



INVERTER DRIVES



# TRAINING OVERVIEW



## EQUIPMENT OVERVIEW

---

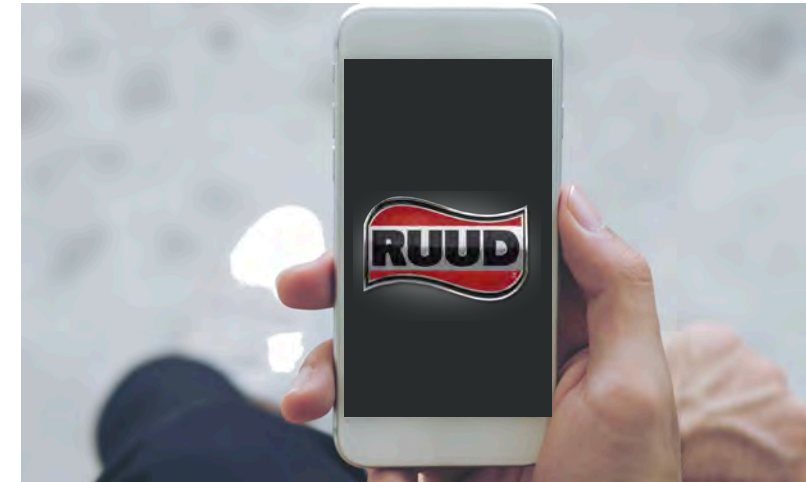
## INVERTER OVERVIEW

## MID-TIER INVERTERS

- Drive components
  - Wiring diagrams
- 

## HIGH-TIER INVERTERS

- Drive components
- Wiring diagrams
- Capacity chart example

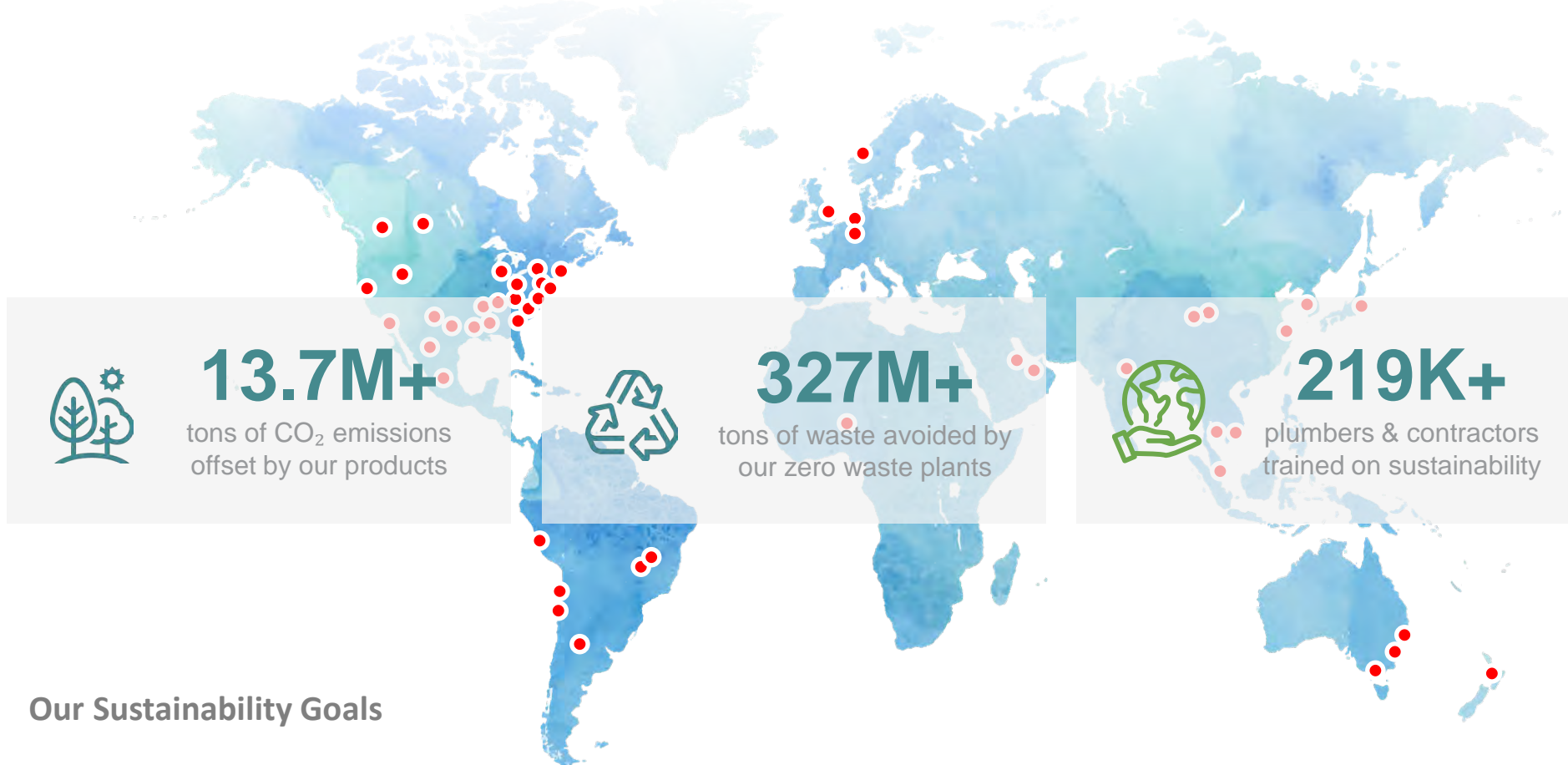


## DIAGNOSTICS & TROUBLESHOOTING

- Running diagnostics (Contractor App)
- LEDs
- Contractor

AT RUUD, WE'RE COMMITTED TO DOING WELL BY DOING GOOD.

# OUR GLOBAL PROGRESS



## Our Sustainability Goals



### DEGREES OF INNOVATION

**Our 2025 goal:** Launch a line of heating, cooling and water heating products that boast a 50% reduction in greenhouse gas footprint.



### DEGREES OF EFFICIENCY

**Our 2025 goal:** Reduce greenhouse gas emissions by 50% and achieve Zero Waste to Landfill in our global manufacturing operations.



### DEGREES OF LEADERSHIP

**Our 2025 goal:** Train 250,000 plumbers, contractors and key influencers on sustainable products or sustainable installation and recycling best practices.

Proudly Recognized  
as a Sustainable Brand



2021 & 2022 ENERGY STAR  
Partner of the Year



Eco-Leader for Five  
Consecutive Years



Awarded for our Variable  
Speed Heat Pump



**A Greater Degree of Good™**

represents our global commitment to sustainability. Look for this badge throughout the training!

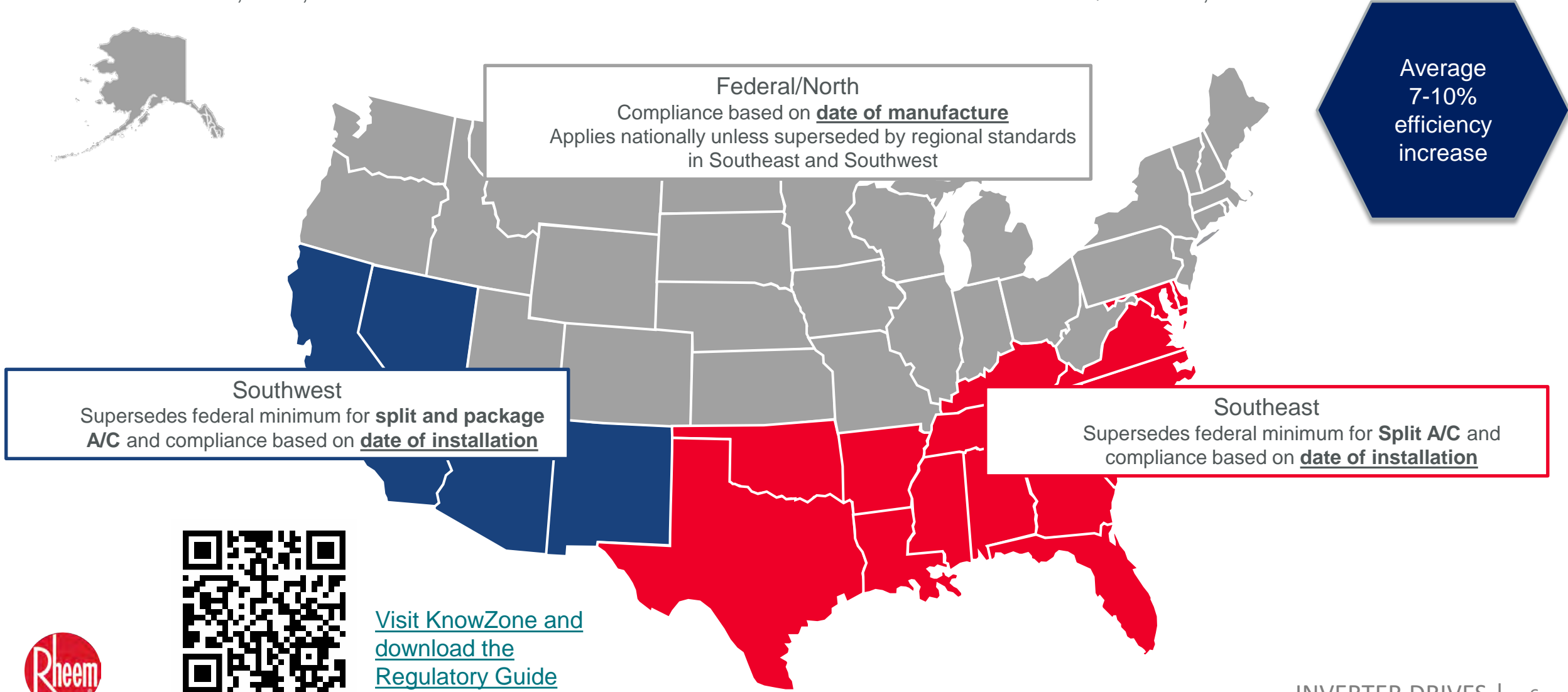


## EQUIPMENT OVERVIEW



# WHY M1? DOE NEW EFFICIENCY STANDARDS

EFFECTIVE JAN 1, 2023, FOR NEW RESIDENTIAL AND SINGLE-PHASE LIGHT COMMERCIAL EQUIPMENT, <65K BTU/HR

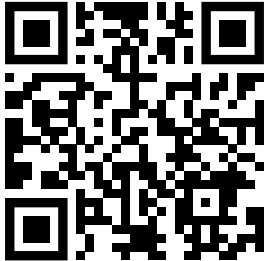


Average 7-10% efficiency increase

**Federal/North**  
Compliance based on date of manufacture  
Applies nationally unless superseded by regional standards in Southeast and Southwest

**Southwest**  
Supersedes federal minimum for **split and package A/C** and compliance based on date of installation

**Southeast**  
Supersedes federal minimum for **Split A/C** and compliance based on date of installation



[Visit KnowZone and download the Regulatory Guide](#)





# UNDERSTANDING REGIONAL STANDARDS

## SOUTHEAST & SOUTHWEST

- No sell through
- Inventory manufactured prior to 1/1/2023: see [latest DOE guidance](#)
- Not applicable to heat pumps – national standard only
- Remember the rule of 3 – 2 – 1
  - 3 Different regional requirements for condensing units
  - 2 Different requirements for package systems
  - 1 National requirement for heat pumps

PRODUCT CATEGORY	APPENDIX M1 REQUIREMENTS JANUARY 1, 2023						
	NORTH REGION		SOUTHEAST REGION		SOUTHWEST REGION		
	SEER2	HSPF2	SEER2	HSPF2	SEER2	EER2	HSPF2
SPLIT AC < 45k BTU/HR	13.4		14.3		14.3	11.7/9.8	
SPLIT AC ≥ 45k BTU/HR	13.4		13.8		13.8	11.2/9.8	
SPLIT HP	14.3	7.5	14.3	7.5	14.3		7.5
SINGLE Packaged AC/GE	13.4		13.4		13.4	10.6	
SINGLE Packaged HP	13.4	6.7	13.4	6.7	13.4		6.7

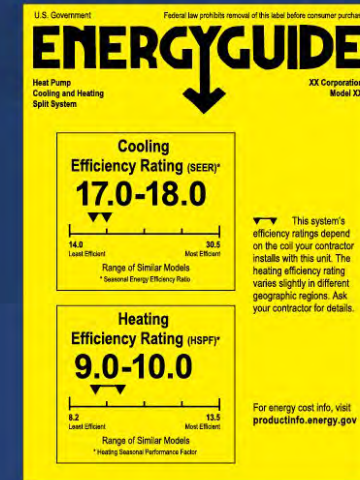




# EXISTING INVENTORY

## Compliance for Existing Inventory *AFTER JANUARY 1, 2023:*

Outdoor AC units manufactured prior to January 1, 2023, rated using Appendix M, can be installed in the Southeast and Southwest Regions, if the lowest FTC label rating (coil-only) is at or above the new minimum efficiency requirements on a conversion basis. Ratings based on Appendix M will need to be cross-referenced with the corresponding Appendix M1 values.

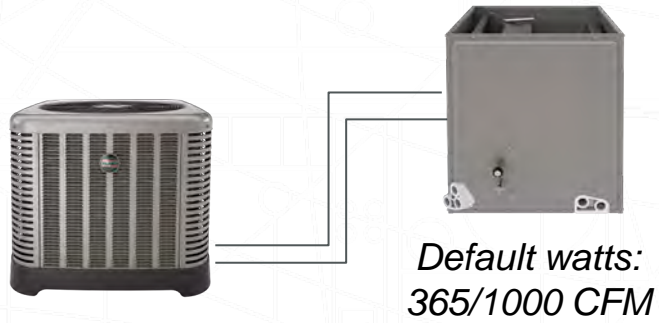




# MAIN ENERGY INCREASE

## CURRENT STANDARD: APPENDIX M

A/C Coil  
Only  
Rating

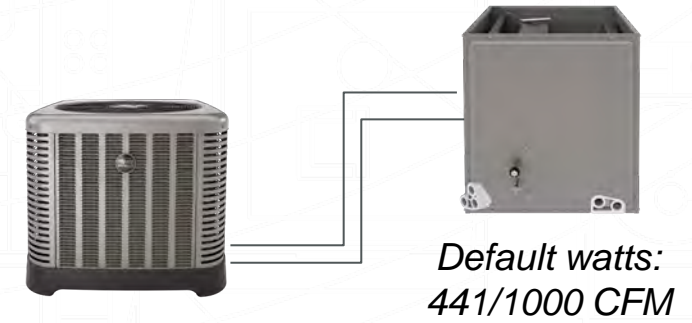


Mix-Match  
Rating

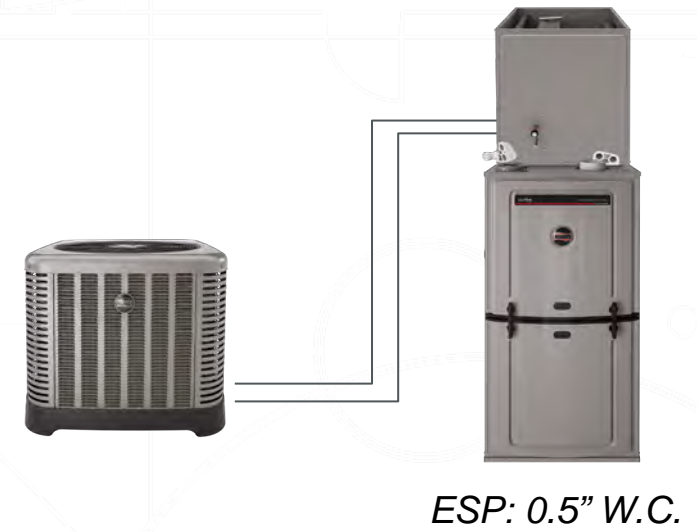


## NEW STANDARD: APPENDIX M1

A/C Coil  
Only  
Rating



Mix-Match  
Rating

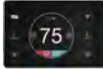









# 2023+ TIERING | AIR CONDITIONER



A/C Tier	Model	Staging	Compressor Type	ODU Fan	SEER2	Bluetooth Enabled	Sustainability Standout	Compatible Thermostat
High	UA18AZ	Mod	Var. Scroll	BLDC	18+	✓		 Ruud®
Mid	UA16AZ	Mid Tier Inv / 3 spd	Twin Rotary	BLDC	16	✓		 2-Stage 24V*
	RA15AZ	Mid Tier Inv / 3 spd	Twin Rotary	PSC / BLDC	15.2	✓		
Base	RA14	1	Scroll	PSC / ECM*	14.3 / 13.8	-		 1-Stage 24V
	RA13NZ	1	Scroll	PSC	13.4	-		

⚠ 18 SEER2 model will run emergency only with 24v control  
 15/16 SEER2 models will run 3 speeds with 24v control



# 2023+ TIERING | HEAT PUMP



18 SEER2 model will run emergency only with 24v control  
 16 SEER2 models will run 3 speeds with 24v control

Heat Pump Tier	Model	Staging	ODU Fan	SEER2	EER2	HSPF2	Bluetooth Enabled	Sustainability Standout	Compatible Thermostat
High	UP18AZ	Mod	BLDC	18+	-	9.0+	✓		 Ruud®
Mid	UP16AZ	Mid Tier Inv / 3 spd	BLDC	16	-	8.0+	✓		 2-Stage 24V*
	RP15AZ	2	PSC	15.0	-	8.0+	-	 2-Stage 24V*	
Base	RP14AZ	2*	PSC	14.3	-	7.5	-	 2-Stage 24V*	



# SUSTAINABILITY STANDOUT SEAL OVERVIEW

While many Ruud products have sustainable features, certain products **stand out as a cut above**—and those products earn the Sustainability Standout™ seal.

