	—	—	—	—	—	—
14,000	2303	12274	2340	12899	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 83 for maximum rpm and watts by fan motor static for alternate voltages.

LEGEND

— Standard Static (460v)
— Medium Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 50V Size 50 Standard and Medium Static (cont) [a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	4.4		4.6		4.8		5.0		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	2265	11550	2301	12091	2337	12638	2373	13191	—	—
11,000	2331	12699	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	—	—	—	—	—	—	—	—
11,000	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—
13,000	—	—	—	—	—	—	—	—
14,000	—	—	—	—	—	—	—	—
15,000	—	—	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—
17,000	—	—	—	—	—	—	—	—
18,000	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
208/203	Standard	2,200	10,800
	Medium	2,600	16,800
575	Standard	2,200	10,800
	Medium	2,477	14,000

LEGEND

— Standard Static (460v)
— Medium Static (460v)

Performance data (cont)

Indoor Fan Performance Data — 50V Size 50 High Static [a,b,c,d]

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
10,000	1075	2078	1132	2456	1186	2845	1238	3244	1288	3653	1337	4071	1384	4499
11,500	1194	2806	1245	3230	1294	3664	1341	4108	1387	4562	1432	5025	1476	5495
13,000	1307	3625	1353	4093	1398	4571	1442	5059	1485	5556	1526	6063	1567	6576
14,500	1416	4532	1459	5043	1500	5564	1541	6095	1581	6634	1620	7183	1658	7738
16,000	1522	5526	1562	6077	1601	6640	1639	7212	1676	7793	1712	8383	1748	8980
17,500	1626	6605	1663	7196	1699	7799	1735	8411	1770	9031	1804	9661	1838	10299
19,000	1728	7767	1762	8398	1797	9040	1830	9691	1863	10351	1896	11019	1928	11694
20,500	1828	9013	1861	9681	1893	10361	1925	11049	1956	11747	1987	12453	2018	13168
22,000	1927	10341	1958	11046	1988	11762	2018	12487	2048	13221	2078	13965	2107	14716
23,500	2024	11752	2054	12492	2083	13243	2111	14003	2140	14775	2168	15554	2196	16341
25,000	2121	13246	2149	14020	2176	14804	2204	15602	2231	16405	2258	17219	2285	18041
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
10,000	1429	4934	1474	5377	1517	5828	1559	6285	1600	6751	1641	7225	1680	7706
11,500	1518	5973	1560	6459	1600	6953	1640	7454	1679	7962	1717	8477	1754	8998
13,000	1607	7098	1646	7626	1684	8162	1721	8705	1758	9255	1794	9811	1830	10373
14,500	1695	8302	1732	8872	1768	9451	1804	10035	1838	10626	1873	11223	1906	11826
16,000	1784	9585	1818	10197	1852	10815	1886	11441	1919	12073	1952	12712	1984	13355
17,500	1872	10944	1905	11596	1937	12255	1969	12922	2001	13594	2032	14273	2062	14958
19,000	1960	12379	1991	13071	2022	13770	2052	14474	2082	15187	2112	15905	2142	16630
20,500	2048	13891	2078	14621	2107	15357	2136	16101	2165	16853	2193	17608	2221	18371
22,000	2136	15476	2164	16242	2192	17018	2220	17798	2248	18587	2275	19383	2302	20184
23,500	2223	17136	2251	17941	2277	18750	2304	19568	2331	20395	2357	21227	—	—
25,000	2311	18873	2337	19711	2363	20558	—	—	—	—	—	—	—	—
AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)													
	3.0		3.2		3.4		3.6		3.8		4.0		4.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	1719	8194	1757	8688	1794	9190	1830	9698	1866	10211	1901	10733	1935	11260
11,500	1791	9526	1827	10061	1862	10601	1897	11149	1931	11701	1965	12261	1998	12826
13,000	1865	10943	1899	11516	1933	12099	1966	12686	1998	13279	2031	13877	2062	14481
14,500	1939	12436	1972	13052	2004	13673	2036	14301	2068	14935	2098	15573	2129	16217
16,000	2016	14006	2047	14663	2078	15325	2108	15991	2138	16665	2168	17344	2197	18026
17,500	2093	15649	2123	16345	2152	17045	2181	17753	2210	18467	2239	19184	2267	19909
19,000	2171	17360	2199	18097	2228	18837	2256	19585	2283	20336	2311	21095	—	—
20,500	2249	19139	2277	19916	2304	20695	2331	21481	—	—	—	—	—	—
22,000	2329	20990	—	—	—	—	—	—	—	—	—	—	—	—
23,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table on page 85 for maximum rpm and watts by fan motor static for alternate voltages.

LEGEND

— High Static (208/230/460v)

Performance data (cont)

Indoor Fan Performance Data — 50V Size 50 High Static (cont)[a,b,c,d]

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	4.4		4.6		4.8		5.0		5.2	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	1969	11794	2003	12335	2036	12882	2068	13433	2100	13993
11,500	2031	13399	2063	13975	2094	14560	2126	15147	2157	15742
13,000	2094	15092	2125	15707	2155	16328	2185	16956	2215	17588
14,500	2159	16867	2189	17521	2218	18180	2247	18846	2276	19516
16,000	2226	18716	2255	19411	2283	20111	2311	20815	2339	21523
17,500	2295	20637	2322	21370	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—
20,500	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—
23,500	—	—	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—	—	—

AIRFLOW (cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	5.4		5.6		5.8		6.0	
	rpm	watts	rpm	watts	rpm	watts	rpm	watts
10,000	2132	14556	2163	15127	2194	15703	2224	16286
11,500	2187	16343	2217	16949	2247	17560	2276	18178
13,000	2245	18225	2274	18868	2302	19516	2331	20168
14,500	2305	20194	2333	20874	2360	21560	—	—
16,000	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—
20,500	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—
23,500	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—

NOTE(S):

a. Fan performance based on standard chassis, wet coils, and clean, standard filters.
b. See Component Pressure Drop table before using Fan Performance tables.
c. Conversion - 1 watt = 0.00134 bhp.
d. Fan performance based on 460-v. See voltage table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
575	High	2,174	16,230

LEGEND

— High Static (208/230/460v)

Performance data (cont)

Exhaust Fan Performance — Sizes 28-34 Low Static (Compact Chassis)

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
3,500	400	57	633	265	765	503	866	756	952	1024	1030	1307	1101	1602
4,000	457	85	677	317	810	581	911	861	996	1153	1072	1458	1142	1776
4,500	514	120	721	375	855	667	956	973	1041	1291	1116	1621	1185	1962
5,000	571	165	765	442	900	761	1001	1093	1086	1438	1161	1793	—	—
5,500	629	220	809	517	944	863	1046	1223	1131	1593	—	—	—	—
6,000	686	285	854	603	988	974	1091	1361	1176	1760	—	—	—	—
6,500	743	363	900	701	1032	1096	1135	1510	—	—	—	—	—	—
7,000	800	453	946	811	1076	1229	1179	1671	—	—	—	—	—	—
7,500	857	557	994	936	1120	1376	—	—	—	—	—	—	—	—
8,000	914	676	1042	1075	1164	1536	—	—	—	—	—	—	—	—
8,500	971	811	1091	1230	—	—	—	—	—	—	—	—	—	—
9,000	1029	963	1141	1402	—	—	—	—	—	—	—	—	—	—
9,500	1086	1133	1192	1592	—	—	—	—	—	—	—	—	—	—
10,000	1143	1321	—	—	—	—	—	—	—	—	—	—	—	—
10,500	1200	1529	—	—	—	—	—	—	—	—	—	—	—	—

Exhaust Fan Performance — Sizes 28-34 Low Static (Standard Chassis)

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	508	255	642	546	746	884	835	1262	915	1677	987	2127	1054	2607	1116	3116
4,000	277	35	569	344	703	685	806	1066	893	1484	971	1937	1041	2420	1107	2933	—	—
5,000	346	68	629	449	765	850	867	1282	954	1746	1030	2240	1100	2764	—	—	—	—
6,000	415	118	687	572	826	1040	929	1528	1015	2043	1092	2586	1160	3155	—	—	—	—
7,000	485	187	743	712	886	1254	990	1806	1077	2378	1153	2973	—	—	—	—	—	—
8,000	554	279	796	869	944	1493	1051	2114	1138	2748	—	—	—	—	—	—	—	—
9,000	623	398	848	1046	1001	1757	1110	2452	1199	3153	—	—	—	—	—	—	—	—
10,000	692	546	900	1244	1056	2044	1168	2820	—	—	—	—	—	—	—	—	—	—
11,000	762	726	952	1467	1109	2356	—	—	—	—	—	—	—	—	—	—	—	—
12,000	831	943	1005	1722	1162	2694	—	—	—	—	—	—	—	—	—	—	—	—
13,000	900	1199	1059	2013	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14,000	969	1497	1115	2345	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15,000	1039	1841	1172	2723	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Exhaust Fan Performance — Sizes 40-50 Low Static

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	508	255	642	546	746	884	835	1262	915	1677	987	2127	1054	2607	1116	3116
4,000	277	35	569	344	703	685	806	1066	893	1484	971	1937	1041	2420	1107	2933	—	—
5,000	346	68	629	449	765	850	867	1282	954	1746	1030	2240	1100	2764	—	—	—	—
6,000	415	118	687	572	826	1040	929	1528	1015	2043	1092	2586	1160	3155	—	—	—	—
7,000	485	187	743	712	886	1254	990	1806	1077	2378	1153	2973	—	—	—	—	—	—
8,000	554	279	796	869	944	1493	1051	2114	1138	2748	—	—	—	—	—	—	—	—
9,000	623	398	848	1046	1001	1757	1110	2452	1199	3153	—	—	—	—	—	—	—	—
10,000	692	546	900	1244	1056	2044	1168	2820	—	—	—	—	—	—	—	—	—	—
11,000	762	726	952	1467	1109	2356	—	—	—	—	—	—	—	—	—	—	—	—
12,000	831	943	1005	1722	1162	2694	—	—	—	—	—	—	—	—	—	—	—	—
13,000	900	1199	1059	2013	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14,000	969	1497	1115	2345	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15,000	1039	1841	1172	2723	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Performance data (cont)

Exhaust Fan Performance — Sizes 28-34 Standard and Medium Static [a,b]

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
2,500	499	126	639	283	753	475	853	697	943	945	1025	1216	1100	1509
4,000	626	217	741	401	841	615	930	858	1012	1124	1088	1414	1159	1723
5,500	776	374	871	590	956	834	1035	1102	1109	1392	1178	1704	1244	2036
7,000	937	618	1017	870	1091	1147	1160	1445	1226	1765	1289	2103	1349	2459
8,500	1105	971	1173	1262	1238	1575	1299	1907	1358	2258	1415	2627	1469	3011
10,000	1277	1456	1336	1787	1393	2138	1448	2507	1501	2892	1552	3293	1602	3710
11,500	1451	2095	1504	2469	1554	2859	1604	3265	1652	3687	1698	4123	1743	4574
13,000	1627	2913	1674	3329	1720	3760	1765	4205	1808	4665	1851	5139	1892	5625
14,500	1805	3931	1847	4390	1889	4863	1929	5349	1969	5847	2008	6359	2047	6882
16,000	1983	5173	2022	5676	2060	6190	2097	6717	2134	7257	2170	7807	2205	8369
17,500	2162	6662	2197	7209	2232	7767	2267	8335	2301	8914	2334	9505	2367	10108

