

TECHNICAL GUIDE

**R-410A
ZW/ZK/ZS SERIES
15 - 25 TON
60 Hertz**



ZW/ZK Shown

Description

ZW Series/ZK Series/ZS Series units are convertible single package high efficiency rooftops. All models have independent refrigeration circuits for efficient part load operation.

Although the units are primarily designed for curb mounting on a roof, they can also be mounted at ground level or set on steel beams above a finished roof.

All ZW/ZK/ZS units are self-contained and assembled on rigid full perimeter base rails allowing for overhead rigging. Every unit is completely charged, wired, piped, and tested at the factory to provide a quick and easy field installation.

All models (including those with an economizer) are convertible between bottom and horizontal duct connections.

ZW/ZK/ZS units are available in the following configurations: cooling only, cooling with electric heat, and cooling with gas heat. Electric heaters are available as factory-installed options only.

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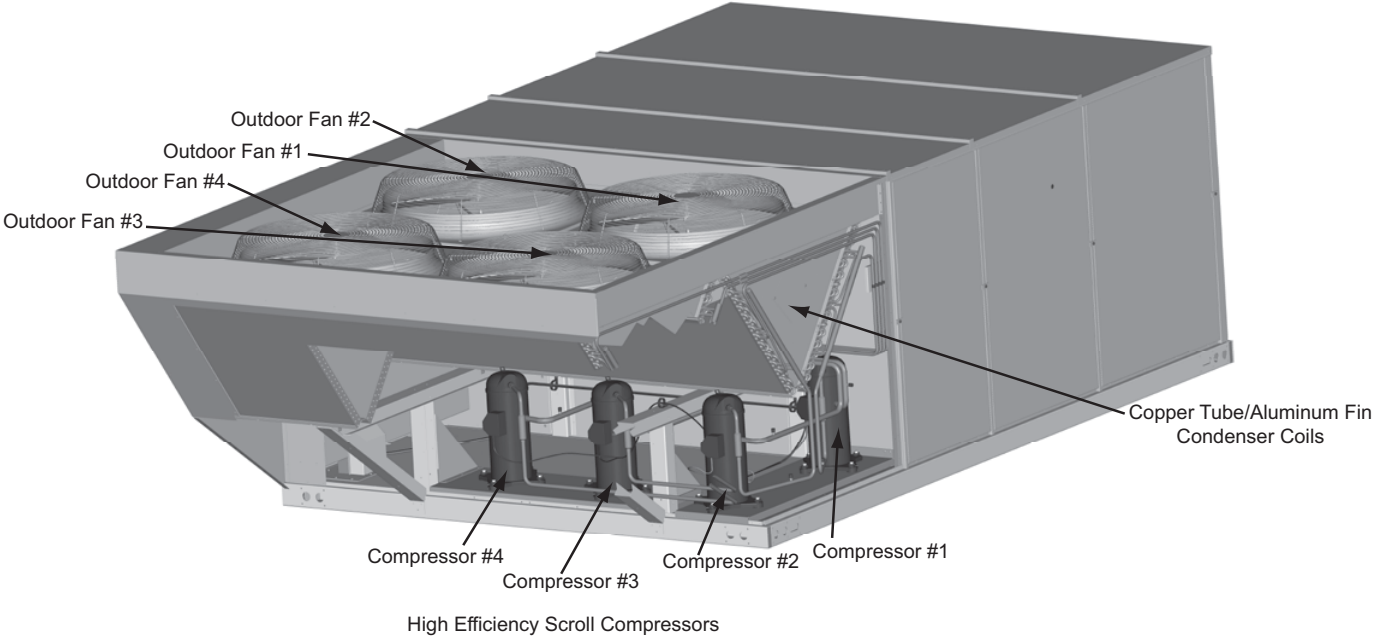
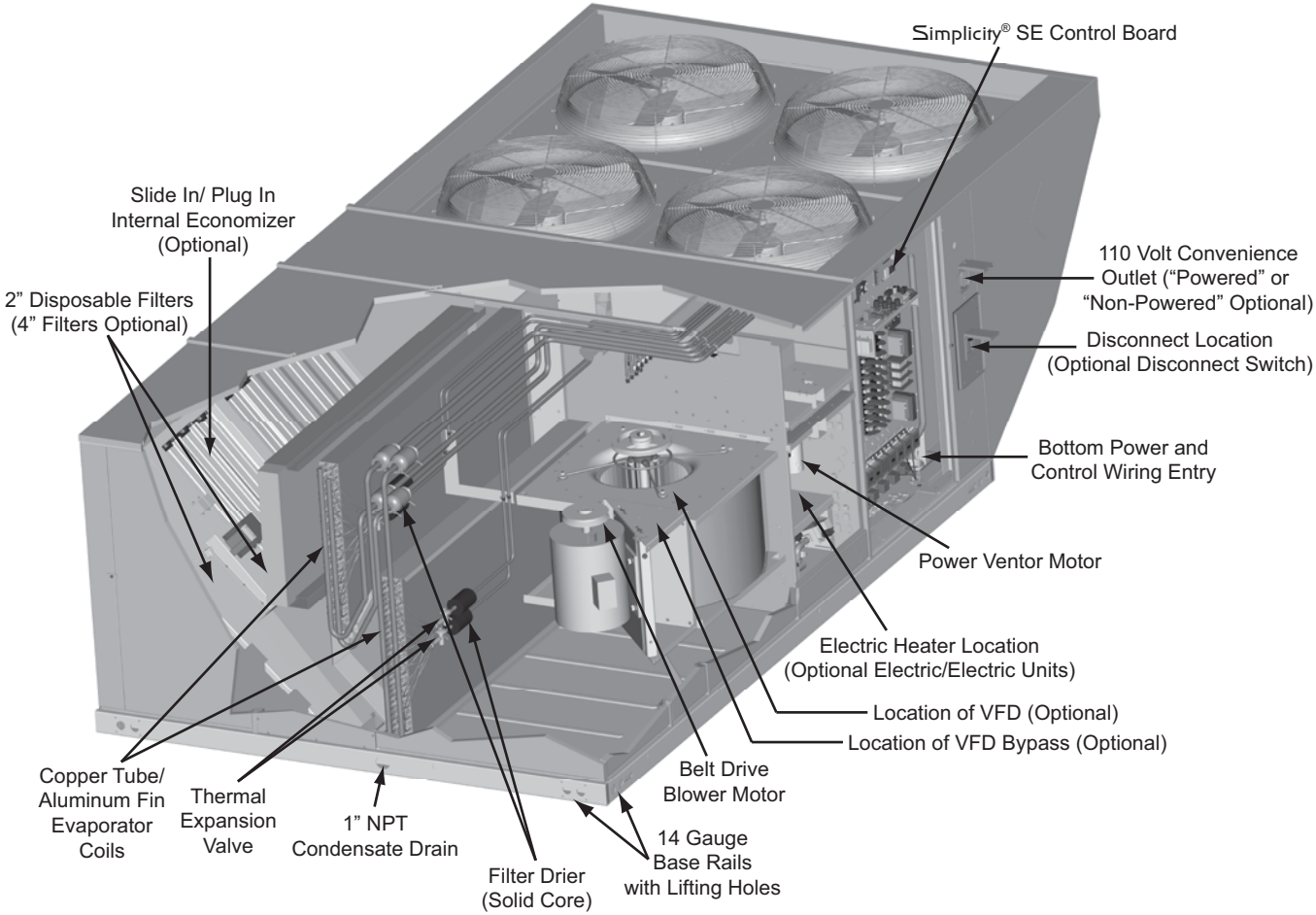