It's given based on a number of internally designated factors relating to product attributes like energy efficiency, longevity, carbon reduction and more.



*This product meets a stringent set of our internally defined sustainability standards*

**SUSTAINABILITY STANDOUT SEAL**

While many Ruud® products have sustainable features, certain products stand out as a cut above—and those products earn the Sustainability Standout™ seal. It's given based on a number of internally designated factors relating to product attributes like energy efficiency, longevity, CO2 reduction and more. We're in the process of adding the seal in places including the product information pages, marketing and training materials—all to help professionals recommend responsible products and consumers make smart purchasing decisions.

**HOW THE SEAL IS EARNED**

To determine which products stand out among our sustainable offerings and have earned the right to bear the Sustainability Standout seal, we created a proprietary point system. In our Sustainability Strategy Sessions during our Product Development Process, we look at the Earth-friendly and user-friendly attributes of the product—such as efficiency, packaging, performance, features and recyclability. We assign each sustainability attribute a point value, and products that earn enough points bear the seal. Those that haven't earned enough points may still be very environmentally friendly. However, this seal is simply a way to make finding the best of the best easier.

**SUSTAINABILITY STANDOUTS**

We're working to bring the Sustainability Standout seal to all the products that qualify. Look for it on upcoming product pages, videos, and other marketing materials to help you identify the product solutions that have earned a closer look.

Look for the Sustainability Standout seal on marketing & training materials.

[RUUD.COM/SUSTAINABILITY](http://RUUD.COM/SUSTAINABILITY)

VIDEOS



[Ruud.com/Progress](http://Ruud.com/Progress)



# HOW THE SUSTAINABILITY STANDOUT SEAL IS EARNED

We created a **proprietary point system** to look at the Earth-friendly and user-friendly attributes of the product like:

- Efficiency
- Packaging
- Performance
- Smart Features
- Recyclability



*This product meets a stringent set of our internally defined sustainability standards*

We assign each sustainability attribute a **point value** and products that earn enough points bear the seal.

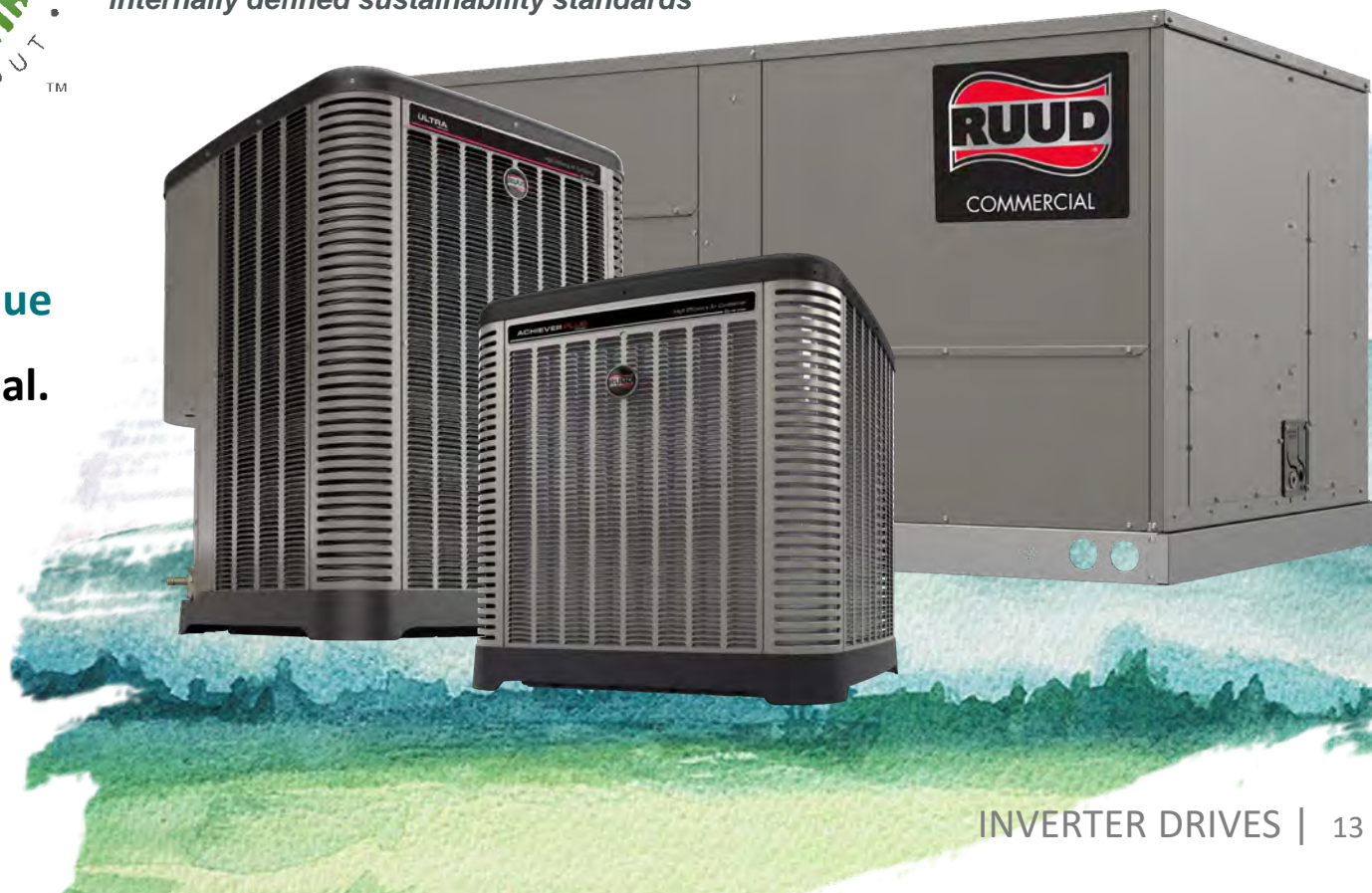
Examples of our products that have earned the

**Sustainability Standout seal include the**

**Ultra Series UA20, Ultra Series UP20,**

**Ultra Series U98V, Achiever Plus Series RGEA14U**

**and Renaissance RACDZT**





# INVERTER OVERVIEW



# WHAT IS AN INVERTER SYSTEM?

- A compressor powered by a simulated AC sinewave from an inverter that can electronically vary compressor speed
- Varying compressor speed varies refrigerant flow
- Varying refrigerant flow varies system capacity





# BENEFITS OF AN INVERTER SYSTEM

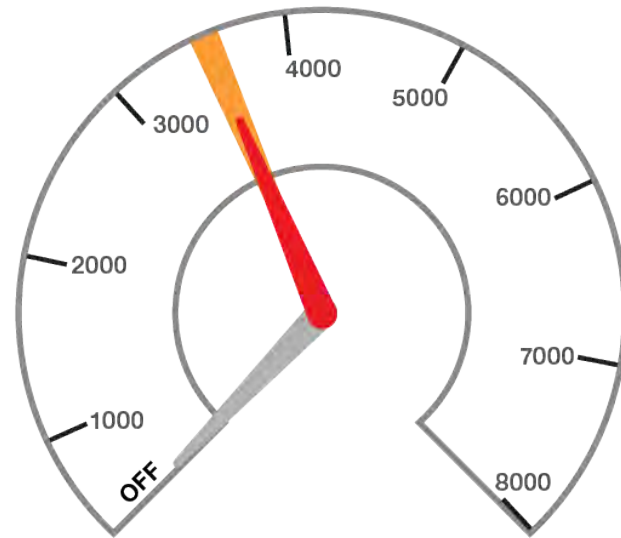
- **Improved energy efficiency** with zero startup energy use and compressor speed modulation
- **Superior home comfort** with precise temperature control and optimal dehumidification
- **Flexible adjustment** of system capacity to closely match building loads
- **Longer life** due to eliminating wear and tear from cycling
  - 10-year unit replacement warranty offered on inverter heat pump and AC applications (RA/RP18, RA/RP16)
- **EcoNet integration** for enhanced efficiency and control



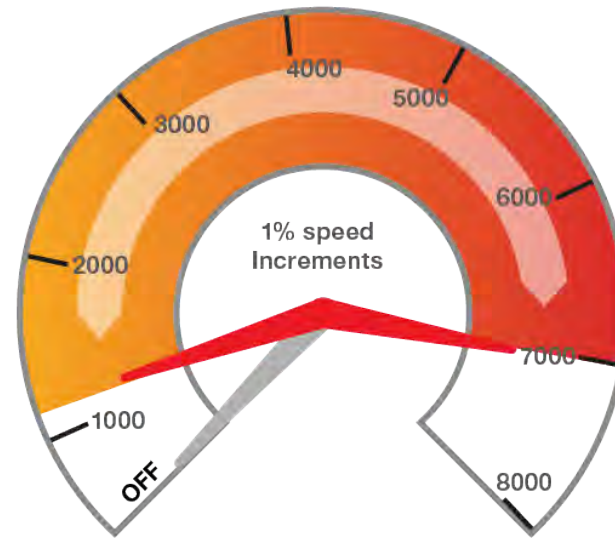


# INVERTER OVERVIEW

- Converts AC Line Voltage Input to DC/Simulated AC Voltage Output
- Compressor is a 3 Phase motor
- Output Voltage from Inverter varies speed of compressor