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
2,500	1171	1822	1238	2153	1302	2503	1363	2869	1421	3251	1477	3649	1531	4061
4,000	1226	2052	1290	2399	1351	2764	1409	3145	1465	3541	1519	3952	1571	4378
5,500	1306	2385	1366	2751	1423	3135	1478	3534	1531	3948	1582	4377	1632	4820
7,000	1406	2833	1461	3223	1514	3629	1566	4050	1616	4485	1664	4935	1712	5398
8,500	1522	3413	1573	3829	1622	4261	1670	4708	1717	5168	1762	5640	1807	6126
10,000	1650	4142	1697	4588	1743	5049	1787	5523	1831	6009	1873	6509	1915	7021
11,500	1788	5039	1831	5518	1873	6009	1915	6513	1955	7030	1995	7557	2034	8098
13,000	1933	6124	1973	6636	2012	7160	2051	7698	2089	8245	2126	8805	2162	9376
14,500	2084	7418	2121	7966	2158	8525	2194	9096	2229	9677	2264	10268	2298	10871
16,000	2240	8942	2275	9527	2309	10122	2342	10727	2375	11344	2408	11971	—	—
17,500	2400	10720	—	—	—	—	—	—	—	—	—	—	—	—

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
2,500	1583	4488	1633	4928	1682	5383	1730	5849	1776	6328	1821	6821
4,000	1621	4819	1670	5272	1718	5739	1764	6218	1809	6711	1854	7215
5,500	1680	5277	1727	5746	1773	6229	1818	6725	1862	7232	1904	7751
7,000	1757	5874	1802	6364	1846	6865	1889	7379	1930	7905	1971	8443
8,500	1850	6626	1892	7137	1934	7661	1975	8196	2014	8743	2054	9301
10,000	1956	7545	1996	8081	2035	8630	2073	9189	2111	9758	2148	10339
11,500	2072	8650	2110	9214	2147	9788	2184	10372	2219	10969	2255	11575
13,000	2198	9957	2234	10549	2269	11152	2303	11765	2337	12390	2371	13023
14,500	2332	11485	2365	12109	2398	12743	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Conversion - 1 watt = 0.00134 bhp.
b. Fan performance based on 460-v. See table below for maximum rpm and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
208/203	Standard	1,900	7,600
	Medium	2,372	14,400
575	Standard	19,00	7,600
	Medium	2,174	10,900

LEGEND

— Standard Static (460v)
— Medium Static(460v)

Performance data (cont)

Exhaust Fan Performance — Sizes 40-50 Standard and Medium Static [a,b]

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
4,000	626	217	741	401	841	615	930	858	1012	1124	1088	1414	1159	1723
5,500	776	374	871	590	956	834	1035	1102	1109	1392	1178	1704	1244	2036
7,000	937	618	1017	870	1091	1147	1160	1445	1226	1765	1289	2103	1349	2459
8,500	1105	971	1173	1262	1238	1575	1299	1907	1358	2258	1415	2627	1469	3011
10,000	1277	1456	1336	1787	1393	2138	1448	2507	1501	2892	1552	3293	1602	3710
11,500	1451	2095	1504	2469	1554	2859	1604	3265	1652	3687	1698	4123	1743	4574
13,000	1627	2913	1674	3329	1720	3760	1765	4205	1808	4665	1851	5139	1892	5625
14,500	1805	3931	1847	4390	1889	4863	1929	5349	1969	5847	2008	6359	2047	6882
16,000	1983	5173	2022	5676	2060	6190	2097	6717	2134	7257	2170	7807	2205	8369
17,500	2162	6662	2197	7209	2232	7767	2267	8335	2301	8914	2334	9505	2367	10108
19,000	2341	8422	2374	9012	2406	9613	—	—	—	—	—	—	—	—
20,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

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
4,000	1226	2052	1290	2399	1351	2764	1409	3145	1465	3541	1519	3952	1571	4378
5,500	1306	2385	1366	2751	1423	3135	1478	3534	1531	3948	1582	4377	1632	4820
7,000	1406	2833	1461	3223	1514	3629	1566	4050	1616	4485	1664	4935	1712	5398
8,500	1522	3413	1573	3829	1622	4261	1670	4708	1717	5168	1762	5640	1807	6126
10,000	1650	4142	1697	4588	1743	5049	1787	5523	1831	6009	1873	6509	1915	7021
11,500	1788	5039	1831	5518	1873	6009	1915	6513	1955	7030	1995	7557	2034	8098
13,000	1933	6124	1973	6636	2012	7160	2051	7698	2089	8245	2126	8805	2162	9376
14,500	2084	7418	2121	7966	2158	8525	2194	9096	2229	9677	2264	10268	2298	10871
16,000	2240	8942	2275	9527	2309	10122	2342	10727	2375	11344	2408	11971	—	—
17,500	2400	10720	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23,500	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—

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
4,000	1621	4819	1670	5272	1718	5739	1764	6218	1809	6711	1854	7215
5,500	1680	5277	1727	5746	1773	6229	1818	6725	1861	7232	1904	7751
7,000	1757	5874	1802	6364	1846	6865	1889	7379	1930	7905	1971	8443
8,500	1850	6626	1892	7137	1934	7661	1974	8196	2014	8743	2054	9301
10,000	1956	7545	1996	8081	2035	8630	2073	9189	2111	9758	2148	10339
11,500	2072	8650	2110	9214	2147	9788	2184	10372	2219	10969	2255	11575
13,000	2198	9957	2234	10549	2269	11152	2303	11765	2337	12390	2371	13023
14,500	2332	11485	2365	12109	2398	12743	—	—	—	—	—	—
16,000	—	—	—	—	—	—	—	—	—	—	—	—
17,500	—	—	—	—	—	—	—	—	—	—	—	—
19,000	—	—	—	—	—	—	—	—	—	—	—	—
20,500	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—
23,500	—	—	—	—	—	—	—	—	—	—	—	—
25,000	—	—	—	—	—	—	—	—	—	—	—	—

NOTE(S):

a. Conversion - 1 watt = 0.00134 bhp.
b. Fan performance based on 460-v. See table below for maximum RPM and watts by fan motor static for alternate voltages.

Voltage	Motor Static	Max rpm	Max Watts
208/203	Standard	1,900	7,600
	Medium	2,372	14,400
575	Standards	1,900	7,600
	Medium	2,174	10,900

LEGEND

— Standard Static (460v)
— Medium Static(460v)

Application guidance

General

Overview

Consider the following guidance on unit installation and application.

Storage

Unit packaging is not design for long term, outdoor storage. Carrier recommends storing the units indoors in a dry, level location. If the units are stored outdoors or are installed prior to building completion, refer to the installation instructions for storage guidance.

NOTE: Special start-up procedures are required for units that have been non-operational (in storage or installed) for more than three (3) months or have been exposed to cold or humidity outside of the recommended storage conditions. Refer to the installation instructions for start-up guidance.

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 25% 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.

Application guidance (cont)

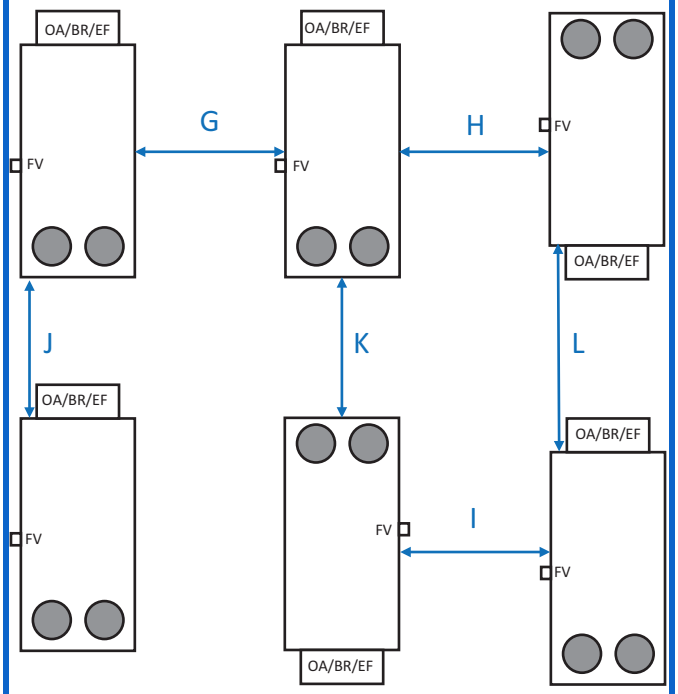
Exhaust outlet clearance

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.

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

Utility sources

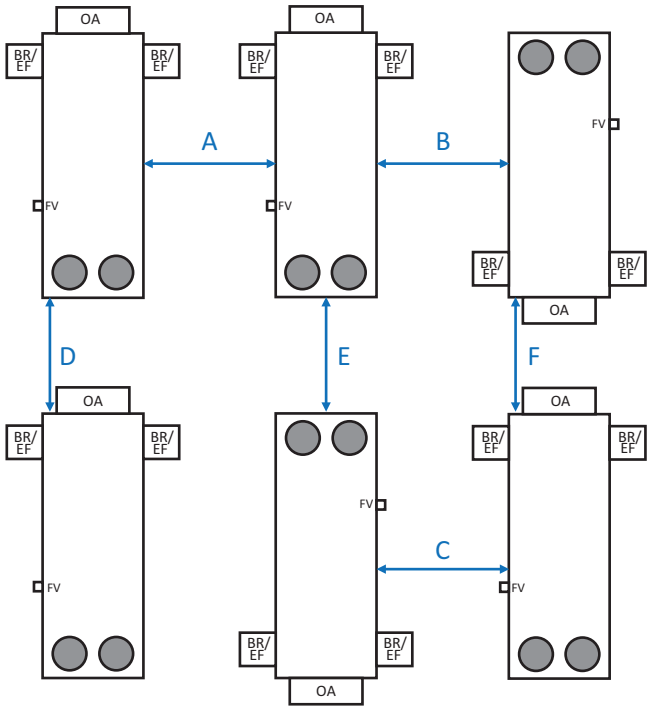
Verify the distance and location of the unit compared to utility sources. Power wire length may be limited by the unit minimum circuit ampacity, available wire size, and the factory terminal block or disconnect lug size.

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.

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

Application guidance (cont)

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 Carrier roof curbs accessory.

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.

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 roof curb accessory. 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 of 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.

Application guidance (cont)

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 guidance (cont)

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, or the cooling or heating airflow is modulated based on the space temperature (SZ-VAV) 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.