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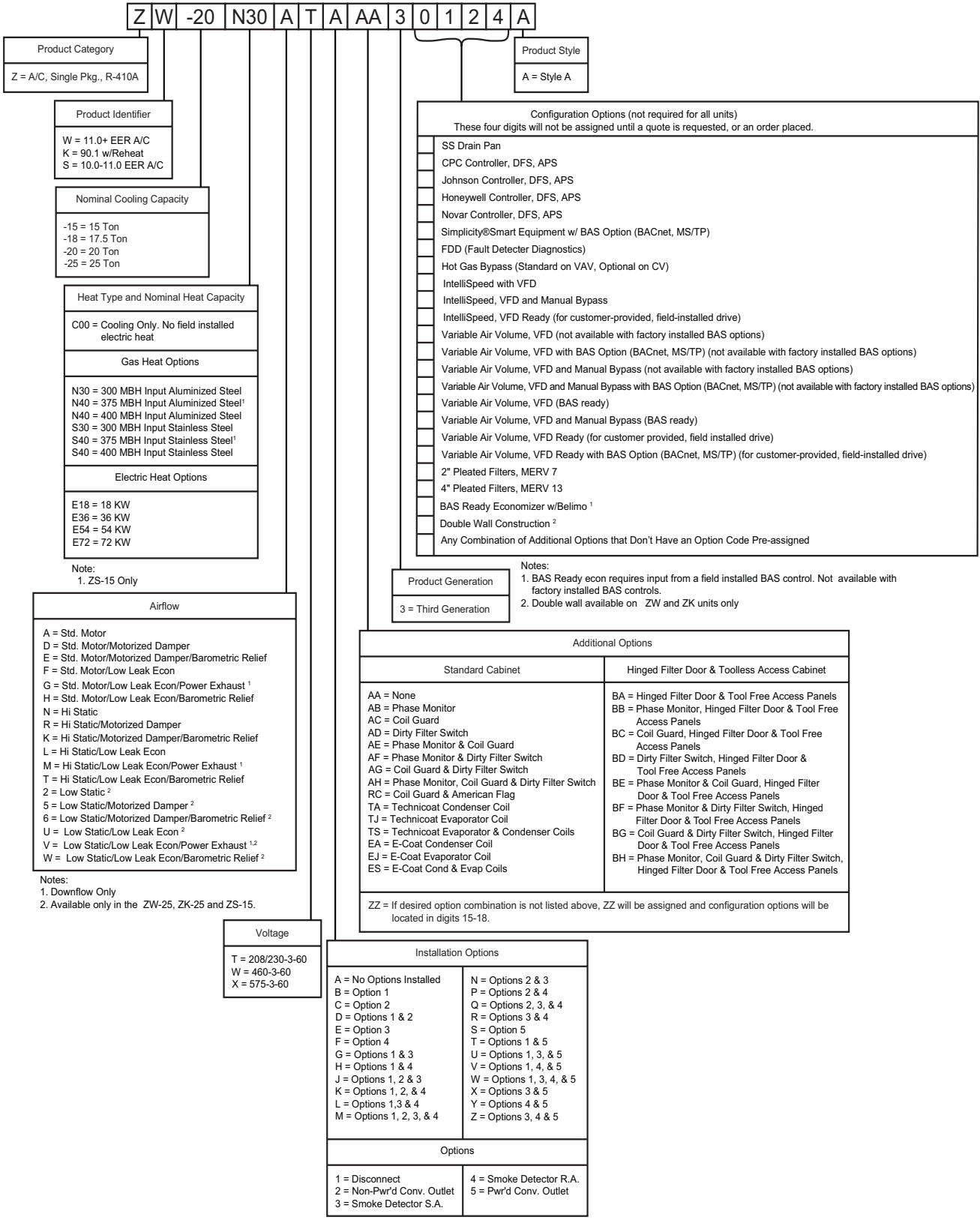
Component Location

(ZW shown)