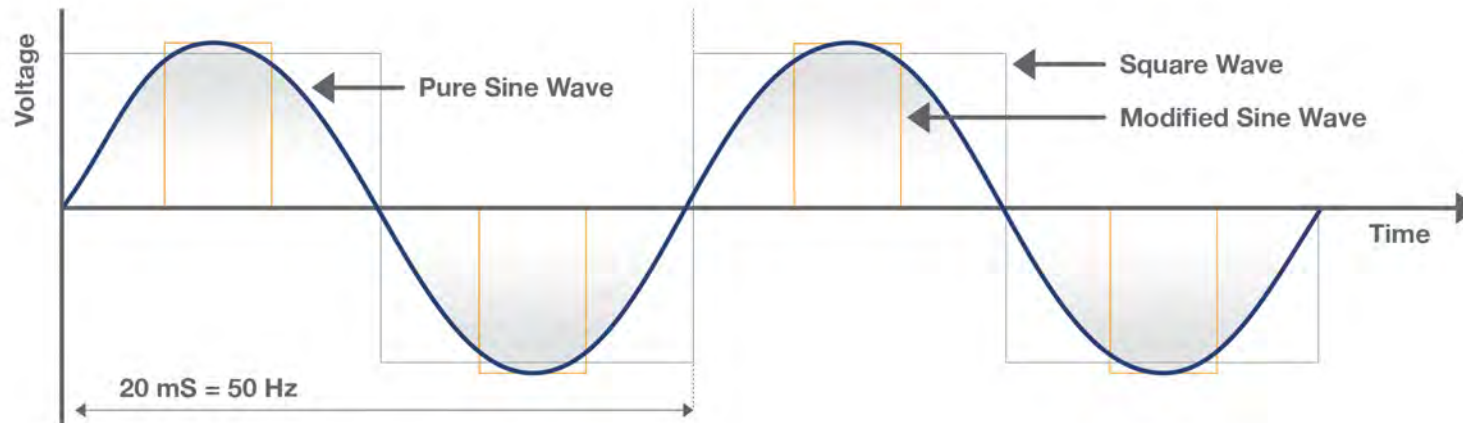
**Single-Stage Compressor**  
3600 RPM



**Variable-Speed Compressor**  
1200–7000 RPM

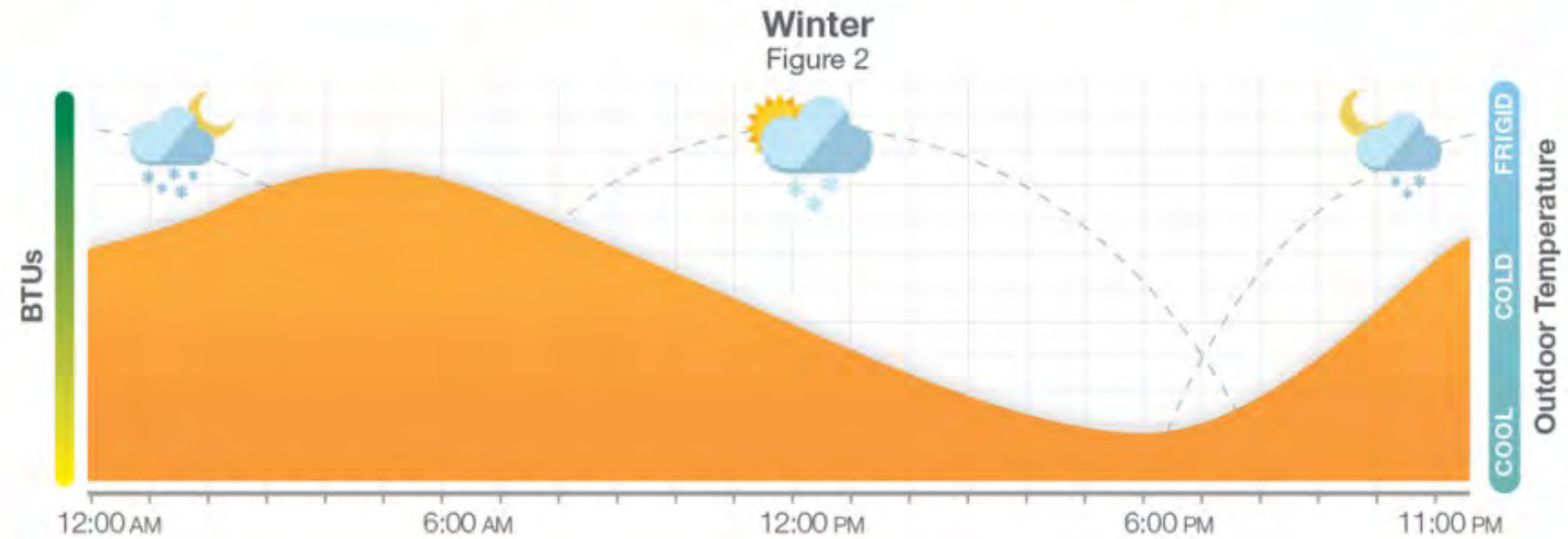
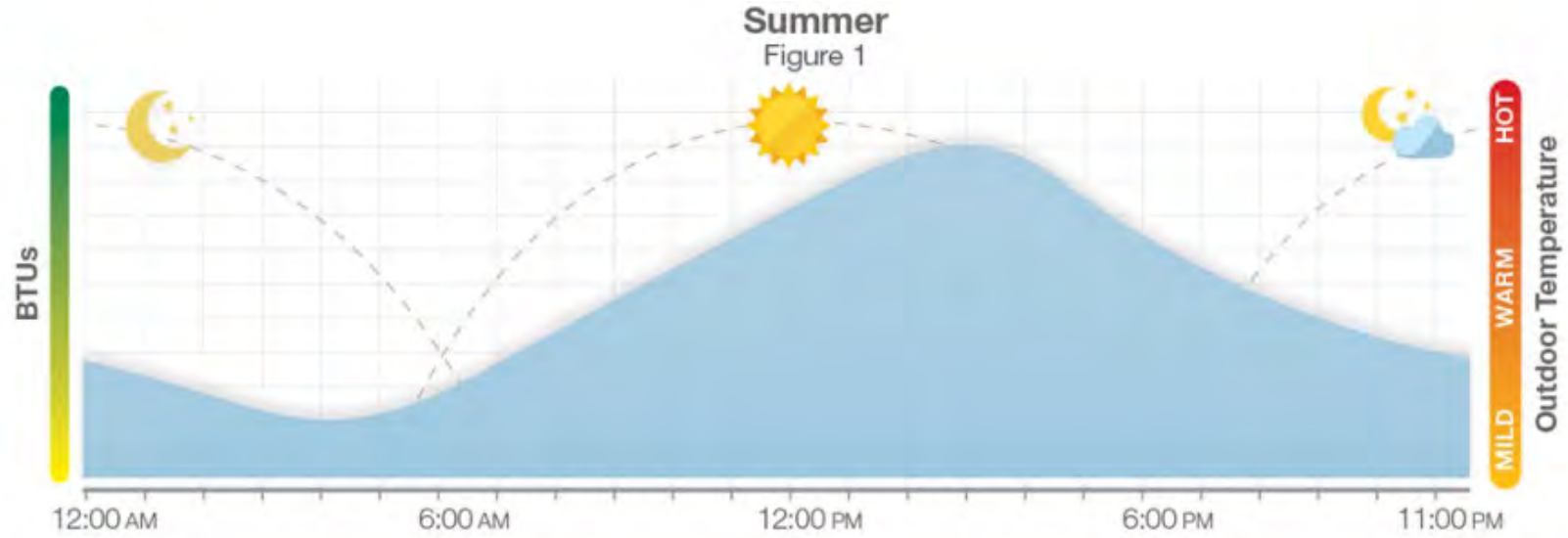


- This is not a DC compressor, it is a 3 phase AC compressor
  - Not an off-the-shelf compressor; it's design to run variable speeds
- Single phase AC input voltage
- The inverter converts that to a DC voltage
- Then, it builds a simulated AC sine wave to run a 3 phase compressor



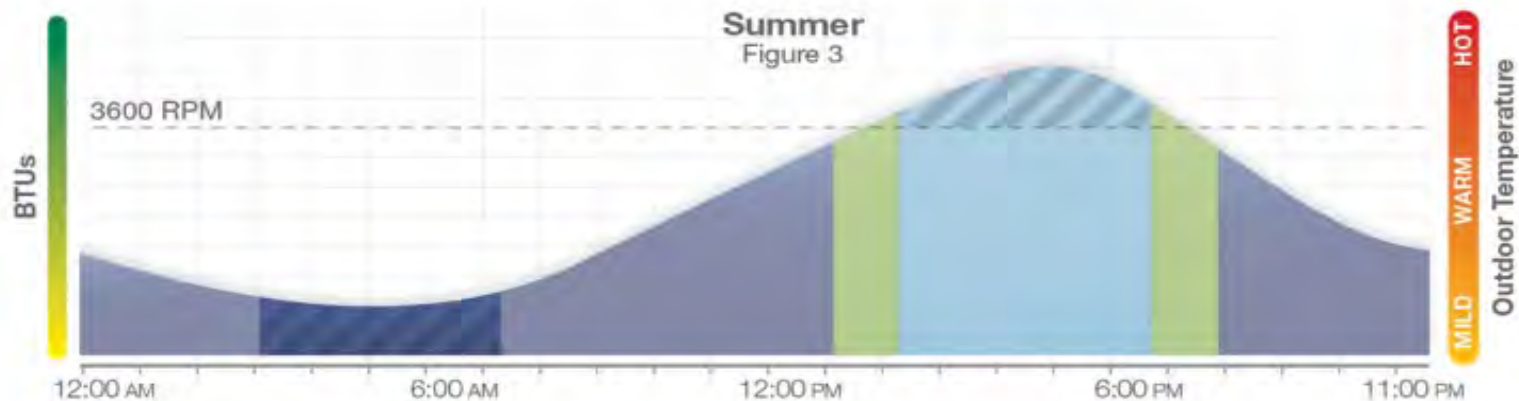


# WHY VARIABLE SPEED?

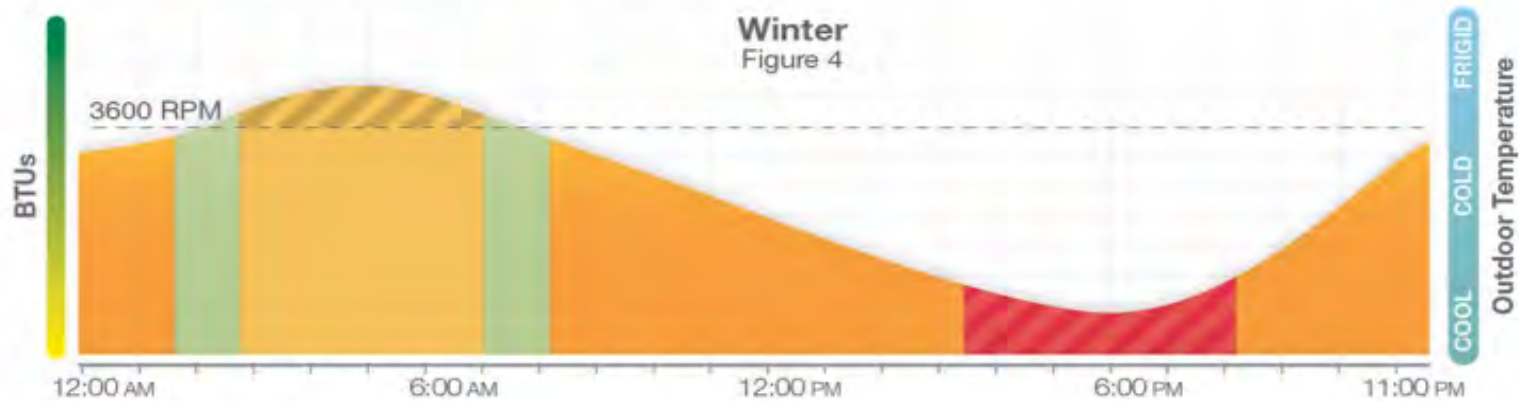




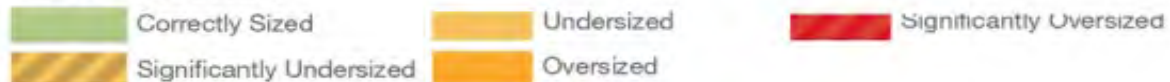
# WHY VARIABLE SPEED?



### Unit Cooling Capacity



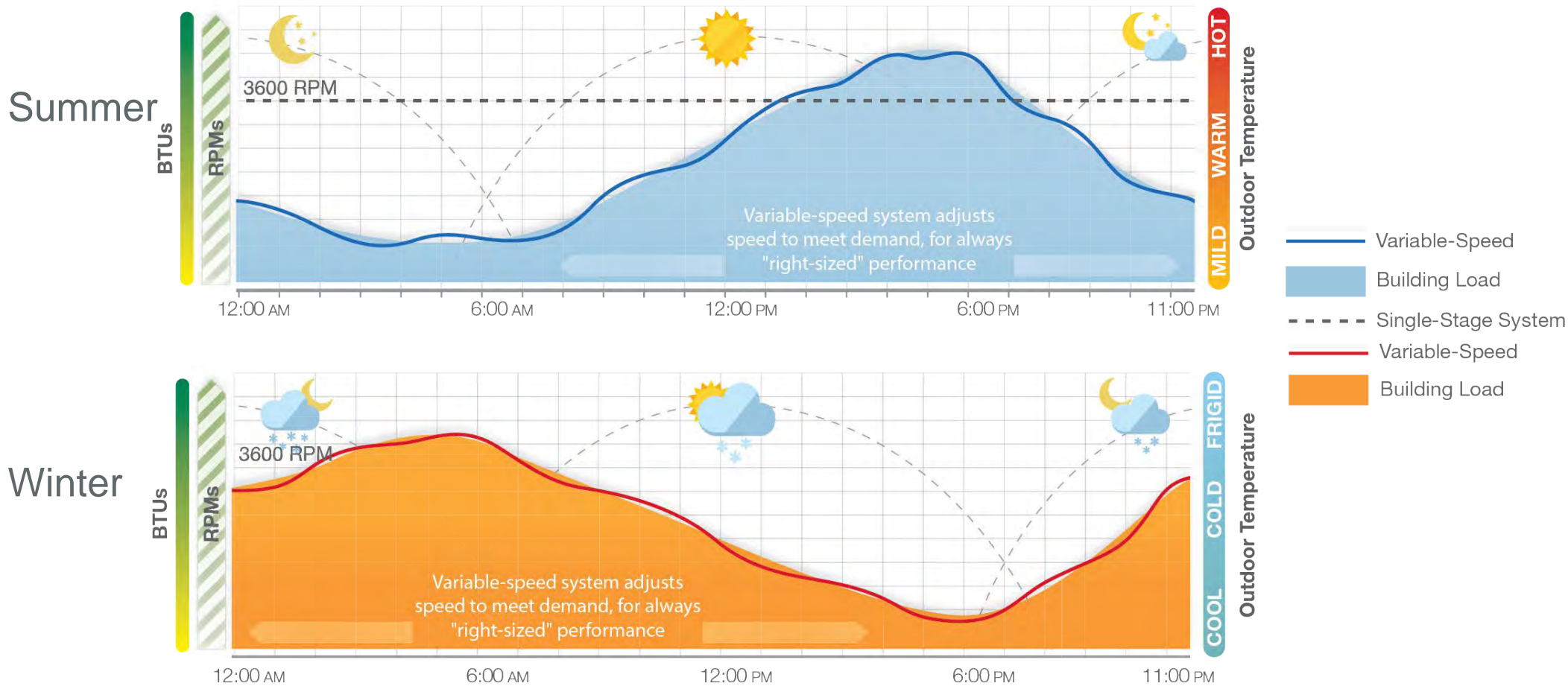
### Unit Heating Capacity





# WHY VARIABLE SPEED?

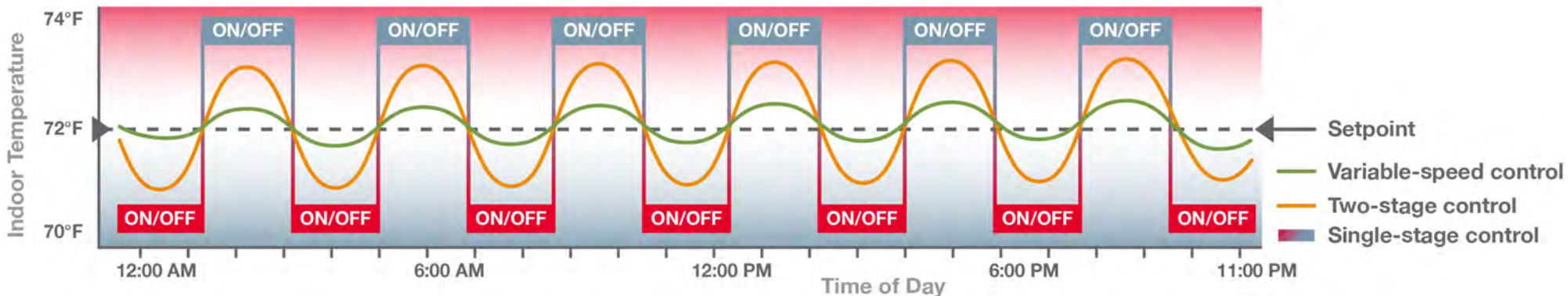
## Seasonal, 24-Hour Cooling & Heating Requirements for the Home: Variable-Speed Operation



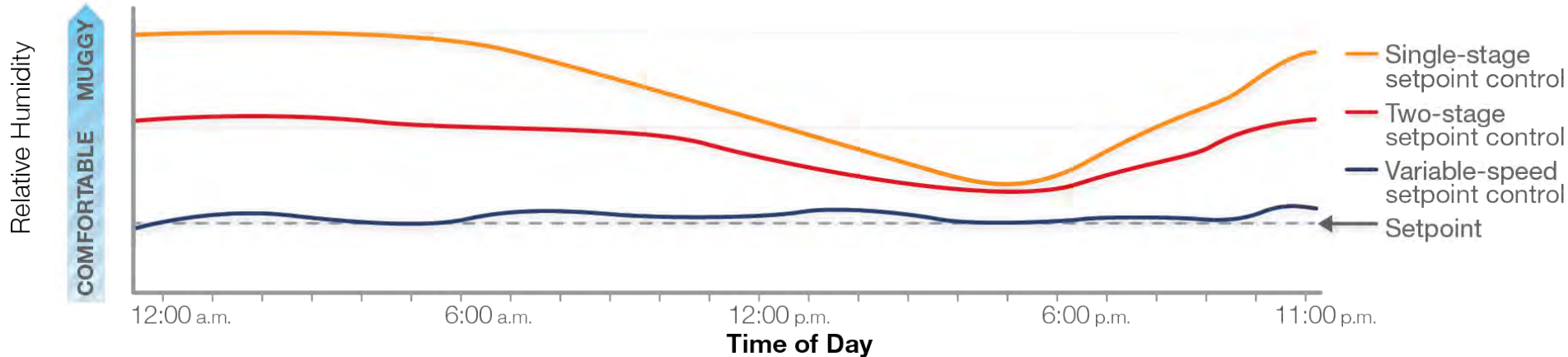


# WHY VARIABLE SPEED?

## Cooling & Heating Temperature Setpoint Profile



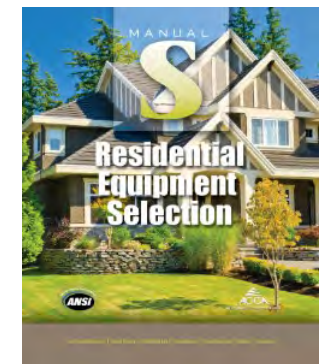
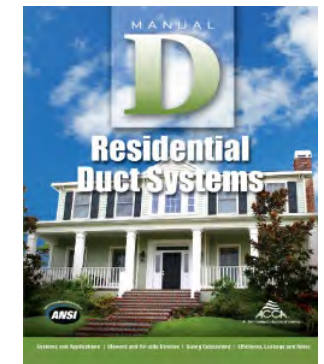
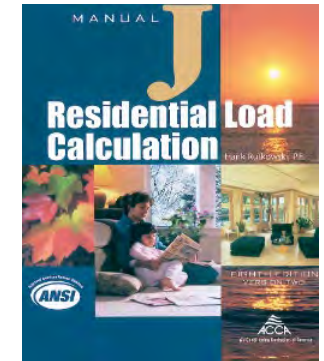
## Summer Cooling Load Profile: Relative Humidity





# LOAD CALCULATIONS – SIZING EQUIPMENT

- Higher efficiency systems must operate (and be installed) closer to design to take advantage of full system performance.
  - Always perform a heat loss/heat gain load calculation to ensure the correct sized components are used.
- For residential/light commercial applications, manual J provides reliable accurate results.
  - An undersized or oversized system will cause problems with poor cooling/heating or poor dehumidification and leave the homeowner with an inefficient system.
  - Sizing or picking the equipment based on the “what’s there now” theory is not a good idea, since performance data for each system will vary.
- Properly sized systems reduce the wear and tear associated with short-cycling, promote air circulation to cut down on inefficient over-conditioning, and improve humidity removal so comfort can be achieved at a higher cooling temperature. All of this is good for energy efficiency, cost, and carbon footprint.
- ACCA manual D is used for proper sizing of ducts.