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 "Features, options, and accessories" on page 14 for airflow limits.

Mechanical cooling and dehumidification recommended 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 "Features, options, and accessories" on page 14 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 recommended 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.

Application guidance (cont)

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.

Operating the unit temporarily in heating during finishing stages of construction may be allowable. See the unit installation and startup instructions for the temporary heating start-up checklist.

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, SZ-VAV, 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 with SZ-VAV for single-zone applications or 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 SZ-VAV, 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 in. 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 in. 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 in. of external static pressure.

Direct expansion options

Standard efficiency, low ambient

Includes standard sound, metal outdoor fans and high-speed outdoor fan motors with variable speed control using Greenspeed® intelligence. Provides a higher MCA/MOCP, higher radiated sound, and lower EER/IEER than high efficiency, low sound, low ambient. Recommended for non-sound sensitive, cooling dominant applications with inexpensive power.

High efficiency, low sound, low ambient

Includes compressor sound blankets, shrouded, AeroAcoustic™ outdoor fans, and low rpm outdoor fan motors with variable speed control using Greenspeed® intelligence. Provides a lower MCA/MOCP, lower radiated sound, and higher EER/IEER than standard efficiency, low ambient. Recommended for sound sensitive applications, cooling dominant or high electric cost applications, or for replacement applications to provide a slightly lower MCA to match existing power wire.

Standard-capacity variable speed compressor

Includes a low-speed, lead variable speed compressor. Provides a lower cooling capacity and lower MCA/MOCP than high-capacity variable speed compressor. Recommended for replacement applications to provide a lower MCA to re-use existing power wire.

High-capacity variable speed compressor

Includes a high-speed, lead variable speed compressor. Provides a higher cooling capacity and a higher MCA/MOCP than standard-capacity variable speed compressor. Recommended for new construction applications or in replacement applications with high cooling or dehumidification loads. May require new power wire in replacement applications.

Humidi-MiZer® adaptive dehumidification

Adaptive dehumidification provides a reheat source that allows the unit to dehumidify without overcooling the space. Humid-MiZer dehumidification 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 standard chassis

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.

Outdoor airflow measuring

Allows SmartVu controls to read the outdoor airflow through the economizer outdoor air damper. Recommended for applications where ventilation measuring is required or for improved ventilation control for energy savings or improved indoor air quality.

SmartVu controls can also 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.

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.

Standard or 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 over 1 in. wg return duct static pressure.

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.

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 lb 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)

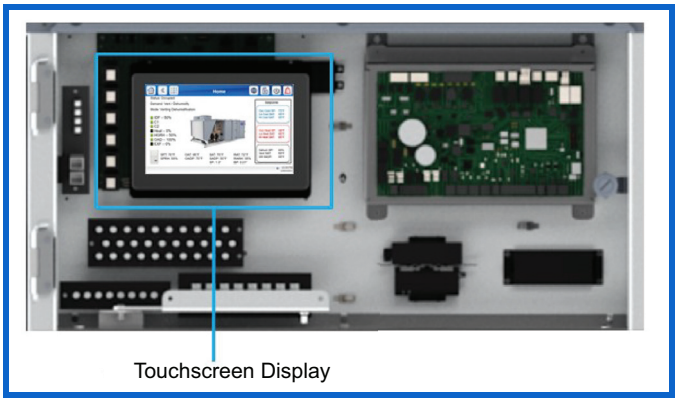
The field-installed UV-C emitters can help inhibit microbial growth on the evaporator coil and in the condensate drain pan.

Recommended for applications that require high indoor air quality.

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

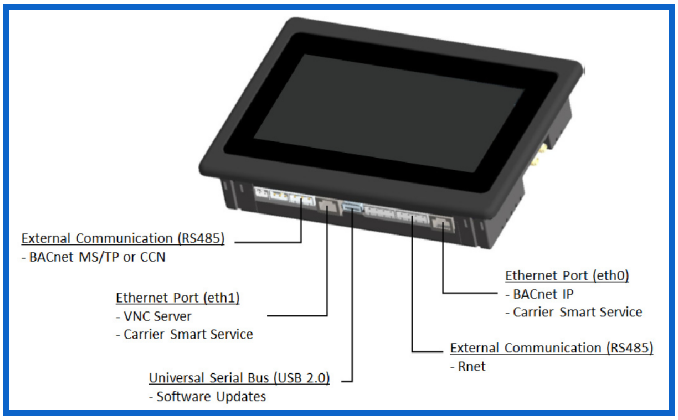
The SmartVu touchscreen display is the primary method of interfacing with the controls for setup and equipment start-up. The touchscreen is a resistive-type, 7 in. LCD that can be activated with a finger, touch-compatible gloves, or stylus. The display is in the dedicated low voltage control box.



The 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.

The SmartVu control provides a suite of ports for communication, including two RS-485 ports, one for BAS communication (including CCN or BACnet MS/TP) and one for Rnet sensors and interfaces (including ZS sensors and i-Vu Equipment touch), a USB port for software upgrades, and two Ethernet ports for BACnet IP, VSC server, or Carrier SmartService connectivity.

NOTE: This iteration of SmartVu can only connect to one of CCN or BACnet MS/TP simultaneously.



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 compatible with Rnet sensors, including ZS sensors. Rnet sensors require a field provided power supply.

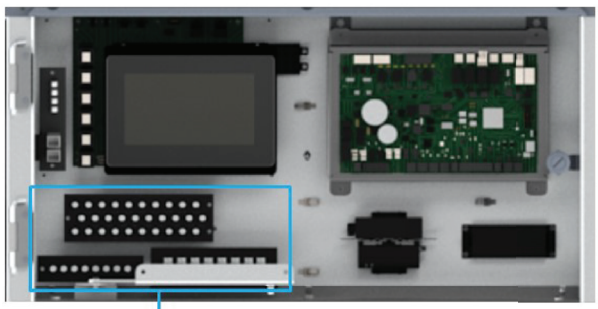
Field-use control inputs

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	Standard
Pre-filter Measuring	Standard
Filter Measuring	Standard

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.



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.
Single-Zone VAV (SZ-VAV)	Indoor fan modulates based on space temperature.
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.

Single-zone variable air volume (SZ-VAV)

When the indoor fan is configured for SZ-VAV and there is only a cooling demand, the indoor fan will modulate linearly between the low and high cool IDF speeds based on the deviation between the space temperature and the cooling space temperature setpoint. The further away the space temperature is from the setpoint, the higher the indoor fan speed will be.

For units equipped with modulating or multi-stage heat and only a heating demand, the indoor fan will modulate linearly between the low and high heat IDF speeds based on the deviation between the space temperature and the heating space temperature setpoint.

For units equipped with two-stage heat, the IDF will operate between the low or high heat IDF speeds based on the demand level. The IDF will be at the minimum indoor fan speed with a vent demand or the high cool IDF with a dehumidify demand.

The indoor fan will operate at the following speeds based on the below operating conditions:

- IDF minimum speed with only a vent demand
- IDF high cool speed with any dehumidification demand
- IDF low cool speed with a low cool demand during free cooling
- IDF high cool speed with a high cool demand during free cooling

SZ-VAV is recommended for sound sensitive applications or applications with higher sensible loads than latent loads. SZ-VAV requires a space temperature sensor and SPT demand source.

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 hardwired 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.

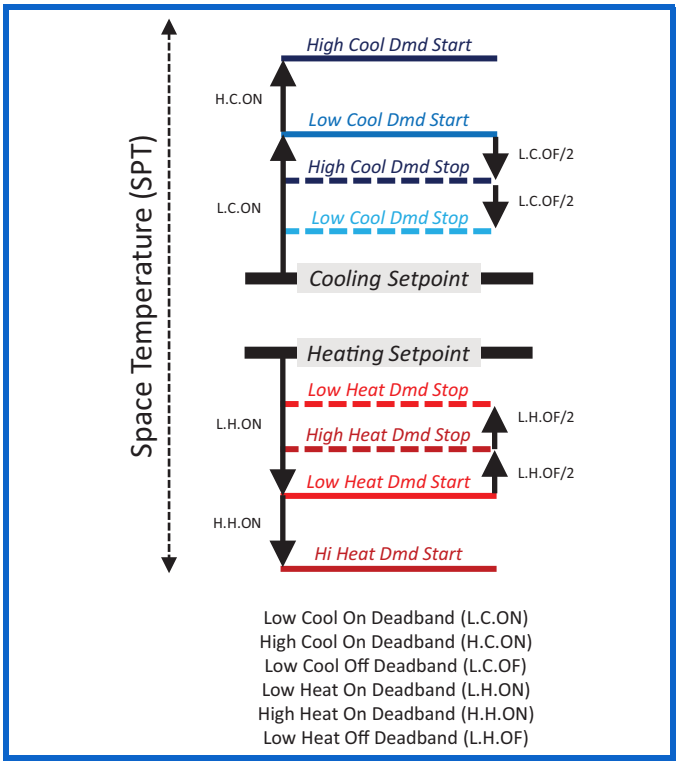
For the input-based cool and heat demand source (TSTAT), the control will monitor the hardwired or networked control inputs to determine if there is a cooling or heating demand.

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.



Controls (cont)

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.

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.

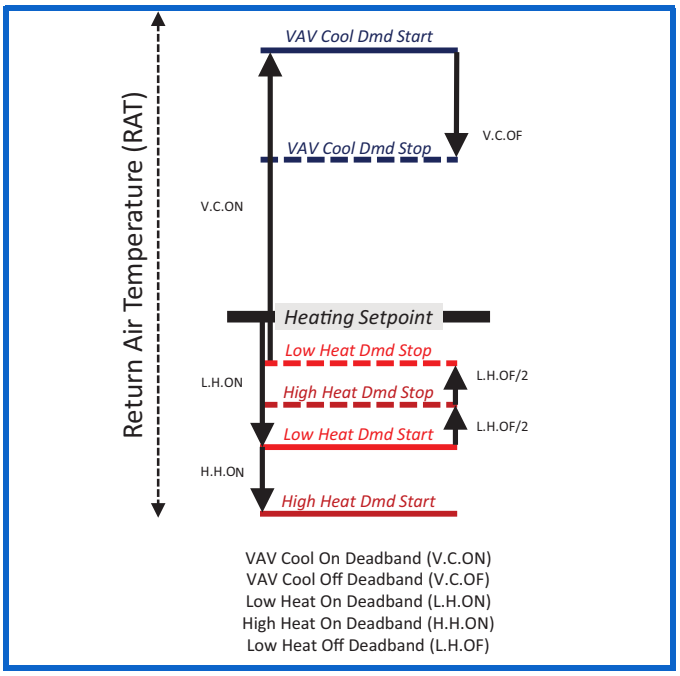
None (occupied or unoccupied)

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

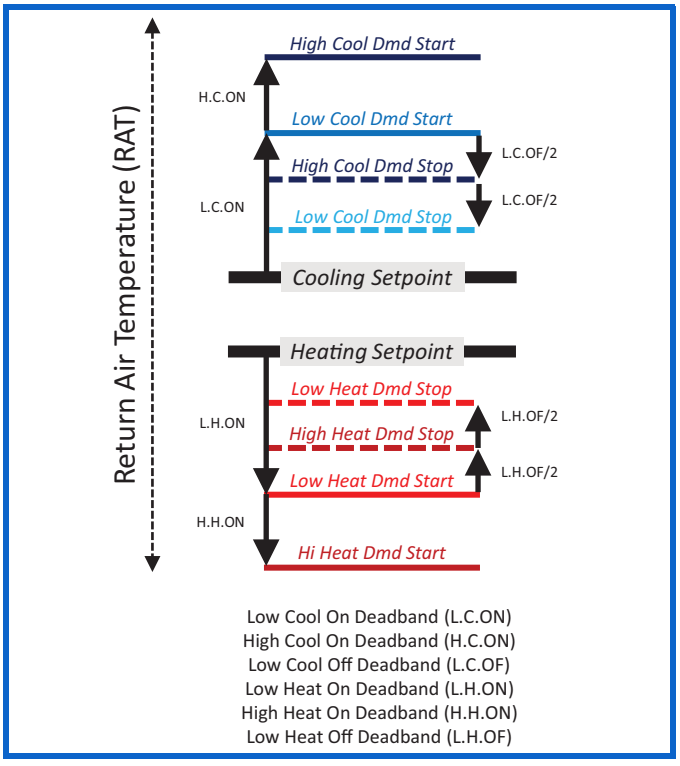
Return air temperature (RAT)

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.