Nomenclature

15-25 Ton Model Number Nomenclature



Features and Benefits

Standard Features

- **High Efficiency** - High efficiency units reach as high as 12.4 EER. Gas/electric units have electronic spark ignition and power vented combustion with steady state efficiencies of 80%. These efficiencies exceed all legislated minimum levels and provide low operating costs.
- **Balanced Heating** -
 - **Gas Heat** - All gas heat units are built with two heating sections for two equal stages of capacity control. Each section includes a durable heat exchanger with aluminized steel or optional stainless steel tubes, a redundant gas valve, spark ignition, power venting, an ignition module for 100% shut-off and all of the safety controls required to meet the latest ANSI standards. The gas supply piping can be routed into the heating compartment through a hole in the base pan of the unit or through a knockout in the piping panel on the front of the unit.
 - **Electric Heat** - All electric heat models (factory installed only) are wired for a single power source and include a bank of nickel chromium elements mounted at the discharge of the supply air blower to provide a high velocity and uniform distribution of air across the heating elements. Every element is fully protected against excessive current and temperature by fuses and two thermal limit switches. The power supply wiring can be routed into the control box through a threaded pipe connection in the base pan of the unit or through a knockout in the wiring panel on the front of the unit.
- **Unit Controllers** - UP ZW/ZK/ZS Series offer factory mounted Simplicity® SE UCB, with optional Communication board, a 4-stage board if 4 stages are required, an Economizer board, and an FDD (Fault Detection and Diagnostic) board. A MAP Device can be used to remotely access.
- **Convertible Airflow Design** - All models (including those with an economizer) are suitable for either bottom or horizontal duct connections. **Models with factory installed power exhaust are suitable for bottom duct connections** only. For bottom duct, you remove the sheet metal panels from the supply and return air openings through the base of the unit. For horizontal duct, you replace the supply and return air panels on the rear of the unit with a side duct flange accessory.
- **Factory Mounted Outdoor Air Dampers** - All models are available with these "factory mounted" outdoor air damper options:
 - Dry bulb economizer with or without power exhaust
 - Motorized outdoor air damper
 - Barometric Relief Damper

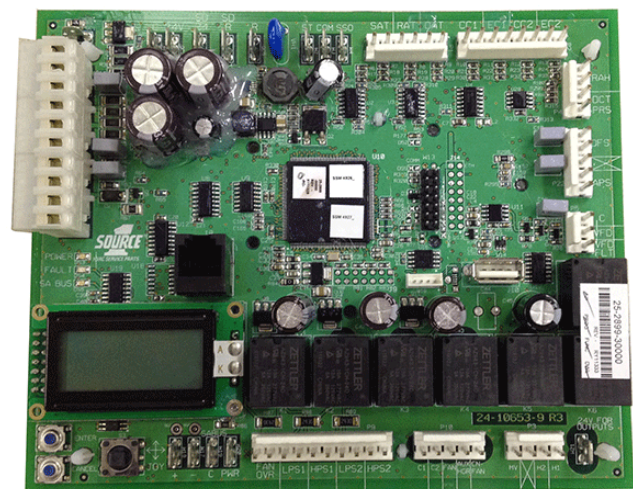
A fixed outdoor air intake assembly will be shipped in the return air compartment of all units ordered without an economizer or motorized outdoor air damper option. The assembly includes a rain hood with a baffle that can be set for 10, 15 or 25% outdoor air. With bottom duct connections,

the fixed outdoor air intake assembly should be mounted over the opening in the return air panel. With horizontal ductwork, it should be mounted on the return air duct.

- **System Protection** - Suction line freezestats are supplied on all units to protect against loss of charge and coil frosting when the economizer operates at low outdoor air temperatures while the compressors are running. Every unit has solid-core liquid line filter-driers and high and low-pressure switches. Internal compressor protection is standard on all compressors. Phase Monitors are optional on all units. This accessory monitors the incoming power to the unit and protects the unit from phase loss and reversed phase rotation.
- **Advanced Controls** - ZW/ZK/ZS Models have Simplicity® SE control boards that standardized a number of features previously available only as options or by utilizing additional controls.

CAUTION

The Simplicity® SE control board used in this product will effectively operate the cooling system down to 0°F when this product is applied in a comfort cooling application for people. An economizer is typically included in this type of application. When applying this product for process cooling applications (computer rooms, switchgear, etc.), please reference applications bulletin AE-011-07 or call the applications department for Unitary Products @ 1-877-UPG-SERV for guidance. Additional accessories may be needed for stable operation at temperatures below 30°F.



- **Units will come with the new state of the art Simplicity SE (Smart Equipment) control system.** The new unit control incorporates the best of the already proven Simplicity™ unitary controls and creates a more robust, intelligent control. The goal of this control is to utilize cutting edge technology making the equipment easier to

install, operate, and service. All units are Factory commissioned, configured, and run tested.

- **Versatile** - The Simplicity SE control can be configured to use with a standard thermostat (easy to connect screw terminals), A zone sensor, or can be setup to communicate with multiple BAS communication protocols to integrate with building automation systems.
- **Reduce field installed complexity** - Each unit will come equipped with factory installed supply air, return air, and outdoor air temperature sensors providing key temperature readings thus reduce field installed complexity.
- **On-board USB Port** - The new control comes with a long list of features including data logging, current and previous system faults and software update capabilities using the on board USB port and common flash drive. Energy use monitoring capabilities allow custom tailoring to allow a system to work more efficiently at all times and occupancy levels. Self test and start-up reports also available from the board VIA the USB port.
- **Embedded LCD Display** - The board has a easy to read, built-in LCD display and easy to use navigation joystick and buttons allowing the user to quickly navigate the menus displaying unit status, options, current function, supply, return and outdoor temperatures, fault codes and other information.
- **Safety Monitoring** - The control monitors the outdoor, supply, and return air temperatures and the high and low pressure switch status on the independent refrigerant circuits. On units with heating the gas valve and high temperature limit switches are monitored on gas and electric heating units. The control also monitors the voltage supplied to the unit and will protect the unit if low voltage due to a brown out, or other electrical issue occurs.
- **Low Ambient** - An integrated low-ambient control allows units to operate in the cooling mode down to 0°F outdoor ambient without additional components or intervention. Optionally, the control board can be programmed to lockout the compressors when the outdoor air temperature is low or when free cooling is available.
- **Anti-Short Cycle Protection** - To aid compressor life, an anti-short cycle delay is incorporated into the standard control. Compressor reliability is further ensured by programmable minimum run times. For testing, the anti-short cycle delay can be temporarily overridden with the push of a button.
- **Fan Delays** - Fan on and fan off delays are fully programmable. Furthermore, the heating and cooling fan delay times are independent of one another. All units are programmed with default values based upon their configuration of cooling and/or heating capacity.
- **Nuisance Trip Protection and Three Strikes** - To prevent nuisance calls, the control board uses a three times, you're out philosophy. The high, low-pressure switch, anti-freeze protection, low voltage or heating high limit must trip three times within two hours before the unit

control board will lock out the associated compressor. An alarm message will be displayed on the LCD screen.