# LOAD CALCULATIONS – SIZING EQUIPMENT

- Requirements for efficiency and performance make it essential to have certifiable equipment combinations and rated capacities
- Rated capacity (BTU/H) is only possible from matched systems
- Matches and Performance Data found on MyRuud/PTS or AHRI.org

## Performance Data @ AHRI Standard Conditions – Cooling

Designated Tested Combination (DTC)												
Outdoor Unit	Air Handler	Total Capacity BTU/H [kW]	Net Sensible BTU/H [kW]	Net Latent BTU/H [kW]	SEER2	EER2	Indoor CFM [L/s]	47 Degree Heating Capacity BTU/H [kW]	47 Degree COP	17 Degree Heating Capacity BTU/H [kW]	17 Degree COP	Region IV HSPF2
RP16AZ24AJ3	RH3VZ2417STACN	22800 [6.7]	17545 [5.1]	4740 [1.4]	16.0	11.0	800 [378]	22800 [10760.5]	3.50	13800 [4.0]	2.40	8.0
RP16AZ36AJ3	RH3VZ3617STACN	34200 [10.0]	25800 [7.6]	8900 [2.6]	16.0	11.0	1100 [519]	34200 [16140.7]	3.20	21700 [6.4]	2.30	7.9
RP16AZ48AJ3	RH3VZ4821STACN	45800 [13.4]	34000 [10.0]	11950 [3.5]	16.0	10.9	1500 [708]	44600 [21049.0]	3.40	28800 [8.4]	2.40	8.0
RP16AZ60AJ3	RH3VZ6024STACN	55000 [16.1]	41300 [12.1]	13700 [4.0]	16.0	10.3	1750 [826]	54000 [25485.3]	3.20	35900 [10.5]	2.40	8.0

**NOTE:** This data includes DTC (Designated Test Combination) ratings and is for reference purposes only. A full listing of official ratings and system match-ups, along with downloadable certificates, can be accessed from the AHRI website: [www.ahridirectory.org](http://www.ahridirectory.org).



# IMPORTANCE OF PROPER LINE SIZING

- Like proper load calculations, line sizing is critical
- Using the wrong line set can cause performance issues and, ultimately, compressor failure
- Existing lines sets cannot be used if they don't meet new system specifications
- Line set considerations:
  - Additional refrigerant charge
  - Fitting losses and maximum equivalent length considerations
  - Refrigerant migration during the off cycle
  - Oil return to the compressor
  - Capacity losses
  - System oil level adjustment
- Find line set information in I&Os and spec sheets

**Table 2A: Refrigerant Line Sizing Chart (English Units)**

15/16 SEER2 Variable Speed Heat Pumps								
Unit Size	Allowable Liquid Line Size	Allowable Vapor Line Size	Outdoor Unit ABOVE or BELOW Indoor Unit					
			Equivalent Length (Feet)					
			<25	26-50	51-75	76-100	101-125	126-150
Maximum Vertical Separation / Capacity Multiplier								
2.0 Ton *SEE NOTE 3	1/4"	5/8"	25 / 1.00	50 / 0.99	33 / 0.98	6 / 0.97	NR	NR
	5/16"	5/8"	25 / 1.00	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96	50 / 0.95
	3/8"	5/8"	25 / 1.00	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96	50 / 0.95
	1/4"	3/4"*	25 / 1.00	50 / 1.00	33 / 0.99	6 / 0.99	NR	NR
	5/16"	3/4"*	25 / 1.00	50 / 1.00	50 / 0.99	50 / 0.99	50 / 0.99	50 / 0.98
3 Ton	3/8"	3/4"*	25 / 1.00	50 / 1.00	50 / 0.99	50 / 0.99	50 / 0.99	50 / 0.98
	5/16"	5/8"	25 / 0.99	50 / 0.97	50 / 0.95	50 / 0.93	36 / 0.91	NR
	3/8"	5/8"	25 / 0.99	50 / 0.97	50 / 0.95	50 / 0.93	50 / 0.91	NR
	5/16"	3/4"	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	36 / 0.97	20 / 0.96
4 Ton	3/8"	3/4"	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96
	1/2"	3/4"	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96
	3/8"	7/8"	25 / 0.99	50 / 0.98	50 / 0.96	50 / 0.95	50 / 0.93	50 / 0.92
	1/2"	7/8"	25 / 0.99	50 / 0.98	50 / 0.96	50 / 0.95	50 / 0.93	50 / 0.92
5 Ton **SEE NOTE 4	3/8"	7/8"	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.98	50 / 0.97
	1/2"	7/8"	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.98	50 / 0.97
	3/8"	3/4"	25 / 0.98	50 / 0.97	50 / 0.95	50 / 0.93	46 / 0.91	NR
	1/2"	3/4"	25 / 0.98	50 / 0.97	50 / 0.95	50 / 0.93	50 / 0.91	NR
	3/8"	7/8"	25 / 0.99	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96	38 / 0.95
5 Ton **SEE NOTE 4	1/2"	7/8"	25 / 0.99	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96	50 / 0.95
	3/8"	1-1/8" **	25 / 1.00	50 / 1.00	50 / 1.00	50 / 0.99	50 / 0.99	38 / 0.99
5 Ton **SEE NOTE 4	1/2"	1-1/8" **	25 / 1.00	50 / 1.00	50 / 1.00	50 / 0.99	50 / 0.99	50 / 0.99
	1/2"	1-1/8" **	25 / 1.00	50 / 1.00	50 / 1.00	50 / 0.99	50 / 0.99	50 / 0.99

**Notes:**

- 1) Do not exceed 150 ft linear line length.
- 2) Do not exceed 50 ft vertical separation between indoor and outdoor units.
- 3) \* 3/4" vapor line should only be used for 2 ton systems if outdoor unit is below or at same level as indoor unit to assure proper oil return.
- 4) \*\* 1-1/8" vapor line should only be used for 5 ton systems if outdoor unit is below or at same level as indoor unit to assure proper oil return.
- 5) Always use the smallest liquid line allowable to minimize refrigerant charge.
- 6) Applications shaded in light gray indicate capacity multipliers between 0.90 and 0.96 which are not recommended, but are allowed.
- 7) Applications shaded in dark gray are not recommended due to excessive liquid or suction pressure drop.





MID-TIER INVERTERS  
(RA15AZ, UA16AZ, UP16AZ)



# MID-TIER CONTROL PANEL

Modbus to P1 on UODC

Inverter drive

Ferrite ring

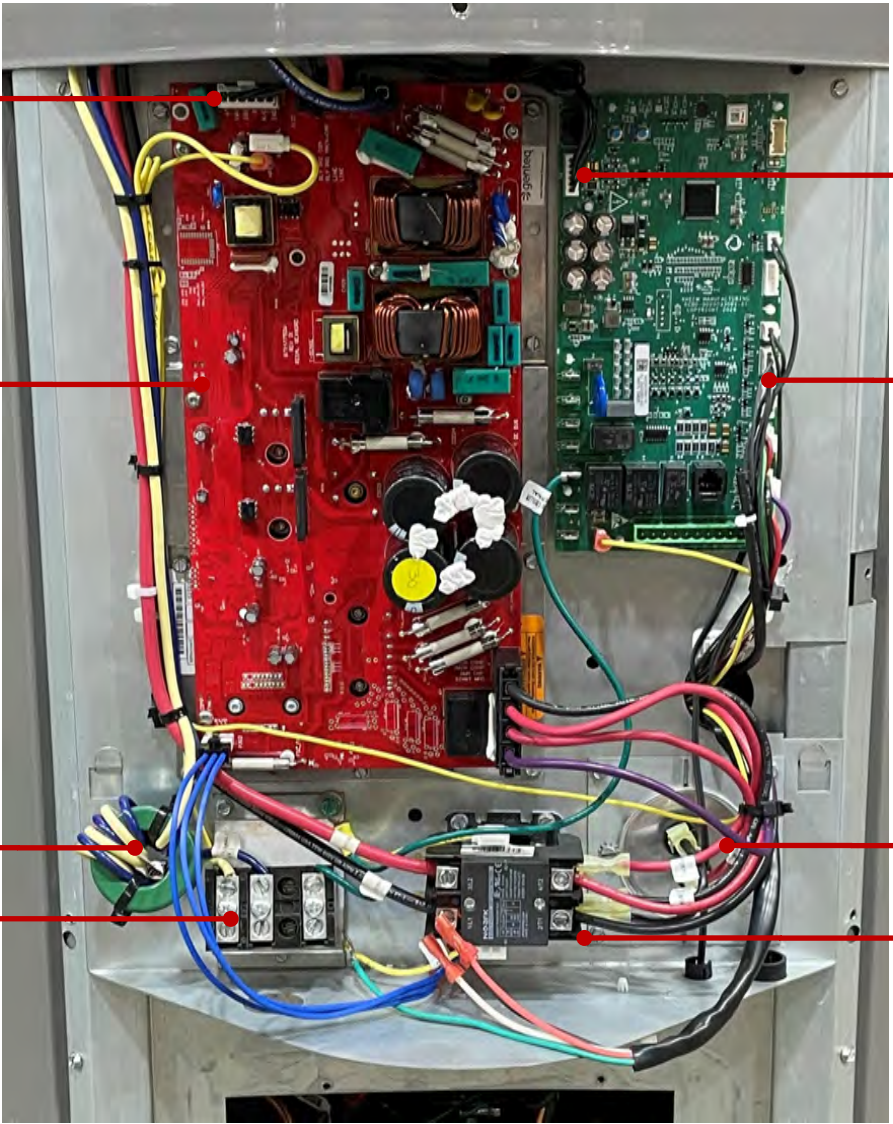
Terminal block

Modbus to J130 on drive

Universal outdoor control (UODC)