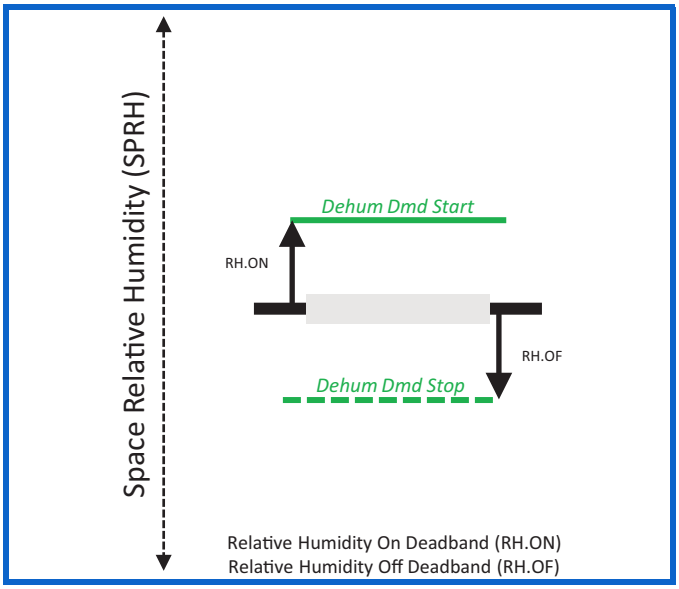
When the space relative humidity drops below the dehumidify relative humidity setpoint, minus the dehumidify off deadband, the dehumidify demand stops.

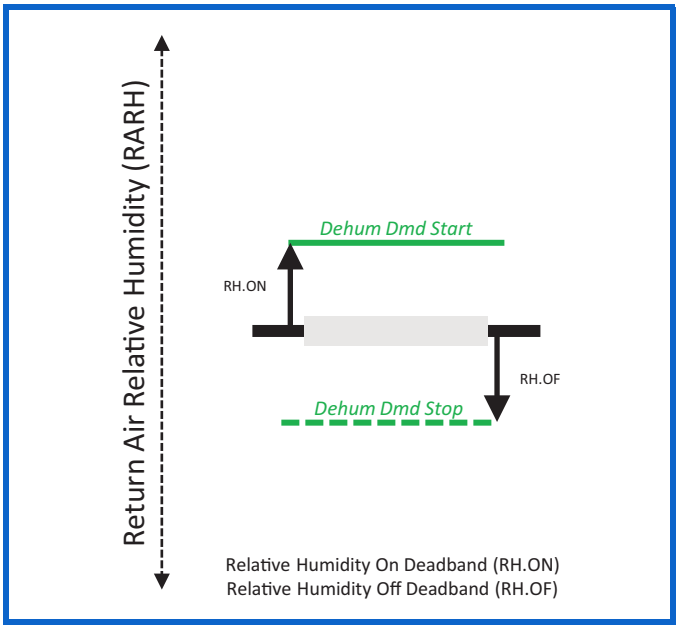
Return air relative humidity (RARH)

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.

Controls (cont)

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.
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.

48/50V Electrical Data[a]

48/50K UNIT SIZE	V-Ph-Hz	VOLTAGE RANGE		COMPRESSOR								OUTDOOR FAN MOTOR				CONTROLS
				A1 High Cap	A1 Std Cap	A2		B1		B2		STD		LOW SOUND		
		Min.	Max.	MRC	MRC	RLA	LRA	RLA	LRA	RLA	LRA	Qty	MOC (ea)	Qty	MOC (ea)	FLA
28	208-3-60	187	253	59..7	57.8	41	304	—	—	—	—	2	6.8	2	5.8	5.3
	230-3-60	187	253	59..7	57.8	41	304	—	—	—	—	2	6.8	2	5.8	4.8
	460-3-60	414	506	27.0	26.2	19.2	147	—	—	—	—	2	3.4	2	2.8	2.4
	575-3-60	518	633	21.6	21.0	16.7	122	—	—	—	—	2	3.3	2	2.4	2.0
30	208-3-60	187	253	64.2	61.1	41	304	—	—	—	—	2	6.8	2	5.8	5.3
	208-3-60	187	253	64.2	61.1	41	304	—	—	—	—	2	6.8	2	5.8	4.8
	460-3-60	414	506	29.0	27.6	19.2	147	—	—	—	—	2	3.4	2	2.8	2.4
	575-3-60	518	633	23.2	22.1	16.7	122	—	—	—	—	2	3.3	2	2.4	2.0
34	208-3-60	187	253	—	66.5	48.1	351	—	—	—	—	2	6.8	2	5.8	5.3
	208-3-60	187	253	—	66.5	48.1	351	—	—	—	—	2	6.8	2	5.8	4.8
	460-3-60	414	506	—	30.1	24.7	197	—	—	—	—	2	3.4	2	2.8	2.4
	575-3-60	518	633	—	24.1	22.4	135	—	—	—	—	2	3.3	2	2.4	2.0
40	208-3-60	187	253	85.5	69.4	48.1	351	—	—	—	—	3	6.8	2	5.8	5.3
	208-3-60	187	253	85.5	69.4	48.1	351	—	—	—	—	3	6.8	2	5.8	4.8
	460-3-60	414	506	40.2	31.4	24.7	197	—	—	—	—	3	3.4	2	2.8	2.4
	575-3-60	518	633	32.2	25.2	22.4	135	—	—	—	—	3	3.3	2	2.4	2.0
50	208-3-60	187	253	94.5	74.8	—	—	41.0	304	27.6	203	4	6.8	4	5.8	5.3
	208-3-60	187	253	94.5	74.8	—	—	41.0	304	27.6	203	4	6.8	4	5.8	4.8
	460-3-60	414	506	42.8	33.8	—	—	19.2	147	14.1	98	4	3.4	4	2.8	2.4
	575-3-60	518	633	34.2	27.1	—	—	16.7	122	11.5	84	4	3.3	4	2.4	2.0

NOTE(S):

a. Data is preliminary and subject to change.

LEGEND

FLA — Full Load Amps
LRA — Locked Rotor Amps
MOC — Maximum Operating Current
MRC — Maximum Run Current
RLA — Run Load Amps

48/50V Electrical Data[a] (cont)

48/50K UNIT SIZE	INDOOR FAN MOTOR									ELECTRIC HEAT (50V ONLY)						POWER EXHAUST												PWRED C/O
	STD STATIC			MED STATIC			HIGH STATIC			LOW		MED		HIGH		LOW STAT (CPT)			LOW STAT (STD)			STD STATIC			MED STATIC			
	Qty	HP (ea)	MOC (ea)	Qty	HP (ea)	MOC (ea)	Qty	HP (ea)	MOC (ea)	kW	FLA	kW	FLA	kW	FLA	Qty	HP (ea)	MOC (ea)	Qty	HP (ea)	MOC (ea)	Qty	HP (ea)	MOC (ea)	Qty	HP (ea)	MOC (ea)	FLA
28	3	3.8	8.3	3	5.2	11.6	3	7.5	16.5	27	75.1	54.1	150.1	81.1	225.2	2	1	3.6	2	1.5	3.9	2	5.1	10.2	2	9.7	19.2	4.8
	3	3.8	8.3	3	5.2	11.6	3	7.5	16.5	36	86.6	72.0	173.2	108.0	259.8	2	1	3.3	2	1.5	3.5	2	5.1	10.2	2	9.7	19.2	4.8
	3	4.4	5.0	3	5.9	6.8	3	9.1	10.3	36	43.3	72.0	86.6	108.0	129.9	2	1	2.0	2	1.5	2.3	2	5.1	5.3	2	9.7	10.1	2.2
	3	3.6	3.3	3	6.3	5.3	3	8.2	7.1	36	34.6	72.0	69.3	108.0	103.9	2	1	1.8	2	1.5	2.0	2	5.1	4.4	2	7.2	6.2	1.7
30	3	3.8	8.3	3	5.2	11.6	3	7.5	16.5	27	75.1	54.1	150.1	81.1	225.2	2	1	3.6	2	1.5	3.9	2	5.1	10.2	2	9.7	19.2	4.8
	3	3.8	8.3	3	5.2	11.6	3	7.5	16.5	36	86.6	72.0	173.2	108.0	259.8	2	1	3.3	2	1.5	3.5	2	5.1	10.2	2	9.7	19.2	4.8
	3	4.4	5.0	3	5.9	6.8	3	9.1	10.3	36	43.3	72.0	86.6	108.0	129.9	2	1	2.0	2	1.5	2.3	2	5.1	5.3	2	9.7	10.1	2.2
	3	3.6	3.3	3	6.3	5.3	3	8.2	7.1	36	34.6	72.0	69.3	108.0	103.9	2	1	1.8	2	1.5	2.0	2	5.1	4.4	2	7.2	6.2	1.7
34	3	3.8	8.3	3	5.2	11.6	3	7.5	16.5	27	75.1	54.1	150.1	81.1	225.2	2	1	3.6	2	1.5	3.9	2	5.1	10.2	2	9.7	19.2	4.8
	3	3.8	8.3	3	5.2	11.6	3	7.5	16.5	36	86.6	72.0	173.2	108.0	259.8	2	1	3.3	2	1.5	3.5	2	5.1	10.2	2	9.7	19.2	4.8
	3	4.4	5.0	3	5.9	6.8	3	9.1	10.3	36	43.3	72.0	86.6	108.0	129.9	2	1	2.0	2	1.5	2.3	2	5.1	5.3	2	9.7	10.1	2.2
	3	3.6	3.3	3	6.3	5.3	3	8.2	7.1	36	34.6	72.0	69.3	108.0	103.9	2	1	1.8	2	1.5	2.0	2	5.1	4.4	2	7.2	6.2	1.7
40	3	4.8	10.8	3	7.5	16.5	3	9.7	19.2	27	75.1	54.1	150.1	81.1	225.2	2	1.5	3.9	2	1.5	3.9	2	5.1	10.2	2	9.7	19.2	4.8
	3	4.8	10.8	3	7.5	16.5	3	9.7	19.2	36	86.6	72.0	173.2	108.0	259.8	2	1.5	3.5	2	1.5	3.5	2	5.1	10.2	2	9.7	19.2	4.8
	3	4.8	5.5	3	5.8	6.8	3	9,7	10.1	36	43.3	72.0	86.6	108.0	129.9	2	1.5	2.3	2	1.5	2.3	2	5.1	5.3	2	9.7	10.1	2.2
	3	4.8	4.0	3	6.3	5.3	3	7.2	6.2	36	34.6	72.0	69.3	108.0	103.9	2	1.5	2.0	2	1.5	2.0	2	5.1	4.4	2	7.2	6.2	1.7
50	3	4.8	10.8	3	7.5	16.5	3	9.7	19.2	27	75.1	54.1	150.1	81.1	225.2	2	1.5	3.9	2	1.5	3.9	2	5.1	10.2	2	9.7	19.2	4.8
	3	4.8	10.8	3	7.5	16.5	3	9.7	19.2	36	86.6	72.0	173.2	108.0	259.8	2	1.5	3.5	2	1.5	3.5	2	5.1	10.2	2	9.7	19.2	4.8
	3	4.8	5.5	3	5.8	6.8	3	9,7	10.1	36	43.3	72.0	86.6	108.0	129.9	2	1.5	2.3	2	1.5	2.3	2	5.1	5.3	2	9.7	10.1	2.2
	3	4.8	4.0	3	6.3	5.3	3	7.2	6.2	36	34.6	72.0	69.3	108.0	103.9	2	1.5	2.0	2	1.5	2.0	2	5.1	4.4	2	7.2	6.2	1.7