- **Lead-Lag** - An integrated Lead-Lag option allows equal run time hours on all compressors, thereby extending the life of all compressors. This option is selectable on the unit control board.
- **Reliable** - From the beginning - All units undergo computer automated testing before they leave the factory. Units are tested for refrigerant charge and pressure, unit amperage, and 100% functionality. For the long term - All units are painted with a long lasting, powder paint that stands up over the life of the unit. The paint used has been proven by a 1000 hour salt spray test.
- **Full Perimeter Base Rails** - The permanently attached base rails provide a solid foundation for the entire unit and protect the unit during shipment. The rails offer rigging holes so that an overhead crane can be used to place the units on a roof.
- **Easy Installation** - Gas and electric utility knockouts are supplied in the unit underside as well as the side of the unit. Utility connections can be made quickly and with a minimum amount of field labor. All units are shipped with 2" throw-away filters installed.
- **Wide Range of Indoor Airflows** - All supply air blowers are equipped with a belt drive that can be adjusted to meet the exact requirements of the job. A high static drive option is available for applications with a higher CFM and/or static pressure requirement.
- **Warranty** - All models include a 1-year limited warranty on the complete unit. Compressors and electric heater elements each carry a 5-year warranty. Aluminized steel tubular heat exchangers carry a 10 year warranty. Stainless steel heat exchangers a 15 year warranty.

Factory Installed Options

UPG offers several equipment options factory installed, for the ZJ/ZR/ZF Series.

- **Dry Bulb Economizers** - All units offer a variety of optional factory installed down flow economizers that are shipped, installed and wired with low leak dampers designed to meet ASHRAE 90.1-2010, AMCA 511 Class 1A damper, and the International Energy Conservation Code (IECC) certification requirements by achieving leakage rates of 3 cfm/sq. ft. at 1" of static pressure. Each economizer goes through a rigorous 60,000 cycle test. Dry bulb, single enthalpy, and dual enthalpy (with field installed kit) can be selected. All economizer options are fully integrated into the Simplicity® SE controls. The economizer has spring return, fully modulating damper actuators and is capable of introducing up to 100% outdoor air. As the outdoor air intake dampers open, the return air dampers close. The changeover from mechanical refrigeration to economizer operation is regulated by the outdoor air dry bulb temperature or the outdoor air enthalpy input. The dual enthalpy kit provides a second input used to monitor the return air (field installed). The installer needs only to assemble the outdoor air hood, attach the enthalpy control the hood and

mount the hood to the unit (Hood and control are provided).

- **Power Exhaust** - Our economizer options are available with power exhaust. Whenever the outdoor air intake dampers are opened for free cooling, the exhaust fan will be energized to prevent the conditioned space from being over-pressurized during economizer operation. The exhaust fan, motor and controls are installed and wired at the factory. The rain hood must be assembled and installed in the field. The power exhaust option can only be used on bottom duct configurations.
- **Motorized Outdoor Air Intake Damper** - Includes a slide-in / plug-in damper assembly with a 2- position, spring return motor actuator which opens to a pre-set position whenever the supply air blower is operating and will drive fully closed when the blower unit shuts down. The rain hood is painted to match the basic unit and must be field assembled before installing.
- **Barometric Relief Damper** - This damper option can be used to relieve internal building air pressure on units with an economizer without power exhaust. This accessory includes a rain hood, a bird screen and a fully assembled damper. With bottom duct connections, the damper should be mounted over the opening in the return air panel. With horizontal ductwork, the accessory should be mounted on the return air duct.
- **Technicoat Condenser Coils** - The condenser coils are coated with a phenolic coating for protection against corrosion due to harsh environments.
- **Technicoat Evaporator Coil** - The evaporator coils are coated with a phenolic coating for protection against corrosion due to harsh environments.
- **E-Coat Condenser Coils** - The condenser coils are coated with an epoxy polymer coating to protect against corrosion.
- **E-Coat Evaporator Coils** - The evaporator coils are coated with an epoxy polymer coating to protect against corrosion.
- **Electric Heaters** - wired for single point power supply. These nickel chromium heater elements are provided with limit and automatic reset capability to prevent operation at excessive temperatures.
- **Variable Air Volume (VAV)** - A factory-installed variable frequency drive (VFD), mounted in the Blower Access compartment, is used to control the speed of the indoor blower motor in order to maintain a constant static pressure in the supply duct. A pressure transducer and VAV control board are mounted inside the control box. The drive comes completely wired and pre-programmed from the factory. An optional, factory-installed manual bypass switch available with factory-installed VFD can be found in the Blower Motor Access compartment. The switch can be used to either route power to the VFD for modulating control of the blower motor, to bypass the drive and operate the motor at full speed, or to power the drive (and not the motor) for diagnostic purposes.

Due to space limitations, VAV is not available with any of the factory-installed BAS options described below, but is available with 'BAS-ready' models. Terminal blocks are provided in the control box for field wiring of the customer-installed BAS.

A 'VFD-ready' option provides the provisions for a customer-installed drive. The unit comes with a mounting bracket installed in the Blower Access compartment which may accommodate other vendor's drives depending on their size. In order to utilize the unit's mounting bracket, the maximum recommended drive dimensions are as follows:

For 5-hp motor applications 13" H x 6" W x 7" D
For 7.5 thru 15-hp motor applications 13" H x 8" W x 8" D

If the drive will not fit in the allotted space, then it will have to be mounted elsewhere; either within the building on a perpendicular wall which is not subjected to excessive temperature, vibration, humidity, dust, corrosive gas, explosive gas, etc., or within an appropriate enclosure rated for outside installation to safeguard against moisture, dust and excessive heat.

A terminal block located in the control box is provided for field connection of the VFD controls.