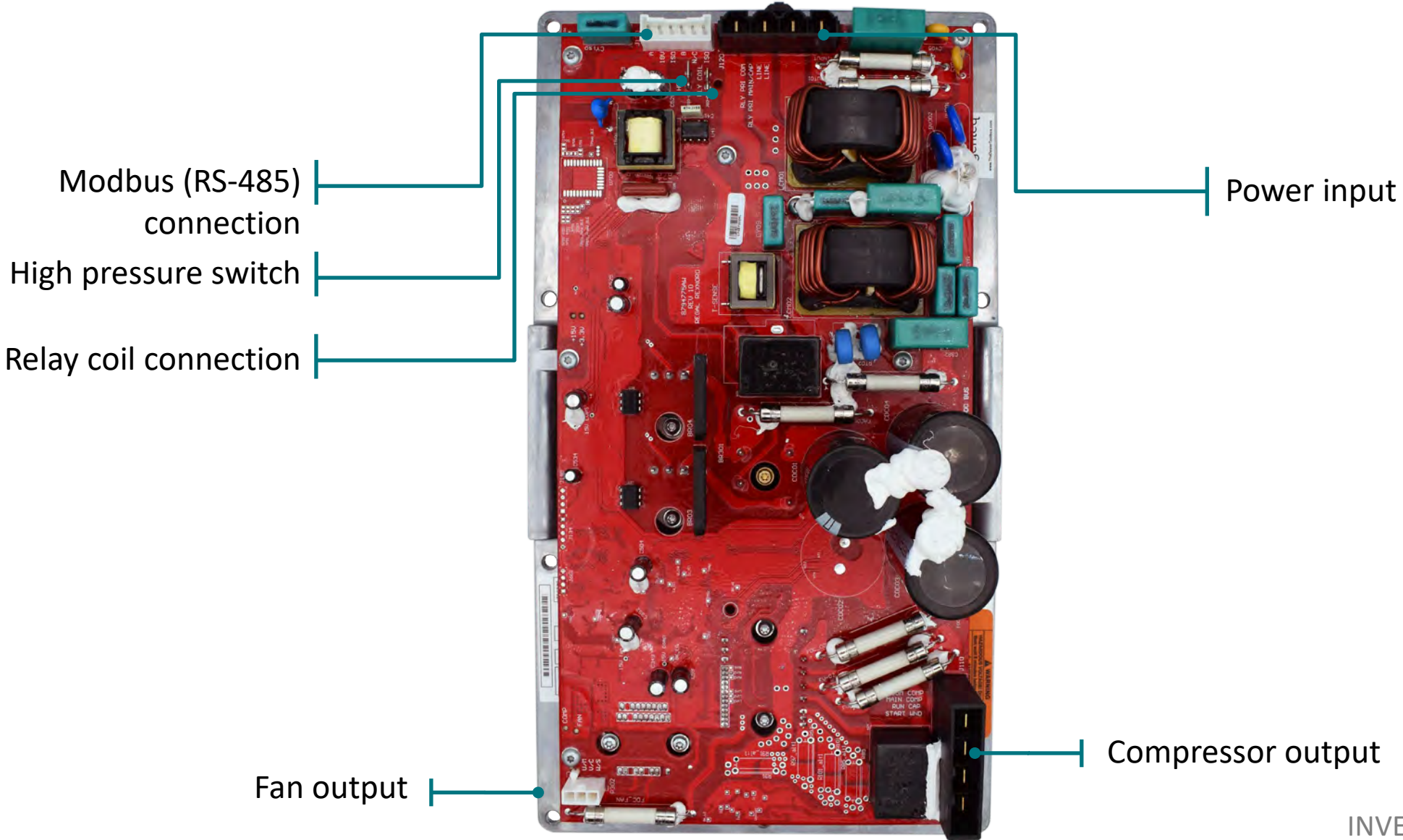
Capacitor

Contractor



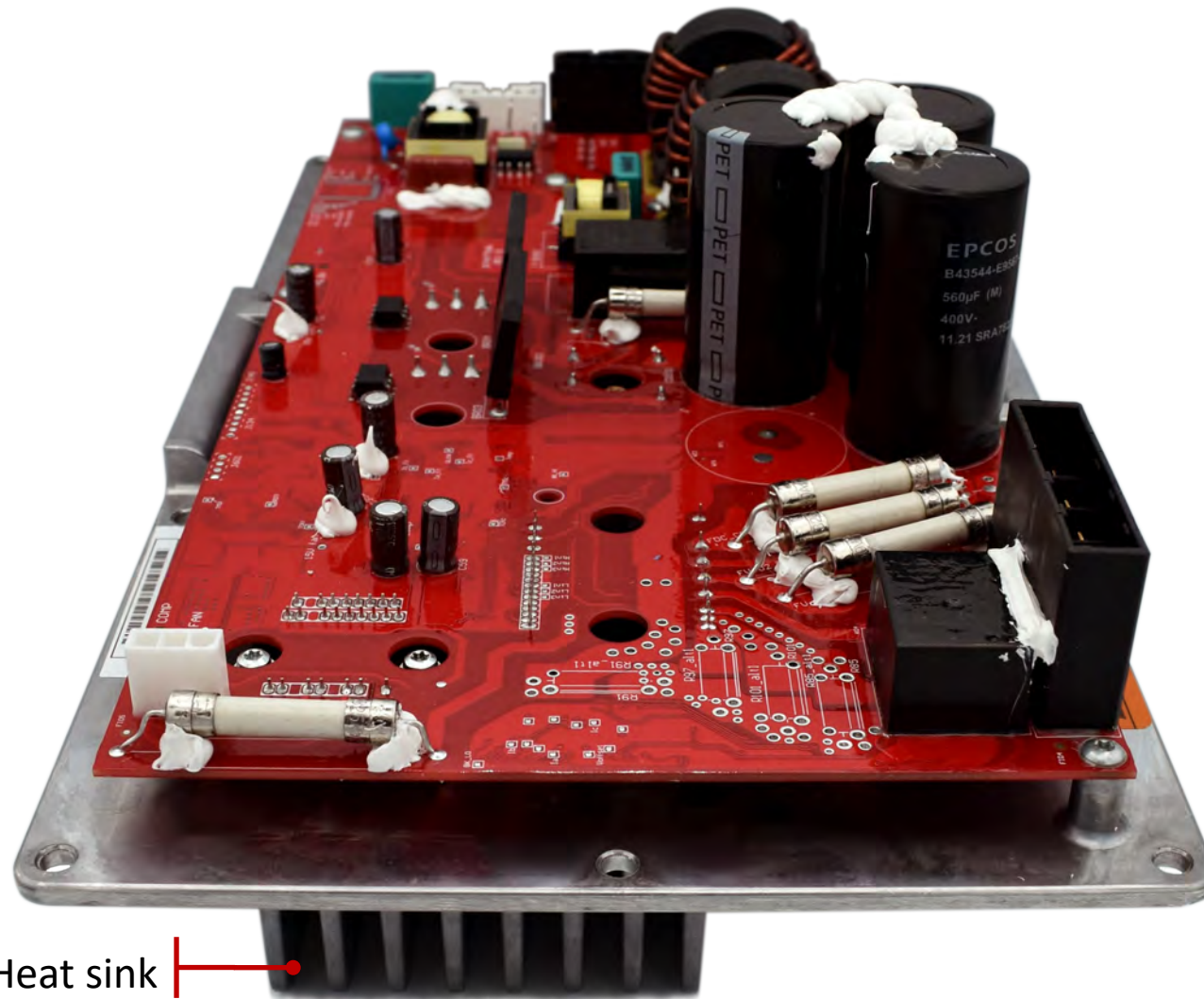


# MID-TIER INVERTER DRIVE





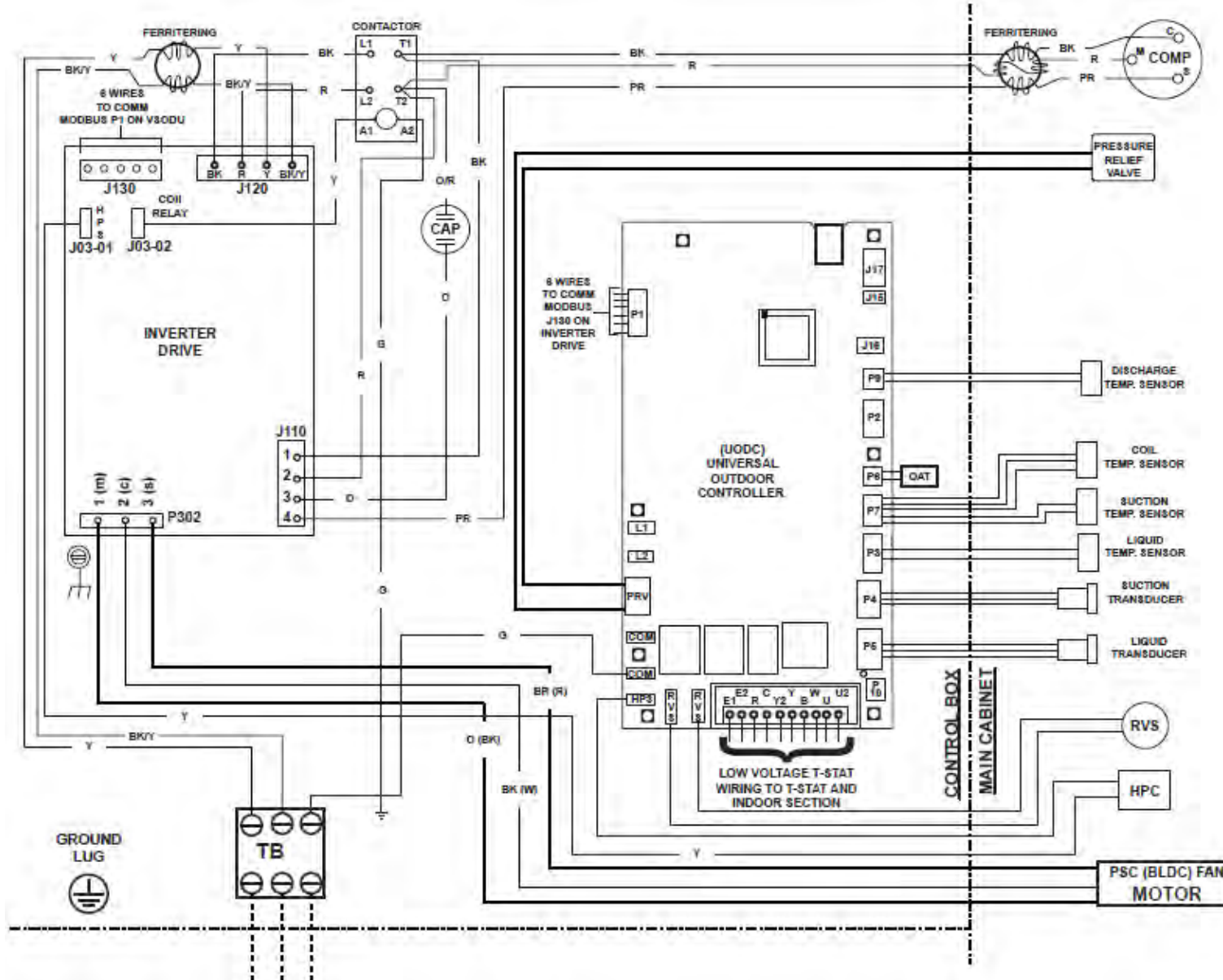
# MID-TIER INVERTER DRIVE (CONT'D)









Heat sink



# MID-TIER HP – WIRING DIAGRAM



## WIRING INFORMATION

- LINE VOLTAGE**  
 -FACTORY STANDARD   
 -FACTORY OPTION   
 -FIELD INSTALLED   
**LOW VOLTAGE**  
 -FACTORY STANDARD   
 -FIELD INSTALLED   
 -REPLACEMENT WIRE   
 -MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105C. MIN.)

**WARNING**  
 -CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., NATIONAL WIRING REGULATIONS, AND LOCAL CODES AS APPLICABLE.

## WIRE COLOR CODE

- BK.....BLACK G.....GREEN PR.....PURPLE  
 BR.....BROWN G Y .....GRAY R.....RED  
 BL.....BLUE O.....ORANGE W .....WHITE  
 Y .....YELLOW

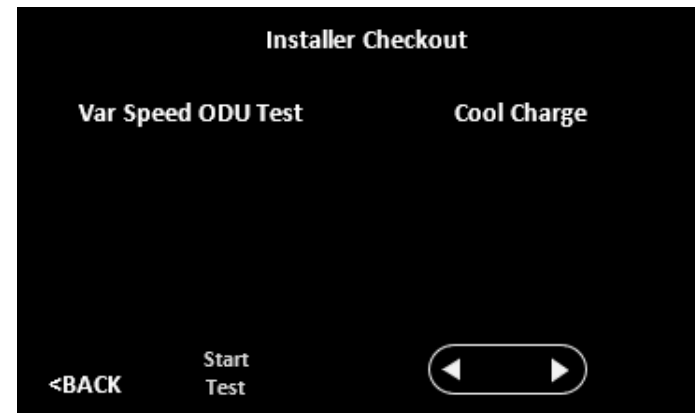
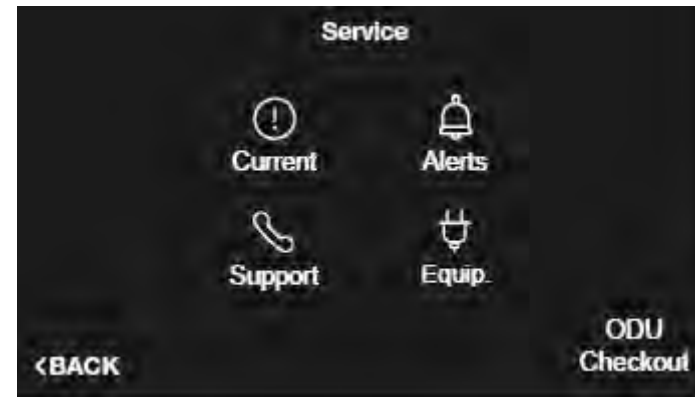
## COMPONENT CODES

- CAP CAPACITOR  
 COM COMMON  
 COMP COMPRESSOR  
 DLT DISCHARGE LINE THERMISTOR  
 GND GROUND  
 HPC HIGH PRESSURE CONTROL  
 HPS HIGH PRESSURE SWITCH  
 OAT OUTDOOR AMBIENT TEMPERATURE  
 OFM OUTDOOR FAN MOTOR  
 PRV PRESSURE RELIEF VALVE  
 RVS REVERSING VALVE SOLENOID  
 TB TERMINAL BLOCK



## EcoNet<sup>®</sup> Enabled

- Charge mode with EcoNet Smart Thermostat
- Menu > Service > ODU Checkout
- Use arrows to select Heat Charge (or Cool Charge) and then tap Start Test.
- Once the system is in charge mode, wait at least 15 minutes before making any charge adjustments.
- Once charging is complete, tap Stop Test.

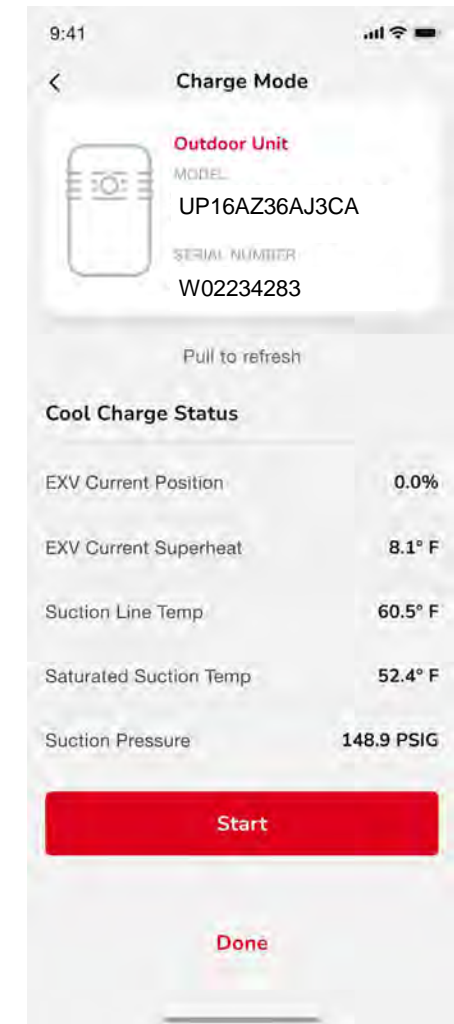
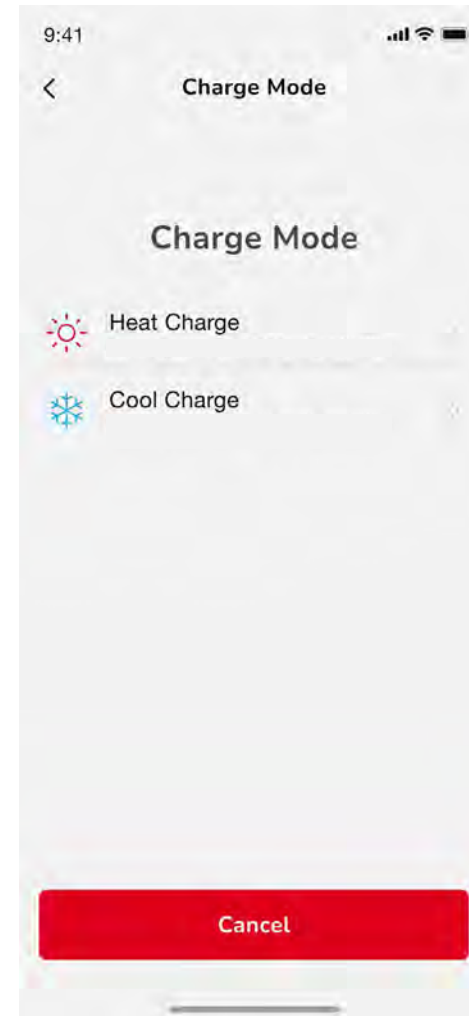




# CONTRACTOR APP CHARGING

The Contractor App allows you to put ODU in charge mode:

- Doesn't require thermostat to be on
- Select the Charge Mode (Heat or Cool)
- Start/Stop Charge Mode from the app
- Monitor the charge status





## HIGH-TIER INVERTERS (UA18AZ/UP18AZ)





# HIGH-TIER CONTROL PANEL

MODBUS cable from RS485  
to P1 on UODC

Inverter drive (EVA3)

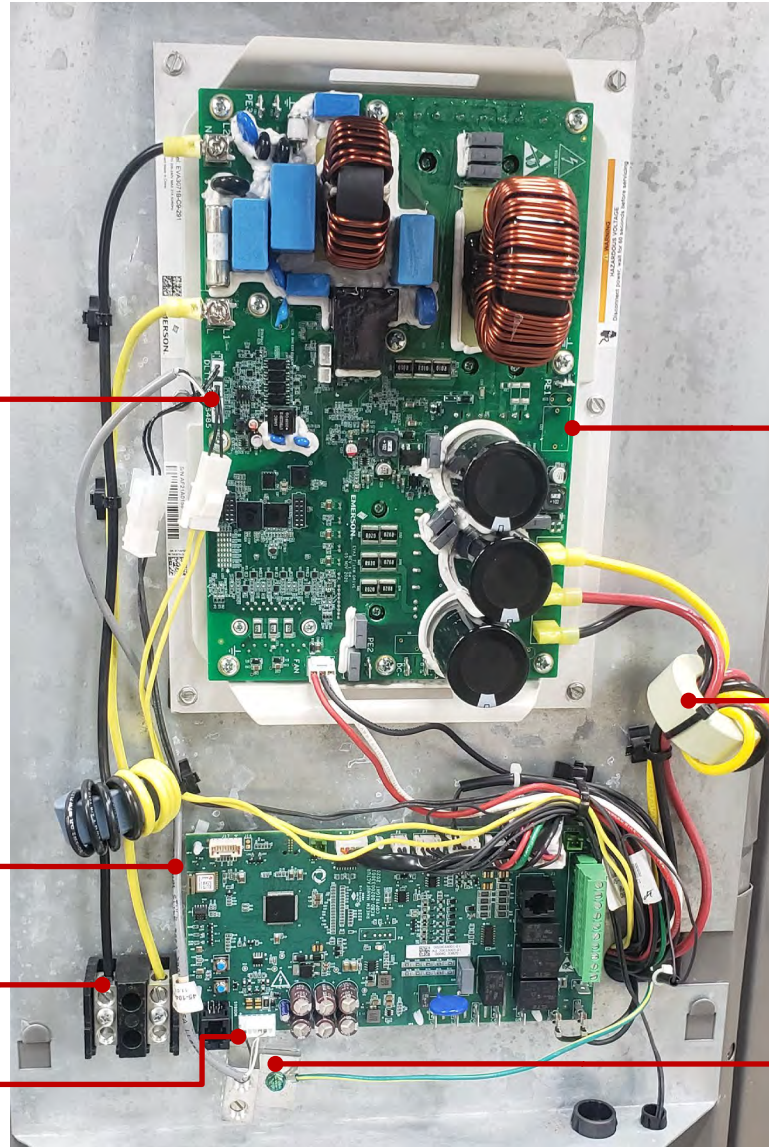
Ferrite ring

Universal outdoor control  
(UODC)