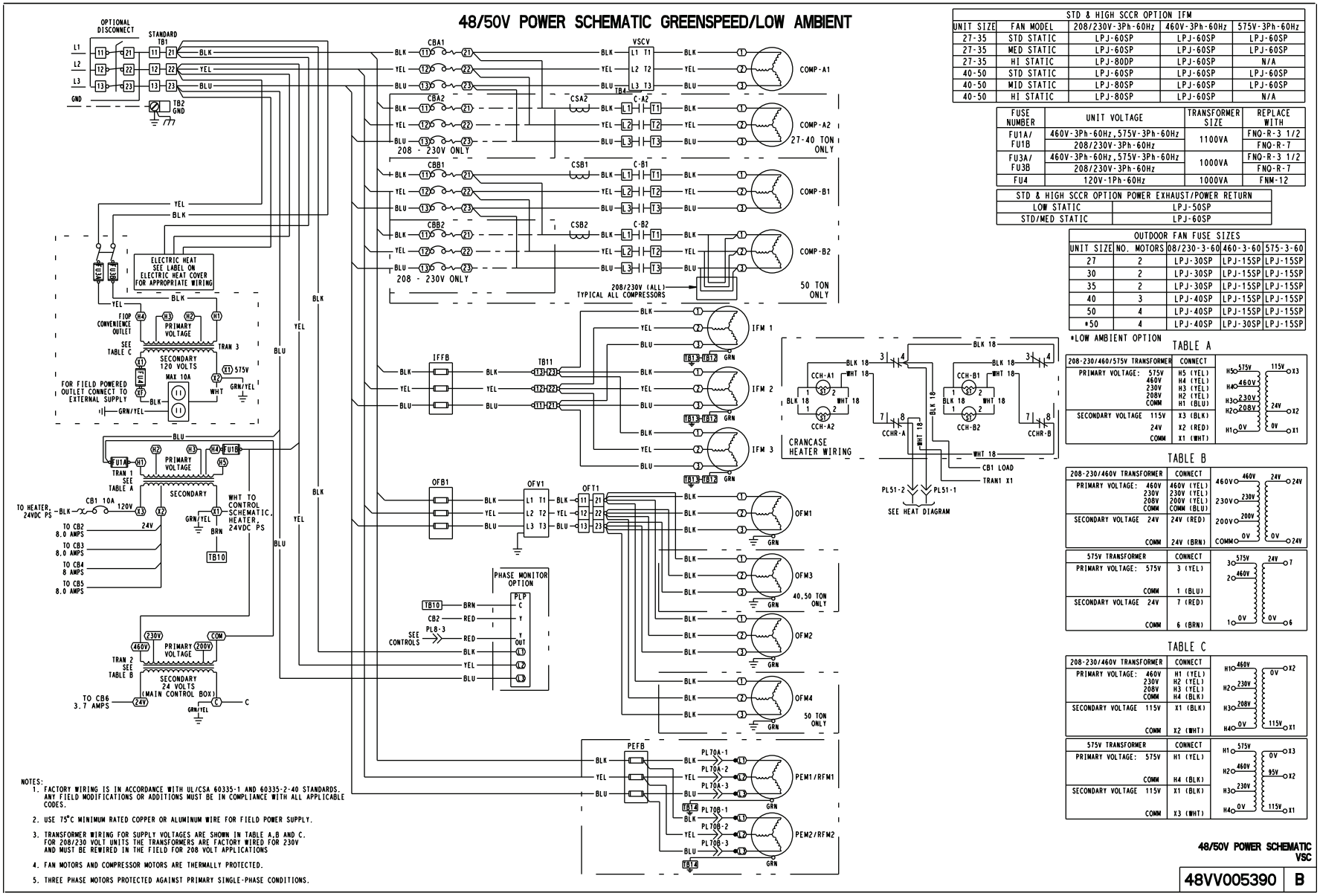
NOTE(S):

a. Data is preliminary and subject to change.

LEGEND

FLA — Full Load Amps
LRA — Locked Rotor Amp
MOC — Maximum Operating Current
MRC — Maximum Run Current
RLA — Run Load Amps

48/50V Power Schematic



STD & HIGH SCCR OPTION IFM				
UNIT SIZE	FAN MODEL	208/230V-3Ph-60Hz	460V-3Ph-60Hz	575V-3Ph-60Hz
27-35	STD STATIC	LPJ-60SP	LPJ-60SP	LPJ-60SP
27-35	MED STATIC	LPJ-60SP	LPJ-60SP	LPJ-60SP
27-35	HI STATIC	LPJ-80DP	LPJ-60SP	N/A
40-50	STD STATIC	LPJ-60SP	LPJ-60SP	LPJ-60SP
40-50	MID STATIC	LPJ-80SP	LPJ-60SP	LPJ-60SP
40-50	HI STATIC	LPJ-80SP	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	
LOW STATIC	LPJ-50SP
STD/MED STATIC	LPJ-60SP

OUTDOOR FAN FUSE SIZES				
UNIT SIZE	NO. MOTORS	208/230-3-60	460-3-60	575-3-60
27	2	LPJ-30SP	LPJ-15SP	LPJ-15SP
30	2	LPJ-30SP	LPJ-15SP	LPJ-15SP
35	2	LPJ-30SP	LPJ-15SP	LPJ-15SP
40	3	LPJ-40SP	LPJ-15SP	LPJ-15SP
50	4	LPJ-40SP	LPJ-15SP	LPJ-15SP
*50	4	LPJ-40SP	LPJ-30SP	LPJ-15SP

*LOW AMBIENT OPTION

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

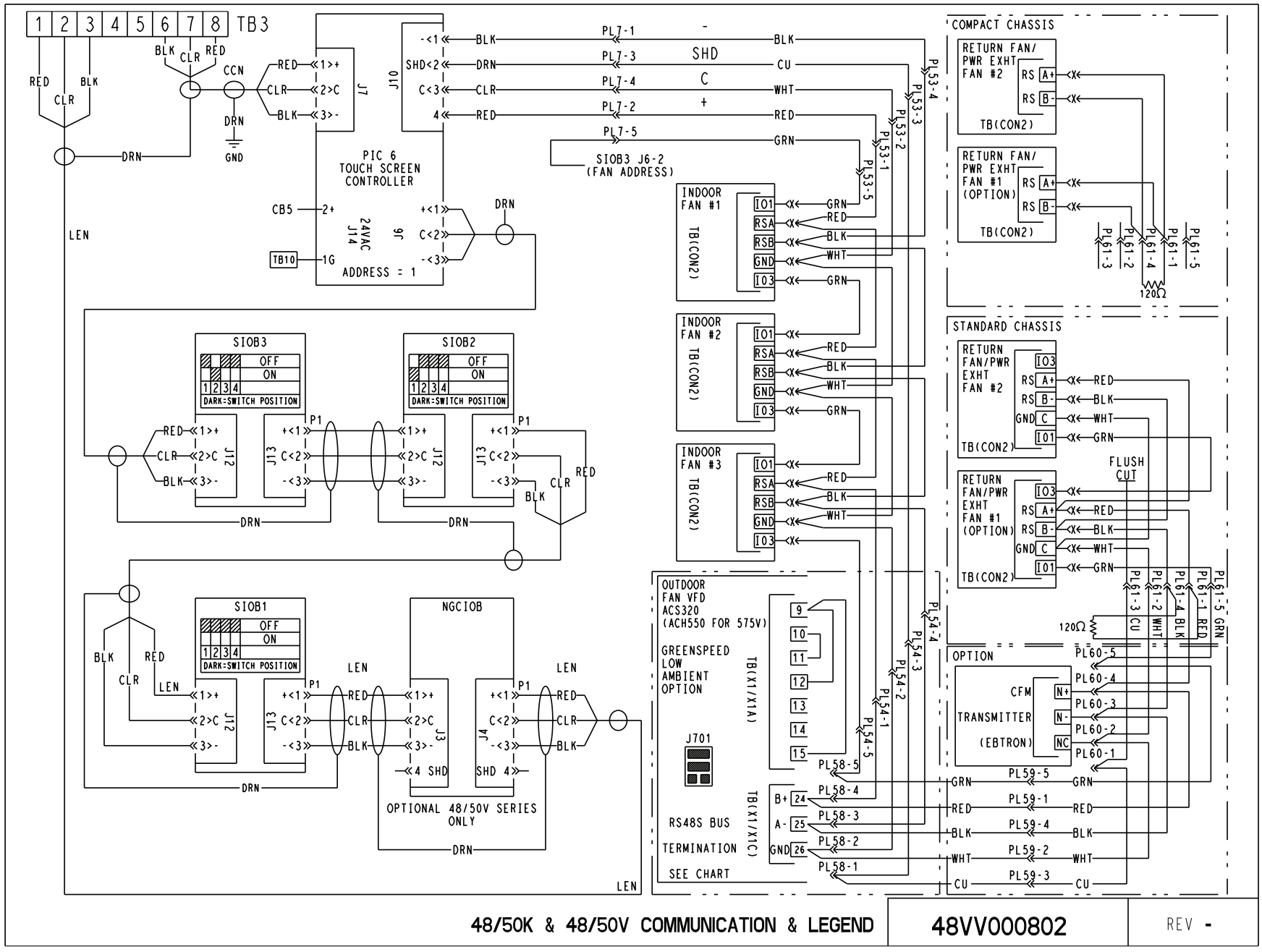
208-230/460V TRANSFORMER	CONNECT
PRIMARY VOLTAGE: 460V	H1 (YEL)
230V	H2 (YEL)
208V	H3 (YEL)
COMM	H4 (BLK)
SECONDARY VOLTAGE 115V	X1 (BLK)
COMM	X2 (WHT)