- **IntelliSpeed™ Supply Fan Control Option (ASHRAE 90.1 compliant, section 6.4.3.10)** - Units configured with the **IntelliSpeed™** Supply Fan Option will contain a VFD for multi-speed supply fan operation. This option allows the supply fan RPM to vary based on the number of compressors or heating stages energized. The economizer's minimum position will also be configurable to vary based on the supply fan VFD frequency output.
- **Hot Gas Bypass** - To allow for low cooling load operation, a direct-acting pressure-modulating bypass control valve installed on the system #1 discharge line is used to divert high temperature, high pressure refrigerant around the TXV in order to maintain a desired minimum evaporator pressure. HGBP is standard on all units with VAV and optional with CV units.
- **Filter Options** - Standard units are shipped with 2" throw-away filters installed. 2" pleated and 4" pleated filters are offered as a factory installed option.
- **Convenience Outlet** - This 110 volt outlet can be "powered" by the unit with a stepdown transformer or you may order the unit with a "non-powered" convenience outlet that can be wired in the field.
- **Disconnect Switch** - For gas heat units and cooling units with electric heat, a HACR breaker sized to the unit is provided. For cooling only units, a switch sized to the largest electric heat available for the particular unit is provided. Factory installed option only.
- **Double Wall Construction** - Optional double wall construction is available to provide smooth inner surfaces for easy and effective cleaning to reduce risk of dirt and bacterial accumulation. Fiberglass insulation is sandwiched between heavy gauge steel sheets to form a durable, rigid casing to withstand higher working pressures and impact forces. The heavy-duty construction provides excellent acoustic and thermal insulation and eliminates erosion of insulation material and contamination of the air stream.

- **Smoke Detectors** - (supply air & return air) The smoke detectors stop operation if smoke is detected within the air compartment.

▲WARNING

Factory installed smoke detectors in the return air, may be subjected to freezing temperatures during "off" times due to outside air infiltration. These smoke detectors have an operational limit of 32°F to 131°F. Smoke detectors installed in areas that could be outside those limitations will have to be moved to prevent having false alarms.

- **Coil Guard** - Customers can purchase a coil guard kit to protect the condenser coil from damage. This is not a hail guard kit.
- **Stainless Steel Heat Exchanger** - For applications in corrosive environments, this option provides a full stainless steel heat exchanger assembly.
- **Stainless Steel Drain Pan** - An optional rustproof stainless steel drain pan is available to provide years of trouble-free operation in corrosive environments.
- **Phase Monitors** - Designed to prevent unit damage. The phase monitor will shut the unit down in an out-of-phase condition.
- **High Static Drive** - May include a belt, blower pulley, motor pulley or a motor change to enhance blower performance.
- **Low Static Drive** - May include a belt, blower pulley, motor pulley or a motor change when standard airflow is not required. **(ZJ/ZR/ZF300 only)**.
- **Dirty Filter Switch** - This kit includes a differential pressure switch that energizes the fault light on the unit thermostat, indicating that there is an abnormally high pressure drop across the filters. Factory installed option or field installed accessory.
- **Hinged Filter Door/"Tool Free" Blower And Access Panels (Not Hinged)** - This option allows for easy access and maintenance.

NOTE: Knobs are shipped separately within the unit to prevent shipping damage. These must be field installed for tool free operation.

- **Hinged/"Tool Free" Blower, Blower Motor, Filter And Electric Access Panels** - This option allows for complete hinged and tool free access to the unit's blower, blower motor, filters and electrical panel sections.

Field Installed Accessories

UPG offers several equipment accessories for field installation, for the ZW/ZK/ZS Series.

- **Dry Bulb Economizers** - All units offer a variety of optional factory installed down flow economizers that are shipped, installed and wired with low leak dampers designed to meet ASHRAE 90.1-2010, AMCA 511 Class 1A damper, and the International Energy Conservation Code (IECC) certification requirements by achieving

leakage rates of 3 cfm/sq. ft. at 1" of static pressure. Each economizer goes through a rigorous 60,000 cycle test. Dry bulb, single enthalpy, and dual enthalpy (with field installed kit) can be selected. All economizer options are fully integrated into the Simplicity SE controls. The economizer has spring return, fully modulating damper actuators and is capable of introducing up to 100% outdoor air. As the outdoor air intake dampers open, the return air dampers close. The changeover from mechanical refrigeration to economizer operation is regulated by the outdoor air dry bulb temperature or the outdoor air enthalpy input. The dual enthalpy kit provides a second input used to monitor the return air (field installed). The installer needs only to assemble the outdoor air hood, attach the enthalpy control the hood and mount the hood to the unit (Hood and control are provided).

- **Motorized Outdoor Air Intake Damper** - Includes a slide-in / plug-in damper assembly with a 2-position, spring return motor actuator which opens to some pre-set position whenever the supply air blower is operating and will drive fully closed when the blower unit shuts down. The rain hood is painted to match the basic unit and must be field assembled before installing.
- **Roof Curbs** - Fourteen-inch high roof curbs provide a water-tight seal between the unit and the finished roof. These full perimeter curbs meet the requirements of the National Roofing Contractors Association (NRCA) and are shipped knocked-down for field assembly. They're designed to fit inside the base rails of the unit and include both a wood nailing strip and duct hanger supports.
- **High Altitude Natural Gas** - Burner orifices and pilot orifices are provided for proper furnace operation at altitudes up to 6,000 feet.
- **Propane** - Burner orifices, pilot orifices and gas valve parts are provided to convert a natural gas furnace to propane.
- **High Altitude Propane** - Burner orifices and pilot orifices are provided for proper furnace operation at altitudes up to 6,000 feet. This accessory supplements the basic propane conversion kit.
- **Side Duct Flanges** - One-inch flanges replace the supply and return air panels on the rear of the unit to accommodate horizontal duct connections. These flanges can also be used individually for bottom supply / horizontal return or horizontal supply/bottom return. They cannot be used on units with power exhaust.
- **Barometric Relief Damper** - This damper accessory can be used to relieve internal building air pressure on units with an economizer without power exhaust. This accessory includes a rain hood, a bird screen and a fully assembled damper. With bottom duct connections, the damper should be mounted over the opening in the return air panel. With horizontal ductwork, the accessory should be mounted on the return air duct.
- **High Static Drive** - May include a belt, blower pulley, motor pulley or a motor change to enhance blower performance.