Incoming power terminal  
block

MODBUS from P1  
to RS485 on drive

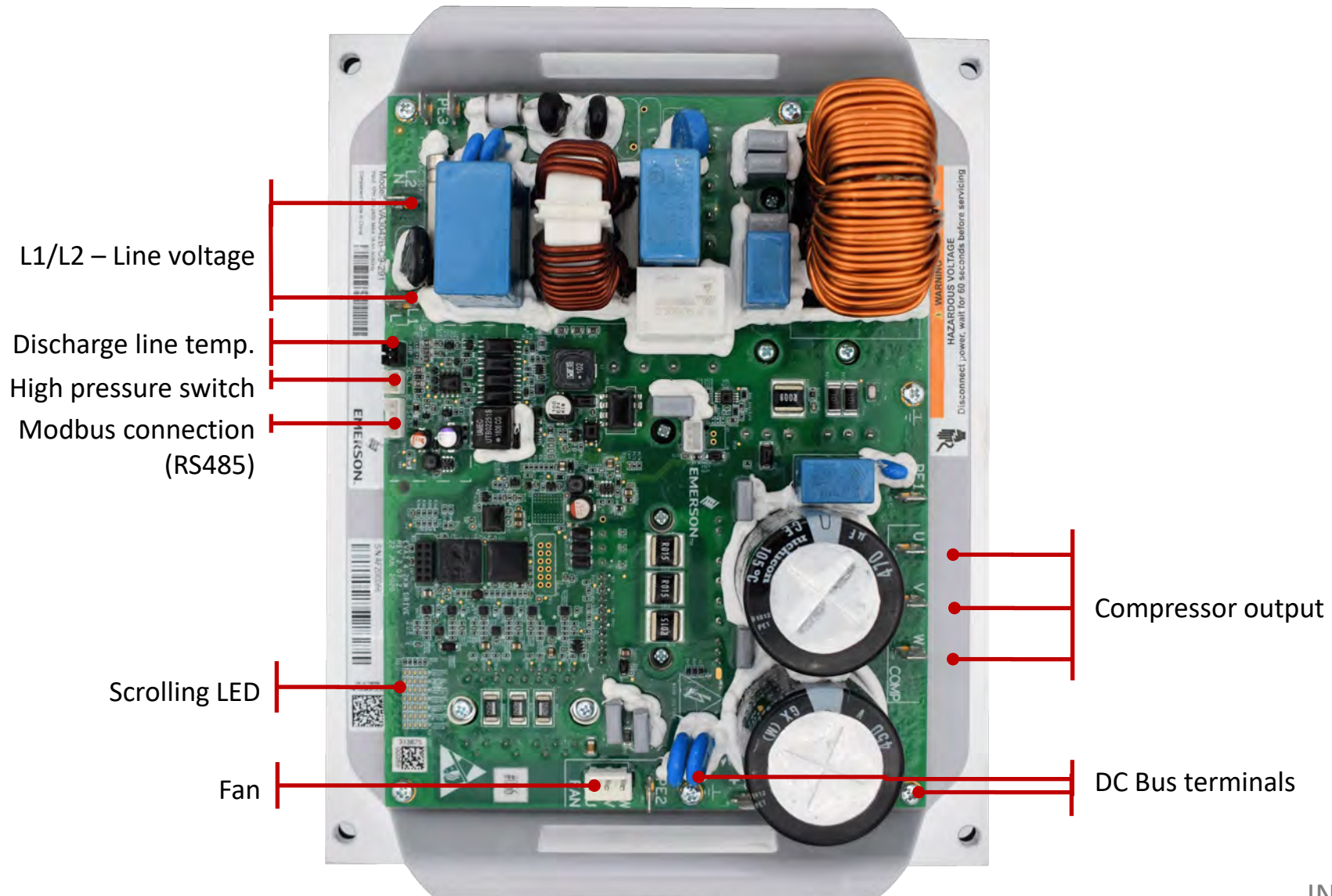
Grounding





# HIGH-TIER INVERTER DRIVE

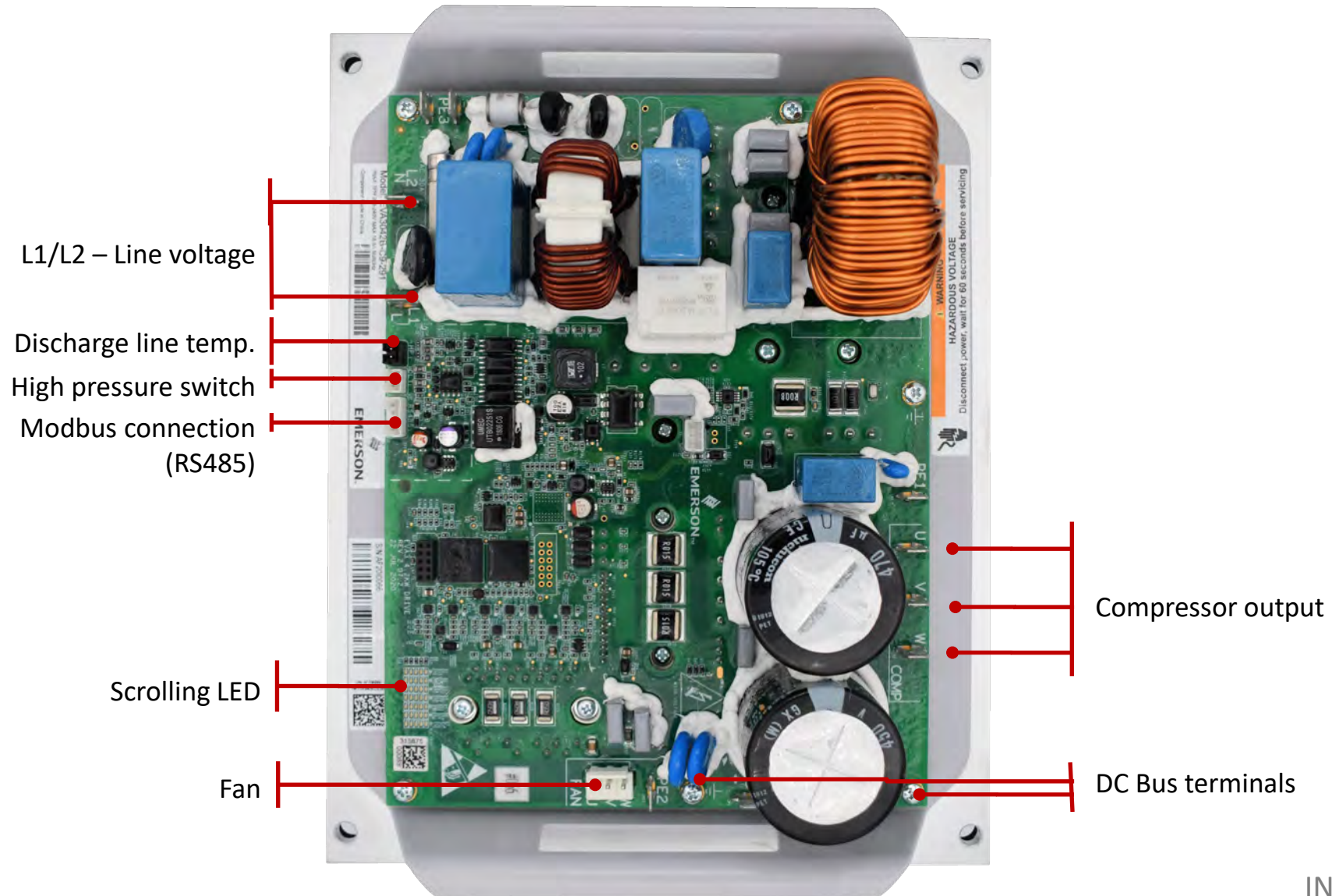
7.1 KW





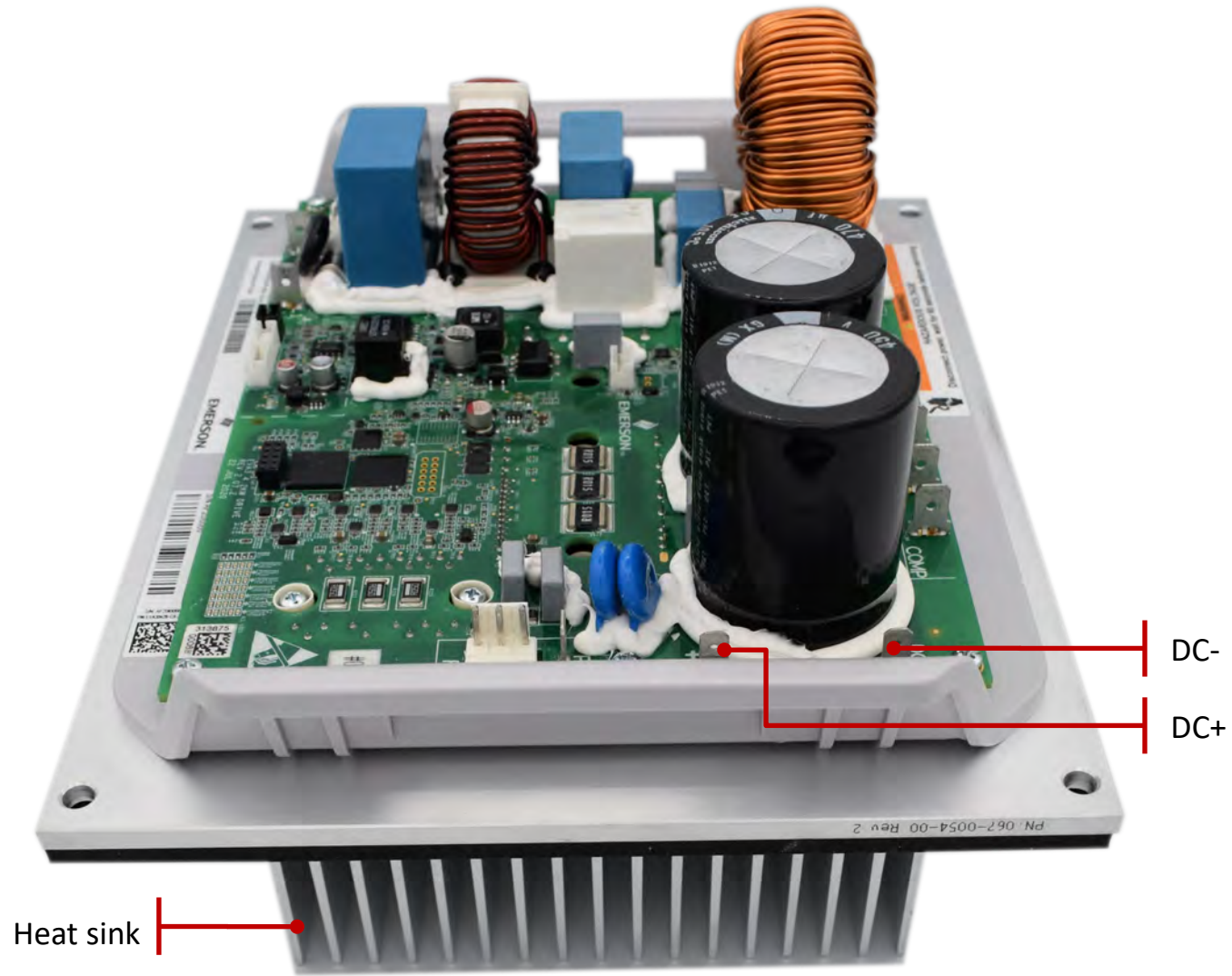
# HIGH-TIER INVERTER DRIVE

4.2KW



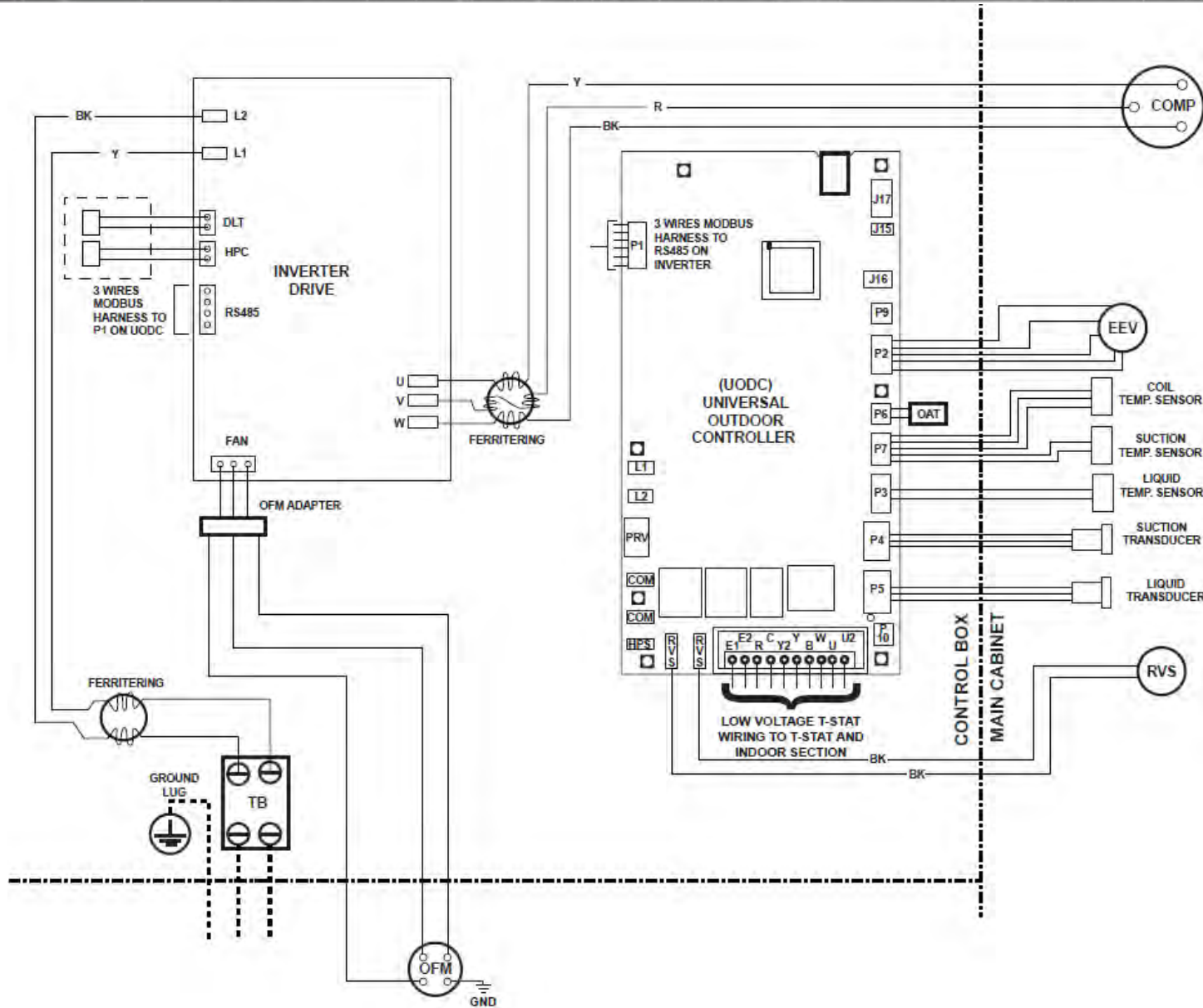


# HIGH-TIER INVERTER DRIVE (CONT'D)





# HIGH-TIER HP – WIRING DIAGRAM



## WIRING INFORMATION

- LINE VOLTAGE**  
 -FACTORY STANDARD   
 -FACTORY OPTION   
 -FIELD INSTALLED
- LOW VOLTAGE**  
 -FACTORY STANDARD   
 -FIELD INSTALLED   
 REPLACEMENT WIRE
- MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105C. MIN.)
- WARNING**  
 -CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., NATIONAL WIRING REGULATIONS, AND LOCAL CODES AS APPLICABLE.