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

48/50V POWER SCHEMATIC VSC

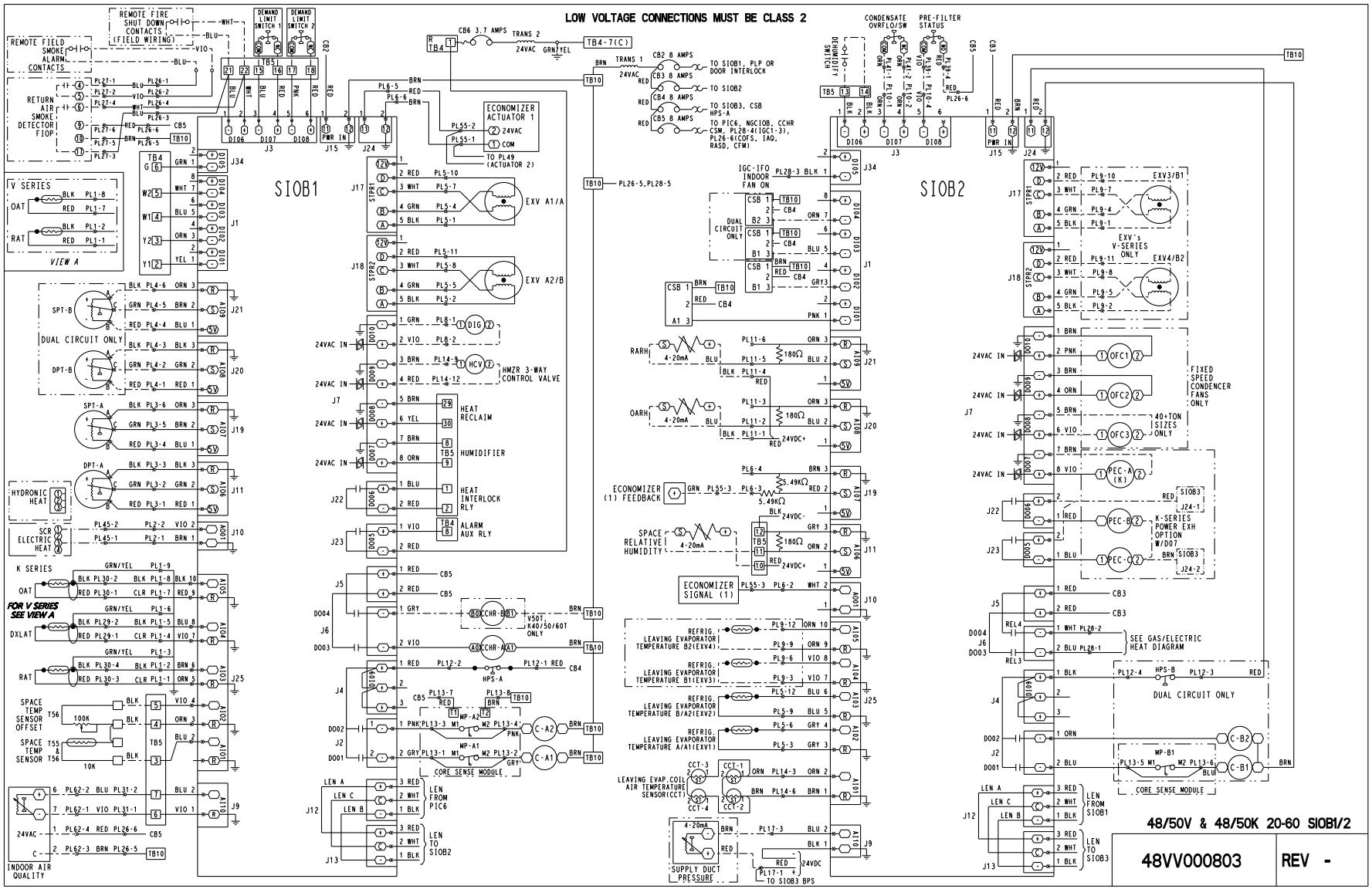
48VV005390 B

48/50V Communication Schematic

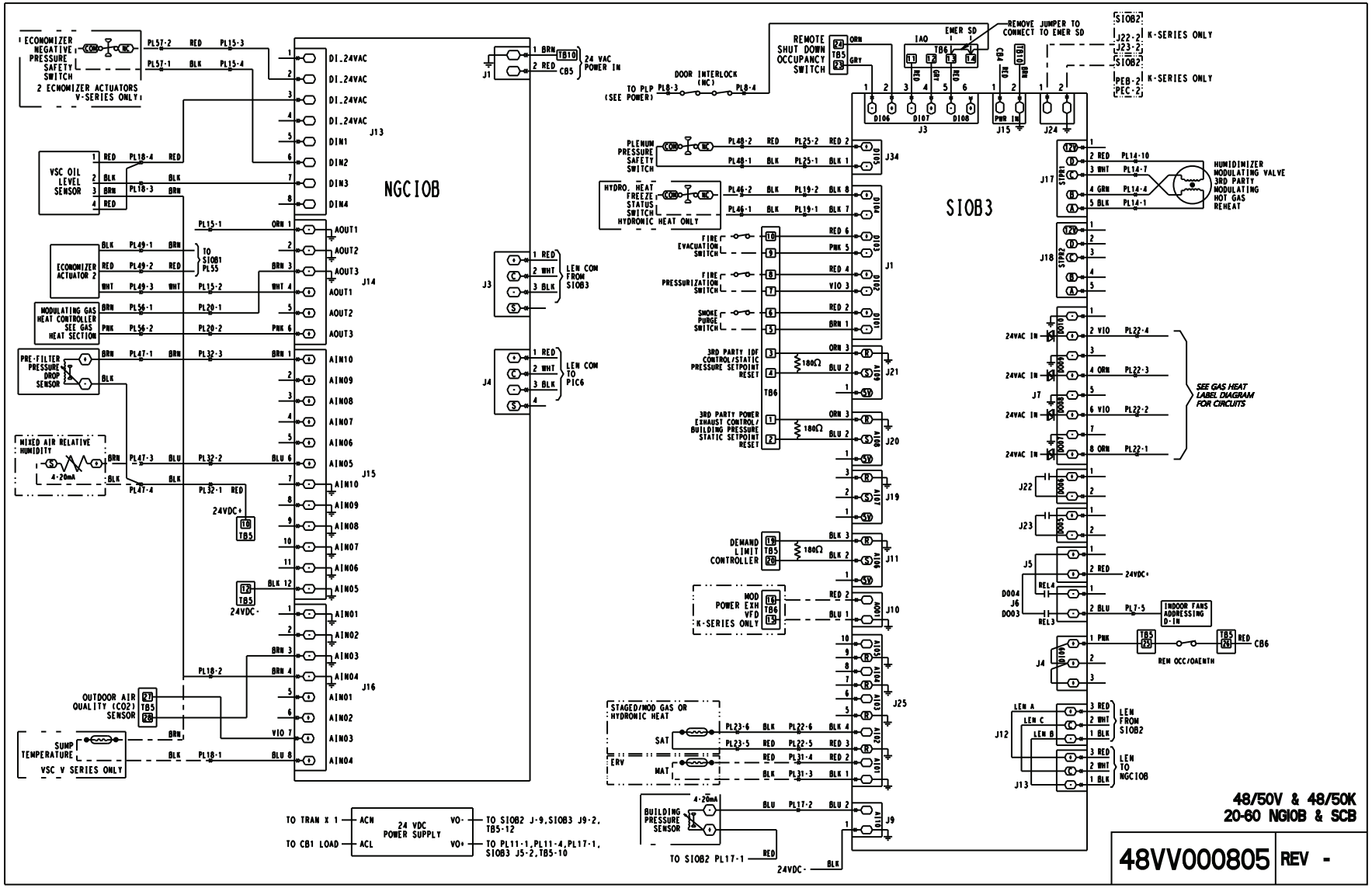


48/50K & 48/50V COMMUNICATION & LEGEND | 48VV000802 | REV -