- **Enthalpy Accessory Control Kit** - This kit contains the required components to convert a single enthalpy economizer to dual enthalpy.
- **Burglar Bars** - Mount in the supply and return openings to prevent entry into the duct work.
- **Flue Exhaust Extension Kit** - In locations with wind or weather conditions which may interfere with proper exhausting of furnace combustion products, this kit can be installed to prevent the flue exhaust from entering nearby fresh air intakes.
- **Wood Skid** - Allows unit to be handled with 90" forks.
- **CO₂ Sensor** - Senses CO₂ levels and automatically overrides the economizer when levels rise above the present limits.
- **Coil Guard** - Customers can purchase a coil guard kit to protect the condenser coil from damage. This is not a hail guard kit.
- **Phase Monitors** - Designed to prevent unit damage. The phase monitor will shut the unit down in an out-of phase condition.

Control Options

Simplicity® SE with Communication Option Control -

The UPG Simplicity® SE with Communication Option Control is factory installed. It includes all the features of the Simplicity® SE control with an additional gateway to BACnet MS/TP (programmable to Modbus or N2 protocols).

Novar® BAS Control - The Novar® building automation system controller is factory installed. Includes supply air sensor, return air sensor, dirty filter indicator switch, and air proving switch.

CPC BAS Control - The Computer Process Controls Model 810-3060 ARTC Advanced Rooftop building automation system controller is factory installed. Includes supply air sensor, return air sensor, with optional dirty filter indicator switch and air proving switch.

Honeywell BAS Control - The Honeywell W7750C building automation system controller is factory installed. Includes air supply sensor, return air sensor, with optional dirty filter indicator switch, and air proving switch.

Guide Specifications

General

Units shall be manufactured by Unitary Products in an ISO 9001 certified facility.

ZW/ZK/ZS units are convertible single package units. ZW models have four independent refrigerant circuits and ZK/ZS models have dual independent refrigerant circuits for efficient part load operation and maximum comfort control. Although the units are primarily designed for curb mounting on a roof, they can also be slab-mounted at ground level or set on steel beams above a finished roof. Cooling only, cooling with gas heat and cooling with electric heat models are available with a wide variety of factory-mounted options and field-installed

accessories to make them suitable for almost every application. All units are self-contained and assembled on full perimeter base rails with holes in the four corners for overhead rigging. Every unit is completely piped, wired, charged and tested at the factory to simplify the field installation and to provide years of dependable operation. All models (including those with an economizer) are suitable for either bottom or horizontal duct connections. Models with power exhaust are suitable for bottom duct connections only. For bottom duct, remove the sheet metal panels from the supply and return air openings through the base of the unit. For horizontal duct, replace the supply and return air panels on the rear of the unit with a side duct flange accessory. All supply air blowers are equipped with a belt drive that can be adjusted to meet the exact requirements of the job. A high static drive option is available for applications with a higher CFM and/or static pressure requirement.

ZW/ZK models have 4 condenser fan motors and ZS models have 2 condenser fan motors. All compressors include crankcase heat and internal pressure relief. Every refrigerant circuit includes an expansion valve, a liquid line filter-drier, a discharge line high pressure switch and a suction line with a freestat and low pressure/loss of charge switch. The unit control circuit includes a 75 VA transformer, a 24-volt circuit breaker and a relay board with two compressor lockout circuits, a terminal strip for thermostat wiring, plus an additional set of pin connectors to simplify the interface of additional field controls. All units have long lasting powder paint cabinets with 1000 hour salt spray test approval under ASTM-B117 procedures. All models are CSA approved. All models include a 1-year limited warranty on the complete unit. Compressors and electric heater elements carry an additional 4-year warranty. Aluminized steel tubular heat exchangers carry an additional 9-year warranty.

Description

ZW units shall be factory-assembled, single packaged, ZW***N Electric Cooling/Gas Heat, ZW***C/E Electric Cooling/Optional Electric Heat, designed for outdoor mounted installation. The 15 ton unit shall have a minimum EER rating of 12.4. The 17.5 ton unit shall have a minimum EER rating of 12.1. The 20 ton unit shall have a minimum EER rating of 11.6. The 25 ton unit shall have a minimum EER rating of 10.4.

ZK units shall be factory-assembled, single packaged, ZK***N Electric Cooling/Gas Heat, ZK***C/E Electric Cooling/Optional Electric Heat, designed for outdoor mounted installation. The 15 ton unit shall have a minimum EER rating of 11.6. The 20 ton unit shall have a minimum EER rating of 12.1. The 25 ton unit shall have a minimum EER rating of 10.5.

ZS units shall be factory-assembled, single packaged, ZS***N Electric Cooling/Gas Heat, ZS***C/E Electric Cooling/Optional Electric Heat, designed for outdoor mounted installation. The 15 and 17.5 ton units shall have a minimum EER rating of 11.0. The 20 and 25 ton units shall have a minimum EER rating of 10.

They shall have built-in field convertible duct connections for down discharge supply/return or horizontal discharge supply/return, and be available with factory installed options or field

installed accessories. The units shall be factory wired, piped, charged with R-410A refrigerant and factory tested prior to shipment. All unit wiring shall be both numbered and color coded. All units shall be manufactured in a facility certified to ISO 9001 standards and the cooling performance shall be rated in accordance with DOE and AHRI test procedures. Units shall be CSA listed, classified to ANSI Z21.47 standards, UL 1995/ CAN/CSA No. 236-M90 conditions.

Unit Cabinet

Unit cabinet shall be constructed of galvanized steel, with exterior surfaces coated with a non-chalking, powdered paint finish, certified at 1000 hours salt spray test per ASTM-B117 standards. Indoor blower section shall be insulated with a minimum 1/2" thick insulation, coated on the airside. Aluminum foil faced insulation shall be used in the furnace compartment and be fastened with ridged fasteners to prevent insulation from entering the air stream. Cabinet panels shall be "large" size, easily removable for servicing and maintenance. Full perimeter base rails shall be provided to assure reliable transit of equipment, overhead rigging and proper sealing on roof curb applications. Disposable 2" filters shall be furnished and be accessible through a removable access door, sealed airtight. Units filter track shall be designed to accommodate either 2" or 4" filters. Fan performance measuring ports shall be provided on the outside of the cabinet to allow accurate air measurements of evaporator fan performance without removing panels or creating air by-pass of the coils. Condensate pan shall be internally sloped and conform to ASHRAE 62-89 self-draining standards. Condensate connection shall be a minimum of 1" I.D. female and be a ridged mount connection. Unit shall incorporate a fixed outdoor air damper with an outdoor air intake opening covered with a bird screen and a rain hood painted to match the exterior of the unit.