## WIRE COLOR CODE

- BK.....BLACK G.....GREEN PR.....PURPLE  
 BR.....BROWN G Y.....GRAY R.....RED  
 BL.....BLUE O.....ORANGE W.....WHITE  
 Y.....YELLOW

## COMPONENT CODES

- CAP CAPACITOR  
 COM COMMON  
 COMP COMPRESSOR  
 DLT DISCHARGE LINE THERMISTOR  
 EVAP COIL TEMP  
 EEV ELECTRONIC EXPANSION VALVE  
 GND GROUND  
 HPC HIGH PRESSURE CONTROL  
 HPS HIGH PRESSURE SWITCH  
 LPT LIQUID PRESSURE TRANSDUCER  
 OAT OUTDOOR AMBIENT TEMPERATURE  
 OFM OUTDOOR FAN MOTOR  
 OLT OUTDOOR LIQUID TEMPERATURE  
 OST OUTDOOR SUCTION TEMPERATURE  
 PRV PRESSURE RELIEF VALVE  
 RVS REVERSING VALVE SOLENOID  
 SPT SUCTION PRESSURE TEMPERATURE  
 TB TERMINAL BLOCK



# HIGH-TIER CHARGING PROCEDURES

## EcoNet Smart Thermostat

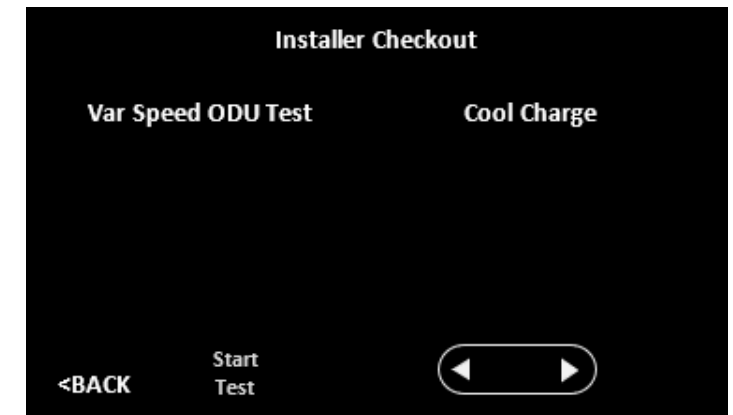
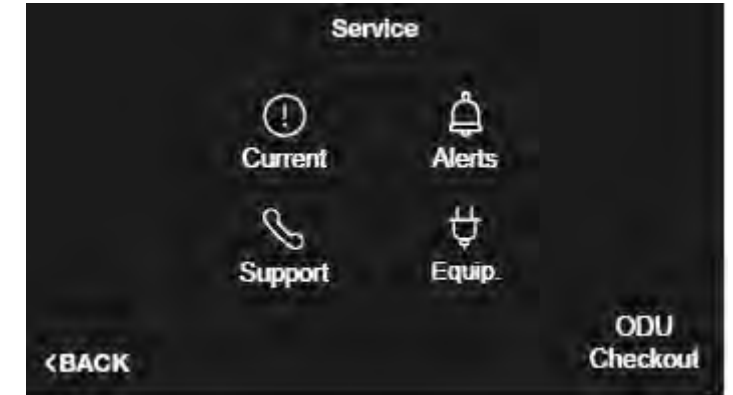
- Charge mode with EcoNet Smart Thermostat
- Menu > Service > ODU Checkout
- Use arrows to select Heat Charge (or Cool Charge) and then tap Start Test.
- Once the system is in charge mode, wait at least 15 minutes before making any charge adjustments.
- Once charging is complete, tap Stop Test.

## Contractor App

- Contractor App allows you to put ODU in charge mode
- Doesn't require thermostat to be on

## Legacy

- Legacy is for emergency use only. Unit will run as single stage unit.
- Wait at least 30 minutes before making any charge adjustments.
- Cannot use Contractor App for charging

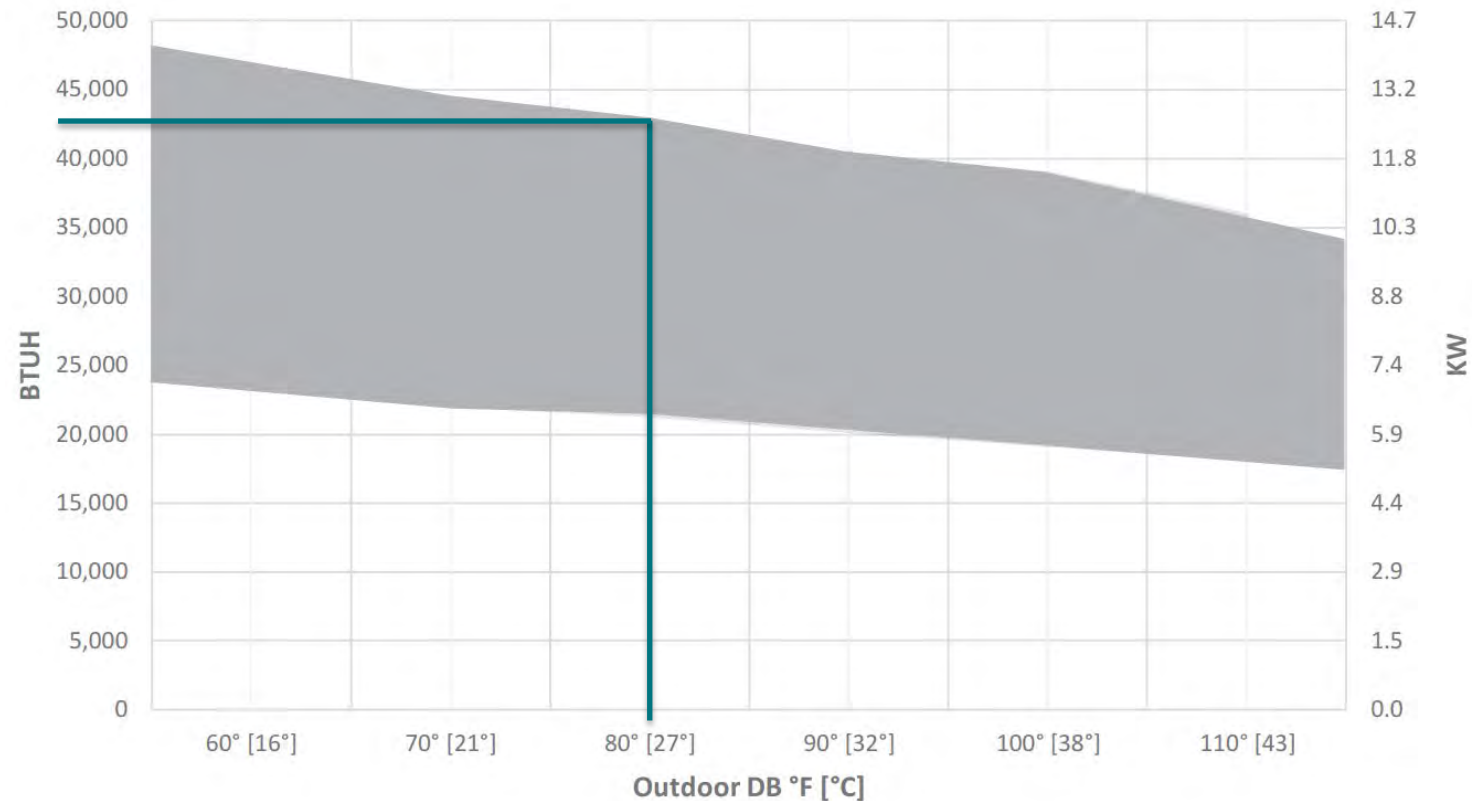




# OVERDRIVE

- Nominal speeds will be the same.
- Now the A18Z will operate like the P20B models
  - The fan speeds and compressor speeds will operate similar to the P20B
  - No temperature trigger any more
- Based on deviation from setpoint
  - Proportional Integral Derivative (PID) control
  - It's a sliding scale based on time and deviation from setpoint
    - It's looking at how far from setpoint the temperature is
    - It's also looking at how long it hasn't moved forward (or even if it's losing ground)
  - It's not a learning algorithm, just a PID algorithm

Cooling Example: 3 Ton HP





# HIGH ALTITUDE LIMITATIONS

- Still have the 2000 m limitations
- This product is not approved for installation at 6561 feet [2000 meters] above sea level or higher.
- Installation at higher altitudes may result in control and unit failures due to electrical arc tracking between electrical components on the inverter drive control board.
- Possibly resulting in fire, electrical shock, property damage, personal injury, or death







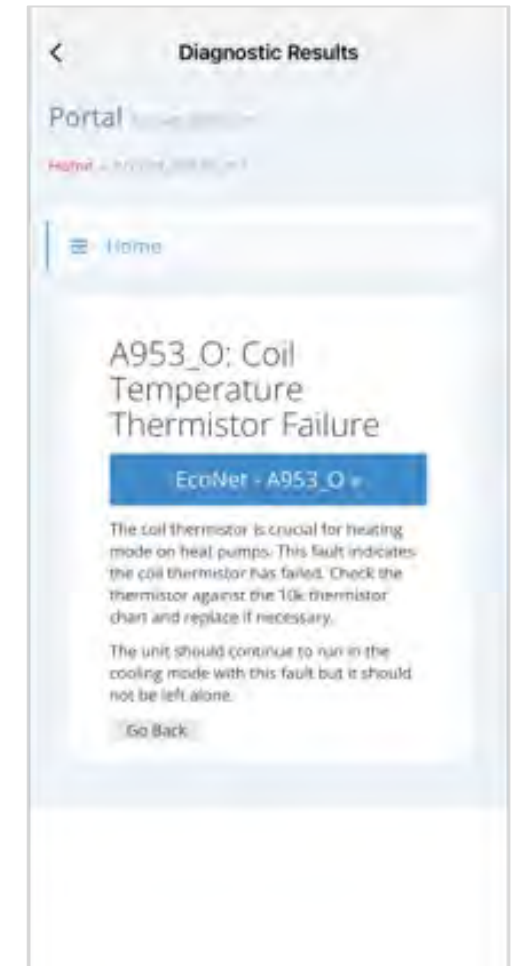
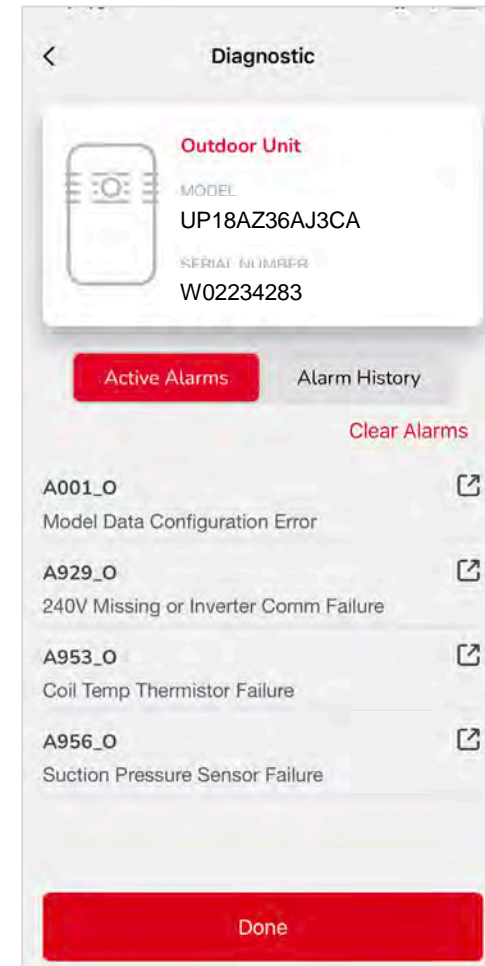
## DIAGNOSTICS & TROUBLESHOOTING



# RUNNING DIAGNOSTICS – CONTRACTOR APP

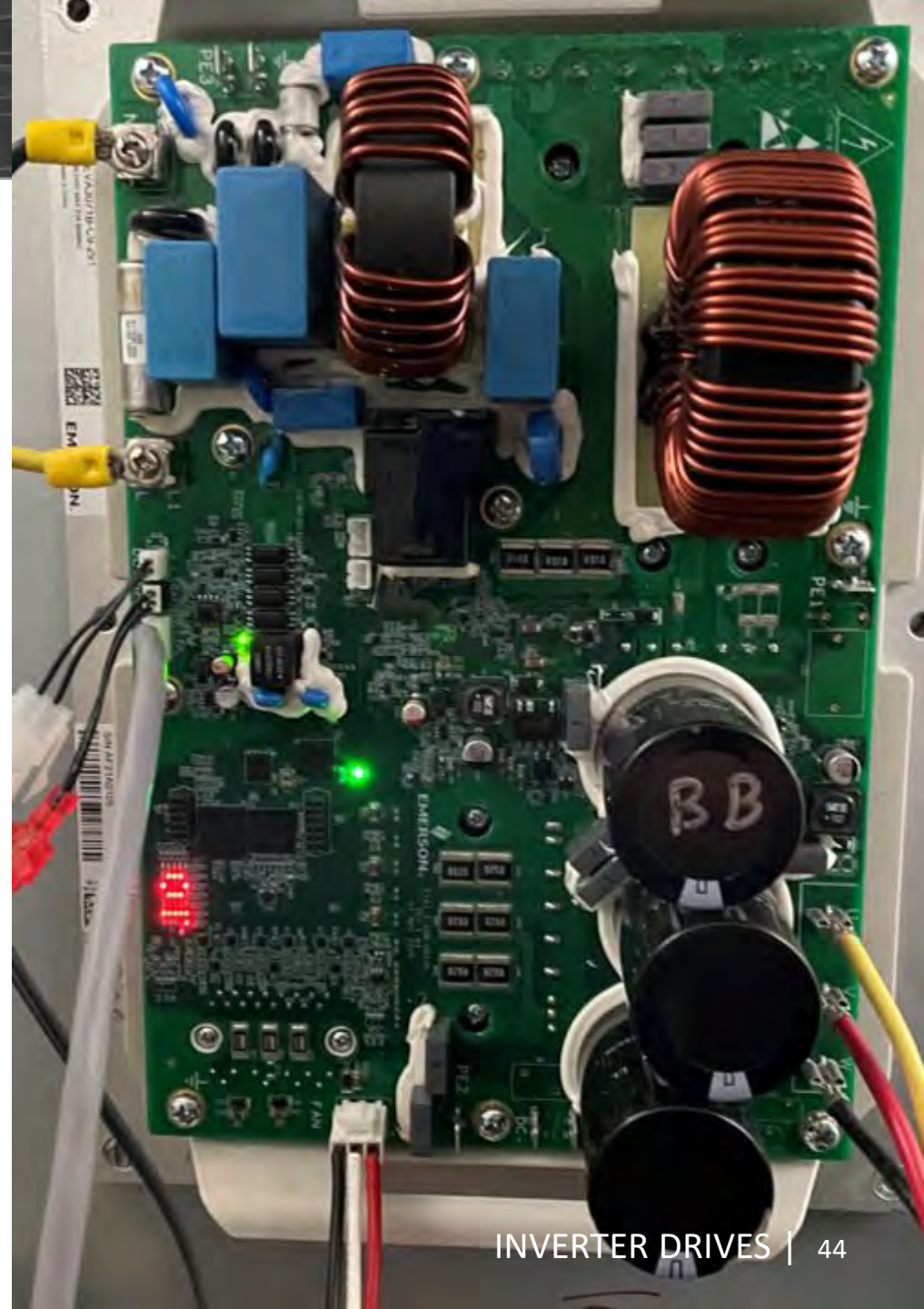
You can run a product's diagnostics via Bluetooth to check for active alarms and view the alarm history.