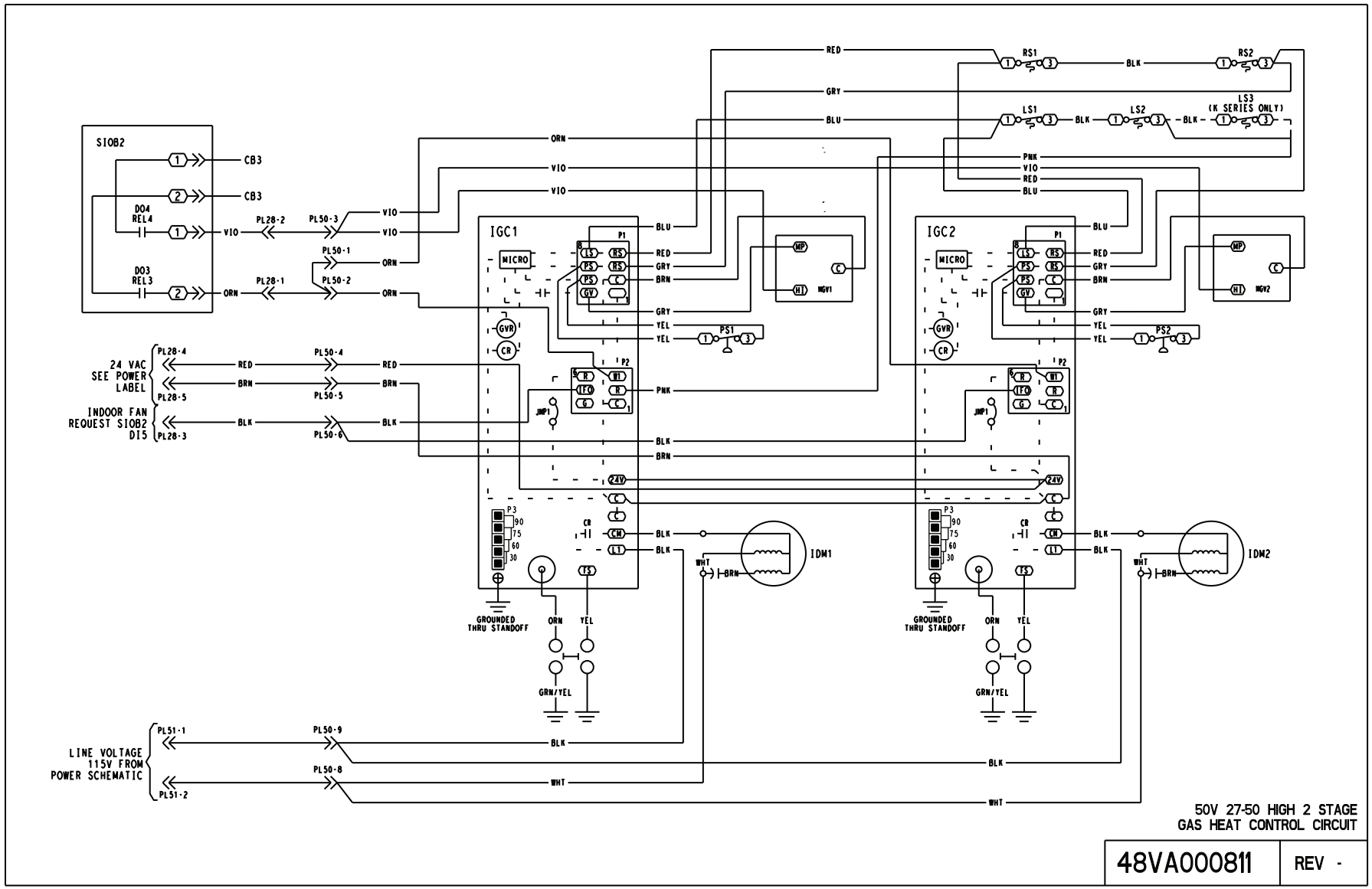
48/50V SIOB 1/2



48/50V NGIOB and SCB



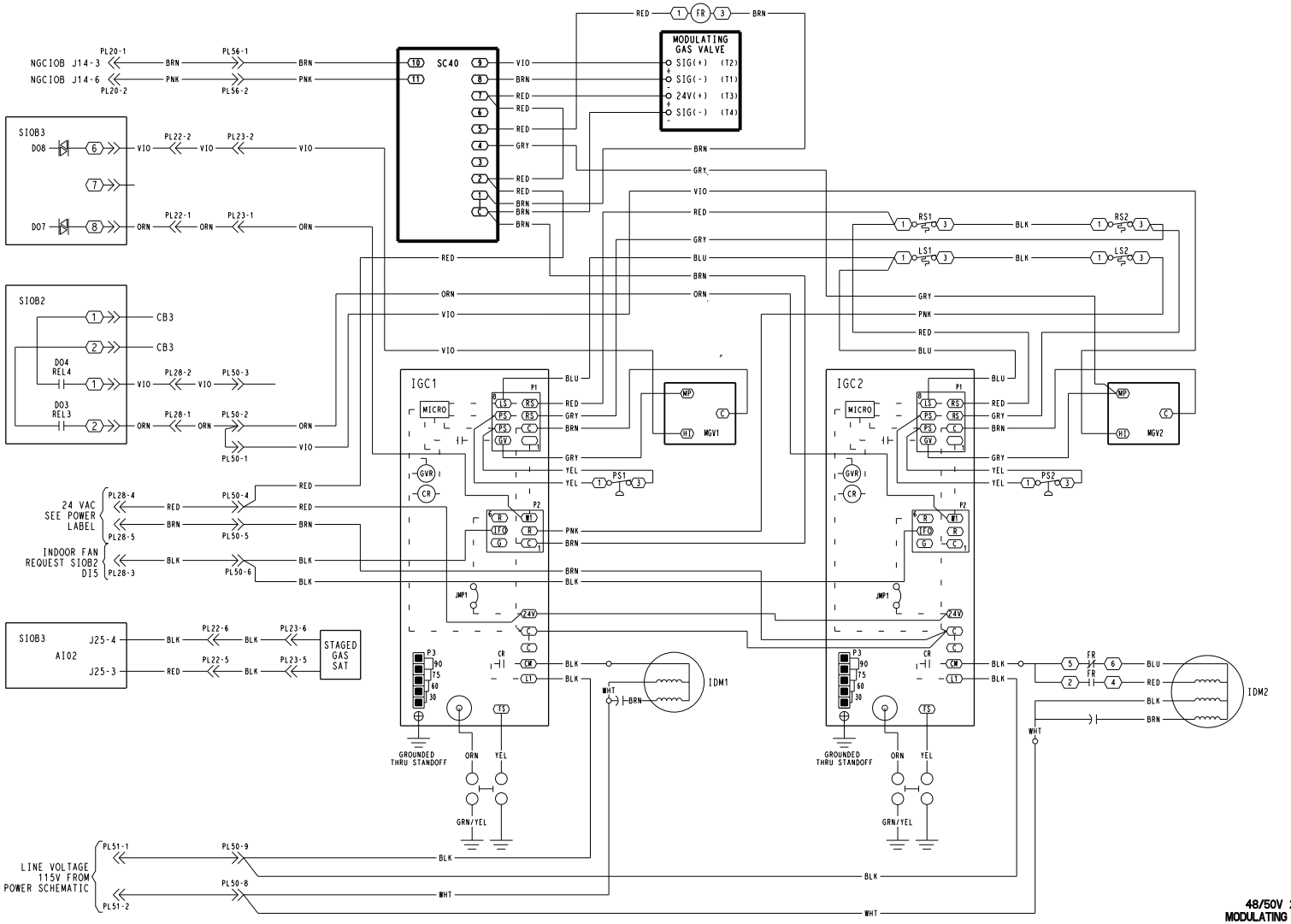
48/50V High 2-Stage Gas Heat Control Circuit



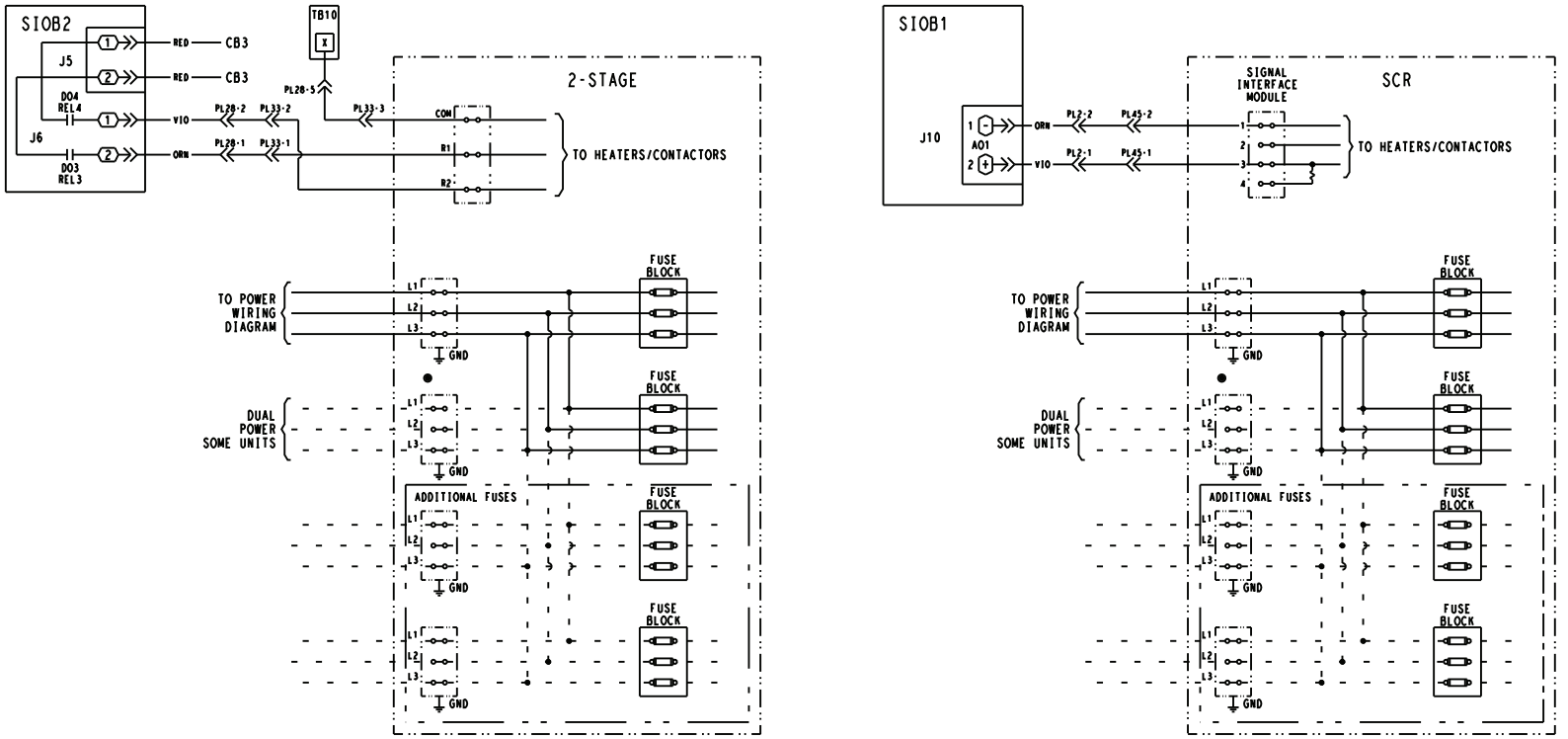
50V 27-50 HIGH 2 STAGE
GAS HEAT CONTROL CIRCUIT