Indoor (Evaporator) Fan Assembly

Fan shall be a belt drive assembly and include an adjustable-pitch motor pulley. Job site selected (B.H.P.) brake horsepower shall not exceed the motors nameplate horsepower rating, plus the service factor. Units shall be designed not to operate above service factor. Fan wheel shall be double-inlet type with forward-curved blades, dynamically balanced to operate smoothly throughout the entire range of operation. Airflow design shall be constant air volume.

A variable air volume (VAV) option using a variable frequency drive (VFD) is available for applications requiring a constant supply duct static pressure. Units equipped for VAV shall be controlled by a duct pressure transducer with a 0 - 5" WC pressure range. The pressure transducer shall provide a 0 - 5 VDC output signal to a VAV control board which, in turn shall provide a 2 - 10 VDC speed reference signal to the VFD. The VAV control board shall operate using factory-installed Supply Air, Return Air and Outside Air Temperature Sensors. Units equipped with VFD's shall have factory-installed manual bypass as an option.

Outdoor (Condenser) Fan Assembly

The outdoor fans shall be of the direct-driven propeller type, discharge air vertically, have aluminum blades riveted to corrosion resistant steel spider brackets and shall be dynamically balanced for smooth operation. The 4 outdoor fan motors shall be totally enclosed with permanently lubricated bearings, internally protected against overload conditions and staged independently.

Refrigerant Components

Compressors:

- a. Shall be Scroll compressors internally protected with internal high-pressure relief and over temperature protection.
- b. Shall have internal spring isolation and sound muffling to minimize vibration and noise, and be externally isolated on a dedicated, independent mounting.

Coils:

- a. Evaporator and condenser coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed. Special Phenolic coating shall be available as a factory option.
- b. Evaporator and Condenser coils shall be of the direct expansion, draw-thru, design.

Refrigerant Circuit and Refrigerant Safety Components shall include:

- a. Balance-port thermostatic expansion valve with independent circuit feed system.
- b. Filter drier/strainer to eliminate any moisture or foreign matter.
- c. Accessible service gage connections on both suction and discharge lines to charge, evacuate, and measure refrigerant pressure during any necessary servicing or troubleshooting, without losing charge.
- d. The refrigeration system shall provide at least 15° F of sub-cooling at design conditions.
- e. All models shall have four independent circuits.
- f. Hot gas bypass option shall be factory-installed on compressor #1 discharge line to provide cooling in low-load applications. HGBP shall be a standard feature on VAV models and an optional feature on CV models.

Unit Controls

- a. Unit shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side.
- b. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit, should any of the following standard safety devices trip and shut off compressor.
 1. High-pressure switch.
- c. Loss-of-charge/Low-pressure switch.

2. Freeze condition sensor, evaporator coil. If any of these safety devices trip, the LCD screen will display the alarm message.
- d. Unit shall incorporate "AUTO RESET" compressor over temperature, over current protection.
- e. Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up.
- f. Unit control board shall have on-board diagnostics and fault message display.
- g. Standard controls shall include anti-short cycle and low voltage protection, and permit cooling operation down to 0 °F.
- h. Control board shall monitor each refrigerant safety switch independently.

Gas Heating Section (ZW/ZK/ZS***N Models)

Shall be designed with induced draft combustion with post purge logic and energy saving direct spark ignition, redundant main gas valve. Ventor wheel shall be constructed of stainless steel for corrosion resistance. The heat exchanger shall be of the tubular type, constructed of T1-40 aluminized steel for corrosion resistance and allowing minimum mixed air entering temperature of 25 °F. Burners shall be of the in-shot type, constructed of aluminum coated steel and contain air mixture adjustments. All gas piping shall enter the unit cabinet at a single location through either the side or curb, without any field modifications. An integrated control board shall provide timed control of evaporator fan functioning and burner ignition. Heating section shall be provided with the following minimum protection:

- Primary and auxiliary high-temperature limit switches.
- Induced draft motor speed sensor.
- Flame roll out switch (automatic reset).
- Flame proving controls. Unit shall have two independent stages of capacity.

Electric Heating (ZW/ZK/ZS***C/E Models)

Nickel chromium electric heating elements shall be provided as required by the application with 1 or 2 stage control, as required, from 13.5 KW to 72 KW capacities. The heating section shall have a primary limit control(s) and automatic reset to prevent the heating element system from operating at an excessive temperature. Units with Electric Heating shall be wired for a single point power supply with branch circuit fusing (where required).

Unit Operating Characteristics

Unit shall be capable of starting and running at 125° F outdoor temperature, exceeding maximum load criteria of AHRI Standard 340/360. The compressor, with standard controls, shall be capable of operation down to 25° F outdoor temperature. Accessory low ambient kit shall be available for operation to 0° F. Unit shall be provided with fan time delay to prevent cold air delivery before heat exchanger warms up (Gas heat only).

Electrical Requirements

All unit power wiring shall enter unit cabinet at a single factory provided location and be capable of side or bottom entry, to minimize roof penetrations and avoid unit field modifications. Separate side and bottom openings shall be provided for the control wiring.

Standard Limited Warranties

- Compressor 5 Years
- Heat Exchanger 10 Years
- Electric Heat Element 5 Years
- Other Parts 1 Year

Optional Outdoor Air (Shall be made available by either/or):

- Dry Bulb Economizer** - Outdoor and return air dampers that are interlocked and positioned by a fully-modulating, spring-return damper actuator. The maximum leakage rate for the outdoor air intake dampers shall be designed to meet ASHRAE 90.1-2010, AMCA 511 Class 1A damper, and the International Energy Conservation Code (IECC) certification requirements by achieving leakage rates of 3 cfm/sq. ft. at 1" of static pressure. During economizer operation, a mixed-air temperature control shall modulate the outdoor and return air damper assembly to prevent the supply air temperature from dropping below 55°F. Changeover from compressor to economizer operation shall be provided by an integral electronic enthalpy control that feeds input into the basic module. The outdoor intake opening shall be covered with a rain hood that matches the exterior of the unit. Water eliminator/filters shall be provided.