- 1 On the Service tab, tap **Run Diagnostic** and select the required product type.
- 2 **Optional:** If the App finds several products of the same type, select the name of the required product in the Found Products list.
- 3 Do one of the following:
  - On the Active Alarms tab, view the list of detected active alarms, their codes and description.
  - On the Alarm History tab, view records of the previously detected alarms.



# BLINKING LEDS

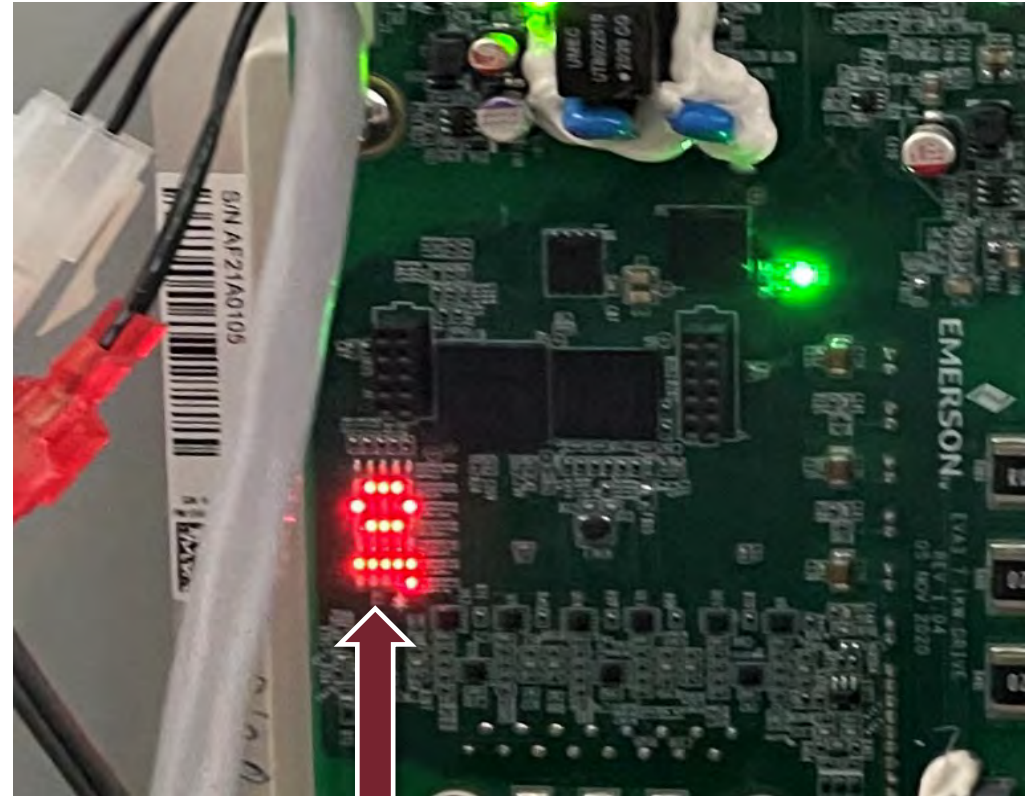
- There is a single RGB LED on the drive for troubleshooting purposes.
- Different colors and blinking rates indicate different conditions/events:
  - **Blinking RED** (fast) – There is a fault present on the drive
  - **GREEN** (0.5Hz) – There are no faults present
  - **Blinking GREEN** (1Hz) – MODBUS message successfully received





# (-)A18 AND (-)P18 DRIVE ALARMS

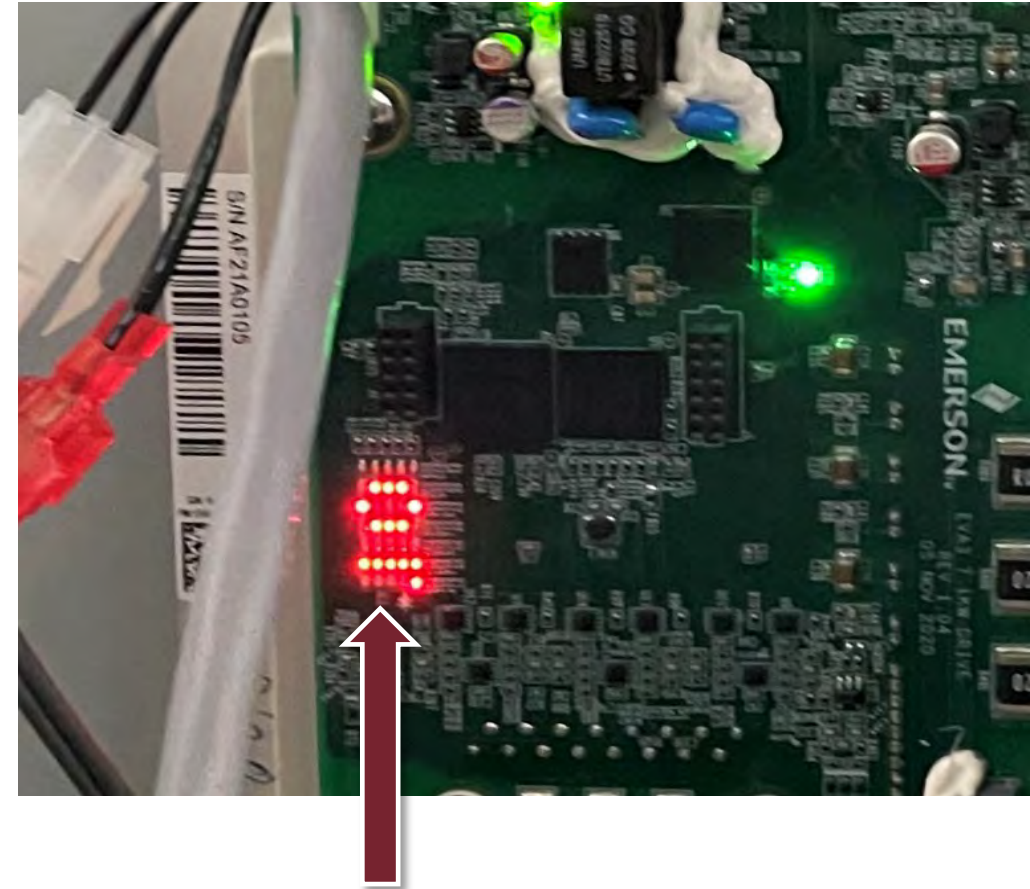
- EV3 drive has a scrolling LED display that will display faults within the drive or compressor circuit.
- The scrolling LED is located at the bottom left corner of the drive as it is situated in the control box
- On power cycle, display will scroll the software version in the drive and then display "EMERSON" unless a fault is present with the drive itself
  - If drive fault is present, an abbreviated description of the fault will scroll



# (-)A18 AND (-)P18 DRIVE ALARMS (CONT'D)

## Example:

- If the Drive loses communication with the UODC,
- Scrolling LED display will now read MODBUS COMMS LOST.
  - The EcoNet fault that corresponds with this fault is A929\_O 240V Missing or Inverter Comm Failure.
  - The UODC cannot differentiate a loss of line voltage to the OD unit and drive and a loss of communication to the drive itself as in both cases, it cannot communicate with a drive.
  - The technician should verify voltage to outdoor unit and then check the Modbus connections.





# CONTACTOR

- If replacing a contactor, must use same type of contactor
- Do not under any circumstance push in the contactor on the mid-tier inverters (-)P16Z (-)A16Z
  - It could cause bodily injury or damage
  - Not a single stage system, there's no continuous power to the other side of the contactor (must be double-pole contactor)
  - There is no troubleshooting benefit





## RESOURCES & FOLLOW-UPS



# DOWNLOADING AND INSTALLING THE CONTRACTORS APP

You can download and install the Contractor App compatible with your operating system.

The App supports iOS 13 or later and Android 7 or later.

## 1 Do one of the following:

- On the unit, locate a blue label with a QR code and scan it with your smartphone. Select your brand. You are redirected to the app download page.

or

- In Google Play Store or the App Store on your smartphone, search the name of the app.

## 2 Download and install the Contractor App.



**ATTENTION CONTRACTORS  
APP REQUIRED FOR SYSTEM SETUP!**

**1. DOWNLOAD THE  
CONTRACTORS APP**  
Download App Here 



**2. CONNECT TO  
BLUETOOTH® TECHNOLOGY**

FOR CONNECTION AND APP RELATED QUESTIONS, PLEASE CONTACT  
CUSTOMER SUPPORT AT: (800) 255-2388



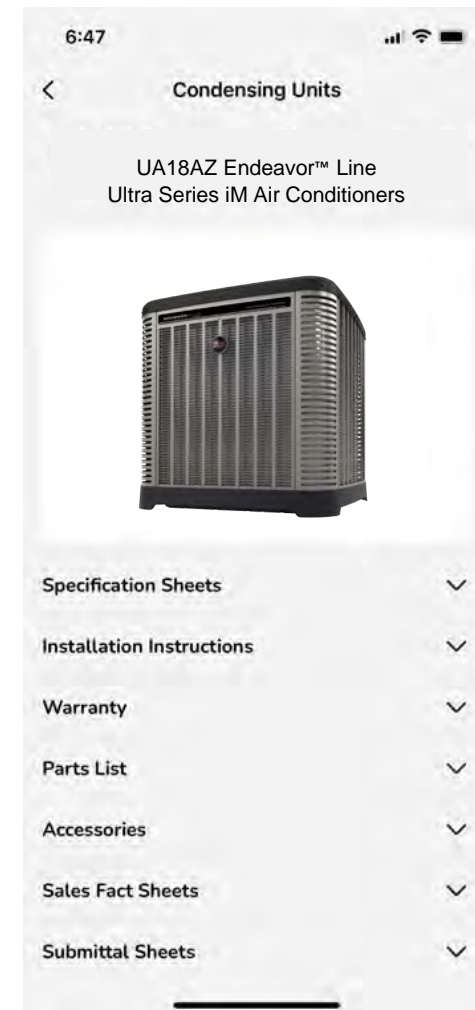
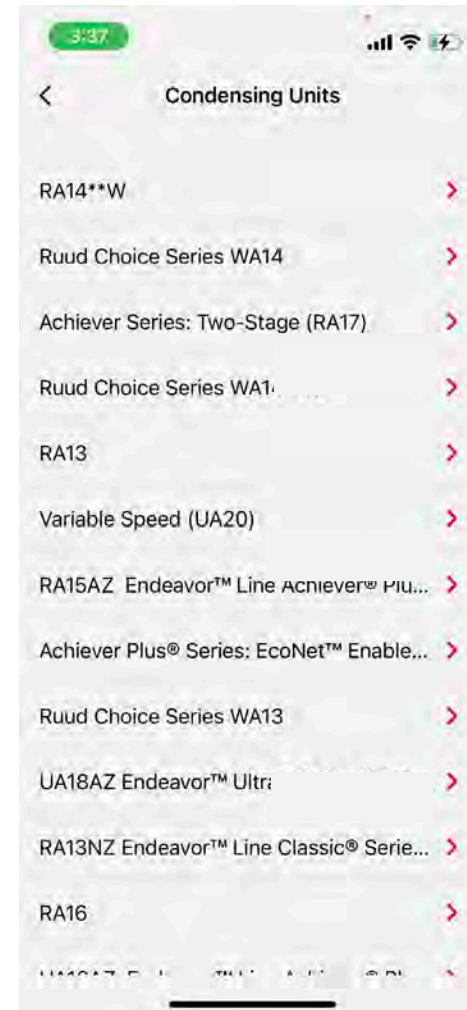
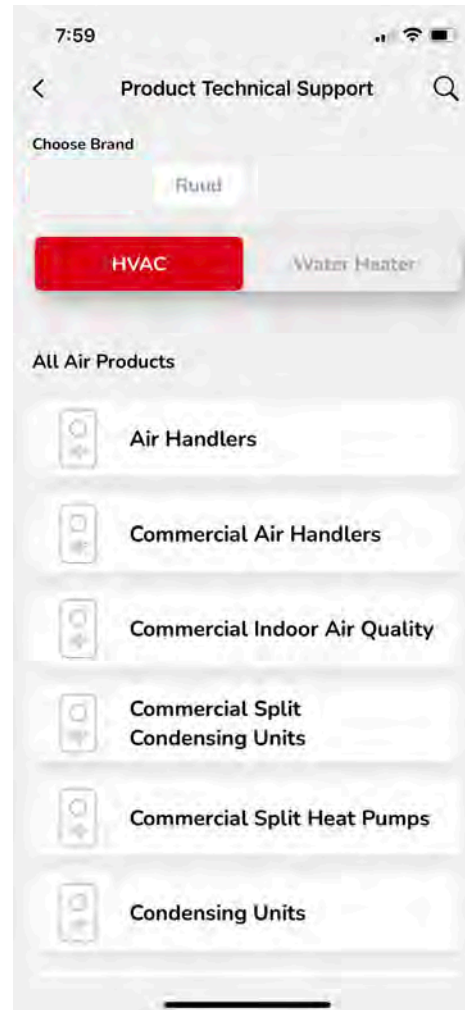
Apple and App Store are registered trademarks of Apple Inc.  
Google Play is a service provided by Google LLC.

spective owners.





- Installation Instructions
- Warranty





# SHOW CUSTOMERS HOW YOU CAN HELP THEM LIVE MORE COMFORTABLY—AND RESPONSIBLY

Learn more about the Sustainability Standout™ seal and Ruud's commitment to sustainability:

[www.Ruud.com/Sustainability](http://www.Ruud.com/Sustainability)

Download our homeowner brochure:





# KEY TAKEAWAYS

## INVERTER SYSTEMS CAN PROVIDE:

- Improved energy efficiency
- Superior home comfort
- Increased equipment life

- Higher efficiency systems must operate (and be installed) closer to design specifications to take advantage of full system performance.
- Rated capacity (BTU/H) is only possible from matched systems
- Refrigerant line sizing is critical
  - Existing lines sets cannot be used if they don't meet new system specifications
- Mid-Tier and High-Tier Systems have different inverter types
  - Mid-Tier = Regal
    - Compressors used are induction, single-phase motors
  - High-Tier = Copeland
    - Compressors used are 3 phase AC compressors designed to run variable speeds
- Charge mode is required
- Low voltage wiring will be different on Mid-Tier, OD unit always communicating
- Diagnostics can be done on Econet or the Contractor App
- Do not under any circumstance push in the contactor on the mid-tier inverters



THANK YOU!  
QUESTIONS?