48VA000811	REV -

48/50V High Modulating Gas Heat



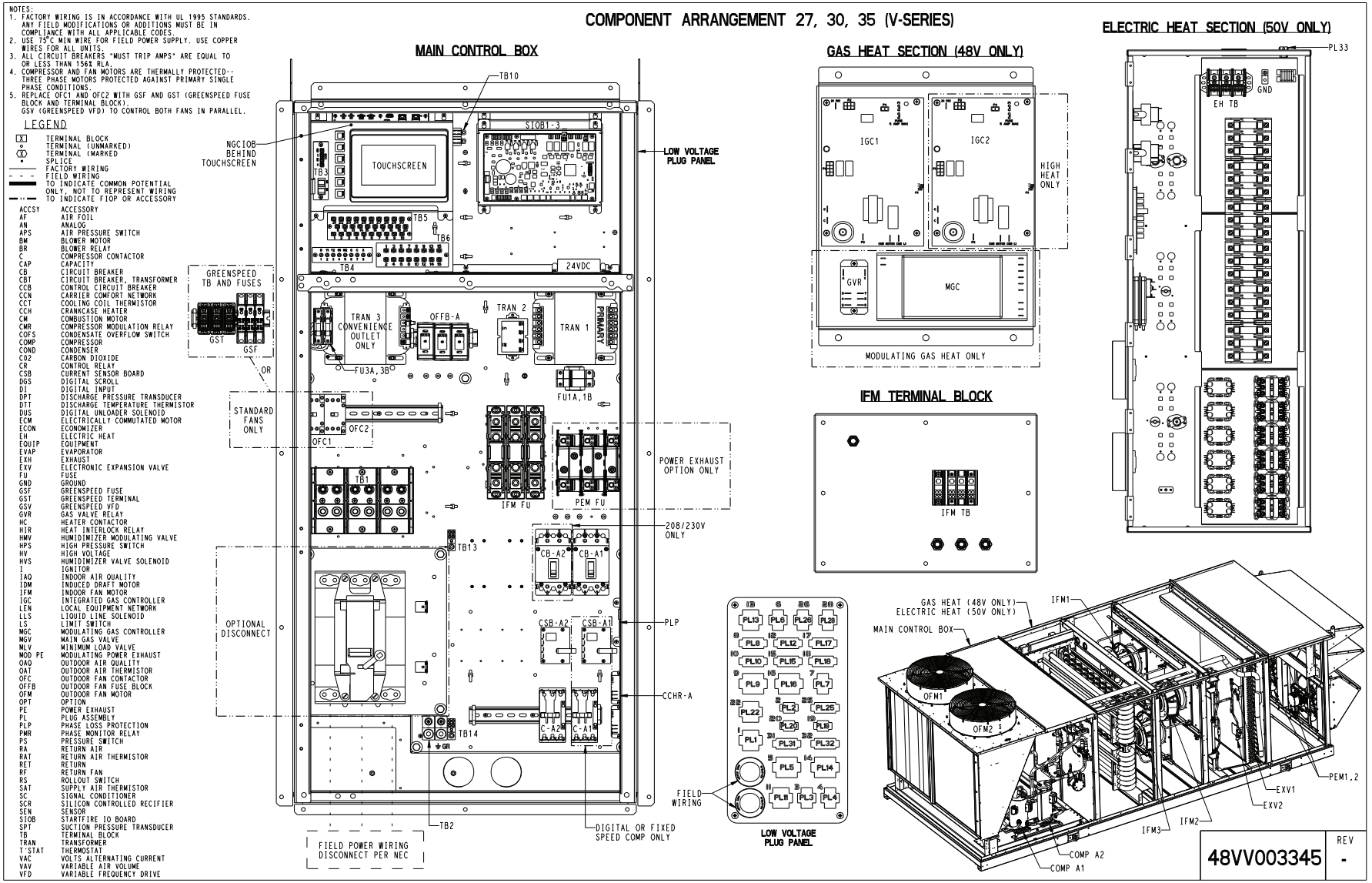
50V Electric Heat Staged SCR



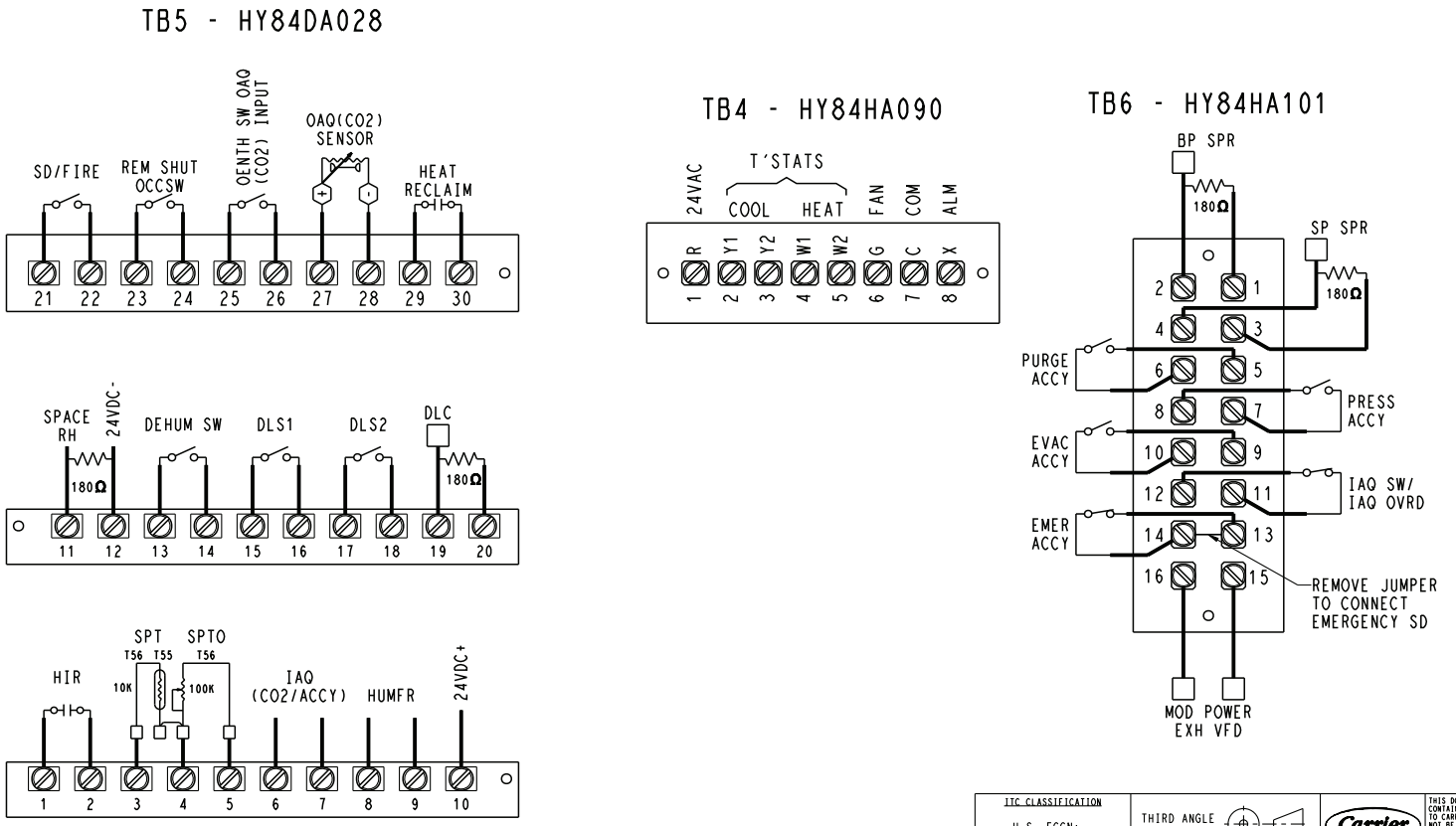
50V 27-50 ELECTRIC HEAT STAGED SCR

48VV00816 | REV -

48/50V Component Arrangement



48/50V Field Wiring Terminal Board Layout



ITC CLASSIFICATION U.S. ECCN:	THIRD ANGLE PROJECTION	Carrier	THIS DOCUMENT AND THE INFORMATION CONTAINED THEREIN IS PROPRIETARY TO CARRIER CORPORATION AND SHALL NOT BE USED OR DISCLOSED TO OTHERS, IN WHOLE OR IN PART, WITHOUT THE WRITTEN AUTHORIZATION OF CARRIER CORPORATION.
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 50 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. 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).
6. Provide the ability to read refrigerant pressures at local display or via BAS network without the use of external refrigerant gauges.
7. Include a USB data port to allow for software upgrades without the need for special tools or programs.
8. 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
9. 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.

10. 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.
11. Include field use control outputs, including field provided modulating heat, field provided heat enable, alarm/aux relay, and damper override relay, as standard.
12. Provide cooling and heating demand source configurations for space temperature sensors, two-stage cool/heat thermostat or network inputs, or return air temperature.
13. 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.
14. 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.
15. Provide the ability to perform cool-tempered venting and heat-tempered venting operation to prevent hot or cold discharge air during vent mode.
16. 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.
17. Provide user-adjustable compressor lockouts based on outdoor air temperature and mixed air temperature, and user-adjustable heating lockouts based on outdoor air temperature.
18. 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.
      d. Refrigerant circuit lead detection and mitigation.
   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 Advance™ (R-454B) 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 28-40 and dual refrigerant circuits on size 50.
   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.
   g. Refrigerant lead detection sensor.
   h. Refrigerant leak mitigation board.
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 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), Single-Zone VAV (SZ-VAV), 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 Single-Zone VAV (SZ-VAV), Staged Air Volume (SAV™), Constant Volume (CV), or Third-party modulation.

M. (23 81 19.13.M.) Outdoor 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) excluding size 34:
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 (With High Efficiency, Low Sound Option):
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 (With High Efficiency, Low Sound Option):
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 Standard Chassis:
   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.

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. Outdoor Airflow Measuring:
   a. The unit shall have an airflow transmitter with thermal dispersion type airflow sensing probes installed in the outdoor air intake.
   b. The airflow reading accuracy shall be within ±5%.
   c. The airflow information shall be viewable from the user interface and available as a network point.
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. Standard or 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. Powered 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. Unpowered 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 50 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. 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).
6. Provide the ability to read refrigerant pressures at local display or via BAS network without the use of external refrigerant gauges.
7. Include a USB data port to allow for software upgrades without the need for special tools or programs.
8. 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.
9. 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.

10. 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.
11. Include field use control outputs, including field provided modulating heat, field provided heat enable, alarm/aux relay, and damper override relay, as standard.
12. Provide cooling and heating demand source configurations for space temperature sensors, two-stage cool/heat thermostat or network inputs, or return air temperature.
13. 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.
14. 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.
15. Provide the ability to perform cool-tempered venting and heat-tempered venting operation to prevent hot or cold discharge air during vent mode.
16. 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.
17. Provide user-adjustable compressor lockouts based on outdoor air temperature and mixed air temperature, and user-adjustable heating lockouts based on outdoor air temperature.
18. 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.
      d. Refrigerant circuit lead detection and mitigation.
   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 Advance™ (R-454B) refrigerant and include a factory refrigerant charge. The unit exterior must be marked as using R-454B 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 28-40 and dual refrigerant circuits on size 50.
   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.
   g. Refrigerant lead detection sensor.
   h. Refrigerant leak mitigation board.
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 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), Single-Zone VAV (SZ-VAV), 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 Single-Zone VAV (SZ-VAV), Staged Air Volume (SAV), Constant volume (CV), or Third-party modulation.

L. (23 81 19.13.L.) Outdoor 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) excluding size 34:
      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 (With High Efficiency, Low Sound Option):
   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 (With High Efficiency, Low Sound Option) :
   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 Standard Chassis:
   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. Outdoor Airflow Measuring:
    a. The unit shall have an airflow transmitter with thermal dispersion type airflow sensing probes installed in the outdoor air intake.
    b. The airflow reading accuracy shall be within ±5%.
    c. The airflow information shall be viewable from the user interface and available as a network point.

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.

Guide specifications 50V (cont)

20. Standard or 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. Unpowered 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. Powered 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.

Guide specifications 50V (cont)

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.
    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.

Pg 144 Catalog No. 04-52480113-01 Printed in U.S.A. Form 48-50V-02APD
Replaces: 48-50V-01APD