Simultaneous economizer/compressor operation is also possible. Dampers shall fully close on power loss.

- Motorized Outdoor Air Dampers** - Outdoor and return air dampers that are interlocked and positioned by a 2-position, spring-return damper actuator. A unit-mounted potentiometer shall be provided to adjust the outdoor and return air damper assembly to take in the design CFM of outdoor air to meet the ventilation requirements of the conditioned space during normal operation. Whenever the indoor fan motor is energized, the dampers open up to one of two pre-selected positions - regardless of the outdoor air enthalpy. Dampers return to the fully closed position when the indoor fan motor is de-energized. Dampers shall fully close on power loss.

Other Pre-engineered Accessories Available

- Roof Curb** - 14" high, full perimeter curb with wood nailer (shipped knocked-down).
- 100% Barometric Relief Damper** - Contains a rain hood, air inlet screen, exhaust damper and mounting hardware. Used to relieve internal air pressure through the unit.
- Propane Conversion Kit** - Contains new orifices and gas valve parts to convert from natural to L.P. gas. One per unit required.

- **High Altitude - Natural Gas** - Contains orifices required for applications between 2000 and 6000 feet altitude.
- **High Altitude - Propane Gas** - Contains orifices required for applications between 2000 and 6000 feet altitude. Must be used with propane conversion kit.
- **Burglar Bars** - Designed to work with above roof curbs, depending on unit model. Fits duct openings of curb supply and return air openings.
- **Side Duct Flange** - Supply and return air duct flanges for side duct applications. Do not use on units with power exhaust.
- **High Static Drive** - May include a belt, blower pulley, motor pulley or a motor change to enhance blower performance.
- **Wood Skid** - Allows unit to be handled with 90" forks.
- **Economizer/motorized Damper Rain Hood (ZW/ZK/ZSNE/C-25 only)** - Contains all hood panels and the hardware for assembling.
- **Anti-Recycle Timer** - Assures 5-minute off time between compressor cycles.
- **Low Ambient Kit** - Provides unit cooling operation down to 0 °F.
- **Coil Guard Kit** - Guard for cooling coil.

Other Factory Installed Options

- **Power Exhaust Option** - To work in conjunction with economizers.
- **Stainless Steel Heat Exchanger**
- **Stainless Steel Drain Pan**
- **Technicoat Phenolic Coated Condenser And Evaporator Coil**
- **E-Coat Epoxy Polymer Coated Condenser And Evaporator Coil**
- **Electronic Single Enthalpy Economizer**
- **Dirty Filter Switch**
- **Double Wall**
- **Phase Monitor**
- **Coil Guard**
- **Powered GFI Convenience Outlet**
- **Non-powered GFI Convenience Outlet**
- **BAS Controls** - Simplicity® SE with BAS Communication (BACnet MS/TP, Modbus, and Johnson Controls N2) Option, CPC, HONEYWELL, NOVAR
- **BAS Ready Economizer** (2-10 V.D.C. Actuator With Simplicity® SE Controller)
- **Hinged Filter Door Access And Tool Free Access Panels**
- **Hinged Tool Free Blower, Blower Motor, Filter And Electrical Access Panels**
- **High Static Drive**
- **Low Static Drive (ZW/ZK/ZS-25 only)**
- **2" Pleated Filters, MERV 7**
- **4" Pleated Filters, MERV 13**

- **Disconnect Switch**
- **Supply Air Smoke Detector**
- **Return Air Smoke Detector**
- **Controls**
 - **Bas Controls** - Simplicity® SE with BAS Option, CPC, HONEYWELL, NOVAR

Hot Gas Reheat

Setpoints and Related Data

Setpoints and related data includes:

- Hot Gas Reheat Alternate Operation Enabled (HGRAlt-En)
- Hot Gas Reheat Enabled for Operation (HGR-En)
- Hot Gas Reheat Alternate Operation Writable (HGRAltWrite)
- Hot Gas Reheat Humidity Setpoint (HGRHum-Sp)
- HGR Unoccupied Humidity Setpoint (HGRUnoccHum-Sp)
- HGR Enabled for Unoccupied Operation (HGRUnocc-En)

Inputs

Inputs include:

- operational space humidity (OprSH)

Outputs

- Outputs include:
- 24 VAC from AUX-HGR to energize the hot gas reheat solenoid

Operation For ZK Units Only

Normal Occupied Operation Mode

If the return humidity is greater than or equal to the Hot Gas Reheat Humidity Setpoint, and no demand for cooling, C1 output energizes and the AUX-HGR output energizes.

If there is a demand for one stage of cooling and the return humidity is greater than or equal to the Hot Gas Reheat Humidity Setpoint, C1 output energizes but the AUX-HGR output de-energizes.

Any additional cooling demands energize compressor outputs, but do not change the status of the AUX-HGR output.

NOTE: If HGR Enabled for Unoccupied Operation is enabled, during unoccupied mode the control works the same as described above, except it uses the HGR Unoccupied Humidity Setpoint instead.

Alternate Mode

If the return humidity is greater than or equal to the Hot Gas Reheat Humidity Setpoint, and no demand for cooling, C1 and AUX-HGR outputs energize, and C2 energizes.

If there is a demand for one stage of cooling and the return humidity is greater than or equal to the Hot Gas Reheat Humidity Setpoint, C1 and AUX-HGR outputs energize, and C2 energizes.

If there is a demand for both first and second cooling stages and the return humidity is greater than or equal to the Hot Gas Reheat Humidity Setpoint, C1 and C2 outputs energize and AUX-HGR de-energizes.

NOTE: If HGR Enabled for Unoccupied Operation is enabled, during unoccupied mode the control works the same as

described above, except it uses the HGR Unoccupied Humidity Setpoint instead.

Dehumidification Sequence in Normal and Alternate Mode

Request	Normal Mode			Alternate Mode		
	HGR	C1	C2	HGR	C1	C2
Dehumidification	On	On	Off	On	On	Off
One Stage of Cooling (Y1)	Off	On	Off	On	On	On
Two Stages of Cooling (Y2)	Off	On	On	Off	On	On

NOTE: The demands for cooling are defined in the Sensor Operation.